

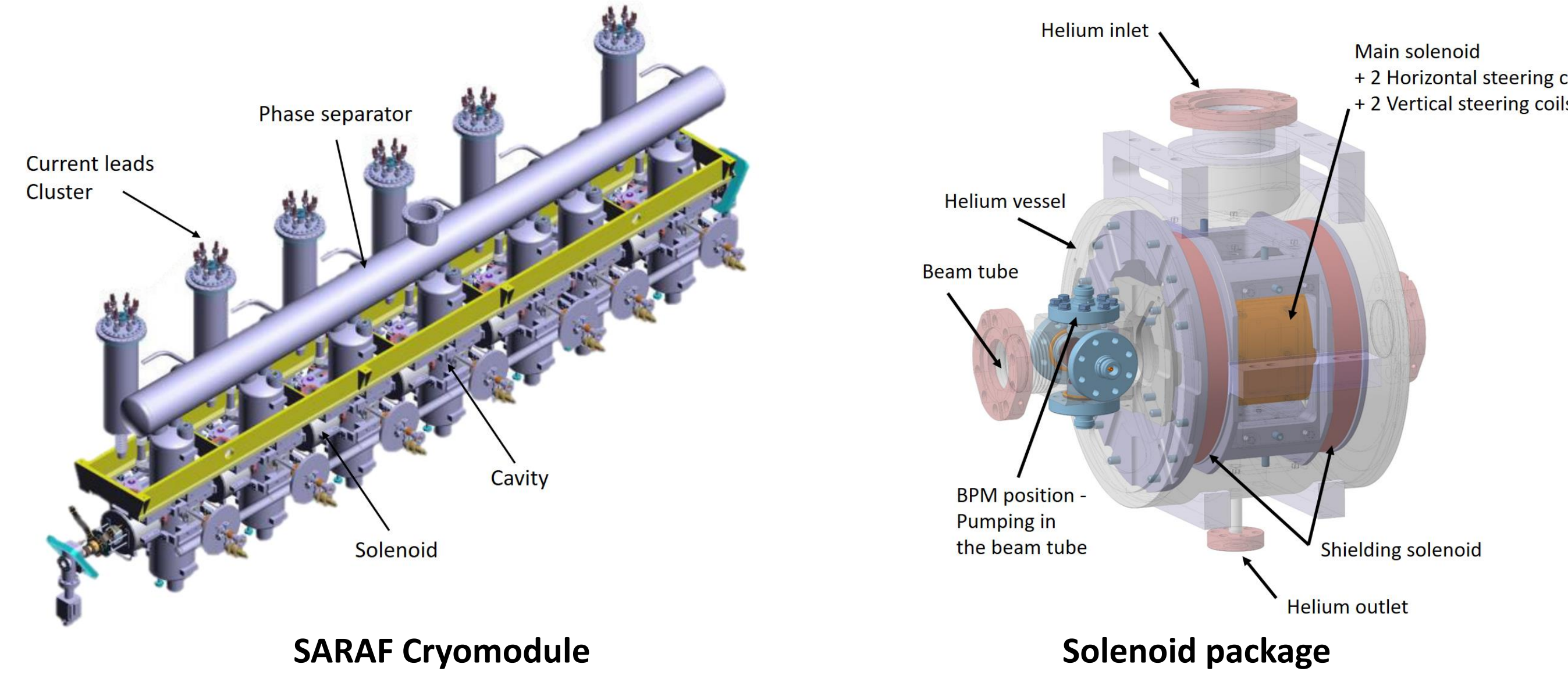
Compact cryogenic test stand for superconducting magnets characterization

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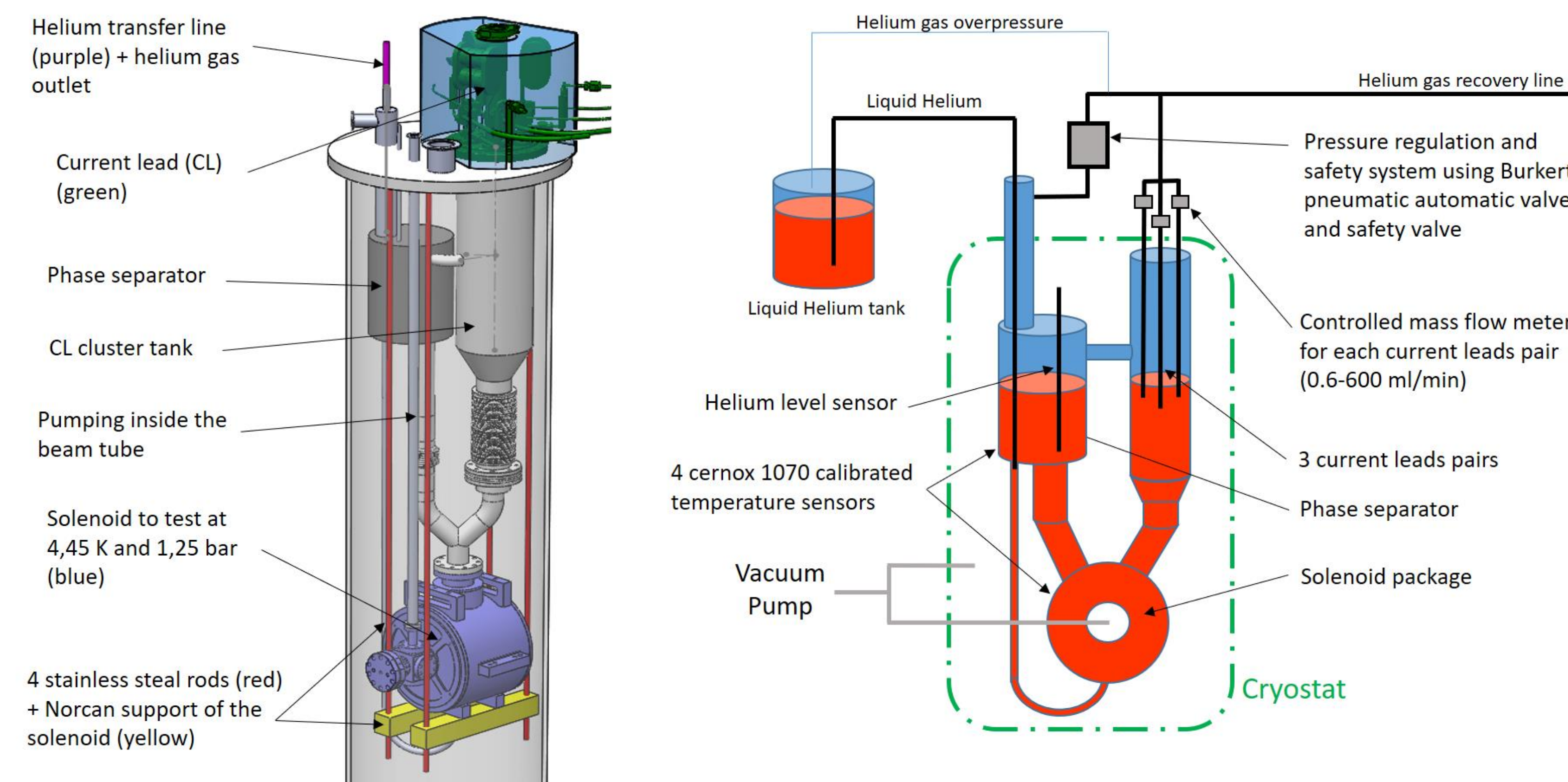
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SARAF (Soreq Applied Research Accelerator Facility)

- Continuous wave (CW), proton and deuteron accelerator
- 20.1 m long** Superconducting Linac (SCL) made of **4 Cryomodules**
- 20** superconducting identical **Solenoid Packages (SP)** located between cavities
- Maximum peak field on-axis is **5.8 T**
- Operating Pressure : **1.25 bar** and Operating Temperature : **4.45 K**

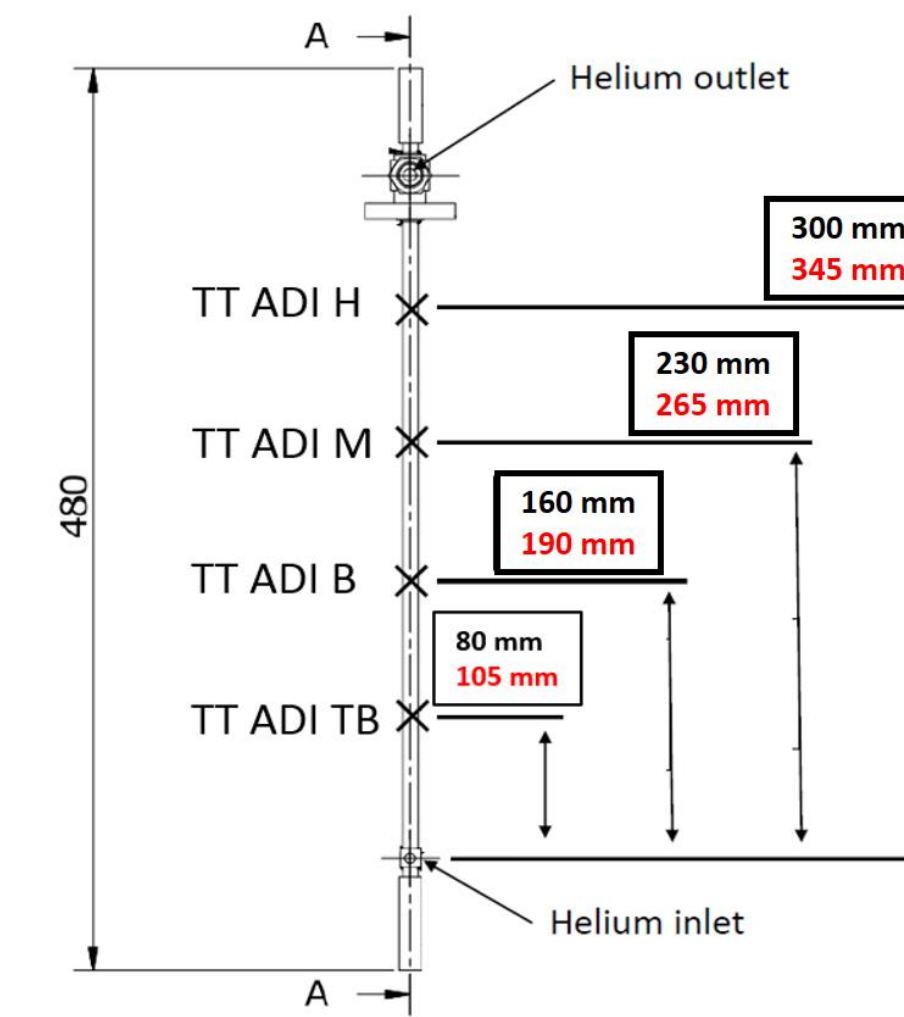
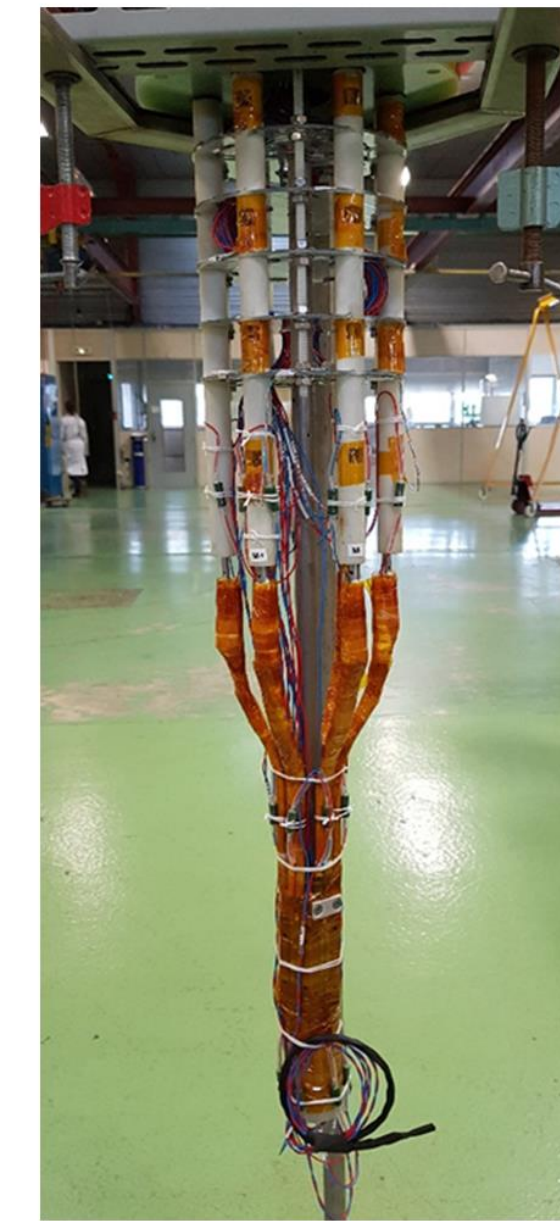


Solenoid package test bench



- Specific “insert” designed with a phase separator (**5 L**) and a current lead tank connected at the bottom of the solenoid package and placed in a **0.4 m** diameter and **1.7 m** height cryostat.
- 32 voltage taps** to measure the electronic behavior of the different coils and their current leads
- Pressure regulation at 1.25 bar inside the helium tank using Burkert® automatic valve
- 1 liquid helium level sensor inside the phase separator tank
- 4 Cernox® (1070) at the surface of the helium tank to monitor the temperature
- National instrument® + LabVIEW® Software for the acquisition of the temperature, pressure, voltage and magnetic field

Current lead cluster



Position of the temperature sensors on the current leads

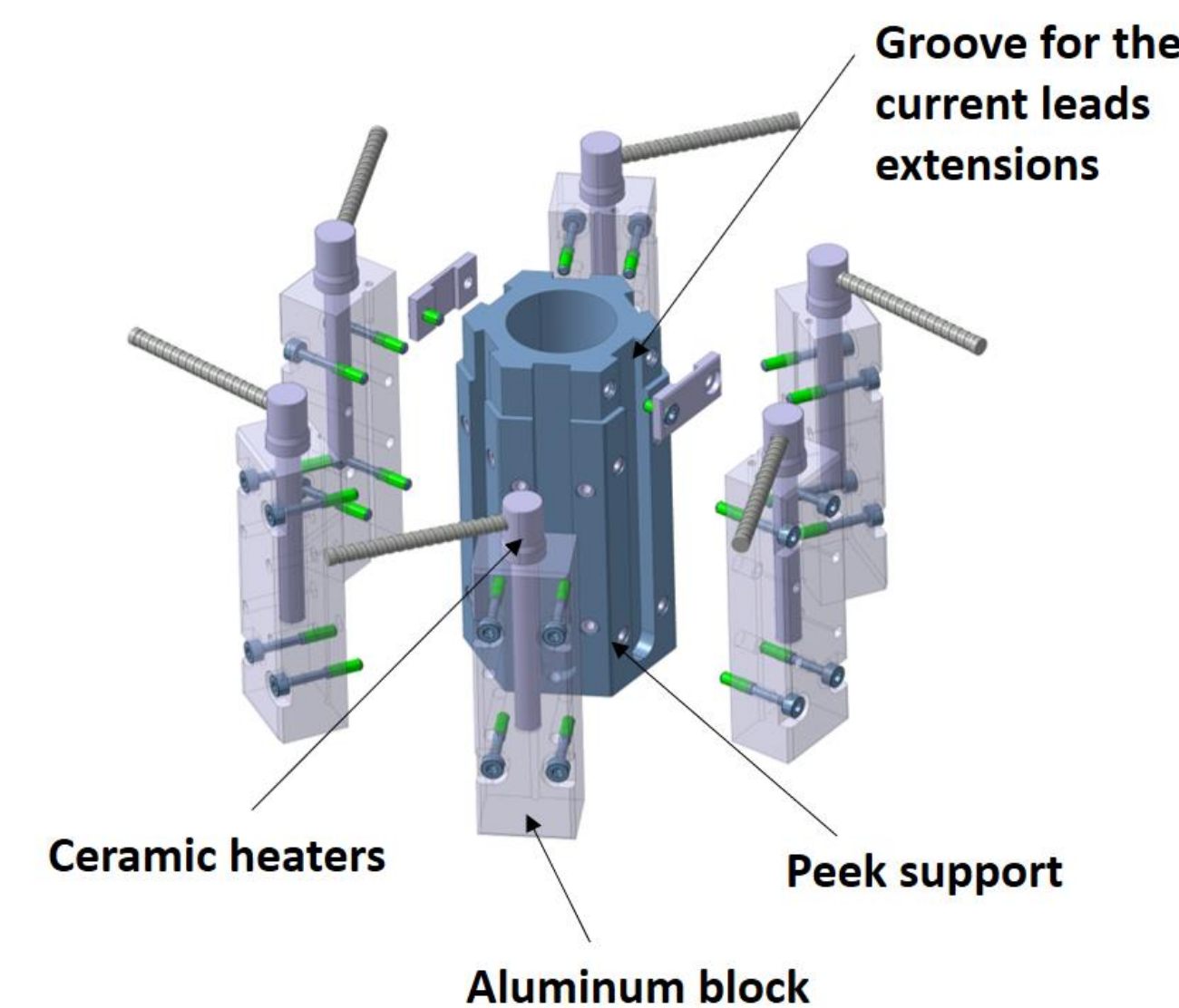
- 3 CAEN® power supplies : One delivers a maximum current of **100 A** and the other two delivers a maximum of **25 A**
- “Burn-proof” brass braid current leads
- 4 platinum sensors (**PT100**) along two current leads glued at the surface of the stainless steel tube surrounding the brass braid
- Red-Y Mass flow meter** (0.6 to 600 mL/min) and Burkert solenoid valves connected to each of the 3 current leads pairs
- National Instrument® Ni 9265 card with LabVIEW® software to control the valve and regulate the helium mass flow of the current leads

Brazing tool

Superconducting cable Joints with Current leads

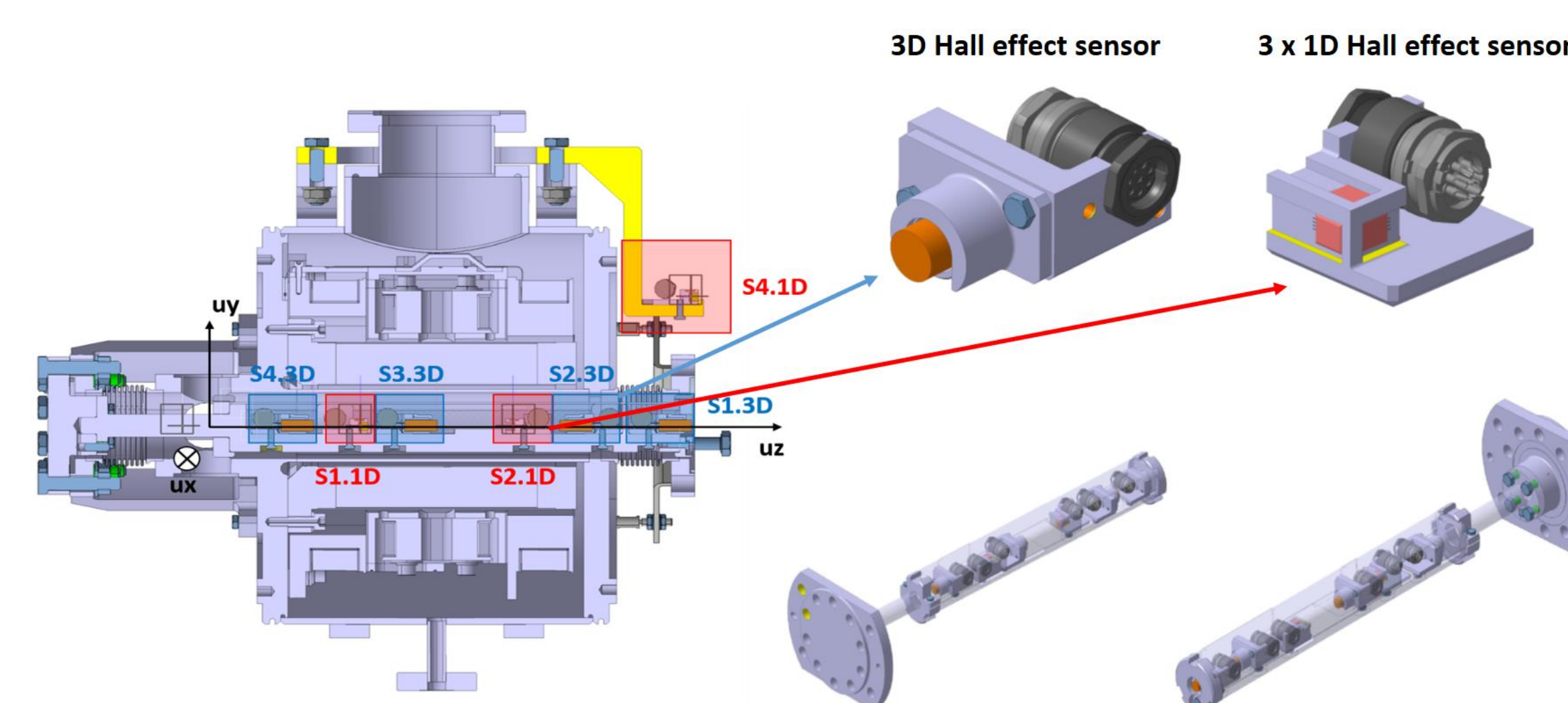


Brazing tool attached on the current leads



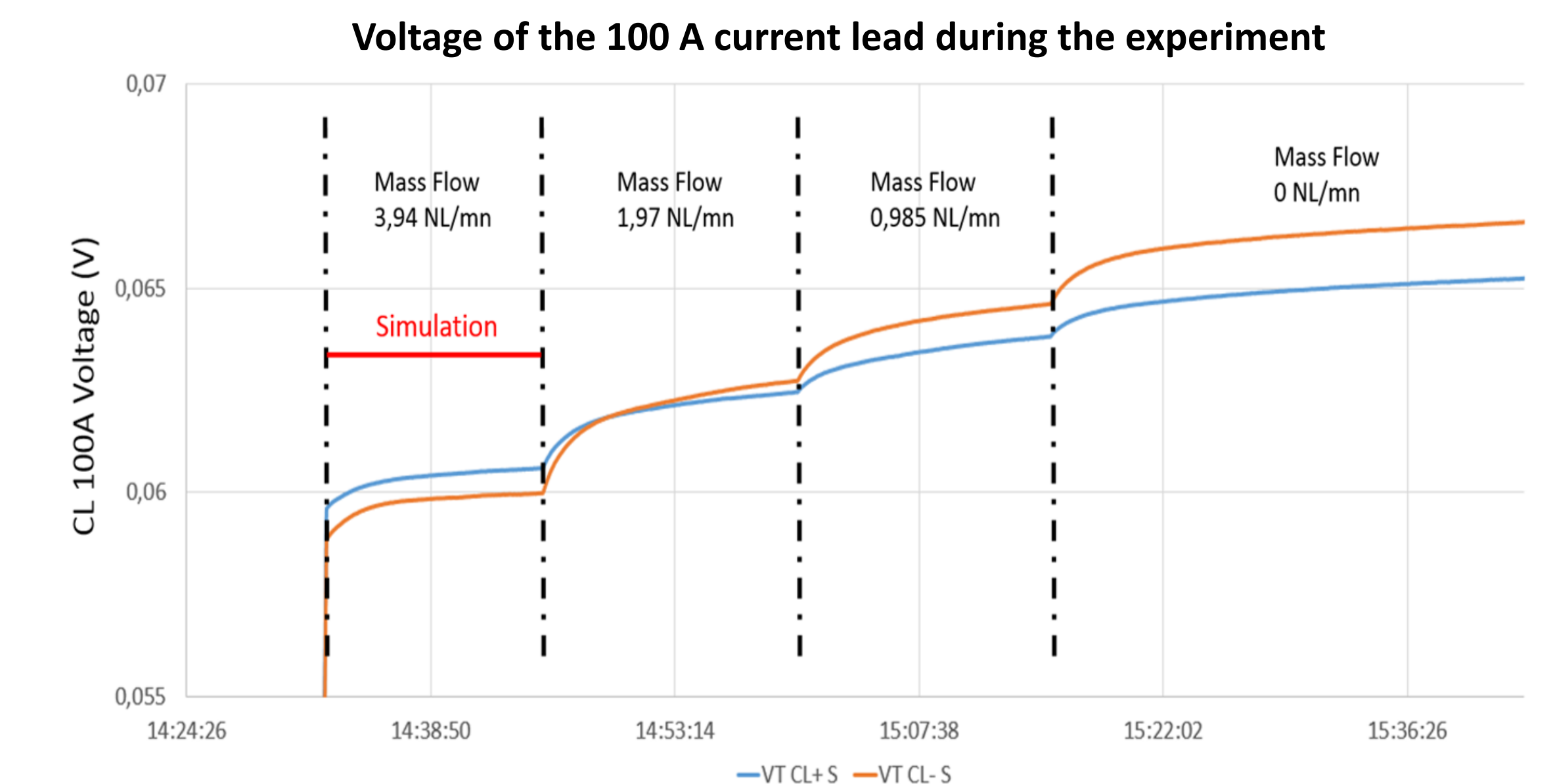
- Specific tool for the silver brazing process
- Peek** support maintains the 6 current lead extensions and electrically isolates each current lead
- 6 aluminum blocks** with ceramic heater, placed on the top increase the temperature up to 250 K
- 1 PT100** placed inside one of the aluminum blocks to regulate the temperature

Magnetic field measurement system



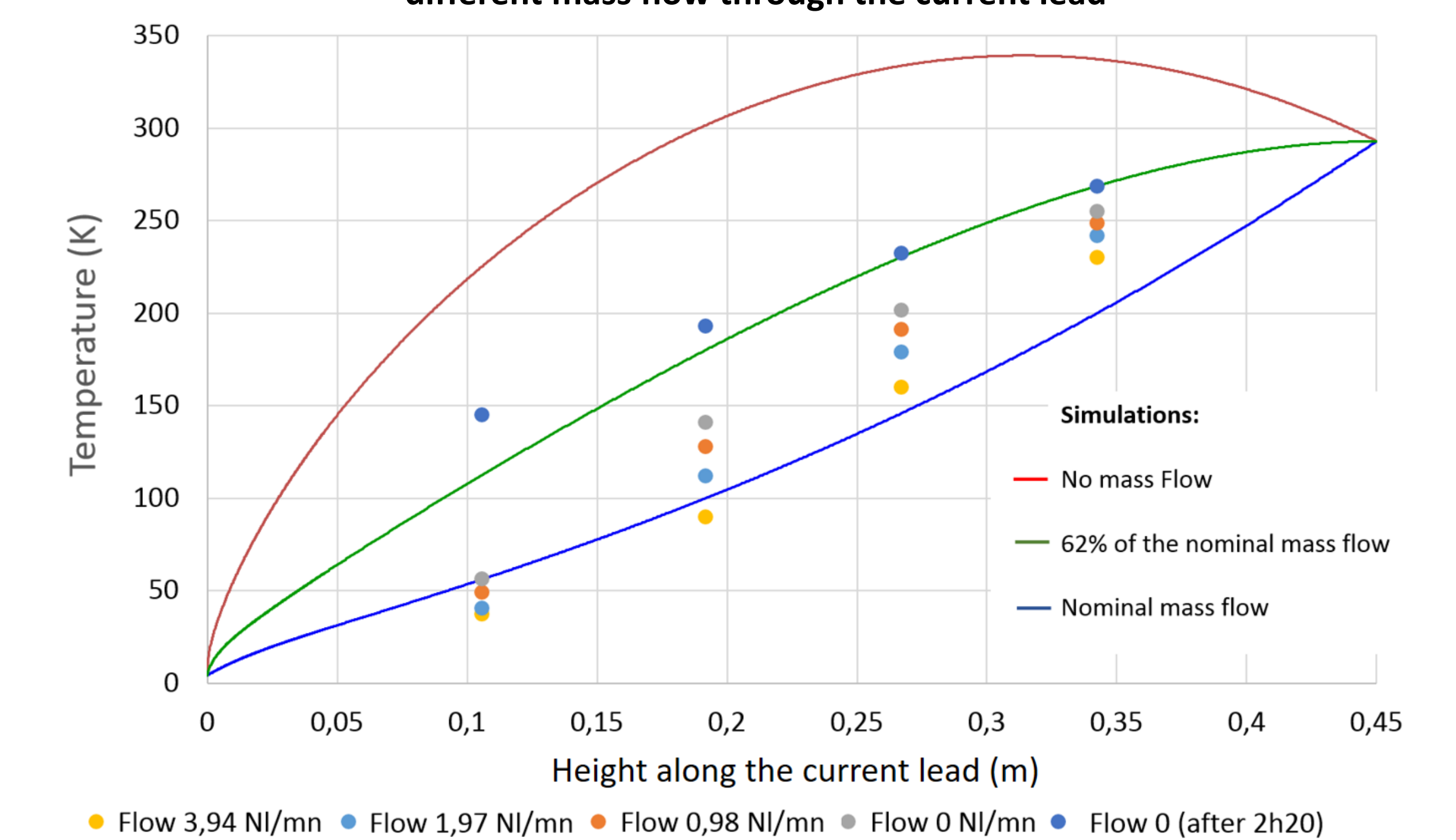
- Individual 3D and 3 x 1D sensor supports, with the main support to be in the beam tube
- All the sensors are connected to Arepoc® USB2AD-modules (programmable resolution 20-24 bits) controlled with LabVIEW®

Current leads Tests results



- Tests at nominal helium mass flow and without helium flowing inside it
- Voltage 5% lower than the simulations performed at nominal conditions
- Voltage never reached the maximum value of the simulation (84 mV) without helium flowing inside the current lead
- No significant thermal or electrical unbalances

Temperature along one 100 A current lead compared to simulation considering different mass flow through the current lead



- No hot spot (above 300 K)
- Temperatures below the temperature profile with 62% of the nominal mass flow

Conclusions

- First result on the prototype current leads cluster has shown better thermodynamic and electric behavior than expected
- The test bench is ready for future tests on the prototype solenoid package