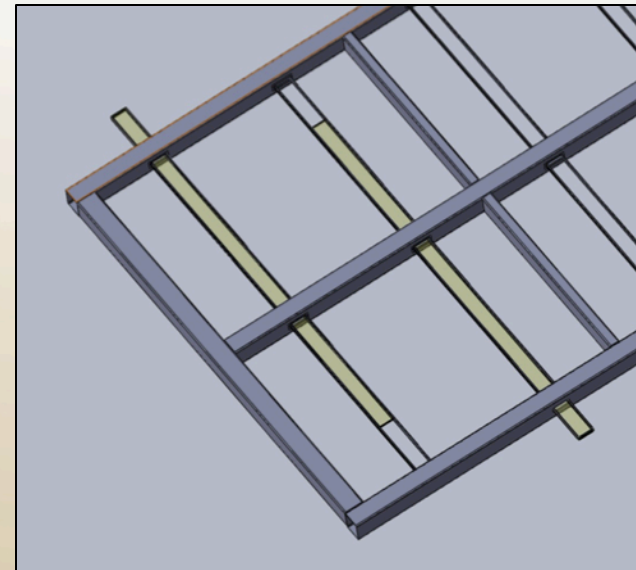
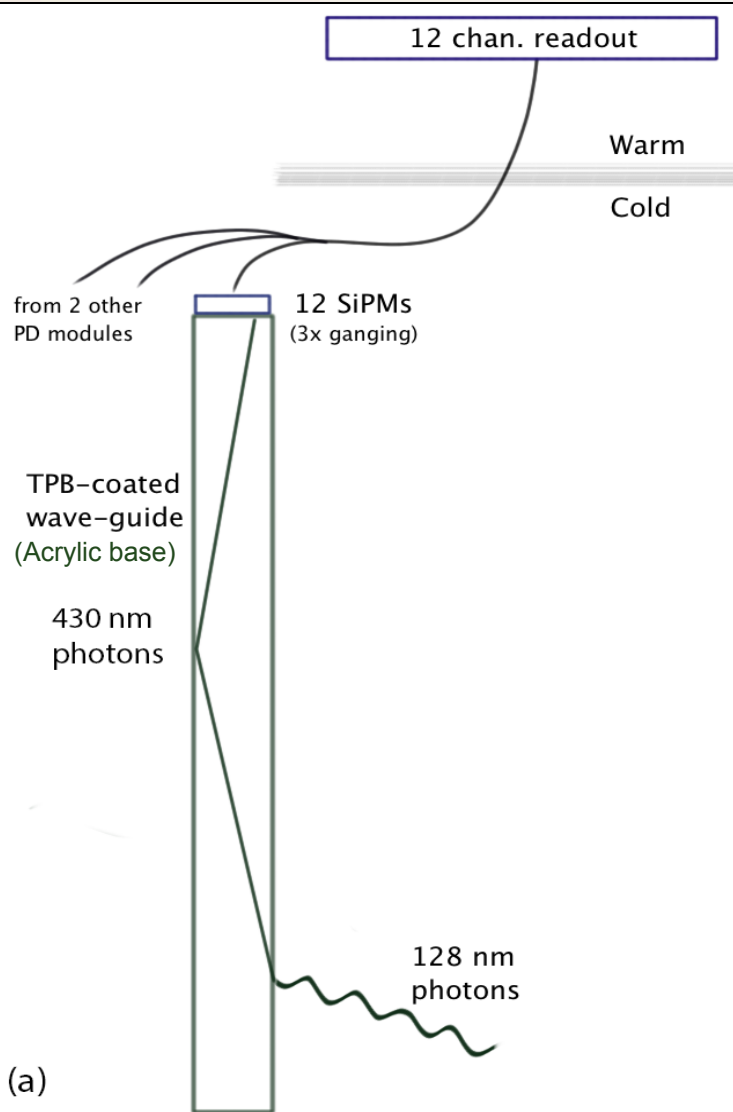


Photon Detector Project Status and Plans

Norm Buchanan
Far Detector General Meeting
October 6, 2015



Colorado
State
University



Reference Design

- 10 PDs (2 m × 6 mm × 83 mm) per APA frame
- 12 SiPMs per PD
- 3 SiPMs per readout channel

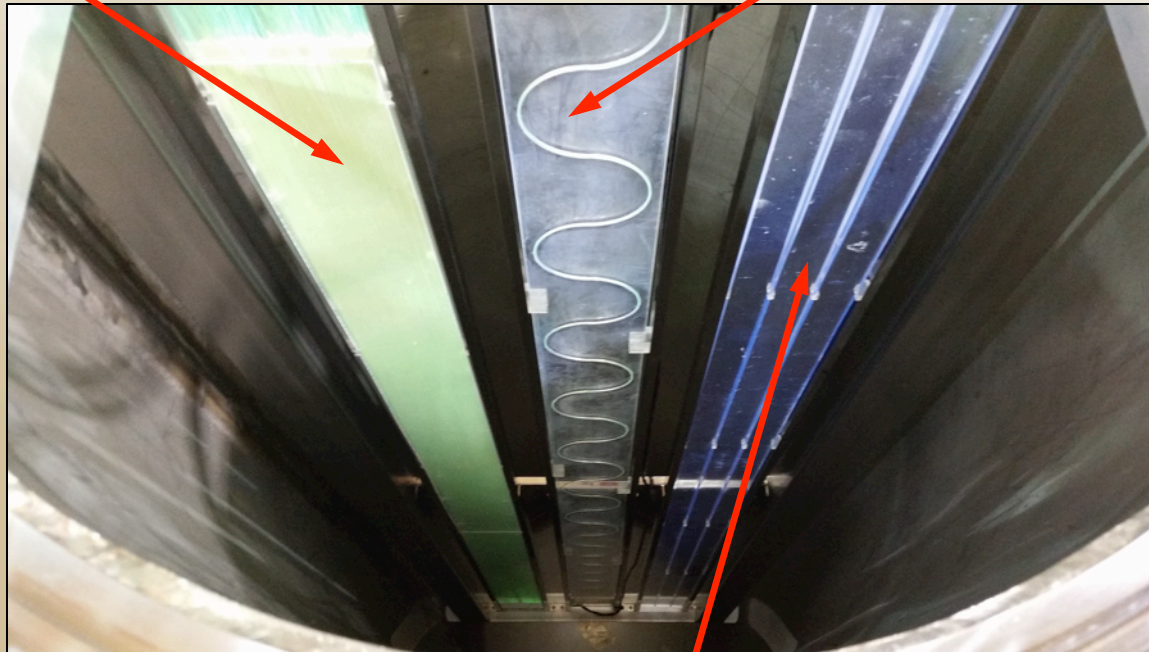
Designs Studied

Fiber Bundle with TPB-coated radiator (CSU)

- 2 rows of Y11 fibers coupled to 6 SiPMs
- Thin plastic radiator coated with TPB mounted above fibers

TPB-coated plate embedded with Y11 fibers(LSU)

- TPB coated Acrylic plate with Y11 fiber snaked through
- 2 SiPMs.

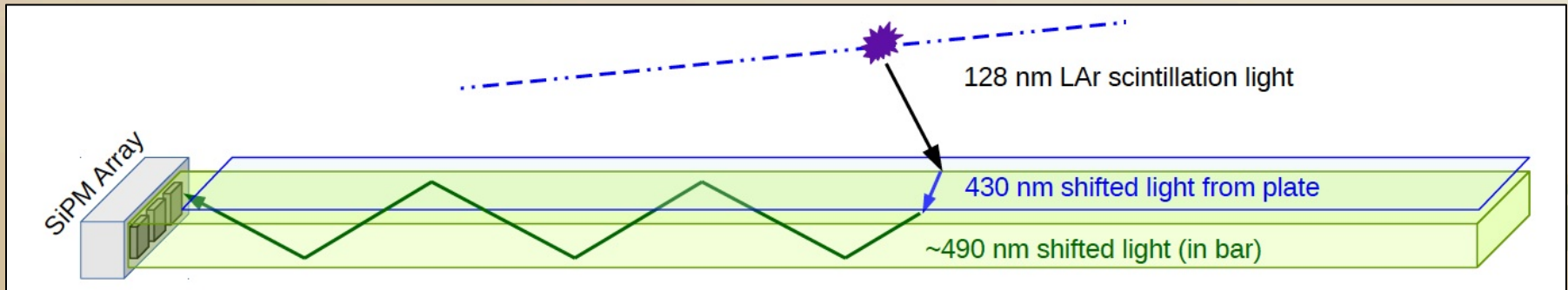


Previous Reference Design

Radiator + WLS Bar (IU)

Design that meets DUNE PD requirements – WLS polystyrene bar utilizing a thin TPB-treated radiator (developed by Indiana University)

Design separates the UVU → UV conversion from light-guide transmission to SiPM processes.



Design we are proceeding with for FY16 (on project)

- **Requirements – highest priority (end of CY 2015?)**
- **^{39}Ar – high priority (ASAP)**
- **Reduction in scope**
 - **reduce number of (on project) designs so we can focus effort on design optimization and component qualification (now)**
 - **PD-APA interface fixed (end of CY 2015)**
 - **Final design selected for protoDUNE (end of FY 2016)**
- **PD module design and APA interface and SiPM readout board and thermal testing (CSU)**
 - **PD module – 2 m prototype complete (Apr 2016)**
 - **PD module and interface testing (Sept 2016)**
 - **SiPM mounting board design/prototype (early 2016)**
 - **SiPM mounting board design/prototype testing complete (Sept 2016)**

- **Light guide and radiator optimization (IU)**
 - Optimized light guide testing complete (Aug 2016)
 - Optimized radiator testing complete (Aug 2016)
- **SSP support (ANL)**
 - Support for SSPs – 35t and PD groups (throughout FY 2016)
- **Cable/connector qualification (ANL)**
 - Candidate cable/connectors procured (Jan 2016)
 - Testing of cables/connectors complete (Sep 2016)

These are the tasks that the project has been able to fund for FY16. The following slides contain other important tasks that are also high priority and need coverage.



1. Light Guide and Wavelength Shifting Radiator Cryogenic Qualification

This work package covers planning and preparation for long-term reliability testing for wavelength shifting (WLS) radiators and light guides for PDs in LAr environments.

Needed to as part of light guide/radiator materials qualification.

2. Long-Term SiPM Cryogenic Qualification

This work package covers testing of candidate SiPMs to determine the expected long-term performance of the devices in a LAr environment.

Needed to as part of SiPM qualification.

3. Passive SiPM Ganging Verification

This work package covers testing sensL SiPMs read out by a single electronics channel in groups of 3 and 6 SiPMs to demonstrate acceptable performance .

Needed to as part of system value engineering. Assumed as part of costed design.



4. Active SiPM Ganging Verification

This work package covers testing sensL SiPMs ganged in groups of 3 and 6 SiPMs with active cryogenic electronic circuitry to demonstrate acceptable performance

Needed to as part of system value engineering. May allow further reduction in needed readout electronics.

5. Readout Electronics design optimization

This work package covers optimization of SiPM readout electronics for performance and cost effectiveness. This includes refining of performance requirements and evaluation of modifications to existing custom electronics as well as examination of possible commercially available options.

Needed to as part of system value engineering.

6. CERN Test PD Design, Engineering and Integration

Scheduling constraints will require completing a design and mechanical prototype of PD modules for the CERN test before we have completed the far detector design development. This work package covers the extra design, engineering, and integration with TPC and CERN test installation groups required to meet this schedule.

Needed to as part of preparation for prototDUNE test.

