

DUNE FD-Trial Assembly Update at Ash River HV Scope



William Miller
3 June, 2019
Version 1



Goals of DUNE-HV Trial Assembly at Ash River

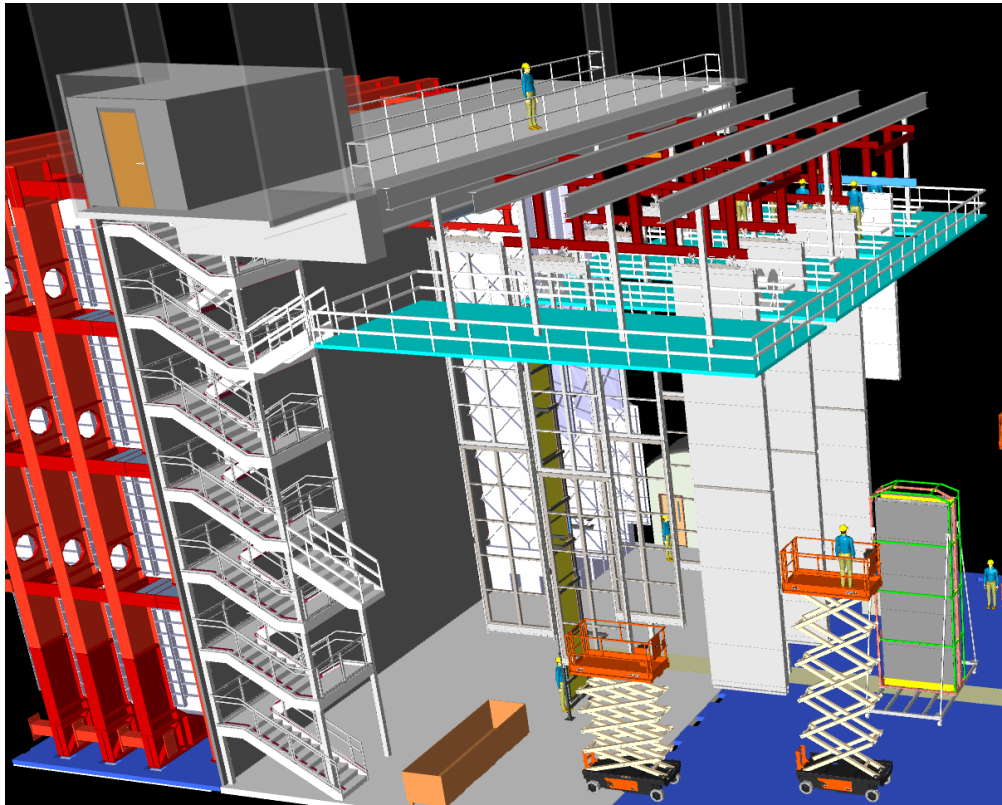
- Test each of the detector installation steps with full scale mechanical mockups based on the HV detector components final design.
 - Verify the component interfaces are accurate and well understood and that the detector can be assembled.
 - Verify the proposed installation tooling is adequate and re-design where needed.
 - Propose design revisions to the detector components where needed.
- Draft HV assembly procedure documents for all the installation work including required engineer and safety documents for all lifting devices and components
- Archive a complete set of component documentation for the mockup tests on EDMS.
- Write full set of Hazard analyses for the installation process and identify points where risk mitigation would be beneficial to reduce the risks and support safety documentation.
- Test proposed access equipment (scaffold, scissor lifts, work platforms) and lifting fixtures.
- Perform assembly time and motion studies including labor estimates which will be used to develop the schedule.

Summary- HV Trial Assembly Scope at Ash River

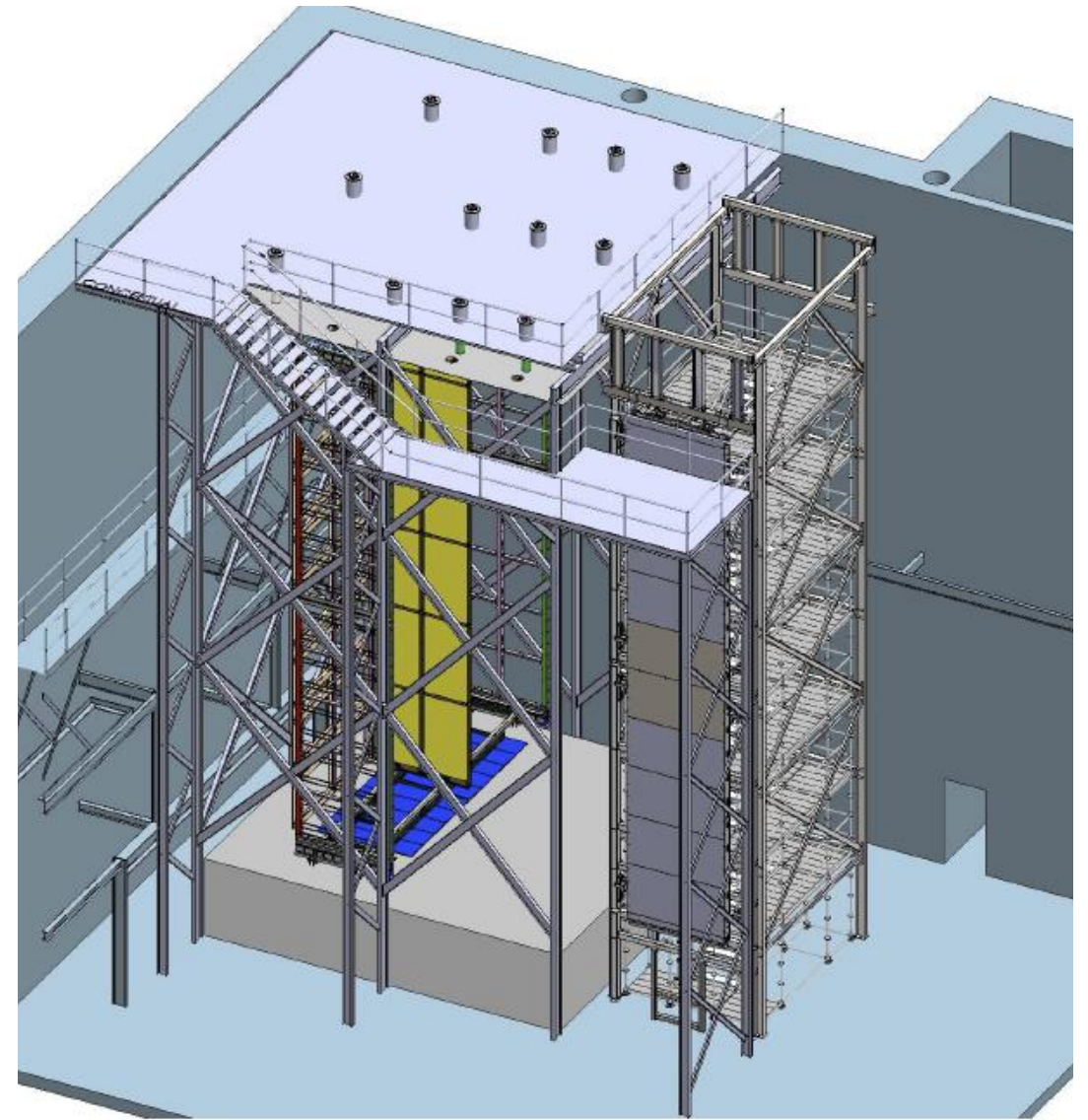
- Phase 1  **NOW FY19-FY20**
 - Build HV Field Cage prototypes for new ground plane support and FC design
 - Build CPA assembly frame and construct first CPA panel
 - Use ProtoDUNE Trial Assembly frame to test new DUNE FC & Endwall deployment and top ground plane support for ProtoDUNE 2 in FY21
- Phase 2  **FY20**
 - Build DSS steel support structure and revise APA Assembly tower to add work platform
 - Build DSS shuttle, 3 sections of DSS beam and test
 - Test movement of CPA and APA from cleanroom to final destination, including cabling of APA along cryostat side wall
 - Test APA, CPA, Endwall and FC deployment in one drift section in first row and row 25
 - Test assembly sequence of final section of TPC including removal of DSS shuttle beam runway rails, moving TPC components so TCO can be closed up

Phase 2 DSS structure

We are starting the preliminary design now. Features include the addition of the decking used DUNE underground



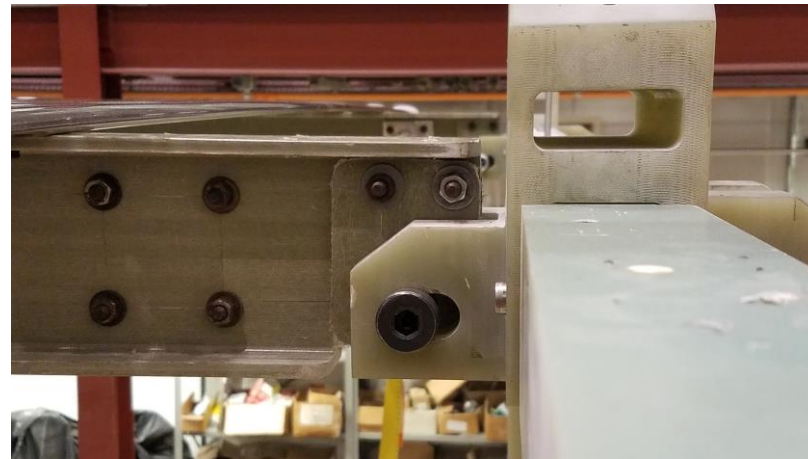
DUNE Cleanroom Underground at SURF



DUNE-Ash River Trial Assembly

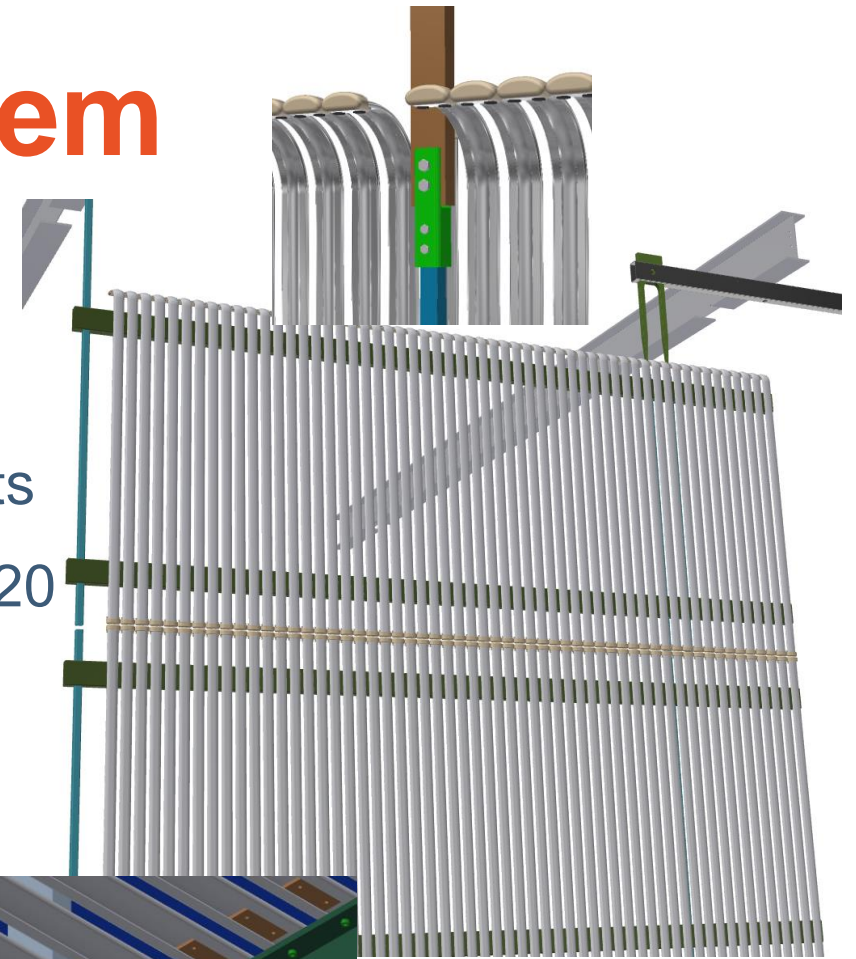
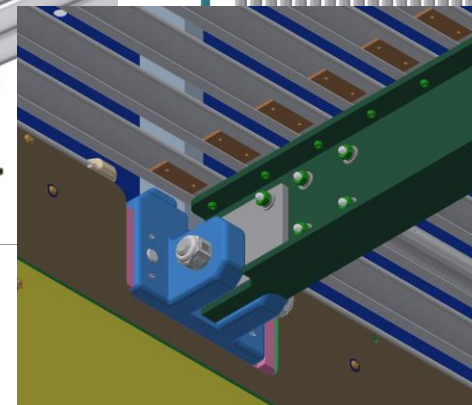
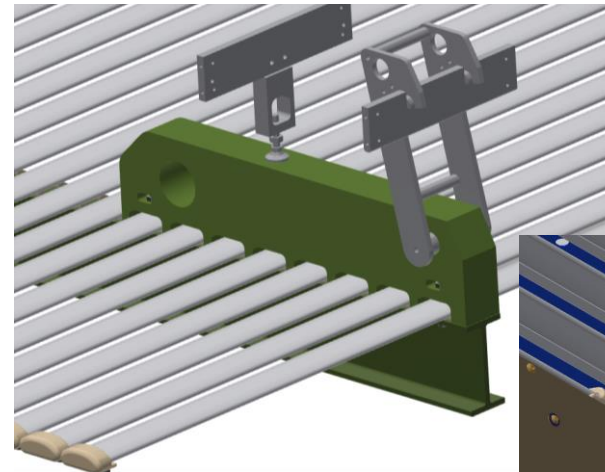
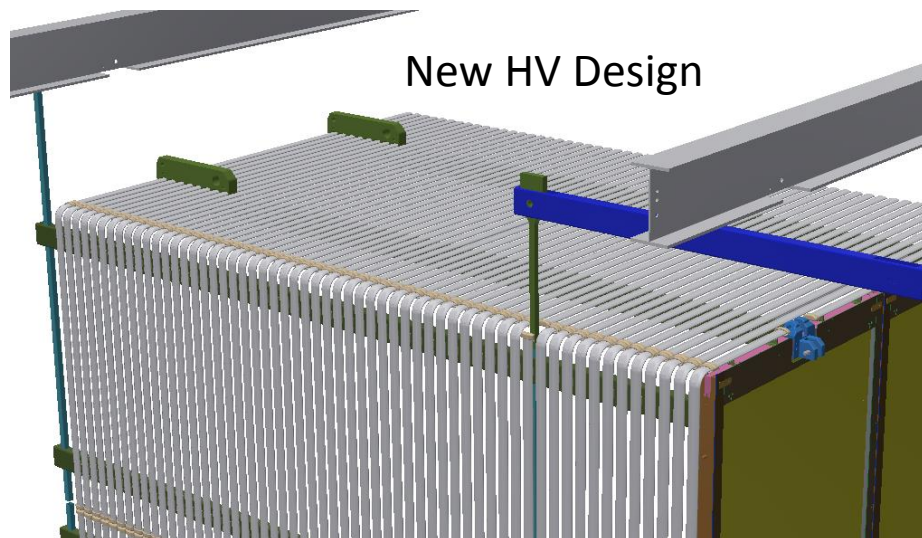
Preliminary FC and Ground Plane tests

- We have done a series of preliminary tests to test the new FC/Ground plane concept including deployment.
- Because of the location of the APA cable feed-thru ports the Field Cage lifting point has been forced to moved further from the APA latches.
- First deployment tests went very well



ProtoDUNE 2- New HV system

- This summer continue to use existing ProtoDUNE support structure to test new HV system design using modified existing components
- Early 2020 -test ProtoDUNE 2 HV with module 0 components
- Test full ProtoDUNE 2 deployment and re-assembly spring-'20



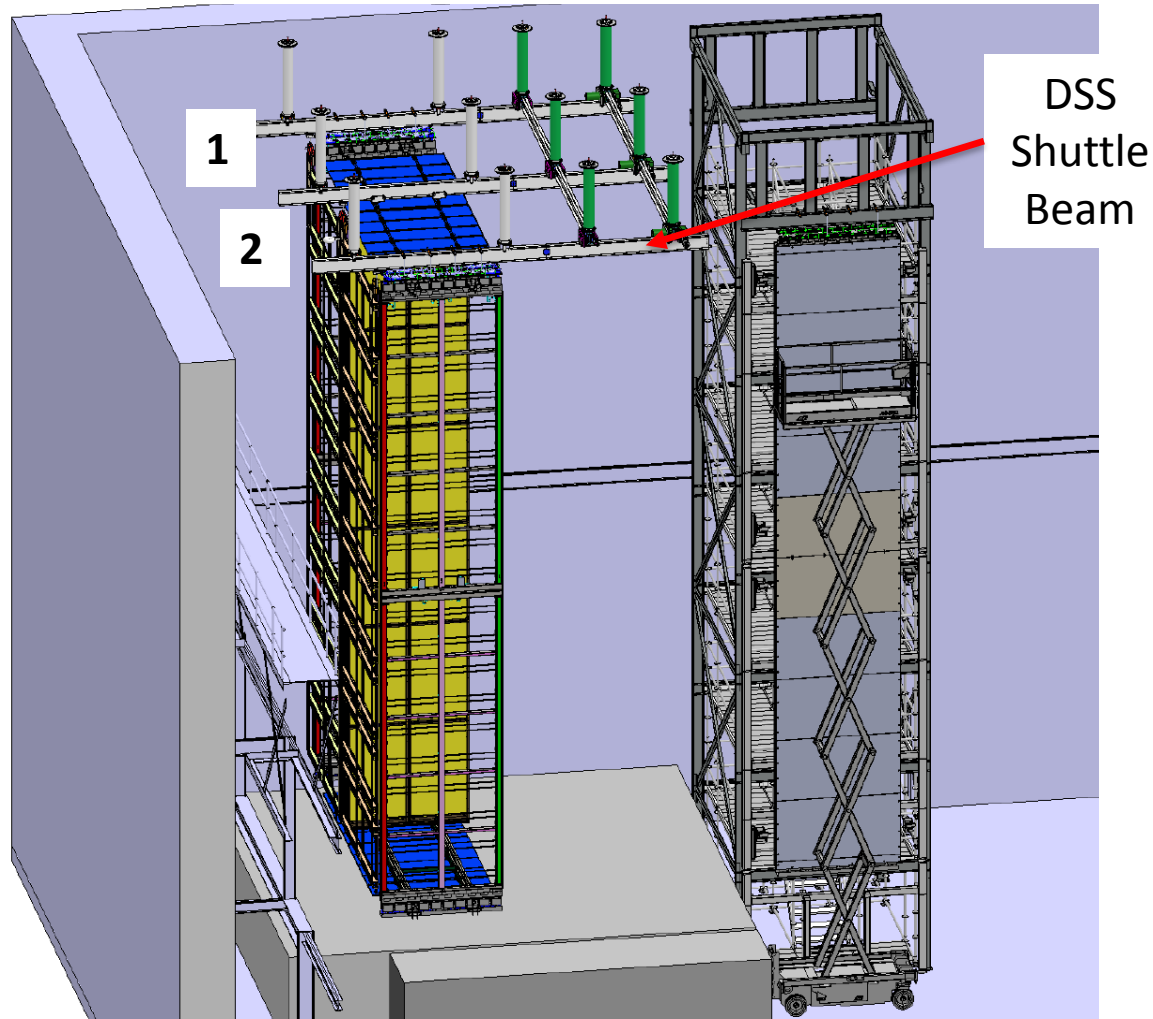
ProtoDUNE 2 Schedule

	2019							2020							2021										
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
ProtoDUNE 2 Trial Assembly																									
Build first HV prototypes																									
Order materials/fabricate Module 0 components																									
Module 0 ProtoDUNE 2 components																									
Disassembly ProtoDUNE tests																									
Full scale ProtoDUNE 2 installation tests																									
APA # 7 CERN																									
ProtoDUNE 2 CERN																									
Disassembly TCO drift volume																									
Open TCO																									
Remove ProtoDUNE-SP TPC																									
Install ProtoDUNE 2-SP Detector																									
Close TCO																									
Deploy second drift volume																									
Fill Detector																									

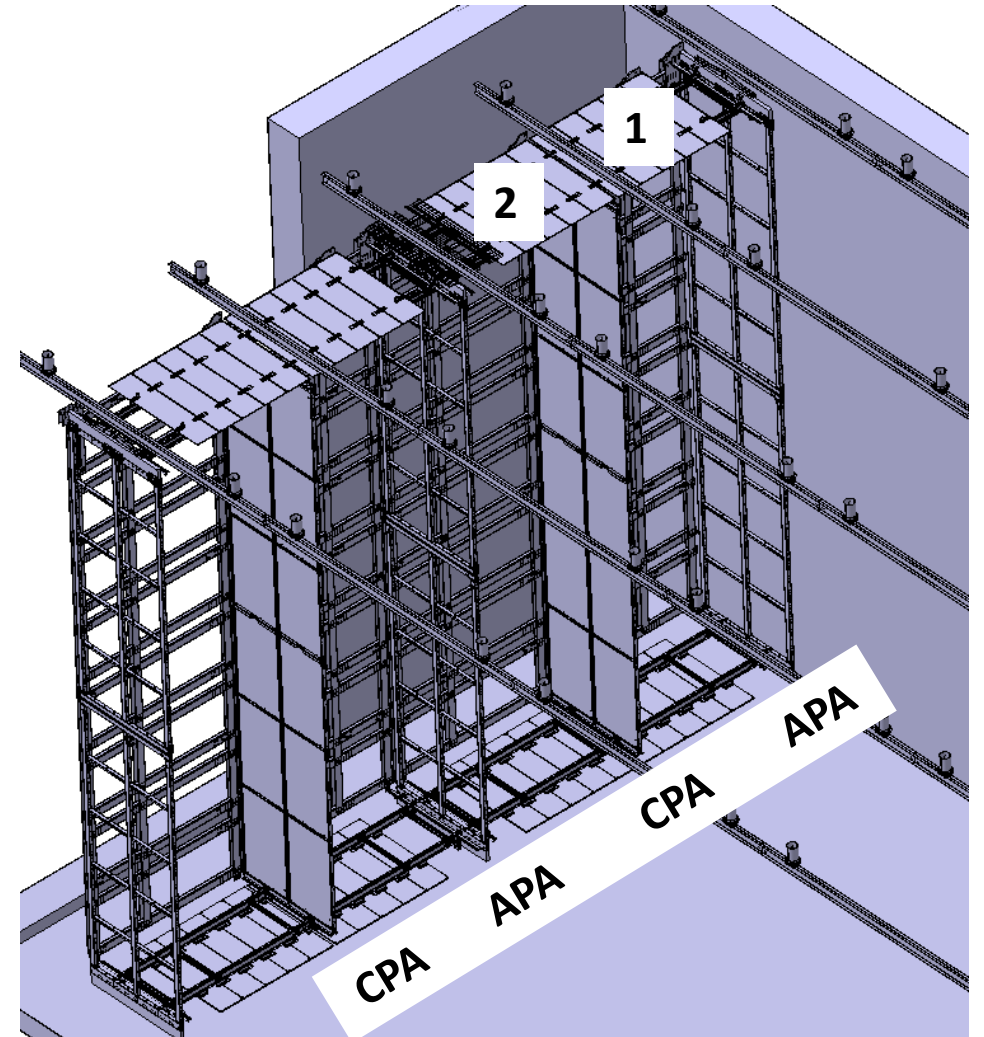
DUNE Trial Assembly Schedule-P6 sandbox

	2019												2020												2021											
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	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				
Trial Assembly Phase 1																																				
APA Assembly Frame Installation																																				
APA Transport and rigging																																				
APA Doublet																																				
APA Cabling Test																																				
Trial Assembly Phase 2																																				
Fabricate/install CPA Assembly																																				
DUNE CPA installed at AR																																				
Design DSS Steel Support System																																				
Design APA Work Platform																																				
Review design, bid documents, procure																																				
Fabricate/Install DSS steel support structure																																				
Initial Test DSS																																				
Module 0 TPC components delivered																																				
First Row installation/deployment tests																																				
25th Row Installation tests																																				
Revised installation tooling and TPC																																				
First Row installation/deployment tests																																				
25th Row Installation/Deployment tests																																				
Trial Assembly Phase 2																																				
Planning, designing, review & procure																																				
Installation of mechanical DSS feed thru																																				
Installation of mechanical Cable feed thru																																				
First Row installation/deployment tests																																				
25th Row Installation/Deployment tests																																				
ProtoDUNE 2 CERN																																				

Two Completed TPC drift volumes with DSS Shuttle

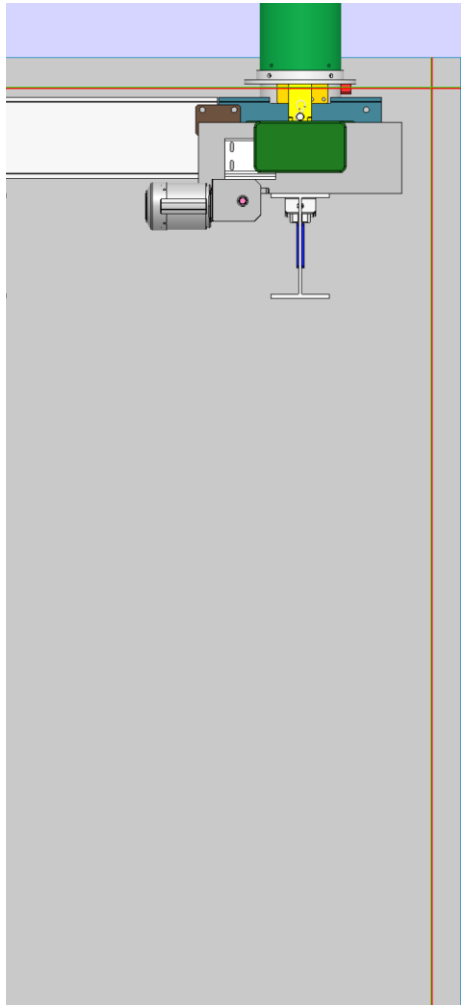


DUNE - Ash River Trial Assembly

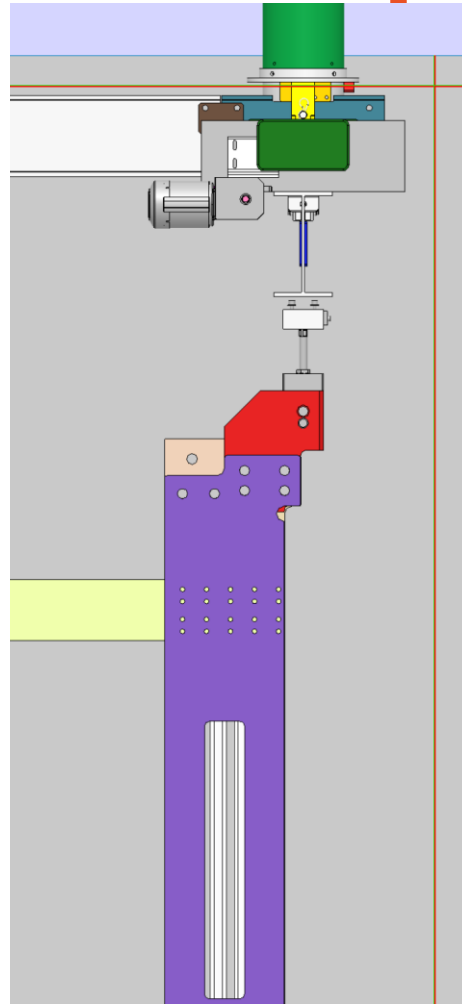


DUNE - Single Phase Detector

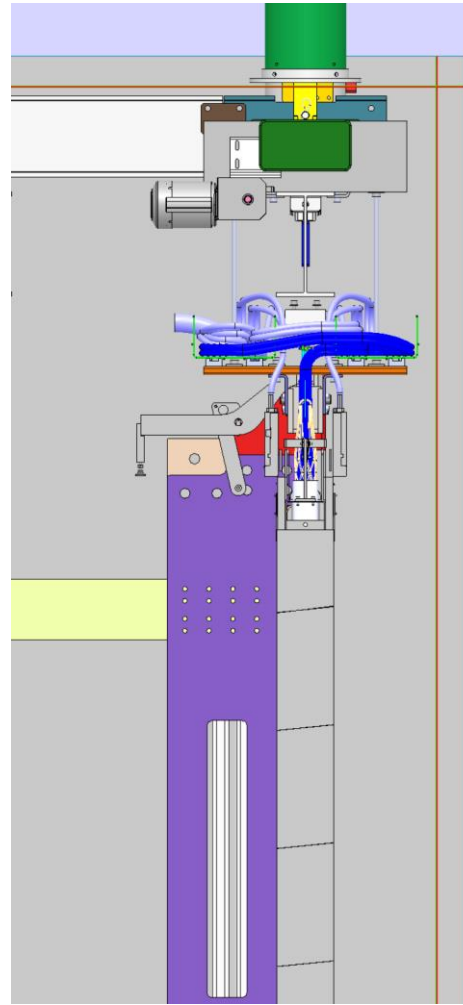
Installation Sequence – Top Corner TPC



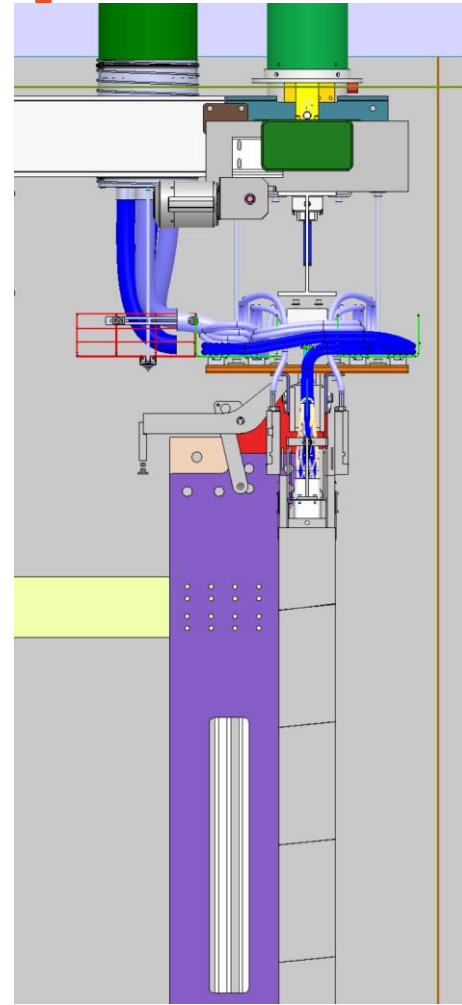
DSS



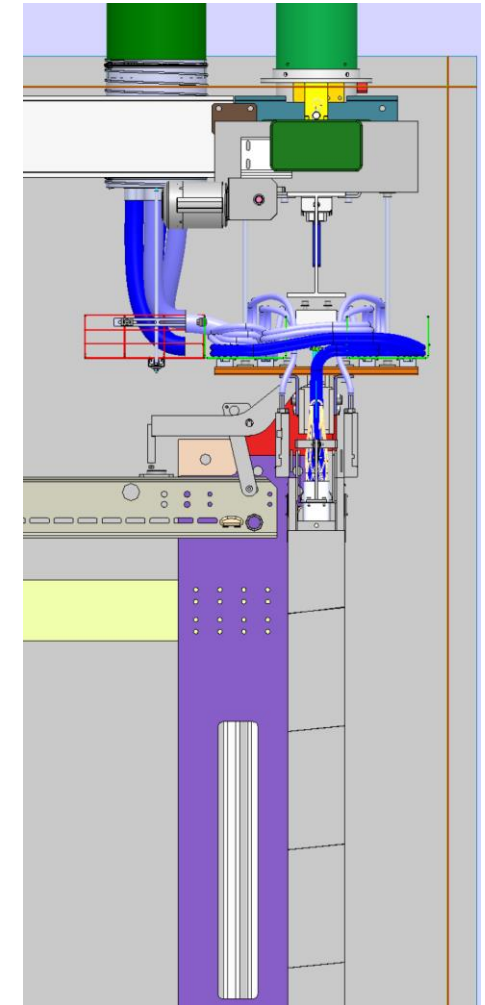
End Wall



APA



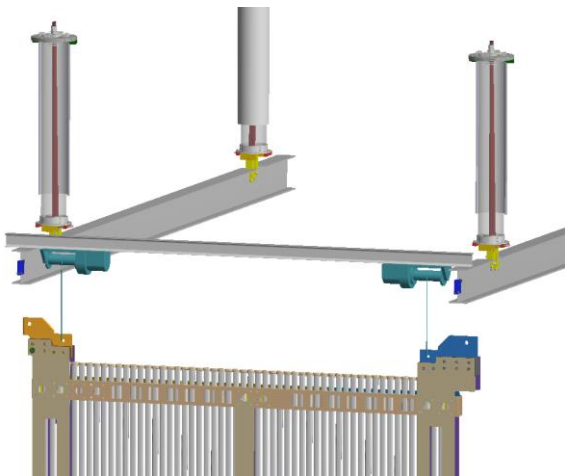
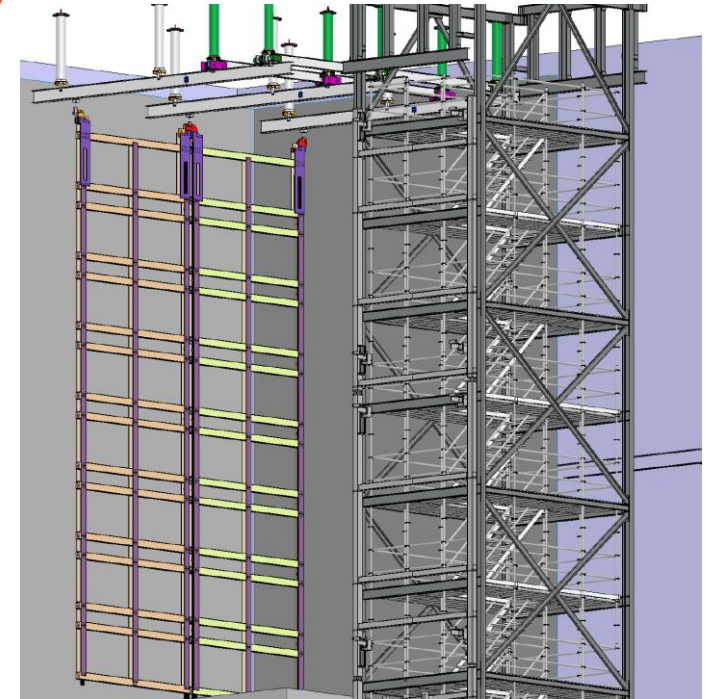
CE Cabling



FC Deployed

Phase 2 – FY20 TPC Assembly Procedures

- Once the DSS and subfloor have been installed we are ready to start
- No access equipment can reach once End Walls are in place**
- First the any instrumentation (purity monitors, temperature sensors, cameras) that are installed at the end of the cryostat must be installed first
 - HV connection is made to CPA
 - Then the 4 end wall sections are build just like in protoDUNE with the pieces connected at floor level and raised up



Purity Monitor



Temp Sensors



HV Connection

Summary

- Doing the entire HV installation process identically as it will be done for both ProtoDUNE 2 and DUNE underground is critical to the success of both
- The new HV design creates some new challenges that need to be confirmed so we have a robust HV system that is both safe and efficient to install and will operate for several decades
- Understanding access requirements for electrical connections and QC testing, alignment considerations all can be confirmed at Ash River before components go into production

