Cubism - Braque's Bottle and Fishes, Paris c.1910-12

Filter update

June 15th 2020
James Sinclair, LHEP

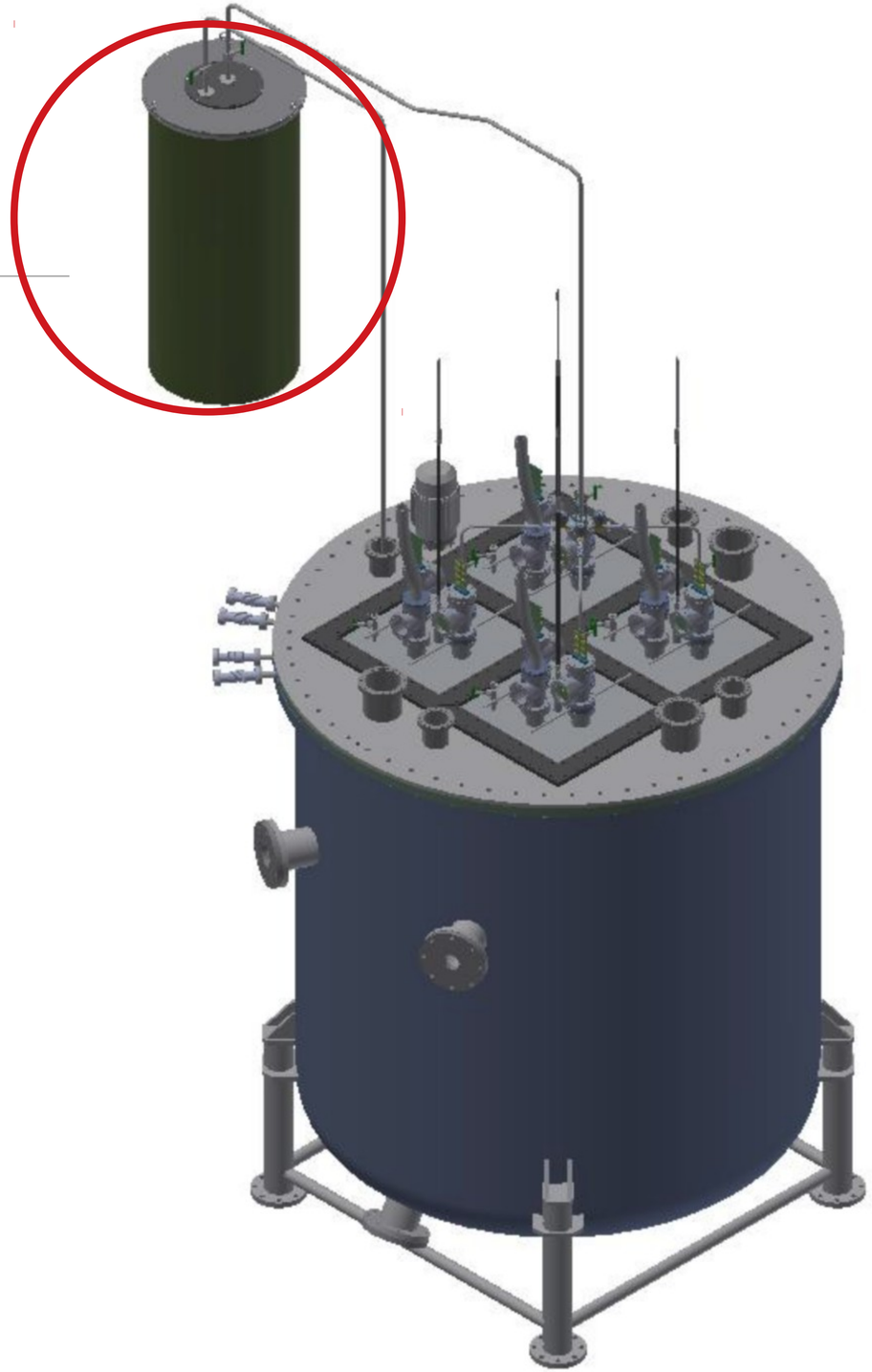
LAr circulation in 2x2

LAr is extracted from the base of each module, using a pump mounted in the top flange.

LAr is pumped into and external LN2-cooled filter.

Then directed into the top of the modules.

All external lines are vacuum insulated.



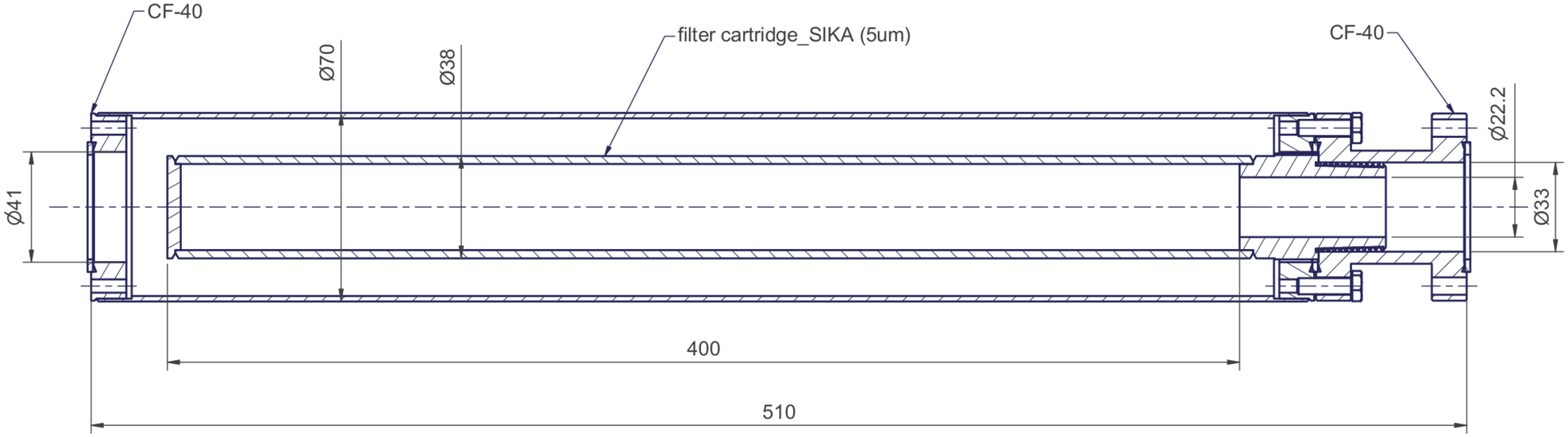
Filter structure

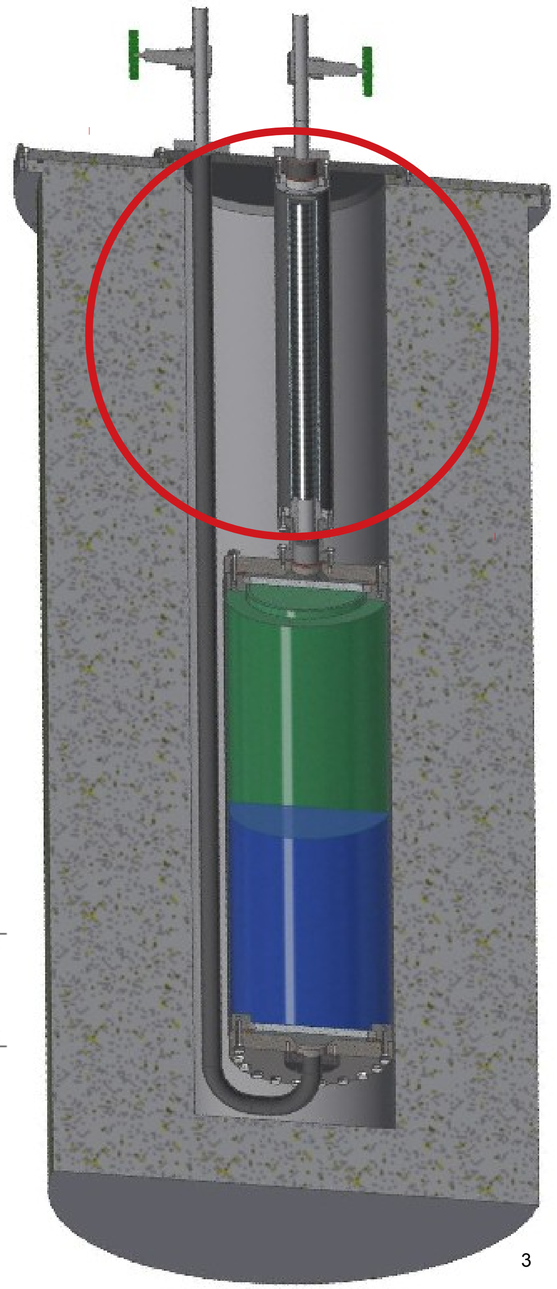
The upper section is a particulate filter; a 400 mm cartridge 1” internal diameter 5 µm sintered stainless cartridge from GKN.

The large surface area is needed to reduce dP across the filter.

As used in MicroBooNE & SBND.

Do not use Swagelok inline filters



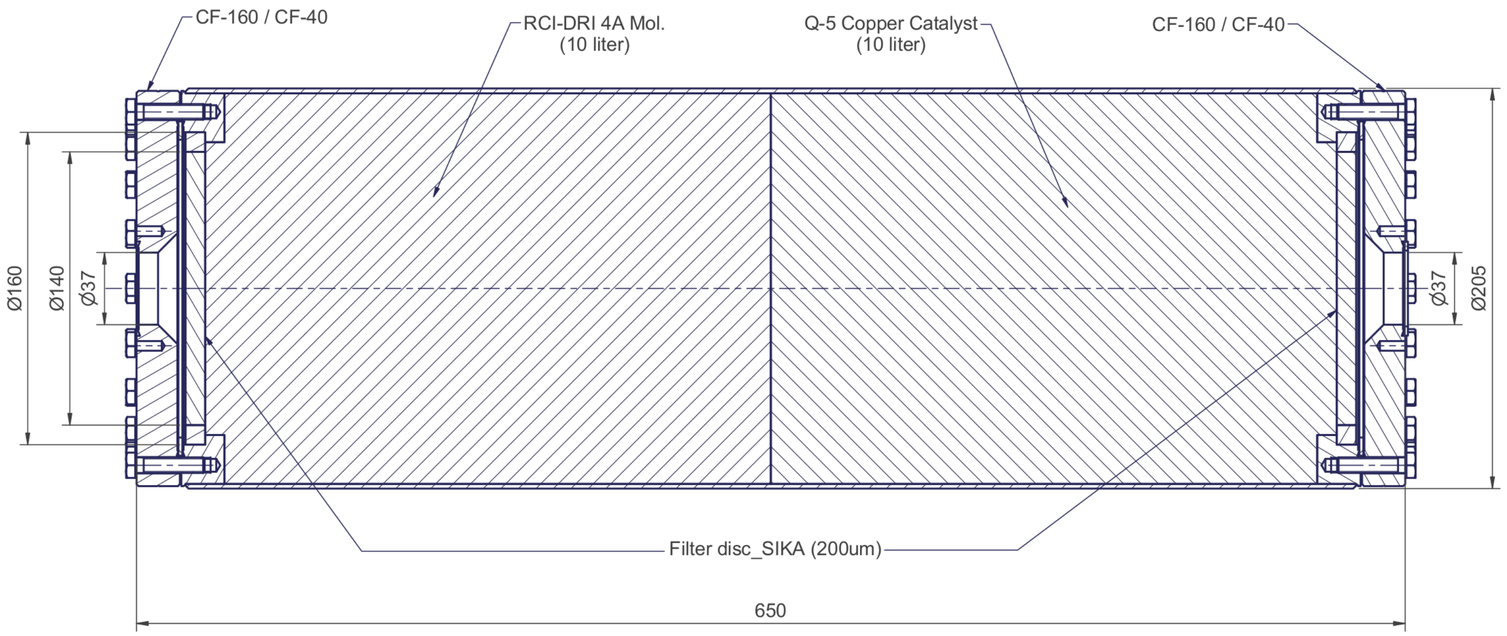


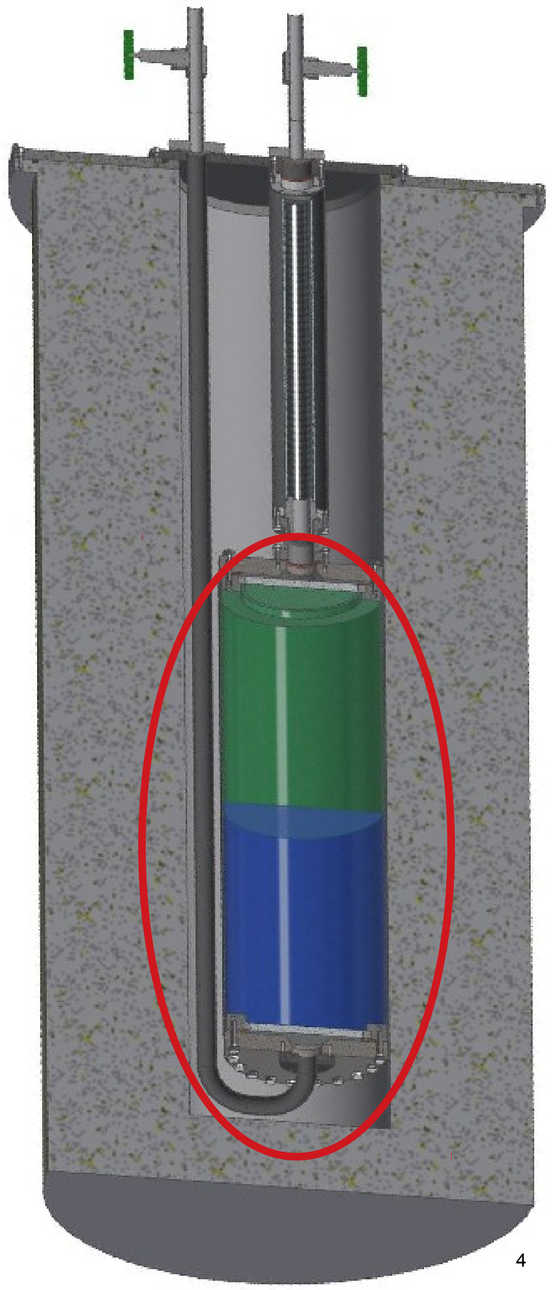
Module outlet

The lower section in an H2O/O2 trap.

Consisting of 10 l of molecular sieve (RCI-DRI 4A Mol-Sieve) and 10 l getter (Q-5 Copper Catalyst) sandwiched between two 160 mm diameter 200 µm sintered stainless diffuser from GKN.

Again, based on the SBND design.





Filter assembly

The filter assembly is nearing completion.

All fabrication is complete and all components have arrived.

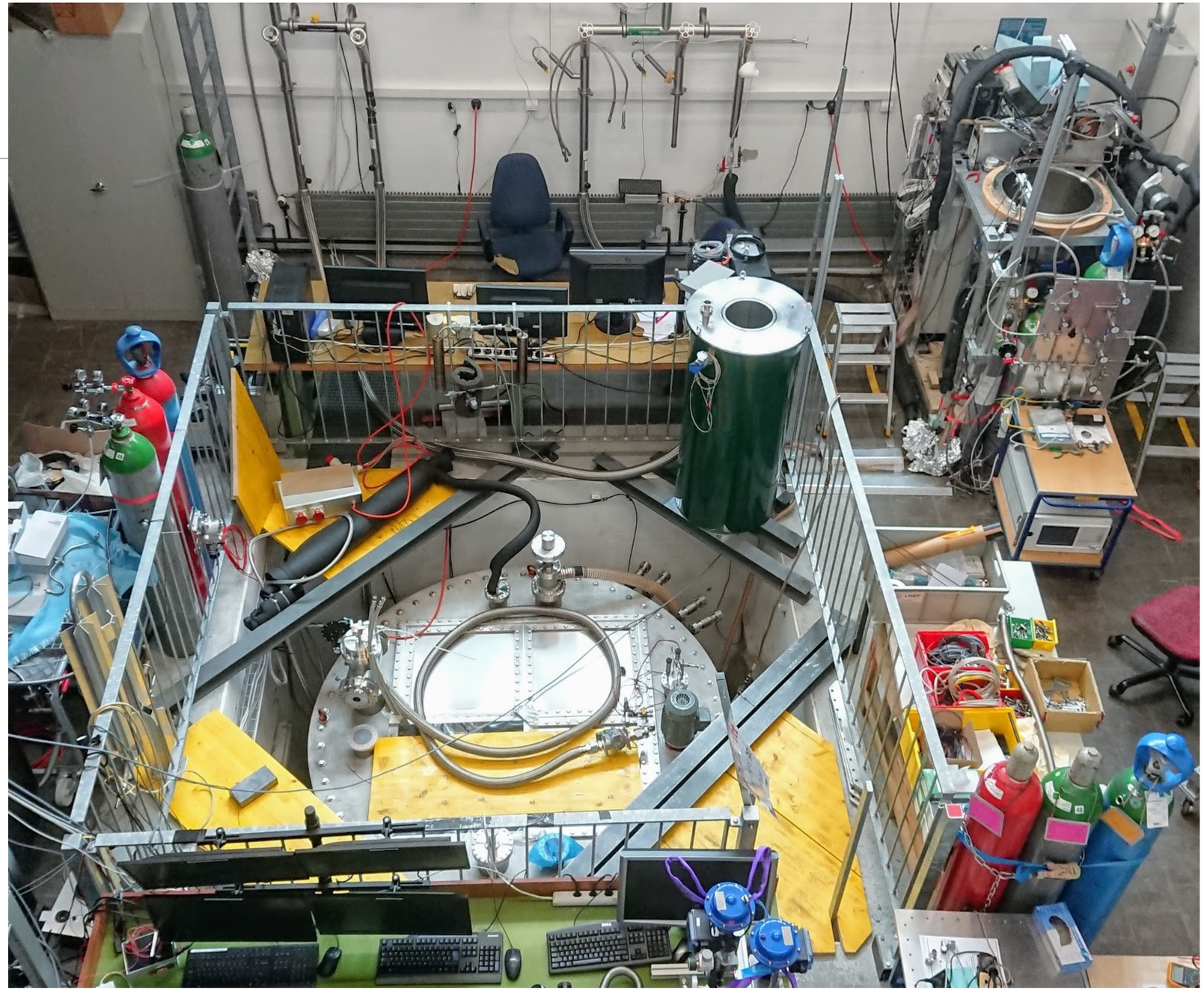
Level metres and temperature sensors are now in place, with associated wiring.

Filter location

The filter cryostat is now mounted at in the corner of the 2x2 pit.

LN2 supply and exhaust lines are in place.

From this location, 4 m lines can be used to connect into the test stand, or the 2x2.



Vacuum insulated lines

Two 4 m long 1” ID vacuum insulated lines have arrived from Demaco.

The lines use a CF40 connection. These will connect into full-metal valves and 6 bar reliefs.

There will be heat loss at the connections, but the ID and insulation will help with maintain LAr flow.

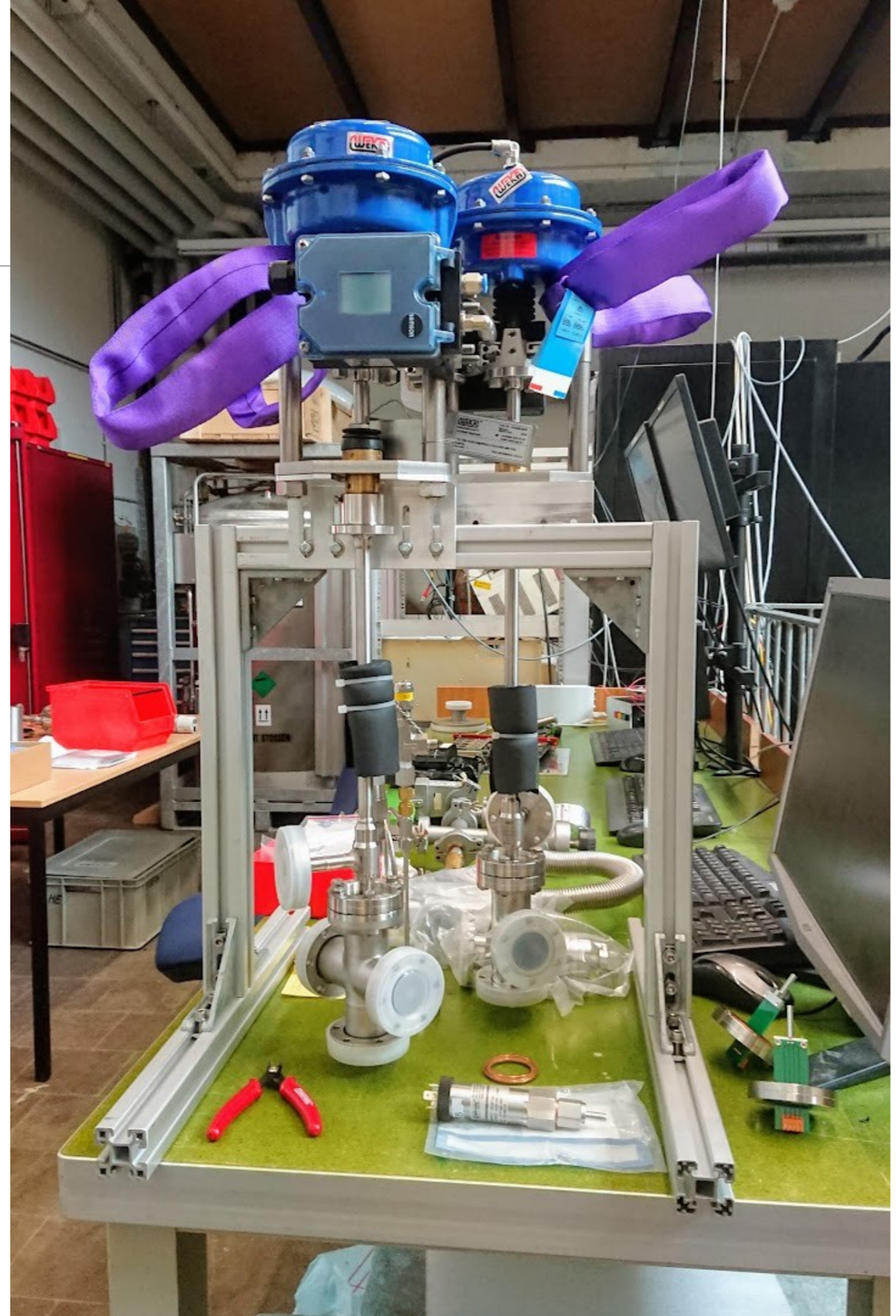
LN2 control valves

We are repurposing a pair of control valves from the 2x2 LN2 cooling lines.

The Weka pneumatically-actuated needle valves are closed-normal at the inlet and open-normal at the outlet.

They are set based on the pressure of the LN2 in the vessel.

2.25 bar = 85 K



Filter regeneration

Fliter regeneration will use hot ARCAL*.

During regeneration the copper getter must not exceed 200°C.

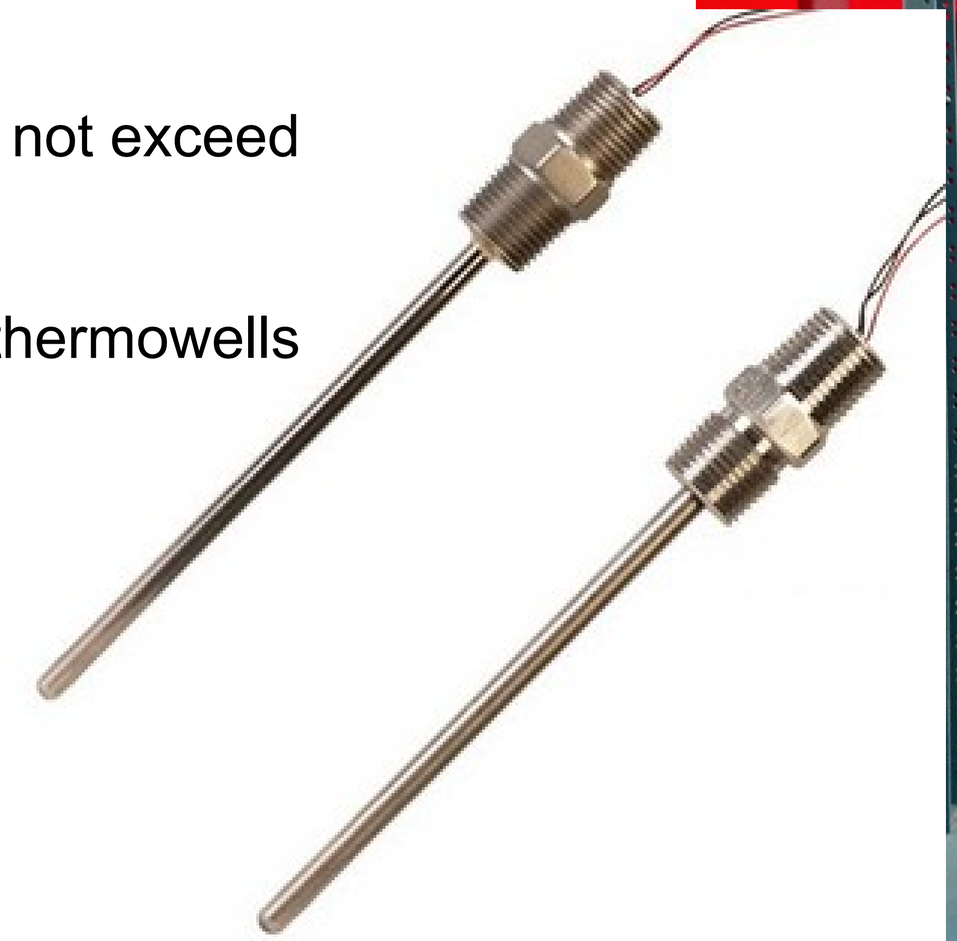
Therefore, we have four RTDs mounted in thermowells in the filter body.

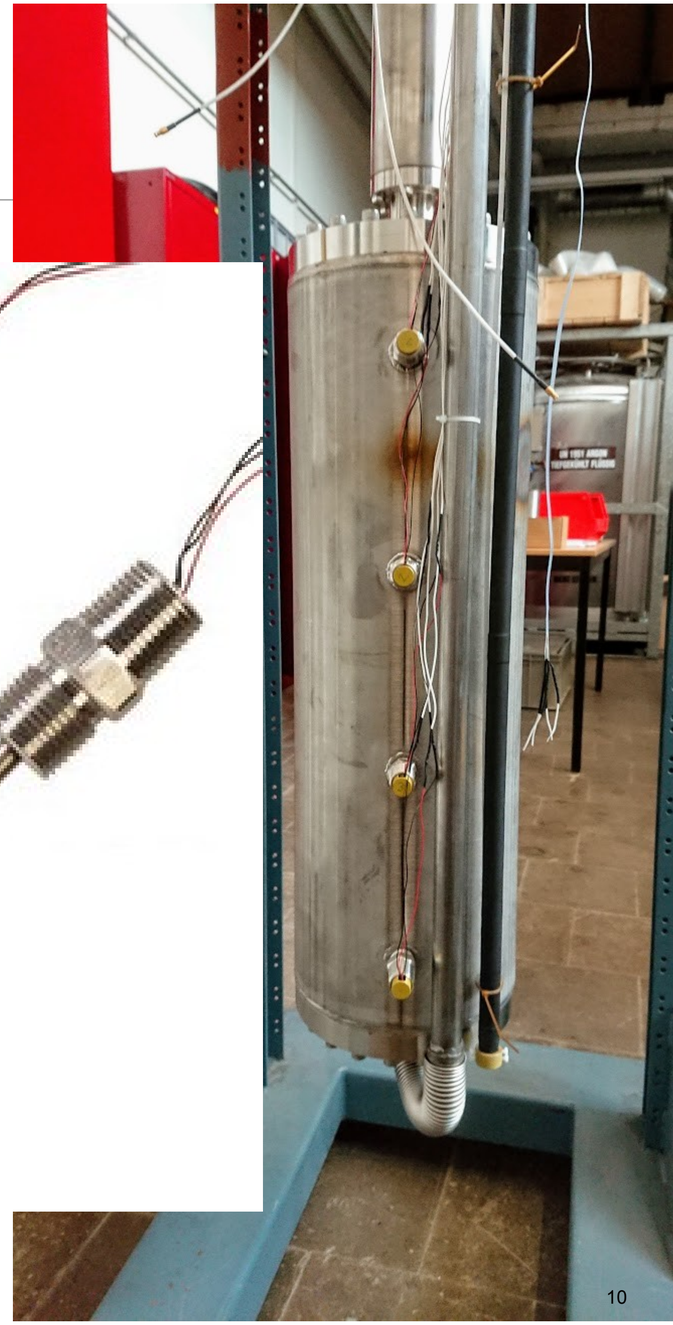
Omega

Probe: PR-12-2-100-1/4-4-E-RP-SL

Thermowell: 3/4-260W-U21/2-304SS

3-wire PT100 -200°C to 500°C





Filter regeneration

The ARCAL* will be heated by an inline gas heater mounted directly to the filter inlet at the top flange.

Omega AHPF-121

Max pressure: 6.9 bar

Inlet: 3/8" NPT-M

Outlet: 1/2" NPT-F

Power: 1200 W

Flow rate: 39 l/min → 425 l/min

Filer regeneration

The ARCAL will be produced in house using an Ar carrier and H2, with an IBEDA varioMix gas mixer.

Mechanically controlled.

Inlet/Outlet: 1/4” NPT-F

Inlet pressure: 2.5 bar → 10 bar

Outlet pressure: 0.75 bar → 8 bar

Flow rate: 12 l/min → 205 l/min

Mix range: 0% → 100%

Filter regeneration

We have the Ar and H2 supply, and the associated regulators.

We still need to produce the lines and fittings:

H2 → mixer

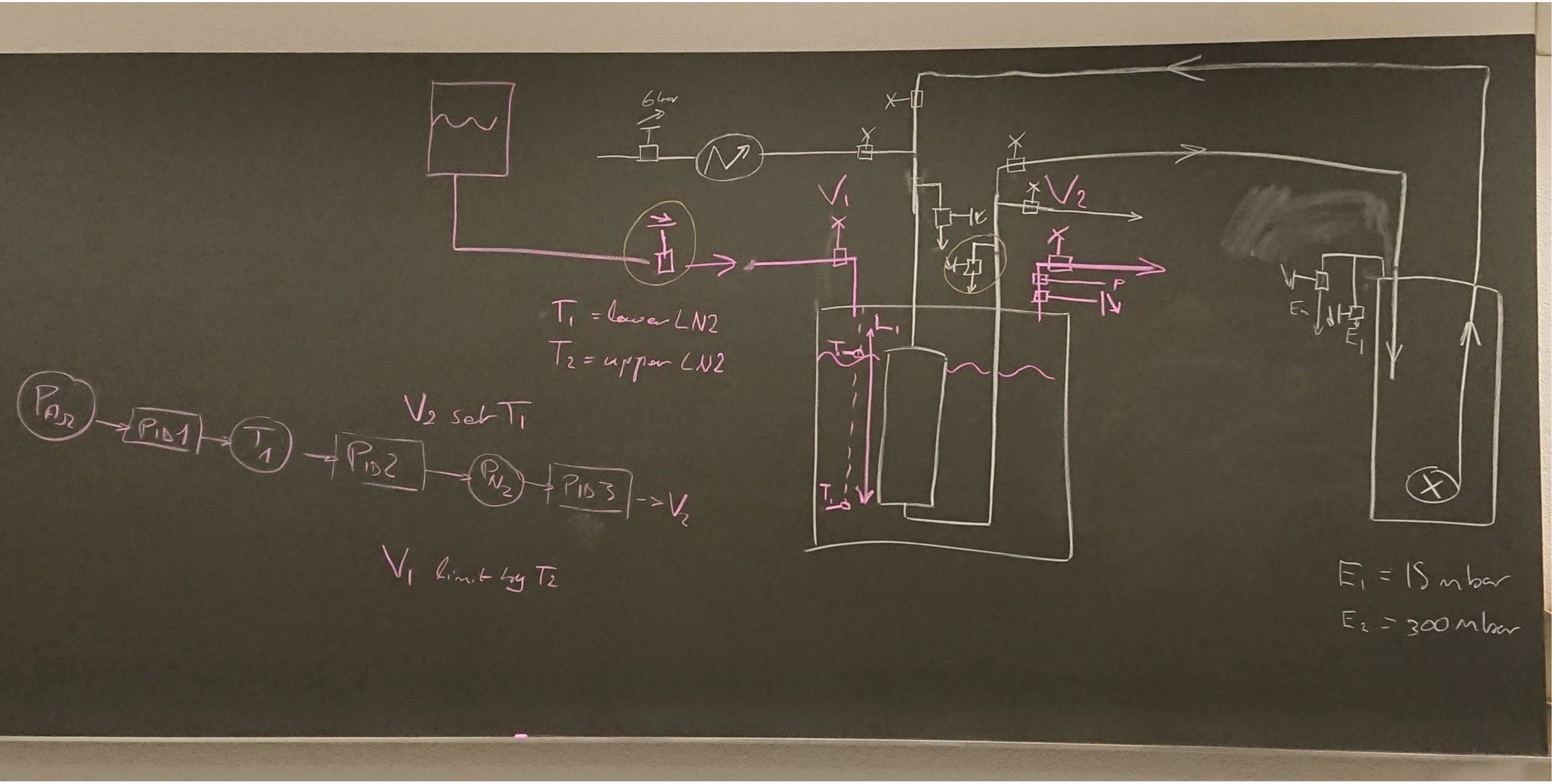
Ar→ mixer

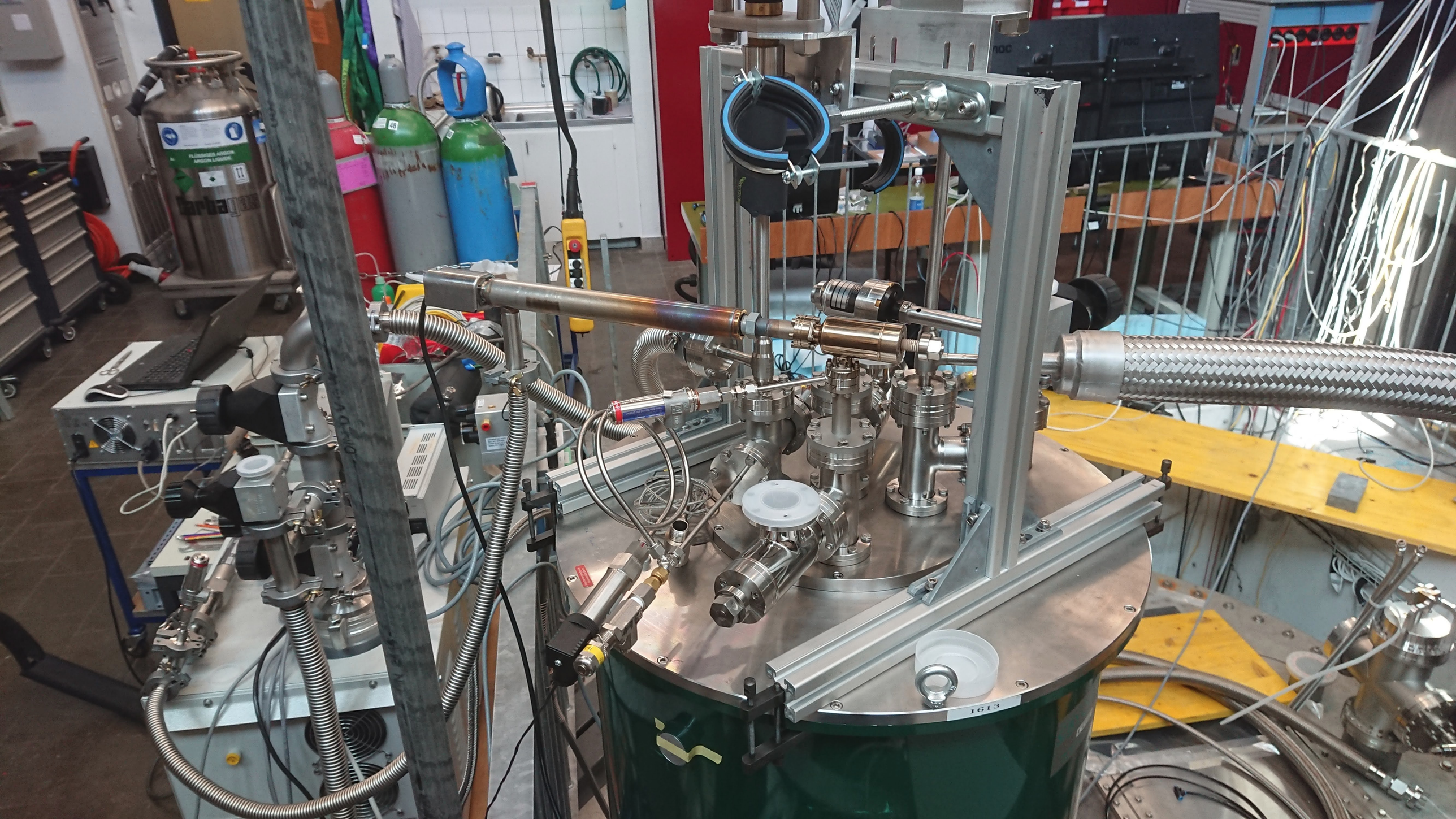
Mixer → Heater (including 6 bar relief)

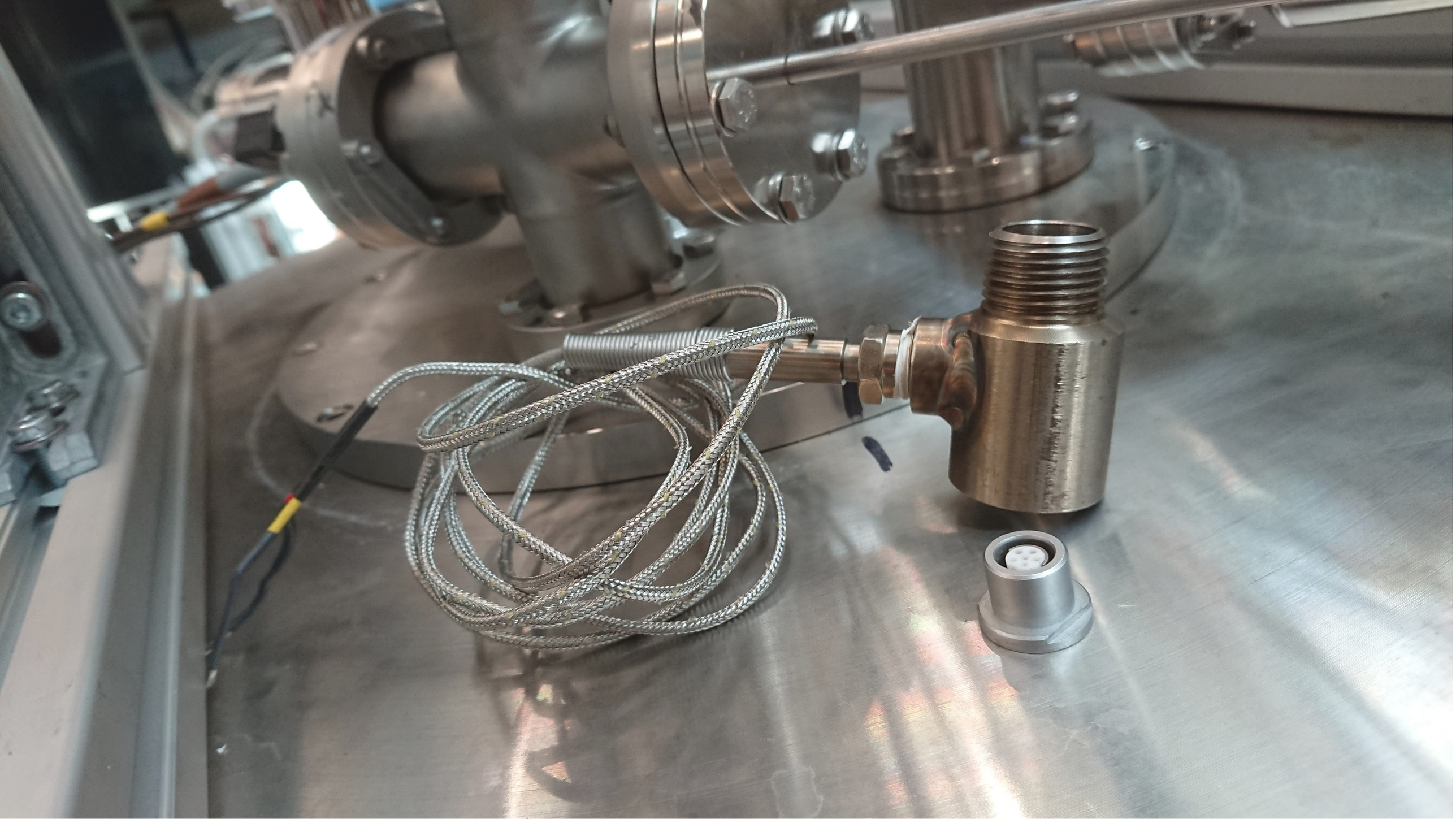
Thermal protection

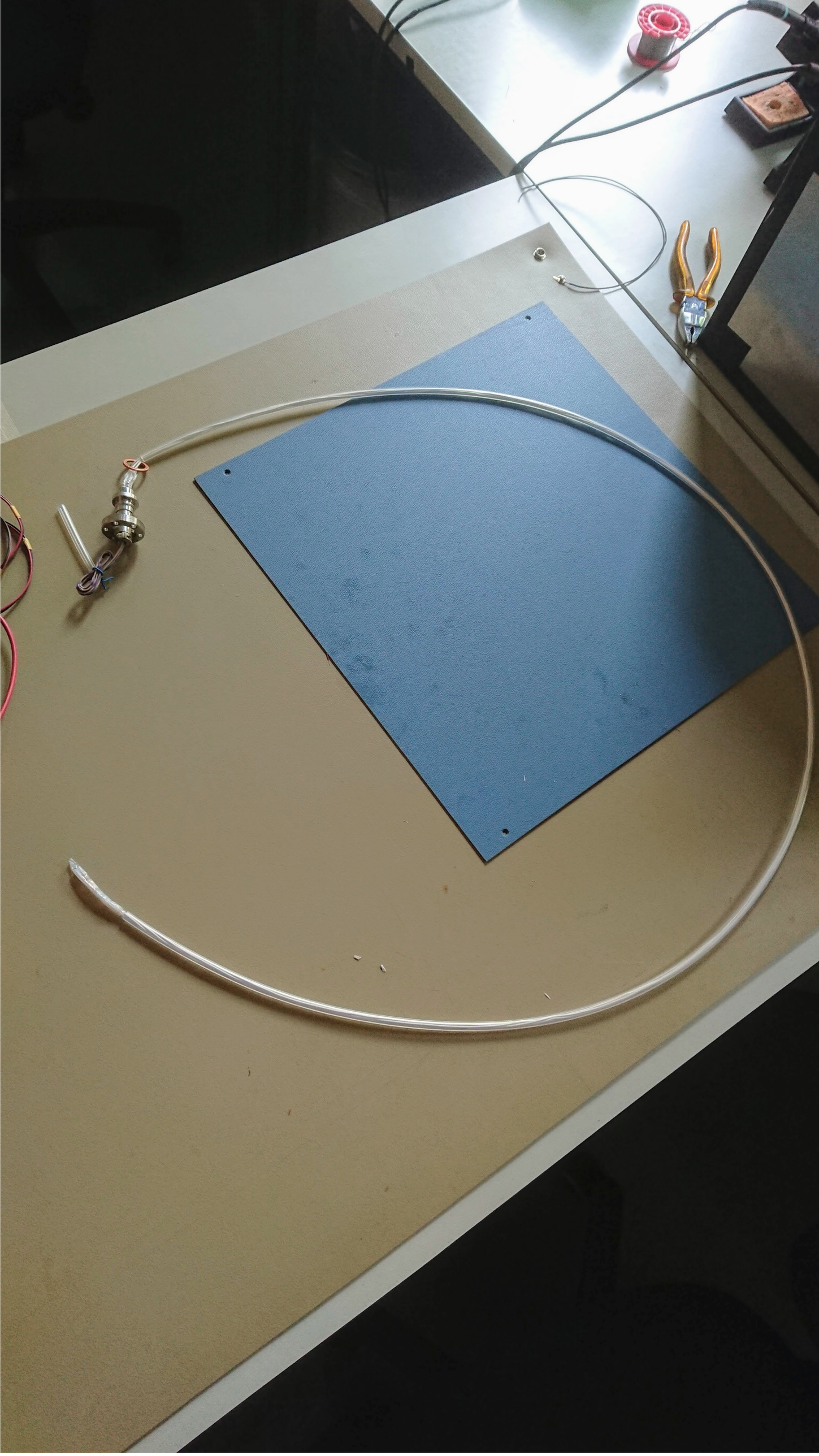
The vessel will be vacuum insulated during regeneration, so internal sensors should be safe, but the top flange will get hot.

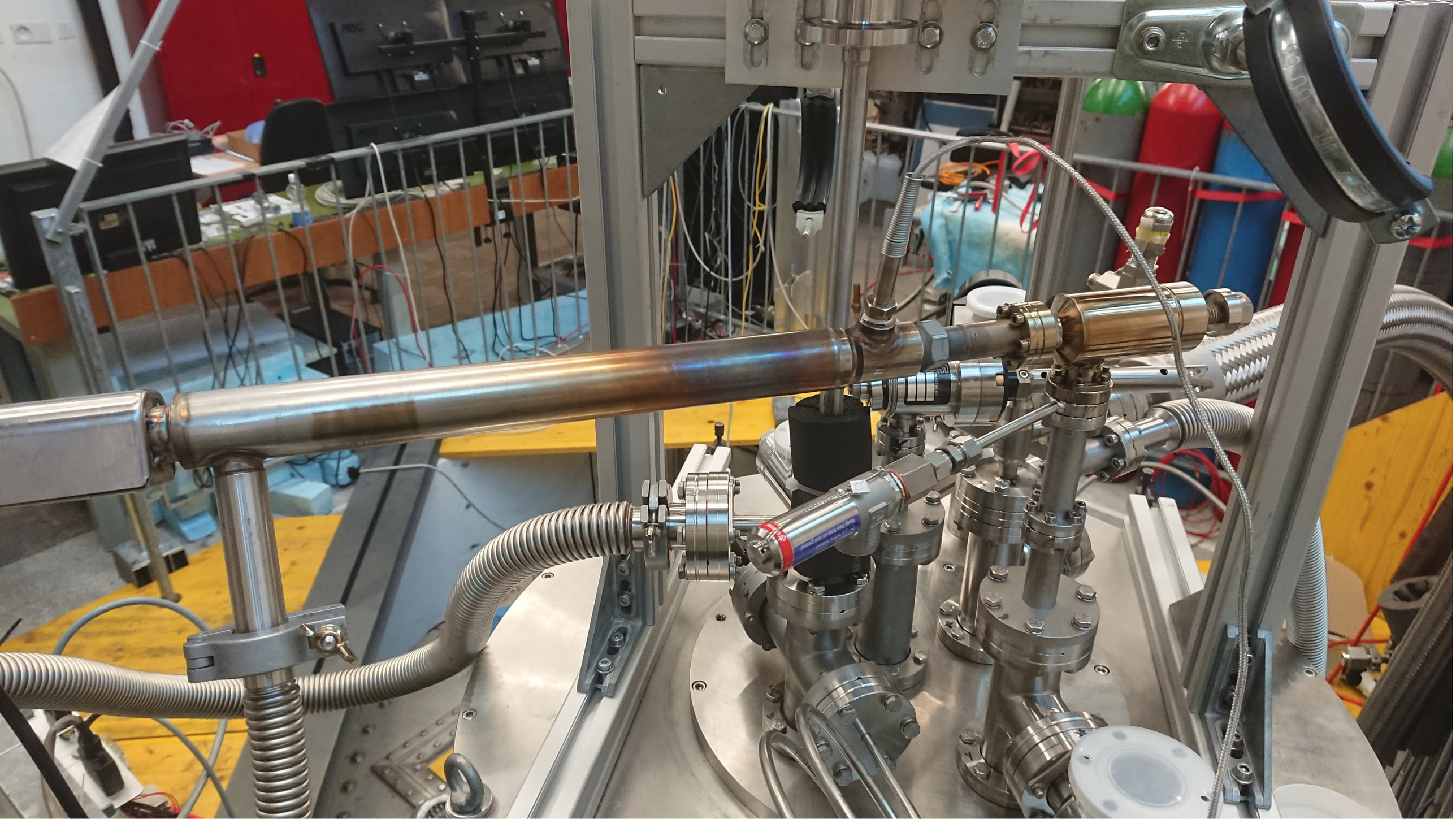
We need to build in thermal protection for everything mounted to the top flange.


Glow
V1
V2
P
E2
E1
T1 = lower LN2
T2 = upper LN2
L1
T2
T1
PAr
PID1
T1
PID2
PN2
PID3
-> V2
V2 set T1
V1 limit by T2
E1 = 15 mbar
E2 = 300 mbar


FLÜSSIGES ARGON
ARGON LIQUIDE
Carbagas
1613

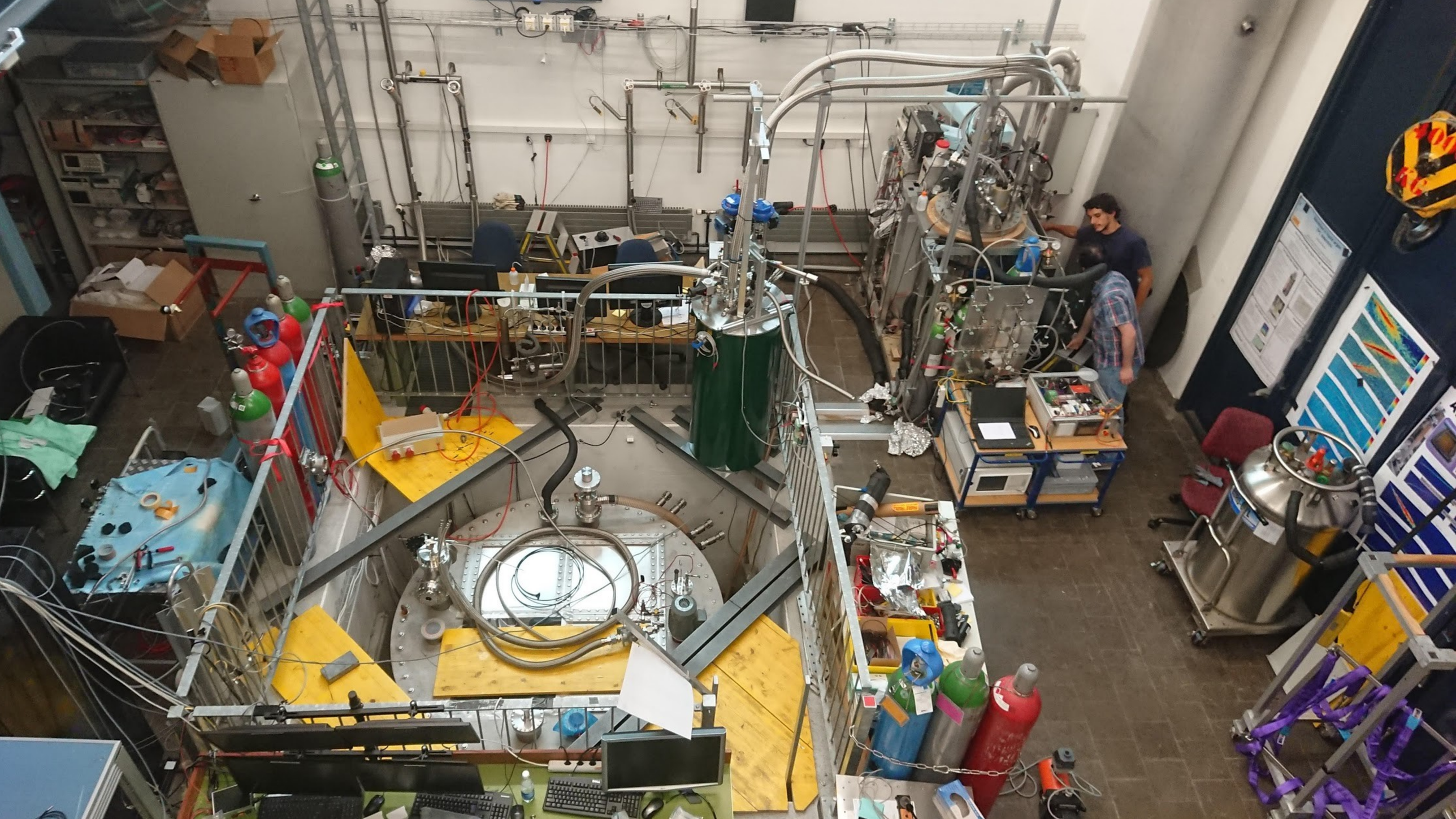







YOGENI
YOGENIC LIMITED
HE 04 1464
tional Telephone: (+44) 81 743 6049
tional Facsimile: (+44) 81 749 5315

PHILIPS
LHEP




H2
Ar
WIKA
bar
psi