



SCO₂ Power Cycle Prototype using Thermal Energy Storage

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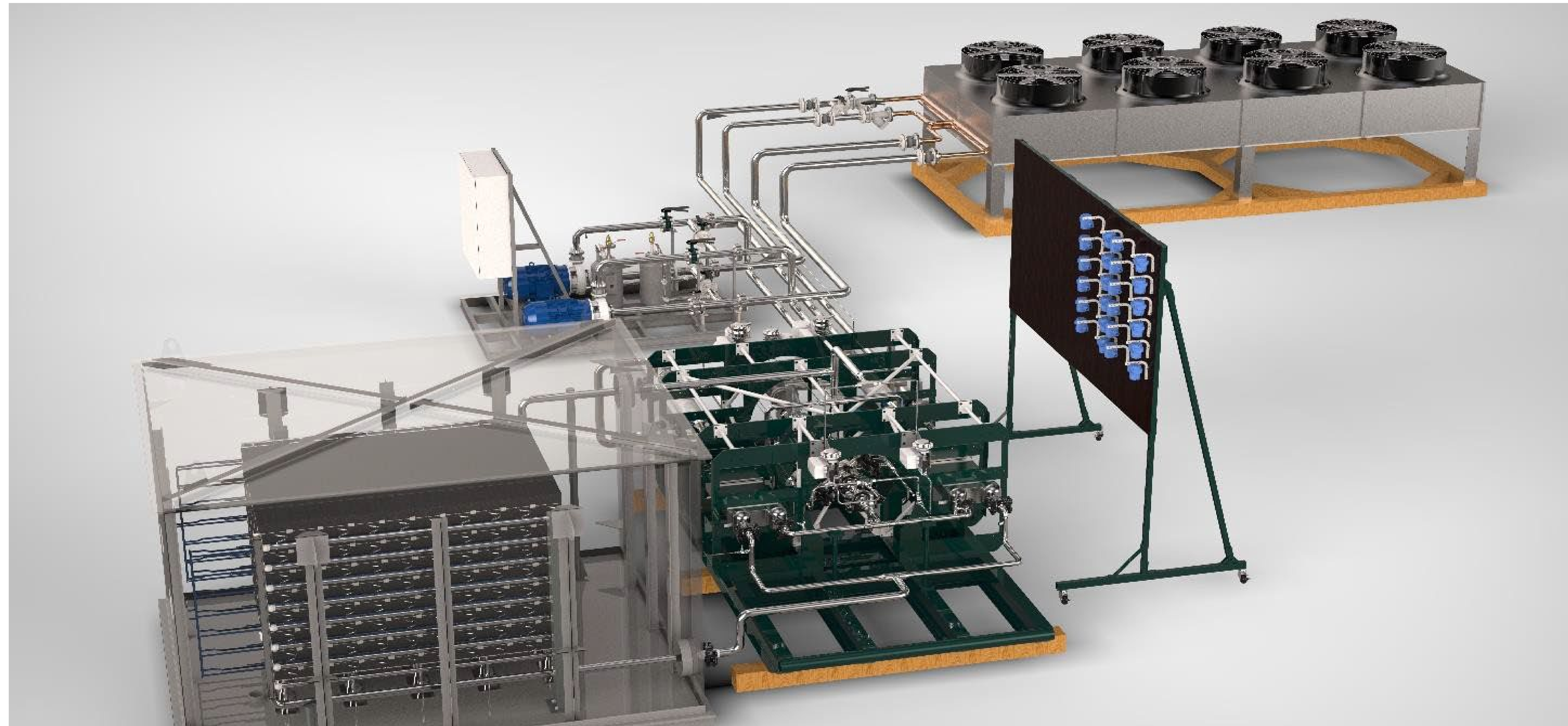
CEO/CTO

Peregrine Turbine Technologies, LLC

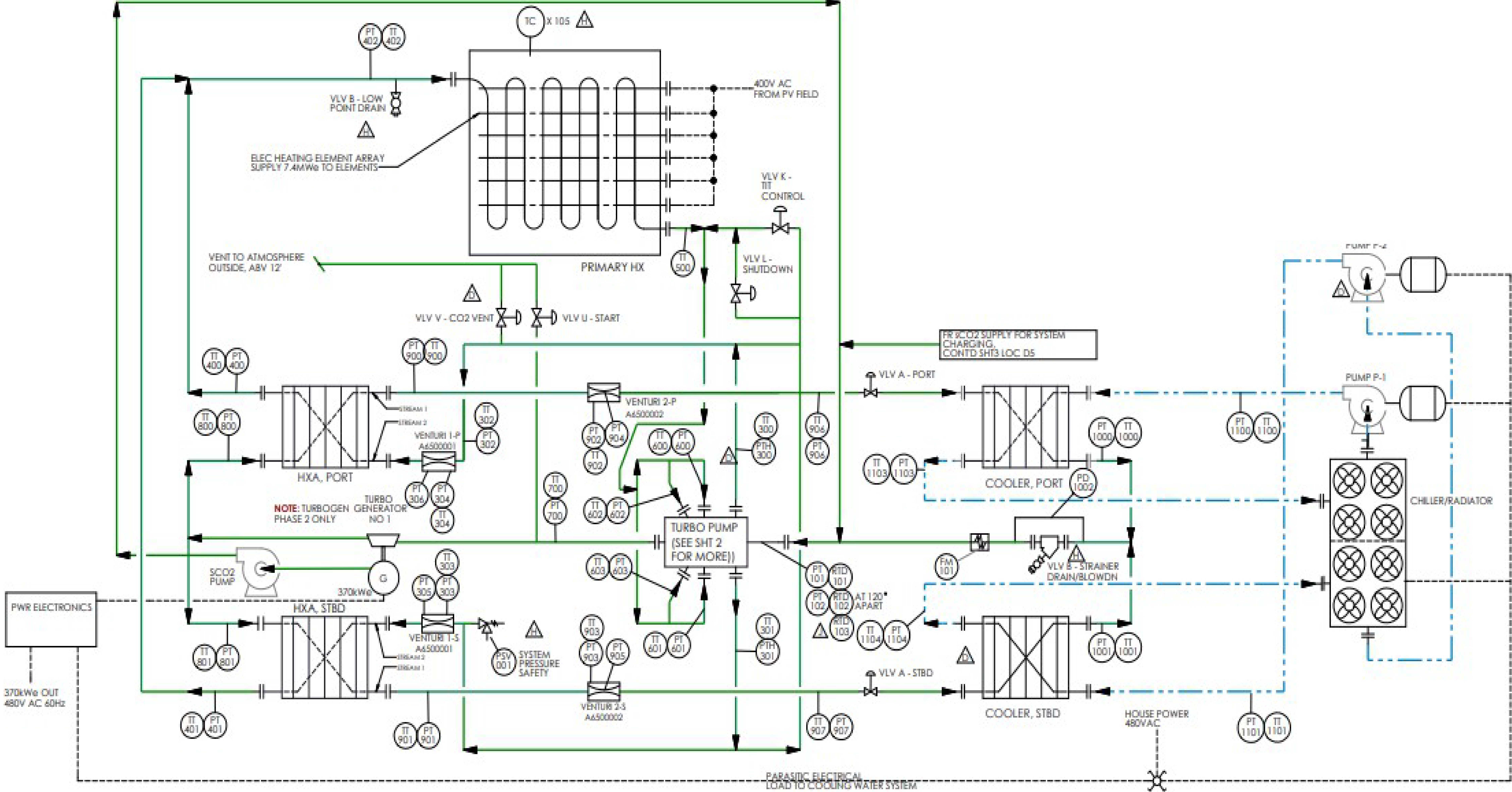
Wiscasset, Maine

Peregrine has built and successfully tested the first test loop integrated with a Thermal Energy Storage (TES) primary heat source

- Resistance heater dispersed in thermal medium bricks to charge system
- Resistance heaters are powered at 480V and either AC or DC.
- Primary HX is integrated with the TES
- SCO₂ loop MAWP of 27.5MPa
- Maximum rated TIT 811K



Phase 1 P&ID Diagram



TES Installation



TES Installation



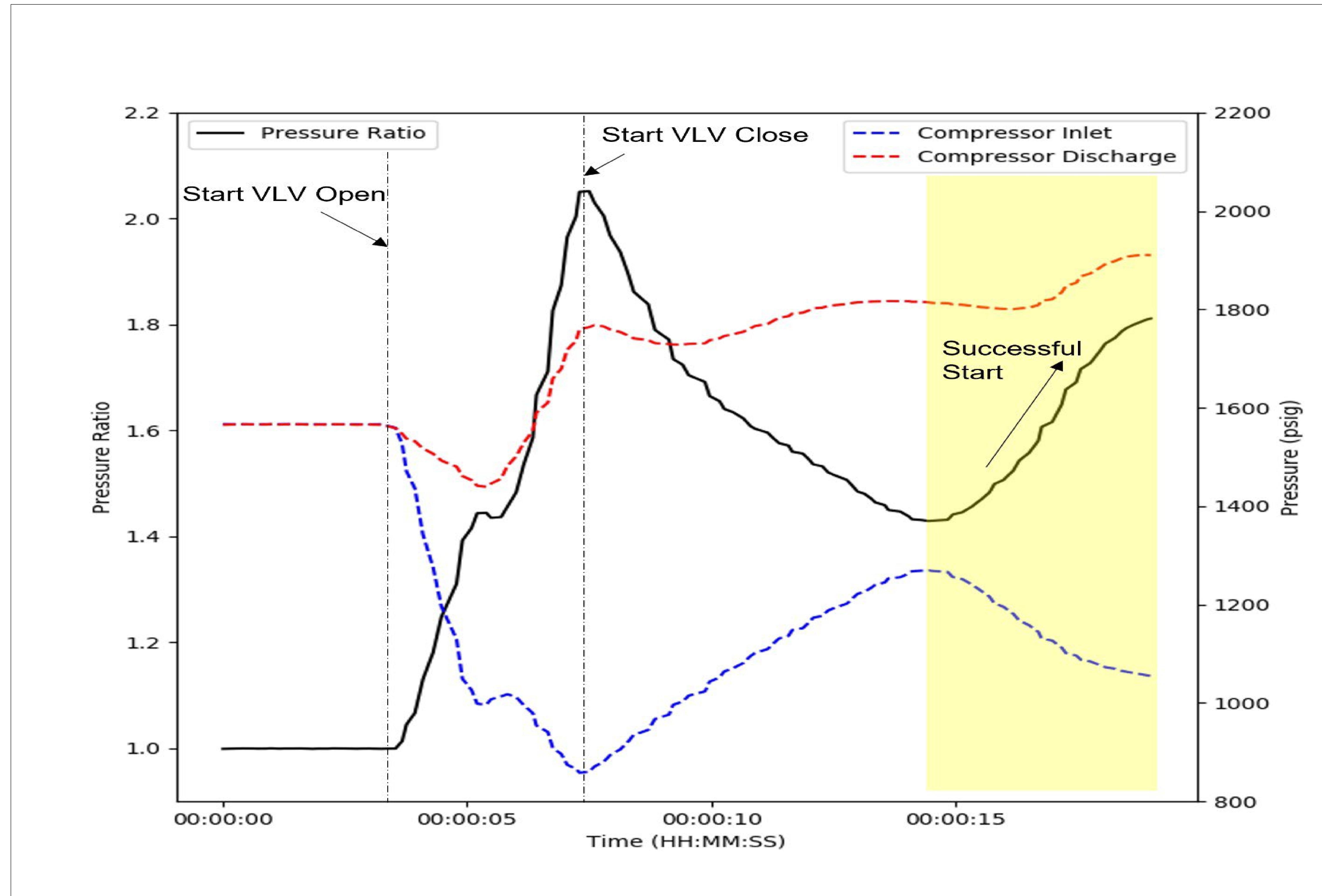
Test Objectives

Program goals include the following:

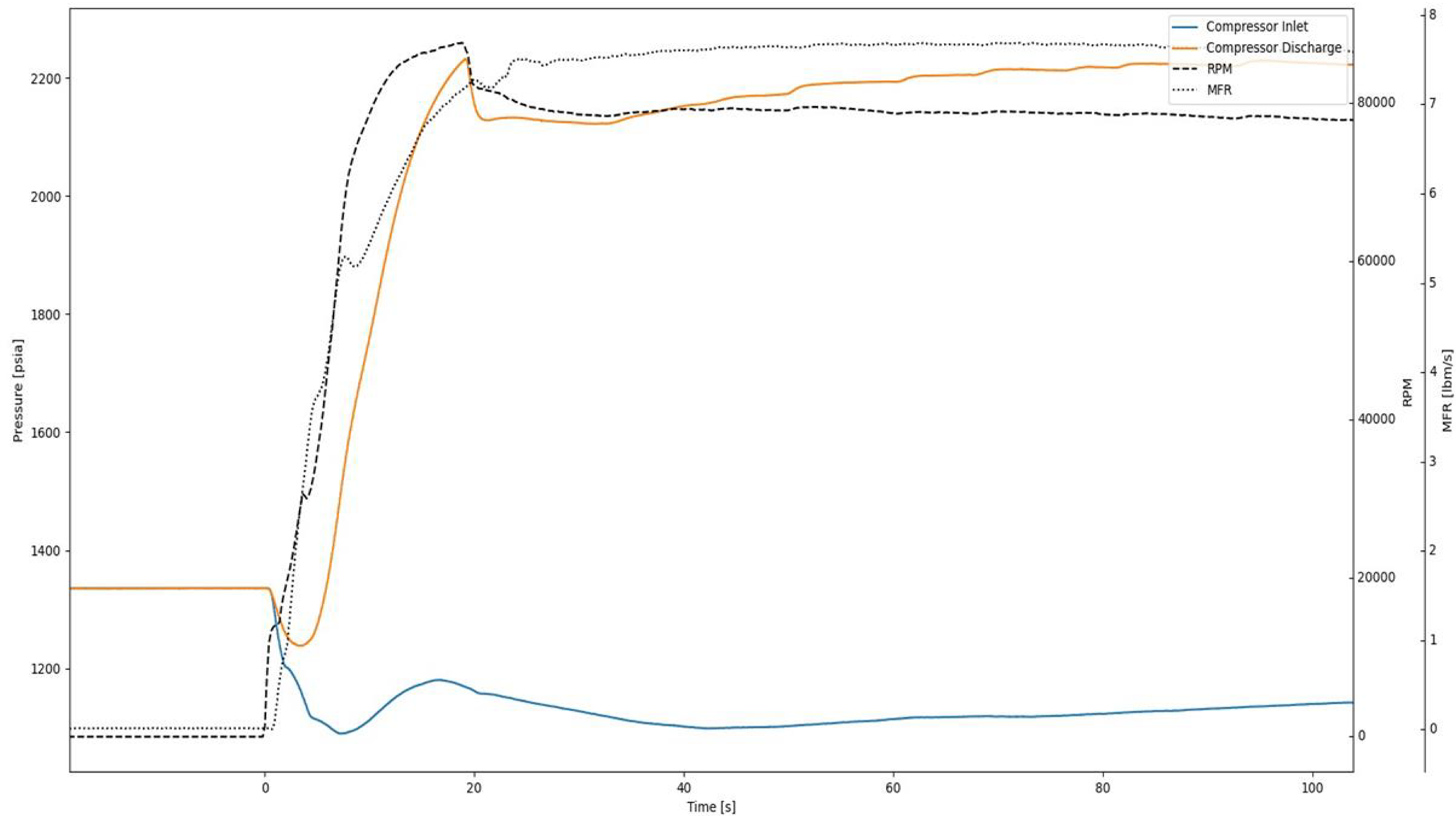
1. Design and optimization of control strategies for power control, compressor inlet condition management, secondary flow management, and anomaly mitigation.
Optimization of discharge start parameters.
2. Operation of turbopump at points well above the limits tested previously at Sandia National Labs
Validation of turbopump thrust balance.
3. Compressor map validation.
4. Characterization of transient performance of TES discharge
5. Exploration of TES charging characteristics using direct electrical heating elements
- 6.

Optimization of Discharge Start Parameters

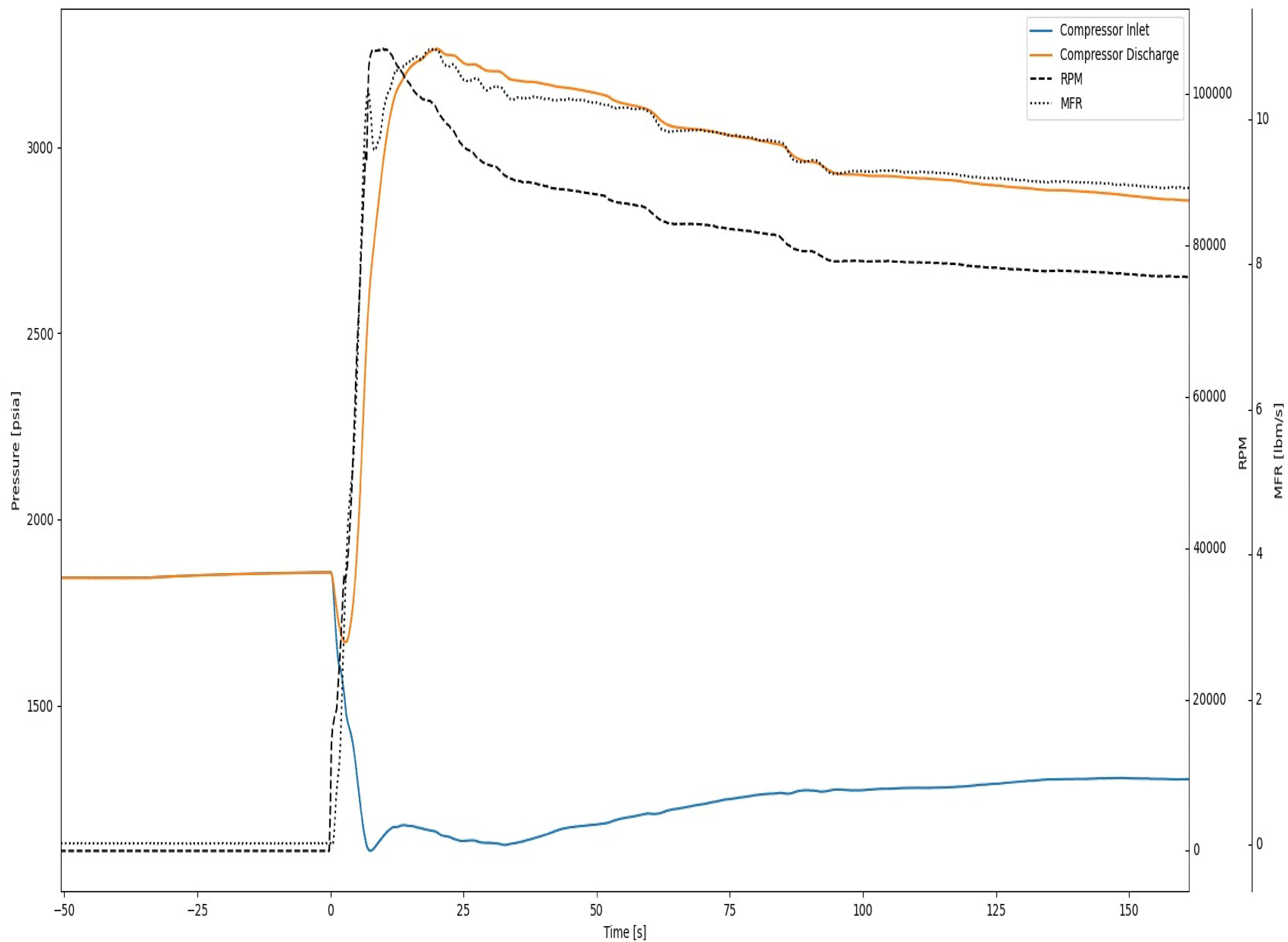
- Peregrine has received patent award for a black-start method for sCO₂ machines.
- The technique has been employed across dozens of starts at Sandia National Labs as well as at Peregrine's test lab with consistently excellent results.
- Requires no starter motor or pump
- Complements the motor-free turbopump employed in the Peregrine Design
- Some experimentation was required to determine optimal start valve closing criteria.



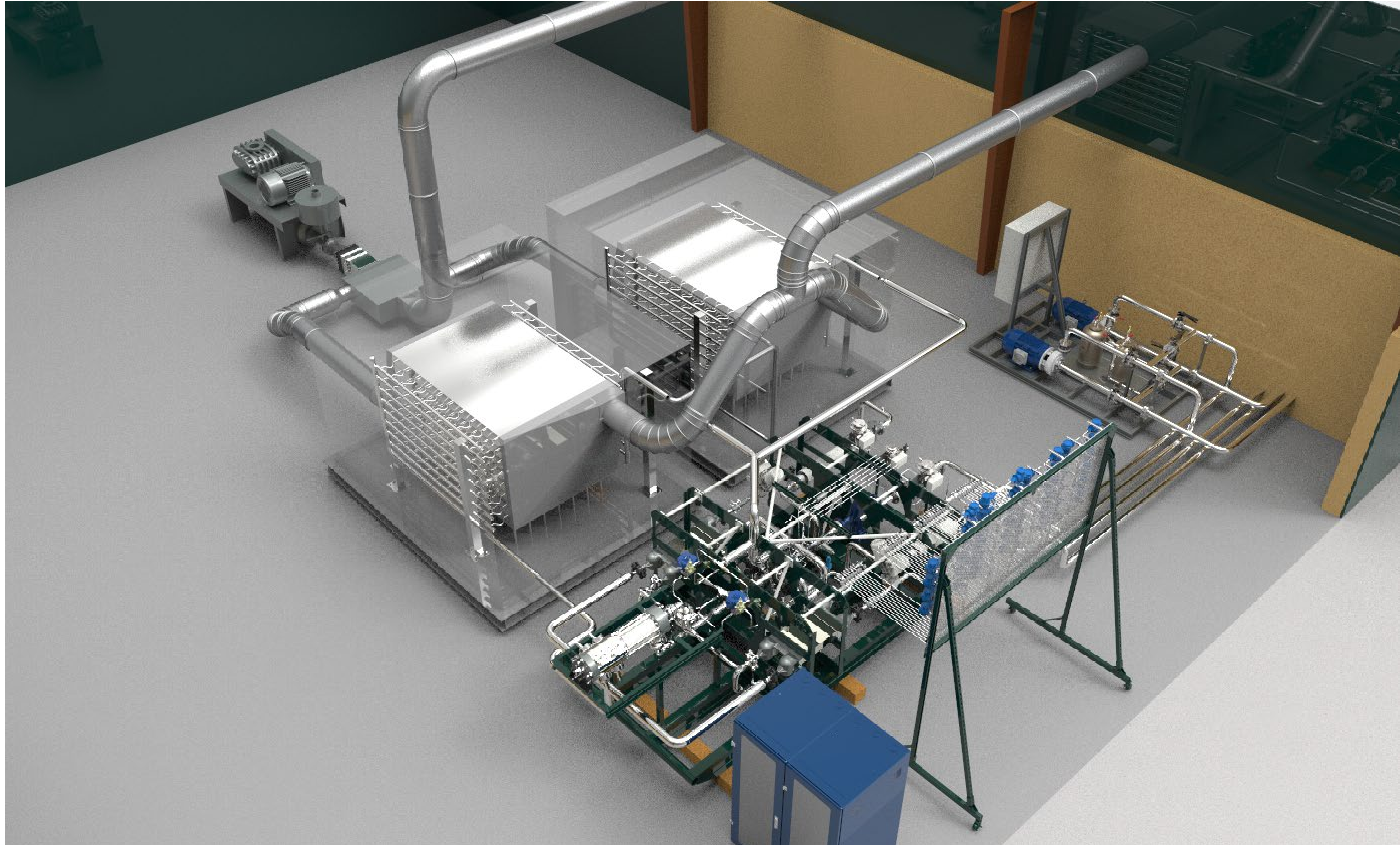
TEST_035_B-3
Compressor Inlet & Compressor Discharge



TEST_036_TEST_B-3
Compressor Inlet & Compressor Discharge



- Integration of 350kW PMG
- Augmentation of TES



Questions?