

Some organizational remarks.

Introductions, projects, relationships.

Welcome

First meeting of the ALD dichroic development program

- SBIR-I was proposed in 2021 and was successfully executed. A visit to the company in Va was organized in 2020.
- SBIR-II was proposed earlier this year.
 - Program is 2 years starting Oct 1, 2022
 - Laboratory scope is scientific requirements, and testing in real experimental conditions.
- Proposed scope on next page.
- The purpose of this meeting is to agree on specifications and to have a mutual understanding of timescales.

People

List of people in this meeting.

Technical meeting like this may take place every 6 months or after a milestone with plenty of notice.

- BNL: Milind Diwan (PI),
 - Yichen Li (Physicist Liquid Argon),
 - Chao Zhang (Physicist Neutrino Physics), Xin Qian (Physicist Neutrino Physics),
 - Minfang Yeh (Physicist, WbLS development)
 - Steve Linden (Instrumentation Physicist)
- Raytum: Steven Lu (PI), Yimin Hu (PI), Feng Niu (optics)
- Berkeley: Gabriel Orebi-Gann (THEIA PI), Jan Boissevain (THEIA engineering)
- UPENN: Josh Klein (Senior Physicist, Neutrinos, SNO+, THEIA), Sam Naugle (Physicist, Simulations)
- Unicamp (Brazil) and CERN: Ettore Segreto (Physicist, X-arapuca), Ana Machado (Physicist, X-arapuca).

Scope

Three types of Dichroic filters are planned to be produced by Raytum with ALD technology during phase II :

- 1) a short-pass filter of cut wavelength of 400nm on flat substrate according to DUNE specifications
- 2) a short pass filter of cutting wavelength of 475nm on integral Winston Cone according to understanding of the THEIA specifications
- 3) a long passing filter of cutting wavelength of 475nm on a disk matching Winston cone's light collecting end.

Schott B270 optical glass is the preferred choice of substrate taking the UV transparency and cost into consideration. Fused silica and UV transparent acrylic substrates will also be evaluated. Raytum Photonics will also perform the optical transmission, reflections test for dichroic filters and a light collection test for the integral Winston cone, as well as durability test according to MIL-STD-810 standard plus cryogenic temperature cycling test.

Testing

Raytum will deliver up to 50 DUNE-compliant dichroic filters to BNL, who will coordinate the effort of depositing a PTP layer on the other side of the flat dichroic filters by thermal evaporation process or use the filters together with PTP deposited films.

At BNL, there are two experimental facilities available to validate the performance of the dichroic filters. A liquid argon test stand (LArFCS) with gas purification system will perform tests of x-ARAPUCA with the dichroic mirrors produced with the ALD technique. The x-ARAPUCA devices for testing will be obtained from colleagues from the University of Campinas (Brazil) who are key collaborators on DUNE and prototypes at CERN. Tests for sorting Cherenkov and scintillation light from a water based liquid scintillator will be performed in an ongoing 1 ton testbed. This will include tests of dichroic filters and Winston cones emersed in the fluid and coupled to PMTs through UVT acrylic windows. Both the liquid argon test stand and the WbLS 1 ton testbed are part of ongoing R&D programs at BNL for liquid argon and water based liquid scintillator development funded separately by the DOE.

Facility status

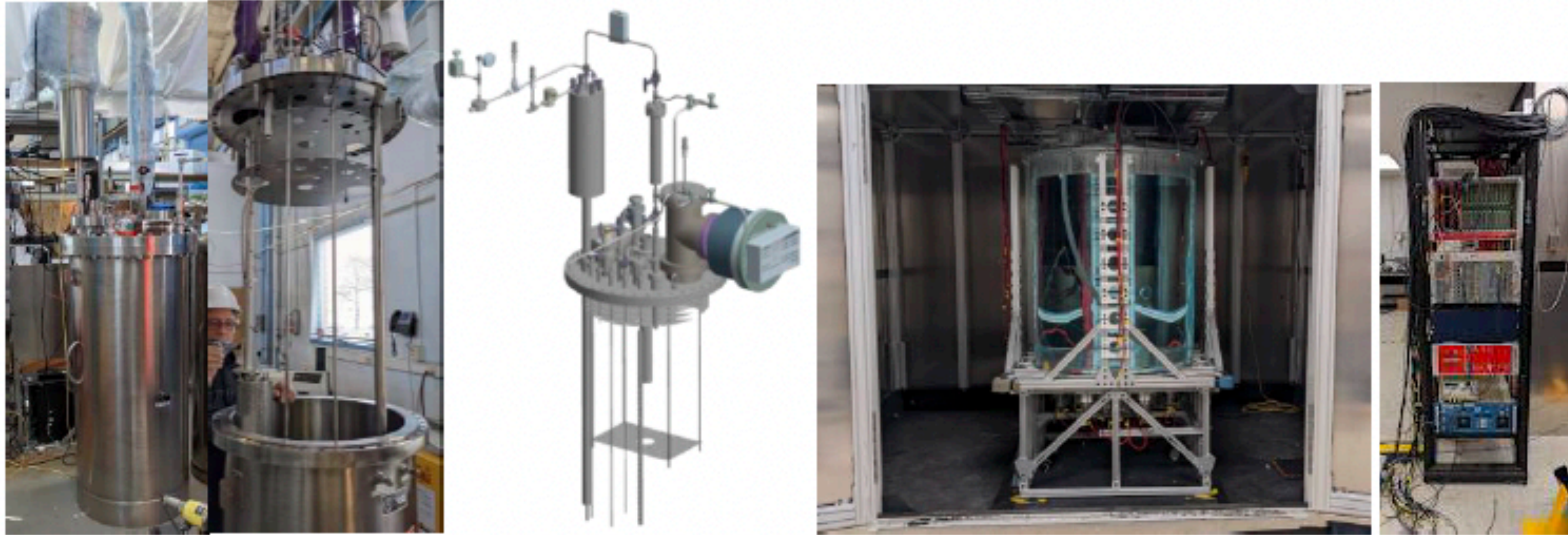


Fig 20: Left: LArFCS system and 3D model for top flange assembly. Right: the 1 ton WbLS system and DAQ.

Both of these facilities are now functional. The LARFCS system has gone through commissioning, for photon detector R&D some design in the volume will be needed. The 1 ton WbLS is currently taking data 24/7 with 1% WbLS solution.

Yichen Li will be in charge of implementing the testing in these facilities.