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sCO2 Brayton Research at Sandia National Laboratories

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U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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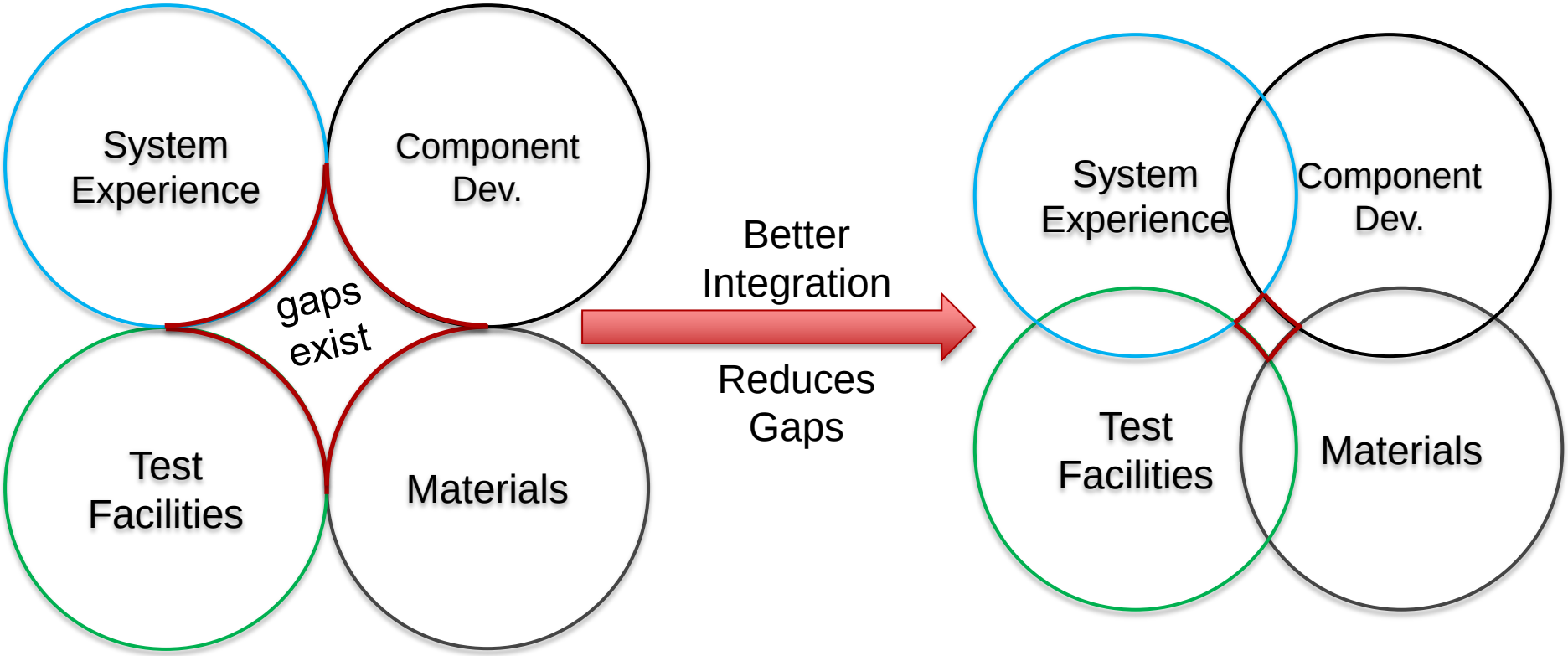
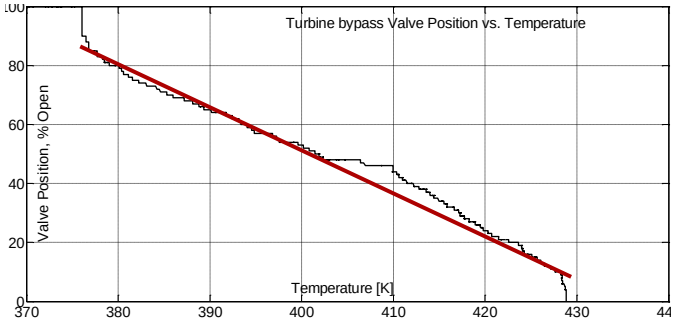
Sandia Lab Brayton Strategy



Current Progress

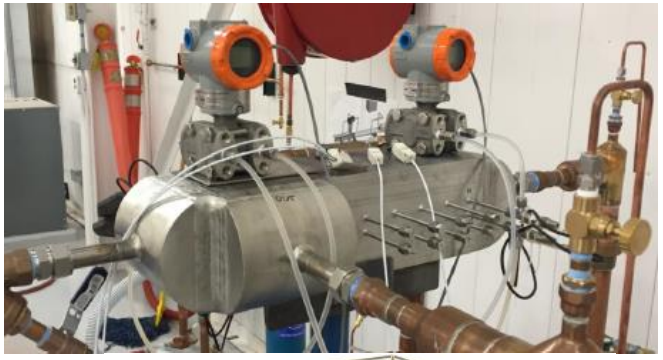
System Experience and Reliability:

- Recent tests achieved two primary conclusions:
  - Robust heat rejection system operations for various climates
  - Turbine/compressor models predict experimental performance
- Establish procedures for pre-test, start-up, and ramp-up
  - Reliable procedures for standard operations
- Root Cause Analysis as tool to refining system operations



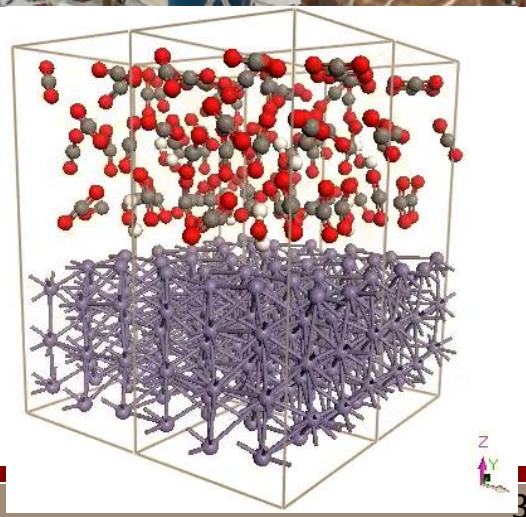
Component Development Tools and Test Facilities:

- Heat Exchanger Test platform: water-to-water up to 100kW$_{th}$
  - Collaborations continue to prove out different PCHE designs
- Building a bearing and seals test platform
- Advanced methods to understand wear/performance
  - Computed Tomography for turbomachinery wear



Understanding Fundamental Issues:

- Fundamental models: simulations aide mechanistic interpretation
  - Molecular dynamics (MD) of ferrous/nickel rich alloys baseline behavior
- Economic Optimization: carbon steel in sCO2 up to 260^{o}C



Future Efforts and Thoughts

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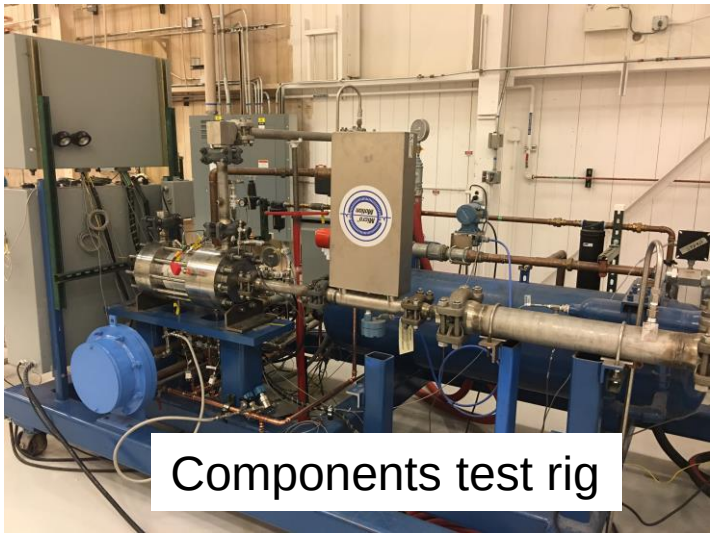
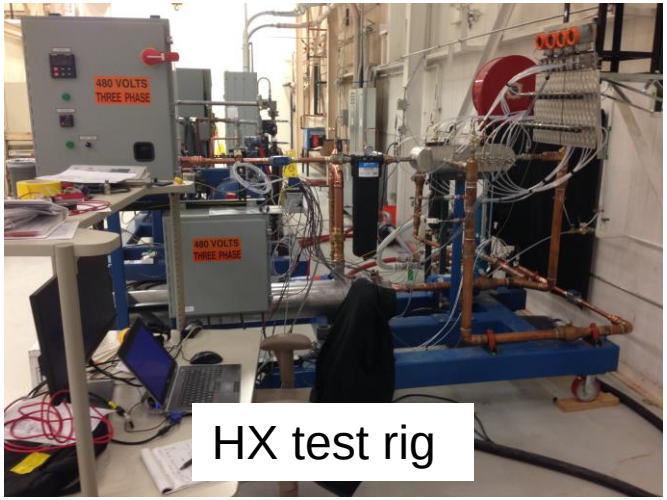
System Experience and Reliability:

- Improving integration among research areas
- Investigate RCBC technology for Pilot Test System
  - Collaborations: identify and formation
  - Prove out: component and system performance
  - Baseline Models: steady state and transient
  - Dry Cooling: assess performance and operational effects
  - Develop control algorithms using testing platforms and baselined models


Components test rig

Component Development Tools and Test Facilities:

- Nuclear Energy Systems Laboratory Development Platform:
  - Create infrastructure to test third-party sCO2 Brayton devices
- Bearing and Seal Test Platform developed in collaboration with industry partners from recent FBOs.



HX test rig

Understanding Materials Issues:

- Selection and development for bearings/seal applications
- Leverage thermochemical and MD modeling:
  - Understand system chemistries
  - V&V with appropriate experiments
- sCO2 Materials Engagement need to be formalized:
  - FE-EERE-NE along with University and Industrial Partners
  - AUSC experience is a great model for this process