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DArT General Meeting at LSC, 21 aprile 2022

ArDM operations

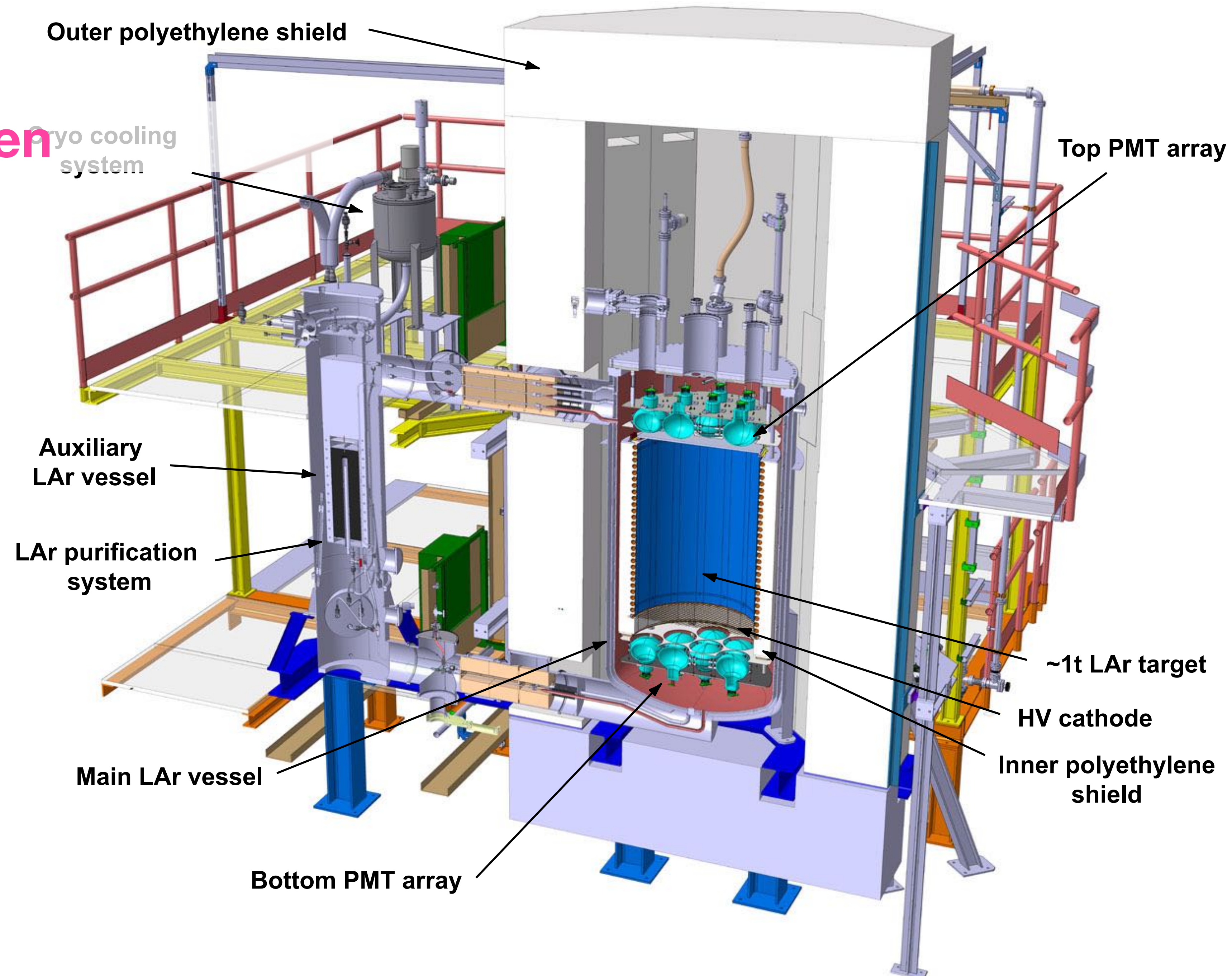
on its cryogenic setup



ArDM setup

What you have just seen

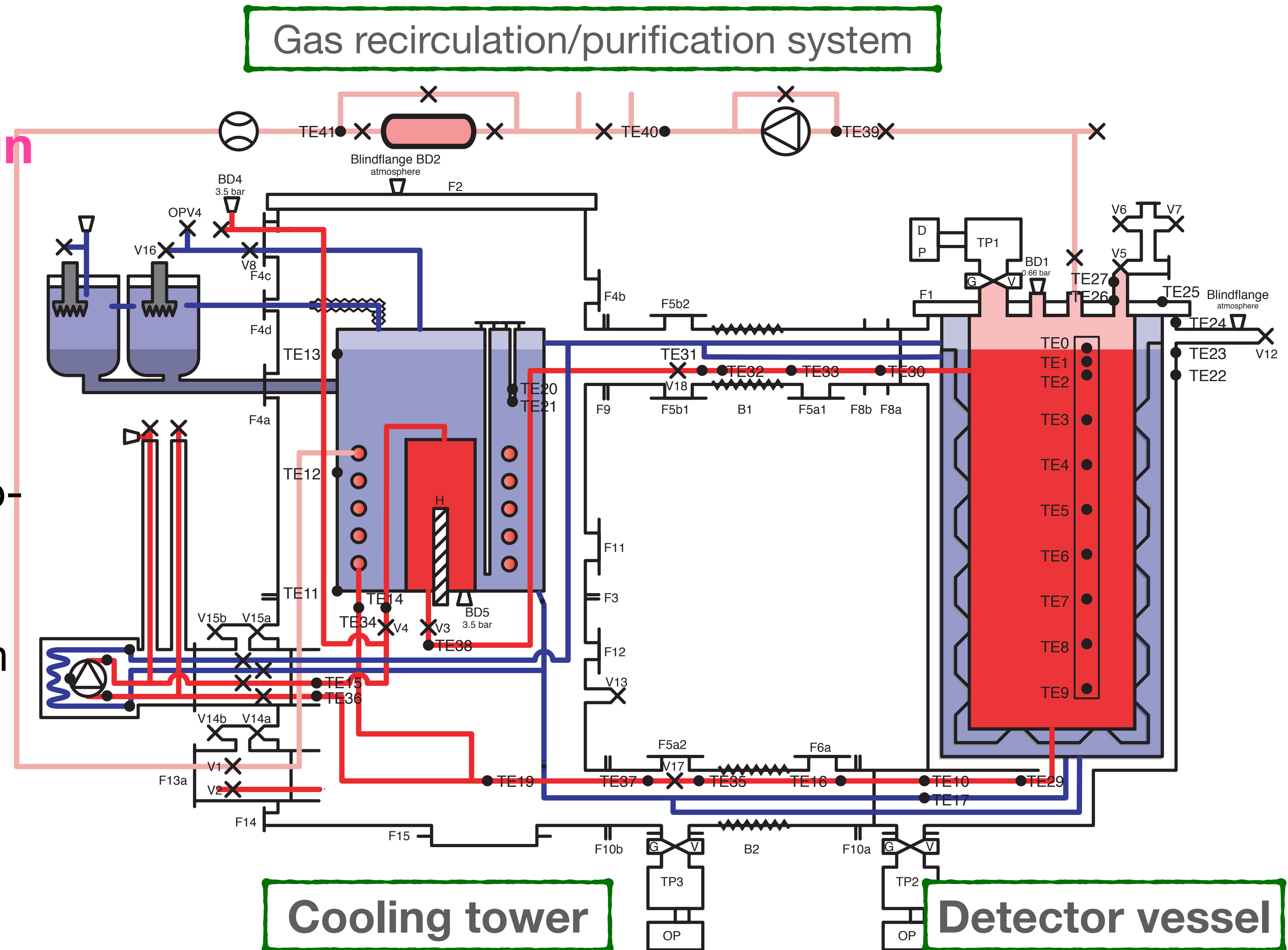
- The last run completed in 2019
- ~tonne LAr transferred to the “recovery vessel”
- The setup in hibernation since
- Pure LAr kept in the recovery vessel, using a cryocooler



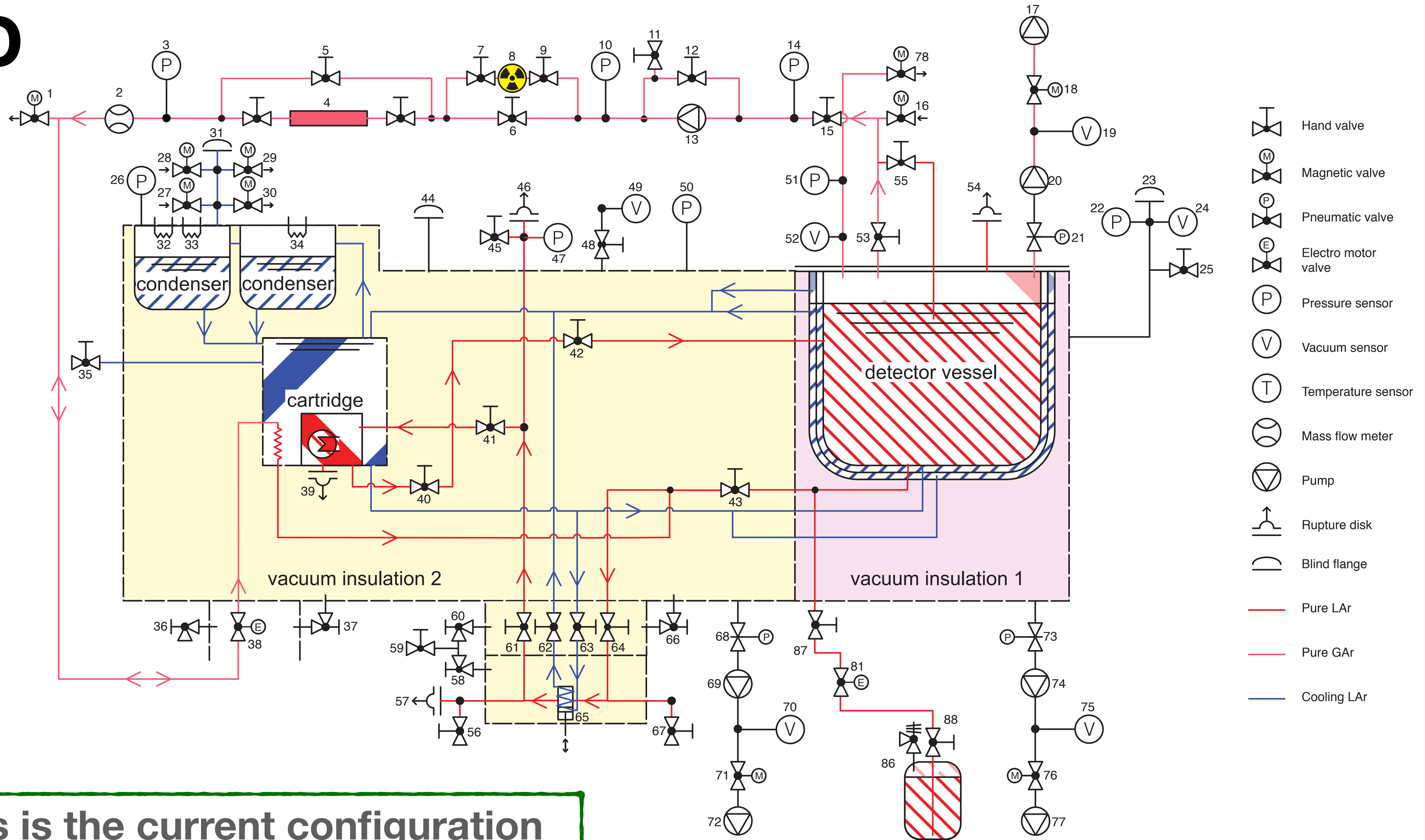
Concept

Cooling bath design

- Two LAr circuits
 - **Pure Ar**
 - **Cooling bath**
- The bath argon is cooled by the cryo-coolers
- The pure argon is cooled by the bath argon
- $P_{\text{Bath}} < P_{\text{Pure}} \approx P_{\text{DARt}}$
- $T_{\text{Bath}} < T_{\text{Pure}} \approx T_{\text{DARt}}$
- $P_{\text{Pure}} \sim 1000 \text{ mbar}$



P&ID

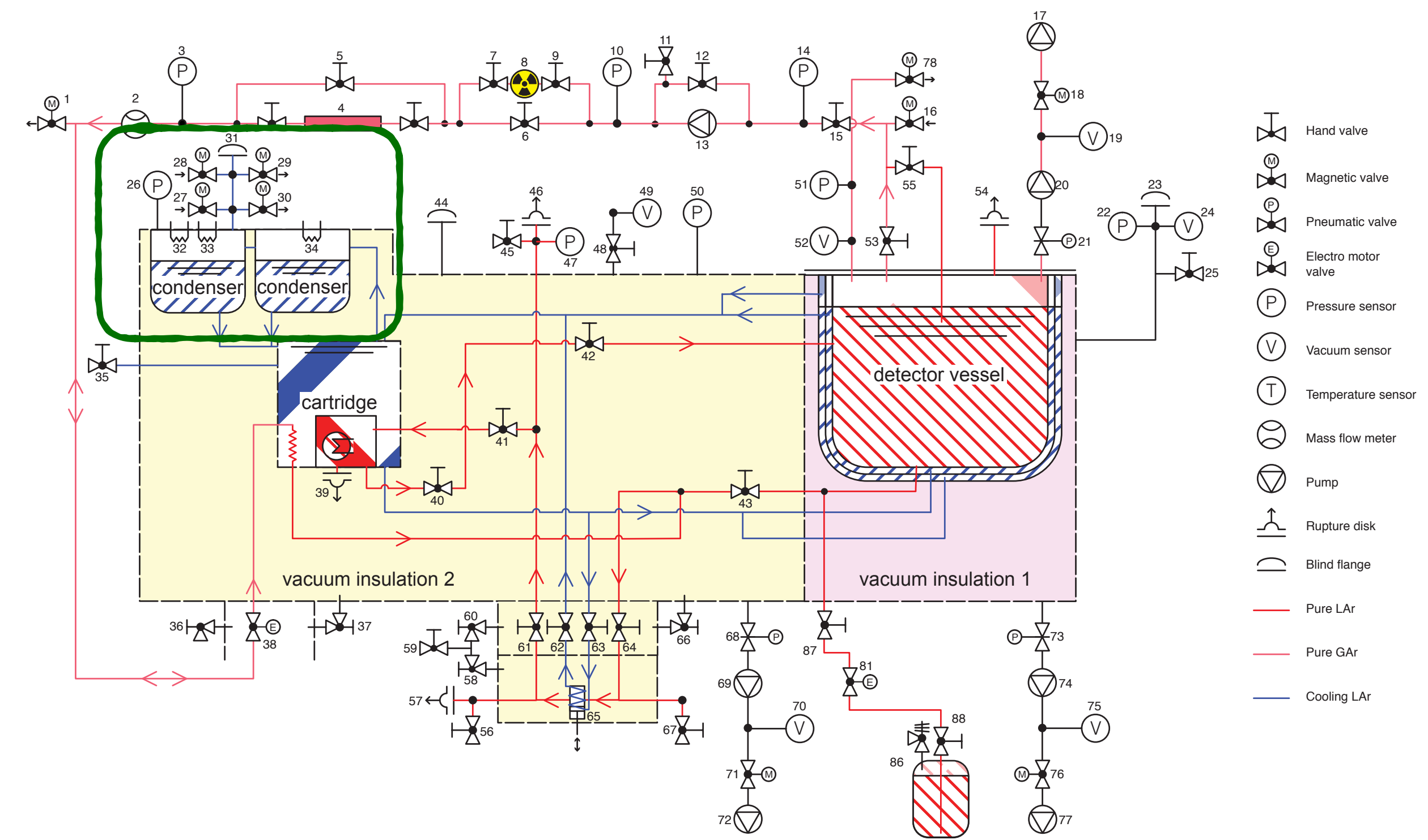


This is the current configuration

Cooling system

Cryocoolers

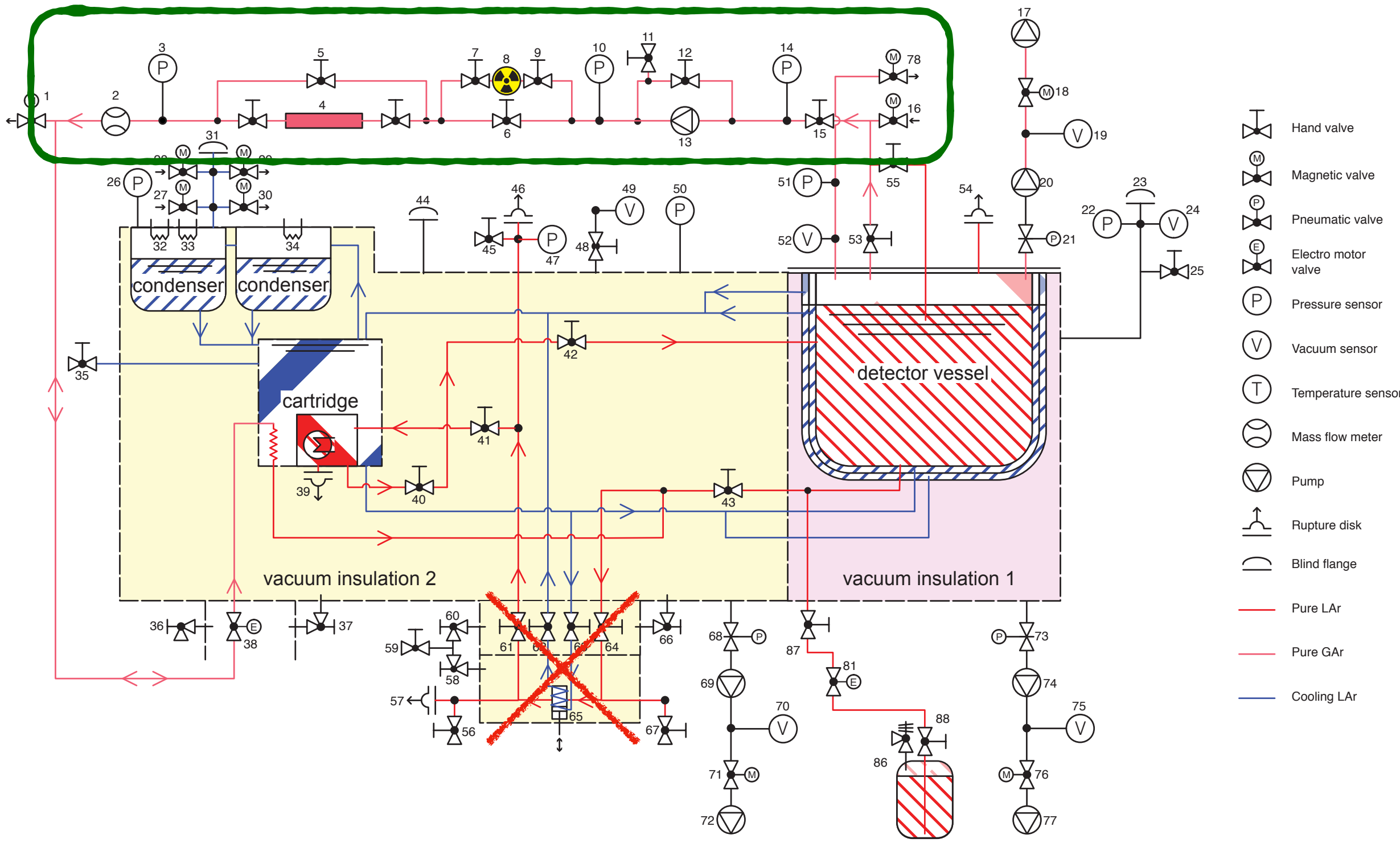
- Three cryocoolers : CC1, CC2 and CC3
 - 2 CCs needed to maintain the thermodynamic conditions
 - 3rd used for filling (condensing)
- Condenser 1 with CC1 and CC2
- Condenser 2 with CC3
- The system pressure/temperature is PID regulated by resistive heaters compensating the cooling power



Ar purification system

Gas recirculation with a getter

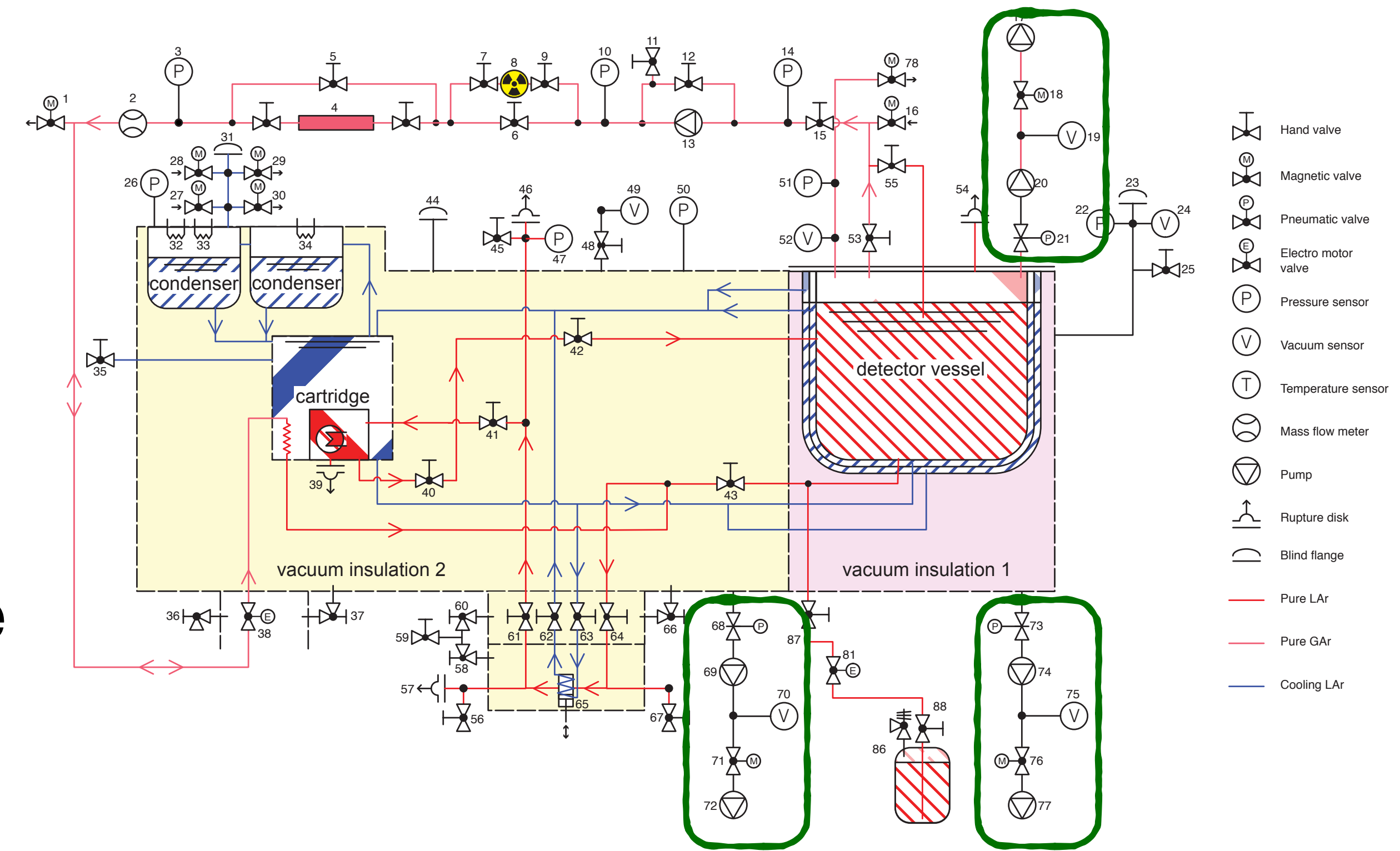
- Components
 - Snorkel
 - Gas recirculation pump — adjustable pumping speed
 - Heating bands
 - Hot getter
- Liquid recirculation pump out of service



Vacuum system

Three sets of pumping systems

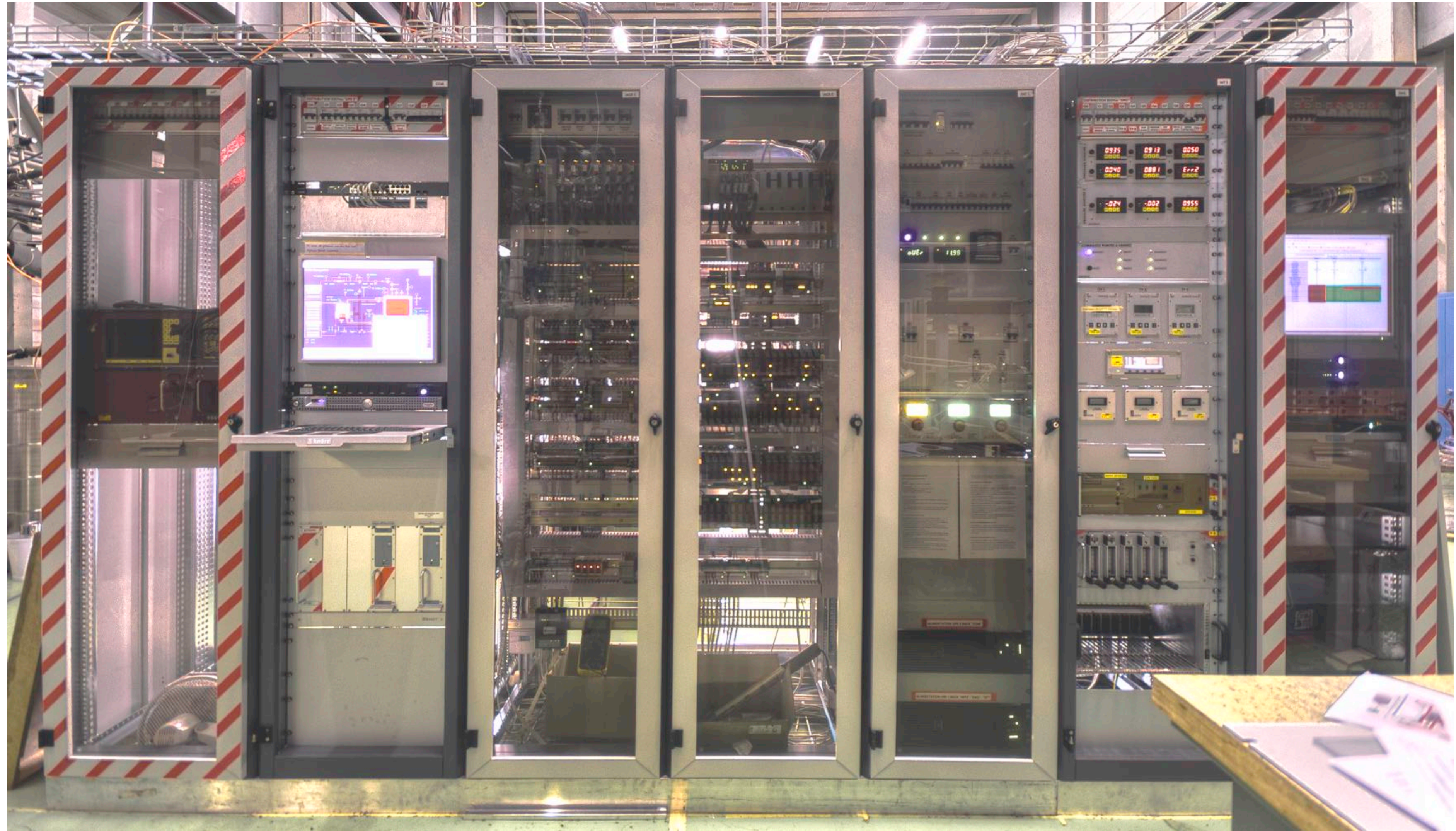
- InsVac1, InsVac2 and the pure Ar volume
- Gate valve + Turbo + Rotary pump
- Each volume has a pressure and a vacuum gauge
- InsVac1 and InsVac2 are to be kept pumped continuously



Slow control

PLC-based control system + UNICOS PVSS SCADA system

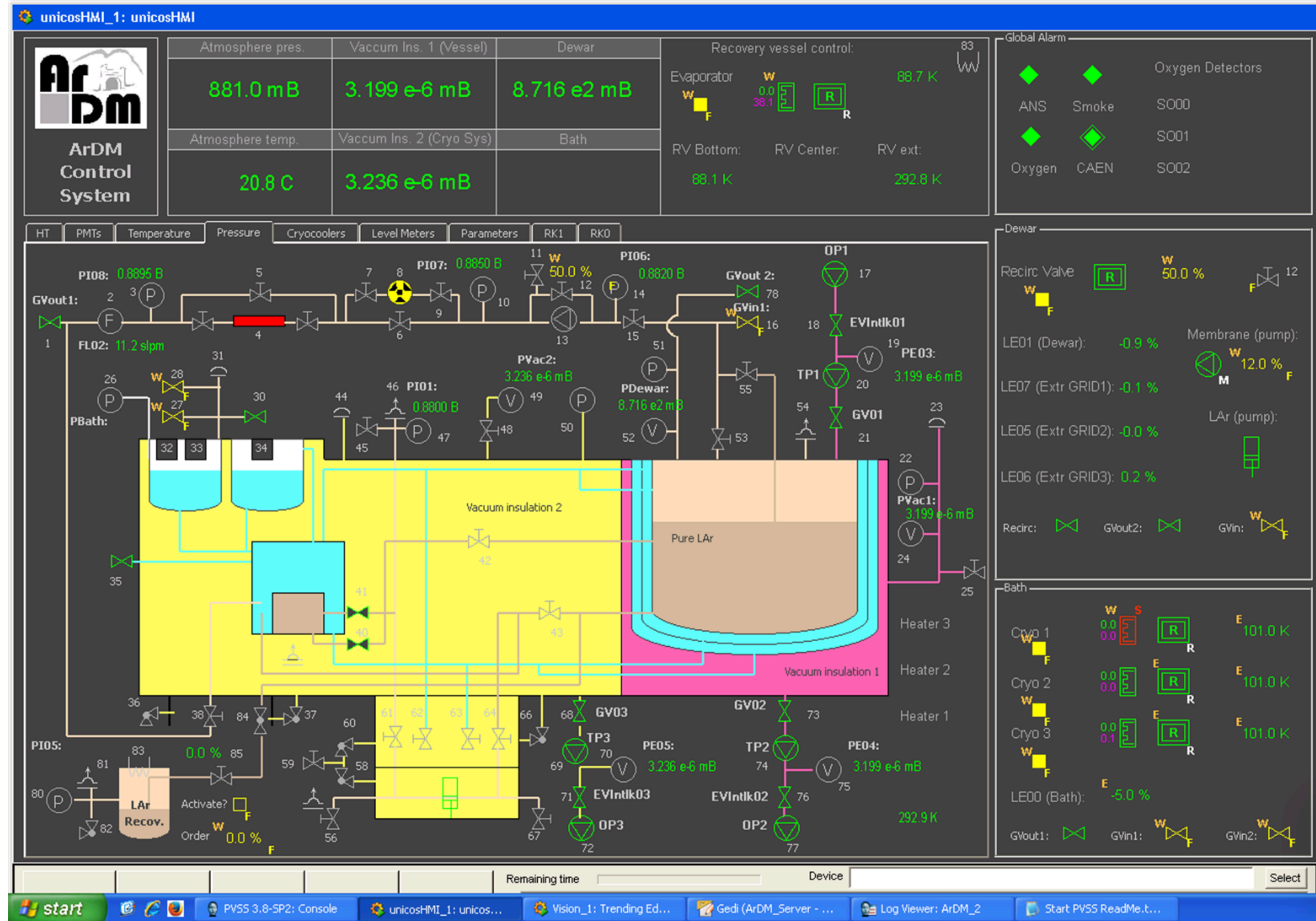
- Made in CERN
- The entire ArDM setup operates fully automatically
- The “industrial” PLC system is robust and reliable
- Update not foreseen
- The devices have to be maintained



Slow control

PVSS

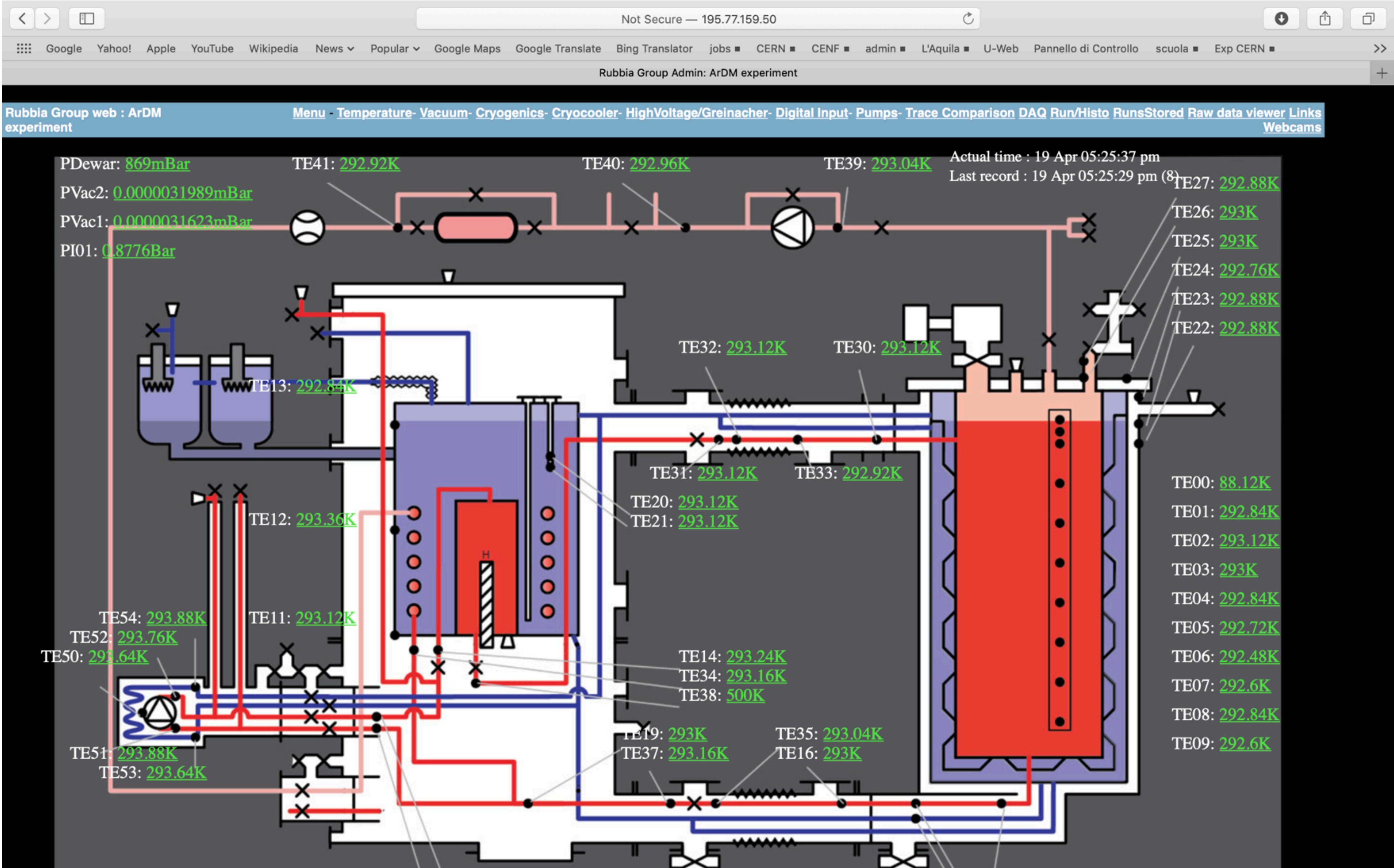
- PVSS is out of date
- Running on Windows XP — pcardm002
- Backup ?



Slow control

Web site

- Not a must but extremely useful
- History, database ?



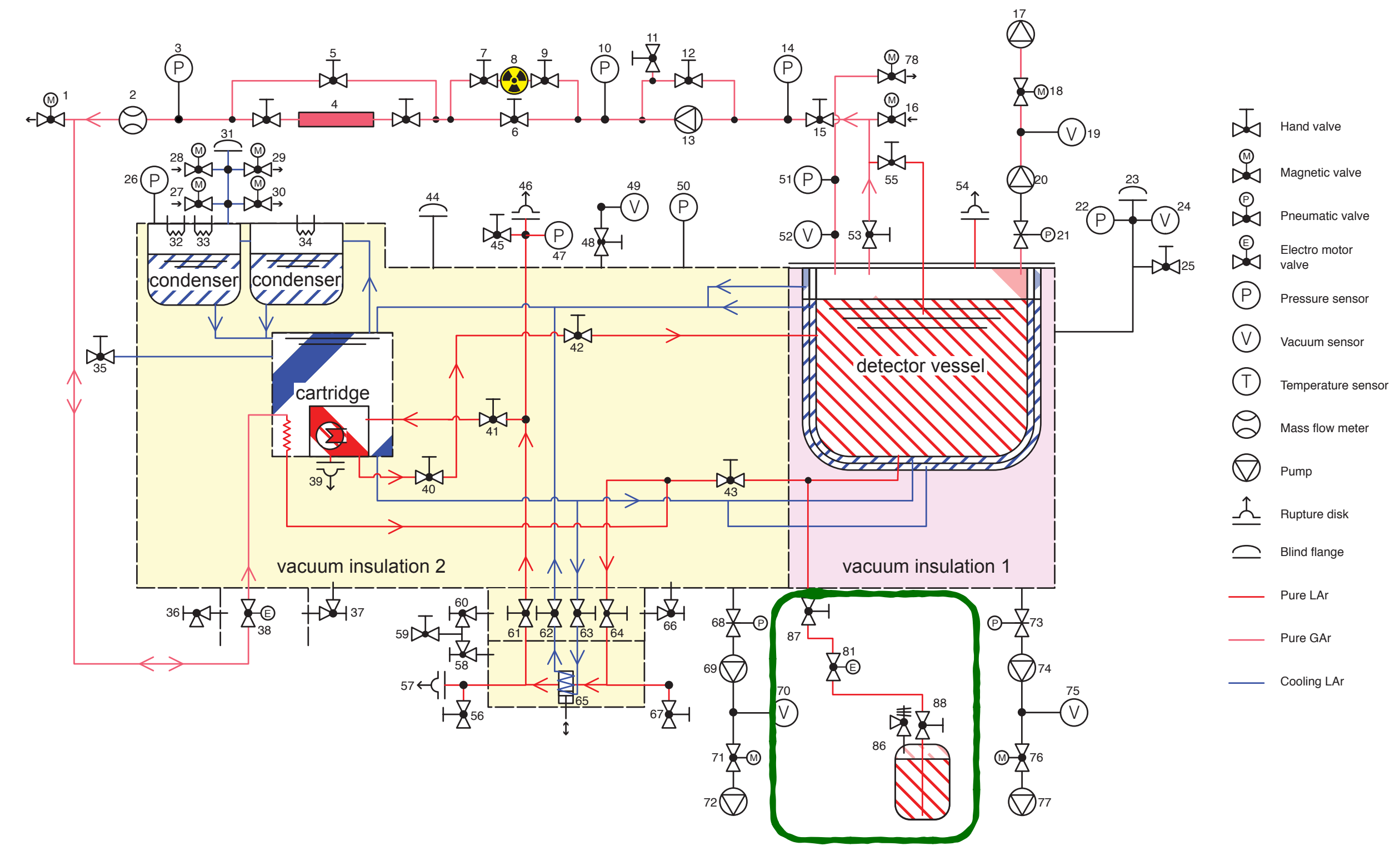
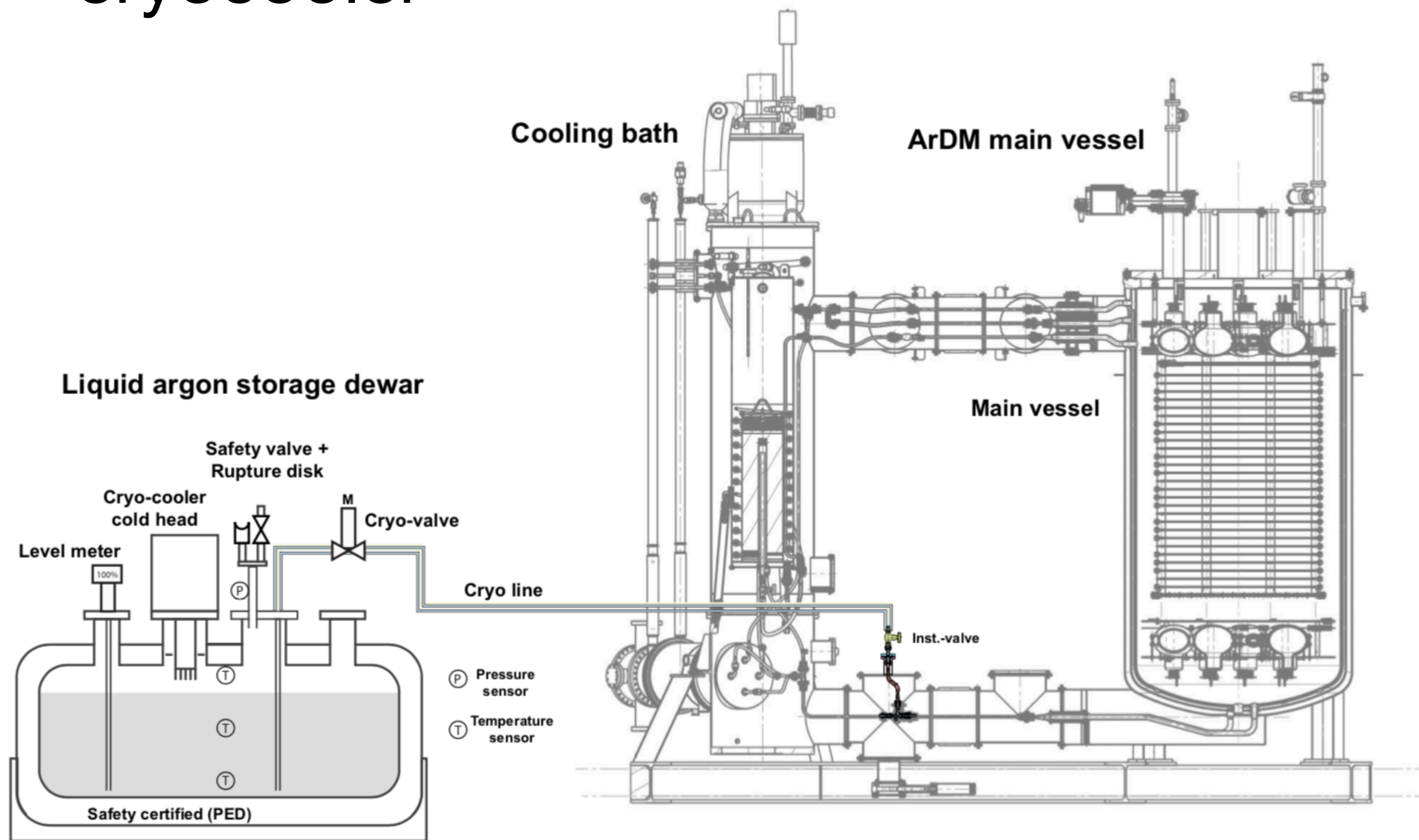
Operation steps

- Pumping
 - 2–4 weeks after the detector installation
- Filling of the bath (~200 L)
 - 1 week
 - Gaseous Ar from the battery is to be condensed
 - Need to procure the battery
- Filling of the pure Ar — from the recovery vessel
 - A couple of hours !
 - Do we have enough LAr ?

Recovery vessel

Refilling of the detector vessel

- The newest component
- Currently active with a dedicated cryocooler



ArDM Note 18-01-v2

Extension of the ArDM experiment with a LAr recovery dewar

Request for its installation in Hall A

W. Mu, C. Regenfus, A. Rubbia – ETHZ

July 24, 2018

Shifts ?

- Usually shifts were not organised except during the filling phases
- Experts on call must receive alarms
 - Need to organise

Recommissioning of the system

- Several issues are observed
 - Pressure gauges
 - Vacuum gauges
- UPS ?
- Need to evaluate the required time / cost

Done