Fusion 6 Documentation

Nov 15th, 2009

Getting Started

Introduction to Fusion

What is Fusion

eyeon Software's Fusion is a compositing program, or more accurately, software used to composite images. Look up the word composition in any dictionary and the most relevant definition would likely be "The combining of distinct parts or elements to form a whole".

Fusion is designed to combine images from many sources and compose them into a final whole. Modern media assembles a multitude of raw materials into the final product that we see in film, television or via the internet. Virtual sets are blended with live action material. Computer generated actors fill in where live stuntmen can't. With each passing year the real and virtual parts of production become more tightly intertwined.

So the job of the compositing artist is to take all of the discreet elements and layers that make up a shot, and turn them into a single image that respects the goals and artistic vision of the production. To achieve this, the artist draws on techniques as diverse as color correction, greenscreen replacement, tracking, particles, blur and glow effects.

Fusion draws on more than 20 years in visual effects post production, providing a complete toolkit for addressing any compositing challenge.

Some Key Features

In addition to providing in excess of 200 tools for image processing, Fusion also provides a large number of features to improve an artists effectiveness and efficiency . The following is a summary of some of the key features provided by Fusion.

- Region of Interest and Domain of Definition renderer with the interactive responsiveness of a full frame based renderer
- Concatenated transformations preserve image sharpness
- Offscreen pixels are preserved through infinite canvas provided by Domain of Definition
- Complete toolset for compositing in 2D and 3D simultaneously
- Reads and writes more than 100 production file formats
- Resolution Independent
- Comprehensive HDRI and floating point color support
- Automation through either Python or eyeonScript (Lua) programming languages
- ASCII based project format for easy integration with asset management
- RAM and disk based caching systems
- Strongly multithreaded native 64 bit application takes full advantage of modern hardware

- GPU accelerated 3D rendering and display
- Real time color calibration through all common 2D and 3D look up table formats.
- Network rendering not just of final projects but for previews and disk caches.
- Background and clustered network rendering directly to RAM and disk based caches
- Bins server provides facility wide access to frequently used tools, macros and settings
- Runs under both Windows and Linux
- Macro system for repackaging many tools into one simplified but powerful tool
- Easy to use and well documented SDK

System Requirements

Before installing Fusion, review the following system requirements.

Hardware Requirements And Recommendations

Processor

Fusion will take advantage of Intel and AMD processors equally well. It is recommended to have at least a Pentium 4 or Althon 64 processor to operate Fusion. The 64 bit version of Fusion will require Fusion is able to take advantage of dual core and hyperthreaded processors, and thrives when multiple processors are available.

Graphics

Fusion requires OpenGL capable ATI or NVidia graphics cards. Available graphics memory should be 256 MB or greater, with 512MB or greater suggested for best performance. The Fusion interface requires a screen resolution of 1280 x 1024 pixels or greater at 32 bit per channel (true color). Higher resolutions are suggested.

Fusion's graphics card requirements will be higher for 3D intensive composites. For example, 3D scenes employing large numbers of textures, or very large textures will require significantly more memory for the graphics card. Additionally Fusion 6 makes more extensive use of the GPU for many 3D operations. A modern graphics card will have a much bigger impact on interactivity and performance in Fusion 6 than was previously true in Fusion 5.

High end workstation class graphics cards should not be required, a decent mid-class gaming class card with large amounts of memory is generally sufficient.

Fusion Render Slaves will be unable to render OpenGL 3D scenes unless they have an OpenGL capable graphics card. Software rendering of 3D scenes will not require a graphics card.

Memory

Fusion is designed to make use of every kilobyte of memory available. A minimum of 1GB of memory is required, and 2GB or greater is strongly recommended. When using 2GB or more of memory in conjunction with 32 bit Microsoft operating systems it is strongly

suggested that the /3GB switch is applied. See http:/ / www. eyeonline. com/ Web/ EyeonWeb/Support/TechFAQ.aspx#15

DVD-ROM And CD

The Fusion installer and training materials are shipped on a DVD-ROM.

USB Port

eyeon Software uses a hardware lock as part of its licensing system. This is a small device that connects to the USB port. The hardware lock should be attached directly to the workstation when local licensing is used. In facilities where Fusion licensing is handled by a FlexLM license server, the hardware lock will be attached to the server running the eyeon licensing daemon.

New licenses of Fusion ship with a USB hardware lock unless a parallel port lock is specified when Fusion is ordered. Upgraded copies of Fusion will use whatever hardware lock that is available to the previous version of Fusion or Vision.

Hard Drives

Fusion requires a minimum of 150 Mb of hard disk space to install, and a typical installation with all help materials, courseware and examples may occupy as much as 4GB of drive space.

When working with images stored locally to the workstation, the speed of the drives can be a major factor in the performance of Fusion. If the majority of the images used in a composite come from a remote fileserver or SAN, the network will be a much bigger factor in rendering speed than the drive performance.

The vfxpedia page http://vfxpedia.com/index.php?title=Choosing_Hardware_for_Fusion should have a detailed discussion of graphics card requirements and performance.

Software Requirements

Operating Systems

The following operating systems are supported by Fusion 6.0

- Microsoft Windows XP Professional Service Pack 2 or greater
- Microsoft Windows XP Professional x64 Edition Service Pack 2 or greater
- Microsoft Windows Vista (Home/Business/Ultimate)
- Microsoft Windows Vista (Business/Ultimate) 64-bit
- Linux (most modern distributions)

QuickTime

The 32 bit version of Fusion requires Apple Quicktime to be installed on the workstation and render nodes in order to read and write to the MOV and PNG file formats. At the time this manual was written Quicktime libraries were unavailable for 64 bit operating systems, and as a result these formats are unavailable in 64 bit native versions of Fusion.

Notes

Microsoft Windows 7 was not yet available when this documentation was written, but initial testing with the release candidate has indicated there should be no major issues. eyeon Software is commited to supporting this operating system when it is released.

Due to the poor Open GL support in most virtualization platforms eyeon does not currently support operation of Fusion under virtualization. The Fusion Render Slave should operate under virtualization, though it is more efficient to run directly on the hardware.

See http://vfxpedia.com/index.php?title=Choosing_Hardware_for_Fusion for the most up to date information on choosing hardware for Fusion.

Basic Concepts

Interface Overview

This chapter should familiarize the reader with the names and locations of the main elements of the Fusion interface. A detailed description of each interface element can be found later in this documentation.

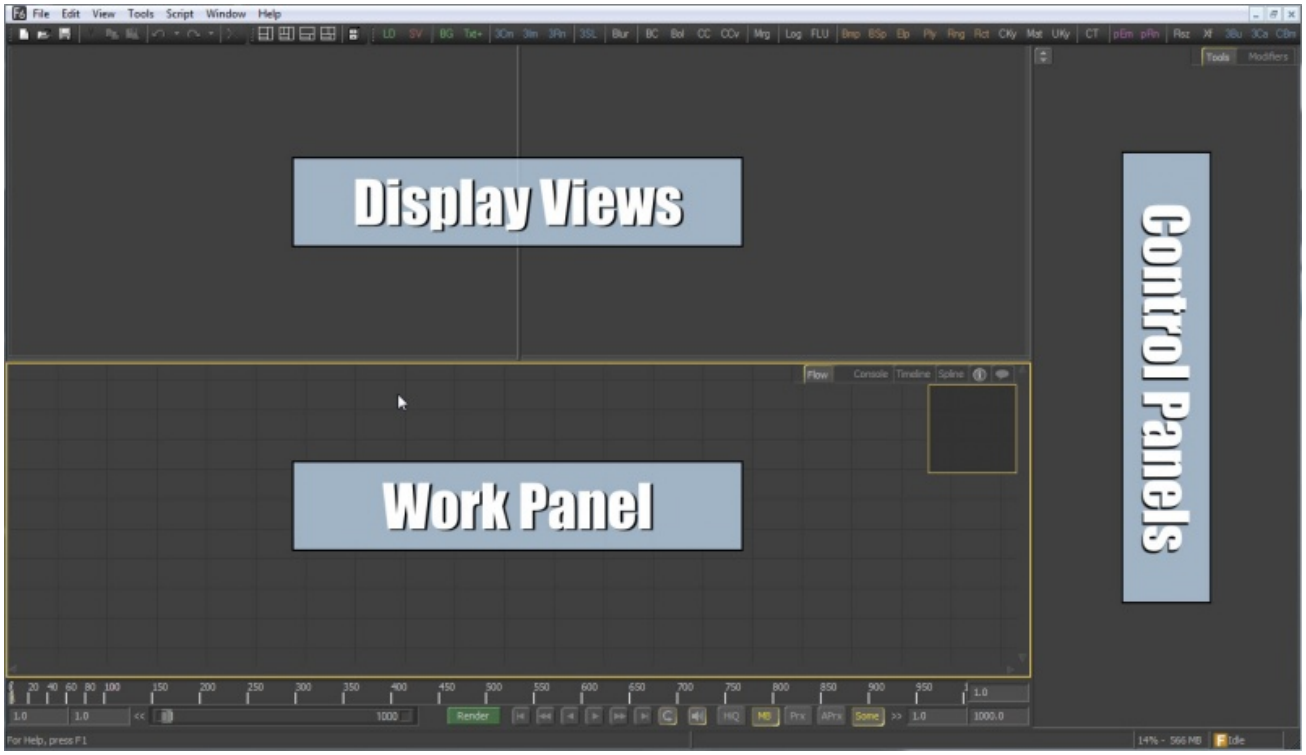
Toolbars

The top of the screen contains the standard application menus which are always located at the top of the application window. In a default Fusion layout there will also be three standard toolbars. These toolbars can be detatched and moved to other parts of the interface. The Tool, Macro and Script Toolbar can be customized to the artists preferences. Additional toolbars can also be created as needed.



See the Menus chapter and Toolbars chapter for more information.

Main Interface



Display Views

The Display Views are used to display 2D images and 3D scenes created within the composition. Display views may also be used to show custom interfaces for analyzing images, such as histograms, waveform monitors, color inspectors and metadata.

See the Display Views chapter for more information.

Work Panel

The work panel is a tabbed region below the display views which hosts 6 interfaces for interacting with Fusion. These are the :

- Flow Editor
- Timeline Editor
- Spline Editor
- Scripting Console
- Comments
- Generation Notes

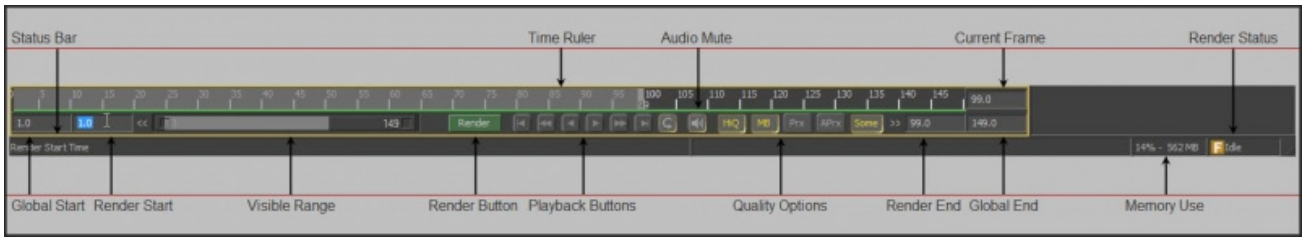
Control Panels

The control panel is a tabbed region on the right side of the window that is used to display the sliders, menus and edit boxes which make up a tools controls. There are two tabs

- Tool Controls
- Modifier Controls

Time Ruler

The Time Ruler is the name given to the controls found beneath the work area. The Time Ruler contains controls for initiating playback as well as setting composition options like current frame, quality, proxy level and motion blur.



See the Time Ruler chapter for more information.

Compositions

The term 'Composition' is used to refer to the Fusion project file. This chapter describes how to create, load, and save compositions. A default installation of Fusion will create a new empty composition when it is launched.

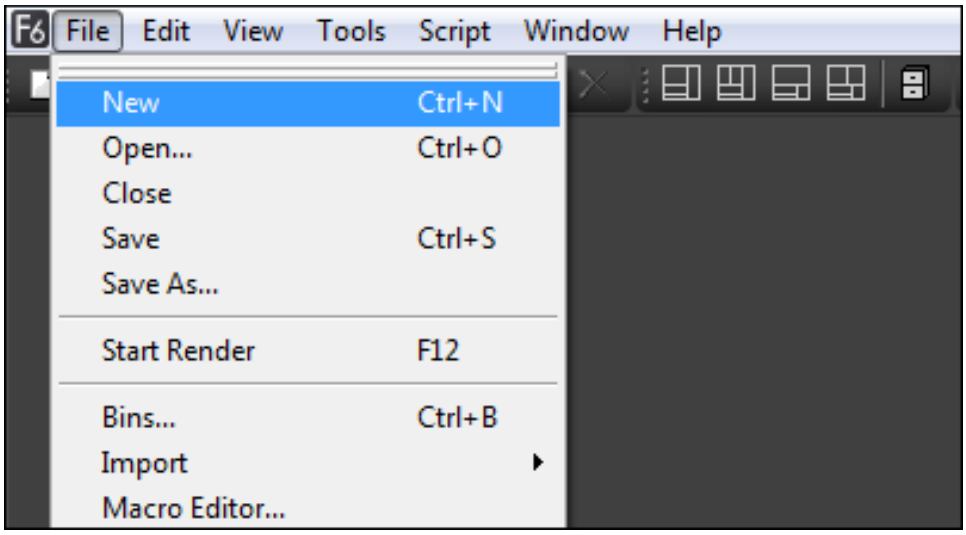
Composition is frequently abbreviated to Comp by Fusion artists.

Creating a New Composition



The following methods can be used to create a new composition :

- Select **File -> New** from the menus at the top of the Fusion window
- Click on the 'New' toolbar button
- Use the *CTRL + N* keyboard shortcut while the Fusion window is active



Saving a Composition

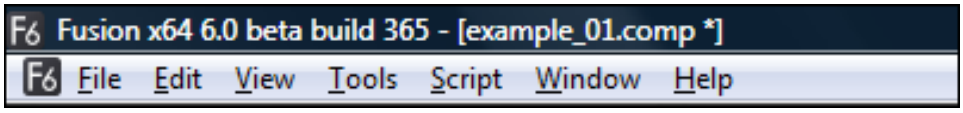


The following methods can be used to save the current composition to the file system

- Select **File -> Save** from the menus at the top of the Fusion window
- Select **File -> Save As** from the menus at the top of the Fusion window to save under a new name
- Click on the 'Save' toolbar button
- Use the *CTRL + S* keyboard shortcut while the Fusion window is active

If the composition has not previously been saved the above methods will ask the artist to provide a file name using the standard file dialog. If the composition has been saved the above methods will save over the existing file. The file extension .comp will automatically be added to the end of the file name chosen by the artist.

Compositions that have unsaved changes will display an asterisk (*) marker next to the composition's name in the Fusion windows title bar, as pictured below.



To save a composition with a new name select **File -> Save As** from the menus at the top of the Fusion window.

Opening a Composition



The following methods can be used to open a composition from the file system

- Select **File -> Open** from the menus at the top of the Fusion window
- Click on the 'Open' toolbar button
- Use the *CTRL + O* keyboard shortcut while the Fusion window is active
- Drag the composition file from the file browser into an empty Fusion window, or to the Time Ruler of the current composition
- Drag the composition file from the bins into an empty Fusion window, or to the Time Ruler of the current composition
- Double click on a composition file in the operating systems file browser

The first three options will all display the standard file dialog.

Closing a Composition



The following methods can be used to close the current composition

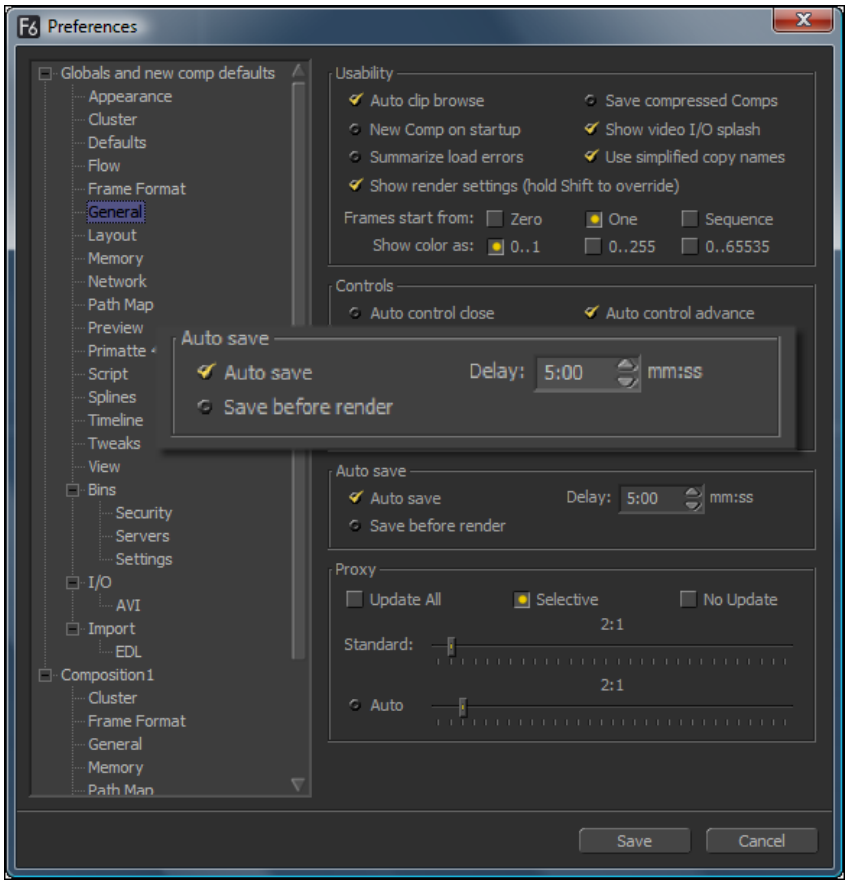
- Select **File -> Close** from the menus at the top of the Fusion window
- Click on the 'Close' icon in the top right of the Composition's window

If the composition has unsaved changes a dialog box will appear asking if the artist wishes to save before closing.

Auto Save

Auto saving is a feature that allows Fusion to automatically save the composition to a temporary file at pre-set intervals. This is to protect the artist from loss of work due to power loss, bugs in the software or accidental closure. A default installation of Fusion has the auto-save feature disabled.

To enable auto save for new compositions open **File -> Preferences** from the menu, then locate **Global:General:Auto Save** in the preferences dialog.



An auto-save file does not overwrite the current composition in the file system. A file with the same name is created in the same folder as the composition, but with the extension .autosave instead of .comp. Unsaved compositions will place the autosave file in the default folder specified by the Comp: path in Paths Panel of the Global preferences.

If an autosave file is present when Fusion loads a composition a dialog will appear asking if the artist wishes to load the autosaved or original version of the composition .

The Composition File Format

Composition files are saved to the file system as human readable plain text files. Using plain text files to describe the project makes it easier for studios to integrate Fusion into existing pipeline and asset management solutions.

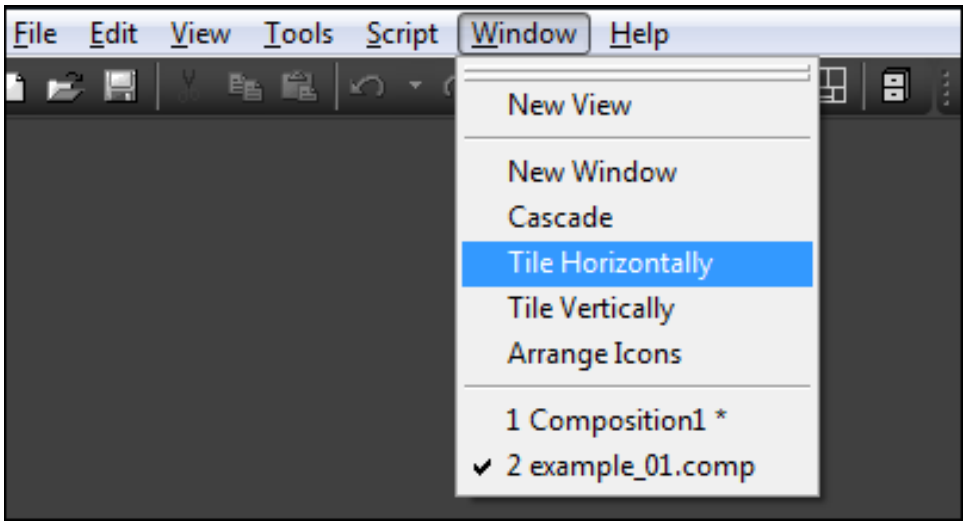
These files can then be opened and edited using any standard text editing program. Fusion is installed with the SciTE text editor which recognizes the format of Fusion compositions and provides additional features such as folding and syntax highlighting. Never use a formatting word processor, such as Microsoft Word or Novell Wordperfect to modify a composition file, as these will generally save additional formatting information which will make the composition unreadable to Fusion.

```
Composition {
    CurrentTime = 1,
    RenderRange = { 1, 100, },
    GlobalRange = { 1, 100, },
    HiQ = true,
    Version = "Fusion x64 6.0 build 365",
    SavedOutputs = 0,
    HeldTools = 0,
    DisabledTools = 0,
    LockedTools = 0,
    AudioOffset = 0,
    Resumable = true,
    OutputClips = {
        "comp:\\out.0001.tif",
    },
    Tools = {
        Bump1 = Bump {
            Inputs = {
                Input = Input {
                    SourceOp = "Transform1",
                    Source = "Output",
                },
                HeightScale = Input {
                    Value = 2.0001,
                },
                MaterialID = Input {
```

Generally speaking the advantages of saving a composition in ASCII format far outweigh the disadvantages, but there is one scenario where it may be desirable to save a composition as a compressed binary file instead of as plain text. Specifically, a composition that contains a very large number of animated polygon style masks may become abnormally large, with sizes in excess of 100MB. In these cases it can be desirable to enable saving of compressed compositions in the **Global:General** preferences.

Multiple Document Interface

Fusion uses a Multiple Document (MDI) interface that allows it to have multiple composition projects open simultaneously. Opening or creating a composition does not close any other compositions which may be open at the time. Instead the compositions are moved to the background.



A list of currently open compositions can be seen at the bottom of the Window menu. The artist can switch between open compositions using one of the following methods :

- Selecting **Window -> composition name** from the menus at the top of the Fusion window
- Using the *CTRL + TAB* keyboard shortcut to toggle between available compositions
- Using the **Window -> Cascade**, **Window -> Tile Horizontally** and **Window -> Tile Vertically** options to automatically arrange the available Compositions so that they are all visible

Having multiple compositions open at once makes it simple for the artist to switch between different compositions, and makes it possible to copy / paste between compositions or to compare parts of one composition with another.

Tools

In Fusion a Tool is an operation that affects one or more images. Tools are responsible for loading images from disk, saving the results of the composition, merging multiple images together, and applying effects like blurs, glows, color corrections and more. This chapter discusses how to add tools to a composition, connect them together, and other basic operations.

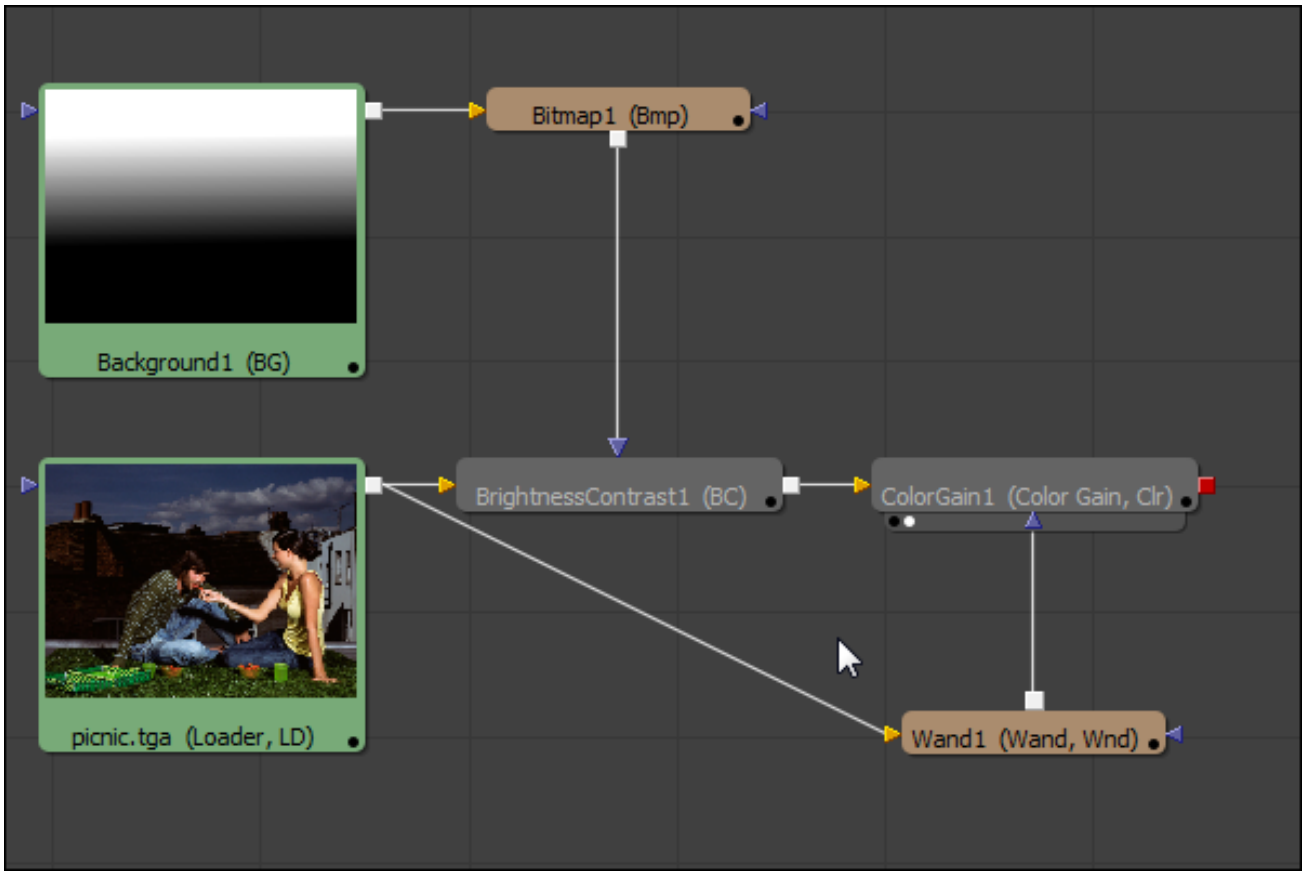
Tools are often referred to by artists as nodes, tiles or operators. These terms are synonymous.

When a tool is added to a composition, a tool tile is added to the Flow editor, and the tools name appears in the Spline and Timeline editors as well. The flow is the only interface where an artist can easily manipulate the connections between tools, so typically this is where the majority of time is spent when working with tools.

Tool Basics

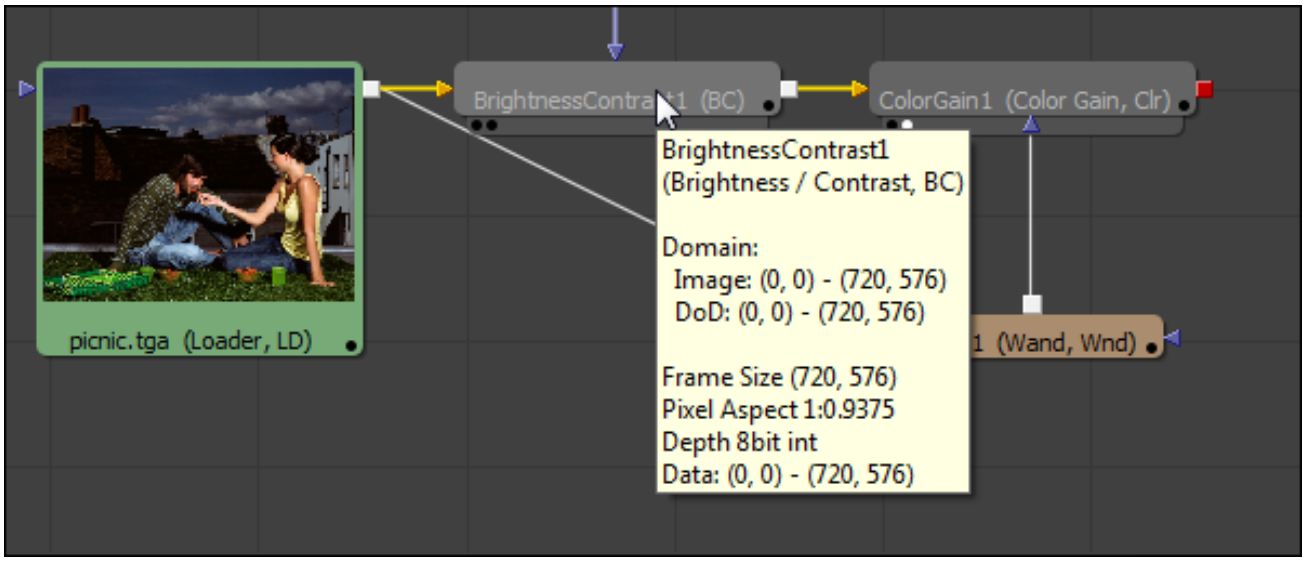
Tool Tiles

Almost every tool in a composition adds a tool tile to the flow. These tiles display show the inputs and output for the tool as small colored icons around the edges of the tile. The arrow-shaped nodes represent the image inputs, and the grey or red square nodes represent the tool's processed output.



The tools name will appear in the center of the tile. Tool tiles can be displayed as a small rectangle or as a larger square. The rectangular form displays the tools name in the center of the tile, while the square form shows either the tools icon or a thumbnail of the image it is outputting. More detail on setting the display options for the tool tiles can be found in the Flow Editor chapter.

Hovering the mouse over a tool will display a pop up with more information about the tool and the image or data it is currently processing.

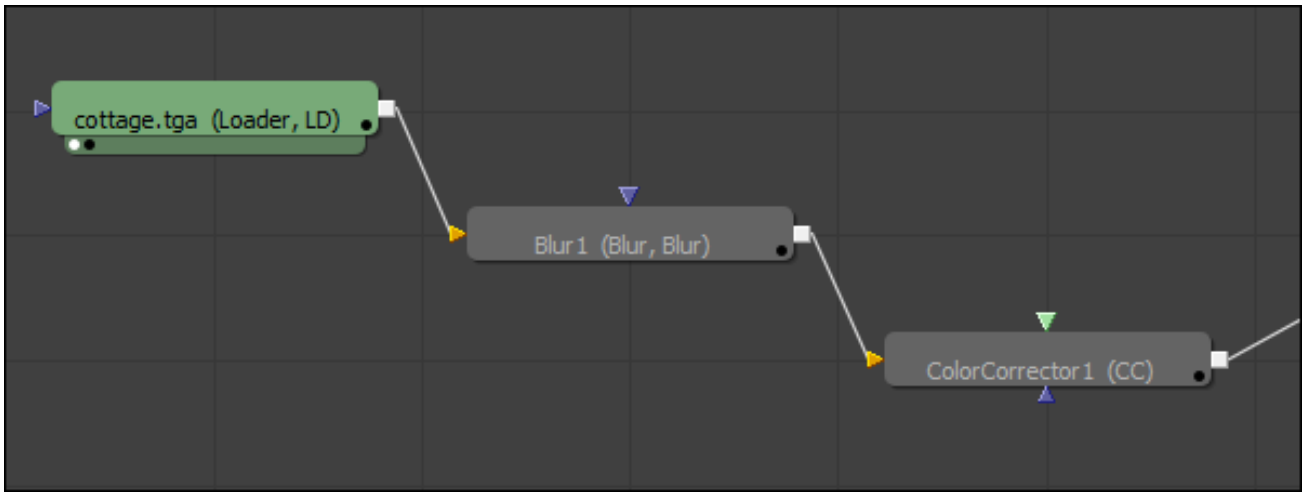


Inputs and Outputs

All tools have one output. They generally also have one or more inputs. Tools are connected together using by drawing connections between the output of one tool and the input of one or more tools. Inputs and Outputs can transmit multi-channel and single channel image data, 3d scene and material data, or particle information. The exact type of data required by each input and produced by each output is described in the tool reference documentation for the specific tool.

Tools cannot have more than one output.

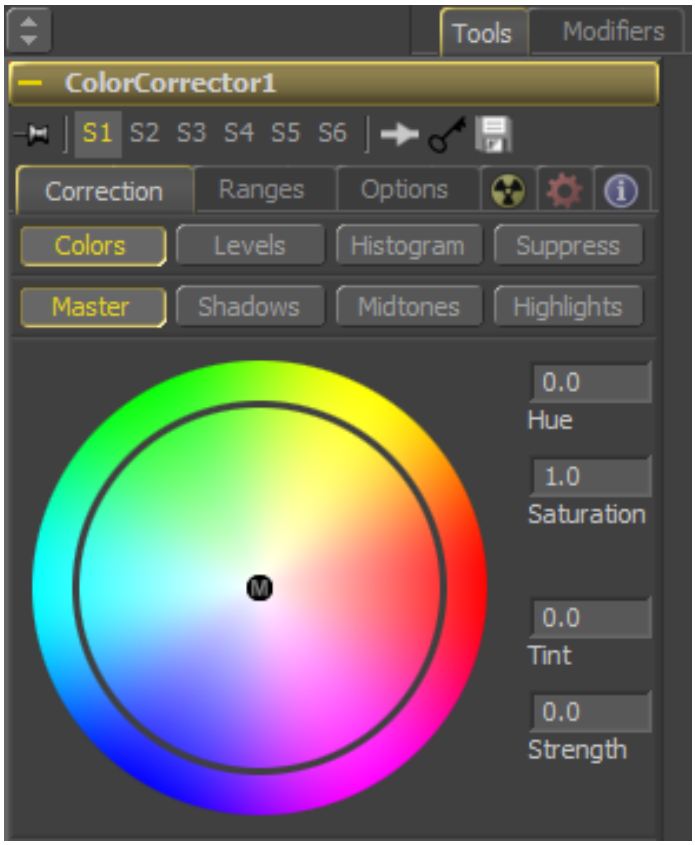
In the example image below a Loader tool's output is connected to a Blur tools input. The Blur tools output is then connected to a Color Corrector.



Holding the mouse pointer over a tool's input will cause a small pop-up containing the input's name to appear after a short time.

Tool Controls

When a tool is selected it's options and settings will appear in the controls panel on the right side of the Fusion interface. See the controls panel documentation for more information.

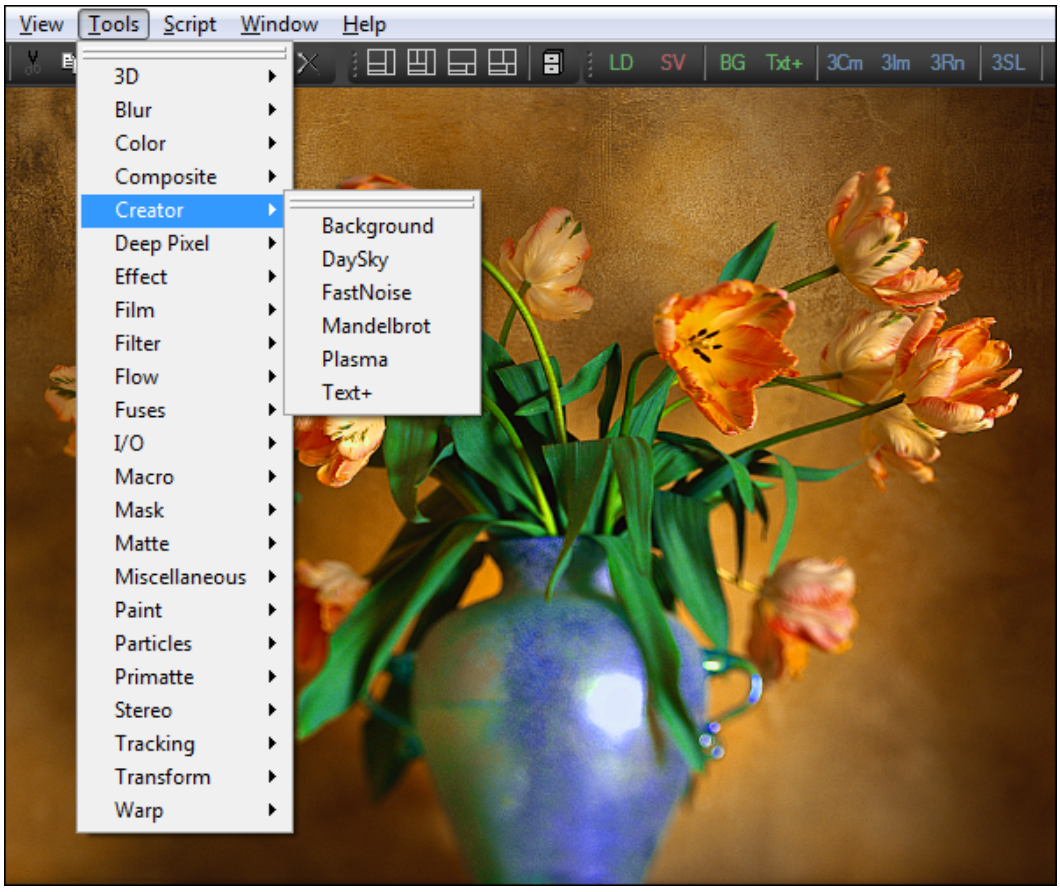


Adding Tools

Tools are added to the composition's Flow Editor using one of the methods described below.

Using The Menus

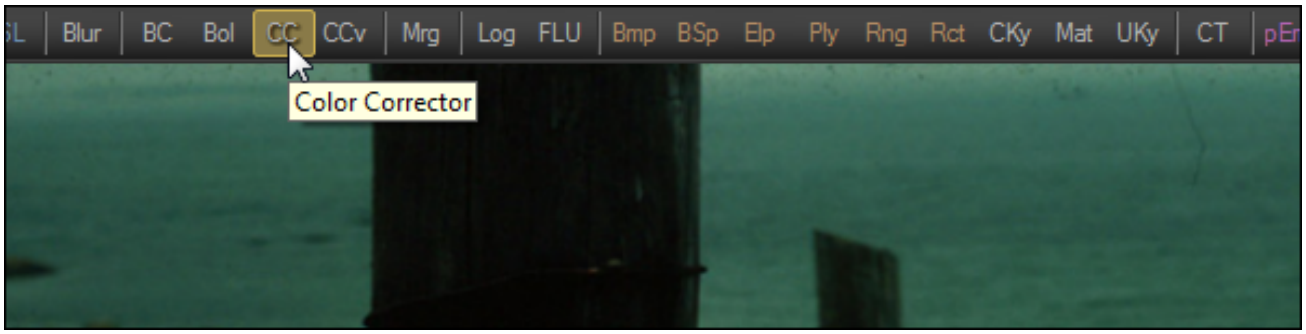
The **Tool** menu at the top left of the Fusion window displays every single tool known to Fusion. These tools are organized into general categories. To add a tool to the composition from this menu, navigate down the category list and select the desired tool.



If another tool is currently active on the flow, the new tool is automatically inserted downstream of the existing tool. The new tool is inserted into the existing connection fo the active tool.

If there is no tool currently active tool in the flow, the new tool will be placed in the first empty space in the flow.

Using The Toolbars



The Toolbars can also be used to add tools to the flow. These small bars display an abbreviated form of each tool's name (i.e. BC for the brightness/contrast tool). Hold the mouse over any toolbar button for a moment to display a pop-up with the unabbreviated name of that tool.

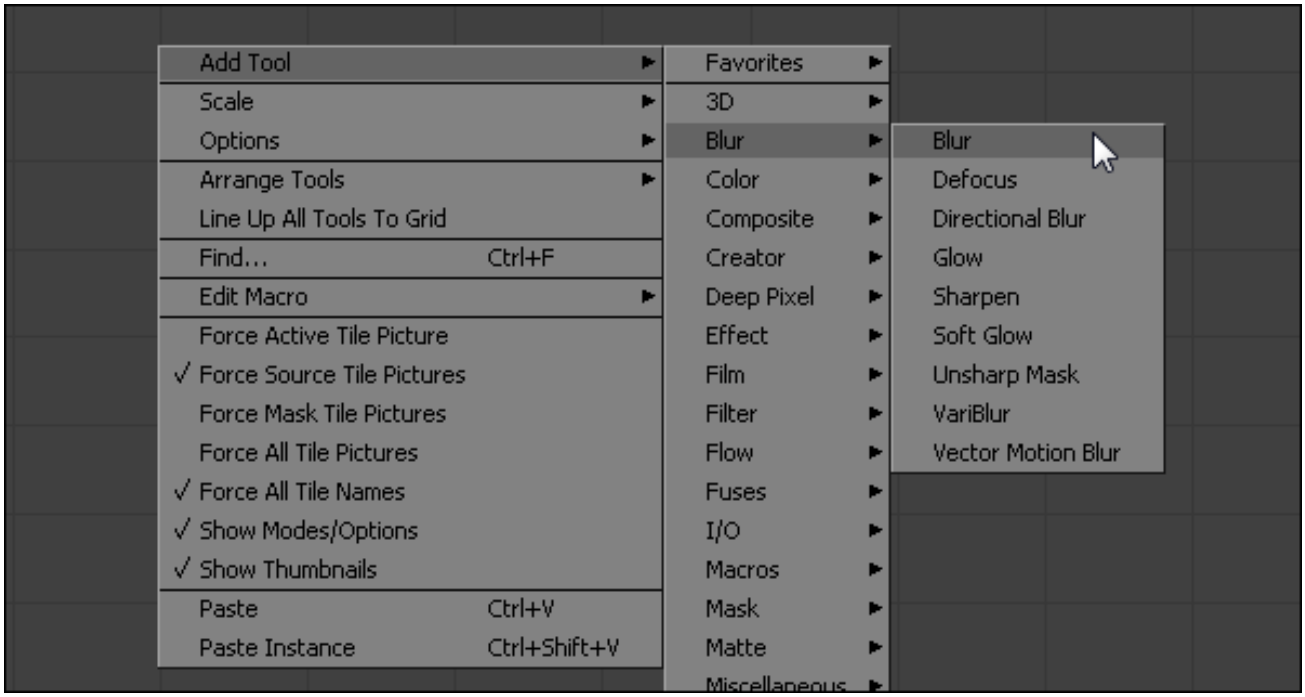
Clicking on a tool's button in a toolbar adds it to the composition exactly as if the tool had been selected from the **Tool** menu (as described above). The artist can also drag the button into the flow to position the tool manually. Dropping the dragged tool over the connection between tools will automatically insert the tool into the connection.

Tools can also be dragged from the toolbars into the left and right display views. This allows tools to be added to the project even if the flow is not currently visible. Tools that are dragged onto a view from the toolbar are added to the flow immediately after the currently viewed tool, regardless of the currently active tool.

For details on using and customizing the toolbars, refer to the toolbars chapter later in this manual.

Using The Context Menu

The **Flow context menu** (displayed when right clicking on an empty part of the flow) and the **Tool context menu** (displayed when right clicking on a tool tile) contain one or more sub-menus that can be used to add tools to the composition.



Add Or Insert Tool

Selecting a tool from the **Add Tool** or **Insert Tool** sub-menus will insert a tool into the flow at the position where the mouse pointer was when the context menu was opened.

If the mouse pointer is positioned over a connection between two tools, the new tool will be inserted into the flow already connected to that pipe (between the existing tools).

Replace Tool

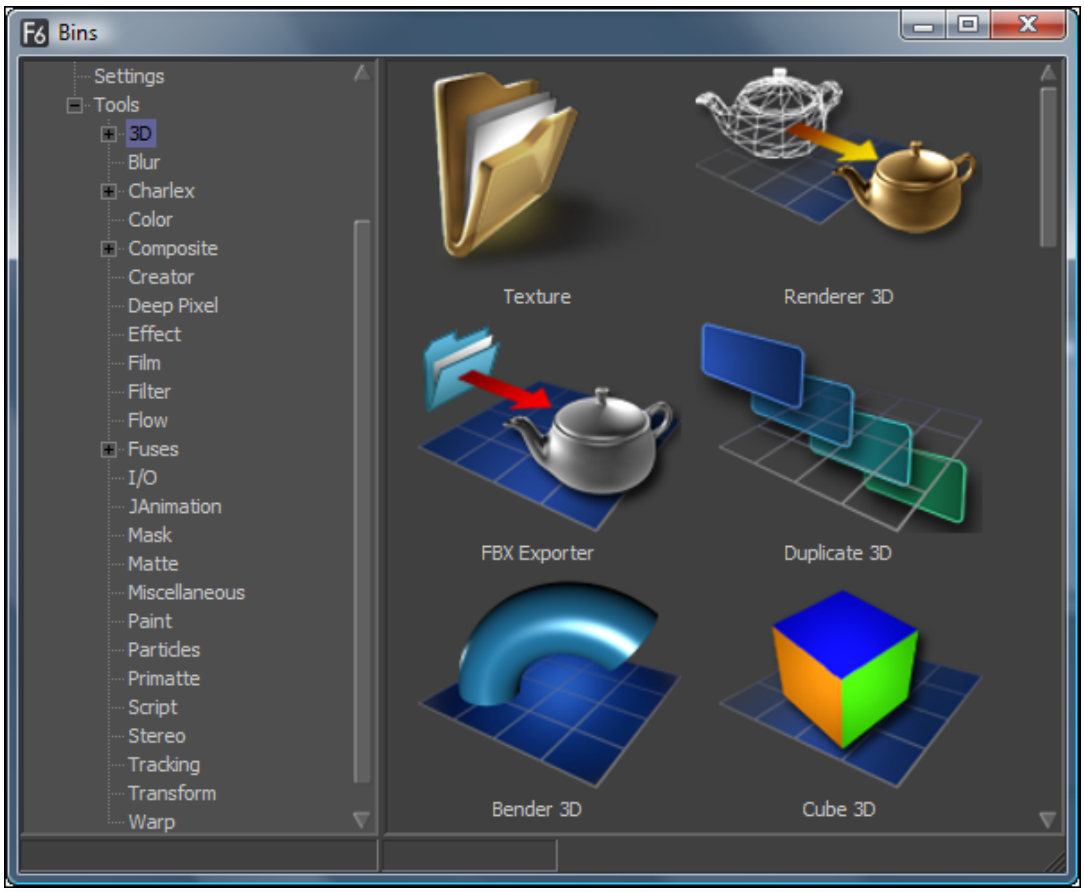
The **Replace Tool** sub-menu only appears when the context menu is opened by right-clicking directly on an existing tool's tile in the flow. Selecting a tool from the Replace menu will replace the current tool with a new one.

If the new tool has controls with the same name as the existing tool, those settings will be copied into the new tool. For example, replacing a Transform tool with a DVE will preserve the values of the center, angle and size controls.

Using The Bins

The Bins can display thumbnail icons for each of the tools and third party plugins that are known to Fusion. To toggle the bins on and off, select *Ctrl + B* from the keyboard, or select **File -> Bins** from the menu.

To add a tool from the bins to the project, drag and drop the tool's icon from the bin into the flow.

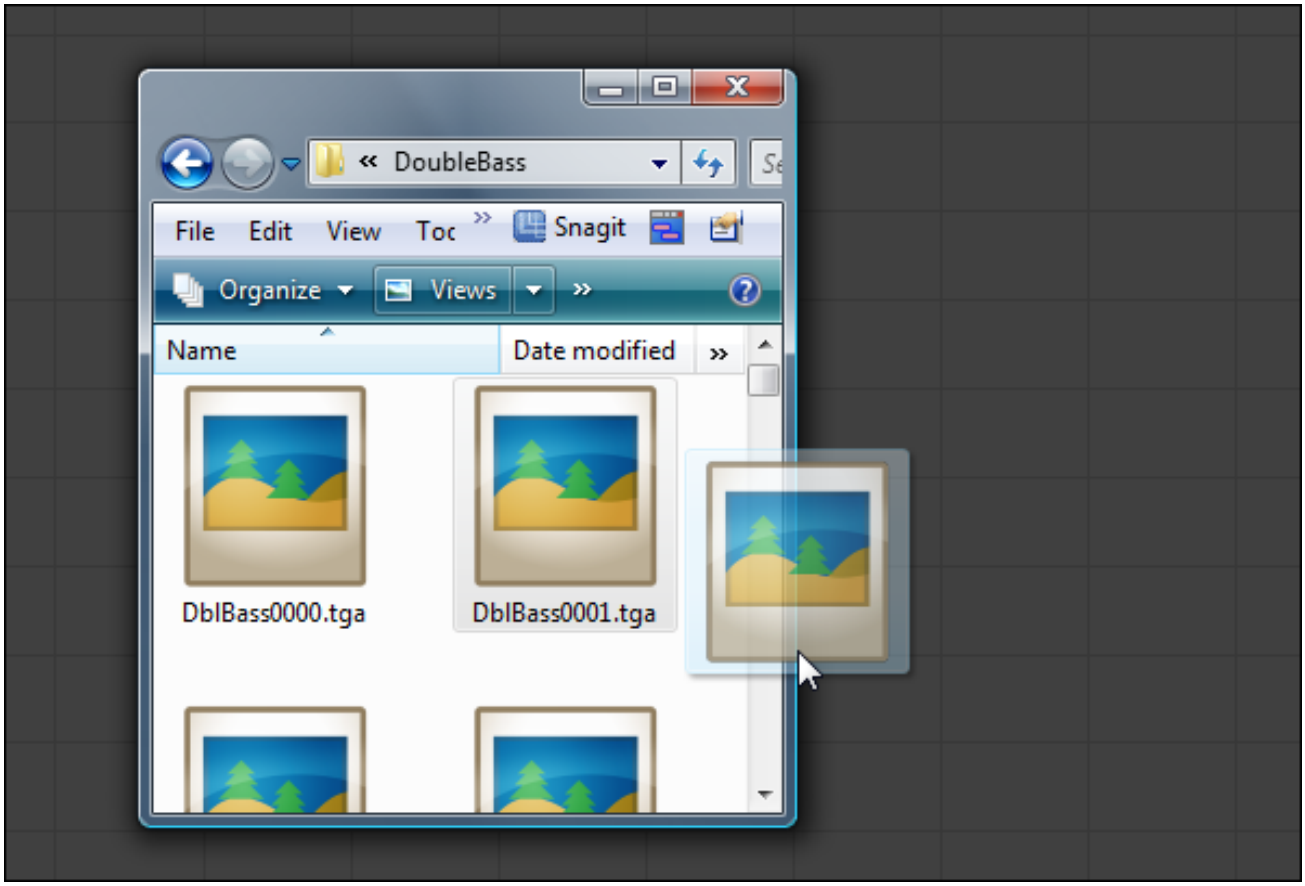


The Bins for a new install of Fusion must be configured to show the tools. They are not automatically placed in the hierarchy. To add the tools to the bins, right-click in the bins and select **Create Tool Folders** from the context menu that appears.

Bins can contain much more than just tools. They provide a useful place for storing shortcuts to saved tool settings, groups, macros and media, making the Bins more flexible than even toolbars. For more information, refer to the Bins chapter of this manual.

Using The File Browser

Dragging and dropping files from the operating system's file browser is an efficient way to quickly add footage or saved tool settings to a flow.



Footage

Dragging a file from the file browser to the flow will automatically add a loader to the flow, directly loading the file or file sequence. If multiple files are dragged into the flow, a separate loader is added for each file.

Holding *SHIFT* while dragging a file from a file sequence will create a Loader tool that is already trimmed to use that file as a still. This can be useful when loading an image taken by a digital still camera.

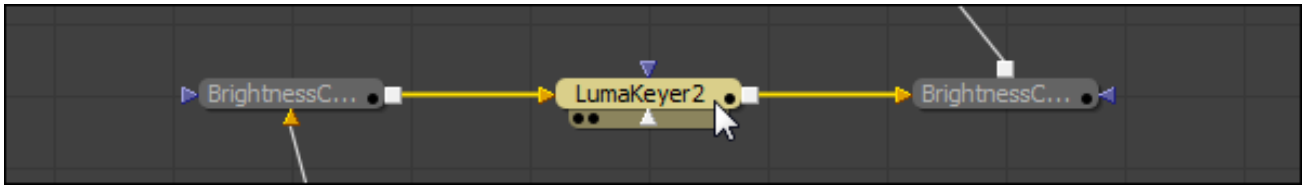
Saved Tool Settings

Dragging a tool's settings (.settings) file from the file browser to the flow will add the tool (or tools) saved in that file to the flow, configured with the settings that were saved into the file.

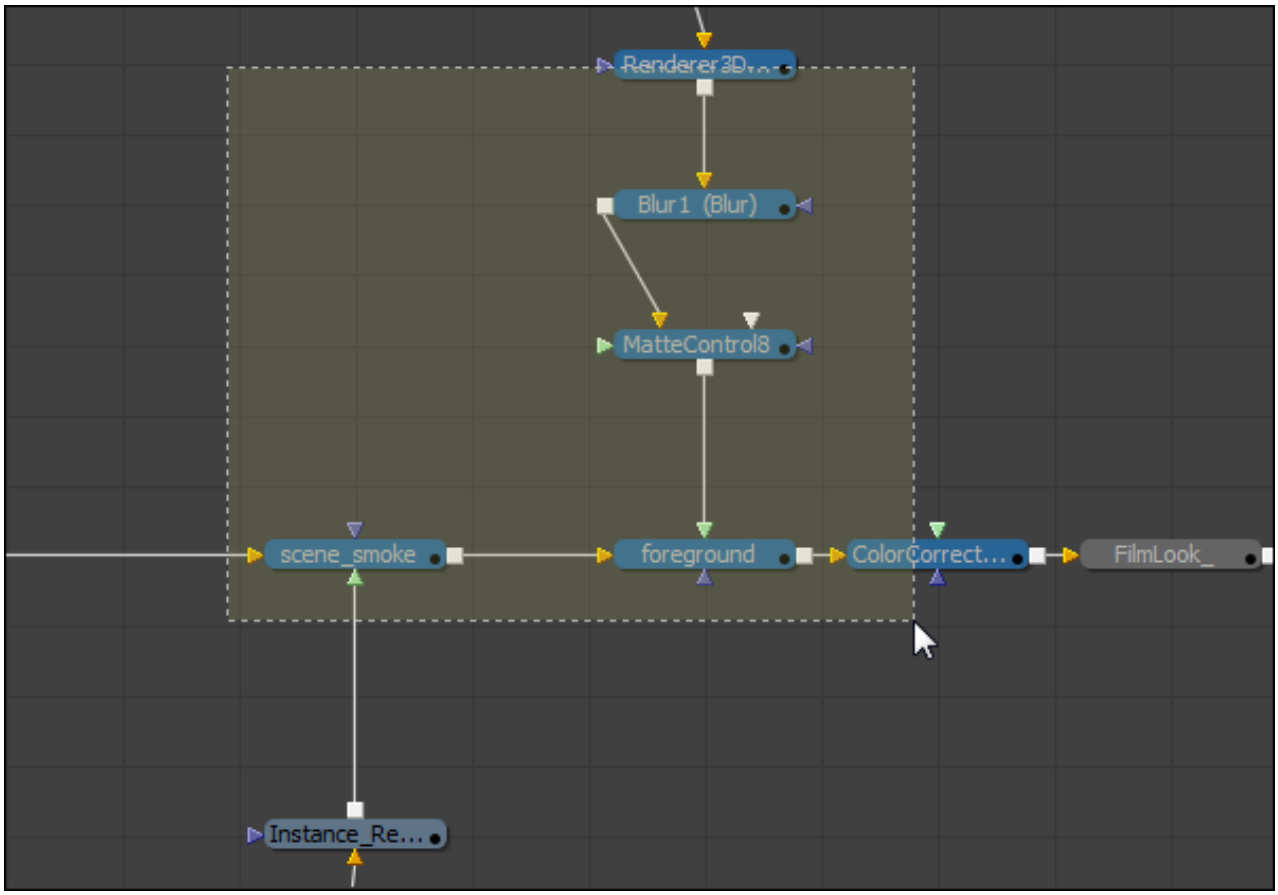
Selecting Tools

In order to move, copy, view or adjust a tools controls it is first necessary to select the tool.

This can be done by *left-clicking* directly on a tools tile, or on the title bar of the tools control window, or even by clicking on the tool's name in the Spline and Timeline Editors. A tool selected this way is known as an **active** tool. The tool tile for the active tool will turn bright yellow. Only one tool can be actively selected at a time.

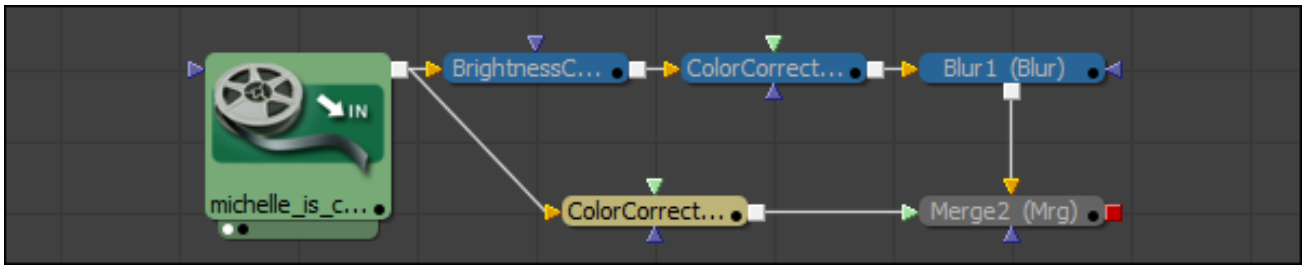


One or more tools can also be selected by left clicking and dragging a rectangle that surrounds the tool or tools to be selected. The tools within the rectangle will be added to the selection group, and the color of the tool tiles will change to blue.



Tools can be added or removed from a selection group by holding down the *CTRL* key while making selections. A selection group may or may not contain an active selection tool.

In the image below there are four tools selected, one of which is active. Two other tools are not selected.



Deleting Tools

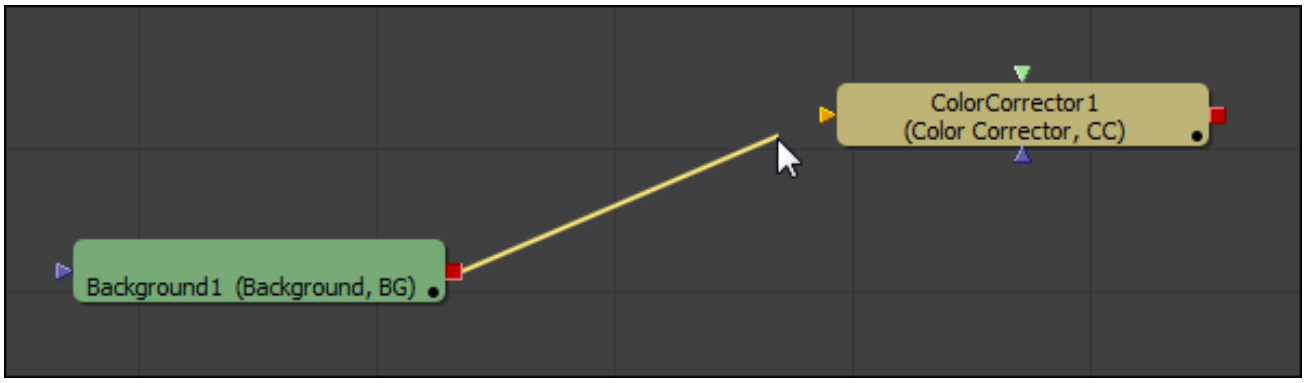
To delete a tool or tools from the composition, first select the tool or tools and then press the *Delete* key on the keyboard. Alternately, *right-click* on one of the selected tools and then select **Delete** from the context menu that appears.

Moving Tools

To move tools around in the flow select one or more tools and then left-click and drag to move them to a new location. All of the currently selected tools will be moved. Larger flows can become disorganized and difficult to understand so several techniques for organizing the flow exist to assist.

Connecting Tools

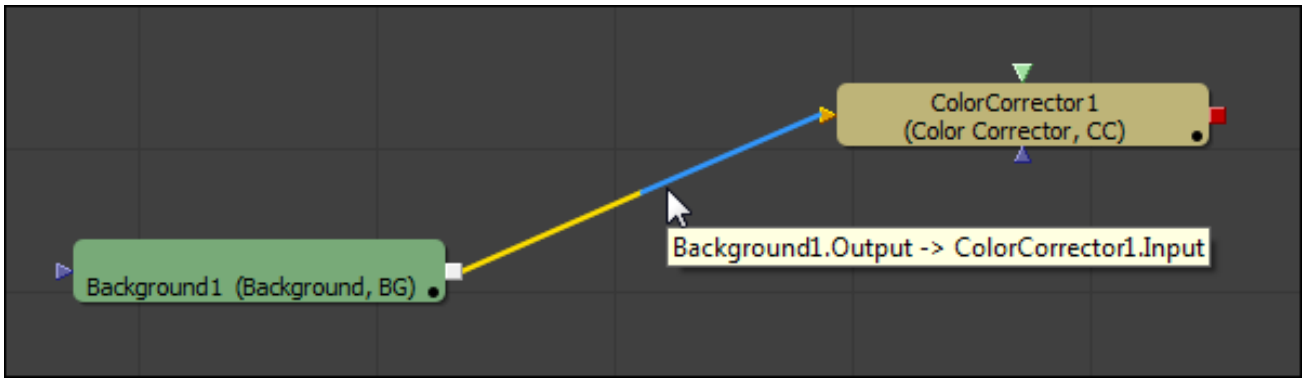
Build a flow by connecting tool tiles together using their inputs and outputs. For example, to connect the output of a background tool to a color corrector tool, the artist would left-click on the output node on the Background tool and drag a connection over the input node of the Color Corrector. A thin line will be drawn between these two nodes to represent that connection.



The connection between tools does not always have to drawn in output to input order. As long as the target input is not already connected to something else it is entirely valid to drag a connection from the input to the output of another tool instead.

Disconnecting Tools

The pipe connecting two tools is divided into two halves; the output half and the input half. To disconnect a tool's inputs or output, click on the input half of the connection between the tools (or click on the input arrow itself) and drag to pull the connection away from the tool.



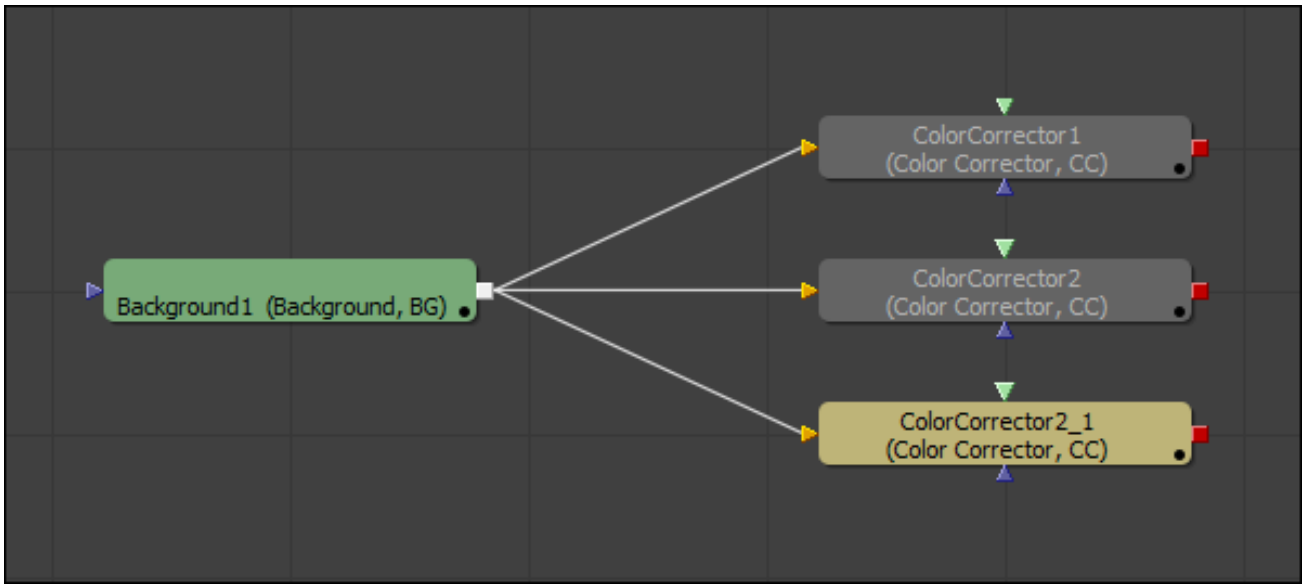
An entire tool can be disconnect by holding down the *Shift* key while moving the tool. If the *Shift* key is still held when releasing the tool then all existing connections to that tool will be removed.

Replacing an Input

Dragging a connection over to an input that already has a connection will create a new connection that replaces the old one.

Branching

The output of any tool can be connected to multiple inputs on other tools, which is a technique called branching. Branching permits a single image to be simultaneously processed by two or more streams of tools.



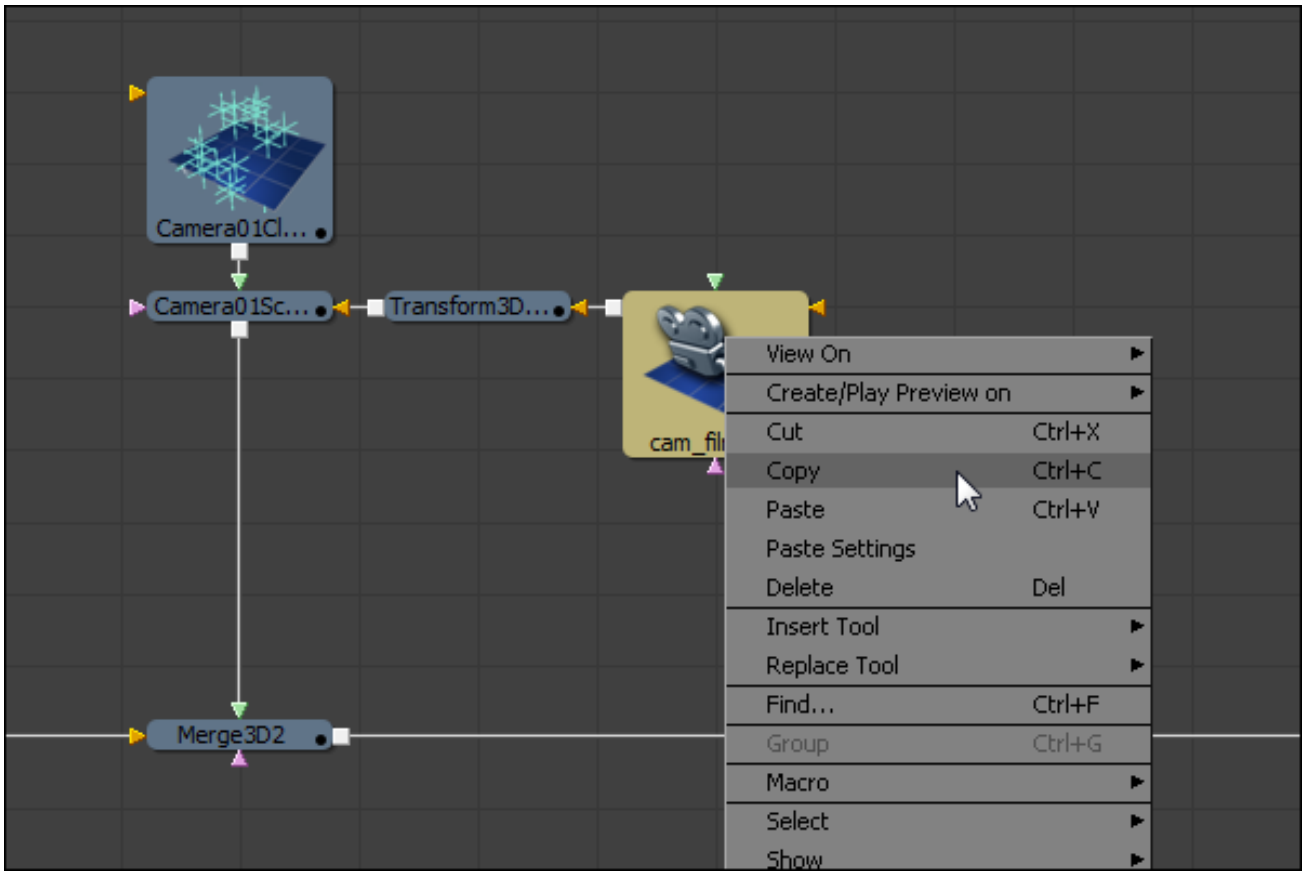
Only one connection per input is allowed but a tool output can have any number of branches and outbound connections.

Copy, Cut and Paste

Copying Tools

There are four ways to copy the currently selected tools to the system clipboard.

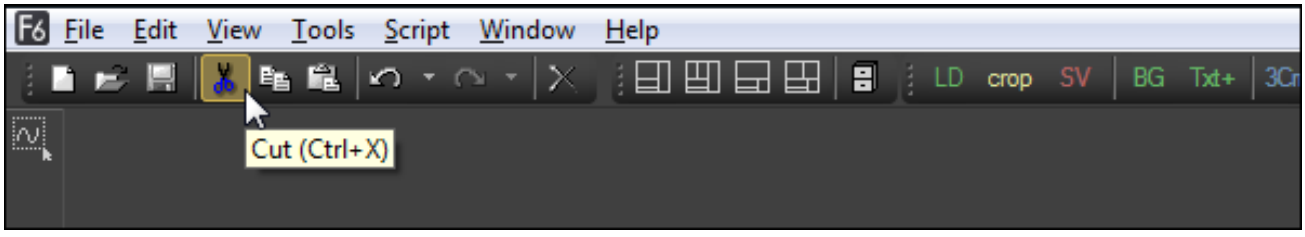
- select **Copy** from the tool context menu
- choose **Edit -> Copy** from the Fusion menus
- click on the Copy icon in the toolbar
- use the *Ctrl-C* keyboard shortcut



Cutting Tools

Cutting removes the selected tools from the composition places them in the system clipboard.

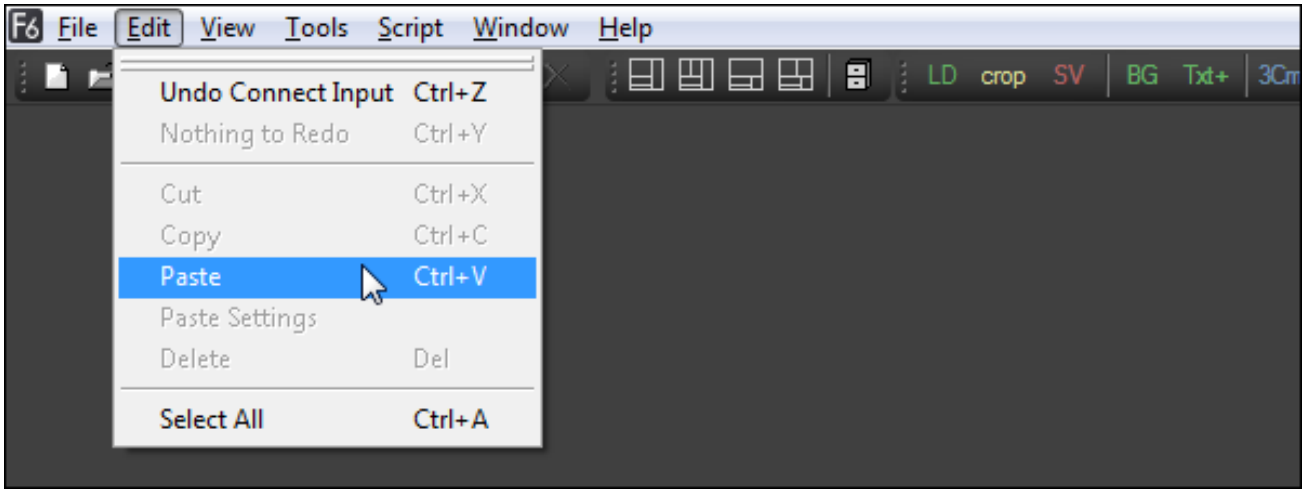
- select **Cut** from the tool context menu
- choose **Edit -> Cut** from the Fusion menus
- click on the Cut icon in the toolbar
- use the *Ctrl-X* keyboard shortcut



Pasting Tools

Pasting will make a copy the tools currently in the clipboard in the composition.

- select **Paste** from the flow context menu
- select **Paste** from the tool context menu
- choose **Edit -> Paste** from the Fusion menus
- click on the Paste icon in the toolbar
- use the *Ctrl + V* keyboard shortcut



The location of the pasted tools in the flow editor varies a lot depending on how the tools are pasted, and whether any tools are selected at the time. The best way to control where the tools appear is to either left-click in the flow and then use the CTRL + V keyboard shortcut, or to use the context menus. In either case, the tools will be placed at the location of the pointer when the mouse was clicked.

To replace a tool already in the flow with the contents of the clipboard, right-click directly on the tool to be replaced and then select Paste from the tool's context menu instead. To insert a tool from the clipboard between two other tools, right-click directly on the pipe between the two tools and select Paste from the context menu.

When the pasted tool is a creator (one that does not have any inputs) the pasted tool will automatically be combined with the active tool using a Merge tool. This auto-merge behavior can be changed with the Default Preference panel in the Global Preferences.

Pasting Tool Settings

Fusion also offers the ability to paste the settings of the tool from the clipboard into another tool. This function has no keyboard shortcut but can be accessed by right-clicking directly on the tool into which the copied settings will be placed.

When copying the settings from one tool to another, only the settings that match between two tools will be copied. For example, when pasting settings from a merge to a transform, the center control values, the blend and the size & angle controls will be copied from one to the other.

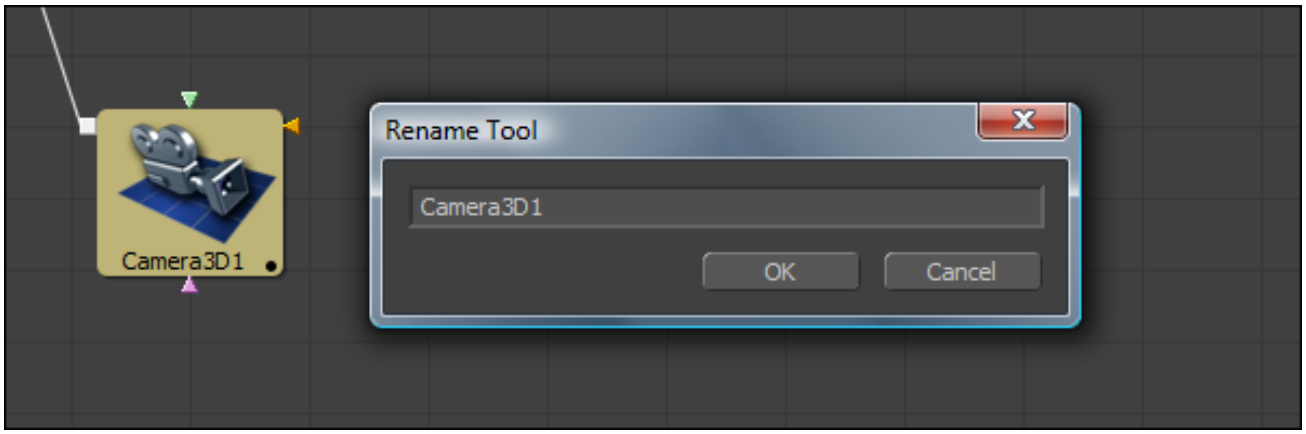
Using a Text Editor

As of Fusion 5.1 and later, tools can be copied from the flow and pasted into a text editor. This will display the tools' data as it would be saved to disk. The text can then be edited and pasted back into the flow, either as a new tool, or to replace the settings of an existing tool.

Renaming Tools

When a tool is added to the composition it will automatically be assigned a name that reflects the name of the tool followed by an number. For example the first Blur tool added to a composition will be called "Blur1".

A tool can be renamed by selecting rename from the **tools context menu** or by using the *F2 keyboard* shortcut. If multiple tools are selected a dialog will appear asking for a name for each tool.



Valid tool names use alphanumeric characters only and cannot contain any spaces. A tool name may not start with a number. This ensures that the tools name remains a valid identifier in the eyeonscript and python languages. Fusion will automatically replace spaces with _ and strip away invalid characters.

Tool Defaults and Settings

Saving New Defaults

When a tool is added to the composition it's controls are set to the default values. The artist can override the default settings with their own custom settings by right clicking on the tool and selecting **Settings -> Save Default**.

When Fusion is constructing the tool it first looks for a .settings file with the same name of as the tool in the folder defined by the

Globals -> Path Maps -> Defaults

preference. If one is found then the settings stored in that file will be used instead.

For example, the default setting for a Blur tool would be called Blur_Blur.setting. The template for the name of the default settings file is INTERNALNAME_PUBLICNAME.settings. This is partly to ensure that plugin tools with identical names to Fusion tools do not overwrite the defaults for Fusion tools.

Removing a Saved Default

To remove a saved default for a tool either delete the .settings file from the Defaults folder or right click on the tool and select **Settings -> Reset Default**.

Saving Tool Settings

The current settings for one or more tools can be saved to disk for later retrieval. These settings can then be loaded from disk, added to the toolbars or bins and retrieved from the tool context menu.

The following methods can be used to save settings for one or more tools.

- Select and then right click on the tool(s) and then choose **Settings -> Save As** from the context menu. A file browser dialog will appear pointing at the folder specified by the

Globals -> Path Maps -> Settings

preference.

- Select and then drag the tool(s) into the bins. This automatically displays the same dialog described above, and also adds a shortcut for the saved settings into the bin.

Unlike saved defaults the .settings files can be saved anywhere on the filesystem. They do not need to be in the default Settings folder.

Loading Saved Settings

To load a setting to an existing tool select **Settings -> Load** from the tools context menu and locate the .setting file using the Filebrowser. The **Settings** sub-menu also displays a list of the last few .settings created with that tool for easy access.

Saved settings can also be used to create new tools by dragging the settings file into the flow from the toolbars, bins or a standard file browser.

Custom Bin Icon for Saved Settings

To create a custom icon for a saved setting create a 32 bit bitmap (.bmp) with exactly the same name as the .settings file and save it to the same folder. The bitmap will be used as the icon for the file when it is added to the bins. The bitmap can be any size, but it is suggested to keep it small for performance.

Scaling and Panning the Interface

This chapter explains how to adjust the position and scale of the main panels in the Fusion interface. The methods describe here generally apply to all parts of Fusion.

The various panels may also provide additional methods for panning and scaling. These will be described in more detail in the chapter dedicated to that panel. Examples of this include the Flow's Navigator window and the Spline Editor's axis labels.

Panning

To pan or reposition the display of any part of the Fusion interface hold the *middle mouse button* down and drag in the desired direction. The artist can also click-drag on the scroll bars that appear on the right and left sides of each interface elemnt when off screen elements are present.

If the mouse does not have a middle mouse button, hold the *Ctrl-Shift* keys down while clicking the *left mouse button*.

Scaling

To smoothly adjust the scale of a panel place the mouse pointer over that interface panel and hold the *left and middle mouse buttons* down while dragging the pointer. Moving the pointer to the left will zoom out and moving to the right will zoom in.

To scale panel in steps place the mouse pointer over the interface and hold down the *middle mouse button*. While holding down the middle mouse button, click on the *left mouse button* to increase the scale, or the *right mouse button* to decrease the scale.

The + and - keys on the numeric keypad can also be used to scale the interface panels.

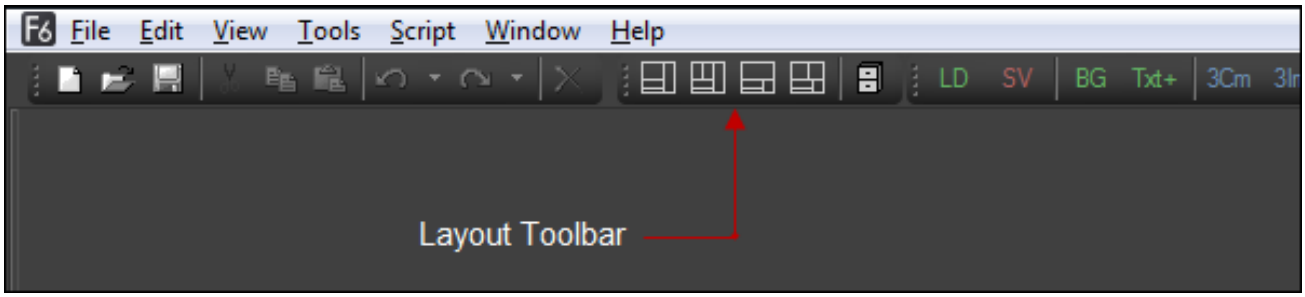
Layout

The size of each interface panel can be set using preset configurations or they can be adjusted manually with the mouse. The display views and work panels are complementary; the more space used to display the work panel, the less space available to show the display views.

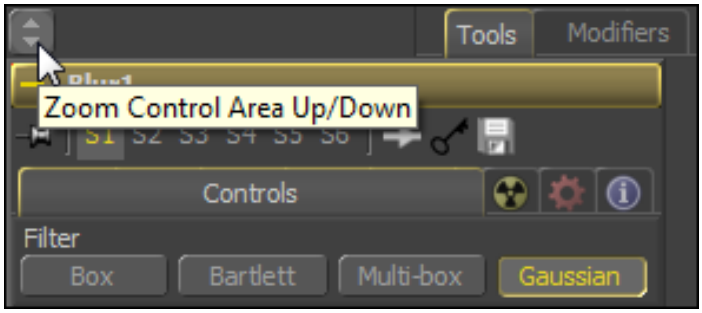
To resize a panel manually *left click and drag* anywhere along the raised border surrounding the edges of the panel.



The layout toolbar provides four preset panel layouts. In a default installation the toolbar is found beneath the menus at the top left of the window.



The top of the tool controls area can be aligned to the bottom of the display view or to the top of the screen. To toggle between these modes, click on the small arrow button in the top left corner of the tool controls. The display views will adjust their width to compensate automatically.



The *F4* keyboard shortcut will collapse all interface panels except the one under the mouse pointer, allowing it to take over almost the entire screen. The *F4* key is a toggle, selecting it again restores the previous layout.

ROI and DOD

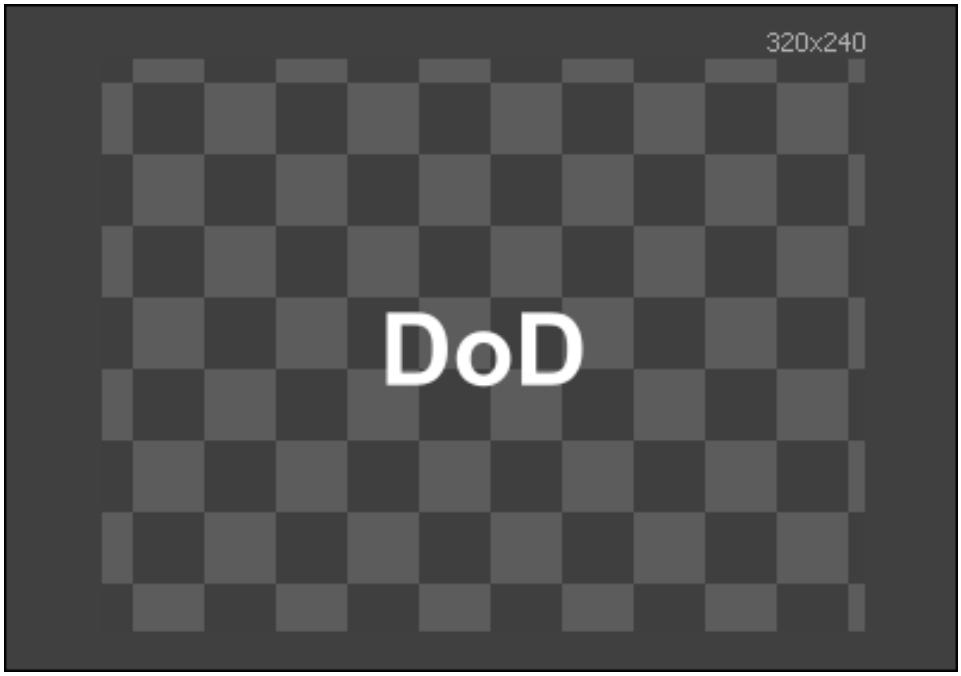
Rendering in Fusion 6 can take advantage of advanced techniques called Region of Interest and Domain of Definition to dramatically improve

Domain of Definition

In compositing the domain of definition refers to a rectangular region that defines what part of an image actually contains data. Domain of definition makes the concept of an image's actual resolution somewhat flexible, since rendering is no longer limited to the actual width and height of the image. This has two effects on the way Fusion renders images.

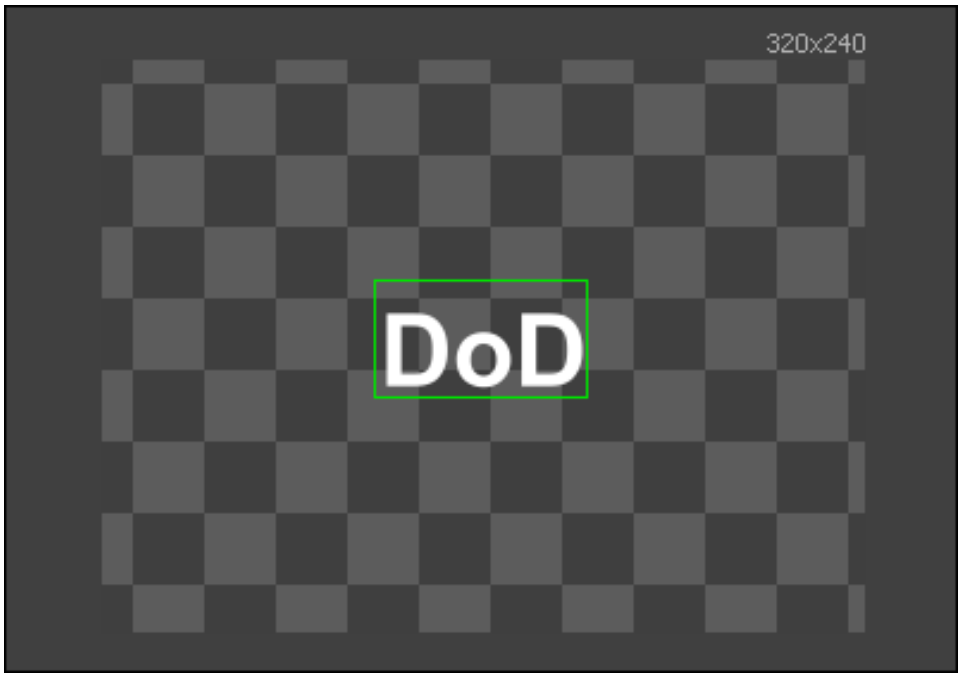
Firstly, tools will no longer be required to render portions of the image that do not get affected by the tool. This helps the renderer to optimize its performance. Secondly, Fusion can now keep track of, and apply a tools effect to pixels which lie outside the visible portion of the image. This concept is often referred to as an 'infinite workspace' or 'infinite canvas'.

The term domain of definition is frequently abbreviated to DoD.



For example consider the above 320x240 pixel image, which shows the output of a Text+ tool rendered against a transparent black background. The text only occupies a portion of the pixels in the image. Without domain of definition Fusion would be required to process every pixel in the image. With a DoD Fusion is able to optimize effects applied to the image, producing faster results and consuming less memory in the process.

The following image shows the same image with the DoD outlined in green.

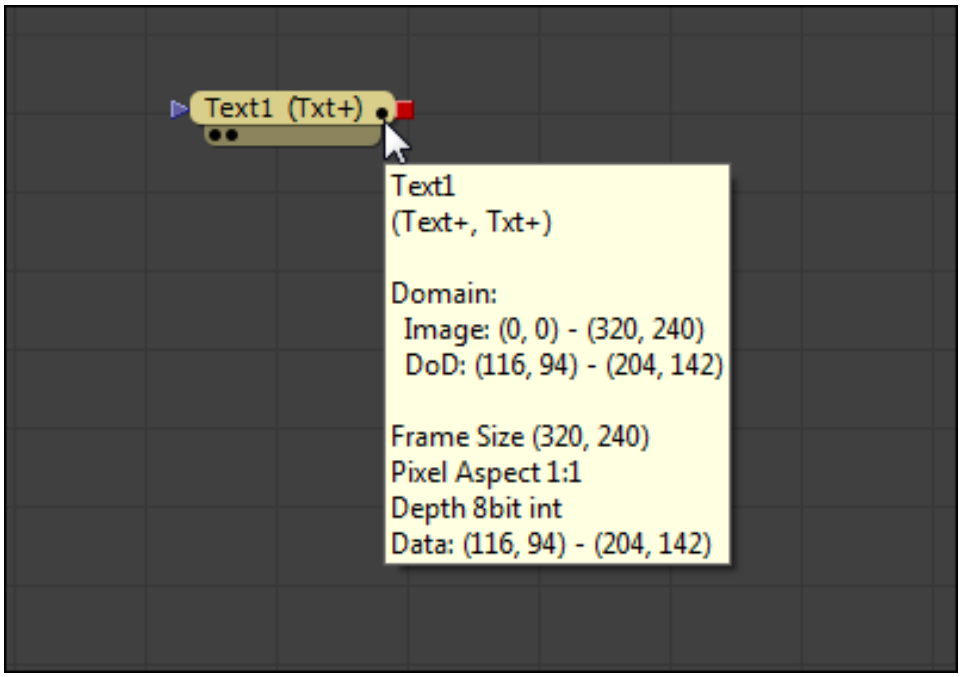


For the most part, the domain of definition is calculated automatically and without the need for intervention from the artist. For example, all of the tools in the Creator category automatically generate the correct DoD. For tools like FastNoise, Mandelbrot and Background this is usually the full dimensions of the image. In the case of the Text+ and virtually all of the mask tools the DoD will often be much smaller.

Media loaded from disk will typically also have the DoD default to the full image width. The exception is media stored in the OpenEXR or Fusion RAW file formats. These formats are capable of storing the DoD of the image, and Fusion will apply this when loading the image.

The domain of definition is established as soon as the image is created or loaded into the composition. From there it passes downstream, where tools combine it with their 'region of interest' in order to determine exactly what pixels should be affected by the tool. The region of interest concept is described in more detail later in this chapter.

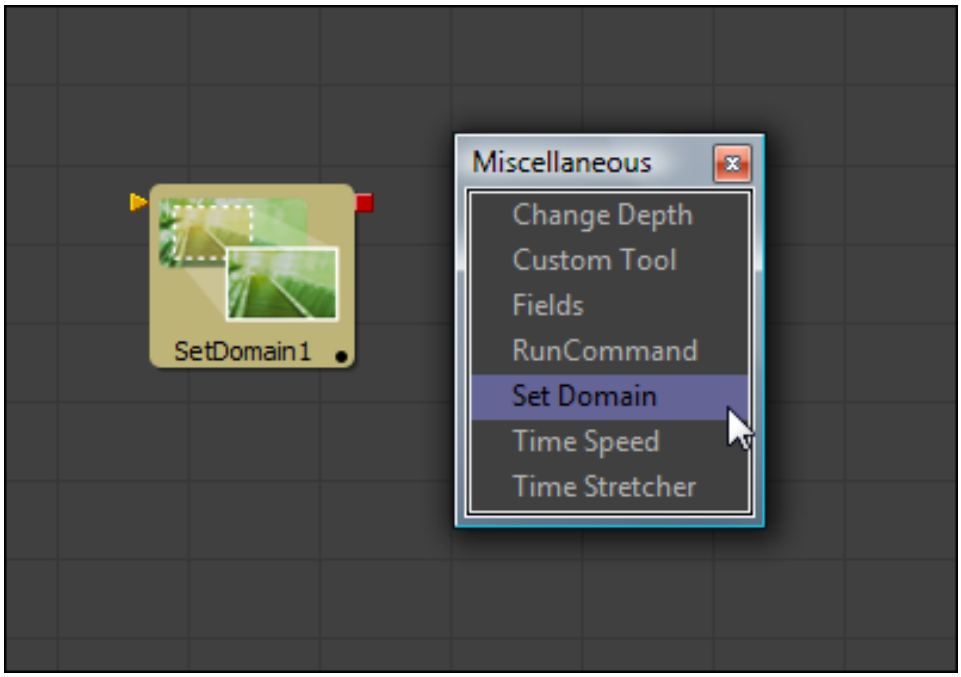
Tools will shrink, expand or move the DoD as they apply their affect the image. This causes the DoD to change from tool to tool. The current DoD for a tool is indicated in the tooltip that appears when the mouse hovers over the tool tile for a moment in the flow, as pictured below.



The DoD is shown as two xy co-ordinates indicating the corners of a rectangular bounding box (in pixels). In the screenshot above the DoD is XXX x YYY, XXX x YYY.

In addition to the DoD used by each tool, the tooltip also shows a the current image dimensions. It may also display a field named 'data', which describes the portion of the image which was last rendered by the tool after combining the DoD with the region of interest.

Note that this information will only appear in the tooltip if the tool has rendered at least once.



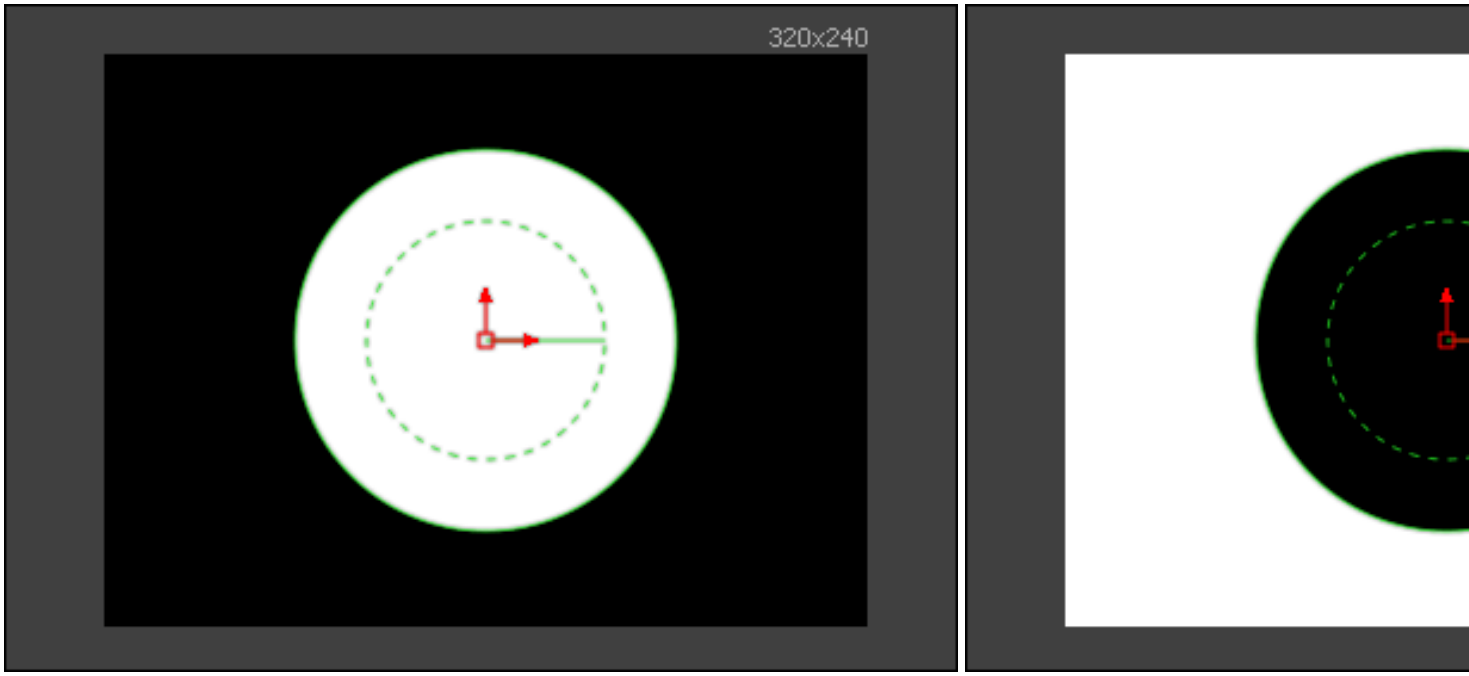
It is also possible to set the DoD for an image manually using the Set Domain tool (found in the Miscellaneous category). This can be useful when dealing with pre-created media that does not occupy the full image dimensions. For example a rendering of a 3D character who walks toward the camera will frequently only occupy a portion of the image. The Set Domain tool can

be used to animate a DoD that covers the character and ignores the rest of the image.

Sampling Outside the DoD

While the DoD's impact of Fusion composites is mostly positive, there are places where it significantly changes the way artists approach a composite. Most frequently this occurs in places where the effect must use or sample pixels that lie outside the current DoD.

The following images best demonstrate the issue. Below we see three images. The first image shows an ellipse mask, the second shows what happens when using a Channel Boolean tool to invert the image without DoD, and the third shows what the same result, but with a DoD.



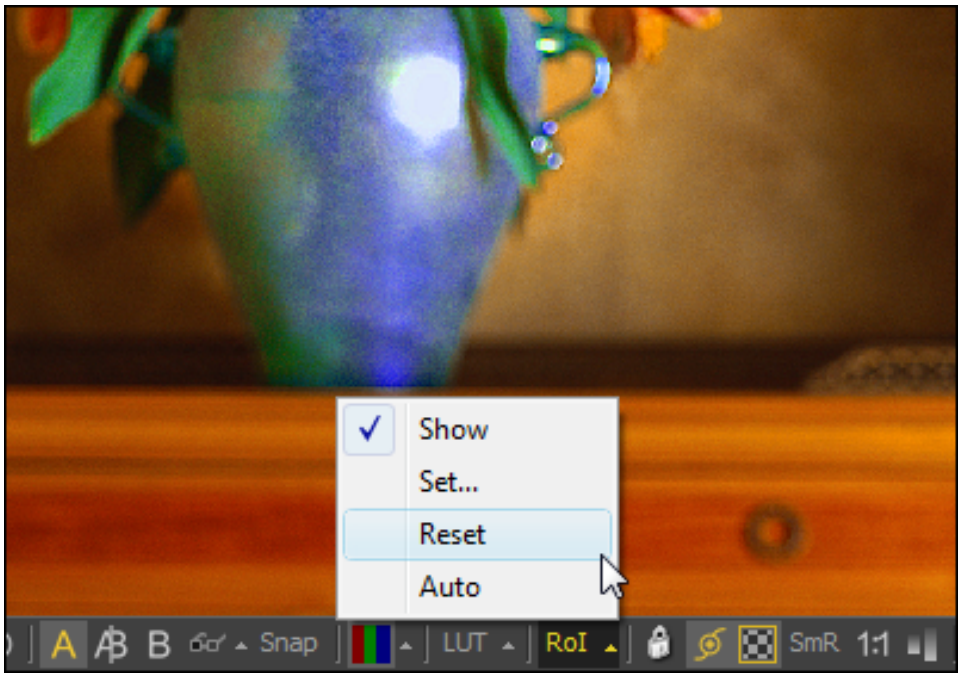
As you can see, the Invert operation is applied only within the area of the DOD. This is usually not the desired result.

Region of Interest

The region of interest is a rectangular region like the domain of definition. Unlike DoD, which tells the renderer what pixels are actually present in the image, the region of interest tells the renderer which pixels actually need to be rendered. When a tool renders it combines the current region of interest with the current DoD to determine what pixels should be affected.

The term region of interest is frequently abbreviated to RoI.

Artists often use the RoI to restrict rendering to a small region of the image. This can significantly improve performance when working with very large compositions or complex compositions.



The RoI button in the 2D display view toolbar can be used to turn the the Region of Interest on or off for that display view. The **Region -> Enable Region** option in the display views context menu will also toggle the RoI. Clicking on the small arrow next to the RoI toolbar button will display the same list of options shown in this context menu.

When RoI is enabled a rectangular RoI control appears in the display view. If this is the first time RoI has been enabled it will be set to the full width and height of the image. Otherwise the last known position of the RoI for that view is used.



Click and drag on the edges of the rectangle to adjust the size of the RoI. Click and drag on the corners of the rectangle to adjust both dimensions at once. To move the RoI without adjusting it's dimensions click and drag on the small circle found at the top left corner of the RoI

rectangle.

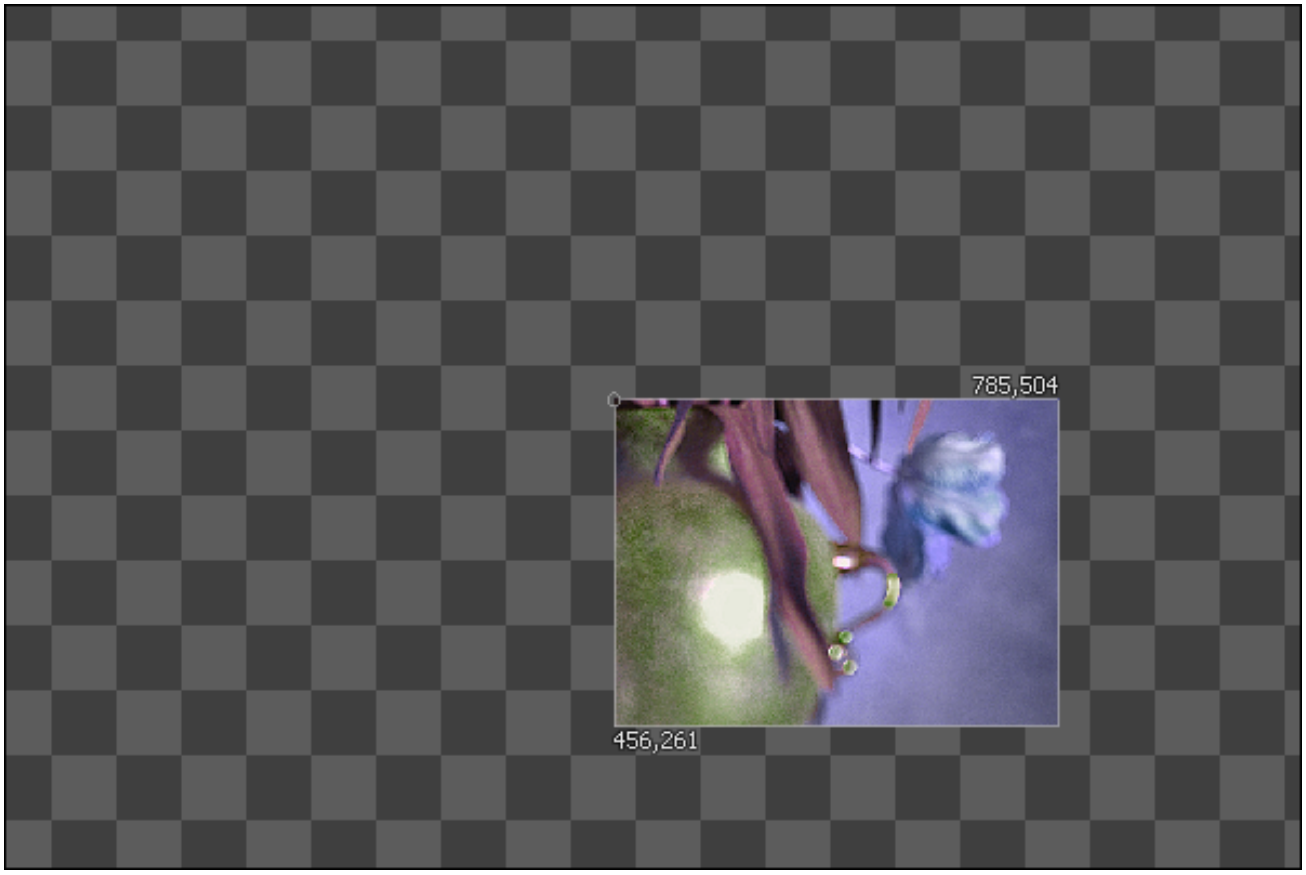
A faster way to set the RoI is to select **Region -> Set** and then click drag in the view to set a RoI rectangle directly.

While the RoI is active Fusion will only request rendering of the pixels inside the region when it displays an image in that view. Flipbook previews created in that view will also respect the current RoI. Saver tools will always use the full image dimensions when writing the image to disk, ignoring any RoI set in the views.

The RoI improves not only rendering speed and memory use, it can also reduce file I/O, since the Loader tool will only attempt to load pixels from within the RoI. This does require that the file format support direct pixel access. The Cineon, DPX, OpenEXR, TIFF and many uncompressed file formats are some of the formats that support this feature.

Changes to the viewed image size will cause the pixels outside the RoI to be reset to the image's background colour. This also includes switching in and out of Proxy mode, as well as Proxy mode switching that happens with Auto Proxy enabled. While the image size is maintained, so will the pixel values outside the RoI when they were last rendered. This can be useful for comparing changes made within the RoI with a previous tool state.

The following images shows how a color correction looks with an RoI applied when Auto Proxy mode is on, and when it is off.





To reset the RoI to the full width and height of the image select **Region -> Reset** from the context menu or the toolbar button menu.

Interface

Flow

The Flow Editor is displayed below the large image display and is Fusion's primary workspace. The flow provides a schematic-type overview of the structure of the project. Each tool is represented by a tile in the workspace, with connections to and from the tile to indicate how each tool relates to the overall processing of the image result.

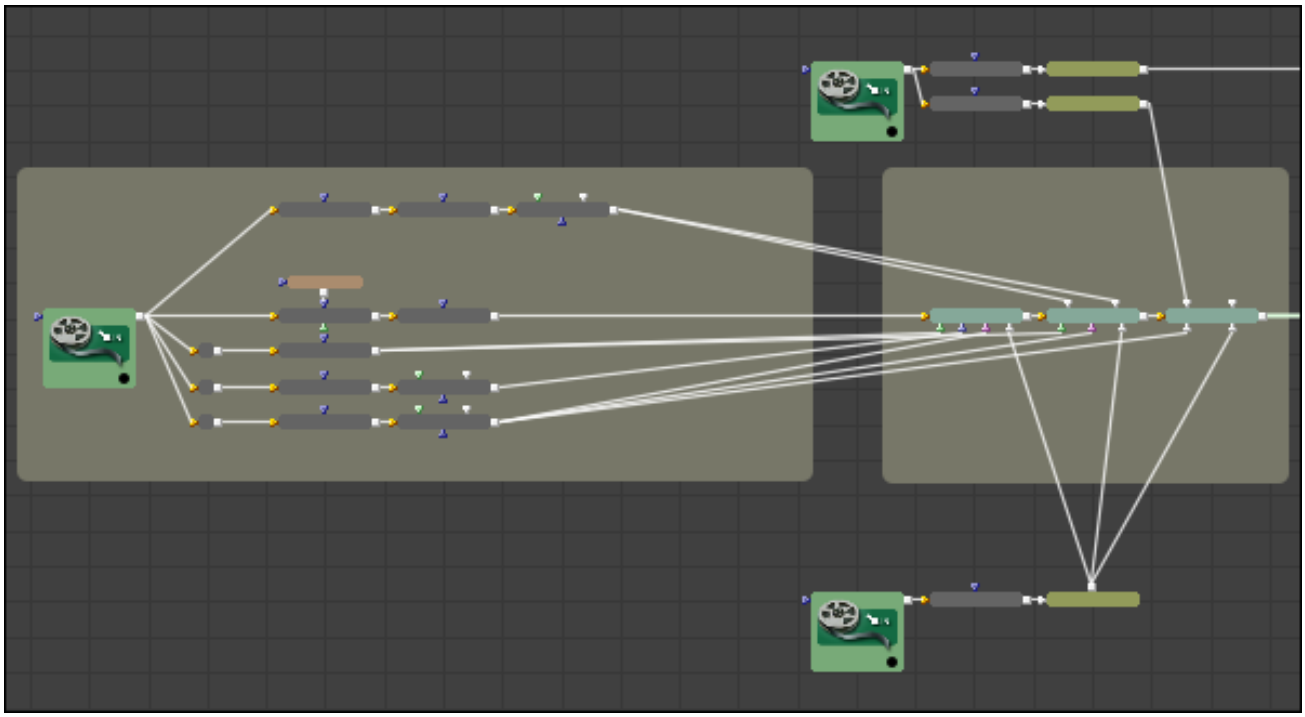
This workspace is known as the flow because images move through the connections like water through pipes. By watching the flow of images through the pipes, an intuitive overview of the current image processing operations can be formed.

This view offers tremendous flexibility for connecting tools, including the ability to branch a tool's output into separate streams and collapse entire groups of tiles to view a thumbnail image of a tool's, or several tools', outputs.

The following illustration shows a simple flow. This flow contains a loader that brings footage in from disk and that loader is connected to a resize tool. The resize tool is, in turn, connected to a saver for rendering the result to disk.



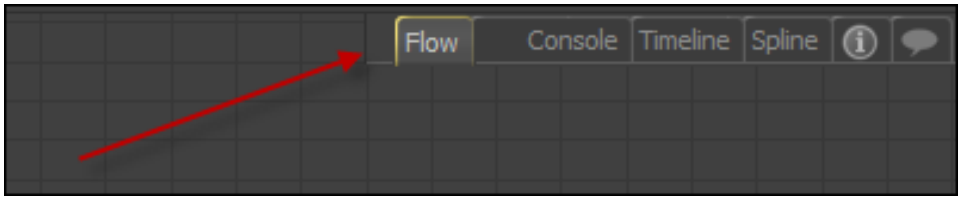
The next illustration shows a more complex flow. It combines multiple layers of footage and demonstrates the idea of branching.



Previous versions of Fusion would save projects to disk using the file extension .flw. This was commonly referred to as a flow. The use of the term flow to refer to a part of the interface as well as the saved project caused some confusion. eyeon renamed the saved project to .comp (for composition). As of version 5, the term flow refers to this portion of the interface only.

Displaying the Flow Editor

To bring the Flow Editor to the front of the work panel click on the Flow tab in the top right of the work panel. You can also use the *F5* keyboard shortcut.



Panning the Flow Editor

To pan the view of the flow, hold the *middle mouse button* down and drag in the desired pan direction, or click-drag on the standard scrollbars at the right and left sides of the flow. Use the *Ctrl-Shift* keys if no middle mouse button is available (for example, on a laptop's touchpad).

Clicking in the Navigator window at the top right of the Flow Editor will also reposition the flow. The navigator overview is described in further detail later in this chapter.

Scaling

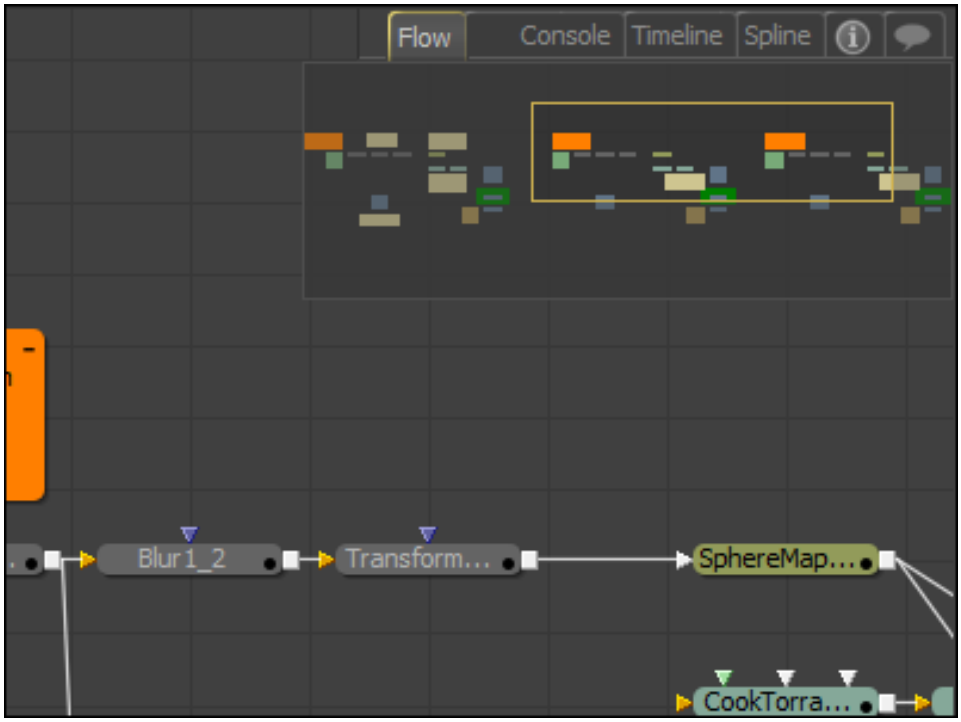
To smoothly scale the contents of the flow place the mouse pointer inside the flow then hold the *middle and left mouse buttons* down while dragging to the left and right. To zoom in on the contents of the flow hold the *middle mouse button and then left click*. To zoom out *middle mouse button and then right click*. The + and - keys on the numeric keypad will also scale the contents of the flow.

The flow's context menu can also be used to set the scale. Right click in an empty part of the flow and click on scale to see a full list of options.

The default scale used by a new flow can be set in **Global ->Flow** preferences. The *CTRL + 1* keyboard shortcut will reset the flow to it's default scale.

Navigator

The Navigator is small rectangular window that appears in the top right corner of the Flow Editor when the flow's contents extend beyond the visible area. The navigator shows an overview of the flows contents. Left click and drag the border at the bottom left corner of the navigator window to resize the window.



Left clicking in the navigator window will recenter the flow. Left click and drag to pan the flow.

The *v* keyboard shortcut can be used to toggle display of the navigator on and off. Once this shortcut has been used to toggle the navigator the navigator will no longer appear and disappear automatically.

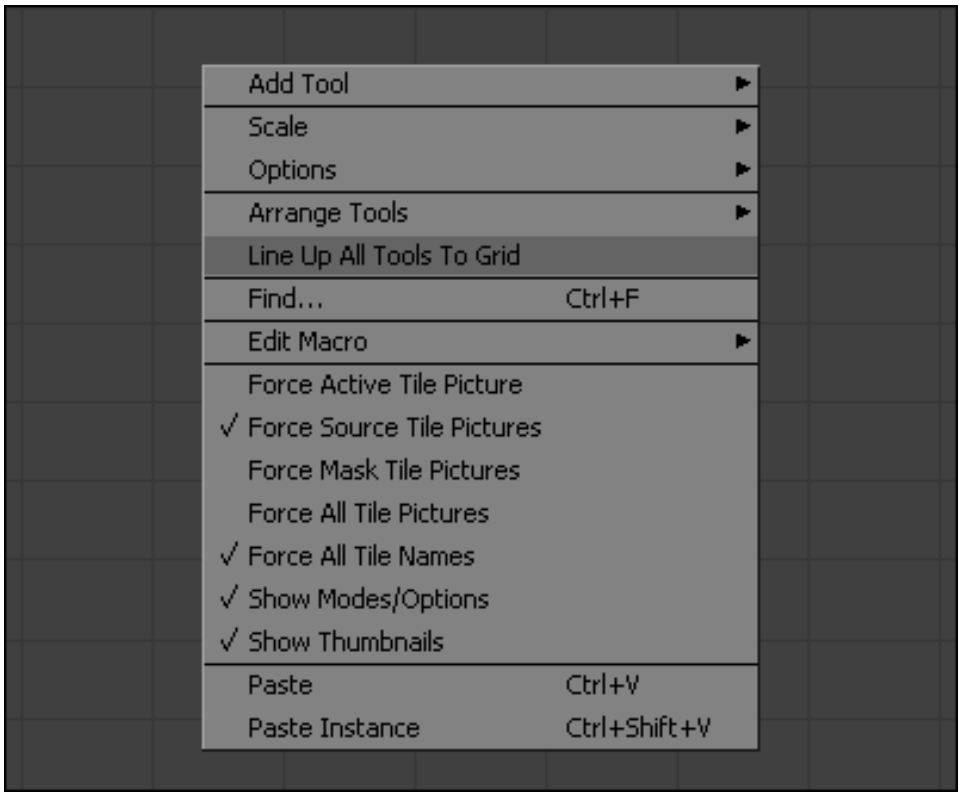
The **Global ->Flow** preferences panel contains radio buttons that can be used to set the Navigator's default behavior in a new composition.

Context Menus

There are two context menus in the flow editor where most functions in the flow are accessed; the Tool and the Flow context menus.

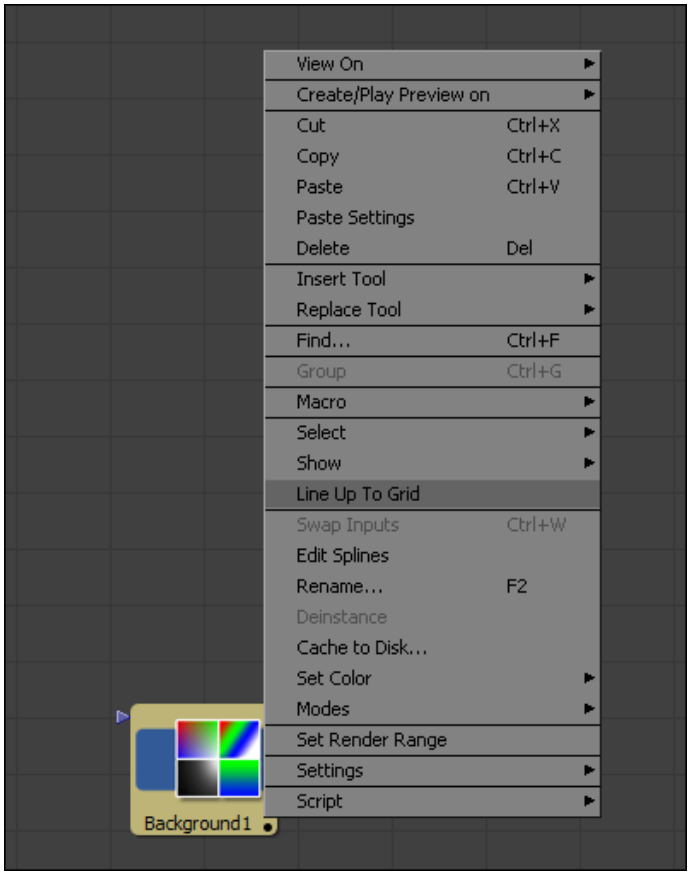
Flow Context Menu

Right-clicking on an empty region of the flow will display a context menu with options and functions for manipulating the flow display in general.



Tool Context Menu

Right-clicking directly over a tool in the flow displays the tool's context menu.



More details on the various options of the context menus can be found at the end of this chapter.

Adding Tools

There are many different ways to add tools to the flow. The artist can use the Edit menu, the Flow context menu and the Tool context menu, as well as dragging and dropping from the bins. It is also possible to drag and drop from the toolbars, bins and from the file browser.

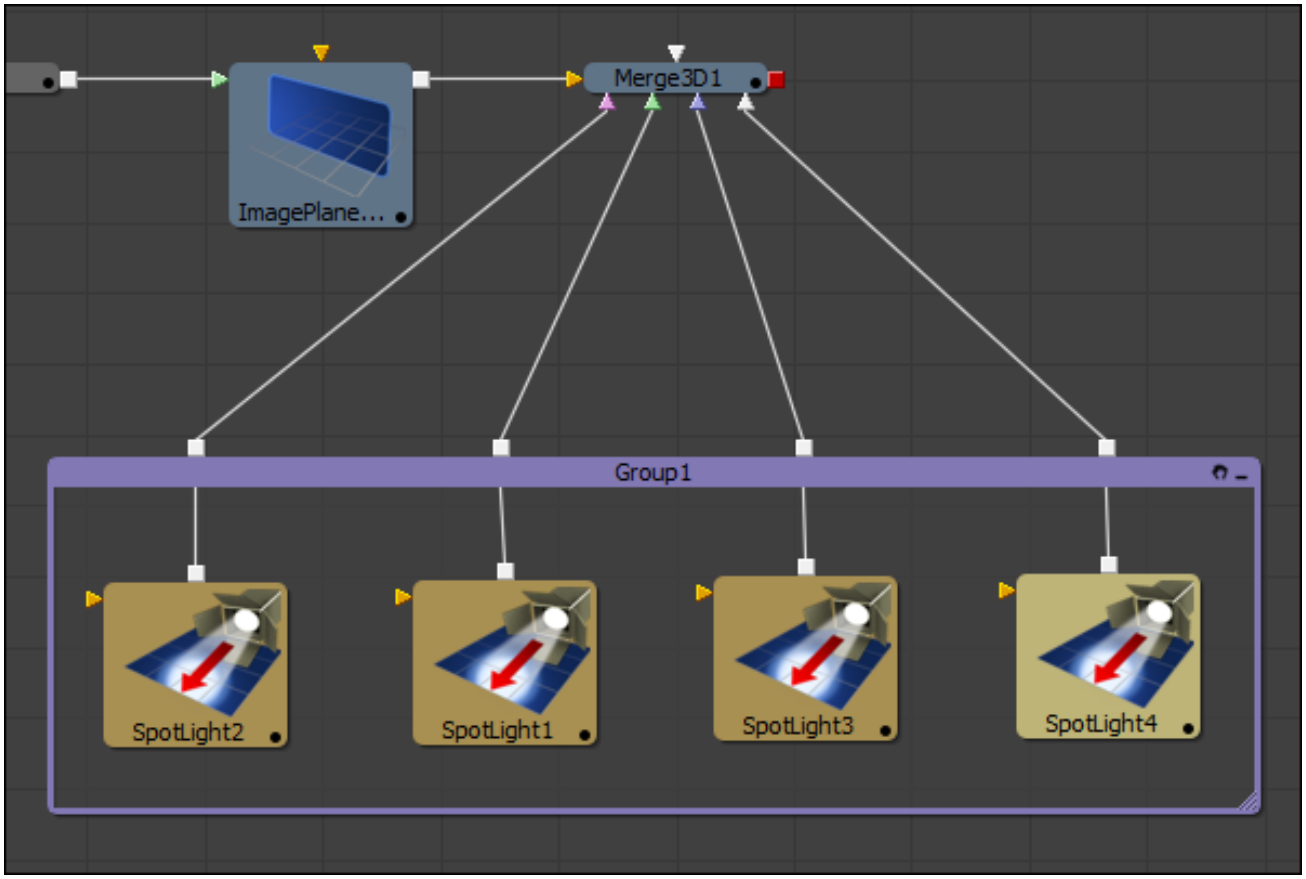
For a full explanation of all of these techniques please refer to the Tools chapter of this documentation,

Groups

Groups are containers on the flow that can hold multiple tools in a small container. They are excellent for keeping the visual complexity of a flow to a minimum.

Groups can contain other groups as well as tools. There is no limit to the number of tools that can be contained within a group.

A group can be collapsed or expanded. A collapsed group is represented by a single tile on the flow, where a group that has been expanded is represented by a small window showing the tools contained within the group.



Creating a Group

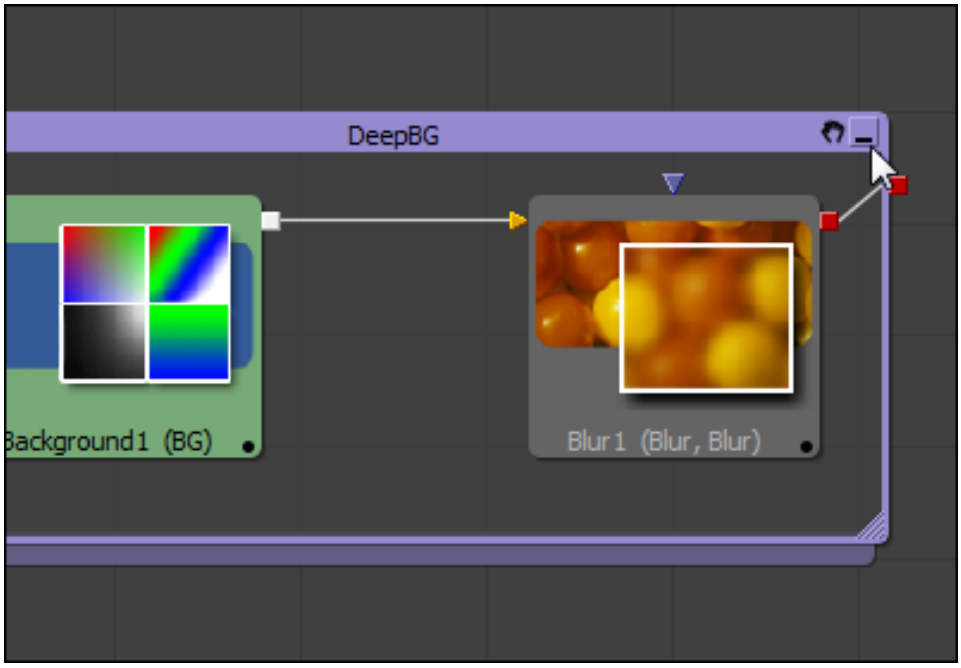
To create a group, select the tools to be added to the group. Right-click on one of the selected tools and choose Group from the context menu that appears. Alternately, you can use the *Ctrl-G* keyboard shortcut.

The tools contained within the group are replaced by a single tile that represents the collapsed group. If any of the tools in the group have any unconnected, or free, inputs when the group is created, those inputs will not be exposed on the groups tool tile.

If an input must be exposed on the groups tool tile make sure that the input is connected to a tool which will not be in the group before creating the group.

Expanding And Collapsing a Group

A collapsed group is represented by one tile on the flow. To open a collapsed group, click on the small icon to the left of the group's name in the tile.



This will reveal a window containing the contents of the the group. The subflow is a separate area that can be scaled, resized and panned independently of the main flow. To collapse the group again, click on the minimize icon at the top right corner of the subflow.

The controls for the various tools in a group can only be accessed if the group is expanded. Double-click on a tool tile within a group to display that tool's controls.

Tools can only be added, inserted or deleted from a group while that group is expanded.

Use the *Ctrl-E* keyboard shortcut when a group is selected to switch between expanded and collapsed modes for that group.

Ungrouping Tools

To remove a group without deleting the tools within it, right-click on the group and select Ungroup from the context menu. The tools inside the group will be placed back in the main flow.

Saving And Reusing Groups

As with any tool a group's settings can be saved to disk for later re-use. See the section on Tool Defaults and Settings in the Flow chapter of this manual for details.

Locking, Panning And Scaling The Group's Subflow

The small button that looks like a hand in the title bar of an open group can be used to toggle panning and scaling of the flow within the group window. This button defaults to enabled in new groups.

Flow Context Menu

Right clicking on an empty portion of the flow displays a context menu containing options which can be used to configure or manipulate the flow.

Favorites

This sub-menu displays the contents of the Favorites Bin, providing a quick way of adding tools, macros and settings to the composition.

AddTool

This sub-menu displays a copy of the Tools menu, and can be used to add or insert new tools into the composition.

Scale

This sub-menu displays a list of options for adjusting the current scaling the flow.

Options

This sub-menu displays a list of options from the which affect the display and behaviour of the Flow Editor. The initial value of these options is generally set in the

Global -> Flow preferences panel. For a complete description of the options see the ../Flow Preferences chapter.

Arrange Tools

When the *Auto Arrange* toggle is enabled in this sub-menu Fusion will automatically move tiles in the flow to accommodate new tiles. Selecting *to Grid* will cause all tiles in the composition to snap to a grid when they are added or moved.

Line Up All Tools To Grid

Selecting this option in the menu will immediately adjust the position of all tiles in the flow, moving them to align with the grid.

Find

Select this option to display a dialog box that can be used to quickly find and select tools in the composition.

Edit Macro

This sub-menu shows a list of currently available macros. Selecting one of the macros will open it for editing.

Force * Tile Pictures

The Force Active, Source, Mask and All Tile Picture options can be used to force the display of tile thumbnail pictures on all tiles within a certain category of tools.

Show Modes / Options

When this toggle option is selected the tool tiles will display icons on the tool tiles to indicate whether the tool is locked and/or cached to disk.

Show Thumbnails

When this toggle option is selected the tool tiles will attempt to display thumbnail images of the tools current output.

Paste and Paste Instance

Use these options to paste the current contents of the clipboard to the flow as either new tools or instanced tools.

Tile Appearance

This section should document the options related to the appearance and style of the tool tiles.

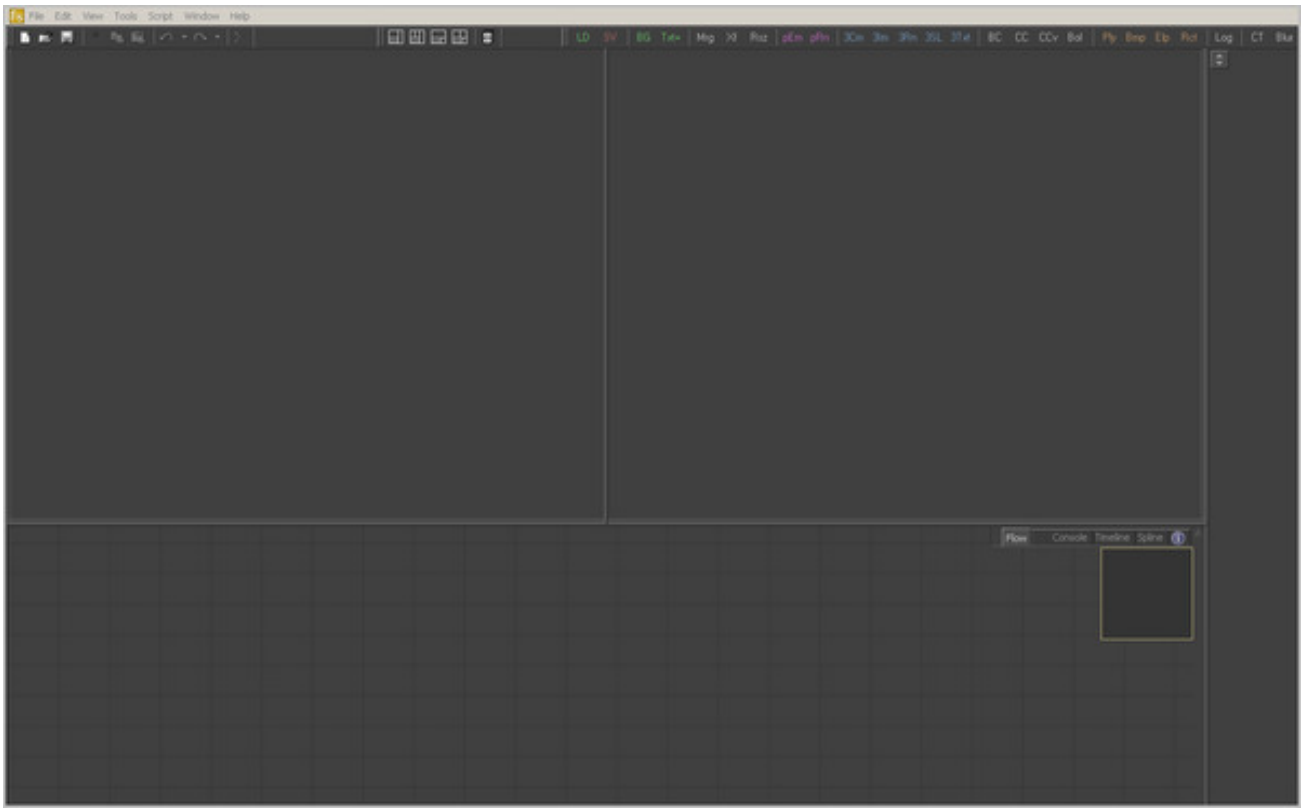
Display Views

Display View Introduction

The Display Views are used to view the output of tools in the compositions. Generally these will be either images or 3D scenes, although the display views also support Flipbook previews, sequence and movie playback and 3D materials. Each display view can display the output of at least one tool in the composition.

Display views also offer the power to analyze images using waveforms, histograms and vectorscopes.

By default, Fusion opens with two display views visible side by side across the top of the program interface. Additional floating display views can be created, or an external video monitor can be used if supported hardware is present on the workstation, such as one of the board's manufactured by Digital Voodoo or Leitch.



The display views are OpenGL-accelerated and rely upon the presence of a good OpenGL-accelerated display device. For a list of supported video cards, visit

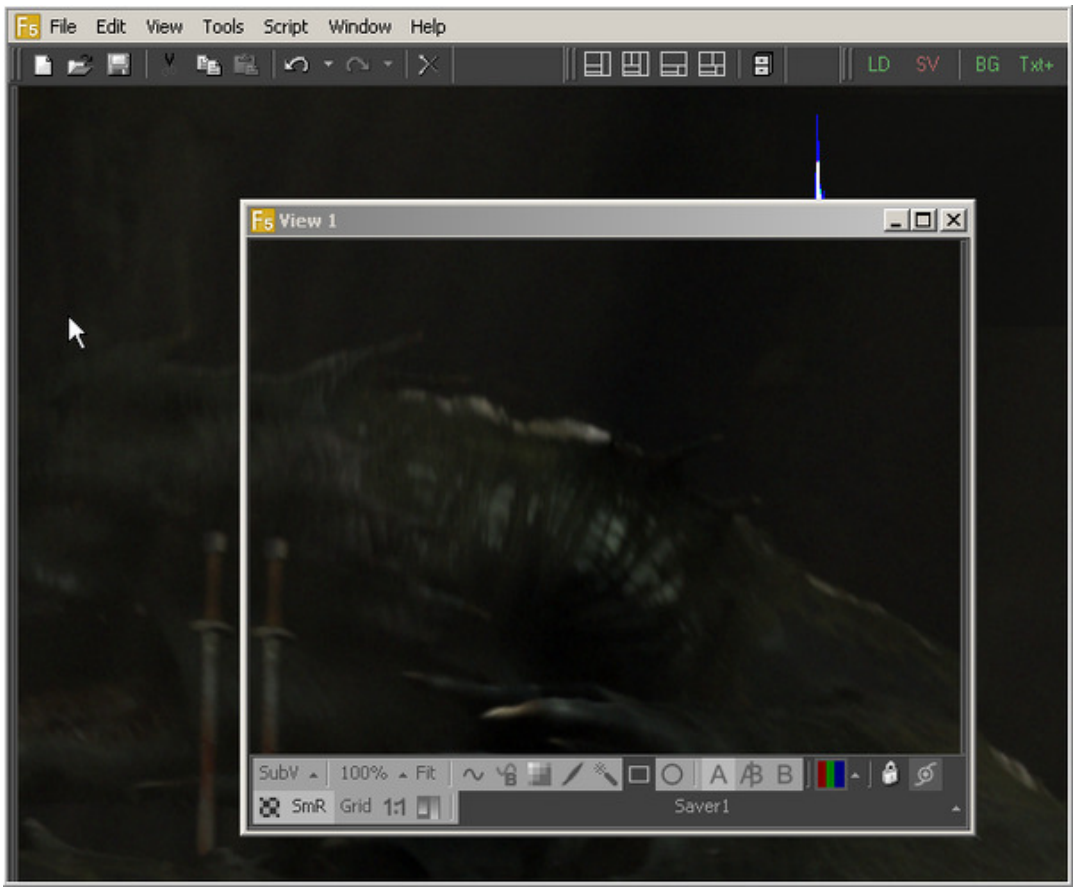
www.eyeonline.com and check the support section of the website.

Left/Right Display Views

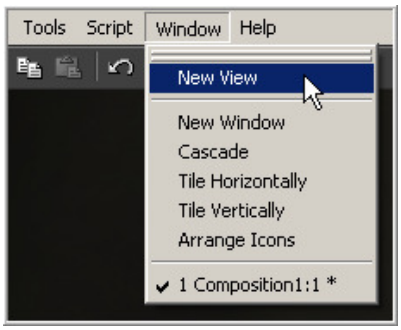
The primary display regions in Fusion are the Left and Right Display Views. Located immediately above the flow, timeline and spline regions, these display views are always available for use.

Floating Display Views

In addition to the large display views above the flow, an unlimited number of Floating Display Views can be created. These floating views are excellent for taking full advantage of a dual monitor configuration. Floating views can also be set to full screen mode to make the best use of screen real estate.



To create a new floating display view, select Window>New View from the menu bar at the top of the screen. The position and configuration of the new view can be saved in the layout preferences, if required.



Hardware Frame Buffers

When supported, or if video hardware is present in the computer, Fusion can take advantage of Hardware Frame Buffers to display images on an external NTSC, PAL or HD monitor.

The hardware display cannot be used to manipulate onscreen controls like center crosshairs or masks. They are extremely valuable for evaluating the images in the same format to which they will be output, and for determining color fidelity and accuracy with a properly-calibrated output monitor.

See the appendices at the end of this manual for a complete list of supported video I/O hardware.

Display View Types

2D Image Viewer

3D and Material Viewer

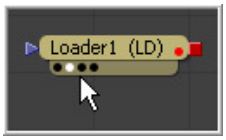
Display View Context Menu

The display view provides a wide range of configuration options via a dynamic context menu that can be accessed by right-clicking in the view. Many of these options also have keyboard shortcuts or can be found in the view toolbar along the bottom of the view.

All of the options found in the Display View Context Menu are explained in depth throughout this chapter.

Displaying an Image in the Views

There are several methods to display the output of a tool in the display views. When a tool is displayed in one of the views, a status light appears on the left side of the tool's tile in the flow. To determine in what view the tool is displayed, hold the mouse pointer directly over the status light until a tooltip appears.



Generally, the leftmost indicator is for the left display view. The next one to the right is for the right display view. Additional indicators are used for floating views and video output devices.

The name of the currently-viewed tool is displayed on the horizontal toolbar at the bottom of the display view.

Viewing Images With Drag And Drop

From The Flow View

Click-drag any tool in the flow into a display view, then release the mouse button to display that tool's output.

From The Tool Controls

Click-drag the tool's control header from the control view on the left into a display view to display that tool's output.

From The File Browser

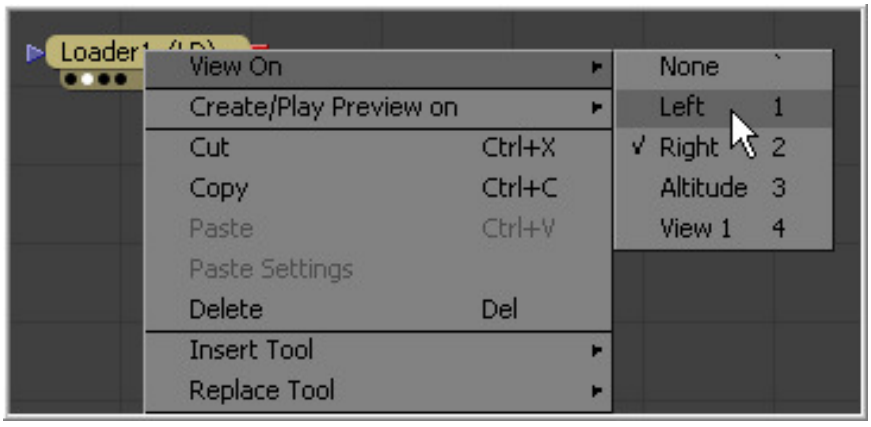
Drag and drop an image from the operating system's file browser into a display view to view that image. This will not add a tool into the flow. It is used only to rapidly preview an image before actually adding it to the flow.

Note: Holding down the Alt key while dragging an image tool into a display view will create a flipbook preview in that view instead. The Render Settings dialog will be displayed, and upon accepting the settings, the tool will be rendered and the resulting frames stored in RAM for fast playback on that view. This is similar to selecting Create Preview On from the tool's context menu. Hold down Shift+Alt instead to skip the dialog and immediately start rendering the preview with the last-used settings.

Viewing Images With The Context Menu

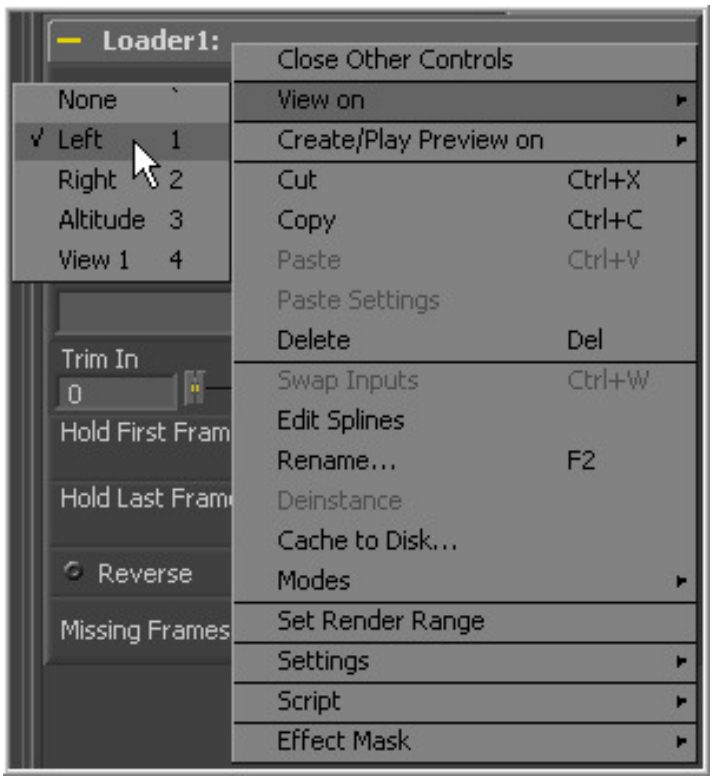
From The Flow View

Right-click on a tool's tile in the flow to display its context menu. Select View On, then choose the display view to use.



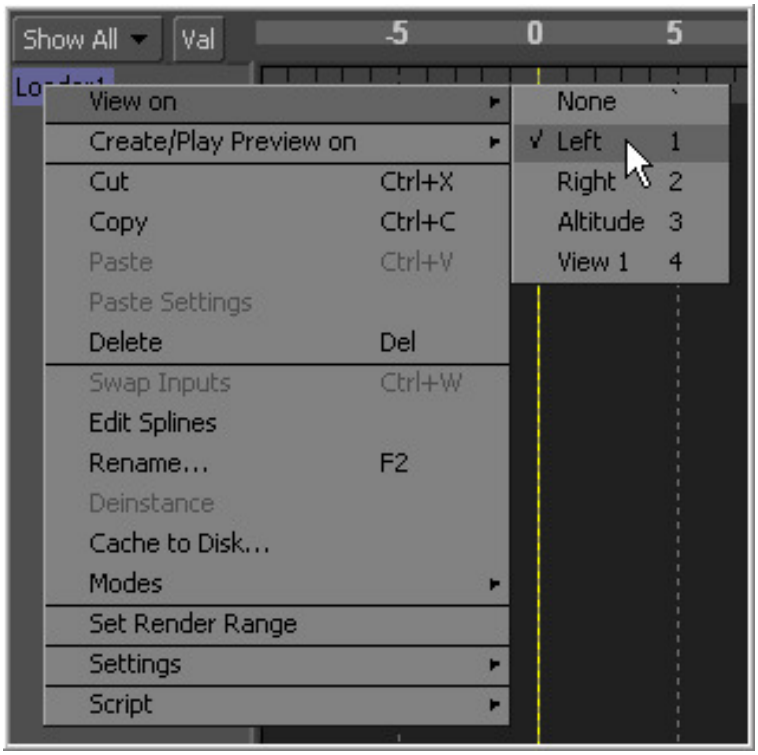
From The Tool Controls

Right-click on the tool's control header on the left to display the context menu for that tool. Select View On, then choose the display view to use.



From The Timeline

Right-click on the tool's name in the tree menu to the left of the timeline to display the context menu for that tool. Select View On, then choose the the display view to use.



Viewing Images With Keyboard Shortcuts

Each display view in Fusion is assigned a numeric shortcut between 1-9, which can be used to quickly display the result of the currently selected tool. The left display view is accessed by pressing `1'. The right display view is accessed with `2', and successive floating views or hardware frame buffers are assigned numbers in the order in which they are created.

To determine the shortcut assigned to a display view, bring up the View On menu in any tool's context menu. The shortcut assigned is displayed to the left of the tool's name in the menu. These shortcuts are available for use when the flow editor or the tool controls are active.

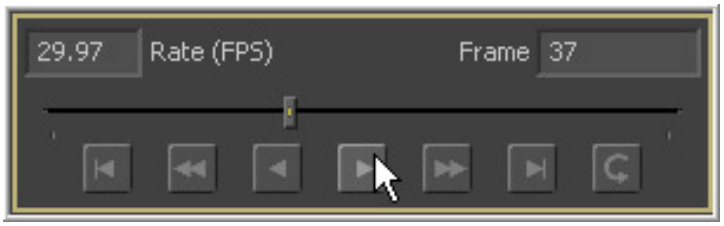
Note *(5.1)* As of Fusion 5.1, the numeric keypad may also be used for display view shortcuts, in addition to the numeric keys arranged horizontally above the keyboard.

Removing Images From The View

To remove all images from all display views in one action, press the tilde (`) key. This key is usually found to the left of the 1 key on American keyboards.

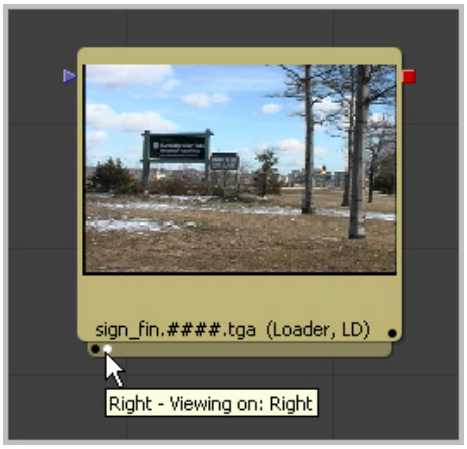
Viewing Images From Disk

Use the display views to show stills, videos or sequences, even if they have not been loaded into the composition using a loader. From the desired view, click the right mouse button and select Load Image from the context menu. This will open a file browser. Navigate to the folder with the footage or image to be viewed and click OK. Still images will be displayed on the view statically. For image sequences and multi-frame formats, the transport controls will appear in the bottom of the control area to play, review, and loop the sequence.



Viewing Images Using Other Methods

Each tool tile has a small strip along the bottom that shows a small white indicator for each view. The strip is generally not visible until the tool is displayed in a view, selected, or the mouse pointer is positioned over the tile.



By hovering the mouse pointer over an indicator, a small popup will identify the view associated with the indicator. Generally, the leftmost indicator is for the left display view. The next one to the right is for the right display view. Additional indicators are used for floating views and video output devices.

When the indicators are visible, click directly on them to display or remove the tool's output image from a display. A white indicator shows that the view is displaying the image, otherwise, the indicator is black.

Display View Position and Layout

It is possible to customize the layout and configuration of fixed views to suit the size of the desktop and monitor, or to match personal preferences.

Once the desired layout has been achieved, use the Grab Document Layout button in the Layout preferences to remember the layout for newly-created documents. The Grab Program Layout button will remember the size and position of any floating views, and enabling Create Floating Views checkbox will automatically create them again when Fusion starts up.

The current view layout is always saved with the comp. Turn off the Recall Layout switch in the Layout preferences to ignore the saved layout when opening a comp.

Layout Toolbar

The Layout Toolbar at the top of the interface (shown below) can be used to configure the display views to several preset layouts.



First Button

This option maximizes the left display view, aligning the tool controls with the top of the screen.

Second Button

This splits the available display region equally between the left and right display views, aligning the tool controls with the top of the screen.

Third Button

This fully maximizes the left display view, aligning the tool controls with the bottom of the display area.

Fourth Button

This fully maximizes the display region, splitting the left and right views equally. The tool controls stay aligned to the bottom of the display region.

Splitter Bars

The relative sizes of the left and right display views can be adjusted using the horizontal splitter bar between them.



Click-drag the splitter to increase or decrease the amount of space used by one display view. The adjacent display view will adjust to suit the new layout.

The amount of vertical space available for both display views can be adjusted by click-dragging on the horizontal scroll bar between the display region and the work region.

Fullscreen Floating Views

Floating views are not affected by the buttons in the layout toolbar. Adjust the size of a floating view using the usual method of click-dragging on the outside of the window border, or by double-clicking on the window's titlebar. Additionally, right-click in the display and set the floating view to Fullscreen from the context menu. The fullscreen option only appears once an image is present in the view.

Fullscreen Fixed Views

To maximize any fixed display view so it fills the screen, place the mouse pointer over the view and press the F4 keyboard shortcut. To restore a maximized view to its original settings press F4 again. This shortcut can also be used to maximize the workspace below the fixed views.

Panning and Scaling the Image

Panning

To pan in any display view, place the mouse pointer in the view and hold the middle mouse button down. Drag the mouse in the desired direction. If the mouse does not possess a middle mouse button, hold Ctrl+Shift and click-drag the view (with the left mouse button) for the same effect.

When viewing a 3D scene, panning will change the point of view (and thus the center point for scaling and rotation too). A combination of panning and rotation will allow you to move the point of view anywhere in the scene.

Note that zooming in will decrease the sensitivity of panning, to allow finer control when navigating around small images and scenes. Correspondingly, pan sensitivity will increase when zooming out. If you need to move the point of view faster, zoom out first or reset the scale with Ctrl+1.

Scaling

The following methods can be used to scale an image or 3D scene once it has been displayed in a view.

Note that there is a lower limit to the scale of a 3D scene. Continuing to zoom in past this limit will instead move ("dolly") the point of view forwards. The mouse wheel will move forward slowly, and the keyboard will move more quickly.

Using the Mouse

Mouse Drag

Place the mouse pointer over the view, then hold the middle and left mouse buttons down while dragging the mouse to the left and right to scale smoothly in and out. The scaling is centered around the starting position of the pointer.

Mouse Click

Place the mouse pointer over the view, then hold down the middle mouse button. While holding down the middle mouse button, click once on the left mouse button to increase the scale or the right button to decrease the scale by a fixed amount. The scaling is centered around the position of the pointer.

Mouse Wheel

Place the mouse pointer over the active view, hold down the Ctrl key, and roll the mouse wheel up or down. Each step on the wheel increases or decreases the scale by a fixed amount, centered around the pointer.

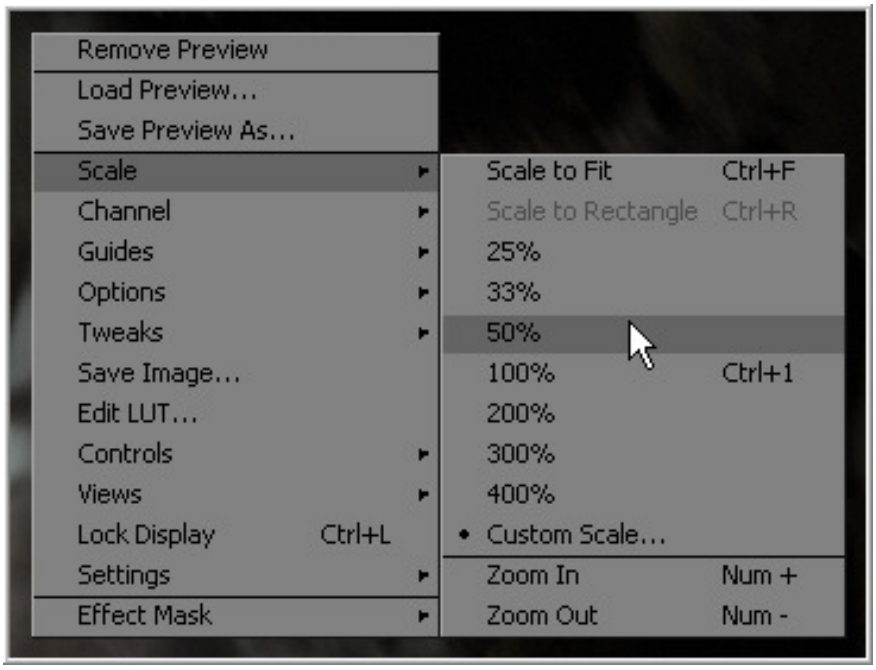
Using the Keyboard

Keyboard

To change the scale by a fixed value, press the + or - keys on the numeric keypad while the display view is active. Ctrl+1 will set the image or scene back to its default of 100% scale, and will recenter it as well. Ctrl+F will fit the image or scene into the visible region.

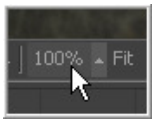
Using the Context Menu

Press the right mouse button while the pointer is positioned over the display view and select Scale from the display view's context menu.



Using the View Toolbar

The scale button in the Display View Toolbar can also be used to adjust the scale of the view. Click anywhere on the scale button to bring up a menu of several preset scales to choose from, or click on the Fit button beside it to fit the image or scene to the view window.



Rotating

When viewing a 3D scene or 3D histogram, the display view can also be rotated. This can be done with the mouse.

Normally, view rotation "orbits" the point of view, to allow easy viewing from any angle. When viewing through a camera in the scene however, this changes to rotate (pitch and yaw) the camera instead.

Using the Mouse

Mouse Drag

Place the mouse pointer over the view, then hold the middle and right mouse buttons down (alternately, Alt key and middle button) while dragging the mouse to the left and right to rotate the view. The rotation is centered around the middle of the view.

Previews

In addition to displaying the output of a tool, the display views are also used to display flipbook previews and do file playback of image sequences and AVI or MOV files straight from disk.

RAM Flipbook Previews

RAM Flipbook Previews are preview renders that exist entirely within RAM. They are created by holding down the Alt key while dragging a tool into the display views, or by selecting Create>Play Preview from the tool context menus.

Once the preview is done rendering, the flipbook will be loaded into the view, temporarily overriding any tool currently displayed in the view. Playback controls appear in the bottom right corner of the interface beneath the tool controls, a Frame counter appears in the corner of the view, and a play/pause button is added to the right of the view's bottom toolbar.

To remove the preview and destroy the flipbook, right-click on the view and select Remove Preview.

Other options on the view's context menu allow enabling looped or ping-pong playback, or (as of Fusion 5.1) Fullscreen mode, which hides the rest of Fusion's interface. View controls are not displayed in Fullscreen mode. To exit Fullscreen mode, deselect it from the context menu, or press the Esc key.

It is also possible to "trim" the flipbook, to skip playback of the first or last few frames. This can be done using the scrub bar in the transport controls that appear at the bottom right of Fusion's window. Ctrl+drag the scrub bar to set or change the frames to be played, or right-click on it to set or reset the in & out points via a menu.

Mouse shortcuts

While the flipbook preview is showing, it can be played or scrubbed using only the mouse. These shortcuts work in Fullscreen mode as well.

Playback

Double-click the left mouse button anywhere in the view to start playback.

Scrubbing

Hold down the right mouse button and drag the mouse left or right to scrub through frames in the flipbook.

Keyboard shortcuts

While the flipbook preview is active, playback and frame advance can also be done with the keyboard. These shortcuts work in Fullscreen mode as well.

Playback

The spacebar can be used to start or stop playback. Hold down Shift while pressing the spacebar to play in reverse.

Forward/reverse

The left and right arrow keys will move the flipbook to the previous or next frame. Hold down Shift as well to jump back or forward 10 frames at a time. Ctrl+left will return to the first frame of the flipbook, while Ctrl+right jumps to the last frame.

File Sequence Previews

When a loader or saver is selected, the file sequence or footage loaded by that tool can be played back in the display view by pressing play on the transport controls that appear in the bottom of the tool controls region.

When the play button is selected, the file preview becomes active and Fusion will load the images as quickly as possible and play them to the display view. By default, the left display view is used for this purpose. That default can be changed using the Preview preferences. By changing these preferences, it is also possible to simultaneously play the file sequence to installed video hardware (this may decrease playback performance).

As with flipbooks, trimming in & out points can also be set for file sequence previews, using the scrub bar in the transport controls that appear at the bottom right of Fusion's window. Ctrl+drag the scrub bar to set or change the frames to be played, or right-click on it to set or reset the in & out points via a menu. By default, trimming done here while a Loader tool is selected will be mirrored in the Loader's Trim In/Out controls. This can be disabled using the scrub bar's context menu.

While the file sequence preview is enabled, normal viewing of tools to that display view is disabled. To return to normal operations, select another tool or blank area of the flow.

Onscreen Controls

The display views show Onscreen Controls, or widgets, for manipulating the controls of the currently selected tool. Common widgets include crosshairs, angle indicators, polylines and paint strokes. Each of these controls can be manipulated directly in the display view using the mouse or keyboard.



The display view shows the controls associated with the tools that are selected in the flow, timeline or spline editor. If multiple tools are selected, the controls for all of those tools are shown.

Note The controls shown are determined only by the tools that are selected, not by the tool displayed in the views. For example, a downstream blur is easily viewed while manipulating the controls for a selected polygon mask or merge.

Enabling/Disabling Onscreen Controls

The onscreen controls for a view can be disabled so that they do not interfere with viewing the image.

To disable the onscreen controls, click once on the Show Controls button in the view toolbar or select Show Controls in the Options submenu of the display view context menu. Alternately, use the Ctrl K keyboard shortcut.



Making Fine Adjustments To Controls

Adjusting a control with the mouse often lacks the precision required for fine work. In cases such as this, the keyboard can often be used to make small finite adjustments to the selected control.

The arrow keys can be used to adjust the position of the control along the vertical or horizontal axis by small steps.

Holding the Ctrl key down while using the arrow keys reduces the scale of each step by a factor of ten. Holding Shift down increases the scale of each step by a factor of ten.

Display View Toolbars

There are two toolbars in the display view; a horizontal view toolbar called the View Toolbar, and a vertical toolbar called the Tool Toolbar. Both are used for showing buttons that are specific to the selected control.

Display View Toolbar

The View Toolbar runs across the bottom of the view, providing access to many of the most commonly-used settings. Most of the buttons found on this toolbar are described in detail throughout this chapter.



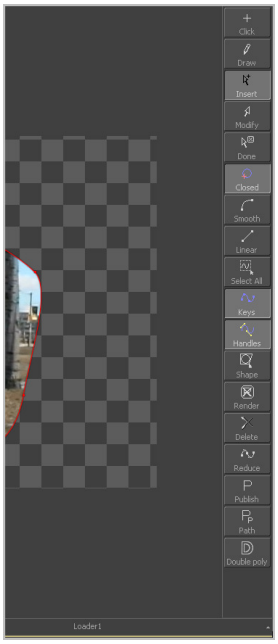
This toolbar is dynamic. The buttons displayed may change depending on the type of viewer.

A 3D display view shows a set of buttons for controlling the display of lights and shadows, for example, but these buttons are missing from a 2D view since they would have no meaning in that context.

To learn more about a button's use, hold the mouse pointer over the button. A small popup will describe the button and its function.

Tool Specific Toolbars

In addition to the toolbar displayed at the bottom of each view, Fusion also has a space reserved to the side of the view for Tool Specific Toolbars. Text, masks, paths, paint strokes and the 3D environment are some of the tools that make use of this toolbar.



Customize the size and type of buttons displayed in this toolbar using its context menu, accessed by right-clicking on the toolbar with the mouse.

Customizing The View Toolbars

Right-click on the toolbar to display its context menu. This menu is used to change the size of the icons used for the buttons, and also to determine whether text labels are used to represent the button's functions.

A and B Buffers

Each display view has two buffers for viewing images. Each buffer can be considered a complete and separate view. Generally, all that is seen the default A buffer.



Note Buffers can be set to different display view types. It is entirely possible to have an A buffer showing the image with a B buffer showing a histogram.

Switching Between Buffers

Toolbar

Click on the view toolbar button labelled A or B to switch to the associated buffer.

Keyboard

Use the comma (,) key to set the active view to the A buffer, the period (.) key to set the view to the B buffer and the (/) key to enable the split wipe mode (described below).

Split Wipe Images

The A|B buffers can be used to enable a split display, where the separate buffers are displayed onscreen simultaneously. The displays are separated by a red splitter bar, which can be adjusted in any direction or angle by click-dragging on the splitter.



To enable the Split Wipe, click on the A|B button.



Turn off the split wipe mode by switching to either the A or B buffer directly using the toolbars or keyboard shortcuts.

While split wipe is enabled, new tools can still be dragged and dropped into either buffer to change the image displayed. Panning or zooming either buffer will keep the other buffer in sync.

Different channels, view LUTs or other display options can be selected for each buffer individually. This allows easy comparison of channels, LUTs etc while in split wipe mode, or by quickly switching between the A and B buffers with the hotkeys.

Occasionally, you will have either zoomed in or panned so far from the splitter that it will be no longer visible in the view. Holding down Ctrl+Alt and clicking anywhere in the image will cause the splitter to jump to the current mouse position.

Holding down Shift while dragging the splitter bar will "snap" it to the nearest 45 degree angle.

Subviews

A Subview is a smaller display view that docks within the main view. It is connected to the same tool as the main view and is often used to show somewhat different information about the image.

For example, the RGB channels may be viewed in the main view, with the alpha channels in a subview. Any of the view types mentioned above can be used in a subview. In fact, several view types are designed for use only in the subview.

For the most part, the subview is nothing more than a miniature view, with its own context menu and options. It responds to the same keyboard shortcuts and navigation controls as any other display view.

Displaying/Hiding The Subview

Use the V key to toggle the subview on and off in the active view. Alternately, click on the subview button in the view toolbar, or select Views>Subview>Enabled from the context menu.

Changing The Subview Type

To change the subview type, click on the small arrow next to the Subview button in the display view toolbar. This will show a popup menu of all available subview types. Select one from the list or right-click in the subview and select the desired view type.

Swapping The Subview With The Main View

Use the Shift-V keyboard shortcut to swap the main view and the subview, or select Views>SubView>Swap from the context menu.

Note This is not always valid, as certain view types can only be used in the subview. In such cases, the swap will not take place.

View Types

As well as showing images, views can be changed to show a variety of different bits of information about the image. Not all views are valid at all times. For examples, the 3D viewer is not available for a 2D tool and many of the viewers are only valid for subviews.

Changing The View Type

To change the View Type, open the display view's context menu and select the desired type from the view's submenu.

2D Viewer

The 2D Viewer is the basic 2D display view for showing images. When used as a subview, a different tool than the one used in the main view can be displayed by dragging and dropping the tool into the subview. This is the only subview type that is not slaved, showing the same tool that is displayed in the main view.

3D Image Viewer

The 3D Image Viewer is the basic 3D display view, available when viewing a tool from the 3D category.

Histogram

The Histogram is an analysis tool that can be used to identify problems with contrast and the dynamic range in an image. This is essentially a graph that shows the frequency distribution of colors in the image. The horizontal axis shows the colors from black to white. The vertical axis shows the number of pixels in the image that occur at each level. Histograms are excellent tools for examining the overall contrast and distribution of colours in an image. As of Fusion 5.2, the Histogram viewer will also show out-of-range colours found in floating point images.

Tip: The Histogram viewer will also display Gradient information. Currently, the only tools in Fusion that can output Gradients are the From Image and Perturb modifiers. Drag the modifier's titlebar into the view to see the gradient represented as a histogram.

3D Histogram

This more advanced histogram type shows the color distribution in an image within a 3D cube. One advantage to 3D Histogram is that it can accurately represent the out-of-range colors commonly found in floating point and high dynamic range images. Navigate the 3D cube like any other 3D view (Alt-MMB to rotate).

Vectorscope

The Vectorscope duplicates the behavior of a specific type of video test equipment, displaying a circular graph that helps to visualize chrominance signals.

Waveform

The Waveform duplicates the behavior of a specific type of video test equipment, displaying a line or bar graph that helps to visualize the voltage, or luminance, of a broadcast signal.

Navigator

The Navigator can only be used in a subview. It provides a small overview of the entire image, with a rectangle that indicates the portion of the image that is actually visible in the main display view. This is useful when zooming in on an image in the main view.

Magnifier

The Magnifier can only be used in a subview. It shows a zoomed-in version of the pixels under the mouse pointer in the main view.

Image Info

The Image Info view can only be used in a subview. The image info tab shows a horizontal bar across the top of the image with information about the frame size, pixel aspect and color depth of the viewed image.

Color Inspector

The Color Inspector can only be used in a subview. The color inspector shows information about the color channels of the pixel under the mouse pointer. It will show all channels present, even the auxiliary channels such as Z buffer, XYZ normals and UV mapping channels.

The color is not sampled from a specific pixel, but rather it is sampled from several pixels. The default setting will sample from a 3 x 3 array of pixels around the mouse pointer. This can be changed by opening the View panel in the preferences and changing the value of the Color Picking Area Size.

Choosing Color Channels

Fusion's display views and subviews are not limited to displaying only the full color version of the image. The separate Color and Depth Channels that comprise the image can be viewed separately.

Use the Channel toolbar button (shown below), the view's context menu or keyboard shortcuts to change the channel displayed in a view.



Click the triangle on the side of the toolbar button to show the list of channels. Clicking elsewhere on the button will switch between Full RGB and Alpha, or the currently viewed channel.

The following hotkeys will also change the channel displayed in the active view:

C - Full RGB color display

R - Display Red channel

G - Display Green channel

B - Display Blue channel

A - Display Alpha channel

Z - Display Z-Buffer channel

Viewing Non Color Channels

The Fusion view has only support for the RGBA and Z channels. To view the auxiliary image data stored in RLA or OpenEXR files, it may first be necessary to copy the data from the auxiliary channel to one of the color channels using a channel boolean tool. Many auxilliary channels employ a 32 bit datatype, so ensure the image is processing at 32bit per channel before applying the channel boolean, or else the data may end up being incorrectly displayed.

The 3D View

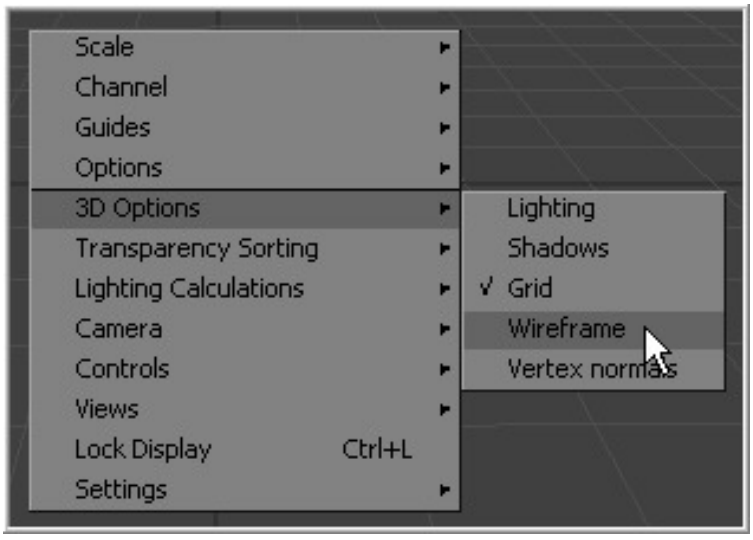
The 3D View is only available when viewing a tool from Fusion's 3D category of tools or viewing some particle systems. It shows a representation of a composite in a true OpenGL-accelerated 3D environment.

Rotating, Panning And Scaling The View

For the most part, navigation in the 3D environment is identical to the navigation of 2D Images in the view. Panning and zooming the view are identical. To rotate in the view, hold the Alt key down and click-drag left or right with the middle mouse button. Alternatively, hold down the middle and right mouse buttons together while dragging horizontally.

Wireframe

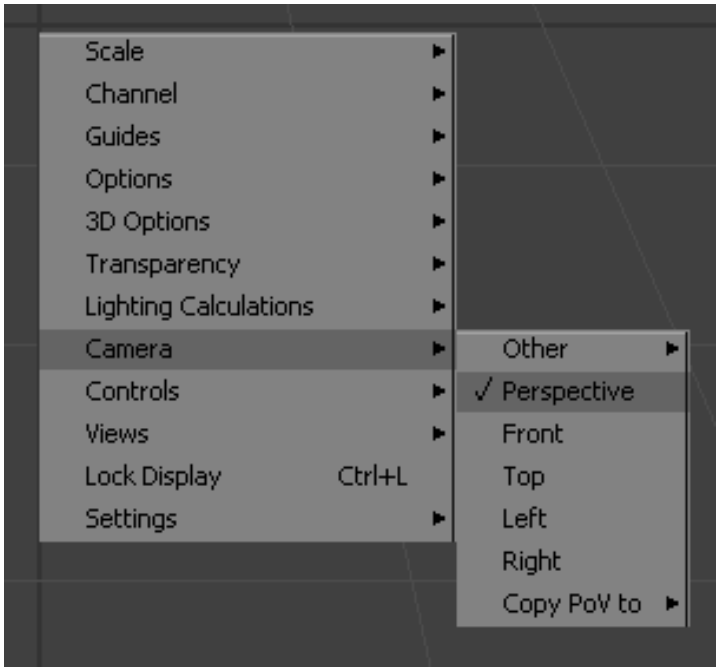
The Wireframe view shows not only 2D Images on image planes, it also shows true geometry, such as that generated by the particle system, text tool, FBX mesh import and basic primitives from the 3D toolset. To display these elements in wireframe rather than shaded mode, click the Wire button in the view toolbar or select 3D Options>Wireframe from the view's context menu.



Changing 3D Viewpoints

By default, the 3D view shows a free perspective camera to get a look at the 3D scene from any angle. Change the view to look through a camera in the scene, a spotlight, or any of the usual orthographic views.

To change the 3D Viewpoints, right-click in the view and select the Camera submenu from the context menu. The choices include Perspective, Front, Top, Left and Right.



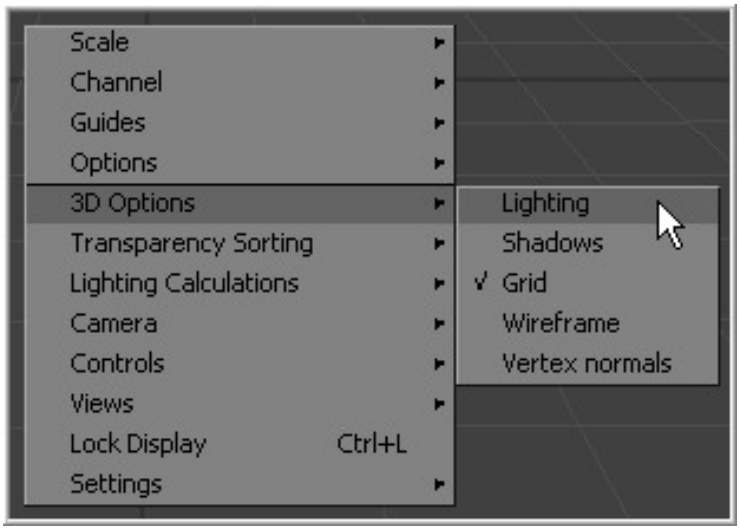
If one or more camera objects are present in the 3D environment, these will also be listed as options in this context menu. Spotlights and other lights or objects in the scene will be listed in the Other submenu. Selecting one of these will show the point of view of the camera, light or object chosen. While looking "through" an object in this manner, rotating, panning or zooming the view will instead change the rotation, position and scale of the camera, light or other object.

The "Copy PoV to" submenu is very useful for instantly positioning and orienting a camera, light or other object to match the current point of view shown in the Display View. Choosing an object from this submenu will copy the view's position and angle to the object's Translation and Rotation controls. Note that this is done in the object's own co-ordinate space; any transformations downstream of the object are not taken into account.

A small text label is usually drawn in the bottom corner of the view to indicate which of the available viewpoints is currently displayed. Right-clicking on this label or the axis control above it acts as a shortcut to the Camera submenu, allowing easy selection of cameras and other viewpoints.

Lighting

A default 3D view has Lighting turned off. Enable the display of lighting by clicking on the Light button in the view toolbar, or by right-clicking and selecting Lighting from the 3D Options sub context menu.

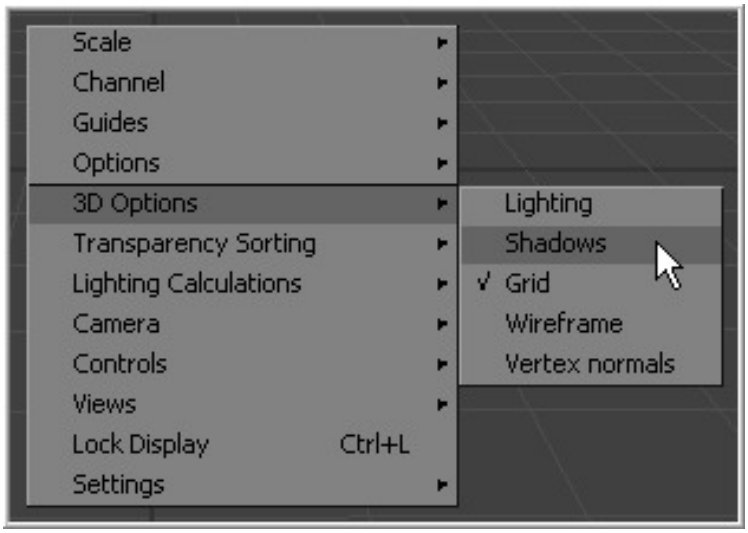


If there are no lights in the scene, default lighting will be used *(Note: Prior to Fusion 5.1, no defaults lights are used and all textures will be dark)*. Adding a light to the scene will disable the default lighting, as will unticking the Default Lights option.

To see the effects of a light upon the scene, view the Merge3D tool that combines the light and the scene, or a tool downstream from this. Viewing just the light tool by itself will show only an empty scene, with nothing to be illuminated.

Shadows

A default 3D view has Shadows turned off. To see shadows in the interactive OpenGL view, enable them by clicking on the toolbar button labelled Shad, or by right-clicking and selecting Shadows from the 3D Options sub context menu.



Quad Display Mode

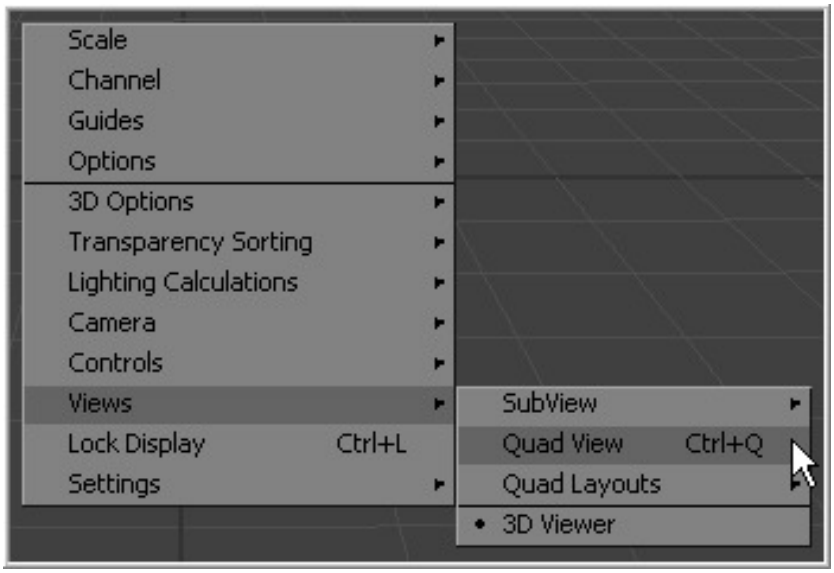
The display view generally only has one surface on which to show an image. It is possible to split the view into four parts. This is called a Quad View. This is most commonly used in conjunction with the 3D view to allow a view of the 3D environment from several different angles at one time.

Although there are four parts to the view, all four will be viewing the same image. When using a quad view to display a 3D environment, there is a choice between displaying the front, left, top, bottom and perspective orthographic views, as well as the view through any cameras or spotlights present in the scene.

When used with a 2D environment, each part can be used to show a different view type. For example, the image in one part can be shown while the other parts show the alpha channel, vectorscope and histogram.

Enabling And Disabling The Quad View

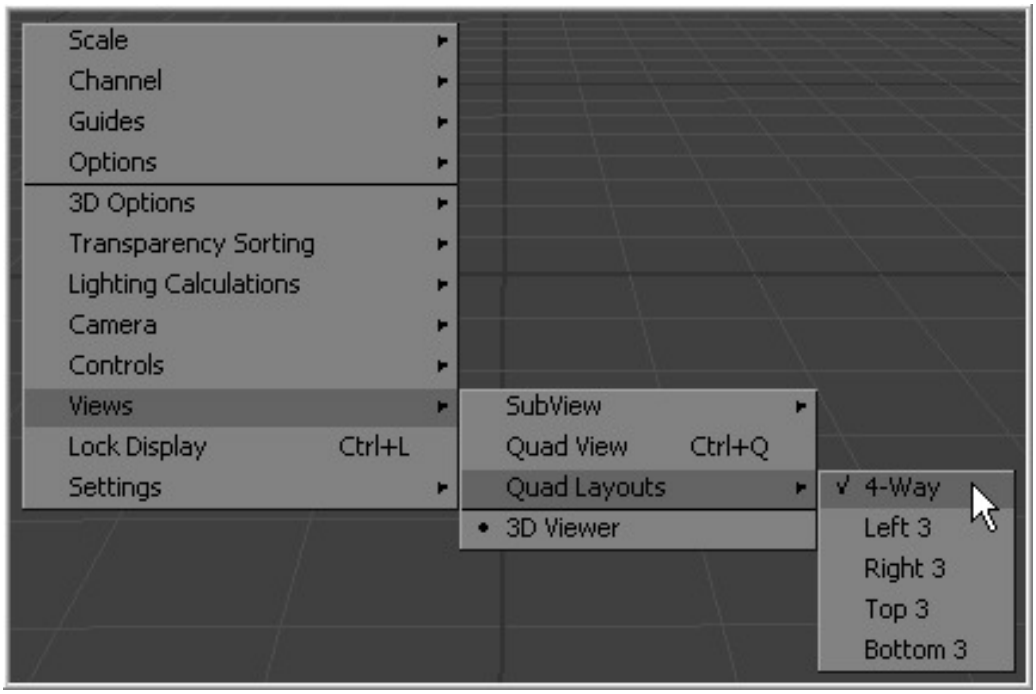
To toggle the display of the Quad View, select Views>Quad View from the display view's context menu or use the Ctrl-Q keyboard shortcut. A Quad button on the view toolbar is also seen when viewing a 3D environment.



Quad View Layouts

There are a variety of Quad View Layouts, ranging from four equally-sized panels to having three small panels across the bottom of a larger single panel.

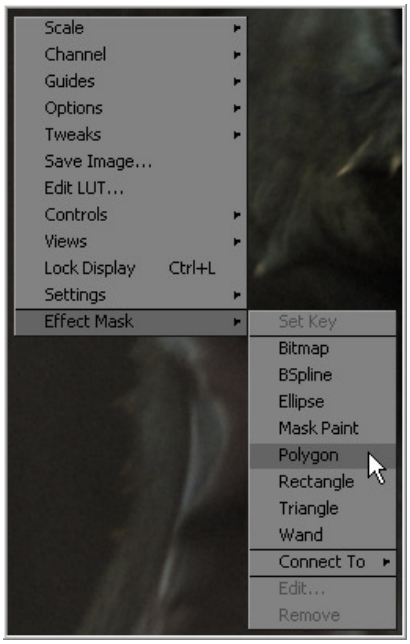
To try the various layouts, toggle Quad View on, then select one of the choices found in the Views>Quad Layout's display view context menu.



Effects Masks

Fusion's Effect Masks are used to restrict the effect of a tool to a specified portion of an image. Masks can be polylines, basic primitive shapes, paint strokes or bitmaps from other tools.

To add an effect mask to the currently displayed tool, click on the button for the desired type of mask in the view toolbar or right-click in the display view and select Effect Mask from the context menu.



The toolbar buttons can only be used to add effect masks. Garbage and pre- masks are added via the view's context menu.

For more information, see the Effect Masks chapter.

Guides

A number of standard Guides can be displayed in the views. The four guides are Monitor Safety, Safe Title, Center and Film.

Enabling And Disabling The Guides

Context Menu

Select Guides>Show Guides from the display view's context menu.

Keyboard

Use Ctrl-G to enable or disable the display of guides in the active view.

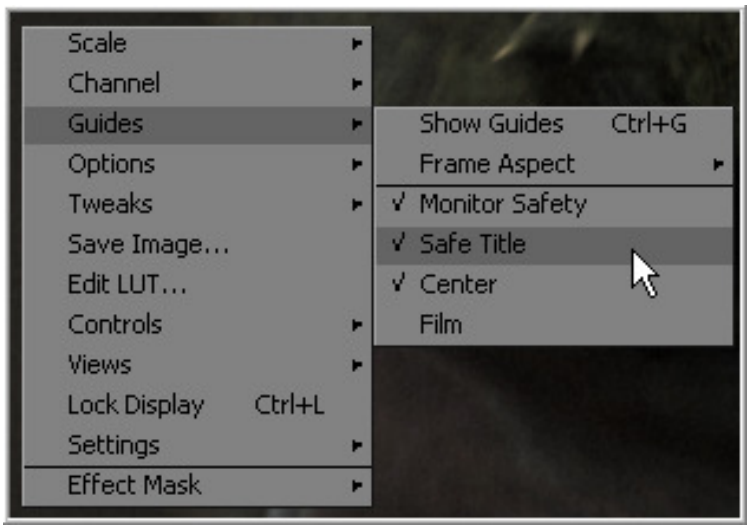
Selecting A Guide

Monitor Safety

This indicates the safe area viewable on most monitors and TV screens.

Safe Title

This indicates the safe area for titles viewable on all TV and monitor screens.



Center

This shows the Center point and X and Y axis of the view.

Film

This displays the Film guides as specified in the Frame Format>Preferences screen. Some frame format defaults have a corresponding default for the guides, whereas some will require customization.

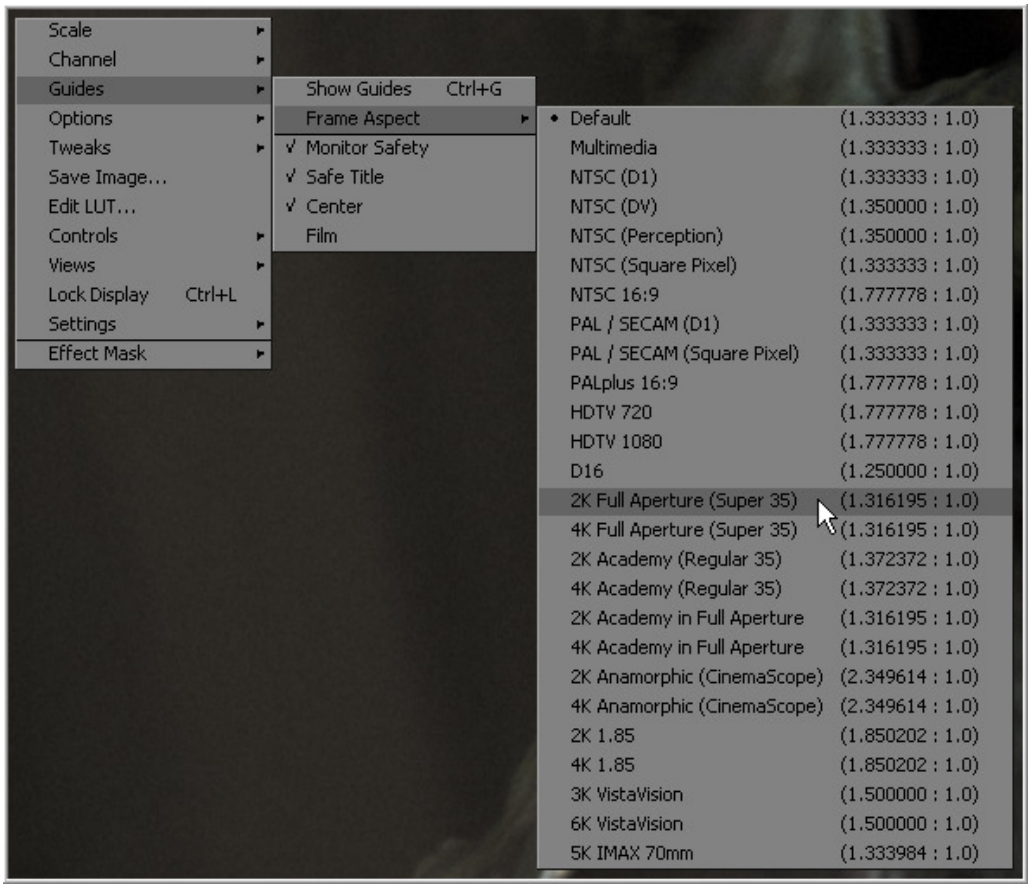
Film Guide 1 contains four text boxes. These boxes specify the offset from the edges of the image for the Left Guide, Top Guide, Right Guide and Bottom Guide, in order. As with all offsets in Fusion, this is a resolution-independent number where 1 is the width of the full image and 0.5 is half the width of the image.

Film Guide 2's text box is used to set the aspect ratio of the projection area.

Guide Frame Aspect

The Guide Frame Aspect can be used to help show how the current image relates to a specified frame format. The frame aspect is usually set to Default. This forces the frame aspect to the same resolution as the image displayed in the view.

When the frame aspect is set using the Guides>Frame Aspect context menu, the guides will represent the exact boundaries of the specified format. The guides will display the correct frame format and any image area outside of that will be dark grey.



Look Up Tables (LUTS)

See the Look Up Tables chapter.

View Preferences and Settings

View Preferences

The default settings for each display view can be changed using the View panel in the Preferences. The position and size of each floating view can also be saved using the Layout menu in the Preferences.

For details on using the layout and view preferences, consult the Preferences appendix in this manual.

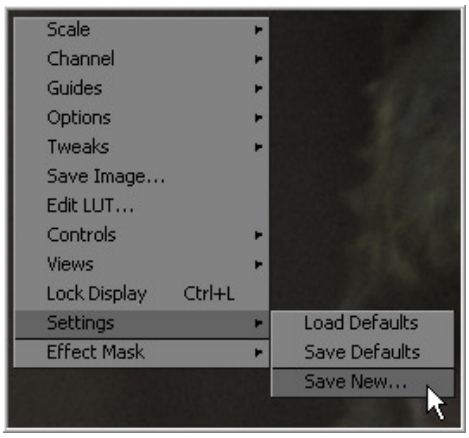
View Settings

It is often preferable to switch between entirely different view configurations while working. For example, while keying, the image is in the main view and the alpha channel is in a subview. View Settings toward the end of a project may consist of the histogram, vectorscope and waveform, as well as the image in a view set to quad view.

Fusion provides the ability to quickly load and save view settings to help reduce the amount of effort required to change from one configuration to another.

Saving View Settings

Once a view is set up as required, select **Setting -> Save New** from the view's context menu to create a new setting. Enter a name for the settings and the overall configuration of the view will be stored in the preferences file.



Loading View Settings

To load previously saved settings, select the settings by name from the Setting menu in the view's context menu.

Loading And Saving Defaults For A View

The view can also be returned to its defaults using the Load Defaults option in the Settings portion of the view context menu.

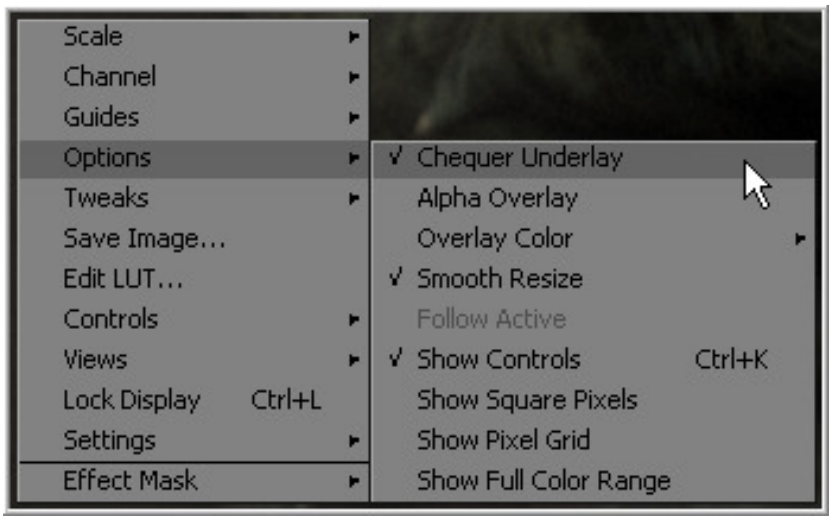
To save a new set of defaults for the view, select the Save Defaults option.

Status Bar Information

General Display Options

Display Options Sub Context Menu

The Display Options Sub Context Menu contains several options to display the views. All of the options listed here can be found in the context menu. Several of them have a button in the view toolbar as well.



Locking The Display

Default: Off

A display can be prevented from updating when it is locked. The display will not update the image from the viewed tool until the view is unlocked. The tool still processes and the new image is queued for display in the view. Toggle this option using the Ctrl-L keyboard shortcut, or by clicking on the Lock button in the view toolbar when viewing a 2D image.

Alpha Overlay

Default: Off

When this option is enabled, the view will show the Alpha channel overlaid on top of the color channels.

Overlay Color

Default: White

Change the color used for the alpha Overlay from the default white using the options in this menu.

Checker Underlay

Default: On

The Checker Underlay shows a checkerboard beneath transparent pixels instead of black. This is the default option for 2D views. Toggle this option by clicking on the Checker button in the 2D view toolbar.

Smooth Resize

Default: On

The Smooth Resize option causes the display view to use a smoother interpolated resizing method when zooming into an image in the views. When smooth resize is disabled, scaling uses the faster nearest neighbor method. This option is enabled by default and can also be toggled by clicking on the SmR button in the view toolbar.

Follow Active

Default: Off

Enabling the Follow Active option will cause the view to always display the currently active tool in the flow.

Show Controls

Default: On

The Show Controls option shows or hides onscreen tool controls in the view. This option is handy when the controls are not necessary or are getting in the way of evaluating the image. This option is toggled using the Ctrl-K keyboard shortcut or by clicking on the Show Controls button in the view toolbar.

Show Square Pixels

Default: Off

Depending on the frame format preferences and the type of footage loaded, many images may have pixels that are rectangular instead of square. Both the NTSC and PAL video standards, as well as some film formats, use rectangular pixels. A computer monitor uses perfectly square pixels.

Fusion will automatically perform aspect correction when viewing non-square images so that the image seen in the views does not appear squashed or stretched. Although this aspect correction helps to correct the shape of the objects in the image, it can also cause aliasing in the image. Fusion uses a relatively fast resize algorithm to make the correction in the views. This aliasing does not affect the final result. It is an artifact of the display view only. Regardless, its presence can obscure real problems in the image.

Enabling the Show Square Pixels option will override the aspect correction in the view to confirm that this `tearing' is an artifact of aspect correction and not a problem with the composite.

Show square pixels can also be toggled on and off using the 1:1 button in the view toolbar.

For more information on the effect of aspect on the composite and how Fusion handles aspect ratio, see the Frame Formats chapter in this manual.

Pixel Grid

Default: Off

Enabling this option will show a light black grid that outlines the exact boundaries of pixels in the image when the image is scaled in past a certain threshold. Toggle this option with the Grid toolbar button.

Show Full Color Range

Default: Off

Enabling the Show Full Color Range option causes Fusion to automatically normalize any image displayed in the view. Normalization causes the brightest pixel in a color channel to be mapped to a value of 1.0 (white) and the darkest pixel to be mapped to a value of 0.0 (black). Midrange values are scaled appropriately to fit within that range.

This allows for the visualization of values outside of the normal viewing range, particularly when working with floating point images. It is also useful when viewing Z-buffer or other auxiliary channels, which often use value ranges far different from those in the color channels.

Toggle this option with the Related View toolbar button.

Display View Label

Each display view has a text label at the bottom right of the view toolbar. This Display View Label indicates the name of the tool currently viewed in the display. Clicking on the label will select the viewed tool and, if the tool is not currently visible in the flow area, it will highlight and pan the tool in the flow editor.



Controls List

Click on the small arrow button to the far right of the label for a popup list of the onscreen controls for the selected tools. The currently active control is marked on the menu. Choosing a different control from the menu will activate it for use. This can be handy when several controls are in the exact same position.

If multiple tools are selected, the menu will provide a complete list of all of their onscreen controls. Selecting a control from the list will highlight and activate this control on the view.

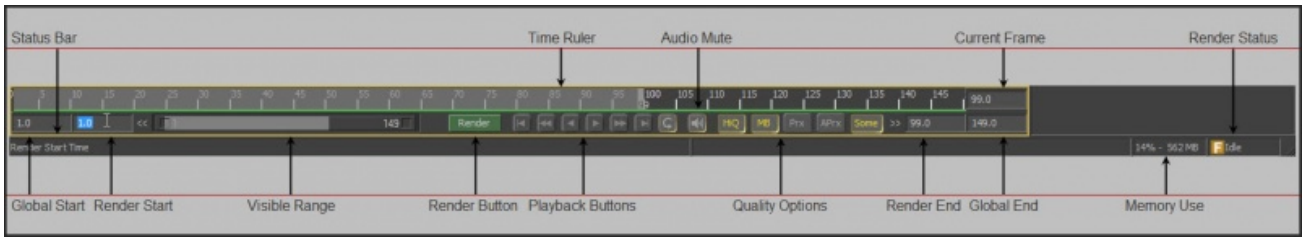


Shortcut: Pressing Tab or Shift+Tab will cycle through the onscreen controls, activating each in turn.

See Also: The view's context menu has further options for control management in the Controls submenu.

Time Ruler

Time Ruler



Current Time

The Current Time field (aka Current Frame) indicates which frame of the project is currently displayed. When tools are displayed in the views it is the current time which is rendered and displayed. Adjustments made to animated controls add keyframes at the current time. The text field at the top-right side of the ruler indicates the current time, and can be used to enter a new time. The Ruler also shows a marker to indicate where the current time is within the currently visible frame range. Left clicking in the ruler will set the current time to the time clicked on.

The following keyboard shortcuts are useful for manipulating current time :

[and]

Advance the current frame forward or backward in time by 1 frame

Shift - [and]

Sets current time to the projects Global Start or Global End Frame

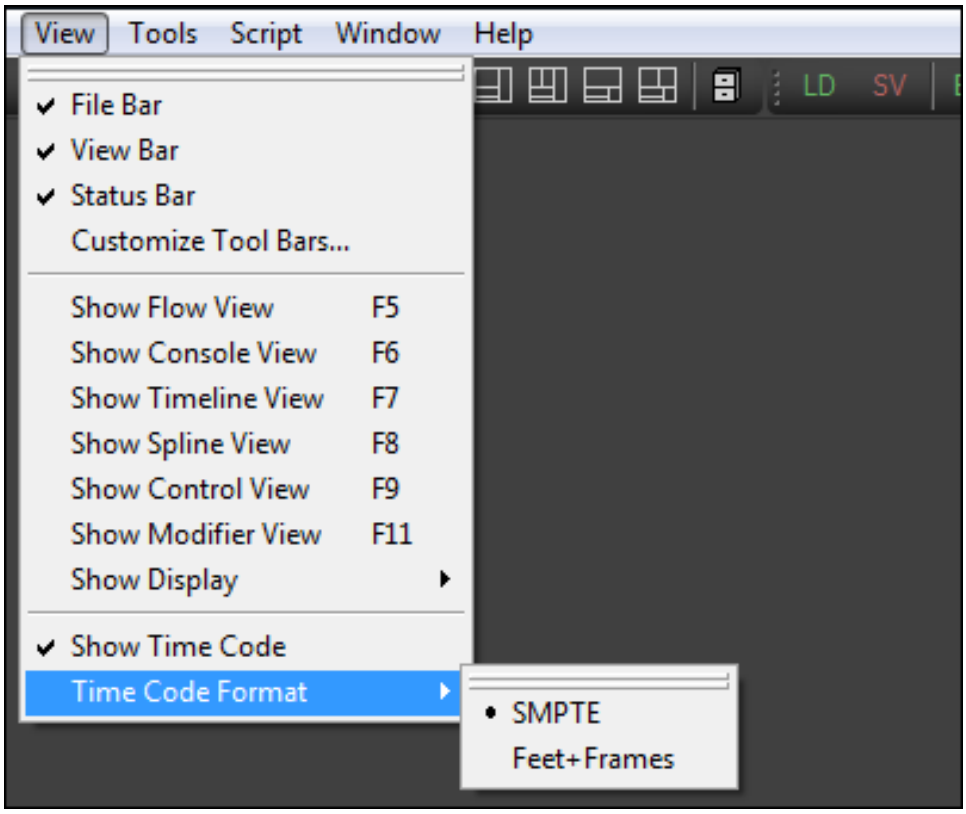
Alt - [and]

If a tool is currently active then the Alt-[and] keys can be used to set the current time to the next keyframe for any animation curves attached to that tools controls. If no tools are active then this shortcut jumps to the next time with a keyframe on any of the animated controls in the composition.

Changing the Display Format

The current time is typically shown as just the current frame number, however this can optionally be configured to show current time in either SMPTE timecode or the film format Feet+Frames instead. To change the current format open the View menu at the top of the interface window and enable the 'Show Timecode' option. Use the 'Time Code Format' menu to select which display format is used.

The options in the compositions frame format preferences panel determine the framerate used for Timecode, or the number of frames found in a foot of film.



Note

Many Fusion edit boxes will evaluate mathematical expressions simple maths - for example, typing 2.0 + 4.0 in most edit boxes will result in the value 6.0. Unfortunately SMPTE timecode uses the + symbol as a separator symbol, so this edit box will not evaluate mathematical expressions which use the + symbol correctly, even when the display format is set to Frames mode.

Ranges

Global Start and End Range

The Global Start and End controls tell Fusion what the compositions valid frames in a project are. Video editors should think of global range in Fusion as the equivalent to the length of the timeline in an editing program. The current time cannot be changed to a frame outside of the global range.

Shift-dragging a tool tile from the Flow Editor to the Time Ruler will automatically set the Global and Render Range to the valid extent of the tool.

Render Start and End Range

The Render Start and End Range controls are to used to set the range of frames which will be used for interactive playback, disk caches and previews or final renders. The range is normally visible in the time slider as a grey highlight over the global time. Frames outside of the render range will not be rendered or played in the flow, although the current time can be changed to these frames to see what the image looks like.

Dragging a tool tile from the Flow Editor to the Time Ruler will automatically set the Render Start and Render End Range to the valid extent of the tool.

Visible Range Slider



The Visible Range slider found beneath the Time Ruler indicates what frames in the composition are currently shown in the Time Ruler. While most artists will leave this at the default value (showing the entire global range) there are times when it can be desirable to show only a small portion of the compositions global range. Dragging the left and right edges of the Visible range slider can adjust the visible range to focus in on a specific area of the composition in the Time Ruler.

Render Button

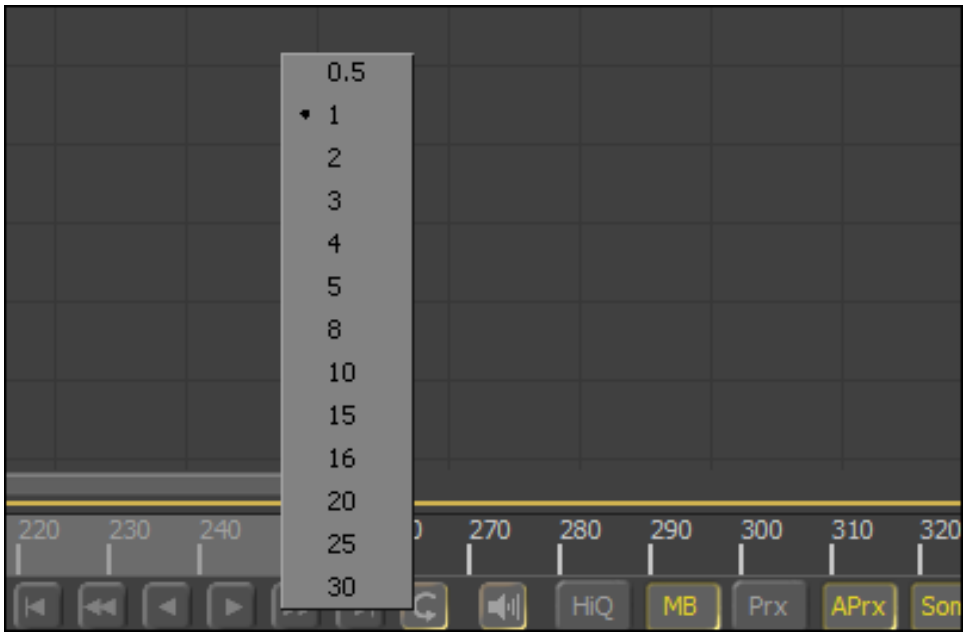
Clicking on the Render Button will cause Fusion to display the compositions Render Settings dialog, where the artist can confirm the render options and initiate rendering of the composition to disk (assuming the composition contains Saver tools). SHIFT clicking on the button will skip the dialog, using default values for the rendering (full resolution, high quality, motion blur enabled)

Playback Buttons



The playback buttons in the Time Ruler can be used to initiate playback of the composition forwards or reverse, to advance current time to the next or previous frame, or to jump current time to the start and end of the Render Range. In this context playback means that fusion will render the composition to display currently viewed tools at the current frame, then advance current time to the next frame (or previous frame) and repeat. There is no assurance of real time playback at the projects full frame rate, unless the frames are already cached in memory.

Right clicking on either the frame advance or previous frame buttons will display a context menu that can be used to set a frame increment. This increment will be respected by playback as well as the frame advance buttons and keyboard shortcuts [and]. This is often useful for rotoscoping on fixed increments, or inspecting a frame one field at a time.

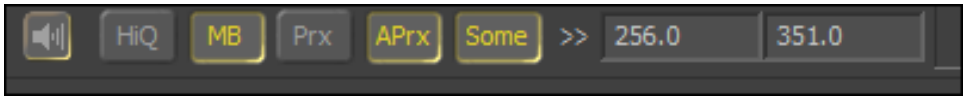


The loop button is a toggle that determines whether playback will stop when the current time reaches the render start or end, or whether playback will loop.

Audio Mute

The Audio button is a toggle which can be used to determine wether the composition attempts to play back any audio associated with the clip. Additionally, right clicking on this button will display a context menu that can be used to select a wav file which can be played along with the composition, and to assign an offset to the audio playback.

Composition Quality Options



High Quality

When working with Fusion interactively to create a flow, the quality of the images in the displays is often less important than the speed with which they are shown. As a result, Fusion does not normally render images interactively at the same quality that is required for final renders. More complex and time consuming operations like area sampling, anti-aliasing and interpolation are skipped to produce results more rapidly. Enabling HiQ mode will force Fusion to produce a full quality render instead.

To enable the HiQ mode, click on the HiQ button at the bottom of the screen. Interactive processing will take longer but the image seen onscreen will be identical to that produced during a final render.

Motion Blur

When the Motion Blur button in the toolbar is toggled off then Fusion will ignore the motion blur options enabled on any of the tools in the composition. This can result in significantly quicker renders and previews, since the sub-frames required to produce motion blur will no longer be calculated.

Proxy And Auto Proxy

Proxy

For increased performance, the Proxy (Prx) button in the time ruler reduces the resolution of the images that are processed interactively. Enable proxy mode to force Fusion to process one out of every x pixels interactively, instead of rendering every pixel. The value of x is decided by right-clicking on the Proxy button and selecting a proxy ratio from the button's context menu.

If a lower resolution version of footage is provided in the Loader's Proxy Filename control, then this footage will be loaded when the Proxy option is enabled, rather than the full resolution footage.

Auto Proxy

The Auto Proxy button enables Fusion to interactively degrade the image while adjustments are made to controls, snapping back to normal resolution when the control is released.

For example, while dragging a center control, Fusion may only process the image at a third the resolution so that updates to the screen can keep up with adjustments. Once the center control is released, the image returns to full quality to confirm the change.

Set the auto proxy ratio by right-clicking on the Auto Proxy button and selecting it from the context menu.

Selective Updates (Some, None And All)

Interactively, Fusion normally renders only the tools that are needed to display the images in the views. The Selective Update button in the time ruler opens the render settings dialog to select the mode used during final and network renders.

There are three modes of Selective Update.

Some

During final renders, Fusion only renders the tools that directly contribute to the output saved to disk. This is known as the Some mode of selective update because only some of the tools in the flow are rendered. Some is the default mode.

None

None will prevent rendering of all tools in the flow, which can be handy for making a large number of changes to a slow composition. When None mode is enabled the display views will be highlighted with a red border to indicate that the display views are not being updated to reflect changes taking place in the composition.

All

All forces all of the tools in the flow to render. This can be useful when interactively adjusting small, fast compositions.

Tool Controls

Tool Controls Introduction

Every tool added to a flow in Fusion has a set of parameters, or controls, that determines how that tool behaves. When that tool is selected, the controls for that tool appear in a window on the right side of the screen in the Controls Area. More than one tool can be selected at a time.

Each control window has a header. This is a small title bar for the window that displays the tool's name and a button to collapse or open the window. The control header is also a good place to access the tool's context menu.

Modifiers can also be attached to a tool's controls. Modifiers are tools like expressions, calculations, trackers and paths. When a modifier is connected to a control on a selected tool, its controls will also appear. These controls appear separately in their own modifiers tab for the controls window.

The Controls Area Interface

Maximizing The Control Area

A small button labelled with a pair of arrows can be found at the top of the controls area to the left of the tabs. Click on this button to toggle the Control Area between maximized and regular modes.

In maximized mode, the tool controls are aligned with the top of the window, taking up the maximum available height for the display of controls.

In regular mode, the tool controls are aligned with the bottom of the display views, making the best possible use of horizontal space for the display views.

Viewing The Control Window For A Tool

To open a tool's controls, select the tool from the flow, timeline tree or spline editor tree. If multiple tools are selected, the control windows for all selected tools will appear.

Hiding The Control Window For A Tool

The control window for a tool can be hidden from display so that the controls never appear, even if the tool is selected.

To hide a control window for a tool, right-click on that tool in the flow, or on the control header, and de-select Modes>Show Controls.

To re-enable the display of the control window for a tool, right-click on the tool's tile in the flow and re-select Modes>Show Controls.

Control Area Display Preferences

There are two different ways to display a tool's controls. The default option shows only the control windows for the selected tools. The alternate option shows the controls for all tools in the control window at once.

To switch to this mode, select File>Preferences from the menu and open the General Preferences. The following options are available.

Auto Control Close

When the Auto Control Close option is enabled, the control window for the selected tool is the only open window. Every other control window is automatically closed whenever a new tool is selected.

Auto Control Hide

When the Auto Control Hide option is enabled, the only control window visible is the one for the currently selected tools. All other control windows are hidden to reduce clutter. This is enabled by default. Turn it off to see all tool controls at once.

Selecting A Tool With The Control Header

A tool becomes the active tool when the tool's control header is clicked. Any onscreen controls for that tool will be displayed in the views that contain an image. This is exactly the same as clicking on a tool in the flow to select it. When a tool is the actively selected tool, its control header changes color.

Viewing And Previewing A Tool With The Control Header

To view a tool in one of the display views, click-drag the tool's control header into one of the display views. To make a preview in one of the display views, hold the Alt key while dragging the tool header into the view.

Viewing A Tool's Splines With The Control Header

To view all of the animated parameters associated with a tool, drag and drop the tool into the spline editor. The splines attached to the tool (if any) will automatically be selected and displayed for editing.

Context Menus

Tool Context Menu

To display the Tool Context Menu from the control window, right-click on the tool header across the top of the controls. This displays the same tool menu options that would be the result of right-clicking on a tool in the flow. See the chapter on the Flow Editor for more

information on these options.

Control Context Menu

The context menu for individual controls can also be accessed. For example, right-clicking on a slider will provide the Control Context Menu, with options to animate the control or add additional modifiers. These options are described in more detail through the rest of this chapter.

Common Controls Tab

The Common Controls Tab is labeled with a radioactive symbol and can be found on virtually every tool found in Fusion. The common controls are generally found even on third-party plugin tools. This tab collects together controls that would normally have appeared on every tool.

The following controls are generally found in this tab. Some controls may not appear on all tools. For example, motion blur settings have no meaning on a Cineon Log tool.

Blend

The Blend control is found in all tools (except loader and creator tools). Use the blend control to blend between the tool's unaltered image input and the tool's final modified output image. When the blend value is 0.0, the outgoing image is identical to the incoming. Normally, this will cause the tool to skip processing entirely, copying the input straight to the output.

Process When Blend Is 0.0

The tool is processed even when the input value is zero.

Red/Green/Blue/Alpha Channel Selector

These four checkboxes can be used to limit the effect of the tool to specified color channels. This filter is often applied after the tool has been processed.

For example, if the red checkbox on a transform tool is deselected, the transformation will first be applied to the image, then the red channel from the original input will be copied back over the red channel of the result.

There are some exceptions, such as tools where deselecting these channel selectors causes the tool to skip processing that channel entirely. Tools that do this will generally possess a set of identical checkboxes on another tab in the tool. In this case, the state of the common control channel selector checkboxes are instanced to the channel selectors found elsewhere in the tool.

Masking

Apply Mask Inverted

Enabling the Apply Mask Inverted option inverts the complete mask channel for the tool. The mask channel is the combined result of all masks applied to a tool.

Multiply By Mask

Selecting this option will cause the RGB values of the masked image to be multiplied by the mask channel's values. This will cause all pixels of the image not included in the mask (i.e. set to 0) to become black.

Object And Material ID Masking

Use Object/Use Material (Checkboxes)

Some 3D software can render to file formats that support additional channels. Notably, the RLA and RPF file formats support object and material ID channels, which can be used as a mask for the effect. This checkbox determines whether the channels will be used if present. The specific material ID or object ID affected is chosen using the next set of controls.

Pick (For Use Object/Use Material)

Use these controls to select which ID will be used to create a mask from the object or material channels of an image. Use the Pick button in the same way as the color picker; to grab IDs from the image displayed in the view. The image or sequence must have been rendered from a 3D software package with those channels included.

Correct Edges

This checkbox only appears when the Use Object ID or Use Material checkboxes are selected. It toggles the method used to deal with overlapping edges of objects in a multi-object image. When this control is toggled on, the Coverage and Background Color channels are used to separate and improve the effect around the edge of the object. If this option is toggled off (or no Coverage or Background Color channels are available), aliasing may occur on the edge of the mask.

For more information on the Coverage and Background Color channels, consult the Auxiliary Channels chapter.

Motion Blur

Motion Blur

This toggles the rendering of Motion Blur on the tool. When this control is toggled on, the tool's predicted motion is used to produce the motion blur caused by the virtual camera's shutter. When the control is toggled off, no motion blur is created.

Quality

Quality determines the number of samples used to create the blur. A quality setting of 2 will cause Fusion to create two samples to either side of an object's actual motion. Larger values produce smoother results but increase the render time.

Shutter Angle

Shutter Angle controls the angle of the virtual shutter used to produce the motion blur effect. Larger angles create more blur but increase the render times. A value of 360 is the equivalent of having the shutter open for one whole frame exposure. Higher values are possible and can be used to create interesting effects.

Center Bias

Center Bias modifies the position of the center of the motion blur. This allows for the creation of motion trail effects.

Sample Spread

Adjusting this control modifies the weighting given to each sample. This affects the brightness of the samples.

Comment Tab

The Comment Tab is marked by a small blue icon that contains the letter I in white. This tab is found on every tool. It contains a single text control that is used to add comments and notes to the tool. Click in the entry area and type the text.

When a note is added to a tool, a small blue icon with the letter I appears on the control header. To see the note in the flow, hold the cursor over the tool tile for a moment. The contents of the comments tab can be animated over time, if required.

Additional controls appear under this tab if the tool is a Loader. See the Creator Tools chapter for details.

Scripting Tab

The Scripting Tab is present on every tool in Fusion. It contains several edit boxes used to add scripts that process when the tool is rendering. For more details on the contents of this tab, please consult the scripting documentation.

Scaling and Panning the Control Window

Resizing The Control Window

To increase the overall width of the Control Window, click-drag on the vertical splitter that separates the controls from the work area and displays. Most controls will resize together with the window. This allows for greater precision with sliders, angles and other tools.

The controls have a minimum width of approximately 280 pixels. They will begin to be cropped rather than be resized past this point.

Panning the Control Window

The control window can be panned up or down to reveal portions which have scrolled out of the visible portion of the screen. To pan, either click drag on the scrollbar that appears to the right of the control window, or hold down the middle mouse button and drag while the mouse pointer is positioned over the control window.

Control Animation

Virtually any control found in Fusion can be animated over time. Controls default to static, with no animation. Animate a control by attaching it to an animation curve. Multiple controls can all be connected to the same animation curve.

Animation Curves

When animating a control, the control is connected to an Animation Curve. These curves are made up of splines from one of four spline types. By default, Fusion uses a Bezier spline when a control is animated. This is the type of spline found in most software packages. Change the default spline type from Bezier to one of the other types by changing the Default Animate option in the Globals>Defaults panel of the preferences.

Bezier Spline

The shape of a Bezier Spline is determined by keyframes that represent the value of a control at a frame. The values between keyframes are determined by interpolation. With a smooth the curve, the weighting of the interpolation between values is determined by two handles attached to each keyframe.

Natural Cubic Spline

A Cubic Spline also uses keyframes to represent the value of the control in time, and appears identical to a Bezier curve when the interpolation between points is linear. When the interpolation is smooth, a cubic spline uses a different method of calculating interpolation that eliminates the need for handles.

NURB Spline

NURB splines also use keyframes, but the value of the keyframe only directly maps to the value of the control when the spline is linear. When the spline is smooth, the keyframes define the shape of the curve with no direct relationship to the value. Although it can be used to create very naturalistic motions, this spline type is rarely used because it is so difficult to control.

To Animate A Control Using The Default Animation Curve

Right-click on the control and select Animate from the context menu. This will attach the control to an animation curve and set a keyframe for the current value at the current frame.

To Animate A Control Using A Non-Default Animation Curve

Right-click on the control and select the desired curve type from the context menu's Modify With submenu.

To Set A Keyframe On An Animated Control

Keyframes are automatically updated whenever the value of a control attached to an animation curve is changed. If there is a keyframe already at the current time, the keyframe is updated, otherwise, a new keyframe is created.

To set a new keyframe without changing the value of the control, right-click on the control and select Set Key On Tool Name: Spline Name from the context menu. This is handy when the animation is to hold a specific value for a length of several frames.

Removing Animation

To remove an animation spline from a control, right-click on the control and select Remove Bezier Spline or Remove Cubic Spline from the context menu.

Connecting A Control To An Existing Animation Curve

Right-click on the control and select the name of the animated control to be connected to from the context menu's Connect To submenu.

Connecting One Control To Another Without Animating Them

It is often useful to connect two controls together without either control having to be animated. In this case, one control must be published first. This is done by right-clicking on the control and selecting Publish, then connecting the second control as described above.

For example, to connect a control to a Shake modifier, place the pointer over the control. Press the right mouse button and select Modify With from the context menu that appears. Then select the modifier that is to act on that control. The context menu will list only modifiers that are valid for that control.

For more information on connections and modifiers, see the Connections And Modifiers chapter later in this manual.

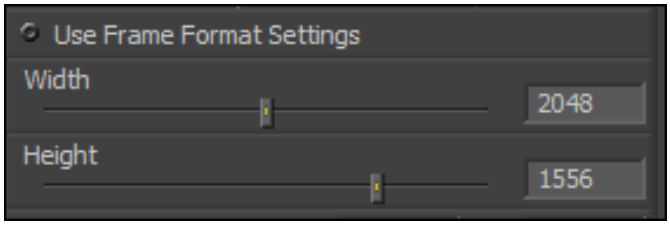
Types of Controls

Types Of Controls

Although a few tools use highly-customized interface elements, the vast majority of controls are modified using a mix of common control elements, such as sliders, angle wheels, checkboxes and button arrays. The following is a description of the most common control types found in Fusion.

Slider Controls

Slider Controls are used to select a single value from a range of values. The artist can click and drag on the sliders handle to adjust the value, or enter a new value manually into the edit box to the sliders left.



Clicking on the gutter to the left or right of the handle will increase or descrease the value by a set amount. Holding down the CTRL of SHIFT key while clicking on the gutter will adjust the values by smaller or larger increments respectively.

Clicking on the sliders handle directly also makes it possible to adjust the values using the left and right cursor keys. The CTRL and SHIFT modifiers can again be used to modify the value change to larger or smaller increments.

While slider controls will usually present with a minimum and maximum value, entering a value directly in the edit box outside that range will often expand the range of the slider to accomodate the value. For example, it is possible to enter 500 in a Blur Size control, even though the Blur Size sliders default maximum value is 100. The slider will automatically adjust it's maximum displayed value to allow entry of these larger values.

Thumbwheel

A Thumbwheel control is identical to a slider except that this control does not have a maximum or minimum value. Thumbwheel controls are typically used on angle parameters, although they do have other uses. To use a thumbwheel control, click on the center portion and drag left or right.



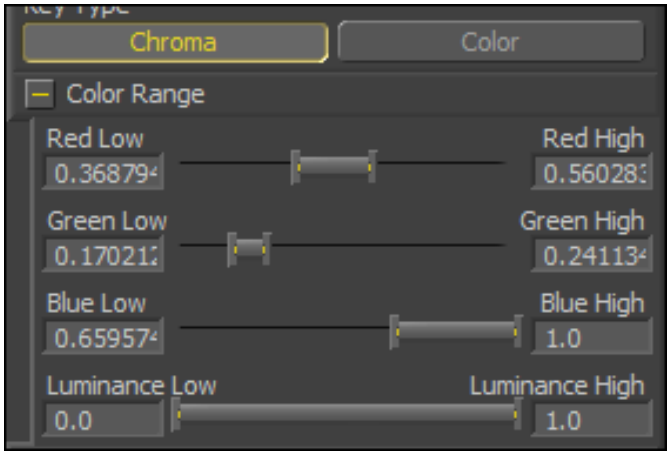
Fine tune the parameter by clicking the arrow heads at either end of the control. The artist can also click directly on the control and then use the left and right cursor arrows to adjust the controls values. As with the slider control the CTRL and SHIFT modifiers can be used to increase or decrease the size of the control change.

Values can also be entered directly into the edit box to the controls right.

Range Controls

Range Controls are used to specify a low value and a high value. To adjust the values, click and drag the handles on either end of the range bar. To adjust the high and low values of the range simultaneously, click and drag from the center of the range bar.

Expand or contract the range symmetrically by holding down the CTRL key and dragging either end of the range bar.



The Range control is actually two separate controls, a Low Range and a High Range. These can be animated and modified individually.

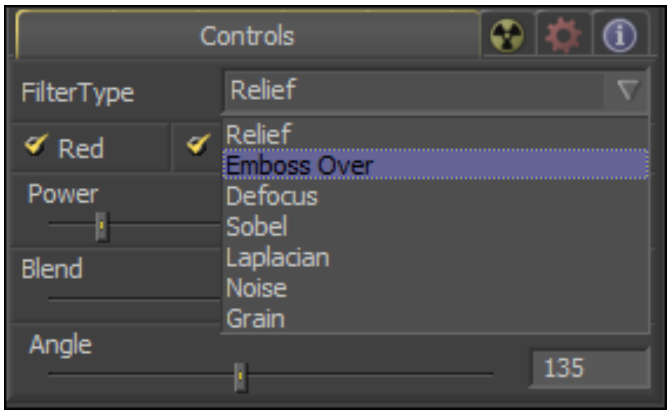
Checkboxes

Checkboxes are controls that have either an on or off value. As with most of the controls in Fusion, they can be animated. The spline that controls an animated control steps in and out when viewed in the spline editor.

Drop-Down Lists

Drop-Down lists are used to select one option from a list of options. Clicking on the control will reveal the full list of available options for selection. One the list is open clicking on any of the entries in the list will cause that entry to be selected.

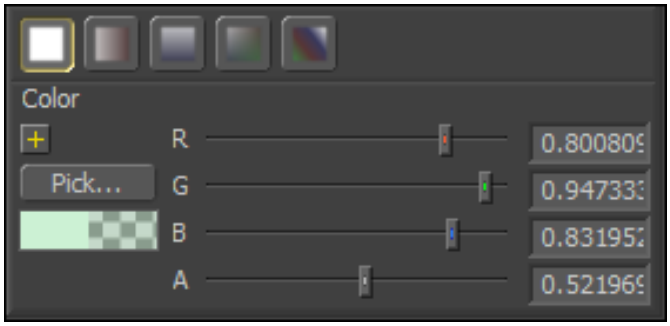
Only one option can be selected at a time, and the currently selected option will be displayed in the control when the menu is closed.



When a drop down box control is animated the integer value 0 represents the first item in the selection, integer value 1 represents the second entry in the list, and so forth.

Color Wheel And Picker

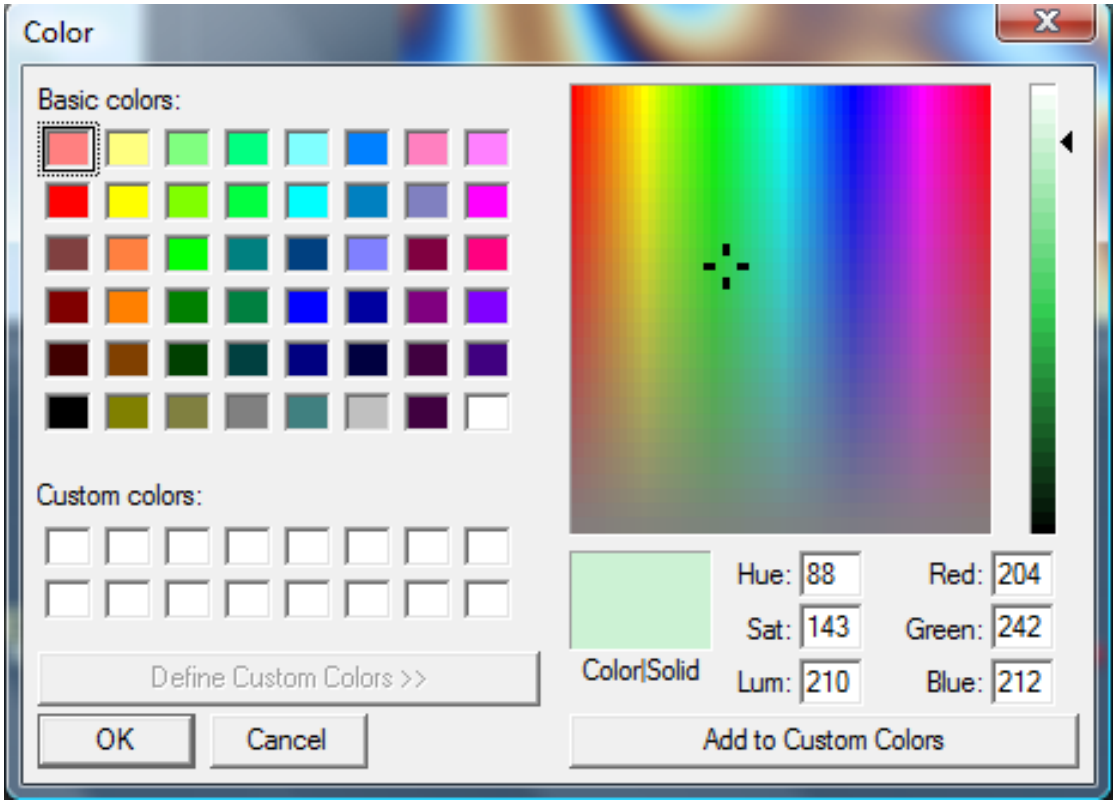
The Color Picker is displayed wherever a tool parameter requires a color as its value. The selected color is shown in the swatch below the pick button. The swatch has two halves; the left half shows the color and the right half shows the color overlaid on a checkerboard to visualize the transparency.



The color picker is extremely flexible and has four different techniques for selecting and displaying colors.

The Windows Color Picker

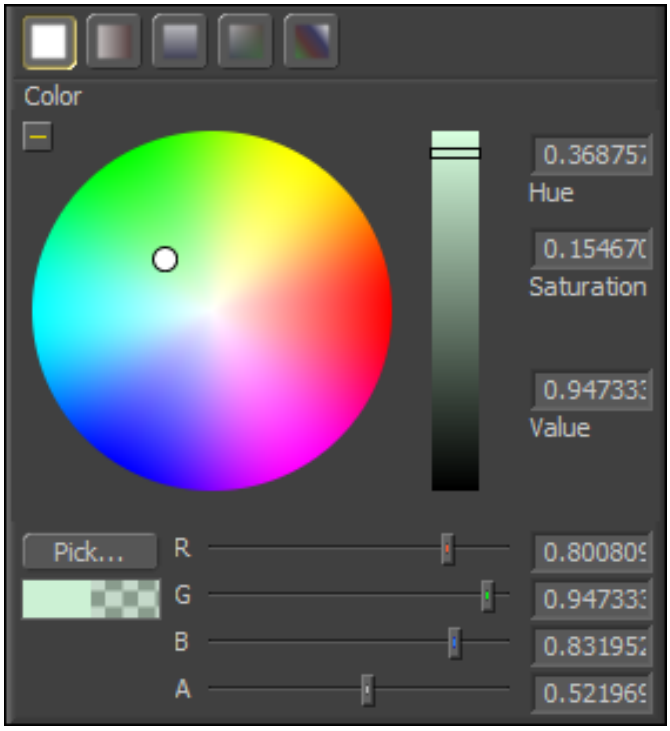
Clicking on the Pick button will display the operating systems standard Color Selector dialog. This dialog can then be used to select a color, and clicking on OK will apply that color to the control.



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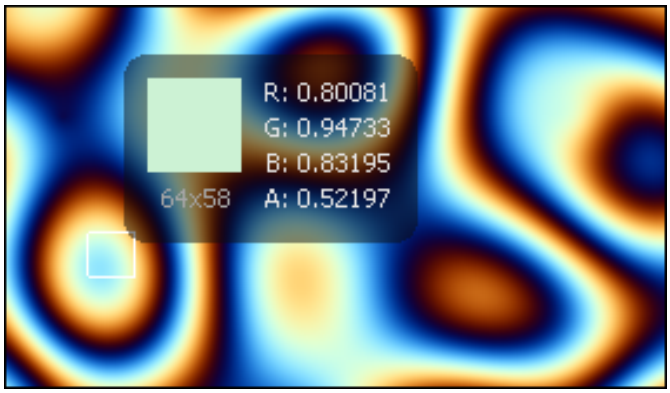
The Color Wheel

Clicking on the small arrow button above the pick button will reveal a Color Wheel with a luminance bar, which can be used to select a color.



Picking Colors From An Image

To select a color directly from an image displayed in one of the Fusion display views, click and hold the Pick button. The cursor will change to the eyedropper tool. While still holding down the mouse button, move the eyedropper over the view. A popup swatch will appear above the mouse pointer showing the selected color and its values.



When the color displayed is the one desired, release the mouse button to set that color.

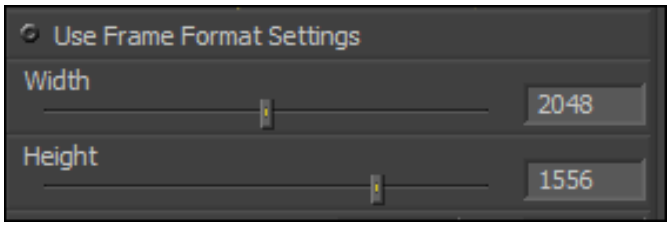
The color picker normally selects from a single pixel in the image. Adjust the size of the selection by holding the Ctr

Types Of Controls

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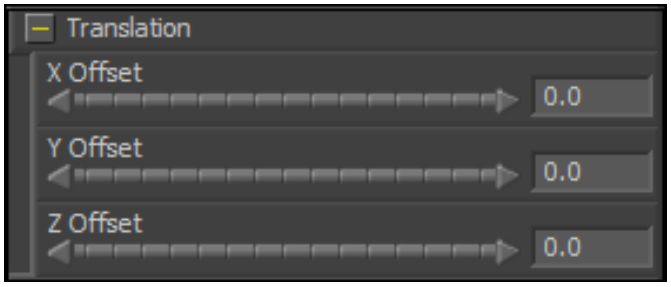
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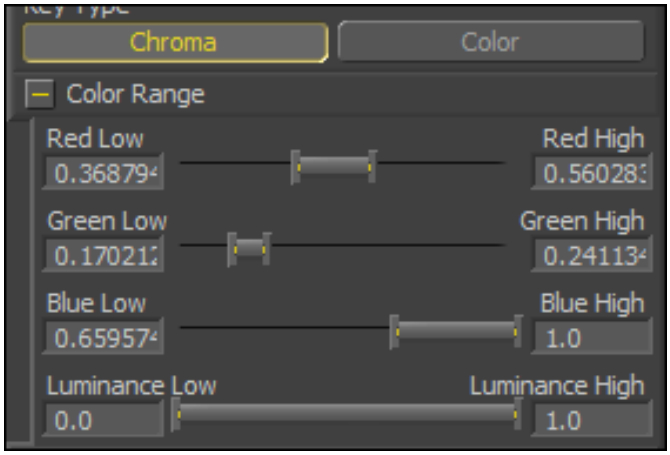
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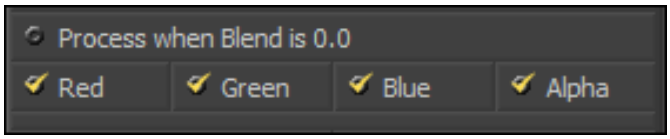
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Checkboxes

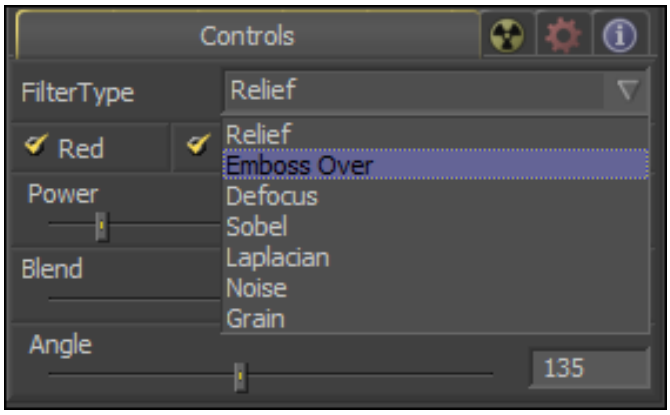
Checkboxes are controls that have either an on or off value. Clicking on the checkbox control will toggle the state between selected and not selected. When this control is aniumated a value of 0 means the control is off while a value of 1.0 or greater will turn it on.



Drop-Down Lists

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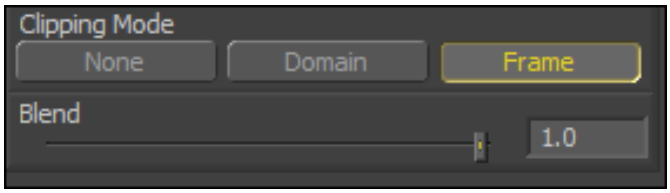
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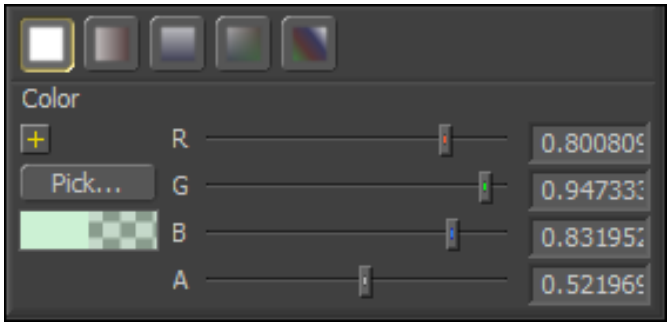
Button Arrays

Button Arrays are groups of buttons that allow the artist to select from a range of options. They are almost identical in Funstion to drop down menu controls, except that in the case of a Button Array it is possible to see all of the available options at a glance.



Color Wheel And Picker

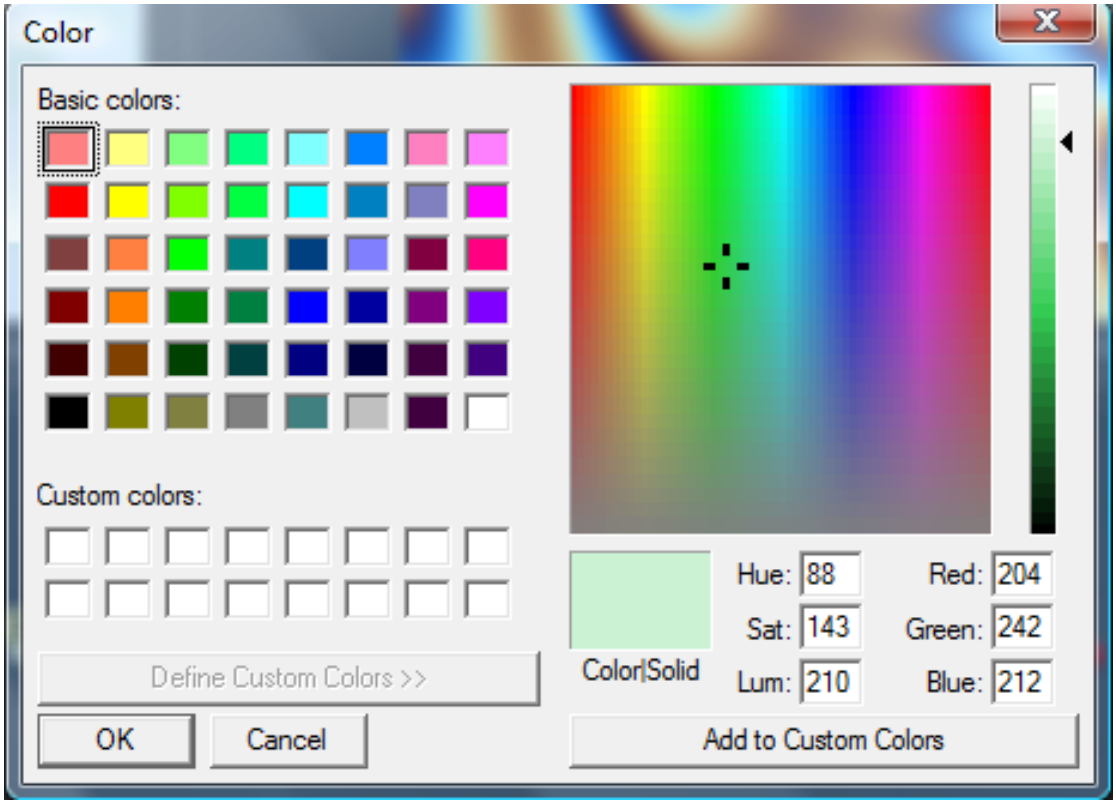
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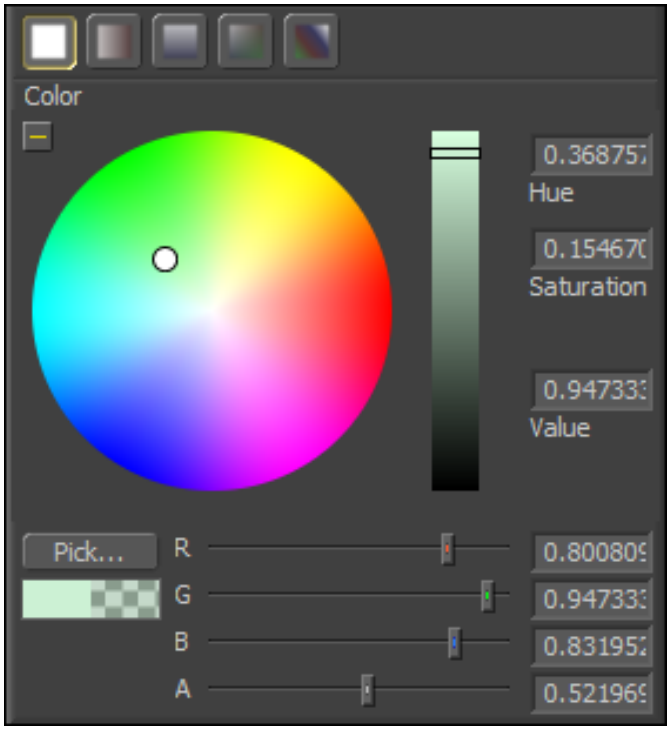
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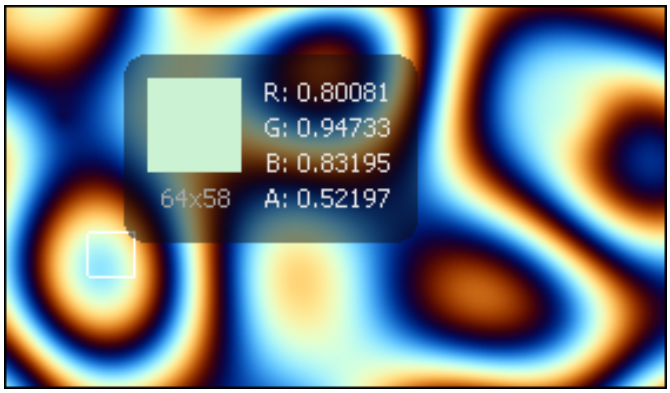
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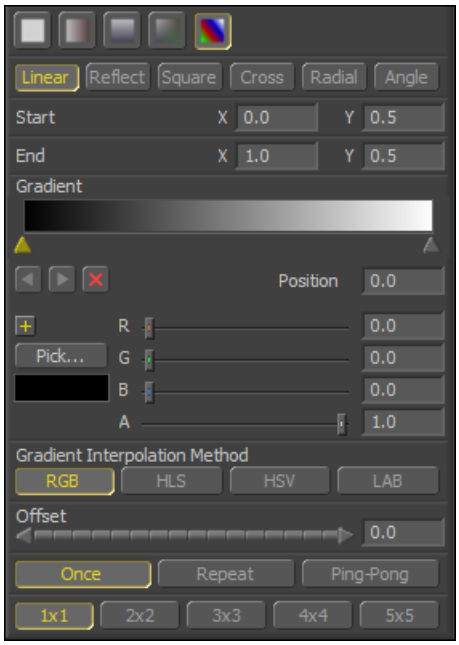


When the color displayed is the one desired, release the mouse button to set that color.

The color picker normally selects from a single pixel in the image. Adjust the size of the selection by holding the Ctrl key and dragging while picking. The size change applies to all color pickers until the size is changed again.

Gradients

The bar Gradient control is used to create the colors that a gradient follows from start to finish, using keyframe colors set along the length of the bar. The gradient control is actually nine or ten controls in total, which are described below.



Gradients have their own context menu, accessed by right-clicking directly on the gradient bar. This provides options for animating, publishing and connecting one gradient to another. It also reveals one modifier specific to gradients that builds a custom gradient by sampling colors from an image produced by a tool in the flow.

Gradient Type

Use this button array to select the method used to draw the gradient. Select from linear, reflect, square, cross, radial and angle gradient types.

Start And End Position

The Start and End Position controls are represented by two crosshairs in the display views, as well as a set of X and Y controls. They determine where the gradient physically begins and ends.

Gradient Colors

This bar type gradient control is used to select the colors through which the gradient will transition when moving from the start position to the end position. Only two color positions are available by default, the start and end colors. To modify one of the colors, select the triangle below the color on the bar. Use the Color Selector controls below to set the color.

New keyframes are added to the gradient control by clicking just beneath the gradient bar. The position of the keyframes can be adjusted by click-dragging on the keyframe. To copy an existing keyframe, hold the Ctrl key down before dragging the keyframe.

To remove a keyframe, click-drag the keyframe straight up past the gradient bar or select the keyframe and click on the red X button.

Gradient Interpolation Method

This button array determines what color space is used to calculate the colors between keyframes.

Offset

The Offset control is used to offset the position of the gradient relative to the start and end markers. This control is most useful when used in conjunction with the repeat and ping-pong modes described below.

Once/Repeat/Ping-Pong

These three buttons are used to set the behavior of the gradient when the offset control scrolls the gradient past its start and end positions.

1x1, 2x2, 3x3, 4x4, 5x5

These buttons control the amount of sub-pixel precision used when the edges of the gradient become visible in repeat mode, or when the gradient is animated. Higher settings will take significantly longer to render.

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Timeline

Timeline Introduction

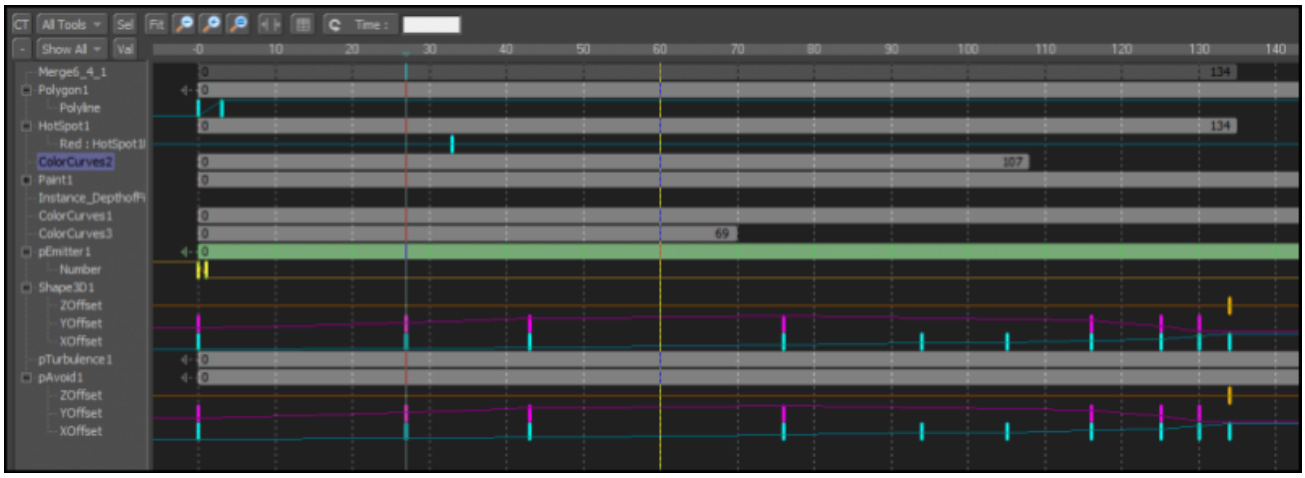
The Timeline Editor presents a view of the composition where individual tools are represented by a horizontal bar where the length and position of the bar along the x axis tells the artist the duration and temporal position of the tool. Tools that contain animated controls display the keyframes beneath the tools timeline bar.

This interface is most frequently useful for adjusting the trim in and out of footage in Loader tools, and for adjusting the timing of keyframes on one or more animation curves. Unlike timeline based compositors the order that tools are presented in the Timeline's tool list is irrelevant to the layering order of the elements in the composition. .

Timeline View

The vast majority of the timeline work area is taken up by the timeline itself, containing the horizontal bars which represent the duration and keyframes for the tools displayed in this work area. The horizontal axis labels in this view represent time and are labeled with frame numbers (unless the View/Show Timecode option has been turned on). By default the timeline shows bars for every single tool in the composition, but as the composition becomes more complex artists will typically find themselves filtering the view according to which tools are selected, animated or by custom filters based on tool type.

The color of the bars in the timeline is based on the same coloring scheme applied to the tool tiles in the flow.

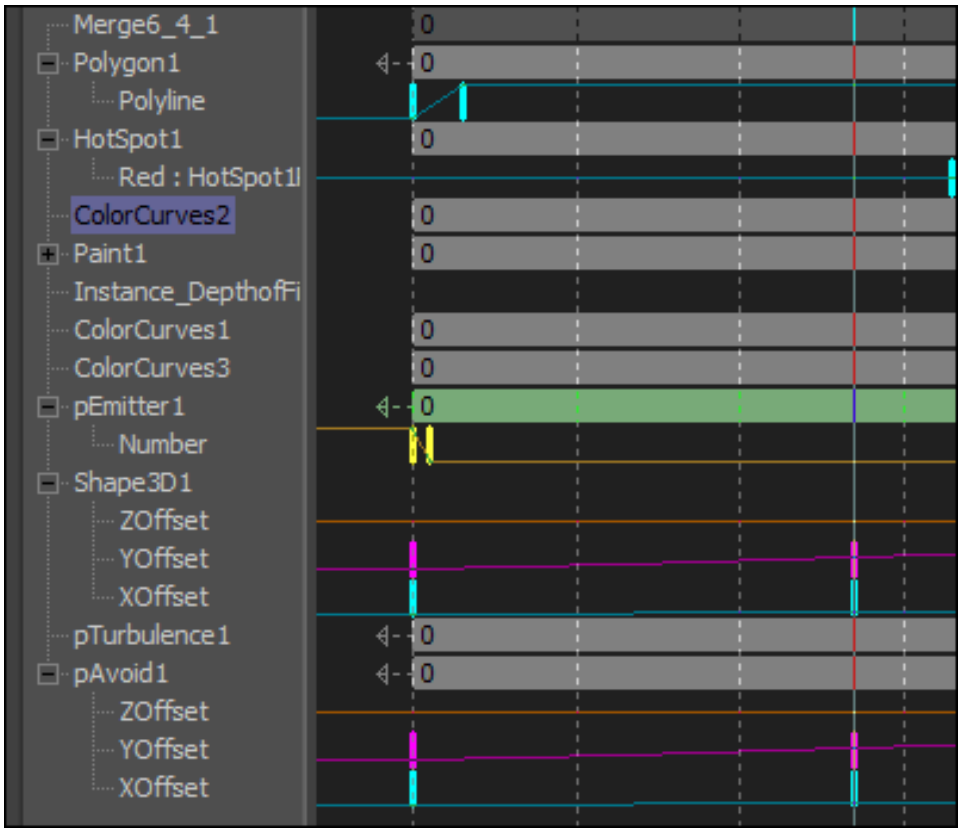


Tool List

The Tool List is the panel to the far left of the Timeline work area. It contains a list of the tools currently displayed in the timeline. Tools with animation splines applied to their controls will have a small + symbol appear next to their names. Clicking on the + symbol will reveal the animations splines keyframes in the row beneath the tool.

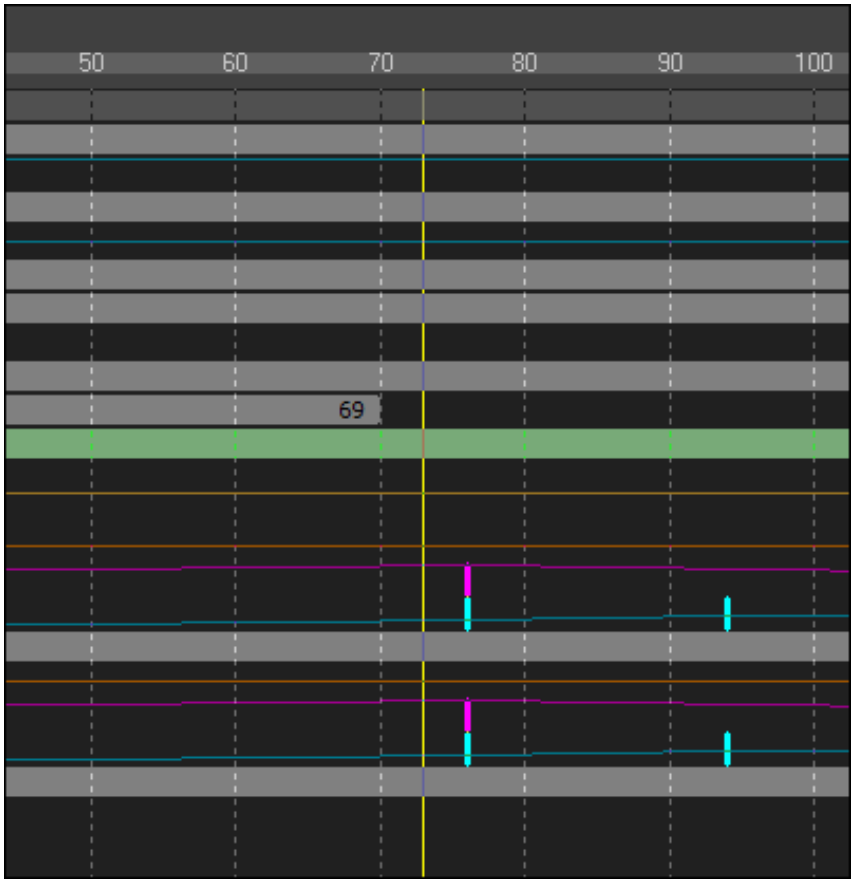
Clicking on a tools name in the list selects that tool, displaying the controls in the Control window. CTRL-Clicking adds and removes tools from the selection set. Right clicking on the tools name displays the tools context menu, just like right clicking on the tools header or the tile in the Flow editor.

Clicking and dragging on the tool's name in the Tool List will allow the artist to re-order the appearance of the tool names. This has no affect on compositing order - moving tool_a beneath tool_b has no impact on the connections between tools as seen in the Flow Editor. Typically this feature is used to help position the timeline bars for related tools closer together in the list.


Merge6_4_1
Polygon1
Polyline
HotSpot1
Red : HotSpot1
ColorCurves2
Paint1
Instance_DepthofFi
ColorCurves1
ColorCurves3
pEmitter1
Number
Shape3D1
ZOffset
YOffset
XOffset
pTurbulence1
pAvoid1
ZOffset
YOffset
XOffset
0

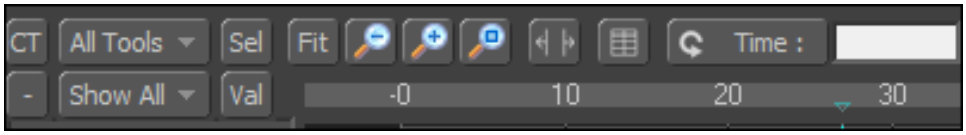
Current Frame Indicator

The Current Frame Indicator is a vertical yellow bar that runs through the timeline view to indicate the position of the current frame along the horizontal axis. Click-dragging this bar will change the Current frame of the composition. Hold down Ctrl+Alt and click in the timeline view to jump the current time indicator to the mouse pointer position.



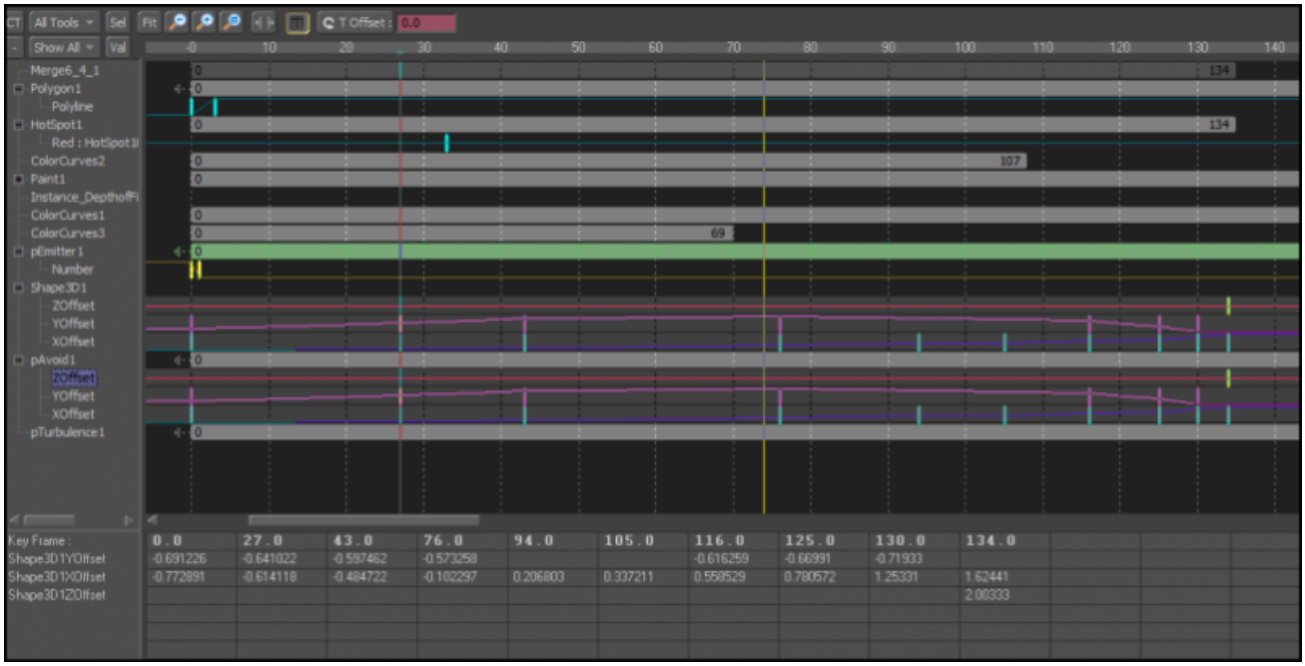
Timeline Toolbar

The Timeline Toolbar sits above the timeline view, providing access to various timeline filters, scaling modes and the spreadsheet.



Spreadsheet

The Spreadsheet view appears at the bottom of the timeline, showing the keyframes and tools in the composition as a numeric spreadsheet. It can be displayed and collapsed using a button in the Timeline toolbar. This alternative interface can be used to adjust tool trimming as well as keyframe values and timing.

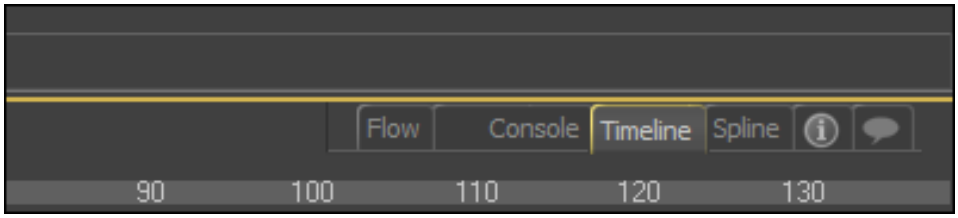


The Spreadsheet Editor is described in greater detail later in this chapter.

Viewing, Scaling And Panning The Timeline

Viewing The Timeline

Click the Timeline Tab located at the top of the flow area to switch the work area view to the timeline editor. The F7 keyboard shortcut will also open the timeline tab. Pressing the F4 key with the cursor over the timeline view maximizes the view on the screen. Press F4 again to return it to the previous size.



Panning/Scrolling The Timeline

To pan the timeline view left or right, click on the middle mouse button and drag to the left or the right. Alternately, use the standard scrollbars at the bottom of the view.

Scaling The Timeline

To change the scale of the timeline view, use one of the following methods:

Using The Toolbars

The scale buttons are located in the top left toolbar. The Fit button attempts to re-scale the view so that all currently-visible tools fit within the timeline view. The buttons with the magnifying glass icons will scale the graph view in or out. To zoom into the selected region, use the Zoom To Rectangle button by click-dragging the rectangle.

Using The Axis Labels

Place the mouse pointer over the darker labels for the horizontal axis and click-drag to resize the timeline view. The view is scaled with the position of the mouse pointer as center.



Using The Mouse

Place the mouse pointer over the timeline view. Click and hold the middle mouse button. While the middle mouse button is held down, click once on the left mouse button to zoom in and once on the right button to zoom out.

Using The Keyboard

Several keyboard shortcuts can be used to scale the display of the graph view while the spline editor is active. The + and - keys on the numeric keypad will scale in and out of the timeline. Use Ctrl-R to enable scale to rectangle mode.

Auto scale

The first time the Timeline editor is displayed in a newly opened or displayed composition, Fusion will attempt to rescale the view horizontally to fit the entire extent of the tools in the timeline. This behaviour can be disabled by the Scale/Auto-Scale option in the Display view context menu.

Working With Tools In The Timeline

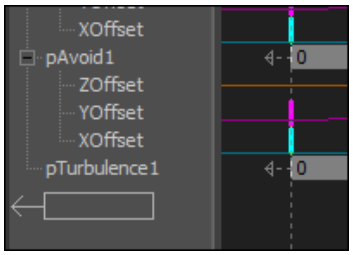
Selecting Tools

To select a single tool in the timeline, either click on the tool's name or on its bar in the timeline. To add another tool to the selection, hold down the Ctrl key while selecting a tool. Holding Ctrl while selecting an already selected tool will remove it from the selection.

Note Selecting a tool from the timeline tree also selects the tool's tile in the flow, with its controls in the control window to the right.

Re-Ordering Tools In The Tree

To re-order the tools listed in the timeline tree, click on the name of the tool and drag it to a new position in the list and release the mouse button.



Moving Tools

To change the position of a tool in time, click-drag on the middle of the tool's bar in the timeline. The mouse pointer will resemble a bar with two arrows pointing in either direction, as pictured below. Moving the bar adjusts the tools Global In and Global Out simultaneously.

Trimming Tools

To trim a tool in the timeline, click-drag on either end of its bar in the timeline. The mouse cursor will change to a vertical bar with a single arrow when the mouse pointer is in the right location to trim.

Trimming tools in the timeline has a different effect depending on whether the tool is a source tool or an effect. Trimming a loader tool will modify the clip time start and clip time end of the loaded sequence or file.

When any other tool in Fusion is trimmed, it will modify the range of that tool's effect. Outside of the trimmed region, the tool will behave as if it were passed through. This can be used to optimize performance in a flow.

Imagine a clip, for example, that is 100 frames long and is connected to a tool that animates a defocus from frames 80 - 100. There is little to no point in processing the defocus tool between frames 0 - 79. Trimming the tool to start at frame 80 in the timeline will effectively prevent it from rendering and consuming memory or processor time until needed.

Extending the First/Last Frame

To extend the First or Last Frame of a loader tool's clip, hold down CTRL while dragging the ends of the bar in the timeline.

See the Loader tool reference for details on extending frames.

Working With Splines In The Timeline

The timeline also shows any splines that are attached to a tool. When the splines are collapsed, they are drawn over the tool's timeline bar. Clicking on the plus sign beside the tool's name in the menu will expand the display so that each spline has its own bar in the timeline.

Keyframes for the splines are normally represented as vertical bars rather than points to make them easier to manipulate.

Changing Keyframe Time

To change the timing of a spline's keyframe, use on of the following methods:

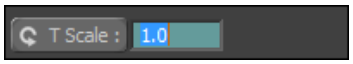
With The Mouse

Click-drag on the keyframe to position it to a new time. Multiple keyframes can also be moved in this fashion by box-selecting or Ctrl-clicking on the desired keyframes. There is no restriction to moving keyframes from a single spline. Keyframes from several splines can be selected and moved together.

The exact position of the dragged keyframe in time is displayed to the right of the spline toolbar when dragging, as well as in the status bar.

With The Toolbar

The time edit box in the Toolbar allows a new position in time to be entered for the selected keyframe or keyframes. Clicking on the Time button will switch it to time offset mode. Clicking again will set it to time scale mode. Both modes can be used to adjust the timing of multiple keyframes at once.



With The Spreadsheet

When the name of the tool is selected in the tool menu, the keyframes will be shown in the Spreadsheet view. The timing of each keyframe can then be edited directly in the spreadsheet.

See the documentation for the spreadsheet later in this chapter for additional details.

Duplicating Spline Keyframes

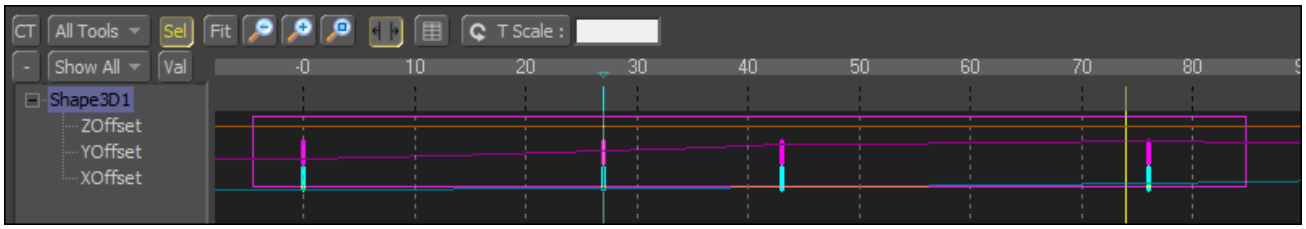
Keyframes and multiple keyframe selections can be duplicated. Select the keyframe(s) to be duplicated and, while holding down the Ctrl key, drag the spline segment to a position without keyframes. The cursor will change from the forbidden symbol to a sub selection cursor. The

keyframes can be dropped without over-writing existing keyframes.

Time Stretching

Time Stretching allows a selected spline, or segment on that spline, to be proportionally stretched or squashed. To enable spline stretching, select this option from the context menu or click on the Time Stretching button in the toolbar.

If more than one keyframe is selected on the spline, the outer keyframes will be surrounded by two vertical purple bars. If no keyframes are selected, click-drag a rectangle to set the boundaries of the bars. The time stretcher can affect more than one spline at a time.

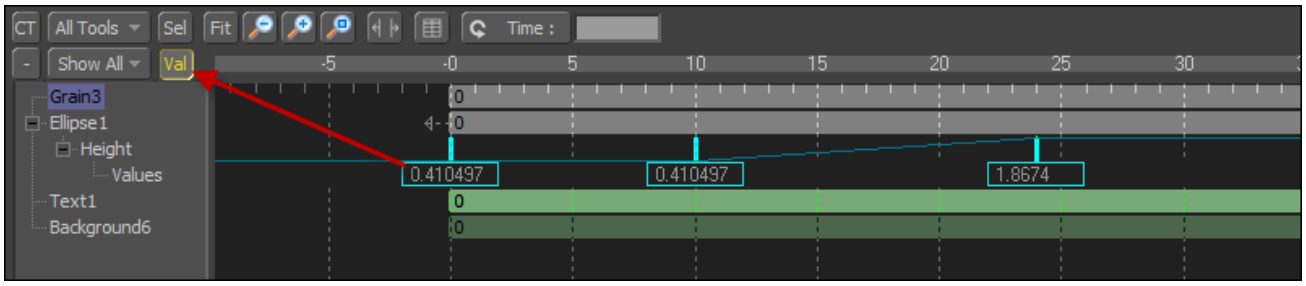


Click-drag on the purple vertical bars to stretch or shrink the timing of the spline segments within the bars. Move these bars back and forth to stretch or squash the spline segment in time.

To disable the time stretching mode, click on the toolbar button again or re-select Time Stretching from the context menu.

Showing Keyframe Values

Clicking on the Val button in the timeline ruler will reveal text boxes beneath each keypoint on a spline bar, showing the spline's current value. Click in the text box to edit the value.

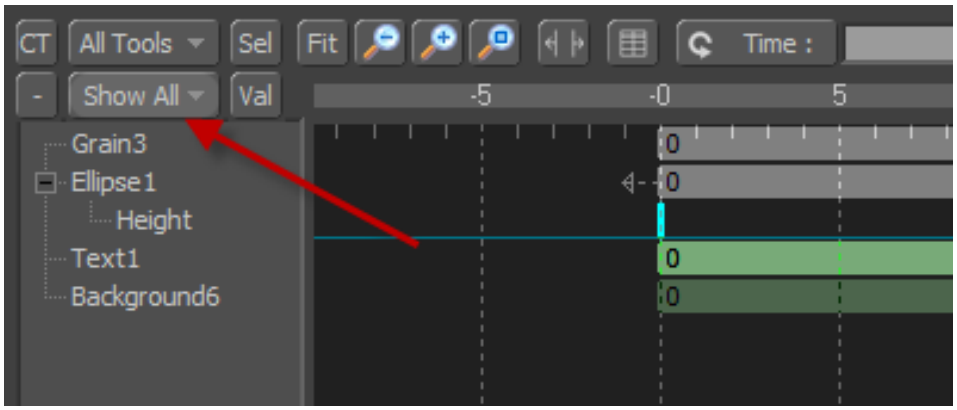


Timeline Filters

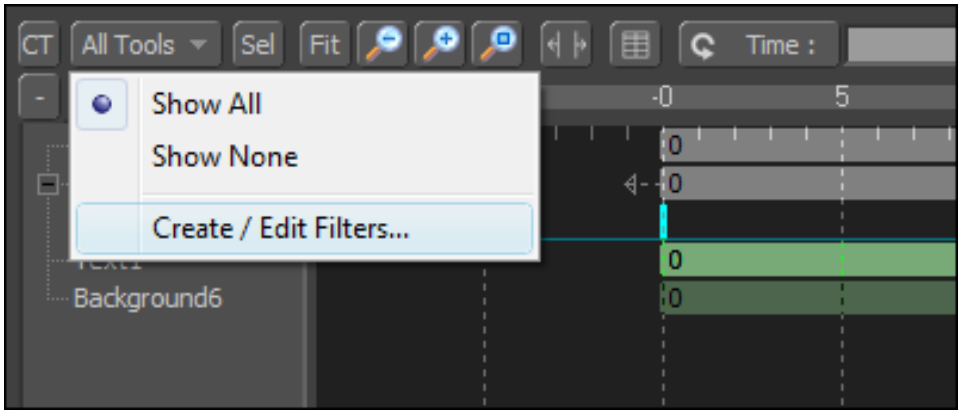
Flows with many tools can quickly become difficult to visualize in the timeline. Timeline filters can now be applied to filter out the display of tools that are not necessary to the current operation. Use pre-made timeline filters, or create new ones as needed, in the timeline preferences.

Applying Filters

To apply a timeline filter, select the Filters button above the tree in the timeline view, as shown below.

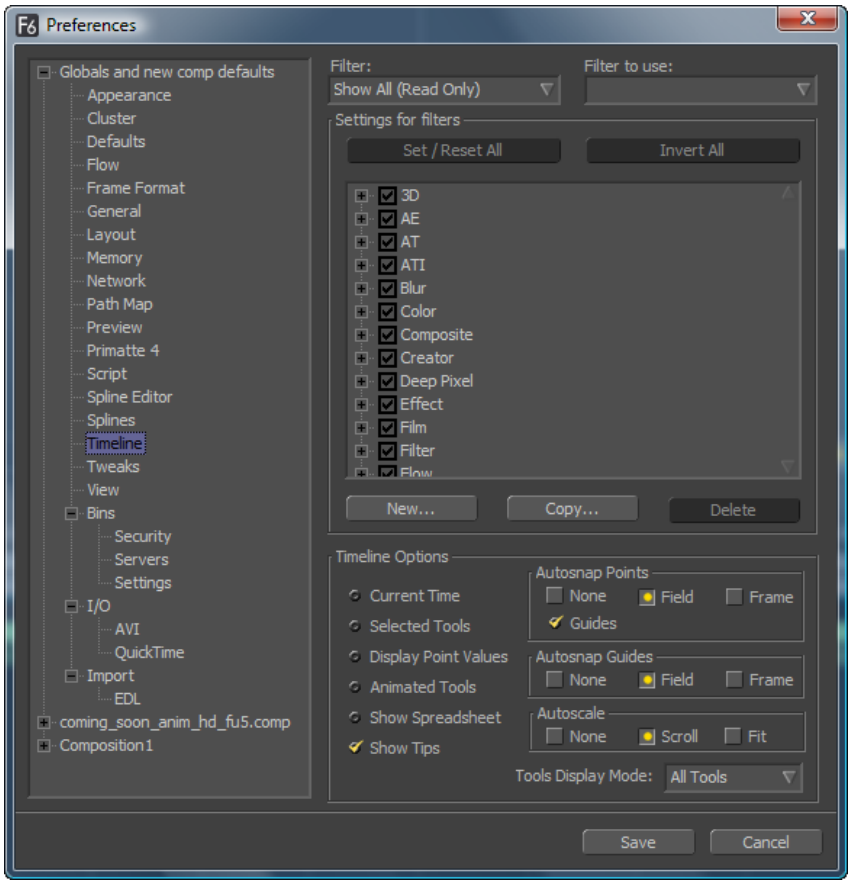


All of the available filters will be shown at the bottom of the menu that appears. Select the desired filter from the list to apply it to the timeline.



Creating Filters

Open the preferences dialog (File>Preferences) and select Timeline in the options tree on the left. This will display the dialog shown below.



Click on the New button to create a new filter. Provide a name for the filter in the dialog box that appears. New filters will default to having all tools enabled for display in the timeline.

Configuring Filters

Use the checkboxes in the tool tree to enable or disable the display of specific tool types and tool categories in a filter.

The Invert Categories and All Categories On/Off buttons can apply global changes to all of the checkboxes, toggling the selected states as described.

When the filter is configured, select the Save button to close the preferences dialog.

Removing Filters

To disable the currently applied filter, select the Show All filter from the Tools button in the timeline. To permanently remove a filter, use the Delete button in the timeline preferences dialog when the filter is selected.

Timeline.def

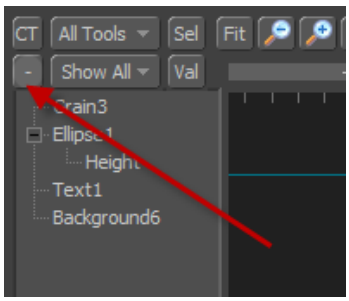
Timeline filters that are created are stored on disk in the file timeline.def, which can be found int the Fusion Profile Directory (the folder where Fusion stores it's preferences). This file can be copied from one system to another to maintain settings on a new installation.

Timeline Options

Collapse/Open All

The Collapse/Open All button is located on the far left of the timeline toolbar, in the second row. It will be labelled with a + or a - symbol, depending on the current state of the tool menu.

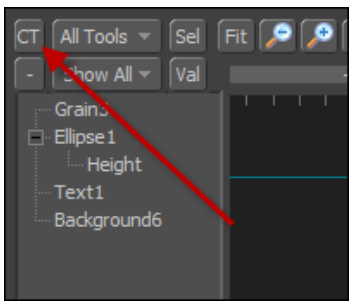
Clicking this button when the label is a minus (-) sign will collapse the tool menu, closing all open branches. When the label is a plus (+) symbol, all branches of the tree menu will be opened.



Current Time Mode

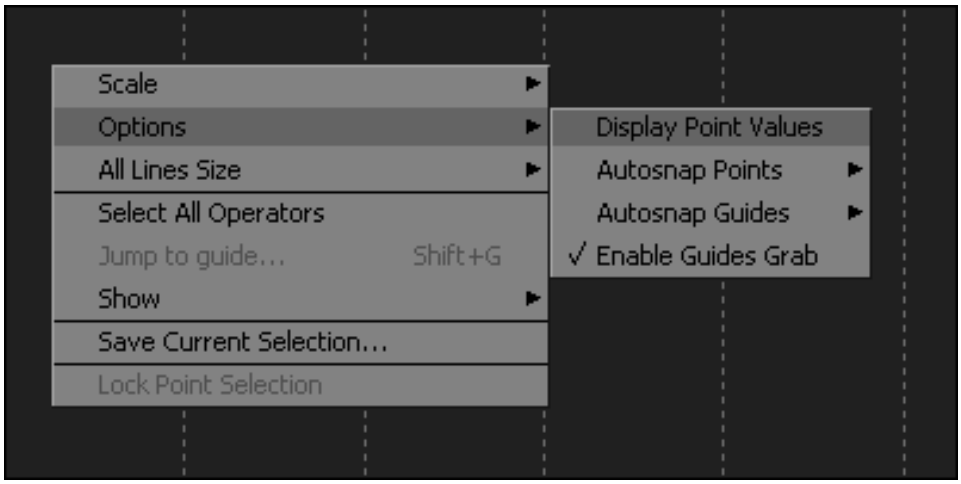
The Current Time button, labelled CT, is located at the far left of the timeline toolbar in the top row. When this button is enabled, it filters the timeline display so that only the tools that are valid at the current time are displayed.

This mode is extremely useful when working on a complex composite with many elements that appear and disappear.



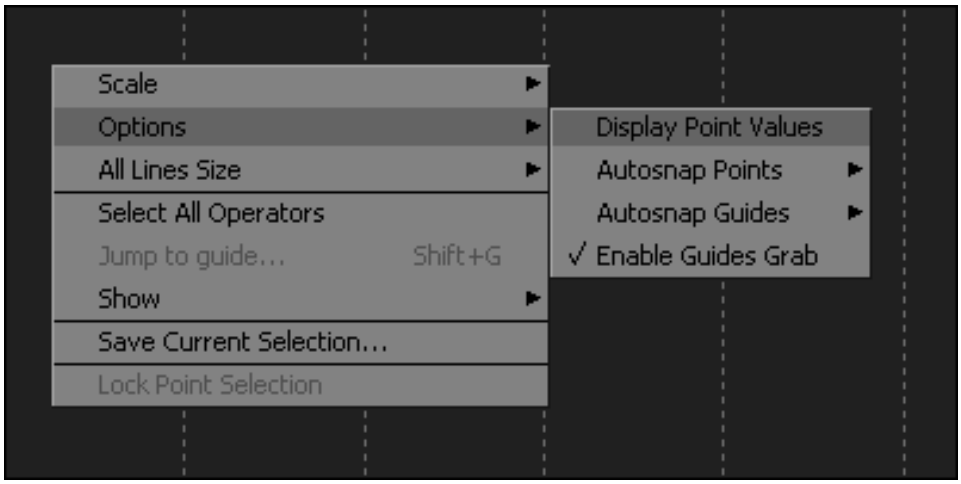
Display Point Values

The Display Point Values option causes all keyframes in the flow to be displayed as points instead of vertical bars. Select Options>Display Point Values from the context menu to enable or disable this option.



Line Size

The Line Size option controls the height of each timeline bar individually. It is often useful to increase the height of a timeline bar, especially when editing or manipulating complex splines.



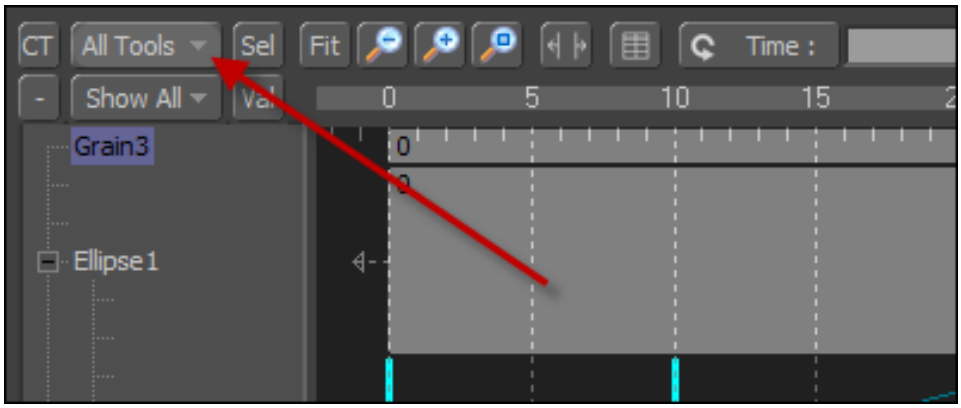
To increase or decrease the height of a timeline bar, right-click on the bar in the timeline view and select one of the five options for line size in the submenu that appears. The default line size is small.

All Lines Size

This submenu provides the same choices as the line size menu but it will affect all bars currently visible in the timeline.

Sort Order

The tool tree has several sort modes to determine the order in which the tools are displayed in the tool menu. These sort modes can be toggled by clicking on the button between the CT (current time) and the Fit button at the top left of the tool menu.



All Tools

The default sort order is All Tools. This will display the tools in linear order, scanning the flow from left to right and top to bottom.

Hierarchy

Hierarchy sorting will display tools by starting with the most background element through to the most foreground, following the connections of the tools in the flow.

Reverse

Reverse does the opposite of hierarchy, working backward from the last tool in the flow toward the most background source tool.

Animated

The Animated sort order is not really a sorting method at all. It is more of a filter that restricts the timeline to showing animated tools only. This is an excellent mode to use when adjusting the timing of animations on several tools at once.

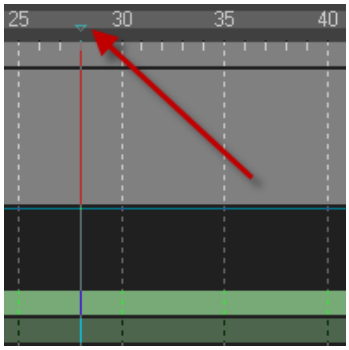
Guides

Guides are markers to help identify important frames in a project. They may indicate the frame where a footfall occurs in the scene, the moment that someone passes through a portal in the image, or any other important event in a composite.

Guides are created in the small area between the time axis labels and the timeline view. They have the appearance of a small blue triangle and a blue line that extends from them vertically through the graph view.

Creating Guides

To create a guide, click in the space immediately above the timeline view and below the time axis labels.



Working With Guides

Holding the mouse pointer still over a guide will bring up a tooltip with the frame to which that guide is set, together with the name assigned to the guide (if any).

Deleting Guides

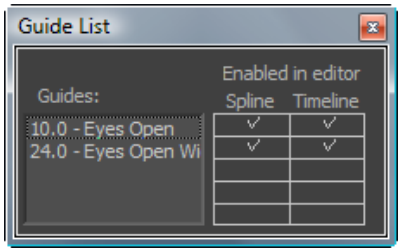
To delete a guide, click-drag it up beyond the axis labels and release the mouse. Alternately, right-click directly on the guide and select Delete Guide from the context menu.

Moving Guides

Click-drag a guide to reposition it along the time axis.

Show Guide List (Shift-G)

Right-clicking in the guides area and selecting Show Guide List will display a small dialog box that lists the current guides in the composition. Double-click on a guide's name to set the current time to the guide's time, and enable/disable the display of the guide in the spline and timeline editors.



Renaming Guides

By default, a guide is named after the time (frame) where it is set. When using guides to navigate, it is often useful to give the guides more descriptive names. To rename a guide, right-click on the guide and select Rename Guide from the context menu.

Sharing Guides With The Spline Editor

Right-click in the guides area and select Show Guide List or press Ctrl-G. A dialog box will appear with the names of the guides in the composition. Clicking on the name of a guide will cause the current time to change to that guide's frame.

There is a pair of checkboxes beside the names of each guide. One is for the spline editor and one is for the timeline.

By default, guides are created as visible in both portions of the Fusion interface. To prevent a guide from appearing in either view, deselect the appropriate checkbox.

Autosnap

To assist in precisely positioning spline keyframes and control points, options to Autosnap to a field, frame or guides can be accessed through the timeline's context menu. Autosnap only affects horizontal (time) positioning.

Configuring Autosnap

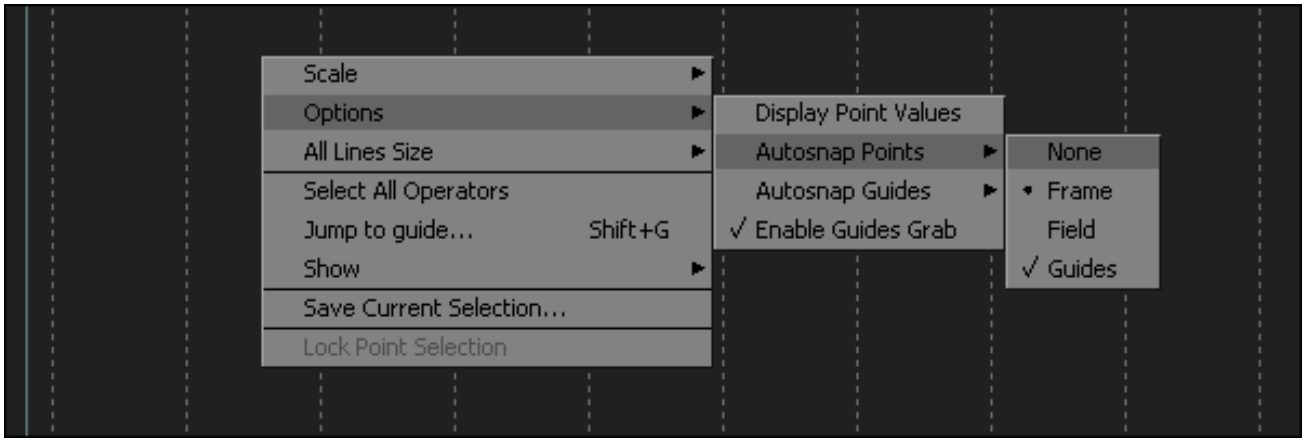
To configure autosnapping, select one of the following options from the Options>Autosnap Points menu in the context menu.

None

None allows free positioning of keyframes and tool bar edges.

Frame

Frame forces keyframes and tool edges to snap to the nearest frame.



Field

Field forces keyframes and tool edges to snap to the nearest field.

Guides

When enabled, the keyframes and tool bar edges snap to guides in the timeline.

Autosnapping And Guides

By default, a newly-created guide will snap to the closest frame. Guides that are moved with the mouse will also snap to the current frame.

This behavior can be changed by selecting Options>Autosnap Guides>None or Options>Autosnap Guides>Field from the context menu.

One of the many advantages to guides is keyframes that are moved close to a guide will snap to the guide, allowing for precise timing. This behavior is on by default and can be disabled by selecting Options>Autosnap Points>Guides in the spline context menu.

None

Guides can be placed anywhere.

Frame

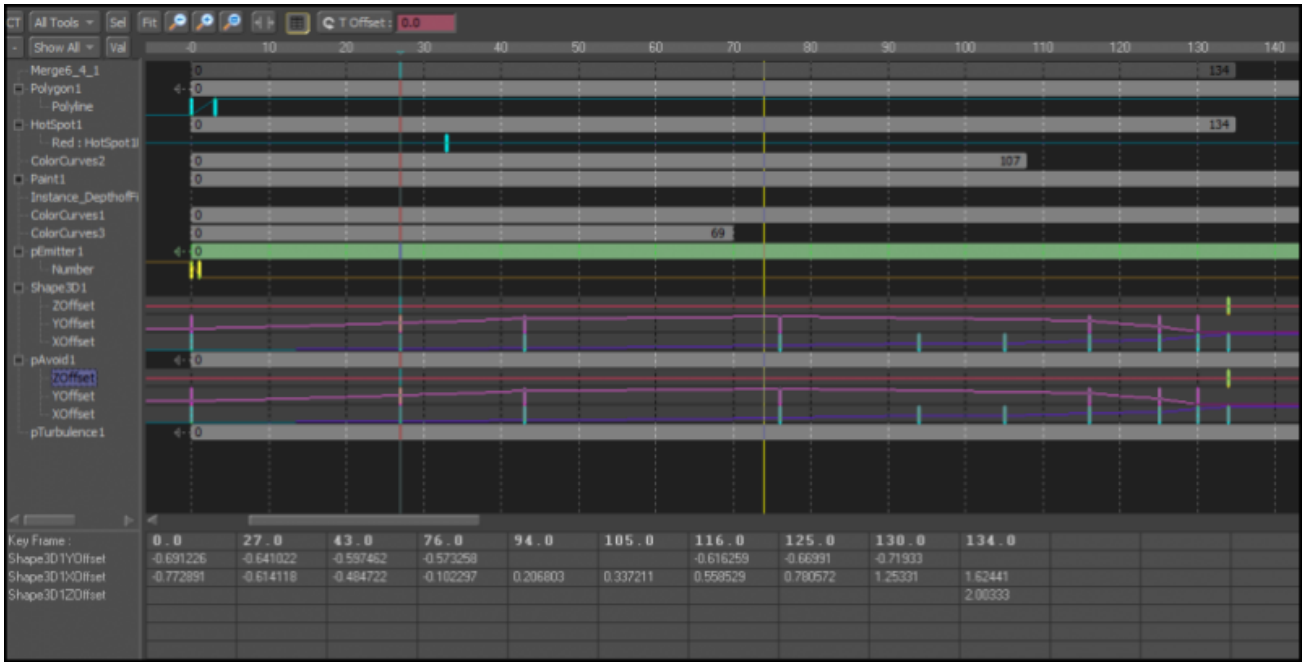
Frame forces all guides to snap to the beginning of the nearest frame.

Field

Field forces all guides to snap to the beginning of the nearest field.

The Spreadsheet Editor

The Spreadsheet Editor is located beneath the timeline editor. To reveal it, click on the Show>Hide Spreadsheet button in the toolbar. The spreadsheet will appear at the bottom of the timeline interface.



To resize the display of the spreadsheet, place the mouse pointer over the border between the spreadsheet and the rest of the timeline. The pointer icon will change to a two-headed arrow. Click-drag the border to resize the available space reserved for the spreadsheet.

Selecting A Tool To Edit

To display a tool's timing in the spreadsheet, select the tool in the timeline editor. The in and out points of the selected tool will appear in the keyframe's line of the spreadsheet. Clicking on the cell that contains the value will make it possible to edit that value. This has the same effect as trimming the tool in the timeline.

Selecting Multiple Tools To Edit

Multiple splines and tools can be edited together in the spreadsheet. Select each tool in the timeline editor by Ctrl-clicking on the tool's name in the tree view.

Selecting Animation To Edit

To edit an animation applied to a tool in the spreadsheet editor, select the animation spline in the timeline. This will display each of the keyframes on that animation spline in the spreadsheet. The values can now be edited by clicking in the cell and typing a new value for the keyframe.

Inserting Keyframes

New keyframes can be added by clicking in an empty keyframe cell and entering the desired time for the new keyframe. The new keyframe will be inserted into the spreadsheet. A new value for the animation can now be entered.

Moving Between Cells Of The Spreadsheet

Select the Tab or Shift Tab keys to move between cells in the spreadsheet editor.

Tool Context Menu

Most of the options found in the Tool Context Menu can also be found in the timeline.

To open the tool context menu, right-click on the Name label for the tool in the tree menu or right-click on the tool's vertical bar in the timeline view. Options here consist of:

For complete documentation of the options in the tool context menu, see the Flow Editor's tool context menu section.

Topics

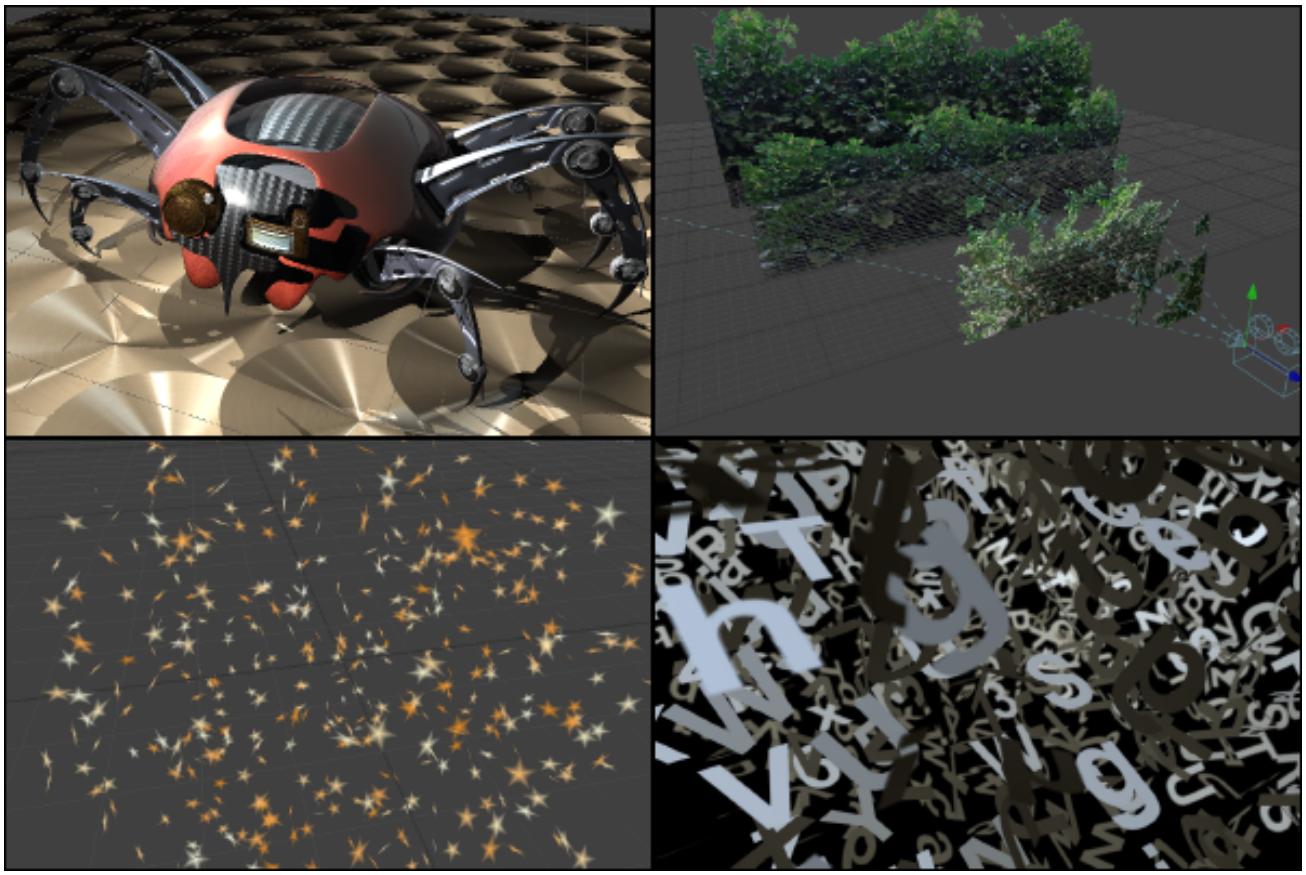
3D

Introduction

Traditional image based compositing is a two dimensional process. Images ayers have only the amount of depth needed to define one as foreground and another as background. This is at odds with the realities of production; that all images are either captured using a camera with freedom in all three dimensions, in a scene that has real depth or has been created in a true 3D modeling and rendering application.

Fusion's advanced 3D environment provides the artist with a complete OpenGL-accelerated 3D environment, including support for geometry, text and particles. This makes tasks such as the ones listed below much easier to perform :

```
* Convert 2D images into image planes.
* Match cameras from 3D matchmoving software, such as Boujou,
Syntheyes, and PF Track.
* Import cameras from popular 3D software packages, such as Maya,
Softimage XSI, LightWave and 3ds Max.
* Create rough primitive geometry or import mesh geometry from FBX
scenes.
* Create realistic surfaces using illumination models and other
realtime capable tools
* Rendering with realistic Depth of Field, motion blur and
supersampling
* OpenGL-accelerated 3D particle systems.
* Extruded and beveled text.
* Shadow casting across geometry.
```



Fusion's 3D toolset includes over 40 different tools. This chapter discusses how these tools can be combined to produce effective 3D composites within Fusion by examining the tasks they perform.

The functionality of OpenGL rendering depends on the hardware. To provide a maximum range of compatibility there are some environment variables that can force Fusion to use specific cg-profiles. If you have some trouble rendering a scene using OpenGL or displaying it in the viewport, try to set the environment variables **GGL_LATEST_FRAGMENT_PROFILE** = arbfp1 and **CGGL_LATEST_VERTEX_PROFILE** = arbvp1

The 3D Scene

A 3D scene is created by tools that output a 3D scene description instead of an image. Examples are tools that generate primitive geometry, import geometry, and create lights and cameras. Tools that modify a 3D scene to warp, deform or duplicate geometry usually also output 3D scenes. Almost all of these tools are collected together into the 3D category of tools.

There is no need to specify whether a composition will be 2D or 3D when it is created, as a composition can seamlessly combine any number of 2D and 3D scenes together. 3D geometry is added to the scene using Image Plane and Shape tools or imported via the FBX Mesh tool. The geometry is combined with lights and cameras using the Merge 3D tool, and rendered into 2D images using the Renderer 3D tool. The look of the geometry is defined by material tools such as the Blinn and Phong tools, and textured with 2D images or environmental maps.

When these tools are viewed in one of Fusion's displays a 3D view is used to allow the artist to navigate and manipulate the scene in 3D. The interactive 3D viewer is highly dependent on the workstations graphics card, relying on support for OpenGL and GPU rendering. The amount of on-board memory as well as the speed and features of the Graphics Procssing Unit (GPU) make a huge difference in the speed and capabilities of the 3D view.

Tools that output 3D scenes cannot be connected directly to inputs that expect 2D images. For example, a the output of an Image Plane tool cannot be connected directly to the input of a Blur. A Render 3D tool must first be used to create a 2D image from the scene for the Blur tool to operate on.

Combining Scenes

See the Combining Scenes page.

Rendering a 3D Scene

See the OpenGl and Software Rendering

Viewing a 3D Scene

See the 3D and Material Viewer page.

Transformations

See the Transformations page.

Cameras

See the Cameras page.

Lighting and Shadows

See the Lighting and Shadows page.

Materials

See the 3D Materials page.

Reflections and Refractions

See the Reflections and Refractions page.

Bump Mapping

See the Bump Mapping page.

Projections

See the Projection Mapping page.

Geometry

See the Geometry page.

Fog and Soft Clip

See the Fog and Soft Clipping page.

Matte Objects

See the Matte Objects page.

Material and Object ID's

See the Material and Object ID page.

Point Clouds and Locator

See the Point Cloud and Locator page.

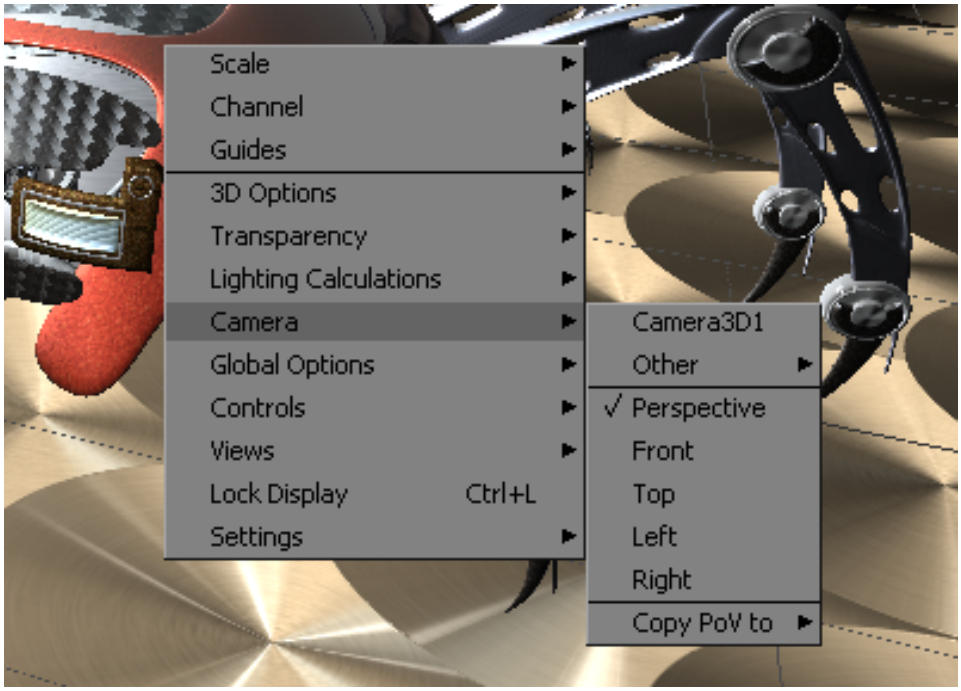
Stereoscopic Projects

See the Stereoscopic page.

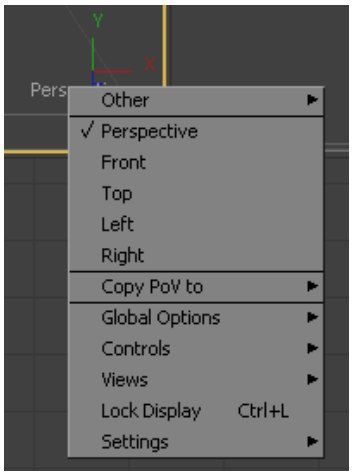
3D and Material Viewer

3D Viewer

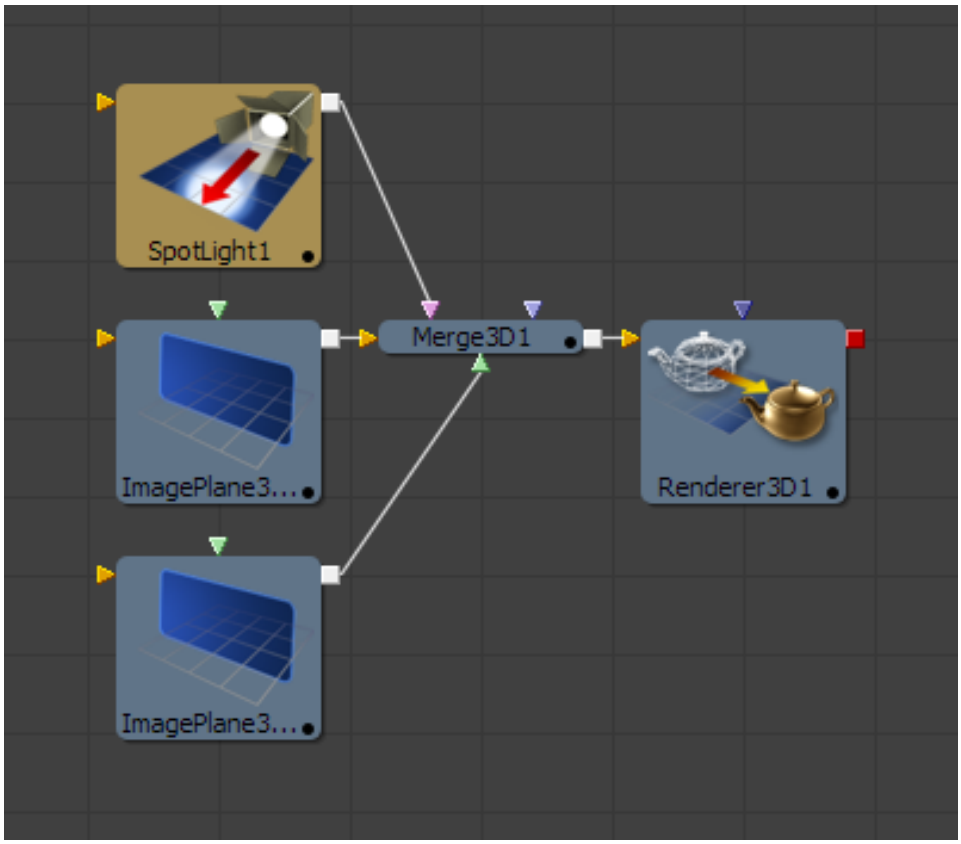
Viewing a tool with a 3D output in any display view will switch the display type to a 3D view. Initially the contents of the scene will be displayed through a default perspective view. To change the viewpoint right click in the view and select the desired viewpoint from the ones listed in the Camera sub-menu. A shortcut to the camera sub-menu is to right click on the axis label displayed in the bottom left or right corner of the display view.



In addition to the usual perspective, front, top, left, right viewpoints, the camera sub-menu will also display all of the cameras and lights present in the scene as potential viewpoints. It is even possible to display the scene from the viewpoint of the geometry by selecting it from the context menu's **Camera -> Other** sub-menu.



The view can't be switched to a viewpoint which is not present in the displayed tool's 3D output. Consider the flow in the image below. Two image planes and a spotlight tool are combined in a single merge tool, which then connects to a renderer. Viewing either image plane in a view will show only the image plane generated by that tool. Viewing the merge will show both image planes.



For a detailed description of the options available in the 3D Viewer, please see the 3D View section of the Display Views chapter.

Navigating The 3D View

For the most part panning and scaling of the 3D display view uses the same controls as the 2D view. To pan, hold the *middle mouse button* and drag the mouse. To dolly (zoom) the view, hold

the *middle and left mouse buttons* and drag the pointer to the left or right. Holding down *CTRL* while spinning the scroll wheel will also dolly the camera.

It is also possible to rotate around the view by holding down the *Alt key* and the *middle mouse button* and dragging the mouse pointer to the left and right.

There are also some useful hotkeys for navigating:

- *A* - Fit all objects in the view
- *F* - Fit to selection (or fit all if nothing is selected)
- *C* - Rotates the view to look at the center of the currently selected object but doesn't moving the view's position

Furthermore, as of Fusion 6, selecting a 3D tool in the flow area now also selects the associated object in the 3D views. You can select a 3D tool in the flow, activate the 3D view (using the *middle mouse button*) and hit *F* to fit the view on the selected object.

Transforming With The Views

When the display view is set to look through an object in the scene, like a camera or spotlight, the usual controls for panning and rotating the view will now directly affect the position of the object.

For example, to adjust the camera position when looking through the camera, placing the mouse in the view with a *middle and left mouse buttons* drag will dolly the camera.

It is even possible to view the scene from the perspective of geometry like image planes and shapes by selecting the object from the **Camera -> Others** menu. The same transformation techniques will then move the position of the object.

Transparency Sorting

While generally the order of geometry in a 3D scene is determined by their Z-position, sorting every face of every object in a large scene can take an enormous amount of time. To provide the best possible performance Fusion defaults to using a fast sorting mode in the OpenGL and interactive displays. The fast sorting mode uses the order of the inputs connected to the Merge 3D to determine the sort order for all objects except the one closest to the viewer. While this approach is much faster than a full sort, when objects in the scene are partially transparent it can also produce incorrect results.

The Sorted (accurate) mode can be used to perform a more accurate sort at the expense of performance. This mode is toggled using the Fast button in the display toolbar, or from the Transparency menu of the views context menu. The Renderer 3D tool also presents a Transparency menu when the Renderer Type is set to OpenGL.

The Software renderer type will always use the slower and more accurate method.



The basic rule is when a scene contains transparency, use the Full/Quick Sort mode, otherwise use the Z Buffer. If the Full sort method is too slow, try switching back to Z buffer.

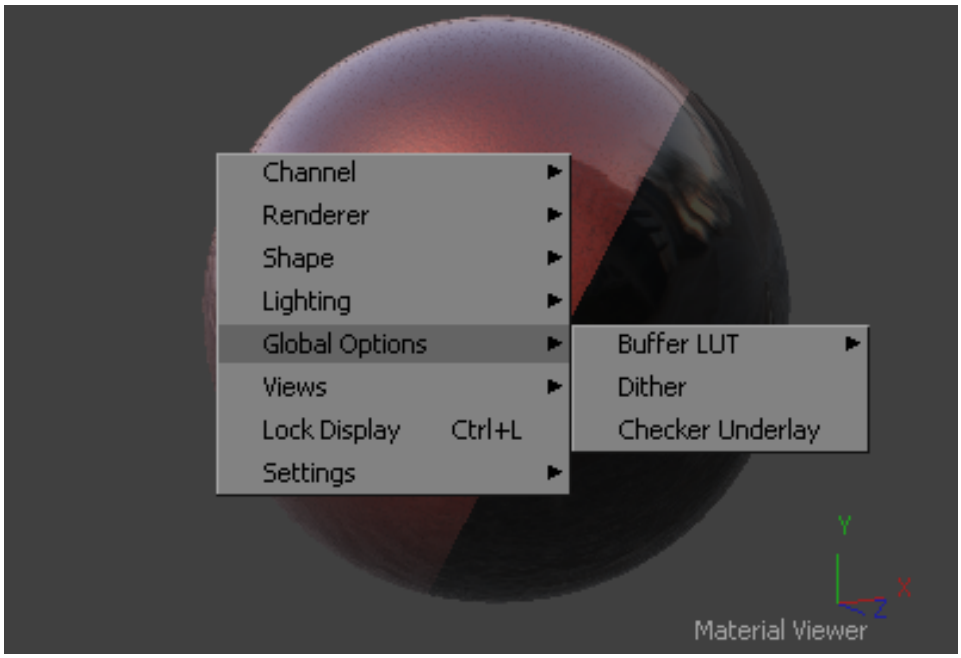
Material Viewer

Viewing a tool which outputs a 3D Material in a display view will switch the display type to a Material viewer. The default state for this view shows the material applied to a lit 3D sphere rendered with OpenGL. The type of geometry, the renderer, and the state of the lighting can all be adjusted from either the the display view toolbar, or the context menu. Each view presents an A and B buffer to assist with comparing multiple materials.

The geometry which the material is applied to is locked to the center of the view and scaled to fit. It is not possible to pan or scale the Material viewer. The view can be rotated on a single axis to provide a different angle on the material. Hold down the *Alt key* and the *middle mouse button* and dragging the mouse pointer to the left and right.

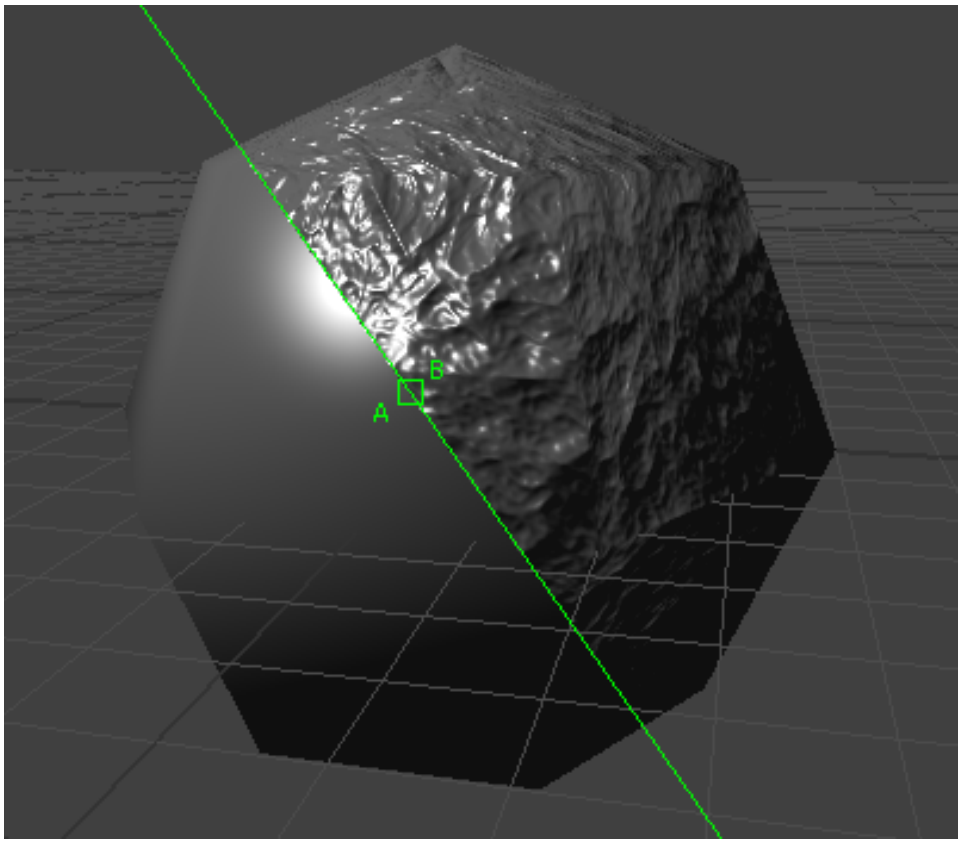
The position of the light can be adjusted by clicking and dragging in the view with the *middle mouse button* held down. Light can also be toggled on and off using the display view toolbar button.

For more information on the Material Viewer refer to the Display View chapter of this manual.



Bump Mapping

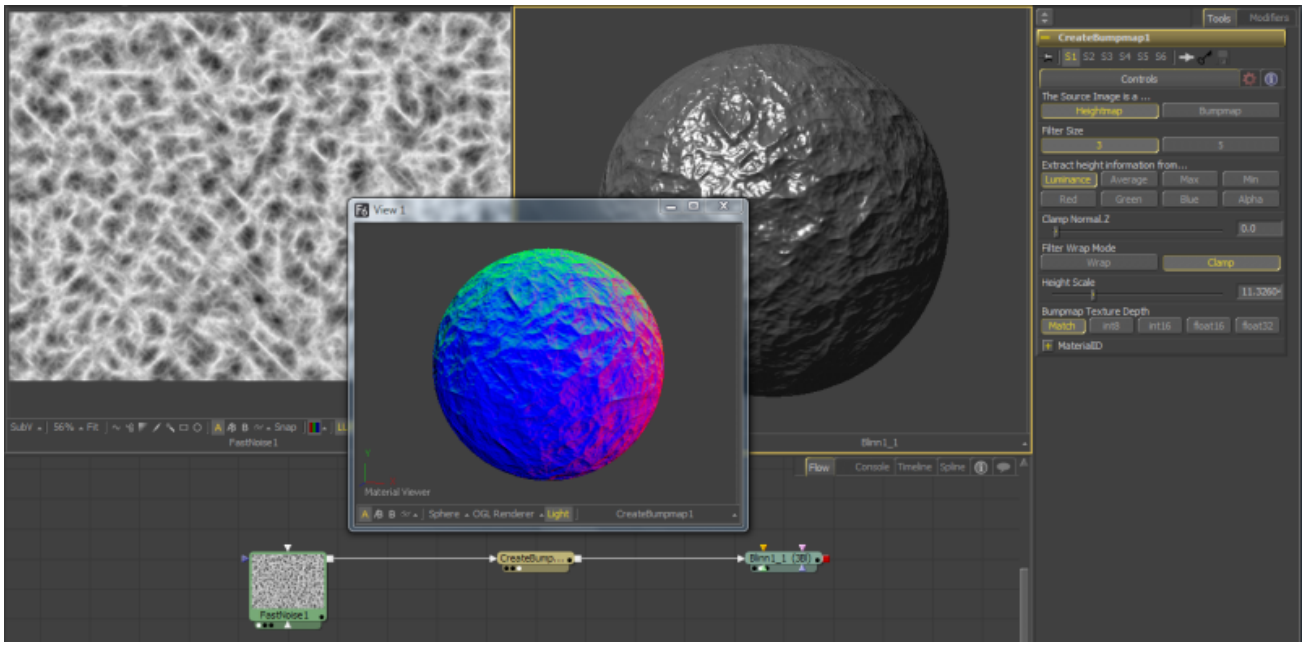
Bump mapping helps to add details and small structures to the object using textures. Bump Mapping is a lighting effect only - it does not modify the geometry of the object or change its silhouette. Bumpmapping requires lighting be on for it to work (as it is a lighting effect) and there must be a lighting model. Bumpmapped reflections/refractions do not require lighting to be on.



Bump maps can be applied to materials and objects using the BumpMap tool. Typically an image containing the bump information is connected to the Bumpmap tool, and this one is connected to the bump input of an illumination model or another material node. There are two ways how to create a bump map for a 3d (material) tool:

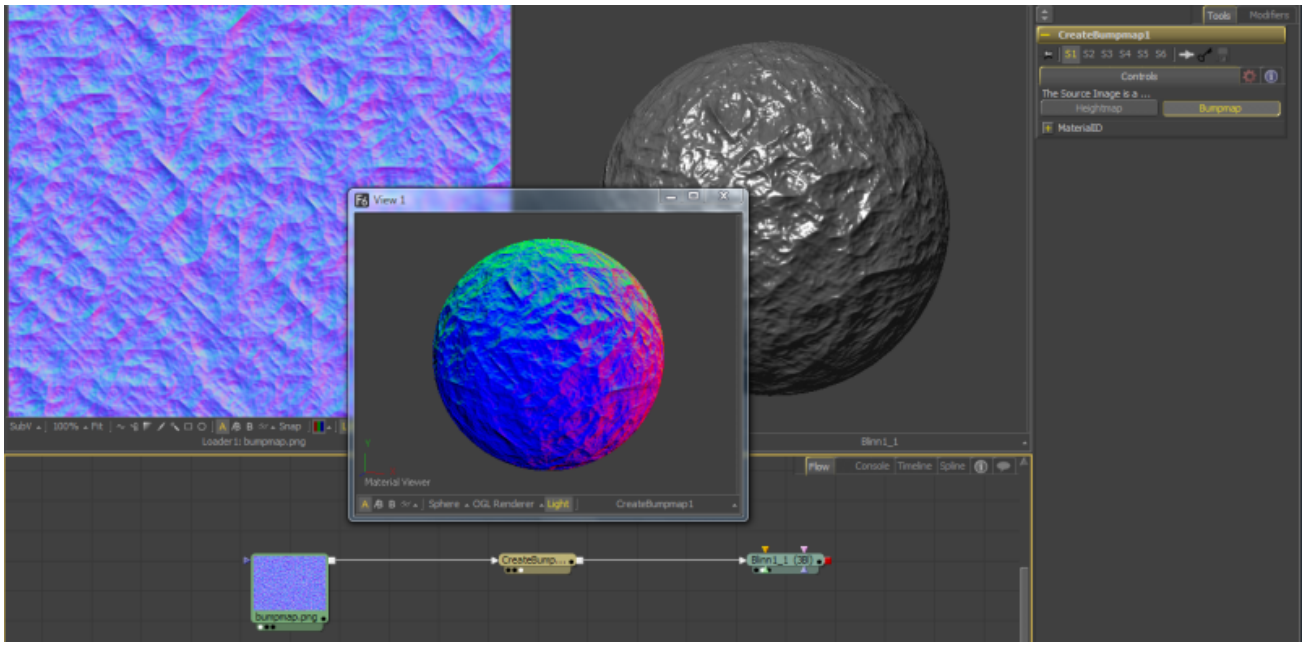
Using a height map

A heightmap is an image where the color value of a pixel represents the height value. It is possible to select which color channel is used for bump creation. White means "high", black means "low", however it is not the luminosity of a pixel in the heightmap that determines the bumpyness but rather how the luminosity changes in the neighbourhood of a pixel. This is why you need to set the scale or detail high on a Fast Noise tool for example in order for it to produce bumpyness since there is not enough variation from pixel to pixel.



Using a bump map

A bump map is an image containing normals stored in the RGB channels used for modifying the normals of the geometry. Typically bumpmaps you author from other 3D applications or image processing software are int8. Normals are 3 float values (nx, ny, nz) whose components are in the range [-1, +1]. Because you can store only 0..255 or [0.0, 1.0] in a int8 image, the normals are compressed/packed from the range [-1, +1] to the range [0, 1] by multiplying by 0.5 and adding 0.5. Compressed/packed and uncompressed/unpacked are terminology used when dealing with bumpmaps. You can use a Custom Tool to do the decompression/compression. When moving from color to normal you want to do (nx, ny, nz) = (2*r-1, 2*g-1, 2*b-1). When moving from normal to color you want to do (r, g, b) = (0.5*nx+0.5, 0.5*ny+0.5, 0.5*nz+0.5). The Create Bumpmap tool expects a compressed bump map. Connecting a bump map directly to the bump input of a material will result in incorrect lighting. Fusion uses a different coordinate system for doing the lighting calculation. The Create Bumpmap tool will do the conversion of the bump map to work correctly.



"Help, my bumpmapping isn't appearing or looks bad!"

- Make sure you have the tools connected correctly. The heightmap/bumpmap should feed into a CreateBumpmap tool and then in turn should feed into the Bumpmap input on a lighting model tool.
- Check that the original image has enough detail/contrast - smoothly varying heightmaps like a default Fast Noise don't have enough variation from pixel to pixel to visibly affect the per pixel normals
- Change the color depth of the heightmap to get better normals. You can also play with the Bumpmap Texture Depth options on the Create Bumpmap tool itself.
- Play with the height scale on the bumpmap tool. If you are feeding it a black and white image like Text+ then a heightscale of 1 works and a heightscale of 50.0 makes it look horrible. If you are feeding it a Fast Noise then you may want to jack up the heightscale to 50 to get the bumpyness.
- Make sure if you are feeding the Bump tool a heightmap its set to heightmap and if you're feeding it a bumpmap its set to bumpmap.
- Check if HiQ is on/off. Some Fusion tools like Text+ produce an antialiased version in HiQ that will substantially improve bumpmap quality.

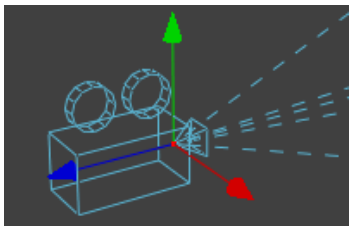
The Export Bumpmap tool

The Create Bumpmap tool helps to convert a heightmap into a bumpmap. This is a 2d tool, and does this conversion only. The output will be an image, BumpMap produces a 3d material. This allows you to manipulate the bumpmap with Fusions image processing tools. When you are done, use the Create Bumpmap tool in

Bumpmap

mode, to connect it to material nodes.

Cameras

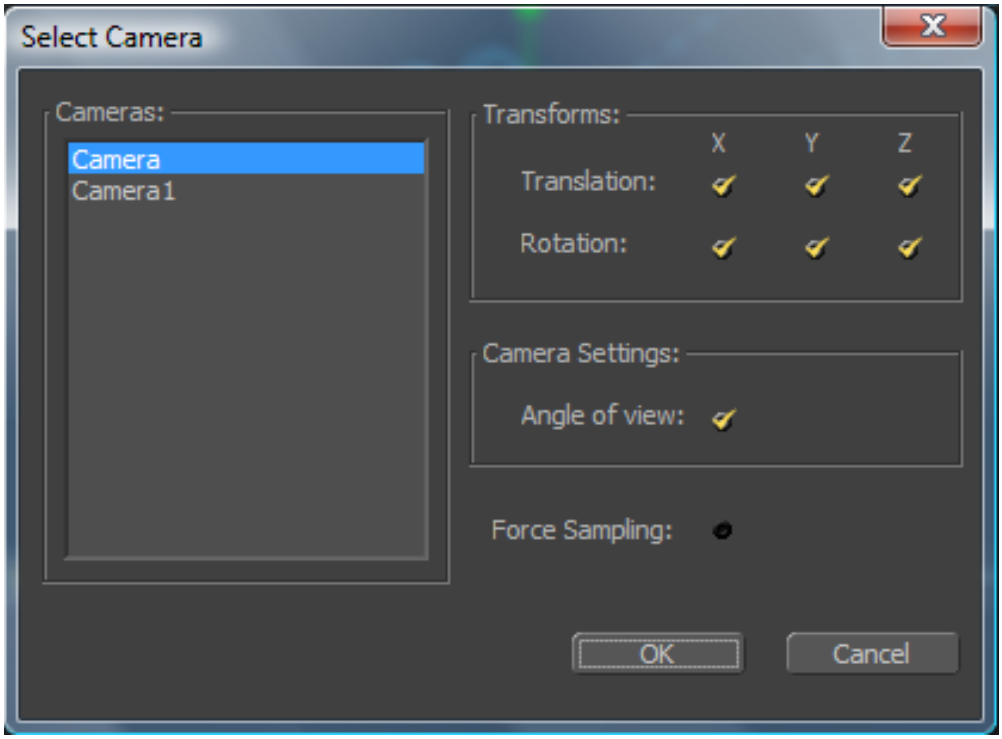


A frequent task for compositors involves matching the Cameras from footage or from a 3D scene in the composite. To simplify this task, Fusion provides a flexible camera tool. The camera can be used as either a free camera or a target camera. Select and adjust Angle Of View, Focal Length, Aperture and Clipping planes to match the behavior of real scenes or 3D cameras.

To allow for exact matching between applications, Fusion can import camera paths and positions from a variety of popular 3D applications.

Importing Cameras

To import a camera from another application, locate and click on the Import Camera button. Use the file browser that appears to locate and select the scene in one of the supported 3D scene files. A dialog box with several options will appear.



If multiple cameras are present in the imported scene, it is possible to choose the one to import from the list on the left. Checkboxes are provided to select the channels of motion that will be imported.

Fusion is able to import animation splines from Maya and dotXSI directly to their own native spline formats. Animation applied to cameras from 3ds Max and LightWave must be sampled

on each frame. When the Force Sampling checkbox is enabled, Fusion will sample each frame of the motion, regardless of the format.

Applications Supported for Camera Import

- 3ds Max (.ASE)

Autodesk's 3ds Max uses a binary file format so Fusion is unable to read the camera directly from the saved scene. Instead, export the camera to an ASCII ASE file. Consult the application's documentation for details. Fusion must sample the camera motion, generating a keyframe for each frame.

- LightWave (.LWS)

NewTek's LightWave scene file is text based so Fusion can easily extract information about cameras from the scene directly. Fusion must sample the camera motion, generating a keyframe for each frame.

- Maya (.MA)

Alias's Maya has a native ASCII scene format so Fusion can extract information about cameras, lights and locators directly from the .ma file. Fusion can import Maya motion as native splines, only importing as many keyframes are seen in the original spline.

- Softimage XSI (.dotXSI)

Avid's Softimage uses a binary format for its native scene so Fusion can import the scene to a text-based format using the dotXSI format. Fusion's support for dotXSI allows it to import native splines, only importing as many keyframes as are present in the original spline.

- Filmbox (.FBX)

Fusion can import cameras from FBX scenes using the Import FBX option in the File menu. This creates a camera with the correct settings. The Import Camera button in the Camera3D tool cannot be used to import from FBX at this time. See below for details.

Parented Cameras

At this time, Fusion is unable to import many Parented or rigged Cameras. If you have trouble importing a camera from any scene, try baking the camera animation in the 3D application before importing it into Fusion.

Combining Scenes

Merge 3D

Each 3D tool outputs a complete 3D scene. This is unlike most traditional 3D modeling and animation programs, where all objects reside within a global scene environment. So the scenes created by a Camera tool and an Image Plane tool are separate until they are somehow combined into the same scene.

The Merge 3D tool takes the output of 3D tools and combines them into a single scene. Unlike the 2D Merge tool the ordering of the elements in the scene is not restricted to just two inputs for background and foreground. Instead the Merge 3D allows for an unlimited number of inputs, and combines them according to their absolute positions in 3D space.

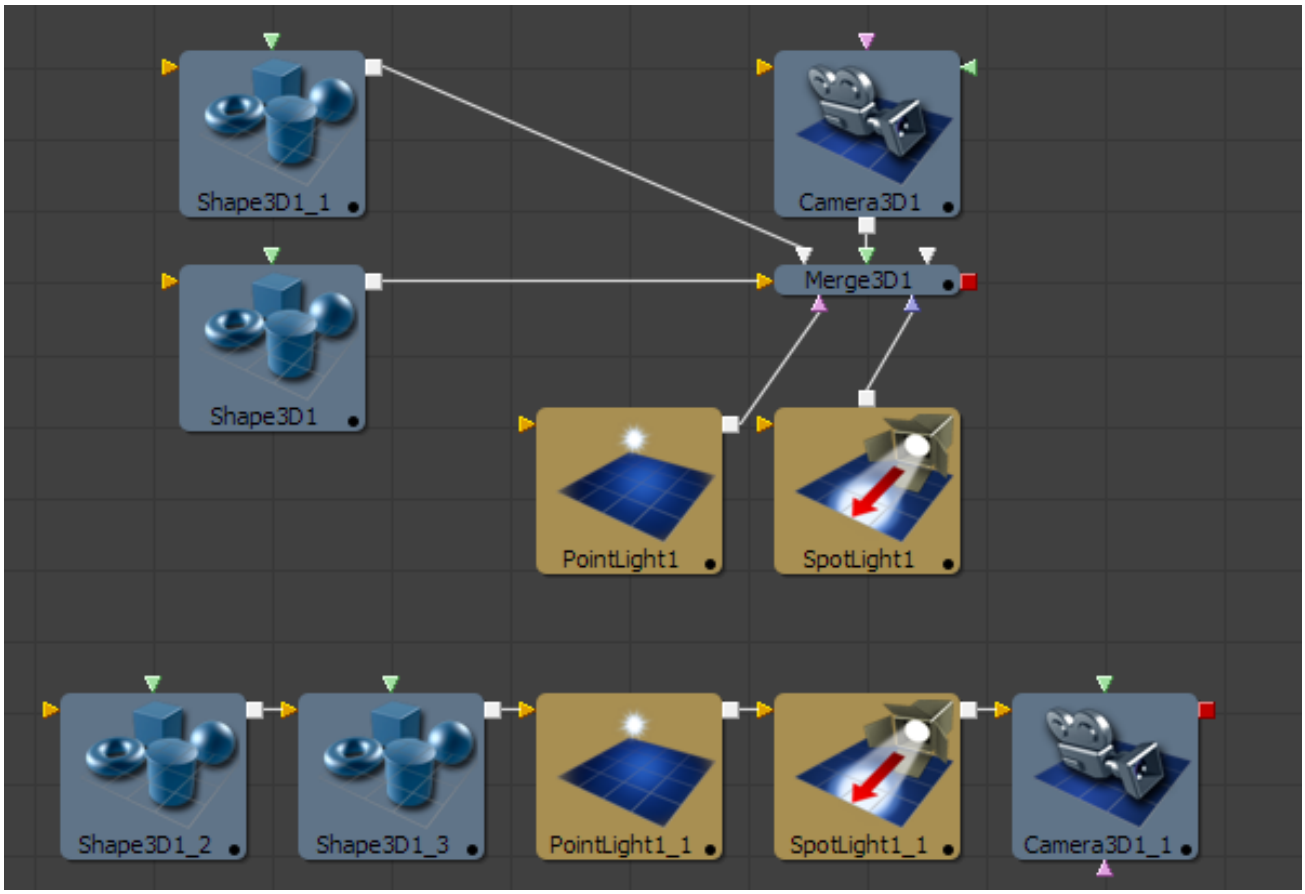
The Merge 3D tool presents very few options in the control panel. The main control panel shows just a single checkbox that the artist can use to determine whether light present in the scene is passed downstream to the output. This mechanism is used to restrict light to a portion of the scene. By default this checkbox is disabled.

This allows the artist to light elements in the scene without worrying about how the light might affect geometry introduced further downstream. For example, the artist may wish to apply a spotlight to brighten the a wall of a building without having that spotlight spill over onto the grass or pavement at the foot of the wall.

Additionally, the Merge 3D tool control panel shows the common 3D transformation tab. These transformation controls can be used to adjust the position, scale and rotation of ALL the elements combined by the merge. This applies not just to geometry but also to lighting and particles. All transformations take place around a common pivot point.

As a result of the two features described above, the Merge 3D tool forms the basis of parenting for the Fusion 3D environment.

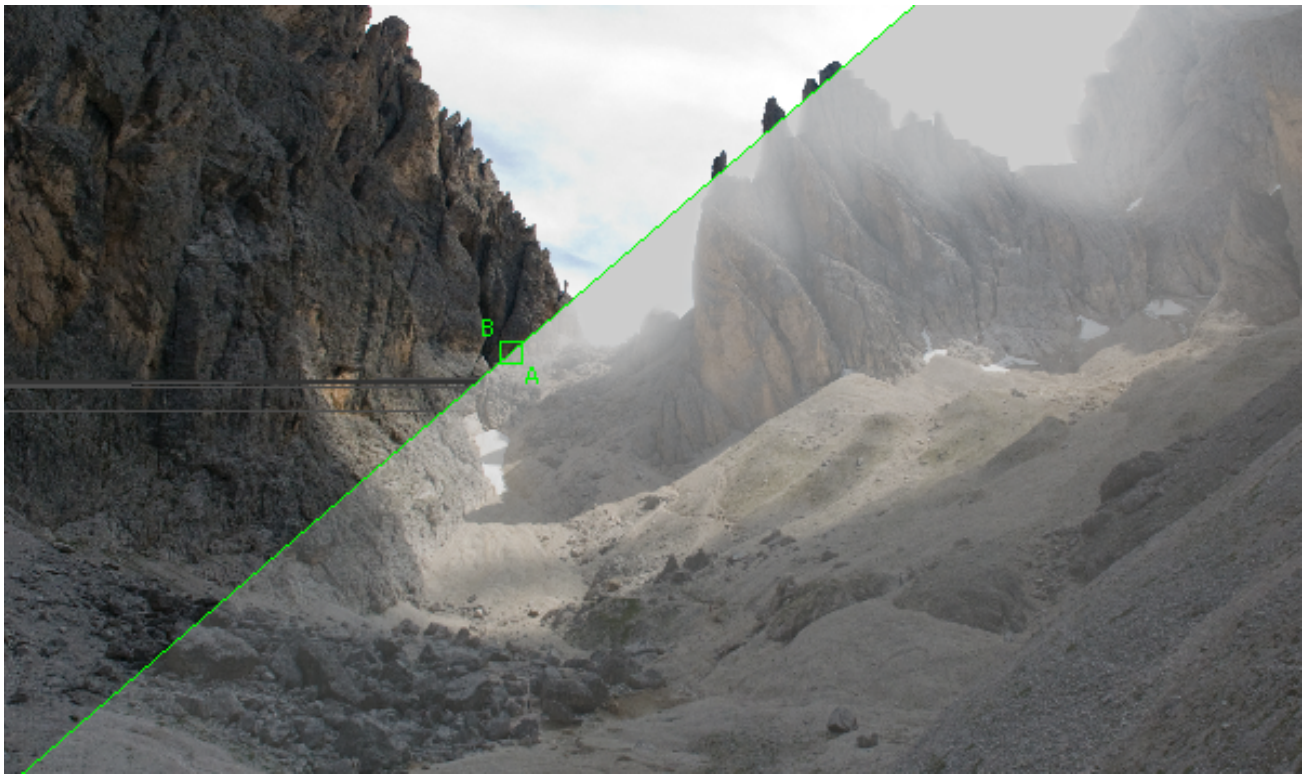
As of Fusion 6 most 3D primitives also provide a 3D scene input which can be used as an alternative to the Merge 3D tool.


Shape3D1_1
Camera3D1
Merge3D1
Shape3D1
PointLight1
SpotLight1
Shape3D1_2
Shape3D1_3
PointLight1_1
SpotLight1_1
Camera3D1_1

Fog and Soft Clipping

Fog 3D

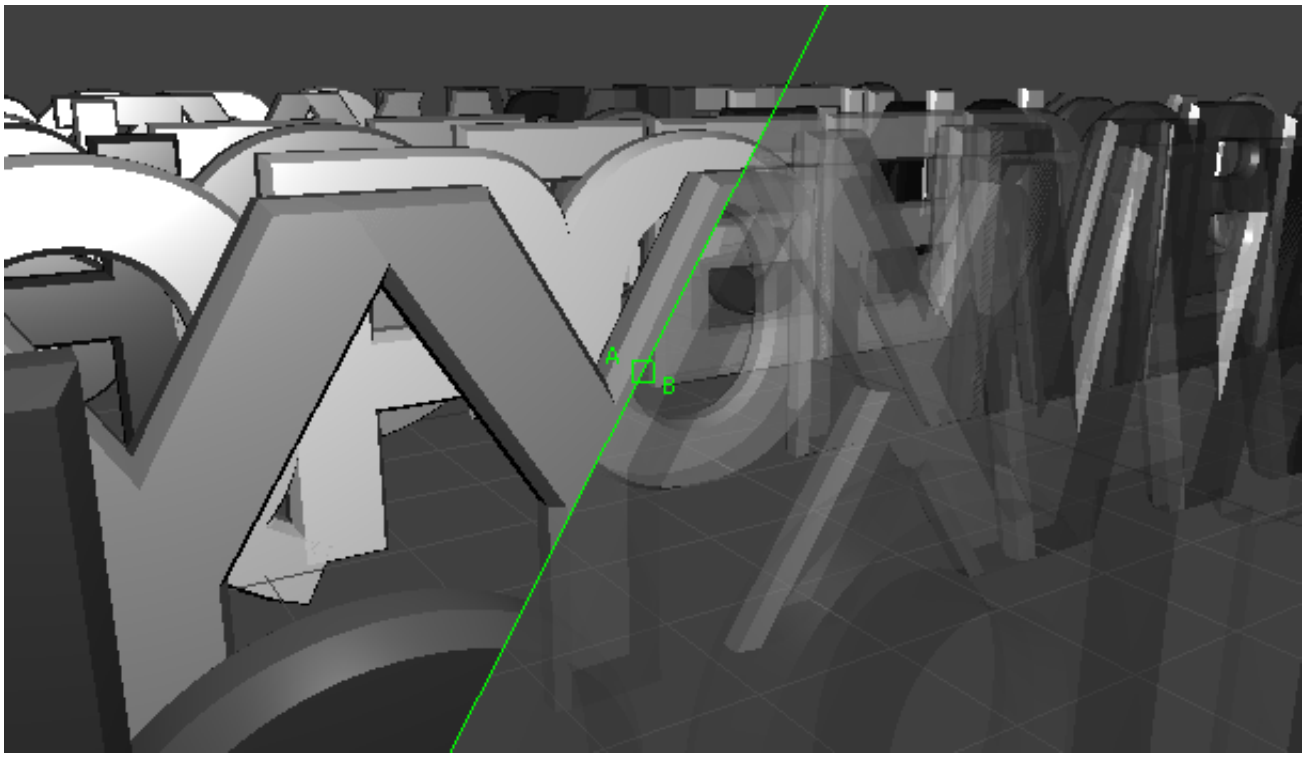
The Fog 3D tool helps tor create realistic fog in the 3d scene. It is based on the depth channel, therefore this tool does not create a volumetric fog.



The Fog 3D tool works well with depth of field and antialiasing supported by Fusions OpenGL renderer. Since it is not a post processing tool (like the Fog tool found in the **Tools/Deep Pixel** menu) it does not need additional channels like Coverage or Background color. Furthermore it supports transparent objects.

Soft Clip 3D

Very similar to the functionality of the Fog 3D tool, is the Soft Clip tool. It allows to fade in object dependend on camera or viewer distance. This allows smooth fly through animations with imagplanes and particles.



Geometry

Primitive Shapes

Fusion supports several basic Primitive Shapes for assembling a 3D scene.

Image Plane

The Image Plane is the basic tool used to place a 2D image into a 3D scene.

Shape

Shape can create planes, cubes, spheres, cylinders, cones and toruses.

Cube

The Cube tool creates a cube with six inputs that allow mapping of different textures to each of the cube's faces.

FBX Mesh

The FBX Mesh tool is used to import mesh geometry from an FBX file. At this time, only static geometry is supported. This tool can only import triangles. The model may need to be converted to triangles when exporting it to the FBX format. The first texture applied to the mesh will also be imported, if available.

Text 3D

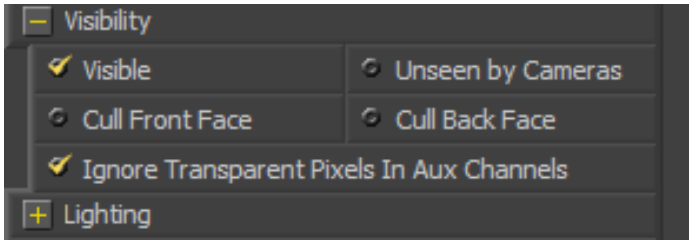
The Text 3D tool is a 3D version of the 2D text tool. This version supports beveling and extrusion but does not have support for the multi-layered shading model available from the 2D text tool.

Particles

When a pRender tool is connected to a 3D view, it will export its Particles into the 3D environment. The particles are then rendered using the 3D renderer instead of the particle renderer. See the Particle Suite chapter for more detail.

Visibility

The Visibility Options are found on all 3D source tools. They control object visibility under various conditions.



Visible

If the visibility checkbox is not selected, the object will not visible in the display views, nor will it be rendered into the output image by the Renderer 3D tool. A non-visible object does not cast shadows.

Unseen by Cameras

If the Unseen by Cameras checkbox is selected, the object will be visible in the display views (unless the Visible checkbox is turned off), except when viewed through a camera. The object will not be rendered into the output image by the Renderer 3D tool. Shadows cast by an Unseen object will still be visible when rendered by the software renderer, though not by the OpenGL renderer.

Cull Front Face/Back Face

Use these options to cull (eliminate) rendering and display of certain polygons in the geometry. If Cull Back Face is selected, all polygons facing away from the camera not be rendered, and will not cast shadows. If Cull Front Face is selected, all polygons facing towards the camera will likewise be dropped. Selecting both checkboxes has the same effect as deselecting the Visible checkbox.

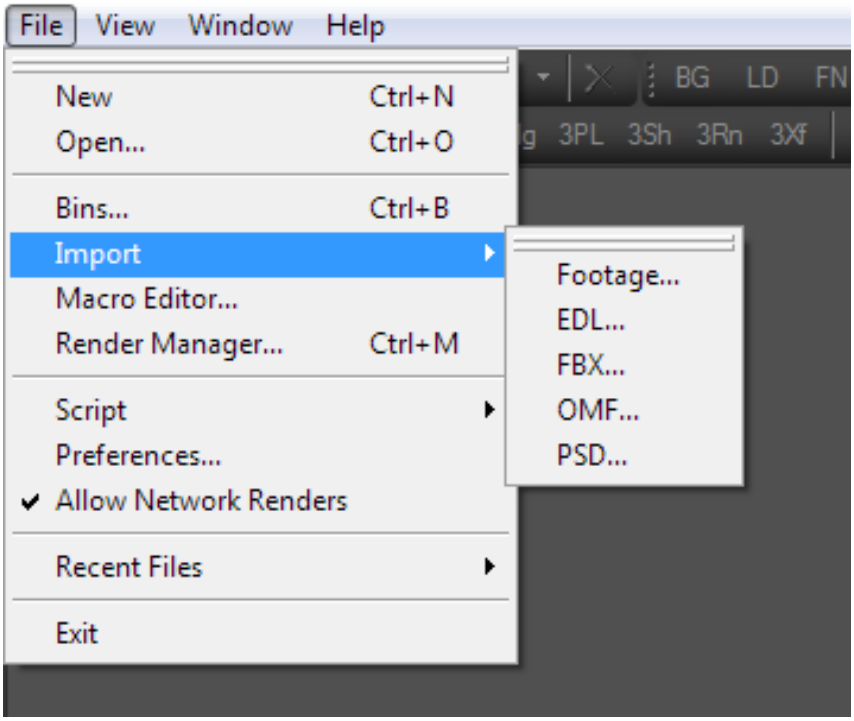
Ignore Transparent Pixels in Aux Channels

In Fusion 5 transparent pixels were rejected by the SW/GL renderers. To be more specific the SW renderer rejected pixels with R=G=B=A=0 and the GL renderer rejected pixels with A=0. This is now optional. The reason you might want to do this is to get aux channels (eg. normals, z, UVs) for the transparent bits. For example, suppose in post you want to replace the texture on an 3D element with a texture that is transparent in certain areas with a texture that is transparent in different areas, then it would be useful to have transparent bits set aux channels (in particular UVs). As another example suppose you are doing post DoF... you will probably not want the z channel to be set on transparent areas as this will give you a false depth. Also keep in mind that this rejection is based on the final pixel color including lighting if it is on. So if you have a specular highlight on a clear glass material, this checkbox will not affect it.

FBX Format

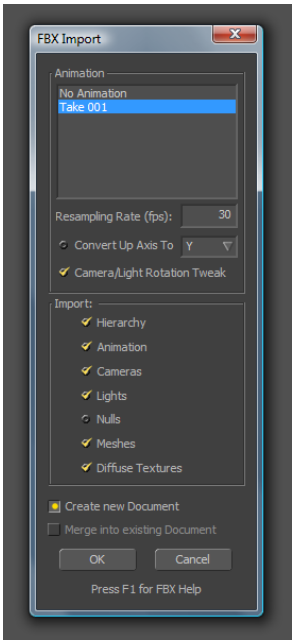
The Filmbox FBX format is a scene interchange format first developed by Kaydara to facilitate the transfer of information from motion capture systems to popular 3D systems. Since Kaydara was acquired by Alias, this format has been made available for more general use and is employed extensively as a way of moving scene information from one scene to another.

For exact details on importing FBX scenes, see the Importing Appendix later in this manual.



Importing An FBX Scene

Use the Import FBX utility found under the File>Import menu to create a composition with the same lights, cameras and basic geometry found in an FBX file.



Importing FBX Geometry

The FBX Mesh tool is used to import mesh Geometry from an FBX file. At this time, only static geometry is supported. The first texture applied to the mesh will also be imported, if available.

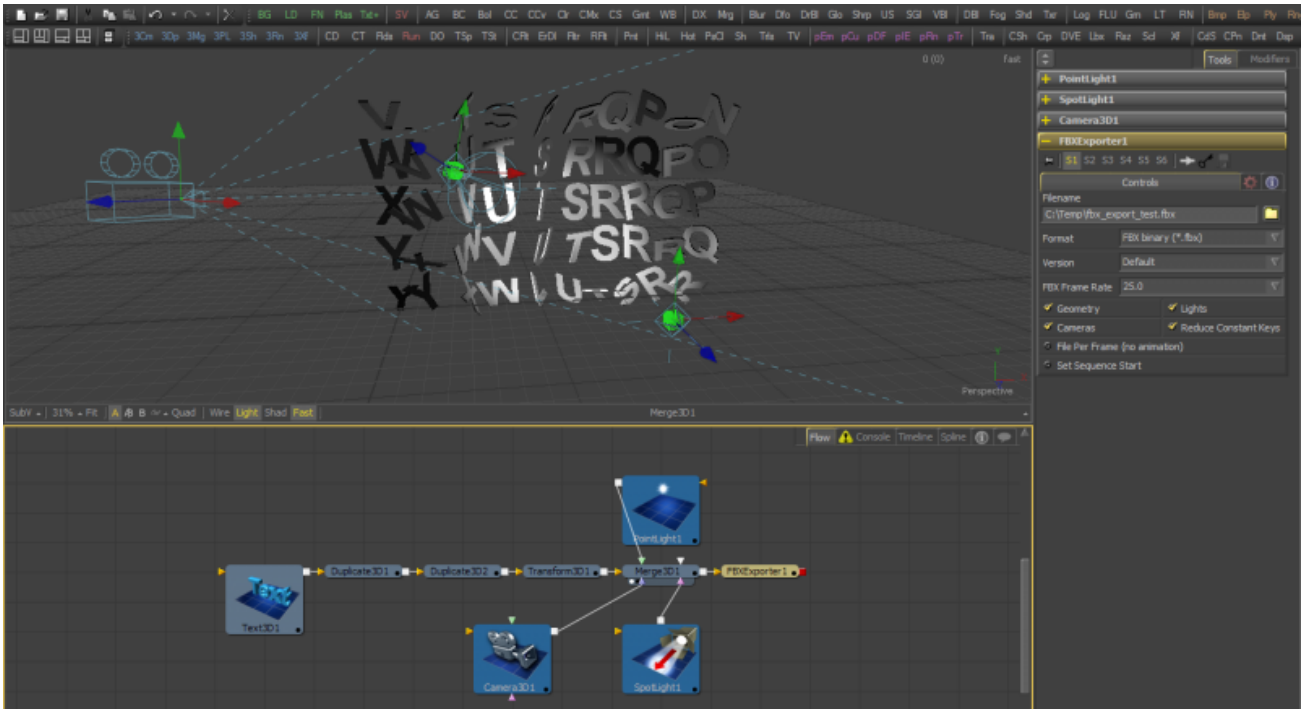
The imported geometry may be enormous compared to the rest of the scene. Different 3D applications use different units to measure their 3D scenes, and Fusion will treat the scales as equal to its own system. For example, one popular application defaults to using millimeters as

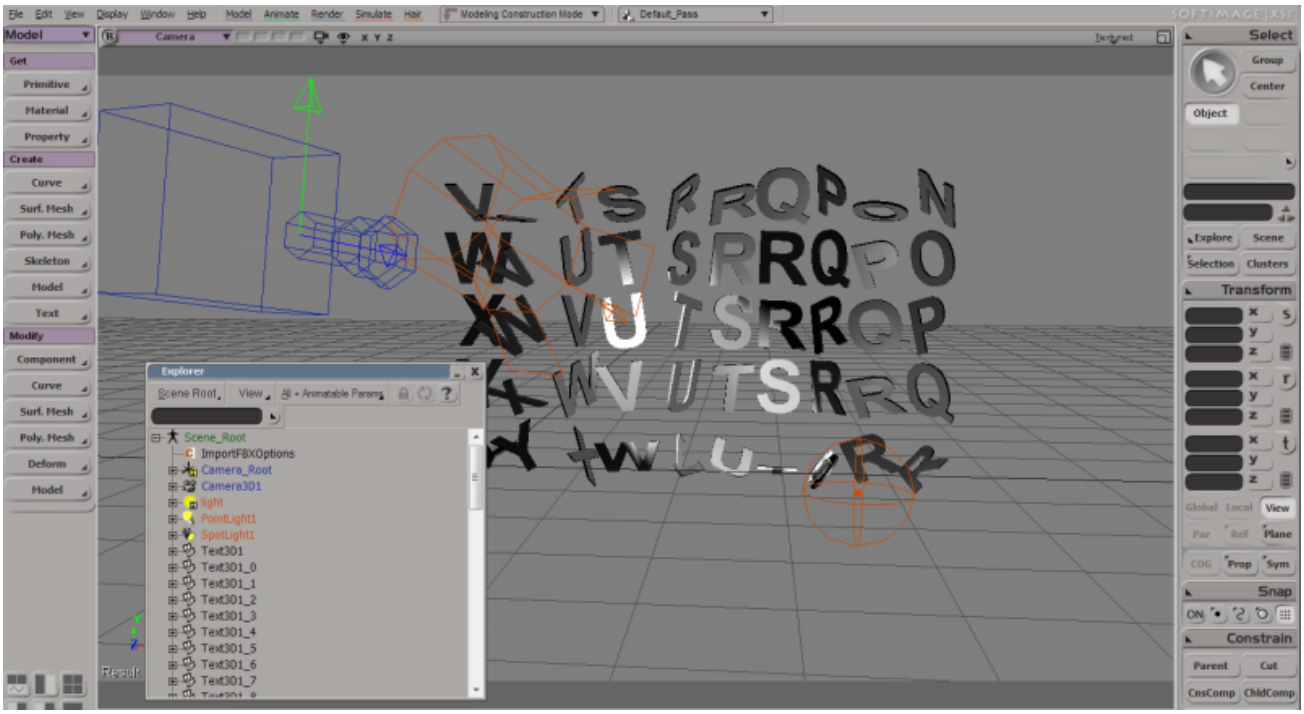
its scale. An object that was 100 millimeters in size will import into Fusion as a massive 100 units.

Use the scale slider in the FBX Mesh tool to reduce the scale of such files to something more reasonable for the scene.

FBX Export

You can also export a Fusion 3D scene to other 3d packages using the FBX Export tool. The exporter allows to write into different file formats like *.dae or *.obj. The tool allows to export Geometry, Cameras and Lights. It is also possible to export animation. The animation data is baked frame by frame. Textures and materials cannot be exported. The following example shows a simple scene in Fusion and the exported fbx in Softimage. Each sphere is a single object after the export.

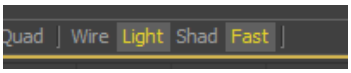




Lights and Shadows

Lighting

Fusion provides four different types of lights for use in 3D scenes; ambient, directional, point and spotlights. These lights can be combined to form very detailed lighting environments. A scene without lights will use a default directional light when the scene is displayed in the views. Once a light is added to the composition by an artist the default light will disappear. To ignore lighting in the display views toggle the Light button in the display view toolbar.



Lighting must be enabled in the Renderer tool. Tools that create or load geometry also present lighting options which can be used to choose whether an object is affected by light or not. When lighting is disabled in either the display views or final renders the image will appear to be lit by a 100% ambient light.

Ambient Light

Ambient Light produces a general uniform illumination of the scene. Ambient light exists everywhere without appearing to come from any particular source. Ambient light cannot cast shadows and will tend to fill in shadowed areas of a scene. Use ambient lights to set a base light level for the scene.

Directional Light

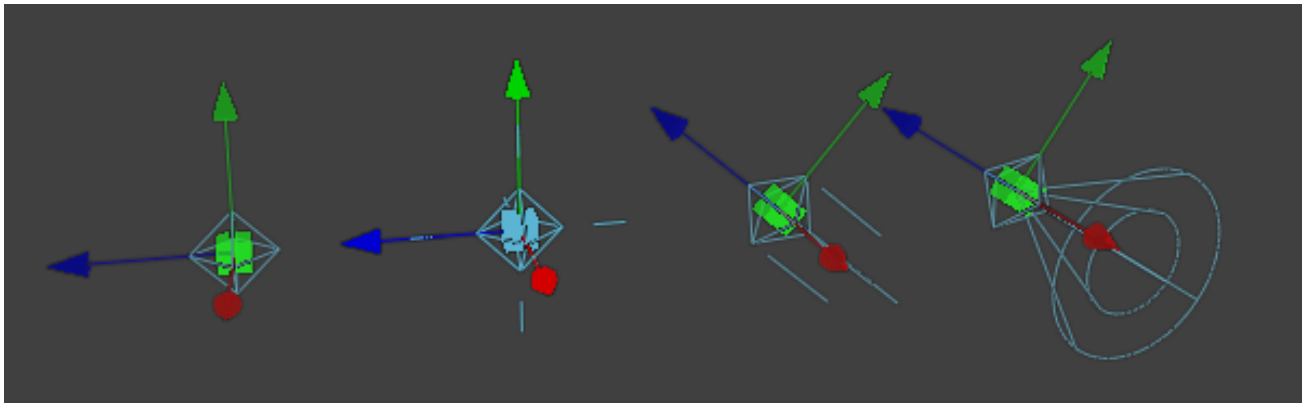
A Directional Light is composed of parallel rays that light up the entire scene from one direction. It is like a wall of light coming from one direction. The sun is an excellent example of a seemingly directional light source.

Point Light

A Point Light is a well-defined light that has a clear source. A light bulb is an excellent example of a point light.

Spot Light

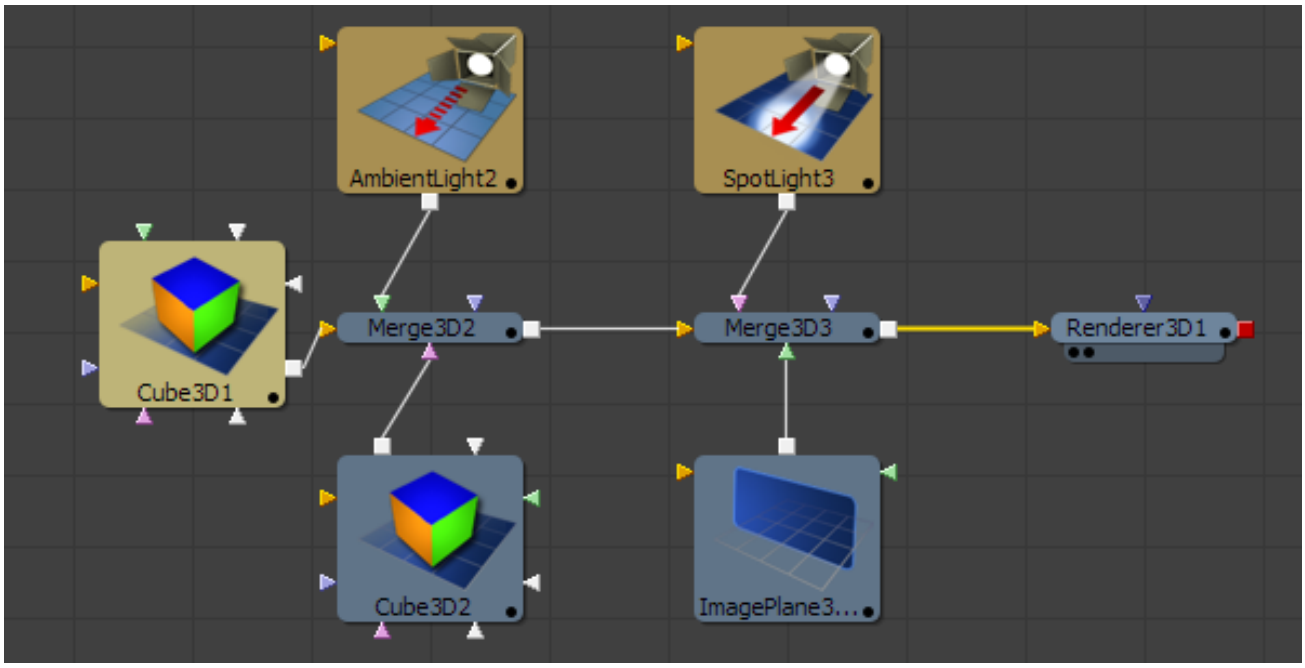
A Spotlight is an advanced point light that produces a well-defined cone of light with falloff, and generally decays over distance. This is the only light type in Fusion capable of producing shadows.



All of the light tools display on-screen widgets in the views when selected. In the case of the Ambient light the position, rotation, and scaling of this widget has no affect on the results. The directional light can be rotated, but position and scale will be ignored. The point light ignores rotation. All three transformations apply to the Spotlight tool.

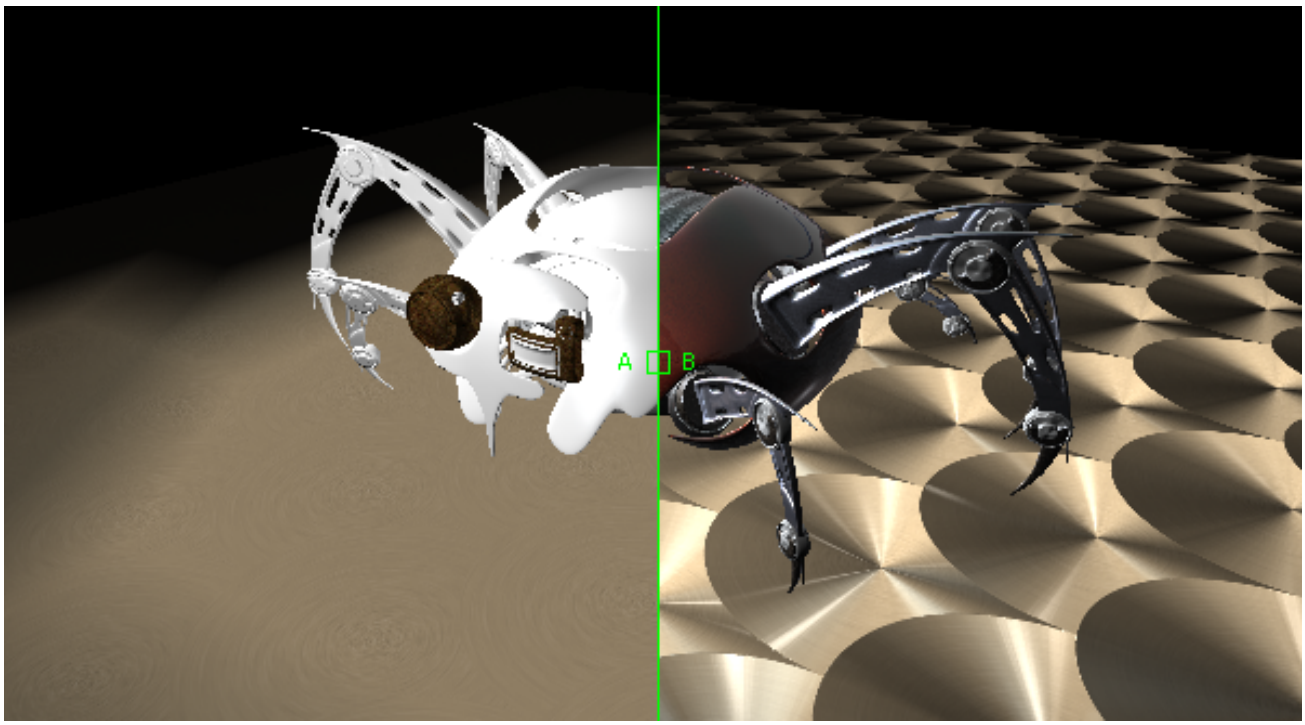
Light Hierarchies

Lights normally do not pass through Merges. This provides a mechanism for controlling what objects are lit by what lights. For example, consider the flow below. Two cubes and an ambient light are combined into a merge, which is then connected to a merge with an image plane and a spotlight. The ambient light will affect only the cubes. Its light does not continue downstream to affect the image plane introduced by the next merge. The spotlight will affect the sphere and both cubes, since all three objects are in the scene by this point.



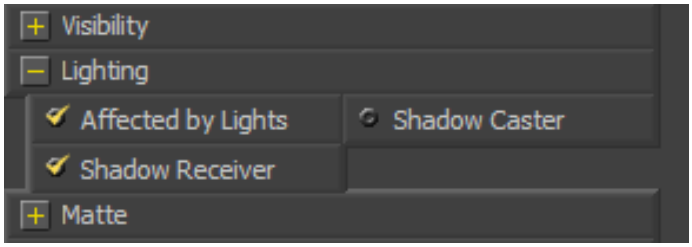
To have lights pass through merges to affect downstream objects, click on the Merge tool's Pass Through Lights option.

Per Vertex Lighting vs. Per Pixel Lighting When the OpenGL renderer calculates the effect of lighting on geometry it defaults to the per-pixel model, which calculates the lighting for each individual pixel. This is required for any advanced shading or projection. An older option called per-vertex is also available, which calculates the effect only at the vertices of the geometry. This mode can be enabled in the display view context menu's **Lighting Calculation** sub-menu, or in the Render tools contorol panel. However, the per-vertex lighting mode is provided for compatibility with older compositions only, and should be avoided in new compositions.



Lighting Options

Most tools that generate geometry have an extra panel of options under the roll out labeled Lighting. These Lighting Options are used to determine how the object reacts to lights and shadows in the scene.



Affected By Lights

If this checkbox is enabled, lights in the scene will affect the geometry.

Shadow Caster

If this checkbox is enabled, the object will cast shadows on other objects in the scene.

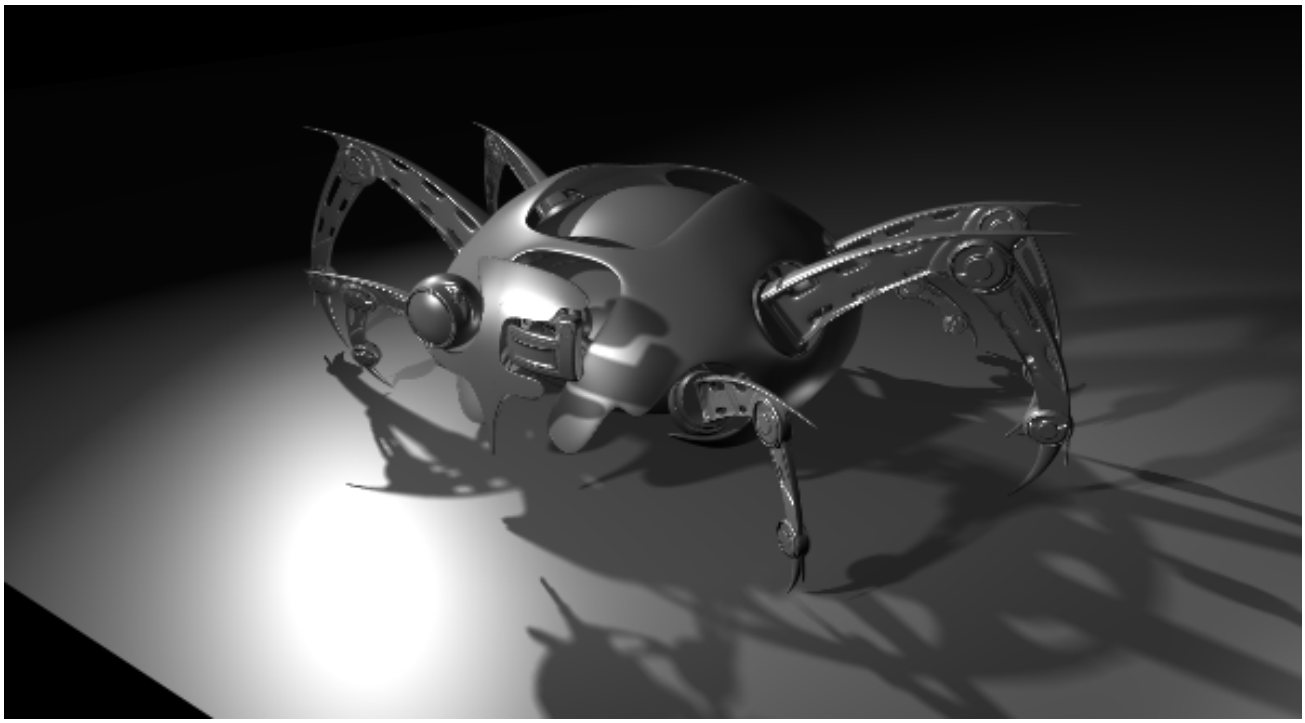
Shadow Receiver

If this checkbox is enabled, the object will receive shadows.

Shadows

The only light that can cast Shadows is the Spotlight. Spotlight tools cast shadows by default, although these shadows will not be visible until shadows are enabled using the display view toolbar button. Shadows will not appear in the output of the Renderer tool unless the Shadows option is enabled fopr that renderer. To prevent a spotlight from casting shadows disable the Enable Shadows checkbox in the tool's control panel.

See the Spotlight tool reference for a more detailed description of the shadow controls.



Shadow Maps

The Shadow Map is one or more internal depthmap layers. Each pixel in a depthmap specifies the pixel's depth in the scene. This is used to assemble the shadow layer that is inserted into the scene.

The quality of the shadow produced depends greatly on the size of the shadow map. Larger maps generate better looking shadows. The wider the cone of the shadow, or the more falloff in the cone, the larger the shadow map will need to be to produce useful quality results. The shadow map is square. Set the value of the Shadow Map Size control to set the size of the depthmap in pixels. Larger maps will take longer to render.

Generally, there is a point of diminishing returns where increasing the size of the shadow map no longer improves the quality of the shadow. This point can usually be found by trial and error. It is recommended to not set the size of the shadow maps any larger than they need to be.

The Shadow Map Proxy control is used to set a percentage by which the shadow map is scaled when Fusion is doing fast interactive previews, such as autoproxy and LoQ renders. A value of .4 represents a 40% proxy.

Multiplicative And Additive Bias

Shadows are essentially textures applied to objects in the scene, occasionally resulting in Z-fighting where the portions of the object that should be receiving the shadows render over top of the shadow instead. The picture below shows typical shadowmap Z-fighting on top, and the corrected shadow is shown below.



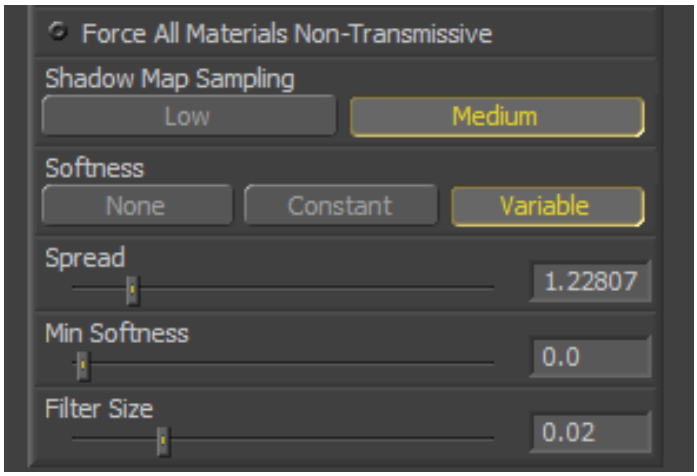
Biasing works by adding a small depth offset to move the shadow away from the surface it is shadowing, eliminating the Z-fighting. When too little bias is added, the objects can self-shadow themselves. When too much is added, the shadow can become separated from the surface.

Adjust the Multiplicative Bias until the majority of the Z-fighting is resolved, then adjust the Additive Bias to eliminate the rest.

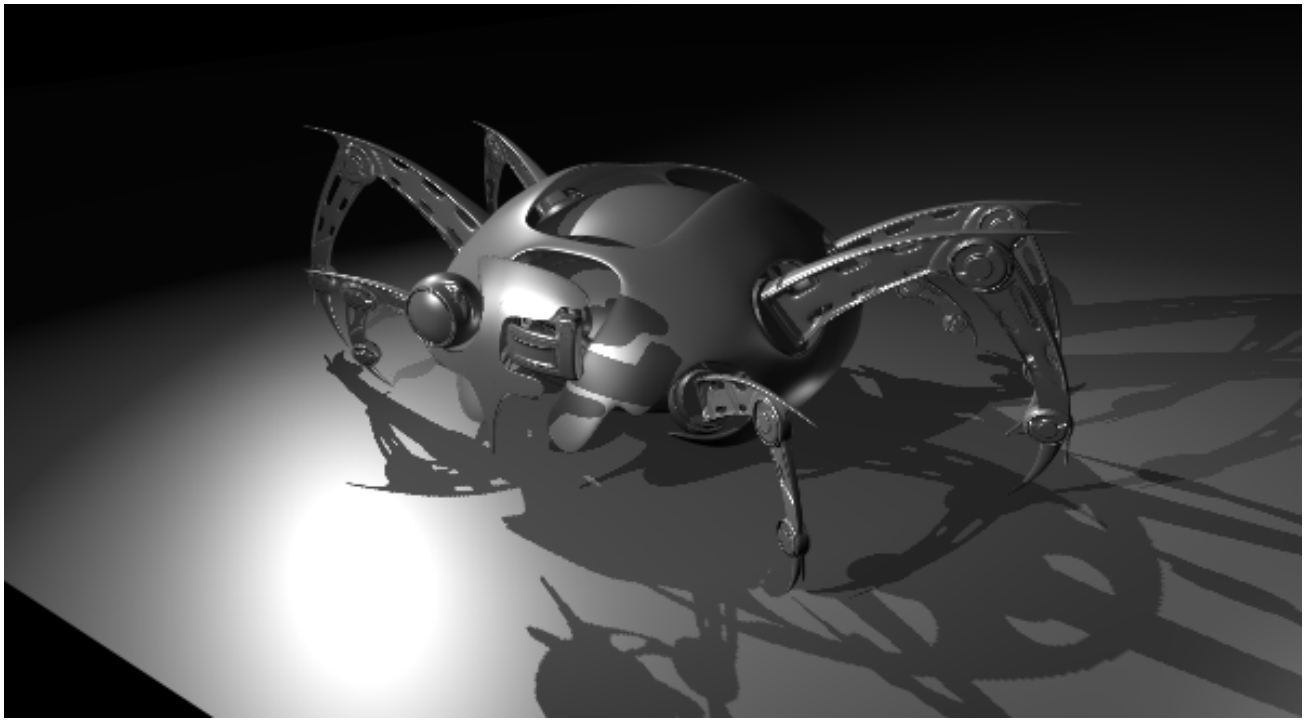
The softer the shadow, the higher the bias will probably have to be. Animating the bias may be required to get a proper result for the frames.

Shadow Softness

The spotlight generates shadows without soft edges by default. Additional options produce shadows with constant and variable shadows. Hard edged shadows will render significantly faster than either of the Soft Shadow options. Shadows without softness will generally appear aliased, unless the shadow map size is large enough. Many artists use softness to cheat the aliasing rather than increasing the shadow map to preserve memory and avoid exceeding the graphics cards capabilities.



Setting the spotlights shadow softness to *None* will render crisp and well defined shadows. The *Constant* option will generate shadows where the softness is uniform across the the shadow, regardless of the shadows distance from the casting geometry. The *Variable* option generates shadows that become softer as they get farther from the geometry which is casting the shadow. This is a more realistic effect, but the shadows are somewhat harder to control. When this option is selected, additional controls for adjusting the falloff of the shadow will appear, as well as sliders for the minimum and maximum softness.



Selecting the Variable option causes the *Spread*, *Min Softness* and *Filter Size* sliders appear. A side effect of the method used to produce variable softness shadows is that the size of the blur applied to the shadow map can become effectively infinite as the shadows distance from the geometry increases. These controls are used to limit the shadowmap by clipping the softness calculation to a reasonable limits.

The Filter Size determines where this limit is applied. Increasing the filter size increases the maximum possible softness of the shadow. Making this smaller can reduce render times but

may also limit the softness of the shadow or potentially even clip it. The value is a percentage of the shadow map size.

See the Spotlight tool reference for additional details on these controls.

Transmittance

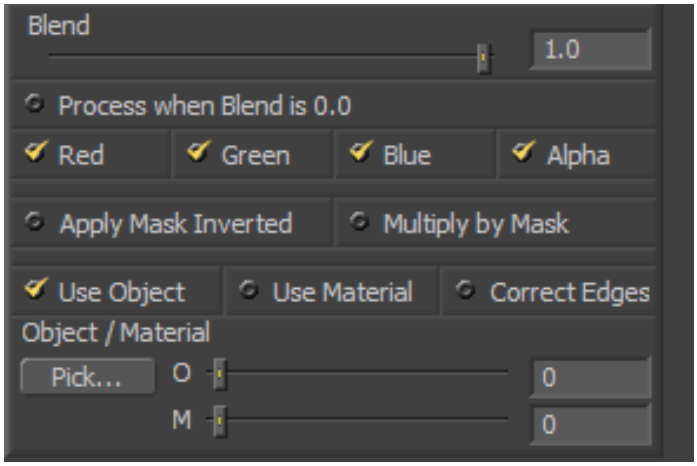
The Transmittance of an object's material plays an important role in determining the appearance of the shadow it casts. Normally, the Transmittance behaviour is defined in each object's Materials tab. Selecting the Force All Materials Non-Transmissive overrides these, causing the shadow map produced by this tool to ignore transmittance entirely.

See the Materials section below for more details.

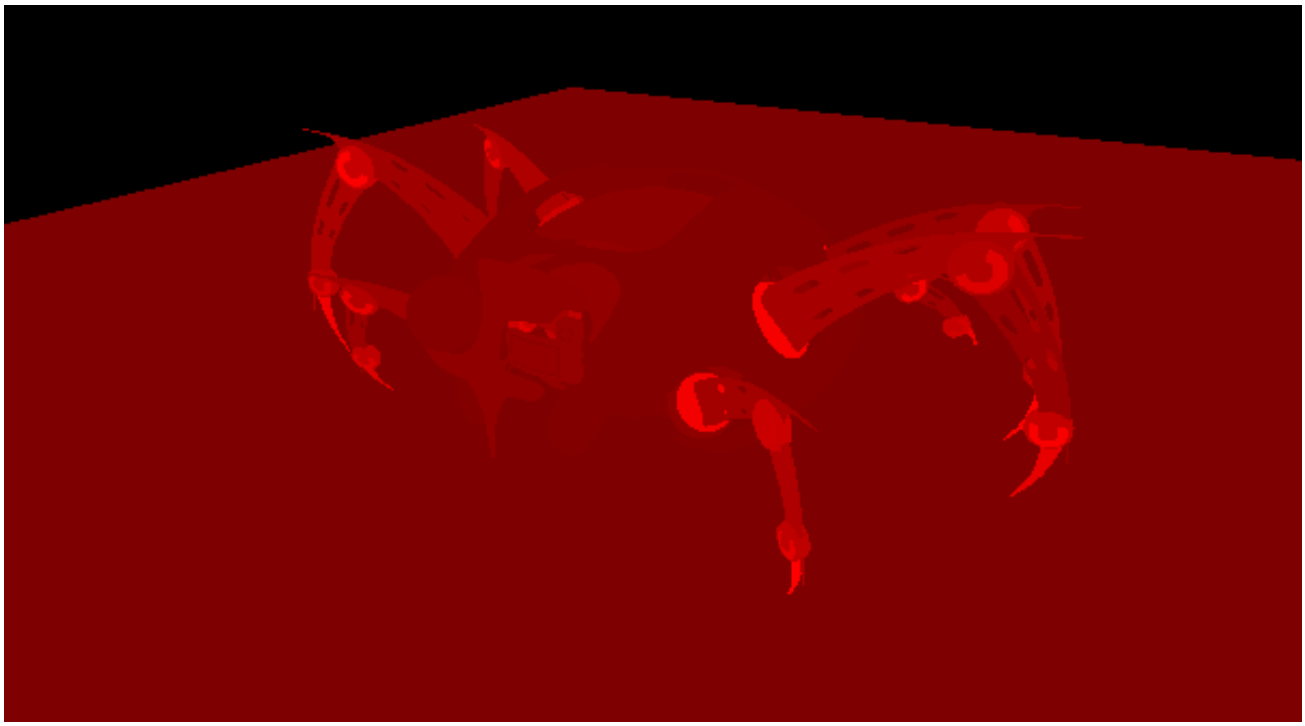
Material and Object ID

Material and Object ID's

The Object ID and Material ID auxiliary channels can be used by any tool in Fusion to generate a matte or mask. The settings used to accomplish this are found in the Common Controls tab of each tool.



Both IDs are assigned automatically upon tool creation in numerical order beginning with 1. It is possible to set the IDs to the same value for multiple objects or materials even if they are different. The Override 3D offers a comfortable way to change the IDs for several objects. The Renderer will write the assigned values into the framebuffers during rendering, when the output channel options for these buffers are enabled. Empty pixels have an ID of 0. It is possible to assign a value of 0 manually to an object or material, but this is not advisable because a value of 0 tells Fusion to set an unused ID when it renders. Fusion allocates a 16-bit image buffer for rendering the ID-channels. The maximum value of 65535 is reserved internally, so it is possible to use a value range from 0 to 65534.



Materials

In order to render a 3D scene, the renderer must take into account the shape of the object as well as the appearance. The geometry of an object could be said to describes the shape of the object, while the material applied to the object describes it's appearance. Fusion 6 introduces a range of new options for applying materials and textures to geometry.

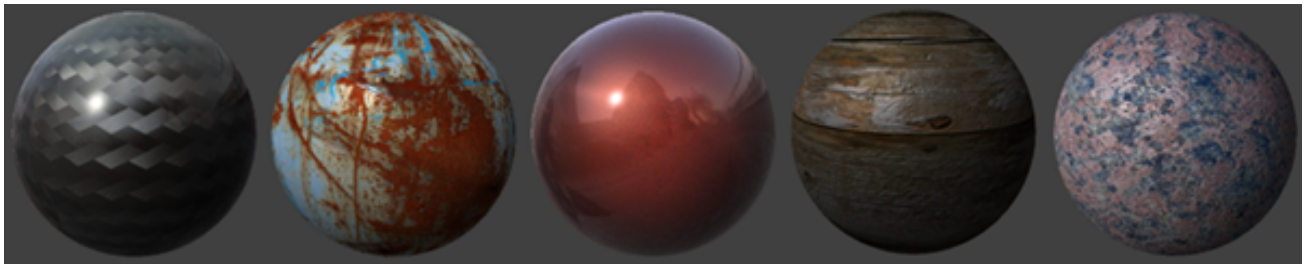
Tools which describe the geometries response to light are called illumination models. Typically these tools are named according to the names of the authours of the mathematical technique used by the tool. The Blinn, Cook Torrance, Ward and Phong tools are the most frequently used illumination models. These tools are found in the **3D -> Material** category of tools.

Most materials also accept textures which can be used to further refine the look of an object, giving it a rough organic appearance or a smooth reflective sheen. Textures can be simple 2D images or they may be more complex bump maps, height maps and reflection maps. These tools are typically found in the **3D Texture** category.

Materials can also be combined together to produce elaborate and highly detailed composite materials. The term shader is often used when describing materials which are combined in this way. Materials are calculated on the graphics cards GPU whenever possible, and to do this Fusion compiles all the material tools into a program called a shader which is executed on the graphics cards GPU.

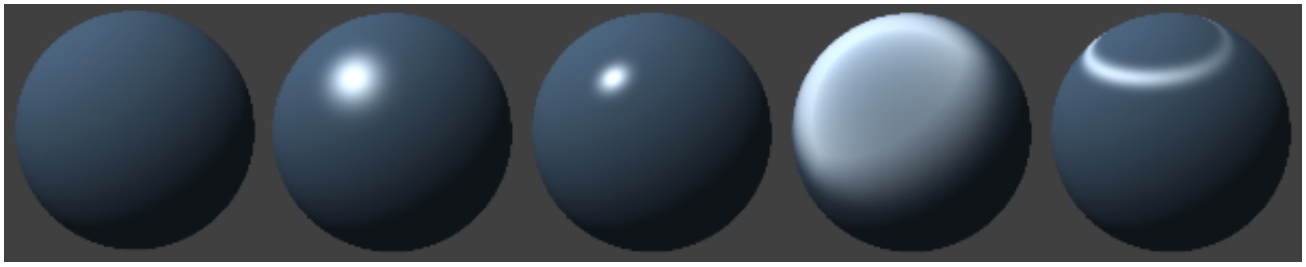
Each tool that creates or loads geometry into the 3D scene also assigns a default basic material, with controls built directly into the tool. The default basic material is a simplified version of the Blinn illumination model. As of Fusion 6 it is now possible to override this basic material using one of several tools which output a 3D Material. These materials provide a

greater degree of control over how the geometry reacts to light, providing inputs for diffuse and specular texture maps, bumpmapping and environmental maps which mimic reflection and refraction.



Illumination Models

Illumination models are advanced materials for creating realistic surfaces like carbon fibre, wood or metal. Each illumination model has advantages and disadvantages which make them appropriate for particular looks. An illumination model determines how a surface reacts to light, so these tools require at least one light source to affect the appearance of the object. In Fusion there are four different models: Blinn, Phong, CookTorrance and Ward. The image below shows their characteristics, in the order they were named.



Basic

The basic material provides basic control over the diffuse, specular and transmittance components of the material. It only accepts a single texture map for the diffuse component. The basic material controls are found in the Material tab of all tools which load or create geometry. Connecting any tool which outputs a 3D material to that tools material input will override the basic material and the controls in the Material tab will be hidden. See the Common 3D Controls section of the tool reference for a complete description of this materials options.

Blinn

The Blinn material is a general purpose material which is flexible enough to represent both mettallic and organic surfaces. At first glance it appears identical to the Basic material, but the Blinn tool allows for a greater degree of control by providing additional texture inputs for the specular color, intensity and exponent (falloff), as well as for reflection and refraction environment maps and bumpmap textures. Blinn is generally more efficient than the Phong illumination model.

Cook Torrance

The Cook Torrance material uses fresnel equations to simulate the behavior of light when moving between media of differing refractive indices. Otherwise it is similar to the Blinn

illumination model. This illumination model is primarily used for shading metal or other shiny and highly reflective surfaces.

Phong

The Phong material produces a result that is commonly thought to model the behaviour of light against polished or plastic surfaces.

Ward

The Ward illumination model is ideal for simulating brushed metal surfaces, as the highlight can be elongated in along the U or V directions of the mapping co-ordinates. This is known as an "anisotrophic" highlight.

Material Components

Regardless of whether the object uses the Basic, Blinn, Cook Torrance, Phong, Ward materials, or a shader which combines several materials, all illumination models share certain characteristics that must be understood.

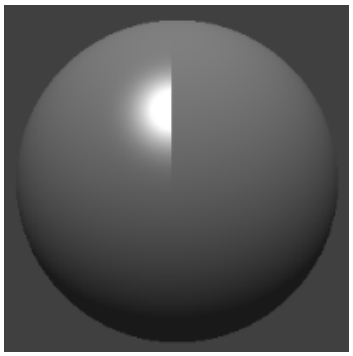
Diffuse

The diffuse component of a material describes the appearance of an object where light is reflected from the object at an angle which leads away from the current viewpoint. This diffuse color and texture could be considered to be the base appearance of an object, before taking into account highlights, reflections, and bumpmaps. The opacity of an object is generally set in the diffuse component of the material.

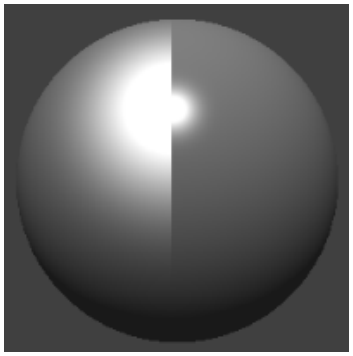
Specular

The specular component of a material describes the appearance of an object where the light is reflected directly back at the current viewpoint. This causes a highlight which is generally brighter than the diffuse component. The more specular a material is, the glossier it appears. Surfaces like plastics and glass tend to have white specular highlights, whereas metallic surfaces like gold have specular highlights that tend to inherit their color from the material color.

Specularity is usually described as color, intensity and exponent. The specular color determines the color of light that reflects from a shiny surface. Specular intensity descibes how large the highlight will be. The following images shows a split view of a sphere with with 50% white as the diffuse color, and 100% white as the specular color. The right side of the sphere has the specular intensity set to 0, while the left one shows the image with specular highlights.



The specular exponent controls the falloff of the specular highlight. The smaller the value, the sharper the falloff and the larger the specular component will be. The following image shows the sphere from the above example with a specular exponent of 9 and again with an exponent of 200.

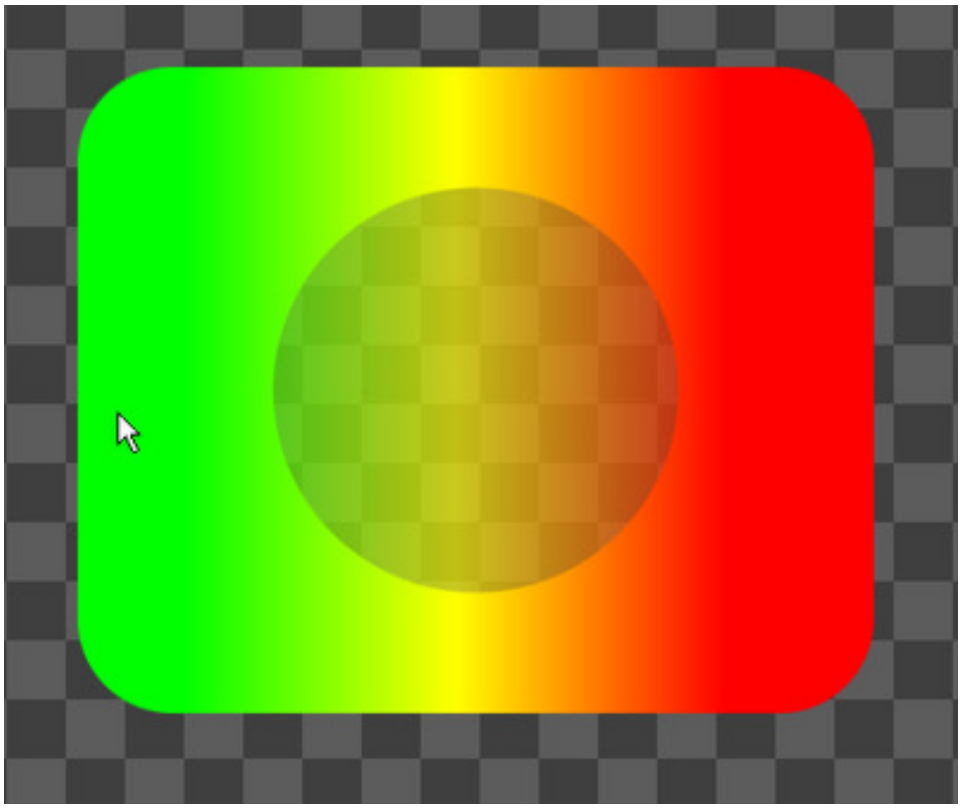


Transmittance

The transmittance component describes how light passes through a semi transparent material. For example, a solid blue pitcher will cast a black shadow, but one made of translucent blue plastic would cast a much lower density blue shadow. The transmittance component is essential to creating the appearance of stained glass. This component is described in greater detail below.

Note that Fusion allows for adjusting the opacity and transmittance of a material separately. The opacity determines how transparent the actual surface is when it is rendered. This might be a bit counter-intuitive to artists unfamiliar with 3D software at first. It is possible to have a surface that is fully opaque yet transmits 100% of the light arriving upon it (so in a sense it is actually a luminous/emissive surface).

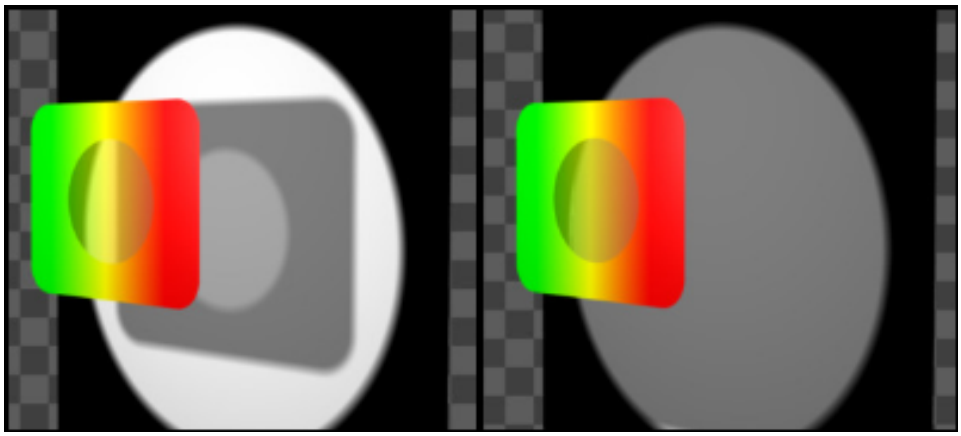
The illustrations below cast a shadow through the following image. The image contains a green-red gradient from left to right. The outside edges are transparent, and the inside is a small semi-transparent circle.



Transmissive surfaces can be further limited using the Alpha and Color Detail control.

Alpha Detail

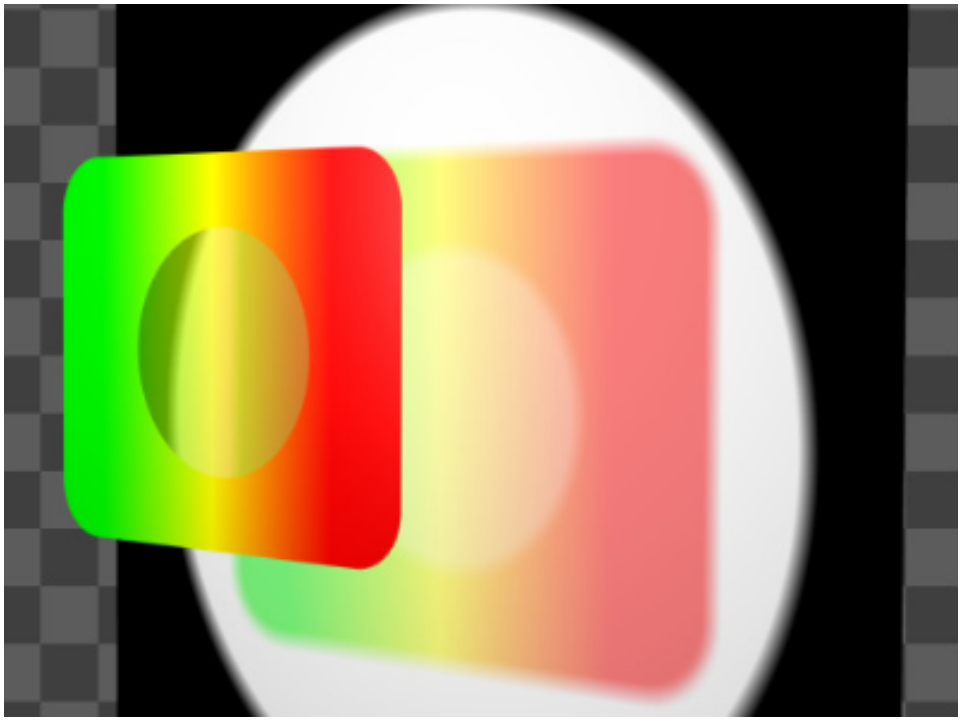
When this slider is set to 0, the alpha channel of the object is ignored and the entire object casts a shadow. If it is set to 1, the alpha channel detemines what portions of the object cast a shadow. Note that the OpenGL view will always cast a shadow from the entire object, ignoring the alpha. Only the software renderer supports alpha in the shadow maps. Below is an example image with Alpha Detail set to 1.0. The shadow is only cast where the alpha channel is greater than 0.



Color Detail

This modulates light passing through the surface by the diffuse color and texture colors. Use this to throw a shadow that contains color details of the texture applied to the object. Increasing the slider from 0 to 1 brings in more of diffuse color and texture color into the

shadow. Note that the alpha and opacity of the object is ignored when transmitting color, allowing an object with a solid alpha to still transmit its color to the shadow. Below is an example image with Color Detail set to 1.0. The gradient is clearly visible in the shadow.



Transmission Color

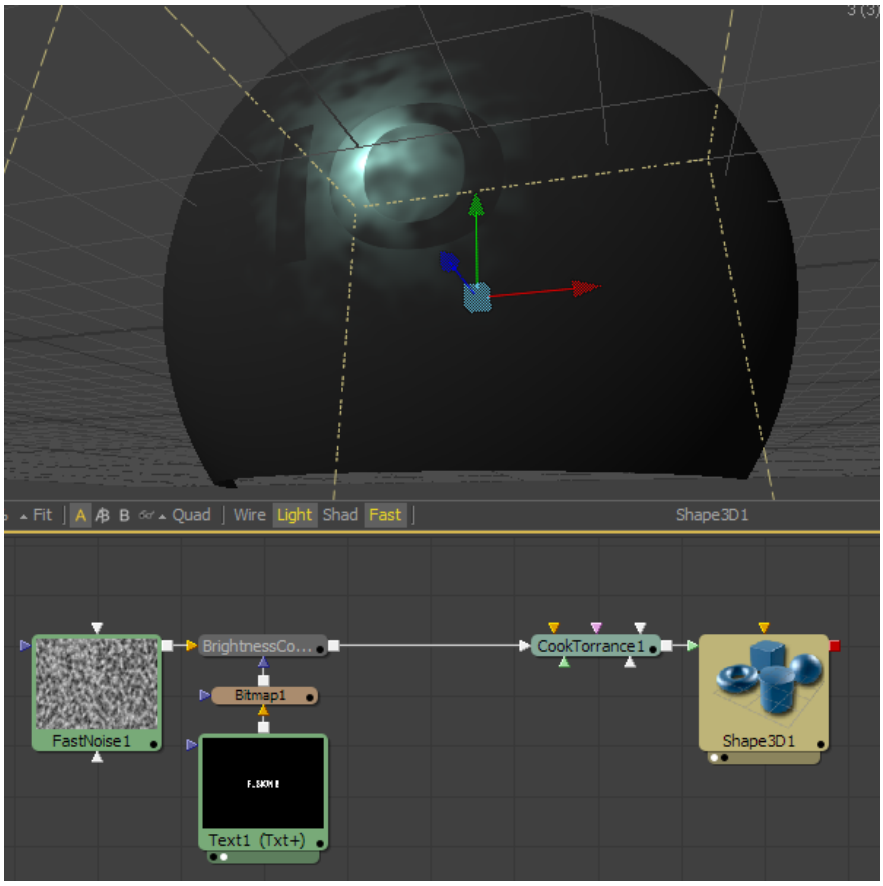
The Transmission Color determines how much color is passed through the object. For an object to have transmissive shadows, set the transmittance color to (1, 1, 1), which means 100% of green, blue, red light pass through the object. Setting this color to RGB = (1, 0, 0). This means that the material will transmit 100% of the red arriving at the surface, but none of the green or blue light.

Textures

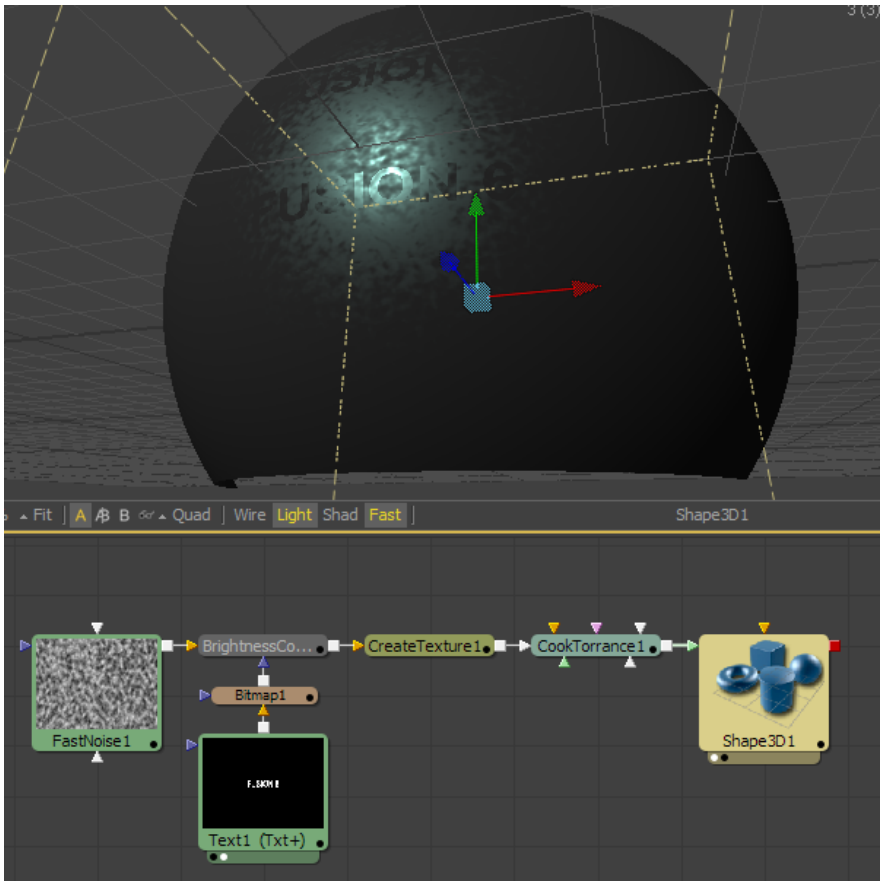
Texture maps are typically either 2D images or 3D materials which are used to modify the appearance of a specific component in an illumination model. This is done by connecting an image (or another material) to the inputs on the material tools tile in the flow editor. When a 2D image is used the UV mapping co-ordinates of the geometry are used to fit the texture over the image, and when each pixel is rendered the material will multiply the value of the component against the value of the corrosponding pixel in the map.

Texture maps are used to modify the diffuse color, specular color, specular exponent, specular intensity, reflection, refraction and bumpmap components of a material. The most commonly used texture maps are applied to the diffuse color component.

The following example shows how to control the roughness of a Cook Torrance material using the image produced by a Fast Noise tool.

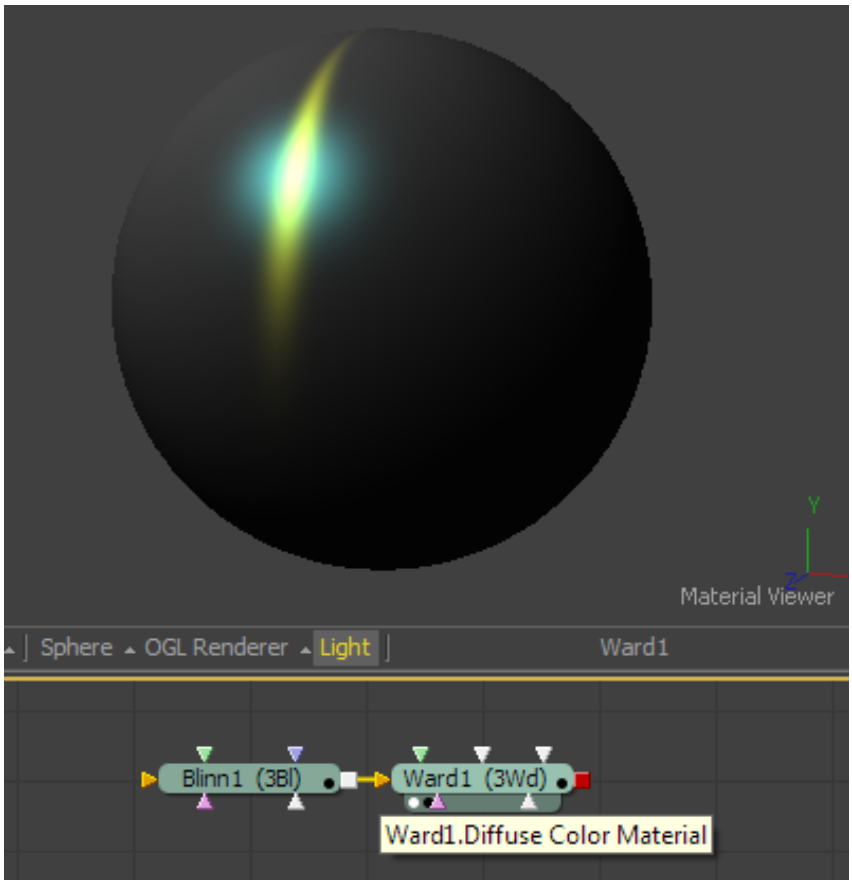


A tool that outputs a material is frequently used instead, to provide a finer degree of control over the texture. In the following example a Texture 2D tool is used to translate the texture in the uv-space of the object.

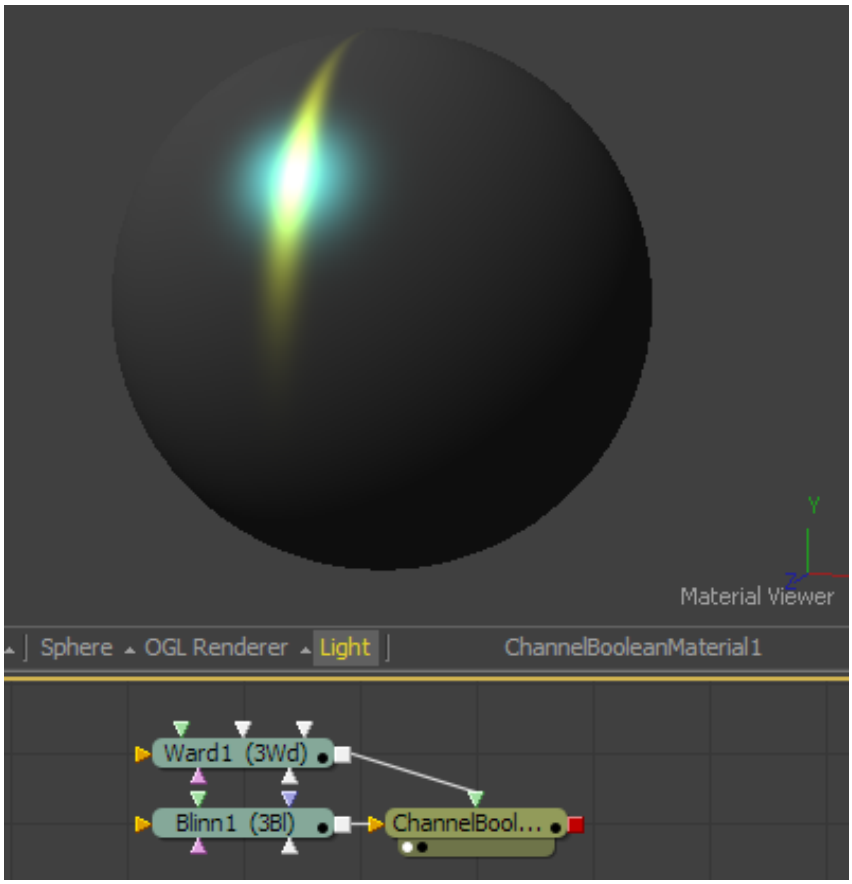


Composite Materials

Building complex materials or shaders is as easy as connecting the output of a material tool to one of the texture inputs of another material of texture tool. When a texture input is supplied with a material instead of a 2D image, it will combine the results of that material with its own calculation. The following example shows how to combine an anisotrophic highlight with a Blinn material.



The output of the Blinn (including its specular) is used to determine the diffuse color of the Ward material. There are times where this is not desirable because the output of the Blinn is relit by the Ward material. The Channel Boolean Material can be used to add the Ward materials specular component to the Blinn material with a greater degree of control.



OpenGL Hardware Limitations

The OpenGL renderer combines the textures and materials in the composition into a shader program which is executed on the graphics card. Each graphics card provides a limited amount of resources and abilities to the shader program.

If too many 3D material tools are connected together or too many lights illuminate a surface the shader will be unable to execute. This is typically indicated by the "unable to activate material..." message. In particular, there are two common limits that shaders in Fusion may bump up against:

1. **Number of Textures:**

   For most graphics card a shader cannot sample from more than 16 unique textures within a shader. This means if you construct a material tree and it is being fed by more than 16 unique images then it can fail to render. Note that some older cards only allow 8 textures while some newer cards allow more than 16.

1. **Number of Constant Registers:**

   Unlike programs that run on your computers, shaders have in comparison a very very small amount of memory to work with. For most cards this is about 4kb to 16kb of *constant parameter memory*. When the shader uses up more constant parameter memory than is available the render of that material will fail. One way of achieving this is by making a large number of spotlights illuminate a single surface. Each spotlight uses up constant parameter memory for things like its direction, position, color, cone angles and

such.

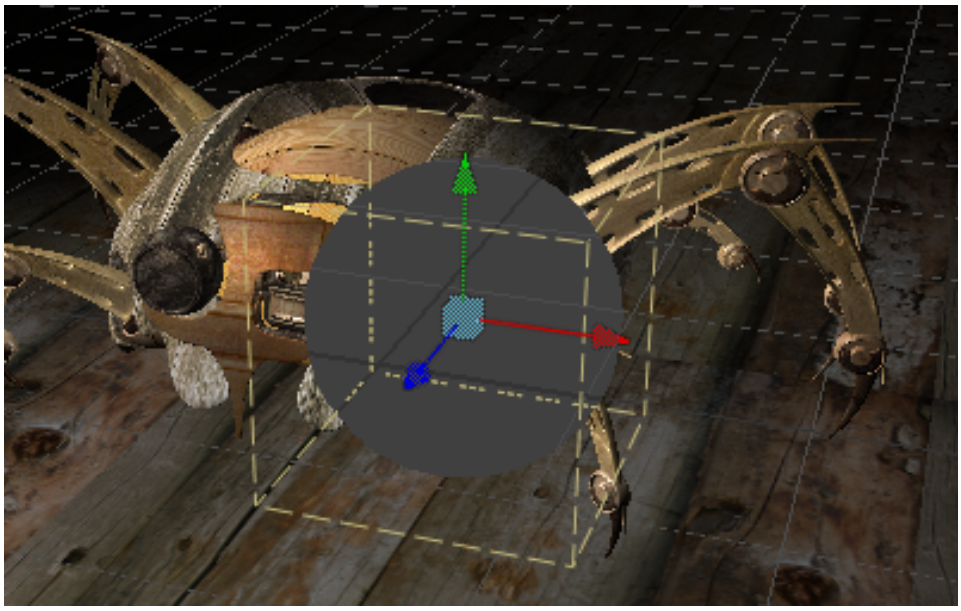
To see the limitations of the current graphics card hold down the SHIFT key while right clicking on the memory indicator in the status bar. Select the 'Debug: List OpenGL Hardware Info' option form the context menu. This will open a text file containing a long list of information about the currently installed graphics card. The number of textures will be displayed as **[ARB_fragment_program Limits] - Max Texture Image Units**, and the Number of Constant Registers can be seen as **[ARB_fragment_program Limits] - Local Parameters**.

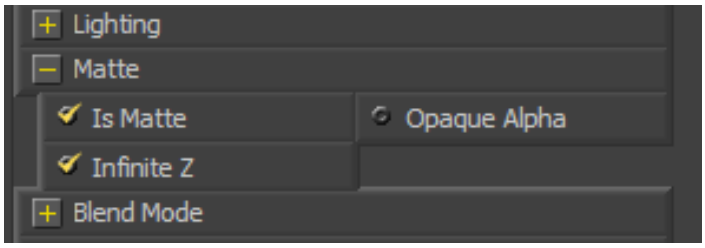
Once these limits have been reached the only options available are to either simplify the scene or use the software renderer. Upgrading the graphics card may help, provided that the newer card does not have the same limits as the current one. (these limits do tend to slowly increase as new generations of cards are brought out).

Matte Objects

Matte Objects

Matte Objects are used for masking out parts of the scene using objects. Effectively, everything what falls behind a matte object didn´t get rendered. However, matte objects itself can contribute information into the z-channel and the object-id framebuffer, leaving all other buffers at their default values. Matte objects are not boolean objects. They do not change any geometry or create new one. The effect of a matte object is scene global. To change the properties for downstream tools, use the Override tool.





Is Matte

When activated, objects whose pixels fall behind the matte objects pixels in Z do not get rendered.

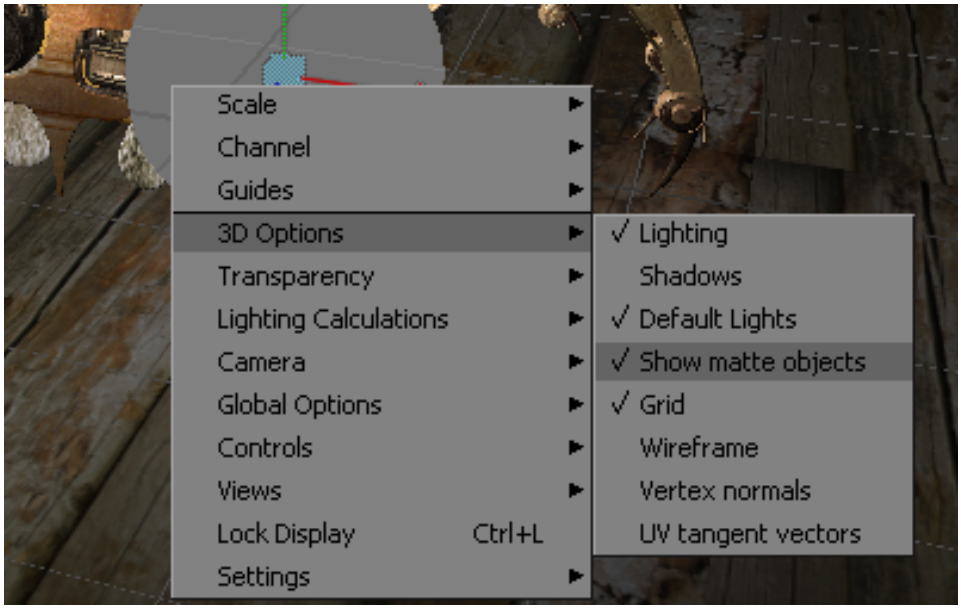
Opaque Alpha

Sets the alpha value of the matte object to 1. This checkbox is only visible when the IsMatte option is enabled.

Infinite Z

Sets the value in the z channel to infinite. This checkbox is only visible when the IsMatte option is enabled.

Matte objects in the view cannot be selected unless the "Show Matte Objects" view option is ticked. However, it is always possible to select the matte object by selecting its tool in the flow.



OpenGl and Software Rendering

Renderer 3D

In order to generate a 2D image from a 3D scene, the scene must first be rendered using a Renderer 3D tool.

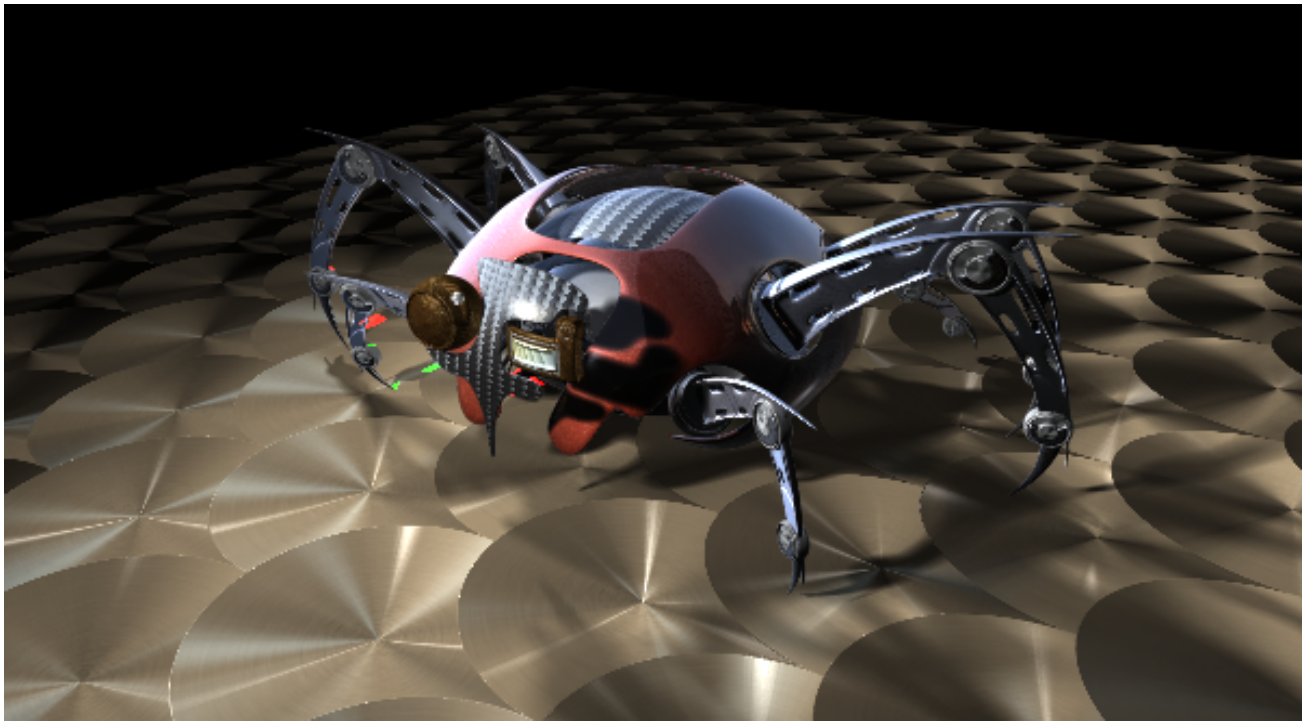
The renderer uses one of the cameras in the scene to produce a 3D image. If no camera is found, a default perspective style view is used. This default view rarely provides a useful angle and it cannot be adjusted, so most 3D scenes include at least one camera.

The image produced by the renderer can be any resolution, up to Fusion's 32,000 x 32,000 pixel limit. The Renderer 3D tool is equivalent to other creator tools, such as the Background, Fast Noise or Text tools. As such, it provides the usual options for fields processing, color depth, and pixel aspect.

Fusion provides two different types of renderer by default; a GPU accelerated OpenGL renderer which produces results almost identical to those shown in the interactive 3D views, and a software renderer which is slower but supports more advanced rendering techniques such as soft shadows or extremely large textures.

Software Renderer

The Software Renderer is the default renderer and is generally used to produce the final output. The software renderer is not dependent on the capabilities of the graphics card, ensuring that the results of the render are always the same whatever the configuration of the machine used to render.



The software render is required to produce soft shadows. This feature is not supported by the OpenGL renderer.

The software renderer can easily handle textures much larger than the graphics card's maximum texture size. It is recommended for maximum quality when working with large images as textures.

As the computer systems used as render slaves in network render farms frequently have either weak graphics cards, or no graphics cards at all, the software renderer is generally preferred when rendering a composite through the render farm.

OpenGL Renderer

The OpenGL Renderer relies on the GPU and memory on the graphics card of the workstation to produce the image. The textures and geometry are uploaded through the systems bus to the graphics card, and OpenGL shaders are used to produce the image. This can be orders of magnitude faster than the software renderer, but limits the OpenGL renders to the capabilities of the graphics card.

With the introduction of very fast GPU's and performance optimized shader languages like NVidia's CG language the OpenGL renderer has become much more flexible. This speed makes techniques like super-sampling and depth of fieldpossible when they would have previously been much too slow for production use. As a result, the OpenGL renderer in Fusion 6 is much more appropriate for final renderings.



Displaying and rendering textures larger than the graphics card's maximum texture size is very difficult for OpenGL, either failing entirely, or slowing the rendering immensely. Most OpenGL-accelerated cards available at the time this chapter was written allowed a maximum texture size of 2048x2048 or 4096x4096, depending on how much memory was installed on the graphics card.

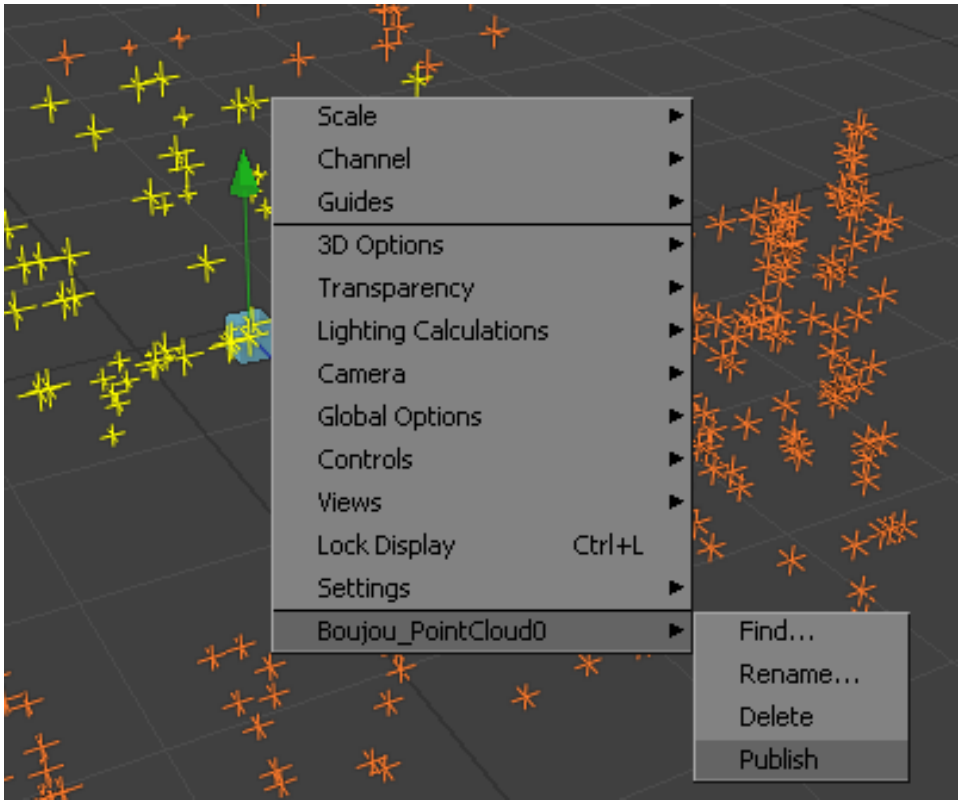
Textures larger than this maximum cannot be displayed directly by OpenGL. Fusion will resize images larger than the maximum to half the maximum texture size of the graphics card to ensure the image can be displayed in the views and rendered by the OpenGL renderer.

Contact the graphic cards vendor to determine the maximum supported texture, or use freely available utilities such as the OpenGL extension viewer found at www.realtech-vr.com.

Point Cloud and Locator

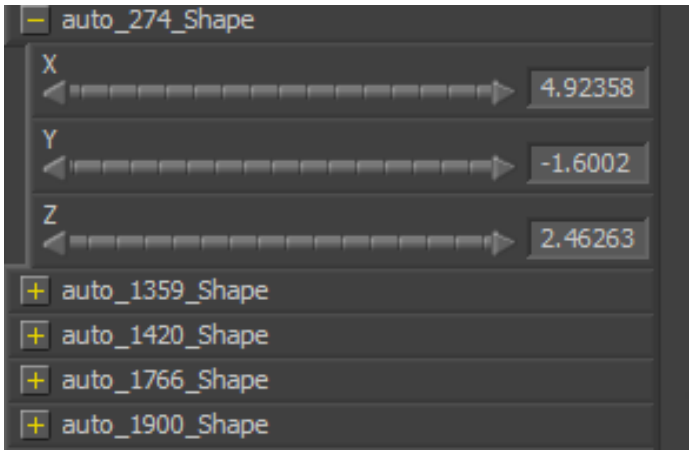
Point Clouds

The Point Cloud tool was designed specifically to make it easier to work with locator clouds generated from 3D tracking software. Applications, such as Syntheyes, Boujou and Maya, will often generate hundreds or even thousands of tracking points. Seeing these points in the scene is important to assist with lining up the image but bringing each point in as an individual locator or geometry can impact on the application's performance dramatically.



The point cloud tool can import point clouds written into scene files from matchmoving software. Importing a point cloud works like importing a camera; browse to the scene file and select the cloud to import from the scene. The entire point cloud is imported as one piece of geometry, which is a significantly faster approach.

Many 3D trackers allow for the naming of individual tracking points, as well as setting tracking points on points of interest. The point cloud tool will quickly find these points and publish them. A published point in the cloud can be used to drive the animation of other parameters.

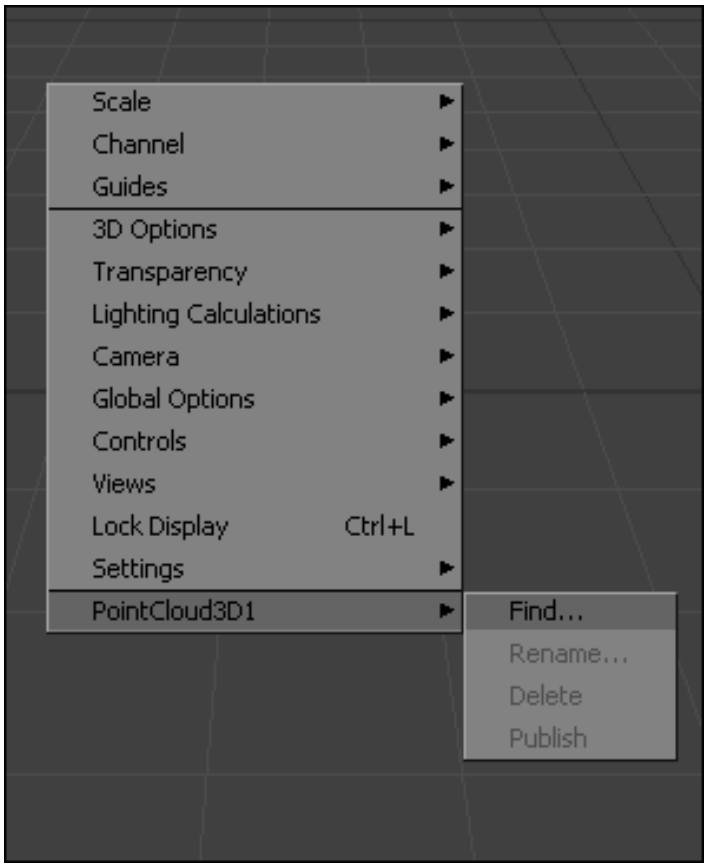


The point cloud is represented as onscreen controls, not geometry. To see it in the views, first select the Point Cloud tool in the flow.

Finding A Point In The Cloud

To find a point in the point cloud, select the Point Cloud tool and right-click in an 3D View. Select Find from the Point Cloud's submenu at the bottom of the context menu. Type the name of the point and click Ok.

If a point that matches the name entered is found, it will be selected in the point cloud and colored yellow.



This is a case-sensitive search. A point named tracker15 will not be found if the search is Tracker15.

Renaming A Point In The Cloud

Use the Point Cloud context menu to Rename a selected point. This only works for a single point. A group of points cannot be renamed.

Publishing A Point

Use the context menu to Publish a selected point or points. A published point exposes its XYZ positions for connections to other controls in the scene. This is useful for connecting objects to the motion of an individual tracker.

Locator

TBA

Projection Mapping

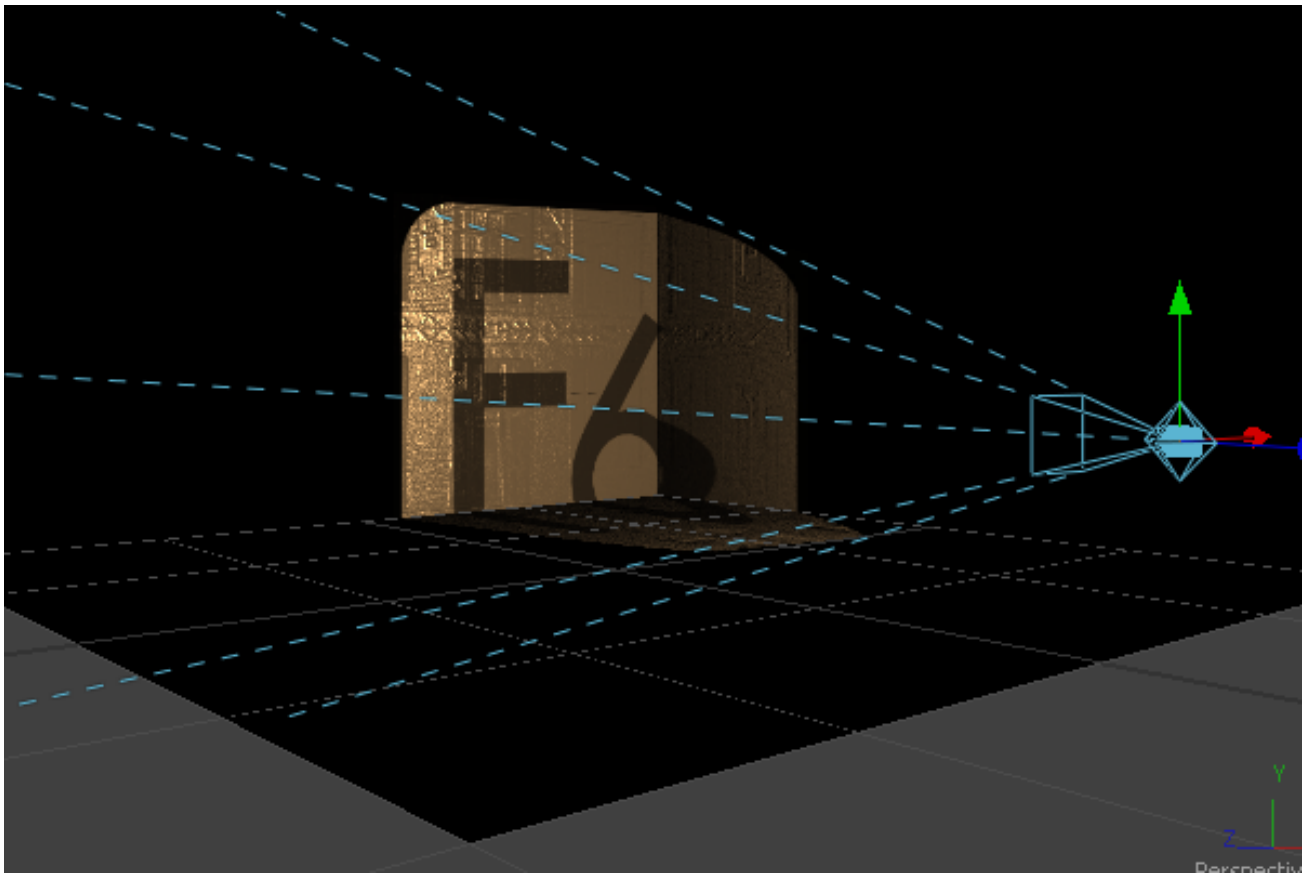
Projection is a technique for texturing objects. Images are mapped onto objects using a Camera or Projector tool. This can be useful in many ways; texturing objects with multiple layers, applying a texture across multiple separate objects, projecting background shots from the camera's viewpoint, image-based rendering techniques and much more.

Projected textures can be allowed to "slide" across the object. If the object moves relative to the Projector 3D, or alternatively, by grouping the two together with a Merge 3D they can be moved as one, and the texture will remain locked to the object.

Basically, there are three different ways to do projection mapping.

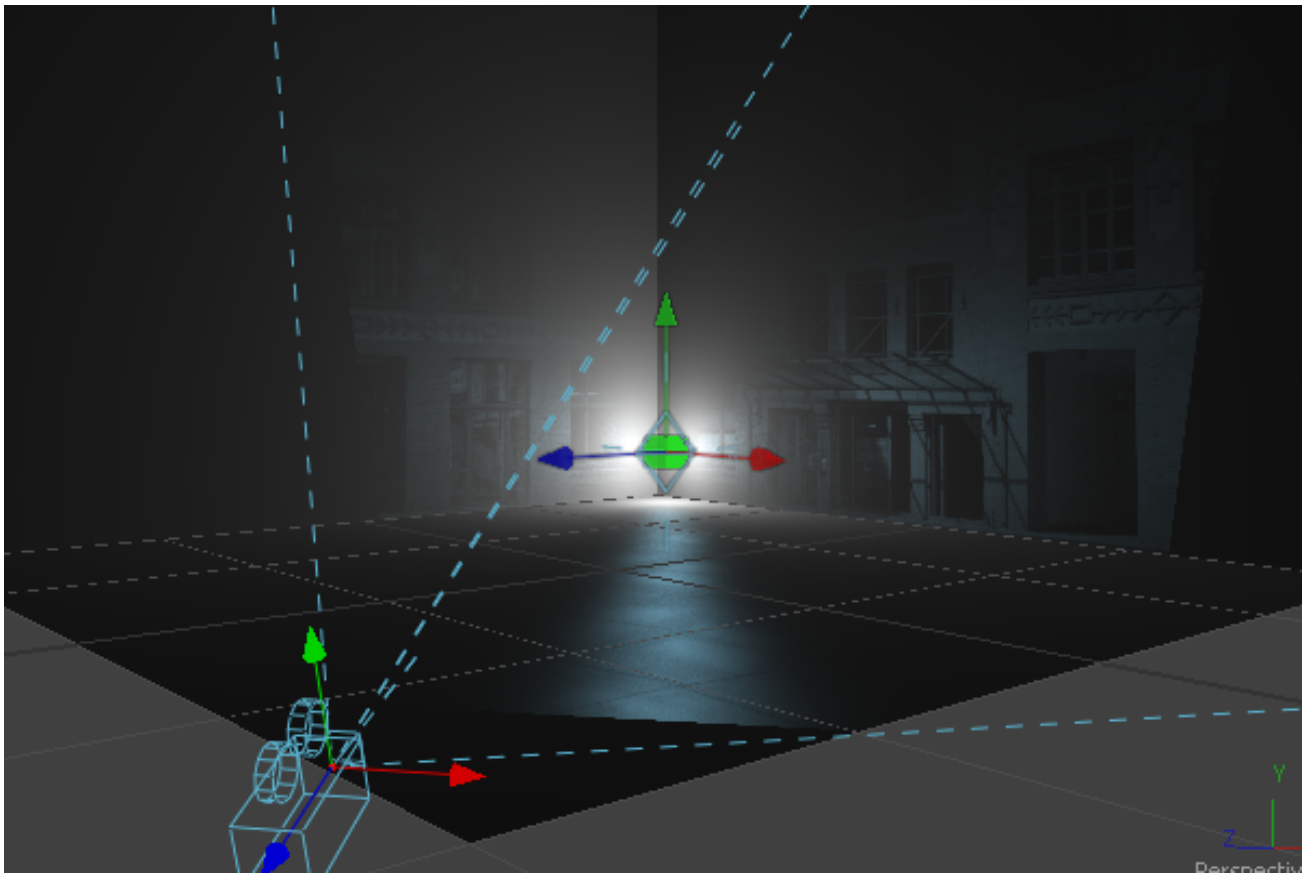
Using the Projector/Camera tool set to project light. The projection is done per pixel

In this mode the Projector or the Camera acts as a light with all lighting features. This mode requires per pixel lighting and lighting must be enabled in order to see some results. It is possible to choose if the projector behaves like a spotlight or an ambient light. Alpha channels cannot be projected. Overlapping projections add together like any other light tool. An internal clipping plane (at around 1.0 distance from camera) limits how close the Projector/Camera can get to the projection receivers. Have a look at the Projector tool documentation for more details.



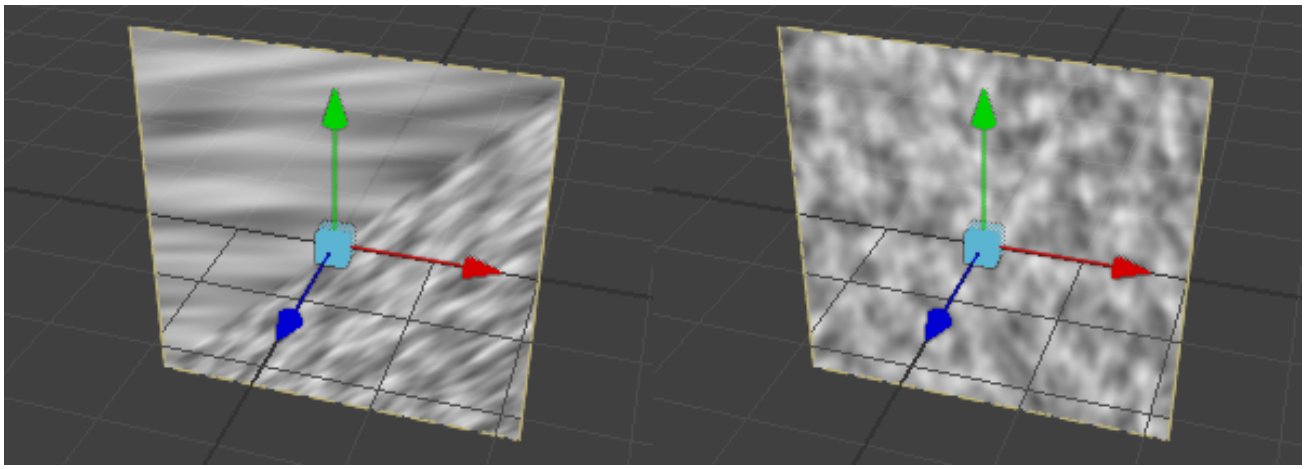
Using the Projector/Camera tool set to project a texture onto a Catcher material

In this mode the projecting tools acts as real texture projectors. There is no light contribution anymore. As a consequence a Catcher tool is required in order to receive the texture and apply it to a material. Only objects using this material will receive the projection. This offers some advantages like the projection of alpha channels and texturing other channels like specular color or roughness. Overlapping projections can combined in various ways (mean, median, blend) via the Catcher tool. An internal clipping plane (at around 1.0 distance from camera) limits how close the Projector/Camera can get to the projection receivers. This mode needs per pixel lighting.



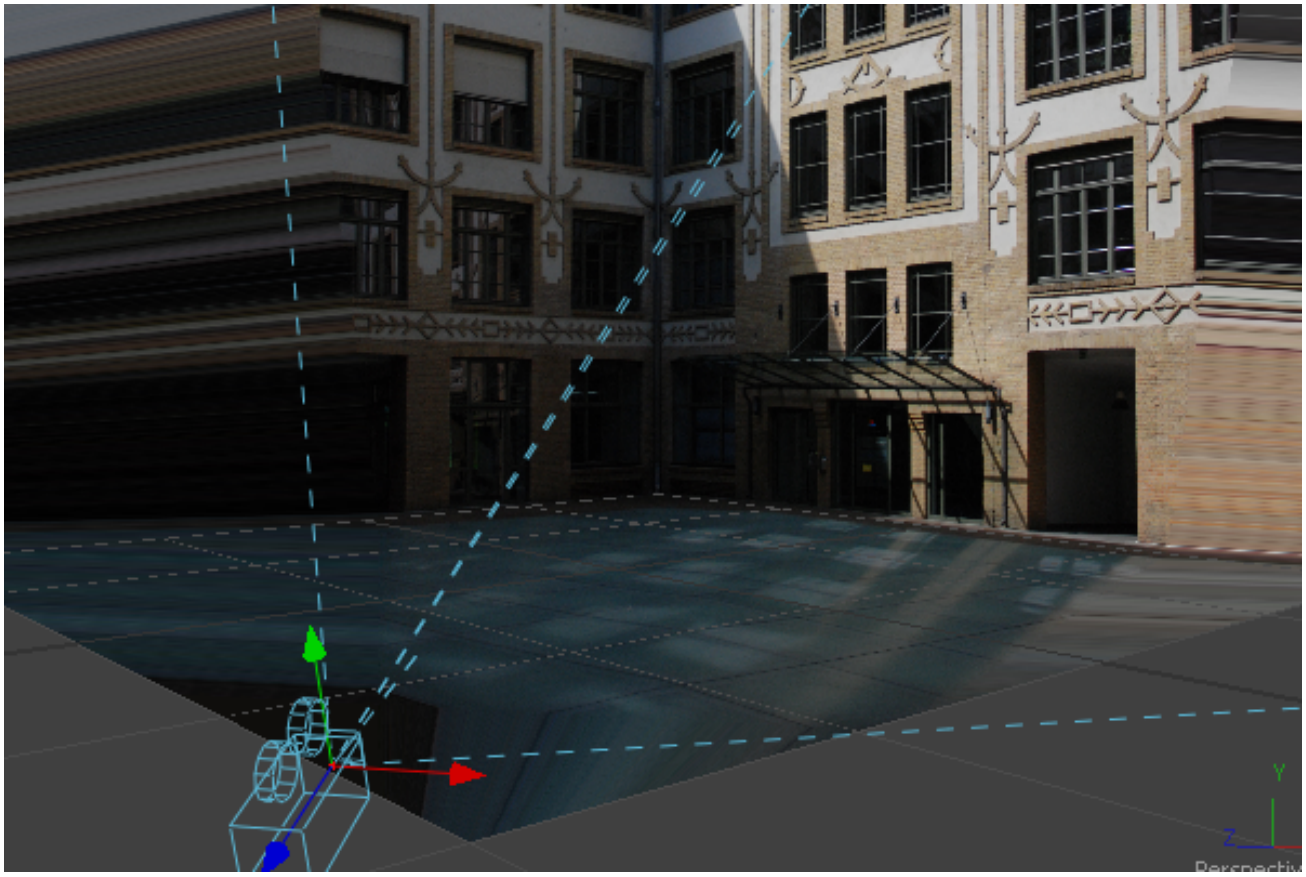
Using the UVMap tool with its MapMode set to Camera/Projector

This mode requires a camera and an UVMap tool downstream of the objects where to apply the texture. The UV Map tool gathers the information from the camera and creates a new UV-map for the upstream objects. These are used for texturing. In order to work properly, the object must be tesselated sufficiently.



Textures are assigned to the object or its materials like any other texturing technique. It supports alpha channels as well as bump mapping. The UVs can be locked to the vertices at a chosen frame. This locking only works as long as long as the mesh is not changing over time since Fusion must be able to match up the mesh at the reference time and the current time. Its transform can be changing, but the mesh itself cannot be. To be more specific, vertices may

not be created or destroyed or reordered. Eg. projection locking will not work on particles because they get created/destroyed, a cube with its tesselation slider animated, a duplicate tool with its time offset set to non zero so addition meshes get created over time.



Reflections and Refractions

The illumination models in Fusion all support the use of environmental reflection maps created by the Reflect tool in the 3D Material tool category. This tool creates an environmental reflection map which can be used to simulate reflections and refractions on an object. Reflections are direct reflections of the light that hits an object, while refractions simulate the distortion of light seen through semi-translucent surfaces.

The reflections and refractions produced in Fusion are not accurate, raytraced solutions, as these would be much too slow in the context of a compositor. Instead Fusion uses a technique common in games called environment mapping to produce an approximation which is good enough for many scenarios. Environment maps assume an objects environment is infinitely distant from the object and renders it into a cubic or spherical texture surrounding the object.

Fusion 6 provides the Cube Map and Sphere Map tools to help create environment texture maps which will produce more realistic results than a simple flat texture mapped directly to the object.

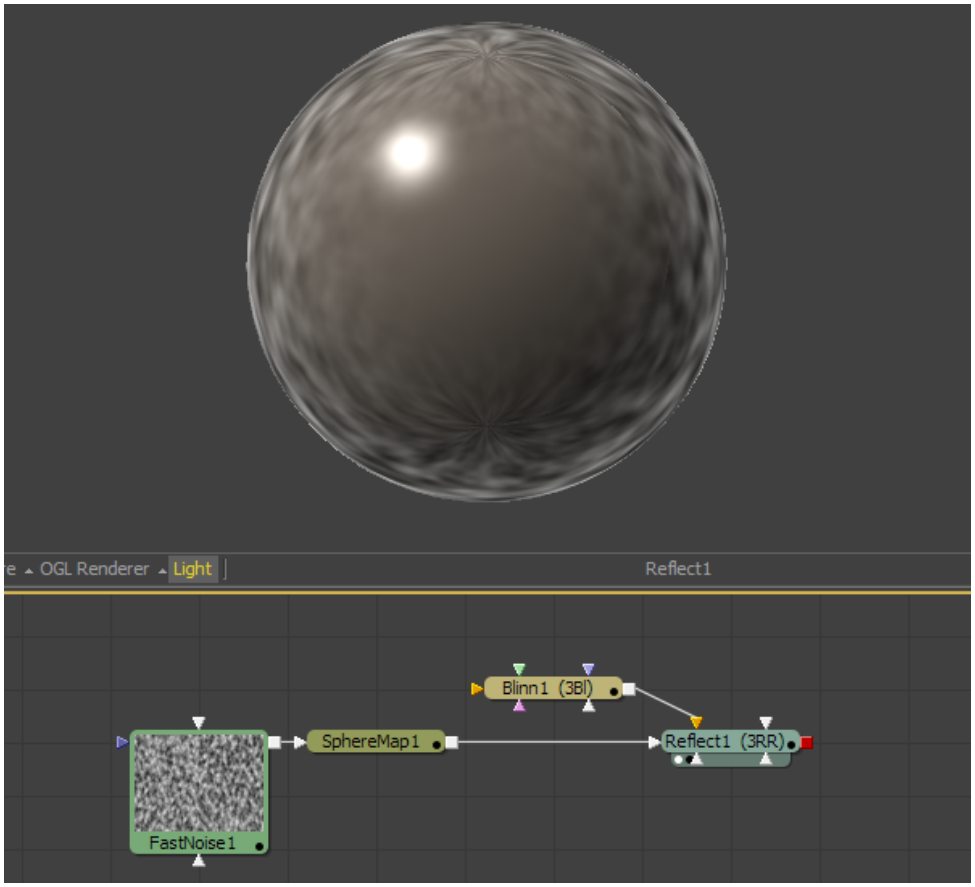


Environment mapped reflections and refractions do not provide self reflection or any other kind of interaction between different objects. In particular, this infinite distance assumption means that objects can not interact with themselves - eg. the reflections on the handle of a teapot will not show the body of the teapot.. It also means that using objects using the same cubemap will not inter-reflect with each other. For example, two neighboring objects would not reflect each other. A separate cubemap must be rendered for each object.

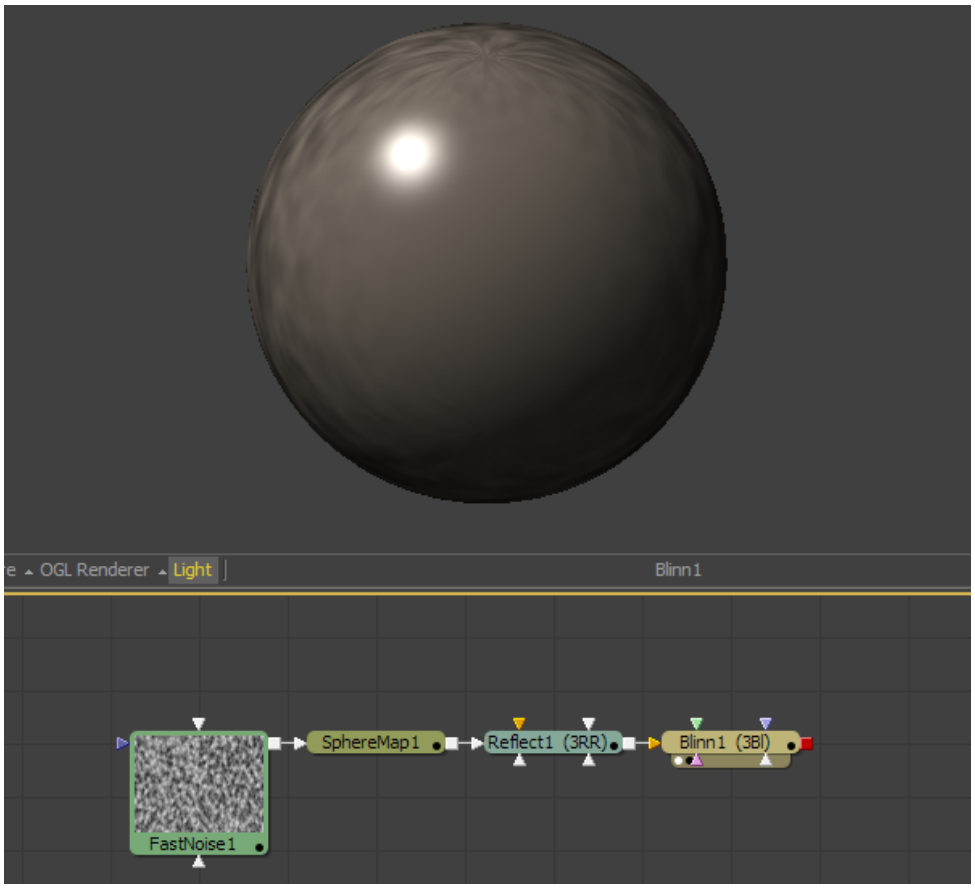
The Reflect tool outputs a material that can be applied to an object directly, but the material does not contain an illumination model. As a result objects textured directly by the Relfect tool will not respond to lights in the scene. For this reason the Reflect tool is usually combined with the Blinn, Cook Torrance, Phong or Ward tools.

Additionally, reflections and lighting may not interact in a realistic fashion. Environment mapped reflections are a texturing effect that is blended over the background color. That makes it possible to apply the reflection either before or after the lighting model. The images below show different approaches to adding reflections to a material:

In this example the Blinn material is connected to the background material input of the reflection. This causes the Blinn to light the reflection texture.



In this example the Reflection texture is connected to diffuse color component of the Blinn, causing the texture to be multiplied by the diffuse color.



The Channel Boolean Material can be used to provide more control over how these are combined, as discussed in the ../Materials section of this chapter. There is no right approach, experiment and select the approach which provides the appropriate effect.

The Reflect tool calculates the reflection differently depending on what type of tool is connected to its texture inputs. If a tool which produces an environmental texture such as the Sphere Map or Cube Map is connected then the reflection/refraction vectors created by the tool are used to map the texture to the object. Connecting a 2D image or a texture created by the Create Texture tool causes the Reflect tool to use the standard UVW texture coordinates instead.

The reflect tool provides the following texture inputs,

Reflect.Reflection.Color.Material

typically receives the environment reflection image

Reflect.Reflection.Intensity.Material

typically receives a texture for scaling the constant/by angle strength of the reflection

Reflect.Refraction.Tint.Material

Typically receives the refraction environment image.

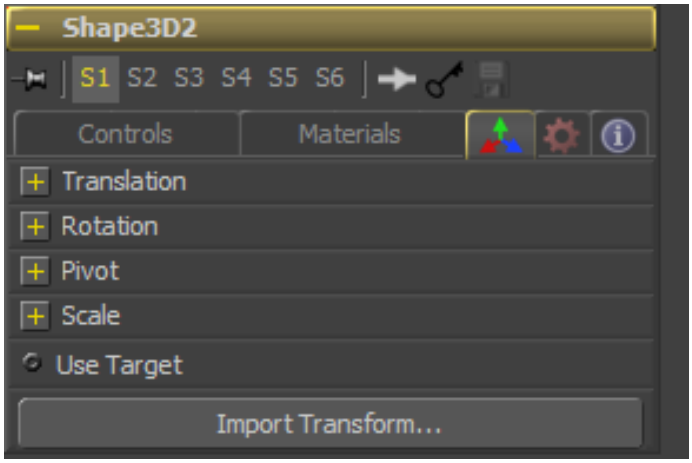
Refraction only occurs where there is transparency in the background material, which is generally controlled through the Opacity slider and/or the alpha channel of the any material or texture used for the background texture input.

Working with reflection an refraction can be tricky sometimes. Here are some hints to make work easier.

- Keep it subtle. Typically environment mapped reflections use just a hint of reflection, between 0.1 and 0.3 strength. Use higher values only for glossy surfaces like chrome
- Bump maps can add detail to the reflections / refractions. Note that Bump Map also lacks an illumination model, so connect it to the illumination model used by the reflect tool.
- When detailed reflections are not required use a relatively small cubemap, such as 128 x 128 or 256 x 256 pixels, and blur out the reflections.
- In photorealistic renderers the reflection is added to the lighting information of the surface. In Fusion it will blend between the reflection color and the color of the surface. For behaviour closer to the photorealistic renderers, create the reflection separately and add it to the illumination model using a Channel Boolean Material tool.
- The refraction is evaluated only when the ray hits the object. There is no additional computation when the ray would leave the object.
- In practice it can be hard for the human brain to distinguish between a physical correct (ray traced) refraction or an environment refraction - as long as everything looks warped the brain doesn’t notice the precise optics.
- The alpha of refracted pixels is set to 1 even though the pixels are technically transparent.
- If the refraction is not visible even when a texture is connected to Reflect.Refraction.Tint.Material, double check the alpha/opacity values of the background material.

Transformations

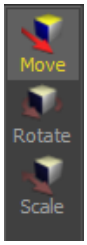
Most of the tools found in the 3D category have Transformation controls that are collected together into a single tab. The controls found in this tab affect how the object is positioned, rotated and scaled within the scene. The Transformation Tab is labeled with a typical 3D coordinate tripod as its icon, as pictured below.



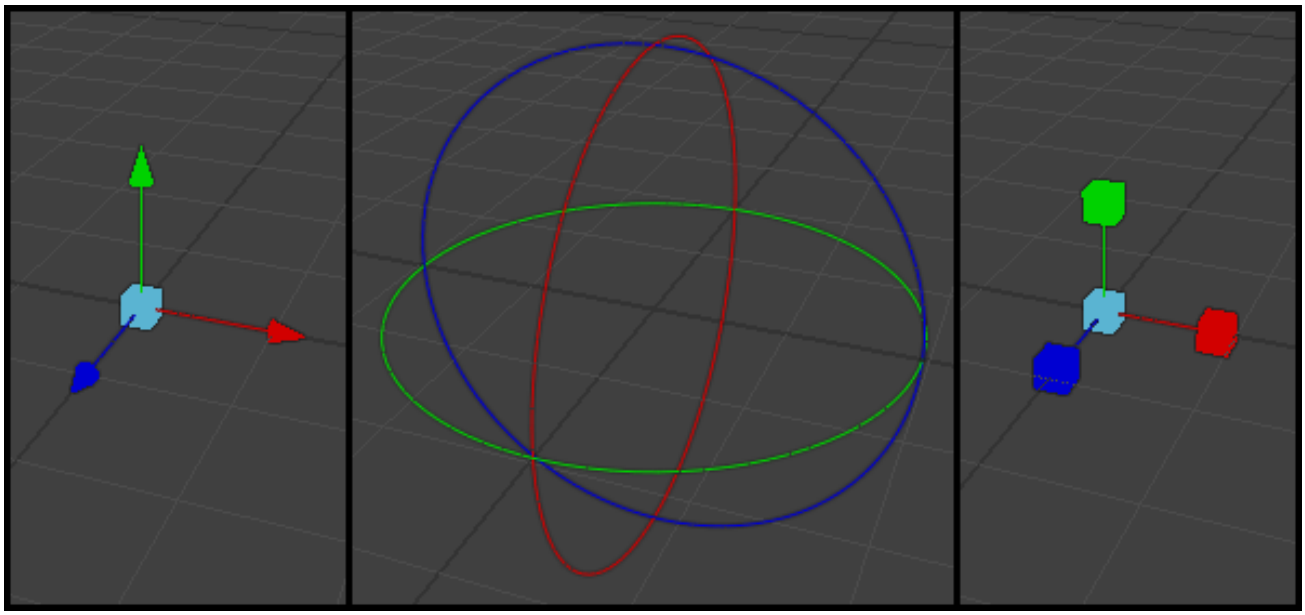
The Offset controls are used to position the object in the scene. The Rotation controls affect the object's local rotation (around its own center). The Scale sliders affect its size.

Onscreen Transformation Widget When an object is selected, it will display an Onscreen Transformation Widget in the display views. The widget has a position, rotation and scale mode. Use the transform toolbar buttons to switch the mode of the selected control or press *q* for position, *w* for rotation and *e* for scaling.

In all three modes, the red portion of the widget indicates the objects local X axis, while green and blue are used for the Y and Z axis respectively. Click-drag in the center of the widget to apply the transformation without constraint, or click-drag directly on a axis to constrain to that axis. As of Fusion 6 holding the *ALT* key down while click dragging in the view allows a selected controls to be adjusted without requiring the artist to click directly on the control.



If the Scale's Lock XYZ checkbox is still selected, only the overall scale of the object can be adjusted (using the red axis). Click-drag on the center of the widget or on the red axis. Adjustments will affect all three axis equally. Unlock the controls to scale the object along individual axis separately.

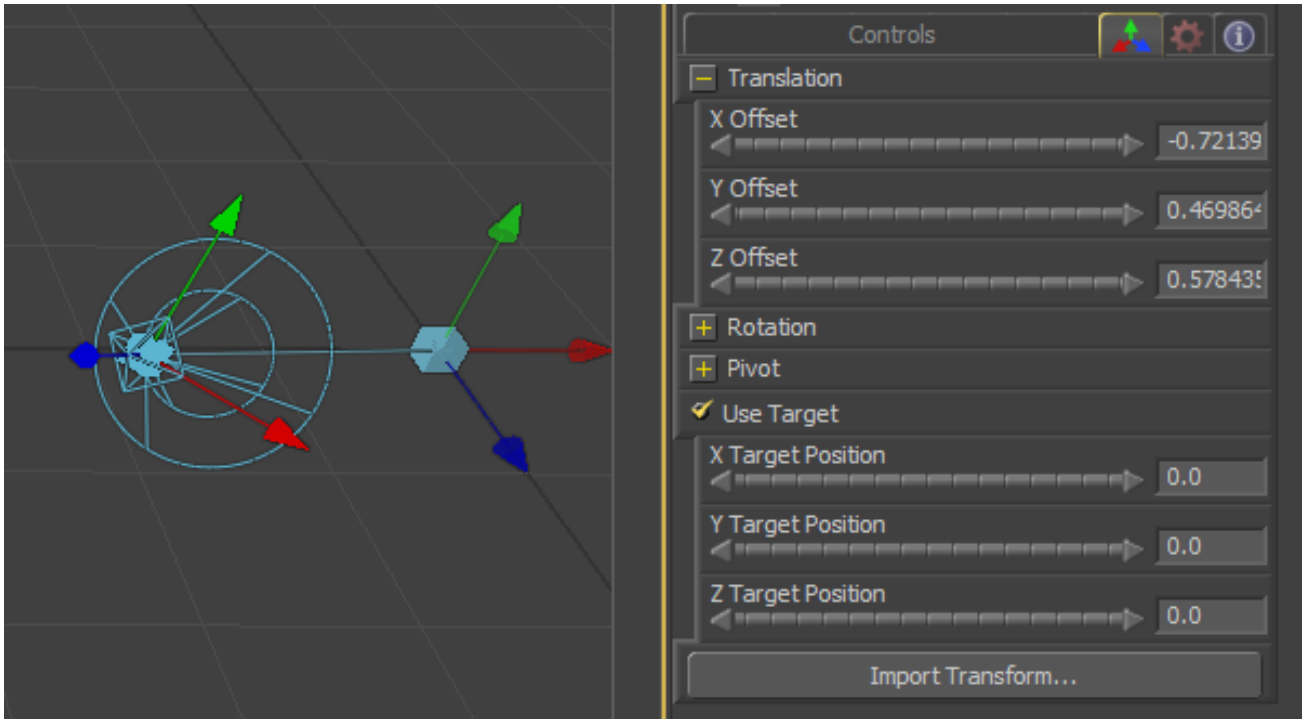


Pivot

In 3D, objects are rotated around a vector (the so-called rotation axis). A vector gives just the direction. By default, this vector goes through the object's center. Force the rotation axis to go through any 3D point using the Pivot control.

Target

Enabling the Use Target checkbox will reveal another set of XYZ controls and a new position control will appear in the display views. A dashed line is drawn between the target and object center in the display views to show the relationship between these controls.



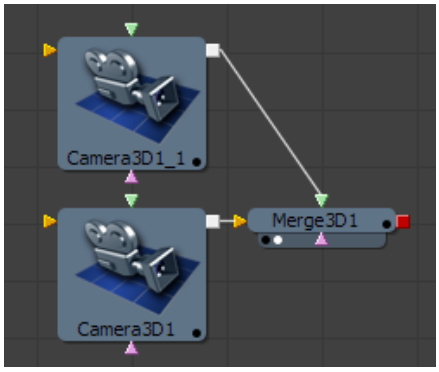
Targets are used to help orient one object to another or to a specific point in the scene. No matter where the object moves, it will rotate to face its target.

For example, if a spotlight is required in the scene to point at an image plane, enable the spotlight's target in the Transformation tab and connect the target's XYZ position to the image plane's XYZ position. No matter where the spotlight is moved, it will rotate to face the image plane.

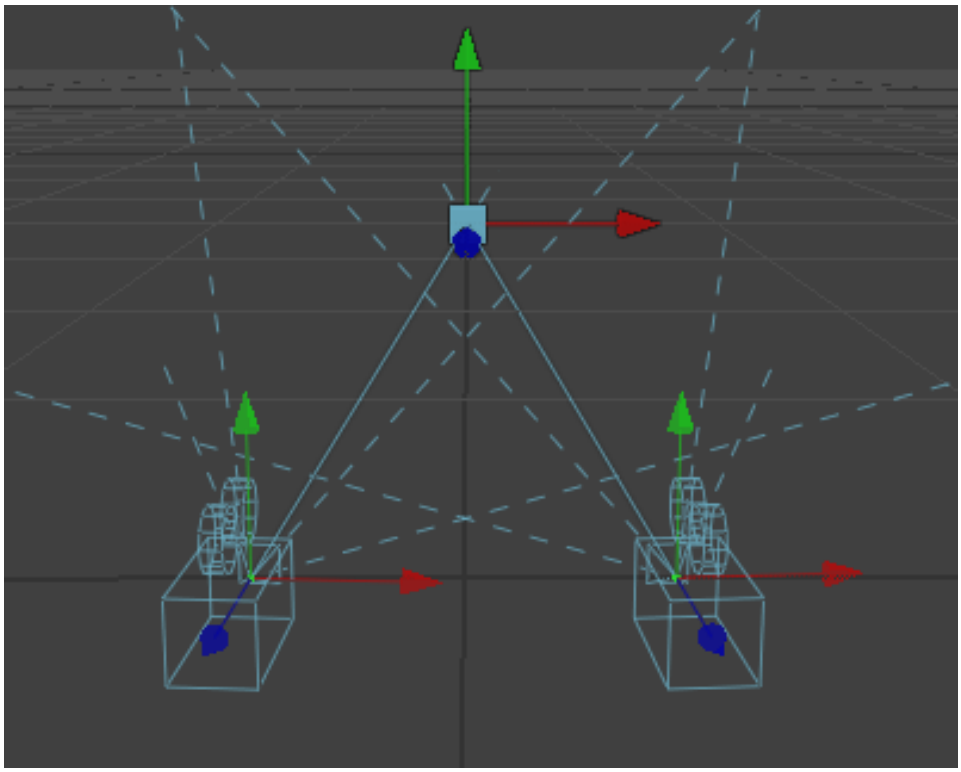
Parenting

One of the many advantages to Fusion's node-based approach to 3D is that Parenting between objects becomes implicit in the structure of the 3D flow. The basis for all Parenting is the Merge tool.

For example, picture a scene with two cameras that are both pointing at exactly the same location, except one is offset from the other by a small amount. This type of rig was frequently used to simulate left eye/right eye stereoscopic cameras (before this feature was built into Camera).



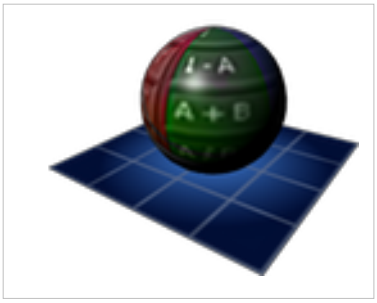
One way to connect them together would be to publish the XYZ Offset controls and the XYZ Animation controls on one of the cameras, and then connect the matching controls on the other camera. A much faster way would be to use a Merge 3D to create a parent transformation for the two cameras, as depicted in the composition below.



In the illustration above, the Merge 3D tool has been renamed to Camera Rig to make its purpose clearer. Anytime the camera rig is adjusted, apply a transformation to the merge's center. To change the relationship between the cameras, for example to offset them further from each other, adjust the individual camera's transformation.

Any transformation applied to a merge is applied to all objects present in the scene at that merge, including cameras, lights and geometry.

3DChannel Boolean



The Channel Boolean Material can be used to remap and modify channels of 3D materials using mathematical operations. For example if you want to use the red channel of a material to control an scalar input of an illumination model which uses the alpha channel (eg. Blinn.SpecularExponent) you can remap the channels here. Furthermore it allows to use geometry specific information like texture space coordinates and normals.

External Inputs



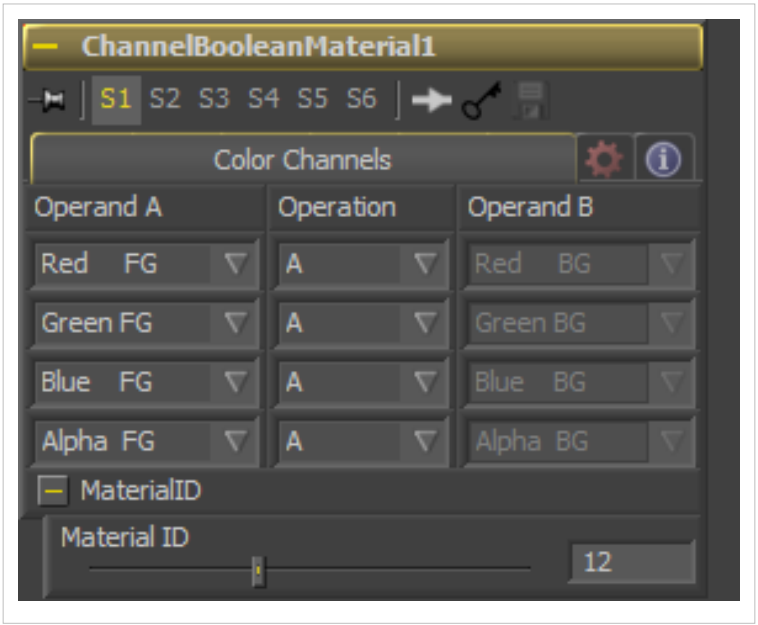
ChannelBooleanMaterial.BackgroundMaterial

[*orange, optional*] This input will accept a 2D image or a 3D material.

ChannelBooleanMaterial.ForegroundMaterial

[*green, optional*] This input will accept a 2D image or a 3D material.

Controls



Operand A/B

The Operand menus, one for each output RGBA channel, allows to set the desired input information for the according channel.

Red/Green/Blue/Alpha/ FG

Reads the color information of the foreground material.

Red/Green/Blue/Alpha BG

Reads the color information of the background material.

Black/White/Mid Grey

Sets the value of the channel to 0, 1 or 0.5.

Hue/Lightness/Saturation FG

Reads the color information of the foreground material, converts it into the HLS color space and put the selected information into the according channel

Hue/Lightness/Saturation BG

Reads the color information of the background material, converts it into the HLS color space and put the selected information into the according channel

Luminance FG

Reads the color information of the foreground material and calculates the luminance value for the channel.

Luminance BG

Reads the color information of the background material and calculates the luminance value for the channel.

X/Y/Z Position FG

Sets the value of the channel to the position of the pixel in 3d space. The vector information is returned in eye space.

U/V/W Texture FG

Applies the texture space coordinates of the foreground material to the channels.

U/V/W EnvCoords FG

Applies the environment texture space coordinates to the channels. Use it upstream of tools modifying the environment texture coordinates like the [[../Refelct_3D|Reflect 3D) tool.

X/Y/Z Normal

Set the value of the channel to the selected axis of the normal vector. The vector is returned in eye space.

Operation

Determines the operation how the operands are combined.

A

Uses operand A only for the output channel

B

Uses operand B only for the output channel

1-A

Subtracts the value of Operand A from 1

1-B

Subtracts the value of Operand B from 1

A+B

Adds the value of operand A and B

A-B

Subtracts the value of operand B from A

A*B

Mulitplies the value of both operands

A/B

Divides the value of operand B from A

min(A,B)

Compares the values of operand A and B and returns the smaller one

max(A,B)

Compares the values of operand A and B and returns the bigger one

avg(A,B)

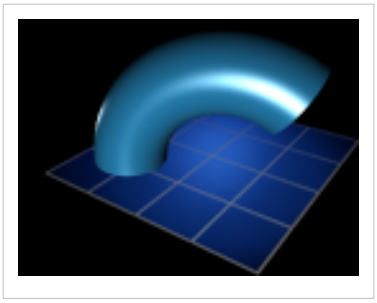
Returns the average value of both operands

Material ID

This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

3D Tools

Bender 3D

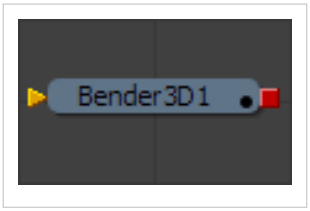


The Bender 3D tool is used to bend, taper, twist or shear the geometry in a 3D scene based upon its bounding box. It takes a 3D scene as input and outputs a modified 3D scene. Only the geometry in the scene is modified. Any lights, cameras or materials are passed through unaffected.

The Bender tool does not produce new vertices in the geometry - only existing vertices in the geometry are altered. As a result, when applying the Bender 3D tool to primitives created in Fusion, it is a good idea to increase the value of the Subdivision controls in the original primitives to give a higher quality result.

The Bender 3D tool was added to Fusion in version 5.1.

External Inputs



The following inputs appear on the tools tile in the Flow Editor.

Bender3D.SceneInput

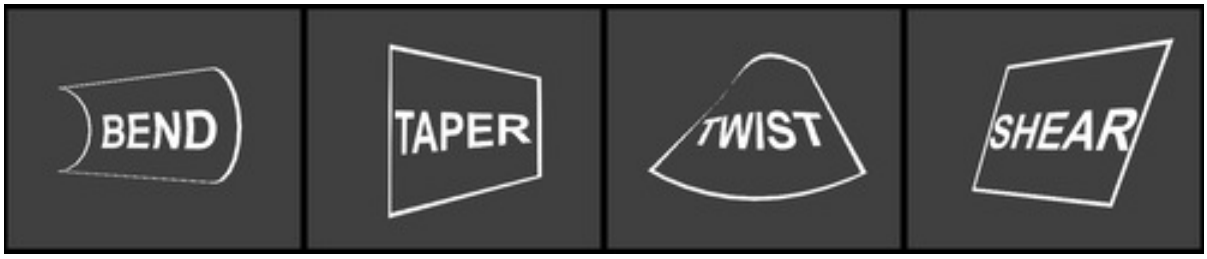
[*gold, required*] This input expects a 3D scene.

Controls Tab



Bender Type

Use the Bender Type to select the type of deformation to apply to the geometry. There are four modes available - Bend, Taper, Twist and Shear.



Amount

Adjust the Amount slider to change the strength of the deformation.

Axis

The Axis control determines the axis along which the deformation is applied and has a different meaning depending on the type of deformation. When bending, this determines the axis that is bent, in conjunction with the Angle control. In other cases, the deform is applied around the specified axis.

Angle

The Angle screw control determines what direction about the axis that a bend or shear is applied. It is not visible for taper or twist deformations.

Range

The Range control can be used to limit the effect of a deformation to a small portion of the geometry. The Range control is not visible for when the Bender Type is set to Shear.

Group Objects

When this is checked, all the objects in the input scene are grouped together into a single object and that object is deformed around the common center, instead of deforming each component object individually.

Unbendable Girder

This control reminds us that the robots could take over at any time. Be on your guard.

Camera 3D



The Camera 3D tool generates a virtual camera though which the 3D environment can be viewed. It closely emulates the settings used in both real and virtual cameras in an effort to make matching the cameras used in other scene elements as seamless as possible.

The camera should be added to the scene using a Merge 3D tool. Displaying a camera tool directly in the display views shows only an empty scene - there is nothing for the camera to see. To view the scene through the camera, view the scene from the Merge 3D tool that introduces the camera, or any tool downstream of that Merge 3D. Then right click in the view and select **Camera -> Cameraname** from the context menu.

Right clicking on the axis label found in the bottom corner will display the Camera sub-menu directly.

The aspect of the display view may be different from the aspect of the camera, so that the view through the camera interactively may not match the true boundaries of the image which will actually be rendered by the Renderer 3D tool. To assist the artist in framing the shot, guides can be enabled that represent the portion of the view the camera actually sees. Right click in the view and select an option from the **Guides -> Frame Format** sub-menu. The default option will use the format enabled in the **Composition -> Frame Format** preferences. To toggle the guides on or off select **Guides -> Show Guides** from the displays context menu, or use the *Ctrl + G* keyboard shortcut when the view is active.

The Camera 3D tool can also be used to perform Camera Projection, where a 2D image is projected through the camera into 3D space. This can be done as a simple Image Plane aligned with the camera, or as an actual projection, similar to the behavior of the Projector 3D tool, with the added advantage of being aligned exactly with the camera.

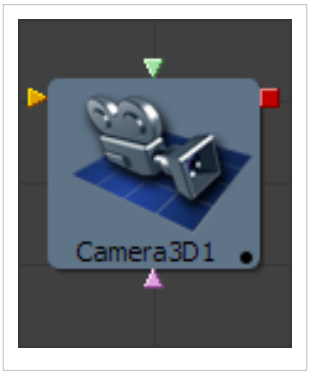
The Image Plane, Projection and Materials tabs will not appear until a 2D image is connected to the Camera 3D tool in the Flow Editor.

The Camera Tool has built in stereoscopic features. They offer control over eye separation and convergence distance. The camera for the right eye can be replaced using a separate camera tool connected to the green input.

Additionally the plane of focus control for depth of field rendering is also available here.

If you add a camera by means of dragging the 3Cm icon from the toolbar onto the 3D view, it will automatically merge it with the scene you are viewing. In addition, it will be automatically set to the current viewpoint, and the view will be set to look through the new camera. Alternatively, it is possible to copy the current viewpoint to a camera (or Spotlight or any other object) by means of the "Copy PoV To" option in the view's context menu, under the Camera submenu.

External Inputs



The following inputs appear on the tools tile in the Flow Editor.

Camera3D.SceneInput

[*gold, required*] This input expects a 3D scene.

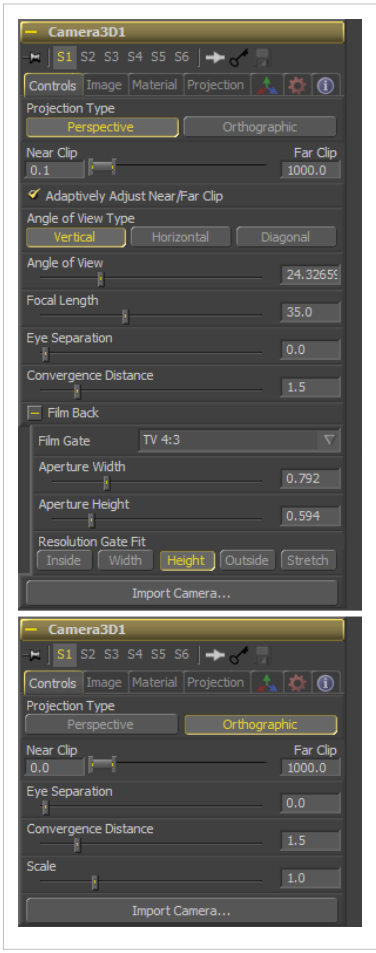
Camera3D.RightStereoCamera

[*green, optional*] This input should be connected to another Camera 3D tool. It is used to override the internal camera used for the right eye in stereoscopic renders and displays.

Camera3D.ImageInput

[*magenta, optional*] This input expects a 2D image. The image is used as a texture when camera projection is enabled, as well as when the camera's Image Plane controls are used to produce parented planar geometry linked to the cameras field of view.

Controls



The options in this tab are used to set the camera's clipping, field of view, focal length and stereoscopic properties.

Projection Type

Use the Projection Type button to choose between Perspective and Orthographic cameras. Generally, real world cameras are perspective cameras. An orthographic camera uses parallel orthographic projection, a technique where the view plane is perpendicular to the viewing direction. This produces a parallel camera output that is undistorted by perspective.

Orthographic cameras only present controls for the near and far clipping planes, and a control to set the viewing volume.

Near / Far Clip

The clipping plane is used to limit what geometry in a scene is rendered based on the objects distance from the camera's focal point. This is useful for ensuring that objects which are extremely close to the camera are not rendered, and for optimizing a render to exclude objects which are too far away to be useful in the final rendering.

The default perspective camera ignores this setting unless the the Adaptively Adjust Near/Far Clip checkbox control below is disabled.

The values are expressed in units, so a far clipping plane of 20 means that any object more than 20 units distant from the camera will be invisible to the camera. A near clipping plane of 0.1 means that any object closer than 0.1 units will also be invisible.

Note that a smaller range between the near and far clipping planes allows greater accuracy in all depth calculations. If a scene begins to render strange artifacts on distant objects, try increasing the distance for the Near Clip plane.

Adaptively Adjust Near/Far Clip

When selected the renderer will automatically adjust the camera's near / far clipping plane to match the extents of the scene. This setting overrides the values of the Near and Far clip range control described above. This option is not available for Orthographic cameras.

Viewing Volume Size

The Viewing Volume Size control only appears when the Projection Type is set to Orthographic. It determines the size of the box that makes up the camera's field of view.

The Z distance of an orthographic camera from the objects it sees does not affect the scale of those objects, only the viewing size does.

Angle Of View Type

Use the Angle of View Type button array to choose how the camera's angle of view is measured. Some applications use vertical measurements, some use horizontal and others use diagonal measurements. Changing the Angle of View type will cause the Angle of View control below to recalculate.

Angle Of View

Angle Of View defines the area of the scene that can be viewed through the camera. Generally, the human eye can see much more of a scene than a camera, and various lenses record different degrees of the total image. A large value produces a wider angle of view and a smaller value produces a narrower, or more tightly focused, angle of view.

The angle of view and focal length controls are directly related. Smaller focal lengths produce a wider angle of view, so changing one control automatically changes the other to match.

Focal Length

In the real world, a lens' Focal Length is the distance from the center of the lens to the film plane. The shorter the focal length, the closer the focal plane is to the back of the lens. The focal length is measured in millimeters. The angle of view and focal length controls are directly related. Smaller focal lengths produce a wider angle of view, so changing one control automatically changes the other to match.

The relationship between focal length and angle of view is: angle = 2 * arctan[aperture / 2 / focal_length]

Use the vertical aperture size to get the vertical angle of view, and the horizontal aperture size to get the horizontal angle of view.

Plane of Focus (for depth of field)

This value is used by the OpenGL Renderer to calculate depth of field. It defines the distance to a virtual target in front of the camera.

Eye Separation

Defines the distance between the both stereo cameras. If the Eye Separation is set to a value larger than 0, controls for each camera will be shown in the display view when this tool is selected.

Convergence Distance

This control sets the stereoscopic convergence distance, defined as a point located along the z-axis of the camera which determines where both left and right eye cameras converge.

Film Back

Film Gate

The Film Gate menu shows a list of preset camera types. Selecting one of the options will automatically set the aperture width and aperture height to match the selected camera type.

Aperture Width/Height

The Aperture Width and Height sliders control the dimensions of the camera's aperture, or the portion of the camera that lets light in on a real world camera. In video and film cameras, the aperture is the mask opening that defines the area of each frame exposed. Aperture is generally measured in inches, which are the units used for this control.

Resolution Gate Fit

Determines how the film gate is fit within the resolution gate. This only has an effect when the aspect of the film gate is not the same aspect as the output image. This setting corresponds to the Maya "Fit Resolution Gate". The modes Overscan, Horizontal, Vertical and Fill correspond to Inside, Width, Height and Outside.

Inside

The image source will be scaled uniformly until one of it's dimensions (X or Y) fits the inside dimensions of the Mask. Depending on the relative dimensions of image source and Mask Background either the image source's width or height may be cropped to fit the respective dimension of the Mask.

Width

The image source will be scaled uniformly until it's width (X) fits the width of the Mask. Depending on the relative dimensions of image source and Mask the image source's Y-dimension might not fit the Mask's Y-dimension, resulting in either cropping of the image source in Y or the image source not covering the Mask's height entirely.

Height

The image source will be scaled uniformly until it's height (Y) fits the height of the Mask. Depending on the relative dimensions of image source and Mask the image source's X-dimension might not fit the Mask's X-dimension, resulting in either cropping of the image source in X or the image source not covering the Mask's width entirely.

Outside

The image source will be scaled uniformly until one of it's dimensions (X or Y) fits the outside dimensions of the Mask. Depending on the relative dimensions of image source and Mask either the image source's width or height may be cropped or not fit the

respective dimension of the Mask.

Stretch

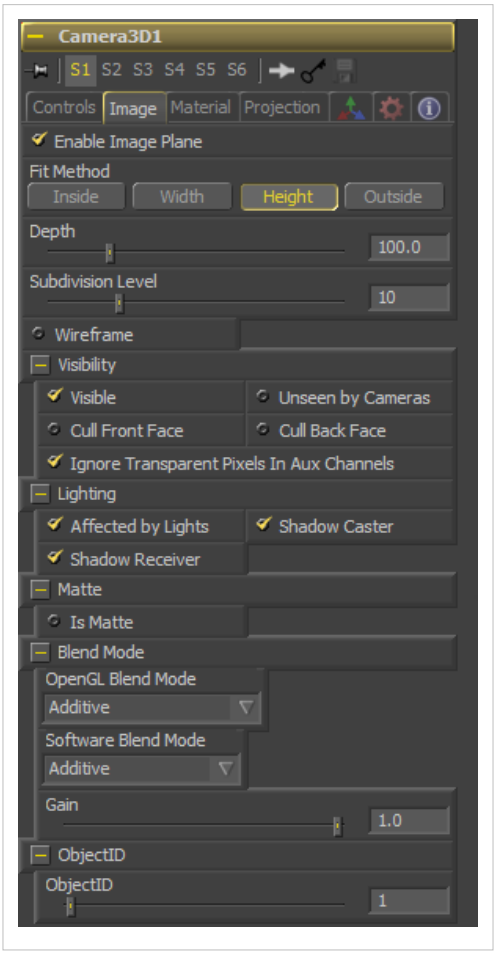
The image source will be stretched in X and Y to accomodate the full dimensions of the generated Mask. This might lead to visible distortions of the image source.

Import Camera

The Import Camera button displays a dialog to import a camera from another application. It supports the following file types:

- LightWave Scene - .lws
- Max Scene - .ase
- Maya Ascii Scene - .ma
- dotXSI - .xsi

Image



When a 2D image is connected to the Camera, an Image Plane is created that is always oriented so that the image fills the camera's field of view. The Image Plane Tab is hidden until

a 2D image is connected to the camera 3D's input on the flow.

With the exception of the controls listed below the options presented in this tab are identical to those presented in the Image Plane tools control tab. Consult that tools documentation for a detailed description.

Enable Image Plane

Use this checkbox to enable or disable the creation of the Image Plane.

Fill Method

Describes how to deal with the input image, if the camera has a different aspect ratio.

Inside

The image source will be scaled uniformly until one of it's dimensions (X or Y) fits the inside dimensions of the Mask. Depending on the relative dimensions of image source and Mask Background either the image source's width or height may be cropped to fit the respective dimension of the Mask.

Width

The image source will be scaled uniformly until it's width (X) fits the width of the Mask. Depending on the relative dimensions of image source and Mask the image source's Y-dimension might not fit the Mask's Y-dimension, resulting in either cropping of the image source in Y or the image source not covering the Mask's height entirely.

Height

The image source will be scaled uniformly until it's height (Y) fits the height of the Mask. Depending on the relative dimensions of image source and Mask the image source's X-dimension might not fit the Mask's X-dimension, resulting in either cropping of the image source in X or the image source not covering the Mask's width entirely.

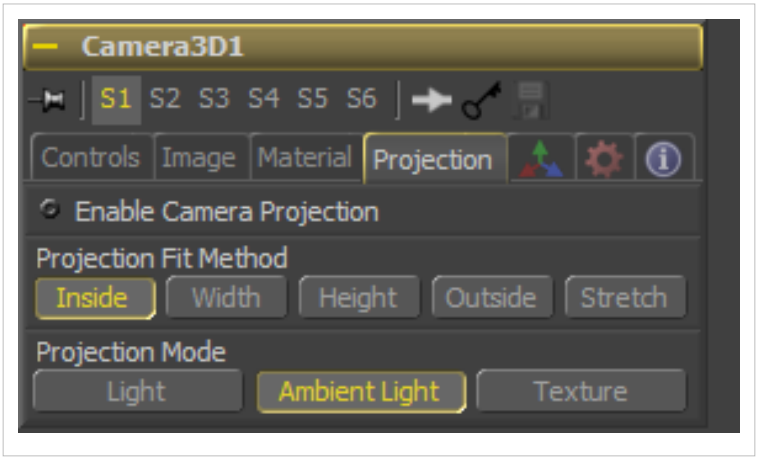
Outside

The image source will be scaled uniformly until one of it's dimensions (X or Y) fits the outside dimensions of the Mask. Depending on the relative dimensions of image source and Mask either the image source's width or height may be cropped or not fit the respective dimension of the Mask.

Depth

The Depth slider controls the image plane's distance from the camera.

Projection



If a 2D image is connected to the camera it becomes possible to project the image into the scene. A projection is different from an Image Plane in that the projection will fall onto the geometry in the scene exactly as if there was a physical projector present in the scene. The image is projected as light, which means the renderer must be set to Enable lighting for the projection to be visible.

See the Projector 3D tool for additional information.

Enable Camera Projection

Select this checkbox to enable projection of the 2D image connected to the camera tool.

Projection Fit Method

This button array can be used to select the method used to match the aspect of projected image to the cameras Field of View.

Projection Mode

Light

Defines the projection as a spotlight.

Ambient Light

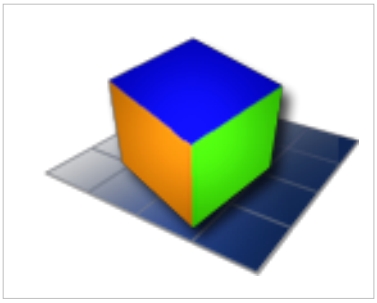
Defines the projection as an ambient light.

Texture

Allows a projection which can be relighted using other lights. Needs a Catcher Tool connected to the appropriate input ports of the specific material.

Notes

Cube 3D



The Cube 3D tool is a basic primitive geometry type capable of generating a simple cube. The tool also provides six additional image inputs that can be used to map a texture onto the six faces of the cube.

Cubes are often used as shadow casting objects and for environment maps. For other basic primitives, see the Shape 3D tool.

External Inputs



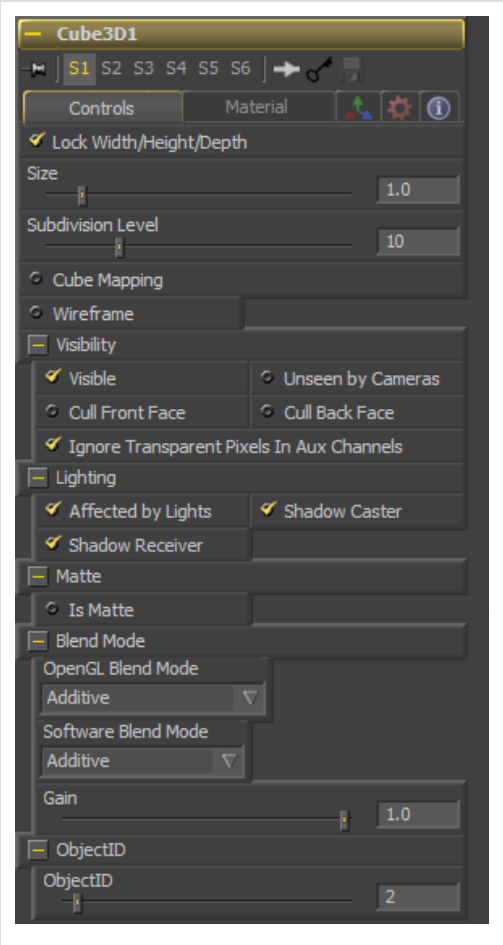
Cube3D.SceneInput

[*orange, optional*] This input expects a scene from a 3D tool output.

Cube3D.*Name*MaterialInput

These 6 inputs are used to define the materials applied to the six faces of the cube. They will accept either a 2D image or a 3D material as valid.

Controls



Lock Width/Height/Depth

This checkbox locks the Width, Height and Depth dimensions of the cube together, so that they are always the same size. When selected, only a Size control is displayed, otherwise separate Width, Height and Depth sliders are shown.

Size or Width/Height/Depth

If the Lock checkbox is selected then only the Size is shown, otherwise separate sliders are displayed for Width, Height and Depth. The Size and Width sliders are the same control renamed, so any animation applied to Size will also be applied to Width when the controls are unlocked.

Subdivision Level

Use the Subdivision Level slider to set the number of subdivisions used when creating the image plane. If the Open GL display and renderer are set to vertex lighting so, the more subdivisions in the mesh, the more vertices will be available to represent the lighting. For this reason, high subdivisions can be useful when working interactively with lights.

Cube Mapping

Enabling the Cube Mapping checkbox causes the cube to wrap its first texture across all six faces using a standard cubic mapping technique. This approach expects a texture laid out in the shape of a cross.

Wireframe

Enabling this checkbox will cause the mesh to render only the Wireframe for the object. When this manual was printed, only the OpenGL renderer supported wireframe, but that may have changed in the time between printing and release.

Visibility

Visible

If the visibility checkbox is not selected, the object will not visible in the display views, nor will it be rendered into the output image by the Renderer 3D tool. A non-visible object does not cast shadows.

Unseen by Cameras

If the Unseen by Cameras checkbox is selected, the object will be visible in the display views (unless the Visible checkbox is turned off), except when viewed through a camera. The object will not be rendered into the output image by the Renderer 3D tool. Shadows cast by an Unseen object will still be visible when rendered by the software renderer, though not by the OpenGL renderer.

Cull Front Face/Back Face

Use these options to cull (eliminate) rendering and display of certain polygons in the geometry. If Cull Back Face is selected, all polygons facing away from the camera not be rendered, and will not cast shadows. If Cull Front Face is selected, all polygons facing towards the camera will likewise be dropped. Selecting both checkboxes has the same effect as deselecting the Visible checkbox.

Ignore Transparent Pixels in Aux Channels

In Fusion 5 transparent pixels were rejected by the SW/GL renderers. To be more specific the SW renderer rejected pixels with R=G=B=A=0 and the GL renderer rejected pixels with A=0. This is now optional. The reason you might want to do this is to get aux channels (eg. normals, z, UVs) for the transparent bits. For example, suppose in post you want to replace the texture on an 3D element with a texture that is transparent in certain areas with a texture that is transparent in different areas, then it would be useful to have transparent bits set aux channels (in particular UVs). As another example suppose you are doing post DoF... you will probably not want the z channel to be set on transparent areas as this will give you a false depth. Also keep in mind that this rejection is based on the final pixel color including lighting if it is on. So if you have a specular highlight on a clear glass material, this checkbox will not affect it.

Lighting

Affected By Lights

If this checkbox is not selected, lights in the scene will not affect the object, it will not receive nor cast shadows, and it will be shown at the full brightness of its colour, texture or material.

Shadow Caster

If this checkbox is not enabled, the object will not cast shadows on other objects in the scene.

Shadow Receiver

If this checkbox is not enabled, the object will not receive shadows cast by other objects in the scene.

Matte

Enabling the IsMatte option will apply a special texture to this object, causing this object to not only become invisible to the camera, but also making everything that appears directly behind the camera invisible as well. This option will override all textures. See the Matte Objects section of the 3D chapter for more information.

Is Matte

When activated, objects whose pixels fall behind the matte objects pixels in Z do not get rendered.

Opaque Alpha

Sets the alpha value of the matte object to 1. This checkbox is only visible when the IsMatte option is enabled.

Infinite Z

Sets the value in the z channel to infinite. This checkbox is only visible when the IsMatte option is enabled.

Blend Mode

A blend mode specifies which method will be used by the renderer when combining this object with the rest of the scene. The blend modes are essentially identical to those listed in the documentation for the 2D Merge tool. For a detailed explanation of each mode see the documentation for that tool.

The blending modes were originally designed for use with 2D images. Using them in a lit 3D environment can produce undesirable results. For best results use the apply modes in unlit 3D scenes rendered in software.

OpenGL Blend Mode

Use this menu to select the blending mode which will be used when the geometry is processed by the OpenGL renderer. This is also the mode used when viewing the object in the display views. Currently the OpenGL renderer only support three blending modes.

Software Blend Mode

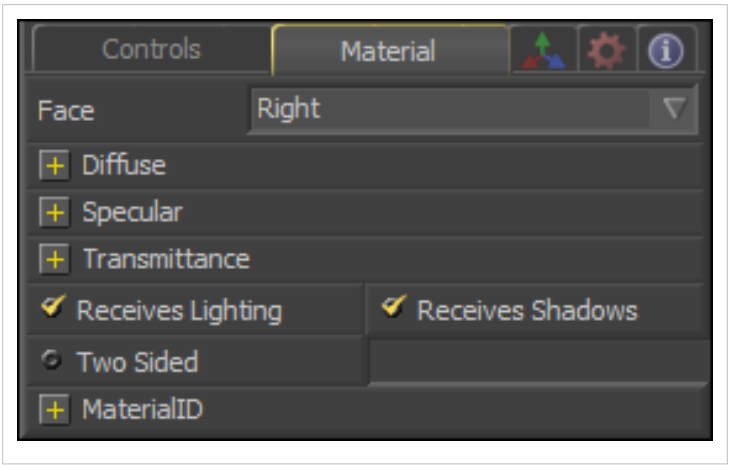
Use this menu to select the blending mode which will be used when the geometry is processed by the Software renderer. Currently the Software renderer supports all of the modes described in the Merge tool documentation except for the Dissolve mode.

Object ID

Object ID

This control is used to set the numeric identifier assigned to this object. The object ID is an integer number that will be rendered into the ObjID auxiliary channel of the rendered image when the Object ID option is enabled in the Renderer 3D tool. See the Object and Material ID section in the 3D chapter for more information.

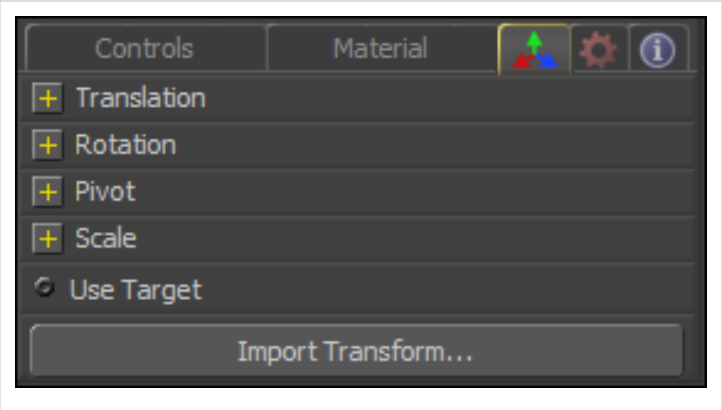
Material Tab



The options which appear in this tab determine the appearance the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are fully described in the Common 3D Controls section of this documentation.

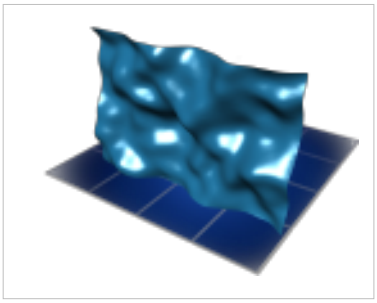
If an external 3D material is connected to the tool tiles material input then the controls in this tab will be replaced with the "Using external material" label.

Transform Tab



The options which appear in this tab determine the position of the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are fully described in the Common 3D Controls section of this documentation.

Displace 3D

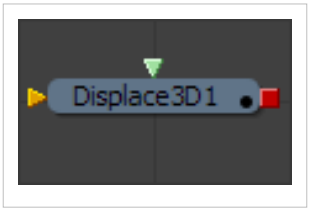


The Displace 3D tool is used to displace the vertices of an object along their normals based upon a reference image. The texture coordinates on the geometry are used to determine where to sample the image.

When using Displace 3D, keep in mind that it will only displace existing vertices and will not tessellate objects. To obtain a more detailed displacement, increase the Subdivision amount for the geometry that is being displaced. Note that the pixels in the displacement image may contain negative values.

Passing a particle system through a Displace 3D tool will disable the 'always face camera' option set in the pEmitter. Particles are not treated as point-like objects, each of the four particle vertices are individually displaced, which may or may not be the preferred outcome.

External Inputs



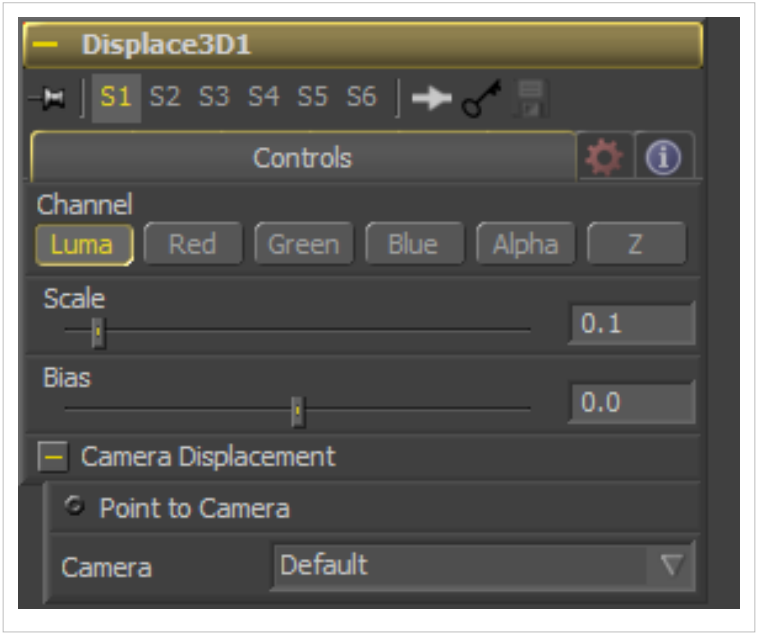
Displace3D.SceneInput

[*orange, required*] This input expects to receive a 3D scene.

Displace3D.Input

[*green, optional*] This input expects a 2D image to be used as the displacement map. If no image is provided this tool will effectively pass the scene straight through to it's output.

Controls



Channel

Determines which channel of the image connected to Displace3D.Input is used to displace the geometry.

Scale and Bias

Use these sliders to scale (magnify) and bias (offset) the displacement. The bias is applied first and the scale afterwards.

Camera Displacement

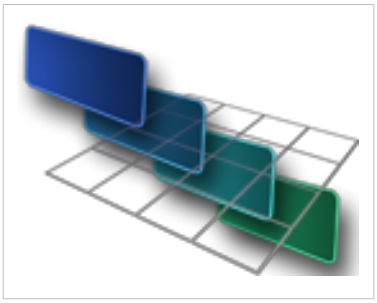
Point to Camera

When the Point to Camera checkbox is enabled, each vertex is displaced towards the camera rather than along its normal. One possible use of this option is for displacing a camera's image plane. The displaced camera image plane would appear unchanged when viewed through the camera, but is deformed in 3D space allowing one to comp in other 3D layers that correctly interact in Z.

Camera

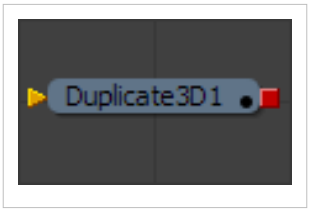
This drop down box is used to select which camera present in the scene will be used to determine the camera displacement when the Point to Camera option is selected.

Duplicate 3D



The Duplicate 3D tool can be used to quickly duplicate any geometry in a scene, applying a successive transformation to each, and creating repeating patterns and complex arrays of objects. The options in the Jitter tab allows for non-uniform transformations, such as random positioning or sizes.

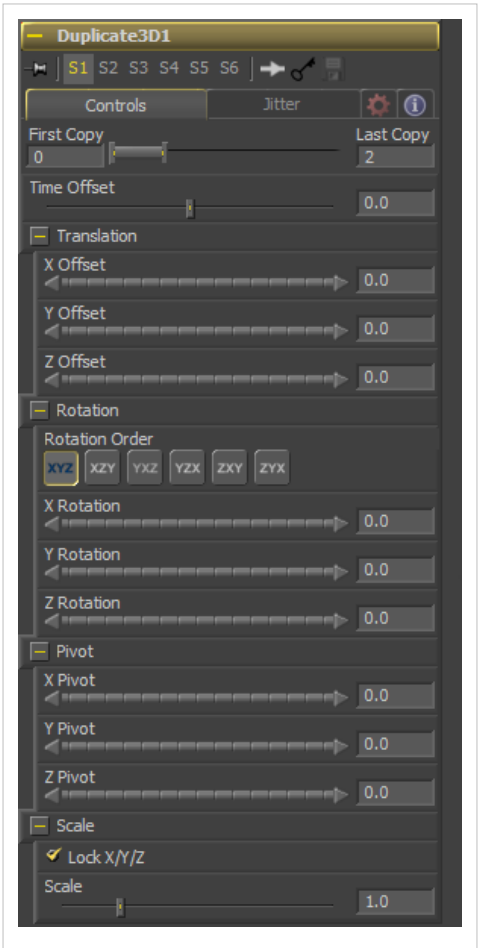
Controls



Duplicate3D.SceneInput

[*orange, required*] This input expects a 3D scene.

Controls



First/Last Copy

Use this range control to set how many copies of the geometry to make. Each copy is a copy of the last copy so, if this control is set to [0,3], the parent is copied, then the copy is copied, then the copy of the copy is copied, and so on. This allows for some interesting affects when transformations are applied to each copy using the controls below.

Using a value for both the First Copy and the Last Copy will show only the original input. Setting the First Copy to a value greater than 0 will exclude the original input and show only the copies.

Time Offset

Use the Time Offset slider to offset any animations that are applied to the source geometry by a set amount per copy. For example, set the value to -1.0 and use a cube set to rotate on the Y axis as the source. The first copy will show the animation from a frame earlier. The second copy will show animation from a frame before that, and so forth. This can be used with great effect on textured planes, for example, where successive frames of a clip can be shown.

XYZ Offset

These three sliders tell the tool how much offset to apply to each copy. So an X Offset of 1 would offset each copy 1 unit 1 unit along the X axis from the last copy.

Rotation Order

These buttons can be used to set the order in which rotations are applied to the geometry. Setting the rotation order to XYZ would apply the rotation on the X axis first, followed by the Y axis rotation, then the Z axis rotation.

XYZ Rotation

These three rotation sliders tell the tool how much rotation to apply to each copy.

XYZ Pivot

The Pivot controls determine the position of the pivot point used when rotating each copies.

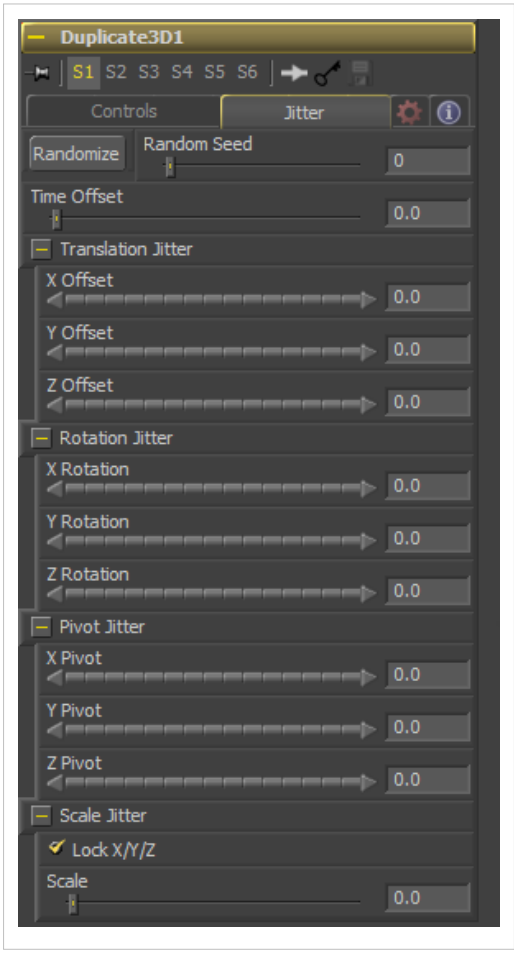
Lock XYZ

When the Lock XYZ checkbox is selected any adjustment to the duplicate scale will be applied to all three axis simultaneously. If this checkbox is disabled the Scale slider will be replaced with individual sliders for the X, Y and Z scale.

Scale

The Scale controls tells duplicate how much scaling to apply to each copy.

Jitter



Random Seed / Randomize

The Random Seed is used to 'seed' the amount of jitter applied to the duplicated objects. Two Duplicate tools with identical settings but different random seeds will produce two completely different results. Click on the randomize button to assign a random seed value.

Time Offset

Use the Time Offset slider to offset any animations that are applied to the source geometry by a set amount per copy. For example, set the value to -1.0 and use a cube set to rotate on the Y axis as the source. The first copy will show the animation from a frame earlier. The second copy will show animation from a frame before that, and so forth. This can be used with great effect on textured planes, for example, where successive frames of a clip can be shown.

Translation XYZ Jitter

Use these three controls to adjust the amount of variation in the translation of the duplicated objects.

Rotation XYZ Jitter

Use these three controls to adjust the amount of variation in the rotation of the duplicated objects.

Pivot XYZ Jitter

Use these three controls to adjust the amount of variation in the rotational pivot center of the duplicated objects. This affects only the additional jitter rotation, not the rotation produced by the Rotation settings in the Controls tab.

Scale XYZ Jitter

Use this control to adjust the amount of variation in the scale of the duplicated objects. Uncheck the Lock XYZ checkbox to adjust the scale variation independently on all three axis.

FBX Exporter 3D



The FBX Exporter provides a method of exporting a Fusion 3D scene to the FBX scene interchange format. Each node in Fusion is a single object in the exported file. Objects, Lights and Cameras will use the name of the node that created them. The tool can be set to export a single file for the entire scene, or to output one frame per file.

In addition to the FBX format this tool can also export to the 3D Studio's .3ds,, Collada's .dae, Autocad's .dxf and the Alias .obj formats.

Like the saver this tool will only output files to disk when performing a final rendering. Since the FBX file structure is different from the way Fusion internally handles the scene there are some limitations to the exported scene:

- Textures will not be included in the exported scene
- PointClouds will not be included in the exported scene
- Animations will be sampled per frame (baked) with linear interpolation from frame to frame
- Camera aligned geometry (like particles) will not remain camera aligned
- Targets (in the Transform Tab of each object) are expressed as rotation data
- Transformations will be expressed using Fusion's native co-ordinate system

If the

Global -> General -> Auto clip browse

option is enabled (default) then adding this tool to a composition from the toolbars or menus will automatically display a file browser.

External Inputs



FBXExporter.Input

[*orange, required*] This input expects a 3D scene.

Controls



Filename

This file browser control can be used to set the file which will be output by the tool. Click on the yellow folder icon to open a file browser dialog.

Format

This control is used to set the format of the output file. It is possible to export the following file formats:

- FBX ascii (*.fbx)
- FBX 5.0 binary (*.fbx)
- Autocad DXF (*.dxf)
- 3D Studio 3DS (*.3ds)

- Alias OBJ (*.obj)
- Collada DAE (*.dae)

Not all of the formats support all of the features of this tool. For example, the OBJ format does not handle animation.

Version

The version drop down menu shows the available versions for the Format selected by the control above. The menu's contents will change synamically to reflect the available versions for that format. If the selected format only provides a single option this menu will be hidden.

Choosing "Default" for the FBX formats uses FBX200611.

Geometry / Lights / Cameras

These three checkbox controls determine wether the tool will attempt to export the named scene element. For example deselecting geometry and lights but leaving cameras selected would output only the cameras currently in the scene.

Reduce Constant Keys

Enabling this option will automatically remove keyframes if the adjacent keyframes have the same value.

File Per Frame (no animation)

Enabling this option will force the tool to export one file per frame resulting in a sequence of numbered files. This will disable the export of animation.

Set Sequence Start

Normally, Fusion will use the render range of a composition to determine the numeric sequence used when rendering a file sequence to disk. Enable this checkbox to reveal the Sequence Start Frame control to set the number of the first frame in the sequence to a custom value.

Sequence Start Frame

This thumbwheel control can be used to set an explicit start frame for the number sequence applied to the rendered filenames. For example, if Global Start is set to 1 and frames 1 - 30 are rendered, files will normally be numbered 0001 - 0030. If the Sequence Start Frame is set to 100, the rendered output would be numbered from 100-131.

FBX Mesh 3D



The FBXMesh3D tool is used to import polygonal geometry from scene files that are saved using the FilmBox (FBX) format. It is also able to import geometry from OBJ, 3DS, DAE and DXF scene files. This provides a method for working with more complex geometry than is available using Fusion's built-in primitives.

When importing geometry with this tool all of the geometry contained in the FBX file will be combined into one mesh with a single pivot and transformation. The FBXMesh tool will ignore any animation applied to the geometry.

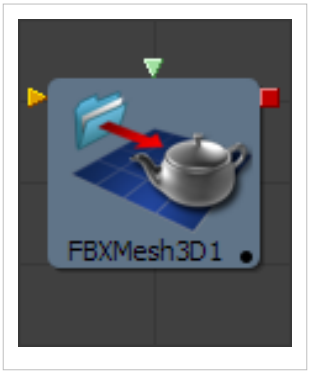
The **File -> Import -> FBX** utility can be used to import an FBX and create individual tools for each camera, light and mesh contained in the file. This utility can also be used to preserve the animation of the objects.

If the

Global -> General -> Auto clip browse

option is enabled (default) then adding this tool to a composition from the toolbars or menus will automatically display a file browser.

External Inputs



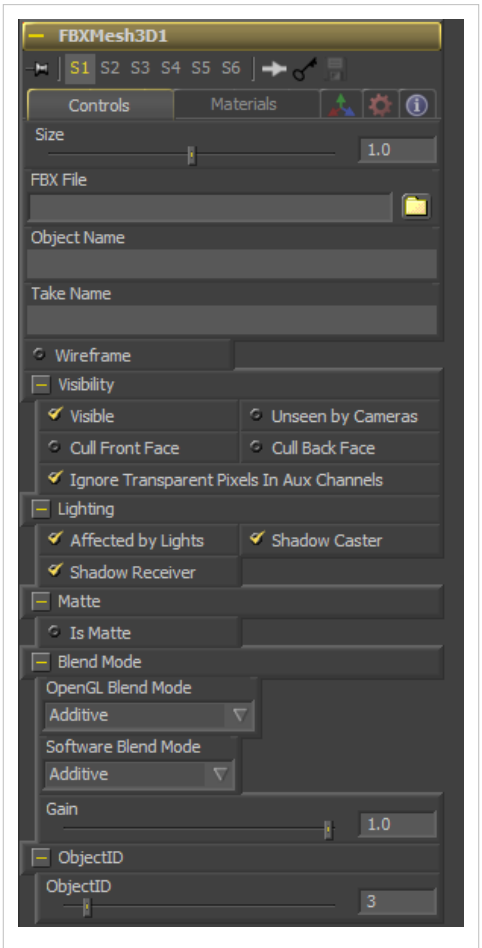
FBXMesh3D.SceneInput

[*orange, required*] This input expects a 3d scene as it's input

FBXMesh.MaterialInput

[*green, optional*] This input will accept either a 2D image or a 3D material. If a 2D image is provided it will be used as a diffuse texture map for the basic material built into the tool. If a 3D material is connected then the basic material will be disabled.

Controls



Size

The Size slider controls the size of the FBX geometry that is imported. FBX meshes have a tendency to be much larger than Fusion's default unit scale, so this control is useful for scaling the imported geometry to match the Fusion environment.

FBX File

This control shows the filename of the currently loaded FBX. Click on the icon of the yellow folder to opena filebrowser that can be used to locate an FBX file. Despite the tools name this tool is also able to load a variety of other formats.

- FBX ascii (*.fbx)
- FBX 5.0 binary (*.fbx)
- Autocad DXF (*.dxf)
- 3D Studio 3DS (*.3ds)
- Alias OBJ (*.obj)
- Collada DAE (*.dae)

Object Name

This input shows the name of the mesh from the FBX file that is being imported. If this field is blank then the entire contents of the FBX geometry will be imported as a single mesh. This input is not editable by the user; it is set by Fusion when importing FBX files via the **File -> Import -> FBX** utility.

Take Name

This input shows the name of the animation take to use from the FBX file. If this field is blank then no animations will be imported. This input is not editable by the user; it is set by Fusion when importing FBX files via the **File -> Import -> FBX** utility.

Wireframe

Enabling this checkbox will cause the mesh to render only the Wireframe for the object. Currently only the OpenGL renderer supports wireframe rendering.

Visibility

Visible

If the visibility checkbox is not selected, the object will not visible in the display views, nor will it be rendered into the output image by the Renderer 3D tool. A non-visible object does not cast shadows.

Unseen by Cameras

If the Unseen by Cameras checkbox is selected, the object will be visible in the display views (unless the Visible checkbox is turned off), except when viewed through a camera. The object will not be rendered into the output image by the Renderer 3D tool. Shadows cast by an Unseen object will still be visible when rendered by the software renderer, though not by the OpenGL renderer.

Cull Front Face/Back Face

Use these options to cull (eliminate) rendering and display of certain polygons in the geometry. If Cull Back Face is selected, all polygons facing away from the camera not be rendered, and will not cast shadows. If Cull Front Face is selected, all polygons facing towards the camera will likewise be dropped. Selecting both checkboxes has the same effect as deselecting the Visible checkbox.

Ignore Transparent Pixels in Aux Channels

In Fusion 5 transparent pixels were rejected by the SW/GL renderers. To be more specific the SW renderer rejected pixels with R=G=B=A=0 and the GL renderer rejected pixels with A=0. This is now optional. The reason you might want to do this is to get aux channels (eg. normals, z, UVs) for the transparent bits. For example, suppose in post you want to replace the texture on an 3D element with a texture that is transparent in certain areas with a texture that is transparent in different areas, then it would be useful to have transparent bits set aux channels (in particular UVs). As another example suppose you are doing post DoF... you will probably not want the z channel to be set on transparent areas as this will give you a false depth. Also keep in mind that this rejection is based on the final pixel color including lighting if it is on. So if you have a specular highlight on a clear glass material, this checkbox will not affect it.

Lighting

Affected By Lights

If this checkbox is not selected, lights in the scene will not affect the object, it will not receive nor cast shadows, and it will be shown at the full brightness of its colour, texture or material.

Shadow Caster

If this checkbox is not enabled, the object will not cast shadows on other objects in the scene.

Shadow Receiver

If this checkbox is not enabled, the object will not receive shadows cast by other objects in the scene.

Matte

Enabling the IsMatte option will apply a special texture to this object, causing this object to not only become invisible to the camera, but also making everything that appears directly behind the camera invisible as well. This option will override all textures. See the Matte Objects section of the 3D chapter for more information.

Is Matte

When activated, objects whose pixels fall behind the matte objects pixels in Z do not get rendered.

Opaque Alpha

Sets the alpha value of the matte object to 1. This checkbox is only visible when the IsMatte option is enabled.

Infinite Z

Sets the value in the z channel to infinite. This checkbox is only visible when the IsMatte option is enabled.

Blend Mode

A blend mode specifies which method will be used by the renderer when combining this object with the rest of the scene. The blend modes are essentially identical to those listed in the documentation for the 2D Merge tool. For a detailed explanation of each mode see the documentation for that tool.

The blending modes were originally designed for use with 2D images. Using them in a lit 3D environment can produce undesirable results. For best results use the apply modes in unlit 3D scenes rendered in software.

OpenGL Blend Mode

Use this menu to select the blending mode which will be used when the geometry is processed by the OpenGL renderer. This is also the mode used when viewing the object in the display views. Currently the OpenGL renderer only support three blending modes.

Software Blend Mode

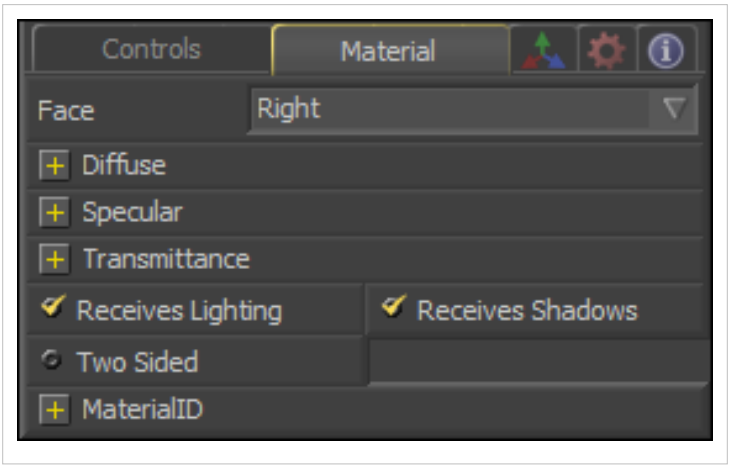
Use this menu to select the blending mode which will be used when the geometry is processed by the Software renderer. Currently the Software renderer supports all of the modes described in the Merge tool documentation except for the Dissolve mode.

Object ID

Object ID

This control is used to set the numeric identifier assigned to this object. The object ID is an integer number that will be rendered into the ObjID auxiliary channel of the rendered image when the Object ID option is enabled in the Renderer 3D tool. See the Object and Material ID section in the 3D chapter for more information.

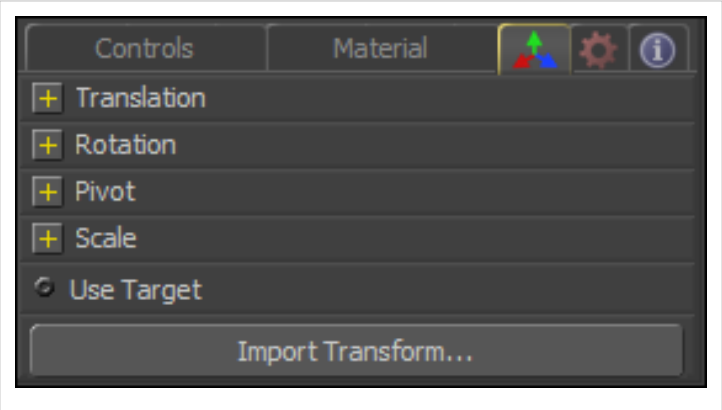
Material Tab



The options which appear in this tab determine the appearance the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are fully described in the Common 3D Controls section of this documentation.

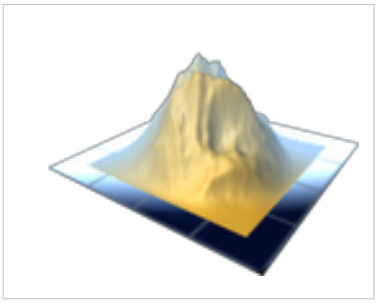
If an external 3D material is connected to the tool tiles material input then the controls in this tab will be replaced with the "Using external material" label.

Transform Tab



The options which appear in this tab determine the position of the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are fully described in the Common 3D Controls section of this documentation.

Fog 3D

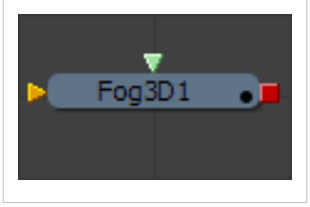


The Fog 3D tool applies depth cue based fog to the scene. It is the 3D version of the Fog tool in the Deep Pixel category. It is designed to work completely in 3D space and takes full advantage of antialiasing and depth of field effects during rendering.

The Fog 3D tool essentially re-textures the geometry in the scene by applying a color correction based on the objects distance from the camera. An optional Density Texture image can be used to apply variation to the correction.

This tool does NOT produce volumetric fog.

Controls



Fog3D.SceneInput

[*orange, required*] This input expects a 3D scene.

Fog3D.DensityTexture

[*green, optional*] This input expects a 2D image. The color of the fog created by this tool is multiplied by the pixels in the image. When creating the image for the Density Texture keep in mind that the texture is effectively projected onto the scene from the camera.

Controls



Enable

Use this checkbox to enable or disable the tool.

Show Fog In View

By default the fog created by this tool is only visible when the scene is viewed using a Camera tool. When this checkbox is enabled, the fog becomes visible in the scene from all points of view.

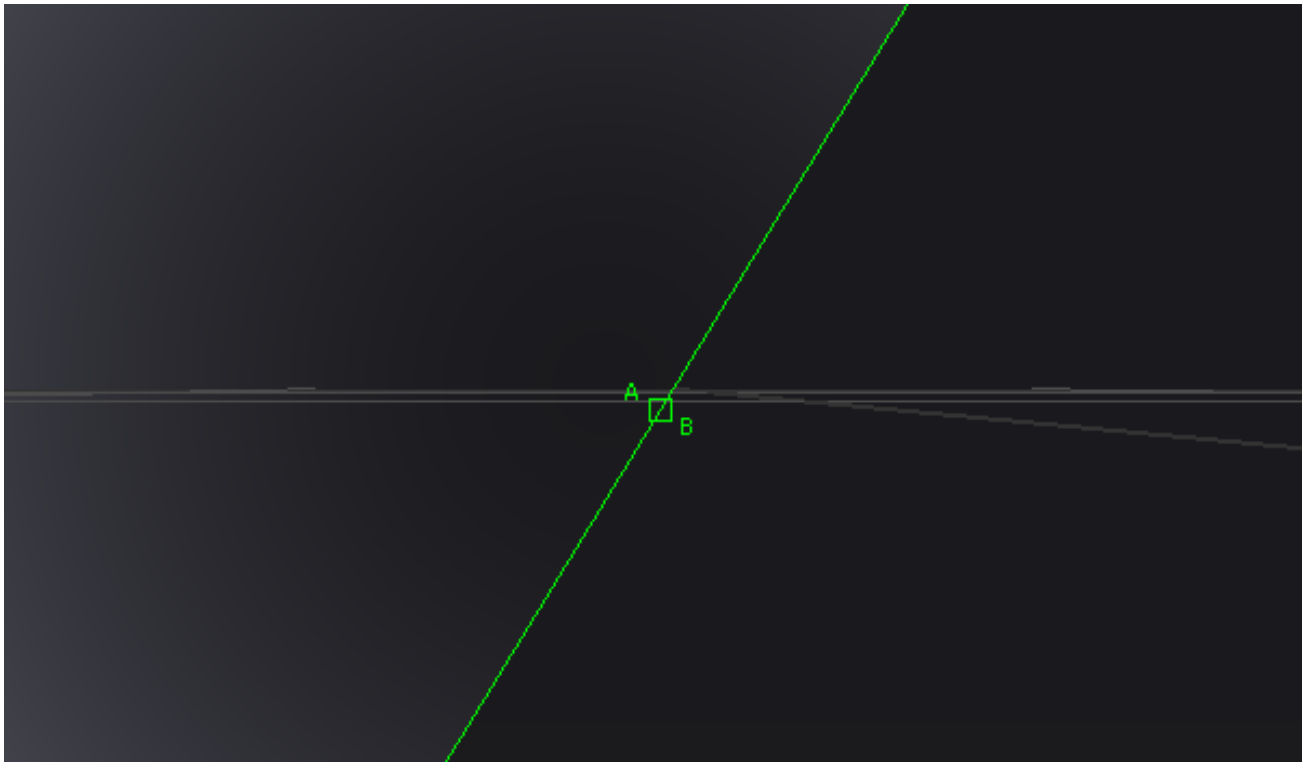
Color

This control can be used to set the color of the fog. The color is also multiplied by the DensityTexture image, if one has been provided.

Radial

By default the fog is done based upon the perpendicular distance to a plane (parallel with the near plane) passing through the eye point. When the radial option is checked the radial

distance to the eye point is used instead of the perpendicular distance. The problem with perpendicular distance fog is that when you move the camera about, as objects on the left or right side of the frustum move into the center they become less fogged even though they remain the same distance from the eye. Radial fog fixes this. Sometimes radial fog is not desirable. For example if you are fogging an object that is close to the camera like an image plane the center of the image plane could be unfogged while the edges could be fully fogged.



Fog type

This control is used to determine the type of falloff applied to the fog.

Linear

Defines a linear falloff for the fog.

Exp

Creates an exponential nonlinear falloff.

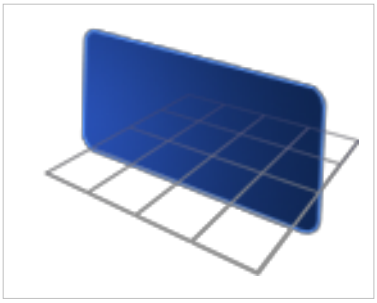
Exp2

Creates an stronger exponential falloff.

Near/Far Fog Distance

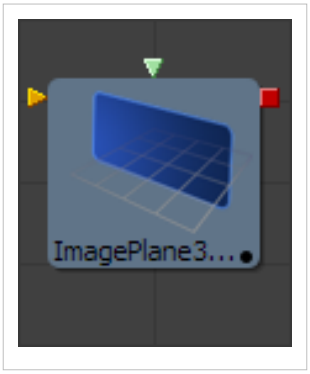
This control expresses the range of the fog in the scene as units of distance from the camera. The Near distance determines where the fog starts, while the Far Distance sets the point where the fog has its maximum effect. Fog is cumulative, so the further an object is from the camera the thicker the fog should appear.

Image Plane 3D



The Image Plane tool produces 2D planar geometry in 3D space. The most common use of the tool is to represent 2D images in the 3D space. An image input on the tool's tile provides the texture for the rectangle from another source in the composition. The aspect of the Image Plane is determined by the aspect of the image used for it's diffuse texture. If planar geometry that whose dimensions are not relative to the texture image is required then use a Shape 3D tool instead.

External Inputs



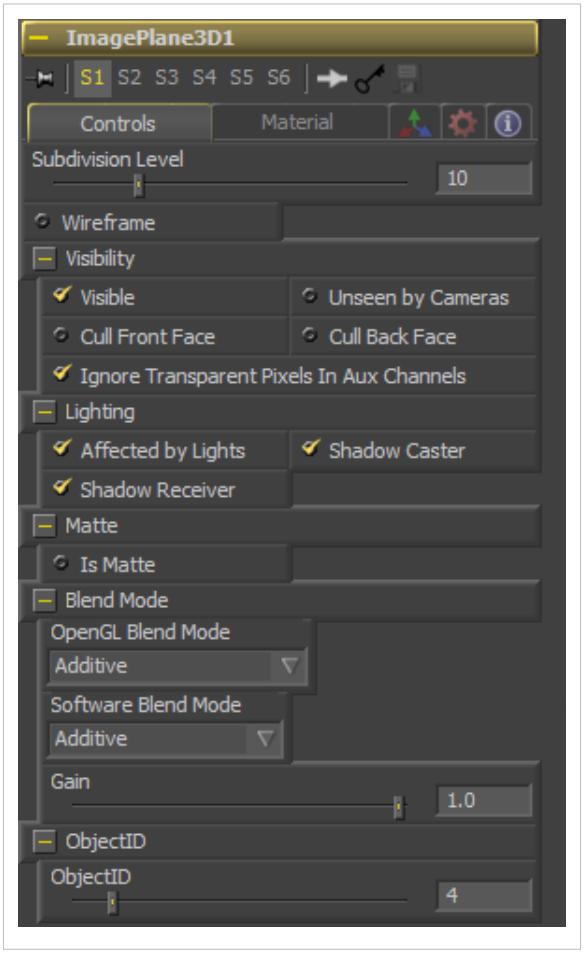
ImagePlane3D.SceneInput

[*orange, optional*] This input expects a 3D scene. As this tool creates geometry, it is not required.

ImagePlane3D.MaterialInput

[*green, optional*] This input will accept either a 2D image or a 3D material. If a 2D image is provided it will be used as a diffuse texture map for the basic material built into the tool. If a 3D material is connected then the basic material will be disabled.

Controls



Subdivision Level

Use the Subdivision Level slider to set the number of subdivisions used when creating the image plane. If the Open GL display and renderer are set to vertex lighting so, the more subdivisions in the mesh, the more vertices will be available to represent the lighting. For this reason, high subdivisions can be useful when working interactively with lights.

Wireframe

Enabling this checkbox will cause the mesh to render only the Wireframe for the object. When this manual was printed, only the OpenGL renderer supported wireframe, but that may have changed in the time between printing and release.

Visibility

Visible

If the visibility checkbox is not selected, the object will not visible in the display views, nor will it be rendered into the output image by the Renderer 3D tool. A non-visible object does not cast shadows.

Unseen by Cameras

If the Unseen by Cameras checkbox is selected, the object will be visible in the display views (unless the Visible checkbox is turned off), except when viewed through a camera. The object will not be rendered into the output image by the Renderer 3D tool. Shadows cast by an Unseen object will still be visible when rendered by the software renderer, though not by the OpenGL renderer.

Cull Front Face/Back Face

Use these options to cull (eliminate) rendering and display of certain polygons in the geometry. If Cull Back Face is selected, all polygons facing away from the camera not be rendered, and will not cast shadows. If Cull Front Face is selected, all polygons facing towards the camera will likewise be dropped. Selecting both checkboxes has the same effect as deselecting the Visible checkbox.

Ignore Transparent Pixels in Aux Channels

In Fusion 5 transparent pixels were rejected by the SW/GL renderers. To be more specific the SW renderer rejected pixels with R=G=B=A=0 and the GL renderer rejected pixels with A=0. This is now optional. The reason you might want to do this is to get aux channels (eg. normals, z, UVs) for the transparent bits. For example, suppose in post you want to replace the texture on an 3D element with a texture that is transparent in certain areas with a texture that is transparent in different areas, then it would be useful to have transparent bits set aux channels (in particular UVs). As another example suppose you are doing post DoF... you will probably not want the z channel to be set on transparent areas as this will give you a false depth. Also keep in mind that this rejection is based on the final pixel color including lighting if it is on. So if you have a specular highlight on a clear glass material, this checkbox will not affect it.

Lighting

Affected By Lights

If this checkbox is not selected, lights in the scene will not affect the object, it will not receive nor cast shadows, and it will be shown at the full brightness of its colour, texture or material.

Shadow Caster

If this checkbox is not enabled, the object will not cast shadows on other objects in the scene.

Shadow Receiver

If this checkbox is not enabled, the object will not receive shadows cast by other objects in the scene.

Matte

Enabling the IsMatte option will apply a special texture to this object, causing this object to not only become invisible to the camera, but also making everything that appears directly behind the camera invisible as well. This option will override all textures. See the Matte Objects section of the 3D chapter for more information.

Is Matte

When activated, objects whose pixels fall behind the matte objects pixels in Z do not get rendered.

Opaque Alpha

Sets the alpha value of the matte object to 1. This checkbox is only visible when the IsMatte option is enabled.

Infinite Z

Sets the value in the z channel to infinite. This checkbox is only visible when the IsMatte option is enabled.

Blend Mode

A blend mode specifies which method will be used by the renderer when combining this object with the rest of the scene. The blend modes are essentially identical to those listed in the documentation for the 2D Merge tool. For a detailed explanation of each mode see the documentation for that tool.

The blending modes were originally designed for use with 2D images. Using them in a lit 3D environment can produce undesirable results. For best results use the apply modes in unlit 3D scenes rendered in software.

OpenGL Blend Mode

Use this menu to select the blending mode which will be used when the geometry is processed by the OpenGL renderer. This is also the mode used when viewing the object in the display views. Currently the OpenGL renderer only support three blending modes.

Software Blend Mode

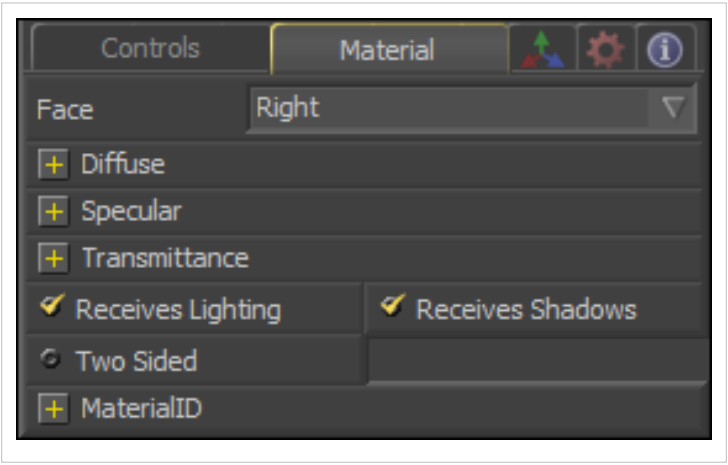
Use this menu to select the blending mode which will be used when the geometry is processed by the Software renderer. Currently the Software renderer supports all of the modes described in the Merge tool documentation except for the Dissolve mode.

Object ID

Object ID

This control is used to set the numeric identifier assigned to this object. The object ID is an integer number that will be rendered into the ObjID auxiliary channel of the rendered image when the Object ID option is enabled in the Renderer 3D tool. See the Object and Material ID section in the 3D chapter for more information.

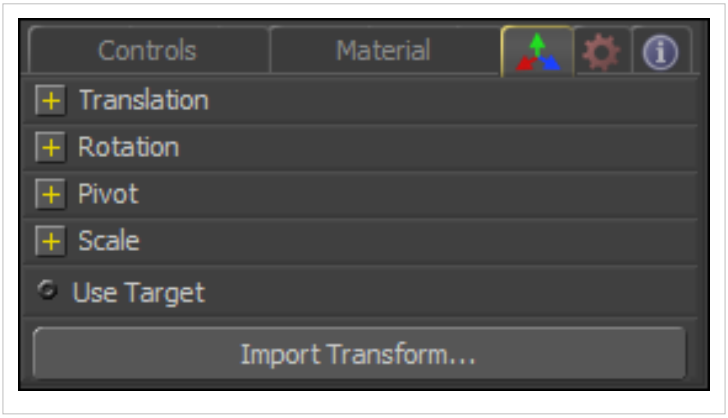
Material Tab



The options which appear in this tab determine the appearance the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are fully described in the Common 3D Controls section of this documentation.

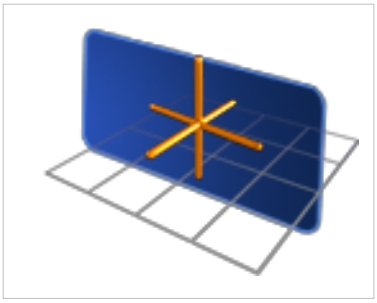
If an external 3D material is connected to the tool tiles material input then the controls in this tab will be replaced with the "Using external material" label.

Transform Tab



The options which appear in this tab determine the position of the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are fully described in the Common 3D Controls section of this documentation.

Locator 3D



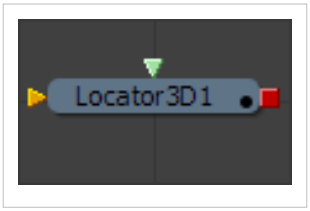
The Locator 3D tool's purpose is to transform a point in 3D space to 2D co-ordinates that other tools can use as part of expressions or modifiers.

When the Locator is provided with a camera and the dimensions of the output image, it will transform the co-ordinates of a 3D control into 2D screen space. The 2D position is exposed as a numeric output which can be connected to from other tools. For example, to connect the center of an ellipse to the 2D position of the Locator, right click on the mask center control and select **Connect To > Locator 3D > Position**.

The scene provided to Locator's input must contain the camera through which the co-ordinates are projected. As a result, the best practice is to place the locator after the merge that introduces the camera to the scene.

If an object is connected to the Locator tool's second input, the locator will be positioned at the object's center, and the Transformation tab's Offset XYZ sliders will function in the object's local co-ordinate space rather than Global scene space. This is useful for tracking an object's position regardless of any additional transformations applied further downstream.

External Inputs



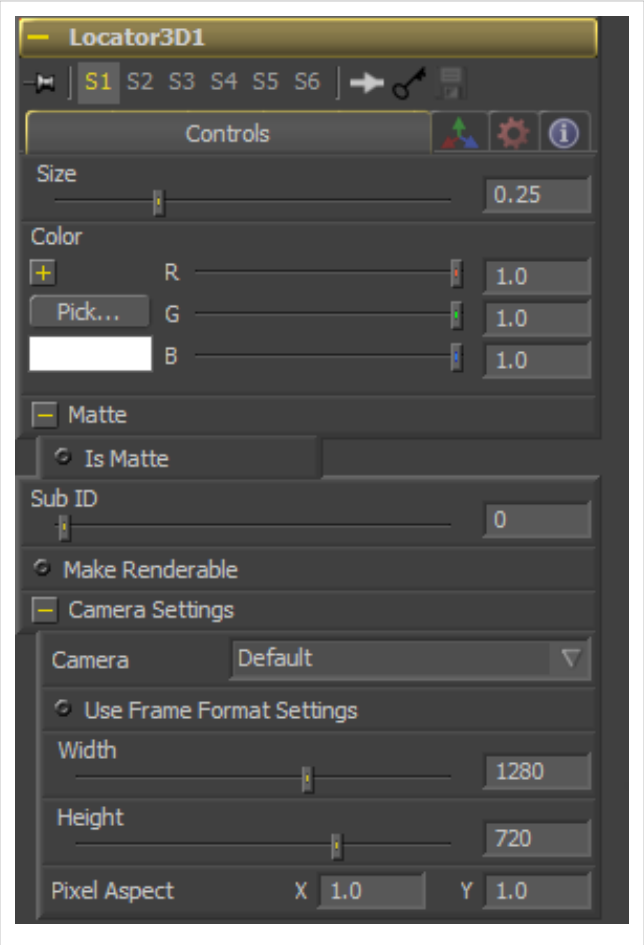
Locator3D.SceneInput

[*orange, required*] This input expects a 3D scene.

Locator3D.Target

[*green. optional*] This input expects a 3D scene. When provided, the transform center of the scene is used to set the position of the locator. The transformation controls for the Locator become offsets from this position.

Controls



Size

The Size slider is used to set the size of the locator's onscreen crosshair.

Color

A basic Color control is used to set the color of the locator's onscreen crosshair.

Matte

Enabling the IsMatte option will apply a special texture to this object, causing this object to not only become invisible to the camera, but also making everything that appears directly behind the camera invisible as well. This option will override all textures. See the Matte Objects section of the 3D chapter for more information.

Is Matte

When activated, objects whose pixels fall behind the matte objects pixels in Z do not get rendered.

Opaque Alpha

Sets the alpha value of the matte object to 1. This checkbox is only visible when the IsMatte option is enabled.

Infinite Z

Sets the value in the z channel to infinite. This checkbox is only visible when the IsMatte option is enabled.

Sub ID

The SubID slider can be used to select an individual sub-element of certain geometry, such as an individual character produced by a Text 3D tool, or a specific copy created by a Duplicate 3D tool.

Make Renderable

Defines if the Locator is rendered as a visible object by the OpenGL renderer. The software renderer is not currently capable of rendering lines, and hence will ignore this option.

Unseen By Camera

This checkbox control appears when the Make Renderable option is selected. If the Unseen by Cameras checkbox is selected, the locator will be visible in the display views, but not rendered into the output image by the Renderer 3D tool.

Controls

Camera

This drop down control is used to select the camera in the scene that defines the screen space used for 3D to 2D co-ordinate transformation.

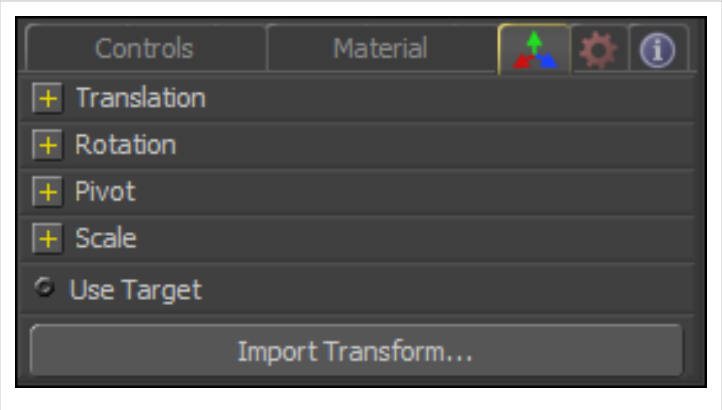
Use Frame Format Settings

Select this checkbox to override the Width, Height and Pixel Aspect controls, and force them to use the values defined in the compositions Frame Format preferences instead.

Width, Height and Pixel Aspect

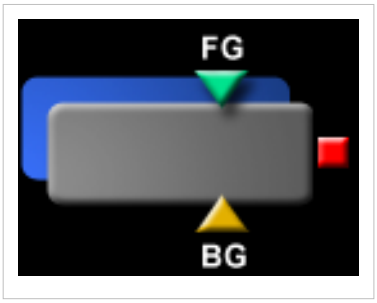
In order for the locator to generate a correct 2D transformation, it must know the dimensions and aspect of the image. These controls should be set to the same dimensions as the image produced by a renderer associated with the camera specified above. Right clicking on these controls will display a context menu containing the frame formats configured in the compositions preferences.

Transform Tab



The options which appear in this tab determine the position of the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are fully described in the Common 3D Controls section of this documentation.

Merge 3D



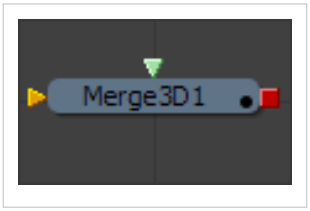
The Merge 3D tool is used to combine separate 3D elements into the same 3D environment.

For example, with a scene that is created with an image plane, a camera and a light, the camera would not be able to see the image plane and the light would not affect the image plane until all three objects are introduced into the same environment using the Merge 3D tool.

The tool tile displays only two inputs at first but, as each input is connected, a new input will appear on the tool, assuring there is always one free to add a new element into the scene.

The merge provides the standard transformation controls found on most tools in Fusion's 3D suite. Unlike those tools, changes made to the translation, rotation or scale of the merge affect all of the objects connected to the merge. This behavior forms the basis for all parenting in Fusion's 3D environment.

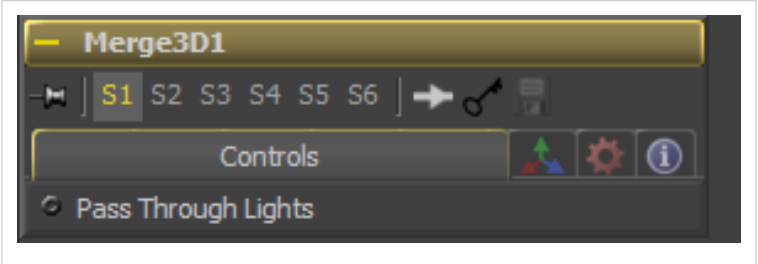
External Inputs



Merge3D.SceneInput[#]

[*any, see description*] These inputs expect a 3D scene. When the tool is constructed it will display two inputs. There is no limit to the number of inputs this tool can accept. The tool dynamically adds more inputs as needed, ensuring that there is always at least one input available for connection.

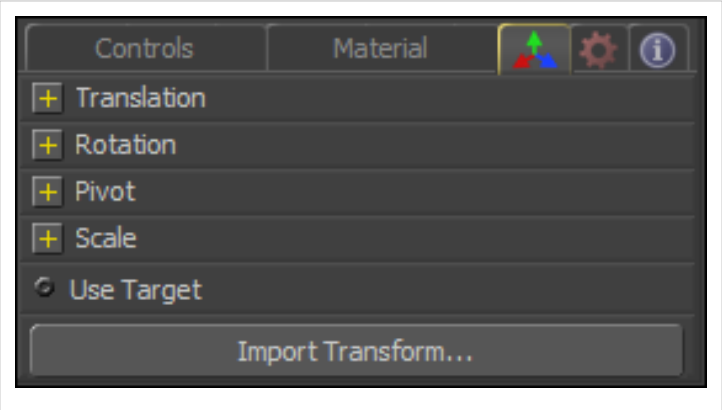
Controls



Pass Through Lights

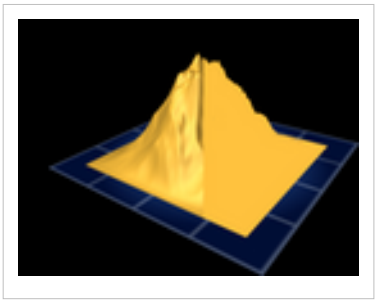
When the Pass Through Lights checkbox is selected, lights will be passed through the merge into it's output so that they can affect downstream elements. Normally, the lights are not passed downstream to affect the rest of the scene. This is frequently used to ensure projections are not applied to geometry introduced later in the scene.

Transform Tab



The options which appear in this tab determine the position of the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are fully described in the Common 3D Controls section of this documentation.

Override 3D



The Override tool let you change object specific options for every object in a 3D scene simultaneously. This is useful, for example, when the artist wishes to set every object in the input scene to render as a wireframe. Additionally this tool is the only way to set the wireframe, visibility, lighting, matte and ID options for 3D particle systems and the Text 3D tool.

It is frequently used in conjunction with the Replace Material tool to produce isolated passes. For example, a scene be branched out to a Override tool which turns off the affected by lights property of each tool, then connected to a Replace Material tool that applies a Falloff shader to produce an falloff pass of the scene.

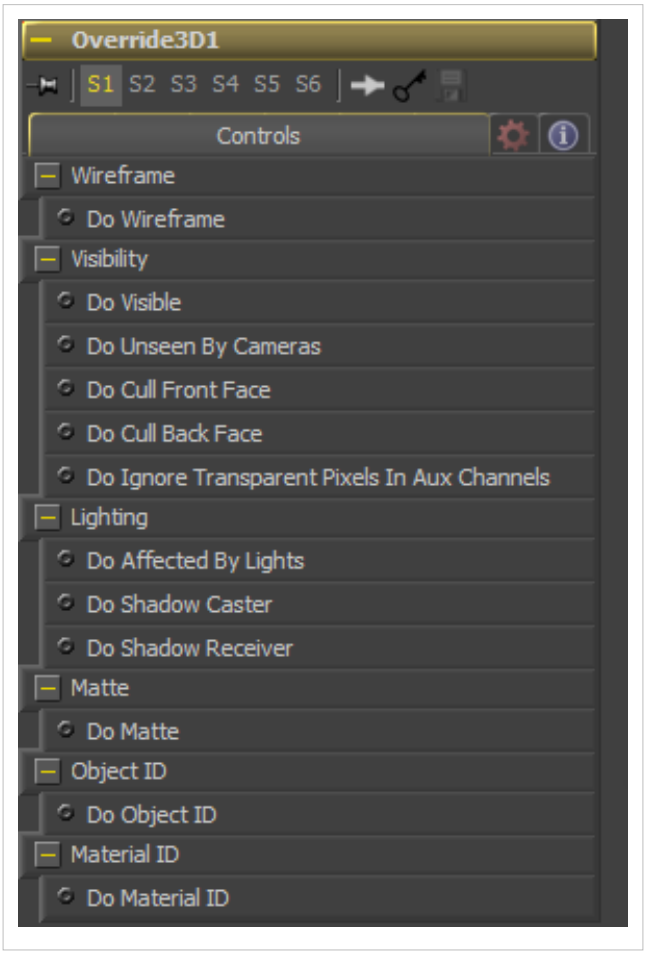
External Inputs



Override3D.SceneInput

[*orange, required*]: This input expects a 3D scene.

Controls



The philosophy of the controls found in the override tool is fairly straightforward. First, the artist selects the option to override using the 'Do [Option]' checkbox. That will reveal a control that can be used to set the value of the option itself. The individual options are not documented here - a full description of each can be found in any geometry creation tool, such as the Image Plane, Cube or Shape tools.

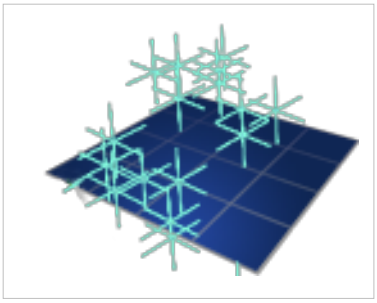
Do [option]

Enables the Override for this option.

[option]

If the Do [option] checkbox is enabled then the control for the property itself becomes visible. The control values of the properties for all upstream objects are overridden by the new value.

Point Cloud 3D



A Point Cloud is generally a large number of nulls created by 3D tracking or modeling software. When produced by 3D tracking software the points typically represent each of the patterns tracked to create the 3D camera path. These point clouds can be used to identify a ground plane and to orient other 3D elements with the tracked image. The Point Cloud 3D tool creates a point cloud by importing a 3D scene and collecting all of the null type objects found within into a single peice of geometry. Using a single mesh object preserves resources and ensures speedy interactive performance.

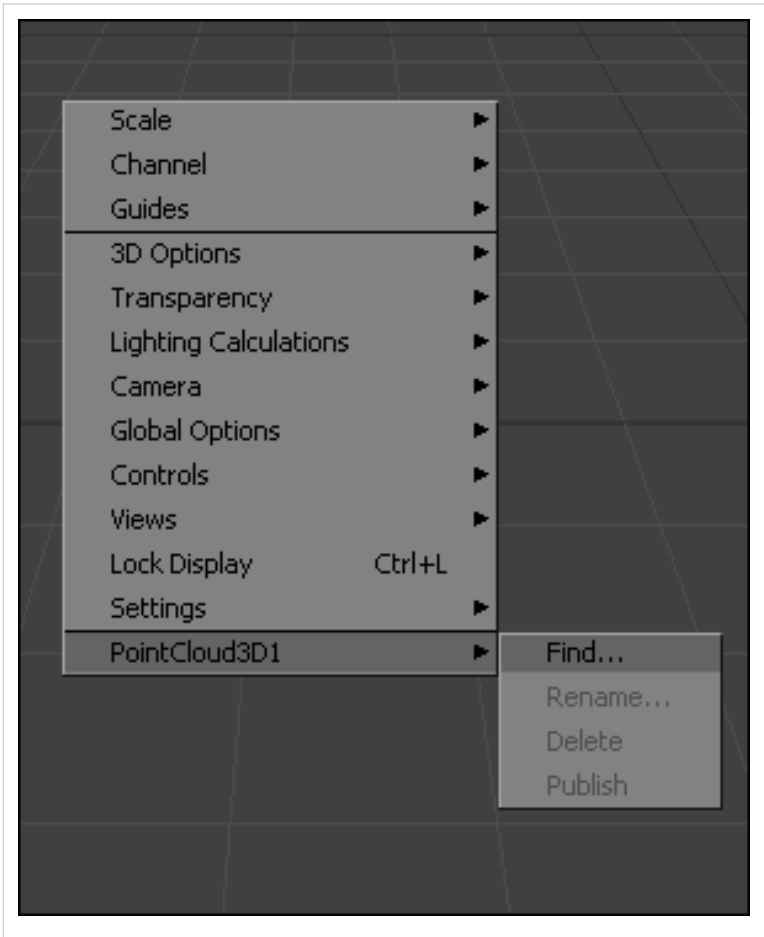
External Inputs



PointCloud3D.SceneInput

[*orange, required*] This input expects a 3D scene.

Onscreen Context Menu



Frequently one or more of the points in an imported point cloud will have been manually assigned in order to track the position of a specific feature. These points usually have names that distinguish them from the rest of the points in the cloud. To see the current name for a point, hover the mouse pointer directly over a point and after a moment a small popup will appear with the name of the point.

When the Point Cloud 3D tool is selected a sub-menu will be added to the display view's context menu with several options that make it simple to locate, rename and separate these points from the rest of the point cloud. The context menu contains the following options:

Find

Selecting this option from the display view context menu will open a dialog that can be used to search for and select a point by name. Each point that matches the pattern will be selected.

Rename

Rename one or more points by selecting Rename from the context menu. Type the new name into the dialog that appears and hit enter. The point will now have that name, with a four digit number added to the end. For example, the name window will be window0000 and multiple points would be window0000, window0001, etc. Names must be valid fusion identifiers (i.e. no spaces allowed, and the name can not start with a number)

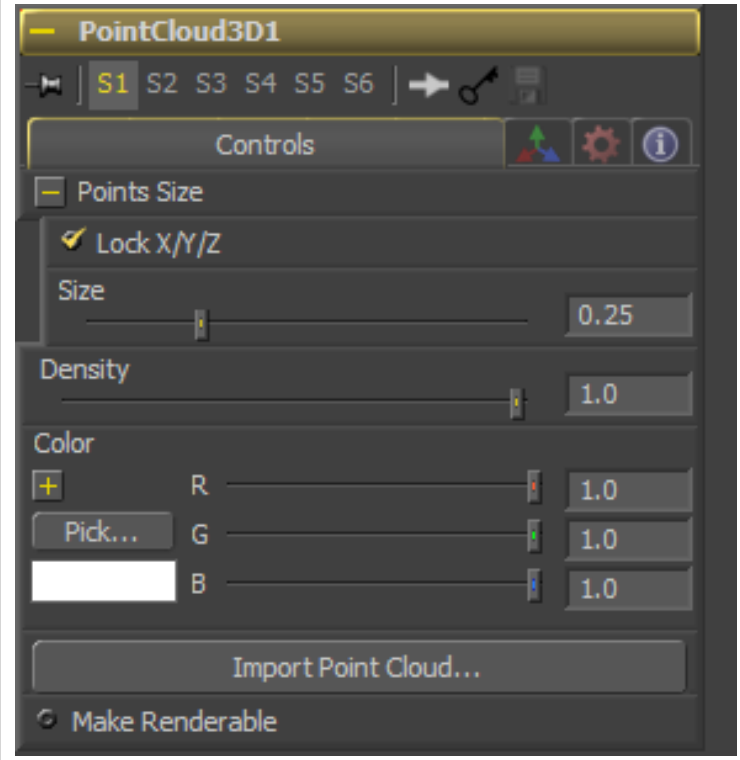
Delete

Selecting this option will delete the currently selected points.

Publish

Normally, the exact position of a point in the cloud is not exposed to the artist. To expose the position, select opne or more points then select the Publish option from this context menu. This will add a co-ordinate control to the control panel for each published point that displays the point's current location.

Controls



Lock X/Y/Z

Deselect this checkbox to provide individual control over the size of the X, Y and Z arms of the points in the cloud.

Size X/Y/Z

These sliders can be used to increase the size of the onscreen crosshairs used to represent each point.

Density

This slider defines the probability of displaying a specific point. If the value is 1 then all points are displayed. A value of 0.2 shows only every fifth point.

Color

Use the standard Color control to set the color of onscreen crosshair controls.

Import PointCloud

The Import Point Cloud button displays a dialog to import a point cloud from another application. Supported filetypes are :

- Alias's Maya .ma
- 3DS Max ASCII Scene Export .ase
- NewTek's LightWave .lws
- Softimage XSI's .xsi.

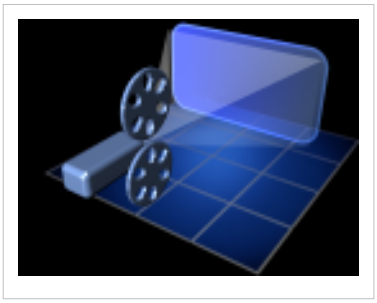
Make Renderable

Determines if the point cloud is visible in the OpenGL viewport, and in final renderings made by the OpenGL renderer. The software renderer does not currently support rendering of visible crosshairs for this tool.

Unseen By Camera

This checkbox control appears when the Make Renderable option is selected. If the Unseen by Cameras checkbox is selected, the point cloud will be visible in the display views, but not rendered into the output image by the Renderer 3D tool.

Projector 3D



The Projector 3D tool is used to project an image upon 3D geometry. This can be useful in many ways; texturing objects with multiple layers, applying a texture across multiple separate objects, projecting background shots from the camera's viewpoint, image-based rendering techniques and much more. The projector tool is just one of several tools capable of projecting images and textures. Each method has advantages and disadvantages. See the Projection section of the 3D chapter for more information about each approach.

Projected textures can be allowed to "slide" across the object, if the object moves relative to the Projector3D, or alternatively, by grouping the two together with a Merge 3D they can be moved as one, and the texture will remain locked to the object.

The Projector 3D tool's capabilities and restrictions are best understood if the Projector is considered to be a variant on the Spot Light tool. The fact that the Projector3D tool is actually a light has several important consequences when used in "Light" or "Ambient Light" projection mode:

- Lighting must be turned on for the results of the projection to be visible.

- The light emitted from the projector is treated as diffuse/specular light. This means that it will be affected by the surface normals and can cause specular highlights. If this is undesirable, set Projector 3D to project into the ambient light channel.
- Enabling shadows will cause Projector 3D to cast shadows.
- Just as with other lights, the light emitted by a Projector 3D will only affect objects that feed into the first Merge 3D that is downstream of the Projector 3D tool on the flow. Enabling Merge 3D's Pass Through Lights checkbox will allow the projection to light objects further downstream.
- The light emitted by a Projector 3D is controlled by the Lighting Options settings on objects and the Receives Lighting options on materials.
- Alpha values in the projected image will not clip geometry in Light or Ambient Light mode. Use Texture mode instead.
- If two projections overlap, their light contributions will be added together.

To project re-lightable textures or textures for non-diffuse color channels (like specular intensity or bump) then use the "Texture" projection mode instead:

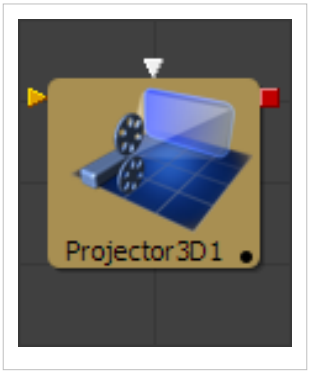
- Projections in texture mode will only strike objects that use the output of the Catcher tool for all or part of the material applied to that object.
- Texture mode projections will clip the geometry according to the alpha channel of the projected image.

See the documentation for the Catcher tool for additional details.

The Camera 3D tool also provides a projection feature, and should be used when the projection is meant to match a camera, as this tool gives the artist more control over aperture, film back, and clip planes. Projector 3D was designed to be used as a custom light in 3D scenes for layering and texturing. The Projector provides better control over light intensity, color, decay and shadows.

When using projectors in an OpenGL view or in the OpenGL Renderer the lighting must be set to per-pixel (the default) in order to see the results of the projection in the main view. The per-pixel lighting mode requires a certain level of shader support from your graphics card (ie. DX9 level or higher graphics card - generally a GeForce 5000 line or newer, Radeon 9000 line or newer will work.) Even if the graphics card does not support pixel shading the projection will still be visible when using the software renderer.

External Inputs



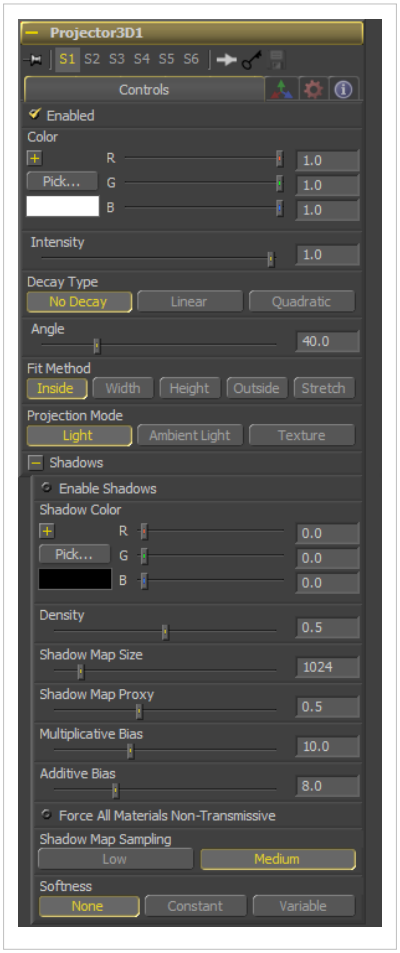
Projector3D.SceneInput

[*orange, optional*] This input expects a 3D scene. If a scene is connected to this input then transformations applied to the spotlight will also affect the rest of the scene.

Projector3D.ProjectiveImage

[*white, optional*] This input expects a 2D image to be used for the projection.

Controls



Enabled

When this checkbox is selected the projector affects the scene. Clear the checkbox to turn it off.

Color

The input image is multiplied by this color before projected into the scene.

Intensity

Use this slider to set the intensity of the projection when the light and ambient light projection modes are used. In texture mode this option scales the color values of the texture after multiplication by the color.

Decay Type

A projector defaults to No Falloff, meaning that its light has equal intensity on geometry regardless of the distance from the projector to the geometry. To cause the intensity to falloff with distance, set the Decay type either to Linear, or Quadratic modes.

Angle

The cone angle of the tool refers to the width of the cone where the projector emits its full intensity. The larger the angle the wider the cone angle, up to a limit of 90 degrees.

Fit Method

The Fit Method determines how the projection is fit within the projection cone.

The first thing to know is that although this documentation may call it a 'cone', the Projector3D tool and the Camera3D tools do not project actual cones - its more of a pyramid of light with its apex at the camera/projector. The Projector3D tool always projects a square pryamid of light, ie. its X and Y angles of view are the same. The pyramid of light projected by the Camera3D tool can be non-square depending on what the Film Back is set to in the camera. The aspect of the image connected into the Projector3D/Camera3D does not affect the X/Y angles of the pyramid, but rather the image is scaled to fit into the pyramid based upon the fit options.

When both the aspect of the pyramid (AovY/AovX) and the aspect of the image (height * pixelAspectY) / (width * pixelAspectX) are the same, there is no need for the fit options and in this case the fit options all do the same thing. However, when the aspect of the image and the pyramid (as determined by the Film Back settings in Camera3D) are different the fit options become important.

For example, 'Fit by Width' will fit the width of the image across the width of the Camera3D pyramid. In this case, if the image has a greater aspect ratio than the aspect of the pyramid, some of the projection will extend vertically outside of the pyramid.

There are five options:

Inside

The image is uniformly scaled so that its largest dimension fits inside of the cone. Another way to think about this, is that it scales the image as big as possible subject to the restriction that the *image* is fully contained within the pyramid of the light. This means, for example, that nothing outside the pyramid of light will ever receive any projected light.

Width

The image is uniformly scaled so that its width fits inside the cone. Note the image could still extend outside of the cone in its height direction.

Height

The image is uniformly scaled so that its height fits inside the cone. Note the image could still extend outside of the cone in its width direction.

Outside

The image is uniformly scaled so that its smallest dimension fits inside of the cone. Another way to think about this is that it scales the image as small as possible subject to the restriction that the image covers the entire pyramid (ie. the *pyramid* is fully contained within the image) This means that any pixel of any object inside the pyramid of light will always get illuminated.

Stretch

The image is non-uniformly scaled so it exactly covers the cone of the projector.

Projection Mode

Light

Projects the texture as a diffuse/specular light

Ambient Light

Uses an ambient light for the projection.

Texture

When used in conjunction with the Catcher tool, this mode allows re-lightable texture projections. The projection will only strike objects that use the Catcher material as part of their material shaders.

One useful trick is to connect a Catcher tool to the Specular Texture input on a 3D material tool (such as a Blinn). This will cause any object using the Blinn material to recieve the projection as part of the specular highlight. This technique can be used in any material input that uses texture maps, such as the specular, and reflection maps.

Shadows

Since the projector is based on a spotlight it is also capable of casting shadows using shadow maps. The controls under this reveal are used to define the size and behaviour of the shadow map.

Enable Shadows

The Enable Shadows checkbox should be selected if the light is to produce shadows. This defaults to selected.

Shadow Color

Use this standard Color control to set the color of the shadow. This defaults to black (0, 0, 0).

Density

The shadow Density determines how opaque the shadow will be. A density of 1.0 will produce a completely transparent shadow, whereas lower values make the shadow transparent.

Shadow Map Size

The Shadow Map Size control determines the size of the bitmap used to create the shadow map. Larger values will produce more detailed shadow maps at the expense of memory and performance.

Shadow Map Proxy

Shadow Map Proxy determines the size of the shadow map used for proxy and auto proxy calculations. A value of 0.5 would use a 50% shadow map.

Multiplicative/Additive Bias

Shadows are essentially textures applied to objects in the scene so there will occasionally be z-fighting, where the portions of the object that should be recieving the shadows render over top of the shadow instead. An example of Z-fighting is shown below.

Biasing works by adding a small depth offset to move the shadow away from the surface it is shadowing, eliminating the z-fighting. Too little bias and the objects can self-shadow themselves. Too much bias and the shadow can become separated from the surface.

Make adjustments to the Multiplicative Bias first, then fine tune the result using the Additive Bias control.

Force All Materials Non-Transmissive

Normally, a RGBAZ shadowmap is used when rendering shadows. By enabling this option you are forcing the renderer to use a Z only shadowmap. This can result in significantly faster shadow rendering while using a fifth as much memory. The disadvantage is that you can no longer cast 'stained-glass' like shadows.

Shadow Map Sampling

Sets the quality for sampling of the shadow map (WIP-note: Ask STephen)

Softness

Soft edges in shadows are produced by filtering the shadowmap when it is sampled. Fusion has three separate filtering methods available when rendering shadows which produce different effects.

None

Shadows will have a hard edge. No filtering of the shadowmap is done at all. The advantage of this method is that you only have to sample one pixel in the shadowmap so it is fast.

Constant

Shadows edges will have a constant softness. A filter with a constant width is used when sampling the shadowmap. The size of the filter is controlled by adjusting the Constant Softness slider. Note that the larger you make the filter, the longer that it will take to render the shadows.

Variable

The softness of shadow edges will grow the further away the shadow receiver is from the shadow caster. The variable softness is achieved by changing the size of the filter based on the distance between the receiver and caster. When this option is selected, the Softness Falloff, Min Softness and Max Softness sliders appear.

Constant Softness

If the Softness is set to constant, then this slider will appear. It can be used to set the overall softness of the shadow.

Softness Falloff

The Softness Falloff slider appears when the Softness is set to variable. This slider controls how fast the softness of shadow edges grows with distance. To be more precise, it controls how fast the shadowmap filter size grows based upon the distance between shadow caster and receiver. Its affect is mediated by the values of the min and max softness sliders.

Min Softness

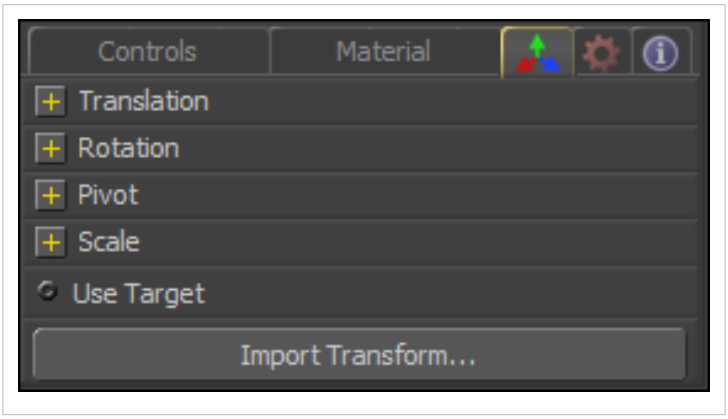
The Min Softness slider appears when the Softness is set to variable. This slider controls the Minimum Softness of the shadow. The closer the shadow is to the object casting the shadow, the sharper it will be up to the limit set by this slider.

Max Softness

The Max Softness slider appears when the Softness is set to variable. This slider controls the Maximum Softness of the shadow. The further the shadow is from the object casting the

shadow, the softer it will be up to the limit set by this slider.

Transform Tab



The options which appear in this tab determine the position of the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are fully described in the Common 3D Controls section of this documentation.

Renderer 3D



The Render 3D tool converts the 3D environment into a 2D image using either a default perspective camera, or else one of the cameras found in the scene. Every 3D scene in a composition should terminate with at least one Render 3D tool. The Renderer tool can use either of the software or OpenGL render engines to produce the resulting image. Additional render engines may also be available via third party plugins.

The Software render engine uses the systems CPU only to produce the rendered images. It is usually much slower than the OpenGL render engine, but produces consistent results on all machines making it essential for renders that involve network rendering. The software mode is required to produce soft shadows, and generally supports all available illumination, texture, and material features.

The OpenGL render engine employs the GPU processor on the graphics card to accelerate the rendering of the 2D images. The output may vary slightly from system to system, depending on the exact graphics card installed. The graphics card driver can also effect the results from the OpenGL renderer. The OpenGL render engines speed makes it possible to provide customized supersampling and realistic 3D depth of field options. Soft shadows cannot be rendered using the software renderer.

Like most tools, the Renderer's motion blur settings can be found under the common control tab (looks like a nuclear warning symbol). Be aware that scenes containing one or more particle systems will require that the motion blur settings on the pRender tools exactly match the settings on the Renderer 3D tool. Otherwise the sub-frame renders will conflict producing unexpected (and incorrect) results.

External Inputs



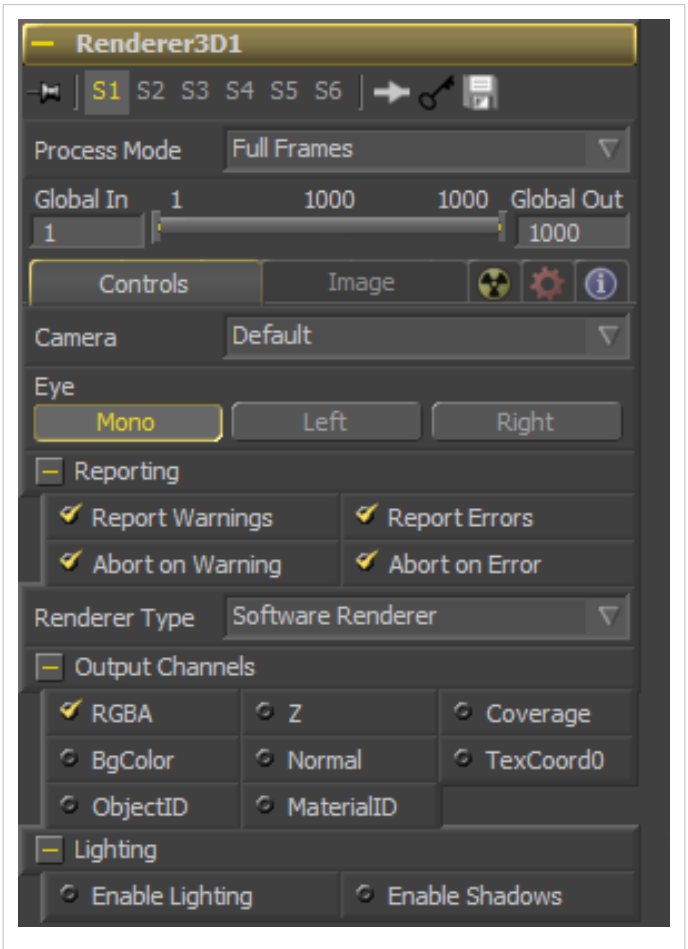
Renderer3D.SceneInput

[*orange, required*] This input expects a 3D scene.

Renderer3D.EffectMask

[*violet, optional*] This input uses a single or four channel 2D image to mask the output of the tool.

Controls



Camera

The Camera drop-down list is used to select which camera from the scene is used when rendering. The default option is Default, which will use the first camera found in the scene. If no camera is located the default perspective view will be used instead.

Eye

The Eye control tells the tool how to render the image in stereoscopic projects. The Mono option will ignore the stereoscopic settings in the camera. The Left and Right options will translate the camera using the stereo seperation and convergence options defined in the camera to produce either left or right eye outputs.

Reporting

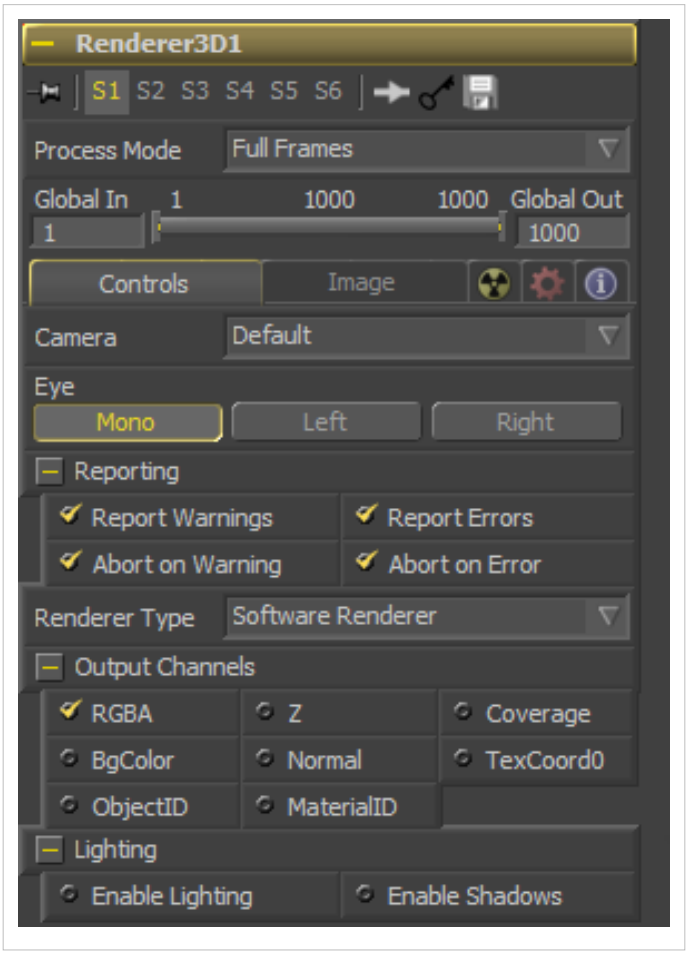
The first two checkboxes in this reveal can be used to determine whether the tool will print warnings and error produced while rendering to the console. The second row of checkboxes tells the tool whether it should abort rendering when a warning or error is encountered. The default for this tool enables all four checkboxes.

Renderer Type

This drop down menu lists the available render engines. Fusion provides two the Software and OpenGL render engines (described above) and additional renderers can be added via third party plugins.

All of the controls found below this drop down menu are added by the render engine. They may change depending on the options available to each renderer. As a result each renderer is described in it's own section below.

Software Controls



Output Channels

In addition to the usual red, Green, Blue and Alpha channels the software renderer can also embed the following channels into the image. Enabling additional channels will consume additional memory and processing time, so these should be used only when required.

RGBA

This option tells the renderer to produce the red, green, blue and alpha color channels of the image. These channels are required and they cannot be disabled.

Z

This option enables rendering of the Z-channel. The pixels in the Z-channel contain a value that represent the distance of each pixel from the camera. Note that the Z-Channel values cannot include anti-aliasing. In pixels where multiple depths overlap, the frontmost depth value is used for this pixel.

Coverage

This option enables rendering of the coverage channel. The coverage channel contains information about which pixels in the z-buffer provide coverage (are overlapping with other objects). This helps tools that use the Z-buffer to provide a small degree of antialiasing. The value of the pixels in this channel indicate as a percentage how much of the pixel is composed of the foreground object.

BgColor

This option enables rendering of the BgColor channel. This channel contains the color values from objects behind the pixels described in the coverage channel.

Normal

This option enables rendering of the X, Y and Z Normals channels. These three channels contain pixel values that indicate the orientation (direction) of each pixel in the 3D space. Each axis is represented by a color channel containing values in a range from [-1,1].

TexCoord

This option enables rendering of the U and V mapping co-ordinate channels. The pixels in these channels contain the texture coordinates of the pixel. Although texture coordinates are processed internally within the 3D system as 3 component UVW, Fusion images only store UV components. These components are mapped into the Red and Green color channel.

ObjectID

This option enables rendering of the ObjectID channel. Each object in the 3D environment can be assigned a numeric identifier when it is created. The pixels in this floating point image channel contain the values assigned to the objects that produced the pixel. Empty pixels have an ID of 0, and the channel supports values as high as 65534. Multiple objects can share a single Object ID . This buffer is useful for extracting mattes based on the shapes of objects in the scene.

MaterialID

This option enables rendering of the ObjectID channel. Each material in the 3D environment can be assigned a numeric identifier when it is created. The pixels in this floating point image channel contain the values assigned to the materials that produced the pixel. Empty pixels have an ID of 0, and the channel supports values as high as 65534. Multiple materials can share a single Material ID . This buffer is useful for extracting mattes based on a texture - for example a mask containing all of the pixels which comprise a brick texture.

Lighting

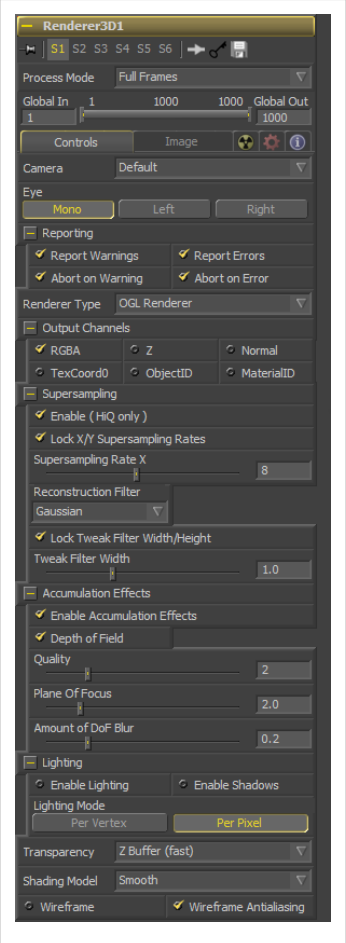
Enable Lighting

When the Enable Lighting checkbox is selected, objects will be lit by any lights in the scene. If no lights are present, all objects will be black.

Enable Shadows

When the Enable Shadows checkbox is selected, the renderer will produce shadows, at the cost of some speed.

OpenGL Controls



Output Channels

In addition to the usual Red, Green, Blue and Alpha channels the OpenGL render engine can also embed the following channels into the image. Enabling additional channels will consume additional memory and processing time, so these should be used only when required.

RGBA

This option tells the renderer to produce the red, green, blue and alpha color channels of the image. These channels are required and they cannot be disabled.

Z

This option enables rendering of the Z-channel. The pixels in the Z-channel contain a value that represent the distance of each pixel from the camera. Note that the Z-Channel values cannot include anti-aliasing. In pixels where multiple depths overlap, the frontmost depth value is used for this pixel.

Normal

This option enables rendering of the X, Y and Z Normals channels. These three channels contain pixel values that indicate the orientation (direction) of each pixel in the 3D space. Each axis is represented by a color channel containing values in a range from [-1,1].

TexCoord

This option enables rendering of the U and V mapping co-ordinate channels. The pixels in these channels contain the texture coordinates of the pixel. Although texture coordinates are processed internally within the 3D system as 3 component UVW, Fusion images only store UV components. These components are mapped into the Red and Green color channel.

ObjectID

This option enables rendering of the ObjectID channel. Each object in the 3D environment can be assigned a numeric identifier when it is created. The pixels in this floating point image channel contain the values assigned to the objects that produced the pixel. Empty pixels have an ID of 0, and the channel supports values as high as 65534. Multiple objects can share a single Object ID . This buffer is useful for extracting mattes based on the shapes of objects in the scene.

MaterialID

This option enables rendering of the ObjectID channel. Each material in the 3D environment can be assigned a numeric identifier when it is created. The pixels in this floating point image channel contain the values assigned to the materials that produced the pixel. Empty pixels have an ID of 0, and the channel supports values as high as 65534. Multiple materials can share a single Material ID . This buffer is useful for extracting mattes based on a texture - for example a mask containing all of the pixels which comprise a brick texture.

Supersampling

Supersampling produces an output image with higher quality anti-aliasing by brute force rendering a much larger image, then rescaling it down to the target resolution. The exact same results can be achieved by rendering a larger image in the first place, then using a Resize tool to bring the image to the desired resolution. Using the supersampling built into the renderer offers two distinct advantages over this method:

1. The rendering is not restricted by memory or image size limitations. For example, consider the steps to create a float16 1920 x 1080 image with 16x supersampling. Using the traditional resize tool would require first rendering the image with a resolution of 30720 x

17280 then using a resize to scale this image back down to 1920 x 1080. Simply producing the image would require nearly 4GB of memory. When supersampling is performed on the GPU the OpenGL renderer can use tile rendering to significantly reduce memory usage.

2. The GL Renderer can perform the rescaling of the image directly on the GPU much more quickly that the CPU can manage it. In general, the more GPU memory the graphics card has the faster the operation will be.

Interactively Fusion will skip the supersampling stage unless the HiQ button is selected in the Time Ruler. Final quality renders will always include supersampling if it is enabled.

Due to hardware limitations point geometry (particles) and lines (locators) are always rendered at their original size - independent from supersampling. This means that these elements will be scaled down from their original sizes, and will likely appear much thinner than expected.

Enable (HiQ only)

This checkbox can be used to enables supersampling of the rendered image. The remaining controls in this reveal will only appear if this is selected.

Lock X/Y Supersampling Rates

When this checkbox is disabled seperate sliders are presented to control the amount of supersampling on the X and Y axis.

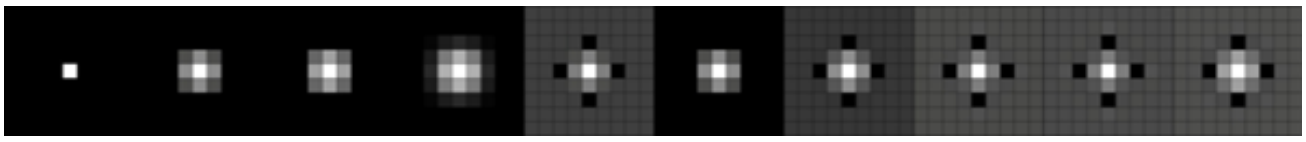
Supersampling Rate X

The supersampling rate tells the OpenGL render how large to scale the image. eg. If the supersampling rate is set to 4 and the GL Renderer is set to output a 1920 x 1080 image, internally a 7680 x 4320 image will be rendered and then scaled back to produce the target image. Set the multiplier higher to get better edge antialiasing at the expense of render time. Typically 8x8 supersampling (64 samples per pixel) is sufficient to reduce most aliasing artifacts.

The supersampling rate doesn't exactly define the number of samples done per destination pixel - the width of the reconstruction filter used may also have an impact.

Reconstruction Filter

When downsampling the supersized image the surrounding pixels around a given pixel are often used to give a more realistic result. There are various filters available for combining these pixels. More complex filters can give better results, but are usually slower to calculate. The best filter for the job will often depend on the amount of scaling and on the contents of the image itself.



The functions of these filters are shown in the image above. From left to right these are:

- Box - This is a simple interpolation scale of the image.
- Bi-Linear (triangle) - This uses a simplistic filter, which produces relatively clean and fast results.
- Bi-Cubic (quadratic) - This filter produces a nominal result. It offers a good compromise between speed and quality.

- Bi-Spline (cubic) - This produces better results with continuous tone images but is slower than Quadratic. If the images have fine detail in them, the results may be blurrier than desired.
- Catmul-Rom - This produces good results with continuous tone images which are scaled down, producing sharp results with finely detailed images.
- Gaussian - This is very similar in speed and quality to Quadratic.
- Mitchell - This is similar to Catmull-Rom but produces better results with finely detailed images. It is slower than Catmull-Rom.
- Lanczos - This is very similar to Mitchell and Catmull-Rom but is a little cleaner and also slower.
- Sinc - This is an advanced filter that produces very sharp, detailed results, however, it may produce visible `ringing' in some situations.
- Bessel - This is similar to the Sinc filter but may be slightly faster.

Window Method

The Window Method menu appears only when the Reconstruction Filter is set to "Sinc" or "Bessel".

- Hanning - This is a simple tapered window.
- Hamming - Hamming is a slightly tweaked version of Hanning.
- Blackman - A window with a more sharply tapered falloff.

Lock Tweak Filter Width/Height

When this checkbox is disabled it is possible to set different values for the X and Y axis when setting the filter width.

Tweak Filter Width

This slider can be used to adjust the size of the filter kernel. The kernal describes how many of the pixels surrounding the current pixel are sampled to produce the scaled result. Decreasing the width of the filter causes the anti-aliasing in the resulting image to appear sharper while increasing it makes it seem blurrier.

Each type of filter has a default width setting. For example, a box filter by default uses a 1x1 kernel, a triangle filter is 2x2, a bi-cubic filter is 3x3, b-spline and catmull-rom use 4x4, while a gaussian filter is 3.34x3.34. The kernel width of the filter is essentially multiplied by the value set in this control.

This can be used as a mechanism to blur to the resulting image but it not recommended as its becomes increasingly inefficient for larger tweak multipliers and consumes significantly more resources. Larger values will often cause a graphics card to fail entirely. For values higher than 4 using a Blur tool on the output image will almost certainly be more efficient.

Accumulation Effects

Accumulation Effects are created by rendering multiple "subframes" to produce the final image. This technique allows depth of field rendering on the graphic hardware. Future versions of Fusion may also allow additional effects based on the accumulation technique.

Enable Accumulation Effects

This checkbox enables calculation of the Accumulation effects. While the OpenGL renderer currently provides only a Depth of Field accumulation, additional modes are planned for the future, so a global switch has been provided.

Depth of Field

This checkbox enables Depth of Field rendering. Depth of Field is created by rendering sub-frame then combining them into a single frame. In each subframe the camera is rotated around a virtual target point. The distance to the target point is set by the Plane of Focus control in the Camera 3D tool. Pixels at the Plane of Focus will appear to be in focus.

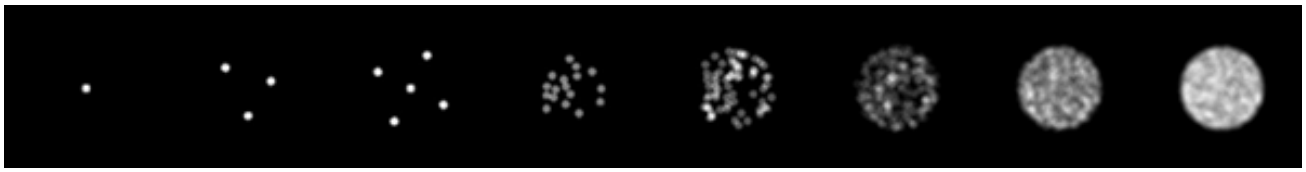
If supersampling is enabled then each sub-frame will be produced using the supersampled size.

For reasons of efficiency the sub-frames created for the DOF effect are also used to produce motion blur when this option is enabled in the common controls tab (marked with the nuclear symbol). Effectively both features "share" sub-frames.

Depth of Field Quality

This control sets the number of sub-frames used to create the DoF calculation. As with motion blur, the value of the control is doubled internally, so setting this control to 2 actually produces 5 sub-frames (4 + 1 original). If both motion blur and DOF are enabled the number of sub-frames produced is determined by the higher quality value. This prevents the number of subframes produced from growing exponentially.

The following images shows the effect of DoF Quality on a small circle:



The value of the controls are from left to right:0, 1, 2, 8, 32, 128, 1024, 4096.

Amount of DoF Blur

Defines how much the camera is moved per subframe from its original position. A higher value will result in a blurrier image or stronger DoF effect.

Lighting

Enable Lighting

When the Enable Lighting checkbox is selected, objects will be lit by any lights in the scene. If no lights are present, all objects will be black.

Enable Shadows

When the Enable Shadows checkbox is selected, the renderer will produce shadows, at the cost of some speed.

Lighting Mode

The per-vertex lighting model calculates lighting at each vertex of the scenes geometry. This produces a fast approximation of the scene's lighting, but tends to produce blocky lighting on poorly tesselated objects. The per-pixel method uses a different method that does not rely on the amount of detail in the scenes geometry for lighting, so generally produces superior results.

While using per-pixel lighting in the OpenGL renderer produces results closer to that produced by the more accurate software renderer, it still has some disadvantages. Even with per-pixel lighting, the OpenGL renderer is less capable of dealing correctly with semi transparency, soft shadows and colored shadows. The color depth of the rendering will be limited by the capabilities of the graphics card in the system.

Transparency

The OpenGL renderer reveals this control for selecting which ordering method to use when calculating transparency.

Z Buffer (fast)

This mode is extremely fast, and is adequate for scenes containing only opaque objects. The speed of this mode comes at the cost of accurate sorting - only the objects closest to the camera are certain to be in the correct sort order. As a result semi-transparent objects may not be shown correctly, depending on their ordering within the scene.

Sorted (accurate)

This mode will sort all objects in the scene (at the expense of speed) before rendering, giving correct transparency.

Quick Mode

This experimental mode is best suited to scenes that almost exclusively contain particles.

Shading Model

Use this menu to select a Shading Model to use for materials in the scene. Smooth is the shading model employed in the views and Flat produces a simpler and faster shading model.

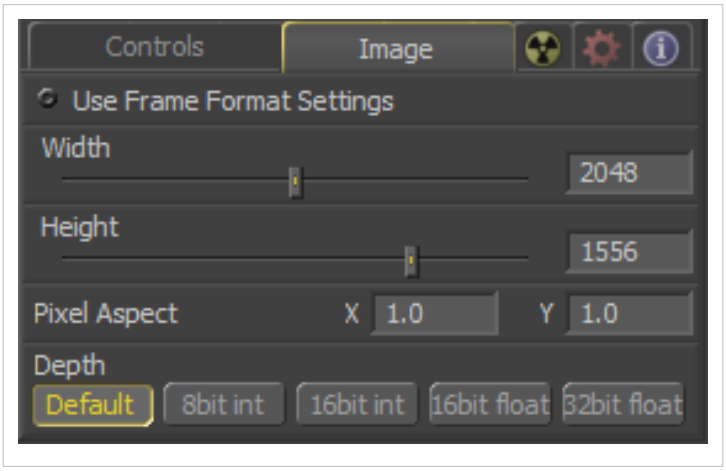
Wireframe

Renders the whole scene as wireframe. This will show the edges and polygons of the objects. The edges are still shaded by the material of the objects.

Wireframe Antialiasing

Enables anti-aliasing for the wireframe render.

Image Tab



The controls in this tab are used to set the resolution, color depth and pixel aspect of the image produced by the tool.

Process Mode

Use this menu control to select the fields processing mode used by Fusion to render changes to the image. The default option is determined by the Has Fields checkbox control in the Frame Format Preferences. For more information on fields processing, consult the Frame Formats chapter.

Global In And Out

Use this control to specify the position of this tool within the project. Use Global In to specify on which frame that the clip starts and Global Out to specify on which frame this clip ends (inclusive) within the project's Global Range.

The tool will not produce an image on frames outside of this range.

Use Frame Format Settings

When this checkbox is selected, the width, height and pixel aspect of the image created by the tool will be locked to values defined in the composition's Frame Format preferences. If the Frame Format preferences change, the resolution of the image produced by the tool will change to match. Disabling this option can be useful to build a composition at a different resolution than the eventual target resolution for the final render.

Width / Height

This pair of controls is used to set the Width and Height dimensions of the image to be created by the tool.

Pixel Aspect

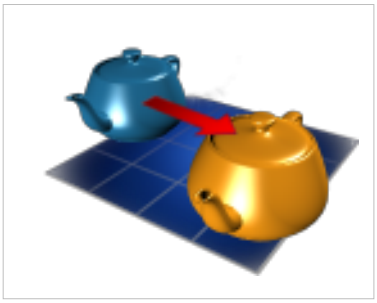
This controls is used to specify the Pixel Aspect ratio of the created images. An aspect ratio of 1:1 would generate a square pixel with the same dimensions on either side (like a computer display monitor) and an aspect of 0.9:1 would create a slightly rectangular pixel (like an NTSC monitor).

Depth

The Depth button array is used to set the pixel color depth of the image created by the creator tool. 32bit pixels require 4 times the memory of 8bit pixels, but have far greater color accuracy. Float pixels allow high dynamic range values outside the normal 0..1 range, for representing colours that are brighter than white or darker than black. See the Frame Format chapter for more details.

Right-click on the Width,Height or Pixel Aspect controls to display a menu listing the file formats defined in the preferences Frame Format tab. Selecting any of the listed options will set the width, height and pixel aspect to the values for that format.

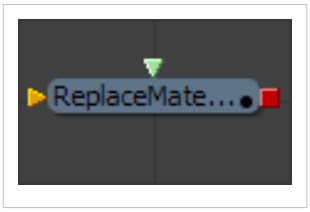
Replace Material 3D



The Replace Material 3D tool replaces the material applied to all of the geometry in the input scene with it's own material input. Any lights or cameras in the input scene are passed through unaffected.

The scope of the replacement can be limited using object and material identifiers. The scope can also be limited to individual channels, making it possible to use a completely different material on the red channel, for example.

External Inputs



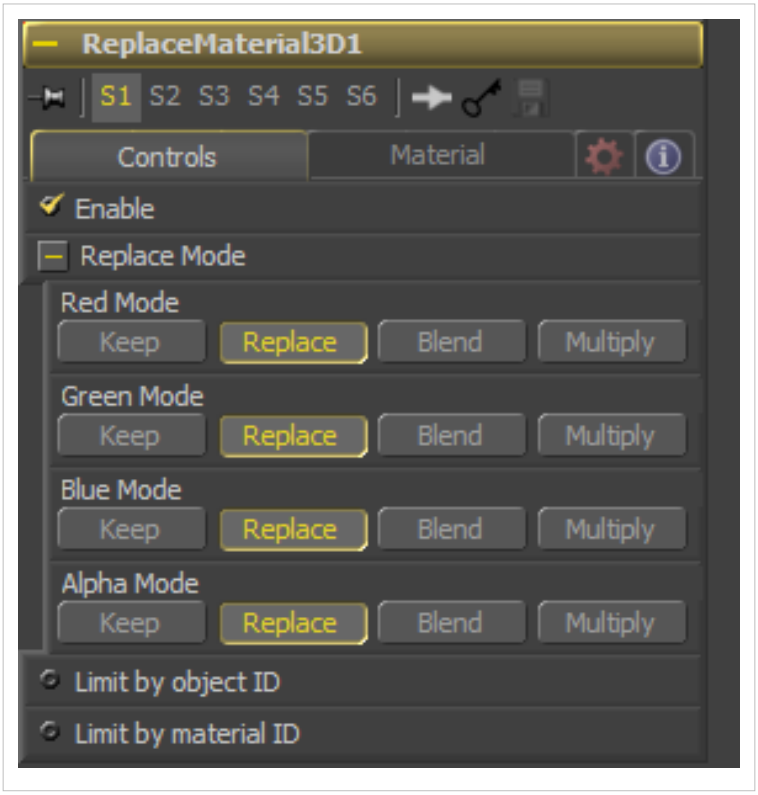
ReplaceMaterial3D.SceneInput

[*orange, required*] This input expects a 3D scene.

ReplaceMaterial3D.MaterialInput

[*green, optional*] This input will accept either a 2D image or a 3D material. If a 2D image is provided it will be used as a diffuse texture map for the basic material built into the tool. If a 3D material is connected then the basic material will be disabled.

Controls



Enable

Enables the material replacement.

Replace Mode

Red, Green, Blue, and Alpha Mode

Offers several replacing modes for each RGBA channel:

Keep

Prevents the channel from being replaced by the input material

Replace

Replaces the material for the according color channel.

Blend

Blends the materials together.

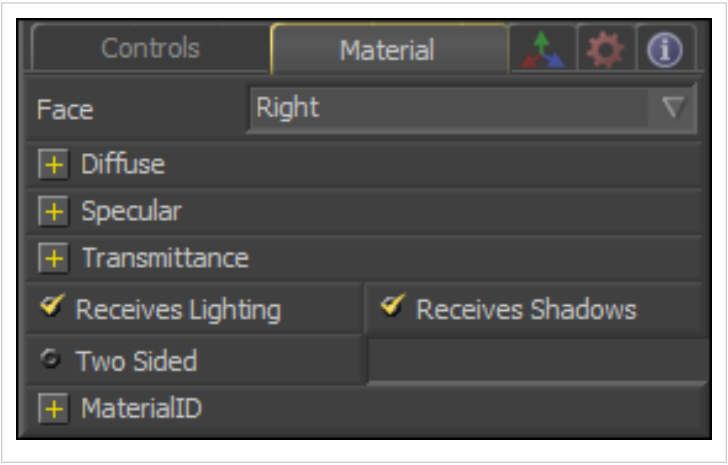
Multiply

Multiplies the according channels of both inputs.

Limit by object ID / material ID

When enabled a slider appears where the desired ID´s can be set. All other objects will keep their materials. If both options are enabled an object must satisfy both conditions.

Material Tab



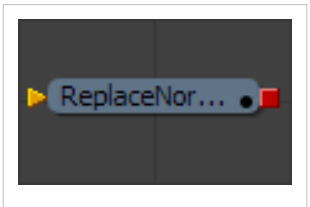
The options which appear in this tab determine the appearance the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are fully described in the Common 3D Controls section of this documentation.

If an external 3D material is connected to the tool tiles material input then the controls in this tab will be replaced with the "Using external material" label.

Replace Normals 3D

This tool can be used to recompute the normals and tangents on polygonal meshes. This tool takes a scene, modifies the meshes in the scene and passes through the lights/cameras/materials. This tool is useful when a mesh imported into Fusion has missing or incorrect normals. For example, this can happen when a portion of the geometry is mirrored during modeling.

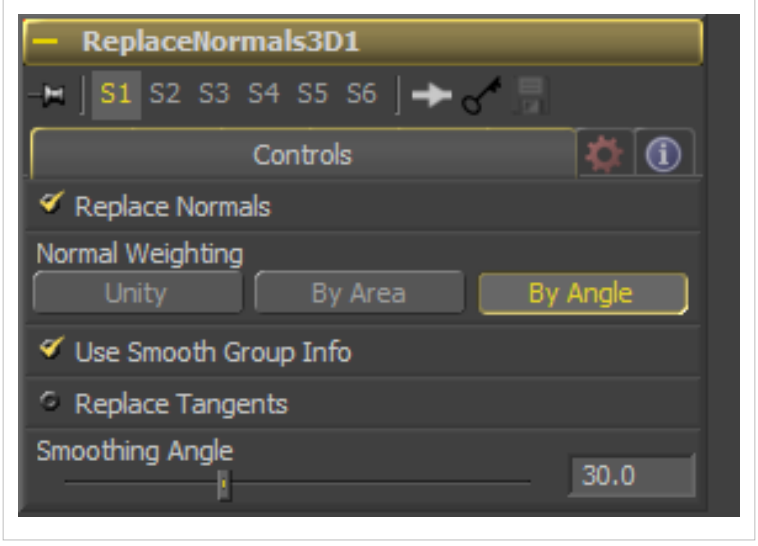
External Inputs



ReplaceNormals3D.SceneInput

[*orange, required*] Receives scene from a 3D tool output.

Controls



Replace Normals

Use this checkbox to enable or disable processing of this tool.

Normal Weighting

Each vertex of each polygon in a mesh will possess a normal. Even though a triangle is flat, the 3 vertex normals will (usually) not all point in the same direction - this is what gives a flat triangle in a sphere a rounded look when lit. When calculating what a normal should be at a vertex, the adjoining triangles are examined and their face normals are averaged together using a weighting scheme. Choosing a different weighting scheme will alter the appearance of the computed normals slightly. It is not a big difference.

Unity

Each of the adjoining triangles face normals are weighted evenly

Area

Each of the adjoining triangles face normals are weighted by the area of their respective triangles

Angle

Each of the adjoining triangles face normals are weighted by the angle they fill about that vertex.

Use Smooth Group Info

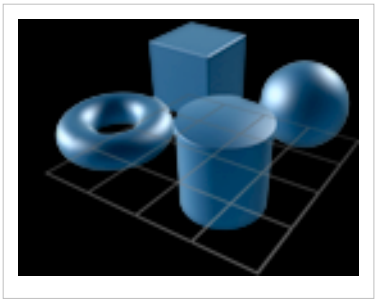
Fusion meshes possess smooth group information (eg. each cube face will belong to separate smoothgroup), but at this point smoothgroups are not editable or visualizable in the views. If this checkbox is enabled, then normal computation does not cross smooth group boundaries.

Replace Tangents

Smoothing Angle

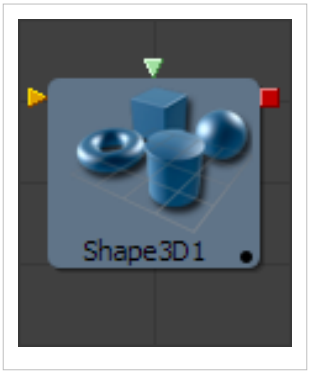
When the angle between two polygons in the surface is greater than this angle the normal computation does not cross this boundary.

Shape 3D



The Shape 3D tool is used to produce several basic primitive 3D shapes, including planes, cubes, spheres and cylinders.

External Inputs



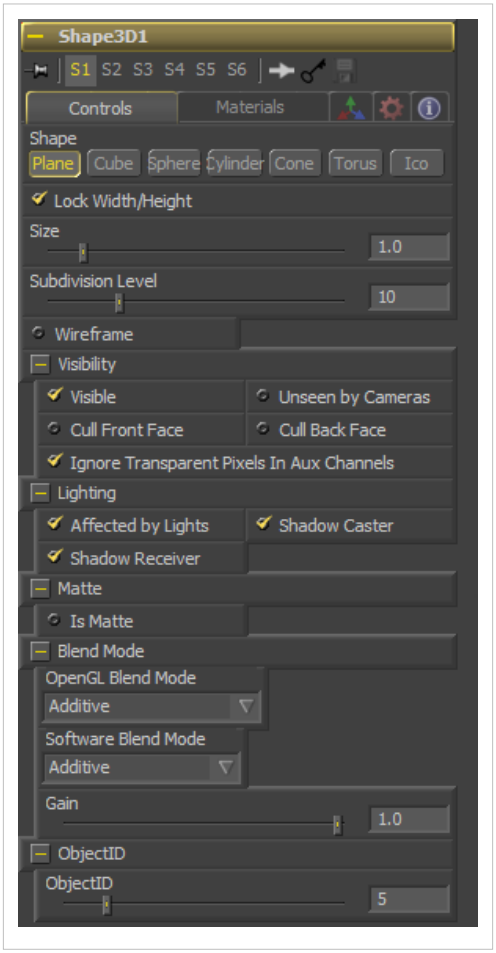
Shape3D.SceneInput

[*orange, required*] This input expects to receive a 3D scene.

Shape3D.MaterialInput

[*green, optional*] [green, optional] This input will accept either a 2D image or a 3D material. If a 2D image is provided it will be used as a diffuse texture map for the basic material built into the tool. If a 3D material is connected then the basic material will be disabled.

Controls



Shape

Select one of these options to determine which geometry primitive will be produced by the Shape 3D tool. The controls below will change to match the selected shape.

Lock Width / Height / Depth

[*Plane, Cube*] If this checkbox is selected, the Width, Height and Depth controls are locked together as a single Size slider. Otherwise, individual control over the size of the shape along each axis is provided.

Size Width / Height / Depth

[*Plane, Cube*] Used to control the size of the shape.

Cube Mapping

[*Cube*] Uses cube mapping to apply the Shape tool's texture (a 2D image connected to the texture input).

Radius

[*Sphere, Cylinder, Cone, Torus*] Sets the radius of the selected shape.

Top Radius

[*Cone*] This control is used to define a radius for the top of a Cone, making it possible to create truncated cones.

Start / End Angle

[*Sphere, Cylinder, Cone, Torus*] This range control determines how much of the sweep of the shape is drawn. A start angle of 180 and end angle of 360 would only draw half of the shape.

Start / End Latitude

[*Sphere, Torus*] This range control determines is used to slice the object by defining a latitudinal sub-section of the object.

Bottom / Top Cap

[*Cylinder, Cone*] Used for Cylinder and Cone shapes only, the Bottom Cap and Top Cap checkboxes are used to determine if the end caps of these shapes are created or if the shape is left open.

Section

[*Torus*] Used for Torus only, Section controls the thickness of the tube making up the torus.

Subdivision Level / Base / Height

[*All Shapes*] Used for all shapes, the Subdivision controls are used to determine the tessellation of the mesh composing the object. The higher the subdivision, the more vertices each shape will have.

Wireframe

Enabling this checkbox will cause the mesh to render only the Wireframe for the object. When this manual was printed, only the OpenGL renderer supported wireframe, but that may have changed in the time between printing and release.

Visibility

Visible

If the visibility checkbox is not selected, the object will not visible in the display views, nor will it be rendered into the output image by the Renderer 3D tool. A non-visible object does not cast shadows.

Unseen by Cameras

If the Unseen by Cameras checkbox is selected, the object will be visible in the display views (unless the Visible checkbox is turned off), except when viewed through a camera. The object will not be rendered into the output image by the Renderer 3D tool. Shadows cast by an Unseen object will still be visible when rendered by the software renderer, though not by the OpenGL renderer.

Cull Front Face/Back Face

Use these options to cull (eliminate) rendering and display of certain polygons in the geometry. If Cull Back Face is selected, all polygons facing away from the camera not be rendered, and will not cast shadows. If Cull Front Face is selected, all polygons facing towards the camera will likewise be dropped. Selecting both checkboxes has the same effect as deselecting the Visible checkbox.

Ignore Transparent Pixels in Aux Channels

In Fusion 5 transparent pixels were rejected by the SW/GL renderers. To be more specific the SW renderer rejected pixels with R=G=B=A=0 and the GL renderer rejected pixels with A=0. This is now optional. The reason you might want to do this is to get aux channels (eg. normals, z, UVs) for the transparent bits. For example, suppose in post you want to replace the texture on an 3D element with a texture that is transparent in certain areas with a texture that is transparent in different areas, then it would be useful to have transparent bits set aux channels (in particular UVs). As another example suppose you are doing post DoF... you will probably not want the z channel to be set on transparent areas as this will give you a false depth. Also keep in mind that this rejection is based on the final pixel color including lighting if it is on. So if you have a specular highlight on a clear glass material, this checkbox will not affect it.

Lighting

Affected By Lights

If this checkbox is not selected, lights in the scene will not affect the object, it will not receive nor cast shadows, and it will be shown at the full brightness of its colour, texture or material.

Shadow Caster

If this checkbox is not enabled, the object will not cast shadows on other objects in the scene.

Shadow Receiver

If this checkbox is not enabled, the object will not receive shadows cast by other objects in the scene.

Matte

Enabling the IsMatte option will apply a special texture to this object, causing this object to not only become invisible to the camera, but also making everything that appears directly behind the camera invisible as well. This option will override all textures. See the Matte Objects section of the 3D chapter for more information.

Is Matte

When activated, objects whose pixels fall behind the matte objects pixels in Z do not get rendered.

Opaque Alpha

Sets the alpha value of the matte object to 1. This checkbox is only visible when the IsMatte option is enabled.

Infinite Z

Sets the value in the z channel to infinite. This checkbox is only visible when the IsMatte option is enabled.

Blend Mode

A blend mode specifies which method will be used by the renderer when combining this object with the rest of the scene. The blend modes are essentially identical to those listed in the documentation for the 2D Merge tool. For a detailed explanation of each mode see the documentation for that tool.

The blending modes were originally designed for use with 2D images. Using them in a lit 3D environment can produce undesirable results. For best results use the apply modes in unlit 3D scenes rendered in software.

OpenGL Blend Mode

Use this menu to select the blending mode which will be used when the geometry is processed by the OpenGL renderer. This is also the mode used when viewing the object in the display views. Currently the OpenGL renderer only support three blending modes.

Software Blend Mode

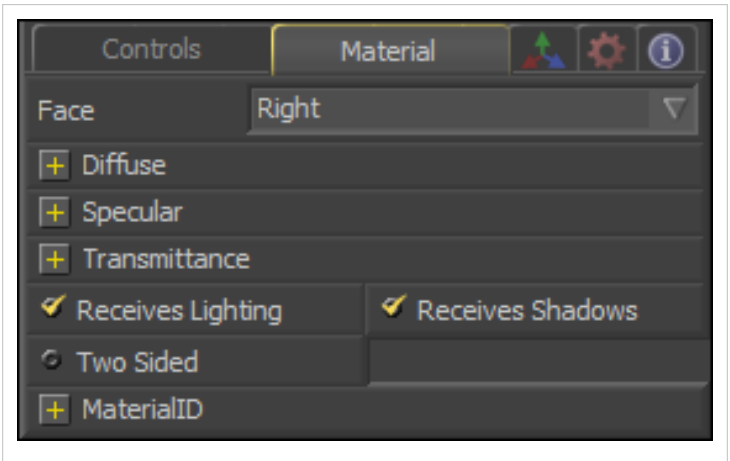
Use this menu to select the blending mode which will be used when the geometry is processed by the Software renderer. Currently the Software renderer supports all of the modes described in the Merge tool documentation except for the Dissolve mode.

Object ID

Object ID

This control is used to set the numeric identifier assigned to this object. The object ID is an integer number that will be rendered into the ObjID auxiliary channel of the rendered image when the Object ID option is enabled in the Renderer 3D tool. See the Object and Material ID section in the 3D chapter for more information.

Material Tab

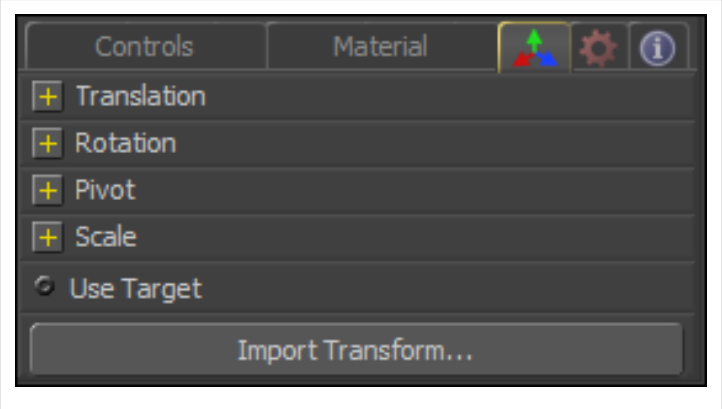


The options which appear in this tab determine the appearance the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are

fully described in the Common 3D Controls section of this documentation.

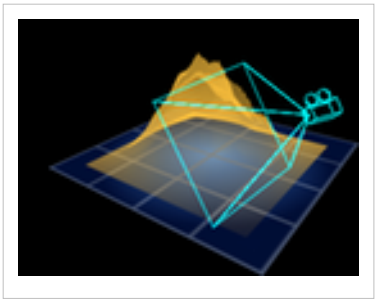
If an external 3D material is connected to the tool tiles material input then the controls in this tab will be replaced with the "Using external material" label.

Transform Tab



The options which appear in this tab determine the position of the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are fully described in the Common 3D Controls section of this documentation.

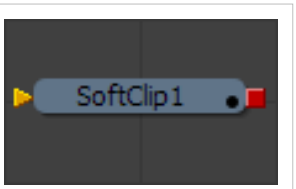
SoftClip



The SoftClip tool is used to fade out geometry and particles that get close to the camera. This to help avoid the visible 'popping off' that affects many particle systems and 3D flythroughs. This tool is very similar to the Fog 3D tool, in that it is dependent on the geometries distance from the camera.

The SoftClip tool is usually placed just before the renderer to ensure that downstream adjustments to lighting and textures do not affect the result. It can be placed in any part of the 3d portion of the flow if the soft clipping effect is only required for a portion of the scene.

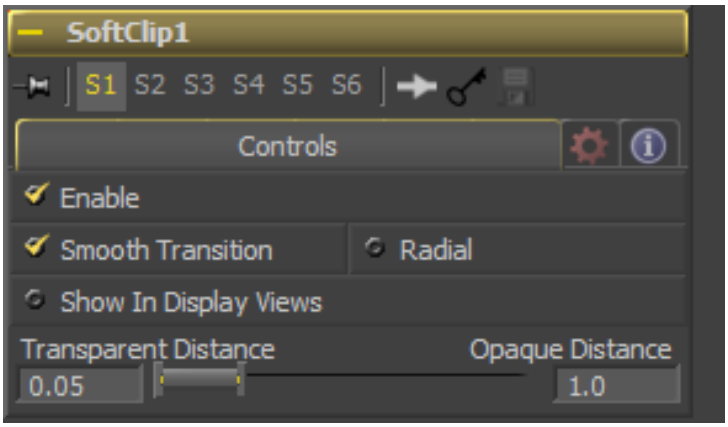
External Inputs



SoftClip.SceneInput

[*orange, required*] This input expects a 3D scene.

Controls



Enable

This checkbox can be used to enable or disable the tool.

Smooth Transition

Changes the linear gradient to a curve shaped one.

Radial

By default the softclipping is done based upon the perpendicular distance to a plane (parallel with the near plane) passing through the eye point. When the radial option is checked the radial distance to the eye point is used instead of the perpendicular distance. The problem with perpendicular distance softclipping is that when you move the camera about, as objects on the left or right side of the frustum move into the center they become less clipped even though they remain the same distance from the eye. Radial softclip fixes this. Sometimes radial softclipping is not desirable. For example if you apply softclip to an object that is close to the camera like an image plane the center of the image plane could be unclipped while the edges could be fully clipped because they are further from the eye point.

Show In Display Views

Normally the effect is only visible when the scene is viewed using a Camera tool. When enabled, the softclip becomes visible in the scene from all points of view.

Transparent/Opaque Distance

Defines the range of the softclip. The objects will begin to fade in from an opacity of 0 at the Transparent Distance and are fully visible at the opaque distance. All units are expressed as distance from the camera along the z-axis.

Text 3D



The Text3D tool is a 3D version of the 2D Text tool. The controls for this tool are mostly identical to the controls for the 2D version in almost all respects, except that it currently only supports one shading element. See Text Plus for more details on the controls found in this tool.

The Text 3D tool was based on a tool which pre-dates the Fuson 3D environment. As a result, some of the controls found in the basic primitive shapes and geometry loaders are not found in this tools controls. Specifically many of the material, lighting and matte options are not found in this tools controls. The Text 3D tool has a built in material, but unlike the other 3D tools it does not have a material input. The shading tab contains controls to adjust the diffuse and specular components. To replace this default material with a more advanced material follow the Text Plus tool with a Replace Material 3D tool. The Override 3D tool can be used to control the lighting, visibility and matte options for this tool.

One thing to beware of when network-rendering a comp that contains a Text3D tool is that each machine that does not have the font installed will fail. Fusion can not share or copy fonts to renderslaves due to legal issues.

External Inputs



Text3D.SceneInput

[*orange, required*] This input expects a 3D scene.

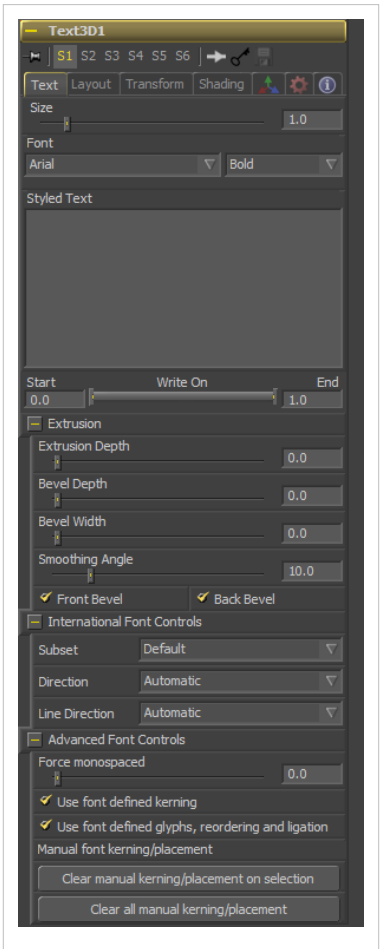
Text3D.ColorImage

[*orange, required*] This input expects a 2D image. It is only visible when the Image mode is enabled in the Material section of the Shading tab.

Text3D.BevelTexture

[*orange, required*] This input expects a 2D image. It is only visible when the Image mode is enabled in the Bevel Material section of the Shading tab.

Text



Extrusion

Extrusion Depth

An extrusion of 0 produces completely 2D text. Any value greater than 0 will extrude the text to generate text with depth.

Bevel Depth

Increase the value of the Bevel Depth slider to bevel the text . The text must have extrusion before this control has any effect.

Bevel Width

Use the Bevel Width control to increase the width of the bevel.

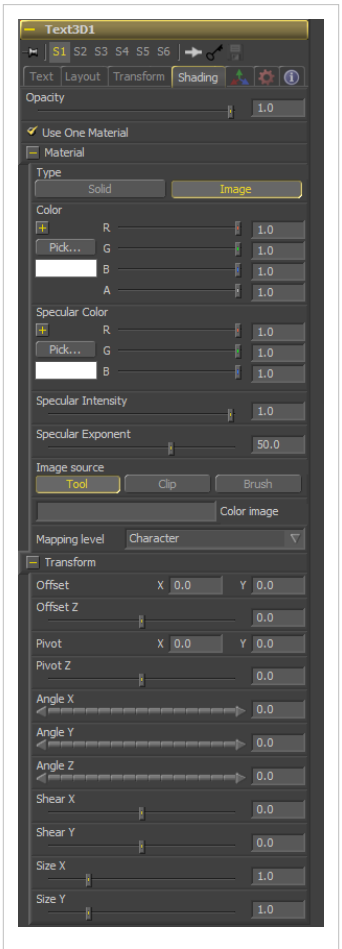
Smoothing Angle

Use this control to adjust the smoothing angle applied to the edges of the bevel.

Front/Back Bevel

Use these checkboxes to enable beveling for the front and back faces of the text separately

Shading



Opacity

Reducing the material's Opacity will decrease the color and alpha values of the specular and diffuse colors equally, making the material transparent and allowing hidden objects to be seen through the material.

Use One Material

Deselecting this option will reveal a second set of material controls for the beveled edge of the text.

Material

Type

To use a solid color texture select the Solid mode. Selecting the Image mode will reveal a new external input on the tools tile that can be connected to another 2D image.

Specular Color

Specular Color determines the color of light that reflects from a shiny surface. The more specular a material is, the glossier it appears. Surfaces like plastics and glass tend to have white specular highlights, whereas metallic surfaces like gold have specular highlights that tend to inherit their color from the material color. The basic shader material does not provide an input for textures to control the specularity of the object. Use tools from the 3D Material category when more precise control is required over the specular appearance.

Specular Intensity

Specular Intensity controls how strong the specular highlight is. If the specular intensity texture port has a valid input, then this value is multiplied by the alpha value of the input.

Specular Exponent

Specular Exponent controls the falloff of the specular highlight. The greater the value, the sharper the falloff, and the smoother & glossier the material appears. The basic shader material does not provide an input for textures to control the specular exponent of the object. Use tools from the 3D Material category when more precise control is required over the specular exponent.

Image Source

This control determines the source of the texture applied to the material. If the option is set to Tool then an input will appear on the tool tile that can be used to apply the output of a 2D tool as the texture. Selecting Clip will expose a file browser that can be used to select a image or image sequence from disk. The Brush option will provide a list of clips found in the Fusion:\Brushes folder.

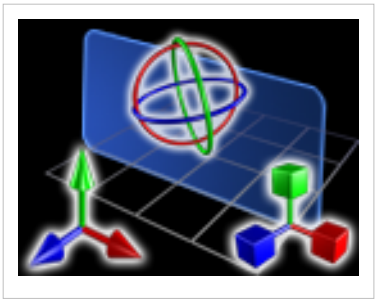
Bevel Material

This reveal only appears when the Use One Material checkbox control is selected. The controls under this reveal are an exact copy of the Material controls above, but are applied only to the beveled edge of the text.

Transform

These controls can be used to transform the material applied to the text. See the Text Plus tool for a complete description of these tools.

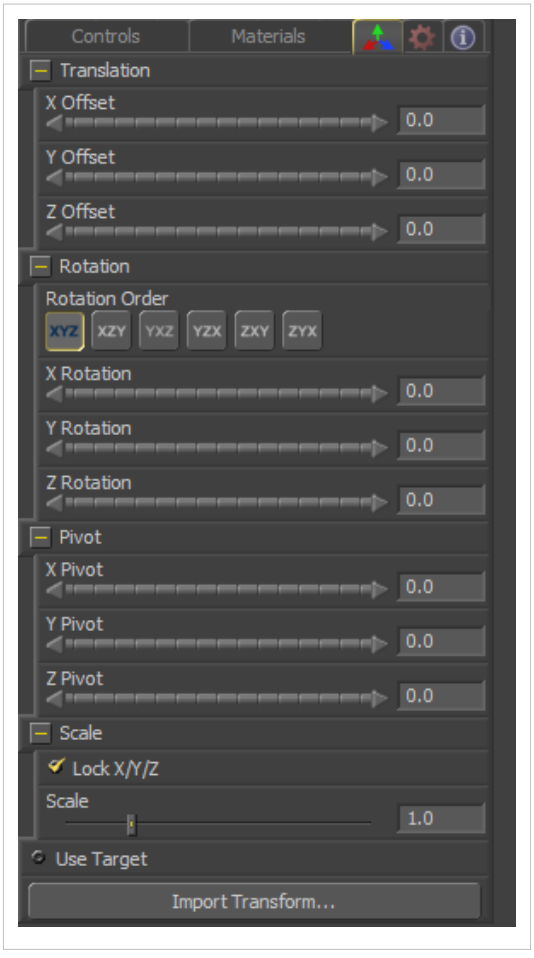
Transform 3D



The Transform 3D tool can be used to translate, rotate or scale all the elements within a scene without requiring a Merge 3D tool. This can be useful for hierarchical transformations, or for offsetting objects that are merged into a scene multiple times.

Its controls are identical to those found in other 3D tools' Transformation tabs.

3D Transform Tab



Translation

X, Y, Z Offset

These controls can be used to position the 3D element.

Rotation

Rotation Order

Use these buttons to select the order is used to apply the Rotation along each axis of the object. For example, XYZ would apply the rotation to the X axis first, followed by the Y axis and then followed by the Z axis.

X, Y, Z Rotation

Use these control to rotate the object around its pivot point. If the Use Target checkbox is selected then the rotation is relative to the position of the target, otherwise the global axis is used.

Pivot Controls

X, Y, Z Pivot

A Pivot point is the point around which an object rotates. Normally, an object will rotate around its own center, which is considered to be a pivot of 0,0,0. These controls can be used to offset the pivot from the center.

Scale

X, Y, Z Scale

If the Lock X/Y/Z checkbox is checked, a single Scale slider will be shown. This adjusts the overall size of the object. If the Lock checkbox is unchecked, individual X, Y and Z sliders will be displayed to allow scaling in any dimension. Note: If the Lock checkbox is checked, scaling of individual dimensions is not possible, even when dragging specific axes of the Transformation Widget in scale mode.

Use Target

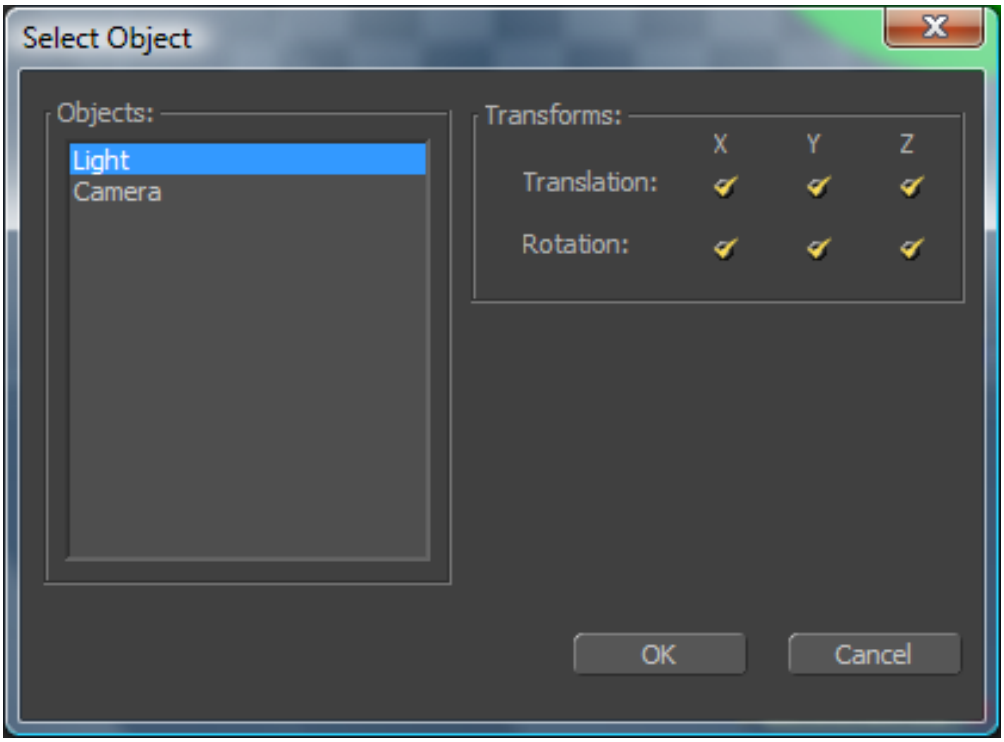
Selecting the Use Target checkbox enables a set of controls for positioning an XYZ target. When target is enabled, the object will always rotate to face the target. The rotation of the object becomes relative to the target.

Import Transform

Opens a file browser where you can select a scene file saved or exported by your 3d application. It supports the following file types:

- LightWave Scene - .lws
- Max Scene - .ase
- Maya Ascii Scene - .ma
- dotXSI - .xsi

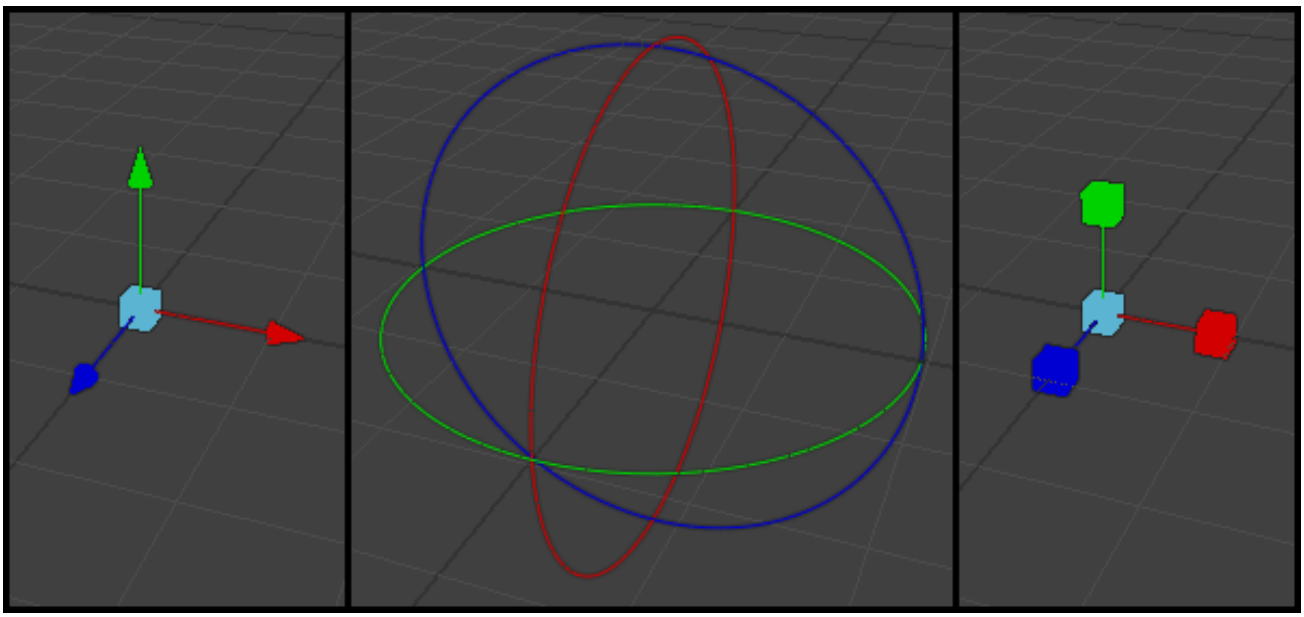
The Import Transform button will only import transformation data. To 3d geometry, lights and cameras consider using the **File -> FBX Import** option from the menus.



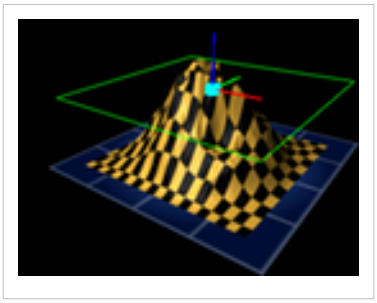
On Screen : Transformation Widget

Most of the controls in this tab are represented in the display view by a Transformation Widget with modes for transformation, rotation and scaling. To change the mode of the widget, select one of the three buttons in the toolbar along the side of the view. The modes can also be toggled using the keyboard shortcut *q* for translation, *w* for rotation and *e* for scaling. In all three modes, individual axes of the control may be dragged to affect just that axis, or the center of the control may be dragged to affect all three axes.

The scale sliders for most 3D tools defaults to locked, which causes uniform scaling of all three axis. Unlock the Lock X/Y/Z Scale checkbox to scale an object on a single axis only.



UV Map



The UV Map 3D tool replaces the UV texture coordinates on the geometry in the scene. These coordinates tell Fusion how to apply a texture to an object. The tool provides planar, cylindrical, spherical, XYZ and Cubic mapping modes, which can be applied to basic Fusion primitives as well as imported geometry. The position, rotation and scale of the texture co-ordinates can be adjusted to allow for fine control over the texture's appearance. An option is also provided to lock the UV produced by this tool to animated geometry according to a reference frame. This can be used to ensure that textures applied to animated geometry do not slide.

While it is possible to adjust the global properties of the selected mapping mode, it is NOT possible to manipulate the UV coordinates of individual vertices directly from within Fusion. The onscreen controls drawn in the display views are for reference only, and can not be manipulated by the artist.

To utilize the full capabilities of the UV Map 3D tool it helps to have a basic understanding of how 2D images are mapped onto 3D geometry. When a 2D image is applied to a 3D surface, it is converted into a texture map which uses UV coordinates to determine how the image translates to the object. Each vertex on a mesh has a (u, v) texture coordinate pair which describes the appearance the object will take when it is unwrapped and flattened. Different mapping modes use different methods for working out how the vertices transform into a flat 2D texture.

When using the UV Map 3D tool to modify the texture co-ordinates on a mesh it is best to do so using the default coordinate system of the mesh or primitive. So the typical workflow would look like Shape 3D -> UV Map 3D -> Transform 3D. The transformation tab on the shape tool would be left to it's default values, and the Transform 3D tool following the UV Map 3D does any adjustments needed to place the tool in the scene. Modifying/animating the transform of the Shape tool will cause the texture to slide across the shape, which is generally undesirable.

The UV Map 3D tool modifies texture coordinates per vertex and not per pixel. If the geometry the UV map is applied to is poorly tesselated, then undesirable artifacts may appear.

The UV Map 3D tool does *not* put a texture or material on the mesh, it only modifies the texture coordinates that the materials will use. This can be kind of confusing because the material usually sits upstream. For example a composition containing the tools

Loader -> Blinn -> Shape 3D (cube) -> UV Map 3D -> Renderer 3D

. In this situation the Shape tool processes and creates the geometry for the cube with the blinn material attached to it. At this point it has the default texture coordinates assigned to it by the Shape tool. Then that cube geometry is passed to UV Map 3D which replaces the

texture coordinates on the cube with different ones. When a pixel with the blinn material is being rendered, it will use the modified UV coordinates to apply the texture.

Camera projections with UV Map 3D

The camera mapping mode makes it possible to project texture coordinates onto geometry through a camera. Enable the Camera mapping mode on the UV Map 3D tool. Directly connect the camera that will be used to create the UV coordinates to the new ‘Camera’ input that appears on the UV Map 3D tool's tile in the flow.

Note that this does not directly project an image throught the camera. The image to be projected should be connected to the diffuse texture input of whatever materialk is assigned to the objects. When the texture is applied it will use the UV coordinates created by the camera. Because this is a texture projection and not light the alpha channel of the texture will correctly set the opacity of the gepmetry.

See the Camera 3D and Projector 3D tool for alternate approaches to projection.

The projection can optionally be locked to the vertices as it appears on a selected frame. This will fail if the number of vertices in the mesh change over time, as Fusion must be able to match up the mesh at the reference time and the current time. To be more specific, vertices may not be created or destroyed or reordered. For this reason projection locking does not work for many particle systems, for primitives with animated subdivisions, and with duplicate tools using non-zero time offsets.

Controls



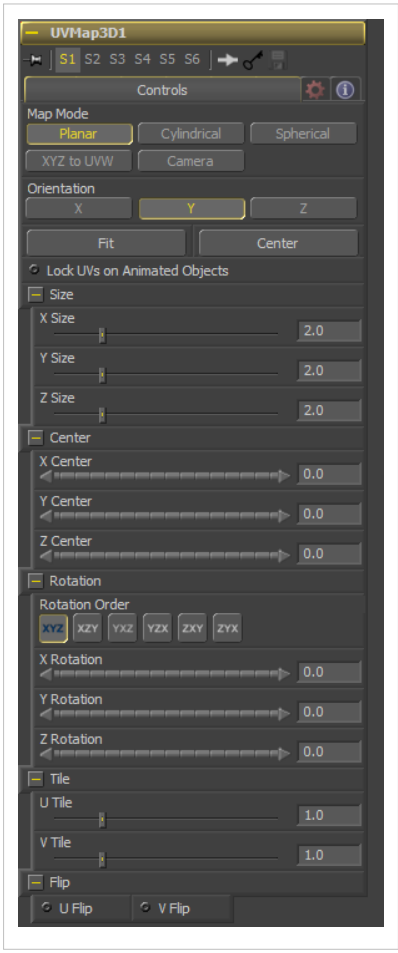
UVMap3D.SceneInput

[*orange, required*] This input expects to receive a 3D scene.

UVMap3D.CameraInput

[*green, optional*] This input expects the output of the Camera 3D tool. It is only visible when the Camera map mode is used.

Controls



Map Mode

Defines how the texture coordinates are created. Think of it as a virtual geometry which projects the uv space on the object.

Planar

Creates the UV coordinates using a plane.

Cylindrical

Creates the UV coordinates using a cylindrial shaped object.

Spherical

The UV´s are created using a sphere.

XYZ to UVW

The position coordinates of the vertices are converted to UVW coordinates directly. This is used for working with procedural textures.

Camera

Enables the camera input port of the tool. After connecting a camera to it, the texture coordinates are created based on camera projection.

Orientation X/Y/Z

Defines the reference axis for aligning the Map Mode.

Fit

Clicking this butten will fit the Map Mode to the bounding box of the input scene.

Center

Clicking this button will move the center of the Map Mode to the bounding box center of the input scene.

Lock UVs on Animated Objects

If the object is animated the UV´s can be locked to it. Enabling this option will do so and also reveal the Ref Time slider where it is possible to choose a reference frame for the UV mapping. Using this feature, it is not required to animate the UVMap parameters. It is enough to set up the UV map at the reference time.

Size X/Y/Z

Defines the size of the projection object

Center X/Y/Z

Defines the position of the projection object

Rotation/ Rotation Order Order

Use these buttons to select which order is used to apply the Rotation along each axis of the object. For example, XYZ would apply the rotation to the X axis first, followed by the Y axis and then followed by the Z axis.

Rotation X/Y/Z

Sets the orientation of the projection object for each axis, dependent from the rotation order.

Tile U/V/W

Defines how often a texture fits into the projected uv space on the according axis. Note that the uvw coordinates are transformed not a texture. Works best when used in conjunction with the Create Texture tool.

Flip U/V/W

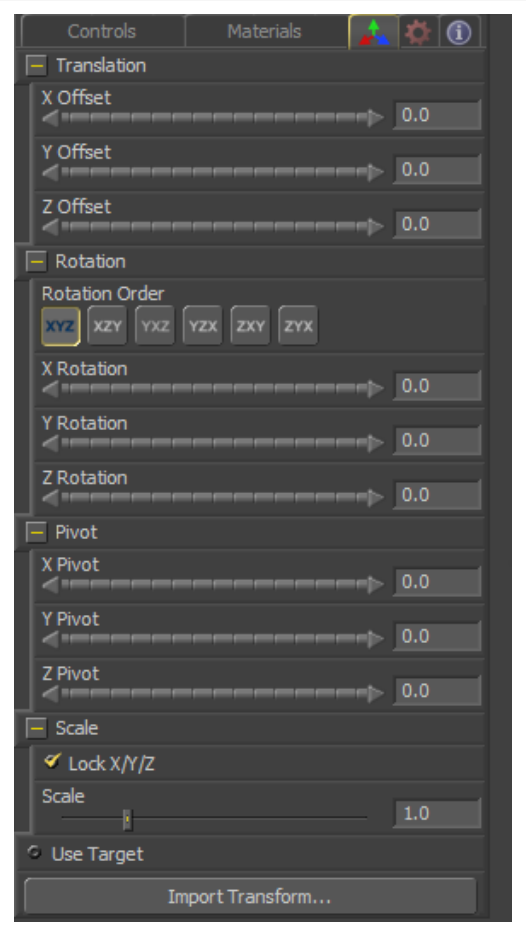
Mirrors the texture coordinates around the according axis.

Common 3D Controls

There are two tabs which are present on nearly every one of the 3D category of tools. Specifically, the Transform tab contain controls necessary for manipulating the position of an object in 3D space, while the Material tab contains controls used to defining the basic material and surface characteristics.

Rather than repeat the same information for each tool the documentation for these controls have been consolidated into this page.

3D Transform Tab



Translation

X, Y, Z Offset

These controls can be used to position the 3D element.

Rotation

Rotation Order

Use these buttons to select which order is used to apply Rotation along each axis of the object. For example, XYZ would apply the rotation to the X axis first, followed by the Y axis and then finally the Z axis.

X, Y, Z Rotation

Use these control to rotate the object around its pivot point. If the Use Target checkbox is selected then the rotation is relative to the position of the target, otherwise the global axis is used.

Pivot Controls

X, Y, Z Pivot

A Pivot point is the point around which an object rotates. Normally, an object will rotate around its own center, which is considered to be a pivot of 0,0,0. These controls can be used to offset the pivot from the center.

Scale

X, Y, Z Scale

If the Lock X/Y/Z checkbox is checked, a single Scale slider will be shown. This adjusts the overall size of the object. If the Lock checkbox is unchecked, individual X, Y and Z sliders will be displayed to allow individual scaling in each dimension. Note: If the Lock checkbox is checked, scaling of individual dimensions is not possible, even when dragging specific axes of the Transformation Widget in scale mode.

Use Target

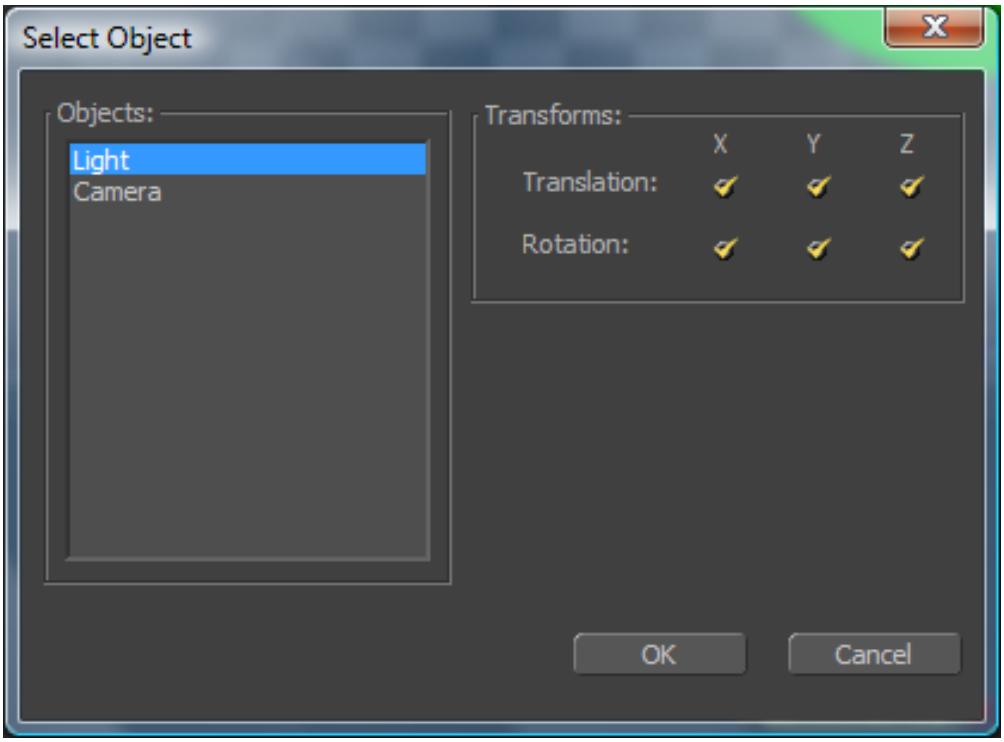
Selecting the Use Target checkbox enables a set of controls for positioning an XYZ target. When target is enabled, the object will always rotate to face the target. The rotation of the object becomes relative to the target.

Import Transform

Opens a file browser where you can select a scene file saved or exported by your 3d application. It supports the following file types:

- LightWave Scene - .lws
- Max Scene - .ase
- Maya Ascii Scene - .ma
- dotXSI - .xsi

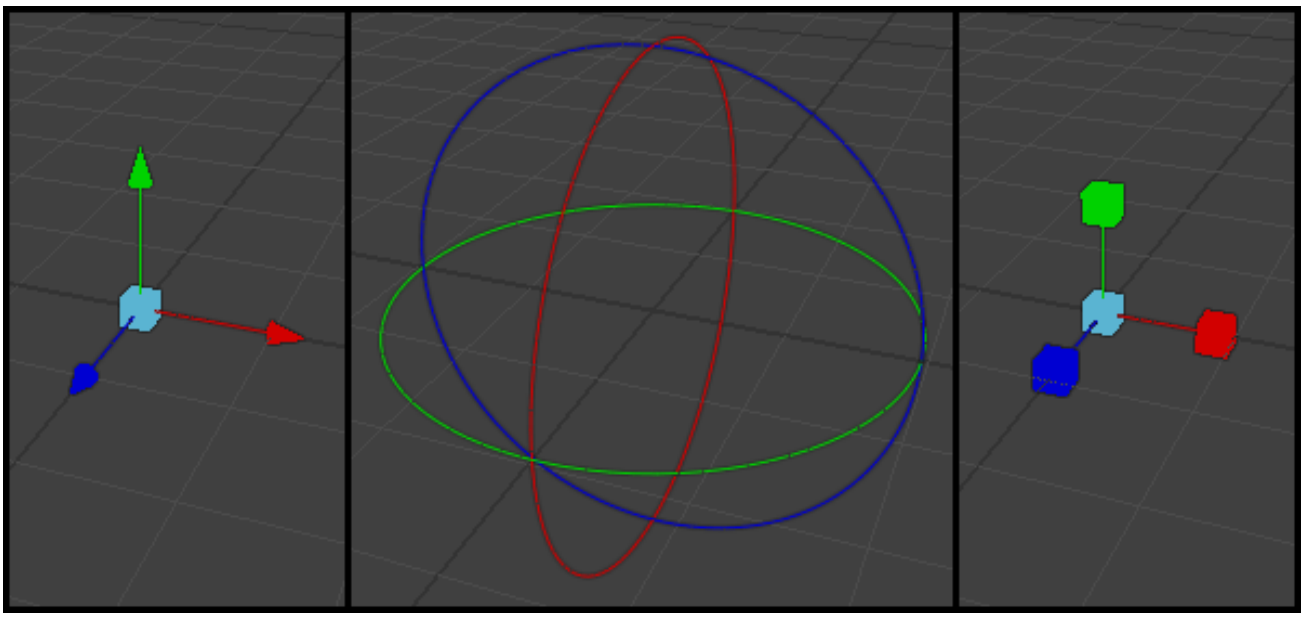
The Import Transform button will only import transformation data. For 3d geometry, lights and cameras consider using the **File -> FBX Import** option from the menus.



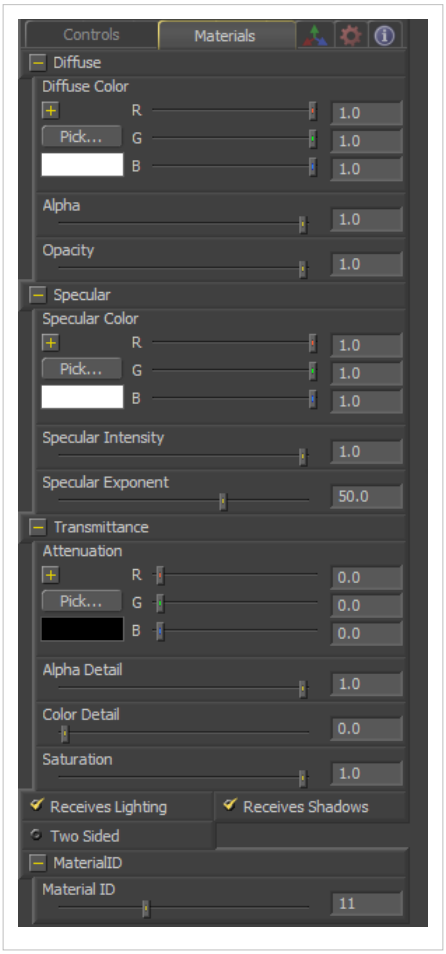
On Screen : Transformation Widget

Most of the controls in this tab are represented in the display view by a Transformation Widget with modes for transformation, rotation and scaling. To change the mode of the widget, select one of the three buttons in the toolbar along the side of the view. The modes can also be toggled using the keyboard shortcut *q* for translation, *w* for rotation and *e* for scaling. In all three modes, individual axes of the control may be dragged to affect just that axis, or the center of the control may be dragged to affect all three axes.

The scale sliders for most 3D tools defaults to locked, which causes uniform scaling of all three axis. Unlock the Lock X/Y/Z Scale checkbox to scale an object on a single axis only.



3D Material Tab



The controls in the material tab are used to determine the appearance of the 3D object when lit. Most of these controls directly affect how the object interacts with light. The controls in this tab represent a basic shader with a limited range of controls. For more advanced control over the objects appearance Fusion provides a wide range of 3D Material tools which can be used to assemble a more finely detailed and precise shader.

When a shader is constructed using the 3D Material tools and connected to the 3D Objects material input the controls in this tab will disappear, to be replaced by a label that indicates that an external material is currently in use.

Diffuse

Diffuse

Diffuse describes the base surface characteristics without any additional effects like reflections or specular highlights.

Diffuse Color

The Diffuse Color determines the basic color of an object when the surface of that object is either lit indirectly or lit by an ambient light. If a valid image is provided to the tools diffuse texture input, then the RGB values provided here will also be multiplied by the color values of the pixels in the diffuse texture. The alpha channel of the diffuse material can be used to control the transparency of the surface.

Alpha

This slider sets the material's Alpha channel value. This affects diffuse and specular colors equally, and affects the alpha value of the material in the rendered output. If the tools diffuse texture input is used then the Alpha value provided here is multiplied by the alpha channel of the pixels in the image.

Opacity

Reducing the material's Opacity will decrease the color and alpha values of the specular and diffuse colors equally, making the material transparent and allowing hidden objects to be seen through the material.

Specular

The *Specular* section provides controls for determining the characteristics of light which reflects towards the viewer. These controls affect the appearance of the specular highlight which appears on the surface of the object.

Specular Color

Specular Color determines the color of light that reflects from a shiny surface. The more specular a material is, the glossier it appears. Surfaces like plastics and glass tend to have white specular highlights, whereas metallic surfaces like gold have specular highlights that tend to inherit their color from the material color. The basic shader material does not provide an input for textures to control the specularity of the object. Use tools from the 3D Material category when more precise control is required over the specular appearance.

Specular Intensity

Specular Intensity controls how strong the specular highlight is. If the specular intensity texture input has a valid connection, then this value is multiplied by the alpha value of the input.

Specular Exponent

Specular Exponent controls the falloff of the specular highlight. The greater the value, the sharper the falloff, and the smoother & glossier the material appears. The basic shader material does not provide an input for textures to control the specular exponent of the object. Use tools from the 3D Material category when more precise control is required over the specular exponent.

Transmittance

Transmittance controls the way light passes through a material. For example, a solid blue sphere will cast a black shadow, but one made of translucent blue plastic would cast a much lower density blue shadow.

There is a separate opacity option. Opacity determines how transparent the actual surface is when it is rendered. Fusion allows for adjusting both opacity and transmittance separately. This might be a bit counter-intuitive to artists who are unfamiliar with 3D software at first. It is possible to have a surface that is fully opaque but transmits 100% of the light arriving upon it, effectively making it a a luminous / emissive surface.

Attenuation

Attenuation determines how much color is transmitted through the object. For an object to have transmissive shadows, set the attenuation to (1, 1, 1), which means 100% of green, blue, red light pass through the object. Setting this color to RGB (1, 0, 0) means that the material will transmit 100% of the red arriving at the surface but none of the green or blue light. This allows for 'stained glass' shadows.

Alpha Detail

When the Alpha Detail slider is set to 0, the alpha channel of the object is ignored and the entire object casts a shadow. If it is set to 1, the alpha channel determines what portions of the object cast a shadow.

Color Detail

The Color Detail slider modulates light passing through the surface by the diffuse color + texture colors. Use this to throw a shadow that contains color details of the texture applied to the object. Increasing the slider from 0 to 1 brings in more of diffuse color + texture color into the shadow. Note that the alpha and opacity of the object is ignored when transmitting color, allowing an object with a solid alpha to still transmit its color to the shadow.

Saturation

The Saturation slider controls the saturation of the color component transmitted to the shadow. Setting this to 0.0 will result in monochrome shadows.

Receives Lighting/Shadows

These checkboxes control whether the material is affected by lighting and shadows in the scene. If turned off, the object will always be fully lit and/or unshadowed.

Two Sided Lighting

This makes the surface effectively two-sided by adding a second set of normals facing the opposite direction on the back side of the surface. This is normally off, to increase rendering speed, but can be turned on for 2D surfaces or for objects that are not fully enclosed, to allow the reverse or interior surfaces to be visible as well.

Normally, in a 3D application only the front face of a surface is visible and the back face is culled, so that if a camera were to revolve around a plane in a 3D application when it reached the backside, the plane would become invisible. Making a plane two sided in a 3D application is equivalent to adding another plane on top of the first but rotated by 180 degrees so the normals are facing the opposite direction on the backside. Thus, when you revolve around the

back, you see the second image plane which has its normals facing the opposite way.

Fusion does exactly the same thing as 3D applications when you make a surface two sided. The confusion about what two-sided does arises because Fusion does not cull backfacing polygons by default. If you revolve around a one-sided plane in Fusion you will still see it from the backside (but you are seeing the frontside bits duplicated through to the backside as if it were transparent). Making the plane two sided effectively adds a second set of normals to the backside of the plane.

Note this can become rather confusing once you make the surface transparent, as the same rules still apply and produce a result which is counter-intuitive. If you view from the frontside a transparent two-sided surface illuminated from the backside, it will look unlit.

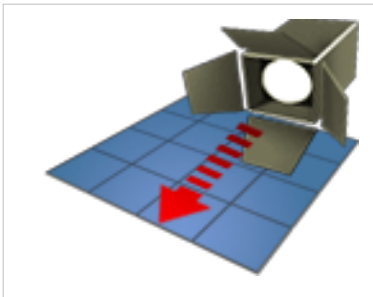
Material ID

Material ID

This control is used to set the numeric identifier assigned to this material. The Material ID is an integer number that will be rendered into the MatID auxiliary channel of the rendered image when the Material ID option is enabled in the Renderer 3D tool. See the Object and Material ID section in the 3D chapter for more information.

3D Lights

Ambient



An Ambient Light is a directionless light that globally illuminates a scene. It has no real position or rotation, although an onscreen widget will appear in the views to indicate that a light is present in the scene. Position controls for the widget are provided to make it possible to move the widget out of the way of other geometry, if necessary.

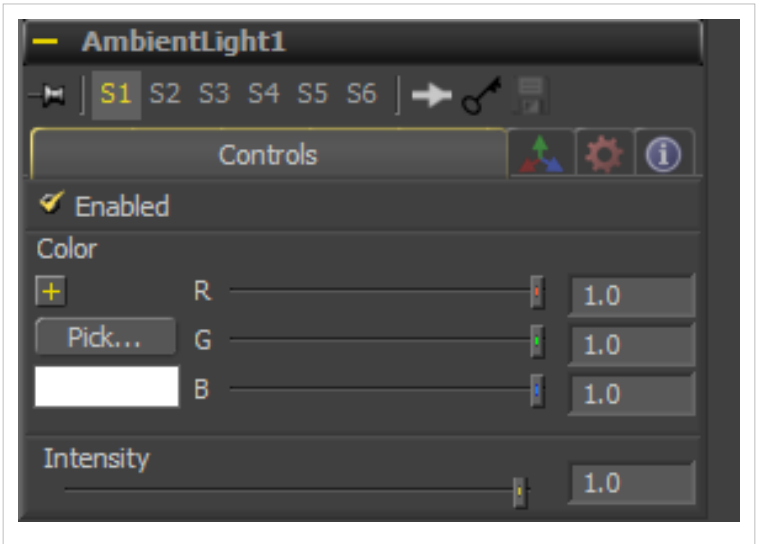
External Inputs



AmbientLight.SceneInput

[*orange, optional*] This input expects 3D scene. If a scene is provided the transform controls in this tool will apply to the entire scene provided.

Controls Tab



Enabled

When the Enabled checkbox is selected, the ambient light affects the scene. Clear the checkbox to turn off the light.

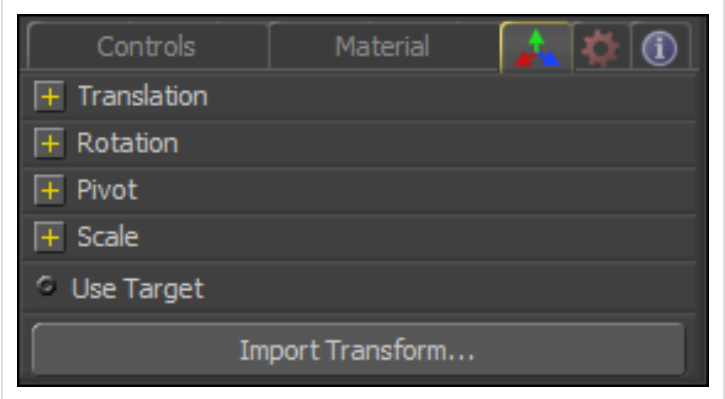
Color

Use this standard Color control to set the color of the light.

Intensity

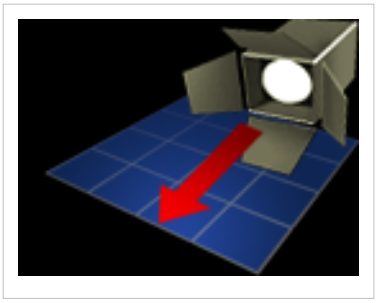
Use this slider to set the Intensity of the ambient light. A value of .2 indicates 20% percent light. A perfectly white texture lit only with a .2 ambient light would render at 20% grey (.2, .2, .2)

Transform Tab



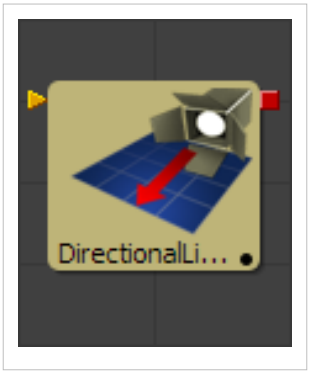
The options which appear in this tab determine the position of the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are fully described in the Common 3D Controls section of this documentation.

Directional



A Directional Light is a light with a clear direction but without a clear source. This light shows an onscreen widget, but the position of the widget has no meaning. The rotation of the widget is used to determine from where in the scene the light appears to be coming.

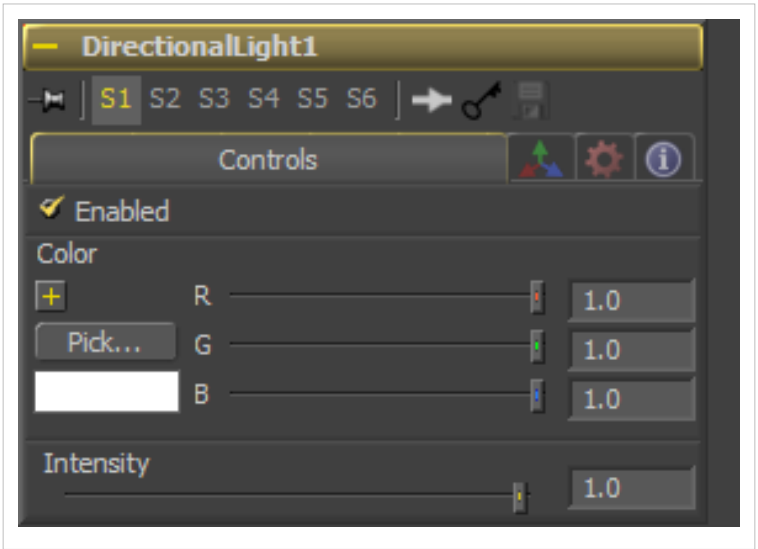
External Inputs



DirectionalLight.SceneInput

[*orange, optional*] This input expects 3D scene. If a scene is provided the transform controls in this tool will apply to the entire scene provided.

Control Tab



This tab contains all parameters for the tool

Enabled

When the Enabled checkbox is selected, the directional light affects the scene. Clear the checkbox to turn off the light.

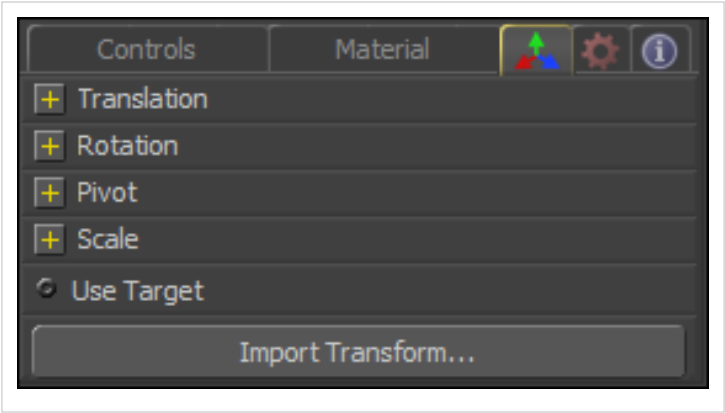
Color

Use this standard Color control to set the color of the light.

Intensity

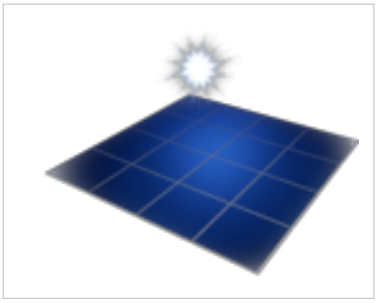
Use this slider to set the Intensity of the ambient light. A value of .2 indicates 20% percent light.

Transform Tab



The options which appear in this tab determine the position of the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are fully described in the Common 3D Controls section of this documentation.

Point Light



A Point Light is a light source with a clear position in space that emits light in all directions. A lightbulb is a point light, as is the sun, although light from the sun can appear to be ambient due to scattering from the atmosphere.

This light shows an onscreen widget, although only the position of the widget affects the light. Since the light is a 360 degree source the rotation of the widget has no meaning. Unlike both ambient and directional lights, a point light may falloff with distance.

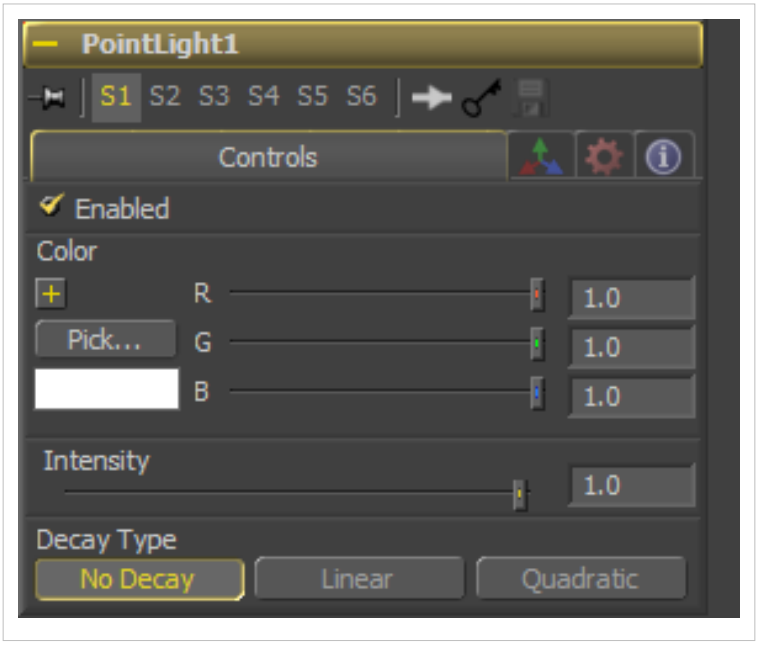
External Inputs



PointLight.SceneInput

[*orange, optional*] This input expects 3D scene. If a scene is provided the transform controls in this tool will apply to the entire scene provided.

Controls Tab



Enabled

When the Enabled checkbox is selected, the point light affects the scene. Clear the checkbox to turn off the light.

Color

Use this standard Color control to set the color of the light.

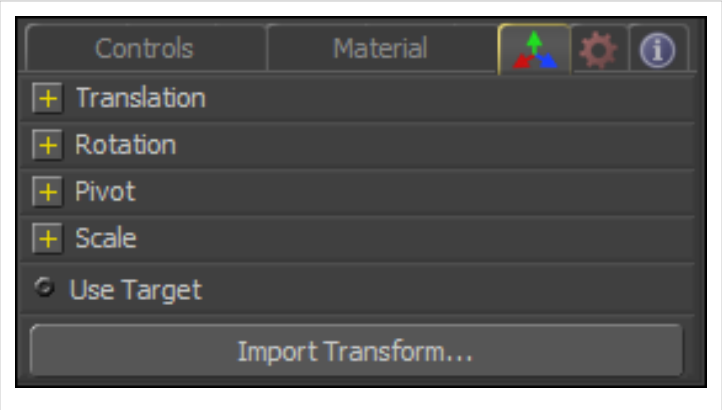
Intensity

Use this slider to set the Intensity of the ambient light. A value of .2 indicates 20% percent light.

Decay Type

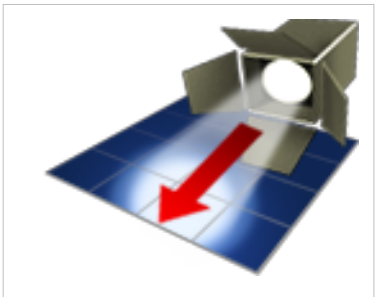
A point light defaults to *No Decay*, meaning that its light has equal intensity at all points in the scene. To cause the intensity to falloff with distance, set the Decay Type either to *Linear* or *Quadratic* modes.

Transform Tab



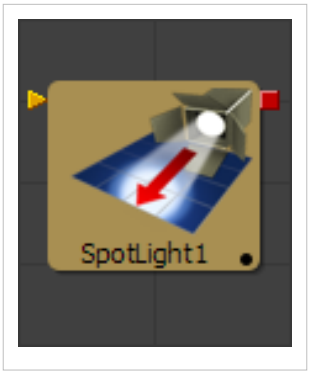
The options which appear in this tab determine the position of the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are fully described in the Common 3D Controls section of this documentation.

Spot Light



A Spotlight is a light that comes from a specific point and that has a clearly defined cone, with falloff of the light to the edges. Experienced stage and theatre lighting technicians will recognize the spotlight as being very similar to standard luminaires that are used in live productions. This is the only type of light currently capable of casting shadows.

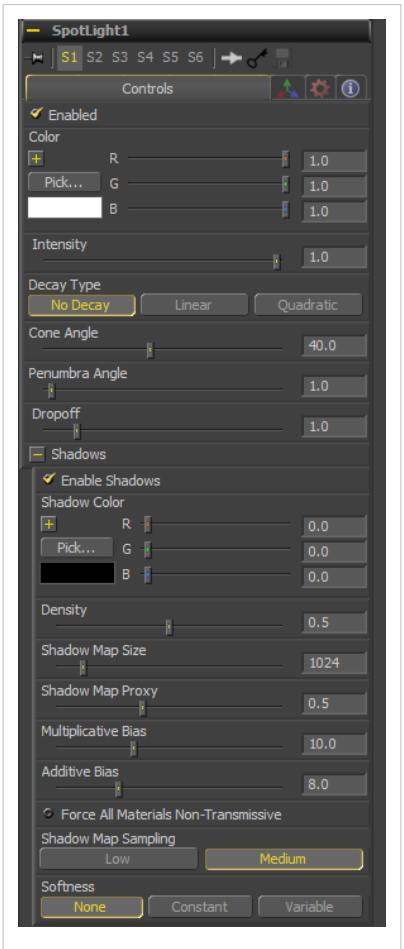
External Inputs



SpotLight.SceneInput

[*orange, optional*] This input expects 3D scene. If a scene is provided the transform controls in this tool will apply to the entire scene provided.

Controls



This tab contains all parameters for the tool

Enabled

When this checkbox is selected the spotlight light affects the scene. Clear the checkbox to turn off the light.

Color

Use this standard color control to set the color of the light.

Intensity

Use this slider to set the intensity of the spotlight.

Decay Type

A spotlight defaults to No Falloff, meaning that its light has equal intensity on geometry regardless of the distance from the light to the geometry. To cause the intensity to falloff with distance, set the Decay type either to Linear, or Quadratic modes.

Cone Angle

The Cone angle of the light refers to the width of the cone where the light emits its full intensity. The larger the angle the wider the cone angle, up to a limit of 90 degrees.

Penumbra Angle

The penumbra angle determines the area beyond the cone angle where the light's intensity falls off towards 0. A larger penumbra angle defines a larger falloff, while a value of 0 generates a hard edged light.

Dropoff

The dropoff controls how quickly the penumbra angle falls off from full intensity to 0.

Shadows

This section provides several controls used to define the shadowmap used when this spotlight creates shadows. See the Lights and Shadows chapter for details.

Enable Shadows

The Enable Shadows checkbox should be selected if the light is to produce shadows. This defaults to selected.

Shadow Color

Use this standard Color control to set the color of the shadow. This defaults to black (0, 0, 0).

Density

The shadow Density determines how opaque the shadow will be. A density of 1.0 will produce a completely transparent shadow, whereas lower values make the shadow transparent.

Shadow Map Size

The Shadow Map Size control determines the size of the bitmap used to create the shadow map. Larger values will produce more detailed shadow maps at the expense of memory and performance.

Shadow Map Proxy

Shadow Map Proxy determines the size of the shadow map used for when the Proxy or Auto Proxy modes are enabled. A value of 0.5 would produce a shadow map at half the resolution defined in the Shadow Map Size.

Multiplicative/Additive Bias

Shadows are essentially textures applied to objects in the scene so there will occasionally be z-fighting, where the portions of the object that should be recieving the shadows render over top of the shadow instead. Biasing works by adding a small depth offset to move the shadow away from the surface it is shadowing, eliminating the z-fighting. Too little bias and the objects can self-shadow themselves. Too much bias and the shadow can become separated from the surface. Make adjustments to the Multiplicative Bias first, then fine tune the result using the Additive Bias control.

See the Multiplicative And Additive Bias section of the 3D chapter for examples and more information.

Force All Materials Non-Transmissive

Normally, a RGBAZ shadowmap is used when rendering shadows. By enabling this option you are forcing the renderer to use a Z only shadowmap. This can result in significantly faster shadow rendering while using a fifth as much memory. The disadvantage is that you can no longer cast 'stained-glass' like shadows.

Shadow Map Sampling

Sets the quality for sampling of the shadow map (WIP-note: Ask STephen)

Softness

Soft edges in shadows are produced by filtering the shadowmap when it is sampled. Fusion has three separate filtering methods available when rendering shadows which produce different effects.

None

Shadows will have a hard edge. No filtering of the shadowmap is done at all. The advantage of this method is that you only have to sample one pixel in the shadowmap so it is fast.

Constant

Shadows edges will have a constant softness. A filter with a constant width is used when sampling the shadowmap. The size of the filter is controlled by adjusting the Constant Softness slider. Note that the larger you make the filter, the longer that it will take to render the shadows.

Variable

The softness of shadow edges will grow the further away the shadow receiver is from the shadow caster. The variable softness is achieved by changing the size of the filter based on the distance between the receiver and caster. When this option is selected, the Softness Falloff, Min Softness and Max Softness sliders appear.

Constant Softness

If the Softness is set to constant, then this slider will appear. It can be used to set the overall softness of the shadow.

Softness Falloff

The Softness Falloff slider appears when the Softness is set to variable. This slider controls how fast the softness of shadow edges grows with distance. To be more precise, it controls how fast the shadowmap filter size grows based upon the distance between shadow caster and receiver. Its affect is mediated by the values of the min and max softness sliders.

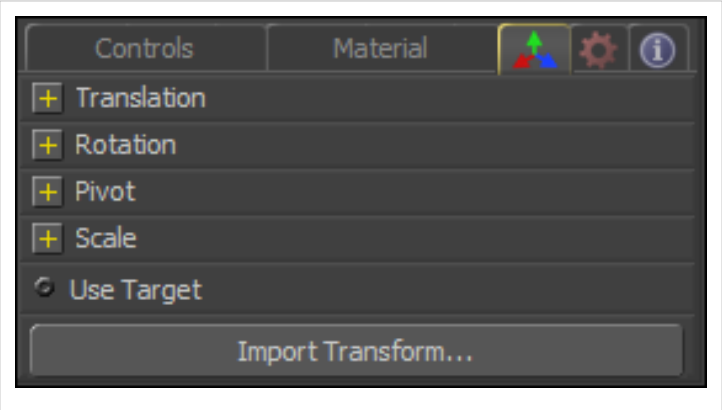
Min Softness

The Min Softness slider appears when the Softness is set to variable. This slider controls the Minimum Softness of the shadow. The closer the shadow is to the object casting the shadow, the sharper it will be up to the limit set by this slider.

Max Softness

The Max Softness slider appears when the Softness is set to variable. This slider controls the Maximum Softness of the shadow. The further the shadow is from the object casting the shadow, the softer it will be up to the limit set by this slider.

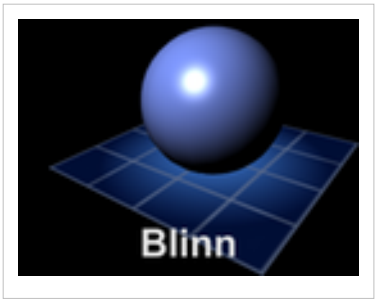
Transform Tab



The options which appear in this tab determine the position of the geometry created by this tool. Since these controls are identical on all tools that generate geometry, these controls are fully described in the Common 3D Controls section of this documentation.

3D Materials

Blinn



The Blinn tool is a basic illumination material which can be applied to geometry in the 3D scene. It describes how the object will respond to light, and provides a large number of texture map inputs to allow fine control over the diffuse, specular and bumpmap components of the material.

The standard basic material provided in the Material tab of most geometry tools is a simplified version of the Blinn tool. The primary difference is that the Blinn tool provides additional texture map inputs beyond just diffuse.

The Blinn tool outputs a 3D Material which can be connected to the material inputs on any 3D geometry tool.

The Blinn model implemented by Fusion calculates the highlight as the dot product of the surface normal and the half angle vector between lightsource and viewer (dot(N, H)). This may not always match the Blinn model illumination model used by other 3D applications. For a technical description of the Blinn shader see http://en.wikipedia.org/wiki/Blinn

External Inputs



Blinn.DiffuseTex

[*orange, optional*] This input will accept a 2D image or a 3D material to be used as a diffuse texture map.

Blinn.SpecularColorTex

[*green, optional*] This input will accept a 2D image or a 3D material to be used as a specular color texture map.

Blinn.SpecularIntensityTex

[*magenta, optional*] This input will accept a 2D image or a 3D material to be used as an intensity map for the materials specular highlights. When the input is a 2D image the

alpha channel is used to create the map while the color channels are discarded.

Blinn.SpecularExponentTex

[*light blue, optional*] This input will accept a 2D image or a 3D material to be used as an falloff map for the materials specular highlights. When the input is a 2D image the alpha channel is used to create the map while the color channels are discarded.

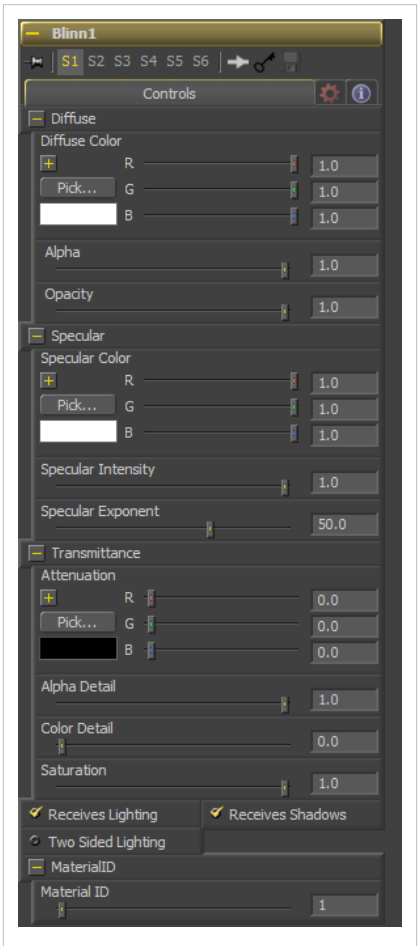
Blinn.BumpmapTex

[*white, optional*]This input will accept a 2D image or a 3D material then uses the RGB information as texture-space normals.

Each of these inputs multiplies the pixels in the texture map by the equivalently named parameters in the tool itself. This provides an effective method for "scaling" parts of the material.

When tools have as many inputs as this one does it is often difficult to make connections any precision. Hold the *CTRL* key down while dragging the output from another tool over the tool tile, and keep holding *CTRL* when releasing the *left mouse button*. A small menu listing all of the inputs provided by the tool will appear. Click on the desired input to complete the connection.

Controls



Diffuse

Diffuse describes the base surface characteristics without any additional effects like reflections or specular highlights. In addition to defining the base color of an object, the diffuse color also defines the transparency of the object. The alpha in a diffuse texture map can be used to make portions of the surface of any object the material is applied to transparent.

Diffuse Color

A materials diffuse color describes the base color presented by the material when it is lit indirectly or by ambient light. If a diffuse texture map is provided then the color value provided here is multiplied by the color values in the texture.

Alpha

This slider sets the material's Alpha channel value. This affects diffuse and specular colors equally, and affects the alpha value of the material in the rendered output. If a diffuse texture map is provided then the alpha value set here is multiplied by the alpha values in the texture map.

Opacity

Reducing the material's Opacity will decrease the color and alpha values of the specular and diffuse colors equally, making the material transparent.

Specular

The parameters in the *Specular* section describes the look of the specular highlight of the surface. These values are evaluated in a different way for each illumination model. See the Notes for more details.

Specular Color

Specular Color determines the color of light that reflects from a shiny surface. The more specular a material is, the glossier it appears. Surfaces like plastics and glass tend to have white specular highlights, whereas metallic surfaces like gold have specular highlights that inherit their color from the material color. If a specular texture map is provided then the value provided here is multiplied by the color values from the texture.

Specular Intensity

Specular Intensity controls how strong the specular highlight is. If the specular intensity texture is provided then this value is multiplied by the alpha value of the texture.

Specular Exponent

Specular Exponent controls the falloff of the specular highlight. The greater the value, the sharper the falloff, and the smoother and glossier the material appears. If the specular exponent texture is provided then this value is multiplied by the alpha value of the texture map.

Transmittance

Transmittance controls the way light passes through a material. For example, a solid blue sphere will cast a black shadow, but one made of translucent blue plastic would cast a much lower density blue shadow.

There is a separate opacity option. Opacity determines how transparent the actual surface is when it is rendered. Fusion allows for adjusting both opacity and transmittance separately. This might be a bit counter-intuitive to artists who are unfamiliar with 3D software at first. It is possible to have a surface that is fully opaque but transmits 100% of the light arriving upon it, effectively making it a a luminous / emissive surface.

Attenuation

Attenuation determines how much color is passed through the object. For an object to have transmissive shadows, set the attenuation to (1, 1, 1), which means 100% of green, blue, red light pass through the object. Setting this color to RGB (1, 0, 0) means that the material will transmit 100% of the red arriving at the surface but none of the green or blue light. This allows for 'stained glass' shadows.

Alpha Detail

When the Alpha Detail slider is set to 0, the alpha channel of the object is ignored and the entire object casts a shadow. If it is set to 1, the alpha channel detemines what portions of the object cast a shadow.

Color Detail

The Color Detail slider modulates light passing through the surface by the diffuse color + texture colors. Use this to throw a shadow that contains color details of the texture applied to the object. Increasing the slider from 0 to 1 brings in more of diffuse color + texture color into the shadow. Note that the alpha and opacity of the object is ignored when transmitting color, allowing an object with a solid alpha to still transmit its color to the shadow.

Saturation

The Saturation slider controls the saturation of the color component transmitted to the shadow. Setting this to 0.0 will result in monochrome shadows.

Receives Lighting/Shadows

These checkboxes control whether the material is affected by lighting and shadows in the scene. If turned off, the object will always be fully lit and/or unshadowed.

Two Sided Lighting

This makes the surface effectively two-sided by adding a second set of normals facing the opposite direction on the back side of the surface. This is normally off, to increase rendering speed, but can be turned on for 2D surfaces or for objects that are not fully enclosed, to allow the reverse or interior surfaces to be visible as well.

Normally, in a 3D application only the front face of a surface is visible and the back face is culled, so that if a camera were to revolve around a plane in a 3D application when it reached the backside, the plane would become invisible. Making a plane two sided in a 3D application is equivalent to adding another plane on top of the first but rotated by 180 degrees so the

normals are facing the opposite direction on the backside. Thus, when you revolve around the back, you see the second image plane which has its normals facing the opposite way.

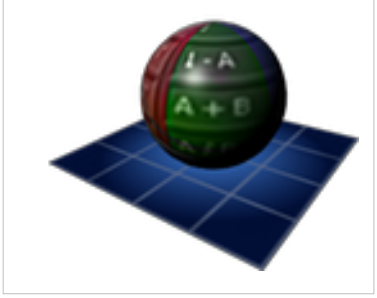
Fusion does exactly the same thing as 3D applications when you make a surface two sided. The confusion about what two-sided does arises because Fusion does not cull backfacing polygons by default. If you revolve around a one-sided plane in Fusion you will still see it from the backside (but you are seeing the frontside bits duplicated through to the backside as if it were transparent). Making the plane two sided effectively adds a second set of normals to the backside of the plane.

Note this can become rather confusing once you make the surface transparent, as the same rules still apply and produce a result which is counter-intuitive. If you view from the frontside a transparent two-sided surface illuminated from the backside, it will look unlit.

Material ID

This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

3DChannel_Boolean



The Channel Boolean Material can be used to remap and modify channels of 3D materials using mathematical operations. For example if you want to use the red channel of a material to control an scalar input of an illumination model which uses the alpha channel (eg. Blinn.SpecularExponent) you can remap the channels here. Furthermore it allows to use geometry specific information like texture space coordinates and normals.

External Inputs



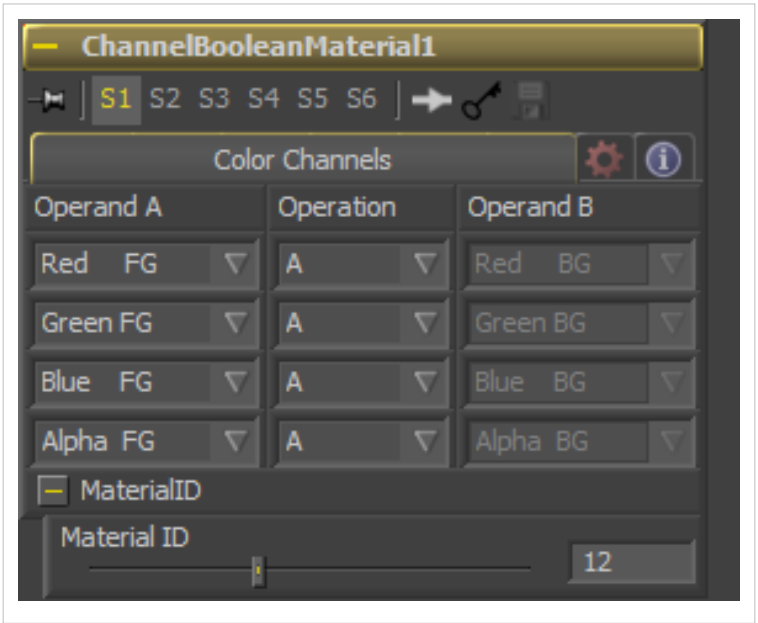
ChannelBooleanMaterial.BackgroundMaterial

[*orange, optional*] This input will accept a 2D image or a 3D material.

ChannelBooleanMaterial.ForegroundMaterial

[*green, optional*] This input will accept a 2D image or a 3D material.

Controls



Operand A/B

The Operand menus, one for each output RGBA channel, allows to set the desired input information for the according channel.

Red/Green/Blue/Alpha/ FG

Reads the color information of the foreground material.

Red/Green/Blue/Alpha BG

Reads the color information of the background material.

Black/White/Mid Grey

Sets the value of the channel to 0, 1 or 0.5.

Hue/Lightness/Saturation FG

Reads the color information of the foreground material, converts it into the HLS color space and put the selected information into the according channel

Hue/Lightness/Saturation BG

Reads the color information of the background material, converts it into the HLS color space and put the selected information into the according channel

Luminance FG

Reads the color information of the foreground material and calculates the luminance value for the channel.

Luminance BG

Reads the color information of the background material and calculates the luminance value for the channel.

X/Y/Z Position FG

Sets the value of the channel to the position of the pixel in 3d space. The vector information is returned in eye space.

U/V/W Texture FG

Applies the texture space coordinates of the foreground material to the channels.

U/V/W EnvCoords FG

Applies the environment texture space coordinates to the channels. Use it upstream of tools modifying the environment texture coordinates like the [[../Refelct_3D|Reflect 3D) tool.

X/Y/Z Normal

Set the value of the channel to the selected axis of the normal vector. The vector is returned in eye space.

Operation

Determines the operation how the operands are combined.

A

Uses operand A only for the output channel

B

Uses operand B only for the output channel

1-A

Subtracts the value of Operand A from 1

1-B

Subtracts the value of Operand B from 1

A+B

Adds the value of operand A and B

A-B

Subtracts the value of operand B from A

A*B

Mulitplies the value of both operands

A/B

Divides the value of operand B from A

min(A,B)

Compares the values of operand A and B and returns the smaller one

max(A,B)

Compares the values of operand A and B and returns the bigger one

avg(A,B)

Returns the average value of both operands

Material ID

This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

Cook Torrance

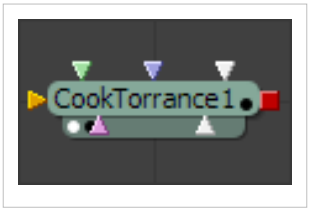


The Cook Torrance tool is a basic illumination material which can be applied to geometry in the 3D scene. The diffuse calculation for this tool is similar to that used in the basic material and the Blinn tool, but the specular highlights are evaluated using an optimized Fresnel/Beckmann equation. This illumination model is primarily used for shading metal or other shiny and highly reflective surfaces.

The Cook Torrance tool outputs a 3D Material which can be connected to the material inputs on any 3D geometry tool.

For a technical description of the Cook Torrance shader see http://en.wikipedia.org/wiki/Specular_highlight

External Inputs



CookTorrance.DiffuseTex

[*orange, optional*] This input will accept a 2D image or a 3D material to be used as a diffuse texture map.

CookTorrance.SpecularColorTex

[*green, optional*] This input will accept a 2D image or a 3D material to be used as a specular color texture map.

CookTorrance.SpecularIntensityTex

[*magenta, optional*] This input will accept a 2D image or a 3D material to be used as an intensity map for the materials specular highlights. When the input is a 2D image the alpha channel is used to create the map while the color channels are discarded.

CookTorrance.SpecularRoughnessTex

[*light blue, optional*] This input will accept a 2D image or a 3D material to be used as a map for modifying the roughness of the specular highlight. The alpha of the texture map is multiplied by the value of the roughness control.

CookTorrance.SpecularRefractiveIndexTex

[*white, optional*] This input will accept a 2D image or a 3D material to be used as a map for modifying the roughness of the specular refractive index. The alpha of the texture map

is multiplied by the value of the refractive index.

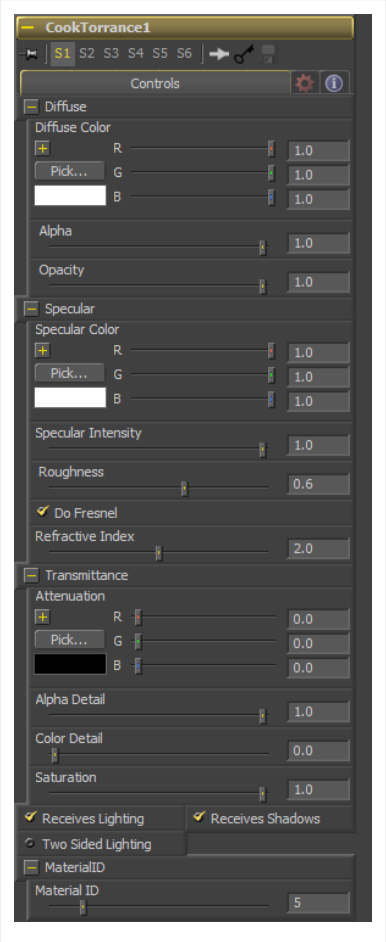
CookTorrance.BumpmapTex

[*white, optional*] This input will accept a 2D image or a 3D material then uses the RGB information as texture-space normals.

Each of these inputs multiplies the pixels in the texture map by the equivalently named parameters in the tool itself. This provides an effective method for "scaling" parts of the material.

When tools have as many inputs as this one does it is often difficult to make connections any precision. Hold the *CTRL* key down while dragging the output from another tool over the tool tile, and keep holding *CTRL* when releasing the *left mouse button*. A small menu listing all of the inputs provided by the tool will appear. Click on the desired input to complete the connection.

Controls



Diffuse

Diffuse describes the base surface characteristics without any additional effects like reflections or specular highlights. In addition to defining the base color of an object, the diffuse color also defines the transparency of the object. The alpha in a diffuse texture map can be used to make portions of the surface of any object the material is applied to transparent.

Diffuse Color

A materials diffuse color describes the base color presented by the material when it is lit indirectly or by ambient light. If a diffuse texture map is provided then the color value provided here is multiplied by the color values in the texture.

Alpha

This slider sets the material's Alpha channel value. This affects diffuse and specular colors equally, and affects the alpha value of the material in the rendered output. If a diffuse texture map is provided then the alpha value set here is multiplied by the alpha values in the texture map.

Opacity

Reducing the material's Opacity will decrease the color and alpha values of the specular and diffuse colors equally, making the material transparent.

Specular

The parameters in the *Specular* section describes the look of the specular highlight of the surface. These values are evaluated in a different way for each illumination model. See the Notes for more details.

Specular Color

Specular Color determines the color of light that reflects from a shiny surface. The more specular a material is, the glossier it appears. Surfaces like plastics and glass tend to have white specular highlights, whereas metallic surfaces like gold have specular highlights that inherit their color from the material color. If a specular texture map is provided then the value provided here is multiplied by the color values from the texture.

Specular Intensity

Specular Intensity controls how strong the specular highlight is. If the specular intensity texture is provided then this value is multiplied by the alpha value of the texture.

Roughness

The Roughness of the specular highlight describes diffusion of the specular highlight over the surface. The greater the value, the wider the falloff, and the more "brushed" and "metallic" the surface appears. If the roughness texture map is provided then this value is multiplied by the alpha value from the texture.

Do Fresnel

Selecting this checkbox will add fresnel calculations to the materials illumination model. This will provide more realistic looking metal surfaces by taking into account the refractiveness of the material. See http:/ / en. wikipedia. org/ wiki/ Fresnel_equations for a more technical discussion.

Refractive Index

This slider appears when the Do Fresnel checkbox is selected. The refractive index applies only to the calculations for the highlight, it does not perform actual refraction of light through transparent surfaces. If the refractive index texture map is provided then this value is multiplied by the alpha value of the input.

Specular

Transmittance

Transmittance controls the way light passes through a material. For example, a solid blue sphere will cast a black shadow, but one made of translucent blue plastic would cast a much lower density blue shadow.

There is a separate opacity option. Opacity determines how transparent the actual surface is when it is rendered. Fusion allows for adjusting both opacity and transmittance separately. This might be a bit counter-intuitive to artists who are unfamiliar with 3D software at first. It is possible to have a surface that is fully opaque but transmits 100% of the light arriving upon it, effectively making it a a luminous / emissive surface.

Attenuation

Attenuation determines how much color is passed through the object. For an object to have transmissive shadows, set the attenuation to (1, 1, 1), which means 100% of green, blue, red light pass through the object. Setting this color to RGB (1, 0, 0) means that the material will transmit 100% of the red arriving at the surface but none of the green or blue light. This allows for 'stained glass' shadows.

Alpha Detail

When the Alpha Detail slider is set to 0, the alpha channel of the object is ignored and the entire object casts a shadow. If it is set to 1, the alpha channel detemines what portions of the object cast a shadow.

Color Detail

The Color Detail slider modulates light passing through the surface by the diffuse color + texture colors. Use this to throw a shadow that contains color details of the texture applied to the object. Increasing the slider from 0 to 1 brings in more of diffuse color + texture color into the shadow. Note that the alpha and opacity of the object is ignored when transmitting color, allowing an object with a solid alpha to still transmit its color to the shadow.

Saturation

The Saturation slider controls the saturation of the color component transmitted to the shadow. Setting this to 0.0 will result in monochrome shadows.

Receives Lighting/Shadows

These checkboxes control whether the material is affected by lighting and shadows in the scene. If turned off, the object will always be fully lit and/or unshadowed.

Two Sided Lighting

This makes the surface effectively two-sided by adding a second set of normals facing the opposite direction on the back side of the surface. This is normally off, to increase rendering speed, but can be turned on for 2D surfaces or for objects that are not fully enclosed, to allow the reverse or interior surfaces to be visible as well.

Normally, in a 3D application only the front face of a surface is visible and the back face is culled, so that if a camera were to revolve around a plane in a 3D application when it reached the backside, the plane would become invisible. Making a plane two sided in a 3D application is equivalent to adding another plane on top of the first but rotated by 180 degrees so the normals are facing the opposite direction on the backside. Thus, when you revolve around the back, you see the second image plane which has its normals facing the opposite way.

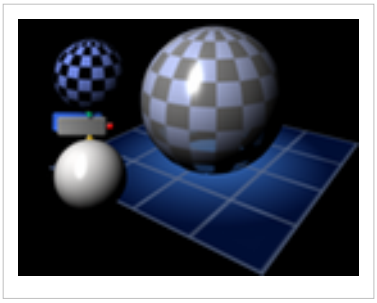
Fusion does exactly the same thing as 3D applications when you make a surface two sided. The confusion about what two-sided does arises because Fusion does not cull backfacing polygons by default. If you revolve around a one-sided plane in Fusion you will still see it from the backside (but you are seeing the frontside bits duplicated through to the backside as if it were transparent). Making the plane two sided effectively adds a second set of normals to the backside of the plane.

Note this can become rather confusing once you make the surface transparent, as the same rules still apply and produce a result which is counter-intuitive. If you view from the frontside a transparent two-sided surface illuminated from the backside, it will look unlit.

Material ID

This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

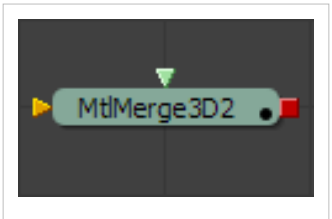
Mtl Merge 3D



The Material Merge tool can be used to combine two separate materials together. This tool can be used to composite material tools, combining multiple illumination materials (Blinn, Cook Torrance) with texture tools (Bumpmap, Reflection) to create complex shader networks.

The tool also provides a mechanism for assigning a new material identifier to the combined material.

External Inputs



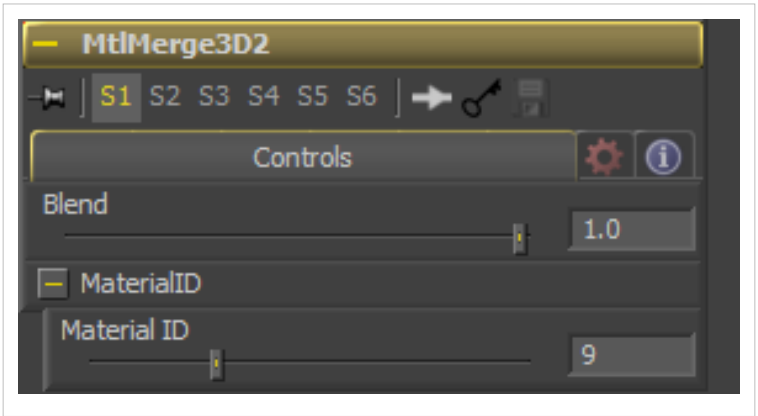
MtlMerge3D.BackgroundMaterial

[*orange, required*] This input will accept a 2D image or a 3D material to be used as the background material. A 2D image will be treated as a diffuse texture map in the basic shading model.

MtlMerge3D.ForegroundMaterial

[*green, optional*] This input will accept a 2D image or a 3D material to be used as the foreground material. A 2D image will be treated as a diffuse texture map in the basic shading model.

Controls



Blend

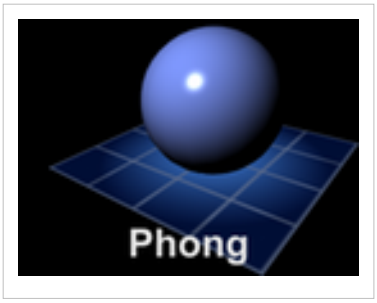
The Blend behavior of the Material Merge is similar to the Dissolve (DX) tool for images. The two materials/textures are mixed together using the value of the slider to determine the percentage each input contributes. While the background and foreground inputs can be a 2D image rather than a material, the output of this tool will always be a material.

Unlike the 2D Dissolve tool both foreground and background inputs are required.

MaterialID

This slider sets the numeric identifier assigned to the resulting material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

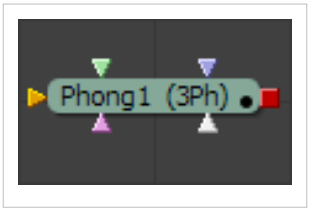
Phong



The Phong tool is a basic illumination material which can be applied to geometry in the 3D scene. It describes how the object will respond to light, and provides a large number of texture map inputs to allow fine control over the diffuse, specular and bumpmap components of the material.

While producing a highlight similar to that produced by the Blinn model, it is more commonly used for shiny/polished plastic surfaces. A more technical description of the Phong shader can be found at http://en.wikipedia.org/wiki/Phong_shading

External Inputs



Phong.DiffuseTex

[*orange, optional*] This input will accept a 2D image or a 3D material to be used as a diffuse texture map.

Phong.SpecularColorTex

[*green, optional*] This input will accept a 2D image or a 3D material to be used as a specular color texture map.

Phong.SpecularIntensityTex

[*magenta, optional*] This input will accept a 2D image or a 3D material to be used as an intensity map for the materials specular highlights. When the input is a 2D image the alpha channel is used to create the map while the color channels are discarded.

Phong.SpecularExponentTex

[*light blue, optional*] This input will accept a 2D image or a 3D material to be used as an falloff map for the materials specular highlights. When the input is a 2D image the alpha channel is used to create the map while the color channels are discarded.

Phong.BumpmapTex

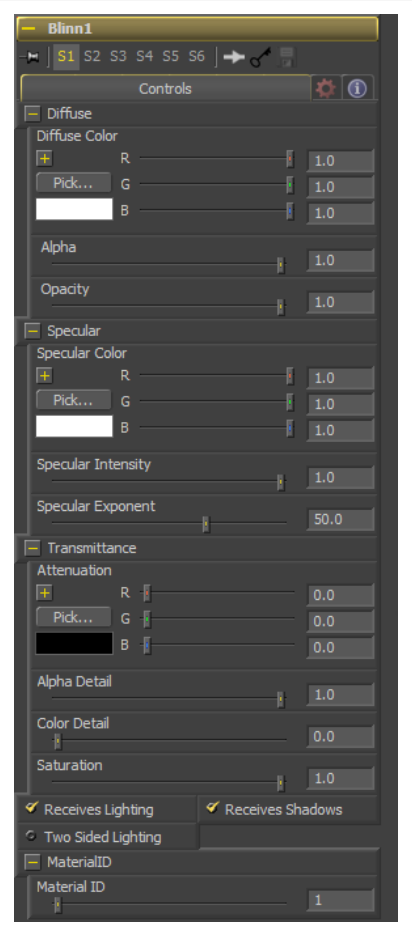
[*white, optional*] This input will accept a 2D image or a 3D material then uses the RGB information as texture-space normals.

Each of these inputs multiplies the pixels in the texture map by the equivalently named parameters in the tool itself. This provides an effective method for "scaling" parts of the

material.

When tools have as many inputs as this one does it is often difficult to make connections any precision. Hold the *CTRL* key down while dragging the output from another tool over the tool tile, and keep holding *CTRL* when releasing the *left mouse button*. A small menu listing all of the inputs provided by the tool will appear. Click on the desired input to complete the connection.

Controls



Diffuse

Diffuse describes the base surface characteristics without any additional effects like reflections or specular highlights. In addition to defining the base color of an object, the diffuse color also defines the transparency of the object. The alpha in a diffuse texture map can be used to make portions of the surface of any object the material is applied to transparent.

Diffuse Color

A materials diffuse color describes the base color presented by the material when it is lit indirectly or by ambient light. If a diffuse texture map is provided then the color value provided here is multiplied by the color values in the texture.

Alpha

This slider sets the material's Alpha channel value. This affects diffuse and specular colors equally, and affects the alpha value of the material in the rendered output. If a diffuse texture map is provided then the alpha value set here is multiplied by the alpha values in the texture map.

Opacity

Reducing the material's Opacity will decrease the color and alpha values of the specular and diffuse colors equally, making the material transparent.

Specular

The parameters in the *Specular* section describes the look of the specular highlight of the surface. These values are evaluated in a different way for each illumination model. See the Notes for more details.

Specular Color

Specular Color determines the color of light that reflects from a shiny surface. The more specular a material is, the glossier it appears. Surfaces like plastics and glass tend to have white specular highlights, whereas metallic surfaces like gold have specular highlights that inherit their color from the material color. If a specular texture map is provided then the value provided here is multiplied by the color values from the texture.

Specular Intensity

Specular Intensity controls how strong the specular highlight is. If the specular intensity texture is provided then this value is multiplied by the alpha value of the texture.

Specular Exponent

Specular Exponent controls the falloff of the specular highlight. The greater the value, the sharper the falloff, and the smoother and glossier the material appears. If the specular exponent texture is provided then this value is multiplied by the alpha value of the texture map.

Transmittance

Transmittance controls the way light passes through a material. For example, a solid blue sphere will cast a black shadow, but one made of translucent blue plastic would cast a much lower density blue shadow.

There is a separate opacity option. Opacity determines how transparent the actual surface is when it is rendered. Fusion allows for adjusting both opacity and transmittance separately. This might be a bit counter-intuitive to artists who are unfamiliar with 3D software at first. It is possible to have a surface that is fully opaque but transmits 100% of the light arriving upon it, effectively making it a a luminous / emissive surface.

Attenuation

> Attenuation determines how much color is passed through the object. For an object to have transmissive shadows, set the attenuation to (1, 1, 1), which means 100% of green, blue, red light pass through the object. Setting this color to RGB (1, 0, 0) means that the material will transmit 100% of the red arriving at the surface but none of the green or

blue light. This allows for 'stained glass' shadows.

Alpha Detail

When the Alpha Detail slider is set to 0, the alpha channel of the object is ignored and the entire object casts a shadow. If it is set to 1, the alpha channel detemines what portions of the object cast a shadow.

Color Detail

The Color Detail slider modulates light passing through the surface by the diffuse color + texture colors. Use this to throw a shadow that contains color details of the texture applied to the object. Increasing the slider from 0 to 1 brings in more of diffuse color + texture color into the shadow. Note that the alpha and opacity of the object is ignored when transmitting color, allowing an object with a solid alpha to still transmit its color to the shadow.

Saturation

The Saturation slider controls the saturation of the color component transmitted to the shadow. Setting this to 0.0 will result in monochrome shadows.

Receives Lighting/Shadows

These checkboxes control whether the material is affected by lighting and shadows in the scene. If turned off, the object will always be fully lit and/or unshadowed.

Two Sided Lighting

This makes the surface effectively two-sided by adding a second set of normals facing the opposite direction on the back side of the surface. This is normally off, to increase rendering speed, but can be turned on for 2D surfaces or for objects that are not fully enclosed, to allow the reverse or interior surfaces to be visible as well.

Normally, in a 3D application only the front face of a surface is visible and the back face is culled, so that if a camera were to revolve around a plane in a 3D application when it reached the backside, the plane would become invisible. Making a plane two sided in a 3D application is equivalent to adding another plane on top of the first but rotated by 180 degrees so the normals are facing the opposite direction on the backside. Thus, when you revolve around the back, you see the second image plane which has its normals facing the opposite way.

Fusion does exactly the same thing as 3D applications when you make a surface two sided. The confusion about what two-sided does arises because Fusion does not cull backfacing polygons by default. If you revolve around a one-sided plane in Fusion you will still see it from the backside (but you are seeing the frontside bits duplicated through to the backside as if it were transparent). Making the plane two sided effectively adds a second set of normals to the backside of the plane.

Note this can become rather confusing once you make the surface transparent, as the same rules still apply and produce a result which is counter-intuitive. If you view from the frontside a transparent two-sided surface illuminated from the backside, it will look unlit.

Material ID

This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

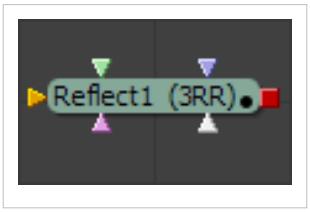
Reflect



The reflection tool is used to add environment map reflections and refractions to materials. Control is offered over the face on and glancing strength, falloff, per channel refraction indexes and tinting. Several texture map inputs can modify the behaviour of each parameter.

The Reflection tool is usually combined with a standard lighting material such as Blinn, Cook Torrance, Phong or Ward by connecting the output of that tool to the Reflection tools background material input. Then a reflection texture is connected to the reflection texture input. This can be a 2D image, but is more frequently an environmental map created by the SphereMap or CubeMap tools.

External Inputs



Reflect.BackgroundMaterial

[*orange, optional*] This input expects a 2D image or a 3D material. If a 2D image is provided the tool will treat it as a diffuse texture map applied to a basic material.

Reflect.Reflection.ReflectionTex

[*green, optional*] This input expects a 2D image or a 3D material. The RGB channels are used as the reflection texture, and the alpha is ignored.

Reflect.Reflection.ReflectionIntensityTex

[*magenta, optional*] This input expects a 2D image or a 3D material. The alpha channel of the texture is multiplied by the intensity of the reflection.

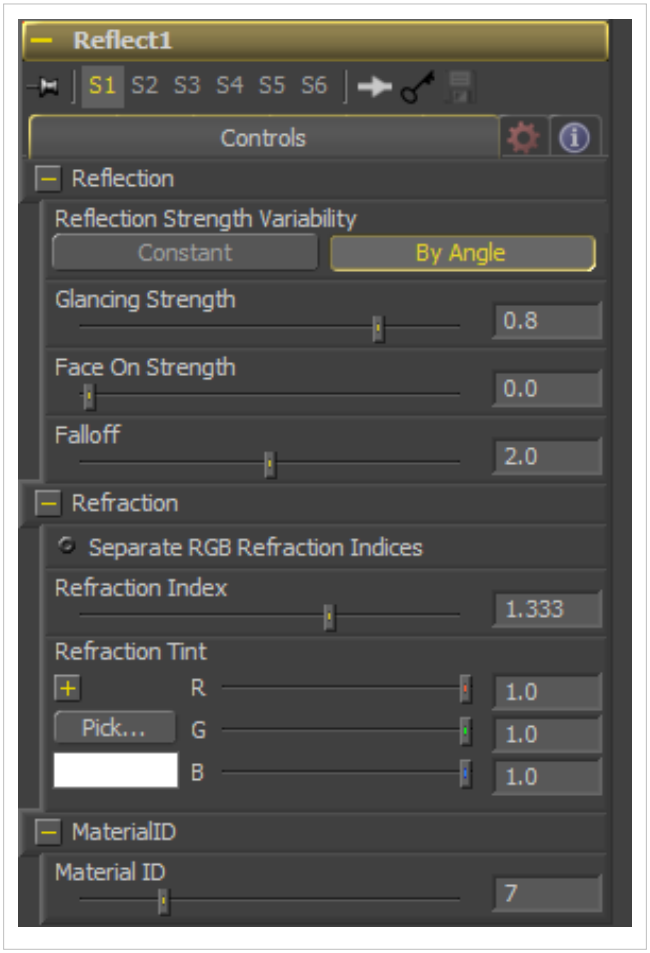
Reflect.Refraction.RefractionTex

[*light blue, optional*] This input expects a 2D image or a 3D material. The RGB channels are used as the refraction texture.

Reflect.BumpmapTex

[*white, optional*] This input will accept a 2D image or a 3D material then uses the RGB information as texture-space normals.

Controls



Reflection

Reflection Strength Variability

This multibutton control can be set to *Constant* or *By Angle* for varying the reflection intensity according to the relative surface orientation to the viewer. The following three controls are only visible when this control is set to *By Angle*.

Glancing Strength

[*By Angle*] The Glancing Strength controls the intensity of the reflection for those areas of the geometry where the reflection faces away from the camera.

Face On Strength

[*By Angle*] The Face On Strength controls the intensity of the reflection for those parts of the geometry that reflect directly back to the camera.

Falloff

[*By Angle*] The Falloff controls the sharpness of the transition between the Glancing and Face On Strength regions. It can be considered to be analogous to applying gamma correction to a gradient between the Face On and Glancing values.

Constant Strength

[*Constant Angle*]This control is only visible when the reflection strength variability is set to *Constant*. In this case the intensity of the reflection is constant regardless of the incidence angle of the reflection.

Refraction

If the incoming background material has a lower opacity than 1, then it is possible to use an environment map as refraction texture. So it is possible to simulate refraction effects in transparent objects.

Separate RGB Refraction Indices

When this checkbox is enabled the Refraction Index slider will be be hidden and three sliders for adjusting the refraction index of the Red, Green and Blue channels will appear in it's place. This allows for simulation of the spectral refraction effects commonly seen in thick imperfect glass, for example.

Refraction Index

This slider controls how strongly the environment map will be "deformed" when viewed through a surface. The overall deformation is based on the incidence angle. Since this is a approximation and not a simulation the results are not intended to accurately model real refractions.

Refraction Tint

The refraction texture is multiplied by the tint color for simulating color filtered refractions. It can be used to simulate the type of coloring found in tinted glass, as seen in many brands of beer bottles, for example.

Material ID

This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

Stereo Mix



The StereoMix tool is used to assign independent materials to the left eye and the right eye renderings of an object. This is commonly used when applying stereographic reflections and refractions using separate maps.

When a scene is viewed or rendered in stereo, the materials attached to the left and right inputs are used for the left and right eye's views, respectively. When rendering in mono, the tool acts as a switcher. When the Renderer 3D tool's eye option is set to produce a mono or left eye rendering, only the left material will be used. When the right eye option is selected, the right material will be used instead.

External Inputs



StereoMix.LeftMaterial

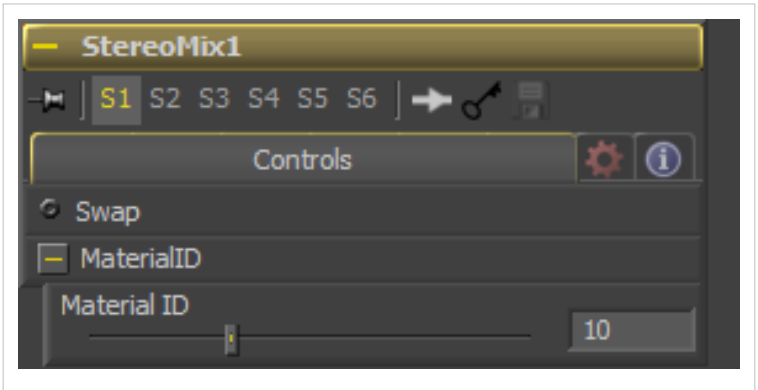
[*orange, required*] This input will accept a 2D image or a 3D material to be used as the material for the left eye rendering. If a 2D image is used it will be converted to a diffuse texture map using the basic material type.

StereoMix.RightMaterial

[*green, required*] This input will accept a 2D image or a 3D material to be used as the material for the right eye rendering. If a 2D image is used it will be converted to a diffuse texture map using the basic material type.

While the inputs can be either 2D images or 3D materials, the output will always be a material.

Controls



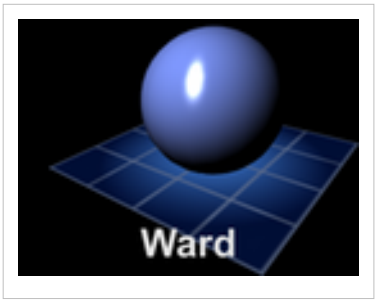
Swap

This option will swap the both inputs of the tool.

Material ID

This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

Ward



The Ward tool is a basic illumination material which can be applied to geometry in the 3D scene. It describes how the object will respond to light, and provides a large number of texture map inputs to allow fine control over the diffuse, specular and bumpmap components of the material.

In particular the Ward tool is ideal for simulating brushed metal surfaces, as the highlight can be elongated in along the U or V directions of the mapping co-ordinates. This is known as an "anisotrophic" highlight.

See http://en.wikipedia.org/wiki/Specular_highlight for a more technical description of the Ward anisotrophic shader.

The Ward tool outputs a 3D Material which can be connected to the material inputs on any 3D geometry tool.

External Inputs



Ward.DiffuseTexture

[*orange, optional*] This input will accept a 2D image or a 3D material to be used as a specular color texture map.

Ward.SpecularColorTexture

[*green, optional*] This input will accept a 2D image or a 3D material to be used as a specular color texture map.

Ward.SpecularIntensityTexture

[*magenta, optional*] This input will accept a 2D image or a 3D material to be used as an intensity map for the materials specular highlights. When the input is a 2D image the alpha channel is used to create the map while the color channels are discarded.

Ward.SpreadUTexture

[*light blue, optional*] This input will accept a 2D image or a 3D material. The value of the Spread U option in the tools controls will be multiplied against the pixel values in the material's alpha channel.

Ward.SpreadVTexture

[*white, optional*] This input will accept a 2D image or a 3D material. The value of the Spread V option in the tools controls will be multiplied against the pixel values in the material's alpha channel.

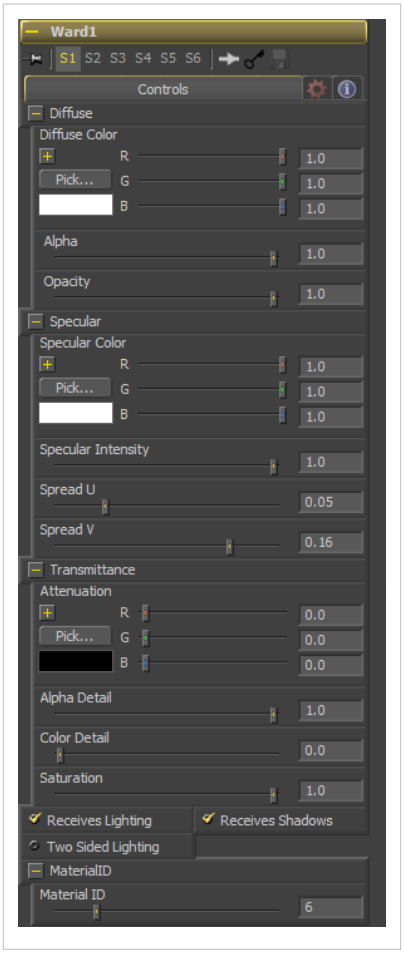
Ward.BumpmapTexture

[*white, optional*]This input will accept a 2D image or a 3D material then uses the RGB information as texture-space normals.

Each of these inputs multiplies the pixels in the texture map by the equivalently named parameters in the tool itself. This provides an effective method for "scaling" parts of the material.

When tools have as many inputs as this one does it is often difficult to make connections any precision. Hold the *CTRL* key down while dragging the output from another tool over the tool tile, and keep holding *CTRL* when releasing the *left mouse button*. A small menu listing all of the inputs provided by the tool will appear. Click on the desired input to complete the connection.

Controls



Diffuse

Diffuse describes the base surface characteristics without any additional effects like reflections or specular highlights. In addition to defining the base color of an object, the diffuse color also defines the transparency of the object. The alpha in a diffuse texture map can be used to make portions of the surface of any object the material is applied to transparent.

Diffuse Color

A materials diffuse color describes the base color presented by the material when it is lit indirectly or by ambient light. If a diffuse texture map is provided then the color value provided here is multiplied by the color values in the texture.

Alpha

This slider sets the material's Alpha channel value. This affects diffuse and specular colors equally, and affects the alpha value of the material in the rendered output. If a diffuse texture map is provided then the alpha value set here is multiplied by the alpha values in the texture map.

Opacity

Reducing the material's Opacity will decrease the color and alpha values of the specular and diffuse colors equally, making the material transparent.

Specular

The parameters in the *Specular* section describes the look of the specular highlight of the surface. These values are evaluated in a different way for each illumination model. See the Notes for more details.

Specular Color

Specular Color determines the color of light that reflects from a shiny surface. The more specular a material is, the glossier it appears. Surfaces like plastics and glass tend to have white specular highlights, whereas metallic surfaces like gold have specular highlights that inherit their color from the material color. If a specular texture map is provided then the value provided here is multiplied by the color values from the texture.

Specular Intensity

Specular Intensity controls how strong the specular highlight is. If the specular intensity texture is provided then this value is multiplied by the alpha value of the texture.

Spread U

Spread U controls the falloff of the specular highlight along the U-axis in the UV-Map of the object. The smaller the value, the sharper the falloff, and the smoother & glossier the material appears in this direction. If the spread u texture is provided then this value is multiplied by the alpha value of the texture.

Spread V

Spread V controls the falloff of the specular highlight along the V-axis in the UV-Map of the object. The smaller the value, the sharper the falloff, and the smoother & glossier the material appears in this direction. If the spread v texture is provided then this value is multiplied by the alpha value of the texture.

Transmittance

Transmittance controls the way light passes through a material. For example, a solid blue sphere will cast a black shadow, but one made of translucent blue plastic would cast a much lower density blue shadow.

There is a separate opacity option. Opacity determines how transparent the actual surface is when it is rendered. Fusion allows for adjusting both opacity and transmittance separately. This might be a bit counter-intuitive to artists who are unfamiliar with 3D software at first. It is possible to have a surface that is fully opaque but transmits 100% of the light arriving upon it, effectively making it a a luminous / emissive surface.

Attenuation

> Attenuation determines how much color is passed through the object. For an object to have transmissive shadows, set the attenuation to (1, 1, 1), which means 100% of green, blue, red light pass through the object. Setting this color to RGB (1, 0, 0) means that the material will transmit 100% of the red arriving at the surface but none of the green or blue light. This allows for 'stained glass' shadows.

Alpha Detail

When the Alpha Detail slider is set to 0, the alpha channel of the object is ignored and the entire object casts a shadow. If it is set to 1, the alpha channel detemines what portions of the object cast a shadow.

Color Detail

The Color Detail slider modulates light passing through the surface by the diffuse color + texture colors. Use this to throw a shadow that contains color details of the texture applied to the object. Increasing the slider from 0 to 1 brings in more of diffuse color + texture color into the shadow. Note that the alpha and opacity of the object is ignored when transmitting color, allowing an object with a solid alpha to still transmit its color to the shadow.

Saturation

The Saturation slider controls the saturation of the color component transmitted to the shadow. Setting this to 0.0 will result in monochrome shadows.

Receives Lighting/Shadows

These checkboxes control whether the material is affected by lighting and shadows in the scene. If turned off, the object will always be fully lit and/or unshadowed.

Two Sided Lighting

This makes the surface effectively two-sided by adding a second set of normals facing the opposite direction on the back side of the surface. This is normally off, to increase rendering speed, but can be turned on for 2D surfaces or for objects that are not fully enclosed, to allow the reverse or interior surfaces to be visible as well.

Normally, in a 3D application only the front face of a surface is visible and the back face is culled, so that if a camera were to revolve around a plane in a 3D application when it reached the backside, the plane would become invisible. Making a plane two sided in a 3D application is equivalent to adding another plane on top of the first but rotated by 180 degrees so the normals are facing the opposite direction on the backside. Thus, when you revolve around the back, you see the second image plane which has its normals facing the opposite way.

Fusion does exactly the same thing as 3D applications when you make a surface two sided. The confusion about what two-sided does arises because Fusion does not cull backfacing polygons by default. If you revolve around a one-sided plane in Fusion you will still see it from the backside (but you are seeing the frontside bits duplicated through to the backside as if it were transparent). Making the plane two sided effectively adds a second set of normals to the backside of the plane.

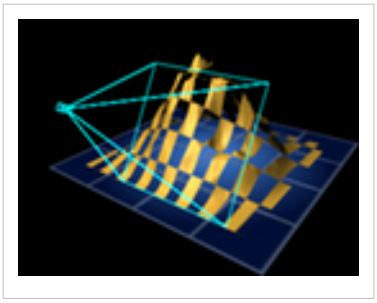
Note this can become rather confusing once you make the surface transparent, as the same rules still apply and produce a result which is counter-intuitive. If you view from the frontside a transparent two-sided surface illuminated from the backside, it will look unlit.

Material ID

This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

3D Texture

Catcher



The Catcher tool is used to intercept texture mode projections cast from Projector 3D and Camera 3D tools. The intercepted projections are converted into a texture map and applied to the Catcher material.

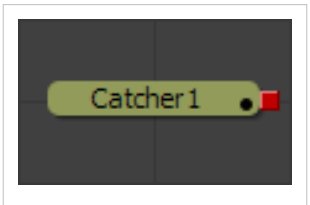
To understand the purpose of the Catcher tool it helps to understand the difference between light based projections and texture based projections. A light based projection simply adds the values of the RGB channels in the projected image to the diffuse texture of any geometry that lies within the projection cone. This makes it impossible to clip away geometry based on the alpha channel of an image when using light mode projections.

Imagine a scenario where the artist wishes to project an image of a building onto an image plane as part of a set extension shot. The artist has first rotoscoped the image to matte out the windows. This will make it possible to see geometry of the rooms behind the wall in the final composite. When this image is projected as light, the alpha channel is ignored, so the matted windows remain opaque.

By connecting the Catcher to the diffuse texture map of the material applied to the Image Plane, and then switching the projection from light or ambient light mode to texture mode, Fusion knows to apply the projected image as a texture map. When using this technique, the windows would become transparent, and it would be possible to see the geometry behind the window.

One advantage to this approach is that the Catcher is not restricted to the diffuse input of a material, making it possible to project specular intensity maps, or even reflection and refraction maps.

External Inputs



This material tool does not have any external inputs.

Controls



Enable

Use this checkbox to enable or disable the tool.

Color Accumulation Mode

The color accumulation mode is used to control how the Catcher will combine the light from multiple projectors. It will have no affect on the results when only one projector is in the scene. This control is designed to work with the Software renderer, and will have no affect when using the OpenGL renderer.

Alpha Accumulation Mode

The color accumulation mode is used to control how the Catcher will combine the alpha channels from multiple projectors. It will have no affect on the results when only one projector is in the scene. This control is designed to work with the Software renderer, and will have no affect when using the OpenGL renderer.

Accumulation Threshold

The accumulation threshold can be used to exclude certain low values from the accumulation calculation. For example, when using the median accumulation mode, a threshold of 0.01 would exclude any pixel with a value of less than 0.01 from the median calculation.

Material ID

This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

Create Bumpmap



The CreateBumpmap tool converts a 2D image into a bump material. It has two modes, a heightmap mode that expects a greyscale image, and a bumpmap mode that expects an RGB representation of normals (usually in tangent space).

Both heightmap and bumpmap modes expects the color values of the image to fall within the range of 0 to 1. If the image map contains colors that fall outside this range it will be necessary to first normalize the image, scaling the values to fit within the 0 to 1 range. One approach would be to use the AutoGain tool.

The bump material varies the lighting applied to a material to give the appearance of height. It is important to note that the bump material does not add additional complexity to the geometry, nor does it displace or modify the polygons which are already present. It is purely a lighting effect, and as such will only be visible when lighting is enabled in the rendering.

There is some conflict over the correct terminology for bumpmapping techniques, and various books and papers use similar terms with completely different and often conflicting meanings. To avoid confusion, this section aims to clarify the meaning meant in this documentation. Here are Fusion conventions:

Heightmap

An greyscale image containing a height value per pixel

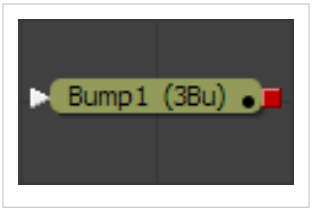
Bumpmap

An image containing normals stored in the RGB channels used for modifying the existing normals (usually provided using tangent space)

Normalmap

An image containing normals stored in the RGB channels used for replacing the existing normals (may be provided using tangent or object space)

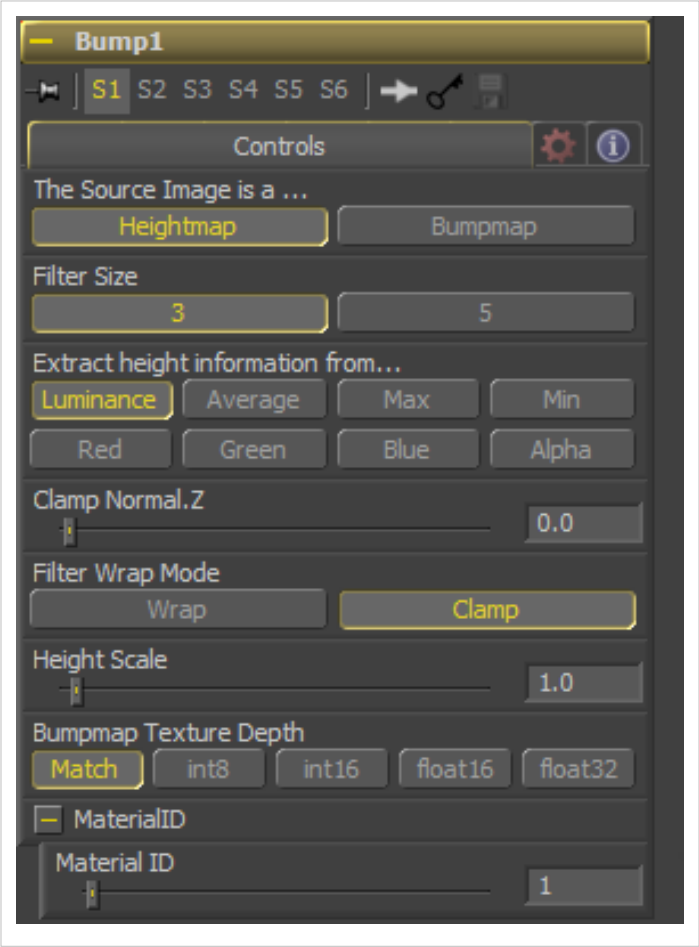
External Inputs



CreateBumpmap.Input

[*white, required*] This input expects a 2D image containing the data that will be used to produce the bump material.

Controls



The Source Image is a...

The bump information can be derived from different type of images. Select the *Heightmap* mode if the image contains greyscale values representing height offsets. If the image uses the red, green and blue channels to represents the X, Y and Z normal offsets, then use *Bumpmap* mode.

While the Heightmap mode offers additional options to determine which channel to use and describing how to clamp the image, the Bumpmap mode uses the RGB values directly and all other options (except for Material ID) will be disabled.

Filter Size

The heightmap is generated using a custom kernel filter. This multibutton control proivides options for setting the filter size. Higher values will generally result in better quality edges at the expense of rendering speed and performance.

Extract height information from...

This option set which channel from the input image the heightmap information is extracted from.

Clamp Normal.Z

This option can be used to clamp the Z values in the heightmap. This can help to reject strange looking results caused by a noisy heightmap.

Filter Wrap Mode

This option "wraps" the heightmap image at the borders, so that the filter produces the correct result when using seamlessly tileable textures.

Height Scale

Applies contrast to the values derived from trhe heightmap. Increasing this value generally yields in a more visible bump map at the expense of detail.

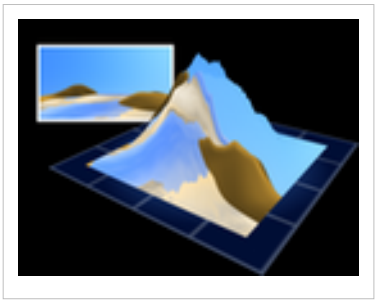
Bumpmap Texture Depth

Optionally converts the resulting bump texture into a different bit depth.

Material ID

This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

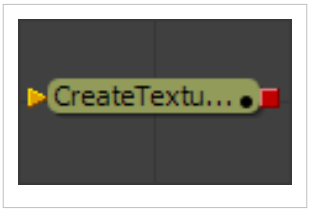
Create Texture



The CreateTexture tool effectively converts an image into a 3D material. While it is possible to connect images directly to illumination models for example, this tool allows one to set the wrap mode and some basic texture space parameters.

Not all wrap modes will be supported by all graphics cards.

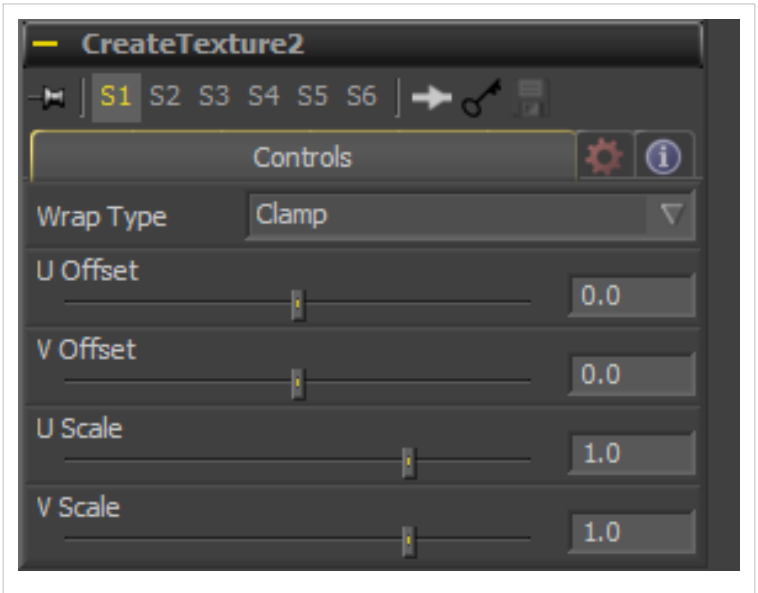
External Inputs



CreateTexture.ImageInput

[*orange, required*] This input expects a 2D image.

Controls



Wrap Mode

If a texture is transformed in the texture space (using the controls below or the UV Map tool) then it´s possible that areas beyond the image borders are mapped on the object. The Wrap Mode determines how the image is applied in these areas.

Wrap

This wraps the edges of the image around the borders of the image.

Clamp

The color at the edges of the images is used for texturing. This mode is similar to the Duplicate mode in the Transform tool.

Black

The image is clipped along it´s edges. A black color with alpha=0 is used instead.

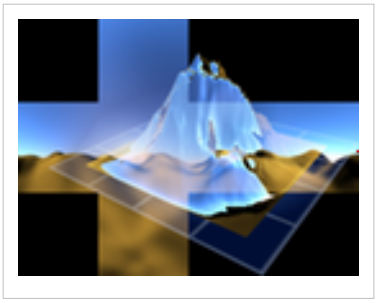
U/V Offset

These sliders can be used to offset the texture along the U and V coordinates.

U/V Scale

These sliders can be used to scale the texture along the U and V coordinates.

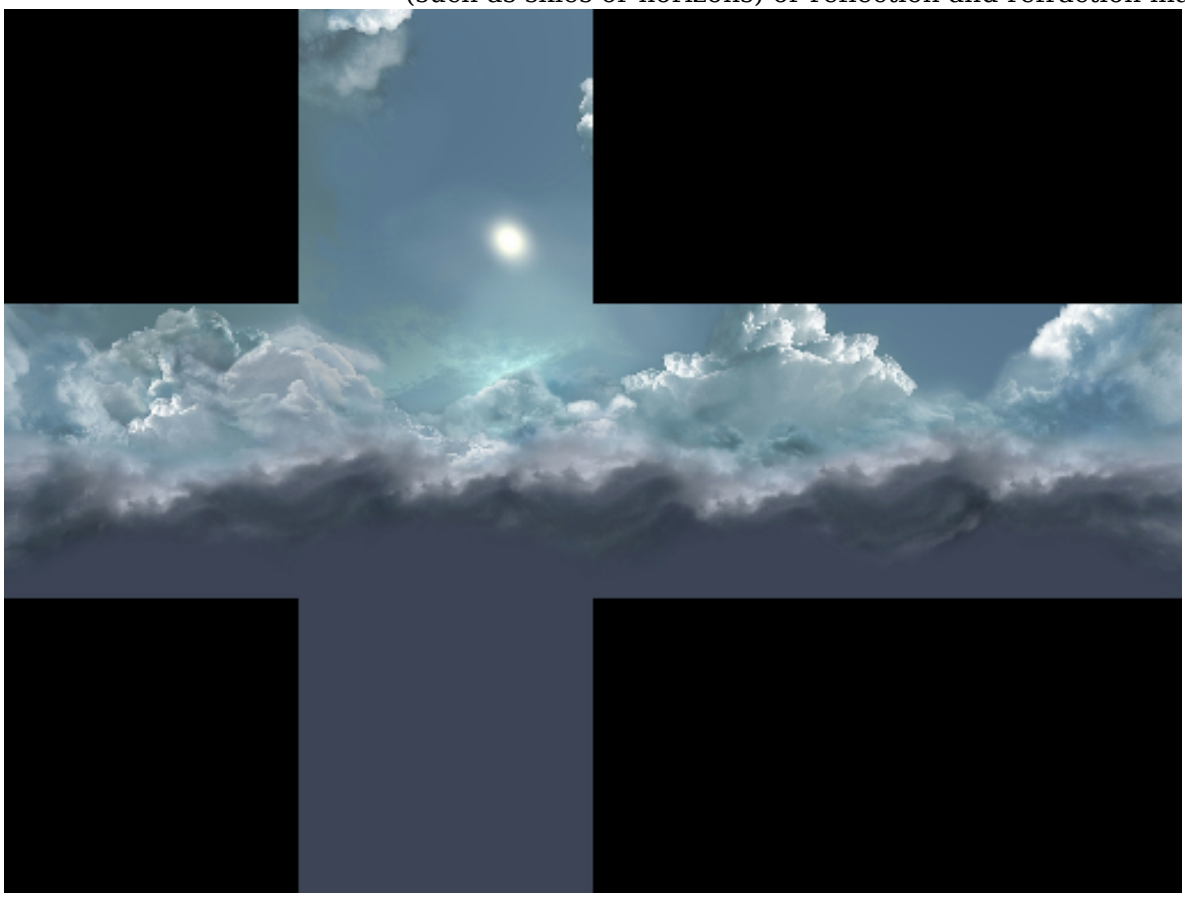
Cube Map



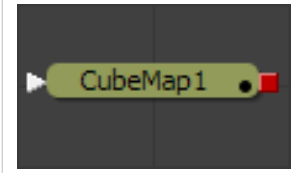
The CubeMap tool creates texture maps using seperate images for each face of the cube. It can also extract the individual faces of the cube from a single image containing an unfolded cube in the vertical or horizontal cross layouts.

A cube map is produced by mounting 6 cameras at 90 degrees angle of views to point up, down, left, right, front, and back.

The tool provides options to set the reference coordinate system and rotation for the resulting texture map. The CubeMap tool is typically used to produce environment maps for distant areas (such as skies or horizons) or reflection and refraction maps.



External Inputs



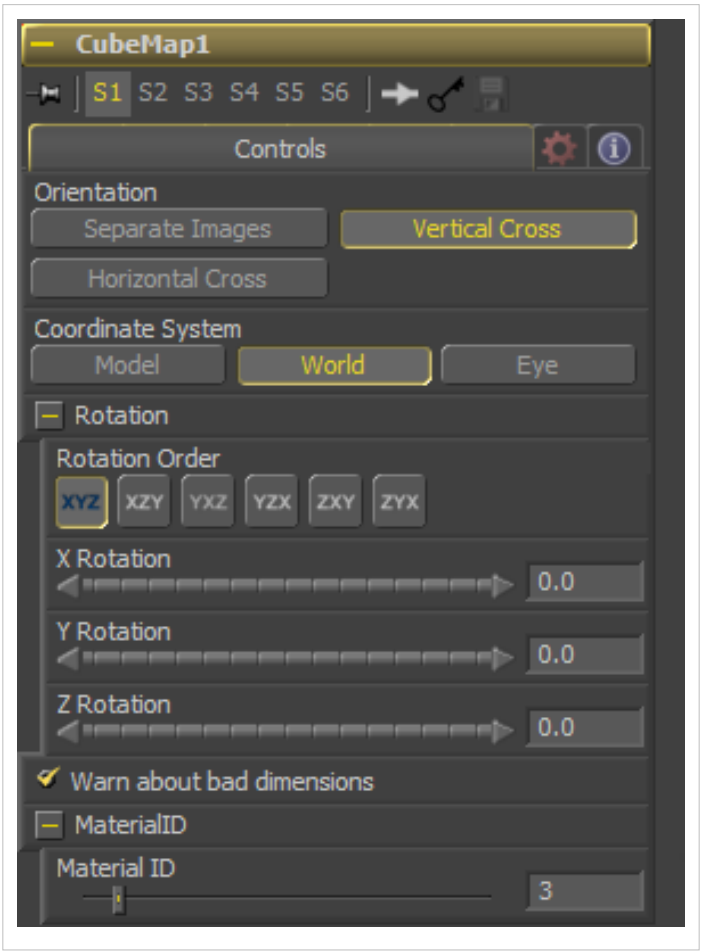
CubeMap.CrossImage

[*white, required*] This input is only visible when the tool is set to the Vertical Cross or Horizontal Cross orientation. It expects a 2D image.

CubeMap.[DIRECTION]

[*white, required*] These six inputs are only visible when the tool is set to the Separate Images orientation mode. Each input expects an image aligned to match the left, right, up, down, front and back faces.

Controls



Orientation

This multibutton control tells the tool which type of input to expect for the cubemap texture. Valid options are:

Separate Images

This option exposes six inputs on the tool tile, one for each face of the cube. If the separate images are not square or not of the same size, they will be rescaled into the largest 1:1 image that can contain all of them.

Vertical Cross

This option exposes a single input on the tool tile. The image should be a unwrapped texture of a cube containing all the faces organized into a vertical cross formation, where the height is larger than the width. If the image aspect of the cross image is not 3:4 the cubemap tool will crop it down so that matches the appropriate aspect ratio.

Horizontal Cross

This option exposes a single input on the tool tile. The image should be a unwrapped texture of a cube containing all the faces organized into a horizontal cross formation, where the width is larger than the height. If the image aspect of the cross image is not 4:3 the cubemap tool will crop it down so that matches the appropriate aspect ratio.

Coordinate System

This multibutton control sets the coordinate system used when converting the image into a texture.

Model

This option orients the texture along the object local co-ordinate system.

World

This option orients the resulting texture using the global or world coordinate system.

Eye

This option aligns the texture map to the coordinate system of the camera or viewer.

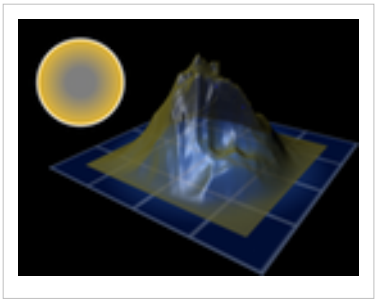
Warn about bad dimensions

Selecting this checkbox will print a warning message into the console if the dimensions of the image provided does not meet the requirements of the selected orientation mode.

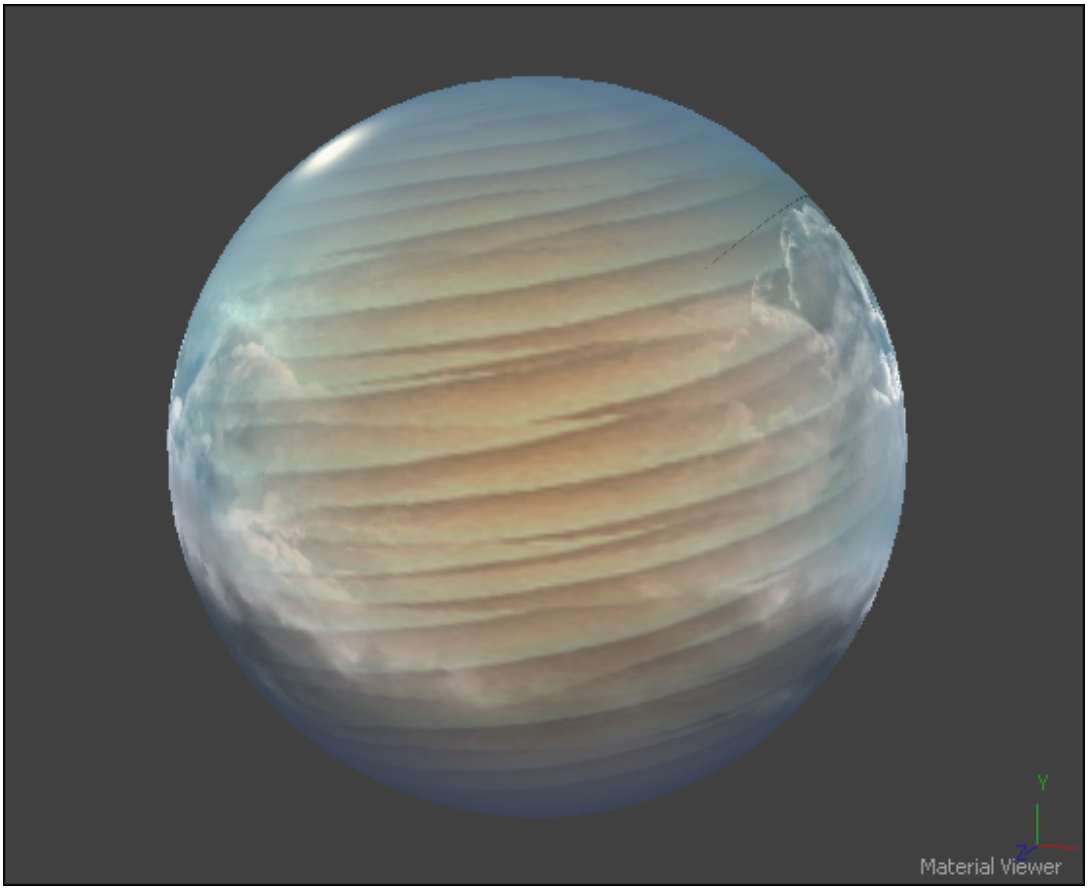
Material ID

This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

Falloff



The Falloff tool blend two materials together based on the incidence angle between the object the material is applied to and the camera. This is useful when the artist wishes to use one material for portions of the geometry that would reflect light directly back to the camera and a different material for parts that reflect light back into the scene.
The following image shows an example of the falloff material using a wood grain texture for the face material and a sky texture for the glancing material



External Inputs



Falloff.FaceOnMaterial

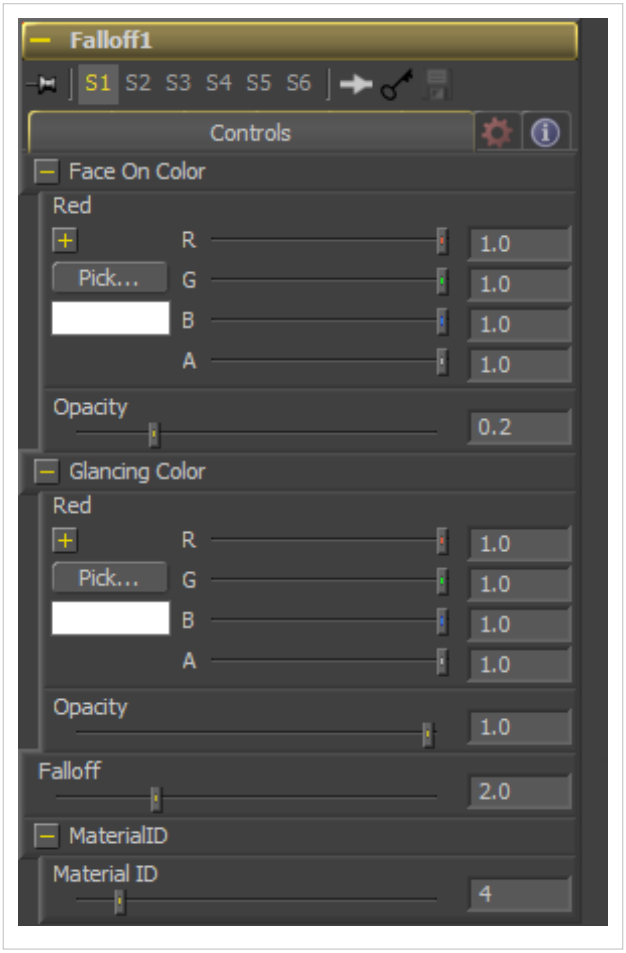
[*orange, optional*] This input expects a 2D image or a 3D material. If a 2D image is provided it will be turned into a diffuse texture map using the basic material shader.

Falloff.GlancingMaterial

[*green, optional*] This input expects a 2D image or a 3D material. If a 2D image is provided it will be turned into a diffuse texture map using the basic material shader.

While the inputs for this tool can be images, the output will always be a material.

Controls



Face On Color

Face On Color

The Face On Color defines the color of surface parts facing the camera. If the Face on texture map is provided then the color value provided here is multiplied by the color values in the texture.

Face on Opacity

Reducing the material's Opacity will decrease the color and alpha values of the Face On material, making the material transparent.

Glancing Color

Glancing Color

The Glancing Color defines the color of surface parts more perpendicular to the camera. If the glancing material port has a valid input, then this input is multiplied by this color.

Glancing Opacity

Reducing the material's Opacity will decrease the color and alpha values of the Glancing material, making the material transparent.

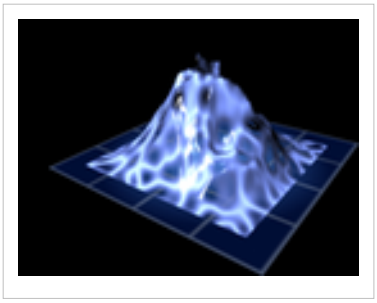
Falloff

This value controls the transition between glancing and face on strength. It is very similar to an gamma operation applied to a gradient blending one value into another.

Material ID

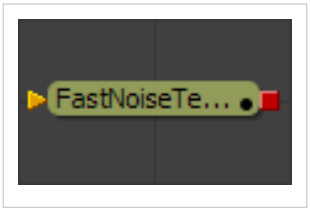
This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

Fast Noise Texture



The Fast Noise Texture tool is the procedural resolution independent version of the the 2D Fast Noise tool. It creates a noise texture directly as a material for usage with 3D tools. It offers a 3D volumetric mode for creating seamless textures in conjunction with tools providing UVW texture coordinates (like the UV Map tool set to "XYZtoUVW" or "Camera")

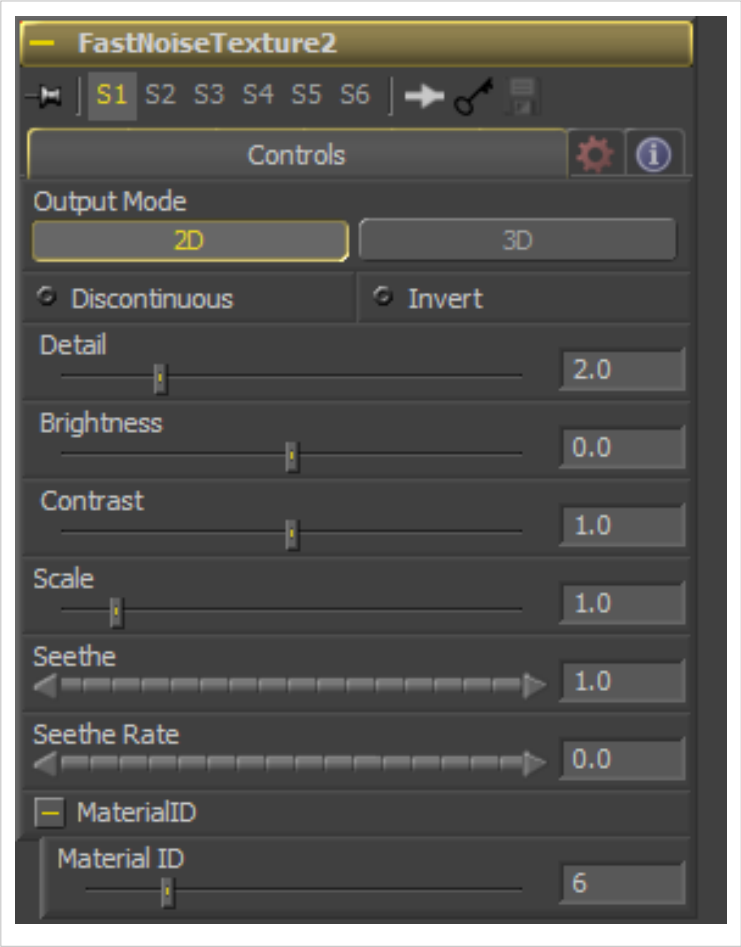
External Inputs



FastNoiseTexture.SourceMaterial

[*orange, required*] This input will accept a 2D image or a 3D material. This is modulated by the noise pattern.

Controls



Output Mode

2D

Calculates the noise texture based on 2D texture coordinates (UV). This mode allows smoothly varying the noise pattern.

3D

Calculates the noise texture based on 3D texture coordinates (UVW). Tools like Shape 3D automatically provide a 3rd texture coordinate, otherwise a 3D texture space can be created using the UV Map tool. Does not support animation of the noise pattern.

Discontinuous

Normally the noise function interpolates between values to create a smooth continuous gradient of results. Enable this checkbox to create hard discontinuity lines along some of the noise contours. The result will be a dramatically different effect.

Invert

Select this checkbox to invert the noise, creating a negative image of the original pattern. This is most effective when Discontinuous is also enabled.

Detail

Increase the value of this slider to produce a greater level of detail in the noise result. Larger values add more layers of increasingly detailed noise without affecting the overall pattern. High values take longer to render but can produce a more natural result (not all graphics cards support higher detail levels in hardware).

Brightness

This control adjusts the overall brightness of the noise map.

Contrast

This control increases or decreases the overall contrast of the noise map. It can exaggerate the effect of the noise.

Scale

The feature scale of the noise map can be adjusted using the Scale slider, changing it from gentle variations over the whole image to a tighter overall texture effect. This value represents the scale along the UV axis.

Scale Z

(3D only) The Scale Z value scales the noise texture along the W axis in texture space.

Seethe

(2D only) The Seethe control smoothly varies the 2D noise pattern.

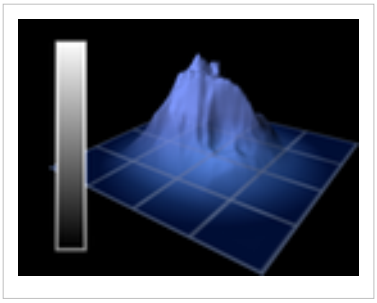
Seethe Rate

(2D only) As with the Seethe control above, the Seethe Rate also causes the noise map to evolve and change. The Seethe Rate defines the rate at which the noise changes each frame, causing an animated drift in the noise automatically, without the need for spline animation.

Material ID

This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

Gradient 3D



With the Gradient 3D tool it is possible to texture objects with a variety of gradient types. It offers many of the controls of the Background tool. While it is not possible to transform the gradient directly in 3d space, it is orientable using the following tools:

Texture Transform tool

The Texture Transform tool can be used to adjust the mapping per pixel.

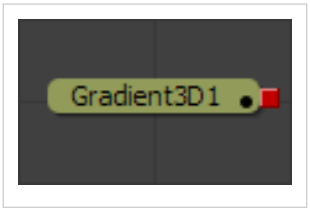
UVMap tool

The UV Map tool can be used to adjust the mapping per vertex (use the XYZtoUVW mode) - this has onscreen controls so you can see what the gradient is doing. Using this tool is recommended because it is faster to evaluate.

This tool was created mostly to test 3D procedural texturing functionality of the material pipeline during development, so not all the buttons work (the samples per pixel buttons and possibly the interpolation method)

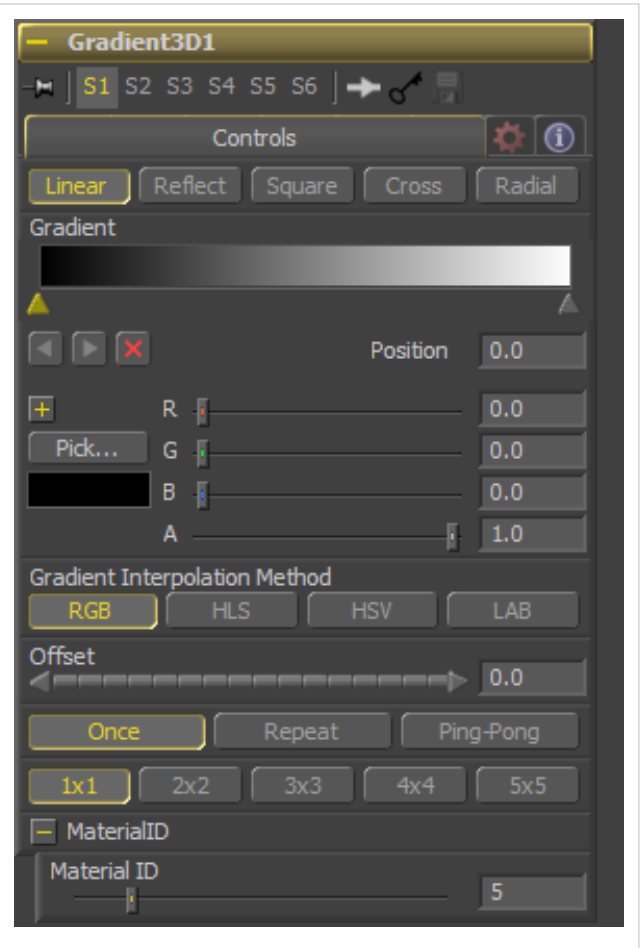
Working with the Gradient tool may be a bit confusing at first. By default the gradient defaults to a linear gradient that goes from -1 to +1 along the Z-axis. All primitives in Fusion (Shape 3D) can output a 3rd texture coordinate for UVW mapping.

External Inputs



This material tool does not have any external inputs.

Controls



Gradient Type

Determines the type of or pattern used for the gradient.

Linear

A simple linear gradient.

Reflect

Based on the linear mode, this gradient will be mirrored at the middle of the textured range.

Square

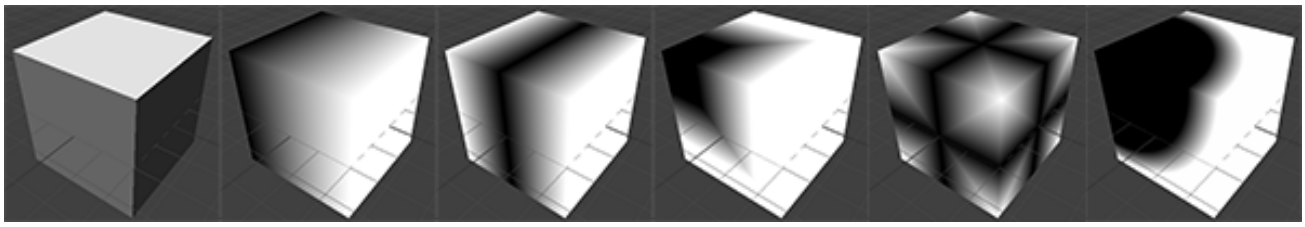
The gradient is applied using a square pattern.

Cross

Similar to the reflect mode, but it will use two axis to apply the gradient.

Radial

The radial mode uses a circular pattern to apply the gradient.



Gradient

The Gradient control consists of a bar where it is possible to add, modify and remove points of the gradient. Each point has its own color. It is possible to animate the color as well as the postion of the point. Futhermore a From Image modifer can be applied to the gradient to evaluate it from an image.

Gradient Interpolation Method

The gradient is linear interpolated from point to point in RGB color space by default. This can result in unwanted colors sometimes. Choosing another color space may provide a better result.

Offset

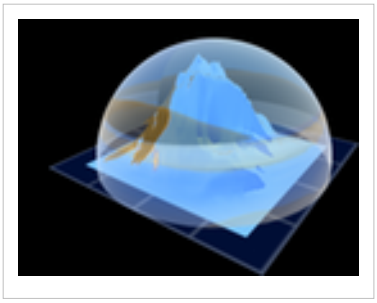
Repeat

Sub Pixel

Material ID

This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

Sphere Map



The SphereMap tool allows the creation of a spherical texture map from an image. The input image should represent the texture information in a longitude/latitude format, where the x axis represents 0-360 degrees longitude and the y axis represents -90 to +90 degrees latitude.

The tool expects an image with an aspect ratio of 2:1. Otherwise the image is clamped according to the following rules:

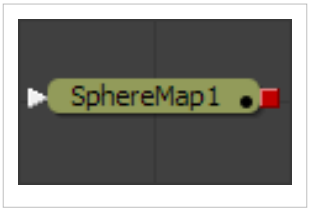
2 * width > height

The width is fit onto the sphere and the poles will display clamped edges.

2 * width < height

The height is fit onto the sphere and there will be clamping about the 0 degree longitude line.

External Inputs



SphereMap.ImageImage

[*white, required*] Receives the RGBA channels from an image output

Controls



Angular Mapping

Adjusts the texture coordinate mapping so the poles are less squashed and areas in the texture get mapped to equal areas on the sphere. In other words, it turns the mapping of the latitude lines from a hemispherical fisheye to an angular fisheye. This mapping attempts to preserve area and makes it easier to paint on or modify a spheremap since the image is not as compressed at the poles.

Rotation

Offers controls to rotate the texture map.

Material ID

This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

Texture Transform



The TextureTransform tool can be used to translate, rotate and scale image textures on the input material. While the input can also be an image, the output will always be a material.

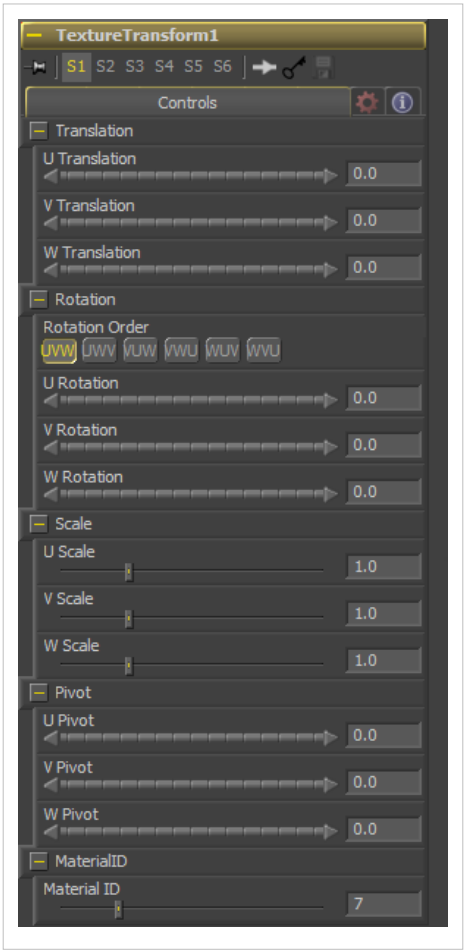
External Inputs



TextureTransform.MaterialInput

[*orange, optional*] This input expects a 2D image or 3D material.

Controls



Translation

U, V, W Translation

These sliders will shifts the texture along U, V, and W axis.

Rotation

Rotation Order

Use these buttons to set the order in which the rotation applied.

U, V, W Rotation

In conjunction with the *Rotation Order* these settings defines the rotation around the UVW axis.

Scale

U, V, W Scale

Scales the texture along the according UVW axis.

Pivot

U, V, W Pivot

Sets the reference point for rotation and scaling

Material ID

This slider sets the numeric identifier assigned to this material. This value will be rendered into the MatID auxiliary channel if the according option is enabled in the renderer.

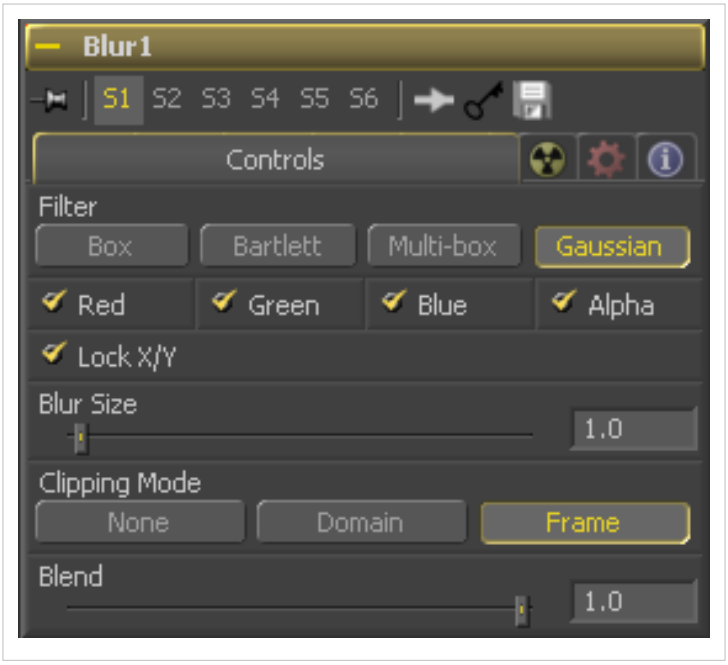
Blur

Blur



The Blur tool does exactly what its name implies - it blurs the input image. This is one of the most commonly used image processing operations.

Controls



Filter Type

The Filter Type button array allows for the selection of the filter to be applied to the image.

Box Blur This option applies a Box Blur effect to the whole image. This method is faster than the Gaussian blur but produces a lower quality result.

Soften Soften applies a general softening filter effect. This filter method is slower than the Gaussian filter, and produces a lower quality result. It is included for compatibility with older flows only.

Bartlett Bartlett applies a more subtle, anti-aliased blur filter.

Multi-Box Multi-Box uses a box filter layered in multiple passes to approximate a Gaussian shape. With a moderate number of passes (e.g. 4), a high quality blur can be obtained, often faster than the Gaussian filter, and without any ringing.

Gaussian Gaussian applies a smooth, symmetrical blur filter, using a sophisticated constant-time Gaussian approximation algorithm. In extreme cases, this algorithm may exhibit ringing see below for a discussion of this. This mode is the default filter method.

Color Channels (RGBA)

The filter defaults to operating on R, G, B and A channels. Selective channel filtering is possible by clicking the check boxes beside each channel to make them active or inactive

Note that this is not the same as the RGBA checkboxes found under the common controls. The Blur tool takes these selections into account before it processes the image, so deselecting a channel will cause the tool to skip that channel when processing, speeding up the rendering of the effect.

In contrast the channel controls under the Common controls tab are applied after the tool has processed.

Lock X/Y

Locks the X and Y blur sliders together for symmetrical blurring. This is checked by default.

Blur Size

Sets the amount of blur applied to the image. When the Lock X and Y control is deselected, independent control over each axis is provided.

Clipping Mode

This option sets the mode used to handle the edges of the image when performing domain of definition rendering. This is profoundly important for tools like Blur which may require samples from portions of the image outside the current domain.

Frame

The default option is Frame, which automatically sets the tools domain of definition to use the full frame of the image, effectively ignoring the current domain of definition. This is identical to the way Fusion worked in versions prior to 6.0.

If the upstream DOD is smaller than the frame, the remaining area in the frame will be treated as black/transparent.

Domain

Setting this option to Domain will respect the upstream domain of definition when applying the tools effect. This can have adverse clipping effects in situations where the tool employs a large filter.

None

Setting this option to None will not perform any source image clipping at all. This means that any data required to process the tools effect which would normally be outside the upstream DOD will be treated as black/transparent.

Blend

This is a cloned instance of the blend slider in the common controls tab. Changes made to this control are simultaneously made to the one in the common controls.

The blend slider mixes the result of the tool with its input, blending back the effect at any value less than 1.0.

Since a perfect Gaussian filter would require examining an infinite number of pixels, all practical Gaussians are of necessity approximations. The algorithm Fusion uses is a highly-optimised approach that has many strengths, but can give rise to visible "ringing" around the edges in certain extreme cases. This ringing only appears when blurring float-depth images, and is normally far below the limits of visibility, especially in final renders or HiQ mode, but may appear in subsequent processing. If you experience this, the new Multi-Box filter may be a viable alternative.

Defocus

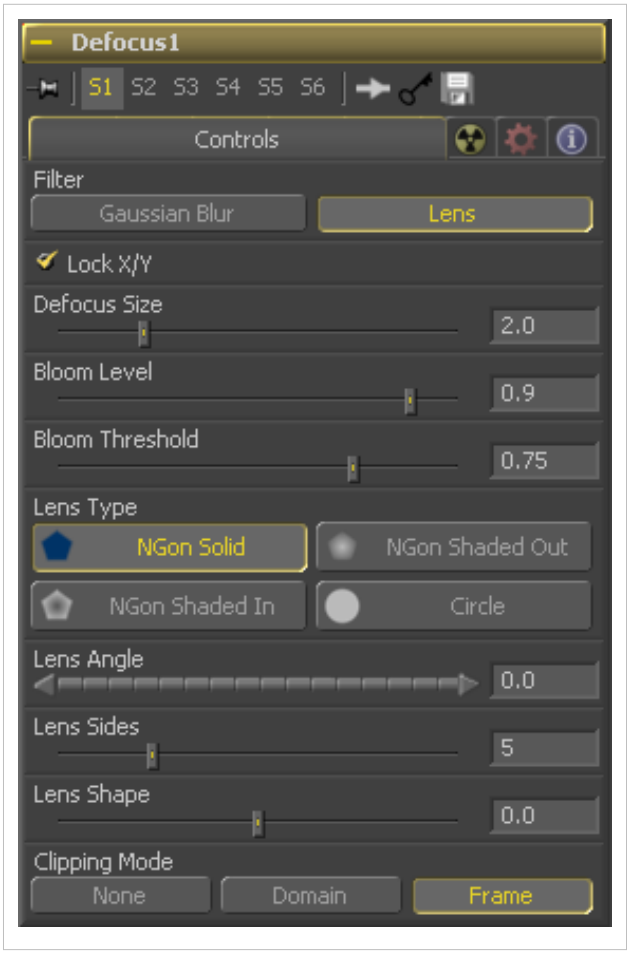
Defocus [DFO]



The Defocus Tool simulates the effects of an out-of focus camera lens, including blooming and image flaring. It provides a fast but relatively inaccurate Gaussian mode, as well as a more realistic but much slower Lens mode.

Controls


Defocus1
S1 S2 S3 S4 S5 S6
Controls
Filter
Gaussian Blur
Lens
Lock X/Y
Defocus Size
2.0
Bloom Level
0.9
Bloom Threshold
0.75
Clipping Mode
None
Domain
Frame



Filter

Use this menu to select the exact method applied to create the defocus. Gaussian applies a fairly simplistic effect while Lens mode will create a much more realistic defocus. Lens mode will take significantly longer than Gaussian.

Lock X/Y

When Lock X/Y is selected, this performs the same amount of defocusing to both the X and Y axis of the image. Deselect to obtain individual control.

Defocus Size

The Defocus Size control sets the size of the defocus effect. Higher values blur the image by greater amounts and produce larger blooms.

Bloom Level

The Bloom Level control determines the intensity and size of the blooming applied to pixels that are above the bloom threshold.

Bloom Threshold

Pixels with values above the set Bloom Threshold are defocused and have a glow applied (blooming). Pixels below that value are only defocused.

Lens Type

The basic shape that is used to create the "bad bokeh" effect. This can be refined further with the Angle, Sides and Shape sliders.

Lens Angle

Defines the rotation of the shape. Best visible with NGon Lens Types. Due to the round nature of a circle this slider will have no visible effect when the Lens Type is set to Circle.

Lens Sides

Defines how many sides the NGon shapes will have. Best visible with NGon Lens Types. Due to the round nature of a circle this slider will have no visible effect when the Lens Type is set to Circle.

Lens Shape

Defines how pointed the NGons are. Higher values will create a more pointed, starry look. Lower values create smoother NGons. Best visible with NGon Lens Types and Lens Sides between 5 and 10. Due to the round nature of a circle this slider will have no visible effect when the Lens Type is set to Circle.

Clipping Mode

This option sets the mode used to handle the edges of the image when performing domain of definition rendering. This is profoundly important for tools like Blur which may require samples from portions of the image outside the current domain.

Frame

The default option is Frame, which automatically sets the tools domain of definition to use the full frame of the image, effectively ignoring the current domain of definition. This is identical to the way Fusion worked in versions prior to 6.0.

If the upstream DOD is smaller than the frame, the remaining area in the frame will be treated as black/transparent.

Domain

Setting this option to Domain will respect the upstream domain of definition when applying the tools effect. This can have adverse clipping effects in situations where the tool employs a large filter.

None

Setting this option to None will not perform any source image clipping at all. This means that any data required to process the tools effect which would normally be outside the upstream DOD will be treated as black/transparent.

Directional Blur

Directional Blur [DrBl]



This tool is used to create directional and radial blurs. It is useful for creating simulated motion blur and light ray type effects. All channels (RGBA) are affected by Directional Blur.

Controls



Type

This button array is used to select the Type of directional blur to be supplied to the image.

Linear

Linear distorts the image in a straight line, resembling the scenery that appears in the window of a speeding train.

Radial

Radial will create a distortion that originates at some arbitrary center, radiating outward the way that a view would appear if one were at the head of the train looking forward.

Centered

The Centered button produces a similar result to linear but the blur effect is equally distributed on both sides of the original.

Zoom

Zoom creates a distortion in the scale of the image smear to simulate the zoom streaking of a camera filming with a slow shutter speed.

Center X And Y

This coordinate control and crosshair affect the radial and zoom motion blur types only. It is used to calculate the position from where the blurring effect starts.

Length

Length adjusts the strength and heading of the effect. Values lower than zero cause blurs to oppose the angle control. Values greater than slider maximum may be typed into the slider's edit box.

Angle

In both linear modes, this control will modify the direction of the directional blur. In the radial and zoom modes, the effect will be similar to that of the camera spinning while looking at the same spot. If the setting of the length slider is other then 0, the effect will create a whirlpool effect.

Glow

This will add a Glow to the directional blur, which can be used to duplicate the effect of increased camera exposure to light caused by longer shutter speeds.

Clipping Mode

This option sets the mode used to handle the edges of the image when performing domain of definition rendering. This is profoundly important for tools like Blur which may require samples from portions of the image outside the current domain.

Frame

The default option is Frame, which automatically sets the tools domain of definition to use the full frame of the image, effectively ignoring the current domain of definition. This is identical to the way Fusion worked in versions prior to 6.0.

If the upstream DOD is smaller than the frame, the remaining area in the frame will be treated as black/transparent.

Domain

Setting this option to Domain will respect the upstream domain of definition when applying the tools effect. This can have adverse clipping effects in situations where the tool employs a large filter.

None

Setting this option to None will not perform any source image clipping at all. This means that any data required to process the tools effect which would normally be outside the upstream DOD will be treated as black/transparent.

Glow

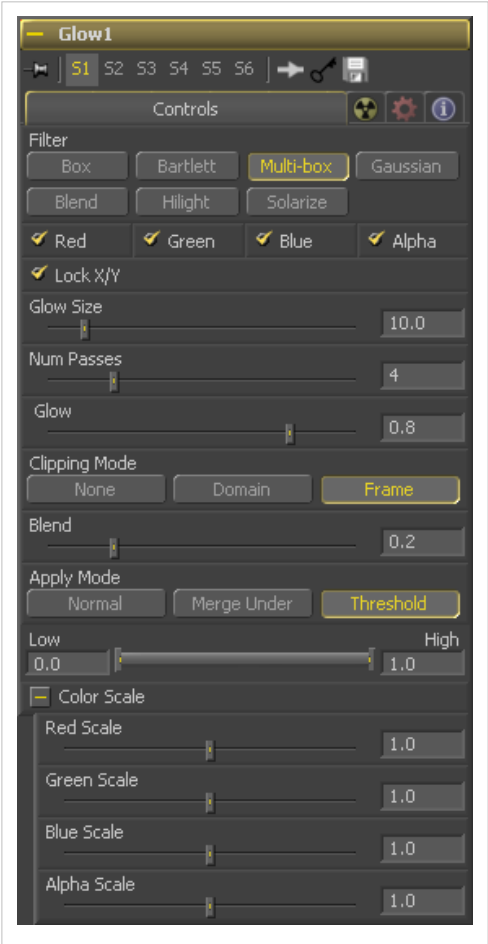
Glow [Glo]



A glow is basically created by blurring an image, then brightening the blurred result and mixing it back with the original.

The Glow tool provides a more convenient way to accomplish this effect, as well as a variety of variations on the theme. For example, a Bartlett glow is a high quality glow with smoother drop off, however, it is more processor-intensive at larger sizes.

Controls



Filter

Use these buttons to select the method of Blur used in the filter. The selections are described below.

Box

A simple but very fast Box filter.

Bartlett

Bartlett adds a softer, subtler glow with a smoother drop off, but may take longer to render than Box.

Multi-Box

Multi-Box uses a box filter layered in multiple passes to approximate a Gaussian shape. With a moderate number of passes (e.g. 4), a high quality blur can be obtained, often faster than the Gaussian filter, and without any ringing.

Gaussian

Gaussian adds a soft glow, blurred by the gaussian algorithm. This is the default method.

Blend

Blend adds a non-linear glow that is evenly visible in the whites and blacks.

Hilight

Hilight adds a glow without creating a halo in the surrounding pixels.

Solarize

Solarize adds a glow and solarizes the image.

Color Channels (RGBA)

The filter defaults to operating on R, G, B and A channels. Selective channel filtering is possible by clicking the checkboxes beside each channel to make them active or inactive.

This is not the same as the RGBA checkboxes found under the common controls. The tool takes these controls into account before it processes. Deselecting a channel will cause the tool to skip that channel when processing, speeding up the rendering of the effect.

In contrast, the channel controls under the common controls tab are applied after the tool has processed.

Lock X/Y

When Lock X/Y is checked, both the horizontal and vertical glow amounts will be locked. Otherwise, separate amounts of blur may be applied to each axis.

Glow Size

Glow Size determines the size of the glow effect. Larger values expand the size of the glowing highlights of the image.

Num Passes

Only available in Multi Box mode. Larger values result in a smoother distribution of the effect but also increase render times. Good to find that thin line between desired quality and acceptable render times.

Glow

The Glow slider determines the intensity of the glow effect. Larger values tend to completely blow the image out to white.

Clipping Mode

This option sets the mode used to handle the edges of the image when performing domain of definition rendering. This is profoundly important for tools like Blur which may require samples from portions of the image outside the current domain.

Frame

The default option is Frame, which automatically sets the tools domain of definition to use the full frame of the image, effectively ignoring the current domain of definition. This is identical to the way Fusion worked in versions prior to 6.0.

If the upstream DOD is smaller than the frame, the remaining area in the frame will be treated as black/transparent.

Domain

Setting this option to Domain will respect the upstream domain of definition when applying the tools effect. This can have adverse clipping effects in situations where the tool employs a large filter.

None

Setting this option to None will not perform any source image clipping at all. This means that any data required to process the tools effect which would normally be outside the upstream DOD will be treated as black/transparent.

Blend

This is a cloned instance of the Blend slider in the common controls tab. Changes made to this control are simultaneously made to the one in the common controls.

The blend slider mixes the result of the tool with its input, blending back the effect at any value less than 1.0.

Apply Mode

Three Apply Modes are available when it comes to applying the glow to the image.

Normal Default. This mode simply adds the glow directly over top of the original image.

Merge Under Merge Under places the glow beneath the image, based on the alpha channel. Threshold mode permits clipping of the threshold values.

Threshold This control clips the effect of the glow. A new range slider will appear. Pixels in the glowed areas with values below the low value will be pushed to black. Pixels with values greater than high will be pushed to white.

High-Low Range Control Only available in Threshold mode. Pixels in the glowed areas with values below the low value will be pushed to black. Pixels with values greater than high will be pushed to white.

Color Scale (RGBA)

These Scale sliders are normally a reveal control labelled Color Scale. They can be used to adjust the amount of glow applied to each color channel individually, thereby tinting the glow.

{{{1}}}

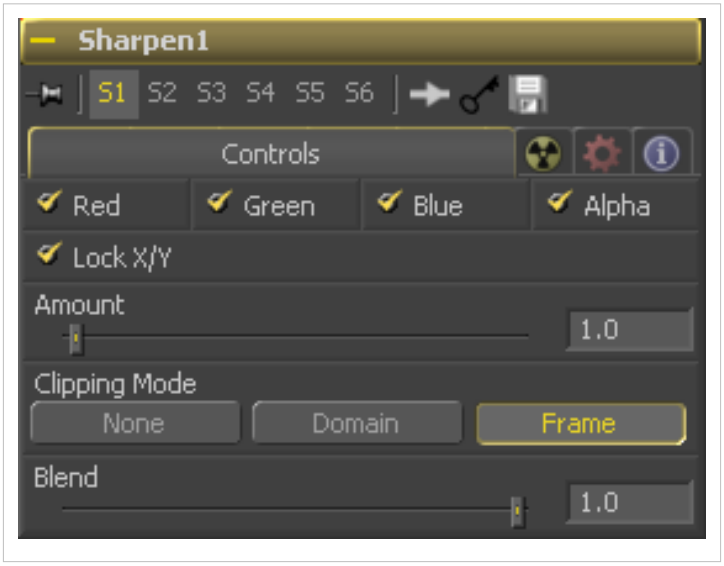
Sharpen

Sharpen [Shrp]



The Sharpen tool uses a convolution filter to enhance detail in an image.

Controls



Color Channels (RGBA)

The filter defaults to operating on R G B and A channels. Selective channel filtering is possible by clicking the checkboxes beside each channel to make them active or inactive.

This is not the same as the RGBA checkboxes found under the common controls. The tool takes these controls into account before it processes, so deselecting a channel will cause the tool to skip that channel when processing, speeding up the rendering of the effect.

In contrast, the channel controls under the common controls tab are applied after the tool has processed.

Lock X/Y

This Locks the X and Y sharpen sliders together for symmetrical sharpening. This is checked by default.

Amount

This slider sets the Amount of sharpening applied to the image. When the lock X/Y control is deselected, independent control over each axis is provided.

Clipping Mode

This option sets the mode used to handle the edges of the image when performing domain of definition rendering. This is profoundly important for tools like Blur which may require samples from portions of the image outside the current domain.

Frame

The default option is Frame, which automatically sets the tools domain of definition to use the full frame of the image, effectively ignoring the current domain of definition. This is identical to the way Fusion worked in versions prior to 6.0.

If the upstream DOD is smaller than the frame, the remaining area in the frame will be treated as black/transparent.

Domain

Setting this option to Domain will respect the upstream domain of definition when applying the tools effect. This can have adverse clipping effects in situations where the tool employs a large filter.

None

Setting this option to None will not perform any source image clipping at all. This means that any data required to process the tools effect which would normally be outside the upstream DOD will be treated as black/transparent.

Blend

This is a cloned instance of the Blend slider in the common controls tab. Changes made to this control are simultaneously made to the one in the common controls.

The blend slider mixes the result of the tool with its input, blending back the effect at any value less than 1.0.

Soft Glow

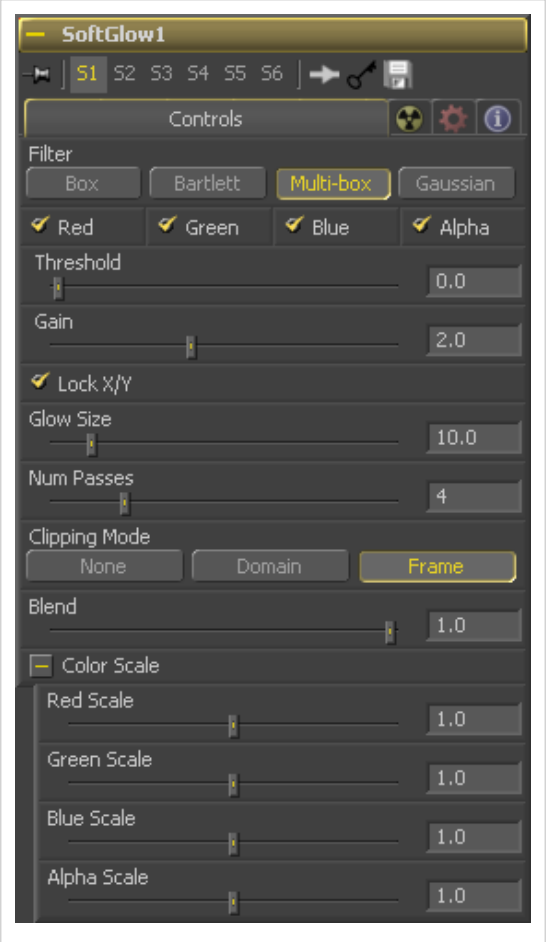
Soft Glow [SGl]



The Soft Glow tool is similar to the Glow tool but performs additional processing of the image to create a much softer, more natural glow.

This tool is perfect for atmospheric haze around planets, skin tones, and simulating dream-like environments.

Controls



Filter

Use these buttons to select the method of Blur used in the filter. The selections are described below.

Box A simple but very fast Box filter.

Bartlett Bartlett adds a softer, subtler glow with a smoother drop off, but may take longer to render than Box.

Multi-Box Multi-Box uses a box filter layered in multiple passes to approximate a Gaussian shape. With a moderate number of passes (e.g. 4), a high quality blur can be obtained, often faster than the Gaussian filter, and without any ringing.

Gaussian Gaussian adds a soft glow, blurred by the gaussian algorithm. This is the default method.

Color Channels (RGBA)

The filter defaults to operating on R G B and A channels. Selective channel filtering is possible by clicking the checkboxes beside each channel to make them active or inactive.

This is not the same as the RGBA checkboxes found under the common controls. The tool takes these controls into account before it processes, so deselecting a channel will cause the tool to skip that channel when processing, speeding up the rendering of the effect.

In contrast, the channel controls under the common controls tab are applied after the tool has processed.

Threshold

This control is used to limit the affect of the soft glow. The higher the threshold, the brighter the pixel must be before it is affected by the glow.

Gain

The Gain control defines how bright the glow is.

Lock X/Y

When Lock X/Y is checked, both the horizontal and vertical glow amounts will be locked. Otherwise, separate amounts of glow may be applied to each axis of the image.

Glow Size

Amount determines the size of the glow effect. Larger values expand the size of the glowing highlights of the image.

Num Passes

Only available in Multi Box mode. Larger values result in a smoother distribution of the effect but also increase render times. Good to find that thin line between desired quality and acceptable render times.

Clipping Mode

This option sets the mode used to handle the edges of the image when performing domain of definition rendering. This is profoundly important for tools like Blur which may require samples from portions of the image outside the current domain.

Frame

The default option is Frame, which automatically sets the tools domain of definition to use the full frame of the image, effectively ignoring the current domain of definition. This is identical to the way Fusion worked in versions prior to 6.0.

If the upstream DOD is smaller than the frame, the remaining area in the frame will be treated as black/transparent.

Domain

Setting this option to Domain will respect the upstream domain of definition when applying the tools effect. This can have adverse clipping effects in situations where the tool employs a large filter.

None

Setting this option to None will not perform any source image clipping at all. This means that any data required to process the tools effect which would normally be outside the upstream DOD will be treated as black/transparent.

Blend

This is a cloned instance of the Blend slider in the common controls tab. Changes made to this control are simultaneously made to the one in the common controls.

The blend slider mixes the result of the tool with its input, blending back the effect at any value less than 1.0.

Color Scale (RGBA)

These Scale sliders are normally a reveal control labelled Color Scale. They can be used to adjust the amount of glow applied to each color channel individually, thereby tinting the glow.

{{{1}}}

Unsharp Mask

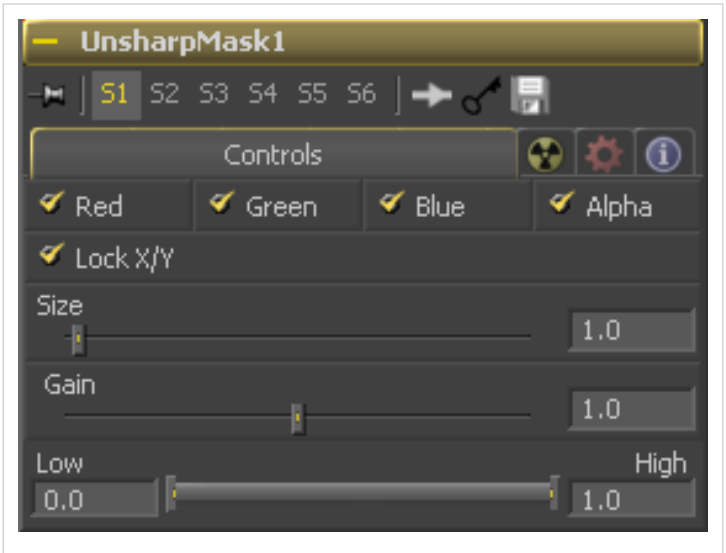
Unsharp Mask [US]



Unsharp masking is a technique used to sharpen only the edges within an image. This tool is most often used to correct for blurring and loss of detail in low contrast images for example, to extract useful detail from long exposure shots of far-away galaxies.

This filter operation is performed by extracting a range of frequencies from the image and blurring them to reduce detail. The blurred result is then compared to the original images. Pixels with a significant difference between the original and the blurred image is likely to be an edge detail. The pixel is then brightened to enhance it.

Controls



Color Channels (RGBA)

The filter defaults to operating on R G B and A channels. Selective channel filtering is possible by clicking the checkboxes beside each channel to make them active or inactive.

This is not the same as the RGBA checkboxes found under the common controls. The tool takes these controls into account before it processes, so deselecting a channel will cause the tool to skip that channel when processing, speeding up the rendering of the effect.

In contrast, the channel controls under the common controls tab are applied after the tool has processed.

Lock X/Y

When Lock X/Y is checked, both the horizontal and vertical sharpen amounts will be locked. Otherwise, separate amounts of glow may be applied to each axis of the image.

Size

This control adjusts the size of blur filter applied to the extracted image. The higher this value, the more likely it is that pixels will be identified as detail.

Gain

The Gain control adjusts how much gain is applied to pixels identified as detail by the mask. Higher values will create a sharper image.

Threshold Low And High

This range control determines the frequencies from the source image to be extracted. Raising low values will eliminate dark pixels from the comparison. Pixels above the high value will have the full effect of the gain applied.

VariBlur

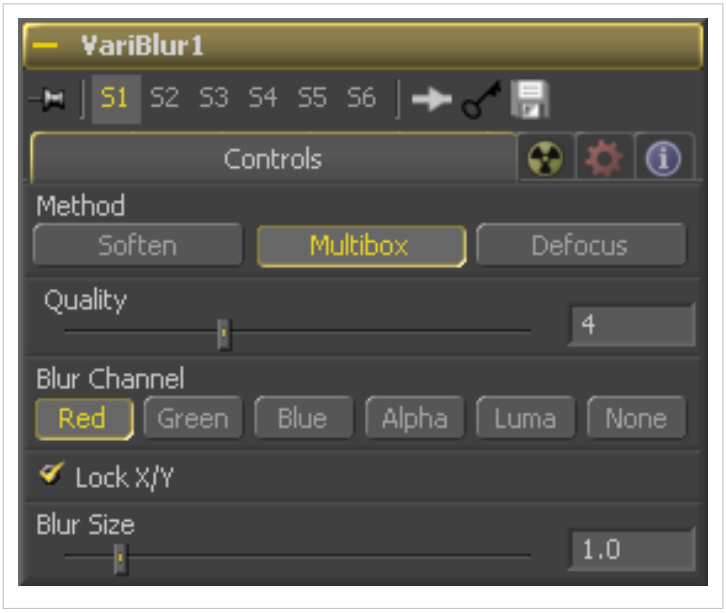
VariBlur [VBl]



The VariBlur tool gives a true per-pixel variable blur, using a second image to control the amount of blur for each pixel. It is somewhat similar in effect to the Depth Blur tool but uses a different approach for cleaner results in many cases.

The Blur Image input must be connected, or no blurring will be performed.

Controls



Method

Soften

This method varies from a simple box shape to a Bartlett triangle to a decent-looking smooth blur as Quality is increased. It is a little better at preserving detail in less-blurred areas than Multibox.

Multibox

Similar to Soften, this gives a better Gaussian approximation at higher Quality settings.

Defocus

Not really a true defocus, this gives a flat, circular shape to blurred pixels that can approximate the look of a defocus.

Quality

Increasing Quality gives smoother blurs, at the expense of speed. Quality set to 1 uses a very fast but simple box blur, for all Method settings. A Quality of 2 is usually sufficient for low Blur

Size values. 4 is generally good enough for most jobs unless Blur Size is particularly high.

Blur Channel

This selects which channel of the Blur Image controls the amount of blurring applied to each pixel.

Lock X/Y

When selected ony a Blur Size control is shown and changes to the amount of blur are applied to both axes equally. If the checkbox is cleared, individual controls appear for both X and Y Blur Size.

Blur Size

Increasing this control will increase the overall amount of blur applied to each pixel. Those pixels where the Blur Image is black or non-existent will never be blurred, regardless of Blur Size.

Vector Motion Blur

Vector Motion Blur [VBl]



This tool is used to create directional blurs based on a Vector Channel.

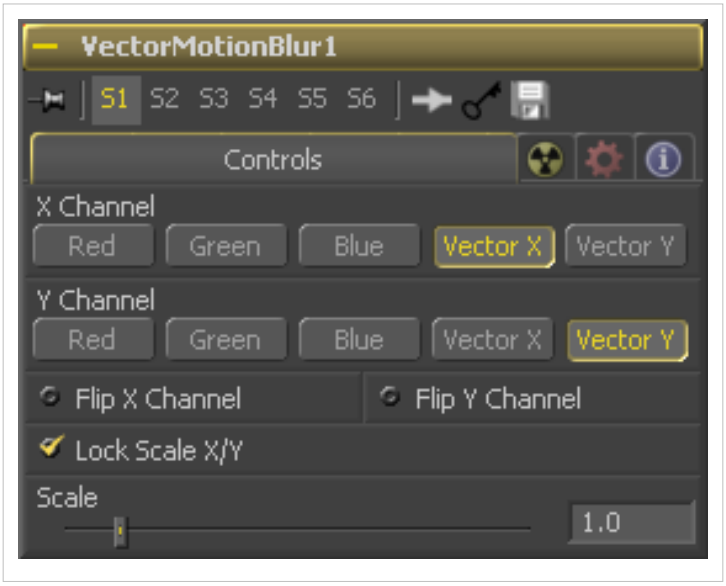
Overview



This tool will perform a 2D blur on the image, using a vector map produced by a 3D application. The vector map is typically two floating point images, one channel specifies how far the pixel is moving in X, and the other specifies how far the pixel is moving in Y. These channels may be embedded in the image in the case of OpenEXR or RLA/RPF images, or may be provided as separate images using the tools Vectors input.

The vector channels should use a float16 or float32 color depth, to provide + and - values. A value of 1 in the X channel would indicate that pixel has moved one pixel to the right, while a value of -10 indicates ten pixels of movement to the left.

Controls



X Channel

Use this Multibutton array to choose which channel of the image will provide the vectors for the movement of the pixels along the X axis.

Y Channel

Use this Multibutton array to choose which channel of the image will provide the vectors for the movement of the pixels along the Y axis.

Flip X Channel

This checkbox can be used to flip, or invert the X vectors. A value of 5 for a pixel in the X vector channel would become -5 when this checkbox is selected.

Flip Y Channel

This checkbox can be used to flip, or invert the Y vectors. A value of 5 for a pixel in the Y vector channel would become -5 when this checkbox is selected.

Lock Scale X/Y

Selecting this checkbox will provide access to seperate sliders for X and Y Scale. Dy default only a single Scale slider is provided.

Scale / Scale X

This slider will be labeled Scale if the Lock Scale X/Y checkbox is not selected, otherwise it will be labelled Scale X. The vector channel value for a pixel is multiplied by the value of this slider. For example, given a scale of 2 and a vector value of 10, the result would be 20.

Scale Y

This slider will only appear if the Lock Scale X/Y checkbox is selected. Otherwise it will be hidden, and use the same value set in the Scale slider above.

Color

Auto Gain

Auto Gain [AG]

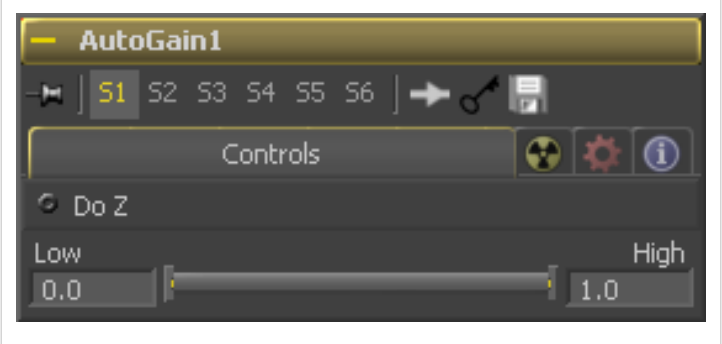


The Auto Gain Tool is used to automatically adjust the color range of an image so that the darkest and brightest pixels are set to user-selected values. By default, the darkest pixels in the image are pushed down to black, the brightest pixels are pushed to white and all of the pixels in between are stretched to cover the color range evenly.

This can be useful when compensating for variations in lighting, dealing with low contrast images, or visualizing the full color range of float images (though the image view's View Normalised Image button is generally more suitable for this).

Variations over time in the input image can cause corresponding variations in the levels of the result. For example, if a bright object moves out of an otherwise dark shot, the remaining scene will get suddenly brighter, as the remaining darker values are stretched to white. This also applies to sudden depth changes when Do Z is applied existing objects may be pushed forward or backwards when a near or far object enters or or leaves the scene.

Controls



Do Z

Select the Do Z checkbox to apply the auto gain effect to the Z-channels. This can be useful for matching the ranges of one Z-channel to another, or to view a float Z-channel in the RGB values.

Range

This Range control is used to set the lowest and highest possible pixel value in the image. All color values in the image are rescaled to fit within this range.

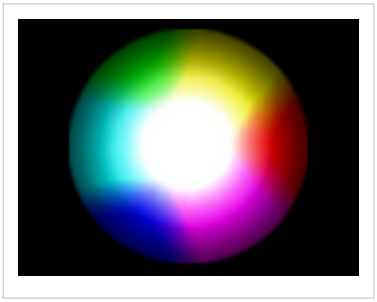
Example



Create a horizontal gradient with the Background tool. Set one color to dark grey (RGB Values 0.2). Set the other color to light grey (RGB Values 0.8).

Add an Auto Gain tool and set the Low value to 0.0 and the High to 0.5. This will cause the brightest pixels to be pushed down to 0.5 and the darkest pixels will get pushed to black. The remainder of the pixel values will be scaled between those limits.

BrightnessContrast



The Brightness Contrast tool is used to adjust the gain, brightness, contrast, gamma and saturation of an image.

The order of the controls represents the order in which each operation is applied (for example, gamma is applied before contrast but after gain).

Controls



Color Channels (RGBA)

The filter defaults to operating on R G B and A channels. Selective channel filtering is possible by clicking the checkboxes beside each channel to make them active or inactive.

This is not the same as the RGBA checkboxes found under the common controls. The tool takes these controls into account before it processes, so deselecting a channel will cause the tool to skip that channel when processing, speeding up the rendering of the effect.

In contrast, the channel controls under the common controls tab are applied after the tool has processed.

Gain

The pixel values are multiplied by the value of this control. A Gain of 1.2 will make a pixel that is R0.5 G0.5 B0.4 into R0.6 G0.6, B0.48 (i.e. 0.4 * 1.2 = 0.48). Gain affects higher values more than it affects lower values so the effect will be strongest in the midrange and toprange of the image.

Gamma

Values higher than 1.0 will raise the Gamma (mid gray), whereas lower values will decrease it. The affect of this tool is not linear and existing black or white levels will not be affected at all. Pure grey colors will be affected the most.

Contrast

Contrast is the range of difference between the light to dark areas. Increasing the value of this slider will increase the contrast, pushing color from the midrange towards black and white. Reducing the contrast will cause the colors in the image to move toward midrange, reducing the difference between the darkest and brightest pixels in the image.

Brightness

The value of the Brightness slider is added to the value of each pixel in the image. This control's affect on an image is linear so the effect will be applied identically to all pixels regardless of value.

Saturation

This control is used to increase or decrease the amount of Saturation in the image. A saturation of 0 has no color. All colors are greyscale.

Low And High

This range control is similar to the gain control in some respects. If Low is anchored at 0.0 and the High value is reduced from 1.0, the effect is identical to increasing the gain. High values are multiplied by the inverse of the high value. (i.e, if high is 0.75, each pixel will be multiplied by 1/0.75 or 1.3333).

Leaving the high anchored at 1.0 and increasing the low is exactly the same as inverting the image colors and increasing the gain and inverting it back again. This pushes more of the image toward black without affecting the whites at all.

Clip Black/White

The Clip Black and Clip White checkboxes are used to clip out of range color values that can appear in an image when processing in floating point color depth. Out of range colors are below black (0.0) or above white (1.0). These checkboxes will have no affect on images processed at 8 bit or 16 bit per channel, as such images cannot have out of range values.

Pre-Divide/Post-Multiply

Selecting the Pre-Divide/Post-Multiply checkbox will cause the image pixel values to be divided by the alpha values prior to the color correction, and then re-multiplied by the alpha value after the correction.

This helps to prevent the creation of illegally additive images, particularly around the edges of a blue/green key or when working with 3D rendered objects.

Channel Boolean

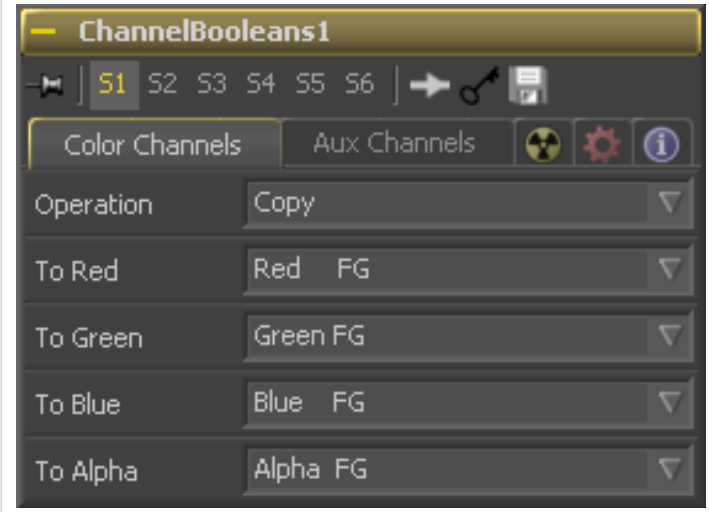
Channel Boolean [Bol]



The Channel Booleans Tool can be used to apply a variety of mathematical and logical operations on the channels in an image. This tool works by using one image's channels to modify another image's channels.

If a foreground input is not available, selecting options that use color channels from the foreground will end up using the background input's color channels instead.

Controls



Operation Type

This drop-down box is used to select the mathematical method applied to the selected channels. It's settings are as follows

Copy

Copy the value from one color channel to another. For example, copy the foreground red channel into the alpha channel to create a matte.

Add

Add the color values from color channel to channel.

Subtract

Subtract the color values of one color channel from another color channel.

And

Perform a logical AND on the color values from color channel to color channel. The foreground image will generally remove bits from the color channel of the background image.

Or

Perform a logical OR on the color values from color channel to color channel. The foreground image will generally add bits from the color channel of the background image.

Exclusive Or

Perform a logical XOR on the color values from color channel to color channel. The foreground image will generally flip bits from the color channel of the background image.

Multiply

Multiply the values of a color channel. This will give the appearance of darkening the image as the values are scaled from 0 to 1. White has a value of one so the result would be the same. Grey has a value of 0.5 so the result would be a darker image or, in other words, an image half as bright.

Divide

Divide the values of a color channel. This will give the appearance of lightening the image as the values are scaled from 0 to 1.

Maximum

Compare the two images and take the Maximum, or brightest, values from each image.

Minimum

Compare the two images and take the Minimum, or darkest, values from each image.

Negative

Invert the FG input to make a Negative version of the image.

Solid

Solid sets a channel to a full value of 255. This is useful for setting the alpha to full value.

Clear

Clear sets a channel to a value of zero. This is useful for clearing the alpha.

Difference

Difference subtracts the greater color values of one color channel from the lesser values of another color channel.

Signed Add

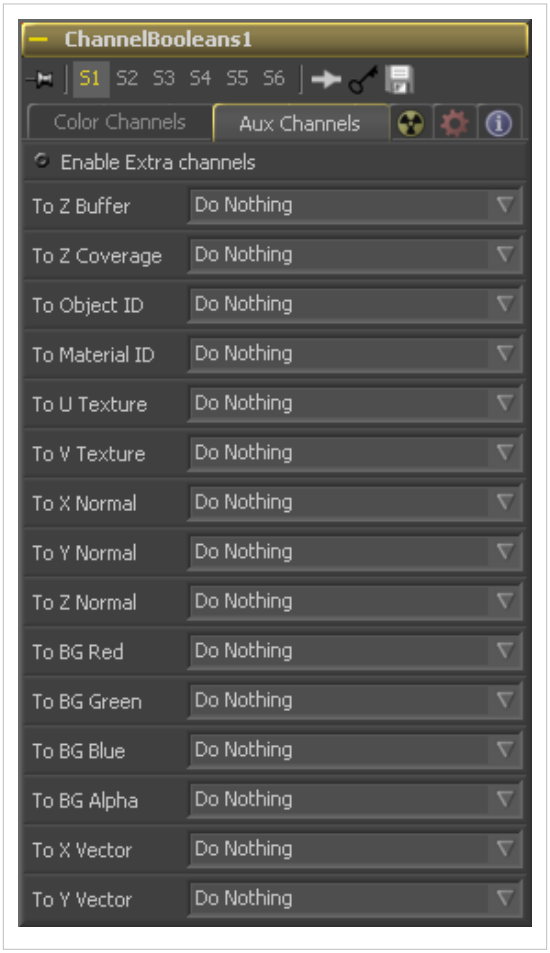
Signed Add subtracts areas that are lower than mid-gray and add areas that are higher than mid-gray, which is useful for creating effects with embossed gray images.

To Red, Green, Blue, Alpha

These menus represent the four color channels of the output image. Use the drop-down menu to select which channel from the source images will be used to produce the output channel.

The default setting simply copies the channels from the foreground channel. Select any one of the four color channels, as well as several auxiliary channels like Z-buffer, saturation, luminance and hue.

Auxiliary Channels



There are several Auxiliary Channels. Use these menus to select a source for the auxiliary channels of the output image. See the chapter on 3D Tools for further details on auxiliary channels.

Enable Extra Channels

When the Enable Extra Channels checkbox is selected, the channel boolean tool will be able to output images with channels beyond the usual RGBA. The remaining controls in this tab will become active and can be used to copy data into the auxiliary channels.

Example



To copy the Alpha channel of one image to its own color channels, set the Red, Green and Blue channels to Alpha BG. Set the Operation to Copy. To copy the Alpha channel from another image, set operation type to Alpha FG.

Color Corrector

Color Corrector [CC]



The Color Corrector Tool is a comprehensive color tool with histograms, matching and equalization, hue shifting, tinting and color suppression.

The Color Corrector has two image inputs. Connect the image to be corrected to the primary input. The secondary input can be used as a reference for histogram matching.

Overview



Controls in the color correction tool are separated into four separate categories colors, levels, histogram and suppress. Selecting one of the category buttons from the array at the top of the Correction Tab will cause that category's controls to appear. Each category is described in detail below.

Colors Mode



Master/Shadows/Midtones/Highlights

This array of buttons determines the range of colors affected by the controls in this tab. For example, when the Shadows range is selected, any color adjustments made will affect only the darker pixels of the image.

The selected state of this button is maintained throughout the Colors, Levels and Suppress sections of the Color Corrector tool.

Note that the controls are independent for each color range. For example, adjusting the Gamma control while in Shadows mode will not change or affect the value of the Gamma control for the Highlights mode. Each control is independent and applied separately.

Adjustments made to the image in the Master channel are applied to the image after any changes made to the Highlight, Midtone and Shadow ranges.

Color Wheel

The Color Wheel display provides a visual representation of adjustments made to Hue and Saturation, as well as any tinting applied to the image. Adjustments can be made directly on the display, or by entering values in the text boxes to the right of the Color Wheel.

Hue

The Hue control provides a method of shifting the Hue of the image (or selected color range) through the color spectrum. The control value has an effective range between 0.0 and 1.0, which represents the angle of rotation in a clockwise direction. A value of 0.25 would be 90 degrees (90/360) and would have the effect of shifting red toward blue, green to red and so on.

The degree of hue shifting can be entered directly into the text control, or by placing the mouse above the outer ring of the color control and dragging the mouse up or down. The outer ring will always show the shifted colors compared to the original colors shown in the center of the control.

Saturation

The Saturation control is used to adjust the intensity of the color values. A Saturation of 0 produces grey pixels without any chroma or color component, whereas a value of 1.0 produces no change in the chroma component of the input image. Higher values will generate over-saturated values with a high color component.

Saturation values can be entered directly into the text control, or by click-dragging the mouse to the left and right on the outer ring of the color wheel control.

Tint/Strength

The Tint control is used to tint an image or selected color range. The values in this control go from 0 to 1.0, which indicate the angle of the tint color on the color wheel. A value of.25 would indicate 90 degrees, which would be midway between green and yellow on the color wheel.

The Strength control determines how much tint is applied to the selected range of colors.

The tinting is represented in the Color Wheel control by small circles that show the color and strength of the tint. The Highlight Ranges marker is a black outline of a circle. The Midtones are represented by a grey circle, and the Shadows by a grey one. The Master Tint Marker is also black, but it has a white M in the center to distinguish it from the others.

The marker for each range can be positioned by the mouse only when the appropriate range is selected. For example, the Highlight Marker cannot be moved when the Master range is selected.

Hold down the Ctrl key while dragging this control will allow you to make finer adjustments by reducing the controls sensitivity to mouse movements. Holding the Shift key down will limit the movement of the marker to a single axis, allowing you to restrict the affect to either tint or strength.

Tint Mode

Fast/Full/Better

These three buttons are used to select the speed and quality of the algorithm used to apply the tint, hue and saturation adjustments. The default is Better, but for working with larger images, it may be desirable to use a lesser, faster method.

Hue

This slider is a clone of the Hue control shown in the color wheel above. The slider makes it easier to make small adjustments to the value with the mouse.

Saturation

This slider is a clone of the Saturation control shown in the color wheel above. The slider makes it easier to make small adjustments to the value with the mouse.

RGB/Red/Green/Blue

These buttons are the same buttons seen in the Histogram, Color and Levels sections of the Color Corrector tool. When the Red channel is selected, the controls in this tab will affect the Red channel only, and so on.

The controls are independent, so switching to Blue will not remove or eliminate any changes made to Red, Green or Master. The animation and adjustments made to each channel are separate. These buttons simply determine what controls to display.

Master RGB Contrast

Contrast is the range of difference between the light to dark areas. Increasing the value of this slider will increase the contrast, pushing color from the midrange towards black and white. Reducing the contrast will cause the colors in the image to move towards midrange, reducing the difference between the darkest and brightest pixels in the image.

Master RGB Gain

The pixel values are multiplied by the value of this control. A gain of 1.2 will make a pixel which is R0.5 G0.5 B0.4 into R0.6 G0.6, B0.48 (i.e. 0.4 * 1.2 = 0.48). Gain affects higher values more than it affects lower values, so the effect will be strongest in the midrange and toprange of your image.

Master RGB Gamma

Values higher than 1.0 will raise the gamma (mid gray) while lower values will decrease it. The affect of this tool is not linear, and existing black or white levels will not be affected at all. Pure grey's will be affected the most.

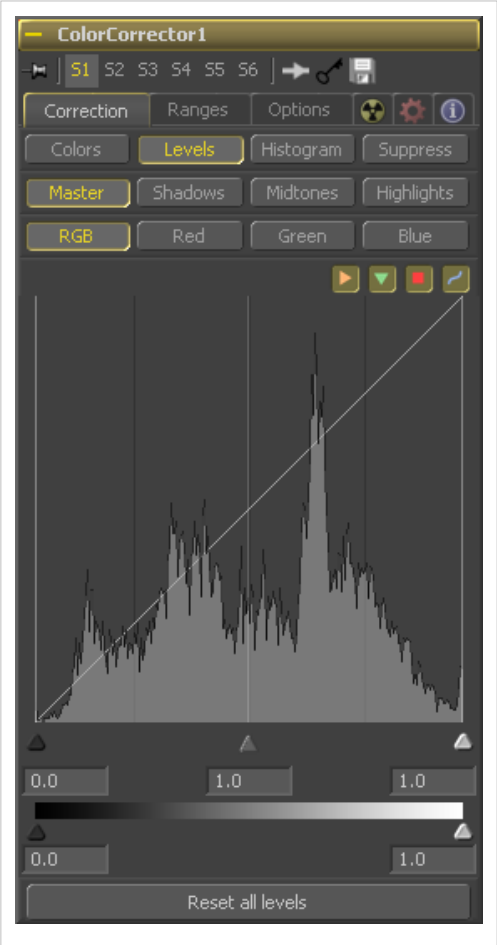
Master RGB Brightness

The value of the brightness slider is added to the value of each pixel in your image. This control's affect on an image is linear, so the effect will be applied identically to all pixels regardless of value.

Reset All Color Changes

Selecting this button will return all color controls in this section to their default values.

Levels Mode



Master/Shadows/Midtones/Highlights

This array is described in the colors mode above.

Histogram Control

A Histogram is a chart that represents the distribution of color values in the scene. The chart reads from left to right, with the leftmost values representing the darkest colors in the scene and the rightmost values representing the brightest. The more pixels in an image with the same or similar value, the higher that portion of the chart will be.

Luminance is calculated per channel, therefore, the Red, Green and Blue channels all have their own histogram and the combined result of these comprise the Master Histogram.

To scale the histogram vertically, place the mouse pointer inside the control and click-drag the pointer up to zoom in or down to zoom out.

RGB/Red/Green/Blue

These buttons are used to select and display the histogram for each color channel or for the master channel.

Display Selector Toolbar

The Display Selector Toolbar provides a method of enabling and disabling components of the histogram display. Hold the mouse pointer over the button to display a tooltip that describes the button's function.

Input Histogram

This enables or disables the display of the Input image's histogram.

Reference Histogram

This enables or disables the display of the Reference image's histogram.

Output Histogram

This enables or disables the display of the histogram from the post color corrected image.

Corrective Curve

This toggles the display of a spline used to visualize exactly how auto color corrections applied using a reference image are affecting the image. This can be useful when equalizing luminance between the input and reference images.

Low/Mid/High

These controls are used to adjust the input image's histogram, compressing or shifting the ranges of the selected color channel.

The controls can be adjusted by click-dragging the triangles beneath the histogram display to the left and right.

Shifting the high value toward the left (decreasing the value) will cause the histogram to slant toward white, shifting the image distribution toward white. The low value will have a similar affect in the opposite direction, pushing the image distribution toward black.

Threshold Output Low/High

The Threshold control can apply clipping to the image, compressing the histogram. Decreasing the level of the High control will reduce the value of pixels in the image, sliding white pixels down toward grey and grey pixels toward black.

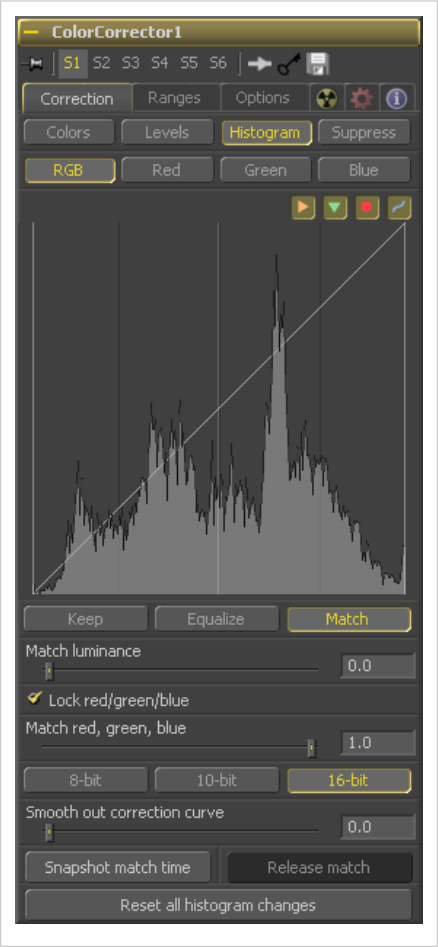
Adjusting the Low control toward high will do the opposite, sliding the darkest pixels toward white.

If the low value were set to 0.1, pixels with a value of 0.0 would be set to 0.1 instead, and all other values would increase to accommodate the change. The best way to visualize the effect is to observe the change to the output histogram displayed above.

Reset All Levels

Clicking on this button will reset all of the controls in the Levels section to their defaults.

Histogram Mode



This color corrector mode produces a Histogram display of the input image. If a reference image is also provided, the histogram for the reference image is also displayed. The controls in this tab are primarily used to match one image to another, using either the Equalize or Match modes of the Color Corrector.

Float Images And Histogram Equalization Or Matching Use the histogram matching or equalization methods on a float image and the color depth of the output image will be converted to 16 bit integer. Two dimensional histograms are not well suited to working with the extreme dynamic range of float images so these operations will always revert to 16 bit integer processing.

Histogram Control

The Histogram Control is described in detail earlier in this tool documentation, under the heading of the Levels Mode.

Keep/Equalize/Match Buttons

Each of these buttons enables a different type of color correction operation.

Keep

Keep produces no change to the image and the reference histogram is ignored.

Equalize

Selecting Equalize adjusts the source image so that all of the color values in the image are equally represented, in essence, flattening the histogram so that the distribution of colors in the image becomes more even.

Match

The Match mode modifies the source image based on the histogram from the reference image. It is used to match two shots with different lighting conditions and exposures so that they will appear similar.

When selected, the Equalize and Match modes reveal the following controls.

Match/Equalize Luminance

This slider affects the degree to which the Color Corrector tool will attempt to affect the image based on its luminance distribution. When this control is zero (the default), matching and equalization are applied to each color channel independently and the luminance, or combined value of the three color channels, is not affected.

If this control has a positive value when Equalizing the image, the input image's luminance distribution will be flattened before any color equalization is applied.

If this control has a positive value when the correction mode is set to Match, the luminance values of the input are matched to the reference before any correction is applied to the R, G and B channels.

The luminance and RGB controls can have a cumulative effect, and generally they are not both set to full (1.0) at the same time.

Lock Red/Green/Blue

When this checkbox is selected, color matching will be applied to all color channels equally. When the checkbox is not selected, individual controls for each channel will appear.

Equalize/Match Red, Green, Blue

The name of this control changes depending on whether the Equalize or Match modes have been selected. The slider can be used to reduce the amount of correction applied to the image to equalize or match it. A value of 1.0 causes the full effect of the equalize or match to be applied, whereas lower values moderate the result.

8 Bit, 10 Bit, 16 Bit Buttons

This array of buttons determines the level of color fidelity used when sampling the image to produce the histogram. 10 Bit produces higher fidelity than 8 Bit, and 16 Bit produces higher fidelity than 10 bit.

Smooth Out Correction Curves

Often, color equalization and matching operations will introduce posterization in an image, which occurs because gradients in the image have been expanded or compressed so that the dynamic range between colors is not sufficient to display a smooth transition. This control can be used to smooth the correction curve, blending some of the original histogram back into the result for a more even transition.

Snapshot Match

Click this button to take a freeze the current reference histogram, storing its current state as a Snapshot in memory. If the reference histogram is not shapshot, the reference histogram is updated from frame to frame. This can cause flickering and phasing of the correction as the tool tries to match a changing source to a changing reference.

Release Match

Click on this button to Release the current snapshot of the histogram and return to using the live reference input.

Reset All Histogram Changes

Selecting this button will remove all changes made to the histogram, returning the controls to default and setting the mode back to keep.

Suppress Mode



Color Suppression provides a mechanism for removing an unwanted color component from the image. The color wheel control is similar to that shown in the Colors section of the tool, but this one is surrounded by six controls, each representing a specific color along the wheel.

To suppress a color in the selected range, click-drag the control that represents that color toward the center of the color wheel. The closer the control is to the center, the more that color will be suppressed from the image.

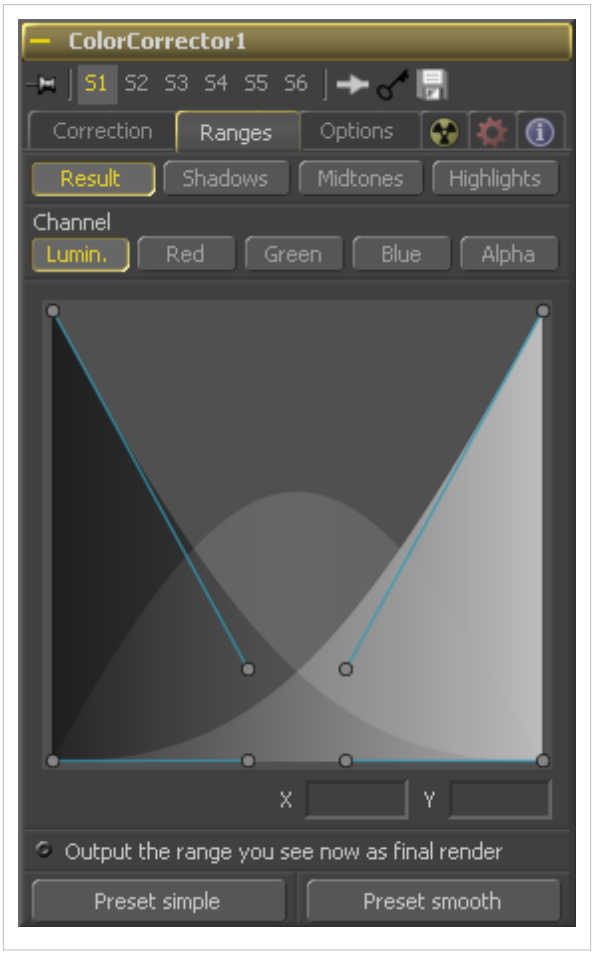
Suppression Angle

Use the Suppression Angle control to rotate the controls on the suppression wheel and zero in on a specific color.

Reset All Suppression

Clicking on this control resets the suppression colors to 1.0, the default value.

Ranges Tab



The Ranges Tab contains the controls used to specify which pixels in an image are considered to be shadows and which are considered to be highlights. The midrange is always calculated as any pixels not already included in either the shadows or the highlights.

Result/Shadows/Midtones/Highlights

These buttons are used to select the color range displayed in the views. They help to visualize the actual pixels that will be included in the range. When the Result button is selected, the image displayed by the color corrector in the views will be that of the color corrected image. This is the default.

Selecting one of the other buttons will switch the display to a greyscale image showing which pixels are part of the selected range. White pixels represent pixels that are considered to be part of the range and black pixels are not included in the range. For

example, choosing Shadows would show pixels considered to be shadows as white and pixels that are not shadows as black. Mid grey pixels are only partly in the range and will not receive the full effect of any color adjustments to that range.

Spline Display

The extent of the ranges is selected by manipulating the spline handles. There are four spline points, each with one Bezier handle. The two handles at the top represent the start of the shadow and highlight ranges, whereas the two at the bottom represent the end of the range. The Bezier handles are used to control the falloff.

The midtones range has no specific controls since its range is understood to be the space between the shadow and the highlight ranges.

The X and Y text controls below the Spline Display can be used to enter precise positions for the selected Bezier point or handle.

Channel

The Channel selection buttons shown in this tab can be used to examine the range of a specific color channel. By default, Fusion displays the luminance channel when the color ranges are examined.

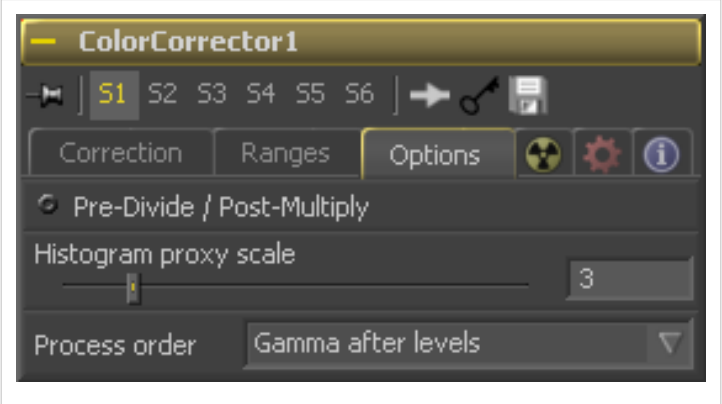
Output The Range You See Now As Final Render

Selecting this checkbox will cause the monochrome display of the range shown in the display views to be output as the final render. Normally, the color tool will output the full RGBA image, even if the tool was left to display one of the color ranges in the view instead. This control makes it possible to use the color corrector tool to generate a range's matte for use as an effect mask in other tools.

Preset Simple/Smooth Ranges

These two buttons can be used to return the spline ranges to either Smooth (default) or Simple (linear) settings.

Options Mode



Pre-Divide/Post Multiply

Selecting this option will divide the color channels by the value of the alpha before applying the color correction. After the color correction, the color values are re-multiplied by the alpha

to produce a properly additive image. This is crucial when performing an additive merge or when working with CG images generated against black.

Histogram Proxy Scale

The Histogram Proxy Scale determines the level of precision used when creating and calculating histograms. Lower values represent higher precision and higher values produce a rougher, generalized histogram.

Process Order

This menu is used to select whether adjustments to the image's gamma are applied before or after any changes made to the images levels.

Color Curves

Color Curves [CCv]

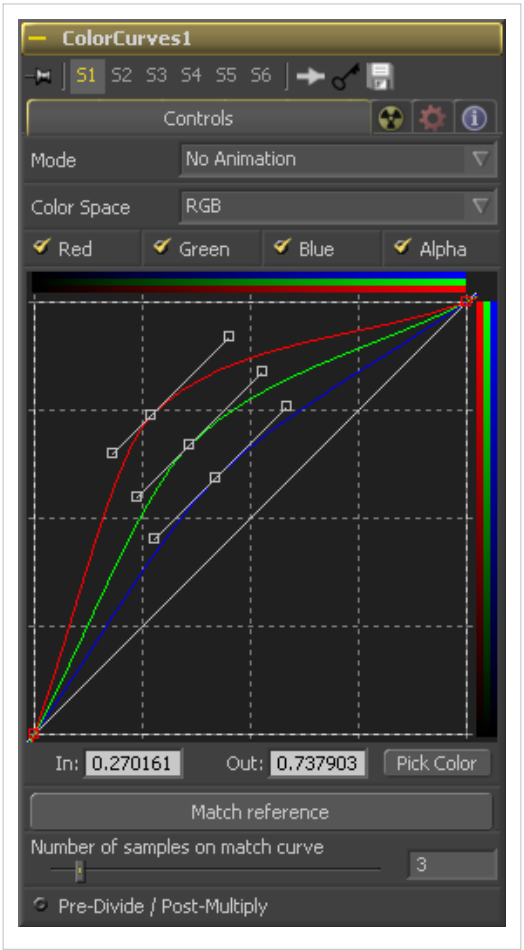


The Color Curves tool is an animatable spline-based tool for performing look up table (LUT) color manipulations. A separate spline is provided for each color channel. The effect can be animated or dissolved and can be applied to the image using RGB, YUV, YIQ, CMY or HLS color spaces.

The LUT view in the color corrector can be scaled using the + and - keys on the numeric keypad. The color curves LUT has full support for out of range values, pixels with color values above 1.0 or below 0.0.

The splines shown in this LUT view are also available from the spline editor, should a greater precision be required when adjusting the controls.

Controls



Mode

The Mode options changes between animated and dissolve modes. The default mode is static, where adjustments to the curves are static. Setting the Mode provides a change spline for each channel, allowing the color curve to be animated over time.

Dissolve mode is essentially obsolete and is included for compatibility reasons only.

Color Space

The splines in the LUT view can represent color channels from a variety of Color Spaces. The default is Red, Green and Blue. The options in this menu allow an alternate color space to be selected. A detailed description of the color spaces available here can be found in the online reference documentation for the Color Space tool.

Color Channels (RGBA)

Use the Color Channel controls to select which channel's spline is currently active for editing. The labels of these controls will change to reflect the names of the channels for the current color space. Normally, they will read as Red, Green and Blue. If the color curves tool is operating in YUV color space, they will read as Y, U and V instead.

These controls do not restrict the affect of the tool to a specific channel. They only select whether the spline for that channel is editable. These controls are most often used to ensure that adding or moving points on one channel's spline does not unintentionally affect a different channel's spline.

Spline Window

The Spline Window shows the curves for the individual channels. It is basically a miniature spline editor. In fact, the curves shown in this window can also be found and edited in the spline editor.

The spline window is a complex control with many options. For a detailed description of how it works, please consult the Tool Controls chapter of the manual.

In And Out

Use the In and Out controls to manipulate the precise values of a selected point. To change a value, select a point and enter the in/out values desired.

Pick

Click on the Pick button and select a color from an image in the display to automatically set keypoints on the spline for the selected color. The new points will be drawn with a triangular shape and can only be moved vertically (if point is locked, only the out value can change).

Points are only added to enabled splines. To add points only on a specific channel, disable the other channels before making the selection.

One use for this technique is white balancing an image. Use the Pick control to select a pixel from the image that should be pure grey. Adjust the points that appear so that the Out value is 0.5 to change the pixel colors to grey.

Use the context menu's Locked Pick Points option to unlock points created using the Pick option, converting them into normal points.

Match Reference

Clicking on the Match Reference button will automatically set points on the curve to match an image provided in the second (reference) input of the color curves tool.

Number Of Samples On Match Curve

This slider determines how many points are used to match the curve to the range in the reference image.

Pre-Divide/Post Multiply

Selecting this checkbox will cause the image's pixel values to be divided by the alpha values prior to the color correction, and then re-multiplied by the alpha value after the correction. This helps to avoid the creation of illegally additive images, particularly around the edges of a blue/green key or when working with 3D rendered objects.

Color Gain

Color Gain [Clr]



The Color Gain tool contains options for adjusting the gain, gamma, saturation and hue of the image. Many of the controls provided by the color gain tool are also found in the Color Corrector tool, but this simpler tool may render more quickly. One feature that distinguishes the color gain tool from the color corrector is its balance controls. These can be used to adjust the tinting of the colors in the high, mids and lows.

Gain Tab



Lock R/G/B

When selected, the Red, Green and Blue channel controls for each effect are combined into one slider. Alpha channel effects remain separate.

Gain RGBA

The Gain RGBA controls multiply the values of the image channel in a linear fashion. All pixels are multiplied by the same factor, but the effect will be larger on bright pixels and smaller on

dark. Black pixels will not be changed (x * 0=0).

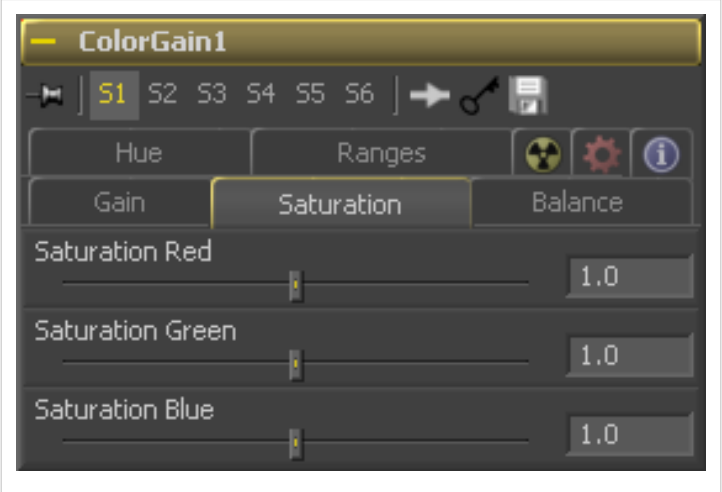
Gamma RGBA

The Gamma RGBA controls affect the brightness of the mid-range in the image. The affect of this tool is non-linear. White and black pixels in the image are not affected when gamma is modified, whereas pure grays are affected most by changes to this parameter. Large value changes to this control will tend to push mid-range pixels into black or white, depending on the value used.

Pre-Divide / Post-Multiply

Selecting this checkbox will cause the image pixel values to be divided by the alpha values prior to the color correction, and then re-multiplied by the alpha value after the correction. This helps to avoid the creation of illegally additive images, particularly around the edges of a blue/green key or when working with 3D rendered objects.

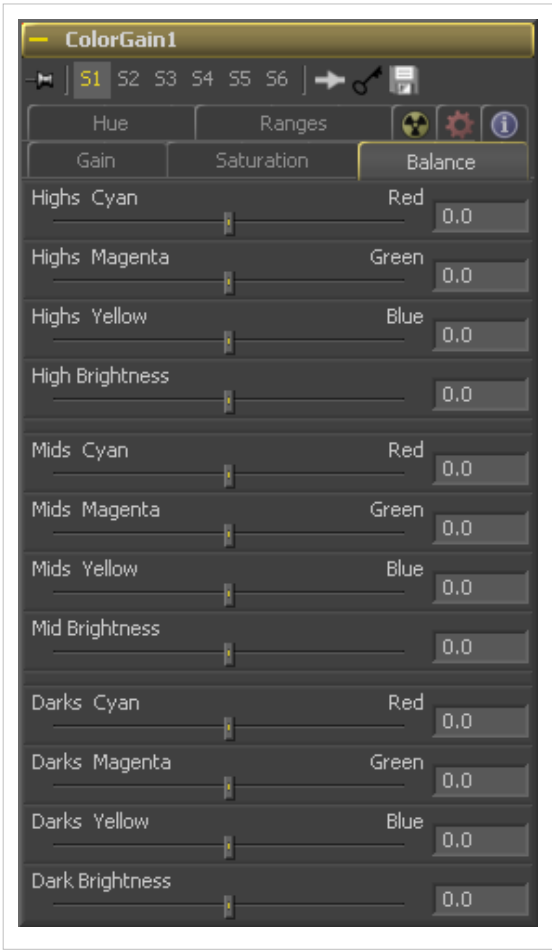
Saturation Tab



RGB Saturation

This setting controls the intensity of the colors in the image channels. A value of 0.0 will strip all of the color out of an image channel. Values greater than one will intensify the colors in the scene, pushing them toward primary colors.

Balance Tab



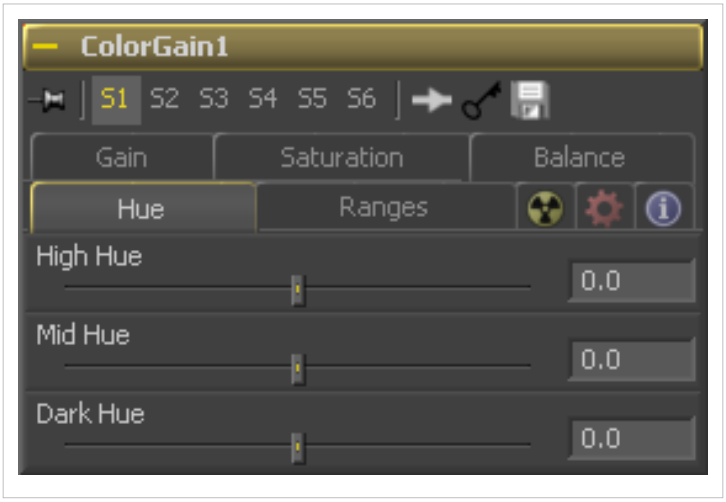
CMY Brightness Highs / Mids / Darks

This section of the color gain tool offers controls for adjusting the overall balance of a color channel. Independent color and brightness controls are offered for the High, Mid and Dark ranges of the image.

Colors are grouped into opposing pairs from the two dominant color spaces. Red values can be pushed toward Cyan, Green Values to Magenta and Blue to Yellow. Brightness can be raised or lowered for each of the channels.

By default, the balance sliders can be adjusted by -1 to +1, but values outside of this range can be entered manually to increase the effect. A value of 0.0 for any slider indicates no change to the image channel. Positive and negative values indicate that the balance of the image channel has been pushed toward one color or the other in the pair.

Hue Tab



High / Mid / Dark Hue

Use the Hue section of the color gain tool to shift the overall hue of the image, without affecting the brightness or saturation. Independent control of the High, Mid and Dark ranges is offered by three sliders.

The following is the order of the hues in the RGB color space Red, Yellow, Green, Cyan, Blue, Magenta and Red

Values above 0 push the hue of the image toward the right (red turns to yellow). Values below 0 push the hue toward the left (red turns to magenta). At -1.0 or 1.0, the hue completes the cycle and returns to its original value.

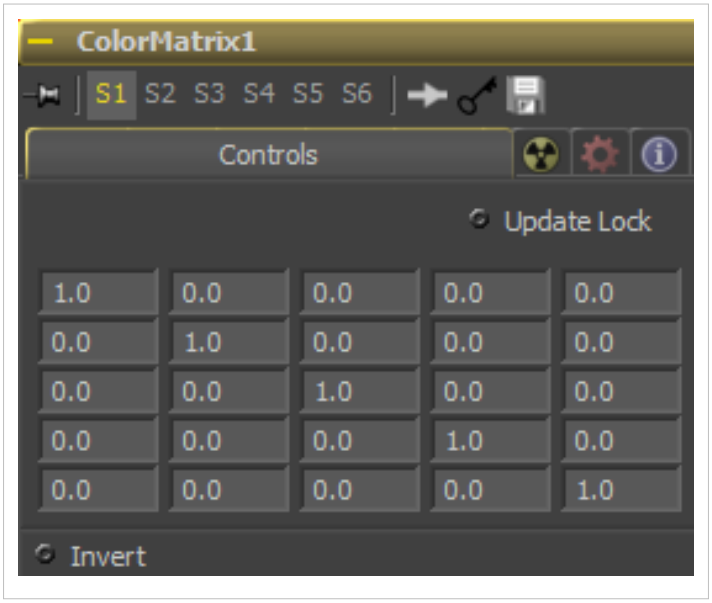
The default range of the hue sliders is -1.0 to +1.0. Values outside of this range can be entered manually.

Color Matrix



The ColorMatrix allows for a vast number of operations to modify values individually in the different color channels.

Controls



Update Lock

When this control is selected, Fusion will not render the tool. This is useful for setting up each value of the tool, then turning Update Lock off in order to render it.

Matrix

This defines what type of operations actually take place. The horizontal rows define the output values of the tool, the vertical columns the input values. The „add“ column allows for simple adding of values to the individual color channels.

By default the output values are identical to the input values.

100% of the Red channel input is copied to the Red channel output. 100% of the Green channel input is copied to the Green channel output. 100% of the Blue channel input is copied to the Blue channel output. 100% of the Alpha channel input is copied to the Alpha channel output.

We can also write the default settings as mathematical equations

[R out] = 1 * [R in] + 0 * [G in] + 0 * [B in] + 0 * [A in] + 0

[G out] = 0 * [R in] + 1 * [G in] + 0 * [B in] + 0 * [A in] + 0

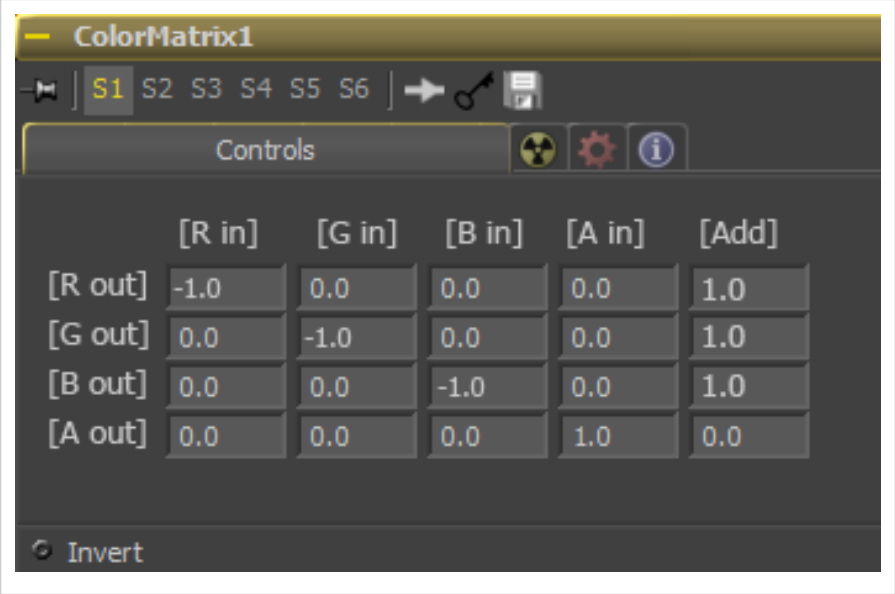
[B out] = 0 * [R in] + 0 * [G in] + 1 * [B in] + 0 * [A in] + 0

[A out] = 0 * [R in] + 0 * [G in] + 0 * [B in] + 1 * [A in] + 0

Invert

Enabling this option will invert the Matrix. Think of swapping channels around, doing other operations with different tools and then copy and paste the original ColorMatrix and set it to invert to get your channels back to the original.

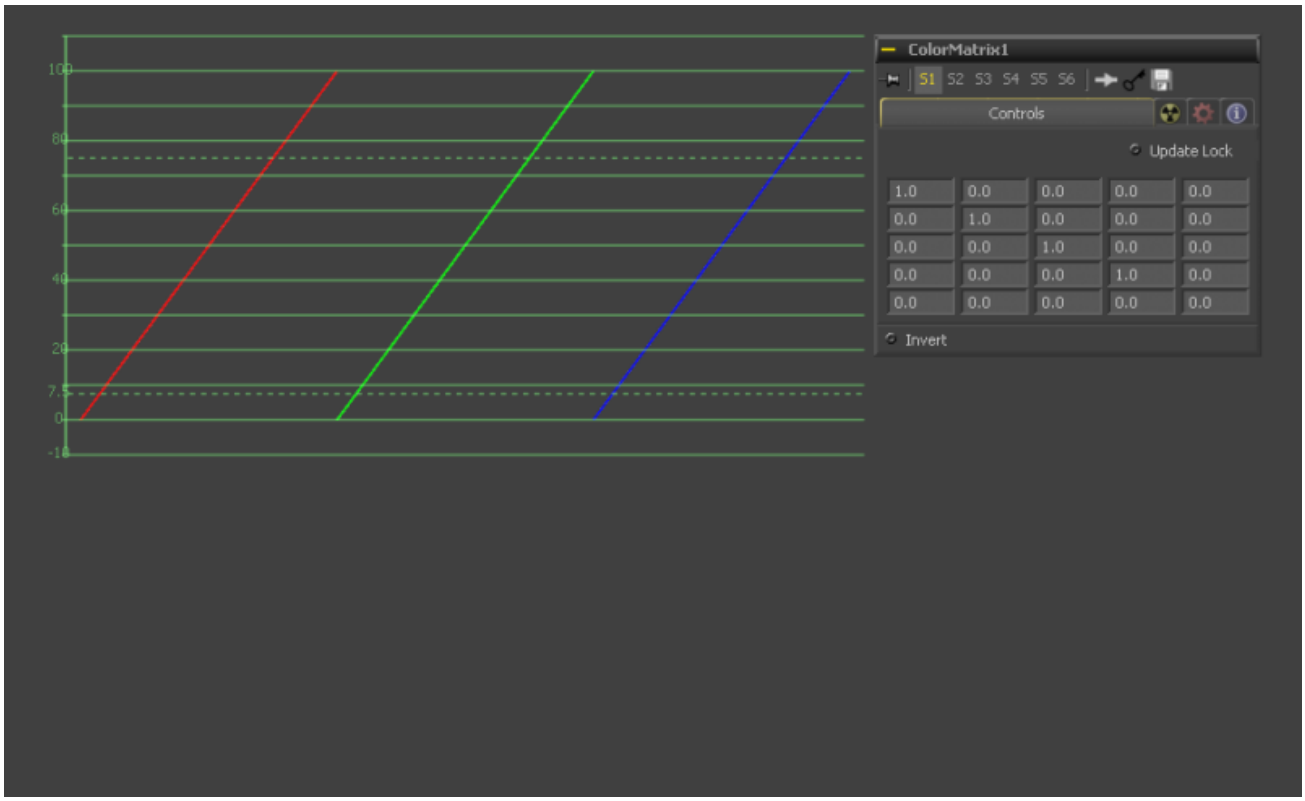
Example 1 -Invert



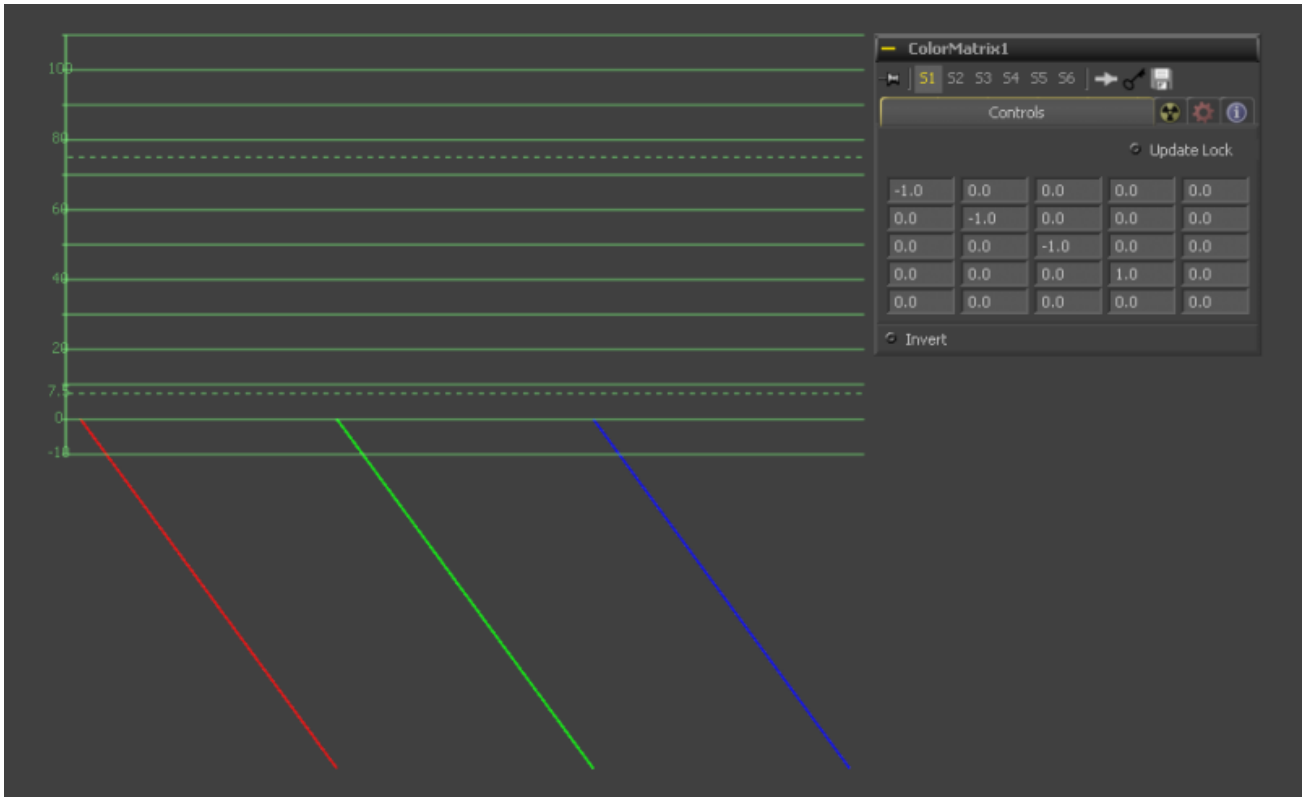
If we want to do a simple invert or negative of the color values, but keep our alpha channel as it is, the matrix would look like this Observe the fact that we have to Add 1 to each channel to push the inverted values back into the positive numbers.

Let's follow this example step by step by viewing the waveform of a 32bit grayscale gradient

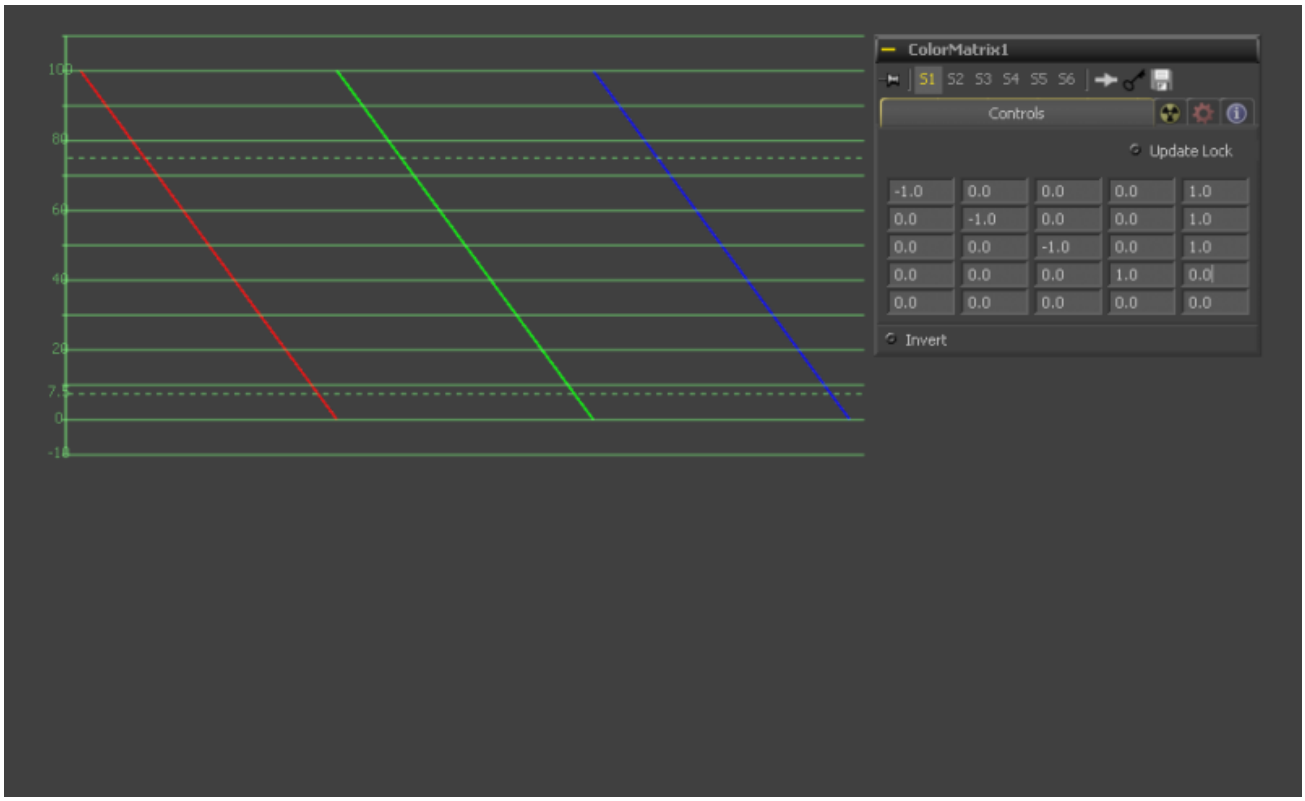
01) The original grayscale



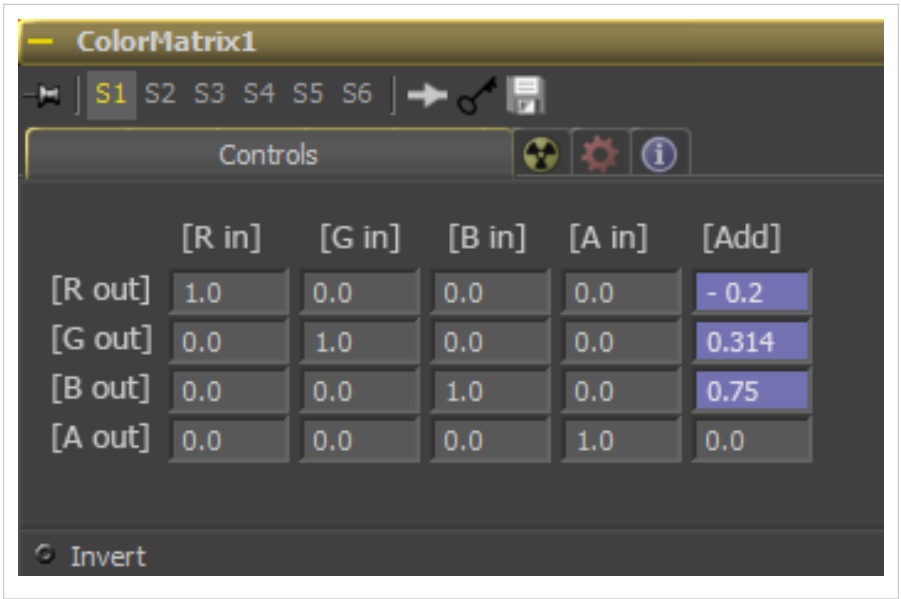
02) RGB set to -1. The values get inverted but fall below 0.



03) Adding 1 to each channel keeps the inversion, but moves the values back into a positive range.



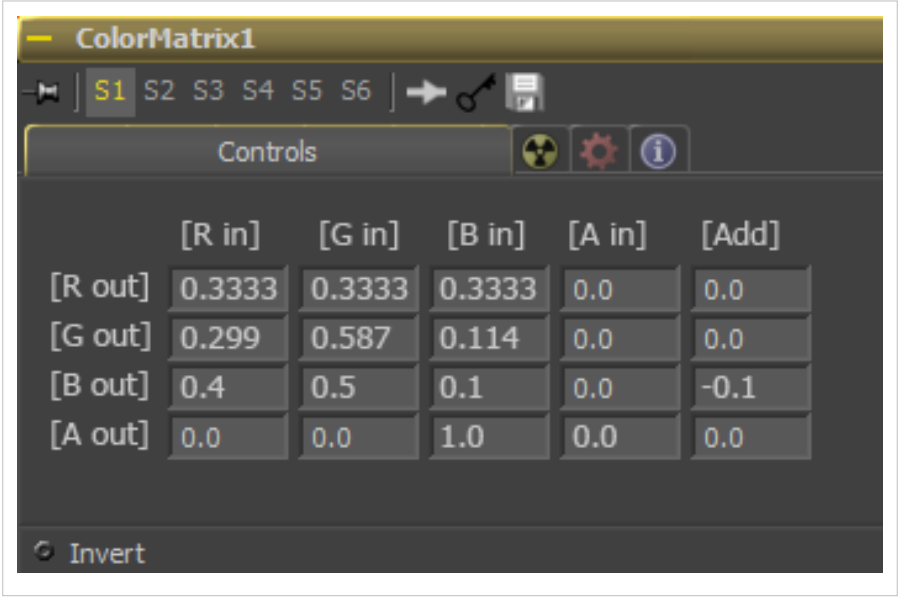
Example 2 -Brightness per Channel



Let's influence the brightness of each channel individually

This subtracts 0.2 from the Red channel, adds 0.314 to the Green channel and adds 0.75 to the Blue channel whilst keeping Alpha as it is.

Example 3 -Copying values

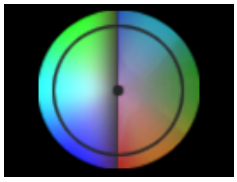


Of course we can also copy color values back and forth between individual channels. Let's make the Red channel contain the luminance values of the image based on thirds and the Green channel contain the luminance values based on the proper black-and-white conversion method, whereas in the Blue channel we use a third method based on getting more information from Red and less from Blue. We also lower the Blue channel's brightness by 0.1 and replace the Alpha Channel with the original Blue channel.

You see that this tool is immensely versatile for all sorts of mathematical channel-based operations. By default the ColorMatrix evaluates like this left

Color Space

Color Space [CS]



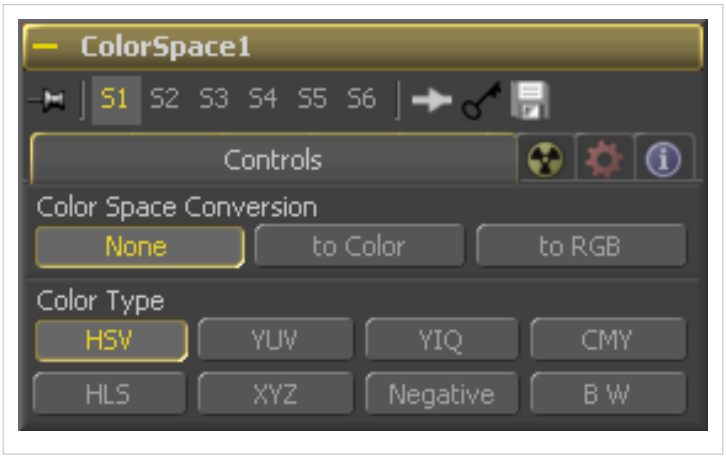
The Color Space tool provides the ability to work on an image in a variety of alternate color space formats. By default, Fusion uses the RGB color space, and most tools and displays interpret the primary channels of an image as Red, Green and Blue.

Changing the color space from RGB will cause most images to look odd, as Fusion's display views will still interpret the primary channels as Red, Green and Blue. For example, viewing an image converted to YUV in one of the display views will show the Y channel as Red, the U channel as Green and the V channel as Blue.

For this reason, most artists use two color space tools one to convert the image to the new color space and the other to convert back to RGB. Tools meant to affect the image while it is in the alternate color space are placed between the two tools, and adjustments are made while viewing the output of the second color space tool.

Several elements of the Fusion interface refer to the RGB channels directly. The four checkboxes used to restrict the affect of the tool to a single color channel are one example. When a conversion is applied to an image, the labels of these elements remain R, G and B, but the values they represent are from the current color space. (Red is Hue, Green is Luminance, Blue is Saturation for a RGB to HLS conversion. The Alpha value is never changed by the color space conversion.)

Controls



Color Space Conversion

This button array has three options.

None

The color space tool has no effect on the image.

To Color

The input image will be converted to the color space selected in the Color Type control found below.

To RGB

The input image will be converted back to the RGB color space from the type selected in the Color Type control below (for example, YUV to RGB).

Color Type

These buttons are used to select the color space conversion applied when the To Color conversion is selected.

HSV (Hue, Saturation And Value)

Each pixel in the HSV color space is described in terms of its Hue, Saturation and Value components. Value is defined as the quality by which we distinguish a light color from a dark one or brightness. Decreasing saturation roughly corresponds to adding white to a paint chip on a palette. Increasing value is roughly similar to adding black.

YUV (Luma, Blue Chroma And Red Chroma)

The YUV color space is used in the analog broadcast of PAL video. This format is often used to color correct images, due to its familiarity to a large percentage of video engineers. Each pixel is described in terms of its Luminance, Blue Chroma and Red Chroma components.

YIQ (Luma, In Phase And Quadrature)

The YIQ color space is used in the analog broadcast of NTSC video. This format is much rarer than YUV and almost never seen in production. Each pixel is described in terms of its Luminance, Chroma (in-phase or red-cyan channel) and Quadrature (magenta-green) components.

CMY (Cyan, Magenta And Yellow)

Although more common in print, the CMY format is often found in computer graphics from other software packages. Each pixel is described in terms of its Cyan, Magenta and Yellow components. CMY is non-linear.

HLS (Hue, Luminance And Saturation)

Each pixel in the HLS color space is described in terms of its Hue, Luminance and Saturation components. The differences between HLS and HSV color spaces are minor.

XYZ (CIE Format)

This mode is used to convert a CIE XYZ image to and from RGB color spaces. CIE XYZ is a weighted space, rather than a non-linear one, unlike the other available color spaces. Non-linear in this context means that equal changes in value at different positions in the colour space may not necessarily produce the same magnitude of change visually to the eye.

Expressed simply, the CIE color space is a perceptual color system, with weighted values obtained from experiments where subjects were asked to match an existing light source using three primary light sources.

This color space is most often used to perform gamut conversion and color space matching between image display formats because it contains the entire gamut of perceivable colors.

Negative

The color channels are inverted.The color space remains RGBA.

BW

The image is converted to black and white. The contribution of each channel to the luminance of the image is adjustable via slider controls that appear when this option is selected. The default values of these sliders represent the usual perceptual contribution of each channel to an images luminance. The color space of the image remains RGBA.

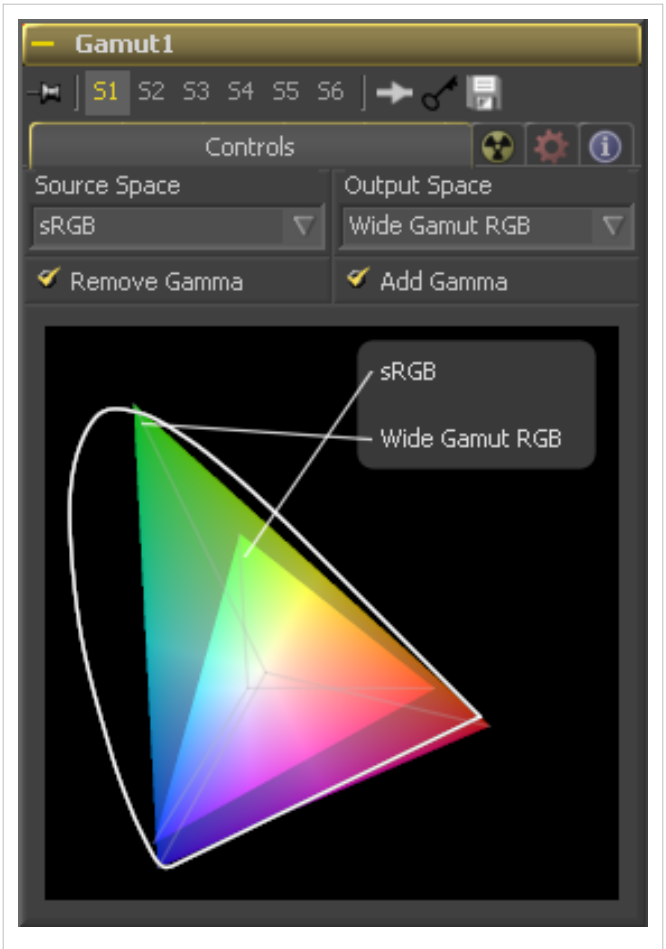
Gamut

Color Gamut [Gmt]



The Color Gamut Tool converts color from different gamuts to other color gamuts.

Controls



Source Space

Source Space determines the input color space of the image.

Output Space

Output Space is the converted gamut to the desired color space.

Remove/Add Gamma

Select these checkboxes to do the gamut conversion in a linear or non-linear gamma.

White Balance

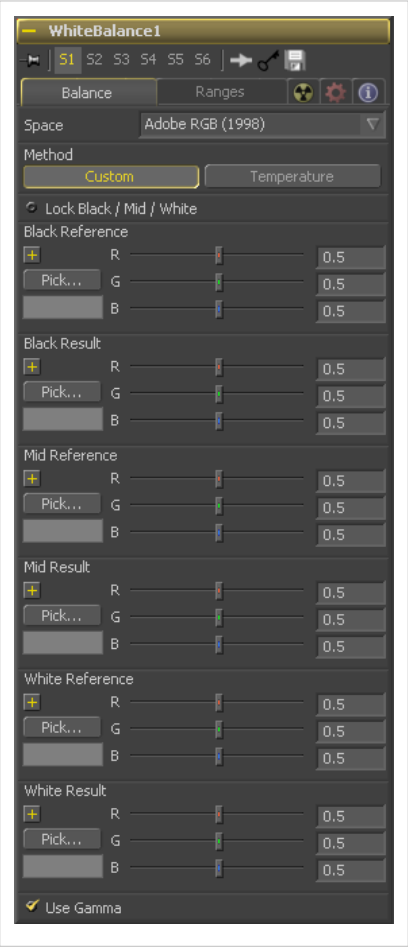
White Balance [WB]



The White Balance Tool can be used to automatically remove color casts in the image caused by the incorrect setup of a camera, problems in a camera's CCD or bad lighting conditions. Correction can be done by selecting a color temperature, or by choosing a neutral color from the original image that exhibits the color cast to be corrected.

Important When picking neutral colors using the Custom method, make sure you are picking from the *source* image, not the *results* of the White Balance tool. This ensures that the image doesn't change while you are still picking, and that the White Balance tool gets an accurate idea of the original colors it needs to correct.

Controls



Color Space

Use this menu to select the Color Space of the source image, if it is known. This can make the correction more accurate since the tool will be able to take the natural gamma of the color space into account as part of the correction. If the color space that the image uses is unknown, leave this menu at its default value.

Method

The white balance tool can operate using one of two methods, a Custom method and a color Temperature method.

Custom

The Custom method requires the selection of a pixel from the scene that should have been pure grey.

The tool uses this information to calculate the color correction required to convert the pixel so that it actually is grey. When that correction is applied to the entire image, it generally white balances the entire shot.

Temperature

The color Temperature method requires that the actual color temperature of the shot be specified.

Lock Black/Mid/White

This checkbox locks the Black, Mid and White points together so that the entire image is affected equally. Unchecking the control will provide individual controls for white balancing each range separately. This control affects both methods equally.

Black/Mid/White Reference

These controls only appear if the Custom method is selected. They are used to select a color from a pixel in the source image. The white balance tool will color correct the image so that the selected color is transformed to the color set in the Result color picker below. Generally, this is grey. A color that is supposed to be pure grey but is not truly grey for one reason or another should be selected.

If the Lock Black/Mid/White checkbox is deselected, different references can be selected for each color range.

For example, try to select a pixel for the black and white references that is not clipped in any of the color channels. In the high end, an example would be a pixel that is light pink with values of 255, 240, 240. The pixel is saturated/clipped in the red, even though the colour is not white. Similarly, a really dark blue-grey pixel might be 0, 2, 10. It is clipped in Red as well, even though it is not black.

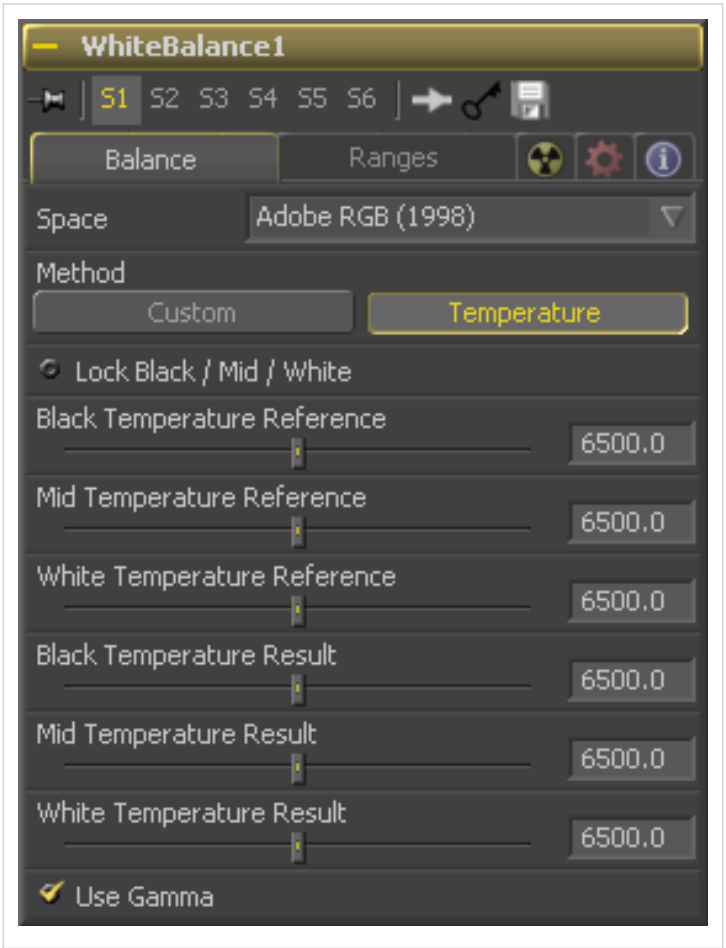
Neither example would be a good choice as a reference pixel because there would not be enough headroom left for the white balance tool.

Black / Mid / White Result

These controls only appears if the Custom method is selected. They are used to select the color to which the tool will balance the reference color. This generally defaults to pure, midrange grey.

If the Lock Black/Mid/White checkbox is deselected, different results can be selected for each color range.

Temperature Control



Temperature Reference

Use this control to set the color Temperature of the source image. If the Lock Black / Mid / White checkbox is deselected, different references can be selected for each color range.

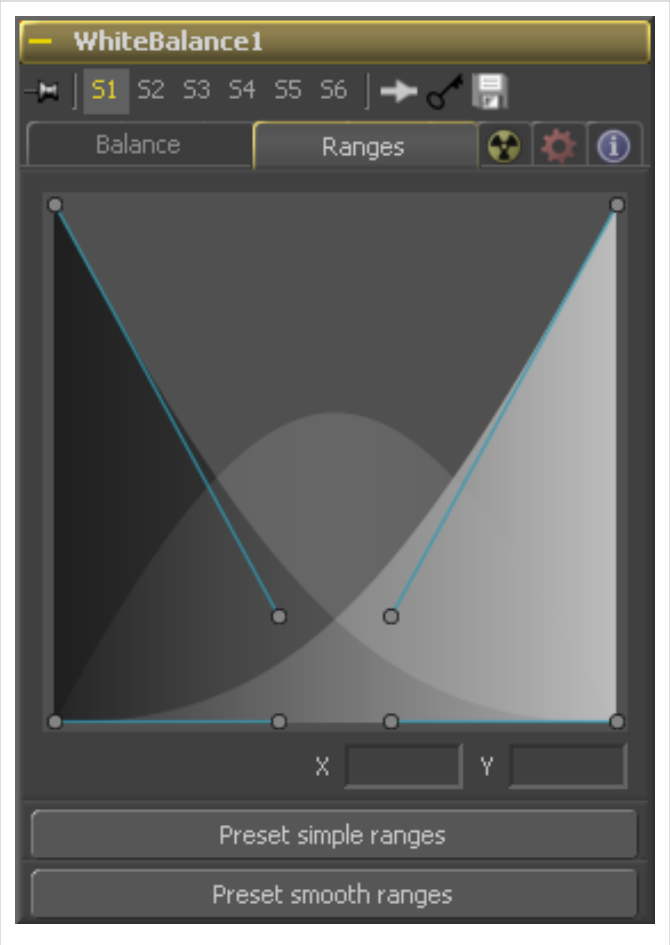
Temperature Result

Use this control to set the target color temperature for the image. If the Lock Black / Mid / White checkbox is deselected, different results can be selected for each color range.

Use Gamma

This checkbox selects whether the tool will take the gamma of the image into account when applying the correction, using the default gamma of the color space selected in the menu at the top of the tab.

Ranges Tab



The Ranges Tab contains the controls used to specify which pixels in an image are considered to be shadows and which are considered to be highlights. The midrange is always calculated as any pixels not already included in either the shadows or the highlights.

Result/Shadows/Midtones/Highlights

These buttons are used to select the color range displayed in the views. They help to visualize the actual pixels that will be included in the range. When the Result button is selected, the image displayed by the color corrector in the views will be that of the color corrected image. This is the default.

Selecting one of the other buttons will switch the display to a greyscale image showing which pixels are part of the selected range. White pixels represent pixels that are considered to be part of the range and black pixels are not included in the range. For example, choosing Shadows would show pixels considered to be shadows as white and pixels that are not shadows as black. Mid grey pixels are only partly in the range and will not receive the full effect of any color adjustments to that range.

Spline Display

The extent of the ranges is selected by manipulating the spline handles. There are four spline points, each with one Bezier handle. The two handles at the top represent the start

of the shadow and highlight ranges, whereas the two at the bottom represent the end of the range. The Bezier handles are used to control the falloff.

The midtones range has no specific controls since its range is understood to be the space between the shadow and the highlight ranges.

The X and Y text controls below the Spline Display can be used to enter precise positions for the selected Bezier point or handle.

Channel

The Channel selection buttons shown in this tab can be used to examine the range of a specific color channel. By default, Fusion displays the luminance channel when the color ranges are examined.

Output The Range You See Now As Final Render

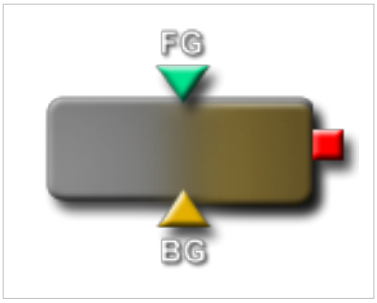
Selecting this checkbox will cause the monochrome display of the range shown in the display views to be output as the final render. Normally, the color tool will output the full RGBA image, even if the tool was left to display one of the color ranges in the view instead. This control makes it possible to use the color corrector tool to generate a range's matte for use as an effect mask in other tools.

Preset Simple/Smooth Ranges

These two buttons can be used to return the spline ranges to either Smooth (default) or Simple (linear) settings.

Composite

Dissolve



The Dissolve Tool is used to mix two images together, providing a gradual transition between two clips. A slider controls the amount of mix between the foreground and background layers. Dissolves are commonly used to transition between one clip and another and are a very common effect in editing. The Gradient Wipe setting allows arbitrary animated dissolve patterns based on the luminance of a third input use this with geometric shapes, fire, water ripples, rain, Perlin noise, particle systems or a video clip of your choice to get a variety of unique and creative transitions. Soft-edged effect masks may also be used to add to the possible effects.

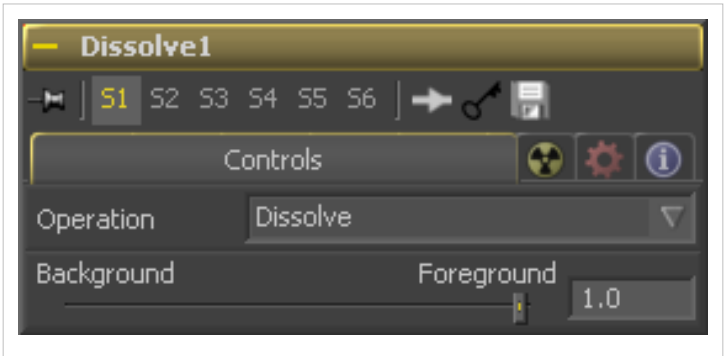
One useful attribute of the Dissolve tool is that, unlike all other tools in Fusion, it does not require a valid Background at all times, but will output either Background or Foreground as appropriate. This allows you to use it as an easy automatic "switcher" tool. You may connect clips to both Background and Foreground, use the Background/Foreground control to determine "priority" of which is output, and if one clip terminates early, the other is automatically output instead. Animating the Background/Foreground control allows manual switching.

The tool tile provides three image inputs Foreground, Background and Gradient Map. The Gradient Map input is required only when Gradient Wipe is selected. The Dissolve tool works best when both foreground and background inputs are images with the same resolution. If input images of different sizes are mixed together, the output size will be large enough to cover both images. If full Foreground or Background is selected, that image is output untouched, at its native size. Animating the Foreground/Background slider in this case may cause undesirable resolution changes.

For example, attempt to dissolve between a NTSC image (background) and a PAL image (foreground) and the output of the Dissolve tool will be NTSC when the slider is set to full background. It will suddenly jump to PAL when set to full foreground. Mix between FG and BG and the resolution of the output image will be the largest dimension from each image in this case the output will be 720 x 576 (PAL sized).

It is recommended to ensure all inputs of the Dissolve tool are the same resolution and pixel aspect.

Controls



Operation

The Operation drop-down menu contains one of seven different methods for mixing the foreground and background inputs. The two images are mixed together using the value of the Background/Foreground slider to determine the percentage each image contributes.

Dissolve

The standard Dissolve mode is the equivalent of a cross dissolve, one clip fades out as another clip fades in.

Additive Dissolve

Similar in look to a standard film dissolve, an additive dissolve adds the second clip and then fades out the first one.

Erode

The Erode method transitions between the two images by growing the darkest areas of the background image to reveal the foreground image. The effect appears similar to a film strip burning out.

Random Dissolve

A randomly generated dot pattern is used to perform the mix of the images.

Random Noise Dissolve

A moving random dot pattern is used to perform the mix of the images.

Gradient Wipe

The dissolve is controlled by the luminance values of the image in the Gradient Map input. The edges of this dissolve can be softened. The density and the color of the border can be adjusted independently.

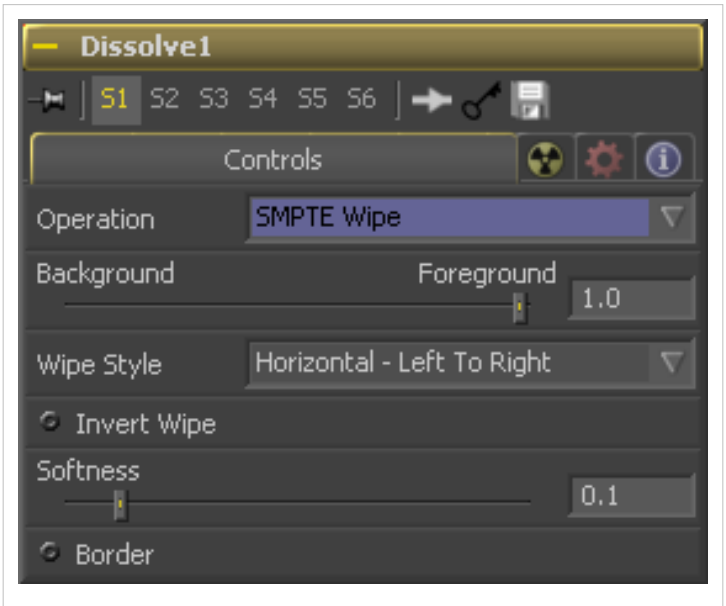
SMPTE Wipe

The SMPTE Wipe is similar to the basic effect wipes found on many video effects switchers. There is a horizontal wipe and a vertical wipe provided. The wipes can have soft edges and borders added. The density and the color of the border can be adjusted independently.

Background / Foreground

This control determines whether the output is the background image, the foreground image, or a mix between the two. The type of mix is determined by the Operation control. If one of the input images is not currently available, the other one will be output regardless of the setting of this slider.

Gradient /SMPTE Wipe controls



The following controls appear only when Gradient Wipe or SMPTE Wipe are selected.

Wipe Style

(SMPTE Wipe only) The drop down list allows the selection of two wipe styles: Horizontal - Left to Right and Vertical - Top To Bottom. The directions of the wipes can be reversed by using the Invert Wipe checkbox.

Invert Wipe

(SMPTE Wipe only) When checked, the direction of the wipe will be reversed.

Softness

Use this control to soften the edge of the transition.

Border

Select the Border to enable coloring of the transitions edge and to reveal the associated controls. The effect is to create a border around the transition edge.

Border Softness

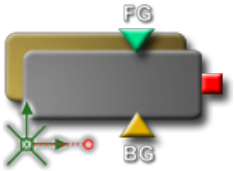
The Border Softness slider controls the width and density of the border. Higher values will create a denser border and lower values will create a thinner one.

Border Color

Use Border Color to select the color used in the border.

Merge

Merge [Mrg]



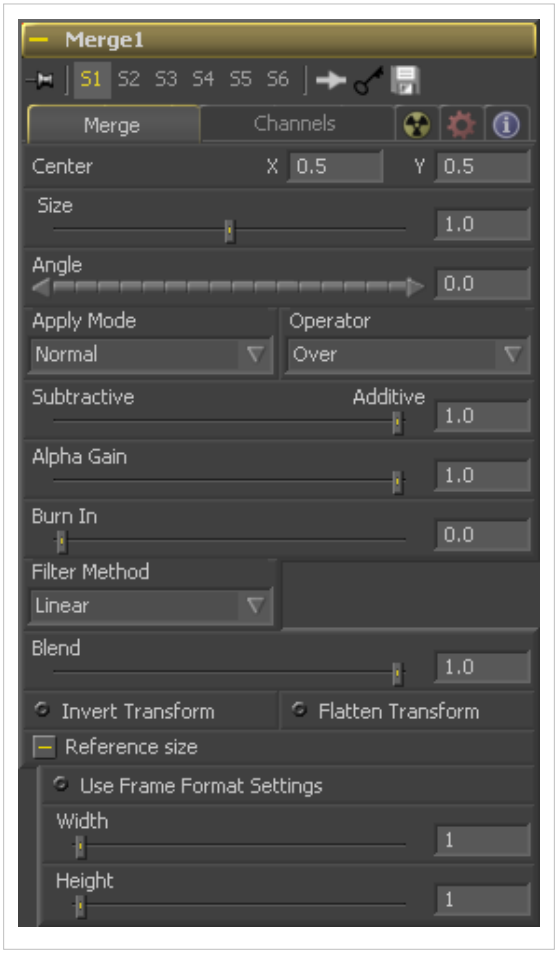
The Merge Tool combines two images based on the alpha (opacity) channel associated with the one in front. This tool takes two inputs a background and a foreground image. The operation mode of the merge determines what method is used to combine the images.

Instead of providing the artist with a dozen tools for each different method used to combine images, Fusion uses a single merge tool that supports the standard over, in, held out, atop and xor methods for compositing images, as well as many common blending modes like screen, dissolve, multiply and overlay.

The merge tool can handle both additive (premultiplied) and subtractive (non-premultiplied) compositing. Use merge to blend between the additive and subtractive results, providing solutions for some otherwise tricky problems.

This tool can also be used to composite images based on information from the Z-buffer channel of the images, if available. Rather than relying on the foreground and background order to determine layer order, Z-merging compares the depth value of each pixel to determine which is the foreground pixel and which is the background pixel.

Merge Tab



Center X And Y

This control determines the position of the foreground image in the composite. The default is 0.5, 0.5, which centers the foreground image in the exact center of the background image. The value shown is always the actual position in normalized coordinates, multiplied by the reference size. See below for a description of the reference size controls.

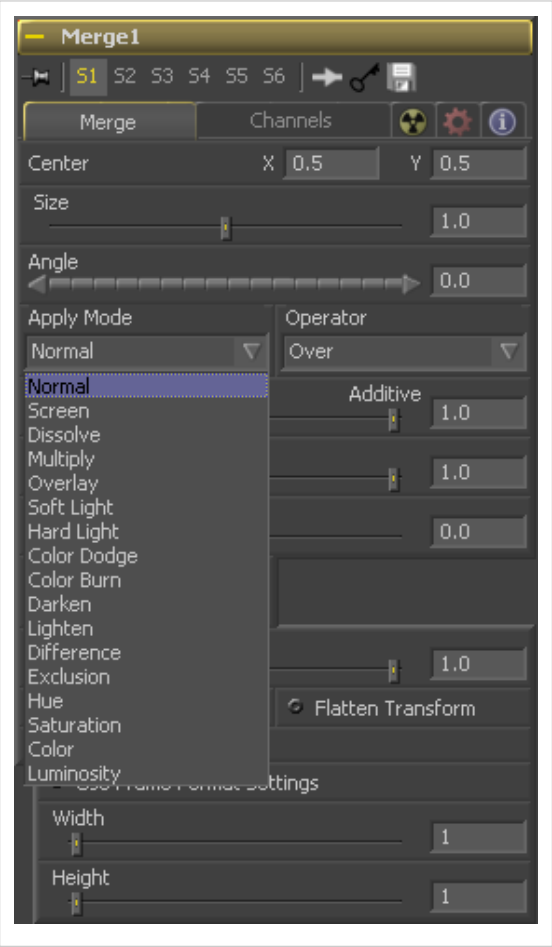
Size

Use this control to increase or decrease the size of the foreground image before it is composited over the background. The range of values for this slider is 0.0 to 5.0, but any value greater than 0 can be entered manually. A size of 1.0 gives a pixel-for-pixel composition, where a single pixel in the foreground is the same size as a single pixel in the background.

Angle

Use this control to rotate the foreground image before it is combined with the background.

Apply Modes



The Apply Mode determines the math used when blending or combining the foreground and background pixels.

Normal

The default merge mode uses the foreground's alpha channel as a mask to determine which pixels are transparent and which are not. When this is active, another menu shows possible operations, including over, in, held out, atop and xor.

Screen

Screen merges the images based on a multiplication of their color values. The alpha channel is ignored and layer order becomes irrelevant. The resulting color is always lighter. Screening with black leaves the color unchanged, whereas screening with white will always produce white. This effect creates a similar look to projecting several film frames onto the same surface.

Dissolve

Dissolve mixes two image sequences together. It uses a calculated average of the two images to perform the mixture.

Multiply

Multiply the values of a color channel. This will give the appearance of darkening the image as the values are scaled from 0 to 1. White has a value of one so the result would be the same. Grey has a value of 0.5 so the result would be a darker image or, in other words, an image half as bright.

Overlay

Overlay multiplies or screens the color values of the foreground image, depending on the color values of the background image. Patterns or colors overlay the existing pixels while preserving the highlights and shadows of the color values of the background image. The background image is not replaced but is mixed with the foreground image to reflect the original lightness or darkness of the background image.

Soft Light

Soft Light darkens or lightens the foreground image, depending on the color values of the background image. The effect is similar to shining a diffused spotlight on the image.

Hard Light

Hard Light multiplies or screens the color values of the foreground image, depending on the color values of the background image. The effect is similar to shining a harsh spotlight on the image.

Color Dodge

Color Dodge uses the foreground's color values to brighten the background image. This is similar to the photographical practice of "dodging" by reducing the exposure of an area of a print.

Color Burn

Color Burn uses the foreground's color values to darken the background image. This is similar to the photographical practice of "burning" by increasing the exposure of an area of a print.

Darken

Darken looks at the color information in each channel and selects the background or foreground images' color value, whichever is darker as the result color. Pixels lighter than the merged colors are replaced and pixels darker than the merged color do not change.

Lighten

Lighten looks at the color information in each channel and selects the background image's or foreground image's color values, whichever is lighter as the result color value. Pixels darker than the merged color are replaced and pixels lighter than the merged color do not change.

Difference

Difference looks at the color information in each channel and subtracts the foreground color values from the background color values or the background from the foreground, depending on which has the greater brightness value. Merging with white inverts the color. Merging with black produces no change.

Exclusion

Exclusion creates an effect similar to but lower in contrast than the difference mode. Merging with white inverts the base color values. Merging with black produces no change.

Hue

Hue creates a result color with the luminance and saturation of the background color values and the hue of the foreground color values.

Saturation

Saturation creates a result color with the luminance and hue of the base color and the saturation of the blend color.

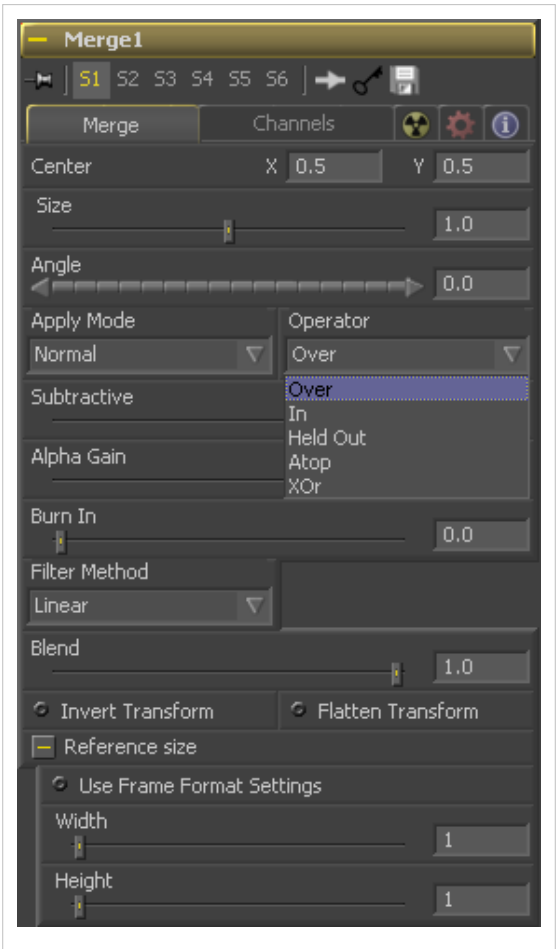
Color

Color creates a result color with the luminance of the background color value and the hue and saturation of the foreground. This preserves the gray levels in the image and is useful for coloring monochrome images.

Luminosity

Luminosity creates a result color with the hue and saturation of the background color values and the luminance of the foreground color values. This mode creates an inverse effect from that of the color mode.

Operator Modes



This menu is used to select the operation mode of the merge. Changing the Operation Mode changes how the foreground and background are combined to produce a result. The menu will only be visible when the merge tool's Apply mode is set to Normal.

Versions earlier than Fusion5 would always use the Over operation.

For an excellent description of the math underlying the operation modes, read Compositing Digital Images, Porter, T., and T. Duff, SIGGRAPH 84 proceedings, pages 253-259. Essentially, the math is as described below. Note that some modes not listed in the Operator dropdown (under, in, held in, below) are easily obtained by swapping the foreground and background inputs (with Ctrl+W) and choosing a corresponding mode.

The formula used to combine pixels in the merge is always fg * x + bg * y. The different operations determine exactly what x and y are, as shown in the description for each mode.

Over

The Over mode adds the FG layer to the BG layer by replacing the pixels in the BG with the pixels from the Z wherever the FG's alpha channel is greater than 1.

x = 1, y = 1-[foreground alpha]

In

The In mode multiplies the alpha channel of the BG input against the pixels in the FG. The color channels of the FG input are ignored. Only pixels from the FG are seen in the final output. This essentially clips the FG using the mask from the BG.

x = [background alpha], y = 0

Held Out

Held Out is essentially the opposite of the In operation. The pixels in the FG image are multiplied against the inverted alpha channel of the BG image. Accomplish exactly the same result using the In operation and a Matte Control tool to invert the matte channel of the BG image.

x = 1-[background alpha], y = 0

ATop

ATop places the FG over the BG only where the BG has a matte.

x = [background alpha], y = 1-[foreground alpha]

XOr

XOr combines the FG with the BG wherever either the FG or the BG have a matte, but never where both have a matte.

x = 1-[background alpha], y = 1-[foreground alpha]

Subtractive And Additive

This slider controls whether Fusion performs an "Additive" or a "Subtractive" merge. An additive merge assumes that the foreground image is pre-multiplied, meaning that the pixels in the color channels have been multiplied by the pixels in the alpha channel. The result is that transparent pixels are always black, since any number multiplied by 0 is always going to be 0.

When the merge tool can assume the image is pre-multiplied, it can perform an additive merge. This "obscures" the background (by multiplying with the inverse of the foreground

alpha), then simply adds the pixels from the foreground.

If the images are not pre-multiplied then usually all that is required is a subtractive merge. This method is similar to additive, but the foreground image is first multiplied by its own alpha, to eliminate any background pixels outside the alpha area.

Fusion defaults to Additive merging for most operations, assuming that the images are pre-multiplied. Using Subtractive merging on a pre-multiplied image may result in darker edges, whereas using Additive merging with a non-premultiplied image will cause any non-black area outside the foreground's alpha to be added to the result.

Although the Additive/Subtractive option could easily have been a checkbox to select one mode or another, Fusion allows for blending between the additive and subtractive modes, an operation that can occasionally be useful for dealing with problem images.

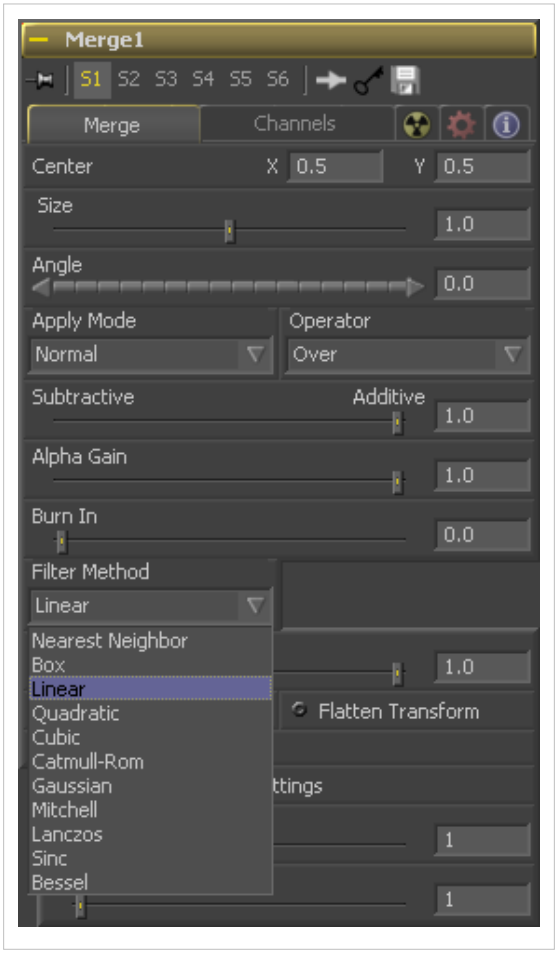
Alpha Gain

Alpha Gain linearly scales the values of the foreground's alpha channel. In subtractive merges, this controls the density of the composite, similarly to Blend. In additive merges, this effectively reduces the amount that the background is "obscured" by, thus brightening the overall result. In an additive merge with Alpha Gain set to 0.0, the foreground pixels are simply added to the background.

Burn In

The Burn In control adjusts the amount of alpha used to darken the background, without affecting the amount of foreground added in. At 0.0, the merge behaves like a straight alpha blend, whereas at 1.0, the foreground is effectively added onto the background (after alpha multiplication if in Subtractive mode). This gives the effect of the foreground image brightening the background image, as with Alpha Gain. In fact, for additive merges, increasing the Burn In gives an identical result to decreasing Alpha Gain.

Filter Modes



Nearest Neighbor

This skips or duplicates pixels as needed. This produces the fastest but crudest results.

Box

This is a simple interpolation resize of the image.

Linear

This uses a simplistic filter, which produces relatively clean and fast results.

Quadratic

This filter produces a nominal result. It offers a good compromise between speed and quality.

Cubic

This produces better results with continuous tone images but is slower than Bi-Cubic. If the images have fine detail in them, the results may be blurrier than desired.

Catmull-Rom

This produces good results with continuous tone images which are resized down. Produces sharp results with finely detailed images.

Gaussian

This is very similar in speed and quality to Bi-Cubic.

Mitchell

This is similar to Catmull-Rom but produces better results with finely detailed images. It is slower than Catmull-Rom.

Lanczos

This is very similar to Mitchell and Catmull-Rom but is a little cleaner and also slower.

Sinc

This is an advanced filter that produces very sharp, detailed results, however, it may produce visible `ringing' in some situations.

Bessel

This is similar to the Sinc filter but may be slightly faster.

Window Method

Some filters, such as Sinc and Bessel, require an infinite number of pixels to calculate exactly. To speed up this operation, a windowing function is used to approximate the filter and limit the number of pixels required. This control appears when a filter that requires windowing is selected.

Hanning

This is a simple tapered window.

Hamming

Hamming is a slightly tweaked version of Hanning.

Blackman

A window with a more sharply tapered falloff.

Kaiser

A more complex window, with results between Hamming and Blackman.

Most of the Resize tool's filters are useful only when making an image larger. When shrinking images, it is common to use the Bi-Linear filter, however, the Catmull-Rom filter will apply some sharpening to the results and may be useful for preserving detail when scaling down an image.

Because this tool changes the physical resolution of the image, we do not normally advise animating the controls.

Various Resize Filters in extreme magnification



From left to right:

Nearest Neighbor - Box - Linear - Quadratic - Cubic - Catmull-Rom - Gaussian - Mitchell - Lanczos - Sinc - Bessel

Blend

This is a cloned instance of the Blend slider in the common controls tab. Changes made to this control are simultaneously made to the one in the common controls.

The Blend slider mixes the result of the tool with its input, blending back the effect at any value less than 1.0. In this case it will blend the background with the merged result.

Invert Transform

Select the Invert Transform control to invert any position, rotation or scaling transformation. This option is useful when connecting the merge to the position of a tracker for the purpose of match moving.

Flatten Transform

The Flatten Transform option prevents this tool from concatenating its transformation with subsequent tools. The tool may still concatenate transforms from its input but it will not concatenate its transformation with the tool at its output. See the Transformations chapter earlier in this manual for details on concatenated transformation.

Reference Size

The controls under the Reference Size reveal do not directly affect the image. Instead they allow you to control how Fusion represents the position of the merge tool's center.

Normally, coordinates are represented as values between 0 and 1, where 1 is a distance equal to the full width or height of the image. This allows for resolution independence, because the size of the image can be changed without having to change the value of the center.

One disadvantage to this approach is that it complicates making pixel accurate adjustments to an image. To demonstrate, imagine an image that is 100 x 100 pixels in size. To move the center of the foreground element to the right by 5 pixels, we would change the X value of the merge center from 0.5, 0.5 to 0.55, 0.5. We know the change must be 0.05 because 5/100 = 0.05.

If you specify the dimensions of the background image in the Reference Size controls, this changes the way the Center control values are displayed so that it shows the actual pixel positions in its X and Y fields.

Extending the example, set the width and height to 100 each and the center will now be shown as 50, 50, and we would move it 5 pixels toward the right by entering 55, 50.

Internally, the merge tool still stores this value as a number between 0 to 1 and, if the center control's value were to be queried via scripting or the center control were to be published for use by other tools, the original normalized value would be retrieved. The change is only visible in the value shown for merge center in the tool control.

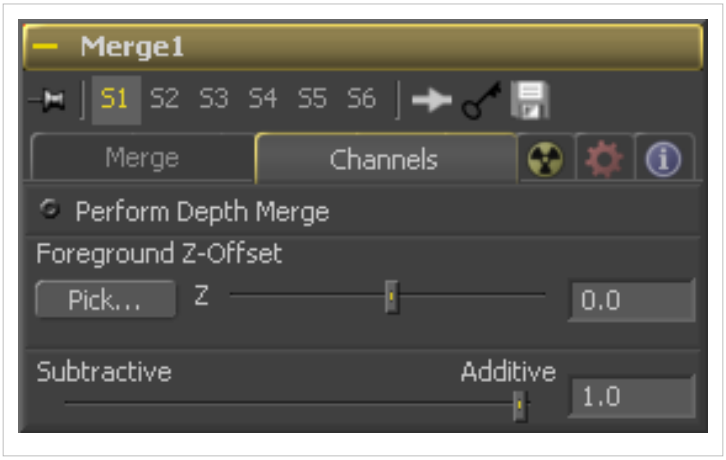
Use Frame Format Settings

Select this to force the merge to use the compositions current frame format settings to set the reference width and reference height values.

Width And Height

Set these sliders to the width and height of the image to change the way that Fusion displays the values of the merge tools center control.

Channels Tab



Perform Depth Merge

When checked, the Z-buffer channel of both images will be used to determine the composite order. Alpha channels are still used for transparency, but the values of the Z-buffer channel will determine the ordering of image elements. If a Z-buffer channel is not available for either image, the setting of this checkbox will be ignored, and no depth compositing will take place.

Depth merging is off by default. If an image has an associated Z-buffer channel, and that channel is not to be used to perform a depth merge, turn this checkbox off.

Foreground Z-Offset

This slider sets an offset applied to the foreground image's Z value. Click the Pick button to pick a value from a displayed image's Z-channel, or enter a value using the slider or input boxes. Raising the value causes the foreground image's Z-buffer to be offset further away along the Z-axis, whereas lowering the value causes the foreground to move closer.

Subtractive And Additive

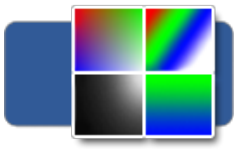
When Z-compositing, it is possible for image pixels from the background to be composited in the foreground of the output because the Z-buffer for that pixel is closer than the Z of the foreground pixel. This slider controls whether these pixels are merged in an additive or a subtractive mode, in exactly the same way as the comparable slider in the Merge tab.

When merged over a background of a different color, the original background will still be visible in the semi-transparent areas. An additive merge will maintain the transparencies of the image but will add their values to the background.

Creator

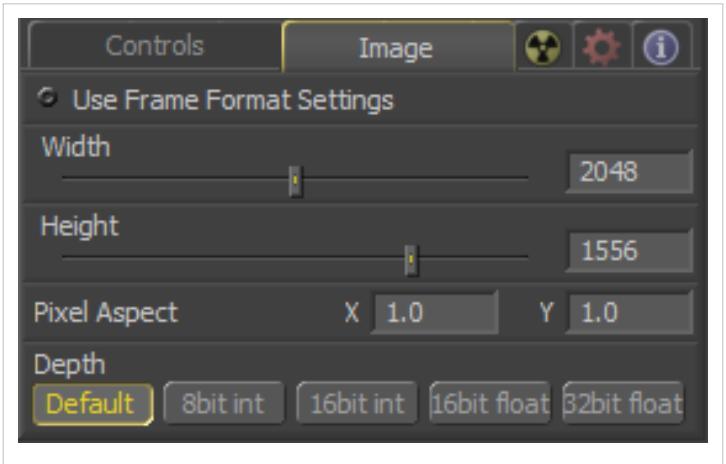
Background

Background [BG]



The Background tool can be used to produce anything from simple color backgrounds to complex loopable gradients.

Image Tab



The controls in this tab are used to set the resolution, color depth and pixel aspect of the image produced by the tool.

Process Mode

Use this menu control to select the fields processing mode used by Fusion to render changes to the image. The default option is determined by the Has Fields checkbox control in the Frame Format Preferences. For more information on fields processing, consult the Frame Formats chapter.

Global In And Out

Use this control to specify the position of this tool within the project. Use Global In to specify on which frame that the clip starts and Global Out to specify on which frame this clip ends (inclusive) within the project's Global Range.

The tool will not produce an image on frames outside of this range.

Use Frame Format Settings

When this checkbox is selected, the width, height and pixel aspect of the image created by the tool will be locked to values defined in the composition's Frame Format preferences. If the Frame Format preferences change, the resolution of the image produced by the tool will change to match. Disabling this option can be useful to build a composition at a different resolution than the eventual target resolution for the final render.

Width / Height

This pair of controls is used to set the Width and Height dimensions of the image to be created by the tool.

Pixel Aspect

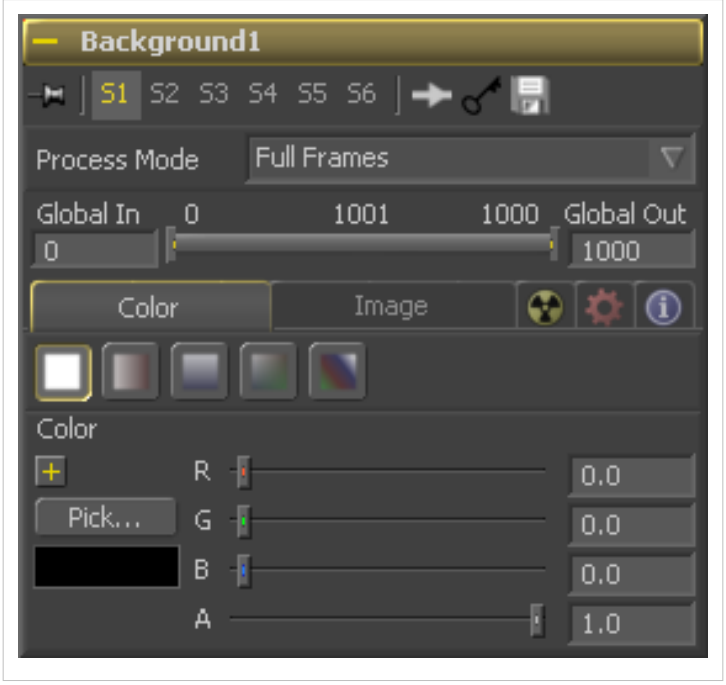
This controls is used to specify the Pixel Aspect ratio of the created images. An aspect ratio of 1:1 would generate a square pixel with the same dimensions on either side (like a computer display monitor) and an aspect of 0.9:1 would create a slightly rectangular pixel (like an NTSC monitor).

Depth

The Depth button array is used to set the pixel color depth of the image created by the creator tool. 32bit pixels require 4 times the memory of 8bit pixels, but have far greater color accuracy. Float pixels allow high dynamic range values outside the normal 0..1 range, for representing colours that are brighter than white or darker than black. See the Frame Format chapter for more details.

Right-click on the Width,Height or Pixel Aspect controls to display a menu listing the file formats defined in the preferences Frame Format tab. Selecting any of the listed options will set the width, height and pixel aspect to the values for that format.

Color Tab



Mode

This control is used to select the mode used by the background tool when the image is generated. Four selections are available.

Solid Color

This default creates a single color image.

Horizontal

This creates a two color horizontal gradation.

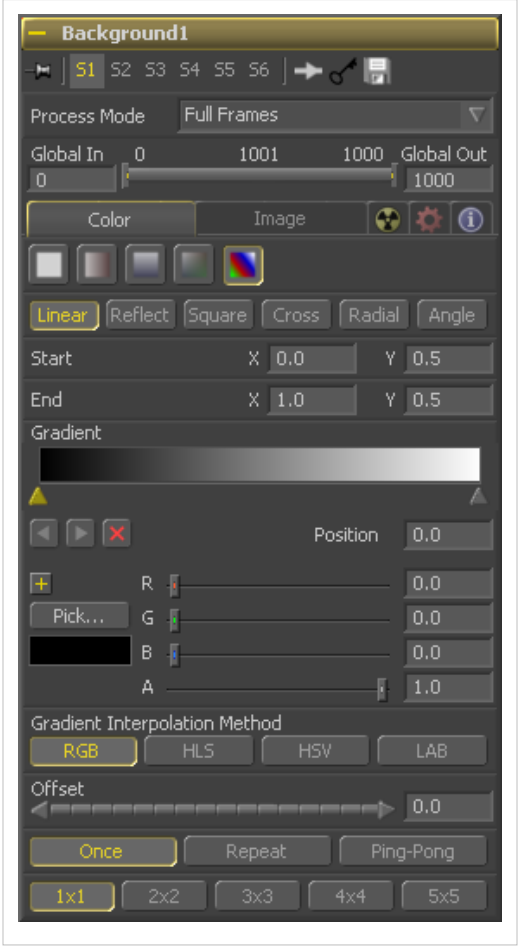
Vertical

This creates a two color vertical gradation.

Four Corner

This creates a four color corner gradation.

Gradient



This creates a background from a custom gradient.

Color

These controls are used to select the color of the Background tool. Depending on the mode selected, one to four color controls will be displayed to create linear color ramp backdrops.

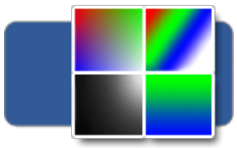
Select one and pick a color from the preset menu or create them. Alternatively, enter values in RGB via the keyboard by clicking in the values box and typing in the value. Each color has its own alpha value slider to adjust the transparency of each color.

Custom Gradient Controls

The Custom Gradient Controls that appear are described in depth in the Tool Controls chapter of this manual. Consult this chapter for details on setting up a custom gradient for use in the background tool.

Day Sky

Day Sky [DS]



The DaySky generator is a practical implementation of the research paper [http//www.cs.utah.edu/vissim/papers/sunsky/sunsky.pdf "A Practical Analytical Model for Daylight"] by Preetham, Shirley, and Smits. A copy of the original paper can be found at the [http//www.cs.utah.edu/vissim/papers/sunsky/ website for the Visual Simulation Group] at the University of Utah.

This tool aims to produce a simulation of the daylight produced at a specific time and location on the earth, and generate a high dynamic range image which represents a map of that light. It is not a sky generator, although it could be combined with a cloud generator or noise tool to produce one.

Controls Tab



Latitude, Longitude

Use these sliders to specify the Latitude and Longitude used to create the Day Sky simulation.

Day, Month, Time

Use these controls to specify the Day, Month and Time for the DaySky simulation.

Turbidity

Turbidity causes light to be scattered and absorbed rather than transmitted in straight lines through the simulation. Increasing the turbidity will give the sky simulation a murky feeling, as if smoke or atmospheric haze were present.

Do Tone Mapping

Deselect this checkbox to disable any tone mapping applied to the simulation. Since the simulation is calculated in 32 bit floating point color space, it generates color values well above 1.0 and well below 0.0. Tone Mapping is a process that takes the full dynamic range of the resulting simulation and compresses the data into the desired exposure range while attempting to preserve as much detail from the highlights and shadows as possible.

Generally this option should only be deselected if the resulting image will later be color corrected as part of a floating point color pipeline.

Exposure

Use this control to select the exposure used for Tone Mapping.

Advanced Tab



Horizon Brightness

Use this control to adjust the brightness of the horizon relative to the sky.

Luminance Gradient

Use this control to adjust the width of the gradient seperating the horizon from the sky.

Circumsolar Region Intensity

Use this control to adjust the intensity or brightness of the sky nearest to the sun.

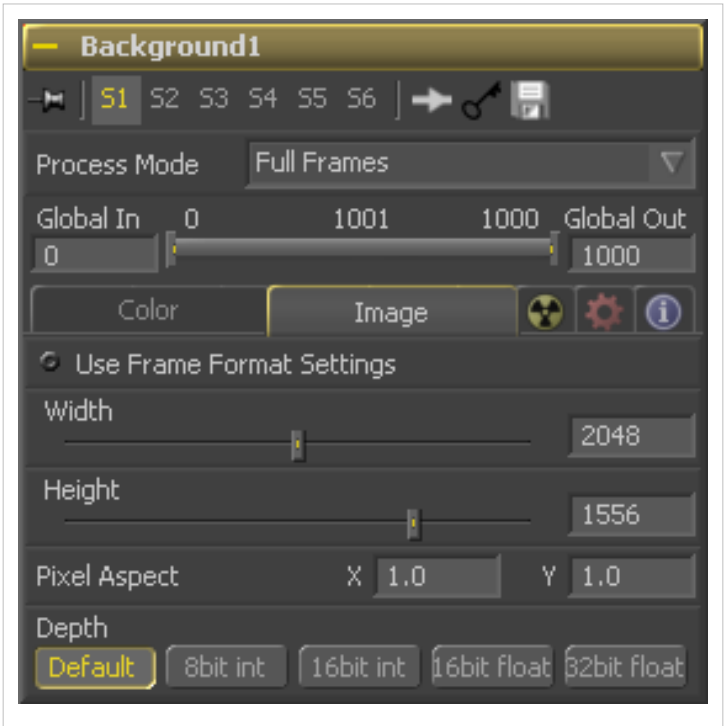
Circumsolar Region Width

Use this control to adjust the width or size of the area in the sky affected by the sun.

Backscattered Light

Use this control to increase or decrease the amount of backscatter light in the simulation.

Image Tab



See the Creator Common Controls section at the beginning of this chapter for a description of the controls under this tab.

Fast Noise

Fast Noise [FN]



The Fast Noise tool is a very fast and flexible Perlin Noise generator. It can be useful for a wide range of effects, from clouds and swirling fog to waves, water caustics, stylised fire & smoke and other organic textures. It is also invaluable as a noise source for other effects, such as heat shimmer, particle systems and dirtiness maps.

Noise Tab



Discontinuous

Normally the noise function interpolates between values to create a smooth continuous gradient of results. Enable this checkbox to create hard discontinuity lines along some of the noise contours. The result will be a dramatically different effect.

Inverted

Select this checkbox to invert the noise, creating a negative image of the original pattern. This is most effective when Discontinuous is also enabled.

Center

Use the center coordinate control to pan & move the noise pattern.

Detail

Increase the value of this slider to produce a greater level of detail in the noise result. Larger values add more layers of increasingly detailed noise without affecting the overall pattern. High values take longer to render but can produce a more natural result.

Brightness

This control adjusts the overall brightness of the noise map, before any gradient color mapping is applied. In Gradient mode, this has a similar effect to the Offset control.

Contrast

This control increases or decreases the overall contrast of the noise map, prior to any gradient colour mapping. It can exaggerate the effect of the noise, and widen the range of colors applied in Gradient mode.

Lock And Scale X/Y

The size of the noise map can be adjusted using the Scale slider, changing it from gentle variations over the whole image to a tighter overall texture effect. The scale slider can be separated into independent X and Y axis scale sliders by clicking on the Lock X/Y checkbox immediately above, which can be useful for a brushed-metal effect.

Angle

Use the Angle control to rotate the noise pattern.

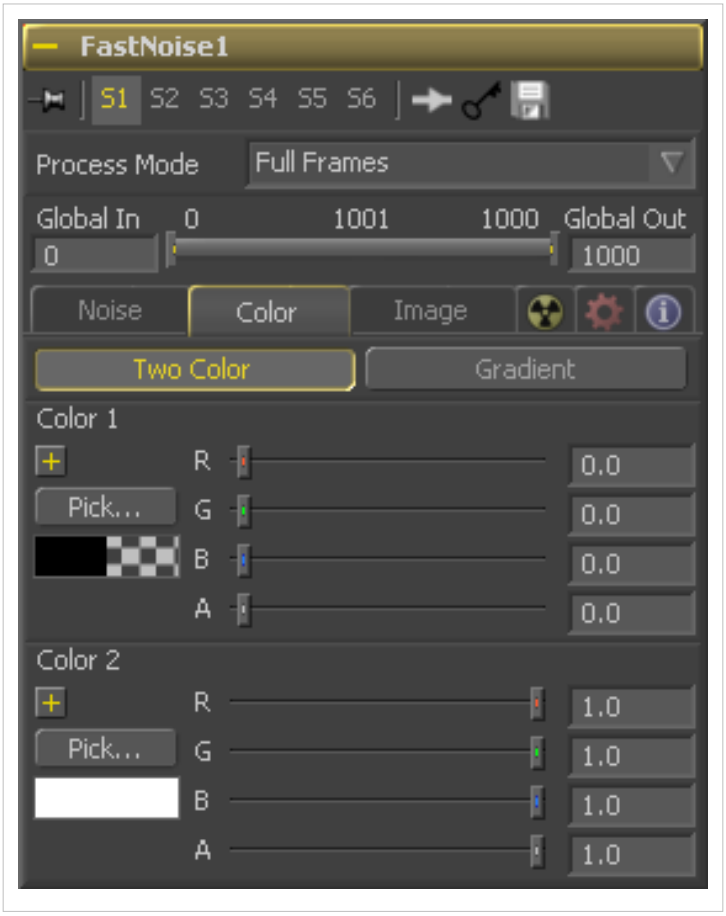
Seethe

Adjust this thumbwheel control to interpolate the noise map against a different noise map. This will cause a crawling shift in the noise, like it was drifting or flowing. This control must be animated to affect the gradient over time, or you can use the Seethe Rate control below.

Seethe Rate

As with the Seethe control above, the Seethe Rate also causes the noise map to evolve and change. The Seethe Rate defines the rate at which the noise changes each frame, causing an animated drift in the noise automatically, without the need for spline animation.

Color Tab



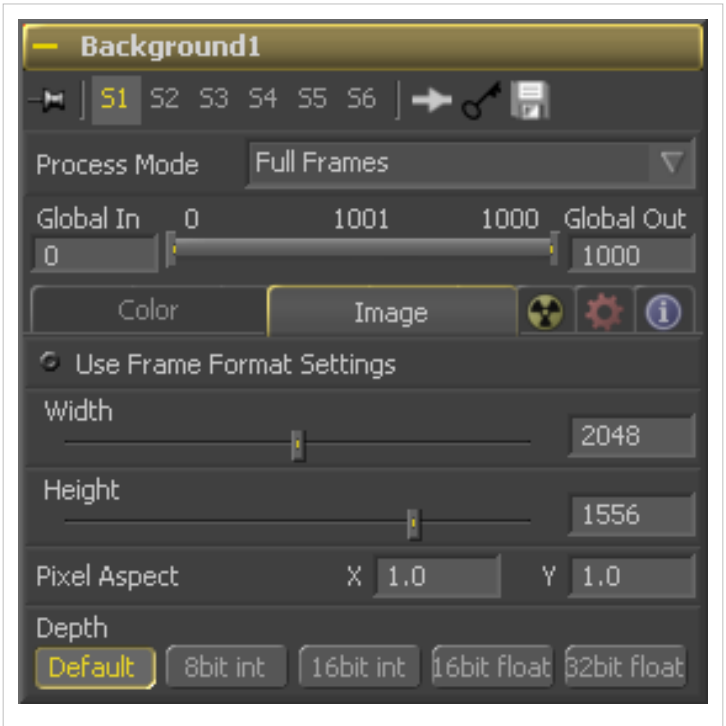
Two Color

A simple two color gradient is used to color the noise map. The noise function will smoothly transition from the first color into the second.

Gradient

The advanced gradient control in Fusion is used to provide much more control over the color gradient used with the noise map. The controls that appear are when this mode is selected are described in depth in the Tool Controls chapter of this manual. Consult this chapter for details on setting up a custom gradient for use in the Fast Noise tool.

Image Tab



See the Creator Common Controls section at the beginning of this chapter for a description of the controls under this tab.

Mask map inputs

These external connections allow you to use masks to control the value of the noise Detail and Brightness controls individually for each pixel. This can allow some interesting and creative effects.

Noise Detail Map

A soft-edged mask connected to the Noise Detail Map will give a flat noise map (zero detail) where the mask is black, and full detail where it is white, with intermediate values smoothly reducing in detail. It is applied before any gradient color mapping. This can be very helpful for applying maximum noise detail in a specific area, while smoothly falling off elsewhere.

Noise Brightness Map

A mask connected to this input can be used to control the noise map completely, such as boosting it in certain areas, combining it with other textures, or if Detail is set to 0, replacing the perlin noise map altogether.

Mandelbrot

Mandelbrot [Man]



This tool creates an image pattern based on the Mandelbrot fractal theory set.

Generation Tab



Position X And Y

This designate the image's horizontal and vertical position or seed point.

Zoom

Zoom magnifies the pattern in or out. Every magnification is recalculated so that there is no practical limit to the zoom.

Escape Limit

Defines a point where the calculation of the iteration is aborted. Low values lead to blurry halos.

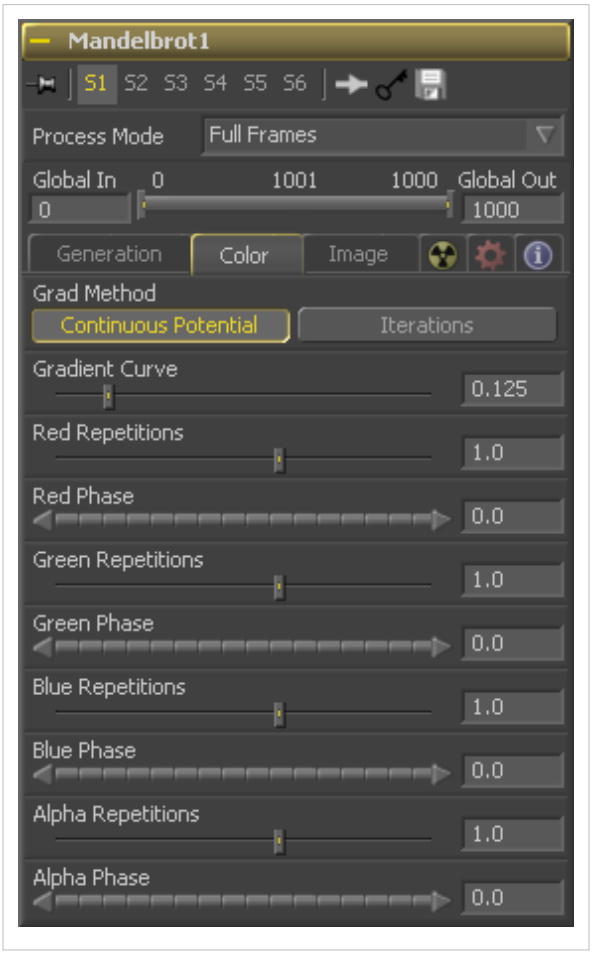
Iterations

This determines the repetitiveness of the set. When animated, it simulates a growing of the set.

Rotation

This rotates the pattern. Every new angle requires recalculation of the image.

Color Tab



Grad Method

Use this control to determine the type of gradation applied at the borders of the pattern.

Continuous Potential

This causes the edges of the pattern to blend to the background color.

Iterations

This causes the edges of the pattern to be solid.

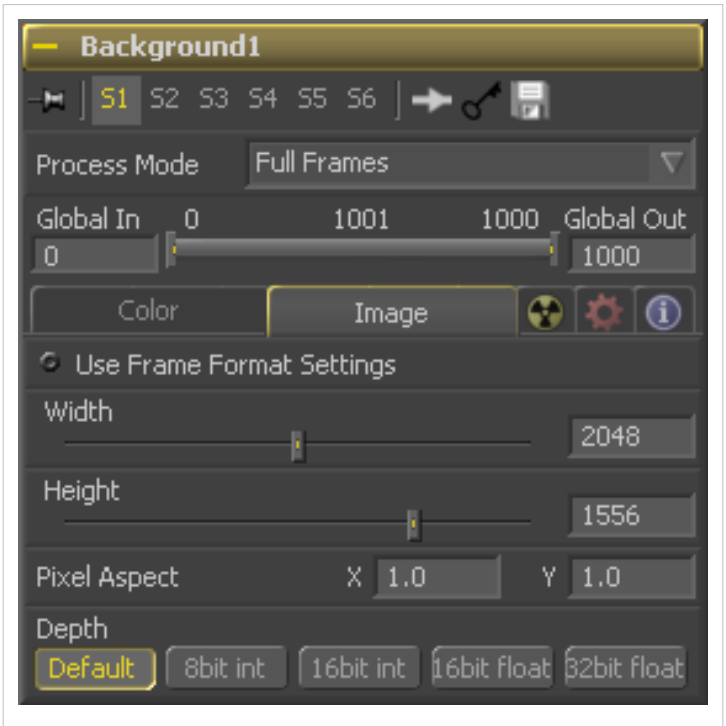
Gradient Curve

This affects the width of the gradation from the pattern to the background color.

R/G/B/A Phase/Repetitions

Set the color values of the pattern generators.

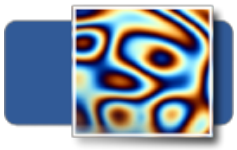
Image Tab



See the Creator Common Controls section at the beginning of this chapter for a description of the controls under this tab.

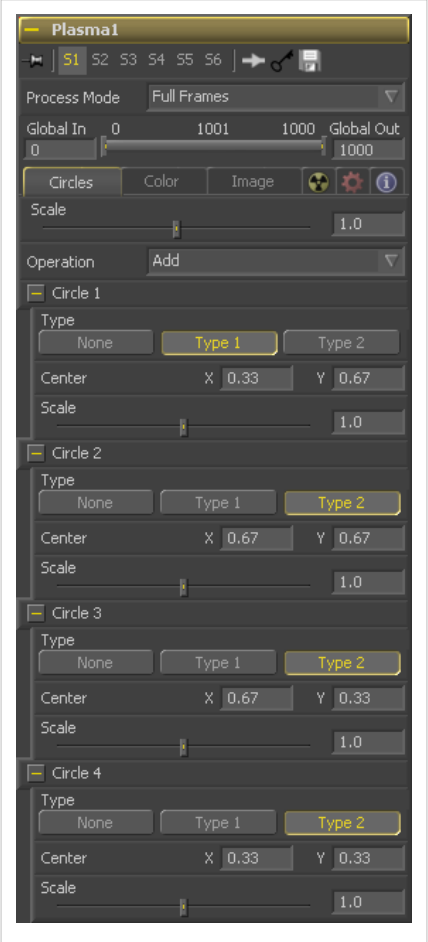
Plasma

Plasma [Plas]



This background generation tool uses four circular patterns to generate images similar to Plasma. It is useful as a deforming pattern for the shadow and deform tools and to create a variety of other useful shapes and patterns. See also the Fast Noise tool.

Circles Tab



Scale

The Scale control is used to adjust the size of the pattern created.

Operation

The options in this menu determine the mathematical relationship between the four circles whenever they intersect.

Circle Type

Select the type of circle to be used.

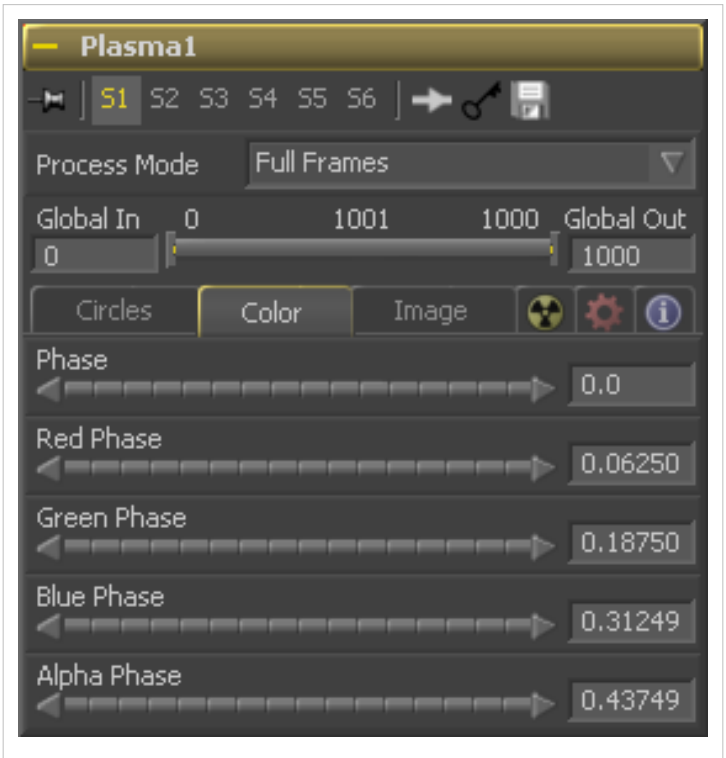
Circle Center

Report and change the position of the circle center.

Circle Scale

Determine the size of the circle to be used for the pattern.

Color Tab



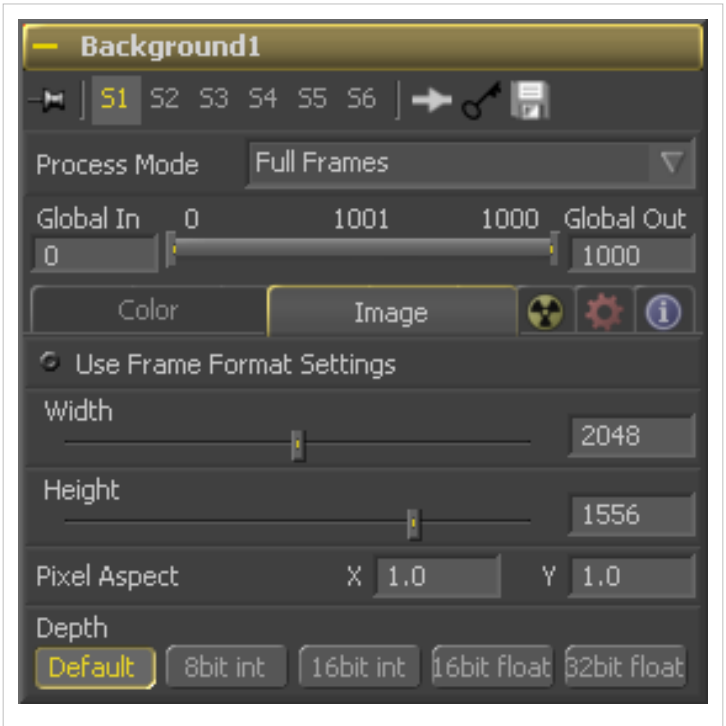
Phase

Phase changes the color phase of the entire image. When animated, this creates psychedelic color cycles.

R/G/B/A Phases

Changes the phase of the individual color channels and the alpha. When animated, this creates color cycling effects.

Image Tab



See the Creator Common Controls section at the beginning of this chapter for a description of the controls under this tab.

TextPlus

Text Plus [Txt+]

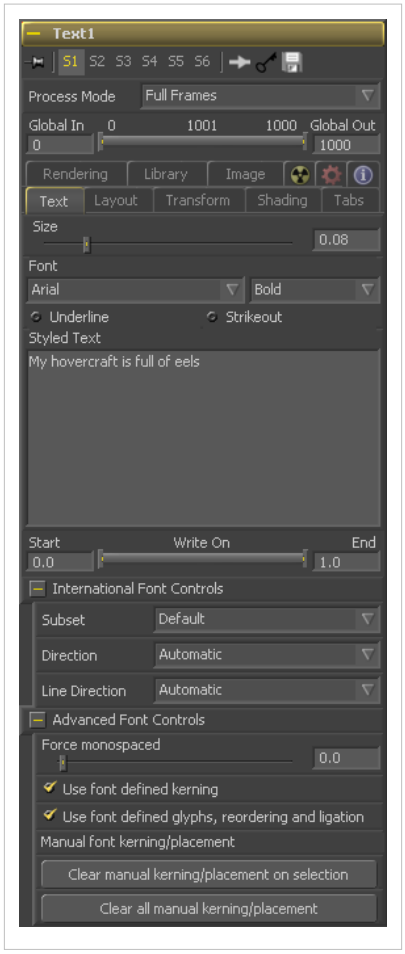


Fusion's text tool is an advanced character generator capable of 3D transformations, multiple styles and several layers of shading. Text can be laid out to a user-defined frame, circle or along a path.

Any True Type or Postscript 1 font installed on the computer can be used to create text. Support for multibyte and unicode characters allows text generation in any language, including right to left and vertically oriented text.

This tool generates a 2D image. To produce extruded 3D text with optional beveling see the Text 3D tool.

Text Tab



Size

This control is used to increase or decrease the size of the text. This is not like selecting a point size in a word processor. The size is relative to the width of the image.

Font

The Font controls are used to select the font used by Fusion to create the text. Fusion has limited support for third-party font managers. Fonts managed by a third-party font manager may need to move to the fonts in the Windows>Fonts folder.

Underline And Strikeout

These checkboxes enable the addition of emphasis styles to the font used.

Styled Text

The edit box in this tab is where the text to be created is entered. Any common character can be typed into this box. The common Windows clipboard shortcuts (Ctrl-C to copy, Ctrl-X to Cut, Ctrl-V to paste) will also work, however right clicking on the edit box displays a custom windows context menu.

The Styled Text context menu has the following options.

Animate

Use this command to set to a keyframe on the entered text and Animate the content over time.

Character Level Styling

This command enables Character Level Styling, which will place a set of controls in the modifiers tab. Use these controls to affect changes in the font, color, size and transformations applied to individual characters.

Comp Name

Comp Name puts the name of the composition in the edit box and is generally used to create slates.

Follower

Follower is a text modifier that can be used to ripple animation applied to the text across each character in the text. See Text Modifiers at the end of this section.

Publish

Publish the text for connection to other text tools.

Text Scramble

A text modifier ID is used to randomize the characters in the text. See Text Modifiers at the end of this section.

Text Timer

A text modifier is used to count down from a specified time or to output the current date and time. See Text Modifiers at the end of this section.

Time Code

A text modifier is used to output Time Code for the current frame. See Text Modifiers at the end of this section.

Connect To

Use this option to connect the text generated by this Text tool to the published output of another tool.

Write On

This range control is used to quickly apply simple Write On and Write Off effects to the text. To create a write on effect, animate the End portion of the control from 1 to 0 over the length of time required. To create a write off effect, animate the Start portion of the range control from 0 to 1.

International Font Controls

This drop down menu can be used to select a language specific to a subset of a font.

Direction

This menu provides options for determining the Direction in which the text is to be written.

Line Direction

These menu options are used to determine the text flow from top-bottom, bottom-top, left-right or right-left.

Force Monospaced

This slider control can be used to override the kerning (spacing between characters) that is defined in the font. Setting this slider to zero (the default value) will cause Fusion to rely entirely on the kerning defined with each character. A value of one will cause the spacing between characters to be completely even, or Monospaced.

Do Font Defined Kerning

This enables kerning as specified in the true type font and is on by default.

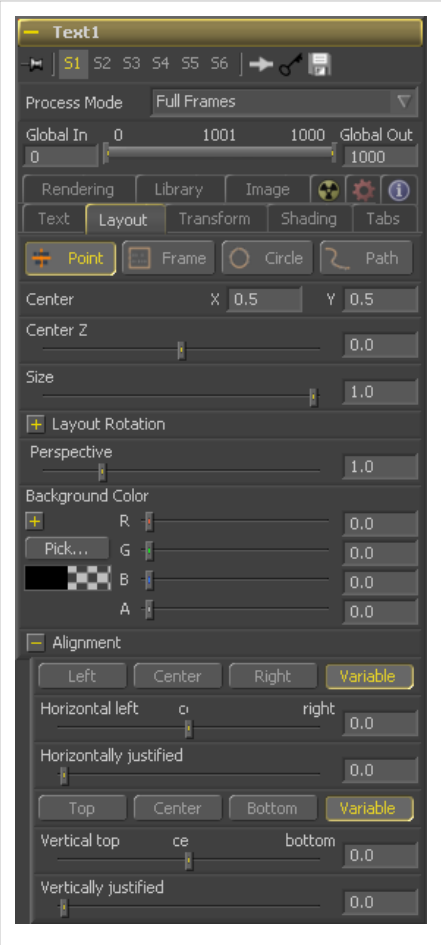
Advanced Font Controls

Use Font Defined Glyphs, Reordering And Ligation Leave this checkbox selected unless instructed to do otherwise by support.

Manual Font Kerning/Placement

Right-clicking on this label will display a context menu that can be used to animate the kerning of the text. See the Toolbar section of this tool's documentation later in this chapter for details on manual kerning.

Layout Tab



The controls used to position the text are located in the Layout Tab. One of four layout types can be selected using the button array.

Point

Point layout is the simplest of the layout modes. Text is arranged according to the around an adjustable center point.

Frame

Frame layout allows you to define a rectangular frame used to align the text. The alignment controls are used to justifying the text vertically and horizontally within the boundaries of the frame.

Circle

Circle Layout places the text around the curve of a circle or oval. Control is offered over the diameter and width of the circular shape. When the layout is set to this mode, the alignment controls determine whether the text is positioned along the inside or outside of the circle's edge, and how multiple lines of text are justified.

Path

Path layout allows you to shape your text along the edges of a path. The path can be used simply to add style to the text, or it can be animated using the Position on Path control that appears when this mode is selected.

Center X, Y And Z

These controls are used to position the center of the layout element in space. X and Y are onscreen controls and Center Z is a slider in the tool controls.

Size

This slider is used to control the scale of the layout element.

Layout Rotation

Select this checkbox and another set of options appears to set the rotation options of the text.

Rotation Order

This button array allows you to select the order in which 3D rotations are applied to the text.

Angle X, Y And Z

These angle controls can be used to adjust the angle of the Layout element along any axis.

Width And Height

The Width control is visible when the layout mode is set to Circle or Frame. The Height control is only visible when the layout mode is set to Frame. They are used to adjust the dimensions and aspect of the Layout element.

Perspective

This slider control is used to add or remove perspective from the rotations applied by the Angle X, Y and Z controls.

Fit Characters

This menu control is only visible when the Layout type is set to Circle. This menu is used to select how the characters are spaced to fit along the circumference.

Position On Path

The Position On Path control is used to control the position of the text along the path. Values less than zero or greater than one will cause the text to move beyond the path in the same direction as the vector of the path between the last two keyframes.

Background Color

This label only appears when the Layout type is set to Path. It is used to provide access to a context menu that provides options for connecting the path to other paths in the flow, and animating the shape of the path over time.

The text generated by this tool is normally rendered against black. This color picker control can be used to set a new background color.

Right-click here for shape animation

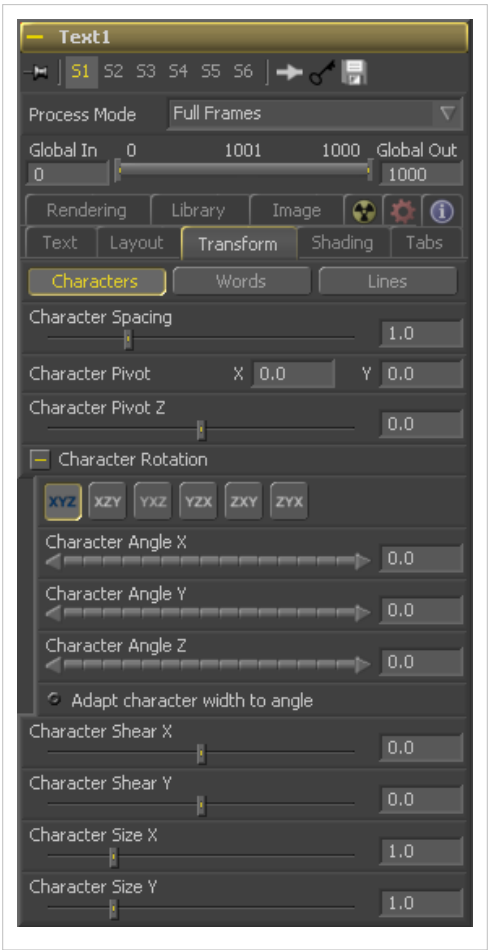
Consult the Motion Paths chapter of this manual for details.

Horizontal And Vertical Alignment

Two identical sets of controls are used to control Vertical and Horizontal Alignment of the text. Use the first array of buttons to choose the alignment of the text. The slider beneath controls

the justification.

Transform Tab



Select Transform

There are three buttons to determine the portion of the text affected by the transformations applied in this tab. Transformations can be applied to line, word and character levels simultaneously. This menu is only used to keep the number of visible controls to a reasonable number.

Characters

Each character of text is transformed along its own center axis.

Words

Each word is transformed separately on the word's center axis.

Lines

Each line of the text is transformed separately on that line's center axis.

Spacing

The spacing slider is used to adjust the amount of space between each line, word or character. Values less than one will usually cause the characters to begin overlapping.

Pivot X, Y And Z

This provides control over the exact position of the axis. By default, the axis is positioned at the calculated center of the line, word or character. The axis control works as an offset, such that a value of 0.1, 0.1 in this control would cause the axis to be shifted downward and to the right for each of the text elements. Positive values in the Z axis slider will move the axis further along the axis (away from the viewer). Negative values will bring the axis of rotation closer.

Rotation Order

These buttons are used to determine the order in which transforms are applied. X, Y and Z would mean that the rotation is applied to X, then Y, and then Z.

Angle X, Y And Z

These controls can be used to adjust the angle of the text elements in any of the three dimensions.

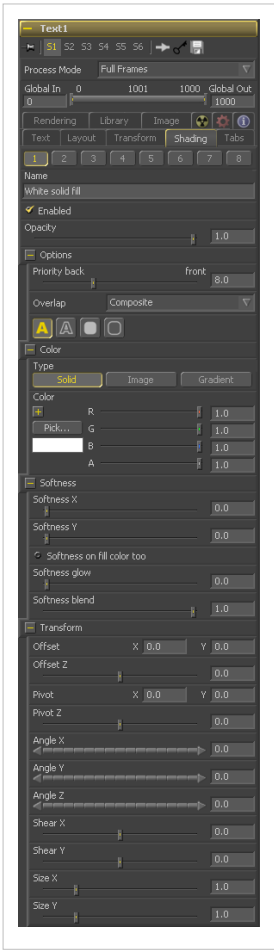
Shear X And Y

Adjust these sliders to modify the slanting of the text elements along the X and Y axis.

Size X And Y

Adjust these sliders to modify the size of the text elements along the X and Y axis.

Shading Tab



The Shading Tab provides controls to adjust the shading, texture and softness of the text. Transformations can be controlled from this tab as well, applying additional transformations to as many as eight separate text shading elements independently. The number menu is used to select the element affected by adjustments to the controls in this tab.

Name

This text label can be used to assign a more descriptive name to each shading element.

Enabled

Select this checkbox to enable or disable each layer of shading elements. Element 1 is enabled by default. The controls for a shading element will not be displayed unless this checkbox is selected.

Opacity

The Opacity slider controls the overall transparency of the shading element. It is usually better to assign opacity to a shading element than to adjust the alpha of the color applied to that element.

Priority Back/Front

This slider determines the layer's order for the shading elements, also known as the Z-order. Slide the control to the right to bring an element closer to the front. Move it to the left to tuck one shading element behind another.

Overlap

This menu is used to select how the renderer deals with an Overlap between two characters in the text.

Composite

This Overlap option will merge the shading over top of itself.

Solid

This option sets the pixels in the overlap region to pure opaque.

Transparent

This option sets the pixels in the overlap region to pure transparent.

Element Type (Buttons)

There are four options available from this menu, providing control over how the shading element is applied to the text. Different controls will appear below depending on the element type selected.

Text Fill

The shading element is applied to the entire text. This is the default mode.

Text Outline

The shading element is drawn as an outline around the edges of the text.

Border Fill

The shading element fills a border surrounding the text. Five additional controls are provided with this shading mode.

Border Outline

The Border Outline mode draws an outline around the border that surrounds the text. It offers several additional controls.

Overlap

(*All Types*) Overlap is used to determine how the shading is handled when portions of the same shading element overlap. Setting this menu to transparent will cause the pixels color and alpha channel to be set to 0 (transparent).

Thickness

(*Outline only*) Use this slider control to adjust the thickness of the outline. Higher values equal thicker outlines.

Adapt Thickness To Perspective

(*Outline only*) Selecting this checkbox will cause your outline to become thinner where the text is further away from the camera, and thicker where it is closer. This will create a much more realistic outline for text transformed in 3D, but takes significantly longer to render.

Outside Only

(*Outline only*) Selecting this checkbox will cause the outline to be drawn only on the outside edge of the text. By default the outline is centered on the edge and partially overlaps the text.

Join Style

(*Outline only*)This menu provides options for how the corners of the outline are drawn. Options include Sharp, Rounded and Beveled.

Line Style

(*Outline only*)This menu offers additional control over the style of the line. In addition to the default solid line, a variety of dash and dot patterns are available.

Shape

(*Border Fill only*) Shape creates a solid rectangular image around the character.

Shape

(*Border Outline only*) Creates a rectangular outline around each character.

Level

(*Border Fill only*) This is used to control the portion of the text border filled.

Text

This draws a border around the entire text.

Line

This draws a border around each line of text.

Word

This draws a border around each word.

Character

This draws a border around each character.

Extend Horizontal And Extend Vertical

(*Border only*) Use this slider to change the dimensions of each border.

Round

(*Border only*) This slider is used to round off the edges of the border.

Color Types

In addition to solid shading, it is also possible to map an external image onto the text. This menu is used to determine if the color of the shading element is derived from a user-selected color or if it comes from an external image source. Different controls will be displayed below depending on the Color Type selected.

Solid Mode

When the type menu is set to Solid mode, color selector controls are provided to select the color of the text.

Image Mode

The output of a tool in the flow will be used to texture the Text. The tool used is chosen using the color Image control revealed when this option is selected.

Color Image

(*Image Mode only*) This color image text box is used to enter the name of the tool in the flow that will provide the image. You can type the name in with the keyboard, drag the tool from the flow into the text box or right click and select connect to from the context menu to select the image to be used.

Image Size

(*Image Mode only*) The image size menu is used to select how the image is mapped to the text.

Full Image

This option applies the entire image to the text.

Text

This option applies the image to fit the entire set of text.

Line

This option applies the image per line of text.

Word

This option applies the image per each word of text.

Character

This option applies the image per individual character.

Softness X And Y

These sliders control the softness of the text outline used to create the shading element. Control is provided for the X and Y axis independently.

Softness On Fill Color Too

Selecting this checkbox will cause blur (softness) to be applied to the shading element as well. The effect is best seen when applied to a shading element colored by an external image.

Softness Glow

This slider will apply a glow to the softened portion of the shading element.

Softness Blend

This slider controls the amount that the result of the softness control is blended back with the original. It can be used to tone down the result of the soften operation.

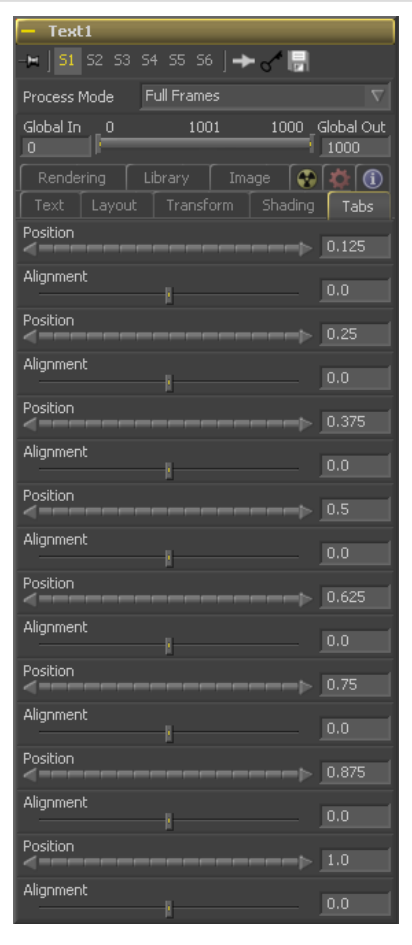
Transform Controls

Selecting the Transform button in the Shading tab will display controls for performing transformations to the shading elements. These controls work in exactly the same way as their equivalents in the Alignment and Layout Tabs, with the addition of a center offset control.

Offset X, Y And Z

These controls are used to apply offset from the text's global center (as set in the Layout Tab) for the shading elements. A value of X0.0, Y0.1 in the coordinate controls would place the shading element center 10 percent of the image further down the screen along the y-axis. Positive values in the Z-Offset slider control will push the center farther away from the camera, while positive values will bring it closer to the camera.

Tabs Tab



The controls in the Tabs area are used to configure the horizontal screen positions of 8 separate tab stops. Any tab characters in the text will conform to these positions.

Because the tab key is used by Fusion to advance to the next control, it is not possible to enter a tab directly into the Styled Text input. Enter a tab using one of the following methods.

ASCII Character

Hold down the Alt key and type 009 on the numeric keypad.

Copy And Paste

copy a tab from another document, such as notepad, and paste it into the text box.

Position

This control is used to set the horizontal position of the tab in the frame. The values range from 0.0 to 1.0 where 0 is the far left side and 1 is the far right side of the frame. The position of the tab will be indicated in the display view by a thin vertical white line when the text tool is selected and the tabs tab is open.

Alignment

Each tab can be set to either left aligned, right aligned or centered. This slider ranges from -1.0 to 1.0, where -1.0 is a left aligned tab, 0.0 is a centered tab and 1.0 is a right aligned tab.

Small white boxes at the top of the tab lines indicate that there are tabs present in the flow. Clicking within these boxes will toggle the alignment of the tab between the three states.

Tabs Tab

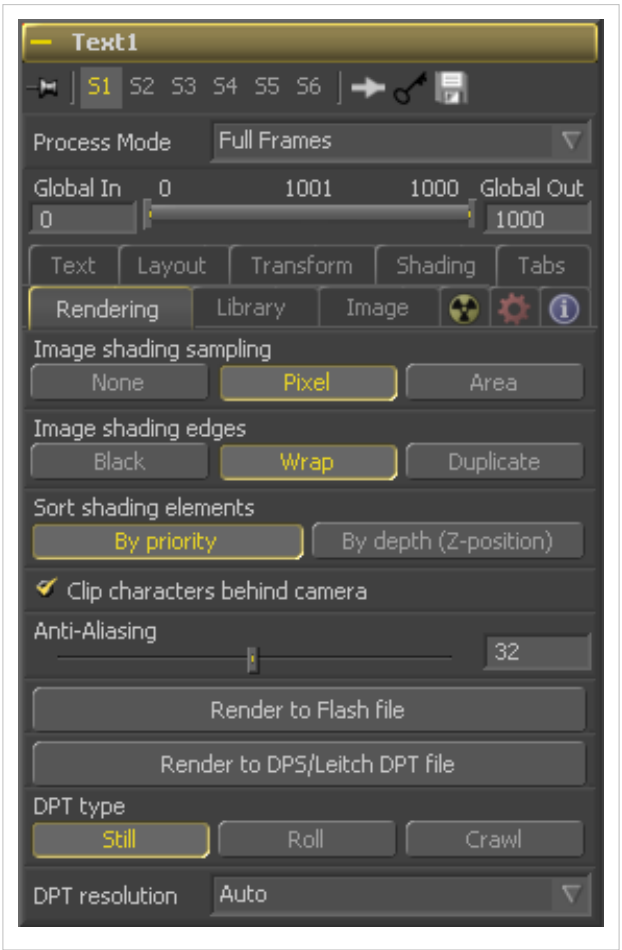


Image Shading Sampling

Use this button array to select the sampling type for shading rendering and transformations. The default of Pixel shading is sufficient for 90% of tasks. To reduce detectable aliasing in the text, set the sampling type to Area. This is slower but may produce better quality results. A setting of None will render faster, but with no additional sampling applied so the quality will be lower.

Image Shading Edges

Use this button array to choose how transformations applied to image shading elements are handled when they wrap off of the text's edges.

Sort Shading Elements

This button selection determines the ordering of the shading elements. The default is By Priority, which organizes the shading elements back to front according to the priority back/front slider in each shading elements controls.

Selecting the By Depth (Z-Position) option will re-organize these according to each element's Z position, as set by the element's transformations.

Clip Characters Behind Camera

This checkbox determines whether characters that go beyond the plane of the camera will be clipped, or if they will reflect back toward the center of the image. This should normally be enabled for clipping, but some interesting effects can be produced when clipping is disabled.

Anti-Aliasing

This slider is used to increase or decrease the amount of anti-aliasing applied to the text. Higher values mean exponentially longer render times, while lower valius reduce render times at the expense of quality.

Render To Flash File

Click this button to render the output of the text tool to a Macromedia Flash file.

Render To DPS/Leitch DPT File

Click this button to render the output of the text tool at the current frame to a dpsReality style DPT file for use with the dpsVelocity editing software.

DPT Type

There are three types of DPT types. Select from Still, Roll and Crawl before clicking on the Render to Reality DPT button above.

DPT Resolution

This menu selects the resolution of the DPT file output when the Render to DPS/Leitch DPS file button is selected. Select the option that matches the hardware for the DPT, or leave this at auto to have the resolution set by the size of the image created by the text tool.

Library Tab



The Shading Library is used to store and retrieve the settings of a text tool for easy re-use.

Put

To add a new text element to the library, click on the Put button. All of the current settings for the tool will be saved according to the name assigned.

A thumbnail will appear in the Shading Library showing how that style looks on the letter A.

Get

Click on a shading element in the library, then click on the Get button to apply those settings to the current tool. Get will replace all of the text as well as the style.

Shading

Clicking on Shading will replace the shading elements only, without affecting the text entered.

Right-click in the shading library window for a list of display options.

Text+Toolbar



When the Text tool is selected, a toolbar will appear in the display views.

Allow Typing In Preview Window

Enable this button to type and edit text directly in the preview window, click on the text to produce a cursor that can be positioned within the text. The cursor can be moved using the arrow keys. Type normally.

Allow Manual Kerning

This button enables Manual Kerning, which overrides the automatic kerning normally applied to text. A small red dot will appear beneath each character of text in the display view. Click-drag on the dot to reposition a character. Also select multiple characters and move them together. Hold the Alt key down while dragging to constrain motion to a single axis.

Use the arrow keys on the keyboard to make manual adjustments to the position of the selected characters. Hold the Ctrl key down while pressing arrow keys to move the character in smaller increments. Shift will move the characters in larger increments.

To animate the position of each character, right-click on the control label Manual Font Kerning/Placement beneath the Text tab's Advanced Font Controls and select Animate from the context menu. A new key will be set on the animation spline each time a character is moved. All characters are animated with the same spline, as with polyline mask animation.

No Text Outline

This button disables the drawing of any outline around the edges of the text. The outline is not a part of the text. It is an onscreen control used to help identify the position of the text.

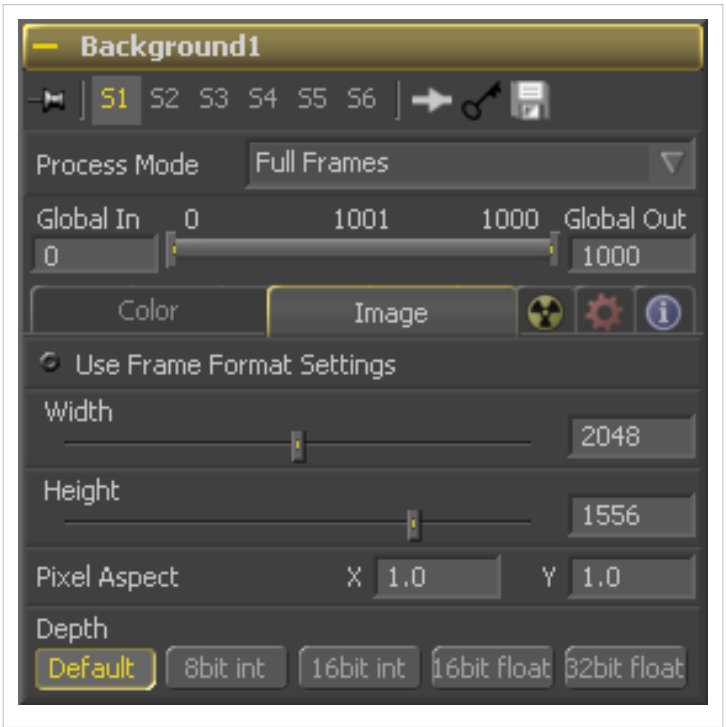
Text outline outside frame only

This button draws an outline around the edges of text which is outside the visible frame. This is useful for locating text which has moved of screen and is no longer rendering a visible result.

Show Always Text Outline

This button draws an outline around the edges of text at all time, whether the text is visible within the frame or not.

Image Tab



See the Creator Common Controls section at the beginning of this chapter for a description of the controls under this tab.

Deep Pixel

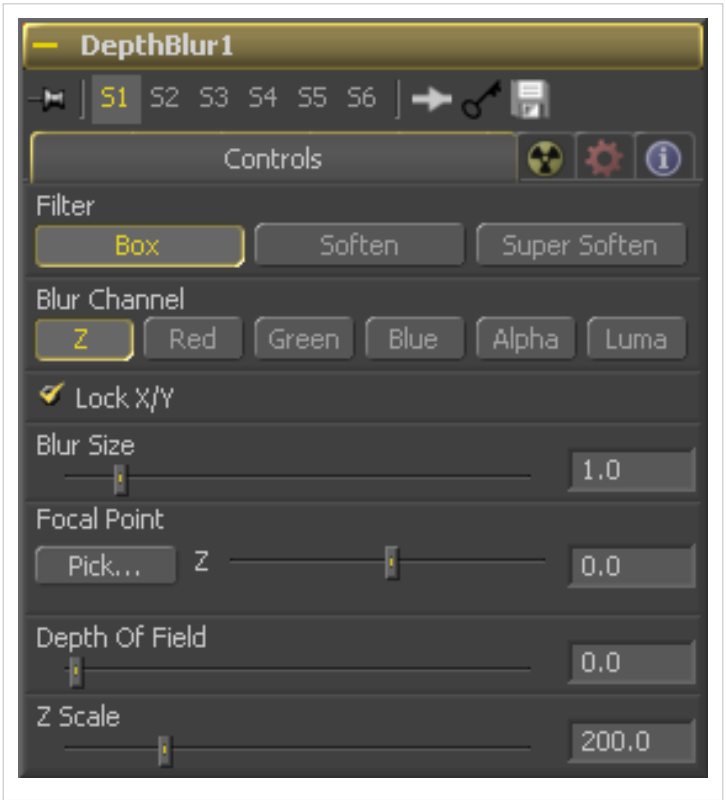
Depth Blur

Depth Blur [DBl]



The Depth Blur Tool is primarily used to create focal length or depth-of-field effects. It blurs 3D rendered images based on included Z channel values, and can also be used for general per-pixel blurring effects by means of the Blur Channels control. If the Blur Image input is connected, channels from that image will be used to control the blur.

Controls



Filter

These buttons are used to select the filter used for applying the blur.

Box

This applies a depth based box blur effect to the image.

Soften

This applies a depth based general softening filter effect.

Super Soften

This applies a depth based high quality softening filter effect.

Blur Channels

Select one of these options to determine the channel used to control the level of blur applied to each pixel. The channel from the main image input is used, unless a tool is connected to the tool's Blur Image input on the flow.

Lock X/Y

When toggled on, this control locks the X and Y blur sliders together for symmetrical blurring.

Blur Size

This slider is used to set the strength of the horizontal and vertical blurring applied to the image.

Focal Point

This control is only visible when the Blur channel is set to use the Z Buffer.

Use this control to select the distance of the simulated point of focus. Lowering the value causes the Focal Point to be closer to the camera, raising the value causes the focal point to be further away.

Click-drag the Pick button (the pointer changes to a dropper) over the displayed image and select a Z-buffer value. If the image does not contain a valid Z-buffer, no change will occur in the value.

Depth Of Field

This control is used to determine the depth of the area in focus. The focal point is positioned in the middle of the region and all pixels with a Z-value within the region stay in focus. For example, if the focal point was selected from the image and set to a value of 300, and the depth of field is set to 200, any pixel with a Z-value between 200 and 400 would remain in focus.

Z Scale

Scales the Z-buffer values by the selected amount. Raising the value causes the distances in the Z channel to expand. Lowering the value causes it to contract. This is useful for exaggerating the depth effect. It can also be used to soften the boundaries of the blur. Some images with small depth values may require the Z Scale to be set quite low, below 1.0.

Fog

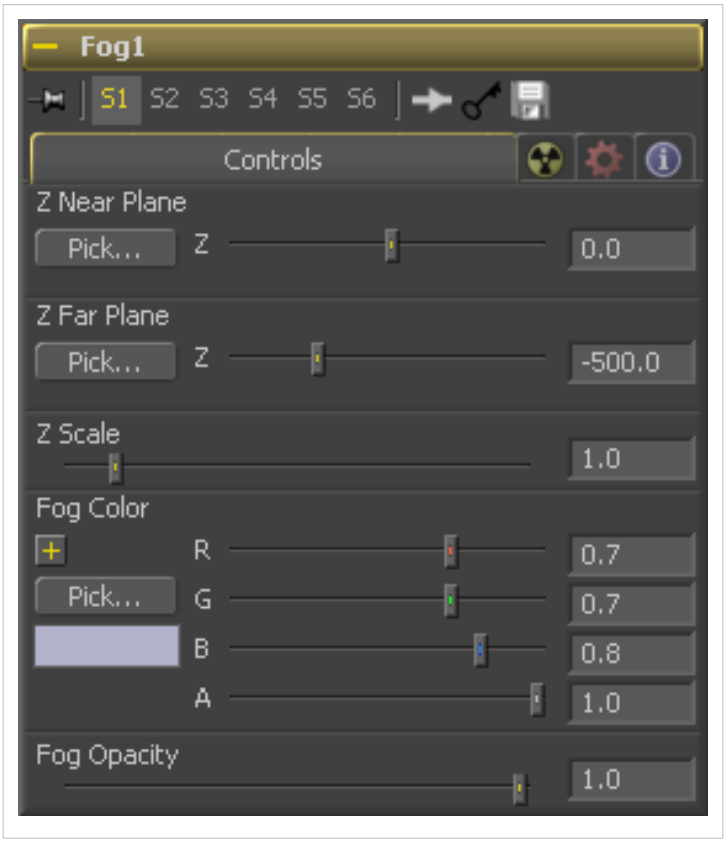
Fog [Fog]



The Fog Tool is used to create simulated fog effects on 3D rendered images that contain a valid Z-buffer channel. The fog can be placed in front of or behind various elements of a rendered image based on the selected Z channel planes. For more information, see the Auxiliary Channels chapter.

The second image input on the fog tool can be used to provide an image that is used as the source of the fog. If no image is provided, the fog consists of a single color. Generally, a noise map of some sort is provided here.

Controls



Z-Buffer Near Plane And Far Plane

These controls are used to select the extents of the fog within the scene. To pick a value, click-drag the Pick button to an area on the image being viewed where the plane is to be located.

The near plane is used to select the depth where the fog thins out to nothing. The far plane is used to select the depth at which the fog becomes opaque.

Z Depth Scale

This option scales the Z-buffer values by the selected amount. Raising the value causes the distances in the Z channel to expand, whereas lowering the value causes it to contract. This is useful for exaggerating the fog effect.

Fog Color

This option displays and controls the current fog color. Alpha adjusts the fog's transparency value.

Fog Opacity

Use this control to adjust the opacity of the fog.

Shader

Shader [Shd]

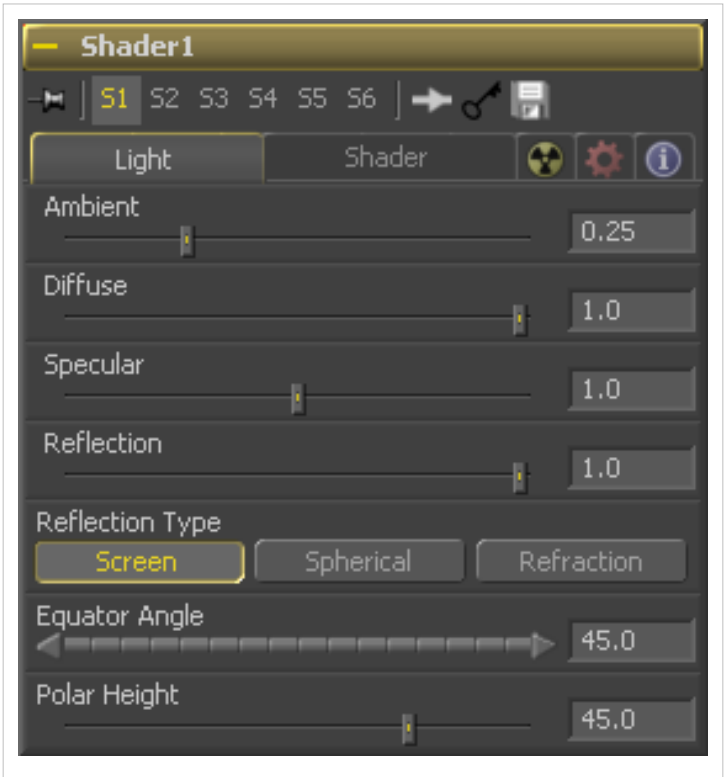


The Shader Tool can control the lighting, reflection mapping and 3D shading of elements in a rendered image. The reflection map image (connected to the green input) can be projected onto all elements in the scene, or to elements selected by the Object and Material ID channels in the common controls. Effect masking can also be used to limit the effect of this tool.

The shader tool relies on the presence of the X, Y and Z normal map channels in 3D rendered images. If these channels are not present, this tool has no effect.

For more information, see the Auxiliary Channels chapter.

Light Tab



Ambient

Ambient controls the amount of Ambient color present in the scene or for the selected object. This is a base level of light, added to all pixels, even in completely shadowed areas.

Diffuse

This option controls the amount of Diffuse color present in the scene or for the selected object. This is the normal color of the object, reflected equally in all directions.

Specular

This option controls the amount of Specular color present in the scene or for the selected object. This is the color of the glossy highlights reflected towards the eye from a light source.

Reflection

This option controls the amount of Reflection contribution in the scene or for the selected object. High levels make objects appear mirrored, low levels overlay subtle reflections giving a polished effect. It has no effect if no reflection map is connected.

Reflection Type

Select from these three buttons to determine the type of reflection mapping used to project the image in the second input.

Screen

Screen causes the reflection map to appear as if it were projected on to a screen behind the point of view.

Spherical

Spherical causes the reflection map to appear as if it were projected on to a huge sphere around the whole scene.

Refraction

Refraction causes the reflection map to appear as if it were refracting or distorting according to the geometry in the scene.

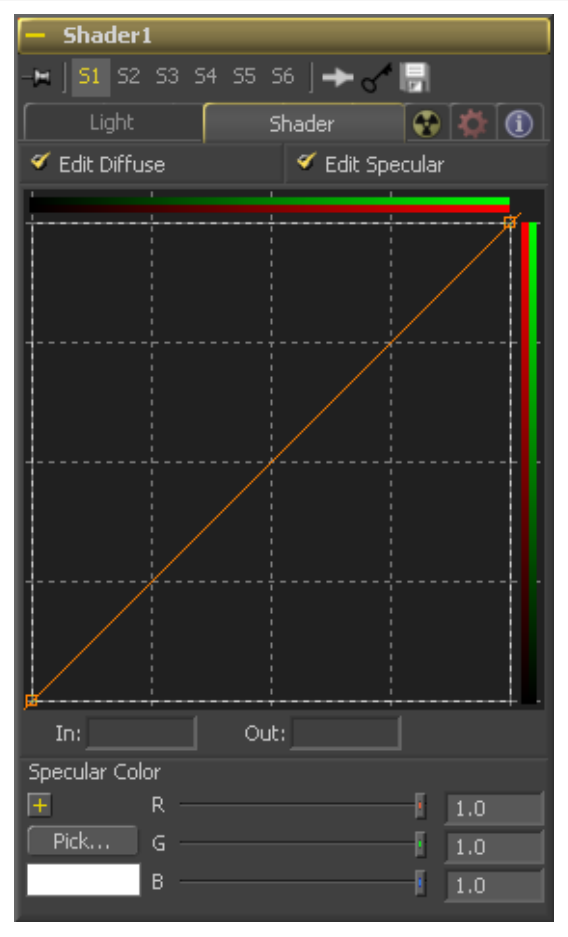
Equator Angle

Equator Angle controls the left to right angle of the light generated and mapped by the Shader tool for the scene or the selected object.

Polar Height

Polar Height controls the top to bottom angle of the light generated and mapped by the Shader tool for the scene or the selected object.

Shader Tab



The Shader Tab offers control of the Shader tool's shader curves.

Edit Diffuse And Specular

Toggle these controls on to enable editing of the shader curves for the individual channels in the Shader spline window.

In And Out

These options are used to display and edit point values on the spline.

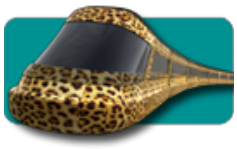
Specular Color

Use the Diffuse curve to manipulate the diffuse shading and the Specular curve to effect the specular shading. Drag a box over a number of points to group select them. Right-clicking displays a menu with options for adjusting the spline curves.

For a complete description of the options and controls for the spline windows, see the documentation for the LUT editor in the Controls chapter of the manual.

Texture

Texture [Txr]

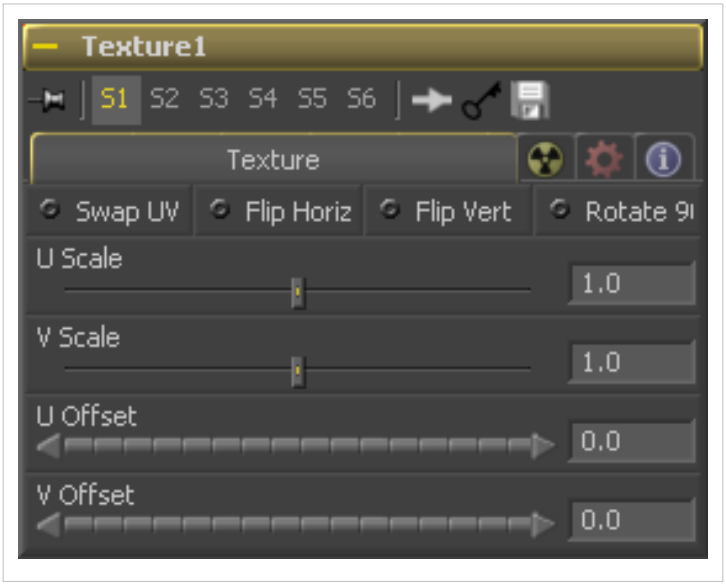


The Texture tool can control the texture mapping of elements in a rendered image. The texture-map image (connected to the green input) can be wrapped around objects to replace the current texture. The Texture tool relies on the presence of U and V Map Channels in 3D rendered images. If these channels are not present this tool has no effect.

Note that background pixels may have U and V values of 0.0, which will set those pixels to the color of the texture's corner pixel. To restrict texturing to specific objects, use an effect mask based on the alpha of the object, or its Object or Material ID channel.

For more information, see the Auxiliary Channels chapter.

Texture Tab



Swap UV

When this checkbox is selected the U and V channels of the source image are swapped.

Flip Horizontal And Vertical

The texture-map image is flipped horizontally and/or vertically when this control is toggled on.

Rotate 90

The texture-map image is rotated 90 degrees when this checkbox is enabled.

U And V Scale

These controls change the scaling of the U and V coordinates used to map the texture. Changing these values effectively enlarges and shrinks the texture map as it is applied.

U And V Offset

Adjust these controls to offset the U and V coordinates. Changing the values causes the texture to appear to move along the geometry of the object.

Effect

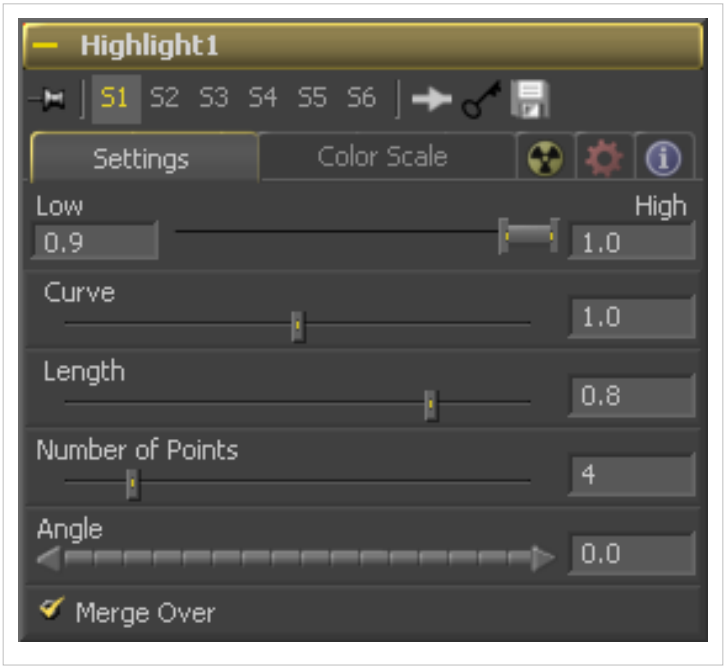
Highlight

Highlight [HiL]



The Highlight filter creates star-shaped highlights in bright regions of the image, similar to a lens star filter effect.

Settings Tab



Low And High

This range control designates the range of luminance values in the image that will generate highlights. Values less than the Low value will not receive highlights. Values above the High value will receive the full highlight effect.

Curve

The Curve value changes the drop off over the length of the highlight. Higher values will cause the brightness of the flares to drop off closer to the center of the highlight, whereas lower values will drop off further from the center.

Length

This designates the Length of the flares from the highlight.

Number Of Points

This determines the number of flares emanating from the highlight.

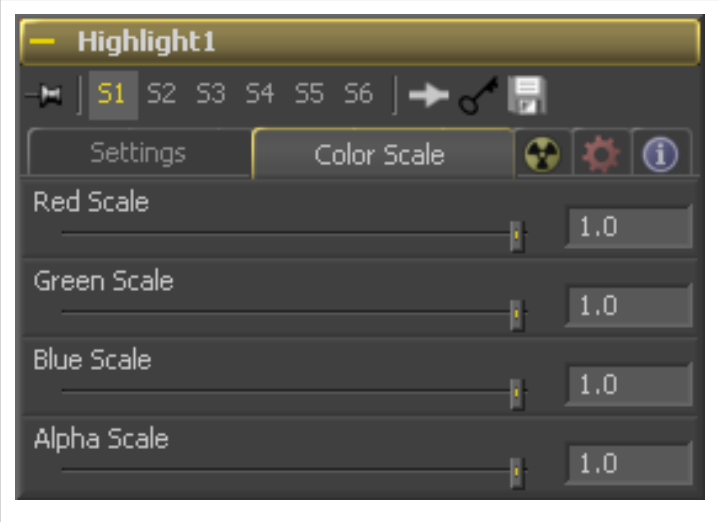
Angle

Use this control to rotate the highlights.

Merge Over

When this checkbox is on, it will overlay the effect on the original image. With the checkbox off, the output will be the highlights only. This is useful for downstream color correction of the highlights.

Color Scale Tab



Red, Green And Blue Scale

Moving the sliders of one or all of these channels down will change the falloff color of the highlight.

Alpha Scale

Moving the alpha slider down will make highlight falloff more transparent.

{{{1}}}

Hot Spot

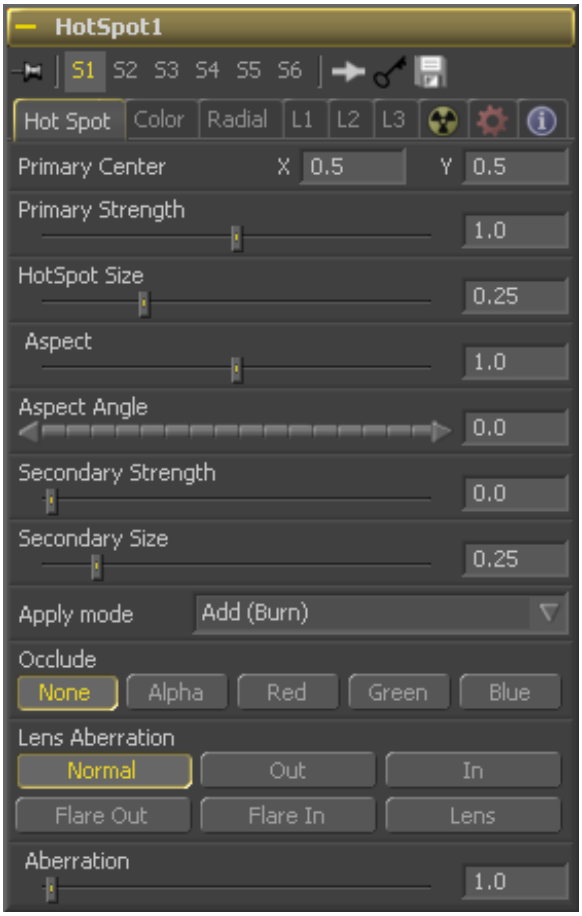
Hot Spot [Hot]



The Hot Spot tool is used to create lens flare, spotlight and burn/dodge effects of various types.

In the real world, lens flares occur when extremely bright light sources present in the scene by the reflections are reflected of elements inside the lens of the camera. One might see lens flares in a shot when viewing a strong light source through a camera lens, like the sun or a bright star.

Hot Spot Tab



Primary Center X And Y

This is the position of the Primary Hot Spot within the scene. Secondary lens elements and reflections are positioned relative to the position of the primary.

Primary Strength

This control determines the brightness of the primary hotspot.

HotSpot Size

This control determines the diameter of the primary Hotspot. A value of 1.0 represents a circle the full width of the image.

Aspect

This controls the Aspect of the spot. A value of 1.0 produces a perfectly circular hotspot. Values above 1.0 will elongate the circle horizontally and values below 1.0 will elongate the circle vertically.

Aspect Angle

This control can be used to rotate the primary hotspot.

Secondary Strength

This control determines the strength, which is to say the brightness, of the secondary hotspot. The secondary hotspot is a reflection of the primary hotspot. It will always be positioned on the opposite side of the image from the primary hotspot.

Secondary Size

This determines the size of the secondary hotspot.

Apply Mode

This control determines how the hotspot affects the underlying image.

Add (Burn)

This causes the spots created to brighten the image.

Subtract (Dodge)

This causes the spots created to dim the image.

Multiply (Spotlight)

This causes the spots created to isolate a portion of the image with light and to darken the remainder of the image.

Occlude

Use this button array to select which channel of the image connected to the HotSpot tool's occlusion input is used to provide the occlusion matte.

Occlusion happens when the source of the hotspot is blocked by something between it and the camera. When the source of a hotspot is occluded, the hotspot simply winks out.

Occlusion can be controlled from Alpha or R ,G or B channels of any image connected to the occlusion input on the tool's tile. The white pixels in the image will occlude the hotspot. Grey pixels will partially suppress the hotspot.

Lens Aberration

Aberration changes the shape and behavior of the primary and secondary hotspots.

In And Out Modes

Elongate the shape of the hotspot into a flare. The hotspot stretches toward the center of the image when in In mode, stretching toward the corners when in Out mode.

Flare In And Flare Out Modes

This option is a lens distortion effect that is controlled by the movement of the lens effect. Flare In will cause the effect to become more severe the closer the hotspot gets to the center. Flare Out causes the effect to increase as the hotspot gets closer to the edges of the image.

Lens

This mode emulates a round, ringed lens effect.

Aberration

The Aberration slider controls the overall strength of the lens aberration effect.

Color Tab



This tab contains a Look Up Table (LUT) that controls the disbursement, brightness and radial influence (mix) of the spot colors. The bottom left corner represents the outer edge of the spot, while the top right corner represents the center of the spot.

Color Channel And Mix

When selected, these checkbox controls enable the editing of the chosen splines in the LUT below.

Red, Green, Blue, And Alpha Splines

The Red, Green, Blue and Alpha splines are used to adjust the color of the spotlight along the radius of the hotspot.

The vertical axis represents the intensity or strength of the color channel, from a value of 0 at the bottom to 1 at the top. The horizontal axis represents the position along the radius of the hotspot, from the outside edge on the left to the inside on the right.

So the default curve of the tool indicates that the red, green, blue and alpha channels all have a linear falloff from the outside edge of the curve to the inside edge.

Mix Spline

The Mix spline is used to determine the influence of the controls that the Radial tab will have along the radius of the hotspot. The horizontal axis represents the position along the circle's circumference, with 0 being 0 degrees and 1.0 being 360 degrees. The vertical axis represents the amount of the radial hotspot to blend with the color hotspot. A value of 0 is all radial hotspot, while a value of 1.0 is all color hotspot.

Note

Right-clicking in the LUT will display a context menu with options related to modifying spline curves.

A complete description of LUT editor controls and options can be found in the Tool Controls chapter of this manual.

Radial Tab



By default, the Hot Spot is rendered as a circle or ellipse and the radial controls are disabled. The radial splines provide a way of generating rays of light, or non uniform density in the hotspot along the circumference of the hotspot. A classic example would be that you could use the radial splines to create a star shape.

Radial On

When selected this control enables the Radial splines. Otherwise the radial matte created by the splines is not applied to the hotspot, and theMix spline in the color controls will have no affect on the hotspot.

Radial Length And Radial Density Splines

The key to these splines is realizing that the LUT editor's horizontal axis represents a position around the circumference of the hotspot. A value of 0.0 is 0 degrees and 1.0 is 360 degrees. With that in mind, the length determines the radius of the light making up the hotspot along the circumference, and the density represents how bright the light is along the circumference.

Radial Repeat

This control will repeat the effect of the radial splines by X number of times. For example, a repeat of 2.0 causes the spline to take effect between 0 and 180 degrees instead of 0 and 360, repeating the spline again between 180 and 360.

Length Angle

This control will rotate the effect of the Radial Length spline around the circumference of the hotspot.

Density Angle

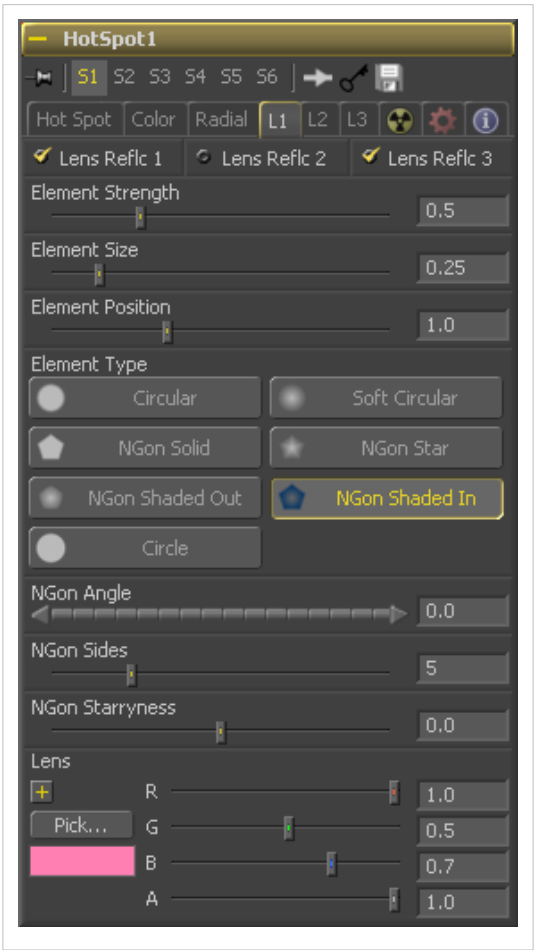
This control will rotate the effect of the Radial Density spline around the circumference of the hotspot.

Note

Right-clicking in the spline area will display a context menu containing options related to modifying spline curves

A complete description of LUT editor controls and options can be found in the Tool Controls chapter of this manual.

L1, L2 And L3 Tab



Each tab contains identical settings and can be used to create additional reflection elements above and beyond the primary and secondary hot spots.

Lens Reflect 1-3

When selected, the reflection caused by the element is enabled.

Element Strength

This determines the brightness of element reflections.

Element Size

This determines the size of element reflections.

Element Position

This determines the distance of element reflections from the axis. The axis is calculated as a line between the hotspot position and the center of the image.

Element Type

Use this array of buttons to choose the shape and density of the element reflections. The presets available are described below.

Circular

This creates slightly soft-edged circular shaped reflections.

Soft Circular

This creates very soft-edged circular shaped reflections.

Circle

This creates a hard-edged circle shape.

NGon Solid

This creates a filled polygon with a variable number of sides.

NGon Star

This creates a very soft-edged star shape with a variable number of sides.

NGon Shaded Out

This creates soft-edged circular shapes.

NGon Shaded In

This creates a polygon with a variable number of sides, which has a very soft reversed (dark center, bright radius) circle.

Ngon Angle

This control is used to determine the angle of the NGon shapes.

Ngon Sides

This control is used to determine the amount of sides used when the Element Type is set to Ngon Star, Ngon Shaded Out, and Ngon Shaded In.

Ngon Starriness

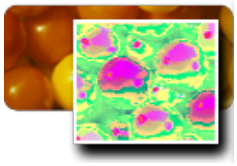
This control is used to bend polygons into star shapes. The higher the value the more star-like the shape.

Lens Color Controls

These controls determine the color of the lens that affects the colors of the reflections. To choose a lens color, pick one from a displayed image, or enter RGBA values using the sliders or input boxes.

Pseudo Color

Pseudo Color [PsCl]



The Pseudo Color Tool provides the ability to produce variations of color based on waveforms generated by the tools controls. Static or animated variances of the original image can be produced. The tool's controls are separated into four identical tabs, one for each of the color channels.

R /G /B /A Tabs



Color Check Box

When selected, this color channel will be affected by the Pseudo Color tool.

Wrap

When selected, waveform values that exceed allowable parameter values will be wrapped to the opposite extreme.

High And Low

High and Low determine the range to be affected by the tool in a specific color channel.

Soft Edge

This slider determines the soft edge of color transition.

Waveform

This selects the type of Waveform to be created by the generator. Four waveforms are available Sine, Triangle, Sawtooth and Square.

Frequency

This controls the Frequency of the waveform selected. Higher values will increase the number of occurrences of the variances.

Phase

This modifies the Phase of the waveform. Animating this control will produce color cycling effects.

Mean

This determines the level or Mean value of the waveform selected. Higher values will increase the overall brightness of the channel until the allowed maximum is reached.

Amplitude

Amplitute increases or decreases the overall power of the waveform.

Shadow

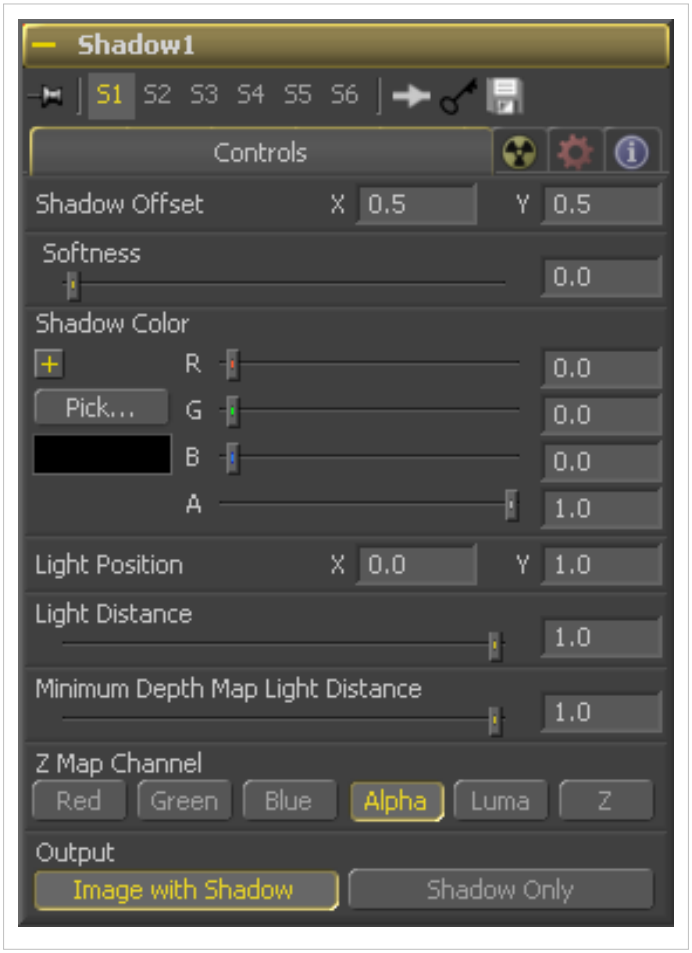
Shadow [Sh]



Shadow is a versatile tool used in the creation of shadows that are based on the alpha channel information from an image. It is also possible to use an additional image to control the shadow's apparent depth.

The Shadow Tool is designed to cast simple 2D shadows. Use a spotlight tool and an image plane tool for full 3D shadow casting.

Controls



Shadow Offset

This control sets the apparent distance of the shadowed object from the background. Adjusting the position of the Shadow Offset crosshair in the views is the quickest way to create simple drop shadows.

Softness

Softness controls how blurry the shadow's edges appear. The further the background is from the object, the fuzzier it becomes.

Shadow Color

Use this control to select the color of the shadow. The most realistic shadows are usually the ones that are not totally black and razor sharp.

Light Position

This control sets the position of the light relative to the shadow-casting object. The Light Position is only taken into consideration when the Light Distance slider is NOT set to infinity (1.0).

Light Distance

This slider will vary the apparent distance of the light between infinity (1) and being at zero distance from the shadow-casting object. The advantage of setting the Light Distance is that the resulting shadow is more realistic-looking with the further parts of the shadow being longer than those that are closer.

Minimum Depth Map Light Distance

This control is active when an image is connected to shadow's Depth Map input. The slider is used to control the amount that the depth map contributes to the Light Distance. Dark areas of a depth map make the shadow deeper. White areas bring it closer to the camera.

Z Map Channel

This menu is used to select which color channel of the image connected to the tools Z Map input will be used to create the shadows depth map. Selections exist for the RGB and A, Luminance and Z buffer channels.

Output

The Output image can either contain the image with shadow applied or the shadow only.

Changing the setting in the output drop-down list controls which mode will be used. This method is useful when color correction, perspective or other effects need to be applied to the resulting shadow before it is merged back with the object.

For example, shadow alpha controls the shadow's degree of transparency.

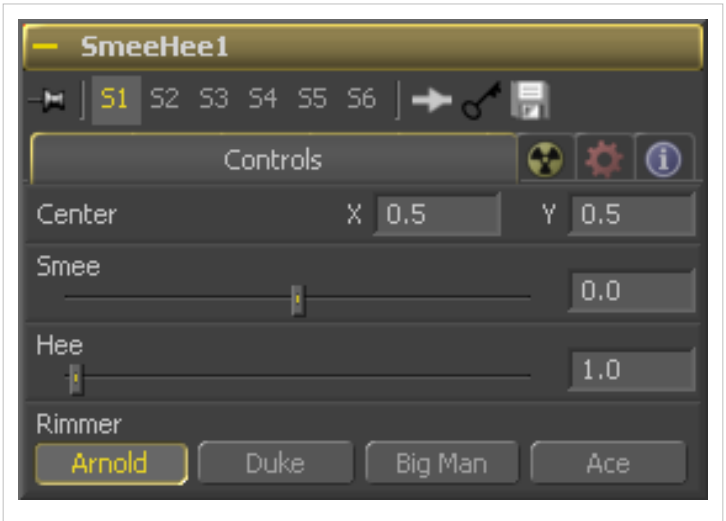
Smee Hee

Smee Hee [Smeg]



SmeeHee is a versatile tool used in the creation of various optical effects. It's the Red Dwarf of Fusions toolset. Based on a research paper which was published by the **Committee for the Liberation and Integration of Terrifying Organisms and their Rehabilitation Into Society** it can create mindbending effects like sub-space conduits, tachyon surges or even chromatic aberration.

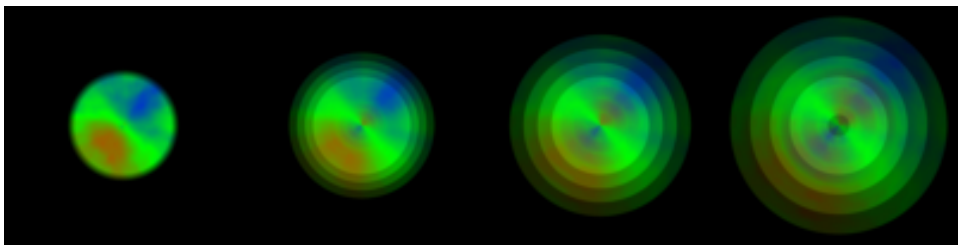
Controls



Center X/Y

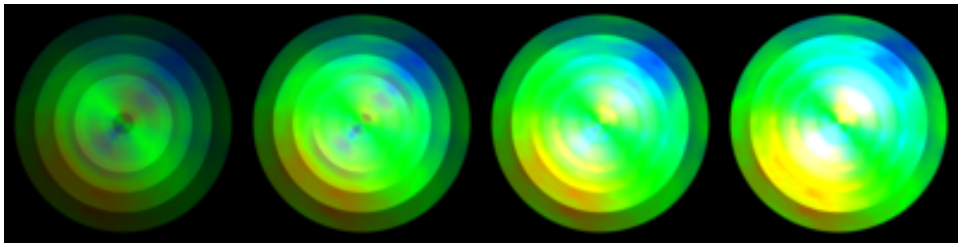
This is the position of the Center from where this effect will be calculated. Think of it like a time tunnel to a parallel universe.

Smee



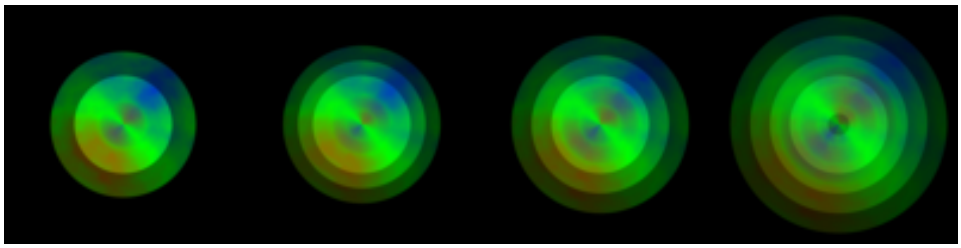
The main control over the influence of the effect. The higher the setting the more the resulting effect looks like a armour-plated alien killing machine. The image above shows various Smee settings between 1 and 10.

Hee



Use this control to add a glow to your Smeeded scene. The bigger the Hee the stronger the glow. The image above shows various Hee settings between 1 and 4.

Rimmer



Rimmer offers you a set of deep space controls. Think of this control like being able to overload the time matrix. The image above shows various Rimmer settings as described below.

Arnold

Basic Rimmer. Just a tiny little bit

Duke

Stronger Rimmer. The effect shows more clearly and has a stronger influence.

Big Man

A more powerful variation of Rimmer. Likely to create much stronger results than the other two.

Ace

Put the pedal to the metal. Use with caution. This might have negative influence on the time-space-continuum.

Trails

Trails [Trls]



The Trails Tool is used to create a ghost-like after-trail of the image. This creates an interesting effect when applied to moving images with an alpha channel. Unlike a directional blur, only the preceding motion of an image is displayed as part of the effect.

This tool is unique within Fusion, in that it makes use of an image buffer to create a feedback loop. This feedback loop takes the output of the trails tool from the previous frame and performs a merge of the current frame over top of it. The various controls of the trails tool are used to modify this frame prior to the merge.

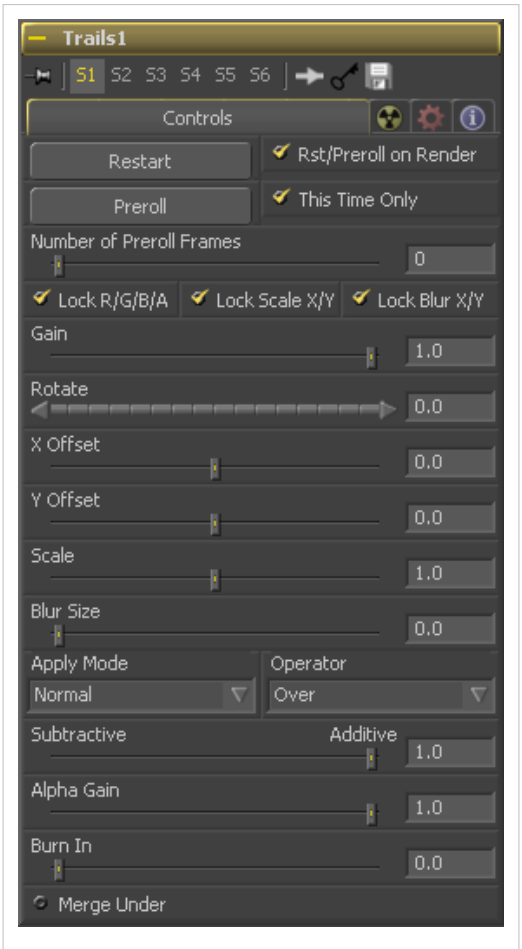
An image buffer is used to store this image until the next frame. This helps to avoid several issues, including the need to re-render the frames multiple times, such as the time stretcher or directional blur effects. The interactive and rendering speed of the tool is, therefore, greatly increased.

It is often necessary to clear the buffer, as changes made interactively in previous frames will remain in the buffer. This tool is not well suited to jumping frames in large increments, which is often done interactively. Each frame will tend to stick in the buffer. When this occurs, simply click the Restart button in order to clear the view.

Once the Trails tool is configured, it may be useful to pass through the effect of this tool until it is time to render a preview or final version.

Due to the way the trails tool operates, this tool cannot be network rendered.

Controls



Restart

This control clears the image buffer and displays a clean frame, without any of the ghosting effect.

Preroll

This will make the trails tool pre-render the effect by the number of frames on the slider.

Reset/Pre-Roll On Render

When this checkbox is enabled, the trails tool will reset itself when a preview or final render is initiated. It will Preroll the designated number of frames.

This Time Only

Selecting this checkbox will make the pre-roll use this current frame only, and not the previous frames.

Number Of Preroll Frames

This determines the number of frames to Preroll.

Lock RGBA

When selected, this checkbox allow the Gain of the color channels to be controlled independently. This allows for tinting of the trails effect.

Lock Scale X/Y

When selected, this checkbox allows the X and Y axis scaling of the image buffer to be manipulated separately for each axis.

Lock Blur X/Y

When selected, this checkbox allows the blurring of the image buffer to be controlled separately for each axis.

Gain

The Gain control affects the overall intensity and brightness of the image in the buffer. Lower values in this parameter will create a much shorter, fainter trail, whereas higher values will create a longer, more solid trail.

Rotate

The Rotate control rotates the image in the buffer before the current frame is merged into the effect.

Offset X/Y

These controls offset the image in the buffer before the current frame is merged into the effect. Control is given over each axis independently.

Scale

The Scale control resizes the image in the buffer before the current frame is merged into the effect.

Blur Size

The Blur Size control applies a blur to the image in the buffer before the current frame is merged into the effect.

Apply Mode

This menu is used to determine the method used by the trails tool when merging one sample over another. The methods in this menu are documented more completely in the Merge tool's documentation in the Composite Tools chapter of this manual.

Operator Mode

This menu is used to select the operation mode of the merge. Changing the Operation Mode changes how the foreground and background are combined to produce a result. The menu will only be visible when the merge tool's Apply mode is set to Normal.

Versions earlier than Fusion5 would always use the Over operation.

For an excellent description of the math underlying the operation modes, read Compositing Digital Images, Porter, T., and T. Duff, SIGGRAPH 84 proceedings, pages 253-259. Essentially, the math is as described below. Note that some modes not listed in the Operator dropdown (under, in, held in, below) are easily obtained by swapping the foreground and background inputs (with Ctrl+W) and choosing a corresponding mode.

The formula used to combine pixels in the merge is always fg * x + bg * y. The different operations determine exactly what x and y are, as shown in the description for each mode.

Over

The Over mode adds the FG layer to the BG layer by replacing the pixels in the BG with the pixels from the Z wherever the FG's alpha channel is greater than 1.

x = 1, y = 1-[foreground alpha]

In

The In mode multiplies the alpha channel of the BG input against the pixels in the FG. The color channels of the FG input are ignored. Only pixels from the FG are seen in the final output. This essentially clips the FG using the mask from the BG.

x = [background alpha], y = 0

Held Out

Held Out is essentially the opposite of the In operation. The pixels in the FG image are multiplied against the inverted alpha channel of the BG image. Accomplish exactly the same result using the In operation and a Matte Control tool to invert the matte channel of the BG image.

x = 1-[background alpha], y = 0

ATop

ATop places the FG over the BG only where the BG has a matte.

x = [background alpha], y = 1-[foreground alpha]

XOr

XOr combines the FG with the BG wherever either the FG or the BG have a matte, but never where both have a matte.

x = 1-[background alpha], y = 1-[foreground alpha]

Subtractive/Additive, Alpha Gain, Burn In

For details on these controls and their effect, consult the documentation for the Merge tool in the Composite Tools chapter.

Merge Under

This merges the current image under the generated trail, rather than the usual, over top operation.

TV

TV [TV]



The TV Tool is a simple tool designed to mimic some of the typical flaws seen in analog television broadcasts and screens.

Controls



Scan Lines

This slider is used to emulate the interlaced look by dropping lines out of the image. A line is dropped by setting it to black, with a transparent alpha. A value of 1 (default) will drop every second line. A value of 2 shows one line, then drops the second and third and repeats. A value of zero turns off the effect.

Horizontal

Use this slider to apply a simple Horizontal offset to the image.

Vertical

Use this slider to apply a simple Vertical offset to the image.

Skew

This slider is used to apply a diagonal offset to the image. Positive values skew the image to the top left. Negative values skew the image to the top right. Pixels pushed off frame wrap around and reappear on the other side of the image.

Amplitude

The Amplitude slider can be used to introduce smooth sine wave-type deformation to the edges of the image. Higher values will increase the intensity of the deformation. Use frequency to determine how often the distortion is repeated.

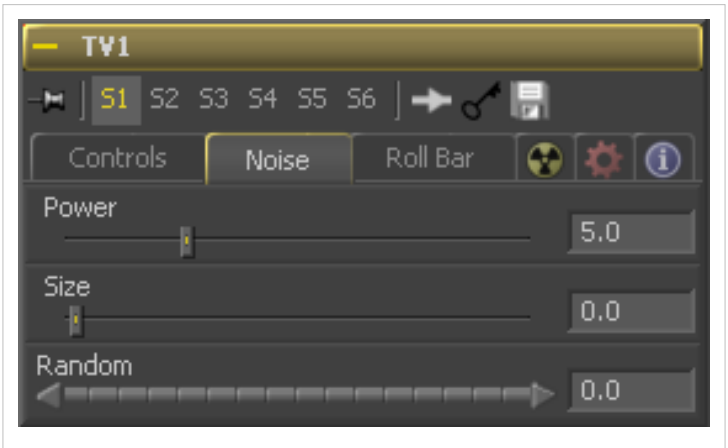
Frequency

The Frequency slider sets the frequency of the sine wave used to produce distortion along the edges of the image when the amplitude control is greater than 1.

Offset

Use Offset to adjust the position of the sine wave, causing the deformation applied to the image via the amplitude and frequency controls to seethe across the image.

Noise Tab



The controls in this tab can be used to emulate `snow', the noise effect seen on a television when a broadcast signal is improperly tuned, weak or absent.

Power

Increase the value of this slider above 0 to introduce noise into the image. The higher the value, the stronger the noise.

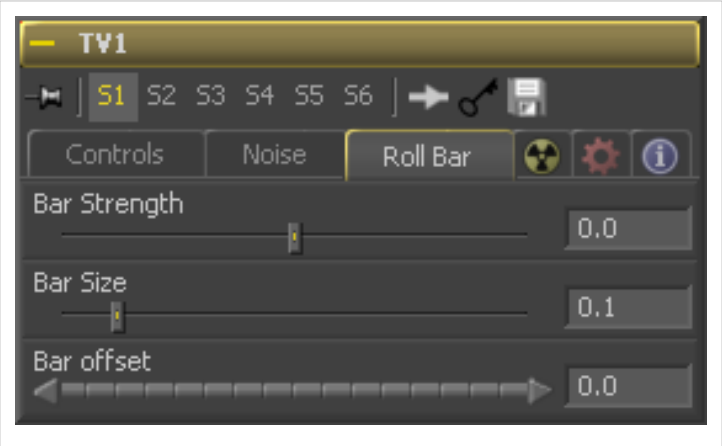
Size

Use this slider to scale the noise map larger.

Random

If this screw control is set to 0, the noise map will be static. Change the value over time to cause the static to change from frame to frame.

Roll Bar Tab



When filming a television with a film or video camera differences in the refresh rate of the television's electron tube and the frame rate of the camera would often cause a rolling bar to appear on the image. The same effect is occasionally seen with defective or poorly calibrated television tubes.

The controls in this tab can be used to duplicate this effect.

Bar Strength

At the default value of 0 no bar is drawn. The higher the value, the darker the area covered by the bar will become.

Bar Size

Increase the value of this slider to make the bar taller.

Bar Offset

Animate this control to scroll the bar across the screen.

Film

Cineon Log

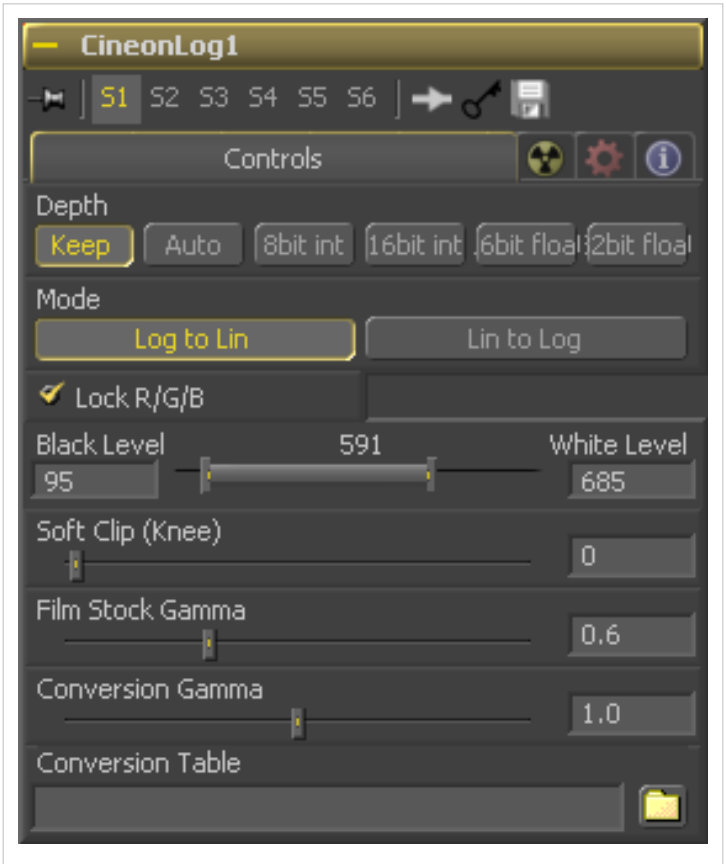
Cineon Log [Log]



The Cineon Log Tool is used to convert image data from logarithmic to linear. Use this tool the log-lin conversion was bypassed in a Cineon Loader to return processing to Linear.

For additional details on the Cineon Log file format, consult the chapter entitled Film In Fusion.

Controls



Mode

These buttons offer two options, one for converting log images to linear and one for converting linear images to logarithmic.

Lock RGB

When selected, the settings in this tab will affect all of the color channels equally. De-select this control to convert the Red, Green and Blue channels of the image using separate settings for each channel.

Black Level And White Level

Use this control to set the black point and white point in the log image before converting. Pixels with values in log space below the Black Level will become out of range values below 0.0. Pixels with values above the White Level will become out of range values above 1.0 after conversion.

When processing in floating point color space, the out of range values stored in the Cineon format are preserved through the conversion. In 16 bit or 8 bit mode the out of range values are clipped.

Soft Clip (Knee)

The Soft Clip control is used to draw values that are out of range back into the image. This is done by smoothing the conversion curve at the top and bottom of the curve, allowing more values to be represented.

Applying a soft clip of any value other than one will immediately cause the tool to process at 16 bit integer, eliminating all out of range values that do not fit within the soft clip.

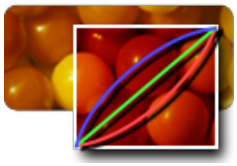
Film Stock Gamma, Conversion Gamma And Conversion Table

These controls are used to set the response curves of the logarithmic data during conversion. In addition to the settings above, a custom ASCII file Look Up Table can be created with specific conversion values. The ASCII LUT file can be loaded using the file folder icon button.

A description of the ASCII LUT format can be found in the appendices.

File LUT

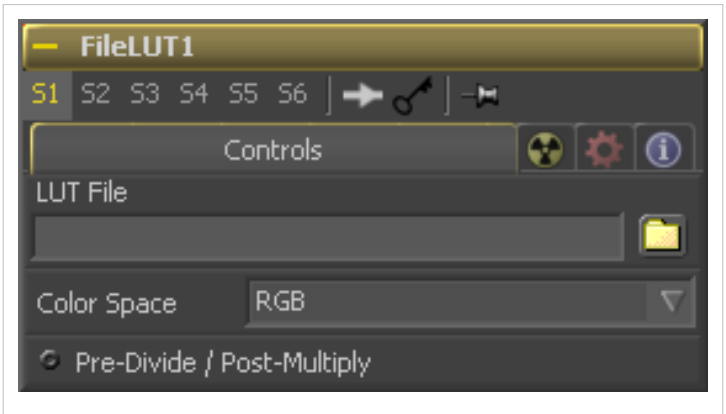
File LUT [FLU]



The File LUT tool applies a look up table (LUT) to the image, either a simple 1D LUT or (as of Fusion 5.2) a supported 3D LUT. Unlike the Color Curves tool it does not use a spline-based LUT. Instead it loads the LUT from a file stored on the system or network.

This approach has two advantages. The first is that the only part of the LUT stored in the composition is the path to the file. Since LUT files can be very large, this can dramatically reduce the file size of a composition when several LUTs are present. The second advantage is that it becomes possible to adjust all File LUT tools using the same file at the same time, simply by changing the contents of the LUT. This can be useful when the same LUT-based color correction is applied in many different compositions.

Controls



LUT File

Use this control to select the path to the file describing the LUT. Currently this tool supports LUTs exported from Fusion in .LUT and .ALUT formats, and (as of Fusion 5.2) Shake's LUT format and a number of 3D LUT formats as well. The tool will fail with an error message on the Console if it is unable to find or load the specified file.

Color Space

Use this control to change the color space the LUT is applied in. The default is to apply the curves described in the LUT to the RGB color space, but options for YUV, HLS, HSV and others are also available.

Pre-Divide/Post Multiply

Selecting the Pre-Divide/Post-Multiply checkbox will cause the image pixel values to be divided by the alpha values prior to applying the LUT, and then re-multiplied by the alpha value after the correction.

This helps to prevent the creation of illegally additive images, particularly around the edges of a blue/green key or when working with 3D rendered objects.

Grain

Grain [Grn]



The Grain tool offers comprehensive film grain emulation. This is useful for introducing simulated grain into a video or computer generated image and matching existing grain in a given scene.

Grain Tab



Power

This slider determines the strength of the grain. A higher value increases visibility, making the grain more prevalent.

RGB Difference

Separate Red, Green and Blue sliders are used to modify the strength of the effect on a per channel basis.

Grain Softness

This slider controls the blurriness or fuzziness of the grain. Smaller values cause the grain to be more sharp or coarse.

Grain Size

This slider determines the size of the grain particles. Higher values increase the grain size.

Grain Spacing

This slider determines the density or amount of grain per area. Higher values cause the grain to appear more spaced out.

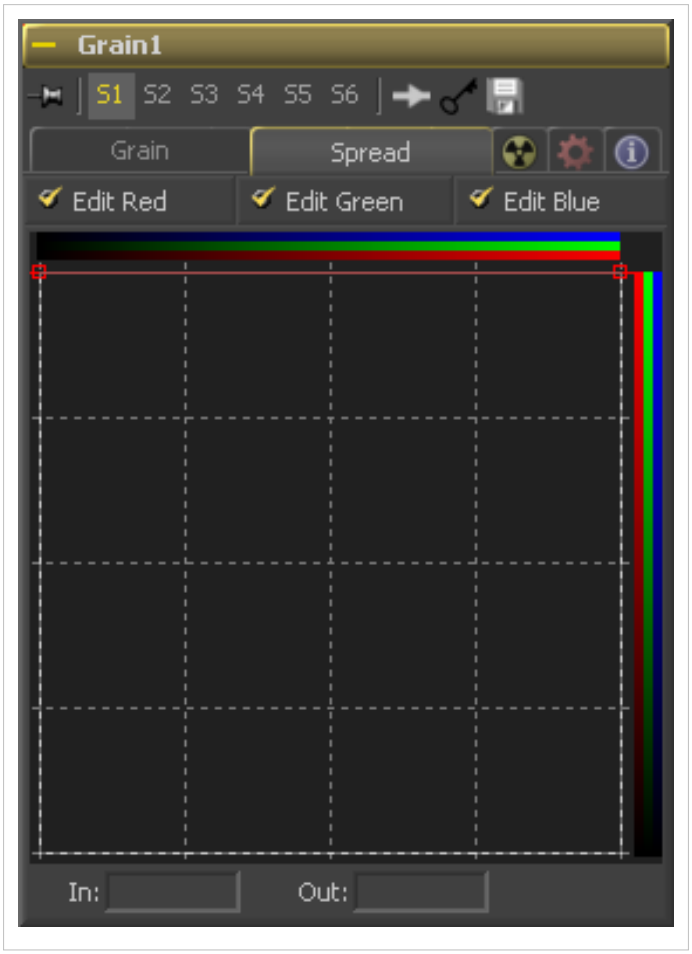
Aspect Ratio

This slider adjusts the aspect of the grain so that it can be matched with anamorphic images.

Alpha-Multiply

When enabled, this checkbox will multiply the image by the alpha, clearing the black areas of any grain effect.

Spread Tab



Color spline curves are shaped using Spread splines. These curves define the strength of the grain.

The horizontal axis (left to right) represents the color values of the image, from black to white. The vertical axis (bottom to top) represents the power of the grain where bottom is none and top is the full amount set in the controls.

Edit RGB Check Boxes

Separate Red, Green and Blue to enable the custom curves for each channel.More grain would appear in the blue channel than the red, and the green channel would receive the least. This curve mimics usual film responses.Right-clicking in the spline area will display a context menu containing options related to modifying spline curves. A complete description of the LUT editor control and its options can be found in the Tool Controls chapter of this manual.

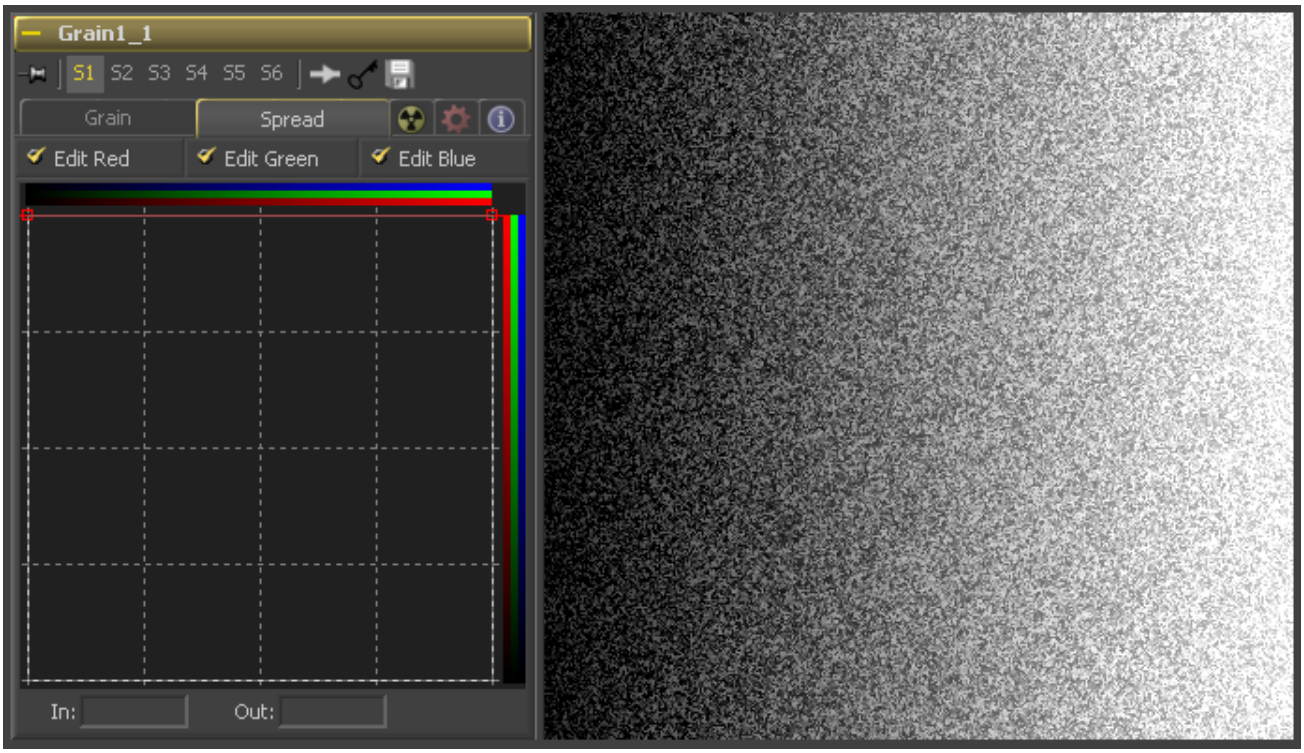
In And Out

This control gives direct editing of points on the curve by setting In/Out point values.

Spread Examples

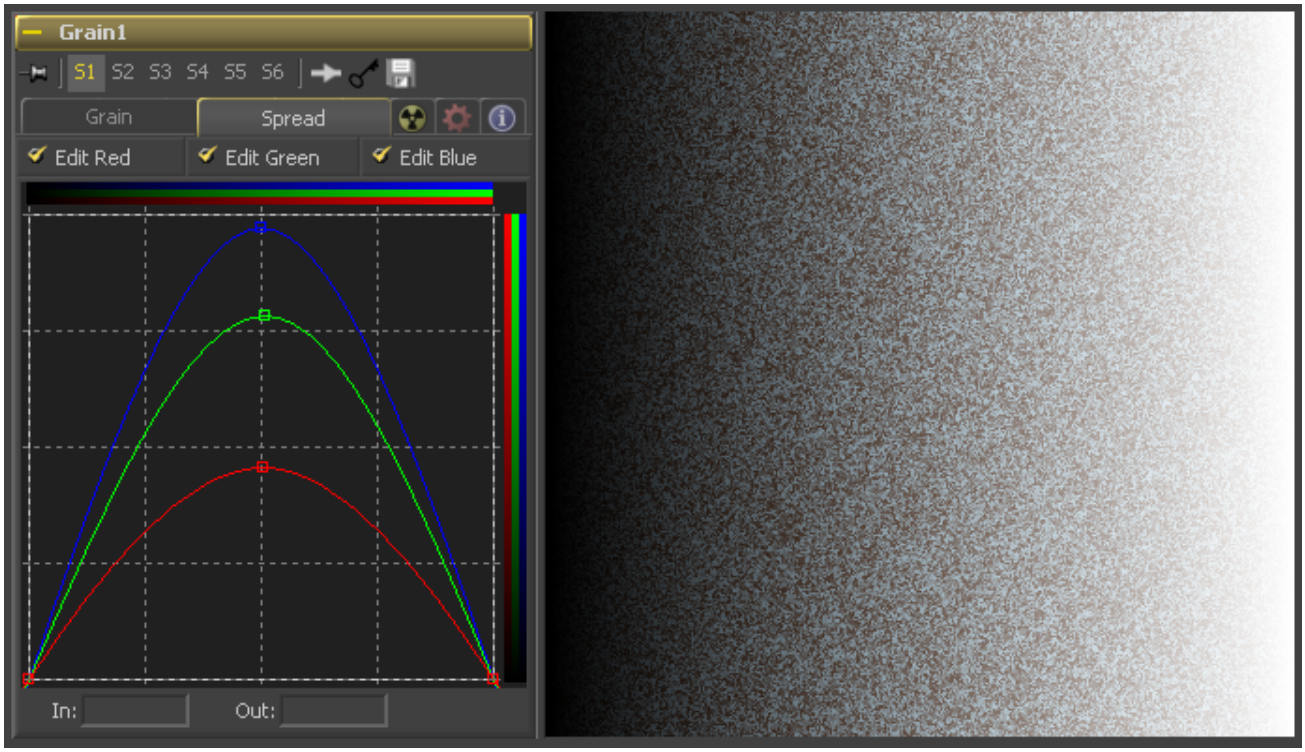


Default Spread



In the default setting the Grain is applied evenly to the entire image as shown here. However film often shows a different amount of grain in the blacks, mids and whites.

Bell shaped spread



Setting a bell shape like so is often a good starting point to create more realistic looking grain. Here we have a non-uniform distribution with different amounts of grain in the red, green and blue channel as well.

In both examples the grain's power has been over-exaggerated to show the effect a bit better.

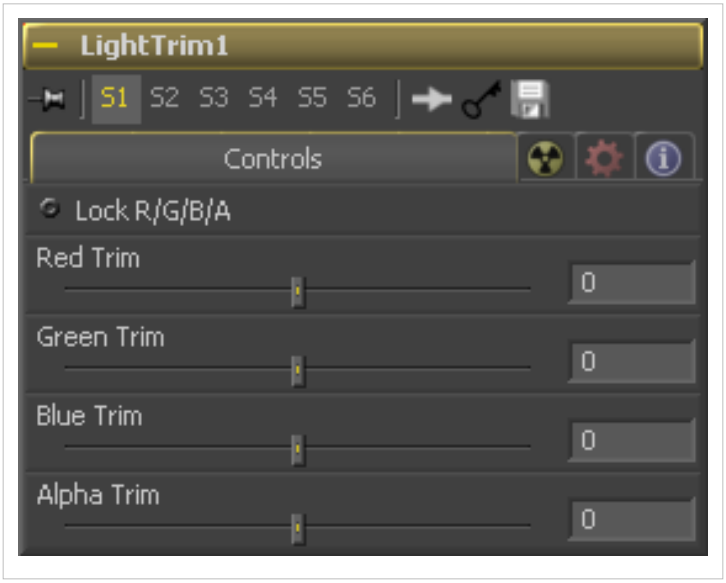
Light Trim

Light Trim [LT]



This tool emulates film scanner light trims. By design, this tool works best with logarithmic data, such as the images stored by the Cineon file system. When logarithmic data is provided, the Light Trim tool can be used to increase or decrease the apparent exposure level of the image.

Controls



Lock RGBA

When selected, the Lock RGBA control collapses control of all image channels into one slider. This selection is on by default. To manipulate the various color channels independently, de-select this check box.

Trim

This slider shifts the color in film, optical printing and lab printing points. 8 points equal one stop of exposure.

Remove Noise

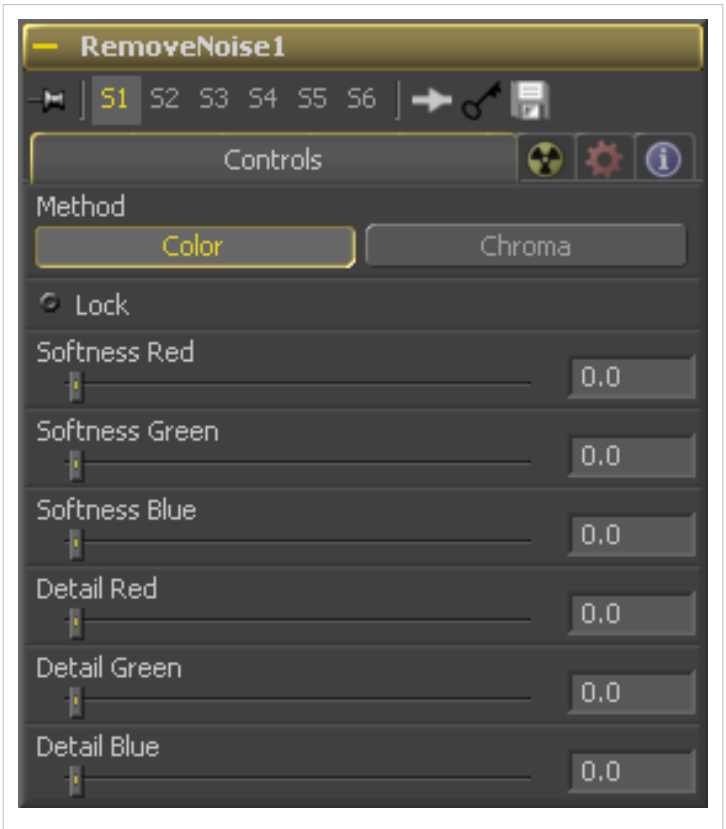
Remove Noise [RN]



The Remove Noise tool provides simple noise management. The basic principle of its operation is the tool blurs the image channels, then compares the blurred image to the original to extract the noise. A sharpness is then applied to the image except where noise was detected.

To use this tool, view the image and look at the Red channel. Then increase the Red Softness until the grain appears to be gone. Next increase the sharpness until the detail reappears, but stop before the grain reappears. Repeat for the Green and Blue channels.

Controls /Color



Method

Use these buttons to choose whether the tool processes color using Color or Chroma methods. This will also give you a different set of control sliders.

Lock

This checkbox will link the softness- and detail-sliders of each channel together.

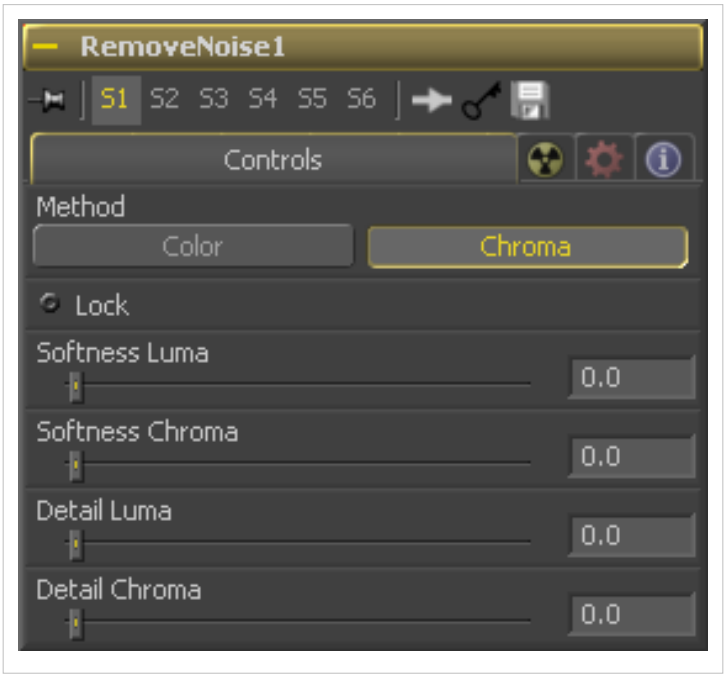
Softness Red, Green And Blue

The Softness sliders determine the amount of blur applied to each channel of the image. In Chroma mode you have sliders for the softness in the luminance and chrominance channels respectively.

Detail Red, Green And Blue

The Sharpness sliders determine how much detail is reintroduced into each channel after each channel is softened. In Chroma mode you have sliders for luminance and chrominance channels respectively.

Controls /Chroma



Filter

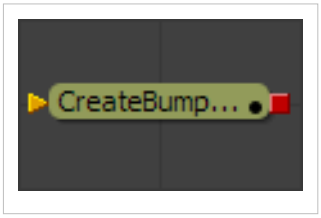
Export Bumpmap



The Export Bumpmap tool converts an greyscale (heightmap) image into a bump map. Check the notes for the naming conventions used in Fusion. Since the resulting bump vector information is represented as RGB, it´s possible to modify them using all the image processing tools in Fusion. Use the Create Bumpmap tool for applying to a material.

Input Port

ExportBumpmap.Input (white): Receives the RGBA channels from an image output for the bump calculation



Controls



This tab contains all parameters for the tool

Filter Size

The process of generating the bump information is basically a Custom Filter. This multibutton control sets the filter size.

Extract height information from...

Set the channel from where to extract the greyscale information from.

Clamp Normal.Z

Ask Stephen... It "clips" the lower values of blue channel in the resulting bump texture (max(slider,bluechannel))?

Filter Wrap Mode

Basically "wraps" the image at the borders, so the filter produces correct result when using seamless tileable textures.

Height Scale

Changes the contrast of the resulting values in the bump map. Increasing this value yields in a more visible bump map.

Bumpmap Texture Depth

Optionaly converts the resulting bump texture into the desired bit depth.

Notes There is some confusion of terminology with bumpmapping depending which papers/books/people you are reading/talking to. This can cause confusion for artists. Here are

Fusion conventions:

Heightmap:

An greyscale image containing a height value per pixel

Bumpmap:

An image containing normals stored in the RGB channels used for modifying the existing normals (usually given in tangent space)

Normalmap:

An image containing normals stored in the RGB channels used for replacing the existing normals (usually given in tangent or object space)

Custom Filter

Custom Filter [CFlt]



The Custom Tool is used to apply custom convolution filters to images. A custom convolution filter can give a wide variety of image effects. For example, emboss, relief, sharpen, blurring and edge detection are all convolution filters. There are many supplied custom filters in the Filters directory that can be loaded by right-clicking on the control header and selecting Settings>Load from the context menu.

A kernel filter is an array (or grid) of either 3 x 3, 5 x 5 or 7 x 7 values. The center of the array represents the current pixel, and entries nearby represent adjacent pixels. A value of 1 applies the full value of the pixel to the filter. A value of 0 ignores the pixel's value. A value greater than one multiplies the pixel's affect on the result. Negative values can also be entered, where the value of the pixel will be subtracted from the average. Only integer values can be entered, 0.5 is not valid.

Controls



Color Channels (RGBA)

The color corrector defaults to operating on R, G, B and A channels. Selective channel editing is possible by clicking the checkboxes beside each channel, making selected channels active or inactive.

This is not the same as the RGBA checkboxes found under the common controls. The tool takes these controls into account before it processes. Deselecting a channel will cause the tool to skip that channel when processing, speeding up the rendering of the effect. In contrast, these controls under the common controls tab are applied after the tool has processed.

Matrix Size

Use this drop-down to set the size of the filter at 3 x 3 pixels, 5 x 5 pixels or 7 x 7 pixels, thus setting the radius of the pixels sampled. The larger the size, the more time it takes to render.

Update Lock

When this control is selected, Fusion will not render the tool. This is useful for setting up each value of the tool, then turning Update Lock off in order to render it.

Filter Matrix

The Filter Matrix control is a 7 x 7 grid of text boxes where a number is entered to represent how much influence each pixel has on the overall convolution filter. The text box in the center represents the pixel that is processed by the filter. The text box to the left of the center

represents the pixel to the immediate left, and so forth.

.The default Matrix size is 3 x 3. Only the pixels immediately adjacent to the current pixel will be analysed. If a larger Matrix size is set, more of the text boxes in the grid will be enabled for input.

Normalize

This controls the amount of filter normalization that is applied to the result. Zero will give a normalized image. Positive values will brighten or raise the level of the filter result. Negative values will darken or lower the level.

Floor Level

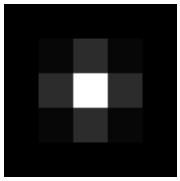
This will add or subtract a minimum, or Floor Level, to the result of the filtered image. Zero will not add anything to the image. Positive values will add to the filtered image and Negative values will subtract from the image.

Examples



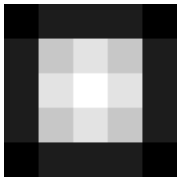
A filter with the values...

0 0 0
0 1 0
0 0 0

 will have zero effect from its neighboring pixels and the resulting image would be unchanged. }}

A blurring effect would be...

1 1 1
1 1 1
1 1 1

 ...where the neighboring pixels are averaged with the center, resulting in a softening effect.

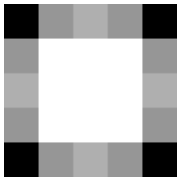
This example will subtract five times the value from the top left and add five times the value from the lower right.

-5 0 0
0 1 0
0 0 5

 If parts of the image that is processed are very smooth in color, the neighboring values will be very similar. In parts of the image where the pixels are different (i.e. an edge), the results will be different and tend to highlight or emboss edges in the image.

Using the values...

1 1 1
1 1 1
1 1 1

 ...and sliding Normalize to Positive will make the image go brighter or glow, simulating film over-exposure.

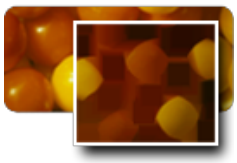
And with the values...

-1 0 0
0 0 0
0 0 1

 ...and sliding Floor Level to Positive will look like a relief filter.

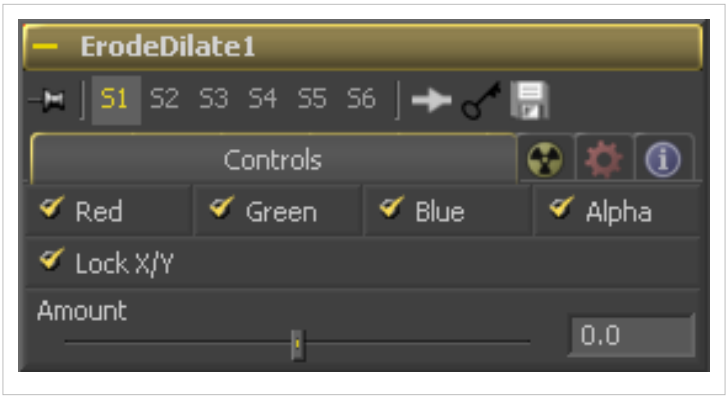
Erode /Dilate

Erode /Dilate [ErDl]



This simple tool erodes or dilates the image, depending on whether the Amount slider is set to a negative or positive value. In Fusion 5.1 this tool was updated to produce subpixel accurate results. This change may affect the results from compositions rendered in 5.1 but created in earlier versions of Fusion.

Controls



Color Channels (RGBA)

The filter defaults to operating on R, G, B and A channels. Selective channel filtering is possible by clicking the checkboxes beside each channel to make them active or inactive. This is not the same as the RGBA checkboxes found under the common controls. The tool takes these controls into account before it processes. Deselecting a channel will cause the tool to skip that channel when processing, speeding up the rendering of the effect. In contrast, the channel controls under the common controls tab are applied after the tool has processed.

Lock X/Y

The Lock X/Y checkbox is used to separate the Amount slider into amount X and amount Y, allowing a different value for the effect on each axis.

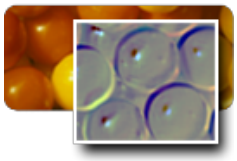
Amount

A negative value for Amount causes the image to erode. Eroding simulates the effect of an underexposed frame, shrinking the image by growing darker areas of the image so that they eat away at brighter regions.

A positive value for Amount causes the image to dilate, similar to the effect of overexposing a camera. Regions of high luminance and brightness grow, eating away at the darker regions of the image. Both techniques will eradicate fine detail in the image and tend to posterize fine gradients.

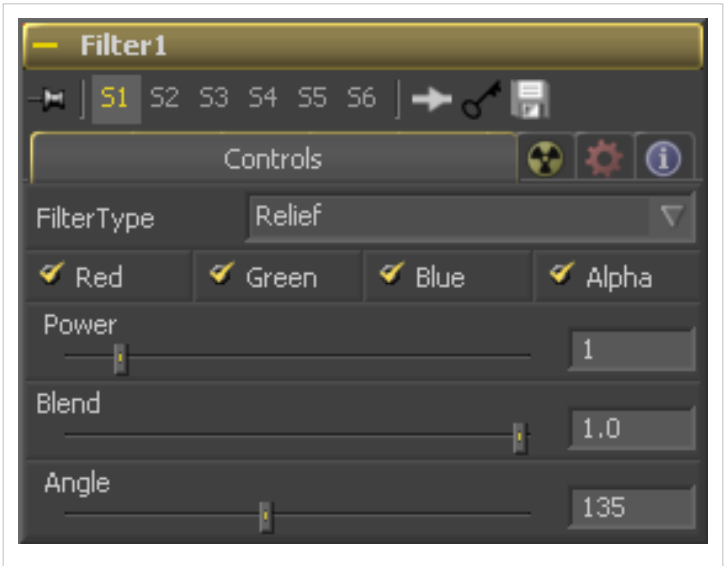
Filter

Filter [Flt]



The Filter Tool contains several pre-set filters, enabling a variety of effects, from radically changing the look of an image to adding subtle randomly-generated film grain.

Controls



Filter Type

This drop-down control provides a selection of filter types. The options are displayed below.

Relief

This appears to press the image into metal, such as an image on a coin. The image will appear to be bumped and overlayed on gray.

Emboss Over

Embosses the image over top of itself, with adjustable highlight and shadow height and direction.

Noise

Uniformly adds noise to images. This is often useful for 3D computer-generated images that need to be composited with live action as it reduces the squeaky clean look that is inherent in rendered images. The frame number acts as the random generator seed. Therefore, the effect is different on each frame and is repeatable.

Defocus

This filter type blurs the image.

Sobel

Sobel is an advanced edge detection filter. Used in conjunction with a Glow filter, it creates amazing neon light effects from live action or 3D rendered images.

Laplacian

Laplacian is a very sensitive edge detection filter that produces a finer edge than the Sobel filter.

Grain

Adds noise to images similar to the grain of film (mostly in the mid-range). This is useful for 3D computer-generated images that need to be composited with live action as it reduces the squeaky clean look that is inherent in rendered images. The frame number acts as the random generator seed. Therefore, the effect is different on each frame and is repeatable.

Color Channels (RGBA)

The filter defaults to operating on R, G, B and A channels. Selective channel filtering is possible by clicking the checkboxes beside each channel to make them active or inactive.

Power

Values range from 1 to 10. It proportionately increases the amount by which the selected filter affects the image. This does not apply to Laplacian filter type.

Angle

This control has a range from 0 to 315 degrees and changes the effect in increments of 45 degrees. This only applies to the Relief and Emboss filters.

Median

Depending on which Filter Type is slected, the control may appear. It varies the Median filter's effect. A value of 0.5 will produce the true median result, as it will find the middle values. A value of 0.0 will find the minimums and 1.0 will find the maximums. Applies to the Median filter only.

Seed

This control is only visible when applying the Grain or Noise filter types. The Seed slider can be used to ensure that the random elements of the effect are seeded with a consistent value. The randomizer will always produce the same result given the same seed value.

Animated

This control is only visible when applying the Grain or Noise filter types. Select the checkbox to cause the noise or grain to change from frame to frame. To produce static noise, remove the selection from this checkbox.

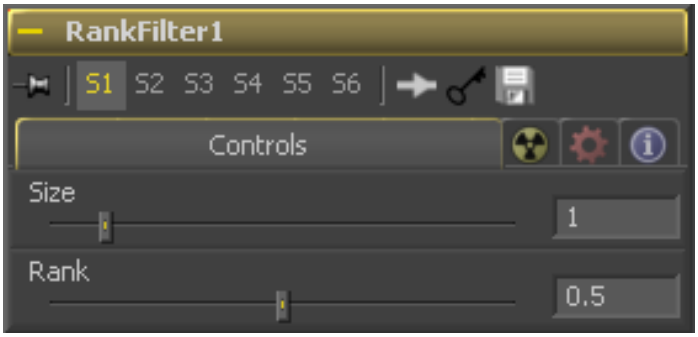
Rank Filter

Rank Filter [RFlt]



The Rank Filter is a very simple tool. This filter examines nearby pixels, sorts the pixels by value, and then replaces the color of all the pixels examined by the color of the pixel with the specified rank. The well known median filter is simply a linear rank filter that selects the median, or middle value from the list of sorted values.

Controls



Size

This control determines the Size in pixels of the area sampled by the filter. A value of 1 will sample only the pixels immediately adjacent to the center pixel, while larger values sample from a larger area.

Small values are excellent for removing salt and pepper style noise, while larger values produce an effect similar to water color paintings.

Rank

The Rank determines which value from the sampled values will be chosen, where 0 is the lowest value and 1 is the brightest. If the value is .5, the pixel in the middle of the list will be sampled for the value.

Examples



For example, a rank filter with a size of 1 will sample 9 adjacent pixels for their values. The following shows some examples with a Size of 5 and a Rank going from 0 to 1. The original image can be seen on the left.



A Rank of 1 and the Size going from 0 to 10. The original image can be seen on the left.



A Rank of 0 and the Size going from 0 to 10. The original image can be seen on the left.



A rank filter with a size of 1 will sample 9 adjacent pixels for their values. The following shows some example values, sorted by value.

```
0.0
0.4
0.4
0.5
0.5
0.7
0.7
0.7
```

A blur filter with the same size would average these values together to produce a value of 3.9. A rank filter lets you choose a value from the list to select. For example, a rank of four would select the fourth item in the list, producing a value of.5

Flow

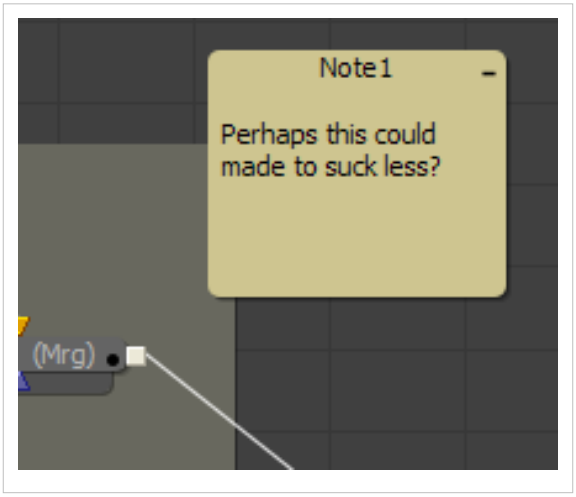
Note

Sticky Note [Nte]



Sticky Notes are a useful way of providing notes, comments and history for a specific area of a comp. By changing their size and color, they can provide unobtrusive comments or crucial notices, as required. Sticky Notes make a good complement to the Comments Tab.

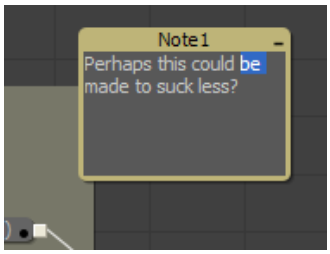
Usage



As with conventional tools, a Sticky Note can be added to a comp by selecting it from the Tools menu, in the Flow category, or from the flow view's Add Tool context menu. The new Sticky Note will be created with its title bar centered on the last click position.

Like Groups, Sticky Notes are created in a smaller, collapsed form. They can be expanded by double-clicking anywhere on them, or by clicking the icon in the top right corner. Once expanded, they can be resized by dragging on any side or corner. To collapse them again, click the icon in the top right corner once more.

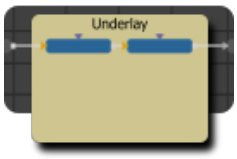
Sticky Notes can be renamed, deleted, copied & pasted and have their tile color and text color changed, using the Flow View's context menu like any other tool. It is also possible to lock them to prevent editing.



To edit the text in a Sticky Note, first expand it by double-clicking anywhere on the note, then click below its title bar. If the note is not locked, the text will become editable.
Note: To cut, copy and paste the text, use the standard keyboard shortcuts; Ctrl+X, Ctrl+C and Ctrl+V. Right-clicking on a Sticky Note being edited will display Fusion's tool context menu, allowing the entire note to be cut, copied and pasted.

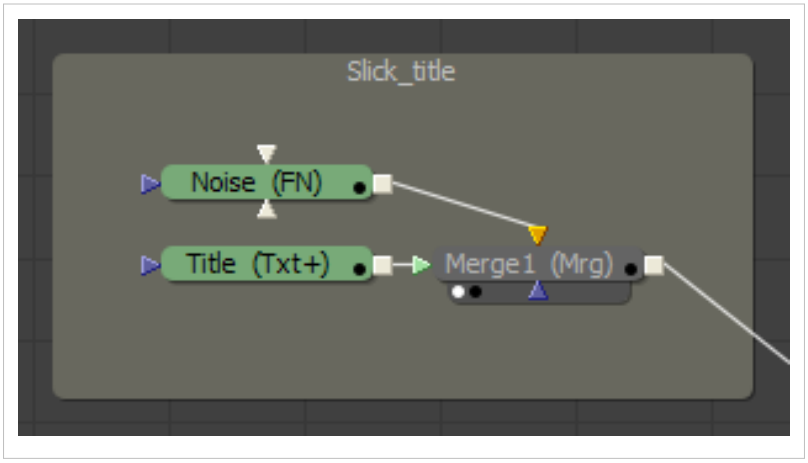
Underlay

Underlay [Und]



Underlays are a convenient method of visually organising areas of a composition. As with Groups, Underlays can improve the readability of a comp by separating it into labelled functional blocks. While Groups are designed to streamline the look of a comp by collapsing complex layers down to single tools, Underlays highlight rather than hide, and do not restrict outside connections.

Usage



As with conventional tools, an Underlay can be added to a comp by selecting it from the Tools menu, in the Flow category, or from the flow view's Add Tool context menu. The new Underlay will be created with its title bar centered on the last click position.

Underlays can be resized by dragging on any side or corner. This will not affect any tools.

Underlays can also be used as simple "selection groups". Activating an Underlay by clicking on its title will select all the tools contained wholly within it as well, allowing the entire set to be

moved, duplicated, passed-through etc.

Note: To select or drag only the Underlay itself, ensure all tools are deselected, then hold down the Alt key while clicking and dragging. This is useful for repositioning, renaming, deleting or changing the color of the Underlay without affecting any of the tools it contains.

Pipe Router

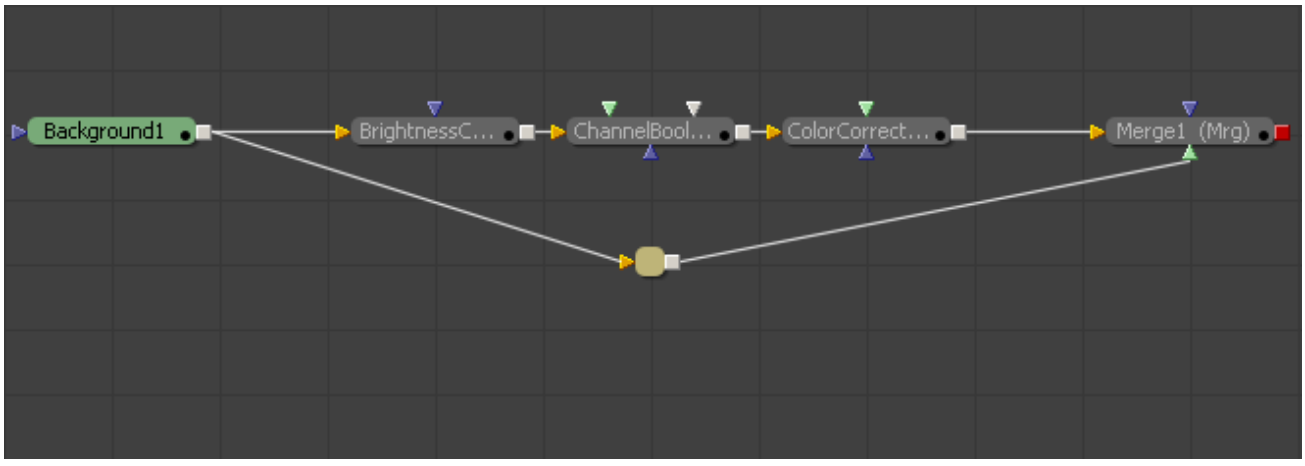
Pipe Router [-/-]



Pipe Routers can be used to neatly organize your comps. Especially for creating "diversions" in your pipes, to make them better visible and help to understand the flow more easily. Pipe Routers do not have any influence on render times.

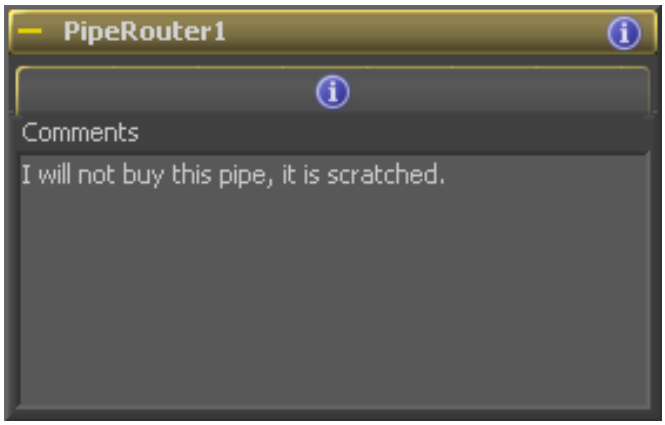
Usage





Pipe Router

To insert a router in your pipe, *Alt left click* on the pipe and place the router anywhere on the flow.



Though Routers have no actual controls, they still can be used to add comments to your comp.

Flow Organization

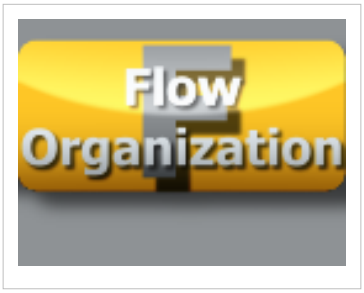
Group

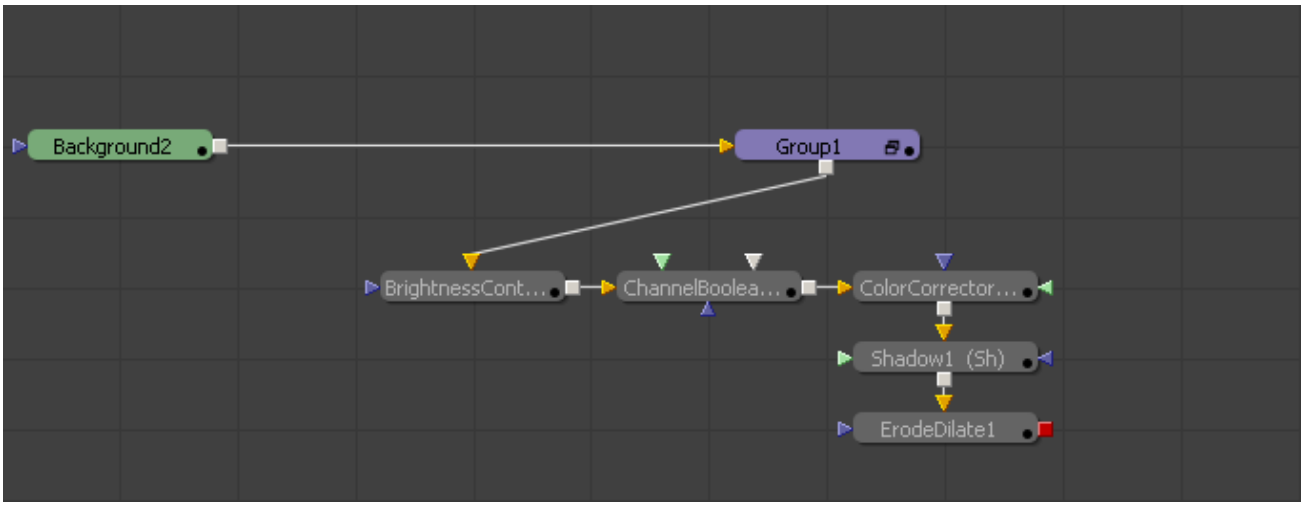
Group [-/-]



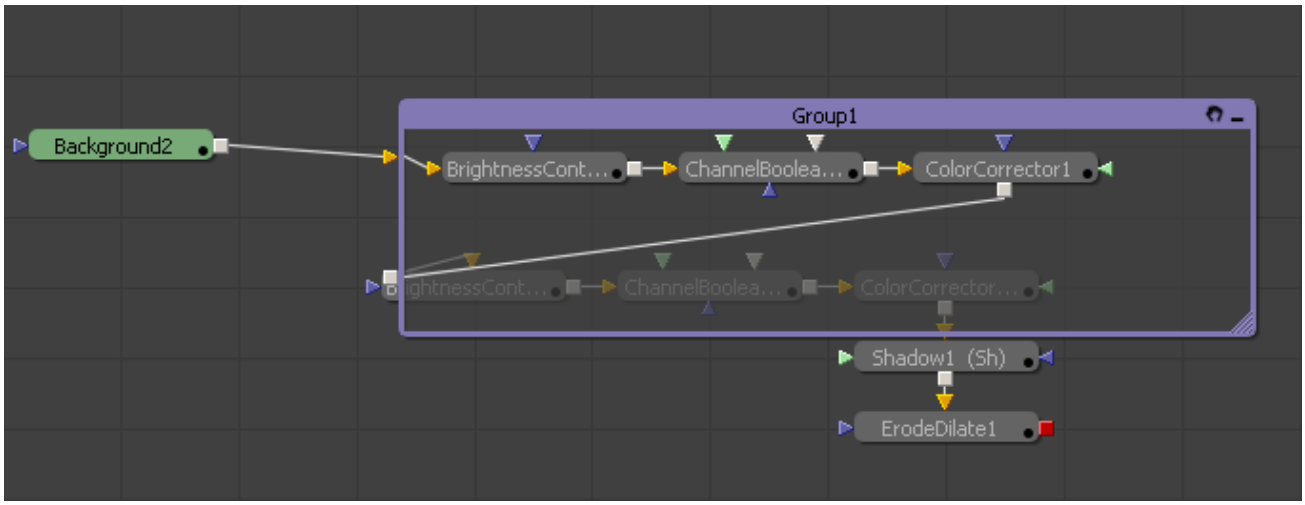
Groups can be used to neatly organize your comps. Especially for cleaning up by putting together multiple tools.

Groups





To group tools select them and either press ctrl-G or right click and select 'Group' from the context menu. Pess ctrl-E to either Expand or Collapse a selected Group. Right click and select 'Ungroup' from the context menu to ungroup all tools.



When opened Groups will hover over existing elements, allowing editing of the enclosed tools.

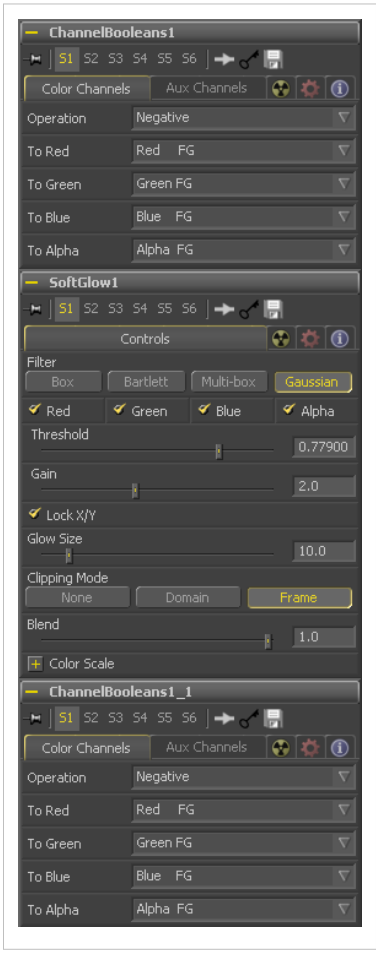
Macro

Macro [-/-]



Macros can be used to combine multiple tools and exposing a user-definable set of controls. They are meant as a fast and convenient way for building your own customized tools.

Usage



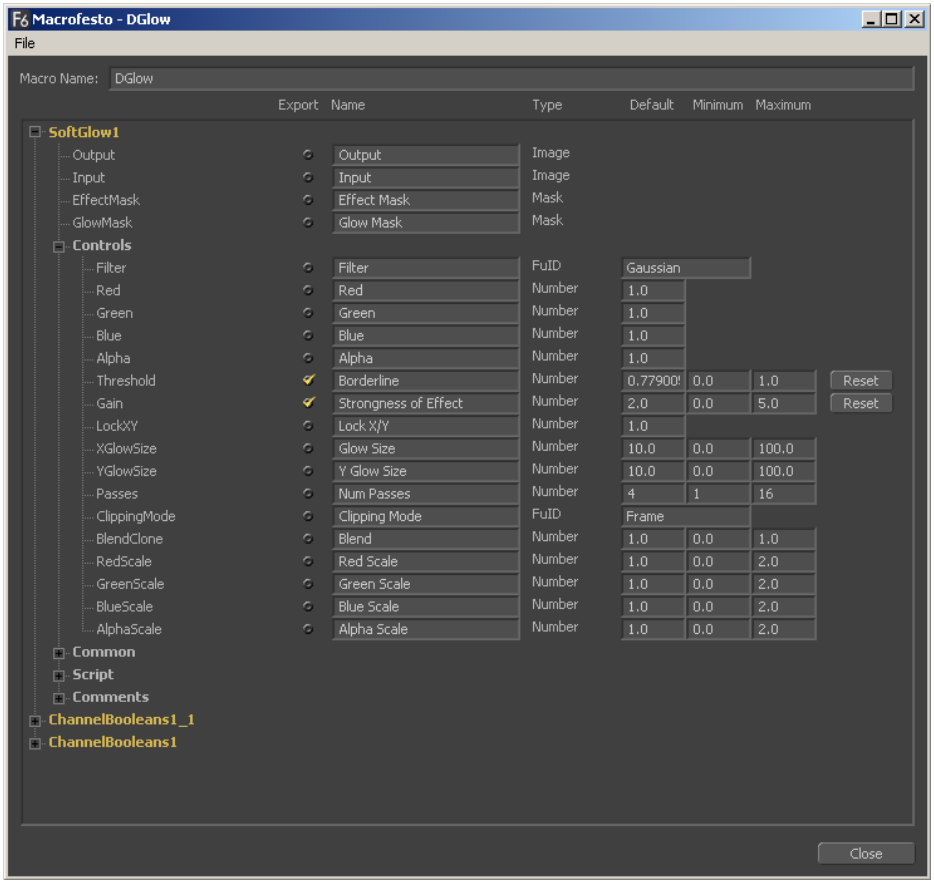
Creating a Macro

To create a Macro select the tools intended for the macro, *right click* on one of them and select "Macro -> Create Macro" from the context menu.

Macro Editor

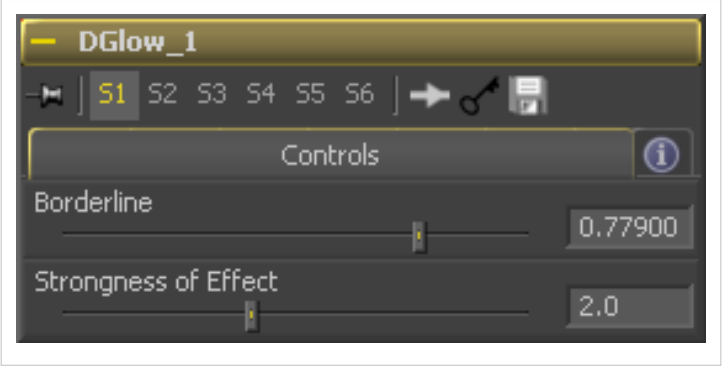


The Macro Editor then allows you to specify and rename the controls that shall be exposed in the final macro. In this example we only expose the Threshold and gain sliders of a Softglow tool which is sandwiched between to ChannelBooleans. After setting up the Macro to your liking, type in a name in the "Macro Name" field and select "File -> Safe".



To add the Macro to your flow *right click* anywhere on the flow and select "Macro -> [NameOfYourMacro]" from the context menu.

The Final Macro



The final Macro looks and behaves just like any other tool in Fusion.

As another example you could take a single ChannelBoolean, set it to "add" mode, and make it into a macro exposing no controls at all, thus creating the equivalent of a "Add Node" like the one that can be found in programs like Shake.

I/O

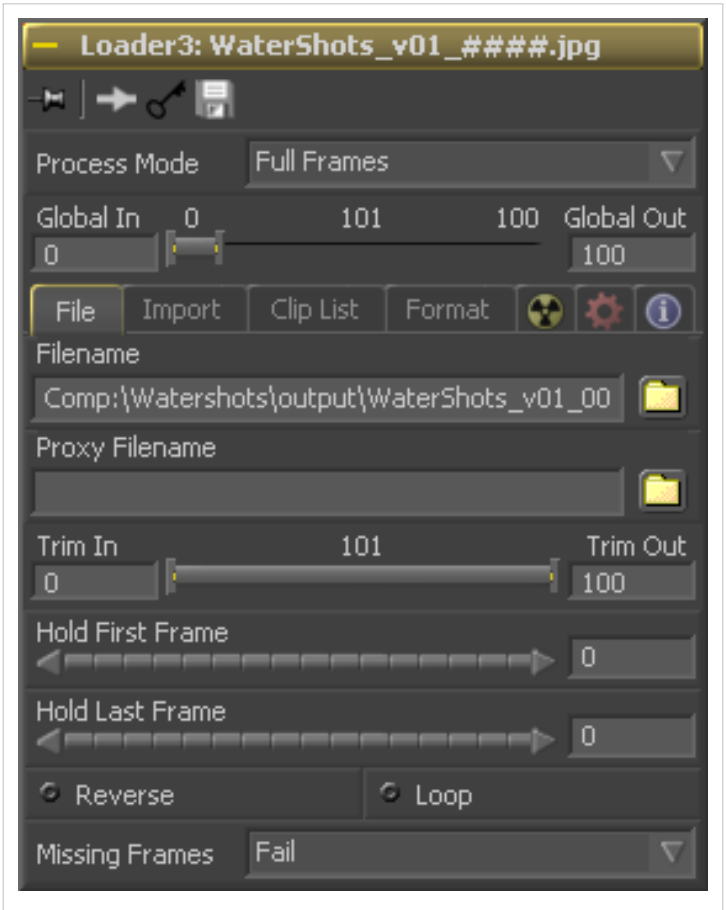
Loader

Loader [LD]



The Loader tool is used to select and load footage from the hard drive or network storage. The Loader is responsible for trimming, looping, and extending the footage, as well as setting the field order, pixel aspect and color depth. Loader is arguably the most important tool in Fusion.

Common Controls



Process Mode

Use this menu to select the fields processing mode used by Fusion when loading the image. The default option is determined by the Has Fields check box control in the Frame Format

Preferences, and the default height as well. Available options are Full frames, NTSC fields, PAL/HD fields, PAL/HD fields (reversed) and NTSC fields (reversed). The two Reversed options load fields in the opposite order, and will thus result in the fields being swapped both in time order and in vertical order as well. Use the Reverse Dominance checkbox (described in the Import Tab below) to swap fields in time only.

For more information on fields processing consult the Frame Formats chapter.

Global In And Out

Use this control to specify the position of this tool within the project. Use Global In to specify the frame on which that the clip starts and Global Out to specify the frame on which this clip ends within the project's Global Range.

The tool will not produce an image on frames outside of this range.

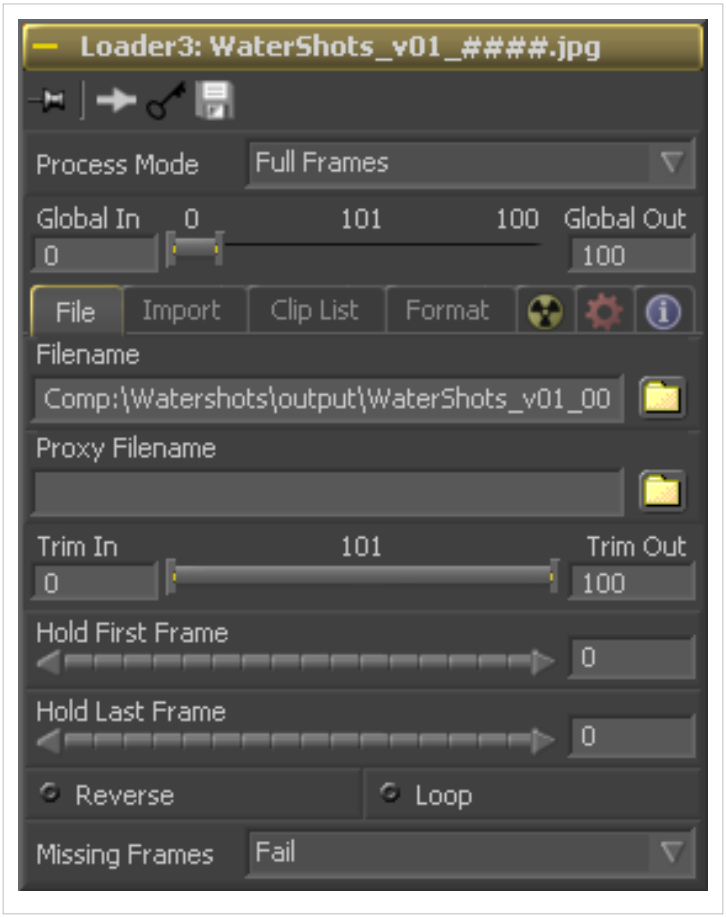
If the Global In And Out values are decreased to the point where the range between the In and Out values is smaller than the amount of available frames in the clip, Fusion will automatically trim the clip by adjusting the Clip Time range control.

If the global in/out values are increased to the point where the range between the in and out values is larger than the amount of available frames in the clip, Fusion will automatically lengthen the clip by adjusting the Hold First/Last Frame controls.

Extended frames are visually represented in the range control by changing the color of the held frames to purple in the control.

To slip the clip in time or move it through the project without changing its length, place the mouse pointer in the middle of the range control and drag it to the new location, or enter the value manually in the Global In value control.

File Tab



Filename

Clicking on the yellow Folder button will display a standard Fusion file browser. The path to the footage can also be typed directly using the text box provided.

The text box supports filename completion. As the name of a directory or file is typed in the text box, Fusion will display a popup that lists possible matches. Use the arrow keys to select the correct match and complete the path.

When a loader is added to the flow, a file dialog will appear automatically to allow selection of a clip from the hard drives. To select footage later, select Cancel. The loader will still be added to the flow. Disable the automatic display of the file browser by disabling Auto Clip Browse in the Global>General Preferences.

File Sequences

It is common practice to use file sequences to identify an image that is part of a series. If the last part of a file's name is a number (not counting file extension), Fusion will automatically scan the directory looking for files that match the sequence.

For example, the following filenames would be valid sequences.

```
image.0001.tga
image.0002.tga
```

```
image.0003.tga
```

```
image151.exr
image152.exr
image153.exr
```

```
image1.tif
image2.tif
image3.tif
```

The following would not be considered a sequence, since the last characters are not numeric.

```
shot.1.fg.tga
shot.2.fg.tga
shot.3.fg.tga
```

It is not necessary to select the first file in the sequence, Fusion will search the entire folder for files matching the sequence in the selected filename. Also, Fusion will determine the length of the sequence based on the first and last numeric value in the filenames. Missing frames are ignored.

For example, if the folder contains two files with the following names

```
image.0001.tga
image.0100.tga
```

Fusion will see this as a file sequence with 100 frames, not a file sequence containing two frames. The Missing Frames drop-down menuis used to choose how Fusion handles missing frames. The Trim In/Trim Out control's context menu can also be used to force a specific cliplength, or to rescan the folder. Both controls are described in greater detail below.

Proxy Filename

The Proxy Filename control only appears once the filename control points to a valid clip. This can specify a clip that will be loaded when the Proxy mode is enabled. This allows smaller versions of the image to be loaded to speed up file I/O from disk and processing.

For example, create a 1/4 scale version of a Cineon film sequence to use as a file proxy. Whenever the proxy mode of the flow is enabled, the smaller resolution proxy clip will be loaded from disk and all processing will be performed at the lower resolution, significantly improving render times.

This is particularly useful when working with large film plates stored on a remote fileserver. Lower resolution versions of the plates can be stored locally, reducing network bandwidth, interactive render times and memory usage.

The proxy clip must have the same number of frames as the source clip, and the sequence numbers for the clip must start and end on the same frame numbers.

It is strongly suggested that the proxies are exactly the same format as the main files. In the case of formats with options, such as Cineon, DPX and OpenEXR, the proxies will use the same format options as the primary.

Trim In And Out

The Trim range control is used to trim frames from the start or end of a clip. Adjust the Trim In to remove frames from the start and Trim Out to specify the last frame of the clip. The values used here are offsets. A value of 5 in Trim In would use the 5th frame in the sequence as the start, ignoring the first four frames. A value of 95 would stop loading frames after the 95th.

Right-click on the range control to see three options appear in a submenu

Autodetect Clip Length This rescans the clip to see if frames have been added or removed since the last time the clip was scanned (when it was loaded).

Set Clip Start Frame Selecting this will display a dialog box to set the number of the actual start frame of the clip on disk. Use this when the first frames of the file sequence are not yet available to set the clip's properties manually.

Set Clip Length This sets the actual clip length, overriding the scanned length. This is useful if the entire clip has not yet been rendered or captured. Used in combination with Set Clip Start Frame it can be used to define a clip before the clip is available.

For example, imagine there is only a single animatic frame available for a scene that is being precomped. The animation department has yet to render the entire layer. Use the Set Clip Start and Set Clip Length to define the clip anyway, and the composition will load the correct frames when they become available. If the Missing Frames control is set to Wait, then rendering will pause until the frame is available, instead of failing.

Hold First And Last Frame

The Hold First Frame and Hold Last Frame controls will hold the first or last frame of the clip for the specified amount of frames. Held frames are included in a loop if the footage is looped.

Reverse

Select this checkbox to reverse the footage so that the last frame is played first and the first frame played last.

Loop

Select this checkbox to loop the footage until the end of the project. Any lengthening of the clip using Hold First/Last Frame or shortening using Trim In/Out is included in the looped clip.

Missing Frames

The Missing Frames drop-down menu provides options for selecting how the loader will behave when an expected frame is missing from the footage, or is unable to load for any reason.

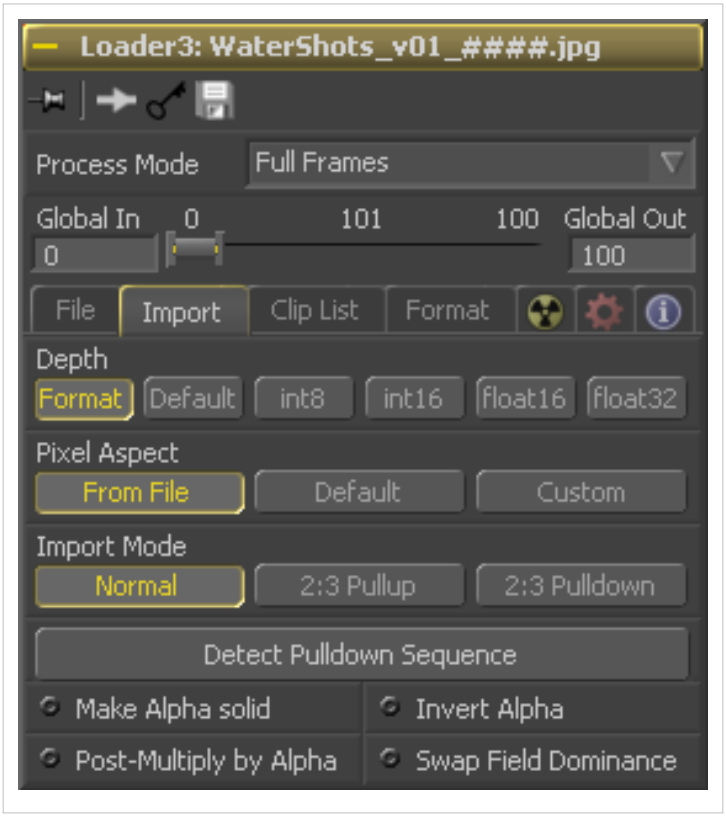
Fail The loader will not output any image unless a frame becomes available. Rendering will abort.

Hold Previous Output the last valid frame until a frame becomes available again. This fails if no valid frame has been seen, for example if the first frame is missing.

Output Black Output a black frame until a valid frame becomes available again.

Wait Fusion will wait for the frame to become available, checking every few seconds. Useful for rendering a flow simultaneously with a 3D render. All rendering will cease until the frame appears.

Import Tab



Depth

The buttons in this array are used to select the color Depth used by Fusion to process footage from this loader. The default option is Format.

Format

The color depth is determined by the color depth supported in the file format loaded. For example, TGA files will automatically process at 8 bit because the TGA file format does not store color depths greater than 8. Cineon files will load at Float, etc. If the color depth of the format is undetermined, the default depth defined in the flow's frame format preferences is used.

Formats that support multiple color depths will be set to the appropriate color depth automatically.

Default The color depth is determined by the settings in the composition's Frame Format Preferences panel.

Int 8 Bit/Int 16 Bit/Float 16/Float 32 These options set the color depth.

For a more complete discussion of color depth and how it affects composites, consult the Frame Formats chapter of this manual.

Pixel Aspect

This button array is used to determine the image's pixel aspect ratio.

From File

The loader will conform to the image aspect detected in the saved file. There are a few formats that can store aspect information. TIFF, JPEG and OpenEXR are examples of image formats that may have the pixel aspect embedded in the file's header. When no aspect ratio information is stored in the file, the default frame format method is used.

Default Any pixel aspect ratio information stored in the header of the image file will be ignored. The pixel aspect set in the composition's frame format preferences will be used instead.

Custom Select this option to override the preferences and set a pixel aspect for the clip manually. Selecting this button will cause the X/Y Pixel Aspect control to appear. For a more complete discussion of pixel aspect and how it affects composites, consult the Frame Formats chapter of this manual.

Custom Pixel Aspect

This control is only visible when the Custom Pixel aspect Method is used. Enter the desired aspect, or right-click on the control to display a menu of common frame formats and their aspects.

Import Mode

This menu provides options for removing pull-up from an image sequence. Pull-up is a reversable method of combining frames used to convert 24fps footage into 30fps. It is commonly used to broadcast NTSC versions of films.

Normal This passes the image without applying pull-up or pull-down.

2&#583 Pull Up This will remove existing 32 pull-down applied to the image sequence, converting from 30fps to 24fps.

2&#583 Pull Down The footage will have pull-down applied, converting 24fps footage to 30fps by creating 5 frames out of every four. The process mode of a loader set to Pull Down should always be Full Frames.

First Frame

This control is used to determine which frame of the 32 sequence is used as the first frame of the loaded clip. It only appears if the pull-up or pull-down options are selected from the Import Mode menu.

Detect Pulldown Sequence

Pressing this button will cause Fusion to attempt to automatically detect and set the Pull-up sequence of the footage. It only appears if pull-up or pull-down are selected from the Import Mode menu. If it succeeds in detecting the order, the First Frame control will automatically be set to the correct value.

Make Alpha Solid

When checked, the original alpha channel of the clip will be cleared and set to solid white (completely opaque).

Invert Alpha

When checked, the original alpha channel of the clip will be inverted. This may also be used in conjunction with Make Alpha Solid to set the alpha to pure black (completely transparent).

Post-Multiply By Alpha

Selecting this option will cause the color value of each pixel to be multiplied by the alpha channel for that pixel. This option can be used to convert subtractive (non-premultiplied) images to additive (premultiplied) images.

Swap Field Dominance

When this control is selected, the field order (dominance) of the image will be swapped, so that the order in time that the fields appear in is reversed. Unlike the Process Mode control, this is done without spatially swapping the scanlines in the image.

Clip List Tab



A single loader can contain multiple files of any format. You can view, select and delete clips within the Clip List tab. New clips will be inserted in the first frame adjacent to the clip closest to the current frame number. To replace, change the current time to a frame of the outgoing clip and select the desired new clip. This clip list allows you to do simple cut and trim edits, and to preview clips together in sequence. By default the Clip List option is disabled.

Load

Load adds a new clip to the clip list. If a valid clip is present at the current time, that clip will be replaced.

Replace

This replaces the currently selected clip in the clip list.

Insert

Insert adds the incoming clip after the selected clip. If no clip is selected, it adds the new clip to the clip list at the current time. Clips will ripple to the right.

Import

Import adds the incoming clip at the time specified by the selected filename (for example, image.0005.tga would be inserted at frame 5). Import is not dependent on current time or selected clip. It simply places the incoming clip at its specified time. Non-linear editors will recognize this as a 3-point replace.

Clip List Usage Tips

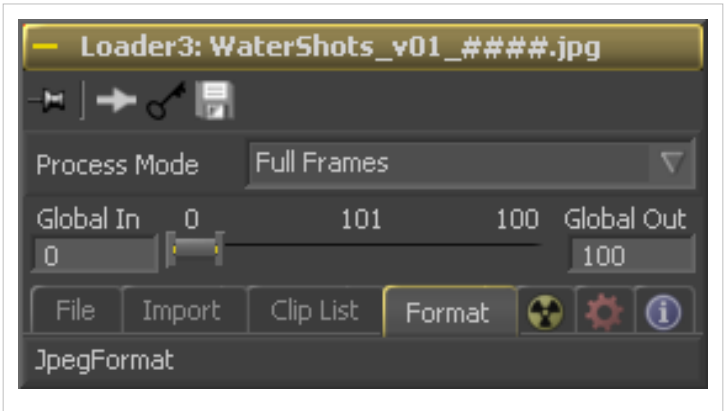
- When more than one clip is present in the list, the controls title bar changes to "Multiple Clips".
- Double-click a clip in the list to change the current time to the start of that clip.
- With a clip selected in the list, press the Del key to remove the clip.
- Drag and drop a file or directory from an Explorer window to replace the list with the new clip.

Clip Lists in the Timeline view

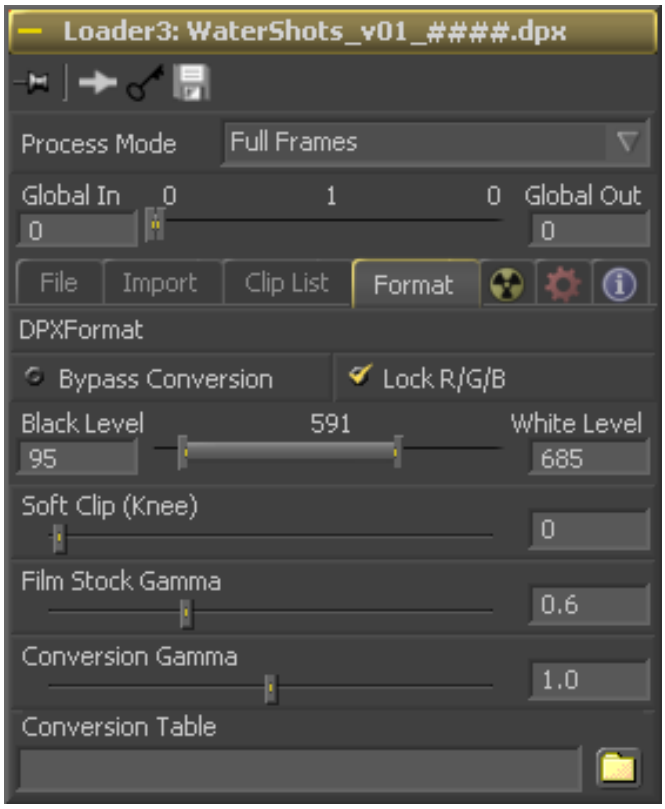
The easiest way to manage a list of clips is to use the Timeline view. The Loader's bar in the Timeline view shows all clips in the list with their relative positions and lengths represented graphically. It also offers many useful editing capabilities

- Individual clips may be trimmed by dragging the end points of their bar.
- Clips can have their start and end frames extended by Ctrl+dragging the end points.
- Clips may be repositioned on the timeline by dragging elsewhere on their bar.
- Clips can also be re-ordered in the list by dragging them before or after other clips.
- Drop one or more files or directories from Explorer to the right of the bars to append new clips to the list.
- Drop one or more files or directories from Explorer into a gap to insert the clips into the list, without affecting the timing of later clips.

Format Tab



The Format Tab contains information, options and settings relative to loading the image format. Not all file formats have options, notably the Cineon, DPX, PSD, OMF, OpenEXR and QuickTime formats all provide additional options when loaded. See Appendix A File Formats for a description of all supported formats. Options for JPG and DPX are shown for reference on the right.



OMF Format

An OMF file is not just a media format, it can contain information about edits, multiple sequences, and even multiple versions of the same shot. If multiple clips exist within the OMF file, the format options may be used to select the desired clip. To import all clips from an OMF file, complete with edit and combine information, use the Import OMF option from Fusion's File menu to create a entire composition from the contents of the OMF.

Photoshop PSD Format

Fusion can load any one of the individual layers stored in the PSD file, or the completed image with all layers. Transformation and adjustment layers are not supported. To load all layers individually from a PSD file, with appropriate blend modes to combine them, use the Import PSD option from Fusion's File menu to create a entire composition from the contents of the PSD file.

Cineon And DPX Format

See the chapter Film In Fusion and the chapter for the Cineon Log tool for a detailed discussion of the options found in the Cineon and DPX file formats.

OpenEXR Format

The [http//www.openexr.com/ OpenEXR] format was developed by Industrial Light and Magic. Its initial design was to provide a compact and flexible format to support storage of high dynamic range images (float). The format has been expanded to support a variety of extra channels and metadata.

The format options for OpenEXR files provide a mechanism for mapping any non-RGBA channels to the channels supported natively in Fusion. Enter the name of a channel in the OpenEXR file into any of the edit boxes next to the Fusion channel name. A command line utility for dumping the names of the channels can be found at http//www.openexr.com/

QuickTime

QuickTime files can potentially contain multiple tracks. Use the format options to select one of the tracks.

Image File Lists

One of the more interesting formats supported by Fusion is the Image File List format. An IFL is actually a text file containing a list of files that should be loaded. Use IFL files to specify a sequence of arbitrarily-named files, or files from different directories.

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Saver

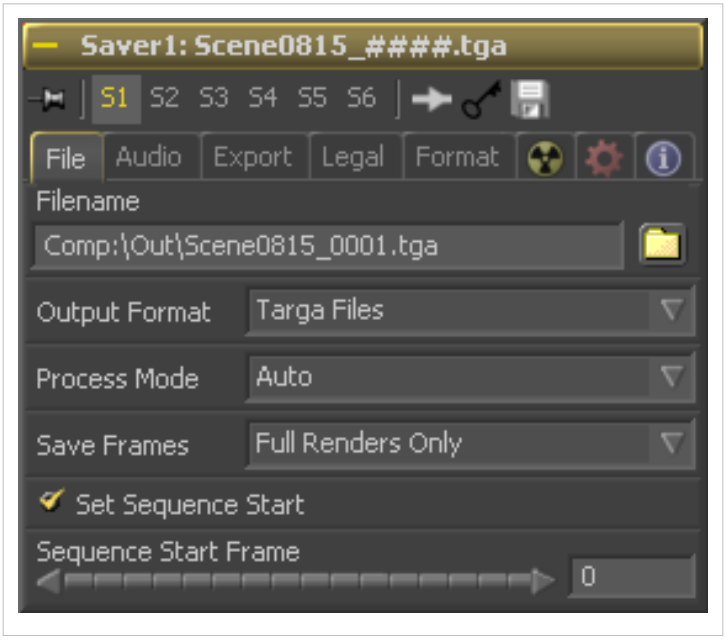
Saver [Sv]



The Saver is responsible for writing the results of a composition to disk. It can be inserted into a composition at any point. The Saver tool can also used to add scratch track audio to your flow, which can be heard during interactive playback.

A composition can contain any number of saver tools, and savers can be placed at any point in the flow.

File Tab



Filename

Use the Filename dialog to select the name and path of the rendered image output. Click on the yellow folder icon to display a file browser to select a folder and filename to be used for output.

Sequence numbering is automatically added to the filename when rendered. For example, if c\renders\image.tga is entered as the filename and 30 frames of output is rendered, the files will automatically be numbered as image0000.tga, image0001.tga, image0003.tga...and so on. Four digit padding is automatically used for numbers lower than 10000.

Specify the number of digits to use padding the sequence number by explicitly entering the digits into the filename. For example, image000000.tga would apply 6 digit padding to the numeric sequence, image.001.tga would use 3 digit padding and image1.tga would use none.

Saving To An Image File List

It is possible to save to an IFL file if more control is required over the filenames written to disk than specified here. To create an IFL, create a text file with the extension .ifl. Each line of the

text file specifies the name for one frame of the output. For example, to render using roman numerals instead of decimals for the file sequence numbering would create the following file.

```
image.i.tga
image.ii.tga
image.iii.tga
image.iv.tga
image.v.tga
```

The render will fail if there are not enough lines to match the number of frames rendered. In the above example, the render would fail after the fifth frame.

Format options cannot be specified when using image file lists to save to disk. The defaults will be used instead.

Output Format

Use this control to select the image format to be saved. Selecting a new format from this menu does not change the extension used in the filename to match. Modify the filename manually to match the expected extension for that format to avoid a mismatch between name and image format.

For a list of file formats supported for saving by Fusion, see Appendix A.

Process Mode

The Process Mode menu is used to set the method of field processing used by Fusion when the flow is rendered.

The default option is Auto. This will render the flow using the field ordering set in the process mode of the most background Loader or Creator tool in the flow.

To force a flow to render individual fields or full frames regardless of the settings of other tools in the flow, change this menu's setting to one of the other listed options.

For example, if the saver's process mode is set to NTSC fields, a loader set to process full frames will still load a full frame from disk, but animation applied to that layer will be applied with field level accuracy. In all cases, footage will be reinterlaced if necessary and saved as frames on disk.

See the Frame Formats chapter for additional details on frame and fields processing in Fusion.

Save Frames

This control selects between two modes

Full Renders Only

Images are only saved to disk when a final render is started using the Start Render button in the Time Ruler.

High Quality Interactive

This render mode is designed for real-time rendering when painting and rotoscoping. Fusion will save each frame to disk as it is processed interactively.

When used correctly, this feature can completely eliminate the need to perform a final render after rotoscoping. It can cause tremendous confusion when used in conjunction with a flow

that contains spline animated parameters.

If these splines are modified in such a way that frames already saved interactively are changed, the frames already on the disk will not automatically be re-rendered. Either step through each frame again or perform a final render to make certain that the result is correct.

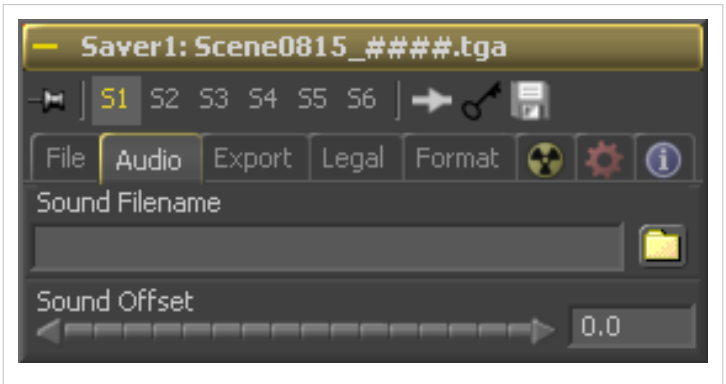
Set Sequence Start

Normally, Fusion will use the render range of a composition to determine the numeric sequence used when rendering a file sequence to disk. Enable this checkbox to reveal the Sequence Start Frame control to adjust the starting number in the sequence to a custom value.

Sequence Start Frame

This thumbwheel control can be used to set an explicit start frame for the number sequence applied to the rendered filenames. For example, if Global Start is set to 1 and frames 1 - 30 are rendered, files will normally be numbered 0001 - 0030. If the Sequence Start Frame is set to 100, the rendered output would be numbered from 100-131.

Audio Tab



The audio functionality is included in Fusion for scratch track (aligning effects to audio and clip timing) purposes only. Final renders should almost always be performed without audio. The smallest possible audio files should be used, as Fusion will load the entire audio file into memory for efficient display of the waveform in the timeline.

The audio track will be included in the saved image if an AVI file format is selected. Fusion currently supports playback of WAV audio, and dpsReality DVA files.

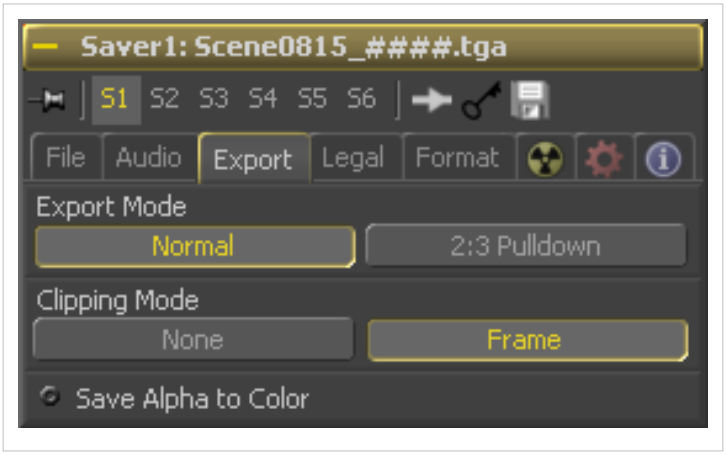
Audio Browse

Select the optional audio scratch track to be used. Select the*.WAV file of choice, then expand the Saver bar in the timeline layout to view the audio waveform. Drag the pointer over the audio wave in the timeline layout to hear the track.

Sound Offset

Drag the control left or right to create an offset in time between the audio and images of the flow.

Export Tab



Export Mode

This menu is used to apply a SMPTE standard 32 pulldown to the footage as it is saved to disk, converting the footage from 24fps to 30 fps.

First Frame

First Frame determines the cadence of the 32 pulldown by choosing what frames are combined from the 24fps source to create the first frame in the 30fps pulldown result. Normally, this should be left to AA. When saving a clip that originally had pulldown that was removed to apply effects and it needs to be reinserted into an existing edit, the cadence of the original clip may need to be matched.

Clipping Mode

These radiobuttons define how the edges of image should be treated. This can also be called source image clipping.

They default to Frame, which will provide the same behaviour as previous versions of Fusion. Since this option will clip to the parts of the image visible within its visible dimensions, it will break any infinite-workspace behaviour. If the upstream DOD is smaller than the frame, the remaining area in the frame will be treated as black/transparent.

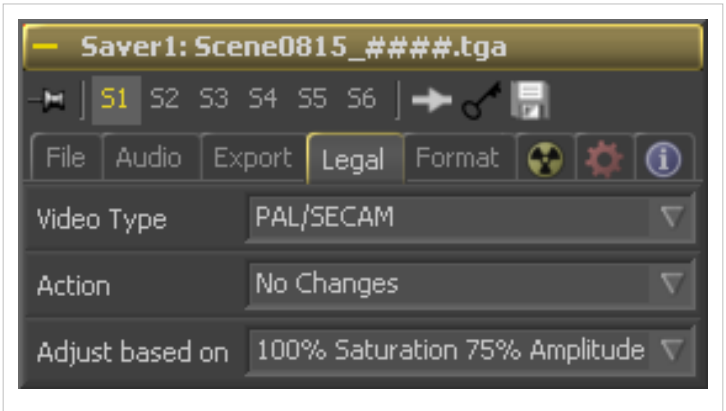
None does not perform any source image clipping at all. This means that any data that would normally be needed outside the upstream DOD will be treated as black/transparent. Be aware that this might create humongous images which can consume a huge amount of diskspace. So you should use this option only if really needed.

For more information about ROI, DOD and Infinite Workspace please see the **dedicated chapter**.

Save Alpha To Color

When selected, this control will cause the alpha channel to be saved into the color channels as a grayscale image. This will completely overwrite any existing color information.

Legal Tab



Video Type

Select the standard to be used for broadcast legal color correction. NTSC, NHK or PAL/SECAM can be chosen.

Action

Use this menu to choose how Fusion will treat illegal colors in the image.

Adjust To Legal

This will cause the images to be saved with legal colors relevant to the Video Type selected.

Indicate As Black

This causes the illegal colors to be displayed as black in the views.

Indicate As White

This causes the illegal colors to be displayed as white in the views.

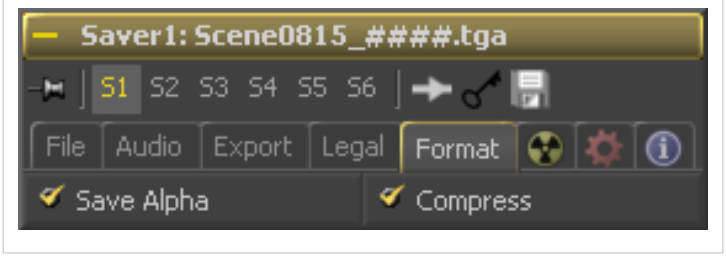
No Changes

This causes the images to be saved unaffected.

Adjust Based On

This menu is used to choose whether Fusion will legalize the image to 75% or 100% amplitude. Very few broadcast markets permit 100% amplitude, but for the most part this should be left to 75%.

Format Tab



The Format Tab contains information, options and settings specific to the image format being saved. The controls for a TGA sequence will be entirely different from the ones displayed when

a DPX file is saved. TGA and DPX are displayed on the right for reference.



There are a tremendous amount of options available for each of the different file formats and it is beyond the scope of this manual to describe them all. Please contact eyeon Software's technical support if you have questions about any of the format options and we will be pleased to assist you.

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Mask

Bitmap

Bitmap Mask [Bmp]



The Bitmap Mask allows images from the flow to act as masks for tools and effects. Bitmap masks can be based on values from any of the color, alpha, hue, saturation, luminance and auxiliary coverage channels of the image.

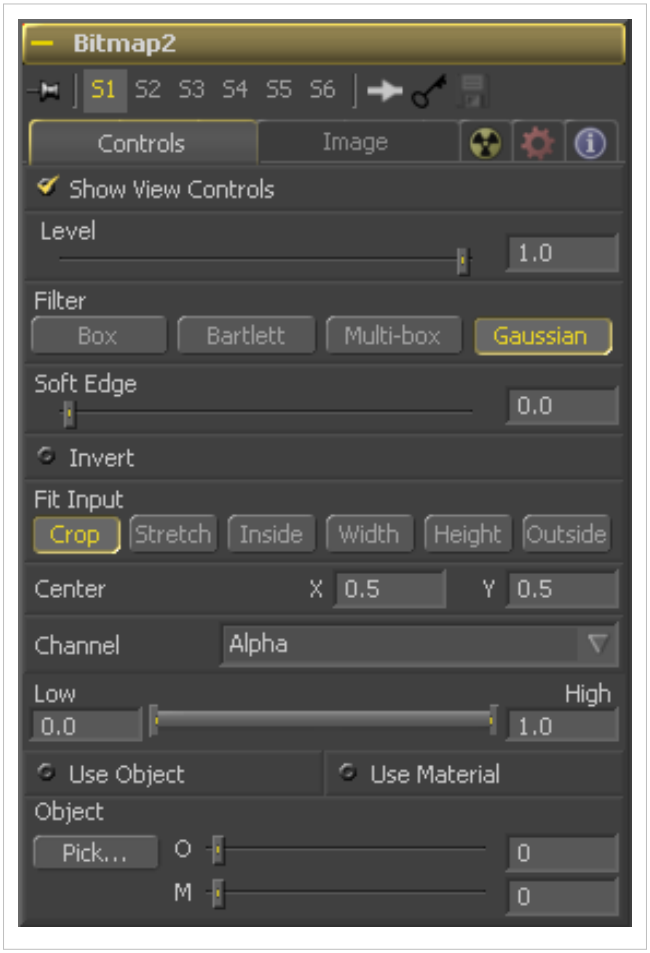
Tools can also be masked based on the object or material ID of a 3D rendered image (provided those channels were included when the file was rendered).

The output of any tool can be connected directly to another tool's Effect Mask input. The bitmap mask tool is not required for many common tasks. If the output is connected directly, the common controls tab for the masked tool will display a control to select which channel of the mask image is used to create the mask.

However, bitmap mask tools may still be required to connect to other mask inputs on some tools, such as Garbage Mattes and Pre-Masks. Also, using a bitmap mask tool between the mask source and the target tool provides additional options that would not be available when connecting directly, such as combining masks, blurring the mask or clipping its threshold.

Many of the controls found in this mask tool are common to all mask tools. These controls are documented at Common Mask Controls.

Controls Tab



Level, Filter, Soft Edge and Border Width

Please refer to the Common Mask Controls.

Fit Input

This control defines how the image source is treated if it does not fit the dimensions of the generated Mask. Imagine a 720*576 image source being used to generate a 1920x1080 mask. In the following section we refer to "image source" as being the 720x576 image (yellow) and "Mask" as being the mask that is actually generated (gray).

Crop



If the image source is smaller than the generated Mask it will be placed according to the X/Y controls, masking off only a portion of the Mask. If the image source is bigger than the generated Mask it will be placed according to the X/Y controls, and cropped off at the borders of the Mask.

Stretch



The image source will be stretched in X and Y to accomodate the full dimensions of the generated Mask. This might lead to visible distortions of the image source.

Inside



The image source will be scaled uniformly until one of it's dimensions (X or Y) fits the inside dimensions of the Mask. Depending on the relative dimensions of image source and Mask Background either the image source's width or height may be cropped to fit the respective dimension of the Mask.

Width



The image source will be scaled uniformly until it's width (X) fits the width of the Mask. Depending on the relative dimensions of image source and Mask the image source's Y-dimension might not fit the Mask's Y-dimension, resulting in either cropping of the image source in Y or the image source not covering the Mask's height entirely.

Height



The image source will be scaled uniformly until it's height (Y) fits the height of the Mask. Depending on the relative dimensions of image source and Mask the image source's X-dimension might not fit the Mask's X-dimension, resulting in either cropping of the image source in X or the image source not covering the Mask's width entirely.

Outside



The image source will be scaled uniformly until one of it's dimensions (X or Y) fits the outside dimensions of the Mask. Depending on the relative dimensions of image source and Mask either the image source's width or height may be cropped or not fit the respective dimension of the Mask.

Other Controls

Channel

Use this control to select the Channel of the input image used to create the mask. Choices include the red, green, blue and alpha channels, the hue, luminance or saturation values, or the auxiliary coverage channel of the input image (if one is provided).

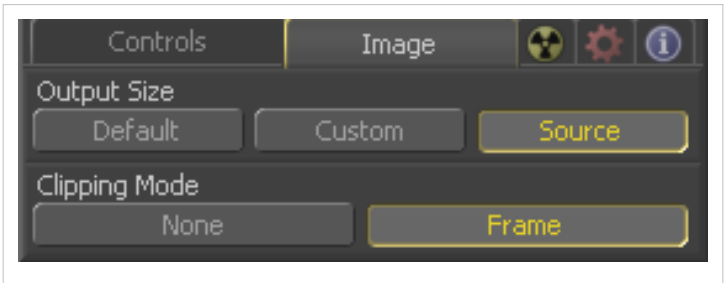
Threshold Low/High

The Threshold range control can be used to clip the bitmap image. Increasing the value of the low control will clip pixels below the specified value to black (0.0). Decreasing the high value will force pixels higher than the specified value to white (1.0).

Use Object/Use Material

This control has no affect unless the input image contains a Material or Object ID channel. When toggled on, the selected object ID and/or material ID is used to create a mask based on the selected object or material. When toggled off, the regular color channels will generate the mask.

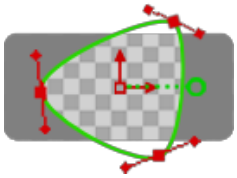
Image Tab



Please refer to Common Mask Controls.

BSpline

B-Spline Mask [BSp]

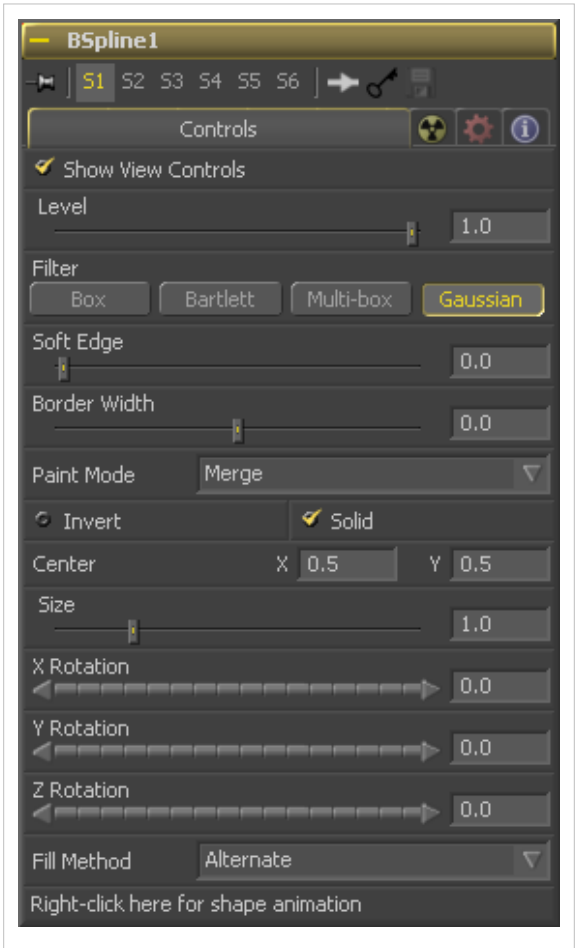


A B-Spline Mask is identical to a Polygon mask in all respects except one. Where Polygon masks use Bezier splines, this mask tool uses B-Splines. Where Bezier splines employ a main point and two handles to manage the smoothing of the spline segment, a B-Spline requires only a single point. This means that a B-Spline shape requires far fewer control points to create a nicely smoothed shape.

The smoothness of a B-Spline is determined by the tension of the control points. To adjust the tension of a B-Spline's control points, select the point, hold down the W key and click-drag the mouse pointer to the left and right to increase or decrease the tension of the curve through that point.

Many of the controls found in this mask tool are common to all mask tools. These controls are documented at Common Mask Controls.

Controls Tab



Level, Filter, Soft Edge and Border Width

Please refer to the Common Mask Controls.

Size

Use the Size control to adjust the scale of the B-spline effect mask, without affecting the relative behavior of the points that compose the mask or setting a keyframe in the mask animation.

X, Y And Z Rotation

Use these three controls to adjust the rotation angle of the effect mask along any axis.

Fill Method

The Fill Method drop-down menu offers two different techniques for dealing with overlapping regions of a polyline. If overlapping segments in a mask are causing undesirable holes to appear, try switching the setting of this control from Alternate to Non Zero Winding.

Right Click Here For Shape Animation

By default, all B-spline masks are animated when they are created. The initial keyframe is set to the current time and any changes to the shape at different times will create new keys.

Right-clicking on this label will display a context menu that offers options for removing or re-adding animation to the mask, or published and connecting the masks together.

Adding Points

Adding Points to a B-spline effect mask is relatively simple. Immediately after creating the mask there are no points but the mask will be in Click Append mode. Simply click once in the display wherever a point is required for the mask. Continue clicking to draw the shape of the mask. When the shape is complete, click on the initial point again to close the mask.

When the shape is closed, the mode of the polyline will change to Insert And Modify. This allows for the adjusting and adding of additional points to the mask by clicking on segments of the polyline. To lock down the mask's shape and prevent accidental changes, switch the polyline mode to Done using the polyline toolbar or context menu.

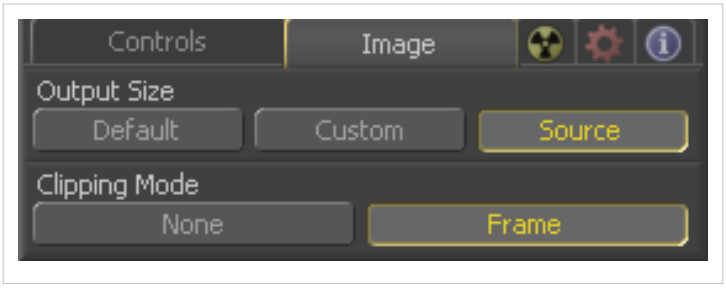


When a B-spline mask is added to a tool, a toolbar will appear in the view with buttons that offer easy access to the modes and tools. Hold the mouse pointer over any button in the toolbar to display a tooltip that describes that button's function.

Change the way the toolbar is displayed by right-clicking on the toolbar and selecting from the options displayed in the toolbar's context menu.

The function of the buttons in this toolbar are explained in depth in the Polylines chapter.

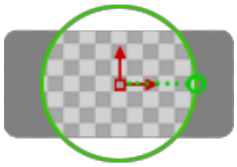
Image Tab



Please refer to Common Mask Controls.

Ellipse

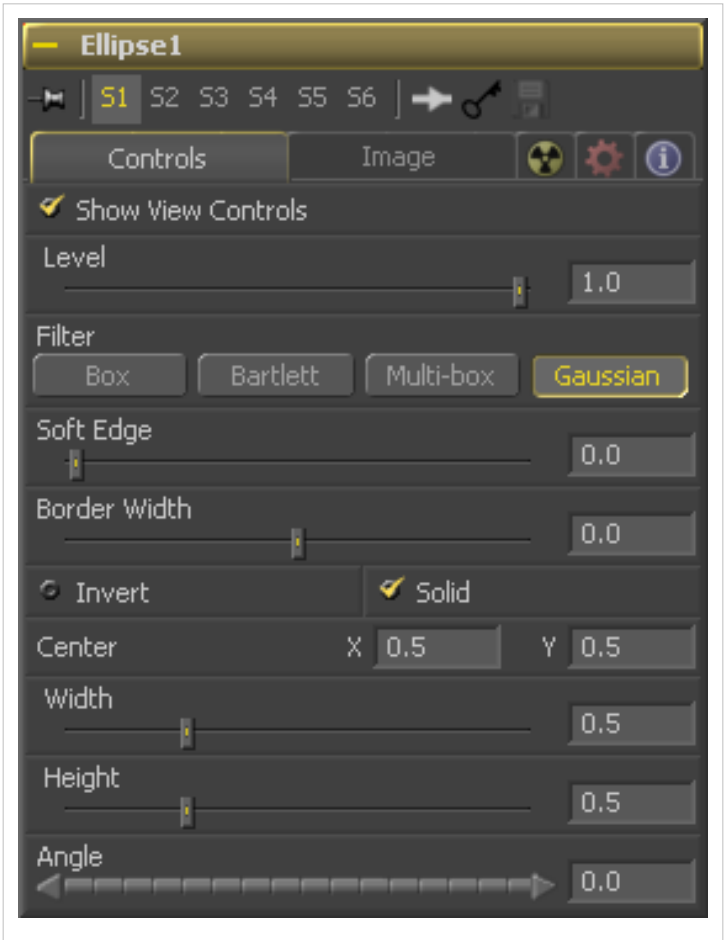
Ellipse Mask [Elp]



The Ellipse Mask is most useful for masking round objects. It is a circle by default but independent control is offered over the width, height and angle, providing for a wide variety of ellipsoidal shapes.

Many of the controls found in this mask tool are common to all mask tools. These controls are documented at Common Mask Controls.

Controls Tab



Level, Filter, Soft Edge and Border Width

Please refer to the Common Mask Controls.

Width

This control allows independent control of the ellipse mask's Width. In addition to the slider in the mask's controls, interactively drag the width (left or right edge) of the mask on the view using the pointer. Any changes will be reflected on this control.

Height

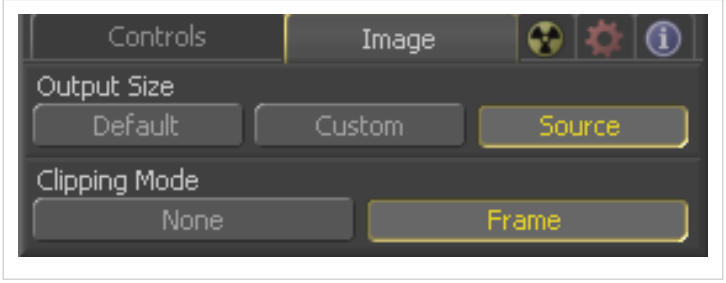
Height allows independent control of the ellipse mask's height. In addition to the slider in the mask's controls, interactively drag the height (top or bottom edge) of the mask on the view using the pointer. Any changes will be reflected on this control.

To change the mask's size without affecting the aspect ratio, drag the on screen control between the edges (diagonal). This will modify both the width and height proportionately.

Angle

Change the rotational angle of the mask by moving the Angle control left or right. Values can be entered in the input boxes provided. Alternately, use the onscreen controls by click-dragging the little circle at the end of the dashed angle line to interactively adjust the rotation of the ellipse.

Image Tab



Please refer to Common Mask Controls.

Mask Paint

Mask Paint [PnM]

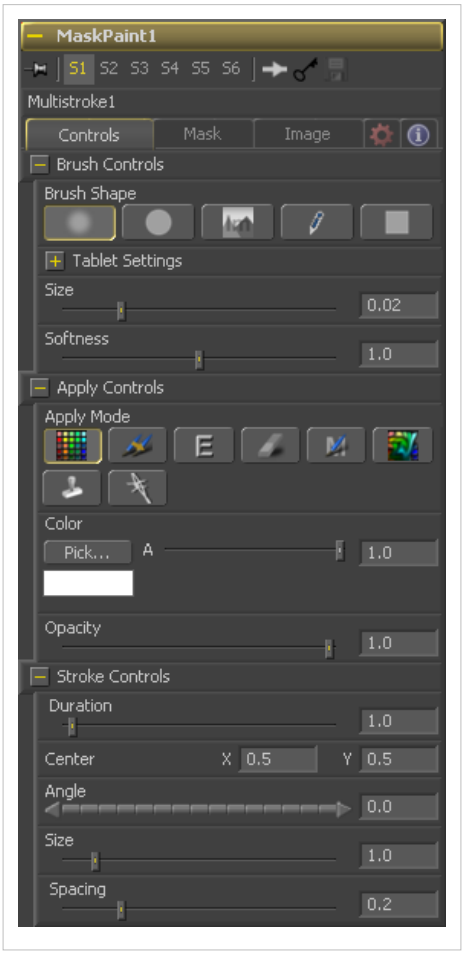


The Mask Paint tool allows direct painting on mask images, using the mouse pointer as if it were a paintbrush. In addition to regular paint strokes, it is possible to apply basic primitive shapes and polyline style strokes.

Each stroke can have a duration that lasts for the entire project, a single frame or field, or an arbitrary number of fields. The strokes can have independent durations in the timeline for easy manipulation of time. Alternatively, Fusion 5.1 offers Multistrokes, a faster but non-editable way for doing many mask cleanup paint tasks.

Many of the controls found in this mask tool are common to all mask tools. These controls are documented at Common Mask Controls.

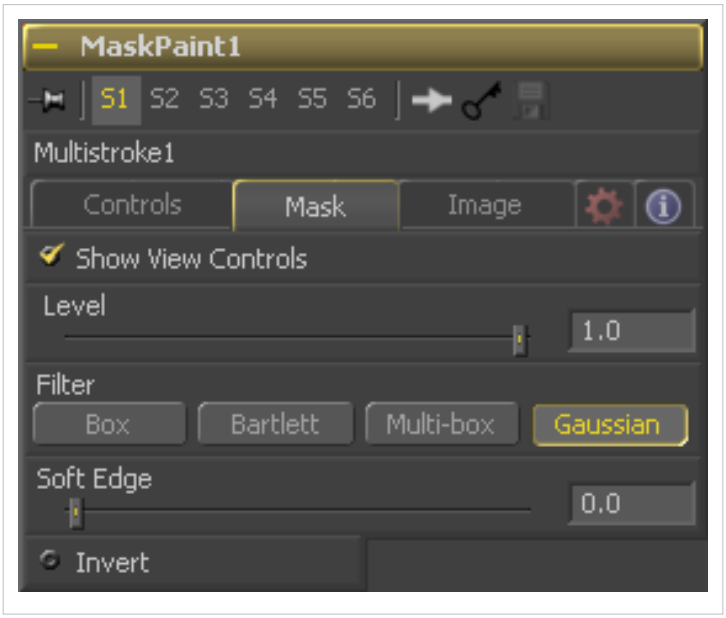
Controls Tab



As the Paint Mask tool is fundamentally identical to the Paint tool, see the Paint tool and the Paint and Rotoscoping chapter for more details on the many options and capabilities available. The only difference is that, as Paint Mask operates on single-channel mask images, there is no

channel selector control and all color controls have only a single Alpha value.

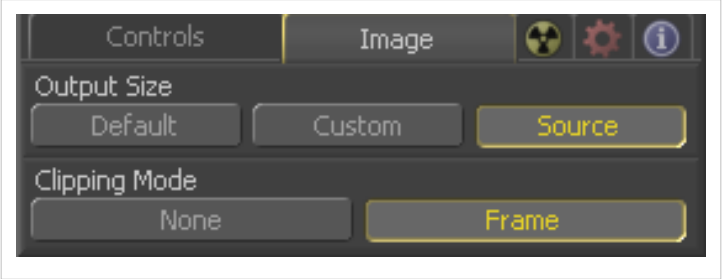
Mask Tab



Level, Filter, Soft Edge and Border Width

Please refer to the Common Mask Controls.

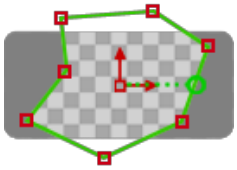
Image Tab



Please refer to Common Mask Controls.

Polygon

Polygon Mask [Ply]



The Polygon Mask is most useful for masking objects that do not have a regular shape. When first added to a tool, the polygon mask consists of only center and angle controls, which are visible onscreen. Points are added to the polyline by clicking in the display view. Each new point is connected to the last one created.

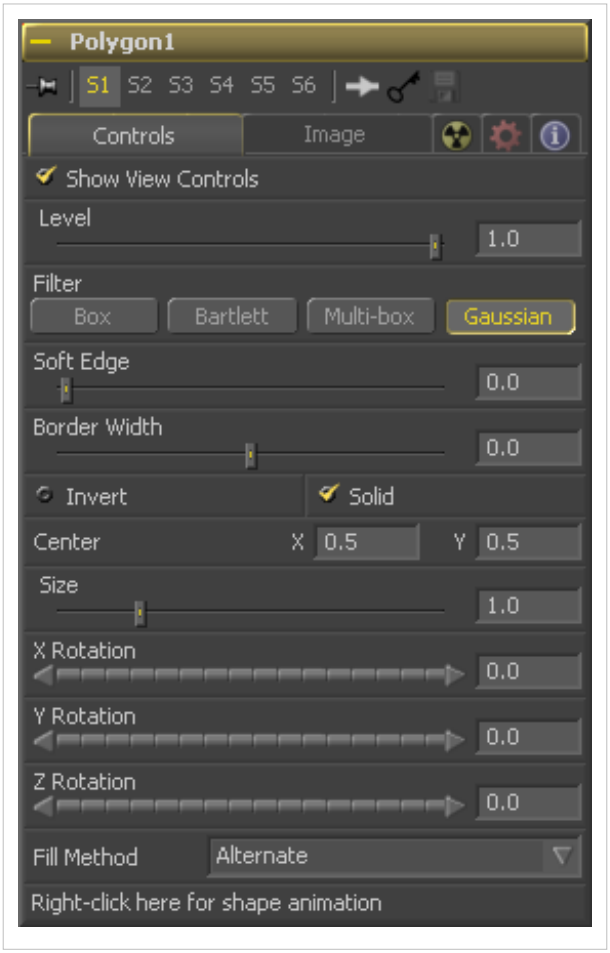
The shape is closed by clicking on the first point created, at which point the mask shape is filled in.

The points that make up the shape of the mask may be independently animated over time and/or published and connected to expressions or other controls. This feature allows for the creation of morphing and travelling masks. Polyline masks are one of the most commonly-used features of Fusion.

The shape of a polygon mask is automatically animated over time when it is added. This animation can be removed, if necessary, as described below.

Many of the controls found in this mask tool are common to all mask tools. These controls are documented at Common Mask Controls.

Controls Tab



Level, Filter, Soft Edge and Border Width

Please refer to the Common Mask Controls.

Size

Use the Size control to adjust the scale of the polygon effect mask, without affecting the relative behavior of the points that compose the mask or setting a keyframe in the mask animation.

X, Y And Z Rotation

Use these three controls to adjust the rotation angle of the effect mask along any axis.

Fill Method

The Fill Method drop-down menu offers two different techniques for dealing with overlapping regions of a polyline. If overlapping polyline segments in a mask are causing undesirable holes in the mask, try switching the setting of this control from Alternate to Non Zero Winding.

Right Click Here For Shape Animation

By default, all polyline masks are animated when they are created. The initial keyframe is set to the current time and any changes to the shape at different times will create new keys.

Right-clicking on this label will display a context menu that offers options for removing or re-adding animation to the mask, or published and connecting masks together.

Adding Points

Adding Points to a polygonal effect mask is relatively simple. Immediately after creating the mask there are no points, but the mask will be in Click Append mode. Simply click once in the display wherever a point is required for the mask. Continue clicking to draw the shape of the mask. When the shape is complete, click on the initial point again to close the mask.

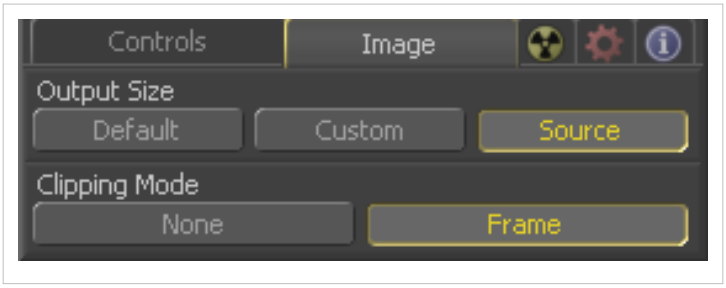
When the shape is closed, the mode of the polyline will change to Insert And Modify. This allows for the adjusting and adding of additional points to the mask by clicking on segments of the polyline. To lock down the mask's shape and prevent accidental changes, switch the polyline mode to Done using the polyline toolbar or context menu.



When a polygon mask is added to a tool, a toolbar will appear in the view with buttons that offer easy access to modes and tools. Hold the mouse pointer over any button in the toolbar to display a tooltip that describes that button's function.
Change the way the toolbar is displayed by right-clicking on the toolbar and selecting from the options displayed in the toolbar's context menu.

The function of the buttons in this toolbar are explained in depth in the Polylines chapter.

Image Tab



Please refer to Common Mask Controls.

Ranges

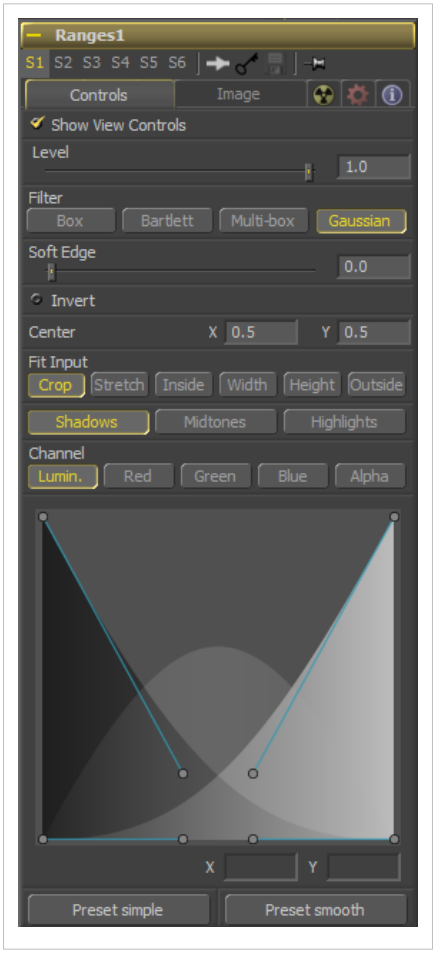
Ranges Mask [Rng]



Similar to Bitmap Mask, the Range Mask allows images from the flow to act as masks for tools and effects. Instead of creating a simple luminance-based mask from a given channel, Range allows spline-based selection of low, mid and high ranges, akin to Color Corrector.

Many of the controls found in this mask tool are common to all mask tools. These controls are documented at Common Mask Controls.

Controls Tab



Level, Filter, Soft Edge and Border Width

Please refer to the Common Mask Controls.

Shadows/Midtones/Highlights

These buttons are used to select which range will be output by the tool as a mask. White pixels represent pixels that are considered to be part of the range and black pixels are not included in the range. For example, choosing Shadows would show pixels considered to be shadows as white and pixels that are not shadows as black. Mid grey pixels are only partly in the range and will not receive the full effect of any color adjustments to that range.

Channel

The Channel selection buttons shown in this tab can be used to extract a mask from the range of a specific color channel. By default, Fusion uses the luminance channel when the color ranges are examined.

Spline Display

The extent of the ranges is selected by manipulating the spline handles. There are four spline points, each with one Bezier handle. The two handles at the top represent the start of the shadow and highlight ranges, whereas the two at the bottom represent the end of the range. The Bezier handles are used to control the falloff.

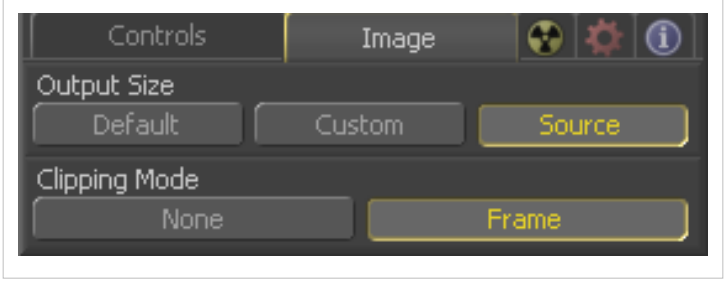
The midtones range has no specific controls since its range is understood to be the space between the shadow and the highlight ranges. In other words, after low and high masks have been applied, midtones is everything else.

The X and Y text controls below the Spline Display can be used to enter precise positions for the selected Bezier point or handle.

Presets

This sets the splines to two commonly-used configurations. **Simple** gives a straightforward linear-weighted selection, while **Smooth** uses a more natural falloff.

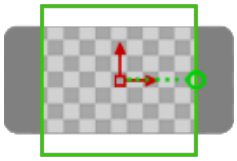
Image Tab



Please refer to Common Mask Controls.

Rectangle

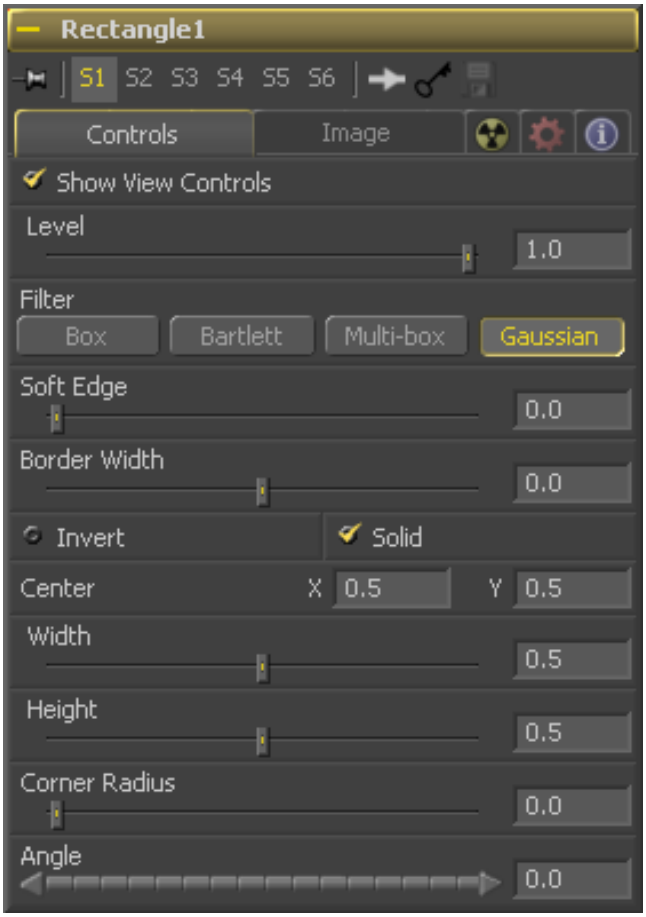
Rectangle Mask [Rec]



The Rectangle Mask creates a simple square or rectangular effect mask.

Many of the controls found in this mask tool are common to all mask tools. These controls are documented at Common Mask Controls.

Controls Tab



Level, Filter, Soft Edge and Border Width

Please refer to the Common Mask Controls.

Width And Height

Use these controls to change the X or Y scale of the rectangular effect mask independently of each other. Alternatively, drag the edges of the rectangle in the display view to interactively adjust its size.

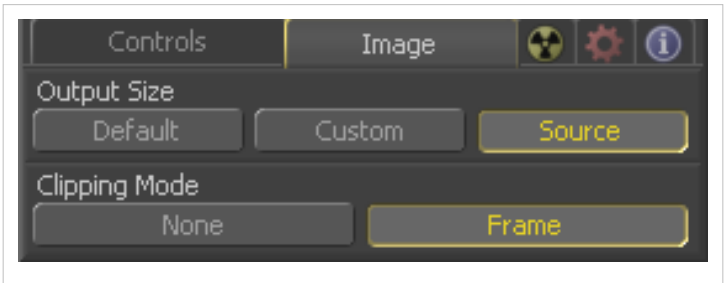
Corner Radius

Corner Radius allows the corners of the rectangle mask to be rounded. A value of 0.0 is not rounding at all, which means that the rectangle has sharp corners. A value of 1.0 will apply the maximum amount of rounding to the corners.

Angle

Change the rotation angle of an effect mask by moving the Angle control left or right. Values can be entered in the provided input boxes. Alternately, use the onscreen controls by click-dragging the little circle at the end of the dashed angle line to interactively adjust the rotation of the ellipse.

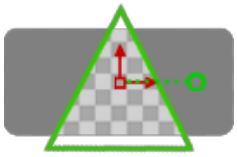
Image Tab



Please refer to Common Mask Controls.

Triangle

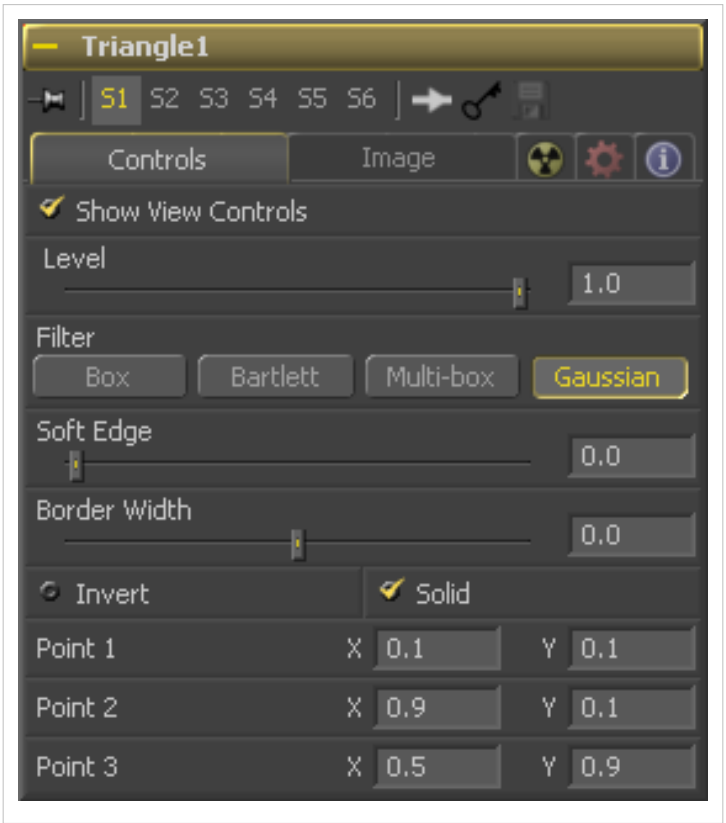
Triangle Mask [Tri]



The Triangle Mask is unique in that it has no center, size or angle control. Unlike most other types of masks, all three points of the triangle may be attached to a tracker or motion path. Complex effect masking is possible using trackers and other tools' paths to manipulate the triangle shape.

Many of the controls found in this mask tool are common to all mask tools. These controls are documented at Common Mask Controls.

Controls Tab



Level, Filter, Soft Edge and Border Width

Please refer to the Common Mask Controls.

Point 1, Point 2, Point 3

These controls indicate the position of the three corners of the triangle. Each point can be published, connected to other controls, animated with a path, or attached to trackers. To perform any of these tasks, right-click on the position control in the mask controls, or directly on the point in the display view, and select the appropriate option from the context menu.

Wand

Wand Mask [Wnd]



The Wand Mask provides the ability to mask an image based on a magic wand-style selection, similar to the magic wand tools found in traditional 2D paint applications. As with a bitmap mask, any image in the composition can be used as a source for the mask. Generally, the default is most useful, where the source image is the input of the tool to which the mask is applied.

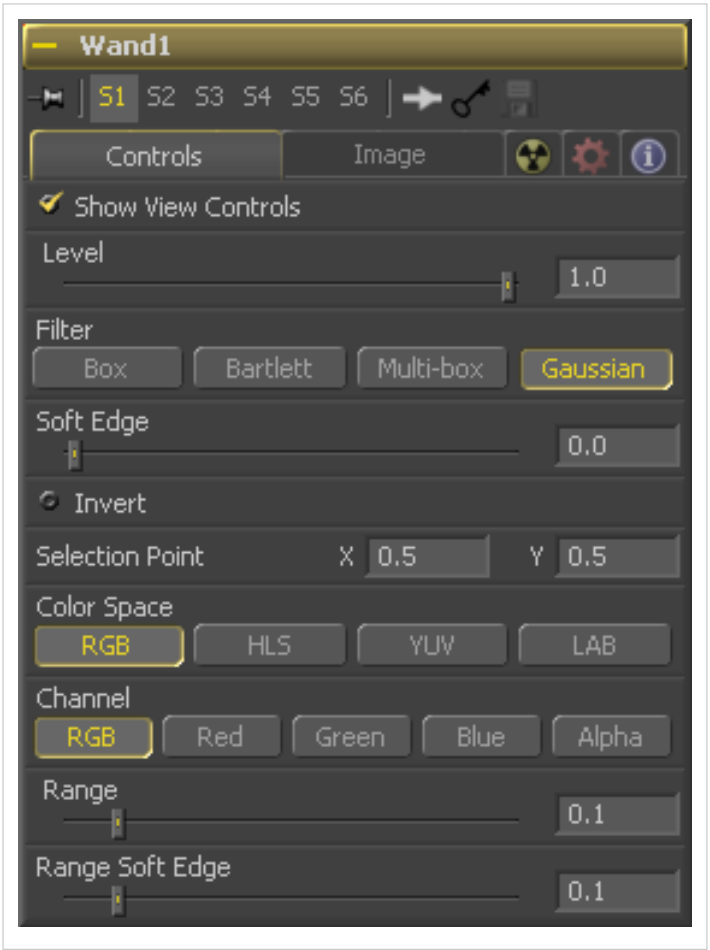
When adding a wand mask to a tool, a crosshair will appear in the display views. This crosshair should be positioned in the image to select the color used to create the wand mask.

The mask itself is created by examining the color of the pixel beneath the selection point and adding that color to the mask. The mask then expands to examine the pixels surrounding the selection point. If the surrounding pixels are the same color, they are also added to the mask. The mask stops expanding when no connecting pixels fall within the color range of the mask.

The tool to be used as the image source for the mask should be connected to the Source (orange) input on the flow. As with other masks, the Effect Mask (blue) input is used to combine the wand's result with other mask tools.

Many of the controls found in this mask tool are common to all mask tools. These controls are documented at Common Mask Controls.

Controls Tab



Level, Filter, Soft Edge and Border Width

Please refer to the Common Mask Controls.

Selection Point

The Selection Point is a pair of X and Y coordinates that determine from where in the source image the wand mask derives its initial color sample. This control is also seen as a crosshair in the display views. The selection point can be positioned manually, connected to a tracker, path or other expressions.

Color Space

The Color Space button group determines the color space used when selecting the source color for the mask. The wand mask can operate in RGB, YUV, HLS or LAB color spaces.

Channel

The Channel button group is used to select whether the color that is masked comes from all three color channels of the image, the alpha channel, or from an individual channel only.

The exact labels of the buttons will depend on the color space selected for the wand mask operation. If the color space is RGB, the options will be R, G or B. If YUV is the color space, the options will be Y, U or V.

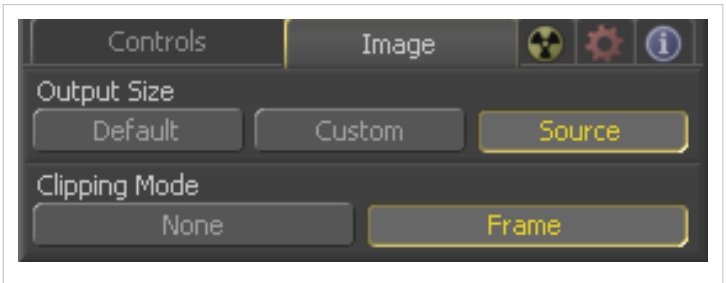
Range

The Range slider controls the range of colors around the source color that will be included in the mask. If the value is left at 0.0, only pixels of exactly the same color as the source will be considered part of the mask. The higher the value, the more that similar colors in the source will be considered to be wholly part of the mask.

Range Soft Edge

The Range Soft Edge determines the falloff range of the colors selected. Any pixel within the range defined above will be treated as 100% within the mask. If the soft range is set to 0.0, no other pixels will be considered for the mask. Increasing the soft range will increase the number of colors close to, but not quite within, the range that will be included in the mask. These pixels will be semi-transparent in the mask.

Image Tab



Please refer to Common Mask Controls.

Common Mask Controls

Common Mask Controls [cmc]



Common Controls can be found in every Mask tool. This chapter is therefor valid for all Mask tools.

Common Mask Controls



Although each mask has its own set of controls unique to that mask type, several of the controls shown are common for all types of masks. The controls listed here are generally found on all masks.

Show View Controls

Use the Show View Controls checkbox to disable the display of the mask controls in the display view. Polylines, centers, angles and other controls will not be displayed, even when the tool is

selected.

Level

The Level control designates the transparency level of the pixels in the mask channel. When the value is 1.0, the effect mask is completely opaque (unless it has a soft edge). Lower values will cause the mask to be partially transparent. The result is identical to lowering the blend control of an effect.

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Filter

This control selects the filtering algorithm to be used when applying Soft Edge to the mask.

Box

This is the fastest method, but at reduced quality. This is best suited for very small amounts of blur.

Bartlett

Otherwise known as a pyramid filter, Bartlett makes a good compromise between speed and quality.

Multi-box

When selecting this filter, the Num Passes slider appears, to let you control the quality. At 1 and 2 passes, results are identical to Box and Bartlett, respectively. At 4 and above, results are usually as good as Gaussian, in less time and with no edge 'ringing'.

Gaussian

The default filter, this uses a true Gaussian approximation and gives excellent results, but is a little slower than the other filters. In some cases it can produce extremely slight edge 'ringing' on floating point pixels.

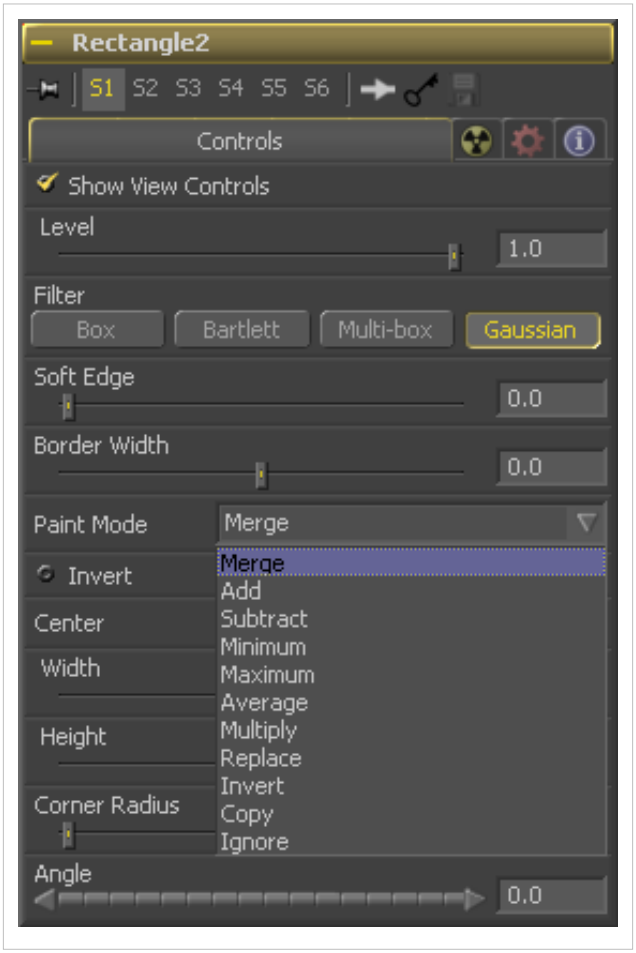
Soft Edge

Use the Soft Edge slider to blur (feather) the edges of the mask, using the selected Filter. Higher values will cause the edge to fade off well beyond the boundaries of the mask. A value of 0.0 will create a crisp, well-defined edge.

Border Width

The Border Width control adjusts the thickness of the mask's edge. When the solid checkbox is toggled on, the border thickens or narrows the mask. When the mask is not solid, an outline of the mask shape is drawn and the thickness of the outline is handled with this control.

Paint Mode



The different Paint Modes determine how the new mask is combined with other masks. This affects what happens to the intersecting area when one mask shape overlaps another.

This control only appears when another, input mask is connected to this mask's Effect Mask input. In other words, the control appears when masks are 'daisy-chained' together. The Paint Mode control will be hidden in the first mask tool in the chain, but will be visible in the other, connected masks.

Merge

Merge is the default for all masks. The new mask is merged together with the input mask.

Add

The mask's values are added to the input mask's values.

Subtract

In the intersecting areas, the new mask values are subtracted from the input mask's values.

Minimum

The input mask's values are compared to the new mask, and the lowest (minimum) value is taken.

Maximum

The input mask's values are compared to the new mask, and the highest (maximum) value is taken.

Average

This calculates the average (half the sum) of the new mask and the input mask.

Multiply

This multiplies the values of the input mask by the new mask's values.

Replace

The new mask completely replaces the input mask wherever they intersect. Areas that are zero (completely black) in the new mask do not affect the input mask.

Invert

Areas of the input mask that are covered by the new mask are inverted - white becomes black, and vice versa. Grey areas in the new mask are partially inverted.

Copy

This mode completely discards the input mask, and uses the new mask for all values.

Ignore

This mode completely discards the new mask, and uses the input mask for all values.

Invert

Selecting this checkbox inverts the entire mask. This differs from the Invert Paint Mode in that it affects all pixels, regardless of whether they are covered by the new mask or not.

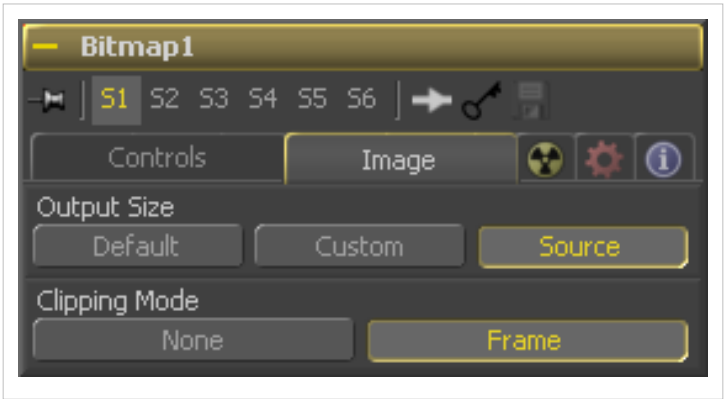
Solid

When the Solid checkbox is enabled, all areas completely enclosed by the mask will be filled solid white. Turning off the checkbox will treat the mask as an outline, with the width of the outline determined by the Border Width control. This checkbox is enabled by default.

Center

All masks have a center, with the exception of the ../Paint/ and ../Triangle/ masks. The Center control allows the center coordinates for the effect mask to be entered manually by clicking in the value box and typing in a new position. The center position of a mask can also be manipulated using the crosshair control displayed in the views.

Image Tab



The Image tab is only visible if nothing is connected to the mask's Effect Mask input. When a tool is connected to this input, the entire Image tab is hidden, and the mask will always match its size to that of the upstream connected tool. Otherwise, the controls on the Image tab are used to determine the output size of the mask.

When the mask is connected to a tool's (blue-grey) Mask input, the mask is always automatically created at the same size of the tool it is connected to. The controls below are only relevant for masks that are connected to the Image input of ordinary tools, or that are unconnected and viewed on their own.

Output Size

This control determines the dimensions of the resulting mask. For most masks, the initial setting is Default, which gives almost identical behaviour to earlier versions of Fusion. This setting will affect unconnected masks and masks being used for purposes other than masking.

Masks connectected to an image tool's Mask input may temporarily use this setting, until the masked image tool (the 'host' tool) first renders and the mask is able to determine the size it should be.

Default

This is the default for most masks. The mask will look for the size of the tool it is masking and match that size. If it is not connected to an image tool's Mask input (or the image tool has not yet rendered), it will render at the dimensions currently specified in the comp's Frame Format preferences. If it is later forced to a different size (by being used to mask an image tool), it will then continue to render at the new size, even if disconnected.

Custom

This setting causes additional controls to appear, and allows the size, aspect and depth of the mask to be specified precisely. These settings will be used for any masks not required for masking an image tool.

Source

The Source option is only visible on some masks with an extra image input, such as ../Bitmap/ and ../Ranges/. It is the default on those masks, and matches the size of the output mask to the size of the input image.

Clipping Mode

These radiobuttons define how the edges of image should be treated. This can also be called source image clipping.

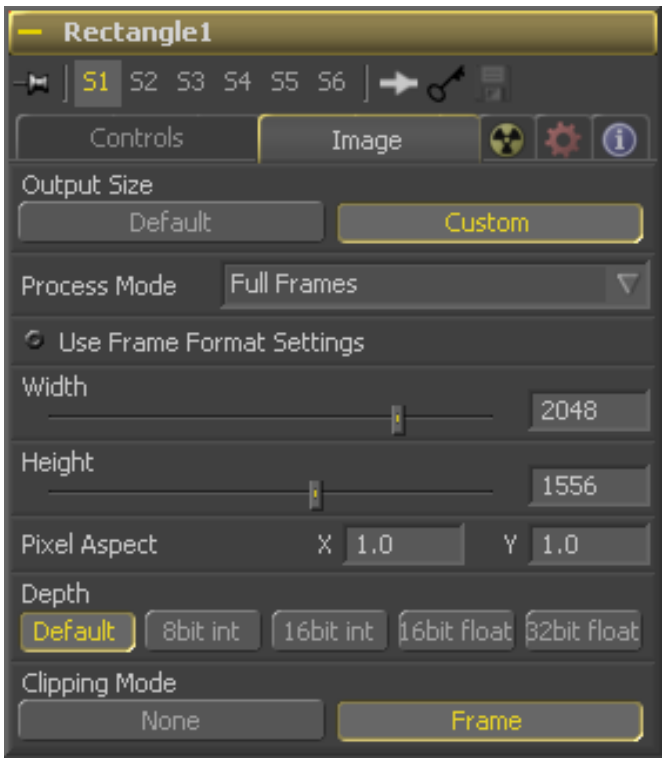
They default to Frame, which will provide the same behaviour as previous versions of Fusion. Since this option will clip to the parts of the image visible within its visible dimensions, it will break any infinite-workspace behaviour. If the upstream DOD is smaller than the frame, the remaining area in the frame will be treated as black/transparent.

None does not perform any source image clipping at all. This means that any data that would normally be needed outside the upstream DOD will be treated as black/transparent. Be aware that this might create humongous images which can consume a huge amount of diskspace. So you should use this option only if really needed.

For more information about ROI, DOD and Infinite Workspace please see the **dedicated chapter**.

Note that masks that show the Source option will usually have a Fit Input control as well. If the output mask is forced to the size of an image tool (by connecting it to a Mask input), the source image may optionally be automatically rescaled to the new output size by means of the mask's Fit Input control.

The remaining controls listed below are only visible when Output Size is set to Custom. These are very similar to the Common controls found on ../../Creator/ tools, such as Background and Fast Noise.



Process Mode

Use this menu control to select the fields processing mode used by Fusion to render changes to the mask. The default option is determined by the Has Fields checkbox control in the Frame

Format Preferences. For more information on fields processing, consult the Frame Formats chapter.

Use Frame Format Settings

When this checkbox is selected, the width, height and pixel aspect of the mask created will be locked to values defined in the composition's Frame Format preferences. If the Frame Format preferences change, the resolution of the mask produced will change to match. Disabling this option can be useful to build a composition at a different resolution than the eventual target resolution for the final render.

Width

Height

This pair of controls is used to set the Width and Height dimensions of the mask to be created.

Pixel Aspect

This controls is used to specify the Pixel Aspect ratio of the created mask. An aspect ratio of 11 would generate a square pixel with the same dimensions on either side (like a computer display monitor) and an aspect of 0.91 would create a slightly rectangular pixel (like an NTSC monitor).

Depth

The Depth button array is used to set the pixel color depth of the image created by the mask. 32bit pixels require 4 times the memory of 8bit pixels, but have far greater accuracy. Float pixels allow high dynamic range values outside the normal 0..1 range, for representing colours that are brighter than white or darker than black. See the Frame Format chapter for more details.

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Matte

Chroma Keyer

Chroma Keyer [CKy]



The Chroma Keyer Tool creates an alpha channel (matte) for an image by removing selected colors from the scene. Unlike the Ultrakeyer, which has specific optimizations for keying from blue and green colors, the chroma keyer works equally well with any color.

Chroma Key Tab



Key Type

This determines the type of selection to be used for the matte creation.

Chroma

Chroma causes a matte to be created based on the RGB values of the selected color range.

Color

This causes a matte to be created based on the hue of the selected color range.

Color Range

These range controls update automatically to represent the current color selection. Colors are selected by selecting the chroma keyer tool's tile in the flow, then click-dragging in the display view to select the colors to be used to create the matte. These range controls can be used to tweak the selection slightly, although generally selecting colors in the displays is all that is required.

Lock Color Picking

When this checkbox is selected, Fusion will prevent accidental growing of the selected range by selecting more colors from the view. It is a good idea to select this checkbox once the color selection has been made for the matte. All other controls in the tool remain editable.

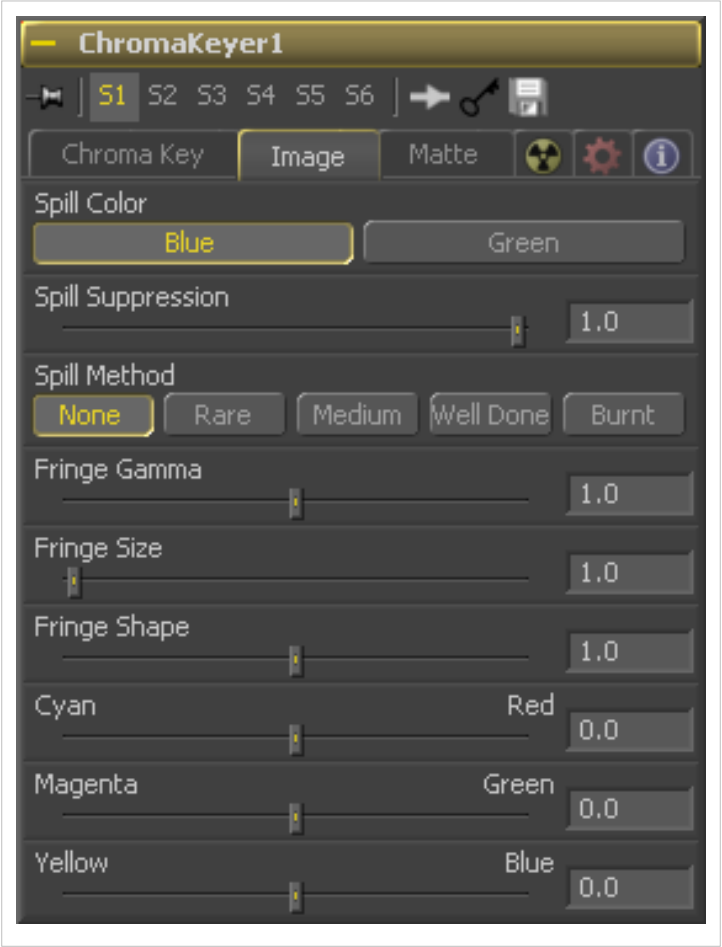
Soft Range

This control softens the selected color range to include additional colors into the matte.

Reset Color Ranges

Clicking on this button resets the chroma keyer's range controls, discarding all color selections. All other sliders and controls maintain their values.

Image Tab



Spill Color

Use these buttons to select the color used as the base for all spill suppression techniques.

Spill Suppression

Spill is generally caused by the transmission of the color of the background through the semitransparent areas of the alpha channel. In the case of blue or green screen keying, this usually causes the color of the background to become apparent in the fringe of the foreground element.

Spill suppression attempts to remove color from the fringe. The process used is optimized for either Blue or Green screens, and you select which color is used as the base from the control above.

When this slider is set to 0 no spill suppression is applied to the image.

Spill Method

This selects the strength of the algorithm used to apply spill suppression to the image.

None

None is selected when no spill suppression is required.

Rare

This removes very little of the spill color, the lightest of all methods.

Medium

This works best for green screens.

Well Done

This medium works best for blue screens

Burnt

This works best for blue. Use this mode only for very troublesome shots. Most likely you will have to add strong color correction after the key to get e.g. your skintones back.

Fringe Gamma

This control can be used to adjust the brightness of the fringe or halo that surrounds the keyed image.

Fringe Size

This expands and contracts the size of the fringe or halo surrounding the keyed image.

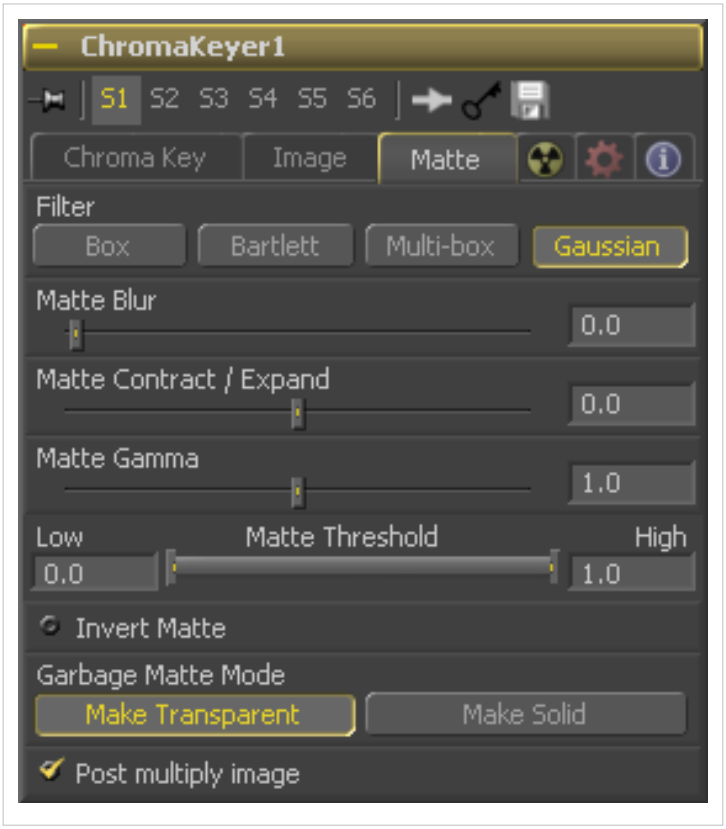
Fringe Shape

Fringe Shape forces the fringe to be pressed toward the external edge of the image or pulled toward the inner edge of the fringe. Its effect is most noticeable while the Fringe Size sliders value is large.

Cyan/Red, Magenta/Green And Yellow/Blue

Use these three controls to color correct the fringe of the image. This is useful for correcting semi-transparent pixels that still contain color from the original background to match the new background.

Chroma Keyer Matte Tab



Filter

Selection of the Filter that is used when blurring the matte.

Box Blur

This option applies a Box Blur effect to the whole image. This method is faster than the Gaussian blur but produces a lower quality result.

Bartlett

Bartlett applies a more subtle, anti-aliased blur filter.

Multi-Box

Multi-Box uses a box filter layered in multiple passes to approximate a Gaussian shape. With a moderate number of passes (e.g. 4), a high quality blur can be obtained, often faster than the Gaussian filter, and without any ringing.

Gaussian

Gaussian applies a smooth, symmetrical blur filter, using a sophisticated constant-time Gaussian approximation algorithm. In extreme cases, this algorithm may exhibit ringing; see below for a discussion of this. This mode is the default filter method.

Matte Blur

Matte Blur blurs the edge of the matte using a standard constant speed gaussian blur. A value of zero results in a sharp, cutout-like hard edge. The higher the value, the more blur applied to the matte.

Matte Contract/Expand

This slider shrinks or grows the semi-transparent areas of the matte. Values above 0.0 expand the matte while values below 0.0 contract it.

This control is usually used in conjuction with the Matte Blur to take the hard edge of a matte and reduce fringing. Since this control only affects semi-transparent areas, it will have no affect on a hard edge's matte.

Matte Gamma

Matte Gamma raises or lowers the values of the matte in the semi-transparent areas. Higher values cause the gray areas to become more opaque and lower values cause the gray areas to become more transparent. Completely black or white regions of the matte remain unaffected.

Since this control only affects semi-transparent areas it will have no affect on a hard edge's matte.

Matte Threshold

Any value below the lower threshold becomes black or transparent in the matte. Any value above the upper threshold becomes white or opaque in the matte. All values within the range maintain their relative transparency values.

This control is often used to reject salt and pepper noise in the matte.

Invert Matte

When this checkbox is selected, the alpha channel created by the keyer is inverted, causing all transparent areas to be opaque and all opaque areas to be transparent.

Garbage Matte Mode

Garbage mattes are mask tools or images connected to the Garbage Matte input on the tool's tile. The garbage matte is applied directly to the alpha channel of the image. Generally, garbage mattes are used to remove unwanted elements that cannot be keyed, such as microphones and booms. They are also used to fill in areas that contain the color being keyed, but that the artist wishes to maintain.

Garbage mattes of different modes cannot be mixed within a single tool. A matte control tool is often used after a keyer tool to add a garbage matte with the opposite effect of the matte applied to the keyer.

Make Transparent

Select this button to make the Garbage Matte transparent.

Make Solid

Select this button to make the Garbage Matte solid.

Post Multiply Image

Select this option to cause the keyer to multiply the color channels of the image against the alpha channel it creates for the image. This option is usually enabled, and is on by default.

Deselect this checkbox and the image can no longer be considered pre-multiplied for purposes of merging it with other images. Use the Subtractive option of the Merge tool instead of the Additive option.

For more information, see the Merge tools documentation.

Difference Keyer

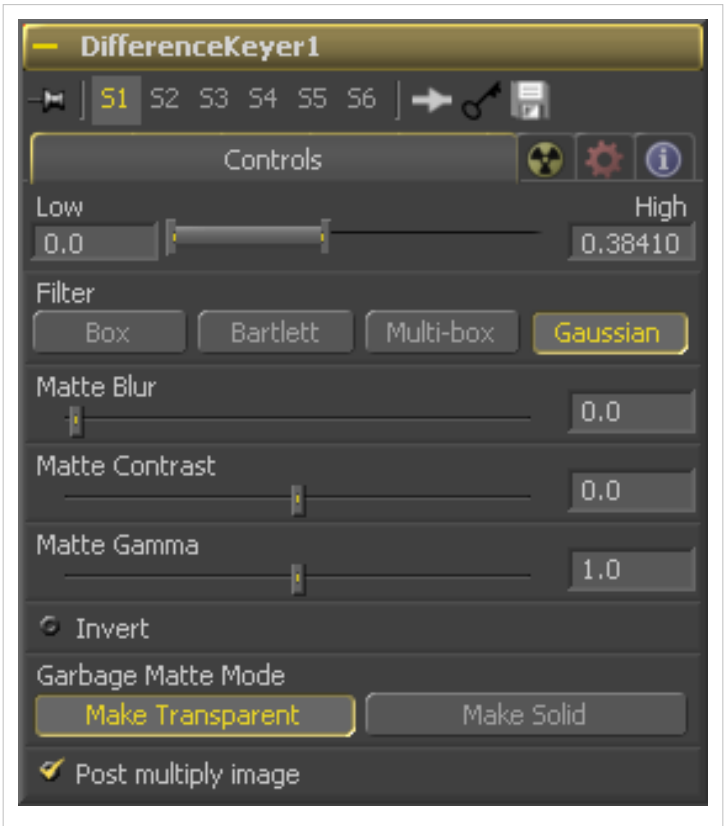
Difference Keyer [DKy]



Difference keying is a process that produces a matte based on the differences between two images. A difference key uses two input images, one containing the subject with the background and another containing the background without the subject.

The Difference Keyer tool is very sensitive and, although the process sounds reasonable at first glance, subtle variations in the position of the camera from shot to shot usually make it difficult to pull a highly-detailed alpha channel using this method. Think of the futile attempt of trying to key smoke in front of a brick wall and using a clean plate of the brick wall as your difference input. Part of the wall's structure will always be visible in this keying method. Instead, a difference keyer is often used to produce a rough matte that is combined with other tools to produce a more detailed matte.

Controls Tab



Threshold High And Low

This slider works by defining a range of difference values between the images to create a matte. A difference below the lower threshold becomes black in the matte. Any difference above the upper threshold becomes white (solid) in the matte. The difference values in the range in between create a gray scale matte.

Filter

Selection of the Filter that is used when blurring the matte.

Box Blur

This option applies a Box Blur effect to the whole image. This method is faster than the Gaussian blur but produces a lower quality result.

Bartlett

Bartlett applies a more subtle, anti-aliased blur filter.

Multi-Box

Multi-Box uses a box filter layered in multiple passes to approximate a Gaussian shape. With a moderate number of passes (e.g. 4), a high quality blur can be obtained, often faster than the Gaussian filter, and without any ringing.

Gaussian

Gaussian applies a smooth, symmetrical blur filter, using a sophisticated constant-time Gaussian approximation algorithm. In extreme cases, this algorithm may exhibit ringing; see below for a discussion of this. This mode is the default filter method.

Matte Blur

This blurs the edge of the matte using a standard constant speed gaussian blur. A value of zero results in a sharp, cutout-like hard edge. The higher the value, the more blur.

Matte Contrast

The Matte Contrast slider changes the look up table curve of the matte's luminance values. This creates a soft cropping of the matte at the low end of the slider and a hard edge expansion of the matte at higher slider values.

Matte Gamma

Matte Gamma raises or lowers the values of the matte in the semi-transparent areas. Higher values cause the gray areas to be more opaque and lower values cause the gray areas to be more transparent. Completely black or white regions of the matte remain unaffected.

Invert

Selecting this checkbox inverts the matte, causing all transparent areas to be opaque and all opaque areas to be transparent.

Garbage Matte Mode

Garbage mattes are mask tools or images connected to the Garbage Matte input on the tool's tile. The garbage matte is applied directly to the alpha channel of the image. Generally, garbage mattes are used to remove unwanted elements that cannot be keyed, such as microphones and booms. They are also used to fill in areas that contain the color being keyed, but that the artist wishes to maintain.

Garbage mattes of different modes cannot be mixed within a single tool. A matte control tool is often used after a keyer tool to add a garbage matte with the opposite effect of the matte applied to the keyer.

Make Transparent

Select this button to make the Garbage Matte transparent.

Make Solid

Select this button to make the Garbage Matte solid.

Post Multiply Image

Select this option to cause the keyer to multiply the color channels of the image against the alpha channel it creates for the image. This option is usually enabled, and is on by default.

Deselect this checkbox and the image can no longer be considered pre-multiplied for purposes of merging it with other images. Use the Subtractive option of the Merge tool instead of the Additive option.

For more information, see the Merge tools documentation.

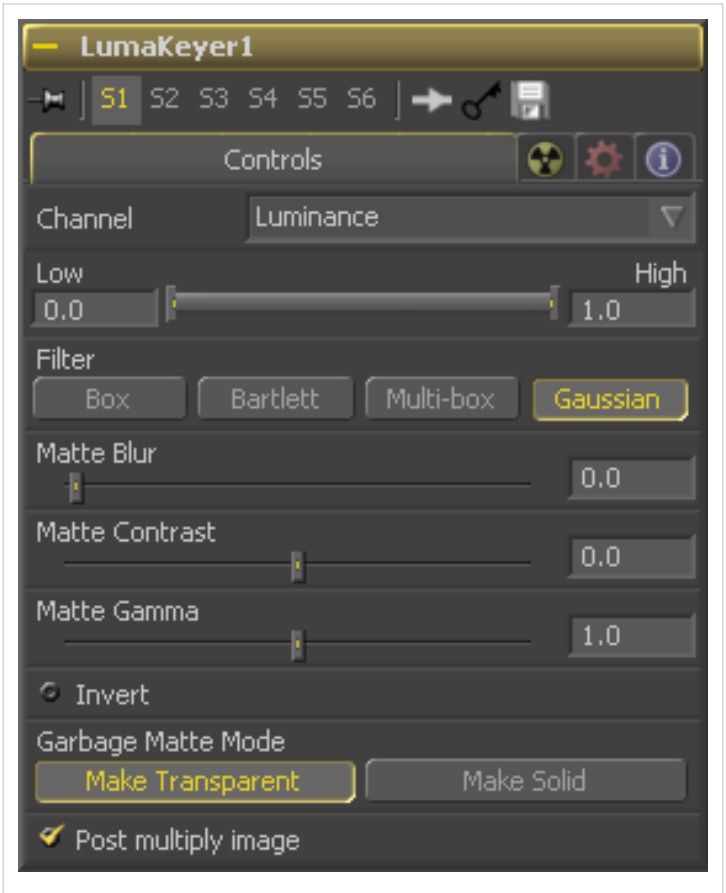
Luma Keyer

Luma Keyer [LKy]



The Luma Keyer Tool uses the overall luminance of an image to create an alpha channel. When this tool was first created it was used exclusively on the luminance channel of the image, but it has since grown to allow pulling mattes from virtually any channel Fusion understands. In some respects, it would now be more accurate to call this tool a Channel Keyer.

Controls Tab



Channel

Use this drop-down list to select the color channel used for creating the matte. Select from the Red, Green, Blue, Alpha, Hue, Luminance, Saturation and Depth (Z-Buffer) channels.

Threshold High And Low

This slider works by defining a range of luminance values in the image to create a matte. Any value below the lower threshold becomes black in the matte. Any value above the upper threshold becomes white (solid) in the matte. All values within the range create the gray scale matte.

Filter

Selection of the Filter that is used when blurring the matte.

Box Blur

This option applies a Box Blur effect to the whole image. This method is faster than the Gaussian blur but produces a lower quality result.

Bartlett

Bartlett applies a more subtle, anti-aliased blur filter.

Multi-Box

Multi-Box uses a box filter layered in multiple passes to approximate a Gaussian shape. With a moderate number of passes (e.g. 4), a high quality blur can be obtained, often faster than the Gaussian filter, and without any ringing.

Gaussian

Gaussian applies a smooth, symmetrical blur filter, using a sophisticated constant-time Gaussian approximation algorithm. In extreme cases, this algorithm may exhibit ringing; see below for a discussion of this. This mode is the default filter method.

Matte Blur

Matte Blur blurs the edge of the matte using a standard constant speed gaussian blur. A value of zero results in a sharp, cutout-like hard edge. The higher the value, the more blur applied to the matte.

Matte Contrast

The contrast slider changes the look up table curve of the mattes luminance values. This creates a soft cropping of the matte at the low end of the slider and a hard edge expansion of the matte at higher slider values.

Matte Gamma

Matte Gamma raises or lowers the values of the matte in the semi-transparent areas. Higher values cause the gray areas to be more opaque and lower values cause the gray areas to be more transparent. Completely black or white regions of the matte remain unaffected.

Invert

When toggled on, the matte is inverted, causing all transparent areas to be opaque and all opaque areas to be transparent.

Garbage Matte

Garbage mattes are mask tools or images connected to the Garbage Matte input on the tool's tile. The garbage matte is applied directly to the alpha channel of the image. Generally, garbage mattes are used to remove unwanted elements that cannot be keyed, such as microphones and booms. They are also used to fill in areas that contain the color being keyed, but that the artist wishes to maintain.

Garbage mattes of different modes cannot be mixed within a single tool. A matte control tool is often used after a keyer tool to add a garbage matte with the opposite effect of the matte applied to the keyer.

Make Transparent

Select this button to make the Garbage Matte transparent.

Make Solid

Select this button to make the Garbage Matte solid.

Post Multiply Image

Select this option to cause the keyer to multiply the color channels of the image against the alpha channel it creates for the image. This option is usually enabled, and is on by default.

Deselect this checkbox and the image can no longer be considered pre-multiplied for purposes of merging it with other images. Use the Subtractive option of the Merge tool instead of the

Additive option.

For more information, see the Merge tools documentation.

Matte Control

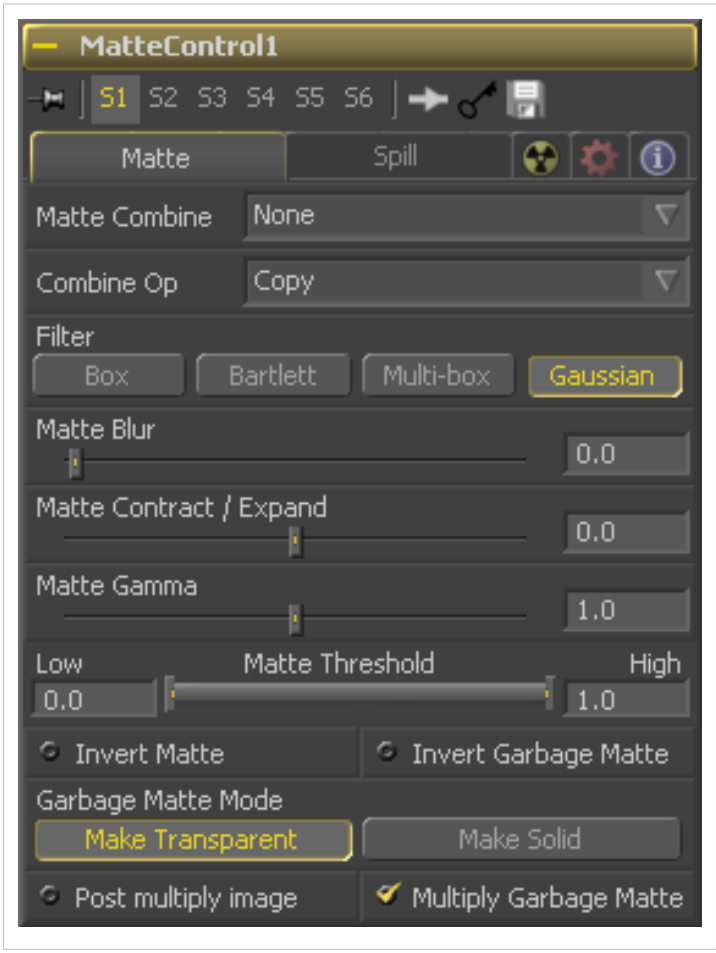
Matte Control [Mat]



Keyer tools are generally used to create an alpha channel on an image that does not already have one. The Matte Control Tool is used to manipulate an existing alpha channel, or to create one by hand via rotoscoping.

The Matte Control tool also has a foreground image input. Use this tool to copy a color channel or alpha channel from the foreground to the background, or to combine alpha channels from the two images.

Controls Tab



Matte Combine

The matte control tool can combine alpha or color channels from an image in the foreground input with the background image. Use this menu to select which operation is applied. The default is set to None for no operation.

None

This causes the foreground image to be ignored.

Combine Red

This combines the FG red channel to the BG alpha channel.

Combine Green

This combines the FG green channel to the BG alpha channel.

Combine Blue

This combines the FG blue channel with the BG alpha channel.

Combine Alpha

This combines the FG alpha channel with the BG alpha channel.

Solid

This causes the BG alpha channel to become completely opaque.

Clear

This causes the BG alpha channel to become completely transparent.

Combine Operation

Use this menu to select the method used to combine the foreground channel with the background.

Copy

This copies the foreground source over the background alpha, overwriting any existing alpha in the background.

Add

This adds the foreground source to the background alpha.

Subtract

This subtracts foreground source from the background alpha.

Inverse Subtract

This subtracts the background alpha from the foreground source.

Maximum

This compares the foreground source and the background alpha and takes the value from the pixel with the highest value.

Minimum

This compares the foreground source and the background alpha and takes the value from the pixel with the lowest value.

And

This performs a logical AND on the two values.

Or

This performs a logical OR on the values.

Merge Over

This merges the foreground source channel over the background alpha channel.

Merge Under

This merges the foreground source channel under the background alpha channel.

Filter

Selection of the Filter that is used when blurring the matte.

Box Blur

This option applies a Box Blur effect to the whole image. This method is faster than the Gaussian blur but produces a lower quality result.

Bartlett

Bartlett applies a more subtle, anti-aliased blur filter.

Multi-Box

Multi-Box uses a box filter layered in multiple passes to approximate a Gaussian shape. With a moderate number of passes (e.g. 4), a high quality blur can be obtained, often faster than the Gaussian filter, and without any ringing.

Gaussian

Gaussian applies a smooth, symmetrical blur filter, using a sophisticated constant-time Gaussian approximation algorithm. In extreme cases, this algorithm may exhibit ringing; see below for a discussion of this. This mode is the default filter method.

Matte Blur

This blurs the edge of the matte using a standard constant speed gaussian blur. A value of zero results in a sharp, cutout-like hard edge. The higher the value, the more blur applied to the matte.

Matte Contract/Expand

This shrinks or grows the matte to exclude some of the keyed image or include some of its surrounding area. Values above 0.0 expand the matte and values below 0.0 contract it.

Matte Gamma

This raises or lowers the values of the matte in the semi-transparent areas. Higher values cause the gray areas to become more opaque and lower values cause the gray areas to become more transparent. Completely black or white regions of the matte remain unaffected.

Matte Threshold

Any value below the lower threshold becomes black or transparent in the matte. Any value above the upper threshold becomes white or opaque in the matte. All values within the range maintain their relative transparency values.

Invert Matte

When this checkbox is selected, the alpha channel of the image is inverted, causing all transparent areas to be opaque and all opaque areas to be transparent.

Garbage Matte

Garbage mattes are mask tools or images connected to the Garbage Matte input on the tools tile. The garbage matte is applied directly to the alpha channel of the image. Generally, garbage mattes are used to remove unwanted elements that cannot be keyed, such as microphones and booms. They are also used to fill in areas that contain the color being keyed, but that the artist wishes to maintain.

Garbage mattes of different modes cannot be mixed within a single tool. A Matte Control tool is often used after a keyer tool to add a garbage matte with the opposite effect of the matte applied to the keyer.

Make Transparent

Select this button to make the Garbage Matte transparent.

Make Solid

Select this button to make the Garbage Matte solid.

Post Multiply Image

Select this option to cause the keyer to multiply the color channels of the image against the alpha channel it creates for the image. This option is usually enabled, and is on by default.

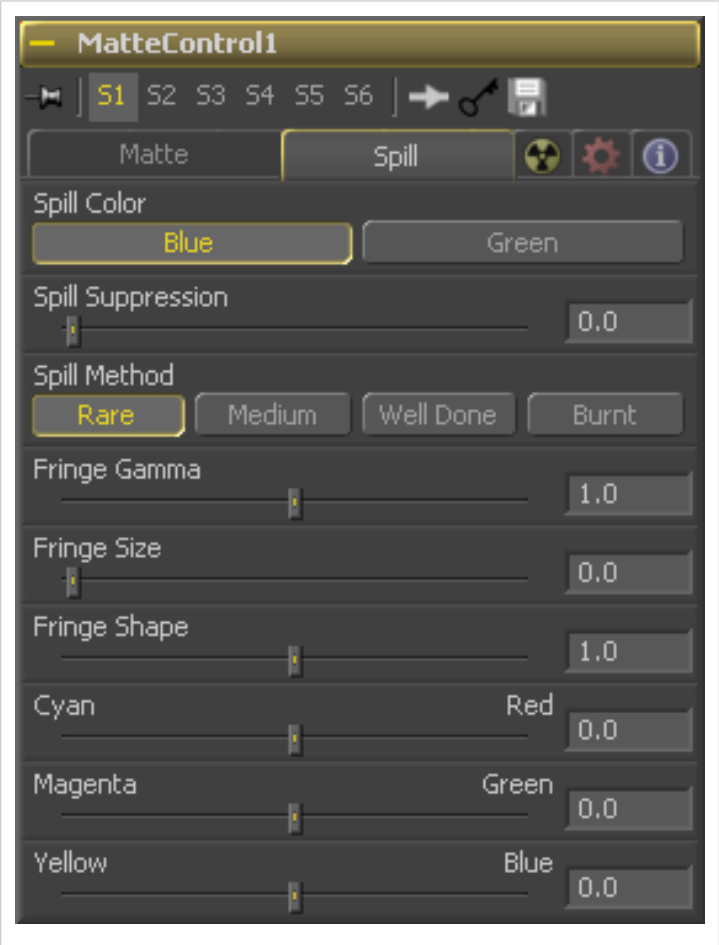
Deselect this checkbox and the image can no longer be considered pre-multiplied for purposes of merging it with other images. Use the Subtractive option of the Merge tool instead of the Additive option.

For more information, see the Merge tools documentation.

Multiply Garbage Matte

When selected, the values of the image's red, green and blue channels will be multiplied against the garbage matte input.

Spill Tab



Spill Color

Use these buttons to select the color used as the base for all spill suppression techniques.

Spill Suppression

Spill is generally caused by the transmission of the color of the background through the semitransparent areas of the alpha channel. In the case of blue or green screen keying, this usually causes the color of the background to become apparent in the fringe of the foreground element.

Spill suppression attempts to remove color from the fringe. The process used is optimized for either Blue or Green screens, and you select which color is used as the base from the control above.

When this slider is set to 0, no spill suppression is applied to the image.

Spill Method

This selects the strength of the algorithm used to apply spill suppression to the image.

None

None is selected when no spill suppression is required.

Rare

This removes very little of the spill color, the lightest of all methods.

Medium

This works best for green screens.

Well Done

This medium works best for blue screens

Burnt

This works best for blue. Use this mode only for very troublesome shots.

Fringe Gamma

This control can be used to adjust the brightness of the fringe or halo that surrounds the keyed image.

Cyan/Red, Magenta/Green And Yellow/Blue

Use these three controls to color correct the fringe of the image. This is useful for correcting semi-transparent pixels that still contain color from the original background to match the new background.

Fringe Size

This expands and contracts the size of the fringe or halo surrounding the keyed image.

Fringe Shape

Fringe Shape forces the fringe to be pressed toward the external edge of the image or pulled toward the inner edge of the fringe. Its effect is most noticeable while the Fringe Size sliders value is large.

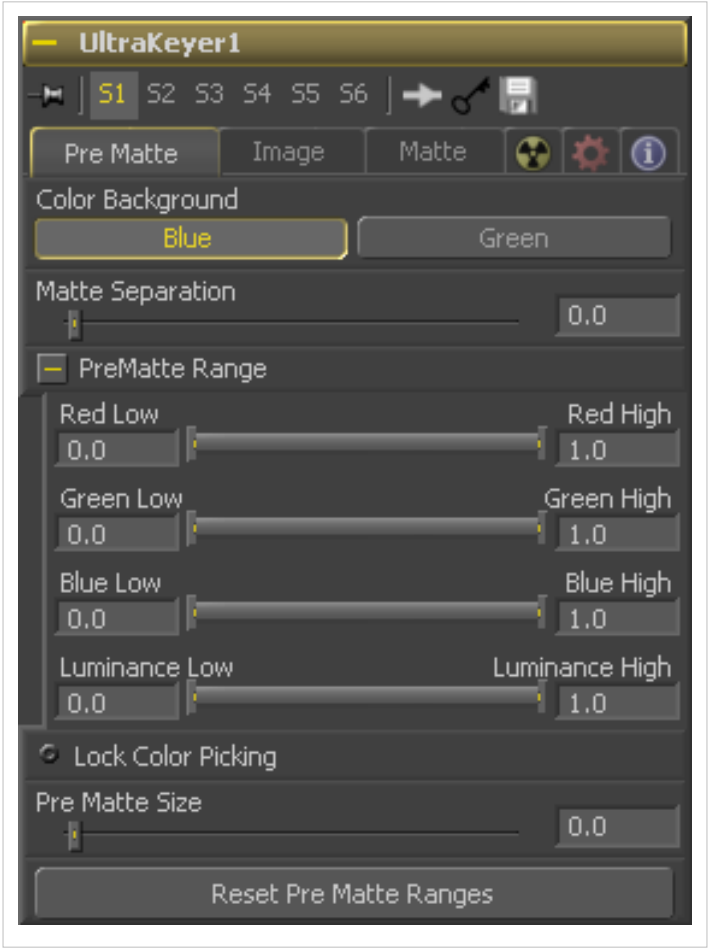
Ultra Keyer

Ultra Keyer [UKy]



The Ultra Keyer Tool is very similar to the chroma key tool, except that it has been specifically optimized to extract mattes from images using bluescreen or greenscreen backgrounds.

Pre Matte Tab



Color Background

The Ultra Keyer is optimized for the removal of blue or green backgrounds. Select the color that matches the image's background using these buttons.

Matte Separation

Matte Seperation performs a pre-process on the image to help separate the foreground from the background before color selection. Generally, increase this control while viewing the alpha

to eliminate the bulk of the background, but stop just before it starts cutting holes in the subject or eroding fine detail on the edges of the matte.

PreMatte Range

These range controls update automatically to represent the current color selection. Generally, the reveal control does not have to be opened to display these controls.

Colors are selected by selecting the Ultra Keyer tool's tile in the flow and click-dragging in the display view to select the colors to be used to create the matte. These range controls can be used to tweak the selection slightly, although generally selecting colors in the displays is all that is required.

Lock Color Picking

When this checkbox is selected, Fusion will prevent accidental growing of the selected range by selecting more colors from the view. It is a good idea to select this checkbox once the color selection is made for the matte. All other controls in the tool remain editable.

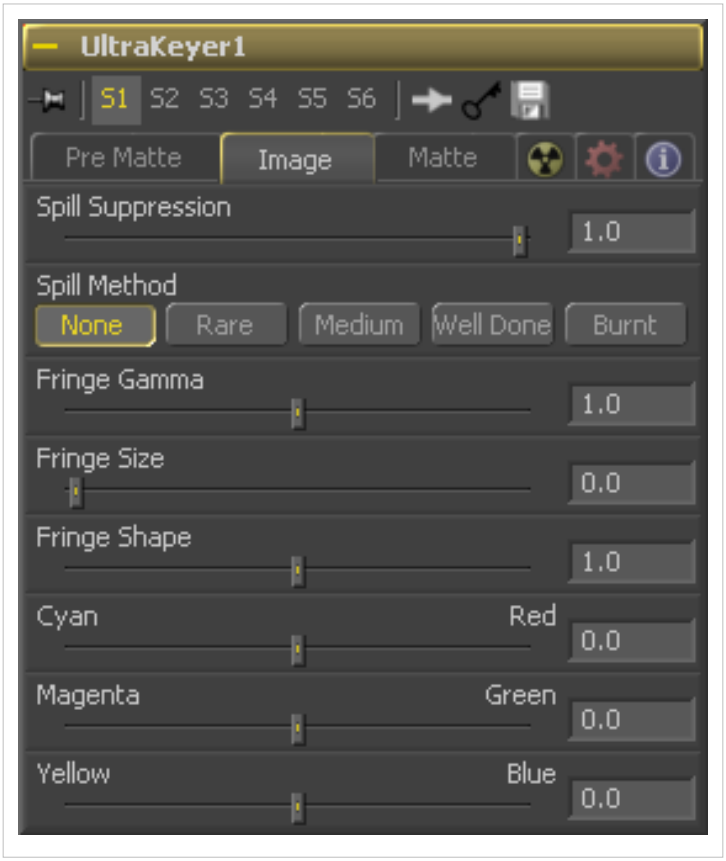
Pre Matte Size

The Pre Matte Size control can be used to soften the general area around the keyed image. This is used to close holes in the matte often caused by spill in semi-transparent areas of the subject. This generally will also cause a small halo around the subject, which can be removed using the matte contract tools found later in the tool.

Reset Pre Matte Ranges

This discards all color selection by resetting the ranges but maintains all other slider and control values.

Image Tab



Spill Suppression

Spill is generally caused by the transmission of the color of the background through the semitransparent areas of the alpha channel. In the case of blue or green screen keying, this usually causes the color of the background to become apparent in the fringe of the foreground element.

Spill suppression attempts to remove color from the fringe. The process used is optimized for either Blue or Green screens, and you select which color is used as the base from the control above.

When this slider is set to 0, no spill suppression is applied to the image.

Spill Method

This selects the strength of the algorithm used to apply spill suppression to the image.

None

None is selected when no spill suppression is required.

Rare

This removes very little of the spill color, the lightest of all methods.

Medium

This works best for green screens.

Well Done

This medium works best for blue screens

Burnt

This works best for blue. Use this mode only for very troublesome shots.

Fringe Gamma

This control can be used to adjust the brightness of the fringe or halo that surrounds the keyed image.

Fringe Size

This expands and contracts the size of the fringe or halo surrounding the keyed image.

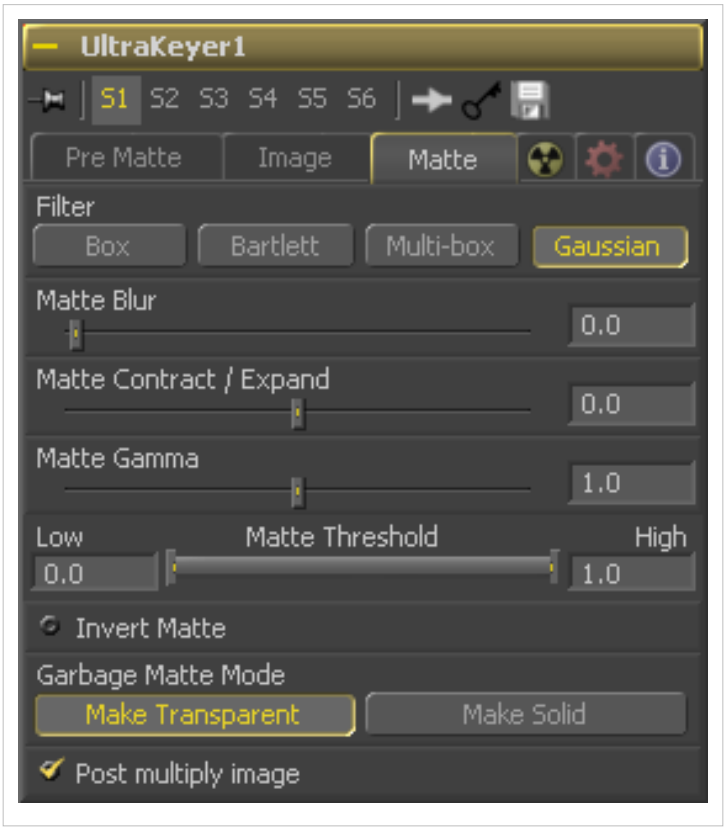
Fringe Shape

Fringe Shape forces the fringe to be pressed toward the external edge of the image or pulled toward the inner edge of the fringe. Its effect is most noticeable while the Fringe Size sliders value is large.

Cyan/Red, Magenta/Green And Yellow/Blue

Use these three controls to color correct the fringe of the image. This is useful for correcting semi-transparent pixels that still contain color from the original background to match the new background.

Matte Tab



Filter

Selection of the Filter that is used when blurring the matte.

Box Blur

This option applies a Box Blur effect to the whole image. This method is faster than the Gaussian blur but produces a lower quality result.

Bartlett

Bartlett applies a more subtle, anti-aliased blur filter.

Multi-Box

Multi-Box uses a box filter layered in multiple passes to approximate a Gaussian shape. With a moderate number of passes (e.g. 4), a high quality blur can be obtained, often faster than the Gaussian filter, and without any ringing.

Gaussian

Gaussian applies a smooth, symmetrical blur filter, using a sophisticated constant-time Gaussian approximation algorithm. In extreme cases, this algorithm may exhibit ringing; see below for a discussion of this. This mode is the default filter method.

Matte Blur

Matte Blur blurs the edge of the matte using a standard constant speed gaussian blur. A value of zero results in a sharp, cutout-like hard edge. The higher the value, the more blur applied to the matte.

Matte Contract/Expand

This slider shrinks or grows the semi-transparent areas of the matte. Values above 0.0 expand the matte while values below 0.0 contract it.

This control is usually used in conjuction with the Matte Blur to take the hard edge of a matte and reduce fringing. Since this control only affects semi-transparent areas, it will have no affect on a hard edge's matte.

Matte Gamma

Matte Gamma raises or lowers the values of the matte in the semi-transparent areas. Higher values cause the gray areas to become more opaque and lower values cause the gray areas to become more transparent. Completely black or white regions of the matte remain unaffected.

Since this control only affects semi-transparent areas it will have no affect on a hard edge's matte.

Matte Threshold

Any value below the lower threshold becomes black or transparent in the matte. Any value above the upper threshold becomes white or opaque in the matte. All values within the range maintain their relative transparency values.

This control is often used to reject salt and pepper noise in the matte.

Invert Matte

When this checkbox is selected, the alpha channel created by the keyer is inverted, causing all transparent areas to be opaque and all opaque areas to be transparent.

Garbage Matte Mode

Garbage mattes are mask tools or images connected to the Garbage Matte input on the tool's tile. The garbage matte is applied directly to the alpha channel of the image. Generally,

garbage mattes are used to remove unwanted elements that cannot be keyed, such as microphones and booms. They are also used to fill in areas that contain the color being keyed, but that the artist wishes to maintain.

Garbage mattes of different modes cannot be mixed within a single tool. A matte control tool is often used after a keyer tool to add a garbage matte with the opposite effect of the matte applied to the keyer.

Make Transparent

Select this button to make the Garbage Matte transparent.

Make Solid

Select this button to make the Garbage Matte solid.

Post Multiply Image

Select this option to cause the keyer to multiply the color channels of the image against the alpha channel it creates for the image. This option is usually enabled, and is on by default.

Deselect this checkbox and the image can no longer be considered pre-multiplied for purposes of merging it with other images. Use the Subtractive option of the Merge tool instead of the Additive option.

For more information, see the Merge tools documentation.

Miscellaneous

Change Depth

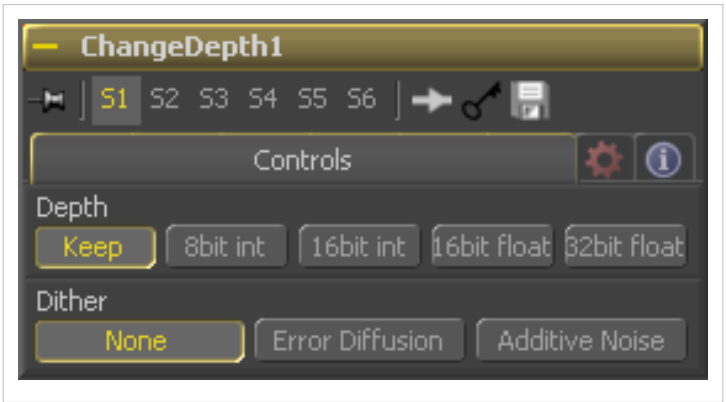
Change Depth [CD]



The Change Depth tool has one simple use; to change the bits per color channel used to process a tool. The single control for this tool is Depth, which contains five buttons. Select Keep to leave the color depth as is, or either 8 bit, 16 bit or Float to change to the selected color depth.

This tool is often used after color correcting Cineon files, converting from Float processing to 16 bit per channel to preserve memory and performance. It can also be useful if from a certain point in your flow you feel the need to process your images in a higher bit depth than their original one or to reduce the bitdepth to save memory.

Controls Tab



Depth

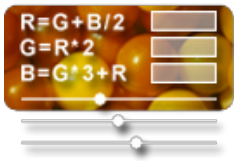
Keep doesn't do anything to the image but rather keeps the input depth. The other options change the bitdepth of the image to the respective value.

Dither

When down converting from higher bit depth it might be useful to add Error Diffusion or additive noise to camouflage artifacts that result from problematic (high contrast) areas.

Custom Tool

Custom [Cu]

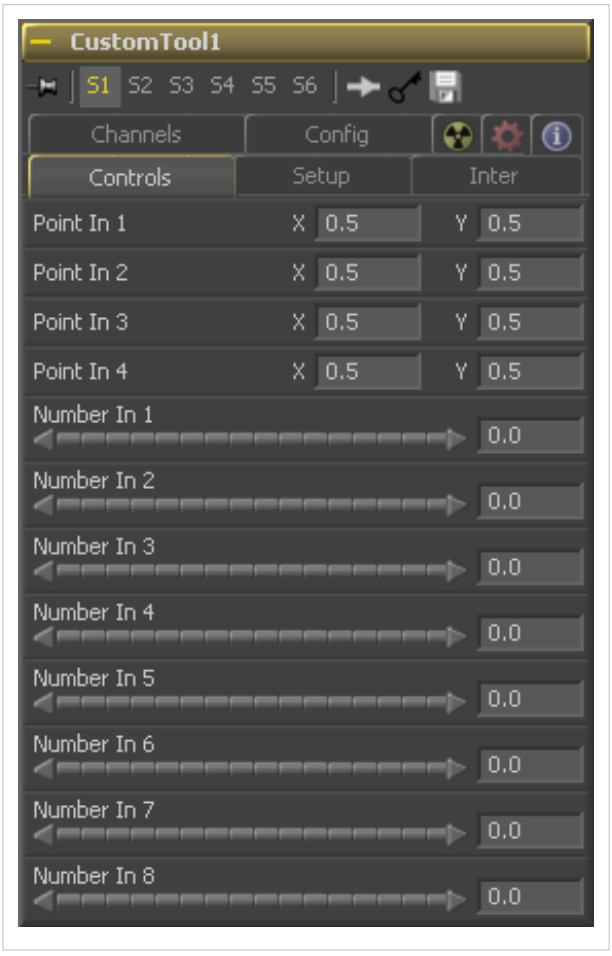


The Custom tool is quite likely the most complex, and the most powerful, tool in Fusion. Any user moderately experienced with scripting, or C++ programming, should find the structure and terminology used by the Custom tool to be familiar.

The Custom tool is used to create custom expressions and filters to modify an image. In addition to providing three image inputs, the Custom tool will allow for the connection of up to eight numeric inputs and as many as four XY position values from other controls and parameters in the flow.

Per-pixel calculations can be performed on the Red, Green, Blue, Alpha, Z, U, V, X Normal, Y Normal and Z Normal channels of the images.

Custom Controls Tab



Point In 1-4, X And Y

These four controls are 2D X and Y center controls that are available to expressions entered in the Setup, Intermediate and Channels tabs as variables p1x, p1y, ..., p4x, p4y. They are

normal positional controls and can be animated or connected to modifiers as any other tool might.

Number In 1-8

The values of these controls are available to expressions entered in the Setup, Intermediate and Channels tabs as variables n1, n2, n3, ..., n8. They are normal slider controls, and can be animated or connected to modifiers exactly as any other tool might.

These controls can be renamed using the options in the Config tab to make their meanings more apparent, but expressions will still see the values as n1, n2, ..., n8.

Custom Setup Tab



Setup 1-4

Up to four separate expressions can be calculated in the Setup tab of the Custom tool. The Setup expressions are evaluated once per frame, before any other calculations are performed. The results are then made available to the other expressions in the Custom tool as variables s1, s2, s3 and s4.

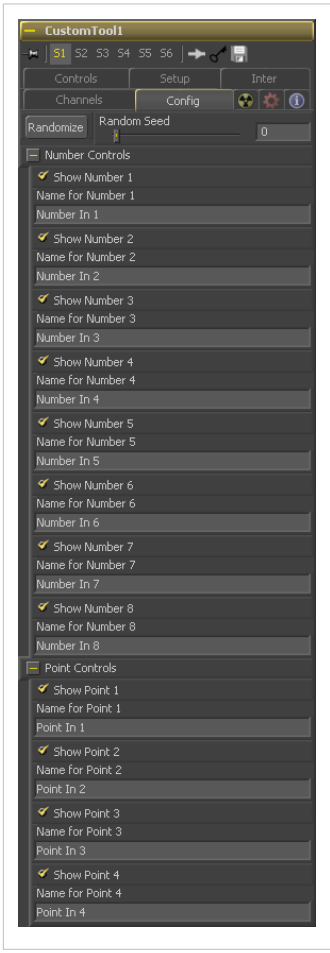
Custom Inter Tab



Intermediate 1-4

An additional four expressions can be calculated in the Inter tab. The Inter expressions are evaluated once per pixel, after the Setup expressions are evaluated but before the Channel expressions are evaluated. Results are available as variables i1, i2, i3 and i4.

Custom Config Tab



The Config tab allows customization of the controls in the Controls tab, simplifying adjustments to the tool. Sliders and point controls can be renamed and hidden. If different types of controls are needed, the UserControls script may be used to add them. The existing sliders can be linked to the new control with expressions, as in this example.

Random Seed

Use this to set the seed for the rand() and rands() functions. Click the Randomize button to set the seed to a random value. This control may be needed if multiple Custom tools are required with different random results for each.

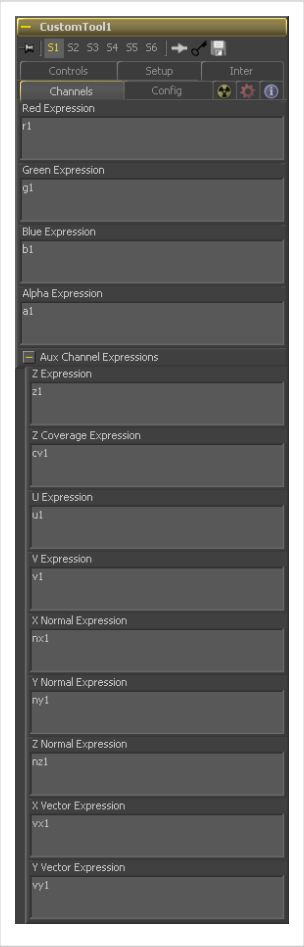
Number Controls

There are eight sets of Number controls, corresponding to the eight Number In sliders in the Controls tab. Untick the Show Number checkbox to hide the corresponding Number In slider, or edit the Name for Number text field to change its name.

Point Controls

There are four sets of Point controls, corresponding to the four Point In controls in the Controls tab. Untick the Show Point checkbox to hide the corresponding Point In control and its crosshair in the Display view. Similarly, edit the Name for Point text field to change the control's name.

Channels Tab



RGBA, Z, UV Expressions And XYZ Normal Expressions

The Channel tab is used to set up one expression per each available channel of the image. Each expression is evaluated once per pixel, and the result is used to create the value for that pixel in the output of the image.

Color Channel expressions (RGBA) should return Floating Point values between 0.0 and 1.0, and all other expression values must produce values between -1.0 and 1.0. The Channel expressions may use the results from both the Setup expressions (as variables s1-s4) and Inter expressions (as variables i1-i4).

Custom Tool Syntax



Value Variables

n1..n8	----	Numeric Inputs
p1x..p4x	----	Position Values (X-axis)
p1y..p4y	----	Position Values (Y-axis)
s1..s4	----	Setup Expression Results
i1..i4	----	Inter Expression Results
time	----	Current Frame
x	----	Horizontal co-ordinate of the current pixel, between 0.0 and 1.0
y	----	Vertical co-ordinate of the current pixel, between 0.0 and 1.0
w (or w1..w3)	----	Width of Image (for image1..image3)
h (or h1..h3)	----	Height of Image (for image1..image3)
ax (or ax1..ax3)	----	Image Aspect X (for image1..image3)
ay (or ay1..ay3)	----	Image Aspect Y (for image1..image3)

{{{1}}}

Channel (Pixel) Variables

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c (or c1..c3)	----	Current Channel (for image1..image3)
r (or r1..r3)	----	Red (for image1..image3)
g (or g1..g3)	----	Green (for image1..image3)
b (or b1..b3)	----	Blue (for image1..image3)
a (or a1..a3)	----	Alpha (for image1..image3)
z	----	Z-Buffer
u	----	U Coordinate
v	----	V Coordinate
nx	----	X Normal
ny	----	Y Normal
nz	----	Z Normal

{{{1}}}

get[ch][#]b(x, y)	----	-e.g. getr1b(0,0)
get[ch][#]d(x, y)	----	-e.g. getr1d(0,0)
get[ch][#]w(x, y)	----	-e.g. getr1w(0,0)

{{{1}}}

getr1b(x,y) output the red value of the pixel at position x, y, if there were a valid pixel present. It would output 0.0, if the position were beyond the boundaries of the image.

getr1d(x,y) output the red value of the pixel at position x, y. If the position specified were outside of the boundaries of the image, the result would be from the outer edge of the image (RGBA only).

getr1w(x,y) output the red value of the pixel at position x, y. If the position specified were outside of the boundaries of the image, the x and y co-ordinates would wrap around to the other side of the image and continue from there. (RGBA only)

To access other channel values with these functions, substitute the r in the above examples with the correct channel variable. (r, g, b, a and, for the getr1b() functions only, z, etc...) as shown above. Substitute the 1 with either 2 or 3 in the above examples to access the images from the other image inputs. .

Mathematical Expressions

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pi	----	The value of pi
e	----	The value of e
log(x)	----	The base-10 log of x
ln(x)	----	The natural (base-e) log of x
sin(x)	----	The sine of x (x is degrees)
cos(x)	----	The cosine of x (x is degrees)
tan(x)	----	The tangent of x (x is degrees)
asin(x)	----	The arcsine of x, in degrees
acos(x)	----	The arccosine of x, in degrees
atan(x)	----	The arctangent of x, in degrees
atan2(x,y)	----	The arctangent of x,y, in degrees
abs(x)	----	The absolute (positive) value of x
int(x)	----	The integer (whole) value of x
frac(x)	----	The fractional value of x
sqrt(x)	----	The Square Root of x
rand(x,y)	----	A random value between x and y
rands(x,y,s)	----	A random value between x and y, based on seed s
min(x,y)	----	The minimum (lowest) of x and y
max(x,y)	----	The maximum (highest) of x and y
dist(x1,y1,x2,y2)	----	The distance between point x1,y2 and x2,y2
dist3d(x1,y1,z1,x2,y2,z2)	----	The distance between 3D points x1,y2,z1 and x2,y2,z2
noise(x)	----	A smoothly varying Perlin noise value based on x
noise2(x, y)	----	A smoothly varying Perlin noise value based on x and y

noise3(x, y, z)	----	A smoothly varying Perlin noise value based on x, y and z
if(c, x, y)	----	returns x if c <> 0, otherwise y

Mathematical Operators

.

!x	----	1.0 if x = 0, otherwise 0.0
-x	----	(0.0 - x)
+x	----	(0.0 + x) i.e. effectively does nothing
x^y	----	x raised to the power of y
x*y	----	x multiplied by y
x/y	----	x divided by y
x%y	----	x modulo y, i.e. remainder of (x divided by y)
x+y	----	x plus y
x-y	----	x minus y
x<y	----	1.0 if x is less than y, otherwise 0.0
x>y	----	1.0 if x is greater than y, otherwise 0.0
{{{1}}}	----	1.0 if x is less than or equal to y, otherwise 0.0
{{{1}}}	----	1.0 if x is greater than or equal to y, otherwise 0.0
{{{1}}}	----	1.0 if x is exactly equal to y, otherwise 0.0
{{{1}}}	----	1.0 if x is exactly equal to y, otherwise 0.0, identical to above
x<>y	----	1.0 if x is not equal to y, otherwise 0.0
{{{1}}}	----	1.0 if x is not equal to y, otherwise 0.0, i.e. identical to above
x & y	----	1.0 if both x and y are not 0.0, otherwise 0.0
x && y	----	1.0 if both x and y are not 0.0, otherwise 0.0, i.e. identical to above
x | y	----	1.0 if either x or y (or both) are not 0.0, otherwise 0.0
x || y	----	1.0 if either x or y (or both) are not 0.0, otherwise 0.0

Example



The following examples are intended to help you understand the various components of the Custom tool.

Rotation

To rotate an image, we need the standard equations for 2D rotation

```
x' = x * cos(theta) - y * sin(theta)
y' = x * sin(theta) + y * cos(theta)
```

Using the n1 slider for the angle theta, and a sample function, we get (for the red channel)

```
getr1b(x * cos(n1) - y * sin(n1), x * sin(n1) + y * cos(n1))
```

This will calculate the current pixel's (x,y) position rotated around the origin at (0,0) (the bottom-left corner), and then fetch the red component from the source pixel at this rotated position. For centred rotation, we need to subtract 0.5 from our x and y coordinates before we rotate them, and add 0.5 back to them afterwards

```
getr1b((x-.5) * cos(n1) - (y-.5) * sin(n1) + .5, (x-.5) * sin(n1) +
(y-.5) * cos(n1) + .5)
```

Which brings us to the next lesson Setup and Intermediate expressions. These are useful for speeding things up by minimising the work that gets done in the channel expressions. The Setup expressions are executed only once, and their results don't change for any pixel, so you can use these for s1 and s2 respectively

```
cos(n1)
sin(n1)
```

Intermediate expressions are executed once for each pixel, so you can use these for i1 and i2

```
(x-.5) * s1 - (y-.5) * s2 + .5
(x-.5) * s2 + (y-.5) * s1 + .5
```

These are the x & y parameters for the getr1b() function, from above, but with the Setup results, s1 and s2, substituted so that the trig functions are executed only once per frame, not every pixel. Now you can use these intermediate results in your channel expressions

```
getr1b(i1, i2)
getg1b(i1, i2)
getb1b(i1, i2)
geta1b(i1, i2)
```

With the Intermediate expressions substituted in, we only have to do all the adds, subtracts and multiplies once per pixel, instead of four times per pixel. As a rule of thumb, if it doesn't change, do it only once.

This is a simple rotation that doesn't take into account image aspect at all. It is left as an exercise to the reader to include this (sorry). Another improvement could be to allow rotation around different points than the center.

Filtering

Our second example duplicates the functionality of a 3x3 Custom Filter tool set to averages the current pixel together with the eight pixels surrounding it. To duplicate it with a Custom tool, add a Custom tool to the Flow, and enter the following expressions into the Setup tab.

(Leave the tool disconnected to prevent it from updating until we are ready.)

S1 1.0/w1

S2 1.0/h1

These two expressions will be evaluated at the beginning of each frame. S1 divides 1.0 by the current width of the frame, and S2 divides 1.0 by the height. This provides a Floating Point value between 0.0 and 1.0 that represents the distance from the current pixel to the next pixel along each axis.

Now enter the following expression into the first text control of the Channel tab (r)

```
(getr1w(x-s1, y-s2) + getr1w(x, y-s2) + getr1w(x+s1, y-s2) +
 getr1w(x+s1, y) + getr1w(x-s1, y) + r1 +
 getr1w(x-s1, y+s2) + getr1w(x, y+s2) + getr1w(x+s1, y+s2)) / 9
```

This expression adds the nine pixels above the current pixel together by calling the getr1w() function nine times and providing it with values relative to the current position. Note that we referred to the pixels by using x+s1, y+s2 rather than using x+1, y+1.

Fusion refers to pixels as Floating Point values between 0.0 and 1.0, which is why we created the expressions we used in the Setup tab. If we had used x+1, y+1 instead, the expression would have sampled the exact same pixel over and over again. (The function we used wraps the pixel position around the image if the offset values are out of range.)

That took care of the red channel, now use the following expressions for the green, blue and alpha channels.

```
(getg1w(x-s1, y-s2) + getg1w(x, y-s2) + getg1w(x+s1, y-s2) +
 getg1w(x+s1, y) + getg1w(x-s1, y) + g1 +
 getg1w(x-s1, y+s2) + getg1w(x, y+s2) + getg1w(x+s1, y+s2)) / 9
```

```
(getb1w(x-s1, y-s2) + getb1w(x, y-s2) + getb1w(x+s1, y-s2) +
 getb1w(x+s1, y) + getb1w(x-s1, y) + b1 +
 getb1w(x-s1, y+s2) + getb1w(x, y+s2) + getb1w(x+s1, y+s2)) / 9
```

```
(geta1w(x-s1, y-s2) + geta1w(x, y-s2) + geta1w(x+s1, y-s2) +
 geta1w(x+s1, y) + geta1w(x-s1, y) + a1 + geta1w(x-s1, y+s2) +
 geta1w(x, y+s2) + geta1w(x+s1, y+s2)) / 9
```

It is time to view the results. Add a Background tool set to solid color and change the color to a pure red. Add a hard edged rectangular Effects Mask and connect it to the expression just created.

For comparison, add a Custom Filter tool and duplicate the settings from the image above. Connect a pipe to this tool from the background to the tool and view the results. Alternate between viewing the Custom tool and the Custom Filter while zoomed in close to the top

corners of the Effects Mask.

Of course, the Custom Filter tool renders a lot faster than the Custom tool we created, but the flexibility of the Custom tool is its primary advantage. For example, you could use an image connected to input 2 to control the median applied to input one by changing all instances of getr1w, getg1w, and getb1w in the expression to getr2w, getg2w, and getb2w, but leaving the r1, g1, and b1's as they are.

This is just one example, the possibilities of the Custom tool are limitless.

Fields

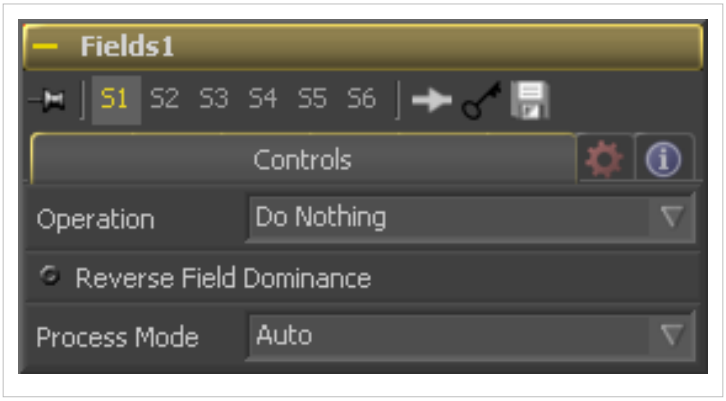
Fields [Fld]



The Fields tool is a robust multi-purpose utility offering several functions related to interlaced video frames. It interpolates separate video fields into video frames, or separates video frames into individual fields. It can be used to assist in the standards conversion of PAL to NTSC, and provides the ability to process fields and frames for specific portions of a flow.

For more information about how Fusion handles fields processing, consult the Frame Formats chapter in this manual.

Controls Tab



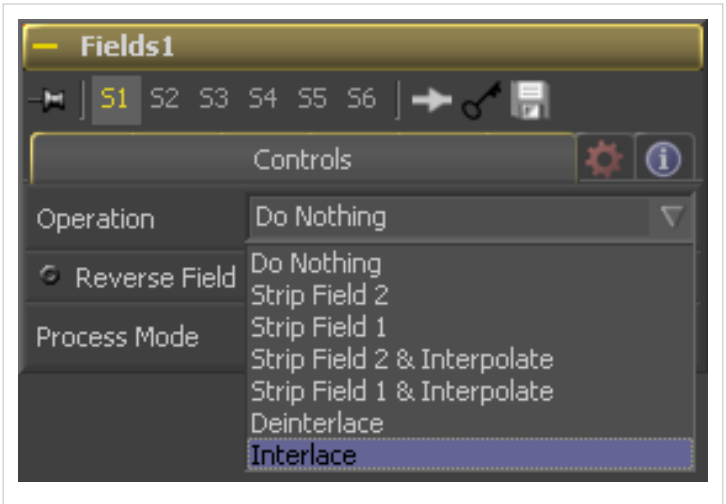
Operation

This control is used to select the type of operation the tool will perform. See below for a closer explanation.

Process Mode

This control is used to select the field's format used for the output image. See below for a closer explanation.

Operation



Do Nothing

This causes the images to be effected by the Process Mode selection exclusively.

Strip Field 2

This removes field 2 from the input image stream, which shortens the image to half of the original height.

Strip Field 1

This removes field 1 from the input image stream, which shortens the image to half of the original height.

Strip Field 2 & Interpolate

This removes field 2 from the input image stream and inserts a field interpolated from field 1 so that image height is maintained. Should be supplied with frames, not fields.

Strip Field 1 & Interpolate

This removes field 1 from the input image stream and inserts a field interpolated from field 2 so that image height is maintained. Should be supplied with frames, not fields.

Interlace

This combines fields from the input image stream(s). If supplied with one image stream, each pair of frames will be combined to form half of the amount of double height frames. If supplied with two image streams, single frames from each stream will be combined to form double height images.

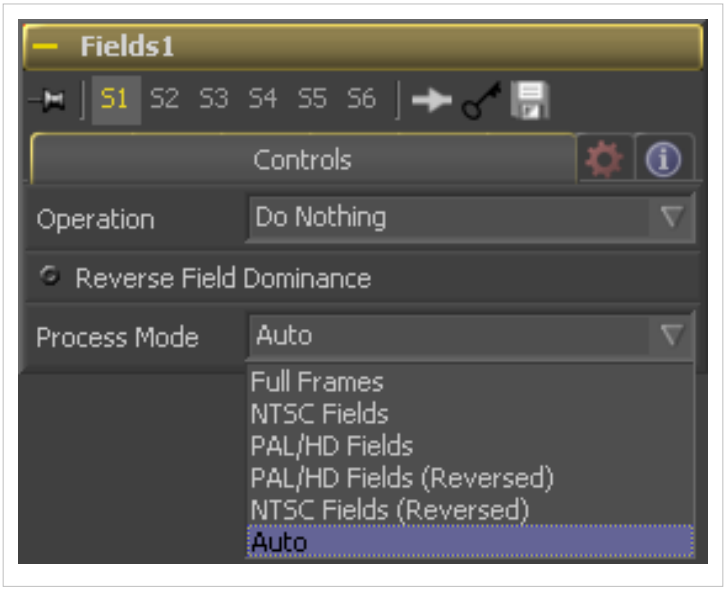
De-Interlace

This separates fields from one input image stream. This will produce double the amount of half height frames.

Reverse Field Dominance

When selected, the Field Order or Dominance of the image will be swapped.

Process



Full Frames

This forces frame processing. Useful for processing frames in a part of a flow that is otherwise field processing.

NTSC Fields

This forces NTSC Field Processing. Useful for processing fields in a part of a flow that is otherwise frame processing.

PAL Fields

This forces PAL Field Processing. Useful for processing fields in a part of a flow that is otherwise frame processing.

PAL Fields (Reversed)

This forces PAL swapped Field Processing.

NTSC Fields (Reversed)

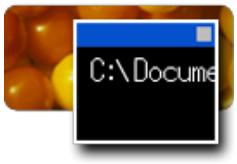
This forces NTSC swapped Field Processing.

Auto

This attempts to match the mode of its input images. Fields is used if the input types are mixed.

RunCommand

Run Command [Run]

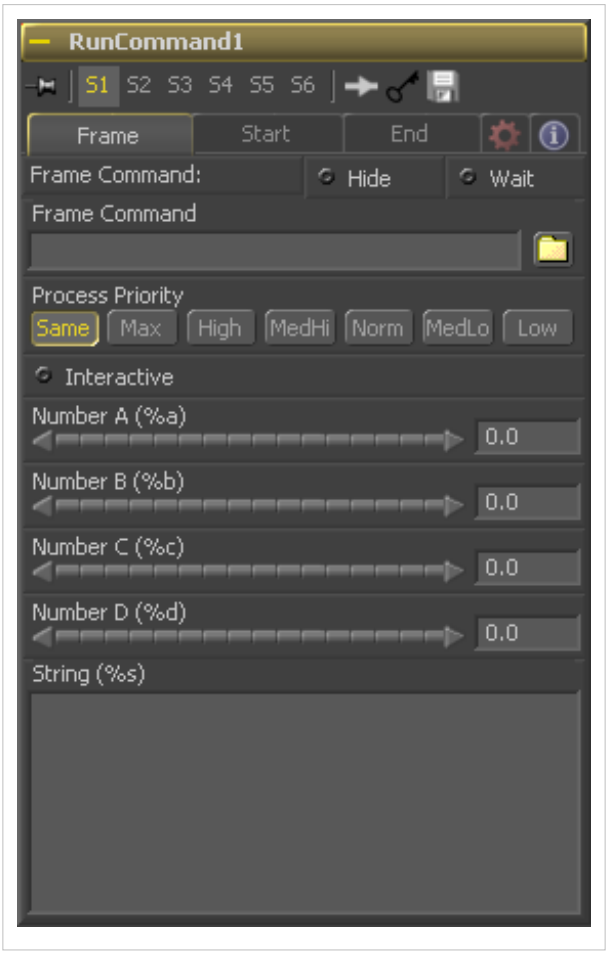


The RunCommand tool is used to execute an external command or batch file at certain points during a render. Choose to run a command once at the start, or at the end of a render, or have the command execute once for each frame.

An image input is not required for this tool to operate. However, if RunCommand is connected to a tool's output, the command will only be launched after that tool has finished rendering. This is often useful when connected to a Saver, to ensure that the output frame has been fully saved to disk first. If the application launched returns a non 0 result, the tool will also fail.

RunCommand can be used to net render other command line applications using the Fusion render manager, as well as a host of other useful functions.

Controls Tab



Frame Command

The first file browser in the tool is used to specify the path and parameters for the command to be run after each frame is rendered. Select the Hide checkbox to prevent the application or

script from displaying a window when it is executed.

Hide

Select this checkbox to suppress the display of any window or dialog started by the command.

Wait

Enable this checkbox to cause the tool to Wait for the remote application or tool to exit before continuing. If this checkbox is cleared, the system will continue rendering without waiting for the external application.

Number A (%B) And Number B (%B)

Various wildcards can be used with the frame commands, these wildcards will be substituted at render time with the correct values.

%a

outputs the number from the Number A thumbwheel control.

%b

outputs the number from the Number B thumbwheel control.

%t

outputs the current frame number (without zero padding).

%s

substituted with the text from the large text entry field.

If you want to add zero padding to the numbers generated by %t, refer to the wildcard with %0x where x is the number of characters with which to pad the value. This also works for %a and %b.

For example, test%04t.tga would return the following values at render time

```
test0000.tga
test0001.tga
test0009.tga
test0010.tga
```

You may also pad a value with spaces by calling the wildcard as %x, where x is the number of spaces with which you would like to pad the value.

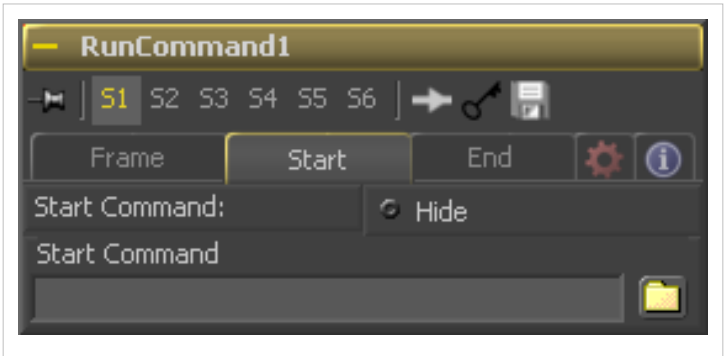
Process Priority

The Process Priority buttons provide options for selecting the priority at which the launched process runs. This determines how much processor time the launched process receives compared to other applications.

Interactive

This checkbox determines whether the launched application should run interactively, allowing user input.

RunCommand Start and End Tabs



The start and end tabs contain a file browser for a command to be run when the composition starts to render, and when the composition is done rendering.

Example



To copy the saved files from a render to another directory as each frame is rendered, save the following text in a file called copyfile.bat to your C\ directory (the root folder).

```
@echo off
set parm=%1 %2
copy %1 %2
set parm=
```

Create or load any flow that contains a Saver. The following example assumes a Saver is set to output D\ test0000.tga, test0001.tga etc. You may have to modify the example to match.

Add a RunCommand tool after the Saver, to ensure the Saver has finished saving first. Now enter the following text into the RunCommand tool's Frame Command text box

```
C\copytest.bat D\test%04f.tga C\
```

Select the Hide frame command check box to prevent the command prompt window from appearing briefly after every frame.

When this flow is rendered, each file will be immediately copied to the C\ directory as it is rendered.

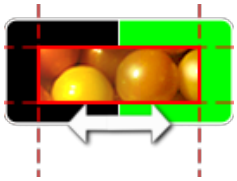
The RunCommand tool could be used to FTP the files to a remote drive or Abekas device on the network, to print out each frame as it is rendered, or to execute a custom image processing

tool.

The RunCommand tool is not restricted to executing simple batch files. eyeonScript, VBScript, Jscript, CGI, and Perl files could also be used, as just a few examples.

Set Bg Color

Set BG Color [SBg]



Set BG Color is used to set the color on the outside region of a DOD. By default the color used by DOD is Black / no Alpha.

Controls Tab

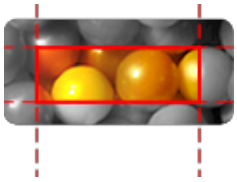


Color Picker

Use these controls to adjust the Color and the Alpha-value for the DOD's Background.

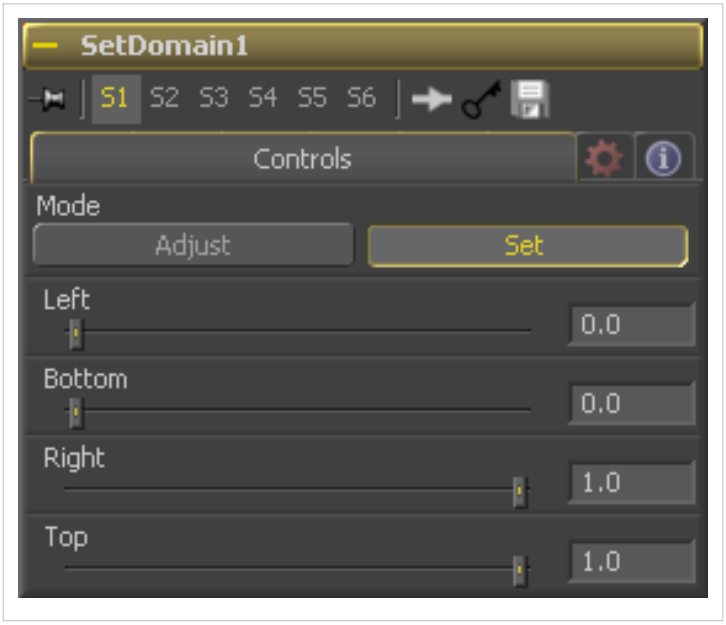
Set Domain

Set Domain [DOD]



Set Domain is used to adjust or set the active area of an image, or in other words the area of the image considered to have valid data. It does not change the image's physical dimensions. Anything outside the DoD will not be processed by downstream tools, thus speeding up rendering of computational intensive tools. Alternatively it can be used to expand the processed area back to the full dimensions of the image.

Controls Tab /Set Mode



Set Mode defaults to the full extend of the visible image.

Left

Defines the left border of the DOD. Higher values on this slider move the left border towards the right, excluding more data from the left margin. 1 represents the right border of the image, 0 represents the left border. The slider defaults to 0. (Left Border)

Bottom

Defines the bottom border of the DOD. Higher values on this slider move the bottom border towards the top, excluding more data from the bottom margin. 1 represents the Top border of the image, 0 represents the bottom border. The slider defaults to 0. (Bottom Border)

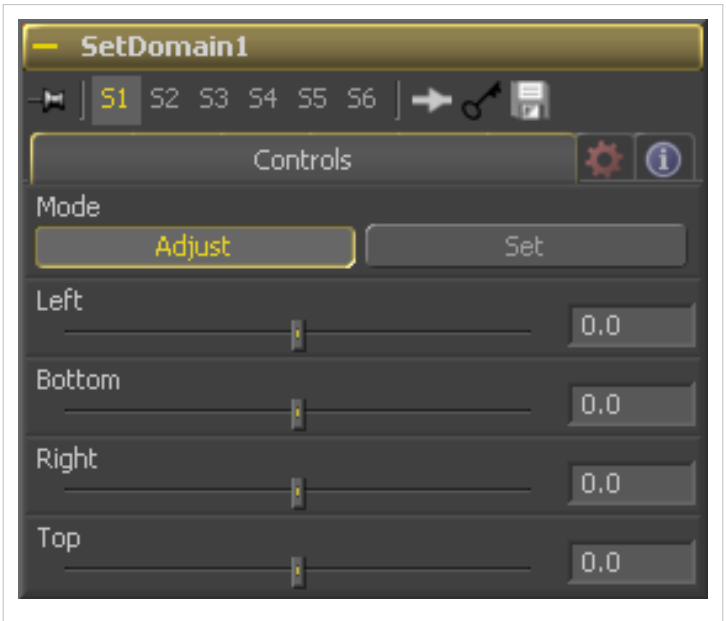
Right

Defines the right border of the DOD. Higher values on this slider move the right border towards the left, excluding more data from the right margin. 1 represents the right border of the image, 0 represents the left border. The slider defaults to 1. (Right Border)

Top

Defines the top border of the DOD. Higher values on this slider move the top border towards the bottom, excluding more data from the top margin. 1 represents the top border of the image, 0 represents the bottom border. The slider defaults to 1. (Top Border)

Controls Tab /Adjust Mode



In Adjust Mode basically the same operations can be carried out like in Set Mode. All Sliders default to 0 though, marking their respective full extend of the image. Positive values shrink the DOD while negative values expand the DOD to include more data.

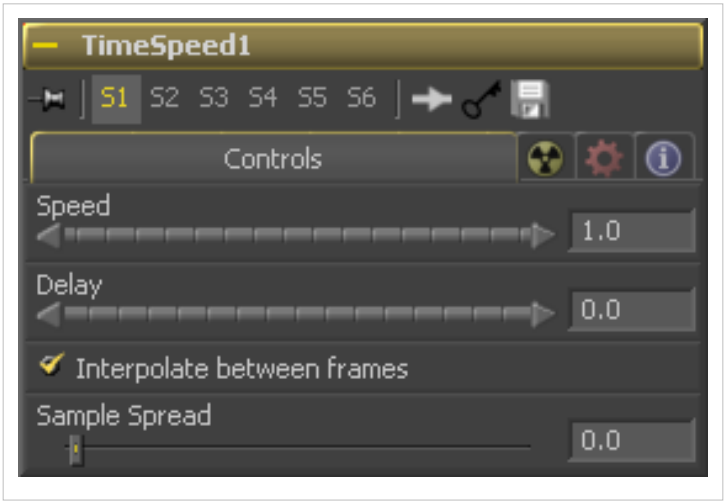
Time Speed

Time Speed [TSp]



Time Speed allows image sequences to be sped up, slowed down, reversed or delayed. Image Interpolation offers smooth, high quality results. Time Speed should be used for static speed changes, or to introduce delays in the footage. To apply animated changes in time, such accelerating or deccelerating time, use a Time Stretcher instead.

Controls Tab



Speed

This control is used to adjust the Speed, in percentage values, of the outgoing image sequence. Negative values reverse the image sequence. 200% Speed is represented by a value of 2.0, 100% is 1.0, 50% is 0.5 and 10% is 0.1.

The Speed control cannot be animated.

Delay

Use this control to Delay the outgoing image sequence by the specified number of frames. Negative numbers will offset time back and positive numbers will advance.

Interpolate Between Frames

When checked, frames before and after the current frame will be Interpolated to create new frames. This usually offers smoother and cleaner results. When cleared, no interpolation will take place.

Sample Spread

This slider controls the strength of the interpolated frames on the current frame. A value of 0.5 causes 50% of the frame before and 50% of the frame ahead of the current frame to be blended with 0% of the current frame.

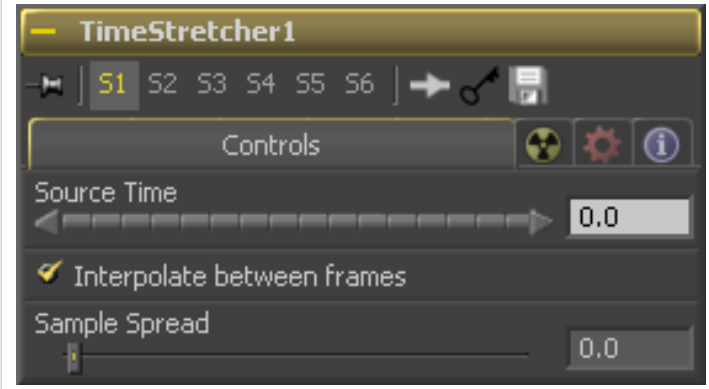
Time Stretcher

Time Stretcher [TSt]



The Time Stretcher tool is similar to the Time Speed tool, but it permits the speed of the clip to be animated over the course of the effect. Full spline control of the effect is provided, including smoothing. As a result, the Time Stretcher can be used to animate a single clip to 200%, back to normal speed, pause for a second, and then play backwards (like a VCR rewinding).

Controls Tab



Source Time

This control designates from which frame in the original sequence to begin sampling.

When a Time Stretcher tool is added to the flow, the Source Time control already contains a Bezier spline with a single keyframe set to 0.0. The position of the keyframe is determined by the current time when the tool is added to the flow.

(The Source Time spline may not be immediately visible until Edit is selected from the Source Time's context menu, or display all splines from the spline window's context menu.)

Interpolate Between Frames

This toggles whether the Time Stretcher will interpolate between the next and previous frames.

Sample Spread

This determines the strength of the interpolated frames on the current frame. A value of 0.5 causes 50% of the frame before and 50% of the frame ahead of the current frame to be blended with 0% of the current frame. A value of 0.25 would blend 25% of the previous and next frames with 50% of the current frame. Set this control over 0.25 only in extreme cases.

Example



Make certain that the current time is either the first or last frame of the clip to be affected in the project. Add the Time Stretcher tool to the flow. This will create a single point on the Source Time spline at the current frame. The value of the source time will be set to zero for the entire Global Range.

Set the value of the Source time to the frame number to be displayed from the original source, at the frame in time it is to be displayed in during the project.

To shrink a 100-frame sequence to 25 frames, follow these steps

- Change the Current Time to frame 0.
- Change the Source Time control to 0.0.
- Advance to frame 24.
- Change the Source Time to 99.
- Check that the spline result is linear.
- Fusion will render 25 frames by interpolating down the 100 frames to a length of 25.
- Hold the last frame for 30 frames, then play the clip backward at regular speed. Continue the example from above and follow the steps below.
- Advance to frame 129.
- Right-click on the Source Time control and select Set Key from the menu.
- Advance to frame 229 (129 + 100).
- Set the Source time to 0.0.

Modifiers

B-Spline

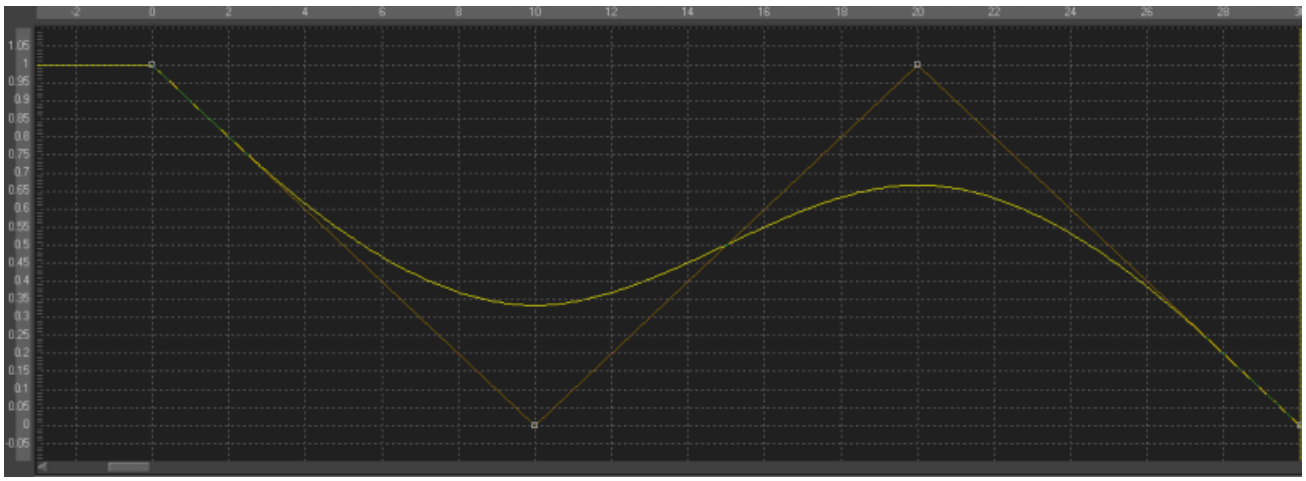
B-Spline [-/-]



The B-Spline is one of the animation modifiers in Fusion and normally is applied to numerical values rather than point values. It can be applied by *right clicking* on a numerical control and selecting "Modify with -> B-Spline".

Usage

Being an animation spline this modifier has no actual controls tab. However its effect can be seen and influenced in the Spline editor.



Notice that, though the actual value of the second keyframe is 0, the value of the resulting spline is 0.33 due to the unique smoothing and weighing algorhythms of a BSpline. The weight can be modified by *left clicking* on the keyframe to select it, holding down *w* as well as the left mouse button and moving the mouse to the left to lower the tension and to the right to increase the tension. This also can be done with multiple selected keyframes simultaneously.

BezierSpline

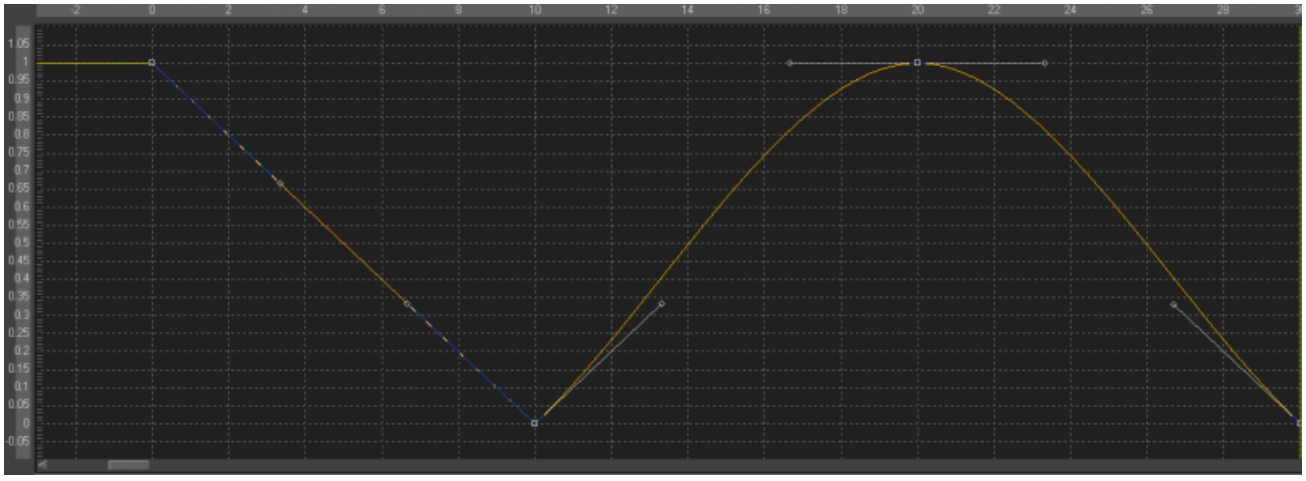
Bezier Spline [-/-]



The BezierSpline is one of the animation modifiers in Fusion and normally is applied to numerical values rather than point values. It is applied by default each time you *right clicking* on a numerical control and select "Animate" It can also be applied by *right clicking* on a numerical control and selecting "Modify with -> Bezier Spline".

Usage

Being an animation spline this modifier has no actual controls tab. However it's effect can be seen and influenced in the Spline editor.



The Bezier Spline offer individual control over each point's smoothness by means of handles. The smoothness can be applied by multiple ways. To make the keys smooth select them and press *Shift-S*. The handles can then be used to further modify the behaviour of in and out.

To make the keys linear select them and press *Shift-L*.

These operations can also be performed using the context menu. Select the keyframe(s), *right click* and select "Smooth" or "Linear". The menu also allows to apply smoothing using a Savitzky-Golay filter. Select the keyframe(s), *right click* and select "Smooth Points -Y Dialog".

Ease In/Out can also be modified by using control slider. Select the keyframe you want to modify, *right click* and select "Ease In / Out..." from the context menu. Then used the sliders to individually control the Ease In/Out numerically.



Calculation

Calculation [-/-]



Calculations are used to create indirect connections between value controls. A calculation can perform a mathematical expression based on two operands, where each operand can be connected to another control or set manually by the user.

Additionally, the calculation control can access the values of a connected control at times other than the current time, using time offsets and time scale controls built into the Calculation Modifier.

The most common use for a calculation is when two controls need to be connected to each other but the range or scope of the value's output by one control are inappropriate for the other control.

Note that the Expression modifier is essentially a more flexible version of the Calculation modifier, with a single exception. It is far easier to manipulate the timing of the operands provided to a Calculation than it is to do so with a Expression.

Calc Tab



First and Second Operand

These sliders are either connected to published or animated controls from other tools in the composition, or manually set to the desired values for the calculation.

Operator

Select from the mathematical operations listed in this menu to determine how the two operands are combined. Clicking on the down arrow opens the menu with the following options:

Time Tab



First and Second Operand Time Scale

These sliders cause the frame used to read the values of the Operands specified in the Calc tab to be scaled. A value of 1 returns the value of the operand at frame x when the composition is set to frame x. For example, if the first operand is animated with a value of 1 to 10 from frame 0 to 10, then a scale of 0.5 would cause the calculation to return a value of 5 at frame 10 (effectively slowing the animation by half for the purposes of the calculation)

First Operand and Second Operand Time Offset

These sliders return the value of the Operand at the Time Offset specified. A value of 10 would return the value of the operand 10 frames forward in time and -10 would return the value of the operand 10 frames back in time. See the example below for a practical example.

Example



The following example uses a calculation to apply blur to a text in inverse proportion to the size of the text.

- Create a new composition, and set the global start and render start to 1. Set the Global End and Render End to 100.
- Add a Text Plus tool to the composition
- Enter a small amount of text in the StyledText input.
- Make sure the current frame is 0
- Set the Size parameter of the text tool to a value of 0.06 at frame 0
- Right click on the Size slider and animate the slider by setting a key.
- Advance to frame 100 and set the value of the Size control to 0.50.
- Add a Blur tool immediately after the Text tool. Connect the Blur input to the text tools output.
- View the Blur tool in one of the display views.
- We want the blur to decrease in strength as the text gets bigger. The controls cannot be directly connected together because the values of the Text Size control are getting bigger instead of smaller.
- Right-click on the Blur size and select Modify With>Calculation from the context menu. A new set of controls will appear in the Modifiers tab while the Blur tool is selected.
- Switch to the Modifier tab (F11)
- Right-click on the First Operand slider. Select Connect To > Text 1 > Size from the context menu. This connection isn't very useful though - the maximum value of the blur size control is 0.5, which is hardly noticable as a blur.
- Set the Operator drop down menu to Multiply.
- Set the Second Operand slider to 100
- Switch to the Time tab of the modifier and set the First Operand Time Scale to -1.0. Normally the First Operand will get the value of the control it is connected to from the same frame as the current time. So at frame 10, the firt operand will be set to the same value as the Text size at frame 10. By setting this value to -1, the value is read from one frame back in time whenever the current time of the composition advances by 1 frame.
- However, this means that the Calculation would be reading the value of the Text size at frame -10 when we are at frame 10 in the composition. To correct for this, set the First Operand Time Offset slider to 100.
- Return to the Tools tab of the Tool Control Area (F9). Press play (spacebar) and watch how the value of the Blur Size relates to the value of the Text Size.

Character Level Styling

Character Level Styling [-/-]

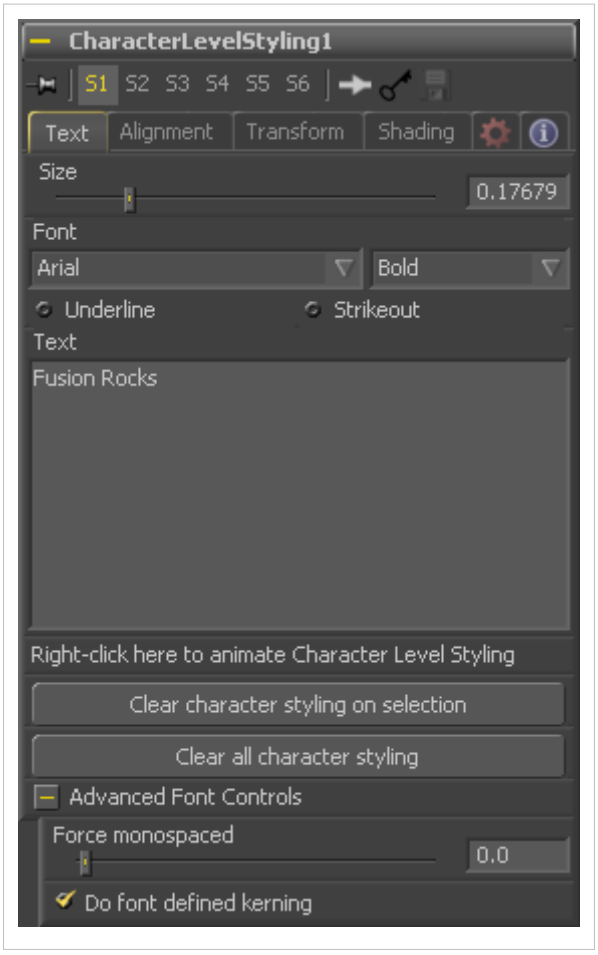


The Character Level Styling modifier only works on Text+ tools. You can then select individual characters directly in your view and apply different text attributes to them. Think of larger capitals at the beginning of each line, different fonts in one word, colored highlighting and more.

It can be applied by *right clicking* into the Styled Text field of a Text+ tool and selecting **Character Level Styling**.

Character Level Styling can only be directly applied to Text+ tools, not to Text 3D tools. However, styled text from a Text+ tool can be applied to a Text 3D tool by means of copying the Text+, *right clicking* on the Text 3D and choosing **Paste Settings**.

Text Tab



Text controls, Alignment, Transform and Shading Tab

Please have a look at the Text+ tool documentation.

Clear Character Styling on Selection

All changes made to the currently selected Characters will be reset

Clear all character styling

All character attributes will be reset to their original values.

Circle

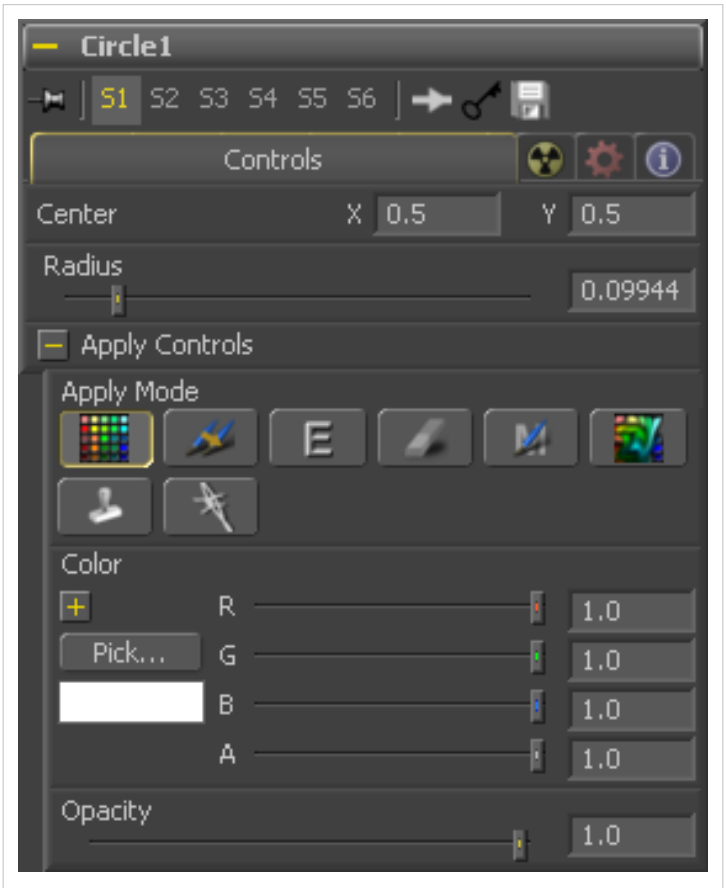
Circle [-/-]



The Circle only works on Paint tools. Creates a circular shape with animatable control over radius and center.

It can be applied by clicking on "Circle" in the Paint tool's stroke menu.

Controls



Center

The Center of the circle.

Radius

The Radius of the circle.

Apply Mode

Please see the Apply Controls of the Paint tool

Color

The Color of the circle.

Opacity

The Opacity of the circle.

CloneMultistroke

CloneMultistroke [-/-]

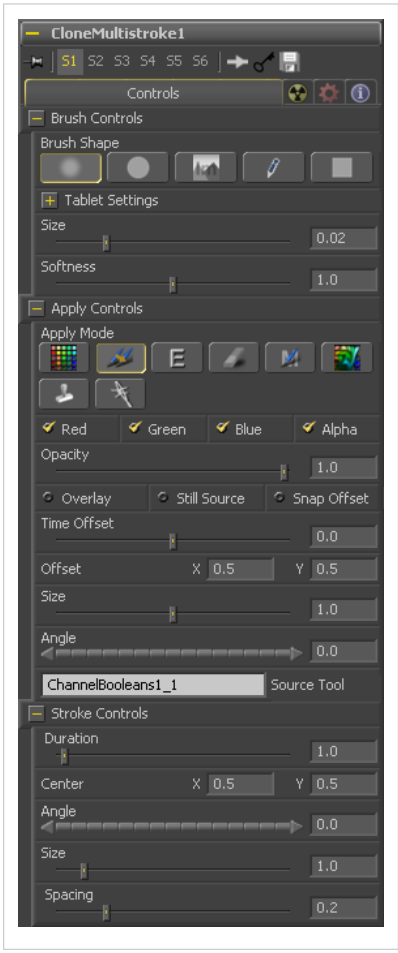


The CloneMultistroke is pretty much like the normal Multistroke, but specifically meant to clone areas from one image to the other. In addition to the Multistroke it has a Source Tool input, described further down. Perfect for those 100-strokes-per-frame retouching paint jobs like removing tracking-markers e.g. Much faster than the Stroke, but not editable later on.

It can be applied by clicking on the 

CloneMultistroke button in the Paint tool's stroke menu.

Controls Tab



Not all of the controls described here appear in all modes. Certain controls are only useful in a specific paint mode and are hidden when they are not applicable. Additionally, several of the controls are considered to be self-explanatory; the purpose of a center control, angle or size control should be relatively straightforward to determine.

To reduce complexity, these controls are not all described. For further details on the functionality of the Controls Tab, please see the Working With Paint Strokes - Animating Strokes section in this chapter.

Brush Controls

Brush Shape

Soft Brush

The Soft Brush type is a circular brush with soft edges. Modify the size of the brush in the display view by holding Ctrl down while dragging the mouse.

Circular Brush

A Circular Brush is a brush shape with hard edges. Resize this brush interactively.

Image Brush

The Image Brush allows images from any tool in the flow, or from a file system, to be used as a brush. See Creating Custom Brushes later in this chapter.

Single Pixel Brush

The Single Pixel Brush is perfect for fine detail work, creating a brush exactly one pixel in size. No anti-aliasing is applied to the single pixel brush.

Square Brush

A Square Brush is a brush shape with hard edges.

Vary Size

Constant

The brush will be a constant size over the stroke.

With Pressure

The stroke size will vary with the actual applied pressure.

With Velocity

The stroke size will vary with the speed of painting. The faster the stroke, the thinner it is.

Vary Opacity

Constant

The Constant brush will be a constant transparency over the entire stroke.

With Pressure

The stroke transparency will vary with the applied Pressure.

With Velocity

The stroke transparency will vary with the speed of painting. The faster the stroke, the more transparent it is.

Softness

Use this control to increase or decrease the Softness of a soft brush.

Image Source

When using the Image Source brush type, select between three possible sources brush images.

Tool

The image source is derived from the output of a tool on the flow. Drag the tool into the source Tool input to set the source.

Clip

The image source is derived from an image or sequence on disk. Any file supported by Fusion's loader can be used. Locate the file using the filename Clip browser that appears to set the clip used as a source.

Brush

Images stored in the Fusion>Brushes directory are used as a brush for the paint tool. Select the brush from a the menu that appears.

Apply Controls

Apply Mode

Color

The Color apply mode paints simple colored strokes on the screen. When used in conjunction with an image brush, it can also be used to tint the brush.

Clone

The Clone apply mode copies portions of one image into another image, or to clones from the same image using adjustable positions and time offsets. Any image from the flow can be used as the source image.

Emboss

The Emboss apply mode embosses the portions of the image covered by the brush stroke.

Erase

Erase reveals the underlying image through all other strokes, effectively erasing portions of the strokes beneath it with out actually destroying the strokes.

Merge

This apply mode effectively Merges the brush onto the image. This mode behaves in much the same way as the color apply mode but has no color controls. It is best suited for use with the image brush type.

Smear

Smear the image using the direction and strength of the brush stroke as a guide.

Stamp

Stamp the brush onto the image, completely ignoring any alpha channel or transparency information. This mode is best suited for applying decals to the target image.

Wire

This Wire removal mode is used to remove wires, rigging and other small elements in the frame by sampling adjacent pixels and drawing them in toward the stroke.

Source Tool

Shows which tool's image output is used to clone from.

Stroke Controls

Size

This control adjusts the Size of the brush when the brush type is set to either soft brush or circle. The diameter of the brush is drawn in the display view as a small circle surrounding the mouse pointer. The size can also be adjusted interactively in the display view by holding the Ctrl key while click-dragging the mouse pointer.

Spacing

The Spacing slider determines the distance between blats (samples used to draw a straight line along the underlying vector shape that composes a stroke or polyline stroke). Increasing the value of this slider increases the density of the stroke, whereas decreasing the value is likely to cause the stroke to assume the appearance of a dotted line.

Stroke Animation

The Stroke Animation menu control provides several pre-built animation effects that can be applied to a paint stroke. This menu only appears for Vector strokes.

All Frames

This default displays the stroke for All Frames of the project where a valid target image is available to the paint tool.

Limited Duration

This exists on the number of frames specified by the Duration slider.

Write On

When Write On is selected, an animation spline will be added to the paint stroke that precisely duplicates the timing of the paint stroke's creation. The stroke will be written on the image exactly as it was drawn. To adjust the timing of the write on effect, switch to the spline editor and use the timestretcher mode to adjust the overall length of the animation spline. To smooth or manually adjust the motion, try reducing the points in the animation spline.

Write Off

Write Off will perform the reverse of write on, drawing the stroke starting from the end and working backward to the start of the stroke.

Write On Then Off

This mode will apply a Write On and then a Write Off animation mode to the stroke.

Trail

Selecting the Trail mode will cause both the start and end points of the stroke to be animated simultaneously, offset from each other by the amount specified in the duration control. This has the effect of creating a segment of the stroke that follows the stroke as if it were a path. As with the write on and off effects, this will start at the frame that is current when the animation mode is selected. The timing of the animation can be adjusted manually using the spline or timeline editors.

Duration

Duration sets the duration of each stroke in frames. This control is only present for Multistrokes or when the stroke animation mode is set to Limited Duration. It is most commonly employed for frame-by-frame rotoscoping through a scene.

Note

Each Vector stroke applied to a scene will have a duration in the timeline that can be trimmed independently from one stroke to the next. The duration can be set to 0.5, which will allow each stroke to last for a single field only when the flow is processing in fields mode.

Write On And Write Off

This range slider appears when the Stroke Animation is set to one of the Write On and Write Off methods. The range represents the beginning and end points of the stroke. Drag the low value upward to give the impression that the stroke is being erased, or drag the high value from 0.0 to 1.0 to give the impression that the stroke is being drawn on the screen. This control can be animated to good effect. It works most effectively when automatically animated through the use of the Write On, Write Off modes of the stroke animation menu.

Make Editable

This button only appears for Vector strokes.. Clicking on 'Make Editable' turns the current stroke into a polyline spline so that the shape can be adjusted or animated.

CompName

Comp Name [-/-]



The Comp Name only works on Text+ tools. It sets the Styled text to become the current Composition Name. This is quite useful to automate burn-ins for daily renderings.

See also the TimeCode modifier.

It can be applied by *right clicking* into the Styled text fiel of a Text+ tool and selecting

Comp Name

.

Controls



This modifier has no controls

Please have a look at the Text+ tool documentation.

CopyEllipse

Copy Ellipse [-/-]

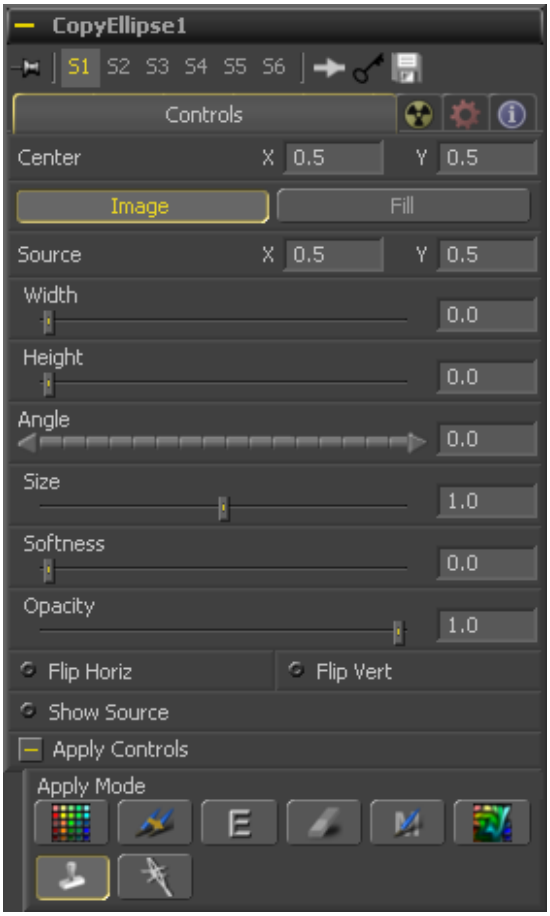


The Copy Ellipse only works on Paint tools. It creates an elliptical shape to clone elements from one area of the image to the other.

It can be applied by clicking on the 

Copy Ellipse button in the Paint tool's stroke menu.

Controls



Center X Y

The Center of the Ellipse. Move this control to determine where the content will be copied to.

Image

The Source will be used to copy content to the destination.

Fill

The Fill color will be used to create a plain fill on the destination.

Source Center X Y

The Center of the Source Ellipse. Move this control to determine where the content will be copied from. Activate "Show Source" to see the on screen controls.

Width / Height Sliders

The Width and Height of the ellipse. This can also be modified with the on screen controls

Angle

The Rotation of the ellipse. This can also be modified with the on screen controls

Size

The overall Size of the ellipse. This is a multiplier to the Width and Height settings.

Softness

The Softness of the edge of the ellipse.

Opacity

The overall opacity of the output.

Flip Horiz / Flip Vert

The area inside the ellipse will be flipped horizontally and/or vertically.

Show Source

Show the on screen controls to adjust the position of the source Ellipse.

Apply Mode

Please see the Apply Controls of the Paint tool

CopyPolyLine

Copy Polyline [-/-]



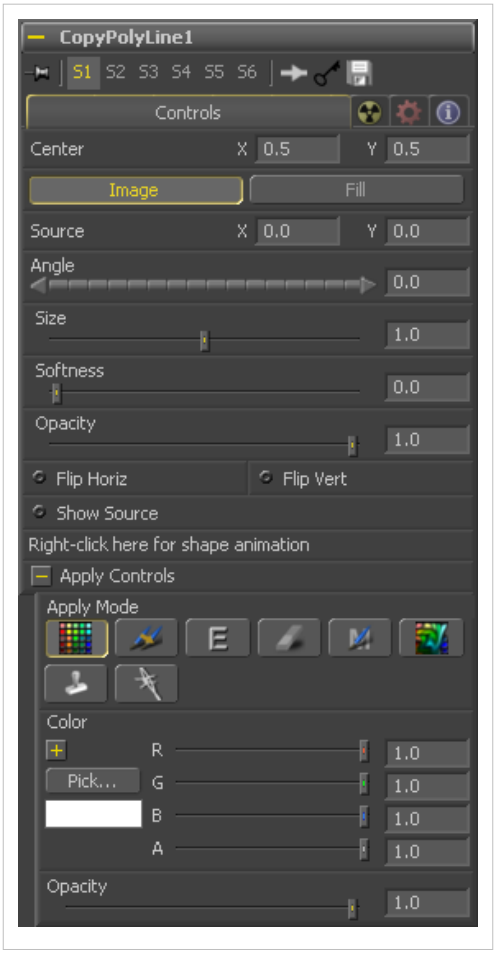
The Copy Polyline only works on Paint tools. It creates a user definable Polyline to clone elements from one area of the image to the other.

See the Polylines_and_Rotoscoping chapter of this manual.

It can be applied by clicking on the 

Copy Polyline button in the Paint tool's stroke menu.

Controls



Center X Y

The Center of the Polyline. Move this control to determine where the content will be copied to.

Image

The Source will be used to copy content to the destination.

Fill

The Fill color will be used to create a plain fill on the destination.

Source Center X Y

The Center of the Source Polyline. Move this control to determine where the content will be copied from. Activate "Show Source" to see the on screen controls.

Width / Height Sliders

The Width and Height of the Polyline. This can also be modified with the on screen controls

Angle

The Rotation of the Polyline. This can also be modified with the on screen controls

Size

The overall Size of the Polyline. This is a multiplier to the Width and Height settings.

Softness

The Softness of the edge of the Polyline.

Opacity

The overall opacity of the output.

Flip Horiz / Flip Vert

The area inside the Polyline will be flipped horizontally and/or vertically.

Show Source

Show the on screen controls to adjust the position of the source Polyline.

Apply Mode

Please see the Apply Controls of the Paint tool

CopyRectangle

Copy Rectangle [-/-]

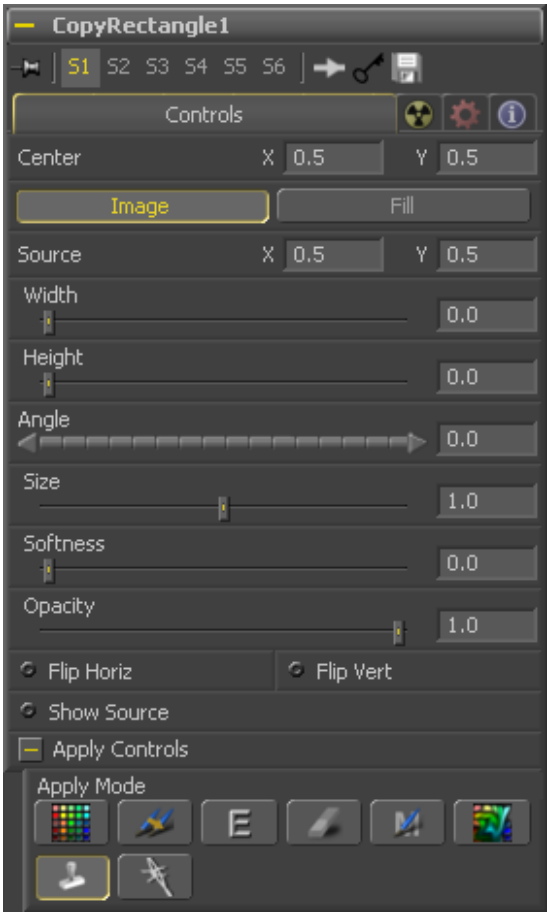


The Copy Rectangle only works on Paint tools. It creates a user definable Rectangle to clone elements from one area of the image to the other.

It can be applied by clicking on the 

Copy Rectangle button in the Paint tool's stroke menu.

Controls



Center X Y

The Center of the Rectangle. Move this control to determine where the content will be copied to.

Image

The Source will be used to copy content to the destination.

Fill

The Fill color will be used to create a plain fill on the destination.

Source Center X Y

The Center of the Source Rectalangel. Move this control to determine where the content will be copied from. Activate "Show Source" to see the on screen controls.

Width / Height Sliders

The Width and Height of the Rectangle. This can also be modified with the on screen controls

Angle

The Rotation of the Rectangle. This can also be modified with the on screen controls

Size

The overall Size of the Rectangle. This is a multiplier to the Width and Height settings.

Softness

The Softness of the edge of the Rectangle.

Opacity

The overall opacity of the output.

Flip Horiz / Flip Vert

The area inside the Rectangle will be flipped horizontally and/or vertically.

Show Source

Show the on screen controls to adjust the position of the source Rectangle.

Apply Mode

Please see the Apply Controls of the Paint tool

Cubic Spline

Cubic Spline [-/-]



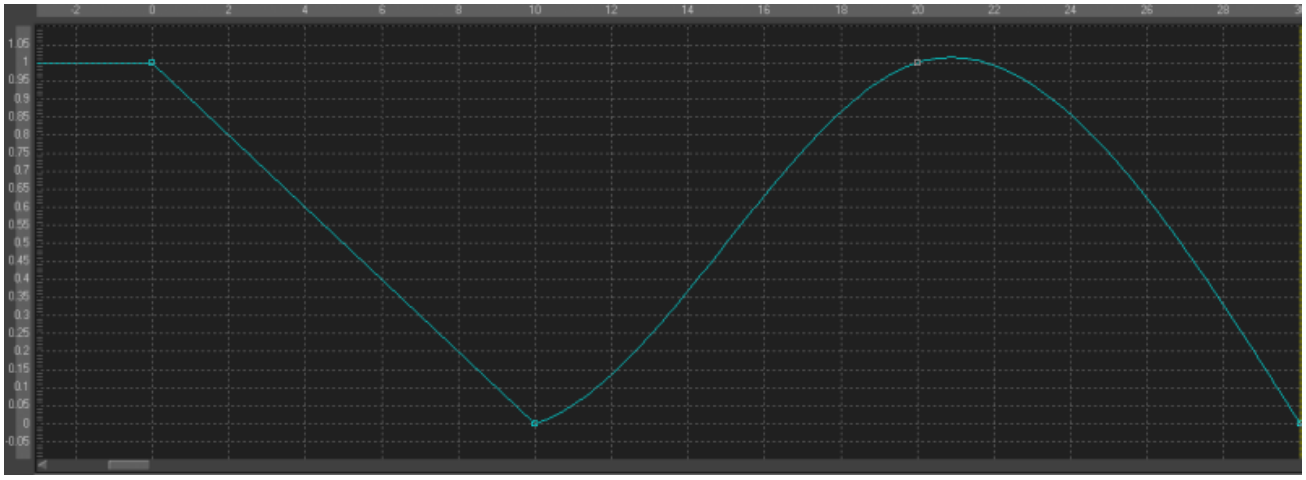
The Cubic Spline is one of the animation modifiers in Fusion and normally is applied to numerical values rather than point values. It can be applied by *right clicking* on a numerical control and selecting

Modify with -> Natural Cubic Spline

.

Usage

Being an animation spline this modifier has no actual controls tab. However it's effect can be seen and influenced in the Spline editor.



Expression

Expression [-/-]



Adding an Expression modifier to a control will add the ability to control and manipulate either position or value controls based on any number of controls, either positional or value-based. This modifier offers exceptional flexibility compared to the more limited ../Calculation/ or Offset modifiers, but it is unable to access values from frames other than the current time.

An Expression will accept up to nine value inputs and nine position inputs that are used as part of a user-defined mathematical expression to output a value.

To add an Expression to a control, right-click on the control and choose

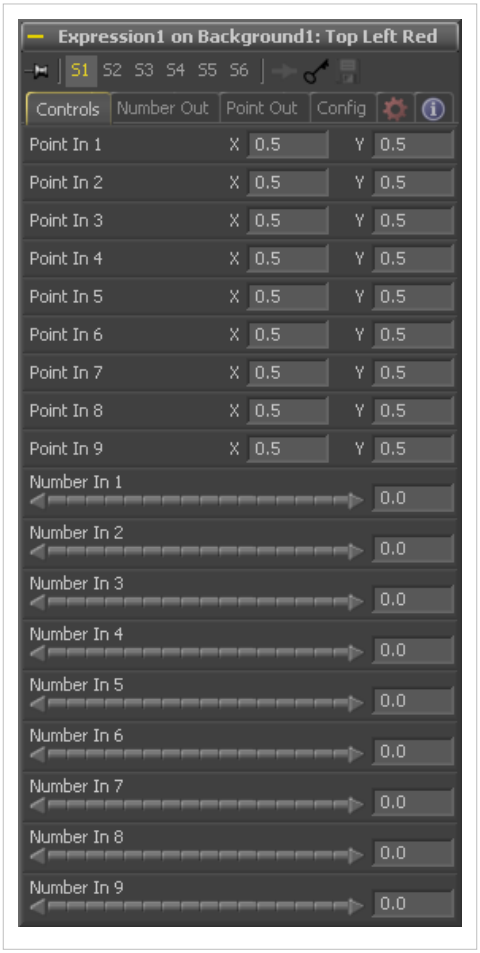
Modify With -> Expression

from the context menu. The type of value that will be returned by the expression entirely depends on the type of control it is modifying.

When used with a value control (like a slider), the expression in the Number Out tab will be evaluated to create the result. When used to modify a positional control (like a tool's center), the Point Out tab will control the result.

The Modifiers view contains the controls for the Expression modifier. Its controls are described below.

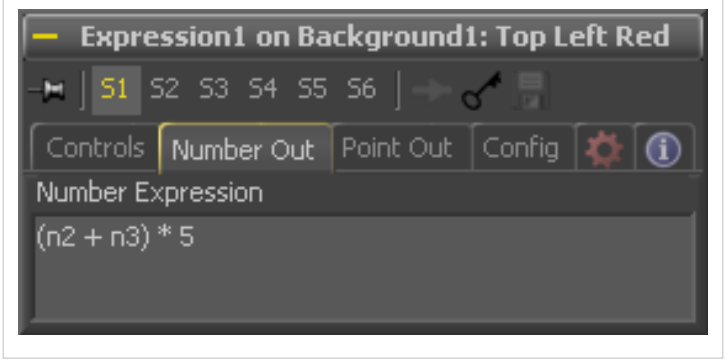
Controls Tab



This tab provides nine number controls, and nine point controls. The values of the number controls can be referred to in an expression as n1 through n9. The X-coordinate of each point control can be referred to as p1x through p9x, while the Y-coordinate is p1y through p9y.

These values can be set manually by the user, connected to other parameters, animated and even connected to other Expressions or Calculations.

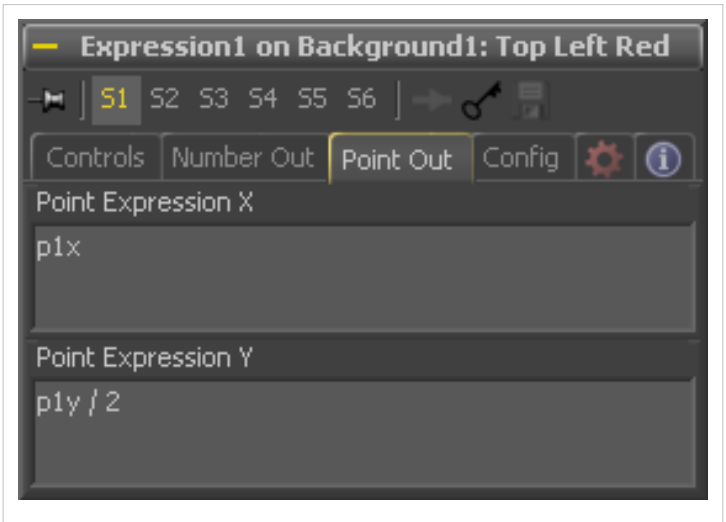
Number Out Tab



This enables a mathematical formula to be entered, which can access the values from both the Number In and the Point In tabs and output a value used to modify the control to which the expression was applied.

See below for the syntax to use in this field.

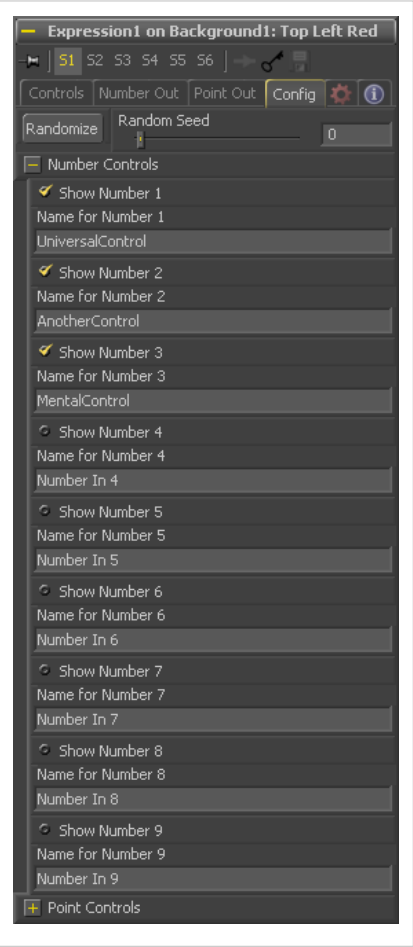
Point Out Tab



Each one of the text boxes in this tab can contain a mathematical formula that can access the values from both the Number In and the Point In tabs and output a value used to modify the control to which the expression was applied. The expression in the top text box control is used to calculate the X-axis value and the bottom text box is used to calculate the Y-axis control.

See below for the syntax to use in this field.

Config Tab



A good expression can be re-used over and over again. As a result, it can be useful to provide more descriptive names for each input and to hide the ones that are unused. The Config Tab of the expressions modifier is used to customize visibility and name for each of the nine point and number inputs.

Random Seed

The Random Seed control is used to seed the Rand() function. The rand(x, y) function produces a random value between X and Y, producing a new value for every frame. As long as the setting of this random seed slider remains the same, the values produced at frame x will always be the same. Adjust the seed slider to a new value to get a different value for that frame.

Show Number Or Point X

There are eighteen of these checkbox controls, one for each of the nine number and point inputs. Enable this checkbox to display the control for Number x or Point x in the Controls tab.

Name For Number Or Point X

There are eighteen of these edit controls, one for each of the nine number and point inputs. Type a new name for the input into this edit control to assign a new name for the input's label in the Controls tab.

Expression Syntax /Formulas



Formulas are entered into the Number Out or Point Out tabs as part of expression. They can be made up of the following functions:

n1..n9	The value of Number Input 1..9.
p1x..p9x	The X of Positional Control 1..9.
p1y..p9y	The Y of Positional Control 1..9.
time	The current time (frame number).
pi	The value of pi.
e	The value of e.
log(x)	The base-10 log of x.
ln(x)	The natural (base-e) log of x.
sin(x)	The sine of x (x is degrees).
cos(x)	The cosine of x (x is degrees).
tan(x)	The tangent of x (x is degrees).
asin(x)	The arcsine of x, in degrees.
acos(x)	The arccosine of x, in degrees.
atan(x)	The arctangent of x, in degrees.
atan2(x, y)	The arctangent of x,y, in degrees.
abs(x)	The absolute (positive) value of x.
int(x)	The integer (whole) value of x.
frac(x)	The fractional value of x.
sqrt(x)	The Square Root of x.
rand(x, y)	A random value between x and y.
rands(x, y, s)	A random value between x and y, based on seed s.
min(x, y)	The minimum (lowest) of x and y.
max(x, y)	The maximum (highest) of x and y.
dist(x1, y1, x2, y2)	The distance between point x1,y2 and x2,y2.
dist3d(x1,y1,z1,x2,y2,z2)	The distance between 3D points x1,y2,z1 and x2,y2,z2
noise(x)	A smoothly varying Perlin noise value based on x
noise2(x, y)	A smoothly varying Perlin noise value based on x and y
noise3(x, y, z)	A smoothly varying Perlin noise value based on x, y and z

if(c, x, y)	Returns x if c <> 0, otherwise y.

Expression Syntax /Operators



Operators are used to evaluate statements. They are combined with functions to perform logical and mathematical calculations in the Number Out and Point Out tabs.

x + y	x plus y.
x - y	x minus y.
x < y	1.0 if x is less than y, otherwise 0.0.
x > y	1.0 if x is greater than y, otherwise 0.0.
bgcolor="#efefef" align="left"	**x** 1.0 if x = 0, otherwise 0.0.
-x	(0.0 - x).
+x	(0.0 + x) (effectively does nothing).
x ^ y	x raised to the power of y.
x * y	x multiplied by y.
x / y	x divided by y.
x % y	x modulo y, (remainder of (x divided by y)).
x <= y	1.0 if x is less than or equal to y, otherwise 0.0.
x >= y	1.0 if x is greater than or equal to y, otherwise 0.0.
x = y	1.0 if x is exactly equal to y, otherwise 0.0.
x == y	1.0 if x is exactly equal to y, otherwise 0.0 (identical to above).
x <> y	1.0 if x is not equal to y, otherwise 0.0.
x != y	1.0 if x is not equal to y, otherwise 0.0 (identical to above).
x & y	1.0 if both x and y are not 0.0, otherwise 0.0.
x && y	1.0 if both x and y are not 0.0, otherwise 0.0 (identical to above).
x | y	1.0 if either x or y (or both) are not 0.0, otherwise 0.0.
x || y	1.0 if either x or y (or both) are not 0.0, otherwise 0.0 (identical to above).

Examples



Example 1

To make a numeric control equal to the Y value of a motion path, add an expression to the desired target control and connect the Path to Point In 1. Enter the formula

```
p1y
```

into the Number Out field.

Example 2

To make the result of the Expressions Number Out be the largest of Number In 1 and Number In 2, multiplied by the cosine of Number In 3, plus the X coordinate of Point In 1, enter the formula

```
max(n1, n2) * cos(n3) + p1x
```

into the Number Out field.

Example 3

Add a Background tool set to solid black and a Hotspot tool. Set the Hotspot size to 0.08 and set the Strength to maximum. Modify the Hotspot center with an Expression. Change the current frame to 0.

Set n1 to 0.0 and add a Bezier spline. At frame 29, set the value of n1 to 1.0. Select both points and loop the spline using the spline editor. Now enter the following equations into the Point Out tab of the expression.

X-Axis Expression

```
n1
```

Y-Axis Expression

```
0.5 + sin(time*50) / 4
```

Render out a preview and have a look at the results. (Try this one with motion blur.)

Fill

Fill [-/-]



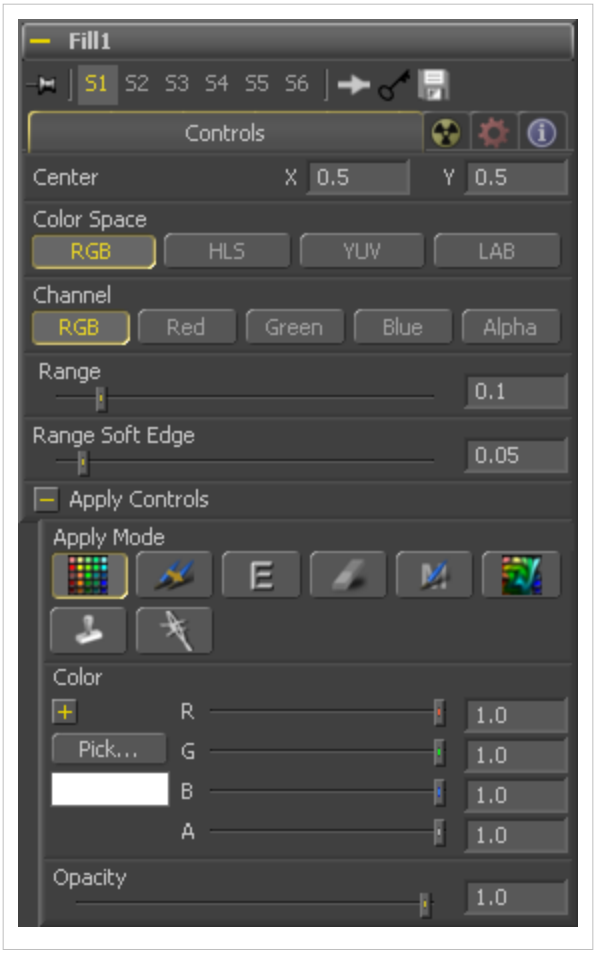
The Fill only works on Paint tools. It fills an area of the image with a user definable color.

From the way it works it can be compared with the Wand mask.

It can be applied by clicking on the 

Fill button in the Paint tool's stroke menu.

Controls



Selection Point

The Selection Point is a pair of X and Y coordinates that determine from where in the source image the fill derives its initial color sample. This control is also seen as a crosshair in the display views. The selection point can be positioned manually, connected to a tracker, path or other expressions.

Color Space

The Color Space button group determines the color space used when selecting the source color for the mask. The fill can operate in RGB, YUV, HLS or LAB color spaces.

Channel

The Channel button group is used to select whether the color that is masked comes from all three color channels of the image, the alpha channel, or from an individual channel only.

The exact labels of the buttons will depend on the color space selected for the fill operation. If the color space is RGB, the options will be R, G or B. If YUV is the color space, the options will be Y, U or V.

Range

The Range slider controls the range of colors around the source color that will be included in the fill. If the value is left at 0.0, only pixels of exactly the same color as the source will be considered part of the file. The higher the value, the more that similar colors in the source will be considered to be wholly part of the fill.

Range Soft Edge

The Range Soft Edge determines the falloff range of the colors selected. Any pixel within the range defined above will be treated as 100% for the fill. If the soft range is set to 0.0, no other pixels will be considered for the fill. Increasing the soft range will increase the number of colors close to, but not quite within, the range that will be included in the fill. These pixels will be semi-transparent in the fill.

Apply Mode

Please see the Apply Controls of the Paint tool

Follower

Follower [-/-]



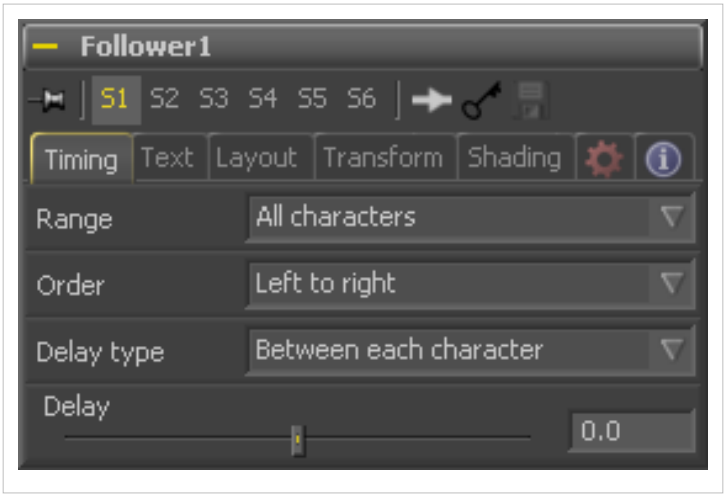
The Follower only works on Text+ tools. This tool allows for a plethora of cool motion graphics effects. The basic idea is that you animate the parameters of a single character and the other characters will follow that animation with a delay.

It can be applied by *right clicking* into the Styled text fiel of a Text+ tool and selecting

Follower

.

Timing Tab



Range

Allows to select if all characters should be influenced or only a selected range. You can drag-select a range of characters directly on the screen.

Order

Determines in which order the Characters are influenced. Available options are:

- Left to right
- Right to left
- Inside out
- Outside in
- Random but one by one
- Completely random
- Manual curve

Delay Type

Determines what sort of delay is applied to the animation Available options are:

- Between each Character

- Between first and last character

Clear all character styling

All character attributes will be reset to their original values.

Text controls, Alignement, Transform and Shading Tab

In these tabs the actual animation for the characters is done.

Observe that simply changing a value in these tabs will have no influence at all. The value needs to be animated for the effect to show.

For a detailed description on the various parameters please have a look at the Text+ tool documentation.

Example



Examine this example comp to get an idea about the Follower



From Image

From Image [-/-]



The From Image only works on Gradients, like e.g. the Gradient on a Background tool. It takes samples of an image along a user definable line and creates a gradient from those samples.

It can be applied by right-clicking on a Gradient control and selecting "From Image".

Controls

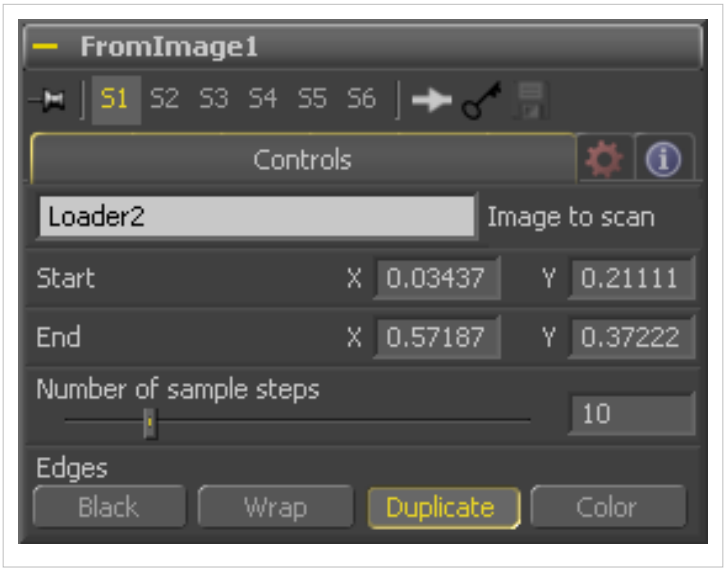


Image to scan

Drop the tool you want to be examined into this box.

Start X/Y, End X/Y

These two point controls define the start- end end-points of the line along which the samples are taken from the image defined in the "Image to scan" box. The points can also be moved directly in the view.

Number of sample steps

Defines how many individual color samples are taken along the line. You can also see the result of this setting when you look at the actual tool's gradient control. The more sample steps you define here, the more individual points you will see on the gradient control.

It is also possible to first create a gradient using the From Image modifier and then remove that modifier from the gradient control again. The created gradient will stay intact and can then be finetuned by hand.

Edges

Edges determines how the edges of the image will be treated when the sample line extends over the actual frame of the image to be sampled.

Black

This outputs black for every point on the sample line outside of the image bounds.

Wrap

This wraps the edges of the line around the borders of the image.

Duplicate

This causes the edges of the image to be duplicated as best as possible, continuing the image beyond its original size.

Color

Outputs a user-definable color instead of black for every point on the sample line outside of the image bounds.

GradientColorModifier

GradientColorModifier [-/-]

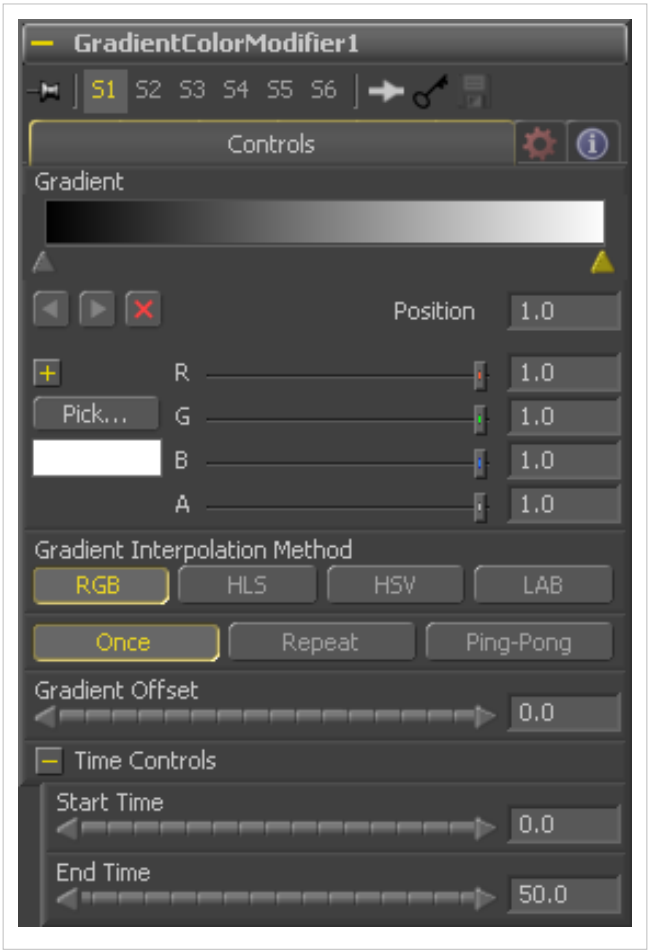


The Gradient Color modifier allows to control the value of a parameter. A gradient with customized values is mapped into a specific time range to control the value. If both time values are set to 0, then the modifer returns the value at the starting point of the gradient. You can use the "offset" control to animate the gradient manually

It can be applied by *right clicking* onto a control and selecting Modify with -> GradientColorModifier

.

Controls Tab



Gradient

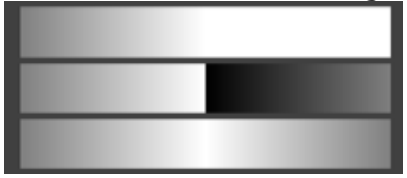
The Gradient control consists of a bar where it is possible to add, modify and remove points of the gradient. Each point has its own color. It is possible to animate the color as well as the postion of the point. Futhermore a From Image modifer can be applied to the gradient to evaluate it from an image.

Gradient Interpolation Method

The gradient is linear interpolated from point to point in RGB color space by default. This can result in unwanted colors sometimes. Choosing another color space may provide a better result.

Repeat

Defines how the left and right border of the gradient is treated.



Gradients set to Once, Repeat and Ping Pong from top to bottom respectively and shifting the gradient to the left.

Once

When using the Gradient Offset control to shift the gradient the border colors will keep their values.

Shifting the default gradient to the left will result in a white border on the left,

shifting it to the right will result in a black border on the right.

Repeat

When using the Gradient Offset control to shift the gradient the border colors will be wrapped around.

Shifting the default gradient to the left will result in a sharp jump from white to black,

shifting it to the right will result in a sharp jump from black to white.

Ping Pong

When using the Gradient Offset control to shift the gradient the border colors ping pong back and forth.

Shifting the default gradient to the left will result in the edge fading from white back to black,

shifting it to the right will result in the edge fading from black back to white.

Gradient Offset

Allows you to pan through the gradient.

Time Controls

The Start Time and End Time screws determine the time range the gradient is mapped into. This is set in frames. The same effect can be achieved by setting the Gradient to "Once" and animating the offset screw.

MIDI Extractor

MIDI Extractor [-/-]

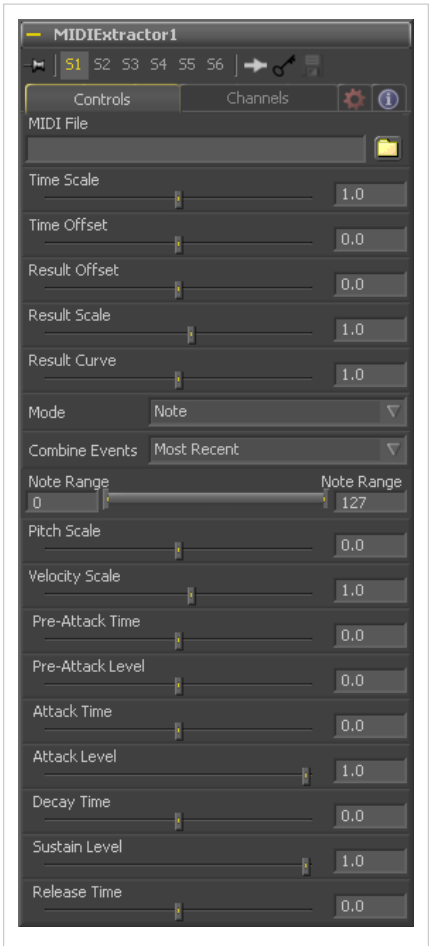


The MIDI Extractor Modifier provides the ability to modify the value of a control using the values stored in a MIDI file. Using the modifier relies on some knowledge of MIDI, which is outside of the scope of this manual to describe in detail.

The value produced by the modifier is extracted from the MIDI event selected in the Mode menu. Each mode can be trimmed so only specific messages for that event are processed. For example, only some notes are processed, while others are ignored. The value of the event can be further scaled or modified by additional factors, such as Scale, Velocity, Attack and Decay.

It can be applied by right-clicking on a control and selecting "Modify with -> Midi Extractor".

Controls Tab



MIDI File

This browser control is used to specify the MIDI File that will be used as the input for the modifier.

Time Scale

Time Scale is used to specify the relationship between time as the MIDI file defines it and time as Fusion defines it. A value of 1.0 will play back the MIDI events at normal speed, 2.0 at double speed, etc.

Time Offset

Time Offset adjusts the sync between the MIDI file's timing and Fusion's timing. If there is an unexpected delay or if the MIDI file should start part way into or before some animation in Fusion, this control can be used to offset the MIDI data as required.

Result Offset, Result Scale

These sliders adjust the range of values produced by the modifier. By default, values between 0 and 1 (or -1 and 1 for PitchBend mode) are generated. This will not always suit the tool/parameter and scale can be used to make this range larger (such as * 0.0 - 2.0). Offset is used to provide some constant value as a base.

Result Curve

The Result Curve can also be used to adjust the output, however, this adjusts the curve of the result. By default, for any input MIDI data, the result will fall linearly between 0.1 (for example, a velocity 127 note will generate 1.0, where 63 will generate approximately 0.5). Result curve applies a gamma-like curve so that middle values can produce higher or lower results while still maintaining the full scale.

Mode

This menu provides Beat, Note, Control Change, Poly AfterTouch, Channel AfterTouch or Pitch Bend, indicating from which MIDI event the values are being read. Beat mode is slightly different in that it produces regular pulses based on the tempo of the MIDI file (including any tempo maps).

The Beat mode does not actually use any specific messages. It bases its event timing on the tempo map contained in the MIDI file.

Combine Events

This menu selects what will happen when multiple events occur at the same time. In Notes mode, this can happen easily. For other events, this can happen if Multiple Channels are selected.

Use this to take the result from the most recent event to occur, the oldest event still happening, the highest or lowest valued event, the average, sum or the median of all events currently occurring.

Beat (Quarters): Beat Mode Only

This defines how often a beat will occur when in Beat mode. This is in Quarter notes so a value of 1.0 will give a beat every quarter.

Note Range: Note And Poly Aftertouch Modes Only

This defines what range of notes will cause a value to be generated. For example, use this to pick out the kick drum from a GM drum track by setting the note range between 35-36.

Pitch Scale: Note Mode Only

Pitch Scale defines how much the result changes with pitch. A value of 1.0 will cause the result to vary from 0.0 to 1.0 over the entire range.

Velocity Scale: Note Mode Only

This defines how much the result changes with velocity. A value of 1.0 will cause the result to vary from 0.0 to 1.0 over the entire range. This is added to the result from pitch scale for the final result.

Control Number: Control Change Mode Only

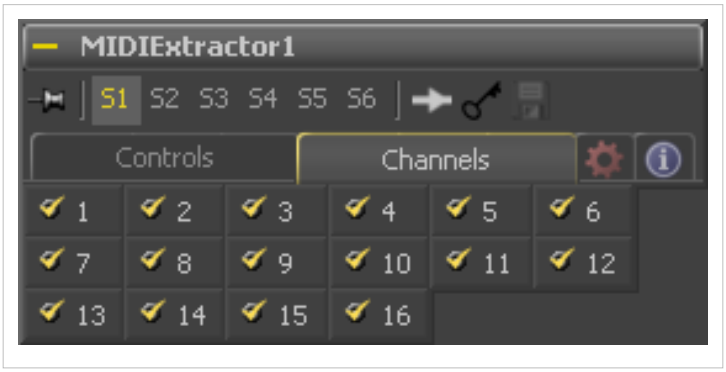
This specifies the MIDI controller number from which to extract events.

Envelope Controls: Note And Beat Modes Only

These define an Envelope to follow for values before, during and after the note or beat. Pre-Attack Time defines how long before the event it will start ramping up to the pre-attack level. Attack is the Time/Level to ramp to once the event has occurred, followed by the Decay ramp and Sustain, until the event stops. This stage is for Notes only. Beats have an instantaneous duration, so it goes straight to Release. Release is the ramp down time after the event finishes. When trying to do a Beat, set Release to some value, or there likely will not be much on the beats.

These values can be used to follow actual sounds in the MIDI sequence, or just to create interesting effects. All time values used in the MIDI Extractor are in seconds.

Channels Tab



Channels

Channels checkboxes select which of the 16 channels in the MIDI file are actually considered for events. This is a good way to single out a specific instrument from an arrangement.

More About MIDI



A single MIDI interface allows 16 channels. Typically, these will be assigned to different instruments within a device or different devices.

Usually, MIDI data is 7 bits, ranging from 0..127. This is represented as a value between 0..1 to be more consistent with the way data is handled throughout the rest of Fusion.

There are quite a number of different MIDI messages and events but the ones that are particularly useful with this modifier are detailed below.

MIDI Messages

Note On This indicates that a note (on a specific channel) is being turned on, has a pitch (0..127, with middle C being 60) and a Velocity (0..127, how fast the key was or whatever was hit).

Note Off

This indicates that a note (on a specific channel) is being turned off, has a pitch (0..127, with middle C being 60) and a Velocity (0..127, how fast the key was or whatever was released).

Control Change

This message indicates that some controller has changed. There are 128 controllers (0..127), each of which has data from 0..127. Controllers are used to set things such as Volume, Pan, amount of Reverb or Chorus, and generic things like foot controllers or breath controllers.

MIDI Events

Channel Aftertouch

This event defines that pressure is being applied to the keys (or whatever) during a note. It is general, overall pressure for this channel so it simply uses a pressure value (0..127).

Poly Aftertouch}}

This event defines that pressure is being applied to the keys (or strings, or whatever) during a note. It is specific to each particular note and, therefore, contains a note number as well as a pressure value (0..127).

General}}

Pitch Bend

The Pitch Bend controller generally specifies the degree of pitch bending or variation applied to the note. Because pitch bend values are transmitted as a 14 bit value, this control has a range between -1 and 1, and a correspondingly finer degree of resolution.

For some other resources on how MIDI works, have a look at: http://www.harmony-central.com/MIDI/Doc/doc.html.

Multistroke

Multistroke [-/-]



The Multistroke is the standard stroke in the Paint Tool. Perfect for those 100-strokes-per-frame retouching paint jobs like removing tracking-markers e.g. Much faster than the Stroke, but not editable later on.

While Multistrokes aren't directly editable, they can be grouped with the PaintGroup modifier, then tracked, moved and rotated by animating the PaintGroup instead. Alternatively, the Edit Multistrokes and Combine Strokes tool scripts can be used to convert multistrokes into ordinary, editable strokes, and vice versa.

It can be applied by clicking on the 

Multi Stroke button in the Paint tool's stroke menu.

Controls Tab



Not all of the controls described here appear in all modes. Certain controls are only useful in a specific paint mode and are hidden when they are not applicable. Additionally, several of the controls are considered to be self-explanatory the purpose of a center control, angle or size control should be relatively straightforward to determine.

To reduce complexity, these controls are not all described. For further details on the functionality of the Controls Tab, please see the Working With Paint Strokes - Animating Strokes section in this chapter.

Brush Controls

Brush Shape

Soft Brush

The Soft Brush type is a circular brush with soft edges. Modify the size of the brush in the display view by holding Ctrl down while dragging the mouse.

Circular Brush

A Circular Brush is a brush shape with hard edges. Resize this brush interactively.

Image Brush

The Image Brush allows images from any tool in the flow, or from a file system, to be used as a brush. See Creating Custom Brushes later in this chapter.

Single Pixel Brush

The Single Pixel Brush is perfect for fine detail work, creating a brush exactly one pixel in size. No anti-aliasing is applied to the single pixel brush.

Square Brush

A Square Brush is a brush shape with hard edges.

Vary Size

Constant

The brush will be a constant size over the stroke.

With Pressure

The stroke size will vary with the actual applied pressure.

With Velocity

The stroke size will vary with the speed of painting. The faster the stroke, the thinner it is.

Vary Opacity

Constant

The Constant brush will be a constant transparency over the entire stroke.

With Pressure

The stroke transparency will vary with the applied Pressure.

With Velocity

The stroke transparency will vary with the speed of painting. The faster the stroke, the more transparent it is.

Softness

Use this control to increase or decrease the Softness of a soft brush.

Image Source

When using the Image Source brush type, select between three possible sources brush images.

Tool

The image source is derived from the output of a tool on the flow. Drag the tool into the source Tool input to set the source.

Clip

The image source is derived from an image or sequence on disk. Any file supported by Fusion's loader can be used. Locate the file using the filename Clip browser that appears to set the clip used as a source.

Brush

Images stored in the Fusion>Brushes directory are used as a brush for the paint tool. Select the brush from a the menu that appears.

Apply Controls

Apply Mode

Color

The Color apply mode paints simple colored strokes on the screen. When used in conjunction with an image brush, it can also be used to tint the brush.

Clone

The Clone apply mode copies portions of one image into another image, or to clones from the same image using adjustable positions and time offsets. Any image from the flow can be used as the source image.

Emboss

The Emboss apply mode embosses the portions of the image covered by the brush stroke.

Erase

Erase reveals the underlying image through all other strokes, effectively erasing portions of the strokes beneath it with out actually destroying the strokes.

Merge

This apply mode effectively Merges the brush onto the image. This mode behaves in much the same way as the color apply mode but has no color controls. It is best suited for use with the image brush type.

Smear

Smear the image using the direction and strength of the brush stroke as a guide.

Stamp

Stamp the brush onto the image, completely ignoring any alpha channel or transparency information. This mode is best suited for applying decals to the target image.

Wire

This Wire removal mode is used to remove wires, rigging and other small elements in the frame by sampling adjacent pixels and drawing them in toward the stroke.

Stroke Controls

Size

This control adjusts the Size of the brush when the brush type is set to either soft brush or circle. The diameter of the brush is drawn in the display view as a small circle surrounding the mouse pointer. The size can also be adjusted interactively in the display view by holding the Ctrl key while click-dragging the mouse pointer.

Spacing

The Spacing slider determines the distance between blats (samples used to draw a straight line along the underlying vector shape that composes a stroke or polyline stroke). Increasing the value of this slider increases the density of the stroke, whereas decreasing the value is likely to cause the stroke to assume the appearance of a dotted line.

Stroke Animation

The Stroke Animation menu control provides several pre-built animation effects that can be applied to a paint stroke. This menu only appears for Vector strokes.

All Frames

This default displays the stroke for All Frames of the project where a valid target image is available to the paint tool.

Limited Duration

This exists on the number of frames specified by the Duration slider.

Write On

When Write On is selected, an animation spline will be added to the paint stroke that precisely duplicates the timing of the paint stroke's creation. The stroke will be written on the image exactly as it was drawn. To adjust the timing of the write on effect, switch to the spline editor and use the timestretcher mode to adjust the overall length of the animation spline. To smooth or manually adjust the motion, try reducing the points in the animation spline.

Write Off

Write Off will perform the reverse of write on, drawing the stroke starting from the end and working backward to the start of the stroke.

Write On Then Off

This mode will apply a Write On and then a Write Off animation mode to the stroke.

Trail

Selecting the Trail mode will cause both the start and end points of the stroke to be animated simultaneously, offset from each other by the amount specified in the duration control. This has the effect of creating a segment of the stroke that follows the stroke as if it were a path. As with the write on and off effects, this will start at the frame that is current when the animation mode is selected. The timing of the animation can be adjusted manually using the spline or timeline editors.

Duration

Duration sets the duration of each stroke in frames. This control is only present for Multistrokes or when the stroke animation mode is set to Limited Duration. It is most commonly employed for frame-by-frame rotoscoping through a scene.

Each Vector stroke applied to a scene will have a duration in the timeline that can be trimmed independently from one stroke to the next. The duration can be set to 0.5, which will allow each stroke to last for a single field only when the flow is processing in fields mode.

Write On And Write Off

This range slider appears when the Stroke Animation is set to one of the Write On and Write Off methods. The range represents the beginning and end points of the stroke. Drag the low value upward to give the impression that the stroke is being erased, or drag the high value from 0.0 to 1.0 to give the impression that the stroke is being drawn on the screen. This control can be animated to good effect. It works most effectively when automatically animated through the use of the Write On, Write Off modes of the stroke animation menu.

Make Editable

This button only appears for Vector strokes.. Clicking on 'Make Editable' turns the current stroke into a polyline spline so that the shape can be adjusted or animated.

Natural Cubic Spline

Natural Cubic Spline [-/-]



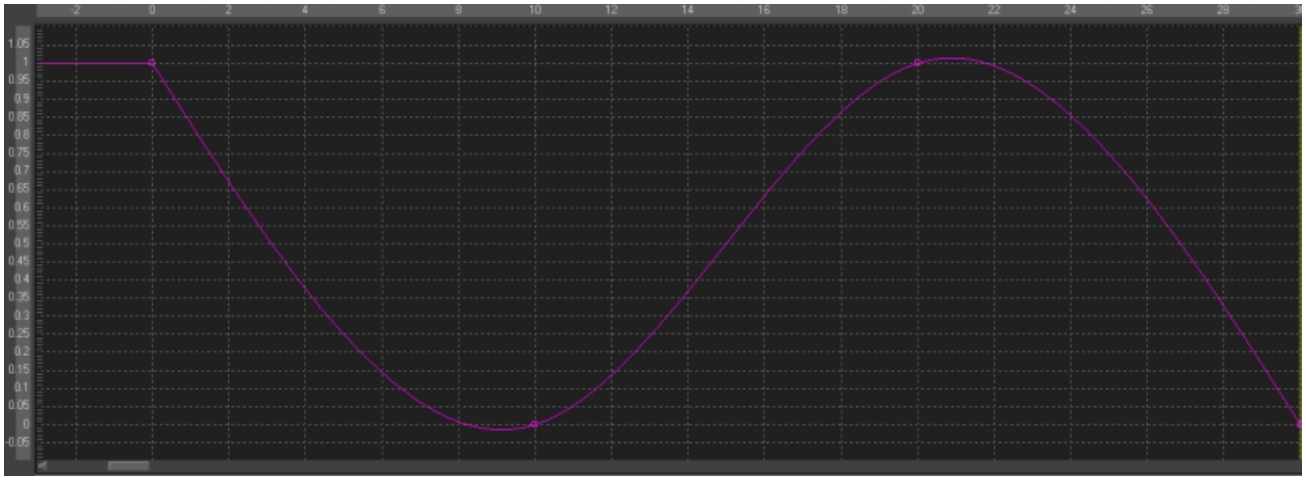
The Natural Cubic Spline is one of the animation modifiers in Fusion and normally is applied to numerical values rather than point values. It can be applied by *right clicking* on a numerical control and selecting

Modify with -> Natural Cubic Spline

.

Usage

Being an animation spline this modifier has no actual controls tab. However it's effect can be seen and influenced in the Spline editor.



Offset

Offset [-/-]



Offsets are useful for creating constant or animated variances between values, relating to various controls, paths and points. There are three types of offsets available in Fusion; Offset Distance, Offset Angle and Offset Position.

Offset Angle

The Offset Angle Modifier outputs a value between 0 and 360 that is based on the angle between two positional controls. The position and offset parameters may be static, connected to other positional parameters or connected to paths of their own. All of the offsets use the same set of controls, which behave differently depending on the offset type used. These controls are described below.

Offset Distance

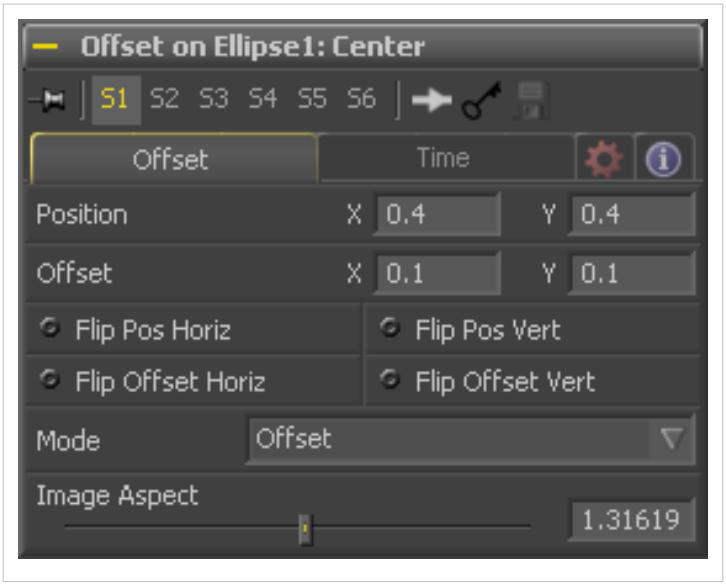
The Offset Distance Modifier outputs a value that is based on the distance between two positional controls. This modifier is the first one discussed that is capable of outputting a value based on a mathematical expression applied to a position.

Offset Position

The Offset Position Modifier outputs a position (X and Y coordinate) that is based on the relationship between positional controls. This modifier is the equivalent of a calculation control except that it outputs X and Y coordinates instead of a value.

It can be applied by right-clicking on a control and selecting "Modify with -> Offset".

Offset Tab



Position X And Y

The first position value is used by the Position to generate the calculation.

Offset X And Y

The first position value is used by the Offset to generate the calculation.

Flip Position Horizontal And Vertical

When these controls are selected, the Position will be mirrored along the vertical or horizontal axis of the image.

Flip Offset Horizontal And Vertical

When these controls are selected, the Offset position will be mirrored along the vertical or horizontal axis of the image.

Mode

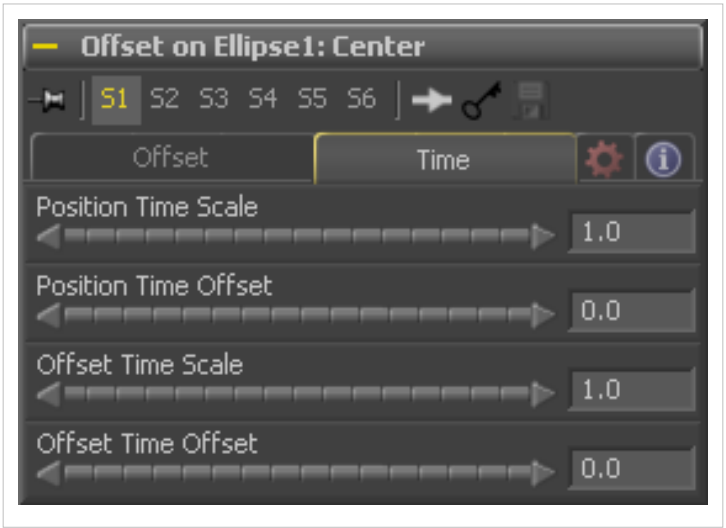
Select an option from the Mode menu to choose the mathematical operation performed by the offset control. Available options are:

- Offset
- Difference (Position - Offset)
- Difference (Offset - Position)
- Average
- Use Position Only
- Use Offset Only
- Maximum
- Minimum
- Invert Position
- Invert Offset
- Invert Sugar
- Random Offset

Image Aspect

Adjust the modifier's output to compensate for the Image Aspect (not pixel aspect) of the project. A square image of 500 x 500 would use an Image Aspect value of 1 and a rectangular image of 500 x 1000 would use an aspect value of 2. The default value is always based on the current frame format selected in the preferences. To calculate image aspect, divide the width by the height. This control can also be used to create the illusion of aspect.

Time Tab



Position Time Scale

This returns the value of the Position at the Time Scale specified (for example, 0.5 is the value at half the current frame time).

Position Time Offset

This returns the value of Position at the Time Offset specified (for example, 10 is 10 frames back).

Offset Time Scale

This returns the value of the Offset at the Time Scale specified.

Offset Time Offset

This returns the value of Offset at the Time Offset specified.

Example



Continue the Text banking example at the beginning of this chapter to illustrate one potential use of offsets.

Select and view the Merge tool in this flow. Right-click on the Merge Size control and select Modify With>Offset Distance from the context menu. This will add two new crosshairs and Offset controls in the Modifier tab.

The size of the text will now be determined by the distance or offset between the two new cross hairs. These points are animatable and can be connected to other controls.

Connect the position value of the offset to the existing path by right-clicking on the Position control and selecting Connect To>Path on Merge 1: Center Value. Manually place the Offset crosshair at the bottom of the screen between the two path points.

Now, the text should shrink near the ends of the path (when the distance between the offset and the path is at its minimum) and grow at its ends (where the distance between the offset and the path is at its maximum).

PaintGroup

Paint Group [-/-]



The Paint Group only works on Paint strokes and objects. It groups all currently selected paint strokes together, making it easier to handle them all together.

Multistroke modifiers can be grouped as well, which includes all the multistrokes contained within that modifier. By animating the Paint Group, it is thus possible to move, track and rotate a collection of multistrokes.

It can be applied by clicking on the 

paint group button in the Paint tool's stroke menu.

Controls



Center X Y

The Center of the Group. Modify this control to move the group around.

Angle

The entire group can be rotated using this control.

Size

Scales the entire group

Show subgroup controls

Displays the controls of the individual strokes in the group amd allows to modify them. Think of this like opening and closing a group of tools

Reset Center

Puts the center back to the position where it was when the group was created.

Ungroup

Disassembles the group back into individual strokes and deletes the Group modifier. For temporary opening of the group use the "Show subgroup controls" switch instead.

Path

Path [-/-]



The XY Path type uses a separate spline for the position along the X axis, as it does for the position along the Y axis.

To animate a coordinate control using a Path, right-click on the control and select Path from the context menu.

Controls Tab



For an in-depth explanation see the chapter working with Motion Paths of this documentation.

Center

The actual center of the path. This can be modified and animated as well to move the entire path around.

Size

The Size of the path. Again this allows for later modification of the animation.

X Y Z Rotation

The Path can be rotated in all three dimensions to allow for sophisticated controls.

Displacement

Every motion path has an associated Displacement Spline in the spline editor. The displacement spline represents the position of the animated control along its path, represented as a value between 0.0 and 1.0. Displacement splines are used to control the speed of a control's movement along its path. To slow down, speed up, stop or even reverse the motion of the control along the path, adjust the values of the points for the path's displacement in the spline editor.

A displacement value of 0.0 in the spline editor indicates that the control is at the very beginning of a path. A value of 1.0 indicates that the control is positioned at the end of the path.

Each locked point on the motion path will have an associated point on the displacement spline. Unlocked points will not have a corresponding point on the displacement spline. Please refer to the For an in-depth explanation see the chapter working with Motion Paths of this documentation as well.

Heading Offset

If other controls like e.g. a mask's Angle is connected to the path's heading, this control allows for adding or aubtracting from the calculated angle.

Right Clik here for shape animation

It is possible to animate the shape of the path as well, or to connect it to other path-controls like Polyline Masks or Paint Strokes.

Switching Default Paths Change the Default Path type used when animating a coordinate control to Path (if this is the preferred type of animation). Open the Global preferences and look under the default's tab for the drop-down list in the default animate section labelled Point With. Change this from the current value to Path. The next time Animate is selected from a coordinate control's context menu, a Path will be used.

Perturb

Perturb [-/-]



The Perturb modifier generates smoothly varying random values for several input types, based on Perlin noise. It can be used to add jitter, shake or wobble to any animatable control, even if the control is already animated. Its results are similar to those of the Shake modifier, though it uses a different set of controls that may be more suitable to the artists needs. Unlike other random modifiers the Perturb modifier can also be applied to polylines, shapes, grid meshes and even color gradients.

For example, to add camera shake to an existing path, right-click on the crosshair and choose Insert -> Perturb, then adjust the Strength down to suit. Alternatively, right-click on the path's Shape Animation control, and apply the wobble to the path's polyline itself (this works best if the polyline has many points, e.g. if it has been tracked, or hand-drawn with the Draw Append pencil tool). A third option is to insert the modifier onto the Displacement control, which will cause the motion along the path to jitter back and forth without actually leaving the line of the path.

Note that Perturb can only add jitter; it cannot smooth out existing animation curves.

Controls Tab



Value

The actual contents of this control will depend on what type of control the modifier was applied to. If the Perturb modifier was added to a basic slider control, the Value will be a slider. If it was added to a gradient control, then a gradient control will be displayed here. Use the control to set the default, or center value for the Perturb modifier to work on.

Jaggedness

(Polylines, Meshes only) This allows you to increase the amount of variation along the length of the polyline or mesh, rather than over time. Increasing this will give a "squigglier" polyline or more tangled mesh, independently of its movement.

Phase

(Polylines, Meshes only) Animating this can be used to move the ripple of a polyline or mesh along itself, from end to end. The effect can be most clearly seen when Speed is set to 0.0.

Random Seed / Randomize

The Random Seed is used to 'seed' the amount of jitter applied by the modifier. Two Perturb modifiers with identical settings but different random seeds will produce two completely different results. Click on the Randomize button to assign a random seed value.

Strength

Use this control to adjust the strength of the Perturb modifier's output, or its maximum variation from the primary value specified above.

Wobble

Use the Wobble control to determine how smooth the resulting values are. Less wobble implies a smoother transition between values, while more wobble produces less predictable results.

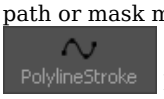
Speed

Increasing the Speed slider value will speed up the rate at which the value changes. This can increase the apparent "wobbliness" in a more predictable fashion than the Wobble control, and make the jitter more frantic or languorous in nature.

PolylineStroke

Polyline Stroke [-/-]

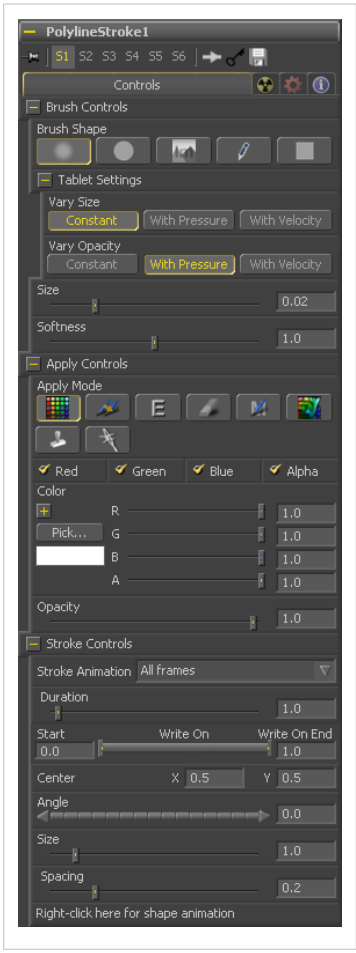


Fusion offers a Polyline Stroke mode. This provides the ability to create and manipulate a stroke in the same way that a path or mask might be created. To add a polyline stroke to the flow, select the 

Polyline Button from the Paint tool's stroke toolbar and click in the view to add the first point. Continue clicking to add additional points to the polyline.

Notice that the usual polyline toolbar buttons will appear in the display toolbar. Polyline strokes are created in click append mode by default, but they can also be created in draw append mode.

Controls Tab



Not all of the controls described here appear in all modes. Certain controls are only useful in a specific paint mode and are hidden when they are not applicable. Additionally, several of the controls are considered to be self-explanatory; the purpose of a center control, angle or size control should be relatively straightforward to determine.

To reduce complexity, these controls are not all described. For further details on the functionality of the Controls Tab, please see the Working With Paint Strokes - Animating Strokes section in this chapter.

Brush Controls

Brush Shape

Soft Brush

The Soft Brush type is a circular brush with soft edges. Modify the size of the brush in the display view by holding Ctrl down while dragging the mouse.

Circular Brush

A Circular Brush is a brush shape with hard edges. Resize this brush interactively.

Image Brush

The Image Brush allows images from any tool in the flow, or from a file system, to be used as a brush. See Creating Custom Brushes later in this chapter.

Single Pixel Brush

The Single Pixel Brush is perfect for fine detail work, creating a brush exactly one pixel in size. No anti-aliasing is applied to the single pixel brush.

Square Brush

A Square Brush is a brush shape with hard edges.

Vary Size

Constant

The brush will be a constant size over the stroke.

With Pressure

The stroke size will vary with the actual applied pressure.

With Velocity

The stroke size will vary with the speed of painting. The faster the stroke, the thinner it is.

Vary Opacity

Constant

The Constant brush will be a constant transparency over the entire stroke.

With Pressure

The stroke transparency will vary with the applied Pressure.

With Velocity

The stroke transparency will vary with the speed of painting. The faster the stroke, the more transparent it is.

Softness

Use this control to increase or decrease the Softness of a soft brush.

Image Source

When using the Image Source brush type, select between three possible sources brush images.

Tool

The image source is derived from the output of a tool on the flow. Drag the tool into the source Tool input to set the source.

Clip

The image source is derived from an image or sequence on disk. Any file supported by Fusion's loader can be used. Locate the file using the filename Clip browser that appears to set the clip used as a source.

Brush

Images stored in the Fusion>Brushes directory are used as a brush for the paint tool. Select the brush from a the menu that appears.

Apply Controls

Apply Mode

Color

The Color apply mode paints simple colored strokes on the screen. When used in conjunction with an image brush, it can also be used to tint the brush.

Clone

The Clone apply mode copies portions of one image into another image, or to clones from the same image using adjustable positions and time offsets. Any image from the flow can be used as the source image.

Emboss

The Emboss apply mode embosses the portions of the image covered by the brush stroke.

Erase

Erase reveals the underlying image through all other strokes, effectively erasing portions of the strokes beneath it with out actually destroying the strokes.

Merge

This apply mode effectively Merges the brush onto the image. This mode behaves in much the same way as the color apply mode but has no color controls. It is best suited for use with the image brush type.

Smear

Smear the image using the direction and strength of the brush stroke as a guide.

Stamp

Stamp the brush onto the image, completely ignoring any alpha channel or transparency information. This mode is best suited for applying decals to the target image.

Wire

This Wire removal mode is used to remove wires, rigging and other small elements in the frame by sampling adjacent pixels and drawing them in toward the stroke.

Source Tool

Shows which tool's image output is used to clone from.

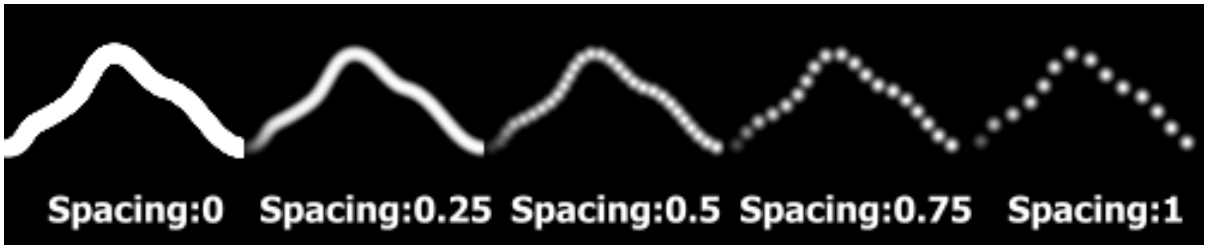
Stroke Controls

Size

This control adjusts the Size of the brush when the brush type is set to either soft brush or circle. The diameter of the brush is drawn in the display view as a small circle surrounding the mouse pointer. The size can also be adjusted interactively in the display view by holding the Ctrl key while click-dragging the mouse pointer.

Spacing

The Spacing slider determines the distance between blats (samples used to draw a straight line along the underlying vector shape that composes a stroke or polyline stroke). Increasing the value of this slider increases the density of the stroke, whereas decreasing the value is likely to cause the stroke to assume the appearance of a dotted line.



Stroke Animation

The Stroke Animation menu control provides several pre-built animation effects that can be applied to a paint stroke. This menu only appears for Vector strokes.

All Frames

This default displays the stroke for All Frames of the project where a valid target image is available to the paint tool.

Limited Duration

This exists on the number of frames specified by the Duration slider.

Write On

When Write On is selected, an animation spline will be added to the paint stroke that precisely duplicates the timing of the paint stroke's creation. The stroke will be written on the image exactly as it was drawn. To adjust the timing of the write on effect, switch to the spline editor and use the timestretcher mode to adjust the overall length of the animation spline. To smooth or manually adjust the motion, try reducing the points in the animation spline.

Write Off

Write Off will perform the reverse of write on, drawing the stroke starting from the end and working backward to the start of the stroke.

Write On Then Off

This mode will apply a Write On and then a Write Off animation mode to the stroke.

Trail

Selecting the Trail mode will cause both the start and end points of the stroke to be animated simultaneously, offset from each other by the amount specified in the duration control. This has the effect of creating a segment of the stroke that follows the stroke as if it were a path. As with the write on and off effects, this will start at the frame that is current when the animation mode is selected. The timing of the animation can be adjusted manually using the spline or timeline editors.

Duration

Duration sets the duration of each stroke in frames. This control is only present for Multistrokes or when the stroke animation mode is set to Limited Duration. It is most commonly employed for frame-by-frame rotoscoping through a scene.

Note

Each Vector stroke applied to a scene will have a duration in the timeline that can be trimmed independently from one stroke to the next. The duration can be set to 0.5, which will allow each stroke to last for a single field only when the flow is processing in fields mode.

Write On And Write Off

This range slider appears when the Stroke Animation is set to one of the Write On and Write Off methods. The range represents the beginning and end points of the stroke. Drag the low value upward to give the impression that the stroke is being erased, or drag the high value from 0.0 to 1.0 to give the impression that the stroke is being drawn on the screen. This control can be animated to good effect. It works most effectively when automatically animated through the use of the Write On, Write Off modes of the stroke animation menu.

Right Click here for shape animation

To animate the Polyline shape like e.g. Polyline Masks, right click on this control and choose animate.

Probe

Probe [-/-]



The Probe Modifier is one of the most versatile modifiers in Fusion. It allows you to control any numeric parameter by the pixel color or luminosity at a certain position or rectangular region of an image.

Think of driving values by the presence or absence of an image or by color values of an image. Using colors to create X Y positions on other controls or measuring graded LUT's to compare values.

It can be applied by right-clicking on a control and selecting "Modify with -> Probe".

Probe Tab

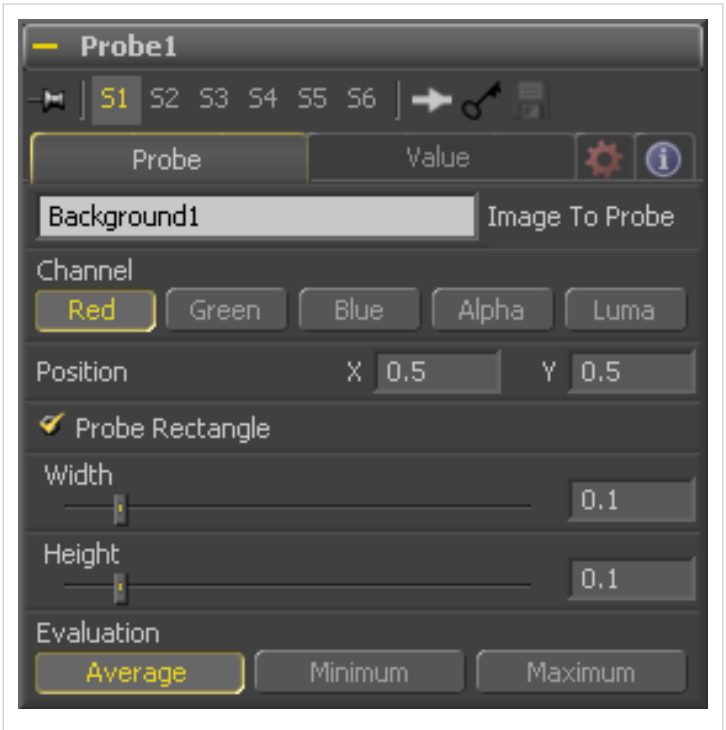


Image To Probe

Drop the tool of the image you want to probe into this field.

Channel

Select the Channel you want to probe. The usual options are

- Red
- Green
- Blue
- Alpha
- Luma

Once a Probe modifier is present somewhere in your comp you can connect other tool's values to it's outputs as well. The Probe allows to connect to it's

- Result
- Red
- Green
- Blue
- Alpha

values individually

Position X Y

The position in the image where the probe samples the values from.

Probe Rectangle

By default the Probe only samples the value of a single pixel at it's position. By using the Probe Rectangle mode you can sample from a larger area of pixels based on the Evaluation method.

Width Height Controls

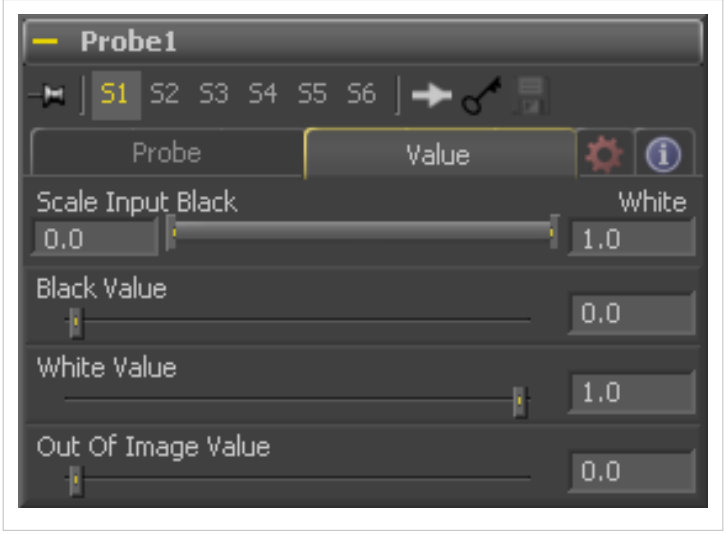
These determine the size of the area to be probed.

Evaluation

Sets how the pixels inside the rectangle are computed to generate the output value. Options are:

- Average (all pixel values inside the rectangle are averaged)
- Minimum (The smallest value of all pixels inside the rectangle is used)
- Maximum (The highest value of all pixels inside the rectangle is used)

Value Tab



Scale Input Black / White

By default the Probe generates the Black Value when the probed area results in a value of 0 (i.e. Black) and it generates it's White Value when the probed area results in a value of 1 (i.e. White). By using this range control you can modify the sensitivity of the Probe.

Black Value

The value that is generated by the Probe if the probed area delivers the result set in Scale Input Black.

White Value

The value that is generated by the Probe if the probed area delivers the result set in Scale Input White.

Out Of Image Value

The value that is generated by the Probe if the probed area is outside the frame boundaries of the probed image. If probing a rectangle, this value will not be generated before the entire rectangle is outside the frame boundaries of the image to be probed.

Publish

Publish [-/-]



Only controls that are animated can be available from the Connect To menu option. A non-animated control (static) must be published before it can be connected. Animated controls are automatically published, whereas static controls have to be manually published.

To publish a control, right-click on the control and select Publish from the context menu.

It can be applied by right-clicking on a control and selecting "Publish".

Publish

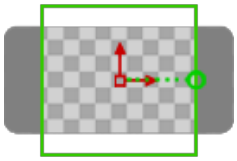


Published Value

This is obviously dependent on which value is published from which tool.

Rectangle

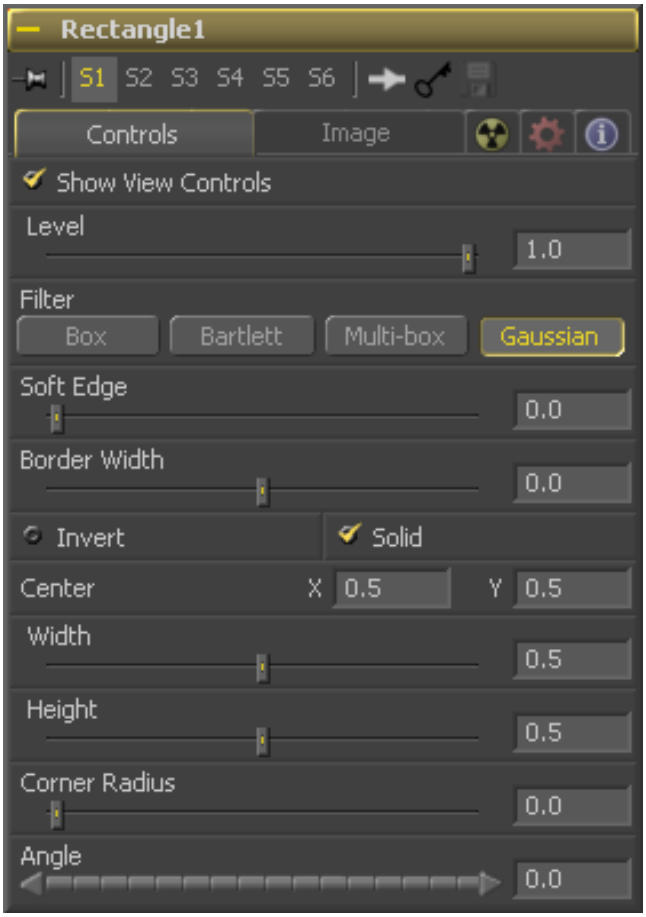
Rectangle Mask [Rec]



The Rectangle Mask creates a simple square or rectangular effect mask.

Many of the controls found in this mask tool are common to all mask tools. These controls are documented at Common Mask Controls.

Controls Tab



Level, Filter, Soft Edge and Border Width

Please refer to the Common Mask Controls.

Width And Height

Use these controls to change the X or Y scale of the rectangular effect mask independently of each other. Alternatively, drag the edges of the rectangle in the display view to interactively adjust its size.

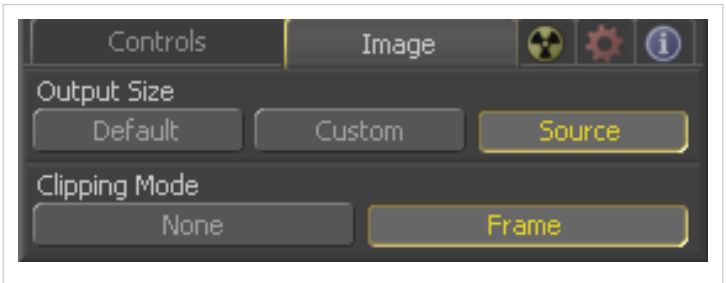
Corner Radius

Corner Radius allows the corners of the rectangle mask to be rounded. A value of 0.0 is not rounding at all, which means that the rectangle has sharp corners. A value of 1.0 will apply the maximum amount of rounding to the corners.

Angle

Change the rotation angle of an effect mask by moving the Angle control left or right. Values can be entered in the provided input boxes. Alternately, use the onscreen controls by click-dragging the little circle at the end of the dashed angle line to interactively adjust the rotation of the ellipse.

Image Tab



Please refer to Common Mask Controls.

Shake

Shake [-/-]



The Shake Modifier is used to randomize a position or value control to create semi-random numeric inputs. The resulting shake can be entirely random. The motion can also be smoothed for a more gentle, organic feel.

To add the shake modifier to a control, select Modify With>Shake from the control's context menu. The shake modifier uses the following controls to achieve its effect.

It can be applied by right-clicking on a control and selecting "Modify with -> Shake".

Shake Tab



Random Seed

The Random Seed control contains the value used to seed the random number generator. Given the same seed, a random number generator will always produce the same results. Change the seed if the results from the randomizer are not satisfying.

Smoothness

This control is used to smooth the overall randomness of the shake. The higher the value is set, the smoother the motion will appear. A value of zero will generate completely random results, with no smoothing applied.

Lock X And Y

This checkbox is used to Unlock the X and Y axis, revealing independent slider controls for each axis.

Min And Max

This control is used to determine the overall strength of the shake. The low values represent the lowest value that can be generated by the randomizer and the high values represent the

highest values. To create a shake that moves a center crosshair anywhere within the image, set the low to 0.0 and the high to 1.0. To restrict the motion to a smaller shake in the bottom right corner of the image, set the Min to 0.70 and the Max to 0.90.

Example



Create a new flow and add a Text tool. Type something in the Text tool and view it in the large display. Add a shake modifier by selecting Modify With>Shake Position from the context menu for the Text Center control.

Switch to the Modifier tab and set the smoothing to 5.0. Set the Low to 0.1 and the High to 0.9. Go to frame 0 and add a Bezier spline to both the Low and the High controls.

Advance to frame 90 and set the Low to 0.45 and the High to 0.55. Render out a preview and view the results. The text should start out by flying all over the screen and then tighten in toward the center of the screen.

Stroke

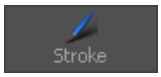
Stroke [-/-]



When the paint tool is first added to the flow, the brush type is set to a medium sized soft, circular brush with a white color apply mode.

Release the mouse button to end the creation of the stroke. To draw another stroke, simply click again and continue. A new stroke will be added to the image with the same settings as the last applied stroke. When the painting is complete, choose the Select button in the paint toolbar to avoid accidentally adding new strokes.

While in brush or polyline modes, the controls displayed in the tool tab affect the next stroke created, not the strokes that are already created. To adjust the settings of an existing stroke, switch to Select mode using the paint toolbar and select the stroke.

To add a stroke to the flow, select the 

Polyline Button from the Paint tool's stroke toolbar, place the mouse or pen over the imaga, click-hold the left mouse button and start drawing.

Controls Tab



Not all of the controls described here appear in all modes. Certain controls are only useful in a specific paint mode and are hidden when they are not applicable. Additionally, several of the controls are considered to be self-explanatory; the purpose of a center control, angle or size control should be relatively straightforward to determine.

To reduce complexity, these controls are not all described. For further details on the functionality of the Controls Tab, please see the Working With Paint Strokes - Animating Strokes section in this chapter.

Brush Controls

Brush Shape

Soft Brush

The Soft Brush type is a circular brush with soft edges. Modify the size of the brush in the display view by holding Ctrl down while dragging the mouse.

Circular Brush

A Circular Brush is a brush shape with hard edges. Resize this brush interactively.

Image Brush

The Image Brush allows images from any tool in the flow, or from a file system, to be used as a brush. See Creating Custom Brushes later in this chapter.

Single Pixel Brush

The Single Pixel Brush is perfect for fine detail work, creating a brush exactly one pixel in size. No anti-aliasing is applied to the single pixel brush.

Square Brush

A Square Brush is a brush shape with hard edges.

Vary Size

Constant

The brush will be a constant size over the stroke.

With Pressure

The stroke size will vary with the actual applied pressure.

With Velocity

The stroke size will vary with the speed of painting. The faster the stroke, the thinner it is.

Vary Opacity

Constant

The Constant brush will be a constant transparency over the entire stroke.

With Pressure

The stroke transparency will vary with the applied Pressure.

With Velocity

The stroke transparency will vary with the speed of painting. The faster the stroke, the more transparent it is.

Softness

Use this control to increase or decrease the Softness of a soft brush.

Image Source

When using the Image Source brush type, select between three possible sources brush images.

Tool

The image source is derived from the output of a tool on the flow. Drag the tool into the source Tool input to set the source.

Clip

The image source is derived from an image or sequence on disk. Any file supported by Fusion's loader can be used. Locate the file using the filename Clip browser that appears to set the clip used as a source.

Brush

Images stored in the Fusion>Brushes directory are used as a brush for the paint tool. Select the brush from a the menu that appears.

Apply Controls

Apply Mode

Color

The Color apply mode paints simple colored strokes on the screen. When used in conjunction with an image brush, it can also be used to tint the brush.

Clone

The Clone apply mode copies portions of one image into another image, or to clones from the same image using adjustable positions and time offsets. Any image from the flow can be used as the source image.

Emboss

The Emboss apply mode embosses the portions of the image covered by the brush stroke.

Erase

Erase reveals the underlying image through all other strokes, effectively erasing portions of the strokes beneath it with out actually destroying the strokes.

Merge

This apply mode effectively Merges the brush onto the image. This mode behaves in much the same way as the color apply mode but has no color controls. It is best suited for use with the image brush type.

Smear

Smear the image using the direction and strength of the brush stroke as a guide.

Stamp

Stamp the brush onto the image, completely ignoring any alpha channel or transparency information. This mode is best suited for applying decals to the target image.

Wire

This Wire removal mode is used to remove wires, rigging and other small elements in the frame by sampling adjacent pixels and drawing them in toward the stroke.

Source Tool

Shows which tool's image output is used to clone from.

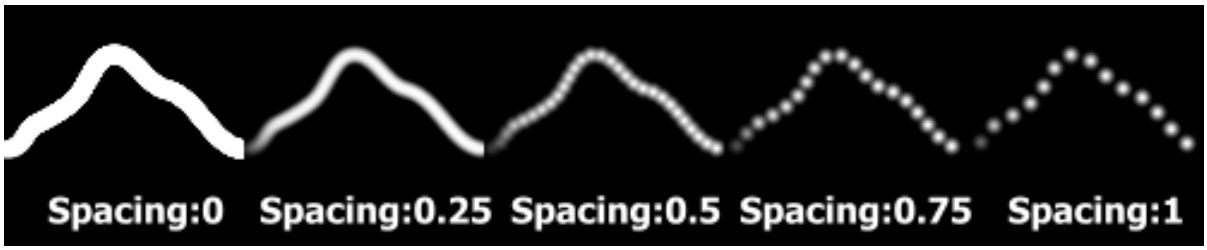
Stroke Controls

Size

This control adjusts the Size of the brush when the brush type is set to either soft brush or circle. The diameter of the brush is drawn in the display view as a small circle surrounding the mouse pointer. The size can also be adjusted interactively in the display view by holding the Ctrl key while click-dragging the mouse pointer.

Spacing

The Spacing slider determines the distance between blats (samples used to draw a straight line along the underlying vector shape that composes a stroke or polyline stroke). Increasing the value of this slider increases the density of the stroke, whereas decreasing the value is likely to cause the stroke to assume the appearance of a dotted line.



Stroke Animation

The Stroke Animation menu control provides several pre-built animation effects that can be applied to a paint stroke. This menu only appears for Vector strokes.

All Frames

This default displays the stroke for All Frames of the project where a valid target image is available to the paint tool.

Limited Duration

This exists on the number of frames specified by the Duration slider.

Write On

When Write On is selected, an animation spline will be added to the paint stroke that precisely duplicates the timing of the paint stroke's creation. The stroke will be written on the image exactly as it was drawn. To adjust the timing of the write on effect, switch to the spline editor and use the timestretcher mode to adjust the overall length of the animation spline. To smooth or manually adjust the motion, try

reducing the points in the animation spline.

Write Off

Write Off will perform the reverse of write on, drawing the stroke starting from the end and working backward to the start of the stroke.

Write On Then Off

This mode will apply a Write On and then a Write Off animation mode to the stroke.

Trail

Selecting the Trail mode will cause both the start and end points of the stroke to be animated simultaneously, offset from each other by the amount specified in the duration control. This has the effect of creating a segment of the stroke that follows the stroke as if it were a path. As with the write on and off effects, this will start at the frame that is current when the animation mode is selected. The timing of the animation can be adjusted manually using the spline or timeline editors.

Duration

Duration sets the duration of each stroke in frames. This control is only present for Multistrokes or when the stroke animation mode is set to Limited Duration. It is most commonly employed for frame-by-frame rotoscoping through a scene.

Note

Each Vector stroke applied to a scene will have a duration in the timeline that can be trimmed independently from one stroke to the next. The duration can be set to 0.5, which will allow each stroke to last for a single field only when the flow is processing in fields mode.

Write On And Write Off

This range slider appears when the Stroke Animation is set to one of the Write On and Write Off methods. The range represents the beginning and end points of the stroke. Drag the low value upward to give the impression that the stroke is being erased, or drag the high value from 0.0 to 1.0 to give the impression that the stroke is being drawn on the screen. This control can be animated to good effect. It works most effectively when automatically animated through the use of the Write On, Write Off modes of the stroke animation menu.

Right Click here for shape animation

To animate the shape like e.g. Polyline Masks, right click on this control and choose animate.

TextScramble

Text Scramble [-/-]



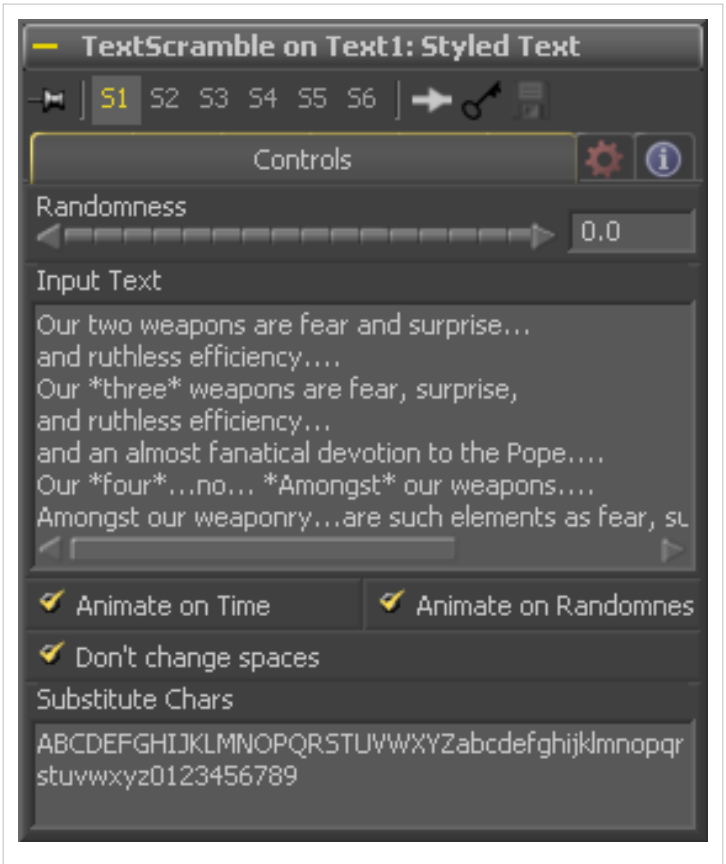
The Text Scramble only works on Text+ tools. It scrambles the Text around, randomly replacing the characters with others from a user definable set.

It can be applied by *right clicking* into the Styled text fiel of a Text+ tool and selecting

TextScramble

.

Controls



Randomness

Defines how many characters are exchanged randomly. A value of 0 will change no characters at all. A value of 1 will change all characters in the text. Animating this screw to go from 0 to 1 will gradually exchange all characters.

Input Text

This reflects the original Text in the Text+ Styled Text. Text can be entered either here on in the Text+.

Animate on Time

When set the characters will get scrambled randomly on every new frame. This switch has no effect when Randomness is set to 0.

Animate on Randomness

When set the characters will get scrambled randomly on every new frame, when the Randomness screw is animated. This switch has no effect when Randomness is set to 0.

Don't change spaces

When set, the length of the single words will stay the same, though their characters get scrambled around.

Substitute Chars

Defines which characters are used to scramble the text.

TextTimer

Text Timer [-/-]

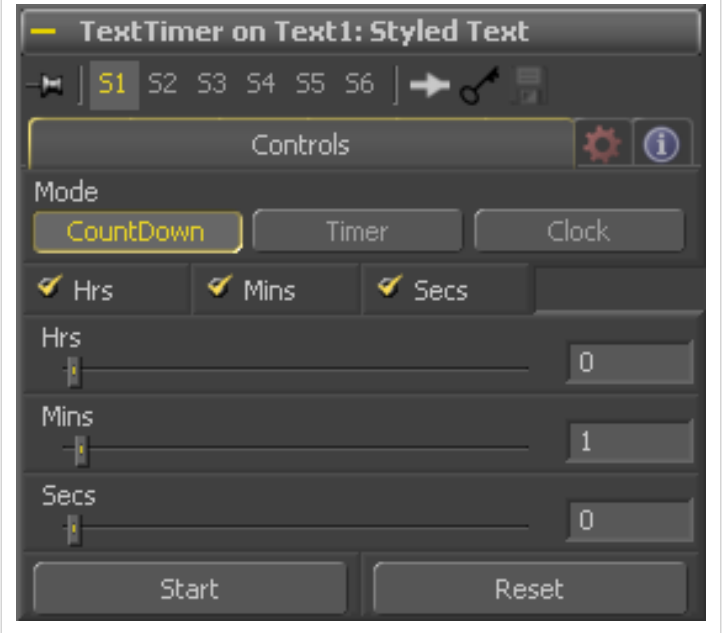


The Text Timer only works on Text+ tools. It makes the Text+ tool in either a Countdown, a Timer or a Clock. This is quite useful for on screen realtime displays or burn in the creation time of a frame into the picture. It can be applied by *right clicking* into the Styled text fiel of a Text+ tool and selecting

TextScramble

.

Controls



Mode

Sets the mode the timer is working in. In "Clock" mode the current system time will be displayed.

Hrs, Mins, Secs (Switches)

Defines which parts of the clock should be shown on screen.

Hrs, Mins, Secs (Sliders)

Set the start time for the countdown and timer mode

Start

Starts the Counter or Timer. Toggles to "Stop" once the timer is running.

Reset

Resets the Counter and Timer to the values set by the Sliders.

TimeCode

TimeCode [-/-]



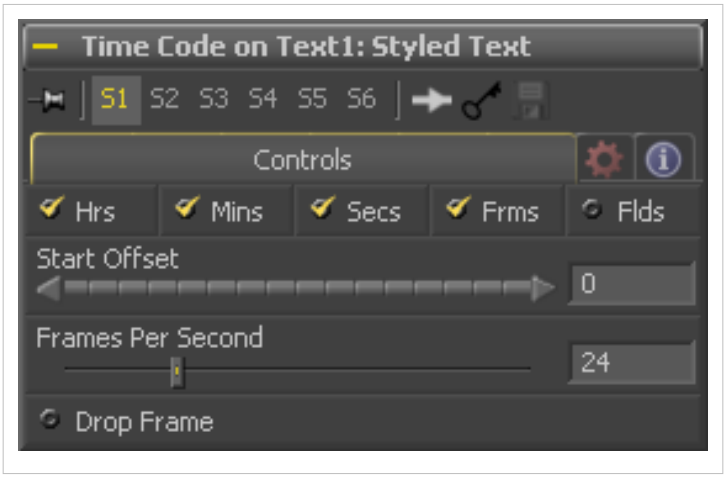
The TimeCode only works on Text+ tools. It sets the Styled text to become a counter based on the current frame. This is quite useful to automate burn-ins for daily renderings.

It can be applied by *right clicking* into the Styled text fiel of a Text+ tool and selecting

TimeCode

.

Controls



Hrs, Mins, Secs, Frms, Flds

Activate or de-activate these options to customize the time code display to show hours, minutes, seconds, frames and fields respectively.

Activating Frames only will give you a plain frame counter

Start Offset

Introduce a positive or negative offset to Fusion's current time to match up with existing time codes.

Frames per second

This should match with your Composition's FPS setting to provide accurate time measurement.

Drop Frame

Activate this checkbox to match the time code with footage that has drop frames, like e.g. certain NTSC formats.

Track

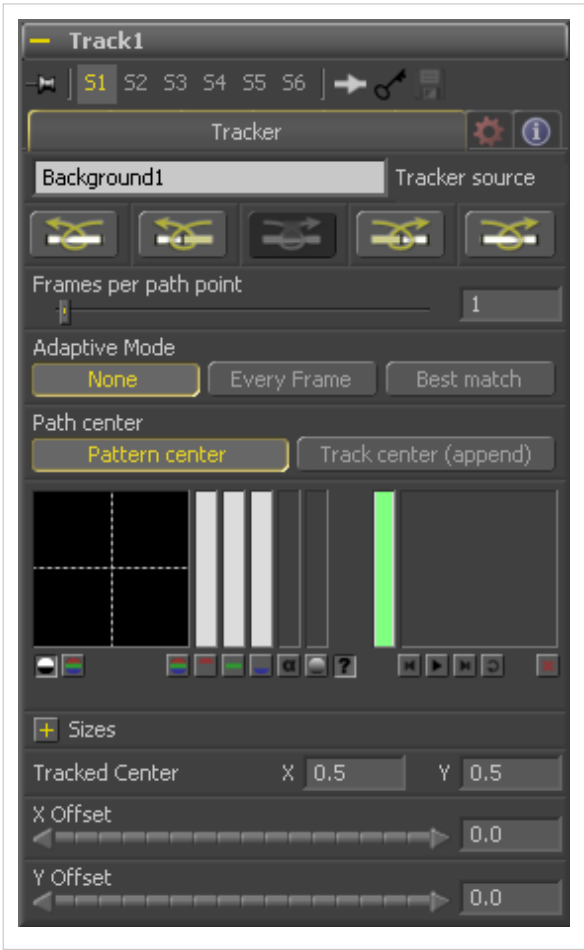
Track [-/-]



Another technique for adding a tracker directly to a control is to apply the tracker as a modifier.

Right-click on the center of the mask and select Ellipse x Center>Modify With>Tracker Position>Steady Position or Unsteady Position. This would add a modifier with a set of controls almost identical to those found in the tracker tool itself.

Tracker Tab



For an in-depth explanation of this tool, please refer to the Tracker documentation in this manual.

The differences between a Tracker Modifier and a Tracker Tool are as follows.

- The tracker modifier can only track a single pattern.
- A source image must be set for the tracker modifier.
- The tracker modifier can only output a single value and cannot be used for complex stabilization procedures.
- The default source image for the modifier is the tool immediately upstream of the tool that contains the modifier (i.e. when adding a tracker modifier to a glow tool with a loader as its input, the tracker source input will default to the output of the loader). Set a different source image for the tracker modifier by typing in the name of the tool. Alternately, drag and drop the source tool from the flow into the text box control.

Example



Imagine that you needed to track an actor's eyes so that an unearthly, alien glow could be applied to the eyes. Add a glow tool and then create an ellipse mask in the shape of the eye.

Vector

Vector [-/-]



The Vector Modifier is used to offset positional controls, such as crosshairs, by distance and angle. These can be static or animated values.

It can be applied by right-clicking on a control and selecting "Modify with -> Vector".

Controls Tab



Origin

This control is used to represent the position from which the vector's distance and angle values originate.

Distance Slider Control

This control is used to determine the distance of the vector from the origin.

Angle Thumbwheel Control

This control is used to determine the angle of the vector relative to the origin.

Image Aspect Slider Control

This control is used primarily to compensate for image aspect differences. A square image of 500 x 500 would use an Image Aspect value of 1, while a rectangular image of 500 x 1000 would use an aspect value of 2. The default for this value is taken from the current frame format preferences using width/height. It may be required to modify this control to match the current image.

Example



- To illustrate, create a simple flow consisting of a black background, a Text tool and a Merge.

- Right-click on the center of the merge and select Modify With>Vector. This will add a vector control header under the small view. Expand it by clicking on the gold triangle. Drag the Distance control to distance the text from the vector origin.
- Drag the Angle thumbwheel to rotate the text around the vector origin.
- Add a path to the vector origin by right-clicking on the Origin control and selecting the Path option from the context menu. Verify that the current frame is set to frame 0 (zero) and drag the Vector Origin crosshair to the bottom left corner of the screen.
- Right-click on the Vector Angle thumbwheel and select Bezier Spline to animate this control.

- Set the Angle Screw to a value of 10.
- Advance to frame 100 and click at the top left corner of the screen to move the vector origin crosshair.
- Set the Vector Angle thumbwheel to a value of 1000. This will cause the text to orbit around the path just created.

XY Path

XY Path [-/-]

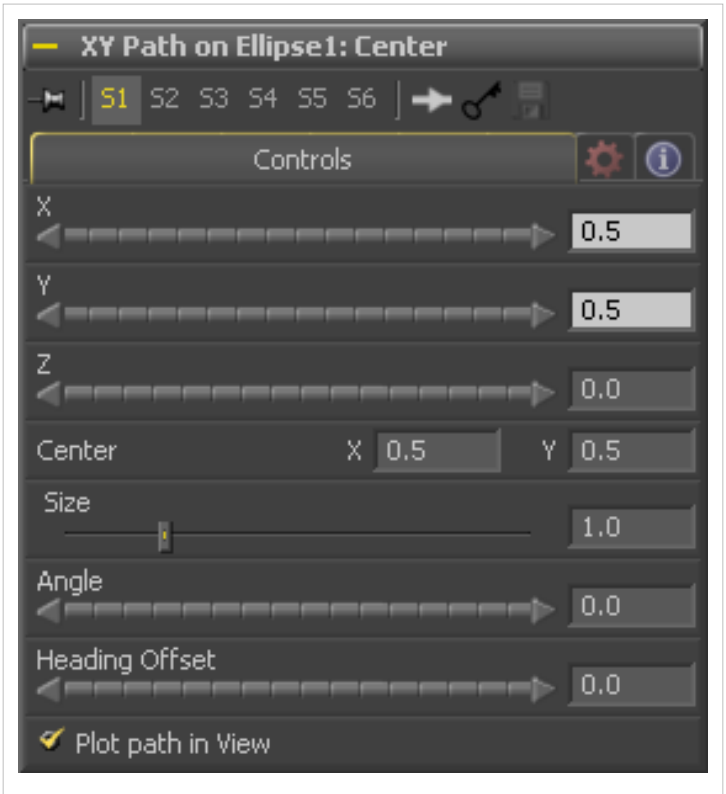


The XY Path type uses a separate spline for the position along the X axis, as it does for the position along the Y axis.

To animate a coordinate control using an XY path, right-click on the control and select Modify With>XY Path from the context menu.

At first glance, XY paths work like displacement paths. To describe the path, change frames and position the control where it should be on that frame, then change frames again and move the control to its new position. Fusion automatically interpolates between the points. The difference is that no keyframes are created on the onscreen path. Look in the spline editor to find the X and Y channel splines. Changes to the controls position will be keyframed on these splines. The advantage to the XY path is that it becomes very easy to work with motion along an individual axis.

Controls Tab



X Y Z values

These reflect the position of the animated control.

Center

The actual center of the path. This can be modified and animated as well to move the entire path around.

Size

The Size of the path. Again this allows for later modification of the animation.

Angle

The Angle of the path. Again this allows for later modification of the animation.

Heading Offset

If other controls like e.g. a mask's Angle is connected to the path's heading, this control allows for adding or aubtracting from the calculated angle.

Plot Path in View

Toggles if or if not the actual path is displayed in the views.

Switching Default Paths Change the Default Path type used when animating a coordinate control to XY path (if this is the preferred type of animation). Open the Global preferences and look under the default's tab for the drop-down list in the default animate section labelled Point With. Change this from the current value to XY Path. The next time Animate is selected from a coordinate control's context menu, an XY path will be used instead of a displacement path.

Paint

Paint

Paint [Pnt]



Paint is an extremely flexible, stroke-based system for making changes directly to a series of images. Use the paint tool for wire and rig removal, image cloning, or to rapidly create custom masks and mattes.

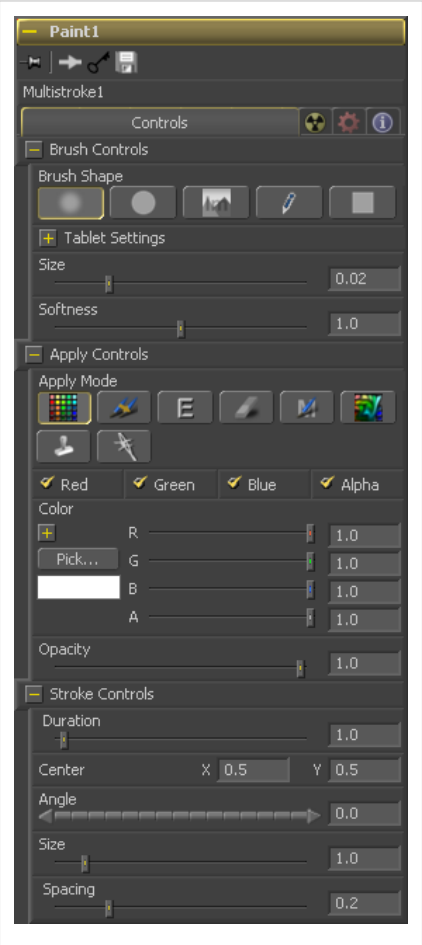
Fusion's paint can even be used to create new images and artistic elements from scratch.

Each paint tool is made up of a series of brush strokes. These strokes are vector shapes created directly on a view. The type of brush used, the size of the stroke and the affect of the stroke on the image are all user-controllable. A wide range of apply modes and brush types are available.

Brush strokes can be made into editable polylines for fine control. They can be animated to change shape, length and size over time. The opacity and size of a stroke can be affected by velocity and pressure (when used with a supported tablet).

Unlimited undo and redo of paint provides the ability to experiment before committing changes to an image sequence. Paint strokes can be re-ordered, deleted and modified with virtually infinite flexibility.

Controls Tab



Not all of the controls described here appear in all modes. Certain controls are only useful in a specific paint mode and are hidden when they are not applicable. Additionally, several of the controls are considered to be self-explanatory the purpose of a center control, angle or size control should be relatively straightforward to determine.

To reduce complexity, these controls are not all described. For further details on the functionality of the Controls Tab, please see the Working With Paint Strokes - Animating Strokes section in this chapter.

Color Space

The Color Space array of buttons is only visible when the current mode is set to fill. These are used to select the color space when sampling colors around the fill center for inclusion in the fill range.

R, G, B And Alpha

When selected, these checkboxes reflect which color channel is being painted. For example, with R, G and B off and Alpha on, painting will occur on the Alpha channel.

Brush Controls

Brush Shape

Soft Brush

The Soft Brush type is a circular brush with soft edges. Modify the size of the brush in the display view by holding Ctrl down while dragging the mouse.

Circular Brush

A Circular Brush is a brush shape with hard edges. Resize this brush interactively.

Image Brush

The Image Brush allows images from any tool in the flow, or from a file system, to be used as a brush. See Creating Custom Brushes later in this chapter.

Single Pixel Brush

The Single Pixel Brush is perfect for fine detail work, creating a brush exactly one pixel in size. No anti-aliasing is applied to the single pixel brush.

Square Brush

A Square Brush is a brush shape with hard edges.

Vary Size

Constant

The brush will be a constant size over the stroke.

With Pressure

The stroke size will vary with the actual applied pressure.

With Velocity

The stroke size will vary with the speed of painting. The faster the stroke, the thinner it is.

Vary Opacity

Constant

The Constant brush will be a constant transparency over the entire stroke.

With Pressure

The stroke transparency will vary with the applied Pressure.

With Velocity

The stroke transparency will vary with the speed of painting. The faster the stroke, the more transparent it is.

Softness

Use this control to increase or decrease the Softness of a soft brush.

Image Source

When using the Image Source brush type, select between three possible sources brush images.

Tool

The image source is derived from the output of a tool on the flow. Drag the tool into the source Tool input to set the source.

Clip

The image source is derived from an image or sequence on disk. Any file supported by Fusion's loader can be used. Locate the file using the filename Clip browser that appears to set the clip used as a source.

Brush

Images stored in the Fusion>Brushes directory are used as a brush for the paint tool. Select the brush from a the menu that appears.

Apply Controls

Apply Mode

Color

The Color apply mode paints simple colored strokes on the screen. When used in conjunction with an image brush, it can also be used to tint the brush.

Clone

The Clone apply mode copies portions of one image into another image, or to clones from the same image using adjustable positions and time offsets. Any image from the flow can be used as the source image.

Emboss

The Emboss apply mode embosses the portions of the image covered by the brush stroke.

Erase

Erase reveals the underlying image through all other strokes, effectively erasing portions of the strokes beneath it with out actually destroying the strokes.

Merge

This apply mode effectively Merges the brush onto the image. This mode behaves in much the same way as the color apply mode but has no color controls. It is best suited for use with the image brush type.

Smear

Smear the image using the direction and strength of the brush stroke as a guide.

Stamp

Stamp the brush onto the image, completely ignoring any alpha channel or transparency information. This mode is best suited for applying decals to the target image.

Wire

This Wire removal mode is used to remove wires, rigging and other small elements in the frame by sampling adjacent pixels and drawing them in toward the stroke.

Stroke Controls

Size

This control adjusts the Size of the brush when the brush type is set to either soft brush or circle. The diameter of the brush is drawn in the display view as a small circle surrounding the mouse pointer. The size can also be adjusted interactively in the display view by holding the Ctrl key while click-dragging the mouse pointer.

Spacing

The Spacing slider determines the distance between blats (samples used to draw a straight line along the underlying vector shape that composes a stroke or polyline stroke). Increasing the value of this slider increases the density of the stroke, whereas decreasing the value is likely to cause the stroke to assume the appearance of a dotted line.

Stroke Animation

The Stroke Animation menu control provides several pre-built animation effects that can be applied to a paint stroke. This menu only appears for Vector strokes.

All Frames

This default displays the stroke for All Frames of the project where a valid target image is available to the paint tool.

Limited Duration

This exists on the number of frames specified by the Duration slider.

Write On

When Write On is selected, an animation spline will be added to the paint stroke that precisely duplicates the timing of the paint stroke's creation. The stroke will be written on the image exactly as it was drawn. To adjust the timing of the write on effect, switch to the spline editor and use the timestretcher mode to adjust the overall length of the animation spline. To smooth or manually adjust the motion, try reducing the points in the animation spline.

Write Off

Write Off will perform the reverse of write on, drawing the stroke starting from the end and working backward to the start of the stroke.

Write On Then Off

This mode will apply a Write On and then a Write Off animation mode to the stroke.

Trail

Selecting the Trail mode will cause both the start and end points of the stroke to be animated simultaneously, offset from each other by the amount specified in the duration control. This has the effect of creating a segment of the stroke that follows the stroke as if it were a path. As with the write on and off effects, this will start at the frame that is current when the animation mode is selected. The timing of the animation can be adjusted manually using the spline or timeline editors.

Duration

Duration sets the duration of each stroke in frames. This control is only present for Multistrokes or when the stroke animation mode is set to Limited Duration. It is most

commonly employed for frame-by-frame rotoscoping through a scene.

Note

Each Vector stroke applied to a scene will have a duration in the timeline that can be trimmed independently from one stroke to the next. The duration can be set to 0.5, which will allow each stroke to last for a single field only when the flow is processing in fields mode.

Write On And Write Off

This range slider appears when the Stroke Animation is set to one of the Write On and Write Off methods. The range represents the beginning and end points of the stroke. Drag the low value upward to give the impression that the stroke is being erased, or drag the high value from 0.0 to 1.0 to give the impression that the stroke is being drawn on the screen. This control can be animated to good effect. It works most effectively when automatically animated through the use of the Write On, Write Off modes of the stroke animation menu.

Make Editable

This button only appears for Vector strokes.. Clicking on 'Make Editable' turns the current stroke into a polyline spline so that the shape can be adjusted or animated.

Working with Paint strokes

Stroke Menu



To create a new paint stroke you can select the type of stroke you want from the menu that is displayed in the view. Please refer to Paint Stroke Modifiers in the Modifiers chapter for further explanation.

Stroke Menu



When a paint stroke is selected or edited a menu is displayed in the view to select different editing opions. Please refer to Working With Polylines for further explanation.

Types of Paint Strokes

Circle

Creates a circular shape with animatable control over radius and center.

Clone Multistroke

Like the multistroke described further below, but specifically meant to clone elements from one image to the other.

Copy Polyline

A Polyline area with animatable offset to to clone elements from one image to the other.

Copy Rectangle

A rectangular shape area with animatable offset to to clone elements from one image to the other.

Fill

Fills an area of the image based on adjustable color values.

Multistroke

Perfect for those 100-strokes-per-frame retouching paint jobs like removing tracking-markers e.g. Much faster than the Stroke, but not editable later on.

Paint Group

Allows easy grouping of multiple strokes with full control over center and size.

Polyline Stroke

A fully editable stroke based on animatable Polylines. Can be connected to existing polylines like Masks or animation Paths.

Rectangle

Creates a rectangular area.

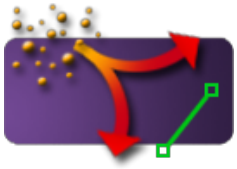
Stroke

The 'standard' Stroke. Fully animatable and editable. Might become slow if hundreds of strokes are used in an image. For huge amounts of strokes better use MultiStroke.

Particles

pAvoid

pAvoid [pAv]

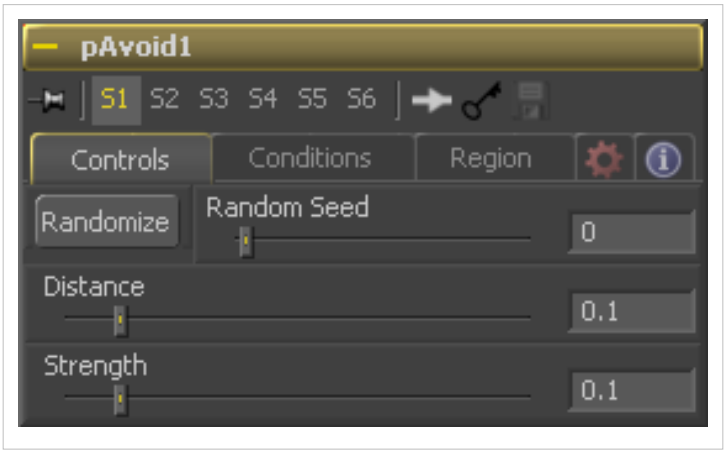


The pAvoid tool is used to create a region or area within the image that affected particles will attempt to avoid entering and/or crossing.

It has two primary controls; one that determines the distance from the region a particle should be before it begins to move away from the region, and another to determine how strongly the particle moves away from the region.

A pAvoid tool creates a `desire' in a particle to move away from a specific region. If the velocity of the particle is stronger than the combined distance and strength of the pAvoid region, the particle's desire to Avoid the region will not overcome its momentum and the particle will cross that region anyway.

Controls Tab



Randomize

Please see 'Particle Common Controls' in the Particles chapter.

Distance

Determines the distance from the region a particle should be before it begins to move away from the region.

Strength

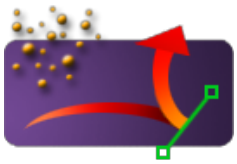
Determines how strongly the particle moves away from the region. Negative values will make the particles move towards the region instead.

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

pBounce

pBounce [pBn]



The pBounce tool is used to create a region from which affected particles will bounce away when they come into contact with the region. The pBounce tool has three main controls, as described below.

Controls Tab



Randomize

Please see 'Particle Common Controls' in the Particles chapter.

Elasticity

Elasticity affects the strength of a bounce, or how much velocity the particle will have remaining after impacting upon the Bounce region. A value of 1.0 will cause the particle to possess the same velocity after the bounce as it had entering the bounce. A value of 0.1 will cause the particle to lose 90% of its velocity upon bouncing off of the region.

The range of this control is 0.0 to 1.0 by default, but greater values can be entered manually. This will cause the particles to gain momentum after an impact, rather than lose it. Negative values will be accepted, but do not produce a useful result.

Variance

By default, particles that strike the Bounce region will reflect evenly off of the edge of the Bounce region, according to the vector or angle of the region. Increasing the Variance above 0.0 will introduce a degree of variation to that angle of reflection. This can be used to simulate the effect of a rougher surface.

Spin

By default, particles that strike the region will not have their angle or orientation affected in any way. Increasing or decreasing the Spin value will cause the Bounce region to impart a spin to the particle based on the angle of collision, or to modify any existing spin on the particle. Positive values will impart a forward spin and negative values impart a backward spin. The larger the value, the faster the spin applied to the particle will be.

Roughness

This slider varies the bounce off of the surface to slightly randomize particle direction.

Surface Motion

This slider makes the bounce surface behave is if it had motion, thus affecting the particles.

Surface Motion Direction

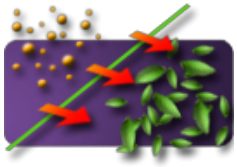
This thumbwheel control sets the angle relative to the bounce surface.

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

pChangeStyle

pChangeStyle [pCS]



The pChangeStyle tool provides a mechanism for changing the appearance or style of particles that interact with a defined region. The primary controls in this tool perfectly mirror those found in the Style tab of the pEmitter tool. Particles that intersect or enter the region defined for this tool will change as described by this tool.

With the possible exception of the pCustom tool, this is the only tool that modifies the appearance of a particle, rather than its motion. It is often used to cause the appearance of particles changing in response to some event, like striking a barrier.

When using the pChangeStyle tool in this fashion, it would be natural to assume that the tool should be placed after the tool causing the event. As an example, consider the creation of a particle system that appears to change its style after bouncing off of a pBounce using a line region. In this case, the pChangeStyle tool also uses a line region, positioned identically to the one in the pBounce tool. Placing the pBounce before the pChangeStyle in the flow causes the particles to bounce off of the region before the pChangeStyle gets an opportunity to calculate its effect on the particle.

The result is that the particle is no longer intersecting with the pChangeStyle tool's region, and so the style never changes.

As a rule, to create a change in style that appears to be caused by a physical event created by another modifier tool in the flow, the pChangeStyle tool must be placed before that tool for the effect to work properly.

Style Tab



Randomize

Please see 'Particle Common Controls' in the Particles chapter.

Change Sets

This option allows to change the particle's set to become influenced by other forces than the original particle. Please see 'Particle Common Controls' in the Particles chapter to learn more about sets.

Style

This option allows to change the particle's Style and thus the look. Please see 'Particle Emitter' in the Particles chapter to learn more about styles.

Color Controls

This option allows to change the particle's Color. Please see 'Particle Emitter' in the Particles chapter to learn more about Color.

Color over life Controls

This option allows to change the particle's Color based on their lifetime Please see 'Particle Emitter' in the Particles chapter to learn more about Color Over Life.

Fade Controls

This option allows to fade the particles in and out at the beginning and end of their lifespan respectively. Please see 'Particle Emitter' in the Particles chapter to learn more about Fade Controls.

Apply Mode

Please see 'Particle Emitter' in the Particles chapter to learn more about Apply Modes.

Sub Pixel Rendered

Please see 'Particle Emitter' in the Particles chapter to learn more about Sub Pixel options.

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

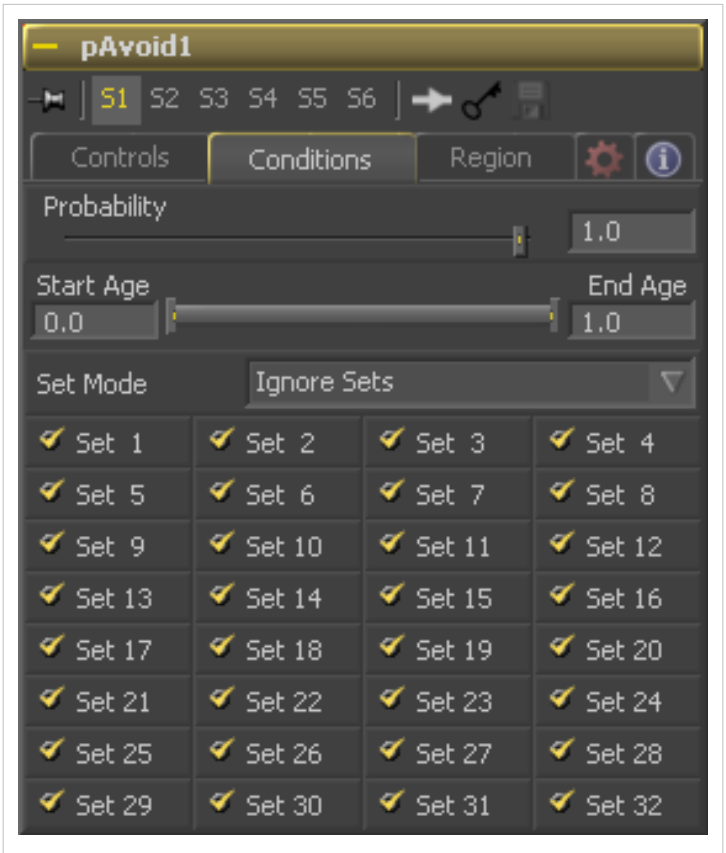
pCommonControls

Particle Common Controls [pCC]



The Common Controls can be found in every Particle tool inside Fusion.

Conditions Tab



Probability

This control determines the Probability or percentage chance that the tool will affect any given particle.

The default value of 1.0 will affect all particles. A setting of 0.6 would mean that each particle has a 60 percent chance of being affected by the control.

Probability is calculated for each particle on each frame. For example, a particle that is not affected by a force on one frame has the same chance of being affected on the next frame.

Start / End Age

This range control can be used to restrict the effect of the tool to a specified percentage of the particle lifespan.

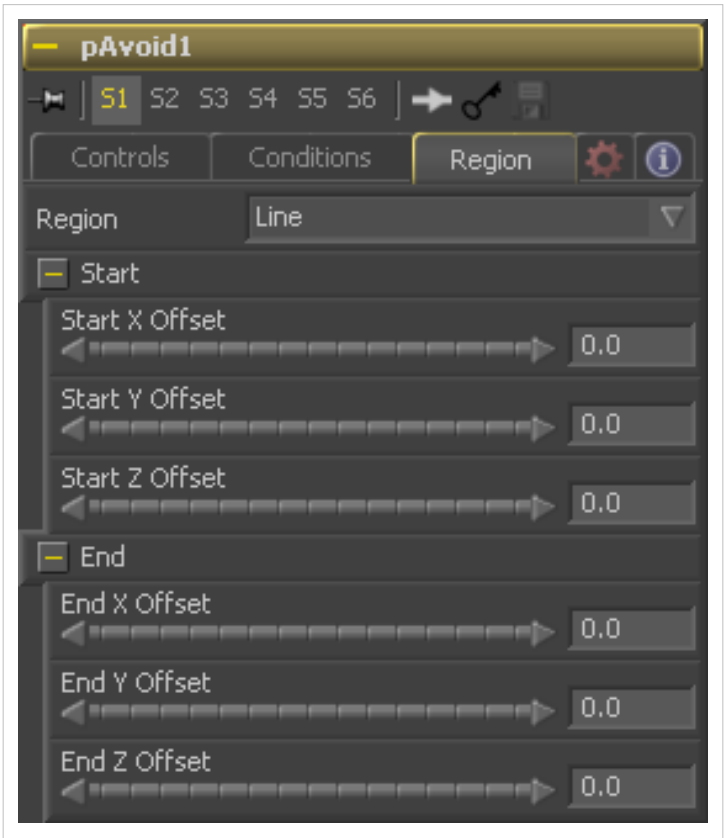
For example, to restrict the affect of a tool to the last 20 percent of a particle's life, set the start value to 0.8 and the end value remains at 1.0. The tool on frames 80 through 100 only affect a particle with a lifespan of 100 frames.

Set Mode And Sets

This menu control determines if the particle tool's effect will be applied to all particles, limited only to particles from a specified set(s), or applied to all particles except the selected set(s).

Sets are assigned by the tools that create particles the pEmitter, pImage Emitter, the pChangeStyle and the pSpawn tools.

Regions Tab



Region

Regions are used to restrict the tool's effect to a geometric region or plane, and to determine the area where particles are created in a pEmitter tool. There are seven types of regions, each with its own controls.

All

In 2D, the Particles will be created anywhere within the boundaries of the image. In 3D, this region describes a cube 1.0 x 1.0 x 1.0 units in size.

Bezier

Bezier mode uses a user-created polyline to determine the region where particles are created. The Bezier mode works in both 2D and 3D modes, however the Bezier polyline region can only be created in 2D.

To animate the shape of the polyline over time or to connect this polyline to another polyline, right-click on the Polyline label at the bottom of the control and select the appropriate option from the context menu.

Bitmap

A Bitmap source from one of the other tools in the composition will be used as the region where particles are born.

Cube

A full 3D Cube is used to determine the region within which particles are created. The height, width, depth and XYZ positions can all be determined by the user and animated over time.

Line

A simple Line control determines where particles are created. The Line is composed of two end-points, which can be connected to Paths or Trackers, as necessary. As with Bezier, this region type works in 3D but the line itself can only be created and adjusted in 2D.

Rectangle

The Rectangle region type is like the Cube type, except that this region has no depth in Z space. Unlike other 2D emitter regions, this region can be positioned and rotated in Z space.

Sphere (3D)

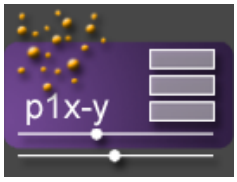
This is a spherical 3D emitter region with size and center Z controls. Sphere (3D) is the default region type for a new pEmitter tool.

Start / End X,Y,Z offset

(Line mode only) These controls define the Start and End point of the line in 3D Space.

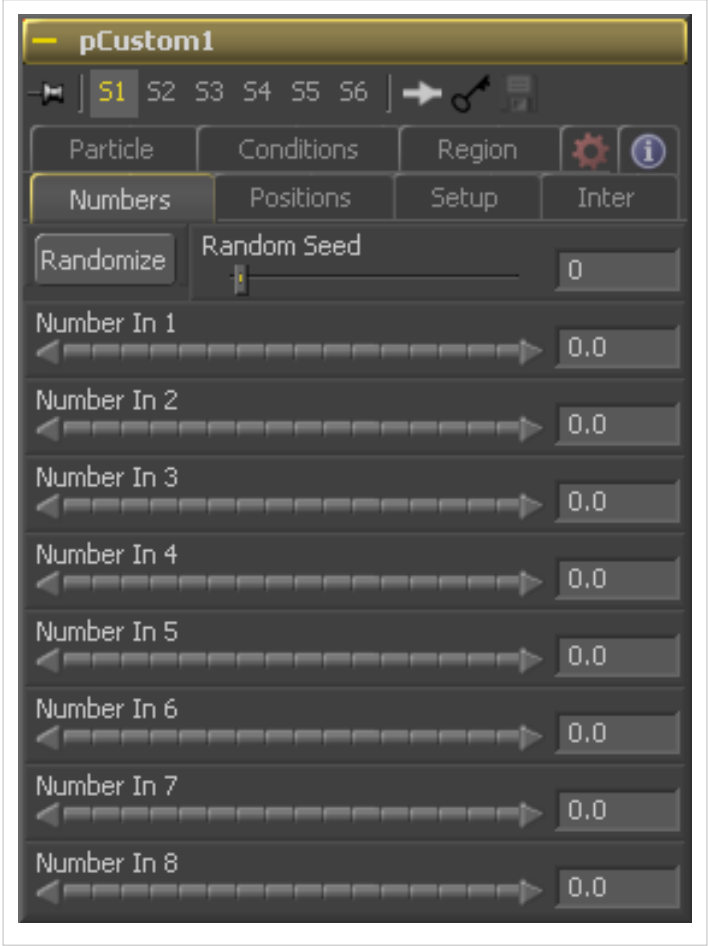
pCustom

pCustom [pCu]



The pCustom tool is used to create custom expressions that affect the properties of particles. This tool is almost identical to the Custom tool, except that the calculations affect properties of the particles rather than the properties of a pixel.

General Concept



The following particle properties are exposed to the pCustom control :

px, py, pz	----	particle position on the x, y, and z axis
vx, vy, vz	----	particle velocity on the x, y and z axis
rx, ry, rz	----	particle rotation on the x, y, and z axis
sx, sy, sz	----	particle spin on the x, y, and z axis

pxi1, pyi1	----	the 2D position of a particle, corrected for image 1's aspect
pxi2, pyi2	----	the 2D position of a particle, corrected for image 2's aspect
mass	----	not currently used by anything
size	----	The current size of a particle
id	----	*(5.2)* The particle's identifier
r, g, b, a	----	The particles Red, Green, Blue and Alpha color values
rgnhit	----	This value is 1 if the particle hit the pCustom tools defined region
rgndist	----	This variable contains the particles distance from the region
condscale	----	The "strength" of the region at the particle's position
rgnix, rgniy, rgniz	----	Values representing where on the region the particle hit
rgnnx, rgnny, rgnnz	----	region surface normal of the particle when it hit the region
w1, h1	----	Image 1 width and height
w2 h2	----	Image 2 width and height
i1, i2, i3, i4	----	The result of the intermediate calculations 1 through 4
s1, s2, s3, s4	----	The result of the setup calculations 1 through 4
n1..n8	----	The values of numeric inputs 1 through 8
p1x, p1y, p1z .. p4x, p4y, p4z	----	The values of position inputs 1 through 4
time	----	The current time or frame of the compositions
age	----	The current age of the particle
lifespan	----	The lifespan of the current particle

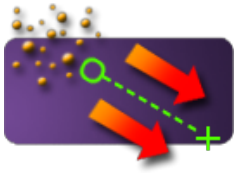
Additional information on the custom class of tools can be found in documentation for the Custom tool. All of the operators, functions and conditional statements described for that tool apply to pCustom as well, including pixel-read functions for the two image inputs (e.g. getr1w(x,y), getz2b(x,y) etc).

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

pDirectionalForce

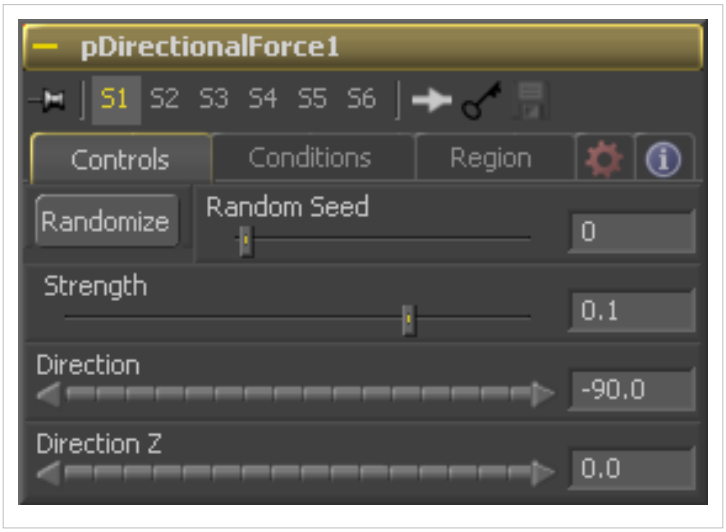
pDirectionalForce [pDF]



This tool applies a uni-directional force that pulls the affected particles in a specified direction. Its primary controls affect the strength of the force, and the angle of the forces pull along the X, Y and Z axis.

As the most common use of this tool is to simulate gravity, the default direction of the pull is down along the Y Axis (-90 degrees) and the default behavior is to ignore regions and affect all particles.

Controls Tab



Randomize

Please see 'Particle Common Controls' in the Particles chapter.

Strength

Determines the power of the force. Positive values will move the Particles in the direction set by the controls, negative values will move the Particles in the opposite direction.

Direction

Determines the direction in X/Y Space.

Direction Z

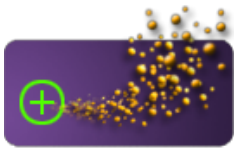
Determines the direction in Z Space.

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

pEmitter

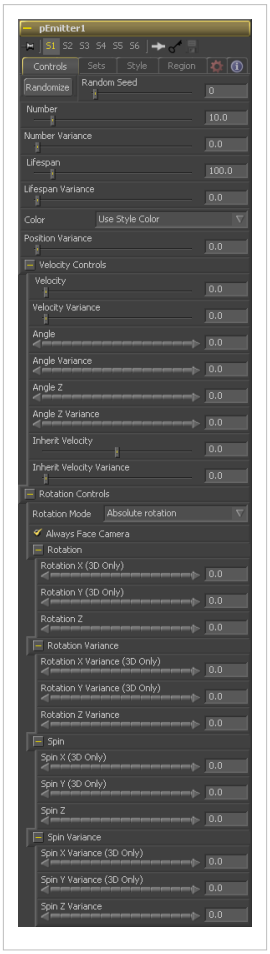
pEmitter [pEm]



The pEmitter tool is the main source of particles (pImageEmitter is another) and will usually be the first tool used in any new particle system. This tool contains controls for setting the initial position, orientation and motion of the particles, as well as controls for the visual style of each particle.

Like all other Particle tools (with the exception of the pRender tool), the pEmitter produces a particle set, not a visible image, and therefore cannot be viewed directly on a display. To view the output of a particle system, add a pRender tool after the pEmitter.

Controls Tab



This tab contains settings that affect the physics of the particles emitted by the tool. These settings do not directly affect the appearance of the particles. They modify behavior like

velocity, spin, quantity and lifespan instead.

Randomize and Random Seed

The Random Seed slider is used to seed all of the variance and random number generators used by the tool when creating the particle system. Two pEmitter tools with exactly the same settings for all controls and the same random seed will generate exactly the same particle system. Changing the random seed will cause variation between the tools. Click on the Randomize button to automatically set a randomly-chosen value for the Random Seed.

Number

This control is used to set the amount of new particles generated on each frame. A value of 1 would cause one new particle to be generated each frame. By frame 10, there would be a total of 10 particles in existence (unless Particle Lifespan was set to less than 10).

Animate this parameter to specify the number of particles generated in total. For example, if only 25 particles in total are desired, animate the control to produce five particles on frame 0-4, then set a key on frame five to generate zero particles for the remainder of the project.

Number Variance

This modifies the amount of particles generated for each frame, as specified by the Number control. For example, if Number is set to 10.0 and Number Variance is set to 2.0, the emitter will produce anywhere from 9-11 particles per frame. If the value of Number Variance is more than twice as large as the value of Number, it is possible that no particles will be generated for a given frame.

Lifespan

This control determines how long a particle will exist before it disappears or `dies'. The default value of this control is 100 frames, although this can be set to any value. The timing of many other particle controls is relative to the Lifespan of the particle. For example, the size of a particle can be set to increase over the last 80% of its life, using the Size Over Life graph in the Style tab of the pEmitter.

Lifespan Variance

Like Number Variance, the Lifespan Variance control allows the Lifespan of particles produced to be modified. If Particle Lifespan were set to 100 frames and the Lifespan Variance to 20 frames, particles generated by the emitter would have a lifespan of 90-110 frames.

Color Source

This provides the ability to specify from where the color of each particle is derived. The default setting is Use Style Color, which will provide the color from each particle according to the settings in the Style tab of the pEmitter tool.

The alternate setting is Use Color From Region, which overrides the color settings from the Style tab and uses the color of the underlying bitmap region.

The 'Use Color From Region' option only makes sense when the pEmitter region is set to use a bitmap produced by another tool in the composition. Particles generated in a region other than a bitmap region will be rendered as white when the 'Use Color From Region' option is selected.

Position Variance

This control determines whether or not particles can be `born' outside of the boundaries of the pEmitter region. By default, the value is set to zero, which will restrict the creation area for new particles to the exact boundaries of the defined region. Increasing this control's value above 0.0 will allow the particle to be born slightly outside of the boundaries of that region. The higher the value, the `softer' the region's edge will become.

Velocity and Velocity Variance

These determine the initial speed or velocity of new particles. By default, the particle has no velocity and will not move from its point of origin unless acted upon by outside forces. A velocity setting of 10.0 would cause the particle to cross the entire width of the image in one step so a velocity of 1.0 would cause the particle to cross the width of the image over 10 frames.

Velocity Variance modifies the velocity of each particle at birth, in the same manner described in Lifespan Variance and Number Variance above.

Angle and Angle Variance

This determines the angle at which particles with velocity applied will be heading at its birth.

Angle Z and Angle Z Variance

This is as above, except this control determines the angle of the particles along the Z space axis (toward or away from the camera).

Rotation Mode

This menu control provides two options to help determine the orientation of the particles emitted. When the particles are spherical, the effect of this control will be unnoticeable.

Absolute Rotation

The particles will be oriented as specified by the Rotation controls, regardless of velocity and heading.

Rotation Relative To Motion

The particles will be oriented in the same direction as the particle is moving. The Rotation controls can now be used to rotate the particle's orientation away from its heading.

Rotation XYZ and Rotation XYZ Variance

These controls allow for Rotation of the individual particles. This can be particularly useful when dealing with a bitmap particle type, as the incoming bitmap may not be oriented in the desired direction.

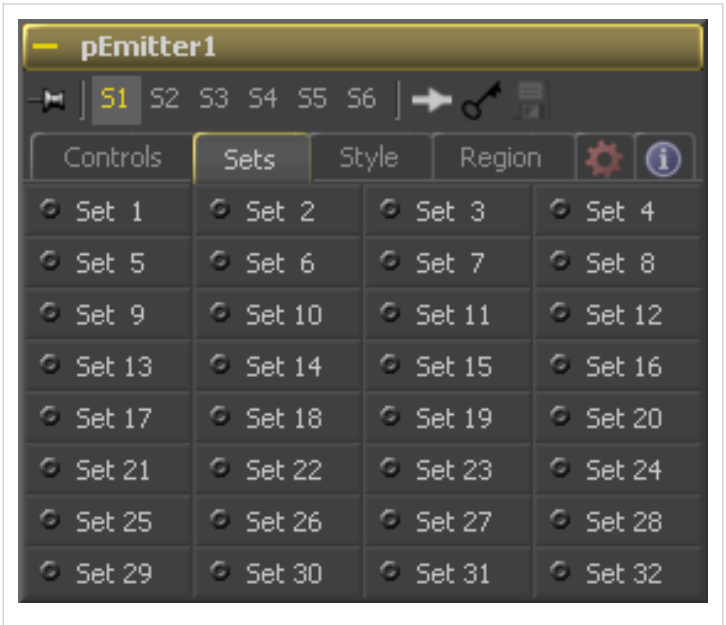
Rotation XYZ Variance can be used to randomly vary the rotation by a specified amount around the center of the Rotation XYZ value to avoid having every particle oriented in the exact same direction.

Spin XYZ and Spin Variance

These provide a spin to be applied to each particle at birth. The particles will rotate 'x' degrees each frame, as determined by the value of Spin XYZ.

The Spin XYZ variances will vary the amount of rotation applied to each frame in the manner described by Number Variance and Lifespan Variance documented above.

Sets Tab

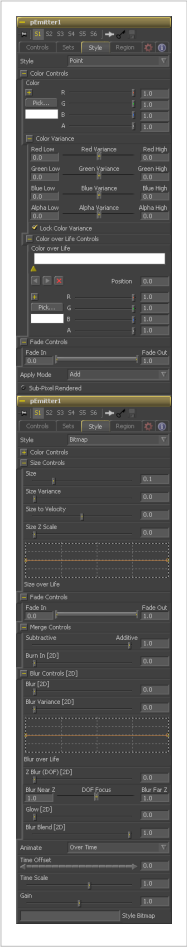


This tab of controls consists of 32 checkboxes that can be used to assign the particles generated by this pEmitter to a specific set.

These controls are useful when a pMerge tool is used to combine multiple pEmitter streams into one. Assigning sets allows individual groups of particles to be addressed by modifier tools like pDirectionalForce and pTurbulence. Sets can also be used to differentiate the particles created with a pSpawn or a pChangeStyle tool from their source particles.

To assign the particles created by a pEmitter to a given set, simply select the checkbox of the set number you want to assign. A single particle stream can be assigned to one or multiple sets.

Style Tab



The Style tab provides controls that affect the appearance of the particles, allowing the look and feel of the particles to be determined and animated over time.

Style Type

The Style Menu control provides access to the various types of particles supported by the Particle Suite. Each style has its own specific controls, as well as controls it will share with other styles.

Point Style

This option produces particles exactly one pixel in size. Controls that are specific to Point Style are Apply Mode and Sub Pixel Rendered.

Bitmap Style and Brush Style

Both the Bitmap and Brush Styles produce particles based on an image file. The Bitmap Style relies on the image from another tool in the Flow and the Brush Style uses image files in the brushes directory. They both have numerous controls for affecting their appearance and animation, described below.

Blob Style

This option produces large, soft spherical particles, with controls for Color, Size, Fade timing, Merge method and Noise.

Coopers Style

This style produces particles composed of bottle caps from the Coopers brand of beer (the best beer in Australia, and quite possibly the world. To dispute our choice please send samples of the superior brew to eyeon Software, c\o the Product Manager).

Line Style

This style produces straight line-type particles with optional 'falloff'. The Size To Velocity control described below (under Size Controls) is often useful with this Line type. The Fade control adjusts the amount of falloff over the length of the line.

Point Cluster Style

This style produces small clusters of single pixel particles. Point Clusters are similar to the Point style, however they are more efficient when a large quantity of particles is required. This style shares controls with the Point style. Additional controls specific to Point Cluster style are Number of Points and Number Variance.

Color

This standard Color Control selects the color and alpha values of the particles generated by the emitter.

Color Variance

These range controls provide a means of expanding the colors produced by the pEmitter. Setting the Red variance range at -0.2 to +0.2 will produce colors that vary 20% on either side of the red channel, for a total variance of 40%. If the pEmitter is set to produce R0.5, G0.5, B0.5 (pure grey), the variance shown above will produce points with a color range between R0.3, G0.5, B0.5 and R0.7, G0.5, B0.5.

To visualize color space as values between 0-256 or as 0-65535, change the values used by Fusion using the Show Color As option provided in the General tab within the Preferences dialog.

Lock Color Variance

This checkbox locks the color variance of the particles. Unlocking this allows the color variance to be applied differently to each color channel, giving rise to a wider range of colors.

Color Over Life

This standard gradient control allows for the selection of a range of color values to which the particle will adhere over its lifetime.

The left point of the gradient represents the particle color at birth. The right point shows the color of the particle at the end of its lifespan.

Additional points can be added to the gradient control to cause the particle color to shift throughout its life.

This type of control can be extremely useful for fire-type effects (for example, the flame may start out blue, turn orange and end a darker red). The gradient itself can be animated over time by right-clicking on the control and selecting Animate from the context menu. All points

on the gradient will be controlled by a single Color Over Life spline, which controls the speed at which the gradient itself changes. You may also use the From Image modifier, which produces a gradient from the range of colors in an image along a line between two points.

Size Controls

The majority of the Size Controls are self-explanatory. The Size and Size Variance controls are used to determine the size and degree of size variation for each particle. It is worth noting that the Point style does not have size controls (each point is a single pixel in size and there is no additional control).

When a Bitmap Particle style is used, a value of 1.0 indicates that each particle should be exactly the same size as the input bitmap. A value of 2.0 will scale the particle up in size by 200%. For the best quality particles, always try to make the input bitmap as big, or bigger, than the largest particle produced by the system.

For the Point Cluster style, the size control adjusts the density of the cluster, or how close together each particle will get.

There are additional size controls that can be used to further adjust the size of particles based on velocity and depth.

Size To Velocity

This increases the size of each particle relative to the Velocity or speed of the particle. The velocity of the particle is added to the size, scaled by the value of this control.

1.0 on this control, such as for a particle travelling at 0.1, will add another 0.1 to the size (velocity * sizetovelocity + size = newsize). This is most useful for Line styles, but the control can be used to adjust the size of any style.

Size Z Scale

This control measures the degree to which the size of each particle is increased or decreased according to its depth (position in Z space). The effect is to exaggerate or reduce the impact of perspective. The default value is 1.0, which provides a relatively realistic perspective effect.

Objects on the focal plane (Z = 0.0) will be actual-sized. Objects farther along Z will become smaller. Objects closer along Z will get larger.

A value of 2.0 will exaggerate the effect dramatically, whereas a value of 0.0 will cancel the effects of perspective entirely.

Size Over Life

This LUT spline control determines the size of a particle throughout its lifespan. The vertical scale represents a percentage of the value defined by the Size control, from 0 to 200%. The horizontal scale represents a percentage of the particle's lifespan (0 to 100%).

This graph supports all of the features available to a standard LUT editor. These features can be accessed by right-clicking on the graph. It is also possible to view and edit the graph spline in the larger Spline view.

Fade Controls

This simple range slider provides a mechanism for fading a particle at the start and end of its lifetime. Increasing the Fade In value will cause the particle to fade in at the start of its life. Decreasing the Fade Out value will cause the particle to fade out at the end of its life.

This control's values represent a percentage of the particle's overall life, therefore, setting the Fade In to 0.1 would cause the particle to fade in over the first 10% of its total lifespan. For example, a particle with a life of 100 frames would fade in from frame 0..10.

Merge Controls

This set of particle controls affects the way individual particles are merged together. The Subtractive/Additive slider works exactly as documented in the standard Merge tool. The Burn-In control will cause the particles to overexpose, or `blow out', when they are combined together.

None of the Merge controls will have any effect on a 3D particle system.

Blur Controls

This set of particle controls can be used to apply a Blur to the individual particles. Blurring can be applied globally, by age, or by Z depth position.

None of the Blur controls will have any effect on a 3D particle system.

Blur And Blur Variance

These controls apply Blur to each particle. Unlike the Blur in the pRender tool, this is applied to each particle independently before the particles are merged together. The Blur Variance slider modifies the amount of blur applied to each particle.

Blur Over Life

This spline graph controls the amount of Blur that is applied to the particle over its life. The vertical scale represents a percentage of the value defined by the Blur control. The horizontal scale represents a percentage of the particle's lifespan.

This graph supports all of the features available to a standard LUT editor. These features can be accessed by right-clicking on the graph. It is also possible to view and edit the graph spline in the larger Spline view.

Z Blur (DoF) And DoF Focus

This slider control applies blur to each particle based on its position along the Z axis.

The DoF Focus range control is used to determine what area of the image remains in focus. Lower values along Z are closer to the camera. Higher values are farther away. Particles within the range will remain in focus. Particles outside that range will have the blur defined by the Z Blur control applied to them.

Apply Mode

This control only applies to 2D particles. 3D particle systems are not affected.

Add

Overlapping particles are combined by adding the color values of each particle together.

Merge

Overlapping particles are merged together.

Style Bitmap

(*Bitmap Style Only*) This control appears when the Bitmap style is selected, along with an orange Style Bitmap input on the tool's icon in the Flow view. Connect a 2D tool to this input to provide images to be used for the particles. You can do this on the Flow view, or you may drag

and drop the image source tool onto the Style Bitmap control from the Flow or Timeline, or right-click on the control and select the desired source from the Connect To menu.

Brush

(*Brush Style Only*)This drop-down list shows the names of any image files stored in the Brushes directory. The location of the Brushes directory is defined in the Preferences dialog, under Path Maps. The default is the Brushes subdirectory within Fusion's install folder. If no images are in this directory, the only option in the menu will be None, and no particles will be rendered.

Animate

(*Bitmap Style Only*) This list determines how the animation of the bitmap source is applied to newly-created particles. It can be hard to visualize the impact of this control until it has been experimented with. A good way to experiment is to load the flow in the Fusion>Examples directory called pTextParticleAge.comp and try out the three settings. View the Text tool in the display view and the pRender tool another view, then step through the frames using the [and] keys.

Over Time

All particles use the image produced by the Style Bitmap tool at the current time, and change to each successive image together in step, as time increases. A particle created at frame 1 will contain the image at frame 1 of the Style Bitmap. At frame 2, the original particle will use the image from frame 2, and so will any new particles. All created particles will share exactly the same bitmap image from their source at all times.

Particle Age

Each particle animates through the sequence of images provided by the Style Bitmap tool, independently of other particles. In other words, an individual particle's appearance is taken from the Style Bitmap tool at successive times, indexed by its age.

Particle Birth Time

New particles take the image from the Style Bitmap tool at the current time and keep it unchanged until the end of the particle's lifespan. Thus, particles generated on a given frame will all have the same appearance, and will stay that way.

Time Offset

(*Bitmap Style Only*) This control allows the bitmap source frame to be Offset in time from the current frame.

Time Scale

(*Bitmap Style Only*) This control can be used to scale the time range of the source bitmap images by a specified amount. For example, a scale of 2 will cause the particle created at frame 1 to be read from the bitmap source at frame 2.

Gain

(*Bitmap and Brush Style Only*) This control is used to apply a correction to the overall Gain of the image that is used as the bitmap. Higher values produce a brighter image, whereas lower values reduce both the brightness and the transparency of the image.

Noise

(*Blob Style Only*) Increasing this control's value will introduce grain-type noise to the blobby particle.

Fade

(*Line Style Only*) The Fade control adjusts the falloff over the line particle's length. The default value of 1.0 causes the line to fade out completely by the end of the length.

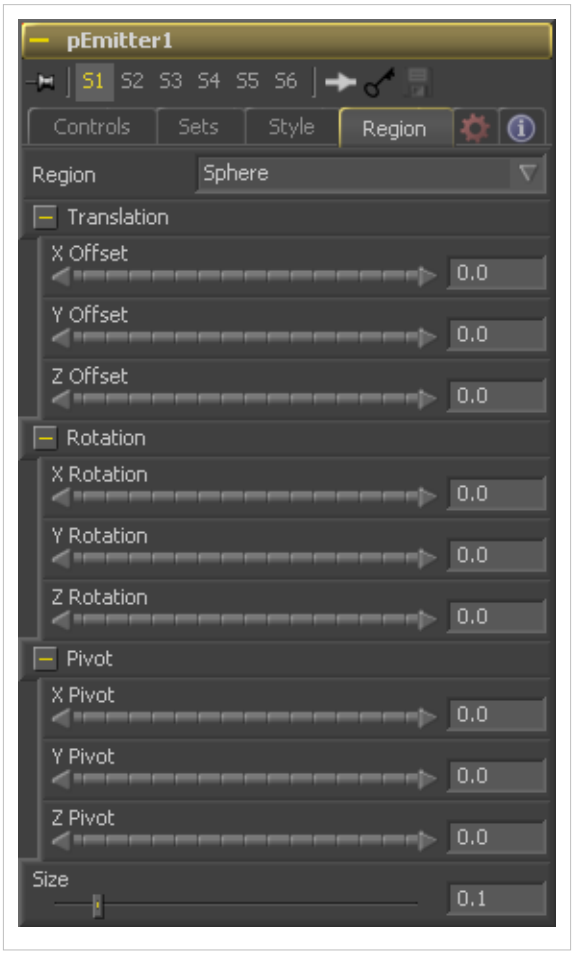
Sub Pixel Rendered

(*Point and Point Cluster Style Only*) This checkbox determines if the point particles are rendered with Sub Pixel precision, which provides smoother looking motion but blurrier particles that take slightly longer to render.

Number Of Points And Variance

(*Point Cluster Style Only*) The value of this control determines how many points are in each Point Cluster.

Region Tab



The controls found under the Region tab are used to determine what portion of the image will actually generate particles. This has no affect on where a particle can go, only on where it is actually created or born. Only one region can be applied to any given particle emitter.

2D-type regions will produce particles along a flat plane in Z Space, usually positioned at Z = 0.0. 3D emitters possess depth and can produce particles inside a user-defined, three-dimensional region.

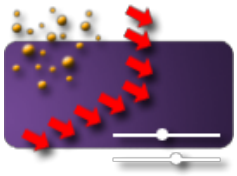
There are seven types of regions available, each with its own set of controls as described in the Particle Common Controls.

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

pFlock

pFlock [pFl]

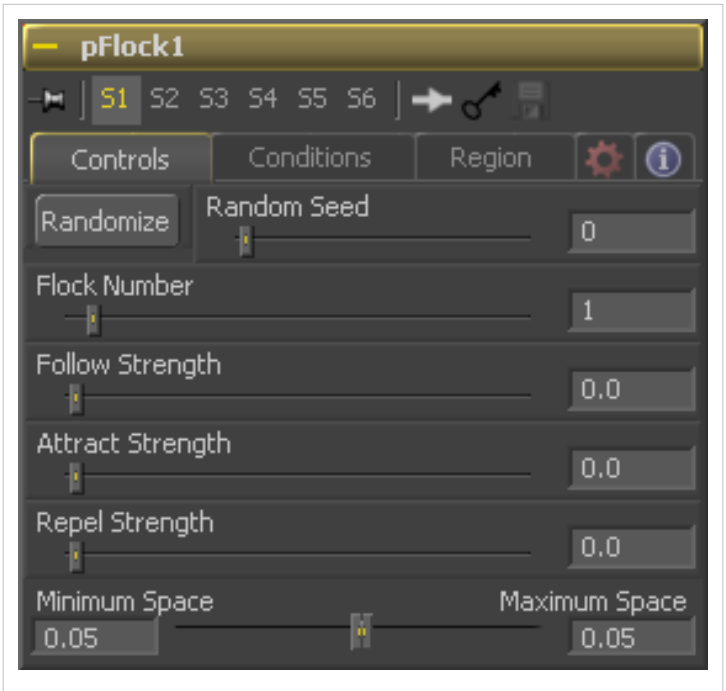


Flocking is a mechanism that can be used to simulate the behavior of organic systems, such as a flock of birds or a colony of ants. Its use can make an otherwise mindless particle system appear to be motivated, or acting under the direction of intelligence.

The pFlock tool works through two basic principles. Each particle attempts to stay close to other particles and each particle attempts to maintain a minimum distance from other particles. The strength of these desires produces the seemingly motivated behavior perceived by the viewer.

The following five parameters control the behavior of the Flocking system.

Controls Tab



Randomize

Please see 'Particle Common Controls' in the Particles chapter.

Flock Number

The value of this control represents the number of other particles that the affected particle will attempt to follow. The higher the value, the more visible `clumping' will appear to be in the particle system, and the larger the groups of particles will appear to be.

Follow Strength

This value represents the strength of each particle's desire to follow other particles. Higher values will cause the particle to appear to expend more energy and effort to follow other particles. Lower values increase the likelihood that a given particle will break away from the pack.

Attract Strength

This value represents the strength of attraction between particles. When a particle moves farther from other particles than the Maximum Space defined in the pFlock tool, it will attempt to move closer to other particles. Higher values cause the particle to maintain its spacing energetically, resolving conflicts in spacing more rapidly.

Repel Strength

This value represents the force applied to particles that get closer together than the distance defined by the Minimum Space control of the pFlock tool. Higher values will cause particles to move away from neighboring particles more rapidly, shooting away from the pack.

Minimum/Maximum Space

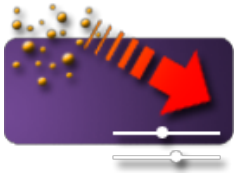
This range control represents the distance each particle attempts to maintain between it and other particles. Particles will attempt to get no closer or further than the space defined by the Minimum/Maximum values of this range control. Smaller ranges will give the appearance of more organized motion. Larger ranges will be perceived as disorganized and chaotic.

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

pFriction

pFriction [pFr]



The pFriction tool applies resistance to the motion of a particle, slowing the particle's motion through a defined region. This tool produces two types of Friction. One type reduces the Velocity of any particle intersecting/crossing the defined region, and one reduces or eliminates spin and rotation.

Controls Tab



Randomize

Please see 'Particle Common Controls' in the Particles chapter.

Velocity Friction

This value represents the Friction force applied to the particle's Velocity. The larger the value, the greater the Friction, thus slowing down the particle.

Spin Friction

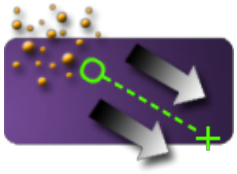
This value represents the Friction force applied to the particle's rotation or Spin. The larger the value, the greater the friction, thus slowing down the rotation of the particle.

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

pGradientForce

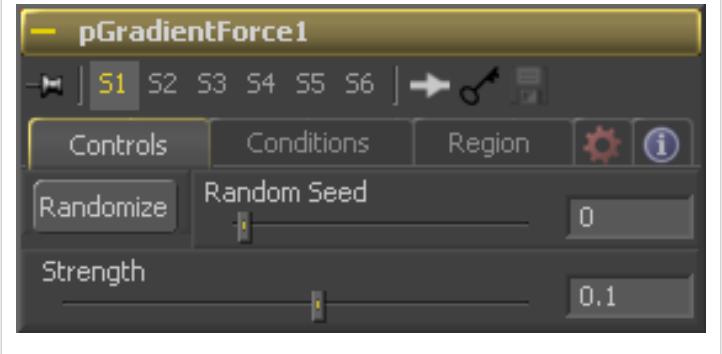
pGradientForce [pGF]



The Gradient Force control accepts two inputs, one from a particle system and one from a bitmap image. The particles are affected by a force generated by the gradients in the alpha values of the input image. Particles will accelerate along the gradient, moving from white to black (high values to low).

This tool can be used to give particles the appearance of moving downhill, or of following the contour of a provided shape.

Controls Tab



Randomize

Please see 'Particle Common Controls' in the Particles chapter.

Strength

Gradient Force has only one specific control, it affects the strength of the force and acceleration applied to the particles. Negative values on this control will cause the Gradient Force to be applied from black to white (low values to high values).

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

pImageEmitter

pImageEmitter [pIE]



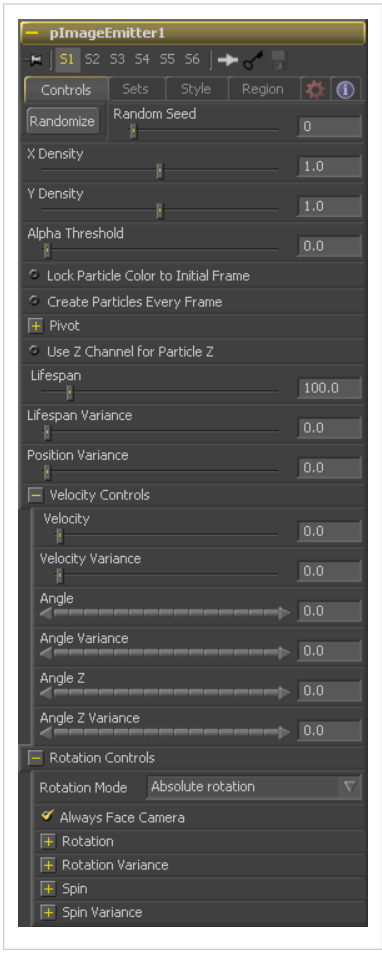
The pImageEmitter tool takes an input image and treats each pixel of the image as if it were a particle. The main differences between the pImageEmitter and the normal pEmitter is that instead of emitting particles randomly within a given region, this tool emits pixels in a regular 2D grid with colors based on the input image.

{{{1}}}

Note: The pixels are emitted in a fixed-size 2D grid on the XY plane, centered on the Pivot position. Changing the Region from the default of All allows you to restrict particle creation to more limited areas. If you need to change the size of this grid, use a Transform 3D tool after the pRender.

Note: Remember that the various emitter controls apply only to particles *when they are emitted*. That is, they set the initial state of the particle, and do not affect it for the rest of its lifespan. Since pImageEmitter (by default) emits particles only on the first frame, animating these controls will have no effect. However, if the Create Particles Every Frame checkbox is turned on, new particles will be emitted each frame, and will use the specified initial settings for that frame.

Controls Tab



The great majority of controls in this tool are identical to those found in the pEmitter, and those controls are documented there. Below are the descriptions of the controls unique to the pImageEmitter tool.

X And Y Density

The X and Y Density sliders are used to set the mapping of particles to pixels for each axis. They control the density of the sampling grid. A value of 1.0 for either slider indicates 1 sample per pixel. Smaller values will produce a looser, more pointilistic distribution of particles, while values above 1.0 will create multiple particles per pixel in the image.

Alpha Threshold

The Alpha Threshold is used for limiting particle generation so that pixels with semi-transparent alpha values will not produce particles. This can be used to harden the edges of an otherwise soft alpha channel. The higher the threshold value, the more opaque a pixel has to be before it will generate a particle. Note that the default threshold of 0.0 will create particles for every pixel, regardless of alpha, though many may be transparent and invisible.

Lock Particle Color To Initial Frame

Select this checkbox to force the particles to keep the color with which they were born throughout the life of the particle. If this is off, and the input image changes on successive

frames, the particles will also change color to match the image. This allows "video playback" on a grid of particles.

Create Particles Every Frame

Enabling this creates a whole new set of particles every frame, instead of just one set on the frame. This can lead to very large particle systems, but allows some interesting effects, for example if the particles are given some initial velocity, or if emitting from an animated source. Try a small velocity, Angle Z of -90 and a seething Fast Noise as a source, to get smoothly-varying clouds of particles that you could fly through. Note that if this checkbox is left off, only one set of particles is ever created, and thus animating any of the emitter's other controls will have no effect.

X/Y/Z Pivot

These controls allow you to position the grid of emitted particles.

Use Z Channel For Particle Z

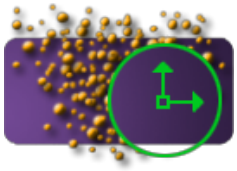
If the input image used to generate the particles has a Z depth channel, that channel can be used to determine the initial position of the particle in Z space. This can have an interesting hollow shell effect when used in conjunction with camera rotation in the pRender tool.

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

pKill

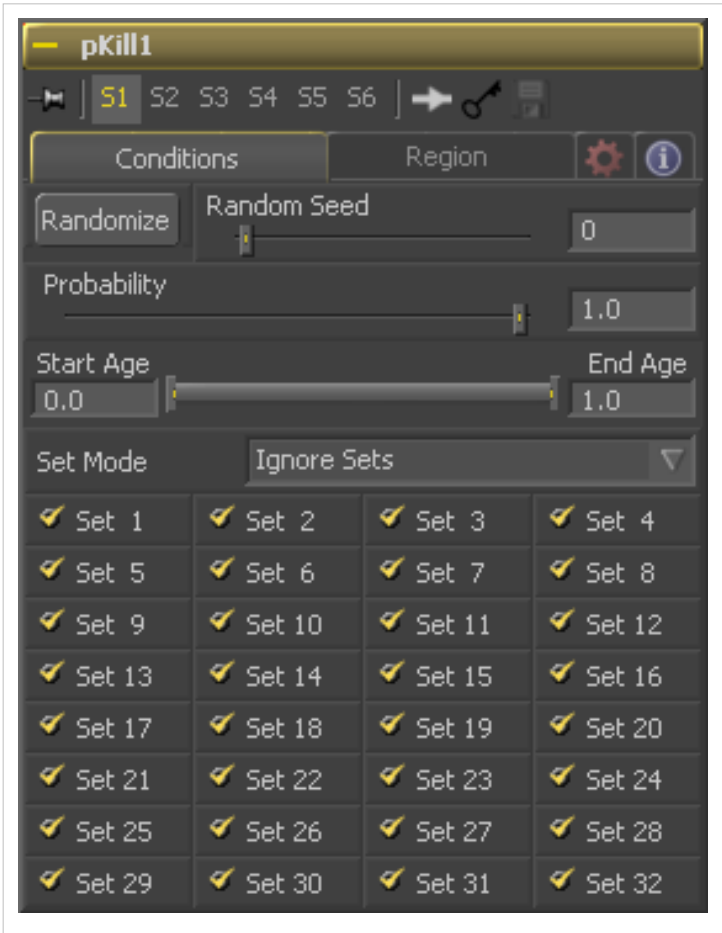
pKill [pKl]



The Kill tool is used to destroy (kill) any particle that crosses or intersects its region. It has no specific controls, as it has only one possible affect on a particle.

The controls found in the Region tab are normally used to limit this tool, by restricting the effect to particles which fall within a certain region, age, set, or by reducing the probability of the tool applying to a given particle.

Particle Kill

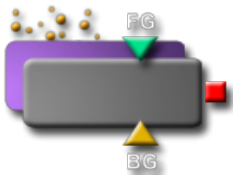


Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

pMerge

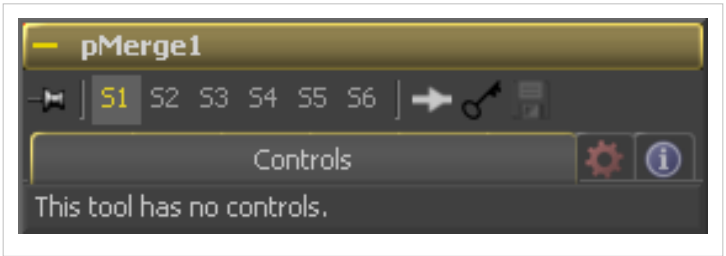
pMerge [pMg]



This tool has no controls whatsoever. It serves to combine particles from two streams. Any tools downstream of the Particle Merge tool will treat the two streams as one.

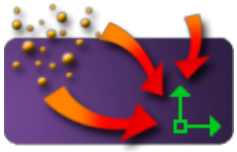
The combined particles will preserve any sets assigned to them when they were created, making it possible for tools downstream of the pMerge to isolate specific particles when necessary.

Particle Merge



pPointForce

pPointForce [pPF]



This tool applies a force to the particles that emanates from a single point in 3D space. The pPointForce can either attract or repel particles within its sphere of influence. There are four controls specific to the pPointForce tool.

Controls Tab



Randomize

Please see 'Particle Common Controls' in the Particles chapter.

Strength

This parameter sets the Strength of the force emitted by the tool. Positive values represent attractive forces. Negative values represent repellent forces.

Power

This determines the degree to which the Strength of the force falls off over distance. A value of zero causes there to be no falloff of strength. Higher values will impose an ever-sharper falloff in strength of the force with distance.

Limit Force

The Limit Force control is used to counter-balance potential problems with temporal sub-sampling. Because the position of a particle is only sampled once a frame (unless sub-sampling is increased in the pRender tool), it is possible that a particle can overshoot the Point Force's position and end up getting thrown off in the opposite direction. Increasing the value of this control reduces the likelihood that this will happen.

X, Y, Z Center Position

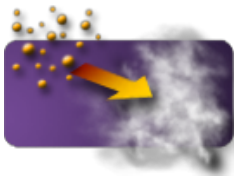
These controls are used to represent the X, Y, and Z coordinates of the point force in 3D space.

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

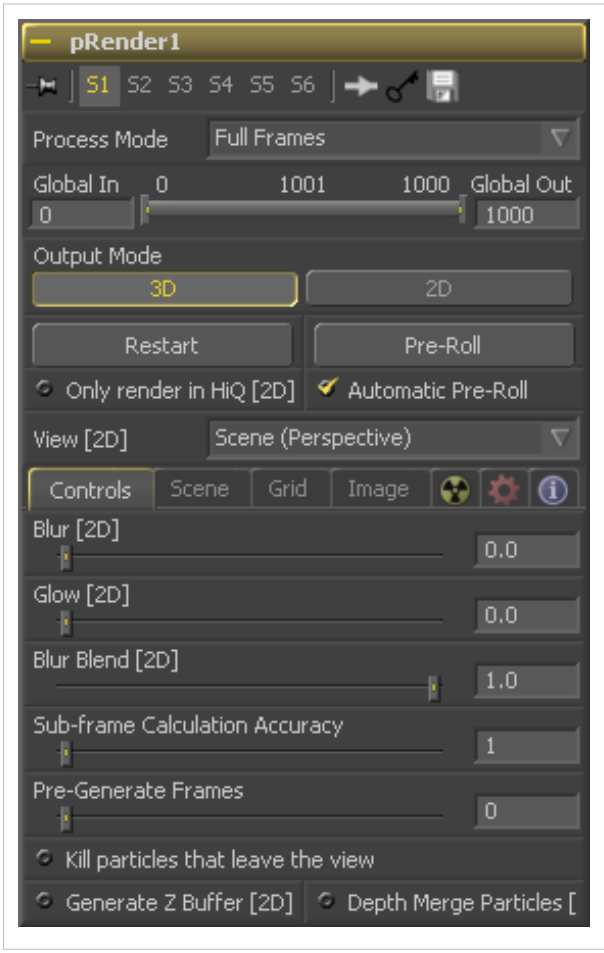
pRender

pRender [pRn]



The pRender tool converts the particle system to either an image or geometry. The default is a 3D particle system, which must be connected to a Renderer 3D to produce an image. This allows the particles to be integrated with other elements in a 3D scene before they are rendered.

Controls Tab



Output Mode (2D / 3D)

While the pRender defaults to

3D

output, it can be made to directly render a

2D

image instead, as with DF4. This is done with the

3D

and

2D

buttons on the Output Mode control. If the pRender is not connected to a

3D

-only or

2D

-only tool, you can also switch it by selecting View>

2D

Viewer from the display view's context menu.

In

3D

mode the only controls in the pRender tool that have any affect at all are Restart, Pre-roll and Automatic Pre-Roll, Sub-Frame Calculation Accuracy and Pre-Generate frames. The remaining controls affect

2D

particle renders only. The pRender tool also has a Camera input on the flow that allows connection of a Camera 3D tool. This can be used in both

2D

and

3D

modes to allow control of the viewpoint used to render an output image.

Render And The Display Views When the pRender tool is selected in a flow, all of the onscreen controls from particle tools connected to it are presented in the display views. This provides a fast, easy-to-modify overview of the forces applied to the particle system as a whole.

Pre-Roll Options

Particle tools generally need to know the position of each particle on the last frame before they can calculate the affect of the forces applied to them on the current frame. This makes changing current time manually by anything but single frame intervals likely to produce an inaccurate image. The controls here are used to help accommodate this by providing methods of calculating the intervening frames.

Restart

This control also works in 3D. Clicking on the Restart button will restart the particle system at the current frame, removing any particles created up to that point and starting the particle system from scratch at the current frame.

Pre-Roll

This control also works in 3D. Clicking on this button will cause the particle system to recalculate, starting from the beginning of the render range up to the current frame. It will not render the image produced. It will only calculate the position of each particle. This provides a relatively quick mechanism to ensure that the particles displayed in the views are correctly positioned.

If the pRender tool is displayed when the Pre-Roll button is selected, the progress of the pre-roll is shown in the display view, with each particle shown as point style only.

Automatic Pre-Roll

Selecting the Automatic Pre-Roll checkbox causes the particle system to automatically pre-roll the particles to the current frame whenever the current frame changes. This prevents the need to manually select the Pre-Roll button whenever advancing through time in jumps larger than a single frame. The progress of the particle system during an Automatic Pre-Roll is not displayed

to the views, to prevent distracting visual disruptions.

About Pre-Roll Pre-Roll is necessary because the state of a particle system is completely dependent on the last known position of the particles. If the current time were changed to a frame where the last frame particle state is unknown, the display of the particle is calculated on the last known position, producing inaccurate results. To demonstrate, add a pEmitter and pRender tool to the composition. View the pEmitter in one of the display views. Right-click in the display view and select Views>2D Viewer from the context menu. Set the Velocity of the particles to 0.1. Place the pEmitter on the left edge of the screen and set the Current Frame to 0. Set a Render Range from 0-100 and press the Play button. Observe how the particle system behaves. Stop the playback and return the current time to frame 0. Make sure that the Automatic Pre-Roll option is off in the pRender tool. Now try jumping from frame 0 to 10, then to frame 60 and 90. Do not pass through the frames in between. Use the current time edit control or click in the ruler directly to jump straight to the frame. See how the particle system only adds to the particles it has already created and does not try to create the particles that would have been emitted in the intervening frames. Try selecting the Pre-Roll button in the Pre-Render tool. Now the particle system state is represented correctly. For simple, fast rendering particle systems, it is recommended to leave the Automatic Pre-Roll option on. For slower particle systems with long time ranges, it may be desirable to only Pre-Roll manually, as required.

Only Render In Hi-Q

Selecting this checkbox causes the style of the particles to be over-ridden when the Hi-Q checkbox is de-selected, producing only fast rendering Point style particles. This is useful when working with a large quantity of slow image-based or blob-style particles. To see the particles as they would appear in a final render, simply enable the Hi-Q checkbox.

View

This drop-down list provides options to determine the position of the camera view in a 3D particle system. The default option of Scene (Perspective) will render the particle system from the perspective of a virtual camera, the position of which can be modified using the controls in the Scene tab. The other options provide orthographic views of the front, top and side of the particle system.

It is important to realize that the position of the onscreen controls for particle tools is unaffected by this control. In 2D mode the onscreen controls are always drawn as if the display view were showing the front orthographic view. (3D mode gets the position of controls right at all times.)

The View setting is ignored if a Camera 3D tool is connected to the pRender tool's Camera input on the Flow, or if the pRender is in 3D mode.

Output Mode

Blur, Glow And Blur Blend

These sliders applies a Gaussian blur, glows and blur blending to the image as it is rendered, which can be used to soften the particles and blend them together. The end result is no different than adding a Blur after the pRender tool in the flow. 2D particles only.

Sub Frame Calculation Accuracy

This determines the number of sub-samples taken between frames when calculating the particle system. Higher values will increase the accuracy of the calculation but also increase the amount of time taken to render the particle system.

Pre-Generate Frames

This control is used to cause the particle system to pre-generate a set number of frames before its first valid frame. This is used to give a particle system an initial state from which to start.

A good example of when this might be useful is in a shot where particles are used to create the smoke rising from a chimney. Pre-Generate Frames would be set to a number high enough to ensure that the smoke is already present in the scene before the render begins, rather than having it just starting to emerge from the emitter for the first few frames.

Kill Particles That Leave The View

Selecting this checkbox control will automatically destroy any particles that leave the visible boundaries of the image. This can help to speed render times. Particles destroyed in this fashion will never return, regardless of any external forces acting upon them.

Generate Z Buffer

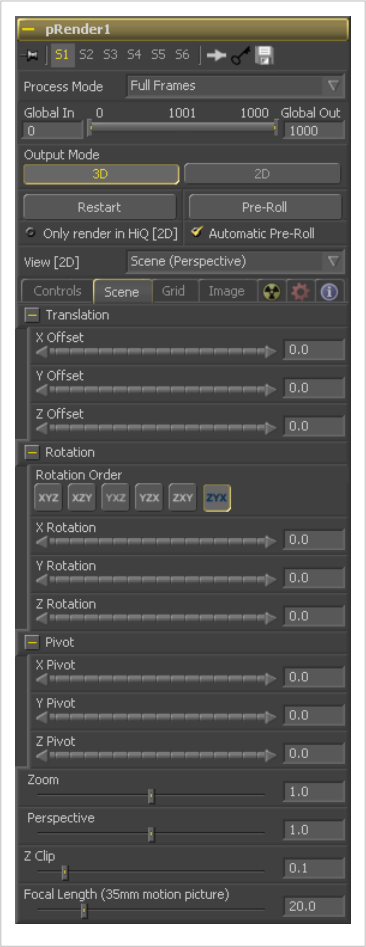
Selecting this checkbox will cause the pRender tool to produce a Z Buffer channel in the image. The depth of each particle is represented in the Z Buffer. This channel can then be used for additional depth operations like Depth Blur, Depth Fog, and Downstream Z Merging.

Enabling this option is likely to increase the render times for the particle system dramatically.

Depth Merge Particles

Enabling this option will cause the particles to be merged together using Depth Merge techniques, rather than layer-based techniques.

Scene Tab



None of the controls in this tab have any effect on a 3D particle system. They apply only to 2D particle systems.

The controls in this tab are used to reposition the virtual camera in 3D space through rotation, translation and axis conversions. Zoom and perspective adjustments can also be made to the camera view. The default values are essentially identical to a front orthographic view.

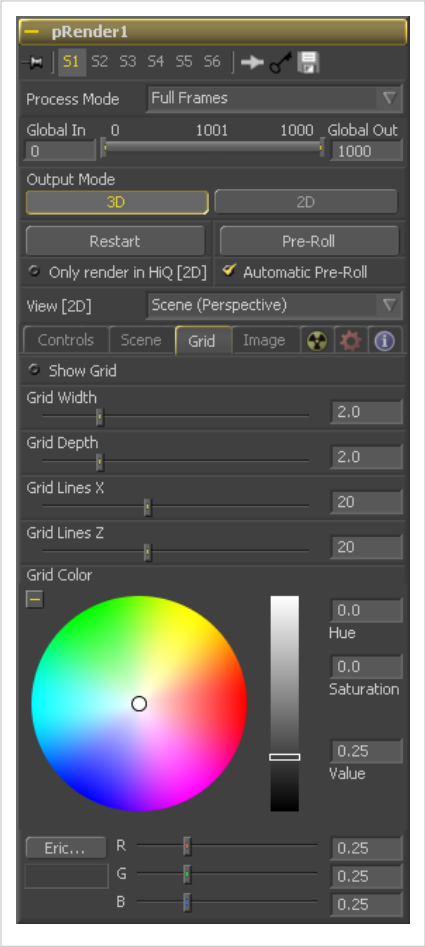
The transformations applied here do not affect the drawing of onscreen controls for particle tools (with the exception of the particle grid described below). Use the front orthographic view for an accurate display of onscreen controls when working with 2D particles.

These controls can be animated.

Z Clip

The Z Clip control is used to set a clipping plane in front of the camera. Particles that cross this plane are clipped, preventing them from impacting on the virtual lens of the camera and dominating the scene.

Grid Tab

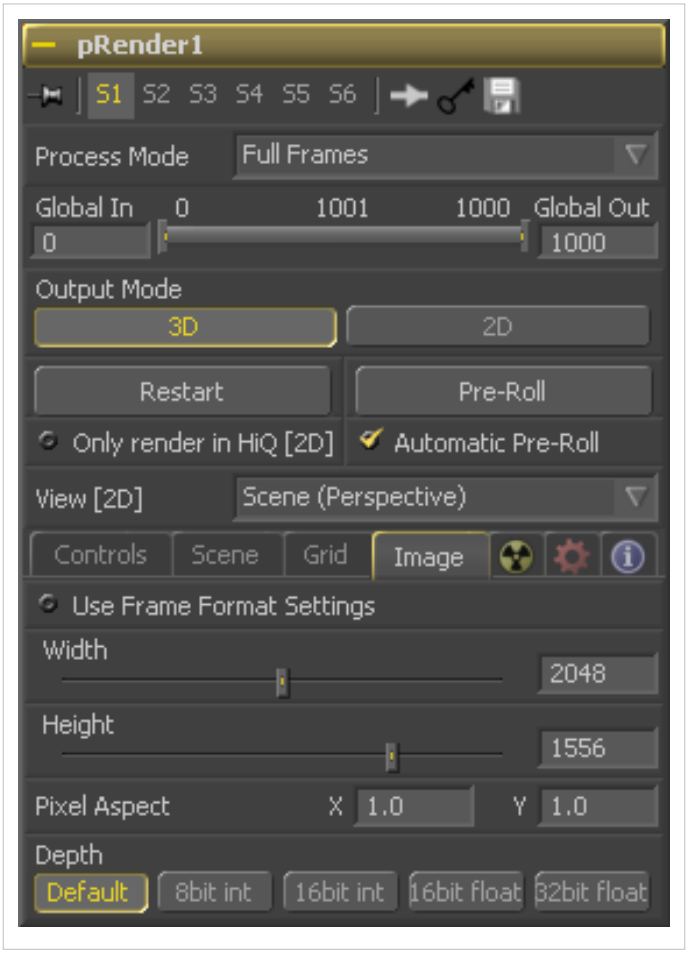


None of the controls in this tab have any effect on 3D particles.

The Grid is a helpful, non-rendering display guide used to orient the 2D particles in 3D space. The grid is never seen in renders, just like a center crosshair is never seen in a render.

The width, depth, number of lines and grid color can be set using the controls found in this tab. These controls cannot be animated.

Image Tab



The controls in the Image tab of this tool determine the width, height and aspect of the image. Refer to the Creator Common Controls page for details on the use of these controls.

Motion Blur

As with other 2D tools in Fusion, motion blur is enabled from within the Fusion tab. You may set Quality, Shutter Angle, Sample Centre and Bias, and blur will be applied to all moving particles.

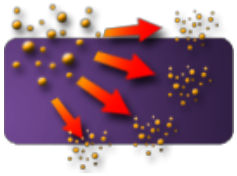
Note: motion blur on 3D mode particles (rendered with a Renderer 3D) also requires that identical motion blur settings are applied to the Renderer 3D tool.

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

pSpawn

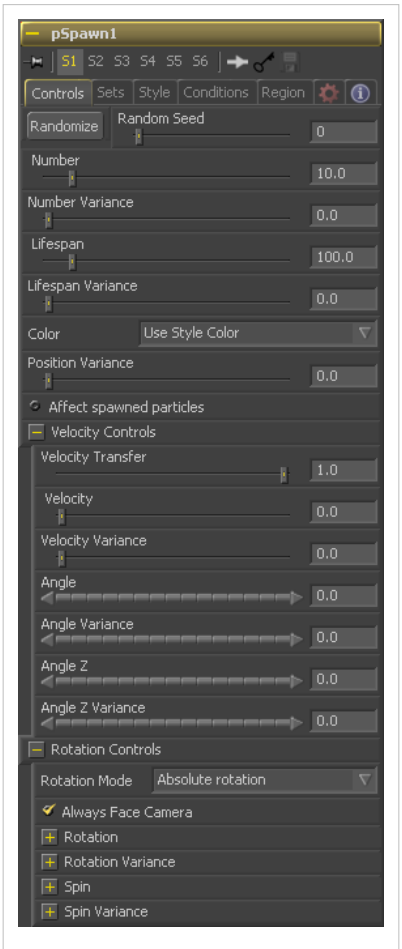
pSpawn [pSp]



The pSpawn tool makes each affected particle act as an emitter that can produce one or more particles of its own. The original particle continues until the end of its own lifespan, and each of the particles it emits becomes wholly independent with a lifespan and properties of its own.

As long as a particle falls under the effect of the pSpawn tool, it will continue to generate particles. It is important to restrict the effect of the tool with limiters like Start And End Age, Probability, Sets and Regions, and by animating the parameters of the emitter so that the tool is operative only when required.

Controls Tab



The pSpawn tool has a large number of controls, most of which exactly duplicate those found within the pEmitter tool. There are a few controls that are unique to the pSpawn tool, and their effects are described below.

Affect Spawned Particles

Selecting this checkbox causes particles created by spawning to also become affected by the Spawn tool on subsequent frames. This can exponentially increase the number of particles in the system, driving render times up to an unreasonable degree. Use this checkbox cautiously.

Velocity Transfer

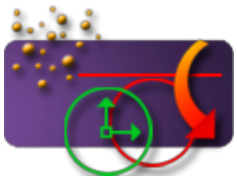
This control determines how much velocity of the source particle is transferred to the particles it spawns. The default value of 1.0 causes each new particle to adopt 100 percent of the velocity and direction from its source particle. Lower values will transfer less of the original motion to the new particle.

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

pTangentForce

pTangentForce [pTF]



This tool is used to apply a tangential force to the particles, a force that is applied perpendicularly to the vector between the pTangentForce's region and the particle it is affecting.

The controls for this tool are used to position the offset in 3D space and to determine the strength of the tangential force along each axis independently.

Controls Tab



Randomize

Please see 'Particle Common Controls' in the Particles chapter.

X, Y, Z Center Position

These controls are used to represent the X, Y, and Z coordinates of the Tangent force in 3D space.

X, Y, Z Center Strength

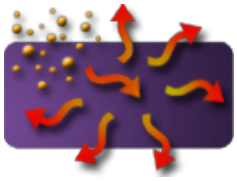
These controls are used to determine the strength of the Tangent force in 3D space.

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

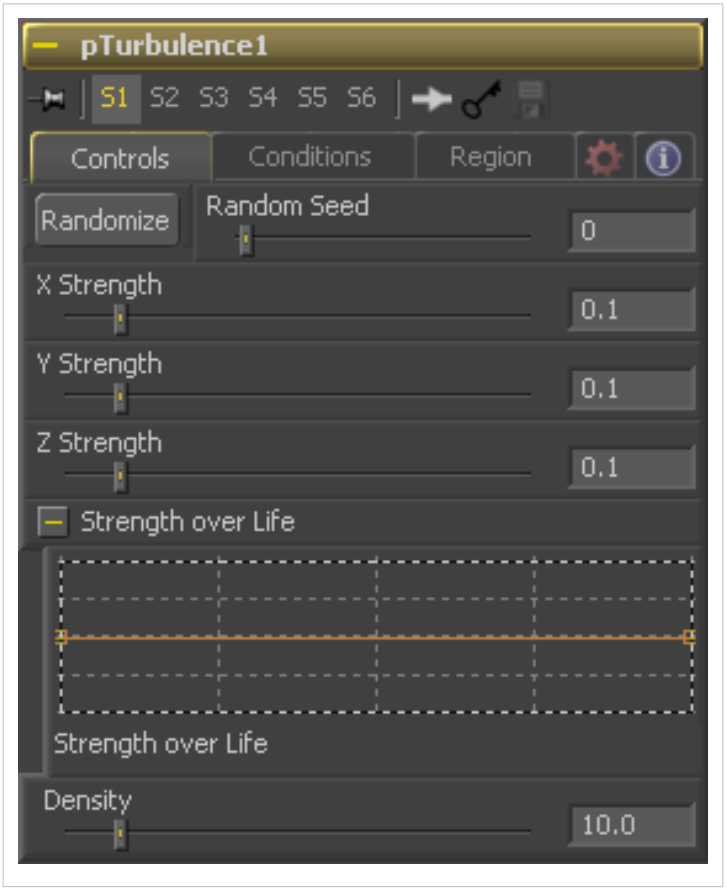
pTurbulence

pTurbulence [pTr]



The pTurbulence tool imposes a frequency-based chaos on the position of each particle, causing the motion to become unpredictable and uneven. The controls for this tool affect the strength and density of the Turbulence along each axis.

Controls Tab



Randomize

Please see 'Particle Common Controls' in the Particles chapter.

X, Y and Z Strength

The strength control affects the amount of chaotic motion imparted to particles.

Strength Over Life

This LUT control can be used to control the amount of turbulence applied to a particle according to its age. For example, a fire particle may originally have very little turbulence

applied at the start of its life, and as it ages, the turbulence increases.

Density

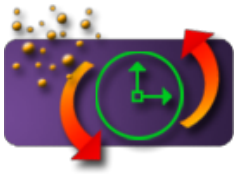
Use this control to adjust the density of the turbulence. Higher values will produce finer variations in the turbulence produced.

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

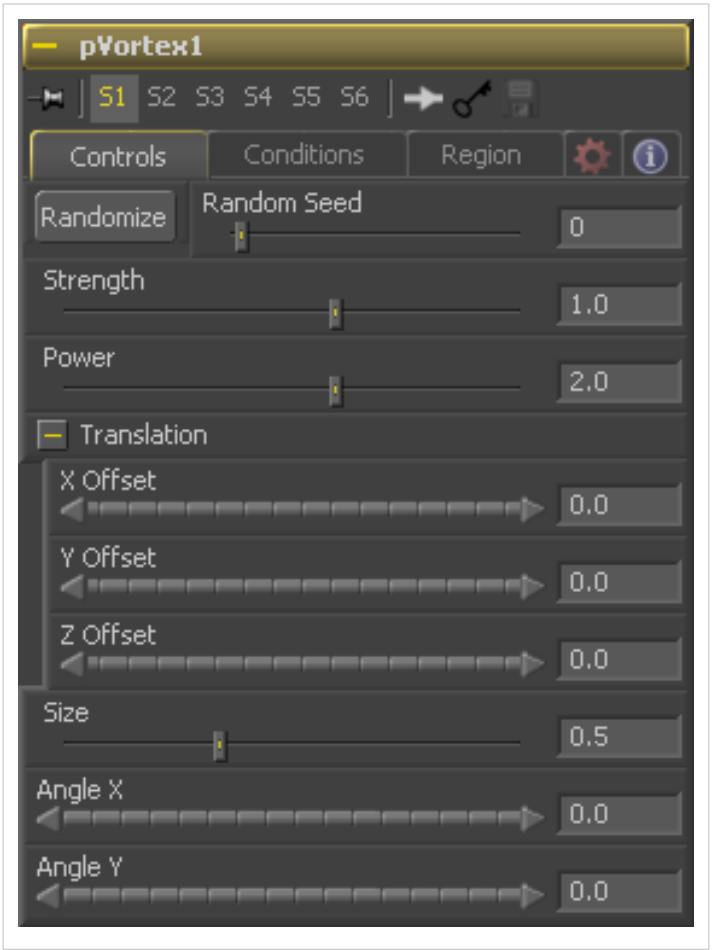
pVortex

pVortex [pVt]



The pVortex tool applies a rotational force to each particle, causing them to be drawn toward the source of the Vortex. In addition to the Common Particle Controls, the pVortex tool also has the following controls.

Controls Tab



Randomize

Please see 'Particle Common Controls' in the Particles chapter.

Strength

This control determines the Strength of the Vortex Force applied to each particle.

Power

This control determines the degree to which the strength of the Vortex Force falls off with distance.

X, Y, and Z Offset

Use these sliders to set the amount by which the vortex offsets the affected particles.

Size

Used to set the size of the vortex force.

Angle X And Y

These sliders control the amount of rotational force applied by the Vortex along the X and Y axis.

Conditions and Regions Tab

Please see 'Particle Common Controls' in the Particles chapter.

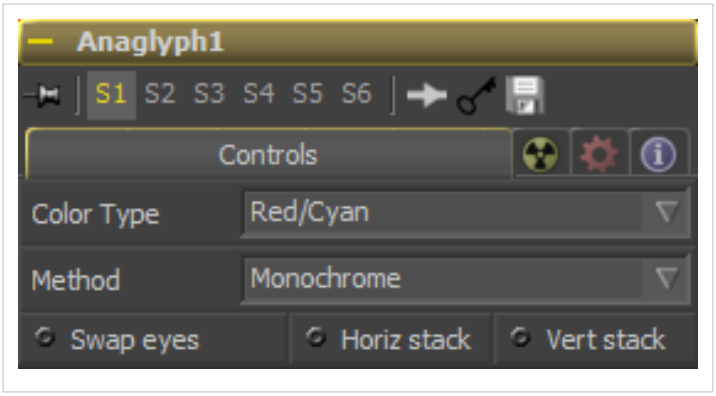
Stereo

Anaglyph



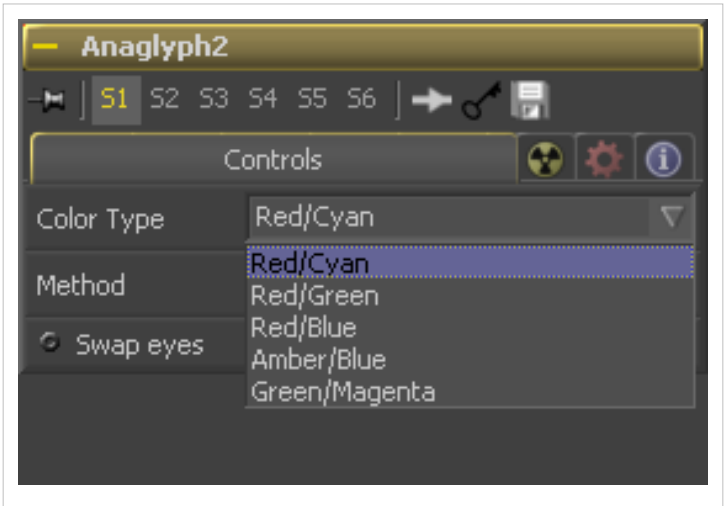
The Anaglyph tool is used to create stereoscopic images by combining separate left eye and right eye images. It features different methods for that. It is most commonly used at the end of a stereoscopic workflow to display or deliver the final result.

Controls Tab



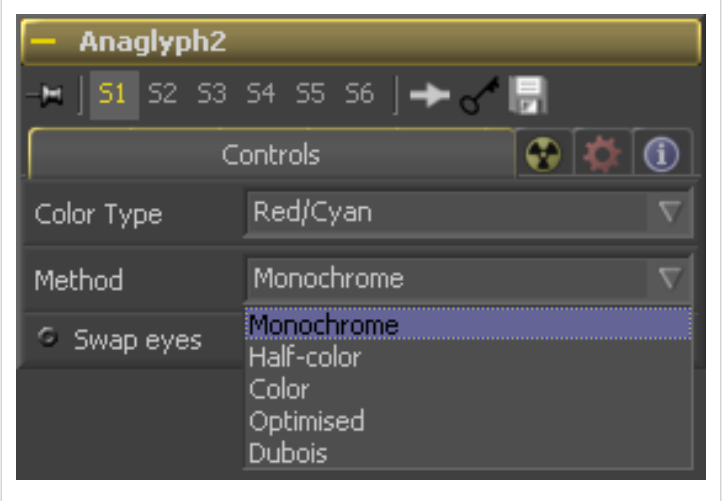
When using separate images for the left and right eye, the left eye image is connected to the orange input and the right eye image is connected to the green input of the tool. When using either horizontally or vertically stacked images containing both left- and right information, these only connect to the orange input. Based on one of the methods described below, the separate images are then combined to create a stereoscopic output.

Color Type menu



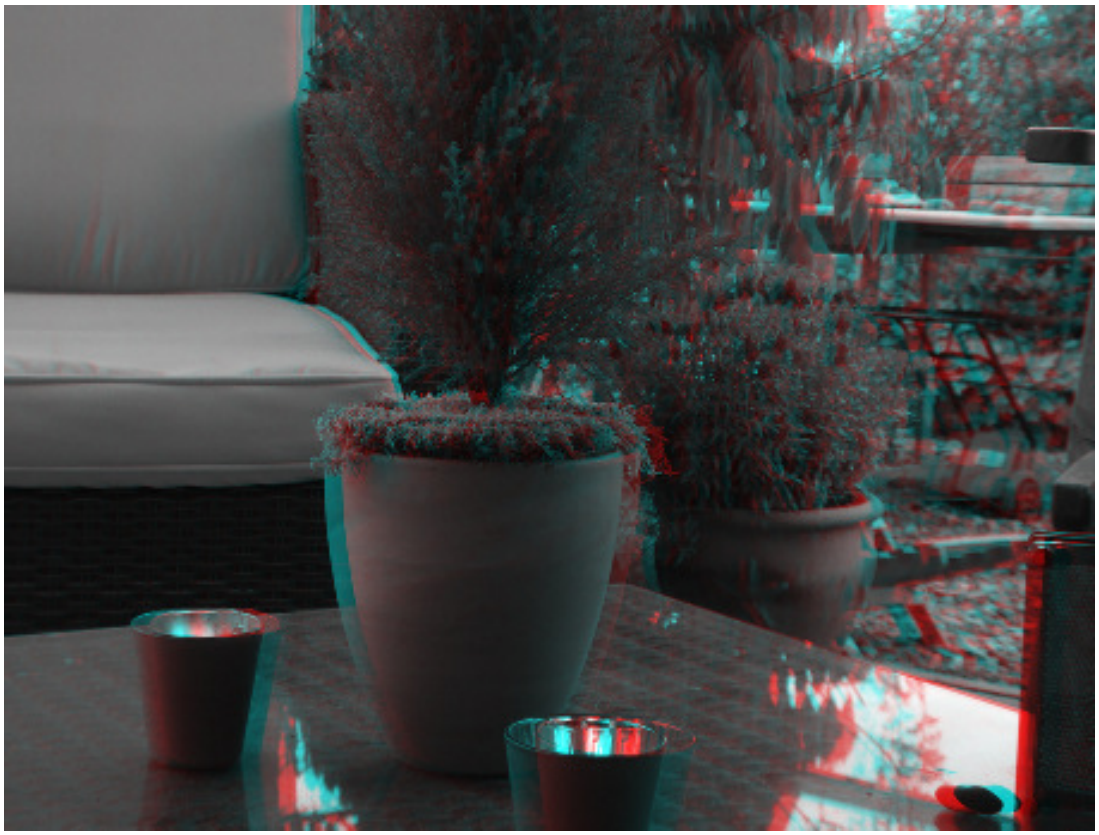
The ColorType menu allows you to choose between different color encodings to fit your preferred display device. To match you stereo glasses you can choose between Red/Cyan, Red/Green, Red/Blue, Amber/Blue and Green/Magenta encoding. Whereas Red/Cyan turns out to be the most commonly used.

Method menu

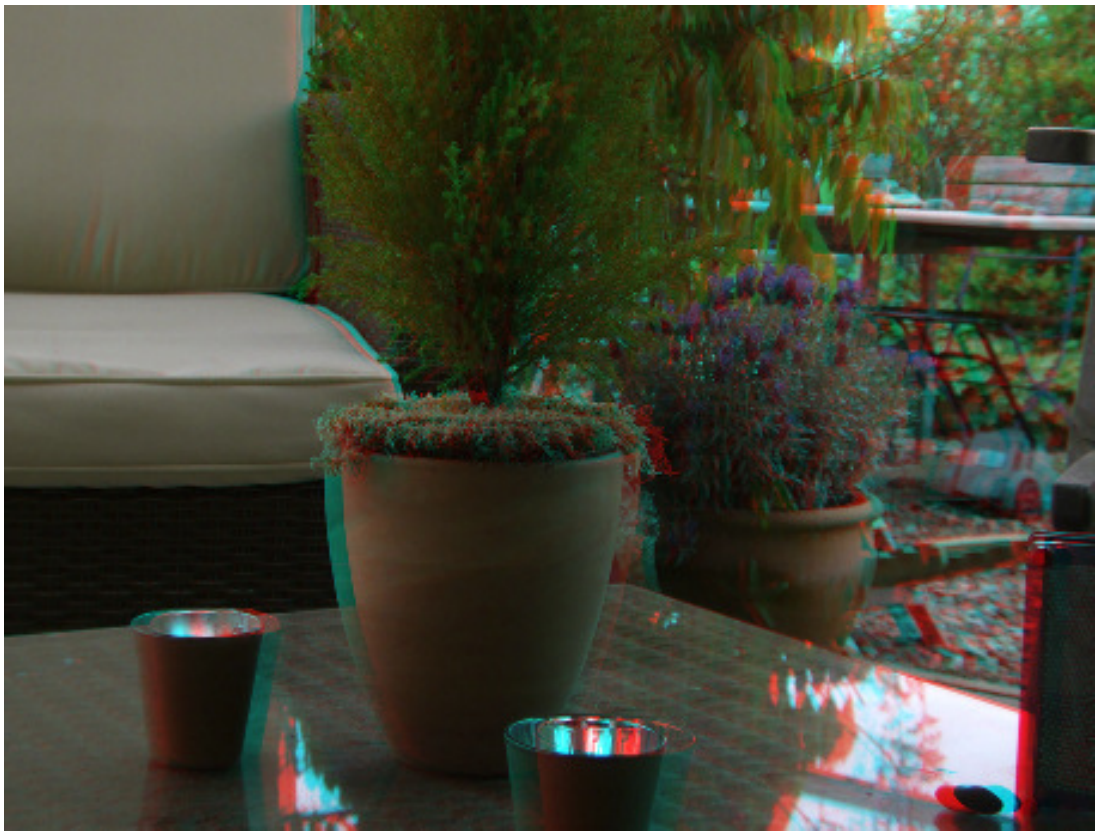


In addition to the color used for encoding the image you can also choose five different methods. Monochrome, Half-Color, Color, Optimized and Dubois.

Monochrome

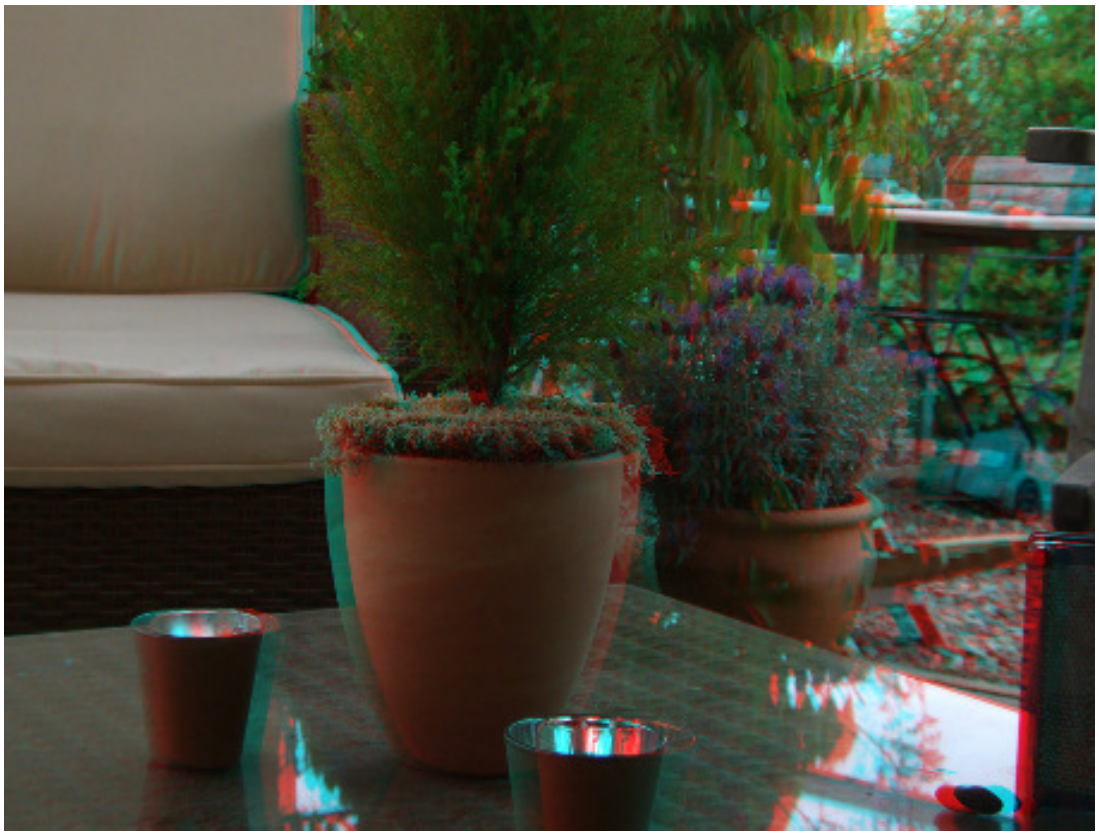


The left eye contains the luminance of the left image, and the right eye contains the luminance of the right image (eg. the luminance of the left image is placed in the output red channel, and the luminance of the right image is placed in the output green and blue channels).
Half-Color

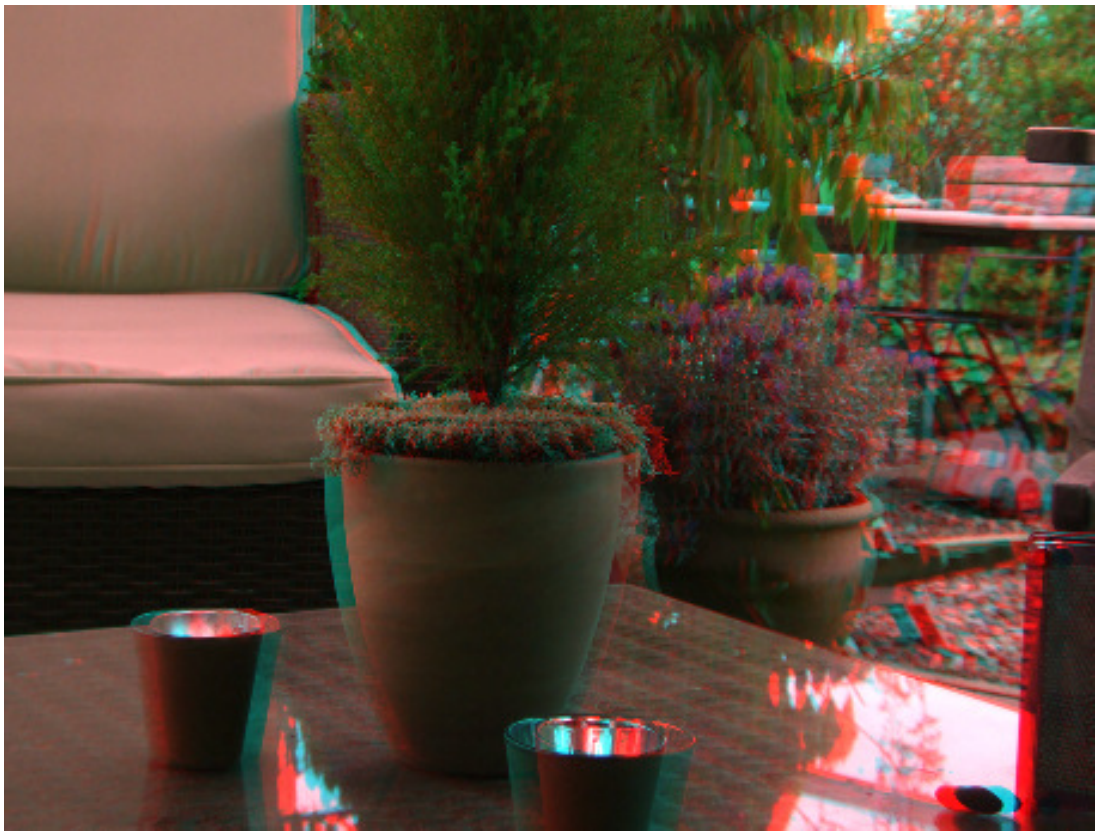


The left eye contains the luminance of the left image, and the right eye contains the colour channels from the right image that match the glasses colour for that eye (eg. the luminance of the left image is placed in the output red channel, and the green and blue channels of the right image are placed in the output green and blue channels).

Color

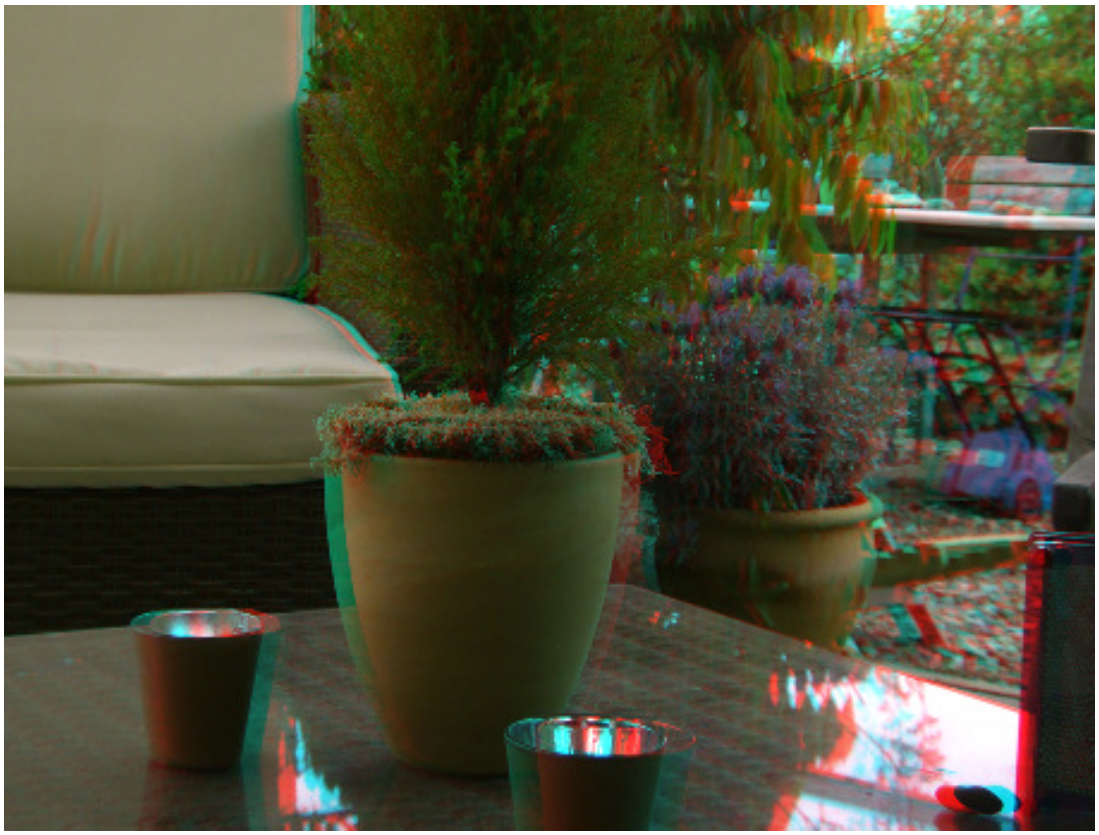


The left eye contains the colour channels from the left image that match the glasses colour for that eye, and the right eye contains the colour channels from the right image that match the glasses colour for that eye (eg. the red channel of the left image is placed in the output red channel, and the green and blue channels of the right image are placed in the output green and blue channels).
Optimized



Used with red/cyan glasses for example, the resulting brightness of what shows through the left eye will be substantially less than the brightness of the right eye. Using typical ITU-R 601 ratios for luminance as a guide, the red eye would give 0.299 brightness, while the cyan eye would give 0.587+0.114=0.701 brightness - over twice as bright. The difference in brightness between the eyes can produce what's referred to as retinal rivalry or binocular rivalry, which can destroy the stereo effect. The Optimised method generates the right eye in the same fashion as the Color method. The left eye also uses the green and blue channels, but in a combination with increased brightness that reduces retinal rivalry. Since it uses the same two channels from each of the source images, it doesn't reproduce the remaining one (eg. 1.05× the green and 0.45× the blue channels of the left image is placed in the output red channel, and the green and blue channels of the right image are placed in the output green and blue channels. Red from both the left and right images is not used).

Dubois



Images with fairly saturated colours can produce retinal rivalry with Half-color, Color and Optimised methods because the colour is only visible in one eye. For example, with red/cyan glasses, a saturated green object looks black in the red eye, and green in the cyan eye. The Dubois method uses the spectral characteristics of (specifically) red/cyan glasses and CRT (Trinitron) phosphors to produce a better anaglyph and in the end tends to reduce retinal rivalry caused by such colour differences in each eye, and also tends to reduce ghosting produced when one eye ‘leaks’ into the other eye. The particular calculated matrix we use is designed for red/cyan glasses and so isn’t available for other glasses types, and since it is also derived from CRT colour primaries, it may not give the best results with a common LCD (though it’ll still likely produces less retinal rivalry and ghosting than the other methods).

Swap eyes

Allows to easily swap the left and right eye input.

Horiz Stack

Takes an image which contains both left- and right-eye information stacked horizontally. These images are often referred to as 'crosseyed' or 'straight stereo' images. You only need to connect that one image to the orange input of the tool. It then creates an image half the width of the original input, using the left half of the original image for the left eye and the right half of the original image for the right eye. Color encoding takes place using the specified color type and method.

Vert Stack

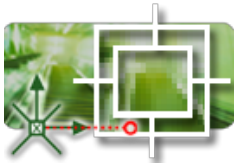
Takes an image which contains both left- and right-eye information stacked vertically. You only need to connect that one image to the orange input of the tool. It then creates an image half

the height of the original input, using the bottom half of the original image for the left eye and the top half of the original image for the right eye. Color encoding takes place using the specified color type and method.

Tracking

Tracker

Tracker [Tra]



The Tracker is used to detect and follow one or more pixel patterns across frames in moving video. The tracking data can then be used to control the position or values of other tools in the composition (for example, the center of a Drip). Additionally, trackers can be used to stabilize an image, or to apply de-stabilization to one image based on the motion of another.

There is no limit to the number of trackers that can be used in one flow, or in the number of connections that can be made to a tracker. This chapter serves as a reference for the various controls in the Tracker, but we strongly suggest you read the more general information about using the tracker in the Tracking chapter.

The Tracker can be employed in two forms; as a tool in the Flow, or as a modifier attached to a control. When the Tracker is used as a tool in the Flow, the image tracked comes from the input to the Tracker tool. There is no limit to the number of patterns that can be tracked by a single Tracker tool.

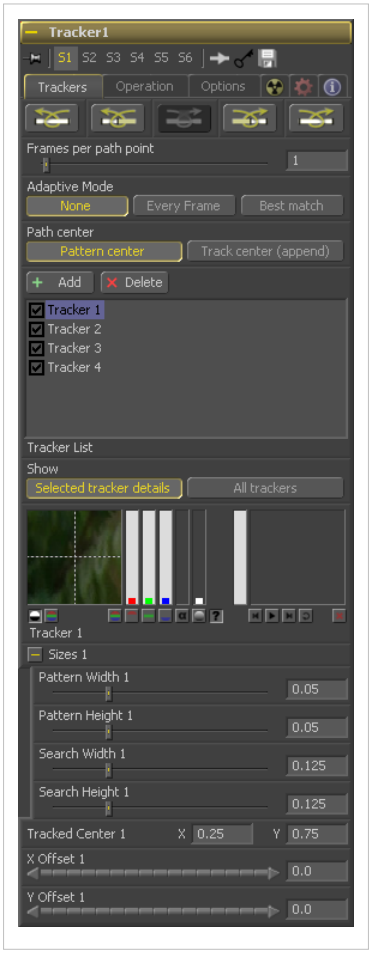
When the Tracker is used as a modifier, its controls appear in the Modifier tab for any tool with a control connected to that modifier. Only one pattern can be tracked in by a Tracker Modifier, but the image source can come from anywhere in the composition. This technique is generally used when tracking a quick position for a control.

X/Y Paths By default the Tracker applies a Displacement Path to the tracked points. To apply an XY Path to the tracked points go to

Preferences -> Globals -> Splines

and set Tracker Path to XY Splines.

Trackers Tab



Track Buttons

There are four buttons used to initiate tracking, and one in the middle used to stop a track in progress. These buttons can track the current pattern forward or backward in time. Hold the mouse pointer over each button for a moment and a tooltip with the name of the button will appear.

The buttons operate as follows :



Track Reverse

Clicking on this button will cause all Active trackers to begin tracking their patterns, starting at the end of the render range and moving backward through time until the beginning of the render range.



Track Reverse From Current Time

Clicking on this button will cause all Active trackers to begin tracking their patterns, starting at the current frame and moving backward through time until the beginning of the render

range.



Stop Tracking

Clicking on this button will Stop the tracking process immediately. This can also be achieved by pressing ESC. This button will only be active when tracking is in process.



Track Forward From Current Time

Clicking on this button will cause all Active trackers to begin tracking their patterns, starting at the current frame and moving forward through time until the end of the render range.



Track Forward

Clicking on this button will cause all Active trackers to begin tracking their patterns, starting at the first frame in the render range and moving forward through time until the end of the render range.

Frames Per Path Point

This value of the slider determines how often the Tracker sets a Keyframe on the Path. The normal default is 1, which sets a Keyframe on the tracked path at every frame. Increasing the value of this slider will cause the tracked path to be less accurate. This may be desirable if the track is returning fluctuating results, but under normal circumstances this control should be left at its default value.

If the project is field rendered, a value of 1 sets a Keyframe on every field. Since the tracker is extremely accurate, this will result in a slight up-and-down jittering due to the position of the tracked pattern fields. For fielded footage tracked in field mode you will get better results setting this slider to a value of 2, which will result in one keyframe per frame of your footage.

Adaptive Mode

Fusion is capable of re-acquiring the tracked pattern as needed, to help with complex tracks. This button array determines what mode of Adaptive tracking is employed.

None

If selected, Fusion searches only for the pattern originally selected in each single frame.

Every Frame

If selected, Fusion re-acquires the pattern every frame. This helps the tracker compensate for gradual changes in profile and lighting over time.

Best Match

If selected, the Tracker will compare the pattern acquired at each frame and compare it to the original selected pattern. If the variation between the two patterns exceeds the threshold amount defined by the Match Tolerance control, Fusion will not re-acquire the pattern on that frame. This helps to avoid tracker drift caused by transient artifacts that cross the pattern's path (such as a shadow).

Path Center

The two buttons in this button array determine how the Tracker behaves when re-positioning a pattern. These controls are used when switching a path from one pattern to another, which happens when a pattern leaves the frame, or changes so significantly it can no longer be tracked.

Pattern Center

When Pattern Center is the Active mode, the tracked path continues from the center of the new path. This is appropriate when replacing an existing path entirely, but when trying to append to a path using a new pattern, this will cause a discontinuity.

Track Center (append)

When Track Center (append) is selected, the path tracked by a new pattern will be appended to the existing path. The Path created is automatically offset by the required amount. This technique will work best if the new pattern is located close to the position of the old pattern to avoid any problems with parallax or lens distortion. This mode can also be used to virtually continue the tracking of patterns that move out of the frame or get obstructed by other objects.

Add / Delete Tracker

Use these to add or delete Trackers from your Tracker List.

Add

Add a new Tracker

Delete

Delete the tracker that is currently selected in the Tracker List.

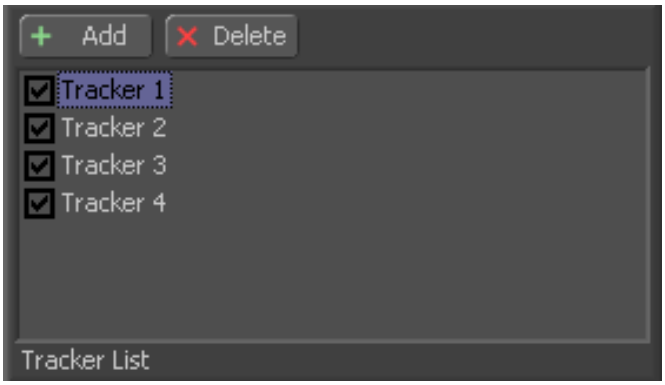
Tracker List

The Tracker List shows the names of all of the patterns created on this tracker. It is also used to add new trackers. The Tracker tool is capable of hosting a virtually unlimited number of tracker patterns.

Click on the Add button immediately above the list to add a new tracker pattern. Each pattern appears in the list by name, next to a small checkbox. Clicking on the name of the pattern will select that pattern. The controls below the list will change to affect that pattern only. Click once on a selected pattern to rename the pattern to something more descriptive. Clicking on the checkbox changes the state of the Tracker.

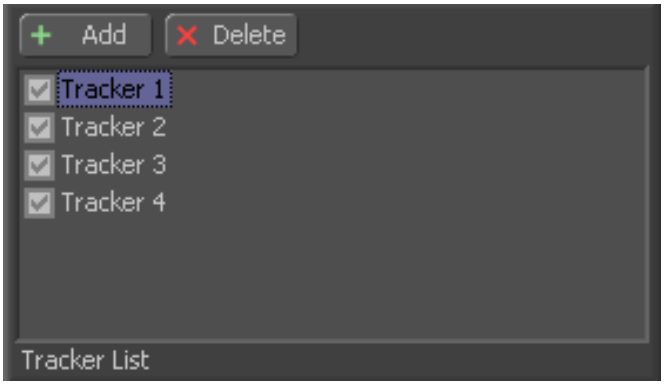
Tracker States

Enabled

(Black Checkbox) 

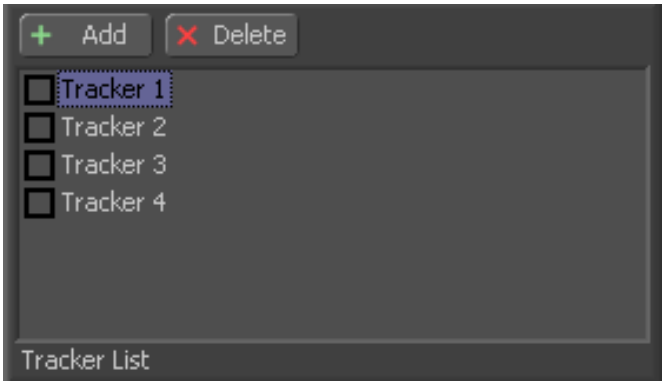
An Enabled pattern will re-track each time the track is initiated. Its path data is available for use by other tools, and the data is available for Stabilization and Corner Positioning.

Suspended

(Grey Checkbox) 

A Suspended pattern does not re-track when the track is initiated. The data is locked to prevent additional changes. The data from the Path is still available for other tools, and the data is available for advanced tracking modes like Stabilization and Corner Positioning.

Disabled

(Clear) 

A Disabled pattern does not create a path when tracking is initialized, and its data is not available to other tools, or for advanced tracking operations like Stabilization and Corner Positioning.

Show

These two buttons determine what controls are displayed in the tool controls. They have no effect on the operation of the Tracker, they only affect the interface.

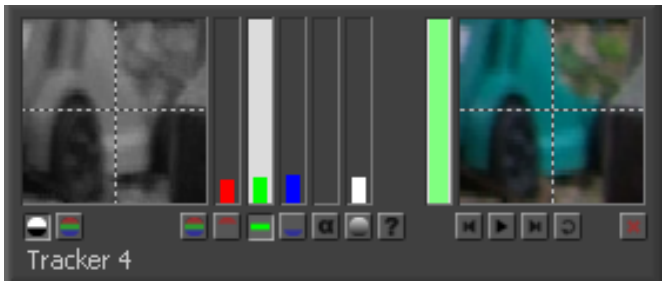
Selected Tracker Details

When Selected Tracker Details is selected, the controls displayed pertain only to the currently selected tracker. You will have access to the Pattern Window and the Offset sliders.

All Trackers

When All Trackers is selected, the pattern window for each of the trackers is displayed simultaneously below the Tracker List.

Pattern Display : Selected Pattern



Left Pattern Display

The Pattern Display has two image windows next to each other, and a series of status bars. The window on the left shows the pattern initially selected, while the one on the right shows a real-time display of the current pattern as tracking progresses.

As the onscreen controls are moved for a pattern, the display in the leftmost window will update to show the pattern. As the pattern is moved, the clarity and contrast of the image channels is indicated by the vertical bars immediately to the right of the image display.

The channel, or channels, with the best clarity are automatically selected for tracking. These channels have a white background in the vertical bar representing that channel. The automatic tracking can be allowed to stand, or you can override the automatic selection and choose the channel used for tracking by disabling the button labelled with a question mark, and selecting the button beneath the channel to track.

Under normal circumstances, the channel selected is indicated in the Pattern Display. If the selected channel is blue, then a greyscale representation of the blue channel for the pattern appears. The image is only represented in full color if all three channels are selected for tracking.

Override this behavior by selecting the Show Full Color button beneath the Pattern Display, instead of the Show Selected Channel button.

As Fusion looks for the channel with the highest contrast automatically, you might end up tracking the boue channel, especially on scanned film material. Unfortunately the blue channel on most filmstock contains the most grain as well, which naturally leads to unclean tracks. Before tracking it's always a good idea to zoom into your footage and check the RGB channels individually.

Right Pattern Display

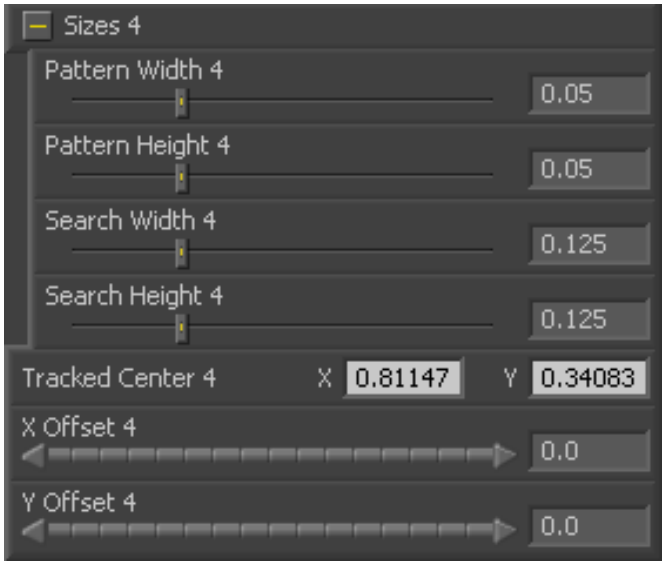
The Pattern Display on the right indicates the actual pattern acquired for tracking. This display is clear until the first time the selected pattern is actually tracked. The Pattern Display becomes active during tracking, displaying the pattern that Fusion acquires from frame to frame.

As the tracking occurs, the pattern from each frame is accumulated into a Flipbook, which can be played back in the pattern window after tracking by using the transport controls at the bottom of the window.

While the track is progressing, the vertical bar immediately to the right of the pattern shows how confident Fusion is that the current pattern matches the originally selected pattern. A green bar indicates a high degree of confidence that the current pattern matches the original. A yellow bar indicates less certainty, and a red bar indicates that Fusion has detected extreme variations in the current pattern, and is no longer certain of its accuracy.

After tracking, the pattern display will show a small flipbook of the track for that pattern, overlaid with a frame number to help identify problem frames for the track

Pattern Width And Height



Use these controls to adjust the width and height of the selected tracker pattern manually. The size of the tracker pattern can also be adjusted in the display view, which is the normal method, but small adjustments are often easier to accomplish with the precision of manual controls.

Search Width And Height

The search area defines how far Fusion will look in the image from frame to frame to re-acquire the pattern during tracking. As with the Pattern Width and Height, the Search Area can be adjusted in the display views, but you may want to make small adjustments manually using these controls.

Tracked Center

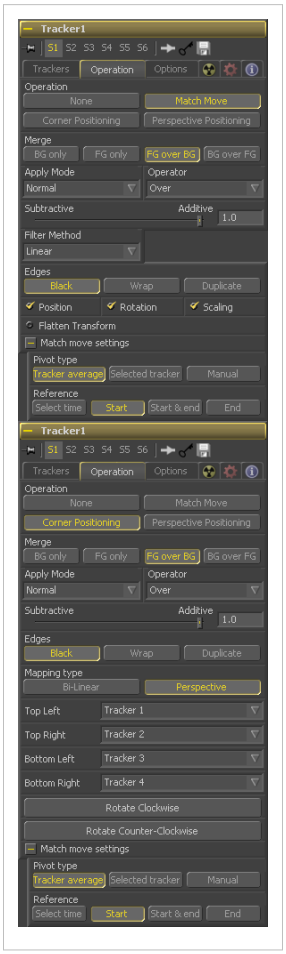
This positional control indicates the position of the tracker's center. To remove a path from a tracker pattern, right-click on this control and select Remove Path from the context menu.

X And Y Offset

You will often need to track the position of an object in the scene, but that object does not provide for a very reliable pattern. The Offsets permit the tracking of something close to the intended object instead. Use these Offsets to adjust the reported position of the Tracker so that the data is reported for the intended pattern instead of the actual one.

The Offset can also be adjusted directly in the view by activating the "allow moving the positioner's offsets" icon next to your view.

Operation Tab



The Tracker tool is capable of performing a wide variety of functions, from match moving an object into a moving scene, smoothing out in a shaky camera movement, or replacing the content of a sign.

Use the options and buttons in the Operation tab to select the function performed by the Tracker tool.

Operation Buttons

These four buttons select the exact function performed by the Tracker. The remaining controls in this tab fine tune the result of the Operation.

None

The Tracker performs no additional operation on the image beyond simply locating and tracking the chosen pattern. This is the default mode, used to create a path that will then drive another control in Fusion.

Match Move

This mode is used when stabilizing an image, or when matching the position, rotation and scaling of the layer for match moving another element into the scene. Stabilizing requires a minimum of one tracker to determine position, and two or more to determine scaling and rotation in the sequence.

Corner Positioning

The Corner Positioning mode is used to track the four corners of a rectangular object, and replace the contents with a new image. A minimum of four trackers is required for this mode, and if there are not enough trackers, new ones will be created until the total equals four.

Perspective Positioning

This mode is similar to the Corner Positioner but, rather than replacing the contents of the rectangle, the four tracked corners are mapped to the four corners of the image. This is generally used to remove Perspective from an image. Like the Corner Positioner, this mode requires four trackers, which will be created if there are not already that many.

Merge

The Merge control determines what is done (if anything) with the image provided to the foreground input of the Tracker. This array of buttons appears when the operation is set to anything other than None.

BG Only

The foreground input is ignored, only the Background is affected. This is used primarily when Stabilizing an image sequence.

FG Only

The Foreground input is transformed to match the movement in the background, and this transformed image is passed through the Tracker's output. This Merge technique is used when match moving one layer's motion to another's.

FG Over BG

The Foreground image is merged over the Background image, using the Merge method described by the Apply Mode control that appears.

BG Over FG

The Background is merged over the Foreground. This technique is often used when tracking a layer with an Alpha channel so that a more static background can be applied behind it.

Apply Mode

This drop-down menu provides a variety of options to determine how the two layers should be combined. The options in this menu are explained in more detail in the reference chapter for the Merge tool.

Subtractive - Additive

This determines whether the foreground layer is placed over the background in using Additive or Subtractive merging techniques. This control is explained in more detail in the documentation for the Merge tool.

Edges Match Move

This button array only appears if the Operation mode is set to Match Move. The various options select how the revealed edges are handled when the image is moved to match position and scaling.

Black Edges

Out of frame edges revealed by Stabilization are left black.

Wrap

Portions of the image moved off frame to one side are used to fill edges that are revealed on the opposite side.

Duplicate

The last valid pixel on an edge is repeated to the edge of the frame.

Position, Rotation, And Scaling Checkboxes

The Position, Rotation and Scaling checkboxes only appear when the mode is set to Match Move. They determine what components of motion that stabilization will attempt to correct in the image. For example, if only the Position checkbox is selected, no attempt will be made to correct for Rotation and Scaling in the image.

Flatten Transformation

This checkbox only appears when the mode is set to Match Move. Like most transformations in Fusion, Stabilization is concatenated with other sequential transformations by default. Selecting this checkbox will flatten the transform, breaking any concatenation taking place and applying the transform immediately.

Mapping Type

The Mapping Type control only appears in the Corner Positioning mode. There are two options in the button array.

Bi-Linear

The first method is Bi-Linear where the FG image is mapped into the BG without any attempt to correct for perspective distortion. This is identical to how previous versions of Fusion operated, and the Classic mode is included pretty much for compatibility reasons only.

Perspective

The preferred setting for this control is True Perspective.

Corner Selector

When the operation of the Tracker is set to either Corner or Perspective Positioner modes, these four drop-down menus appear. They are used to select which trackers map to each of the four corners of the rectangle used by these modes. This is useful when a tracker has more than four patterns selected, and you must choose which are used by the positioners.

Rotate Buttons

These controls only appear when the operation of the Tracker is set to either Corner or Perspective Positioner modes. They are used to rotate the FG image by 90 degrees before it is applied to the BG.

Stabilize Settings

The Tracker tool automatically outputs several steady and unsteady position outputs to which other controls in the Flow can be connected. The Stable Position output provides X and Y coordinates to match or reverse motion in a sequence. These controls are available even when the operation is not set to Match Move, since the Stable Position output is always available for connection to other tools.

See the Tracking page for details.

Axis Type (Stabilize Setting)

Under virtually all circumstances, the axis for any stabilization should be the average position of all trackers on that frame, however, the rare occasion arises when the tracker's axis must be elsewhere.

This array of buttons allows for the selection of an axis for the Stabilization based on the position of a single tracker, or a manual position.

Reference (Stabilize Setting)

The Reference controls are used to set the `snapshot frame' for Stabilization. When you stabilize an image, there must be a position that is considered correct, to which all subsequent movement is detected, and corrected.

Select Time

The Select Time Reference mode determines the `snapshot frame' based on the frame where the pattern is first selected. All Stabilization is intended to return the image back to that reference.

Start

The snapshot frame is determined to be the first frame in the tracked path. All Stabilization is intended to return the image back to that reference.

Start And End

The Start and End Reference mode is somewhat different from all other Reference modes. Where the others are intended to take a snapshot frame to which all stabilization returns, immobilizing the image, the Start and End mode is intended to smooth existing motion, without removing it. This mode averages the motion between the Start and End of the path, drawing a straight line between those points.

When this mode is Active, it reveals the Reference Intermediate Points control. Increasing the value of this control increases the number of points in the path used by the Reference, smoothing the motion from a straight line between start and end without making it wholly linear.

End

The snapshot frame is determined to be the last frame in the tracked path. All Stabilization is intended to return the image back to that Reference.

Onscreen Controls



Each pattern in the tracker has its own set of onscreen controls, used to select the pixels in the image to be tracked. These controls are visible in the display views whenever a tracker is selected in a flow.



The onscreen control is indicated by a red rectangle with a handle in the top left corner. This rectangle indicates the position of the pattern in the image. Every pixel within the rectangle is considered to be part of the pattern used for tracking. Resize the pattern by clicking and dragging on the rectangles borders.



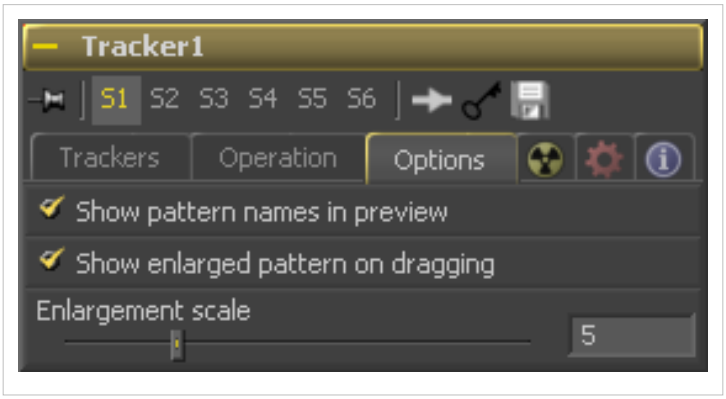
Whenever the mouse moves over the pattern rectangle, a second rectangle with a dashed outline appears. This represents the search area, which determines how far away from the current pattern the Tracker looks on the next frame. This should always be larger than the pattern, and it should be large enough to encompass the largest frame-to-frame movement in the scene. Faster moving objects require larger search areas and slower moving objects can get away with smaller search areas. The larger the search area, the longer it will take to track, so try not to make the search area larger than necessary.



Click-dragging on the handle repositions the pattern. While repositioning the pattern, a thumbnail window with an enlarged view of the pattern is displayed in the views, to assist with precise positioning of the pattern. This thumbnail disappears when the mouse button is released. The magnification ratio can be adjusted in the options tab. If the selected tracker has

a custom name, the name of that tracker will be displayed as a label at the bottom right of the search area rectangle.

Options Tab



Show Pattern Names in Preview

This option defines if the Tracker's name will be displayed in the view. Switch it off to see just the Pattern Rectangle instead.

Show Enlarged Pattern On Dragging

This option defines if there is an enlarged view on positioning the Pattern Rectangle or not.

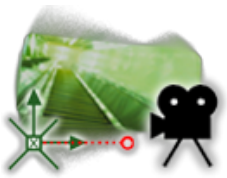
Enlargement Scale

The Zoom factor that is used on positioning the Pattern Rectangle when the above option is on.

Transform

Camera Shake

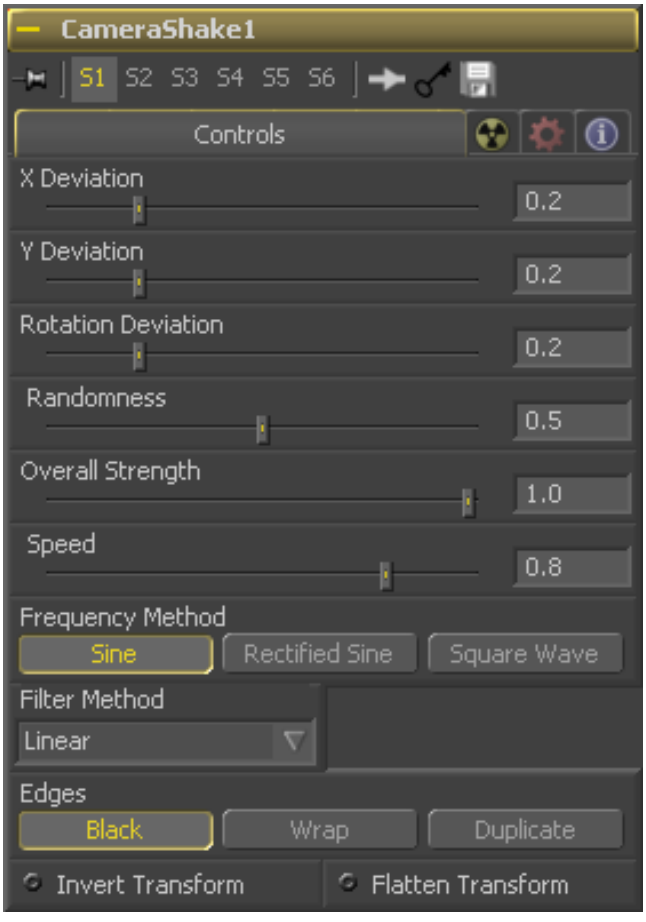
Camera Shake [CSh]



This tool can simulate a variety of Camera Shake style motions from organic to mechanical. It is not the same as the Shake Modifier, which generates random number values for tool controls. See the Connections and Modifiers chapter for more information about the Shake Modifier.

The Camera Shake tool concatenates its result with adjacent transformation tools. For more information on concatenation, consult the Transformations chapter.

Controls Tab



Deviation X And Y

These controls determine the amount of shake that is applied to the image along the horizontal (X) and vertical (Y) axis. Values between 0.0 and 1.0 are permitted. A value of 1.0 generates shake positions anywhere within the boundaries of the image.

Rotation Deviation

This determines the amount of shake that is applied to the rotational axis. Values between 0.0 and 1.0 are permitted.

Randomness

Higher values in this control cause the movement of the shake to be more irregular or random. Smaller values cause the movement to be more predictable.

Overall Strength

This adjusts the general amplitude of all the parameters and blends that affect in and out. A value of 1.0 applies the effect as described by the remainder of the controls.

Speed

Speed controls the frequency, or rate, of the shake.

Frequency Method

This selects the overall shape of the shake. Available frequencies are Sine, Rectified Sine and Square Wave. A Square Wave will generate a much more mechanical looking motion than a Sine.

Edges

This determines how the Edges of the image are treated.

Black

This causes the edges that are revealed by the shake to be black.

Wrap

This causes the edges to wrap around (the top is wrapped to the bottom, the left is wrapped to the right, etc.).

Duplicate

This causes the Edges to be duplicated causing a slight smearing effect at the edges.

Invert Transform

Select this control to Invert any position, rotation or scaling transformation. This option might be useful to exactly removing the motion produced in an upstream Camera Shake.

Flatten Transform

The Flatten Transform option prevents this tool from concatenating its transformation with adjacent tools. The tool may still concatenate transforms from its input but it will not concatenate its transformation with the tool at its output. See the Transformations chapter earlier in this manual for details on concatenated transformation.

Filter Modes

Nearest Neighbor

This skips or duplicates pixels as needed. This produces the fastest but crudest results.

Box

This is a simple interpolation resize of the image.

Linear

This uses a simplistic filter, which produces relatively clean and fast results.

Quadratic

This filter produces a nominal result. It offers a good compromise between speed and quality.

Cubic

This produces better results with continuous tone images but is slower than Bi-Cubic. If the images have fine detail in them, the results may be blurrier than desired.

Catmull-Rom

This produces good results with continuous tone images which are resized down. Produces sharp results with finely detailed images.

Gaussian

This is very similar in speed and quality to Bi-Cubic.

Mitchell

This is similar to Catmull-Rom but produces better results with finely detailed images. It is slower than Catmull-Rom.

Lanczos

This is very similar to Mitchell and Catmull-Rom but is a little cleaner and also slower.

Sinc

This is an advanced filter that produces very sharp, detailed results, however, it may produce visible `ringing' in some situations.

Bessel

This is similar to the Sinc filter but may be slightly faster.

Window Method

Some filters, such as Sinc and Bessel, require an infinite number of pixels to calculate exactly. To speed up this operation, a windowing function is used to approximate the filter and limit the number of pixels required. This control appears when a filter that requires windowing is selected.

Hanning

This is a simple tapered window.

Hamming

Hamming is a slightly tweaked version of Hanning.

Blackman

A window with a more sharply tapered falloff.

Kaiser

A more complex window, with results between Hamming and Blackman.

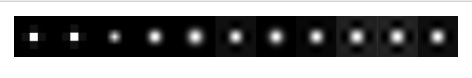
Most of the Resize tool's filters are useful only when making an image larger. When shrinking images, it is common to use the Bi-Linear filter, however, the Catmull-Rom filter will apply some sharpening to the results and may be useful for preserving detail when scaling down an image.

Because this tool changes the physical resolution of the image, we do not normally advise animating the controls.

Example



Various Resize Filters in extreme magnification



From left to right:

Nearest Neighbor - Box - Linear - Quadratic - Cubic - Catmull-Rom - Gaussian - Mitchell - Lanczos - Sinc - Bessel

Crop

Crop [Crp]



The Crop tool can be used to cut out a portion of an image or to offset the image into a larger image area. This tool actually changes the resolution of the image, and should not be animated under normal circumstances.

It is possible to crop an image in the view by viewing the upstream tool and selecting a region with the mouse. To do so first activate Allow Box Selection  by clicking on the icon next to your view, then dragging a rectangle to perform the operation.

Crop Tab



Offset X And Y

These controls position the top left corner of the cropping window. Values larger than the actual resolution of the cropped image cause it to disappear off the edges of the output image. Values below 0 will push the input image toward the bottom right of the result. The values of these controls are measured in pixels.

Size X And Y

Use this control to set the vertical and horizontal resolution of the image output by the Crop tool. The values of these controls are measured in pixels.

Keep Aspect

When toggled on, the Crop tool maintains the aspect of the input image.

Keep Centered

When toggled on, the Crop tool automatically adjusts the X and Y Offset controls to keep the image centered.

Reset Size

This resets the image dimensions to the Size of the input image.

Reset Offset

This resets the X and Y Offsets to their defaults.

Change Pixel Aspect

Enable this checkbox to reveal a Pixel Aspect control that can be used to change the pixel aspect that the image is considered to have. See the Frame Formats chapter for details on how pixel aspect operates in Fusion.

Clipping Mode

This option sets the mode used to handle the edges of the image when performing domain of definition rendering. This is profoundly important for tools like Blur which may require samples from portions of the image outside the current domain.

Frame

The default option is Frame, which automatically sets the tools domain of definition to use the full frame of the image, effectively ignoring the current domain of definition. This is identical to the way Fusion worked in versions prior to 6.0.

If the upstream DOD is smaller than the frame, the remaining area in the frame will be treated as black/transparent.

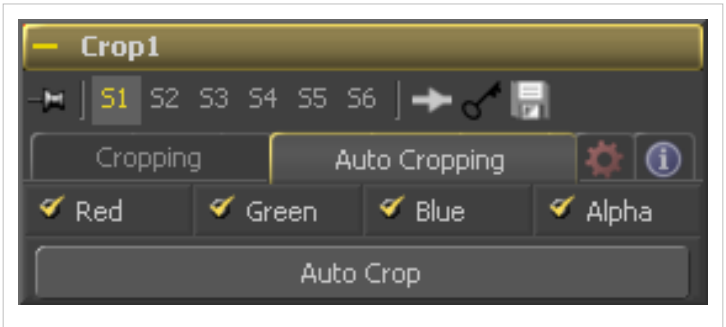
Domain

Setting this option to Domain will respect the upstream domain of definition when applying the tools effect. This can have adverse clipping effects in situations where the tool employs a large filter.

None

Setting this option to None will not perform any source image clipping at all. This means that any data required to process the tools effect which would normally be outside the upstream DOD will be treated as black/transparent.

Auto Crop Tab



RGBA Color Channels

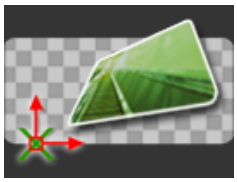
Select which channels are examined for an Auto Crop. This is useful for auto cropping images with non-solid backgrounds in a specific color channel, (like a blue color gradient). Toggling the channel off causes Auto Crop to ignore it when evaluating the image.

Auto Crop

This evaluates the image and attempts to determine the background color. It then crops each side of the image to the first pixel that is not this color.

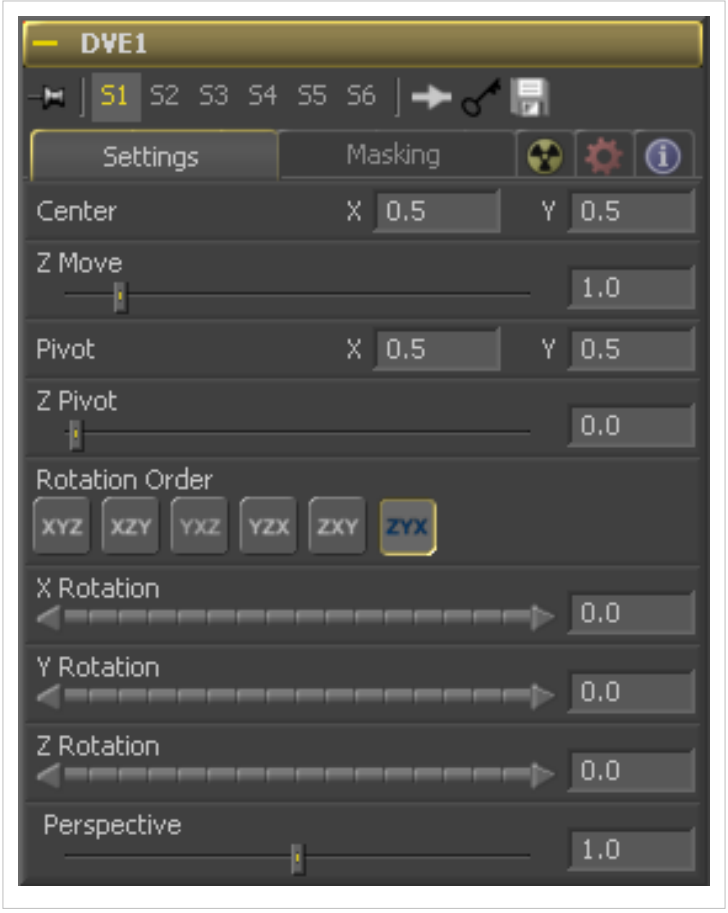
DVE

DVE [DVE]



The DVE tool is a 3D-image transformation similar to tools found in an online edit suite. The tool encompasses image rotations, perspective changes and Z moves. The axis can be defined for all transformations.

Settings Tab



Pivot X, Y and Z

Position the axis of rotation and scaling. The default is 0.5 0.5 for X and Y, which is in the center of the image, and 0 for Z, which is at the center of Z space.

Rotation Order

Use these buttons to determine in what order rotations are applied to the image.

XYZ Rotation

These controls are used to rotate the image around the pivot along the X, Y and Z axis.

Center X And Y

This positions the center of the DVE image on screen. The default is 0.5, 0.5, which positions the DVE in the center of the image.

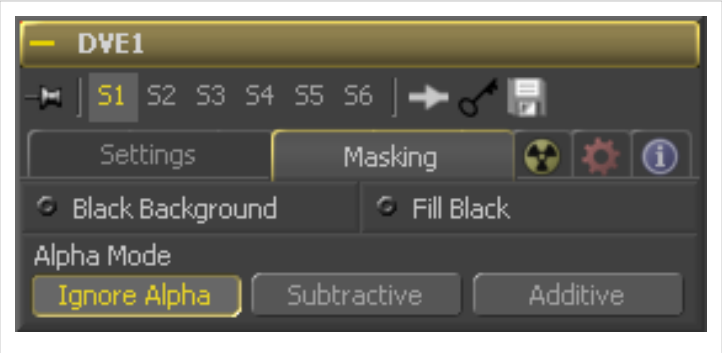
Z Move

This zooms the image in and out along the Z axis. Visually, when this control is animated, the effect is similar to watching an object approach from a distance.

Perspective

This adds additional Perspective to an image rotated along the X or Y axis, similar to changing the Field of View and zoom of a camera.

Masking Tab



The DVE tool allows pre-masking of its input image. This offers the ability to create transformations from the masked area of the image while leaving the remainder of the image unaffected.

Unlike regular effect masking, the masking process occurs before the transformation. To use this feature, connect a mask to the DVE tool's DVE Mask input. Alternatively, select the DVE tool, right-click on the view and select DVE Mask from the context menu. All of the usual mask types can be applied to the DVE mask.

Black Background

Toggle this on to erase the area outside the mask from the transformed image.

Fill Black

Toggle this on to erase the area within the mask (before transformation) from the DVE's input, effectively cutting the masked area out of the image. Enabling both Black Background and Fill Black will show only the masked, transformed area.

Alpha Mode

This determines how the DVE will handle the alpha channel of the image, when merging the transformed image areas over the untransformed image.

Ignore Alpha

This causes the input image's alpha channel to be ignored, so all masked areas will be opaque.

Subtractive / Additive

These cause the internal merge of the pre-masked image over the input image to be either Subtractive or Additive. For more information on Subtractive and Additive merges, see the Merge tool.

Letterbox

Letterbox [Lbx]



Use the Letterbox Tool to adapt existing images to the frame size and aspect ratios of any other format. The most common use of this tool is to adapt film resolution images to NTSC or PAL sized frames for viewing on an external television monitor. Horizontal or vertical black edges are automatically added where necessary to compensate for aspect ratio differences.

Controls Tab



Formats Context Menu

Place the pointer on the Aspect X or Y control and press the right mouse button to display a menu with available frame formats. Select any one of the choices from the menu to set the Height, Width and Aspect controls automatically, or enter the required information manually.

Width And Height

The values of these controls determine the size of the output image as measured in pixels.

Pixel Aspect X And Y

The controls determine the Pixel Aspect Ratio of the output image.

Center X And Y

This center control repositions the image window when used in conjunction with Pan-And-Scan mode. It has no effect on the image when the tool is set to Letterbox mode.

Mode

This control is used to determine the Letterbox tool's mode of operation.

Letterbox/Envelope

This corrects the aspect of the input image and resizes it to match the specified width.

Pan-And-Scan

This corrects the aspect of the input image and resizes it to match the specified height. If the resized input image is wider than the specified width, the center control can be used to animate the visible portion of the resized input.

Filter Modes

Nearest Neighbor

This skips or duplicates pixels as needed. This produces the fastest but crudest results.

Box

This is a simple interpolation resize of the image.

Linear

This uses a simplistic filter, which produces relatively clean and fast results.

Quadratic

This filter produces a nominal result. It offers a good compromise between speed and quality.

Cubic

This produces better results with continuous tone images but is slower than Bi-Cubic. If the images have fine detail in them, the results may be blurrier than desired.

Catmull-Rom

This produces good results with continuous tone images which are resized down. Produces sharp results with finely detailed images.

Gaussian

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Sinc

This is an advanced filter that produces very sharp, detailed results, however, it may produce visible `ringing' in some situations.

Bessel

This is similar to the Sinc filter but may be slightly faster.

Window Method

Some filters, such as Sinc and Bessel, require an infinite number of pixels to calculate exactly. To speed up this operation, a windowing function is used to approximate the filter and limit the number of pixels required. This control appears when a filter that requires windowing is selected.

Hanning

This is a simple tapered window.

Hamming

Hamming is a slightly tweaked version of Hanning.

Blackman

A window with a more sharply tapered falloff.

Kaiser

A more complex window, with results between Hamming and Blackman.

Most of the Resize tool's filters are useful only when making an image larger. When shrinking images, it is common to use the Bi-Linear filter, however, the Catmull-Rom filter will apply some sharpening to the results and may be useful for preserving detail when scaling down an image.

Because this tool changes the physical resolution of the image, we do not normally advise animating the controls.

Example



Various Resize Filters in extreme magnification

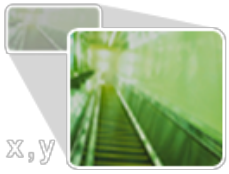


From left to right:

Nearest Neighbor - Box - Linear - Quadratic - Cubic - Catmull-Rom - Gaussian - Mitchell - Lanczos - Sinc - Bessel

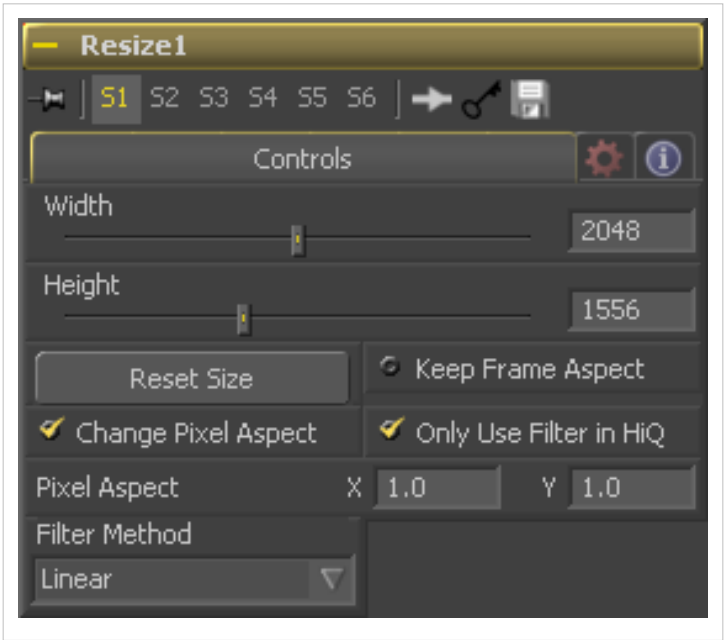
Resize

Resize [Rsz]



Use the Resize tool to increase or decrease the resolution of an input image. This is useful for converting images from one format to another (for example, from film to video resolution).

Controls Tab



Width

This controls the new resolution for the image along the X axis.

Height

This controls the new resolution for the image along the Y axis.

Keep Aspect

When toggled on, the Resize tool maintains the aspect of the original image, preserving the original ratio between width and height.

Reset Size

Reset the image dimensions to the original size of the image.

Reset Size

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Only Use Filter in HiQ

The Resizetool will normally use the fast Nearest Neighbor filter for any non-HiQ renders, where speed is more important than full accuracy. Disable this checkbox to force Resize to always use the selected filter for all renders.

Change Pixel Aspect

Enable this checkbox to reveal a Pixel Aspect control that can be used to change the pixel aspect that the image is considered to have. See the Frame Formats chapter for details on how pixel aspect operates in Fusion.

Filter Method

When rescaling a pixel, surrounding pixels are often used to give a more realistic result. There are various algorithms for combining these pixels, called filters. More complex filters can give better results, but are usually slower to calculate. The best filter for the job will often depend on the amount of scaling and on the contents of the image itself.

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Example



Various Resize Filters in extreme magnification



From left to right:

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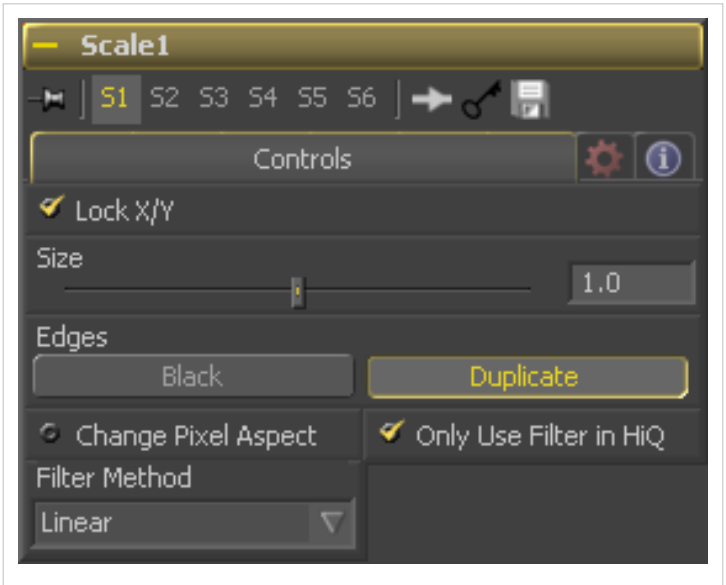
Scale

Scale [Scl]



The Scale tool is almost identical to the Resize tool, except that Resize uses exact dimensions where the Scale tool uses relative dimensions to describe the change to the source image's resolution.

Controls Tab



Lock X/Y

When selected ony a Size control is shown and changes to the image's scale are applied to both axis equally. If the checkbox is cleared, individual size controls appear for both X and Y Size.

Size X/Y

The Size control is used to set the scale used to adjust the resolution of the source image. A value of 1.0 would have no affect on the image, while 2.0 would scale the image to twice it's current resolution. A value of 0.5 would halve the image's resolution.

Change Pixel Aspect

Enable this checkbox to reveal a Pixel Aspect control that can be used to change the pixel aspect that the image is considered to have. See the "Frame Formats" chapter for details on how pixel aspect operates in Fusion.

Only Use Filter in HiQ

The Scale tool will normally use the fast Nearest Neighbor filter for any non-HiQ renders, where speed is more important than full accuracy. Disable this checkbox to force Scale to always use the selected filter for all renders.

Filter Method

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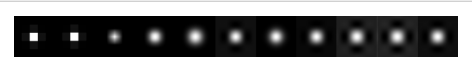
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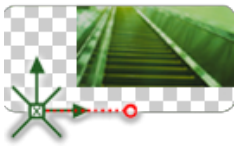


From left to right:

Nearest Neighbor - Box - Linear - Quadratic - Cubic - Catmull-Rom - Gaussian - Mitchell - Lanczos - Sinc - Bessel

Transform

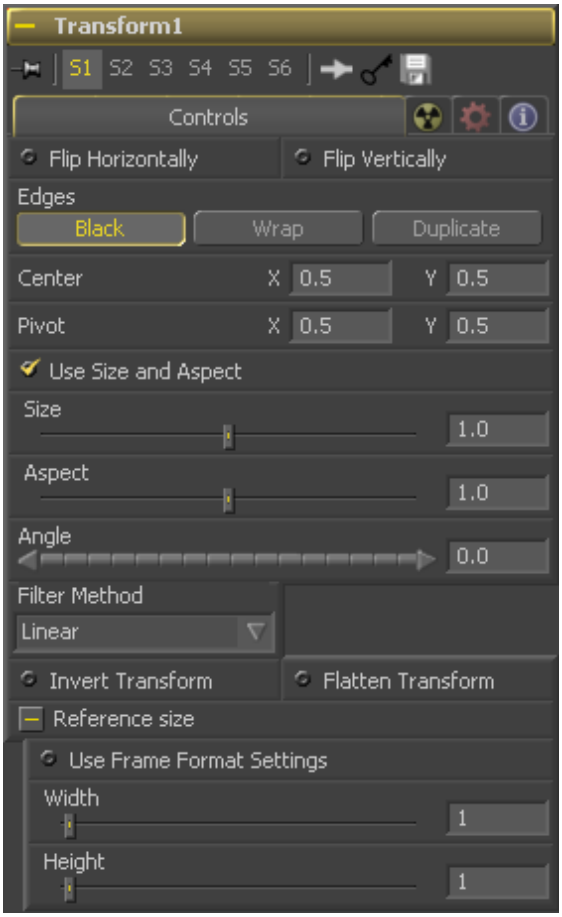
Transform [Xf]



The Transform tool can be used for simple 2D tranformations of the image, such as moving, rotating and scaling. The image's aspect can also be modified using the Transform tool.

The Transform tool concatenates its result with adjacent transformation tools. For more information on concatenation, consult the Transformations chapter.

Controls Tab



Flip Horizontally And Vertically

Toggle this control on to flip the image along the X or Y axis.

Edges

Edges determines how the edges of the image will be treated.

Black

This causes the edges of the image that are revealed to be black.

Wrap

This wraps the edges of the image around the borders of the image. This is useful for seamless images to be panned, creating an endless moving background image.

Duplicate

This causes the edges of the image to be duplicated as best as possible, continuing the image beyond its original size.

Center X And Y

This sets the position of the image on the screen. The default is 0.5, 0.5, which places the image in the center of the screen. The value shown is always the actual position multiplied by the reference size. See below for a description of the reference size.

Pivot X And Y

This positions the axis of rotation and scaling. The default is 0.5, 0.5, which is the center of the image.

Use Size And Aspect

This checkbox determines whether the Transform tool provides independent Size controls for the X and Y scale, or if Size and Aspect controls are used instead.

Size

This modifies the Size, or scale, of the image. Values range from 0 to 5, but any value greater than zero can be entered into the edit box. If the Use Size And Aspect checkbox is selected, this control will scale the image equally along both axis. If the Use Size And Aspect option is off, independent control is provided for X and Y.

Aspect

This control changes the Aspect Ratio of an image. Setting the value above 1.0 stretches the image along the X axis. Values between 0.0 and 1.0 stretch the image along the Y axis. This control is available only when the Use Size And Aspect checkbox is enabled.

Angle

This control rotates the image around the axis. Increasing the Angle rotates the image in a counter-clockwise direction. Decreasing the Angle rotates the image in a clockwise direction.

Invert Transform

Select this control to Invert any position, rotation or scaling transformation. This option is useful when connecting the Transform to the position of a tracker for the purpose of re-introducing motion back into a stabilized image.

Flatten Transform

The Flatten Transform option prevents this tool from concatenating its transformation with adjacent tools. The tool may still concatenate transforms from its input but it will not concatenate its transformation with the tool at its output. See the "Transformations" chapter earlier in this manual for details on concatenated transformation.

Reference Size

The controls under the Reference Size reveal do not directly affect the image. Instead they allow you to control how Fusion represents the position of the Transform tools center.

Normally co-ordinates are represented as values between 0 and 1, where 1 is a distance equal to the full width or height of the image. This allows for resolution independence, because you can change the size of the image without having to change the value of the center.

One disadvantage to this approach is that it complicates making pixel accurate adjustments to an image. To demonstrate, imagine an image that is 100 by 100 pixels in size. To move the center of the image to the right by 5 pixels, we would change the X value of the transform center from 0.5, 0.5 to 0.55, 0.5. We know the change must be 0.05 because 5/100 = 0.05.

The reference size controls allow you to specify the dimensions of the image. This changes the way the control values are displayed, so that the Center shows the actual pixel positions in the X and Y fields of the center control. Extending our example, if you set the Width and Height to 100 each, the center would now be shown as 50, 50, and we would move it 5 pixels toward the right by entering 55, 50.

Internally the Transform tool still stores this value as a number between 0 to 1, and if you were to query the center controls value via scripting, or publish the center control for use by other tools then you would retrieve the original normalized value. The change is only visible in the value shown for transform center in the tool control.

Use Frame Format Settings

Select this to force the merge to use the compositions current frame format settings to set the Reference Width and Reference Height values.

Reference Width and Height Sliders

Set these to the width and height of the image to change the way that Fusion displays the values of the transform tools center control.

Filter Method

Nearest Neighbor

This skips or duplicates pixels as needed. This produces the fastest but crudest results.

Box

This is a simple interpolation resize of the image.

Linear

This uses a simplistic filter, which produces relatively clean and fast results.

Quadratic

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Because this tool changes the physical resolution of the image, we do not normally advise animating the controls.

Example



Various Resize Filters in extreme magnification



From left to right:

Nearest Neighbor - Box - Linear - Quadratic - Cubic - Catmull-Rom - Gaussian - Mitchell - Lanczos - Sinc - Bessel

Warp

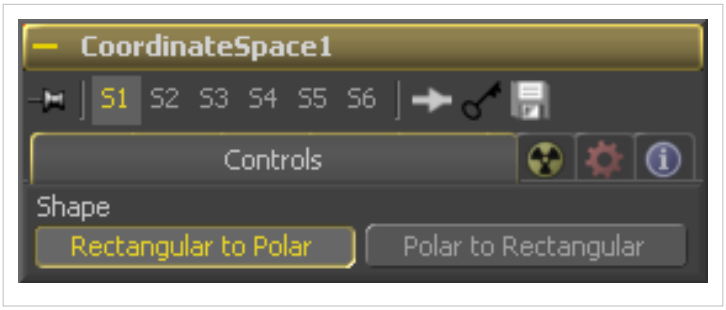
Coordinate Space

Co-ordinate Space [CdS]



The Co-ordinate Space tool changes the coordinate space of the image at its input from Rectangular to Polar or from Polar to Rectangular.

Controls Tab



Select between Rectangular to Polar and Polar to Rectangular. Consider the following example to demonstrate the two coordinate spaces.

Example



To demonstrate a basic tunnel effect that can be achieved with this tool,

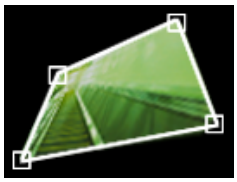
- create some text and animate it to move along a path from the top of the frame to the bottom.
- Connect the output of the Text+ tool to a Coordinate Space tool.
- Select Polar to Rectangular from the Shape menu.

As the text moves from top to bottom along the original path, it will appear to move from an infinite distance in the Coordinate Space tool. It may be necessary to flip the text using the Transform (Xf) tool to make it appear the correct way in the Coordinate Space tool.

Another common use for the Co-ordinate Space tool is to use it in pairs, two of them set to different Shape settings with a Drip or Transform tool in between. When used in this way, the effect gets modified while the image remains the same.

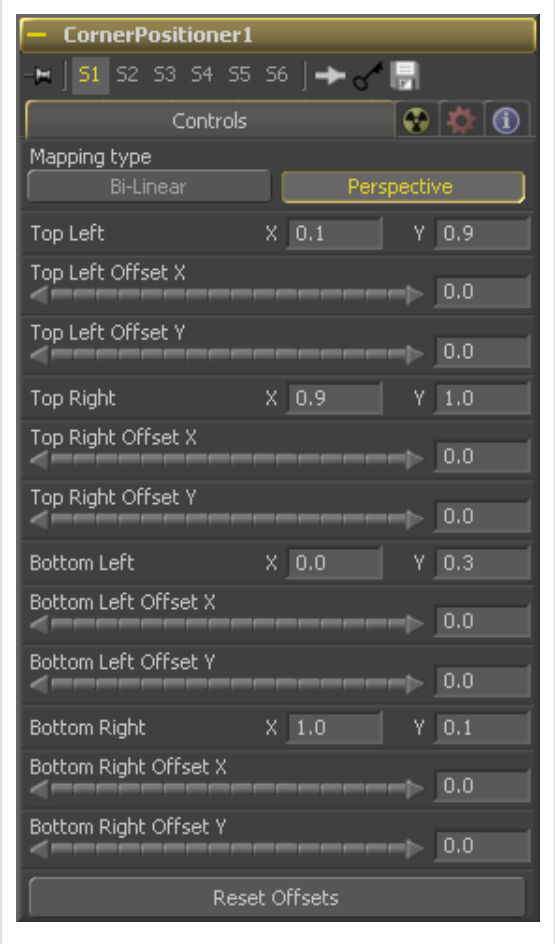
Corner Positioner

Corner Positioner [CPn]



The Corner Positioner can be used to interactively position the four corners of an image. This would typically be used this to replace a sign or other rectangular portion of a scene. Connect all corners to Paths or Trackers for animation purposes.

Controls Tab



Mapping Type

This determines the method used to project the image caused by the Corner Positioner. In

Bi-Linear

mode, a straight 2d warping takes place. In

Perspective

mode, the image is calculated with the offsets in 2d space and then mapped into a 3d perspective.

Corners X And Y

There are four points in the Corner Positioner. Click-drag these around to position each corner of the image interactively. Attach these control points to any of the usual modifiers.

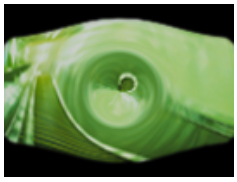
The image input will be deformed and perspective corrected to match the position of the four corners.

Offset X And Y

These controls can be used to offset the position of the corners slightly. Useful when the corners are attached to trackers with patterns that may not be positioned exactly where they are needed.

Dent

Dent [Dnt]



The Dent function creates a circular deformation of an image similar to a fish eye lens effect, with the choice of six different Dent filters.

Controls Tab



Type

Select the type of Dent filter to use from this menu. All parameters for Dent are animatable

Dent 1

This creates a bulge dent.

Kaleidoscope

This creates a dent, mirrors, and inverts it.

Dent 2

This creates a displacement dent.

Dent 3

This creates a deform dent.

Cosine Dent

This creates a fracture to a center point.

Sine Dent

This creates a smooth rounded dent.

Center X And Y

This positions the Center of the Dent effect on the image. The default values are 0.5, 0.5, which center the effect in the image.

Size

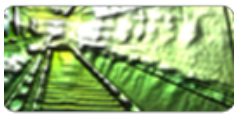
This changes the Size of the area affected by the dent. Animate this slider to make the Dent grow.

Strength

This changes the overall Strength of the Dent.

Displace

Displace [Dsp]

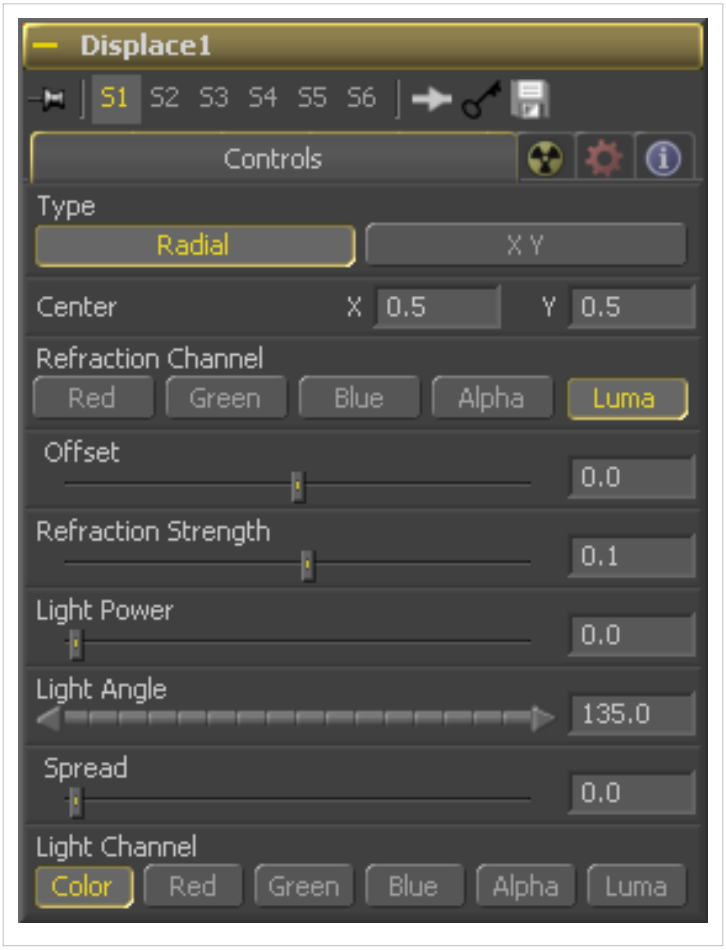


This tool uses a map image to displace or refract another image. This is useful for creating a vast range of effects from bevels and heat distortion to glass and water effects.

The Radial mode pushes pixels inwards or outwards from a center point, based on pixel values from the displacement map. The XY mode uses two different channels from the map to displace pixels horizontally and vertically, allowing more precise results. Using the XY mode the Displace tool can even accomplish simple morphing effects.

The Light controls allow directional highlighting of refracted pixels, for simulating a bevelled look.

Controls Tab



Type

The type buttons can choose in what mode the displace tool operates. The Radial mode uses the map image that refracts each pixel out from the center, while X/Y mode provides control over the amount of displacement along each axis individually.

Note that there is one set of refraction controls while in Radial mode, and two sets in XY mode, one for each of the X and Y channels.

Center (Radial only)

The center control defines the point from which pixels are displaced towards or away from.

Refraction Channel

This array of buttons controls which Channel from the foreground image is used to displace the image. Select from Red, Green, Blue, Alpha or Luminance channels. In XY mode, this control appears twice, once for the X displacement and once for the Y displacement.

Refraction Strength (Radial)

Controls the strength of the refraction. Higher values cause stronger or more pronounced refraction.

X And Y Refraction (X / Y)

Two separate sliders appear to control the Refraction strength along the X and Y axes separately. Otherwise, this is exactly like refraction strength.

Light Power

This controls the intensity or strength of the simulated light, causing bright and dim areas to form according to the contour of the refraction image. Higher values cause the bright and dim areas to be more pronounced.

Light Angle

This sets the angle of the simulated light source.

Spread

This widens the displacement effect and takes the edge off the refraction map. Higher values cause the ridges or edges spread out.

Light Channel

Select the channel from the refraction image that will be used as the simulated light source. Select from Color, Red, Green, Blue, Alpha or Luminance channels.

Drip

Drip [Drp]



The Drip function creates a ripple effect over the entire image, which has the potential to animate outward from a central source. There are a variety of different Drip effects from which to choose.

Controls Tab



Shape

Use this control to select the shape of the Drip.

Circular

This creates circular ripples. This is the default Drip mode.

Square

This creates even-sided quadrilateral drips.

Random

This creates randomly dispersed noise that distorts your image. Similar to a particle effect.

Horizontal

This creates horizontal waves that move in one direction.

Vertical

This creates vertical waves that move in one direction.

Exponential

This creates a Drip effect that looks like a diamond shape with inverted, curved sides (an exponential curve flipped and mirrored).

Star

This creates an eight-way symmetrical star-shaped ripple that acts like a kaleidoscope when the phase is animated.

Radial

This creates a star-shaped ripple that emits from a fixed pattern.

Center X And Y

Use this control to position the center of the Drip effect in the image. The default is 0.5, 0.5, which centers the effect in the image.

Aspect

Control the Aspect Ratio of the various drip shapes. A value of 1.0 causes the shapes to be symmetrical. Smaller values cause the shape to be taller and narrower, while larger values cause shorter and wider shapes.

Amplitude

The Amplitude of the Drip effect refers to the peak height of each ripple. Use the slider to change the amount of distortion the Drip applies to the image. A value of 0.0 gives all ripples no height and, therefore, makes the effect transparent. A maximum amplitude of 10 makes each ripple extremely visible and completely distorts the image. Higher numbers can be entered via the text entry boxes.

Dampening

Controls the Dampening, or falloff, of the Amplitude as it moves away from the center of the effect. It can be used to limit the size or area affected by Drip.

Frequency

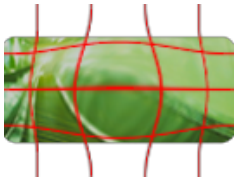
This changes the number of ripples emanating from the center of the Drip effect. A value of 0.0 indicates that there will be no ripples. Move the slider up to a value of 100, to correspond with the density of desired ripples.

Phase

This controls the offset of the frequencies from the center. Animate the Phase value to make the ripple emanate from the center of the effect.

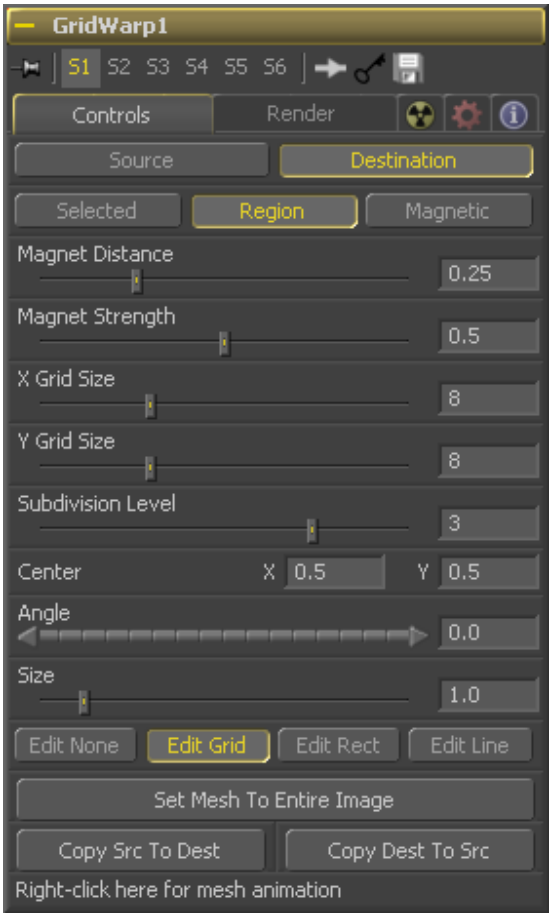
Grid Warp

Grid Warp [Grd]



The Grid Warp tool is a simple 2D deformation grid with flexible vertices. The image will be deformed so that the Source Grid matches the Destination Grid. See the Grid Warp tools chapter for additional information.

Controls Tab



Source And Destination

The Source and Destination buttons determine whether the Source grid or Destination grid is currently active. Only one grid can be displayed or manipulated at a time. The selected button will be highlighted to indicate that is the active grid at the moment.

All of the other controls in this tab affect the grid selected by this control.

Selection Type

These three buttons determine the selection types used for manipulating the points. There are three options available.

Selected

When in selected mode adjustments to the grid will be applied only to the currently selected points. This mode is identical to normal polyline operation.

Region

In region mode, all points within the area around the mouse pointer when the left mouse button is clicked will move. New points that enter the region during the move will be ignored. Choosing this option will expose Magnet Distance and Magnet Strength controls to determine the size and falloff of the area.

Magnetic

In Magnetic mode, all points within the area around the mouse pointer when the left mouse button is clicked will move. New points that enter the region during the move will be affected as well. Choosing this option will expose Magnet Distance and Magnet Strength controls to determine the size and falloff of the area.

Magnet Distance

The default tool for selecting and manipulating the grid is a magnet tool. The magnet is represented in the display view by a circle around the mouse pointer. The Magnet Distance slider controls how large the region of affect for the magnet is, as in the size of the circle. Click-drag on the grid and any vertex within the range of the slider will move.

To increase the size of the magnet, increase the value of this slider. Alternately, adjust the size of the magnet by holding down the D key while click-dragging the mouse.

Magnet Strength

The Magnet Strength slider will increase or decrease the falloff of the magnet cursor's effect. At a setting of 0.0, the magnetic cursor has no effect, and vertices will not move at all. As the values increase, the magnet causes a greater range of motion in the selected vertices. Use smaller values for a more sensitive adjustment and larger values for broad-sweeping changes to the grid.

X & Y Grid Size

The X and Y Grid Size sliders control the number of divisions in the grid. Where the X and Y divisions intersect, a control vertex is created.

Be aware that changing either of these controls after applying changes in the grid will reset the entire grid. Set the X and Y grid sizes to the appropriate resolution before making serious detailed adjustments to the grid.

Subdivision Level

The Subdivision Level determines how many subdivisions there are between each set of divisions. Subdivisions do not generate vertices at intersections. The more subdivisions there are, the smoother the deformation is likely to be (and the slower it will be to render the deformation).

Center

The Center coordinates determine the exact center of the grid. The onscreen center control is invisible while editing the grid. Select to Edit Rect mode and grid center becomes visible and available for editing.

Use the center control to move the grid through a scene without affecting the animation applied to the individual vertices. For example, while deforming lips on a face, track the motion of the face with a tracker and connect the grid center to the tracker. This matches the grid with slight movements of the head while focussing on the deformation of the lips.

Angle

This Angle control rotates the entire grid.

Size

The Size control increases or decreases the scale of the grid.

Edit Buttons

There are four edit modes available, each of which can be selected by clicking on the appropriate button.

Edit None

Set the grid to Edit None mode to disable the display of all onscreen controls.

Edit Grid

The Edit Grid mode is the default mode. While this mode is enabled, the grid is drawn in the display view and the control vertices of the grid can be manipulated directly.

Edit Rectangle

When the grid is in Edit Rectangle mode, the onscreen controls display a rectangle that determines the dimensions of the grid. The sides of the rectangle can be adjusted to increase or decrease the grid's dimension. This mode also reveals the onscreen center control for the grid.

Edit Line

The Edit Line mode is extremely useful for creating grids around organic shapes. When this mode is enabled, all onscreen controls will disappear and a spline can be drawn around the shape or object to be deformed. While drawing the spline, a grid is automatically created that best represents that object. Additional controls for Tolerance, Over Size and Snap Distance appear when this mode is enabled. These controls are documented below.

Set Mesh To Entire Image

The Set Mesh To Entire Image button automatically resets the size of the grid to the exact dimensions of the image. Any adjustments to vertices within the grid will be reset.

Copy Buttons

These two buttons provide a technique for copying the exact shape and dimensions of the source grid to the destination, or the destination grid to the source. This is particularly useful after setting the source grid to ensure that the destination grid's initial state matches the source grid before beginning a deformation.

Point Tolerance

This control is only visible when the edit line mode is enabled. The Point Tolerance slider determines how much tesselation the grid will apply to closely match the density of points in the spline. The lower this value, the less vertices there will be in the resulting grid and the more uniform the grid will appear. Higher values will start applying denser grids with variations to account for regions in the spline that require more detail.

Oversize Amount

This control is only visible when the edit line mode is enabled. The Oversize Amount slider is used to set how large an area around the spline should be included in the grid. Higher values create a larger border, which can be useful when blending a deformation back into the source image.

Snap Distance

This control is only visible when the edit line mode is enabled. The Snap Distance slider dictates how strongly the drawn spline will attract surrounding vertices. If a vertex is close enough to a spline's edge, the vertex will move to line up with the spline. The higher the value, the further the reach of the spline.

Right-Click Here For Mesh Animation

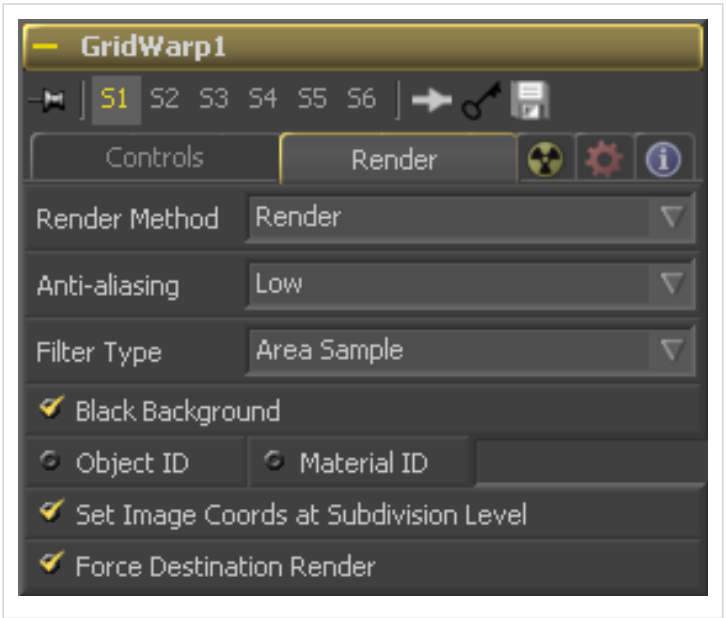
The grids are static by default. Right-clicking on the Right-Click Here For Mesh Animation label will provide a context menu with options for animating the grid or connecting it to another grid in the composition.

The grid uses a polychange spline. Any adjustment to any of the control points will add or modify the keyframe for all points to the polychange spline.

Right-Click Here For Shape Animation

This label only appears in the edit line mode. Right-clicking on the Right-Click Here For Shape Animation label will reveal a context menu that can be used to animate the shaping polyline or to connect it to other polylines in the composition.

Render Tab



Render Method

The Render Method drop-down menu is used to select the rendering technique and quality applied to the mesh. The three settings are arranged in order of quality, with the first (wire frame) as the fastest and lowest of quality. The default mode is Render, which produces final resolution, full quality results.

Anti-Aliasing

The Anti-Aliasing control is a checkbox in wireframe render mode.

It is otherwise a drop-down menu with three levels of quality. Higher degrees of anti-aliasing improve image quality dramatically but vastly increase render times. The Low setting may be an appropriate option while setting up a large dense grid, or previewing a flow, but almost never for a final render.

Filter Type

The Area Sample control is only visible when the render mode is not set to Wireframe. Checked by default, disabling this checkbox prevents the grid from calculating area samples for each vertex in the grid. Area sampling vastly improves render quality at the cost of speed.

Wireframe Width

This control only appears when the Render Method is set to wireframe. It determines the width of the lines that make up the wireframe.

Anti-aliased

This control only appears when the Render Method is set to wireframe. Use this checkbox to enable/disable antialiasing for the lines that make up the wireframe.

Black Background

The Black Background checkbox determines whether pixels outside of the grid in the source image will be set to black or if they will be preserved.

Object ID And Material ID

Enable the Object ID or Material ID checkboxes to have the grid output the proper ID channel in the final render.

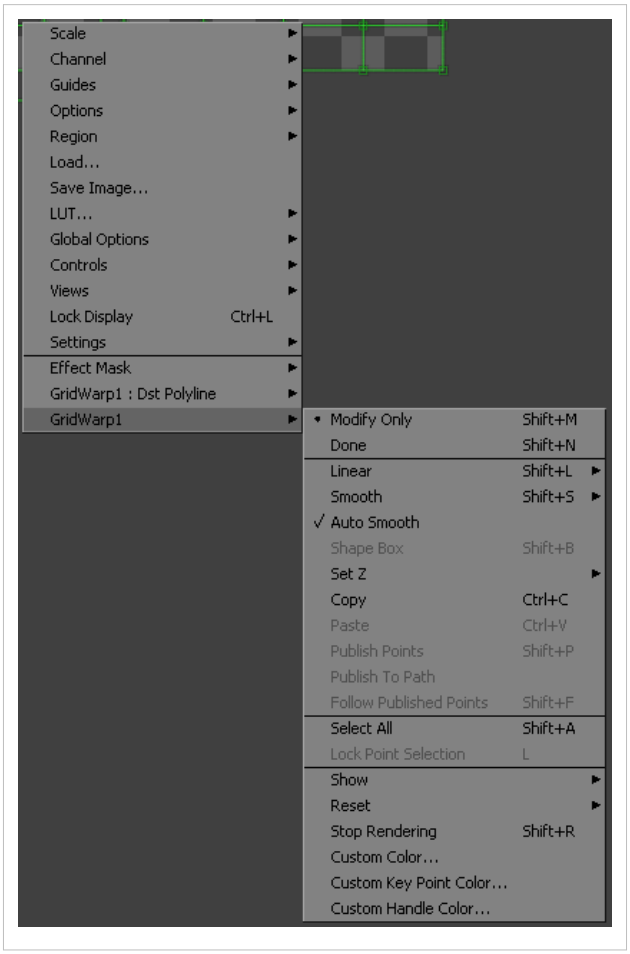
Set Image Co-ordinates at Subdivision Level

Checkbox, Defaults to On.

Force Destination Render

Checkbox, Defaults to On.

Right Click Menu



The grid warp tool places a submenu for both source and destination grids in the display view's Context Menu. Both menus have the exact same name, where only the menu for the active grid is populated with options. The other menu is empty. The context menu options are all available from the toolbar that appears in the display view.

Modify Only/Done

These two options set the mesh to modify only and done modes, respectively. Select Modify Only to edit the mesh or Modify Done to prevent any further changes to a mesh.

Smooth/Linear

Use Smooth and Linear to apply or remove smoothing from selected vertices.

Auto Smooth Points

When Auto Smooth Points is enabled, the vertices in the grid will automatically be smoothed whenever they are moved. This is generally on by default.

Z Under/Z Same/Z Over

When two vertices in a grid overlap, one ends up getting clipped by the other. Z Under, Z Same and Z Over are used to select which vertices are rendered on top and which are rendered behind.

Select All

This option will Select All points in the mesh.

Show Key Points, Handles, Grid and Subdivisions

Use these four options to enable or disable the display of the grid, key points (vertices), Bezier handles and subdivisions in the display views.

Reset Selected Points

Reset Selected Points (vertices) to their default positions.

Reset All Points

This will Reset All Points (vertices) in the mesh to their default positions.

Stop Rendering

This option will enable Stop Rendering, which disables all rendering of the grid warp tool until the mode is turned off. This is frequently useful when making a series of fine adjustments to a complex grid.

Controls Tab



Whenever the grid warp tool is selected and is in edit grid mode, the grid warp toolbar is displayed in the views. This toolbar provides a variety of options for manipulating and adjusting the grid. The Toolbar Buttons in this toolbar are described above in the context menu.

Perspective Positioner

Perspective Positioner [PPn]



The Perspective Positioner is the complementary tool to the Corner Positioner tool. By positioning corner points on an image and moving them, it is possible to remove the perspective from an image.

This function can also be used to wobble and warp the image by animating the points over time.

Controls Tab



Corners X And Y

There are the four control points of the Perspective Positioner. Interactively drag these in the views to position each corner of the image.

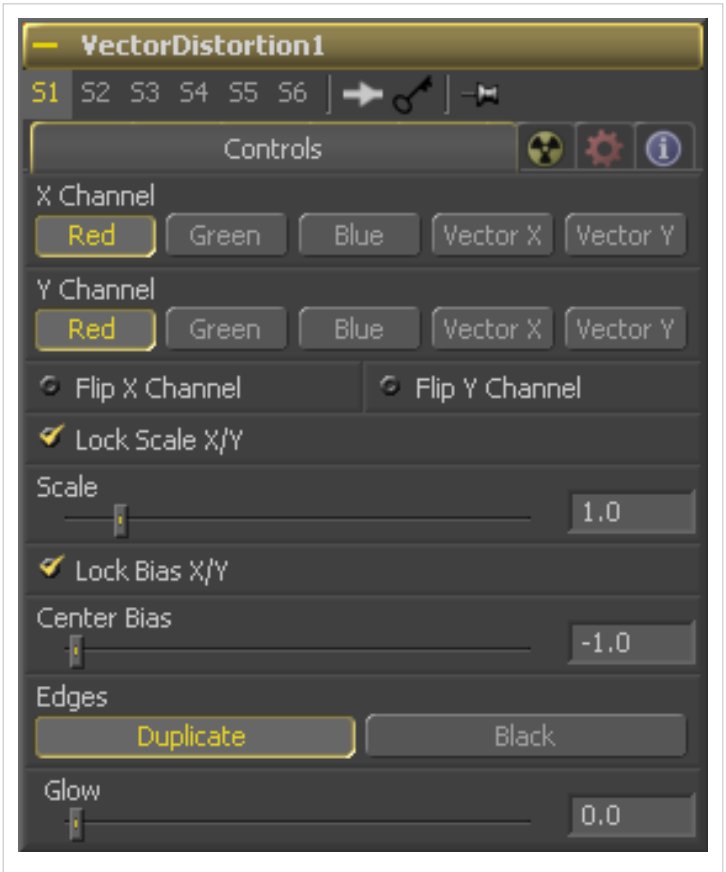
Vector Distortion

Vector Distortion [Dst]



The Vector Distortion tool distorts the main source image along the X and Y axis separately, based on the vector channel data in the source image, or a channel from a second image, reference image.

Controls Tab



X Channel & Y Channel

Use these buttons to select which channel of the reference image will be used to distort the X and Y channels. If no Distort reference image is connected to the second (green) input of the tool then channels from the main input are used instead.

Flip X & Flip Y Channel

Use these checkboxes to flip the direction of the distortion along the specified axis.

Lock Scale X/Y

Select this checkbox to separate the Scale slider into separate Scale X and Scale Y sliders.

Scale

Use the scale slider to apply a multiplication to the values of the distortion reference image.

Lock Bias X/Y

Select this checkbox to separate the Bias slider into separate Bias X and Bias Y sliders.

Center Bias

Use the Center Bias slider to shift or nudge the distortion along a given axis.

Edges

The Edges buttons are used to set how the tool deals with pixels that reach the edge of the screen.

Glow

Use this slider to add a glow to the result of the vector distortion.

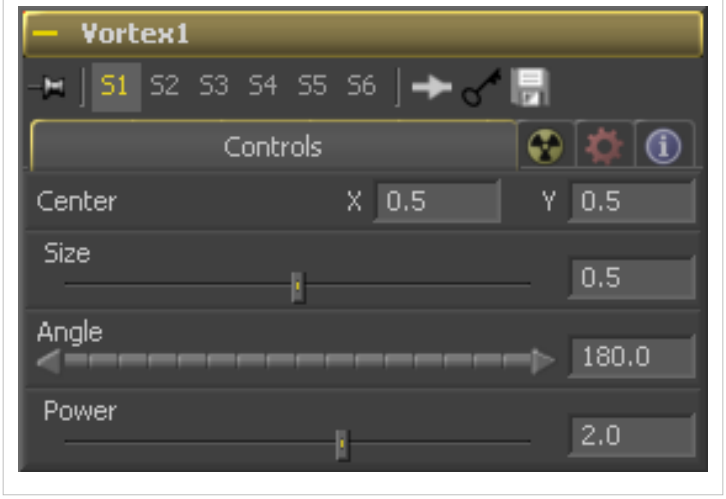
Vortex

Vortex [Vtx]



The Vortex effect appears as a swirling whirlpool in specified regions of the image. The Vortex can be made to move and grow by animating the various controls.

Controls Tab



Center X And Y

This control is used to position the center of the Vortex effect on the image. The default is 0.5, 0.5, which positions the effect in the center of the image.

Size

Change the area effected by the Vortex in the display window by dragging the circumference of the effect or by using the Size slider.

Angle

Drag the rotation handle on the display or use the screw control to change the amount of rotations in the Vortex. The higher the angle value, the greater the swirling effect.

Power

Increasing the Power slider makes the Vortex smaller but tighter. It effectively concentrates it inside the given image area.

Article Sources and Contributors

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