

# Preparing for the Final Design Review (update of the presentation from 7/26)

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# Content

- Final report from ASIC FDR
- Quick overview of the documentation for the TPC electronics FDR with notes on the status of documents

# The ASICs FDR

- The final report from the review was made available today in [EDMS](#)
  - 1.1 Key Comments and Recommendations
    1. The three ASICs were presented very well. Complete documentation and clear presentations by designers established their individual preparedness for deployment as well as mature stage of co-development.
    2. The review committee is confident that the designs are ready to go for engineering runs as planned by the design team.
    3. These engineering runs will produce enough chips to equip ProtoDUNE-II and ProtoDUNE-II will provide final system tests.
    4. This production will also be used to finalized and refined the quality control (QC) plan.
    5. The team must continue the tests with the frontend motherboards (FEMBs) and available prototype chips.
    6. The long-term testing, and in particular the accelerated lifetime testing in LN<sub>2</sub> of the existing chips is to be continued as well as the simulation of the submitted designs.
    7. The production readiness review (PRR) should be scheduled after ProtoDUNE-II commissioning with the FEMBs produced after the FDR of these boards expected in Fall 2021.
- Proceeding with engineering run submissions of ColdADC+COLDATA (today), LArASIC (tomorrow)
- Expect to receive wafers at the beginning of November

# Documentation for the FDR (ii)

- Design updates
  - The TDR cannot / will not contain all the details of the design, it needs to be supported by additional documentation
    - ASICs (DONE)
    - FEMBs
    - Cold cable plant (In progress)
    - CE boxes
    - Cable trays system and cable restraints for the lower APA
    - Cryostat crossing tube with its cable support system
    - Spool piece
    - Warm interface electronics crate with the PTB, heaters and fans
    - Warm Interface Board
    - Power and timing card
    - Filter boards for bias voltage
    - Warm cable plant and fiber connections (In Progress)
    - Bias voltage and low voltage power supplies (in Progress)
    - Interface with the DUNE detector safety system (Almost complete)
    - Details of the QA / QC plan
    - Plans for online software
    - Plans for offline software
    - Naming convention for components (In Progress)
    - Firmware and software management plan

# Documentation for the FDR (iii)

- Grounding and shielding plan (to be approved by the grounding committee prior to the FDR)
- Mechanical CAD models (+ engineering drawings, + assembly drawings and parts lists)
  - CE boxes and interface with APA (brackets, tees) (In Progress)
  - Cable trays attached to the DSS (including temporary cable tray) (In Progress)
  - Cable restraint system attached to lower APA (In Progress)
  - TPC Electronics spool piece (In Progress)
  - CE flange with cable restraint system (no change from ProtoDUNE)
  - Warm interface electronics crate (no change from ProtoDUNE)
  - Cable support system in the cold box including cable routing
  - Cable routing inside the cryostat (Almost complete)
  - Cable routing on top of the cryostat
  - CTS / cryogenic + robotic system

# Documentation for the FDR (iv)

- Electrical schematics and boards layout

- FEMB (existing, some modifications)
- PCB on the CE flange (existing, some modifications)
- PTB (no change from ProtoDUNE ?)
- WIB (existing, some modifications)
- PTC
- Interface with DDSS (includes power and controls for heaters and fans) (complete)
- Low voltage power distribution
- Bias voltage power distribution
- Filter cards (done ?)
- Patch panel for power and signals in the cold box
- ASICs test stand
- FEMB test stand
- Other test stands

For all these items do also

- Specification of electrical cabling and wiring connections
- Bills of materials
- Documentation links for COTS components

# Requirements

- We have 3 level of requirements
  - EB held
  - TB held
  - Consortium held
- No point in changing the top level (EB held) requirements. Need to check whether any changes are needed at the level of TB held requirements, need to finalize the consortium ones
- For the ASICs review we looked at a subset of the requirements and made small changes on the consortium held ones

# Installation

- We have a very detailed installation plan for FD1 that needs to be reviewed (it would help if the installation review happened prior to our FDR)
- Some minor uncertainties on the timeline for work that takes place on the top of the cryostat to be solved
- Need to have a similar document for ProtoDUNE-II



# Interface Documents

- Have very good draft for 5 interface documents
  - APA, HV, PD, DAQ, CALCI

but some work is required (expect DAQ document to get much more detailed)

Updated draft of APA interface document (needed for APA FDR)

- Now have an understanding of what goes in the interface documents with COMP and PHYSICS (need to find the time to write them)
- Drafts exist for interface documents with DSS, Installation, Facility, but there is still a lot of work to be done
- Interface drawings: progress on some, more work to be done on others

# Engineering Analysis Plan

- Very good head start with structural analysis plan ready (compliance office has reviewed multiple versions, now in the process of running finite element analyses, need to write report on the results)
- Need to something similar for
  - Electrical safety (justify cable gauges, size of traces)
    - Shekhar volunteered to work on this, but need progress on other documentation before he can prepare the electrical safety document
  - Fluidodynamics (in the crossing tubes)

# QA/QC

- There is a draft document for the QC procedures on ASICs that needs some small revisions
- This document needs to be extended to cover FEMBs
- Need QC plan for all other components
  
- Update the lessons learned document
- Manufacturing and procurement plan (exists for ASICs)
  
- Plan for remaining prototyping activities

# Cost and Schedule

- There is going to be an internal Fermilab review of cost and schedule in September
  - Updated BOE files to be prepared in August
- Institutional responsibilities
  - Making progress on these, would like to be able to present final distribution of testing activities during the construction at the next DOE review (complete assignment of tasks by mid-October)