

# FD2 PDS Status Update

13 January 2023  
DUNE FD2 PDS  
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# Why is the December Cold Box Important?

- The downselection of PD cold electronics components for module-0 relies on the December run. The **PD Final Design Review (March 21-23)** will also focus on the results of this **December run** - and then increased statistics in **February run (start “CRP5 Cold Box” Jan 30th week)**. In particular, the decisions of the following:
  - DC-DC Bias generation approach
  - Cathode Analog readout amplification stage topology
  - Cathode Signal-over-Fiber laser approach
  - Membrane HD-style and VD-style cold analog readout

# What happened in the December Cold Box?

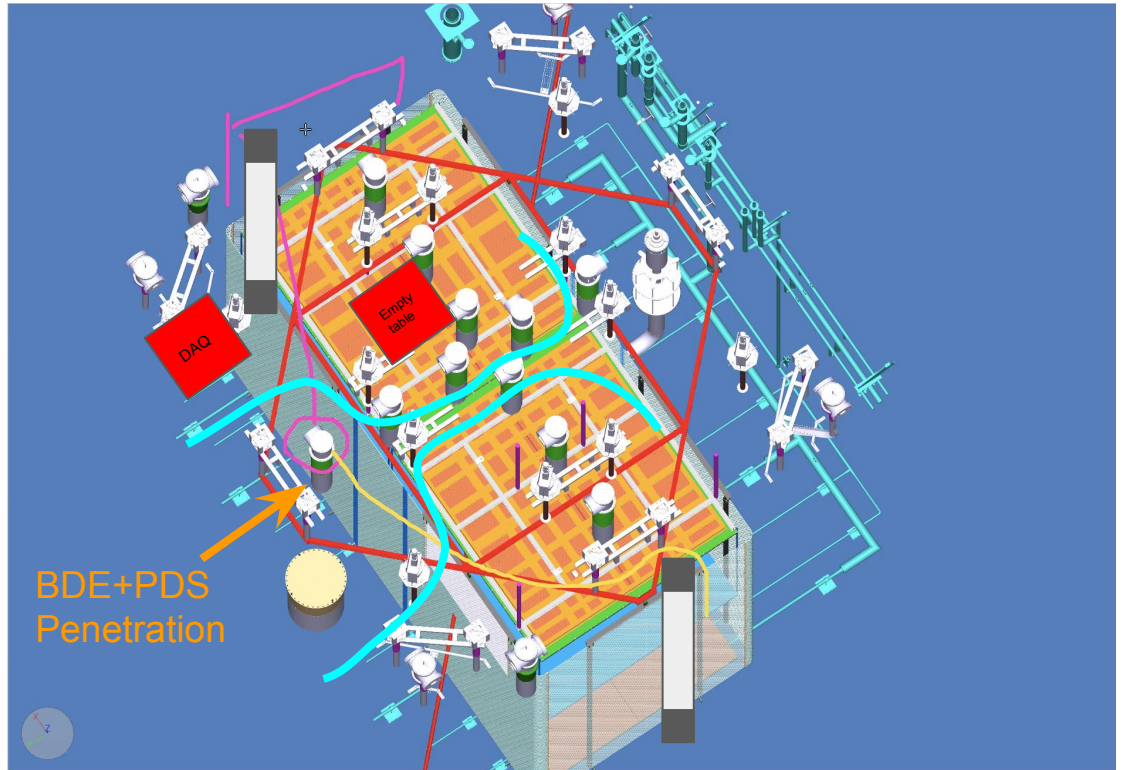
- Mid-run the readout electronics behavior changed
  - This casts some doubt on all aspects we were trying to downselect:
    - DC-DC Bias generation approach
    - Cathode Analog readout amplification stage topology
    - Cathode Signal-over-Fiber laser approach
    - Membrane HD-style and VD-style cold analog readout
- However, I posit we do have enough information to go with this topology:
  - (2/4) DMEM v1.0 {LV, bias, and signal over HD cold cable} at top membrane (for 4 XA)
  - (3) DCEM v1.2 {LV, bias, and signal over HD cold cable} at bottom membrane (for 3 XA)
  - (1) DCEM v1.2 {LV over HD cold cable, bias gen, and SoF} at bottom membrane (for 1 XA)
  - (8) DCEM v1.2 {PoF, bias gen, and SoF} at cathode (for 8 XA)
  - (9) bias gen locations
    - Need a decision on split from Bias breakout meeting
      - Early indications are at least half will be LBL bias

# Cold Box must be highest priority

- We must understand what happened with Cold Box now open and demonstrate stability in the February Cold Box in advance of the **Final Design Review (March 21-23)**
- Week of January 23rd the Cold Box will close again
  - We have 10 days to turnaround a fix!
- Mike Miller has already identified the 4.7uF 1206 and 0805 on the DCEMs fail within 7 cold cycles - and Mike identified replacements (tested 100 through 25x thermal cycles (77K to 313K) with 40V applied):
  - 4.7uF 0805 should be TDK C2012X7R1H475K125AE
  - 4.7uF 1206 should be Murata GRJ31CZ72A475KE01L (cold maintains 92% of capacitance)

# Module-0 Installation Plan (same as shown in Dec)

- Membrane XA
  - Jan. (2) Top-nTCO
    - HD-style, Short cable
  - Feb. (2) Top-TCO
    - HD-style, Short cable
  - Mar. (2) Bottom-nTCO
    - VD-style, Long cable
  - Mar. (2) Bottom-TCO
    - (1) VD-style, Long cable
    - (1) SoF VD-style, Long fiber
- Cathode XA
  - Feb. (4) nTCO
    - (2) 1.5/1.0mm FC
    - (2) 1.5/1.0mm pigtail
  - Feb. (4) TCO
    - (2) 1.5/1.0mm FC
    - (2) 1.5/1.0mm pigtail



# We need a reality check now on module-0 installation!

- People are trying to plan travel
- Shipments (and as a result testing) seem to be lagging
- We need to understand implications of shipments on installation timeline
  - And see how we can mitigate
- Next slide shows why we can hold January 23 week for installation of non-TCO top membrane XA pair.

# First two module-0 XA status

	1st module	2nd module
Frame	OK at CERN	Has not left Fermilab shipping as of 11-Jan
Flex and SiPMs	OK at CERN (Hamamatsu)	OK at CERN (Hamamatsu)
Vikuiti for Flex	OK installed on flex	Manually use pieces at CERN
Vikuiti for backplane	4 pieces have not left Fermilab shipping as of 11-Jan	Installed on backplane, backplane has not left Fermilab
Cables from flex to MB	OK installed	OK at CERN
<b>Motherboard</b>	Claudio is shipping vendor-populated (2) DMEM v1.0; At CERN are (2) hand populated. Worried about 47uF X5R caps.	
<b>Electronics box</b>	Talk at Paul at 3p 11-Jan. Ship 18-Jan target from Iowa, ship 2 (cutouts in all 4 corners for cables). Peter flies from Fermi on 22-Jan. Jay flies from CSU on	
<b>Cold cables</b>	Shared (split) cable, Jay carry on 21-Jan (Ryan will contact Dave 13-Jan)	
WLS	OK at CERN	Carla not worried at CERN
Filters	OK at CERN	OK at CERN
Shielding Mesh	Stony Brook plans to ship 18-Jan	
Mounting vertical lines	OK at CERN	OK at CERN
Response Monitoring System	OK will be brought from CIEMAT on Jan 23rd	
Penetration	Not til February - first module cables will not be pulled up until BDE cables are ready to be pulled up	

# Organizing FD2 PDS Travel

- For Cold Box and Module-0 travel, enter your unconfirmed/confirmed travel:
  - [https://docs.google.com/spreadsheets/d/1qT\\_wY5rvEtjS2t741bd8TGejxSAtKZIWu3m8GozzA/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1qT_wY5rvEtjS2t741bd8TGejxSAtKZIWu3m8GozzA/edit?usp=sharing)
- Daily 'FD2 PDS Calendar' schedule maintained here:
  - <https://calendar.google.com/calendar/u/0?cid=bjVmaGNqZ2NhMzM1MmFrbmJtYjNIODRkMmtAZ3JvdXAuY2FsZW5kYXluZ29vZ2xlLmNvbQ>



# 2023 Schedule

Reviews and Deliveries	Module-0	Cold Box	Date	Week #	Month
			02-Jan	53	Jan '23
INFN Hamamatsu 500 SIPM Delivery			09-Jan	1	
FBK 750 SIPM Delivery		CERN Cold Box Install	16-Jan	2	
CERN Collaboration Meeting	2x Module-0 non-TCO top Membrane Install (v6)		23-Jan	3	
FNAL/CERN Hamamatsu 700 SIPM Delivery	8x Module-0 Cathode Install	CERN Cold Box C+ Run	30-Jan	4	
	2x Module-0 top TCO-side Membrane Install	INFN-Na Cold Box Run	06-Feb	5	Feb '23
			13-Feb	6	
			20-Feb	7	
			27-Feb	8	
			06-Mar	9	Mar '23
	4x Module-0 bottom Membrane Install		13-Mar	10	
Final Design Review			20-Mar	11	
			27-Mar	12	
Module-1 Design Workshop			03-Apr	13	Apr '23
			10-Apr	14	
	Module-0 Install milestone		17-Apr	15	
CD2/3 Director's Review			24-Apr	16	
			01-May	17	May '23
			08-May	18	
			15-May	19	
			22-May	20	
			29-May	21	
		Cold Box D Install (v7) "Module-1"	05-Jun	22	Jun '23
			12-Jun	23	
			19-Jun	24	
			26-Jun	25	
			03-Jul	26	Jul '23
CD2/3 IPR DOE Review		Cold Box D Run "Module-1"	10-Jul	27	
			17-Jul	28	
			24-Jul	29	
			31-Jul	30	
			07-Aug	31	Aug '23
			14-Aug	32	
			21-Aug	33	
			28-Aug	34	
	Module-0 Ops (?)		04-Sep	35	Sep '23
			11-Sep	36	
			18-Sep	37	
			25-Sep	38	
			02-Oct	39	Oct '23
Production Readiness Reviews Start			09-Oct	40	
			16-Oct	41	
			23-Oct	42	
			30-Oct	43	

# 2023 Schedule

- Critical Checkpoints:
  - February - CERN Cold Box
  - March - Final Design Review
  - April - module-1 Design Workshop
  - July - CERN Cold Box
- Threads:
  - Pre-FDR (**Jan-Mar**):
    - Converge on components and qualification plan
  - Pre-module-1(**Apr-Jun**)
    - At design workshop, no more options
    - Qualification tests of final design
  - Demonstrate qualified solution (**Jul-Aug**)
    - 4 cathode XA + 2 membrane  $\frac{1}{2}$ -XA at CERN Cold Box
  - Document and Review (**Sep-Dec**)
  - 2024 launch Production