Single-Phase Photon Detector Cryostat Top SP-PD Work Summary

David Warner for SP-PD Consortium Winter 2020 DUNE Collaboration Meeting February 3, 2020



Outline

• Action item from August I&I meeting (Lead)

ID#	Item	Responsibility	Date needed	Priority	Status
<mark>81971</mark>	Define position of PD monitoring fiber flange	Warner, Nessi		3	

- Electronics in the mini-rack
- PD Cryostat Top Connections
 - Fiber connections
 - Slow control fibers
 - Module readout
 - PD monitoring fibers
 - Copper connections
 - Daphne
 - Monitoring
- PD cryostat top access during detector installation/QC testing
 - Installation/Initial continuity checks
 - Weekly operational tests
- Summary of outstanding issues

Action Item 18971: PD Monitoring System Fiber

- Provisional decision: Fibers for the PD monitoring system will be routed through the PD signal flange
 - 8 positions on each outer APA row
 - 16 total positions
- Will use the same SMA connector flanges as in ProtoDUNE (3 per flange, 15 total fiber positions)



ProtoDUNE Fiber Flange





Monitoring Fiber Routing Path



Fiber Routing Through Crossing T



February Item 18971Summary:

- PROPOSAL: All PD fibers/cables will route through PD flange
 - No PD fibers passing through DSS feedthroughs
- Outstanding details:
 - Routing and anchoring of fibers to DSS beams
 - Routing of fibers through crossing T
 - Mounting of PD monitoring system electronics in mini-racks

Mini-rack Electronics Mounting

- Warm Electronics (DAPHNE)
 - Baseline: Two 2U tall modules per crossing tube
 - Available for installation March 2024 (full system)
- Monitoring System (Baseline design SSP)
 - Baseline: 3U of modules at 16 positions along outer APA (8 per side)
 - Available for installation October 2023 (full system)
- (Est.) 2U fiber patch panel at each mini-rack location (Preinstalled by I&I team)
- Additional room for cryogenic instrumentation?

PD Connections

- Fibers
 - 3 fibers per DAPHNE module (Data, slow control, timing)
 - 3 fibers (max) per monitoring electronics module (16 total)
- Copper
 - 48VDC (~25W) per DAPHNE module
 - Similar (not yet finalized) power requirement for PD monitoring/flashers
 - Not clear if power will be routed in one shielded cable and distributed at minirack or if we will use multiple cables.
- Fibers and power will be routed by electrical technicians prior to PD electronics module installation (Needed April 2026 in P6)

Cryostat Top Electronics Installation

- PD readout and monitoring electronics are required for detector installation QC checks
- Strong PD consortium preference for PD consortium scientists/technicians performing installation/checkout (with DAQ support)
- P6 currently shows 25 PD electronics installation/testing periods (one per APA row, approximately 15d duration)
 - PD consortium preference to compress to installing all at one time and testing, which would revise P6

Installation QC on Cryostat Top

- PD cable continuity checks and operational check immediately upon APA stack installation
 - PD cables inside crossing tube installed by I&I and TPC personnel
 - PD personnel will connect warm cables from flanges to warm electronics
 - I&I personnel may pre-position cables in tray
 - PD will connect monitoring system fibers if present at hatch
 - PD will conduct end-to-end check of readout at this time (DAQ support?).
- Periodic (upon completion of an APA row?) darkening of cryostat to allow operating photosensors for end-to-end checkout
 - "Weekend shift"
 - Requires 2 PD personnel

PD Cryostat Top Installation Schedule

131.02.02.05.12.07.0	4 PD Warm Electronics/UV flasher Installation/Checkout	200d	16-Apr-26	03-Feb-27
13122.A12866	Install/Checkout warm electronics detector slices 1-2	20d	16-Apr-26	13-May-26
13122.A14388	NON-DOE - PD Warm Electronics/UV flasher Installation/Checkout	200d	16-Apr-26	03-Feb-2
13122.A12868	Install/Checkout warm electronics detector slices 3-4	15d	14-May-26	04-Jun-20
13122.A12870	Install/Checkout warm electronics detector slices 5-6	15d	05-Jun-26	25-Jun-2
13122.A12872	Install/Checkout warm electronics detector slices 7-8	15d	26-Jun-26	17-Jul-26
13122.A12874	Install/Checkout warm electronics detector slices 9-10	15d	20-Jul-26	07-Aug-2
13122.A12876	Install/Checkout warm electronics detector slices 11-12	15d	10-Aug-26	28-Aug-2
13122.A12878	Install/Checkout warm electronics detector slices 13-14	15d	31-Aug-26	21-Sep-2
13122.A12880	Install/Checkout warm electronics detector slices 15-16	15d	22-Sep-26	12-Oct-2
13122.A12882	Install/Checkout warm electronics detector slices 17-18	15d	13-Oct-26	02-Nov-2
13122.A12884	Install/Checkout warm electronics detector slices 19-20	15d	03-Nov-26	23-Nov-2
13122.A12886	Install/Checkout warm electronics detector slices 21-22	15d	24-Nov-26	16-Dec-2
13122.A12888	Install/Checkout warm electronics detector slices 23-24	15d	17-Dec-26	12-Jan-2
13122.A12890	Install/Checkout warm electronics detector slices 25	15d	13-Jan-27	03-Feb-2

Outstanding Issues

- PD monitoring
 - Flange layout
 - Space for cryo temp sensors?
 - Space for calibration optical fibers?
 - Fiber routing on DSS
- Mini-Racks
 - Mini-rack size
 - Finalize power requirements
 - Finalize layout of mini-rack
 - Include space for cryogenic instrumentation module(s)?
 - Include cooling fans?
- Installation schedule detail
 - Electronics installation & testing
 - PD End-to-end checks