LAr R&D Progress Updates

Yichen

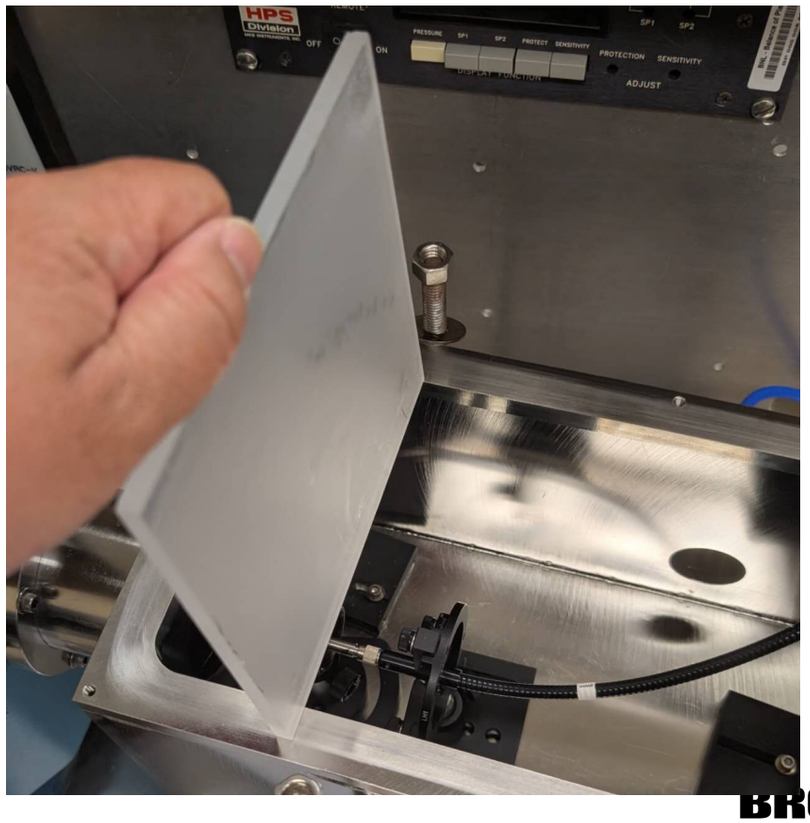
5/27/25

Lab Safety and Space Management

- **Power Outage Status**
  - The long multi-day power outage has been postponed. It is now scheduled for January 2026, so it will not take place this summer.
  - There will still be two brief power outages lasting a few hours each later this year, expected to occur on weekends. A notice will be distributed as the dates approach.
- **Regarding the unexpected outage on May 7th,**
  - Please remember to report any equipment damage either to department safety or me. The contractor's insurance may be able to cover the losses incurred.

PTP coating measurement

- **Additional Samples from SBU**
  - Rado brought several pieces from SBU
    - 1x from Fermilab, 2x made in SBU(labelled #41, #42)
    - #41 seems to be too large to fit, Rado will cut a smaller piece and bring it back on Friday
    - Will conduct the same measurement as previous samples for comparison
  - High sensitivity spectrometer from Thomas
    - We could borrow the equipment for this week
    - Our own is on order



Plan for the future measurement

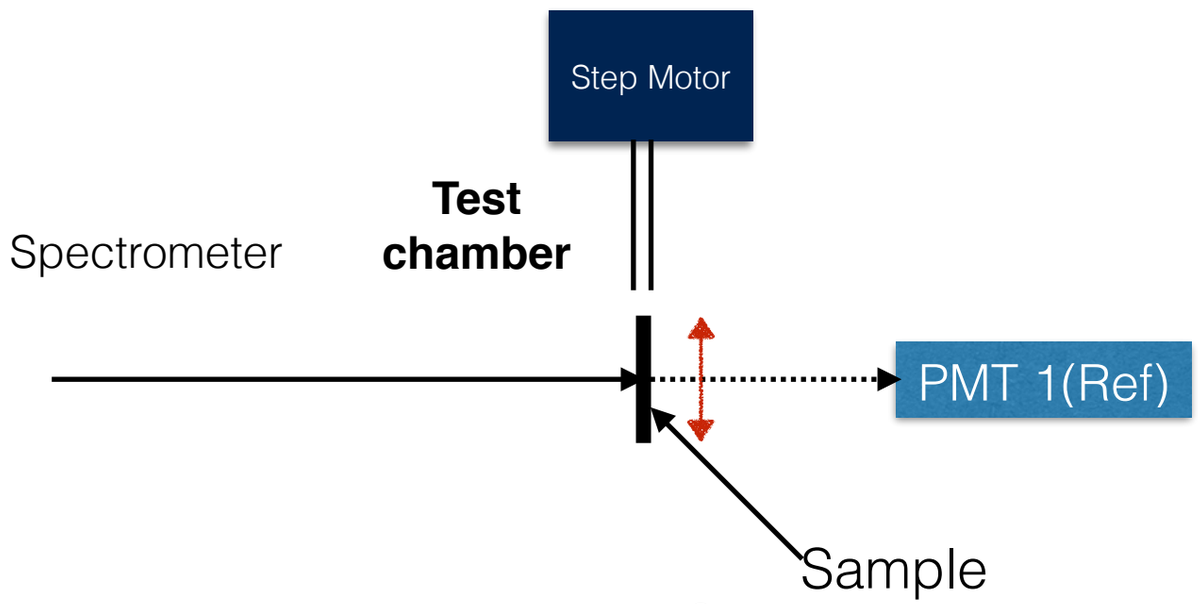
- **Measurement for the filter**
  - Emission spectrum
  - Light yield (absolute/relative), QE, transmission, and etc.
- **Requirements**
  - Light source intensity(absolute/relative), with optical power meter or PMT at no gain mode
  - Full light collection
- **Apparatus**
  - Construction of the test chamber
  - Mechanics stage to slight in and out the filters

Plan for the future measurement

- **Measurement Procedure inside the collimator box**
  - Due to the partial light collection: Light spot larger than the collimator
  - We can only conduct relative measurement using the BC408 as a reference for now
  - The optical properties of BC408 is known
  - With current equipment, by setting up the samples at the same location inside the collimator box with the same collection, we can establish relative measurement on light yield, transmission refer to BC408
  - This requires precisions in the sample positions

Plan for the future measurement

- **Measurement Procedure with the test chamber**
  - Setup the sample on the light path intercept the beam with focusing the minimum light spot
  - Remove the sample first, measure the full power of light from monochromator with PMT at no gain mode or a power meter
    - Calibrated PMTs available in stock
    - Thermal power meter available
  - Insert the sample, measure the light at the back of the sample with full collection with collimator (collimator size need to be larger than the light spot)
  - The intensity may also be measured with spectrometer with attenuation by neutral density filters



Diffusion data updates

- **The Diffusion info we put on our liquid argon property pages has not been updated for while**
  - Adding more recent data to keep the webpage update
  - Just collected the data, will update the plot and fitting results
- **Additional data Collection**
  - Measurement of the Longitudinal Diffusion of Ionization Electrons in the MicroBooNE Detector, **MicroBooNE** 2021, https://arxiv.org/pdf/2104.06551
    - D_L = 3.74^{+0.28}_{-0.29} cm^2/s at 273.9 V/cm at 89.4 ± 0.2 K
  - Electroluminescence pulse shape and electron diffusion in liquid argon measured in a dual-phase TPC, **DarkSide**, 2018 https://arxiv.org/pdf/1802.01427
    - 100 V/cm, D_L = 4.35 ± 0.05 cm^2/s
    - 150 V/cm, D_L = 4.21 ± 0.04 cm^2/s
    - 200 V/cm, D_L = 4.05 ± 0.04 cm^2/s
  - Electron Diffusion in the ProtoDUNE-SP LArTPC, **ProtoDUNE** 2021, https://indico.fnal.gov/event/44492/contributions/214335/
    - At 500 V/cm, D_L = 3.91 ± 0.13 cm^2/s at 87.68 K
  - **SBND**, found in the Slack history (confirming with Hanyu)
    - D_L = 4 cm^2/s 0.5 kV/cm and 88.4 K