



Effect of Compressor Inlet Temperature on Cycle Performance for a Supercritical Carbon Dioxide Brayton Cycle

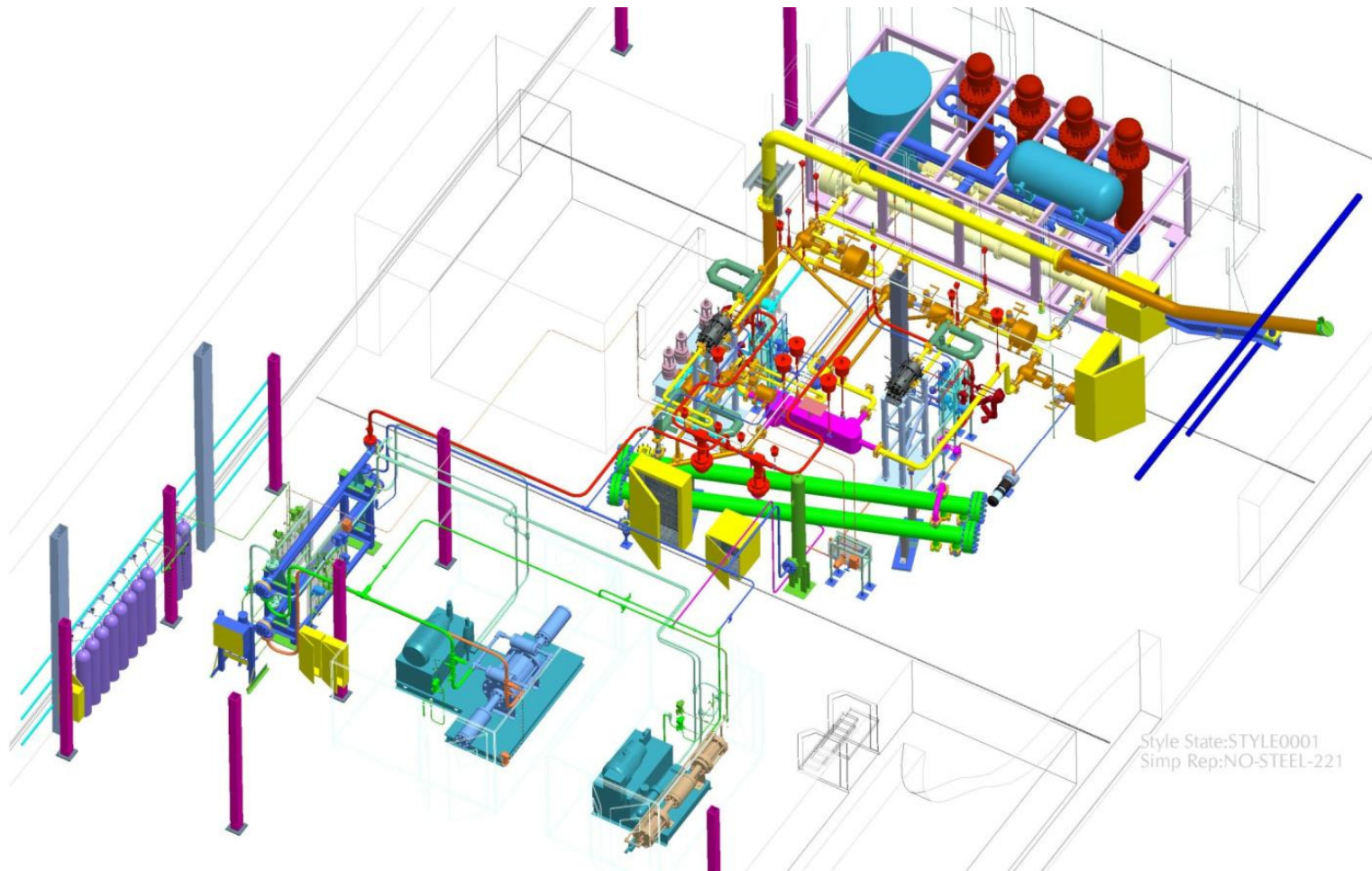
Jacqueline Lewis, Eric Clementoni, Tim Cox

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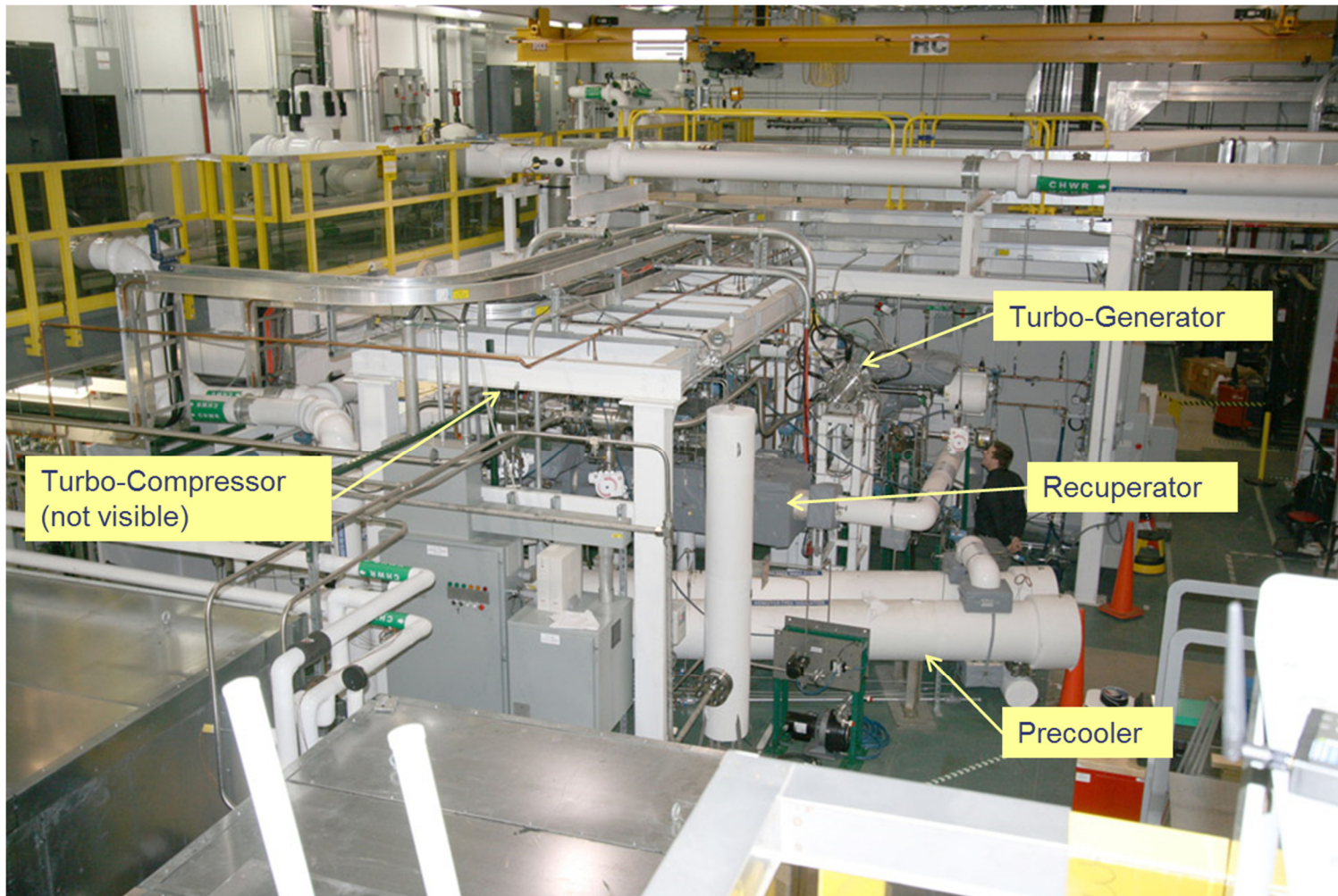
Presentation Summary

- sCO₂ Integrated System Test (IST) Overview
- IST System Control
- Test Configuration
- Compressor Inlet Pressure and Density Sensitivities
- Cycle Performance Sensitivities
- Compressor Performance
- Conclusions

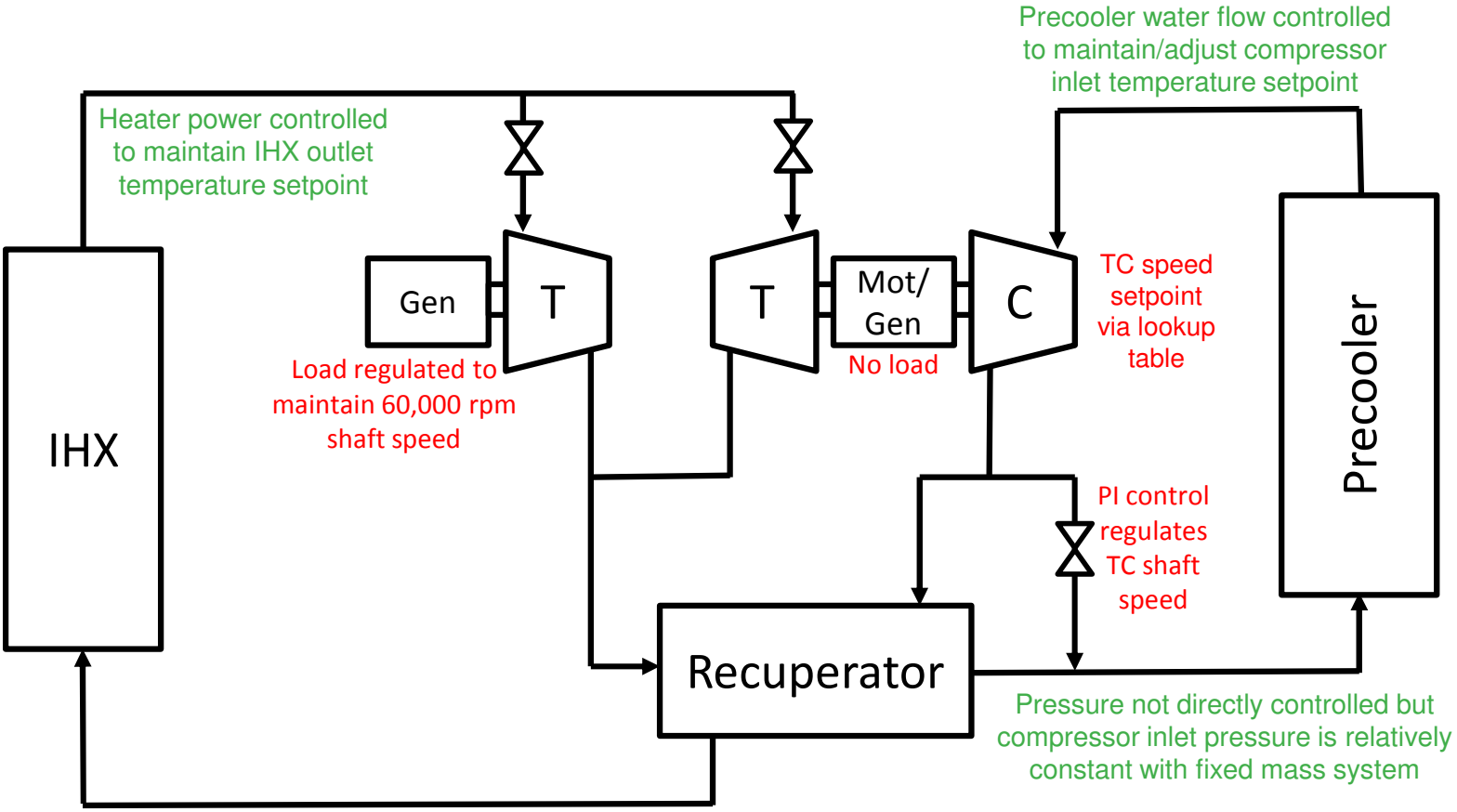
IST Physical Layout



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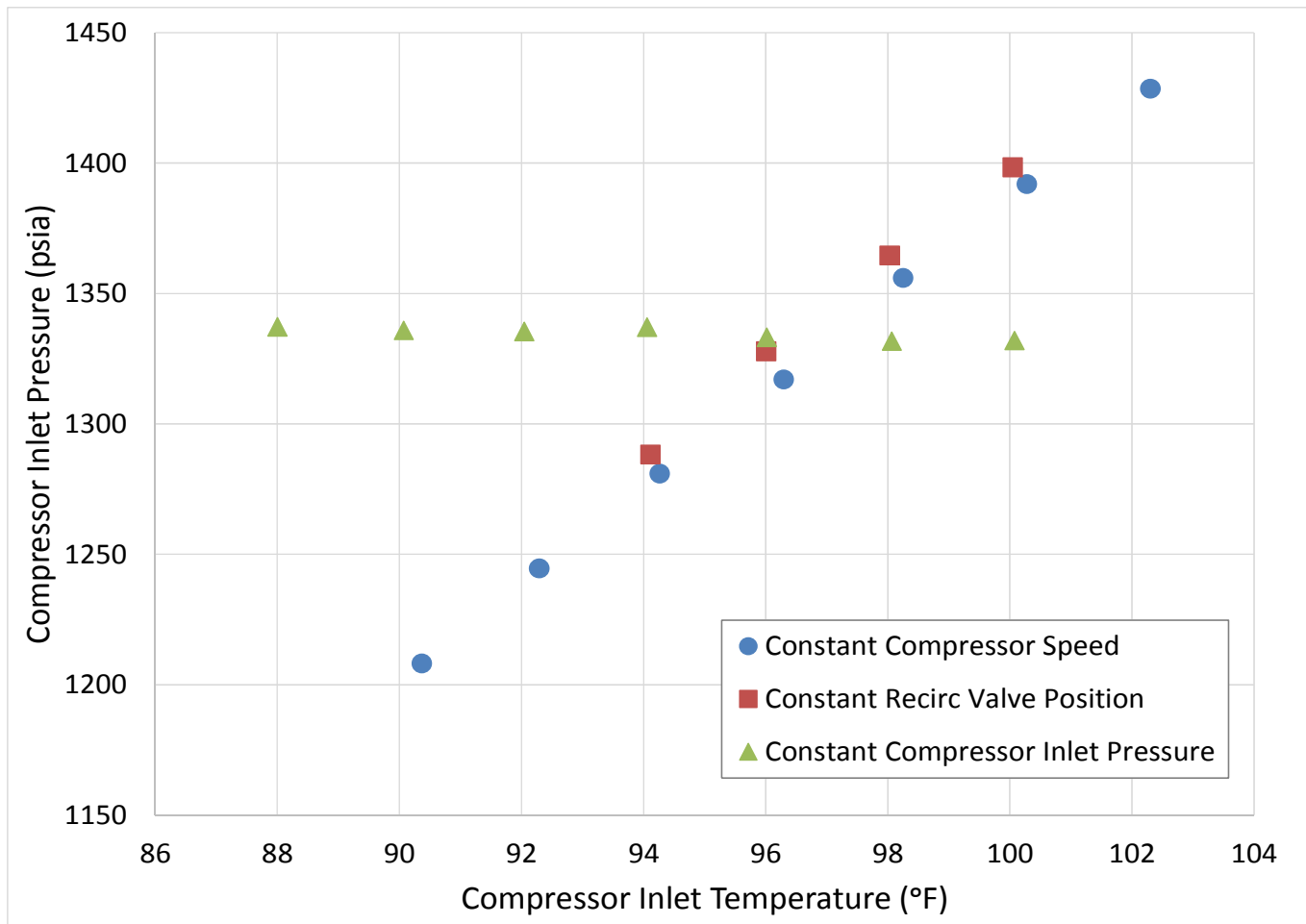
Normal System Control Overview



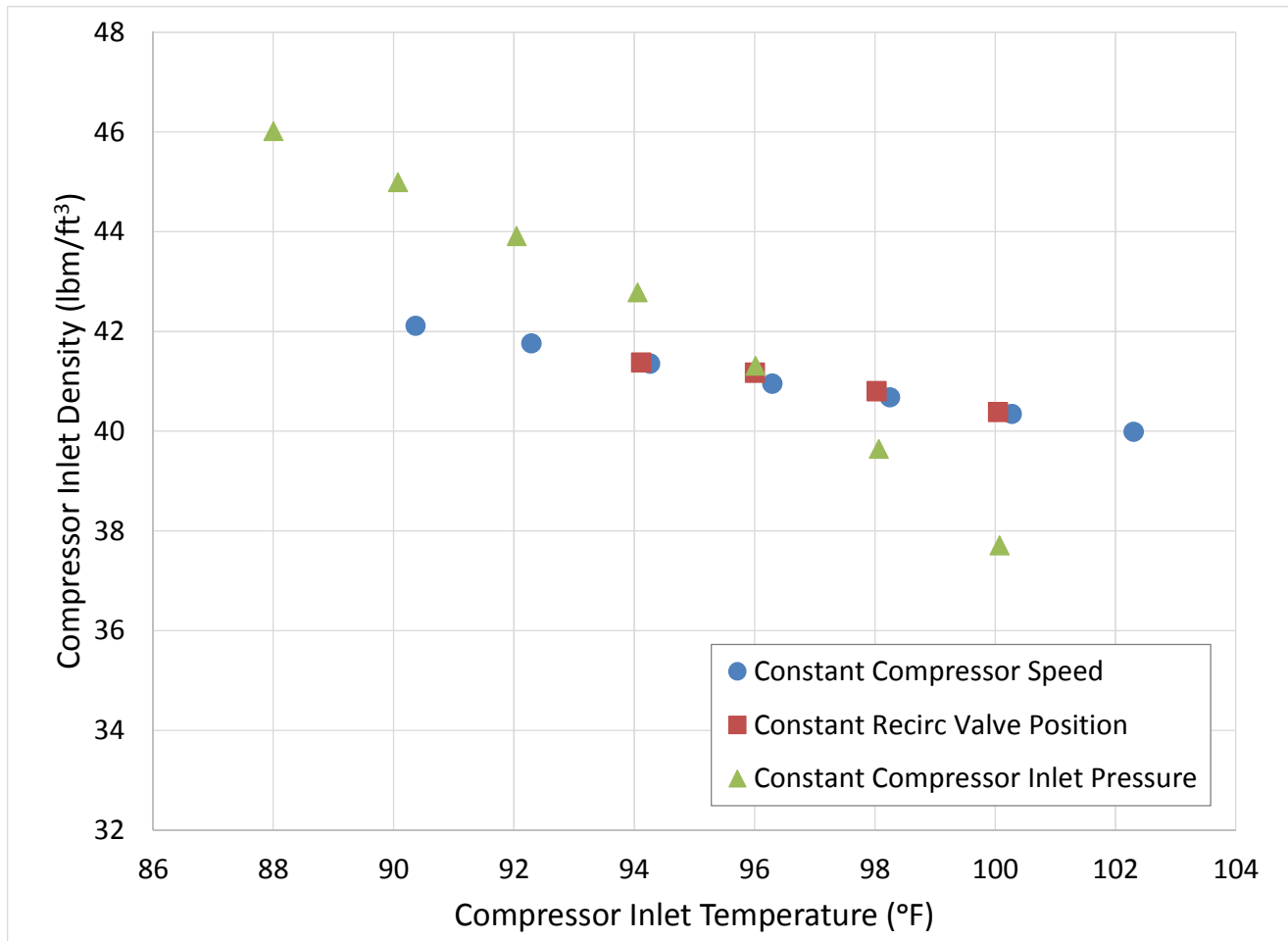
Test Configurations

- Three test configurations
 - Constant compressor speed (constant mass)
 - Compressor recirculation valve maintains compressor speed
 - Constant compressor recirculation valve position (constant mass)
 - Compressor speed allowed to change with fixed system resistance
 - Constant compressor inlet pressure
 - Same as first test with mass adjustments to maintain pressure
- Evaluate performance over widest range of compressor inlet temperatures possible
 - Limited by min/max power, compressor recirculation valve position, maintaining margin to critical point

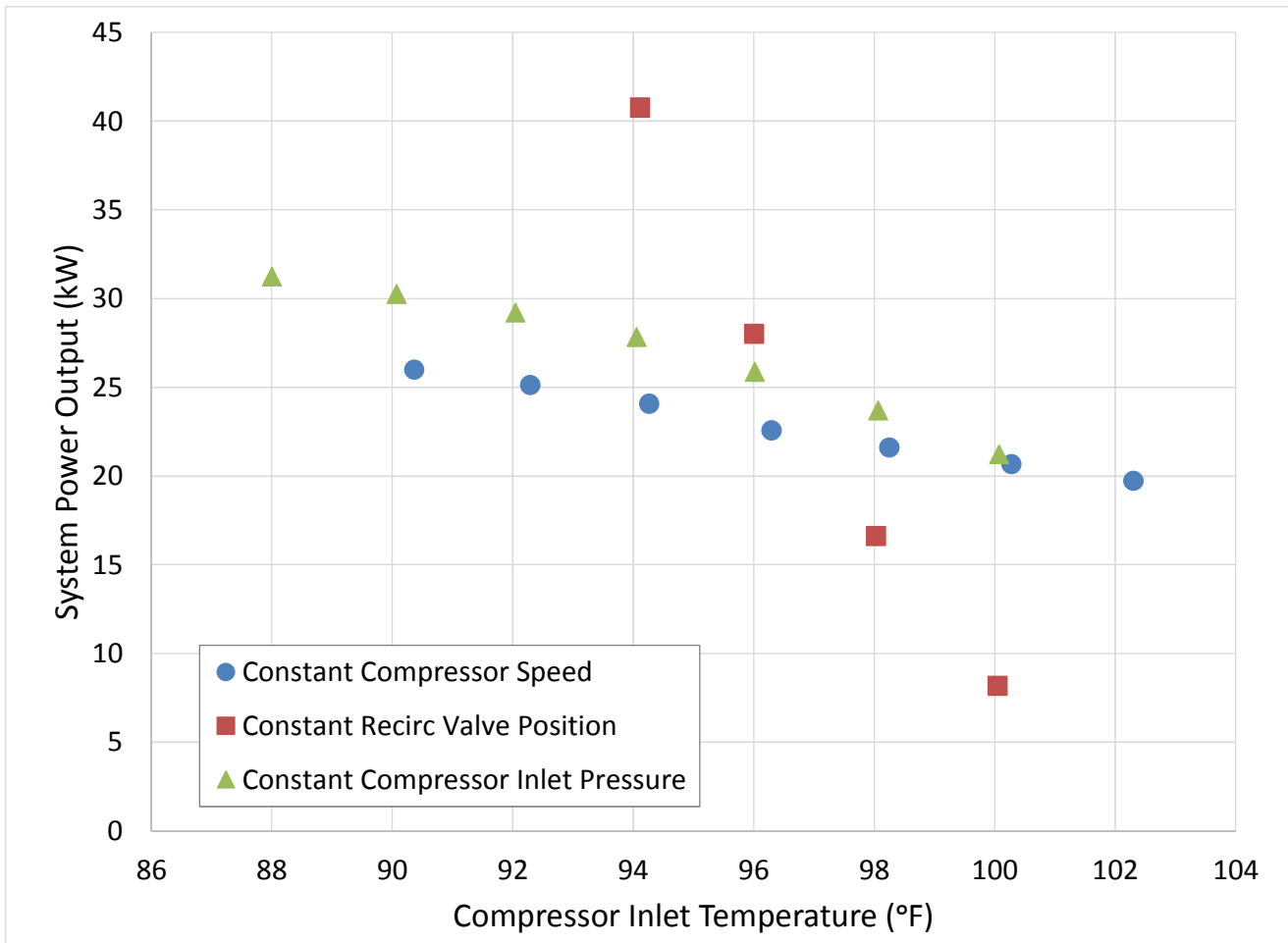
Compressor Inlet Pressure Sensitivity



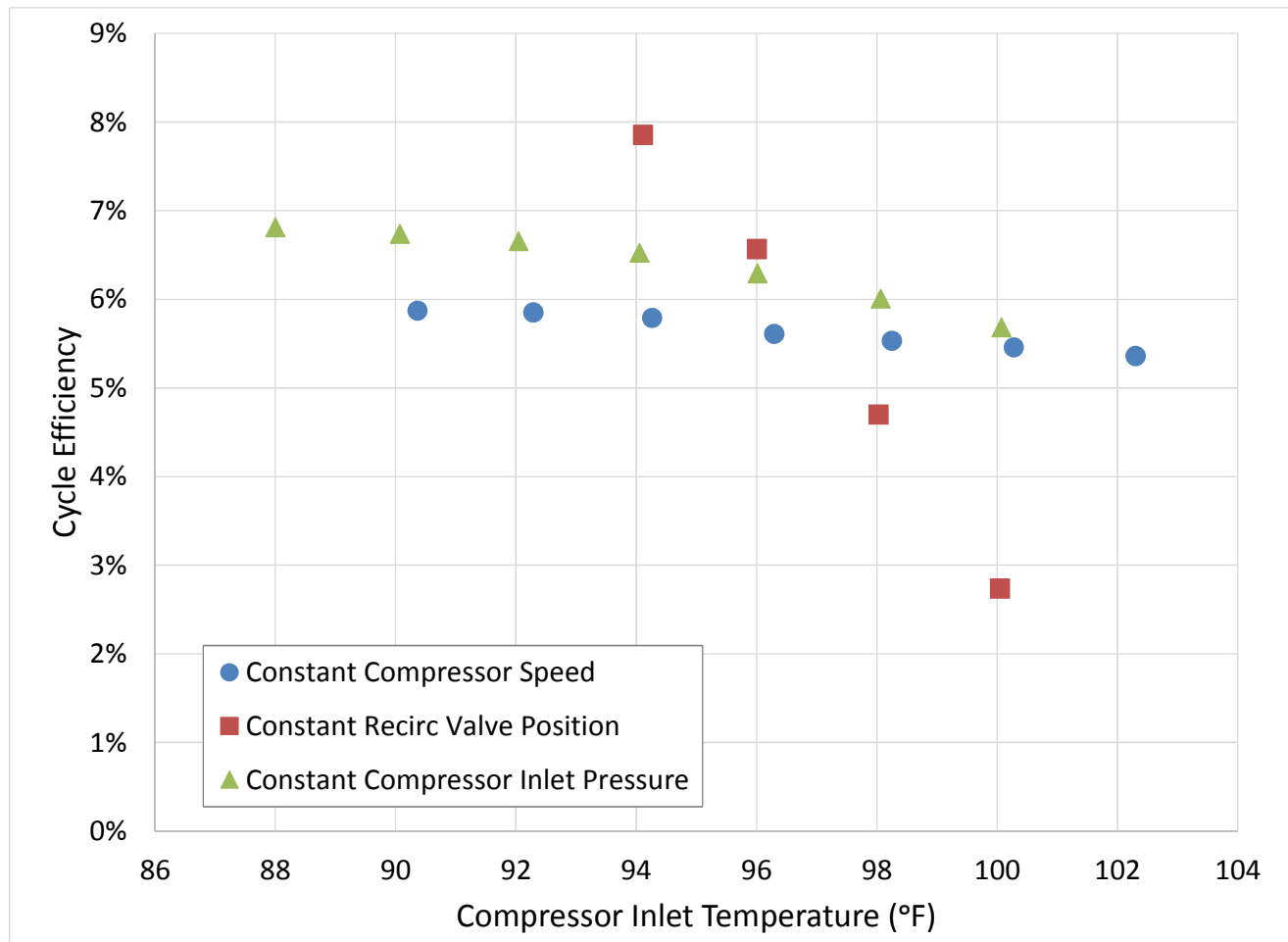
Compressor Inlet Density Sensitivity



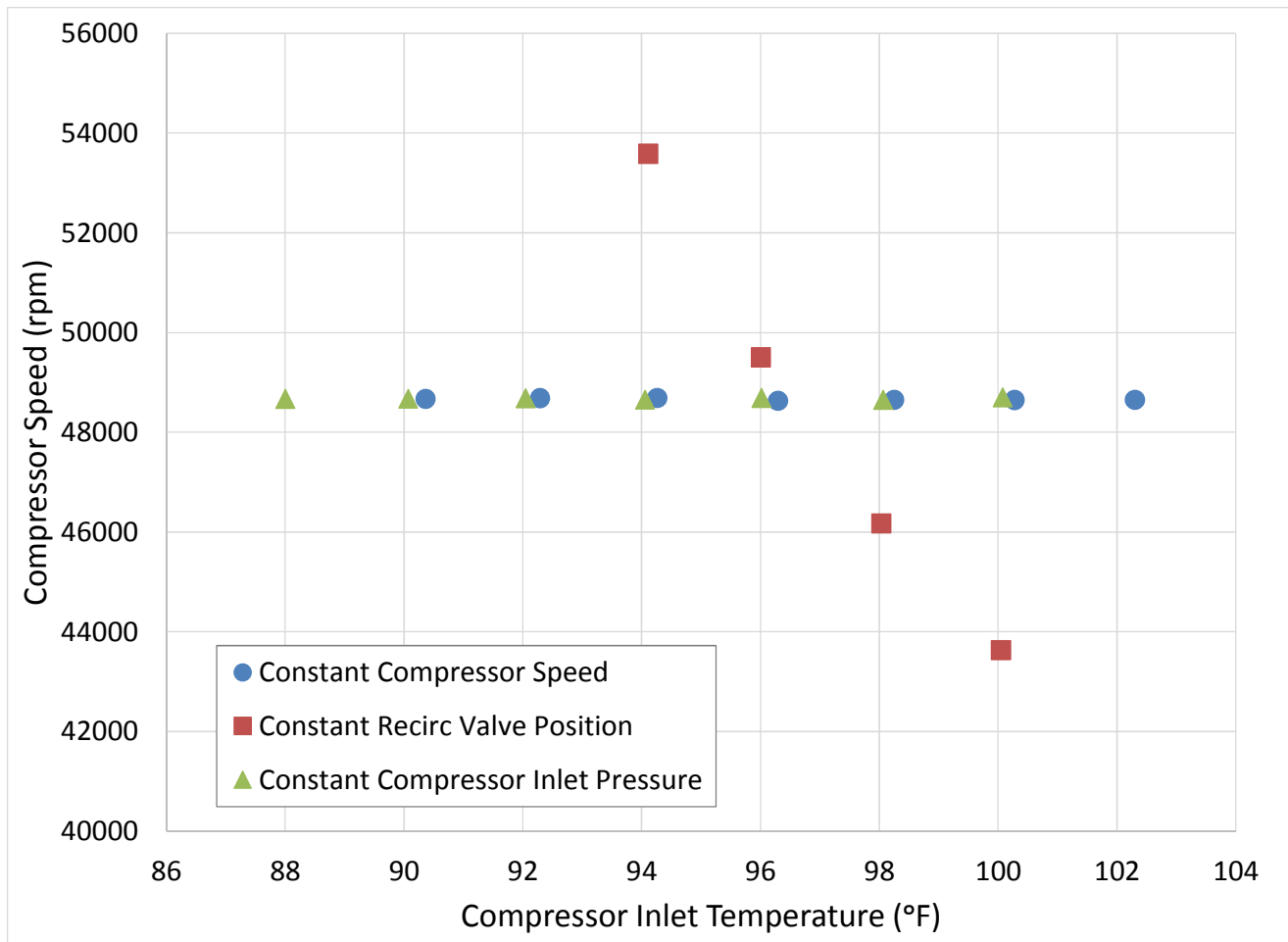
System Power Output Sensitivity



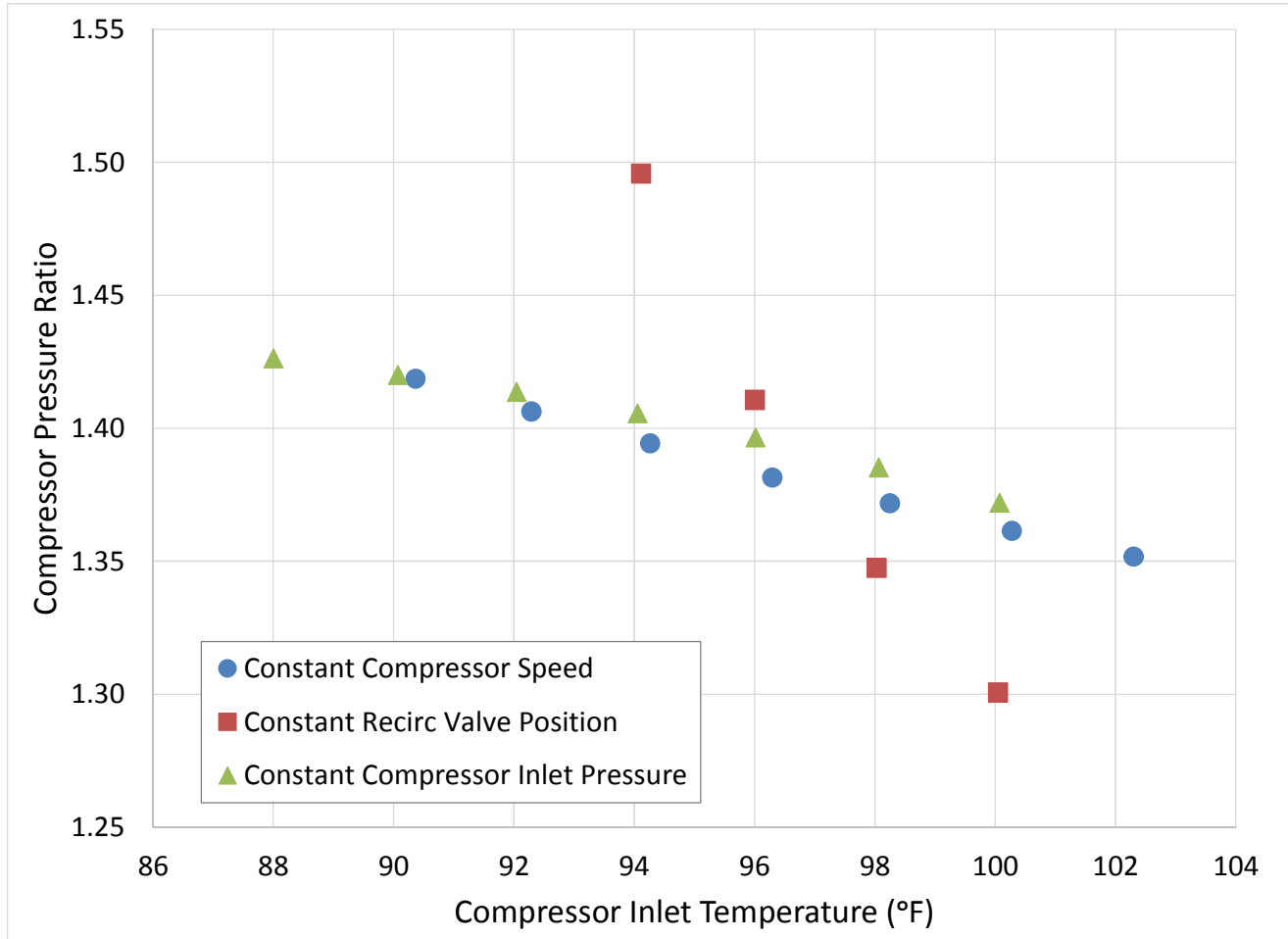
Cycle Efficiency Sensitivity



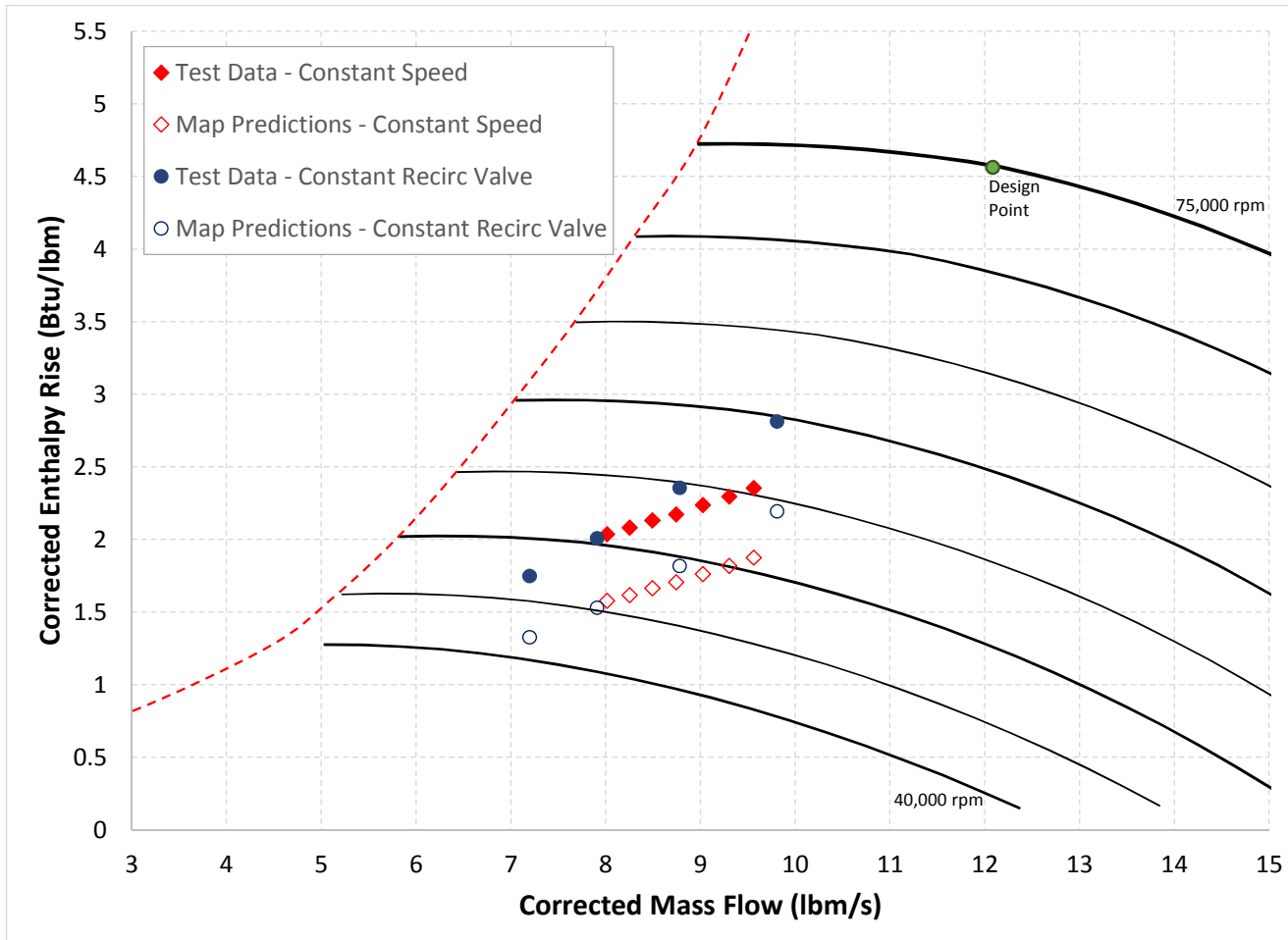
Compressor Speed Sensitivity



Compressor Pressure Ratio Sensitivity



Comparison of Compressor Performance to Map Predictions



Conclusions

- IST has demonstrated stable performance over a range of compressor inlet temperatures
 - Widest range in temperatures for fixed compressor speed tests → as low as 88°F
 - Widest range of power levels for fixed compressor recirculation valve position test
- Compressor performance continues to exceed map predictions
 - Consistent offset independent of compressor inlet temperature
- Sensitivities may be dependent upon scale of system and specific components used