LAr R&D Progress Updates 07/21/26

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Lab Safety and Space Management

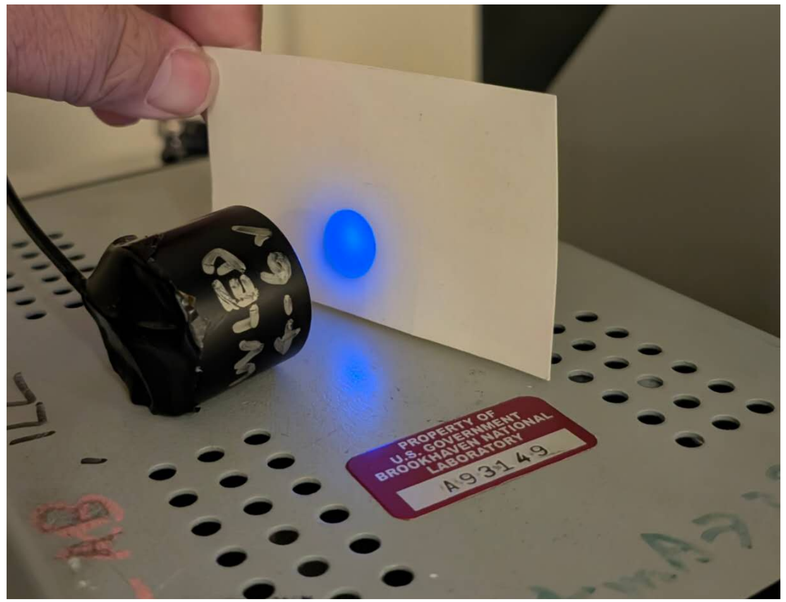
- Most of ESRs in Physics have been approved to restart
  - The safety regulation enforcement is noticeable stricter
  - Please be careful when working in the lab
  - Stop working order can be issued by anyone during work
  - Please keep your trainings up to date

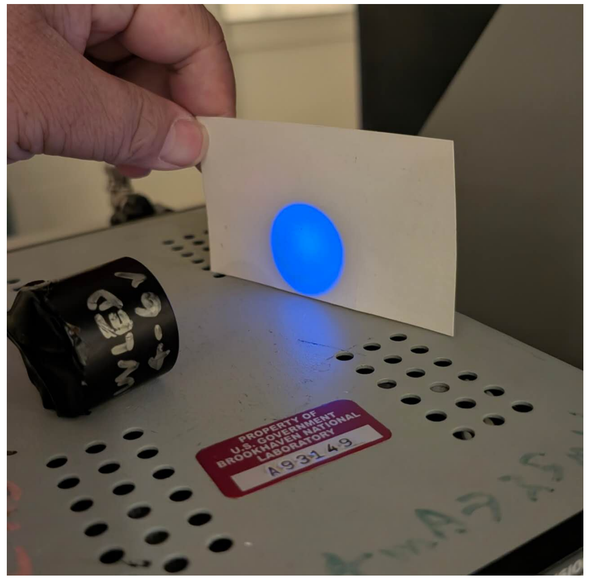
Measurement taken last/this week

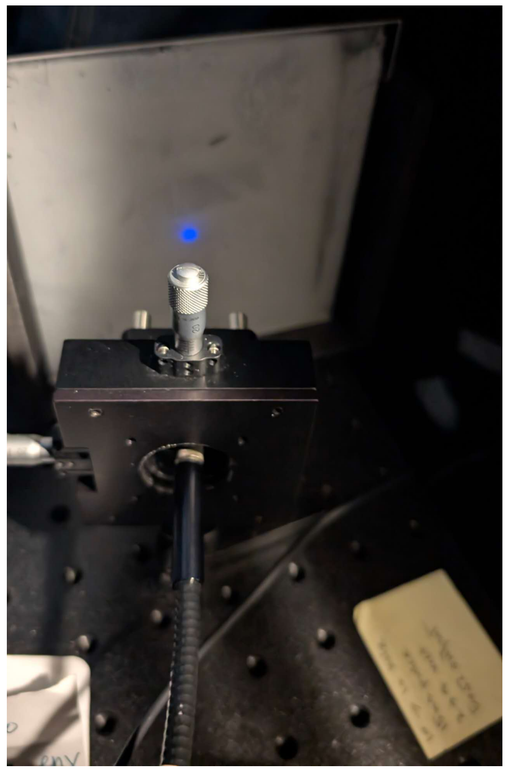
- Light trap testing
  - Starting with a 465nm LED used for the SPE calibration
    - Clear light trapping observed
  - 275nm UV LED test for pTP converted lights
    - Just borrowed from Instrumentation
    - Initial light trapping signal observed, more investigation needed
- Xenon collection assembly
  - All supply cylinders weighted on a scale
  - Baking is complete
  - Coordinating for the safety walkthrough for Work Permit approval

Light trapping prototype measurement

- 270 nm LED with pulsed output with fiber collimator
- Initial trial with collimator does not observe signal, now running with no collimation
- LED turned up at high driven pulse, light trapping initially observed







X-arapucca assembly cost estimation

- Made a cost estimation for the later assembly
  - WLS plate is the dominant cost, probably would be higher with more thickness
  - Readout electronics cost is not included at this moment

Item	Description	Quantity	Unit Cost	Estimated Total	Notes
WLS Plates	Eljen EJ-286-PS wavelength-shifting plastic, 3 mm × 150 mm × 150 mm, diamond-milled edges, clear pressed faces. Quote received from the same vendor supplying DUNE.	5	$446	**$2,230**	Delivery: ~6 weeks ARO. Largest remaining procurement item.
SiPMs	Hamamatsu S13370-6075CN (same model used in ProtoDUNE), assuming 24 channels for the complete X-ARAPUCA assembly.	24	$20–25	**$480–600**	Cost depends on final purchase price and quantity discount.
PA12 Filament (In-house Printing)	Material for printing the remaining mechanical components in-house.	2 spools	$75	**~$150**	Does not include labor or printer operating time.
Commercial 3D Printing (Alternative)	Outsourced printing of cryogenic nylon components, including one filter holder and seven SiPM pusher blocks.	1 filter holder + 7 pushers	$75 (holder), $3 (pusher)	**~$96**	Alternative to in-house printing; shipping not included.
Estimated Remaining Hardware Cost	Total estimated procurement cost for the remaining major components.	—	—	**~$2,806–2,980**	Total depends on the selected 3D-printing option and final SiPM pricing.

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

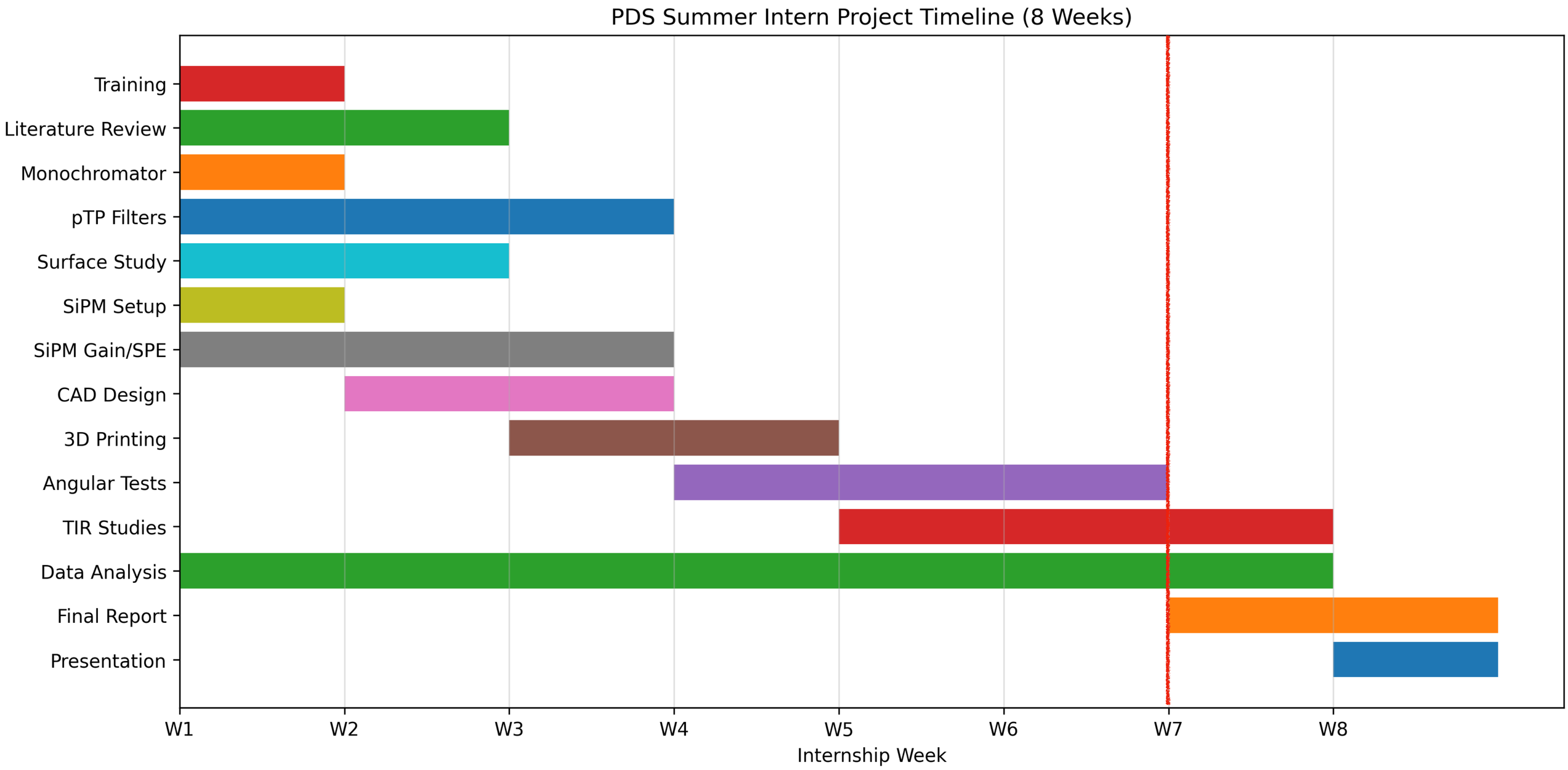
Deliverables

- 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