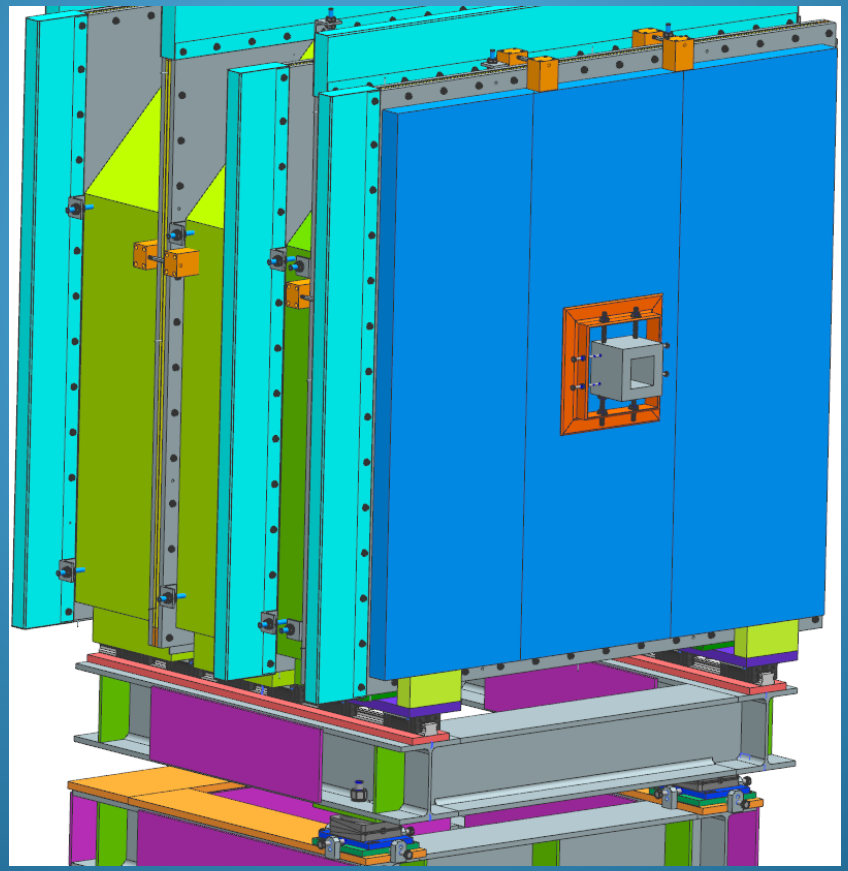
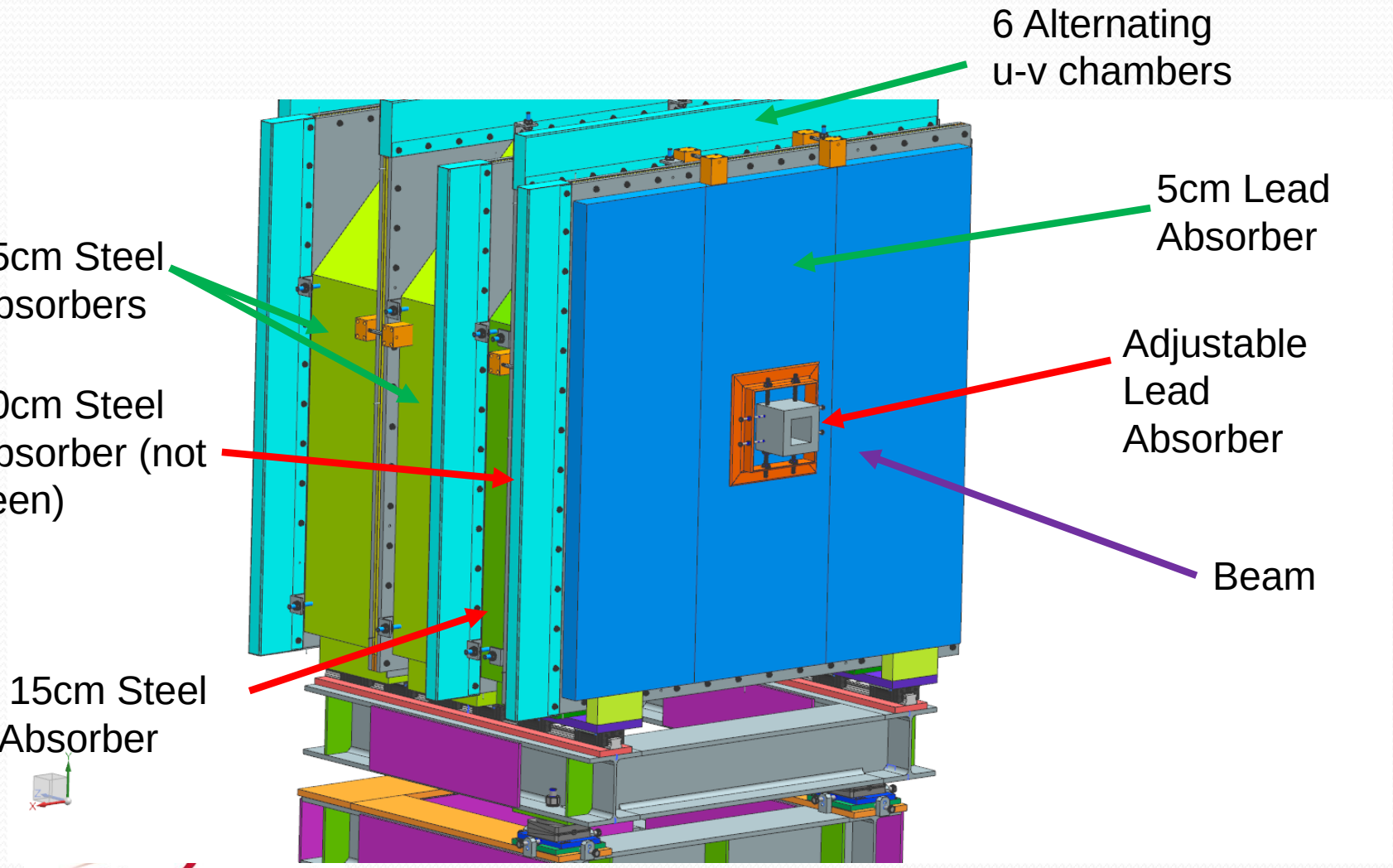
Engineering Design, Fabrication, Operation and Installation of CPP Hardware



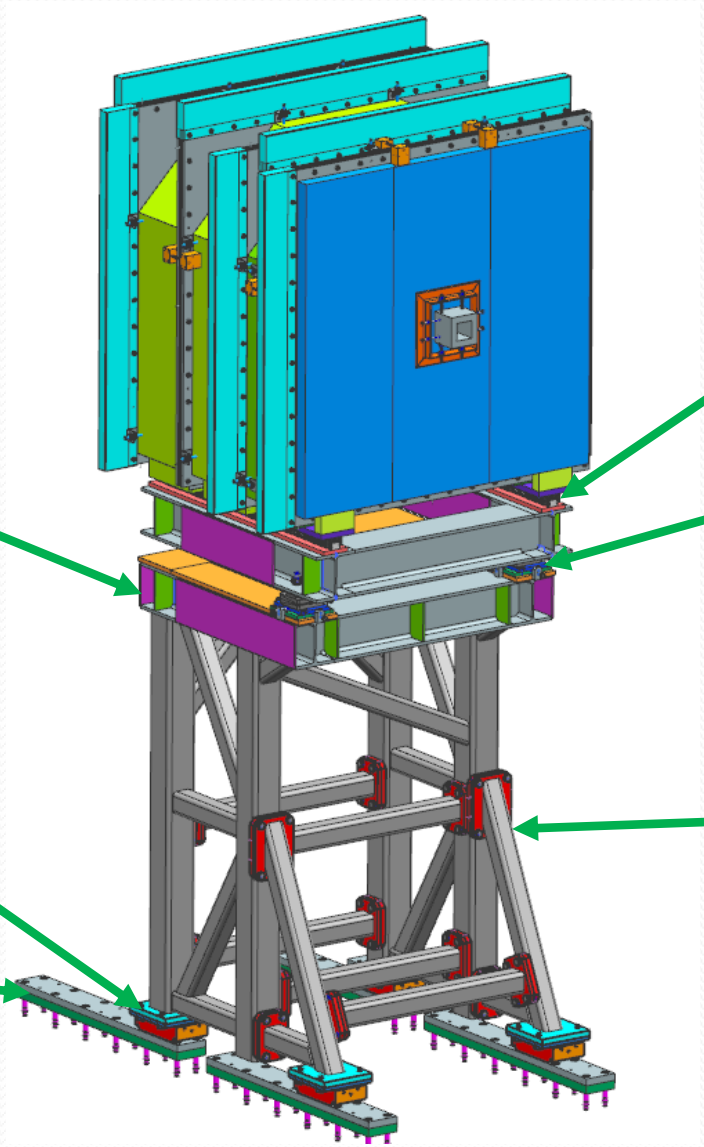
General Engineering Requirements

- Platform
  - Able to support 25 tons
  - Ability to move with FCAL platform
  - Align detector within mm accuracy
- Fixed Lead absorber - 5cm
- Adjustable Lead Absorber – mm accuracy
- 4 Steel absorbers aligned within mm accuracy and support chambers
- 6 chambers Aligned within mm accuracy
- Installation to meet Beam schedule
- Accessible maintenance during run
- Changeable Target- Lead/frame supplied by UMASS
- Ability to move Tagger Microscope – help from UCONN
- Argon/CO_2 gas delivery

CPP Detector



CPP Support Stand



Thompson Rails

XYZ Adjustments

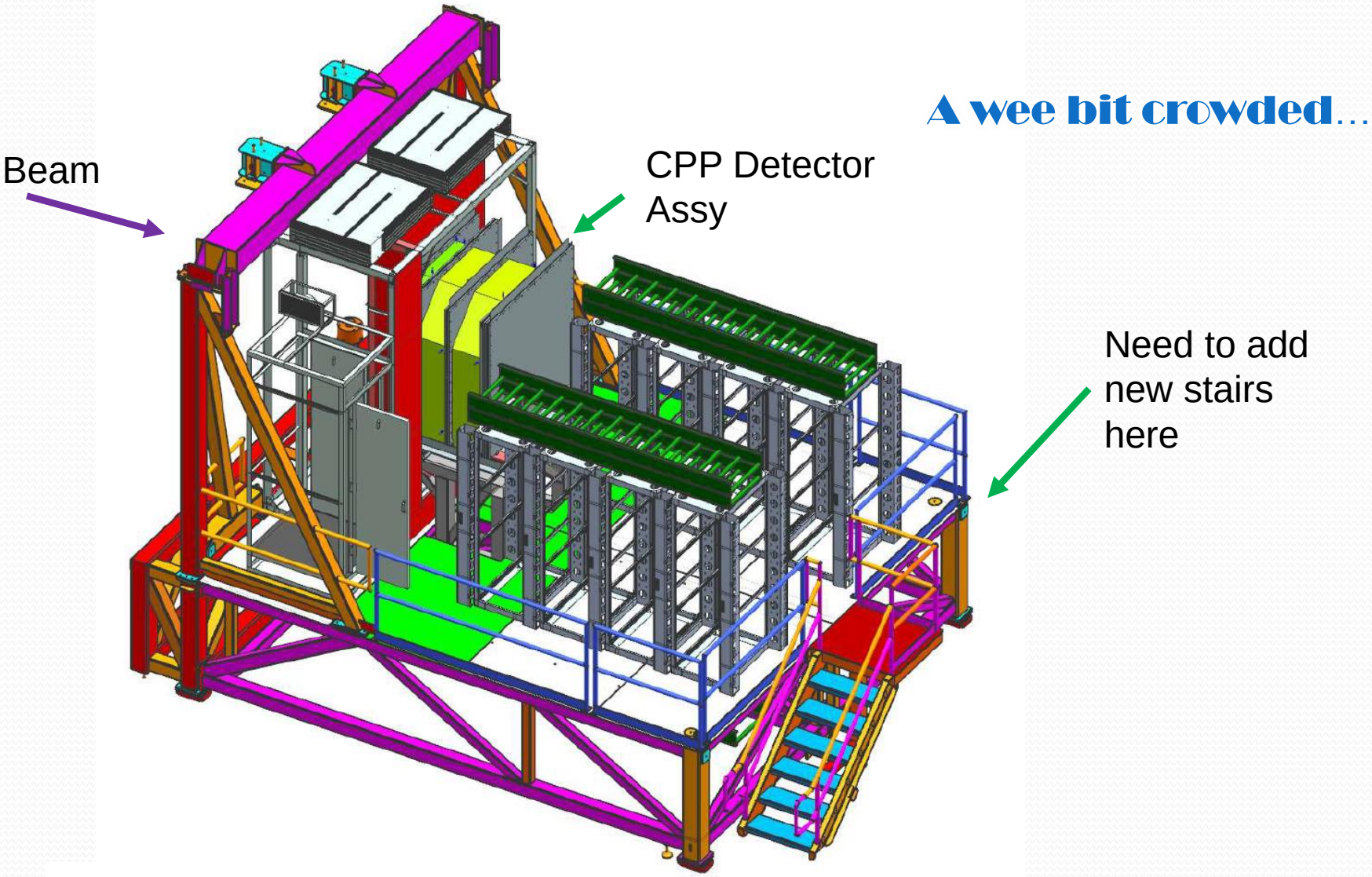
Main Section of frame to be craned in prior to attaching other pieces

Hillman Rollers

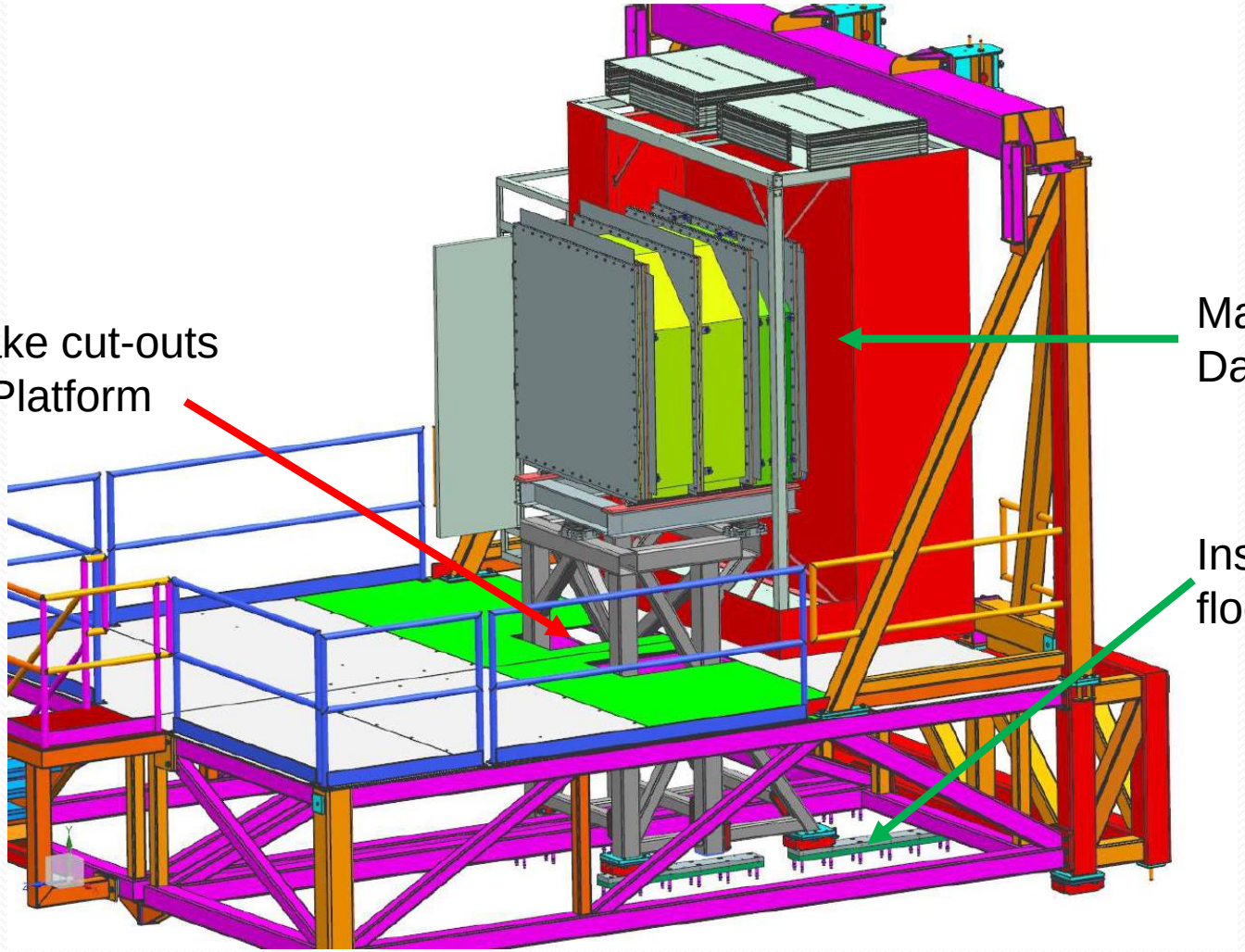
Pieces to be added after craning in position

Steel Plates Grouted to Floor

CPP Overall Installation

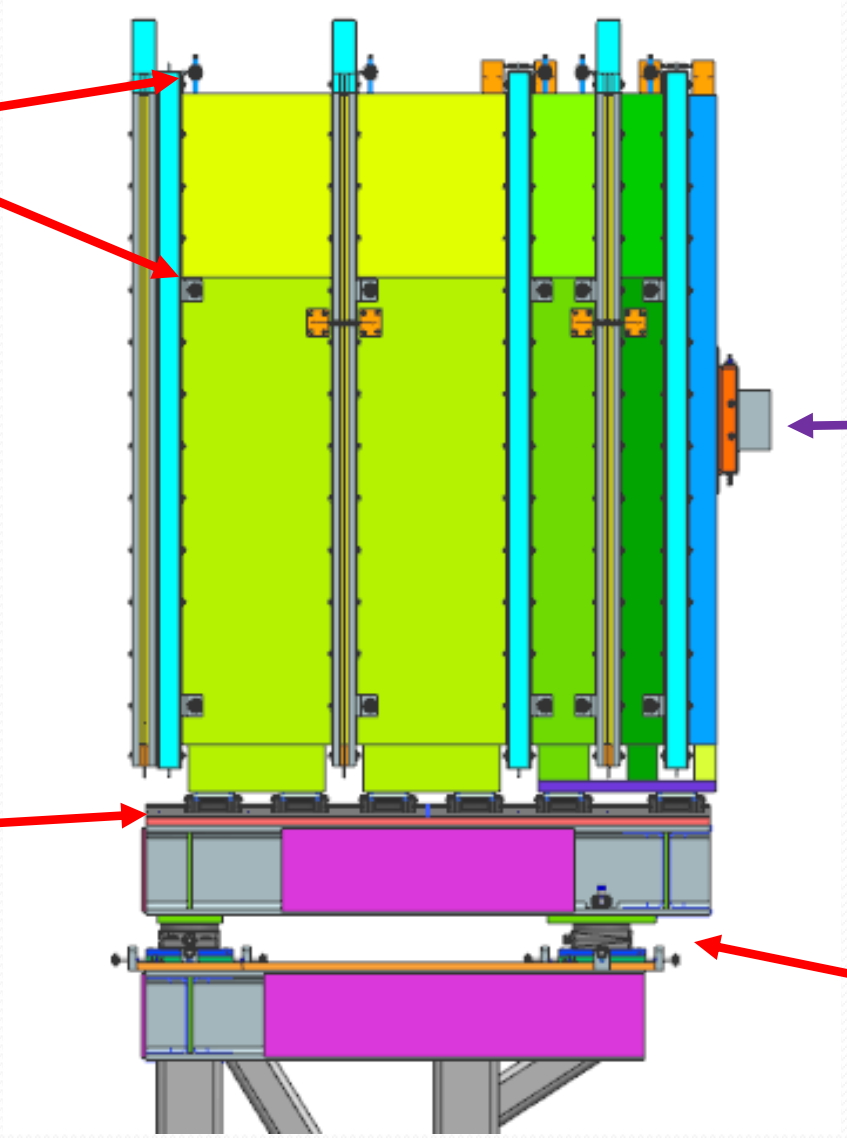


Dark Room and Platform Modification



Sliding Rail System

Chambers Support and fine adjustment from steel

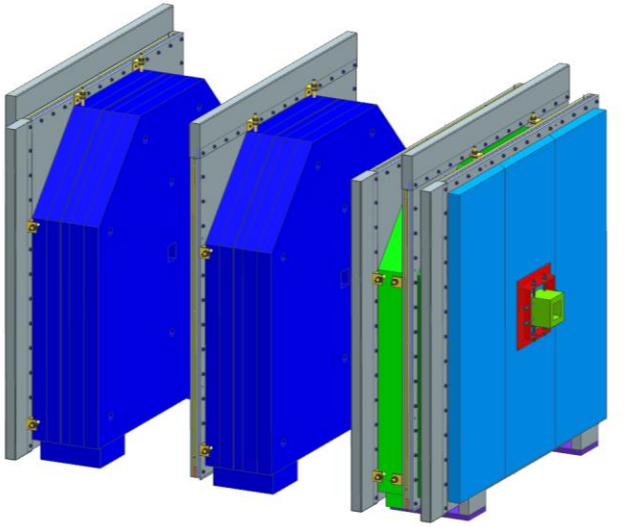


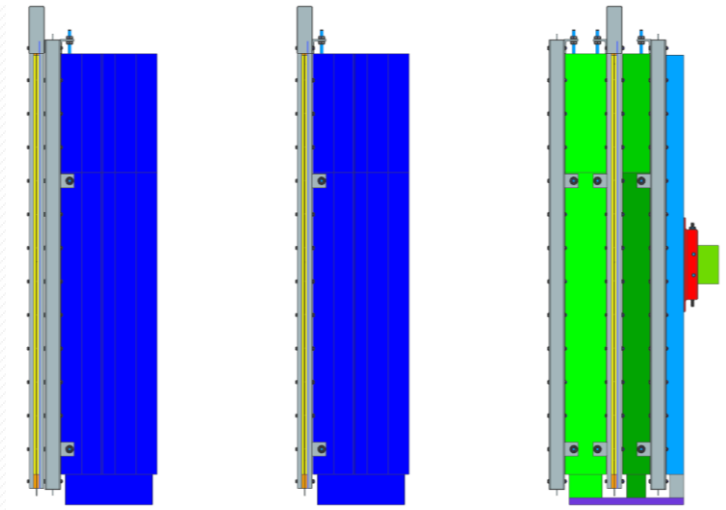
Beam

Thompson Rails support each absorber

Fine alignment system X/Z ± 1cm, Y ± 6mm

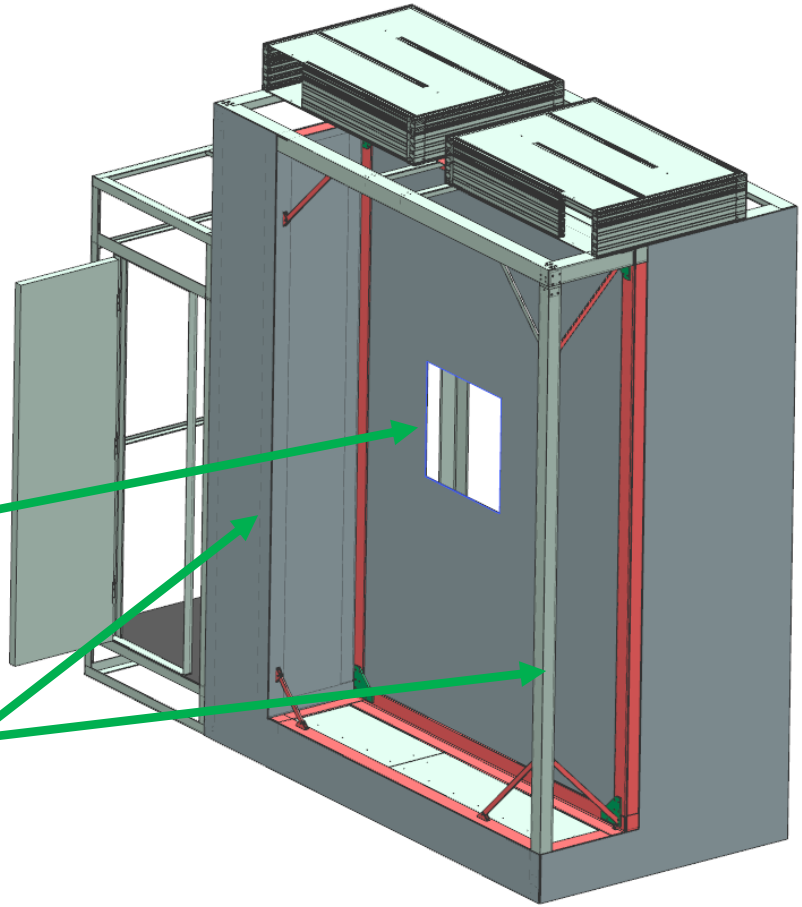
Detector Assy





- Detector pre-assembled in Hall D in 3 sections prior to installation
- All chambers pre-tested in EEL prior to bringing to hall
- Each section is pre-aligned and fiducialized before installation
- Each section craned on to support structure (max wt under 16,000lbs)
- Final alignment in situ
- Cabling and final tests in situ

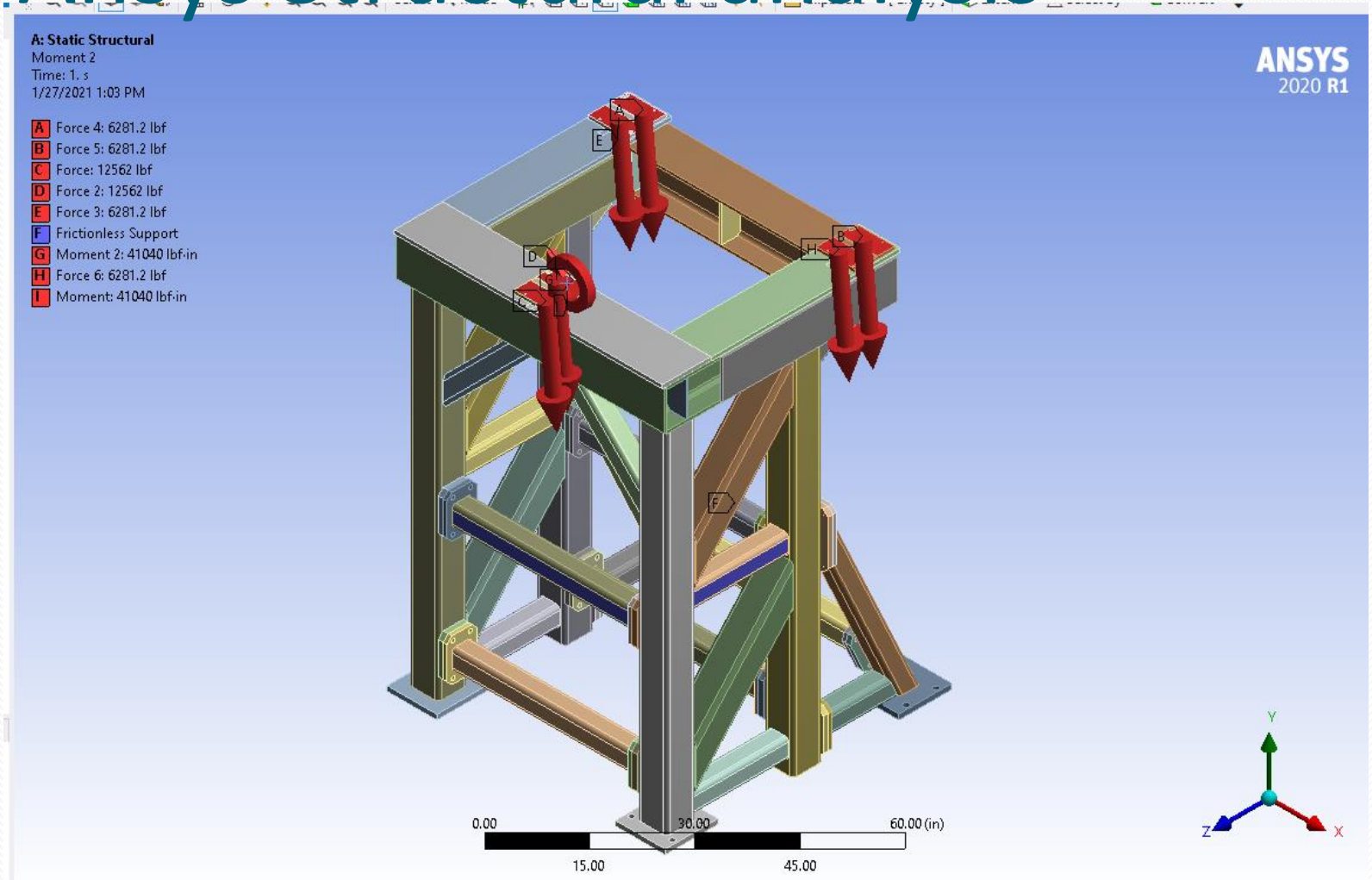
Dark Room Mod



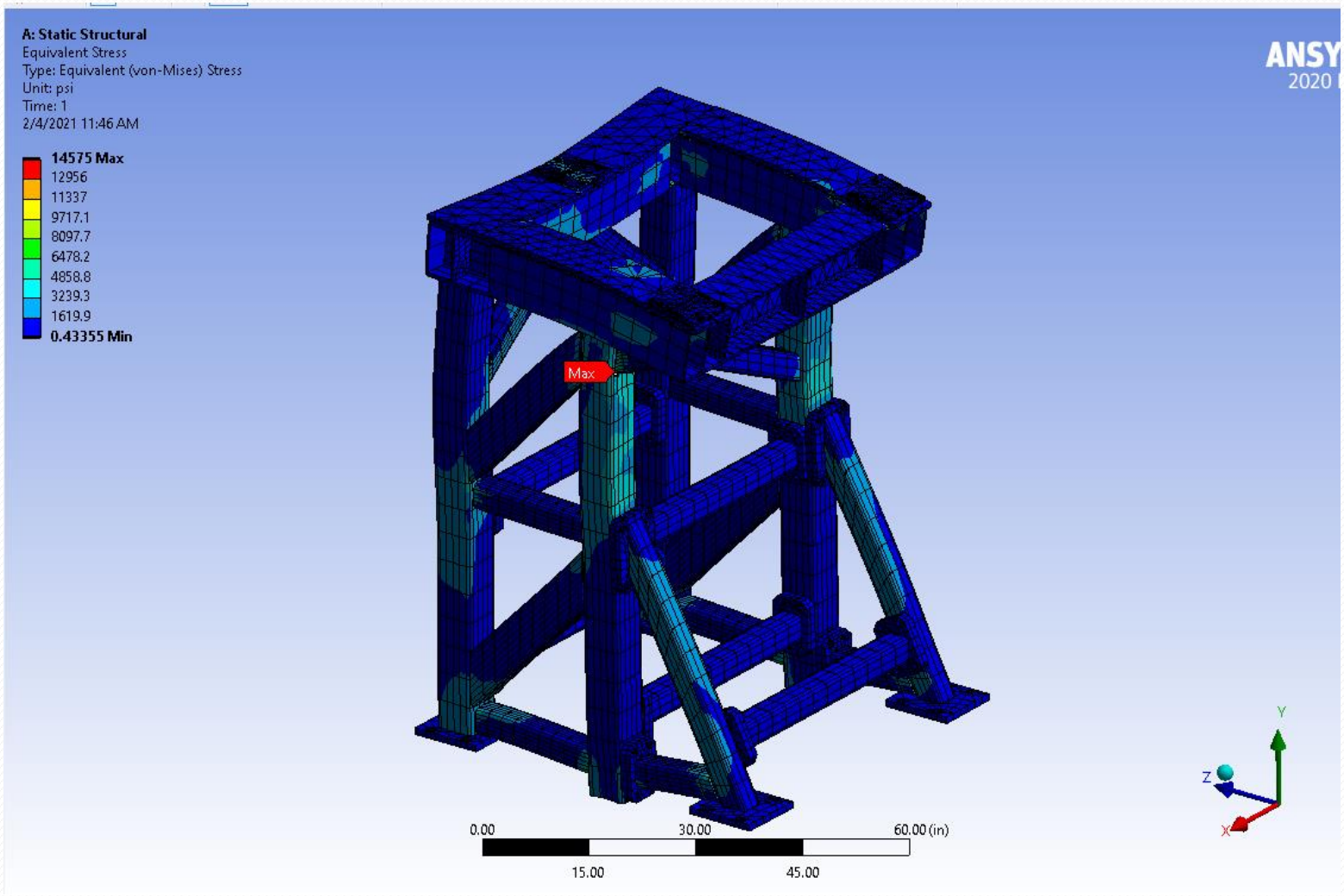
Removable cutout in wall for Lead adjustment

Old wall comes to this edge

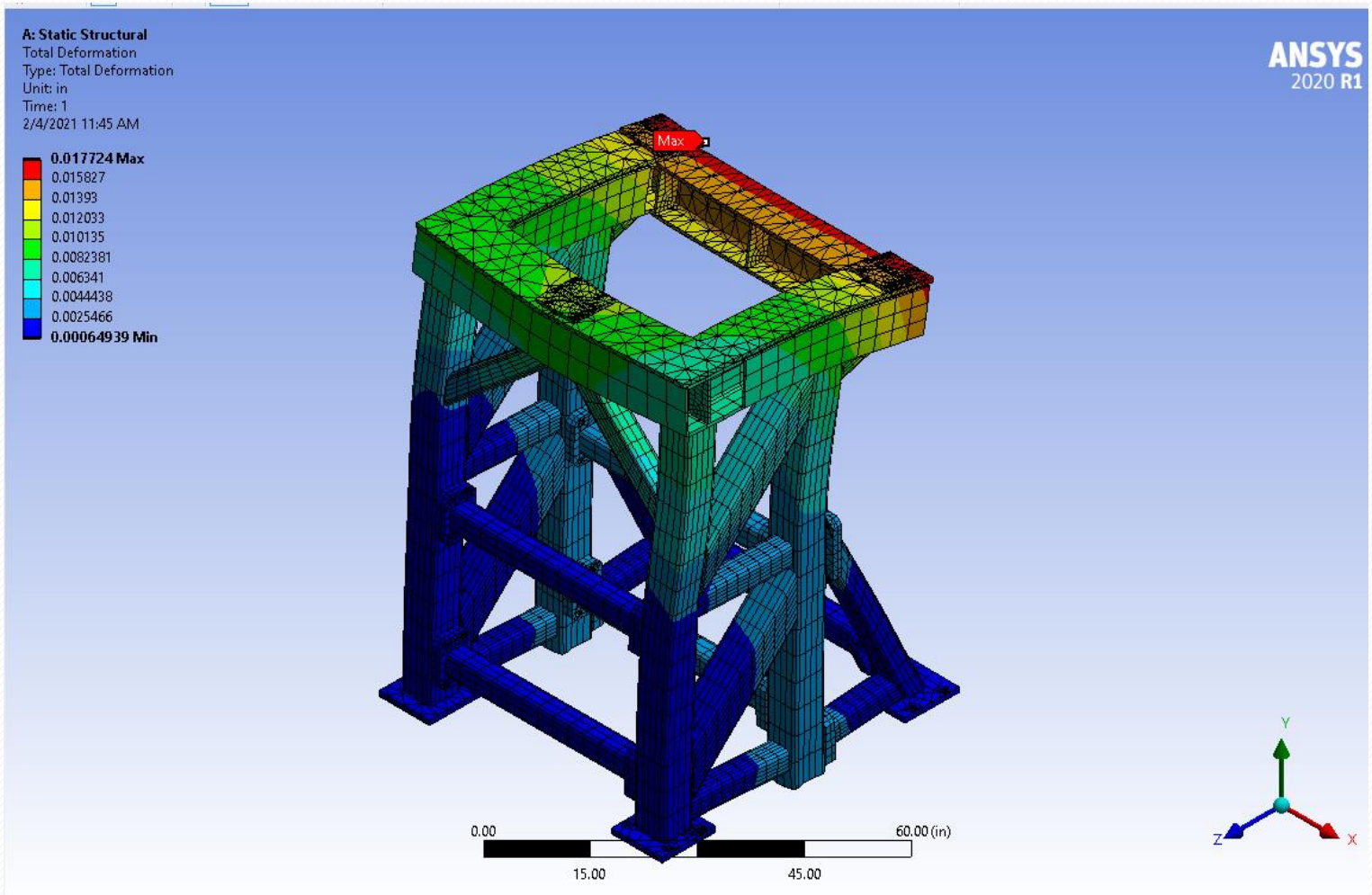
Ansys Structural analysis



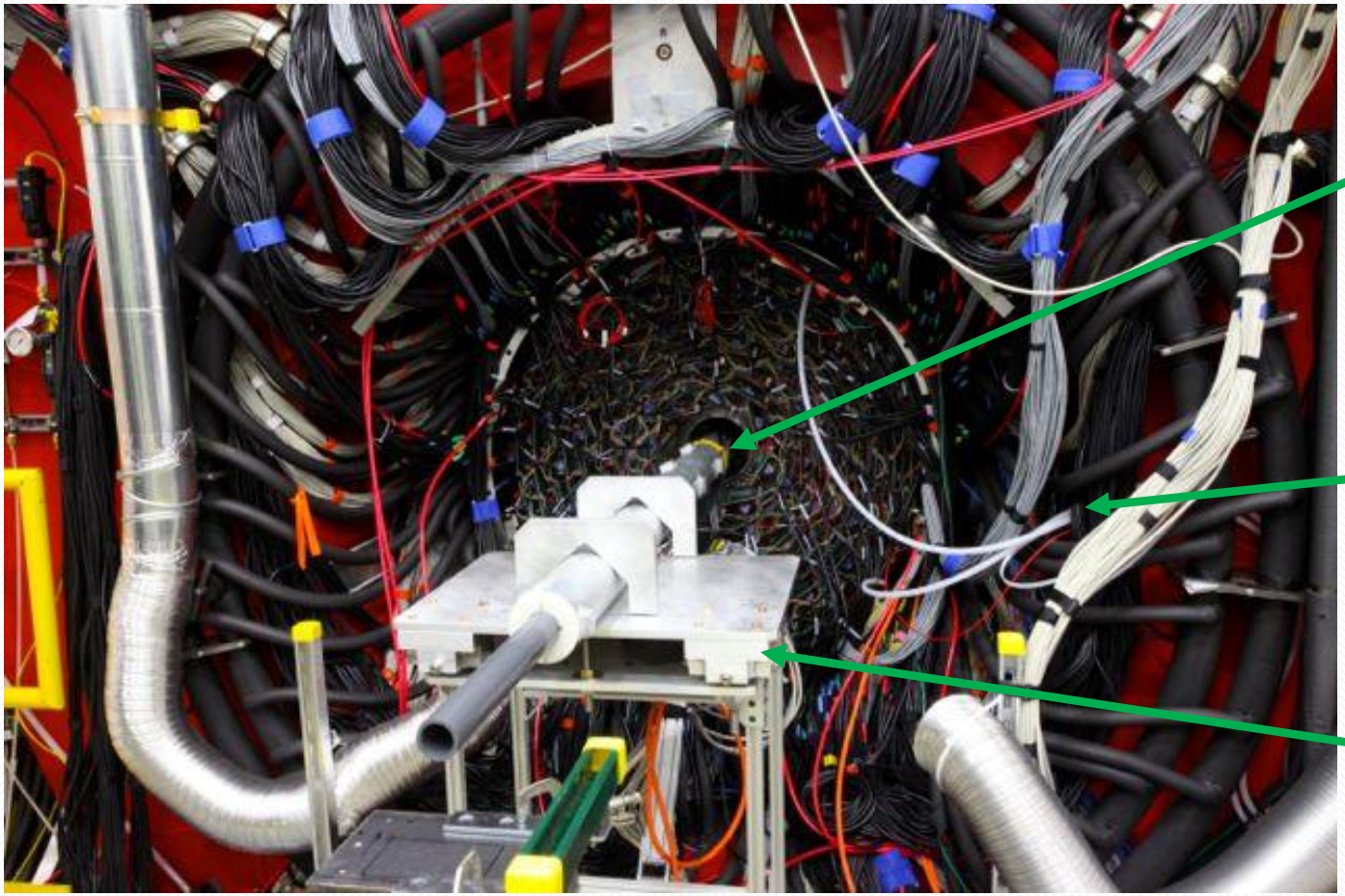
CPP Stand – low stresses



CPP Stand Deflections



Existing Solid Target fixture

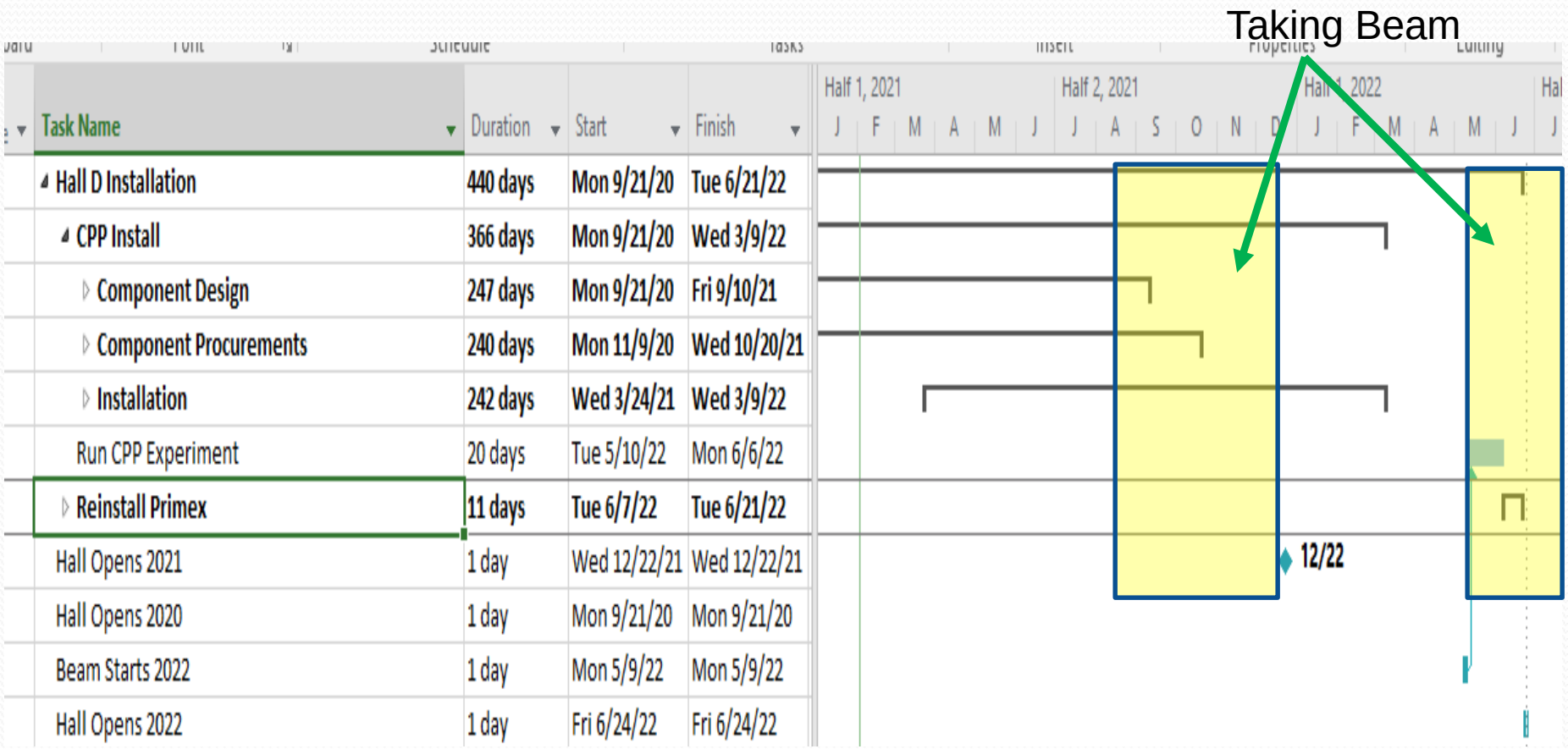


Lead target will be inside bore of CDC electronic boards

Change out area within 600G Magnetic Field of Solenoid

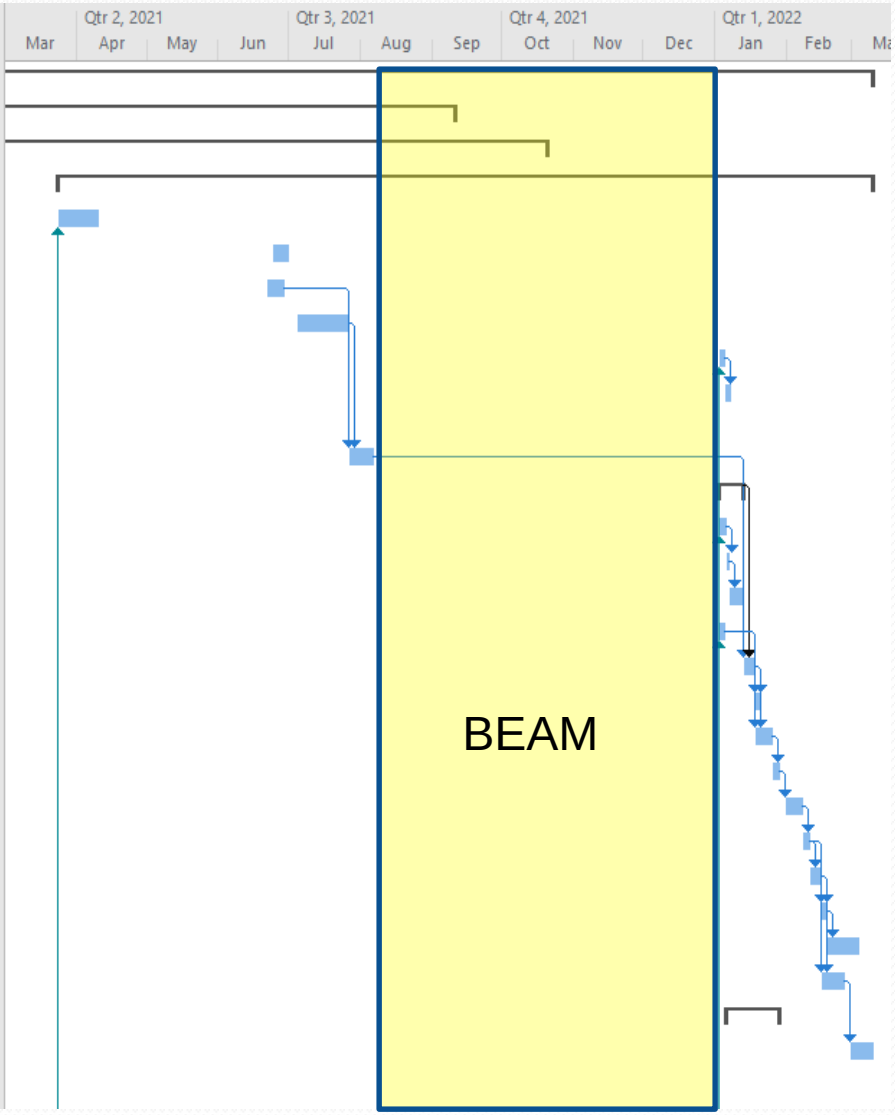
Adjustable cartridges – sub mm

Engineering Schedule



Task Name	Duration	Start	Finish
Hall D Installation	440 days	Mon 9/21/20	Tue 6/21/22
CPP Install	366 days	Mon 9/21/20	Wed 3/9/22
Component Design	247 days	Mon 9/21/20	Fri 9/10/21
Component Procurements	240 days	Mon 11/9/20	Wed 10/20/21
Installation	242 days	Wed 3/24/21	Wed 3/9/22
Run CPP Experiment	20 days	Tue 5/10/22	Mon 6/6/22
Reinstall Primex	11 days	Tue 6/7/22	Tue 6/21/22
Hall Opens 2021	1 day	Wed 12/22/21	Wed 12/22/21
Hall Opens 2020	1 day	Mon 9/21/20	Mon 9/21/20
Beam Starts 2022	1 day	Mon 5/9/22	Mon 5/9/22
Hall Opens 2022	1 day	Fri 6/24/22	Fri 6/24/22

Task Name	Duration	Start	Finish
CPP Install	**366 days**	**Mon 9/21/20**	**Wed 3/9/22**
Component Design	**247 days**	**Mon 9/21/20**	**Fri 9/10/21**
Component Procurements	**240 days**	**Mon 11/9/20**	**Wed 10/20/21**
Installation	**242 days**	**Wed 3/24/21**	**Wed 3/9/22**
Modify FCAL Platform	13 days	Wed 3/24/21	Fri 4/9/21
install floor rails	5 days	Thu 6/24/21	Wed 6/30/21
Install FCAL platform stairs mod	5 days	Tue 6/22/21	Mon 6/28/21
Modify Dark room	16 days	Mon 7/5/21	Mon 7/26/21
Remove ComCal	2 days	Mon 1/3/22	Tue 1/4/22
Remove vertical cable managers & trim cable tray	3 days	Wed 1/5/22	Fri 1/7/22
install support stand	9 days	Tue 7/27/21	Fri 8/6/21
Assemble 1st section of detector on floor	**8 days**	**Mon 1/3/22**	**Wed 1/12/22**
Assemble	3 days	Mon 1/3/22	Wed 1/5/22
Fiducialize	1 day	Thu 1/6/22	Thu 1/6/22
Test all systems	4 days	Fri 1/7/22	Wed 1/12/22
Move Electronics to Temp Racks	2 days	Mon 1/3/22	Tue 1/4/22
Install 1st section of detector	3 days	Thu 1/13/22	Mon 1/17/22
Align Stand w/detector	2 days	Tue 1/18/22	Wed 1/19/22
Assemble 2nd section of detector on floor	6 days	Tue 1/18/22	Tue 1/25/22
Install 2nd section of detector	3 days	Wed 1/26/22	Fri 1/28/22
Assemble 3rd section of detector on floor	6 days	Mon 1/31/22	Mon 2/7/22
Install 3rd section of detector	3 days	Tue 2/8/22	Thu 2/10/22
Hook Up Gas system	3 days	Fri 2/11/22	Tue 2/15/22
Final Survey	2 days	Wed 2/16/22	Thu 2/17/22
Test all systems	10 days	Fri 2/18/22	Thu 3/3/22
Solid Lead Target	8 days	Wed 2/16/22	Fri 2/25/22
Move Microscope	**17 days**	**Thu 1/6/22**	**Fri 1/28/22**
Beamline	8 days	Mon 2/28/22	Wed 3/9/22
Run CPP Experiment	20 days	Tue 5/10/22	Mon 6/6/22



Design/Fabrication/Installation Resources and Responsibilities

- Design – Hall D Engineering (Tim and Stephanie)
  - Structural Analysis – Tim, Tom Renzo from Facilities reviewer
  - Drawings - Stephanie
- Fabrication – Hall D Engineering responsible for all ordering, some in house fab and Vendor fab
- Chamber Fab/Testing - Umass
- Installation – Hall D Tech staff will do all installation work
  - Welding – Josh Foyles/Chris Allen
  - Material Handling – all Hall D Tech staff
  - Plasma Cutting – Hall D Tech staff (equip from Hall C)
  - Gas System – Hall D Tech Staff
  - Cabling/Electronics – Elton, Fernando, Chris S., Nick S.

Maintenance Requirements and Responsibilities

- Monitor/Control Gas system – Tech Staff
- Electronics – Elton/Fernando
- Moveable lead absorber adjustments – Experiment Personnel – 1X
- Target Changes – Experiment Personnel – periodically

Component Status

- Detector System Preliminary Design Complete
- CPP Stand
  - Drawings released
  - Preliminary Structural Analysis Complete
  - Out for Bid
- Steel Absorbers in final design – cost estimate complete
- Rollers, rails and adjustment wedges in house
- Target System in Conceptual phase – some hardware exists
- Gas System – Use CDC system with some additional manifold and bubblers

Hazards

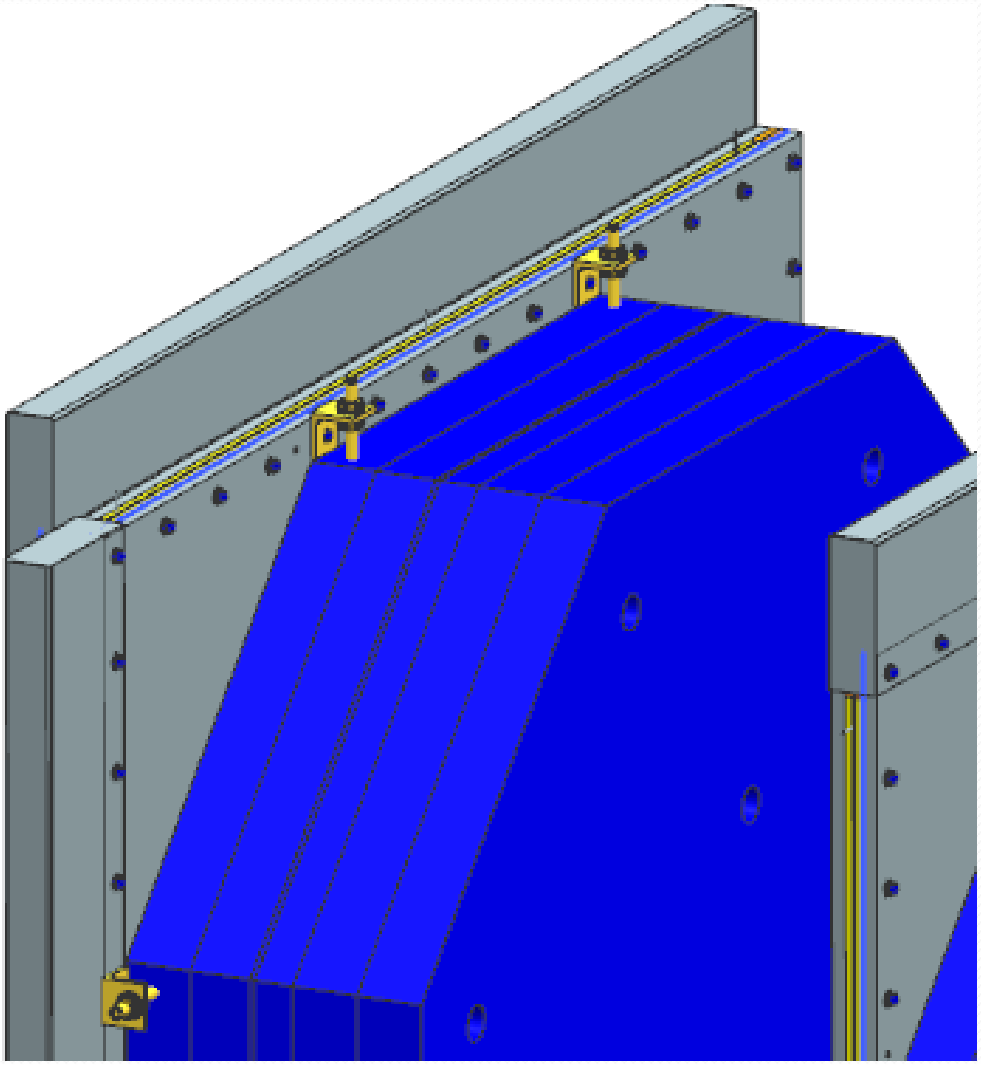
- During Physics Run
  - Electronics
  - ODH
  - Magnetic Field
  - Thin Vacuum Window
- Installation/Testing
  - Welding
  - Plasma cutting
  - Grinding
  - Material Handling
  - Elevated Platform
  - Electronics
  - Pressure systems
  - ODH

Summary

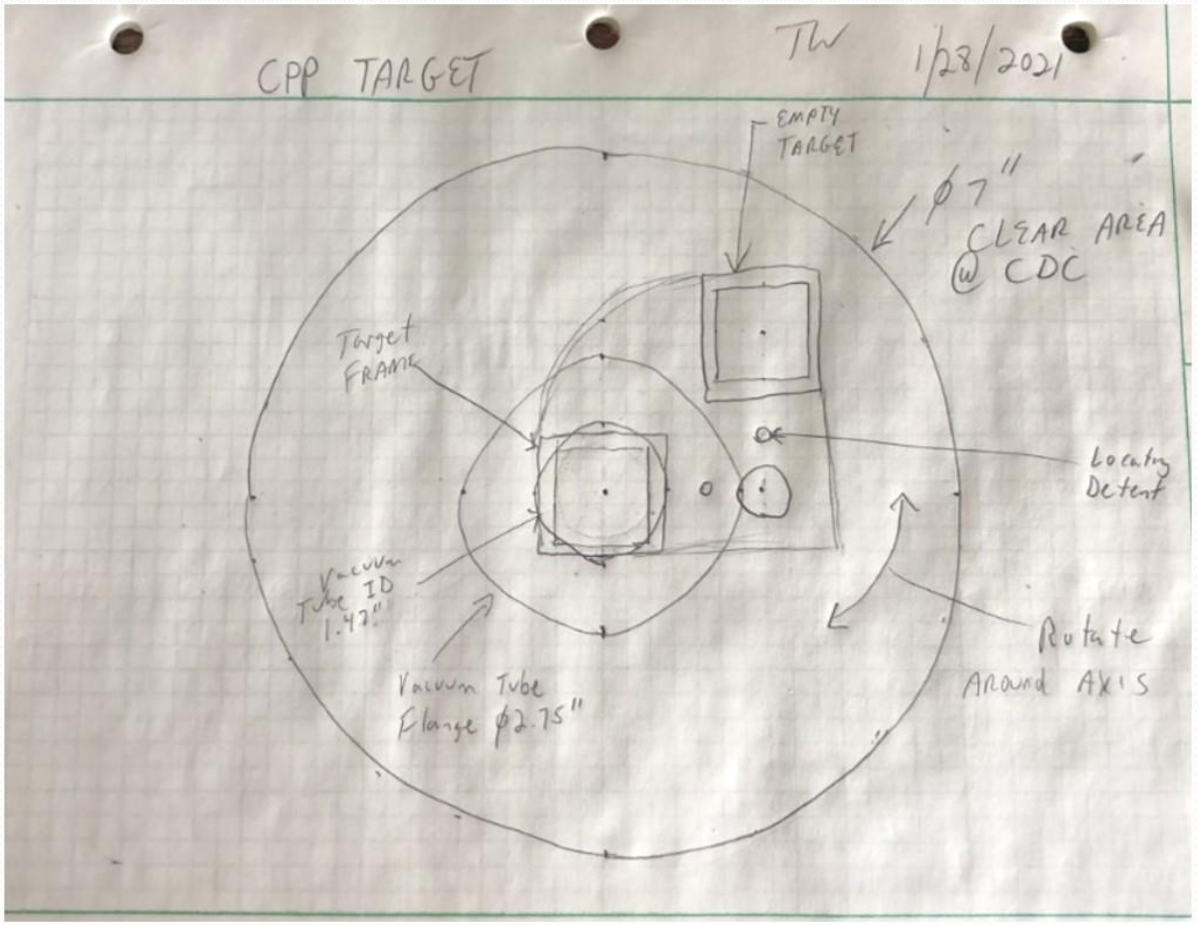
- Requirements for Design, Installation, Operation and Maintenance are known
- Preliminary Design Essentially Complete – some released
- Design, Fabrication and Installation Schedule developed
- Hazards are Known and Being Addressed
- Responsibilities and Resources are Determined

Backup Slides

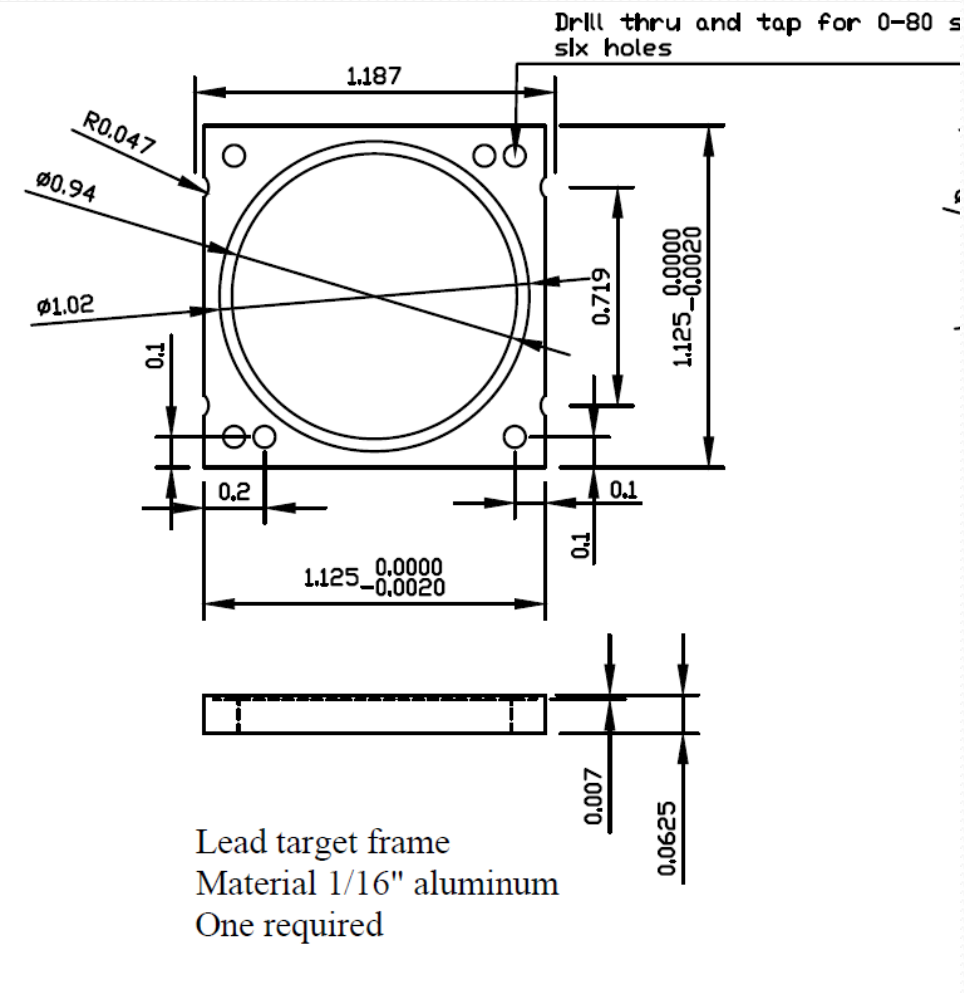
Chamber Adjustment



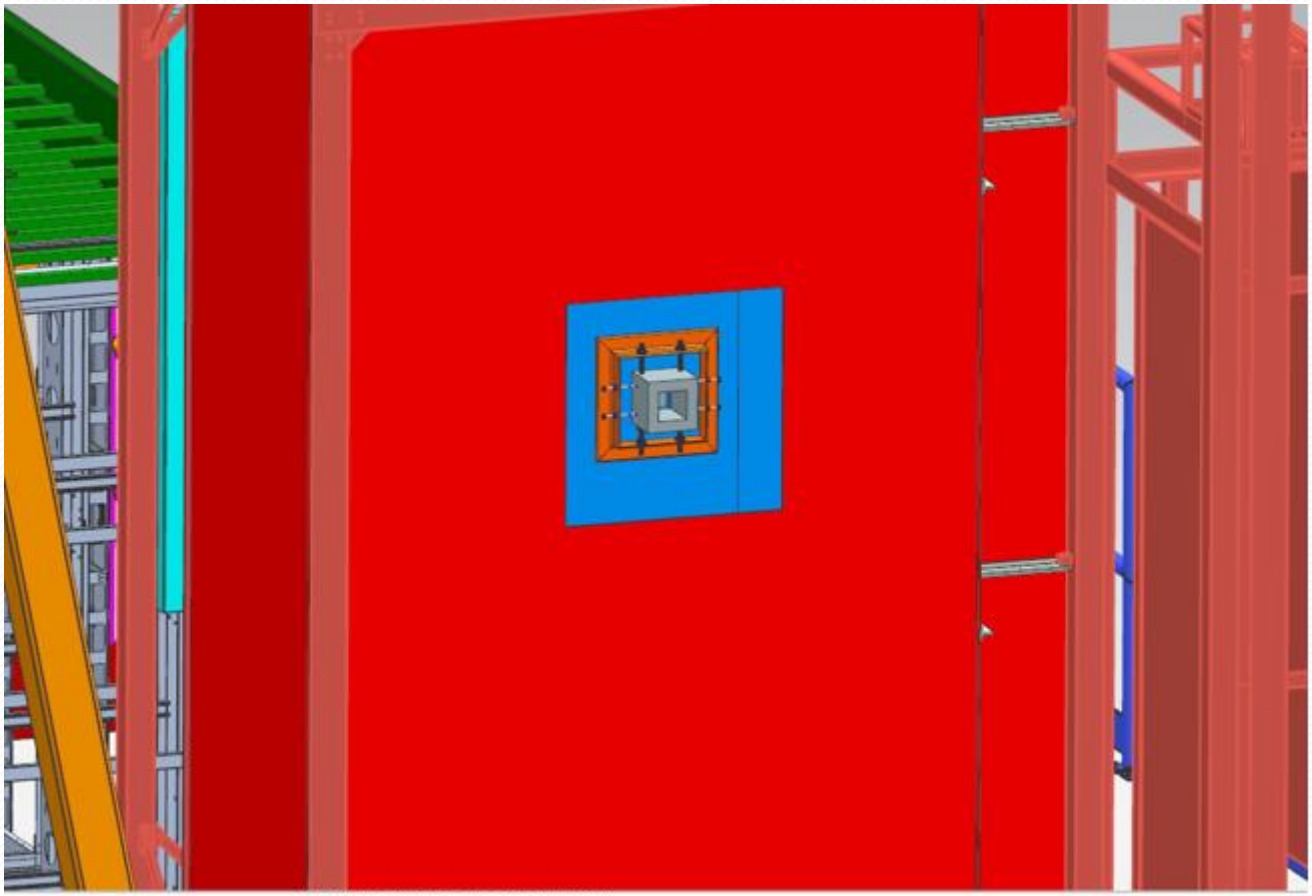
Target Change Mechanism



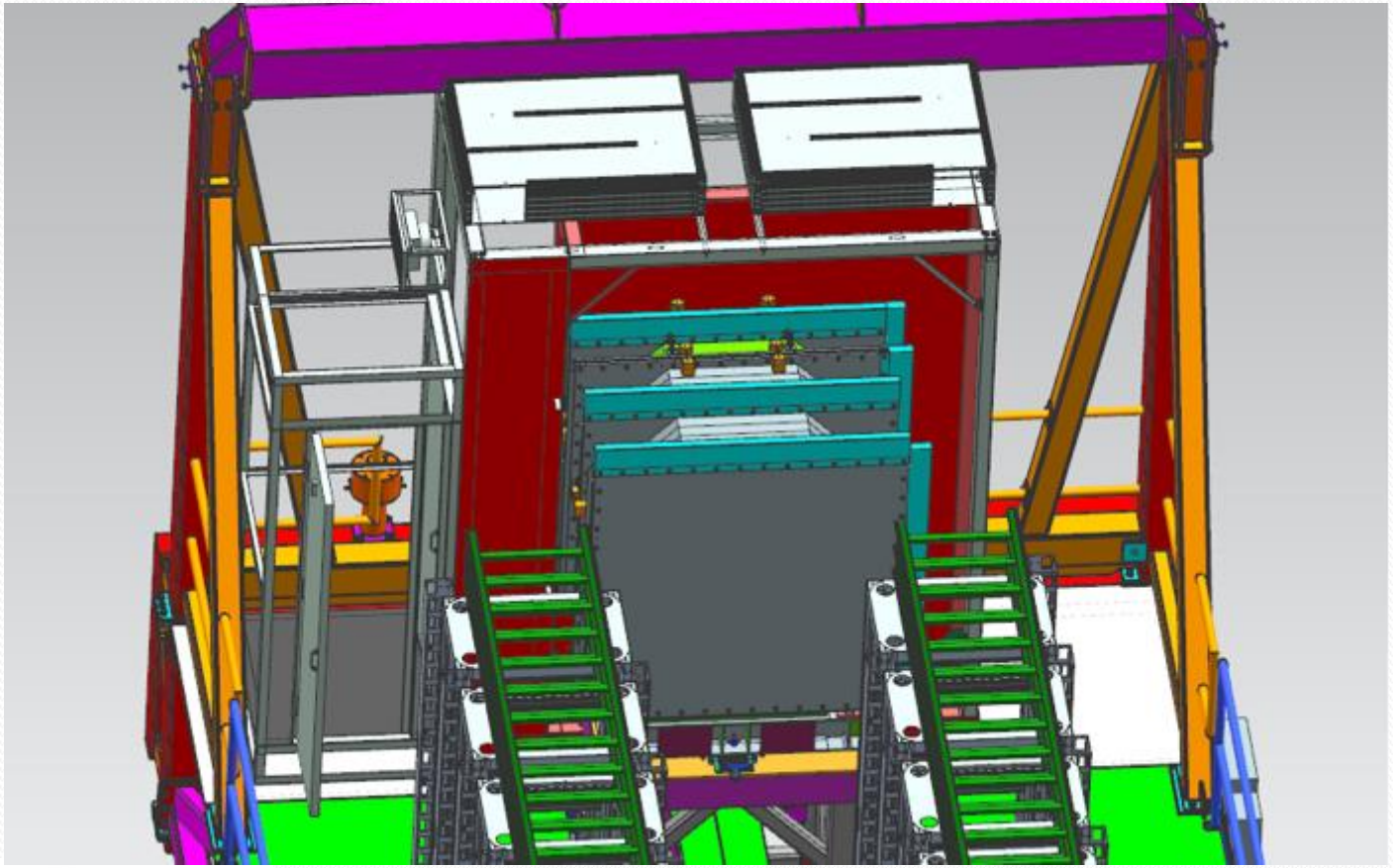
Lead Target Frame



Access to Adj. Lead Absorber



Access to Electronics



Additional Stair Access