Improvements to the Steady State Option
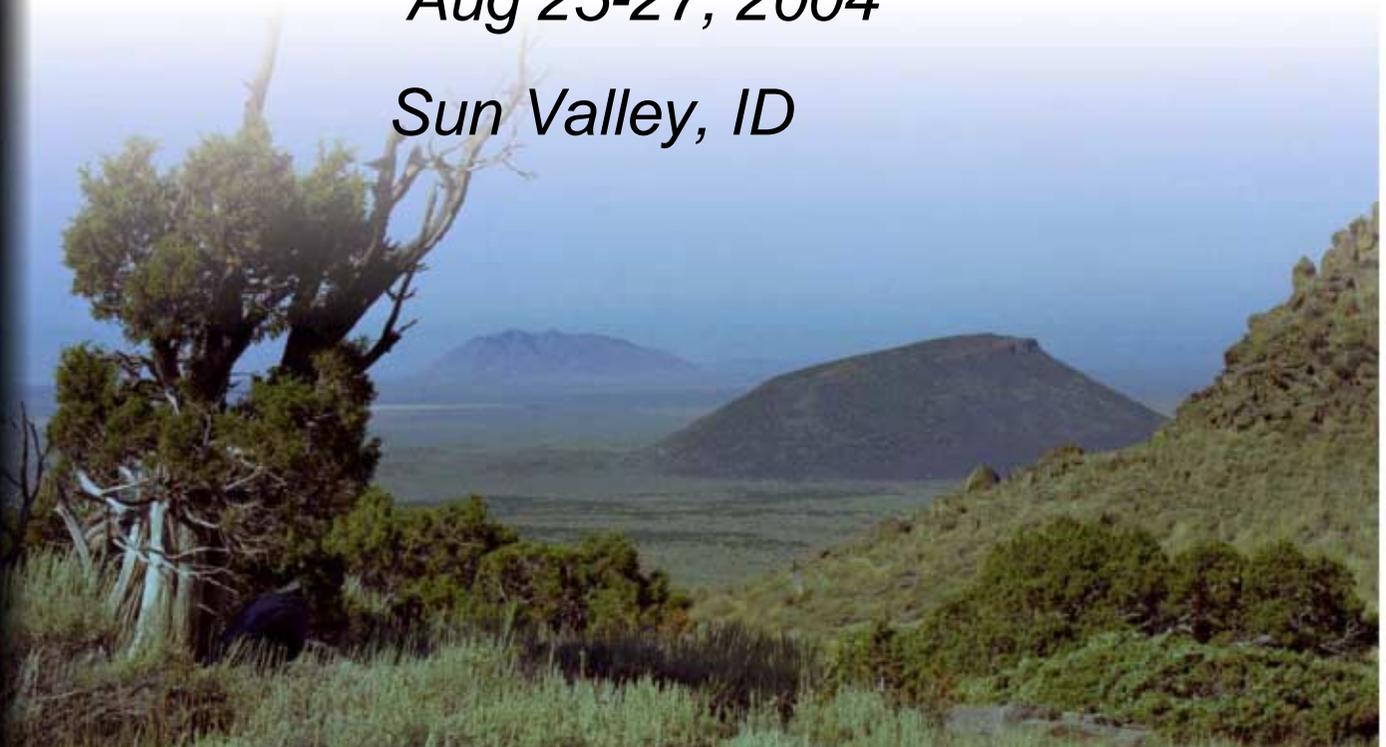
Walter Weaver

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Outline

- **Background**

- **Improvements to steady state**

- **Test results**

- **Summary**

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Background

- **Steady state mode in RELAP5-3D modifies heat structure heat capacity for faster approach to steady state**

- **Steady state checking routine activated unless deactivated by user on time step cards**

- **Input decks either leaves out trips or modifies set points so trips do not activate during null transient to steady state**

- **User has no control over CHF**

- **User may select other options for faster approach to steady state, i.e., nearly-implicit solution algorithm**

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Improvements to Steady State Option

- *Trips deactivated for steady state mode*

    - *trip printout shows appropriate activation time but trip has no effect*

- *CHF deactivated for steady state model*

    - *surface flux may exceed CHF flux*

Improvements to Steady state Option (cont.)

- *Set of solution control options override options on time step cards*

  - nearly-implicit solution algorithm

  - bypass mass error time step control

  - semi-implicit coupling of heat structures to volumes

  - steady state checking routine deactivated, summary printout indicates when steady state checker thinks solution has reached steady state

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Improvements to turbine model (cont.)

- **Default behavior may be overridden by new input card**

    - *107 card, three integers*

    - *first integer, 1 = activate trips, 0 = deactivate trips*

    - *second integer, 1 = activate CHF, 0 = deactivate CHF*

    - *third integer, 1 = use solution control on time step cards, 0 = use new default solution controls*

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Trip Test Cases

Test cases based on typpwrr installation test case converted to steady state mode with CHF and solution controls activated.

- executed on unmodified code to establish base behavior

- executed with trips activated, identical results to base case

- results of these two cases show that new default trip behavior can be overridden by the user

Trip Test Cases (cont.)

- *executed with trips disabled (new default behavior) to establish base behavior for modified code*

- *executed with trips activated but set points modified so that trips do not activate, identical results to previous run*

- *Results of these two cases show that new default trip behavior is working as expected, i.e. that trips are disabled.*

CHF Test Cases

- *CHF test case based on Bennett film boiling test case, with trips and solution controls enabled*

- *Executed with unmodified code to establish base behavior, i.e., film boiling in top of test section*

- *Executed with CHF enabled, identical results to base case*

- *Executed with CHF disabled, printout shows that surface heat flux exceeds CHF heat flux for nodes in film boiling in base case*

Solution Controls Test Case

Test case based on typpwrr installation test case converted to steady state mode with trips and CHF enabled and solution controls different than new defaults options

- executed with unmodified code to establish base behavior for unmodified code

- executed with solution controls enabled, identical results to base behavior of unmodified code

- these results show that new defaults behavior can be overridden by the user

Solution Control Test Cases (cont.)

- *executed with solution controls disabled to establish new base behavior for modified code*

- *executed with solution controls enabled and controls modified to be identical to new default control options, results identical to previous run*

- *results of these two test cases show that new solution control defaults working as expected*

Summary

- *New default options for steady state mode*

- *Results of test cases show that new default options work as expected*

- *Results of test cases show that new default behavior can be overridden through user input*

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