

Preparations for ProtoDUNE-HD-II

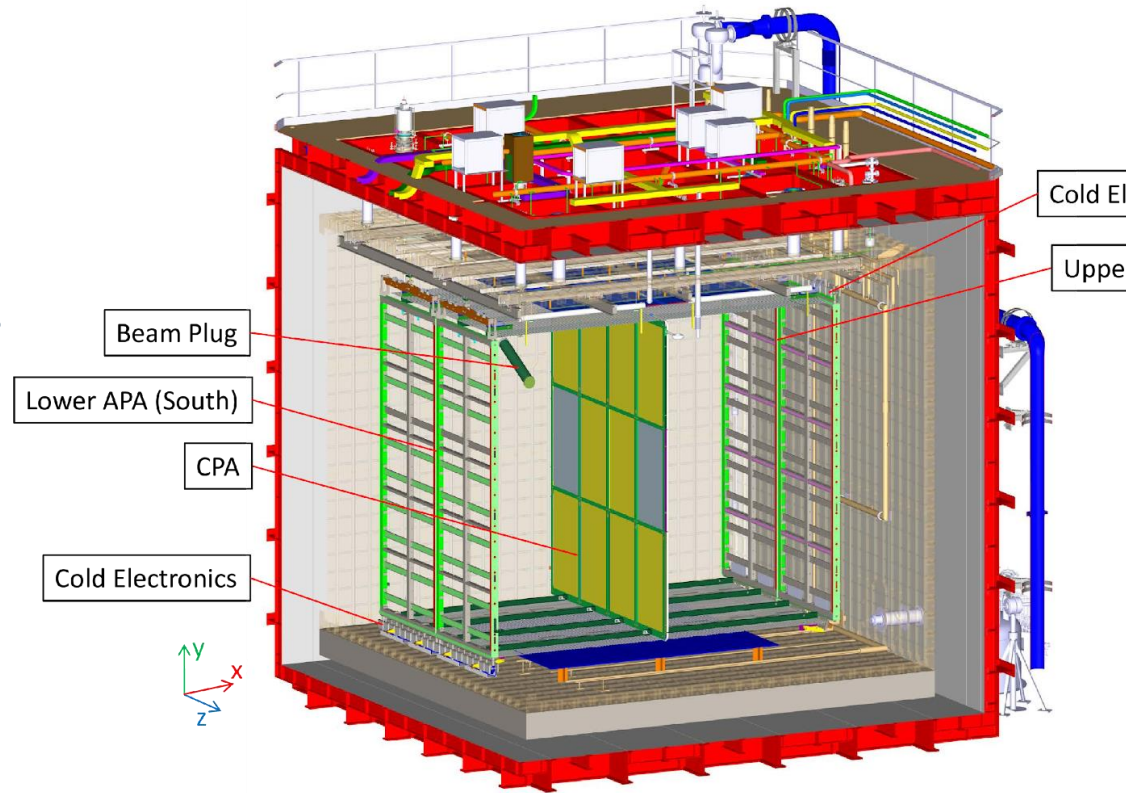
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ProtoDUNE-HD-II

- Four APAs (two installed in the normal orientation, two upside down)
- Final DUNE components
- More in Volodya's presentation next
- In this presentation discuss timeline and opportunities for involvement



ASICs Final Design Report

- Final report available in [EDMS](#)
 - The review committee is confident that the designs are ready to go for engineering runs as planned by the design team.
 - The team must continue the tests with the frontend motherboards (FEMBs) and available prototype chips.
 - The long-term testing, and in particular the accelerated lifetime testing in LN2 of the existing chips is to be continued as well as the simulation of the submitted designs.
 - 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.
- Designs of LArASIC (p5/p5b) and COLDATA (p4) transferred to MOSIS and IMEC for starting the engineering runs

ASICs Timeline (i)

- We expect to receive the wafers with the ASICs from the foundries at the end of October/beginning of November
 - We already know this for the LArASIC wafers (MOSIS)
 - We need confirmation for the ColdADC+COLDATA wafers (CERN/IMEC)
- Once we receive the wafers, we need to dice them and package them
- In the past we have used ISE (Taiwan) for packaging, but the lead time with them is too long
- Will use GTK (Taiwan, already used by our PixLar colleagues) for packaging the chips from the engineering run
- Expect 8 weeks turnaround

ASICs Timeline (ii)

- Assume we will have packaged chips available at the beginning of January
 - Need $O(800)$ LArASIC and ColdADC for ProtoDUNE-HD-II, $O(200)$ COLDATA, plus similar amounts for populating CRPs for the vertical drift detector module 0
 - Probably have at least a factor 2 more of ASICs
 - Testing of chips for ProtoDUNE-HD-II needs to proceed as quickly as possible
 - This may require people to travel to BNL for testing chips and FEMBs
- One of the goals of 2022 is to demonstrate distributed QC on all the ASICs
 - New test boards, new cryogenic/robotic test system
 - Commission with all the chips for VD module 0 / extra chips
 - Establish final QC procedures in preparation for Production Readiness Review

FEMB Timeline (i)

- Next week Shanshan will present status of prototyping of current monolithic FEMB (LArASIC p5, ColdADC p2, COLDATA p3)
- This is not yet the FEMB for ProtoDUNE/DUNE
 - Incorporate lessons learned from initial tests
 - Reduce cable plant between FEMB and WIB (need to move from 12 to 10 signal connections, 9 to 8 power connections)
 - Optimize power distribution
 - Decide on calibration / monitoring signals exchanged between FEMB and WIB
 - How to use FEMB I/O bits of COLDATA (requires COLDATA p4)
- Expect 2nd prototype of monolithic FEMB in September/October

FEMB Timeline (ii)

- We do not have a sufficient number of packaged LArASIC to assemble enough FEMBs for tests in ICEBERG / cold box at CERN
- Perform tests with CTS / eventually 40% APA at BNL
- 2nd iteration of FEMB will require new cables, modified CE flange, new WIB
- Aim at submitting order for PCB fabrication for ProtoDUNE well before the end of November, have PCBs in hand prior to the beginning of ASIC testing
- Start populating FEMBs as soon as we have sufficient number of tested ASICs for 25 FEMBs
- Aim to deliver tested FEMBs for installation on APAs at CERN in February, try to deliver sufficient number of FEMBs for 4 APAs before the end of March
- Continue building FEMBs for VD module 0 and for qualifying QC procedures at institutions that will be testing FEMBs during detector construction in the remainder of 2022

New components

- Design of FEMB, cold cables, CE flange, WIB are all tied together
- Will go through final list of requirements for WIB design (small modifications relative to the current DUNE WIB prototype) in September, will have first prototype board at the end of October
- Already ordered new cable samples
- Need to start delivering new WIBs/cables to CERN in parallel to FEMB
- Need to make a plan on how many WIBs to produce (need >20 for ProtoDUNE-II-HD, >8 for VD module 0, plus DAQ test stands, FEMB test stands)

Not everything on Day 1

- Things that may not be ready on Day 1 of ProtoDUNE-HD-II
 - New PTC
 - Connection with DUNE detector safety system (includes powering and controlling heaters and fans)
 - Interlock on individual channels of low voltage and bias power supplies from DDSS
- These may be added at a later date, we will be able to start data taking with the ProtoDUNE PTC and powering system for heaters/fans
- ProtoDUNE-HD-II will continue data taking until end of 2023, aim to demonstrate functionality prior to the end of 2022 and prior to DUNE Production Readiness Review

Getting involved

1. Vertical drift CRP test, recommission cold box, validate APA design
 - September / October 2021, using ProtoDUNE electronics
2. ASIC and FEMB testing
 - Start in January 2022 at BNL, expand later to all QC test sites
 - Work in January is time critical, cannot rely on BNL group alone, please volunteer to travel to BNL for 2-3 weeks
3. ProtoDUNE-HD-II installation and commissioning
 - Start in 2nd half of February 2022, need team of people that will continue at least until the Summer

Please talk to David Christian, Cheng-Ju Lin, and me