GST – Inner Detectors Installation and Assembly concept – v03-2025

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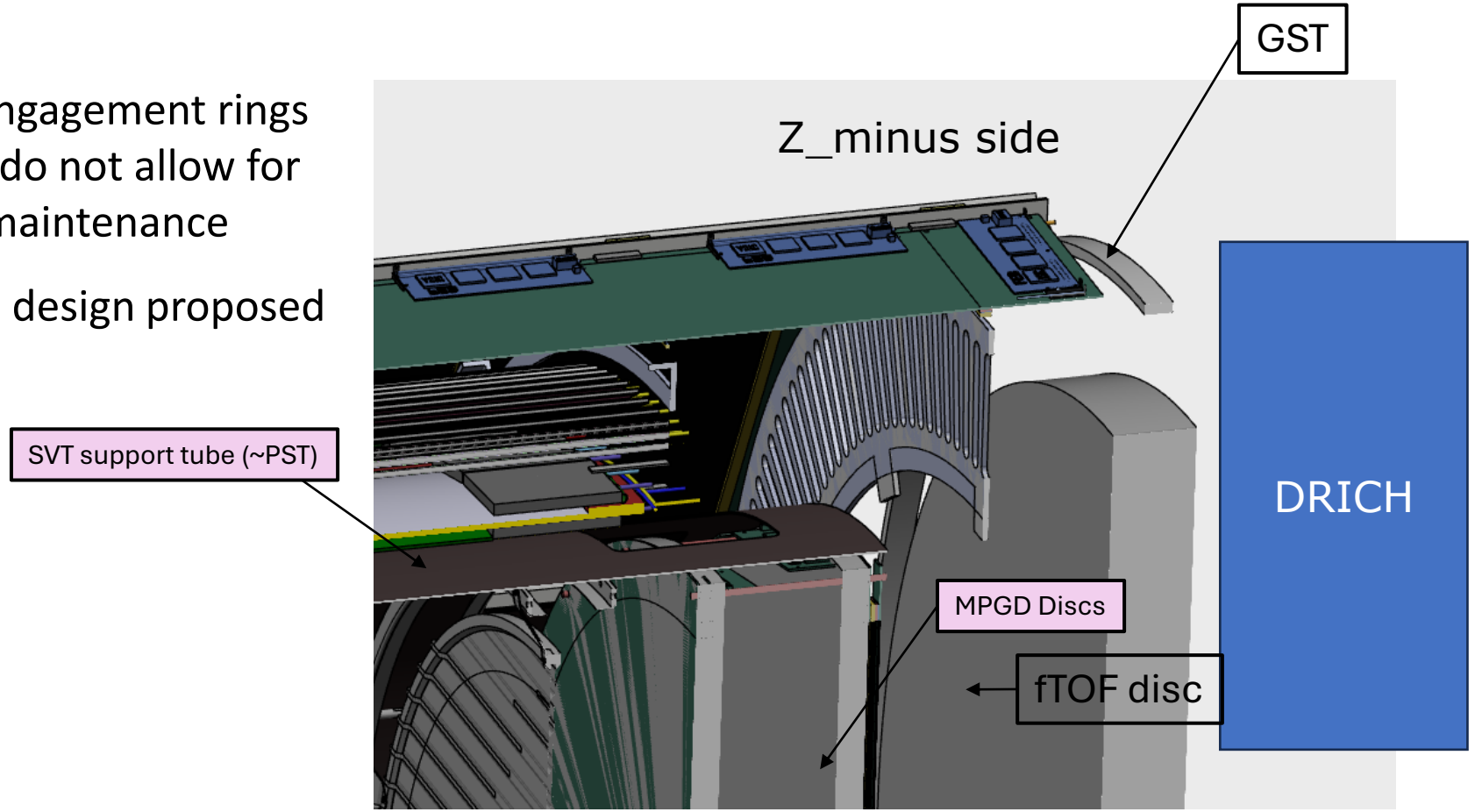
Independent assembly

Serial assembly dependency

Motivation

- Changes needed in the installation sequence to accommodate the need for services space on Z_minus side.
- From SVT presentation we can see that the services space currently needed is about x2 than what is available.
- With this layout the engagement rings as currently designed do not allow for easy installation and maintenance
- New engagement ring design proposed

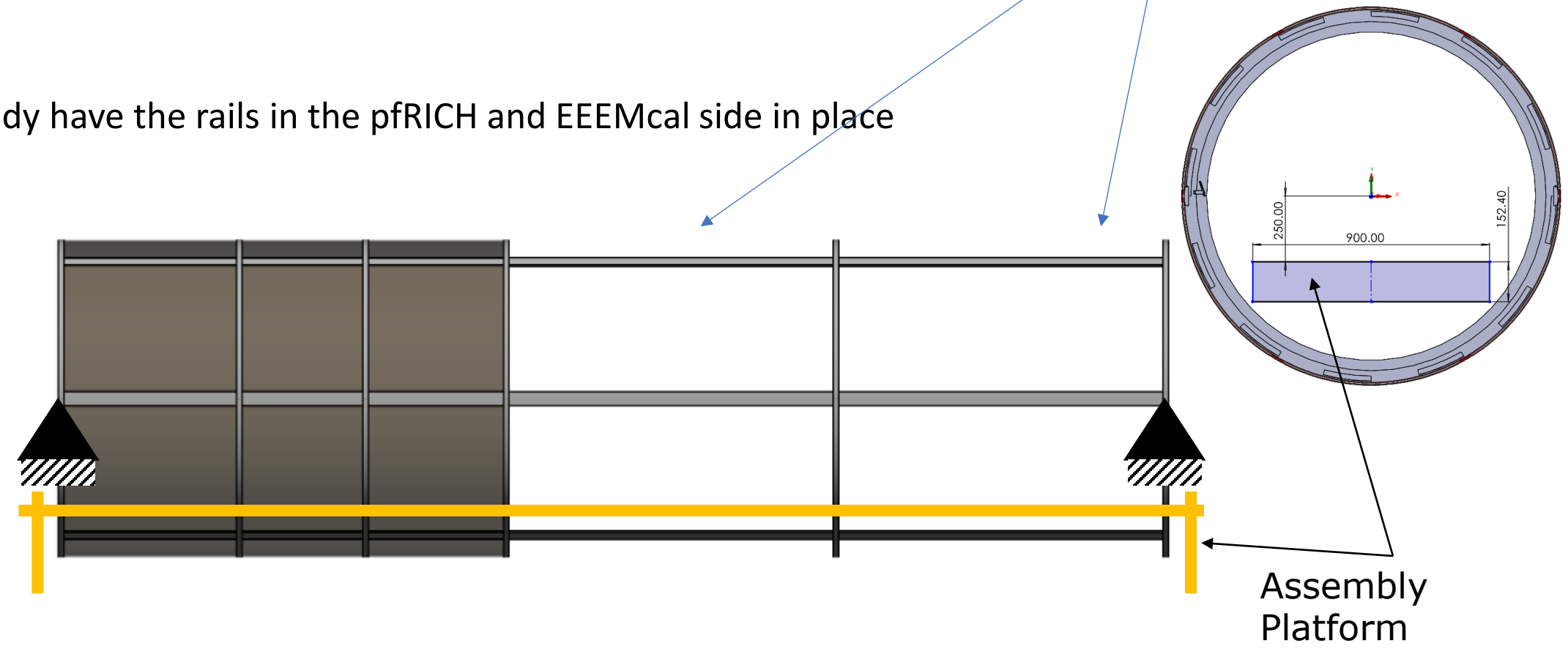


Package 1 sub-assembly

1. GST – start with partially assembled GST – note – panels are missing on the bTOF end of GST.

The GST will have to be supported at the ends and there will be a platform going through and through to assembly the barrel TOF (bTOF) staves.

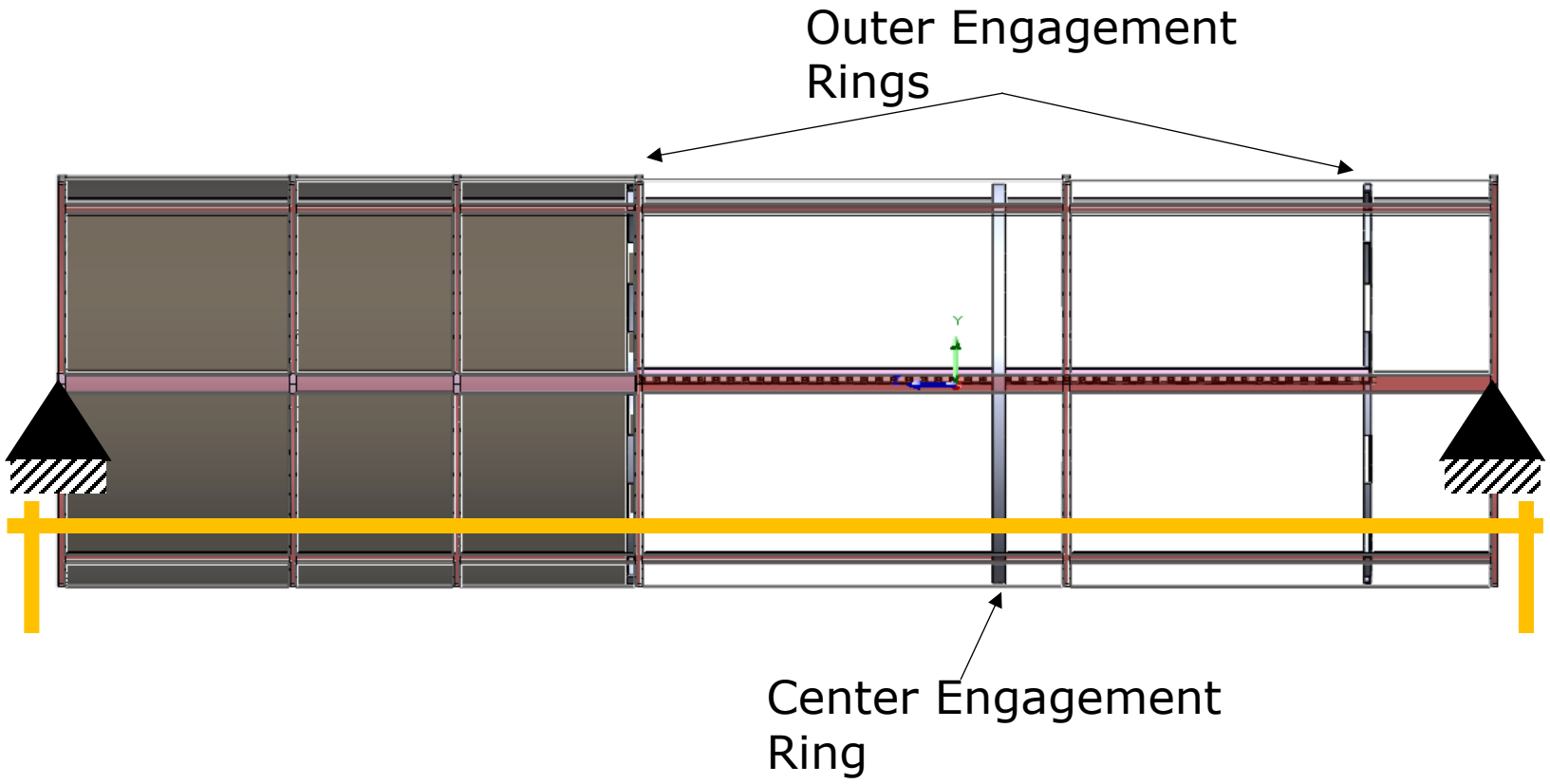
This will already have the rails in the pfRICH and EEEMcal side in place



Package 1 sub-assembly

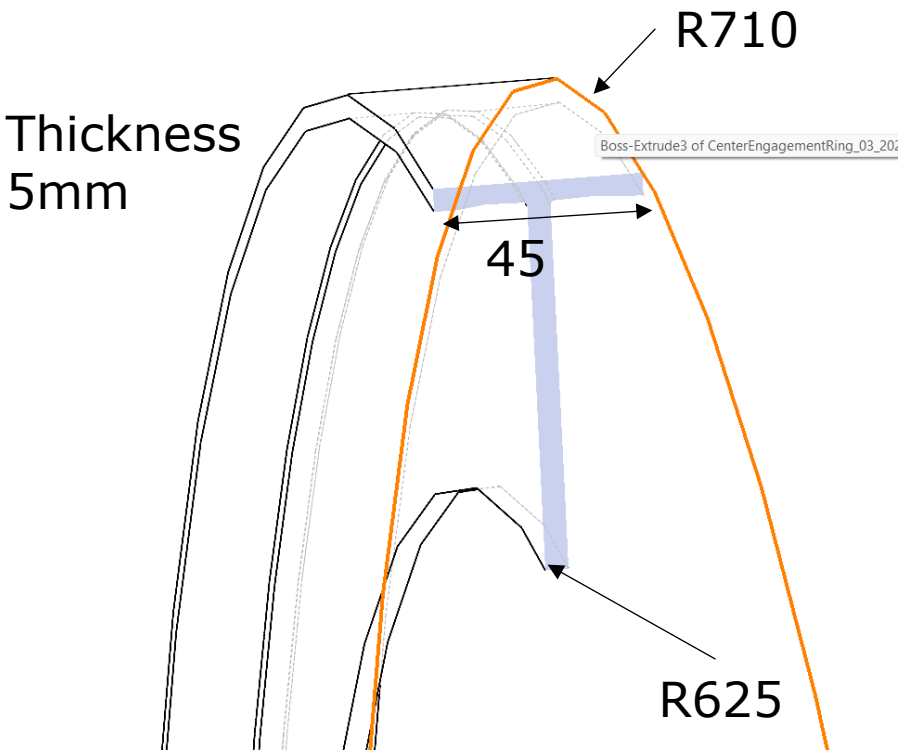
2. Engagement rings will be mounted inside the GST in place and bonded permanently to the GST with dowel pins / positioning jigs

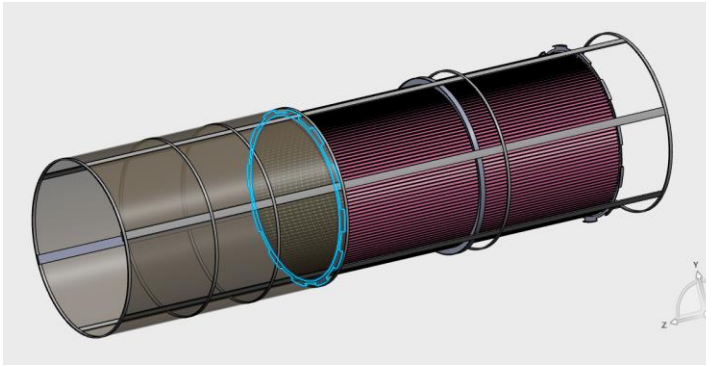
The center engagement ring has all the dowel pins already attached and glued to it to position and mount the bTOF staves

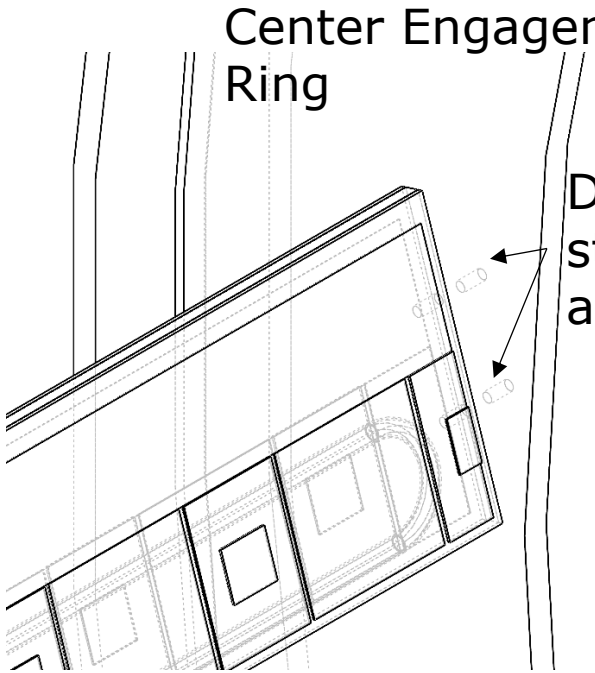


New Design of Engagement Rings and bTOF assembly

- bTOF is symmetric and 1.3 m on each side of the center engagement ring
- Center engagement ring has a t-profile







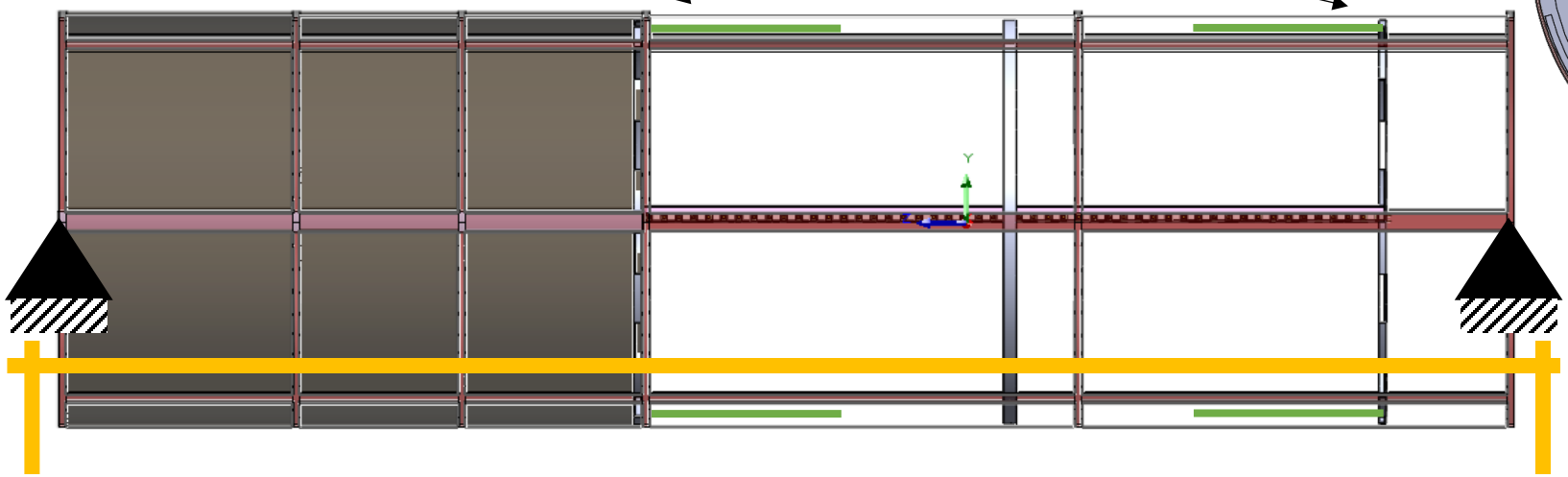
The dowel pins are permanently attached to the center engagement ring.

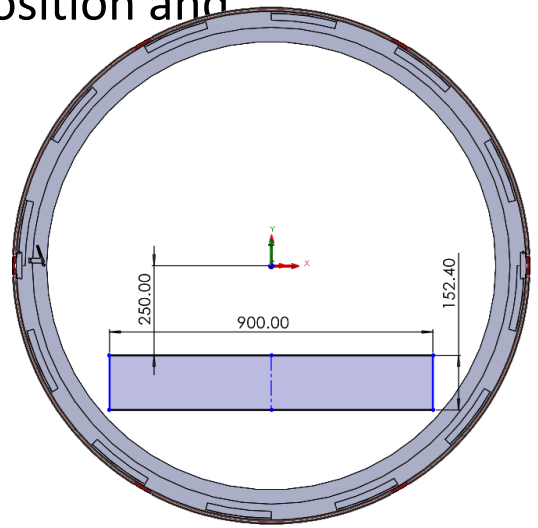
Package 1 sub-assembly

2. Engagement rings will be mounted inside the GST in place and bonded permanently to the GST with dowel pins / positioning jigs

The center engagement ring has all the dowel pins already attached and glued to it to position and mount the bTOF staves

Mount patch panels/portcard holders on the outer engagement rings

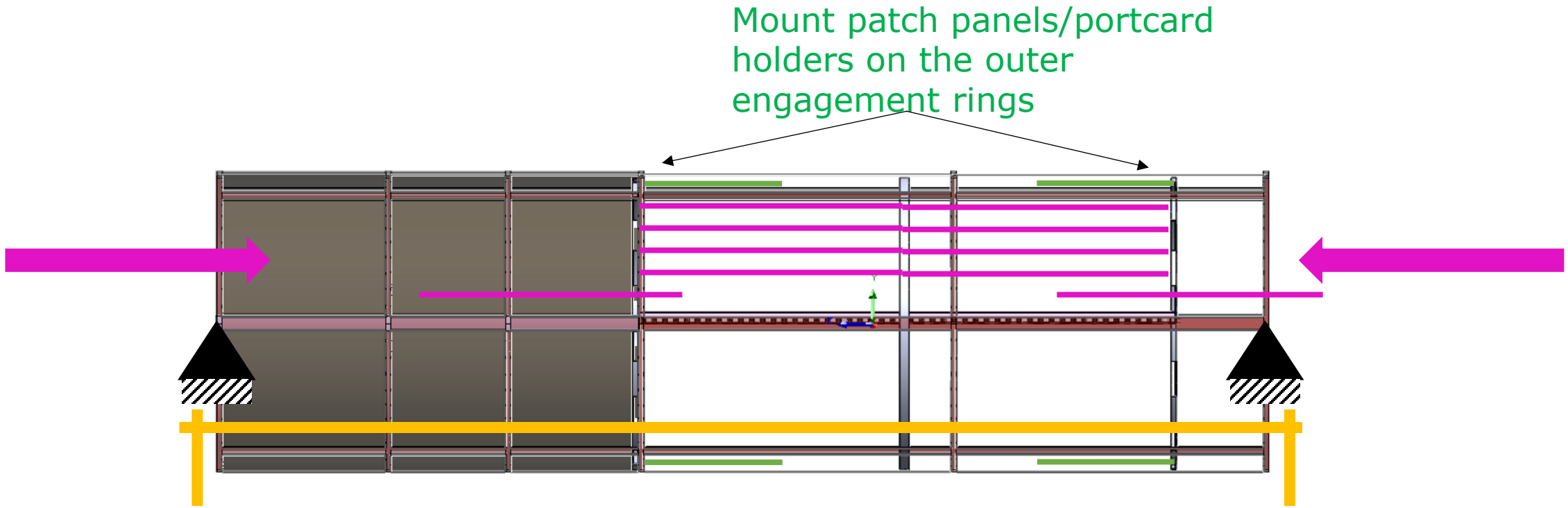




At this point there is access both on the radially inside and outside the bTOF space/envelope

Package 1 sub-assembly

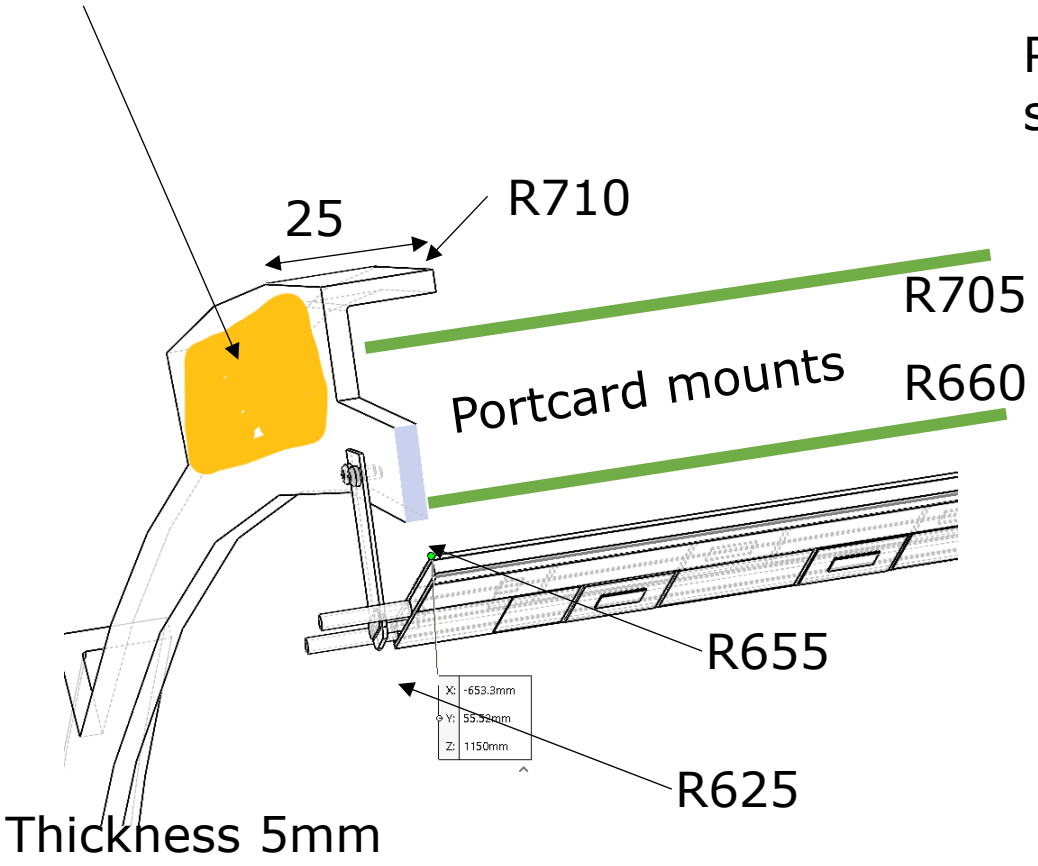
3. Each bTOF stave will come from the Z_plus and Z_minus side to get mounted on the center engagement ring dowel / locating pins.

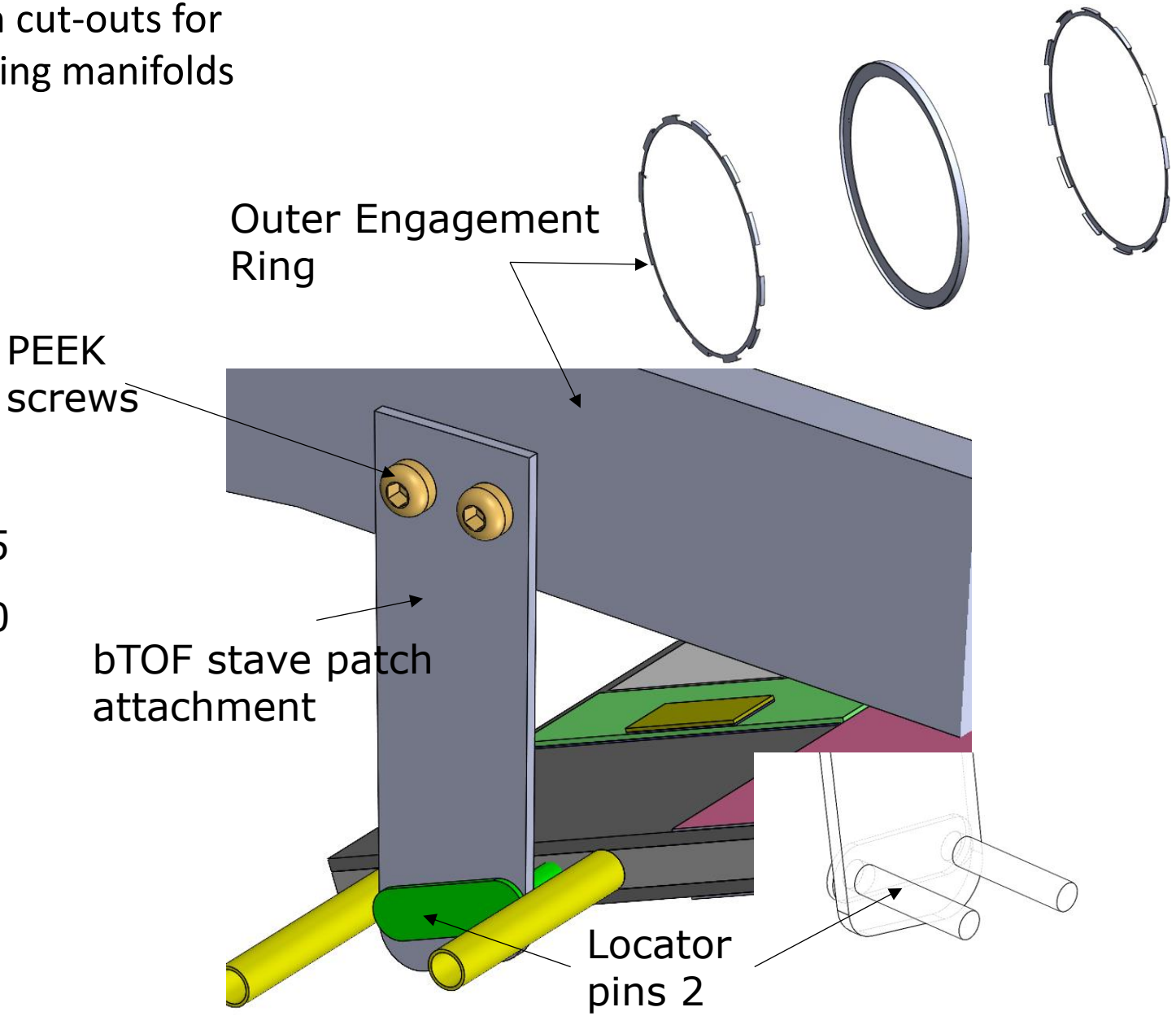


At this point there is access both on the radially inside and outside the bTOF space/envelope

New Design of Engagement Rings and bTOF assembly

- Outer engagement ring has a L-profile with cut-outs for mounting portcards/patch panels and cooling manifolds

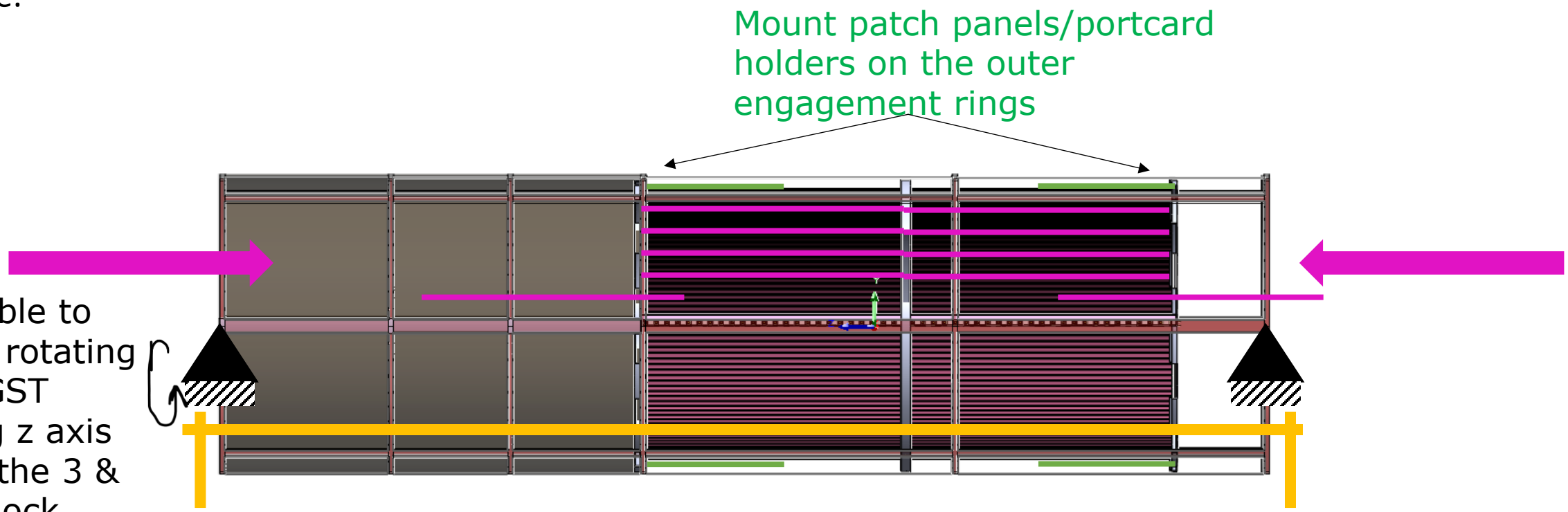




Package 1 sub-assembly

3. Once all the staves have been mounted – we can cable each stave to a port card / patch panel

And cooling lines to a cooling manifold. Current cooling performance and thermal FEAs indicate that we can service 12 staves with one global cooling to bTOF system inlet and then spread the manifold line.



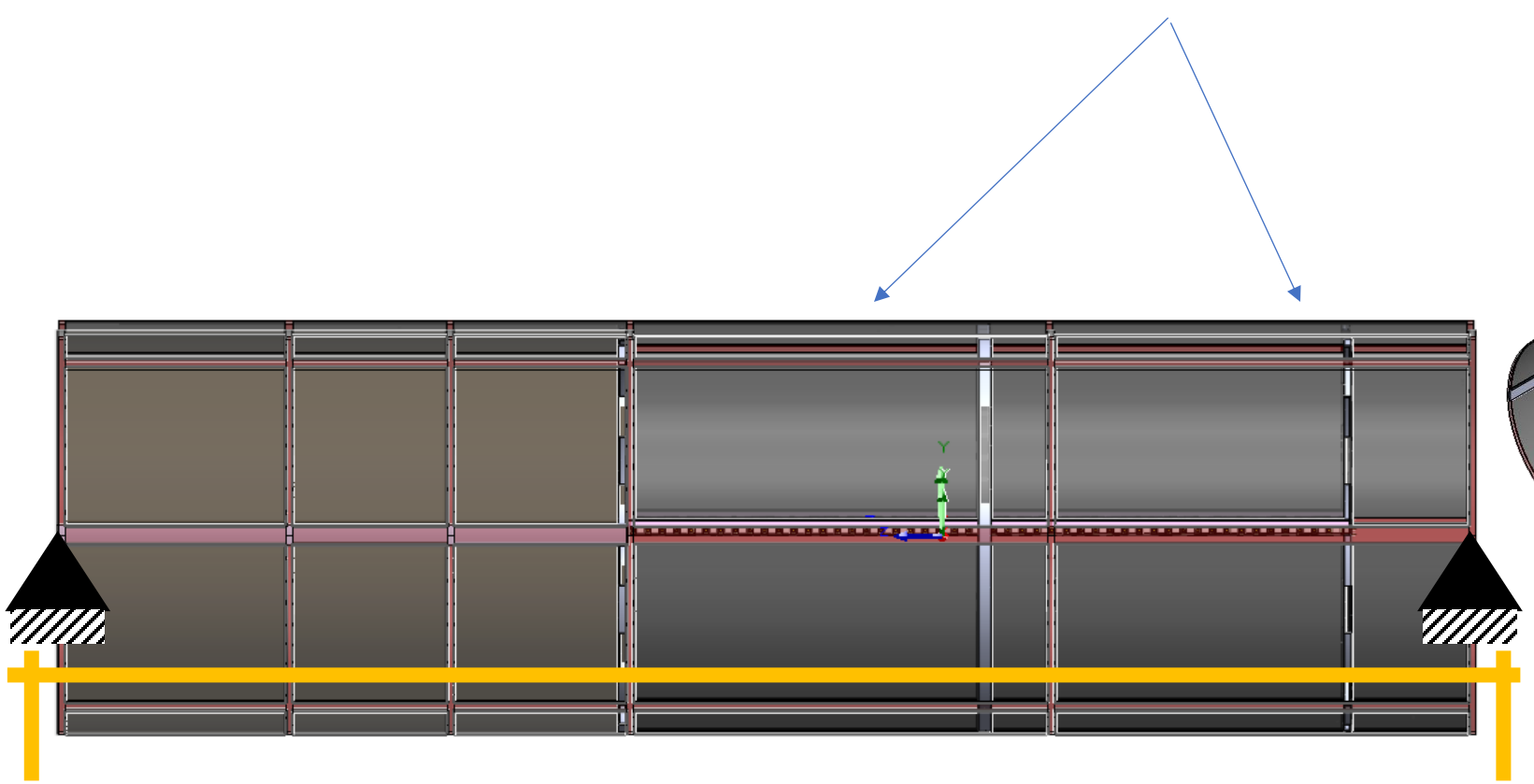
Possible to keep rotating the GST along z axis with the 3 & 9 o'clock mounts

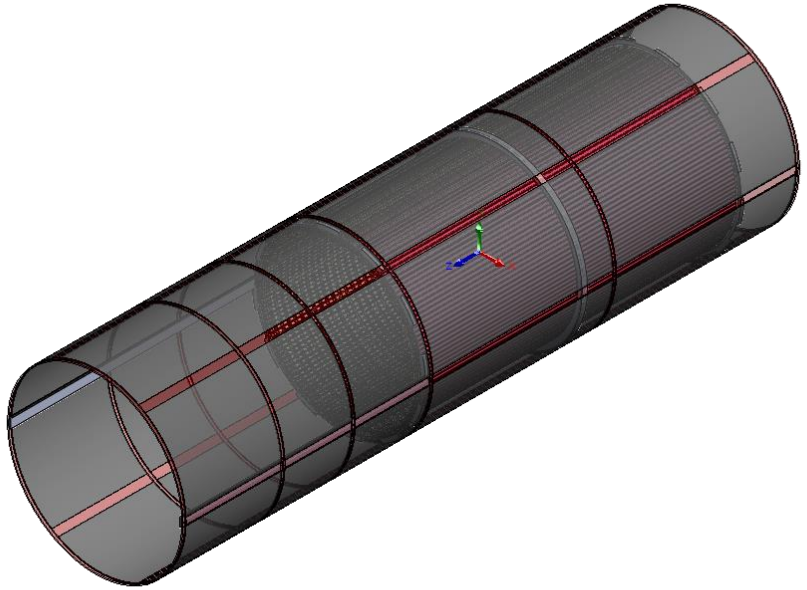
At this point there is access both on the radially inside and outside the bTOF space/envelope

Package 1 sub-assembly

3. Replace the GST panel (which will be screwed or bolted in) – into the GST ribcage.

These panels will be shear panels and will be thinner than the ones on the pfRICH and EEEMCal end.





At this point there is access both on the radially inside and outside the bTOF space/envelope

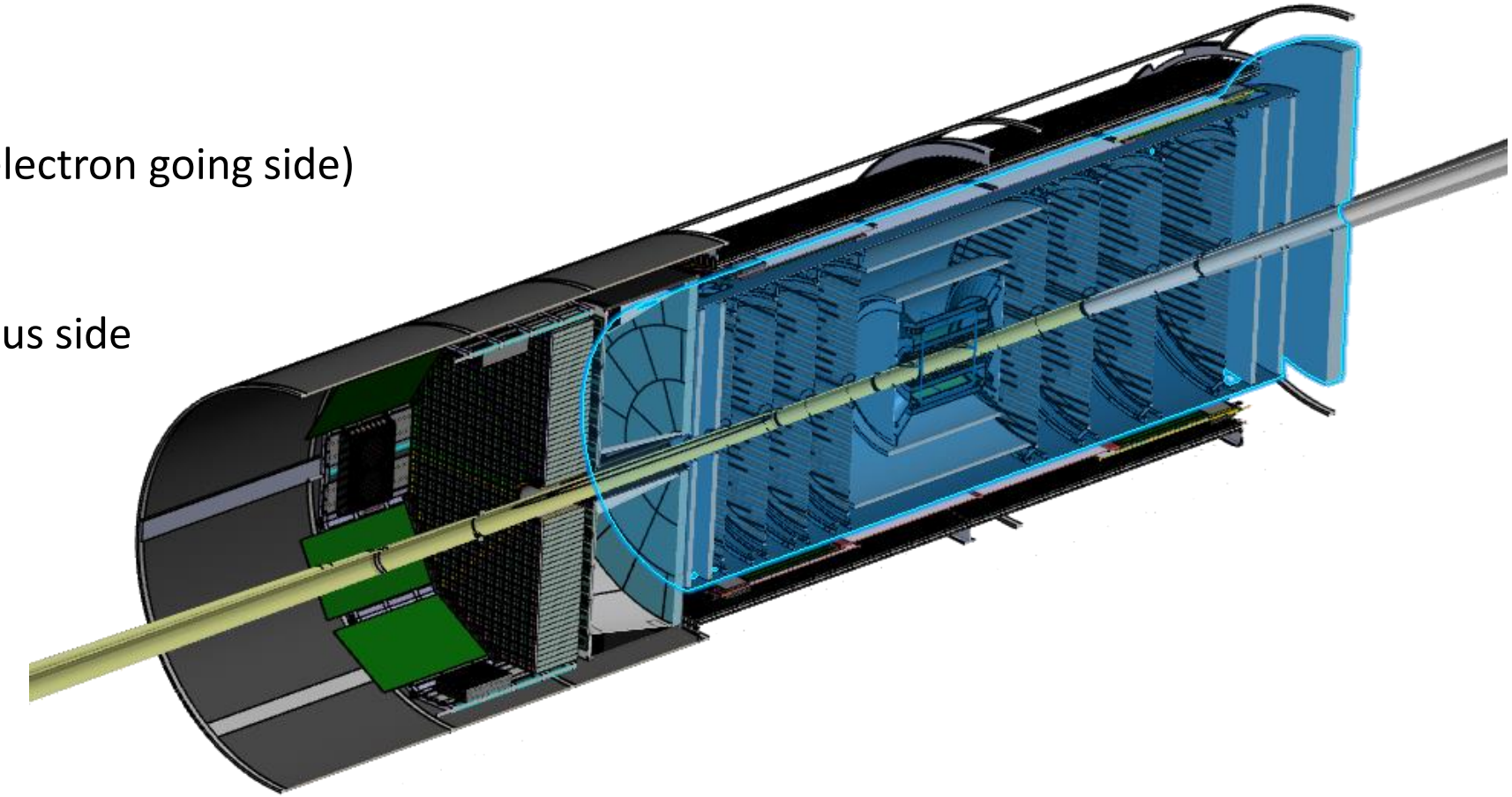
Package 1 sub-assembly is ready

Questions ?

Package 2 sub-assembly

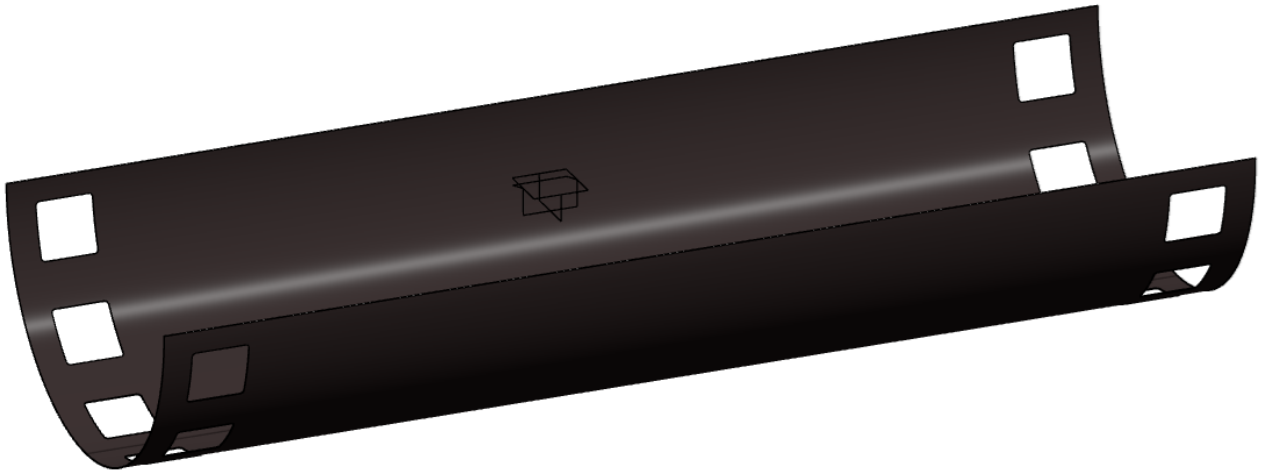
- Package 2 is the SVT subassembly –

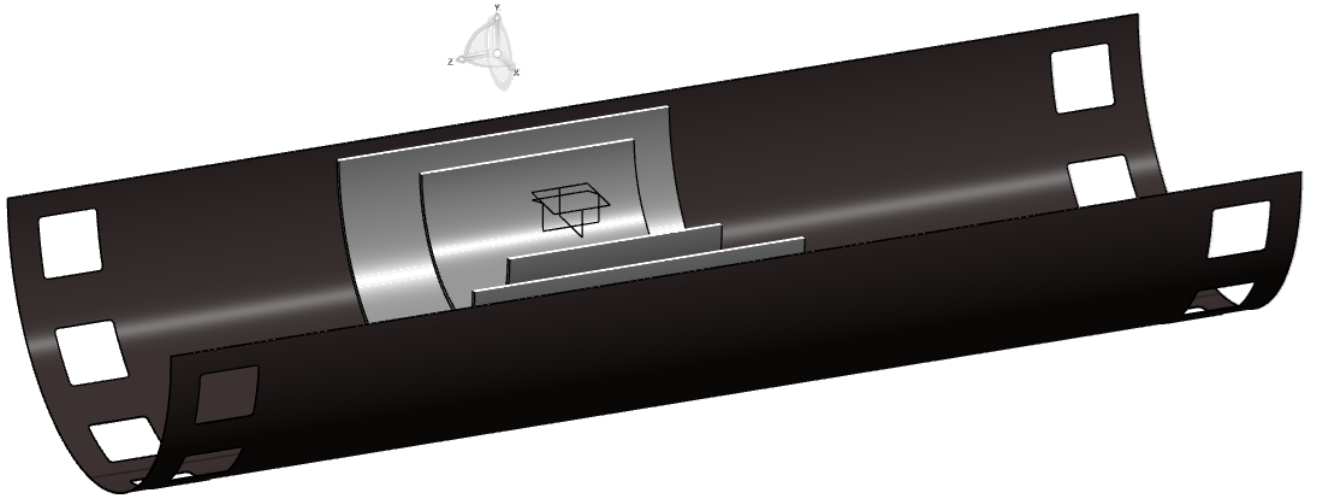
1. SVT support tube (~PST)
2. SVT barrels
3. SVT discs
4. MPGD discs on Z_plus (electron going side)
5. Beam Pipe
6. Services support on Z_plus side



SVT Assembly Sequence 1

- Outermost barrel layer with the support cylinder – layer 4 mounted on the SVT support structure (~PST)



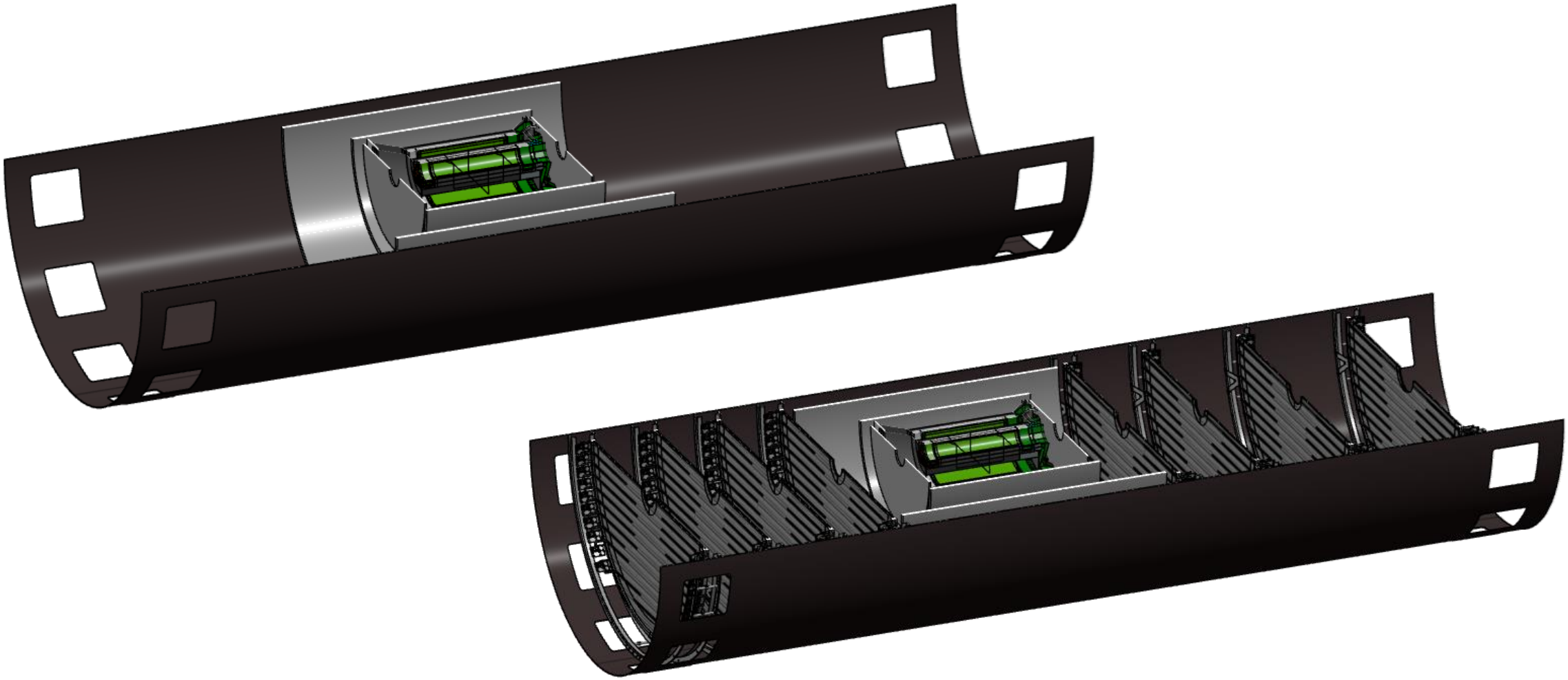


SVT Assembly Sequence 2

- Installation and wiring of layer 3 and layer 2
- Inner most barrel layers 1 and 0 and cabling

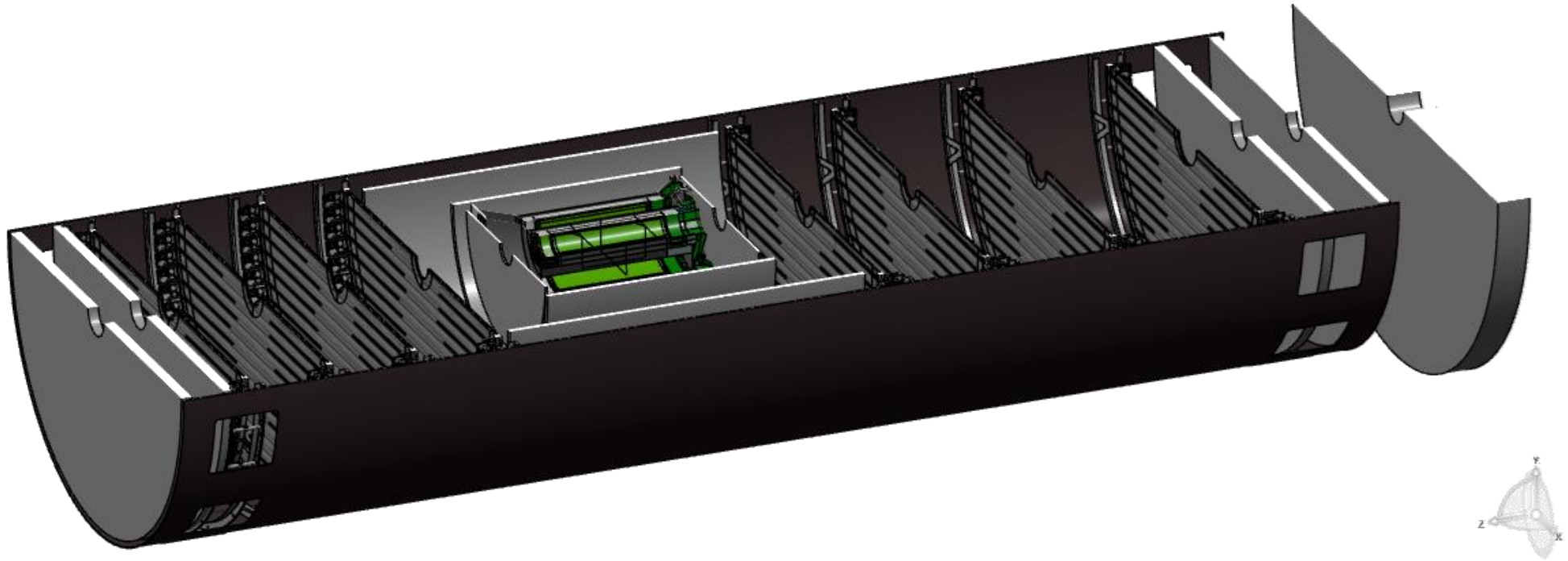
SVT Assembly Sequence 3

- Assemble discs from inside (closest to IP) to out in Z+/-



SVT Assembly Sequence 4

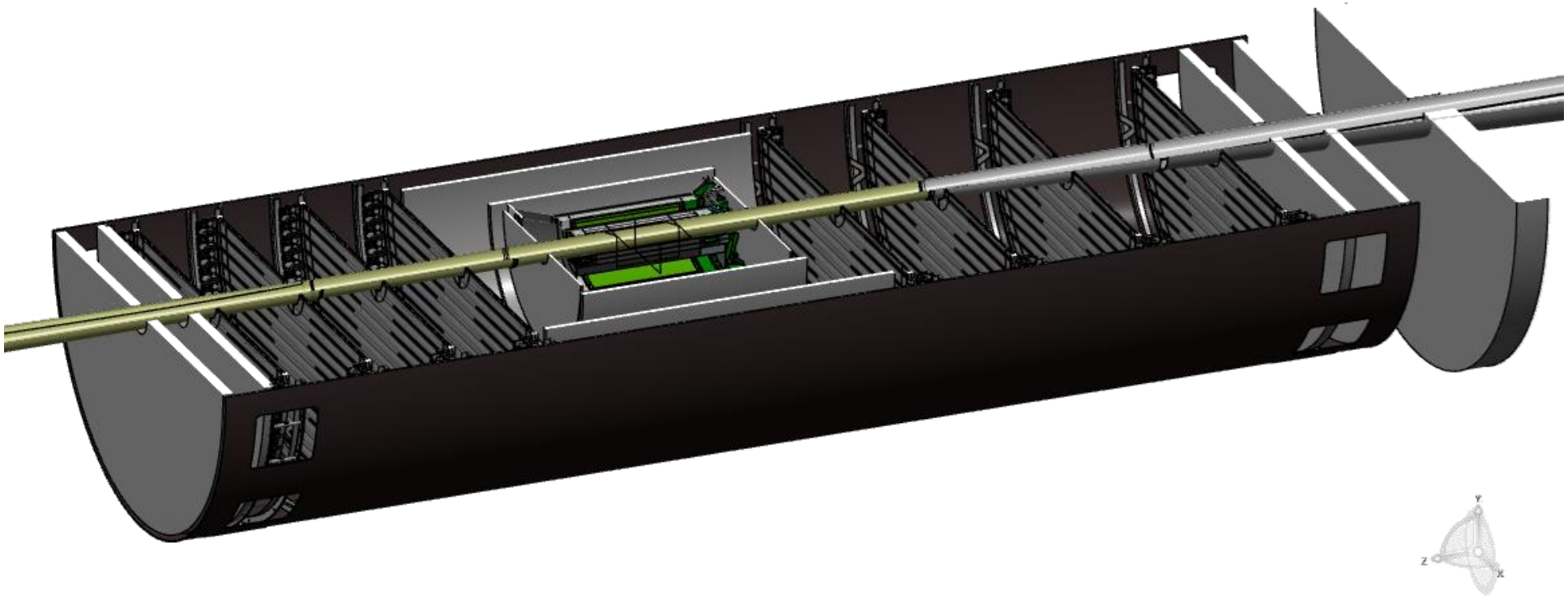
- Mount MPGD discs and fTOF disc (maybe)
- The cabling and packaging is done here.



SVT Assembly Sequence 5

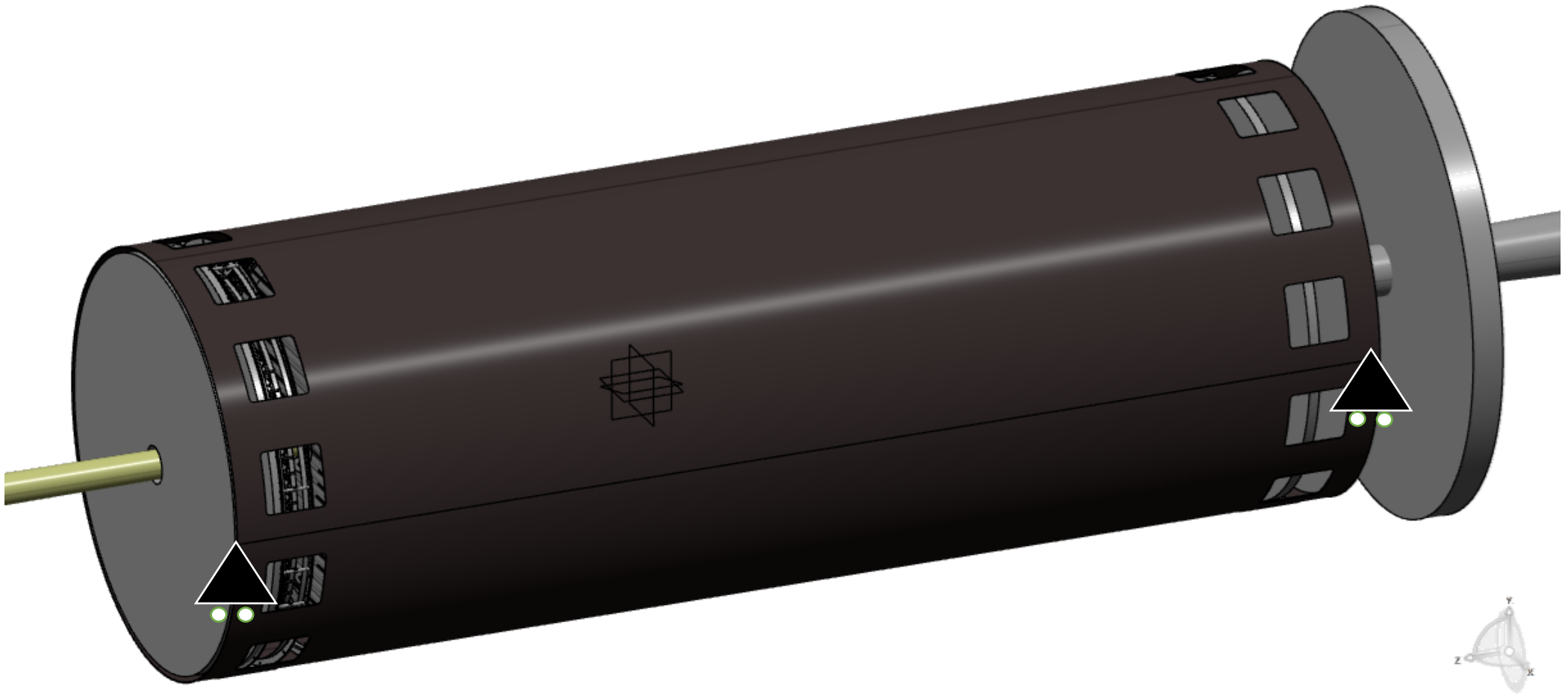
- Install the beam pipe with supports in the bottom half shell of the SVT package

- A similar assembly on the top half of the shell for the SVT package will be implemented



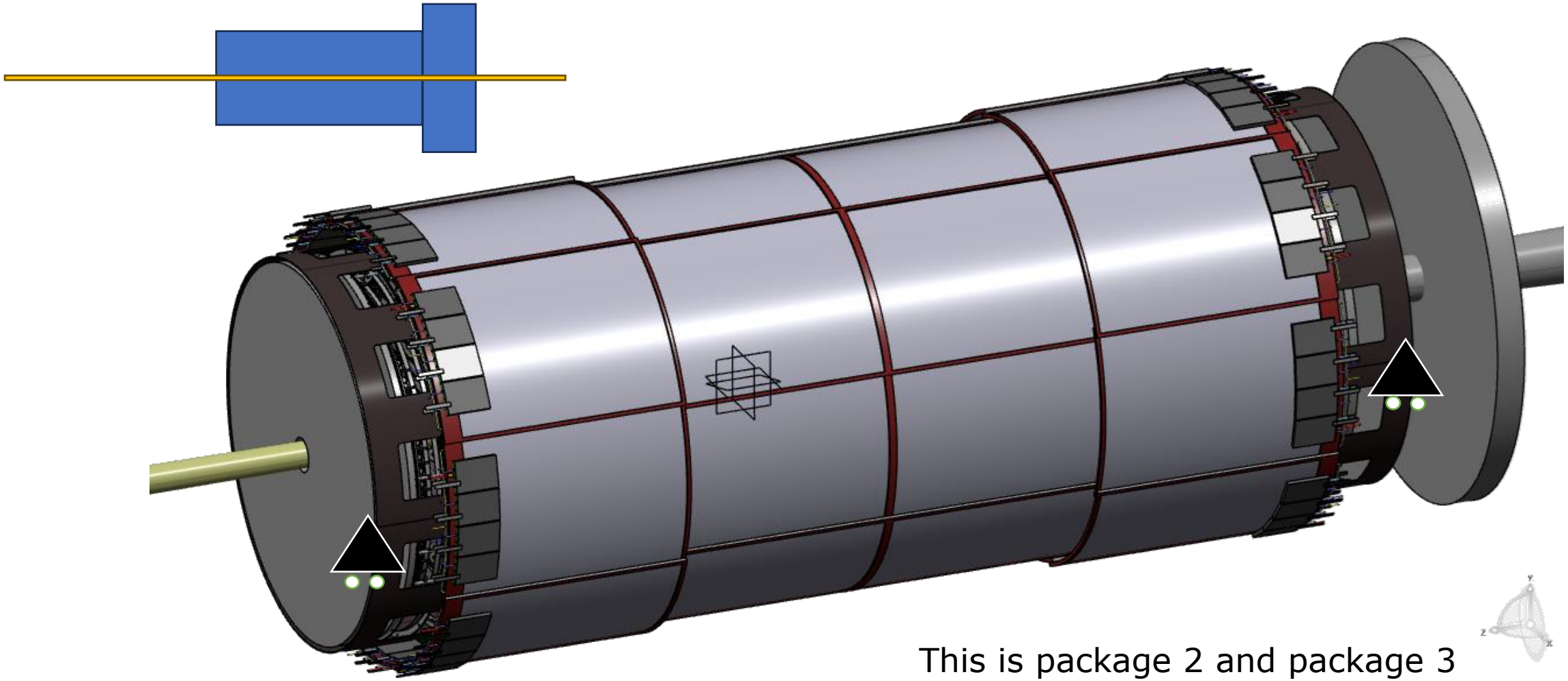
SVT Assembly Sequence 5

- Close this package and make this as Package 2 sub-assembly



SVT Assembly Sequence 6

- Cymbal MPGD gets mounted with the 8 i-beams on the PST at this point.



This is package 2 and package 3 completed

Comparing methods 1 & 2

1. Supports on a frame structure directly to Engagement Rings

- Cells can be individually placed
- For services dressing there is access from both sides (inside Cymbal and outside Cymbal) radially
- The sub-assembly needs to be inserted into the engagement ring assembly - need additional temporary jigs and rails.

2. Support from Pixel Support Tube (if the pixel support tube concept is approved)

- Cells can be individually placed
- For services dressing there is access from radially outside Cymbal
- The sub-assembly will be inserted into engagement rings along with the SVT assembly – we already are working to make this integration mechanism.

THIS IS BEING EXPLORED AS THE SVT GLOBAL MECHANICS DESIGN COMES ALONG

Note – this is now default 1325-20250312 - srk

Slide from 14th Feb 2024

Package 2+3 sub-assembly is ready

Questions ?

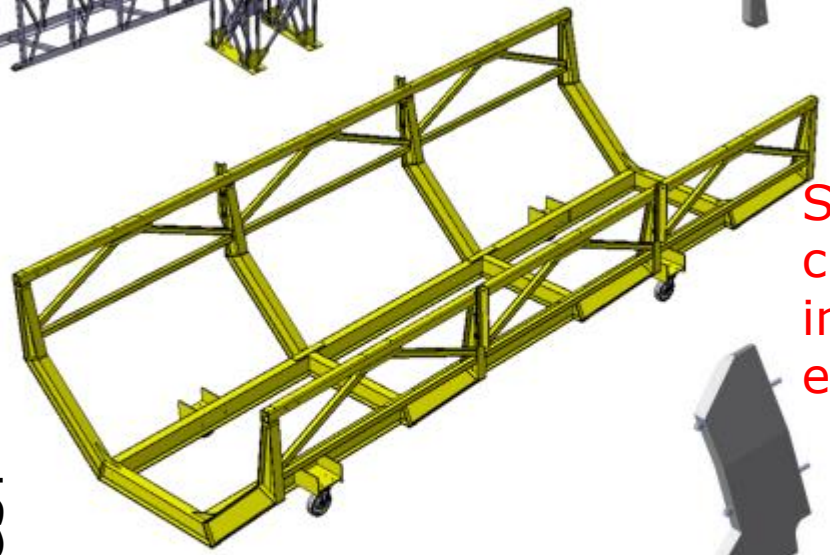
Installation of Package 2/3 into Package 1

- This has not been completely designed
- The concept is using similar eifel tower mechanism
- Borrowing slides from CMS work
- Next slides are copied from CMS project – all credits for this to CMS group at CERN.

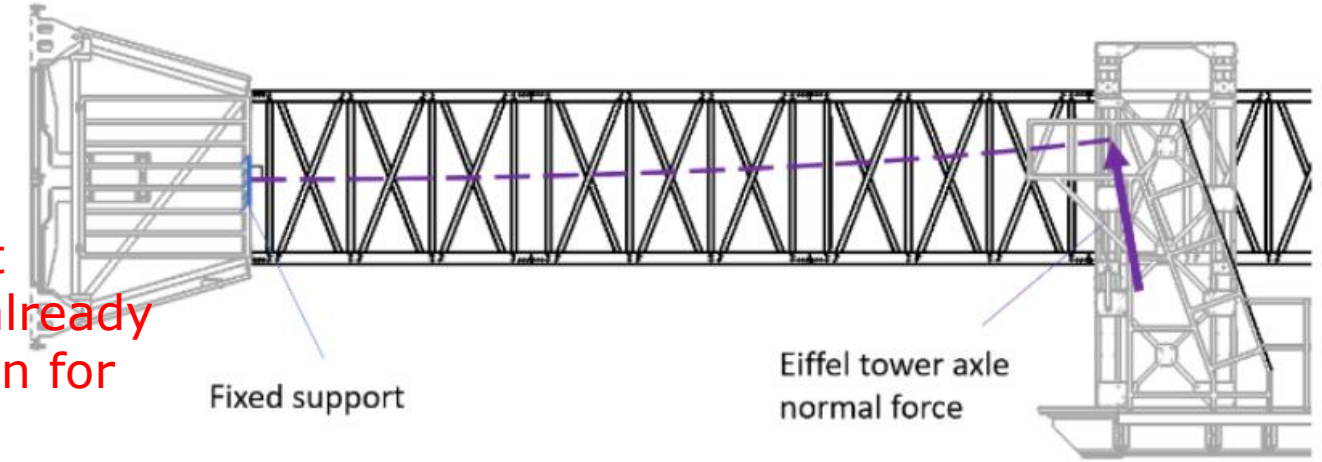
Approach from CMS and adaptation to ePIC

Modular Eiffel Tower

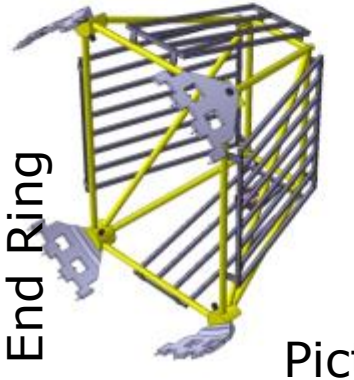
Wheels/Rails



Support cradle already in design for ePIC

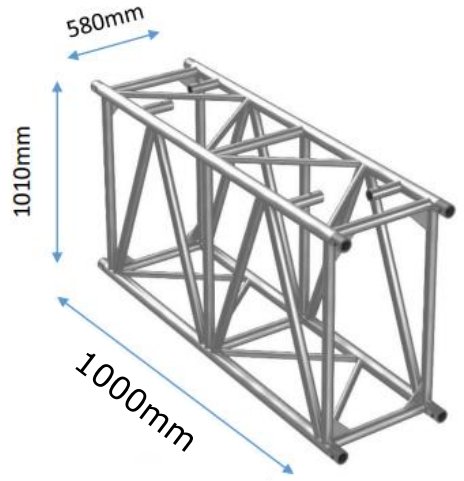


Pull interface that attaches to the GST End Ring



Bananas

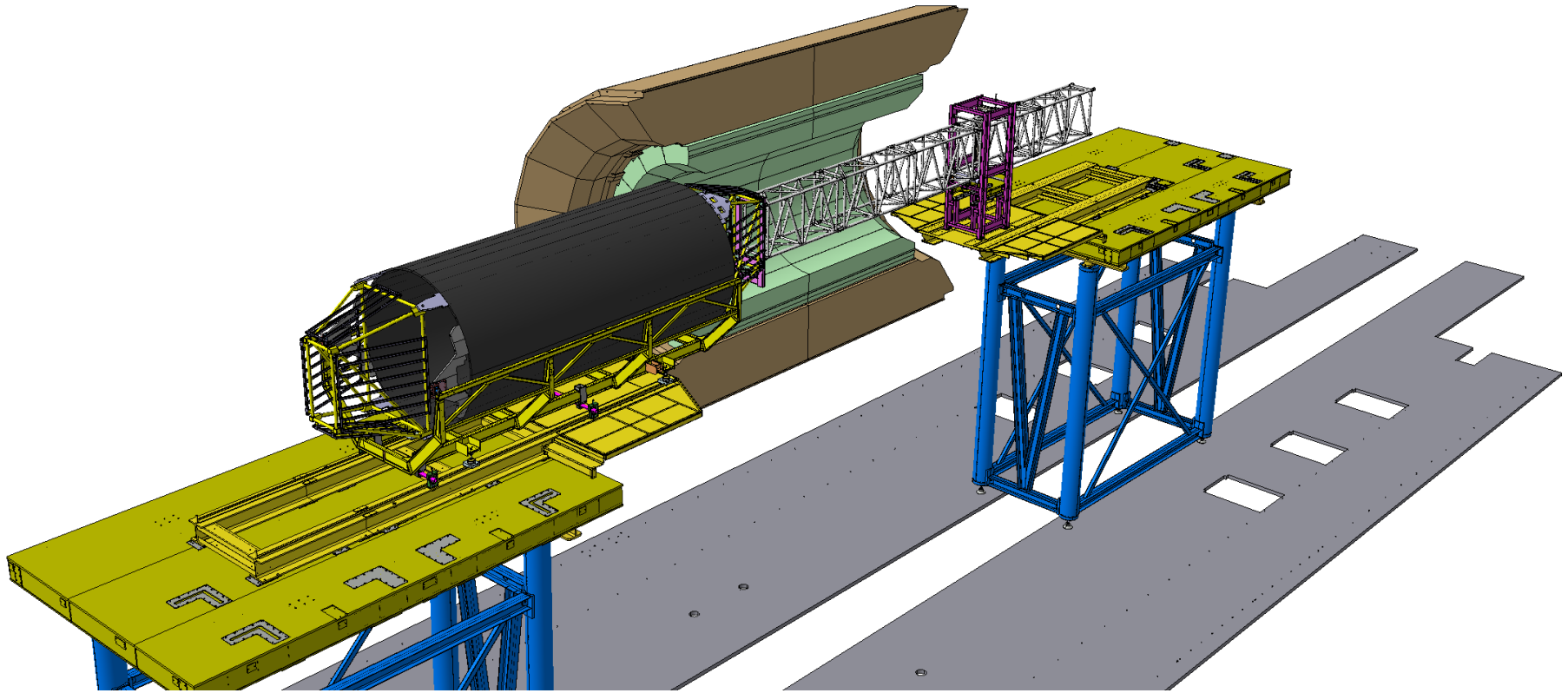
Modular structural design that is able to be mounted as the structure is pushed / removed since there is not enough space on the platform on electron side



Pictures from Mikko Barinoff – CMS CERN ; indico 1112851

Eiffel tower concept

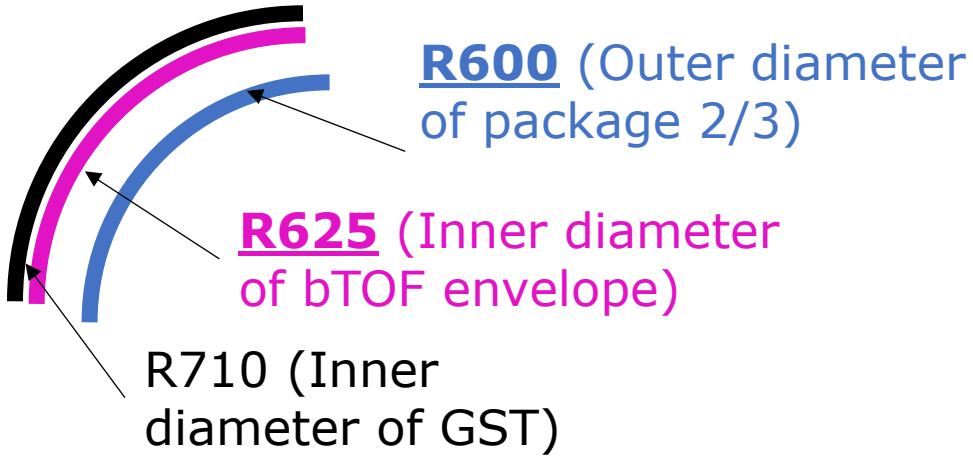
Concept from CMS for installation and removal for the Tracking detector

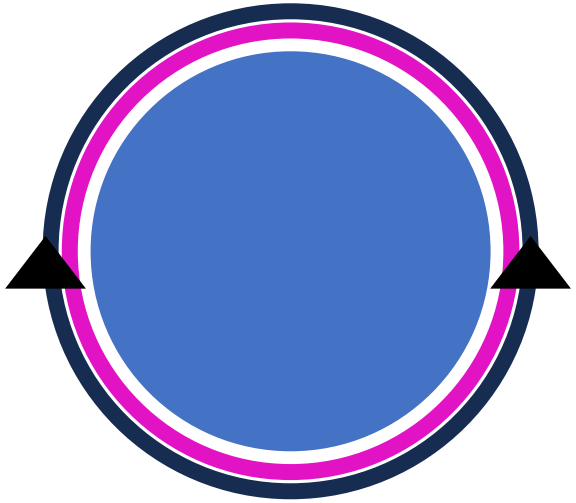


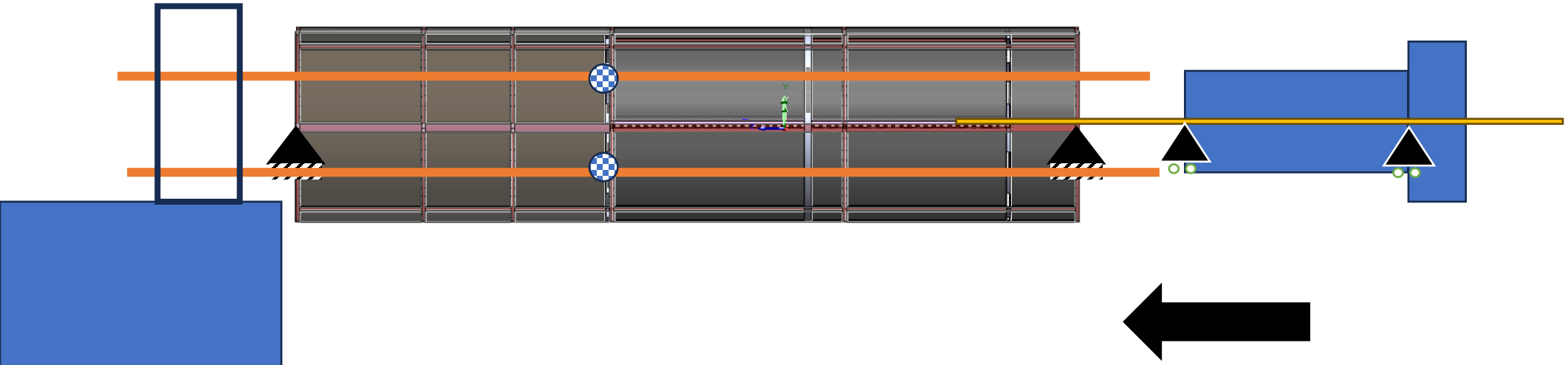
(video)

Installing Package 2/3 into Package 1

There is 25 mm (1inch) clearance radially for this insertion of Package 2/3 into Package 1







Package 2/3 gets inserted into package 1 using small eifel tower and rails at 3 and 9 o'clock

GST + Inner Detectors installation into barrel HCal / BIC (?)

- Similar to the eifel tower mechanism on the solid end rings of the GST.

- Question from discussion with Dan/Roland – Does the GST get supported from end plate of the Barrel HCAL or from BIC ?

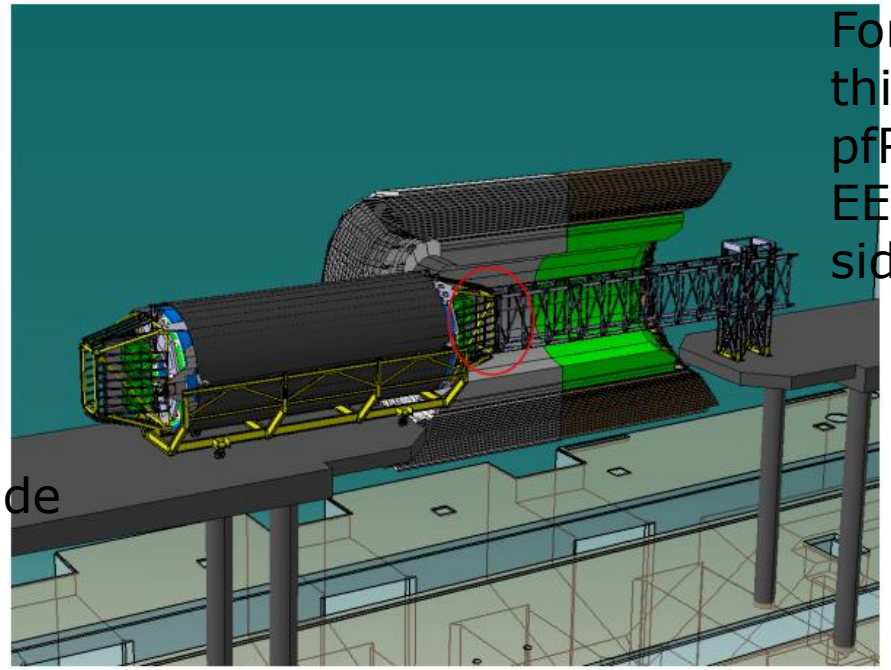
Questions ?

Back up slides

Approach from CMS and adaptation to ePIC

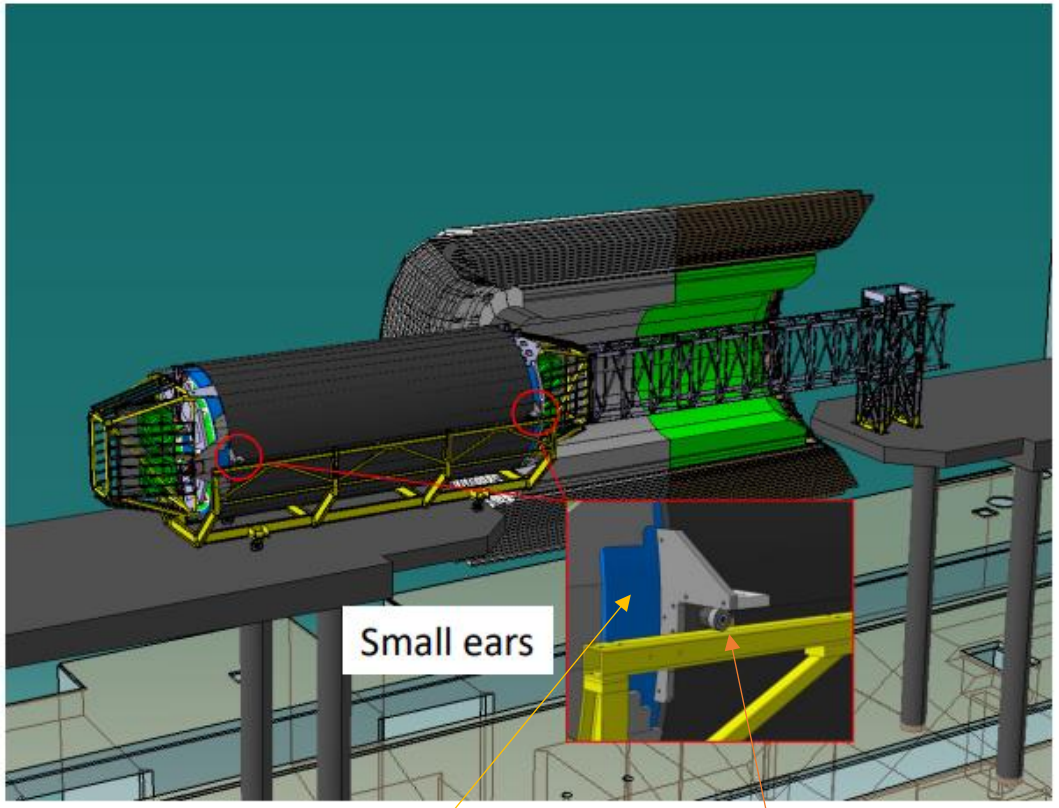
Step 1: Connecting the Eiffel tower to the Tracker

- The Eiffel tower is connected to the Z+ -end steel nose cone



For ePIC this is dRICH side

For ePIC this is pfRICH / EEMCal side



Bananas

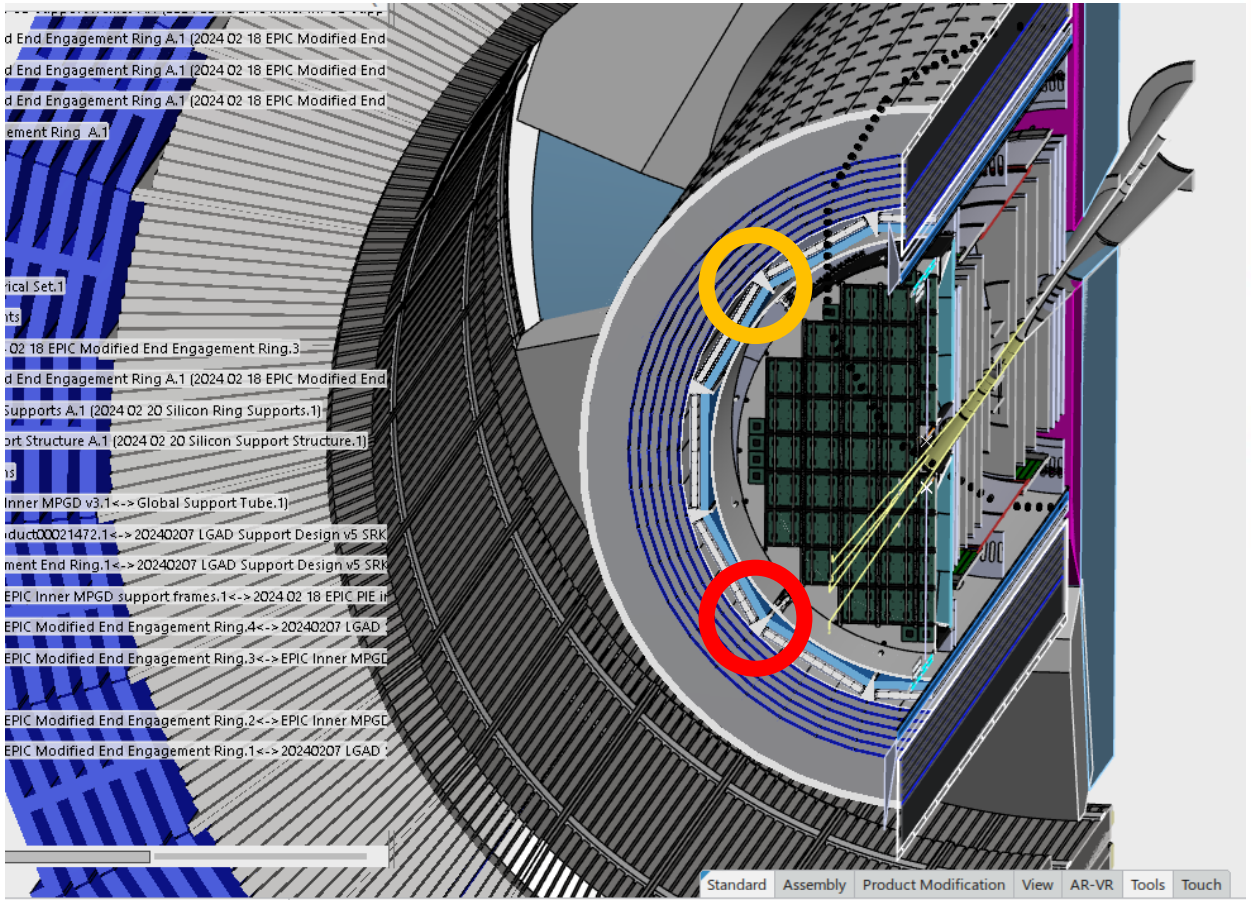
Detector rides on these wheels at 3 and 9 o-clock for CMS

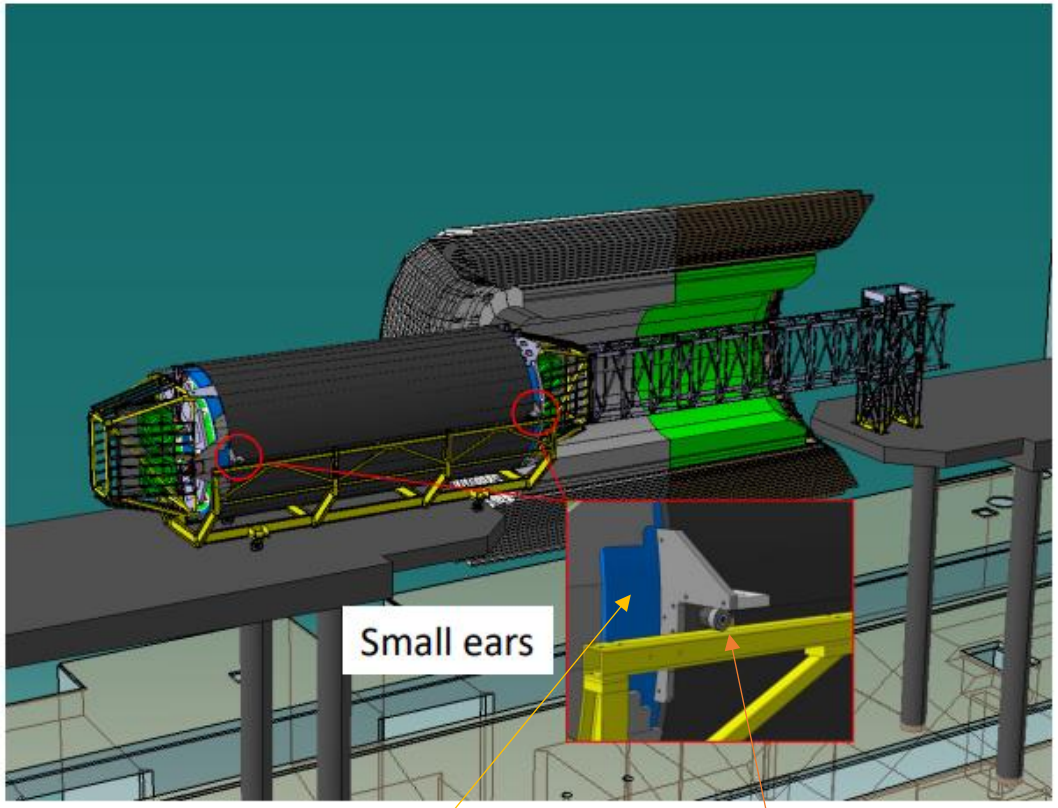
Approach from CMS and adaptation to ePIC

Suggestion from J. Harvey

This is redundancy/safety rail

This is the load bearing rail for installation

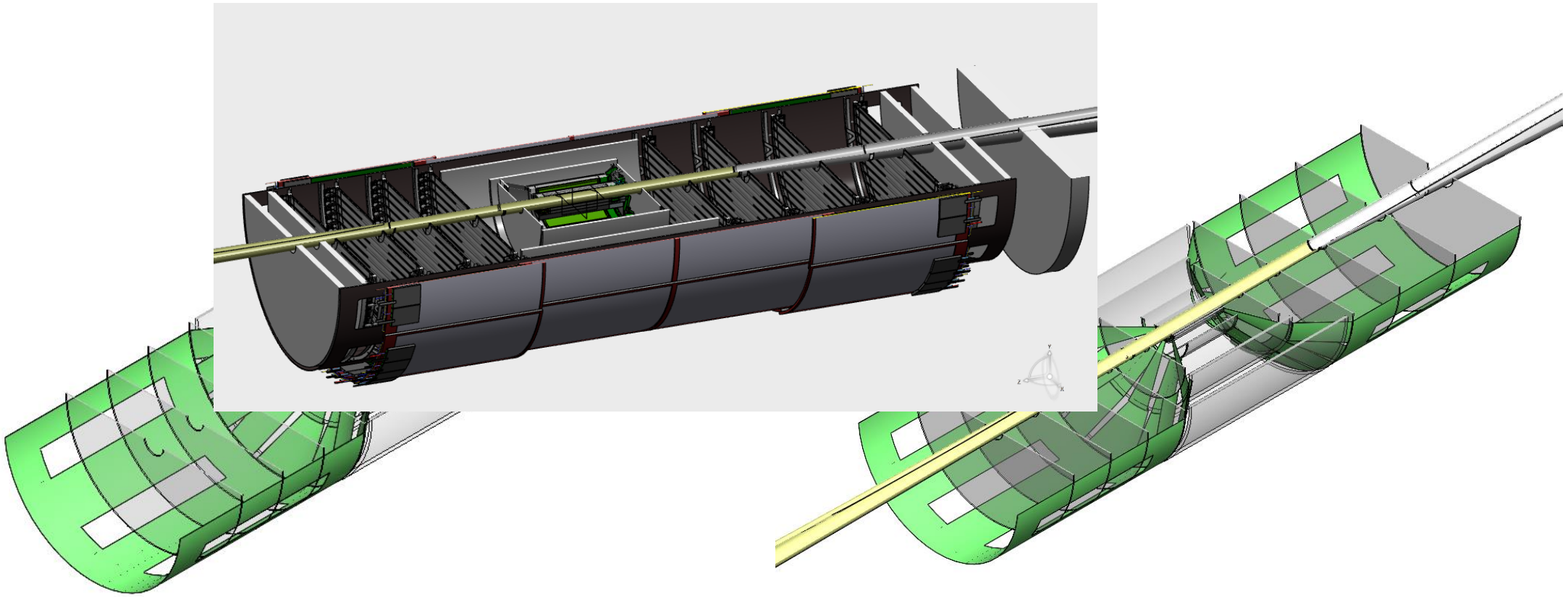




Bananas

Detector rides on these wheels at 3 and 9 o-clock for CMS

Assembly Sequence 8



Insert beam pipe and repeat the assembly for the top clamp structure in reverse order