Carbon fiber composites used in the inner ePIC detector structures

Sushrut Karmarkar, Andy Jung

Slides borrowed from Rahul S., Roland W., Dan C., Alex E. and presentations from MPGD and SVT groups

Most of these slides are from presentations given in the Jan. 2025 collaboration meeting

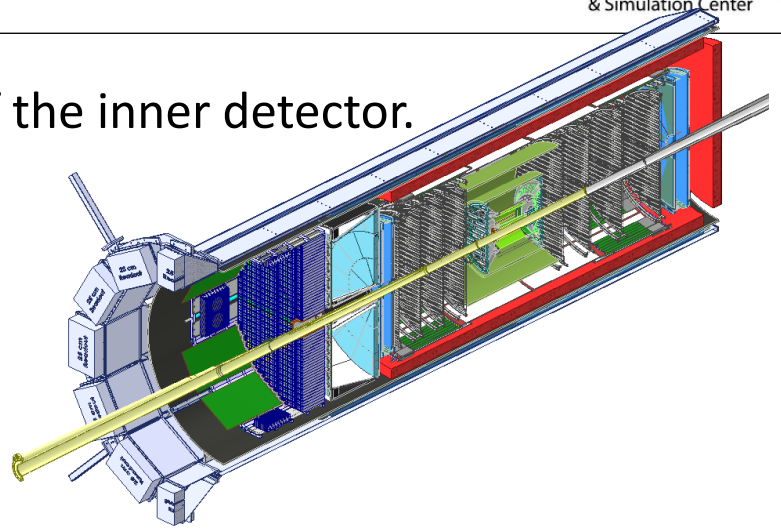
23 Jan 2025

DISCLAIMER

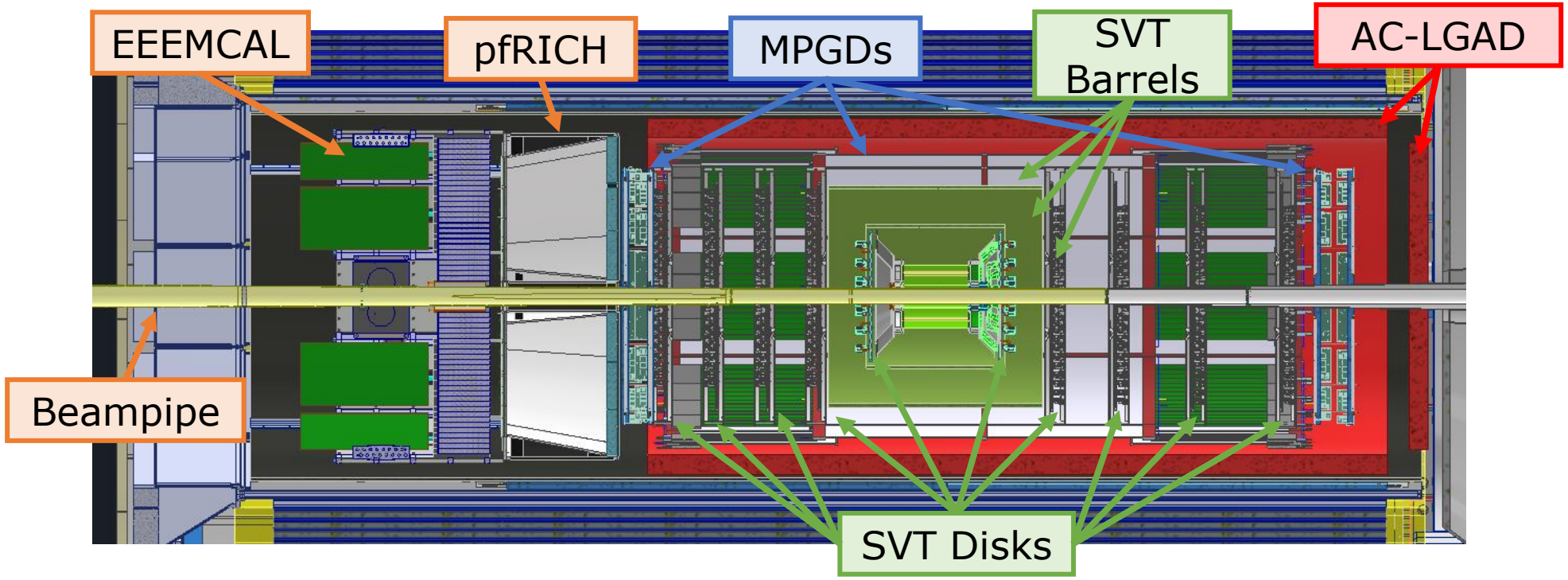
- This is a slide deck about the various sub-detector assemblies where carbon fiber composites are being designed / implemented for use.
- This gives an overview of the carbon fiber composite mechanical structures present in overall integration of the inner detector.
- I do not know where electrical grounding is needed and where it is not needed. I am a structural and materials engineer and thus cannot comment on it either.
- This presentation is put together to help electronics, electrical engineers, physicists and global systems teams to know / get a starting point on where to expect CFRP structures in the inner detector space.

Schematics of the inner detectors

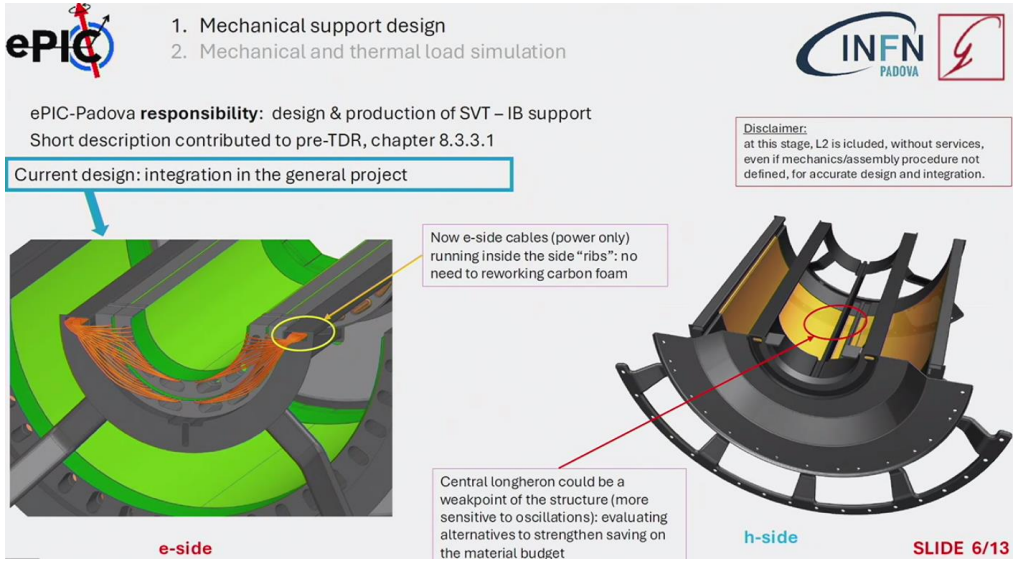
- CFRP structures are essentially used in all sub-detector assemblies of the inner detector.

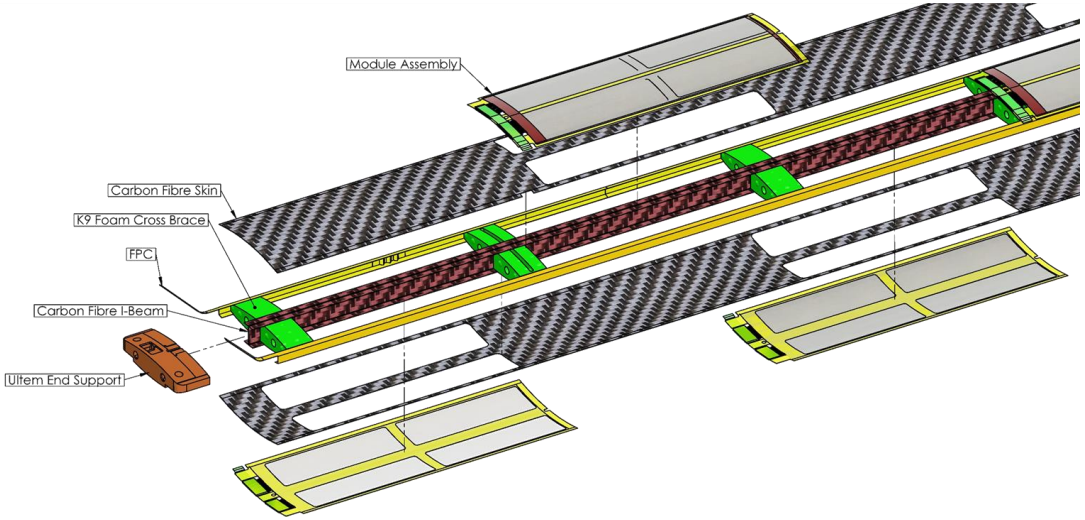


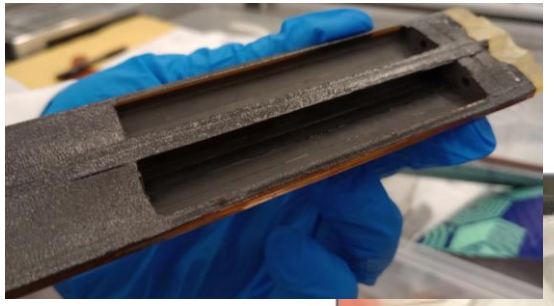
- Slide from R. Sharma's talk

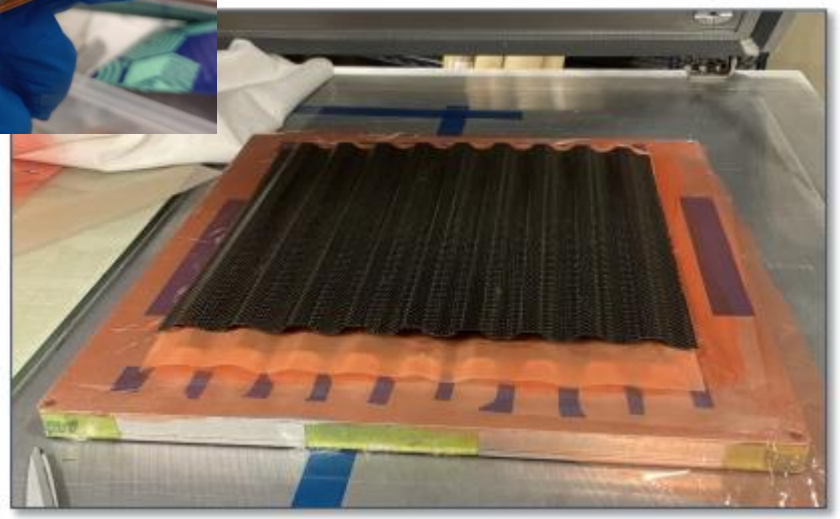


SVT CFRP structures





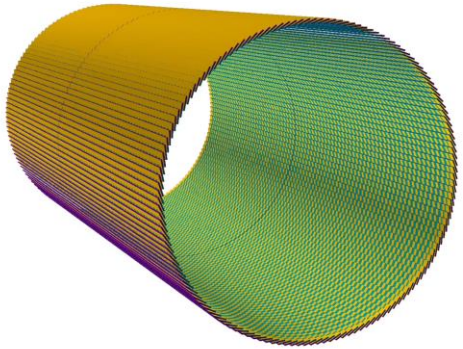


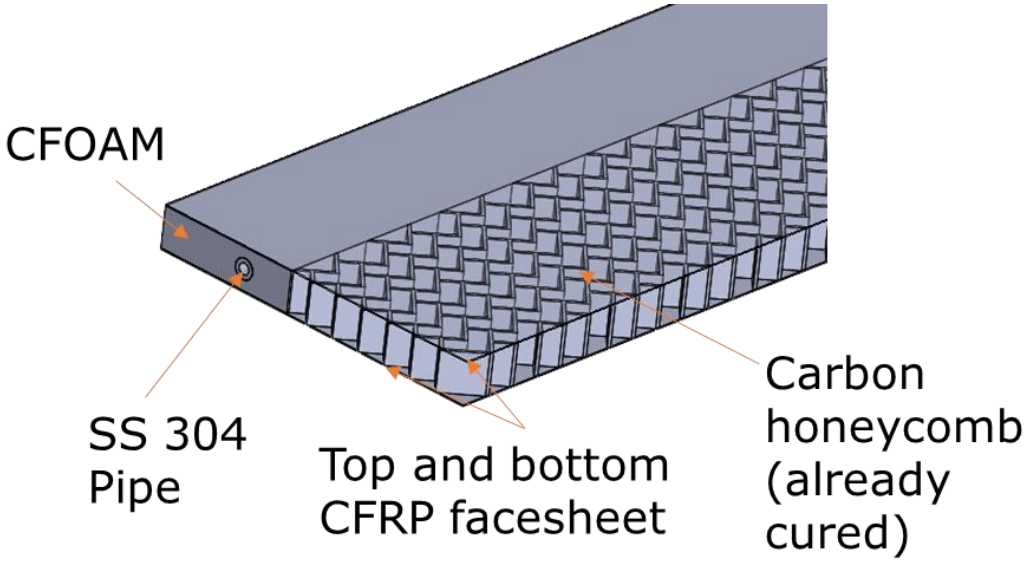


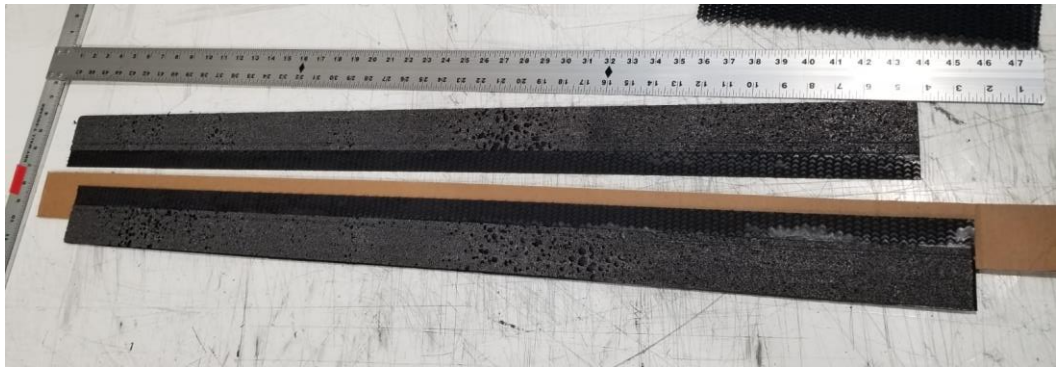
- Slides from a lot of people in SVT groups. Nicole A., Adam H., Georg V., Domenico and others.

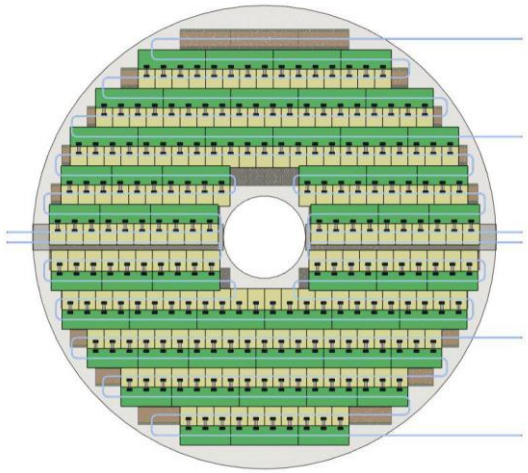
AC LGAD BTOF and FTOF structures

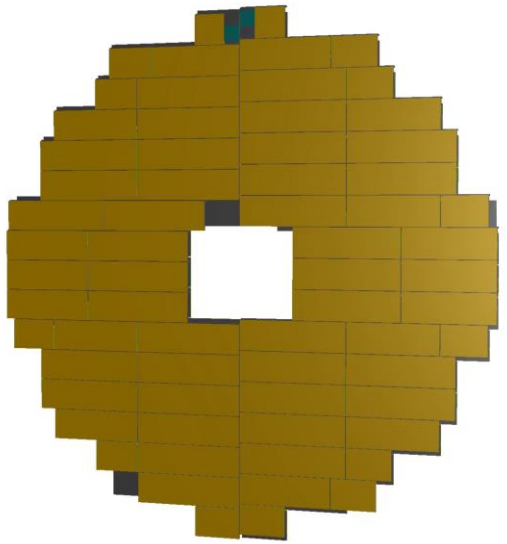
- BTOF – staves
- FTOF – disc support structures
- Engagement rings to hold the staves





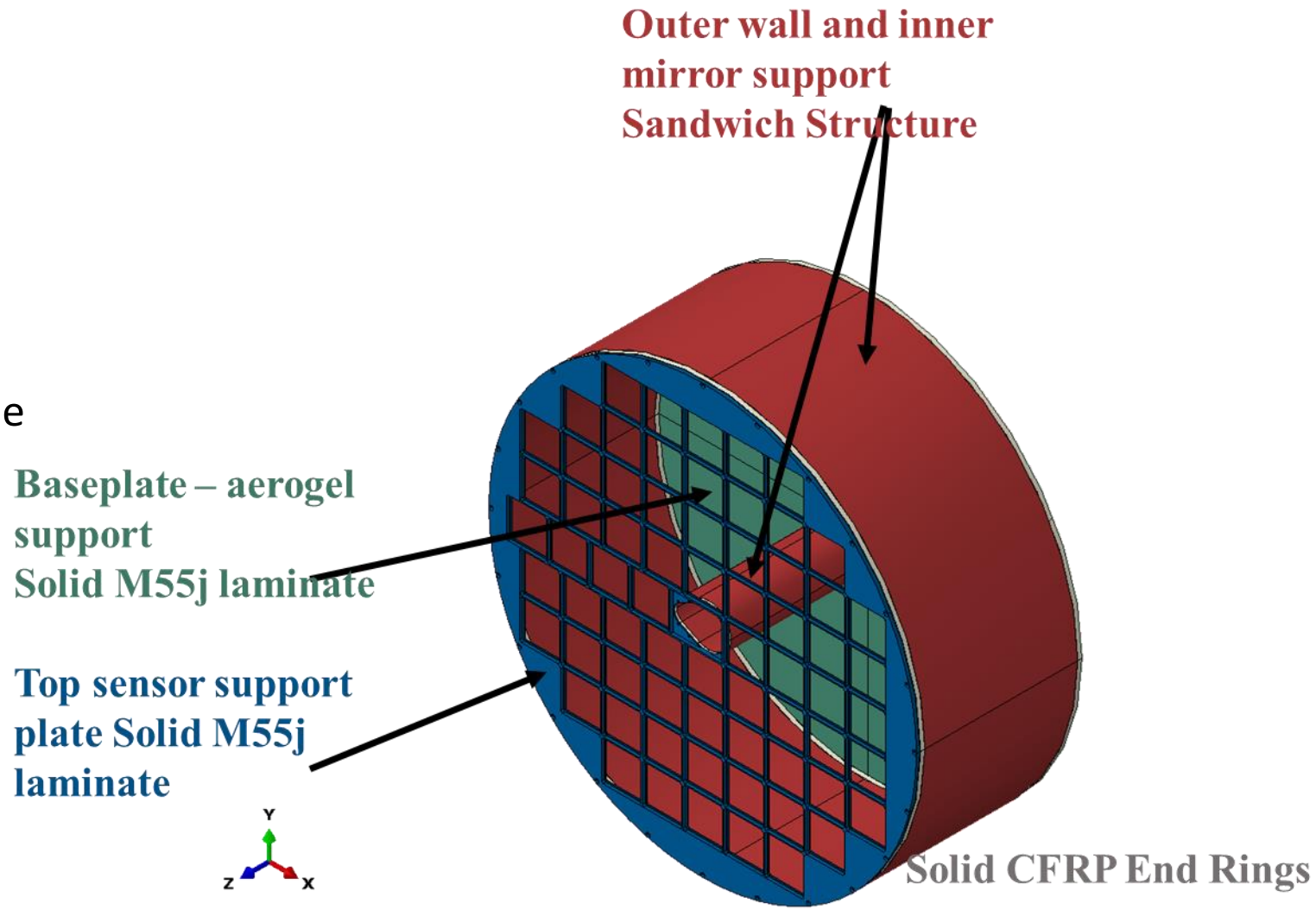






pfRICH CFRP structures

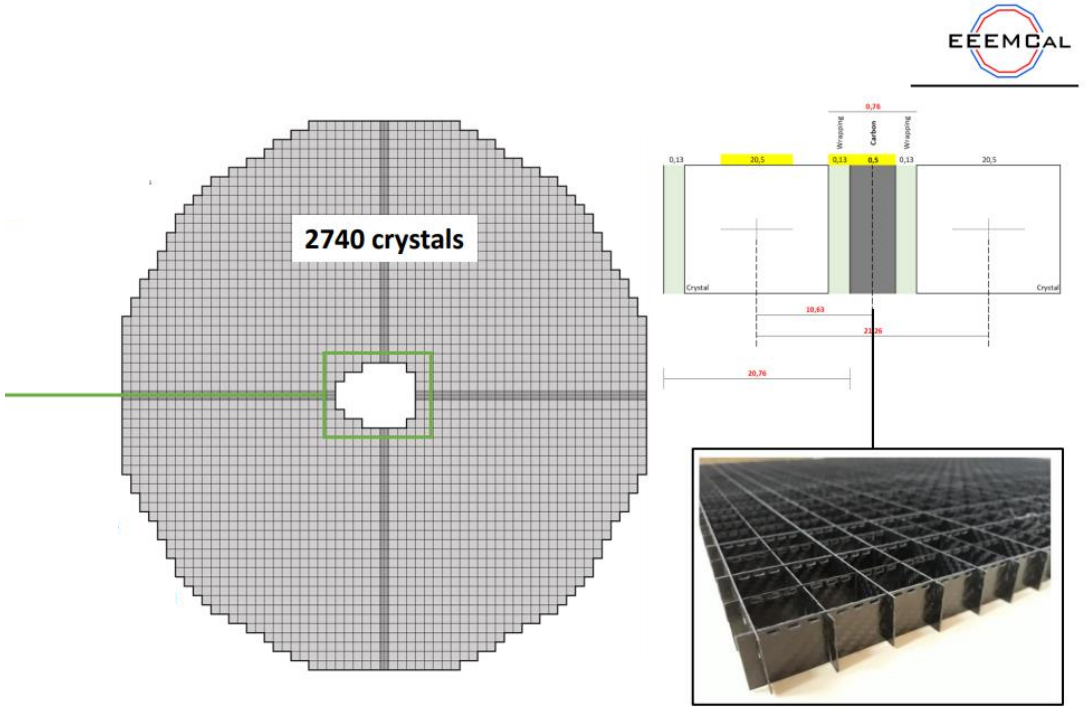
- Sensor plane
- End Rings for Vessel
- Vessel walls
- Mirror supports
- Aerogel support plane
- Top cover on HRPPD sensor plane (potentially)



EEEMCAL CFRP structures

- Slide from Julien B.

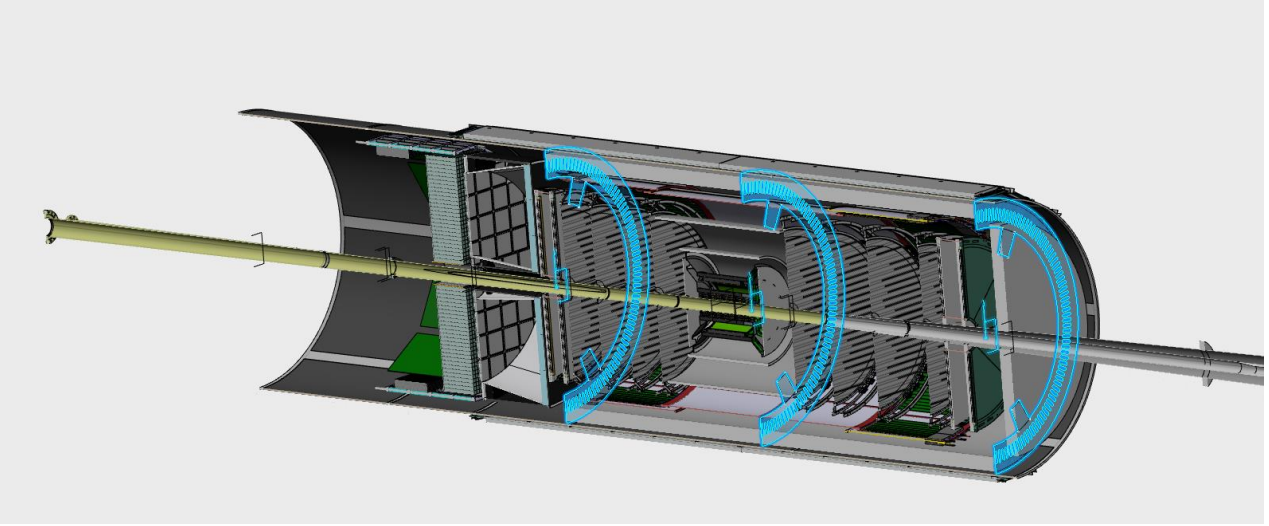
- CFRP structures used for crystal support and separation

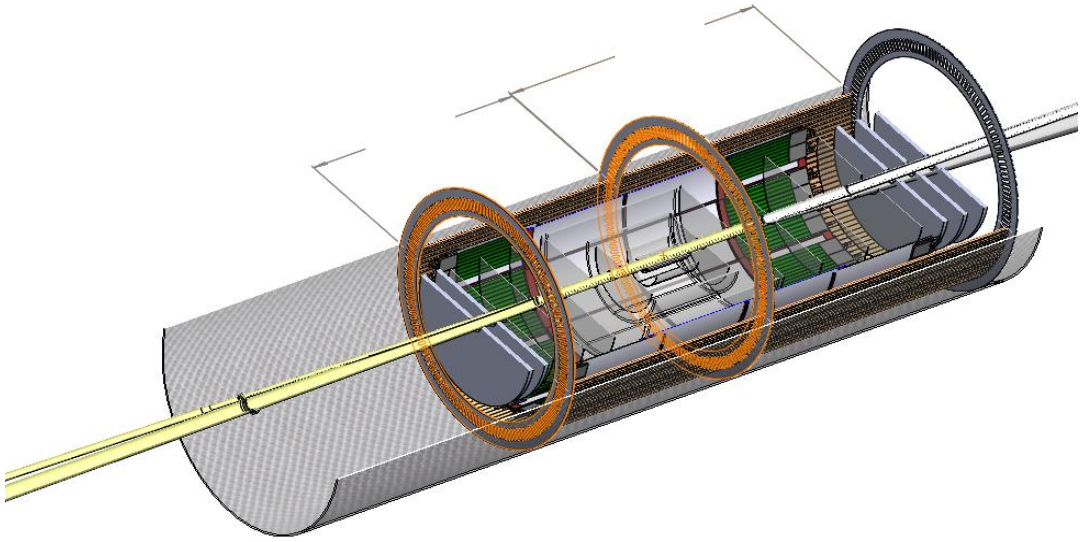


Carbon plate (NPS calorimeter)

Global support tube and other support structures

- Engagement rings
- Global Support Tube (GST)
- Service cones for IB and OB (SVT)
- Support ribs for Inner MPGD and MPGD discs
- Beam pipe support structures (fishing line like structure) – design in progress

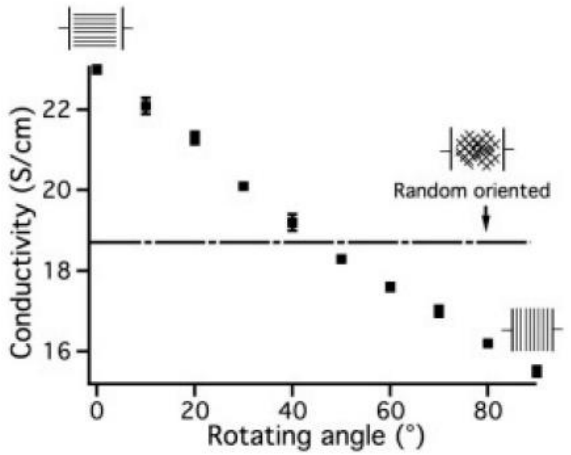




Electrical properties of CFRP laminates

- The electrical conductivity of CFRP laminates and sandwich laminates used in ePIC will depend on the choice of material, layup sequence and number of discrete connections to make the support structures (continuity)

- If ***(IF)*** a detector sub-assembly needs grounding, then it is possible to include that in the structural design for the global integration systems and services.



- Zhao, Q., Zhang, K., Zhu, S., Xu, H., Cao, D., Zhao, L., Zhang, R. and Yin, W., 2019. Review on the electrical resistance/conductivity of carbon fiber reinforced polymer. *Applied Sciences*, *9*(11), p.2390.

No summary, for a summary talk.