Romaine Kunst
Demcon Kryoz

Zero-vibration cryocooling for Einstein Telescope

18-09-2025

Consortium

COOLL

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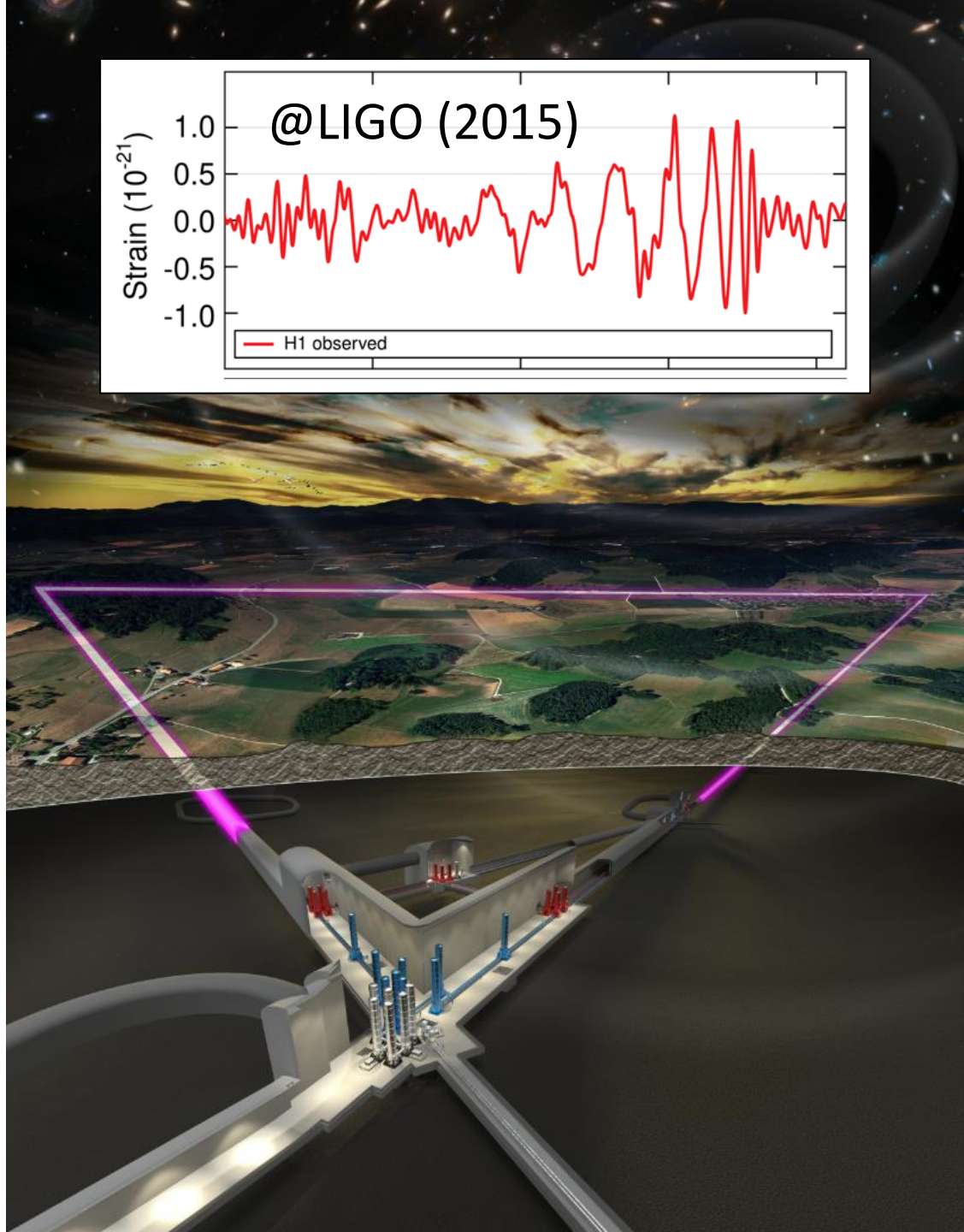
UNIVERSITY OF TWENTE.

Einstein Telescope

Next generation gravitational wave detector

- Requires **ultra-stable cryogenic cooling** to reduce noise, demanding precise thermal control at temperatures as low as **10 K (-265°C)** in an ultra-high vacuum environment

- Traditional cryocoolers cannot meet the extreme vibration requirement of **32 nm peak-to-peak**



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ETpathfinder

- ETpathfinder is a **R&D infrastructure** for technology benchmarking by testing and prototyping innovative concepts and enabling technologies for the Einstein Telescope

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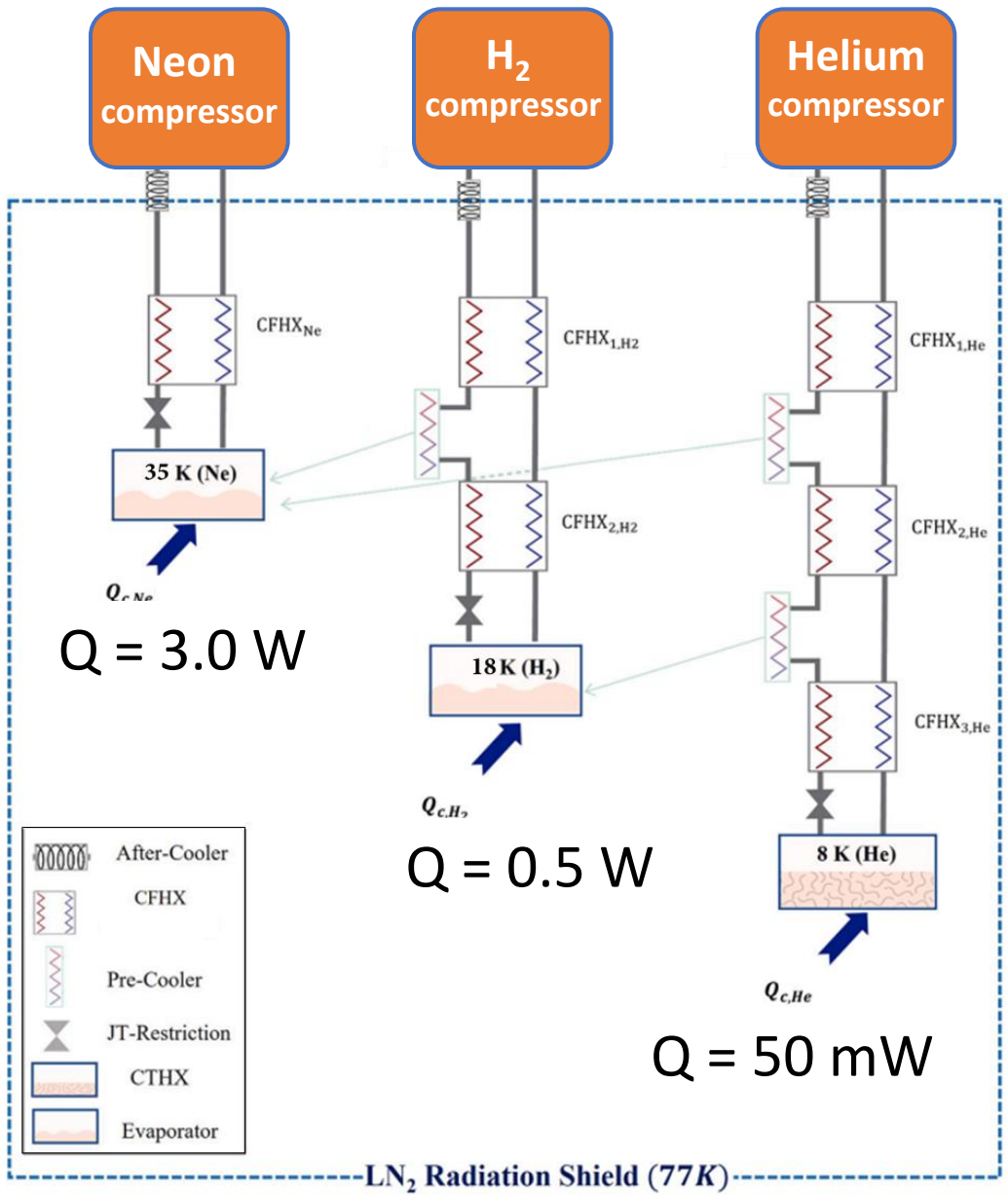
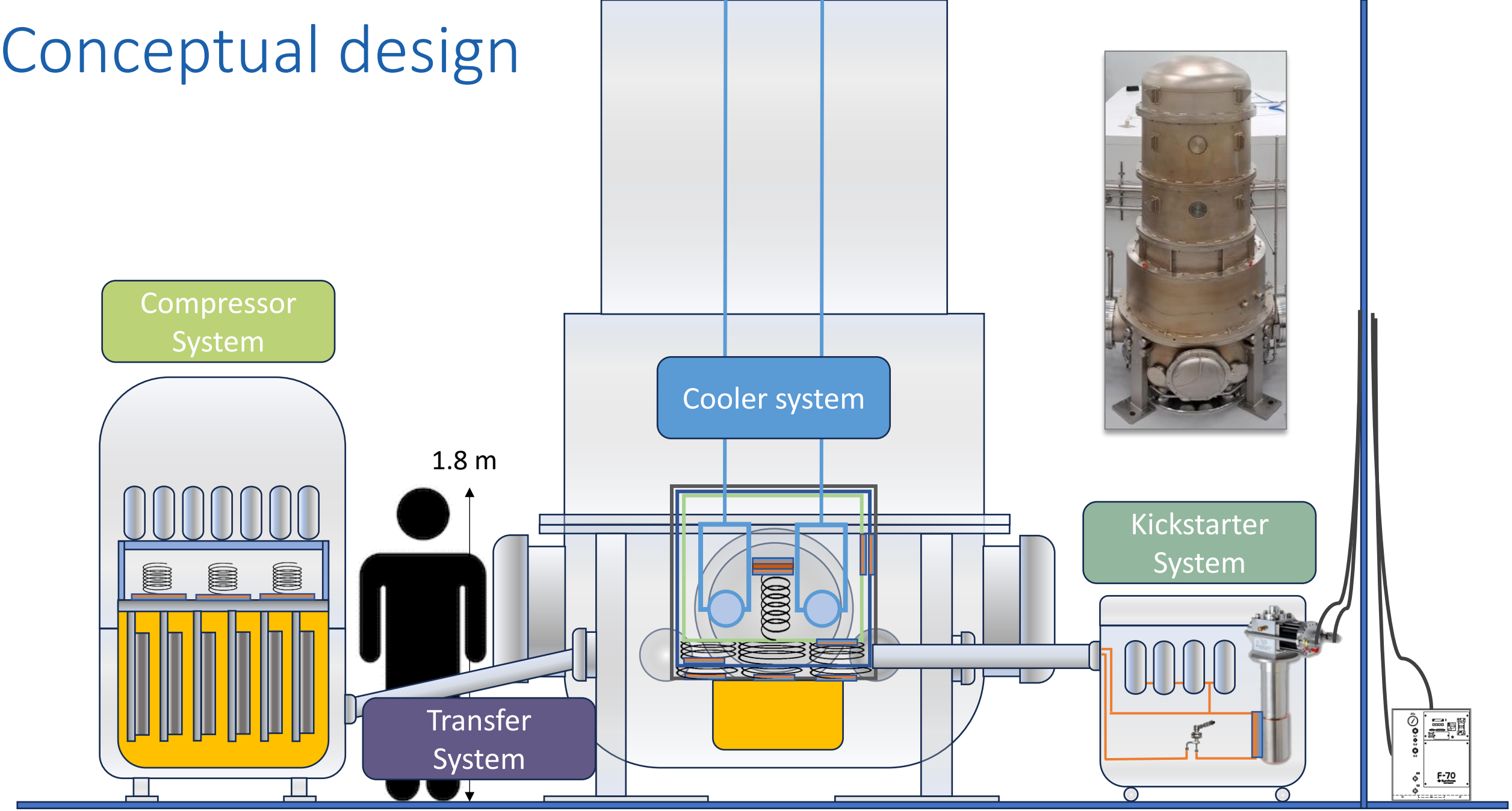
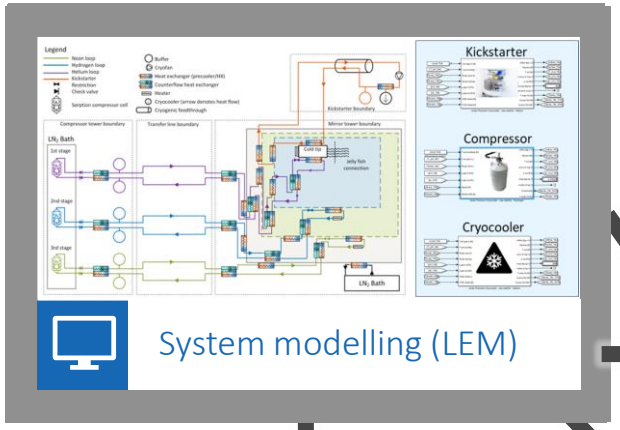
ETpathfinder

- Our solution is a **sorption based** 3-stage Joule-Thomson cryocooler
- Neon / Hydrogen / Helium stages
- Sorption compressors to achieve compression without moving parts



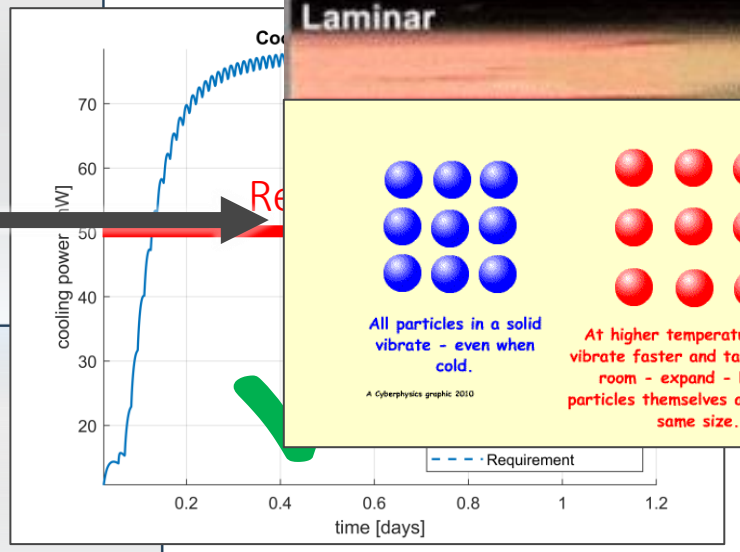
Conceptual design

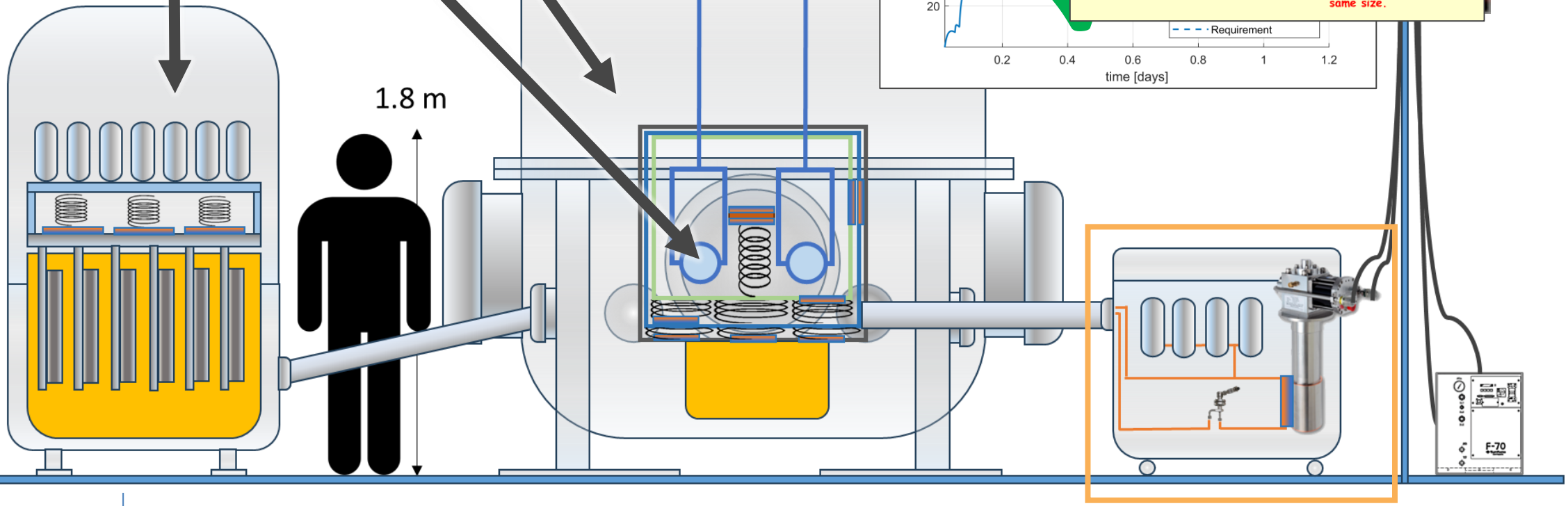




Requirement verification

-265°C





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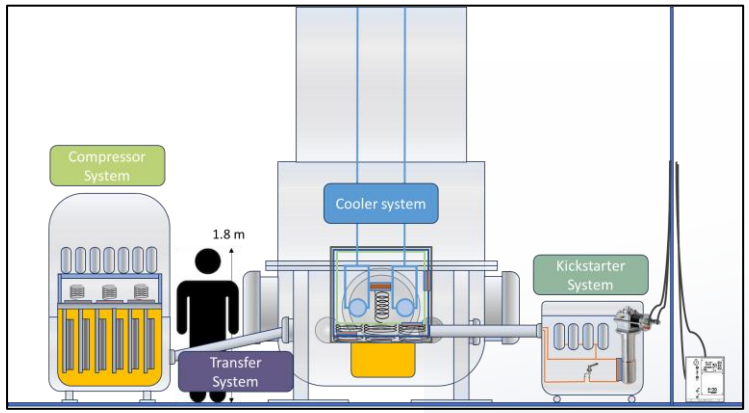
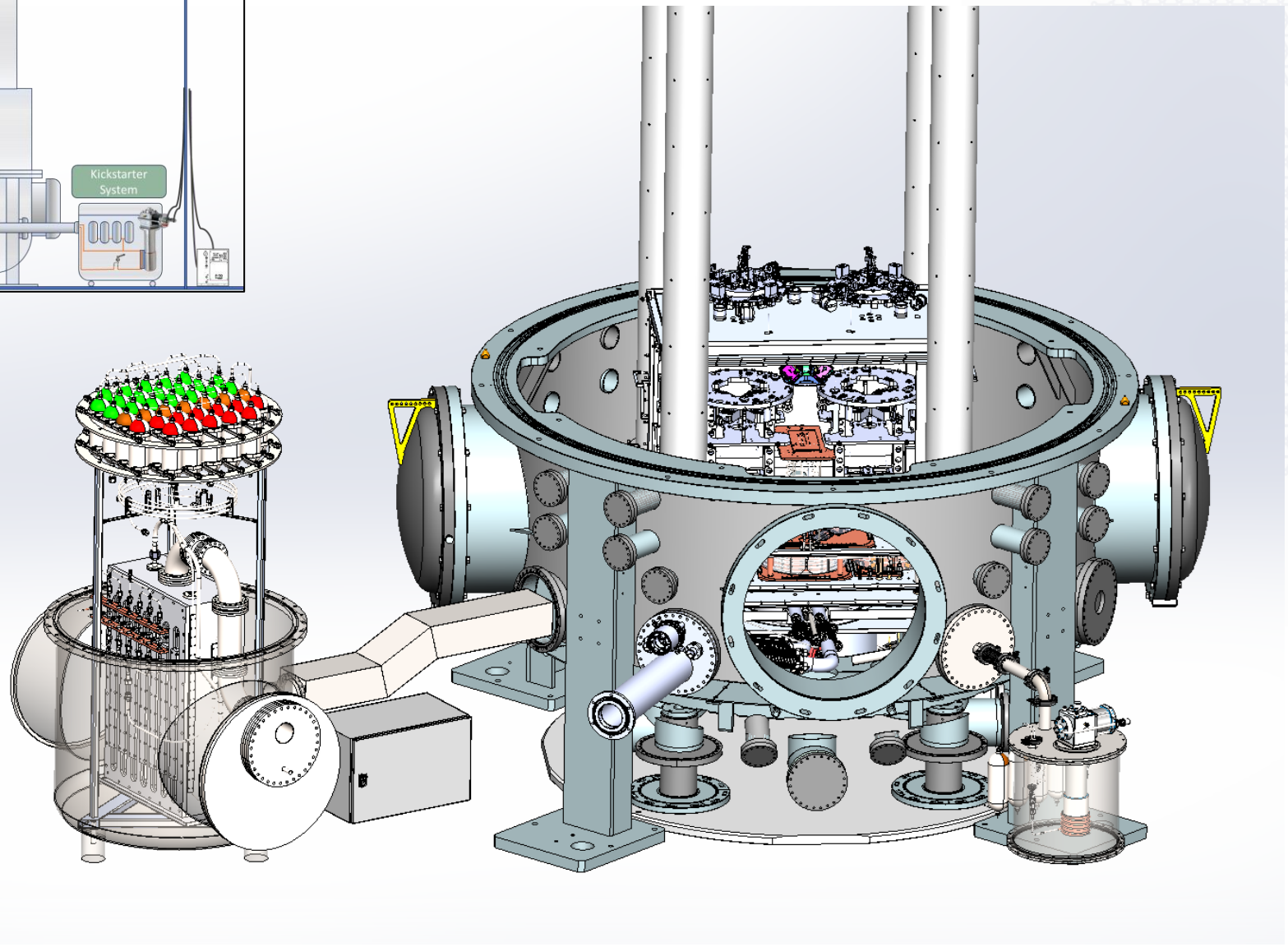
Conceptual design

Detailed design





Assembly & lifetime testing

- Sorption cells tested
  - Burst testing ✓
    (>430 bar @cryo, requirement: 97 bar)
  - Lifetime testing ✓
    (pressure cells tested up until 1M cycles)
- Vibration testing
  - Fluid Induced Vibrations ✓

Thanks for listening!

- Questions?