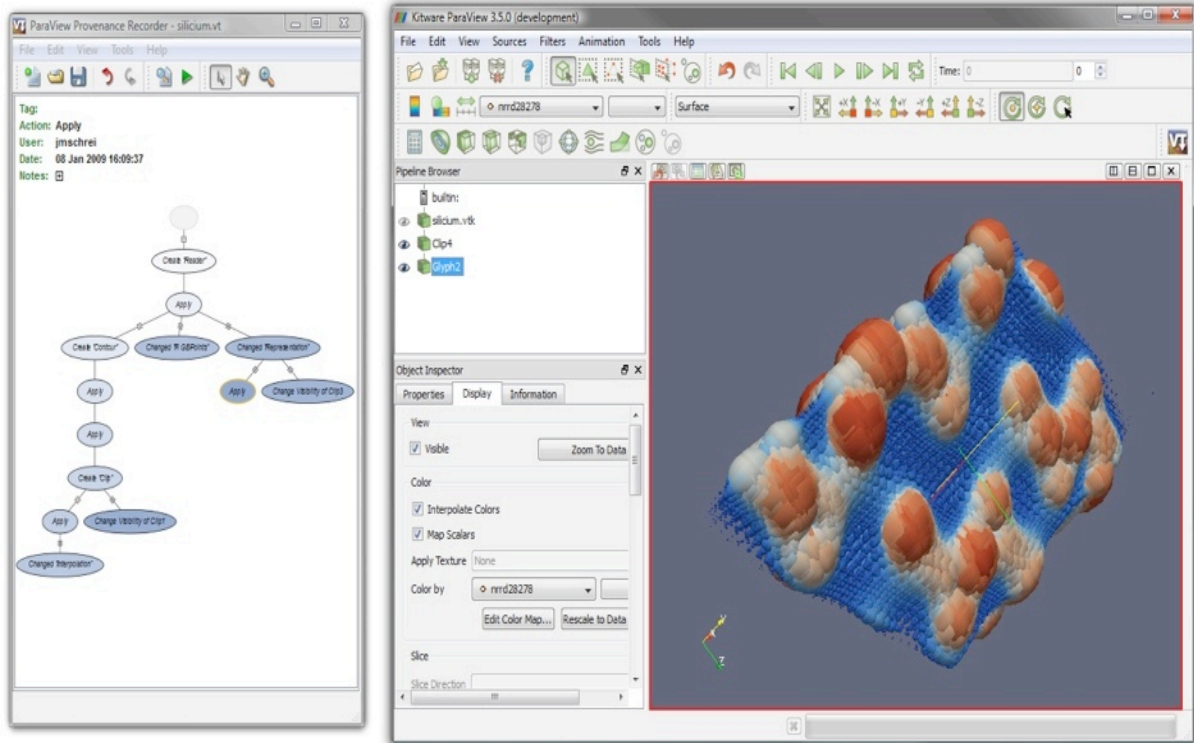




## PROVENANCE EXPLORER FOR PARAVIEW



1.0 RELEASE

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# Introduction

VisTrails Provenance Explorer for ParaView is a unique tool that allows interaction between different stages in the design process. A completely interactive visual trail (or vistrail) is transparently created while a user interacts with the ParaView system. The vistrail is much more than a simple history log— the contents are displayed in a branching version tree that can be browsed, annotated, queried, analyzed, and re-used. VisTrails' provenance technology makes it possible to maintain the important decisions and steps that are used to create a digital asset along with the final result. This is especially useful for the transfer of knowledge and expertise from one user to the next.

# Getting Started

## Editions

VisTrails Provenance Explorer is available at [www.vistrails.com/paraview.html](http://www.vistrails.com/paraview.html)

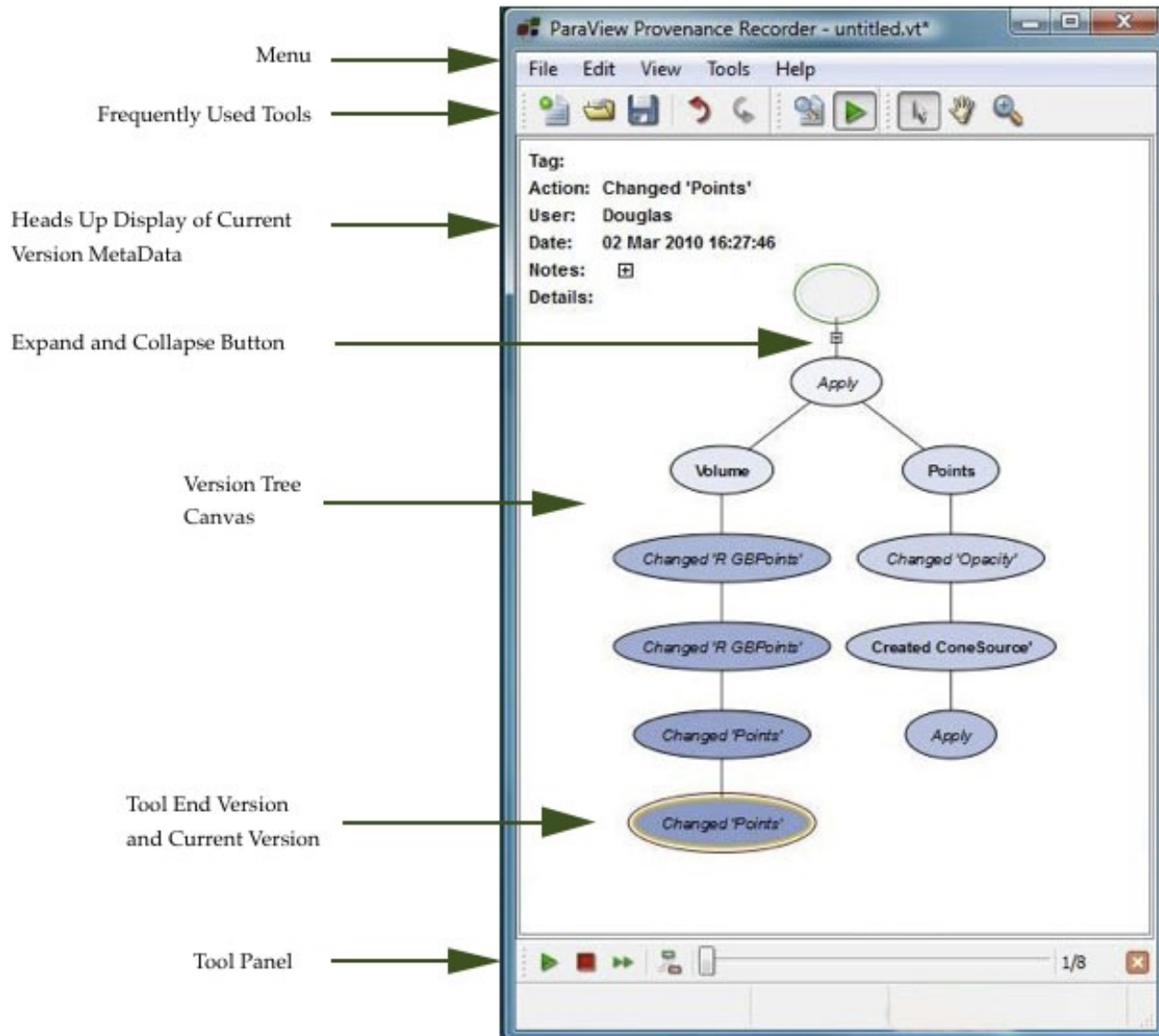
## Installation

System Requirements: VisTrails Provenance Explorer requires ParaView-3.6.2 to be installed on a Windows platform (XP/Vista/7) or Linux and is available in 32 and 64 bit.

1. Download ParaView from [www.paraview.org/paraview/resources/software.html](http://www.paraview.org/paraview/resources/software.html)
2. Windows Installation: Run the Windows Installer.
  - a. Windows Vista: Right click on the .exe setup file and select "Run as administrator"
  - b. Windows XP: Log in as administrator and execute the .exe setup file
3. Initialize the plug-in by opening ParaView and selecting the **Tools** → **Manage Plugins/Extensions** → **Load** menu item, and clicking on the Load button in the Plugin Manager box. In the Load Plugin pop up box select **bin** → **plugins** → **VisTrailsPlugin** → **VisTrailsPlugin.dll**. After selecting the VisTrailsPlugin.dll, the plugin will be started and the Plugin Manager box can be closed.
4. Linux Installation:
  - a. Untar paraview-3.6.2-Linux32-x86.tar.gz
  - b. Execute Paraview from the bin folder.
  - c. Initialize the plug-in by selecting **Tools** → **Manage Plugins/Extensions**. In the Load Plugin pop up box select **bin** → **Plugins** → **VisTrailsPlugin** → **lib** → **VisTrailsPlugin.so**

# The Plug-in Interface

The plug-in consists of the following components:



## Interacting with the Version Tree

The Version Tree is a visual representation of all the operations that a user performs in ParaView. The Tree is completely interactive, allowing all versions of the scene to be recreated by simply selecting a version. Branches form in the tree after undo operations or when the user selects a previous version in the Tree and continues to work in ParaView from that version. Here we describe some of the interactions that are possible with the plug-in for navigating and annotating the Version Tree.

### Navigating

*Select:* Versions can be selected in the Version Tree using the Select tool located on the toolbar at the top of the plug-in. The ParaView display will be updated to reflect the state of the scene when the selected version was created. By default, the camera settings and panel layouts in Paraview change when selecting versions in the Tree to reflect the settings that were used during recording. To change this behavior, the **Lock View** toolbar item can be enabled and the camera and panel layouts will remain static during navigation.

*Pan/Zoom:* The Version Tree Canvas can be interactively navigated using the **Pan** and **Zoom** tools on the toolbar, or alternatively, by clicking and dragging the middle mouse button (**Pan**) or the right mouse button (**Zoom**) in the Canvas. The mouse scroll wheel can also be used to **Zoom** the Version Tree. To set the view of the Version Tree to show all versions, the **View → Frame All** menu item can be selected. Similarly, to zoom into the current selection, the **View → Frame Selection** menu item can be selected.

*Undo/Redo:* Undo and redo can be performed in the plug-in using the **Ctrl+z** and **Shift +z** shortcuts, respectively, or by selecting the **Undo** and **Redo** buttons from the top toolbar. Undo in Paraview and the plugin are synchronized so that the operation moves the current version up one version in the Tree and redo moves the current version back down to the version that was undone.

*Expand/Collapse:* The Version Tree automatically collapses intermediate steps to reduce the clutter of a large Tree. Expanding and Collapsing the Tree to view intermediate steps

can be performed in several ways. The easiest is by selecting the Expand or Collapse buttons directly on the Canvas. Menu items View → Expand Branch and View → Collapse Branch operate on the versions in the same branch of the Tree as the current version. View → Collapse All will collapse the entire Tree into its smallest form. By default, the most recently created versions are not collapsed in the Version Tree, as specified by the Number of Visible Versions preference accessed via the Edit → Preferences menu item.

*Hide/Show:* The Version Tree maintains all the operations a user performs. However, there are cases where a user may perform a series of erroneous steps in Paraview and desire to back up using undo and continue working with the correct steps. An undesired branch in the Tree, such as one created by the scenario described, can be hidden by selecting the highest version in the branch and selecting **View → Hide Branch**. The **View → Show All** menu item will restore all hidden branches.

## Annotating

Useful metadata is captured automatically by the plug-in and displayed in the plug-in's Heads Up Display. This metadata refers to the current version and is updated when a new version is selected. Static information for each version includes the name of the user that performed the operation, the time and date the operation was performed, and action and details strings that describe the operation. By default the metadata is truncated to reduce the size in the display. By hovering the mouse over an item, a tooltip will appear showing the full content.

Optional annotations can also be added to any version by the user.

*Tags:* A tag is a user specified string that bookmarks important versions in the Tree. Tagged versions are never collapsed and are thus always easily accessible. A tag replaces the action text that is displayed in the center of a version. To add or edit a tag, simply double click on a selected version and type the tag into the edit box that is displayed.

*Notes:* Additional information, in the form of notes, can be added to a version to assist in understanding the operation that was performed or give insight into the creation process. Editing the notes for a version is performed by selecting the + symbol in the

Notes section of the Heads Up Display. This opens a dialog that allows a full set of notes to be entered. The first few words of the notes are then displayed in the Heads Up Display to indicate that there are notes associated with the current version.

## **File Handling**

A vistrail is stored as a .vt file that contains the provenance information to recreate each step that was used in the creation of a scene in Paraview. By default, any Paraview scenes that are opened or imported are incorporated into the vistrail so it can be recreated from the vistrail alone (see Preferences). A vistrail is associated with a Paraview Project in the same way a Paraview scene is. Any textures, or other files that are not included in a Paraview scene file are also not included in a vistrail. Thus, as with a scene, a full project should be distributed with a vistrail if external texture files or caches are referenced or created.

# Tools

VisTrails Provenance Explorer contains several additional tools to assist in the capture, analysis, and reuse of provenance. These tools are described in detail here.

## Time Statistics

Statistics can be generated using the metadata that is associated with each version in the Version Tree.

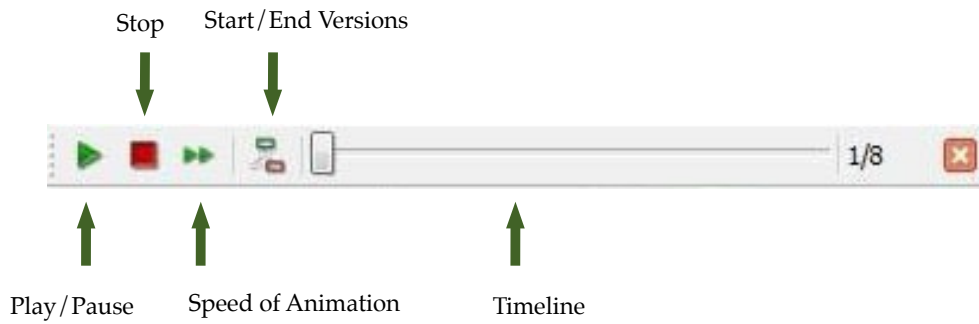
The plug-in includes one such statistic for computing the amount of time that has been spent on the scene. **Compute Statistics** will compute and display the time that each user spent on a vistrail or on a series of steps in a vistrail. This time is calculated for active sessions and ignores the time between sessions. To compute statistics for the entire vistrail, the **Tools → Compute Statistics** menu item is used. To compute statistics for a sequence of operations in the Tree, the **Tools → Compute Sequence Statistics...** menu item is used. This latter tool prompts the user via the status bar to select two versions from the tree. After the selection is made, a dialog will open that shows the time spent per user on the actions that occurred between the two selected versions. Closing the Time Statistics dialog will return the plug-in to an operational state.

## Search

The Tags, Actions, Users, Date, and Notes metadata can be queried using the **Tools → Search** tool. When the tool is activated, a panel is displayed that allows textual queries to be entered. Matching versions are highlighted in the Version Tree with the default **Search** setting from the Search Icon drop down menu. To hide all versions from the Tree that do not match, the **Refine** setting from the drop down menu can be used.

## Playback

The playback tool allows the versions to be animated sequentially, giving an effect similar to a movie that was captured of the scene creation process. Selecting **Tools → Playback** opens the following playback panel at the bottom of the plug-in window.



When the Playback panel is open, two versions in the Version Tree are given green and red indicators to show the start and end versions of the animation. By default, the root of the tree is the start version and the current is the end version. The **Start/End Versions** button in the panel allows the user to redefine these versions using a selection prompt. The animation can be started and paused using the **Play/Pause** button and reset to the start version using the **Stop** button. The **Timeline** indicates the current version of the animation and can be interactively moved to adjust the current version directly in the animation. The speed at which the versions are replayed can be defined using the **Speed of Animation** drop down menu.

## Preferences

The following preferences are found in the dialog accessed by the **Edit → Preferences** menu item of the plug-in. Changes to the plug-in's preferences are maintained with ParaView preferences.

***Number of recent versions visible:*** This drop down menu allows the user to specify the number of versions in the Version Tree that are shown before an automatic collapse operation is performed.

***Take state snapshots:*** This check box allows the user to disable snapshots from being performed automatically by the plug-in.

***Number of actions between snapshots:*** This drop down menu specifies how frequently the automatic snapshots are taken.

***Store opened and imported files in vistrail:*** The plug-in manages files in different ways, similar to ParaView's Open/Import versus Reference functionality. If this check box is selected, any files opened or imported in ParaView will be copied into the vistrail file so that the vistrail is self-contained. If this check box is not selected, the files are all referenced and will need to be distributed along with a vistrail for it to be fully functional on another machine.

***Plug-in window always on top:*** If checked, this option will keep the plug-in on top of any other ParaView windows so that it is always visible.

# Simple Tutorial

This section will guide you through a series of steps to navigate and modify an existing vistrails that models geometry within Paraview.

## Navigating a Vistrails and Adding Annotations

1. Open ParaView and start the Provenance Explorer Plug-in by selecting **Tools - Manage Plugins/Extensions - Load**. The VisTrails Plugin is under the following folder:  
**bin → plugins → VisTrailsPlugin → VisTrailsPlugin.dll**

2. In the ParaView main window, select **File - Open** and open the iron\_protein.vtk file.

*\*Note: Protein.vtk is part of the ParaViewData folder which can be downloaded from:*

<http://paraview.org/files/v3.6/ParaViewData3.6.zip>

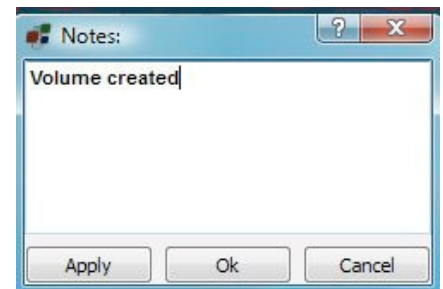
3. In ParaView Object Inspector Properties, click on Apply.

4. In the Display option, change the Representation Style to Volume.

5. In the VisTrails Provenance Explorer double click on the current version (highlighted in yellow) in the tree. This displays a text edit box. Clear the text in the box and type 'Volume' followed by the Return or Enter key.

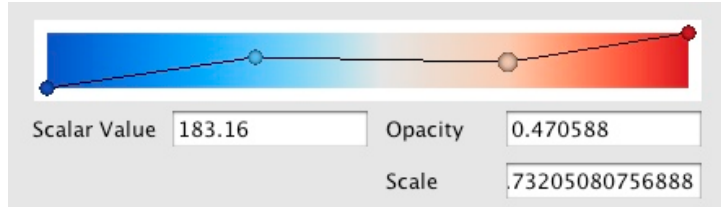


6. In the Provenance Explorer Plugin add a note by clicking on the + sign in the top left corner. Once the Notes window pop-up, add the text "Volume created" and click on the Apply button, followed by the Okay button.



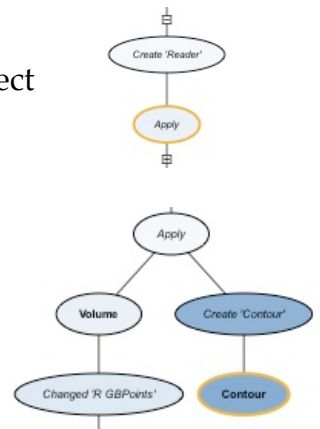
The version you just created now has a tag and will always be shown in the tree.

6. In the Paraview Object Inspector Window, click on Display Option - Edit Color Map button. In the Color Scale Editor pop-up window, change the colors around by single clicking inside of the color box. In the Provenance Explorer Window, click on the current version (highlighted in yellow) in the tree, and rename it to "Transfer Function".



7. In the Provenance Explorer, click on the first + sign of the tree. And select the Apply version.

8. In the ParaView menu, click on the Contour Icon followed by the Apply button in the Object Inspector Window. Rename the last version tree in Provenance Explorer to Contour. Now you have just created another path in the version tree.



9. Rename the current tree in Provenance Explorer to "Isosurface".

Back to the Paraview window, change the Value Range of the Isosurfaces to 100 by double-clicking on the value, and rename it to 100. Next click on the New Value button and add two new values: 128 and 191 and clicking in the Apply button.

10. In the Object Inspector window, click on the Display option and change the Opacity to 0.5. Now rename the current version in Provenance Explorer to "Isosurface 3".

11. In the Provenance Explorer Plugin, go to **Tools - Compute Statistics**. The name of the user, active time and total time will be shown in the pop-up window.

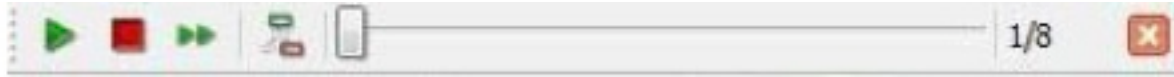
12. In the Provenance Explorer Plugin, go to **Tools - Compute Sequence Statistics**. Select the "Apply" version for the start version and "Isosurface 3" version for the end version. The user, active time, and total time will be shown in the pop-up window.

13. In the Provenance Explorer Plugin, go to **Tools** and select Playback.

To play first select the Select Versions



and select the first and end version



followed by the play icon.