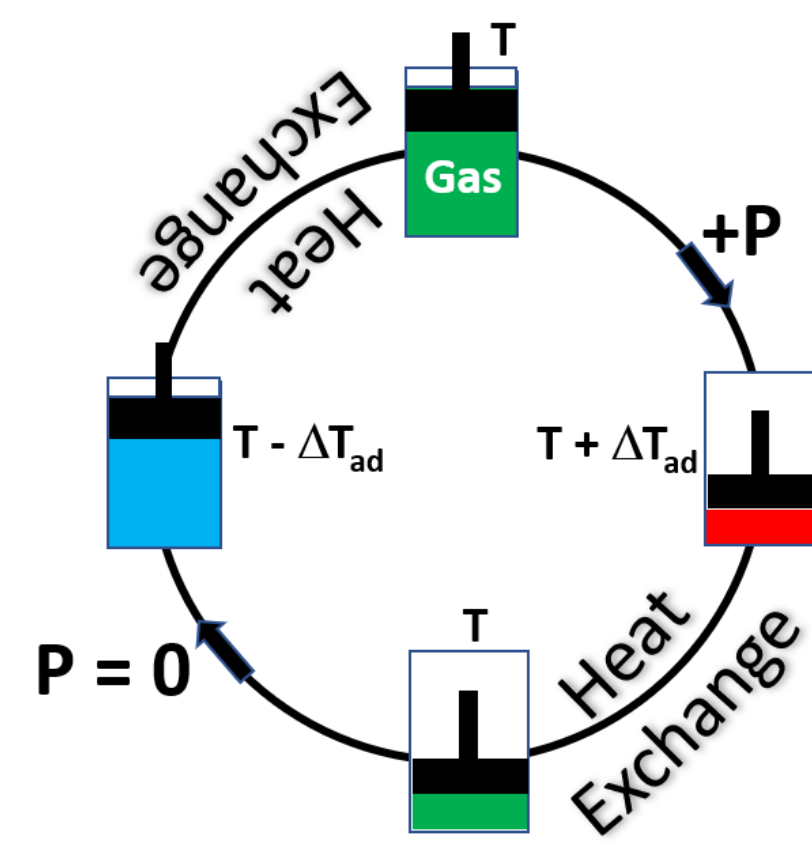
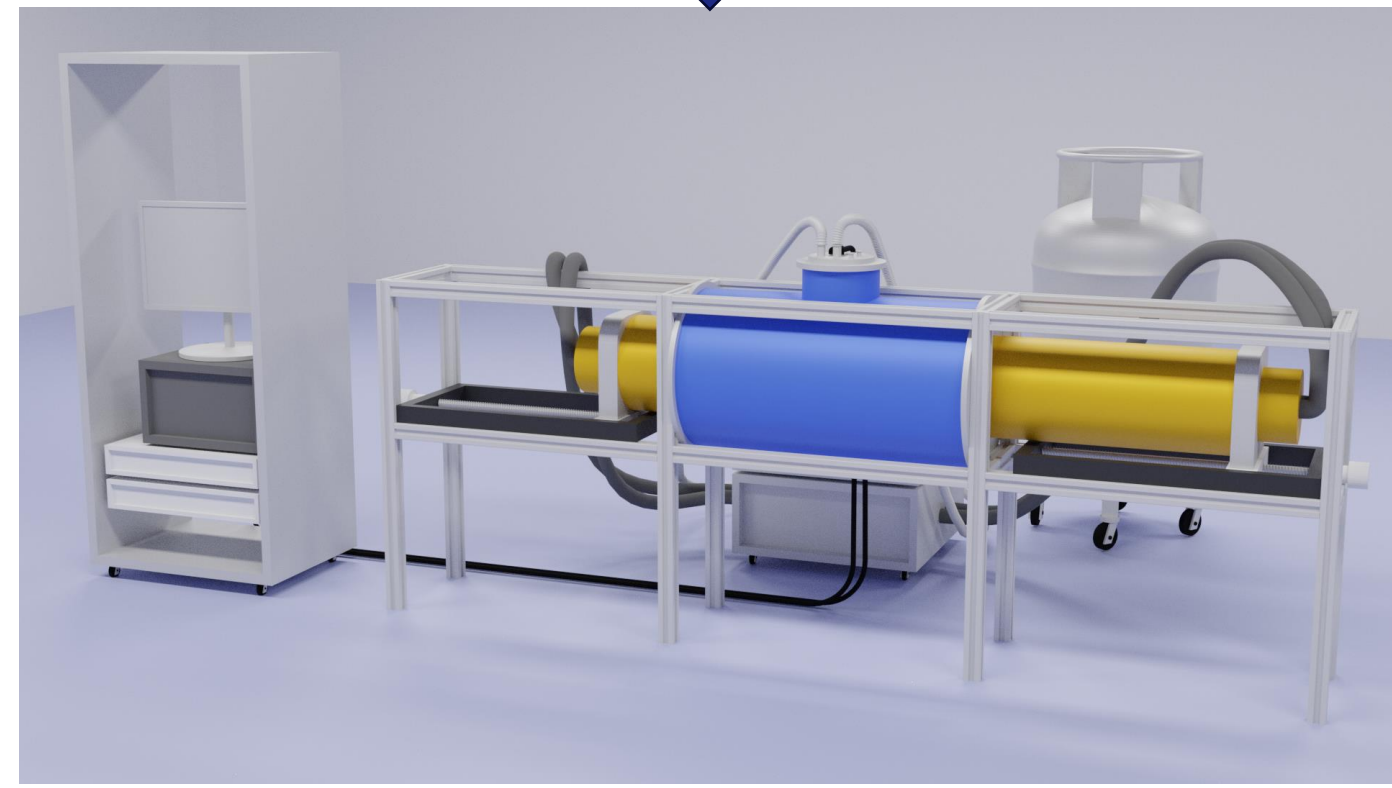


What is it all about?

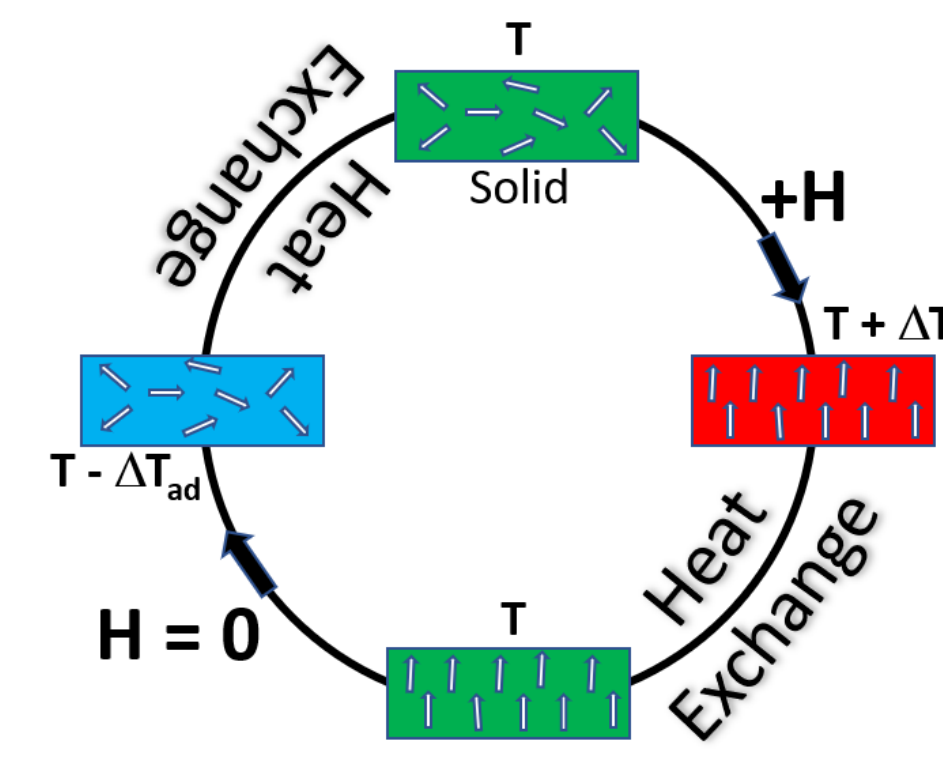
Hydrogen is commonly liquefied by gas compression-expansion. Our goal is to replace this process for temperatures <100 K with a magnetic refrigeration cycle.



Gas compression-expansion cycle

P pressure
 H magnetic field
 T temperature

■ hot
■ ambient
■ cold



Magnetic refrigeration cycle

Gas compression-expansion

- High energy demand (10-12 kWh/kgH₂)
- High CAPEX and OPEX
- Big and complex installation
- Suffers from “economy of scale”

MCHL technology

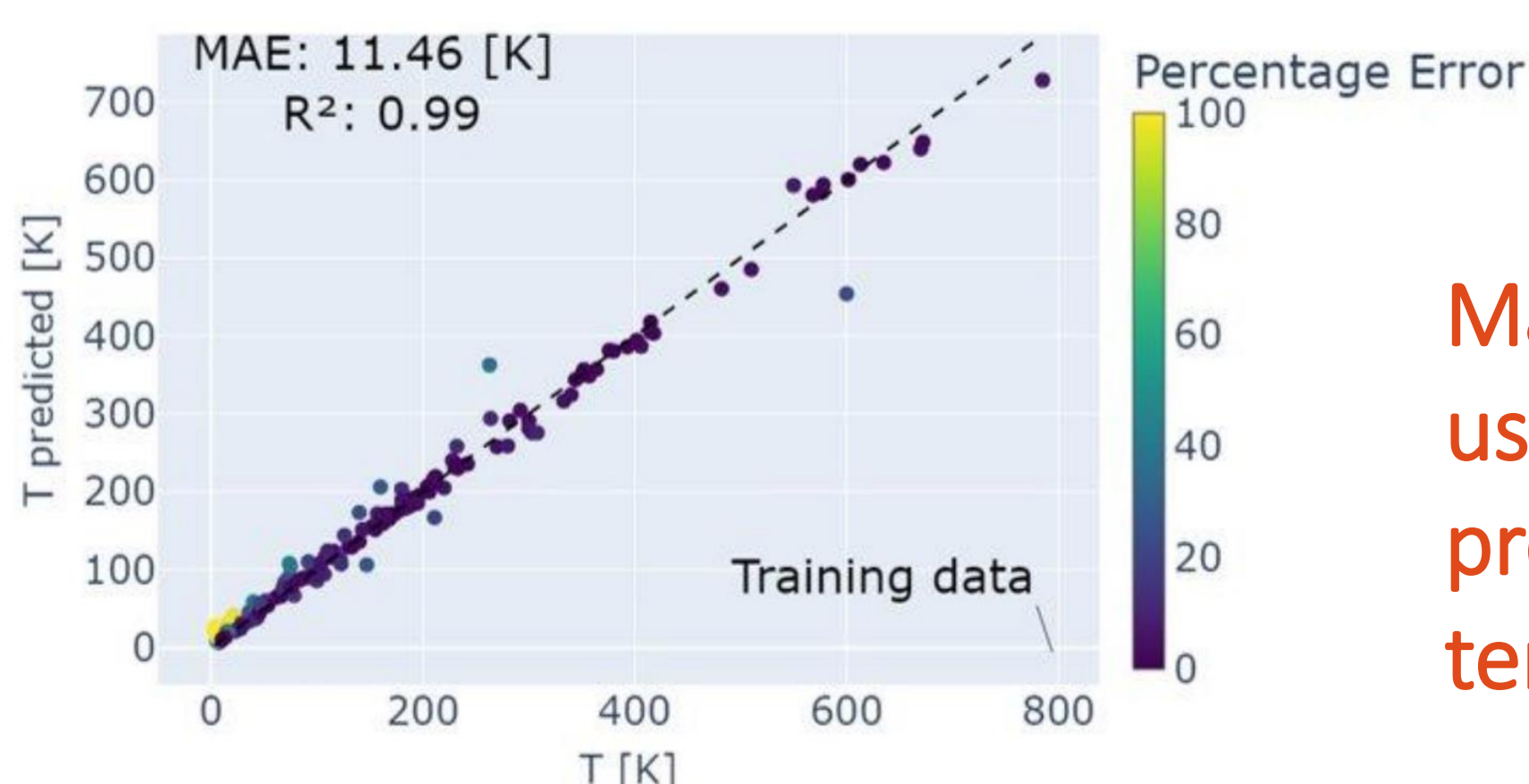
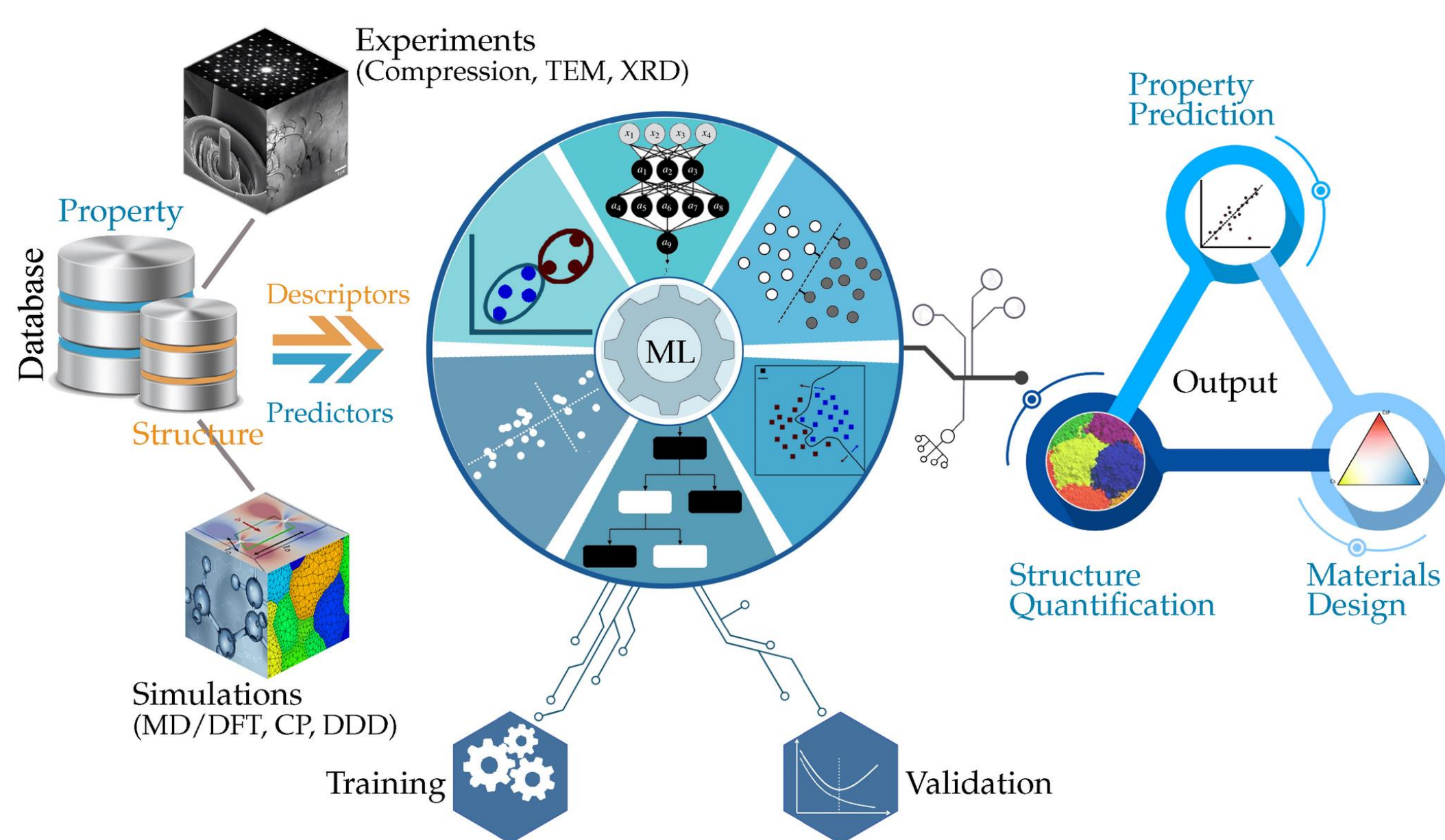
- Low energy demand (5-6 kWh/kgH₂)
- Low CAPEX and OPEX
- More efficient at smaller scale (1-5 TPD)
- Flexible to adopt to fluctuating load

What are the challenges?

Immature technology (needs 7-10 years to achieve market penetration).
 The use of critical raw materials (rare earth elements) and cobalt.
 Insufficient heat exchange. Needs to be improved to reach full potential.

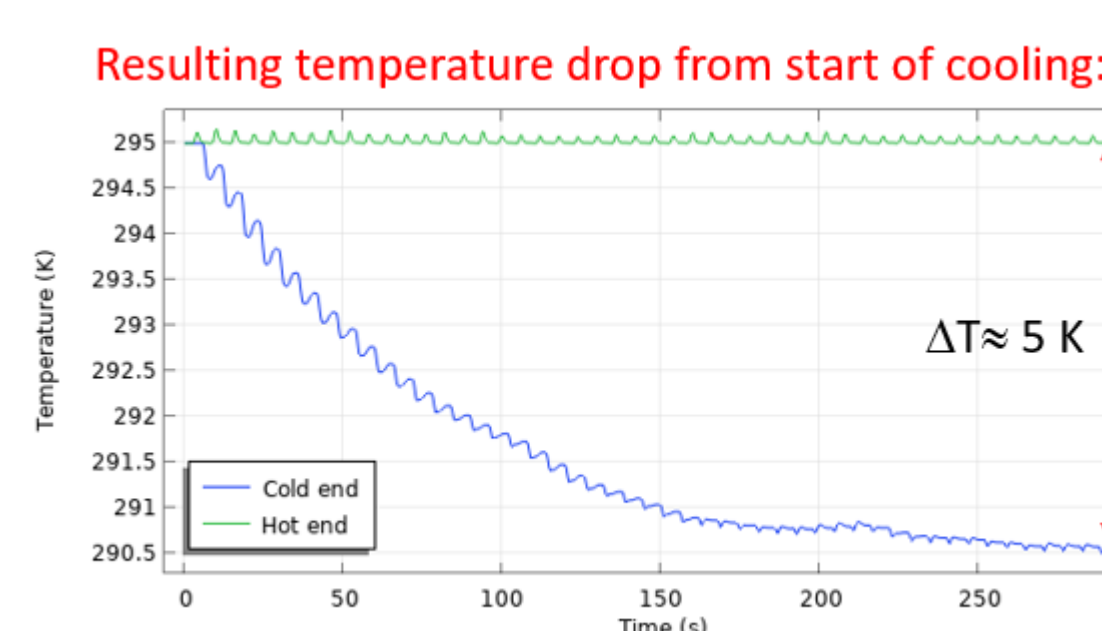
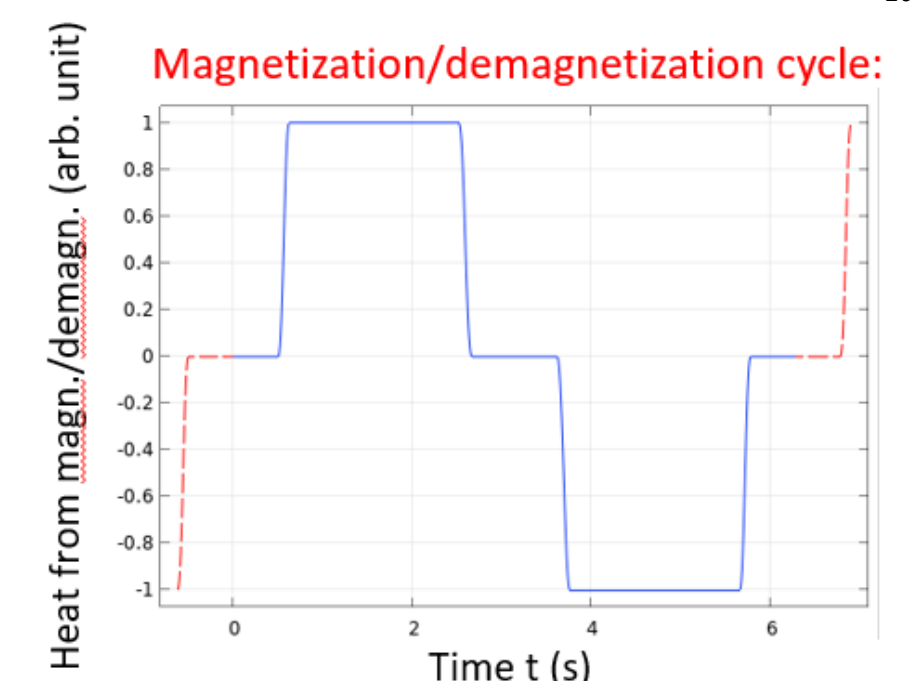
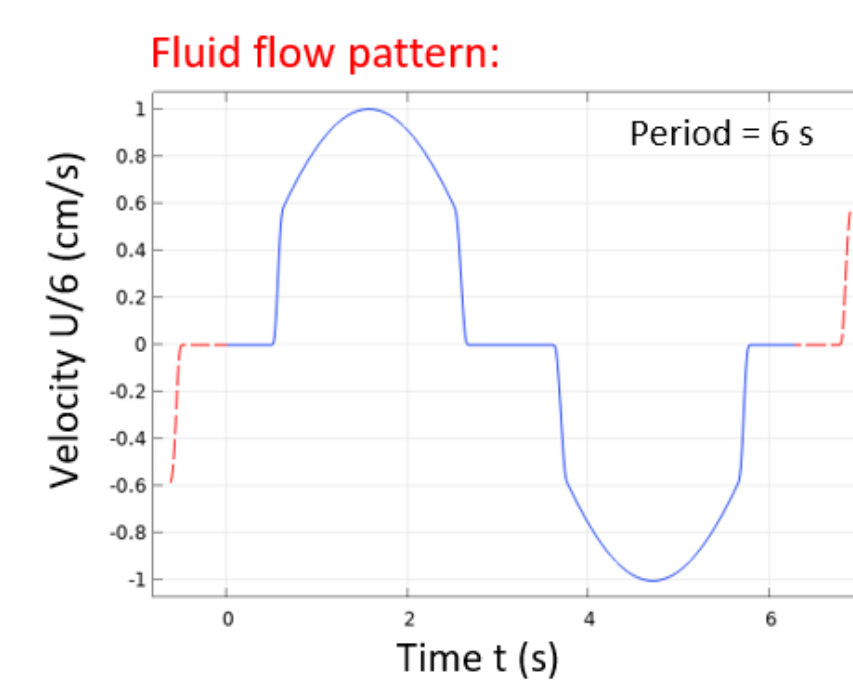
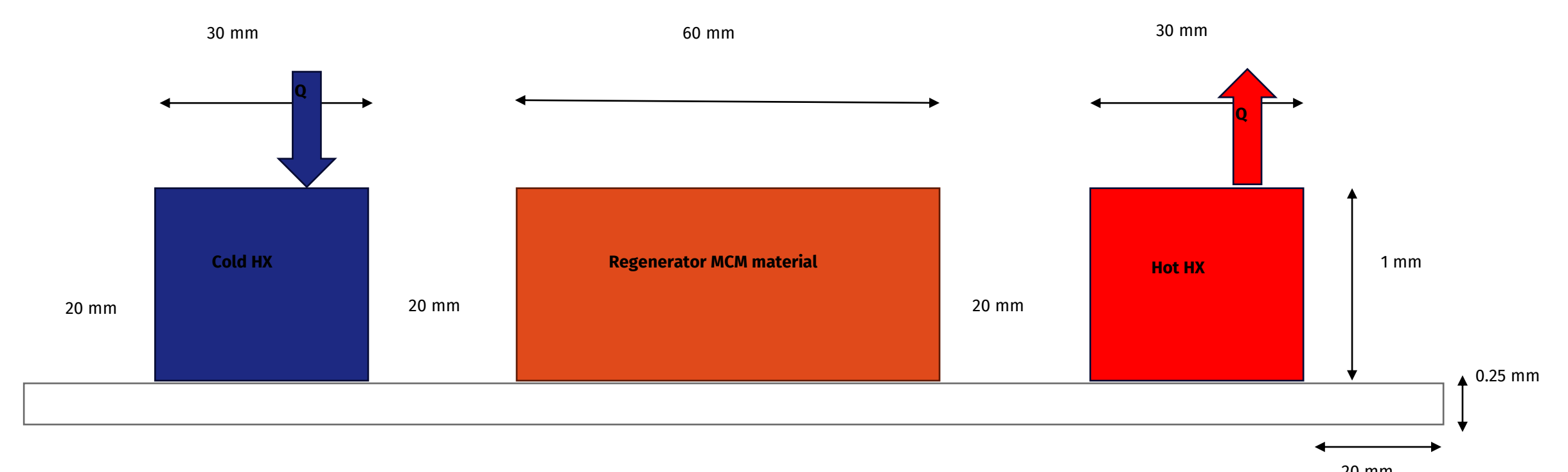
What are we doing in HYDROGENi?

Replace critical raw materials



Materials Informatics using machine-learning to predict magnetic ordering temperatures

Improve heat exchange



COMSOL simulation of active magnetic regenerator / heat exchanger for MCHL