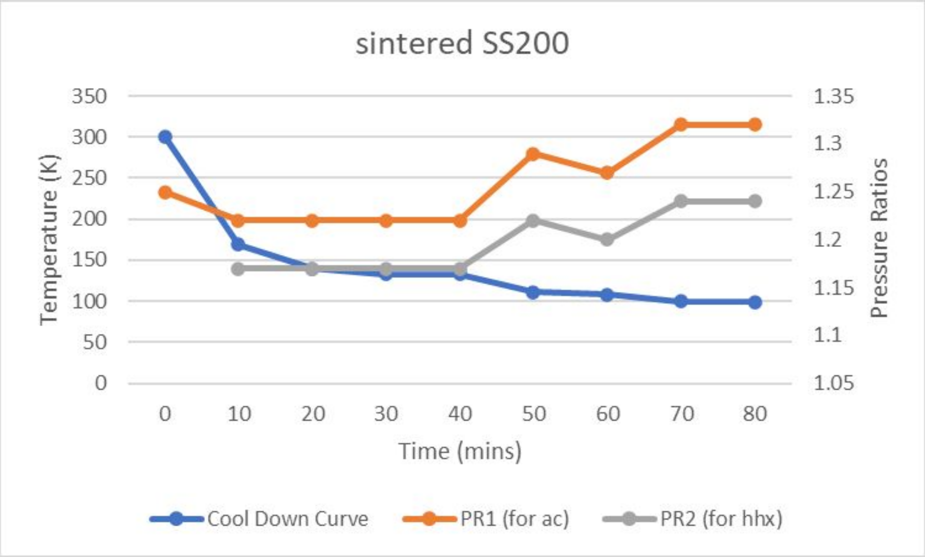
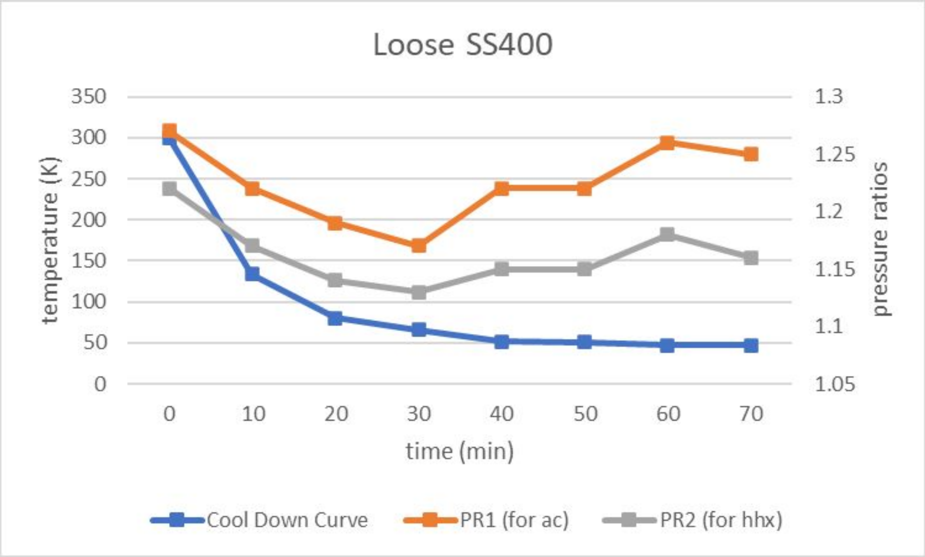
Results

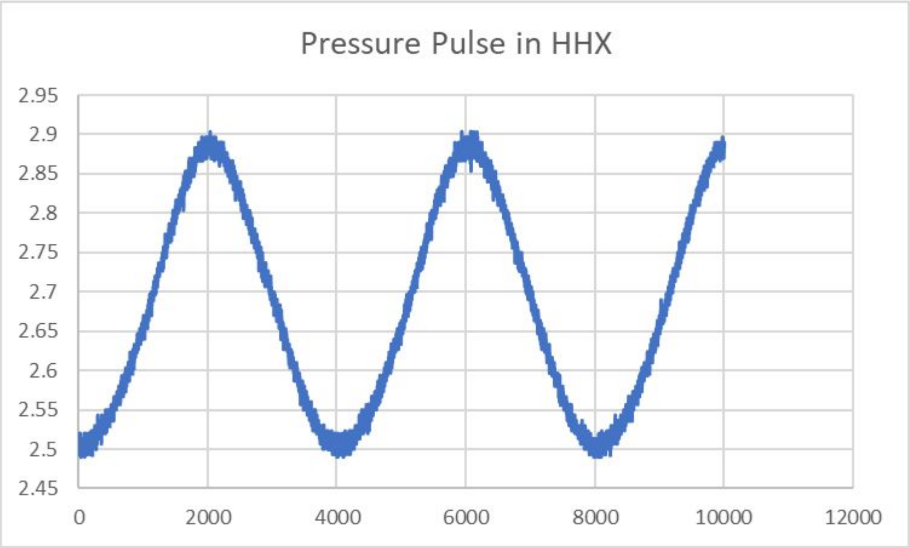
Richa Mohta

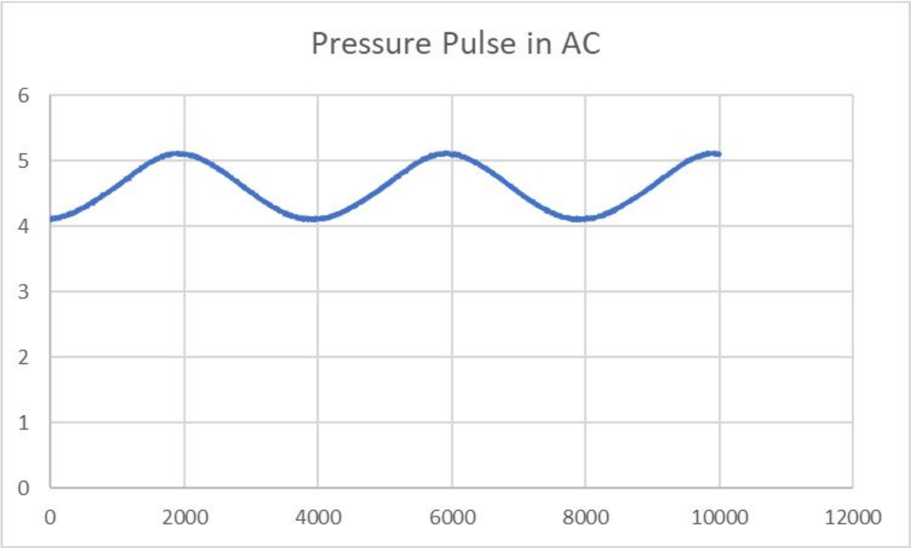




- Achieves 99 K temperature at 300 W
- Pressure Ratios are higher
- Pressure Ratios are relatively stable at same power input
- The difference in pressure ratios at the aftercooler and at the hot heat exchanger is less

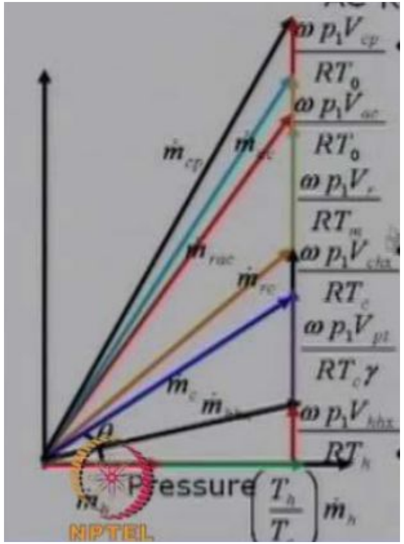
- Achieves 47 K temperature at 300 W
- Pressure Ratios are not as high
- The drop in Pressure Ratios is more
- The difference goes on increasing (due to increased losses in the regenerator matrix)





For loose SS400 matrix, at 300W, in 1 sec

Phasor Analysis



Phasor DIagram of OPTC

$$P = P_o + P_1 \cos(\omega t) \quad (1)$$

$$T = T_o + T_1 \cos(\omega t)$$

$$\dot{m}_c = \frac{T_h}{T_c} C_1 P_1 \cos \omega t + \frac{\omega V_{pt}}{RT_{mpt}} P_1 \cos(\omega t + \pi / 2) \quad (2)$$

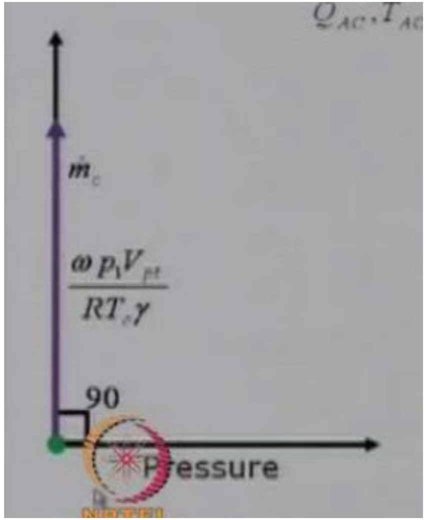
$$Q = \frac{1}{2} R T_c \frac{P_1}{P_0} |\dot{m}_c| \cos(\theta) \quad (3)$$

- In the Pulse Tube:
  - Processes are adiabatic
  - P & T variations are sinusoidal (1)
- Pressure in the system is constant
- Processes are isothermal in the AC, HHX, CHX, regenerator and compressor ($T=T_o$)

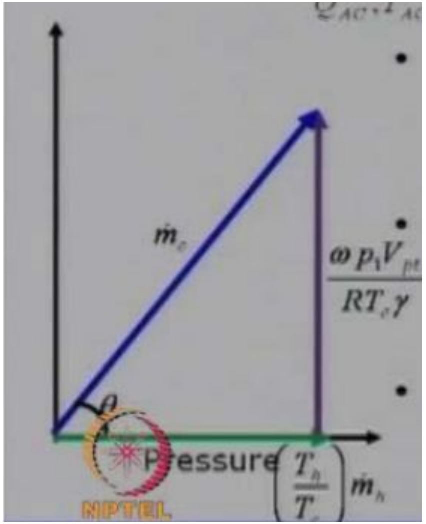
- Phasor diagram is a vectorial representation of mass flow rate at the cold end and pressure, where ϑ is the phase angle between them (got from (2))
- It is important because the refrigeration effect depends on the pressure ratio, mass flow rate, temperature and the **phase angle** (3)
- To maximize the refrigeration effect we need to minimize ϑ- this is why we need phase shift mechanisms

Classification of PTC based on Phase Shift Mechanisms & Phasor Diagrams of PT:

1. Basic Type
2. Orifice Type
3. Double inlet valve Type
4. Inertance Tube Type- Used for High freq PTC



1



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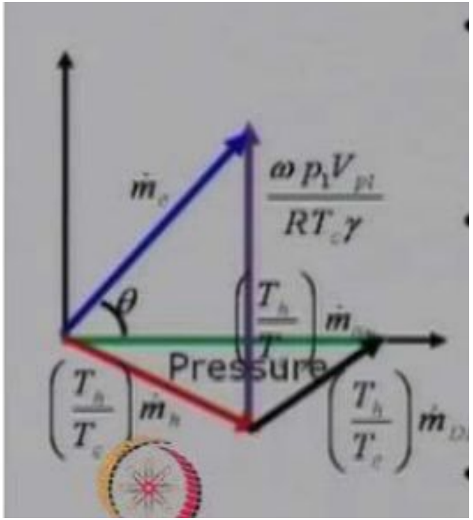

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SAGE

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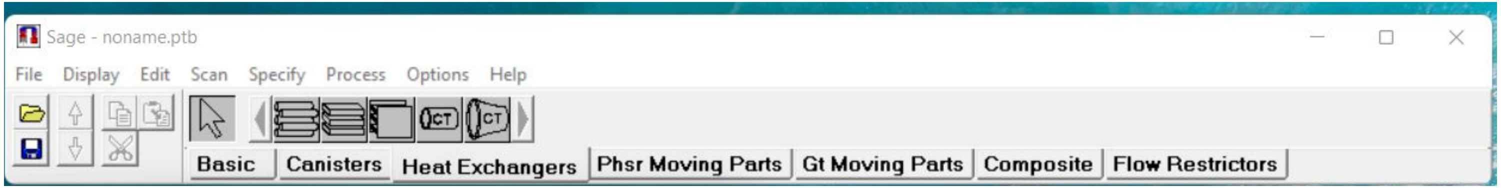
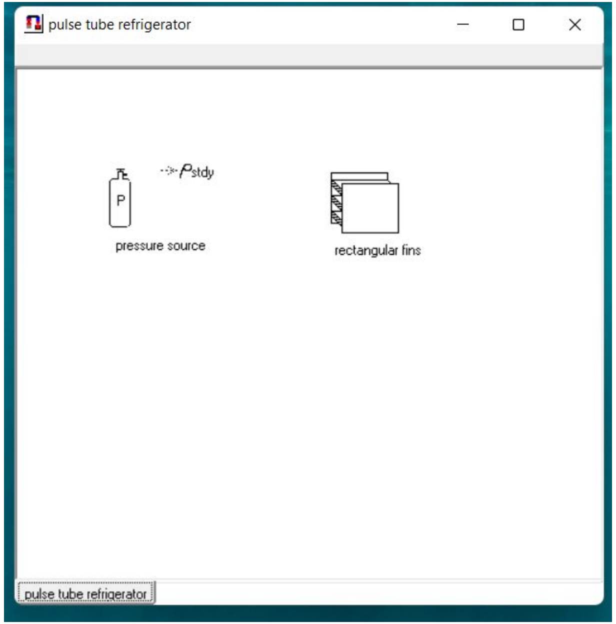
What is SAGE

- Graphical interface for simulation and optimization of engineering models
- Models are collections of components building blocks, connected and assembled in a particular way
- The boundary interconnections between each component are given
- The system can be modeled as a series where the output of one component is an input to the next
- The inputs and outputs can be in terms of mass flow rate, heat, work etc
- Models are solved to give outputs corresponding to the inputs

What is SAGE





- Individual components from the given options can be added
- Their inputs, outputs, geometries, constraints, functions can be specified
- The processes can be solved and optimized