



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



Filter update



ArgonCube Engineering call
May 22nd 2020
James Sinclair, LHEP

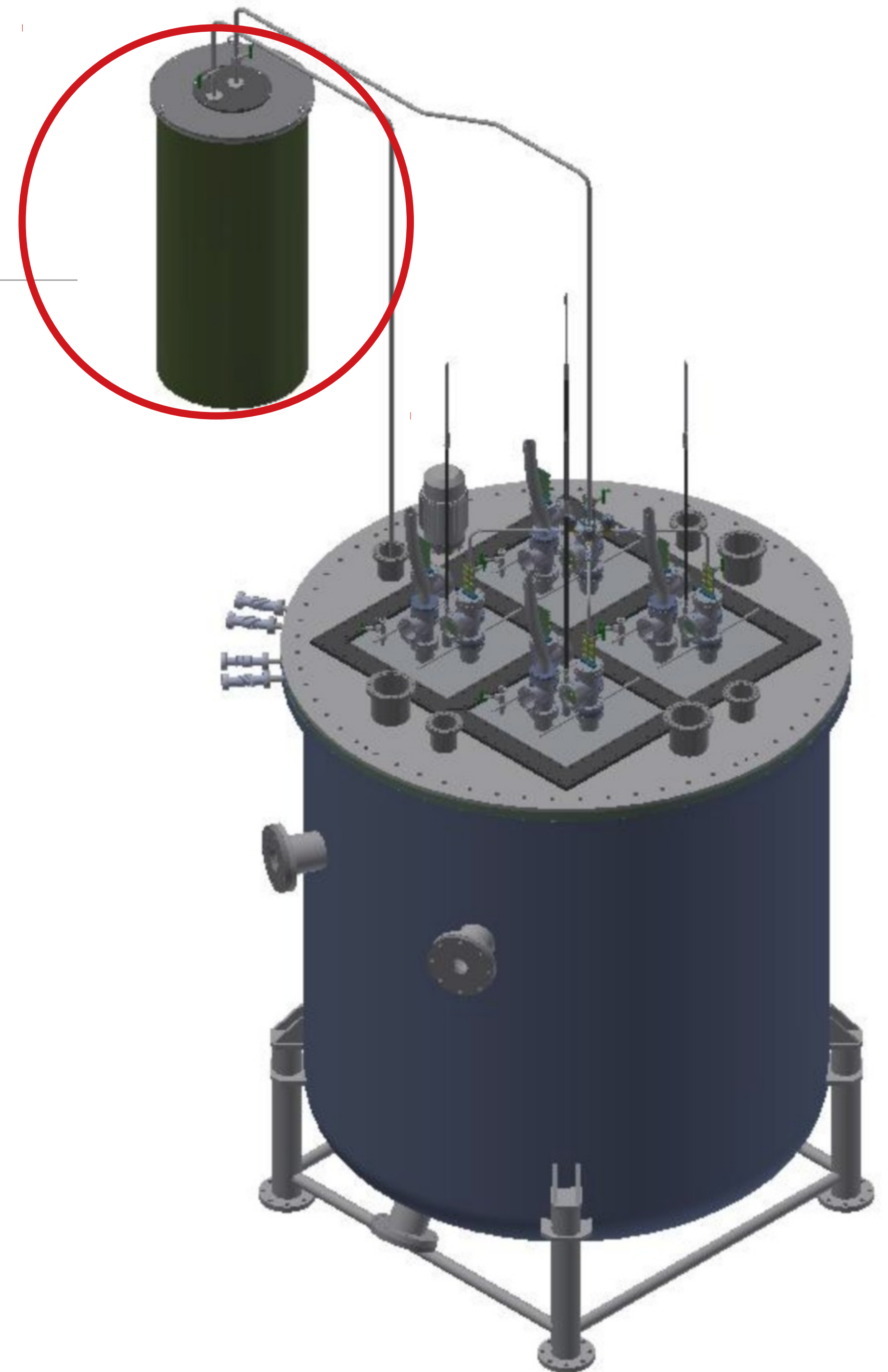
LAr circulation in 2x2

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

LAr is pumped into an external LN₂-cooled filter.

Then directed into the top of the modules.

All external lines are vacuum insulated.



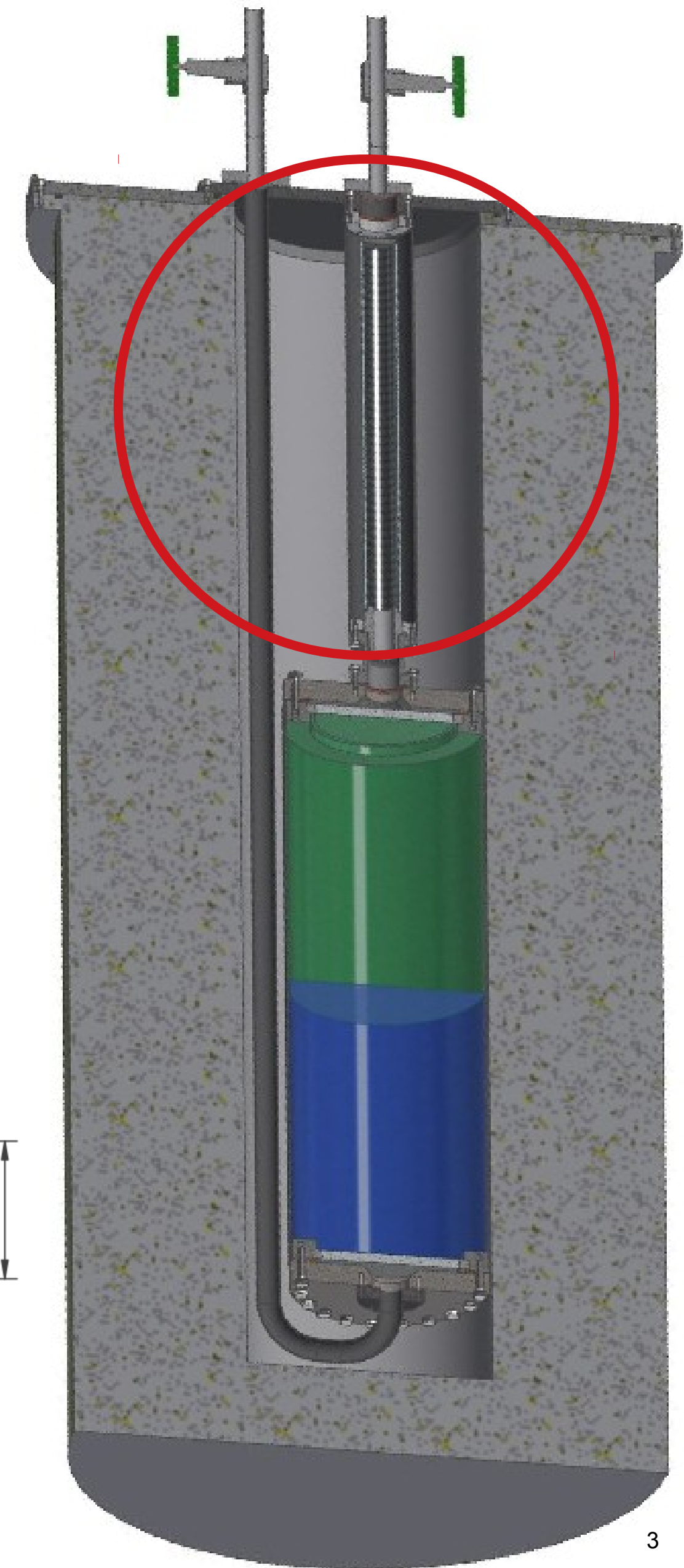
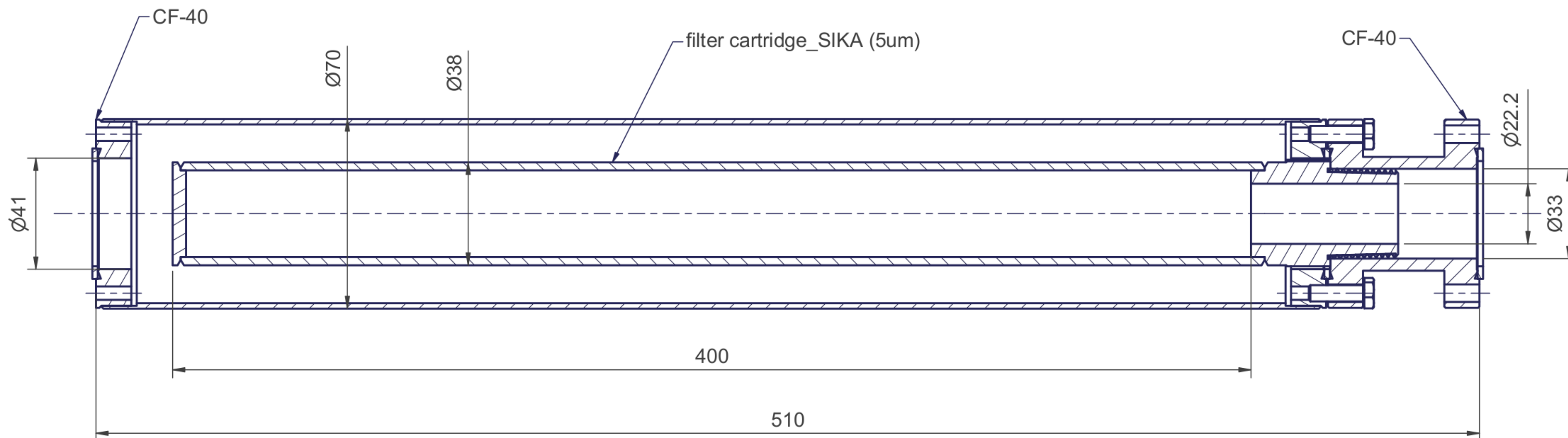
Filter structure

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

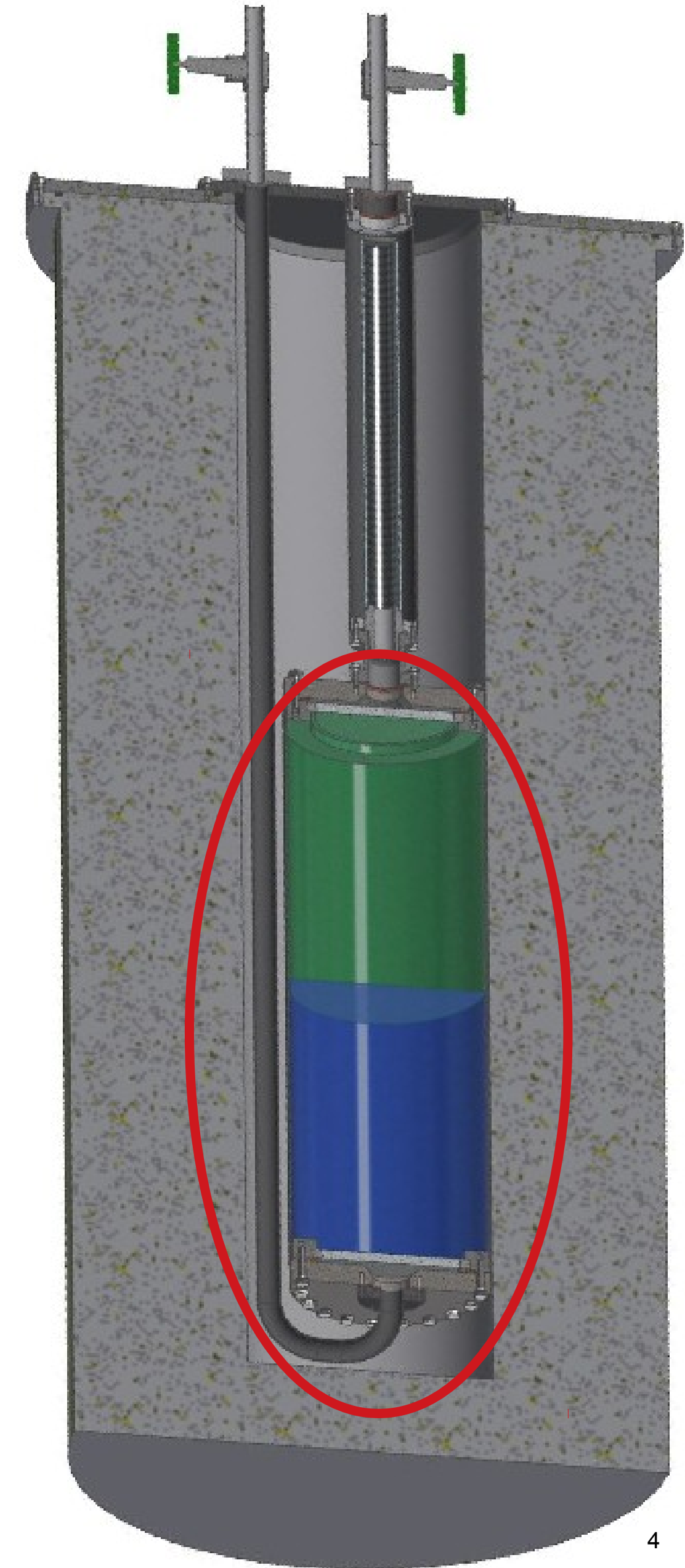
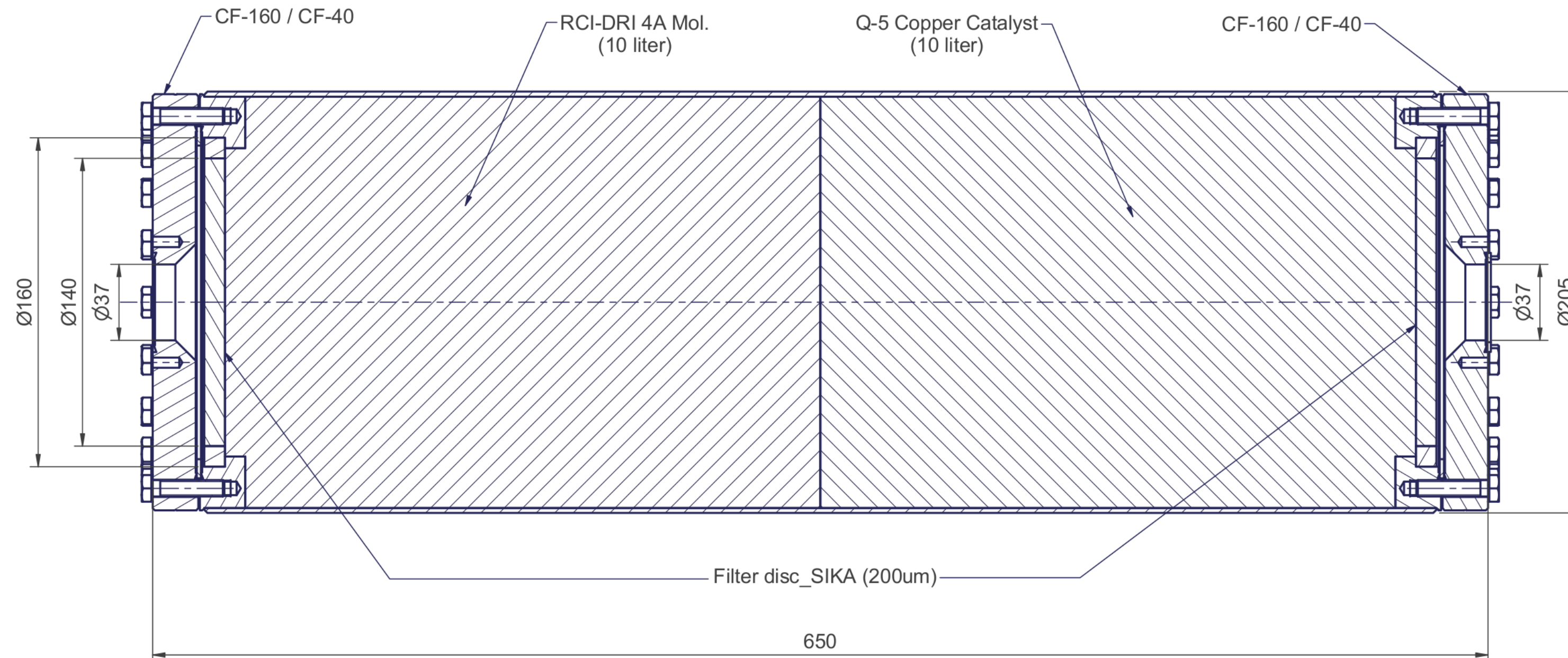


Module outlet

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 μ m 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.

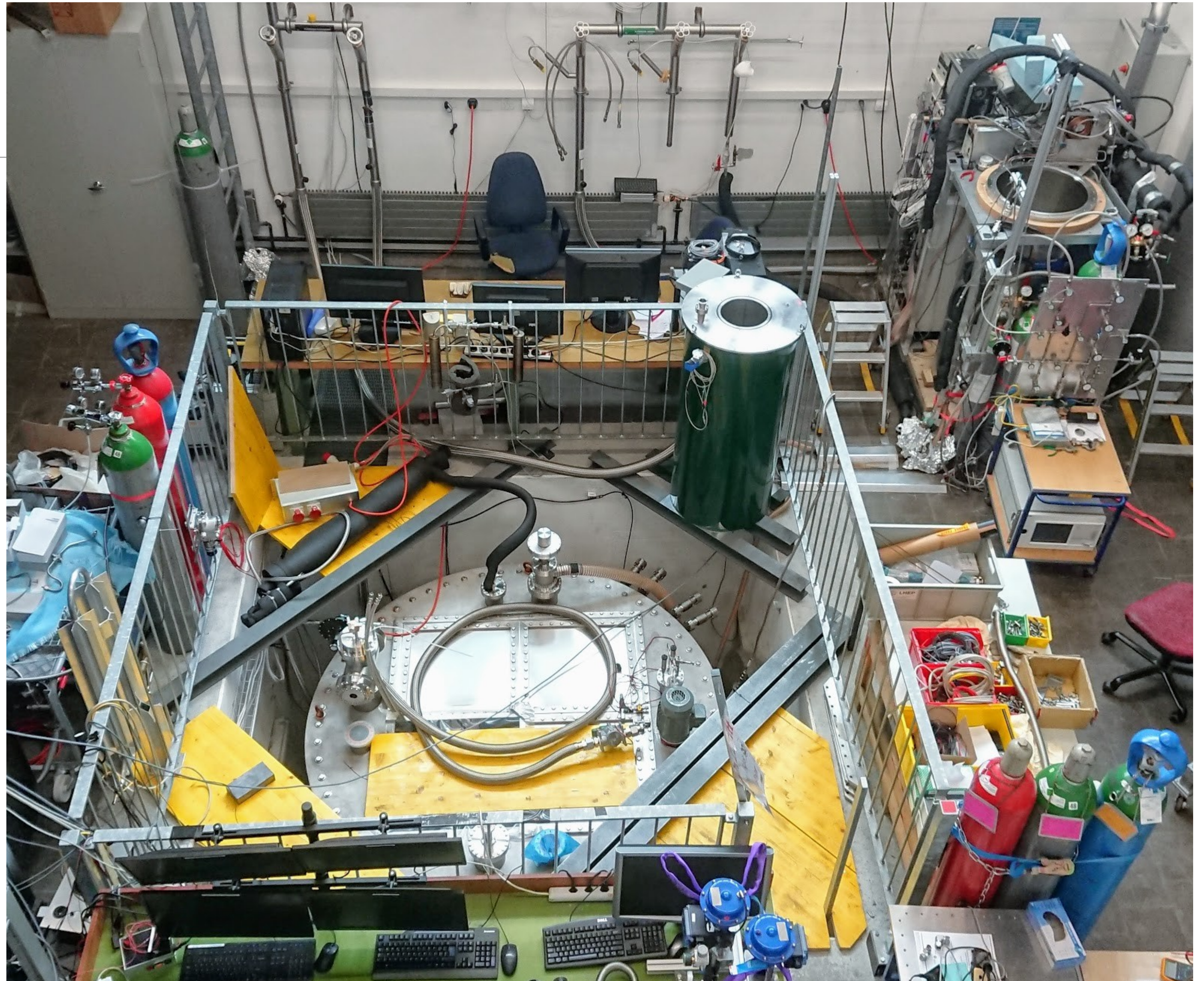


Filter location

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.



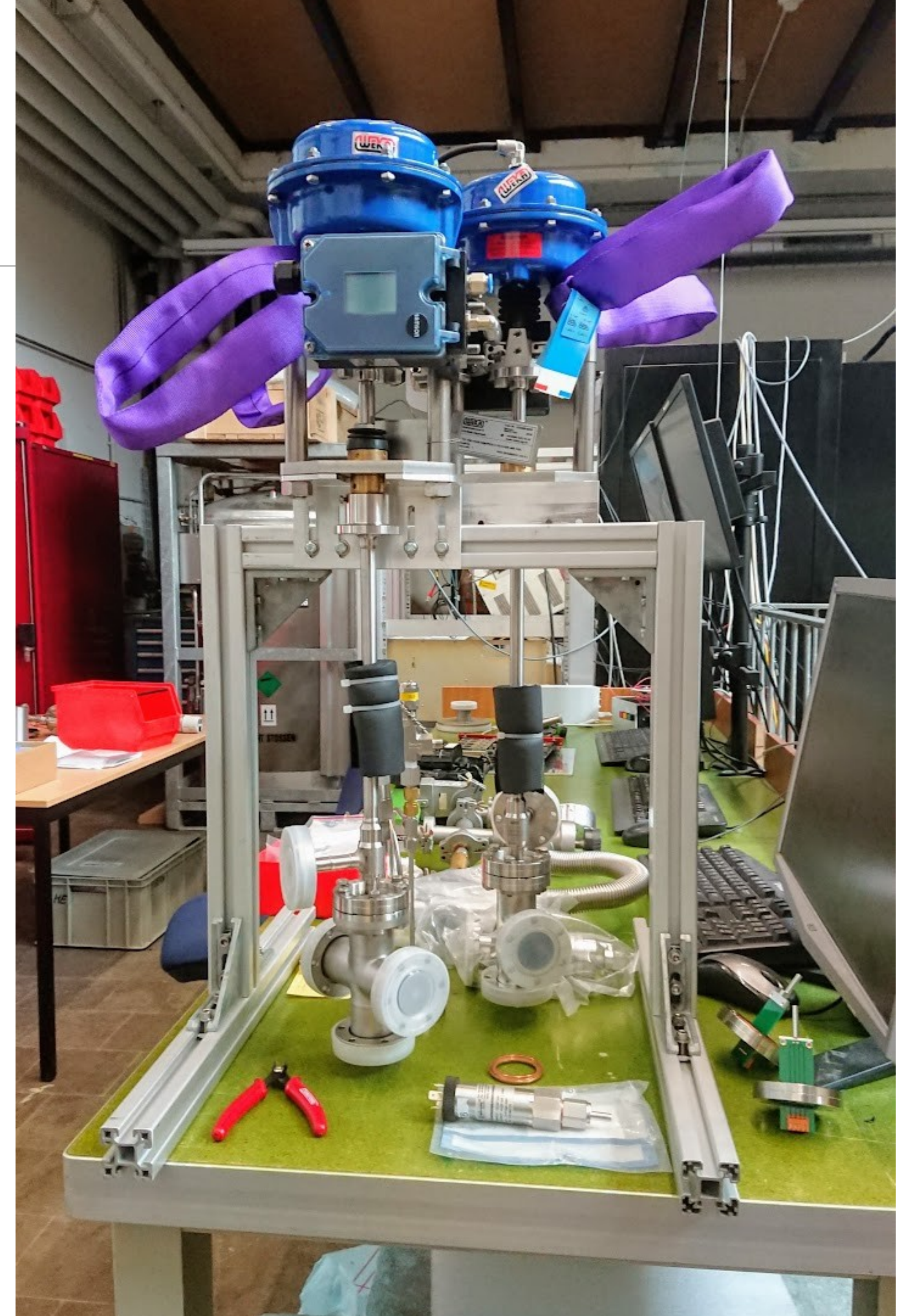
LN2 control valves

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

Filter 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.

