

Technical Coordination

Eric James
LBNC Meeting
March 4-6, 2020

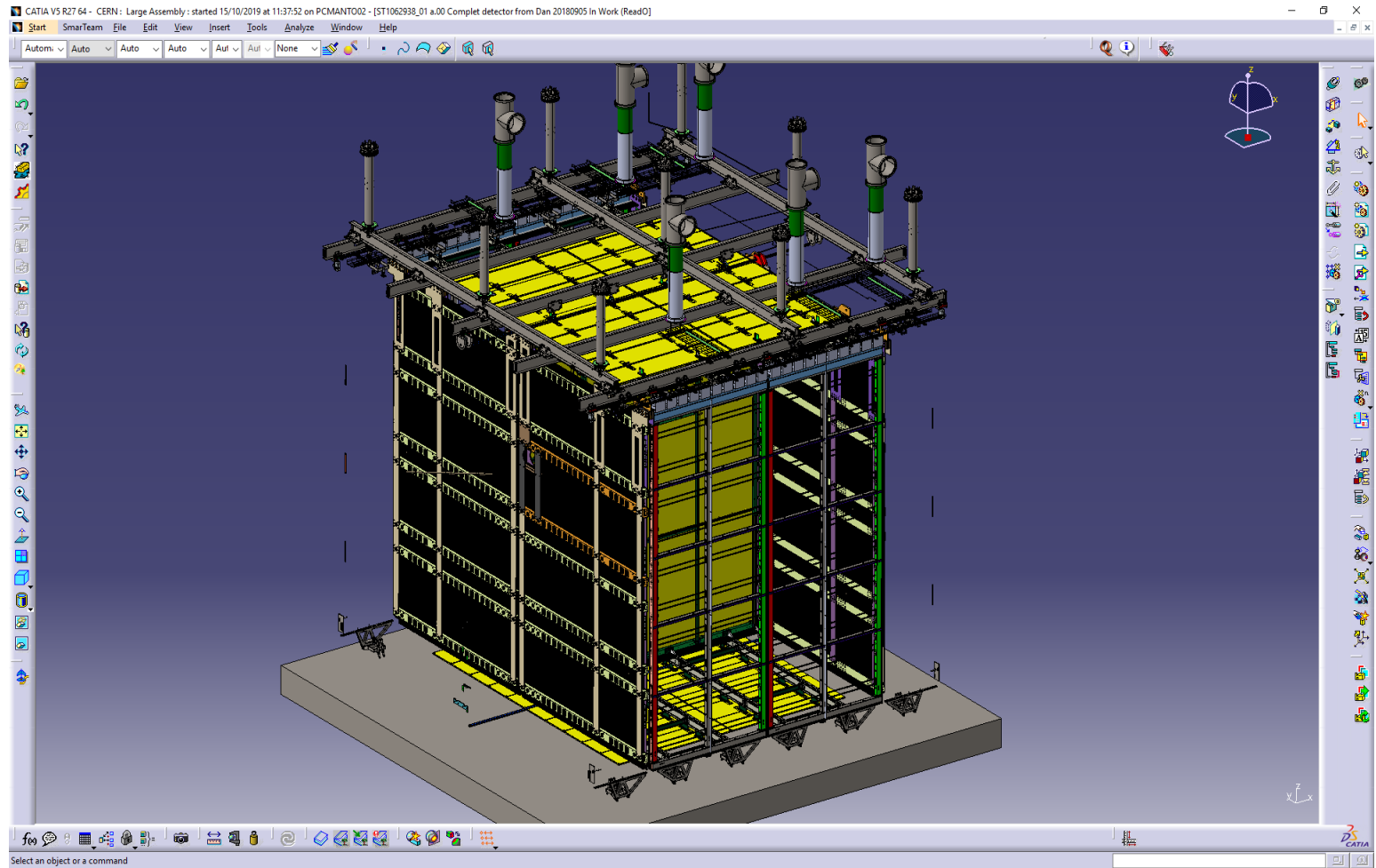
Introduction

- Major Milestones for SP Far Detector
 - LBNC Approval and public release of TDR
 - Winding down of ProtoDUNE-I SP operations will over next 1-2 months (Xenon-doping tests, Pulsed Neutron Source tests?, and testing with higher drift-field voltages)
- With respect to the SP Far Detector, we are now winding down R&D phase and entering into the construction phase
 - Next step is production of “Module Zero” detector components, which will be tested 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-I SP 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

- Technical Coordination is working 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 Drivers

- 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 Target

- 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

Activity ID	Activity Name	Planned Duration	Start	Finish
131.02.01-2.04	ProtoDUNE II and Ash River Prototyping	795d	1-Apr-20	31-May-23
13121.A1000	AR ProtoDUNE-II Installation Tests - Phase I (APA up)	44d	01-Apr-20*	2-Jun-20
13121.A1002	AR Procure FD Test Installation Infrastructure	44d	01-Apr-20*	2-Jun-20
13121.A1014	PD-II Empty and Purge Cryostat	130d	15-Apr-20*	16-Oct-20
13121.A1004	AR Construct FD Test Installation Infrastructure	22d	3-Jun-20	2-Jul-20
13121.A1006	AR ProtoDUNE-II Installation Tests - Phase II (APA Dow	22d	6-Jul-20	4-Aug-20
13121.A1008	AR Far Detector Installation Tests - Phase I (Row 1)	87d	5-Aug-20	8-Dec-20
13121.A1016	PD-II Prepare for TCO Opening	44d	19-Oct-20	21-Dec-20
13121.A1010	AR Holiday Shutdown 2020	22d	9-Dec-20	13-Jan-21
13121.A1018	PD-II CERN Holiday Shutdown 2020	22d	22-Dec-20	27-Jan-21
13121.A1012	AR Far Detector Installation Tests - Phase II (Row 25)	87d	14-Jan-21	17-May-21
13121.A1020	PD-II Open Cryostat TCO	44d	28-Jan-21	30-Mar-21
13121.A1022	PD-II Disassemble ProtoDUNE-I	65d	31-Mar-21	30-Jun-21
13121.A1024	PD-II Modify Cryostat Infrastrucutre	22d	1-Jul-21	2-Aug-21
13121.A1026	PD-II Setup Cleanroom	22d	1-Jul-21	2-Aug-21
13121.A1028	PD-II Clean Cryostat/Cleanroom	22d	3-Aug-21	1-Sep-21
13121.A1030	PD-II Modify & Install CPAs	22d	2-Sep-21	4-Oct-21
13121.A1032	PD-II Integrate, test, & Install APA 1-2	22d	5-Oct-21	3-Nov-21
13121.A1034	PD-II integrate, test, & Install APA 3-4	22d	4-Nov-21	7-Dec-21
13121.A1036	PD-II Install EW, Close TPC	22d	8-Dec-21	12-Jan-22
13121.A1038	PD-II Install Calibration/Monitoring Instrumentation	22d	8-Dec-21	12-Jan-22
13121.A1040	PD-II CERN Holiday Shutdown 2021	22d	13-Jan-22	14-Feb-22
13121.A1042	PD-II Close TCO	22d	15-Feb-22	16-Mar-22
13121.A1044	PD-II Purge, Cool, & Fill Cryostat	44d	17-Mar-22	17-May-22
13121.A1046	PD-II Commission & Operate Detector	260d	18-May-22	31-May-23

Schedule Milestones

- April 2020 : End ProtoDUNE-I 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

- In constructing ProtoDUNE-II, we will as much as possible incorporate the processes that will be used for the Far Detector
- Unlike ProtoDUNE-I, Far Detector consortia will take direct responsibility for the construction, installation, and commissioning of their sub-systems
- ProtoDUNE-II will be driven by same international matrix of responsibilities as that proposed for the Far Detectors
- 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-I)

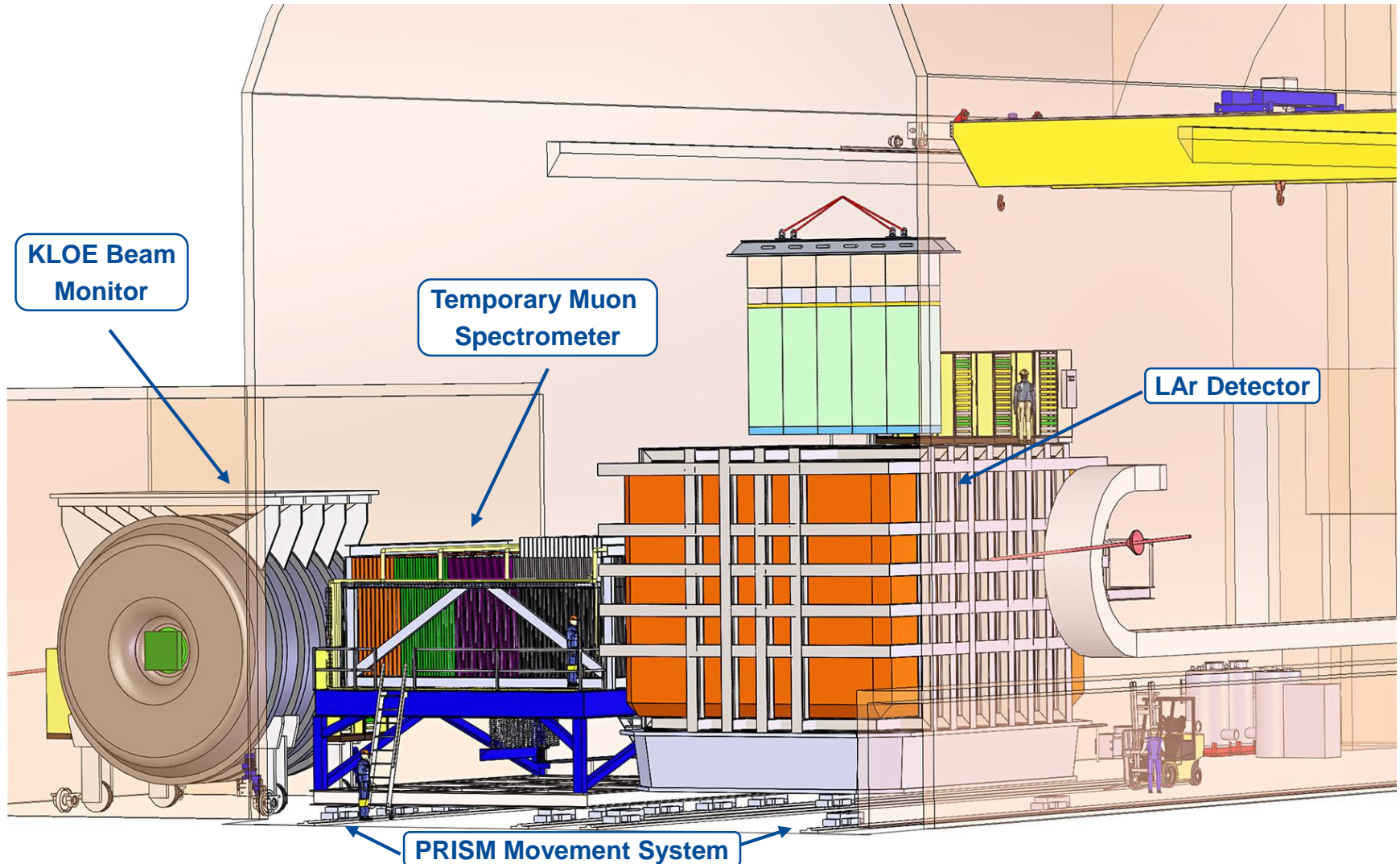
ProtoDUNE-DP

- Significant progress continues to be made towards commissioning and understanding the performance of the ProtoDUNE-DP detector
- This effort is expected to continue through the end of 2020
- Based on what is learned over the next year, a plan will be formulated for the second phase of ProtoDUNE-DP operations

Near Detector Status

- Collaboration has initiated process for forming the institutional consortia that will take responsibility for delivering the different Near Detector elements
- Near Detector Technical Board will be formed and become active once the consortia are in place
- Technical Coordination already has an active Near Detector Integration Engineering team working to ensure that the facility currently under design meets Near Detector requirements

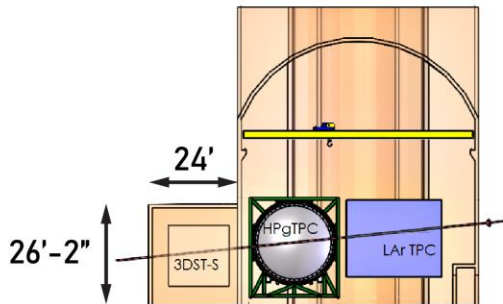
Proposed Day One Near Detector



Near Detector Facility

BCR 0332 Cavern:

Alcove Volume = 14,444 ft³

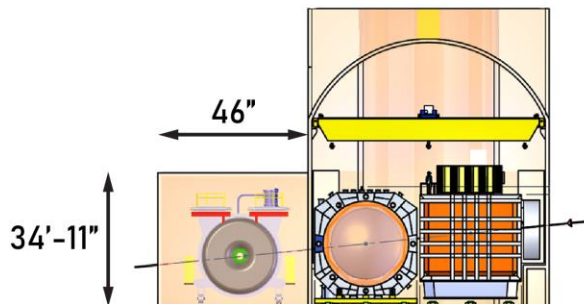


Larger KLOE Alcove Cavern Configuration:

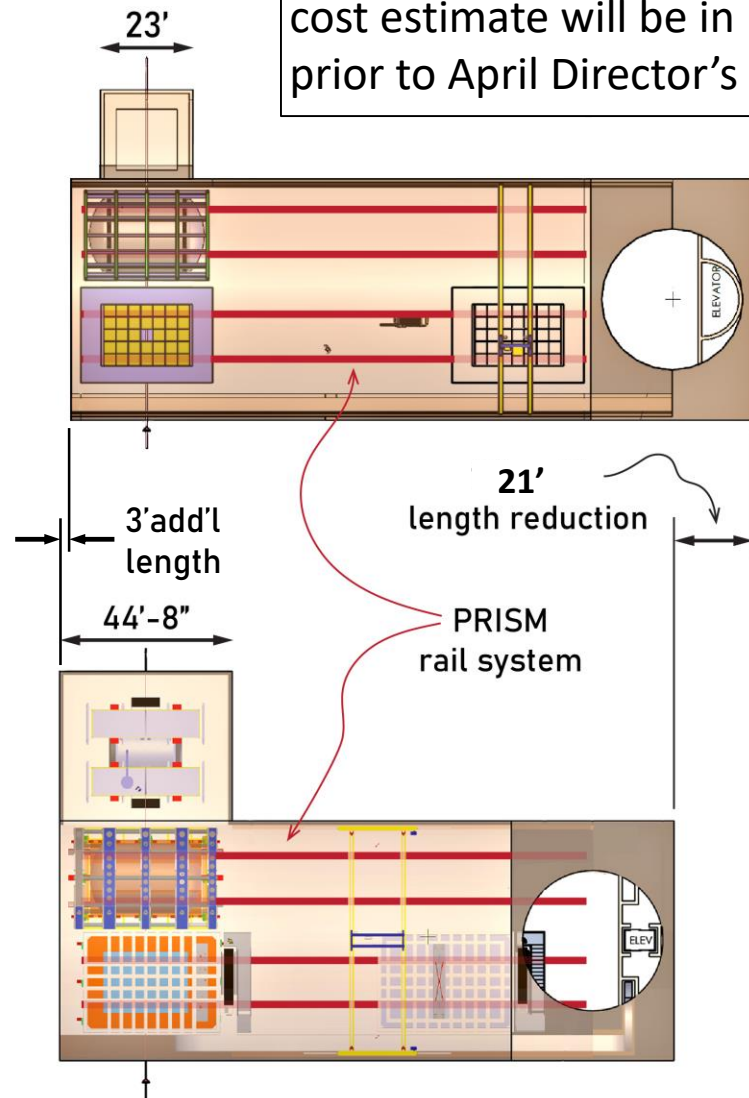
Alcove Volume = 71,742 ft³

Alcove Volume Delta to BCR 0332 = 57,298 ft³

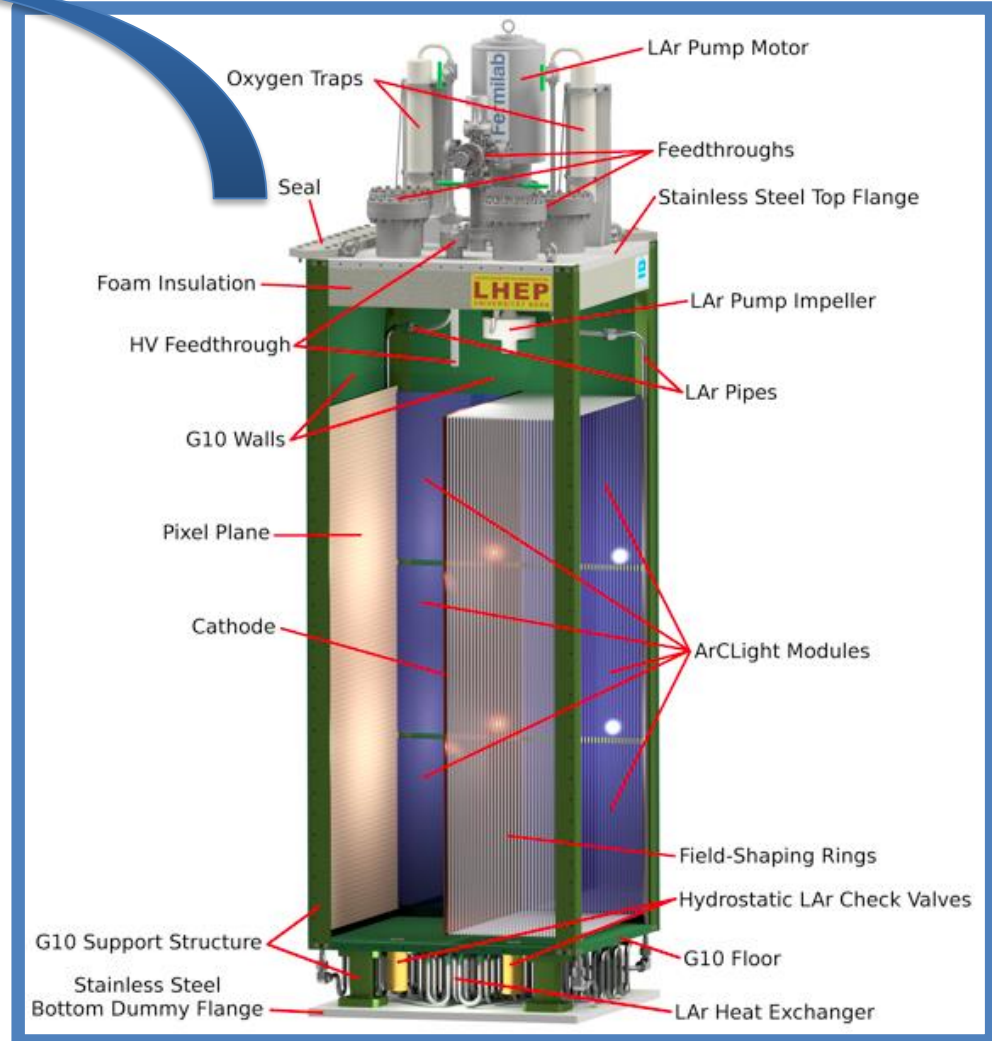
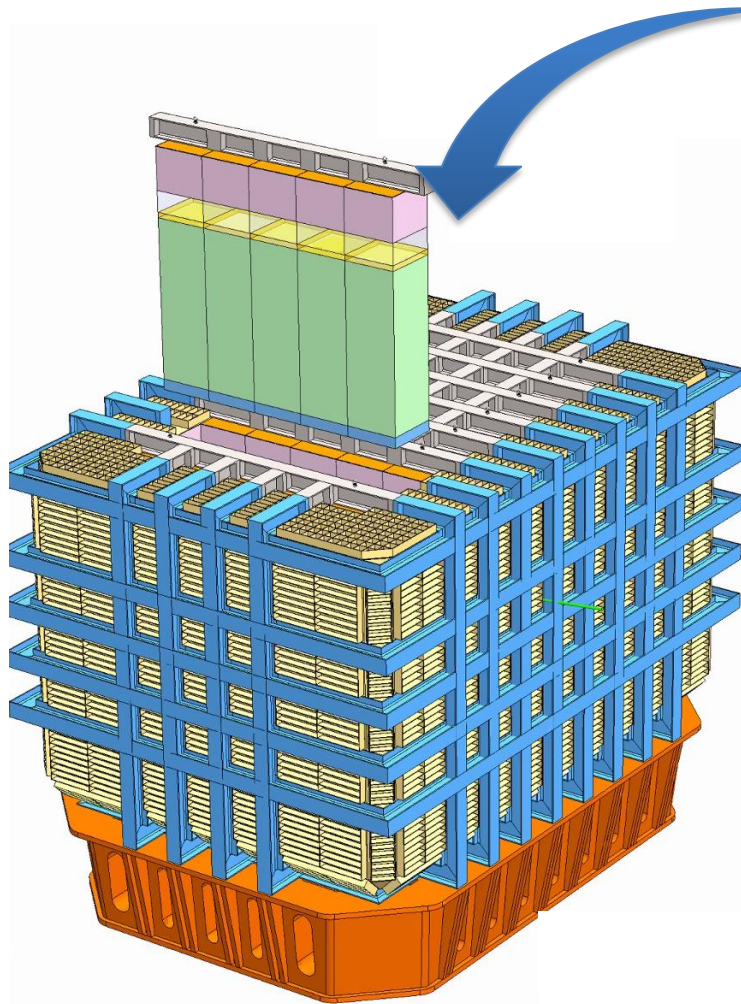
Remove 21'-3" = 18' of Main Cavern Width = (56,700) ft³



50% preliminary design and cost estimate will be in hand prior to April Director's review



LAr Detector Prototyping



ProtoDUNE-ND

- Initial operation of full-scale LAr detector module at Bern is targeted for this summer to validate the technical readiness of the design
- 2x2 LAr demonstrator will be assembled and tested at Bern in the Fall and then brought to Fermilab in 2021 to be operated in a neutrino beam
- These activities will be carried out by the LAr Detector consortium (once formed) with support from Technical Coordination

Summary

- Next major milestone towards construction of the first Far Detector Module will be the implementation and operation of the ProtoDUNE-II SP detector at CERN
- Effort will ramp-up over next year
- Operation of ProtoDUNE-DP detector in 2020 will help define the next stage of ProtoDUNE-II program
- DUNE has initiated formation of the Near Detector consortia and critical prototyping efforts in 2020 will focus on validating the ND LAr Detector technology