# NuScale Integral System Test Facility

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**U.S. Nuclear Regulatory Commission**
**Pre-Application Meeting**
**Rockville, MD**

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# Outline

- Introduction
- Proposed Certification Testing
- Overview of Test Facility
- Schedule

# Introduction

- NuScale will conduct a series of integral system tests in support of its safety analysis code assessment process
- A 1/3 scale integral system test facility has been constructed at Oregon State University
- Testing will be conducted under an Appendix B Quality Assurance program

# Proposed Certification Testing

- Objective is to obtain qualified data to evaluate the integral performance of safety analysis codes for important thermal hydraulic transients
- NuScale Integral System tests will include characterization tests, a spectrum of design-basis, small-break LOCAs, and Non-LOCAs such as:
  - Natural circulation assessment
  - Decay Heat Removal System operation
  - Containment Heat Removal System operation
  - Inadvertent opening of a reactor vent valve or reactor recirculation valve
  - Main steam line break
  - Feedwater line break
- NuScale will seek NRC input regarding test matrix development

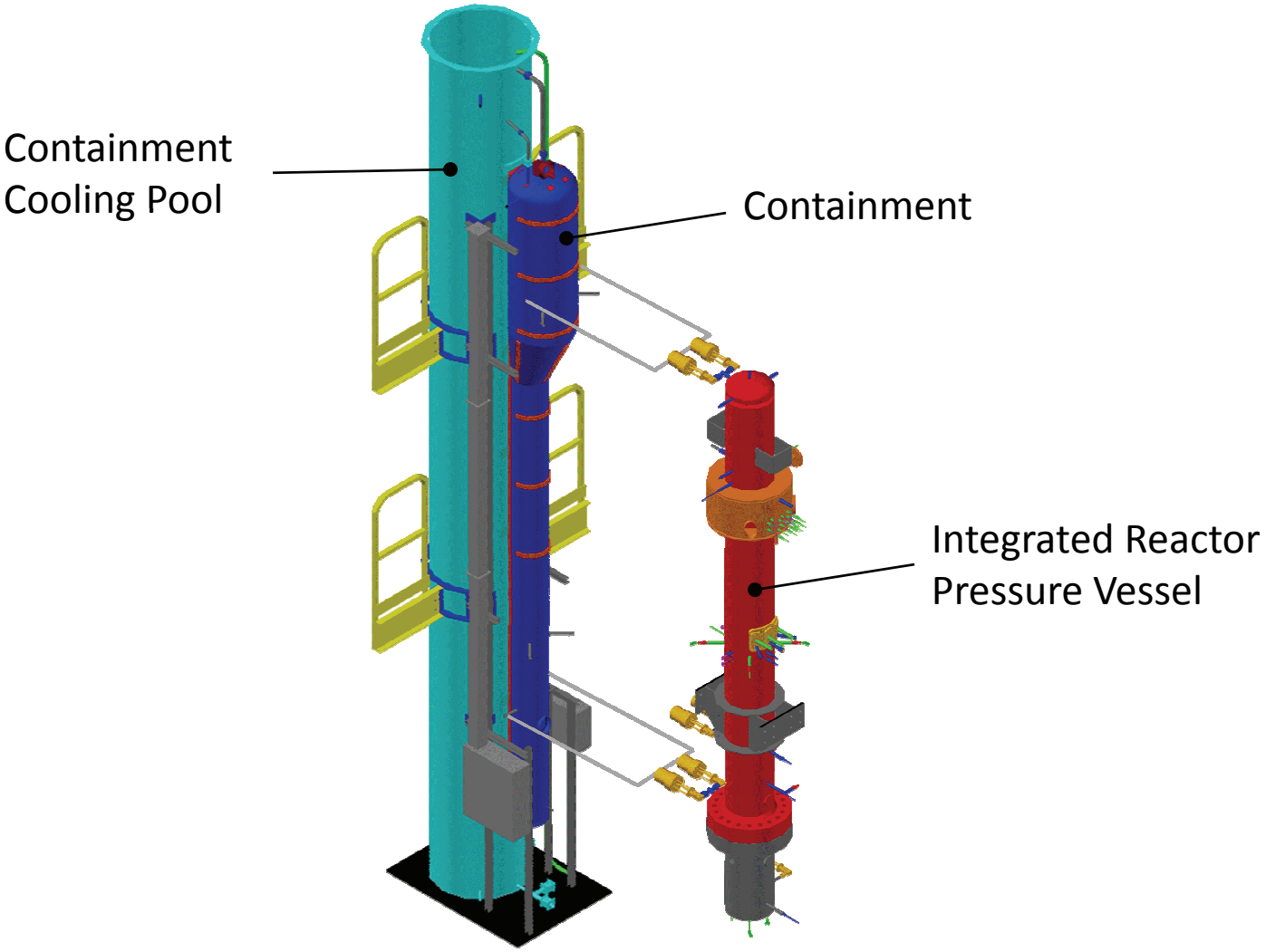
# Integral System Test Facility

- A scaling analysis was used to guide the design, construction, and operation of a 1/3-scale integral system test facility for the original MASLWR design
- NuScale is modifying the facility to incorporate design improvements
- OSU has significant testing capability
  - Performed DOE and NRC certification tests for the AP600 and AP1000 designs
  - 10 CFR 50 Appendix B, NQA-1, 10 CFR 21

# Scaling Ratios

| | |
|---|---|
| Pressure Ratio | 1:1 |
| Temperature Ratio | 1:1 |
| Length Ratio | 1:3.1 |
| Time Ratio | 1:1 |
| Velocity Ratio | 1:3.1 |
| Cross-sectional Area Ratio | 1:82 |
| Volume Ratio | 1:254.7 |
| Power Ratio | 1:254.7 |
| Active Heat Transfer Area Ratio | 1:254.7 |
| Active Heat Transfer Wall Thickness Ratio | 1:1 |

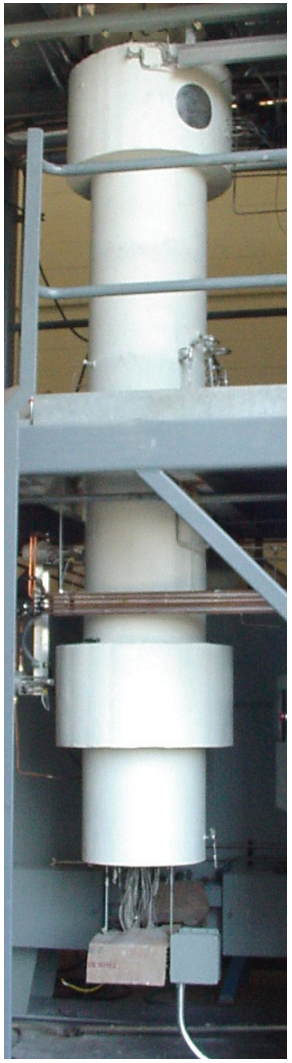
# NuScale Integral System Test Facility Schematic

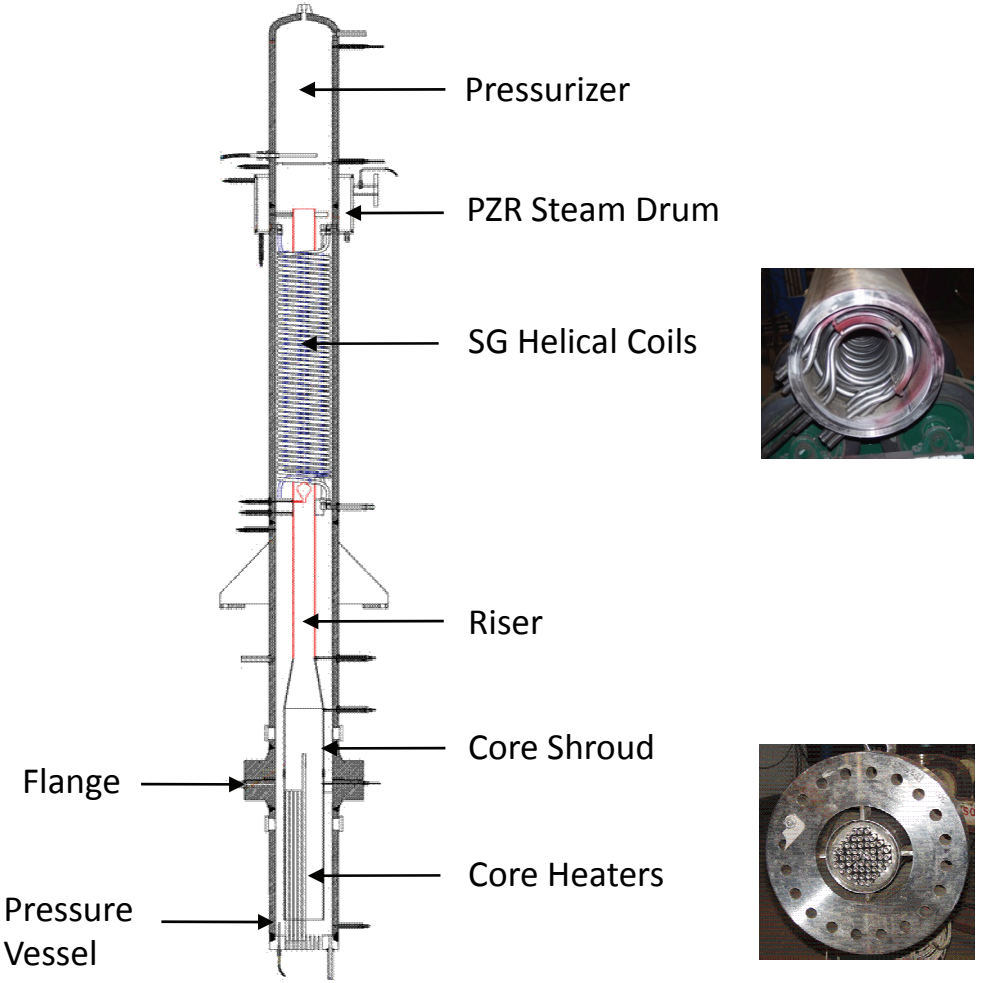


# NuScale Integral SystemTest Facility

- **Stainless steel integral system test facility operating at full system pressure and temperature**
  - Reactor vessel
  - Electrically heated rod bundle
  - Core shroud with riser
  - Pressurizer
  - Sump recirculation valves
  - Helical coil steam generator
  - Variable-speed feedwater pump
  - Containment vessel
  - Containment cooling pool
  - Instrumentation

# Integrated Reactor Test Vessel









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# Containment and Cooling Pool

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# Instrumentation and BOP

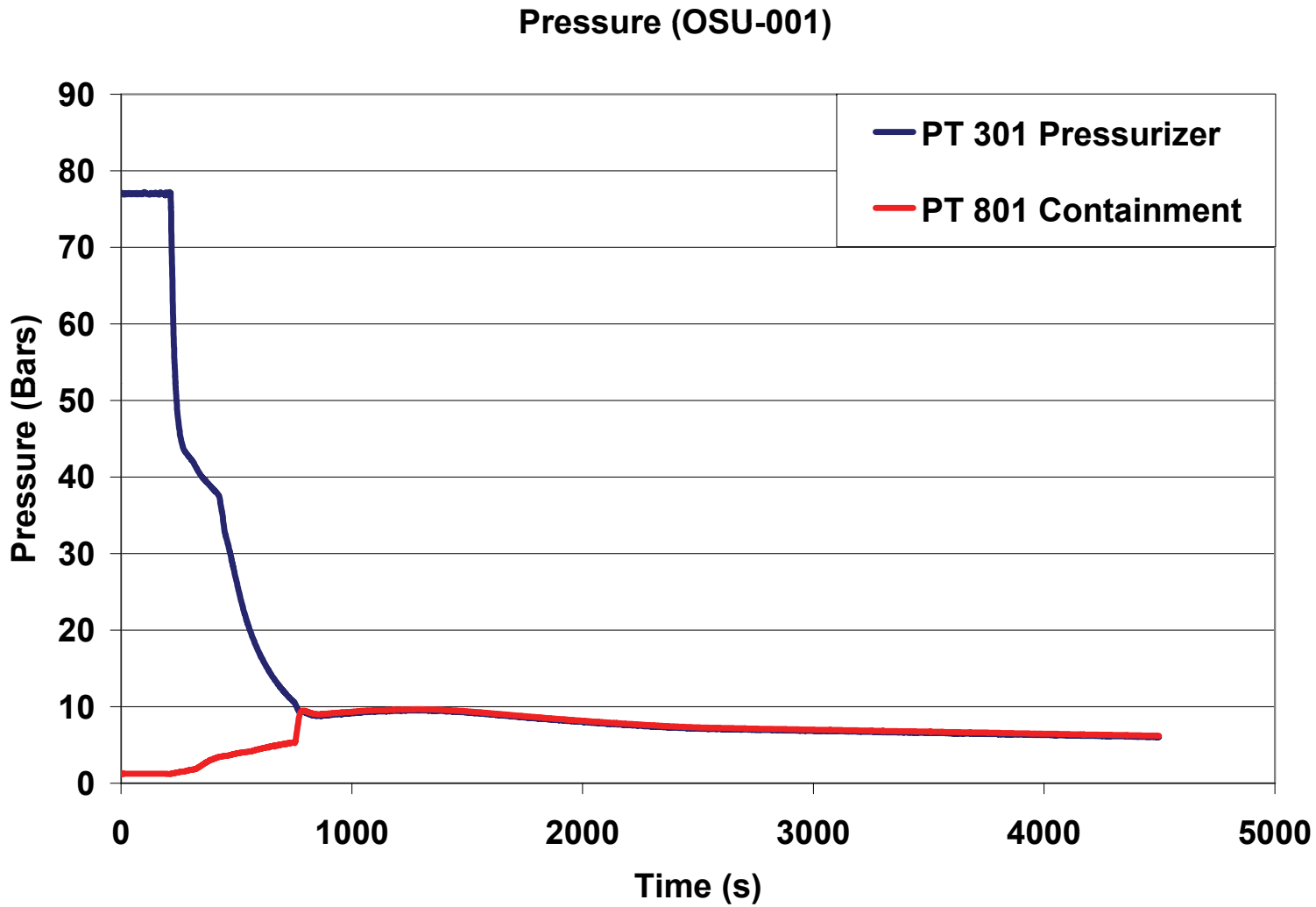
- 3 Power measurements
- 32 Fluid thermocouples
- 1 Vortex flow meter
- 3 Coriolis flowmeters
- 1 Magnetic flowmeter
- 1 Mass vortex flowmeter
- 1 DP flowmeter
- 5-Gauge pressure meters
- 6 Differential pressure meters
- 2 Level DP meters
- Complete Data Acquisition System and programmable logic controls
- Balance of plant; water supply, chemical treatment, air supply, power supply

# DOE NERI Tests

| Test # OSU-MASLWR | Simulation | Low ADS #1 (%) | Low ADS #2 (%) | RVV #1 (%) | RVV #2 (%) | SRV #1 | SRV #2 |
|---|---|---|---|---|---|---|---|
| 001 | Inadvertent Actuation of 1 submerged ADS valve | *Failed Shut | 100 | 100 | 100 | 100 | 100 |
| 002 | Natural Circulation Parametric Study to 210 kW | N/A | N/A | N/A | N/A | N/A | N/A |
| 003A | Natural Circulation Parametric Study to 210 kW | *Failed Shut | N/A | N/A | N/A | N/A | N/A |
| 003B | Inadvertent Actuation of Single RVV | *Failed Shut | 100 | *Failed Shut | 100 | 100 | 100 |

*Assumed Multiple Failures and no DHRS

# Pressure Trends for OSU-001



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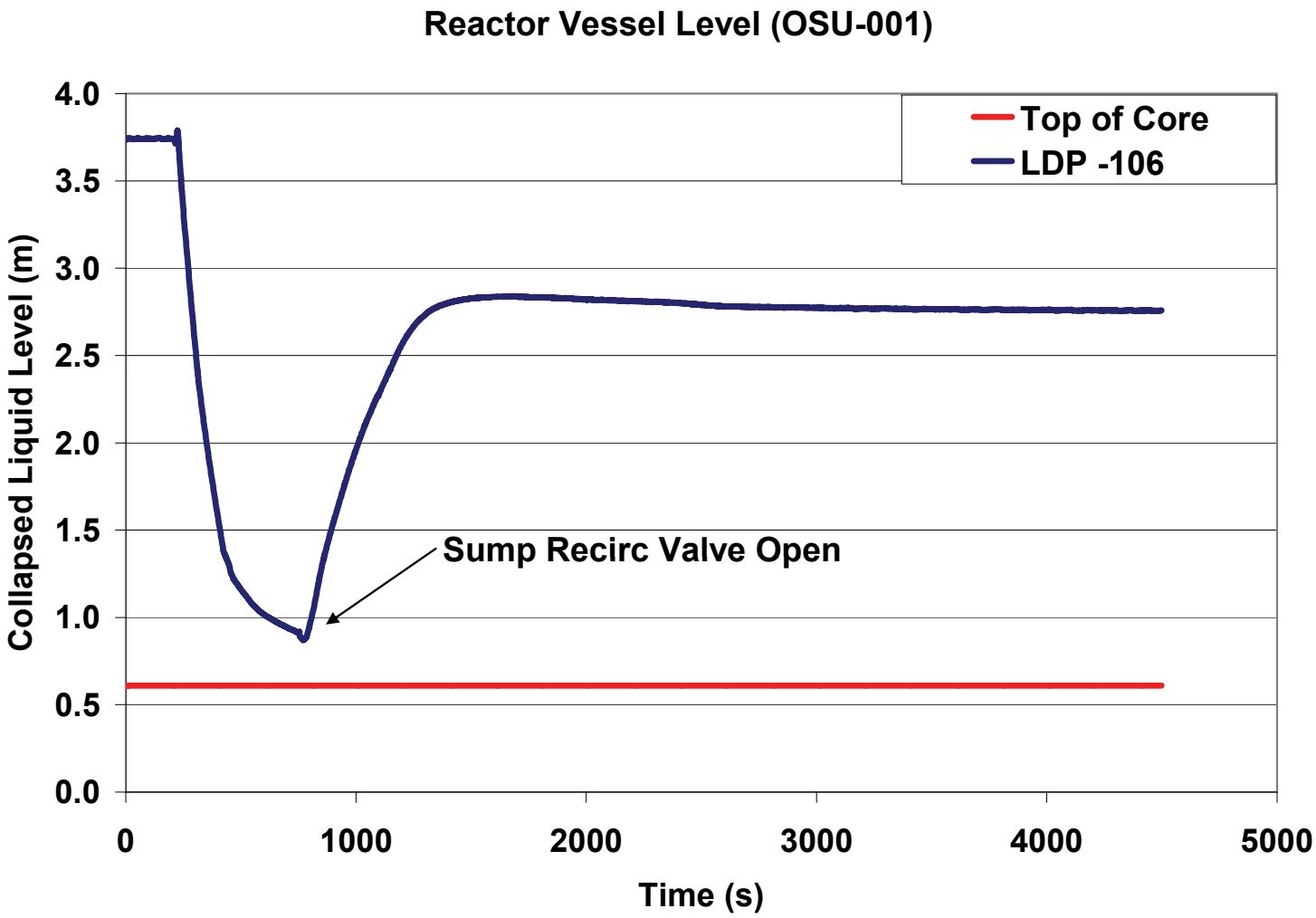
# Reactor Vessel Level (OSU-001)



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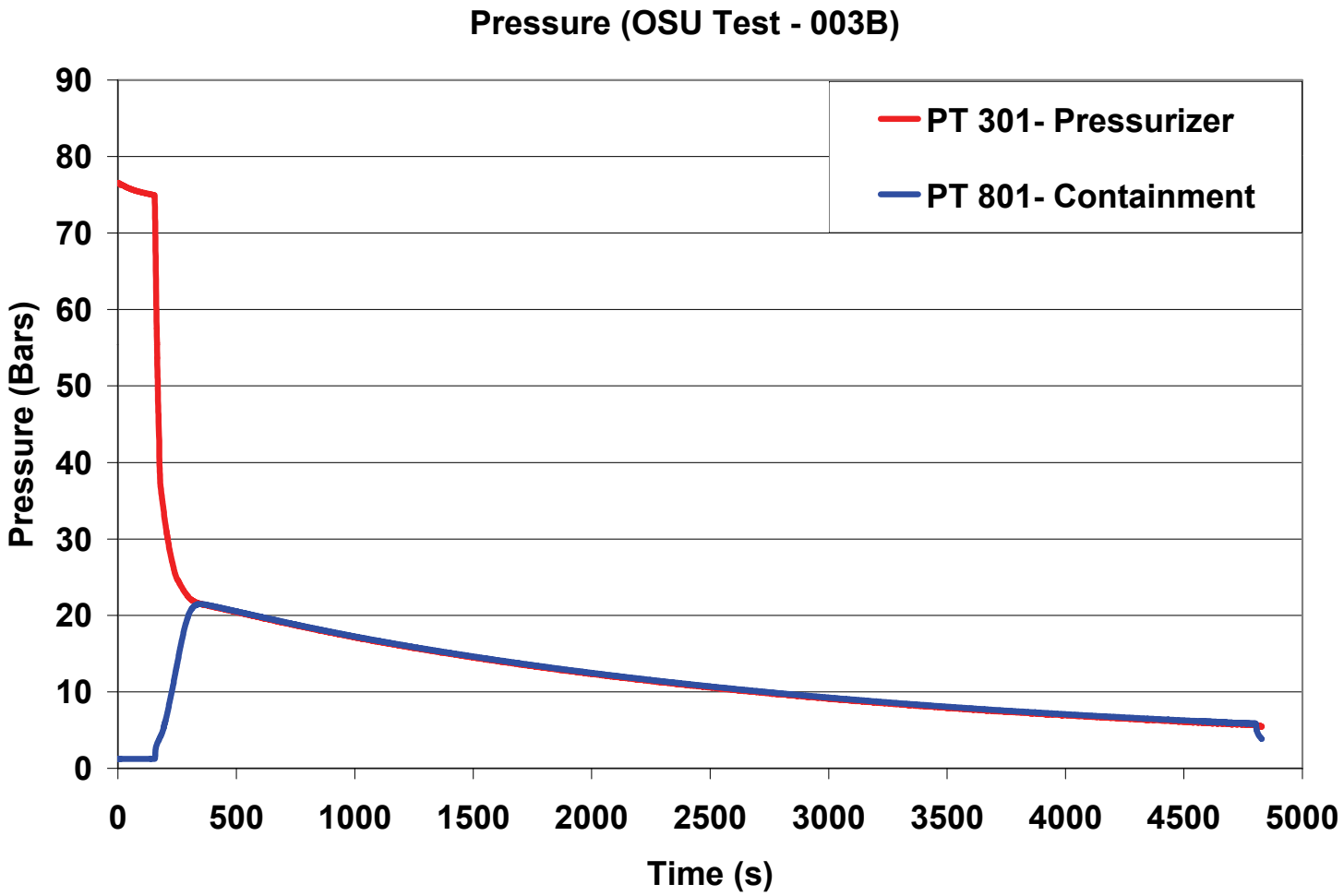
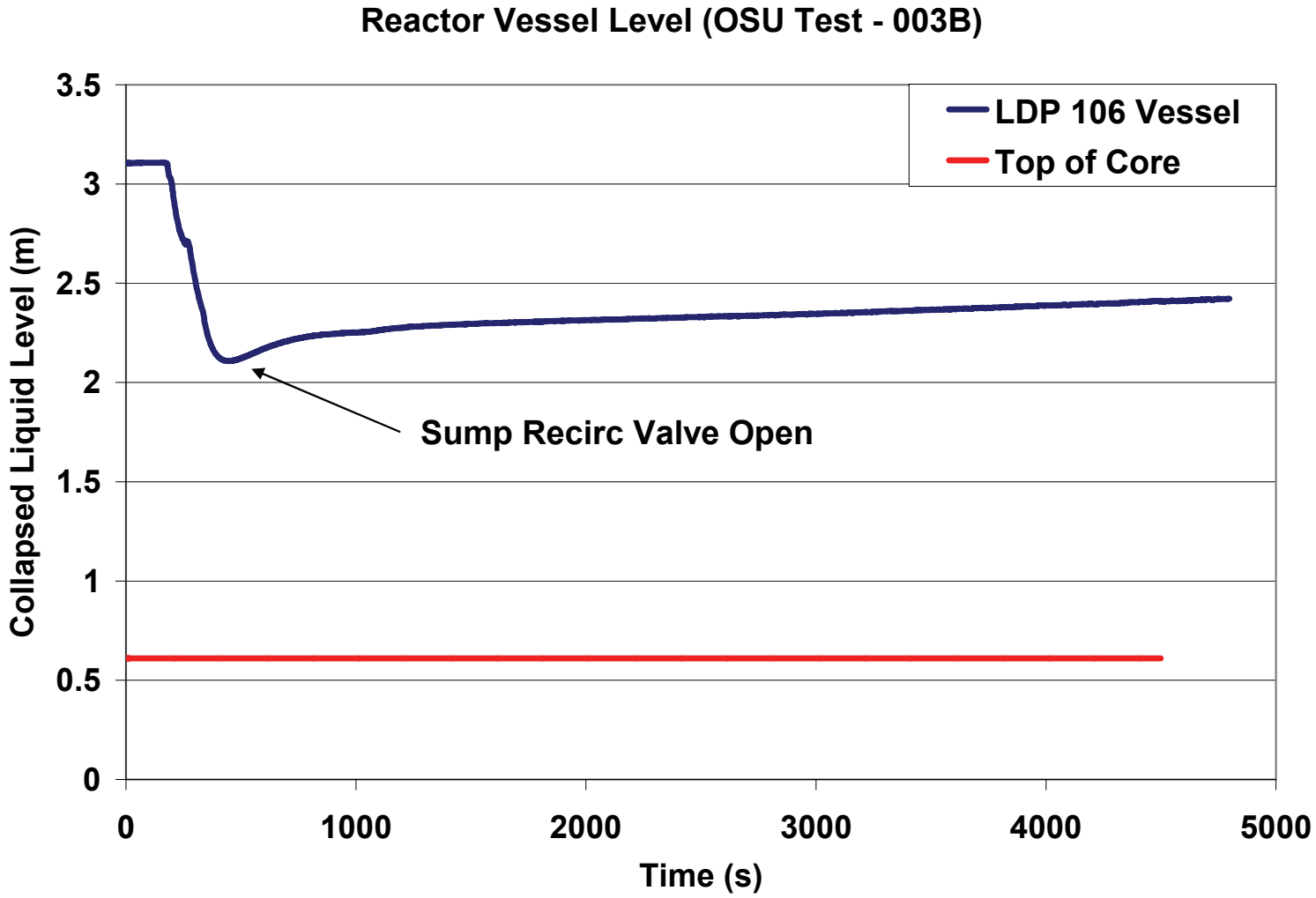
# Pressure Trends for OSU-003B



# Reactor Vessel Level (OSU-003B)



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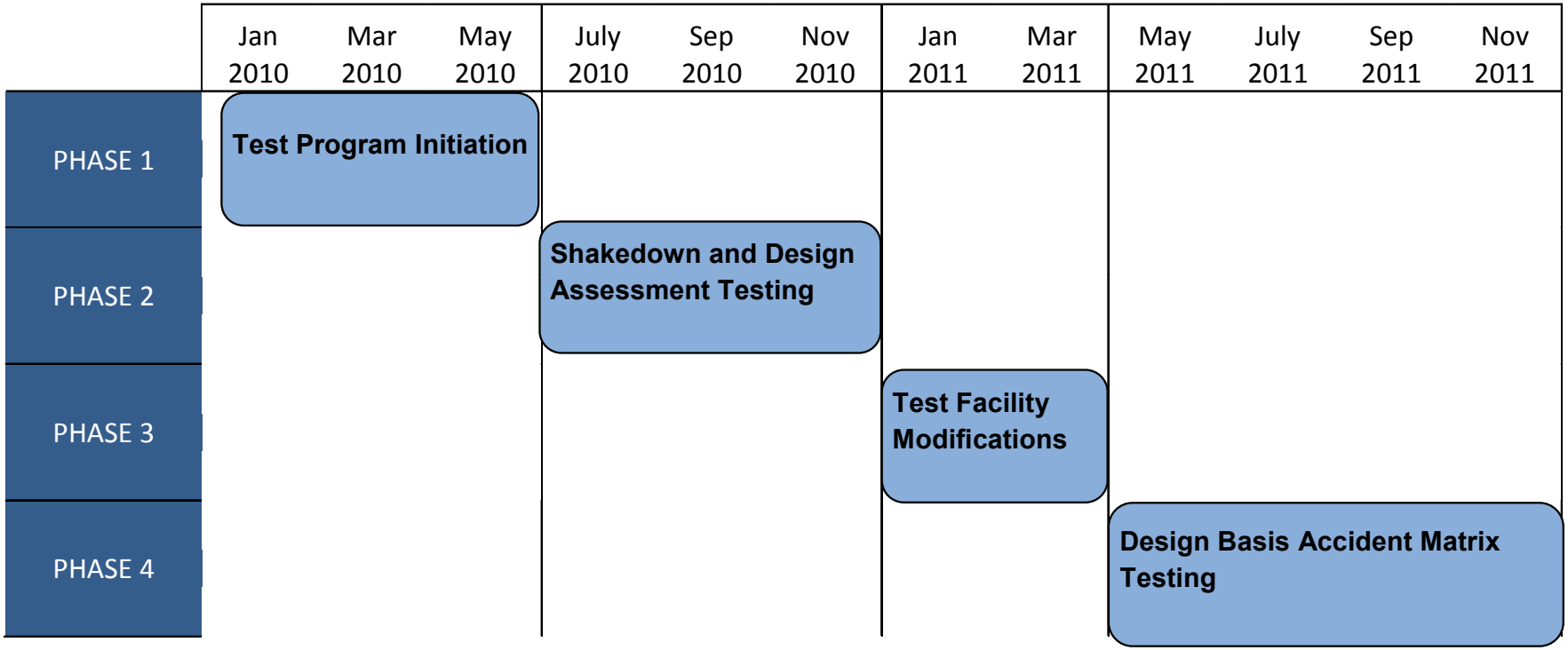
# Schedule



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