DEEP UNDERGROUND NEUTRINO EXPERIMENT

# Design Review: DUNE Single Phase Cathode Plane Assembly, Field Cage and High Voltage

**CERN, 9–10 November 2016**

Opening Executive Session

M.C.

# Review Goals

**The Committee is requested to review the DUNE cathode plane assembly (CPA), field cage (FC) and high voltage (HV) technical design and determine if it is at a state commensurate with that needed for producing the equipment planned for the NP04 ProtoDUNE prototype detector operation at the CERN Neutrino Platform in 2018.**

- *Assessing if the design is fatally flawed or if it seems reasonable to launch detector construction*
- *Provide comments, and recommendations to improve the design.*
  - *Given the short timescale to build and install the detector in 2018 before LS2 starts, the project may not be able to implement all of the recommendations. Committee should focus on key aspects*
- *Note positive aspects of the design*

# Review Charge

**Design**

1. Does the CPA/FC/HV **design meet the requirements**? Are the requirements/justifications sufficiently complete and clear?
2. Are CPA/FC/HV **risks** captured and is there a plan for managing and mitigating these risks?
3. Does the design lead to a reasonable **production schedule**, including QA, transport, installation and commissioning?
4. Does **the documentation** of the CPA/FC/HV technical design provide sufficiently comprehensive analysis and justification for the CPA/FC/HV design adopted?
5. Are all CPA/FC/HV **interfaces** to other detector components (APA, detector support system and beam plug) and cryostat documented, clearly identified and complete? Does the TPC integrated **3D model** adequately represent the mechanical interfaces to the CPA/FC/HV and between adjacent CPA/FC?
6. Are the CPA/FC/HV 3D model, top level **assembly drawings**, detail/part drawings and the material and process specifications sufficiently complete to demonstrate that the design can be constructed and installed?

**Electrical**

7. Is the **grounding** of the FC ground planes and to the APA and shielding/filtering of the HV understood and adequate?
8. Are the design radii, surface finish, cleanliness and QC standards adequate to **support operation** at the design HV?
9. Is the **HV system** design comprehensive and integrated? Are appropriate safety concerns incorporated into the design? Is the HV system monitoring properly integrated in the Detector Safety System? Is appropriate HV filtering in place to effectively reduce noise on cold electronics and photon system?
10. Is the **HV feedthrough** design comprehensive and integrated?

**Operation**

11. Are **operation conditions** (loads and temperature) listed, understood and comprehensive?
12. Are the CPA/FC/HV engineering analyses sufficiently comprehensive for **safe handling, installation and operation** at the CERN Neutrino Platform? Is the installation plan for the CPA/FC/HVs sufficiently well developed? Is the design for the installation tooling adequate for installation of the CPA/FC/HV?
13. Is the CPA/FC/HV **quality assurance, quality control and test plan adequate**? Have applicable lessons-learned from previous LArTPC devices been documented and implemented into the QA plan? Does the plan appropriately account for CPA/FC/HV production at multiple international sites with different standards (metric/imperial) for available stock materials?
14. Are the **teams** sufficiently resourced to deliver on time?

# Agenda and Documents

https://indico.cern.ch/event/568427/

| TIME | Talk | Speaker |
|---|---|---|
| **Wednesday 9/11** | | |
| 8:30 – 9:00 | Review Committee Session | Reviewers |
| 9:00 – 9:30 | ProtoDune overview, CPA/FC/HV overview | F.Pietropaolo |
| 9:30 – 10:15 | Electrical Design | B.Yu |
| 10:15 – 10:30 | Coffee break | |
| 10:30 – 11:15 | CPA Mechanical Design | V.Guarino |
| 11:15 – 12:00 | FC Mechanical Design | R.Sharma |
| 12:00 – 12:45 | Lunch | |
| 12:45 – 13:30 | Interfaces | B.Yu |
| 13:30 – 14:00 | HV system | G.Horton-Smith |
| 14:00 – 14:30 | HV feedthrough design | F.Sergiampietri |
| 14:30 – 15:00 | Beamplug (information only) | T.Loew |
| 15:00 – 15:30 | Coffee | |
| 15:30 – 16:15 | Installation | D.Wenmann |
| 16:15 – 16:45 | Executive session | Reviewers |
| **Thursday 10/11** | | |
| 8:30 – 9:15 | Fabrication, schedule | V.Guarino |
| 9:15 – 10:00 | QA/QC/Testing plans | F.Pietropaolo |
| 10:00 – 10:30 | Executive Session | Reviewers |
| 10:30 – 10:45 | Coffee | |
| 10:45 – 12:00 | Q&A | |
| 12:00 – 12:30 | Lunch | |
| 12:30 – 14:30 | Panel Writing | Reviewers |
| 14:30 – 15:00 | Close Out Session | |
| 15:00 – 16:00 | Final Report | |

# Review Committee

Mar Capeans, Chair (CERN EP) – phys
Sebastien Murphy (ETHZ) - phys
Fernando Baltasar (CERN HSE) - eng
Wolfgang Klempt (CERN EP) - phys
Filippo Resnati (CERN EP) - phys
B.Baller (Fermilab) - phys
G.Gallo (Fermilab) - eng
R.Preece (STFC) – eng

# Deliverables

- The committee should present its findings, comments, and recommendations in a closeout meeting with DUNE management (PUBLIC SESSION) at the end of the review on Nov10 14:30
  - Slides & Draft written report: Findings, Comments (Observations) and Recommendations (Actions)

- Available time during the 2 next days:
  - WEDNESDAY 9:
    - Opening Executive Session with MANAGEMENT Wed 8:30-9 and 16:15-16:45
      - Intro to review, Questions to management
    - Executive Session Wed 16:15-16:45
    - Writing time till dinner at 19:30
  - THURSDAY 10:
    - Executive Session Wed 10-10:30
      - Preparation of Q&A to project members for next session (Q&A with project 10:45-12)
    - Executive Session Panel writing Wed 12:30-14:30 (2h)
      - Preparation draft written report and CLOSEOUT slides for management (14:30)

- The committee should provide a final written report by November 18.

# Work Share

- Charge Questions assigned to 1 lead review, who should:
  - Prepare Questions for Q&A session
  - Draft findings, comments, recommendations for the written report

| # | Charge Question | Key Talks Concerned | Editing responsibility |
|---|---|---|---|
| 1 | Does the CPA/FC/HV design meet the requirements? Are the requirements/justifications sufficiently complete and clear? | All + Documents | B.Baller |
| 2 | Are CPA/FC/HV risks captured and is there a plan for managing and mitigating these risks? | All | F.Baltasar |
| 3 | Does the design lead to a reasonable production schedule, including QA, transport, installation and commissioning? | Fabrication, Schedule / Victor Guarino<br>Installation / Daniel Wenman | M.Capeans |
| 4 | Does the documentation of the CPA/FC/HV technical design provide sufficiently comprehensive analysis and justification for the CPA/FC/HV design adopted? | - | B.Baller |
| 5 | Are all CPA/FC/HV interfaces to other detector components (APA, detector support system and beam plug) and cryostat documented, clearly identified and complete? Does the TPC integrated 3D model adequately represent the mechanical interfaces to the CPA/FC/HV and between adjacent CPA/FC? | Interfaces / Bo Yu<br>Documents | G.Gallo |
| 6 | Are the CPA/FC/HV 3D model, top level assembly drawings, detail/part drawings and the material and process specifications sufficiently complete to demonstrate that the design can be constructed and installed? | | R.Preece |
| 7 | Is the grounding of the FC ground planes and to the APA and shielding/filtering of the HV understood and adequate? | Electrical Design / Bo Yu<br>HV system / Glenn Horton-Smith<br>HV Feedthrough Design / F.Sergiampietri | S.Murphy |
| 8 | Are the design radii, surface finish, cleanliness and QC standards adequate to support operation at the design HV? | All | S.Murphy |
| 9 | Is the HV system design comprehensive and integrated? Are appropriate safety concerns incorporated into the design? Is the HV system monitoring properly integrated in the Detector Safety System? Is appropriate HV filtering in place to effectively reduce noise on cold electronics and photon system? | HV system / Glenn Horton-Smith | W.Klempt |
| 10 | Is the HV feedthrough design comprehensive and integrated? | HV Feedthrough Design / F.Sergiampietri | W.Klempt |
| 11 | Are operation conditions (loads and temperature) listed, understood and comprehensive? | ProtoDUNE-CPA/FC/HV Overview / F.Pietropaolo | F.Resnati |
| 12 | Are the CPA/FC/HV engineering analyses sufficiently comprehensive for safe handling, installation and operation at the CERN Neutrino Platform? Is the installation plan for the CPA/FC/HVs sufficiently well developed? Is the design for the installation tooling adequate for installation of the CPA/FC/HV? | Installation / Daniel Wenman | R.Preece |
| 13 | Is the CPA/FC/HV quality assurance, quality control and test plan adequate? Have applicable lessons-learned from previous LArTPC devices been documented and implemented into the QA plan? Does the plan appropriately account for CPA/FC/HV production at multiple international sites with different standards (metric/imperial) for available stock materials? | QA/QC/Testing Plans / F.Pietropaolo | F.Resnati |
| 14 | Are the teams sufficiently resourced to deliver on time? | - | M.Capeans |

# Committee Questions to Management