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# RELAP4/MOD7 DEVELOPMENT

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The RELAP4/MOD7 computer code is the most recent in a series of RELAP4 computer programs. RELAP4/MOD7, as developed by EG&G Idaho, Inc., is based on the RELAP4/MOD6 code with several new models and features incorporated. The RELAP4/MOD7 code will be released to the National Energy Software Center by December 31, 1979. New models and features are summarized below.

o    Improved Vertical Slip Model

An improved vertical slip model has been added to RELAP4/MOD7. A more realistic void fraction calculation, which is used as input to the slip correlations, has been included. A simple flow regime map and flow regime dependent slip correlation have been included.

o    Reactor Kinetics

The reactor kinetics calculation has been improved and some minor errors corrected.

o    Decay Heat Model

The new ANS decay heat standard has been added to the program and the old ANS standard removed. Decay heat is now calculated as a function of burnup using reactor operating history.

o    <u>Nonequilibrium Model</u>

An explicit nonequilibrium model has been incorporated in RELAP4/MOD7. This model allows subcooled liquid and saturated vapor to exist in the same control volume and allows a more accurate calculation of phenomena associated with ECC injection.

o    <u>Best Estimate Fuel Model</u>

The FRAP (Fuel Rod Analysis Program) code has been added to RELAP4/MOD7 providing a RELAP4-FRAP calculation with feedback between FRAP mechanical properties and gap conductance calculations to the RELAP4 hydraulic calculation.

o    <u>Steam Table Improvements</u>

Improvements have been made to the water properties routines. A more accurate interpolation scheme has been added and entropy has been added as a usable water property.

o    <u>PWR Self-Initialization Feature</u>

A PWR self-initialization feature has been added to RELAP4/MOD7 which ensures consistent input to the transient calculation.

o    <u>Automatic Renodalization</u>

An automatic renodalization feature is available which allows a calculation to proceed from blowdown into reflood without having to transfer data by hand to a separate RELAP4 calculation.

o    Decoupled Heat Transfer Time Step

The heat transfer time advancement has been decoupled from
the hydraulic time advancement which significantly reduces
computer computational time when the heat transfer conditions are
not changing rapidly compared to hydraulic conditions.

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# RELAP4/MOD7 Development and Checkout

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# RELAP4/MOD7

- ## New models

- ## New capabilities

INEL-S-21 681

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# RELAP4/MOD7
# New Models

- **Improved vertical slip model**

  - **Void fraction calculation**

  - **Flow regime dependent**

- **Improved reactor kinetics**
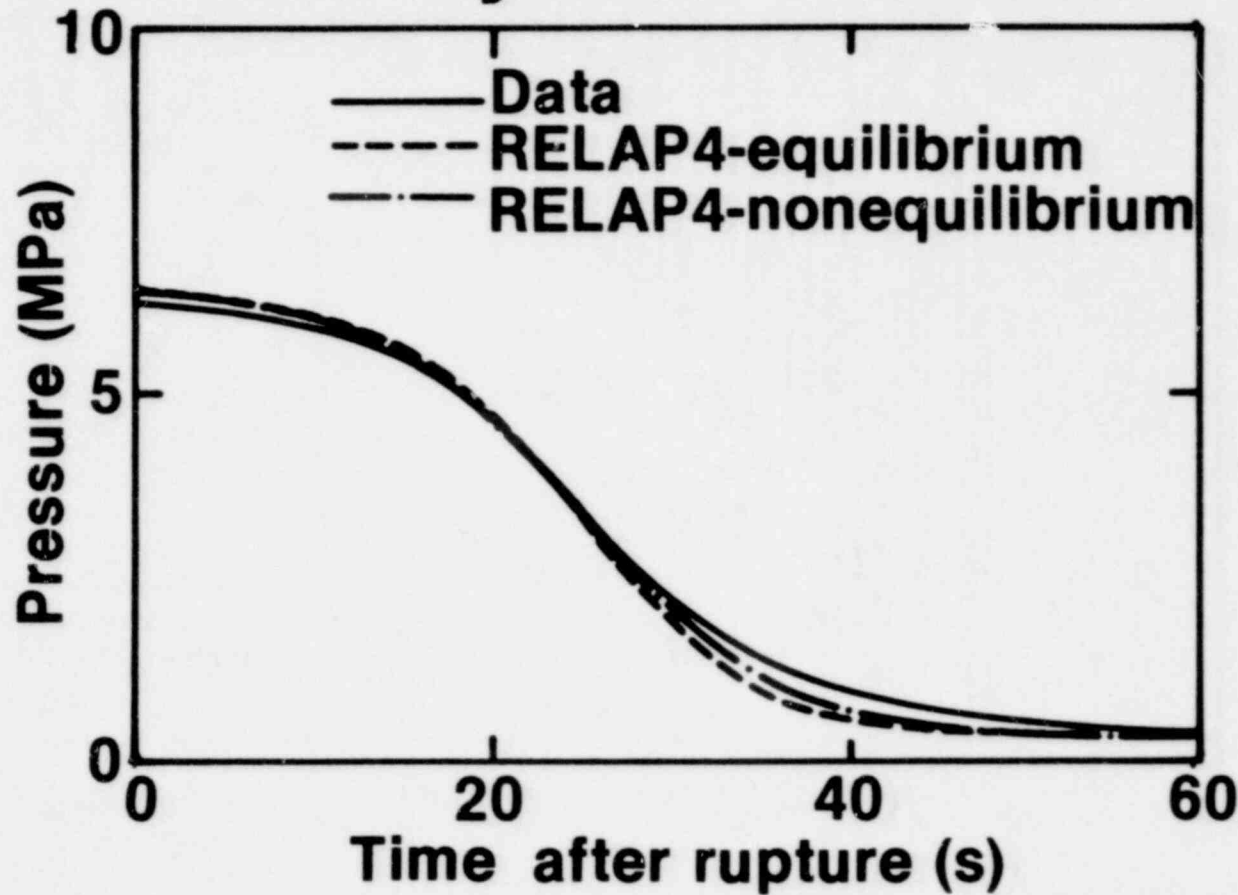
INEL-S-21 680

# RELAP4/MOD7
# New Models (cont'd)

- Decay heat model

    - New ANS standard

    - Burnup


- Nonequilibrium model

    - Subcooled liquid/saturated vapor

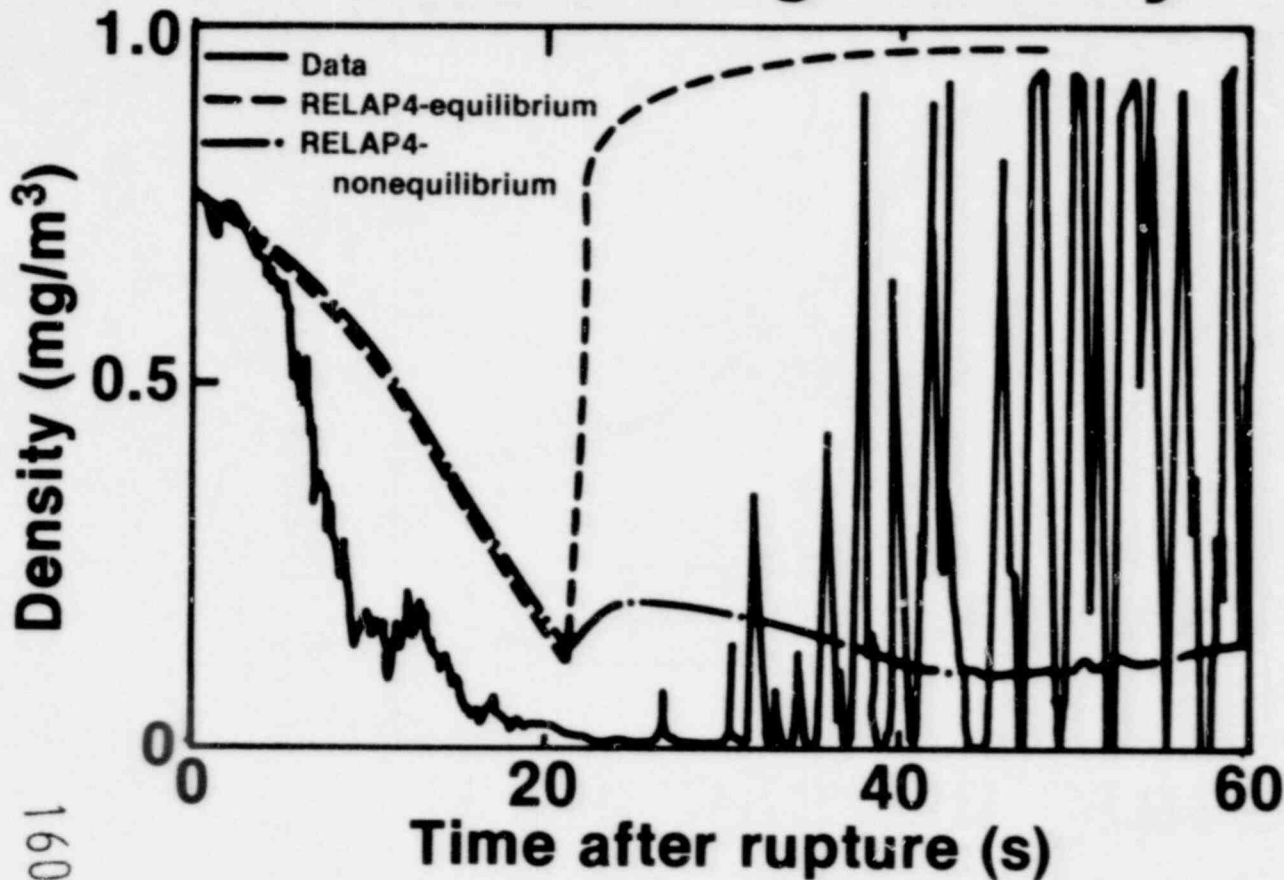# RELAP4/MOD7 Nonequilibrium Calculation
# L1-4 System Pressure



INEL-S-21 687

# RELAP4/MOD7 Nonequilibrium Calculation
# L1-4 Cold Leg Density



INEL-S-21 682

# RELAP4/MOD7
# New Models (cont'd)

- FRAP fuel model
    - Best estimate

- New CHF correlation
    - Large data base
    - Local conditions

- Steam table accuracy

- Other improvements

INEL-S-21 683

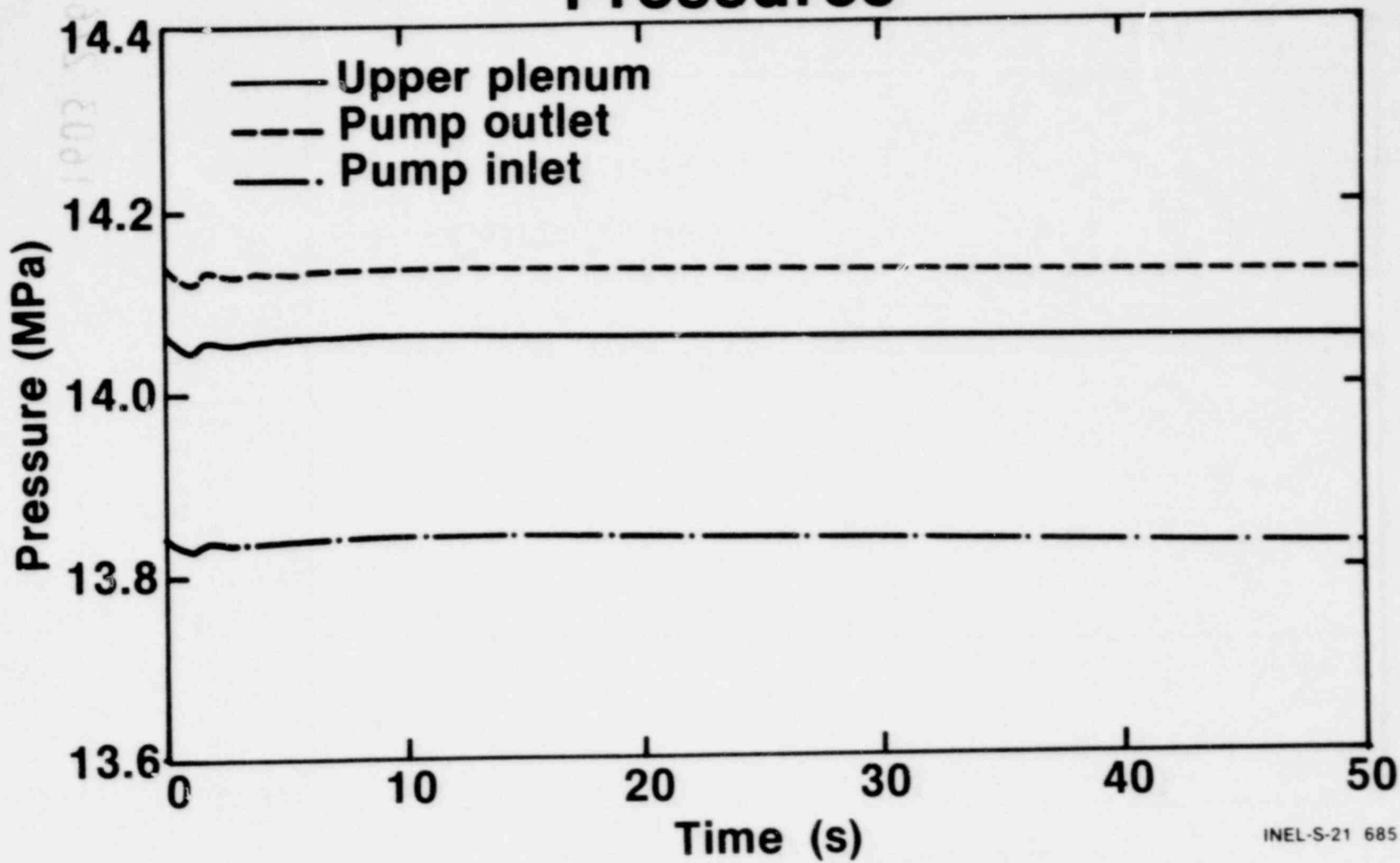# RELAP4/MOD7
# New Capabilities

- Automatic renodalization

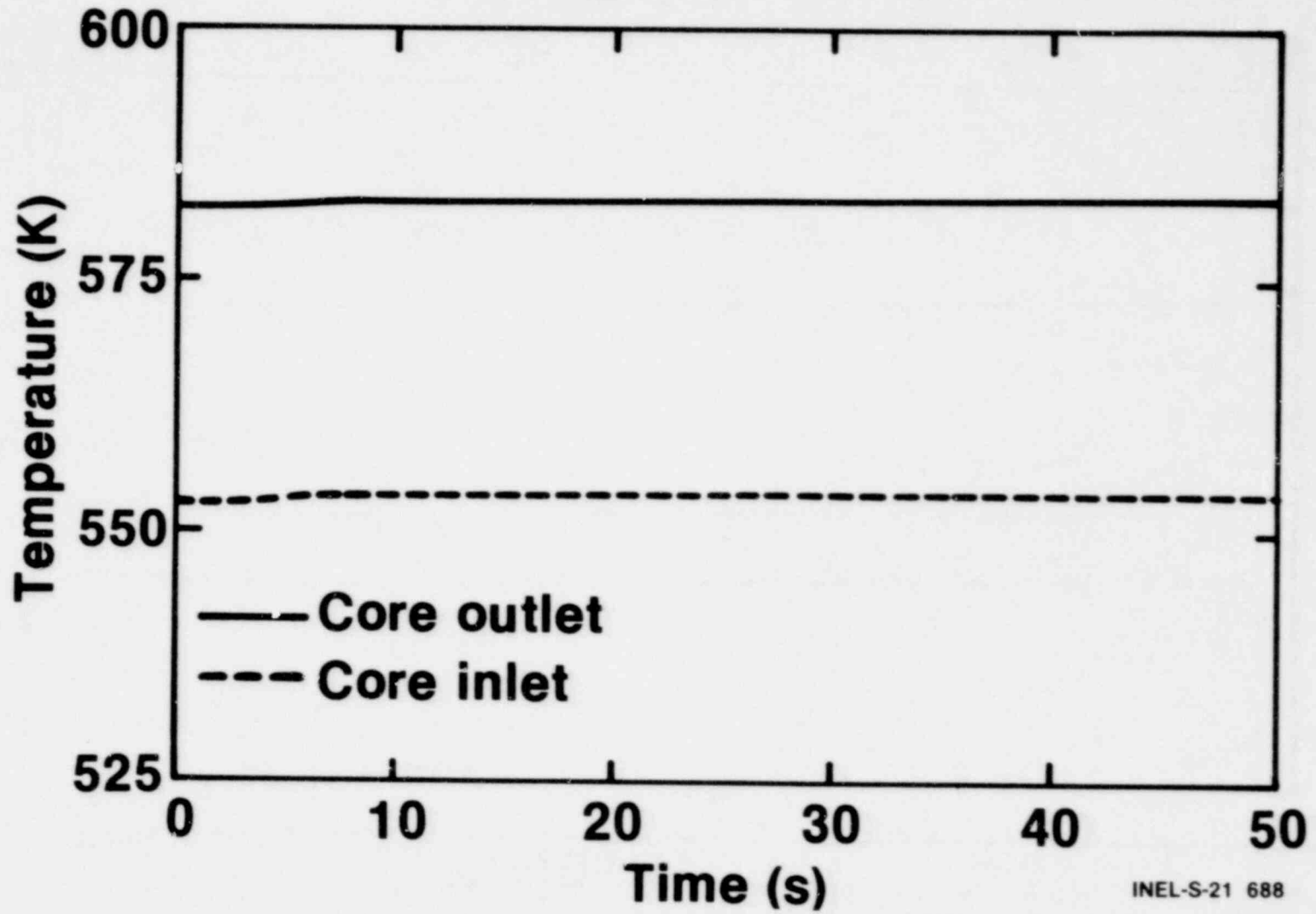- Decoupled heat transfer time step

- PWR self-initialization

# Self-Initialization LPWR Pressures

Upper plenum

Pump outlet

Pump inlet

INEL-S-21 685

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# Self-Initialization LPWR Temperatures

INEL-S-21 688

# RELAP4/MOD7

- **Will be released 12/31/79**

- **Significant improvement in 1-D BE computer code**

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