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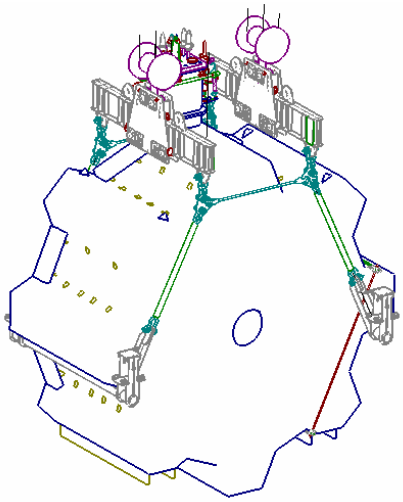
ATLAS – EC Toroid Installation

REPORT

of Dynamical Conflict Checking



Done by: Georgian CAD/CAM Engineering Center

Platform: Dassault System CATIA V5R12

Dynamical Conflict Checking Strategy

- Two type of conflicts where considering – Clashes and Clearances
- Dynamical conflict checking is carring out separatly for each segment of EC toroid (ECT) lifting path
- Cases, when the clearance between the moving ECT and the estimated environment arround, was less than 1000mm, was not considered in detaild

ECT lifting was anaysed separatly for:

1. Warm Structure
2. Cavern Civil Engineering
3. Heating & Ventilation
4. Cryogenics
5. HO Structure
6. HS Structure
7. Trucks in Access Position
8. Platforms
9. Barrel Brackets & Rails
10. Muon Chambers
11. Services for Extended Calorimeter
12. Services for Muon Spectrometer
13. Vacuum Vesels

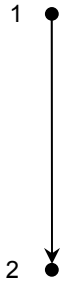
Predefined Lifting Path of EC Toroid

ECT lifting path consists of 3 support points where center of ECT have to be moved. Coordinats are mesured according to origin point in Z0. In first point of movement center of ECT is coinsidence with the ground floor of SCX1. In this position X=0mm; Y=-16’376.00mm; Z=80’211.00mm. Coordinates of all support points of ECT Lifting path are presented in table 1.

Table 1

Points	X	Y	Z
1	0mm	-16’376.00mm	80’211.00mm
2	0mm	-16’376.00mm	6’800.00mm
3	0mm	-15’976.00mm	6’800.00mm
4	0mm	-15’976.00mm	0.00mm

Segment #1: Movement from point 1 to point 2



X_1= 0.00 mm
Y_1= -16'376.00 mm
Z_1= 80'211.00 mm

$Length_{(Z)}$= 73'411.00 mm

X_2= 0.00 mm
Y_2= -16'376.00 mm
Z_2= 6'800.00 mm

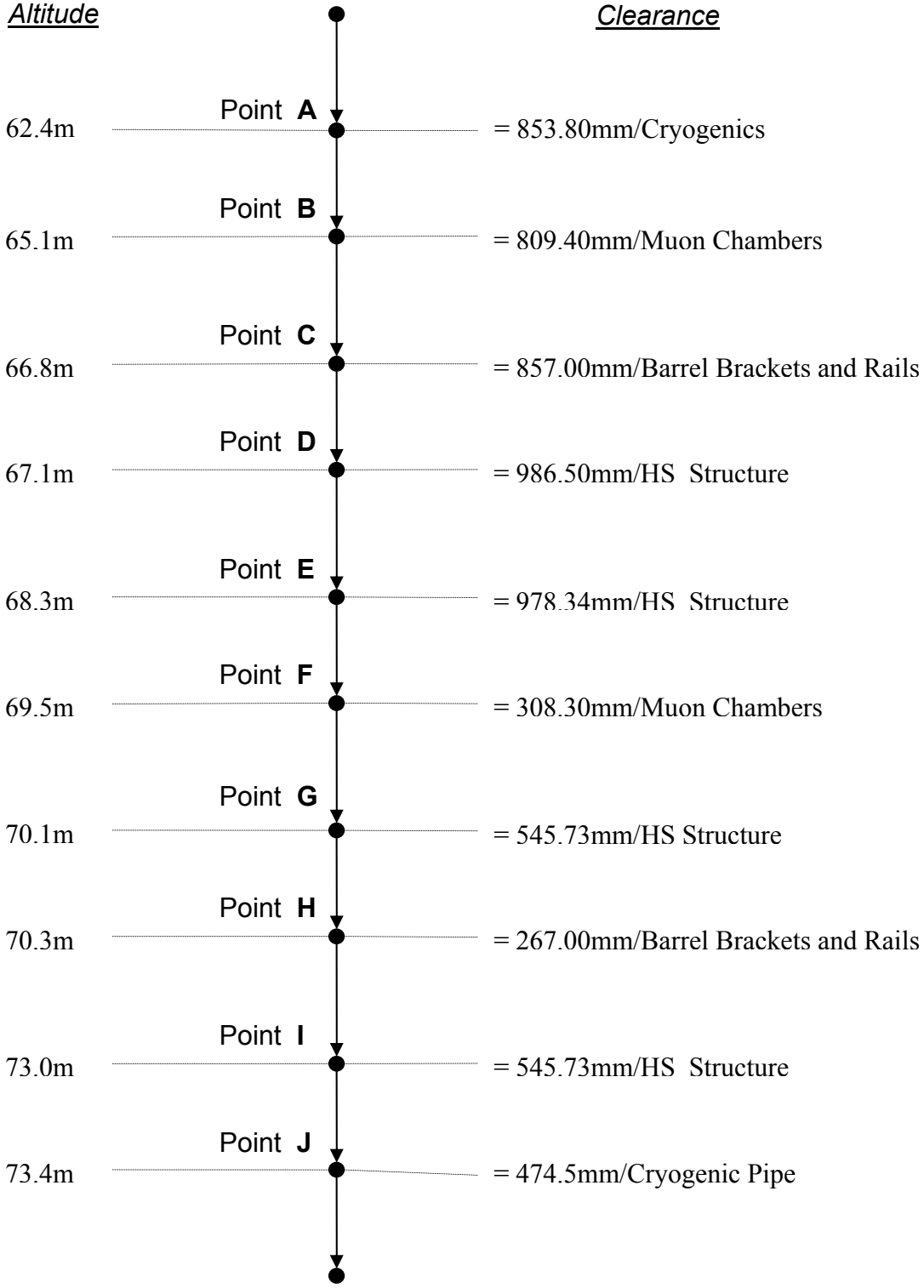
Picture 1

Table 2

Grouping Environment by the Clearance			
More then *1000mm*		Less then *1000mm*	
Environment	*Clearance (mm)*	*Environment*	*Clearance (mm)*
• Warm Structure		• Cryogenics	474.5
• Civil Engineering	1'135.00	• Muon Chambers	308.30
• Heating & Ventilation	1'462.00	• Barrel Brackets & Rails	267.00
• HO Structure		• HS Structure	545.73
• Access Structure	1'200.00		
• Services of Ext. Calorim.	2'197.00		
• Vacuum Vessels	1'142.00		

Segment #1: Movement from point 1 to point 2

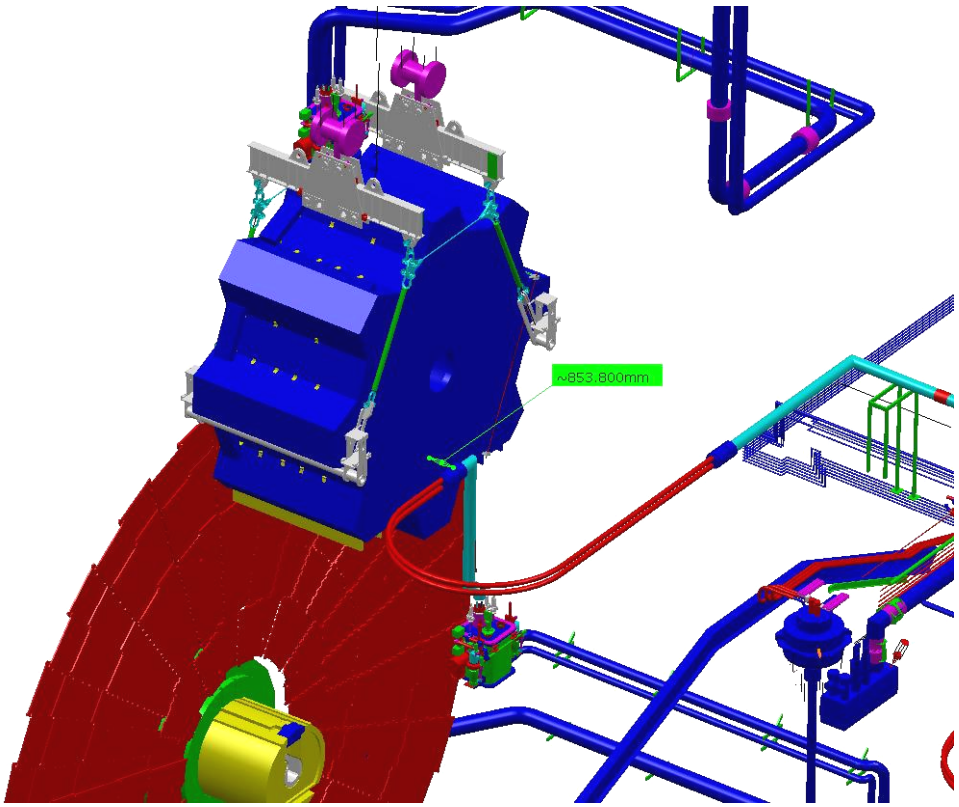
Conflicts Summary



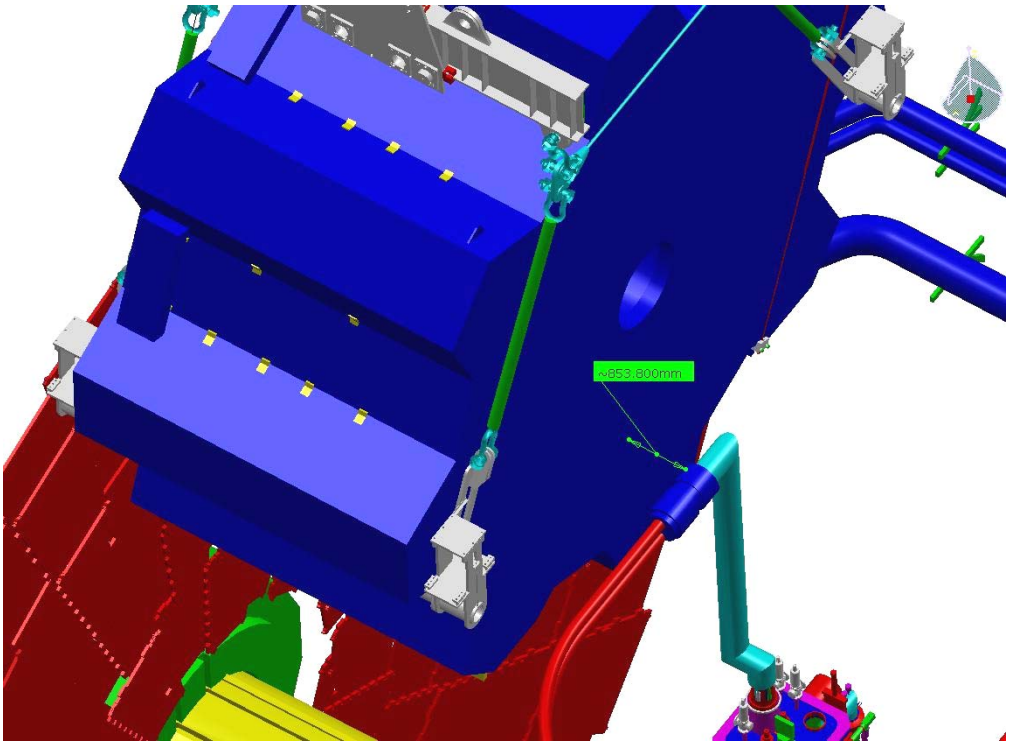
Segment #1: Movement from point 1 to point 2

Point A: Altitude 62.4m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Cryogenic Pipe	853.8mm	Not Considered



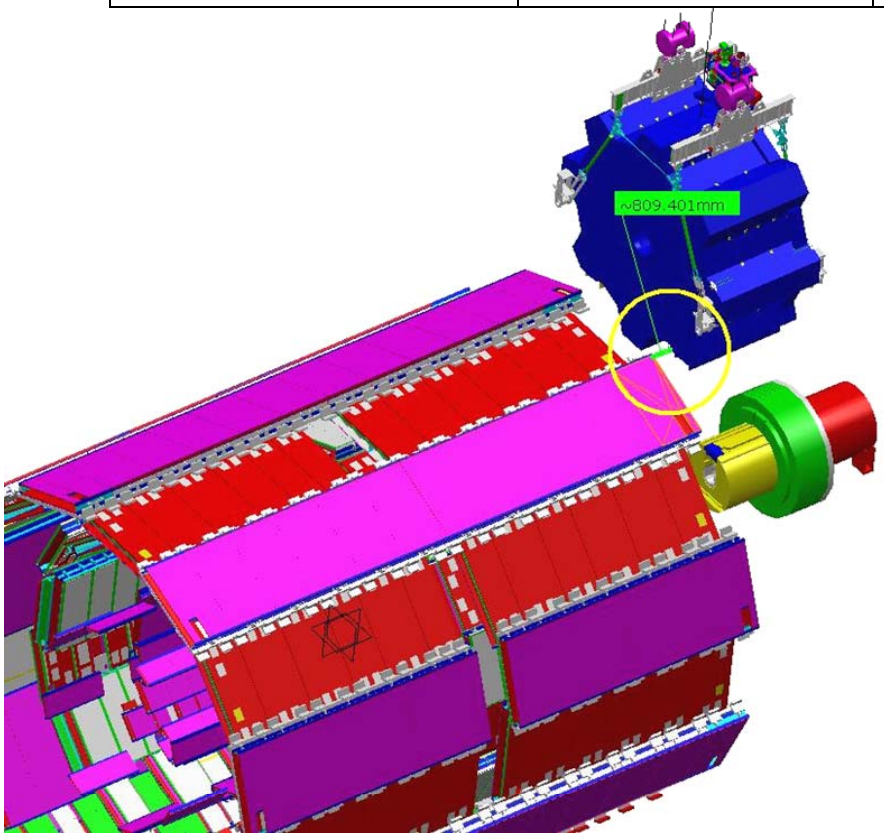
X=0.00mm
Y=-16’376.00mm
Z=17’798.00mm



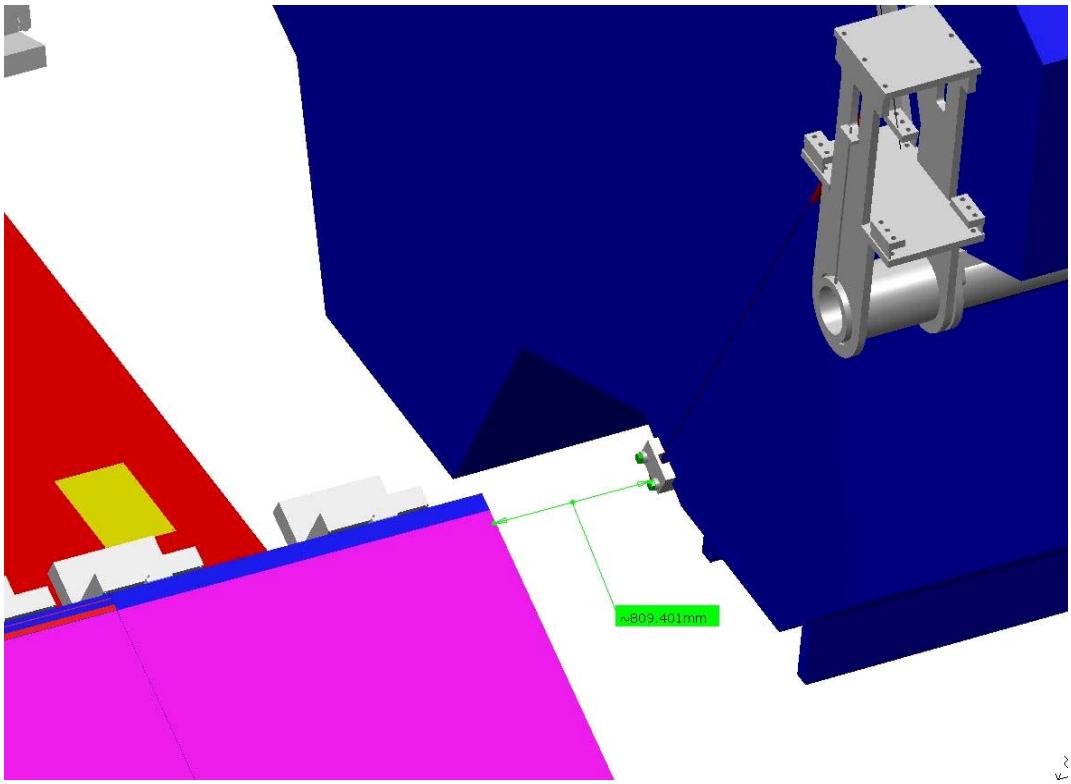
Segment #1: Movement from point 1 to point 2

Point B: Altitude 65.1m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Muon Chambers	809.4mm	Not Considered



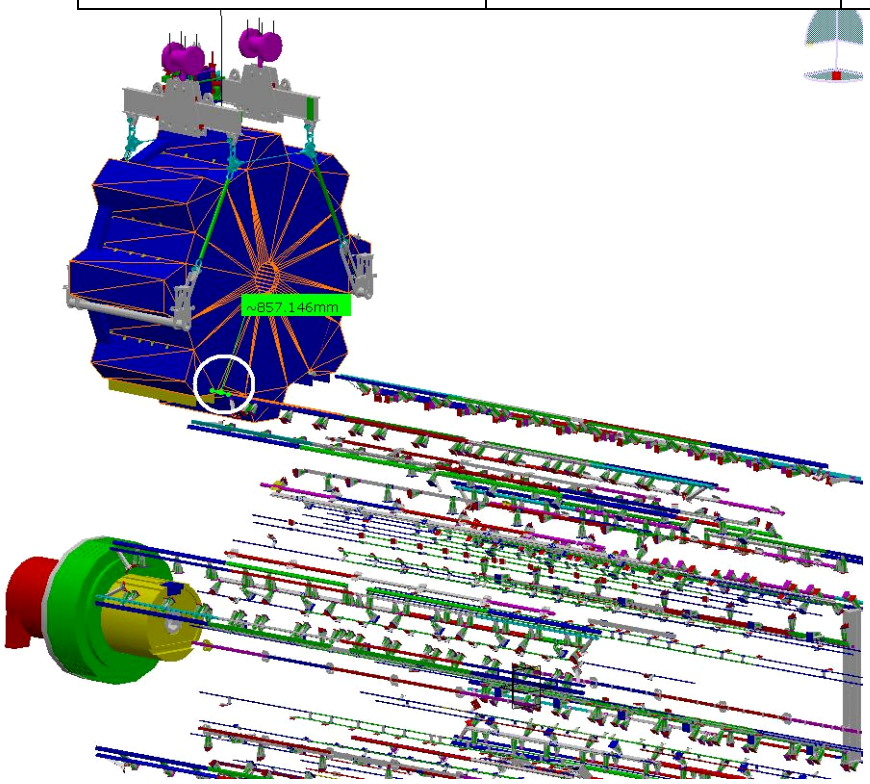
X=0.00mm
Y=-16’376.00mm
Z=15'145.00mm



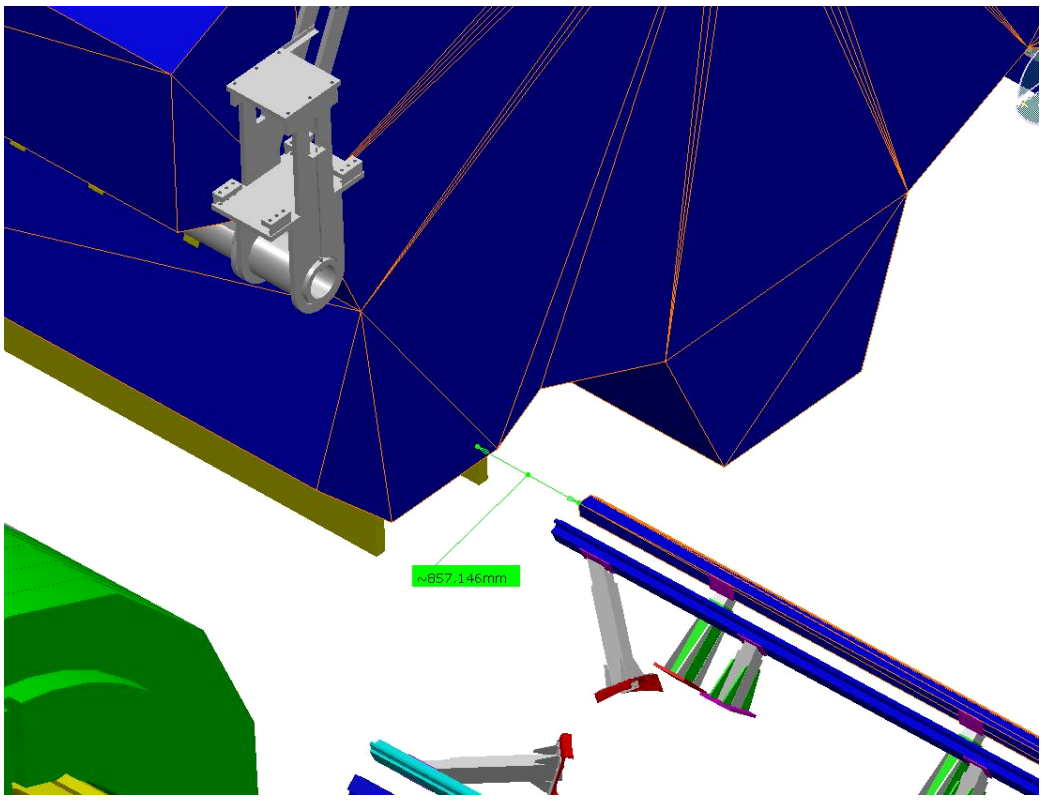
Segment #1: Movement from point 1 to point 2

Point C: Altitude 66.8m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Barrel Brackets & Rails	857.00mm	Not Considered



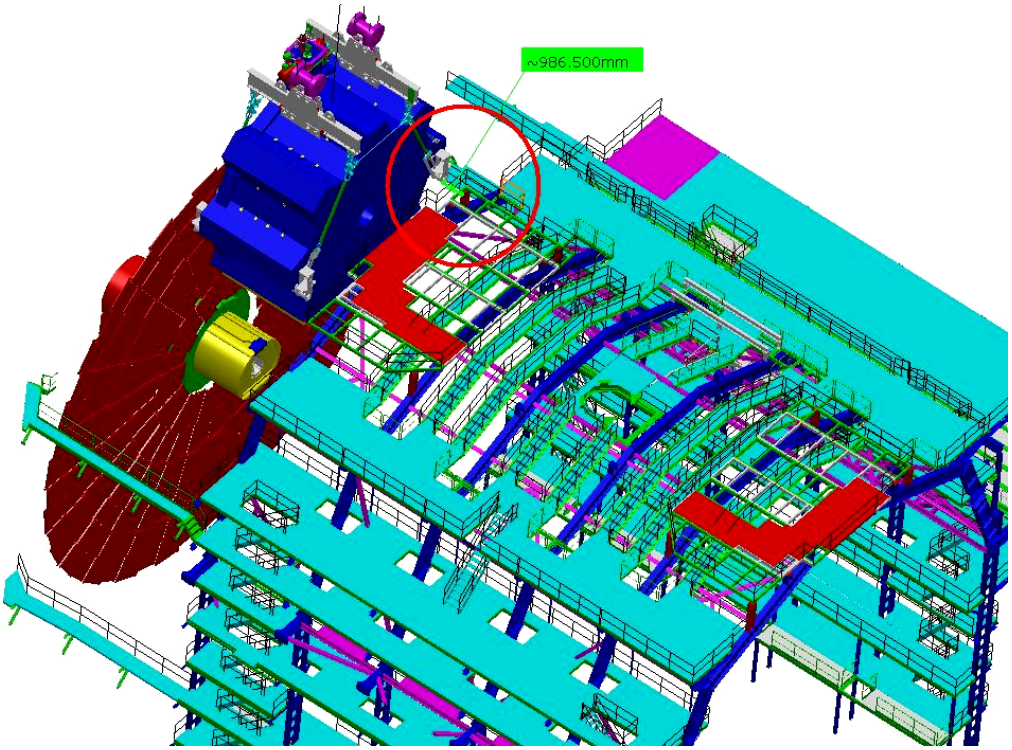
X=0.00mm
Y=-16’376.00mm
Z=13'400.00mm



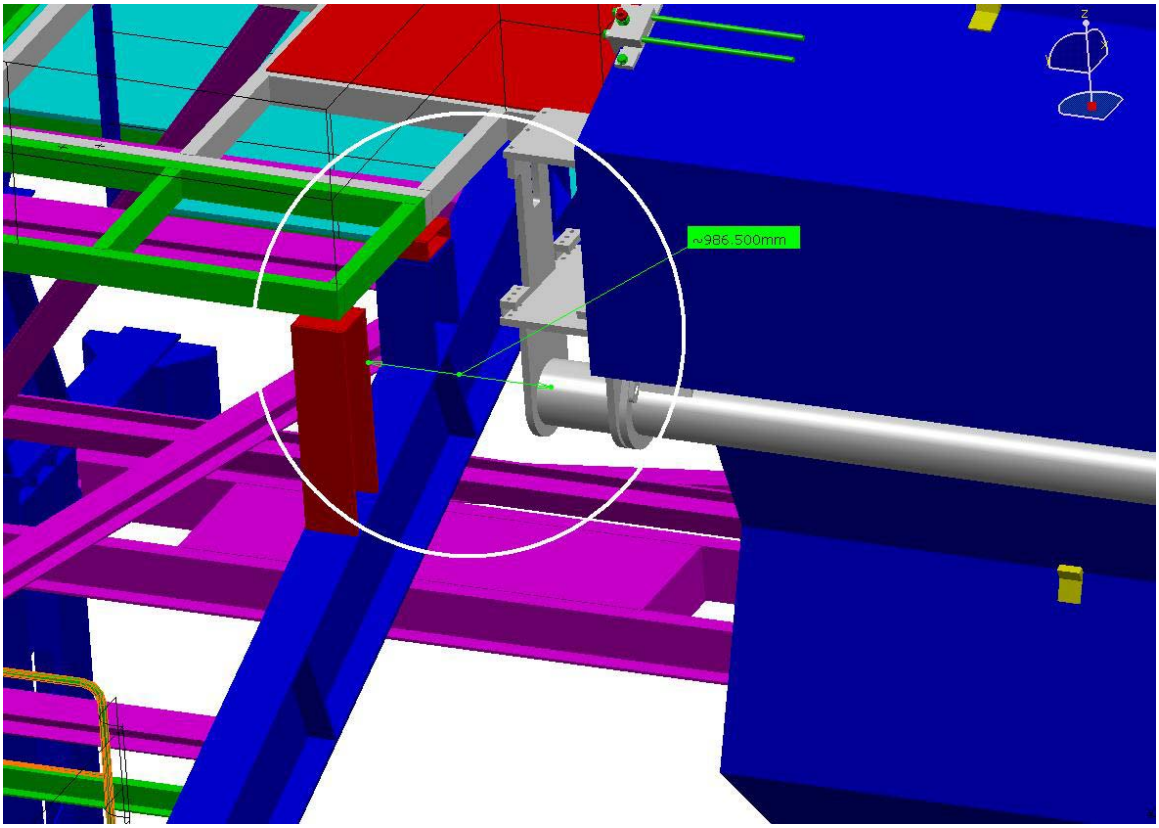
Segment #1: Movement from point 1 to point 2

Point D: Altitude 67.1m Side A / USA15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	HS Structure	986.50mm	Not Considered



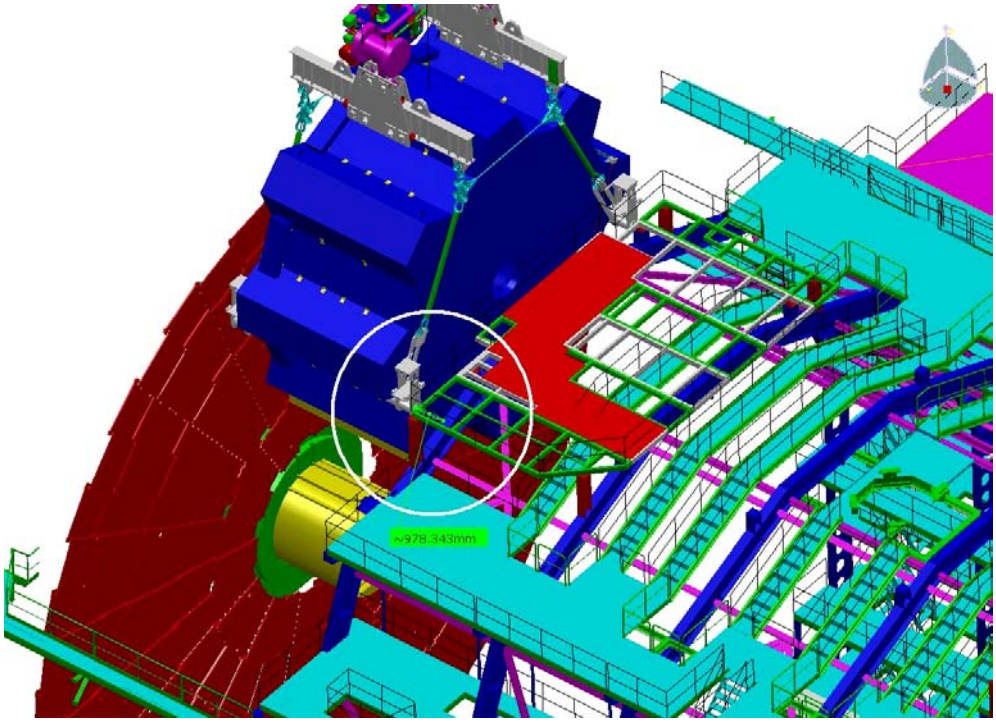
X=0.00mm
Y=-16’376.00mm
Z=13'090.00mm



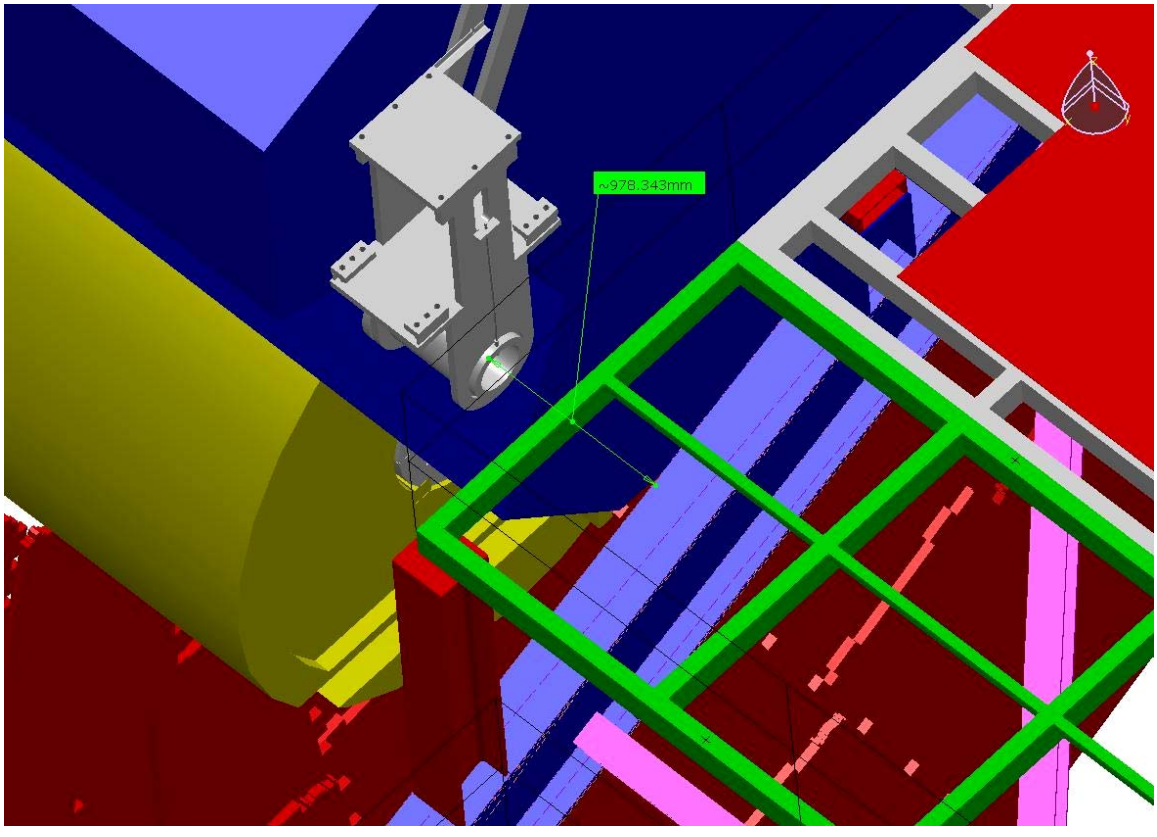
Segment #1: Movement from point 1 to point 2

Point E: Altitude 68.3m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	HS Structure	978.34mm	Not Considered



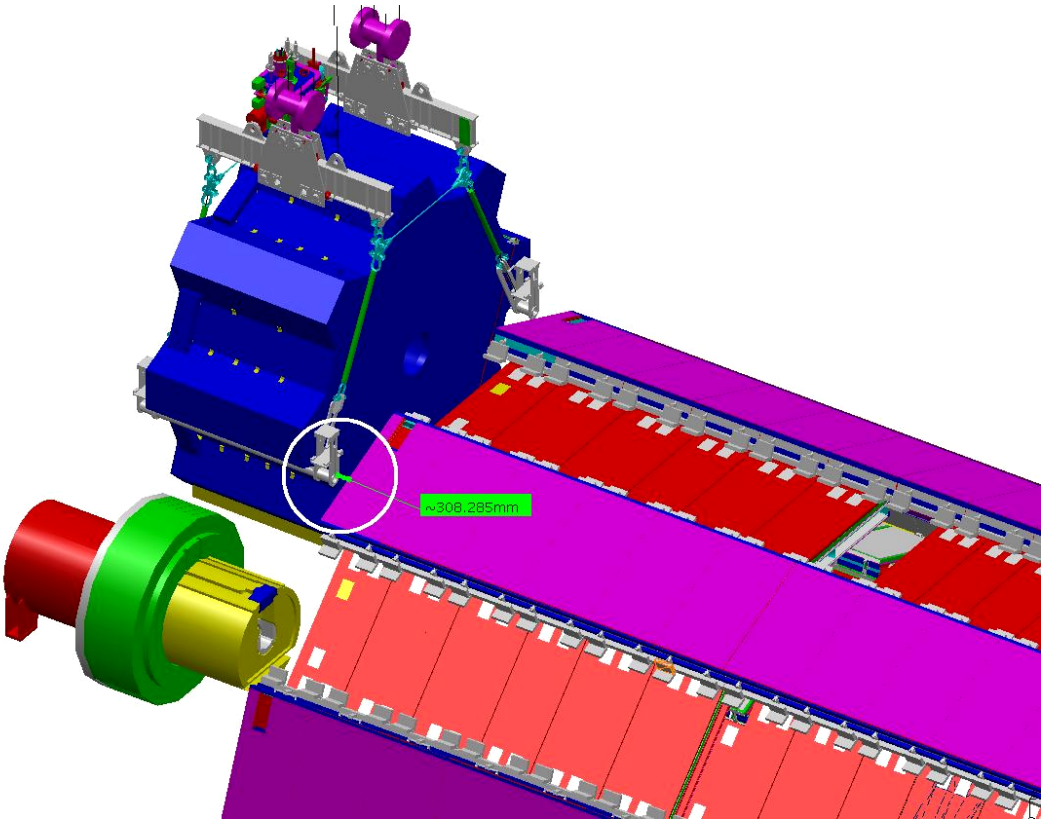
X=0.00mm
Y=-16’376.00mm
Z=11'890.00mm



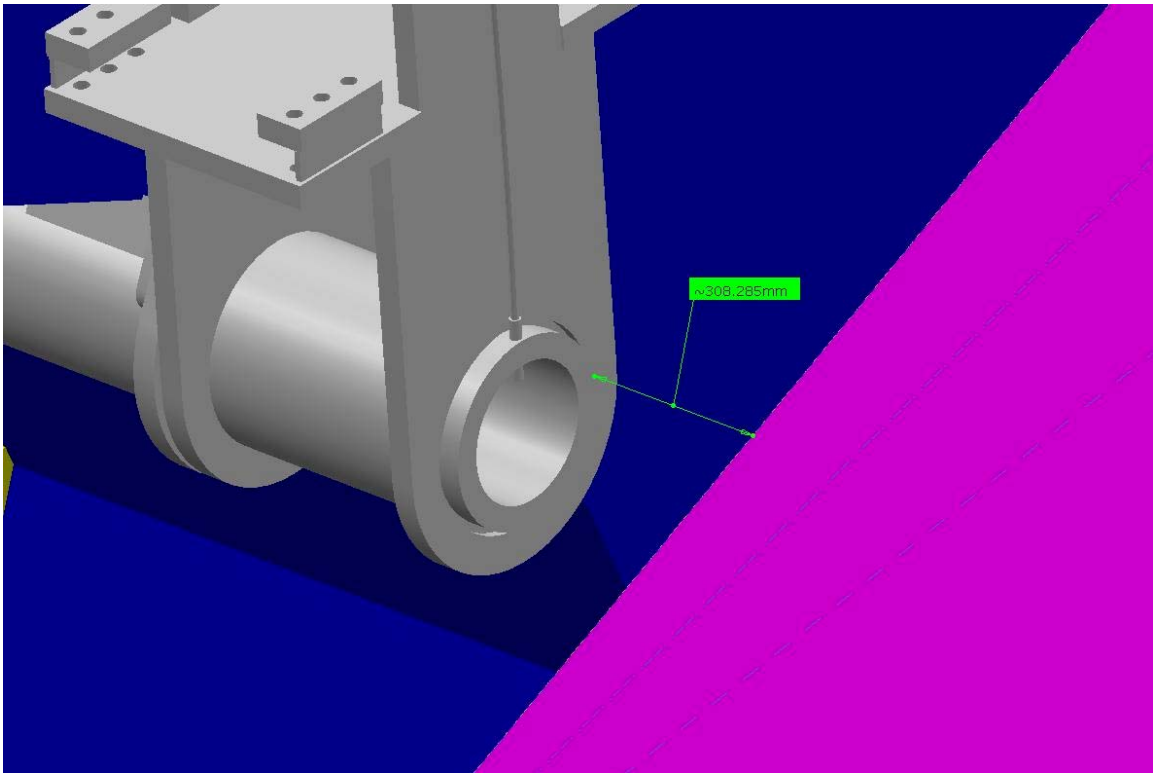
Segment #1: Movement from point 1 to point 2

Point F: Altitude 69.5m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Muon Chambers	308.30mm	Not Considered



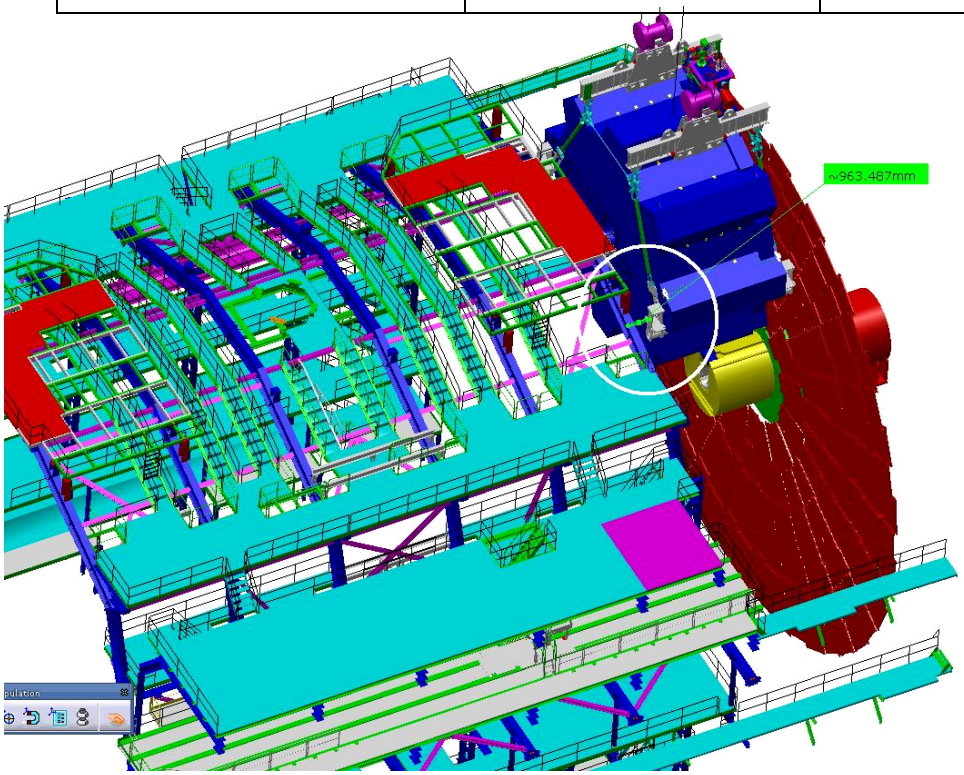
X=0.00mm
Y=-16’376.00mm
Z=10'745.00mm



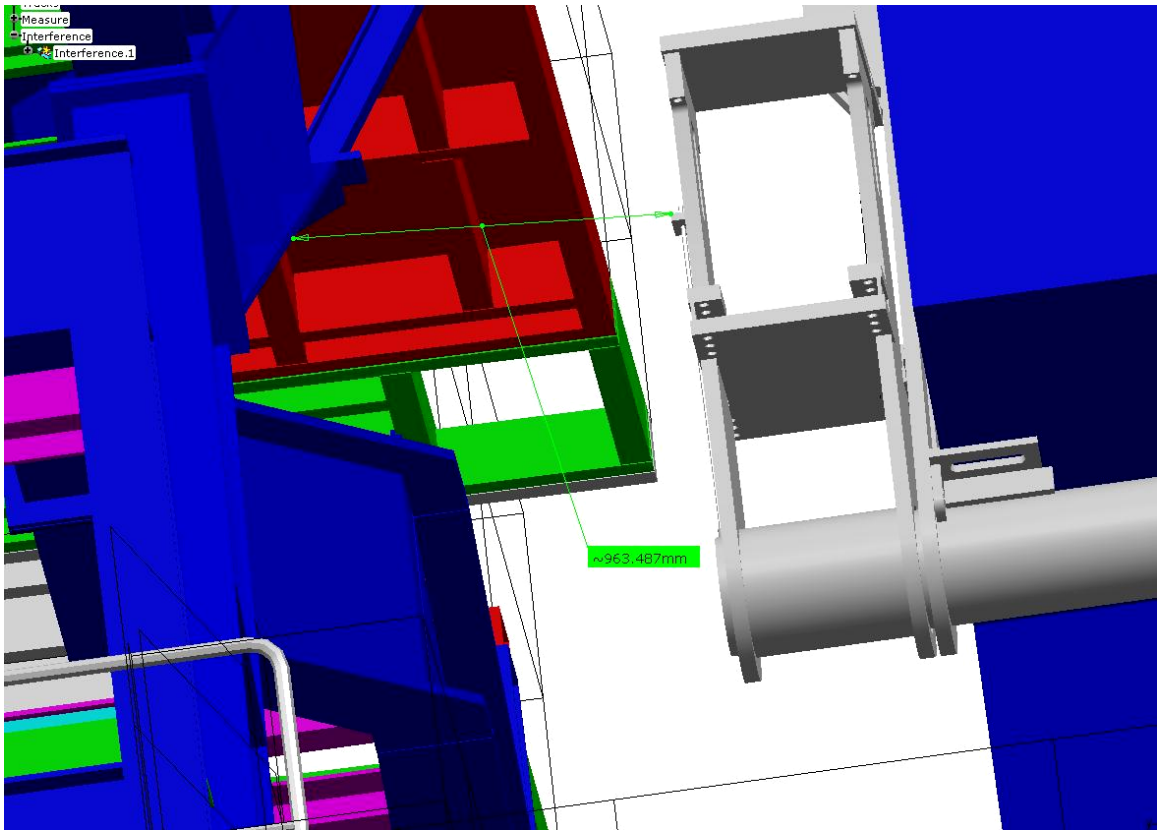
Segment #1: Movement from point 1 to point 2

Point G: Altitude 70.1m Side A / USA15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	HS Structure	963.50mm	Not Considered



X=0.00mm
Y=-16’376.00mm
Z=10'090.00mm

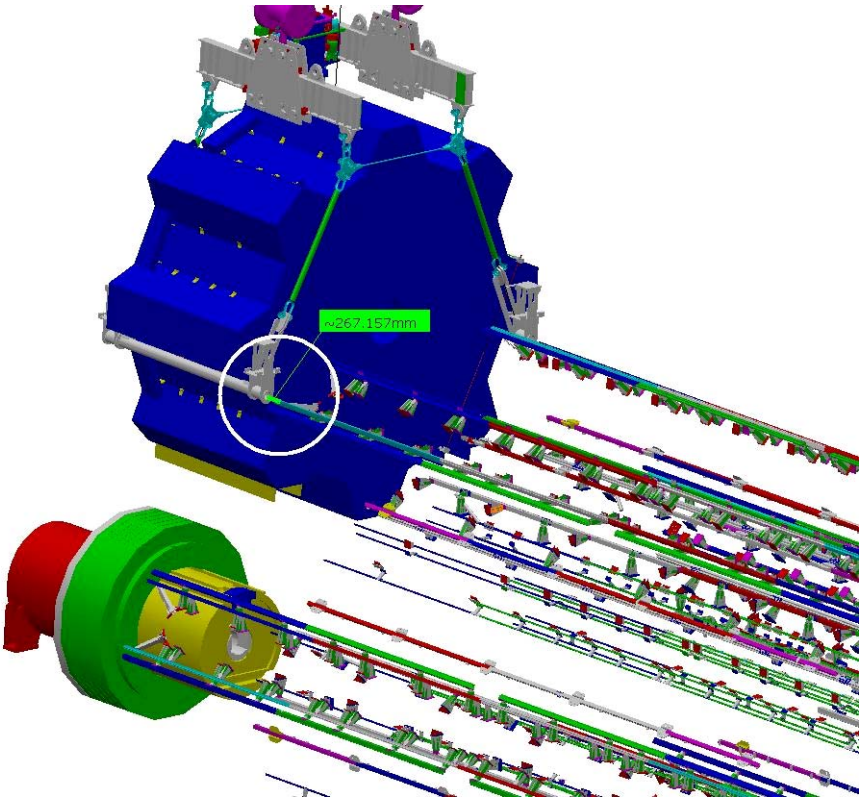


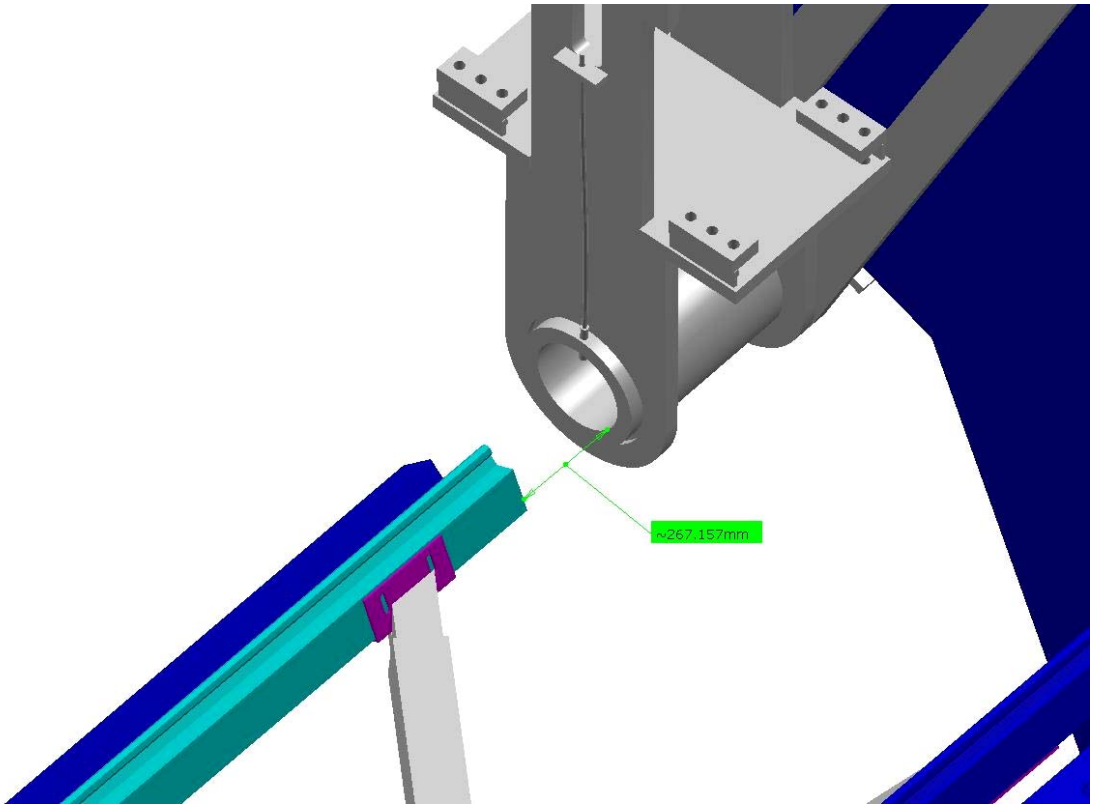
Segment #1: Movement from point 1 to point 2

Point H: Altitude 70.3m Side A / USA15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Barrel Brackets & Rails	267.00mm	Not Considered

X=0.00mm
Y=-16'376.00mm
Z=9'900.00mm

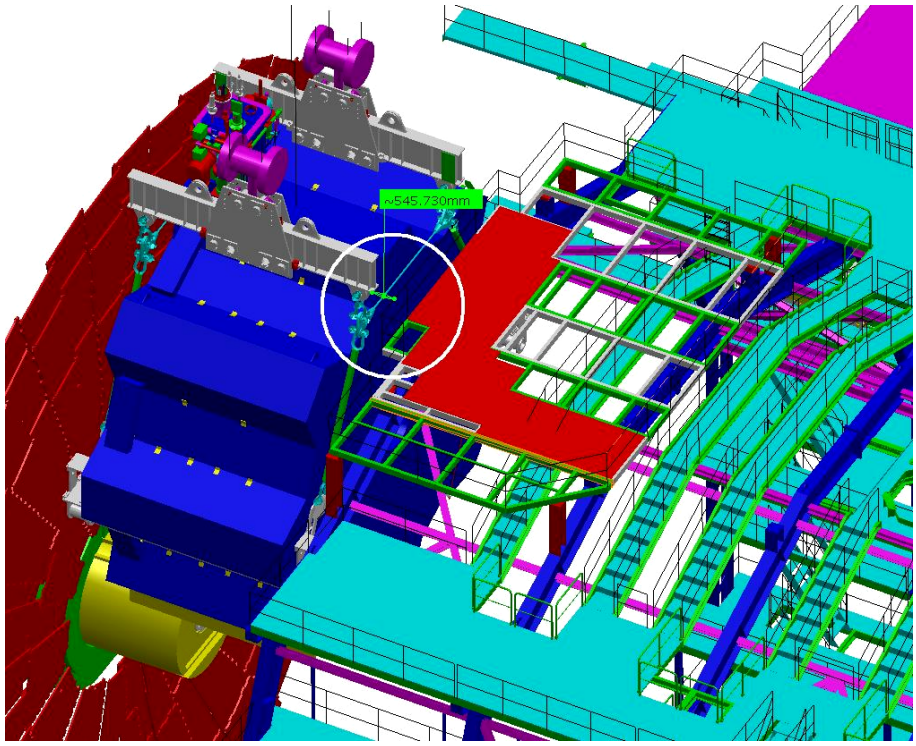




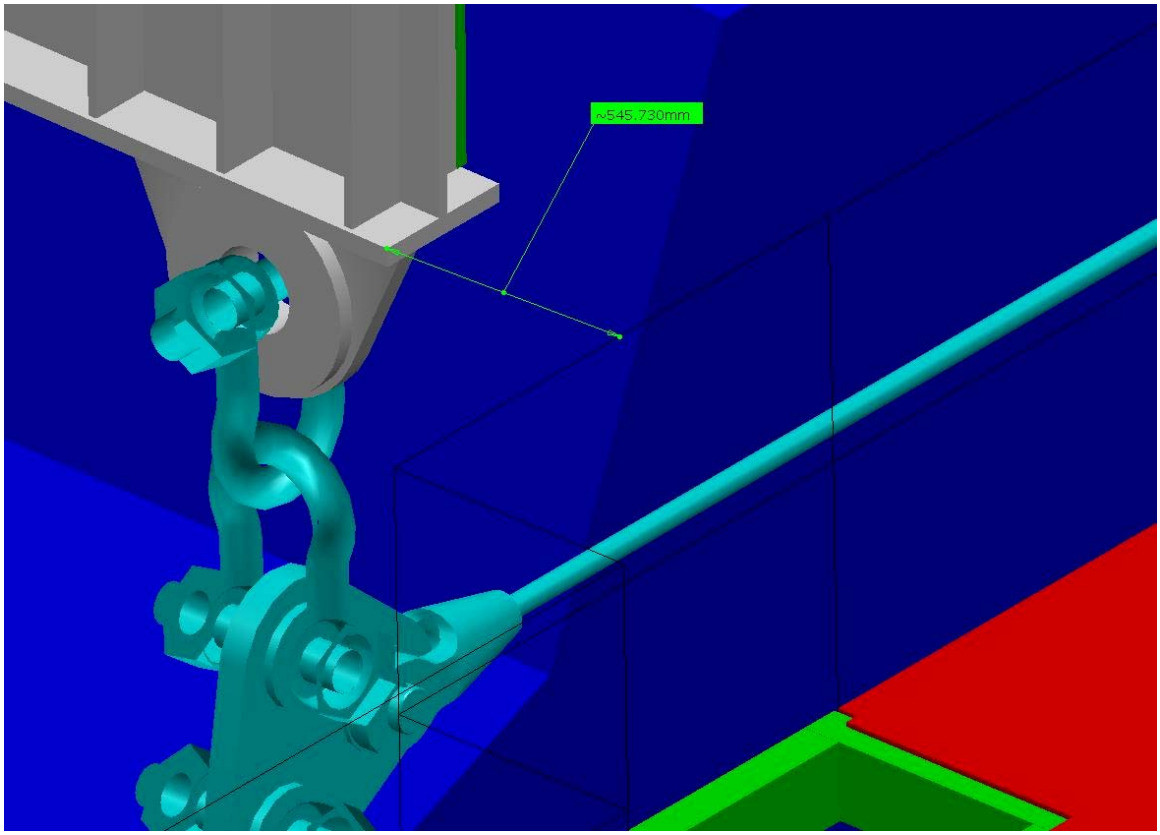
Segment #1: Movement from point 1 to point 2

Point I: Altitude 73.0m Side A / USA15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	HS Structure	545.73mm	Not Considered



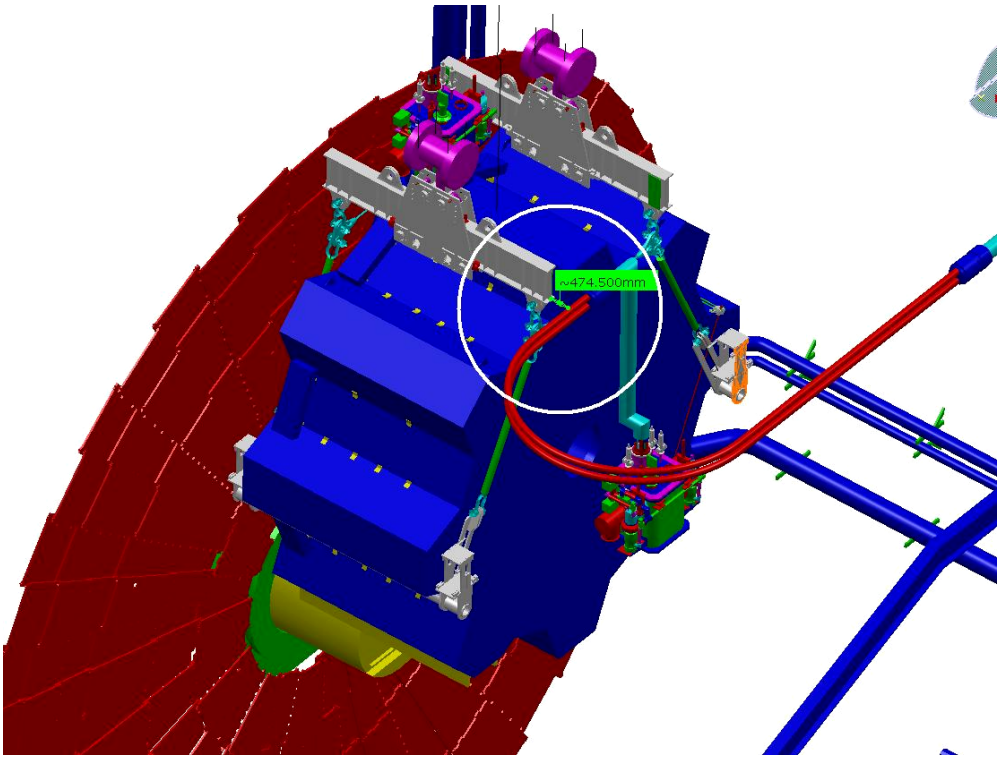
X=0.00mm
Y=-16’376.00mm
Z=7'300.00mm



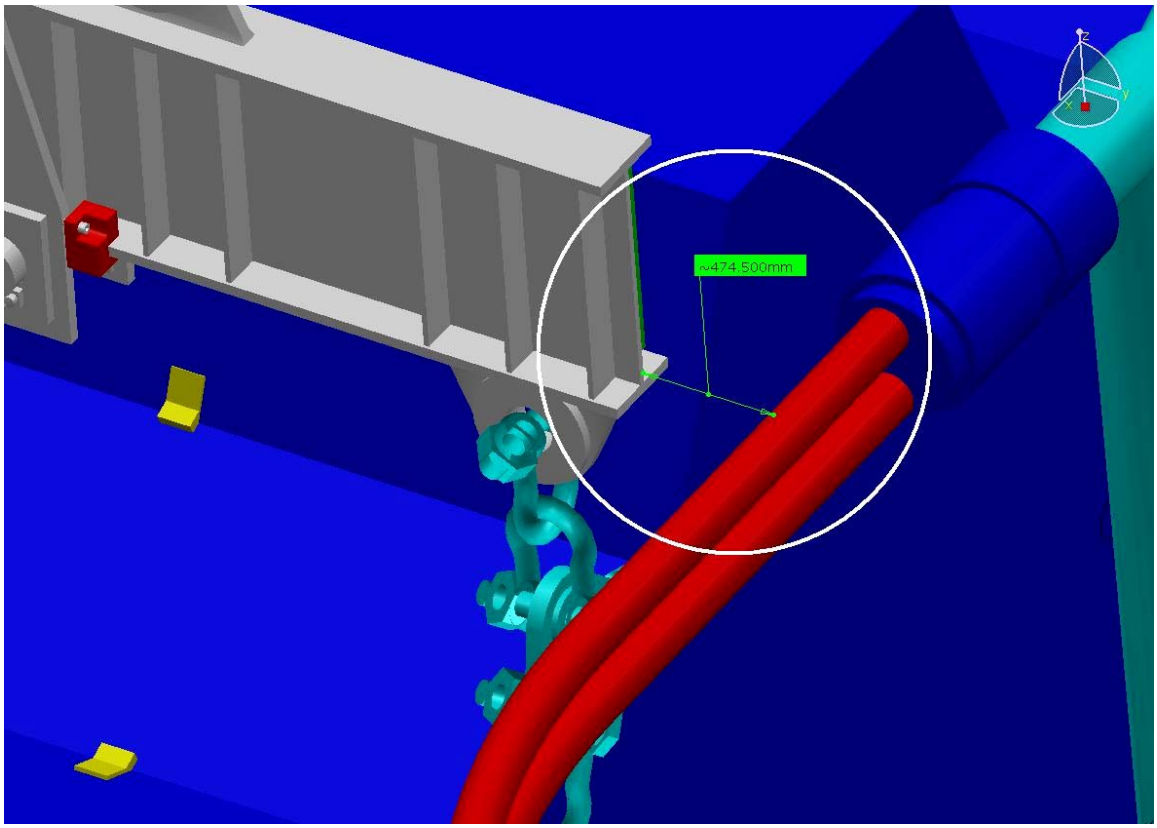
Segment #1: Movement from point 1 to point 2

Point J: Altitude 73.4m Side A / USA15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Cryogenic Pipe	474.50mm	Not Considered



X=0.00mm
Y=-16’376.00mm
Z=6'800.00mm



Segment #2: Movement from point 2 to point 3

X_2= 0.00 mm
Y_2= -16’376.00 mm
Z_2= 6’800.00 mm

X_3= 0.00 mm
Y_3= -15’975.00 mm
Z_3= 6’800.00 mm

$Length_{(Y)}$= 400.00 mm

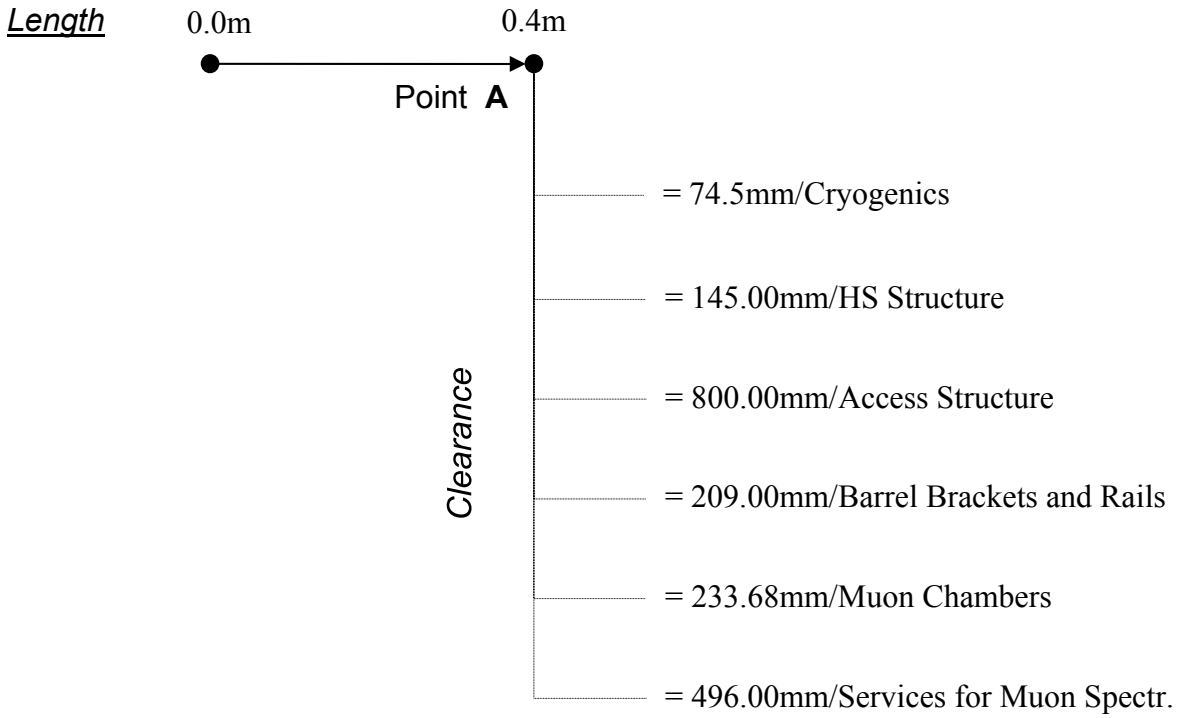
Picture 2

Table 3

Grouping Environment by the Clearance			
More then *1000mm*		Less then *1000mm*	
Environment	*Clearance (mm)*	*Environment*	*Clearance(mm)*
• Warm Structure	1’911.00	• Cryogenic pipe	74.50
• Heating & Ventilation		• HS Structure	145.00
• HO Structure		• Access Structure	800.00
• Services of Ext. Calorim.		• Barrel Brachets and Rails	209.00
• Vacuum Vessels		• Muon Chambers	233.70
		• Services for Muon Spectr.	496.00

Segment #2: Movement from point 2 to point 3

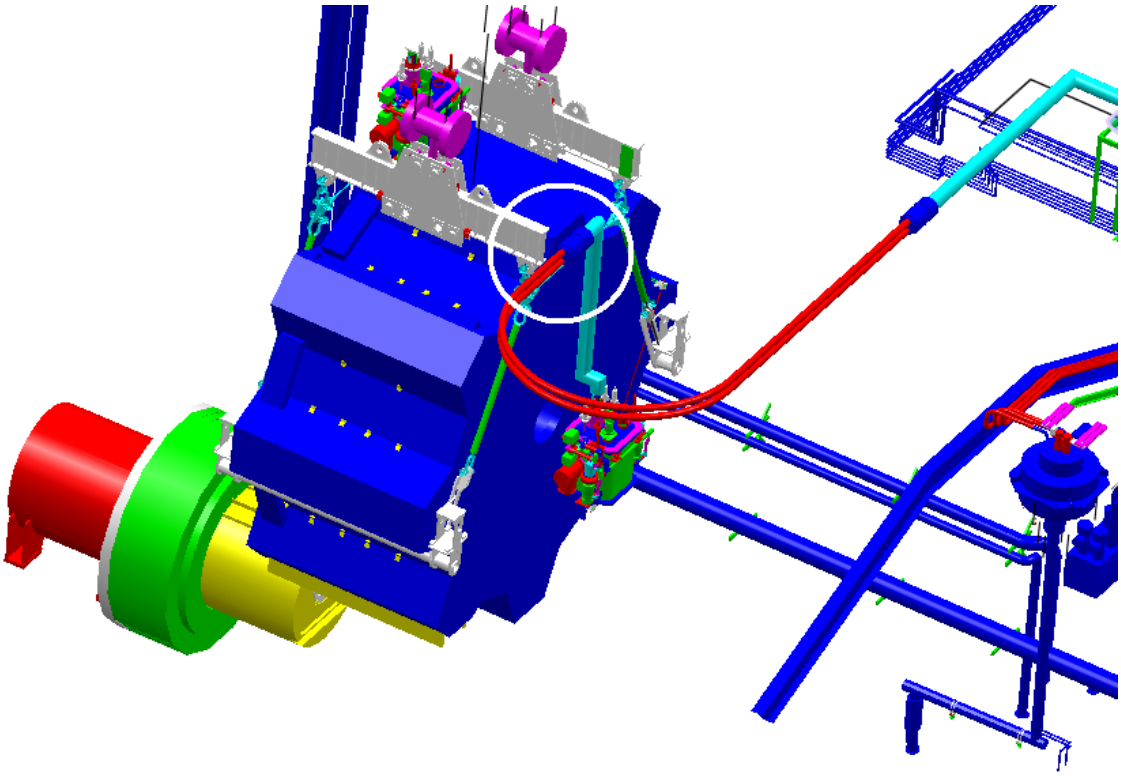
Conflicts Summary



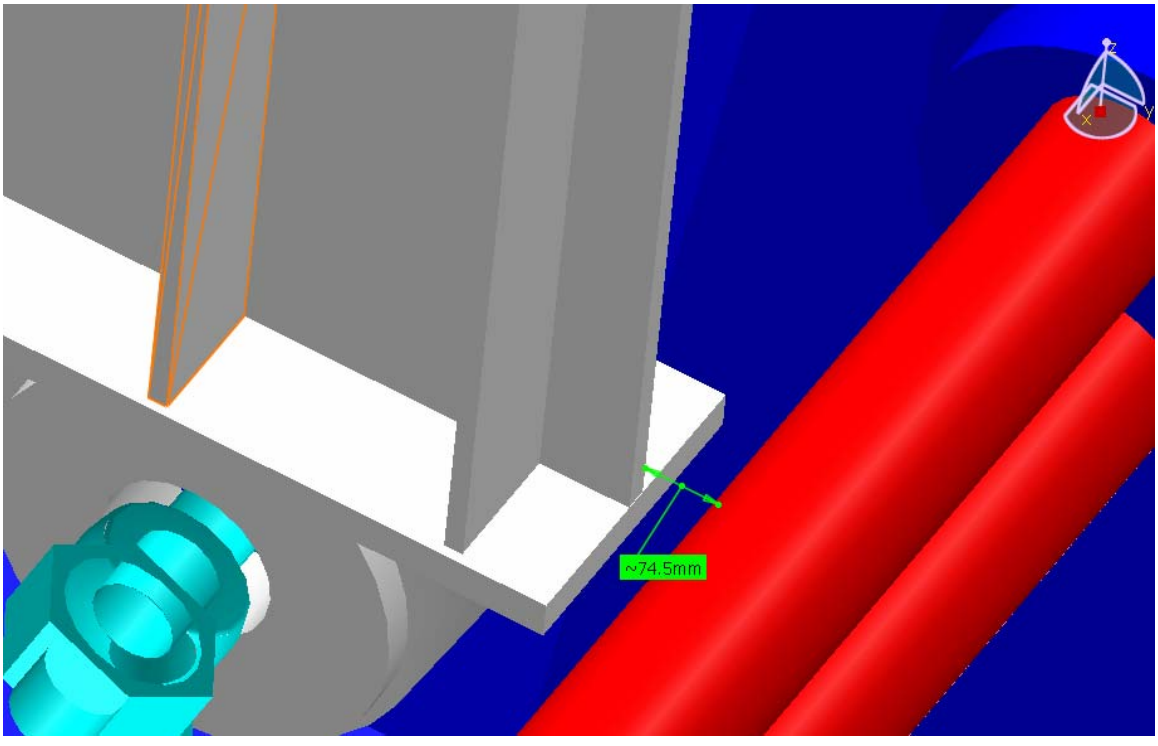
Segment #2: Movement from point 2 to point 3

Point A: Altitude 73.4m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Cryogenic Pipe	74.50mm	Not Considered



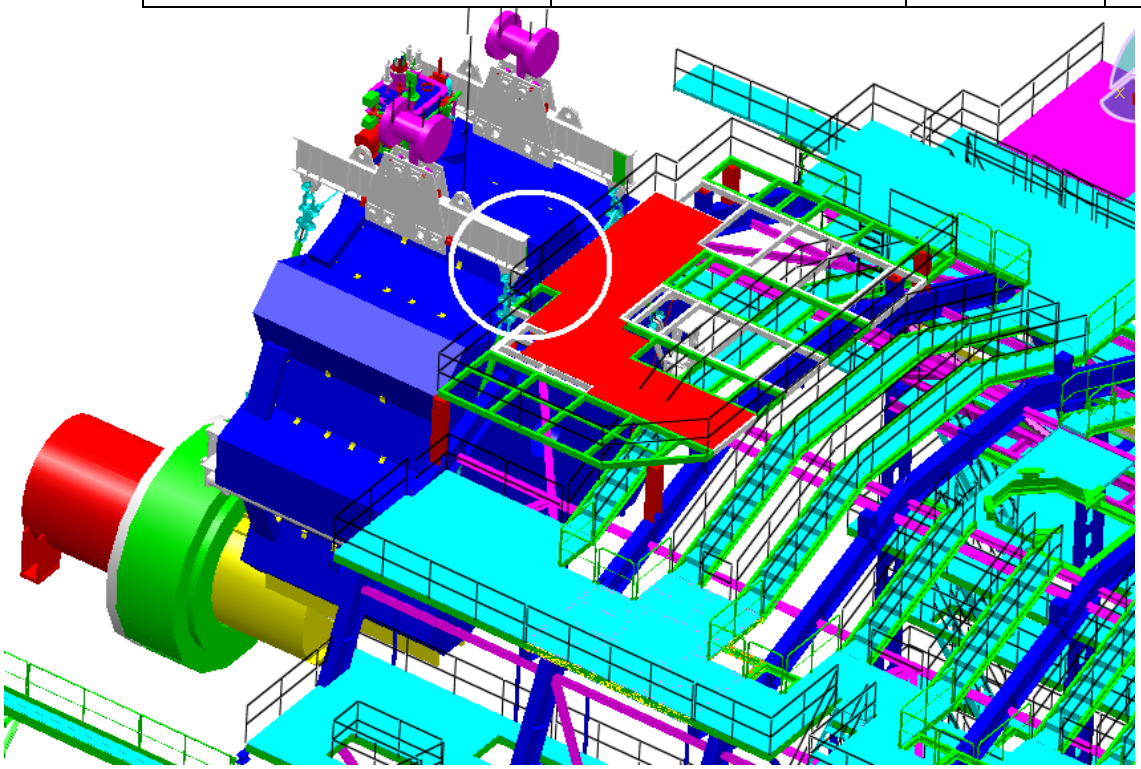
X=0.00mm
Y=-15’976.00mm
Z=6.800.00mm



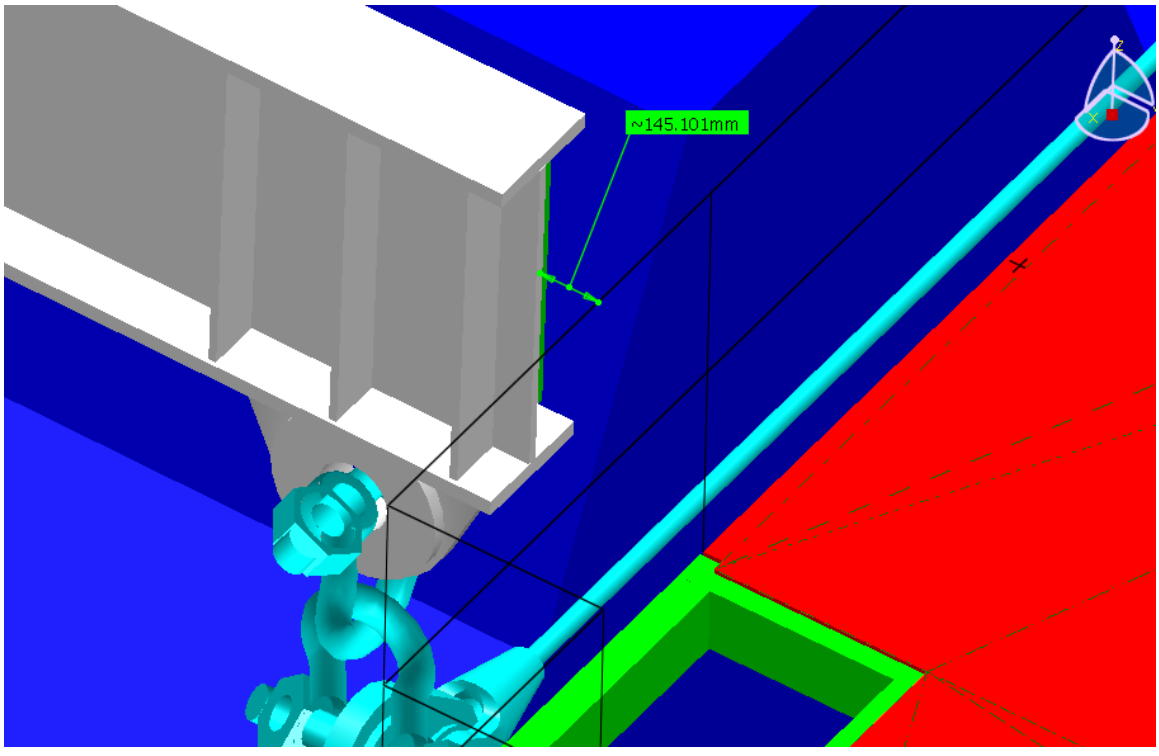
Segment #2: Movement from point 2 to point 3

Point A: Altitude 73.4m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	HS Structure	145.00mm	Not Considered



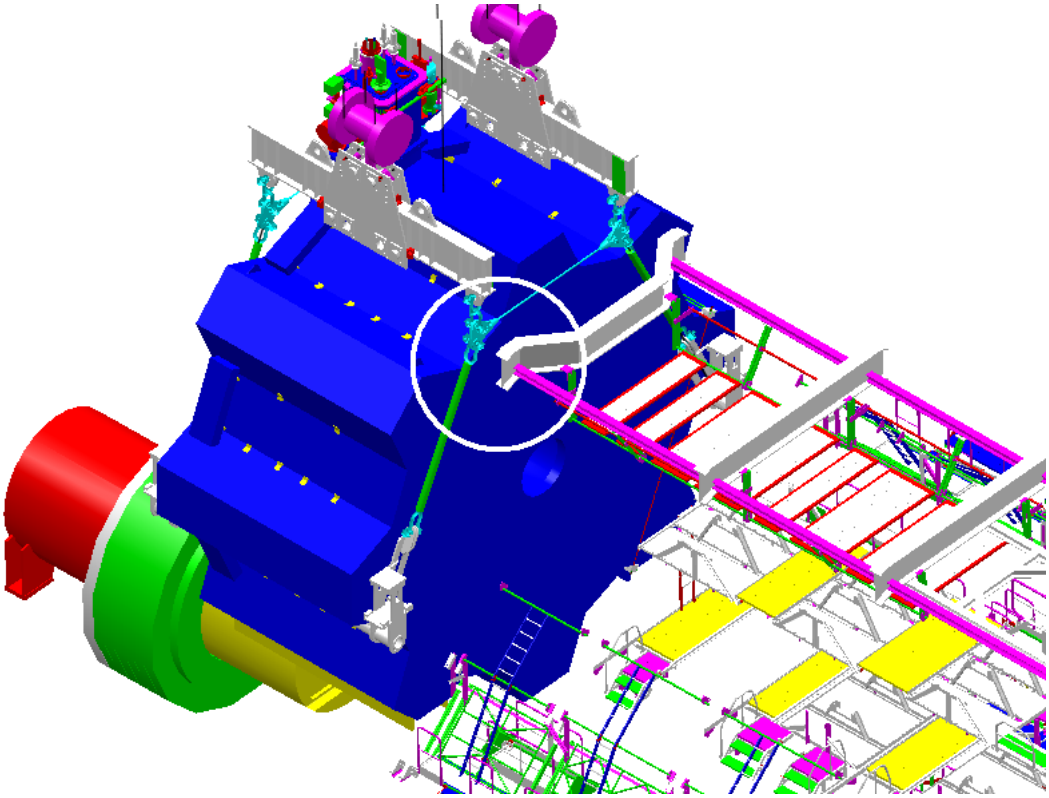
X=0.00mm
Y=-15'976.00mm
Z=6.800.00mm



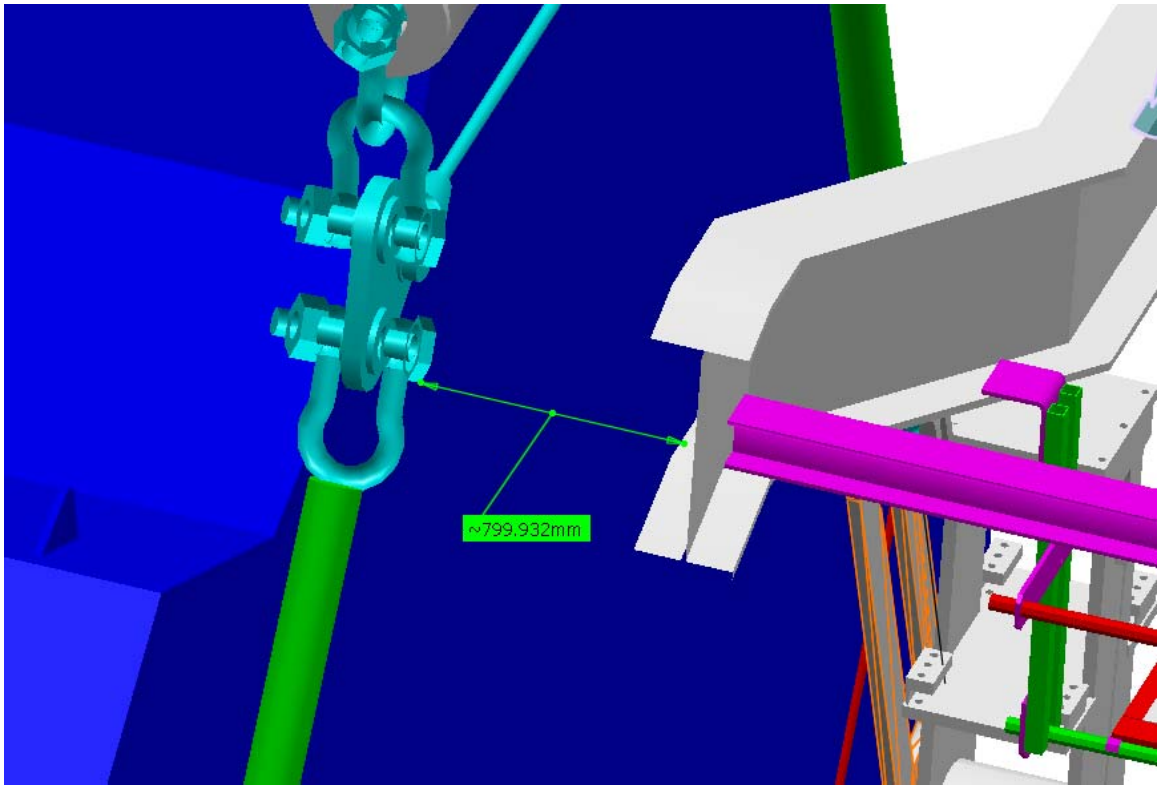
Segment #2: Movement from point 2 to point 3

Point A: Altitude 73.4m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Access Structure	800.00mm	Not Considered



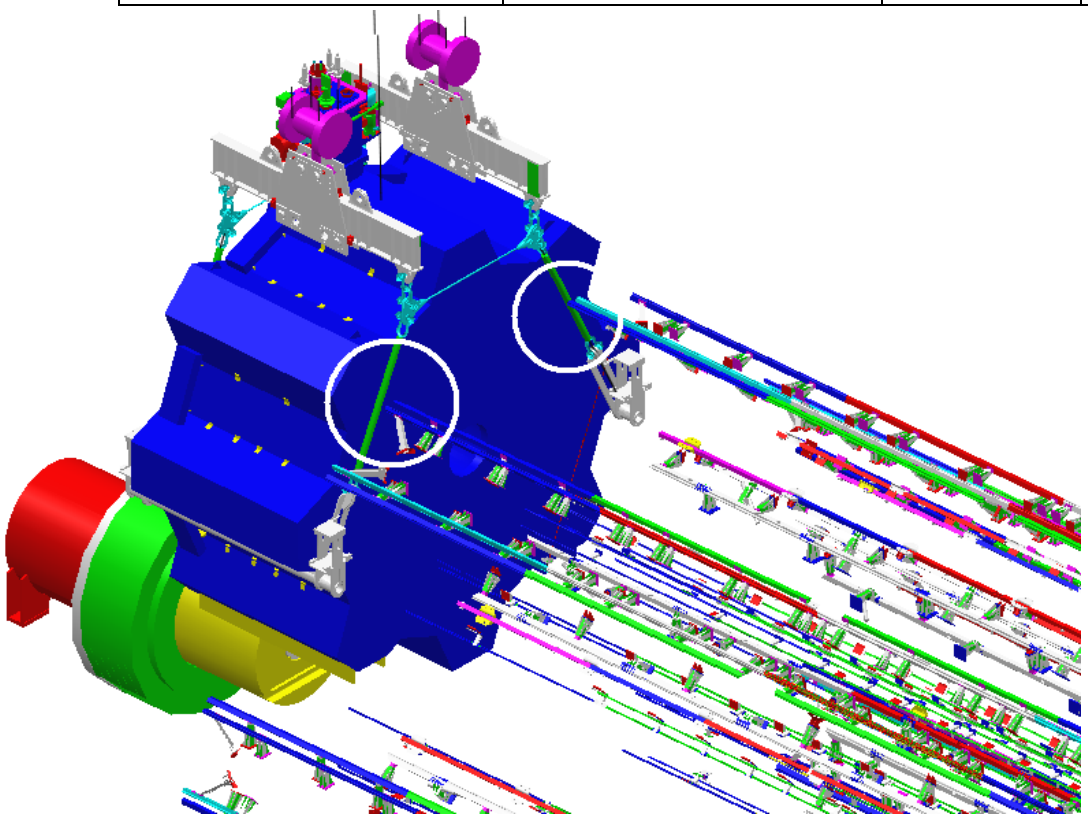
X=0.00mm
Y=-15’976.00mm
Z=6.800.00mm



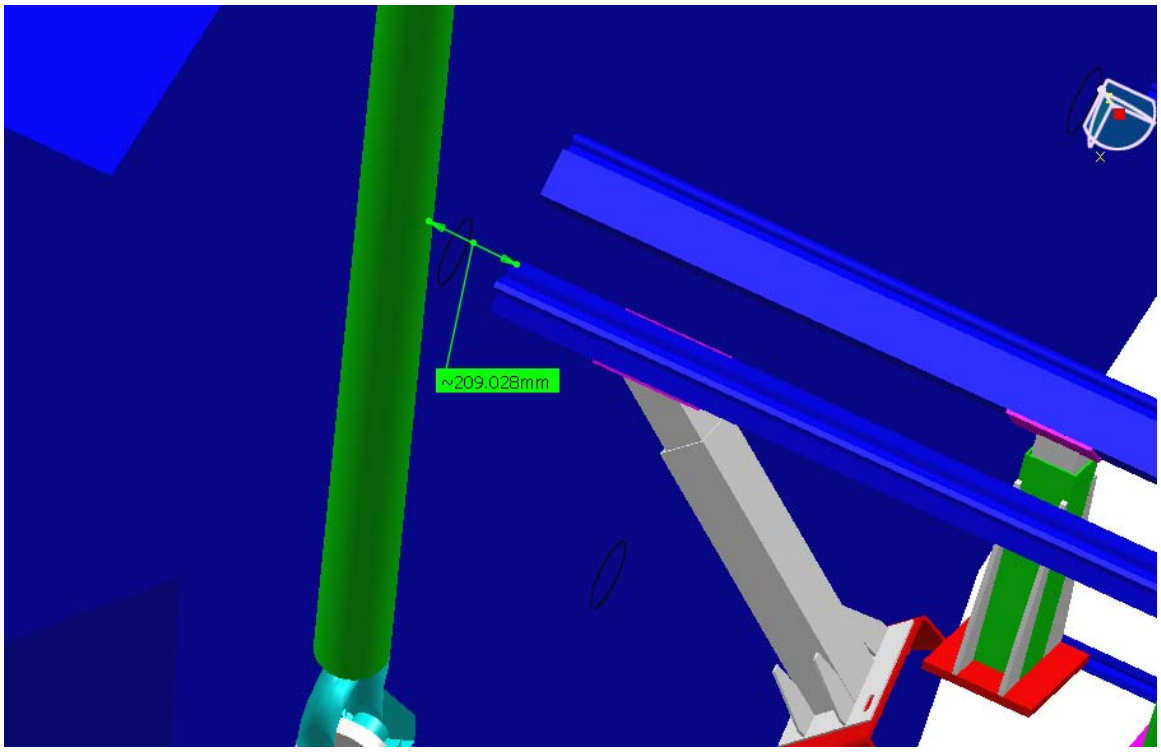
Segment #2: Movement from point 2 to point 3

Point A: Altitude 73.4m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Barrel Brackets and Rails	209.00mm	Not Considered



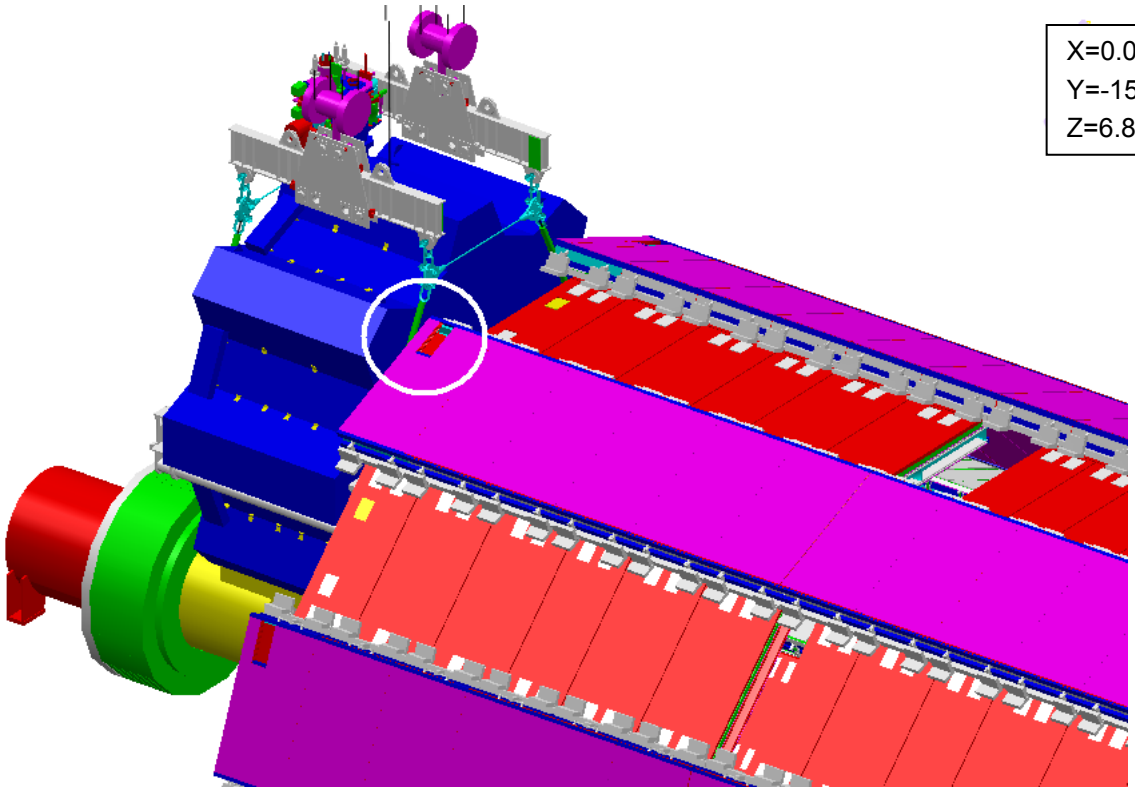
X=0.00mm
Y=-15’976.00mm
Z=6.800.00mm

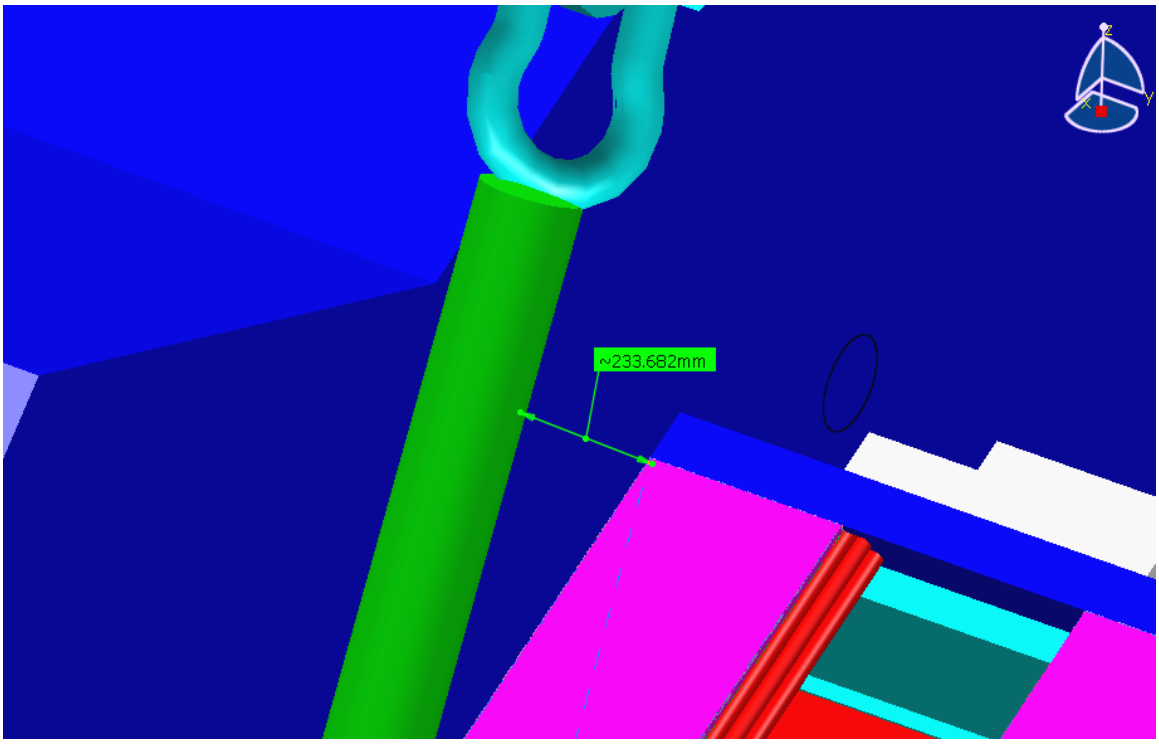


Segment #2: Movement from point 2 to point 3

Point A: Altitude 73.4m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Muon Chambers	233.68mm	Not Considered

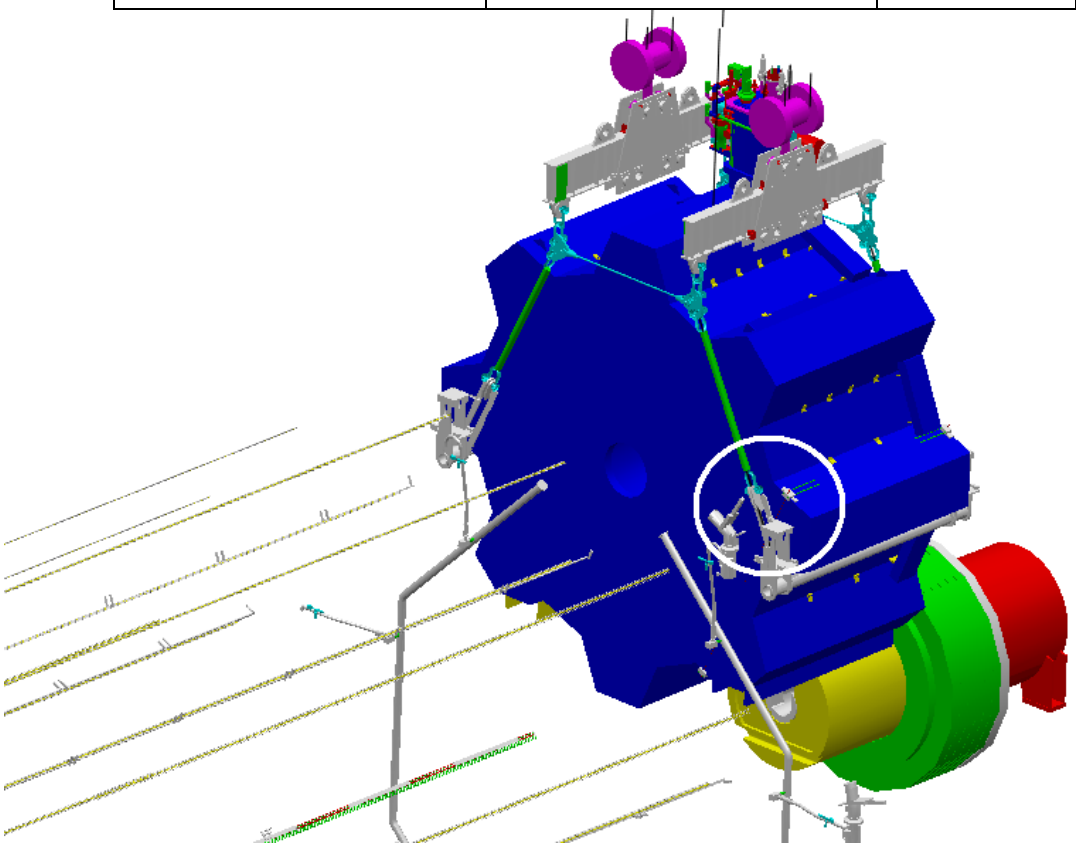




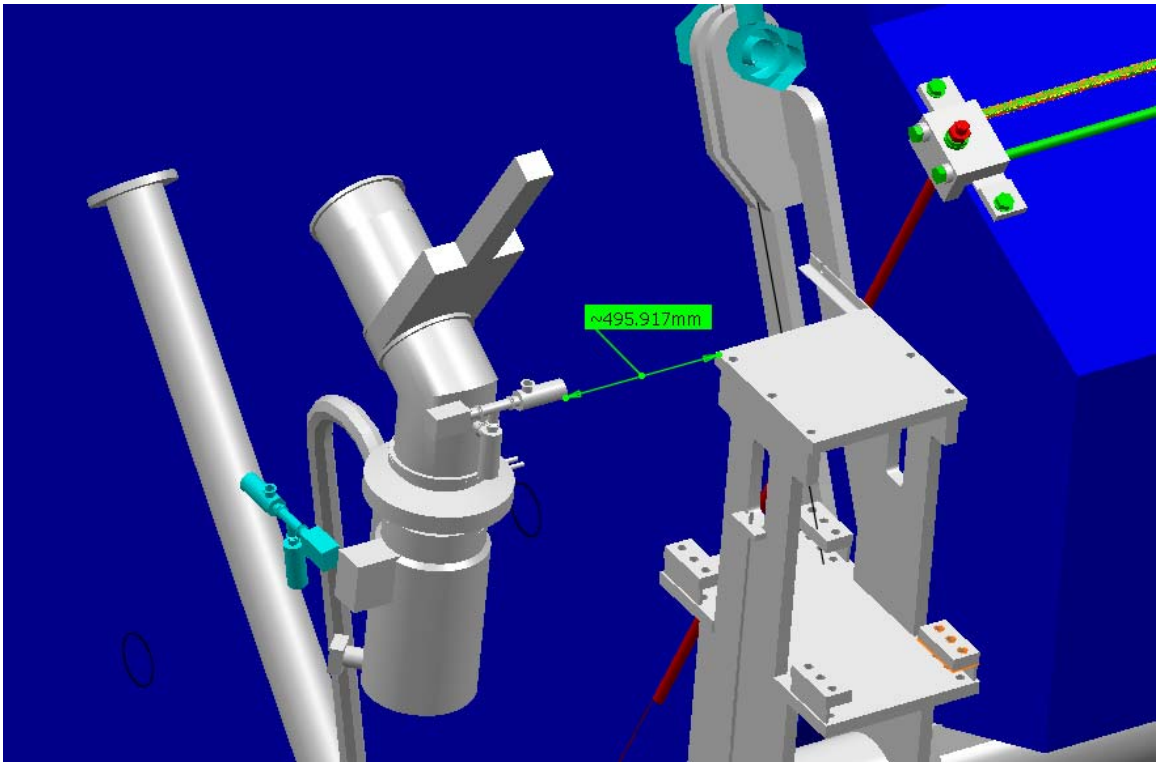
Segment #2: Movement from point 2 to point 3

Point A: Altitude 73.4m Side A / USA15

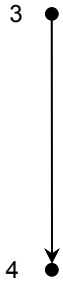
Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Services for Muon Spectr.	496.00mm	Not Considered



X=0.00mm
Y=-15'976.00mm
Z=6.800.00mm



Segment #3: Movement from point 3 to point 4



X_1= 0.00 mm
Y_1= -15'976.00 mm
Z_1= 6'800.00 mm

$Length_{(Z)}$= 6'800.00 mm

X_2= 0.00 mm
Y_2= -15'976.00 mm
Z_2= 0.00 mm

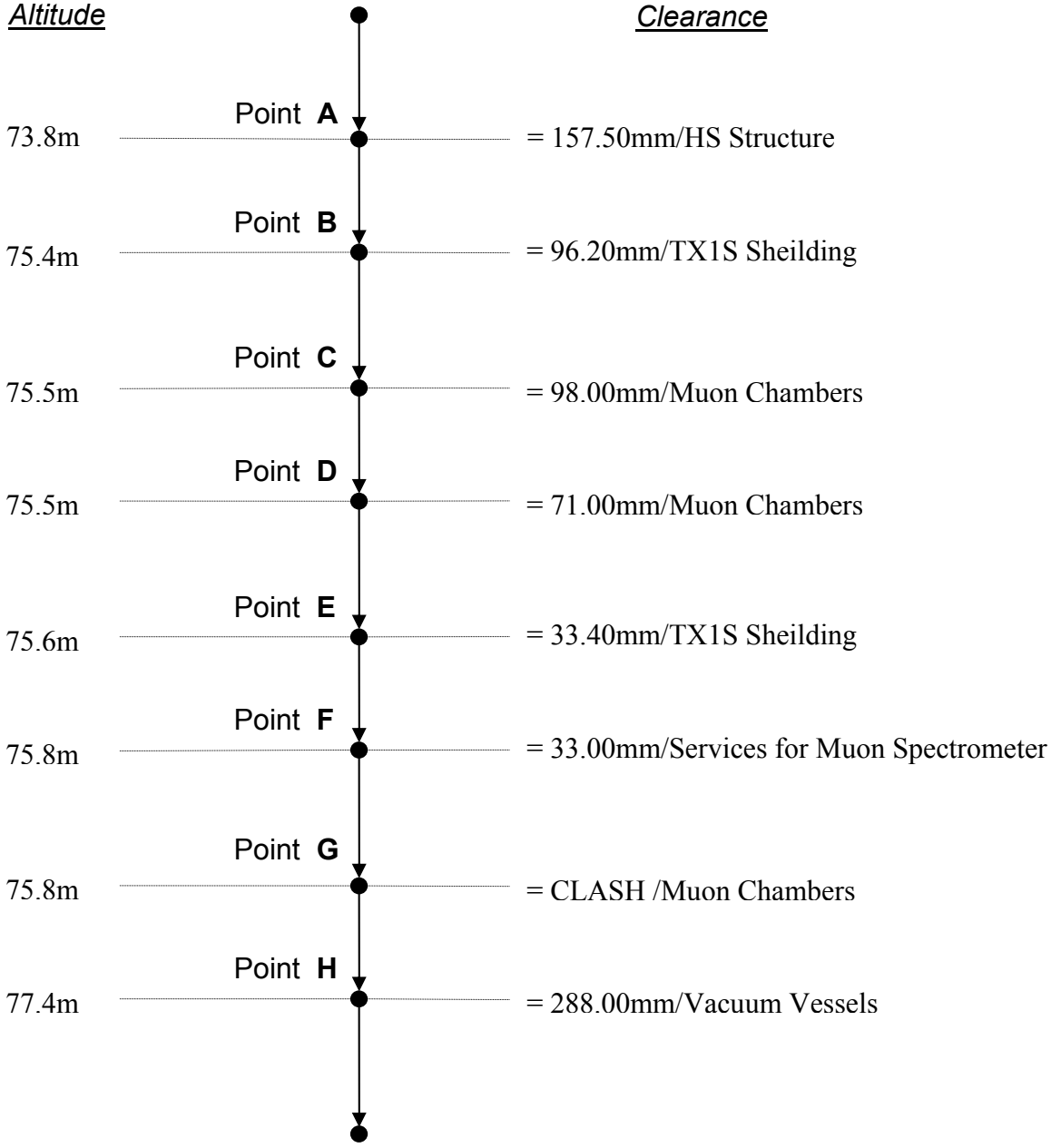
Picture 3

Table 4

Grouping Environment by the Clearance			
More then *1000mm*		Less then *1000mm*	
Environment	*Clearance (mm)*	*Environment*	*Clearance (mm)*
• Warm Structure		• Muon Chambers	CLASH
• Feet and Rails		• HS Structure	157.50
• HO Structure		• TX1S Sheilding	33.40
• Trucks in Access Position		• Services for Muon Spect.	33.00
• Access Structure		• Vacuum Vessels	288.00
• Services of Ext. Calorim.			
• Cryogenics			

Segment #3: Movement from point 3 to point 4

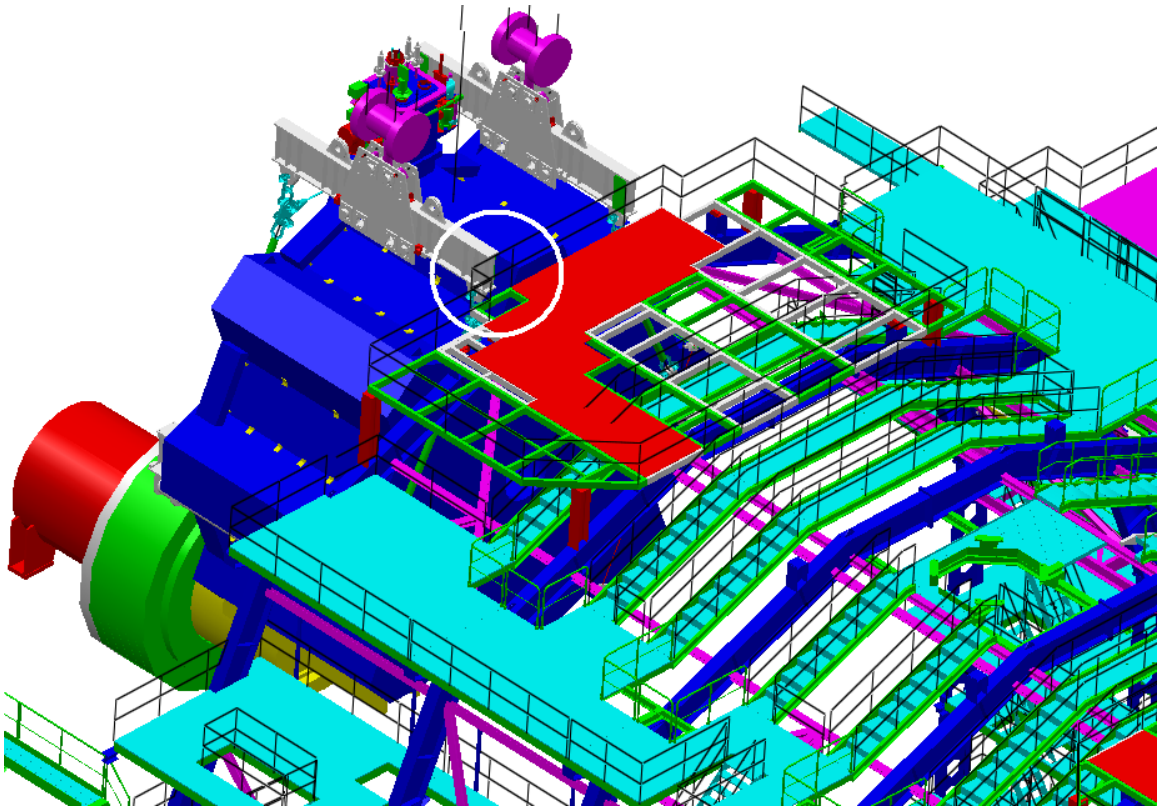
Conflicts Summary



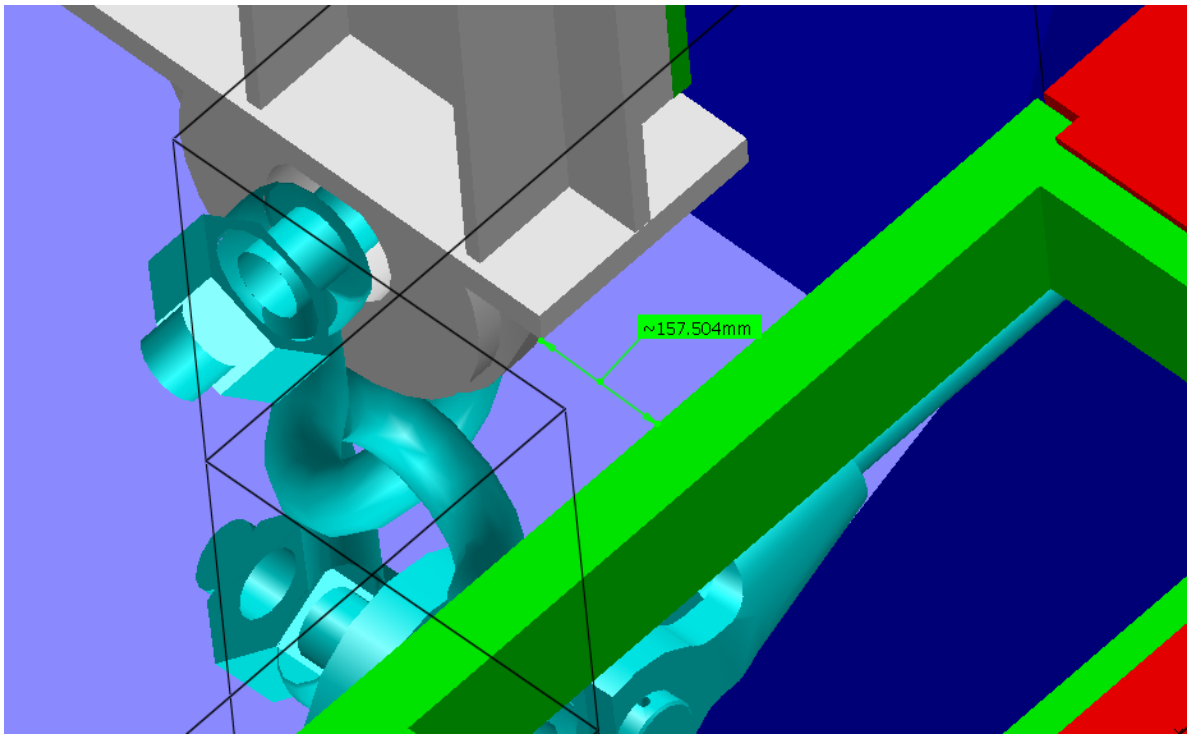
Segment #3: Movement from point 3 to point 4

Point A: Altitude 73.8m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	HS Structure	157.50mm	Not Considered



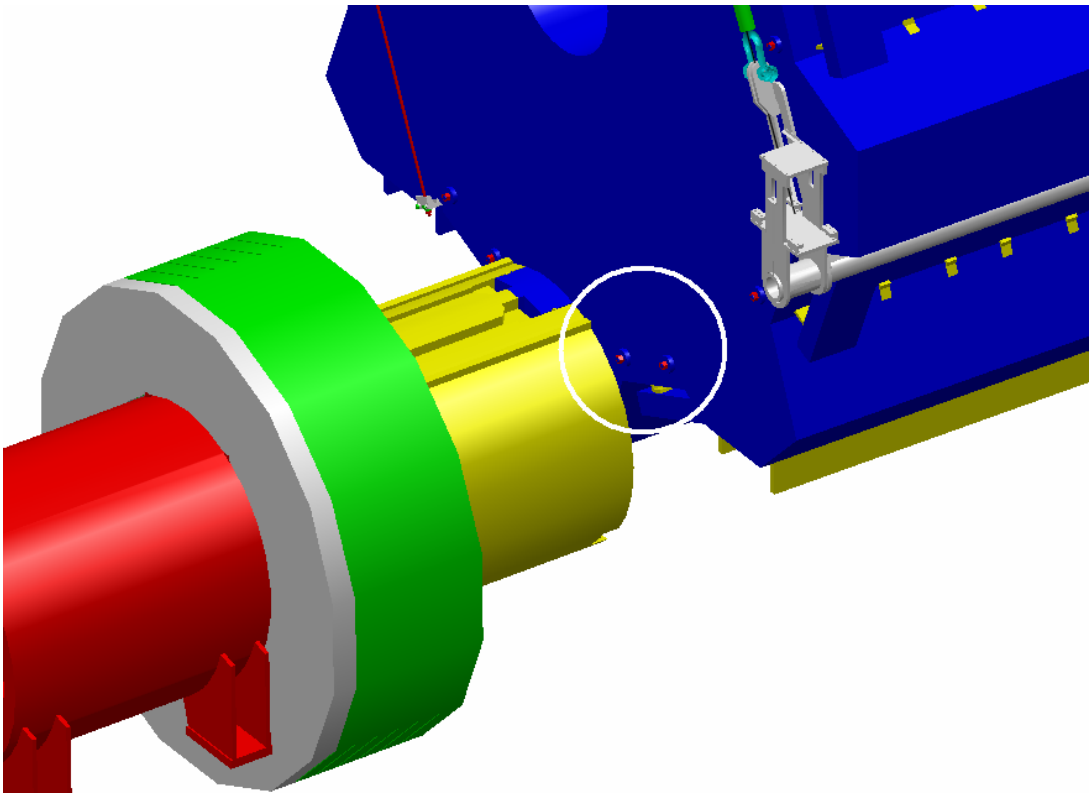
X=0.00mm
Y=-15’976.00mm
Z=6’370.00mm



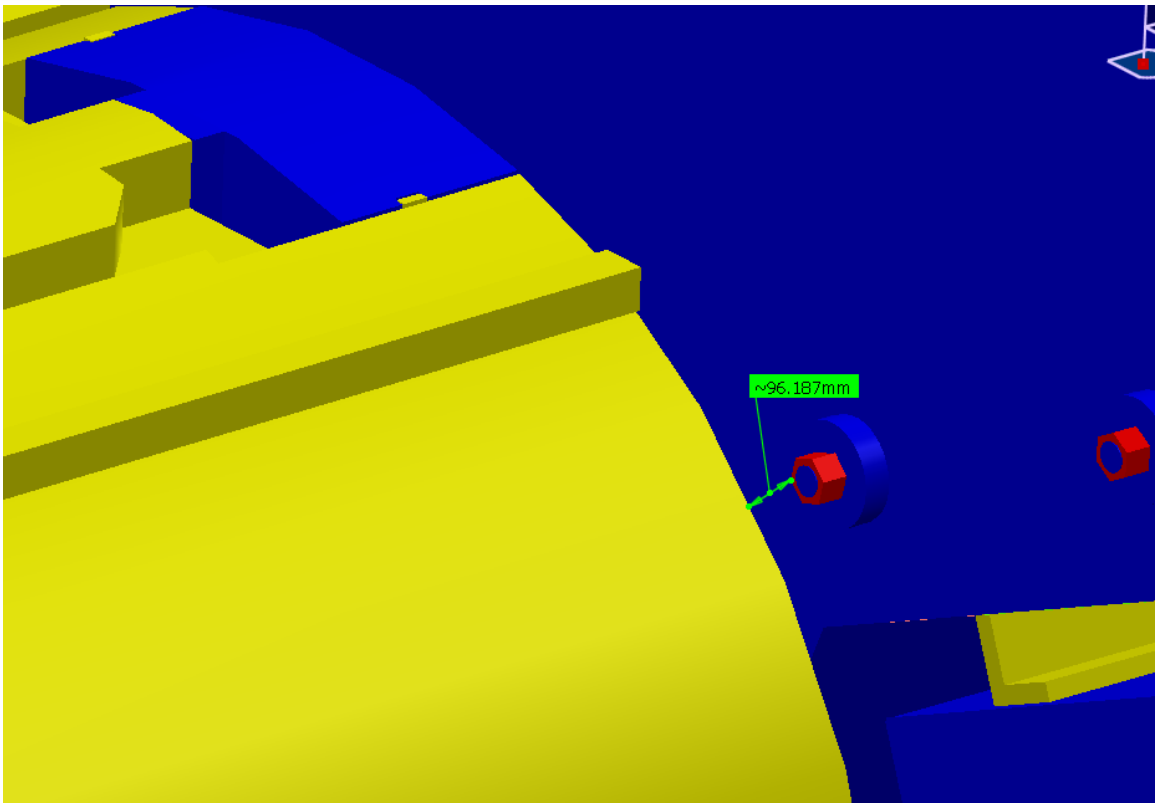
Segment #3: Movement from point 3 to point 4

Point B: Altitude 75.4m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	TX1S Sheildin	96.20mm	Not Considered



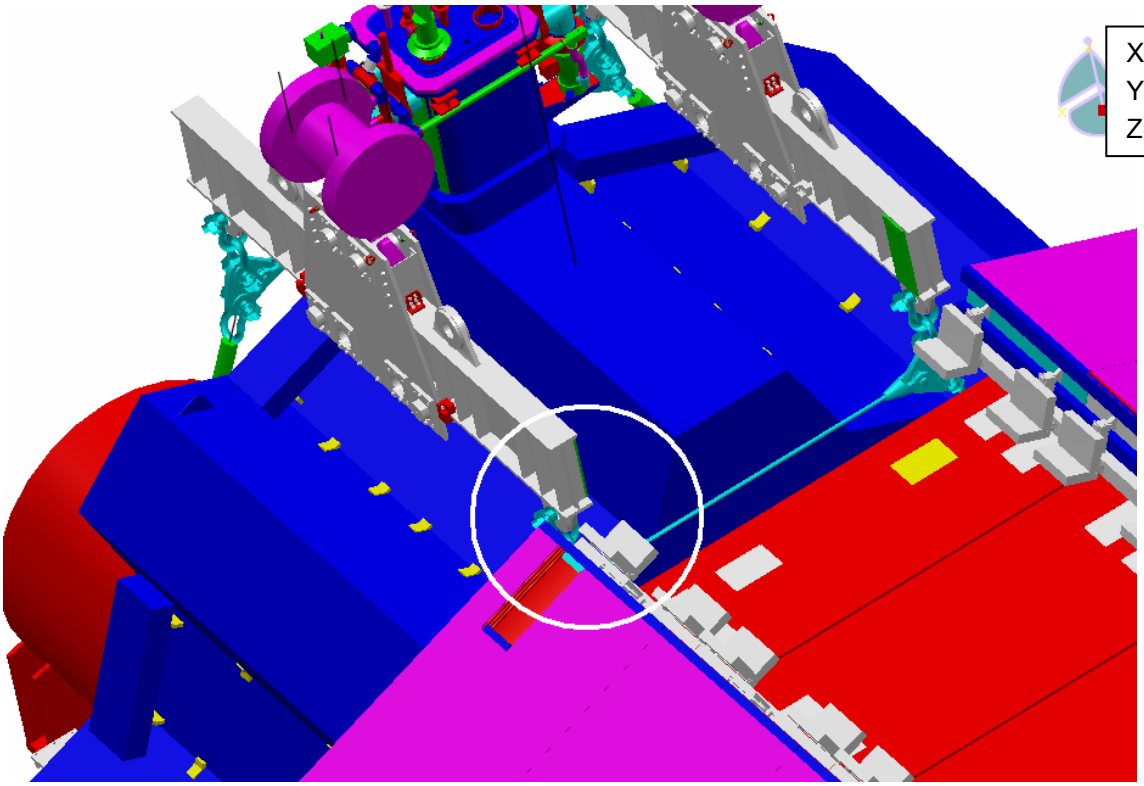
X=0.00mm
Y=-15’976.00mm
Z=4'779.00mm

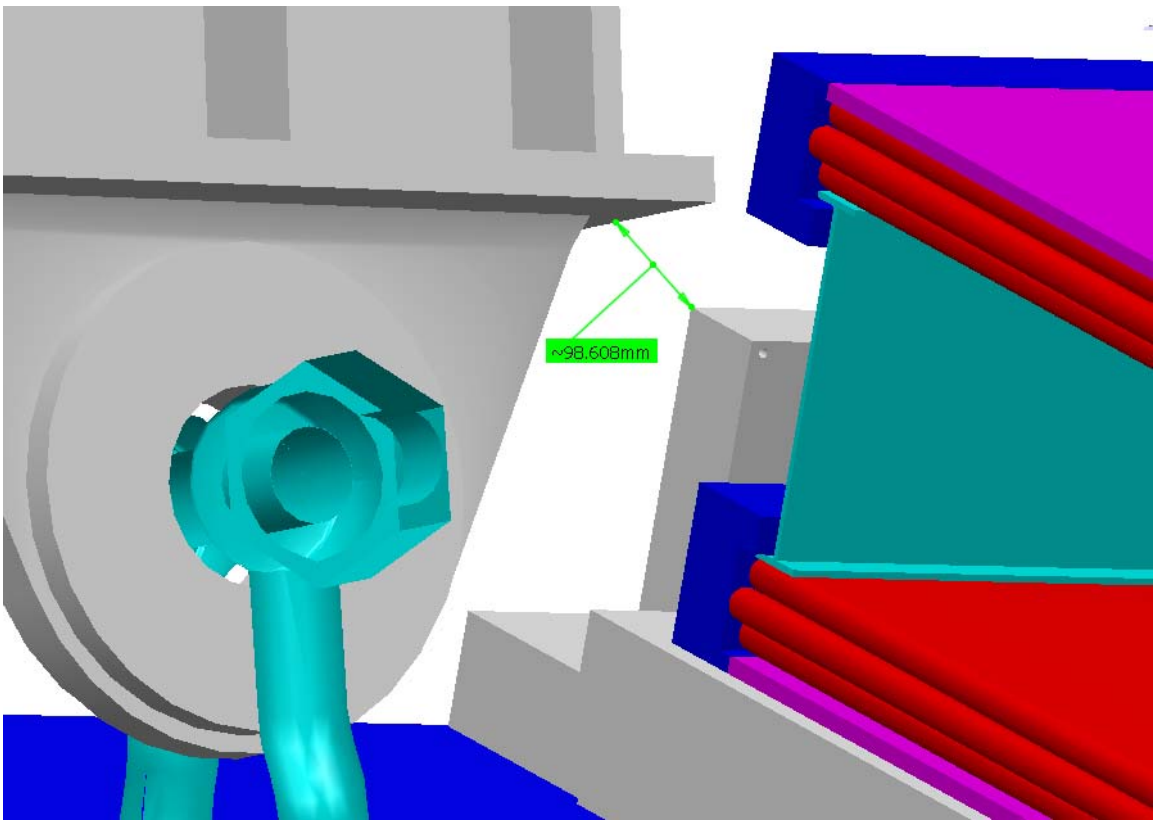


Segment #3: Movement from point 3 to point 4

Point C: Altitude 75.5m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Muon Chambers	98.00mm	Not Considered

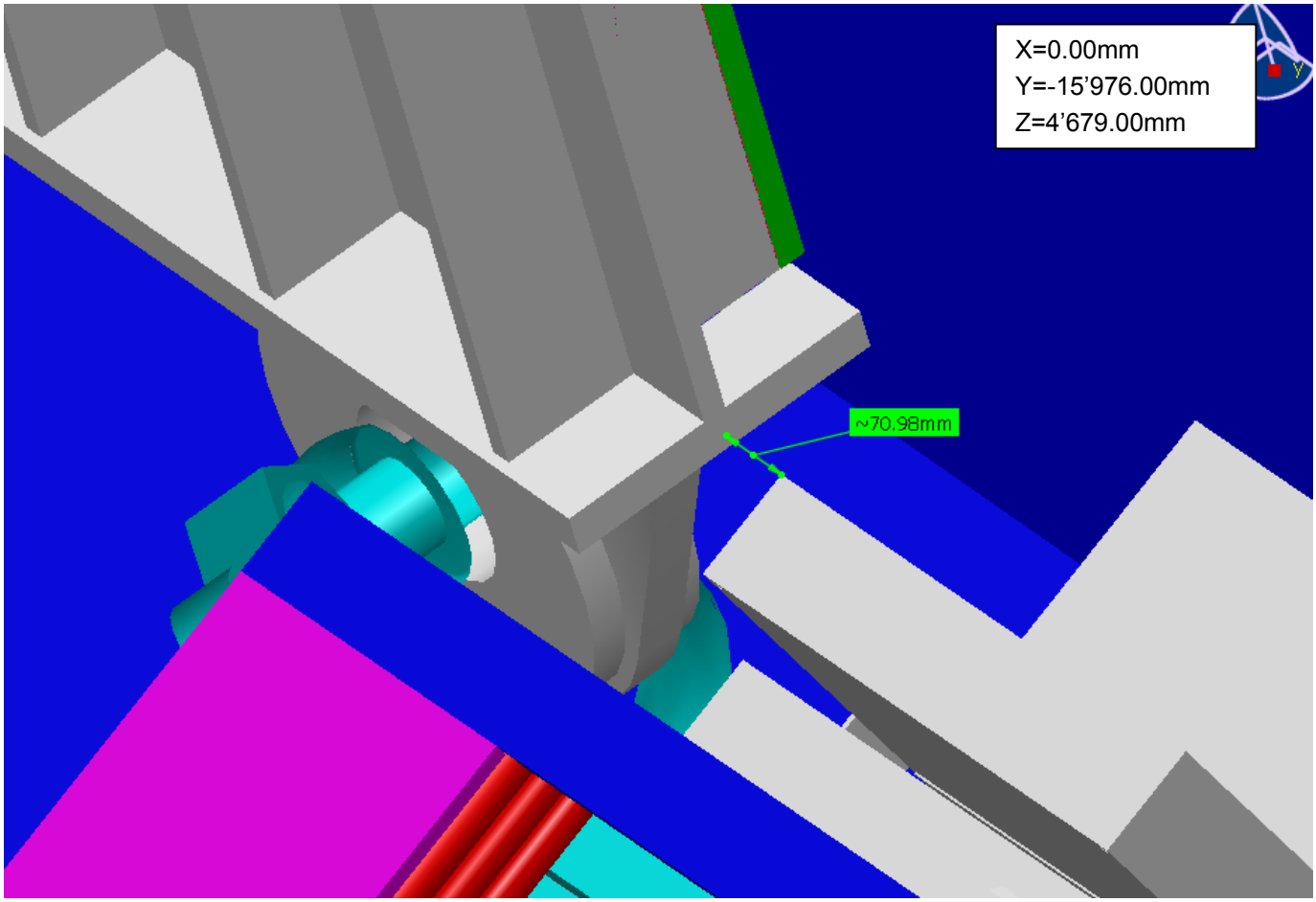




Segment #3: Movement from point 3 to point 4

Point D: Altitude 75.5m Side A / US15

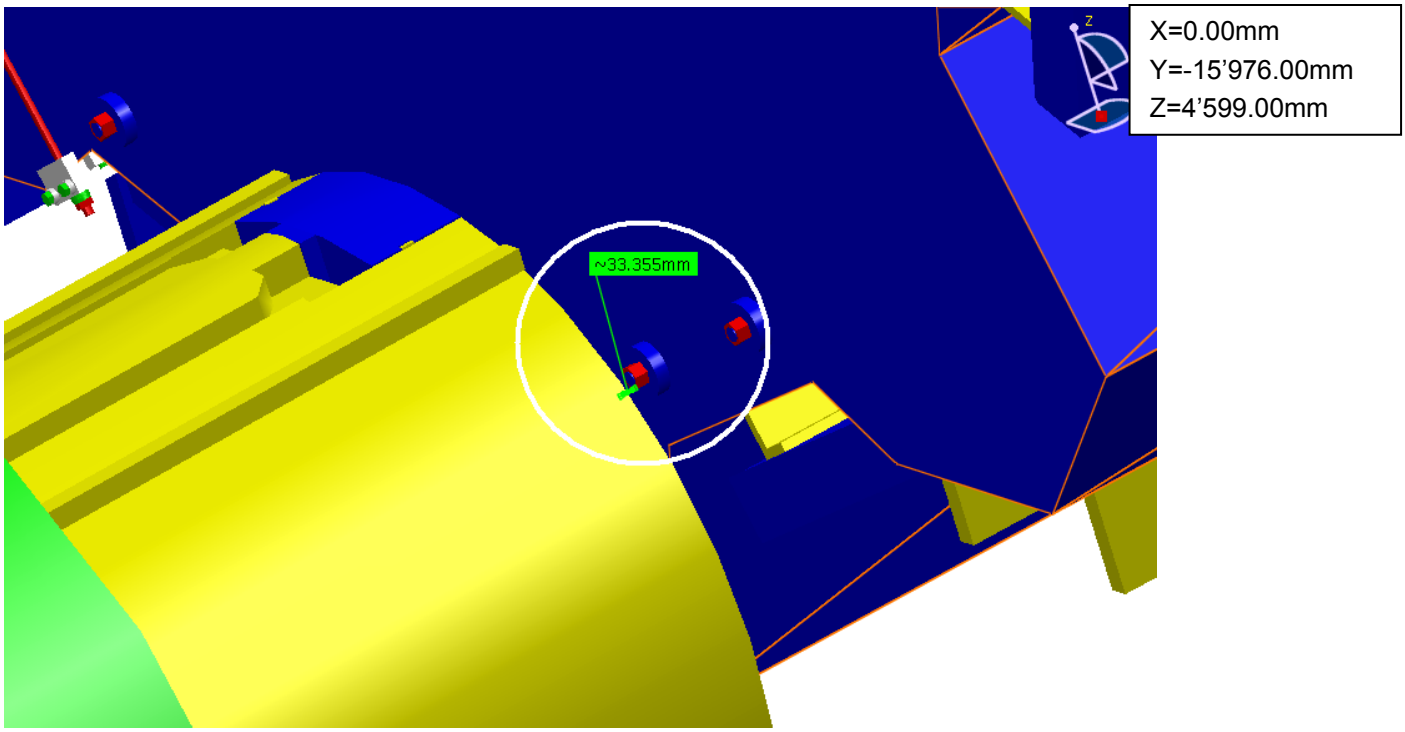
Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Muon Chambers	71.00mm	Not Considered

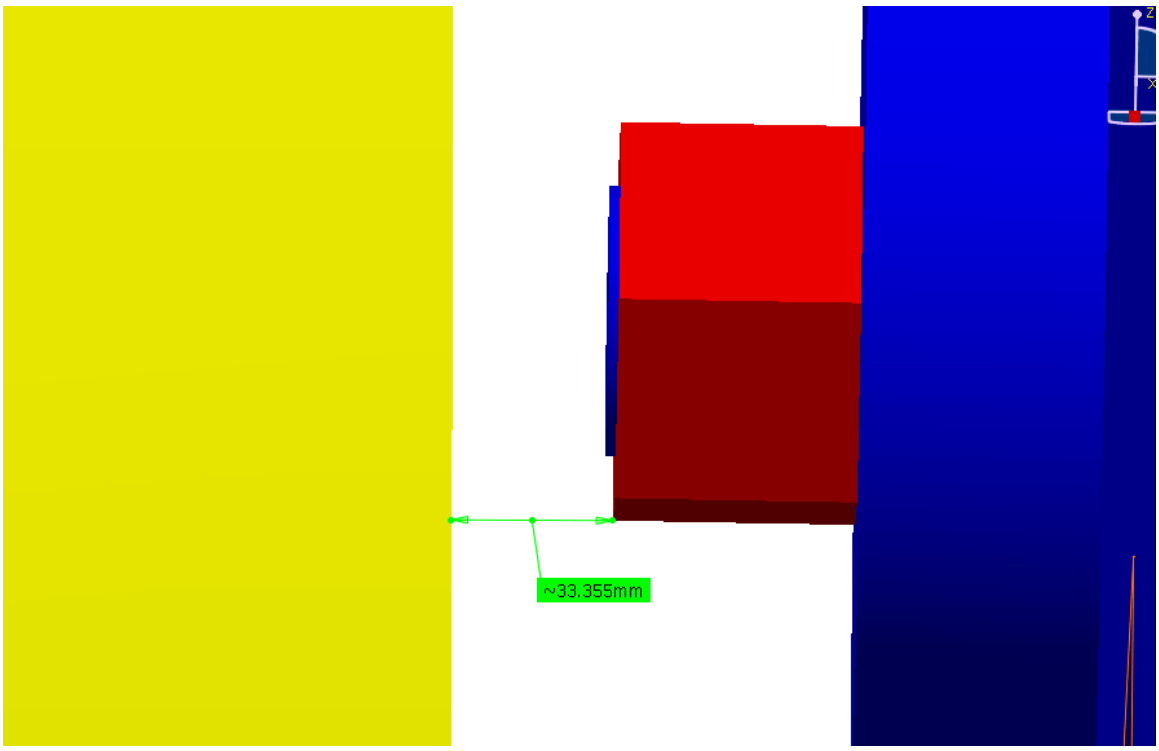


Segment #3: Movement from point 3 to point 4

Point E: Altitude 75.6m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	TX1S Sheilding	33.40mm	Not Considered



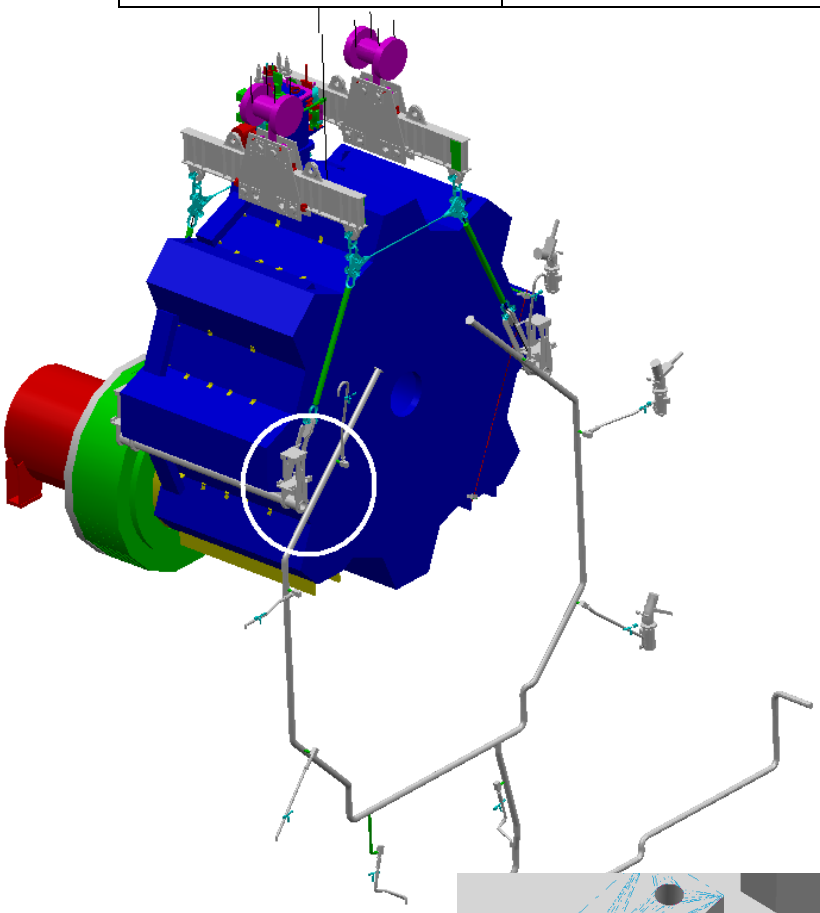


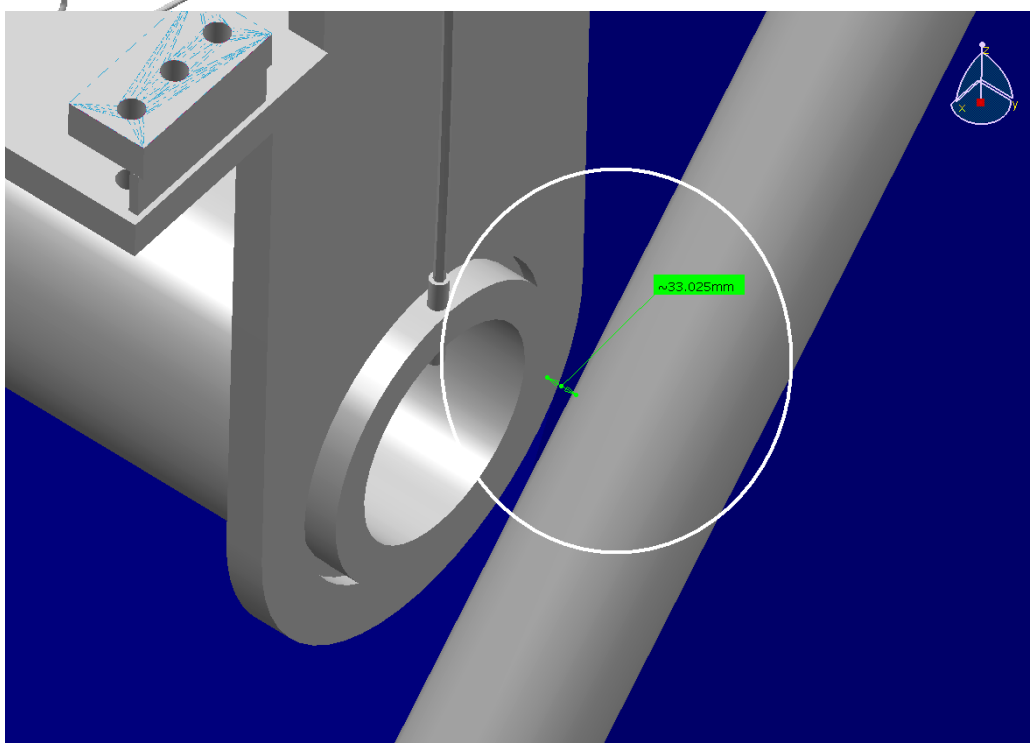
Segment #3: Movement from point 3 to point 4

Point F: Altitude 75.8m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Services for Muon Spectr.	33.00mm	Not Considered

X=0.00mm
Y=-15’976.00mm
Z=4’449.00mm

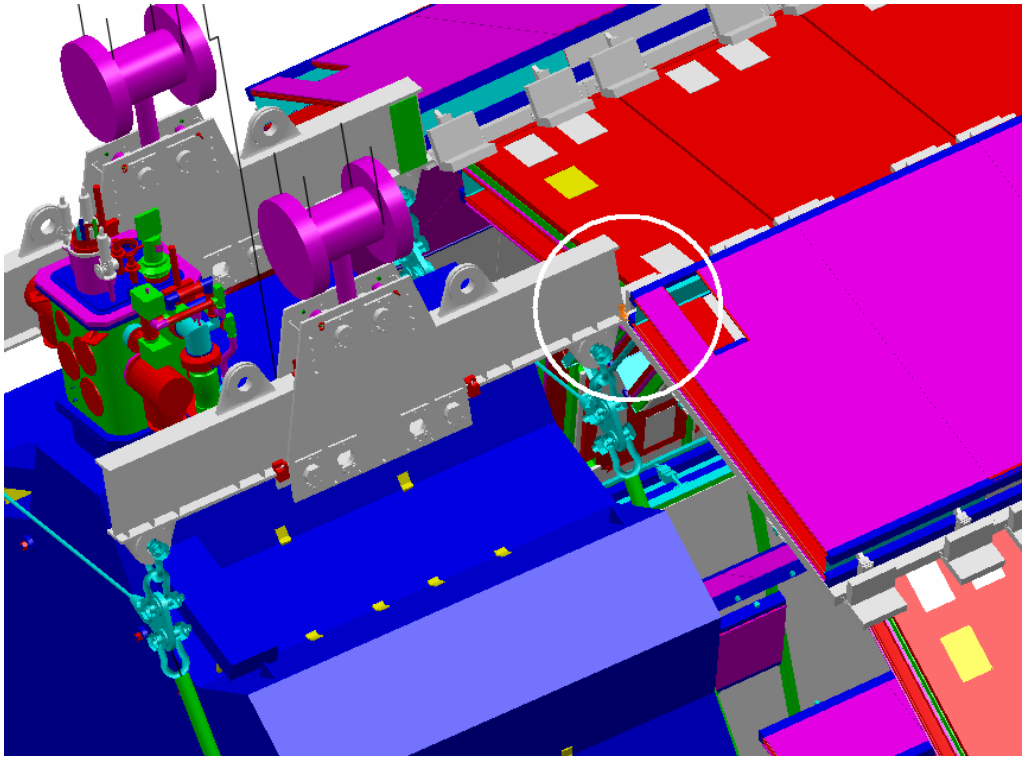




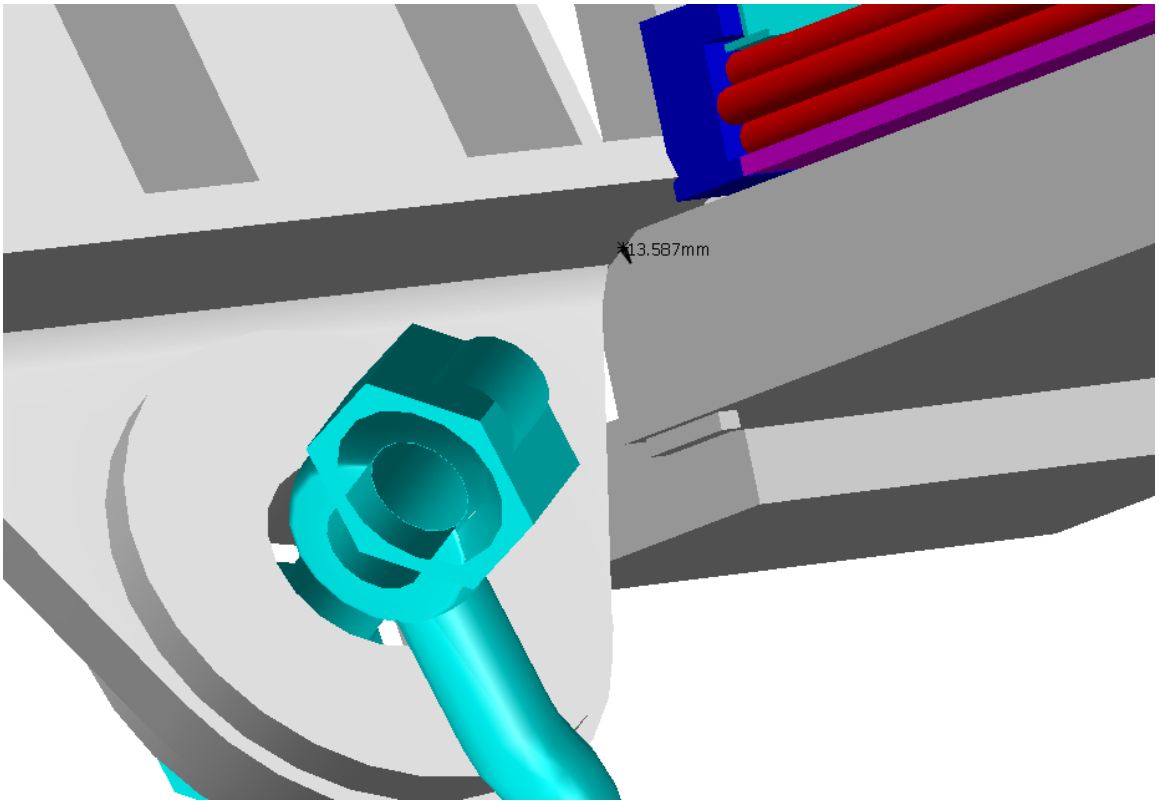
Segment #3: Movement from point 3 to point 4

Point G: Altitude 75.8m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Muon Chambers	CLASH	Not Considered



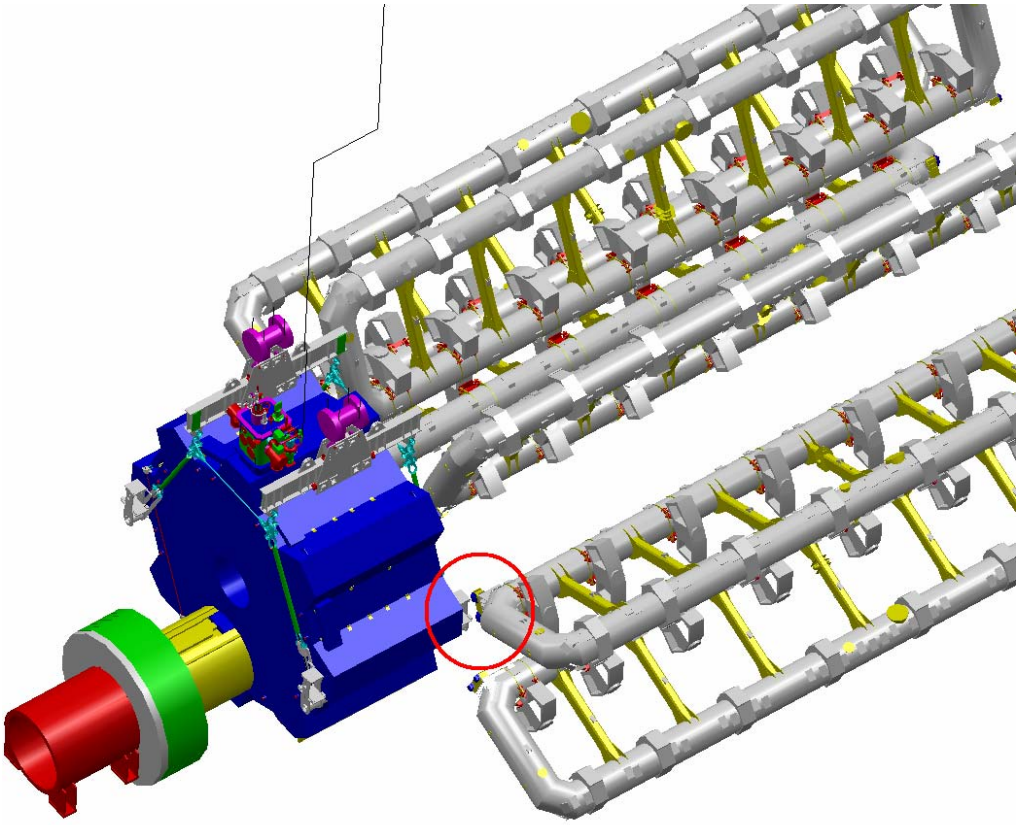
X=0.00mm
Y=-15’976.00mm
Z=4’404.00mm



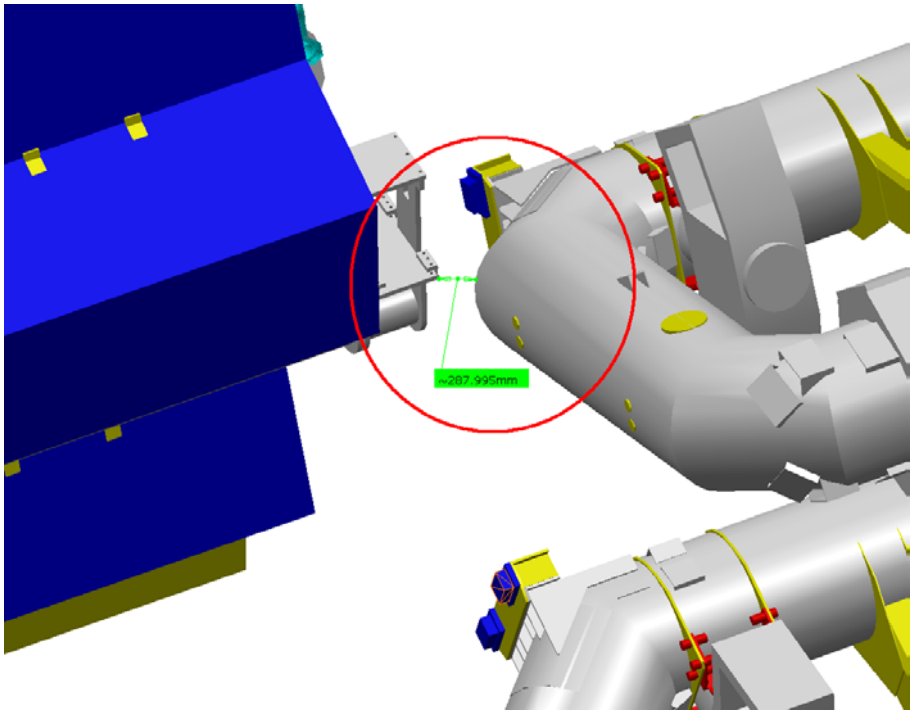
Segment #3: Movement from point 3 to point 4

Point H: Altitude 77.4m Side A / US15

Moving Object	*Environment*	*Clearance*	*Status*
EC Troid	Vacuum Vessels	288.00mm	Not Considered



X=0.00mm
Y=-15’976.00mm
Z=2’799.00mm



Conclusions

Predefined Path of ECT lifting can not be realized without major modifications of elements as follow:

Muon Chambers – to remove CLASH on the altitude 75.8m. See Point G, Segment#3 for details

- To remove clearance 71.00mm on the altitude 75.5m. See Point D, Segment#3 for details

Cryogenic Pipe - to remove clearance 74.50mm on the altitude 73.4m. See Point A, Segment#2 for details

Most tight case exists on the altitude 75.6/75.8m where extremely small clearances on the opposite side of ECT are detected – with TX1S_Sheilding/33.40mm (Point E, Segment#3) and Service_pipe_for_Muon_Spectrometer/33.00mm (Point F, Segment#3)