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# Symbolic Nuclear Analysis Package (SNAP) RELAP5 to TRACE Conversion Plug-in Tutorial

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# Introduction

The Symbolic Nuclear Analysis Package (SNAP) consists of a suite of integrated applications designed to simplify the process of performing thermal-hydraulic analysis. SNAP 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 analysis codes. The modular plug-in design of the software allows functionality to be tailored to the specific requirements of each analysis code.

This tutorial is designed to provide instruction on how use the SNAP RELAP5 to TRACE Conversion plug-in. The RELAP5 to TRACE plug-in provides the ability to convert a RELAP5 into a functionally equivalent TRACE model. This tutorial describes the process of model conversion, and includes instructions for using SNAPs animation plug-in to perform a comparative analysis of the RELAP5 and TRACE models.

The RELAP5 to TRACE Conversion utility is considered advanced SNAP functionality. This tutorial assumes the user has a basic familiarity with the SNAP ModelEditor. The following requirements must be met for this tutorial.

- SNAP version 26.5 or higher with the following plugins installed:
  - RELAP5 2.3.3
  - TRACE 1.6.2
  - R52TRACE v 0.1.2
- A local calculation server running with the following executables defined:
  - RELAP5 v 3.3ef or higher
  - TRACE v 5.0 rc3 or higher with TPR active.

For any ModelEditor UI related questions, refer to the “Symbolic Nuclear Analysis Package (SNAP) User’s Manual.”

## Exercise 1: Converting a RELAP5 Model to TRACE

In this exercise a RELAP5 model will be converted to TRACE. A RELAP5 model will be loaded into the ModelEditor. The R52TRACE conversion plug-in will then be used to select the model components for conversion, and complete the conversion process.

Figure 1 below displays the primary hydraulic view of a RELAP5 typical PWR model that will be used for this tutorial. This model has been slightly modified from the sample TYPPWR model provided with SNAP. The initial conditions for this model have been retrieved from a steady state calculation which was run to 1000 seconds.

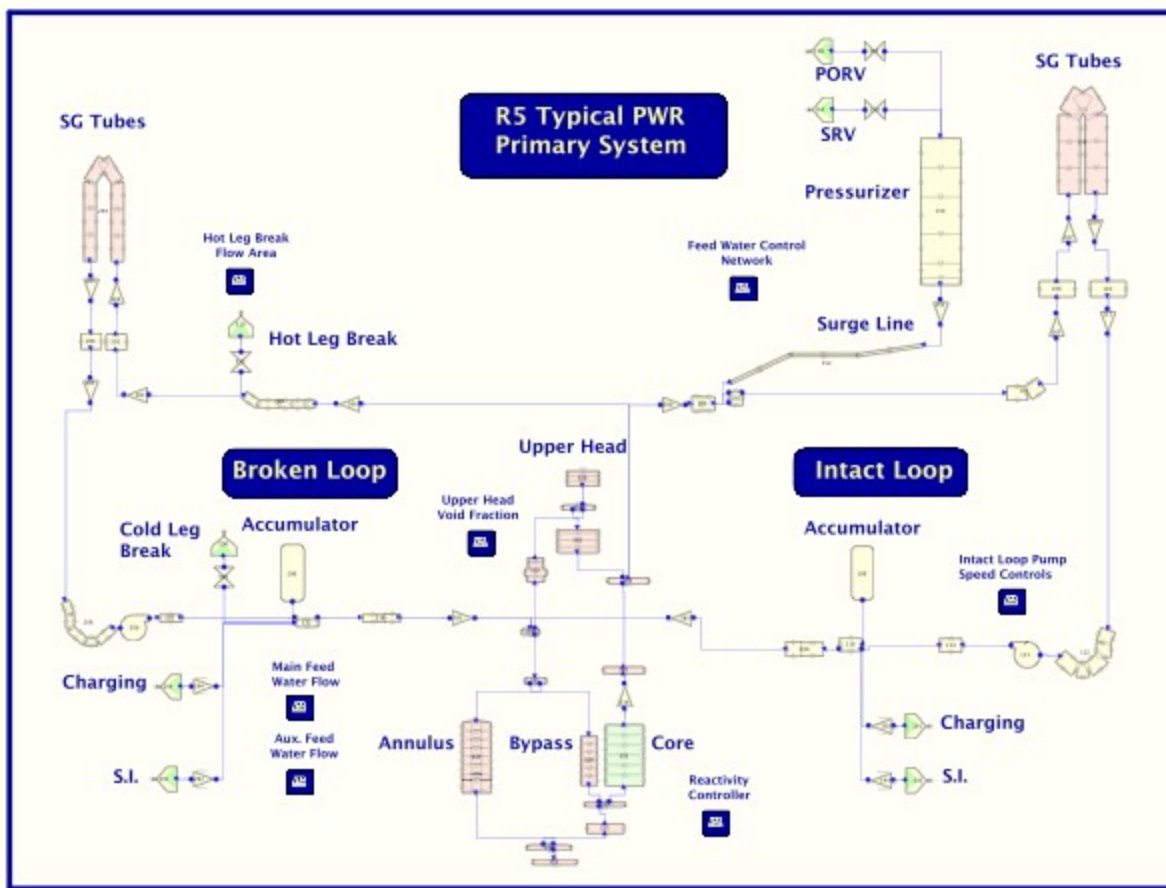


Figure 1: RELAP5 Typical PWR

1. Launch the ModelEditor. Under Windows, select the “All Programs►SNAP►Model Editor” option from the Start menu. This will open the ModelEditor and display the welcome dialog.
2. Select the **Open an Existing ModelEditor File** option and the click the **OK** button. You will next be prompted to select the model to open. Select the *RELAP5\_Typpwr.med* file provided with this tutorial, and press the **Open** button. Once the model has been loaded into the Model

Editor, it will be ready for conversion.

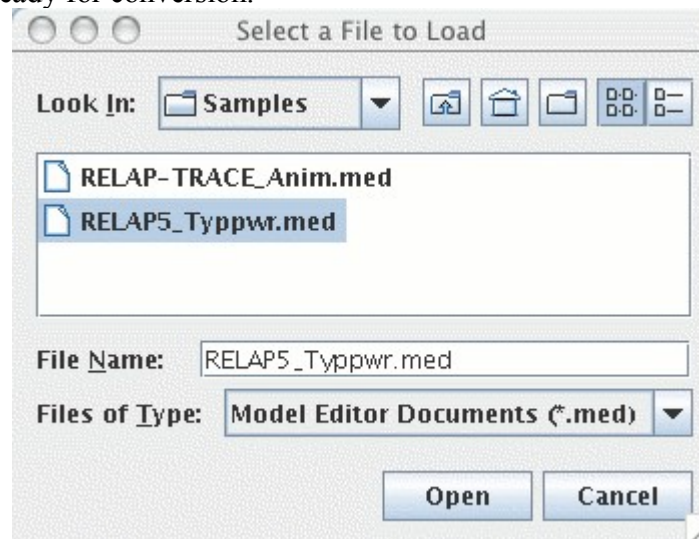


Figure 2: Open File Dialog

3. Locate the ModelEditor **Tools** menu item and select option **Convert to TRACE** shown in Figure 3. This opens the conversion utility dialog with the category selection panel visible. This panel provides a listing of the model categories. The list will only display categories inside the model that contains components.

**Note:** This option is only available when the RELAP5 to TRACE conversion plug-in has been properly installed, and a RELAP5 model is selected.

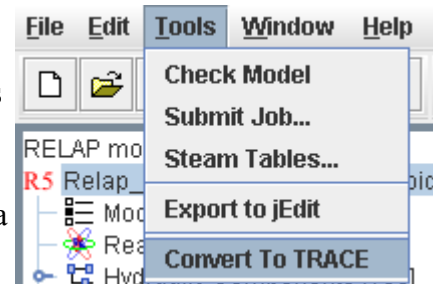


Figure 3: Convert Menu Item

4. Press the **Select All** button at the bottom of the dialog to include all components in the RELAP5 model for conversion.
5. Select the Category column for the **Views** and press the **Select** button to open the Component Selection dialog. This dialog allows you to specify exactly which components will be included during the conversion process. The component selection dialog is shown in Figure 4.
6. De-select all the views except the *Primary Hydraulic View* and close the component selection dialog by pressing the **OK** button.

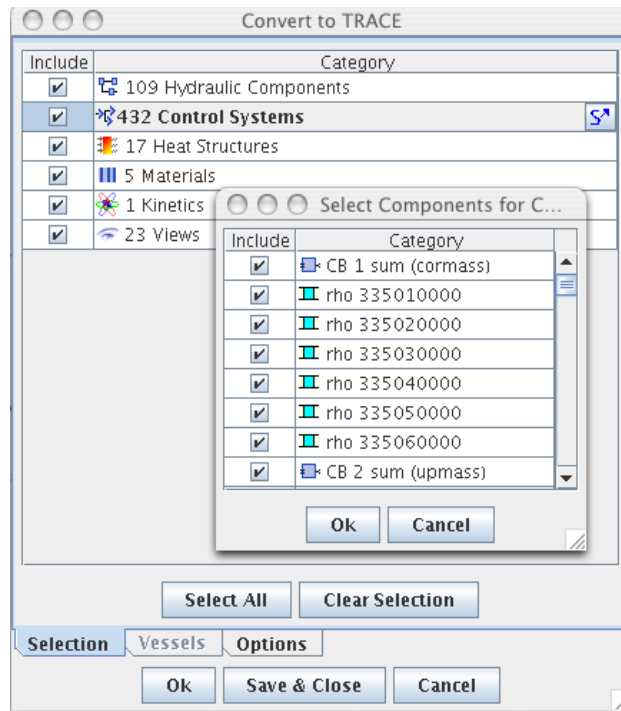


Figure 4: Component Selection

7. Press the **Save & Close** button to temporarily suspend the conversion process. The conversion dialog will close. The state of the conversion will be preserved, and stored with the model. This allows the conversion process to be interrupted and restarted at a later time.
8. Restart the conversion process by selecting the **Convert to Trace** menu item in the **Tools** menu. Notice that the components which were previously included for conversion are still selected.
9. Press the **Select All** button.
10. Notice that the **Options** tab is enabled. This indicates that one or more of the component converter objects has properties that may be modified by the user in order to customize the conversion. Select the **Options** tab at the bottom of the dialog. This selects the Conversion Options panel, shown in Figure 5.
11. Double click on the Materials node in the Navigator at the top of the Conversion Options Panel, and select one of the materials.

Notice that the property view in the bottom of the dialog displays the fields **Density** and **Emissivity**. These values are required to convert the RELAP5 TBL/FCTN materials into TRACE user defined materials.

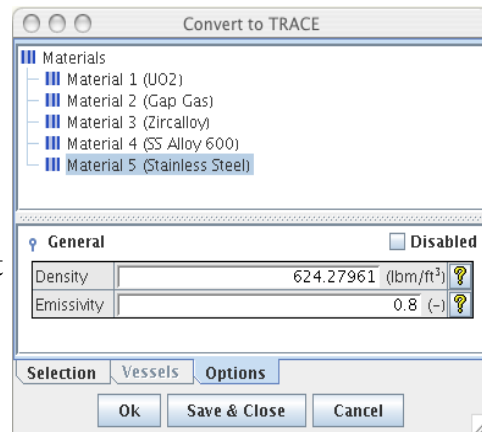


Figure 5: Conversion Options

12.Ensure that the following values are defined for the materials:

- **Density:** 624.27961 lbm/ft<sup>3</sup>
- **Emissivity:** 0.8

13.Press the **OK** button. This will complete the conversion process and will create a new TRACE model containing the RELAP5 components converted for TRACE.

After the conversion has completed the Report Dialog will open. This dialog, displayed in Figure 6, lists the RELAP5 components by category, and lists the results of the conversion. Pressing the info (i) button next to the results opens a small dialog that includes details of the conversion including key properties such as total hydraulic volume, and total elevation change.

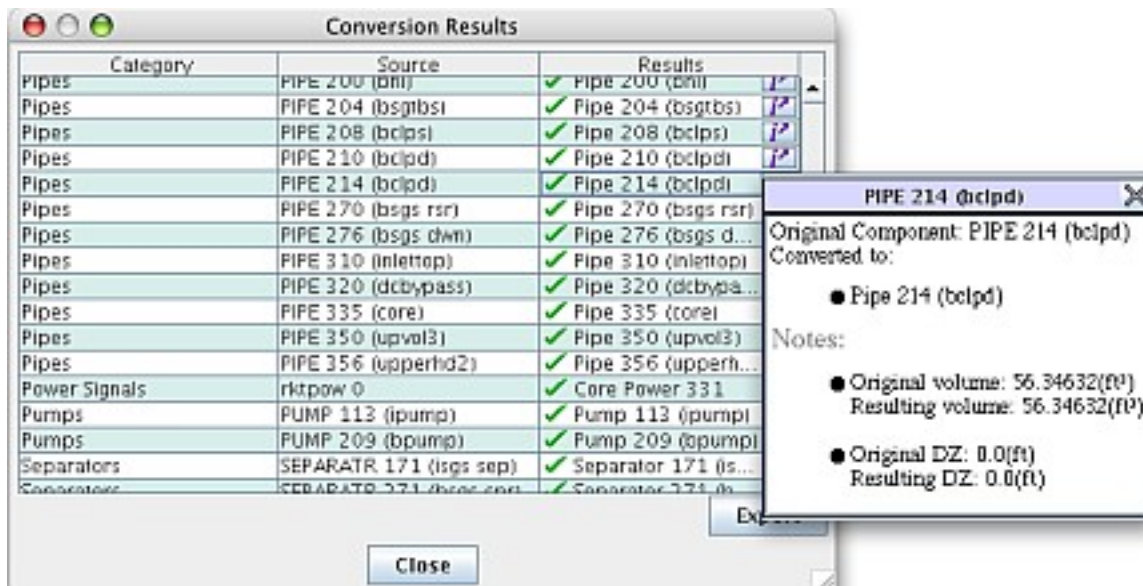


Figure 6: Report Dialog

14.Select the **Export Report** button from the report dialog. This will export the conversion details of every component that has been converted into a single HTML file.

15.Save the report to the desktop as *report.html*, and open the file inside your native browser. Verify that the conversion was successful by searching for errors encountered during the conversion.

16.Save the resulting TRACE model to the *TRACE\_Typpwr.med* in the *Samples* directory provided with this tutorial. This model will be used for the next exercise.

## Exercise 2: Comparative Animation

In this exercise the original RELAP5 model will be run as a null-transient out to 12000 seconds.. Then the converted TRACE model will be run as a steady state calculation, and animated in parallel with the previously run RELAP5 model using specially prepared animation model.

**Note:** See the SNAP users manual for instructions on setting up a local calculation server.

1. If the ModelEditor is not currently open, launch the ModelEditor. Under Windows, select the “All Programs►SNAP►Model Editor” option from the Start menu.
2. Select the **Open an Existing ModelEditor File** option and then click the **OK** button or select the **Open** option from the File menu. You will next be prompted to select the model to open.
3. Select the *RELAP\_Typpwr.med* from the *Samples* directory provided with this tutorial.
4. Select the **Submit Job** option from the **Tools** menu the RELAP5 model. This opens the Job submission dialog displayed in Figure 7
5. In the job submission dialog create a new Target Folder labeled Conversion and ensure that the correct RELAP5 executable is selected.
6. Press the **Submit** button to initiate the RELAP5 analysis code with the sample model. Continue with the tutorial while the RELAP5 model executes.

The image shows a 'Submit Calculation' dialog box with the following fields and options:

- Server:** bugs.appliedprog.com:5006
- Executable:** 33EF\_BIG
- Target Folder:** /Runs/Conversion/
- Run Options:**
  - Name:** RELAP\_Typpwr\_ss
  - Overwrite:** Yes (selected), No, Prompt
  - Priority:** 5
  - Interactive:** True (selected), False
  - Start Paused:** True, False (selected)
- Parametric:**
  - Enabled:** (checkbox)
  - First:** < none >
  - Second:** < none >
- Restart:**
  - No Restart** (selected), Selected Restart File
- View Console Output:** (checkbox, checked)
- Buttons:** Submit, Cancel

Figure 7: RELAP5 Submission



7. Select the **Open** option from the File menu, and select the *TRACE\_Typpwr.med* file created inside Exercise 1, and press the **Open** button.

The conversion process initializes the model as a steady state model by setting the **stdyst** model property to 1 for Generalized Steady State.

8. Open the TRACE job submission dialog, shown in using the **Submit Job** menu item from the Tools menu.

9. Select the TRACE executable, and select the **Target Folder** created in Step 3. Select TRUE for the **Start Paused** option, and enter *TRACE\_Typpwr\_ss* as the **Name**. The submission dialog should appear as in Figure 8. Now press the **Submit** button.

10. Select the “File►Open” menu item, and open the *RELAP5 TRACE Anim.med* file included with this tutorial. This model is an animation mask that has been built for comparative analysis of the RELAP5 and TRACE TYPPWR models.

This model has two data sources, allowing the RELAP5 model previously submitted to animate in parallel with the TRACE model.

Figure 8: TRACE Submission

11. Expand the Data Sources node in the navigator, as shown in Figure 9. Select the first node which is labeled R5, and open the Source Run URL editor. This opens a dialog which displays the available calculations for animation.

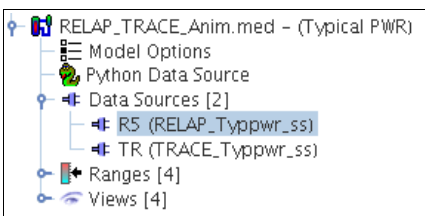


Figure 9: Data Source Navigator

12. Navigate to and select the previously submitted RELAP5 run and press the **OK** button. Ensure that the R5 node has the following properties defined:

- **Master Source** : FALSE
- **Begin Time Offset** : 0.0s

13. Select the TR data source in the Navigator, and select the **Source URL** for the paused TRACE run, as displayed in Figure 10.

This data source should be defined as the Master Source. The Master source provides the current time data for the animation. The secondary data sources interpolate their data to match the Master run time data. Since the graphics interval values inside the time step data are preserved during the conversion, the RELAP5 plot file will have similar data points to the TRACE plot file.

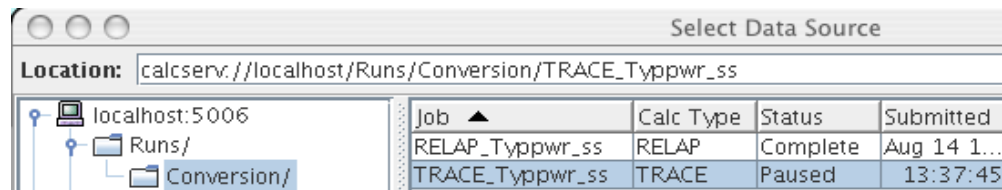


Figure 10: Data Source Selection

14. Once the data sources have been selected, press the **Connect** button from the animation controls to establish the connections to the Calculation Server. The animation controls will become active when the connection has been completed, as displayed in Figure 11



Figure 11: Active Animation Controls

15. Animate the results of the calculation by pressing the **Play** button, and then pressing the **OK** button when asked to resume the calculation. Visually compare the RELAP5 model to the TRACE model as the runs progress.

Variables from both calculations may be plotted in APTplot directly from the ModelEditor by selecting an animation bean and selecting **Plot Data** from the right-click pop-up menu.

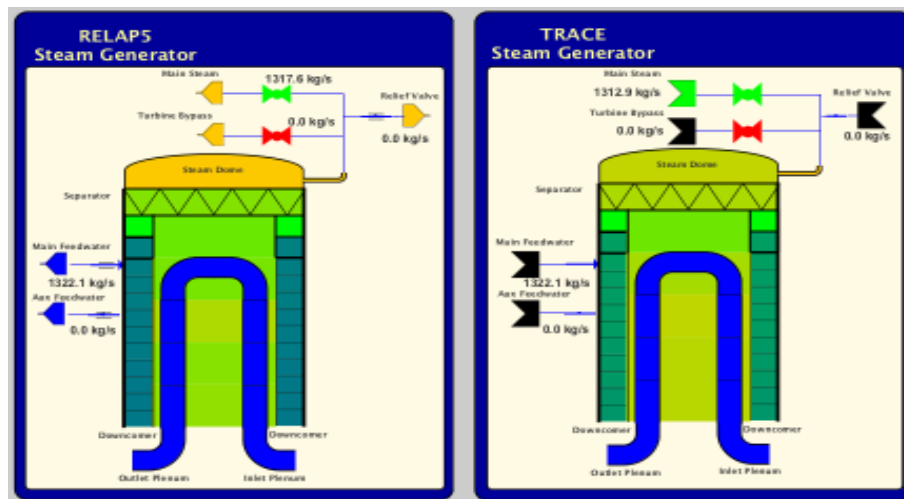


Figure 12: Comparative Animation