

PDS Preparations for Module 0

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Aug. 26, 2022

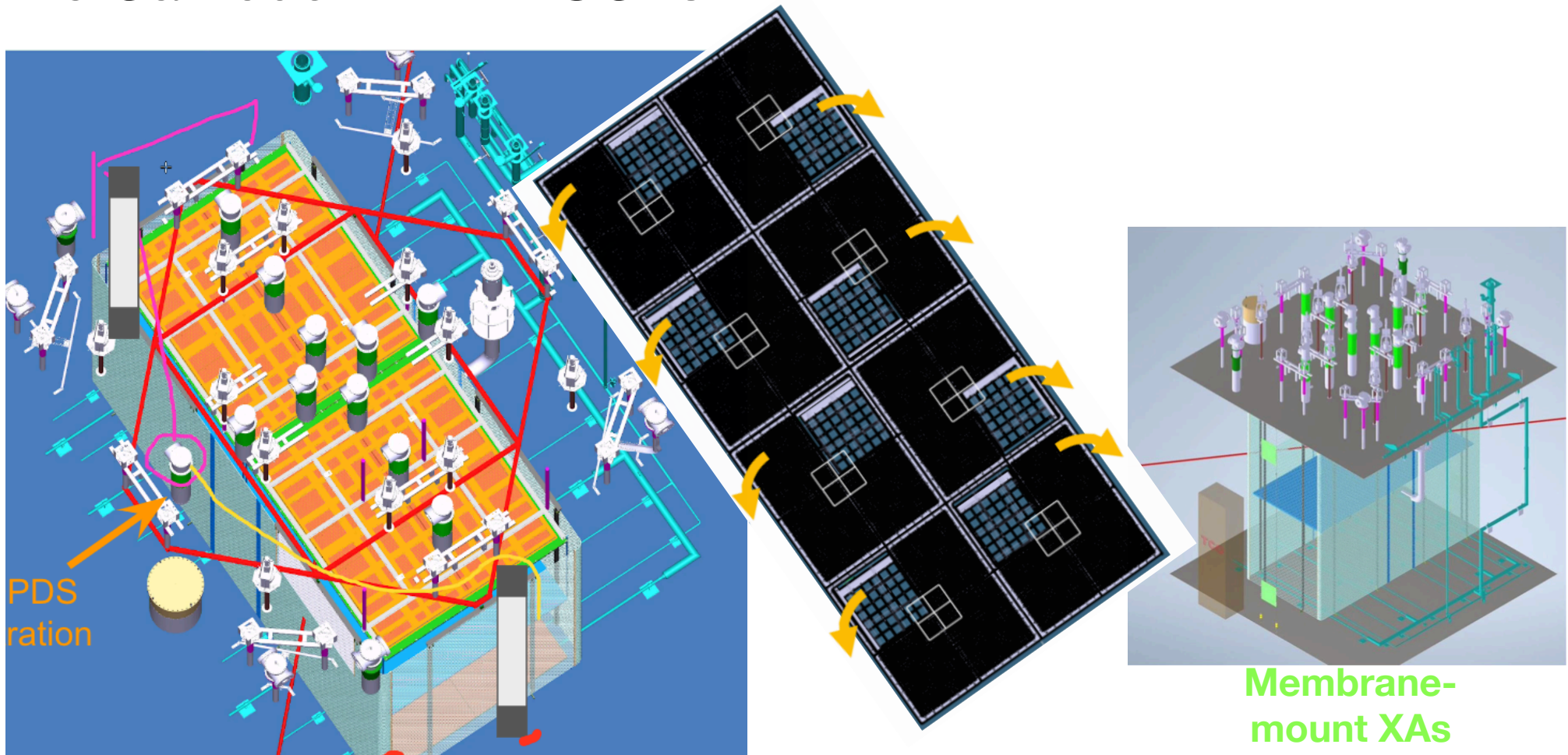
Outline

- Module 0 overview
- Ongoing R&D work & timeline
- Fabrication timeline
- Installation

Module 0 PDS Overview

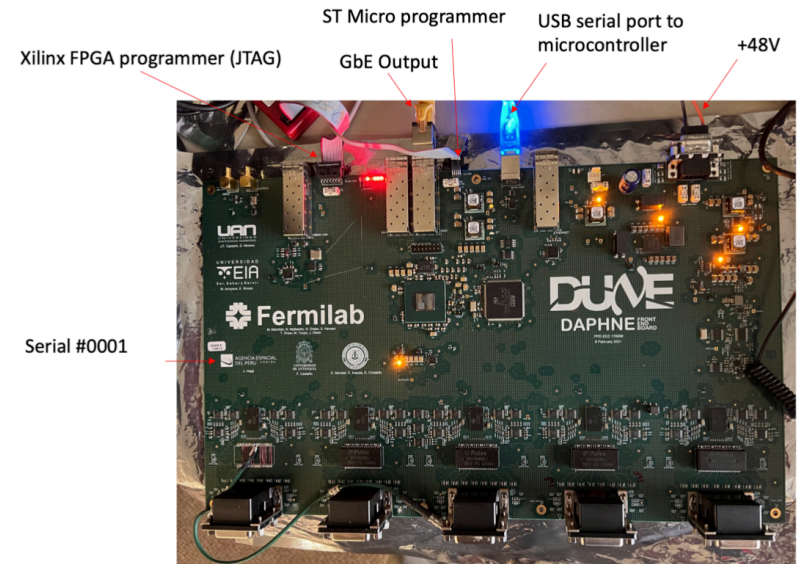
- 8 Membrane-mount X-ARAPUCAS
 - 1 column of 4 XAs on each end
- 8 Cathode X-ARAPUCAS

32 Fibers total
to Cathode-
mount XAs



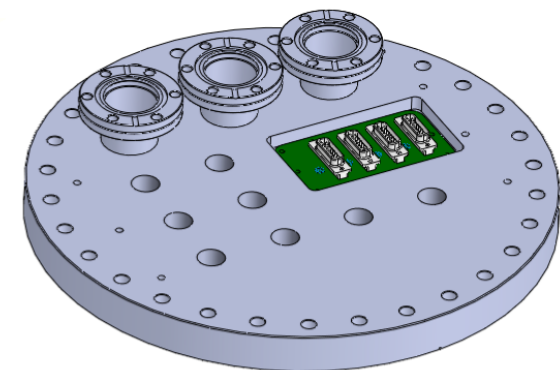
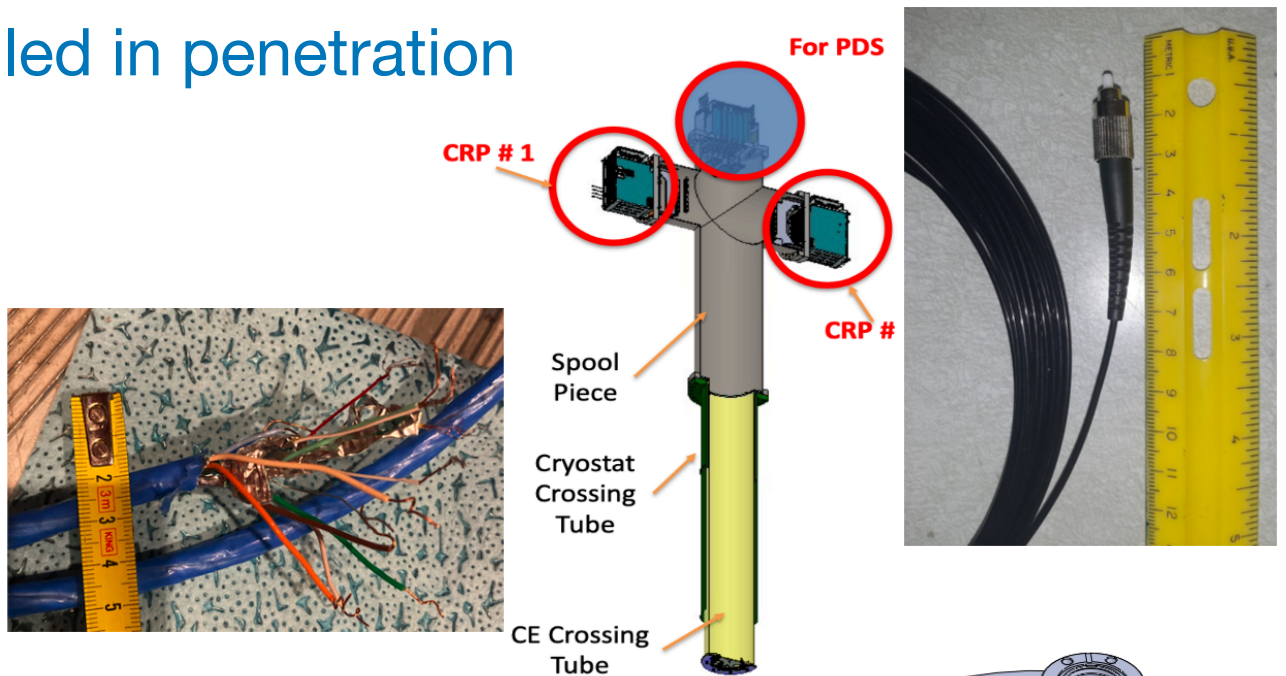
Warm electronics

- Limited DAQ integration
 - Simple digitizers/oscilloscope
 - DAPHNE digitizer to pursue DAQ integration
 - Simple Power-over-fiber (PoF) transmitter units
- Space needs
 - 1 full-height rack
 - Managed through Module 0 integration meetings



Cables, Flanges, Fibers

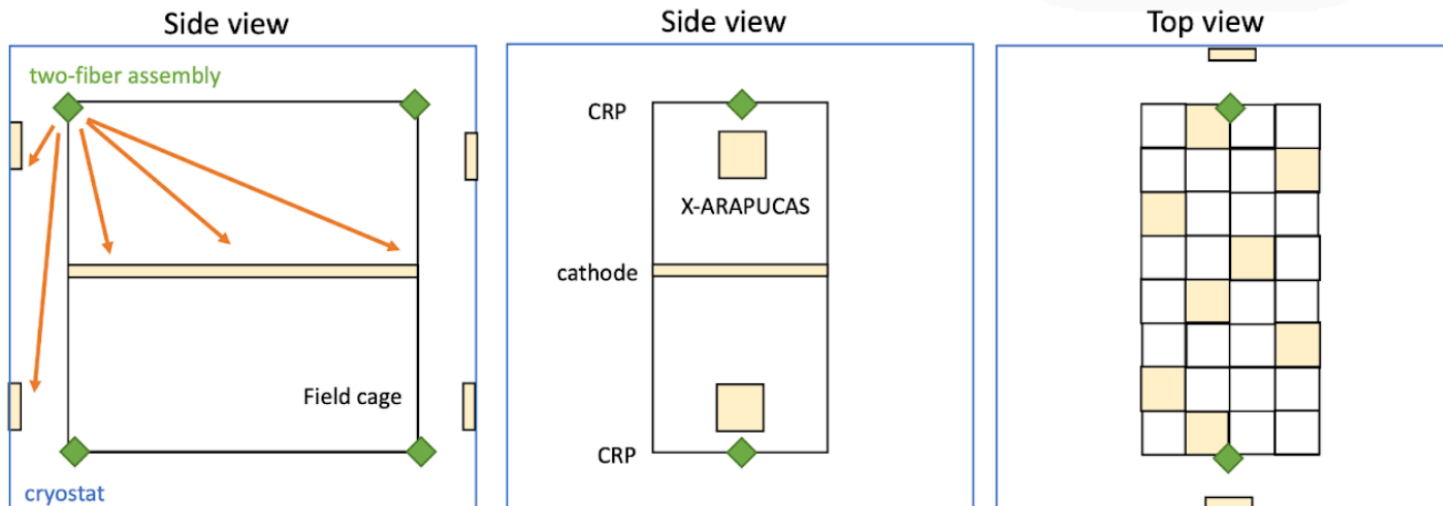
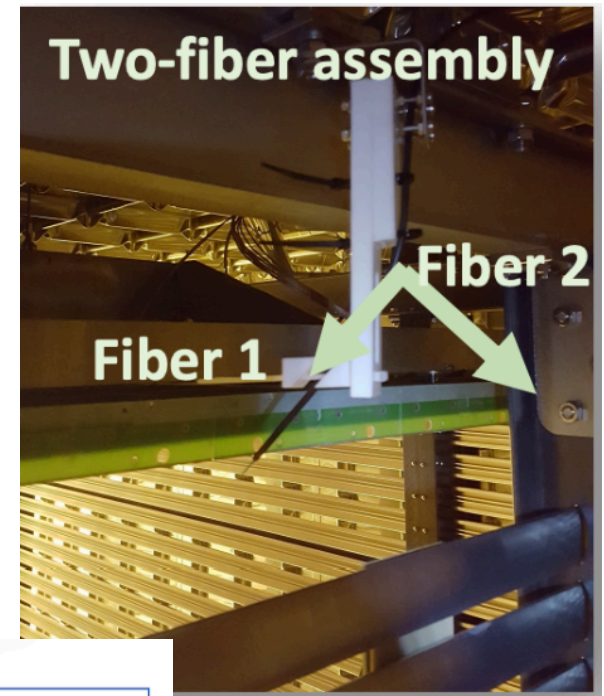
- 32 fibers for cathode-mount XAs
 - Additional 32 installed in penetration for splicing.
- 4 Cat-6 cables for membrane-mount



PDS Module 0 footprint fits in 1 flange

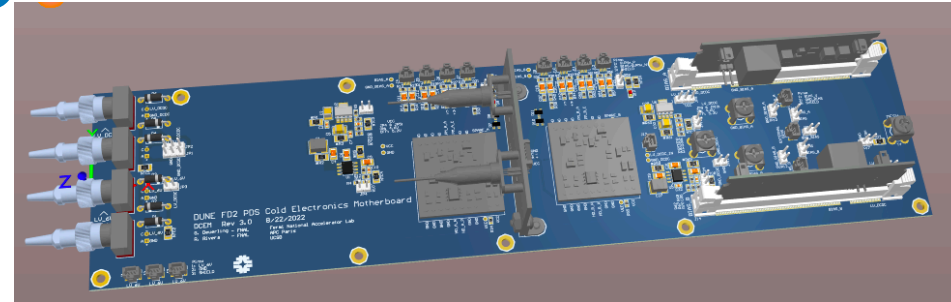
Response Monitoring System

- 8 fibers in 4 assemblies
 - Number of flasher units & components?
- Fibers mounted to CRP superstructure
- Benefits from FD1 experience

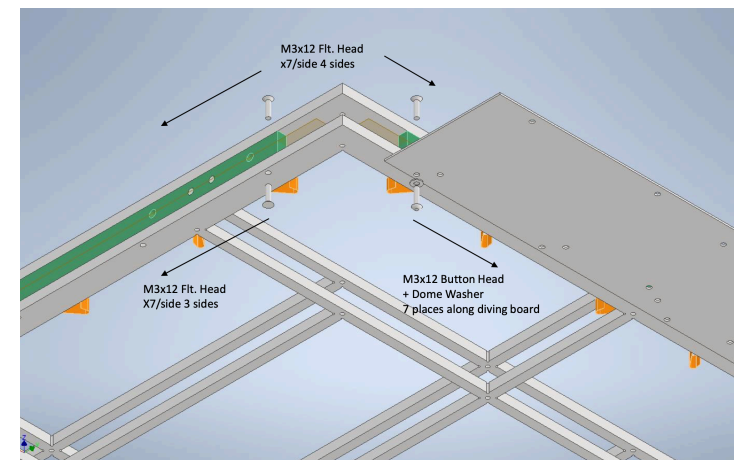


Ongoing R&D

- Analog readout
 - FNAL, APC
 - Targeting DCEM board to allow HD-style signal conditioning, use of same board for cathode & membrane
- SiPM bias generation & distribution
 - BNL, FNAL, INFN, Iowa, LBL
 - Optimizing fiber (PoF) footprint, stability, reliability
 - Bias generation from LV, custom vs commercial
 - Possibility of distribution of bias between XAs - HV discharge risk.
 - Balun box for distributing HV between XARAPUCAs
- XARAPUCA
 - INFN, NIU, CSU, Iowa
 - Mechanical design of frame, targeting reduced complexity, maximizing effective area, shape of SiPM dimples, glue vs. spring-loaded, conductive shielding.



1 per XARAPUCA



Ongoing R&D, cont.

- Fibers

- SDSMT

- Optimize jacket & insulation to minimize light leakage, maximize robustness: 105 μm

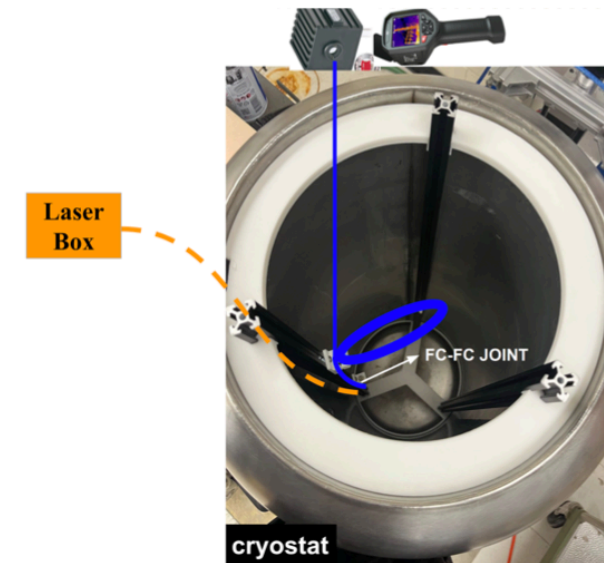
- Installation

- maximum fiber bending radius
- splicing
- fiber routing

- Cables

- Michigan

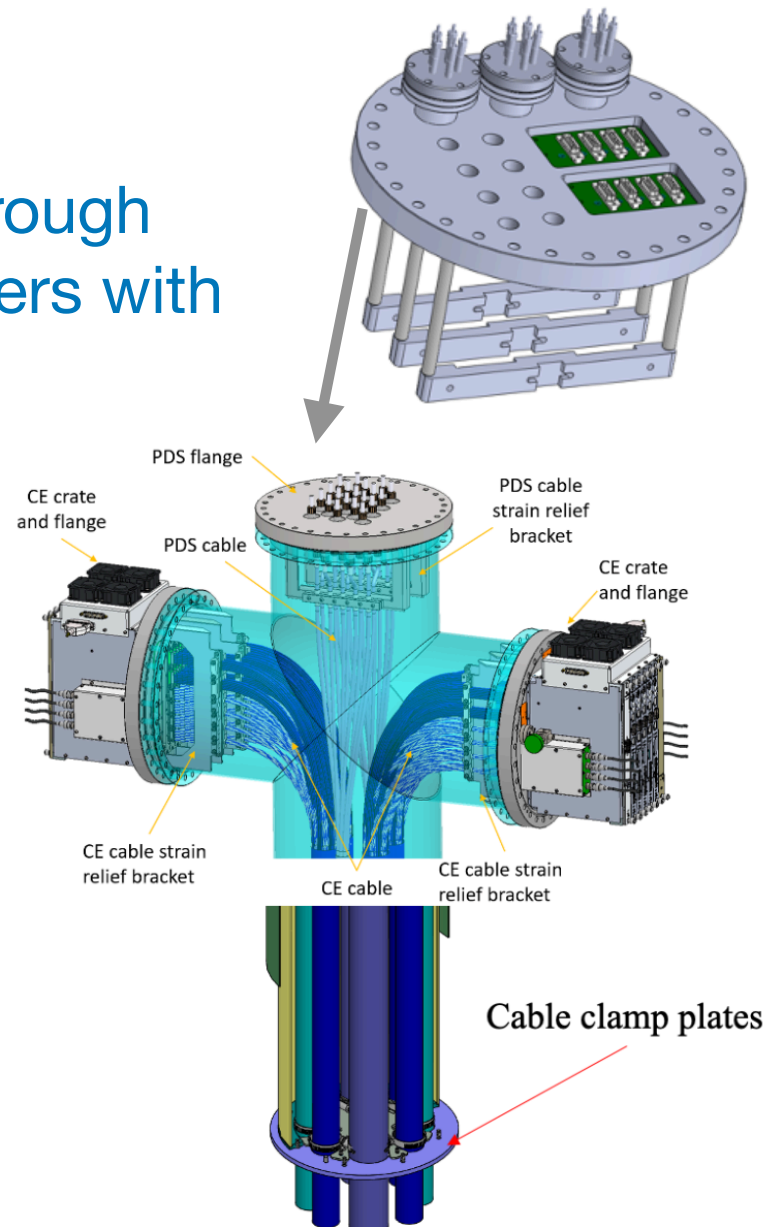
- Internal, external installation



Fiber test stand at SDSMT

Ongoing R&D, cont.

- Flange and Penetration
 - Penetration Mock-up at BNL
 - Targeting optimization of feedthrough installation, routing of cables/fibers with BDE cable, strain relief.
- Flange
 - BNL, Michigan



Coldbox Plan

- We are between 2 Coldbox runs dedicated to PDS
- Further studies in upcoming CRP3,4 runs.

Module-0	Cold Box	Date	Week #	Month
		04-Jul	28	Jul '22
		11-Jul	29	
		18-Jul	30	
		25-Jul	31	
	Cold Box B+ Install (v3)	01-Aug	32	Aug '22
		08-Aug	33	
		15-Aug	34	
		22-Aug	35	
	Cold Box B++ Install	29-Aug	36	
		05-Sep	37	Sep '22
		12-Sep	38	
		19-Sep	39	
	Cold Box CRP3 Install (v4)	26-Sep	40	
		03-Oct	41	Oct '22
	Downselect SiPM Mounting and BIAS generation	10-Oct	42	
		17-Oct	43	
		24-Oct	44	
		31-Oct	45	
		07-Nov	46	Nov '22
	Downselect Dichroic filters	14-Nov	47	
	Cold Box CRP4 Install (v5)	21-Nov	48	
		28-Nov	49	

Components Delivery

Module-0 Fabrication	Fab & Deliver Module-0 Cables, Connectors, Grounding, and Shielding for ProtoDUNE2-VD	11/11/22	30	12/11/22
Module-0 Fabrication	Fab & Deliver Module-0 Bias for ProtoDUNE2-VD	11/24/22	30	12/24/22
Module-0 Fabrication	Fab & Deliver Module-0 PoF for ProtoDUNE2-VD	11/24/22	30	12/24/22
Module-0 Fabrication	Fab & Deliver Module-0 SoF for ProtoDUNE2-VD	12/25/22	30	1/24/23
Module-0 Fabrication	Fab & Deliver Module-0 Signal Conditioning for ProtoDUNE2-VD	11/5/22	30	12/5/22
Module-0 Fabrication	Fab & Deliver Module-0 Fibers for ProtoDUNE2-VD	11/5/22	30	12/5/22
Module-0 Fabrication	Fab & Deliver Module-0 Feedthroughs for ProtoDUNE2-VD	11/5/22	30	12/5/22
Module-0 Fabrication	Fab & Deliver Module-0 Response & Monitoring for ProtoDUNE2-VD	11/5/22	30	12/5/22
Module-0 Fabrication	Fab & Deliver Module-0 X-ARAPUCA mechanics v5 for ProtoDUNE2-VD	11/5/22	30	12/5/22
Module-0 Fabrication	Fab & Deliver Module-0 photo-collector components for ProtoDUNE2-VD	11/5/22	14	11/19/22
Module-0 Fabrication	Fab & Deliver Module-0 Warm electronics for ProtoDUNE2-VD	11/15/22	30	12/15/22
Module-0 Fabrication	Fab & Deliver Module-0 Optimized Warm electronics for ProtoDUNE2-VD	1/14/23	30	2/13/23
Milestone	T7 MS: FD2 PDS Ready for Module-0 install at CERN ProtoDUNE2-VD	1/24/23	-	1/24/23

- *Note - 2 membrane-mount XAs is minimum per column, ideally 4 from spares or CB PTs to represent FD2 topology of 0.5 cables/XA*

Installation

- Details of plan will be presented and approved in Module 0 integration meetings
- PDS installation starts early December 2022

Module-0	Cold Box	Date	Week #	Month
		04-Jul	28	Jul '22
		11-Jul	29	
		18-Jul	30	
		25-Jul	31	
	Cold Box B+ Install (v3)	01-Aug	32	Aug '22
		08-Aug	33	
		15-Aug	34	
		22-Aug	35	
	Cold Box B++ Install	29-Aug	36	
		05-Sep	37	Sep '22
		12-Sep	38	
	Cold Box CRP3 Install (v4)	19-Sep	39	
		26-Sep	40	
		03-Oct	41	Oct '22
	Downselect SIPM Mounting and BIAS generation	10-Oct	42	
		17-Oct	43	
		24-Oct	44	
		31-Oct	45	
		07-Nov	46	Nov '22
	Downselect Dichroic filters	14-Nov	47	
	Cold Box CRP4 Install (v5)	21-Nov	48	
		28-Nov	49	
		05-Dec	50	Dec '22
4x Module-0 Membrane Install		12-Dec	51	
		19-Dec	52	
		26-Dec	53	
		02-Jan	1	Jan '23
		09-Jan	2	
		16-Jan	3	
		23-Jan	4	
		30-Jan	5	
8x Module-0 Cathode Install		06-Feb	6	Feb '23
		13-Feb	7	
		20-Feb	8	
		27-Feb	9	
		06-Mar	10	Mar '23
		13-Mar	11	
		20-Mar	12	
Module-0 Install milestone		27-Mar	13	

Part tracking

- I am drafting a spreadsheet to track production & delivery of components needed for Module 0
- We also need to start using the DUNE Parts Database
 - Need someone with DB expertise or willingness to learn quickly
 - See <https://edms.cern.ch/document/2505353/3>