

Dune compatibility

Jack Fowler

DSS review

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Outline

- ProtoDUNE SP and installation plans
- DUNE and installation concept
- Detector comparison
- Interface with cryostats
- Summary

NP04 (ProtoDUNE SP) TPC

Prototype of the single phase DUNE far detector.
Full scale modules, but only half height.

The TPC has 6 APAs, 6 CPAs, 28 field cage modules, 15k readout channels

Active volume:

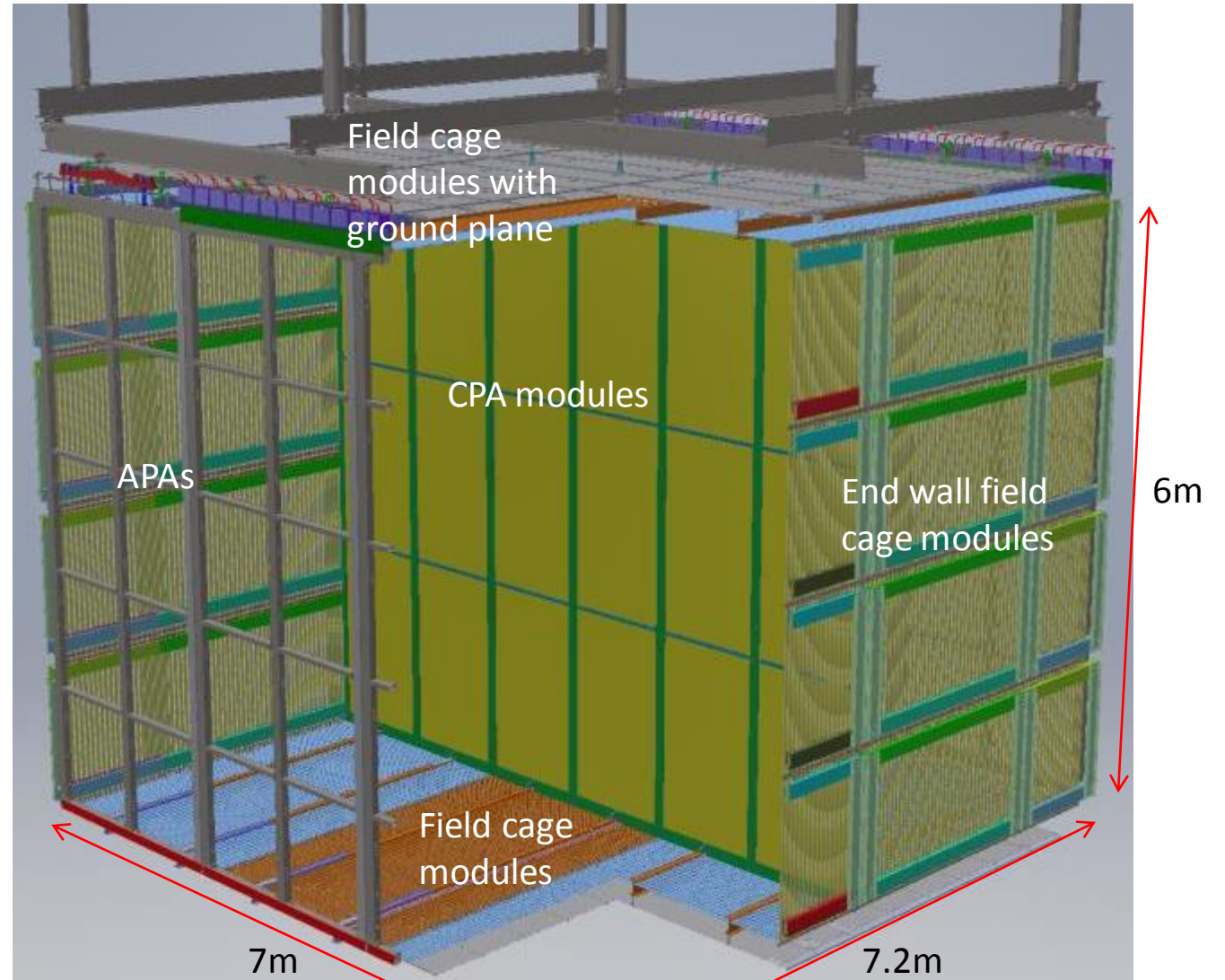
W: 3.6m x 2, H: 6m, L: 7m

300 ton active mass

Installed under 3 mounting rails suspended under the cryostat ceiling

Innovative features:

- Cold analog and ADC ASICs and FPGAs
- Double sided APA readout with electronics on one end only
- All resistive cathode plane
- Modular field cage with metallic profiles
- APAs with integrated photon detectors
- Low mass beam plug on field cage



DUNE FD TPC (Single Phase)

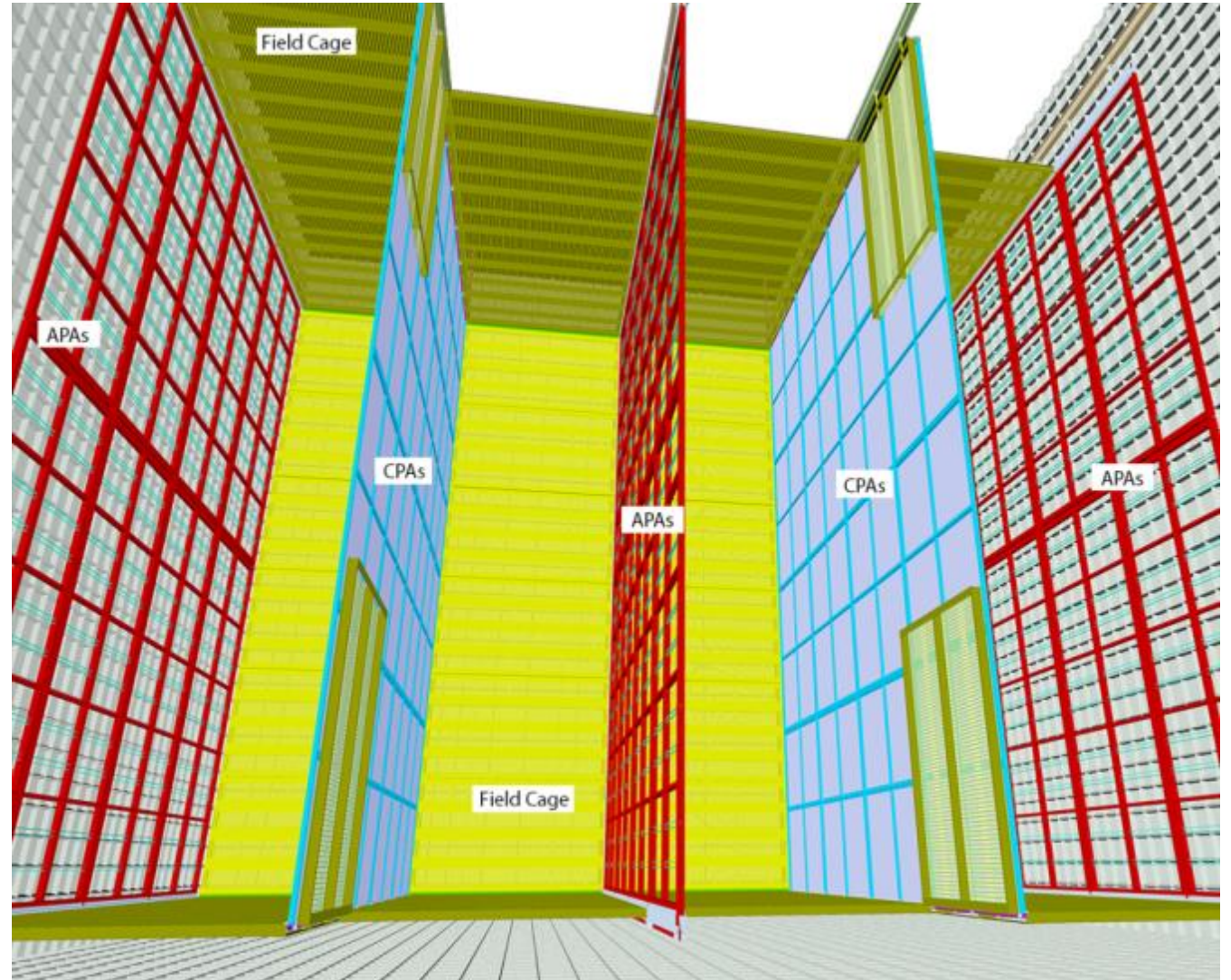
10 kton fiducial cryostat. Each has:
150 APAs, 200 CPAs
2000 m² field cage modules
385k readout channels

Active volume:
W: 14.5m, H: 12m, L: 58m

Installed under 5 mounting rails suspended
under the cryostat ceiling

Innovative features:

- Cold analog, ADC and digital multiplexer ASICs
- Double sided APA readout with electronics on one end only
- 2 APAs connected end to end for a 12m active height
- All resistive cathode plane
- Modular field cage with metallic profiles



Comparison of Key TPC Features

	NP04 ProtoDUNE	DUNE
Common	Both detectors will be installed inside a self supporting cryostat through a TCO at the end.	
Dimensions	3.6m drift (reconfigurable to 2.5m), 6m (H), 7m (L), 2 planes of 3 APAs	3.6m drift (no reconfiguration), 12m (H), 58m (L), 3 planes of 50 APAs
APA	Qty. 6 assemblies	Qty. 150 assemblies
CPA	13.8 m ² of surface area	2070 m ²
Field cage	Top and bottom 99.4 m ² End wall 86.4 m ²	Top and bottom 1656 m ² End wall 346 m ²
Photon detector	Qty 60 assemblies	Qty. 1500 assemblies
HV	1 feed thru at 180kV	4 feed thrus at 180kV
Active Mass	300 tons	13800 tons
Detector Feed Thrus	29	200 estimated

ProtoDUNE installation plans

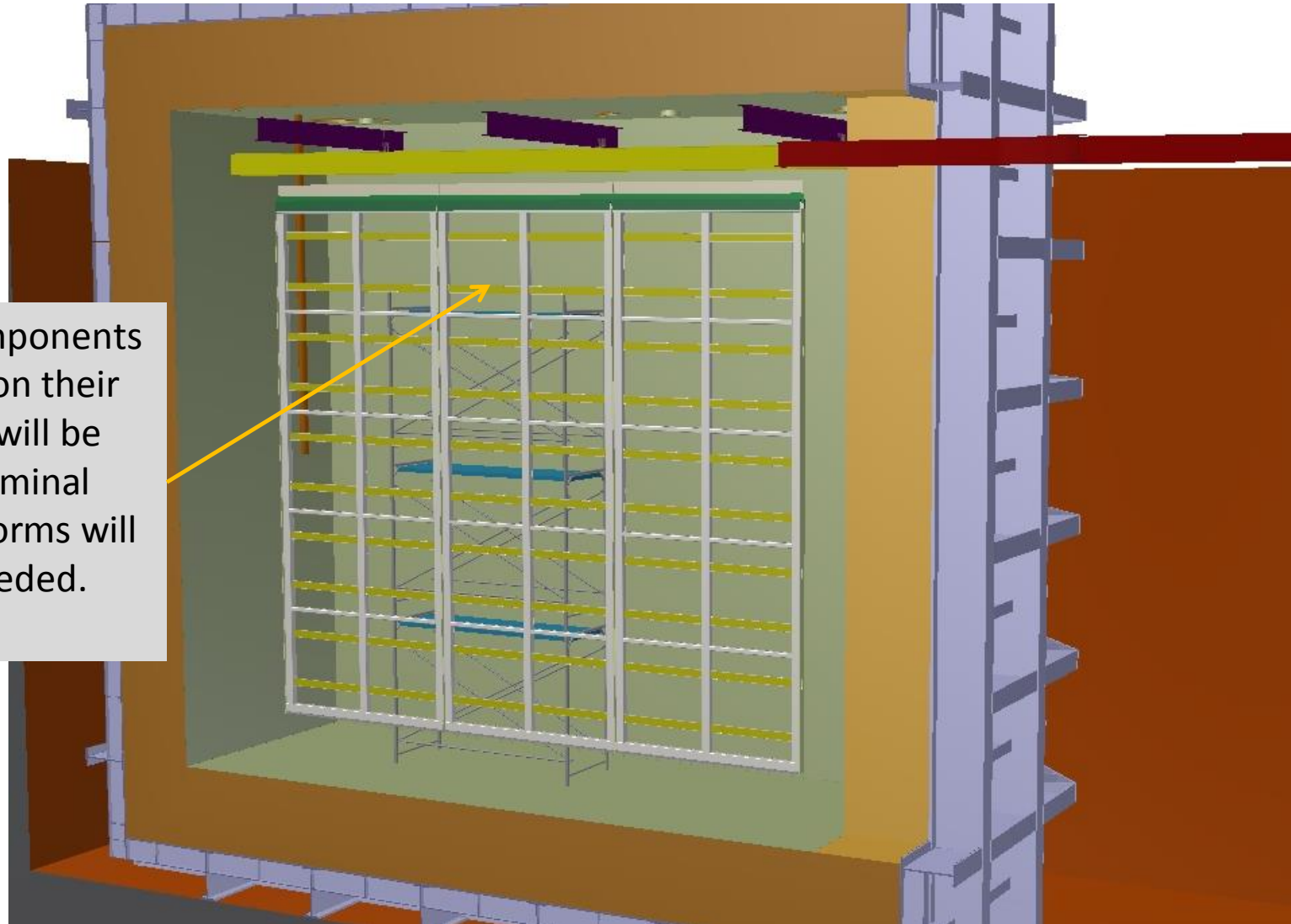
Runway Beams

Bridge beams

The APAs (and CPAs) will be installed vertically through the TCO via an extension rail.

Temporary access platforms will be constructed inside the cryostat for access to the detector as needed.

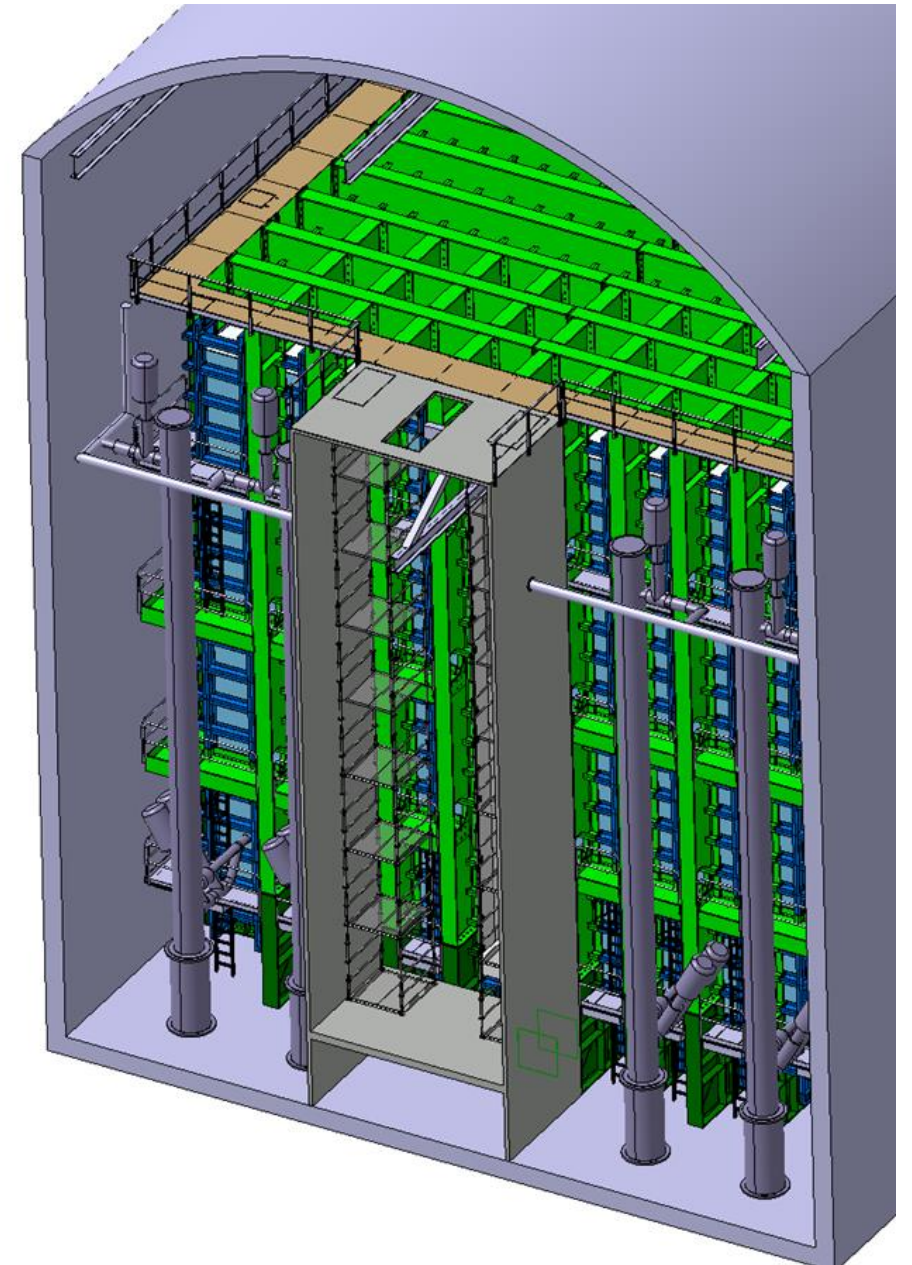
ProtoDUNE installation plans (cont)



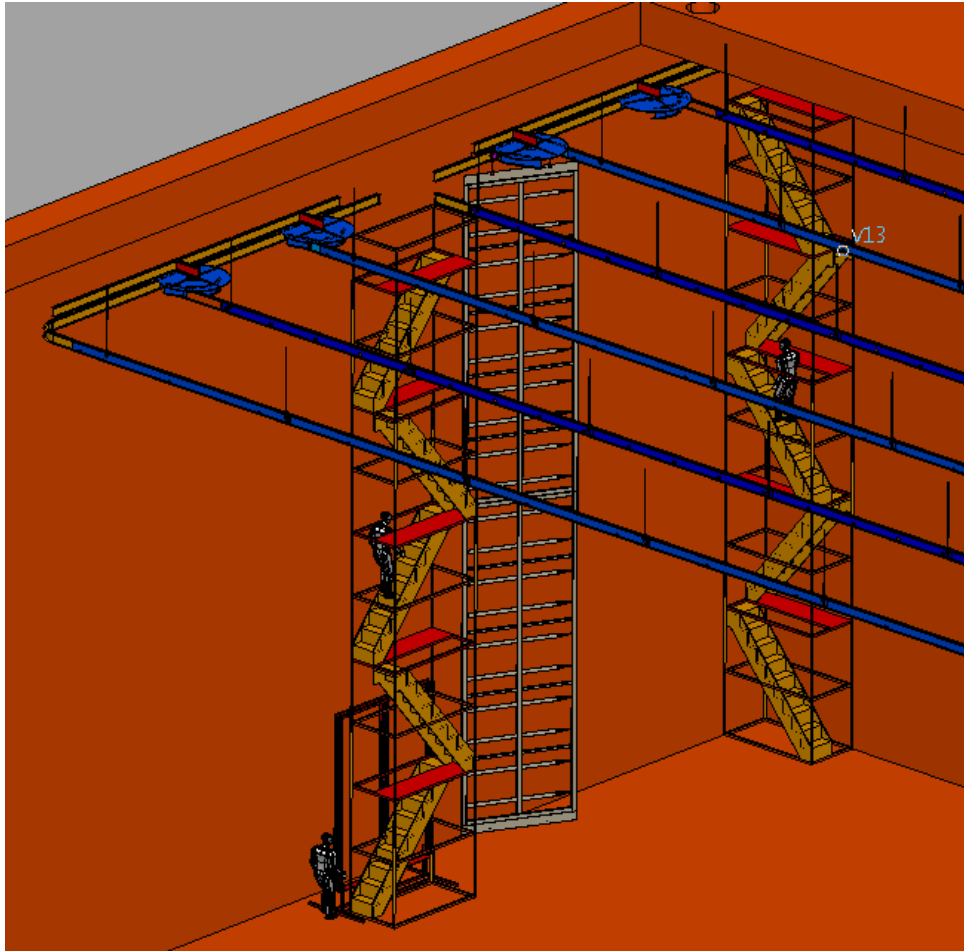
After a full row of components have been installed on their rail, the entire row will be translated to its nominal position. Access platforms will be relocated as needed.

Dune installation plans

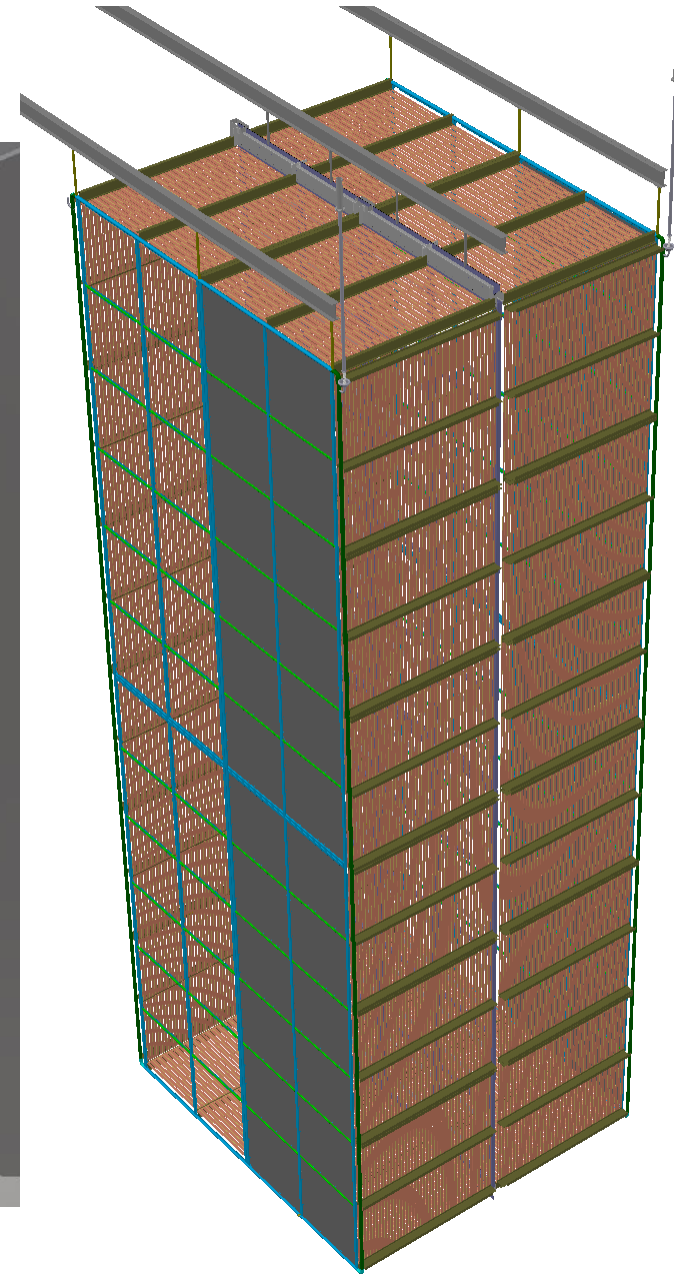
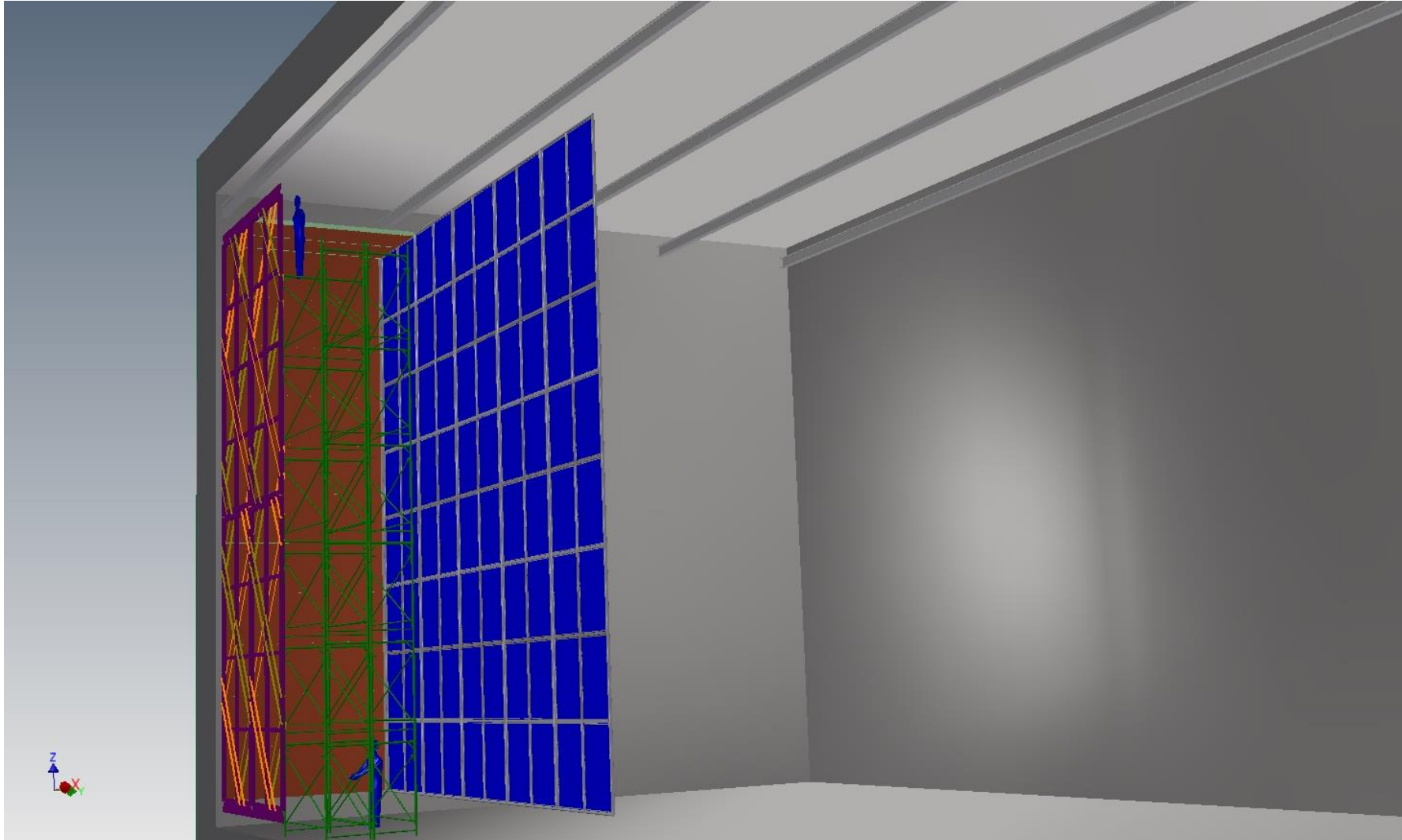
- For Dune the installation plans are similar.
- The cryostat will be constructed with a TCO to move the TPC components inside.
- The TPC components will be maneuvered inside the cryostat on a series of rails connected by gates and switches. (see next slide)



Distribution of TPC components inside cryostat (concept)

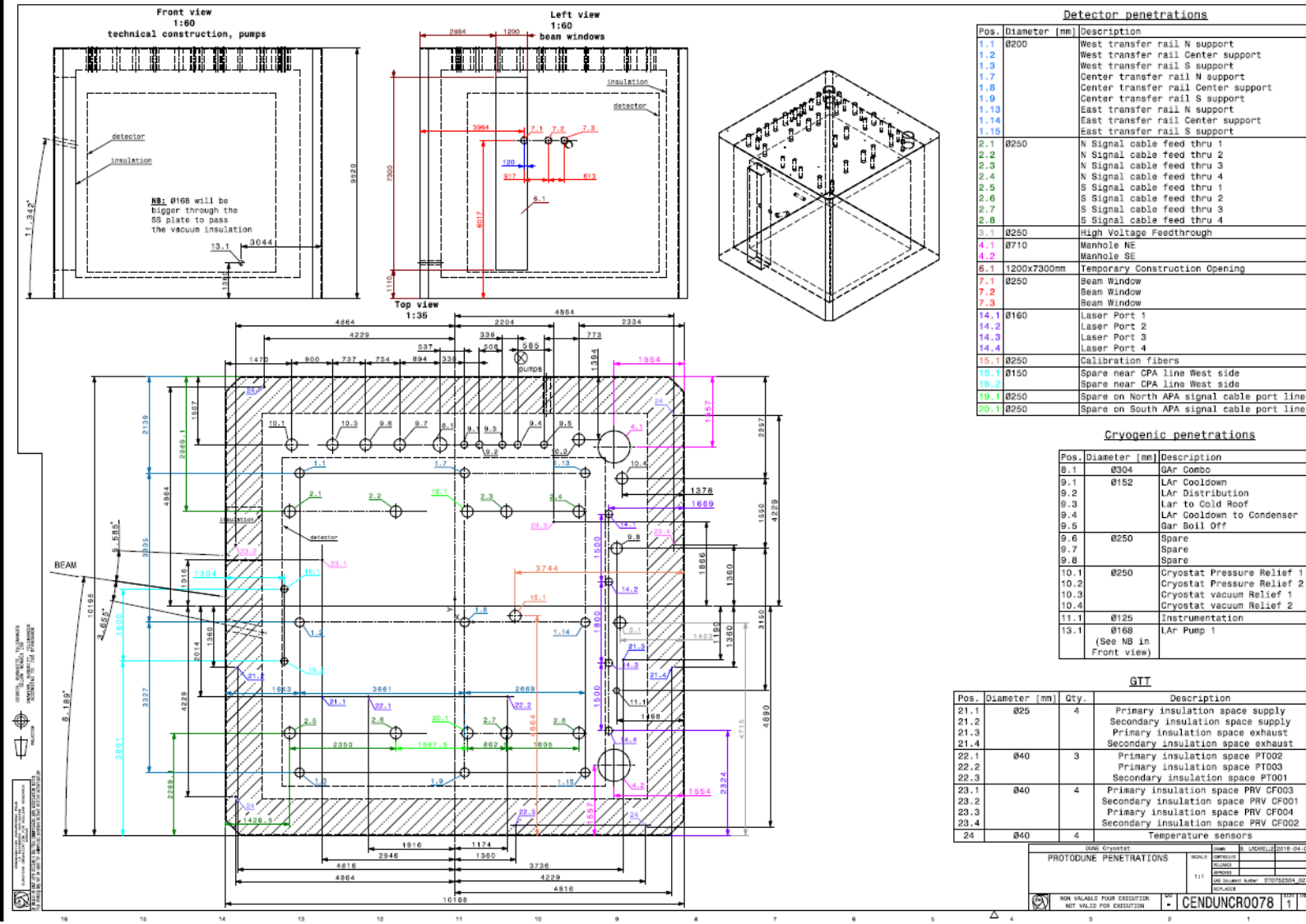


Installation concept DUNE



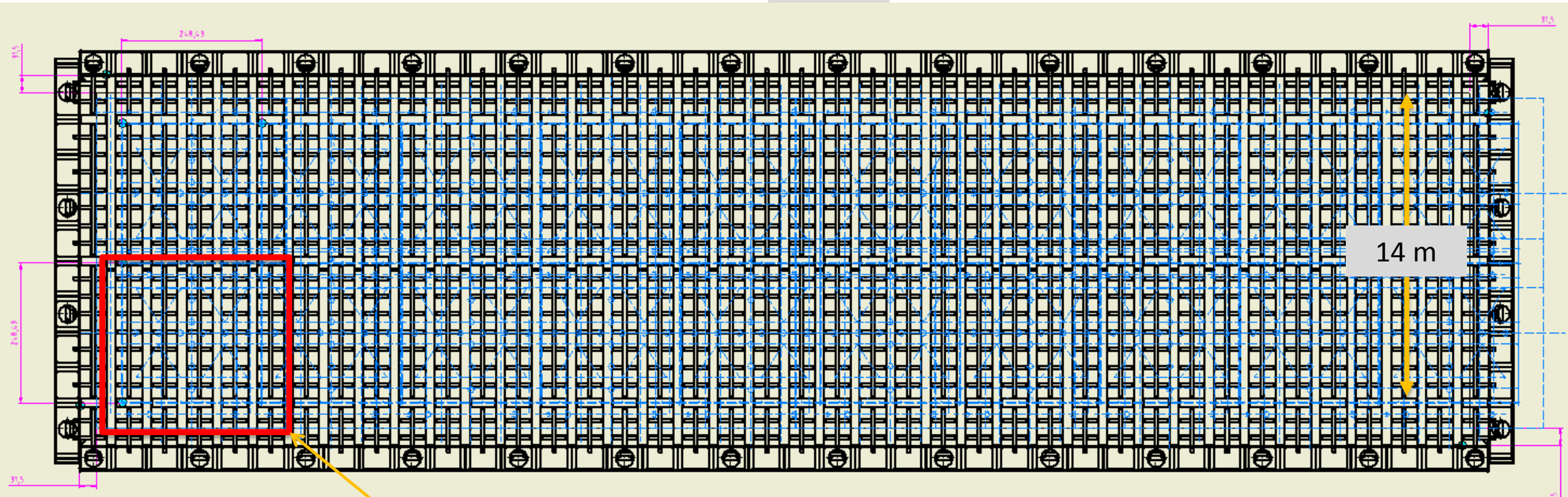
Cryostat penetration drawing ProtoDUNE SP

<https://edms.cern.ch/document/1543241/3>



Dune cryostat

62 m



Foot print of
ProtoDUNE

Design similarities

- Trolleys will be used for Dune component delivery, but removed.
- CTE and contraction issues are an order of magnitude greater. Over 62 m, the SS will contract ~ 190 mm.
- No runway beams are planned. They will be replaced by a series of switches and gates.
- Current plan is to use similar I beam cross section for beams, but plan to evaluate commercial monorail systems for compatible sections and materials.
- The TPC will be installed through a TCO at the end of the cryostat.
- ProtoDUNE has been a very good learning exercise for the design and layout of the cryostat penetrations. The experience is very useful as we begin the design of the Dune detector.

Summary

- There are many similarities between planned detector installation for Dune and ProtoDUNE.
- The experiences from the trial assembly and actual installation in EHN1 will influence the Dune design.
- The ProtoDUNE design work has already provided important input for the beginning Dune design work.

Back up slides

Beam concept for DUNE

