ProtoDUNE II

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FS Integration/Installation Meeting
February 4, 2020

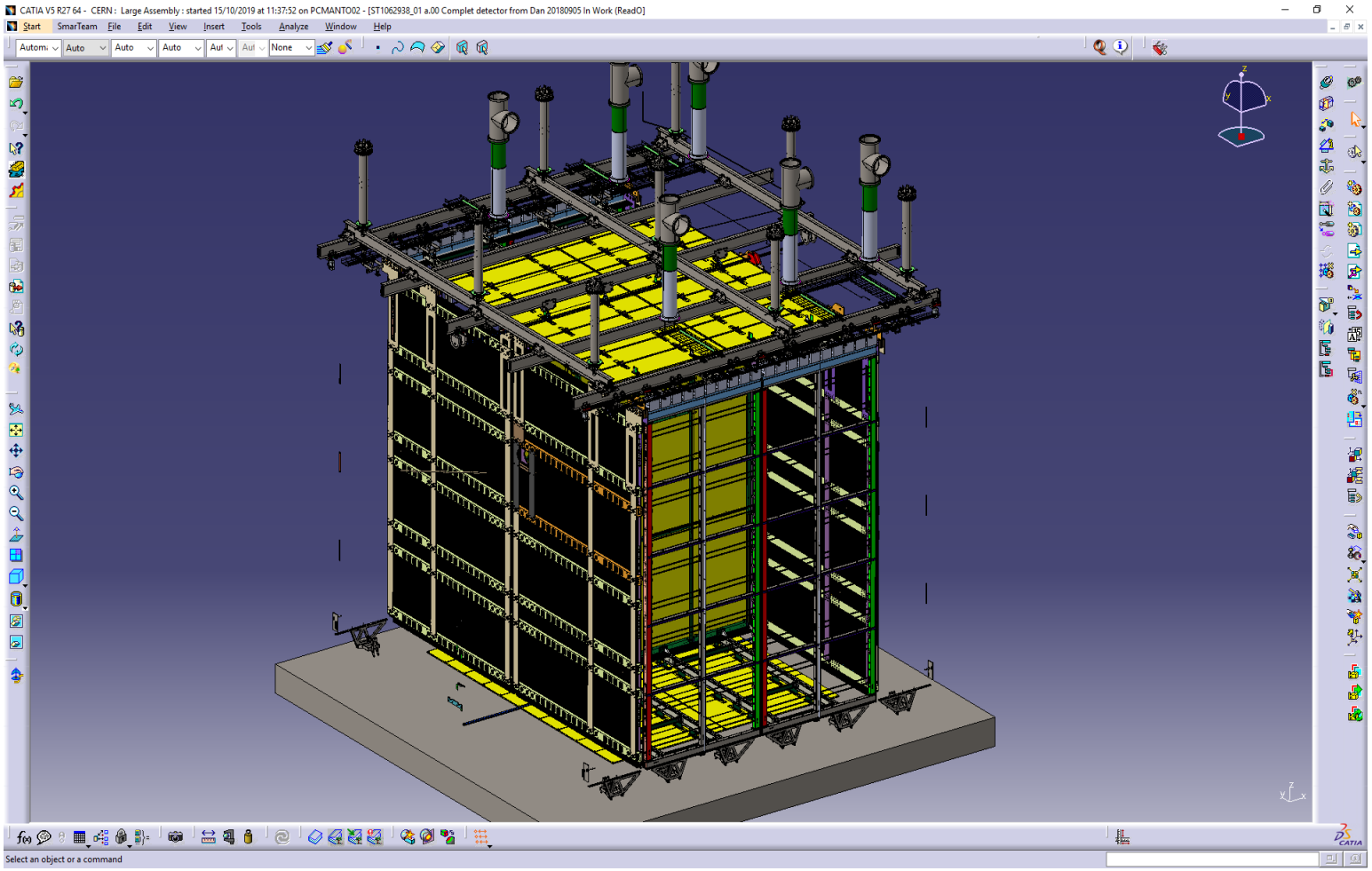
Introduction

- Major Milestones for SP Far Detector
  - LBNC Approval and public release of TDR
  - Wind down of ProtoDUNE-SP operations will over next 2-3 months (Xenon-doping tests, Neutron source tests?, and testing with higher drift-field voltages)
- With respect to the SP Far Detector, we are now entering the construction phase (R&D phase is ending)
  - Moving toward production of Module Zero detector components for final testing in ProtoDUNE II

ProtoDUNE II Goals

- Full characterization of ”Module 0”s for DUNE Far Detector; improved APAs, CRPs, cold electronics, photon detectors etc.
- Increase beam data statistics (cross section measurements, particle identification, calibration, reconstruction)
- Complete data sets with different polarities for electrons, muons, pions, kaons, and protons in momentum range 0.3-7 GeV
- Develop, implement, and demonstrate new calibration techniques including a laser calibration system and a pulsed neutron source

ProtoDUNE II Configuration



Proposed Configuration

- 4 APAs instead of 6
- Flipped APAs on one-side (electronics on bottom)
- DUNE-like distances between Cryostat and EW FCs
- Improved cryogenics systems (based on experience from ProtoDUNE-SP I and ProtoDUNE-DP)
- New calibration and cryogenic instrumentation (laser, neutron source, temperature sensors on APAs, etc.)
- As much as possible, final Far Detector components

Next Steps

- An effort has been initiated to understand how the ProtoDUNE II TPC will be assembled
  - Need engineering design for how APAs will be hung upside-down from the Detector Support Structure rails
  - Based on this design, need to converge on an integrated model that defines the position of TPC within cryostat
  - Allocation of cryostat penetrations based on TPC location
- Workshop is being planned for May 7-8 at CERN to settle on calibration systems and cryogenic instrumentation for ProtoDUNE II (and DUNE)

Schedule

- Overall schedule for ProtoDUNE II is driven by the availability of the production cold electronics
- APA Production needs to begin over next six months
  - Cold Testing of new frame with mesh, photon detector cables, and temperature sensors at PSL (Early March)
  - Construction of first, pre-production APA starting this Spring
  - Goal is to test pre-production APA in Cold Box At CERN as soon as possible
  - Final APA Design Review this Summer
  - Initiate production of ProtoDUNE II APAs

Schedule - II

- Final design reviews for other sub-systems are targeted for late 2020 (allows production of these sub-systems to begin in early 2021)
- Goal would be to have all components at CERN by end of Summer 2021 so that the detector can be installed by the end of the year
  - Cold electronics will likely be arriving just in time

Schedule - III

	2020												2021												2022			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
ProtoDUNE 2 Trial Assembly																												
Build first HV FC prototypes																												
Order materials/fabricate Module 0 components																												
Module 0 ProtoDUNE 2 FC delivered																												
Module 0 ProtoDUNE 2 CPA,EW delivered																												
Full scale ProtoDUNE 2 installation tests																												
ProtoDUNE 2 CERN										Ash River Average 2 FTE									Ash River Average 2 FTE									
Disassembly TCO drift volume																												
Open TCO																												
Remove ProtoDUNE-SP TPC																												
Cryostat Mods, clean roon																												
Install ProtoDUNE 2-SP Detector																												
Close TCO																												
Fill Detector																												

- April 2020 : End ProtoDUNE-SP Operations
- October 2020 : Cryostat Accessible
- January 2021 : Open TCO, Remove Detector
- Summer 2021 : Prepare Cryostat
- Fall 2021 : Detector Installation
- January 2022 : Close TCO, Begin Operations

Organization

- ProtoDUNE II will be a major undertaking and require a strong team to pull it off successfully (on par with what was required for ProtoDUNE)
  - Some initial discussions have taken place – need to get this organization up and functioning quickly
  - Great opportunity for students and postdocs – those involved in ProtoDUNE will attest to experience
- As much as possible, we want to incorporate the processes that will be used for the Far Detector
  - Far Detector consortia will be responsible for sub-system construction, installation, and commissioning

Summary

- Next major milestone towards construction of the first Far Detector Module will be the implementation and operation of the SP ProtoDUNE II detector at CERN
- Effort will ramp-up over next year
- The involvement of additional collaboration members will be necessary for successfully carry out this effort