LAr R&D Progress Updates 03/17/26

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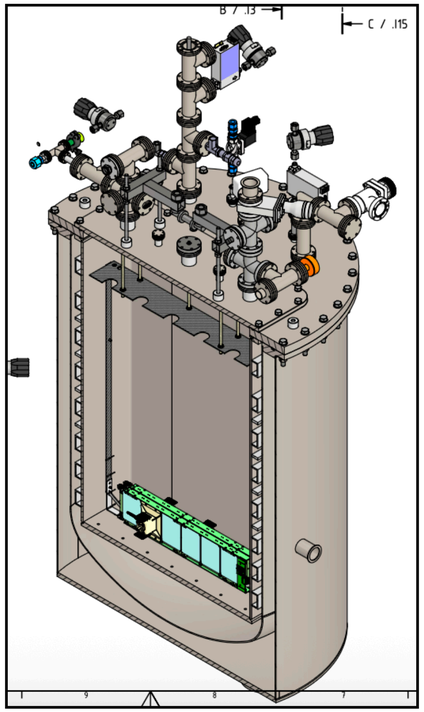
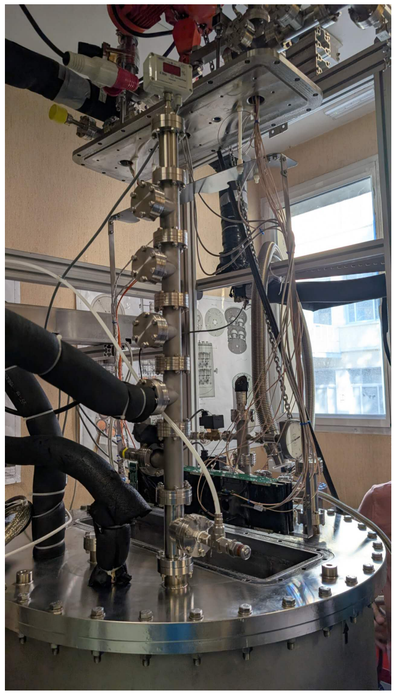
Lab Safety and Space Management

- The Physics Department will be going through an Electrical Safety self-assessment over the next few weeks.
  - Some staff may be randomly selected for brief interviews or asked about how electrical work is planned and performed.
  - Make sure everyone is familiar with your role when it comes to electrical safety, things like job planning, hazard awareness, and following the proper procedures.
  - For QEW, ECP, WCC, or involved in electrical work in any way, it’s a good idea to be comfortable walking through how you approach your work safely.

Filter Testing Setup at CIEMAT

- The main cryostat the outside cylindrical dewar with 600L volume
- The testing dewar is an inner vessel with cuboid shape with about 100L volume
- The cooling is done by filling outside dewar with pressurized LN2
- Seal is done using metal enforced vitton O-ring+vacuum seal, 3 seals in total, about 2000 euro each
- Drawing received



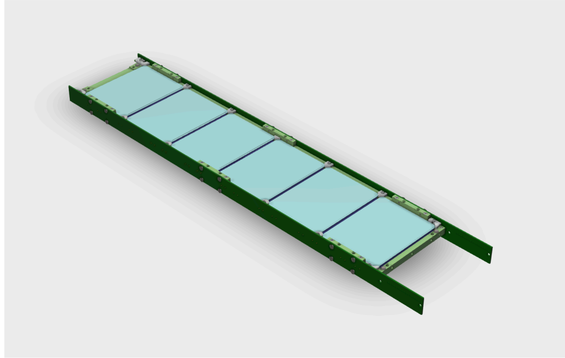


Filter Testing at CIEMAT

- Cryogenic operation
  - Pumping down for 1 week before fill
  - Filling with UHP GAr argon to the testing dewar, condensing with the LN2 bath in the main dewar
  - No purification
  - 1 micro-second life only, sufficient for light measurement
  - Started pumping today in the afternoon before lunch
  - Measurements take 2 days

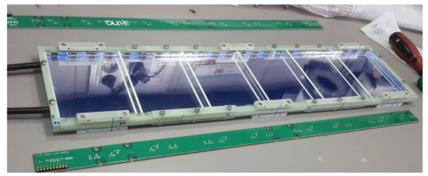
X-Arapuca setup-Supercell Vs. Megacell

- There are two X-Arapuca setup at CIEMAT
  - One for VD named **Megacell** using 14.3x14.3cm filters
    - Megacell has been disassembled
  - The other for HD name **Supercell** using 10x8cm filters
    - The current unit for this test (CAD file received)

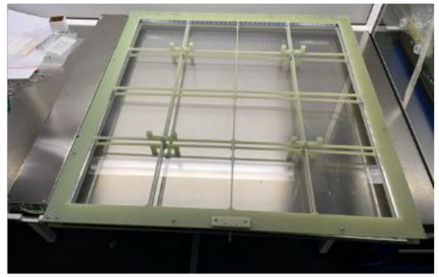


- **DUNE HD X-ARAPUCAs** (10x50 cm^2): 6000 modules in DUNE FD, tested in ProtoDUNE-HD in 2024.
- **DUNE VD X-ARAPUCAs** (60x60 cm^2): 672 modules in DUNE FD, being tested in ProtoDUNE-VD.

HD X-ARAPUCA

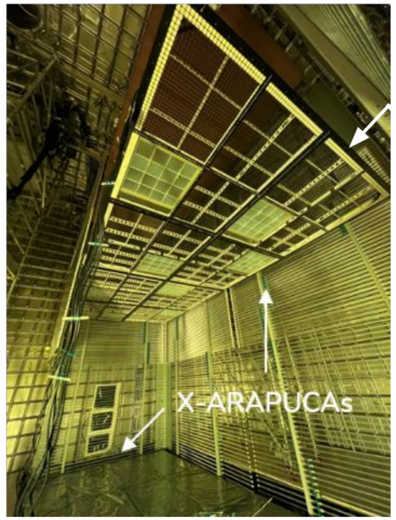


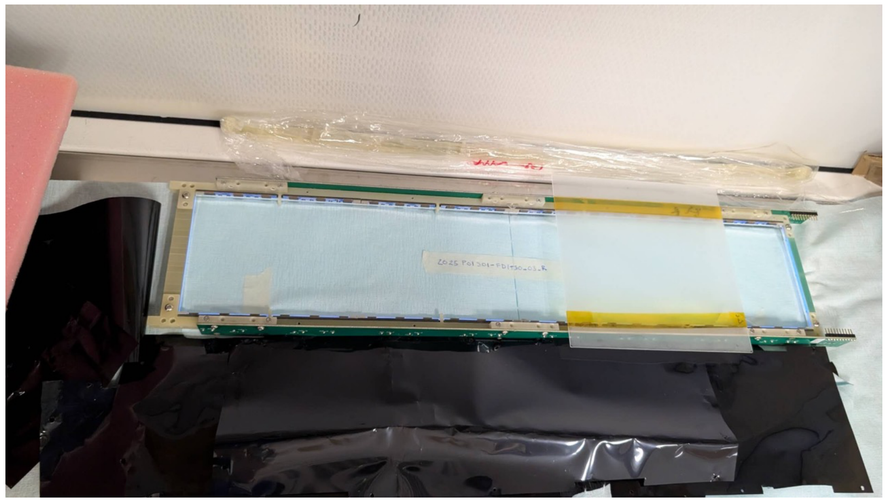
VD X-ARAPUCA



ProtoDUNE-HD

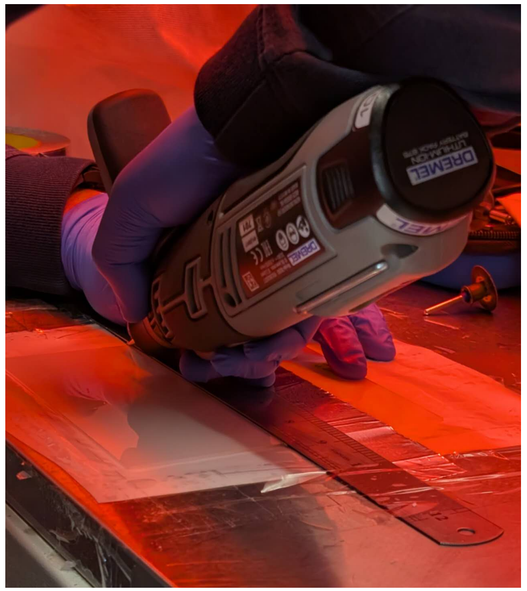
ProtoDUNE-VD

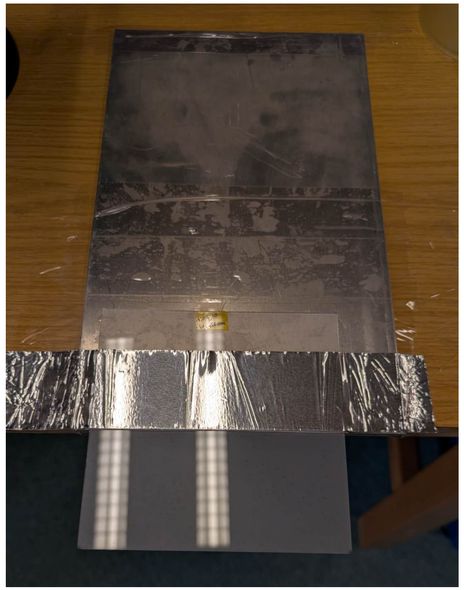


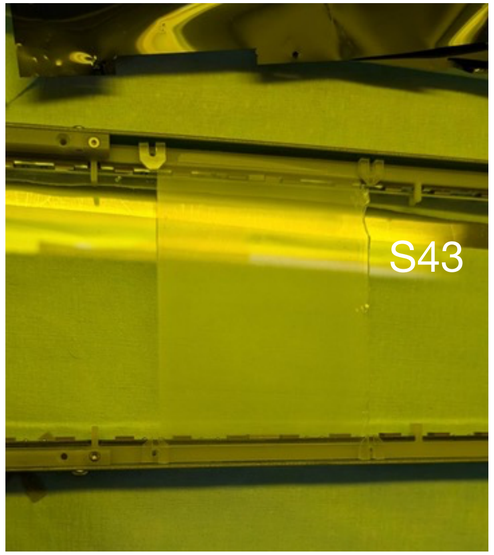


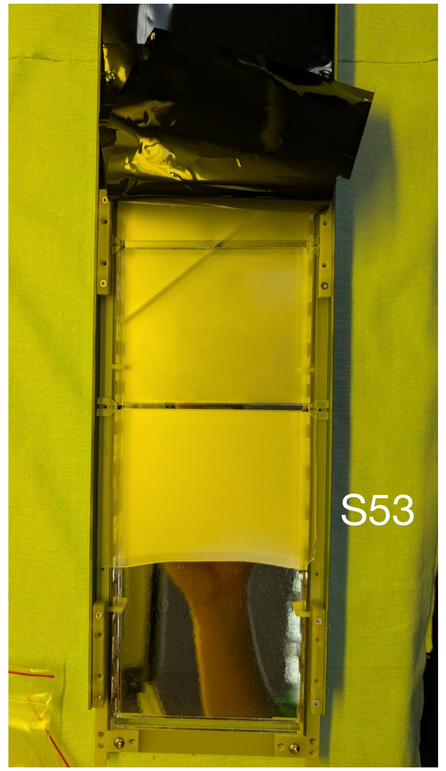
Filter cut

- In order fit our filter to the Supercell, filter cutting processed
  - Given the high risk, we started with back one, S43 to test the possibility
  - Using diamond head to create a grove on the then bend
    - Both can fit into supercell
    - Not quite clean edge and tiny cracks at the edge
    - Proceed with S53 with a curved cut on the edge but almost no cracks
  - S53 fits to the Supercell with slightly large gap on one side



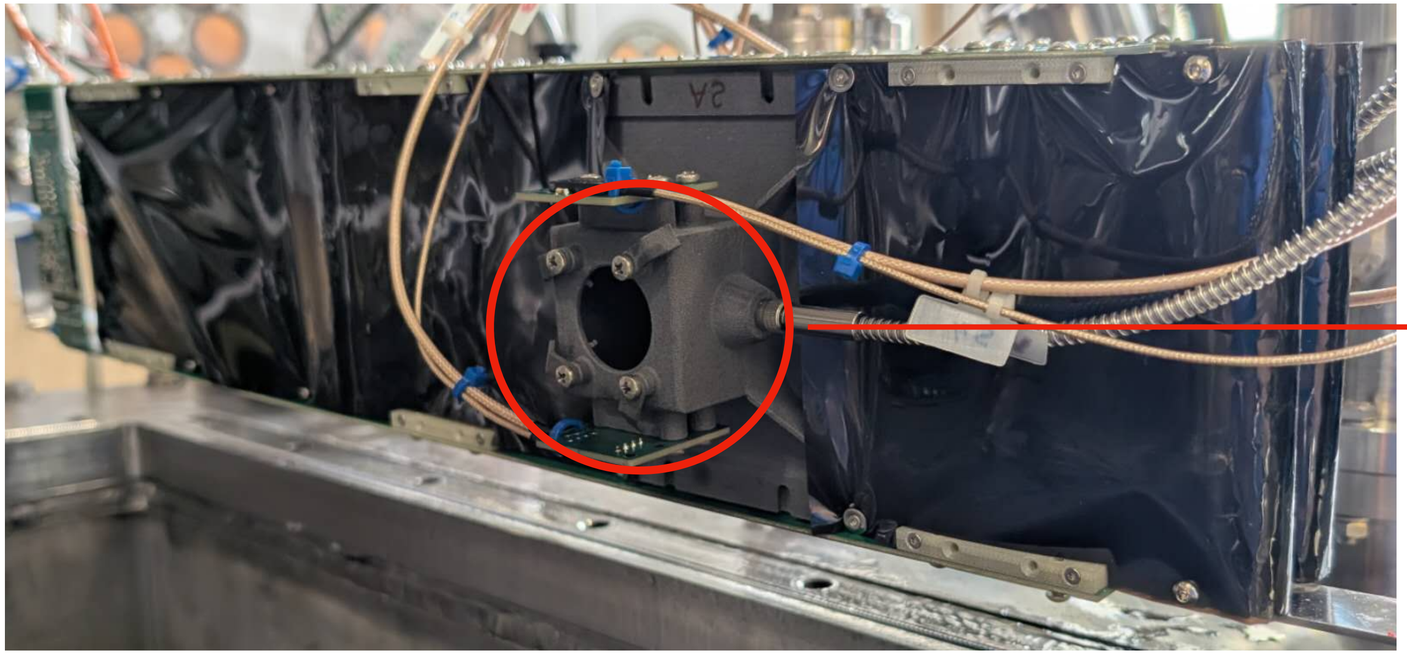


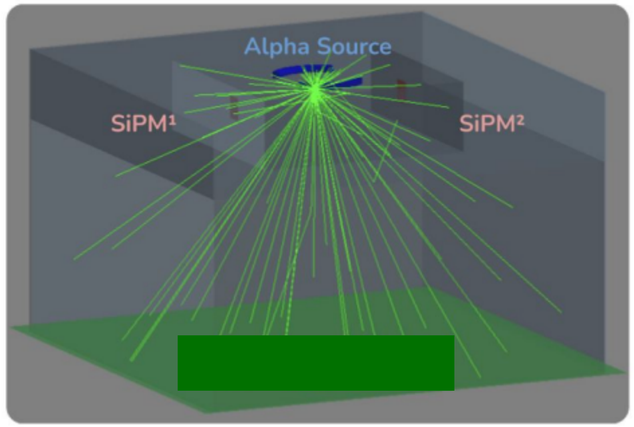




Filter cut

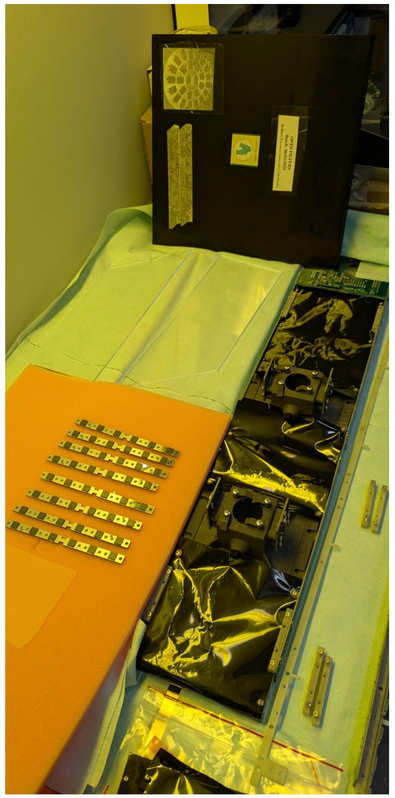
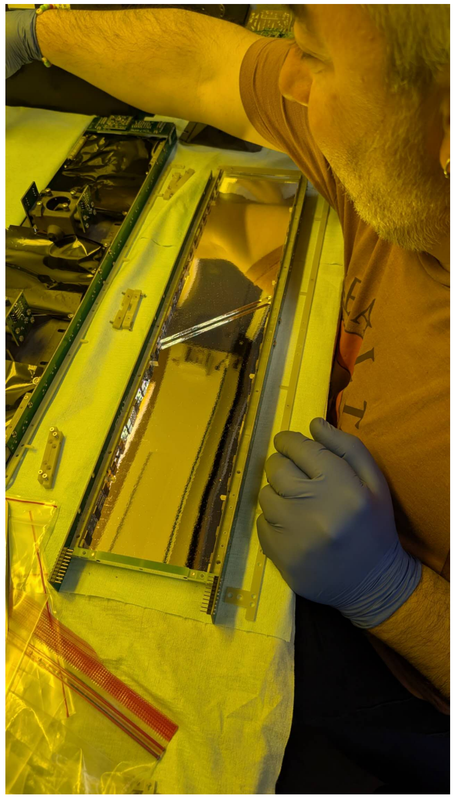
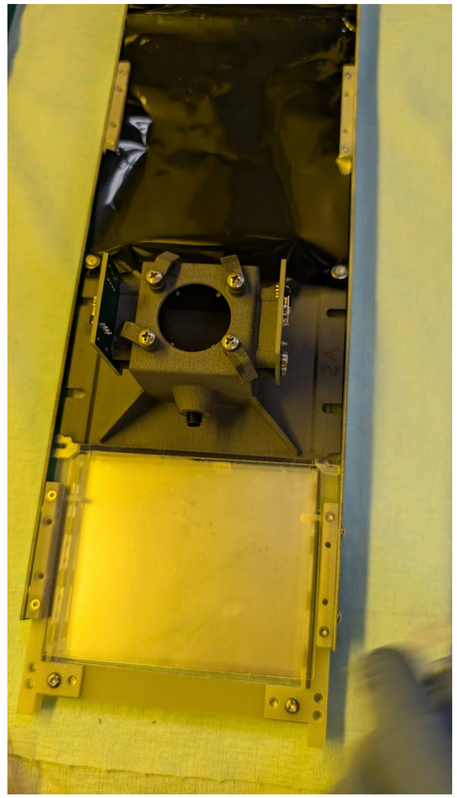
- The measurement only need 1 filter with alpha source illumination, Ideally, it would ideal to replace all the filters on the Supercell
  - Given the difficulty and uncertainties for the cut, we are only going to put in S53 for this measurement
  - Only need a small area with about 4 x 4cm size for alpha source light illumination
  - The impact of other filters is minimal
  - Just realized the small pieces created in the cut can fit in the integration ball at Chemistry Dept for QE measurement

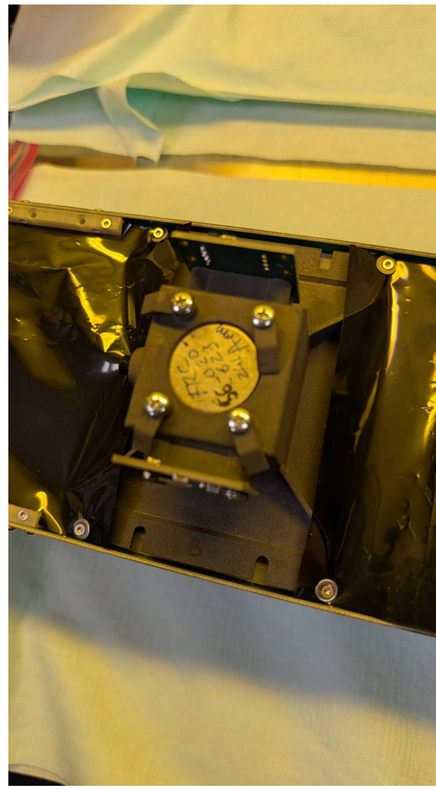




Supercell re-assembly

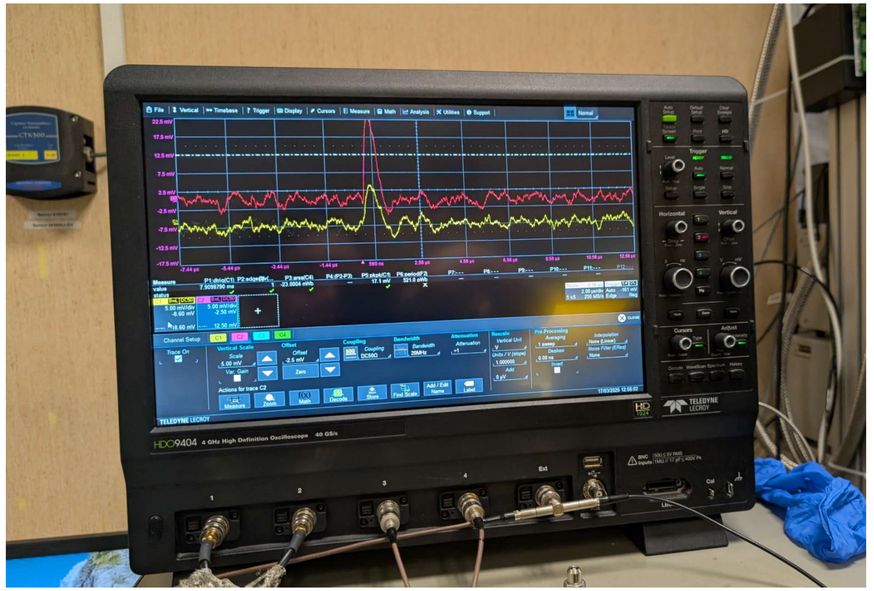
- Both supercell was taken out from the dewar for re-assembly
  - Fully disassembled to put on the same Hamamatsu VUV SiPMs
  - With filter on the same position on the supercell, side-by-side filter comparison to the pTP filter made in Brazil can be done

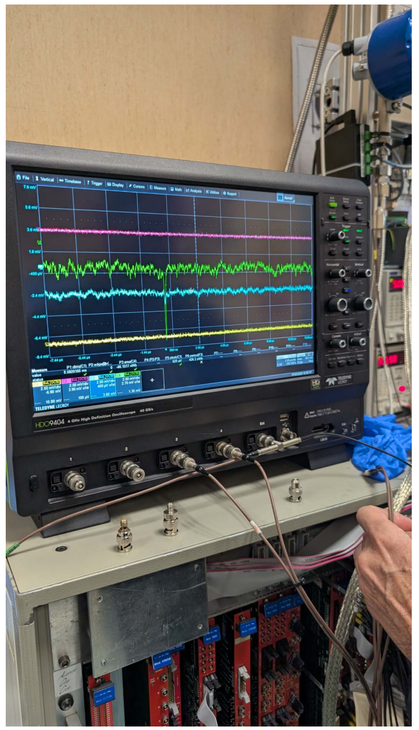







Pre-pumping test

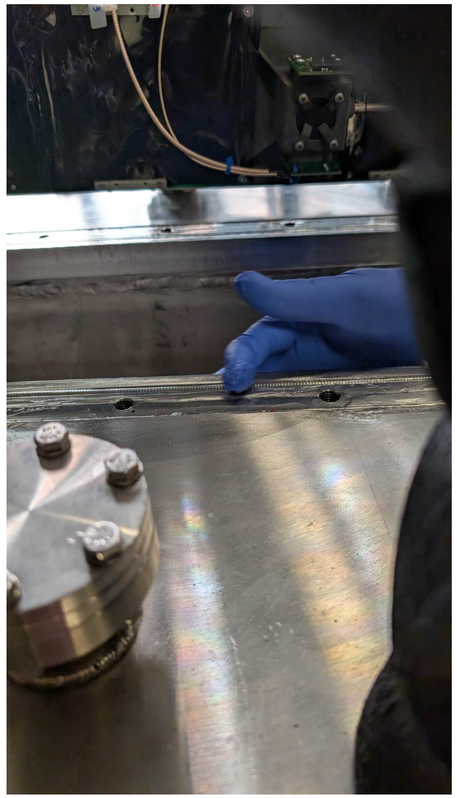
- Cabling and testing
  - All the connections were put back
  - Electronics and SiPMs tested with 450nm calibration laser

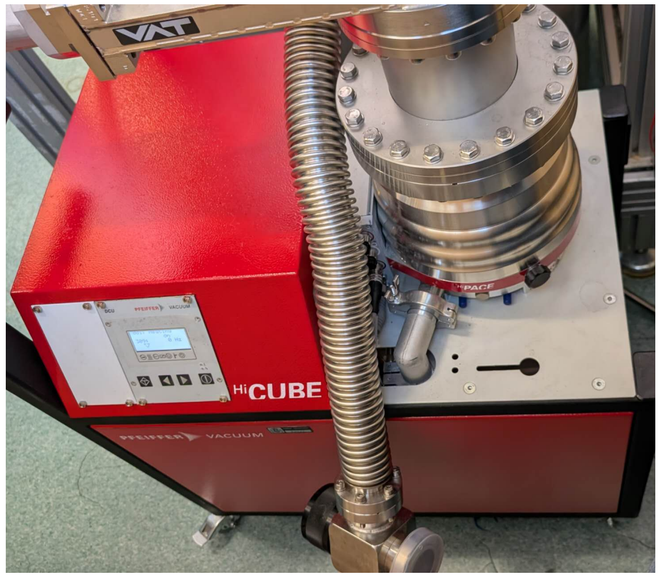




Pumping down

- Re-apply vacuum silicone grease
- Very large 10” turbo pump
- Vacuum down to 3.1E-4 mbar at the end of the day
- Will keep pumping for a week





Checklist

✓ Detector CAD design files and assembly drawings

- Bill of materials and key material specifications
  - Partilaly known,Will check back with the mechanical engineering tomorrow

✓ Simulation model and code (GEANT4 or other), including documentation

  ✓ Clara will provide later

- Sample raw and processed data with data format description
  - Just had discussion with Clara, her student can do the analysis and she will talk to the student about providing raw data

✓ Any spare detector modules or related hardware

  - The supercell will be used for the last time in this time but they want to keep it
  - Their team is going to switch to production scheme of SiPM testing for DUNE with a 2500L cryogenic system, I will visit the lab tomorrow