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# Assembly and Installation of WCTE Detector

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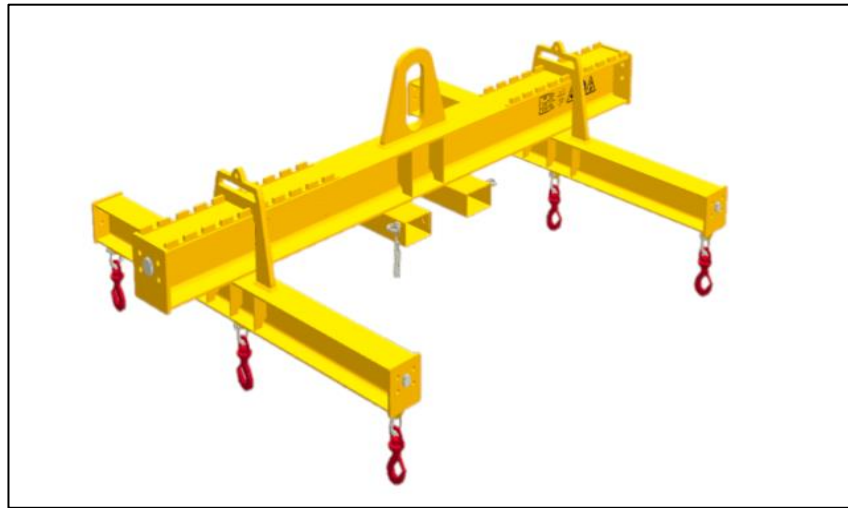
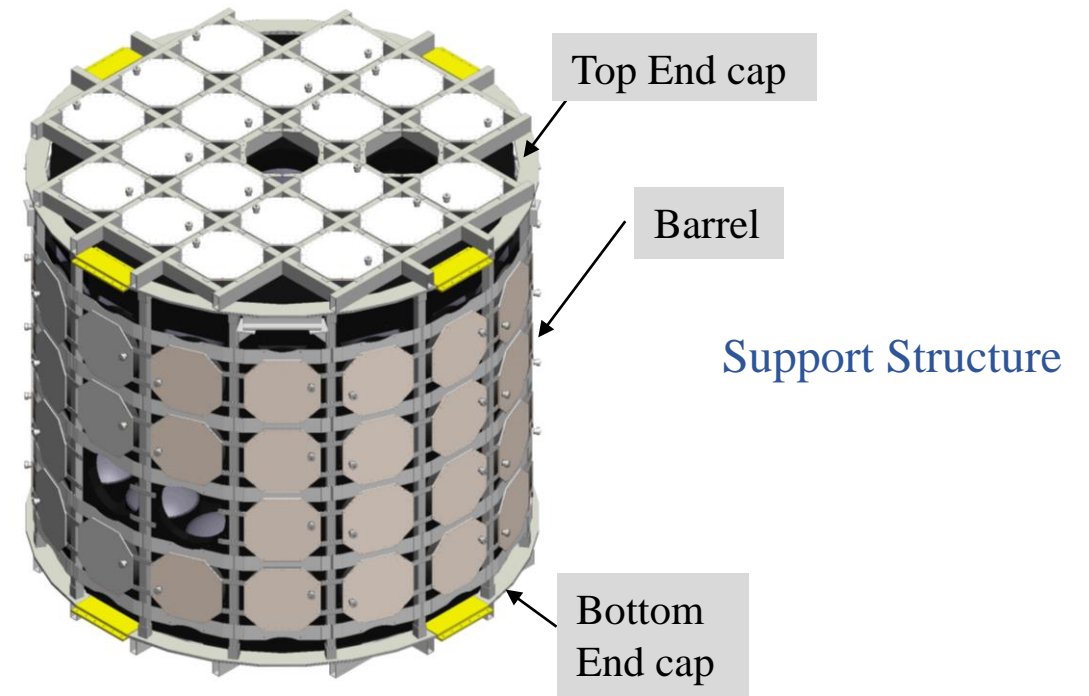
**Date: July 19, 2022**

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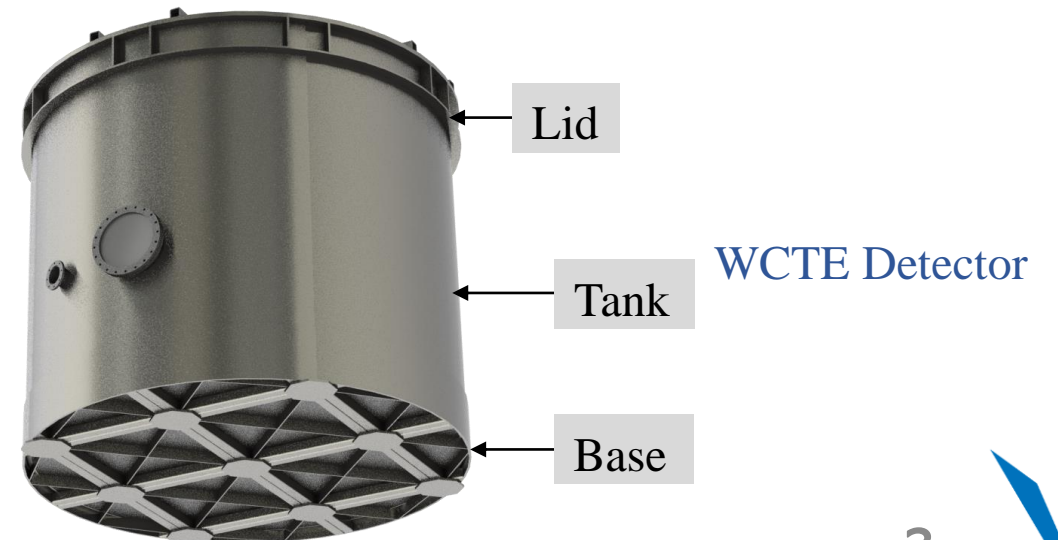
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# Assembly and Installation Locations

- Installation and Assembly of Support Structure in Assembly hall (slide no. 3-8)
- Placement of Support Structure into the Tank will be at T-9 Experimental area
- H-Type Lifting Beam (suggested by CERN) will be used

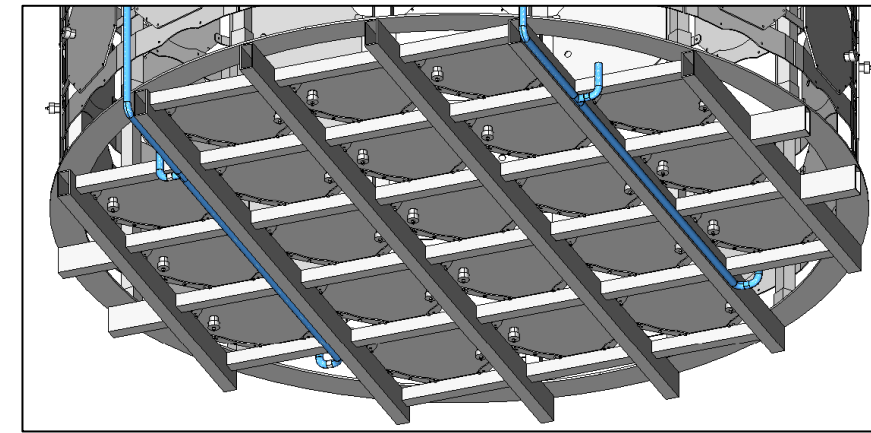


H-Type Lifting Beam

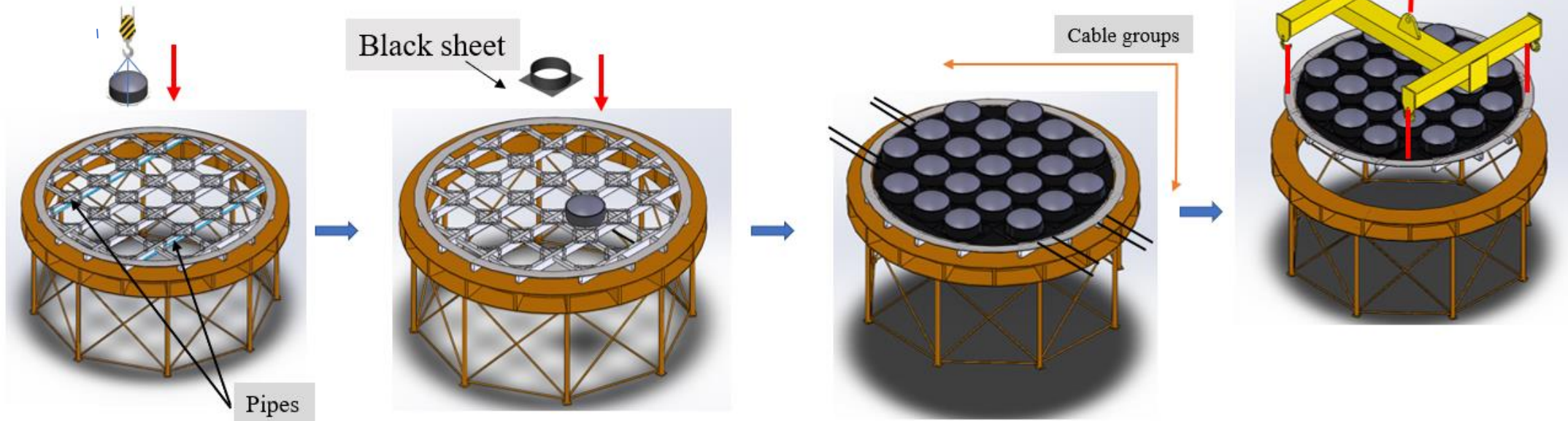


# PART I - Bottom End Cap

1. Fix all the Pipes for the Bottom End Cap
2. Place mPMT near its position
3. Lower the mPMT, fix it using Stud bolts
4. Make electrical and mechanical connections of Feed-through connector
5. Mount the underwater lights and photogrammetry devices
6. Once all mPMTs of a cable group are fixed, tie and secure the cables
7. Place the black sheet on it and fix it on the same studs.

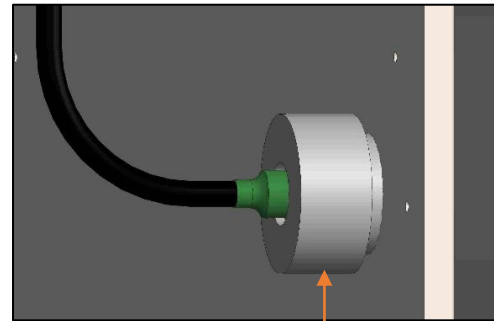
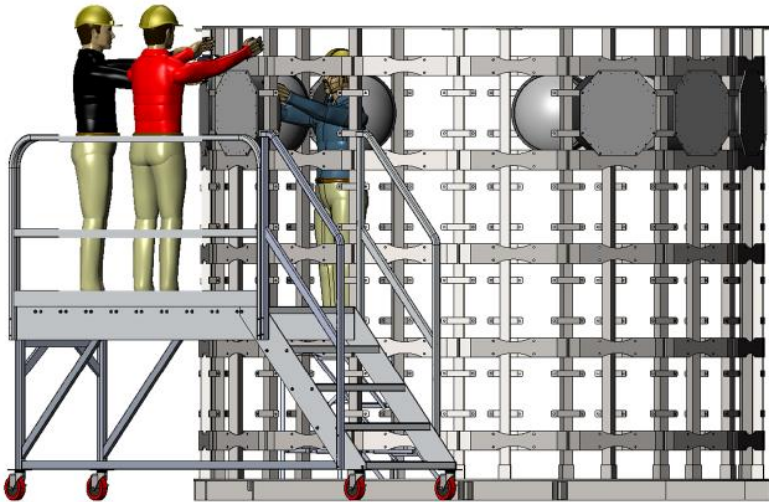


Pipes – Bottom End cap

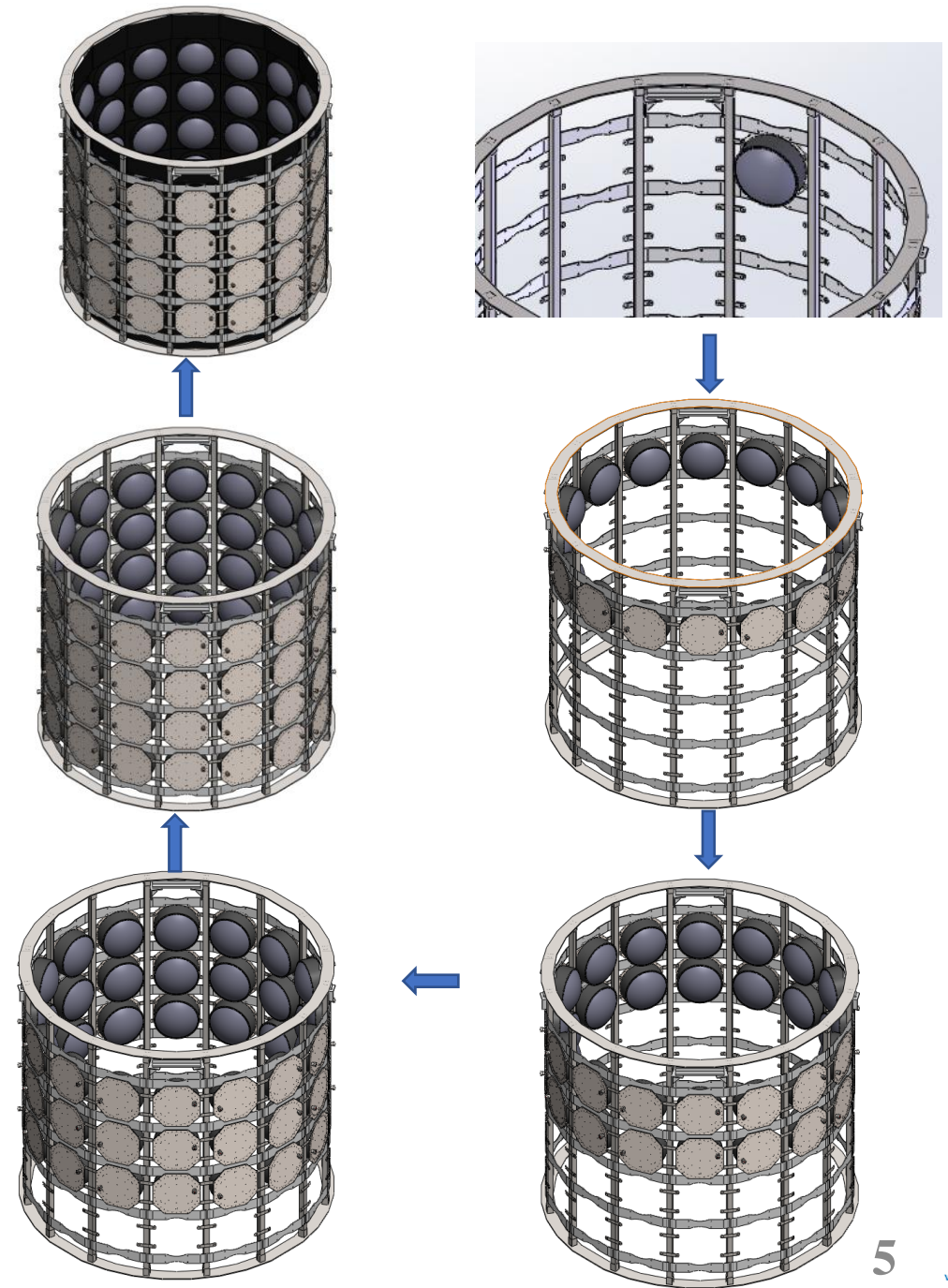


# PART II - Barrel

1. Using an elevated platform mount mPMTs for top two rows
2. Place and Fix the mPMT at its place for the bottom two rows of the barrel
3. Make electrical and mechanical connections of Feed-through connector
4. Tie and secure the cables according to the layout
5. Mount Black sheets, fix it on the same Stud bolts used for mPMT module

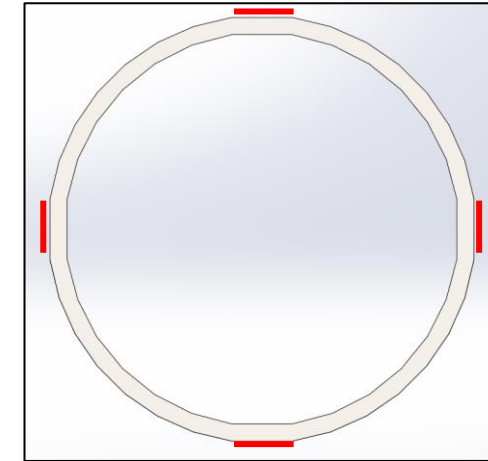
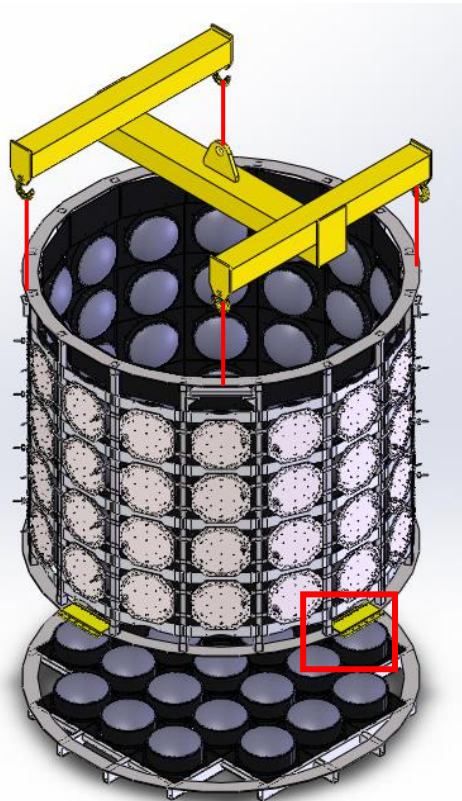


Feed-through connector

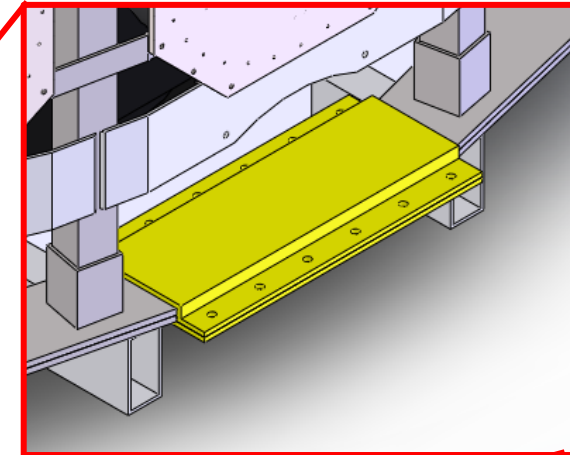


# PART III - Bottom End Cap & Barrel

1. Lift the Barrel and align the clamp positions
2. Join the Barrel and Bottom end cap using the clamps
3. Fix the clamps using Bolts and nuts
4. Tie the bottom end cap cables to the barrel columns



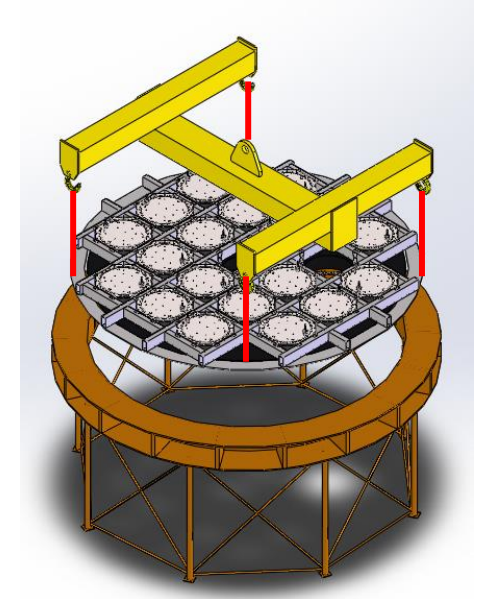
Straight  
Portion



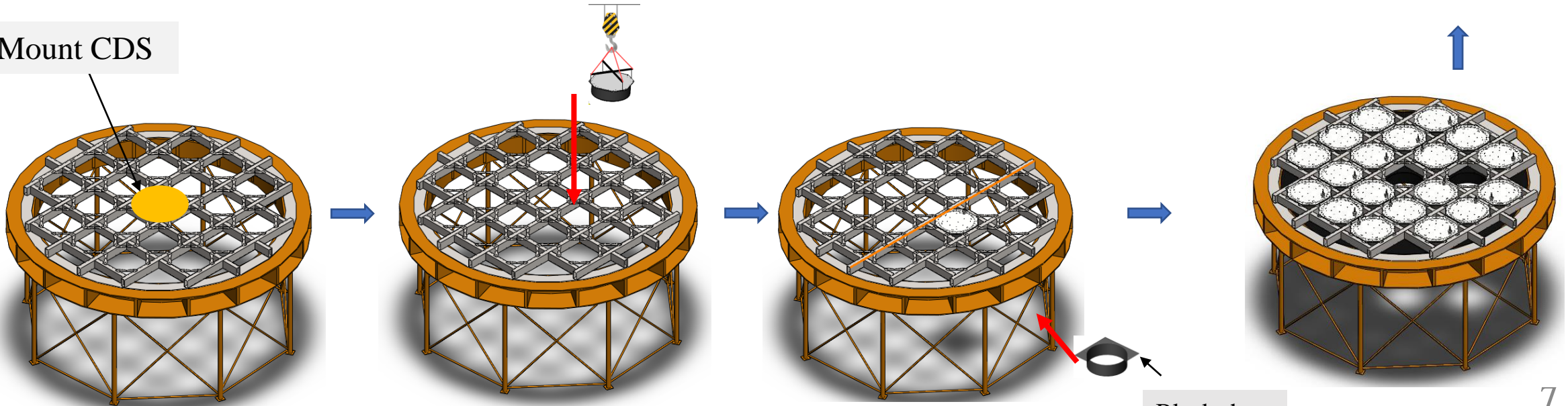
Clamp

# PART IV - Top End Cap

1. Place the Top End Cap on an Elevated Platform
2. Mount the Calibration Deployment System (CDS)
3. Lower the mPMTs and fix them in their place
4. Make electrical and mechanical connections of Feed-through connector
5. Mount the underwater lights and photogrammetry devices
6. Tie and secure all the cables
7. Mount Black sheets from bottom side



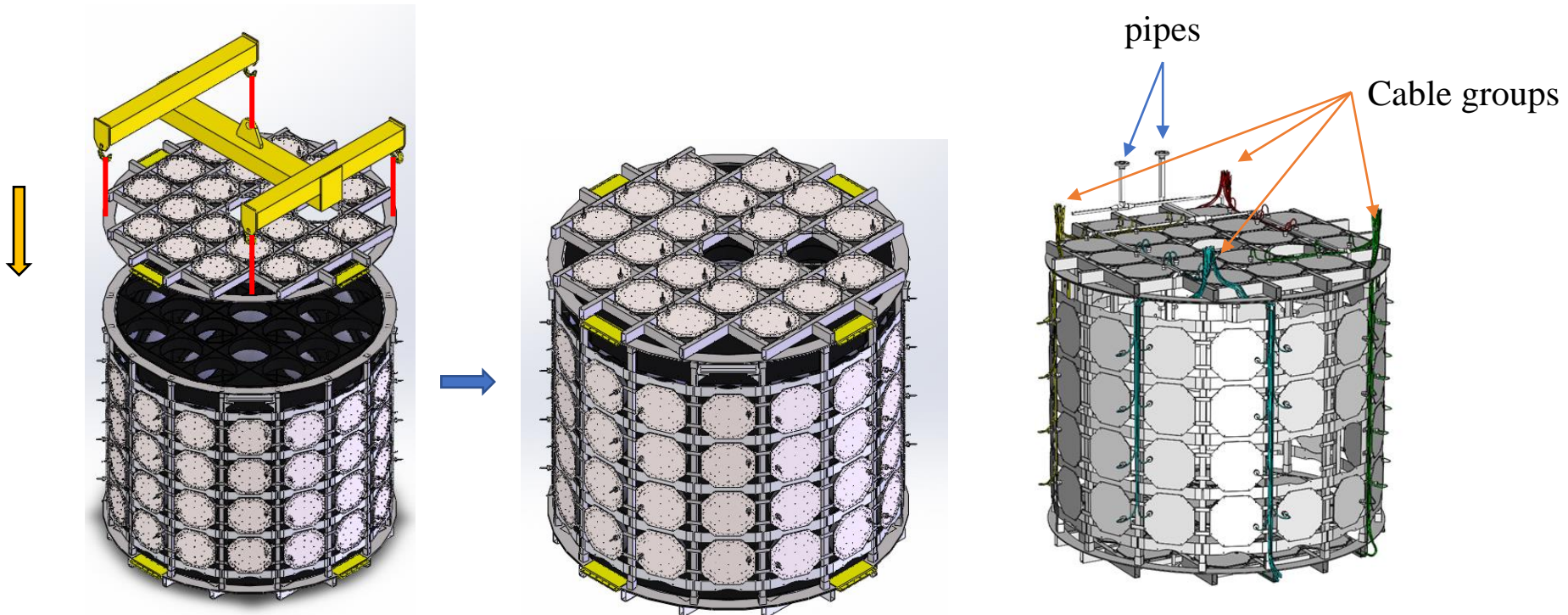
Mount CDS



Black sheet

# PART V - Top End Cap & Barrel

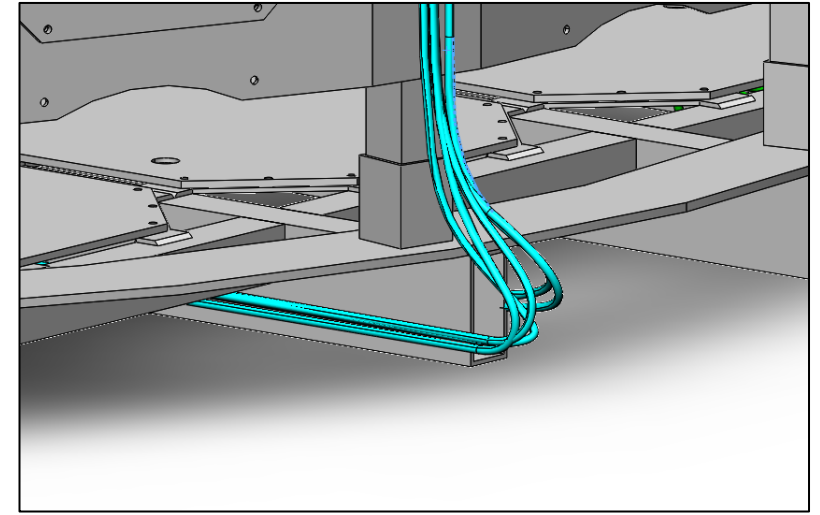
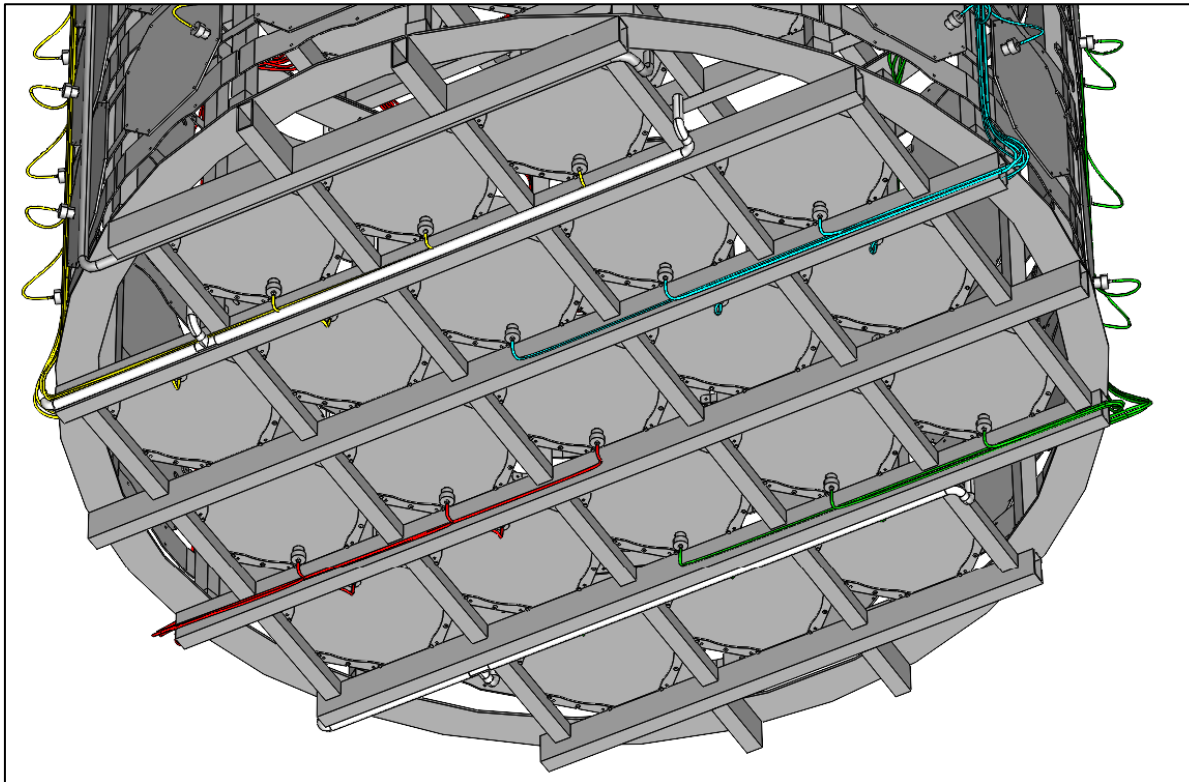
1. Lift and place the top end cap on Barrel and align it with the Clamp positions
2. Use an elevated platform to access the top end cap, join both rings using the clamps
3. Complete the top end cap piping
4. Secure all the cable groups on the top end cap



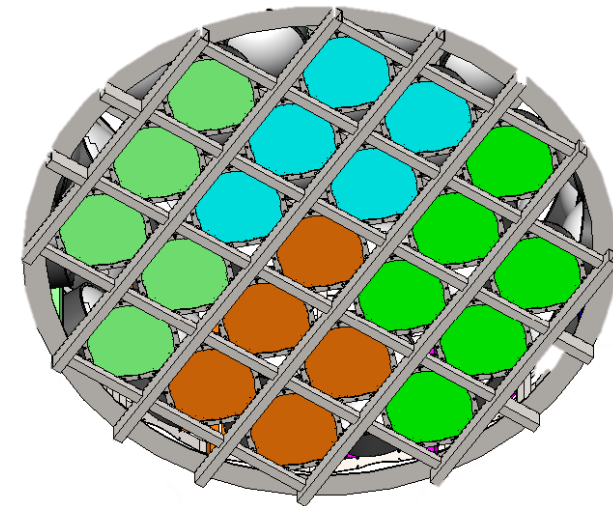


# Bottom End Cap Cable Arrangements

On the Bottom end cap, the cables are grouped in the pattern as shown and then travel up along the nearest column

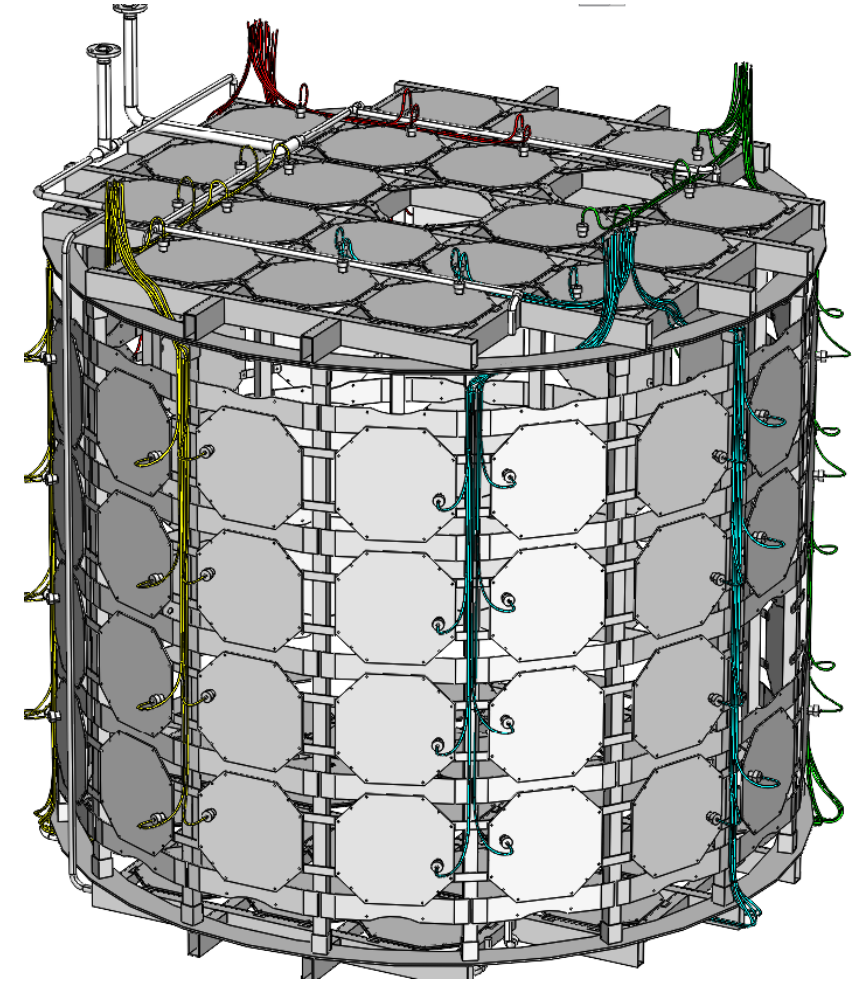
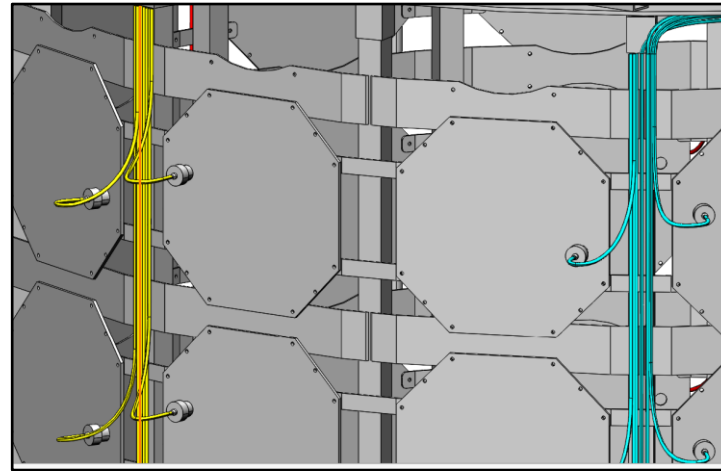
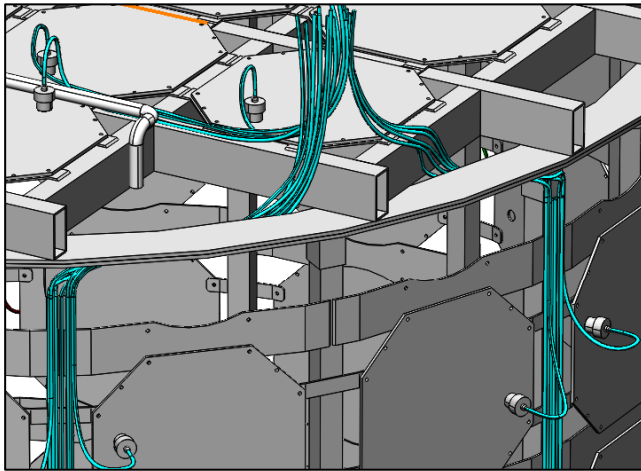


Bending from outside



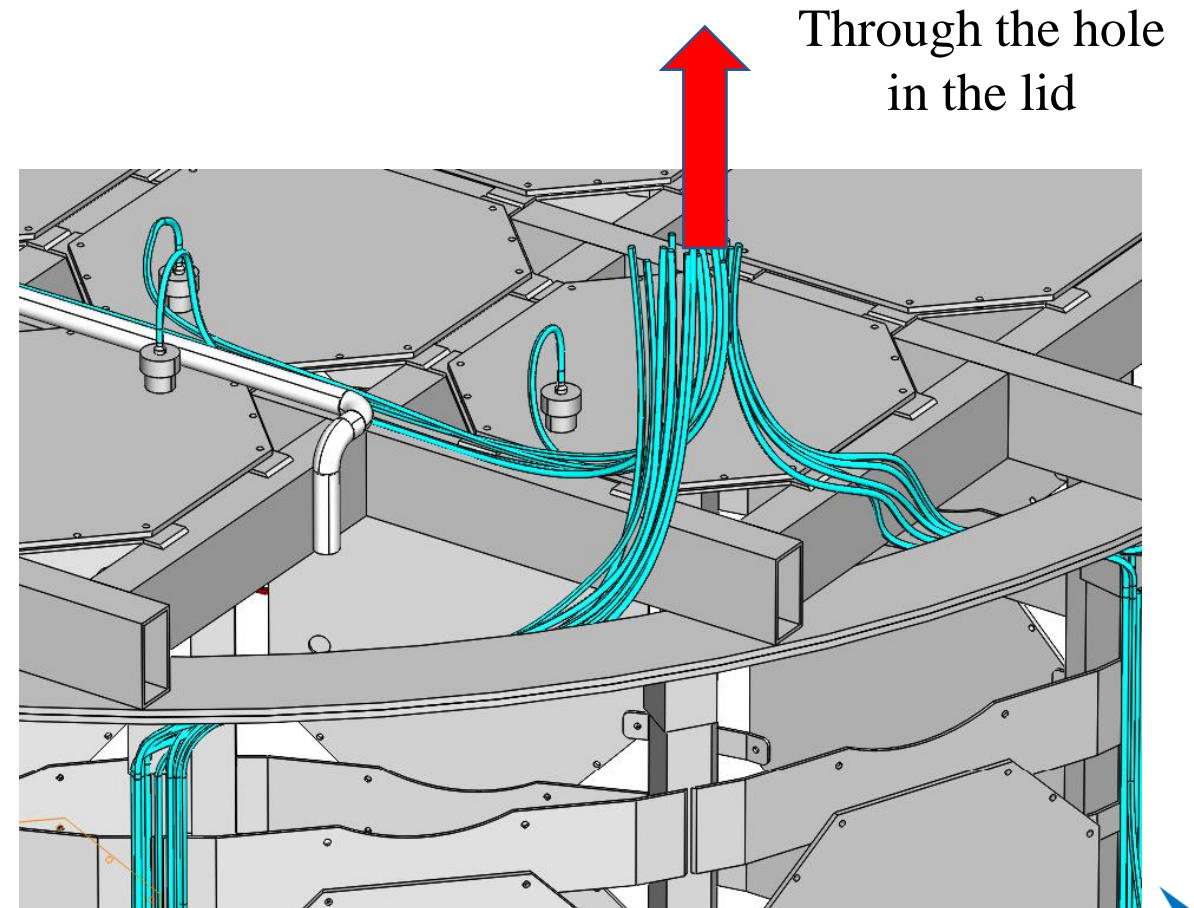
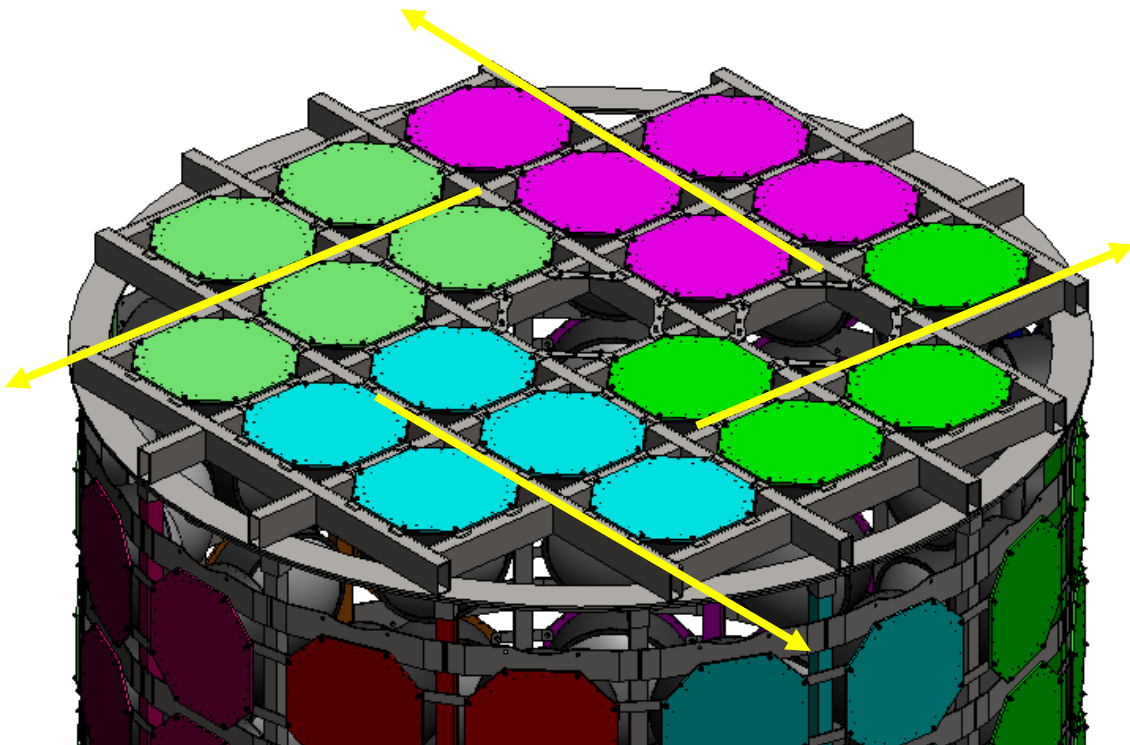
# Barrel Cable Arrangements

- Cables will travel along the outer side of Barrel columns
- Adjacent mPMT columns are used to group cables
- Total 8 cable groups will travel up the barrel column
- Nearest two groups are merged with the one of the Top End Cap group



# Top End Cap Cable Arrangements

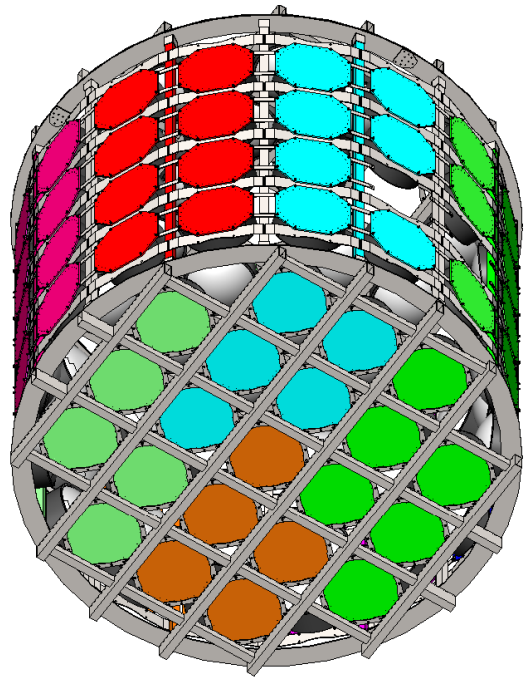
Cables are placed in a way they travel along a single direction and grouped at the four corners



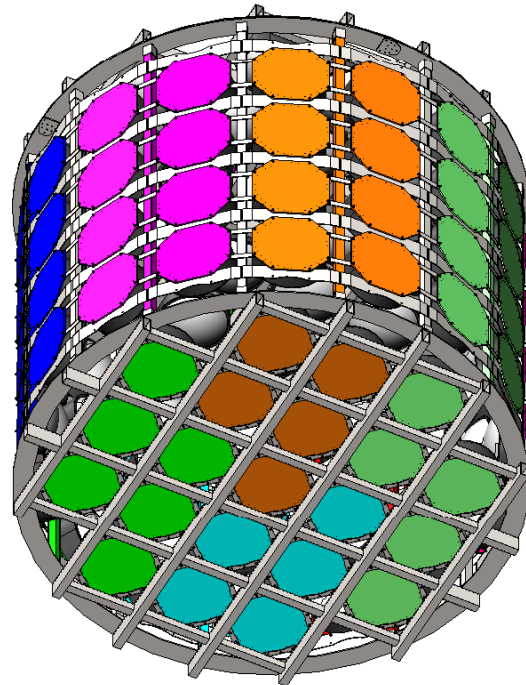
# Cable Distribution summary

On Barrel, cables from adjacent mPMTs are grouped and move up along the column

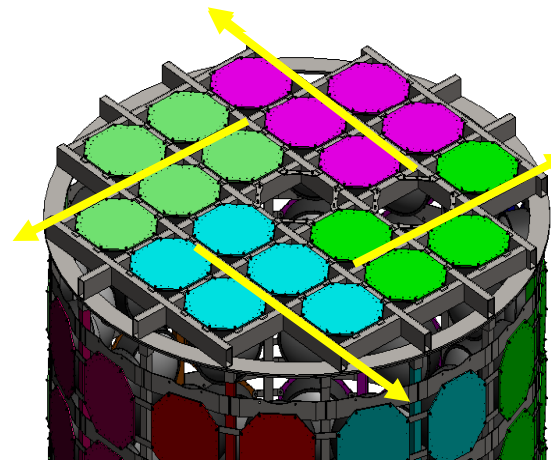
Group	On Col		Top	Total
	Barrel	Bottom		
Blue	7	5	5	25
Red	8	0		
Green	7	6	4	25
Dark Blue	8	0		
Magenta	8	0	5	26
Orange	8	5		
Light Green	8	5	5	26
Pink	8	0		
<b>Total</b>				<b>102</b>



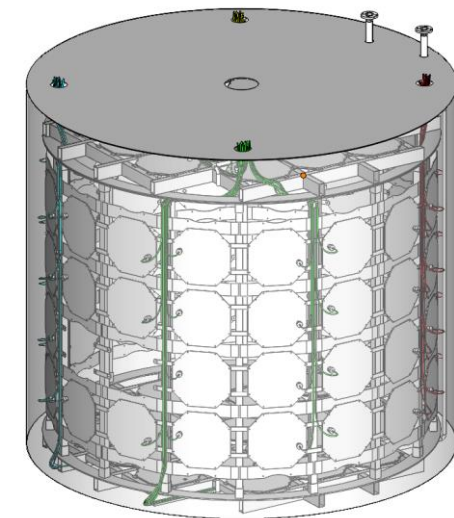
Front View



Back View



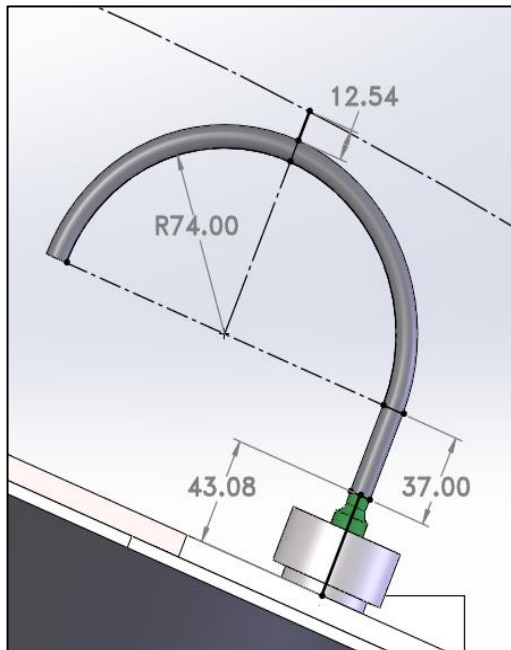
Top View



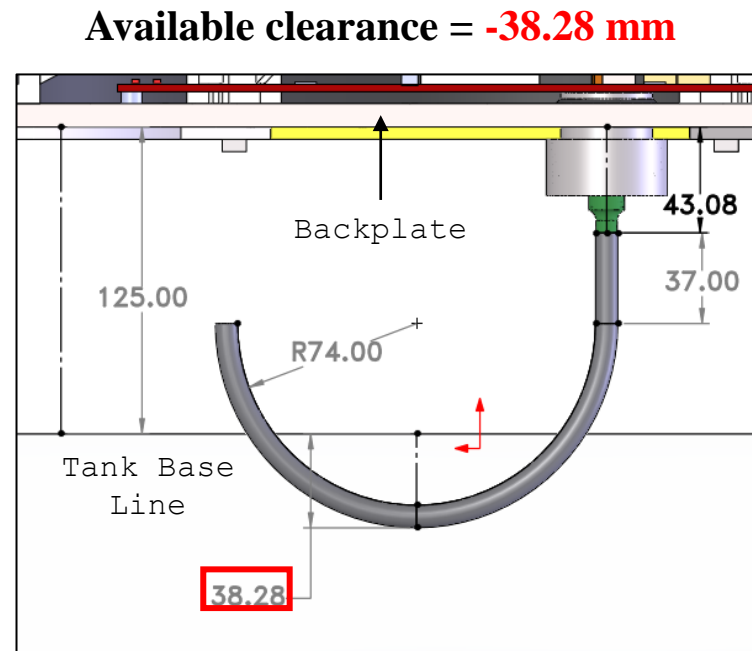
Assembled Detector

# Available Clearance for Feed-through Connector

- Required space = 43 (backplate to H.S.S) + 37mm (Straight) + 74mm (B.R.) + 9.2 mm (Cable Diameter) = **163.2 mm**
- Available clearance = **12.54 mm\***

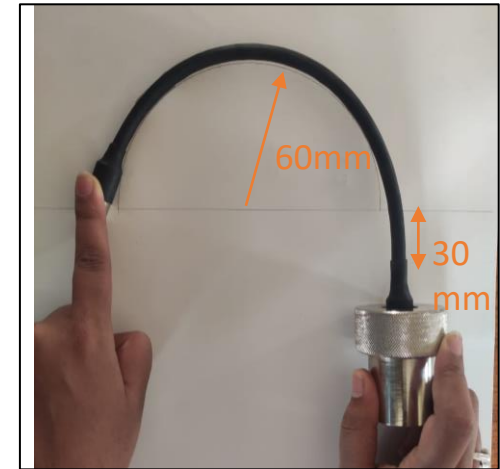


Barrel



Bottom End-cap – **Interference!**  
**70 mm extra space is required**  
 (including 30mm clearance)

- VIIT measured the straight length required for CAT 5e, it is approximately half of bend radius

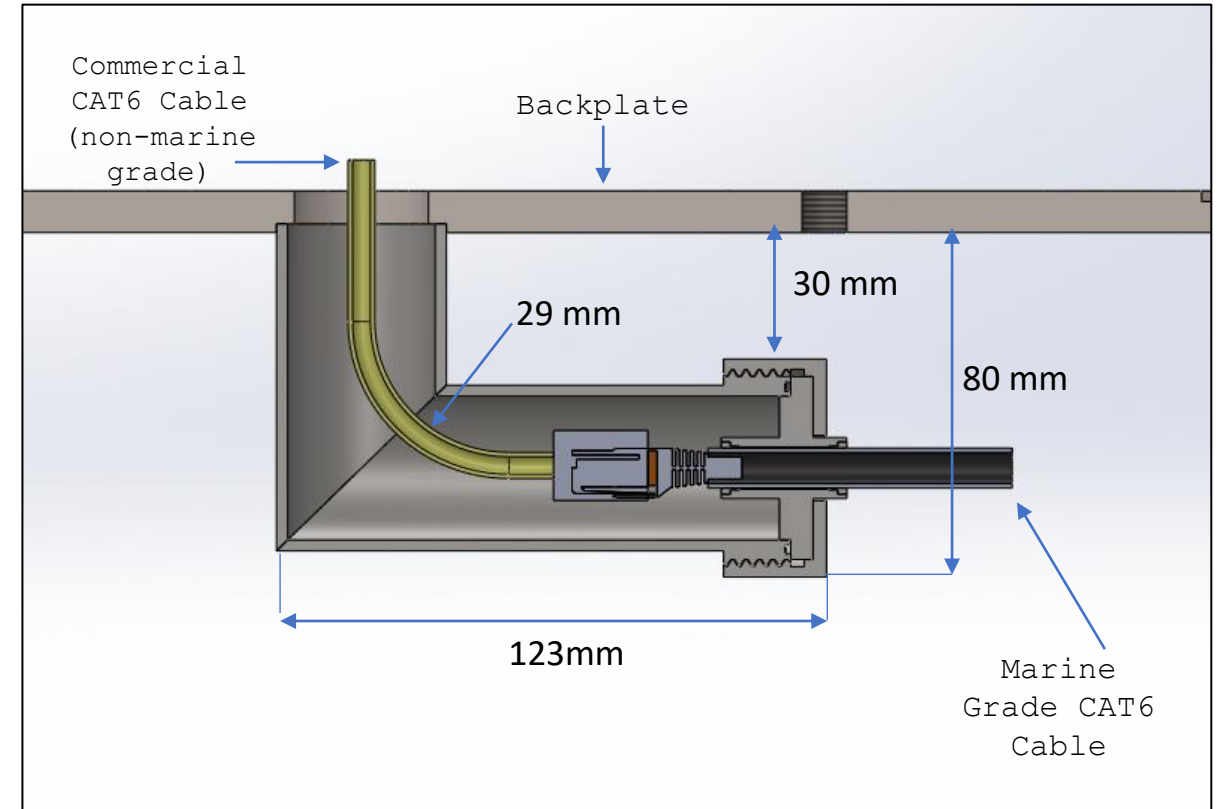


- CAT 5e cable is changed to CAT 6 which has Bending radius of 74mm and diameter  $9.2 \pm 0.5\text{mm}$ . (update received from Krzysztof Dygnarowicz)

\* 20mm minimum clearance for Detector assembly is suggested by CERN, thus 30 mm clearance between cables and tank is considered.

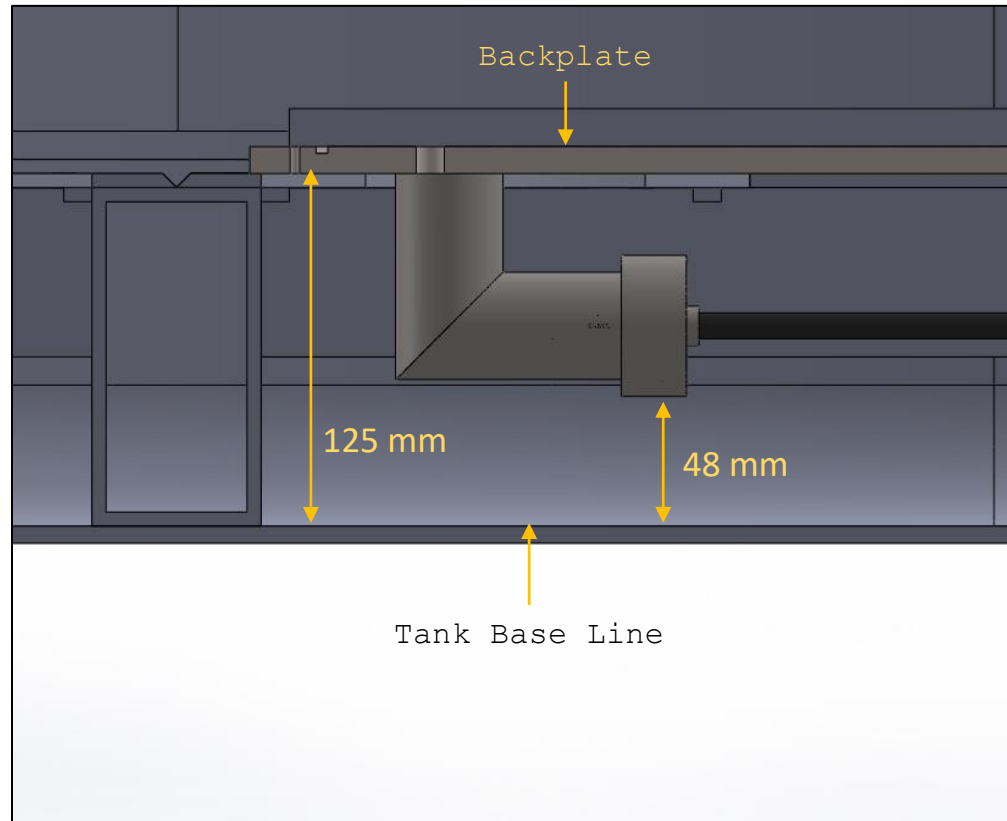
# Possible Solution: L-Bent Feed-Through Connector

- Diameter of commercial \*CAT6 (non marine grade) =  $5.8 \text{ mm} \pm 0.3 \text{ mm}$
- Bending Radius =  $5 \times \text{Diameter} = 29 \text{ mm}$

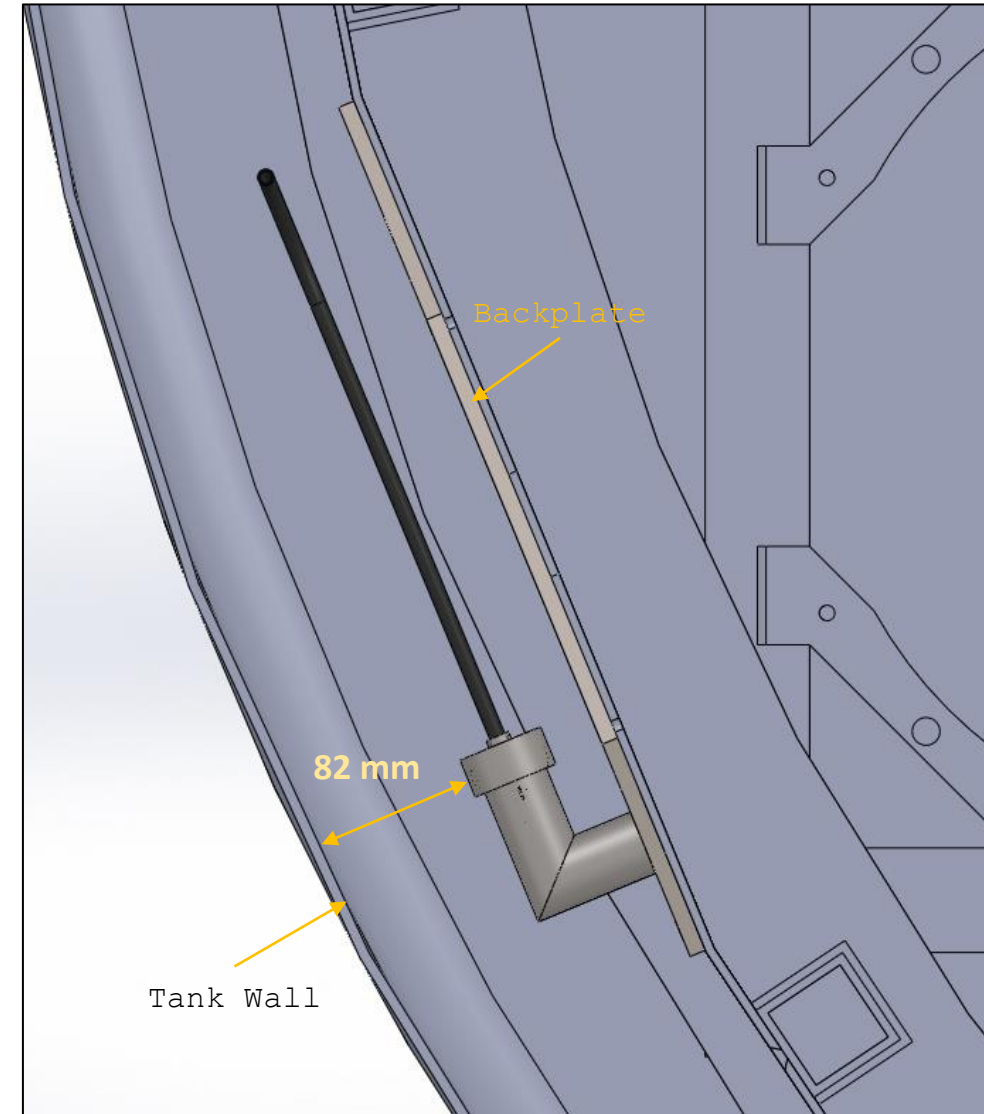


## L-Bent Feed-through:

- Clearance at bottom end cap is 48 mm, which is **18 mm more than required (30mm)**
- Clearance at barrel Tank wall = **82 mm**
- Alignment will be easy



Bottom End-cap

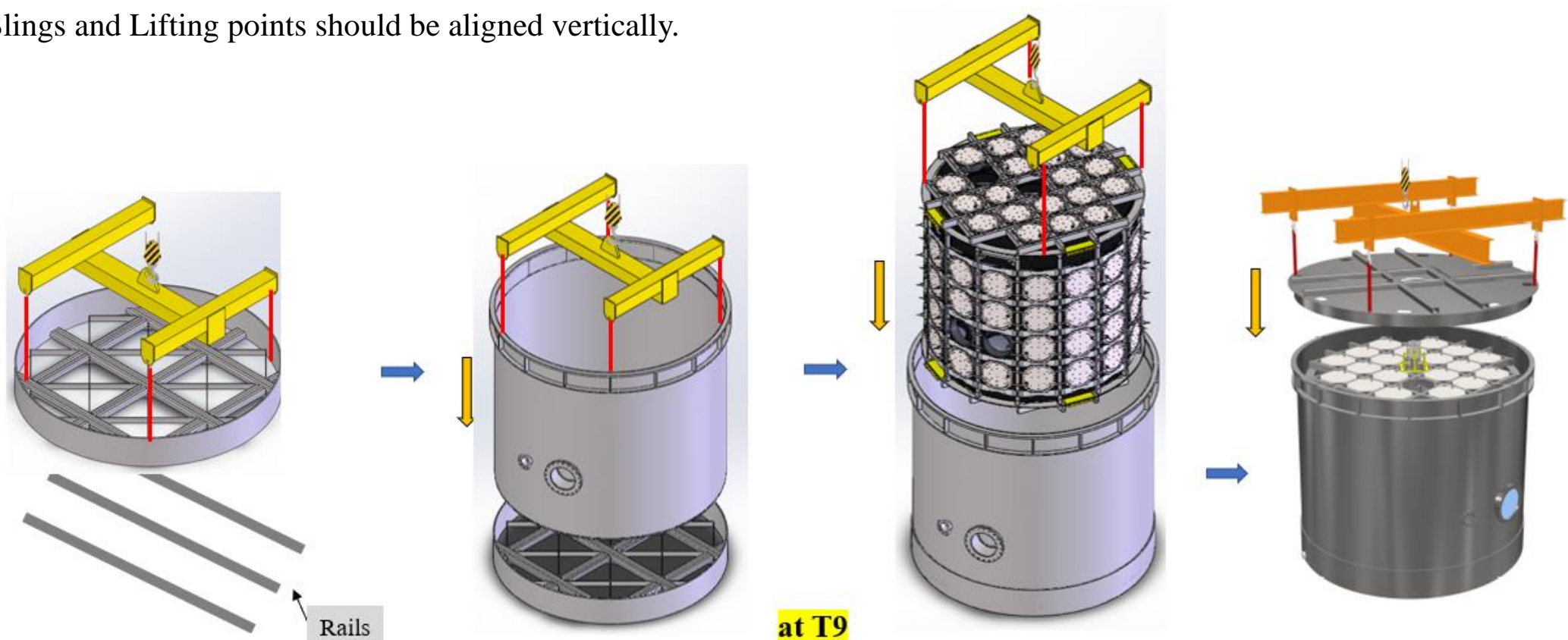


Barrel

# WCTE Detector - Assembly Procedure

1. Fix the base on rails at the T9 area
2. Move the tank into the T9 area; align it correctly w.r.t to the base and place on it
3. Then lift the structure assembly and place it inside the tank
4. Place the lid on the top of the tank

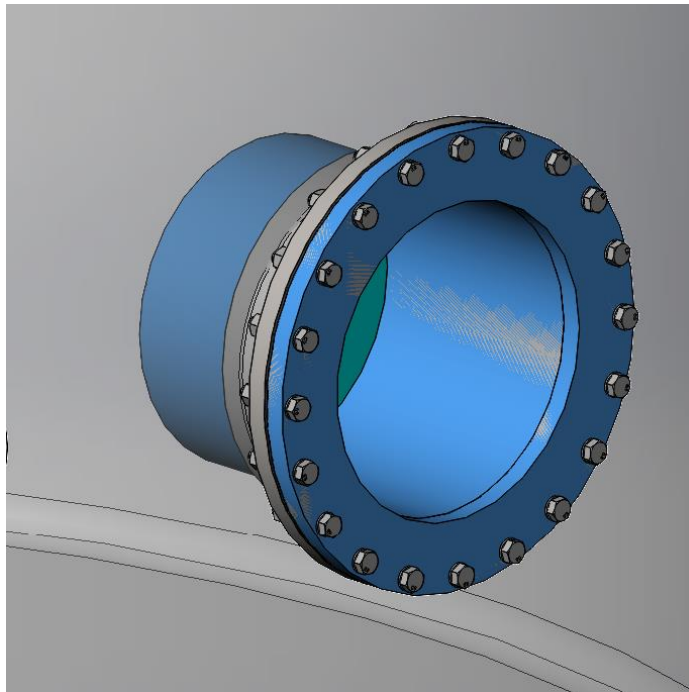
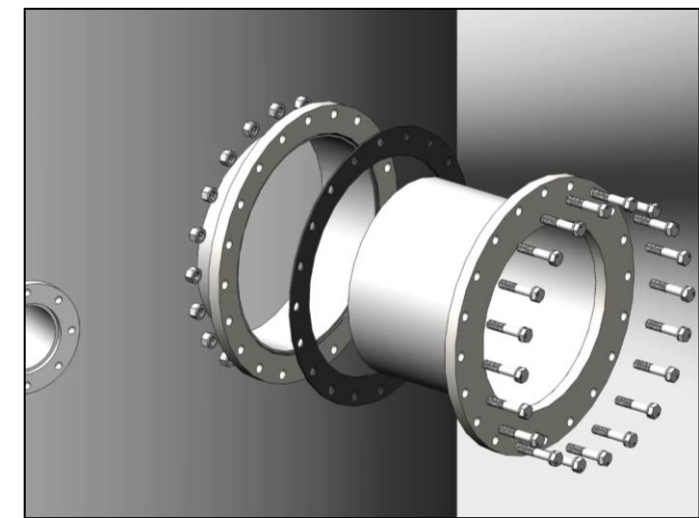
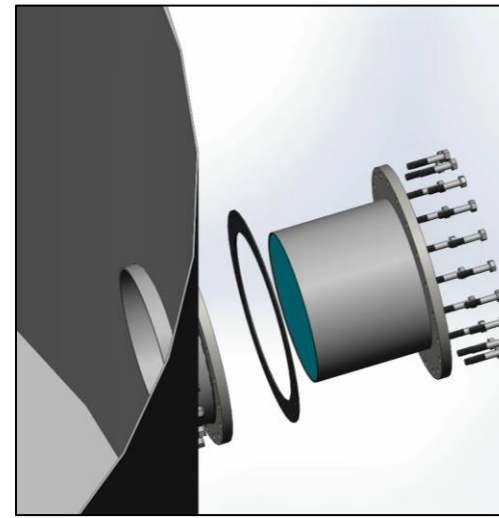
Note: Slings and Lifting points should be aligned vertically.





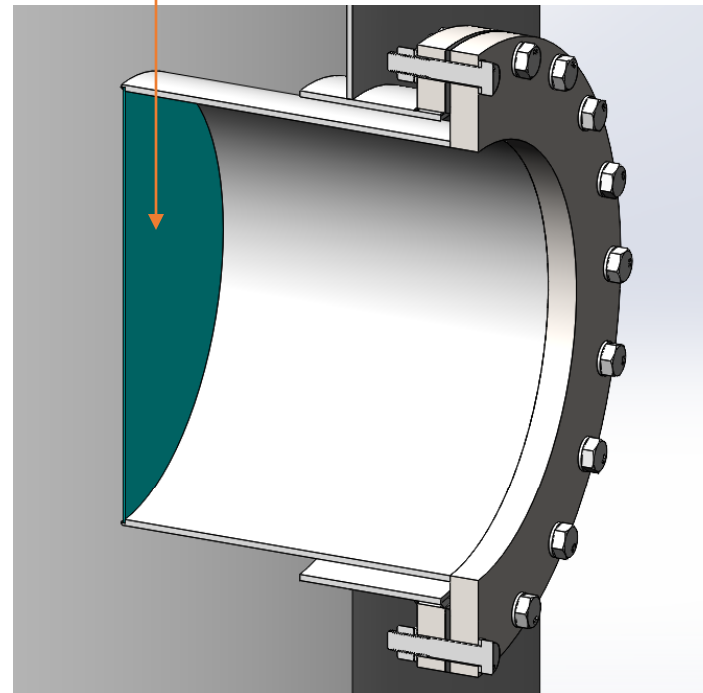
# Installation of Tertiary Beam Window

1. Weld Outer flange to the tank
2. Align gasket and Inner flange
3. Join Inner flange and Outer flange using Bolts and nuts



The parts marked blue are one single unit

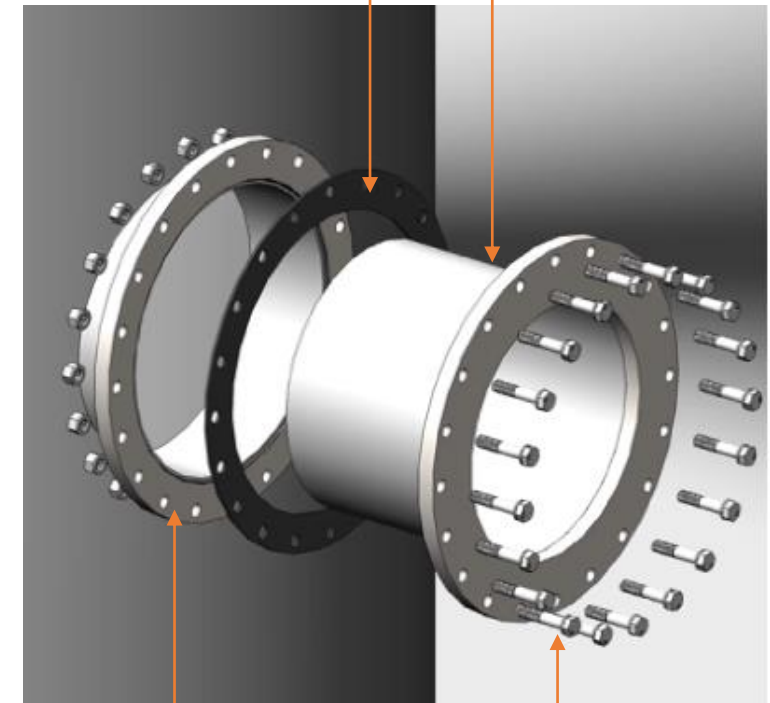
Beam window



Pipe protrudes inside the tank at required length

Gasket

Inner Flange



Outer flange

Bolts

# Acknowledgement

Chandrashekhar Garde

Ashok Mache

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Prajwal Lale

Thank you!