

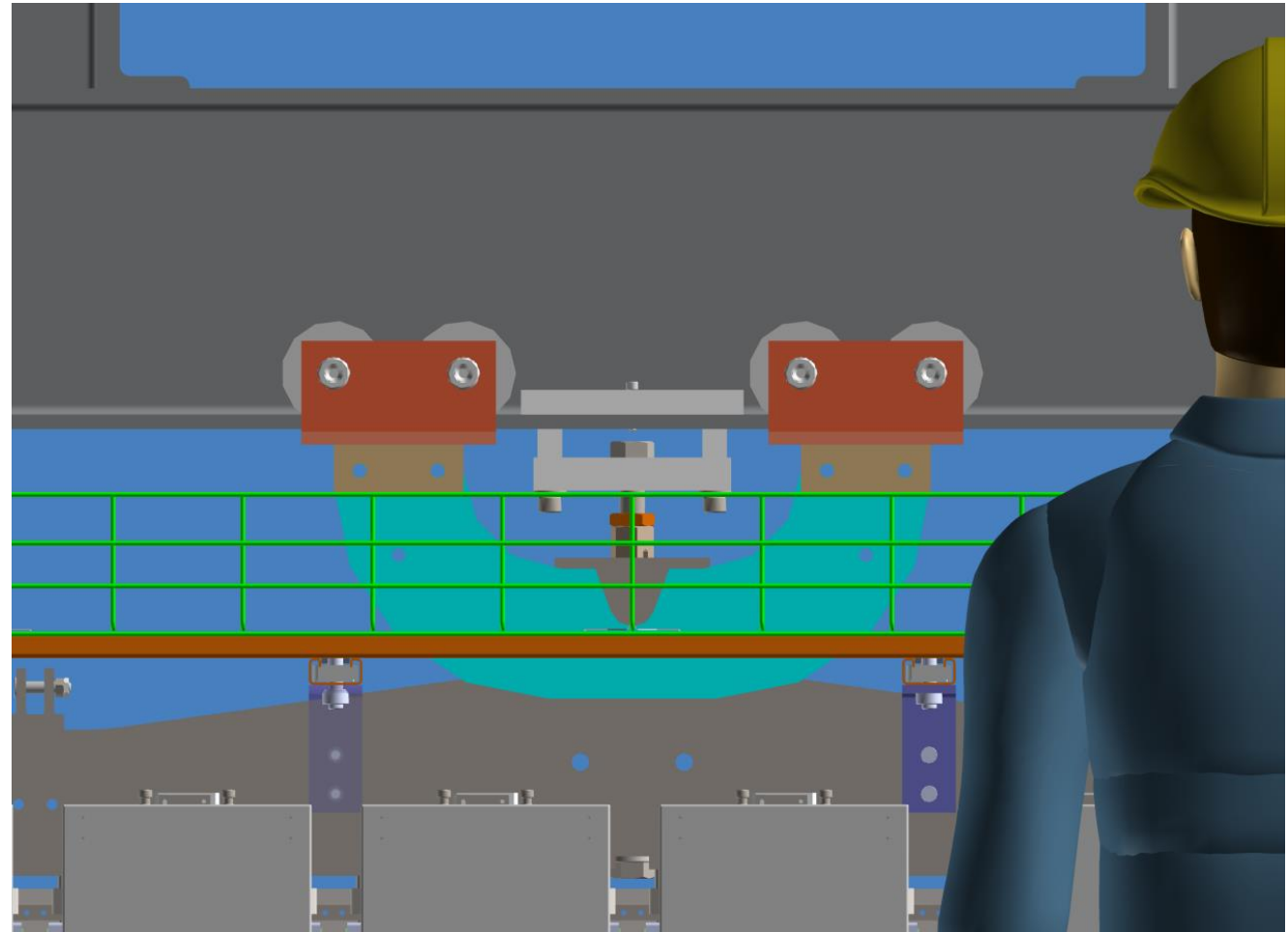
DUNE Trolley Designs
William Miller
University of Minnesota
16, September 2020



Phase 2 DSS support structure at Ash River

APA Trolley

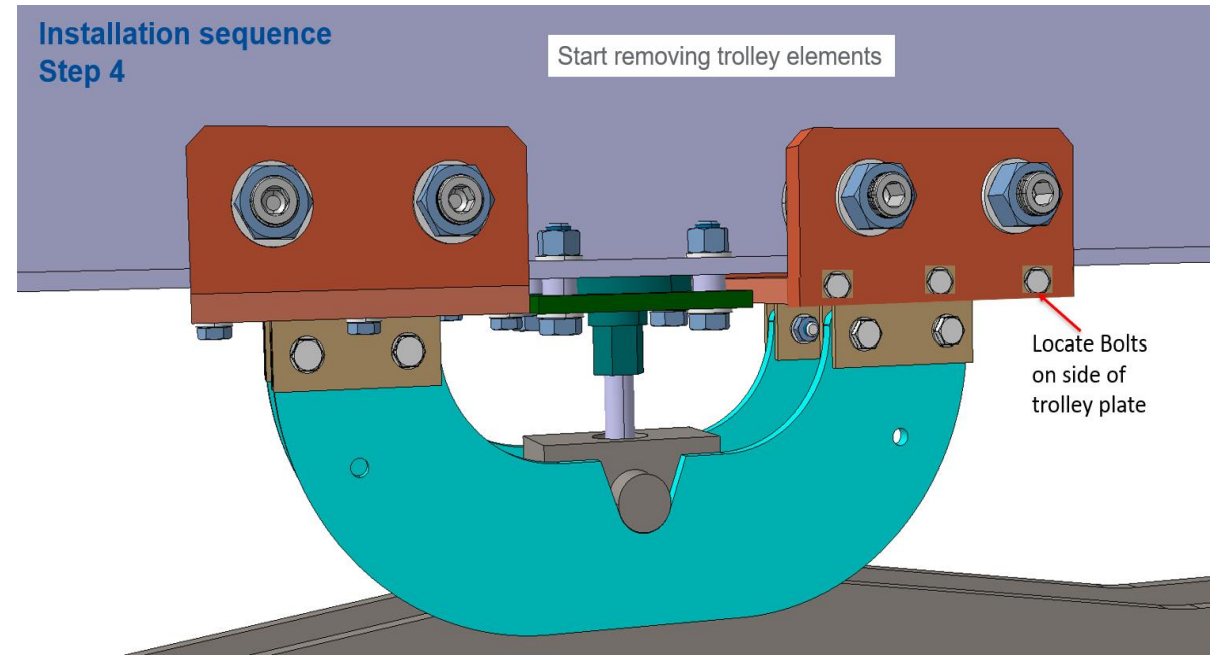
1. Design improvements for better access and removal.
2. Design changes to PSL yoke
3. Test trolley for Ash River
4. Use them in ProtoDUNE?
5. The sequence and the number of trolleys are different from what Benoit proposed at the DSS meeting.
6. APA vertical cable tray trailing trolley?



APA Trolley in Ash River model

Access the trolley

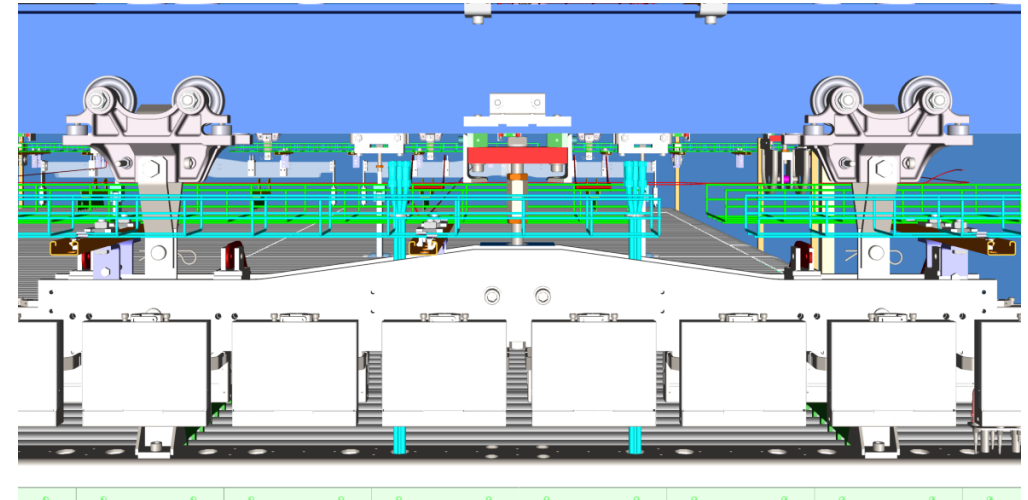
- Access will be difficult with bolts pointed down on trolley. It would be better to locate them on the side ONLY on the accessible side. Use a long bolt into a threaded plate on the back side. That way there is no bolt to remove.
- Have a tie off hole on the back trolley plate so it can be pulled up over the top. All parts need to be on a lanyard.
- Access to APA Hanger important, size of hanger bolt and tread sized to easily lift the load into position.



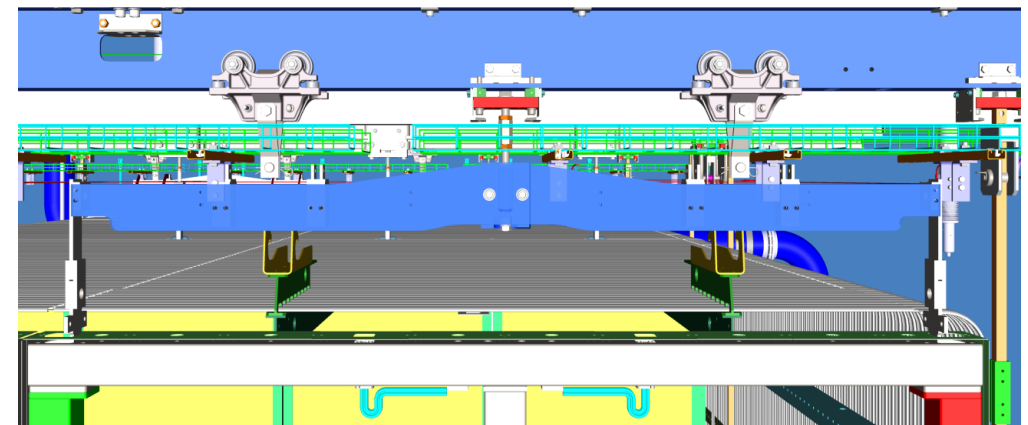
Open questions

- Modifications to Yoke connection-PSL ?
- ProtoDUNE 2 Trolleys
 - Standard APA use new Trolley?
 - Inverted APA use the old trolley design?
- I am assuming that CERN engineering group will complete design and write engineering note?
- If off the shelf items (trolley wheels) are used are they US certified as well as CE?
- Does Ash River have the first set manufactured?
- We will have to do a load test, write procedures and Hazard Analyses and get them approved by Fermilab and University of Minnesota ES&H.

Current Navisworks model of ProtoDUNE 2



Standard APA configuration



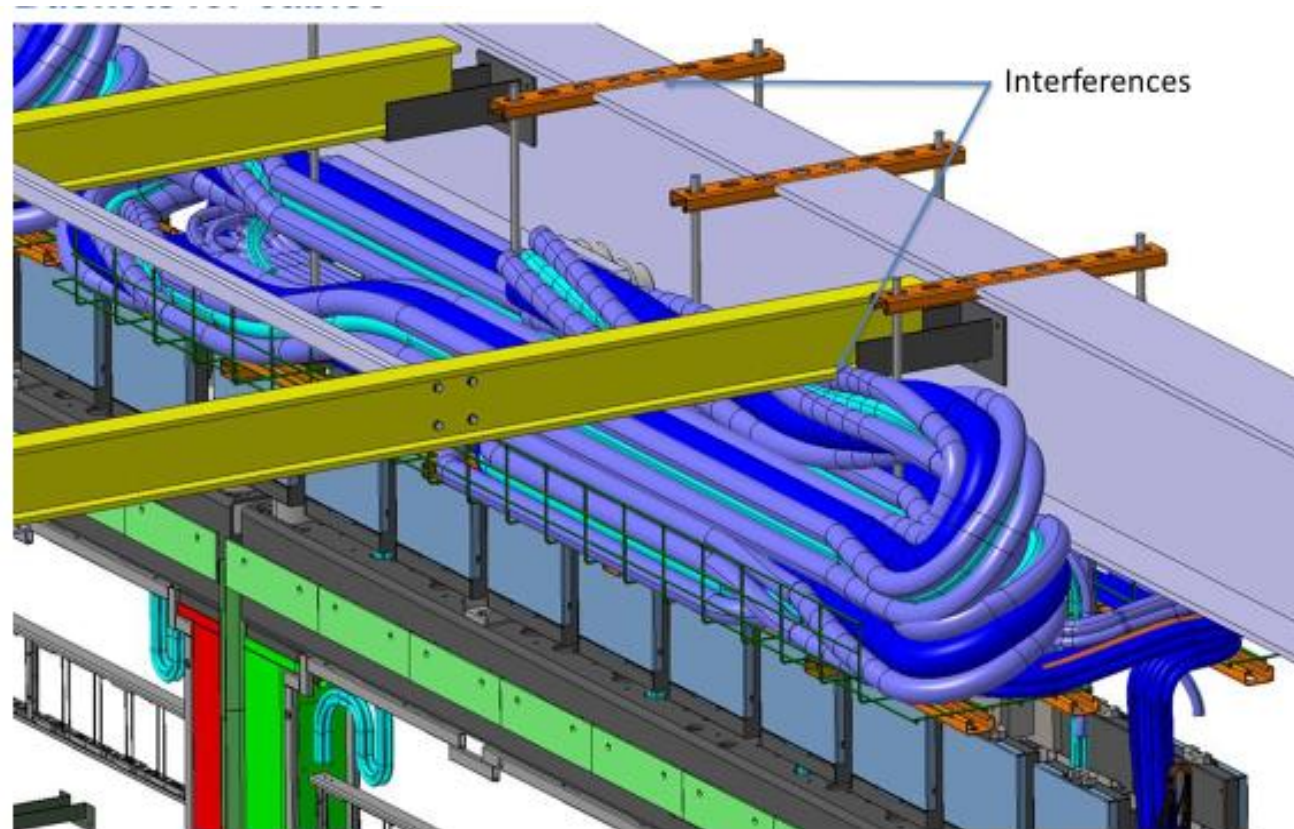
Inverted APA with new yoke and "lifter"

Sequence and number of trolleys

- Our current installation plans uses approximately 16 trolleys:
 - Up to 6 on the 3 main assembly lines plus 1 on the spare line
 - Up to 3 in the Cold boxes
 - In the cryostat we would have 3 new APAs entering each week and the cabling and testing process takes about week so potentially you could need 6 more trolleys
- When the trolley is removed is still an open question until the cable management test at BNL are completed.
- Current best estimate is
 - Move the APA into position so that APA side alignment pins are engaged
 - Attached APA Hanger to yoke so it remains in a stable position
 - Do not remove trolleys until all the cable tests are completed and cable management is done in case there are issues.
 - Remove trolleys in tethered pieces and place in scissor lift for use with the next APA

Removal of ground plane support during cabling

- If the ground plane supports which are fixing the distance between the DSS beams can be removed during the cable process when this would remove some access issues
- We would have to think about the installation sequence. Removing the support beams before the APA goes into position would minimize damage and clearance to the cable trays

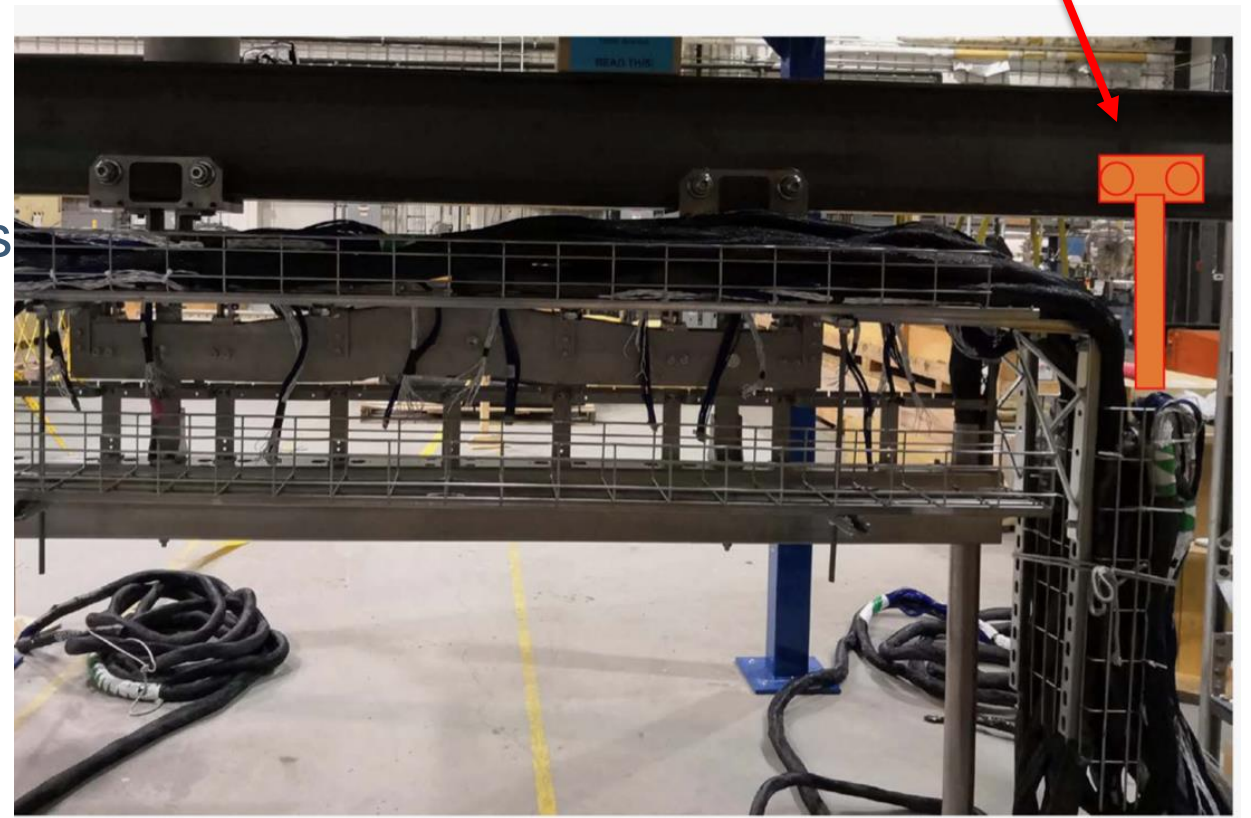


Vertical Cable Tray – Work in Progress

Without a trailing trolley to remove the off balanced cable load the APA could hang out of plane by ~10cm

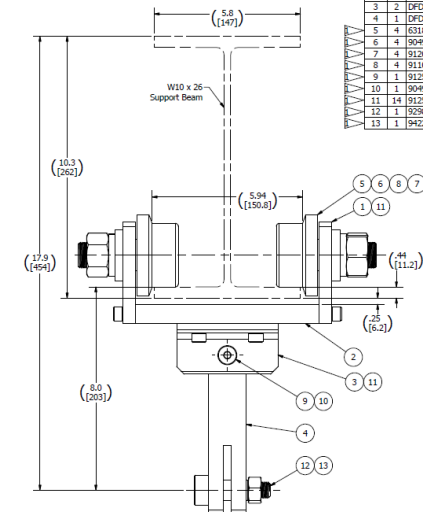
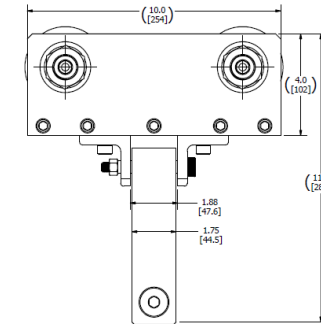
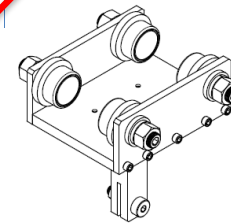
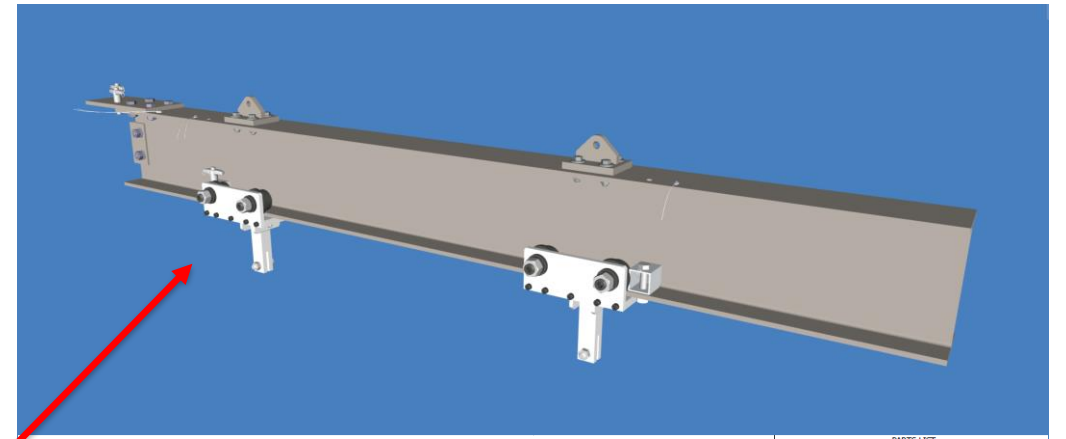
- It looks like we are moving in the direction of having a trailing vertical cable tray to manage the cable that goes into the feed-thru.
- The load would be on a separate trolley, but it would also be secured to the APA via 10mm Rivnut?
- It would be in place during the cold box test and removed as part of the cabling process in the cryostat.

Trailing Trolley to support vertical tray



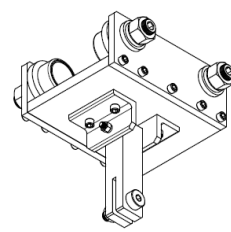
CPA/Slave Trolley

- Current status of the slave trolley (identical to the CPA Trolley except no DSS mounting holes) this is the original design used on the DSS by Vic.
 - It was approved for use during the Phase 1 APA doublet test completed last year.
 - It is getting re-reviewed as part of the updated APA lifting fixture upgrade to allow us to move a completed APA Double to the TCO beam on the Phase 2 DSS support structure.
- We have had several rounds of discussions with Argonne and Giuseppe and expect a completed and approved trolley design by the end of this week
- We have two slave trolleys for the APA Double and Ash River will fabricate two CPA trolleys for the CPA for the DUNE Trial Assembly work.



ITEM	QTY	PART NUMBER	REV	DESCRIPTION
1	2	DFD-25-1201	00	SIDE FRAME
2	1	DFD-25-1202	00	TROLLEY BASE PLATE
3	2	DFD-25-1203	00	CLEVIS ANGLE
4	1	DFD-25-1204	00	HANGER BAR
5	4	6318K550		Track Roller; 02.5 x 1.63W, W/ AXLE
6	4	504994955		HEX NUT, 1-1/4 UNC GR 8
7	4	91201A038		FLAT WASHER; 01.00" NOM
8	4	91101A038		WASHER LOCK; 01.00" NOM
9	1	91259A723		SHOULDER SCREW, 1/2 DIA x 2-3/4 LG
10	1	90999A931		HEX NUT, 3/8-16 UNC, GR 8
11	14	91251A624		SHCS, .375-16UNC x 1.0 LG
12	1	92981A606		SHOULDER SCREW, 020mm x 40mm LG
13	1	94231A105		HEX NUT, M16 x 2, CLASS 12

SOURCE OR EQUIVALENT:
McMASTER-CARR
P.O. BOX 4355
CHICAGO, IL 60680-4355
630-633-0300



NOTE:
1 - ALL DIMENSIONS IN inches (mm)
2 -
Approx WT= 42 lbs

UNLESS OTHERWISE NOTED		SCALE	W/P	DATE	BY	CHK'D	APP'D	REV
ALL DIMENSIONS ARE DECIMAL UNLESS NOTED		RTRMK/JW		6/26/2019				
DRAWN BY		DATE	BY	PROJECT NAME	DATE	DESCRIPTION		
PROJECT NUMBER		DATE	APP'D/RELEASED	DATE	SLAVE TROLLEY ASSEMBLY (APA BASELINE)			
DESIGNED BY		DATE	DATE	DATE	PROJECT NO. / PART NUMBER			
CHECKED BY		DATE	DATE	DATE	PROJECT NO. / PART NUMBER			
DRAWN BY		DATE	DATE	DATE	PROJECT NO. / PART NUMBER			
SCALE		1:1	1 OF 1	DFD-25-1200				
SHEET		C		05				

Argonne NATIONAL LABORATORY Engineering Operations & Facilities



Once Engineering notes approved, DSS Load Test plan and HA approved for testing Phase 2 structure



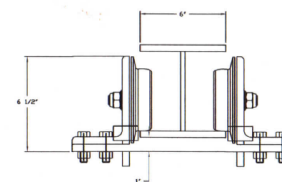
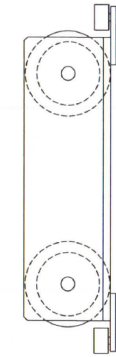
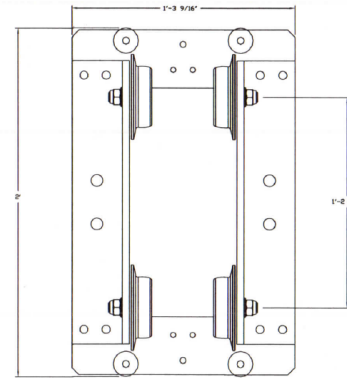
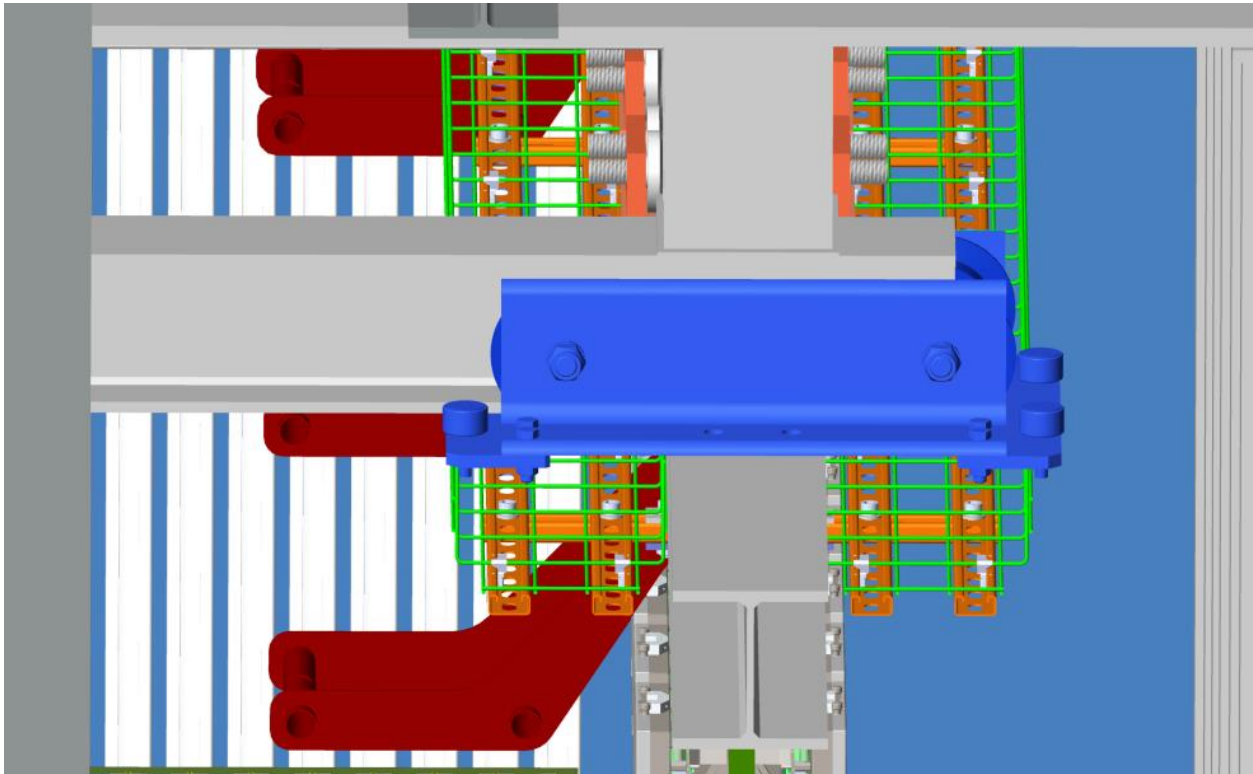
Ash River Phase 2 DSS Load Test Plan
William Miller
Tom Wieber
University of Minnesota



Phase 2 DSS support structure at Ash River

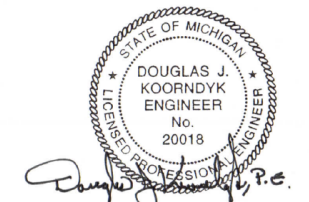
Shuttle beam trolley design problem

This is an issue that came up at Ash River. Best design practices to minimis racking from AR crane person says that the distance between the wheels and cam followers should be a minimum of 4 times the width of the beam (~24"). **There is already no room for trolley design as is moving the outside DSS beam out 22mm adds to the issue**



Notes:

- Trolley/End truck capacity is 3TONS
- Adjust width of trolley plates based on flange width of 6IN.
- Slotting holes will allow some field adjustment
- Trolley wheels are from Coffing CB series 3ton trolley
- Grade 8 Bolts for all connections
- QTY 4 (2 SETS)



REVIEW FOR APPROVAL

APPROVED FOR CONSTRUCTION

REVISE AND RESUBMIT FOR REVIEW

REVISE AND RESUBMIT FOR RECORD

NOT APPROVED

DATE: _____

BY: _____

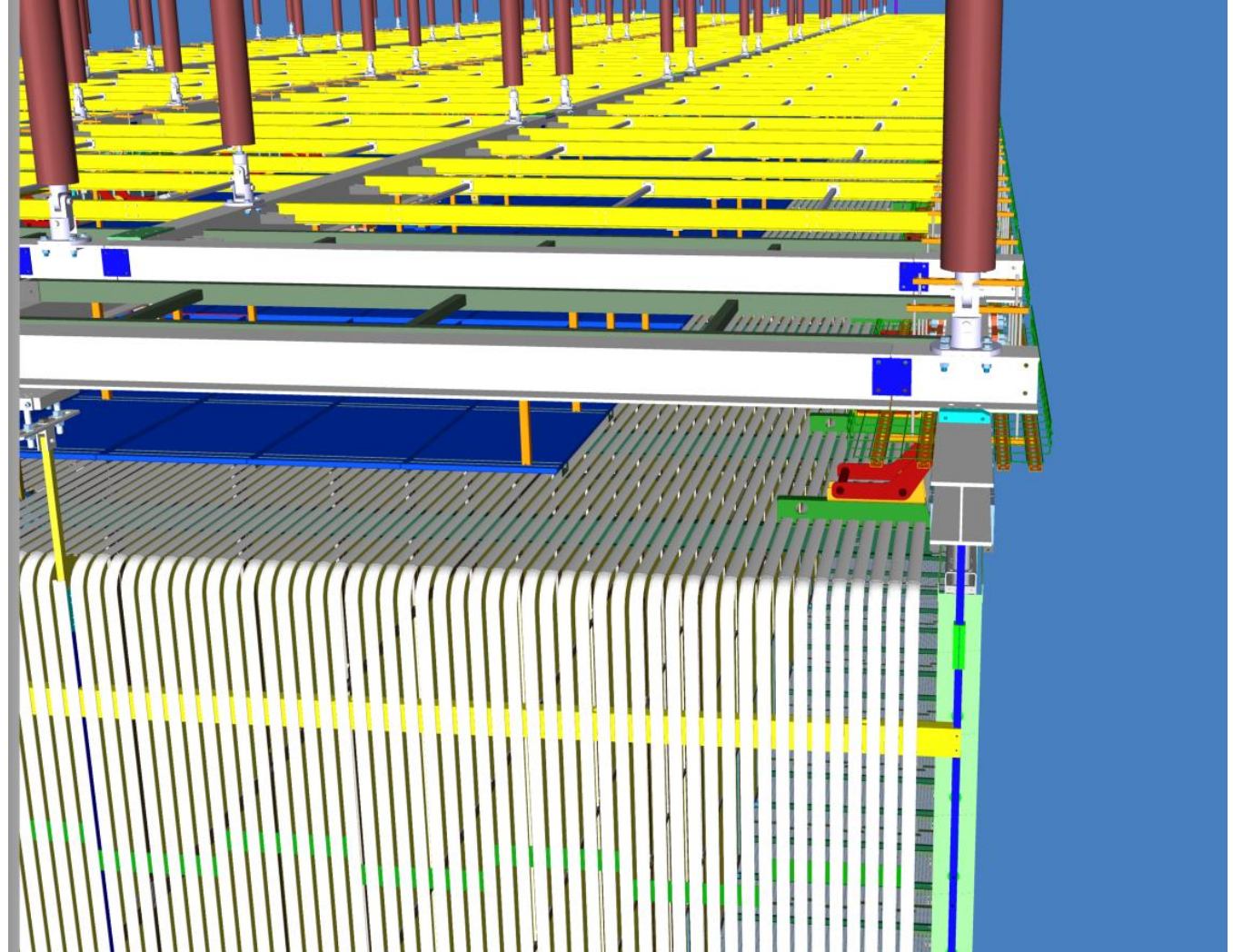
TOTAL	QOL	NOVA FAR DETECTOR	DATE	7/9/20	SALES ORDER
DESCRIPTION	Proto-Dune Bridge Trolley				
DRAWN BY	DWS				
CHECKED BY					
DATE					
SCALE					
BY					
DATE					



Shuttle Trolley missing in v.6 model

- The issues are the same in the cryostat as it was in Ash River.

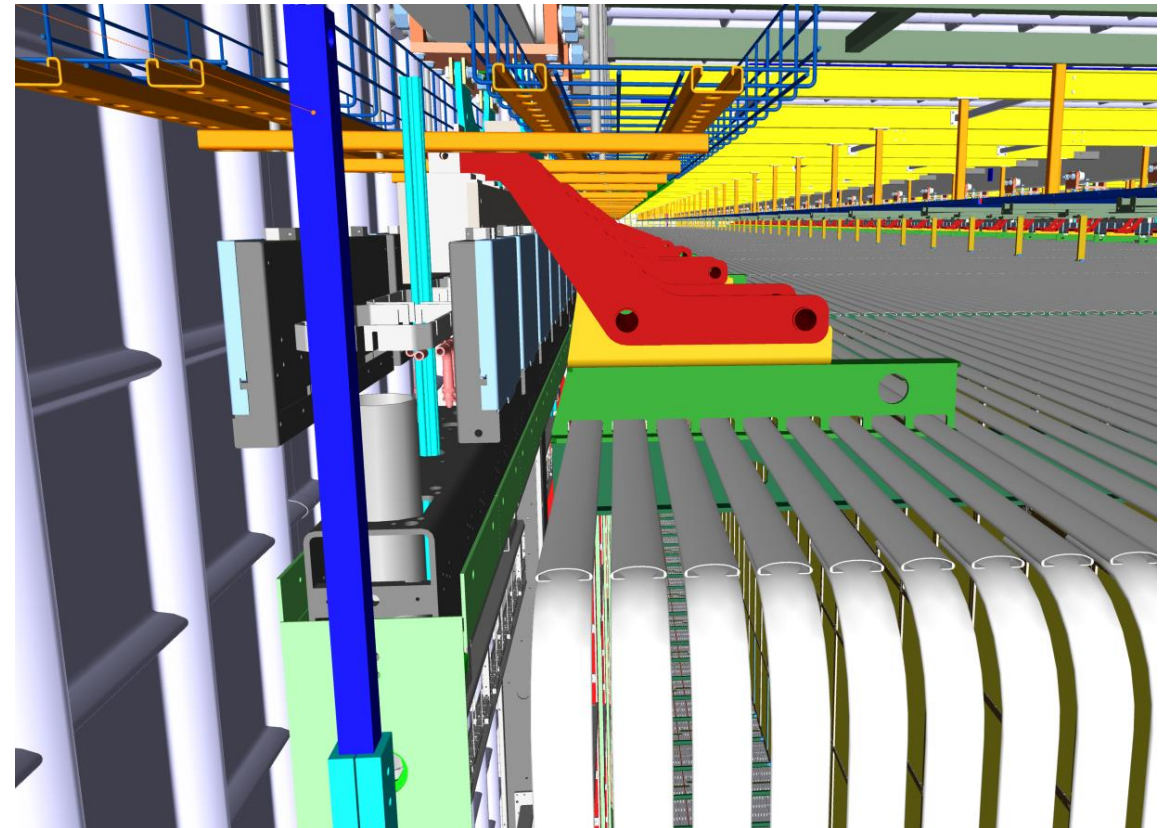
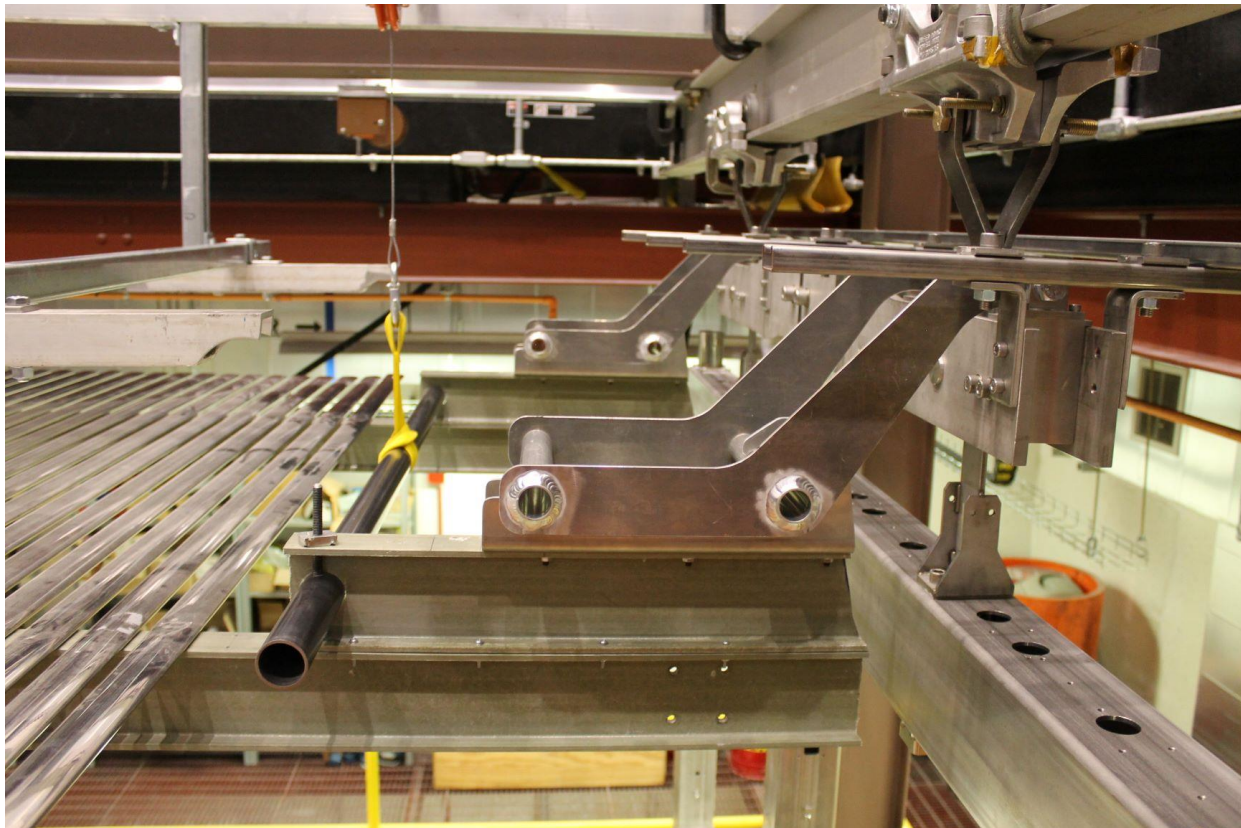
Runway beam needs to be extended as far as possible



Additional installation comments from change in DSS location

Length of Top and Bottom FC

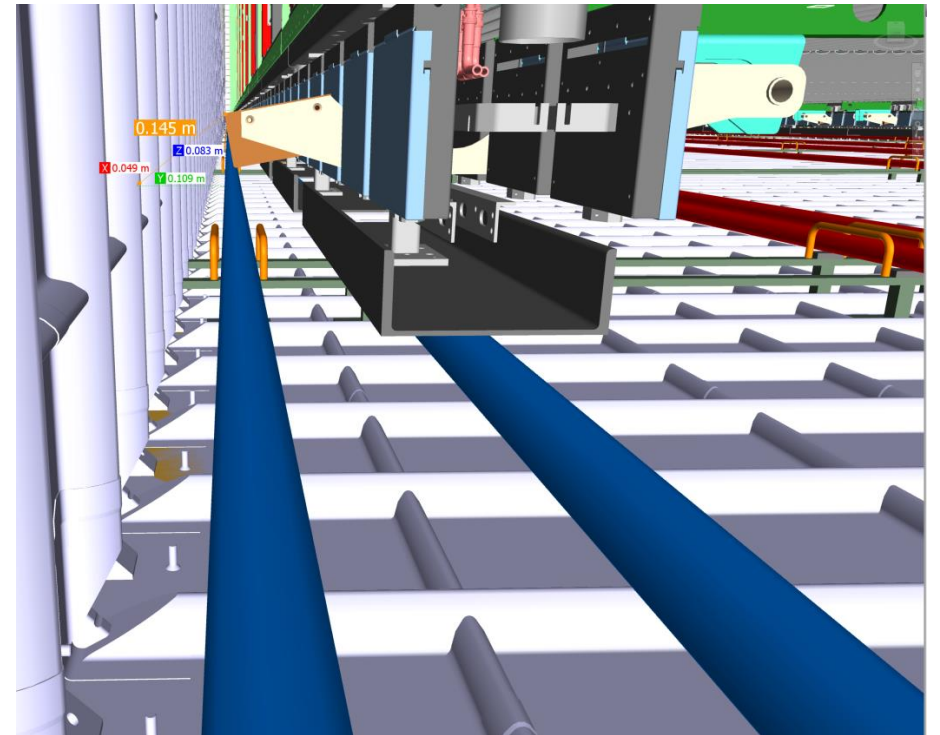
Does the length of the top and bottom FCs and End Walls increase by the 11mm additional spacing between the DSS runway beams? I assume this changes



Clearance of Bottom FC latch

- If the cable tray load is not balanced well at the top the bottom may be at a different position. This is particularly true during transport when the APA is “swinging free”
- Ash River Test during showing potential off set

A load test was performed to understand how much the lower APA deflects if an asymmetric load is placed on the cable trays. A 150lb load was placed on the cable tray after the APA was freed from all lower constraints. The deflection measure was 1” at the middle and 1.5” at the bottom.



DSS stabilization support during installation

This was shown during DSS PDR and how we remove this needs to be understood. The current installation sequence has us starting to deploy the ground planes and the first Field Cages when we have approximately 17 rows completed.

