Recent Developments and Insights from Application of ADS-IDAC Dynamic PRA Platform **(PSAM9 0344)**

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9th Int. Conf. on Probabilistic Safety Assessment and Management (PSAM9)
Hong Kong, May 18-23, 2008

Recent Developments and Insights from Application of ADS-IDAC Dynamic PRA Platform Presentation Outline

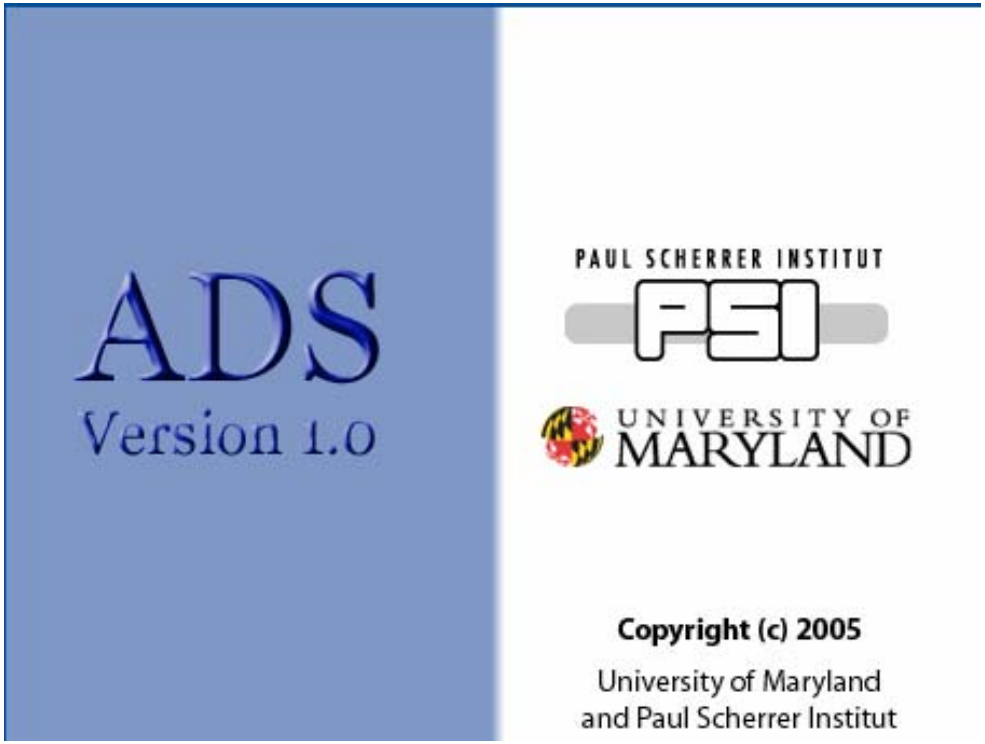
- Overview
- Current ADS state
- Simulation results
- Discussion

The views expressed are those of the authors and do not necessarily represent the views of the U.S. NRC and other organizations mentioned.

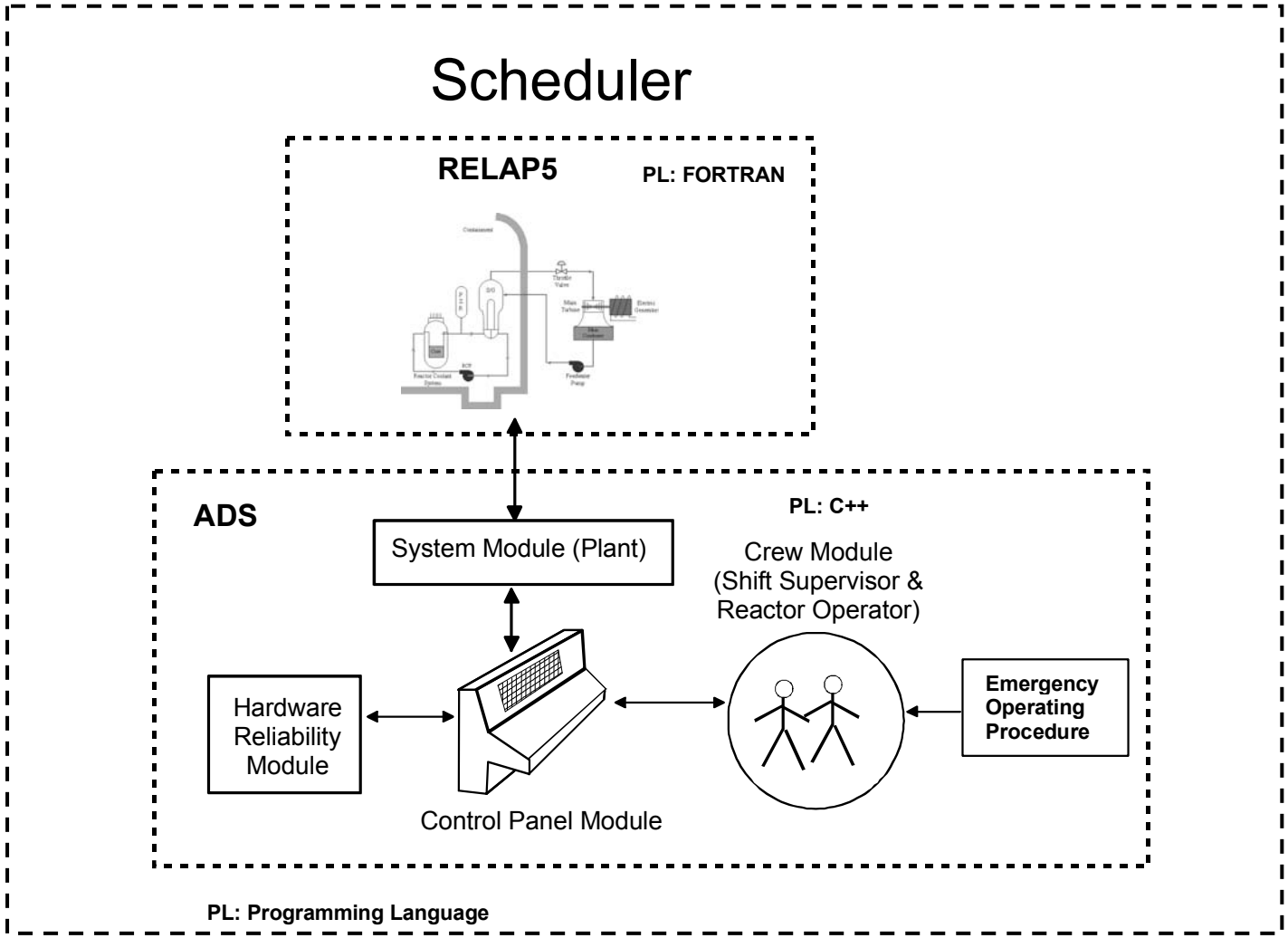
ADS-IDAC Overview

- Objective
  - Perform Dynamic PRA through rule-based, systematic computer simulation with focus on human effect on risk
- Approach
  - Model and simulate operator-operator and operator-plant interactions in a *probabilistic* computer simulation environment
  - Integration of five modules for simulation
    - System, Control Panel, Crew (include operating procedures), Hardware Reliability, and Scheduler
  - Risk scenarios are generated and presented in form of use of the discrete dynamic event tree (D-DET)
- History
  - Various versions have been developed over the past 15 years at the University of Maryland (ADS, ADSII, ADS-G2, ADS-RELAP, and ADS-IDAC)
  - Revisions leading to current version (10/2006) are made through a collaborative arrangement between University of Maryland and Paul Scherrer Institute, Switzerland

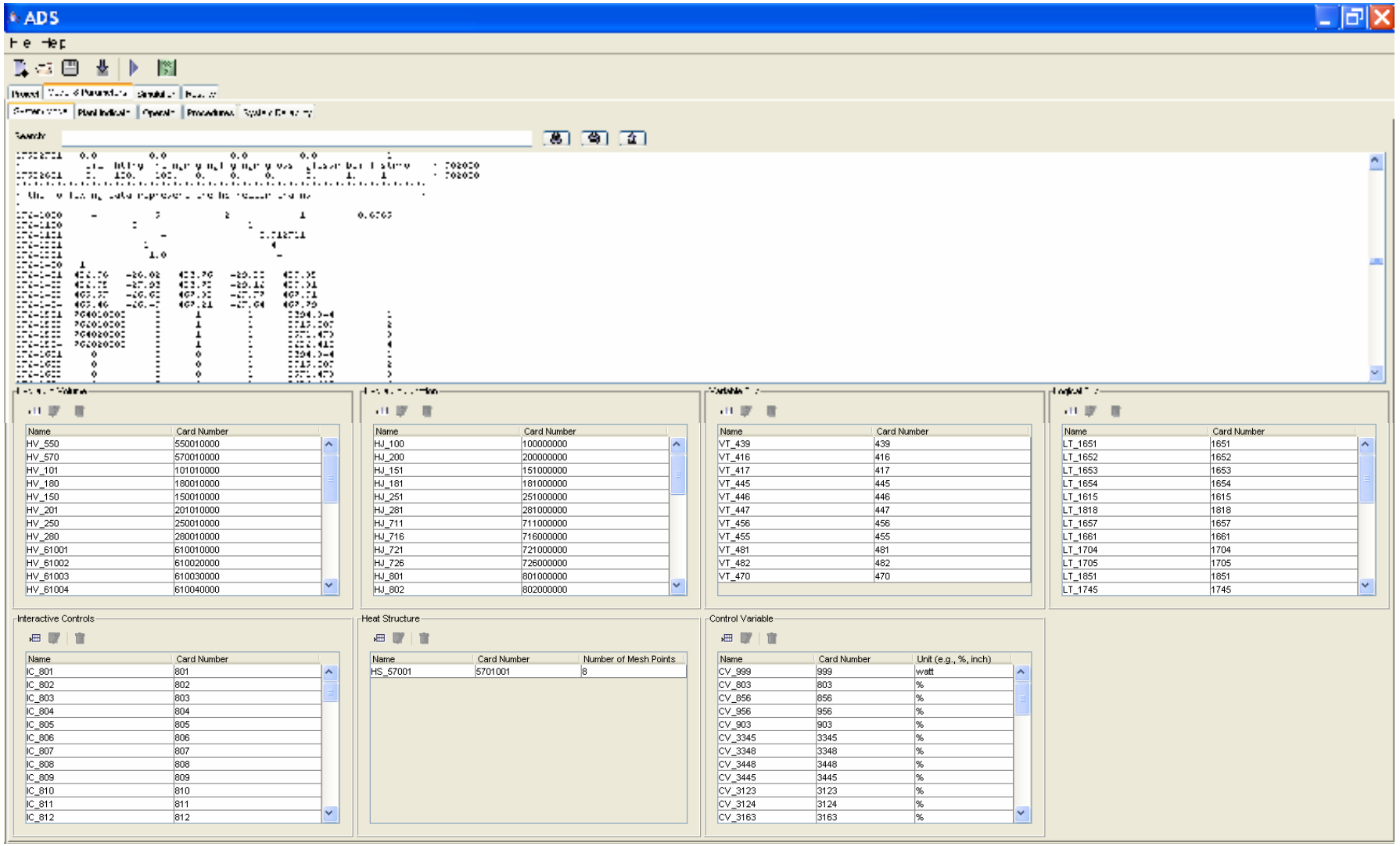
ADS Simulation Program



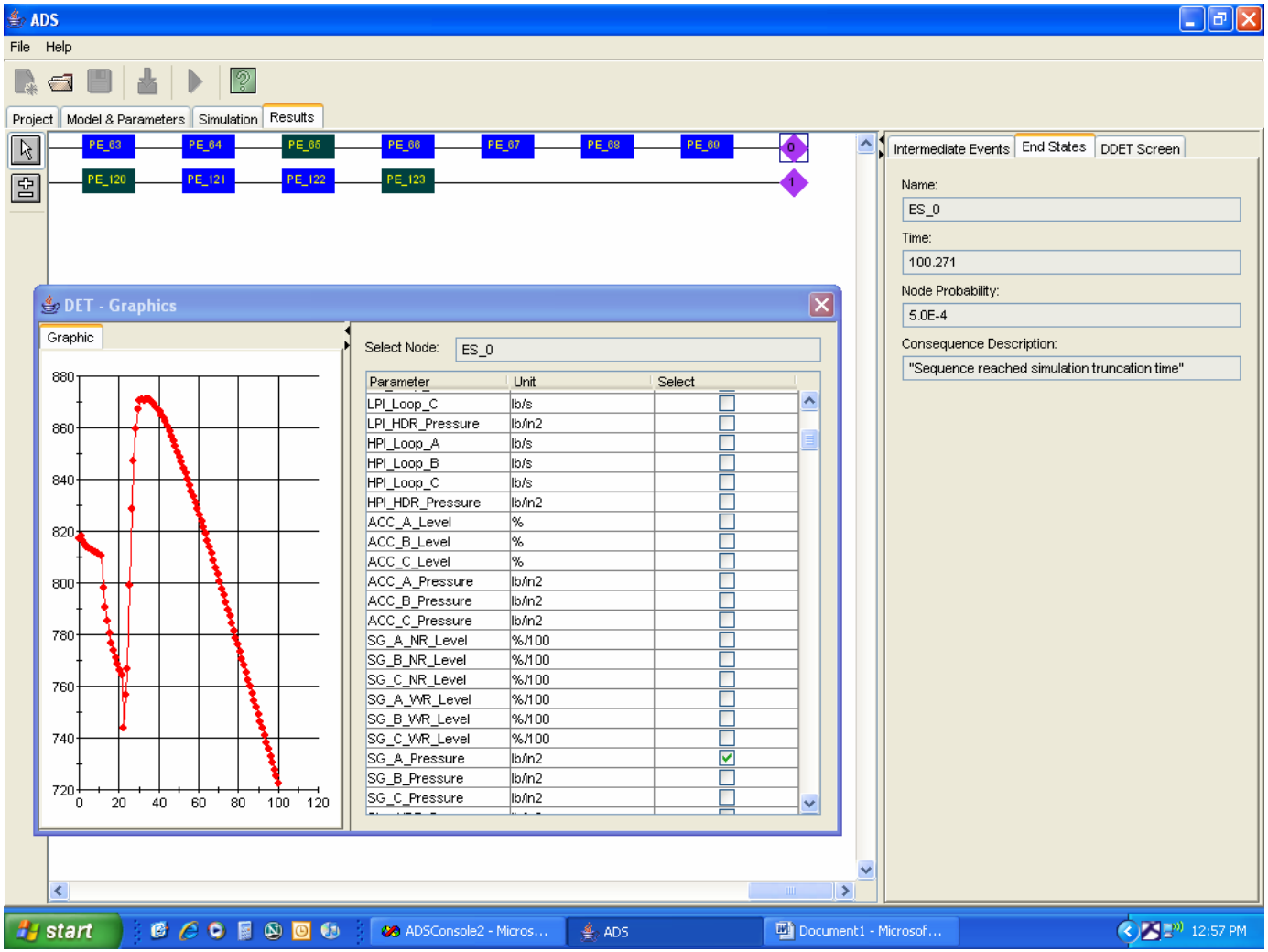
ADS-IDAC Modules



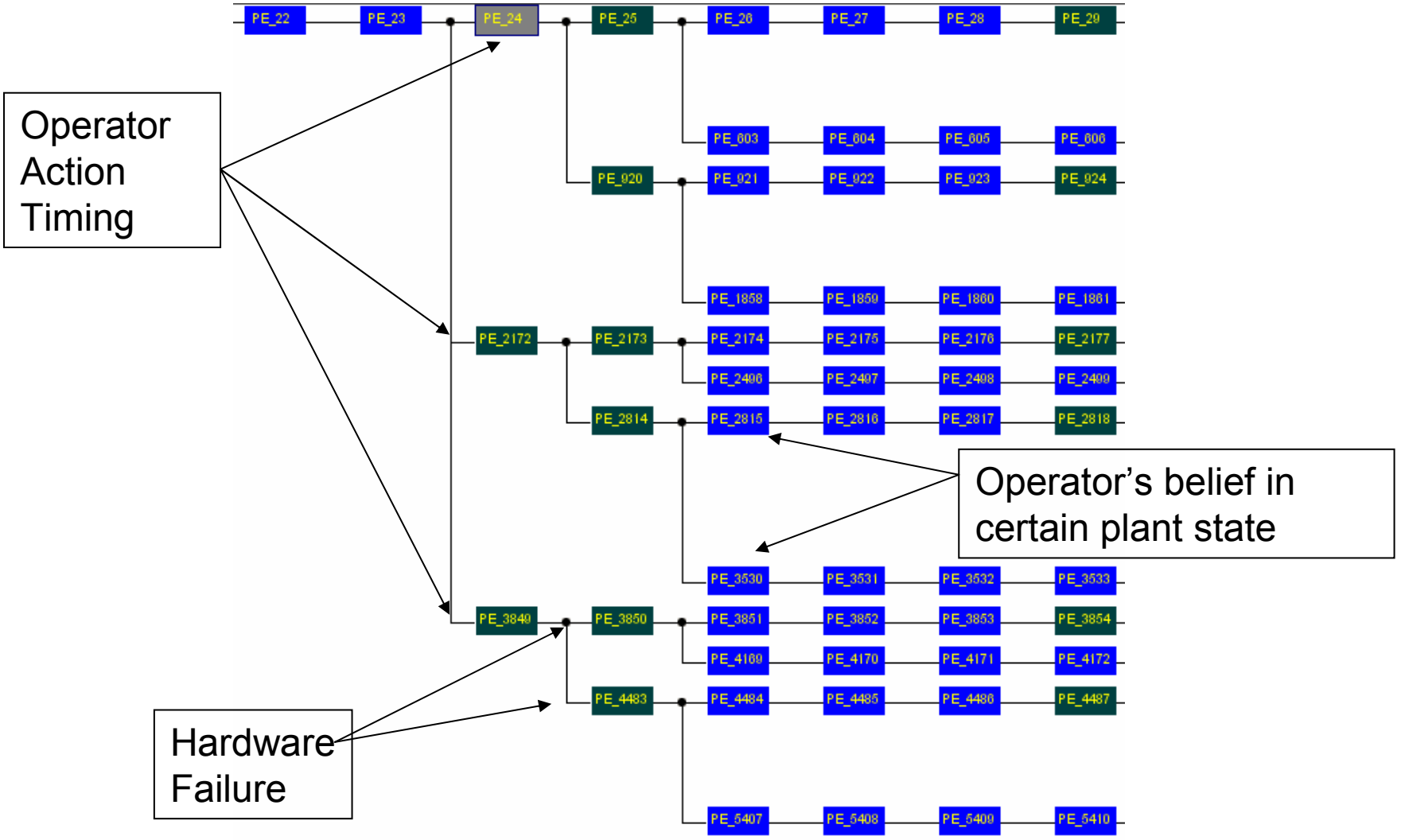
System Module Editing Screen



Result Viewing Screen



A Sample DDET



ADS-IDAC for HRA

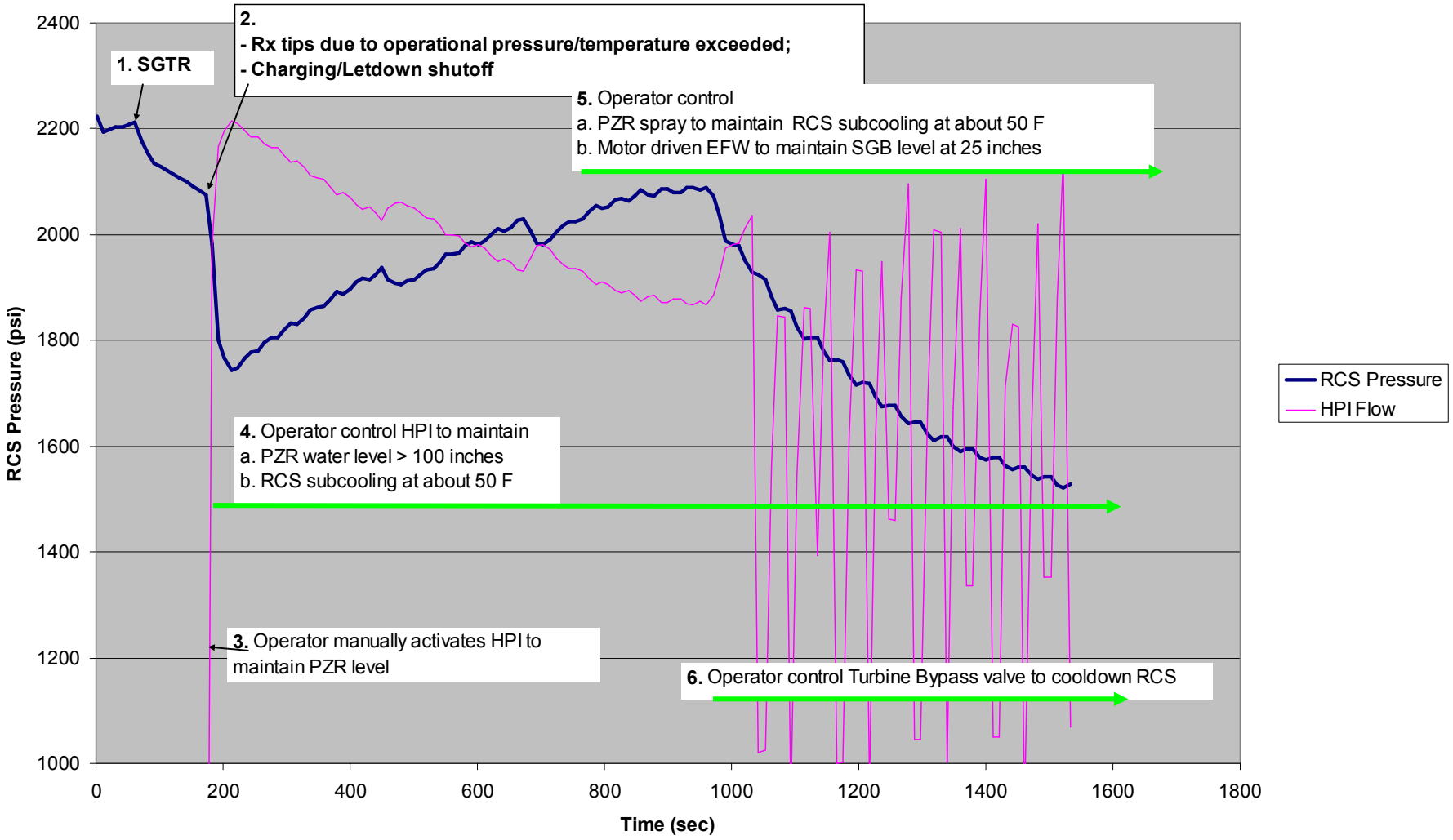
- Rich in contextual information for modeling crew behavior
- Two-operator crew
  - Decision Maker (SRO) & Action Taker (RO)
- Currently simulated crew behavior
  - Follow procedure literally
  - Key symptom-response behavior
- Probabilistically modeled crew response
  - Symptom-response behavior
  - Action time
- Separate simulation engine from input data
  - Manipulating scenarios without no changes in source code

Event Description

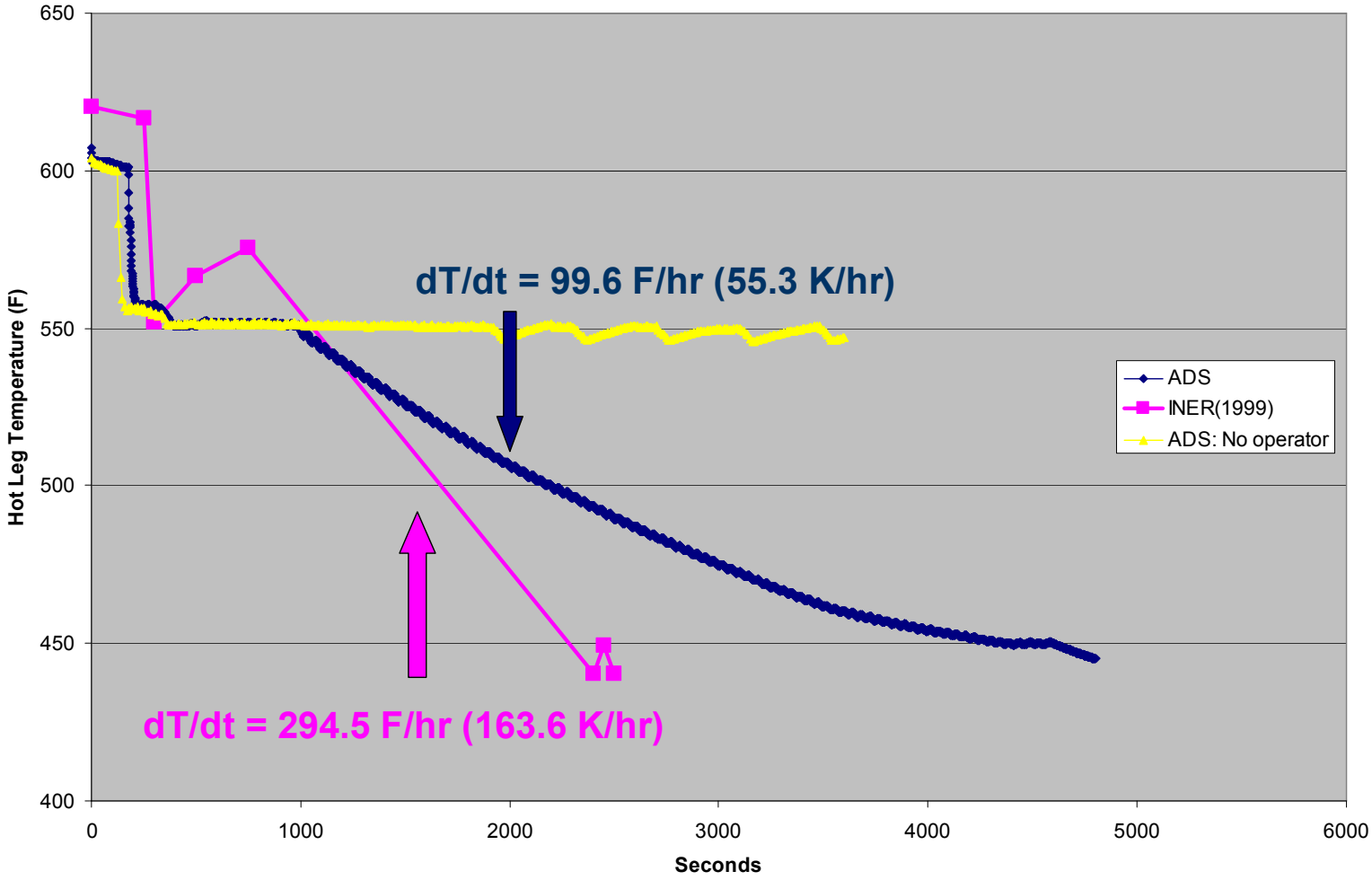
- A 2 cm in diameter SGTR
- Hardware failures when demanded:
  - HPI fails on demand
  - All other plant systems functioned as designed

“Nominal” System-Crew Responses

(Operator Activates HPI)



Fine Modeling in Operator Response

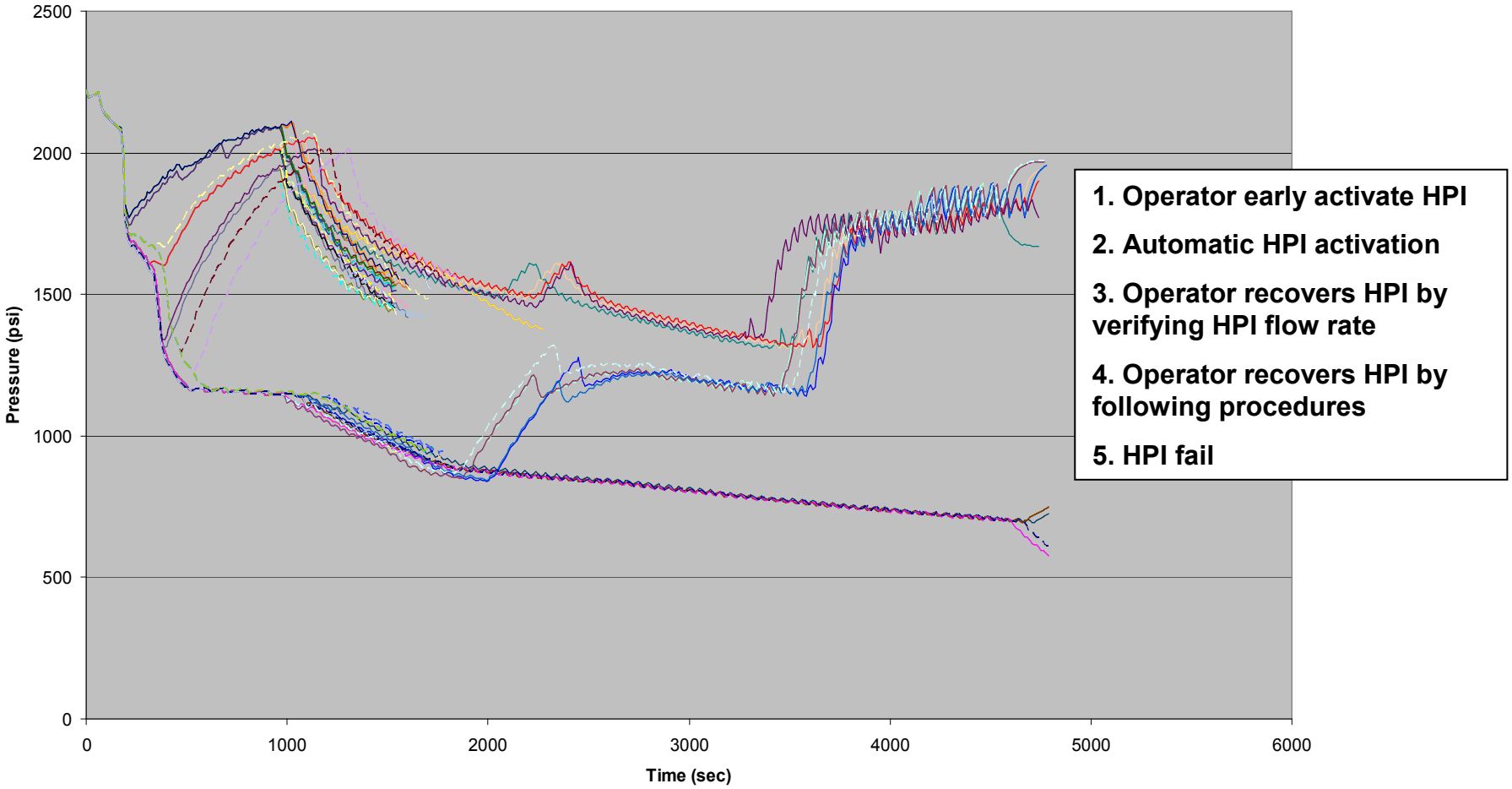


Scenario Variations

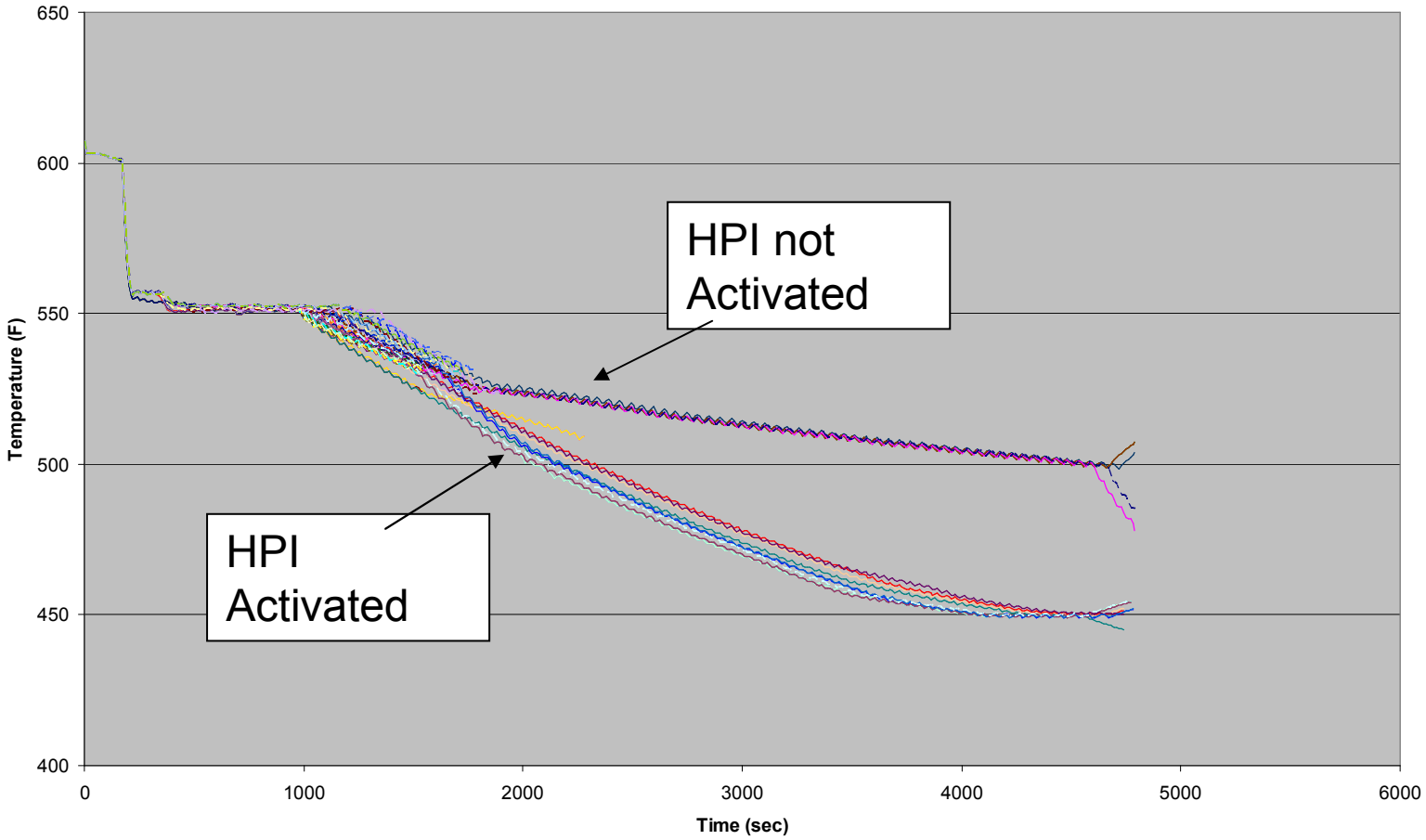
Summary of Simulation Results

- 74 sequences are generated
- 41,892 Pivotal Event (PE) generated
- Simulation time 10 Hr 48 Min in a 3G PC

RCS Pressure Variation



Hot Leg A Temperature Variation



Discussion

- HRA oriented simulation
- Potential of ADS-IDAC for studying new control room designs
  - Computer-based procedures
    - Faster procedure following pace
    - Affect team communication/situation awareness
    - Priorities assigned to automatic control functions
  - Alarm processing system
    - Prioritize, screen, and group alarms
- Distributed computation ADS has been developed

Example of Operational Goal Conflict