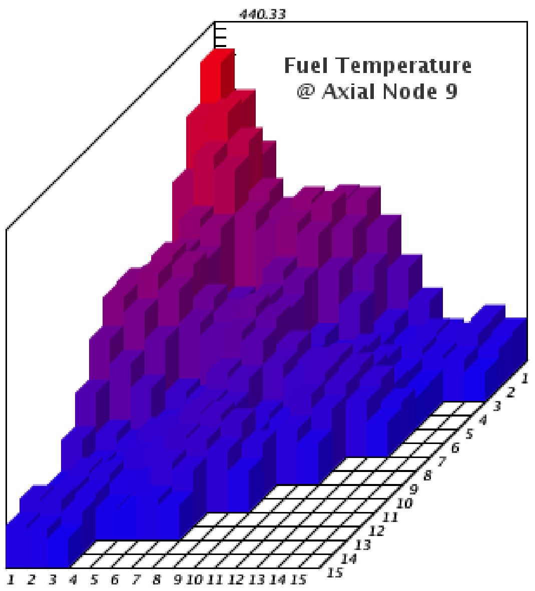
Symbolic Nuclear Analysis Package (SNAP)

User's Manual



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Chapter 1. Introduction

The Symbolic Nuclear Analysis Package (SNAP) consists of a suite of integrated applications designed to simplify the process of performing engineering analysis. SNAP is built on the Common Application Framework for Engineering Analysis (CAFEAN) which provides a highly flexible framework for creating and editing input for engineering analysis codes as well as extensive functionality for submitting, monitoring, and interacting with the codes.

SNAP currently includes support the CONTAIN, COBRA, FRAPCON-3, MELCOR, PARCS, RADTRAD, RELAP5 and TRACE analysis codes. Each code is supported by a separate plug-in.

The list of currently installed plug-ins can be found in the Chapter 2, *The Model Editor* **About** dialog by pressing the **Plugins** button.

The SNAP Application Suite

The SNAP application suite includes the Model Editor, JobStatus and the Configuration Tool client applications as well as the Calculation Server. In this context, a client application is one that typically is run on the local machine and provides a graphical user interface. A server application is one that runs in the background or on a different computer to provide job processing or access to data.

- Model Editor: The primary SNAP client-side user interface. It is responsible for the development and modification of input models for the supported analysis codes. The Model Editor is also responsible for animating the results of those analyses using the Animation plug-in. In addition, the Model Editor is responsible for the creation and design of job streams: arbitrarily complex application flows that can be run on a Calculation Server or High Performance Computing (HPC) environment.

- Calculation Server: The primary SNAP server-side application. It is responsible for executing applications set up in the Configuration Tool on input defined in a Job Stream from the Model Editor. It also manages the output files generated by executing the applications. It also provides control of and communication with active and completed calculations and streams.

- Configuration Tool: A client-side application used to specify properties for the SNAP client applications as well as to startup, shutdown and configure a local Calculation Server.

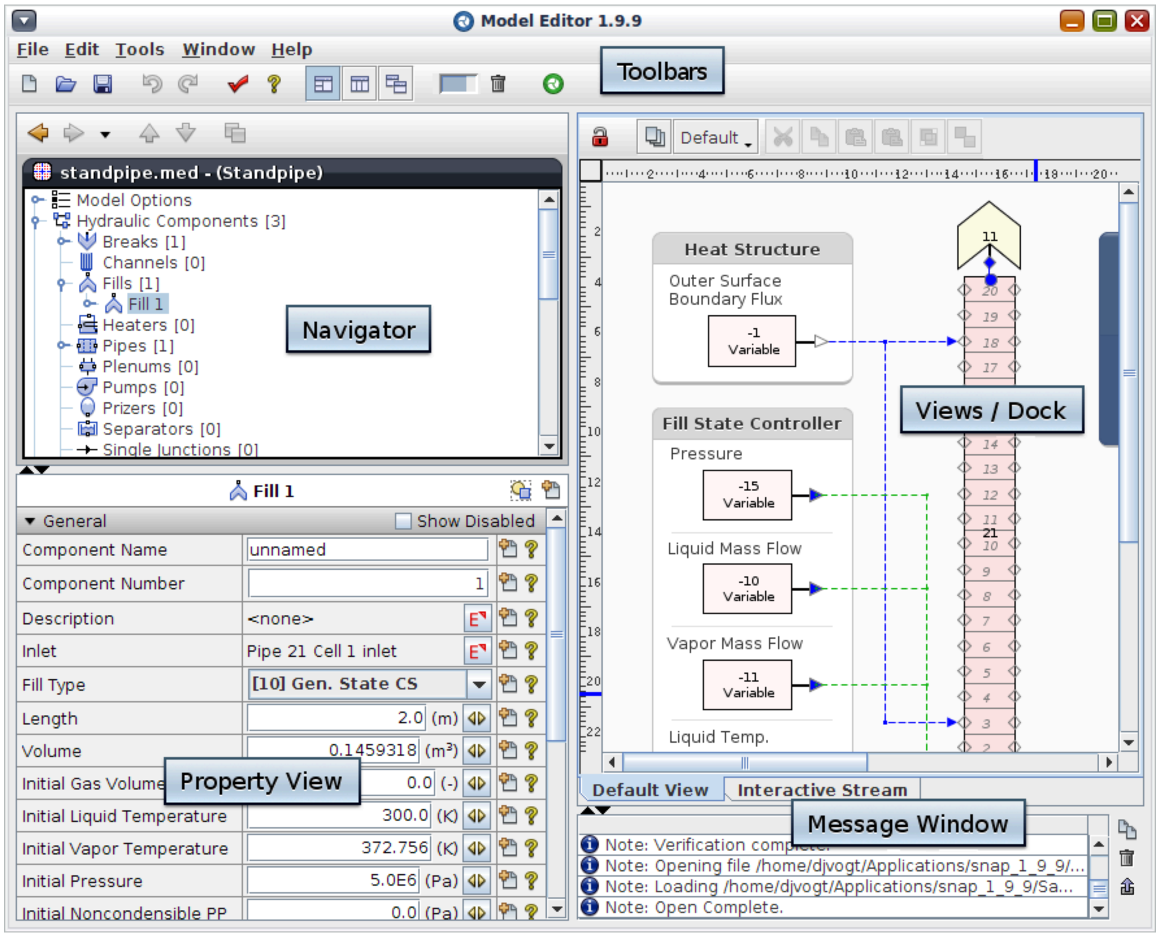
- Job Status: The client side application that is used to display the status of jobs on a server, import local data files as new jobs, and in general monitor job stream execution..

Chapter 2. The Model Editor

The Model Editor is the primary SNAP client application. With it, a user may both design input for analysis codes, display animated representations of calculation results, and build and submit job streams (see Chapter 5, *Job Streams*). The Model Editor provides a consistent interface regardless of the analysis code in question.

2.1. The Model Editor User Interface

SNAP's Model Editor user interface is illustrated in Figure 2.1, “Model Editor UI”. The primary components are labeled and a brief description of each follows.



Component Name	unnamed
Component Number	1
Description	<none>
Inlet	Pipe 21 Cell 1 inlet
Fill Type	[10] Gen. State CS
Length	2.0 (m)
Volume	0.1459318 (m³)
Initial Gas Volume	0.0 (-)
Initial Liquid Temperature	300.0 (K)
Initial Vapor Temperature	372.756 (K)
Initial Pressure	5.0E6 (Pa)
Initial Noncondensible PP	0.0 (Pa)

```
Note: Verification complete.
Note: Opening file /home/djvogt/Applications/snap_1_9_9/...
Note: Loading /home/djvogt/Applications/snap_1_9_9/Sa...
Note: Open Complete.
```

Figure 2.1. Model Editor UI

2.1.1. The Main Toolbars

The main toolbars include basic file operations, model operations, and undo/redo (see Figure 2.2, “Model Editor Main Toolbar”). These toolbars can be individually enabled or disabled using a right-click pop-up menu located on the main toolbar panel.

Buttons for the basic file and model operations include **New**, **Open** and **Save** as well as shortcuts for **Undo**/**Redo**, **Check Model**, and **About**.

The Window Mode buttons can be used to change the basic layout of the major Model Editor components. The first displays the Navigator above the Property View. The second displays the Navigator, Property View, and Views all horizontally aligned, with the Message Window underneath. The third is a multi-window mode, where each major component receives its own window.

The memory toolbar displays information on the current memory usage.

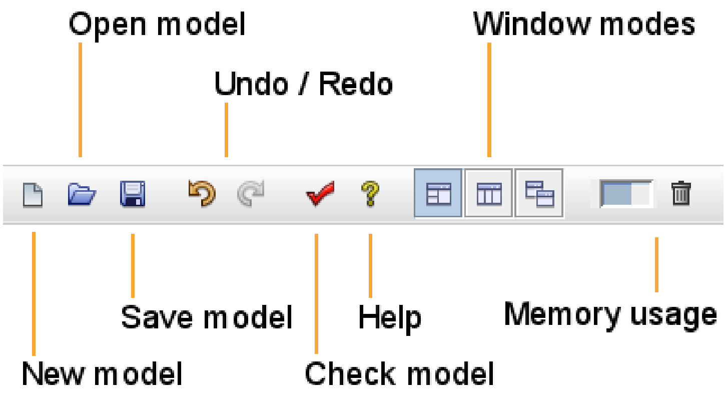


Figure 2.2. Model Editor Main Toolbar

2.1.2. Main Menu Items

The main menu contains several menus of commonly used actions.

The **File** menu contains the following items:

- **New** - Creates a new model (see Section 2.3, "Creating a Model"). The Ctrl-N shortcut (Command-N on Mac OS) is supported on most platforms.
- **Open** - Opens a model (see Section 2.3.1, "Opening a New Model"). The Ctrl-O shortcut (Command-O on Mac OS) is supported on most platforms.
- **Open Recent** - Opens a recently used model, broken down into sub-menus by plug-in.
- **Save** - Saves the model (see Saving a Model). The Ctrl-S shortcut (Command-S on Mac OS) is supported on most platforms.
- **Save As** - Saves the model with a new name (see Saving a Model). The Ctrl-Shift-S shortcut (Command-Shift-S on Mac OS) is supported on most platforms.
- **Revert Modifications** - Reloads the current model from disk. While graphically editing a restart case, this will close the restart case, and reload it from the source model.
- **Close** - Closes the current model, removing it from the Navigator. If the model has unsaved changes, a prompt will be displayed asking whether the model should be saved.
- **Close All** - Closes all open models. If any of the models have unsaved changes, a prompt will be displayed asking which models should be saved.

- **Import** - Imports a model. This provides a menu of the file formats that can be imported by the currently loaded plug-ins. In the case of COBRA, the **COBRA ASCII** item will create a new COBRA model and import the given file as COBRA input.

- **Export** - Exports the current model. This menu lists the file formats that can be exported by the current model, defined by its plug-in.

- **Exit** - Closes the Model Editor. If any open models have unsaved changes, a prompt will be displayed asking which models should be saved.

The **Edit** menu contains the following items:

- **Undo** - Reverts the last modification made to the current model. Successive undo actions revert additional changes. The Ctrl-Z shortcut (Command-Z on Mac OS) is supported on most platforms.

- **Redo** - Reverts the last undo, effectively restoring the change. An additional redo action becomes available for each undo performed on the model. Making any change to the model clears the list of available redo actions. The Ctrl-Y shortcut (Command-Y on Mac OS) is supported on most platforms.

- **Preferences** - Opens the Model Editor preferences window (see Section 2.2, “User Preferences”).

- **Plugin Manager** - Opens a dialog listing all available SNAP plug-ins. Toggling the check-box next to each plug-in allows for loading and unloading the plug-in.

- **Find** - Opens the Find Components dialog for the current model (see XREF).

The **Tools** menu contains the following items:

- **Check Model** - The Check Model button and menu item both perform a model validation check on the current model. The checks performed for a model are defined by its plug-in.

- **Submit Job** - A job stream can be submitted by selecting the **Submit Job** menu item from the main **Tools** menu. Refer to Section 5.4, “Submitting Job Streams” for more information on the job submission process.

- **Export to jEdit** -This item exports the current model to the jEdit text editor. Refer to Section 3.3.1, “General Properties” for more information about configuring jEdit for use by the Model Editor.

- **Configuration Tool** - Opens the Configuration Tool SNAP application (see Chapter 3, *The Configuration Tool*).

- **Job Status** - Opens the Job Status SNAP application (see Chapter 4, *Job Status*).

- **Model Note Viewer** - Opens the Model Note Viewer (see Section 2.4, “Model Notes”).

The **Window** menu contains one item, **Commands**, that opens a **Commands** dialog, which can be used to process Model Editor batch commands (see Section 2.10, "Batch Command Syntax"). When other Model Editor windows are open, this menu will also list those dialogs. Selecting an open window menu item will bring that window to the foreground.

The **Help** menu contains the following items:

- **Help Contents** - Opens the SNAP User's Manual as an interactive help system.
- **About** - Displays information about the Model Editor, installed SNAP plug-ins, included technologies, contact information, etc..

2.1.3. The Navigator

The Navigator is used to select models and access their contents (see Figure 2.3, "Example Navigator View"). The Navigator can be said to consist of three major components: the toolbar, the accordion, and the model contents. Each of these is discussed below.

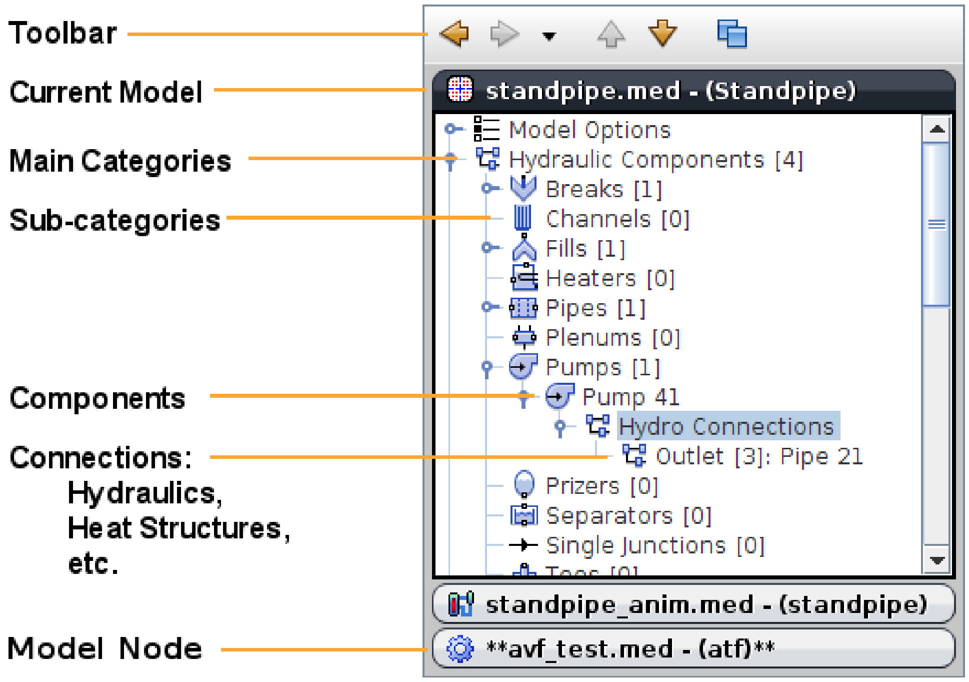


Figure 2.3. Example Navigator View

The *model contents* provides a logical, hierarchical representation of the current model's components and views. Each model is broken down into categories of components. The majority of these categories are plug-in specific, however some (such as views) are shared between all plug-ins. All of the model's components, including non-visual elements such as Model Options, are accessible from the Navigator.

The Accordion

The *accordion* organizes models and displays their contents. It consists of everything below the Navigator toolbar. In the example figure, the Model Nodes labelled **W4Loop.med**,

typpwr_anim.med, and **avf_trace.med** each represent an open model. Model nodes can be expanded to display their contents (**W4Loop.med** in the figure), or contracted (**typpwr_anim.med** and **avf_trace.med**).

When a model is expanded, at most two models to either side are displayed as contracted model nodes. Other models are hidden from view until the expansion changes. Clicking a collapsed node expands it. Double-clicking an expanded node contracts it. A single click on an expanded node displays a model panel in the Property View if the plug-in defines such a panel. The constantly expanding and contracting behavior of model nodes is where the term "accordion" originates.

Exactly one model can be expanded at a time. This expanded node is the *current model*. Contracting the current model with a double-click does not clear its status as the current model. Instead, collapsing the current model provides a complete view of all open models.

Note Only those 2D Views associated with the current model are displayed in the *Views* area. When a view is undocked, it remains visible regardless of which model is selected. However, activating an undocked view selects its parent model in the Navigator.

Navigator Toolbar

The *Navigator toolbar* provides access to several navigation shortcuts. These are, from left-to-right:

1. **Go Back -** Every time the selection changes in the *model contents* changes, a step is added to a selection history. This button returns the selection to the most-recent step in the history, moving the current selection into a forward history. This can change the current model if the previous selection is not in the selected model.

2. **Go Forward -** Similar **Go Back**, but in the other direction.

3. **History -** Displays a pop-up with the last several selections in the Navigator selection history. Selecting an item restores that selection, moving all more recent selections into the forward selection history. Right-clicking on either the Go Back or Go Forward buttons brings up a similar list for the indicated direction.

4. **Up -** Expands the model above the current model.

5. **Down -** Expands the model below the current model.

6. **List -** Displays a pop-up menu listing all open menus. Selecting a model in the pop-up expands it.

Other Navigator Tools

A right-click on nodes in the Navigator opens a pop-up menu. Items in this menu can be used to add, delete or edit components, as well as to perform operations on the model.

The **Show ASCII** item will open an ASCII View showing what the corresponding model's ASCII deck would look like for the selected component. This non-editable view is handy for those analysts who are familiar with ASCII decks and want to verify that they are creating viable ASCII input for their codes.

Note The number of components within a category or sub-category is displayed in brackets following the node name. Notice in Figure 2.3, “Example Navigator View” that there are 4 hydraulic components, and one of these components is a pump.

Note A model's name will appear surrounded by a pair of stars if that model has changes that need to be saved. Notice that in Figure 2.3, “Example Navigator View” that the model **avf_test.med** has unsaved changes while **standpipe.med** and **standpipe_anim.med** do not.

The **Ctrl-Tab** shortcut key can be used to quickly switch between models. Press and hold **Ctrl**, then press **Tab**, to display a model selection pop-up, as shown in Figure 2.4, “Model Selection Pop-up”. Repeatedly pressing **Tab** will cycle through the history of selected models. When the **Ctrl** key is released, the highlighted model is expanded in the accordion.

The list in the model selection pop-up is not displayed in the same order in which the models were opened, but rather the order in which they were most recently selected. Furthermore, the second entry in the list is selected when the **Ctrl-Tab** shortcut is pressed, so that the two most recently used models can be quickly swapped.

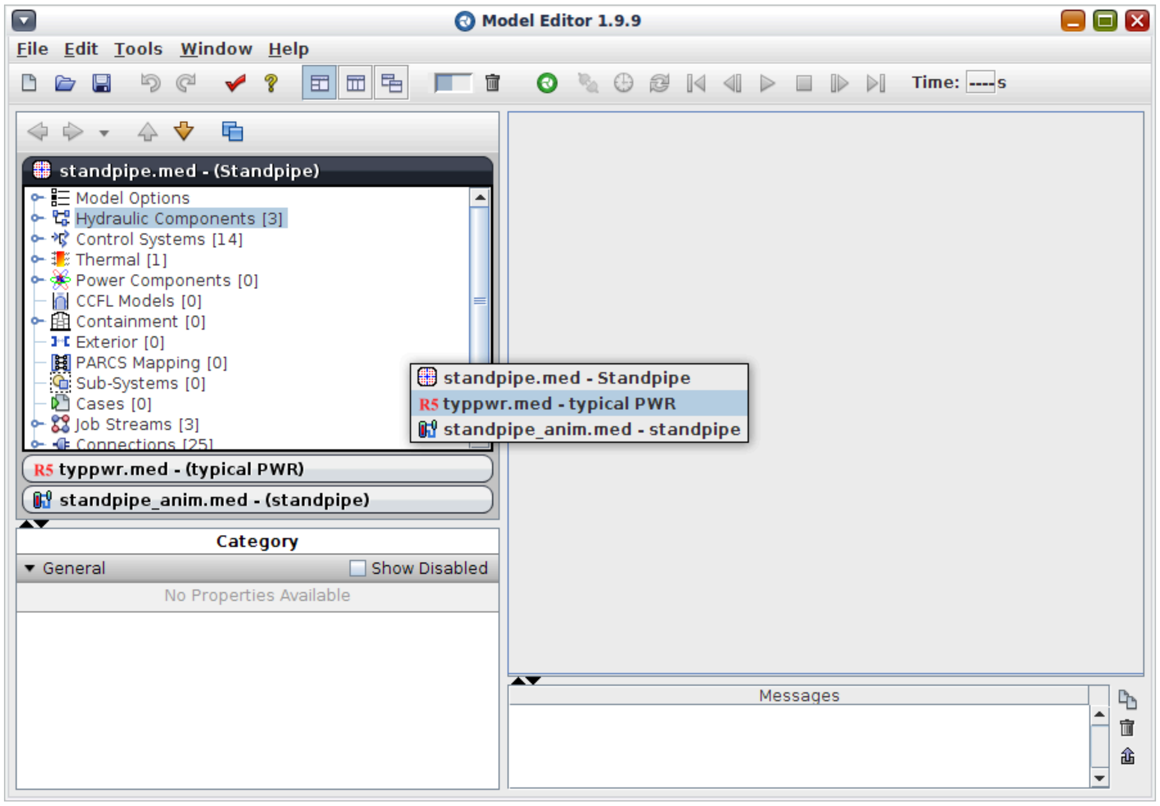
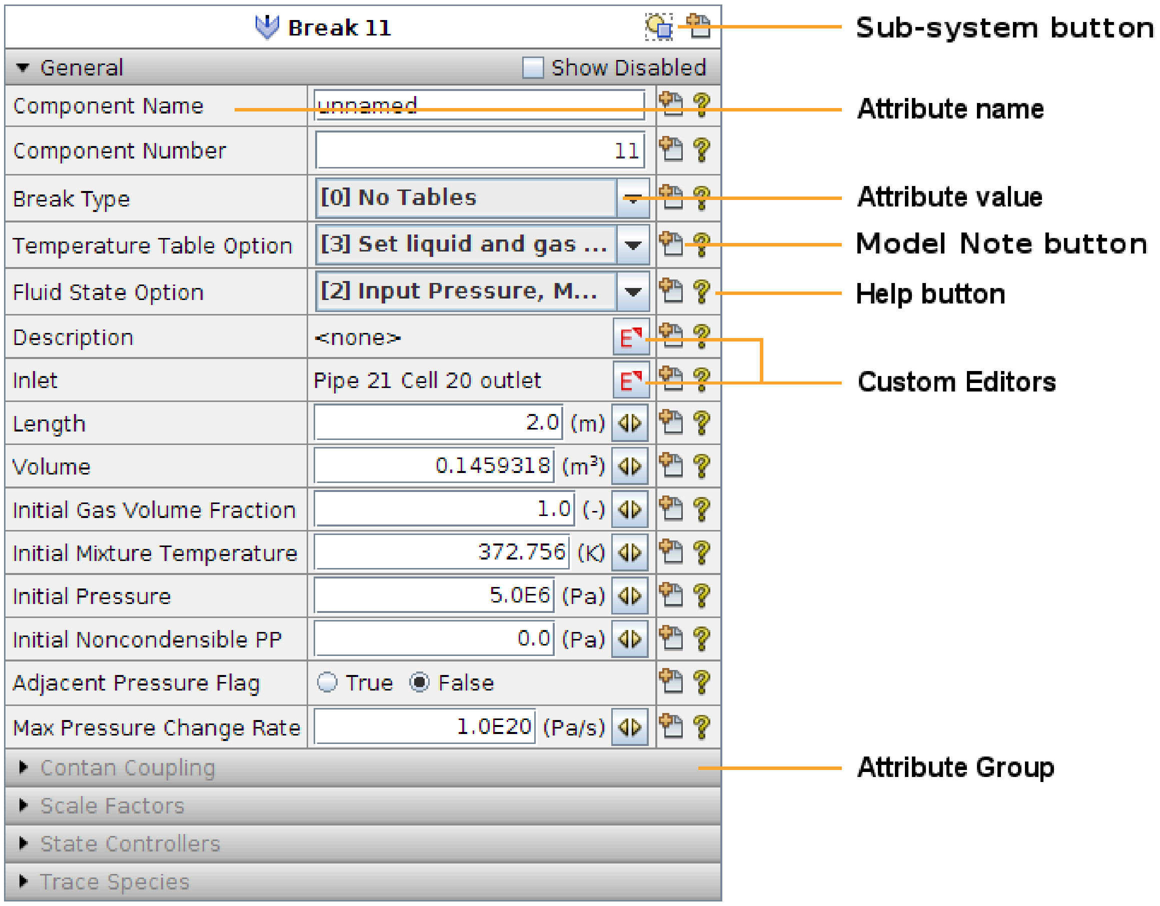


Figure 2.4. Model Selection Pop-up

2.1.4. The Main Property View

The Main Property View, shown in Figure 2.5, “Example Property View”, provides the central point for viewing and editing properties of model components, Display Beans, etc.. It displays the properties of the current selection from either the Navigator or a 2D View. Changes to these properties will immediately be reflected in all other open views (2D, ASCII, Property, etc.). An example of a Property View is shown in Figure 2.5, “Example Property View”.



Break 11

▼ General — Show Disabled

Component Name	unnamed
Component Number	11
Break Type	[0] No Tables
Temperature Table Option	[3] Set liquid and gas ...
Fluid State Option	[2] Input Pressure, M...
Description	<none>
Inlet	Pipe 21 Cell 20 outlet
Length	2.0 (m)
Volume	0.1459318 (m³)
Initial Gas Volume Fraction	1.0 (-)
Initial Mixture Temperature	372.756 (K)
Initial Pressure	5.0E6 (Pa)
Initial Noncondensible PP	0.0 (Pa)
Adjacent Pressure Flag	True [✓ False]
Max Pressure Change Rate	1.0E20 (Pa/s)

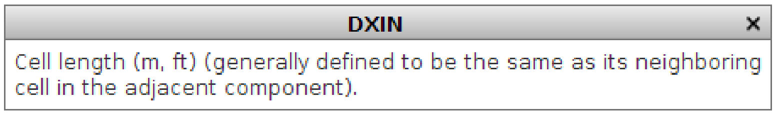
▸ Contan Coupling
▸ Scale Factors
▸ State Controllers
▸ Trace Species

Figure 2.5. Example Property View

Attribute Groups are used to organize the properties of a component within the Property View. Clicking anywhere in the Attribute Group title area will expand or collapse the list of attributes. Each group has a 2 column table of the attributes (description and value). Every object has a **General** attribute group as its first section; other objects add groups as needed.

The **Sub-system Button** opens a pop-up menu containing items related to sub-systems for the select component(s). If the component has been placed into a sub-system, this item can be used to select the parent sub-system in the Navigator. Otherwise, the component can be placed into an existing sub-system from the menu. Sub-systems are explained in greater detail in Section 2.7, “Sub-System Integration”.

Help Button - A help button ? appears next to each property. Pressing this button will display a more detailed description of the attribute, as shown in Figure 2.6, “Sample Attribute Description”.


DXIN

Cell length (m, ft) (generally defined to be the same as its neighboring cell in the adjacent component).

Figure 2.6. Sample Attribute Description

Show Disabled Check Box - This check box (shown in Figure 2.5, “Example Property View”) is used to activate the display of disabled properties in each of the attribute groups. The **Show Disabled** check box always appears in the title area for the **General** attribute group.

Note Disabled properties do not appear by default in the property view. Enabling and disabling properties is the means by which the Model Editor hides attributes of a component that are not relevant given its current configuration.

Custom Editor (also referred to as the **Edit** button) and Component Selection (also referred to as **Select**) buttons are located adjacent to some attribute values. These buttons open detailed custom dialogs for editing components and for selecting other model components where appropriate. These icons are used throughout the SNAP to indicate that pressing the button will open another dialog to either edit or select a value.

Note A separate Property View can be opened for individual components by double-clicking on the component in either the Navigator or a 2D View. The same separate Property View can also be opened by selecting the **Properties** item from the right-click pop-up menu of the component in either location.

The size and content of custom dialogs varies between plug-ins and components. In general, however, they are either "Modal" dialogs whose changes can be cancelled without affecting the mode or "Non-Modal" dialogs whose changes affect the model immediately. The simplest way to distinguish between the two is the buttons that appear at the bottom. If the dialog includes an **OK** and a **Cancel** button then it is "Modal" and its changes will not be applied to the model until the **OK** button is pressed. Most "Non-modal" dialogs will instead have a **Close** button that simply closes the dialog. Some very complex "Non-modal" dialogs will not include a close button at all but will rely on the close button provided by the Operating System (Windows) or Window Manager (UNIX).

2.1.5. 2D Views

2D Views provide a mechanism to visualize models. Components can be placed on a view and arranged in logical ways. Once placed, creating and editing connections between components in a view is as simple as a few clicks with the Connection Tool. Views also support various annotations, such as text, simple graphic shapes, and complex polygons, allowing the user to build an image that represents the model of interest clearly and appealingly (see Section 2.3.4, “Creating Annotations” for more information on view annotations).

The *Font* property of a 2D View controls the font used in automatic text annotations in 2D views, such as the CC numbers displayed in the middle of most components. This property overrides the *2D View Font* selected in the user's general preferences.

A 2D View can be embedded in other views to allow the user to drill-down into more complex parts of the model shown in other views. Once added to another view, these embedded views will be represented by the **Display Icon** specified in the view properties. The **Add To View** menu in the 2D View's right-click pop-up menu is used to embed a 2D View into another 2D View.

2.1.5.1. View Toolbars

The view toolbars located above the 2D View include the main view toolbar, a toolbox toolbar, and optional plug-in specific toolbars used to insert components into the view. The main view toolbar contains buttons for cut, copy, paste, paste special, group, and ungroup operations. Paste special can be used to paste multiple copies of a copied set (refer to Figure 2.7, “2D View Toolbars”). The **Lock View** button is used to lock the views in the model. Locking a view prevents the manipulation of its contents.

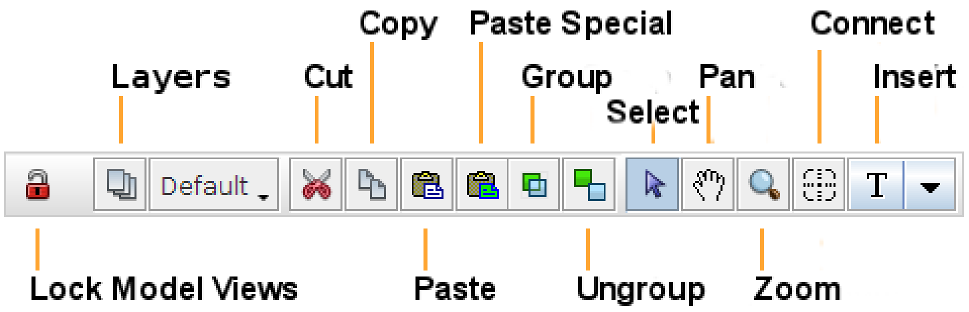


Figure 2.7. 2D View Toolbars

The toolbox toolbar contains buttons used for manipulating the View in various ways. These include the following:

Layers Button

The Layers button opens the Layer Manager, described in Section 2.1.5.4, “2D View Layers”. The second button can be used to select the current default layer.

Select Tool

The select tool is used to select, move, and manipulate elements of a View. Components may be selected using the left mouse button. Clicking an unselected element while holding Ctrl will add it to the selection; clicking a selected element while holding Ctrl will remove it from the selection. The Model Editor also supports "rubber band" selection: pressing the mouse button in an empty area of the View, then dragging the cursor, will draw a rubber band used to select a group of components.

Pan Tool

The pan tool is used to change the visible portion of a View. This feature can be used to maneuver around a large model by pressing the left mouse button and dragging. The displayed portion of the model will move with the mouse.

Zoom Tool

The zoom tool changes the position and scale of the View. Clicking in the View will zoom in a set amount; holding the shift-key and clicking will zoom out the same fixed amount. Clicking and dragging to select a region (drawing a box) will zoom in to the selected region. Right-clicking in the View with the zoom tool will show a menu for selecting a specific zoom position or fitting the entire View to the window.

Connect Tool

This tool is used to create connections between components. To connect two components, place the pointer over a **from** connection point and click the left mouse button, then move the pointer to the desired **to** connection point on another component and left click again. The mouse pointer will turn into a blue dot when a viable **to** connection point is passed over. A line representing the connection will then be drawn in the View.

Insert Tool

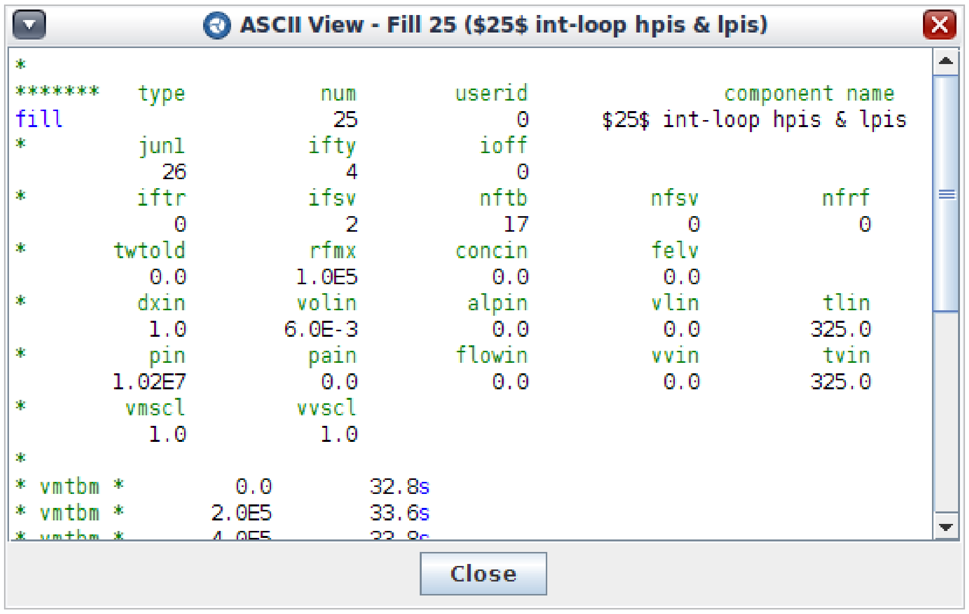
The insert tool includes a button to activate the tool and a drop down menu to select the type of annotation or component to insert. Once a type has been selected, left-clicking anywhere in the view will create an object of the selected type. After the insertion is complete the insertion tool will be deactivated.

To insert multiple components of the same type hold the **Ctrl** key during the insertion click. This will keep the insertion tool active and allow multiple inserts.

2.1.5.2. View Menu Items

View menu items can be accessed via the right-click pop-up menu of the View and the menu bar for undocked views. The actual pop-up menu displayed will depend on the item type (and quantity) currently selected in the view. The specific code plug-ins dictate what items the right-click menus contain, however certain menu items appear frequently and are described here. Many of the menu items available from the right-click menu in the 2D view perform identical functions to those in the Navigator.

- **Hide Menubar / Show Menubar -** When a view is undocked, its menubar can be hidden with the **Hide Menubar** item. Once hidden, the right-click pop-up menu for the view will display the **Show Menubar** item to restore the menu.
- **Properties -** This item opens a separate property view for the selected object. This separate property view is functionally equivalent to the main property view shown in Figure 2.5, “Example Property View”.
- **Show ASCII -** The **Show ASCII** menu item will open a window showing what the corresponding model's ASCII deck would look like for the selected component. This view is handy for analysts who are familiar with ASCII decks and want to verify that they are creating viable ASCII input for their codes.



```
*
*******    type           num        userid              component name
fill                       25             0    $25$ int-loop hpis & lpis
*          junl          ifty          ioff
             26             4             0
*          iftr          ifsv          nftb          nfsv          nfrf
              0             2            17             0             0
*        twtold          rfmx        concin          felv
            0.0         1.0E5           0.0           0.0
*          dxin         volin         alpin          vlin          tlin
            1.0        6.0E-3           0.0           0.0         325.0
*           pin          pain        flowin          vvin          tvin
         1.02E7           0.0           0.0           0.0         325.0
*         vmscl         vvscl
            1.0           1.0
*
* vmtbm *         0.0         32.8s
* vmtbm *       2.0E5         33.6s
```

Figure 2.8. ASCII View

- **Reference Docs -** The **Reference Docs** menu item opens the analysis code manual in another window, scrolled to the relevant portion for the selected component.

- **Copy -** Copies the selected objects to the clipboard. Whenever a new cut or copy operation is performed, the copy/paste buffer's contents is overwritten with the new cut/copy object and the old object is lost. The **Ctrl-C** keyboard shortcut (Command-C on Mac OS) is supported on most platforms.

- **Cut -** Copies the selected objects to the clipboard and then removes these objects from the view. This process *does not remove components from the model* but merely removes the graphical representation of those components from the view. The **Ctrl-X** keyboard shortcut (**Command-X** on Mac OS) is supported on most platforms.

- **Paste -** Pastes the graphical items (not the model components) previously copied to the clipboard. The **Ctrl-V** keyboard shortcut (**Command-V** on Mac OS) is supported on most platforms.

  Note A component can only be represented in a view by a single drawn component.

- **Paste Special -** Opens the Paste Special dialog to allow duplicates of the copied *model components* to be pasted. This dialog is a plug-in specific feature, however, most current plug-ins allow pasting multiple copies and renumbering the components as they are pasted. The **Shift-Ctrl-V** keyboard shortcut (**Shift-Command-V** on Mac OS) is supported on most platforms.

- **Group / Ungroup -** The grouping feature of 2D views allows the user to create a "visual group" for a set of selected visual objects (annotations, display beans, etc.). Once created, a visual group is treated as a single object in the view. Selecting any part of the group will select the entire group. Moving, cutting, copying, etc. affects the entire group. Groups can be dissolved at any time by pressing the **Ungroup** button.

  Note Groups can themselves be grouped. When placed into another group, they retain their composition. For example, if two components and a group are combined into another group, performing an ungroup action will yield two components and a group.

- **Delete -** This item removes the currently selected item(s) from the model. A confirmation dialog is presented before the item is deleted. The **Delete** keyboard shortcut is supported on most platforms.

  Note Deleted objects are not saved on the clipboard.

- **Align -** The Align sub-menu contains items can be used to line up objects in a view by the objects' top, bottom, left, or right faces, as well as by their horizontal or vertical centers.

- **To Front / To Back -** These items move the selected object either to the "front" or "back" of the view, relative to other components. **To Front** ensures that no other objects will appear over the selected beans. **To Back** ensures that the selected objects will not appear over others.

- **Scale Drawing -** This item allows the user to change the default scaling of a drawn component. Drawn components may be scaled by length, width, or both. Adjusting the sliders in the Scale

Drawing dialog will cause the on screen display of the object to reflect the new scale. The user may also choose to enter the scaling factors by hand in the available text boxes. This scaling only affects the visual display of the component, the underlying geometry data is unchanged.

Note In some cases it may be more convenient to use the 2D View scaling described in Section 2.3.5, "Component Display Scaling".

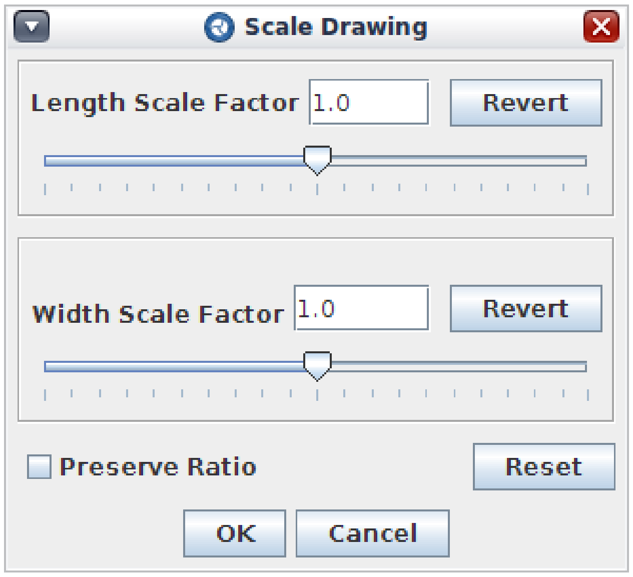


Figure 2.9. Scale Drawing Dialog

- **Organize -** If more then one object is selected, the **Organize** menu item may be used. This item will apply the code plug-in's layout algorithm to arrange the selected items in a visually clear way. Drawing organization is a plug-in specific operation that may not be supported.

- **Redraw -** Sometimes the graphical views' display is not automatically updated when a change to the model is made in another view. This item will cause the current view to be redrawn to reflect the current state of the model and its components.

- **Print View Menu -** The items in this menu allow the view to be printed. The **Entire View** item will print the entirety of the view, regardless of the current zoom scale or pan location. The **Current Perspective** item will print the only the visible portion of the view using the current zoom scale and pan location.

- **Export Image Menu -** The items in this menu are used to export the view as an image. The following formats are currently supported: JPEG, PDF, PNG, SVG, TIFF. Items are provided to export either the **Entire View** or the **Current Perspective**, similar to the Print View Menu above.

- **Select Menu -** The select menu can be used to select a sub-set of the objects in a view by type. Items are provided in the sub-menus for selecting every type that can be added to the view.

- **Zoom Menu -** This menu includes items for setting the current zoom to either **Fit To View** or the following preset scales: **%10**, **%25**, **%50**, **%75**, **%100**, **%150**, **%200**.

- **Undock View -** Undocking a view removes it from the Model Editor main window and opens it in a separate window. This feature can be especially useful for presentations, as the undocked view can then be maximized to fill the entire screen. Closing and re-opening the view will return it to the docked state.

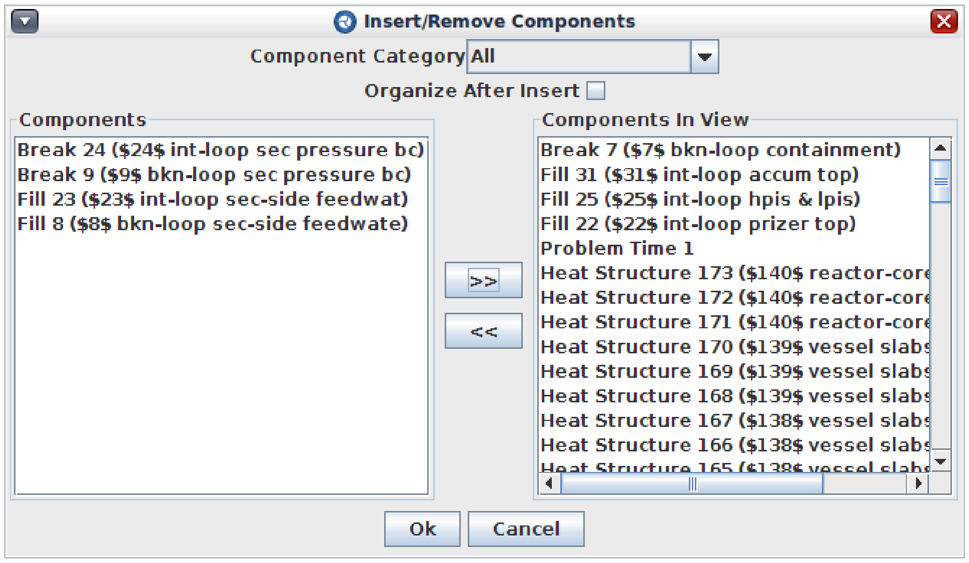
- **Close** - Closes the current view. The view can be re-opened by selecting the **Open** item in the right-click pop-up menu of the view's node in the Navigator, or by double-clicking it.

2.1.5.3. View Tools Menu

The **Tools** menu of the view's right-click pop-up contains a set of useful operations that are used less often. The following are some of the more frequently used menu items in the **Tools** menu.

Note Plug-ins can add items not described here to the Tools menu.

- **Add / Remove Components** - This item will open a dialog that allows the user to choose from a list of components in the model, shown in the left hand column, to add to the view. The user may remove components from the view with this dialog. Components are added to the view by selecting them in the **Components** list then pressing the >> button, and vice versa.


Insert/Remove Components

Component Category All

Organize After Insert

Components
Break 24 (24 int-loop sec pressure bc)
Break 9 (9 bkn-loop sec pressure bc)
Fill 23 (23 int-loop sec-side feedwat)
Fill 8 (8 bkn-loop sec-side feedwate)

Components In View
Break 7 (7 bkn-loop containment)
Fill 31 (31 int-loop accum top)
Fill 25 (25 int-loop hpis & lpis)
Fill 22 (22 int-loop prizer top)
Problem Time 1
Heat Structure 173 (140 reactor-core
Heat Structure 172 (140 reactor-core
Heat Structure 171 (140 reactor-core
Heat Structure 170 (139 vessel slabs
Heat Structure 169 (139 vessel slabs
Heat Structure 168 (139 vessel slabs
Heat Structure 167 (138 vessel slabs
Heat Structure 166 (138 vessel slabs
Heat Structure 165 (138 vessel slab

Figure 2.10. Add / Remove Components Dialog

- **Show All Connections** - When components are added to a view, drawn connections are created to represent connections between the components. The drawn connections can be **Cut** from the display to simplify the view. **Show All Connections** will restore any drawn connections missing from the view.

- **Reset Connections** - This will cause all of the selected components connections to be "reset". A connection that has been reset discards any user-specified modifications to the connection in favor of the default path.

- **Import / Export View Template** - These items allow view templates to be imported and exported for a view. A View Template is a file that contains the annotations, component locations, etc. required to reproduce a view inside of another, similar model. This allows for easy duplication of detailed 2D views between models. View templates also allow preserving complex views when a model must be modified outside of the Model Editor and re-imported.

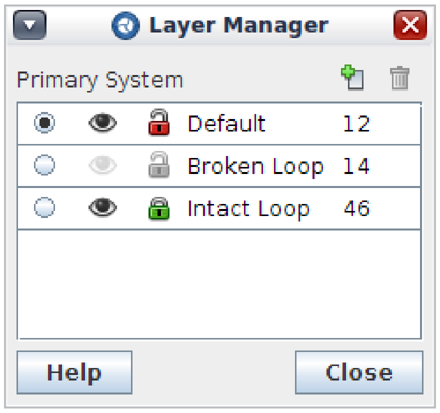
- **Trim Excess Canvas** - This action removes the unused canvas space inside a view. Trimming the canvas is provided so that a view can be set to a very large "working area" while designing the view, then quickly resized to the appropriate dimensions when complete.
- **Export to jEdit** - This item exports the current model to the jEdit text editor. Refer to Section 3.3.1, "General Properties" for more information about configuring jEdit for use by the Model Editor.

2.1.5.4. 2D View Layers

Layers are provided as a tool for organizing and manipulating the contents of a 2D View. Layers are essentially a named collection of zero or more display elements, with each layer belonging solely to its parent 2D View. Each layer may be individually hidden or locked. Hiding layers is a simple visibility toggle: the components in a hidden layer are not drawn in the view. Layer locks function similarly to view locks: the contents of a locked layer cannot be selected in the view. Hiding and locking layers is provided to selectively reduce clutter and complexity in heavily-populated views.

Note Unlike the layers common to graphics applications, view layers do not affect the stacking, or "depth", of elements in a view. Moving an element between layers will not affect its display relative to other components. This design allows the fluid movement of display elements between layers based solely on role and logical grouping. As a side effect, this allows for non-destructive layer sorting. Layers are automatically sorted by name to ease layer management.

All 2D Views contain a 'Default' layer which cannot be removed or renamed. Additional layers can be added using the Layer Manager, available from the **Layers** button on the 2D View toolbar (see Figure 2.11, "The Layer Manager Window", described below). Layers can also be created by using the **Move to Layer -> New** menu item in the right-click pop-up menu of a View.



●			Default	12
○			Broken Loop	14
○			Intact Loop	46

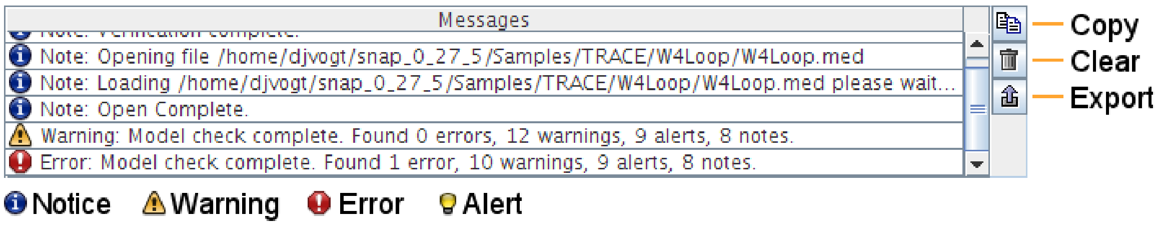
Figure 2.11. The Layer Manager Window

As shown in the figure, the **Layer Manager** is where most layer activity occurs. Layers may be added with the **Create Layer** button at the top of the dialog, and selected layers may be removed with the **Remove Layer** button. The central list details each layer with visual, interactive status indicators. The radio button on the left of each entry controls which layer is "active": all new elements added to the view are automatically associated with the active layer. The **visibility** button (in the form of an eye icon), controls whether the layer is hidden. This indicator is a toggle button for layer visibility: a fully opaque eye represents a visible layer, while a transparent, faded eye indicates the layer is hidden. The **locked** indicator is another toggle button, switching to and from a locked and unlocked status. The fourth element displays the name of the layer, which can be edited with a double-click. The fifth and final portion of each entry is a non-interactive tally of the elements in the layer.

Once an element is placed in the view, it is placed in the currently active layer. To change the layer to which one or more display elements belong, select the elements in the View and open the right-click pop-up menu. Select **Move to Layer -> <Layer name>** to move the selected elements to that layer. The drop-down next to the **Layers** button in the 2D View toolbar can be used to select the active layer.

2.1.6. The Message Window

The Message Window displays a running list of error, warning, alert, and notice messages. Processes such as saving a file or checking a model will produce messages in this window. Buttons located along the right side of this window are used to clear the window, export selected messages to a file, or copy selected messages to the clipboard.

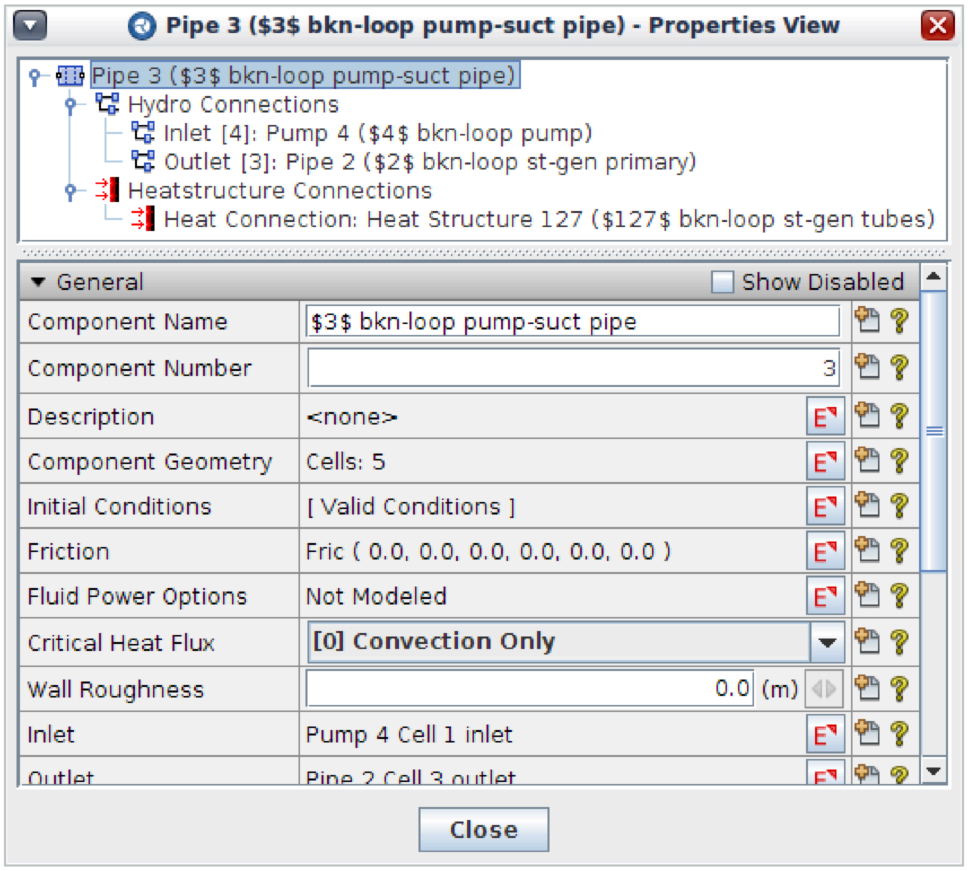

Messages

```
Note: Opening file /home/djvogt/snap_0_27_5/Samples/TRACE/W4Loop/W4Loop.med
Note: Loading /home/djvogt/snap_0_27_5/Samples/TRACE/W4Loop/W4Loop.med please wait...
Note: Open Complete.
Warning: Model check complete. Found 0 errors, 12 warnings, 9 alerts, 8 notes.
Error: Model check complete. Found 1 error, 10 warnings, 9 alerts, 8 notes.
```

Figure 2.12. Message Window

2.1.7. Mini Navigator

The Mini Navigator provides a detailed look at selected model components. The navigator portion of the editor lists the selected component and any associated connections. The lower portion of the editor provides a editable Property View of the component selected in the upper navigator view. The Mini-Navigator Property View provides the same editors and help documentation as the main Property View.


Pipe 3 (3 bkn-loop pump-suct pipe) - Properties View

Pipe 3 (3 bkn-loop pump-suct pipe)
- Hydro Connections
  - Inlet [4]: Pump 4 (4 bkn-loop pump)
  - Outlet [3]: Pipe 2 (2 bkn-loop st-gen primary)
- Heatstructure Connections
  - Heat Connection: Heat Structure 127 (127 bkn-loop st-gen tubes)

General — Show Disabled

Component Name	3 bkn-loop pump-suct pipe
Component Number	3
Description	<none>
Component Geometry	Cells: 5
Initial Conditions	[Valid Conditions]
Friction	Fric (0.0, 0.0, 0.0, 0.0, 0.0, 0.0)
Fluid Power Options	Not Modeled
Critical Heat Flux	[0] Convection Only
Wall Roughness	0.0 (m)
Inlet	Pump 4 Cell 1 inlet
Outlet	Pipe 2 Cell 3 outlet

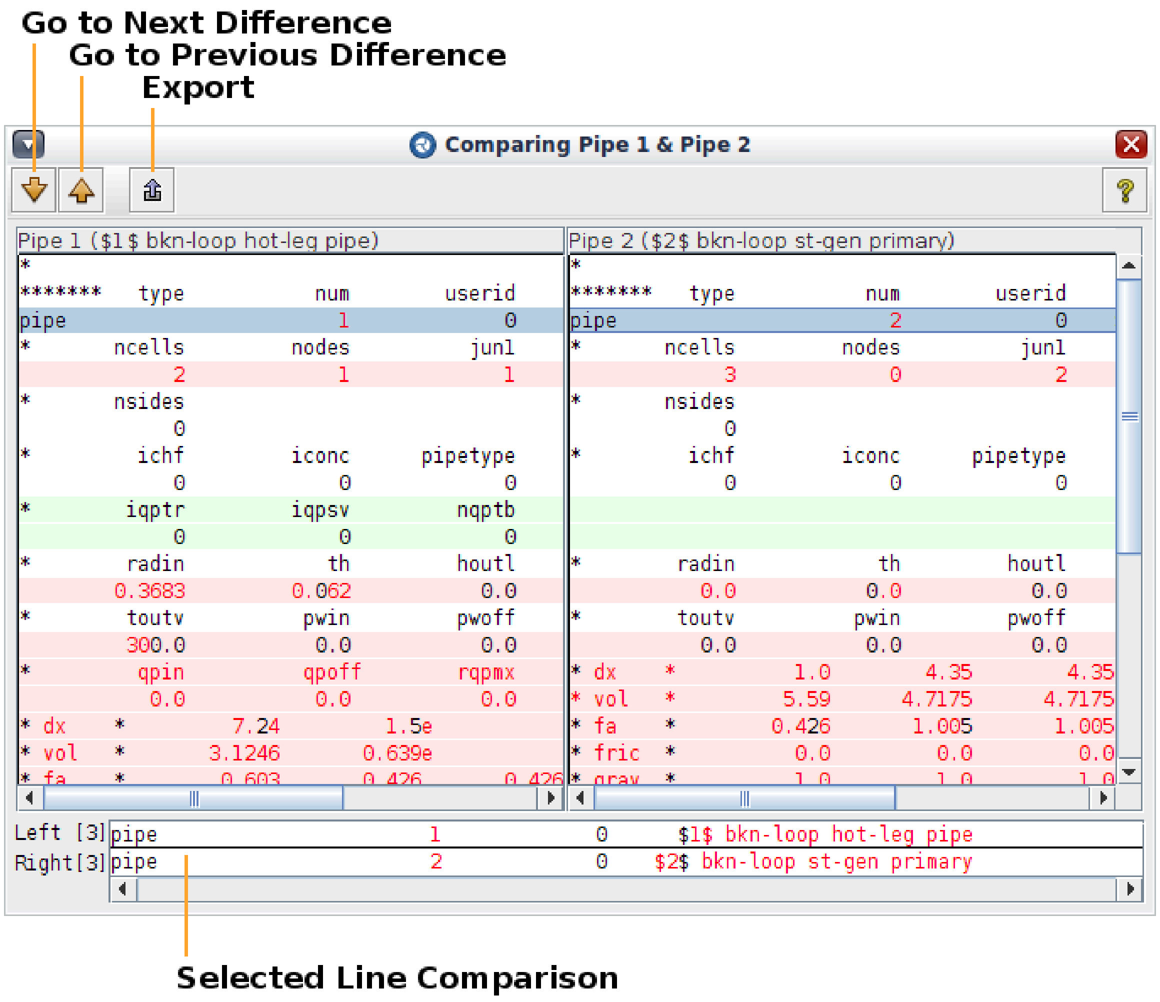
Figure 2.13. Mini-Navigator

2.1.8. The Component Differencing Utility

The component differencing utility provides a means of comparing the ASCII output of two component selections. Component selections can vary in size, ranging from a single component to entire models, where all components of two models can be compared side-by-side.

2.1.8.. Comparing Single Component Selections

The component differencing utility provides two methods for comparing selections of single components; the target components view menu, and the right-click menu of a component's navigator node. Choosing the **Select Left Side to Compare** item adds the selected component to the left side of a difference viewer. If a component has already been added to the left side of a comparison, the **Compare to...** menu item will add the currently selected component to the right side of a difference viewer. The differences between the ASCII output of the components will be calculated, and a new Component Difference Viewer will be displayed, as shown in Figure 2.14, “Component Difference Viewer”.



```
Pipe 1 ($1$ bkn-loop hot-leg pipe)                 Pipe 2 ($2$ bkn-loop st-gen primary)
*                                                  *
*******   type        num       userid             *******   type        num       userid
pipe                    1            0             pipe                    2            0
*       ncells      nodes         junl             *       ncells      nodes         junl
             2          1            1                          3          0            2
*       nsides                                     *       nsides
             0                                                  0
*         ichf      iconc     pipetype             *         ichf      iconc     pipetype
             0          0            0                          0          0            0
*        iqptr      iqpsv        nqptb
             0          0            0
*        radin         th        houtl             *        radin         th        houtl
        0.3683      0.062          0.0                        0.0        0.0          0.0
*        toutv       pwin        pwoff             *        toutv       pwin        pwoff
         300.0        0.0          0.0                        0.0        0.0          0.0
*         qpin      qpoff        rqpmx             * dx    *          1.0       4.35       4.35
           0.0        0.0          0.0             * vol   *         5.59     4.7175     4.7175
* dx    *        7.24        1.5e                  * fa    *        0.426      1.005      1.005
* vol   *      3.1246      0.639e                  * fric  *          0.0        0.0        0.0
* fa    *       0.603       0.426       0.426      * grav  *          1.0        1.0        1.0

Left  [3]pipe                 1          0       $1$ bkn-loop hot-leg pipe
Right[3]pipe                 2          0     $2$ bkn-loop st-gen primary
```

Figure 2.14. Component Difference Viewer

The Component Difference Viewer displays the ASCII decks of two selected components side-by-side, with special formatting added to each side to indicate the detailed differences between the sources. Lines which are identical in both sources are reproduced in black text with a white background. When the line is present in both sides but has differences, the background color is set to light red. The specific characters which are different are displayed in a red font. Added and deleted lines have their backgrounds colored light blue and light green, respectively. To ensure that the source lines "line up" properly in the difference viewer window, blank lines are inserted in certain locations of the sources. These added blank lines have gray backgrounds and are not part of the component's actual ASCII output: they are included to enhance the visibility of the differencing utility.

The Component Difference Viewer provides buttons for navigating through the differences. Clicking on one of these buttons causes the viewer to navigate to and select the first line of the next (or previous) contiguous set of differences. Additionally, an export button is included which allows the user to export the differences between the two sources to an external text file. The export output format is similar to that of the GNU diff utility.

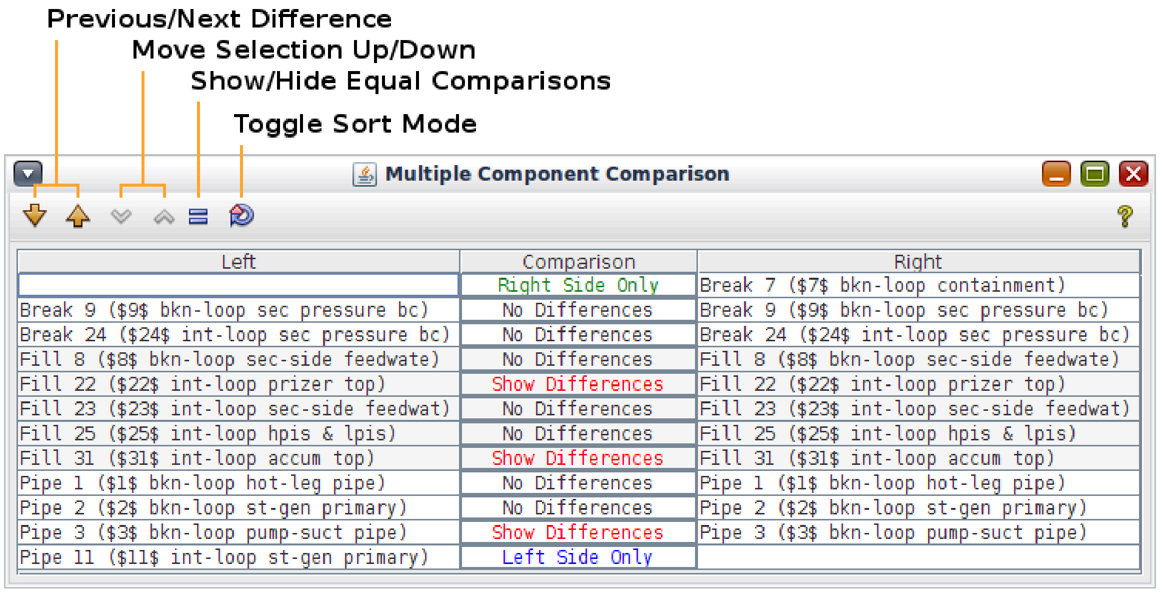
The bottom panel of the Component Difference Viewer contains a vertical comparison of the left and right source lines at the currently selected row. Character-specific differences between the two lines are colored red.

When a component is compared to itself, the left side of the Difference Viewer caches the current ASCII lines of the component. If the component is changed from within the Model Editor, the right side of the Difference Viewer updates its ASCII lines to reflect the new state of the component's output. This allows the user to view the differences made to a component's ASCII output by changing a certain value in the Model Editor.

2.1.8.2. Comparing Multiple Component Selections

The Component Differencing Utility can also be used to compare differences between two selections of multiple components. Initialization of the Multiple Component Comparison Window can be accessed by either the view menu for a multiple selection, the right-click menu for a selection of multiple navigator nodes, or the right-click menu of a model navigator node. Once left and right selections have been defined, a new Multiple Component Comparison Window is provided.

Note Multiple component comparisons can only be performed on component selections from the same plug-in type.



Left	Comparison	Right
	Right Side Only	Break 7 (7 bkn-loop containment)
Break 9 (9 bkn-loop sec pressure bc)	No Differences	Break 9 (9 bkn-loop sec pressure bc)
Break 24 (24 int-loop sec pressure bc)	No Differences	Break 24 (24 int-loop sec pressure bc)
Fill 8 (8 bkn-loop sec-side feedwate)	No Differences	Fill 8 (8 bkn-loop sec-side feedwate)
Fill 22 (22 int-loop prizer top)	Show Differences	Fill 22 (22 int-loop prizer top)
Fill 23 (23 int-loop sec-side feedwat)	No Differences	Fill 23 (23 int-loop sec-side feedwat)
Fill 25 (25 int-loop hpis & lpis)	No Differences	Fill 25 (25 int-loop hpis & lpis)
Fill 31 (31 int-loop accum top)	Show Differences	Fill 31 (31 int-loop accum top)
Pipe 1 (1 bkn-loop hot-leg pipe)	No Differences	Pipe 1 (1 bkn-loop hot-leg pipe)
Pipe 2 (2 bkn-loop st-gen primary)	No Differences	Pipe 2 (2 bkn-loop st-gen primary)
Pipe 3 (3 bkn-loop pump-suct pipe)	Show Differences	Pipe 3 (3 bkn-loop pump-suct pipe)
Pipe 11 (11 int-loop st-gen primary)	Left Side Only	

Figure 2.15. Multiple Component Comparison Window

The Multiple Component Comparison Window consists of two sets of selected components (the left side and right side) and a group of results comparison buttons. Initially, the components of each selection are sorted by category name and component number. Components with the same category name and number are horizontally aligned in the comparison window. If a component exists on one side and not the other, then it is aligned with a blank line. Components can also be sorted by category alone by clicking the **Toggle Sort Mode** button. When components are sorted by category alone, components can be aligned on the same row as components with different component numbers, and all required blank lines are added at the end of each group of components that share the same category. The background of the table cells of components in every other category group are tinted.

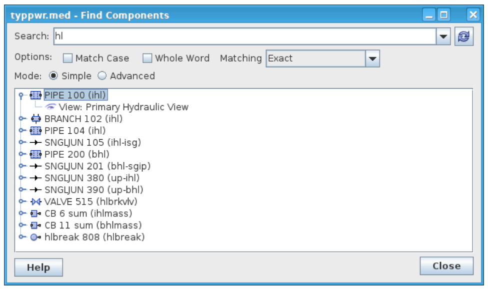
The comparison buttons indicate the differences between components on the same row. If a component is aligned with a blank, then the comparison button indicates which selection the component belongs to, and clicking on that button launches a Component Difference Viewer with text only on one side. If a component is aligned with another component, then the comparison button displays whether the components contain differences in their ASCII output, and clicking the comparison button will display an appropriate Single Component Difference Window. The **Show/Hide Equal Comparisons** button controls whether or not comparisons without differences are displayed in the table.

The ordering of components within each selection can be modified manually by using the **Move** buttons. Clicking a **Move** button will reposition the selected components up or down a row. Comparisons between the newly-aligned components are computed, and the Difference Viewer Launch Buttons are updated accordingly. **Move** operations are restricted to the bounds of each selected component's category group. For example, in the figure above, a break cannot be moved down to be compared to a fill. The move buttons are only enabled when the sort mode is set to sort by category and component number.

When a Multiple Component Comparison Window is created, the left selected components are cached. If a component contained in the left selection is modified from the Model Editor, the changes will not be reflected in the left side of the Multiple Component Comparison Window (or any Single Component Difference Viewer initialized from the Multi-Component Window). Conversely, if a component exists in the right selection, and is changed from the Model Editor, the Multiple Component Comparison Window (and any resulting Single Component Difference Viewers) will update to reflect the changes. This functionality allows the user to compare different "versions" of the same components and models, and can be a useful tool for learning how changing values in the Model Editor interface impacts a model's ASCII deck.

2.1.9. The Find Components Dialog

The Find Components dialog searches the current model to find all of the components that match a provided target string. The simple search behavior compares the target string against the combined category label, component number, and component name. For example the comparison text for pipe number 100, named "ihl" would be "PIPE 100 ihl". The advanced search behaviors and user interface features are described below.


typpwr.med - Find Components

Search: hl

Options: Match Case Whole Word Matching Exact

Mode: [✓ Simple] Advanced

PIPE 100 (ihl)
View: Primary Hydraulic View
BRANCH 102 (ihl)
PIPE 104 (ihl)
SNGLJUN 105 (ihl-isg)
PIPE 200 (bhl)
SNGLJUN 201 (bhl-sgip)
SNGLJUN 380 (up-ihl)
SNGLJUN 390 (up-bhl)
VALVE 515 (hlbrkvlv)
CB 6 sum (ihlmass)
CB 11 sum (bhlmass)
hlbreak 808 (hlbreak)

Figure 2.16. Find Components Dialog

2.1.9.1. Search Options

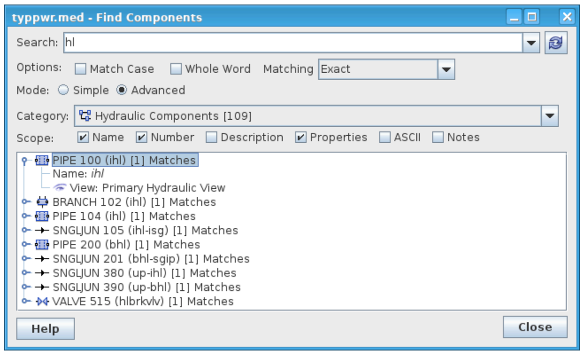
The Find Components dialog includes the following features for both basic and advanced searches:

- Match Case: This option activates case sensitivity to the search, regardless of search mode.

- While Word: This option eliminates matches where the characters to the left and right of the search string are alpha-numeric. This option is not available during regular expression matching.
- Matching - Exact: The search string must match the exact characters to count as a match.
- Matching - Simple Wildcards: The '*' character will match with any number of characters, and the '?' character will match with any single character.
- Matching - Regular Expressions: The search string will be parsed as a regular expression to match against the components.

2.1.9.2. Advanced Searching

The advanced searching capabilities enables searching for components through different scopes. The different scopes that are available and how they work are described below. When an advanced search is performed, the comparisons that resulted in a match are displayed below the matched components in a tree structure. Selecting these results will highlight the relevant target property.



Search: hl

Options: ☐ Match Case ☐ Whole Word Matching Exact

Mode: ○ Simple ● Advanced

Category: Hydraulic Components [109]

Scope: ✓ Name ✓ Number ☐ Description ✓ Properties ☐ ASCII ☐ Notes

```
PIPE 100 (ihl) [1] Matches
  Name: ihl
  View: Primary Hydraulic View
BRANCH 102 (ihl) [1] Matches
PIPE 104 (ihl) [1] Matches
SNGLJUN 105 (ihl-isg) [1] Matches
PIPE 200 (bhl) [1] Matches
SNGLJUN 201 (bhl-sgip) [1] Matches
SNGLJUN 380 (up-ihl) [1] Matches
SNGLJUN 390 (up-bhl) [1] Matches
VALVE 515 (hlbrkvlv) [1] Matches
```

Figure 2.17. Advanced Find Components

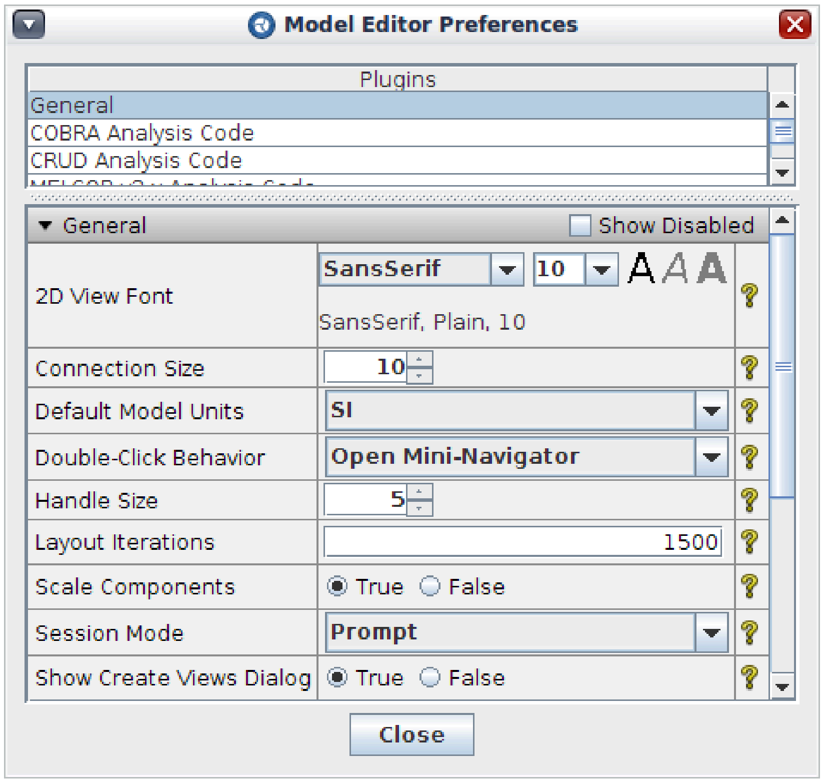
The Advanced panel for the Find Components dialog includes a drop-down list for limiting the search results by category, as well as checkboxes for determining what to compare the search string against to find a component. Each search scope option is compared individually against the search string. The search scope options are as follows:.

- *Name*: Matches the search string against the component name.
- *Number*: Matches the search string against the component number.
- *Description*: Matches the search string against the body of the component description.
- *Properties*: Matches the search string against the display name or help text of the root properties of the component.
- *ASCII*: Matches the search string against each line of the generated ASCII for a component.
- *Notes*: Matches the search string against the body of referenced notes. This allows searching for components by the contents of referenced notes.

2.2. User Preferences

The SNAP Model Editor user preferences are available from the main **Edit** menu. These options are presented as a set of General Preferences (such as **Handle Size**) used by all plug-ins in addition to plug-in specific configuration.

The General Preferences are divided into two Attribute Groups: **General** and **Colors**. These are described in more detail below.



2D View Font	SansSerif 10 — SansSerif, Plain, 10
Connection Size	10
Default Model Units	SI
Double-Click Behavior	Open Mini-Navigator
Handle Size	5
Layout Iterations	1500
Scale Components	[✓ True] False
Session Mode	Prompt
Show Create Views Dialog	[✓ True] False

Figure 2.18. Model Editor Preferences Dialog

2.2.1. General Preferences

Preferences in the General category refer to a number of miscellaneous preferences, some of which shall be applied to all plug-ins.

- **2D View Font -** This value sets the font used in automatic text annotations in 2D views, such as the CC numbers displayed in the middle of most components. This value can be overridden for each view by setting the *Font* property for the view.

- **Connection Size -** This value sets the size of the connection points, which defaults to 10 pixels. Connection points are graphic shapes that indicate where a connection to a component can be made. Different shapes imply different connection semantics on a plug-in specific basis. For instance, in the TRACE plug-in, a circle is used to indicate a point that may be used to start a connection. A diamond is used to indicate a point that may be used to end a connection. Refer to Figure 2.19, “Connection points used in the TRACE plug-in”.

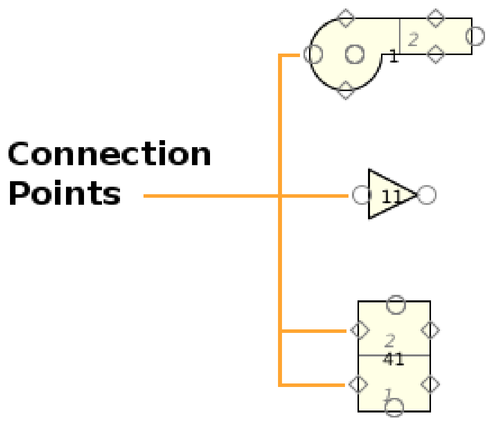


Figure 2.19. Connection points used in the TRACE plug-in

- **Default Model Units -** Selects whether models default to using SI or British units.
- **Double Click Behavior** - When a user double clicks an object in a view, the Model Editor will either select the object in the Navigator view or open a Section 2.1.7, “Mini Navigator” view. This option controls which behavior will occur.
- **Handle Size -** This value sets the size of “handles,” or the boxes that are drawn in the selection frame. It defaults to **5**. See Figure 2.20, “Handles and Selection Frame”.

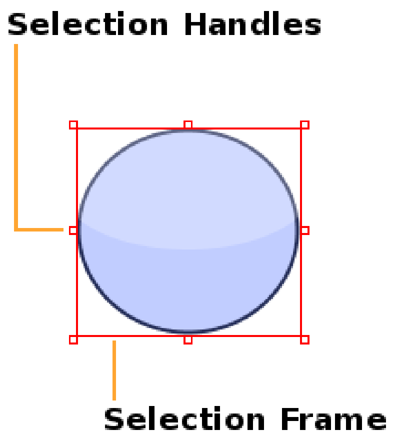


Figure 2.20. Handles and Selection Frame

- **Layout Iterations -** A user may choose to “organize” a model (or selection of the model) in a graphical view. In short, organize operations attempt to reposition the components on the canvas in a logical and “clean” fashion. The iteration number entered here determines how much time should be spent on this process. Generally, higher numbers produce better layouts, but cause the organization process to take longer. The default value is 1500.

  Note The Layout Iterations preference is used as a hint for the layout systems included with each plug-in. Thus, the effect of this preference varies from plug-in to plug-in.

- **Scale Components -** When this option is selected, components shown in a graphical view are scaled in size based on the data entered for that component (volume, length, etc.). Because small components can become difficult to see with much larger components, the user may choose to turn off scaling when components are of drastically different size.

- **Show Create Views Dialog -** When set to true, a Create Views dialog will be displayed for each model imported into the Model Editor.

- **Show Welcome Dialog -** This option controls the appearance of the welcome dialog at the Model Editor startup.

- **View Tab Layout -** Determines the display mode for view tabs that take more horizontal space than allocated to the view area. **Scroll Tabs** provides a scrolling mechanism that hides buttons until scrolled into the viewable area, where **Wrap Tabs** displays all tabs across several rows.

- **Temporary Folder -** This optional property can be used to specify the location in which temporary files are generated, particularly when submitting job streams.

- **Always Use Anti-Aliasing -** When set to true, all drawings in 2D Views will be anti-aliased (some drawings are always anti-aliased). Anti-aliasing greatly improves the appearance of most drawings by smoothing curves and rough edges. Anti-aliasing incurs a performance cost, so turning this off may result in faster 2D View scrolling and repaints.

- **View Selection Model -** Determines how selections made in the Navigator affect 2D Views. **Independent**, the default, states that Navigator selections do not effect views. **Follows Navigator** indicates that a selection made in the Navigator causes that component to be selected in the View.

- **Xpdf Executable -** Sets the location of the xpdf executable used to display PDFs on UNIX systems. This option is not available on Windows installations of SNAP.

2.2.2. Color

This section lists the different colors assigned to various components inside 2D views. There are two ways to modify a color preference. The first is to click on the box displaying the color as it would appear and select a new color from the drop down menu. Second, a user can click on the text field to the left of the color box, which displays the color as three integers under the RGB color scheme. Changing these numbers and pressing Enter will change the color to the corresponding color in the RGB scheme.

Note Color preferences are used as hints for plug-in 2D View rendering and are not supported by all plug-ins.

2.3. Creating a Model

Assisting the creation of models is the primary purpose of the Model Editor. Models are typically classified in one of two categories: pre-processing and post-processing. A pre-processing model is generally comprised of components used to form the basis of a calculation. Alternatively, a post-processing model is used to display either the results of a calculation or some other form of data; in SNAP, this usually takes the form of an Animation. This section shall focus on functionality common to pre-processing models. Refer to Chapter 6, *The Animation Plugin* for more information about post-processing in SNAP.

Note Pre-processor models are submitted as job streams (see Chapter 5, *Job Streams*).

2.3.1. Opening a New Model

Pressing the **New** button on the main toolbar will open the model type selection dialog as shown in Figure 2.21, "Example New Model Dialog". This dialog allows the selection of any of the currently loaded plug-ins for a new model. After selecting the desired type a new model will be created and added to the Navigator. A single empty view will also be created and opened.

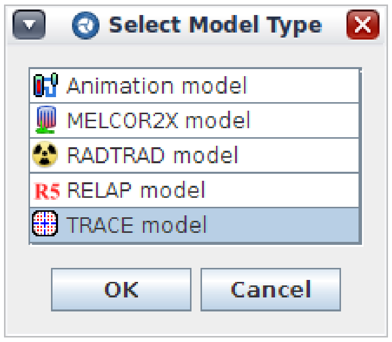
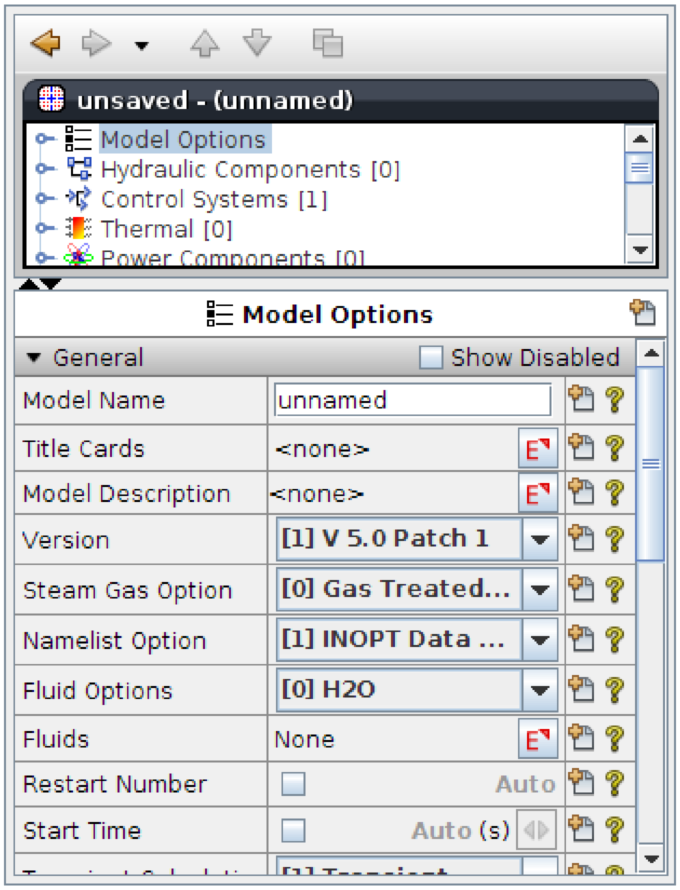


Figure 2.21. Example New Model Dialog

After creating a new model, special attention should be paid to its **Model Options** node in the Navigator, as it contains several important model specific properties (refer to Figure 2.22, "Model Options").



Model Name	unnamed
Title Cards	<none>
Model Description	<none>
Version	[1] V 5.0 Patch 1
Steam Gas Option	[0] Gas Treated...
Namelist Option	[1] INOPT Data ...
Fluid Options	[0] H2O
Fluids	None
Restart Number	Auto
Start Time	Auto (s)

Figure 2.22. Model Options

2.3.2. Creating and Editing Components

SNAP provides several methods of creating and editing components. The most common method is to use the component insertion button located above the 2D View (see Section 2.1.5.1, “View Toolbars”). This button opens a pop-up menu that contains all of the component types organized by category as shown in Figure 2.23, “Adding TRACE Components from the View Toolbar”. As an example, when editing TRACE models, Pipes are located in the **Hydraulic Components** category, while user-defined numerics are located under **Numerics**.

Once the appropriate component type has been selected, the button to the left of the drop down menu button changes to the icon of that component type and the view cursor changes into a cross-hair. A left-click within the 2D View will insert the component. Adding a component may open a completion dialog for the component before it is inserted into the model. The Select Tool will be automatically activated after the insertion is complete to allow moving or resizing the newly created component. Holding the **Ctrl** key when inserting a component will leave the Insert Tool active, allowing multiple components to be created without reactivating the Insert Tool for each.

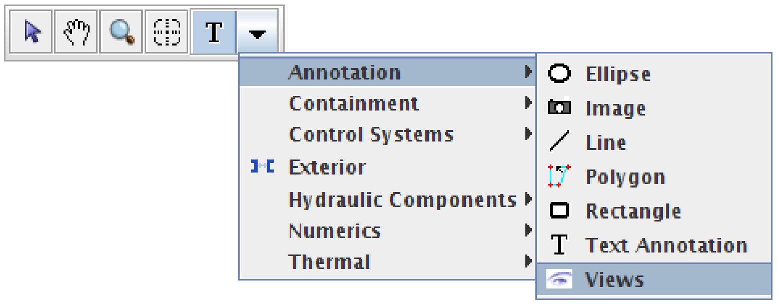


Figure 2.23. Adding TRACE Components from the View Toolbar

The second method of adding a component involves the Navigator, as illustrated for a Fill component within a TRACE model in Figure 2.24, “Adding TRACE Components from the Navigator”. First, expand the component category of the desired component; in the example, this is the **Hydraulic Components** category. Next, right-click on the desired component type to display a pop-up menu and select **New**. This creates a new component of the specified type with a default name.

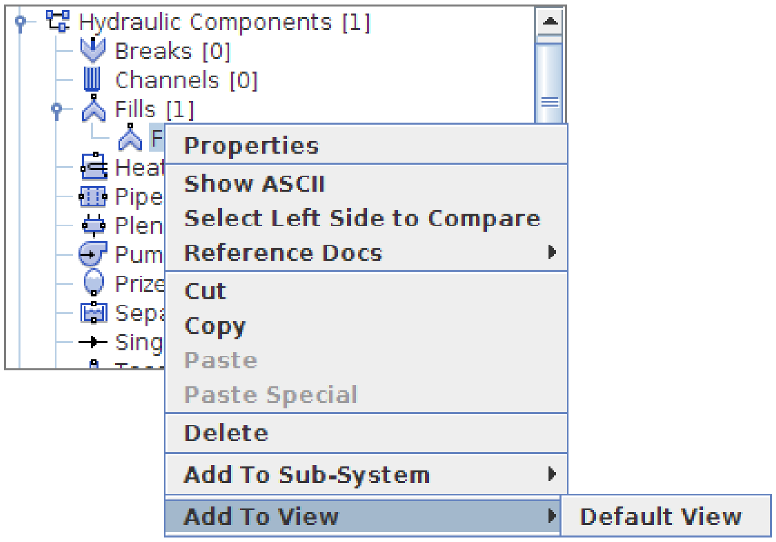


Figure 2.24. Adding TRACE Components from the Navigator

To add the newly created component to a 2D View, right-click on the component in the listing under the component type to display a pop-up menu. From this menu, select the desired View to which the component is added from the **Add to View** sub-menu. The component will be placed within the selected View. Alternatively, the component can be added to a 2D View by clicking and dragging the component from the Navigator into the View.

To edit a component, select the component, either in the 2D View or in the Navigator. The properties for that component will then appear in the Main Property View. See Section 2.1.4, “The Main Property View” for more information on editing properties.

2.3.3. Creating Drawn Connections

Some components placed in the 2D view can be connected via the connection tool. Placing the connecting tool over a valid connection point causes the tool to change into a cross-hair. Clicking on the connection point starts a connection, shown on the screen as a red line drawn from the connection point to the moue cursor. Clicking on another compatible connection point completes the connection between the components. When hovering over the second connection point, the cross-hair will display a blue dot in the cursor. The compatibility of connection points varies between plug-ins.

Once connections between components are constructed, they can be selected and edited in the Property View. The type of connection created depends on the connected components and the points from which the connection was made. A sample drawn connection between two pipes is shown below:

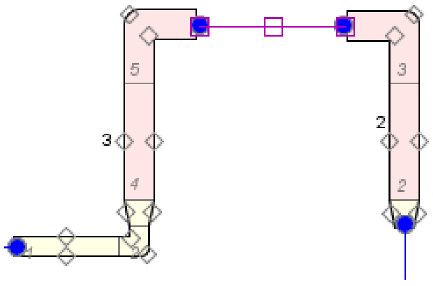


Figure 2.25. Drawn Connection

Drawn Connections have a series of options which are made available by bringing up the right-click pop-up menu on a given connection. These options are as follows:

- **Cut** - This option provides the ability to remove a Drawn Connection from a view. Cutting a connection does not delete the selected connection. The points which are involved in a connection that was cut remain filled with blue to indicate a connection still exists at that point.
- **Reset** - Selecting this option will reset a modified connection path back to its original position.
- **Add/Remove Point** - Drawn Connection paths can be adjusted by dragging adjustment points located on the connection. These points can be added or removed in order to define a connection path appropriately. The position where the right-click occurs determines where the point will be added or removed. A point is only removed if one existed at the position of the mouse click.
- **Straight Line** - Setting this option provides a straight Drawn Connection path. All previously set path adjustment points will be removed.
- **Properties** - This provides a pop-up Property View listing of the specific connection properties. The pop-up Property View is identical to the view provided by clicking on the connection.
- **Disconnect** - Deletes the selected connection.
- **Drawing Style** - The drawing style of a connection is determined by this property. The following describes the available options:
  - **Single Line** - The default drawn connection display.
  - **Source Marker** - A marker which denotes the name of the source of the selected connection.

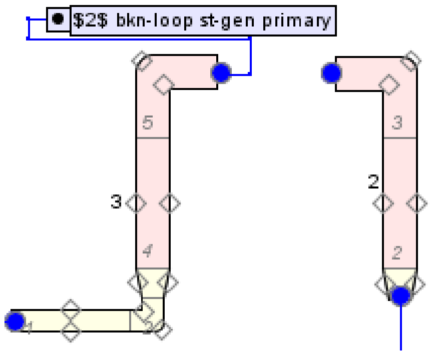


Figure 2.26. Source Marker Connection Style

- **Target Marker -** A marker which denotes the name of the target of the selected connection.

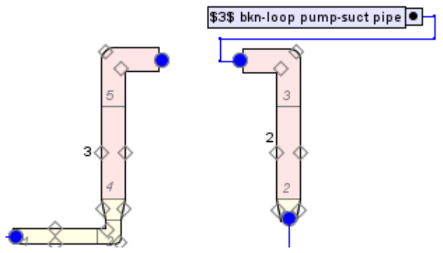


Figure 2.27. Target Marker Connection Style

- **Source and Target -** Two markers which denote the name of the source and target of the selected connection.

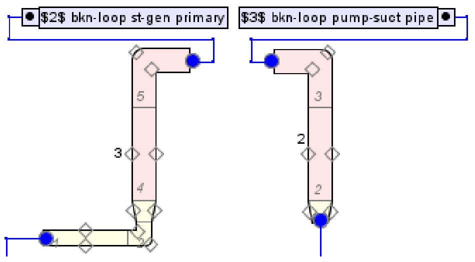


Figure 2.28. Source and Target Connection Style

2.3.4. Creating Annotations

Annotations can be used to mark-up a view with static information about its contents. For example: a rectangular annotation with a titled border can be used behind a group of components to visually separate them from the surrounding components. Annotations are created in a view using the Insertion Tool. All Annotations appear in the Insert Tool drop-down menu under the **Annotations** sub-menu.

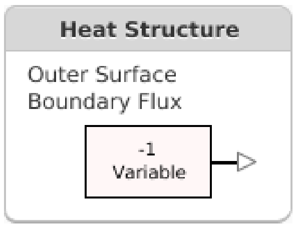


Figure 2.29. Compound Annotation Example

The example shown in Figure 2.29, "Compound Annotation Example" illustrates a complex object built from 2D View annotations. The main body consists of gray and white rectangular polygons with curved segments at the corners. A highlight at the top is created from a single, semi-transparent white line. A duplicate of the lower white polygon, with its outline disabled and its fill color set to a semi-transparent black, comprises the shadow at the bottom. The highlighted "Heat Structure" text is composed of two text annotations with a one pixel difference in placement, one white and one black.

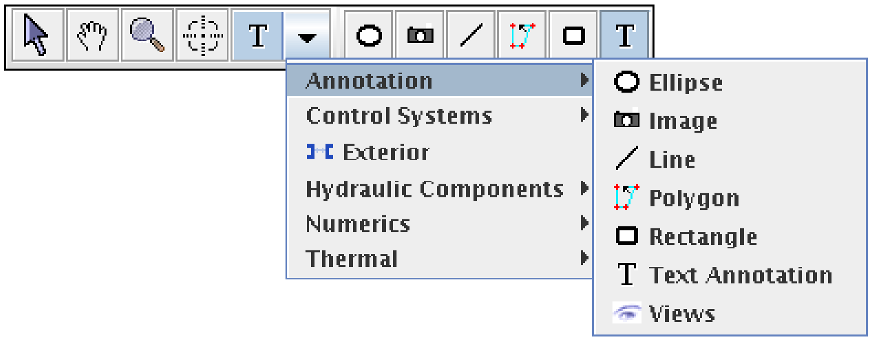


Figure 2.30. Adding Annotations from the View Toolbar

The following types of annotations are included with the Model Editor and available for use in any view. More information about the specific properties of each annotation type can be found in the pop-up help buttons to the right of each property in the Main Properties View.

Note The **Views** item also appears in the Annotation menu for convenience. This item creates an embedded view icon that can be used to *drill-down* to the view it represents.

Ellipse

The ellipse (or Elliptical Annotation) is a very simple rounded shape with an optional filled center. When inserting an ellipse, left-clicking will insert an ellipse of the default size. To insert an ellipse of a specific size, left-click and drag inside a 2D View to create a rubber-band box that is approximately the desired size, then release the mouse button.

The following properties can be specified for an Elliptical Annotation:

- **Height** - The vertical height of the annotation (in pixels).
- **Width** - The horizontal width of the annotation (in pixels).
- **Fill Background** - When this property is set to **True**, the ellipse will paint its center using the **Background Color** specified. When this property is set to **False** the center of the ellipse will be transparent.
- **Background Color** - The color used to fill the center of the ellipse when **Fill Background** is True.
- **Outline Color** - The color used to paint the outline of the ellipse.
- **Line Thickness** - The thickness of the line drawn around the outline of the ellipse.

Image

The image annotation allows an image to be displayed inside a view and it is inserted with a simple left-click. Newly created image annotations will display the default light bulb image. The following properties can be specified for an Image Annotation.

- **Height** - The vertical height of the annotation (in pixels).
- **Width** - The horizontal width of the annotation (in pixels).

- **Border -** An optional border can be specified for an image annotation. Etched, line and beveled borders are available using the provided border editor.

- **Image -** The **Image** property is used to select the image to display. Once selected, this image data will be loaded directly into the annotation and stored with the view.

- **Tooltip Text -** The image annotation includes optional tool-tip text. This text is displayed when hovering the mouse over the image. Some simple HTML tags may be specified for this property, but must be surrounded by <html></html> tags.

Line

Line annotations are solid or dashed lines with optional arrow heads. The line thickness, line color, and relative arrowhead size can all be specified.

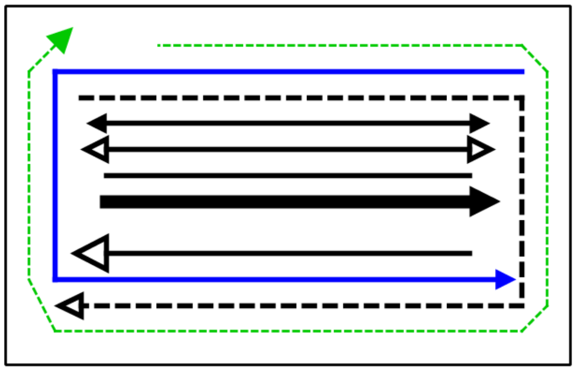


Figure 2.31. Line Annotation Examples

Line annotations are defined by a set of segments. Creating a line a annotation involves defining the anchor points of the line as a series of clicks. The first left-click will begin the line. Moving the mouse will show a rubber-band line drawn to the previous point in the line. Left-clicking again at another location will create a line segment to that location. Additional left clicks will create more line segments. Double-clicking with the left mouse button will complete the last segment and insert the line annotation using the defined segments.

At any point during the insertion process, the right mouse button can be used to remove the previously added point. If there is only a single point defined then this will cancel the line insertion.

Once inserted, the points that make up a line may be relocated by left-clicking and dragging the red rectangular handles around the points. In addition, the right-click pop-up menu of the line includes the **Add Point** and **Remove Point** menu items. The **Add Point** item can be used to add a new relocatable point anywhere on the line. The **Remove Point** item can be used to remove all but the first and last points of a line. Note that the **Remove Point** item is only available when right-clicking on (or very near) a point.

- **Arrow Size -** The size of the annotation's arrow heads relative to the specified line thickness.

- **Dashed -** When this property is **True** the line will be drawn with a dashed pattern.

- **Color -** The color used to draw the line.

- **First / Second Arrow Head -** The style used to draw the line's arrow heads. Each head style can be specified individually. Available styles include None (no head), Filled (a filled triangle) and Hollow (an unfilled triangle).

- **Thickness -** The thickness (in pixels) of the line. This value also affects the size of the arrows on either end of the line.

- **Tooltip Text -** The line annotation includes optional tool-tip text. This text is displayed when hovering the mouse over the annotation. Some simple HTML tags may be specified for this property but must be surrounded by <html></html> tags.

Polygon

The polygon annotation is a 2D closed figure made up of any number of line segments and curves.

Inserting a polygon annotation is a process of defining the line segments that will make up the polygon. The first left-click will begin the polygon. Moving the mouse will show that a rubber-band line is drawn to the previously defined point. Left-clicking again at another location will create a line segment and begin drawing the rubber band line to that location. Additional left clicks will create more line segments. Double-clicking with the left mouse button will complete the last segment, close the shape, and insert the polygon annotation using the defined segments.

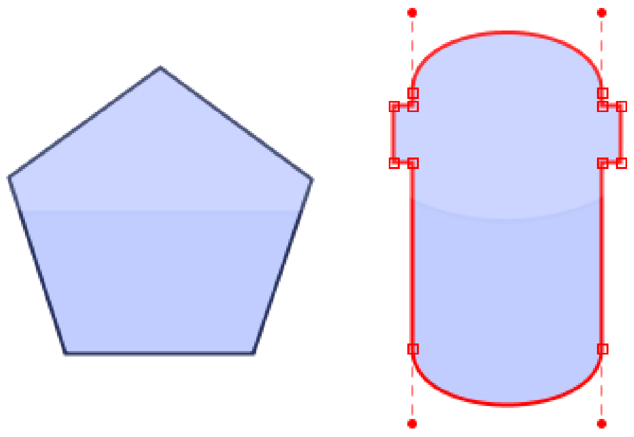


Figure 2.32. Polygon Annotation Examples

At any point during the insertion process, the right mouse button can be used to remove the previously added point. If there is only a single point defined then this will cancel the polygon insertion.

Once inserted, the points that make up a polygon may be relocated by left-clicking and dragging the red rectangular handle around the point. The vertical and horizontal line segments in a polygon may also be relocated by clicking left-clicking and dragging the line. Any curved segments may be left-clicked and dragged to move the entire polygon. Also, left-clicking and dragging with the shift button pressed will drag the polygon regardless of whether lines or points are clicked.

The right-click pop-up menu of a polygon includes the following additional items which are used to manipulate the following figure:

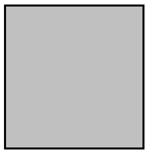


Figure 2.33. 2D View Polygon

- **Flip Horizontal / Flip Vertical -** These features are used to horizontally or vertically mirror the points about the center of a polygon.

- **Reshape Polygon -** This feature is used to completely reshape a polygon into a regular polygon with a user specified number of sides and outer radius. The number of sides and outer radius is requested by an input dialog.

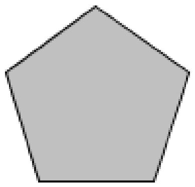


Figure 2.34. Reshaped Polygon

- **Rotate Polygon -** This rotates the polygon points clockwise a user specified number of degrees. The number of degrees is requested by an input dialog.

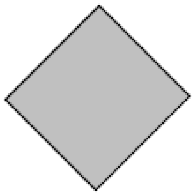


Figure 2.35. Rotated Polygon

- **Scale Polygon -** This feature scales the points of the polygon by a user specified fraction. The scale fraction is requested by an input dialog.

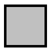


Figure 2.36. Scaled Polygon

- **Curve Segment / Straighten Segment -** Sets the closest segment to be curved if it is currently straight, or straight if it is curved. Curved segments can be manipulated by dragging the control points that appear when the polygon is selected.

- **Hide Segment -** Hides the line segment or curve closest to the mouse cursor.

The following properties can be specified for a Polygon after insertion:

- **Fill Style -** The style used to fill the contents of the polygon: **Unfilled**, **Solid** (color), or **Pattern**. If **Unfilled** is selected the inside of the polygon will be transparent.

- **Fill Color -** The color used to fill the contents of the polygon when the Solid style is selected.

- **Fill Pattern -** The pattern used to fill the contents of the polygon.
- **Pattern Foreground/Background -** The colors used to paint the foreground and background of the pattern filling the polygon.
- **Outline Style -** The style of line that will be used to outline the polygon. If **None** is selected no outline will be painted.
- **Outline Color -** The color used to outline the polygon.

Rectangle

The rectangle annotation creates a rectangle with an optional filled background and border. By default the rectangle has squared corners but can be rounded by setting the **Rounded Corners** property to **True**.

When inserting a rectangle, left clicking will insert a rectangle of the default size. To insert a rectangle of a specific size, left click and drag to create a rubber-band box that is approximately the desired size and release the mouse button.

The following properties can be specified for a rectangular annotation:

- **Height -** The vertical height of the annotation (in pixels).
- **Width -** The horizontal width of the annotation (in pixels).
- **Rounded Corners -** When set to **True** the corners of this rectangular annotation will be rounded using the **Rounded Arc Height** and **Width**.
- **Rounded Arc Height / Width -** The height and width (in pixels) of the arc used to round the corners of the annotation when **Rounded Corners** is true.
- **Fill Background -** When this property is set to **True**, the annotation will paint its center the **Background Color** specified. When this property is set to **False** the center of the annotation will be transparent.
- **Background Color -** The color used to fill the center of the annotation when **Fill Background** is True.
- **Outline Color -** The color used to paint the outline of the annotation.
- **Line Thickness -** The thickness of the line drawn around the outline of the annotation.
- **Border -** An optional border can be specified for a rectangular annotation. Etched, line and beveled borders are available using the provided border editor.

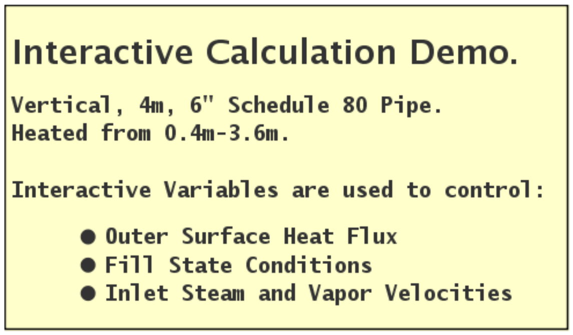
Text

The text annotation is used to label or describe portions of a view and can be inserted with a left-click. Like other annotations, the text annotation can optionally fill its background with a specified color and has an optional border.

The content of a text annotation can be edited directly by double clicking it in the 2D View. This will open a text field for editing the content of the annotation.

The following is a list of the properties of a text annotation:

- **Tooltip Text -** The text annotation includes optional tool-tip text. This text is displayed when hovering the mouse over the annotation. Some simple HTML tags may be specified for this property, but must be surrounded by <html></html> tags.
- **Foreground Color -** The color used to paint the text entered for this annotation. Note that HTML tags specified in the **Text** of this annotation may override this color value.
- **Fill Background -** When this property is set to **True**, the annotation will paint its background the **Background Color** specified. When this property is set to **False**, the center of the annotation will be transparent.
- **Background Color -** The color used to fill the background of the annotation when **Fill Background** is True.
- **Border -** An optional border can be specified for a text annotation. Etched, line and beveled borders are available using the provided border editor.
- **Text Margin -** The amount of space used to surround the text in the Text Annotation.
- **Text -** The text displayed in the text annotation. Figure 2.37, “Text Annotation Example” is an example of a text annotation using the optional HTML tag support.


Interactive Calculation Demo.

```
Vertical, 4m, 6" Schedule 80 Pipe.
Heated from 0.4m-3.6m.

Interactive Variables are used to control:

    ● Outer Surface Heat Flux
    ● Fill State Conditions
    ● Inlet Steam and Vapor Velocities
```

Figure 2.37. Text Annotation Example

HTML tags can be entered directly into the text of a text annotation. These tags will be interpreted by the built-in Java HTML renderer. This allows tables, bulleted lists, font colors, font sizes, etc. to be specified directly in a text annotation. The above example can be seen by entering the following text:

```
<h2>Interactive Calculation Demo.</h2>
<code>
  Vertical, 4m, 6" Schedule 80 Pipe.<p>
  Heated from 0.4m-3.6m.<p><p>
  Interactive Variables are used to control:
  <ul>
    <li>Outer Surface Heat Flux</li>
    <li>Fill State Conditions</li>
    <li>Inlet Steam and Vapor Velocities</li>
  </ul>
</code>
```

Additional Properties

When in a pre-processor model, annotations also provide an **Associated Component** property. This property allows specifying a reference to a model component represented by the annotation. In a locked view, clicking on an annotation will select its associated component in the Navigator.

2.3.5. Component Display Scaling

The scaling of components within a 2D View is controlled by the **Pixels Per Meter** property of the view. The initial default value of 20 pixels per meter is designed to display complete model diagrams for large, full plant models. If view components appear too small to identify key details, the relative size of the components may be increased by adjusting the **Pixels Per Meter** property.

Note To display the View properties within the Main Property View, switch to the Selection Tool and select any point in the view not occupied by a component.

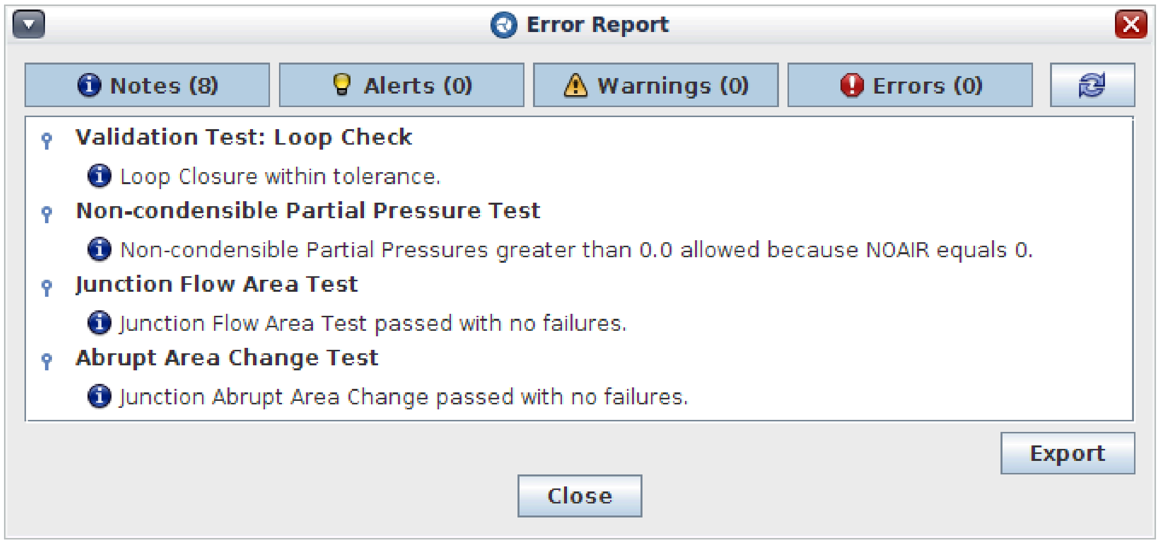
A View's **Width Scale Factor** defines relative width to height scaling for components placed in the view. Adjusting this property will make components appear wider or thinner.

Note The 2D drawing of components can also be scaled individually using the Scale Drawing menu item, as described in Section 2.1.5.2, “View Menu Items”.

2.3.6. Checking a Model for Errors

Once a model has been completed, it can be checked for errors. To do so, select either the **Check Model** button from the main toolbar, or the **Check Model** menu item located under the **Tools** menu. A model report dialog will be displayed, such as in Figure 2.38, “Model Report Window”.

Within this dialog, the toggle buttons near the top can be used to enable/disable the display of the corresponding type of message. The **Refresh** button in the upper right will force another model validation, the results of which will be displayed in the current model report dialog. Finally, the **Export** button can be used to write an HTML copy of the report to a file.



Validation Test: Loop Check
Loop Closure within tolerance.
Non-condensible Partial Pressure Test
Non-condensible Partial Pressures greater than 0.0 allowed because NOAIR equals 0.
Junction Flow Area Test
Junction Flow Area Test passed with no failures.
Abrupt Area Change Test
Junction Abrupt Area Change passed with no failures.

Figure 2.38. Model Report Window

If the model is free of errors, the model report dialog will display the message **`"Error check complete. No errors found."`** If errors are discovered, the problematic component can be selected immediately by double clicking on the error message.

Model validation tests, such as the elevation checker, may be enabled and disabled by editing the **Model Validation** property of the **Model Options** navigator node.

2.3.7. Saving a Model

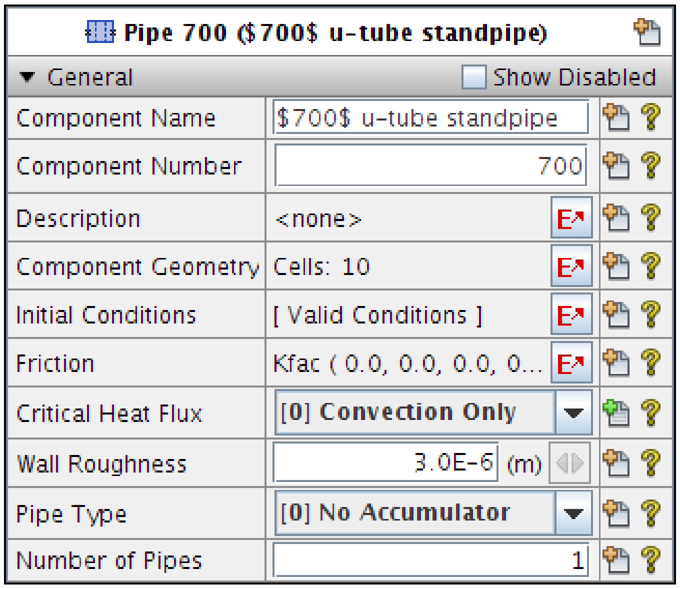
A model can be saved by using either the **File** -> **Save** menu item, or the **Ctrl-S** key combination shortcut (**Command-S** on Mac OS). If the model has not yet been named, a Save dialog will be displayed within which the name and location of the model may be selected. The **File** -> **Save As** menu item, or the **Ctrl-Shift-S** shortcut (**Command-Shift-S** on Mac OS) can be used to save the model to another location.

Note Model Editor documents have a default extension of `.med`.

2.4. Model Notes

The Model Notes feature provides a simple way to add informative messages to one or more components. These notes consist of a title, a user-defined type, and an HTML document. Any number of notes can be associated with a component, and a given note can be associated with any number of components.

The basic per-component notes capability is available for all Model Editor plug-ins. Some plug-ins (such as RELAP5 and TRACE) provide more extensive support, including references to notes at the attribute level.



Pipe 700 (700 u-tube standpipe)

▼ General ☐ Show Disabled

Component Name	700 u-tube standpipe
Component Number	700
Description	<none>
Component Geometry	Cells: 10
Initial Conditions	[Valid Conditions]
Friction	Kfac (0.0, 0.0, 0.0, 0...
Critical Heat Flux	[0] Convection Only
Wall Roughness	3.0E-6 (m)
Pipe Type	[0] No Accumulator
Number of Pipes	1

Figure 2.39. Property View Model Note Button

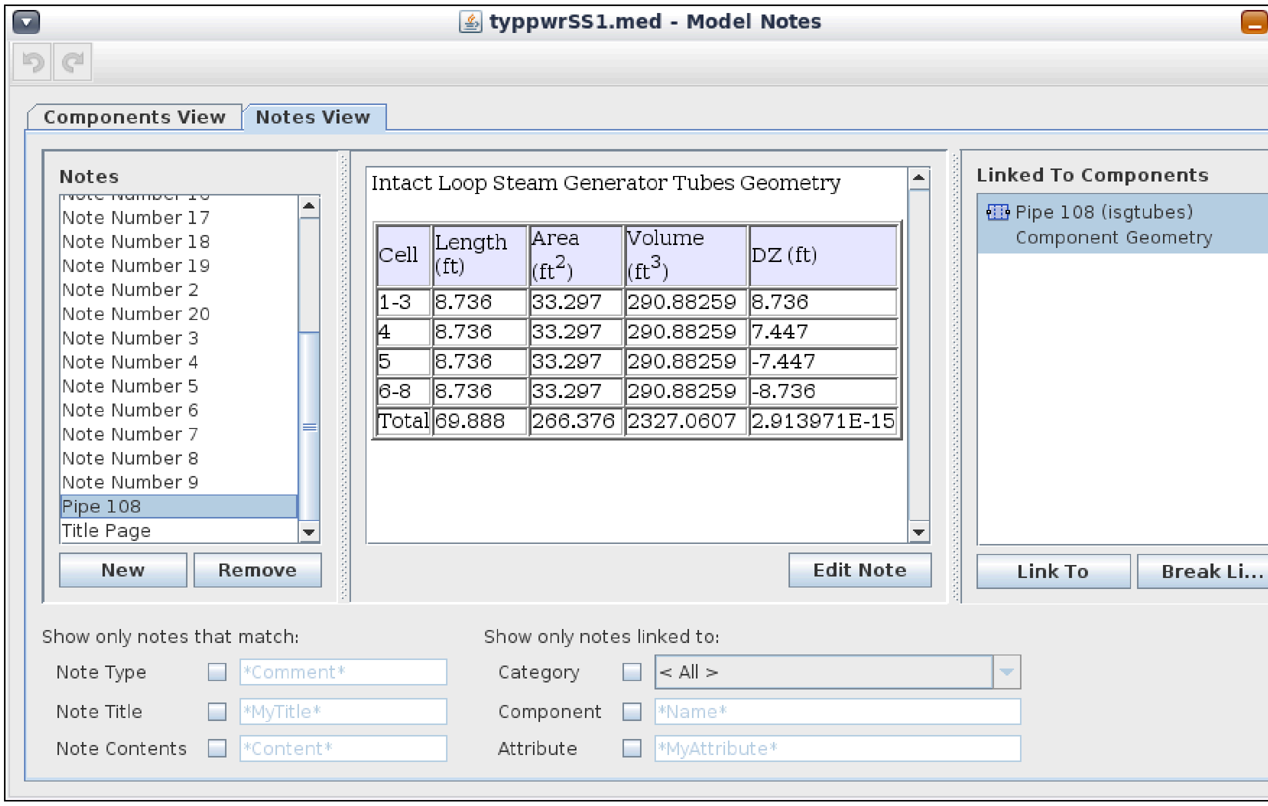
Model notes are viewed and managed primarily with the Model Note Viewer. It can be used to view or edit every note in the model or those associated with selected set of components.

The Model Notes viewer is available either from the **Tools** menu or a Properties View and is shown in Figure 2.40, "Model Note Viewer - Notes View" and Figure 2.41, "Model Note Viewer - Components View". The viewer display will be customized to show a different set of components and properties depending on which button/item is used.

- The **Tools -> Model Note Viewer** menu item opens the model note viewer for the entire model and shows all notes and components available.
- The Properties View's **Model Note Viewer** button (to the right of the property view title) opens the note viewer for the currently selected objects (Pipe 700 in Figure 2.39, "Property View Model Note Button"). This is the same viewer used to display all notes. However, the **Category** will be set to **< Selected Components >** and it will display notes only for the object currently displayed in the property view.
- Each property's **Model Note Viewer** button (to the right of each property) opens the note viewer showing only that property. For example, the notes attached to the **Critical Heat Flux** property of all pipes could be displayed by selecting all of the pipes and pressing the note viewer button for that property.

The model note viewer displays in one of two modes. The "Notes View" shows a list of notes in the model on the left and where they're "Linked To" (i.e. used) on the right. The "Components View" shows a four column view of the components and their attributes. Each of these modes is a separate tab in the model note viewer. At the bottom of both views is a set of optional search parameters that can be used to narrow the displayed notes and links.

The notes view is made up of the list of notes (left), search options (bottom), and links to components (right), and a preview of the currently selected note (center).



Intact Loop Steam Generator Tubes Geometry

Cell	Length (ft)	Area (ft^2)	Volume (ft^3)	DZ (ft)
1-3	8.736	33.297	290.88259	8.736
4	8.736	33.297	290.88259	7.447
5	8.736	33.297	290.88259	-7.447
6-8	8.736	33.297	290.88259	-8.736
Total	69.888	266.376	2327.0607	2.913971E-15

Pipe 108 (isgtubes)
Component Geometry

Show only notes that match:

Note Type	☐	*Comment*
Note Title	☐	*MyTitle*
Note Contents	☐	*Content*

Show only notes linked to:

Category	☐	< All >
Component	☐	*Name*
Attribute	☐	*MyAttribute*

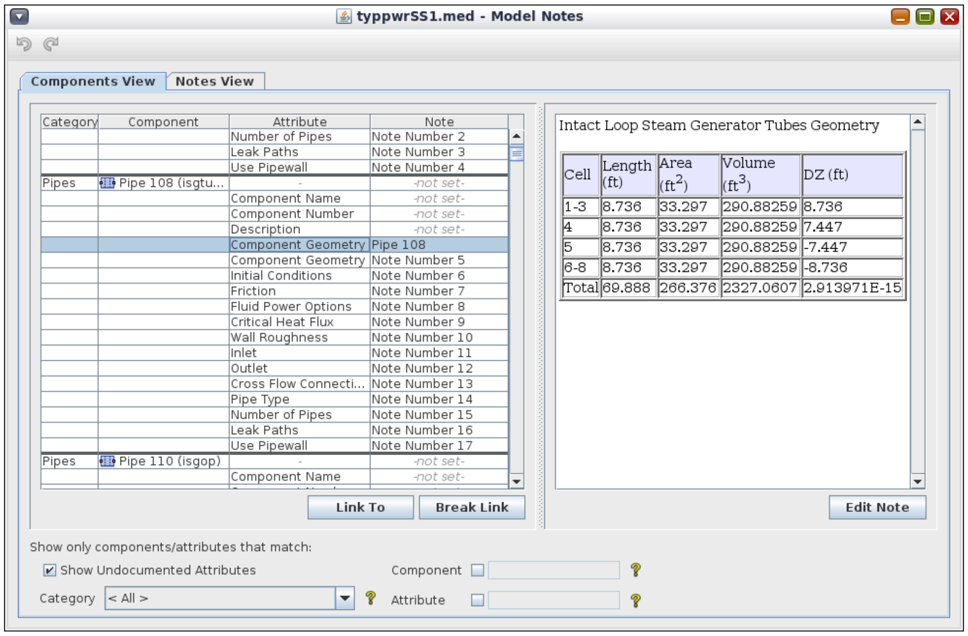
Figure 2.40. Model Note Viewer - Notes View

Two sections of search options are available. The options on the left are used to narrow the list of notes and those on the right match the components and/or attributes linked to notes. Each parameter can be enabled by the check-box to the right of the option's name. All of the enabled search parameters must match for the note to be displayed.

The **Notes** list on the left contains all of the notes in the model that match the current search parameters. The **New** and **Remove** buttons are used to create new notes and and remove the selected notes from the model. The **Edit Note** button at the bottom of the note display opens the note editor for the selected note.

The **Linked To Components** list to the right shows the list of components and attributes that refer to the selected note. **Link To** and **Break Link** buttons are provided to add or remove references.

The components view is made up of a set of optional search parameters and a list of the components and documentable attributes that match the selected search parameters. If the attribute does not reference a note, the **Note** column will show **-not set-**, otherwise the note's title will be shown. If multiple notes are referred to by an attribute, then the attribute will be displayed in several rows, once for each note.



Category	Component	Attribute	Note
		Number of Pipes	Note Number 2
		Leak Paths	Note Number 3
		Use Pipewall	Note Number 4
Pipes	Pipe 108 (isgtu...	-	-not set-
		Component Name	-not set-
		Component Number	-not set-
		Description	-not set-
		Component Geometry	Pipe 108
		Component Geometry	Note Number 5
		Initial Conditions	Note Number 6
		Friction	Note Number 7
		Fluid Power Options	Note Number 8
		Critical Heat Flux	Note Number 9
		Wall Roughness	Note Number 10
		Inlet	Note Number 11
		Outlet	Note Number 12
		Cross Flow Connecti...	Note Number 13
		Pipe Type	Note Number 14
		Number of Pipes	Note Number 15
		Leak Paths	Note Number 16
		Use Pipewall	Note Number 17
Pipes	Pipe 110 (isgop)	-	-not set-
		Component Name	-not set-

Intact Loop Steam Generator Tubes Geometry

Cell	Length (ft)	Area (ft^2)	Volume (ft^3)	DZ (ft)
1-3	8.736	33.297	290.88259	8.736
4	8.736	33.297	290.88259	7.447
5	8.736	33.297	290.88259	-7.447
6-8	8.736	33.297	290.88259	-8.736
Total	69.888	266.376	2327.0607	2.913971E-15

Show only components/attributes that match:

[✓] Show Undocumented Attributes

Category < All >

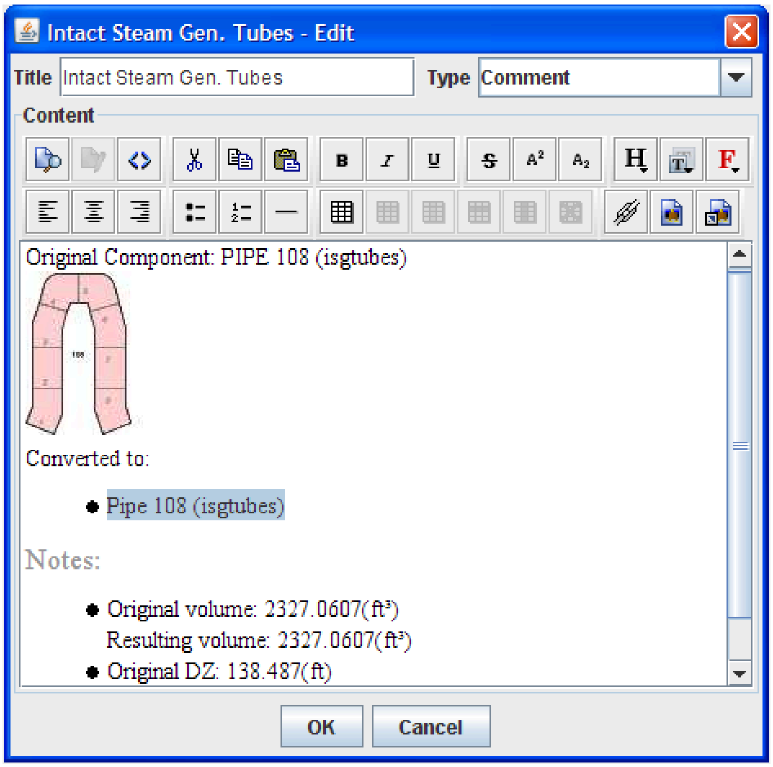
Component ☐

Attribute ☐

Figure 2.41. Model Note Viewer - Components View

A new note (or reference to a note) can be added either by double-clicking on the attribute entry in the list or by pressing the **Link To** button. Notes can be removed or edited by pressing the **Break Link** or **Edit Note** buttons respectively. The **Show Undocumented Attributes** check-box is used to show or hide those attributes that do not refer to any notes.

Each of these views uses the note editor shown in Figure 2.42, “Model Notes Editor” to display and edit model notes. This editor supports basic HTML formatting such as bold, italic and bulleted lists, as well as image links and hyper-links to external documents. These features, and several others, are available as buttons on the note editor toolbar.



Title: Intact Steam Gen. Tubes

Type: Comment

Original Component: PIPE 108 (isgtubes)

Converted to:

- Pipe 108 (isgtubes)

Notes:

- Original volume: 2327.0607(ft³)
  Resulting volume: 2327.0607(ft³)
- Original DZ: 138.487(ft)

Figure 2.42. Model Notes Editor

In addition to the toolbar provided options, the note editor also supports pasting images and formatted text into a note from applications such as Adobe Acrobat Reader and Microsoft Word. Images pasted in this way are stored directly in the note rather than using an external link.

2.5. SNAP Variables and Functions

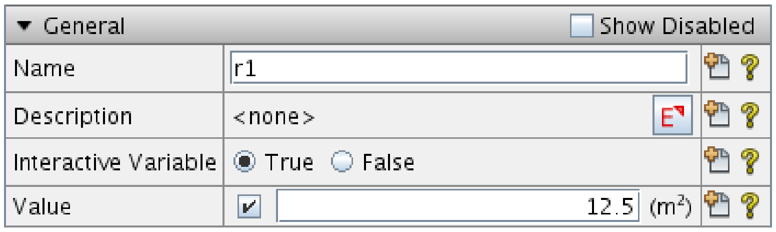
The SNAP User-Defined Numerics (UDN) feature is designed to allow properties of a model to be modified and/or calculated outside the normal input for the model. To this end, a user may create real, integer, boolean, string, and table variables, as well as functions. The use and capability of each is detailed in the following sections.

Variables and functions are located in the **Numerics** category, typically found just before the **Views** category toward the bottom of the Navigator. The **Numerics** sub-categories, **Integers**, **Reals**, **Booleans**, **Strings**, **Tables**, and **Functions**, provide access to the numerics themselves. Each of these can be created in the standard fashion: right-click the category node for the desired type and select **New** from the resulting pop-up menu.

Note Upon creating a new Real variable, a prompt will appear requesting the units of the new variable. The available units vary by plug-in (although most plug-ins have a "dimensionless" type, often displayed as **No Unit (-)**). When assigning a reference to a Real value (discussed in the next section), the units of the value must match the units of the variable being selected.

2.5.1. Single Value Variables (Reals, Integers, Booleans, Strings)

Of the six numerics categories, integers, reals, strings, and booleans, represent a single-value. These variables share a number of common attributes with little variation in semantics. The properties of a real are displayed in Figure 2.43, “Numerics Properties”.



▼ General ☐ Show Disabled

Name	r1
Description	<none>
Interactive Variable	[✓ True] False
Value	✓ 12.5 (m²)

Figure 2.43. Numerics Properties

There are two ways to assign a variable to a value. The first (and only method for table cells that support numerics), is to right-click in the editor for that value and select the **Select Shared Value** item from the pop-up menu. The second is to press the **Select a shared value** button (◁▷) on the right side the property editor. A dialog will be displayed to allow selecting the desired variable.

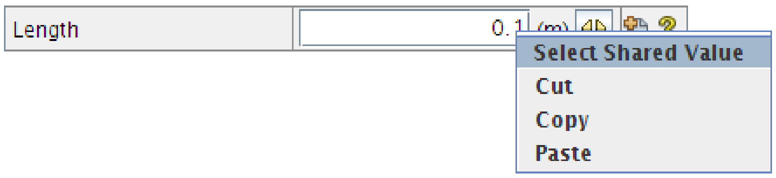


Figure 2.44. Selecting a User Defined Variable

All single-value variables share the following properties.

- **Name** - the name of the variable.

  The Standard naming convention requires variable names to start with a letter, an underscore(_), a dollar ($), or a minus (-) followed by a dollar ($). It also limits the characters that can be used after the start of the name to letters, numbers, and underscores.

  Variable names must be unique within the model. An error message will be displayed in the model check if any duplicated variable names are detected.

  When choosing a variable in an editor, the choices are listed alphabetically, so wise choice of names can save time and avoid confusion.

  Note The optional *Legacy* naming convention allows variable names to include any ASCII character except quotation marks and asterisks. This naming convention can be selected by setting the *Naming Convention* property of the Numerics node in the Navigator.
- **Description** - an optional and arbitrary, user-defined description.
- **Interactive Variable** - determines whether the variable can be modified by functions. When set to **True**, a lock appears next to the variable's icon, and attempting to modify the variable in

a function will exit with an error. Conversely, setting this attribute to **False** removes the lock and allows the variable to be modified functions.

- **Value -** the current value of the variable. Any attribute or value that references the variable will use this value instead of its own. When **Interactive Variable** is set to **False**, this value is uneditable and is set by function evaluation.The value field includes an activation checkbox. When the activation checkbox is not checked, the variable is inactive. Optional model properties that reference inactive variables will behave as though they are also disabled.
- **Initial Value -** if the variable is not interactive, the initial value is copied into **Value** at the beginning of function evaluation (see Section 2.5.6, "User-Defined Functions"). This defines the base-point of the variable so that repeated function evaluation achieves consistent results. This attribute is only shown when **Interactive Variable** is set to **False**. The initial value field includes an activation checkbox. This defines the activation state of the *Value* at the beginning of function evaluation.

Note When toggling **Interactive** from **True** to **False**, the contents of **Value** are copied into **Initial Value**, and vice versa. This behavior is intended to prevent accidentally losing a value when switching the variable type.

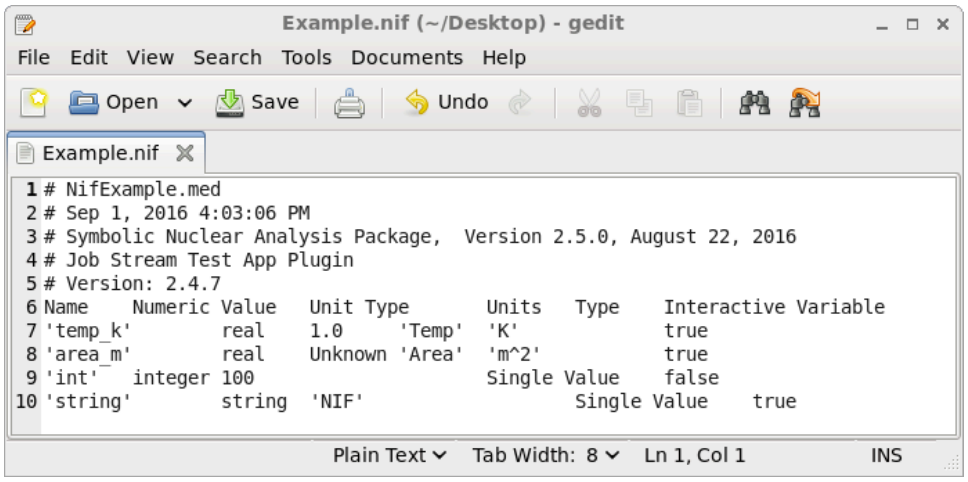
Enumerated Variables

Integer and string variables have the following exclusive properties related to the definition of an enumerated variable.

- **Type** - determines whether the variable is an enumeration (**Enumeration**), or a standard **Single Value**.
- **Enumerated Values -** defines the values in the enumeration. For integer variables, each value is a named integer. For string variables, each value is a character string. The values may be defined in any order.
- **Value -** the enumerated value acting as the current variable value. The drop-down allows selection from the list of enumerated values in the variable.

2.5.2. Numeric Import Files

The Model Editor provides the ability to import and export single value variables. These variables are exported to a Numeric Import File (NIF). Variables may also be imported from a NIF. A NIF is a table formatted, comma or tab separated, file in which each column designates a variable property and each row designates a single variable. The header row in a NIF is the first non-comment entry and may be sparsely defined. The hash(#) symbol denotes the beginning of a comment and causes the remainder of a line to be ignored.


Example.nif (~/Desktop) - gedit
File Edit View Search Tools Documents Help
Open
Save
Undo
Example.nif
Plain Text
Tab Width: 8
Ln 1, Col 1
INS

```
# NifExample.med
# Sep 1, 2016 4:03:06 PM
# Symbolic Nuclear Analysis Package,  Version 2.5.0, August 22, 2016
# Job Stream Test App Plugin
# Version: 2.4.7
Name    Numeric Value   Unit Type       Units   Type    Interactive Variable
'temp_k'        real    1.0     'Temp'  'K'             true
'area_m'        real    Unknown 'Area'  'm^2'           true
'int'   integer 100                     Single Value    false
'string'        string  'NIF'                   Single Value    true
```

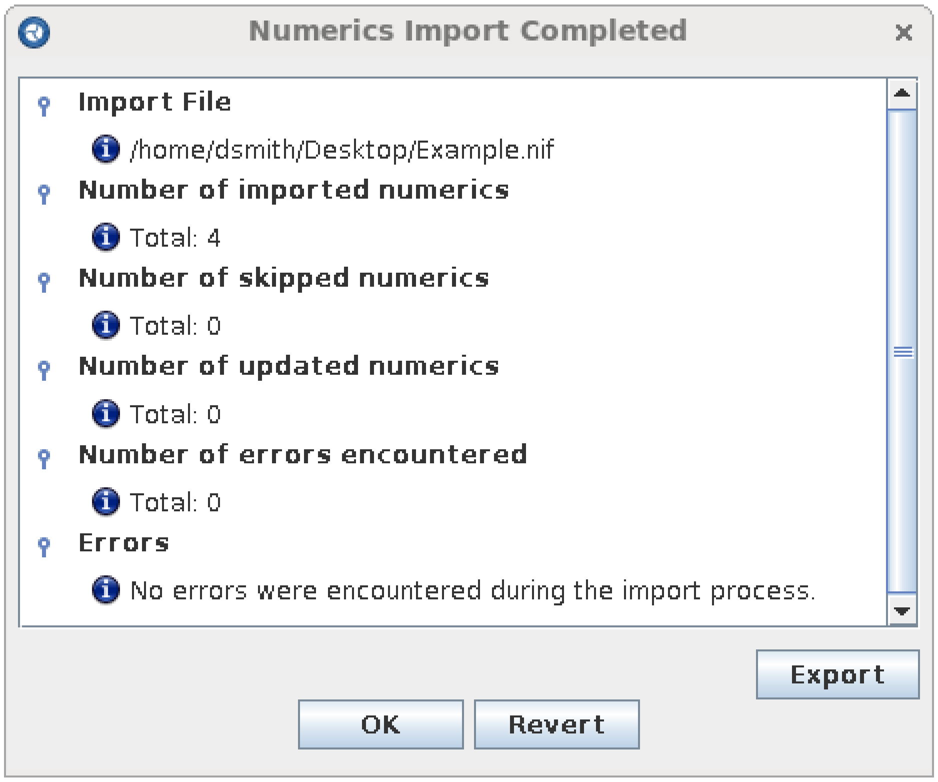
Figure 2.45. Numeric Import File Example

Property	Valid Values	Quotation Delimited	Required/Optional
Numeric	integer, string, real, boolean	No.	Required.
Unit Type	String matching the unit types available to the model.	Yes.	Required for Real variables.
Units	String matching the units available to the unit type.	Yes.	Required for Real variables.
Name	Quotation delimited string (single quotes).	Yes.	Required.
Description	Quotation delimited string (single quotes).	Yes.	Optional
Type	Enumeration, Single Value	No.	Required for Integer or String variables.
Enumerated Values	Semi-colon separated list of quoatation delimited strings (single quotes).	Partial.	Required for Integer or String enumerations.
Value	Integer: any integer. Real: any real number. Boolean: true or false. String: single quotation delimited entry.		Optional
Parametric	On, Off	No.	Required for Boolean and Interactive variables.
Interactive Variable	True, False	No.	Required for Real and Boolean variables and non-enumerated Integer or String variables.

Table 2.1. NIF Properties

Importing

Importing User-Defined Numerics is initiated by right clicking on the Numerics category in the navigator and selecting the **Import Numerics** option. Once a file is imported an error report dialog is shown. The contents of the report dialog may be exported to a text file.


Numerics Import Completed

Import File

/home/dsmith/Desktop/Example.nif

Number of imported numerics

Total: 4

Number of skipped numerics

Total: 0

Number of updated numerics

Total: 0

Number of errors encountered

Total: 0

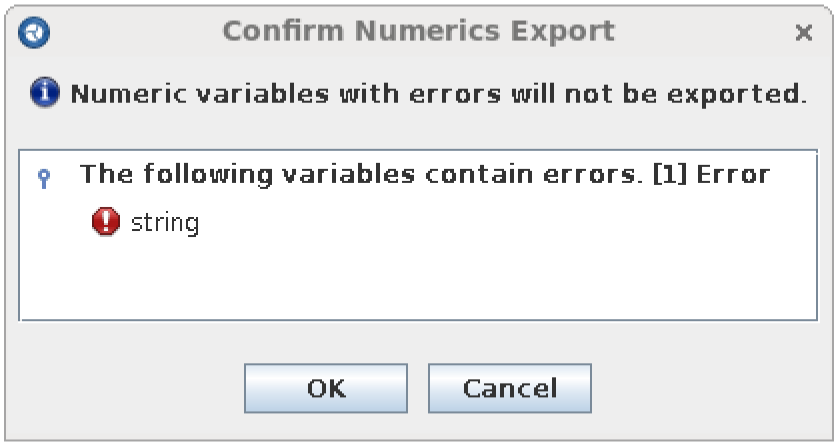
Errors

No errors were encountered during the import process.

Figure 2.46. The Numerics Import Completed Dialog

Exporting

Exporting User-Defined Numerics is initiated by right clicking on the Numerics category in the navigator and selecting the Export Numerics option. User-Defined Numerics containing errors will not be exported.


Confirm Numerics Export

Numeric variables with errors will not be exported.

The following variables contain errors. [1] Error

string

Figure 2.47. The NIF Export Error dialog

2.5.3. Numerics in a View

SNAP variables can be added to a 2D view in the same way as other components: the **Add To View** menu in the variable's Navigator node pop-up menu, the **Create View** item from the

Numerics Navigator node, etc.. These values are represented in a view as a **Drawn Numeric**. Drawn Numerics that correspond to integers and reals appear as a text label and optional text field (depending on the **Editable** option, described below) that displays the name of the variable, current value, and units if applicable (e.g. "Area 1" in Figure 2.48, "User Defined Numerics Example"). Booleans appear as check-boxes with a text label that displays the name of the numeric.

Note Drawn Numerics for table variables and functions are not currently supported.

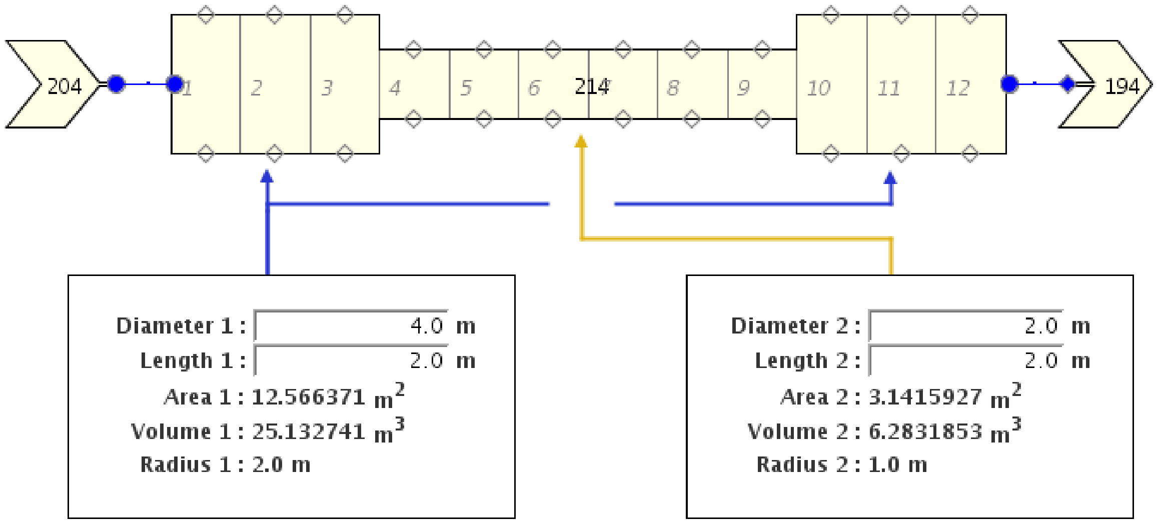


Figure 2.48. User Defined Numerics Example

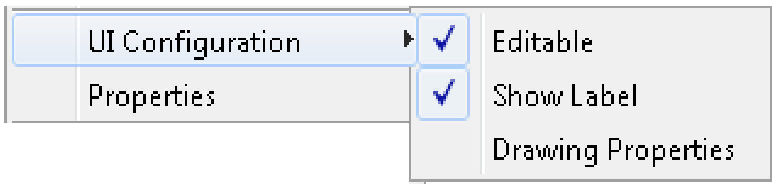


Figure 2.49. Drawn Numeric Menu

The appearance and capability of a drawn integer or real can be changed by using the following items in its right-click pop-up menu, as shown in Figure 2.49, "Drawn Numeric Menu".

- **Editable** - This check-box item enables editing an input variable by entering a new value into the Drawn Numeric (e.g. "Diameter 1" in Figure 2.48, "User Defined Numerics Example" above). Entering a value into a Drawn Numeric and pressing **Enter** will change the value in the same way as editing the numeric properties directly.

  Note Numerics can be edited in a locked 2D View. Locking the View makes editable Drawn Numerics easier to use, as they can no longer be selected by mistake.

- **Show Label** - This check-box item enables and disables the display of the user numeric name in the Drawn Numeric.

- **Drawing Properties** - The drawing properties item opens the Drawn Numeric Properties dialog. This dialog can be used to modify the drawn numeric's label text (replacing the name of the numeric), font, foreground and background colors, and border

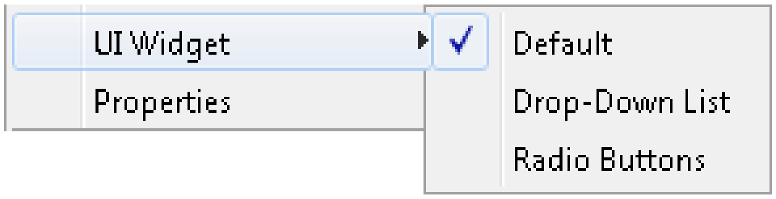


Figure 2.50. Drawn Numeric Enumerated Integer Menu

The drawn numeric enumerated variable provides three seperate editing modes. A default text field is provided which allows hand entered values where only valid enumerated values are accepted. A drop-down list is available where each of the available enumerated items are selected from a list in a vertical menu. Finally, a radio button display is provided which allows the selection of a single enumerated value. These drawing modes are displayed in the following figure:

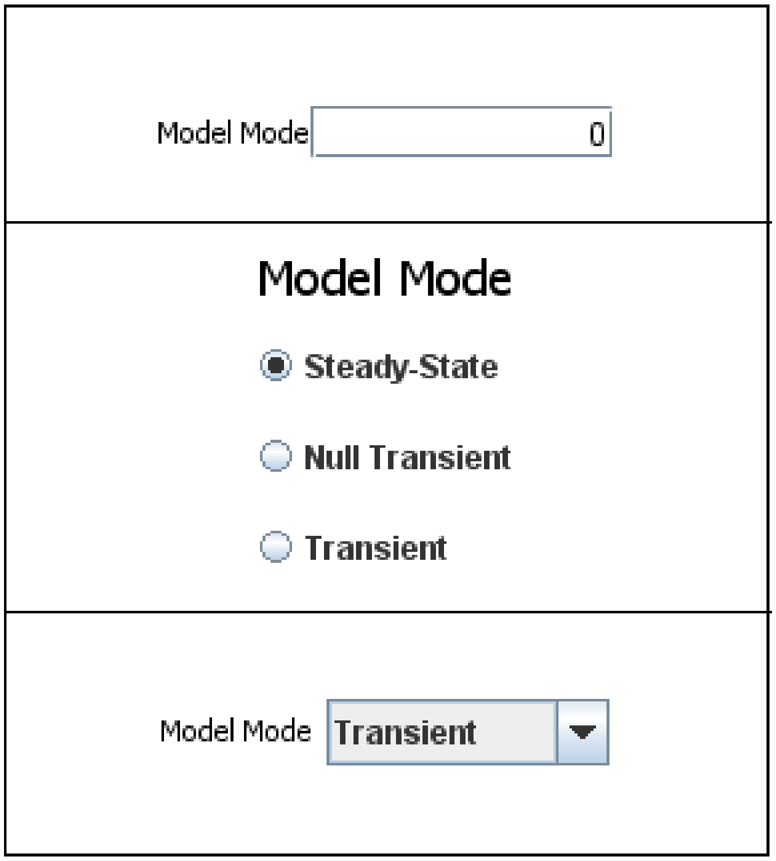
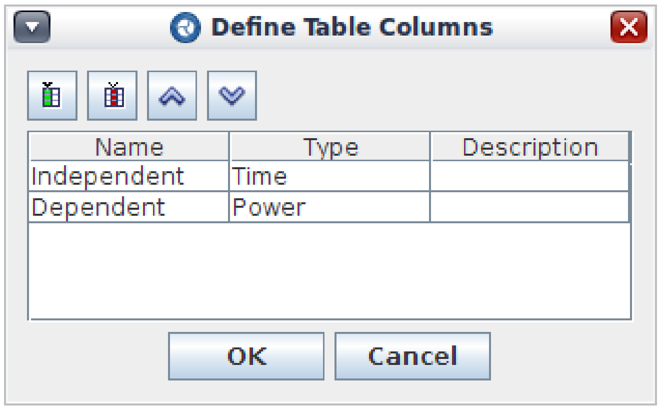


Figure 2.51. Enumerated Integer Drawing Modes

2.5.4. Table Variables

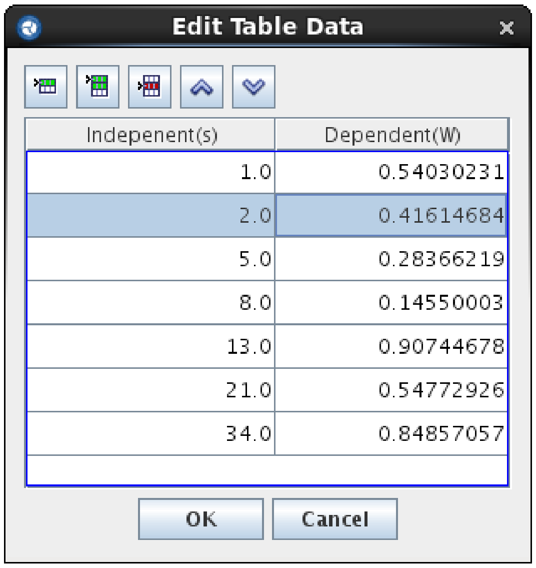
Table variables allow arbitrary data tables which may be accessed in user-defined functions and referenced by various tables elsewhere in the model. Upon creating a table variable, a **Define Table Columns** dialog is displayed, as shown in Figure 2.52, “Numerics Table Initialization”. This dialog is used to determine the names, types, and order of the columns in the table. Once created, this *column signature* can be modified through the Columns property. The number, type and order of columns may not be modified if the table is referenced by a model property.



Name	Type	Description
Independent	Time	
Dependent	Power	

Figure 2.52. Numerics Table Initialization

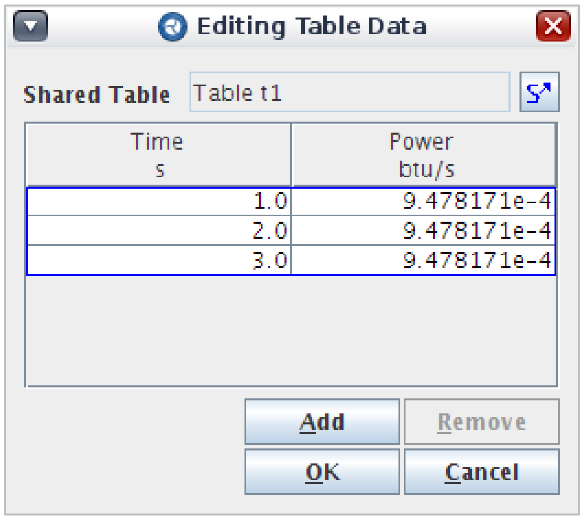
Once the table is created, its data can be edited through the **Table Data** attribute. This opens the **Edit Table Data** dialog (see Figure 2.53, “Table Data Dialog”). This dialog allows adding and removing rows, moving rows up and down, and editing cell values. The *Add Multiple Rows* button allows up to 9999 rows to be added at once.



Indepenent(s)	Dependent(W)
1.0	0.54030231
2.0	0.41614684
5.0	0.28366219
8.0	0.14550003
13.0	0.90744678
21.0	0.54772926
34.0	0.84857057

Figure 2.53. Table Data Dialog

Table variables may be used as the data source for tables that support references. Most attributes that support references will use the standard table editor shown in Figure 2.54, “Table Editor with Reference”. The **Shared Table** field at the top of the editor is used to set or clear the referenced table variable. When a table variable reference is applied, its data is displayed in the table area.



Editing Table Data

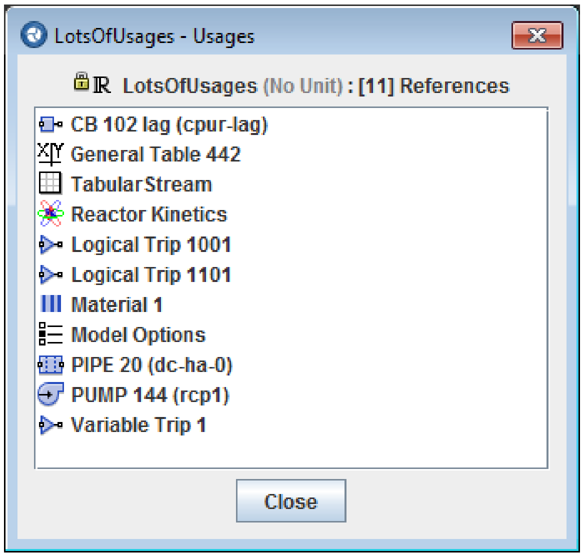
Shared Table: Table t1

Time s	Power btu/s
1.0	9.478171e-4
2.0	9.478171e-4
3.0	9.478171e-4

Figure 2.54. Table Editor with Reference

2.5.5. Show Usages

The Show Usages feature makes it easy to determine which components a particular variable has been assigned to. This feature is available via the Show Usages item in the right-click pop-up menu of any variable. Selecting this item will open the Usages dialog shown below. If the selected variable has not been assigned to any property then the Show Usages menu item will be disabled.



LotsOfUsages - Usages

LotsOfUsages (No Unit) : [11] References

- CB 102 lag (cpur-lag)
- General Table 442
- TabularStream
- Reactor Kinetics
- Logical Trip 1001
- Logical Trip 1101
- Material 1
- Model Options
- PIPE 20 (dc-ha-0)
- PUMP 144 (rcp1)
- Variable Trip 1

Figure 2.55. Variable Usages

The Usages dialog is non-modal dialog that automatically updates as changes are made to the model (edits, Undo/Redo, etc.). The list of components using the selected variable is displayed in the center of the dialog. Clicking on any component in the list will select that component in the Navigator, if possible.

2.5.6. User-Defined Functions

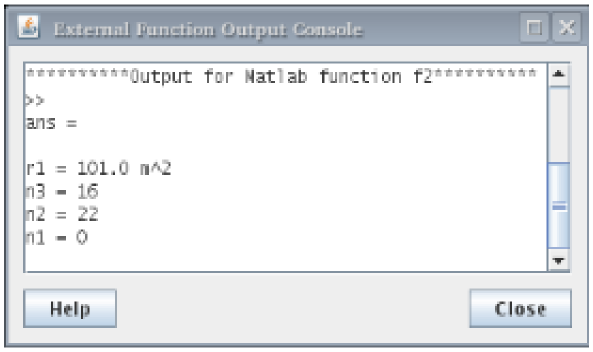
User-defined functions provide a means of working with SNAP variables from high-level code and external applications. SNAP includes support for Python, Matlab, Octave, and Mathcad user-defined functions.

Note To use Matlab or Octave, the application installation location must be specified in the SNAP configuration. Refer to Section 3.3.1, “General Properties” for more information.

The properties of user-defined functions differ by type, however, all functions support the following properties:

- **Name -** the name of the function.
- **Function Type -** this property indicates the external application or language that will interface with a selection of variables. Note that the function type cannot be changed after the function is created.
- **Enabling Boolean -** this property determines whether the function is invoked during function execution. When set to reference a boolean variable, the function will only be executed when the boolean value is set to **True**.
- **Engineering Units -** this property controls the units of values passed to the function. If the unit type specified is different from the current model units then the value of each input variable will be converted appropriately before its value is passed to or retrieved by the function. Values assigned to output variables will also be converted to the model units before assignment.

Some functions include a *Show Console* property. When activated, the external function console will be displayed. All output from the external applications (or Python execution) will be displayed in the console as shown in Figure 2.56, “External Function Output Console”.



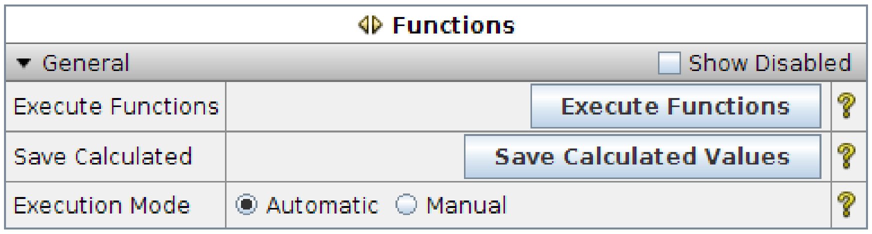
```
**********Output for Matlab function f2**********
>>
ans =

r1 = 101.0 m^2
n3 = 16
n2 = 22
n1 = 0
```

Figure 2.56. External Function Output Console

2.5.6.1. Function Execution and Category Properties

Selecting the **Functions** category displays the properties displayed in Figure 2.57, “Functions Properties”.



Functions

General | Show Disabled

Execute Functions	Execute Functions	?
Save Calculated	Save Calculated Values	?
Execution Mode	[✓ Automatic] Manual	?

Figure 2.57. Functions Properties

Functions can be explicitly executed in one of the following ways:

- The **Execute Functions** property editor in the **Functions** category properties.
- The right-click pop-up menu on the **Functions** category contains an **Execute Functions** item.

Before function execution, all non-interactive numerics have their current **Value** replaced by their **Initial Value**. Afterwards, functions are executed in the sequence they appear in the Navigator; this ordering can be customized via the **Move Up** and **Move Down** items found in the right-click pop-up menu for numeric functions. As described in Section 2.5.6, "User-Defined Functions", functions that reference an **Enabling Boolean** will only execute when the referenced boolean evaluates to **True**.

After function execution, the **Save Calculated Values** editor button of the **Function** category properties can be used to copy current numeric **Values** into their **Initial Values** field.

The **Execution Mode** property can be used to control how and when functions are executed in the model. When set to **Automatic**, certain actions, such as submitting a stream or exporting a parametric model, will cause function evaluation. When set to **Manual**, only the explicit function execution methods described above will cause function evaluation.

2.5.6.2. The Matlab-UDN Interface

When an instance of Matlab is opened from the Model Editor, Matlab commands that initialize the Matlab-UDN interface are automatically executed. This interface provides a Java object in Matlab that contains methods for accessing and modifying SNAP variables that were passed into Matlab as input and output variables.

The Matlab function type includes the following properties:

- **Show Console** - this property, when selected, gathers all output from the external applications (or Python execution) and displays it in a pop-up dialog when the function has completed execution, as shown in Figure 2.56, "External Function Output Console".

- **Input/Output Variables** - these properties indicate the variables available to Matlab. Variables in the inputs list are available to the Matlab script as an input: their value can be retrieved for use in calculations. Similarly, variables in the outputs list are available as outputs: their value can be modified by the Matlab script.

- **Script File** - this property specifies the location of the script that will be passed to Matlab. The select button to the right of the field can be used to select the file with a file browser. The edit button further to the right will open the script in Matlab.

The following interface functions are available for use in Matlab M-Files.

Note As a convention, the interface object is always named `cafean`. Therefore, calls to interface methods must be of the form `cafean.method()`, where `method` can be any of the following methods and their appropriate signatures.

- `getModelName()` - returns the name of the SNAP model associated with this interface instance.

  ```
  M = cafean.getModelName()
  ```

- `addMessage( 'message' )` - adds a message to be displayed in the Message Window when the function completes execution.

  ```
  cafean.addMessage( 'Default Message' )
  ```

- `getMessages()` - returns a newline-delimited list of messages currently set to be displayed in the Message Window.

  ```
  S = cafean.getMessages()
  ```

- `getReturnStatus()` - gets the return status for this interface instance. A return status of `0` indicates normal behavior, a non-zero return status will cause the Model Editor to not update any output variables that were set to be updated.

  ```
  i = cafean.getReturnStatus()
  ```

- `setReturnStatus( value )` - sets the return status for this interface instance. This method does its best to coerce `value` into an integer.

  ```
  cafean.setReturnStatus( 0 )
  ```

- `listVariables()` - returns a newline-delimited list of variables that have been added to the current Matlab session by the interface. Each variable is represented in the format "name = value".

  ```
  cafean.listVariables()
  ```

- `getVariable( 'name' )` - checks the list of variables for variable `name` and, if found, returns the current value of that variable. If the variable could not be found, an error message is added to the Message Window.

  ```
  A = cafean.getVariable( 'Area_1' )
  ```

- `setVariable( 'name', value )` - sets the value of the indicated numeric. If the indicated numeric is not found, or the input value cannot be coerced into the appropriate type, an error message is added to the Message Window.

  ```
  cafean.setVariable( 'Area_2', A )
  ```

- `getTableValue( 'name' , row, column )` - gets the value of the specified table at [row, column]. Table indexes are consistent with the Matlab convention, and thus start at 1.

  ```
  X = cafean.getTableValue( 't1', 1, 1)
  ```

- `setTableValue( 'name', row, column, value )` - sets the table value at the given cell. Makes the same attempt at type coercion as `setVariable.`

```
cafean.setTableValue( 't1', 1, 1, X)
```

Note Suppressing output from a Matlab command is achieved by appending a semicolon to the end of the command. Suppressed Matlab output will not be displayed in the External Function Output Console.

2.5.6.3. The Octave-UDN Interface

GNU Octave is a high-level language, primarily intended for numerical computations. It provides a convenient interactive command line interface for solving linear and nonlinear problems numerically, and for performing other numerical experiments. It may also be used as a batch-oriented language for data processing.

The Octave UDN interface is functionally identical to the Matlab interface. Refer to the Matlab section for more information.

2.5.6.4. The Mathcad-UDN Interface

When functions of type **Mathcad** are executed, a Mathcad session is opened with the specified *Worksheet File*.

- **Show Application Window** - this property determines whether the Mathcad window is displayed.
- **Input/Output Variables** - these properties indicate the variables available to Matlab. The specified input and output variables are loaded into the worksheet automatically, and are ready for use by the worksheet. When the worksheet finishes executing, the values of the output variables are updated accordingly.
- **Worksheet File** - this property specifies the location of the script that will be passed to Mathcad. The select button to the right of the field can be used to select the file with a file browser. The edit button further to the right will open the script in Mathcad.

2.5.6.5. Python User-Defined Functions

The Python interactive scripting language can be used to calculate SNAP variable values using values from other variables, values retrieved from a data source and any data accessible using the Python standard library. Additional Python libraries may be installed in the SNAP Installation folder (SNAP/python/) or the user's preferences folder ($HOME/.snap/2.0/python/). These libraries are made available to built-in Jython interpreter and will be added to the PYTHONPATH environment variable for the external command-line interpreter.

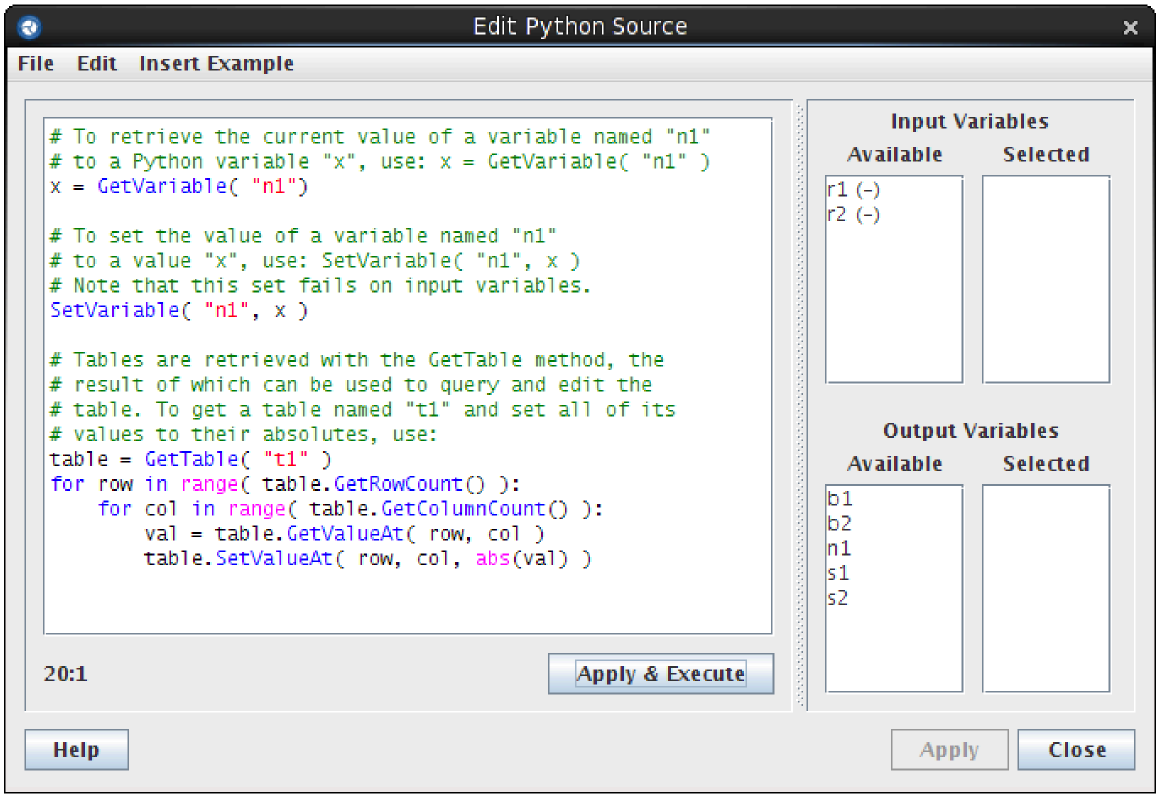
Python functions have the following additional properties:

- **Show Console** - This property, when set to True, gathers all output from the external applications (or Python execution) and displays it in a pop-up dialog when the function has completed execution, as shown in Figure 2.56, “External Function Output Console”.
- **Python Source** - This property represents the user-specified Python source code that will be executed by the function. Pressing the edit button in this editor will open the Python

Source dialog (described below). Functions may make use of any standard Python capabilities including the definition and usage of functions, classes, etc..

- **Python Interpreter** - This property determines whether the built-in Python interpreter (Jython) or a user-specified Python interpreter will be used to execute the function. SNAP currently supports Python versions 2 (2.7+) and 3 (3.6+).
- **Python Executable** - The external Python interpreter that will be used to execute the function. If no interpreter is specified then the function will attempt to find 'python' in the user's path.

The Python Source dialog contains a python source editor and lists of the input and output variables that were accessed by the last execution of the function. The menu bar at the top of the dialog contains additional features described below. The **Apply** button saves the current source changes to the function. As implied by the name of the button, the dialog is non-modal: other dialogs and Model Editor functionality can be used while this dialog is open, including editing dialogs for other functions. The **Apply and Execute** button saves the current source and executes all of the functions in the model. The source editing panel includes useful features for editing Python code including syntax highlighting, auto indent, and displayed line numbers.



```
# To retrieve the current value of a variable named "n1"
# to a Python variable "x", use: x = GetVariable( "n1" )
x = GetVariable( "n1")

# To set the value of a variable named "n1"
# to a value "x", use: SetVariable( "n1", x )
# Note that this set fails on input variables.
SetVariable( "n1", x )

# Tables are retrieved with the GetTable method, the
# result of which can be used to query and edit the
# table. To get a table named "t1" and set all of its
# values to their absolutes, use:
table = GetTable( "t1" )
for row in range( table.GetRowCount() ):
    for col in range( table.GetColumnCount() ):
        val = table.GetValueAt( row, col )
        table.SetValueAt( row, col, abs(val) )
```

Figure 2.58. Python Source Dialog

Python Code

The function retrieves data from variables and/or external sources, computes values, and places data back into variables. The code supports standard Python v 2.0 or 3.0, including the definition and usage of functions, classes, etc.

The following built-in functions are available to Python functions:

- `GetVariable( name )` - returns the value of the indicated variable.

  `X = GetVariable( "Symbolic Name" )`

  `GetVariable will raise an error if the value of the requested variable is inactive.`

- `SetVariable( name, value )` - sets the value of the indicated variable, and sets the value active.

  `SetVariable( "Symbolic Name", X )`

  `SetVariable` does its best to coerce values into the appropriate type. In the case of booleans, all non-zero values passed to a boolean variable are converted to `True`; all zero values are converted to `False`. Similarly, boolean values copied into other variables are treated as `0` for `False` and `1` for `True`.

- `GetVariableActive( name )` - returns the activation state of the value field for the indicated variable.

  X = GetVariableActive("Symbolic Name")

- `SetVariableActive( name, value )` - sets the activation state of the value field for the indicated variable.

  SetVariableActive("Symbolic Name", X)

- `SetIfInactive( name, value )` - sets the value of the indicated variable if and only if the value is currently inactive.

  SetIfInactive("Symbolic Name", X)

  This is the equivalent of the following code:

  ```
  if not GetVariableActive( "Symbolic Name" ):
      SetVariable( "Symbolic Name", X )
  ```

- `GetTable( name )` - returns a table object that can be used to query dimensions of a table, as well as get and set its values. Table objects have the following methods.

  - `GetRowCount()` - returns the number of rows in the table.

  - `Get ColumnCount()` - returns the number of columns in the table.

  - `GetValueAt( row, column )` - gets the table value at the given cell. Indexes start at 0.

  - `SetValueAt( row, column, value )` - sets the table value at the given cell. Indexes start at 0. This function makes the same effort as `SetVariable` to coerce values to the appropriate type.

  The following is an example of table usage.

  ```
  table = GetTable( "t1" )
  for row in range( table.GetRowCount() ):
      for col in range( table.GetColumnCount() ):
  ```

```
val = table.GetValueAt( row, col )
table.SetValueAt( row, col, abs( val ) )
```

- `GetDataSource( name )` - This method returns the data source with the given name. The result can be used to retrieve values from the data source using the getValue method. The keys that can be used for a given data source (e.g. My Value) will vary depending on the type of data source being used. A spreadsheet data based source, for example, might use spreadsheet cell locations such as "C1" or "SheetA.N41" as keys.

  ```
  d = GetDataSource( "d1" )

  x = d.getValue( "My Value" )
  ```

Additional Dialog Functionality

The following additional features are available in the Python editing dialog.

- **File** menu - this menu contains entries dedicated to manipulating the Python code itself. The function code can be written to a file with the **Export File** item. The **Import File** menu item will replace the Python source code with the contents of the selected text file. **Append File** imports the contents of the selected file to the end of the existing code; **Prepend File** inserts the file's contents in the beginning of the python source.

- **Edit** menu - this menu contains items centered around the system clipboard. Items are present to **Cut** and **Copy** the currently selected Python code, and to **Paste** the contents of the clipboard into the code panel.

- **View menu -** this menu contains an option for displaying or hiding the variables panel.

- **Insert Example** menu - items in this menu do exactly what the name implies: insert Python samples into the code panel.

2.6. Component Sub-Systems

Component sub-systems are a convenient way to improve the logical layout of a model by allowing the components that make up physical systems (such as steam generators) to be grouped together. Component sub-systems appear in the Navigator under the **Sub-Systems** category node and can be created by selecting **New** from the category's right-click pop-up menu.

Sub-systems also support component-level and attribute-level documentation links and can be used as a central location for documentation that applies equally to an entire sub-system (see Section 2.4, “Model Notes”).

The list of components included in a sub-system can be changed by editing the **Components** property of the sub-system. A sub-system can contain any number of components as well as other sub-systems. A component or sub-system can only be included in a single sub-system.

Component sub-systems currently support the following additional features:

- **Copy/Paste Special -** When a sub-system is copied, the contents of that sub-system are copied as well. Use the **Paste Special** feature to paste the sub-system within a model or to a different model. This will allow the newly pasted components to be renumbered.

- **Create View / Add To View -** The right-click pop-up menu of any Sub-System can be used to either create a new 2D View with the included components or add them to an existing 2D View.

- **Show ASCII -** The **Show ASCII** feature can be used with sub-systems in the same way as other components. The ASCII view for a sub-system includes the ASCII that would be displayed for each of the included components in the order they appear in the sub-system.

- **Component Differencing** - Much like **Show ASCII** above, the **Component Differencing** feature can also be used with sub-systems. The differenced ASCII will be that of the included components in the order that they appear in the sub-system.

- **Exportable** *(Optional)* - The **Exportable** property is used to specify those sub-systems that are complete "Composite Components" that will be used with the Sub-System Integration feature described below. This feature is not supported by all plug-ins.

Note Component Sub-Systems is an optional feature that may not be supported by all pre-processor plug-ins.

2.7. Sub-System Integration

The sub-system integrator (or "Master Integrator") allows a sub-system in one model to be imported into another model. Once imported, the integrator can also be used to *update* the imported sub-system without requiring the components to be reconnected manually.

Note In this section the descriptions refer to the "Composite Component" model (the model that a sub-system will be copied from) and the "Full Plant" model (the model that the components will be copied into). However, sub-system integration is not limited to this situation alone.

For example, a standalone steam generator model could be created with all of the necessary boundary conditions to run to a steady state. The hydraulic components and heat structures that make up the steam generator can then be added to a sub-system. This sub-system could then be imported into a full plant model and connected to the appropriate locations. Later, when changes are made to the steam generator model the full plant model can be updated to include these changes. All of the connections made in the full plant model will be automatically reconnected.

Note Sub-system integration can also be performed via the batch command interface using the SUB_SYS_IMPORT command as described in Batch Command Syntax.

Using the Sub-System Integrator

The following steps are required to import a sub-system.

1. Create a "Composite Component" model.

2. Create a sub-system in the "Composite Component" model.

3. Create or open the "Full Plant" model.

4. Right-click on the **Sub-Systems** node in the Navigator and select the **Import Sub-System** menu item.

5. Select the MED (Model Editor Document) file containing the "Composite Component" model. This will then open the Select Sub-Systems dialog to allow the desired sub-system to be selected.

6. Select the desired exportable sub-system from the combo box in the top left-hand corner of the Select Sub-Systems dialog.

7. Select **<Create New Target>** from the combo box in the top right-hand corner of the Select Sub-Systems dialog.

8. Press **Next** to complete the import. This will display a the message "Sub-system integration complete." The imported sub-system can then be connected to the "Full Plant" model.

The following steps are required to update an imported sub-system.

1. Right-click on the sub-system's Navigator node and select the **Update Sub-System** menu item.

2. Select the MED (Model Editor Document) file containing the "Composite Component" model. This will then open the Select Sub-Systems dialog shown in Figure 2.59, “Select Sub-Systems Window”.

3. Select the desired sub-system in each of the combo boxes at the top of the dialog.

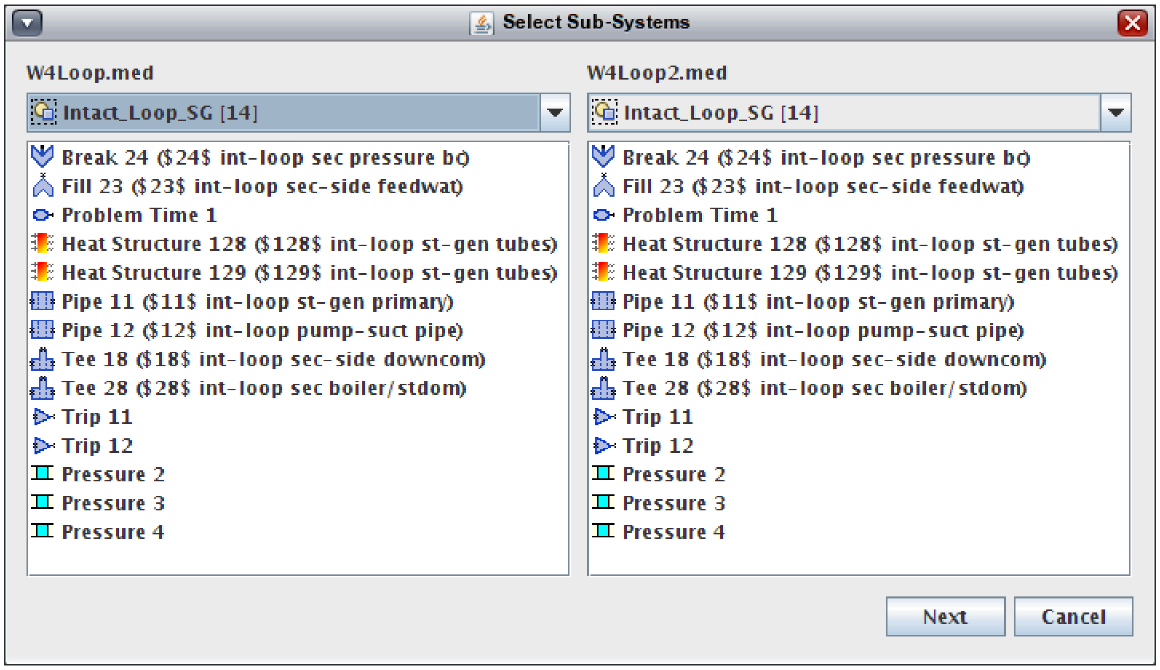
4. Press **Next** to continue the update.

   If any interconnections are discovered that cannot be supported by the update, a message window will be displayed listing the details for each connection. Pressing **Cancel** at this point will stop the process without modifying the model.

   If all connections are supported, the Display Cross References dialog will be displayed as shown in Figure 2.60, “Cross-Reference Display”.

5. Examine the interconnections listed in the dialog to ensure that the correct sub-system has been selected, then press **Finish** to complete the update. Pressing **Cancel** instead at this point will stop the process without modifying the model.

The Select Sub-Systems Window

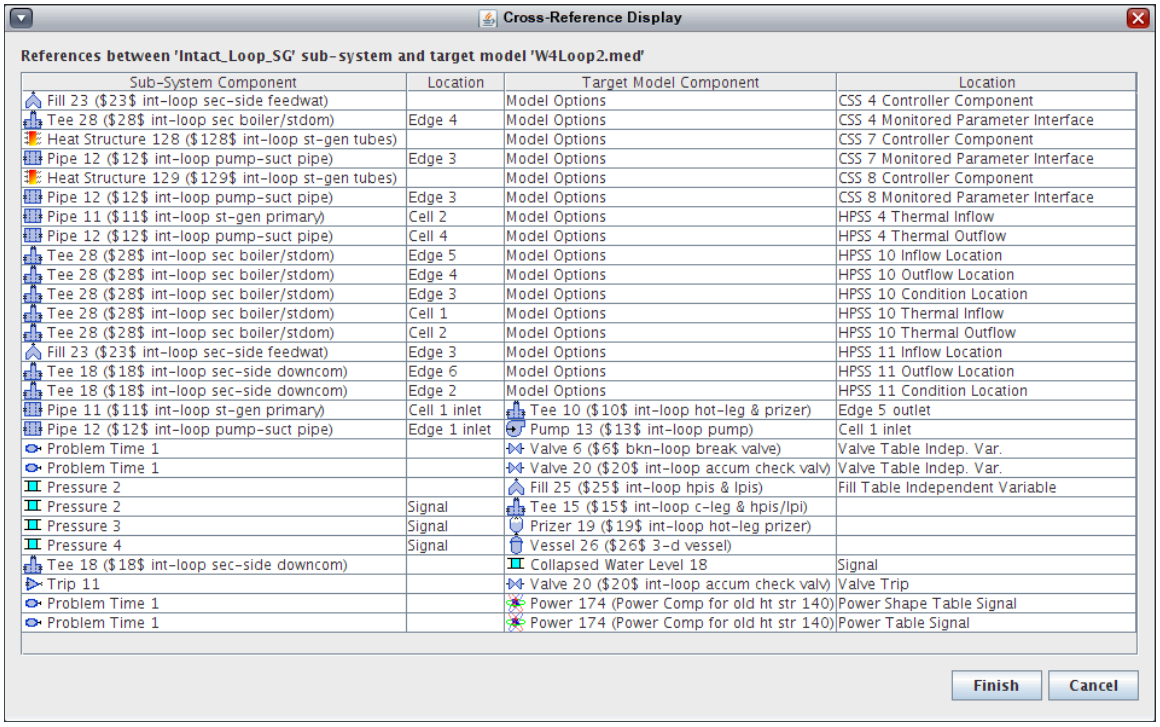

Select Sub-Systems

W4Loop.med	W4Loop2.med
Intact_Loop_SG [14]	Intact_Loop_SG [14]
Break 24 (24 int-loop sec pressure bc)	Break 24 (24 int-loop sec pressure bc)
Fill 23 (23 int-loop sec-side feedwat)	Fill 23 (23 int-loop sec-side feedwat)
Problem Time 1	Problem Time 1
Heat Structure 128 (128 int-loop st-gen tubes)	Heat Structure 128 (128 int-loop st-gen tubes)
Heat Structure 129 (129 int-loop st-gen tubes)	Heat Structure 129 (129 int-loop st-gen tubes)
Pipe 11 (11 int-loop st-gen primary)	Pipe 11 (11 int-loop st-gen primary)
Pipe 12 (12 int-loop pump-suct pipe)	Pipe 12 (12 int-loop pump-suct pipe)
Tee 18 (18 int-loop sec-side downcom)	Tee 18 (18 int-loop sec-side downcom)
Tee 28 (28 int-loop sec boiler/stdom)	Tee 28 (28 int-loop sec boiler/stdom)
Trip 11	Trip 11
Trip 12	Trip 12
Pressure 2	Pressure 2
Pressure 3	Pressure 3
Pressure 4	Pressure 4

Figure 2.59. Select Sub-Systems Window

The Select Sub-Systems Window is used to select which sub-system in each model (full plant vs. composite component) will be used in the integration. On the left side of the window is the "composite component" model, a drop-down list of the exportable sub-systems in that model, and the list of components in that sub-system. Similarly, the "full plant" model is in right side of the window.

The Cross-Reference Display



References between 'Intact_Loop_SG' sub-system and target model 'W4Loop2.med'

Sub-System Component	Location	Target Model Component	Location
Fill 23 (23 int-loop sec-side feedwat)		Model Options	CSS 4 Controller Component
Tee 28 (28 int-loop sec boiler/stdom)	Edge 4	Model Options	CSS 4 Monitored Parameter Interface
Heat Structure 128 (128 int-loop st-gen tubes)		Model Options	CSS 7 Controller Component
Pipe 12 (12 int-loop pump-suct pipe)	Edge 3	Model Options	CSS 7 Monitored Parameter Interface
Heat Structure 129 (129 int-loop st-gen tubes)		Model Options	CSS 8 Controller Component
Pipe 12 (12 int-loop pump-suct pipe)	Edge 3	Model Options	CSS 8 Monitored Parameter Interface
Pipe 11 (11 int-loop st-gen primary)	Cell 2	Model Options	HPSS 4 Thermal Inflow
Pipe 12 (12 int-loop pump-suct pipe)	Cell 4	Model Options	HPSS 4 Thermal Outflow
Tee 28 (28 int-loop sec boiler/stdom)	Edge 5	Model Options	HPSS 10 Inflow Location
Tee 28 (28 int-loop sec boiler/stdom)	Edge 4	Model Options	HPSS 10 Outflow Location
Tee 28 (28 int-loop sec boiler/stdom)	Edge 3	Model Options	HPSS 10 Condition Location
Tee 28 (28 int-loop sec boiler/stdom)	Cell 1	Model Options	HPSS 10 Thermal Inflow
Tee 28 (28 int-loop sec boiler/stdom)	Cell 2	Model Options	HPSS 10 Thermal Outflow
Fill 23 (23 int-loop sec-side feedwat)	Edge 3	Model Options	HPSS 11 Inflow Location
Tee 18 (18 int-loop sec-side downcom)	Edge 6	Model Options	HPSS 11 Outflow Location
Tee 18 (18 int-loop sec-side downcom)	Edge 2	Model Options	HPSS 11 Condition Location
Pipe 11 (11 int-loop st-gen primary)	Cell 1 inlet	Tee 10 (10 int-loop hot-leg & prizer)	Edge 5 outlet
Pipe 12 (12 int-loop pump-suct pipe)	Edge 1 inlet	Pump 13 (13 int-loop pump)	Cell 1 inlet
Problem Time 1		Valve 6 (6 bkn-loop break valve)	Valve Table Indep. Var.
Problem Time 1		Valve 20 (20 int-loop accum check valv)	Valve Table Indep. Var.
Pressure 2		Fill 25 (25 int-loop hpis & lpis)	Fill Table Independent Variable
Pressure 2	Signal	Tee 15 (15 int-loop c-leg & hpis/lpi)	
Pressure 3	Signal	Prizer 19 (19 int-loop hot-leg prizer)	
Pressure 4	Signal	Vessel 26 (26 3-d vessel)	
Tee 18 (18 int-loop sec-side downcom)		Collapsed Water Level 18	Signal
Trip 11		Valve 20 (20 int-loop accum check valv)	Valve Trip
Problem Time 1		Power 174 (Power Comp for old ht str 140)	Power Shape Table Signal
Problem Time 1		Power 174 (Power Comp for old ht str 140)	Power Table Signal

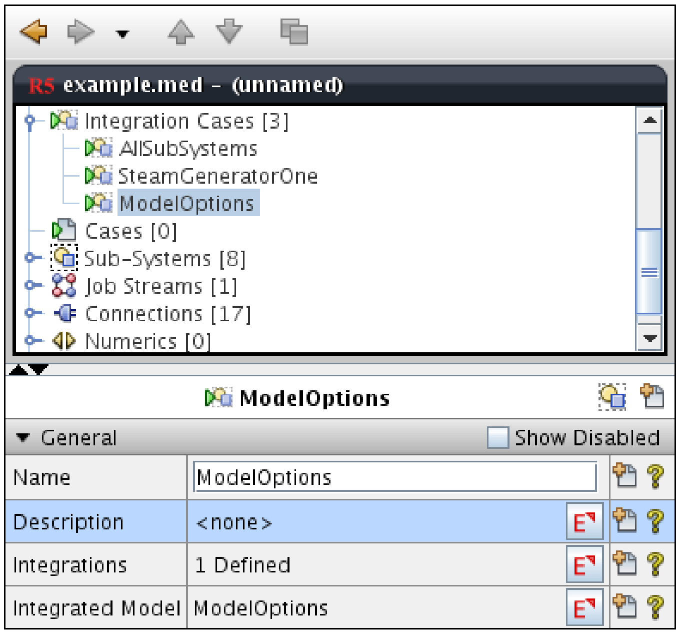
Figure 2.60. Cross-Reference Display

The cross-reference display contains a list of all of the interconnections between the "full plant" model and the sub-system that will be handled during the integration process. The table in the center of the window is made up of 4 columns. The two left-most columns list the components inside the sub-system. The two right-most columns list the components outside the sub-system. The location columns indicate where in the listed component the interconnection occurs. For example: In Figure 2.60, “Cross-Reference Display” above, the inlet **Pipe 11 cell 1** is connected to the outlet of **Tee 10 edge 5**.

Note This window is not displayed when importing a sub-system for the first time as there are no interconnections to handle.

2.8. Integration Cases

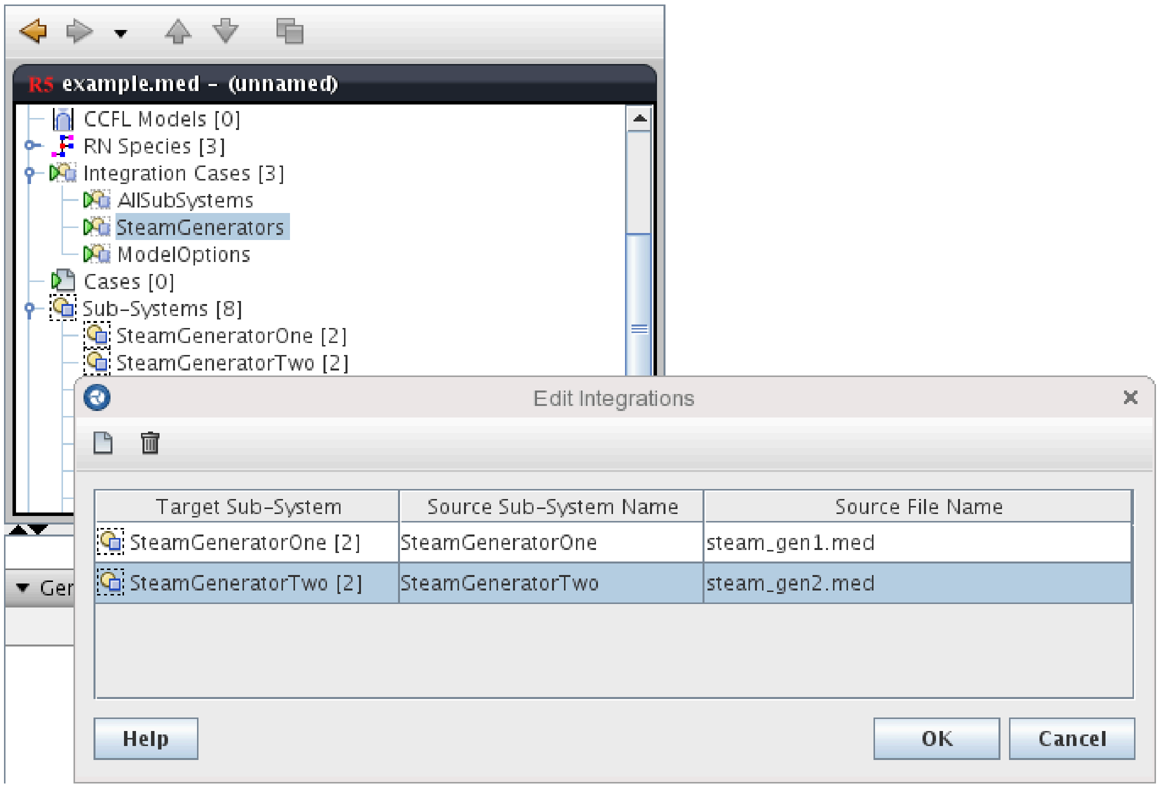
The Integration Case component represents a pre-defined set of sub-system integrations performed in the specified order. The set of integrations will be performed when the case is graphically edited (much like restart cases) and when the case is exported to a local file.



Name	ModelOptions
Description	<none>
Integrations	1 Defined
Integrated Model	ModelOptions

Figure 2.61. Integration Case Properties

Integration cases appear in the Navigator and the Property View in the same way as other components. Each integration case has an *Integrations* property that represents the set of sub-system integrations that it will perform. A target sub-system, source model MED, and source sub-system must be specified for each integration.



Target Sub-System	Source Sub-System Name	Source File Name
SteamGeneratorOne [2]	SteamGeneratorOne	steam_gen1.med
SteamGeneratorTwo [2]	SteamGeneratorTwo	steam_gen2.med

Figure 2.62. Integrations Editing Dialog

The integration case graphical editing feature is nearly identical to that used by restart cases. It is available via the **Edit Case** right-click pop-up item and the *Integrated Model* property view editor. This feature performs the specified sub-system integrations on a temporary model and opens it in virtual editing mode. Unlike restart cases, the integration case does not support the **Save** feature while graphically editing. No changes made during the graphical edit will be available once the virtual model is closed. It does, however, support the **Export** and **Save As** features supported by non-virtual models. **Save As**, while graphically editing, will save the currently (integrated) model as a new file and open it in the normal editing mode.

Integration Cases also support the **Export Case** right-click pop-up menu item used by other restart cases. This menu item will perform the specified sub-system integrations on a temporary model and export the resulting full model to the user-selected file.

2.9. Command Line Usage

The SNAP installation includes platform specific launchers for each of the included applications. For Windows a set of executables are included. For UNIX type systems (including Mac OS X) shell scripts are included. These launchers are placed in the `bin/` directory of the SNAP installation and can be executed directly from the command line. This allows the Model Editor to be executed from other applications or scripts. When combined with batch commands (Section 2.10, “Batch Command Syntax”) this allows the Model Editor to be used by automated systems such as analysis code test suites.

A special version of the Model Editor, called MEBatch, can be used for executing batch scripts. MEBatch runs in "headless mode", which allows it to run on machines without a graphical environment, such as a typical server. To invoke MEBatch, use the Windows `mebatch.exe` executable of the `mebatch.sh` shell script, both of which are in the `bin/` directory of the SNAP installation.

Note Some commands, such as **`SHOW`** and **`HIDE`** are will not function in headless mode.

When run from the command line, certain options can be specified for the Model Editor. The command line options can be displayed by running the Model Editor from the command line with the option --**`usage`** as shown below.

```
Symbolic Nuclear Analysis Package (SNAP) Model Editor
Version: 1.0.0

Command line usage:
  snap [--batch filename] [--debug] [--nosplash]
       [--noscreen] [--remote] [--usage] [--version]
  where --batch identifies a batch file to process.
        --debug turns on debug mode.
        --nosplash turns off the splash screen.
        --noscreen turns off screen file logging.
        --remote disables double buffering for remote X displays.
        --usage prints this message and exits.
        --version prints the version info and exists.
```

When running MEBatch, the command line syntax is as follows. The key difference between invoking the Model Editor from a command line and MEBatch is that MEBatch requires a batch file (specified without **`--batch`**) somewhere in its list of arguments.

```
Command line usage:
  mebatch <batchfile> [--debug] [--usage] [--version]
  where <batchfile> identifies a batch file to process.
```

```
        --debug turns on debug mode.
        --usage prints this message and exits.
        --version prints the version info and exists.
```

`--batch <filename>`	The Model Editor supports a batch command language. This argument is used to specify a batch file that will be run before the Model Editor is displayed. Refer to Section 2.10, “Batch Command Syntax” for a detailed explanation of the Model Editor batch command syntax.
`--debug`	This option enables various debugging features of the Model Editor and is recommended that this parameter only be used by plug-in developers.
`--noscreen`	This option disables console logging, instead telling SNAP to write its output directly to the console.
`--nosplash`	This option disables the splash window display on startup.
`--remote`	The default JAVA double-buffering scheme causes a significant UI performance loss on some systems when displaying the Model Editor from a remote machine. This option disables the double-buffering and may improve performance in these circumstances.
`--usage / --help`	This option displays the usage information shown above and exits.
`--version`	This options displays the current Model Editor version and exits.

2.10. Batch Command Syntax

The following is the standard batch command set. Each command is listed with optional fields shown in between less than < and greater than > signs, while required fields are shown between square brackets [ ].

Note Not all commands are supported when running with MEBatch, which runs in headless mode (see Section 2.9, “Command Line Usage”). These commands are noted as not supported in headless mode.

- **`SHOW`** - The show command is used to display the primary user interface. This allows for batch commands to execute in such a way that the user receives immediate visual feedback. If this option is not used, the Model Editor will run without a graphical interface. This command is not supported in headless mode.

- **`HIDE`** - This command hides the primary user interface. This command is not supported in headless mode.

- **`MESSAGE [message]`** - Where `message` contains a quoted string to be displayed to the used.

  The **`MESSAGE`** command can be used to display a single quoted message to the user in a pop-up dialog with an OK button. This batch command will stop the batch file process until the user presses OK. In headless mode, this command writes a message to the console; no user interaction is necessary.

- **`CHECK_MODEL`** - This performs a model check in an identical manner to the Check Model button on the main toolbar. This is useful for a batch verification of a large number of models.

- **`EXIT`** - The exit command is used to close the Model Editor. This should be used at the end of a batch file to ensure that the Model Editor process does not continue running. If the batch file contains the **`SHOW`** command, this will close the user interface as well.

- **`OPEN <Mn> [filename]`** - Where **`Mn`** is defined as one of the ten valid model labels numbered **`M0-M9`**.

  The **`OPEN`** command is used to open a MED (`*.med`) file in the Model Editor. Upon opening, the new model becomes the current model. Optionally, the user may declare that the model inside that file should be identified with one of the ten labels. Acceptable values for the label field are M0 through M9. Until that model is closed, it may be accessed using its label in subsequent batch commands. The last parameter is the file name and should include the full path to the file.

- **`SAVE <Mn> [filename]`** - Where **`Mn`** is defined as one of the ten valid model labels numbered **`M0-M9`**.

  The **`SAVE`** command is used to save a model in MED format. Optionally, the user may specify the model to be saved by that model's predefined label. Acceptable values for the label field are **`M0`** through **`M9`**. If no label is given, the current model will be saved. The last parameter is the file name and should include the full path to the save file.

- **`CLOSE <Mn>`** - Where **`Mn`** is defined as one of the ten valid model labels numbered **`M0-M9`**.

  The **`CLOSE`** command is used to close a currently open model. Optionally, the user may specify the model to be closed by that model's predefined label. Acceptable values for the label field are **`M0`** through **`M9`**. If no label is given, the current model will be closed. Any unsaved changes to the given model will be lost when closed.

- **`SETCONST <Mn> [name] [value]`** - Where **`Mn`** is defined as one of the ten valid model labels numbered **`M0-M9`**.

  This command is used to set the current value of a User Defined Constant to the specified value. The name of the constant must be enclosed in double-quotes if the name contains any spaces.

- **`SETVAR <Mn> [name] [value]`** - Where **`Mn`** is defined as one of the ten valid model labels numbered **`M0-M9`**.

  This command is used to set the current value of a User Defined Numeric to the specified value. The name of the constant must be enclosed in double-quotes if the name contains any spaces.

  Note This command only sets the value of interactive variables, and is meant to replace the **`SETCONST`** command.

- **`EXECUDF <Mn>`** - Where **`Mn`** is defined as one of the ten valid model labels numbered **`M0-M9`**.

  Executes the User Defined Functions in the specified model (if given) or the current model if none is specified.

- **`EXPORT_SMZ <Mn> [job stream name] [filename]`** - Where **`Mn`** is defined as one of the ten valid model labels numbered **`M0-M9`**.

  This command is used to export a full Stream Manager ZIP file including the stream definition and all input models to the given file. The resulting SMZ cannot be used to execute the stream directly. It can, however, be very useful when testing application-specific and site-specific modules.

- **`SET [property] [value]`** - The set command is used to set a property to a specific value. Where **`[property]`** is defined as:

  - **`CURRENT`** - The current model. Valid values of **`CURRENT`** are **`M0-M9`**.

  Note At this time, only the property **`CURRENT`** (the current model) can be changed.

- **`SUB_SYS_IMPORT <Mn> [target sub-system name] [filename] [source sub-system name]`** - Where **`Mn`** is defined as one of the ten valid model labels numbered **`M0-M9`**.

  This command updates the target sub-system with given name with the components in the source sub-system found in the source model in the given MED filename. Any messages reported during the integration process will be displayed in the Message Window (if one is available) and in the Model Editor's screen file. These messages include those that would be reported if the integration was performed in the user interface as well as new error messages reported by the SUB_SYS_IMPORT command.

- **`LOGFILE [filename]`** - The logfile command is used to specify a file where messages are logged. The filename should include the full path to the log file.

- **`MACRO <Mn> [filename]`** - Where **`Mn`** is defined as one of the ten valid model labels numbered **`M0-M9`**, and `filename` is the file name which should include the full path to the file in quotes.

  This command executes the Python macro contained in the specified file.

- **`LOCK_VIEWS <Mn>`** - Where **`Mn`** is defined as one of the ten valid model labels numbered **`M0-M9`**.

  This command will lock all of the views for the specified model. The current models views will be locked if the model label is not specified. This command is not supported in headless mode.

- **`UNLOCK_VIEWS <Mn>`** - Where **`Mn`** is defined as one of the ten valid model labels numbered **`M0-M9`**.

  This command will unlock all of the views for the specified model. The current models views will be unlocked if the model label is not specified. This command is not supported in headless mode.

Plug-in Specific Commands

In addition to those commands listed above, each Model Editor code plug-in can support plug-in specific batch commands. Plug-in specific batch commands must be prefixed with the corresponding plug-in ID. For example, a TRACE import command would resemble the following:

```
TRACE IMPORT ASCII_FULL "trace_model.inp"
```

Inline File Arguments

Some plug-in specific commands require a way to specify more complex multi-line input for some commands. An *Inline File* is intended as a way to place a larger, more strictly formatted set of data as a single value argument. An *Inline File* argument must be the last argument to a batch command.

```
PLUGIN SETDESCRIPTION <
This is an example of using an Inline File to set the
description of a model.
This description can span multiple lines and will maintain
its
spacing
and formatting.
.
```

Note that the *Inline File* begins with the `<` (less than) character and ends with a `.` (period). The `<` should be at the end of the line preceding the Inline File and the `.` should be on the line after the *Inline File* on a line by itself.

Chapter 3. The Configuration Tool

The Configuration Tool is used to configure global properties for the SNAP client applications. This tool is also used to startup, shutdown, and configure the local SNAP Calculation Server.

3.1. Menu Items

The Configuration Tool includes a menu bar which contains access to various functions outlined below.

- **File -> Save All -** Saves the current configuration and notifies the running calculation server that the configuration has changed and should be refreshed. This also informs any open Model Editor or Job Status applications that the configuration has changed and should be reloaded.
- **File -> Export Public Keys -** Exports the public encryption keys used for connecting to the local Calculation Server from a remote location. Using this menu item opens a file selection dialog which may be used to specify the name and location of the key.

  Note The Outlook email application may not allow filenames that end with the .key extension.
- **File -> Generate Server Keys -** Regenerates the public encryption keys used for connecting to the Calculation Server from a remote location. All previously exported keys will be invalidated.
- **Edit -> Copy -** Copies the selected applications and/or platforms to the clipboard so duplicates can be pasted.
- **Edit -> Paste -** Inserts duplicates of the previously copied applications and/or platforms into the selected settings section.
- **Edit -> Remove -** Removes the selected applications and/or platforms.
- **Edit -> Undo -** Undoes the last change.
- **Edit -> Redo -** Re-applied the changes that were previously undone.
- **Edit -> Set Default -** This menu contains one menu item for each platform that the selected application is located on. These itemsitems set the selected application as the default for the corresponding platform.

3.2. Main Window

The Configuration Tool main window includes the same Navigator and Property View interface layout used by the Model Editor (see Section 2.1.3, “The Navigator” and Section 2.1.4, “The Main Property View”). The Navigator on the left displays a tree of nodes related to specific configurations: selecting a node displays its editable properties in the Property View on the right. Standard SNAP functionality is provided, including multi-selection edit, Undo/Redo (via toolbar buttons), Cut/Copy/Paste/Delete (via toolbar buttons and right-click pop-up menus), and pop-up help for each property.

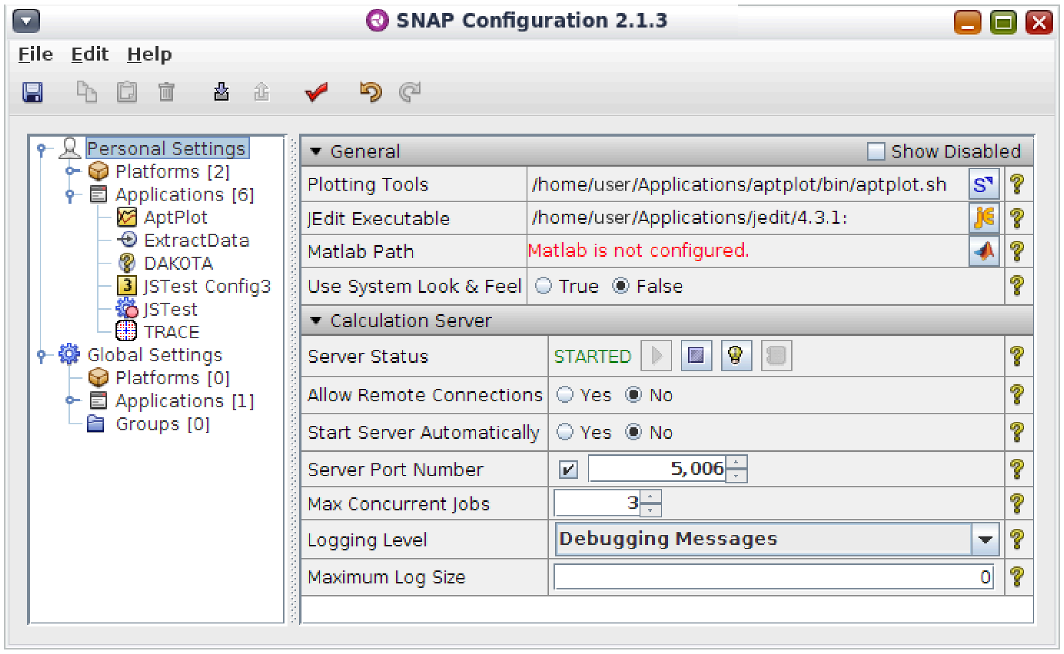
The **Check Configuration** button is available on the main toolbar of the Configuration Tool. Pressing this button will open a list of the errors, warnings, and other messages resulting from a check of the current SNAP configuration.

The Navigator has two root nodes: one for **Personal Settings** stored in the user's home folder, and one for **Global Settings** stored in a separate, locally accessible folder. Each of these nodes has a **Platforms** node containing the defined platforms and an **Applications** node containing the defined applications. Both the general SNAP settings and local calculation server settings are accessed from the **Personal Settings** node.

The **Global Settings** node contains a **Groups** node that contains additional grouped sets of platforms and applications. Portions of the **Global Settings** that are read-only (i.e. the files containing them are read-only) are displayed with a lock icon. The properties of read-only nodes are displayed in the Property View but cannot be changed.

Note The **Global Settings** only appears when a global configuration has been specified as part of the SNAP configuration. Consult your local system administrator for information related to specifying a global stream configuration.

The Configuration Tool allows a user to add or remove **Platforms**, **Applications** and **Groups** from the current site configuration. The parent tree node of each of these types includes the **New** pop-up menu item that can be used to create new instances of each type. They can then be removed by selecting the **Remove** item from the right-click pop-up menu of the **Application**, **Group**, etc..



- Personal Settings
  - Platforms [2]
  - Applications [6]
    - AptPlot
    - ExtractData
    - DAKOTA
    - JSTest Config3
    - JSTest
    - TRACE
- Global Settings
  - Platforms [0]
  - Applications [1]
  - Groups [0]

General — Show Disabled

Plotting Tools	/home/user/Applications/aptplot/bin/aptplot.sh
JEdit Executable	/home/user/Applications/jedit/4.3.1:
Matlab Path	Matlab is not configured.
Use System Look & Feel	True [✓ False]

Calculation Server

Server Status	STARTED
Allow Remote Connections	Yes [✓ No]
Start Server Automatically	Yes [✓ No]
Server Port Number	✓ 5,006
Max Concurrent Jobs	3
Logging Level	Debugging Messages
Maximum Log Size	0

Figure 3.1. Configuration Tool Main Frame

3.3. Personal Settings

Personal Settings specify local configuration which is stored in the user's `.snap` folder. Available settings range from the installation paths of utility applications used by SNAP to the configuration of the implicit local calculation server.

3.3.1. General Properties

The **General Properties** group includes options pertinent to all applications in the SNAP suite.

Plotting Tool

This property defines the installation path of the plotting tool used by client applications to plot data. For example, right-clicking on an animation component in the Model Editor will display a pop-up menu with a **Plot Data** menu item. Selecting this item will launch another dialog within which Data Channels specified for that component are listed. After selecting one or more channels and pressing the **OK** button, the specified **Plotting Tool** will be launched. Data specific to the selected channels will be provided to this application for plotting. SNAP currently supports the AcGrace and AptPlot plotting packages.

Note For AcGrace under Windows, cygwin's bin and usr\X11R6\bin directories must be included in your system path, i.e. "`c:\cygwin\bin;c:\cygwin\usr\X11R6\bin;`" without quotes.

jEdit Editor

This property defines the installation path of jEdit, used by SNAP for displaying ASCII data. jEdit is a pure-Java, programmer's text editor that was chosen for use with the SNAP system because of its stability and multitude of features.

Matlab Editor

The location of a Matlab installation used by SNAP for interfacing the Matlab Computational Engine with SNAP User-Defined Numerics (see Section 2.5, “SNAP Variables and Functions”). Upon selecting a directory, the Configuration Tool checks to see if the specified folder is valid. A Matlab installation directory is valid if it contains a subdirectory named **`bin`**, which in turn contains a directory whose name depends on the current operating system and architecture (e.g. the target folder for a 32-bit architecture running Windows is **`win32`**). System-specific shared objects necessary for proper function of the Matlab-UDN Interface are contained in this directory. A few common Matlab installation directories are listed below.

- Windows: `C:\Program Files\Matlab`, `C:\MATLAB`
- Linux/UNIX/Mac: `userhome/matlab`, where `userhome` is the path to the current user's home directory.

Use System Look & Feel

When set to **Yes**, SNAP applications will be displayed with system-specific window decorations. When set to **No**, the platform independent look and feel will be used. Turning the system look & feel **On** or **Off** requires a restart of all client applications.

Use System Look & Feel is only available on platforms for which the Configuration Tool is able to detect a system-specific look and feel, such as Microsoft Windows®.

3.3.2. Calculation Server Properties

These properties configure the implicit local Calculation Server. The Calculation Server status can be controlled using the **Server Status** property described below.

Server Status

The Server Status property can be used to start or stop the Calculation Server, as well as obtain information about an active server. The Server Status editor is displayed in Figure 3.2, “Stopped Calculation Server” and Figure 3.3, “Started Calculation Server”. The buttons on both properties are, from left to right: **Start Server**, **Stop Server**, **Show Server Status**, and **Open Log Viewer**.

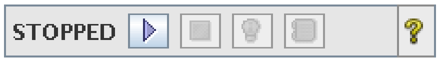


Figure 3.2. Stopped Calculation Server

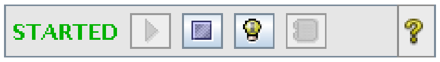


Figure 3.3. Started Calculation Server

- **Start Server -** This button activates the Calculation Server. It is only available when the Calculation Server is stopped.
- **Stop Server -** This button deactivates the Calculation Server. It is only available when the Calculation Server is running.
- **Show Server Status -** This button displays a dialog containing information about client applications connected to the currently active Calculation Server. It is only available when the Calculation Server is running.
- **Open Log Viewer -** *This feature is not yet implemented.*

Allow Remote Connections

When set to **Yes** the Calculation Server will allow connections from other users and other machines. To allow remote connections, first change **Allow Remote Connections** property to **Yes**. Then, export the server's public key to a convenient location by selecting the **Export Public Key** item from the **File** menu. This key can then be transferred to those users who require access to the server.

Note The Outlook email application may not allow filenames that end with the .key extension.

Start Server Automatically

When activated (**Yes**), the **Start Server Automatically** preference will enable the local server to startup when needed by local client applications. When not activated (**No**), the user will be prompted to startup the server instead. Client applications are considered local only if they are running on the same computer as the server (referred to as "localhost") and running as the same user as the server.

This property will enable the local server to startup automatically:

- when submitting a stream
- when browsing the local calculation server via Job Status
- when selecting a run for an animation from the local server
- when connecting an animation to the local server

Server Port Number

Defines the port number that the Calculation Server will listen on. Changing this property does not take effect until the Calculation Server has been restarted.

Max Concurrent Jobs

Sets the maximum number of tasks that the Calculation Server will execute simultaneously. Any other tasks submitted after this maximum has been reached will wait in a queue for the first available opening.

Logging Level

This parameter determines the level of detail used in writing information to the Calculation Server log file.

Maximum Log Size

The maximum size (in bytes) of the log files created by the calculation server. After reaching this limit, the current log file will be renamed **`calculation_server_1.log`** and logging will continue in a new **`calculation_server.log`**. An unlimited log file size can be set by specifying 0 for the maximum size.

Changing this property does not take effect until the Calculation Server has been restarted.

Start Server at Login

When set to **Yes** a shortcut will be placed in the **Startup** group of the user's **Start Menu**. This option is only available on Windows platforms.

Default Applications

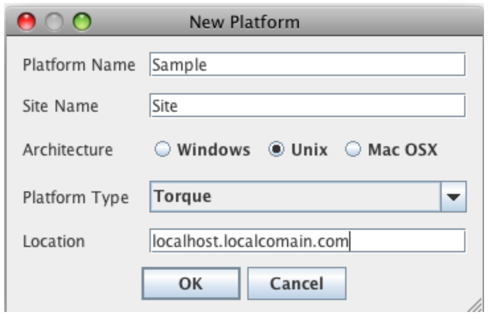
This property allows the user to select which applications should be used as the default from amongst those available on the local Calculation Server. When a default is selected, job steps of that type will use that default without selecting it explicitly. When no default is selected but there is only one application defined for the local Calculation Server then it is treated as the default.

3.4. Platforms

Platforms represent computer systems where applications may be executed. Each platform definition indicates either a calculation server or a High Performance Computing (HPC) environment, such as a cluster. A calculation server is a single machine that handles the execution of all tasks. An HPC environment distributes tasks to specific computing resources, typically nodes in a cluster.

3.4.1. Platform Creation

When a new platform is created, the platform creation dialog is displayed (see Figure 3.4, “Platform Creation Dialog”). This window is used to define the platform location and type. The new platform is added to the tree after pressing the dialog's **OK** button.


New Platform

Platform Name: Sample

Site Name: Site

Architecture: Windows [✓ Unix] Mac OSX

Platform Type: Torque

Location: localhost.localcomain.com

Figure 3.4. Platform Creation Dialog

Note Consult your local system administrator for the correct values to enter in this dialog.

Platform Name

The short, human readable name used to identify the platform to the user. It is used as the second part of the *Platform ID*. Platform Name only accepts names composed of letters, numbers, and underscores.

Note A platform's *Platform ID* must be unique within the user's Personal Settings.

Site Name

The short, human readable name used to identify the site at which the platform is located. It is used as the first part of the *Platform ID*. Specifies the name by which the platform will be identified. Site Name only accepts names composed of letters, numbers, and underscores.

Architecture

The architecture (i.e. operating system) of the computing system represented by this platform. Available selections include Windows, Unix, and Mac OS X. This must be correctly specified so that the stream manager can use the correct line endings when writing files and the correct file path separators when locating files.

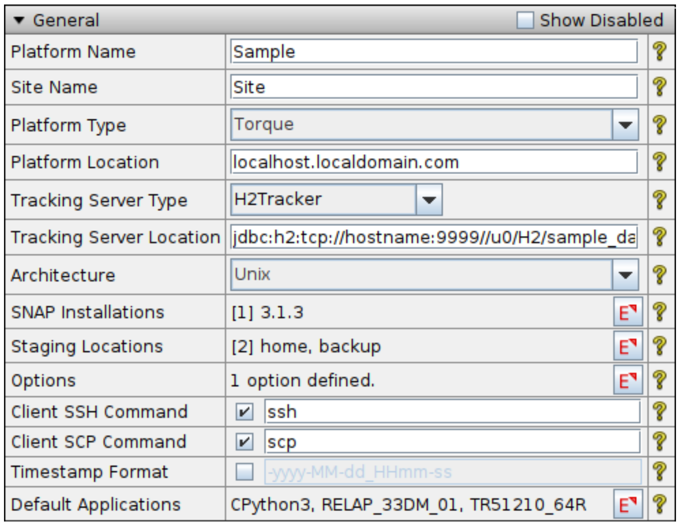
Platform Type

The name of the Platform Module that will be used to manage access to this platform. This can either be a calculation server or one of the HPC-specific platform modules loaded by the Configuration Tool at start-up.

Location

The location of this platform as defined by the Platform Module. For a calculation server, this is the host name and port on which the server is accessed, in the form "**`hostname:port`**" (sans quotes). Otherwise, this value is interpreted in a manner specific to the selected platform module. Typically this is the host name or IP address of the HPC resource. For the Torque platform reference implementation, this value is the hostname of the main cluster node.

3.4.2. Platform Properties



▾ General ☐ Show Disabled

Platform Name	Sample
Site Name	Site
Platform Type	Torque
Platform Location	localhost.localdomain.com
Tracking Server Type	H2Tracker
Tracking Server Location	jdbc:h2:tcp://hostname:9999//u0/H2/sample_da
Architecture	Unix
SNAP Installations	[1] 3.1.3
Staging Locations	[2] home, backup
Options	1 option defined.
Client SSH Command	✓ ssh
Client SCP Command	✓ scp
Timestamp Format	☐ -yyyy-MM-dd_HHmm-ss
Default Applications	CPython3, RELAP_33DM_01, TR51210_64R

Figure 3.5. Platform Properties

Note Consult your local system administrator for the correct values to enter for these properties.

Platform Name

The short, human readable name used to identify the platform to the user. It is used as the second part of the *Platform ID*. Platform Name only accepts names composed of letters, numbers, underscores, and periods.

Note A platform's *Platform ID* must be unique within the user's Personal Settings.

Site Name

The short, human readable name used to identify the site at which the platform is located. It is used as the first part of the *Platform ID*. Specifies the name by which the platform will be identified. Site Name only accepts names composed of letters, numbers, underscores, and periods.

Note A platform's *Platform ID* must be unique within the user's Personal Settings.

Platform Type

The name of the Platform Module that will be used to manage access to this platform. This can either be a calculation server or one of the HPC-specific platform modules loaded by the Configuration Tool at start-up.

Platform Location

The location of this platform as defined by the Platform Module. For a calculation server, this is the host name and port on which the server is accessed, in the form "**`hostname:port`**" (sans quotes). Otherwise, this value is interpreted in a manner specific to the selected platform module. Typically this is the host name or IP address of the HPC resource. For the Torque platform reference implementation, this value is the hostname of the main cluster node.

Tracking Server Type

Defines the type of tracking database server associated with this platform. As a stream executes, the tracking server is updated with status information. The H2Tracker reference implementation is provided with Job Stream; this tracker stores stream status information in an H2 database. This property is not available for Calculation Server platforms.

Tracking Server Location

The JDBC URL that identifies the location of the tracking database server. This property is not available for Calculation Server platforms.

Architecture

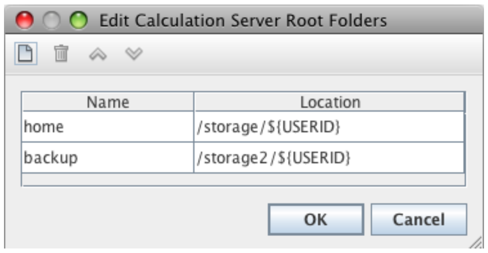
The architecture (i.e. operating system) of the computing system represented by this platform. Available selections include Windows, Unix, and Mac OS X. This must be correctly specified so that the stream manager can use the correct line endings when writing files and the correct file path separators when locating files.

SNAP Installations

The location of each version of SNAP installed on this platform.

Staging Locations

The locations where intermediate files, such as the stream definition, will be stored while a job stream is running. The **Edit** button for this property opens the Staging Locations dialog, shown in Figure 3.6, "Staging Locations Dialog". This dialog allows the user to define the available staging locations for the platform.



Name	Location
home	/storage/${USERID}
backup	/storage2/${USERID}

Figure 3.6. Staging Locations Dialog

The following tokens can be included in a *Location* and will be replaced automatically.

- *${USERID}* - The current user name.

- *${USERID_LOWER}* - The current user name in all lower-case characters.
- *${USERID_UPPER}* - The current user name in all upper-case characters.
- *${SNAPINSTALL}* - The SNAP installation folder.

Options

The set of custom options provided as defaults to the Platform Module for this platform. For example, the TORQUE_BIN property for the Torque/MAUI clustering system.

Client SSH Command

The remote secure shell command that will be used when communicating with the platform from this client.

Warning: If the full path to the SSH executable is included it must not contain spaces.

Client SCP Command

The remote secure copy command that will be used when sending files to the staging location for this platform.

Warning: If the full path to the SCP executable is included it must not contain spaces.

Timestamp Format

The format used to append the current date/time to the name of each stream when it is submitted. This is used to name the stream (for tracking) as well as the stream definition transmitted to the platform. The following pattern letters are available:

- y - Year
- M - Month in year
- d - Day in month
- a - AM/PM Marker
- H - Hour in day (0-23)
- k - Hour in day (1-24)
- K - Hour in am/pm (0-11)
- h - Hour in am/pm (1-12)
- m - Minute in hour
- s - Second in minute
- S - Millisecond
- z - Timezone

- Z - Timezone

The default timestamp is: -yyyy-MM-dd_HHmm-ss

For example: If 'MyStream' was submitted at noon on the fourth of July the stream would be submitted as: MyStream-2010-07-04_1200-00 Pattern letters are usually repeated, as their number determines the exact presentation.

_yyyyMMdd_HHmmss	MyStream_20100704_120000
yyyy.MM.dd-HH:mm:ss	2001.07.04-12:08:56
yyyyy.MMMMM.dd-hh:mmaaa	02001.July.04-12:08PM
EEE_d_MMM_yyyy_HH:mm:ssZ	Wed_4_Jul_2001_12:08:56-0700
yyMMddHHmmssZ	010704120856-0700

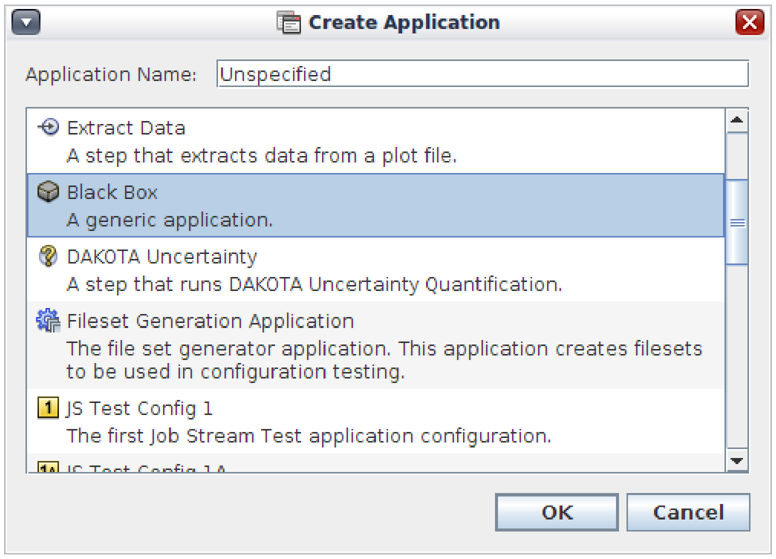
Table 3.1. Examples

Default Applications

This property allows the user to select which applications should be used as the default from amongst those available on the platform. When a default is selected, job steps of that type will use that default without selecting it explicitly. When no default is selected but there is only one application defined for the platform then it is treated as the default.

3.5. Applications

Applications represent executables that may be launched as part of a job stream. Each application corresponds to a job step that may be added to the stream. Consequently, each step represents the execution of one or more tasks utilizing that executable. When adding a new application, the **Create Application** dialog is displayed, as shown in Figure 3.7, “Create Application Dialog”. Within this dialog, the type of application being created is selected. Available application types are loaded from the SNAP installation `plugins` directory.


Create Application

Application Name: Unspecified

Extract Data
A step that extracts data from a plot file.

Black Box
A generic application.

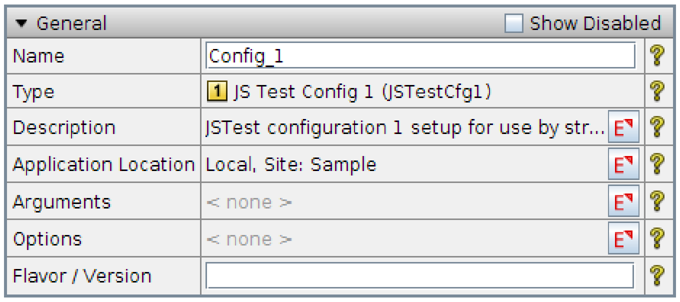
DAKOTA Uncertainty
A step that runs DAKOTA Uncertainty Quantification.

Fileset Generation Application
The file set generator application. This application creates filesets to be used in configuration testing.

JS Test Config 1
The first Job Stream Test application configuration.

Figure 3.7. Create Application Dialog

Applications have the following properties as shown in Figure 3.8, “Application Properties”.



General	Show Disabled
Name	Config_1
Type	1 JS Test Config 1 (JSTestCfg1)
Description	JSTest configuration 1 setup for use by str...
Application Location	Local, Site: Sample
Arguments	< none >
Options	< none >
Flavor / Version	

Figure 3.8. Application Properties

Name

The name by which the application is identified within a stream. Application names allow letters, numbers, and underscores. Application definition names must be unique within the user's Personal Settings.

Note Steps identify the application used to run them by name. Changing the name of an application referenced by a step will invalidate streams used in this SNAP configuration until the application references are manually adjusted.

Type

The application type selected when the application was created. This value cannot be changed.

Description

An arbitrary description of the application. This text is shown in dialogs used to select the application associated with a particular job step.

Arguments

This is the list of command-line arguments that will be applied to the application when executed. Arguments should be entered separately, one per row. This eliminates the need to "escape" spaces, backslashes(\), etc..

For example: The arguments for the command "myprogram -i inputfile -o outputfile" would be entered as:

1. -i
2. inputfile
3. -o
4. outputfile

Options

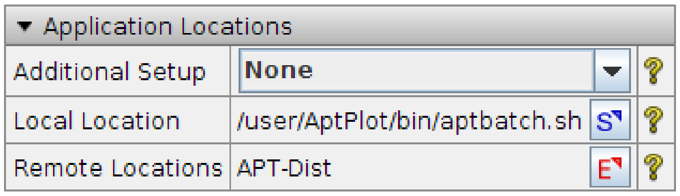
Job Steps may provide additional options that can be configured through this property. Each additional option is specified as a name/value pair, which is then interpreted by the step and/or wrapper as needed. Consult the application documentation for any additional options provided for the step.

Flavor/Version

The flavor and/or version of the application. This optional value serves as an additional indication to the application of how this executable should be handled.

Application Locations

The **Application Locations** attribute group holds all the properties related to specifying the location of the application, both on the local machine and on other platforms.



Application Locations	
Additional Setup	None
Local Location	/user/AptPlot/bin/aptbatch.sh
Remote Locations	APT-Dist

Figure 3.9. Application Location Properties

The following properties are available.

- **Additional Setup** - Specifies any additional setup required for the application. It has the following values:
  - **None** - The most common setup, this indicates an application that will be executed from its specified location.
  - **Retrieve Executable** - The executable at the specified location will be copied to either the working directory of associated steps or the staging location (pending **Target Location**).
  - **Extract ZIP Archive** - The ZIP archive at the specified location will be extracted to either the working directory of associated steps or the staging location (pending **Target Location**).
  - **Run Installer** - The installer at the specified location will be executed to either the working directory of associated steps or the staging location (pending **Target Location**).

- **Local Location**, **Retrieve From**, **ZIP Location**, **Installer Location** - The location of the executable, ZIP archive, or installer specified by the application.

- **Target Location** - Indicates whether the file specified by the Location property above is managed. With **Working Directory**, the file will be copied to, extracted at, or installed at the working directory of associated steps. For **Staging Location**, the file will be handled at the stream staging location. This property is only available for **Additional Setup** values other than **None**.

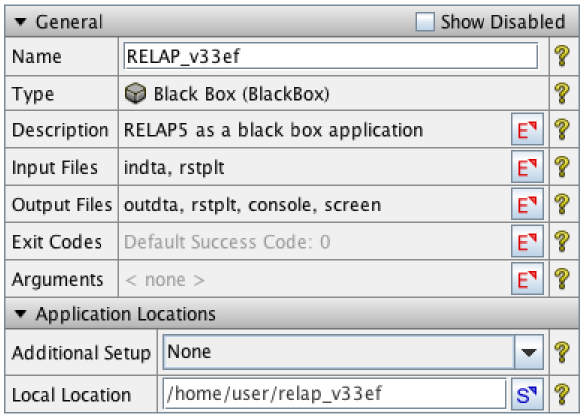
- **Executable Name** - The name of the executable. This value has different meanings depending on the value of **Additional Setup**. For **Retrieve Executable**, this is the name that the executable will be given when copied to its destination. For **Extract ZIP Archive** and **Run Installer**, this value specifies a relative path to the executable (including the name of the executable itself) that will be created after extraction or installation. This property is only available for **Additional Setup** values other than **None**.

- **Remote Locations** - Specifies the **Location** of the executable, archive, or installer on other platforms. This property is only available when at least one Platform is defined whose **Platform Type** is not set to **Calculation Server**.

3.6. Black Box Applications

Black box applications are used to add simple applications, such as PERL scripts or other custom executables, to a job stream without building a full application plug-in. Black boxes are intended to be extremely simple. Anything that requires more complicated behavior should be built as an application plug-in.

Black Box application definitions have the following properties, as shown in Figure 3.10, "Black Box Properties". All properties serve the same purpose as those described in Section 3.5, "Applications", with the following additional attributes.

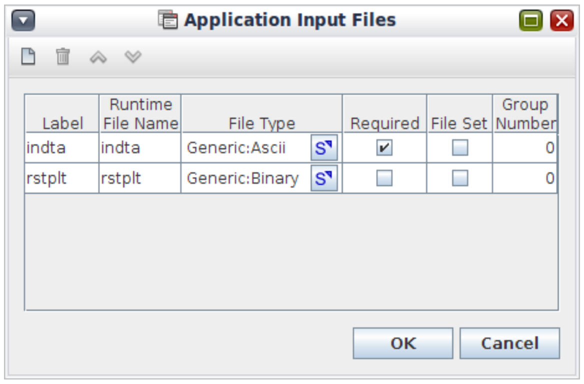


Name	RELAP_v33ef
Type	Black Box (BlackBox)
Description	RELAP5 as a black box application
Input Files	indta, rstplt
Output Files	outdta, rstplt, console, screen
Exit Codes	Default Success Code: 0
Arguments	< none >
Additional Setup	None
Local Location	/home/user/relap_v33ef

Figure 3.10. Black Box Properties

Input Files

The input files must be defined for a black box application. Each input file required by the black box application must be defined, with a unique label, a unique runtime file name, and a file type specified.

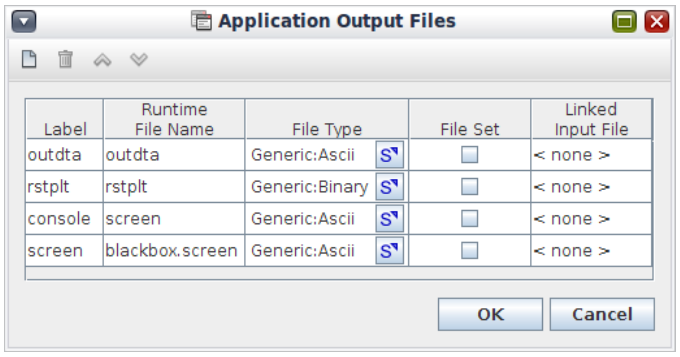


Label	Runtime File Name	File Type	Required	File Set	Group Number
indta	indta	Generic:Ascii	✓	☐	0
rstplt	rstplt	Generic:Binary	☐	☐	0

Figure 3.11. Black Box Inputs

Output Files

The output files dialog is used to specify the application outputs for a black box. The output files from the application may be used in downstream job steps and can be copied to a custom storage location after the job step completes. Each output file of a black box must define a unique output label, a unique runtime filename, and a file type.



Label	Runtime File Name	File Type	File Set	Linked Input File
outdta	outdta	Generic:Ascii	☐	< none >
rstplt	rstplt	Generic:Binary	☐	< none >
console	screen	Generic:Ascii	☐	< none >
screen	blackbox.screen	Generic:Ascii	☐	< none >

Figure 3.12. Black Box Outputs

Exit Codes

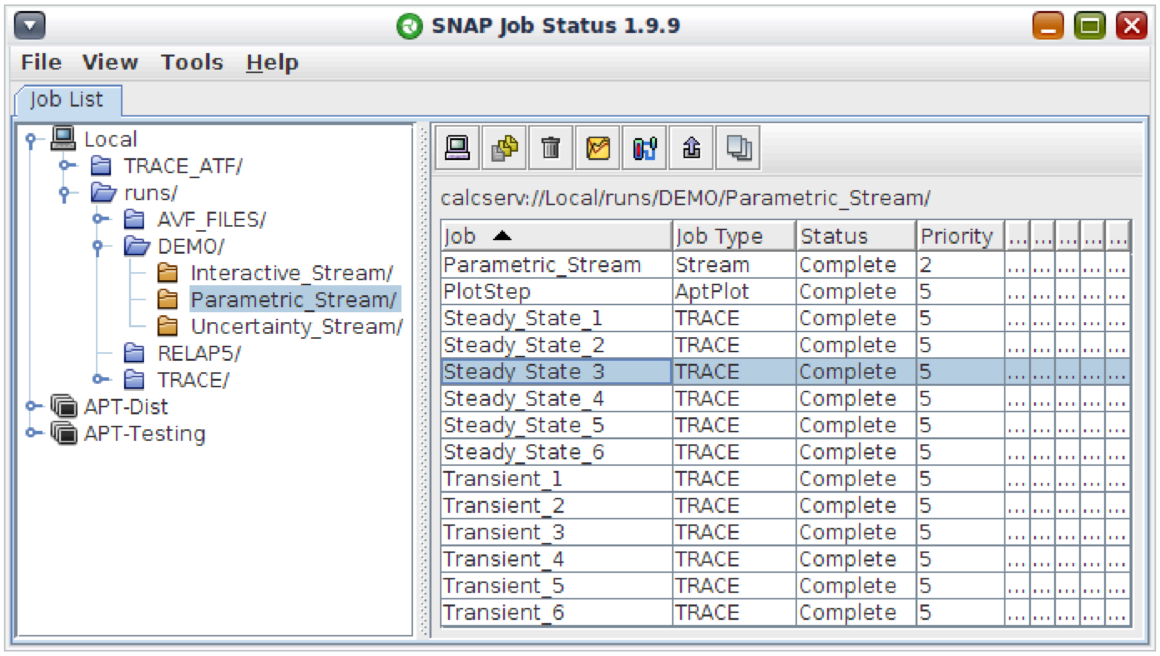
Black Box applications are assumed, by default, to use a zero exit code to indicate success. Some applications, however, return non-zero exit codes to indicate an otherwise successful execution that produced non-fatal warnings. The Exit Codes property can be used to specify which of these exit codes should be considered successful for a Black Box application.

Chapter 4. Job Status

The Job Status application is a client application which details the status of jobs submitted to a Calculation Server. It also provides support for adding connections to remote Calculation Servers and importing local files into the list of jobs available on the local Calculation Server.

4.1. Job List

The Job Status User Interface (UI) is composed of a Job Navigator on the Left and a Job Panel on the right. These are placed in a **Job List** tab at the top of the application, used to differentiate between the core Job Status UI and Job Consoles (see Section 4.3, “Job Consoles”), which are opened as additional tabs. This section describes the **Job List** tab.



calcserv://Local/runs/DEMO/Parametric_Stream/

Job	Job Type	Status	Priority	...	...	...	...	...
Parametric_Stream	Stream	Complete	2	...	...	...	...	...
PlotStep	AptPlot	Complete	5	...	...	...	...	...
Steady_State_1	TRACE	Complete	5	...	...	...	...	...
Steady_State_2	TRACE	Complete	5	...	...	...	...	...
Steady_State_3	TRACE	Complete	5	...	...	...	...	...
Steady_State_4	TRACE	Complete	5	...	...	...	...	...
Steady_State_5	TRACE	Complete	5	...	...	...	...	...
Steady_State_6	TRACE	Complete	5	...	...	...	...	...
Transient_1	TRACE	Complete	5	...	...	...	...	...
Transient_2	TRACE	Complete	5	...	...	...	...	...
Transient_3	TRACE	Complete	5	...	...	...	...	...
Transient_4	TRACE	Complete	5	...	...	...	...	...
Transient_5	TRACE	Complete	5	...	...	...	...	...
Transient_6	TRACE	Complete	5	...	...	...	...	...

Figure 4.1. The Job Status UI

The Navigator to the left represents a logical hierarchy of platforms (a.k.a. servers) and folders. Each platform can be expanded into a list of mounted folders, which can in turn be expanded into a list of sub-folders. Selecting an item in this view changes the contents of the Job Panel, displaying the jobs run at that location.

Note Platforms are added and removed in the Configuration Tool (see Section 3.4, “Platforms”).

Right-click pop-up menus are available for each platform and folder displayed in the Job Navigator. The contents of each of these menus are described below.

The Calculation Server's pop-up menu contains the following menu items:

- **Connect** - Attempt to make a connection to the server. This may show a failed icon if the server is unavailable or the specified server key is invalid.
- **Disconnect** - Disconnects from the server.
- **Reconnect** - Disconnects from the server and attempts to reconnect. This option is equivalent to using the **Disconnect** and **Connect** options above.
- **Mount Root Folder** - Opens a file selection dialog for specifying a folder on the local Calculation Server which should be mounted as a root folder. For more information on this functionality, refer to Section 4.2, "Root Folders and Sub-Folders".

  Note Root folders cannot be mounted or unmounted for remote Calculation Servers.

The folder pop-up menu contains the following menu items:

- **Create Folder** - Creates a new sub-folder within the selected folder. Selecting this option opens a dialog which requests a name for the new folder.
- **Rename Folder** - Opens a dialog for renaming the folder. This option is not available for root folders.
- **Remove Folder** - Removes a folder from the Calculation Server. This option is not available for root and non-empty folders.
- **Import Completed Job** - Imports a job from the selected folder into the Calculation Server. For more information, refer to Section 4.5, "Importing Jobs".
- **Unmount [folder name]/** - Unmounts the folder, removing it from the Job Navigator. This option is only available to folders that have been mounted as root folders; it is not available for subfolders.

4.1.1. Menu Items

The Job Status menu bar contains several menus, described here. The **File** menu contains only one item, **Exit**, which closes JobStatus. The **View** menu contains one check-box per column in the Job Panel table. Each check-box toggles the corresponding column's visible status.

The **Tools** menu contains entries specific to the currently selected job. It has the following items:

- **Console Output** - Displays the Console View detailing the status of the selected job. This option is only available for calculations that are currently active (i.e. running, interactive, paused, etc.)
- **View Files** - this menu is used to view or open files associated with the given job. The secondary sub-menus, described below, organizes the file types supported by Job Status.
  - **Documents** - word processor documents, such as OpenDocument Format (ODF) files. Files opened from this category are opened in the system's native document viewer associated with the given file's type.
  - **Images** - image files, such as JPG, GIF, and PNG files. Images are opened with the system's native image viewer.

  - **PDFs -** Portable Document Format files, a platform-independent file type used to preserve exact document formatting between machines, operating systems, and individual viewers. PDFs are opened with the system's native PDF viewer.

  - **Plot Files -** job data files, containing results of the calculation as multiplexed or demultiplexed plot data. Plot files are opened in AptPlot (see Section 3.3.1, “General Properties” for info on configuration AptPlot with SNAP). After loading the file, AptPlot will display a list of channels in the file.

  - **Text Files -** ASCII text files. Opening a text file opens the File Viewer, described in Section 4.4, “File Viewer”.

  Note With the exception of **Text Files**, files cannot be displayed for remote Calculation Servers.

- **Plot -** Opens the selected job file for plotting. The application used to open the file is specified by the Plotting Tool property in the Configuration Tool (see Section 3.3.2, “Calculation Server Properties ”). This option is only available when the job has been loaded.

- **Send Command -** Displays a dialog for sending an interactive command to the selected job. This option is only available for interactive calculations.

- **Terminate -** Terminates the selected job, ending the underlying process. This action sends an early termination signal to the process and does not attempt to shut it down gracefully. This option is only available for jobs that are currently active.

- **Change Priority -** Changes the priority of the selected job. This priority determines the order in which jobs are started by the Calculation Server. Otherwise, jobs are selected based on the order of their submission into the queue. Larger numbers correspond to higher priorities. This option is only available for jobs waiting to be started in the job queue.

- **Load Data -** Loads a completed job into memory. Most options in the **Tools** menu can only be activated after a job has been loaded.

- **Unload Data -** Unloads a job, freeing any system resources, (such as cached plot records) used by the job.

- **Animate -** Animates the selected job in the Model Editor with its associated post-processing MED. Animate functions identically to **Animate With** when no animation model has been associated with the currently selected job.

- **Animate With -** Animates the selected job in the Model Editor with a post-processing MED selected in a file browser. After selecting a file via Animate With, the same MED can be animated for that task with the **Animate** item.

- **Release -** Releasing a job removes the Calculation Job File (.cjf) but does not remove any of the job's data files.

- **Delete -** Removes the job from the Calculation Server. This removes the Calculation Job File (*.cjf) as well as any data files associated with the job.

Note Most **Tools** options require that a job first be loaded into the calculation server.

The **Help** menu contains the following items:

- **Help Topics -** Displays the Job Status SNAP help set.
- **Included Technologies -** Displays a dialog listing various technologies included in SNAP and their corresponding licenses.

4.1.2. Job Panel Toolbar

The toolbar in the Job Panel provides several tools for the currently selected job in the table. The provided tools can change depending on the currently selected job, its type, and its status. Below is a description of the available tools.

Job Console - Opens a Job Console for the selected job. See Section 4.3, “Job Consoles” for a description of the Job Console.

Terminate - Terminates the selected job, ending the underlying process. This action sends an early termination signal to the process and does not attempt to shut it down gracefully. This option is only available for jobs that are currently active.

Send Command - Displays a dialog for sending an interactive command to the selected job. This option is only available for interactive calculations.

Release - Releasing a job removes the Calculation Job File (.cjf) but does not remove any of the job's data files.

Delete - Removes the job from the Calculation Server. This removes the Calculation Job File (*.cjf) as well as any data files associated with the job.

Plot - Opens the selected job file for plotting. The application used to open the file is specified by the Plotting Tool property in the Configuration Tool (see Section 3.3.2, “Calculation Server Properties”). This option is only available when the job has been loaded.

Animate - Animates the selected job in the Model Editor with its associated post-processing MED. If no suitable MED has been associated with the job, a file browser will be displayed to select an appropriate model.

Load Data - Loads a completed job into memory. Most options in the **Tools** menu can only be activated after a job has been loaded.

Unload Data - Unloads a job, freeing any system resources, (such as cached plot records) used by the job.

View Files - opens a pop-up menu used to view or open files associated with the given job. See Section 4.1.1, “Menu Items” for a description of the **View Files** menus.

4.1.3. Status Indicators

Several status indicators can be placed over folders in the Navigator to indicate activity, either in the folder or in some sub-folder.

▷ **Running** - At least one task is running in the indicated folder. This status has the highest priority of the various status indicators: other jobs in the folder could be paused or waiting, and sub-folders could be active.

⏸ **Paused** - At least one interactive task is paused in the indicated folder. This status has higher priority than **Waiting** and **Active**:

🕒 **Waiting** - At least one task is waiting to begin execution in the indicated folder. This status has higher priority than **Active**.

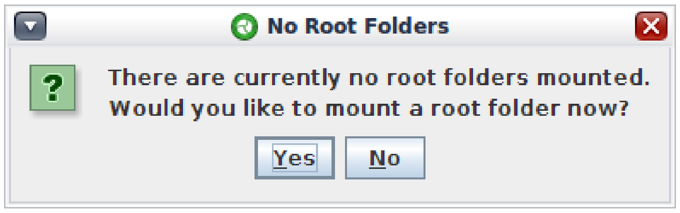
● **Active/Loaded** - Indicates that a job in the folder has either been loaded or that some sub-folder has some type of activity, such as running, paused, waiting, or loaded jobs. This is the lowest priority indicator: any folder containing running, paused, or waiting jobs will not display the **Active** status.

Folders without any of these indicators are *inactive*: no jobs in the folder or any of its sub-folders are running, paused, waiting, or loaded.

4.2. Root Folders and Sub-Folders

The Calculation Server includes support for multiple Root Folders (with sub-folders) that can contain any number of jobs. These Root Folders can be mounted in Job Status by selecting the Mount Root Folder item from the right-click pop-up menu of the local Calculation Server node, **Local**. These folders can be unmounted by selecting the **Unmount** item from the right-click pop-up menu for the folder. Unmounting a folder does not remove any data contained in that folder.

To mount or unmount folders, the server's node must first be expanded to make a connection to the server. If no root folders are mounted on the Local server, a prompt will be shown allowing the user to mount one (Figure 4.2, "No Root Folders Prompt").


No Root Folders

There are currently no root folders mounted.
Would you like to mount a root folder now?

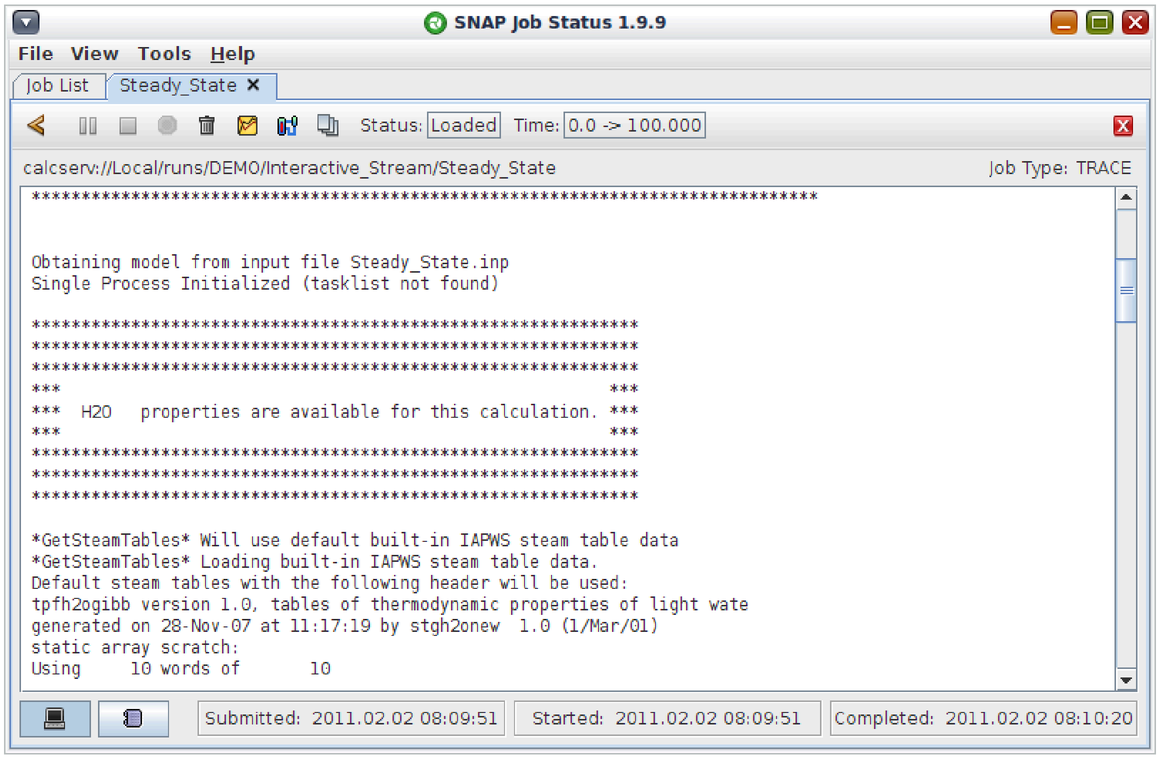
Figure 4.2. No Root Folders Prompt

Sub-folders can be created by selecting the parent folder and selecting the **Create Folder** item from the right-click pop-up menu. These sub-folders can also be renamed or deleted by selecting the **Rename Folder** or **Delete Folder** item from the right-click pop-up menu of the folder.

Note Only completely empty folders can be removed through Job Status.

4.3. Job Consoles

A Job Console for a specific task can be opened by pressing the **Job Console** button in the toolbar, or by double-clicking the row in the Job Panel table. A sample console is shown in Figure 4.3, “Sample Job Console for a TRACE Job”. The central area is the heart of any Job Console, displaying the console output of the job as it runs. Additional features are described below.


SNAP Job Status 1.9.9
File View Tools Help
Job List
Steady_State
Status: Loaded
Time: 0.0 -> 100.000
calcserv://Local/runs/DEMO/Interactive_Stream/Steady_State
Job Type: TRACE
Submitted: 2011.02.02 08:09:51
Started: 2011.02.02 08:09:51
Completed: 2011.02.02 08:10:20

```
*******************************************************************************


Obtaining model from input file Steady_State.inp
Single Process Initialized (tasklist not found)

*************************************************************
*************************************************************
*************************************************************
***                                                       ***
***  H2O   properties are available for this calculation. ***
***                                                       ***
*************************************************************
*************************************************************
*************************************************************

*GetSteamTables* Will use default built-in IAPWS steam table data
*GetSteamTables* Loading built-in IAPWS steam table data.
Default steam tables with the following header will be used:
tpfh2ogibb version 1.0, tables of thermodynamic properties of light wate
generated on 28-Nov-07 at 11:17:19 by stgh2onew  1.0 (1/Mar/01)
static array scratch:
Using     10 words of       10
```

Figure 4.3. Sample Job Console for a TRACE Job

The actions in the console toolbar function identically to those described in Section 4.1.2, “Job Panel Toolbar”, with the following additional items.

Select Job - This button causes Job Status to switch to the **Job List** tab, expand the folder path to location of the job represented by this console, and select the job in the Job Panel table.

Play - Resume calculation for paused jobs. This button is only available for interactive jobs.

Pause - Suspends calculation for running jobs. This button is only available for interactive jobs.

Stop - End the current job. Unlike terminate, this button sends an interactive command to the job telling it to complete, rather than killing the process. This button is only available for interactive jobs.

Close Console - Closes this Job Console tab. Consoles can also be closed with the **X** button in the console tab. Closing the Job Console does not terminate or stop the underlying job.

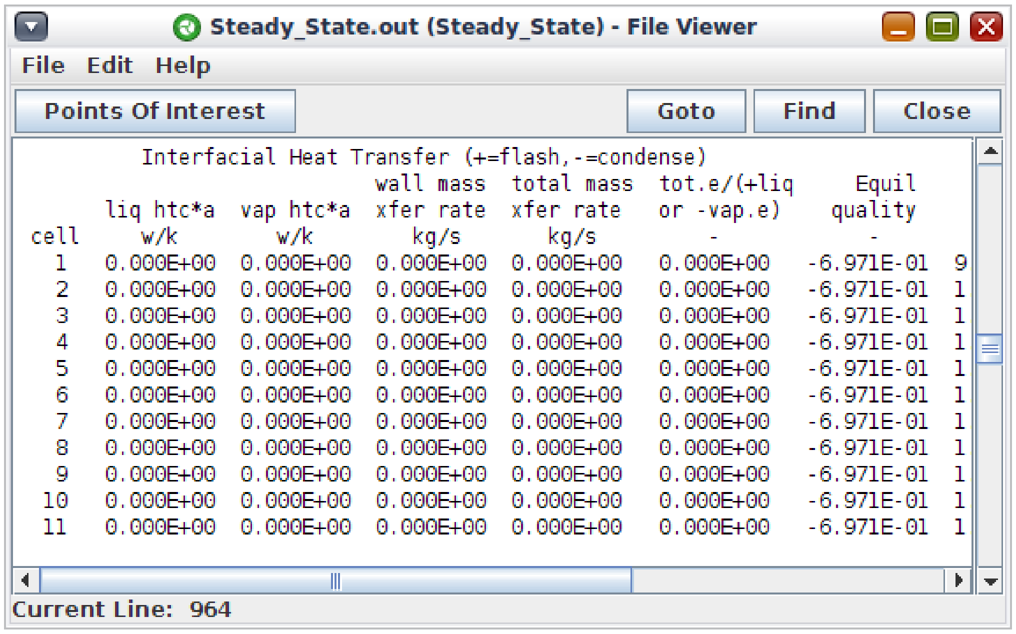
Job Consoles for most tasks will display a pair of toggle buttons in the lower left corner used to control the output displayed in the central text area.

Screen - When selected, the console output of the underlying job process will be displayed.

Task - When displayed, the 'task log' will be displayed. This log details the execution of the task relative to its parent job stream.

4.4. File Viewer

When displaying a text file, the File Viewer is shown, as seen in Figure 4.4, "File Viewer displaying a TRACE Output". This window can display the contents of text files on local or remote calculation servers, and provides the additional functionality described below.



```
         Interfacial Heat Transfer (+=flash,-=condense)
                               wall mass  total mass  tot.e/(+liq     Equil
      liq htc*a   vap htc*a   xfer rate   xfer rate   or -vap.e)     quality
cell     w/k         w/k        kg/s        kg/s          -             -
  1   0.000E+00   0.000E+00   0.000E+00   0.000E+00   0.000E+00   -6.971E-01  9
  2   0.000E+00   0.000E+00   0.000E+00   0.000E+00   0.000E+00   -6.971E-01  1
  3   0.000E+00   0.000E+00   0.000E+00   0.000E+00   0.000E+00   -6.971E-01  1
  4   0.000E+00   0.000E+00   0.000E+00   0.000E+00   0.000E+00   -6.971E-01  1
  5   0.000E+00   0.000E+00   0.000E+00   0.000E+00   0.000E+00   -6.971E-01  1
  6   0.000E+00   0.000E+00   0.000E+00   0.000E+00   0.000E+00   -6.971E-01  1
  7   0.000E+00   0.000E+00   0.000E+00   0.000E+00   0.000E+00   -6.971E-01  1
  8   0.000E+00   0.000E+00   0.000E+00   0.000E+00   0.000E+00   -6.971E-01  1
  9   0.000E+00   0.000E+00   0.000E+00   0.000E+00   0.000E+00   -6.971E-01  1
 10   0.000E+00   0.000E+00   0.000E+00   0.000E+00   0.000E+00   -6.971E-01  1
 11   0.000E+00   0.000E+00   0.000E+00   0.000E+00   0.000E+00   -6.971E-01  1
```

Figure 4.4. File Viewer displaying a TRACE Output

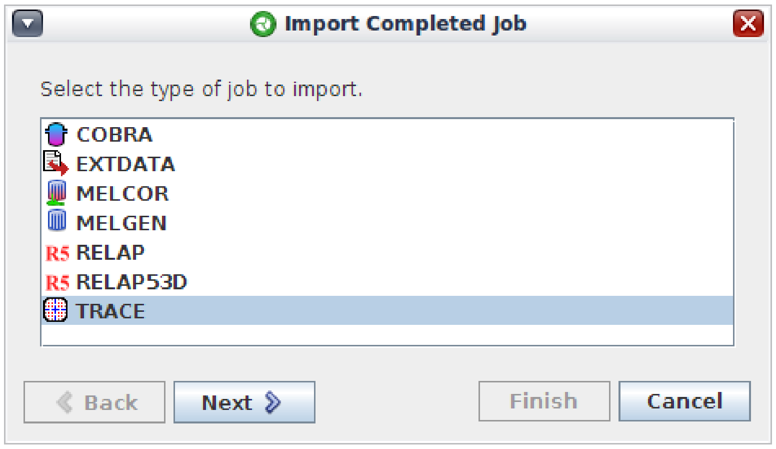
The **Points of Interest** button opens a window used to jump to areas of interest in the text file. Points are interest are defined on a plug-in by plug-in basis. The **Goto** button can be used to jump to a specific line in the file, with line numbers starting at 1. The **Find** button allows searching the file for a specific piece of text.

4.5. Importing Jobs

Job Status allows importing jobs for use by SNAP. The primary motivation for importing a job is typically to use it as a source of data in a post-processing model. In addition, all other job management features provided by SNAP are available for imported jobs.

To import a job, its corresponding files must first reside in a root folder or one of its sub-folders. The actual names of the files and their organization vary by plug-in, but typically the files should all reside in a sub-folder with the name of the job that will be imported. So if the hypothetical job `SteadyState` in the folder `DEMO` is to be imported, its files will be in the folder `DEMO/SteadyState`.

Selecting **Import Completed Job** from the parent folder's right-click pop-up menu begins the import process, opening the dialog shown in Figure 4.5, “Job Import: First Step”. This dialog is a *wizard*: choices made at each step determine the results of the next step. At any time, steps can be traversed with the **Back** and **Next** buttons.

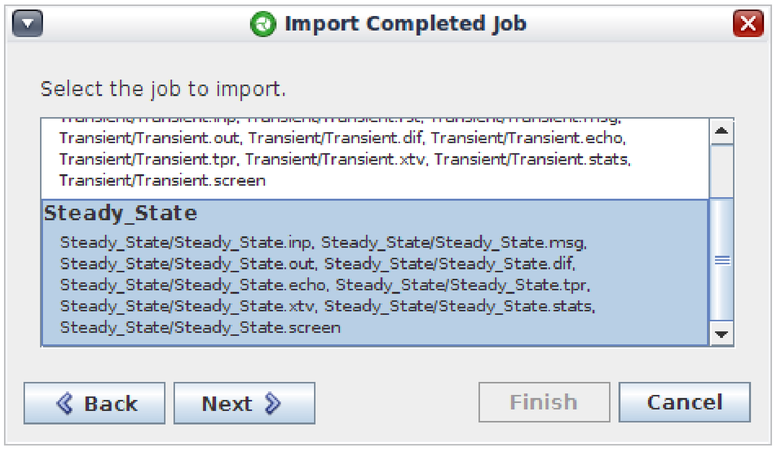


Select the type of job to import.

- COBRA
- EXTDATA
- MELCOR
- MELGEN
- RELAP
- RELAP53D
- TRACE

Figure 4.5. Job Import: First Step

The first step of importing a job is to indicate its type. All plug-ins that support importing jobs will be listed. Pressing the **Next** button moves to the second step, as shown in Figure 4.6, “Job Import: Second Step”.



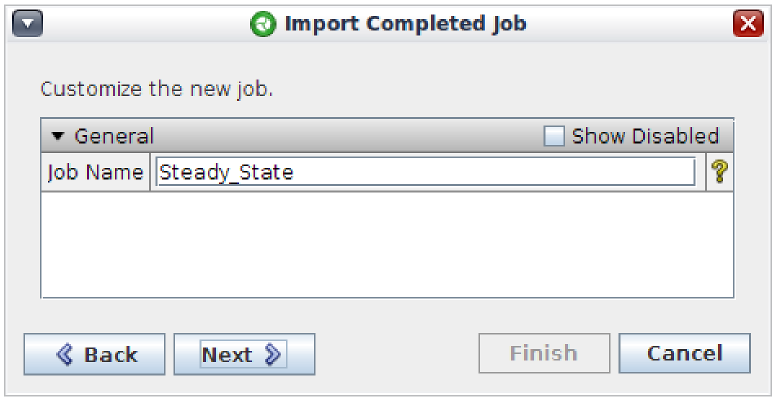
Select the job to import.

Transient/Transient.out, Transient/Transient.dif, Transient/Transient.echo,
Transient/Transient.tpr, Transient/Transient.xtv, Transient/Transient.stats,
Transient/Transient.screen

Steady_State
Steady_State/Steady_State.inp, Steady_State/Steady_State.msg,
Steady_State/Steady_State.out, Steady_State/Steady_State.dif,
Steady_State/Steady_State.echo, Steady_State/Steady_State.tpr,
Steady_State/Steady_State.xtv, Steady_State/Steady_State.stats,
Steady_State/Steady_State.screen

Figure 4.6. Job Import: Second Step

In the second step, any combination of files that the plug-in job importer recognize as a potential job will be listed. In the figure, a job titled **Steady_State** has been recognized by the TRACE importer, and all the corresponding files in the `State_State` folder are listed. The **New_Undefined_Job** entry at the top of the list can be used to enter a job manually. Undefined jobs will not have the benefit of the default values created by selecting a job from the list: each entry will have to be manually specified.



Import Completed Job

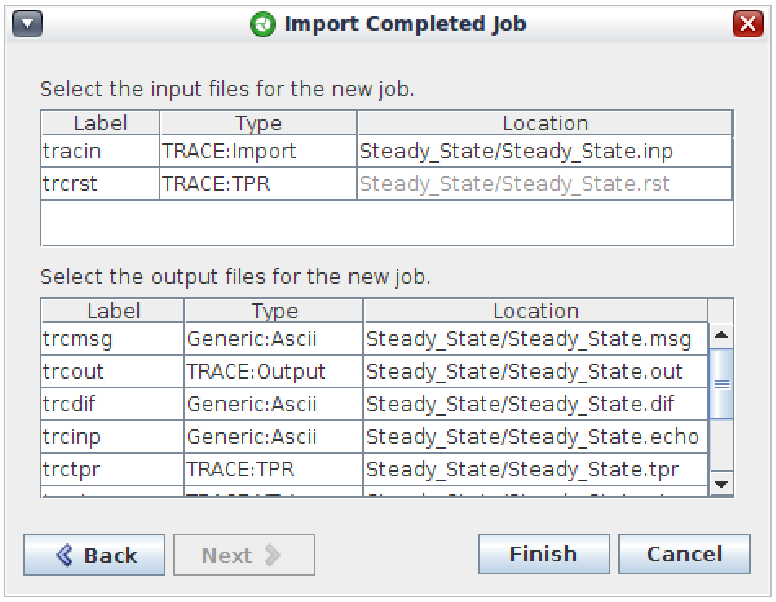
Customize the new job.

General — Show Disabled

Job Name	Steady_State

Figure 4.7. Job Import: Third Step

The third step, shown in Figure 4.7, “Job Import: Third Step”, is used to specify the name of the new imported job. Any additional properties required by the plug-in job importer will also be displayed here. Unless importing a new, undefined job, changing the name of the imported job is strongly recommended against.



Import Completed Job

Select the input files for the new job.

Label	Type	Location
tracin	TRACE:Import	Steady_State/Steady_State.inp
trcrst	TRACE:TPR	Steady_State/Steady_State.rst

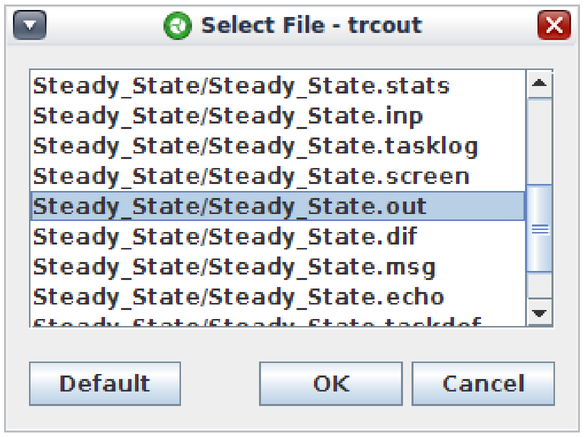
Select the output files for the new job.

Label	Type	Location
trcmsg	Generic:Ascii	Steady_State/Steady_State.msg
trcout	TRACE:Output	Steady_State/Steady_State.out
trcdif	Generic:Ascii	Steady_State/Steady_State.dif
trcinp	Generic:Ascii	Steady_State/Steady_State.echo
trctpr	TRACE:TPR	Steady_State/Steady_State.tpr

Figure 4.8. Job Import: Final Step

The fourth and final step, shown in Figure 4.8, “Job Import: Final Step”, is used to specify the files that are part of the imported job. The two tables indicate the files defined as inputs and outputs. A grayed-out **Location** indicates that the expected file is not present.

The **Location** column can be used to change the file for each entry. Pressing the **Select** button in the Location cell editor opens **Select File** dialog, shown in Figure 4.9, “Job Import: Select File Dialog”, used to select which available file is used for the given input/output. Note that files can be left unspecified as needed.



Steady_State/Steady_State.stats
Steady_State/Steady_State.inp
Steady_State/Steady_State.tasklog
Steady_State/Steady_State.screen
Steady_State/Steady_State.out
Steady_State/Steady_State.dif
Steady_State/Steady_State.msg
Steady_State/Steady_State.echo
Steady_State/Steady_State.taskdef

Figure 4.9. Job Import: Select File Dialog

Once files have been specified as needed for the new job, pressing the **Finish** button will complete the import.

Chapter 5. Job Streams

A Job Stream is a component in a pre-processor plug-in model that defines the work flow for executing analysis applications. There are two major types of Job Streams: Graphical and Python Directed. A model may have any number of graphical and python directed job streams, each built to run a different set of applications.

Graphical Job Streams are defined by stream steps (single application executions), files (primarily used as application input), switches (logical operations used to control job stream work flow), and reference models. More detailed information regarding graphical streams can be found in Section 5.1, “Graphical Job Stream Basics” and the sections that follow.

Python Directed streams are controlled by a user-specified Python script using bindings provided with SNAP. These streams make use of SNAP's Python bindings to manipulate input models and execute applications. They can be created as components in the Model Editor like graphical streams or submitted from the command line. Creating stream components in the Model Editor is described in Section 5.2, “Creating Job Streams”. The specifics of Python Directed streams is covered in Section 5.8, “Python Directed Job Streams”.

5.1. Graphical Job Stream Basics

This section describes basic job stream concepts referred to regularly throughout this chapter.

5.1.1. Stream Steps

Stream steps represent applications that will be executed. Each application has a number of input files that must be supplied, and produces a number of output files after execution. The outputs of a stream step can be used to supply the inputs of another application. The resulting chain of applications is what makes up the job stream. The input files for the step can come from previous job steps, external file references, or from the model node. The stream element that represents the file inside the job stream is called the file source.

The inputs for a job step may be single files, or file sets. Each input is identified with a label that appears inside the step when it is rendered inside the 2D view, and when the inputs are displayed inside a property dialog. The file type on each input is used to restrict what files may be selected as a file source.

Parametric Stream Steps

If a single file input of a step is supplied multiple file sources, the step will be executed multiple times. This is called a parametric step. Each of the resulting executions of the step are called tasks. The properties that define the differences between the parametric tasks are the parametric keywords. These keywords are used to define the different tasks on the job step. The total listing of tasks for a job step, organized by parametric keyword, is called the file sequence of that step. Individual tasks may be filtered out from execution. A specific combination of parametric keywords may be excluded directly, or a numeric filter can be used to allow a shared numeric value to define which tasks should be executed.

5.1.2. External File Sources

Job streams require the ability to select files from outside of the Model Editor to include as the inputs for job steps. There are two external file sources: external file, and file set. The external file represents a single file that will be included in the job stream submission. The file set represents multiple files joined together. The protocols for selecting the files use a customizable interface. By default the local file selection and calculation server file selection routines are included.

A file set can be used to generate a parametric job step by using it as the file source for a single file input. The files that are included in the set are used to generate the file sequence that defines the parametric keywords in this case.

5.1.3. Model Nodes

Job streams use model nodes to include the files generated by the model editor for a model. Simple job streams will only require a single model node. Inside an engineering template model, these nodes are used to specify the base models. In this case the model nodes represent the reference models, not the model in which the job stream is defined. Additionally, a model node may be used to represent a restart case.

The model nodes are used to supply the parametric model files produced when doing a parametric study using the different stream types. The different stream types will produce a set of input files for each of the files produced by a model. The properties used to define the parametric model define the parametric keywords that will be included with any job step that uses a parametric model node as a file source. This list of parametric keywords is used to generate the file sequence from parametric model nodes.

5.1.4. Input Switches

Input switches allow a job stream to determine which file source to apply to a job step based on the value from a shared numeric. The switch consists of a set of input branches, that must each define the same type of input file. Each input branch defines the set of shared numeric values when that branch should be used. The first input branch whose numeric conditions evaluates to TRUE will be used as the input for any stream step that uses the switch as a file source.

5.1.5. Keywords

Keywords are name/value pairs that are applied on a file, a step, or an ouput file of a step which are inherited downstream from their declaration. There are four types of keywords supported by the job stream system:

- *Custom* : These keywords are defined by the users on a file, step or output step. Custom keywords may overwrite the value of an inherited keyword, but not an automatic keyword. Two custom keywords on the same step may not have the same name.

- *Automatic* : These keywords are automatically defined by the execution wrapper for the current step. Typically these are produced by parsing the output files generated by an analysis code. For example, the TRACE plug-in parses the output file to extract the last timestep in the calculation and automatically generates the keyword "end_time" with the last time's value.

- *Inherited* : These keywords are custom or automatic keywords inherited from an upstream step or file. These may be overwritten by custom keywords on the current step. When inheriting keywords from upstream steps, keywords are considered to be in conflict if the names match, but the values are different. This is possible when faning in from multiple steps. The original keywords are available on the input files for the current step, but will not flow downstream frmo the current step.
- *Parametric* : These keywords are automatically generated when a step is parametric. These keywords cannot be overwritten by the job step, and are inherited downstream as Parametric keywords, unlike other keyword types.

Custom keywords support embedded variable tokens inside their values. The variable tokens appear as follows: *${var:<name>}*, where the <name> portion is replaced with the name of the variable. If a variable is embedded in a custom keyword for a parametric job step in a parametric job stream, the keyword value will vary based on the parametric task data. This allows different tasks generated from a single job step to have different keywords.

5.2. Creating Job Streams

Creating a simple Job Stream can be summed up with the following process:

1. Create a Job Stream.
2. Create one or more Stream Steps in the stream.
3. Connect the model to the first Stream Step.
4. Connect the output of each Stream Step to the input of the next Stream Step.
5. Connect the required external files to each Stream Step.

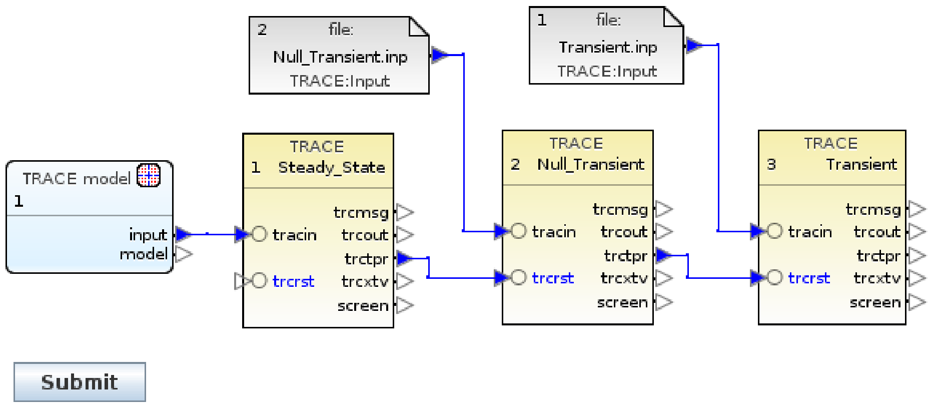
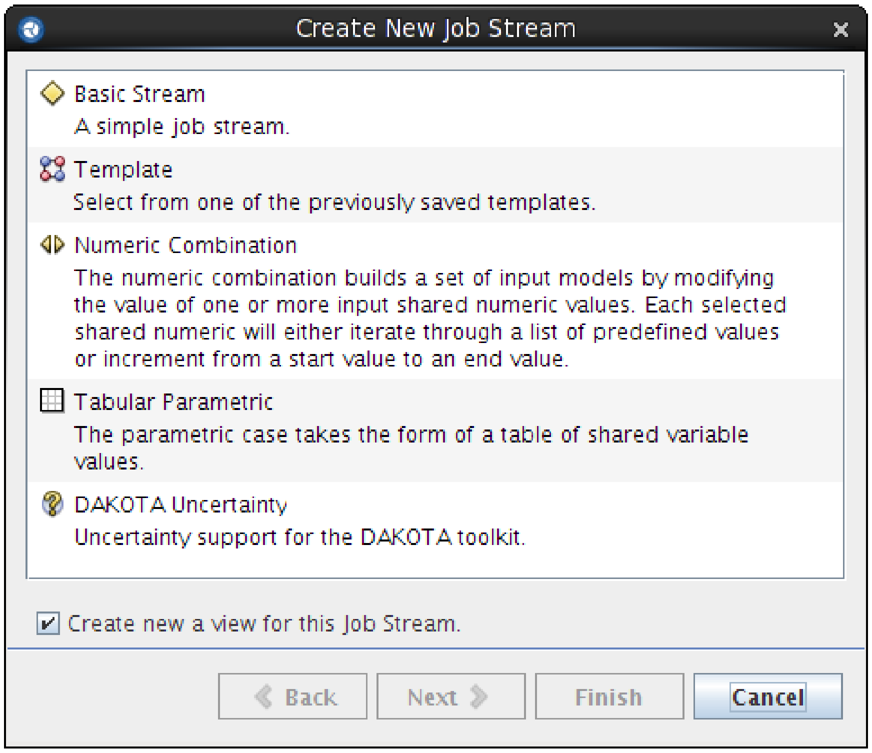


Figure 5.1. Simple TRACE Job Stream

This section will focus on how this process works in the context of a simple TRACE Job Stream. The stream in Figure 5.1, “Simple TRACE Job Stream” is made up of three executions of the TRACE analysis code in a series. The **Null Transient** and **Transient** executions use an output file from the previous step (trctpr) as an input (trcrst).

5.2.1. Creating a Job Stream

Job Streams can either be created in the Navigator or inserted directly into a 2D view. To create a Job Stream in the Navigator, right-click on the **Job Streams** node and select the **New** menu item. To insert one directly into a 2D view, first press the down-arrow next to the insertion tool to pop up the list of available component types, then select **Job Streams** from the list. This will activate the Insertion Tool for inserting Job Streams. Click anywhere in a view to start creating a new Job Stream. Once the Job Stream is created, a Job Stream drawing (a customizable submit button) will be inserted into the view.


Create New Job Stream

Basic Stream
A simple job stream.

Template
Select from one of the previously saved templates.

Numeric Combination
The numeric combination builds a set of input models by modifying the value of one or more input shared numeric values. Each selected shared numeric will either iterate through a list of predefined values or increment from a start value to an end value.

Tabular Parametric
The parametric case takes the form of a table of shared variable values.

DAKOTA Uncertainty
Uncertainty support for the DAKOTA toolkit.

[✓] Create new a view for this Job Stream.

Figure 5.2. Creating a New Job Stream

New Job streams are initialized using the **Create New Job Stream** dialog. Various stream initialization options (stream type, predefined stream, etc.) can be selected in the top of this dialog. The navigation buttons at the bottom of the dialog, Back and Forward, can be used to move through the initialization process. The **Finish** button will add the newly created stream to the model and select it in the Navigator and the view (if applicable).

The first panel in the process lists the available stream types (Basic, Numeric Combination, etc.). A stream's type determines the kinds of parametric studies that can be performed using the stream. The **Basic** type is a good first choice as it does not include the extra complexity of parametrics. Selecting any standard stream type will display the list of predefined Job Streams provided by the current plug-in (TRACE, SCALE, etc.). Selecting the **Template** option will display a list of the user's stream stemplates. A Job Stream's type may be changed at any time. Refer to section Section 5.3.1, “Job Streams” for a detailed description of the available stream types.

A complete description of each Job Stream properties is available in Section 5.3.1, “Job Streams”, however, the following properties require special note.

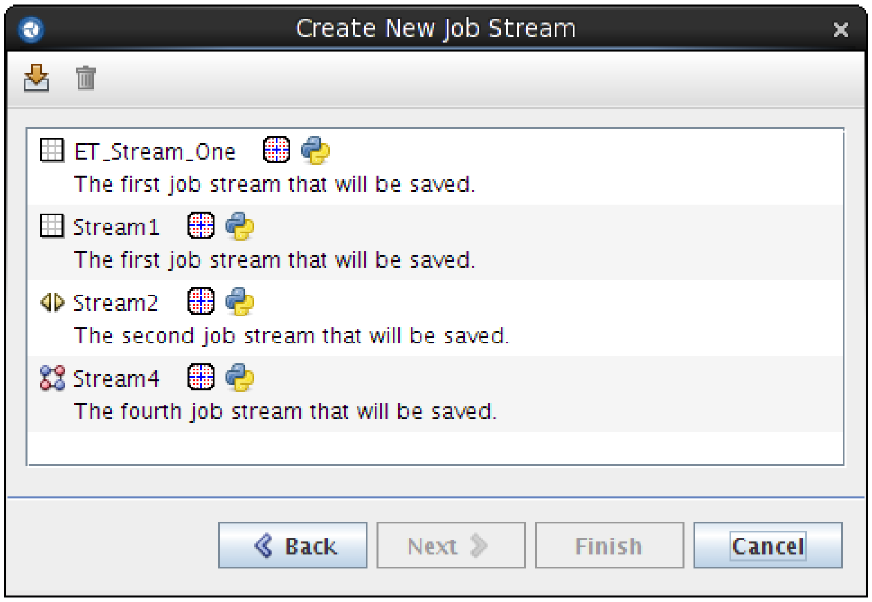
- **Name** – The files and folders created for the stream are named using the Job Stream's name as the base. It should be descriptive enough to identify the purpose of the stream without being too long for a folder name.
- **Platform** – The computing platform that this stream will be submitted to by default. For most users only the **Local** platform (the local Calculation Server) will be available.

- **Root Folder** – The location on the Calculation Server where this stream will be placed. The **E** (Edit) button to the right of the root folder selector can be used to add/remove folders to the local Calculation Server.
- **Relative Location** – The location of the stream within the selected Root Folder (above). This relative location can be used to organize the set of streams submitted to a particular location. Relative Location paths must use the slash character '/' as a folder separator; a backslash cannot be used.

Stream Templates

Stream templates are a convenient way to save a commonly used Job Stream from one model and quickly add it to another model. Each stream template includes the stream, stream steps, input switches, files, model nodes, and reference models (Engineering Template models only), that were used in the original Job Stream.

Selecting the **Template** option in the **Create New Job Stream** dialog will display a list of the user's stream templates. Each template is displayed using the stream type icon (Basic, Numeric Combination, etc.), the template name (e.g. "Stream1"), the template description, and an icon representing each type of job step included in the template (e.g. TRACE and Python).


Create New Job Stream

ET_Stream_One
The first job stream that will be saved.
Stream1
The first job stream that will be saved.
Stream2
The second job stream that will be saved.
Stream4
The fourth job stream that will be saved.

Figure 5.3. Select Stream Template

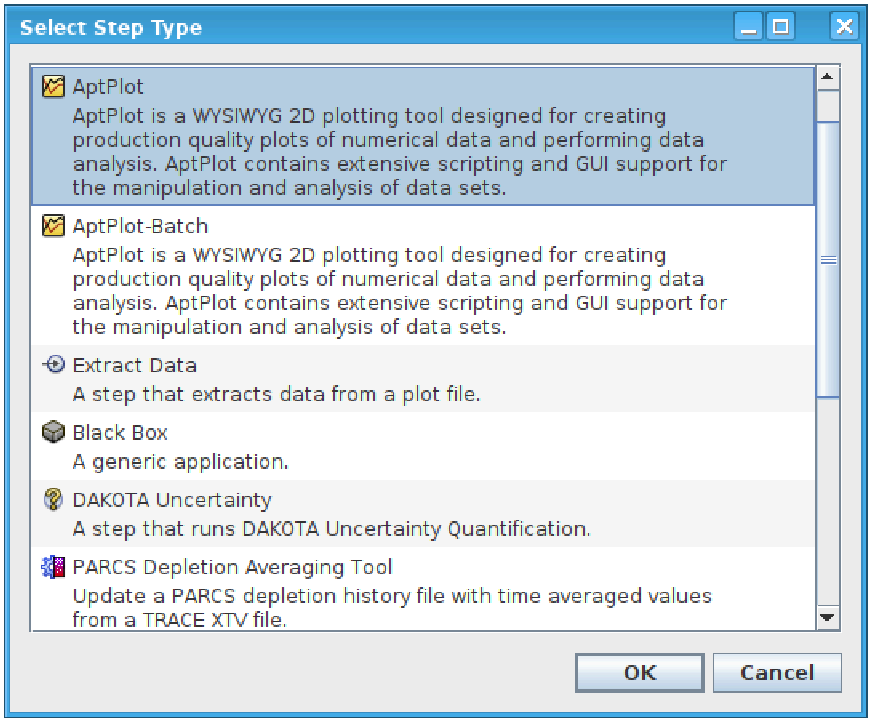
New stream templates can be created by selecting the **Save as a Template** item in the Job Stream right-click pop-up menu. Any of the available templates can then be used to create a new Job Stream by selecting the template in the Create New Job Stream dialog. Templates from other locations can be imported into the current user's templates list by pressing the **Import Template** button. An existing template can be removed from the list by selecting it in the list and pressing the **Remove** button.

5.2.2. Creating Stream Steps

Like Job Streams, Stream Steps can be created either in the Navigator or within a 2D View. In either case, steps must be created within the context of a Job Stream.

To create a new Stream Step in the Navigator, first expand the **Job Streams** node. This will show the list of Job Streams in the model. Then expand the node for the stream to which the step should be added. Finally, right-click on the **Stream Steps** node and select the **New** menu item.

Inserting a new Stream Step into a 2D view is much the same as inserting a stream. First, press the down-arrow next to the insertion tool to pop up the list of available component types. Then select **Stream Steps** from the list. This will activate the Insertion Tool for inserting new Stream Steps. Click anywhere in a view and a new Stream Step will be inserted.



AptPlot
AptPlot is a WYSIWYG 2D plotting tool designed for creating production quality plots of numerical data and performing data analysis. AptPlot contains extensive scripting and GUI support for the manipulation and analysis of data sets.

AptPlot-Batch
AptPlot is a WYSIWYG 2D plotting tool designed for creating production quality plots of numerical data and performing data analysis. AptPlot contains extensive scripting and GUI support for the manipulation and analysis of data sets.

Extract Data
A step that extracts data from a plot file.

Black Box
A generic application.

DAKOTA Uncertainty
A step that runs DAKOTA Uncertainty Quantification.

PARCS Depletion Averaging Tool
Update a PARCS depletion history file with time averaged values from a TRACE XTV file.

Figure 5.4. Select Step Type Dialog

The **Select Step Type** dialog will appear as soon as the Stream Step is created. This dialog lists the types of applications that are available to the selected Job Stream. New applications can be defined in the Configuration Tool as described in Section 3.5, “Applications”. Selecting an application and pressing the **OK** button will insert a new Stream Step into the Job Stream shown at the top of the dialog.

A complete description of the properties of a Stream Step is given in Section 5.3.3, “Stream Steps”.

5.2.3. Connecting the Model

The current model (i.e. the TRACE model in this example) is represented in a Job Stream by a "Model Node." Streams can have any number of model nodes that each provide a different view of the model. For example: if a TRACE model included several restart "cases", then a model node could be created for each case. This would allow a Stream Step to use a case by connecting to the model rather than referencing an external file. Newly created Job Streams start with one Model Node. Additional nodes can be added at any time. Model Nodes are discussed in greater detail in Section 5.3.2, “Model Nodes”.

Model Nodes can be added to a view from the Navigator by using drag-n-drop. First, expand the **Job Streams** node, then the node for the stream. Expand **Model Nodes** under the stream, then drag the Model Node to the 2D view.

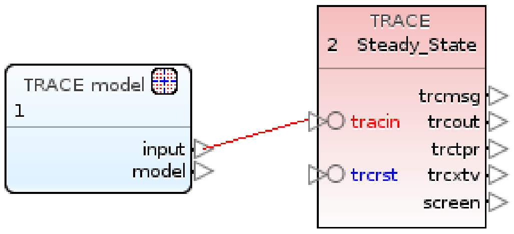


Figure 5.5. Connecting a Model Node

Once the Model Node is added to a 2D view it can easily be connected to the input of a Stream Step. Just activate the **Connection Tool** in the view, click on the model node's connector then click on the step's connector. In this example, first click on the model node's **input** connector and then on the TRACE step's **tracin** (i.e. "TRACE Input") connector. Once connected, the TRACE step will retrieve its input directly from the current model.

5.2.4. Connecting Stream Steps

The essence of a Job Stream is the flow of data through a set of Stream Steps. Each step takes its inputs, executes an application or process, then passes one or more of its outputs to the next step in the stream. In the example below, two of the TRACE steps get one of their inputs from the previous step. More specifically they use the previous step's **trctpr** (TRACE Portable Restart) file as their **trcrst** (TRACE Restart File) input.

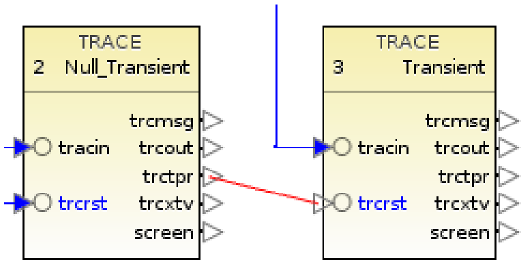


Figure 5.6. Connecting Stream Steps

Stream Steps are connected to steps in the same way that model nodes are connected to steps. Activate the **Connection Tool** in the view, click on the first step's output connector, then click on the next step's input connector. In this specific example, the output connector is **trctpr** and the input is **trcrst**. Because they are connected, the second step is now dependent on the first. This means that the second step will not execute until the first is complete and the trctpr file is available.

5.2.5. Connecting External Files

External file components are a Job Stream's method of handling files that are not managed directly by a model and cannot be represented by a model node. These files are represented as either an External File (for a single file) or a File Set (for multiple files).

External files can be created in the same way as Steps or model nodes. That is, either using the New menu item in the Navigator or the Insertion Tool directly in a 2D View. Once created, external files can be connected to steps in the same way as Model Nodes or other steps; connect the output connector of the file to the input connector of the step.

The initial connection from an External File to a step also sets the **File Type** property of the file. This type determines what inputs the file can be connected to as well as how the file will be handled by the Job Stream system.

Each External File should be named by editing its **Name** attribute. Note that this is the name of the External File component, not the name of the file it refers to. This allows the External File **Name** to indicate the function of the file rather than the on-disk name. For example: the External File can be named "Null_Transient_Input" rather than "w4loopnt.inp."

A complete description of the properties of an External File is given in section Section 5.3.4, “Files and File Sets”.

5.3. Job Stream Components

This section focuses on the components that make up a job stream and the properties of each. These components are covered individually in the following sections.

1. **Job Streams** - The central component of the job stream system. Each of the following elements are created and used as part of a particular Job Stream component. The properties of a Job Stream component are described in Section 5.3.1, “Job Streams”.

2. **Model Nodes** - Model Nodes represent a currently open model used by a Job Stream. In most cases, this is also the model that contains the Job Stream. The Model Node component is described in Section 5.3.2, “Model Nodes”.

3. **Stream Steps** - Stream steps represent applications that will be executed by the job stream. The properties of stream steps are described in Section 5.3.3, “Stream Steps”.

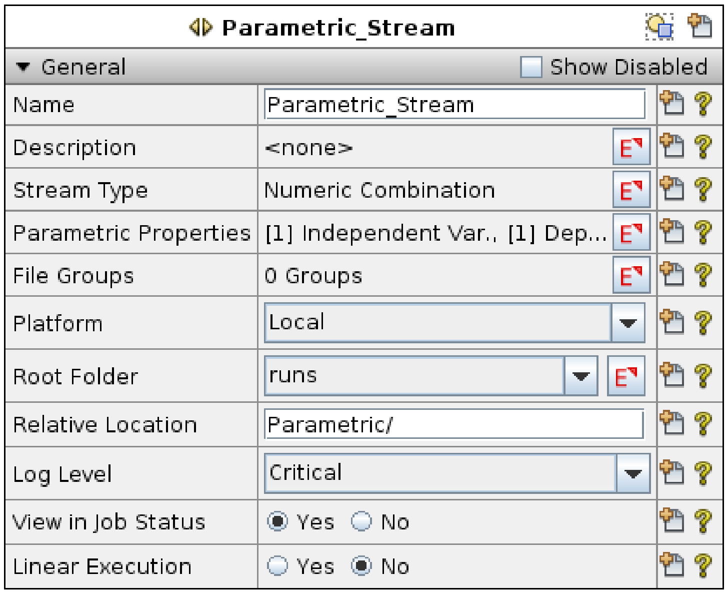
4. **Files and File Sets** - External File and File Set components represent files and sets of files that are used in a job stream but are not provided by a model. These external file references are described in Section 5.3.4, “Files and File Sets”.

5. **Input Switches** - Input Switches allow the flow of a job stream to branch based on the value of a user-defined numeric. The creation and use of input switches is explained in Section 5.3.5, “Input Switches”.

6. **Stream Types** - The stream type is a direct property of the Job Stream component that determines the types of parametric manipulations that can be performed on the stream. The Stream Type property of the Job Stream component is described in Section 5.3.1, “Job Streams” below. The available stream types are described in Section 5.3.6, “Stream Types”.

Refer to Section 5.2, “Creating Job Streams” for an overview of how to create and connect complete job streams.

5.3.1. Job Streams



Parametric_Stream	
General	Show Disabled
Name	Parametric_Stream
Description	<none>
Stream Type	Numeric Combination
Parametric Properties	[1] Independent Var., [1] Dep...
File Groups	0 Groups
Platform	Local
Root Folder	runs
Relative Location	Parametric/
Log Level	Critical
View in Job Status	[✓ Yes] No
Linear Execution	Yes [✓ No]

Figure 5.7. Job Stream Properties

Job Stream components are the central piece of the job stream system. They include the set of steps, the files that will be used, and the conditional logic that determines which steps will be executed. Figure 5.7, "Job Stream Properties" shows the properties of a typical a Job Stream. Properties in this list are shown or hidden based on the values of other properties or the stream type. Each of these properties will be described in detail below.

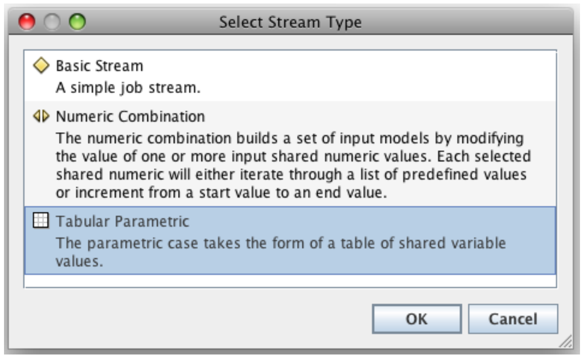
Name

The name for this job stream. This will be used to name the log files, folders, and relative paths for the tasks that make up this stream. To avoid confusion, Job Stream names should be unique within a model. Job Streams only accept names composed of letters, numbers, underscores, and dashes.

Stream Type

A stream's type determines the types of parametric manipulations that can be performed on the stream.

The Stream Type Selection Dialog opens when a new job stream is created. This dialog allows the user to select the type of job stream by displaying a list of the supported stream types that are currently loaded.


Select Stream Type

Basic Stream
A simple job stream.

Numeric Combination
The numeric combination builds a set of input models by modifying the value of one or more input shared numeric values. Each selected shared numeric will either iterate through a list of predefined values or increment from a start value to an end value.

Tabular Parametric
The parametric case takes the form of a table of shared variable values.

Figure 5.8. Stream Type Dialog

The following stream types are always available to new or existing Job Streams. Additional stream types may be available depending on the SNAP installation.

- **Basic** - This is the simplest of the stream types and does not allow parametrics of any sort. This type can be used when parametric features are not required.

- **Numeric Combination** - A Numeric Combination stream builds a set of input models by modifying the value of one or more input shared numeric values. This stream type is described in detail in section Section 5.3.6.1, “Numeric Combination”.

- **Tabular** - A Tabular Parametric stream defines parametric tasks using a table of shared variable values. This stream type is described in more detail in section Section 5.3.6.2, “Tabular Parametric”.

- **Python Directed** - Python Directed streams are controlled by a user-specified Python script. Python Stream components allow these streams to be created and submitted within a model rather than from the command-line. The behavior of these components is determined primarily by three properties: *Python Script Location*, *Python Script*, and *Bundled Files*. Each of the properties are described below.

  Python Directed streams are described in more detail in Section 5.8, “Python Directed Job Streams”.

Note The Stream Type can be changed at any time.

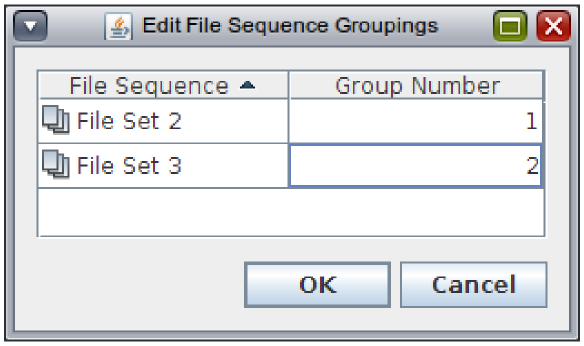
Parametric Properties

The Parametric Properties editor provides access to the additional parametric stream configuration provided by the stream type. The editor launched by pressing the **Edit** button varies based on the selected type. Parametric properties are described in detail in Section 5.3.6, “Stream Types”. This property is not available for Basic streams.

File Groups

File groups are used to associate the File Sequence produced by two or more input sources together. When two parametric file sources with associated file sequences are connected to the input of a job step, the entries of their file sequences are combined one-to-one. This means that instead of the step including a task for the combination of each entry in both file sequences, the step will contain a task for the first entries in both sequences, then a task for the second entries, etc.. File sequences associated in this manner must have the same number of entries. An error will be reported if the file sources have different lengths, which will prevent the job stream from being submitted.

The editor for the **File Groups** property allows the user to associate different file sources together. The File Sequence Groupings dialog is populated with the list of all the file sets, and parametric model nodes in the job stream. A group number can be set for each file sequence via the drop-down editor in that row's **Group Number** column. The file sequences generated by the file sources with the same group number are associated together.



File Sequence	Group Number
File Set 2	1
File Set 3	2

Figure 5.9. File Sequence Groupings

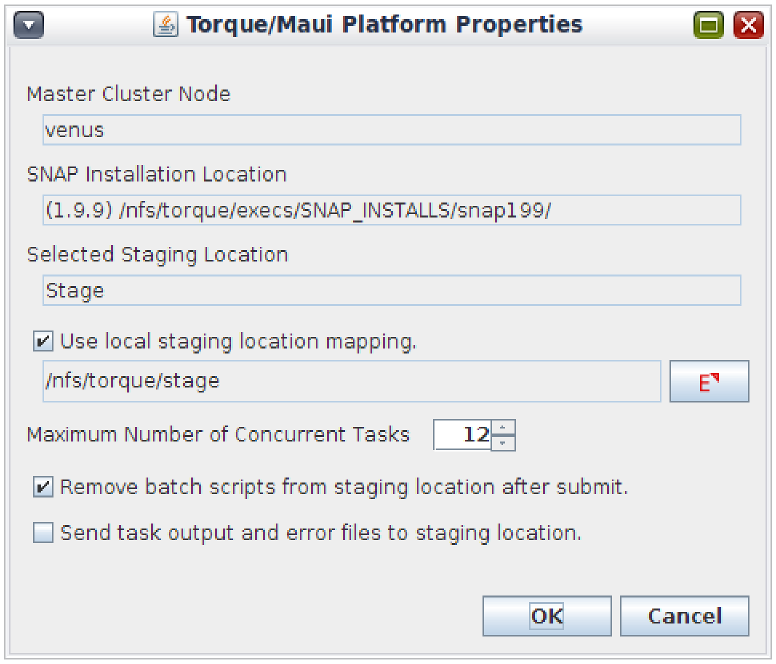
Platform

The platform (i.e. computer system) that the stream will be submitted to by default. This selection determines how the stream's platform related properties will be displayed. For example: the **Root Folder** property is only displayed when the "Local" (local Calculation Server) platform is selected.

This editor allows the user to select from the platforms that have been defined in the Configuration Tool as described in Chapter 3, *The Configuration Tool* . Changing the platform may require that the **Submission Properties** be redefined for each stream step.

Platform Properties

This property is used to customize the way the stream is submitted to the selected Platform. As these properties are very specific to the type of platform selected, each platform type provides its own platform properties dialog. For example: The "Torque/Maui" platform properties dialog includes the "Use local staging location mapping" option.



Master Cluster Node: venus

SNAP Installation Location: (1.9.9) /nfs/torque/execs/SNAP_INSTALLS/snap199/

Selected Staging Location: Stage

[✓] Use local staging location mapping.

/nfs/torque/stage

Maximum Number of Concurrent Tasks: 12

[✓] Remove batch scripts from staging location after submit.

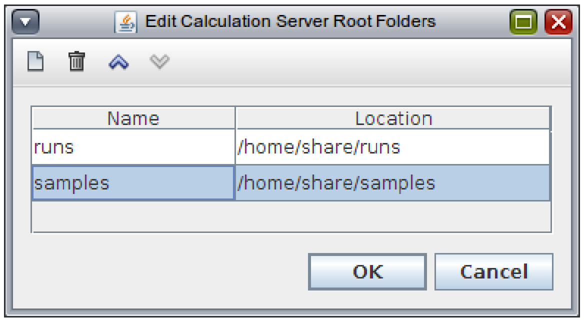
[ ] Send task output and error files to staging location.

Figure 5.10. Torque/Maui Platform Properties

Note Some platform types (such as the Calculation Server) do not use Platform Properties.

Root Folder

This property determines where on the local Calculation Server the stream will be executed. The **E** (Edit) button to the right of the root folder selector can be used to add/remove folders for the local Calculation Server.



Name	Location
runs	/home/share/runs
samples	/home/share/samples

Figure 5.11. Calculation Server Root Folders

Note Only the "Local" platform (local Calculation Server) uses the Root Folder property.

SNAP Installation

The SNAP installation that will execute this stream on the selected platform. The list of SNAP installations is specified for the Platform in the Configuration Tool. This allows a single Platform to provide access to current versions of SNAP without removing access to older versions.

Note The Calculation Server does not support the SNAP Installation property.

Staging Location

The location on the selected platform where the stream's "intermediate" files are placed. Intermediate files are the files required either by the entire stream (i.e. the Stream Definition) or by down-stream tasks. For example: the output file produced by one task would be placed on the staging location at the end of its execution so that the next task in the stream would be able to use it as an input.

By default, any remaining intermediate files are removed at the end of stream execution.

Note The local Calculation Server uses the Root Folder property in place of the Staging Location.

Relative Location

The location of the stream within the selected Root Folder or Staging Location. This relative location can be used to organize the set of streams submitted to a particular location. If the relative location does not exist, it will be created during the submission process. The job stream will create a directory inside the relative folder where the stream steps will be executed.

Note The slash character '/' must be used as a folder separator for relative locations. The backslash character cannot be used.

Submission Properties

This property is used to customize the way the Stream Manager job (the central job stream process) is submitted to the selected Platform. These properties are specific to the type of selected platform; the available properties are identical for each step. Each platform type provides its own submission properties dialog.

For example: The "Torque/Maui" platform properties dialog includes the "Process Priority" and "Maximum CPU Time" options.

Log Level

This enumeration defines the level of details that will be included in the job stream log files. The selected value represents the minimum message level to display. For example, selecting **Information** defines that all messages flagged as Information, Warning, or Critical will be included, but not messages flagged as Debug.

View In Job Status

This flag indicates whether job status should be opened, and the job stream automatically selected when the job stream is submitted. If **Yes** is selected, Job Stream will be opened, and brought to the front of the screen. If an instance of Job Status is already available, that instance will be brought to the front of the screen. The submitted job stream will be selected either in the calculation server or the Tracking server.

Linear Execution

Job Streams using Linear Execution are executed one task at a time, prioritized by their Step Number. In a normal (non-linear) Job Stream tasks will be executed as soon as their dependencies are available (i.e. up-stream tasks are complete) up to the maximum number allowed by the platform.

This option should only be used in situations where the stream must execute one task at a time and each task must complete before another can be be executed.

In most cases this property should be left at its default value: *No*

Python Application

This property lets you select the Python application that will be used to execute this Python Directed stream. The application is one of the Python application definitions specified in Configuration Tool. By default it is set to the automatically created definition named 'Python' that uses the Jython interpreter bundled with SNAP.

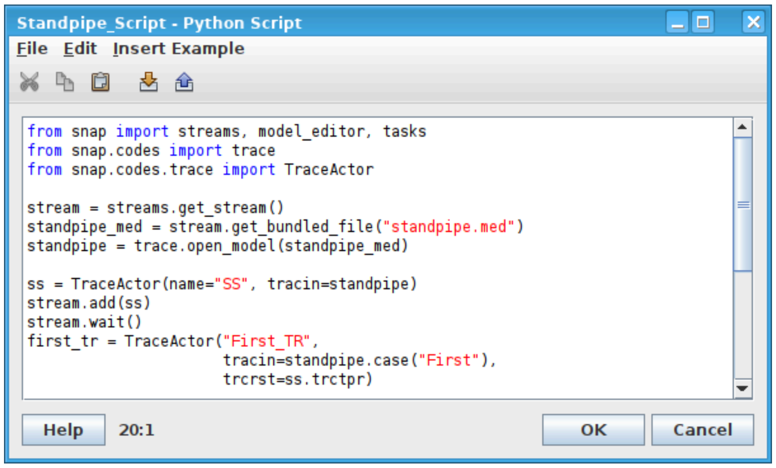
To switch to a different Python version, either change the 'Python' definition to refer to your python executable or create a new new definition and use it instead.

Python Script Location

This property determines whether a Python script will be edited with the model (**Edited Here**) or referenced on disk (**File on Disk**).

Python Script

This property is either, the path to the Python script or the content of the script itself, depending on the value of the *Python Script Location* property. If a file location is being used then the editor will attempt use a relative path to the selected file. If *Edited Here* is selected then editing this property will open the Python Script editor shown in Figure 5.12, "Python Stream Script Editor".



```
from snap import streams, model_editor, tasks
from snap.codes import trace
from snap.codes.trace import TraceActor

stream = streams.get_stream()
standpipe_med = stream.get_bundled_file("standpipe.med")
standpipe = trace.open_model(standpipe_med)

ss = TraceActor(name="SS", tracin=standpipe)
stream.add(ss)
stream.wait()
first_tr = TraceActor("First_TR",
                      tracin=standpipe.case("First"),
                      trcrst=ss.trctpr)
```

Figure 5.12. Python Stream Script Editor

The script editor is a sytax highlighted (i.e. colored) Python source editor. Below the editor is a label indicating the cursor location as a line and column. The current number of lines in the script is displayed to the right of the cursor location.

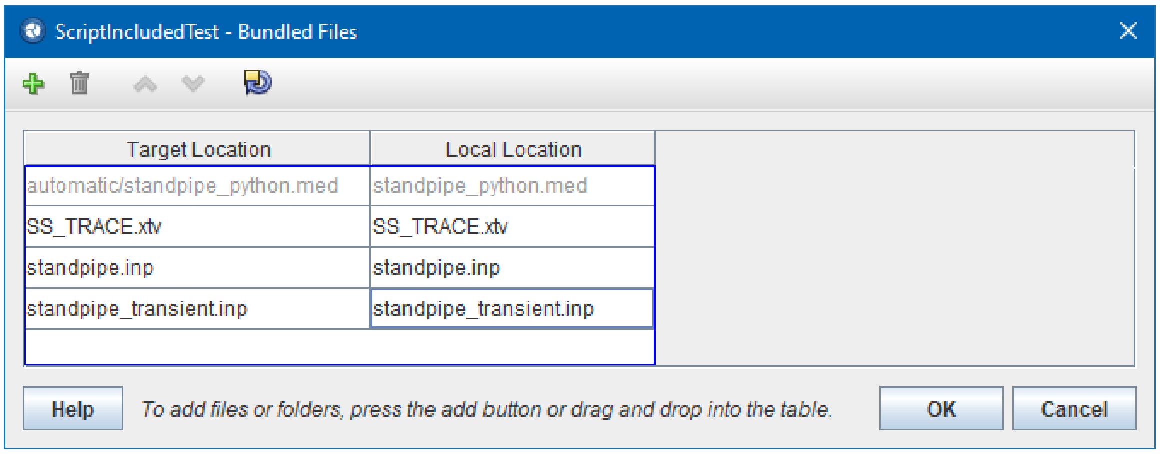
Menu items and toolbar buttons provide the standard Cut/Copy/Paste and Import/Export operations. The items in the **Insert Example** menu will insert one of a variety of code snippets that illustrate everything from opening an MED file to running a job with one of the supported analysis codes.

The contents of this script and Python Directed streams in general are described in more detail in Section 5.8, “Python Directed Job Streams”.

Bundled Files

The bundled files of a Python stream will be transmitted with the stream to the server during submission. Refer to Section 5.8.3, “Bundled Files” for more information about using bundled files in a Python stream.

Editing this property opens the Bundled Files dialog shown in Figure 5.13, “Bundled Files Dialog”.


ScriptIncludedTest - Bundled Files
Help
To add files or folders, press the add button or drag and drop into the table.
OK
Cancel

Target Location	Local Location
automatic/standpipe_python.med	standpipe_python.med
SS_TRACE.xtv	SS_TRACE.xtv
standpipe.inp	standpipe.inp
standpipe_transient.inp	standpipe_transient.inp

Figure 5.13. Bundled Files Dialog

The center piece of this dialog is the table of bundled files. The toolbar at the top of the dialog contains buttons to **Add**, **Remove**, **Move Up**, **Move Down**, and **Sort**, the table.

Each bundled file has a *Target Location* and a *Local Location*. The target location is used to determine where to place the file under the bundled files directory. For example, a file with a target location of "myfolder/myfile.dat" would be accessible with the following.

```
snap.streams.get_stream().get_bundled_file("myfolder/myfile.dat")
```

The local location is the path to the file on the local computer. The editor for this location will attempt use a relative path to the selected file, where possible.

Note The target and local locations of automatically included files appear greyed out and cannot be edited.

Files can be added to the table by pressing the **Add** button or by dragging one or more files or folders into the table. When a folder is selected by either method, the dialog will recursively add every file in the folder and its sub-folders. In the process, it will assign relative target locations to each selected file.

Parametric Table

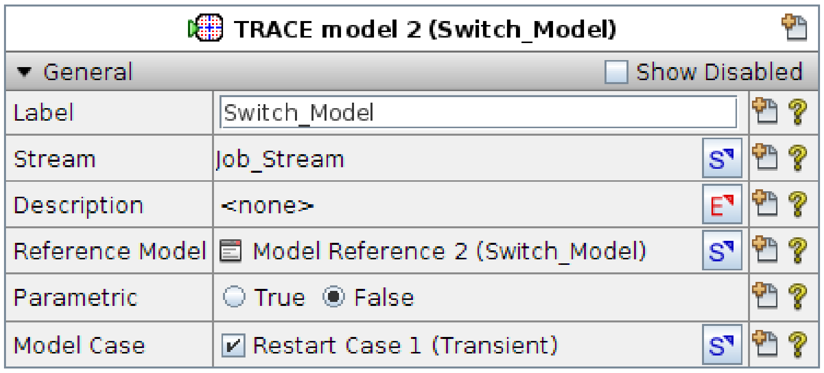
This property provides many of the features of the Tabular Parametric job stream type to Python Directed streams. Its user interface in the stream is also essentially identical to that used by

Tabular Parametric. Refer to Section 5.3.6.2, “Tabular Parametric” for detailed information on how to use this user interface. Refer to Section 5.8.4, “Parametric Table” for a detailed description of how to apply a Parametric Table to a model in a Python Directed stream.

5.3.2. Model Nodes

A model node represents a model currently loaded into the Model Editor. For most job streams, this will be a reference to the current model.

The outputs for each model node are the different files that may be exported by the model editor for referenced model. Model nodes may be set to parametric, which indicates that the model node will use the current stream type to generate a set of input files. The properties of a model node are shown in Figure 5.14, “Model Node Properties”.


TRACE model 2 (Switch_Model)

General ☐ Show Disabled

Label	Switch_Model
Stream	Job_Stream
Description	<none>
Reference Model	Model Reference 2 (Switch_Model)
Parametric	○ True ● False
Model Case	✓ Restart Case 1 (Transient)

Figure 5.14. Model Node Properties

Model nodes have the following properties.

Label

The label by which the model is referred to in the stream. This need not be the name of the actual model. It must be unique amongst the Model Nodes in its Job Stream and it should be descriptive enough to identify the purpose of the model. Model Nodes only accept names composed of letters, numbers, underscores, and dashes.

Stream

The Job Stream to which the model node belongs. This property can be edited to move the model node between streams.

Description

This property allows an arbitrary description of the model node to be entered.

Reference Model

This property is used to indicate which Reference Model is represented by this model node. This property is only displayed for model nodes in an Engineering Template stream.

Parametric

Determines whether the model's outputs will be a set of parametric input files. This property is only enabled when the model node is part of a stream with a parametric Stream Type, such as Numeric Parametric. Toggling this property will change the appearance of the node in a 2D View to more easily distinguish between parametric and non-parametric models.

Model Case

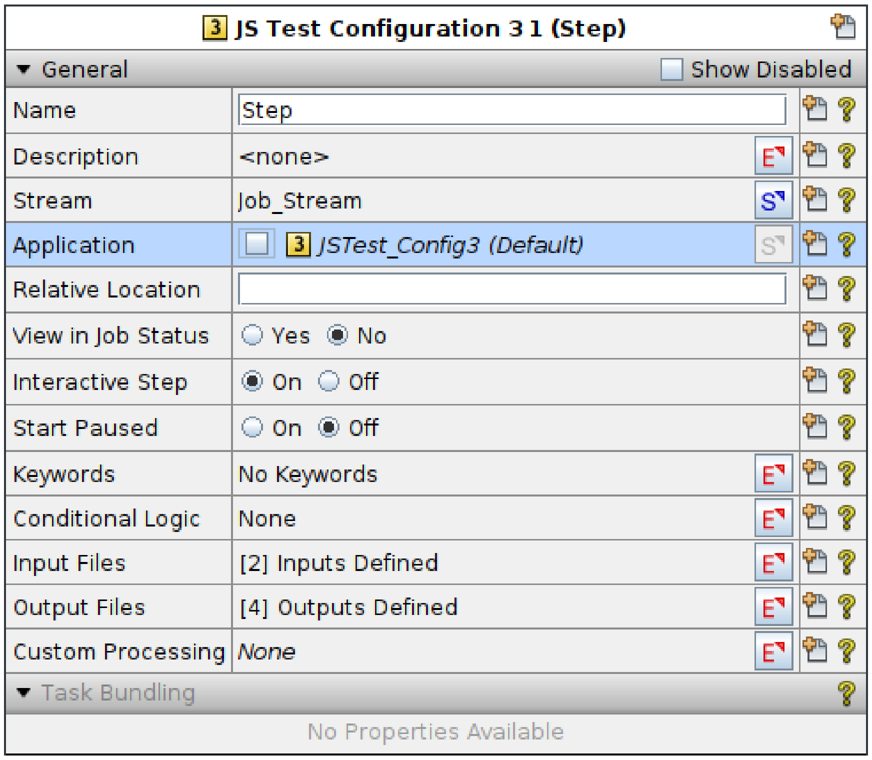
When the model represented by the model node has one or more restart cases, this property can be enabled to select a restart that will further clarify the role of the node. By using restart cases, a single model can specify multiple restarts, allowing model node references to that model to use the restarts in a stream without relying on external files.

5.3.3. Stream Steps

Stream steps represent applications that will be executed by the job stream. Steps have inputs and outputs representing files that are used by or created by the application. Outputs may be connected to down-stream steps as inputs. The creation of stream steps is discussed in Section 5.2.2, “Creating Stream Steps”.

Job steps that have multiple input sources for an input file may be parametric. Parametric steps create a separate task for each combination of parametric inputs. A detailed discussion of parametrics is given below, in "Parametric Tasks".

Stream steps each include the properties shown in Figure 5.15, “Stream Step Properties”. Each of these properties is described in detail below.


JS Test Configuration 3 1 (Step)

General — Show Disabled

Name	Step
Description	<none>
Stream	Job_Stream
Application	JSTest_Config3 (Default)
Relative Location	
View in Job Status	Yes [✓ No]
Interactive Step	[✓ On] Off
Start Paused	On [✓ Off]
Keywords	No Keywords
Conditional Logic	None
Input Files	[2] Inputs Defined
Output Files	[4] Outputs Defined
Custom Processing	None

Task Bundling

No Properties Available

Figure 5.15. Stream Step Properties

Name

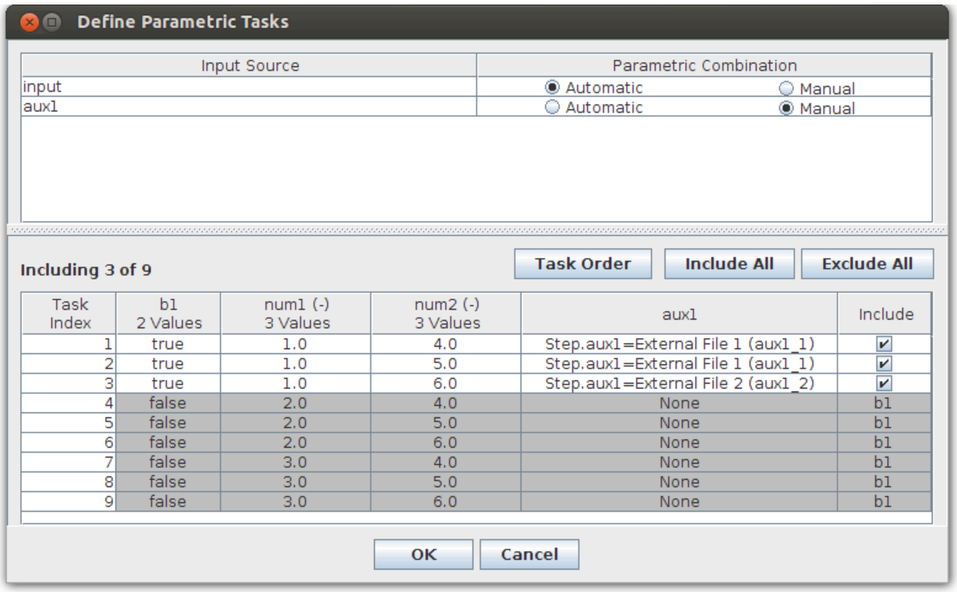
The files and folders created for stream steps are named using the step's name as the base. It should be descriptive enough to identify the purpose of the step without being too long for a folder name. Consequently, steps with the same relative location must have unique names (unique step names are advised regardless, if only for clarity). Job Steps only accept names composed of letters, numbers, underscores, and dashes.

Stream

This property indicates the job stream in which the step is contained. The step can be moved to a different stream by pressing the S (Select) button to the right and selecting a different stream. Note that changing the stream that a step is contained in does not affect other steps and/or files that it may be connected to.

Parametric Tasks

Parametric cases can be generated in two ways. The first method is to create multiple connections to a single input node. The second is by connecting a output-set of a stream component to a non-set input of another stream component. In a stream step that satisfies one of these conditions, the **Parametric Tasks** property is enabled. Pressing the **E** (Edit) button at the right of the editor opens the Parametric Tasks dialog.



Input Source	Parametric Combination
input	[✓ Automatic] Manual
aux1	Automatic [✓ Manual]

Including 3 of 9

Task Index	b1 2 Values	num1 (-) 3 Values	num2 (-) 3 Values	aux1	Include
1	true	1.0	4.0	Step.aux1=External File 1 (aux1_1)	✓
2	true	1.0	5.0	Step.aux1=External File 1 (aux1_1)	✓
3	true	1.0	6.0	Step.aux1=External File 2 (aux1_2)	✓
4	false	2.0	4.0	None	b1
5	false	2.0	5.0	None	b1
6	false	2.0	6.0	None	b1
7	false	3.0	4.0	None	b1
8	false	3.0	5.0	None	b1
9	false	3.0	6.0	None	b1

Figure 5.16. Parametric Tasks Dialog

The Parametric Tasks Dialog lists the parametric tasks that will be generated for a stream step. The top portion of the dialog (shown inFigure 5.16, “Parametric Tasks Dialog”) allows the user to specify which input sources will be combined manually. By default, all of the input sources will be combined automatically. If there is only one input source defined for this step, the top portion of the dialog will be hidden.

Each row in the task table (the table in the bottom portion of the dialog) represents a single task that will be generated. The columns represent a single variable name of the variables/files that make up the parametric set. Manually combined parametric inputs get a single column, regardless of how many variables make up that parametric input. The **Include** column allows the user to specify which parametric tasks will be included in the job submission.

If a disabling variable has been added to the stream type properties for this stream, the **Include** column for all affected rows in the task table will be uneditable; it will instead specify the name of the variable controlling its inclusion or exclusion. The task table can be sorted on any column by clicking on the a column header. A label included in the dialog indicates how many tasks are currently included, and buttons for including or excluding all tasks are also provided.

The order of parametrics tasks can be changed through the **Task Order** button. This button opens a dialog which allows changing the order of the parametricly combined keywords, and changing if those keyword values will be sorted in ascending or descending order. Changing the task order in this way overrides the task order generated from the parametric sources, and any downstream tasks will default to the task order defined in an upstream step.

Application

This optional property determines which application will be executed by this step's tasks. When *Application* is activated (checked), an application of the step's type can be selected from those available on the current platform.

When *Application* is inactive (un-checked) then it will use the default application selected in the Configuration Tool. When no default is selected but there is only one application defined for the platform then it is treated as the default. In either case, the default application will be displayed in the editor in italic font.

An error will be reported if no application is selected and no default is available.

Relative Location

The location of this step in relation to the location of the entire stream. This relative location can be used to organize the set of steps within the stream. Relative Location paths must use the slash character '/' as a folder separator. Note: Step names must be unique within a given relative location.

Animation Model

This property allows selecting the location of an Animation MED file used to animate the step. Editing the value opens a file browser used to select the MED.

Open Animation

This property defines how the step's **Animation Model** is used during stream execution. When set to **Immediately**, the selected **Animation Model** will be opened and connected to the task as soon as it begins to execute.

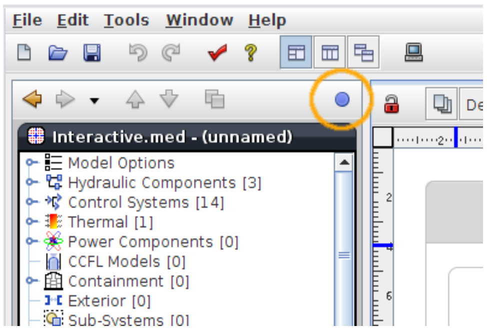


Figure 5.17. Available Jobs Indicator

When set to **Prompt**, the user will be notified when the task is available for animation. As soon as any jobs are available, the **Available Jobs** indicator will appear on the right side of the Navigator toolbar. To animate one of the waiting jobs, click on the indicator and a list of the available jobs will be displayed. Selecting any job from the list will immediately open the selected **Animation Model** and connect to the job.

Interactive Step

When this property is **On**, this step's tasks will connect to the Calculation Server the task was submitted to. This connection will allow clients to communicate with the task to send interactive commands and retrieve the current calculation time, multiplexed plot data, console output, etc..

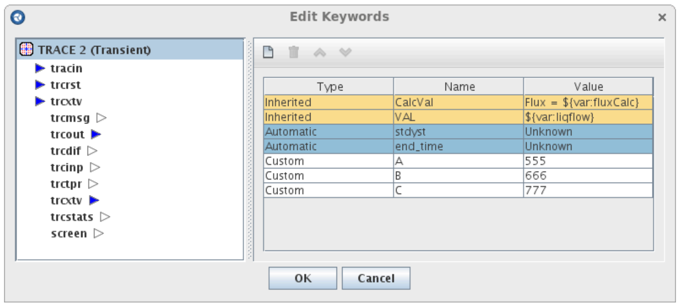
Note The Interactive Step option is only available when submitting to a Calculation Server.

Start Paused

This property instructs this step's tasks to pause immediately after starting. This property is only available for interactive steps (see above) when submitting to a Calculation Server.

Keywords

This dialog provides the capability to examine the inherited and automatic keywords for a job step, and to define custom keywords for the step, and its outputs. Keywords are further described in Section 5.1.5, "Keywords".



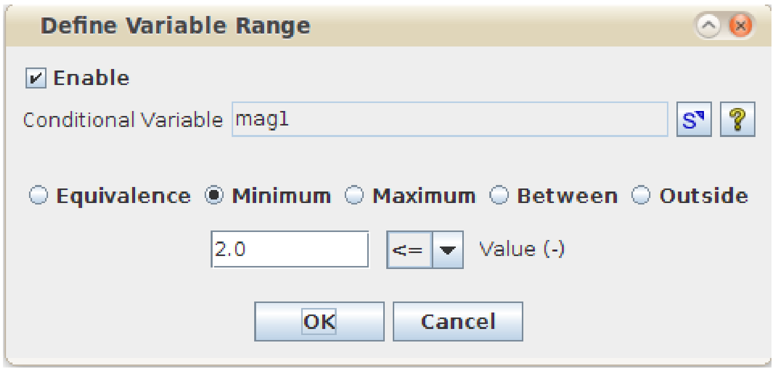
Type	Name	Value
Inherited	CalcVal	Flux = ${var:fluxCalc}
Inherited	VAL	${var:liqflow}
Automatic	stdyst	Unknown
Automatic	end_time	Unknown
Custom	A	555
Custom	B	666
Custom	C	777

Figure 5.18. Define Job Step Keywords

The list on the left hand side of the table shows the current step, along with its input and output connections. The input and output files have an icon that indicates wether the file is connect, and whether the file represents a single-file or a set of files. For input files the icon appears on the left side of the file label, and for output files, the icon appears on the right side of the file label.

Conditional Logic

The user-defined numeric conditions that determine whether this step should be included in the job stream. These conditions are evaluated during submission and can be used to exclude specific tasks of a parametric step. Editing the property displays the dialog shown in Figure 5.19, "Define Variable Range Dialog".



Define Variable Range

[✓ Enable]

Conditional Variable: mag1

Equivalence [✓ Minimum] Maximum Between Outside

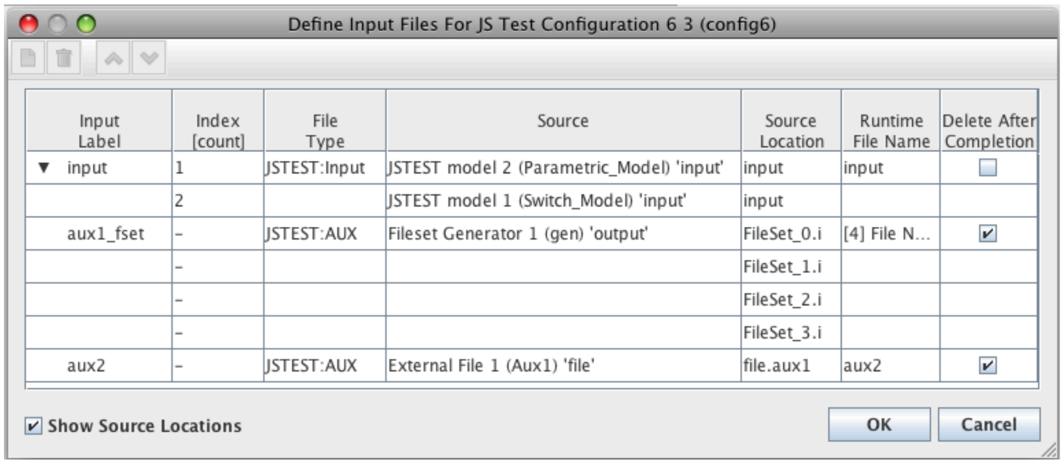
2.0 <= Value (-)

Figure 5.19. Define Variable Range Dialog

The **Enable** check-box controls whether conditional logic is applied to the step. When enabled, the **Conditional Variable** field can be used to select a user-defined numeric upon which the logic will be based. Finally, once a numeric reference has been defined, the variable range upon which the conditional is defined can be specified. The valid set may be defined as: a single value, all the values above or below a set-point, all the values between two set points, or all the values outside of two set points. Each set-point can be either inclusive (<=) or exclusive (<).

Input Files

This property represents the "inputs" to a step which correspond to the input files that the application expects when it is executed. The source of each input can be selected using the "Define Input Files" dialog available by pressing the **E** (Edit) button to the right of the property. This dialog lists all of the inputs to the step in a table as shown below.



Define Input Files For JS Test Configuration 6 3 (config6)

Input Label	Index [count]	File Type	Source	Source Location	Runtime File Name	Delete After Completion
▼ input	1	JSTEST:Input	JSTEST model 2 (Parametric_Model) 'input'	input	input	☐
	2		JSTEST model 1 (Switch_Model) 'input'	input		
aux1_fset	-	JSTEST:AUX	Fileset Generator 1 (gen) 'output'	FileSet_0.i	[4] File N...	✓
	-			FileSet_1.i		
	-			FileSet_2.i		
	-			FileSet_3.i		
aux2	-	JSTEST:AUX	External File 1 (Aux1) 'file'	file.aux1	aux2	✓

[✓ Show Source Locations]

Figure 5.20. Input Files Dialog

Each input is represented by one or more rows in the table with the following columns.

- **Input Label**

  The short, human-readable "label" for the input. This is not a file name used at runtime, but rather a short description displayed in 2D views and lists to uniquely identify this input.

  When multiple input connections exist for a given input, this column can expand the table to show all the sources.

- **Index [count]**

  If this step is parametric, the **Index** column displays the total number of parametric sources for each parametric input. If the label is expanded, then this column contains the index of the input source.

- **File Type**

  The type of file that this input expects. File types are typically listed as `[Type Source]:[Type Name]`. For example: the TRACE ASCII output file (trcout) is of type `TRACE:Output`.

- **Source**

  The **Source** column allows the user to define the file source for the input. The editor for the source column allows the user to select from any of the inputs in the job stream that have a type matching that input's **File Type**.

- **Source Location** (optional)

  The **Source Locations** column displays the absolute location of the source file specified in the **Source** column. This column is only displayed if the **Show Source Locations** check-box is checked at the bottom of the dialog.

- **Runtime File Name**

  The name(s) that will be used for this input when this step's tasks are executed.

- **Delete After Completion** (Calculation Server only)

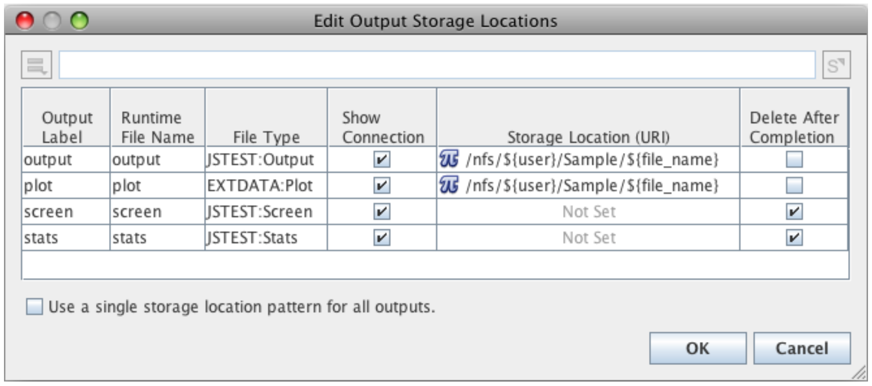
  The check-boxes in this column indicate which inputs will be explicitly deleted after the application executes. This column is only available when submitting to a Calculation Server.

- **Save to Staging Location** (all but Calculation Server)

  The check-boxes in this column indicate which inputs will be saved to the selected Staging Location after the application executes. This column is not available when submitting to a Calculation Server.

Output Files

This property represents the "outputs" of a step which correspond to the output files that the application creates when it is executed. The **Output Files** property of a stream step is edited via the Output Files Dialog.


Edit Output Storage Locations
Use a single storage location pattern for all outputs.
OK
Cancel

Output Label	Runtime File Name	File Type	Show Connection	Storage Location (URI)	Delete After Completion
output	output	JSTEST:Output	✓	/nfs/${user}/Sample/${file_name}	☐
plot	plot	EXTDATA:Plot	✓	/nfs/${user}/Sample/${file_name}	☐
screen	screen	JSTEST:Screen	✓	Not Set	✓
stats	stats	JSTEST:Stats	✓	Not Set	✓

Figure 5.21. Output Files Dialog

The Output Files Dialog lists the output files that will be produced by the application. Each output is represented by a single row in the table with the following columns.

- **Output Label**

  The short, human-readable "label" for the output. This is not a file name used at runtime but rather a short description displayed in 2D views and lists to uniquely identify this output.

- **Runtime File Name**

  The name(s) that will be used for this output when this step's tasks are executed.

- **File Type**

  The type of file that this output creates. File types are typically listed as `[Type Source]:[Type Name]`. For example: the TRACE ASCII output file (trcout) is of type `TRACE:Output`.

- **Show Connection**

  The check-boxes in this column indicate which outputs will be displayed as connectors for this step in 2D Views.

- **Storage Location** (URI)

  This column defines where the output file(s) will be stored after the task is completed. This field is optional and if left blank, the output file will not be stored. The storage location of the currently selected output can be edited in the text field at the top of the dialog.

  Storage locations can also contain patterns that can create file names based on system-specific or model-specific tokens. To insert a storage location token into a storage location, position the cursor in the desired insertion position in the storage location text field and click the **Insert Storage Location Token** button to the right of the text field. The list of available tokens and a description of each is given below.

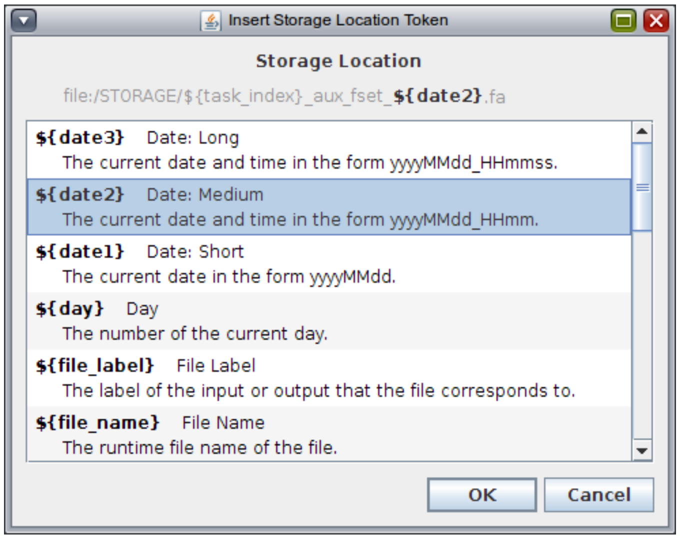
  Note The storage location must contain a well-formed URI (Uniform Resource Identifier).

- **Delete After Completion** (Calculation Server Only)

The check-boxes in this column indicate which outputs will be explicitly deleted after the application executes. This column is only available when submitting to a Calculation Server.

- **Save to Staging Location** (all but Calculation Server)

  The check-boxes in this column indicate which inputs will be saved to the selected Staging Location after the application executes. This column is not available when submitting to a Calculation Server.



file:/STORAGE/${task_index}_aux_fset_**${date2}**.fa

${date3} Date: Long
The current date and time in the form yyyyMMdd_HHmmss.

${date2} Date: Medium
The current date and time in the form yyyyMMdd_HHmm.

${date1} Date: Short
The current date in the form yyyyMMdd.

${day} Day
The number of the current day.

${file_label} File Label
The label of the input or output that the file corresponds to.

${file_name} File Name
The runtime file name of the file.

Figure 5.22. Storage Location Tokens Dialog

Figure 5.22, "Storage Location Tokens Dialog" shows the Storage Location Tokens Dialog. This dialog contains the list of available storage tokens, as well as a preview of the storage location with the currently selected token added in the specified position. The complete list of available storage location tokens is as follows:

- **`${date1}`** Date Short- The current date and time in the form yyyyMMdd.
- **`${date2}`** Date Medium- The current date and time in the form yyyyMMdd_HHmm.
- **`${date3}`** Date Long- The current date and time in the form yyyyMMdd_HHmmss.
- **`${day}`** Day- The number of the current day.
- **`${file_label}`** File Label- The label of the input or output that the file corresponds to.
- **`${file_name}`** File Name- The runtime file name of the file.
- **`${file_index}`** File Set Index- The index of the file within its file set.
- **`${kw_n: <keyword>}`** Keyword Name- The name of a keyword, if it is present.
- **`${kw_v: <keyword>}`** Keyword Value- The value of a keyword, if it is present.
- **`${month}`** Month- The number of the current month.
- **`${pkw_v: <keyword>}`** Parametric Keyword Value- The value of the given parametric keyword. An error will be reported in the stream check if the given keyword is not available.

- **`${step}`** Step Name- The user-specified name of the Job Step.
- **`${steploc}`** Step Name- The user-specified relative location of the Job Step.
- **`${stream}`** Stream Name- The user-specified name of the Job Stream.
- **`${streamloc}`** Stream Location- The user-specified relative location of the Job Stream.
- **`${task_ident}`** Task Ident- The ID number of the task in the form XXYYYYY where X is the job step number and Y is the task index.
- **`${task_index}`** Task Index- The index of the task.
- **`${task}`** Task Name- The name of the task as generated from the step name and task index.
- **`${user}`** User ID- The user ID of the current user.
- **`${year}`** Year- The number of the current year.

Note To use a storage location token that includes the characters "<keyword>", replace "<keyword>" with the keyword, no additional quotations or brackets are necessary (Sample usage: ${pkw_n: r1}).

Custom Processing

Custom processing allows the user to further customize the execution of each task in a job stream by adding user-specified operations that will be performed as part of the task. These operations can be specified as using system commands and Python scripting. Refer to Section 5.5, “Stream Step Custom Processing” for detailed information on Python Scripting in a stream step.

5.3.4. Files and File Sets

Two types of file components are supported in Job Streams: External Files and File Sets. Upon creation of a new file, the File Completion dialog is shown and allows the user to choose to create a single file or a set of files.

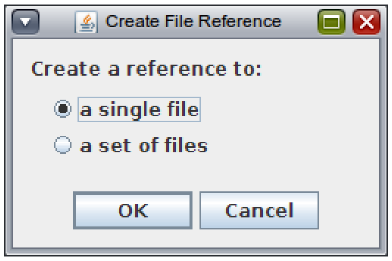


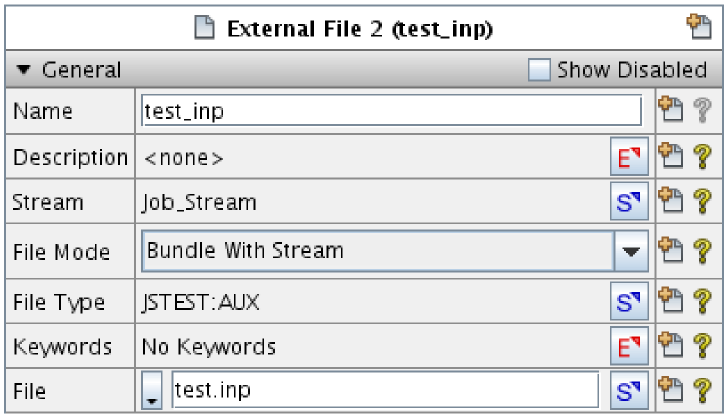
Figure 5.23. File Completion Dialog

5.3.4.1. External Files

An External File represents a single file that either is locally accessible to the Model Editor, or can be selected by one of the available file selection implementations.

External File Properties

The general properties for an external file are shown in Figure 5.24, “External File Properties”.



External File 2 (test_inp)

General

Show Disabled

Name	test_inp
Description	<none>
Stream	Job_Stream
File Mode	Bundle With Stream
File Type	JSTEST:AUX
Keywords	No Keywords
File	test.inp

Figure 5.24. External File Properties

Name

The name by which the External File is referred to within a stream. Note that this is the name of the External File component, not the name of the file it refers to. This allows the External File **Name** to indicate the function of the file rather than the on-disk name. For example: the External File can be named "Null_Transient_Input" rather than "w4loopnt.inp."

External Files only accept names composed of letters, numbers, underscores, and dashes. These names should be unique within the Job Stream's External Files and File Sets.

Description

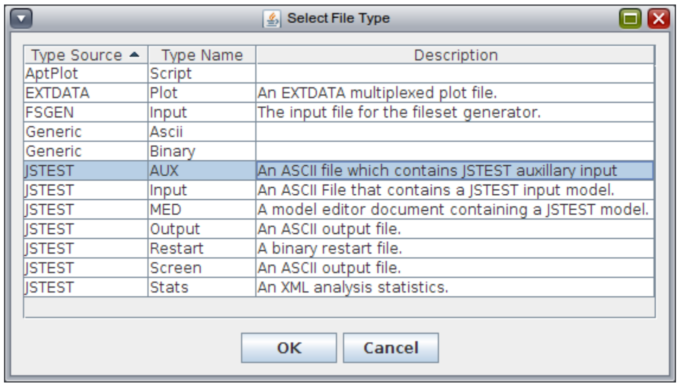
This property allows for an arbitrary description of the external file.

Stream

The parent stream to which the external file belongs. The external file can be moved between streams by editing this property.

File Type

The **File Type** property specifies the type of file(s) represented by this File component. The File Type Selection Dialog displays the list of available file types. Each available type is described by a source, name, and short description.



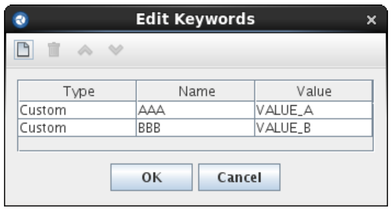
Select File Type

Type Source	Type Name	Description
AptPlot	Script	
EXTDATA	Plot	An EXTDATA multiplexed plot file.
FSGEN	Input	The input file for the fileset generator.
Generic	Ascii	
Generic	Binary	
JSTEST	AUX	An ASCII file which contains JSTEST auxillary input
JSTEST	Input	An ASCII File that contains a JSTEST input model.
JSTEST	MED	A model editor document containing a JSTEST model.
JSTEST	Output	An ASCII output file.
JSTEST	Restart	A binary restart file.
JSTEST	Screen	An ASCII output file.
JSTEST	Stats	An XML analysis statistics.

Figure 5.25. File Type Selection Dialog

Keywords

The Keywords property allows the user to define custom keywords on an External File. These keywords will be inherited downstream by any job step that uses this external file as an input. Job stream keywords are described in Section 5.1.5, “Keywords”.



Type	Name	Value
Custom	AAA	VALUE_A
Custom	BBB	VALUE_B

Figure 5.26. Define External File Keywords

File

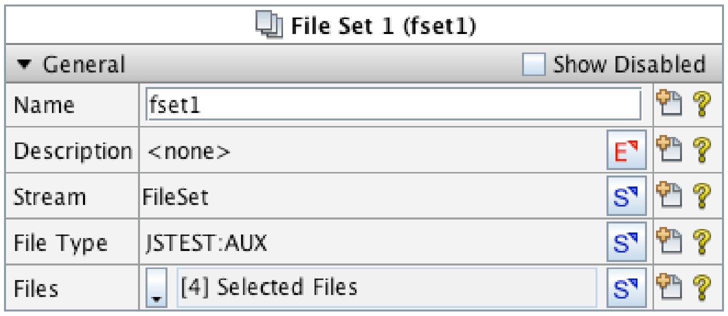
The **File** property represents the physical location of the selected file displayed as a URI. The drop-down button on the left side of the editor is used to select the protocol that handles locating the file. The **Local File** protocol is always provided; additional protocols may be available. Pressing the editor **S** (Select) button opens a dialog used to select the file based on the specified protocol. For Local File, this opens a standard file browser. Other protocols provide similar selectors tailored to their specific requirements.

5.3.4.2. File Sets

A file set is used to define a set of multiple files that are either locally accessible to the Model Editor, or can be selected using an available file protocol.

File Set Properties

The general properties for file sets are shown in Figure 5.27, “File Set Properties”. File Sets have the same properties as External Files, with the exception of the **Files** property (see Section 5.3.4.1, “External Files” for the definition of other File Set attributes).

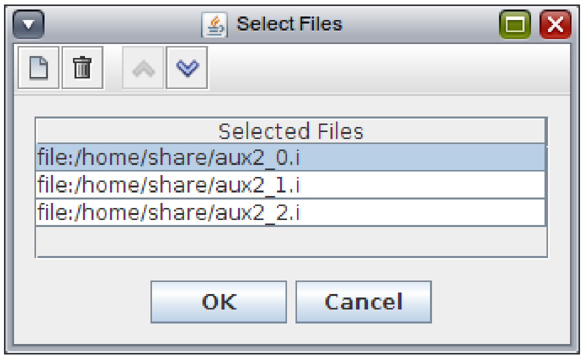


Name	fset1
Description	<none>
Stream	FileSet
File Type	JSTEST:AUX
Files	[4] Selected Files

Figure 5.27. File Set Properties

Files

The **Files** property of a file set defines the physical locations of the files selected for this file set. Similar to the **File** property of an External File, files in a File Set use a protocol to specify how all files in the set are located. The protocol can be selected with the drop-down button on the left side of the editor. Pressing the **Select** button opens the Select Files dialog, shown in Figure 5.28, “File Set Selection Dialog”. Individual files can be added, removed, and reordered via this dialog.



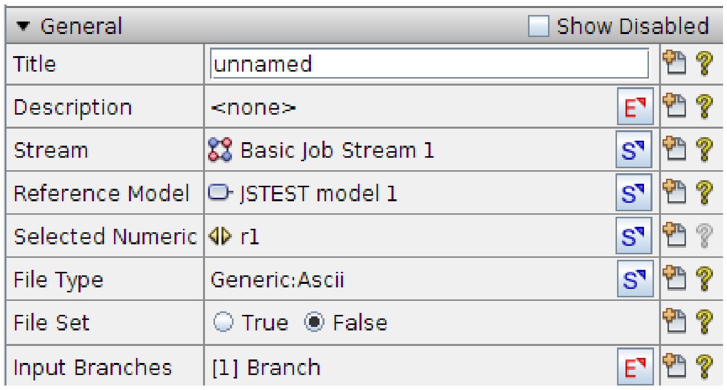
Selected Files
file:/home/share/aux2_0.i
file:/home/share/aux2_1.i
file:/home/share/aux2_2.i

Figure 5.28. File Set Selection Dialog

Adding a file to the set opens the file selection UI specific to the selected protocol. For the Local File protocol, this is a standard file browser.

5.3.5. Input Switches

In essence, an Input Switch takes multiple inputs and selects only one of these to pass through as a single output. It makes this selection based on the value of a user-defined numeric (or "shared value"). To do this, a switch has a set of Input Branches that correspond to input connections. Each of these input branches has conditional logic based on the selected user-defined numeric. When the stream is submitted, each of the Input Branches is evaluated in order to determine which input source will be used as the output of the switch.



Title	unnamed
Description	<none>
Stream	Basic Job Stream 1
Reference Model	JSTEST model 1
Selected Numeric	r1
File Type	Generic:Ascii
File Set	True [✓ False]
Input Branches	[1] Branch

Figure 5.29. Input Switch Properties

Figure 5.29, "Input Switch Properties" shows the properties for an input switch. The **Selected Numeric** property determines the user-defined numeric whose value will be used when evaluating the **Input Branches**. The selected numeric can be a shared Real, Integer, or Boolean.

Note The **Selected Numeric** and **Input Branches** properties are disabled while the value of the **Reference Model** property is **<none>**. Also, the **Input Branches** property is not editable while the value of the **Selected Numeric** property is **Unspecified**.

Title

The name by which the Input Switch is referred to within a stream. This title indicates the function of the switch and should be unique amongst the Input Switches in a stream. Input Switches only accept titles composed of letters, numbers, underscores, and dashes.

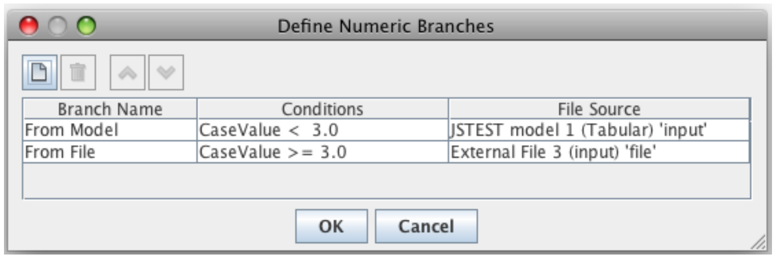
File Set

This property determines whether the switch will operate on individual files or a file set. It can only be modified if the switch has no existing connections.

When this iset to true the switch will only allow file sets to be connected to its input branches. Note that each of the input file sets connected to the branch must have the same number of files.

Input Branches

Input Branches represent the different input sources that may be used for the output of this switch. The Numeric Branches Dialog allows the user to specify the branches for a particular switch. Each branch corresponds to a distinct value of the numeric specified in the switch's **Selected Numeric** property. Branches are evaluated in the order they appear in this dialog, and the first branch whose conditions evaluate to true will be selected. The order of the branches can be modified via the **Up** and **Down** buttons located at the top of the dialog. The conditions column of each branch is edited via the Branch Conditions Dialog. For a detailed description of the Branch Conditions Dialog, see the section called “Branch Conditions”.

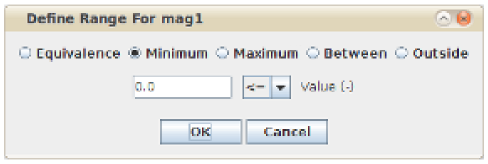


Branch Name	Conditions	File Source
From Model	CaseValue < 3.0	JSTEST model 1 (Tabular) 'input'
From File	CaseValue >= 3.0	External File 3 (input) 'file'

Figure 5.30. Input Switch Numeric Branches Dialog

Branch Conditions

Each branch of an input switch must have numeric conditions which specify when a particular input branch is active. For Real and Integer numerics, these conditions are defined as a set of valid numeric values. The valid set may be defined as: a single value, all the values above or below a set-point, all the values between two set points, or all the values outside of two set points. Each set-point can be either inclusive (<=) or exclusive (<).



Equivalence [✓ Minimum] Maximum Between Outside

0.0 <= Value (-)

Figure 5.31. Numeric Branch Condition Dialog

Parametric

A parametric input switch determines which input branch will be passed as the output of the switch for each parametric case defined by the stream type. The variables from the parametric case are set in the model, and the functions executed before the switch evaluates the input. This allows an input switch to return a different input file for separate parametric cases. If no branch is selected then this switch will not produce an output file for that parametric case.

A non-parametric input switch determines which input branch will be selected as the output using the value of the switch variable when the stream is exported. The same input branch will be selected for all parametric cases defined in the job stream. If no branch is selected then this switch will not produce an output file for any parametric case.

In either case, if no input branch conditions are met by the current value, the input switch will not pass any of the inputs as its output. Tasks created by downstream steps will be filtered out if a required input is supplied by an input switch that does not have a selected input branch.

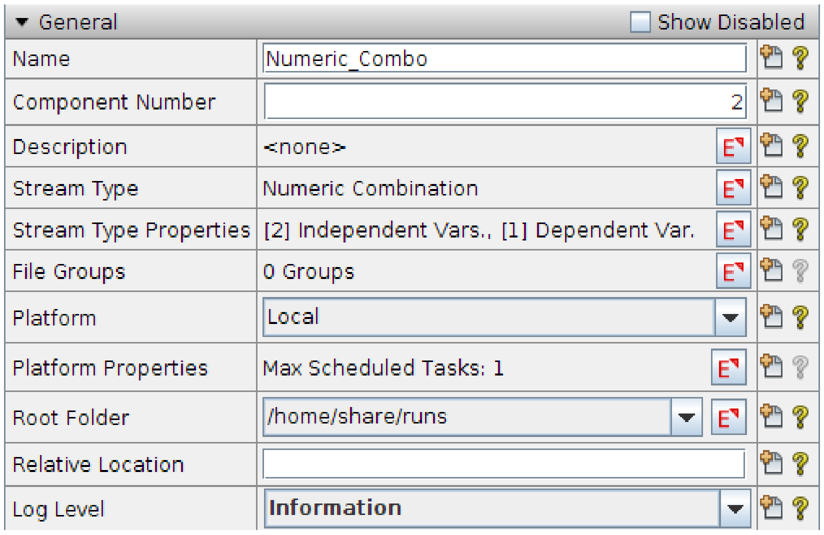
5.3.6. Stream Types

Job Streams that are set to have a type other than **Basic** can be used to define parametric cases. The parametric cases depend on the type of stream selected. Once the parametric properties are defined, the model nodes inside the job stream may be set to parametric. The two types of parametric stream types available are Numeric Combination, and Tabular Parametric.

Parametric tasks produced by a parametric stream type are defined in terms of parametric keywords. Each task has a unique combination of name=value keywords that describe the contents of the tasks. For example, within a Numeric Combination stream, the keywords listed for each task will be named after the Independent or Dependent Variables, and the value of each keyword will be the corresponding value of that variable for the task.

5.3.6.1. Numeric Combination

A Numeric Combination Job Stream builds a set of input models by modifying the value of one or more numeric variables. Each selected variable is modified by either a set of explicit values or a range of values defined by a start, end, and increment. The complete combination of independent variable values, coupled with the dependent values evaluated at those combinations, defines the set of parametric tasks.



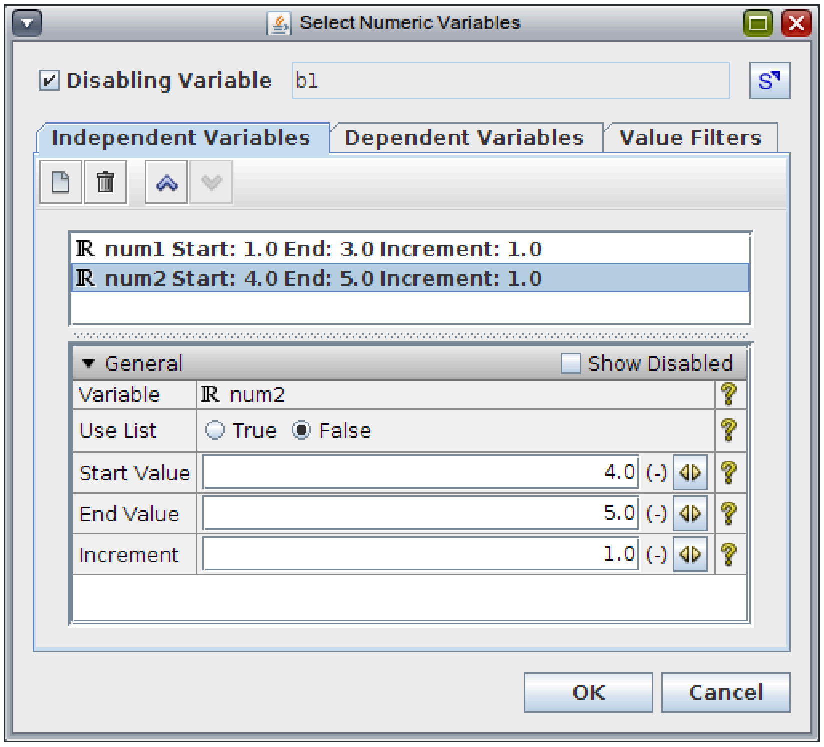
Name	Numeric_Combo
Component Number	2
Description	<none>
Stream Type	Numeric Combination
Stream Type Properties	[2] Independent Vars., [1] Dependent Var.
File Groups	0 Groups
Platform	Local
Platform Properties	Max Scheduled Tasks: 1
Root Folder	/home/share/runs
Relative Location	
Log Level	Information

Figure 5.32. Numeric Combination Stream Properties

Editing the Stream Type Properties opens the **Select Numeric Variables** dialog, shown in Figure 5.33, “Numeric Variables Dialog - Independent Variables Tab”. This dialog allows the user to specify the independent and dependent variables that vary over the parametric tasks, and to filter specific values from the results.

Independent Variables

The list of **Independent Variables** will be explicitly modified for each case. This will produce one case for each combination of independent variable values. For example, if independent variable **num1** is an explicit list of four values, and independent variable **num2** is a range that produces three values, the resulting stream will have 12 parametric tasks as a base.



Disabling Variable ✓ b1

ℝ num1 Start: 1.0 End: 3.0 Increment: 1.0
ℝ num2 Start: 4.0 End: 5.0 Increment: 1.0

General — Show Disabled

Variable	ℝ num2
Use List	True [✓ False]
Start Value	4.0 (-)
End Value	5.0 (-)
Increment	1.0 (-)

Figure 5.33. Numeric Variables Dialog - Independent Variables Tab

Within the **Independent Variables** tab, single-value variables can be added to the list, removed, or re-ordered. Variables can also be copied from and pasted into the independent variables list from other stream types or applications. When copying or pasting the independent variable values, only the variable reference is included. The properties of the combination (list, start/end/increment, etc.) are not copied.

Selecting a value in the list will display properties related to the parametric cases defined for the numeric.The **Use List** property controls whether the parametric cases are defined as an explicit list of values (**True**) or as a range of values (**False**). When **Use List** is **True**, the **Value List** property is used to define the explicit values. Otherwise, the range is described by the **Start Value**, **End Value**, and **Increment** properties.

Each value described by an Independent Variable will be used to create parametric keywords for the stream. These keywords take the form of `name=value` pairs. In the above example, one such keyword for a task would be `num2=4.0`.

Dependent Variables

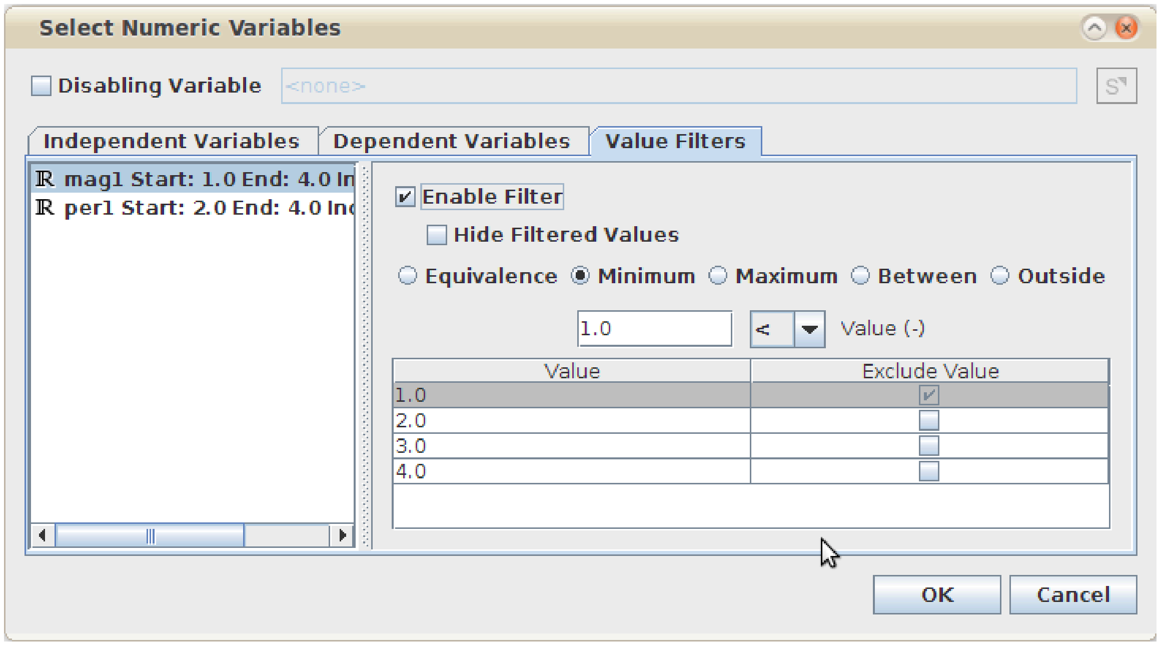
Dependent Variables provide a means of adding additional parametric keywords to a Numeric Combination. Variables can be copied from and pasted into the dependent variables list from other stream types or applications.

Each Dependent Variable is specified as a reference to a numeric variable. User-defined functions are evaluated after the independent variable values have been set for each case. The user-defined numeric referenced by the Dependent Variable is then stored as a parametric keyword value for that case.

Dependent variables cannot be used to add parametric cases, they exist solely to provide streams with additional meta-data.

Value Filters

Value Filters are used to exclude specific parametric cases from the list of cases created by the numeric combination. The filter is specified as a numeric range, and can be configured to define a specific numeric value, a minimum value, a maximum value, the set of values between two numbers, or the set of values outside of two numbers. The value filters table contains the values for the selected numeric. For each value, a check-box allows each individual case to be excluded. Any filtered value will have the background of its table row shaded grey. Filtered values can be hidden from the table by selecting the **Hide Filtered Values** check-box.



ℝ magl Start: 1.0 End: 4.0 In
ℝ perl Start: 2.0 End: 4.0 Inc

[✓] Enable Filter
[ ] Hide Filtered Values
Equivalence [● Minimum] Maximum Between Outside

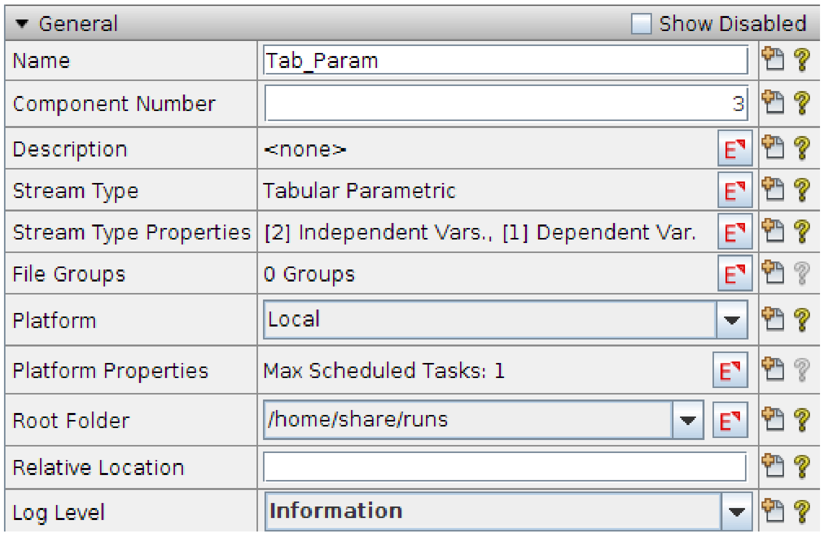
1.0 < Value (-)

Value	Exclude Value
1.0	✓
2.0	☐
3.0	☐
4.0	☐

Figure 5.34. Numeric Variables Dialog- Value Filters Tab

5.3.6.2. Tabular Parametric

A Tabular Parametric stream is a specialized Numeric Combination Job Stream that defines parametric tasks using a table of shared variable values.

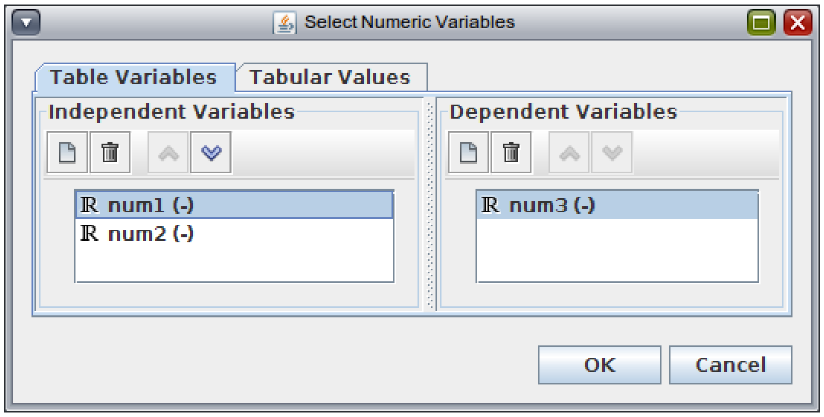


General	Show Disabled
Name	Tab_Param
Component Number	3
Description	<none>
Stream Type	Tabular Parametric
Stream Type Properties	[2] Independent Vars., [1] Dependent Var.
File Groups	0 Groups
Platform	Local
Platform Properties	Max Scheduled Tasks: 1
Root Folder	/home/share/runs
Relative Location	
Log Level	Information

Figure 5.35. Tabular Parametric Stream Properties

Stream Type Properties

Independent variables can be added, removed, and re-ordered in the Table Variables tab. Dependent variables are additional user numerics that are included in the parametric keywords. Both the independent and dependent variable lists support single and multiple copy/paste. The tabular values are not included in the copy/paste behavior so pasting a variable reference will add default values for each entry in the table.



Select Numeric Variables

Table Variables | Tabular Values

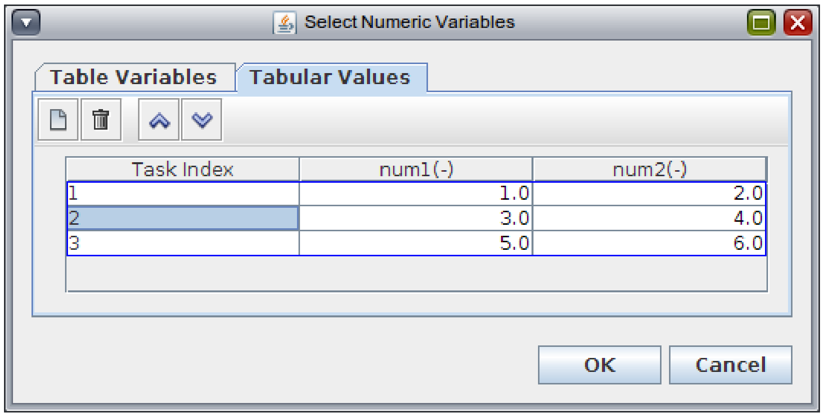
Independent Variables
- ℝ num1 (-)
- ℝ num2 (-)

Dependent Variables
- ℝ num3 (-)

OK | Cancel

Figure 5.36. Numeric Variables Dialog- Table Variables Tab

For tabular parametric streams, parametric cases are defined via the Tabular Values tab of the Numeric Variables Dialog. The structure of the tabular values table is defined by the independent variables specified in the Table Variables tab of the dialog. The table contains a column for task index and a column for specifying the value of each independent value. Parametric cases can be added, removed, and re-ordered.



Task Index	num1(-)	num2(-)
1	1.0	2.0
2	3.0	4.0
3	5.0	6.0

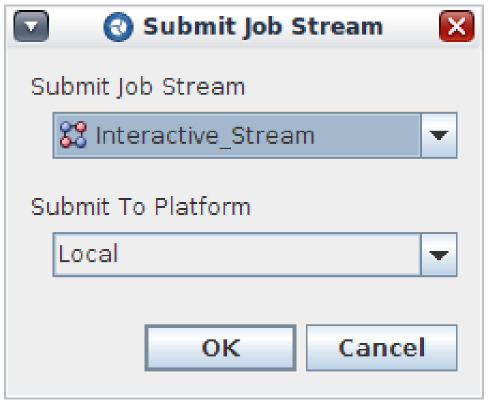
Figure 5.37. Numeric Variables Dialog- Tabular Values Tab

5.4. Submitting Job Streams

Submitting a job stream is the process of sending it to a Platform (such as a Calculation Server) so that it can be executed.

Job streams can be submitted for execution in the following ways:

- Select "**Submit Job...**" from the **Tools** menu. This opens the dialog shown in Figure 5.38, “Submit Job Stream Dialog”. This dialog allows the user to select both the stream to submit and the platform to which it will be submitted. Pressing the **OK** button submits the stream.
- Add the stream to a 2D View by either selecting **Add To View** from its right-click pop-up menu, or by dragging the stream into the 2D View. This will add a button to the View used to execute the stream. This button can only be used when its parent 2D View is locked. The stream is submitted to the **Platform** selected in the stream's properties.
- Right-click on the stream in the Navigator, and select **Submit Stream to <Platform>**, where the stream's selected **Platform** is displayed.



Submit Job Stream: Interactive_Stream
Submit To Platform: Local

Figure 5.38. Submit Job Stream Dialog

Regardless of which method is used the Model Editor will export and/or bundle up all of the necessary files and send a complete description of the stream to the selected platform. If the stream's **View in Job Status** property is set to **Yes**, Job Status will open and highlight the submitted stream.

5.5. Stream Step Custom Processing

Custom processing allows the user to further customize the execution of each task in a job stream by adding user-specified operations that will be performed as part of the task. These operations can be specified as using system commands and Python scripting. System commands are platform and system-specific commands that will be run in the order that they are entered as if they were entered into a terminal window on the target computer. Python Scripting custom processing logic is used when more intricate processing or cross-platform compatibility is required.

Custom processing operations will be run at four specific points in during task execution.

- Setup - (System Commands Only)

  These operations are run during the 'setup' phase, before files are copied or any other processing occurs.

- Pre-Execution

  These operations are run immediately before the application is executed, after inputs have been copied and processed. Any additional modifications to input files can be performed in this phase.

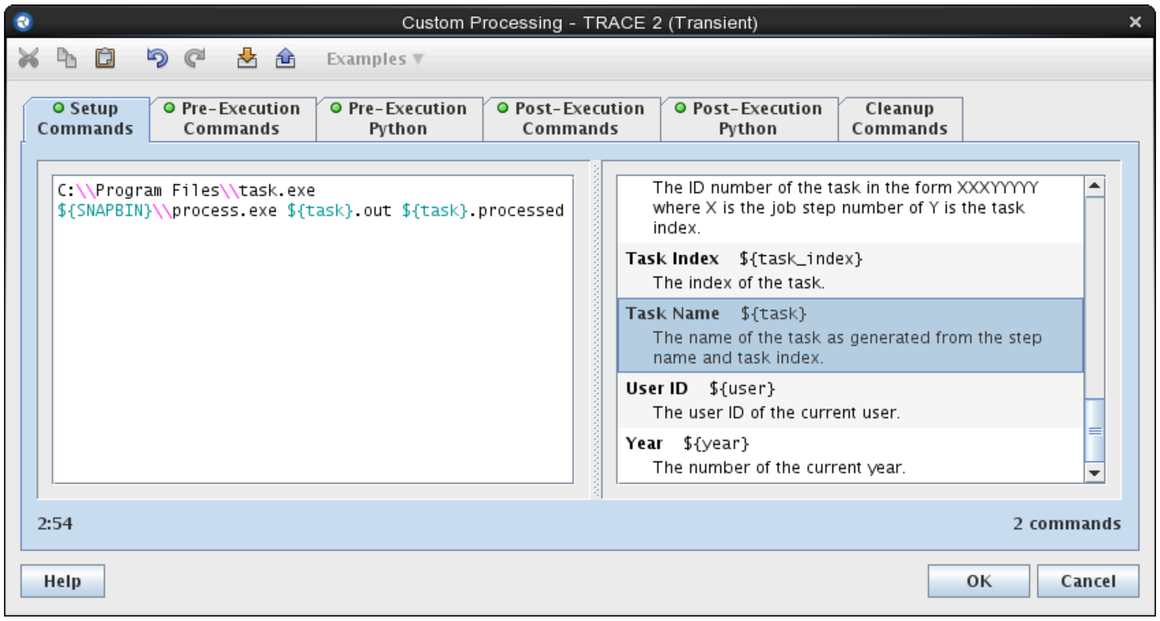
- Post-Execution

  These operations are run after the application has been executed. Any additional post-processing of the outputs can be performed in this phase.

- Cleanup - (System Commands Only)

  These operations are run just before the task is deleted by the Calculation Server. Any additional dereferencing or deletions required by the task can be performed in this phase.

The Custom Processing user interface (below) presents the system commands and python scripting in separate "processing tabs" in the order that they will be run (system before python, setup before pre-execution, etc.). Processing tabs that have operations defined will include a green dot. Above the processing tabs is a toolbar with a set of standard text editing buttons (cut/copy/paste, undo/redo, and import/export) as well as the "Examples" button used to insert sample Python code.



```
C:\\Program Files\\task.exe
${SNAPBIN}\\process.exe ${task}.out ${task}.processed
```

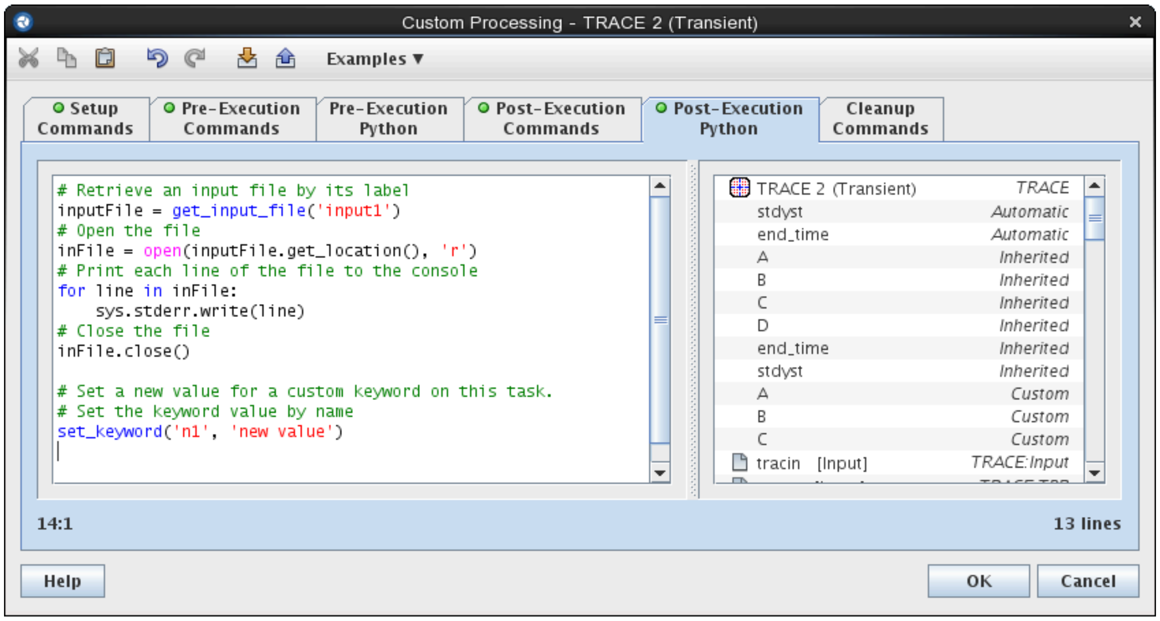
	The ID number of the task in the form XXXYYYYY where X is the job step number of Y is the task index.
Task Index ${task_index}	The index of the task.
Task Name ${task}	The name of the task as generated from the step name and task index.
User ID ${user}	The user ID of the current user.
Year ${year}	The number of the current year.

2:54 **2 commands**

Figure 5.39. Custom Processing - System Commands

On the left side of each processing tab is a sytax highlighted (i.e. colored) "source code" editor. Below the editor is a label indicating the cursor location as a line and column. The number of commands or lines defined is displayed to the right of the cursor location. The right side contains either a list of the tokens for system commands or a list of files and keywords for python scripting.

The list to the right side of the system commands contains the list of tokens that can be inserted into system commands. These tokens will be replaced during job stream submission. A description is included in the list for each available token. Double-clicking on a token in this list will insert it at the cursor location in the source code editor.



```
# Retrieve an input file by its label
inputFile = get_input_file('input1')
# Open the file
inFile = open(inputFile.get_location(), 'r')
# Print each line of the file to the console
for line in inFile:
    sys.stderr.write(line)
# Close the file
inFile.close()

# Set a new value for a custom keyword on this task.
# Set the keyword value by name
set_keyword('n1', 'new value')
```

TRACE 2 (Transient)	*TRACE*
stdyst	*Automatic*
end_time	*Automatic*
A	*Inherited*
B	*Inherited*
C	*Inherited*
D	*Inherited*
end_time	*Inherited*
stdyst	*Inherited*
A	*Custom*
B	*Custom*
C	*Custom*
tracin [Input]	*TRACE:Input*

14:1 **13 lines**

Figure 5.40. Custom Processing - Python Scripting

The list to the right side of the python scripting source editor contains the step's input and output files. Double-clicking on an input or output file will insert sample code into the source editor that shows how to retrieve the file in a python script. The list also contains the step/task and input/output file keywords. Double-clicking on a keyword will insert sample code into the source editor that shows how to retrieve the keyword's value. The Job Stream specific utility methods and classes provided are described in section Section 5.5.2, “Python Scripting”.

5.5.1. System Commands

System commands are platform and system-specific commands that will be run in the order that they are entered as if they were entered into a terminal window on the target computer. In each of these commands, the backslash character '\' is treated as an escape character. It can be used to indicate no-break spaces, such as a space in a file name or to use a backslash within the command. To execute a command 'task.exe' in 'C:\Program Files\', the command must be entered as 'C:\\Program\ Files\\task.exe'. The forward slash '/' can be used in place of the backslash in folder paths, even on the Windows platform.

5.5.2. Python Scripting

Python custom processing logic is used when more intricate processing or cross-platform compatibility is required.

Utility Methods

The following set of utility methods are provided to allow Python scripts to interact directly with the Wrapper Module during task execution. These methods give the script access to input files, output files, keywords, etc.. The Python classes included with and used by these methods are detailed in the sections below.

Method Name	**Description**
get_step_name()	Gets the user-specified name of the step.
get_task_name()	Gets the name of the task. The task name is the name of the step with a suffix for parametric tasks.
get_stream_staging_location()	Gets the folder used by the stream for intermediate files, logs, etc..
get_task_staging_location()	Gets the folder used by the task for intermediate files, logs, etc..
get_input_files(label)	Gets a list of InputFile objects (see below) that contain the label, local file name, location, and keywords. If no files are connected to the input and it is required (or not defined) then a NameError will be raised. Note: If this input is referencing the output files of an upstream task (see “Reference Input” above) then the list will instead contain the path to each file.
get_input_file(label)	Gets an InputFile object describing the first (or only) file for the input with the given label. See get_input_files(label) above.

Method Name	Description
get_output_files(label)	Gets a list of OutputFile objects (see below) that contain the label, local file name, and keywords.
get_output_file(label)	Gets an OutputFile object describing the first (or only) file for the output with the given label.
get_keywords()	Gets the list of all keywords applied to this task as a list of Keyword objects (see below). Note: This list does not include parametric keywords.
get_keyword(name)	Gets the keyword applied to this task with the given name as a Keyword object (see below).
set_keyword(name, value)	Sets the value of the Custom task keyword with the given name to the given value. Raises a NameError if no such custom keyword is found.
get_parametric_keywords()	Gets the list of parametric keywords applied to this task as a list of Keyword objects (see below).
get_parametric_keyword(keywordName)	Gets the parametric keyword applied to this task with the given name as a Keyword object (see below).
script_failed()	Indicates that the script (and thus the task) failed to execute properly. This method may be called multiple times. Once this method has been called, the task cannot be returned to a successful status.

The InputFile Class

Instances of the InputFile class are returned by get_input_files and get_input_file (above). This class provides the following methods.

Method Name	Description
get_label()	Gets the unique identifier of this input file.
get_name()	Gets the user-specified local file name of this file. This name will not correspond to the actual location of the file unless the file is being copied (rather than referenced). See “Reference Input” above. Note: Scripts should use get_location() when opening input files.
get_location()	Gets the on-disk location of this input file. This location may be identical to the name (above) if "Reference Input" is 'No'.
get_keywords()	Gets the list of keywords applied to this input as a list of Keyword objects (see below).
get_keyword(name)	Gets the parametric keyword with the given name as a Keyword object (see below). Note: This list does not include parametric keywords.

Method Name	Description
get_parametric_keywords()	Gets the list of parametric keywords applied to this input as a list of Keyword objects (see below).
get_parametric_keyword(name)	Gets the parametric keyword with the given name as a Keyword object (see below).

The OutputFile Class

Instances of the OutputFile class are returned by get_output_files and get_output_file (above). This class provides the following methods.

Method Name	Description
get_label()	Gets the unique identifier of this input file.
get_name()	Gets the user-specified local file name of this file. This name will not correspond to the actual location of the file unless the file is being copied (rather than referenced). See “Reference Input” above. Note: Scripts should use get_location() when opening input files.
get_keywords()	Gets the list of keywords applied to this input as a list of Keyword objects (see below).
get_keyword(name)	Gets the parametric keyword with the given name as a Keyword object (see below). Note: This list does not include parametric keywords.
set_keyword(name,value)	Sets the value of the Custom output file keyword with the given name to the given value. Raises a NameError if no such custom keyword is found.
get_parametric_keywords()	Gets the list of parametric keywords applied to this output as a list of Keyword objects (see below).
get_parametric_keyword(name)	Gets the parametric keyword with the given name as a Keyword object (see below).

The Keyword Class

Instances of the Keyword class are used to represent keywords applied to either input files or tasks.

Method Name	Description
get_name()	Gets the name of this keyword as a string.
get_value()	Gets the value of this keyword as a string.
is_read_only()	Returns true if this keyword is read-only and cannot be modified.
set_value(value)	Sets the value of this keyword to the given value.

5.6. Diagnosing Submitted Job Streams

SNAP Applications write messages to screen and log files that can help diagnose issues. Job streams and their tasks also write to log files. The log for the entire job stream (the *Stream Log*) contains messages indicating where the stream executed, and what staging location it used. This log also indicates which tasks were submitted, started, and finished (or failed). The log files for each task contain information more specific to the task being executed. This includes messages for each input file retrieved and each output file stored as well as any errors that might have occurred. The stream and task log files are available in *Job Status* via either the File Viewer or Job Consoles.

If the stream is not available on a Calculation Server then the log files must be examined directly rather than using Job Status. The log file for the entire stream is written to the stream's Staging Location during execution and is named [Stream Name].streamlog. The individual log files for the tasks in the stream are written to each task's folder under the stream's staging location with the name [Task Name].tasklog.

When submitting to the Calculation Server it may sometimes be necessary to examine its log file to determine how or why a stream failed. The Calculation Server log files are written to the current user's SNAP preferences folder. A new log file is created each time the server is started. Up to 9 previous log files are retained.

```
<home>\.snap\2.0\log\calculation_server.log
```

The SNAP application screen files are also stored in the user's SNAP preferences folder. These files may contain additional information that can be used to diagnose an application failure. They are not typically necessary.

- `Calculation Server`

  `<home>\.snap\2.0\cs.screen`

- `Job Status`

  `<home>\.snap\2.0\js.screen`

- `ModelEditor`

  `<home>\.snap\2.0\me.screen`

The current user's home directory (<home> above) can be found in:

- Windows 7 or Vista

  `C:\Users\<username>\.snap\2.0\`

- Windows XP

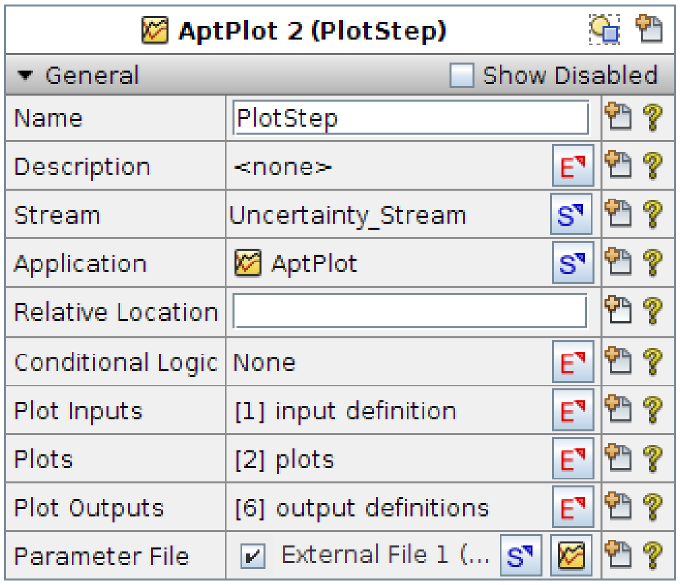
  `C:\Documents and Settings\<username>\.snap\2.0\`

- UNIX / Linux

```
$HOME/.snap/2.0/
```

5.7. AptPlot Step

A specialized AptPlot step is included with the Model Editor. A single AptPlot step can specify any number of plots, all of which are generated every time its parent stream is run.



AptPlot 2 (PlotStep)

General ☐ Show Disabled

Name	PlotStep
Description	<none>
Stream	Uncertainty_Stream
Application	AptPlot
Relative Location	
Conditional Logic	None
Plot Inputs	[1] input definition
Plots	[2] plots
Plot Outputs	[6] output definitions
Parameter File	✓ External File 1 (...

Figure 5.41. AptPlot Step Properties

An AptPlot step has the standard properties found in a step, with the following additional attributes.

- **Plot Inputs** - the inputs to the step, see Section 5.7.2, “AptPlot Step Inputs”.
- **Plots** - the plots created by the step, see Section 5.7.3, “AptPlot Step Plots”.
- **Plot Outputs** - the images and data output by the step, see Section 5.7.4, “AptPlot Step Outputs”.
- **Parameter File** - an optional parameter file (see Section 5.7.1, “Parameter Files”). This is the *global* parameter file: it is used by all plots unless they explicitly specify a parameter file of their own.

5.7.1. Parameter Files

A parameter file is a series of AptPlot batch commands that formats a plot. A Parameter File property is used to specify the optional parameter file for a step or plot definition. When such a **Parameter File** property is enabled, an optional input is added to the step.

The **Parameter File** property editor has a **Select** button and an **AptPlot Preview** button. The **Select** button can be used to make connections to the parameter file input. Pressing it opens the pop-up menu shown in Figure 5.42, “Parameter File Select Menu”. From the menu, an existing External File can be selected for the selection, or a new External File can be selected. The **AptPlot**

Preview button is enabled when the param input is connected to an External File available on the local machine. Pressing the **Preview** button will open AptPlot with the indicated parameter file.

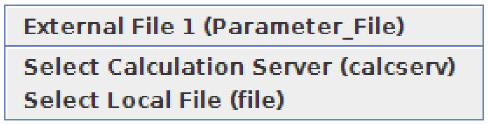
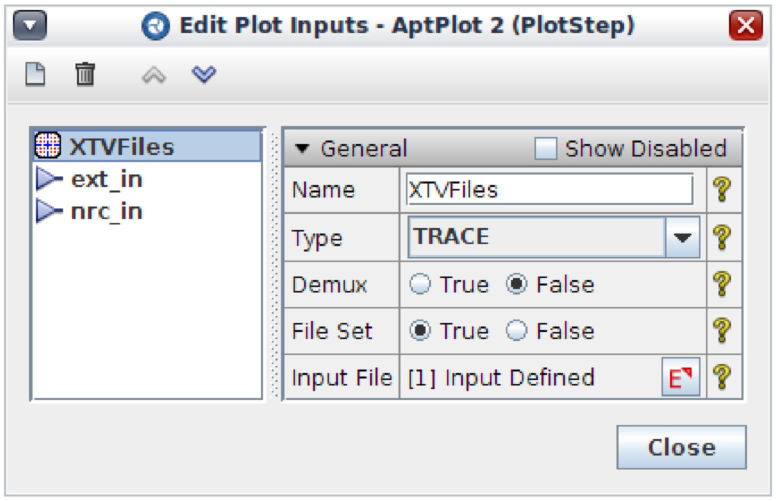

External File 1 (Parameter_File)
Select Calculation Server (calcserv)
Select Local File (file)

Figure 5.42. Parameter File Select Menu

5.7.2. AptPlot Step Inputs

As AptPlot supports a host of input formats which can be opened in arbitrary numbers, an AptPlot step must define the inputs which will be used to generate its plots. The step **Plot Inputs** property is used to specify these inputs. Pressing the **Edit** button in the **Plot Inputs** property editor opens the **Edit Plot Inputs** dialog, shown in Figure 5.43, "AptPlot Step Edit Inputs Dialog". Note that this dialog is *non-modal*; other dialogs and Model Editor functions can be used while this dialog is open. Changes made in this dialog can be undone and redone with the standard undo/redo buttons and menu items.



Name: XTVFiles
Type: TRACE
Demux: True [✓ False]
File Set: [✓ True] False
Input File: [1] Input Defined

Figure 5.43. AptPlot Step Edit Inputs Dialog

On the left side of the dialog is a list of inputs available to the AptPlot step. On the right side of the dialog are the properties for the selected input. The toolbar at the top can be used to add, remove, and reorder inputs. Each input added in this dialog adds another input to the step, visible on its left side when displayed in a 2D View.

Inputs have the following properties.

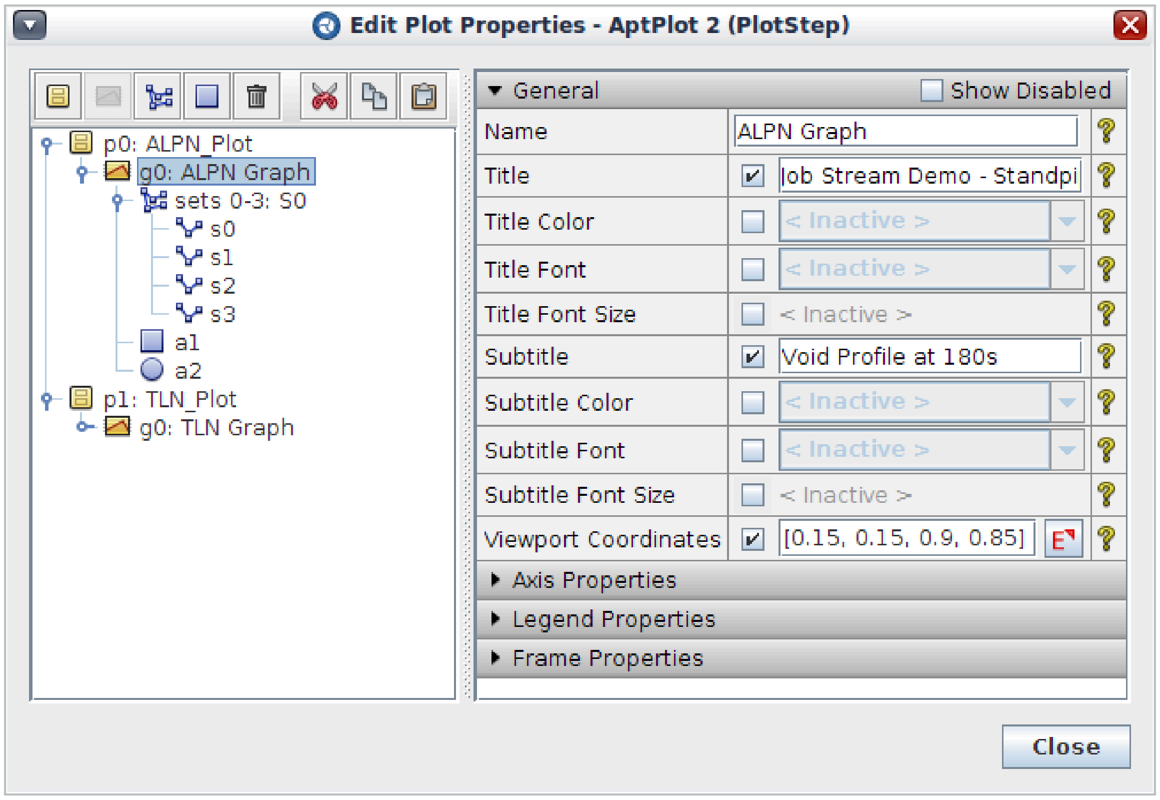
- **Name -** The name of the input. Names must be unique among inputs in a particular AptPlot step. This name specifies the label for the corresponding input on the step.
- **Type -** Indicates the type of file. In the figure, a single TRACE input has been specified, which can be connected to any TRACE:XTV output (be it from a TRACE step output, an external file, etc.). Most supported types correspond to one of the analysis code files supported by AptPlot. However, the following additional types are supported.
  - **ASCII -** generic, space-delimited columns ASCII data as supported by AptPlot. The file type of ASCII inputs is `AptPlot:ASCII Data`.

  - **Variables ASCII** - AptPlot Equation Interpreter saved variables in ASCII format. The file type of Variables ASCII inputs is **`AptPlot:Variables`**.
  - **Variables PIB** - AptPlot Equation Interpreter saved variables in PIB format. The file type of Variable PIB inputs is **`AptPlot:PIB-Variables`**.

- **File Set** - Indicates that this input is a file set input, allowing parametric steps to *fan-in* to the input. When a parametric step or external file set is connected to a file set input, any data sets that reference the input will create one set per parametric task (see Section 5.7.3, "AptPlot Step Plots").
- **Input File** - Indicates the external file or step output connected to the AptPlot step input. The **Edit** button opens the **Define Input Files** dialog used to manually edit the input (see the section called "Input Files").

5.7.3. AptPlot Step Plots

The **Edit** button for the step **Plots** property opens the **Edit Plot Properties** dialog, shown in Figure 5.44, "AptPlot Step Edit Plot Properties Dialog". This editing dialog is the heart of the AptPlot step. Within it, the plots, graphs, data sets, and annotations created by the step are added, edited, and removed. Note that this dialog is *non-modal*; other dialogs and Model Editor functions can be used while this dialog is open. Changes made in this dialog can be undone and redone with the standard undo/redo buttons and menu items.



Name		ALPN Graph
Title	✓	Job Stream Demo - Standpi
Title Color		< Inactive >
Title Font		< Inactive >
Title Font Size		< Inactive >
Subtitle	✓	Void Profile at 180s
Subtitle Color		< Inactive >
Subtitle Font		< Inactive >
Subtitle Font Size		< Inactive >
Viewport Coordinates	✓	[0.15, 0.15, 0.9, 0.85]

Figure 5.44. AptPlot Step Edit Plot Properties Dialog

On the left side of the dialog is a tree of AptPlot definitions. The contents of the tree are as follows.

1. At the top level of a tree is the list of *plots* in the step. Each plot is a unique "canvas" upon which graphs are drawn.

2. Each plot may contain any number of *graphs*. A graph is a region of the plot that displays any data set values within its coordinate space.

3. Each graph may contain any number of *data sets* and *annotations*. Data sets are the coordinates displayed as points or lines in the graph. Annotations are rectangles, ellipses, lines, and strings of text used to mark the plot.

4. Data sets connected to a file set input may contain a generated list of *sub-sets*, described below.

The toolbar over the can be used to add or remove plots, graphs, data sets, and annotations. Graphs can only be added when the parent plot is selected; data sets and annotations can only be added when the parent graph is selected. Additionally, cut, copy, and paste actions are available on the right side of the toolbar. All of these actions are also available from the right-click pop-up menu of the various entries in the tree.

Selecting a definition in the tree displays its contents in the Property View to the right. The definition is edited in this Property View. The **Edit Plot Properties** dialog supports multi-edit: selecting several components will display their shared properties in the Property View.

Most properties in the definitions are *namelist properties*: their values are optionally defined. Any given value is only specified in the generated plots if its value is enabled and defined. This allows the AptPlot step to use parameter files to define the plot, while individual parameters in the plot definitions *overrides* the parameter file formatting.

5.7.3.1. Plots

Plot definitions may specify a parameter file, as described in Section 5.7.1, “Parameter Files”.

5.7.3.2. Data Sets and Sub-Sets

Each data set definition in a graph describes a set of independent and dependent data extracted from an input source. Data set definitions have the following properties related to specifying the displayed data.

- **Input** - defines a reference to the input from which this data set definition reads data.

- **Plot Type** - defines the type of data read into the set. The following types are supported.
  - **Time** - a set of values is extracted from the input, with time (the independent values in the data) automatically retrieved based on the specified dependent data.
  - **Time Point** - same as the **Time** type, but interpolated to a single point at a specified time.
  - **Parametric** - two sets of values are extracted from the input, specifying both the independent and dependent values.
  - **Parametric Point** - same as the Parametric type, but interpolated to a single point at a specified time.
  - **Axial** - allows for the creation of axial profile plots at a specified time. Axial plots are described in greater detail below.

- **Independent Data** - the source independent data. This channel has different semantics depending on the selected input and the value of **Independent Type**.

- For plot file inputs, such as a TRACE XTV file, this denotes a data channel name. The syntax of data channel names varies by type (consult the AptPlot documentation for more info).
- For ASCII inputs, this denotes index of the data column to use.
- For Variable inputs (both ASCII and PIB), this denotes the name of a vector variable in the file.

Independent Data can only be specified for **Parametric** and **Parametric Point** data sets.

- **Independent Type -** determines whether **Independent Data** specifies a single channel or a complex expression. When set to **Expression**, **Independent Data** is interpreted as an AptPlot Equation Interpreter expression, with one distinction. Data channel names must be surrounded by curly-braces, i.e. **`{CHANNEL_NAME}`**. For example, the TRACE channel **`pn-400A01`** must be written in the expression as **`{pn-400A01}`**. A simplistic sample expression:

```
{pn-400A01} - {pn-400A02}
```

  To use the braces '{' and '}' within an expression, escape them with a backslash '\', so that '{' becomes '\{' and '}' becomes '\}'. To use a backslash, escape it as '\\'.

  Independent Data can only be specified for **Parametric** and **Parametric Point** data sets.

- **Dependent Data -** similar to **Independent Data** for the dependent portion of the data set.

  Dependent Data can be used for axial profile plots. Axial **Dependent Data** values use the construct %2N, %3N, etc. to indicate the portion of the channel name substituted with axial mesh indexes. The integer in the construct determines how many padding zeros are applied for indexes less than the ceiling index.

- **Dependent Type -** similar to **Indpendent Type** for the dependent portion of the data set.
- **Time -** specifies the time at which **Time Point**, **Parametric Point**, and **Axial** type data sets are based.
- **Axial Locations -** defines the axial or z-direction locations for a series of mesh locations in a single component along the direction of flow for the data channel being plotted. Axial plots are described in greater detail below.

Sub-Sets

When a data set references a file set input connected to a parametric output, sub-sets are generated, as shown in Figure 5.44, “AptPlot Step Edit Plot Properties Dialog”. As shown, four generated subsets, **s0**-**s3**, represent the four parametric tasks connected to the input. A sub-set indicates that the data-set will be generated once for the corresponding parametric task. These sub-sets can be used to override the formatting of the parent data set. This is useful when each set should have a different line color or symbol, for example.

Sub-sets cannot change how data is read from the parent input, they can only adjust display properties.

Axial Profile Plots

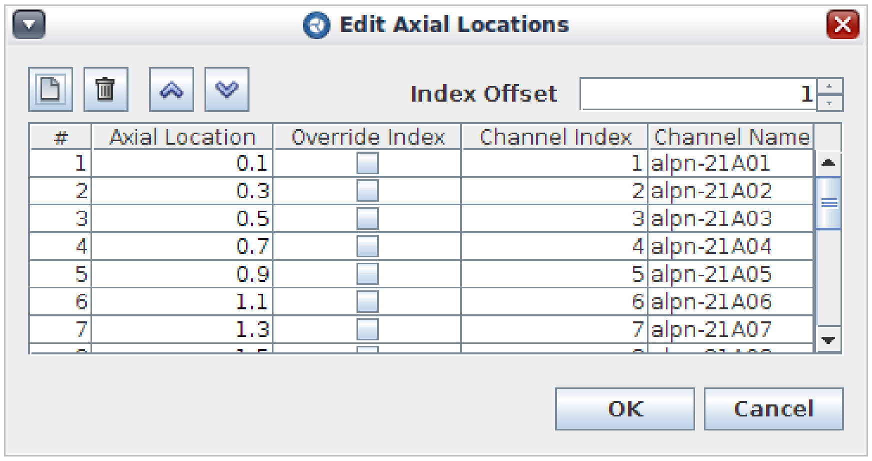
Axial profile plots allow for plotting the value of numerous data channels at specific axial locations (typically an elevation) at a given time. When **Plot Type** is set to **Axial**, the **Dependent**

Data specifies a channel pattern rather than a specific channel. **Dependent Data** values use the construct %2N, %3N, etc. to indicate the portion of the channel name substituted with axial mesh indexes. The integer in the construct determines how many padding zeros are applied for indexes less than the ceiling index.

The **Axial Locations** property defines the extracted values added to the data set. This dialog can be used to add and remove axial locations, and enable and set an optional axial index override. Axial locations can be added, removed, and reordered with buttons at the top of the dialog. **Index Offset** determines the first axial index substituted into the **Dependent Data** pattern.

In the table, **Axial Location** defines an independent data point in the set, and may be set to the desired value. The **Override Index** column can be used to manually specify the axial index for the data channel associated with the given axial location. When **Override Index** is selected, **Channel Index** can be defined as the substituted index. Finally, **Channel Name** displays the result of substituting the axial index (either automatic or overridden) into the **Dependent Data** pattern.

To help visualize the use of axial plots and the definition of axial locations, consider Figure 5.45, "Edit Axial Locations Dialog". Assume that the data set **Time** value has been set to 180.0. Consider the first row in the table. In the resulting set, the independent data value will be set to 0.1, the axial location. Channel "alpn-21A01" will be read from the input source, and its dependent data value at time 180.0 will be interpolated from the data. The resulting value is used as the dependent data value. This is repeated for each row in the table.

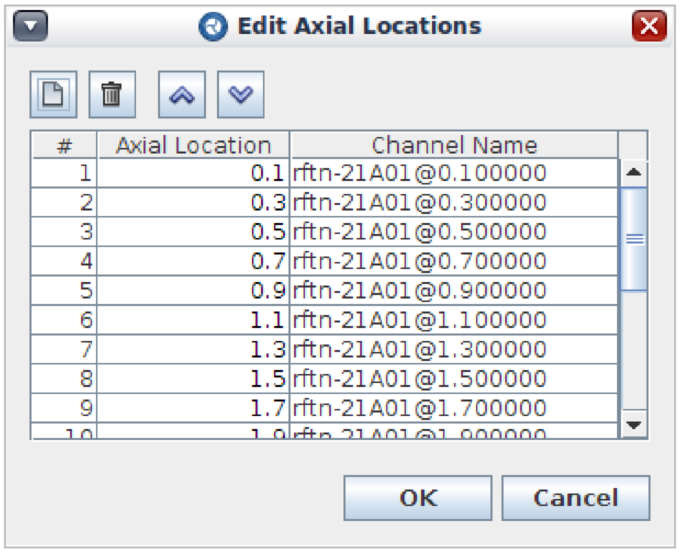


Index Offset: 1

#	Axial Location	Override Index	Channel Index	Channel Name
1	0.1	☐	1	alpn-21A01
2	0.3	☐	2	alpn-21A02
3	0.5	☐	3	alpn-21A03
4	0.7	☐	4	alpn-21A04
5	0.9	☐	5	alpn-21A05
6	1.1	☐	6	alpn-21A06
7	1.3	☐	7	alpn-21A07

Figure 5.45. Edit Axial Locations Dialog

When the **Dependent Data** channel represents a channel with fine-mesh renodalizations built into the plot file, such as **`rftn`** in TRACE, the need to specify axial indexes is unnecessary. Instead, data is retrieved at the appropriate axial location automatically using the AptPlot **`@elevation`** construct, as shown in Figure 5.46, "Edit Axial Locations Dialog with Dynamic Elevations".

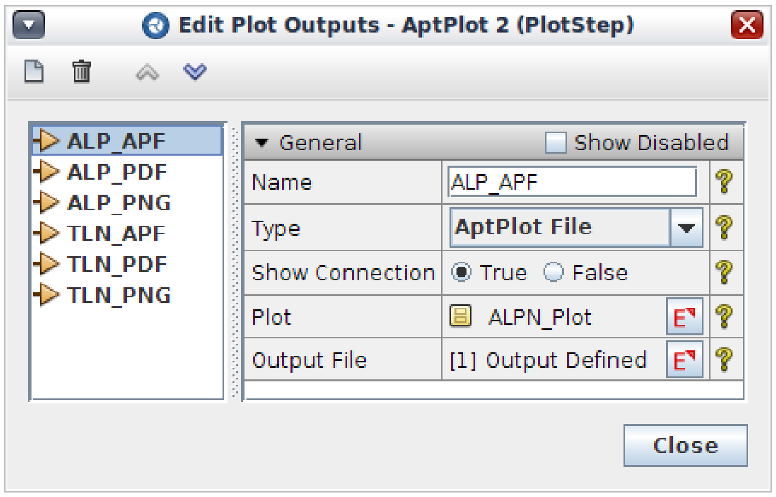


#	Axial Location	Channel Name
1	0.1	rftn-21A01@0.100000
2	0.3	rftn-21A01@0.300000
3	0.5	rftn-21A01@0.500000
4	0.7	rftn-21A01@0.700000
5	0.9	rftn-21A01@0.900000
6	1.1	rftn-21A01@1.100000
7	1.3	rftn-21A01@1.300000
8	1.5	rftn-21A01@1.500000
9	1.7	rftn-21A01@1.700000
10	1.9	rftn-21A01@1.900000

Figure 5.46. Edit Axial Locations Dialog with Dynamic Elevations

5.7.4. AptPlot Step Outputs

Similar to plot inputs, an AptPlot step must define the outputs used to save the contents of generated plots. The step **Plot Outputs** property is used to specify these outputs. Pressing the **Edit** button in the **Plot Outputs** property editor opens the **Edit Plot Outputs** dialog, shown in Figure 5.47, "AptPlot Step Edit Outputs Dialog". Note that this dialog is *non-modal*; other dialogs and Model Editor functions can be used while this dialog is open. Changes made in this dialog can be undone and redone with the standard undo/redo buttons and menu items.



ALP_APF
ALP_PDF
ALP_PNG
TLN_APF
TLN_PDF
TLN_PNG

Name	ALP_APF
Type	AptPlot File
Show Connection	[✓ True] False
Plot	ALPN_Plot
Output File	[1] Output Defined

Figure 5.47. AptPlot Step Edit Outputs Dialog

On the left side of the dialog is a list of outputs created by the AptPlot step. On the right side of the dialog are the properties for the selected output. The toolbar at the top can be used to add, remove, and reorder outputs. Each output added in this dialog adds another output to the step, visible on its right side when displayed in a 2D View.

Outputs have the following properties.

- **Name -** The name of the output. Outputs must be unique among outputs in a particular AptPlot step. This name specifies the label for the corresponding output on the step.
- **Type -** Indicates the type of generated file. The standard image outputs supported by AptPlot are provided. The following additional output types are provided.
  - **AptPlot File** - creates an AptPlot File (APF) that can be used to recreate the plot in AptPlot.
  - **ASCII** - creates an ASCII file of space-delimited columns of data.
  - **Variables ASCII** - creates an AptPlot Equation Interpreter variables file in ASCII form.
  - **Variables PIB** - creates an AptPlot Equitation Interpreter variables file in PIB form.
- **Show Connection -** determines whether the connection for the output is displayed on the step.
- **Plot** - the plot represented by this output. For image types, this defines the completed plot output to the image. For others, it defines which data sets are available for export.
- **Exported Set** - When **Type** is set to **ASCII**, this indicates the data set written to the ASCII data file.
- **Exported Sets -** When Type is set to **Variables ASCII** or **Variables PIB**, this is used to determine the data sets written to the variables file, as well as the names of the vectors assigned to each set.
- **Outputs File -** Indicates the external file or step output connected to the AptPlot step output. The **Edit** button opens the **Define Outputs Files** dialog used to manually edit the output (see the section called “Output Files”).

5.8. Python Directed Job Streams

Python Directed streams are controlled by a user-specified Python script. These streams make use of SNAP's Python bindings to create job streams that are much more dynamic than their graphical counterparts. Detailed documentation for these bindings can be found in HTML format in the file doc/python/snap/index.html included with the SNAP installation.

Both graphical and Python streams can execute the same applications and manipulate the same models. Python directed streams, however, have access to the power and flexibility of Python. This enables the use scientific and mathematical libraries such as NumPy, SciPy, and PyGSL, in the context of a running job stream. It allows access to resources outside the stream such as relational databases, to retrieve data guiding a stream or to store processed results. It also opens the door for looping and convergence capabilities not available in a graphical context.

Continue to Section 5.8.1, “Building a Stream with Python” for an overview of how to build a Python Directed Job Stream.

Python Directed streams can be created as components in the Model Editor like graphical streams. This allows streams that make direct use of a model to be edited and submitted in the context of that model. These properties of a Job Stream component are described in more detail in Section 5.3.1, “Job Streams”.

Python Directed streams can also be submitted using the command-line submit utility described in Section 5.8.5, “Submitting from the Command-Line”.

5.8.1. Building a Stream with Python

A Python Directed stream is essentially a user-specified script that creates "Actors" and adds them to the running stream. Each actor represents one execution of an application. These scripts typically open, import, or reference, input models that are passed to each application via its actor. So, for example: Opening an MED file and passing the resulting model as the input to an analysis code.

Using the TRACE analysis code, this example would look something like the following.

```
import pathlib
from snap import streams
from snap import model_editor
from snap.codes.trace import TraceActor

# open the standpipe model
standpipe = model_editor.open_model("/share/project/standpipe/standpipe.med")

# setup the TRACE steady state actor with standpipe
# as its tracin input
ss = TraceActor(name="SS", tracin=standpipe)

# Add the TRACE job to the currently running stream
streams.get_stream().add(ss)

# Wait for the TRACE job to finish
streams.get_stream().wait()
```

In this example, the first import is the Python built-in pathlib library that is used by the SNAP bindings to handle system-dependent paths. The second two imports are the Python bindings for Job Streams and the Model Editor. The fourth is the the code support module for the TRACE analysis code. These modules are described in more detail in Section 5.8.2, “SNAP Python Modules”.

The next line in the example is the call to the model_editor module's `open_model()` method. This call opens the given MED file (standpipe.med) in the Model Editor and returns a reference to the model so it may be used later.

The next line creates a TRACE "Actor" object and gives it the name "SS" for "Steady State". It also passes in the newly opened standpipe model for the "tracin" parameter. Tracin is the name of the input model for the TRACE analysis code. This says that the standpipe model should be automatically exported and passed along as the input model for the TRACE job.

The snap.streams module's `get_stream()` method returns a reference to the current stream in the next line. This reference is then used by the stream's `add(...)` method to add the TRACE job to the stream's job queue. The add method takes either a single Actor or a list of Actors that will be added to the stream.

The final line calls the stream's `wait()` method to pause the Python script until the stream has no jobs left to execute. This allows the script to wait for the Actors it has added to complete before it goes on. Though that doesn't matter for this small example, streams that create Actors in loops, such as convergence or optimization, will need to wait for results before continuing.

This example can be extended to show a few of the more essential features such as log messages, downstream tasks, restart cases, explicit Path references, and pre/post execution Python.

```
# add a note to the stream log
```

```
streams.get_stream().logger.info("Steady State complete.")
```

This part sends a simple "info" log message to the stream log file. The stream property "logger" is a reference to a Logger from the built-in "logging" module. For convenience, nearly every object in the stream system has a reference to a similar logger. Any messages sent to these loggers will be sent directly to the stream log, available in Job Status.

```
# setup the first version of the transient
first_tr = TraceActor("First_TR",
                      tracin=standpipe.case("First"),
                      trcrst=ss.trctpr)
```

This portion creates an Actor with the name "First_TR" (first transient). This actor is using the TPR file from the steady state job (ss.trctpr) for its restart input (trcrst). This syntax requests that the steady state TPR file be copied to the first transient job's location when required. Like the steady state job above, the tracin input is also coming from the standpipe model. This time, however, it is requesting that the Restart Case component named "First" be exported and used rather than the base standpipe model.

```
# setup the second version of the transient
second_tr = TraceActor("Second_TR")
```

This portion creates an Actor named "Second_TR" (second transient) but does not include any input files in the constructor. These inputs will be specified explicitly instead.

```
# get the TPR file from the steady state job
ss.trctpr >> second_tr.trcrst
```

In some cases, it is more convenient to specify an Actor's inputs after it is created. The right shift (>>) and left shift (<<) operators are used to make these "connections". These operators are seen as "arrows" pointing in the direction that the file will be passed. In this case, the TPR output of the steady state job (ss.trctpr) is being passed as the restart input to the second transient job (second_tr.trcrst). This syntax, like that used for the first transient, requests that the steady state TPR file be copied to the second transient job's location when required.

Note This same operation could be performed using the left shift (<<) operator simply by reversing the parameters: `second_tr.trcrst << ss.trctpr`

```
# get the restart input file from a file on disk
pathlib.Path('/share/project/standpipe/long_transient.inp') >> second_tr.tracin
```

This section uses the right shift (>>) operator to connect an existing restart input model from a location on disk. The location is specified using a Path from the Python built-in pathlib library. The right shift operator is a convenient way to connect input files that have already been exported as well as those that will be modified by some external process prior to execution.

```
# create a function for the second transient to run just before it executes.
def my_pre_execute_function():
    from snap import tasks
    tasks.get_logger().critical("Pre-Execute function called.")

# create a function for the second transient to run just after it executes.
def my_post_execute_function():
    from snap import tasks
    tasks.get_logger().critical("Post-Execute function called.")
```

This part of the example defines two functions: one to run before the job executes and one to run after. These functions will be used in the next part to provide pre and post execution behavior for the second transient actor.

Note that both of these functions import the `snap.tasks` module. The `snap.tasks` module contains all of the helper and utility methods provided to interact with the task: file locations, keywords, etc.. For more information about this module, refer to Section 5.8.2, "SNAP Python Modules".

```
second_tr.pre_execute = my_pre_execute_function
second_tr.post_execute = my_post_execute_function
```

These two lines illustrate simplicity of pre and post execute scripting in python streams. First the `pre_execute` and then the `post_execute` properties are set to reference the two previously defined functions. This indicates to the actor that it should pass the contents of each method to the task on the server side where it will be executed. This process uses the built-in Python `inspect` module to retrieve the source code for each function then inserts them into the task.

```
# Add the TRACE jobs to the currently running stream and wait for them to finish
streams.get_stream().add([first_tr, second_tr])
streams.get_stream().wait()
```

This final section adds the TRACE jobs to the stream's job queue and waits for them to finish.

This example is intended to show how to build the simplest of job streams using only the TRACE analysis code. Additional Python stream examples illustrating other features and analysis codes are included with SNAP in the `SNAP/Samples/` directory.

5.8.2. SNAP Python Modules

The SNAP's Python bindings are included as a collection of six modules in the python/ directory of the SNAP installation. These modules are automatically added to the PYTHONPATH environment variable when executing a script. They are also documented using NumPy-style docstrings so they can be added to the project resources of a Python editor or IDE to provide code completion and pop-up help.

- `snap` - The SNAP bindings package that includes support for Python Directed Job Streams (`snap.streams`) and the Model Editor (`snap.model_editor`).
- `snap.codes` - The package containing all analysis code support modules. This includes `fast` (FAST), `trace` (TRACE), `melcor` (MELGEN/MELCOR), `blackbox` (Black Box), and other supported codes.
- `snap.streams` - The core module that provides access to the SNAP Job Stream system and the currently running stream. This includes the Stream, Actor, File Handle, and Keyword classes. It also provides the logic that handles connections between actors and automatically exporting models from the Model Editor.
- `snap.streams.applications` - A set of classes and accessors that wrap the the set of application definitions available to the running stream. Application definitions are created in Configuration Tool and described in Section 3.5, "Applications".
- `snap.streams.file_types` - A set of classes and accessors that wrap the the set of file types available to the running stream. This module is not often used directly by Python streams.
- `snap.streams.parametrics` - A collection of utilities that can be used to create parametric jobs. This module currently contains the ParametricTable class that wraps

the values specified in the Parametric Utility Job Stream component property. Refer to Section 5.8.4, "Parametric Table" for more detailed information about these utilities.

- `snap.streams.platforms` - The platform (cluster) support module of the SNAP Job Stream system.
- `snap.streams.search` - The stream file searching module is used to find files in either the running stream or a completed locally accessible stream. It can search for files by file type, actor name, task or file keywords, file names, etc..

  For example, searching for the TRACE TPR files with a file keyword "alpn" greater than 0.5 would look much like the following.

  ```
  files = snap.streams.get_stream().search().type_eq("TRACE:TPR")
                                            .file_kw_gte("alpn", 0.5)
                                            .result()
  ```

  This feature is intended to be used as file and keyword based conditional logic. It could be to perform additional post-processing on only those tasks that meet a specific set of critera. It could also be used to eliminate failures from a series of jobs.

- `snap.utils` - A set of utility modules used by the SNAP bindings and analysis code module implementations.
- `snap.model_editor` - This module provides a set of bindings for the SNAP Model Editor and logic to automatically manage an instance in the background. It provides access to a wide array of features including batch commands, plug-in specific models, restart cases, initial condition sets, etc..
- `snap.tasks` - This module contains all of the helper and utility methods provided to interact with the task: file locations, keywords, etc..

Note For more detailed information about each of these modules, refer to the auto-generated API documentation provided in the `doc/python/snap/` directory of the SNAP installation. This directory contains HTML files that describe each module's public classes, properties, and methods.

5.8.3. Bundled Files

The stream's bundled files will be transmitted with the stream to the server during submission. This can be plot files, table data, input models, and anything else required by the stream. Up to 250 megabytes of files can be included with the stream.

Files that are bundled with the stream are extracted on the server side just before the script begins. Scripts can access these files via the stream's `get_bundled_file` and `find_bundled_files` methods. Like nearly all file path related properties in the SNAP bindings, these methods return built-in Python `pathlib.Path` objects.

For example: Opening a single bundled data file called `myfile.dat` might look like this.

```
stream = snap.streams.get_stream()
path = stream.get_bundled_file("myfile.dat")
mydata = path.open("r")
```

Finding the list of bundled PMAXS files for a PARCS job would resemble the following.

```
my_job.add_pmax(stream.find_bundled_files('*.PMAX'))
```

When using a Job Stream component, the model's MED file is automatically bundled with a stream. If it is an Engineering Template model then all of its Reference Models will be bundled as well. Refer to the section called “Bundled Files” for more information about this process.

5.8.4. Parametric Table

Parametric Tables are one way to emulate the parametric tasks features of graphical streams within a Python directed stream. They are used to apply a set of independent varaible values to the SNAP Variables in a model. They can be created either using the Parametric Table property of a Job Stream component or they can be loaded from a spreadsheet in either CSV or Microsoft Excel XLSX format.

The table data structures are defined in the snap.sterams.parametrics module containing the ParametricTable, TableRow, and TableCell, classes. More detailed information about parametric tables can be found in the auto-generated API documentation provided in the `doc/python/snap/streams/` directory of the SNAP installation.

Parametric Table Example

The following example illustrates the use of a parametric table using the TRACE Standpipe model included with SNAP. Each section of the example will be described in more detail below.

```
01: import snap.streams as streams
02: import snap.model_editor as model_editor
03: from snap.codes.trace import *
04: import parametric
05:
06: stream = streams.get_stream()
07:
08: my_model = model_editor.open_model('/user/local/SNAP/Samples/TRACE/StandPipe/standpipe.med')
09:
10: for row in parametric.TABLE:
11:     row.apply_values(my_model)
12:     actor_name = row.new_task_name('MyJob')
13:     trace = TraceActor(actor_name, tracin=my_model)
14:     stream.add(trace)
15:
16: my_model.clear_parametric_keywords()
```

The first three lines are fairly typical imports for a Python Directed job stream. The first two import SNAP's job streams and Model Editor modules so they can be used to export models and execute them. The third imports the contents of the TRACE analysis code support module (`snap.codes.trace`).

```
01: import snap.streams as streams
02: import snap.model_editor as model_editor
03: from snap.codes.trace import *
04: import parametric
```

The last import, `parametric`, is specific to the Parametric Table property of a Job Stream component. The 'parametric' module will be generated using the tabular data specified in the component. An example of a small generated parametric table with three independent variables and three dependent variables is given below.

```
# generated parametrics.py example
import snap.streams.parametrics

TABLE = snap.streams.parametrics.ParametricTable()
TABLE.set_column_names('x1',  'x2',  'x3')
TABLE.add_row         ('1.0', '2.0', '3.0')
TABLE.add_row         ('2.0', '3.0', '4.0')
TABLE.add_row         ('3.0', '4.0', '5.0')

TABLE.dependents = ['y1', 'y2', 'y3']
```

Lines 6-8 of the example get a reference to the currently running stream and open the standpipe model included with SNAP.

```
06: stream = streams.get_stream()
07:
08: my_model = model_editor.open_model('/user/local/SNAP/Samples/TRACE/StandPipe/standpipe.med')
```

Line 10 iterates over the rows in the generated table. Each of these rows is represented by a TableRow instance (snap.streams.parametrics.TableRow) which can be used to access the values specified for that row.

```
10: for row in parametric.TABLE:
```

The apply_values method on line 11 applies the values of this table row to the SNAP Variables in `my_model` (an MEDModel instance). The SNAP Variables whose names correspond to the table's column names will be assigned the value in the given row for that column. Parametric keywords will be created in the given MEDModel for each of these independent variables. Refer to the auto-generated API documentation for more detailed information about TableRow and the apply_values method.

```
10: for row in parametric.TABLE:
11:     row.apply_values(my_model)
12:     actor_name = row.new_task_name('MyJob')
13:     trace = TraceActor(actor_name, tracin=my_model)
14:     stream.add(trace)
```

Line 12 uses TableRow's `new_task_name` method to create a name for the new actor. This method creates a new task name in the form `[prefix]_[task_index]` where `task_index` is padded on the left with zeros to match the largest number available (minimum of two). So 100 rows would be prefix_001, 1000 would be prefix_0001, and so on.

Lines 13 and 14 create and submit a new TRACE job using my_model as the input.

```
16: my_model.clear_parametric_keywords()
```

Line 16 discards the parametric keywords defined in `my_model` so that they will not be applied to future exports. If the model will not be used again after this point then this step is unnecessary. This method is intended to be used when working with a model for non-parametric purposes just after performing parametric operations.

5.8.5. Submitting from the Command-Line

The SNAP installation includes a platform-specific launcher for the stream submit utility. For Windows, this is an executable (submit.exe), and for UNIX type systems (including Apple OSX) this is a shell script (submit.sh). The launcher is placed in the bin/ directory of the SNAP installation and can be executed directly from the command line.

```
submit [--platform=] [--python=] [Root Folder]/[Location]/<Name>
<python script> [Bundled File 1] [Bundled File 2] ...[Bundled
File n]
```

Argument	Description
--debug	Enables debug-level logging for the stream. (optional)
--platform=[name]	The ID of the platform that this stream will be submitted to. The 'Local' platform is used if none is specified. (optional)
--python="[path]"	The location of the python executable that will be used to execute the script. If none is specified then the application definition called "Python" will be used instead. (optional)
Root Folder	The first root folder is used if none is specified. (optional)
Location	The relative location of this stream in relation to the selected root folder. (optional)
Name	The name for this job stream. This will be used to generate the relative path for the tasks that make up this stream. (required)
Bundled File	A file location of a file that should be bundled with the stream. This parameter can appear any number of times. This is described in Section 5.8.3, “Bundled Files”. (optional)

5.9. Sequences

A Job Stream Sequence is a set of Job Streams that will be executed in order. Each entry (Job Stream) in the Sequence will be executed in turn until all of the entries have been completed. Each of these Job Streams may be submitted multiple times as separate "iterations". A user-defined Python script can be defined for each Job Stream that controls its execution. The script can be used to change input files, variable values, and the number of times the Job Stream will be submitted.

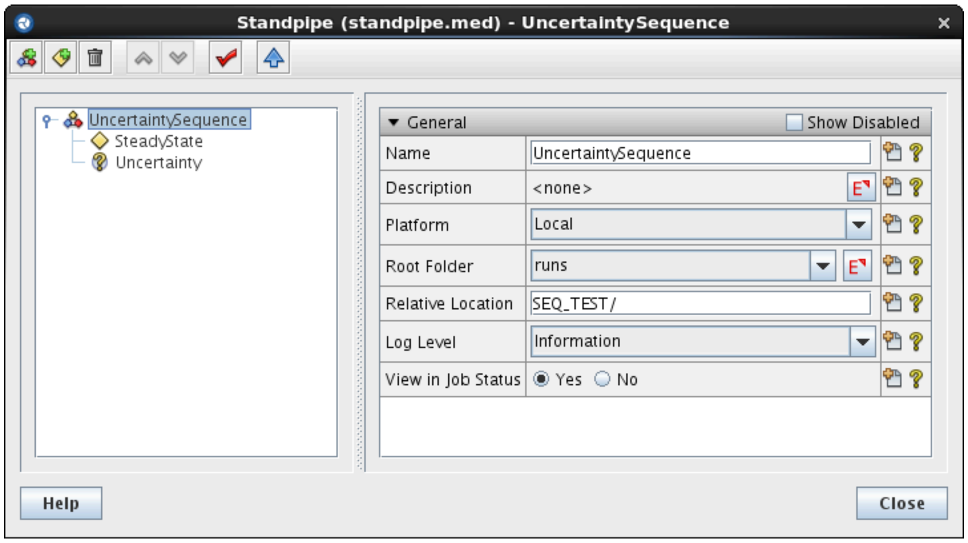
The sequence submission process will package all of the files required for its Job Streams into a single submission package. This includes all parallel input files used by SNAP plug-ins, such as PARCS cross-section files. The current model and any Engineering Template reference models will also be included in the submission package. This package is transmitted to the Calculation Server at submit time. The Sequence Manager application, packaged with SNAP, processes the input file, unpackages the source files, and submits the specified Job Streams.

The Job Streams in a sequence will be submitted to a location in the Calculation Server defined by the Relative Location of the sequence and the sequence name. This will replace the relative path value for each of the job streams, if one is specified. Iterative sequence entries (i.e. those that will execute more than once) will be futher segregated using the base name of the Job Stream followed by an iteration number. For example: "MyStream_001", "MyStream_002", etc..

Sequence entries, after the first entry, can use dynamic file replacement to define the locations of External Files and File Sets. This provides the ability to chain Job Streams together using the output files of one stream as inputs for subsequent streams. The dynamic file replacement allows the available files to be searched using a range of criteria including file type, keyword values, and iteration number.

5.9.1. Sequence Dialog

The Sequence editing dialog, shown below in Figure 5.48, “Job Stream Sequences Editing Dialog”, may be opened by selecting the Job Stream node in the Navigator and editing the Sequences property. This dialog has a tree of Sequences on the left with each Sequence's Entries as child nodes. The right side of the dialog displays the properties of the selected node (Sequence or Eequence Entry) on the left. The main toolbar is at the top of the dialog and contains various buttons for creating and editing Sequences.


Standpipe (standpipe.med) - UncertaintySequence

UncertaintySequence
SteadyState
Uncertainty

General [ ] Show Disabled

Name	UncertaintySequence
Description	<none>
Platform	Local
Root Folder	runs
Relative Location	SEQ_TEST/
Log Level	Information
View in Job Status	[● Yes] ○ No

Figure 5.48. Job Stream Sequences Editing Dialog

Sequences Toolbar

The main toolbar has buttons to create and reorder Sequences and Entries, validate a Sequence, and submit a Sequence.

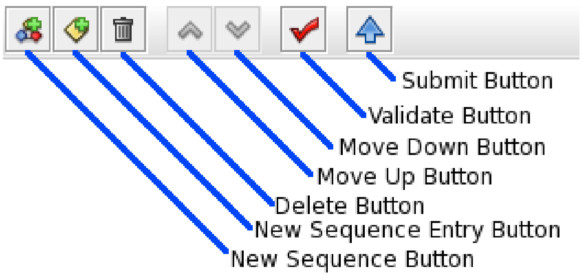


Figure 5.49. Job Stream Sequences Toolbar

- **New Sequence Button**: This button adds a new Job Stream Sequence to the current model.
- **New Sequence Entry Button**: This button adds a new Entry (Job Stream) to the currently selected Sequence. This button will only be enabled when a Sequence is selected in the tree and the model contains a Job Stream that is not already included in the selected sequence.
- **Delete Button**: This button removes whatever is selected in the tree. If a Sequence is removed all of its Entries will also be removed.

- **Move Up Button**: This moves the selected element in the tree one node higher.
- **Move Down Button**: This moves the selected element in the tree one node lower.
- **Validate Button**: This button validates the selected Sequence. If the Sequence contains any errors, an error report dialog will be displayed. Sequences with errors cannot be submitted.
- **Submit Button**: This button submits the current Sequence to the selected platform.

Platform

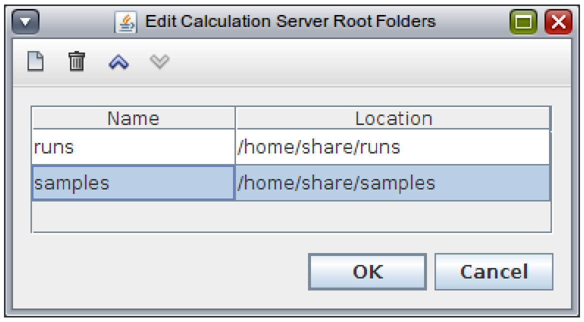
The platform (i.e. computer system) that the Sequence will be submitted to by default. This selection determines how the Sequence's platform related properties will be displayed. For example: The **Root Folder** property is only displayed when the "Local" (local Calculation Server) platform is selected. Currently only the Local Calculation Server is supported.

Platform Properties

This property is used to customize the way the Sequence is submitted to the selected Platform.

Root Folder

This property determines where on the local Calculation Server the sequence will be executed. The **E** (Edit) button to the right of the root folder selector can be used to add/remove folders for the local Calculation Server.



Name	Location
runs	/home/share/runs
samples	/home/share/samples

Figure 5.50. Calculation Server Root Folders

Note Only the "Local" platform (local Calculation Server) uses the Root Folder property.

Relative Location

The location of the Sequence within the selected Root Folder or Staging Location. This relative location and the current Sequence name will be used in place of the Relative Locations of each of the included Job Streams.

Log Level

This enumeration defines the level of detail that will be included in the Sequence and Job Stream log files. The selected value represents the minimum message level to display. For example, selecting **Information** defines that all messages flagged as Information, Warning, or Critical will be included, but not messages flagged as Debug.

View In Job Status

This flag indicates whether Job Status should be opened, with the Sequence automatically selected, after it is submitted. If **Yes** is selected, the Sequence will be opened and brought to the front of the screen. If an instance of Job Status is already available, that instance will be brought to the front of the screen.

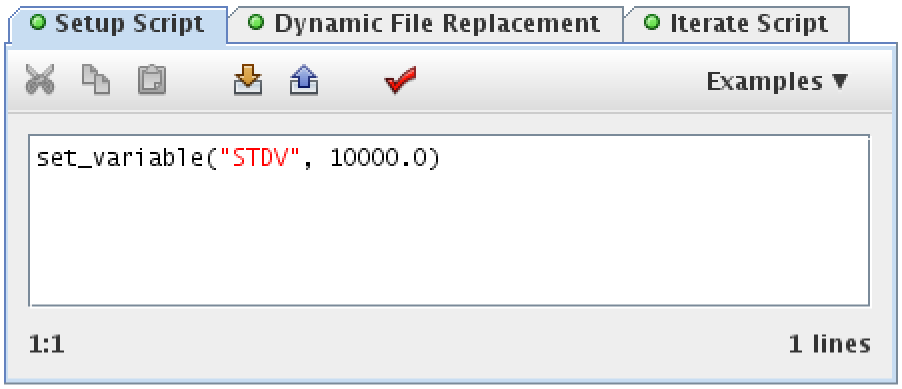
5.9.2. Sequence Entries

A Sequence Entry represents a single Job Stream in a Sequence. Each Entry may include an initialization script, Dynamic File Replacements, and an iteration script. The Entry is submitted to the Calculation Server by the Sequence Manager using a packaged copy of the relevent models an accessory files. All parallel files required for the Sequence Entry submissions will be packaged along with the Sequence when it is submitted.

Setup Script

The Setup Script is a Python script that will be executed before the entry's Job Stream is submitted. This script allows variable values to be set and Job Stream file locations to be re-defined. The panel includes standard clipboard toolbar buttons, import/export buttons, and a syntax validation button.

Note The syntax validation button checks the Python syntax of the script but does not guarantee that it will run with without errors. Runtime errors will appear in the .py_screen file in the Sequence staging folder.

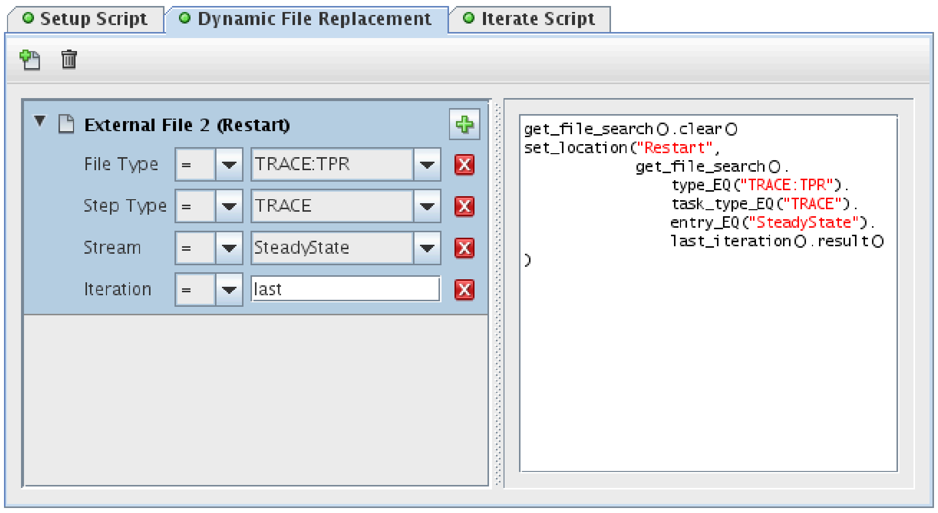


```
set_variable("STDV", 10000.0)
```

Figure 5.51. Initialization Script

Dynamic File Replacement

Dynamic File Replacement is a graphical system for building a Python script to replace the file locations of External Files and File Sets of a Sequence Entry with the output files from preceding Sequence Job Streams. These file replacements are added on the Dynamic File Replacement panel, shown in Figure 5.52, “Dynamic File Replacement”. The list on the left shows the existing file replacments for the current Sequence. The panel on the right shows the generated Python script for the selected replacement.



File Type = TRACE:TPR
Step Type = TRACE
Stream = SteadyState
Iteration = last

```
get_file_search().clear()
set_location("Restart",
             get_file_search().
                 type_EQ("TRACE:TPR").
                 task_type_EQ("TRACE").
                 entry_EQ("SteadyState").
                 last_iteration().result()
)
```

Figure 5.52. Dynamic File Replacement

A Dynamic File Replacement consists of search criteria used to restrict the available files. All newly created file replacements start with a single "File Type" criteria defined (see below). This initial criteria can be removed or changed to any other available critera. The available file search criteria are described below.

- **Stream**: Search the available files by stream name. This allows the equals and not equals operations.
- **Iteration**: Search by the iteration number. The word "Last", when used with the equals operation, results in a custom command. This type allows the equals, not equals, less than, less than or equals, greater than, and greater than or equals operations.
- **Step Type**: Search the available files by the type of step that produced the files. This type allows the equals and not equals operations.
- **Step Name**: Search the available files by the name of the step that produced the files. This type allows the equals and not equals operations.
- **Step Keyword**: Search the available files by the name and value of a step keyword. This type allows the equals, not equals, less than, less than or equals, greater than, and greater than or equals operations.
- **File Type**: Search the available files by the file type. This type allows the equals and not equals operations.
- **File Name**: Search the available files by the output file name. This type allows the equals and not equals operations.
- **File Label**: Search the available files by the label of the output file. This type allows the equals and not equals operations.
- **File Keyword**: Search the available files by the name and value of a file keyword. This type allows the equals, not equals, less than, less than or equals, greater than, and greater than or equals operations.

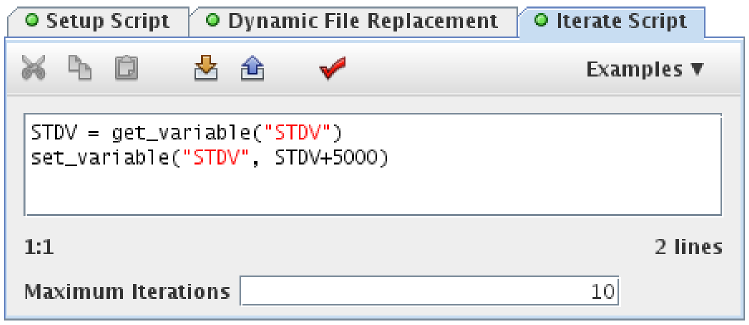
The Dynamic File Replacement panel attempts to determine if the defined set of criteria will return a single file (External File) or at least one file(File Set). If a Step Keyword or File Keyword criteria is included in the search then no prediction can be made.

Note The Python code displayed on the right side of the panel can be copied into the Setup Script and modified to add more complex file replacements.

Iteration Script

The Iteration Script controls the number of times a Job Stream will be executed and can change file locations and/or variable values to steer the calculation. Task and file keywords, produced in preceding executions, provide input between executions.

Note Local variable values defined in the Iteration script are not preserved between executions.



```
STDV = get_variable("STDV")
set_variable("STDV", STDV+5000)
```

Maximum Iterations: 10

Figure 5.53. Sequence Iteration Script

The Iteration Script panel includes the Maximum Iterations field. This is a hard maximum on the number of times the Job Stream will be submitted. This maximum may be further limited by calling the `set_finished()` method (see Section 5.9.3, “Python Built-ins for Sequences”).

5.9.3. Python Built-ins for Sequences

The following built-in Python classes and methods are available for the Setup and Iteration scripts of a Sequence Entry.

General

The following are general Python methods available in the Setup and Iteration Scripts.

- `get_keyword(name)`: Returns the value of a keyword corresponding to the given full path from the previous iteration.
- `get_variable(name)`: Returns the value of a variable corresponding to the given name set in the previous iteration. Note: this method returns a typed value. Real variables are type Float, Boolean variables are type Boolean etc.
- `set_variable(name, value)`: Sets the value of a variable for the next iteration.
- `get_file_search()`: Returns the instance of the Search class (described below) that will be used for this iteration.

- `get_iteration_number()`: This returns the current iteration number.
- `set_finished()`: This method indicates to the Sequence Manager that no more executions of this Sequence Entry (and thus Job Stream) are required.
- `is_finished()`: Returns True if the set_finished() method has been called.
- `get_sequence_name()`: This method returns the name of the Sequence that is being executed.
- `get_sequence_staging_location()`: This method returns the folder used by the Sequence for intermediate files, logs, etc..
- `set_location(name, location)`: This method sets the location of an external file to the provided SearchResult.
- `set_locations(name, locations)`: This method sets the file locations of a file set to the provided SearchResult set.

Entry

This class represents a single Sequence Entry in the Sequence.

- `get_iterations()`: This method returns the set of Iterations objects that describe the execution of the Sequence Entry.

Iteration

This class represents a single execution of a Sequence Entry's Job Stream. Job Streams that are executed multiple times will be represented by multiple Iteration objects.

- `get_stream_name()`: Returns the name of the Job Stream executed during this iteration. This name includes the iteration number as a suffix (e.g. MyStream_001, MyStream_025, etc.).
- `get_stream_location()`: Returns the directory location where the Job Stream was executed.
- `get_keywords()`: Returns the set of Keywords in this iteration.
- `get_keyword(name)`: Returns the typed value of the Keyword with the given name.

Search

This class performs file searches on all of the previously completed Job Streams. This includes all the previous Sequence Entries as well as the previous Iterations of the current Sequence.

Note In the following criteria, floating point keyword value matching has a tolerance of 1.0E-9.

- `clear()`: Clears the search criteria to prepare for a new search.
- `results()`: Returns a list of SearchResults based on the existing criteria, or None if there are no matching files.

- `result()`: Returns a single SearchResult based on the existing criteria. Note this will return the first file that matches all of the critieria.
- `entry_EQ(name)`: Adds a search criteria which requires the entry name to match the parameter.
- `entry_NE(name)`: Adds a search criteria which requires the entry name to NOT match the parameter.
- `iteration_EQ(name)`: Adds a search criteria which requires the iteration number to match the parameter
- `iteration_NE(name)`: Adds a search criteria which requires the iteration number to NOT match the parameter.
- `last_iteration()`: Adds a search criteria that selects the last iteration executed.
- `last_iterations(count)`: Adds a search criteria that selects the last 'N' iterations
- `step_name_EQ(name)`: Adds a search criteria which requires the step name to match the parameter.
- `step_name_NE(name)`: Adds a search criteria which requires the step name to NOT match the parameter.
- `step_type_EQ(typeName)`: Adds a search criteria which requires the step type to match the parameter.
- `step_type_NE(typeName)`: Adds a search criteria which requires the step type to NOT match the parameter.
- `task_name_EQ(name)`: Adds a search criteria which requires the task name to match the parameter. The task name is the step name with a parametric task number suffix, e.g step_T01, step_T99, etc.
- `task_name_NE(name)`: Adds a search criteria which requires that the task name NOT match the parameter. The task name is the step name with a parametric task number suffix, e.g step_T01, step_T99, etc.
- `task_kw_EQ(name, value)`: Adds a search criteria which requires the value of a task keyword to match the provided value.
- `task_kw_NE(name, value)`: Adds a search criteria which requires the value of a task keyword to NOT match the provided value.
- `task_kw_GT(name, value)`: Adds a search criteria which requires the value of a task keyword to be greater than the provided value.
- `task_kw_GTE(name, value)`: Adds a search criteria which requires the value of a task keyword to be greater than or equal to the provided value.
- `task_kw_LT(name, value)`: Adds a search criteria which requires the value of a task keyword to be less than the provided value.

- `task_kw_LTE(name, value)`: Adds a search criteria which requires the value of a task keyword to be less than or equal to the provided value.
- `name_EQ(value)`: Adds a search criteria which requires the file name to match the provided value.
- `name_NE(value)`: Adds a search criteria which requires the file name to NOT match the provided value.
- `label_EQ(value)`: Adds a search criteria which requires the output file label to match the provided value.
- `label_NE(value)`: Adds a search criteria which requires the output file label to NOT match the provided value.
- `type_EQ(value)`: Adds a search criteria which requires file type to match the provided value.
- `type_NE(value)`: Adds a search criteria which requires the file type to NOT match the provided value.
- `file_kw_EQ(name, value)`: Adds a search criteria which requires the value of a file keyword to match the provided value.
- `file_kw_NE(name, value)`: Adds a search criteria which requires the value of a file keyword to NOT match the provided value.
- `file_kw_GT(name, value)`: Adds a search criteria which requires the value of a file keyword to be greater than the provided value.
- `file_kw_GTE(name, value)`: Adds a search criteria which requires the value of a file keyword to be greater than or equal to the provided value.
- `file_kw_LT(name, value)`: Adds a search criteria which requires the value of a file keyword to be less than the provided value.
- `file_kw_LTE(name, value)`: Adds a search criteria which requires the value of a file keyword to be less than or equal to the provided value.

SearchResult

This class represents a single file returned from a `Search.results()` call. The SearchResult contains the location on disk of the file as well as all of the properties that can be used for search criteria.

- `get_location()`: This method returns the file location for this search result.
- `get_entry()`: Returns the name of the sequence entry where this file was produced.
- `get_iteration()`: Returns the iteration number for the iteration where this file was produced.
- `get_step_name()`: Returns the name of the step that produced this file.

- `get_task_name()`: Returns the name of the task that produced this file. This is the same as the step name, with the parametric task index suffix added.
- `get_task_type()`: Returns the application type that produced this file.
- `get_file_name()`: Returns the name of this file.
- `get_file_type()`: Returns the type of this file.
- `get_file_label()`: Returns the ouput label for this file.
- `get_task_keywords()`: Returns all of the task keywords associated with this file as a set of Keywords.
- `get_task_keyword(name)`: Returns the value of the task keyword on this file with the provided name.
- `get_file_keywords()`: Returns all of the file keywords associated with this file as a set of Keywords.
- `get_file_keyword(name)`: Returns the value of the file keyword on this file with the provided name.

Keyword

This class represents a keyword as a name/value pair.

- `get_name()`: Returns the name (not the path) of this keyword.
- `get_value()`: Returns the value of this keyword.

Chapter 6. The Animation Plugin

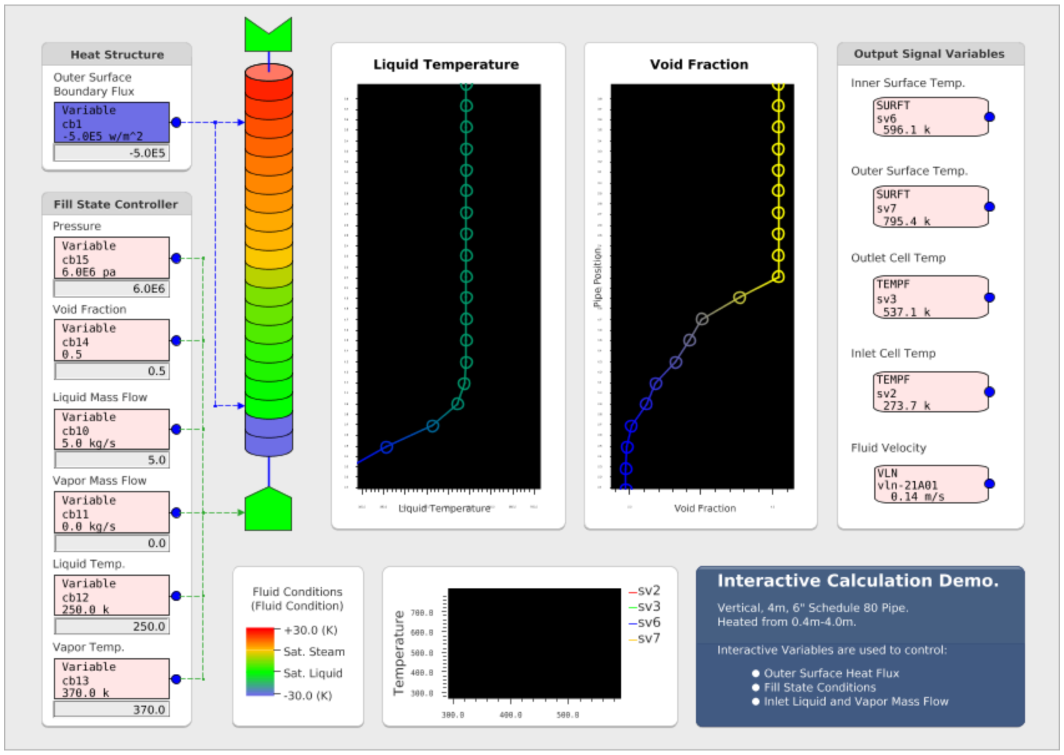


Figure 6.1. Example Animation Mask

SNAP's interactive and post-processing capabilities are predominately realized within its animation displays. Within such a display, the results of a calculation may be animated in a variety of ways.

Animation models (or "masks") are composed of Views containing a number of visual elements, each of which contain properties that may be edited in the Main Property View. An animation display retrieves data from a Calculation Server and represents it visually in some fashion. This data can be from actively running calculations, completed calculations, imported EXTData files, etc.

6.1. Creating a New Animation Model

Pressing the New button on the main toolbar will open the model type selection dialog as shown in Figure 6.2, “New Model Dialog”. Select the Animation model option and press OK. This will create a new Animation model and add it to the Navigator. A single empty 2D view will also be created and opened.

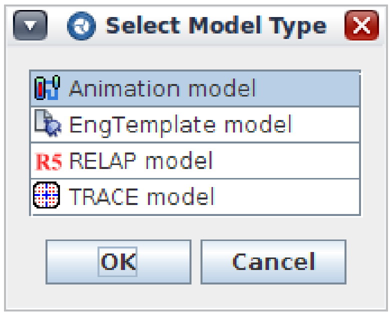


Figure 6.2. New Model Dialog

6.2. Animation Components

Animation models contain several component types: Data Sources, Color Maps, Plot Definitions, and Views. Creating and editing these components is identical to other components in the Model Editor. (Refer to Section 2.3.2, “Creating and Editing Components” for more information.)

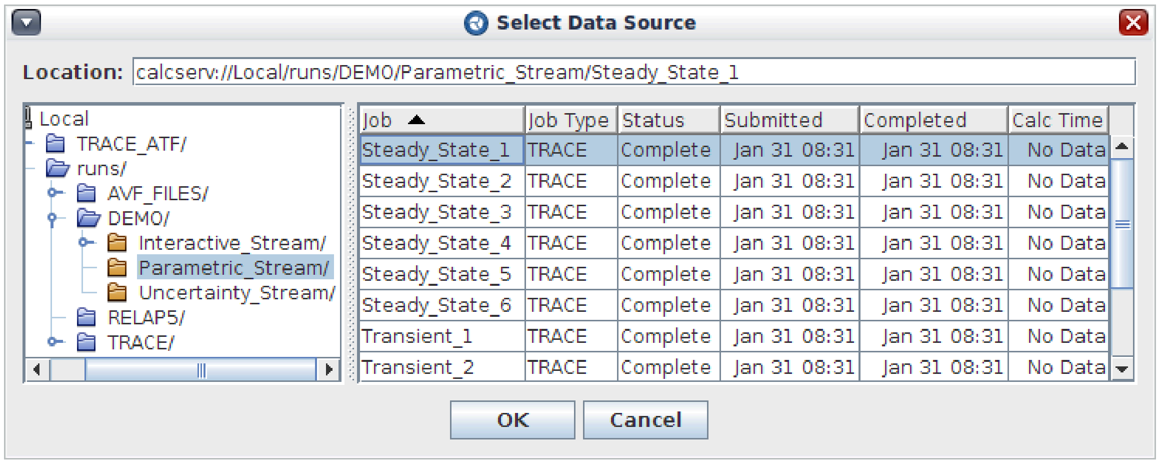
The majority of the objects in an Animation model are display beans and Annotations within 2D views. Refer to Section 6.8, “Display Beans” and Section 2.3.4, “Creating Annotations” for more information on the creation and use of display beans and Annotations.

6.3. Data Sources

An animation requires one or more Data Sources to animate data. A Data Source is most often a reference to a job on a Calculation Server. While animating, the Model Editor will retrieve data from the Calculation Server and display visual representations of that data. This process repeats until either the data is exhausted or the user interrupts the animation.

Each Animation Model requires one *Master* Data Source and may have any number of *Slave* Data Sources. Slave sources are other sources of data from a Calculation Server whose data will be interpolated relative to the Master Data Source.

To specify a job for a data source, first select the Data Source from the Data Sources category in the Navigator. Then locate the **Source Run URL** property in the Main Property View and press the red E↗ button to launch the Select Data Source dialog (shown in Figure 6.3, “Select Data Source Dialog”).



Location: calcserv://Local/runs/DEMO/Parametric_Stream/Steady_State_1

```
Local
  TRACE_ATF/
  runs/
    AVF_FILES/
    DEMO/
      Interactive_Stream/
      Parametric_Stream/
      Uncertainty_Stream/
    RELAP5/
    TRACE/
```

Job	Job Type	Status	Submitted	Completed	Calc Time
Steady_State_1	TRACE	Complete	Jan 31 08:31	Jan 31 08:31	No Data
Steady_State_2	TRACE	Complete	Jan 31 08:31	Jan 31 08:31	No Data
Steady_State_3	TRACE	Complete	Jan 31 08:31	Jan 31 08:31	No Data
Steady_State_4	TRACE	Complete	Jan 31 08:31	Jan 31 08:31	No Data
Steady_State_5	TRACE	Complete	Jan 31 08:31	Jan 31 08:31	No Data
Steady_State_6	TRACE	Complete	Jan 31 08:31	Jan 31 08:31	No Data
Transient_1	TRACE	Complete	Jan 31 08:31	Jan 31 08:31	No Data
Transient_2	TRACE	Complete	Jan 31 08:31	Jan 31 08:31	No Data

Figure 6.3. Select Data Source Dialog

Expanding each Calculation Server node in the job tree (on the left) will show the root folders for that server. Expanding each folder will show any contained sub-folders and jobs. Selecting a folder will display the list of jobs in that folder (to the right). Selecting a single job in the tree will show the details of that job to the right. Note that the **Location** field is updated when selecting jobs. This location is the URL to the job that will be used for the Data Source. For example: Figure 6.3, "Select Data Source Dialog" shows a selected job (Steady_State_1) that is the result of a parametric TRACE run.

Note Unlike other Animation components, Data Sources cannot be added to a view.

EXTDATA Channel Name Patterns

The EXTDATA Channel Name Patterns group contains a set of patterns used to generate channel names from Volume IDs for the Display Beans connected to this Data Source. The resulting channels can then be used with Color Maps to display Liquid Temperature, Quality, etc., based on the bean's selected Volume ID. This allows EXTDATA jobs that follow an appropriate naming convention to be used with Display Beans that use Volume IDs in the same way as TRACE, RELAP5, or MELCOR jobs.

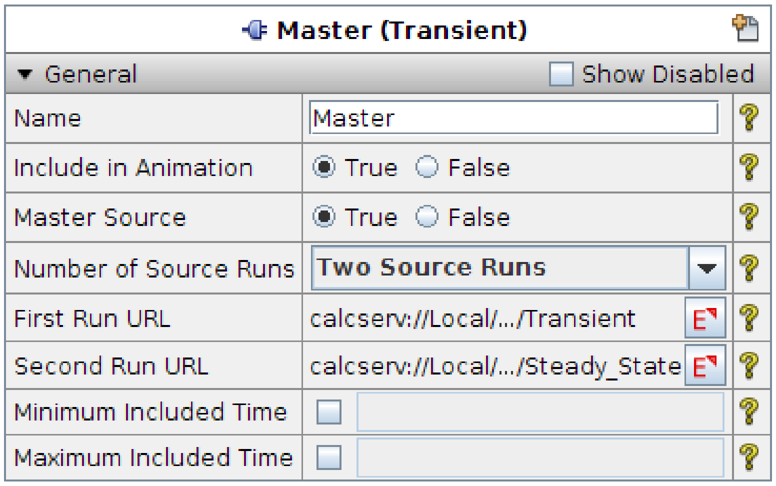
Patterns can be entered for liquid temperature, vapor temperature, saturation temperature, pressure, void fraction, and quality. Note that Color Maps of type Fluid Condition require only four of these patterns: liquid temperature, vapor temperature, saturation temperature, and void fraction.

The string '%V' is used to represent the volume ID in these patterns. For example: The pattern 'prefix-%V-suffix' would result in the channel 'prefix-301A01-suffix' for volume ID 301A01.

Note These patterns are only used when an Experimental Data (EXTDATA) job is selected for this Data Source.

6.4. Sequenced Data Sources

The Animation Plug-in's Data Source component allows multiple Source Run URLs jobs to be specified as a sequence. To enable this feature, set the **Number of Source Runs** property to the number of jobs in the sequence (up to 4) then select each job in the sequence (as described in Section 6.3, “Data Sources”) for the First, Second, Third and Fourth run URL properties.


Master (Transient)

General | Show Disabled

Name	Master
Include in Animation	[✓ True] False
Master Source	[✓ True] False
Number of Source Runs	Two Source Runs
First Run URL	calcserv://Local/.../Transient
Second Run URL	calcserv://Local/.../Steady_State
Minimum Included Time	☐
Maximum Included Time	☐

Figure 6.4. Data Source Properties

When using a sequence of jobs the playback time will begin at the first job's start time with the first job as the current job. When the playback time reaches the start time of the next job it will become the current job and re-initialize all display beans to animate that job's data. The same process will occur at the start time of the third job, and so on.

Note Only the last job in a sequence can be actively running. The preceding jobs must be completed.

The channel name list for a sequence is the union of the channel lists of the jobs included in the sequence. Channels that are not available in the current job during an animation will behave in the same manner as other undefined channels. (For example: The single volume bean is colored flat gray.) When the current job changes to a job that includes the previously undefined channel it will be animated with the currently available data as normal.

6.5. The Python Data Source

The Python Data Source is used to animate data values that must be calculated based on data from one or more Data Sources. These calculated values are stored in "virtual data channels" in the python source. Virtual data channels can be selected and used in Display Beans like other data channels.

The Python Data Source contains two segments of user-defined Python code that define its virtual data channels. These two segments are executed at different times: one during initialization, and one at each timestep. Standard Python can be used in both segments, including the definition and usage of functions, classes, etc..

- The **Initialization Source** is the block of Python source code executed upon activation of this Python Data Source. This code should include:
  - The registration of data channels from other Data Sources.
  - The assignment of initial values for virtual data channels in this Python Data Source.

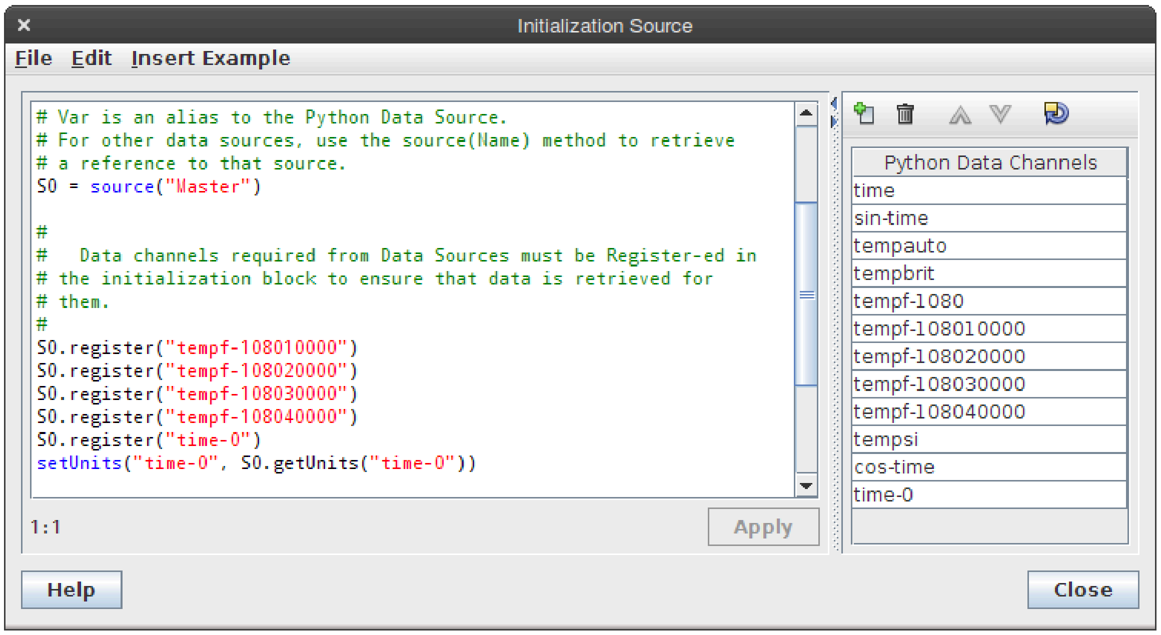
- The assignment of unit strings (s, lbm, ft, etc.) for virtual data channels in this Python Data Source.
- The definition of any methods or global variables that will be used in the Transient Source during animation.

- The **Transient Source** is the block of Python source code executed after each timestep of data is retrieved from the master data source. This code should include:
  - The retrieval of current values for required data channels in other Data Sources.
  - The assignment of new values for virtual data channels in this Python Data Source with setChannel calls.

Both of these source segments are edited by using the source editor described below.

Python Source Editor

The source editor provides a syntax highlighted text editor (center) for editing initialization and transient Python data source code. The Apply button below the source editor will apply the current set of changes without closing the editor. The current cursor line and column is displayed the left of the apply button.



```
# Var is an alias to the Python Data Source.
# For other data sources, use the source(Name) method to retrieve
# a reference to that source.
S0 = source("Master")

#
#   Data channels required from Data Sources must be Register-ed in
# the initialization block to ensure that data is retrieved for
# them.
#
S0.register("tempf-108010000")
S0.register("tempf-108020000")
S0.register("tempf-108030000")
S0.register("tempf-108040000")
S0.register("time-0")
setUnits("time-0", S0.getUnits("time-0"))
```

Figure 6.5. Python Data Source Source Editor

The virtual data channels in the python data source are displayed on the right side of the source editor in the *Python Data Channels* list. Virtual data channels can be added, removed, reordered, and sorted using the toolbar above the list. To make a data channel available to Display Beans in this Python Data Source, first add the channel name to the list, then use calls to setChannel in your Transient Source python code to give that channel a value at each timestep. The same virtual data channel list can be edited in both the transient and initialization source editing windows.

The first virtual data channel ("time") is automatically created and cannot be removed or reordered. Its value is assigned automatically to the master data source's current calculation time plus the python data source's *Begin Time Offset* property.

Example Python code for the various data source specific methods can be found in the **Insert Example** menu.

Animation Utility Functions

The python data source provides a default set of general utility functions. It also provides a set of unit conversion utility functions that will be described later.

- `setChannel(name, value)`

  Sets the value of the virtual data channel with the given name. *(Python Data Source Only)*

- `setUnits(name, unitString)`

  Sets the unit string of the virtual data channel with the given name. *(Python Data Source Only)*

- `time()`

  Returns the current calculation time of the data source in seconds. For the master data source, this is the same time that is displayed in the time toolbar and display bean.

- `source(name)`

  Returns a reference to the data source with the given name wrapped in an instance of AnimSource (see below).

The Animation Source Class

The AnimSource class acts as a wrapper for animation data sources. It serves to simplify the visible interface and provide automatic unit conversion for retrieved data channel values. The following functions are available to AnimSource instances:

- `register(channels)`

  Data channels in regular (i.e. non-python) Data Sources must be registered by the initialization source to ensure that they will be made available to the transient source during animation. *(Non-Python Data Sources Only)*

- `__call__(name)`

  Returns the current value of the data channel with the given name in this data source. For example, the following code retrieves the current value of the data channel "tempf-1000" from the AnimationSource reference "S0".

  ```
  temperature = S0("tempf-1000")
  ```

- `getChannel(name)`

  This method is identical to `__call__(name)` above.

- `getUnits(name)`

  Returns the units string ("F", "btu/hr", etc.) of the data channel with the given name in this data source. This method can be used to pass unit information from one data source to the python data source in conjunction with the animation utility function `setUnits(name, unitString)` described above.

- `useSIUnits()`

  Indicates that all data channel values retrieved from this data source should be in SI units. Note that this is the default behavior for all data sources.

  See isSIUnits() below.

- `useBritshUnits()`

  Indicates that all data channel values retrieved from this data source should be in British units.

  See isBritishUnits() below.

- `useAutoUnits()`

  Indicates that all data channel values retrieved from this data source should use the Engineering Units setting for the Animation model to determine SI or British conversion.

  See isAutoUnits() below.

- `isSIUnits()`

  Returns true if this data source is using SI units for all returned data values.

  See useSIUnits() above.

- `isBritishUnits()`

  Returns true if this data source is using British units for all returned data values.

  See useBritishUnits() above.

- `isAutoUnits()`

  Returns true if this data source is using automatic units conversion based on the Engineering Units setting for the Animation model.

  See useAutoUnits() above.

Unit Conversion Functions

The python data source includes a default set of unit conversions provided as global functions. These functions are listed below.

Pressure

- `psia2Pa(value)` - Pounds per Square Inch Absolute to Pascal

- `Pa2psia(value)` - Pascal to Pounds per Square Inch Absolute

Temperature

- `K2C(value)` - Kelvin to Celsius
- `K2F(value)` - Kelvin to Fahrenheit
- `K2R(value)` - Kelvin to Rankine
- `C2K(value)` - Celsius to Kelvin
- `C2F(value)` - Celsius to Fahrenheit
- `C2R(value)` - Celsius to Rankine
- `F2K(value)` - Fahrenheit to Kelvin
- `F2C(value)` - Fahrenheit to Celsius
- `F2R(value)` - Fahrenheit to Rankine
- `R2K(value)` - Rankine to Kelvin
- `R2C(value)` - Rankine to Celsius
- `R2F(value)` - Rankine to Fahrenheit

Sp. Volume

- `CMpKG2CFpLBM(value)` - m^3/kg to ft^3/lbm
- `CFpLBM2CMpKG(value)` - ft^3/lbm to m^3/kg

Int. Energy

- `JpKG2BTUpLBM(value)` - J/kg to BTU/lbm
- `BTUpLBM2JpKG(value)` - BTU/lbm to J/kg

Mass Flux

- `LBMpSFT2KGpSM(value)` - kg/m^2 to lbm/ft^2
- `KGpSM2LBMpSFT(value)` - lbm/ft^2 to kg/m^2

6.6. Color Maps

A Color Map is a user defined range of colors and a corresponding user defined range of values used for display bean animation. During an animation, a typical behavior of a display bean is to change color based on the current value of its associated data channel. For example, a Single Element display bean is depicted as a rectangle. If it is tied to a generic color map with a single segment ranging between values of 0 and 100, with respective colors of red and blue, when animating a value of 75, the rectangle will appear as a deep red. Alternatively, when animating a value of 25, the rectangle will display a deep blue. Any values exceeding the minimum and maximum values of the color map will be displayed by the colors defined for the minimum and maximum values (alternatively, colors can be specified for out or range values).

As Color Maps are themselves components, any number can be created and optionally added to a 2D View (see Figure 6.6, “Generic Color Map”).

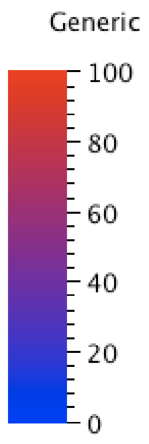
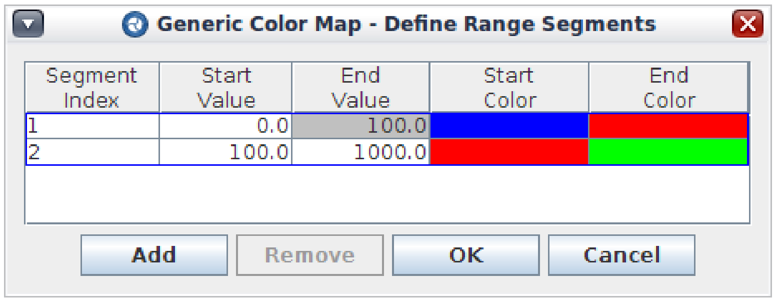


Figure 6.6. Generic Color Map

The properties available for a Color Map are dependent on its current **Color Map Type**. Also, the properties available for each type are completely separate from those for other types. For example: the **Segments** specified for the **Temperature** type are independent of the **Segments** specified for the **Liquid Temperature** type. This means that changing **Color Map Type** will alter what property is being shown in the display beans using that map.

The **Segments** of a color map are consecutive regions of increasing value that may have different starting and ending colors. This allows for different regions of the overall color map to have separate color values. The dialog for editing a color map's segments is displayed in Figure 6.7, “Color Map Segments”.



Segment Index	Start Value	End Value	Start Color	End Color
1	0.0	100.0	🟦	🟥
2	100.0	1000.0	🟥	🟩

Figure 6.7. Color Map Segments

Temp / Pressure / Quality / Void Fraction

These color map types work with beans that use either a Volume ID or a Data Channel to retrieve animation data. These types use a sets of min/max values and min/max colors to determine the displayed color for each bean. For beans that use a Volume ID, the channel that is displayed will be determined by the animation module, which loads the data from a graphics file.

Generic

This color map type allows minimum/maximum values (and colors) to be specified along with SI and British units for these values. Note that the engineering units MUST defined for proper unit conversion.

Generic is the most flexible color map type for display beans that use the **Volume ID** property. When these beans use a color map of type Generic they will use a user-speficied pattern to determine which data channel to animate. These patterns can be specified for each plug-in currently loaded (i.e. one for TRACE, another for RELAP5). Refer to the pop-up help for the **Channel Name Patterns** property for more information on the pattern syntax.

The *Nonlinear Scaling Option*, *Nonlinear Scaling Parameter*, and *Nonlinear Scaling Type* properties can be used to apply a nonlinear scale to the color map interpolation. When the *Nonlinear Scaling* option is used the color map data will be scaled in a nonlinear fashion using the supplied scaling parameter. The *Nonlinear Scaling Type* property determines the color map depiction when displayed in drawn views.

Generic 2D

This color map type allows for a gradient to be applied along an X and Y axis. Colors are first interpolated based on the data value in the Y direction, then transitions to a single fixed color based on the data value in the X direction. The X Direction color can be specified as fixed at either the minimum X value, or maximum X value. An example follows with the Y axis having a blue to red color gradient over the range 0 to 100, and the X axis having a gradient that transitions to white from 0 to 1.

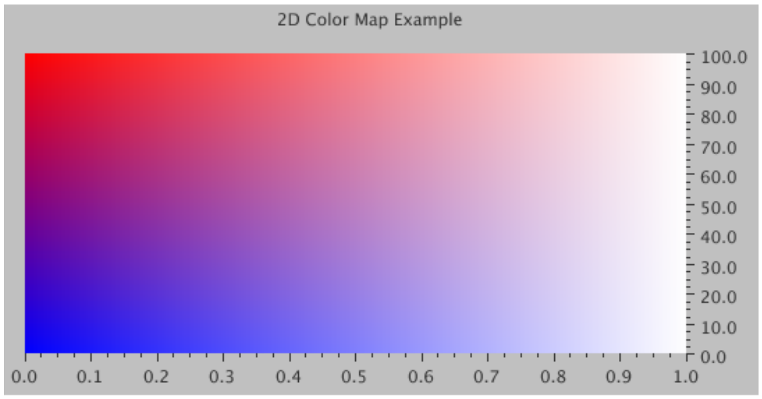
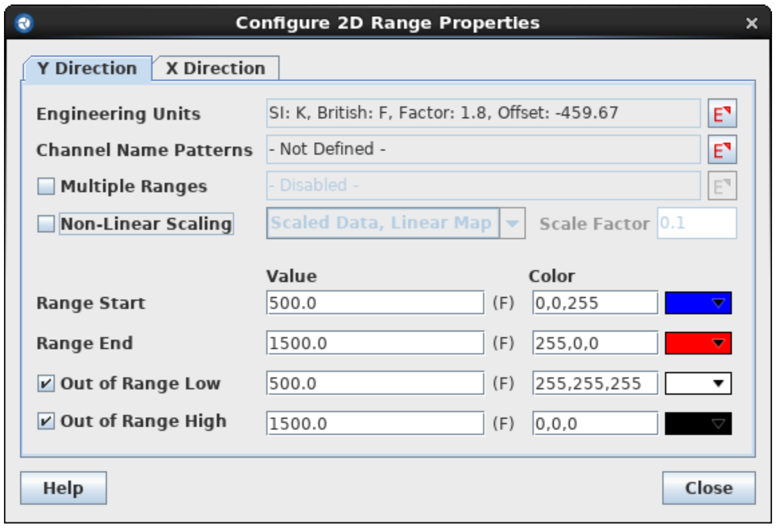


Figure 6.8. Generic 2D Color Map

The Generic 2D properties are available in a single dialog via the *Configuration* property. The *Configuration* dialog supports all of the properties in the Generic color map type located in the *Y Direction* tab, with an additional property set to define the X direction color range data located in the *X Direction* tab. This includes the *Out of Range High/Low*, *Engineering Units*, *Channel Name Patterns*, and *Nonlinear Scaling* properties. While the X direction only supports a single color segment via the *Range Limit Minimum* and *Range Limit Maximum* properties, the Y direction may have multiple color segments defined when the *Multiple Ranges* checkbox is enabled, or a single color segment defined by the *Range Start* and *Range End* properties. Note that like the Generic color map type, engineering units MUST be defined for proper unit conversion. The *Configuration* dialog is displayed below.



Configure 2D Range Properties

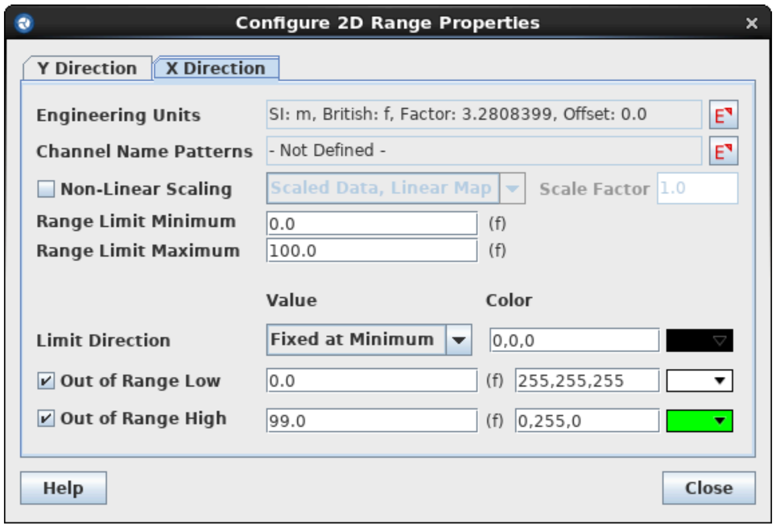
Y Direction | X Direction

Engineering Units	SI: K, British: F, Factor: 1.8, Offset: -459.67		
Channel Name Patterns	- Not Defined -		
☐ Multiple Ranges	- Disabled -		
☐ Non-Linear Scaling	Scaled Data, Linear Map	Scale Factor	0.1

	Value		Color	
Range Start	500.0	(F)	0,0,255	🟦
Range End	1500.0	(F)	255,0,0	🟥
✓ Out of Range Low	500.0	(F)	255,255,255	⬜
✓ Out of Range High	1500.0	(F)	0,0,0	⬛

Help | Close

Figure 6.9. 2D Range Configuration Dialog - Y Axis



Configure 2D Range Properties

Y Direction | X Direction

Engineering Units	SI: m, British: f, Factor: 3.2808399, Offset: 0.0		
Channel Name Patterns	- Not Defined -		
☐ Non-Linear Scaling	Scaled Data, Linear Map	Scale Factor	1.0
Range Limit Minimum	0.0	(f)	
Range Limit Maximum	100.0	(f)	

	Value		Color	
Limit Direction	Fixed at Minimum		0,0,0	⬛
✓ Out of Range Low	0.0	(f)	255,255,255	⬜
✓ Out of Range High	99.0	(f)	0,255,0	🟩

Help | Close

Figure 6.10. 2D Range Configuration Dialog - X Axis

The *Out of Range Low* and *Out of Range High* properties can be used to constrain valid values within the minimum and maximum values in each direction of the color map. When the Y direction value is out of range and the X direction value is in range, the Y direction out of range color is interpolated with the current X direction color as if it was part of the defined color map. When the X direction value is out of range, the X direction out of range color will always be the corresponding color. The out of range properties are optional and when inactive, out of range data will be treated as the minimum/maximum value.

The Generic 2D color map type can only be used with beans that use a **Volume ID**. The Y direction *Channel Name Pattern* and X direction *Channel Name Pattern* in conjuction with various volume bean Volume IDs will determine which data channels will be animated.

Fluid Condition

This color map type displays the current fluid conditions of a volume (by **Volume ID** only) as a set of color ranges. Separate color ranges are specified for sub-cooled, saturated and superheated liquid. For this color map type, the superheat and subcool values are specified as a number of degrees from the saturation temperature.

Note The Fluid Condition color map type can only be used with beans that use a **Volume ID**.

6.7. Animation Playback

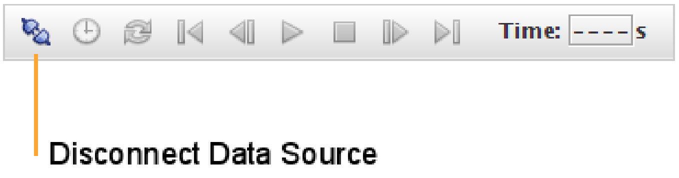


Figure 6.11. Playback Controls

When an Animation Display is open, the Animation Playback Controls will become available in the Main Toolbar. The playback controls are a collection of buttons used to drive an animation. They are illustrated in Figure 6.11, “Playback Controls” and Figure 6.12, “Playback Controls: Connected”.

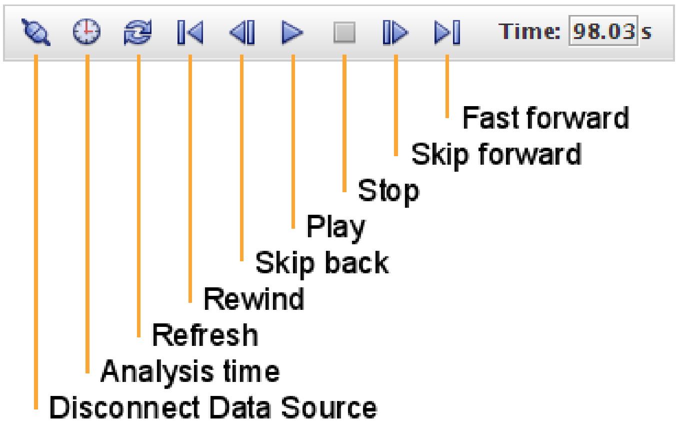


Figure 6.12. Playback Controls: Connected

- **Connect Data Source -** Connects the Animation to the currently defined Data Sources. Once connected to a Data Source, this button becomes the **Disconnect Data Source** button. Only one Animation Model may be connected at a time.
- **Disconnect Data Source -** Disconnects from the current Data Sources.
- **Analysis Time -** Opens the Analysis Time dialog. This dialog is used seek a specific time in the calculation, as well as to configure various time-related settings for the animation.
- **Rewind -** Moves the animation back to the first available time value.

- **Skip Backward** - Moves the animation backward by a fixed number of time steps. This number of time steps can be configured in the Analysis Time dialog by changing the **Skip Forward/Back Steps**.

- **Play Animation** - Begins playback of the animation. Once pressed, this button becomes a **Pause** button which can be used to pause playback.

- **Stop Animation** - Halts the currently animating job. The **Stop** button is only available when the job is currently active (executing) and the current playback is at the last available timestep.

- **Skip Forward** - Moves the animation forward by a fixed number of time steps. This number of time steps can be configured in the Analysis Time dialog by changing the **Skip Forward/Back Steps**.

- **Fast Forward** - Moves the animation forward to the last available time value.

Note Skip Forward and Skip Backward are not supported by all plug-ins.

6.8. Display Beans

Display beans are objects that can be added to a 2D view to display values retrieved from a job on a Calculation Server or an external data source. Display beans are created using the Insertion Tool in the exact same way as Annotations. Display beans can also be resized, reshaped and moved in a similar fashion to annotations.

Note For most plug-ins the quickest way to create a simple display is to copy the contents of a 2D View (e.g. a set of interconnected pipes or control systems) and paste into an Animation view.

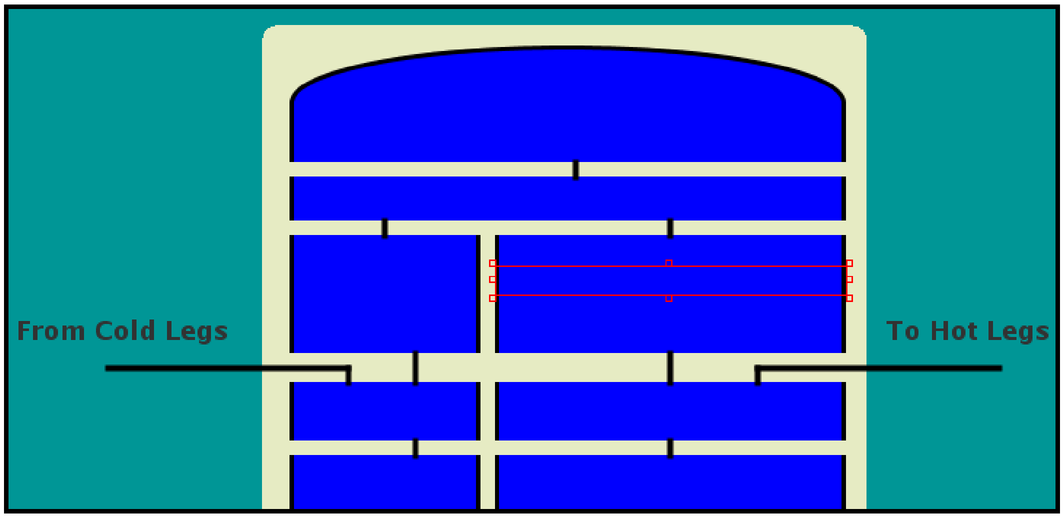
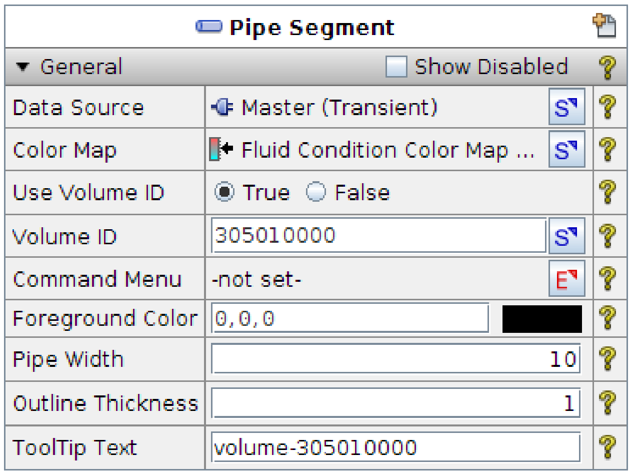


Figure 6.13. display beans Example

Each bean displays its data in a different way but they all share a common set of functionality. The following is a list of features supported by most display beans. In the case that a beans does not support one of these features it will be noted in that bean's description.


Pipe Segment

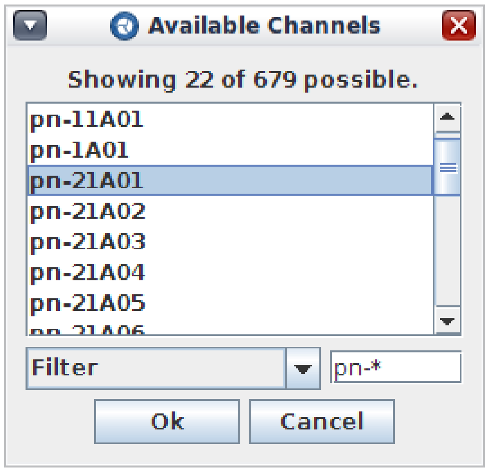
General	Show Disabled
Data Source	Master (Transient)
Color Map	Fluid Condition Color Map ...
Use Volume ID	[✓ True] False
Volume ID	305010000
Command Menu	-not set-
Foreground Color	0,0,0
Pipe Width	10
Outline Thickness	1
ToolTip Text	volume-305010000

Figure 6.14. Sample Properties

- **Data Source -** All display beans connect to at least one Data Source, some more than one. Those beans that use more than one Data Source include pop-up explaining what aspects of the bean will use each source. Refer to Section 6.3, “Data Sources” for more detailed information on Data Sources and Data Source selection.

- **Color Map -** A Color Map is used to map a data value (or values) to a color for animation. Refer to Section 6.6, “Color Maps” for more detailed information on Color Maps and Color Map selection.

- **Channel Name -** The name of the data channel (or often data channels) that will be animated by the bean. Display beans that use a single data channel will most often use the channel selector shown in Figure 6.15, “Channel Selection Dialog”. Beans that use multiple data channels (such as the Axial Plot bean) include more customized selectors.


Available Channels

Showing 22 of 679 possible.

pn-11A01
pn-1A01
pn-21A01
pn-21A02
pn-21A03
pn-21A04
pn-21A05

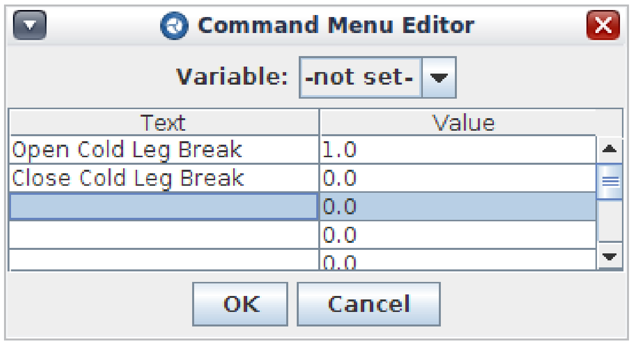
Filter: pn-*

Figure 6.15. Channel Selection Dialog

- **Volume ID -** The Volume ID property is used by some display beans to animate sets of data channels based on the current type of the Color Map selected for the bean. This is most often used for properties such as void fraction, liquid temperature and fluid conditions where the data channel names can be implied based on the Volume ID and color map type. In these cases, the animation module (for the analysis code being animated) is responsible for determining the required data channels.

Note A bean will only use either channel names or volume IDs to identify data values. Some beans allow switching between the two.

- **Tooltip Text -** This is the tool-tip that is displayed when the mouse is over the bean. Optionally, this tool-tip text can be a valid HTML document but if so it must include the `<html>` and `</html>` tags.
- **Command Menu** - The command menu an easy way to send interactive commands to a calculation during animation. This feature allows the user select an interactive variable and specify a list of values (and corresponding text for each name) for a display bean. Once defined, these values can be selected from the **Commands** sub-menu of the right-click pop-up menu of the bean. Selecting any of the menu items in the **Commands** menu will send the corresponding value to the calculation as an interactive command.



Text	Value
Open Cold Leg Break	1.0
Close Cold Leg Break	0.0
	0.0
	0.0
	0.0

Figure 6.16. Command Menu Editor

The following sections describe the display beans included with the Animation plug-in broken down by their sub-menu location in the Insertion Tool pop-up menu. Additional beans may be installed separately or included with other pre-processor plug-ins. Refer to the individual plug-in users' manuals for more information on the beans they include.

6.8.1. Control System

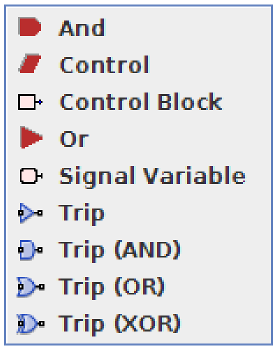


Figure 6.17. Control System Beans

The control systems beans are intended for use in creating logical representations of control systems for animation. These beans do not actually perform any logic operations but merely display the value of their selected data channels.

6.8.1.1. And / Or / Control

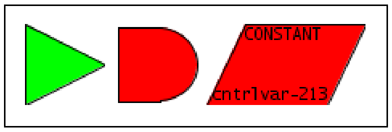


Figure 6.18. And / Or / Control Beans

The And, Or and Control beans (shown above) are more customized versions of the Single Element bean that can be used to layout rough control systems for animation.

6.8.1.2. Control Block / Signal Variable / Trips

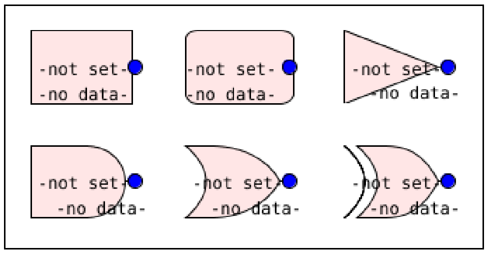


Figure 6.19. Control Block, Signal Variable, and Trip Beans

The Control Block, Signal Variable and Trip beans are intended can be used to layout logical control systems such as those in the TRACE and RELAP plug-ins. These beans can be created via the Insertion Tool or by pasting a control system type component into an animation view from a code plug-in that supports control system display bean creation (such as TRACE or RELAP5).

These beans support the standard single data source and data channel along with a numerical format (for the float display) and a label to replace the data channel name when animating. In addition, SI and British units strings can be provided for display depending on the units setting for the animation model.

6.8.2. Indicators

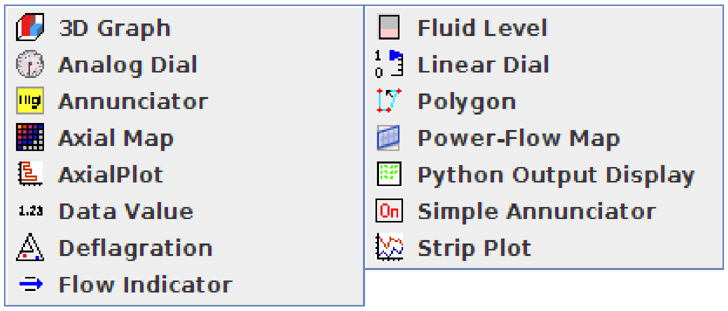


Figure 6.20. Indicator Beans

The Indicators group contains a set of more specialized beans for plotting and data display.

6.8.2.1. 3D Graph

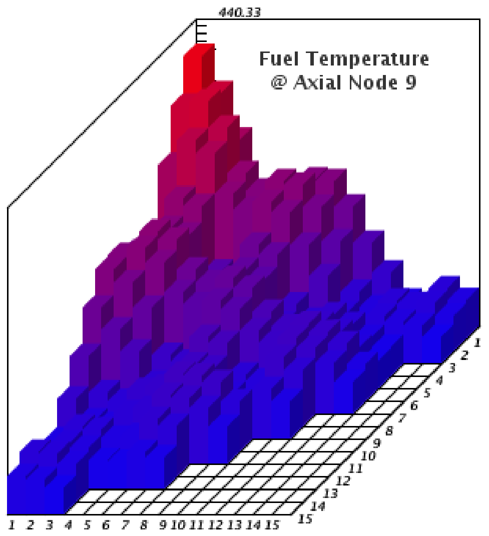


Figure 6.21. 3D Graph Bean

The 3D Graph bean is a three dimensional representation of data values similar in nature to the Stacked Element bean (see Stacked Element). Individual cells in the grid may be disabled, allowing pattern-based selection of data channels to skip unneeded cells. Orientation, grid spacing, and relative lengths of the X, Y, and Z axes can be customized. The example shown in Figure 6.21, "3D Graph Bean" displays fuel temperatures, where all empty spaces in the grid are disabled cells. The following steps are required to setup a new 3D Graph Bean:

1. Insert a new 3D Graph bean using the Insert Tool.
2. Set the number of columns and rows in the bean with the **Dimensions** property.
3. Disable any unneeded cells by editing the **Enabled Cells** property. This displays a dialog of toggle buttons which can be used to enable or disable each cell in the grid.
4. Specify data channel names for each element in the bean.

   Open the *Channel Nodes* dialog by editing the **Data Channels** property of the bean. The table at the top of this dialog contains the channel names for each element in the bean arranged by row and column in the same order as they will be rendered by the bean. These channels can be input individually (by editing each table cell) or input in groups by selecting the **Use Pattern** check box and specifying a **Pattern**.
5. Select an appropriate **Color Map** for the bean.

In addition to the normal bean customization, the 3D Graph bean provides the following additional properties:

- **Orientation -** Determines the relative angles and lengths of the X, Y, and Z axes.
- **Grid Origin -** Determines the position of the grid along the Z axis.
- **Display Wire Mesh -** When set to *True*, a wire-frame mesh is used to display data. When set to *False*, the default bar graphs are displayed.

- **Wire Thickness -** The thickness of lines used in displaying a wire mesh.
- **Column Spacing** and **Row Spacing -** Determines the relative widths of columns and rows. Editing either property opens the *Grid Spacing* dialog, which displays the current spacing values.
- **Display Grid -** When set to *True*, lines indicating the borders of cells in the grid are displayed.
- **Display Opaque Grid -** When set to *True*, the cells of the grid are filled with the color specified by the **Grid Base Color** property.
- **Display Labels** - When set to *True*, numbers indicating the index of cells in the grid are displayed along the X and Y axes. If the **Position Labels on Axes** property is set to *False*, the labels will be displayed along the bottom and right lines of the grid parallel to the X and Y axes.
- **Display Ticks -** When set to *True*, tick marks will be displayed along the Z axis. The spacing of these tick marks is determined by the specified Color Map.

6.8.2.2. Analog Dial

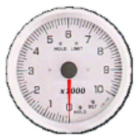


Figure 6.22. Analog Dial Bean

The Analog Dial is a 0-10 representation of a single data channel as a dial. A scale factor must be set to translate the value of the data channel into the 0-10 range.

6.8.2.3. Annunciator

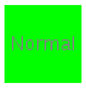


Figure 6.23. Annunciator Bean

The Annunciator bean is a more complete version of the Simple Annunciator that includes High, High-High, Low and Low-Low values.

6.8.2.4. Axial Map

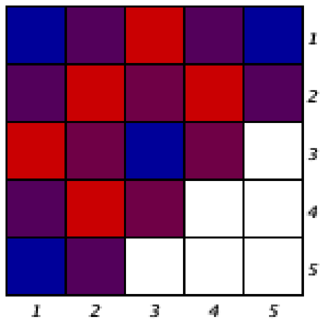


Figure 6.24. Axial Map Bean

The Axial Map bean is a specialized case of the 3D Graph bean. Its functionality is identical to a 3D Graph bean with a Z axis length of 0 and both X and Y angles set to 0. See the section 3D Graph more information on properties specific to this bean.

6.8.2.5. Axial Plot

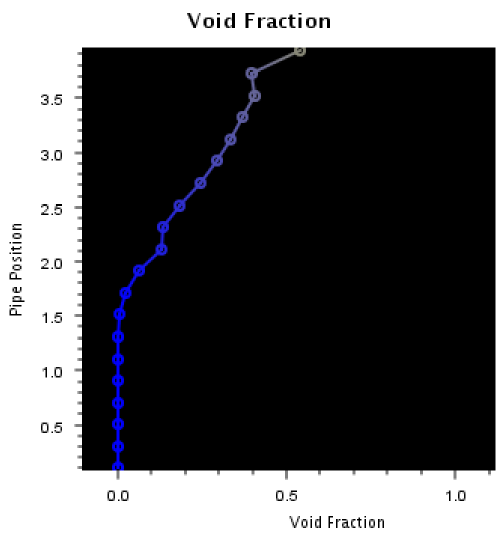


Figure 6.25. Axial Plot Bean

The Axial Plot bean displays a line plot based on a set of data channels for each timestep rendered. If desired, multiple data channel sets can be input to display a line plot for each set. Each data channel set consists of a number of x/y pairs of data channels that determines the location of each point on the plotted line. Optionally, the x channel may be input as Fixed X Positions for situations where there is no x data available as data channels or the x data does not change over time.

A large number of properties are available in the Axial Plot bean to customize the plot, line and axis appearance. Refer to the pop-up help available next each property for more information on axial plot customization.

6.8.2.6. Data Value

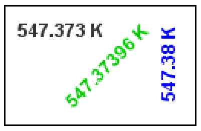


Figure 6.26. Data Value Bean

The Data Value bean simply displays the numerical value of the selected data channel. The font, foreground color, border, etc. can be customized like most display beans. Also, a numerical format may be specified (in C printf format) to control how the data value is displayed.

The Data Value bean also supports displaying the selected channel using user-defined custom units. Once the Custom units display is selected a conversion factor, offset value, and units string (such as ft/s), can be specified that will be used to display the value. Separate conversion settings are available to display the value in SI or British units.

6.8.2.7. Deflagration

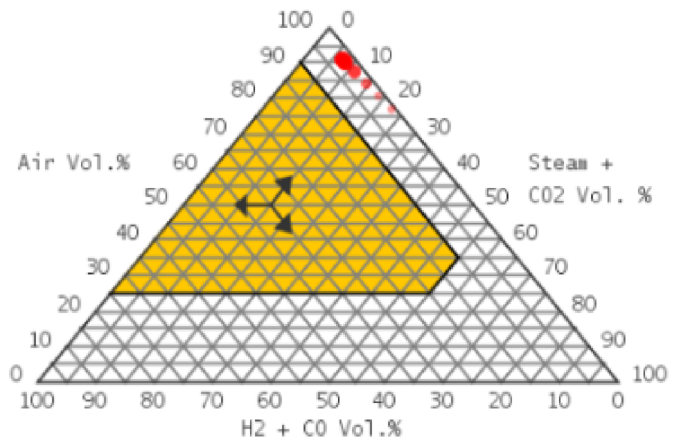


Figure 6.27. Deflagration Bean

The Deflagration bean is used to monitor the concentrations of combustible gases in a containment volume. This data is displayed on a trilinear graph. Trilinear graphs are used to plot three variables that sum to 100% at any location on the graph. The three axes used for the deflagration bean are Air Volume Percentage, H2 + CO Volume Percentage, and Steam + CO2 Volume Percentage. A Deflagration bean requires at least three data channels (**Steam Channel**, **O2 Channel**, and either **H2 Channel** or **CO Channel**), and can optionally include data channels for CO2 and H2/CO. The ignition region (shown in the above figure in orange) is drawn based on the properties listed below, as well as the values of the data channels.

- **Min. O2 Mole Frac**.(XO2IG)- Minimum oxygen mole fraction limit for ignition (Default = 0.05).
- **Diluent Mole Frac. Limit**(XMSCIG)- Maximum diluent (Steam + CO2) mole fraction for ignition (Default = 0.55).
- **H2 Mole Frac. Limit**(XH2IGN)- Hydrogen mole fraction limit for ignition (Default = 0.1).
- **CO Mole Frac. Limit**(XCOIGN)- Carbon monoxide mole fraction limit for ignition (Default = 0.167).

The ignition region depends on time-dependent gas concentrations within each containment volume, and may change during animation. The equations used for determining the boundaries of the ignition region are as follows:

- Air Axis: XO2IG*((X02+XN2)/X02), where X02 is the value of the data channel specified in the **O2 Channel** property, and XN2 is (1.0-XO2-XH2-XCO-XH2O-XCO2), where XH2, XCO, XH2O, and XCO2 correspond to the current values of their associated data channels.
- H2+CO Axis: XH2IGN + (XCO*((1.0-XH2IGN)/XCOIGN)), where XCO is the value of the data channel specified in the **CO Channel** property.

- Steam+CO2 Axis: XMSCIG.

The default behavior of the Deflagration bean (when no data source is connected or the proper data channels have not been initialized) is to fill the ignition region gray, at locations based on default values (25% Air, 55% Steam+CO2, 10% H2+CO). When the data channels are properly initialized and the bean is animating, the ignition region is drawn based on the above equations.

Note The ignition region will disappear for low O2 concentrations.

During animation, the containment volume marker is displayed in the Deflagration bean as a point on the tri-gram whose coordinates correspond to the volume's current gas concentrations. The marker's color can be customized via the **Marker Color** property. A trail of the hydraulic volume's marker can be drawn so that as the marker moves in the bean, its travel path can be displayed as a series of circles that become increasingly smaller and transparent. The length of the hydraulic volume's marker trail, in seconds, can be customized via the bean's **Marker Trail Length** property. The three small arrows drawn in the bean indicate how to "read" values from the deflagration bean. For example, the Air Volume Percentage of the containment volume is found by following the horizontal lattice line to the left side of the bean. The color of the lattice can be modified by changing the value of the **Lattice Color** property.

6.8.2.8. Flow Indicator

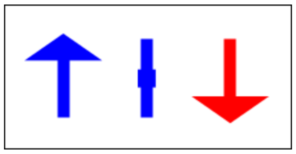


Figure 6.28. Flow Indicator Beans

The flow indicator bean is used to indicate flow beyond a forward and reverse threshold pair. When the data value is above the forward threshold the indicator will display an up arrow. When the data value is below the reverse threshold the indicator will display a down arrow. When the data value is between the two thresholds the indicator will be displayed as a single line. The flow indicator can be customized with a foreground color for forward and backward indication, a border and an orientation (north, south, east or west).

6.8.2.9. Fluid Level

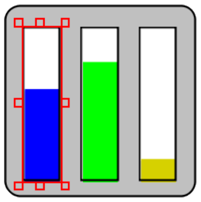


Figure 6.29. Fluid Level Bean

The Fluid Level bean is a specialized version of the Single Volume bean. This bean has a **Level Data Channel** that is used to indicate the liquid fluid level (using specified minimum and maximum values) and a **Volume ID** used to determine the color of the filled region. Like many other display beans, this bean includes a background color, border, tool-tip text, etc.

6.8.2.10. Linear Dial

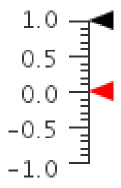


Figure 6.30. Linear Dial Bean

Linear Dials are vertical axes where a "needle" moves along the meter to indicate the current value. Up to two channels can be displayed per linear dial (**Data Channel 1** and **Data Channel 2**). The color used for the channel value needle can also be customized via **Channel 1 Color** and **Channel 2 Color**.

In addition to the normal font, background color, etc. this bean can be customized by setting the following plot appearance related properties.

- Orientation. Sets which side of the bean contains the value needles.
- Maximum Value. The maximum value displayed in the dial.
- Minimum Value. The minimum value displayed in the dial.
- Scale Factor. Incoming values are multiplied by this scale factor.
- Minor Ticks Per Major. The number of smaller ticks displayed between major ticks.
- Major Tick Count. The number of major ticks in the dial. Each major tick also displays the value at that location.

6.8.2.11. Polygon

The Polygon is the same object as the Polygon Annotation described in the section called “Polygon”. When placed in an animation model the polygon includes a **Data Source**, **Color Map** and an either a **Data Channel** or a **Volume ID**.

Polygon beans also support arbitrary levels in a manner similar to the Linear Dial bean (see Section 6.8.2.10, “Linear Dial”). When level tracking is turned on, a horizontal threshold will fill the polygon from the bottom to the top, depending on how close the current value of **Level Data Channel** is to the specified **Maximum Level** and **Minimum Level**.

The following properties relate to displaying level data in a polygon.

- **Use Level Data Channel -** Determines whether this polygon will use level information.
- **Level Data Channel -** The channel that drives the displayed level in the polygon.
- **Level Foreground -** The color of the filled in level region.
- **Maximum Level -** The value of **Level Data Channel** that completely fills the polygon.

- **Minimum Level** - The value of **Level Data Channel** that completely empties the polygon.

6.8.2.12. Power Flow Map

The Power-Flow Map display bean animates percent power and flow rate values over a set of user specified mapping lines. The Power-Flow Map takes data channel values and calculates percentage values against the specified maximum rated percentages. The map provides a series of configurable properties including the ability to specify the maximum and minimum displayed boundary values. A map line editor is provided which creates lines based on the percent values specified. The map fonts, colors, and maximum/minimum displayed boundary values are all configurable through the bean's property view. Scaling factors are provided to allow specific conversions on data values based on current model units.

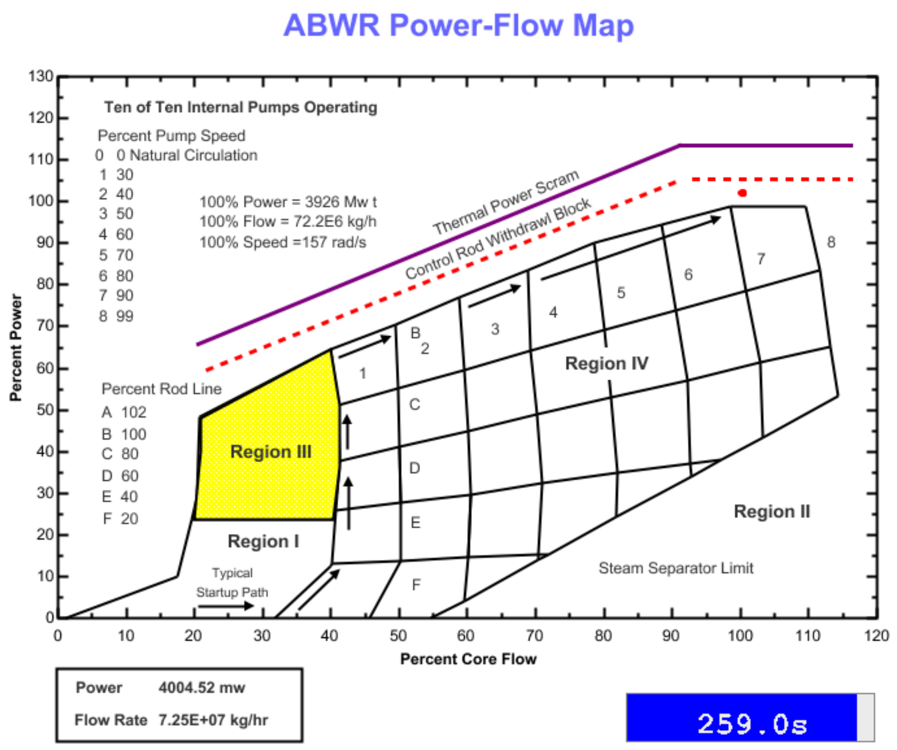
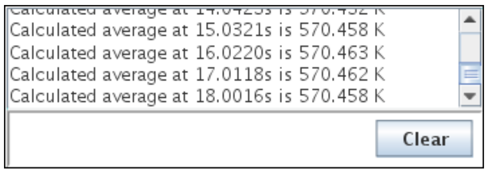


Figure 6.31. Power Flow Map

6.8.2.13. Python Output Display



```
Calculated average at 14.0423s is 570.452 K
Calculated average at 15.0321s is 570.458 K
Calculated average at 16.0220s is 570.463 K
Calculated average at 17.0118s is 570.462 K
Calculated average at 18.0016s is 570.458 K
```

Figure 6.32. Python Output Bean

The Python Output bean is a specialized bean for displaying the printed output and error streams of the Python Data Source (Section 6.5, “The Python Data Source”). The font, background color, border, and error message display properties can be used to customize this bean.

6.8.2.14. Simple Annunciator

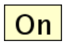


Figure 6.33. Simple Annunciator Bean

The Simple Annunciator bean is used to indicate 'On' when the data value has increased beyond the specified **On Threshold** and then 'Off' when the value has decreased beyond the specified **Off Threshold**. The text displayed ('On' above) can be specified by changing the **On Text** property. When off, no text is displayed. Also, like many other display beans, this bean includes a background color, border, tool-tip text, etc.

6.8.2.15. Strip Plot

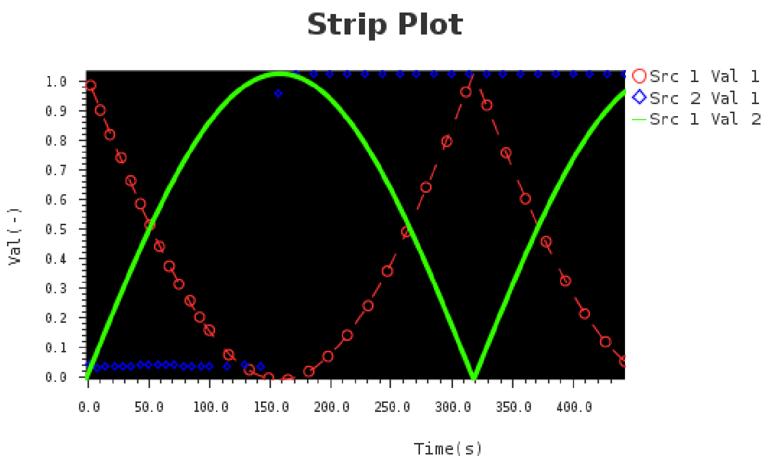


Figure 6.34. Strip Plot Bean

The Strip Plot bean is a color coded line plot of multiple data sets. For each data set, a single plot point is added to the line for each animated timestep. Rewinding time will clear all plotted points and restart the plot from the new current time. A data set is defined by a **Data Source** and a **Data Channel**. The data channel describes the dependent variable for the data set, with the independent variable determined by the Strip Plot's independent base units property. Data sets also contain properties that control how its values are drawn. The drawing properties for each data set are:

- **Label -** The label used to identify this data set in the plot legend. When set to blank, the data channel name appears in the legend.
- **Line Type -** Controls the style of the line that connects this data set's values. Line can either be drawn dashed or solid.
- **Line Width -** The thickness (in pixels) to draw the line.
- **Line Color -** The color to draw the line.
- **Symbol Type -** The symbol that is drawn for each point.
- **Symbol Size -** The size (in pixels) to draw each symbol.
- **Symbol Skip Factor -** The number of points to skip between each symbol that is drawn.

In addition to the normal title, font, background color, etc. this bean can be customized by setting the following plot appearance related properties.

- **Y-Axis Scaling -** When set to *Logarithmic*, the logarithm (base 10) of all data is plotted instead of the actual values, and the Y-Axis is adjusted to display only major ticks that are powers of 10.
- **Autoscale Y-Axis -** When *True* the Y-Axis minimum,maximum and tick spacing will be automatically determined. When *False* the Y-Axis boundaries are determined by the values of the **Maximum Y Value** and **Minimum Y Value** properties.
- **Plot Background Color -** The background color of the plot region.
- **Show Label -** When set to *True* the legend (shown at the top right) will be displayed showing the channel names and their corresponding line colors.
- **X-Axis Label -** The label used to describe the x-axis.
- **Y-Axis Label -** The label used to describe the y-axis.
- **Independent Base -** Determines the x-scaling of the plot and how much data is visible at one time.
- **Independent Base Units -** The units for the independent base property. If the new independent base unit is a time unit, its conversion factor will be applied to the value specified by the independent base.

  Note The independent units currently supported are enumerated in the following list.

  - Seconds
  - Minutes
  - Hours
  - Days
  - Rod Average Burnup (MWd/MTU)
  - Rod Average Burnup (GWd/MTU)
- **Major Tick Number Format -** The pattern used to format the x and y axis. This formatting pattern follows that defined for the C function printf.

6.8.3. Interactive

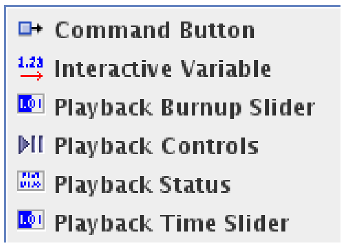


Figure 6.35. Interactive Beans

The **Interactive** category provides display beans used to drive an animation or send commands to an interactive job.

6.8.3.1. Command Button

This bean provides a 2D View button that activates a set of predefined interactive commands when pressed. The **Label** attribute can be used to specify the text displayed by the button. The **Commands** property allows specifying which interactive variables are modified and to what values. The **Commands** editor opens a dialog for adding and removing commands. When the model is connected to a data source, new commands can be selected from a drop down list of known interactive variables.

6.8.3.2. Interactive Value

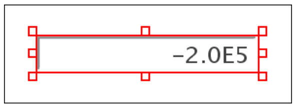


Figure 6.36. Interactive Value Bean

This bean is designed as a controller for an interactive variable inside a calculation. In essence, it is an enhanced Data Value that allows the retrieved value to be edited and sent as an interactive command. To use this bean, first specify a **Data Channel** to be displayed. Then, specify the **Variable Name** of the interactive variable in the calculation. During animation the data value will be displayed in red for a brief time each time the value changes.

6.8.3.3. Playback Controls

The Playback Controls bean is identical to the controls available on the main toolbar. Refer to Section 6.7, "Animation Playback" for more information on these controls.

6.8.3.4. Playback Status

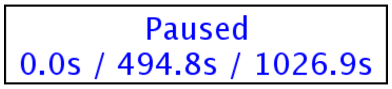


Figure 6.37. Playback Status Bean

The playback status bean shows the status of the current animation including the current, start and end times. The time display can be customized with a numerical format as well as the standard font and foreground color properties.

6.8.3.5. Playback Time Slider

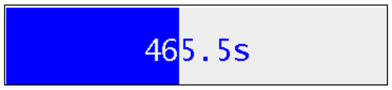


Figure 6.38. Playback Time Slider Bean

This bean can be used to quickly scroll through to an approximate location in a calculation. Clicking inside the bounds (while the view is locked) will skip the playback to a time relative to the clicked position in the slider. Clicking and dragging to interactively skip the animation following the mouse. The time display can be customized using a numerical format, font and foreground color or hidden entirely.

6.8.3.6. Playback Burnup Slider

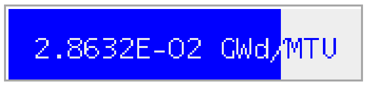


Figure 6.39. Playback Burnup Slider Bean

Similar to the Playback Time Slider, this bean can be used to scroll through an approximate location in a calculation, but displays the data source's rod average burnup value rather than time. Clicking inside the bounds (while the view is locked) will skip the playback to a time relative to the clicked position in the slider. Clicking and dragging to interactively skip the animation following the mouse. The time display can be customized using a numerical format, font and foreground color or hidden entirely.

6.8.4. Plant Components

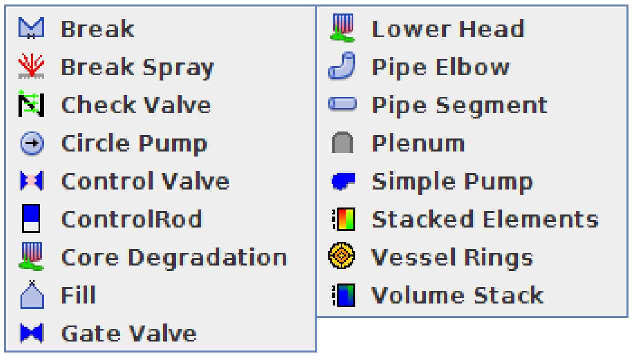


Figure 6.40. Plant Component Beans

6.8.4.1. Break

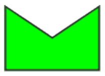


Figure 6.41. Break Bean

The Break bean is a simple indication of whether a data value is above a specified **Threshold Value**. The break display can be customized by its **On Color**, **Off Color**, **Orientation** and **Line Width**.

6.8.4.2. Break Spray

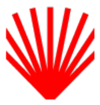


Figure 6.42. Break Spray Bean

The Break Spray is intended to represent a break in a fluid system with a color change and a spraying animation. The properties available for this bean are nearly identical to the Break Bean with the exception of the **Line Width** used to control the thickness of the spray lines.

6.8.4.3. Check Valve

The Check Valve bean represents a valve that can be fully open or fully closed. When the data value is greater than or equal to the **threshold** the valve is considered open is drawn with arrows colored in the **Open Color**. When the data value is less than the **threshold** the valve is considered closed and is drawn with the **Closed Color**. The Check Valve is driven by a single data channel and allows for rotation in any direction.

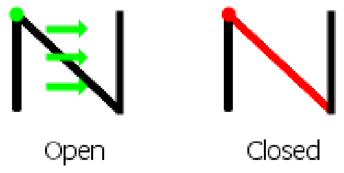


Figure 6.43. Check Valve Bean

6.8.4.4. Circle Pump

The Circle Pump bean is a component which has a circular shape and indicates flow direction using both forward and reverse flow indication arrows. The circle pump is driven by a single data channel. When the value of the channel is less than 0.0 - the **Threshold Value**, the forward flow indicator is drawn. This indicator is drawn at the specified **Reverse Flow Angle** colored using the **Reverse Flow Color**. When the value of the channel is greater than 0.0 - the **No-Flow Threshold** value and less than 0.0 + the **No-Flow Threshold** value, an indicator is drawn using the **No-Flow Threshold Color** at the specified **Forward Flow Angle**. When the value of the channel is greater than 0.0 + the **No-Flow Threshold** value an indicator is drawn using the **Forward Flow Color** with the specified **Forward Flow Angle**. The Circle pump provides a **Flip Horizontally** right click pop-up menu item which will swap the flow angles horizontally. Additionally, the pump allows the specification of the **Arrow Outline Color**, **Outer Outline Color**, **Inner Outline Color**, **Inner Circle Color**, and **Background Color**.

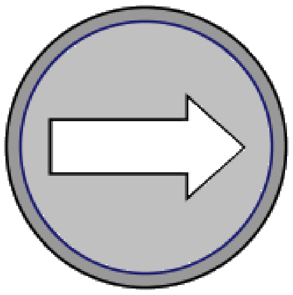


Figure 6.44. Circle Pump Bean

6.8.4.5. Control Rod

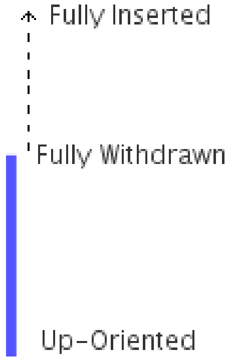


Figure 6.45. Control Rod Bean

The Control Rod bean is intended to represent a control rod's location relative to a set of bounds. The **Inserted Position** defines the location that corresponds to the control rod being fully inserted. The **Withdrawn Position** defines the location that corresponds to the control rod being fully withdrawn. The length of the control rod relative to the overall size of the bean can be customized via the **Rod Proportion** property. The control rod is drawn using the Rod Color. The **Rod Orientation** property controls the vertical orientation of the control rod. Up oriented indicates the control rod is inserted from the bottom, and down oriented means the control rod is inserted from the top.

6.8.4.6. Control Valve

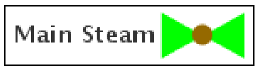


Figure 6.46. Control Valve Bean

The Control Valve bean represents a valve that can be partially open. When the data value is greater than or equal to the **Open Value** the valve is considered open is drawn using the **Open Color**. When the data value is less than or equal to the **Closed Value** it is considered closed and is drawn using the **Closed Color**. Values in between the two are considered partially open and an interpolated color between the two colors is used.

6.8.4.7. Core Degradation

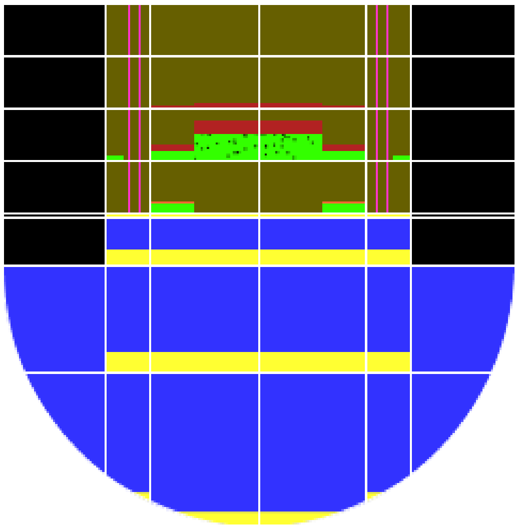


Figure 6.47. Core Degradation Bean

The Core Degradation bean represents a Core component based on its geometry and the volume percentages of certain properties in its cells. The Core Degradation Bean monitors the volume percentages of water (blue), fuel (pink), particulate debris (green), molten pools (red and orange), supporting and non-supporting structures (yellow) in both the channel and bypass portions of each core cell. Unmodeled cells (cells with elevations greater than the difference between the **Core Support Plate Elevation** property and the **Lowest Vessel Elevation** property, and inner radii greater than the value of the **Core Radius** property) are shown in black. The lower plenum curve is defined by the **Vessel Inner Radius** property. The geometry of the bean can be modified via the **Axial Lengths** and **Radial Lengths** properties.

Each cell must be mapped to a control volume that provides water level and volume data for the channel and bypass portions of each cell. The cell-control volume maps for the channel and bypass portions are editable via the **Channel-Control Volume Map** and **Bypass-Control Volume Map** properties. Only control volumes specified in the **Control Volumes** property can be mapped to cell channel and bypass portions; control volumes specified in this property also have maximum and minimum elevations specified. Geometry and control volume data are only input for one "half" of the core; the data is mirrored for the other side. The **Drawing Mode** property controls whether the whole core, the left half, or the right half are drawn. The black "specks" in the green particulate debris beds indicate the porosity of the debris beds. The **Lower Head Type** property controls the drawing of the lower plenum curve, when this property is set to **Cylindrical**, the lower plenum is modeled as a rectangle. The Reactor Type property can be used to limit the drawing of the bypass portions of core cells. When the value of **Reactor Type** is set to **PWR**, the bypass portion of core cells is only drawn in the outermost radial ring, otherwise the bypass is drawn for all cells.

Note The Core Degradation Bean currently supports only MELCOR data sources.

6.8.4.8. Fill

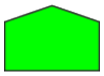


Figure 6.48. Fill Bean

This bean differs from the Break Bean only in its shape (see Break Bean).

6.8.4.9. Gate Valve

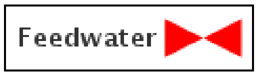


Figure 6.49. Gate Valve Bean

The Gate Valve bean represents a valve that can only be fully open or fully closed. It differs from the Break Bean only in its shape.

6.8.4.10. Lower Head

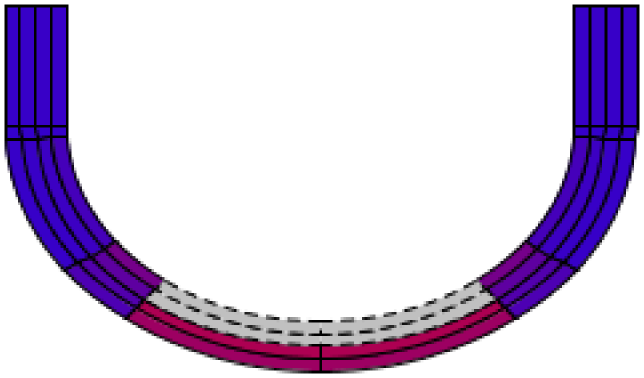


Figure 6.50. Lower Head Bean

The Lower Head bean represents a Core component's lower head based on its geometry and the values of its associated plot data. The geometry of the Lower Head bean is defined by the **Lower Head Type**, **Inner Radius**, **Lower Head Thickness**, **Thickness Scale Factor**, and **Lower Head Height** properties. The outer radius of the lower head is determined by multiplying the Lower Head Thickness by the Thickness Scale Factor. The lower head is divided radially into rings, and the thicknesses of these rings are editable via the **Ring Thicknesses** property. Each ring thickness is multiplied by the Thickness Scale Factor to determine its relative thickness. The lower head bean is divided into a number of segments, whose lengths are defined by the **Segment Radials** property. Each length specifies the inner radius of the corresponding segment. Duplicate entries in the Segment Radials array indicate a vertical segment of the lower head. Vertical segments of the lower head are equally spaced based on the difference between the Lower Head Height property and the largest Segment Radial value. As in the Core Degradation bean, input is entered for only one "half" of the lower head, and the data is mirrored for the other side. The **Drawing Mode** property controls whether the whole lower head, left half, or right half are displayed. The radial rings are indexed from the outside in, meaning that radial 1 is the outermost ring.

The Lower Head Bean compares the values of plot data associated with each lower head node against failure criterion. During animation, each node's area is filled in using a color determined by the current data value and the color map specified in the **Color Map** property (Note: the Lower Head Bean currently does not support Color Maps of type Fluid Condition). The **Lower Head Failure Type** property defines the plot variables that are associated with this bean, and can be set to **Temperature** or **Plastic Strain**. When the Lower Head Failure Type is set to Temperature, the value of each lower head node's associated temperature plot variable is checked against the value of the **Lower Head Failure Temperature** property. If the node's temperature exceeds the failure temperature, the node's outline is drawn using a dotted line, and the node's area is greyed out. If the Lower Head Failure Type is set to Plastic Strain, each node's plastic strain is compared against the value of the **Plastic Strain Failure Threshold** property to determine node failure.

Note The Lower Head Bean currently supports only MELCOR data sources.

6.8.4.11. Pipe Elbow

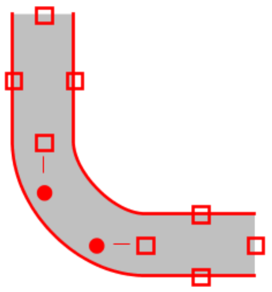


Figure 6.51. Pipe Elbow Bean

The pipe elbow bean is an indicator intended to resemble a piping elbow. The elbow is defined by four points that must be placed on the View when the bean is created. These form the center "line" of the pipe, with the bend placed between the second and third points.

Pipe Elbow beans have the following custom properties:

- **Use Volume ID -** When set to **True**, the pipe may specify a **Volume ID** to select the data to animate. When set to **False**, a single **Channel Name** is specified instead.
- **Pipe Width -** The width of the pipe from the center line. This value may also be edited directly in the view, as described below.
- **Outline Thickness -** The thickness of the outline (in pixels).

When a pipe elbow selected, as shown above, a number of control points become available for editing the bean directly in the View. The points in the pipe path may be repositioned by dragging any of the four square control handles in the center of the pipe. The width of the pipe may be directly manipulated by dragging the control handles on the sides of the pipe. Finally, the circular control points extending from the second and third points in the path control how far the pipe bends in that direction; they may be dragged into and out of the anchor point to adjust the curve.

6.8.4.12. Pipe Segment

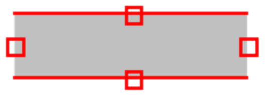


Figure 6.52. Pipe Segment Bean

The pipe segment bean is an indicator intended to resemble a single, straight length of pipe, but may also be used for any rectangular value indicator. The segment is defined by two points that must be placed on the View when the bean is created. The two control points form the center line of the pipe.

Pipe Segments beans have the following custom properties:

- **Use Volume ID -** When set to **True**, the pipe may specify a **Volume ID** to select the data to animate. When set to **False**, a single **Channel Name** is specified instead.
- **Pipe Width -** The width of the pipe from the center line. This value may also be edited directly in the view, as described below.
- **Outline Thickness -** The thickness of the outline (in pixels).

When a pipe segment selected, as shown above, a number of control points become available for editing the bean directly in the View. The points in the pipe path may be repositioned by dragging either of the square control handles in the center of the pipe. Additionally, the width of the pipe may be directly manipulated by dragging the control handles on the sides of the pipe.

6.8.4.13. Plenum

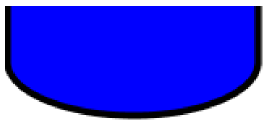


Figure 6.53. Plenum Bean

The plenum bean is a more customized version of a Single Volume bean that is intended to resemble an upper or lower plenum. Like the Single Volume, the this bean uses a **Volume ID** to select the data to animate. In addition to the normal Font, Foreground Color, Border, etc. this bean's shape and appearance can be customized with the following properties.

- **Plenum Type -** The plenum orientation type. (Upper or Lower)
- **Curved Fraction -** The fraction of the plenum that is curved. (0.0 - 1.0)
- **Outline Width -** The thickness of the outline (in pixels).

6.8.4.14. Simple Pump

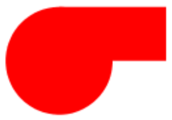


Figure 6.54. Simple Pump Bean

The Simple Pump bean is a simple indication of whether a data value is above a specified **Threshold Value**. The pump display can be customized by its **On Color**, **Off Color** and **Facing East** properties.

6.8.4.15. Single Element

Single Element has been replaced by the Pipe Segment bean. Single Elements saved in existing MED files are automatically converted to pipe segment beans upon opening the model.

6.8.4.16. Single Volume

Single Volume has been replaced by the Pipe Segment bean. Single Volumes saved in existing MED files are automatically converted to pipe segment beans upon opening the model.

6.8.4.17. Stacked Elements

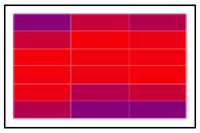


Figure 6.55. Stacked Element Bean

The Stacked Element bean is a 2 dimensional stack of Single Element beans designed to simplify the process of visualizing areas of dense nodalization or long stretches of sequential channel numbering. The example shown in Figure 6.55, “Stacked Element Bean” has 6 rows and 3 columns of fuel rod temperatures.

To create a complete Stacked Element bean:

1. Insert a new Stacked Element bean using the Insert Tool.

2. Set the number of columns in the bean by adding entries to the **Column Widths** table.

   This table is used (in normalized form) to scale the size of each column in the bean. The number of entries in this table determines the number of columns and the value for each determines its relative width.

3. Set the number of rows in the bean by adding entries to the **Row Heights** table.

   This table, like the Column Widths table, is used to determine the number of rows and their relative heights.

4. Specify data channel names for each element in the stack.

   Open the *Select Channels* dialog by editing the **Node Volumes** property of the bean. The table at the top of this dialog contains the channel names for each element in the bean laid out by row and column in the same order as they will be rendered by the bean. These channels can be input individually (by editing each table cell), selected individually (by selecting the **Channel Selection** radio button) or input in groups by specifying a **Pattern**.

   Refer to the pop-up help of the Select Channels dialog for a more detailed discussion of channel selection individually and by pattern.

In addition to the normal bean customization, the stacked element bean provides 2 stack-specific properties:

1. **Opaque Nodes -** When this is set to False, nodes that do not have channels specified will be transparent.
2. **Draw Outline -** When this is set to true, a line border will be drawn in the foreground color around each element in the stack and around the entire stack.

6.8.4.18. Vessel Rings

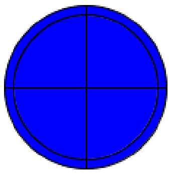


Figure 6.56. Vessel Rings Bean

The Vessel Rings Bean is a series of concentric circles each divided into azimuthal sectors. The Rings bean may have any number of rings, and each ring may have any number of azimuthal sectors. Each azimuthal sector is assigned a volume number, and the first sector may include an offset angle indicating where it begins around the circle. Optionally, regions that have no volume number may be transparent, appearing as a void in the volume.

6.8.4.19. Volume Stack

This bean differs from the Stacked Element bean only in that **Volume ID**s are selected for each element rather than channel names (see Stacked Element).

6.8.5. TRACE 3D Vessel

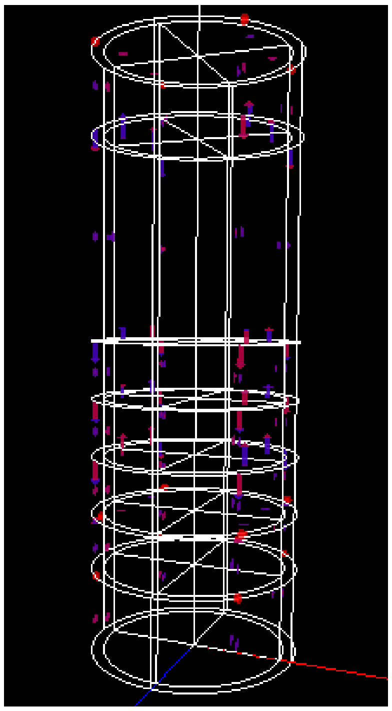


Figure 6.57. TRACE 3D Vessel Bean

The TRACE 3D Vessel Bean is a 3D representation of a TRACE Vessel component. The **Vessel Type** property determines the data the bean will visualize. When this property is set to **Solid**, each vessel cell is rendered in a solid color correspond to that cell's current fluid conditions. When the Vessel Type is set to **Wireframe**, the bean provides a wire-frame view of a Vessel component similar to the one displayed in the TRACE Vessel Geometry dialog. In wireframe mode, the velocities of each vessel cell are displayed as arrows. For each vessel cell, flow indicator arrows display both liquid phase and vapor phase flow along each axis. The colors used to render these arrows are editable via the **Liquid Flow Indicator Color** and **Vapor Flow Indicator Color** properties. The magnitude and orientation (positive or negative along each axis) of each flow indicator arrow is controlled by the value of the corresponding vessel cell's plot data during animation. Scale factors can be applied to the magnitude of flow indicator arrows along each axis via the **Flow Indicator X Scale Factor**, **Flow Indicator Y Scale Factor**, and **Flow Indicator Z Scale Factor properties**.

Note The TRACE 3D Vessel Bean currently supports only TRACE data sources, and can only be created via the **Copy as Bean** button found in the TRACE Vessel Component's Geometry Dialog.

6.8.6. TRACE 3D Vessel Rings

The TRACE 3D Vessel Rings bean is used to visualize the data for a TRACE vessel. The bean is displayed as a stack of discs broken down into cells by radial rings and azimuthal sectors, with each disc representing a paritcular axial level. 3D Vessel Rings can be created one of two ways. The bean can be created via the Insertion Tool, and is found under the TRACE Beans category. Also, when in a TRACE model, you can right-click a Vessel component and select **Copy as 3D Rings Bean** from the pop-up menu. Pasting into the view of an animation model will then create a 3D Vessel Rings bean using the geometry and component number of the selected vessel.

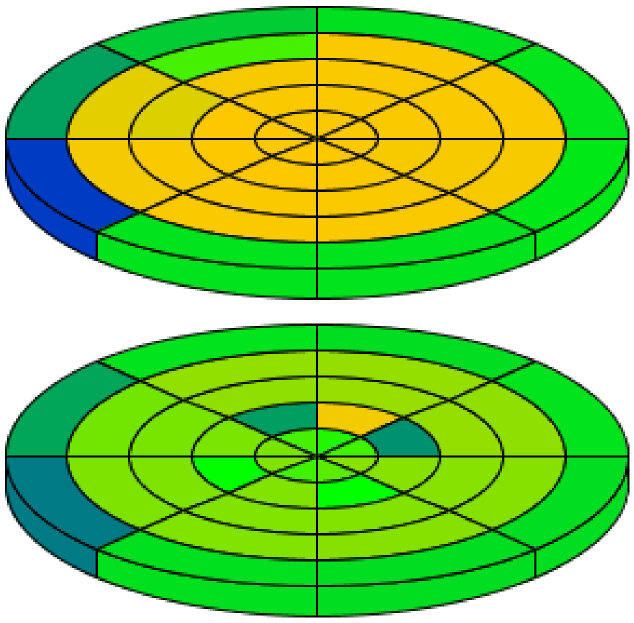


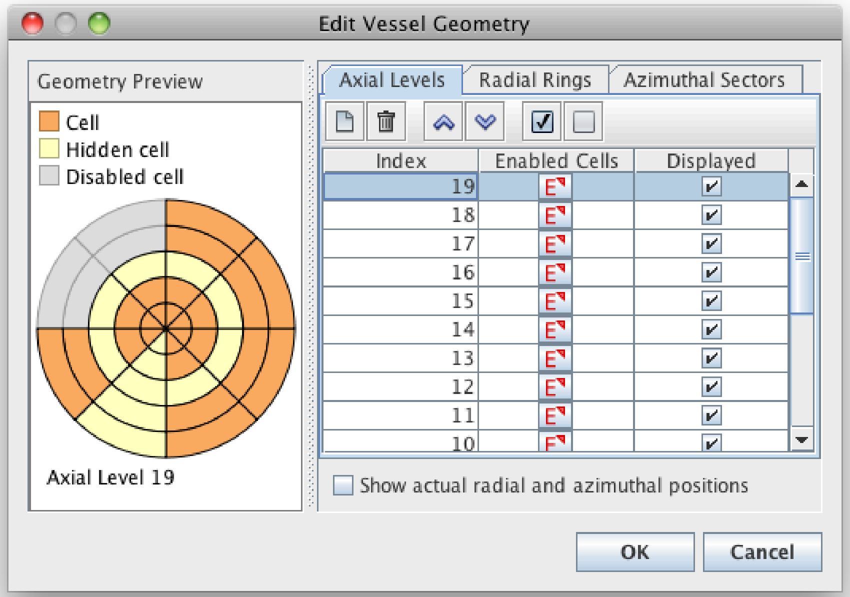
Figure 6.58. TRACE Vessel Rings Bean

The 3D Vessel Rings bean has the following custom properties:

- **Vessel CC Number** - the component number for the vessel represented by the bean. The bean uses the geometry, axial orientation and referenced color map to automatically determine the volume IDs and channel names required to animate the vessel.
- **Axial Orientation** - determines whether the axial levels are ordered bottom-up or top-down.
- **Vessel Geometry** - used to set the overall structure of the vessel. The editor opened for this property is described below.
- **Tilt** - controls the tilt of the vessel rings towards the viewer. At 0 degrees, the rings are seen from the top. At 90 degrees, the rings are fully tilted up and only the edge is visible.
- **Rotation** - defines a rotation for the rings around their midpoint. Valid values range from -360 to 360 degrees, with 0 degrees indicating no rotation.
- **Disc Distance** - the distance between disc center points as a factor of overall disc-width. Distance is defined as a factor so that resizing the disc does not fundamentally alter the positioning of rings within the bean.
- **Edge Height** - the maximum height of the ring edge in pixels.
- **Draw Labels** - a flag that determines whether axial level labels are drawn next to each ring.

3D Vessel Rings Geometry Editor

Editing the Vessel Geometry property opens the Vessel Geometry editor.



Index	Enabled Cells	Displayed
19	E	✓
18	E	✓
17	E	✓
16	E	✓
15	E	✓
14	E	✓
13	E	✓
12	E	✓
11	E	✓
10	E	✓

☐ Show actual radial and azimuthal positions

Figure 6.59. Vessel Geometry Editor

The tabbed panel on the right is used to edit the geometry. Each tab contains a table with three columns, where the first column always lists node indexes. In the Axial Levels tab, the central column edits the enabled cells for each axial level (described in greater detail below). In the Radial Rings tab, the central column edits the radii for the vessel rings. In the Azimuthal Sectors tab, the central column edits the azimuthal angle for each sector. In all three tabs, the right-most column toggles the visibility of that level, ring or sector. When radial rings or azimuthal sectors are disabled, the hidden region is shown as an empty area in the 2D view. When axial levels are hidden, their corresponding slices are simply not shown, and the remaining slices are shifted upward or downward depending on the axial orientation.

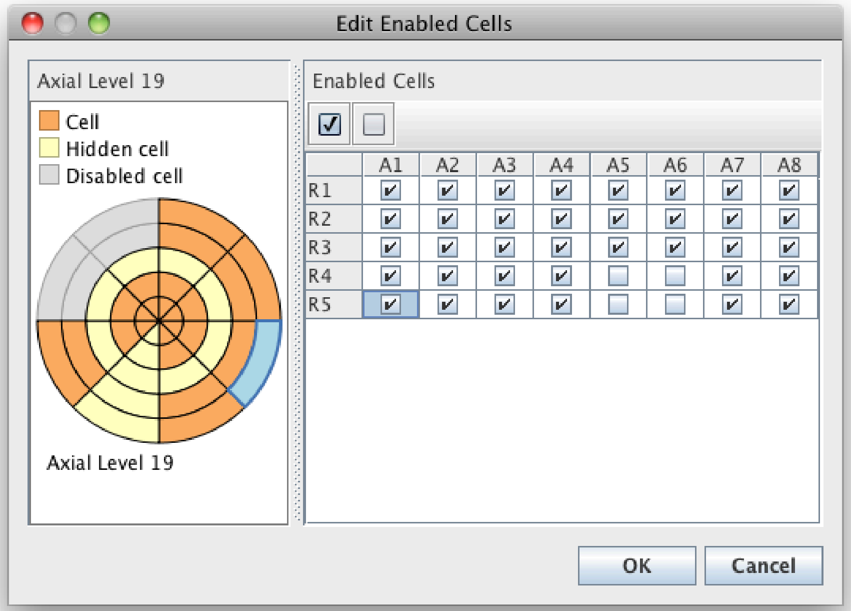
The check at the bottom of the table toggles whether radial and azimuthal positions are shown as actual distances from the origin or as delta values from the previous node. For example, a vessel with radii of 0.75ft, 1.0ft, and 1.5ft will show radii of 0.75ft, 0.25ft, and 0.5ft when this check-box is deselected.

Note When editing with actual positions, all radii and azimuthal angles must be greater than or equal to zero and monotonically increasing. At least one value must be defined for both. Azimuthal angles cannot exceed 360 degrees. The preview area will indicate any violations of these constraints.

The toolbar at the top of each table contains the following operations. Press the **New** (🗋) button to add a row to the table. Press the **Remove** (🗑) button to delete the selected rows. Reorder the selected cells with the **Move Up** (⌃) and **Move Down** (⌄) buttons. Toggle the visiblity of all nodes with the Show All (☑) and Hide All (☐) buttons. Finally, the additional buttons in the Azimuthal Sectors tab can be used to quickly normalize all nodes to equal angles in a full-core (360 degrees), half-core (180 degrees) and quarter-core (90 degrees) configuration.

To the left of the tabbed panel is a preview area which displays the general structure of the vessel geometry. The preview is color coded based on the hidden and disabled status of the individual cells. Making a selection in the any of the tables will highlight the selected level, ring or sector in the preview area. Conversely, nodes can be selected in the preview with the left mouse button. Making a selection in the preview area will update the selection in the Radial Rings and Azimuthal Sectors tables to match the chosen cells. In the figure above, radial ring 2 and azimuthal sector 3 have both been hidden, while the cells in the range azimuthal 5-6 and radial 3-4 have been disabled.

The enabled status of cells is edited from the central column of the Axial Levels table, which opens the Enabled Cells window. This shows a table of values broken down into columns by azimuthal sector and rows by radial ring. The enabled flag controls whether a cell can be shown on that level; an enabled cell can still be hidden the visibility flag on a radial ring or azimuthal sector.



🟧 Cell
🟨 Hidden cell
⬜ Disabled cell

Axial Level 19

	A1	A2	A3	A4	A5	A6	A7	A8
R1	✓	✓	✓	✓	✓	✓	✓	✓
R2	✓	✓	✓	✓	✓	✓	✓	✓
R3	✓	✓	✓	✓	✓	✓	✓	✓
R4	✓	✓	✓	✓	☐	☐	✓	✓
R5	✓	✓	✓	✓	☐	☐	✓	✓

Figure 6.60. Enabled Cells Window

Press the **OK** button to store the changes made to the geometry. The edit can be discarded at any time by pressing the **Cancel** button or closing the geometry editor.

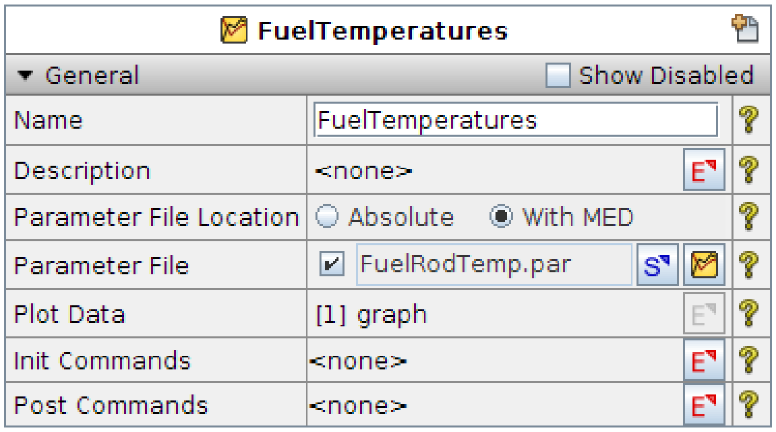
6.9. Plot Definitions

Animation models may specify a number of predefined plot definitions for use in plotting data with specific formatting. Plot definition components are created in the **Plot Definitions** category. The following sections describe plot definition properties, how they tie into AptPlot, and view integration.

It should be noted that throughout these sections, references will be made to animation model Data Sources. Plot definition functionality is exclusive to *local* data sources: jobs run on a calculation server executing on the user's machine. Trying to use display a plot with a remote Data Source will omit any remote sources and display an error.

6.9.1. Plot Definition Properties

Selecting a plot definition in the Navigator will display its properties in the Property Editor (Figure 6.61, “Plot Definition General Properties”).



FuelTemperatures	
General	☐ Show Disabled
Name	FuelTemperatures
Description	<none>
Parameter File Location	○ Absolute ● With MED
Parameter File	✓ FuelRodTemp.par
Plot Data	[1] graph
Init Commands	<none>
Post Commands	<none>

Figure 6.61. Plot Definition General Properties

The following properties are available in the **General** attribute group.

- **Name -** An arbitrary name. The name controls how the plot is labelled in the Navigator.
- **Description** - An arbitrary description for the plot definition.
- **Parameter File Location** - Determines how the AptPlot parameter file (described below) is located. When set to **Absolute**, the complete path to the file will be specified. **With MED** indicates that the plot file will reside in the same directory as the model MED file. The latter option cannot be selected for new, unsaved models.

  Some notes on changing this property when **Parameter File** is already set. When changing from **Absolute** to **With MED**, the folder path of the parameter file is removed automatically, and the file is assumed to exist in the same folder as the MED. If the file does not exist in this location (and exists in the original path), a prompt will be displayed asking whether the file should be copied to the MED folder. When changing from **With MED** to **Absolute**, the file name is prefixed with the complete path to the MED file. Warnings will be displayed in the message window if any of the indicated files do not exist.
- **Parameter File -** The location of an AptPlot parameter file. This is the main source of plot customization. An AptPlot parameter file typically contains commands that define the plot, from its background color to the graph count to the formatting of individual data sets. A parameter file does not normally contain data set values.

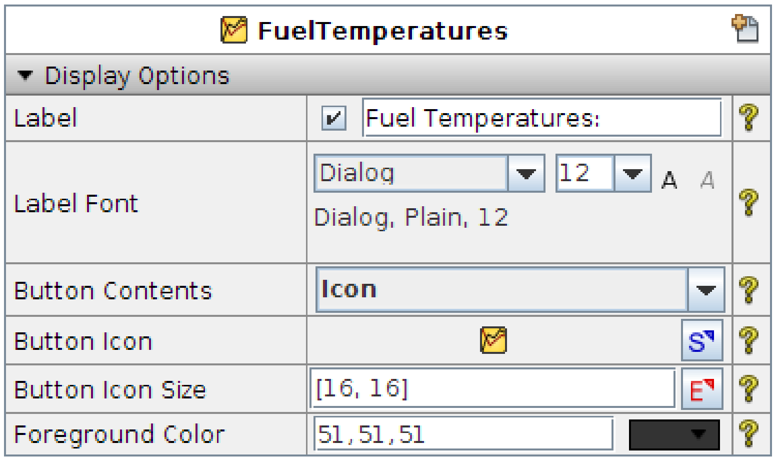
  The **Select** button on the editor opens a file chooser for selecting the parameter file. When **Parameter File Location** is set to **With MED**, this button opens a file selector limited solely to the folder housing the model MED. The **Plot** button in the Parameter File editor will launch AptPlot and load the indicated parameter file without providing plot data.

  Note Parameter files can be explicitly created in AptPlot by selecting **Plot** > **Save parameters...** from the main menu. The result is a file selection dialog that determines where the parameter file is stored and which graphs it includes.
- **Plot Data** - Defines the graphs in the plot and which data channels are displayed in each. Editing this attribute is described below.
- **Init Commands** - An arbitrary series of AptPlot batch commands that will be executed before data is plotted.

- **Post Commands -** Similar to **Init Commands**, but executed after data is plotted.

The following properties are available in the **DIsplay** attribute group.

- **Display Label -** An optional label attached to the plot definition when displayed in a View. This is described in further detail in Section 6.9.3, “Plot Definitions in a View”.
- **Label Font -** Defines the font of the **Display Label** text in a View.
- **Button Contents -** Determines whether the plot definition display button contains an icon, text, or both.
- **Button Icon -** The icon displayed in the button. The editor can be used to select an image file for use as the icon. Any image selected by the property editor will be saved directly in the MED. This property is only enabled when **Button Contents** is set to display the icon.
- **Button Icon Size -** The size of the icon displayed in the button. The value can be entered in the form "`[width, height]`" (sans quotes). Neither the square brackets nor the comma in the text value are necessary when entering the width manually. This property is only enabled when **Button Contents** is set to display the icon.
- **Button Text -** Defines the text displayed in the button. This property is only enabled when **Button Contents** is set to display text.
- **Font -** The font used to display text in the button. This property is only enabled when **Button Contents** is set to display text.
- **Foreground Color -**

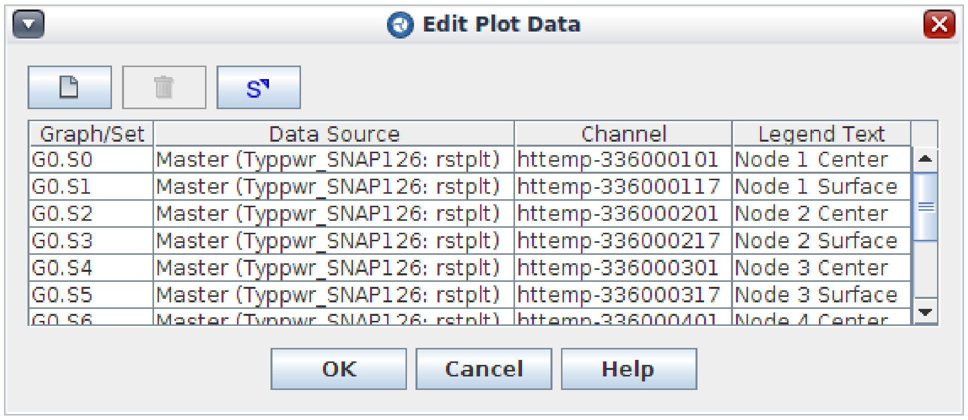

FuelTemperatures

▼ Display Options

Label	✓ Fuel Temperatures:
Label Font	Dialog, 12, Dialog, Plain, 12
Button Contents	Icon
Button Icon	
Button Icon Size	[16, 16]
Foreground Color	51,51,51

Figure 6.62. Plot Definition Display Properties

Pressing the **Edit** button in the Plot Data property editor will open the dialog shown in Figure 6.63, “Edit Plot Data Dialog”. Plot definition graphs are added, removed, and edited in this window. Each row in the table indicates a selected data channel: the columns indicate the graph and set that will contain the channel data, the Data Source from which the channel retrieved, the name of the data channel, and an optional legend entry. The **Graph/Set**, **Data Source**, and **Channel** columns are not directly edited in the table: their contents are automatically determined by the assignment of channels to graphs, outlined below. The **Legend Text** column is editable.



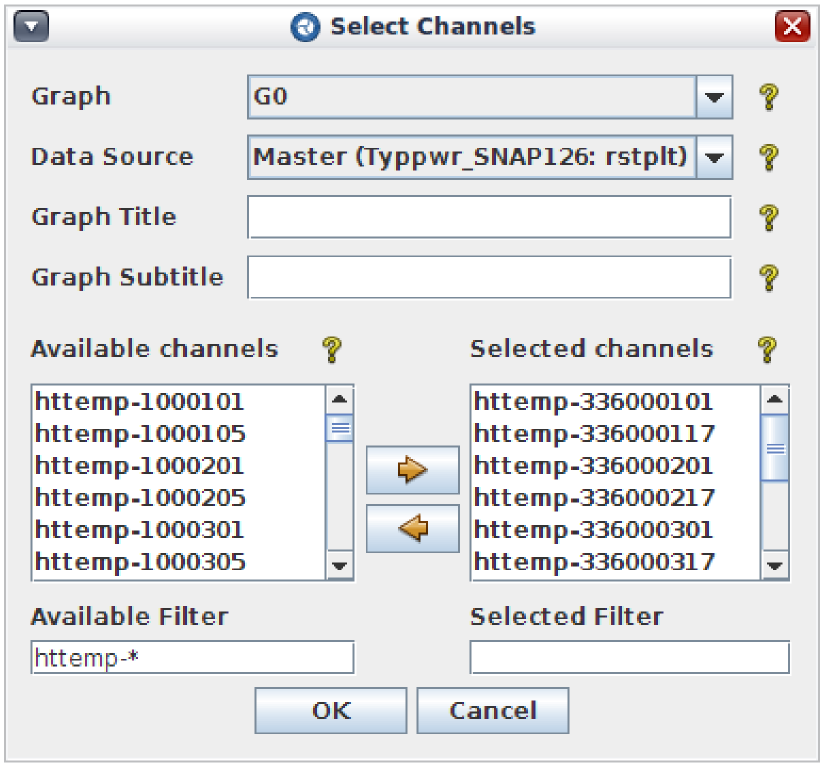
Graph/Set	Data Source	Channel	Legend Text
G0.S0	Master (Typpwr_SNAP126: rstplt)	httemp-336000101	Node 1 Center
G0.S1	Master (Typpwr_SNAP126: rstplt)	httemp-336000117	Node 1 Surface
G0.S2	Master (Typpwr_SNAP126: rstplt)	httemp-336000201	Node 2 Center
G0.S3	Master (Typpwr_SNAP126: rstplt)	httemp-336000217	Node 2 Surface
G0.S4	Master (Typpwr_SNAP126: rstplt)	httemp-336000301	Node 3 Center
G0.S5	Master (Typpwr_SNAP126: rstplt)	httemp-336000317	Node 3 Surface
G0.S6	Master (Typpwr_SNAP126: rstplt)	httemp-336000401	Node 4 Center

Figure 6.63. Edit Plot Data Dialog

Pressing the **Select** button in the **Edit Plot Data** dialog opens the dialog shown in Figure 6.64, “Select Channels Dialog”. Data channels are mapped on a per graph and Data Source basis. The **Graph** list controls which graph is being edited, while the **Data Source** list selects which channels are displayed. Channels can be moved from the **Available** list to the **Selected** list (and back) via the arrow buttons in the center of the dialog: channels in the **Selected** list are plotted.

The channels lists may be filtered with the fields below each list: the asterisk (*) character can be used to match any chunk of text within the filter. For example, the filter **p*** shown in the figure will match any channel name starting with the character p.

The **Select Channels** dialog may also be used to set custom titles and subtitles for individual graphs. To do so, specify the desired title or subtitle in the **Graph Title** and **Graph Subtitle** fields when the appropriate graph is selected.



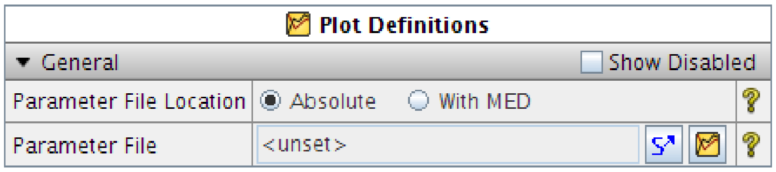
Graph: G0
Data Source: Master (Typpwr_SNAP126: rstplt)
Graph Title:
Graph Subtitle:

Available channels	Selected channels
httemp-1000101	httemp-336000101
httemp-1000105	httemp-336000117
httemp-1000201	httemp-336000201
httemp-1000205	httemp-336000217
httemp-1000301	httemp-336000301
httemp-1000305	httemp-336000317

Available Filter: httemp-*
Selected Filter:

Figure 6.64. Select Channels Dialog

Selecting the **Plot Definitions** category in the Navigator will display the property shown in Figure 6.65, “Plot Definitions Category Properties”. In this context, the **Parameter File Location** and **Parameter File** properties function similarly to those described above, specifying an optional parameter file that is used by *all* plot definitions. If a plot definition specifies a parameter file when a category file is defined, both are used: the category file is read first, then the plot definition file. This behavior allows defining general formatting for all plots while allowing plot-specific overrides.


Plot Definitions

General ☐ Show Disabled

Parameter File Location	● Absolute ○ With MED
Parameter File	<unset>

Figure 6.65. Plot Definitions Category Properties

6.9.2. Plot Definitions and AptPlot

Plot definitions utilize AptPlot to plot channel data. The next section describes how to plot data and create plot batch scripts from plot definitions. It should be noted that the following two conditions must hold to perform any action described in this section.

1. AptPlot must be installed and correctly configured in the SNAP configuration (see Section 3.3.1, “General Properties”). AcGrace is not supported, and may not work correctly.

2. A Data Source in the animation model must be connected (see Section 6.7, “Animation Playback”).

A plot definition's right-click pop-up menu contains a **Display in AptPlot** item (Figure 6.66, “Plot Definition Right-Click Pop-up Menu”). Selecting this menu item will launch AptPlot and display the plot.

Note The process of launching AptPlot and sending it plot commands may complete much more quickly than AptPlot's actual start-up. When selecting the menu-item, if the menu disappears and nothing seems to happen, wait a few seconds before trying again.

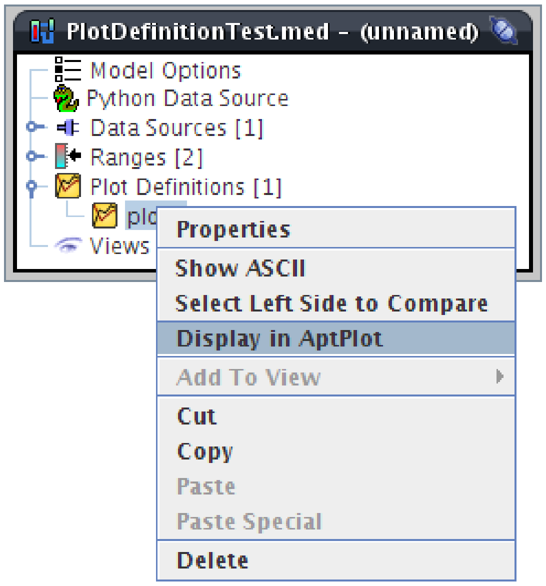
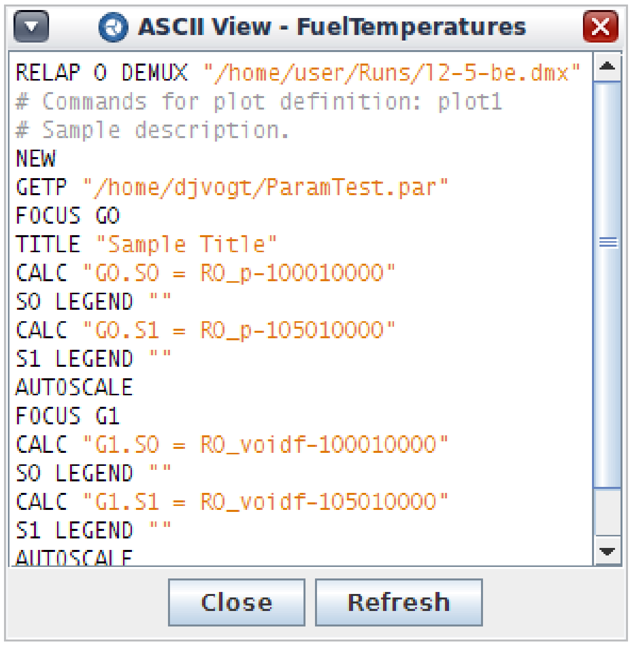


Figure 6.66. Plot Definition Right-Click Pop-up Menu

To see the batch commands used to create a plot, right-click on a plot definition and select **Show ASCII**. This will display the **ASCII View** dialog shown in Figure 6.67, "Plot Definition Batch Commands".

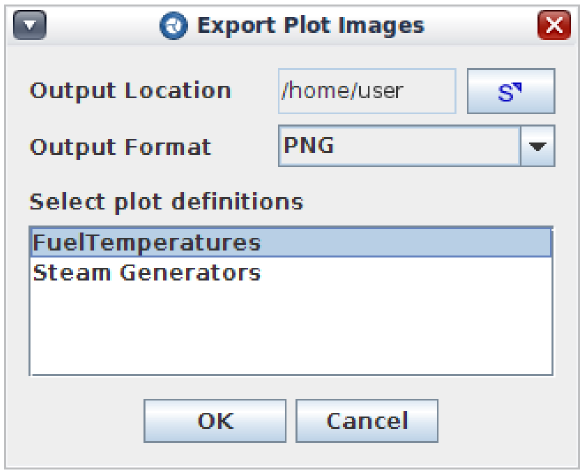


```
RELAP 0 DEMUX "/home/user/Runs/12-5-be.dmx"
# Commands for plot definition: plot1
# Sample description.
NEW
GETP "/home/djvogt/ParamTest.par"
FOCUS G0
TITLE "Sample Title"
CALC "G0.S0 = R0_p-100010000"
S0 LEGEND ""
CALC "G0.S1 = R0_p-105010000"
S1 LEGEND ""
AUTOSCALE
FOCUS G1
CALC "G1.S0 = R0_voidf-100010000"
S0 LEGEND ""
CALC "G1.S1 = R0_voidf-105010000"
S1 LEGEND ""
AUTOSCALE
```

Figure 6.67. Plot Definition Batch Commands

Right-clicking on the **Plot Definitions** category will open a pop-up menu containing the items **Export Plot Images** and **Export Plot Commands** (among others). Both items open the export dialog shown in Figure 6.68, "Plot Definitions Export Dialog". When **Export Plot Images** is chosen, the dialog is used to select a directory where images will be created, the image format, and the plots to be exported as images. Pressing the OK button will launch AptPlot in the background and generate the images. When **Export Plot Commands** is selected, the dialog functions similarly, except that user enters a file where the batch commands for the selected plots are written, but not executed.

Note When exporting images, each plot is named after the plot definition.



Output Location: /home/user
Output Format: PNG

Figure 6.68. Plot Definitions Export Dialog

6.9.3. Plot Definitions in a View

Plot Definitions can be placed in a view to facilitate quick plotting. To do so, either drag the plot definition from the Navigator to the view, or right-click the definition and select **Add to View** > **[Desired View]**. In the view, a plot definition is represented by a single button: pressing this button when the view is locked will launch AptPlot and display the plot. The optional **Display Label** property in a plot definition can be used to specify a label displayed next to the button.

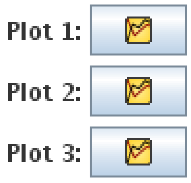


Figure 6.69. Plot Definitions in a View

Chapter 7. Using the jEdit Plug-in

jEdit is a pure-Java, programmer's text editor that was chosen for use with the SNAP system because of its stability and multitude of features. The built-in support for syntax highlighting definitions and extensible plug-in architecture make it a very valuable tool when working with ASCII formatted input files. For a detailed listing of jEdit's available features see the jEdit homepage at http://jedit.sourceforge.net.

7.1. Installing the jEdit Plug-in

The current jEdit plug-in for SNAP is designed to work with jEdit version 4.2 or higher. Older versions of jEdit will not work properly with the SNAP plug-in. To acquire and install jEdit, consult the Download section of the jEdit homepage at http://jedit.sourceforge.net.

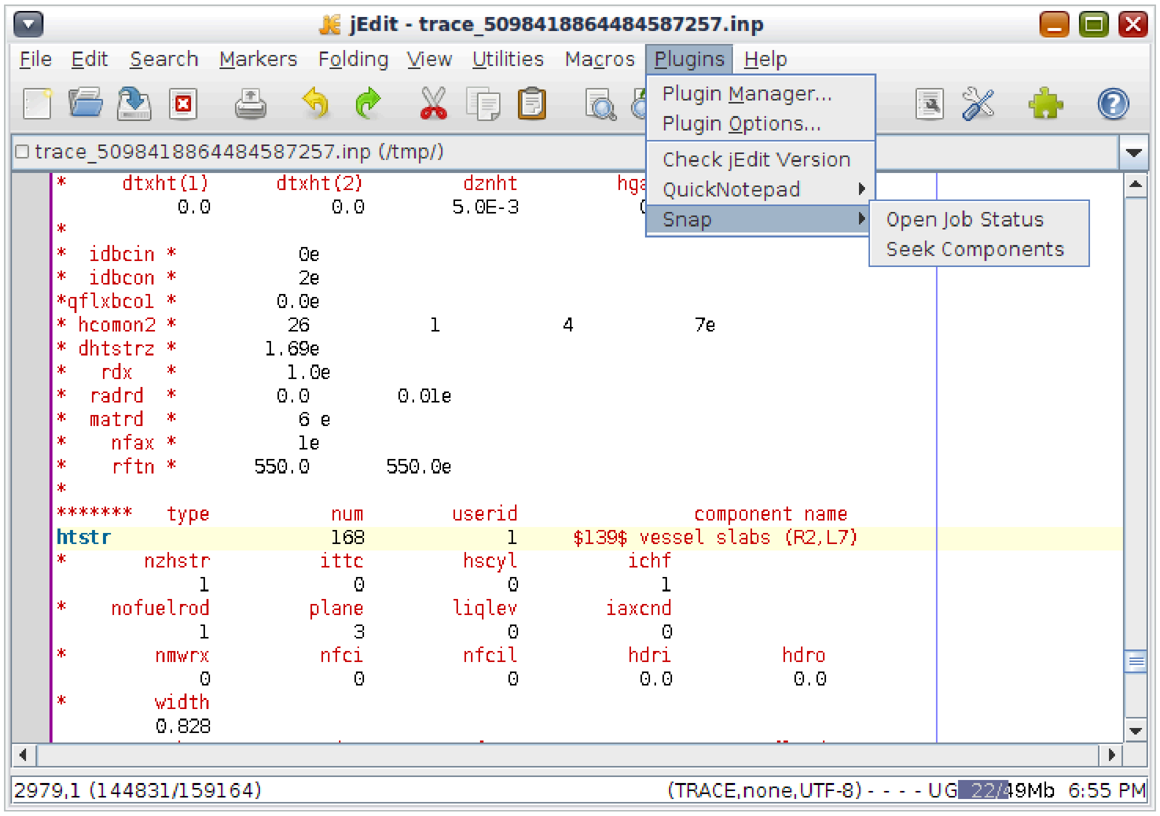
Once jEdit is installed, the SNAP plug-in can be installed through the Configuration Tool. In **Personal Settings**, the **jEdit Executable** property defines where jEdit is located. In the property editor, pressing the jEdit configuration button () opens a file browser used to select the jEdit installation directory. For most, this would be:

```
<path to install>/jEdit/4.2/
```

Selecting a file will both set the jEdit location in the SNAP configuration, and install the jEdit SNAP plug-in.

7.2. Using jEdit with SNAP

The jEdit application is used primarily for the **Export to jEdit** item in the **Tools** menu. This item is available in most SNAP plug-ins. This feature is used to export the ASCII input for the selected object (model, component, etc.) to a temporary file which is then opened in jEdit. There, the exported ASCII can be reviewed or copied and pasted into other input files.

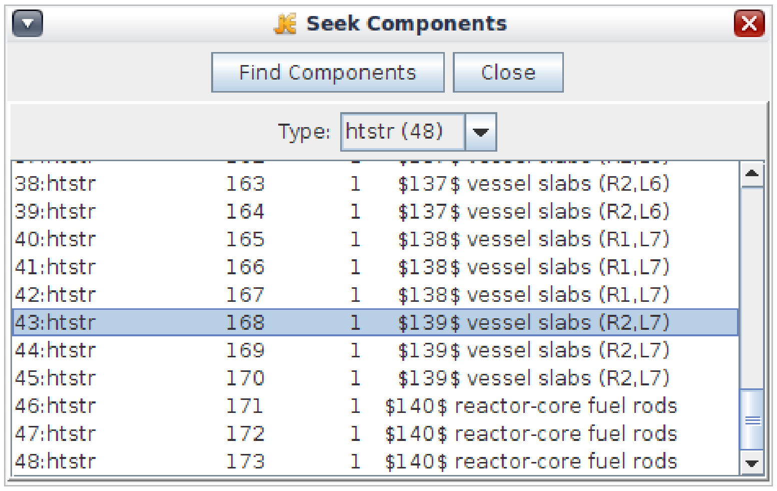


```
*     dtxht(1)      dtxht(2)        dznht         hgz
         0.0           0.0        5.0E-3            0
*
*  idbcin *           0e
*  idbcon *           2e
*qflxbcol *         0.0e
* hcomon2 *          26            1           4           7e
* dhtstrz *        1.69e
*    rdx  *          1.0e
*  radrd  *        0.0         0.01e
*  matrd  *           6 e
*    nfax *           1e
*    rftn *       550.0        550.0e
*
*******    type             num        userid               component name
htstr                       168             1      $139$ vessel slabs (R2,L7)
*       nzhstr             ittc          hscyl          ichf
             1                0              0             1
*    nofuelrod            plane         liqlev        iaxcnd
             1                3              0             0
*        nmwrx             nfci          nfcil          hdri          hdro
             0                0              0           0.0           0.0
*        width
         0.828
```

Figure 7.1. The jEdit Editor

The SNAP jEdit Plug-in provides the following additional features to jEdit:

- **Syntax Highlighting** - The jEdit plug-in currently supports syntax highlighting for the TRACE and RELAP5 analysis codes.
- **Seek Components** - The Seek Components dialog (shown in Figure 7.2, “The Seek Components Dialog”) is used to locate components within the input deck. The type drop-down contains a list of component types found in the model along with the number of each type located in parentheses. The components for the selected type are displayed in the list. Selecting a component in the list will result in that component being scrolled into view. The Seek Components dialog currently supports the TRACE and RELAP5 analysis codes.



```
38:htstr        163     1   $137$ vessel slabs (R2,L6)
39:htstr        164     1   $137$ vessel slabs (R2,L6)
40:htstr        165     1   $138$ vessel slabs (R1,L7)
41:htstr        166     1   $138$ vessel slabs (R1,L7)
42:htstr        167     1   $138$ vessel slabs (R1,L7)
43:htstr        168     1   $139$ vessel slabs (R2,L7)
44:htstr        169     1   $139$ vessel slabs (R2,L7)
45:htstr        170     1   $139$ vessel slabs (R2,L7)
46:htstr        171     1  $140$ reactor-core fuel rods
47:htstr        172     1  $140$ reactor-core fuel rods
48:htstr        173     1  $140$ reactor-core fuel rods
```

Figure 7.2. The Seek Components Dialog

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