

Naples Cryogenic Test Facility for Photosensors

Workshop on PDE measurement of X-Arapuca VD
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G. Grauso, Y. Suvorov, N. Canci, F. Di Capua, G. Matteucci, G. Fiorillo



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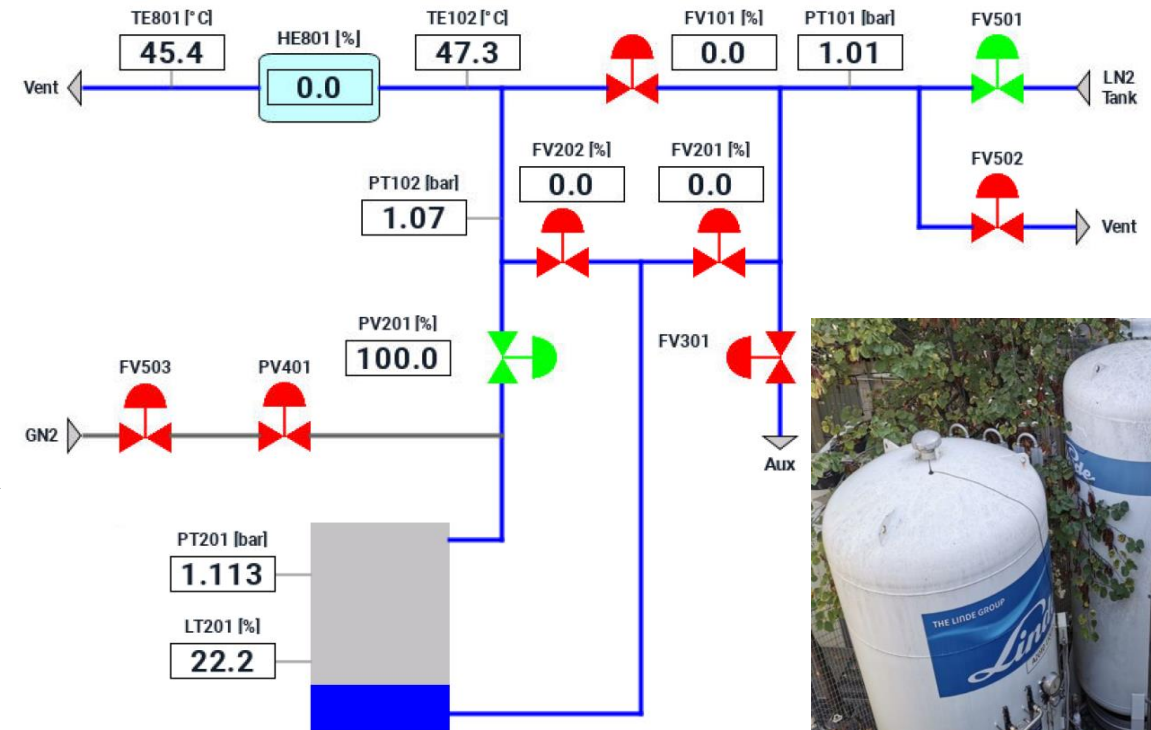
Facility Description: Cryostat

- System composed of a double wall vacuum insulated vessel (1.02 m internal diameter – 1.31 m height) coupled with a single wall domed flange
- Equipped with PT100 temperature/level meter sensors, pressure transducer, analog pressure indicator and 4 safety valves. Max allowed pressure: 3 bar.
- Top flange with CF flanges for electrical, optical and slow control feedthroughs
- The cryostat is designed with a dedicated lateral flange to fill from the bottom of the vessel
- Dedicated DAQ and electronics
- It represents the main part of PDU Test Facility developed for DarkSide collaboration



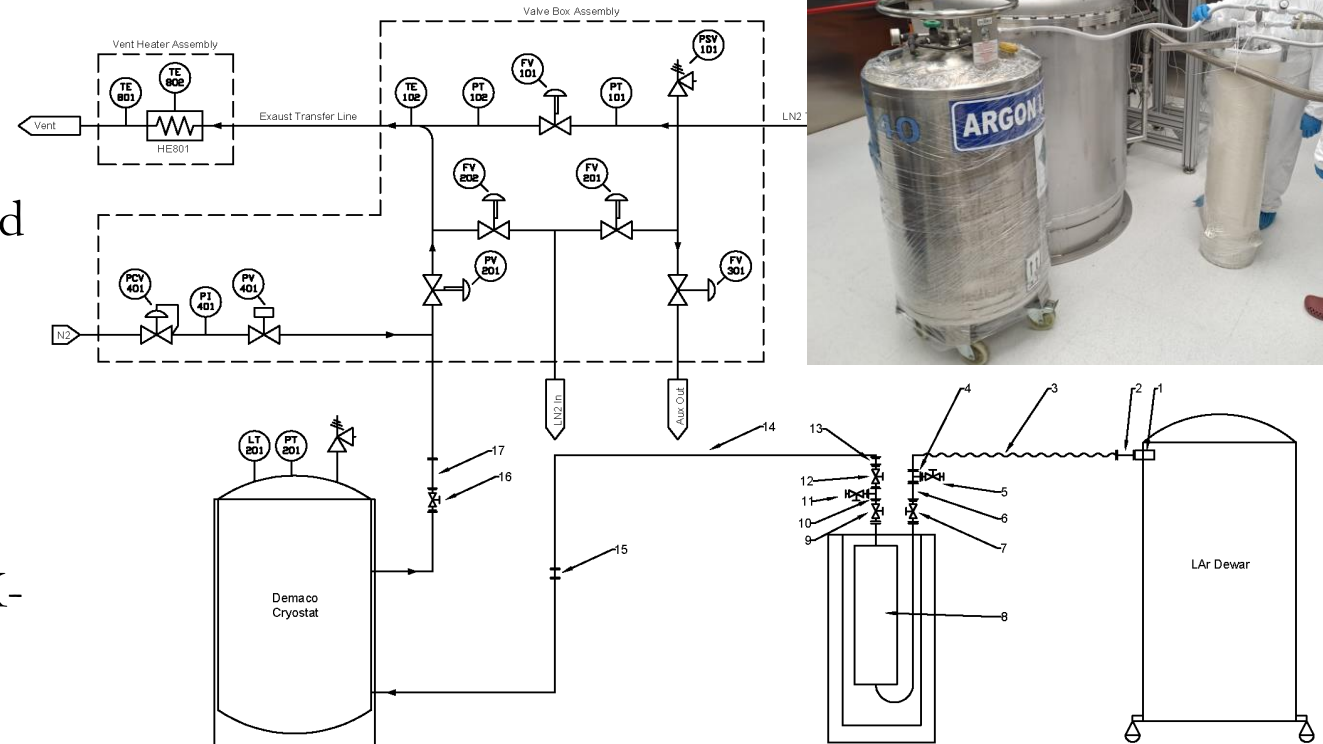
Facility Description: Cryogenics

- Dedicated fully automatic LN filling/draining cryogenic system
- Proportional/automatic valves controlled by industrial PLC; operating parameters (pressure, temperatures, liquid level, etc.) monitoring by a National Instruments PXI computer and LabView-based slow control program
- Pressure in the cryostat maintained at selected SP by the cryogenic automatic system
- Controlled LN filling (about 7 hrs) and draining (about 15 hrs)
- Facility directly connected to an external 3000 l LN storage tank (operation pressure of 2.5 bar)



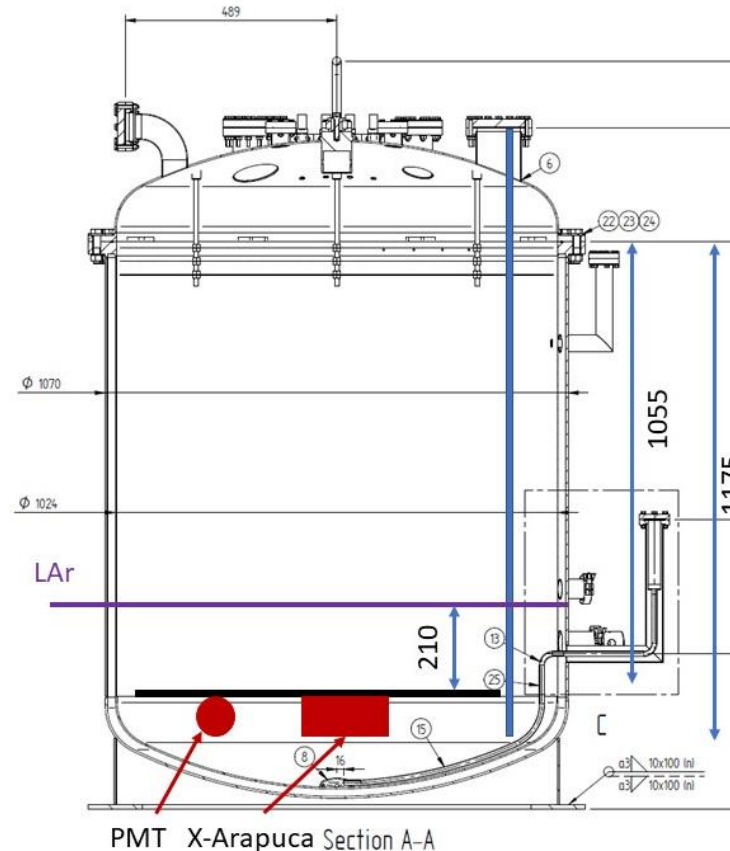
Commissioning test with LAr

- The cryostat has been filled with LAr 5.0 filtered by an in-line Trigon (Engelhard Q5-Cu0226)
- The facility slow control system has been used to control the pressure in the cryostat and monitor the parameters during filling and normal operation phases
- The cryostat has been filled above the X-Arapuca and PMT level
- LAr purity has been monitored through the measurement of the scintillation light slow component with both cryogenic PMT and X-Arapuca

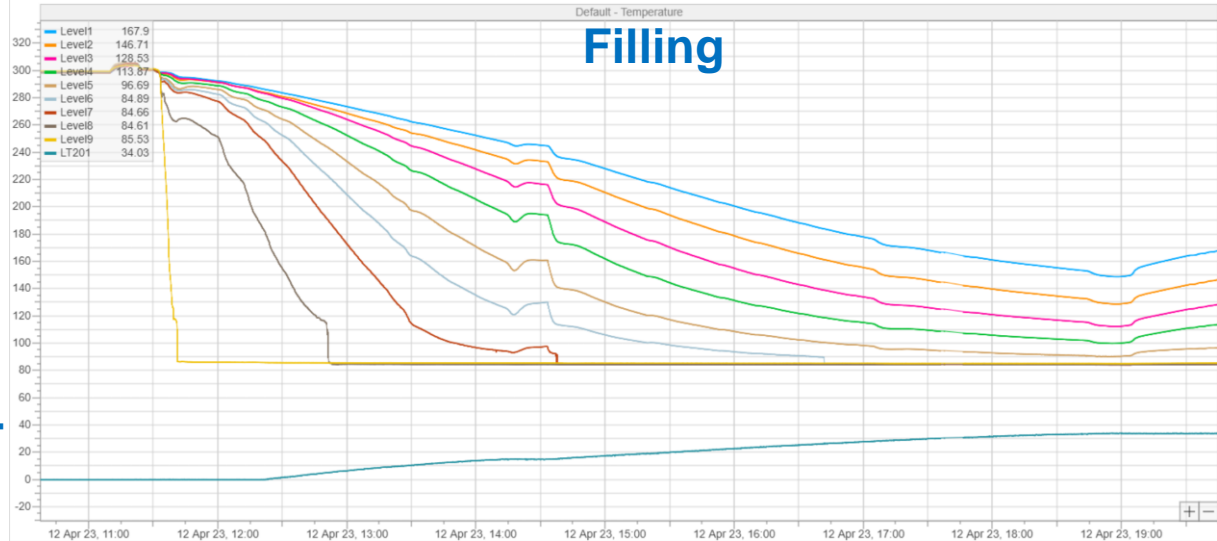


Commissioning test with LAr

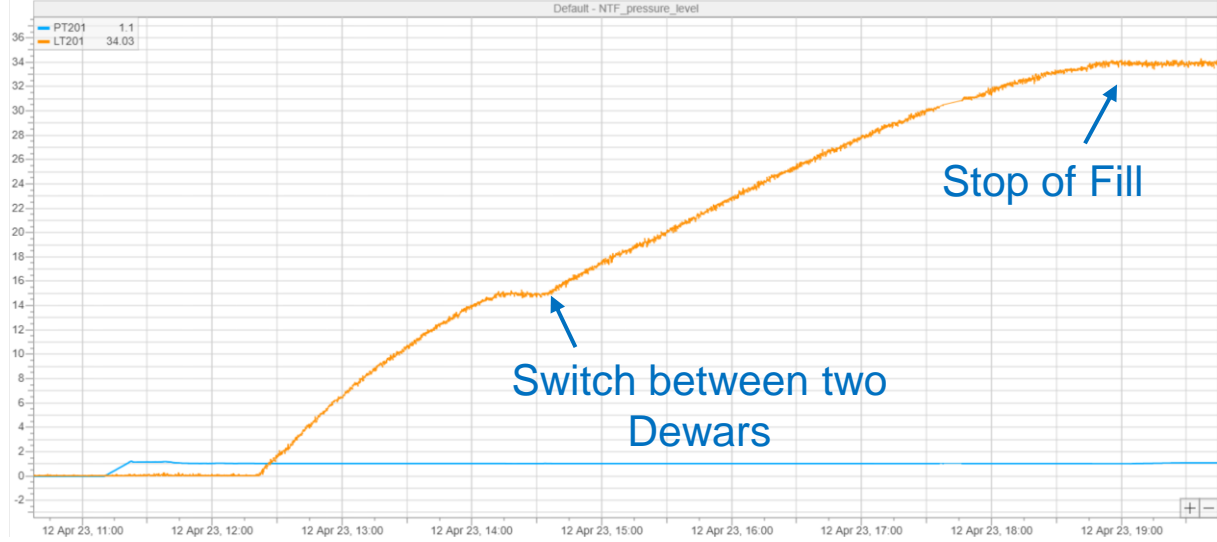
- Vacuum level in cryostat of 5×10^{-4} mbar (in 24 hrs)
- Open-bath dewar with purification cartridge filled with LAr
- Criostat fill from two portable 240 l dewars
- Pressure in the cryostat mantained stable ~ 1050 mbar by an automatic controlled proportional valve at the venting line
- LAr level in the cryostat ~ 42 cm (295 l) from the bottom reached in approx. 8 hrs
- The evaporation rate of the LAr is of ~ 4 cm every 24 hrs (30 l)



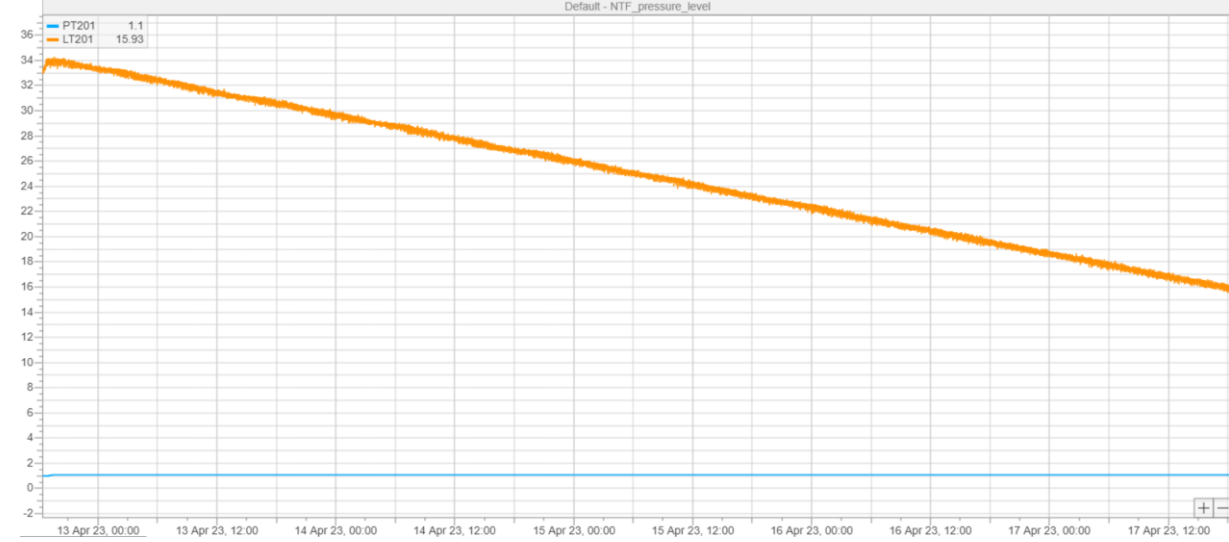
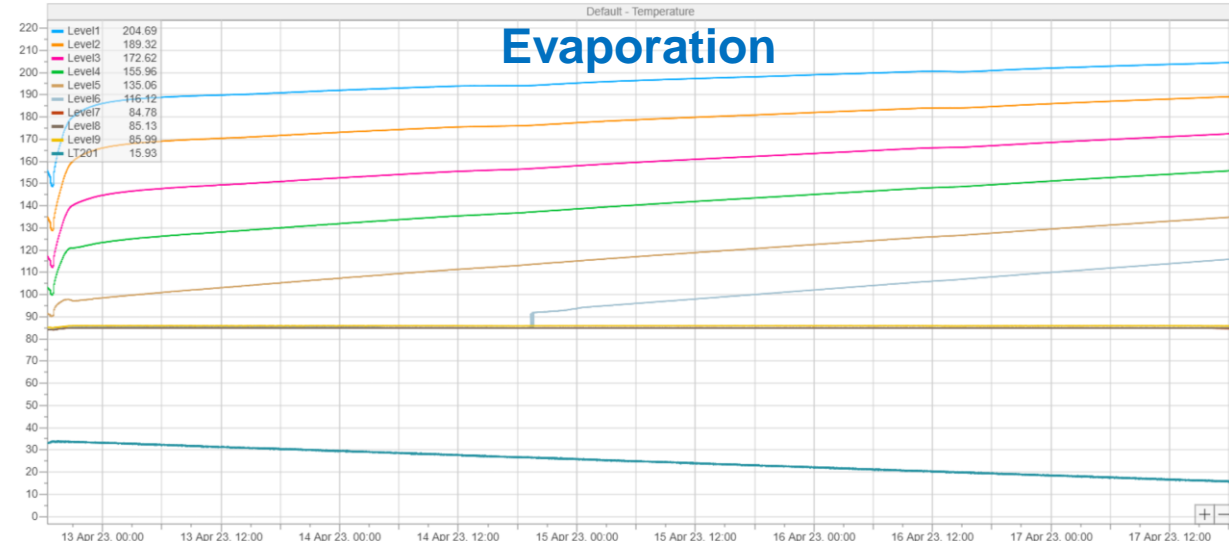
Temperatures and Level



Level and Pressure



Evaporation

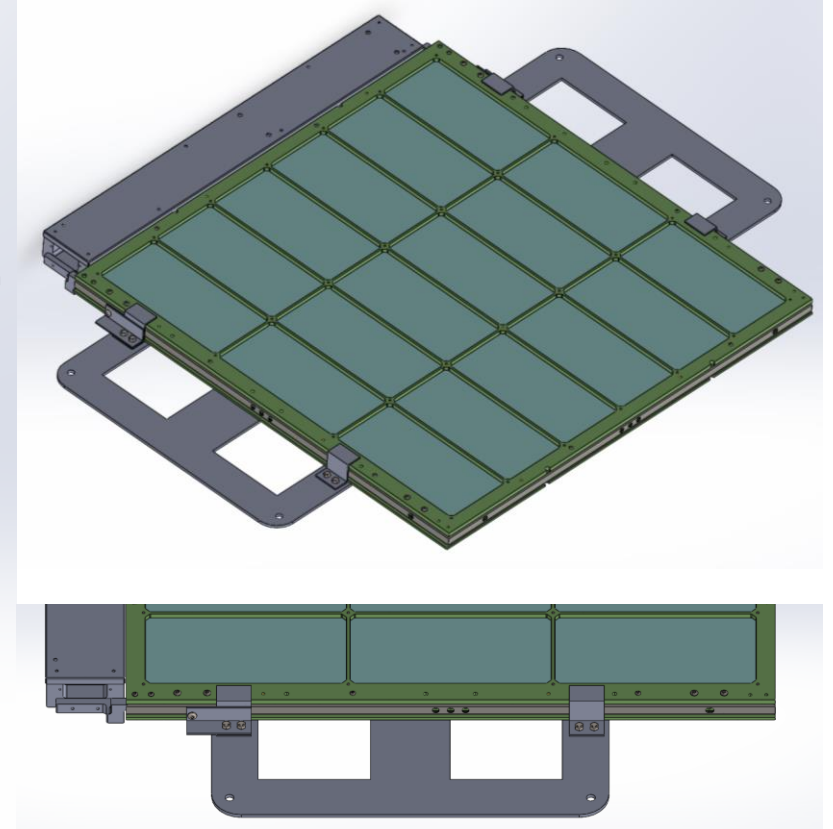
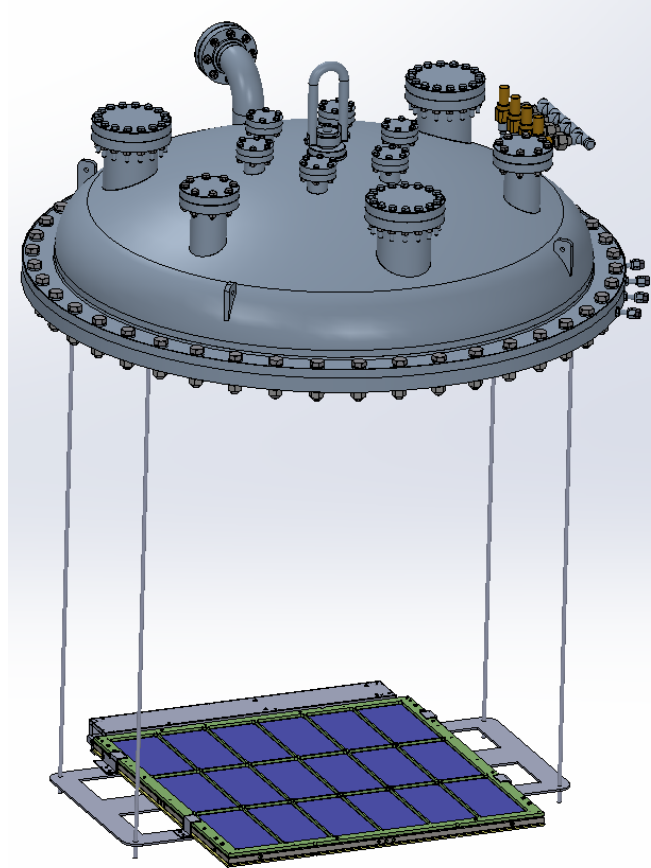


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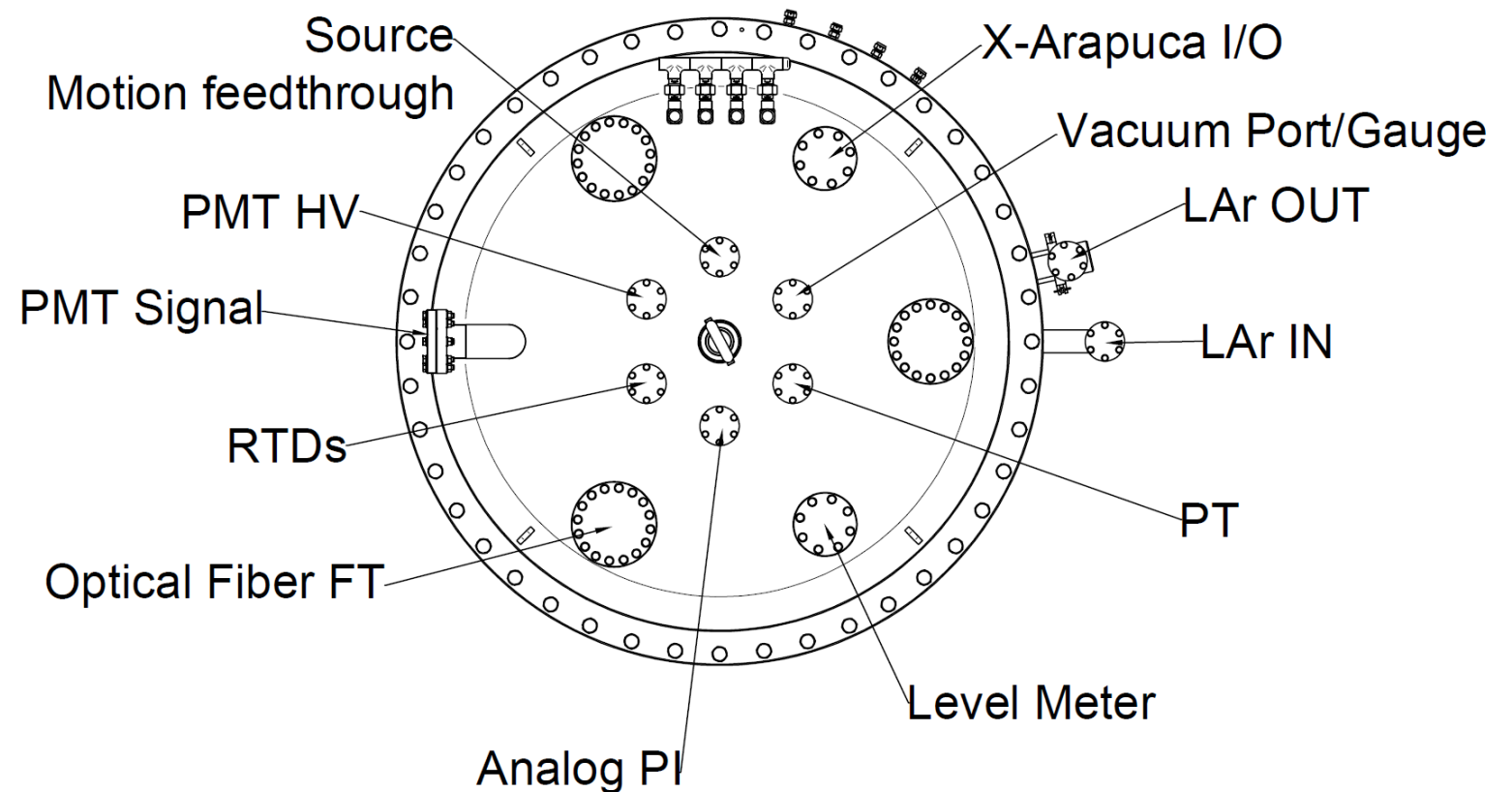
XA Megacell test: Mechanics

- Support stainless steel AISI 304 plate to hold the XA Megacell face up is in production
- Threaded rods to hang the structure to the flange and adjust its vertical position
- Lateral stainless steel elements to block the Megacell in a fixed position on the plate are in production
- A PMT will be installed on the support plate to monitor and compare the LAr purity as in commissioning test



Output flange layout, source and manipulator

- Criostat output flanges: six CF40, three CF63, three CF100
- A magnetic manipulator system through a CF40 will be installed to hold and move a $(250 \text{ Bq}) \text{ } ^{241}\text{Am}$ alpha source above the Megacell
- Illumination system with optical feedthrough and light diffusers
- 405 nm laser, UV led source



Conclusions

- Commissioning test completed – no issues
- Filling approx. 295 l in 8 hrs
- Evaporation rate: 4% (approx. 4 cm) in 24 hrs
- Depending on the duration of the test we plan to use 3 dewars:
 - 2 dewars to fill the cryostat (approx. 480 l)
 - 1 dewar to fill the filter vessel
- Placing the XA-Megacell at the same quote of the X-Arapuca during commissioning test we estimated 8 days with LAr level above the Megacell for the test

