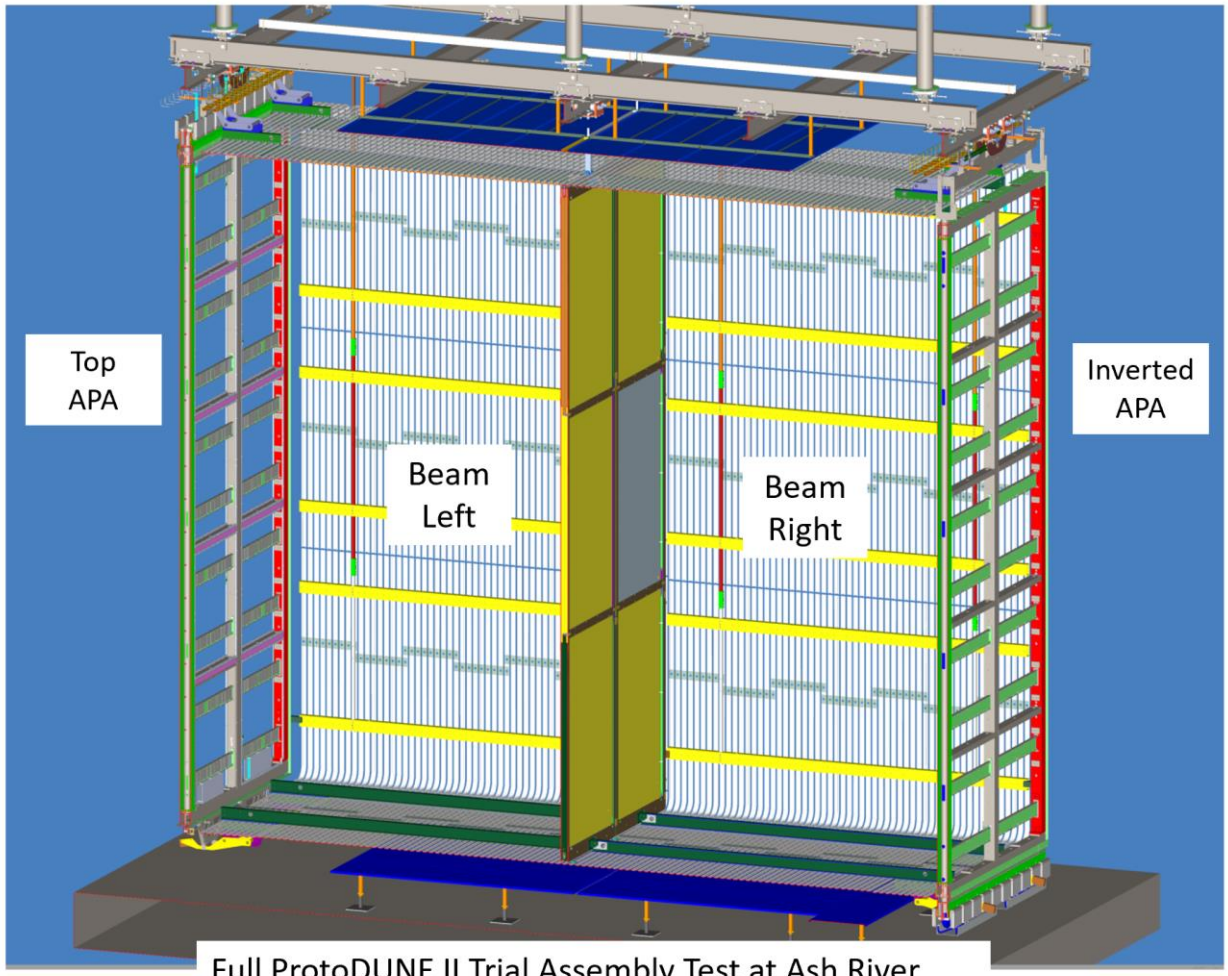
Ash River – ProtoDUNE II Trial Assembly Tests – Inverted APA



Full ProtoDUNE II Trial Assembly Test at Ash River

William Miller
Tom Wieber
Charles Cadeau
University of Minnesota
29 June 2021

Summary of Documents-Load Tests

Summary of Documentation
APA Trolley-Yoke Load tests & Inverted APA
T. Wieber, W. Miller 6-16-2021v2
EDMS-2596552

Task	Description	EDMS # or comments	Status	Approval
ProtoDUNE Structure	ProtoDUNE Trial Assembly Structure Drawings	EDMS-2364484/1	Done	Approved
	ProtoDUNE Trial Assembly Structure Cals	EDMS-2364485/1	Done	Approved
Structural Notes	CERN Trolley	EDMS-2470054	Done	Internally Approved
	APA Pair and Trolley Adapter – Engineer Note	EDMS-2559844/1	Done	Approved-Giuseppe
	ProtoDUNE II Lower APA lowering System-Eng. Note	EDMS-2568860/1	Done	Approved-Giuseppe
	ProtoDUNE II Lower APA Yoke Eng. Note	EDMS-2592644/1	Done	Approved-Giuseppe
	APA Yoke – Engineer Note	EDMS-2100877/1	Done	
Drawings	CERN Trolley	EDMS-2384125/1	Done	
	ProtoDUNE II Lower APA lowering System-Drawings	EDMS-2568860/1	Done	
	APA Trolley Adapter	PSL-8760905	Done	
	ProtoDUNE II Lower APA Yoke - Drawing	EDMS-2592644/1	Done	
	APA Yoke - Drawings	PSL-8760-080	Done	
Procedure Review	APA doublet on CERN trolley procedure	EDMS-2592633	Done	Newhart (FNAL)Lott (UMN)
	APA doublet on CERN trolley procedure-HA	EDMS-2592634/1	Done	Newhart (FNAL)Lott (UMN)
	ProtoDUNE II Inverted APA Load Test	EDMS-2594679	Done	Newhart (FNAL)Lott (UMN)
	ProtoDUNE II Inverted APA Load Test-HA	EDMS-2594681	Done	Newhart (FNAL)Lott (UMN)
	ProtoDUNE II Standard APA Load Test	EDMS-2595758	Done	Newhart (FNAL)Lott (UMN)
	ProtoDUNE II Standard APA Load Test-HA	EDMS-2595754	Done	Newhart (FNAL)Lott (UMN)
	ProtoDUNE II APA lowering system procedure	EDMS-2595947	Draft	
	ProtoDUNE II APA lowering system procedure-HA	EDMS-2595952	Draft	

ProtoDUNE II Goals of the Week

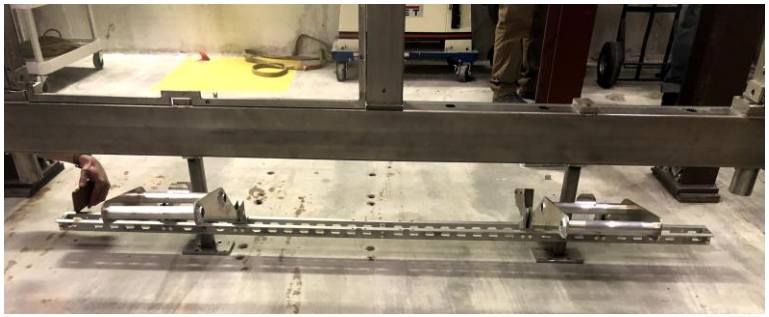
- Review procedures and HA documentation with FNAL & UMN ES&H -**DONE**
- Load test CERN ProtoDUNE II APA Trolley and Lower APA Yoke assembly- **Successfully Completed - Updated Procedure/HA will be posted to EDMS**
  - Load tested at 125% of rated load-943.47 kg
  - Witnessed only 4 out of 8 detent pins were loaded on lateral plate
- Load test CERN ProtoDUNE II APA Trolley and Top APA Yoke assembly- **Successfully Completed – Updated Procedure/HA will be posted to EDMS**
  - Load tested at 125% of rated load-943.47 kg
  - Witnessed only 4 out of 8 detent pins were loaded on lateral plate(different locations than previous test)
- Need to test CERN APA Trolley for DUNE and ProtoDUNE at 150% rated load without Yoke- **Order proper connection to replace yoke.**
- Load Test Inverted APA Lowering system- **Test delayed**
  - We developed alignment issues related to block pulleys, they could not be rotated to 180° so that cable tracked properly
  - Switching to web version of winch to minimize issues with stiffer ¼” cable
  - Working on revised design

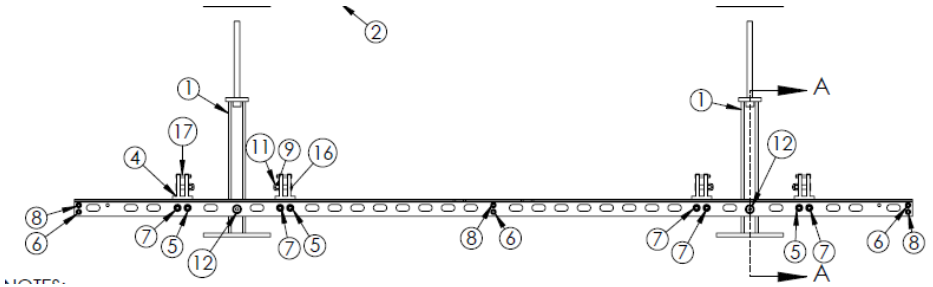
ProtoDUNE II Goals of the Week

- Deploy both drifts- Only deployed inverted APA side we did not have FC latches and hooks to deploy both sides. Deployment went well

Observations & Lessons Learned

- We need to modify the height ProtoDUNE II structure at Ash River to match cryostat at CERN. We will install ProtoDUNE II standoffs and raise the ProtoDUNE II structure to the proper height.

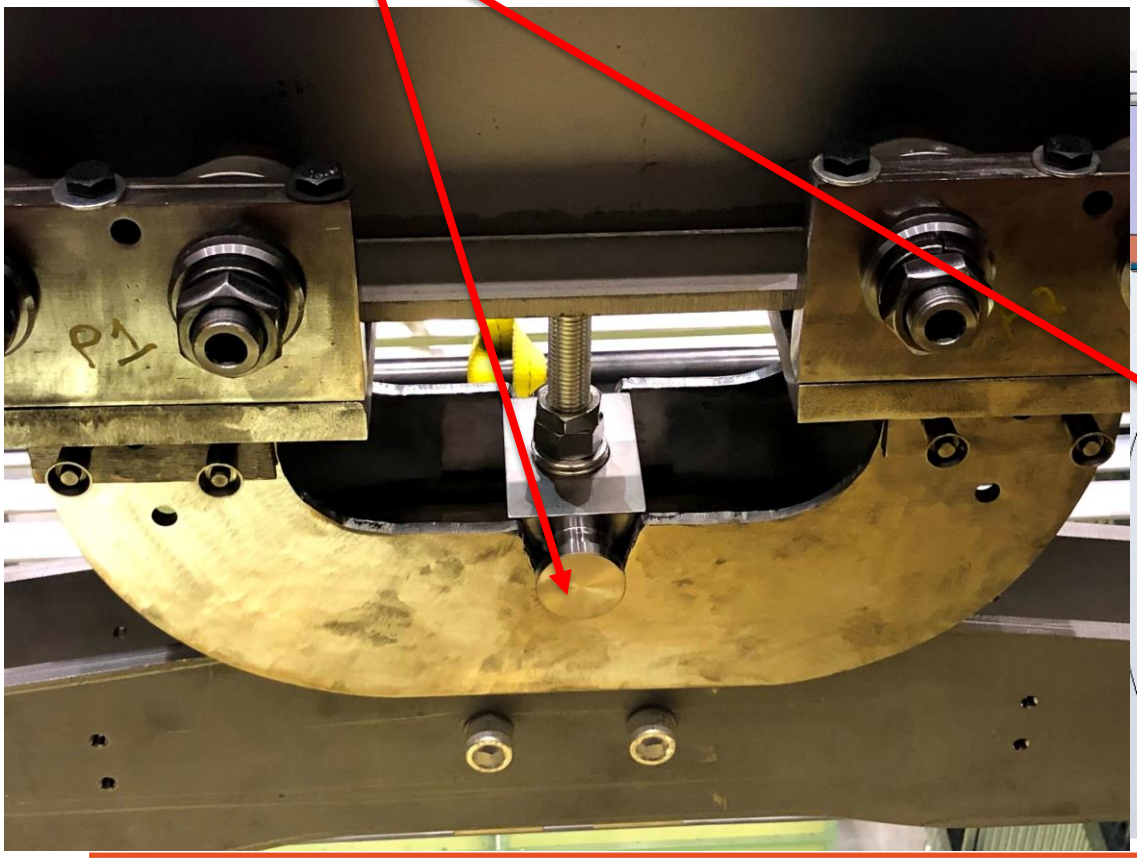


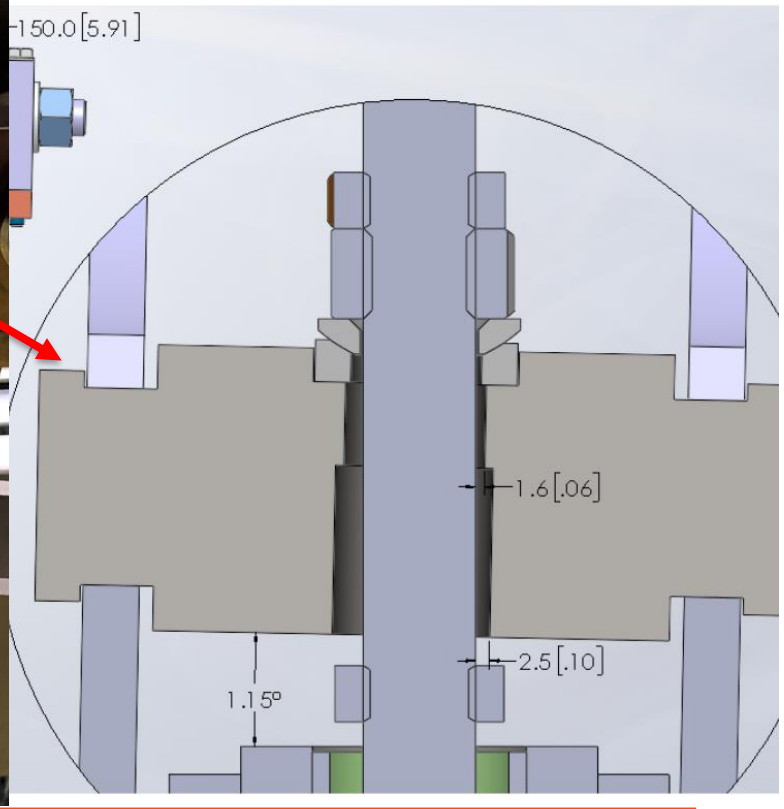


- Fabricate ProtoDUNE II length standoff lower APA- Ours are standard DUNE
  - Need updated drawing from PSL and determine if PSL or University will fabricate the correct part
- Elevation of CPA, APA and End Wall could not be set correctly with the ground clearance problem and no TPC hangers

Observations & Lessons Learned

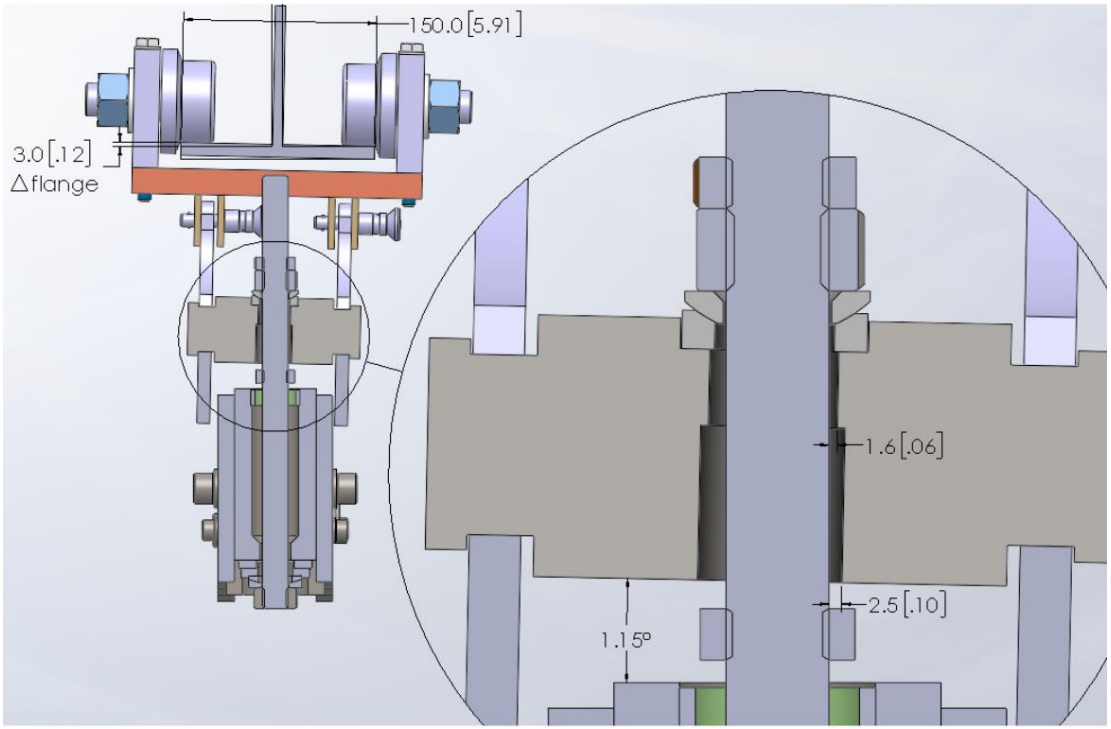
APA Adapter connection: Increase the diameter of the outer retention ring feature of the adapter to minimize possibility of not securely engaging





Observations & Lessons Learned

APA Adapter: The ProtoDUNE II stainless steel beams are twisted enough that the spherical washers were certainly needed



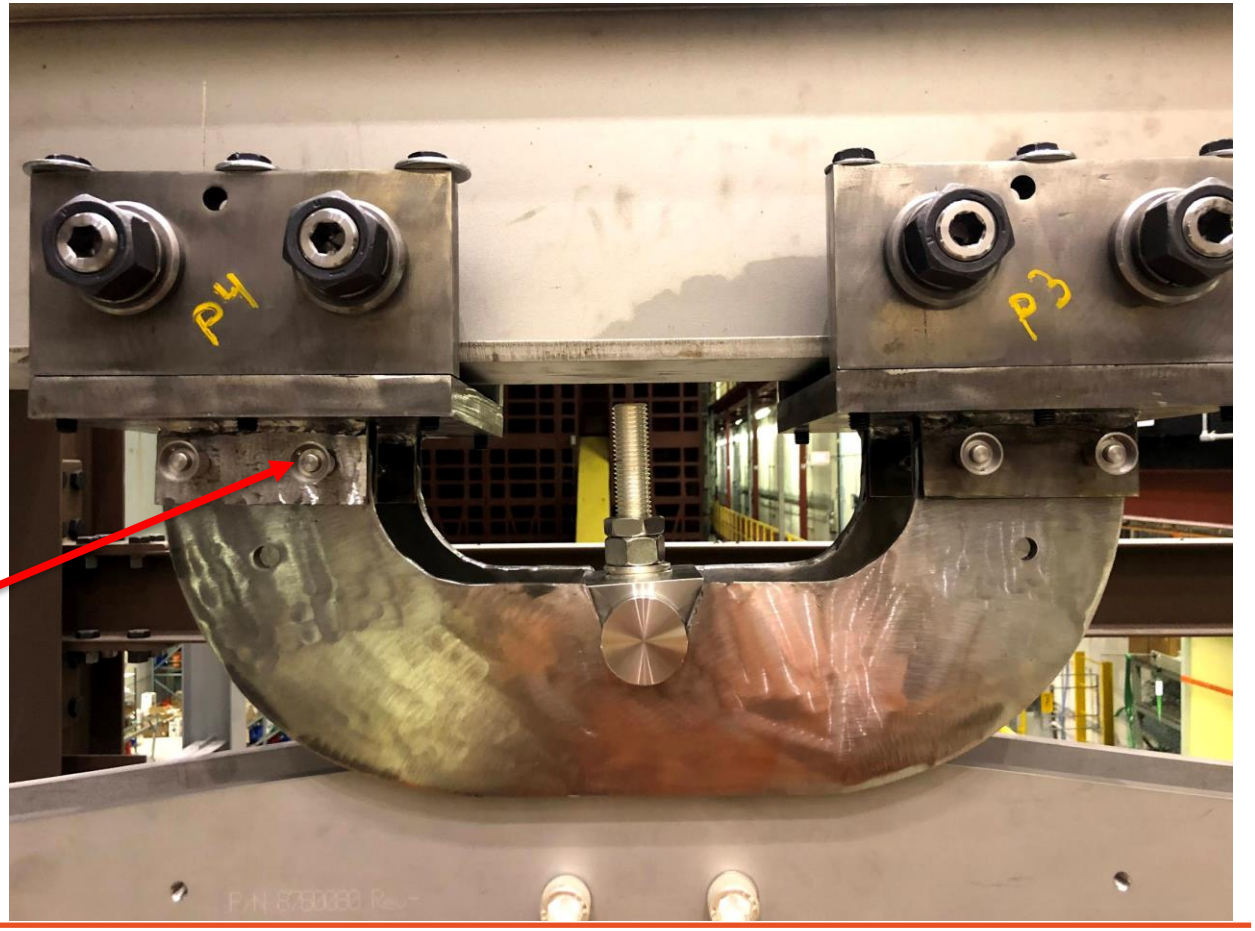
Observations & Lessons Learned

APA Adapter: The Top APA only has a cable conduit on one side this causes the APA to hang out of plum, you can see easily see this in the APA Adapter pivoting left to right

Observations & Lessons Learned

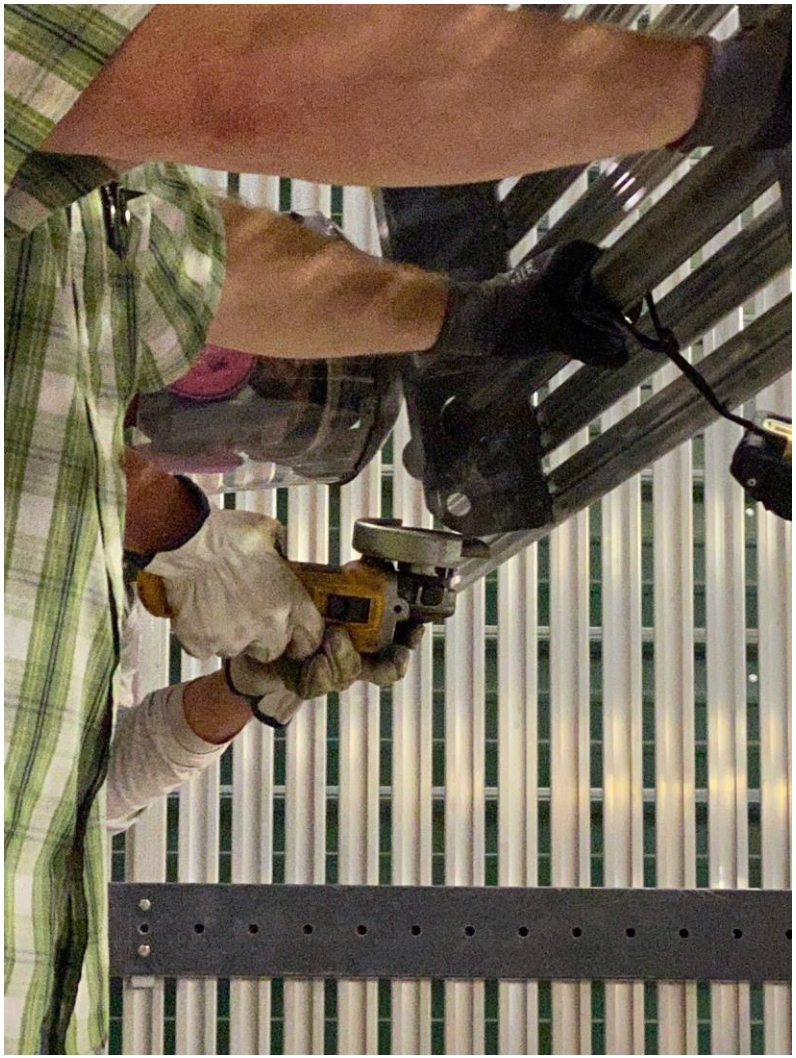
Load tests on APA Trolley: some of the quick disconnect pins have no load on them, In some cases only 4 out of the 8 were loaded

Loose pin that could be rotated on Top APA



Observations & Lessons Learned

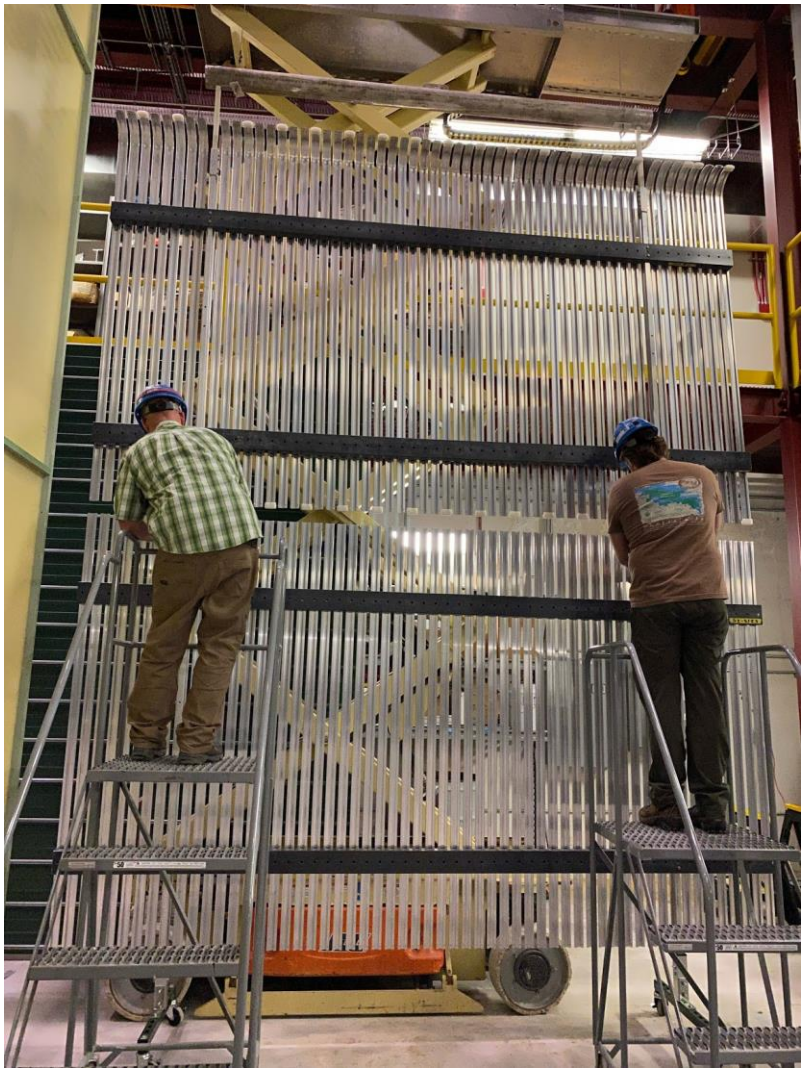
- FC did not have rounded edges on pivoting end, it was fixed on drawings but not on supplied parts, also missing reinforcement plates. Do they need to put back on? **Verify drawings of FC, also check for reinforcement plates**
- Could not hand walk bottom FC into position, need to install on CPA in cleanroom installation sequence



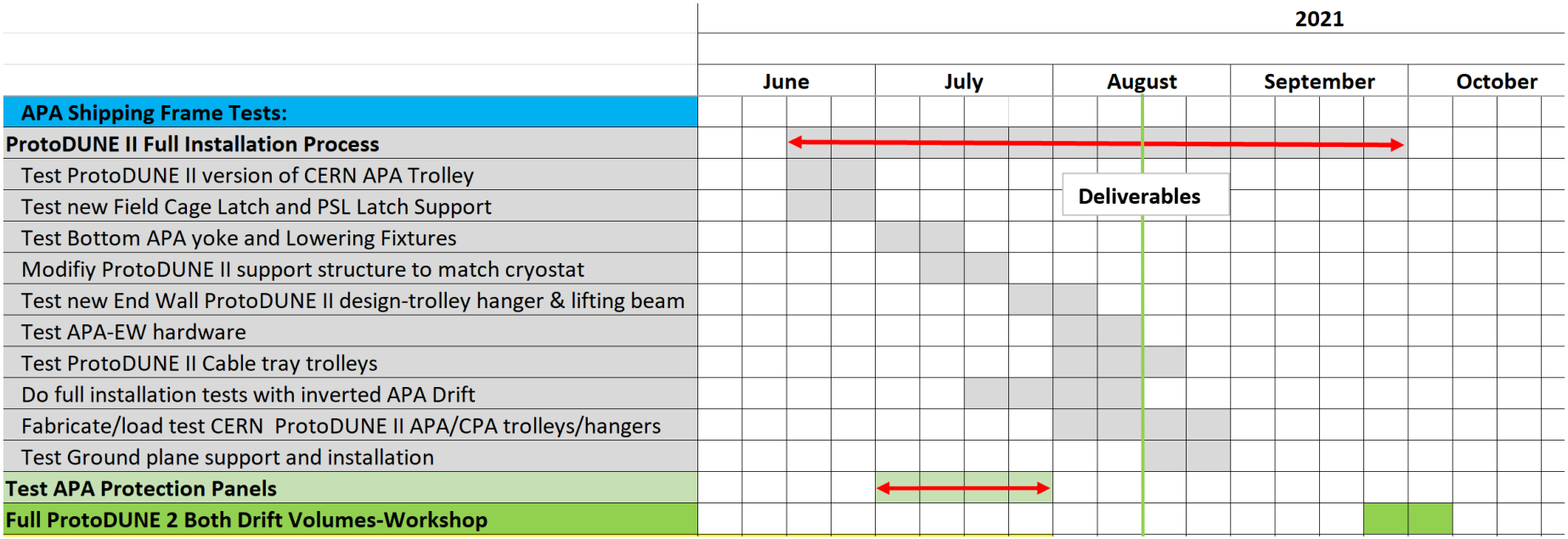
Observations & Lessons Learned

End Wall Installation: There is not enough clearance if both end walls are side by side during installation. This is just fine since for ProtoDUNE II we can raise the Endwalls one at a time and roll them into position.

We will have to make the installation procedures for Row 1 in DUNE the same so that we can slide them into position.



Schedule for Full Scale Tests start in Mid-August



Test schedule is dependent on receiving/fabrication all additional TPC components including approved engineering notes and drawings.

Deliverables for Full Scale Test

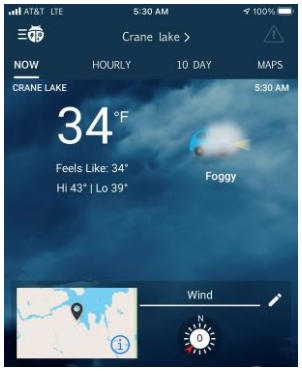
Task	Responsibility
Two APA Hangers (CERN design)	UMN to fabricate
Minimum of one stainless steel APA Trolley-test removal	UMN to fabricate
Fabricate SS APA Trolleys for ProtoDUNE II	To be determined
CERN CPA Trolley and Hanger- **CERN to complete design**	UMN to fabricate
Support for Ground Plane, both support beam and ground plane connection – **CERN to complete design**	UMN to fabricate
Connection between APA and Endwall	ANL & UMN
Connection between CPA and Endwall	ANL & UMN
Support Beam for Ground planes supports the top FC deployment tool – modify as needed	ANL & UMN
Second set of End Wall Yoke components for Ash River	UMN
Build ProtoDUNE II style Endwall lifting fixture- **HV Design**	UMN to fabricate

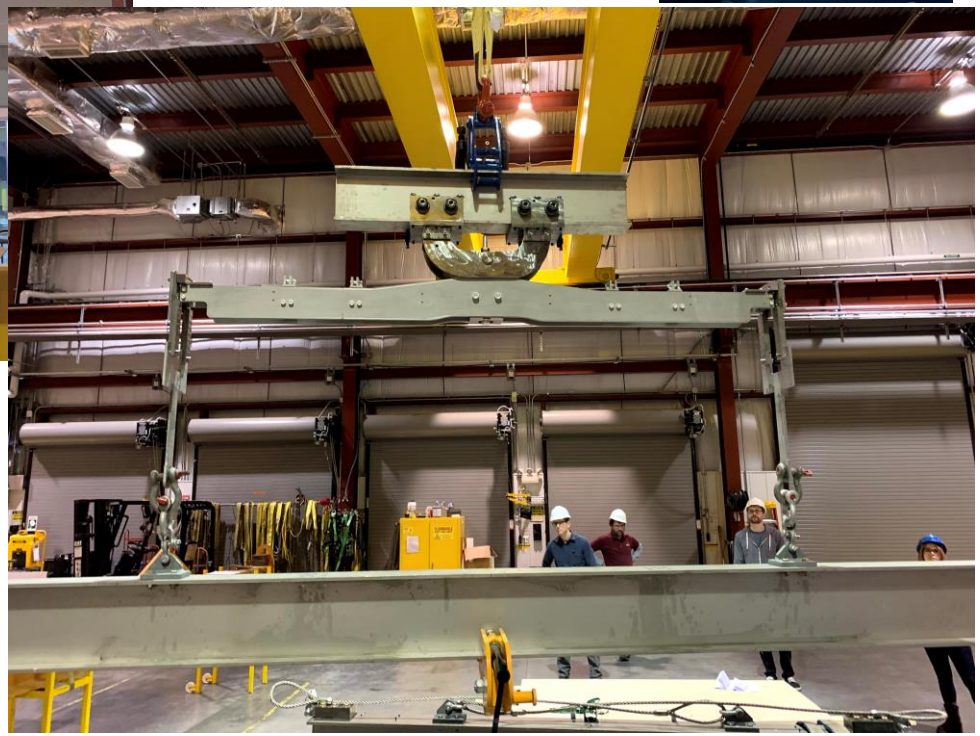
Deliverables for Full Scale Test

Task	Responsibility
ProtoDUNE II Cable guide/support inverted APA	PSL, ??
Test installing cables into Lower APA conduit at Ash River	UMN, cables BNL
Cable Tray with trolleys for ProtoDUNE II – BNL design	UMN to fabricate
Fabricate ProtoDUNE inverted II APA standoffs for Ash River	??
Complete redesign of inverted APA lowering fixture- PSL	UMN to fabricate
Final design Latch shipment from HV (Rocker and Hook)	ANL & UMN

All deliverables need approved engineer notes and fabrication drawings, UMN will be responsible for writing procedures and HAs and getting them approved through ES&H

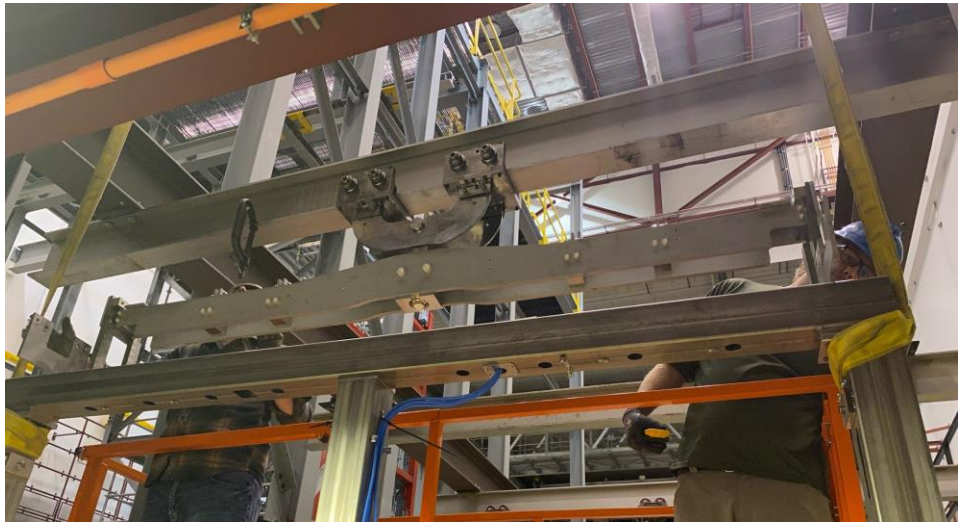
APA Trolley and Yoke Load tests

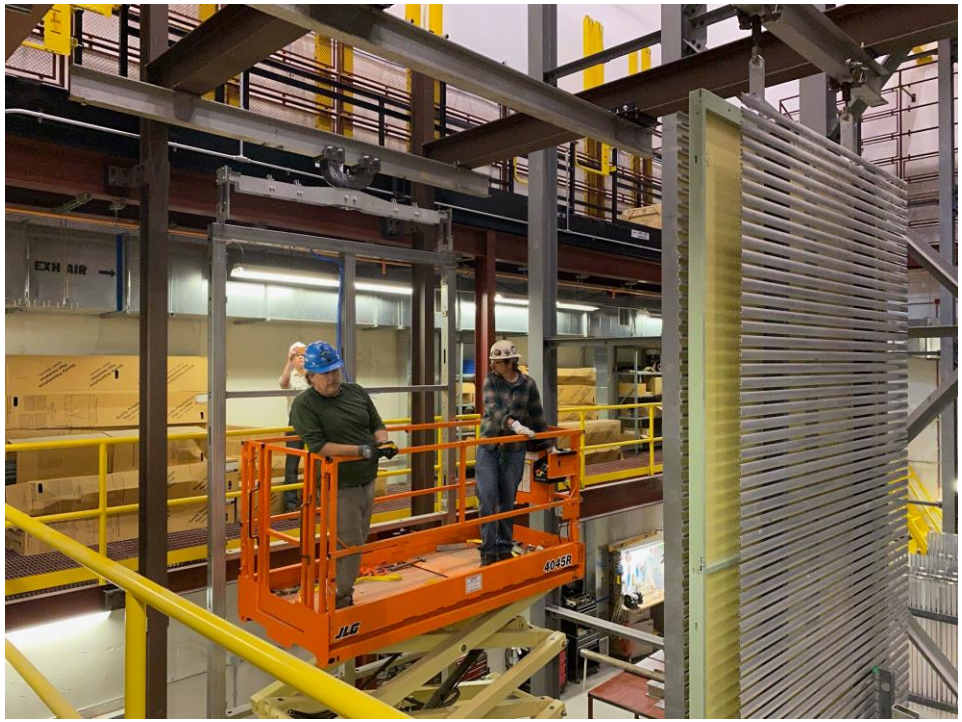




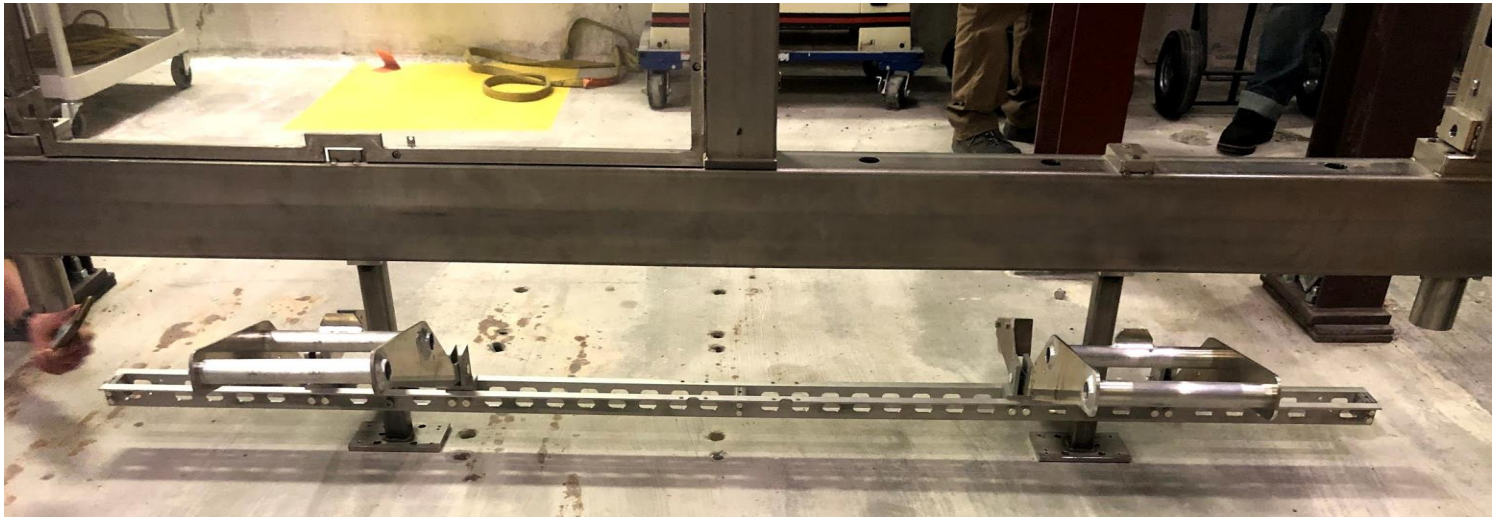
Inverted APA

Taking the lower APA off the APA Tower

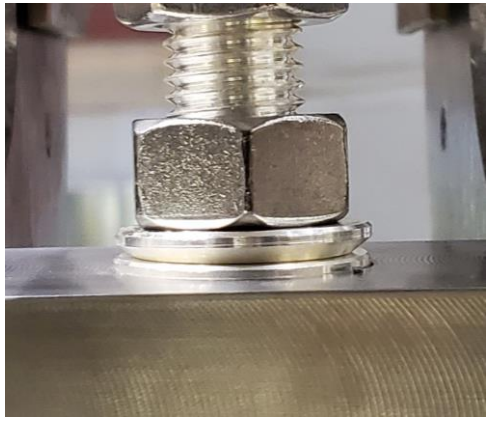




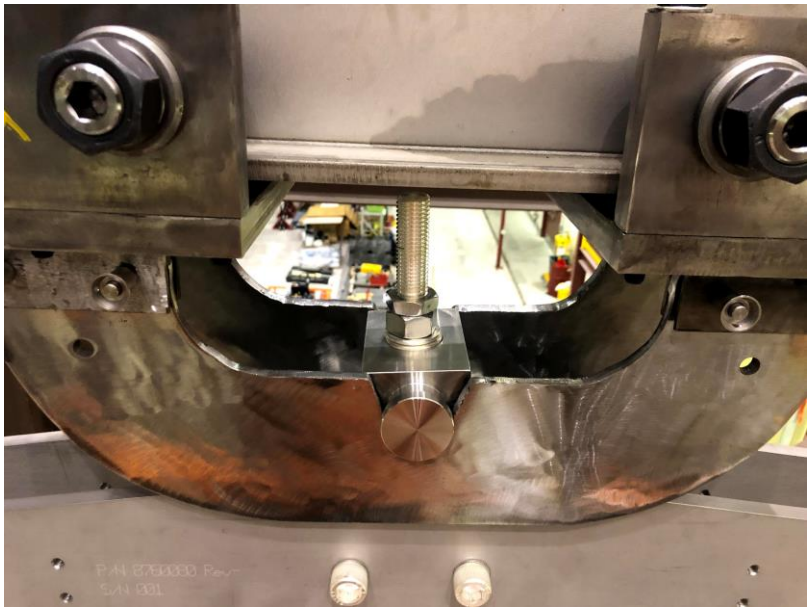
Bottom standoffs on Inverted APA



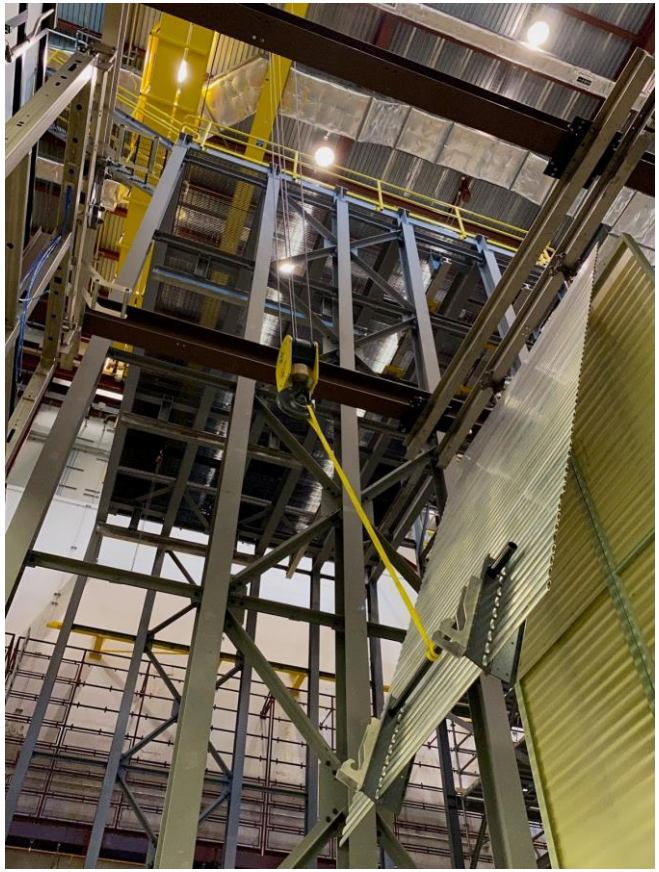
Top APA

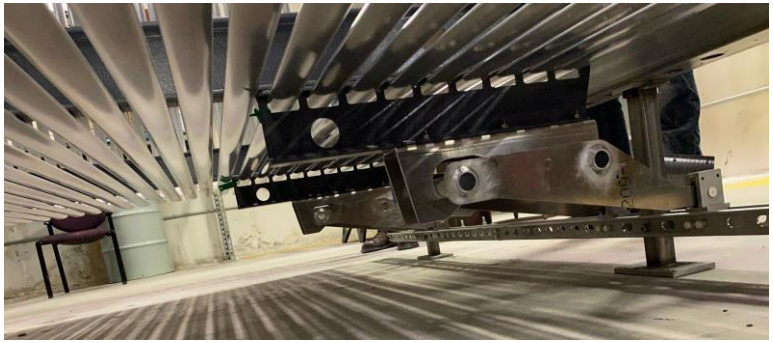


Only had a cable conduit on one side is it was off balanced left/right and on a twisted SS beam E front/back



CPA and Top/Bot FC





Endwall Installation