



Status of DUNE FD2 PDS FDR Documentation and Responses to Recommendations from Previous Reviews

Peter Shanahan

FD2 PDS Final Design Review

18 April 2023

In partnership with:



Outline

- Full list of FDR Documentation
 - <https://edms.cern.ch/document/2824342/1>
- Charge-Question-View of Documents
- Charge-Question-View of Talks
- Interfaces
- Previous Reviews and Responses

Question 1: Sufficiency of Design, Testing, Validation, Risk Mitigation - Documents

- Testing at Cathode HV
 - TDR <https://edms.cern.ch/document/2810246/1> (EB, In Work)
- 30-year Validation
 - QA/QC Plan <https://edms.cern.ch/document/2730720/2>,
Lifetime Brief <https://edms.cern.ch/document/2882322/1> (Consortium, In Work)
- Technical Risks, Mitigations
 - Risk Register <https://edms.cern.ch/document/2868864/1> (TB, In Work),
 - HV Impact Mitigation <https://edms.cern.ch/document/2864518/1> (Consortium, In Work)

Question 2: Lessons-learned Incorporated into Design, Design Validated - Documents

- Lessons-learned document for ProtoDUNE-VD
 - TDR <https://edms.cern.ch/document/2875448/1> (Consortium, In Work)
 - Includes general document & XARAPUCA-assembly document.

Question 3: Mechanical specs completeness, 3D models, 2D drawings, Compliance Office Approval

- 3D models
 - <https://edms.cern.ch/project/CERN-0000240990> (Consortium, In Work)
- Drawings & Parts
 - <https://edms.cern.ch/project/CERN-0000240991> (Consortium, In Work)
- Engineering Analysis
 - Analysis Plan: <https://edms.cern.ch/document/2883231/1> (Consortium * & CO, In Work)
 - Structural Analysis: <https://edms.cern.ch/document/2883232/1> (Consortium, In Work)
 - Independent Review - (Compliance Office, Started April 14).

Question 4: Electrical specs completeness, schematics, drawings, connections, safety analysis, grounding

- Ground & Shielding Plan
 - <https://edms.cern.ch/document/2882805/1> (TB, In Work)
- Schematics, Layouts, BOMs for
 - Cathode DCEM (<https://edms.cern.ch/document/2795423/1>)
 - Laser Adapter (<https://edms.cern.ch/document/2814387/1>)
 - LBL bias generator v2.0 (<https://edms.cern.ch/document/2795425/1>)
 - DMEM (<https://edms.cern.ch/document/2795424/1>)
 - HD Amplifier v0.2 (<https://edms.cern.ch/document/2805804/1>)
 - PoF Laser Housing Unit (<https://edms.cern.ch/document/2882326/1>)
 - DAPHNE Card - <https://edms.cern.ch/document/2383685/2> (FD1 version, Released)
- Cabling & Connections
 - <https://edms.cern.ch/document/2882804/1> (Consortium, In Work)

Question 5: Transportation & Installation

- Addressed in
 - ProtoDUNE-VD Installation & Lessons Learned - <https://edms.cern.ch/document/2875448/1> (Consortium, In Work)
 - FD2 Installation Plan - <https://edms.cern.ch/document/2730715/2> (Integration Office, In Work)
 - QA/QC Plan - <https://edms.cern.ch/document/2730720/2> (Consortium, In Work)

Question 6: Drafts for Procurement, Manufacturing, QC, PIDs

- Addressed in QA/QC Plan
 - <https://edms.cern.ch/document/2730720/2> (Consortium, In Work)

Question 7: Project Planning Materials

- Interfaces - See following slides
- Risk Register
 - <https://edms.cern.ch/document/2868864/1> (TB, In Work)
- Schedule Documents
 - <https://edms.cern.ch/document/2868847/1> (TB, In Work)


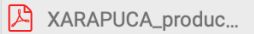
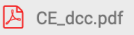
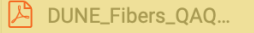


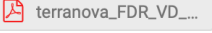
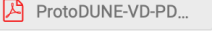
Question 8: Recommendations from Previous Reviews

- Tracking spreadsheet
 - <https://edms.cern.ch/document/2681916> (Review Office, In Work),
<https://edms.cern.ch/document/2874212/1> (Long-form responses)
- Technical Coordinator Closeout
 - <https://edms.cern.ch/document/2873224/1> (Engineering Check)

Question 9: Effort to PRR, Planning for Production

- Cost & Schedule
 - <https://edms.cern.ch/document/2868847/1> (EB, In Work)
- Institutional Responsibilities (MOU Annex)
 - <https://edms.cern.ch/document/2810434/3> (EB, In Work)

Question 1: Sufficiency of Design, Testing, Validation, Risk Mitigation - Talks

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| 1:00 PM | PD Consortium and introduction to FD2 PDS Final Design Review [15' + 5' Q&A] Speaker: Ettore Segreto (UNICAMP) | 5:10 PM | Break |
| 1:20 PM | Requirements and FD2 PDS Design and Performance (overview) [25' + 15' Q&A] Speaker: Flavio Cavanna (Fermilab) | 5:20 PM | Mechanical Design- detailed overview. [15' + 15' Q&A] Speaker: David Warner (Colorado State University)  |
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| 3:40 PM | Electrical Design III - Photosensor (SiPMs) [15' + 5' Q&A] Speaker: Francesco Terranova (Univ. of Milano-Bicocca and INFN)  | 7:20 PM | Assesments |
| 4:00 PM | Design Validation I: highlight results from VD PD Prototyping Phase [20' + 15' Q&A] Speaker: Sabrina Sacerdoti (APC) | | |
| 4:35 PM | Design Validation II: protoDUNE VD Module-0 Experience [20' + 15' Q&A] Speakers: Anselmo Cervera, Anselmo Cervera (IFIC-Valencia)  | | |

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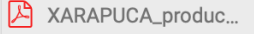
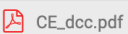
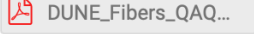




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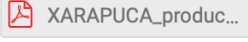
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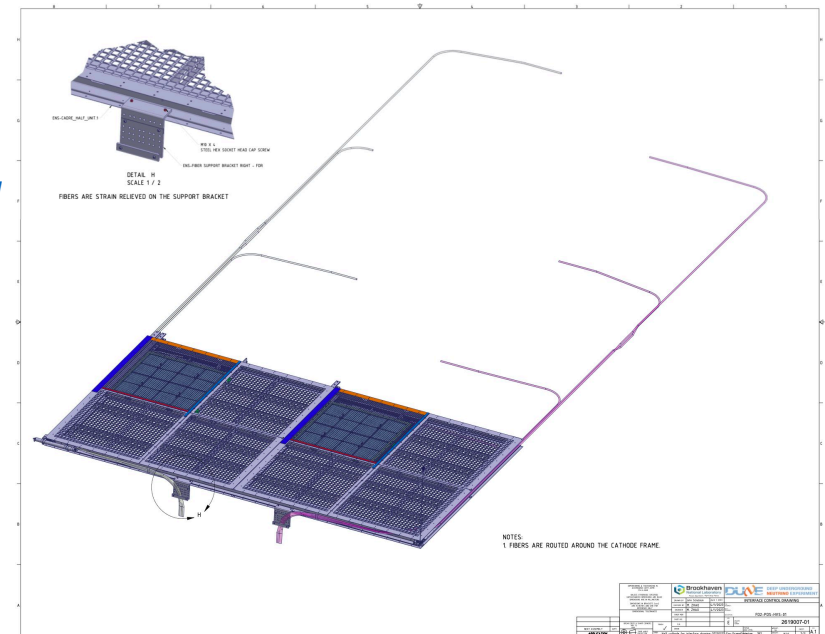
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| 5:20 PM | Mechanical Design- detailed overview. [15' + 15' Q&A] | Speaker: David Warner (Colorado State University) | FD2 PDS Final Desi... |
| 5:50 PM | WaveLength Shifter Plates and Dichroic Filters [15' + 5' Q&A] | Speaker: Carla Maria Cattadori (INFN Milano Bicocca) | |
| 6:10 PM | Production process, QA/QC, lessons learned [10' + 5' Q&A] | Speaker: Kurt Francis (Northern Illinois University) | XARAPUCA_produc... |
| 6:25 PM | Fiber test stand, QA/QC, installation [10' + 10' Q&A] | Speaker: Diana Leon (SDSMT) | DUNE_Fibers_QAQ... |
| 6:45 PM | Long lifetime validation, Risks evaluation and mitigation strategies [20' + 15' Q&A] | Speaker: Ryan Rivera (FNAL) | DUNE FD2 PDS Ris... |
| 7:20 PM | Assesments | | |

Interfaces - PDS-HVS

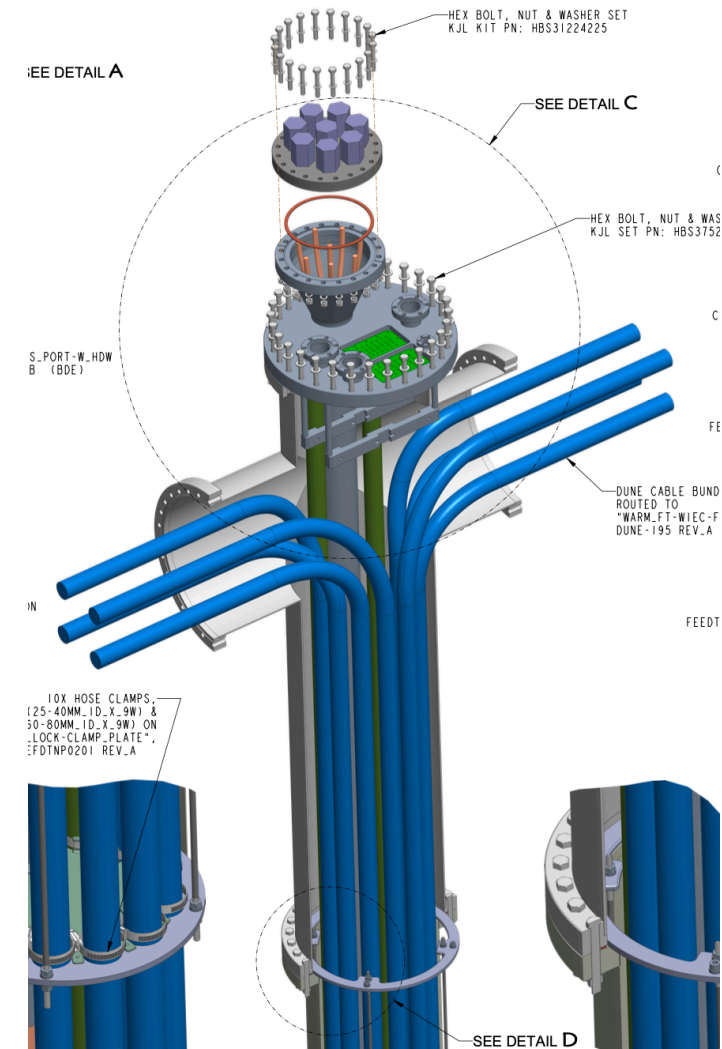
- HVS has the most involved PDS hardware interface
- Key interfaces
 - Presence of PDS modules on -300 kV cathode, risk of charge build-up on PDS modules, risk of damage from discharge, routing of PDS fibers on cathode and field cage, routing of PDS monitoring (LED diffuser) fibers on field cage support beam, impact of HVS LEDs (for monitoring cameras).
- To-dos
 - *Fix 3D model of PD Module placement in cathode (locally correct, but issues with symmetry of global placement) - in progress, expect resolution soon.*
 - Evaluate support hardware & fiber run based on ProtoDUNE-VD run.
 - Characterize and mitigate impact of Camera LEDs
 - Finalize final fiber installation procedure for FD2 (I&I).
 - Plan, conduct, and HV discharge tests.
- Status - New version uploaded April 17, awaiting consortium approval.



Interfaces - BDE

- 2nd-most involved hardware interface with PDS
- Key interfaces
 - All PDS fibers & cables share cryostat penetrations with BDE
 - Cross-piece same as for FD1.
 - PDS Flange design updated for membrane-mount cable connectors, PoF/SoF fibers, Response Monitoring System (Flasher) Fibers
 - Septum to isolate (in ProtuDUNE) SoF & PoF fibers
 - Indirect interfaces (via I&I) for fiber/cable installation procedure, use of shared cable trays.
- To dos
 - Generate FD2 version (move Septum to isolate upper RMS fibers)
- Status
 - Update to posted version in progress.

Design for ProtoDUNE-VD



Other Interfaces

DAQ - <https://edms.cern.ch/document/2088726/5>

- Joint FD1/2 DAQ-PDS Interface, released.

Computing - <https://edms.cern.ch/document/2145149/1>

- Bare-bones ICD. Incorporating FD2 into FD1 ICD (<https://edms.cern.ch/document/2145146/3>) may be best approach.

CRP - <https://edms.cern.ch/document/2619004/1> (released)

- Simplified since PDR. No direct interfaces, need to monitor installation procedures and clearance between fibers and CRP.

Calci

- Reduced scope from FD1: no laser, inspection cameras in HVS scope
- Need to evaluate impact of purity monitor on PDS system.

Responses to Previous Reviews

- Tracking spreadsheet
 - <https://edms.cern.ch/document/2681916> (Review Office, In Work),
<https://edms.cern.ch/document/2874212/1> (Long-form responses)
- Technical Coordinator Closeout
 - <https://edms.cern.ch/document/2873224/1> (Engineering Check)
 - Of 19 recommendations, all are closed with exception of *[15] Complete the interface documents, with priority to the interfaces with the BDE electronics, HVS and cryostat systems and complete the approval process, to start a rigorous change control mechanism.*