

# FD2 PDS

## Status and Schedule through Module-0

19 July 2022  
DUNE PD Consortium Meeting  
Ryan Rivera - FD2 PDS L2

# Overview

- FD2 PDS at the CERN VD Cold Box
  - Demonstration Progression
- DOE Project Review Schedule Implications
  - TDR Writing
- Design & Optimization
- Module-0 Plan

# Cold Box pictorial schedule

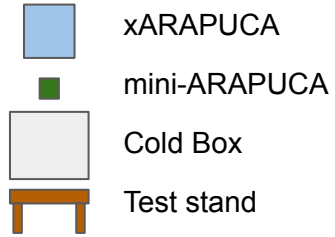
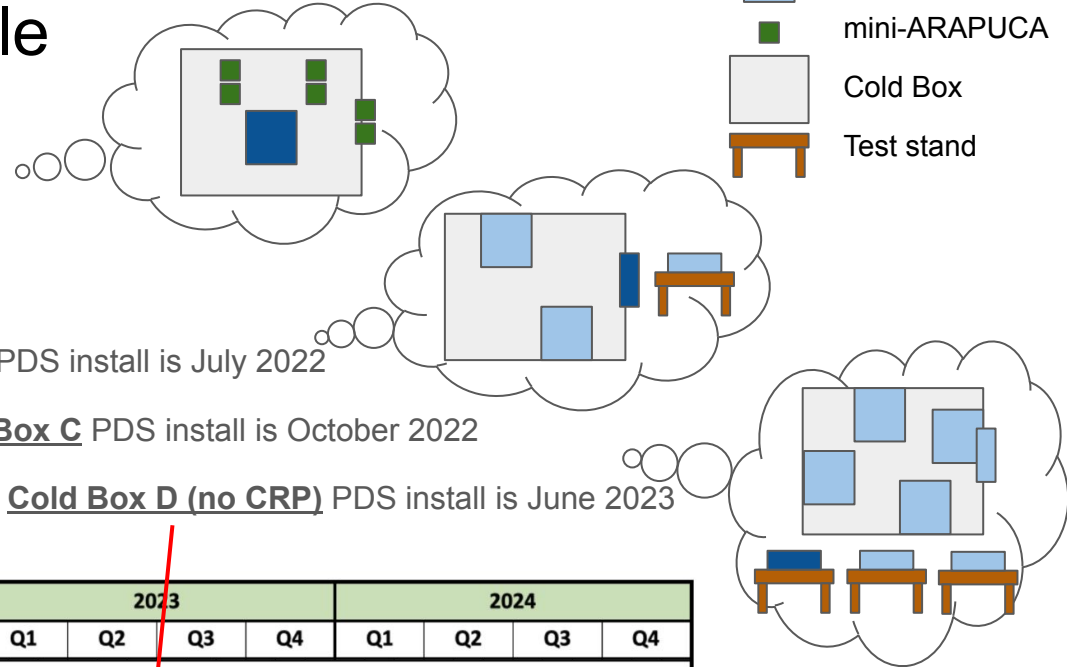
## Parasitic ARIADNE run

**Cold Box A** PDS install is 18 April 2022

**Cold Box B** PDS install is July 2022

**Cold Box C** PDS install is October 2022

**Cold Box D (no CRP)** PDS install is June 2023



FD2-VD	2022				2023				2024			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<b>Cold-box runs</b>												
CRP #1												
CRP #2	production	production	production	production								
CRP #3			production	production								
CRP #4												

We are here

# Successful Cold Box Installation

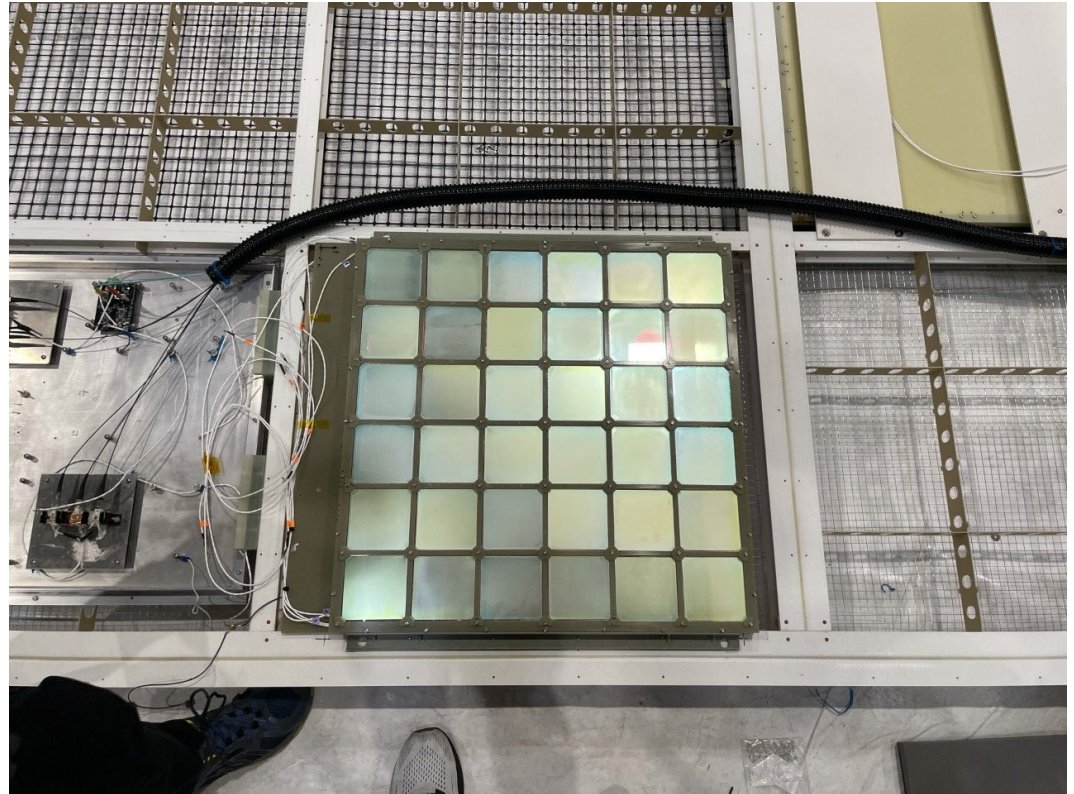
- We received a lot of great contributions at the Cold Box!
  - The PD Consortium delivered.
  - There was a fantastic response from PD Consortium colleagues when we needed extra hands to reach the installation finish line.



Picture from Chris Macias (Iowa)

# New X-ARAPUCA v2!

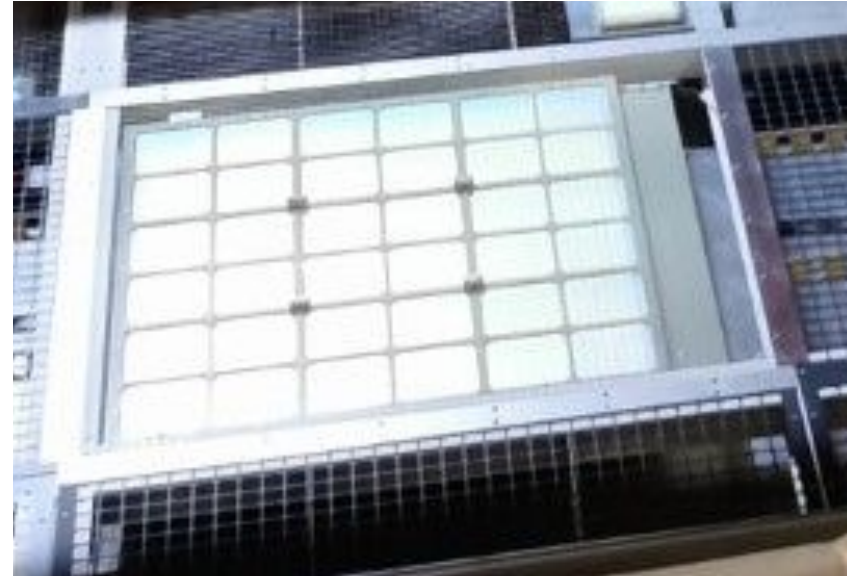
- 97mm x 97mm filters
- 60cm x 60cm WLS
- 160 SiPMs
  - S13360-6050VE biased at 46V



Picture from Chris Macias (Iowa)

# Retrofit X-ARAPUCA v1

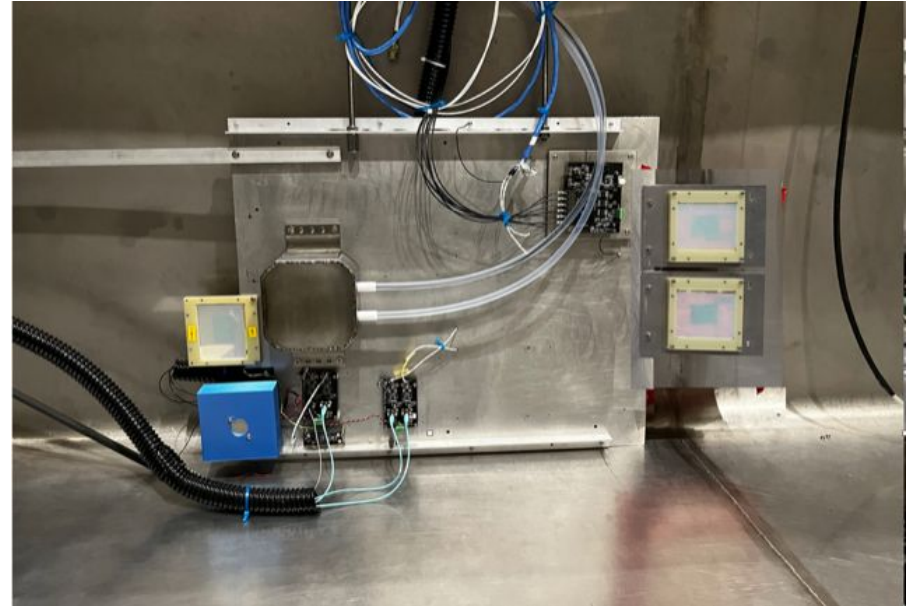
- 97mm x 97mm filters
- 60cm x 60cm WLS
- 160 SiPMs
  - S14160-6050HS biased at 36V



Picture from Chris Macias (Iowa)

# GaAs Study on the Wall

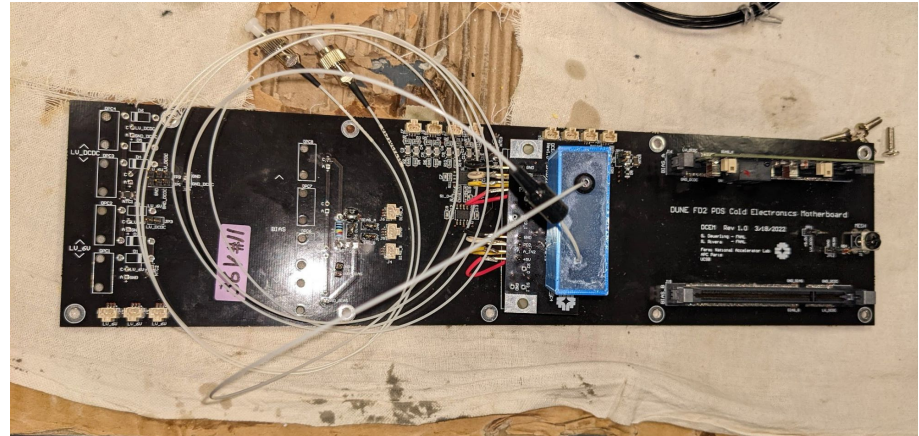
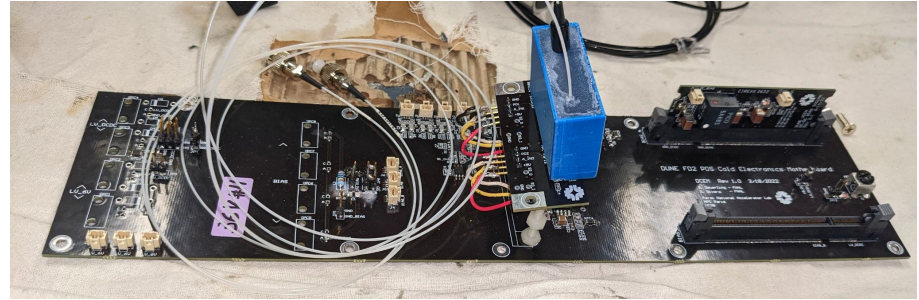
- 3 mini-ARAPUCAs to evaluate GaAs components





# Cold Readout Electronics

- Power-over-Fiber
  - Si receivers
  - 6V in
- Bias generation
  - 36V and 46V
  - PICO 5A48S
- Analog
- Signal-over-Fiber
  - 2x potted lasers



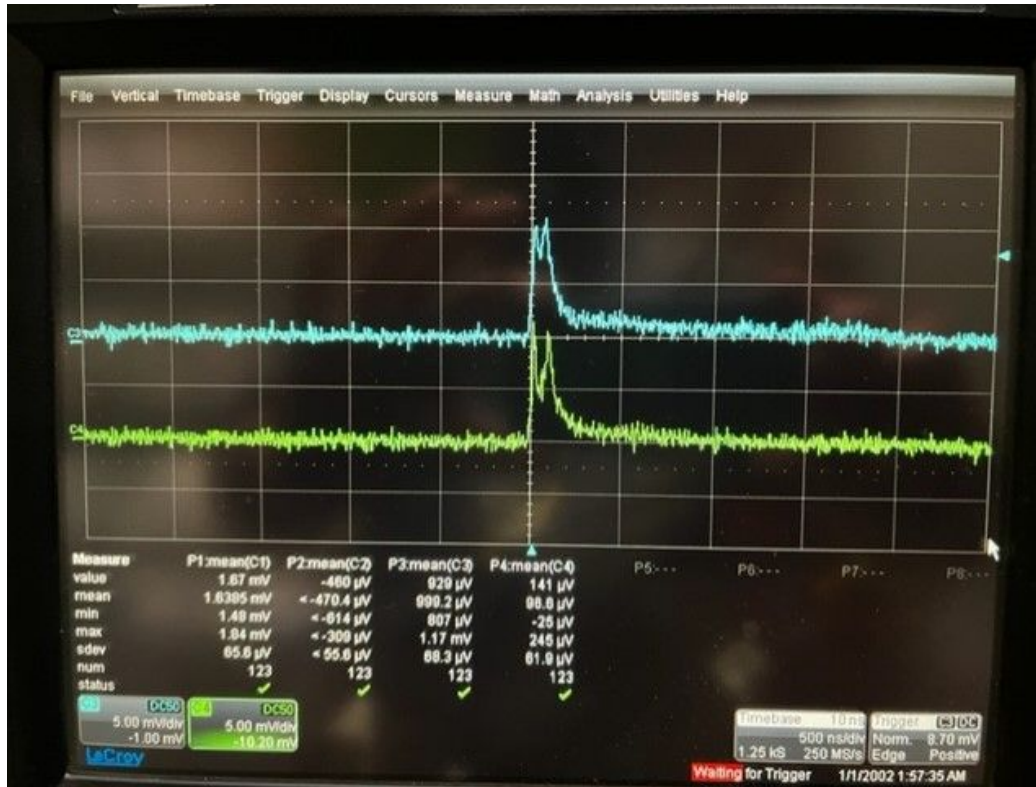


# Closing the CRP lid

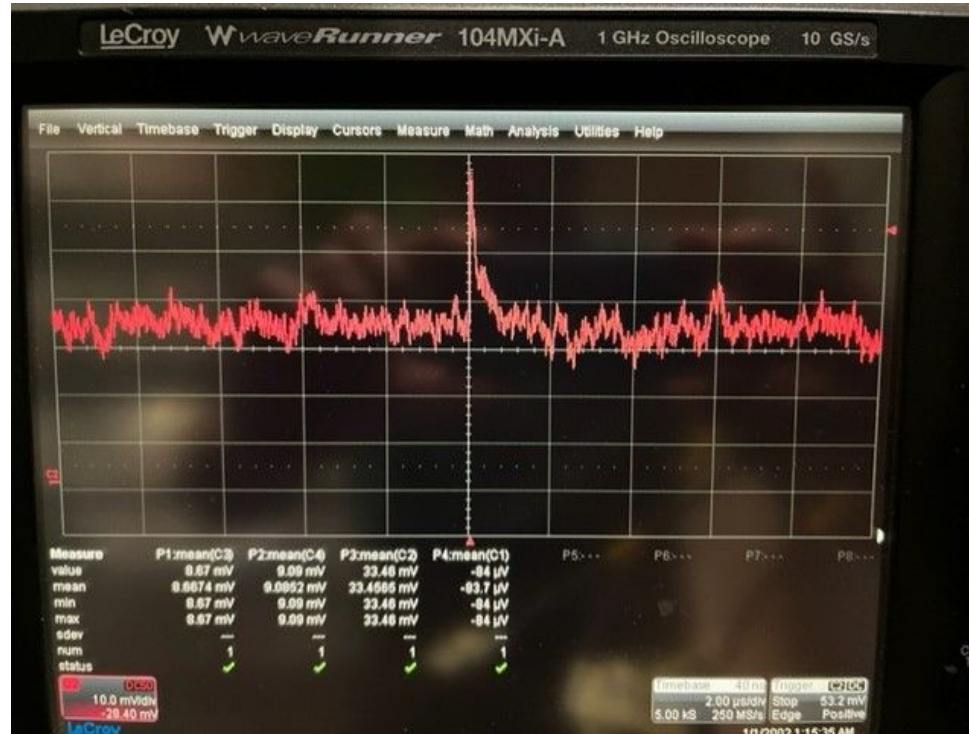


Picture from Chris Macias (Iowa)

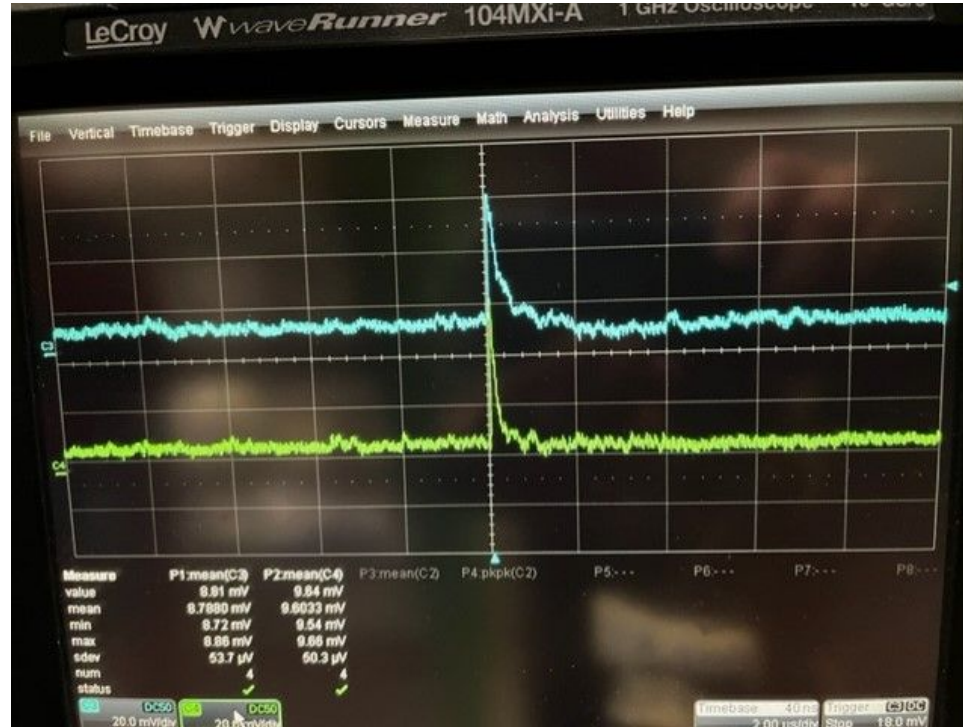
# New XA at Cold Box w/Si PoF and PICO Bias



# mini-ARAPUCA w/GaAs PoF + PICO Bias



# mini-ARAPUCA w/GaAs + copper Bias



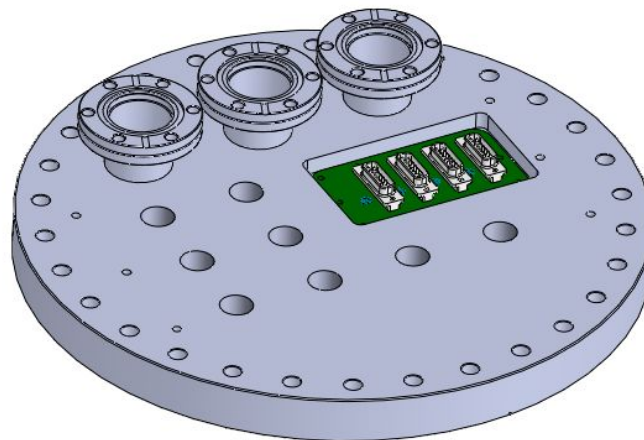
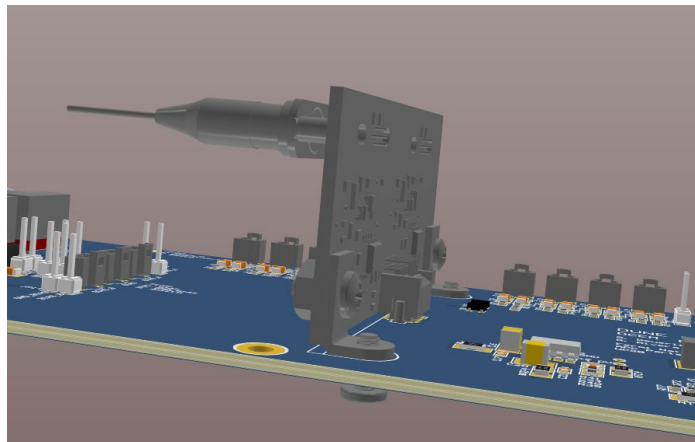
# Upcoming Reviews and Reports

- July/August 2022 - Technical Design Report
  - Need to generate a significant amount of text this week! Rough draft in place by July 25.
  - Michel Sorel and Bob Wilson need content to edit!
- 06 December 2022 - FD2 PDS Final Design Review
  - Final design decisions documented week of November 28
- April 2023 - DOE CD2/3 Review
  - Cost/Schedule changes frozen end-of-August 2022
- End-of-2023 Production Readiness Review(s)
  - May want to separate fiber installation PRR to allow more time for prototyping
    - Independent of X-ARAPUCA production/orders



# Design & Optimization

- Analog Readout
  - Fiber coupling
  - Integrate membrane readout
  - Push S/N
- Digital Readout
  - S/N advantage ( $\sim 8.5$ ), power disadvantage
- Detector Frame/Photo-Collector
  - Frame Design -- Paul Debbins Iowa, CSU
  - XA Assembly and Shipping -- NIU
  - Filter optimization
  - SiPM coupling -- INFN
- Bias Generation
  - Bias distribution ("Balun box") -- BNL
  - Commercial bias (PICO) -- Iowa/FNAL
  - Custom approach -- LBL
  - Custom approach -- INFN
- Power-over-Fiber
  - Fiber selection
  - Splicing
- Installation
  - Fiber bending radius, splicing -- SDSMT
  - Flange  $\Rightarrow$  UMich and Manhong BNL
  - Cables  $\Rightarrow$  UMich





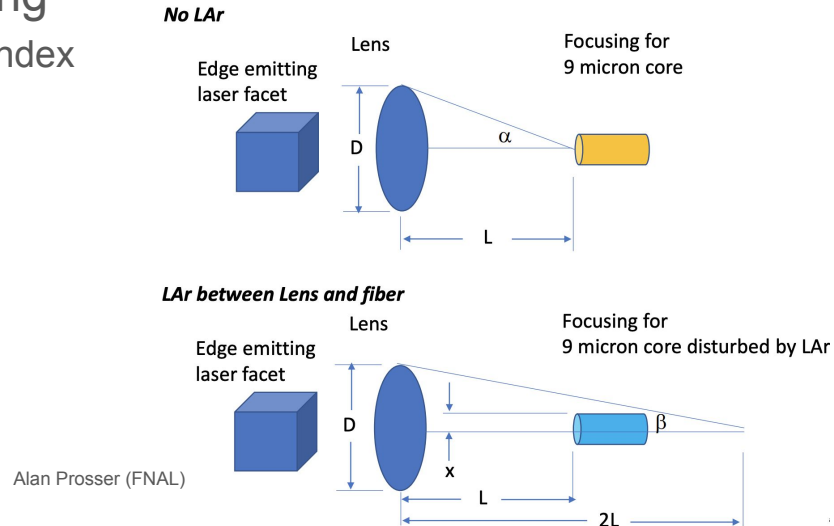
# Critical Downselects

## 1. Bias Generation

- With viable bias generation, each XA can have independent power
- HV discharge studies point to need for independent power close to field cage

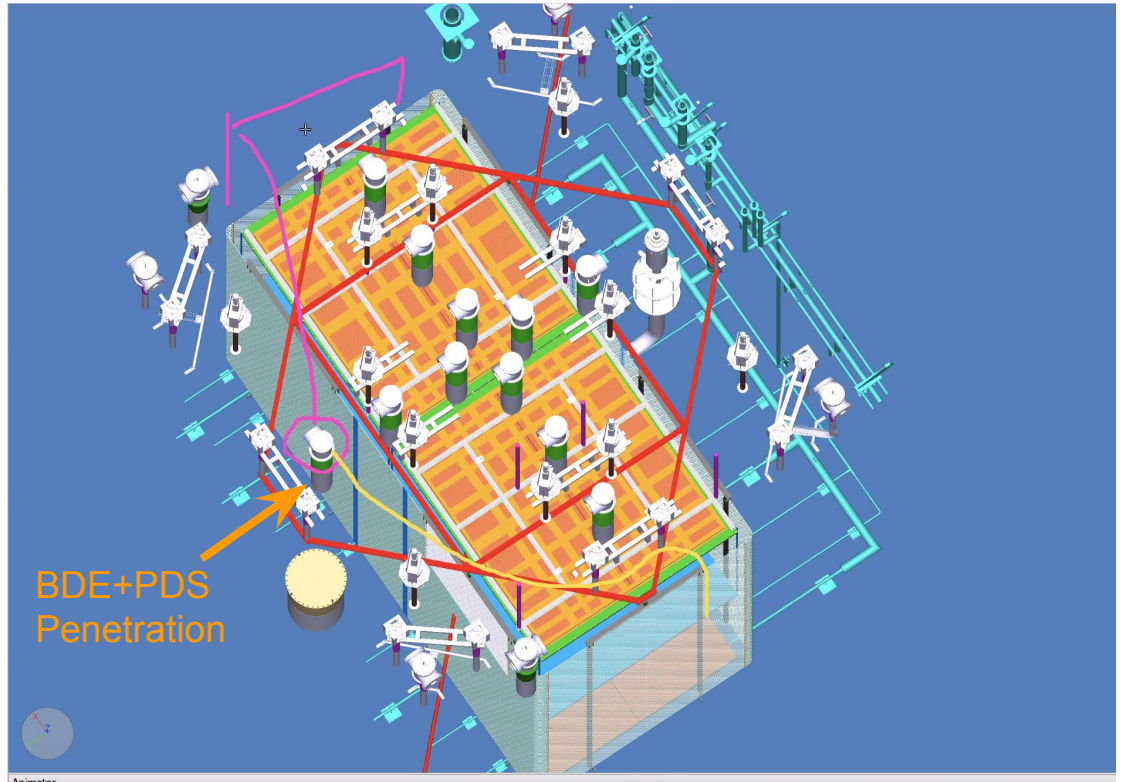
## 2. Signal-over-Fiber fiber coupling

- Compensate for LAr refractive index



# Module-0 Topology

- 4 Membrane-mount XA installed December 2022
  - One column on short-wall is being pushed from a mechanical perspective
- 8 Cathode-mount XA installed January 2023
- Response & Monitoring
  - Attached to top CRP
  - Direct to XA



# FD2 PDS Weekly Schedule (1 of 2)

Reviews and Deliveries	Module-0	Cold Box	Date	Week #	Month
			04-Jul	29	Jul '22
			11-Jul	30	
			18-Jul	31	
			25-Jul	32	
		Cold Box B+ Install	01-Aug	33	Aug '22
			08-Aug	34	
			15-Aug	35	
			22-Aug	36	
		Cold Box B++ Install	29-Aug	37	
			05-Sep	38	Sep '22
			12-Sep	39	
		Cold Box CRP3 Install	19-Sep	40	
			26-Sep	41	
			03-Oct	42	Oct '22
			10-Oct	43	
			17-Oct	44	
			24-Oct	45	
			31-Oct	46	
			07-Nov	47	Nov '22
			14-Nov	48	
		Cold Box CRP4 Install	21-Nov	49	
			28-Nov	50	
			05-Dec	51	Dec '22
			12-Dec	52	
	Module-0 Membrane Install		19-Dec	53	
			26-Dec	54	
			02-Jan	2	Jan '23
			09-Jan	3	
			16-Jan	4	
			23-Jan	5	
	Module-0 Cathode Install		30-Jan	6	
			06-Feb	7	Feb '23
			13-Feb	8	
			20-Feb	9	
			27-Feb	10	
			06-Mar	11	Mar '23
			13-Mar	12	
			20-Mar	13	
	Module-0 Install milestone		27-Mar	14	
			03-Apr	15	Apr '23
			10-Apr	16	
			17-Apr	17	
CD2/3 Review					

  
We are here

# FD2 PDS Weekly Schedule (2 of 2)

24-Apr	18	May '23
	19	
	20	
	21	
	22	
	23	
	24	Jun '23
	25	
	26	
	27	
	28	Jul '23
	29	
	30	
	31	
	32	
	33	Aug '23
	34	
	35	
	36	
	37	Sep '23
	38	
	39	
	40	
	41	Oct '23
	42	
	43	
	44	

Cold Box D Install		
Module-0 Ops		
Production Readiness Review		


# Organizing FD2 PDS Travel

- Please enter your unconfirmed/confirmed travel to help everyone plan:
  - [https://docs.google.com/spreadsheets/d/1qT\\_wY5rvEtjS2t741bd8TGejxSAtKZIWu3m8GozzA/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1qT_wY5rvEtjS2t741bd8TGejxSAtKZIWu3m8GozzA/edit?usp=sharing)
- Latest daily schedule maintained here (source for weekly schedules):
  - <https://calendar.google.com/calendar/u/0?cid=bjVmaGNqZ2NhMzM1MmFrbmJtYjNIODRkMmtAZ3JvdXAuY2FsZW5kYXluZ29vZ2xlLmNvbQ>

# FD2 PDS Meetings

- Please email Flavio/Ryan to be added to mailing lists

CDT	CEST	Monday	Tuesday	Wednesday	Thursday	Friday
9:00	16:00				Analog Readout - Dave C / Bias Generation - Mike M	ProtoDUNE-VD PDS Planning - Flavio C
10:00	17:00			Photo-Collector - Carla C		
11:00	18:00	Mechanical - Vishnu Z		Cold Electronics - Flavio C		
12:00	19:00					Power-over-Fiber - David M

 New Meeting