

Dynamic Energy Conversion for Space Nuclear Power Systems

Bruno Gallo and Mohamed El-Genk

Motivation:

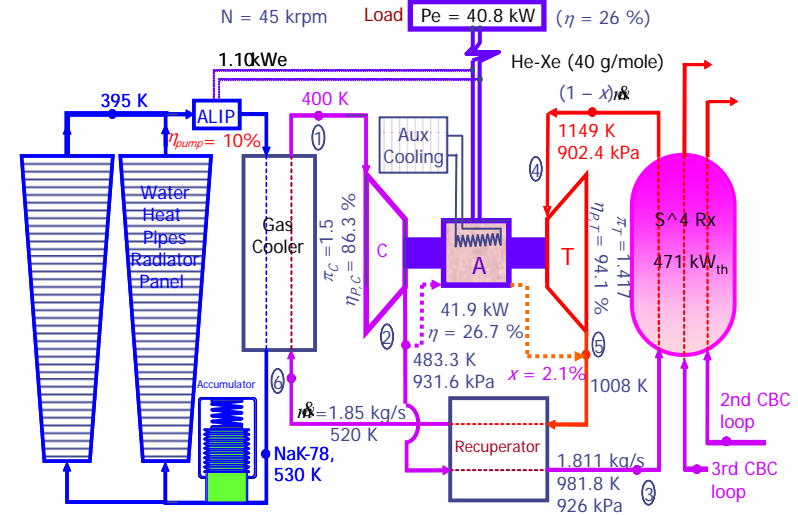
Design an accurate and fast-running model to design and predict performance of centrifugal turbo-machine units for space power system applications.

Contributions/Important Results:

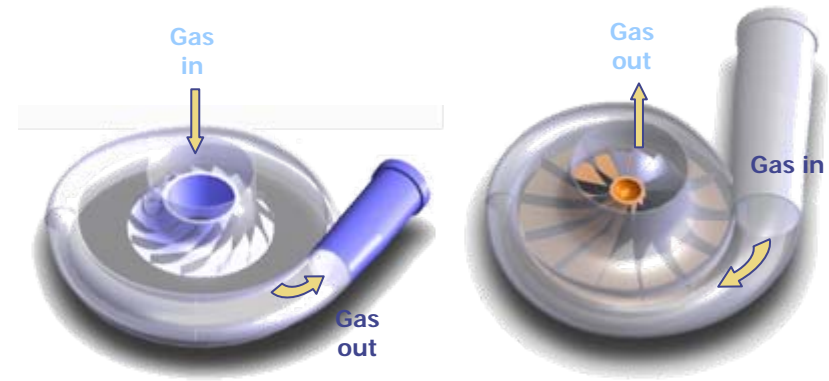
- Developed integrated single-shaft centrifugal turbo-machine model for power generation.
- Developed accurate methodology for the properties of noble gases and binary mixtures as function of pressure and temperature.
- Model results using Matlab/Simulink® give unit performance and operation surface.

Applications:

- Power generation for Lunar and Mars outposts and long-time mission exploration to distant planets.



Layout of a Space Reactor Cycle Power System with a Closed Brayton Cycle Loop

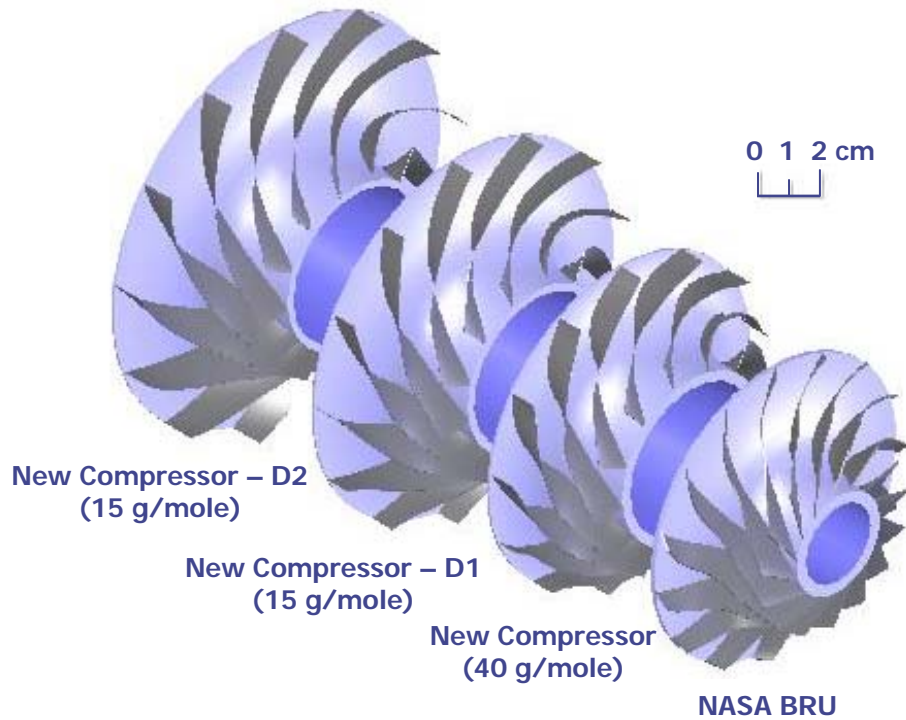


Centrifugal Compressor

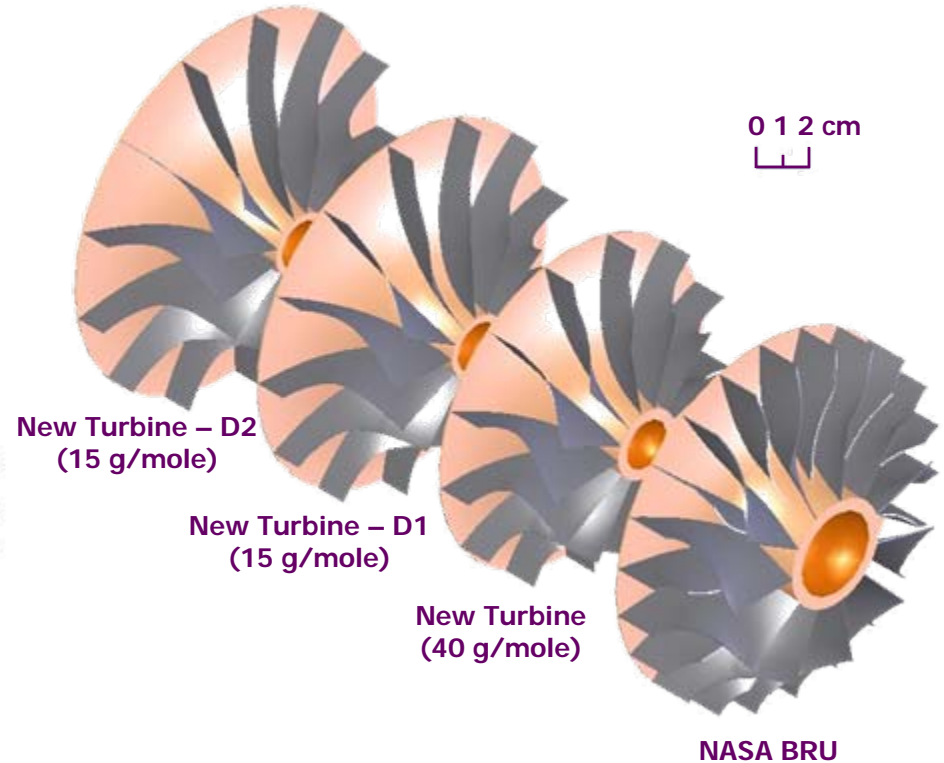
Centrifugal Turbine



BRU Turbo-Machines



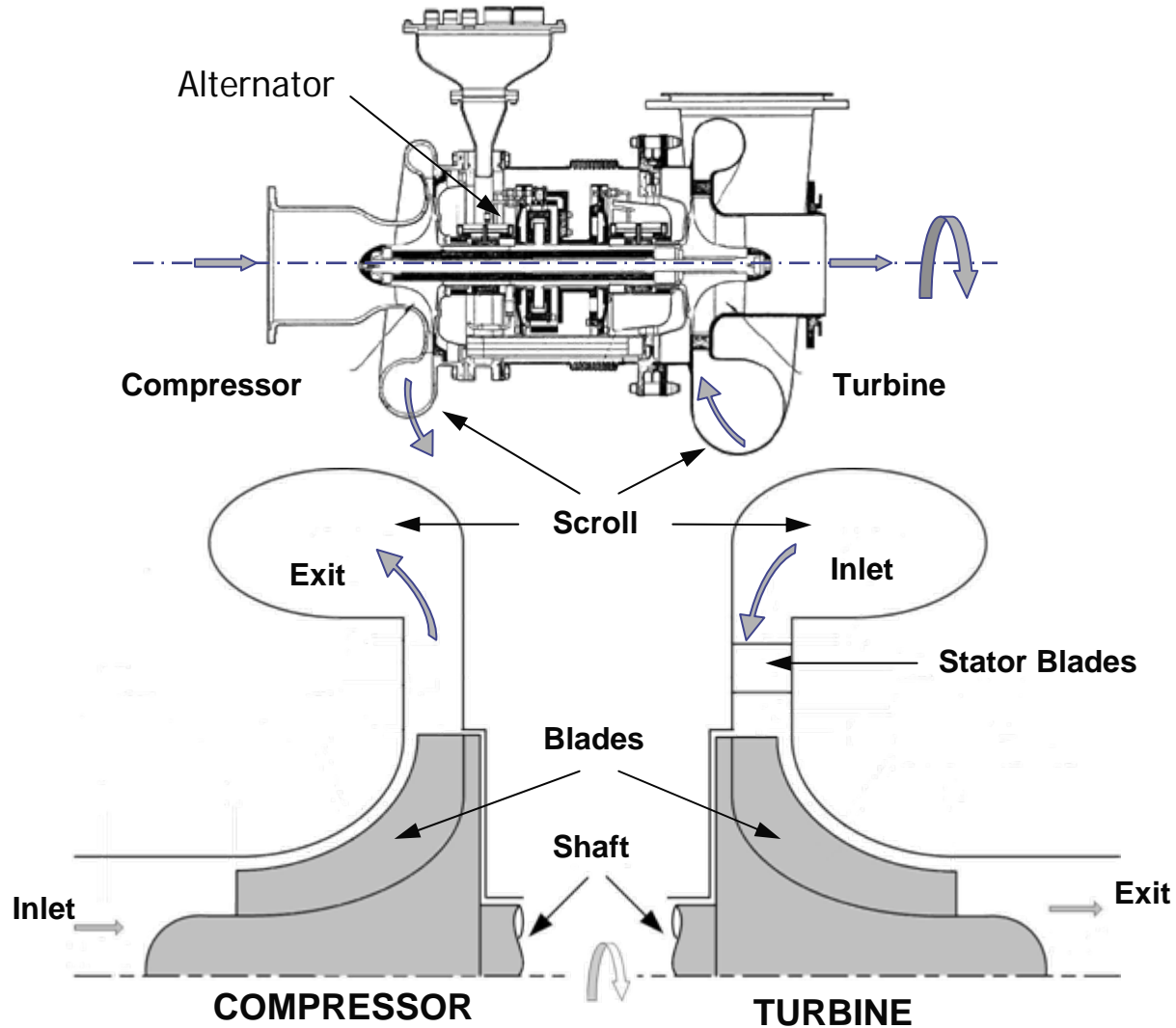
Compressors



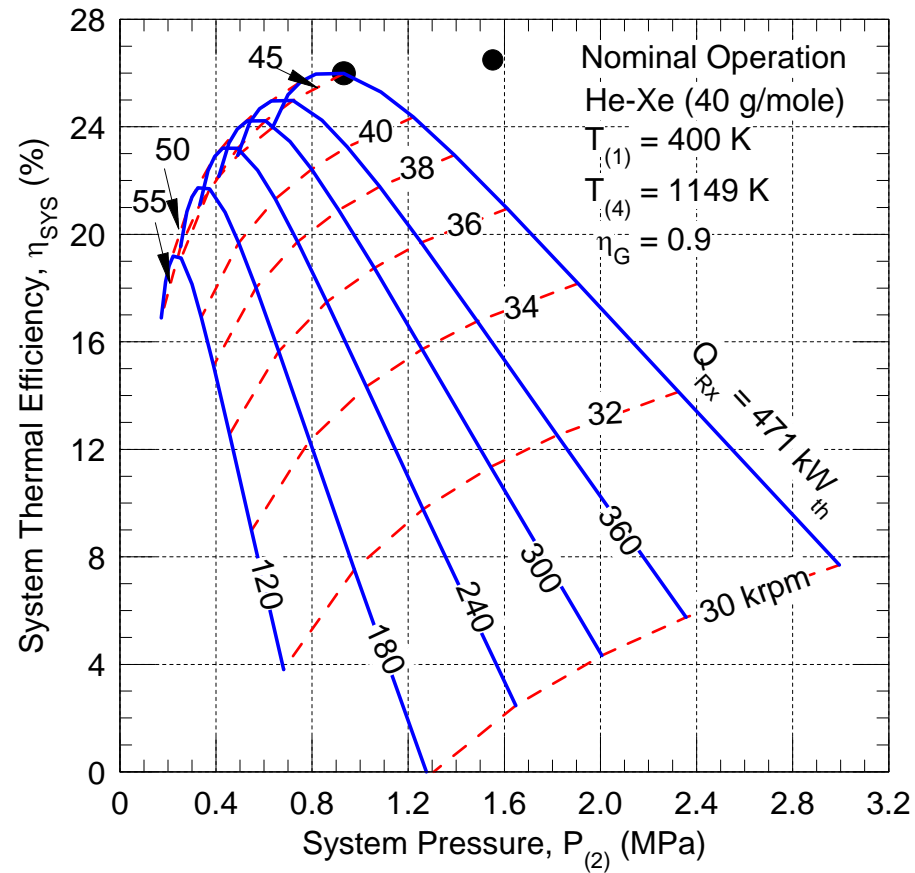
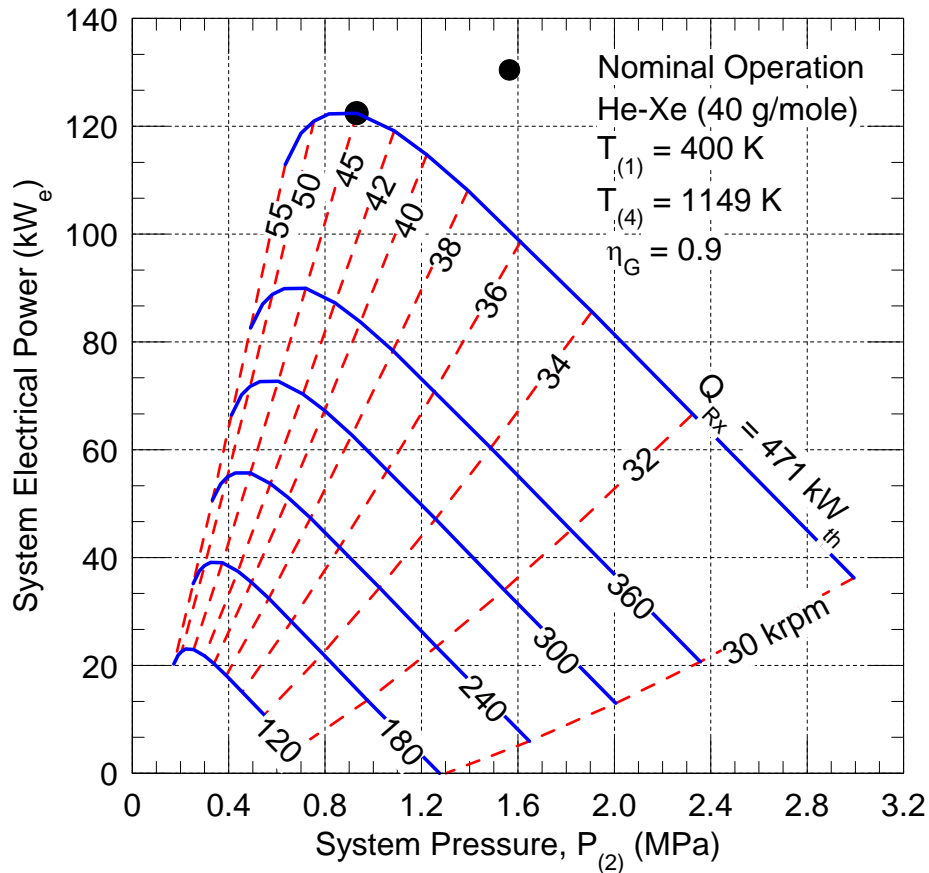
Turbines



CBC - Schematics



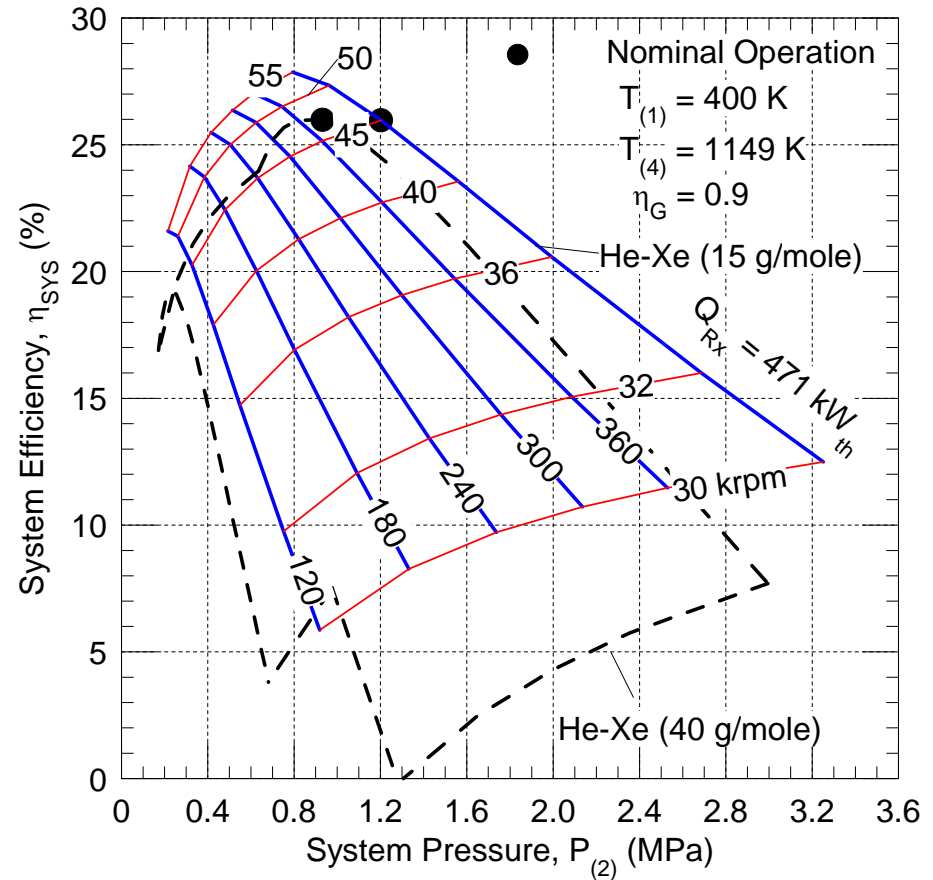
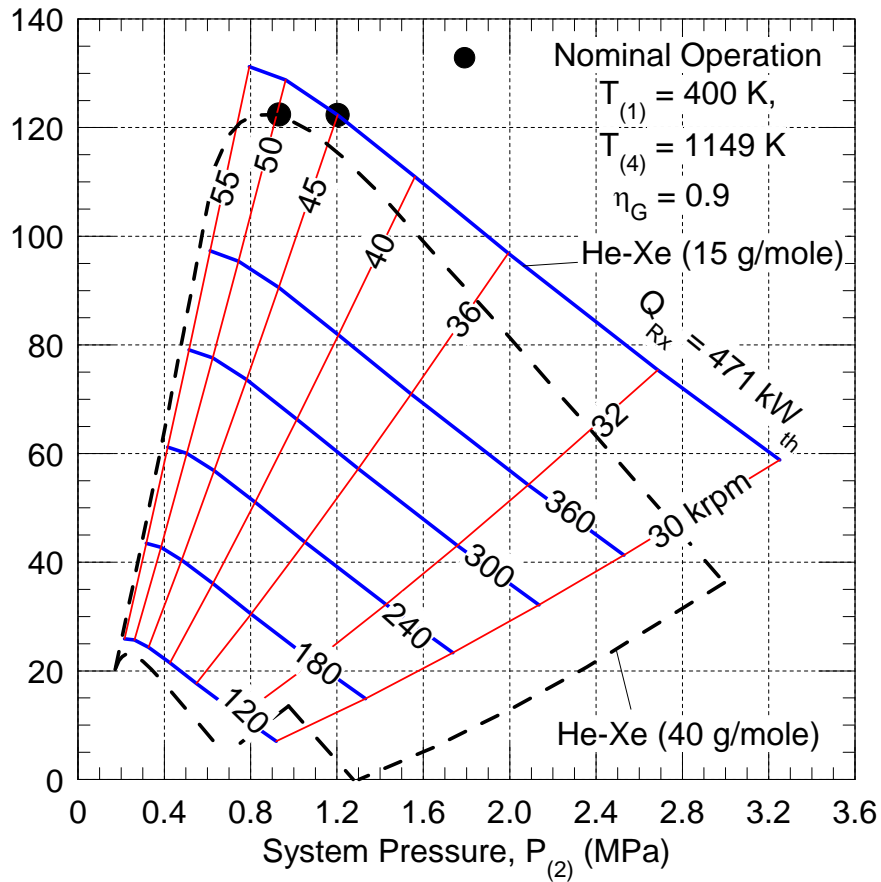
Integrated Unit Performances



He – Xe (40 g/mole)



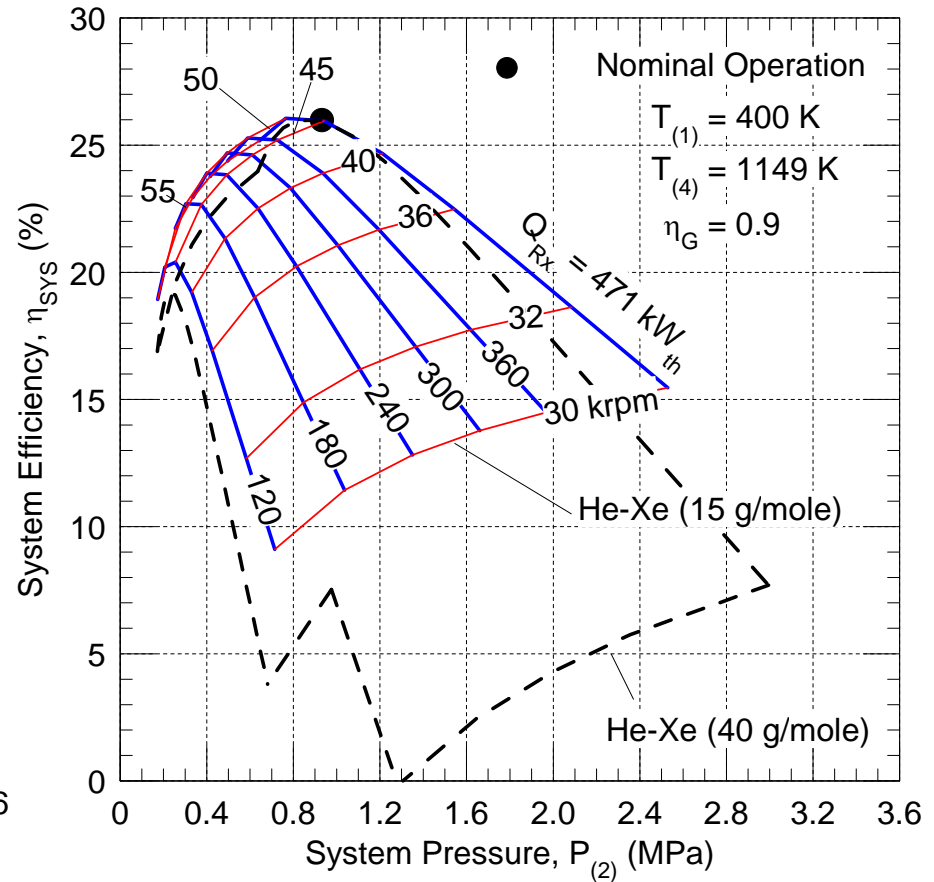
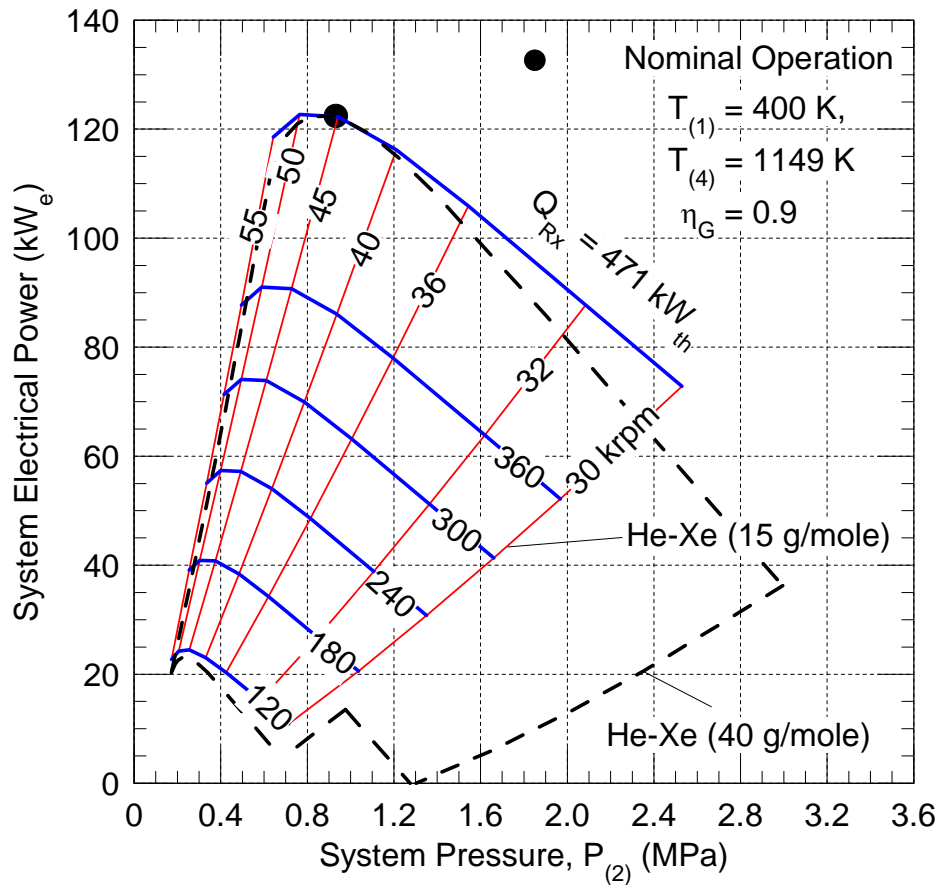
Integrated Unit Performances



He – Xe (15 g/mole) – Design 1



Integrated Unit Performances



He – Xe (15 g/mole) – Design 2

