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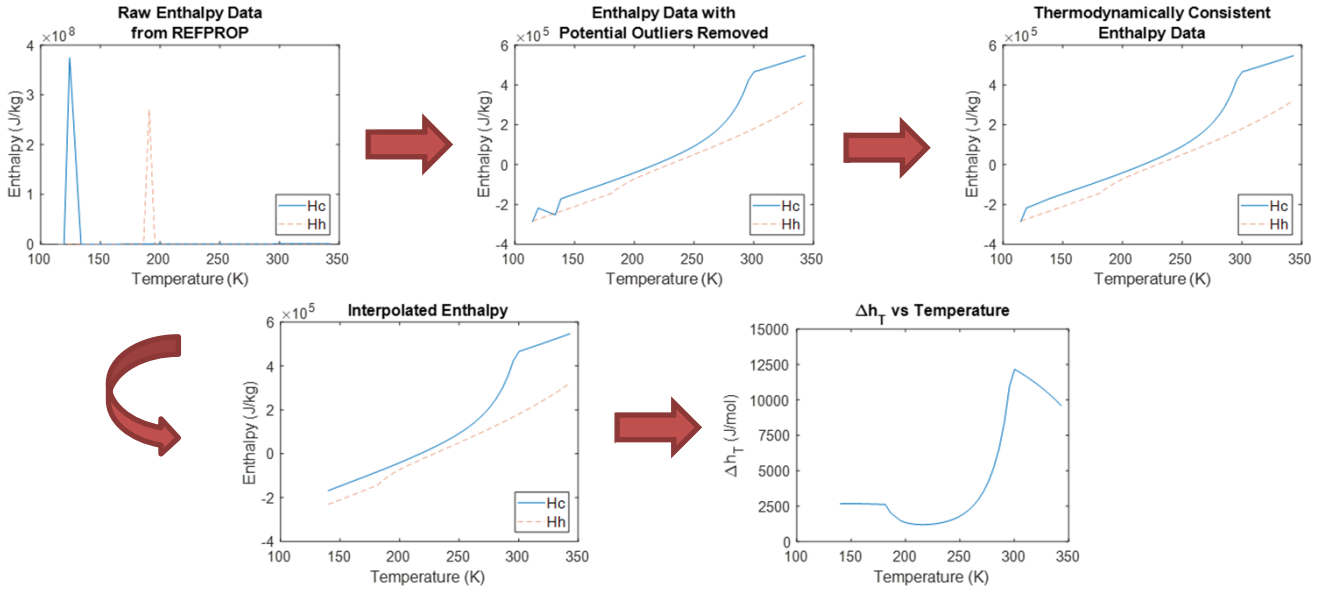
Background

- Even though Joule-Thomson (JT) cryocoolers offer advantages over Stirling-cycle coolers, their use has been limited due to the low thermodynamic efficiency of the cycle at typical cryogenic device temperatures
- For the efficiency to be competitive, the JT cryocooler must provide cooling at low pressure ratios and low values of operating pressure
- Under these conditions, using a mixed gas fluid can provide greater cooling capacity than is possible with a pure fluid
- However, properly selecting a suitable mixture is a challenging design problem

Goals and Objectives

- A computational tool has been developed to optimize mixture composition and operating parameters for a mixed gas JT (MGJT) system with operating parameters ranging from 110K to above room temperature.
- A prototype of a MGJT cryocooler was constructed and installed in a test facility to experimentally validate and refine the mixture optimization model.
- Experimental testing is under way to compare the experimental and optimization results and further develop the model for increased accuracy of the optimal mixture composition.

Model Visualization & Prototype



Visualization of five-step process for determining minimum Δh_T for composition of a three-component mixture.

A SOLIDWORK CAD rendering of the MGJT cryocooler.