

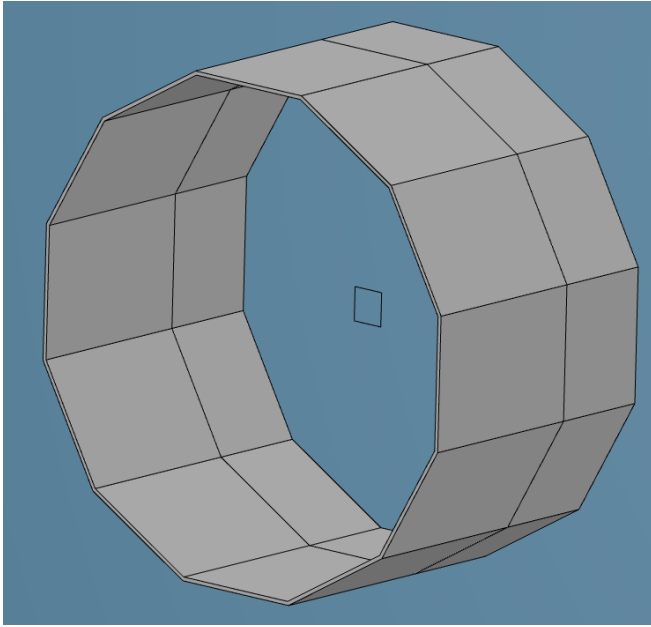
GST and EEEMCal updates

Anish Tilak and Sushrut Karmarkar

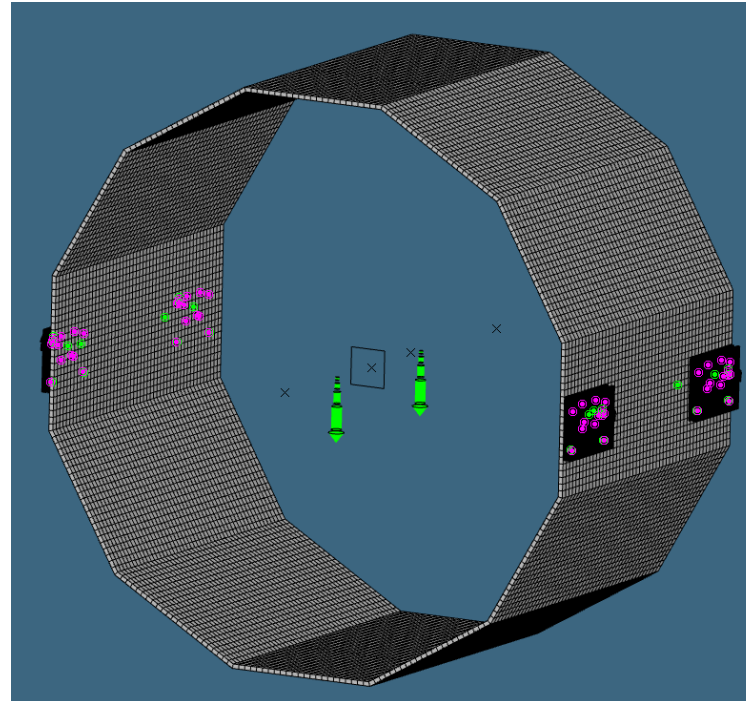
10 August 2026

GST Rail Mechanism – Iteration 3 – Model Setup

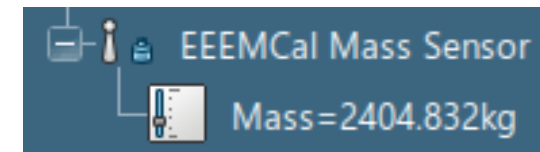
File: AMT EIC EEEMCal_Rail_Support_FullScale_SIM 20260803



- EEEMCal outer shell (uniform thickness of 10mm) is added to the model which is the actual load.
- The EEEMCal has a mass of 2400kg in total and is supported by 4 mounting mechanisms.
- The center of gravity (COG) of the EEEMCal is not at its midplane but is shifted towards the EEEMCal crystals.

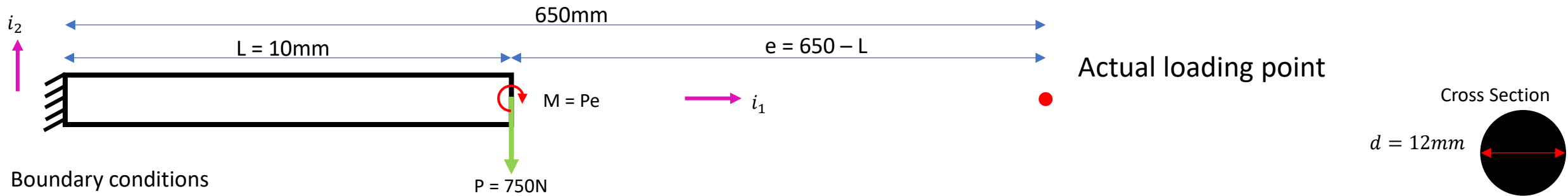


- The density assigned to the two parts/sections is:
 - Crystals: 78300 kg/m³
 - Non-crystals: 78400 kg/m³
- The mass acts at (0,0,2212.5) mm from IP



Hand Calculations – Sanity Check

Note: The transverse displacement is computed using the Timoshenko Beam Theory for order of magnitude purposes ONLY, not an accurate displacement



Boundary conditions

- At $X_1 = 0$
 - $u_2 = 0$
 - $\phi_3 = 0$
- At $X_1 = L$
 - $K_{22} \left(\frac{du_2}{dX_1} - \phi_3 \right) = -P$
 - $H_{33}^c \frac{d\phi_3}{dX_1} = -M$

- $H_{33}^c = \frac{E\pi d^4}{64}$
- $K_{22} = \frac{9}{10}GA = \frac{9}{10}G \frac{\pi d^2}{4}$

Governing equations:

- $H_{33}^c \frac{d^2\phi_3}{dX_1^2} + K_{22} \left(\frac{du_2}{dX_1} - \phi_3 \right) = 0$
- $\frac{d}{dX_1} \left[K_{22} \left(\frac{du_2}{dX_1} - \phi_3 \right) \right] = 0$

$$E = 200\text{GPa}, \nu = 0.3 \rightarrow G = 77\text{GPa}$$

Transverse displacement is given by:

$$u_2(X_1) = \frac{PX_1^2}{H_{33}^c} \left[\frac{X_1}{6} - \frac{L}{2} \right] - \frac{MX_1^2}{2H_{33}^c} - \frac{PX_1}{K_{22}}$$

At the tip, $X_1 = L$,

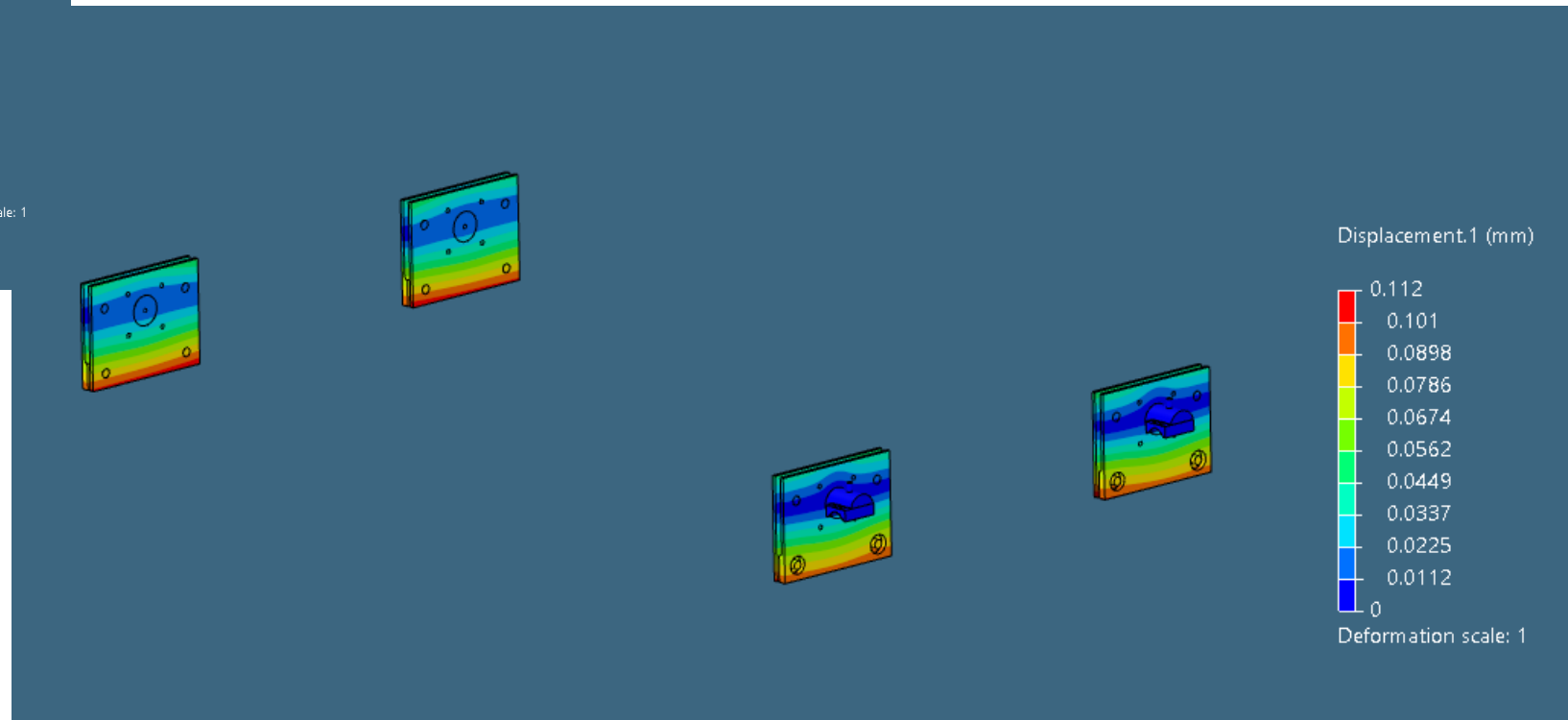
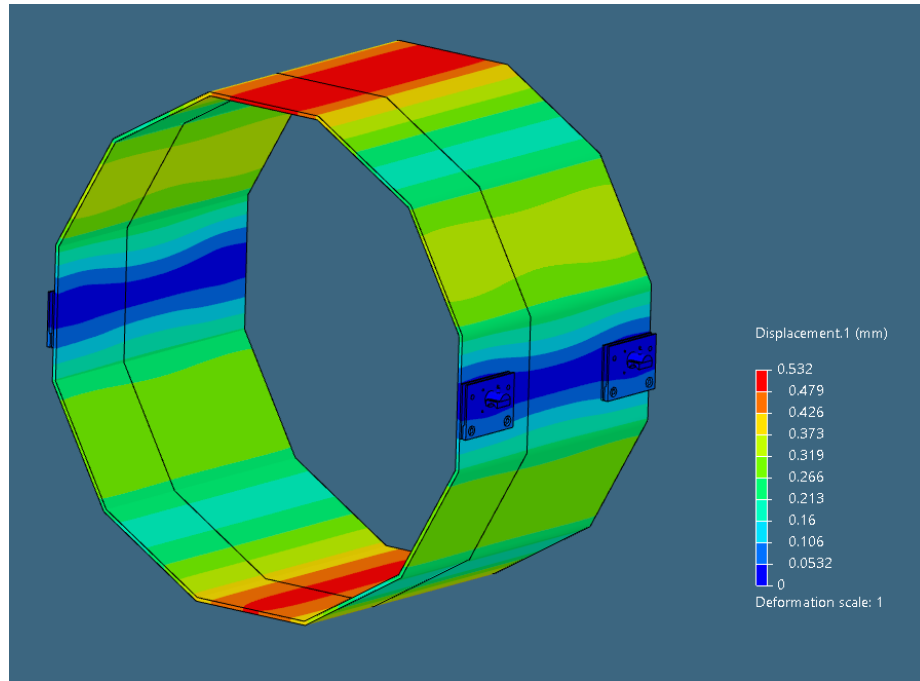
$$u_2(L) = -\frac{PL}{H_{33}^c} \left[\frac{L^2}{3} + \frac{L}{2} + \frac{H_{33}^c}{K_{22}} \right]$$

Substituting values and solving,

$$u_2 = -0.6 \text{ mm}$$

GST Rail Mechanism – Iteration 3 – Results – Displacement

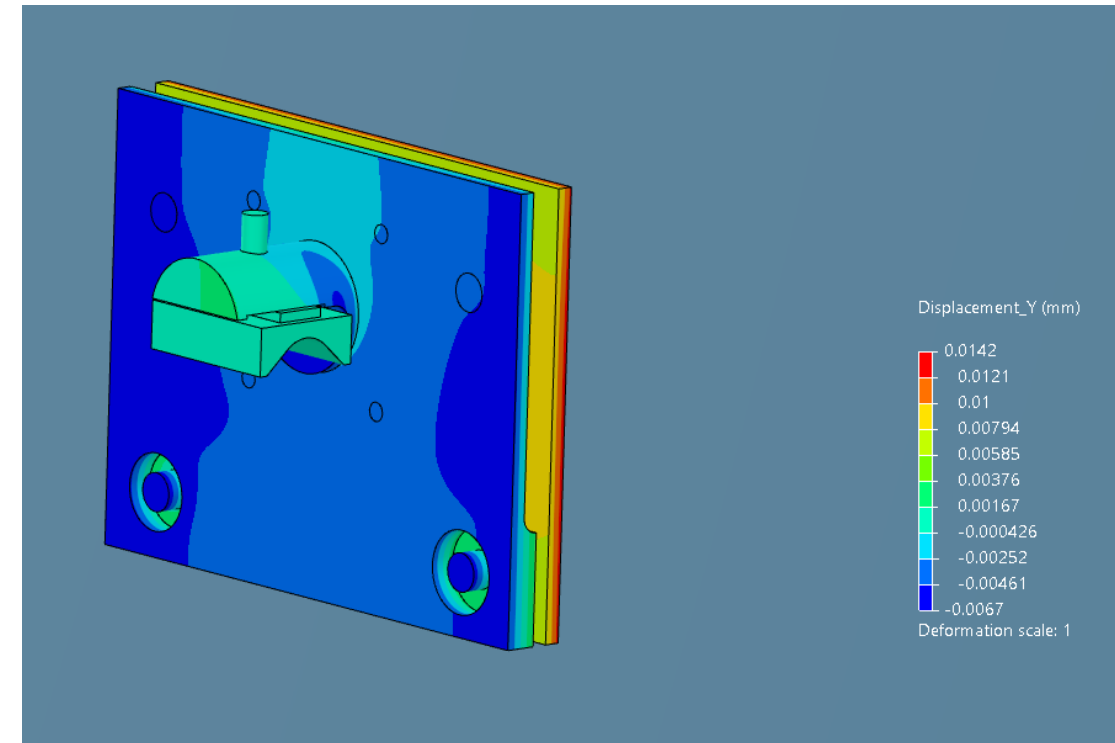
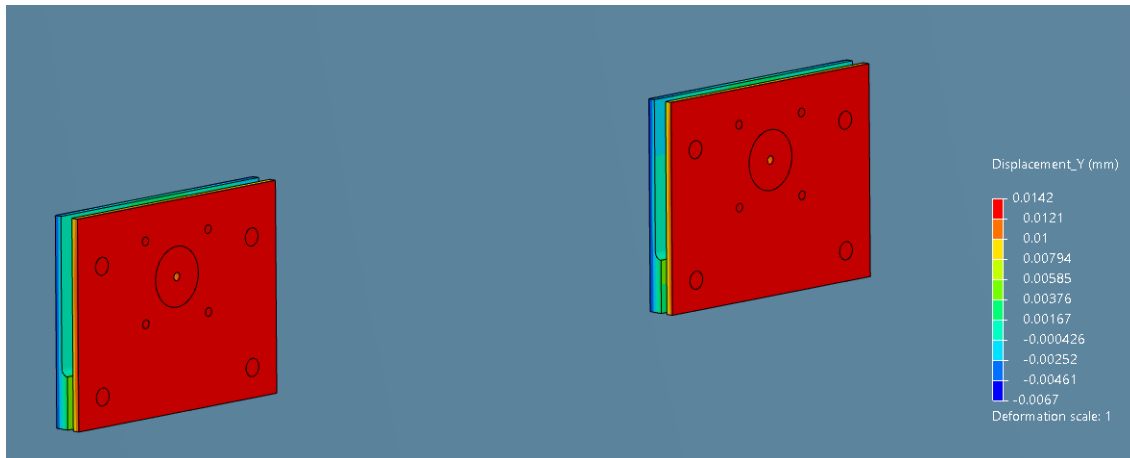
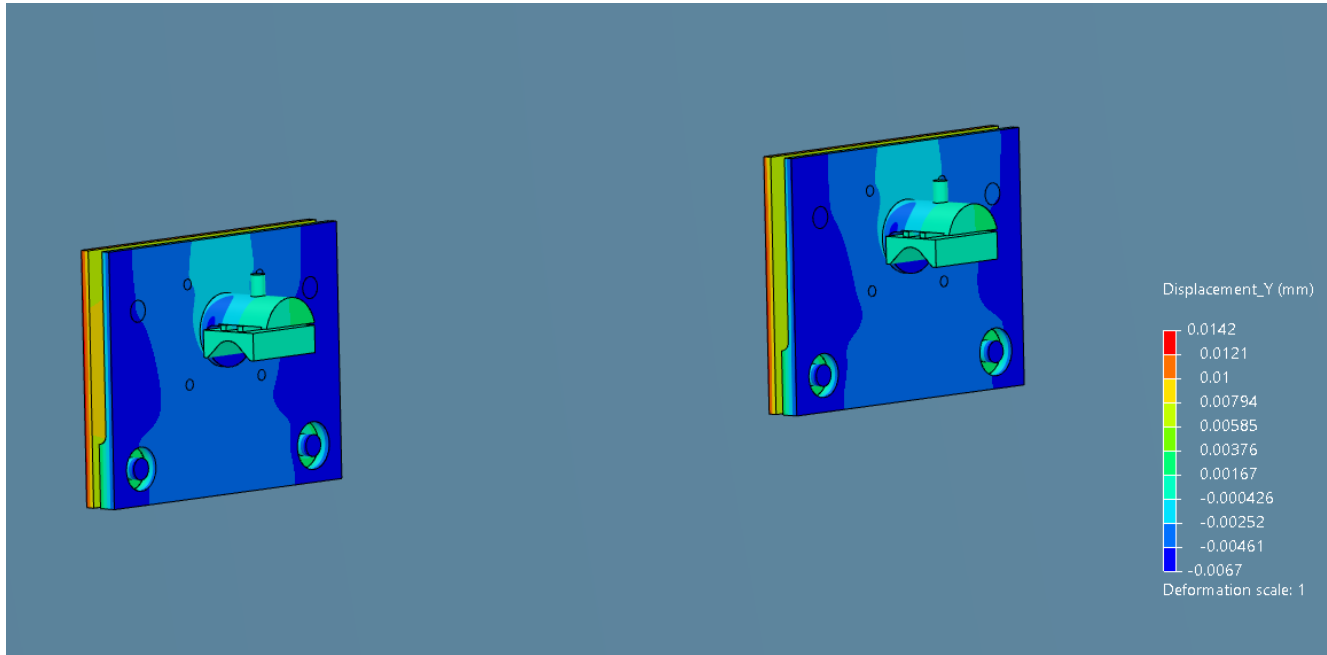
File: AMT EIC EEEMCal_Rail_Support_FullScale_SIM 20260803



GST Rail Mechanism – Iteration 3 – Results – Displacement



GST Rail Mechanism – Iteration 3 – Results – Displacement Y

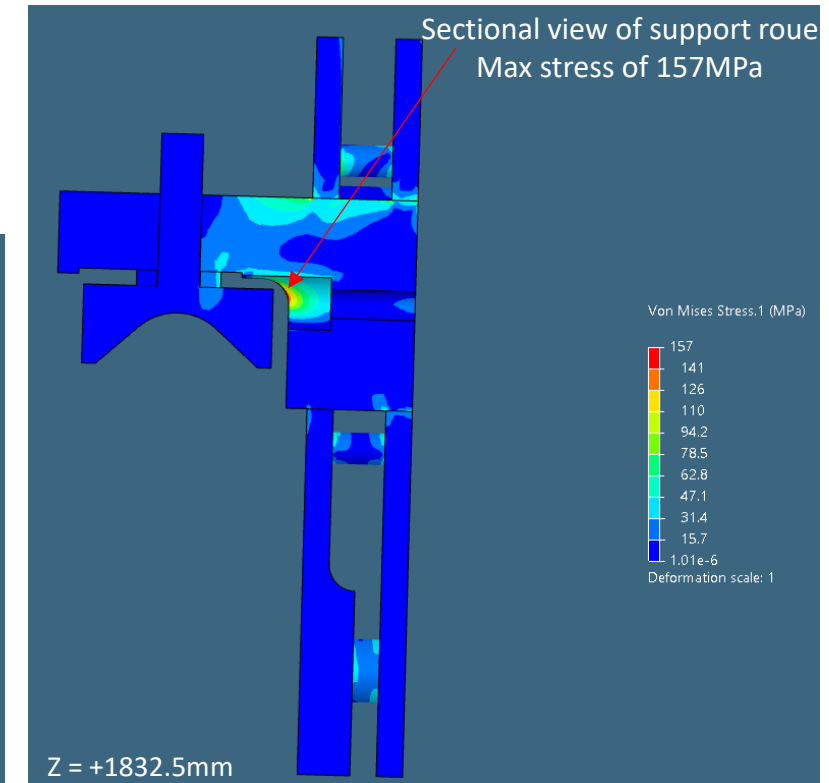
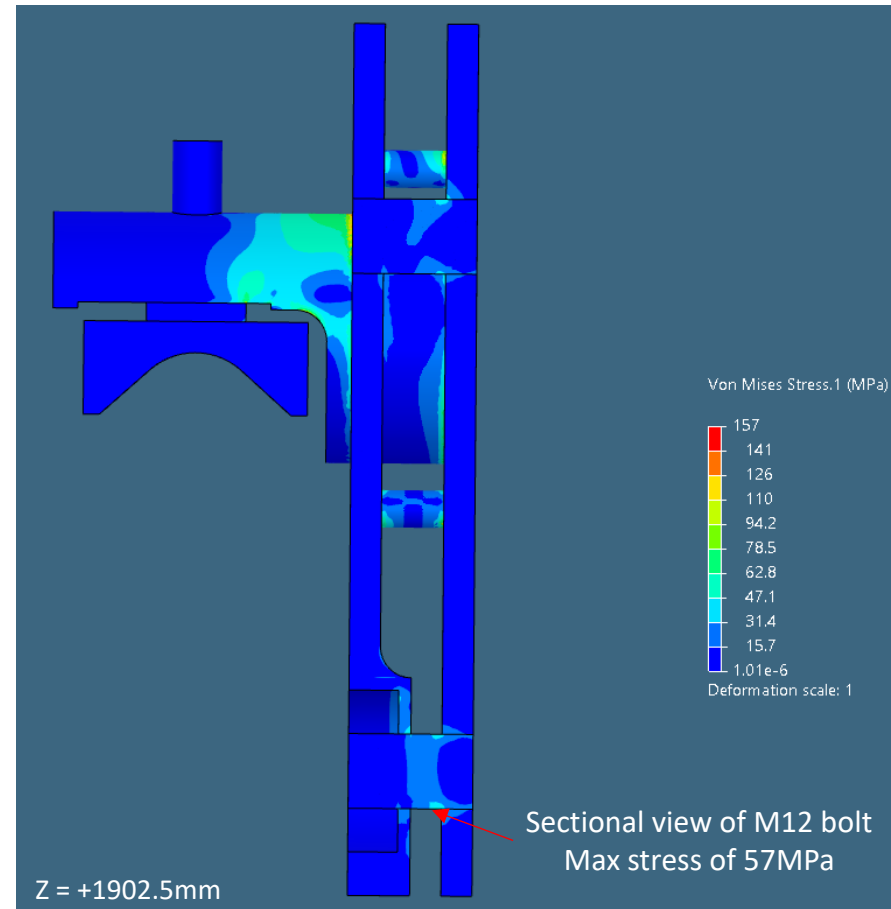
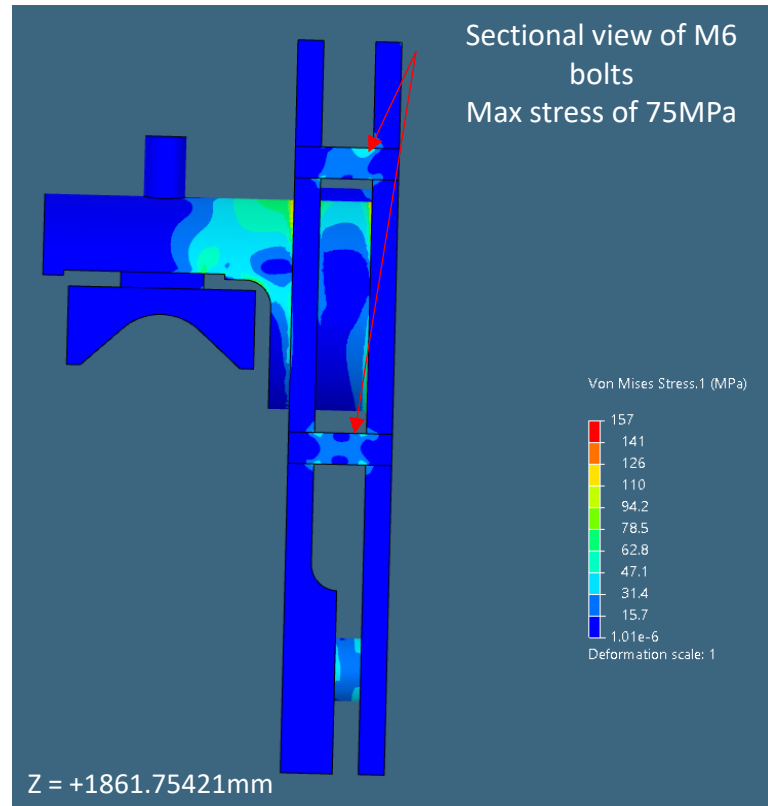


GST Rail Mechanism – Iteration 3 – Results – Displacement X



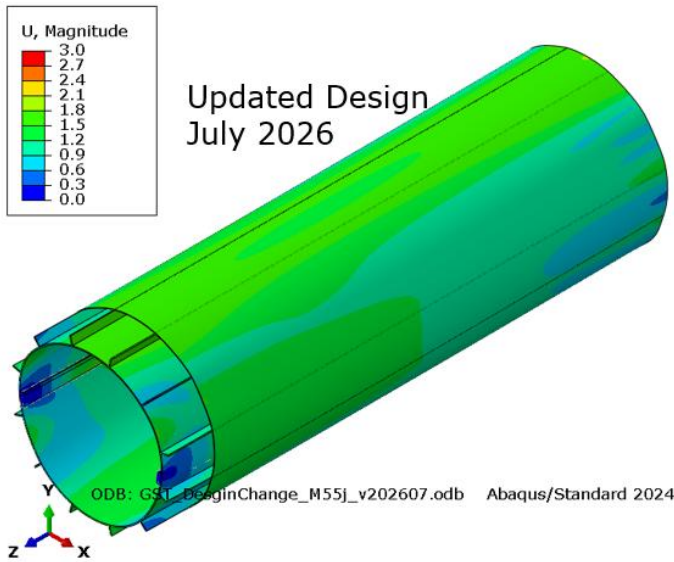
GST Rail Mechanism – Iteration 3 – Results – Stress

Cross section in XY plane

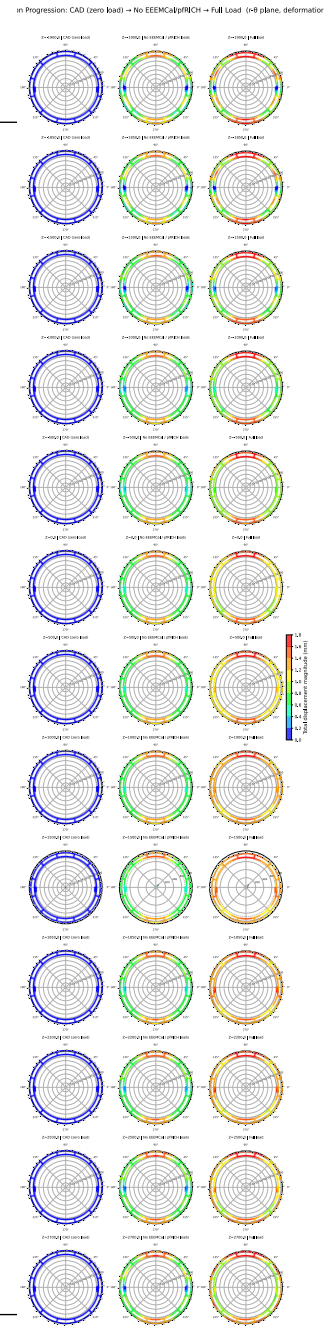
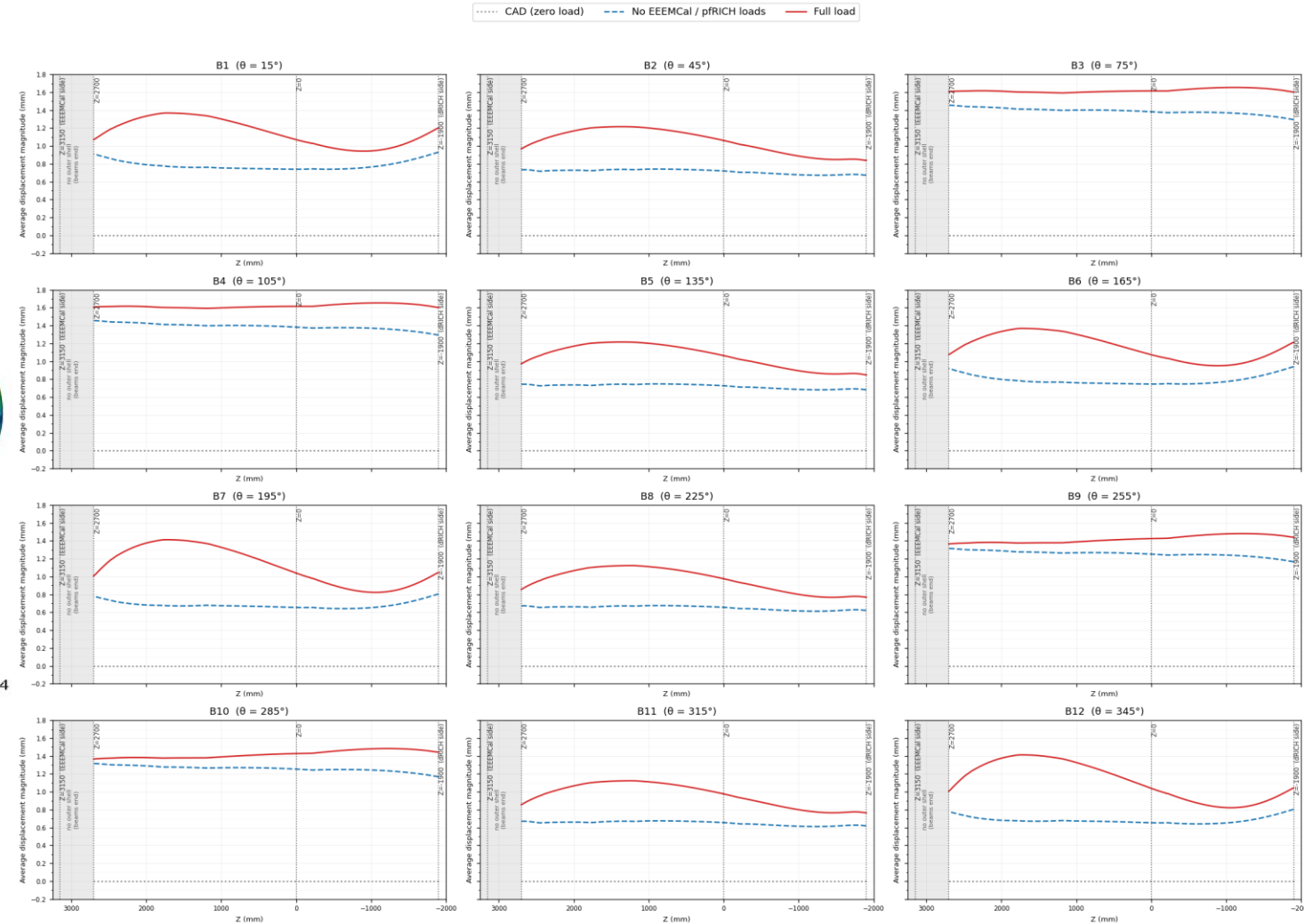


Deformation plots are now made and shared

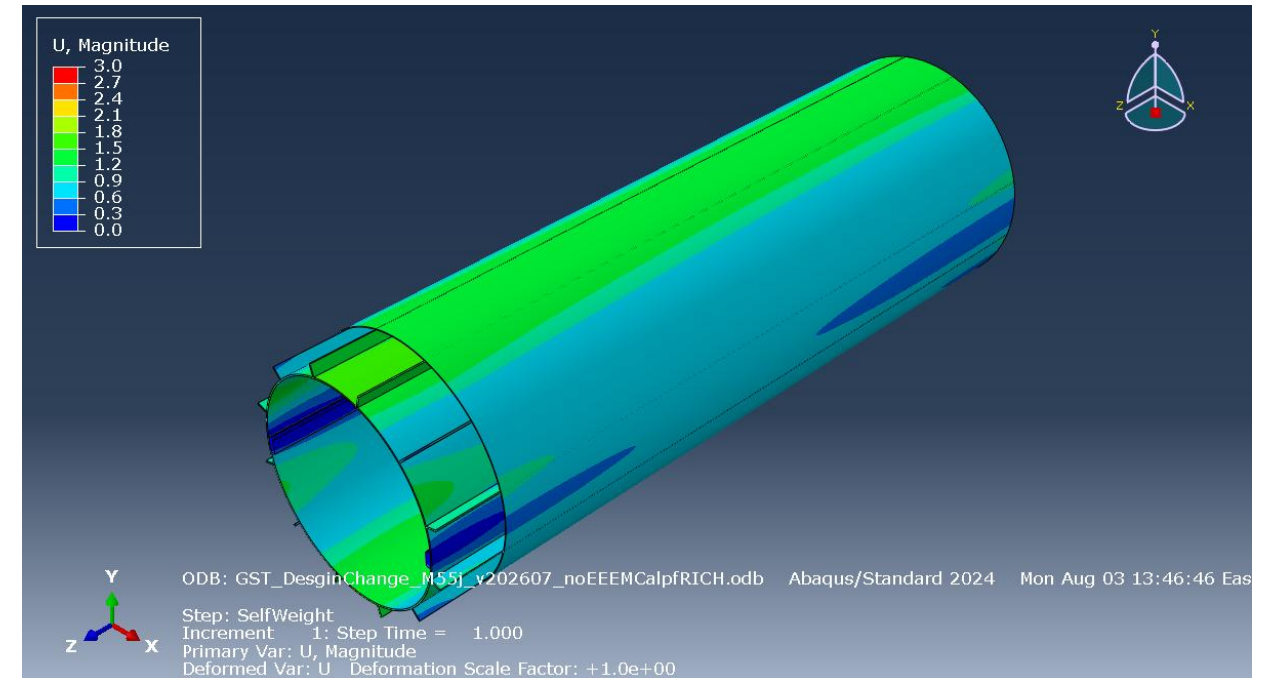
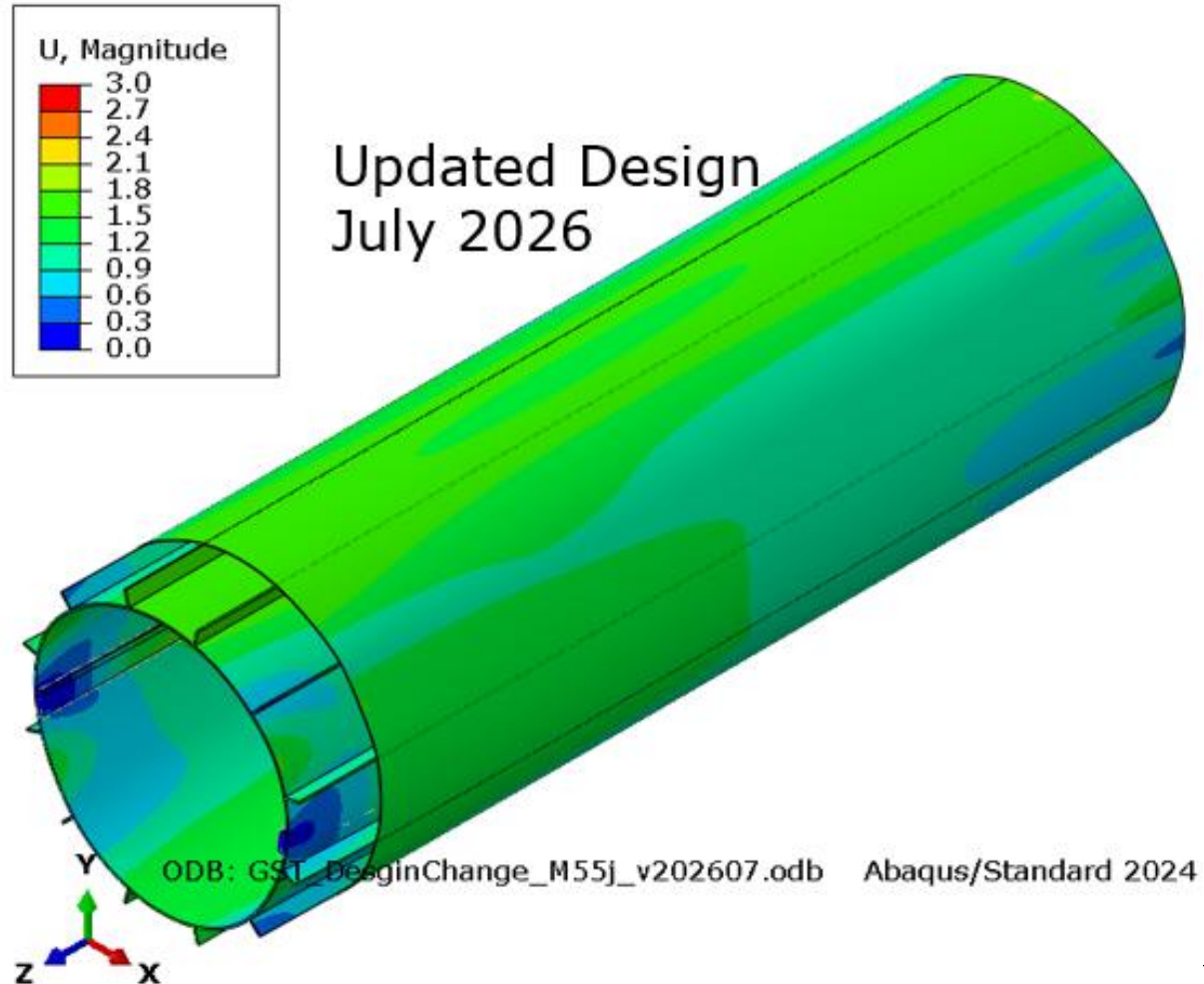
[LINK FOR DETAILED PLOTS AND RAW DATA – 2026 08 03 GST updates - EEEMCal mount file share](#)



GST — average deformation along each of the 12 beams, full Z scan
CAD (zero load) → No EEEMCal/pfRICH → Full load



Simulation of GST mid load step – everything EXCEPT EEMCAL and pFRICH and the associated services



Coming up

1. ~~FEA results for the EEEMCal Mount (DONE)~~
2. Adjustment mechanism for the GST package
3. Envelope drawing for GST and Inner Detectors
4. Assembly Sequence for Inner Detectors
5. TOF tray insertion mechanisms