

GST Simulation Updates – HP-DIRC radial mounting

Simulation for the radial mounting scheme for the HP-DIRC (BaBar) Bars
radially into the GST frame

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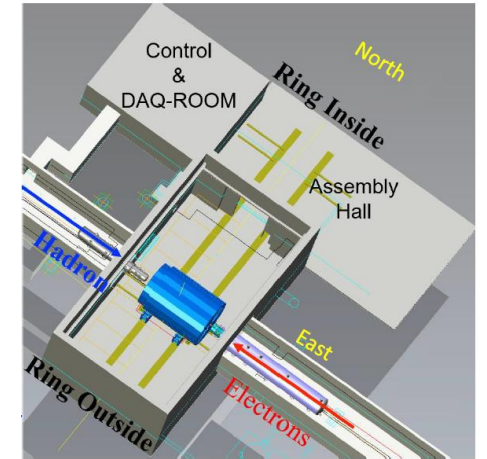
14 Sept 2026

Motivation

⬡ **Charge questions** – what is the deformation if we remove sections of the outer barrel CFRP layer while integrating the HP-DIRC crystals into the GST and what are the deformations there after for the GST upon installation of the rest of the components.

⬡ This assumes the installation sequence of the detectors in GST as follows –

1. Start with the “blank” GST.
2. First insert the HP-DIRC + Outer MPGD (this is TBD – just used for the “weights”)
3. Then the PST package gets installed with the beam pipe.
4. The package is moved into the experimental hall.
5. TOF+Cymbal trays are installed
6. pfRICH
7. EEEMCal

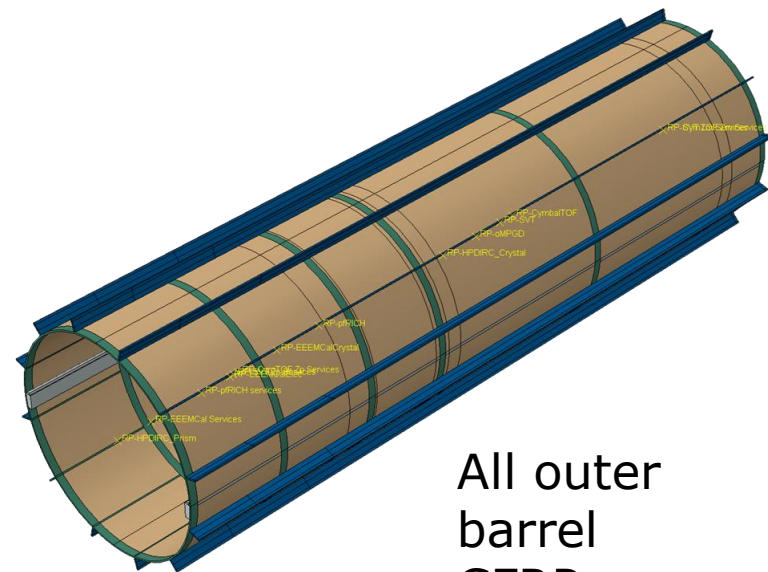
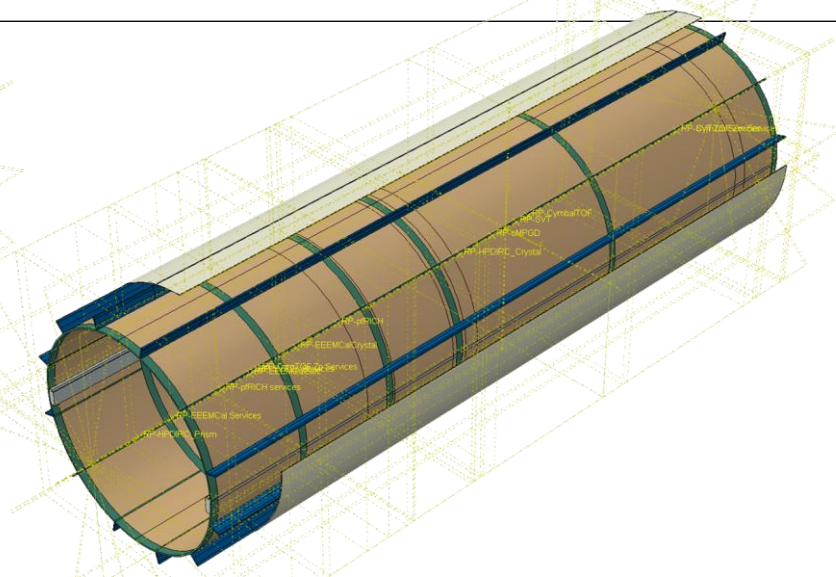
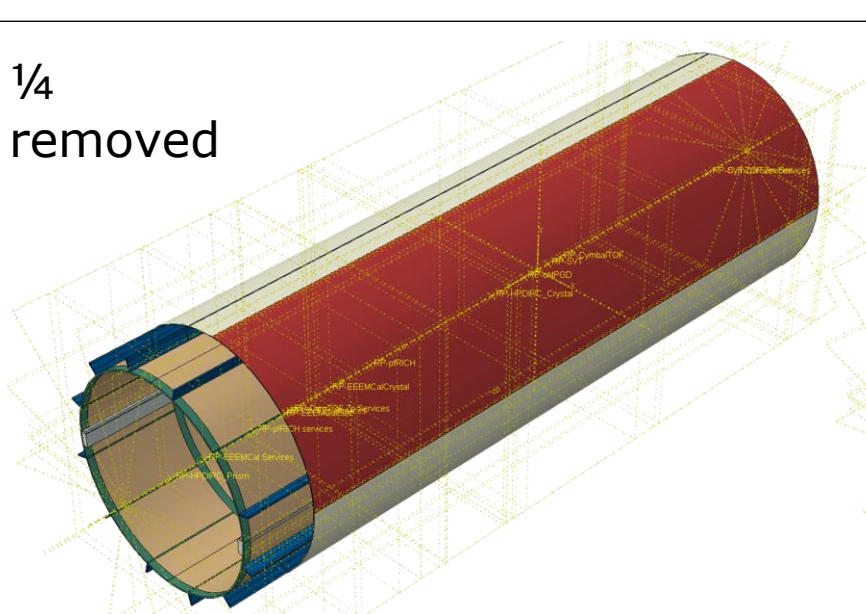


In assembly hall

In Experimental hall

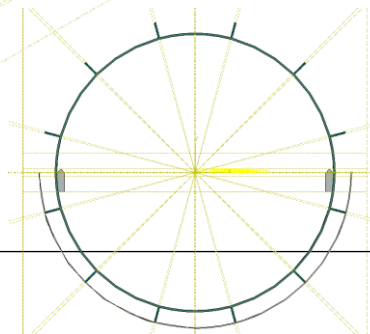
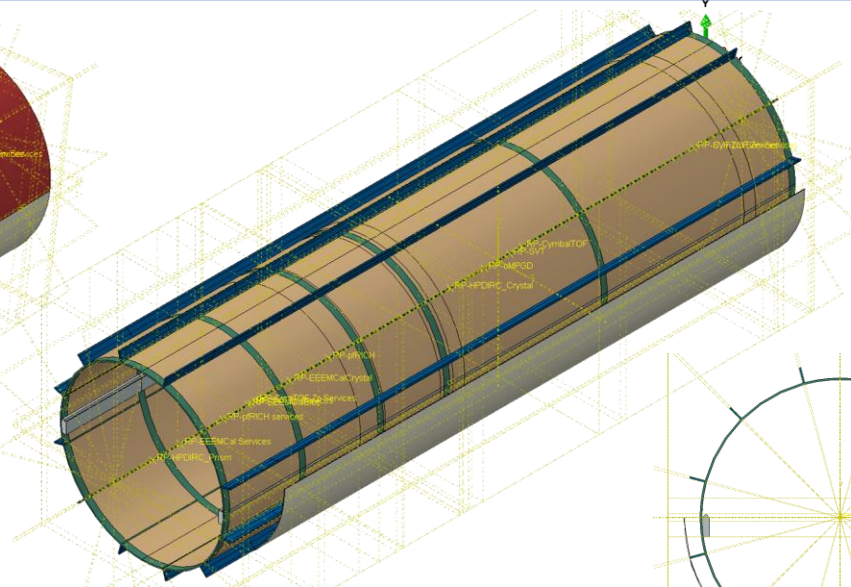
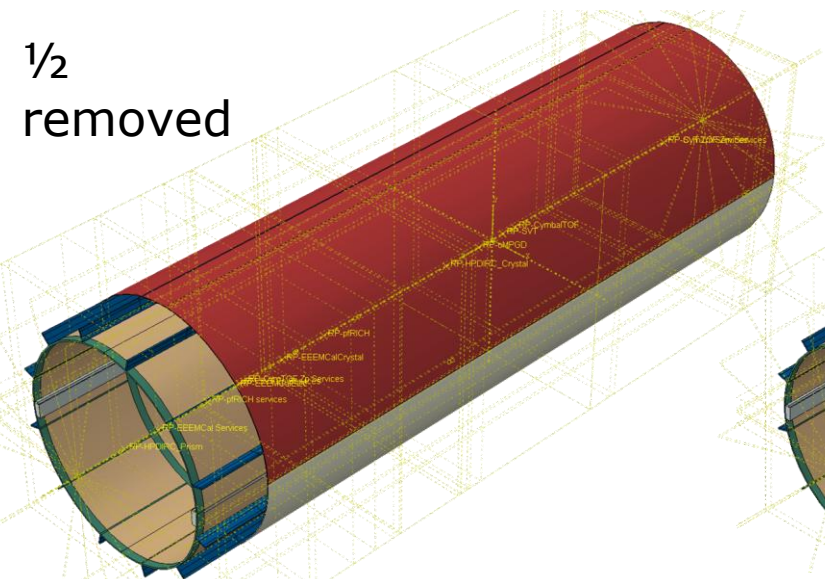
Cases under study

$\frac{1}{4}$
removed



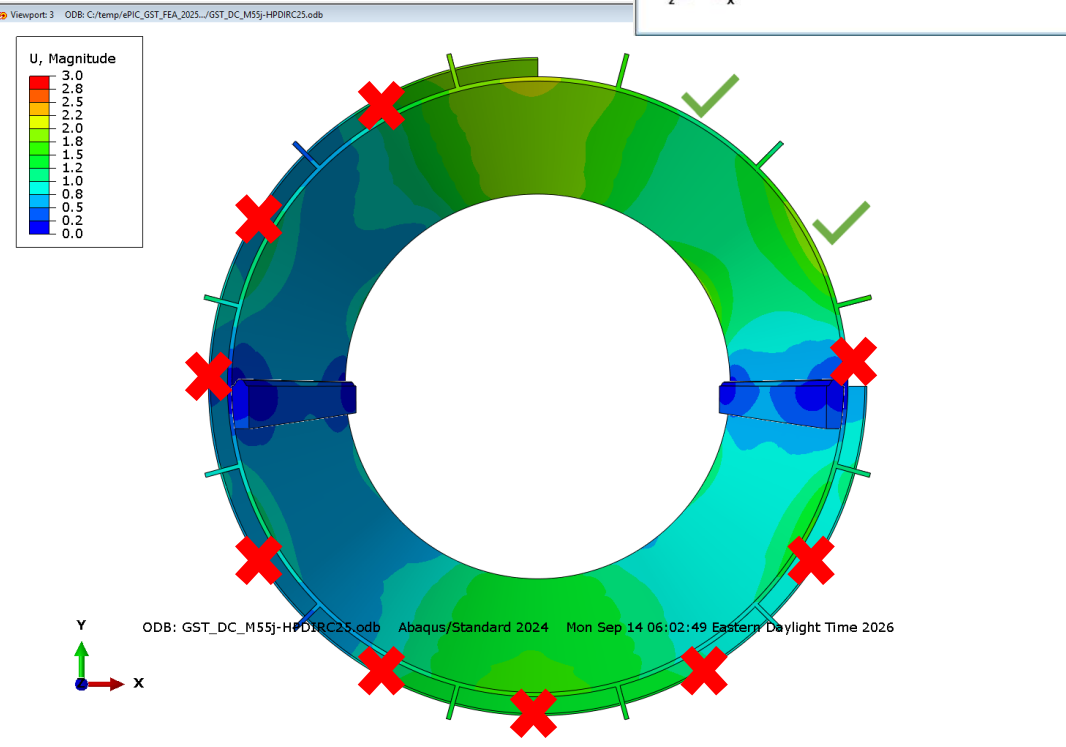
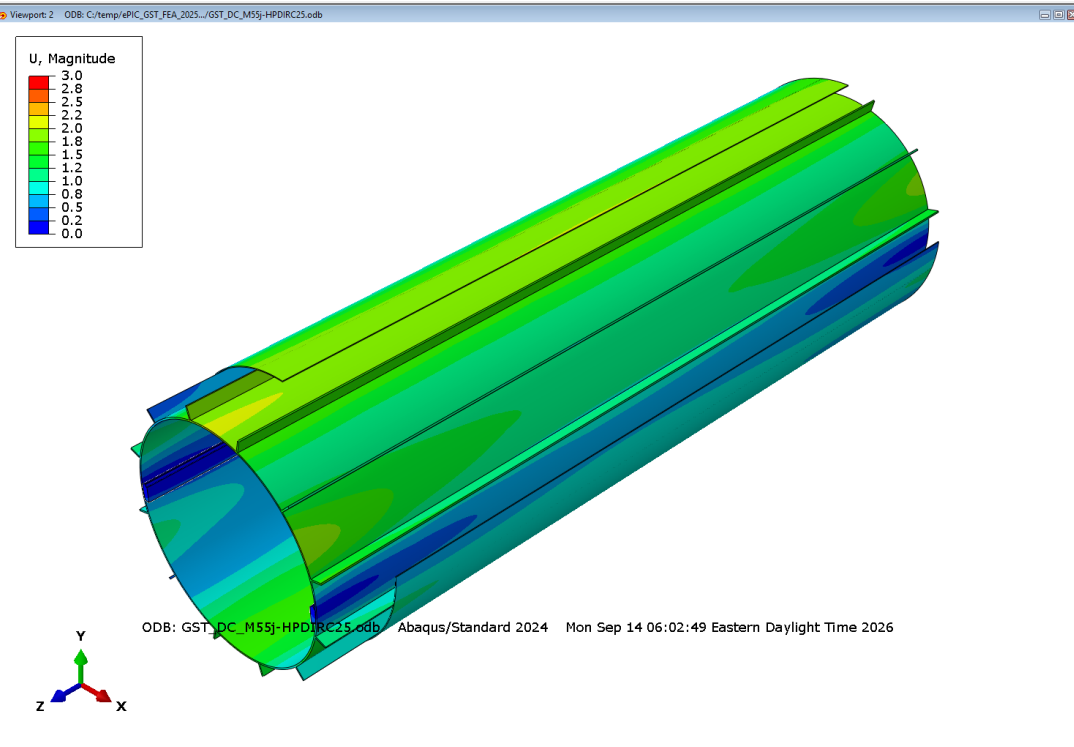
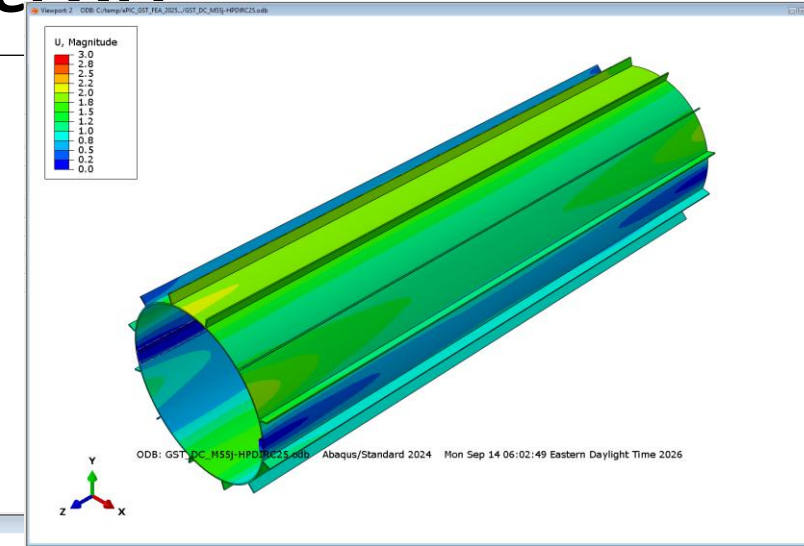
All outer
barrel
CFRP
removed

$\frac{1}{2}$
removed



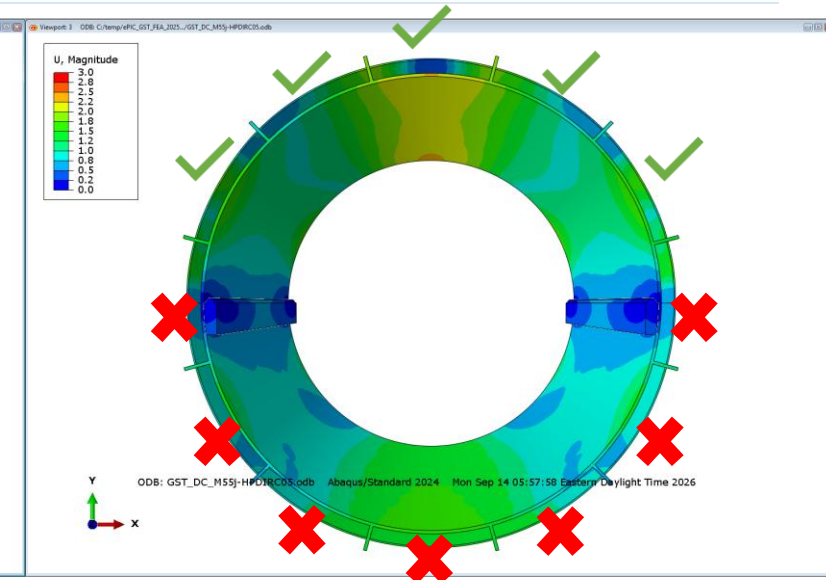
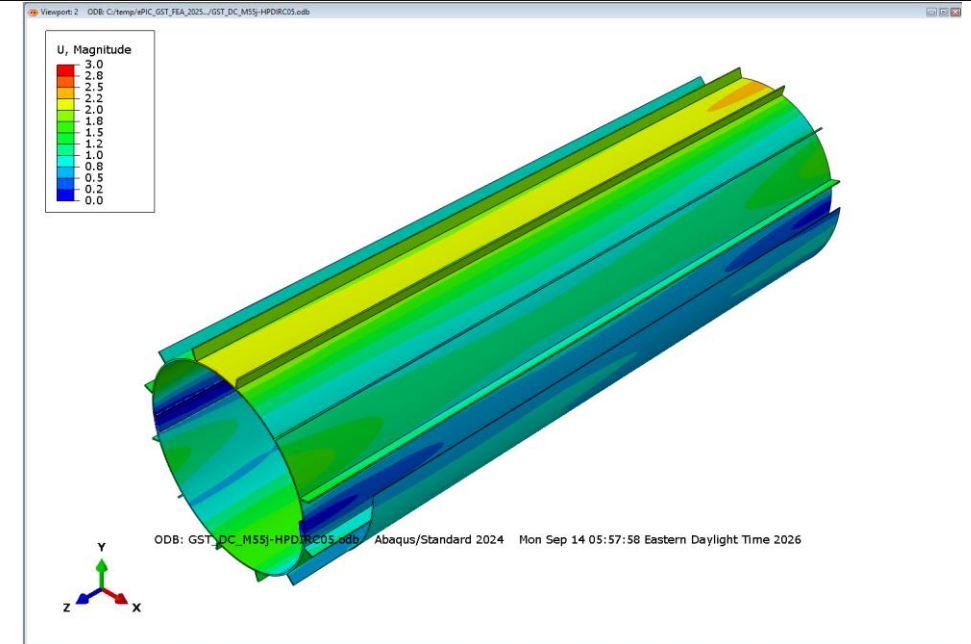
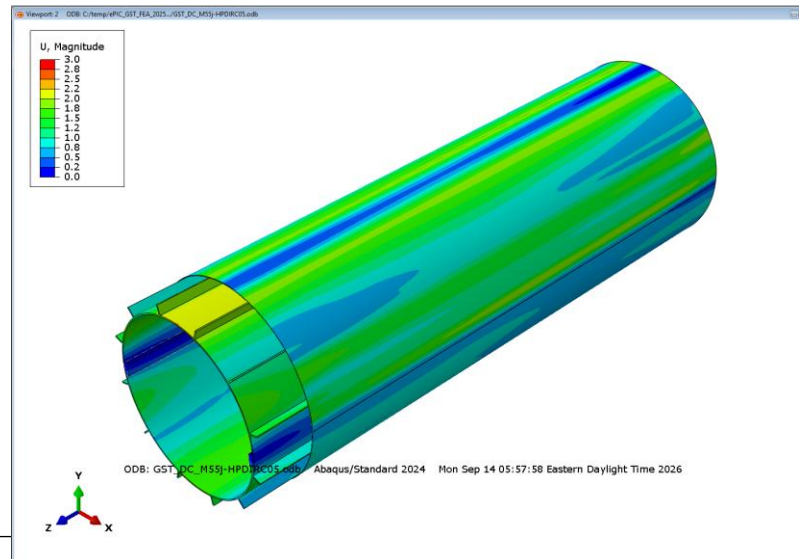
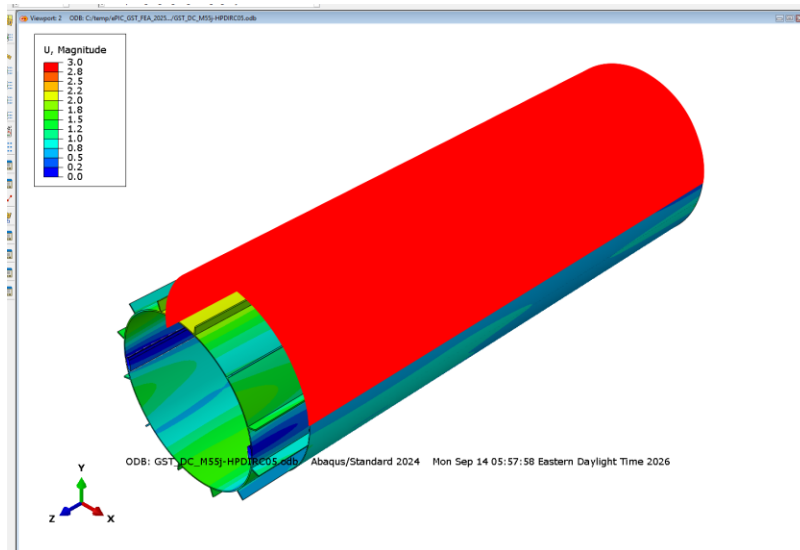
GST with 2 sector HPDIRC load – panel OFF

- ⬡ HP-Dirc mounted in two “sectors” with the panel off.
- ⬡ We can manage these deflections



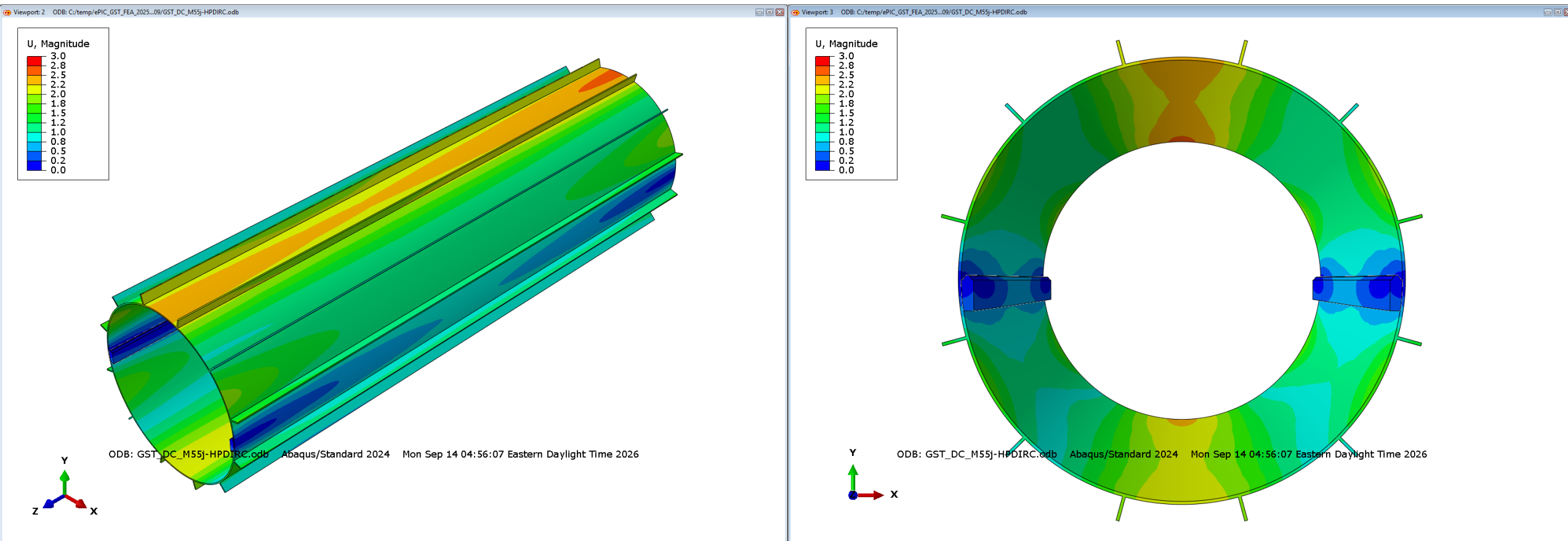
GST 5 sector HP DIRC load with Panel ON

- ⬢ Might need to check this simulation – the first results show that the load coupling is not happening correctly in the simulation.
- ⬢ However, even this the deformations are not too bad.



Fully loaded HP-DIRC all panels off

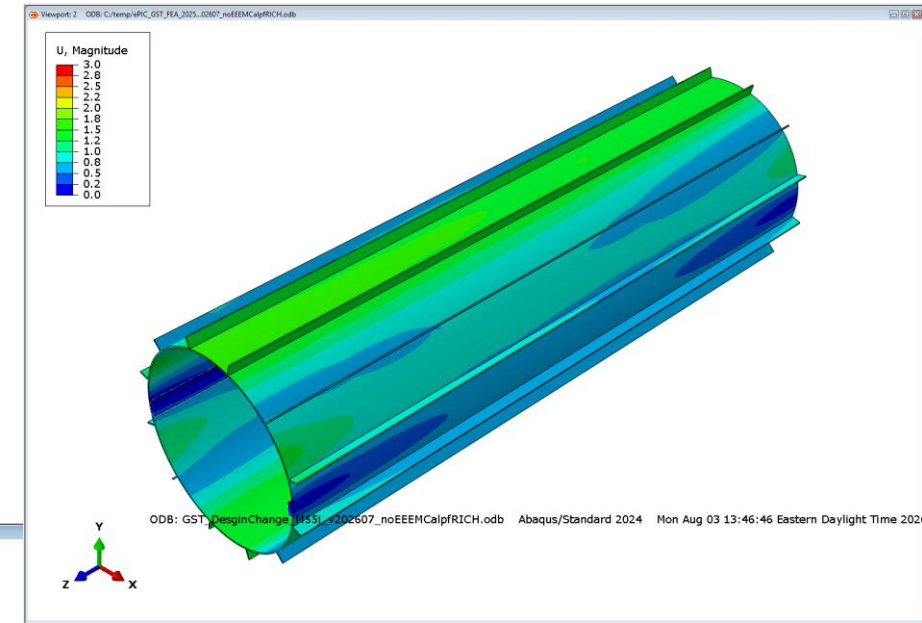
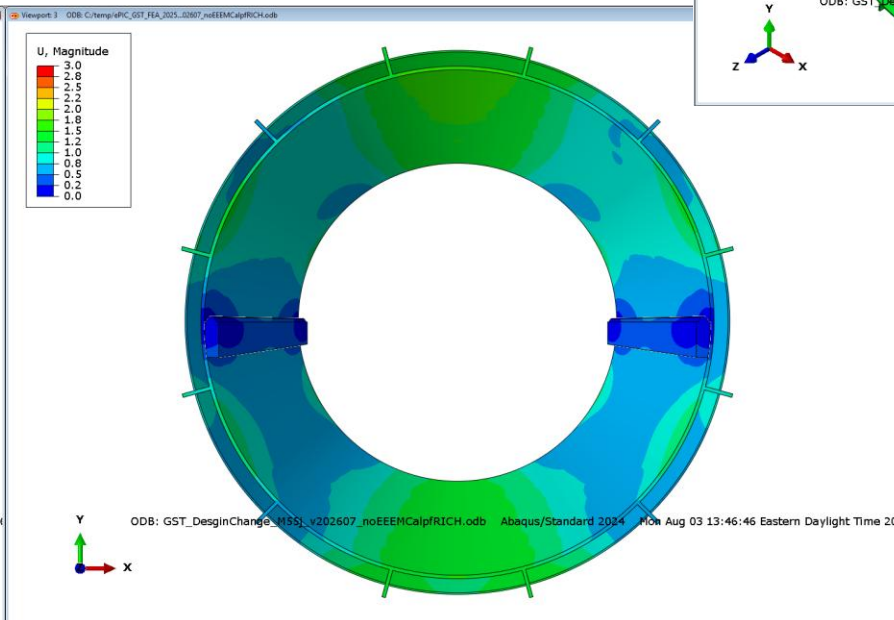
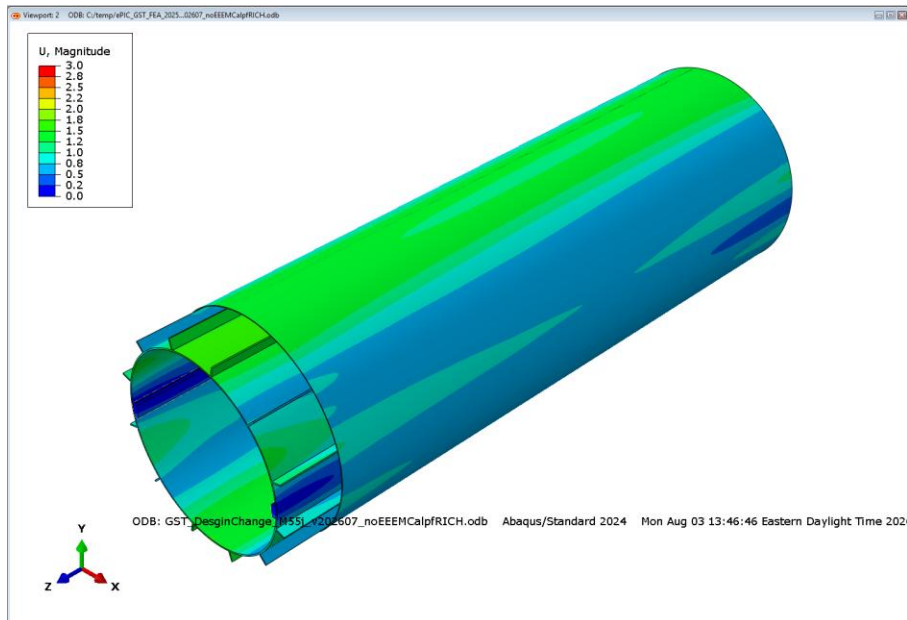
- First simulation started with the thought – what happens if we do not have the outer barrel for the GST at all. – we are “losing” between 0.8 to 1mm deformation – deformation is more in this case as expected. All 12 Hp Dirc sectors are present in this simulation.



Partial load – Single barrel skin (no EEEMCAL & pfRICH)

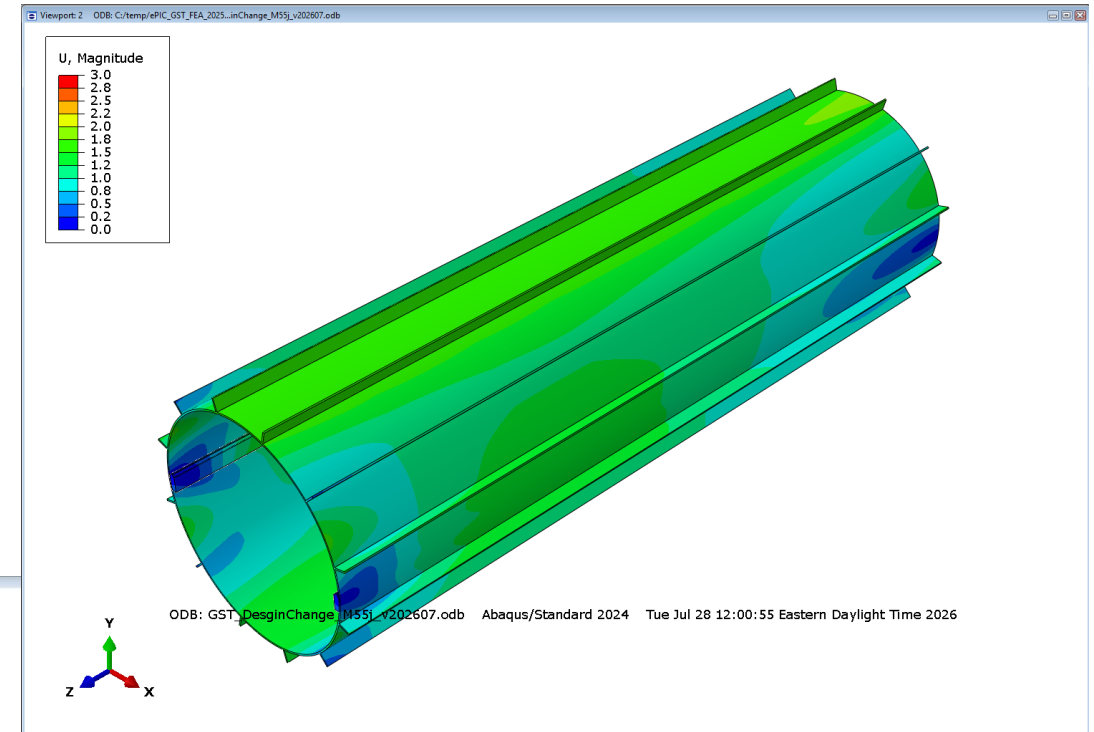
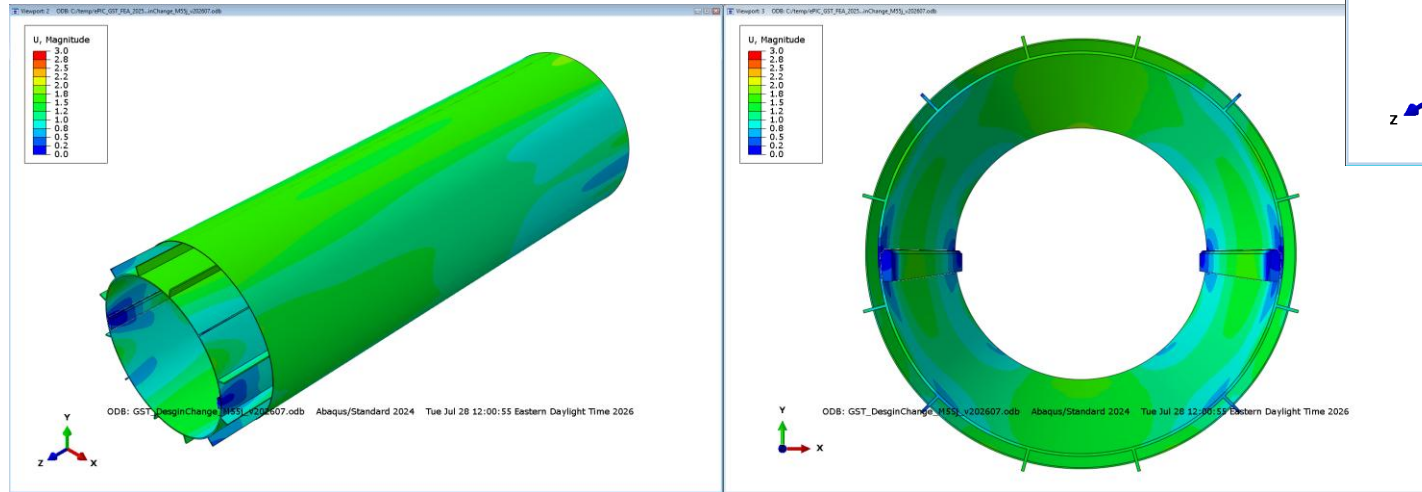
For reminder –
simulations from
July/August 2026

- ⬡ We are going to take 0.6 to 0.8 mm deflection penalty if we use panel approach
- ⬡ Looking at changing some designs on the outer panel (have some geometrical stiffening to recover this loss)



Fully loaded – Single barrel skin (no segmentation)

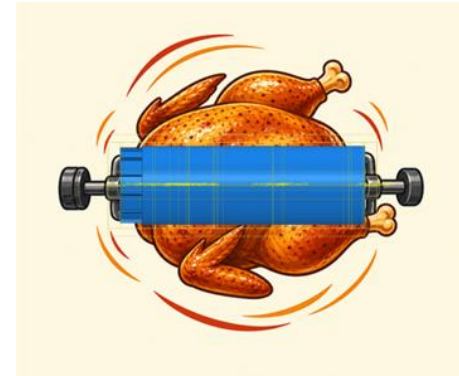
For reminder –
simulations from
July/August 2026



So what do we know after these simulations?

- ⬢ We can install the HP-DIRC radially inward instead of sliding if we so choose. This call needs to be made by Alex Eslinger and HP DIRC group.
- ⬢ In terms of installation and assembly this is a much easier way than sliding the HP-DIRC babar bars 5m into the GST.
- ⬢ We need more detailed simulations for each of the assembly stage.
- ⬢ The current idea is that we will only install radially inwards from ONE orientation. Most likely in the 12 o'clock vertically downwards.
- ⬢ The GST will be held on a Rotisserie and will be rotated as needed. (we have done this in the past)

Examples of the rotisserie



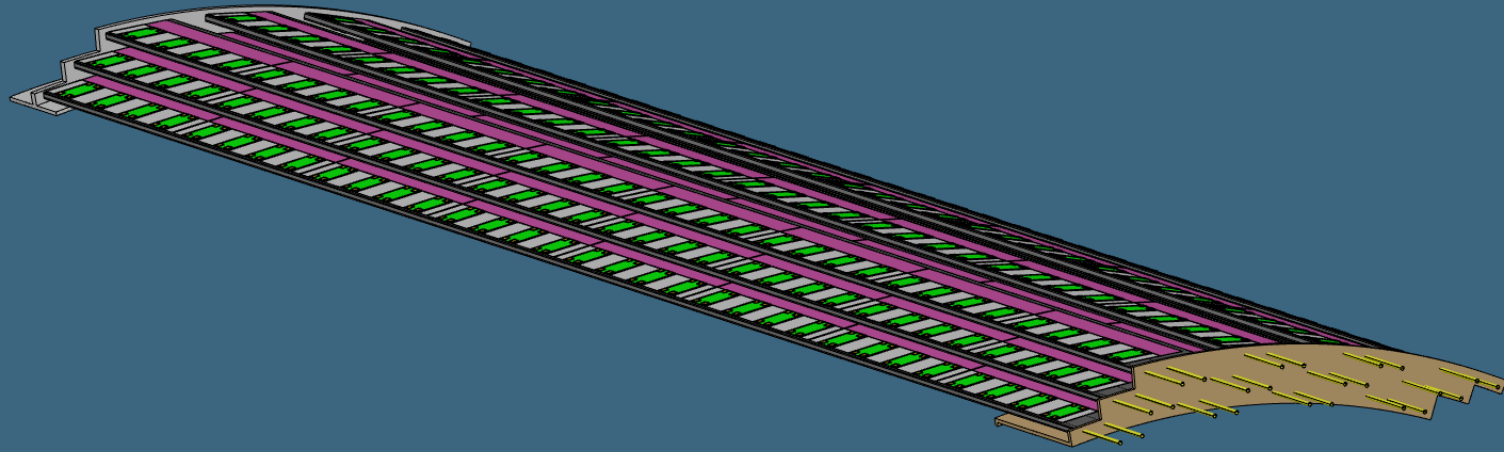
What's happening next?

- ⬡ Simulation of all the load cases for the rotisserie is a BIG time commitment. I have all the cases – 12 clocking locations as well as doing it to try and distribute the weight evenly.
- ⬡ There are preliminary design ideas for the panel structure for the GST, needs to be detailed out.
- ⬡ I will only do this once I get a green light that it is okay / needed to spend this time in doing the simulations from
 1. Andy Jung
 2. Alex Eslinger
 3. BNL Engineering team
 4. Radial insertion is selected as a viable installation path for HP-DIRC

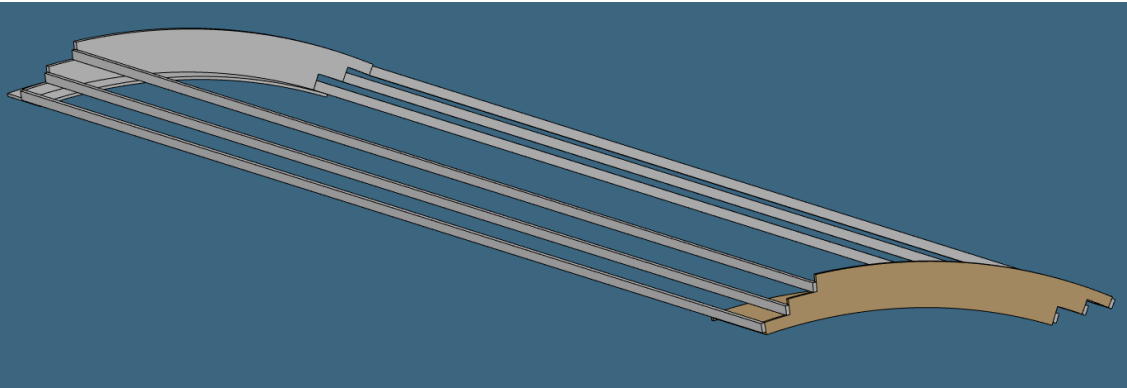
TOF Tray simulations for deformation

Anish Tilak

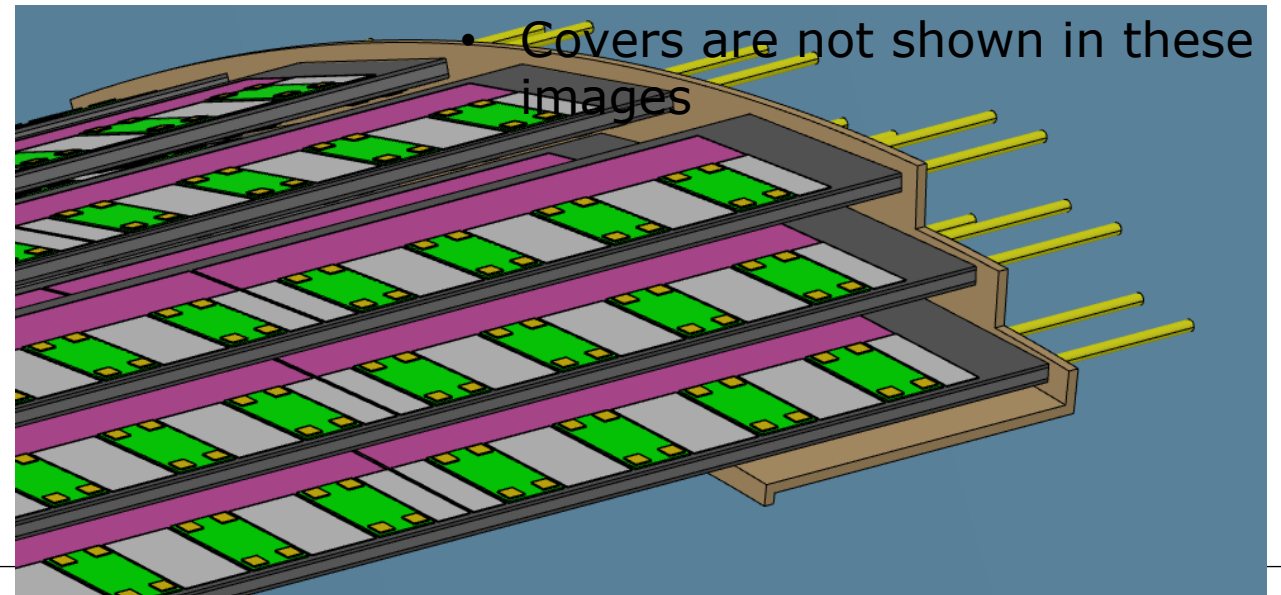
TOF Tray Assembly



- Tray assembly with 12 staves in 3 layers
- Staves with 8 stavelets supported between center & end support
- Mass of one stave is approximately 1.5kg



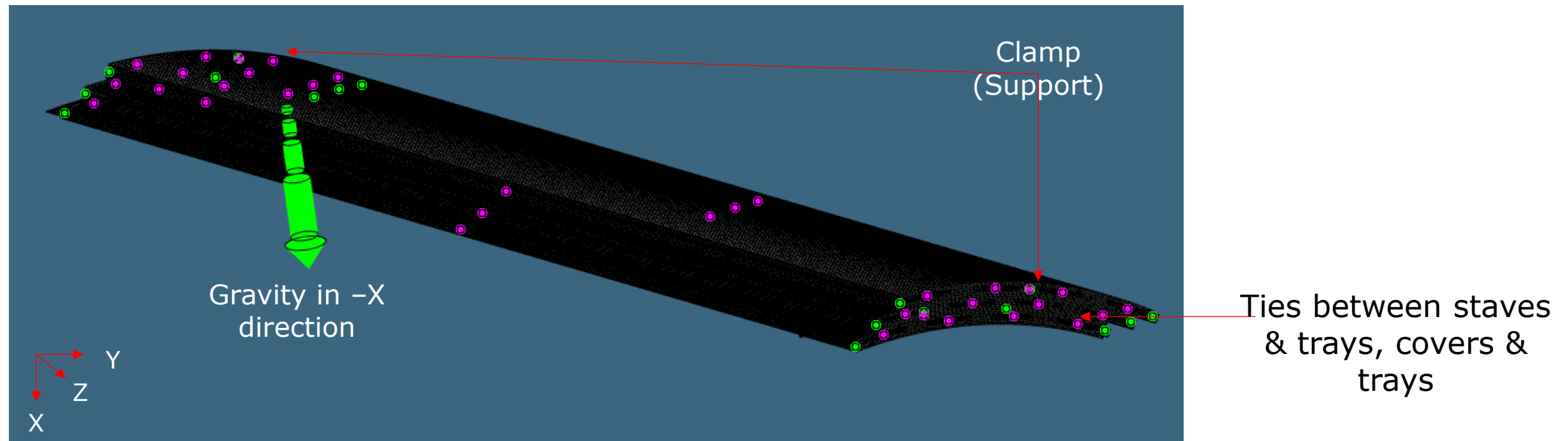
Longitudinal beams are connected on the sides to make the structure stiff



- Covers are not shown in these images

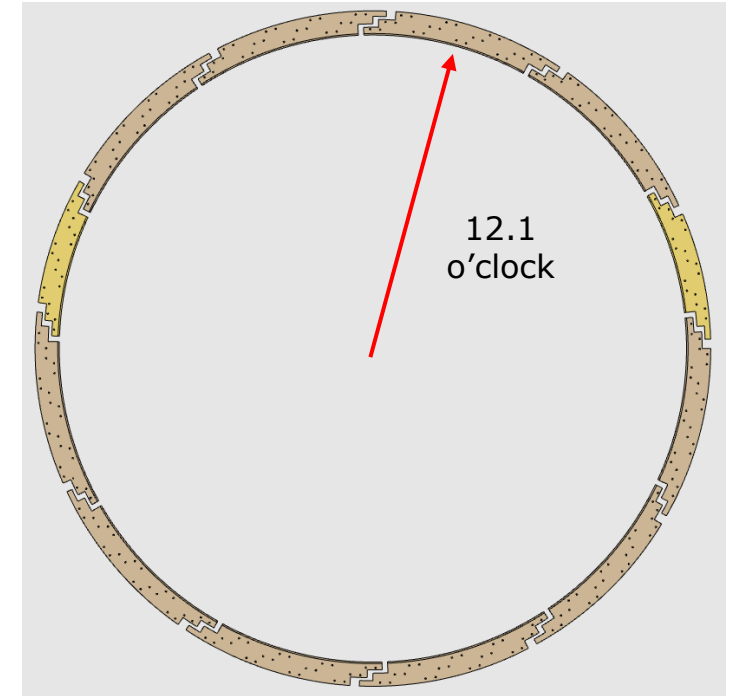
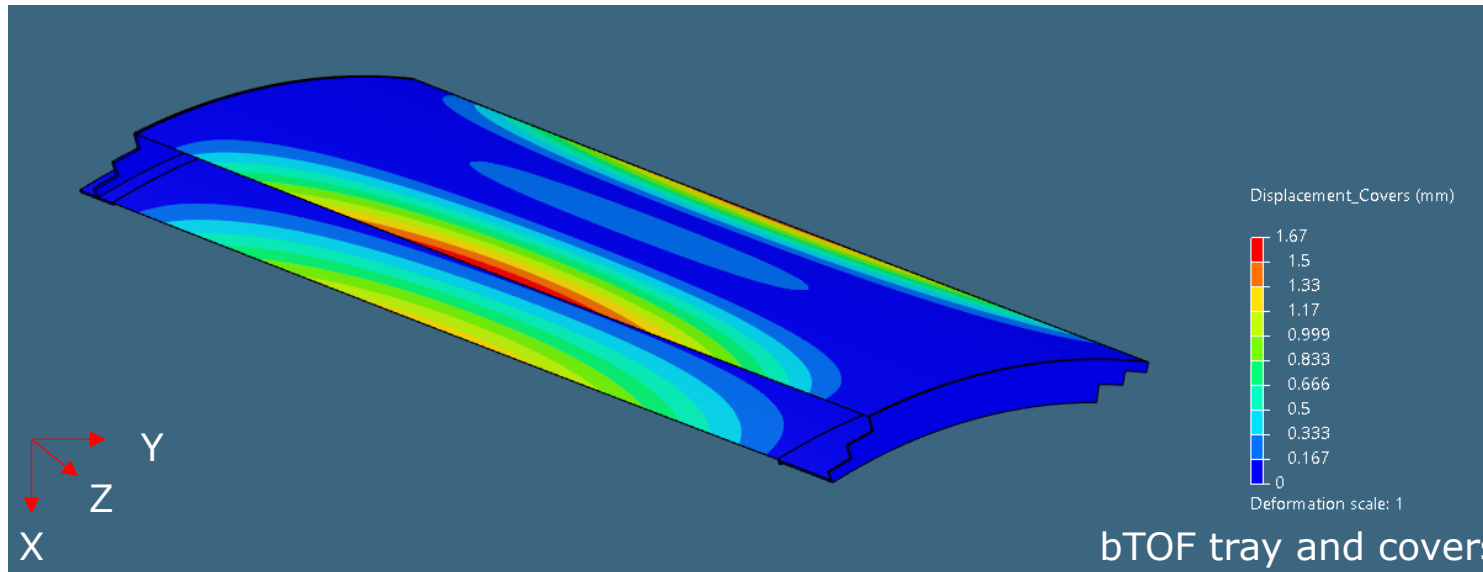
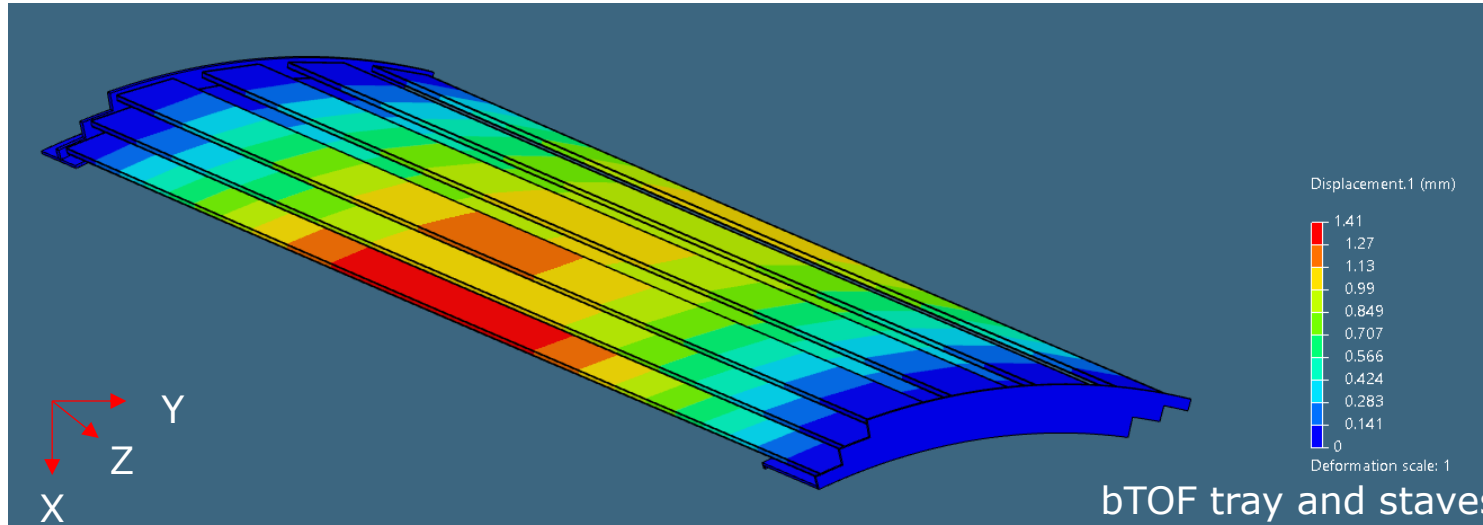
TOF Tray Assembly – Model Definition and Boundary conditions

File: AMT EIC bTOF_Tray_Assembly_SIM 20260818



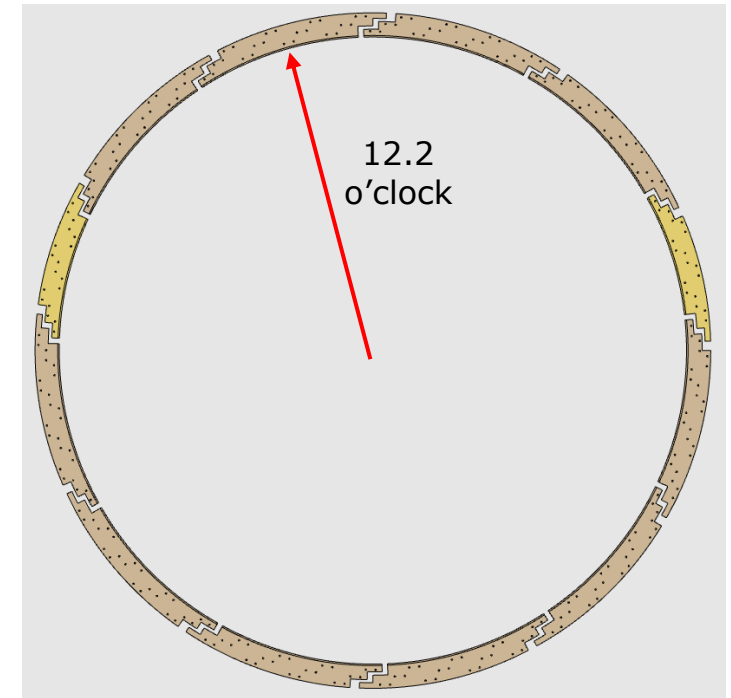
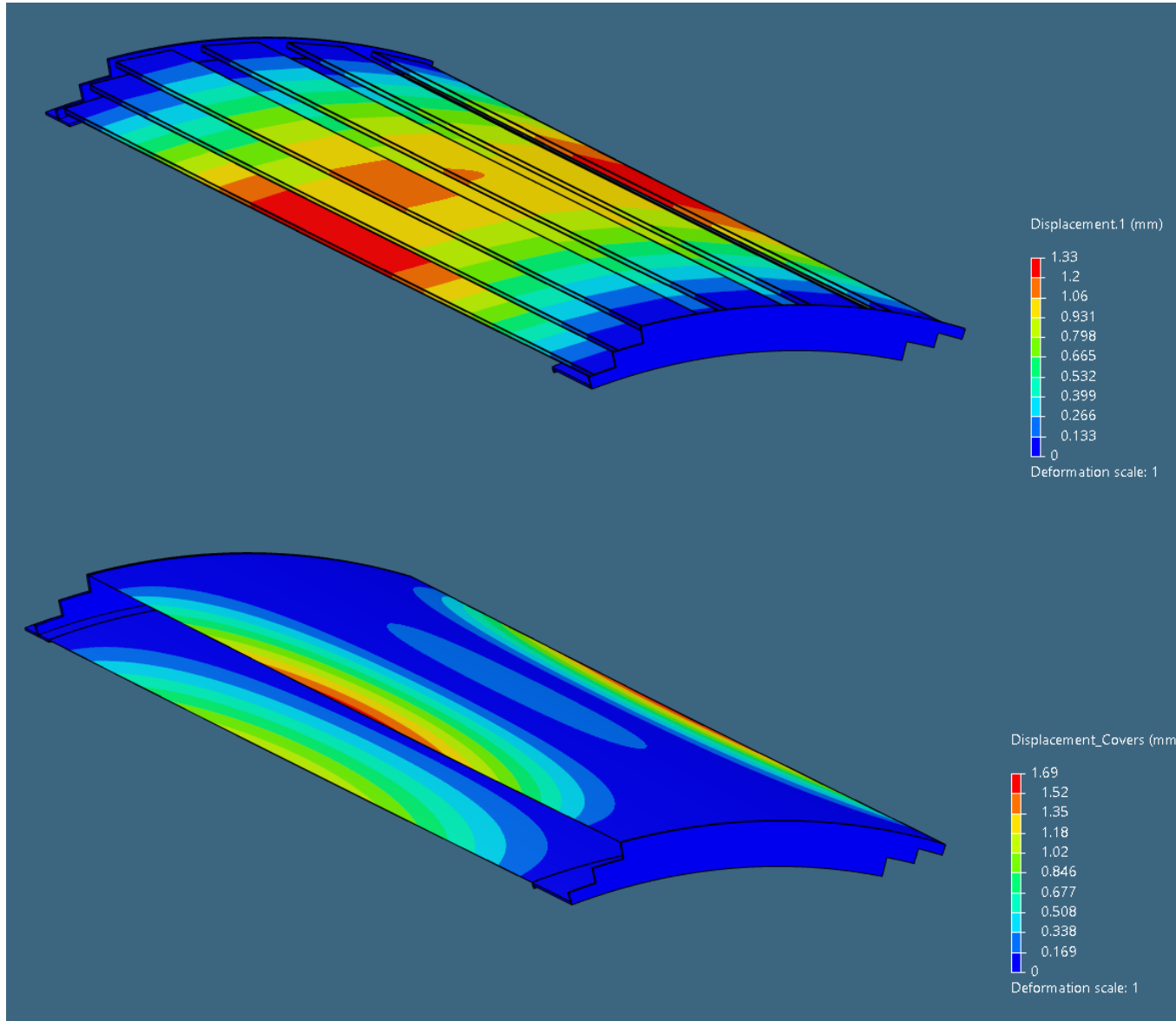
- All composite laminates have been modeled using IM7/F6 woven cloth having cured thickness of 0.225mm.
- Carbon foam core in the stave was modeled as isotropic material (with a density of 4500 kg/m^3 to have a mass of 1.51kg)

TOF Tray Assembly – Results – 12.1 o'clock position

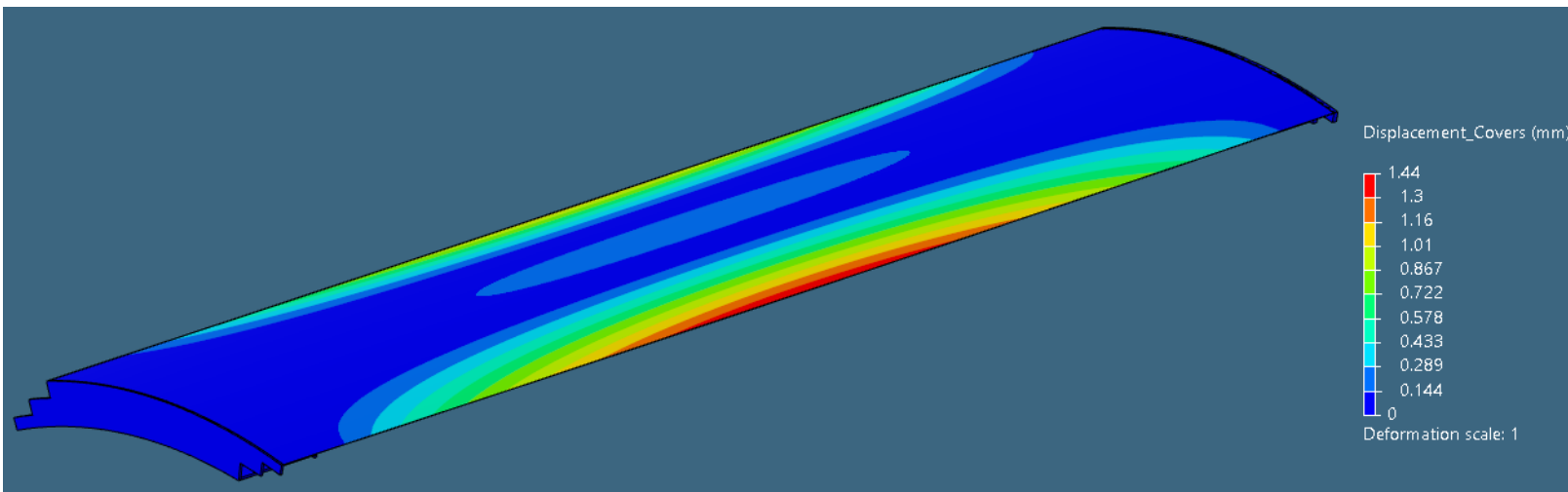
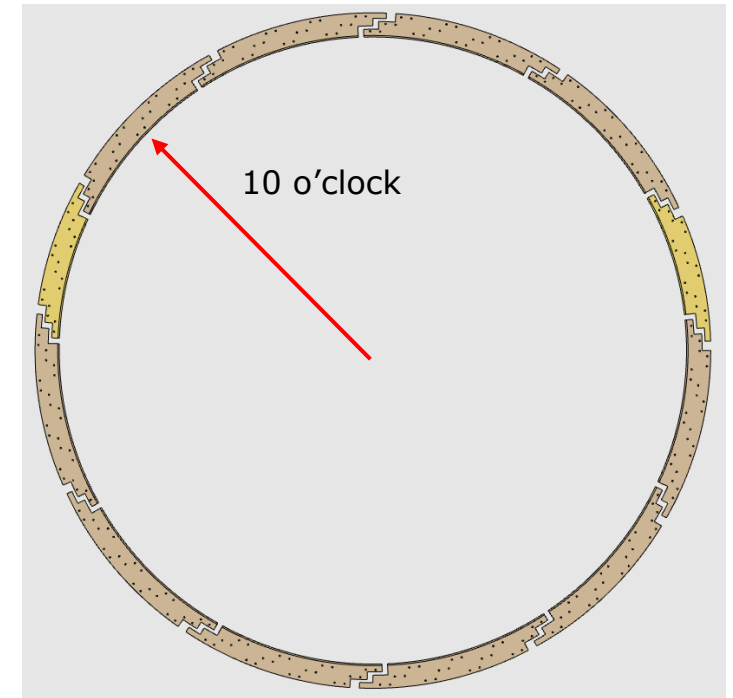
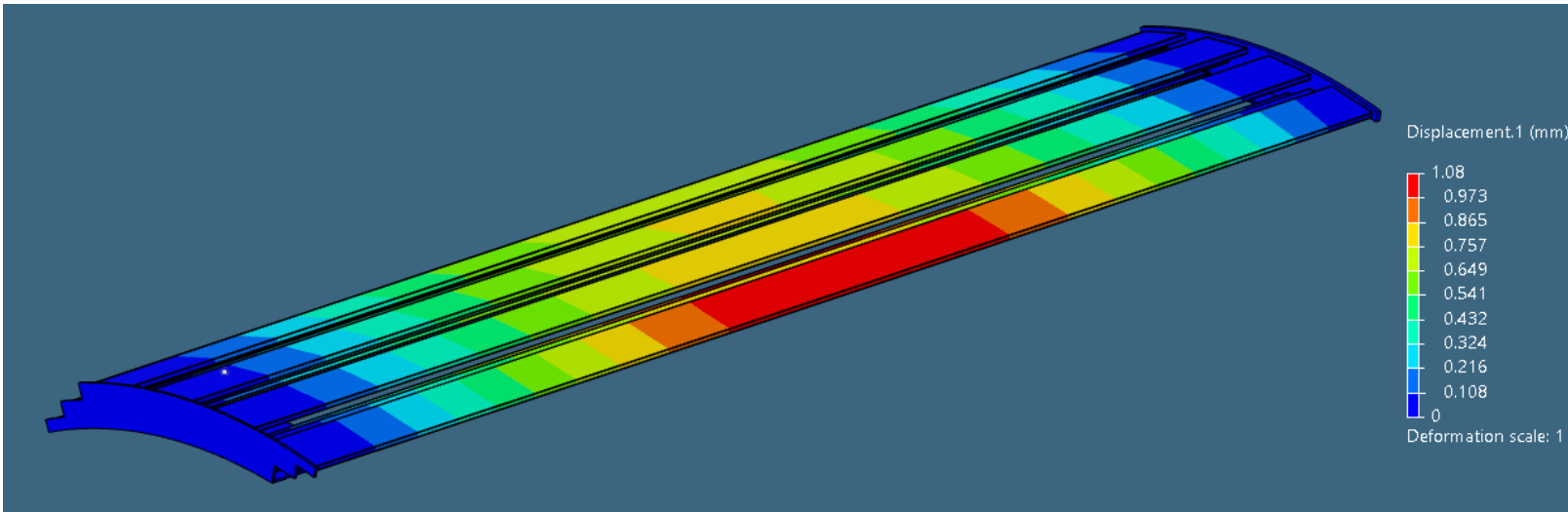


- Maximum displacement of 1.4mm is seen on the stave (sagging of the stave in the middle)

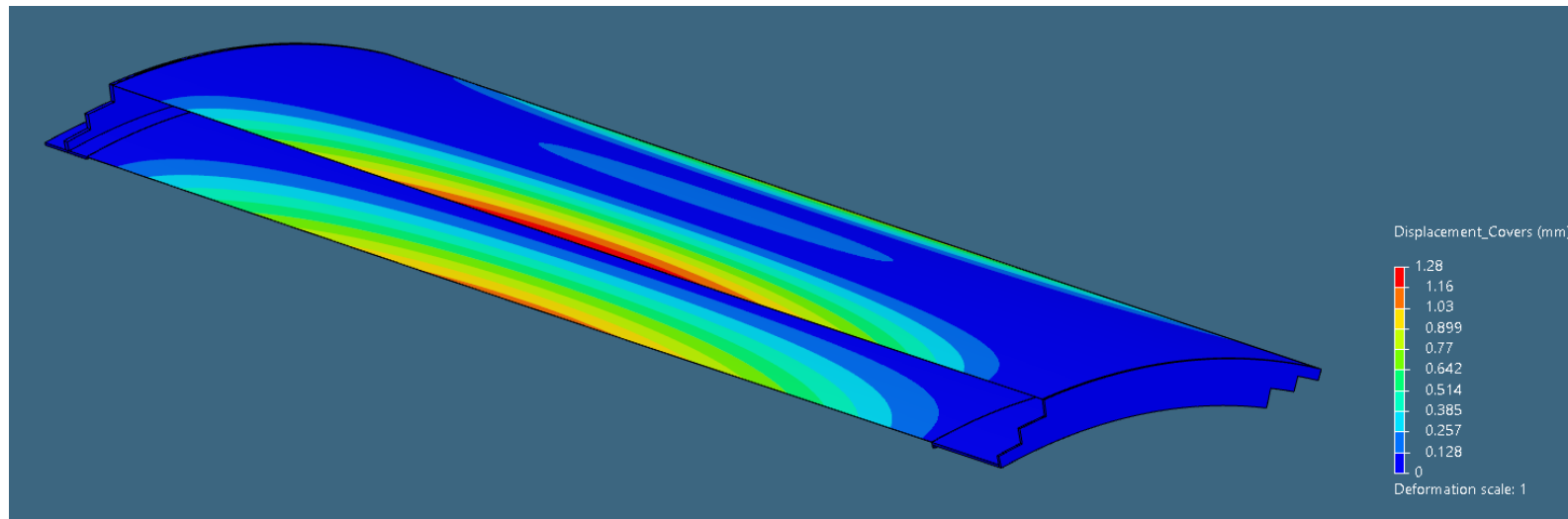
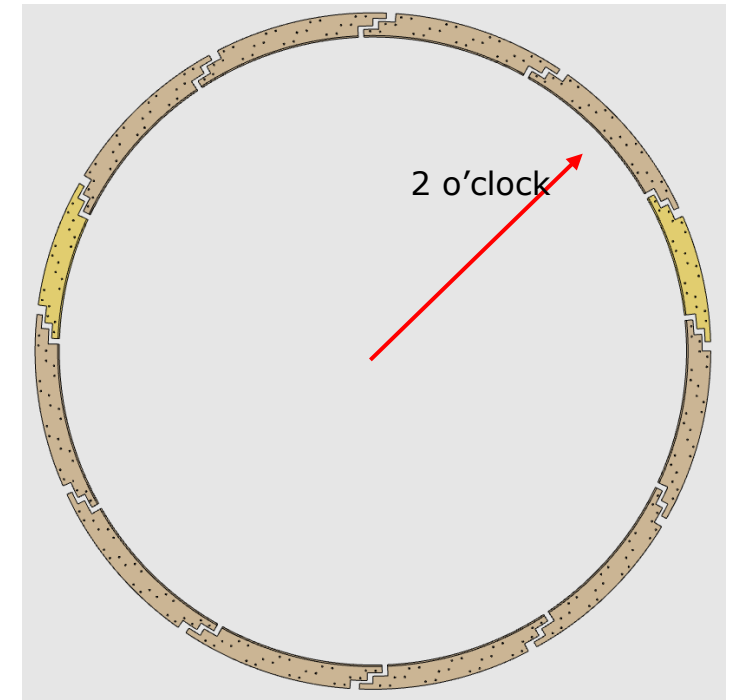
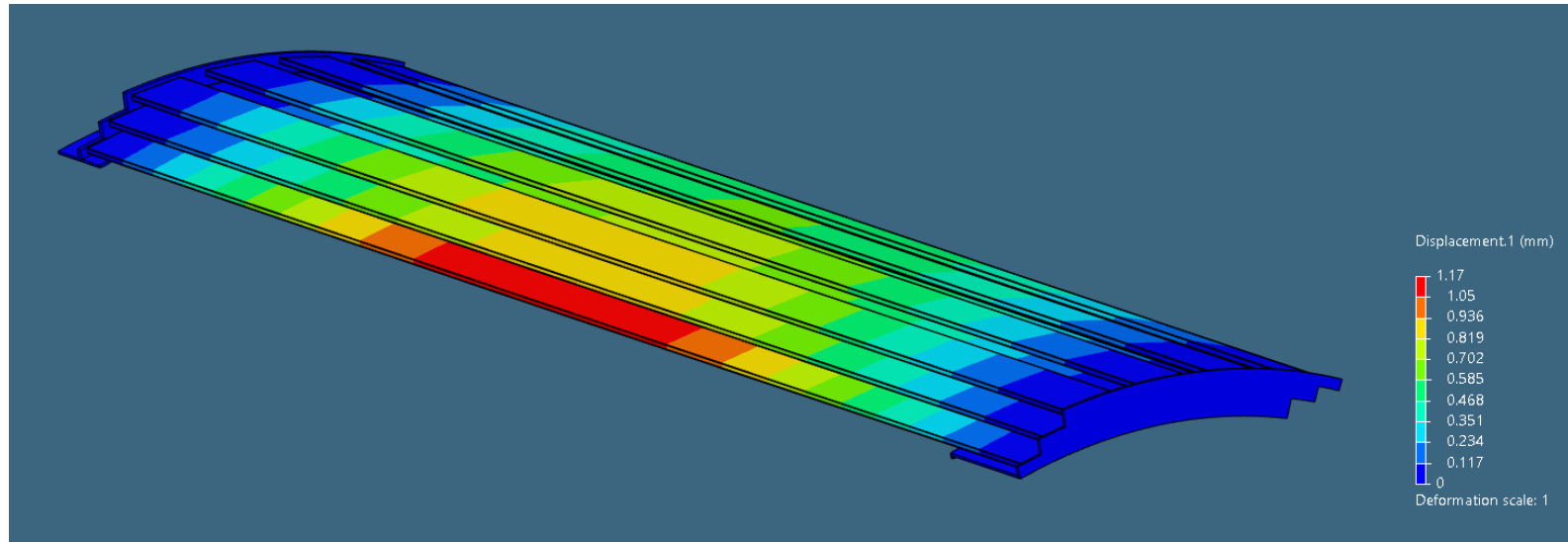
TOF Tray Assembly – Results – 12.2 o'clock position



TOF Tray Assembly – Results – 10 o'clock position



TOF Tray Assembly – Results – 2 o'clock position



TOF Tray Assembly – Results – 6.2 o'clock position

