RELAP5-3D Backup Improvements

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Outline

- RELAP5-3D Backup Feature
- Backup Issues Resolved
- Pending Backup Issues
- Conclusions

RELAP5-3D Backup Feature

- The RELAP5-3D backup feature is implemented to protect a calculation from failing after an error.

- Some of the situations that can cause a backup to occur for a calculation include: phase appearance/disappearance, excessive mass error, velocity flip-flop, noncondensable appearance/disappearance, and water packing.

- To mitigate these issues, the backup feature causes the code to repeat the time step that had an error with a smaller time step size.

- This requires the code to store various old-time variables and restore them when backing up. In the case of some variables, the code requires that more than one old time step value is stored.

- An artificial backup was also added to the code to force the code to perform a backup. This is used to test the backup feature and is primarily used in the verification test set.

Backup Issues Resolved

- Found cases in which all of the variables used in a calculation were identical, but the results were slightly different because of differences in order of operations.
    - Corrected those issues that were found so that calculations were identical.

- Found in some cases that variables that were needed after a backup were not stored correctly.
    - These variables were added so that they would be stored after a backup.

Pending Backup Issues

- There are some issues that have not been resolved completely.

- Found issues when backing up a problem that had an accumulator drain completely.

  - The problem failed backup testing because of a changed logic path after draining. Have backed up some additional variables, a few other issues to correct.

- Found issues with problems that have noncondensable gases.

  - When noncondensable gases are present the coding does not always backup correctly. Working on fixes.

Conclusions

- The RELAP5-3D backup capability has been improved and made more robust.

- The verification testing has uncovered most of the problems that have been resolved.

- There are some pending backup issues with associated with accumulator emptying and noncondensables.

- These issues are being addressed, and we hope to resolve them soon.