LBLOCA Simulation

Objective

In the steady state exercises, a few control systems were added to help the model reach the target steady state values. The objective of this exercise is to run a LBLOCA simulation off the steady-state calculation and examine the results.

Setup

You can either continue with the model from the previous exercise, or open the SNAP model named 'PBTT_SS6.med' in the folder 'Day4\Afternoon\BWR\' under the workshop main folder.

Create a Restart Input File

Restart input files are created in the 'Cases' dialog in the Navigator Window.

1. Locate and add a new case (right-click) to create a restart file.
2. In the Properties Window change the editing mode to Graphical.
3.  xpand the Restart Model box. Note that expanding the Restart Model box opens up SNAP for creating a restart input file.

For this exercise the large break is assumed to occur in the Loop A pump suction leg at the isolation valve. The break is modeled as a double-ended guillotine break. An assumption associated with the break is the core power is tripped at time zero.

4. Delete VALVE 61 (loop isolation valve) and add two BREAK components to the Windows view. The BREAKs model atmospheric conditions. It is assumed the temperature is 300 K.
5. Connect the BREAKs to the pipe components (PIPE 60 and 62) that the VALVE was connected to.

6. Complete the input to the BREAKs with the following information:
   a) Length: 1.0 m
   b) Volume: 1.0e4 m^3
   c) Initial gas volume fraction: 1.0
   d) Initial mixture temperature: 300 K
   e) Initial Pressure: 1.0e5 Pa

This completes the necessary input for the large break we will simulate. Note that depending on the type of transient that will be simulated other parameters may be changed, such as a degradation of the ECCS, etc. The next step is to change the restart input file from a steady-state calculation to a transient simulation.

7. Locate the 'Model Options' in the Navigator Window.
8. In the Properties Window, modify the Transient Calculation from steady-state to Transient mode. Note that running in the steady-state mode, trips are not evaluated. In the transient mode trips are now evaluated.
9. Locate and open up the time step data dialog box in the properties window. It is desired to run a 100 second transient, using a time step size of 0.01 seconds and a graphics interval of 1.0 second. Update the time step information.

When these changes have been entered into the restart model we need to save the changes

10. At the top of the Navigator Window locate and click on the save button.

Setup a Job Stream to Run the LBLOCA

In this step, a job stream will be created to run the transient restart file created above. The transient calculation will begin as a resart from the steady-state calculation made earlier.

1. Locate and add a New Job Stream sequence.
2. In the 'Create New Job Stream' dialog popup, Select the basic stream and then click on the next button.
3. Select the option to do a restart of a completed TRACE job and click the finish button.

In the new job stream window that appears do the following:

4. Click on the Submit button and Name the calculation 'BWR-LBLOCA'
5. Click on the Restart file box and in the Properties Window make the following changes:
   a) Click on the down arrow in the File box and select the Calculation Server
   b) In the 'Select File' dialog popup, navigate to the place where the BWR steady-state calculation is located. Click on the ".tpr" file. Note that the tpr file contains the calculated information from the steady-state calculation to initiate the restart run.
6. Select the TRACE Restart_Job box in the view window and do the following:
   a) Assure the TRACE executable is selected.
   b) Toggle the view in job status to yes
   c) An animation model is available for the calculation. Connect to the animation model that is located in the 'Day4\Afternoon\BWR\' folder and is called PBTT_SS_Animation.med
   d) Turn on start pause. This will cause the calculation to pause and allow the animation model to be connected before continuing the calculation.

e) Click on Yes to Create a Demultiplex Plot File. A Demultiplex plot file rearranges the plot data to make plotting the calculated parameters faster.

RUN THE LBLOCA

As in the previous runs, lock the view and run the transient simulation.

Observe the progression of the transient in the animation file. Note there is a tab at the bottom of the animation file called Transient plots. In this view there are several plots that show different calculated parameters. Also available is the AptPlot to view the transient results.

Some questions to consider are:

1. Does the system pressure respond as expected?
2. What is happening to the core bypass flow?
3. What is the core average void fraction (void inside the CHANs)?
4. If the CHAN void is all steam, where is the injected ECCS fluid going?
5. What is happening to the PCT?
6. What would we expect to see if the transient was run out further?