LAr R&D Progress Updates 06/09/26

Henry, Amoggh, Yichen

Brookhaven National Laboratory

Lab Safety and Space Management

- ECP monthly meeting
  - Test first before using old electrical equipment
- DUNE HV cable testing setup EEI updates
  - I inspected the setup earlier
  - A modification is planned to be made
  - Will update the EEI inspection

Measurement taken last week

- Transmission measurement with the FS5 spectrometer at Chemistry Department
- SiPM calibration with VUV SiPMs
  - Henry will report in his slides
- Prototype 3D printing design and initial printing
  - 2 iterations made
  - Should have close to final version at Version 3

Transmission measurement

- The transmission measured with FS5 spectrometer
  - The measurement is simple the counts with a scan of single wavelength light
- We took three measurement
  - Counts with nothing
  - Counts with blank B33 substrate
  - Counts with pTP coating on B33 substrate
- The ratio between the no sample data is the measurement of transmission/absorbance
  - Instrument software calculated absorbance, agree with offline calculation
  - Converted Transmission for B33 agrees with vendor

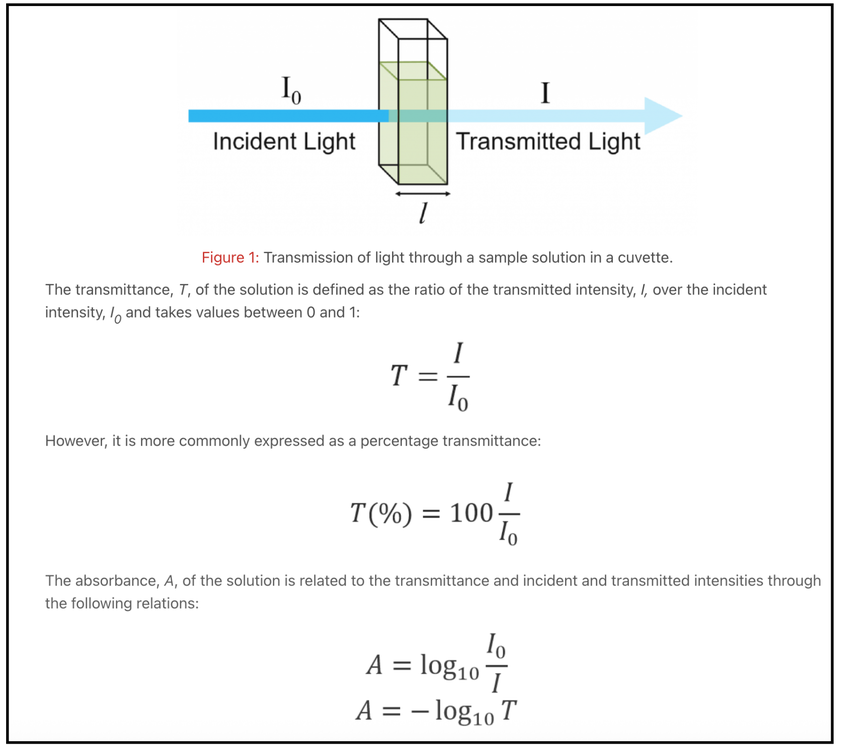


Figure 1: Transmission of light through a sample solution in a cuvette.

The transmittance, T, of the solution is defined as the ratio of the transmitted intensity, I, over the incident intensity, I_0 and takes values between 0 and 1:

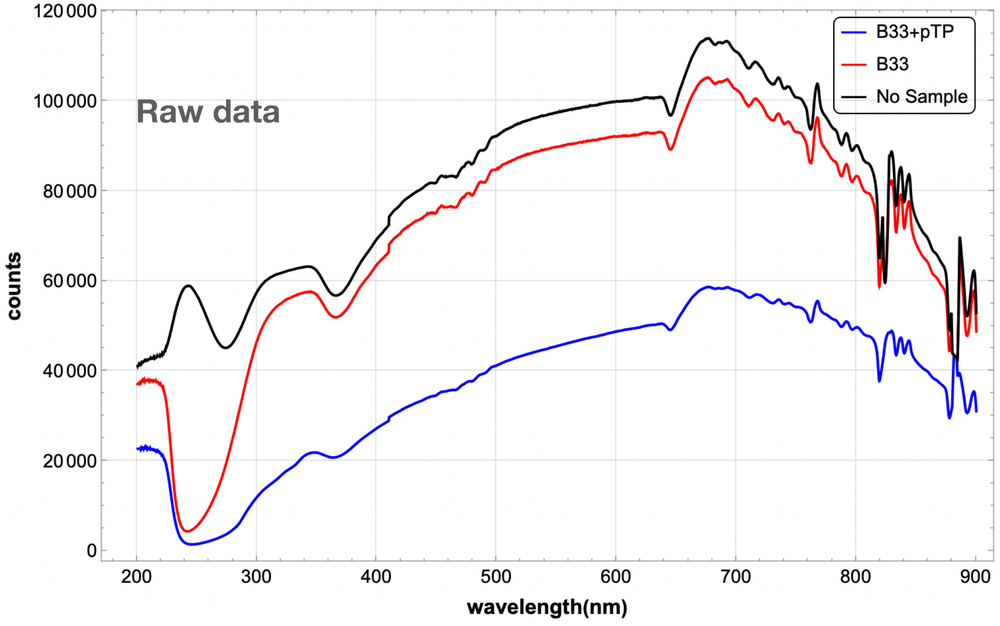
$$T = \frac{I}{I_0}$$

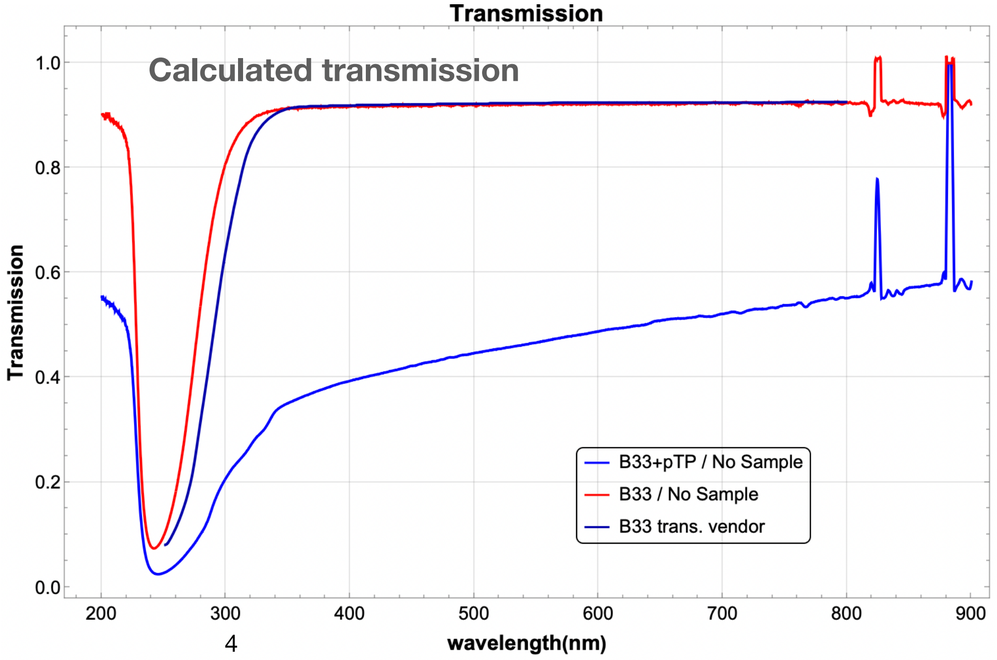
However, it is more commonly expressed as a percentage transmittance:

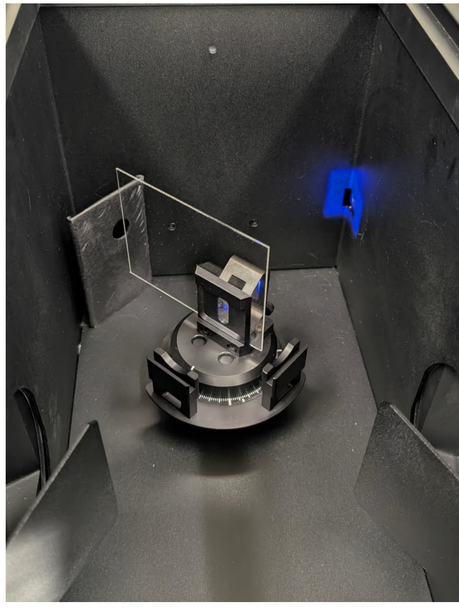
$$T(\%) = 100\frac{I}{I_0}$$

The absorbance, A, of the solution is related to the transmittance and incident and transmitted intensities through the following relations:

$$A = \log_{10}\frac{I_0}{I}$$
$$A = -\log_{10} T$$

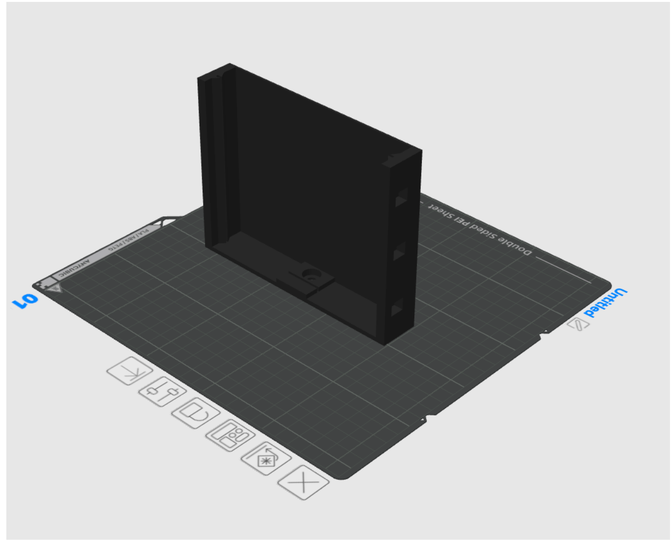


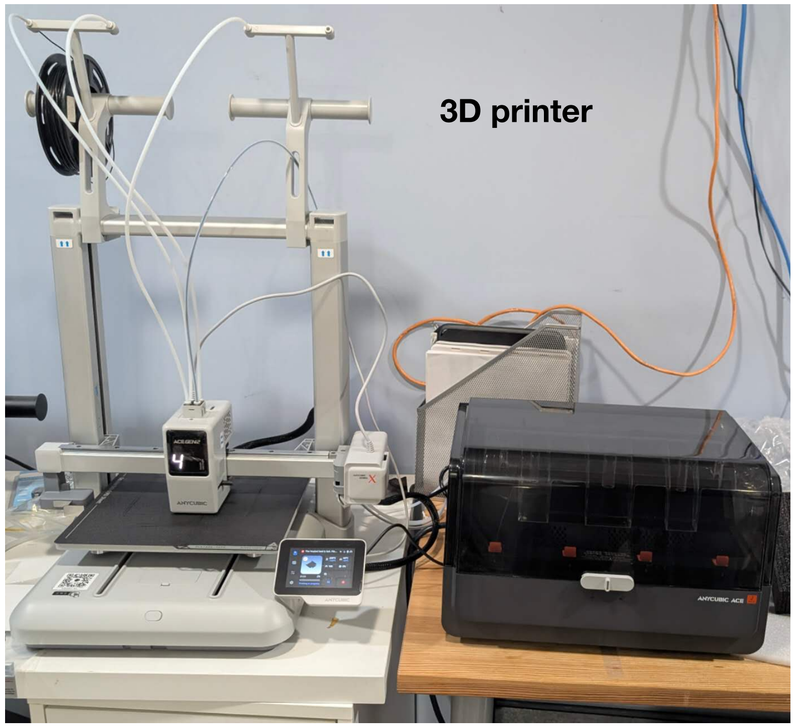


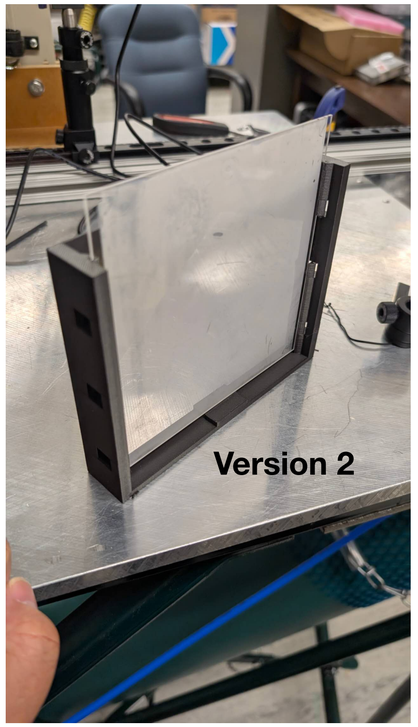


Prototype with 3D printing

- Henry made the 3D model for the substrate holder
  - Two versions have been made and tried with fitness test
  - Version 3 should be close to final version
- I got new 3D printer at home to printout the model
  - Total printing time is about 3 hrs
- Talked to Jeff about using the 3D printer at CE testing lab, he agreed







Plan for summer intern students

Photon Detection System Development and Optical Characterization

Project Goals

- Characterize pTP wavelength-shifting (WLS) filters for PDS applications.
- Calibrate and evaluate VUV SiPM performance.
- Develop a prototype optical detector assembly.

Major Tasks

1. pTP Filter Characterization

- Complete measurements of remaining pTP filter samples.
- Study effects of:
  - Filter thickness
  - Manufacturing variations with longer scanning distance
- Evaluate coating conditions
- Comparison measurement with SBU samples
- Quantum yield measurement
- Transmission measurement

2. VUV SiPM Characterization

- Single Photoelectron (SPE) measurements using oscilloscope.
- Gain calibration and breakdown voltage determination.
- Gain vs. Overvoltage.

3. Detector Prototype Development

- CAD design and 3D printing (PLA prototype).
- Assembly of:
  - Filter mount
  - SiPM holder
  - Detector base
- Mechanical integration testing.

4. Optical Studies

- Investigation of Total Internal Reflection (TIR) effect
- Angular response measurements.
- Relative light collection efficiency measurements.

5. Monochromator Measurements

- Debris sample expected from Yimin

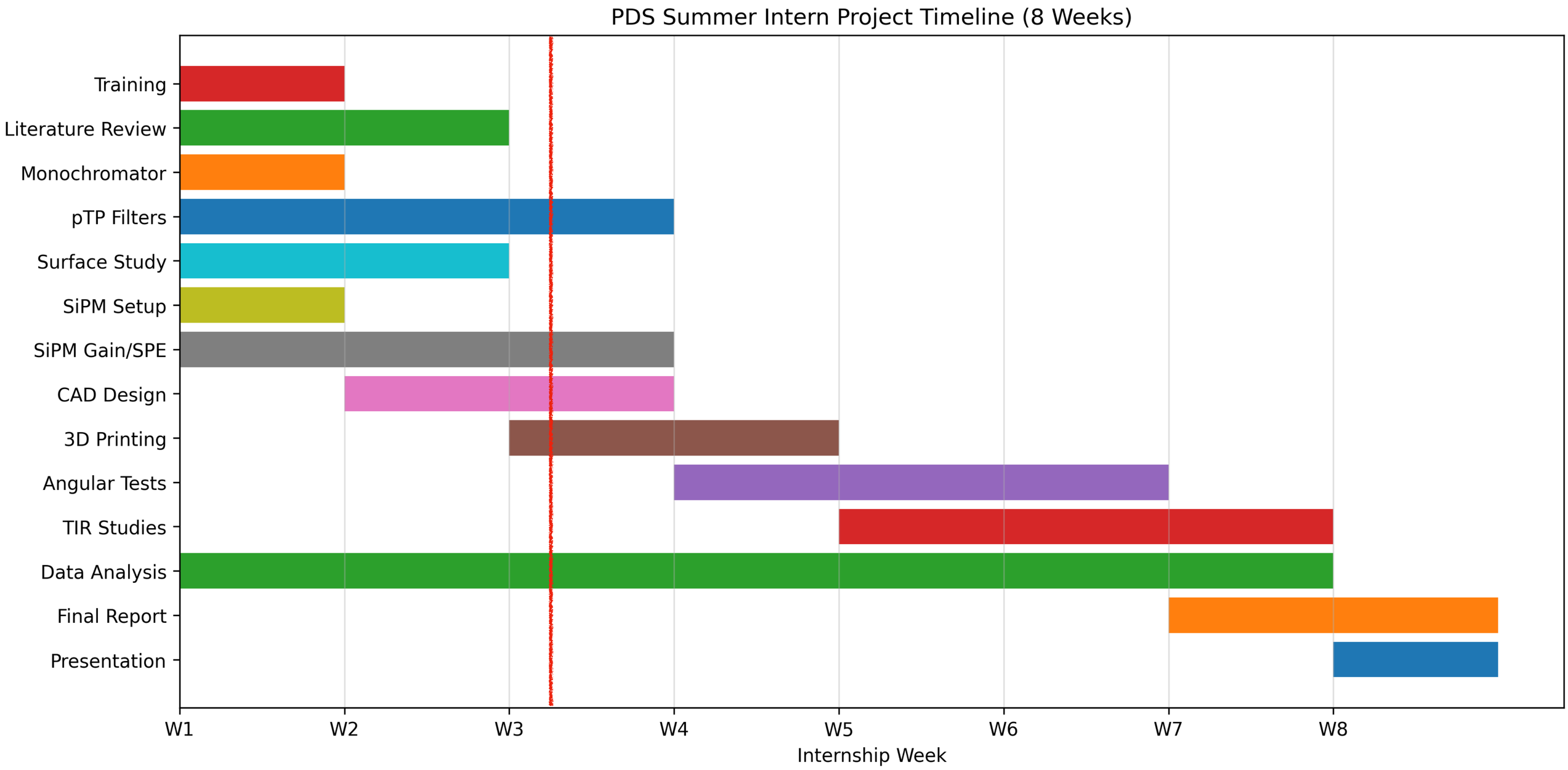
Deliverables

- Complete pTP filter performance database.
- SiPM calibration and SPE analysis package.
- Prototype detector assembly.
- Final technical report(tentative):
  "Characterization of pTP Filters and VUV SiPMs for Photon Detection Systems"

Skills Gained

✓ Optical measurements
✓ SiPM characterization
✓ Data analysis
✓ Mechanical design & 3D printing
✓ Detector instrumentation: spectrometer, profilometer, oscilloscope and etc.

Photon Detection System Development and Optical Characterization Plan



Plan for summer intern students

LAr Stand and Xenon Collection System Project

Cryogenic Operations, Xenon Collection, and Purity Monitoring

Project Goals

- Gain hands-on experience with liquid argon cryogenic systems.
- Support xenon collection and cryogenic operations.
- Construct and commission Xenon collection system
- Operation of cryogenic system

Major Tasks

1. Xenon Collection System

- Study system design and operation.
- Participate in system construction
  - Cryogenic plumbing
  - Leak check
  - Gas handling
  - Hardware installation
- Monitor xenon recovery performance.

2. Cryogenic Hardware & Controls

- Learn detector support infrastructure.
- Work with sensors, instrumentation, and controls.
- Introduction to LabVIEW monitoring and operation.

3. Inline Filter Construction

- Assemble new inline filter
- Leak checking and validation.
- Activation and commissioning procedures.

4. LAr Filling and Purity Measurements

- Liquid argon fills.
- Monitor purity evolution and system performance.
- Analyze purity-monitor data.

Deliverables

- Xenon collection performance assessment.
  Commissioned inline filter system.
- Purity measurement dataset and analysis.
- Final technical report:
  "Commissioning and Performance Evaluation of the Xenon Collection System"

Skills Gained

✓ Cryogenic operations
✓ Vacuum and gas systems
✓ Detector support systems
✓ Hardware assembly and troubleshooting
✓ LabVIEW controls
✓ Experimental data analysis

LAr Stand and Xenon Collection System Project Plan