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Motivation

- The supercritical carbon dioxide gas turbine cycle has numerous advantages over traditional power cycles
- The high density of CO2 in the supercritical region reduces the required compressor work, resulting in increased cycle efficiency
- The equipment associated with the S-CO2 gas turbine cycle is less expensive than that of the traditional Rankine cycle
  - Turbomachinery size is reduced due to the high density of S-CO2
  - Complexities associated with phase changes of the working fluid are eliminated
- Leakage of S-CO2 from the compressor into the generator cavity at high pressure gradients causes frictional losses and decreases cycle efficiency
- Optimizing compressor seals would reduce frictional losses in the generator, increasing cycle efficiency

Project Goals

- Test the leakage rates of S-CO2 through a variety of seals (labyrinth, dry liftoff, etc.) at high pressure gradients
- Use data to create models for predicting the leakage rate for different seal geometries
- Use models to design seal geometries that minimize leakage
- Fabricate and test optimized seal geometries

Experimental Setup

- Test section allows for testing of different seal geometries
- Inlet pressure and temperature are controlled to set the inlet state
- Outlet pressure is controlled to vary the pressure drop across the seal
- Mass flow rates, densities, temperatures, and pressures are measured at the inlet and outlet to the test section