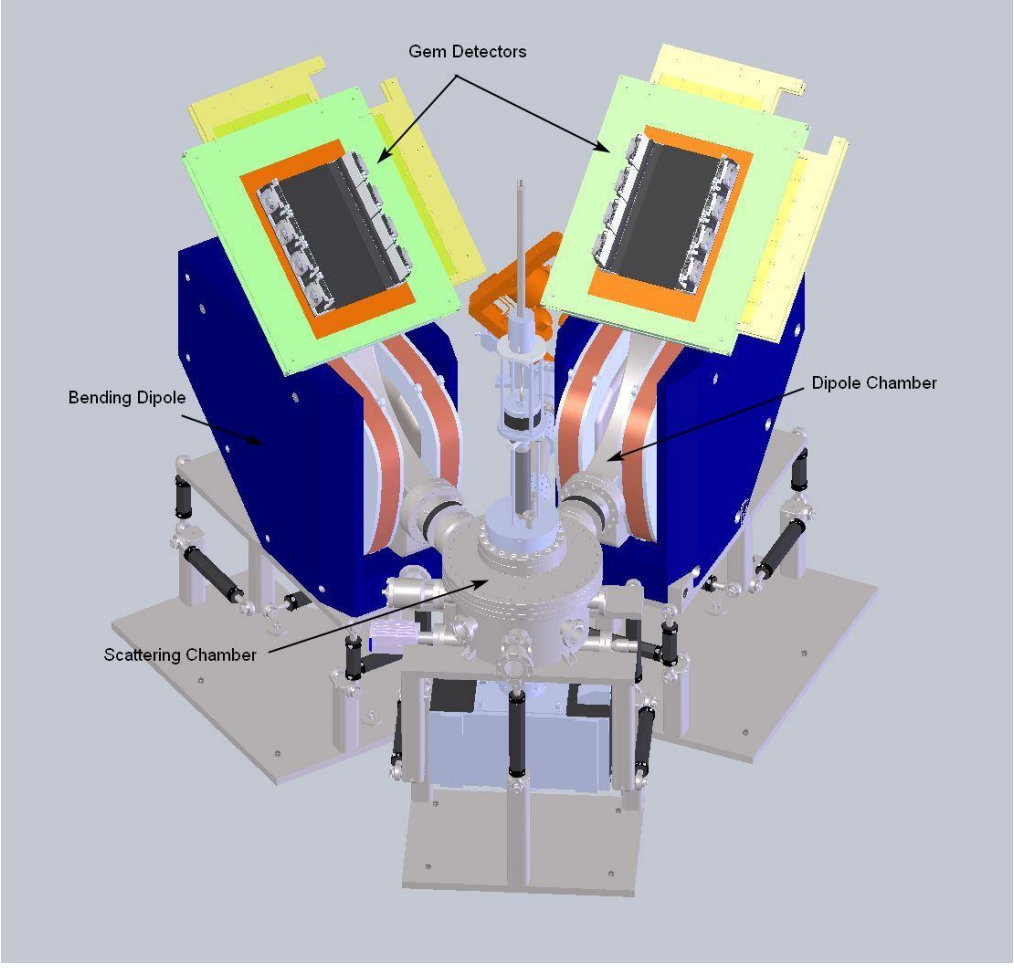
DarkLight at ARIEL

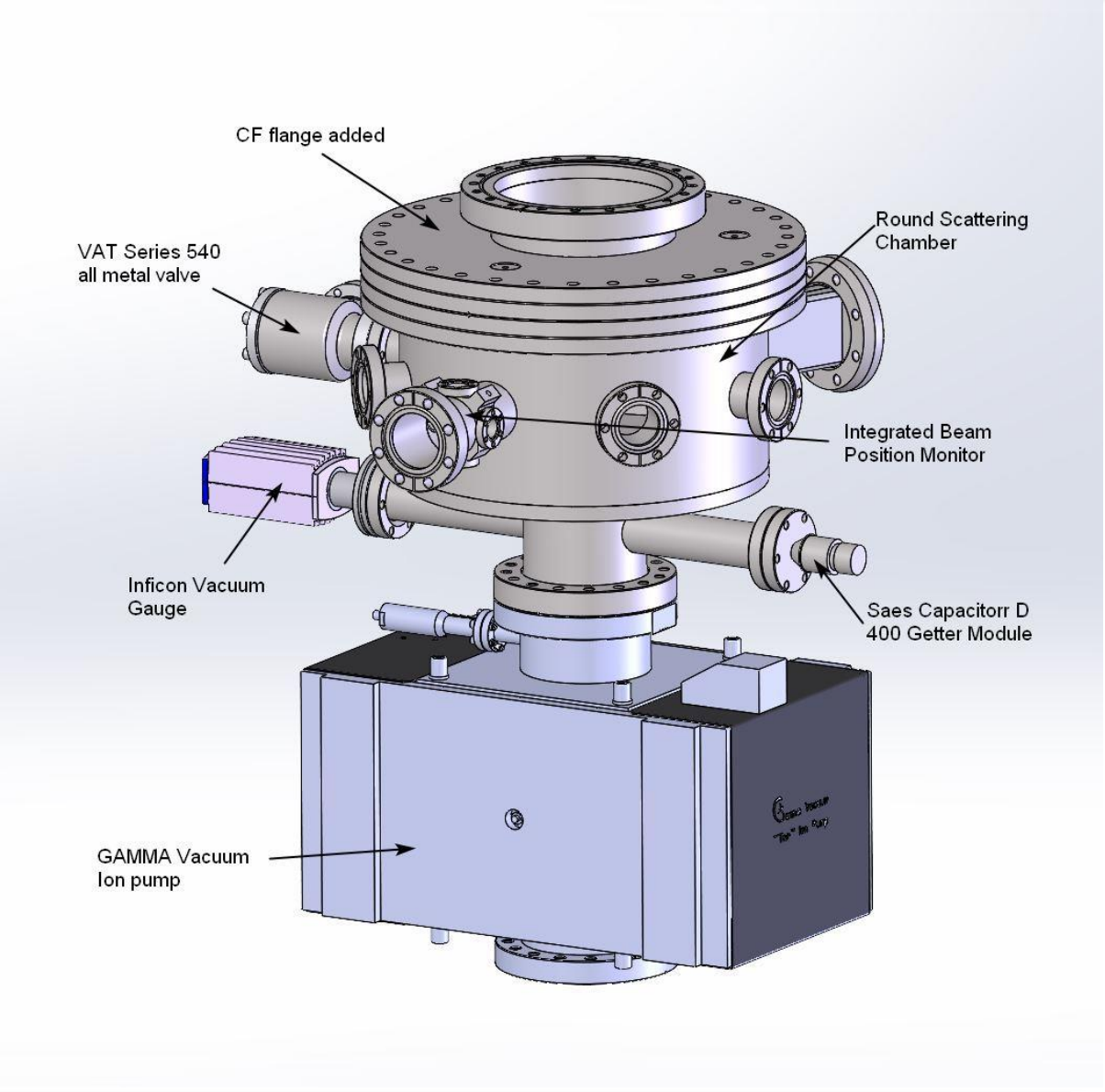
Update November 2023

Latest Experiment layout



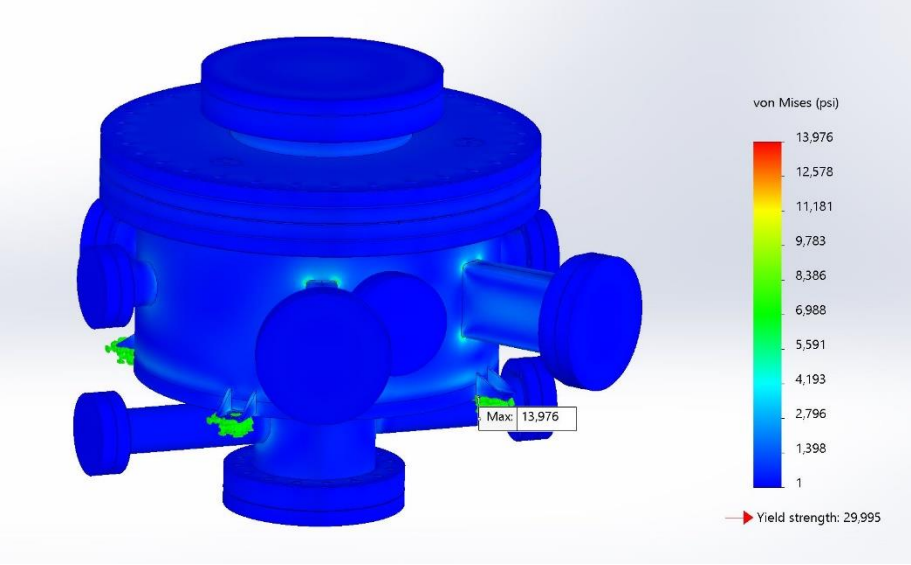
DarkLight Scattering Chamber

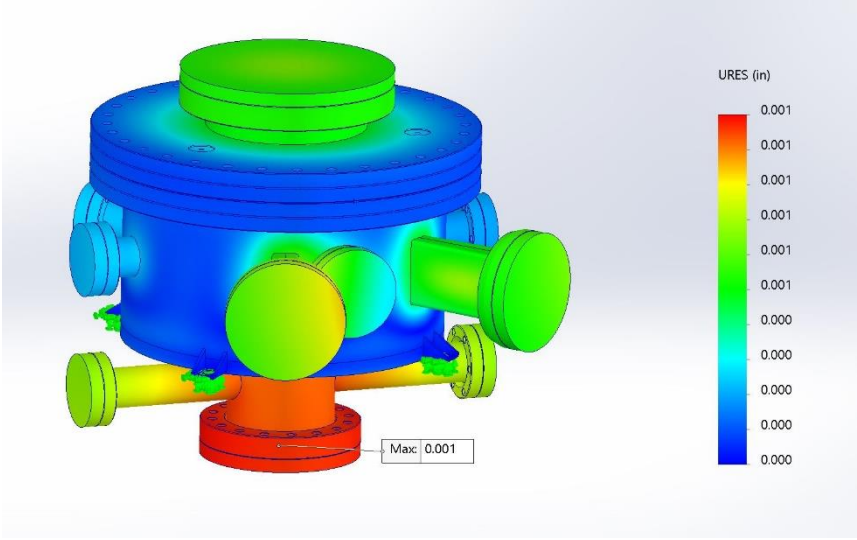
- Minor changes to Scattering Chamber. We produced drawings for quote and manufacture.



Scattering Chamber Analysis

Did the FEA analysis again and it shows low stress levels with a yield safety factor of 2+.

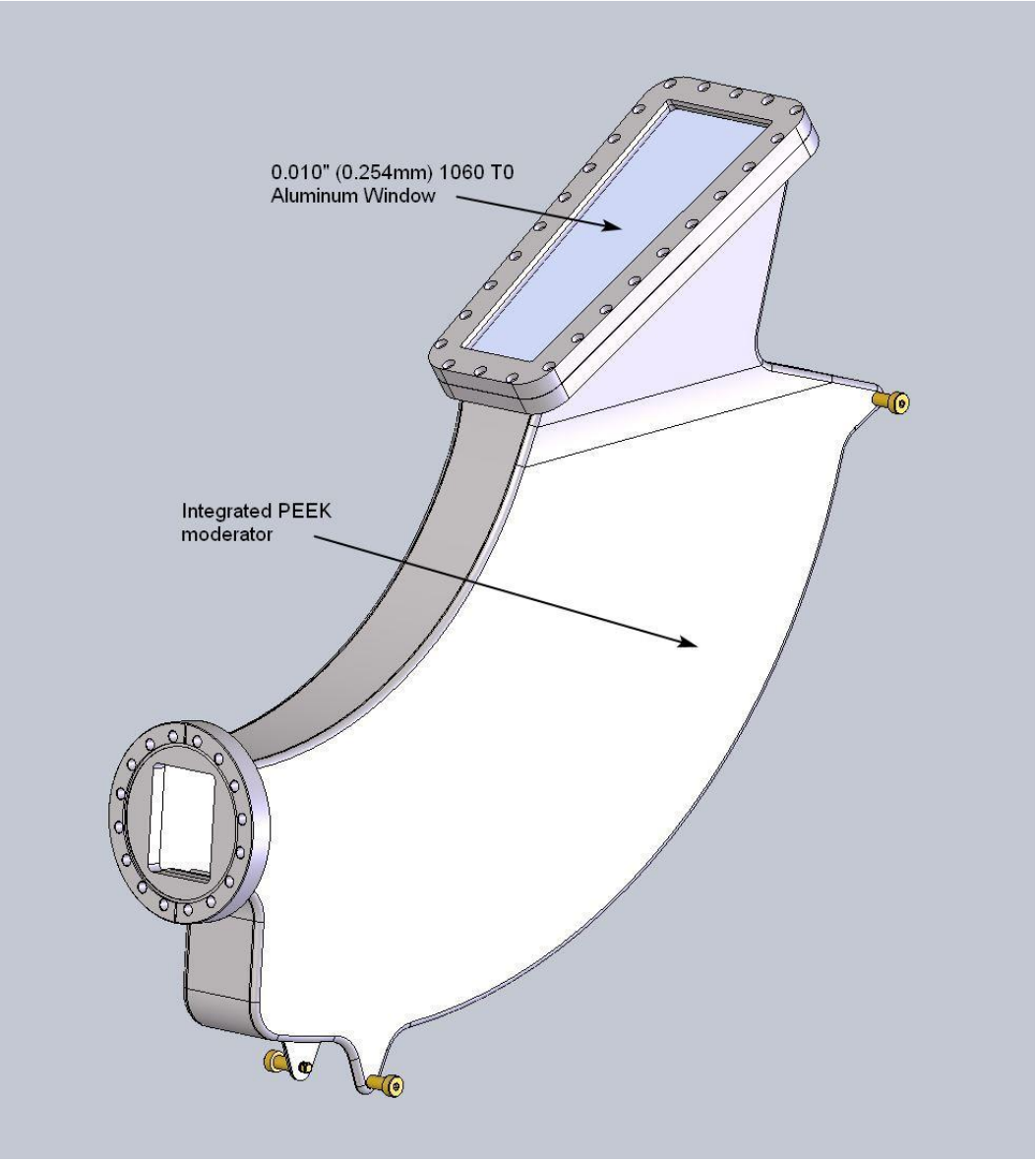




FEA of displacement is also very low (0.001”). No issues with target position when chamber is pumped down.

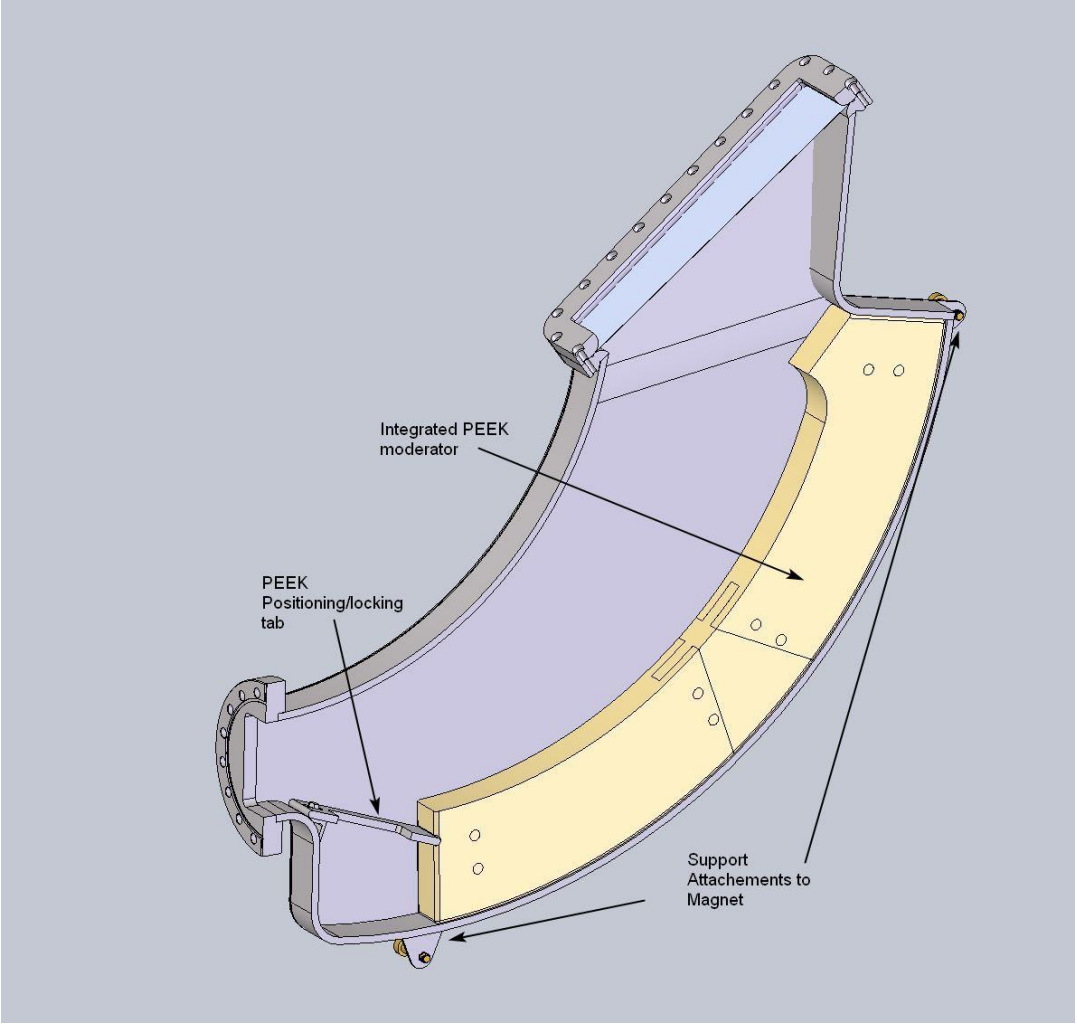
Dipole Vacuum Chamber

Integrating PEEK moderator into vacuum chamber has increased the size.



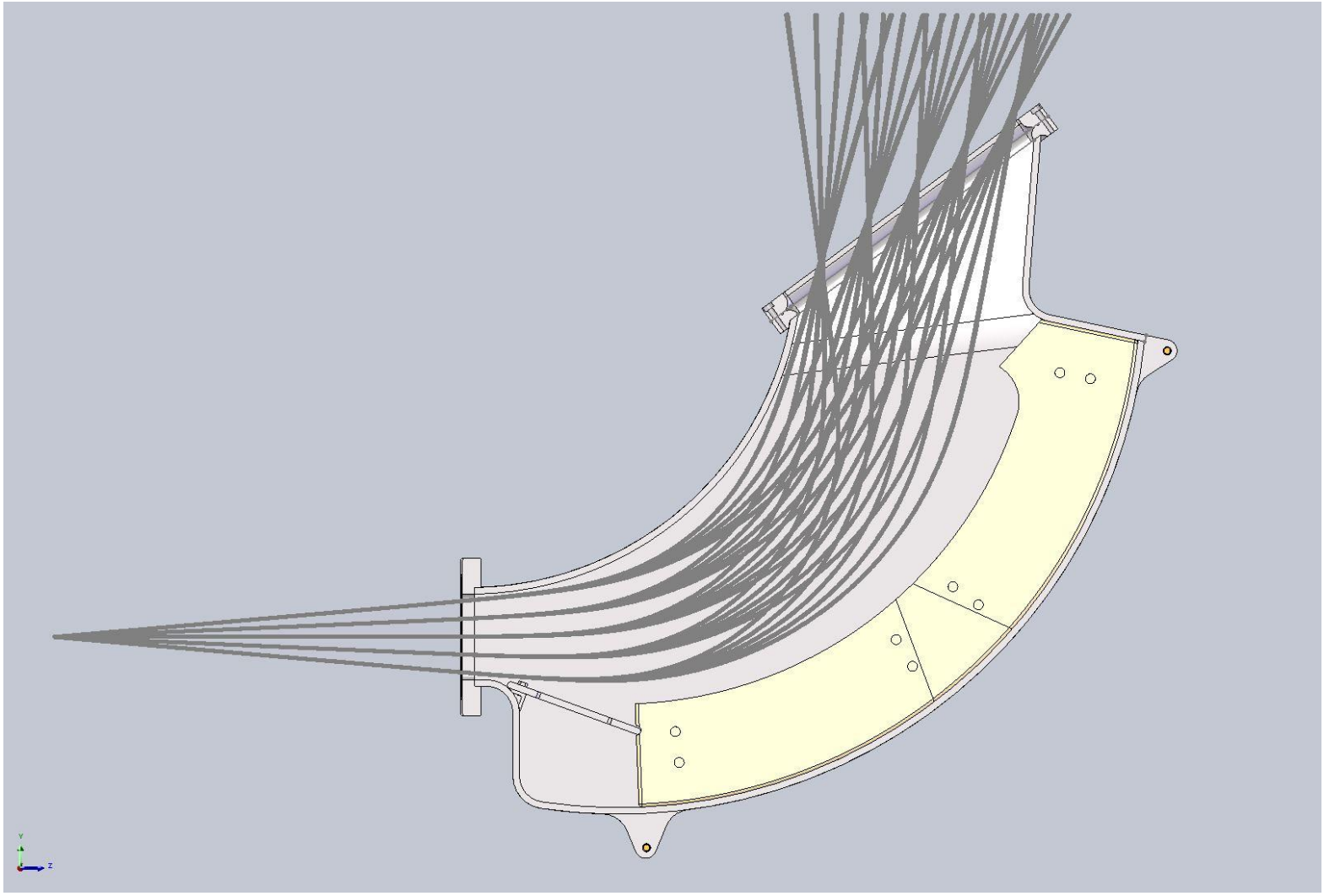
Dipole Chamber Section View

PEEK will be inserted and fixed in place after chamber is fabricated and welded.



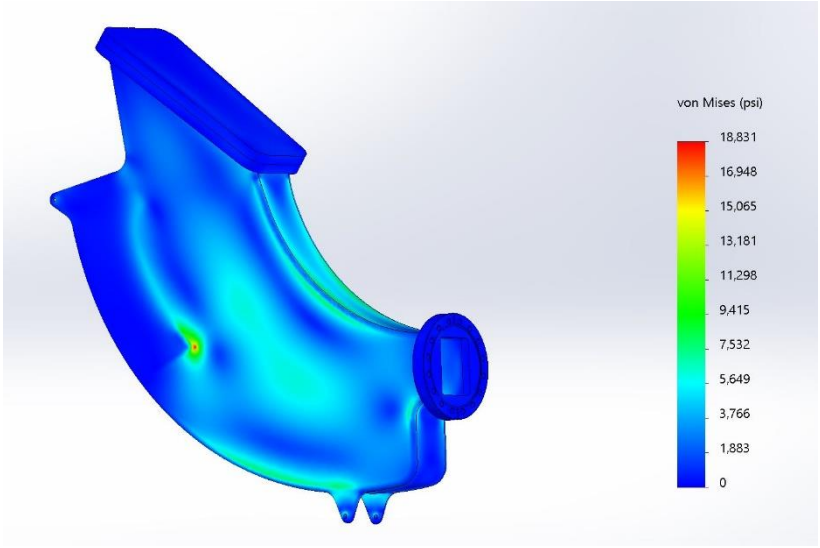
Section View w/ latest tracks

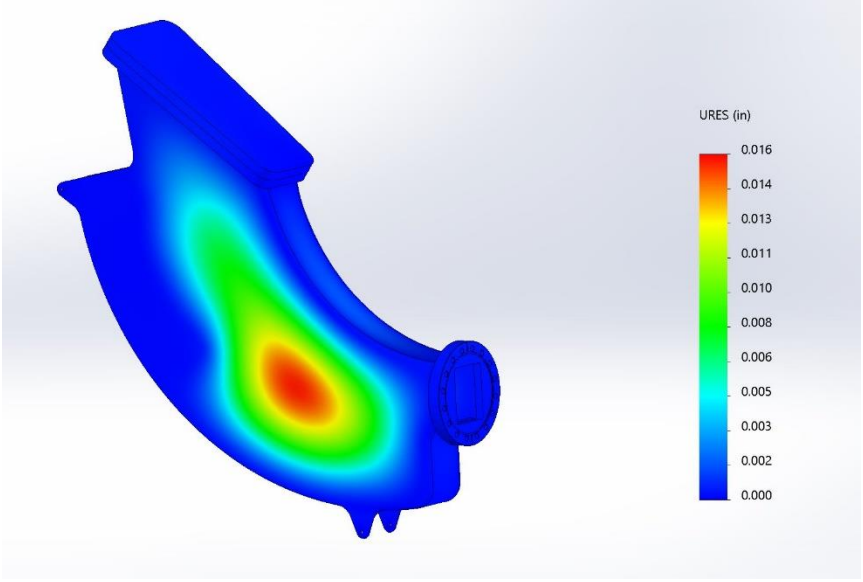
Gem's located at Focal plane. Tracks clear flanges.



Magnet Chamber Analysis

FEA analysis of new Dipole chamber has a factor of 2+ safety margin. PEEK inserts are part of the structure.

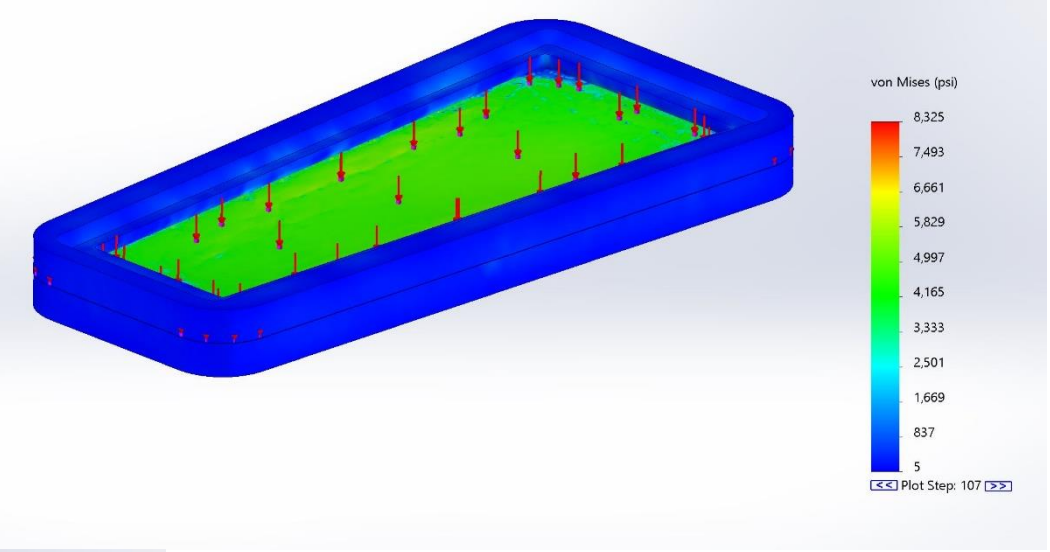


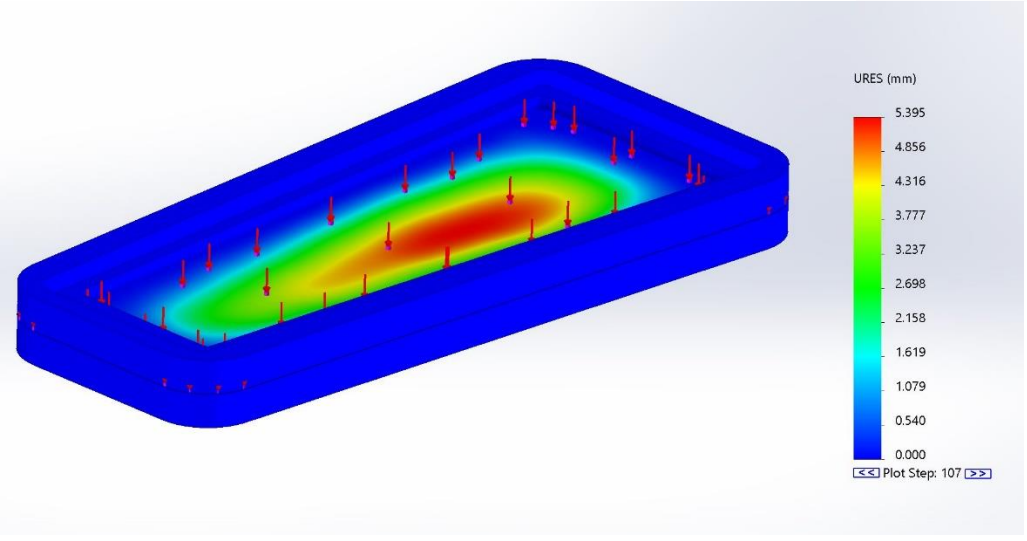


Deflection analysis shows less than ½ mm displacement.

Thin window analysis

Smaller window puts stress levels above yield (expected) but below ultimate strength of material. In my experience this is the thinnest an aluminum window will be safe for operation.





The analysis shows approx. 1/4 inch of displacement. The smaller window has less deflection.

Summary

- Scattering Chamber and bellows spool pieces have been ordered. Approximately 16 week delivery.
- We anticipate producing drawings and going out for bid on the magnet chambers in the next 2 weeks. We expect the same delivery timeframe.
- All vacuum systems will be thoroughly cleaned and leak checked. All hardware will be vented and silver coated.
- If time allows we will assemble the system at Bates and bake it out.
- We will use standard conflat flanges with copper seals for all connections except the magnet chamber windows.
- The window will use small cross section o-rings made from Viton. We will also look into aluminum helicoflex seals.
- We will use a Gamma TiTan CV ion pump with an integrated NEG module producing 500 l/s of pumping. In addition we will add a SAES Capacitorr NEG module.
- Total outgassing for chamber and windows is approx. 3×10^{-6} torr-l/s
- Therefore final chamber pressure will be in the low 10^{-9} torr range.
- We have several ports on the scattering chamber for ARIEL diagnostics.
- Metric hardware will be used.
- Will need to meet with the ARIEL survey group to ensure we have adequate tooling for surveying to install.