



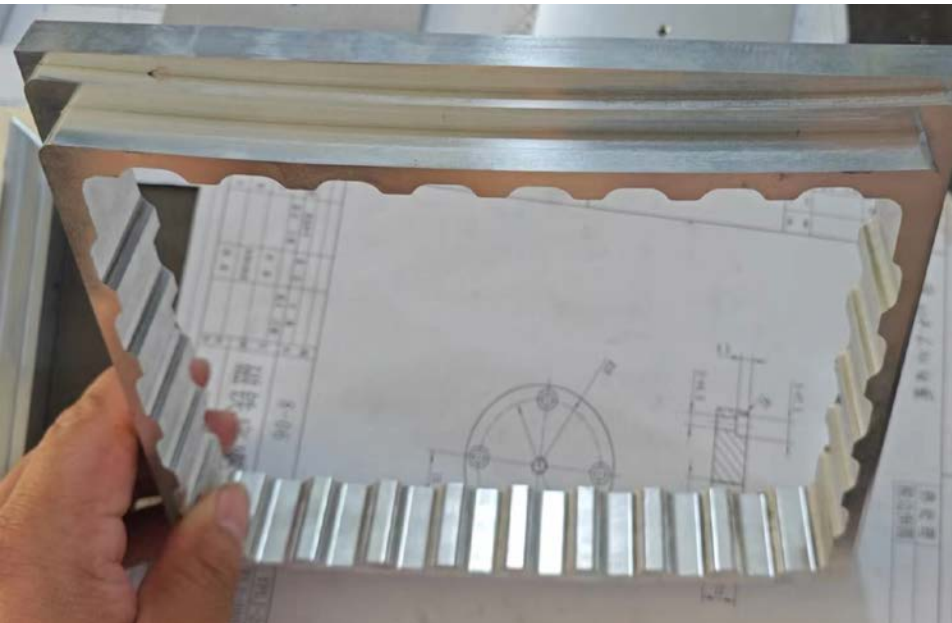
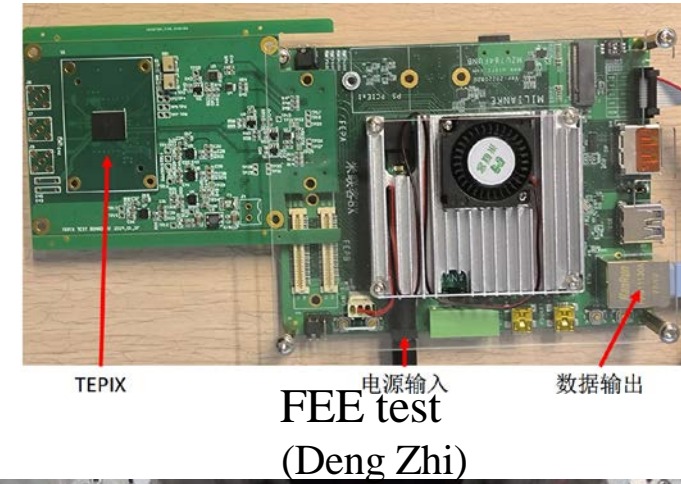
Progress of Pixelated readout TPC for CEPC TDR

Huirong Qi

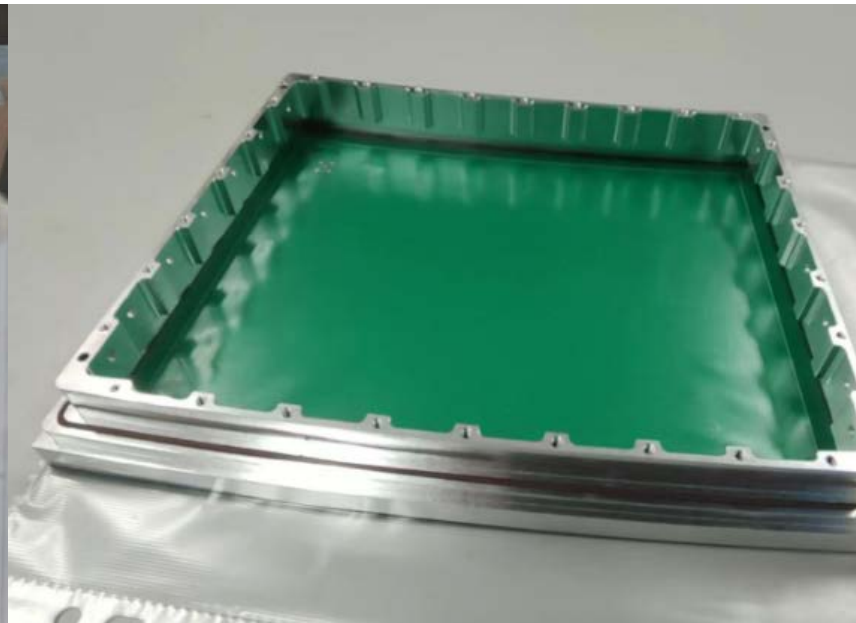
Weekly meeting of CEPC Track Group, June 28, 2024

Module of the beam test

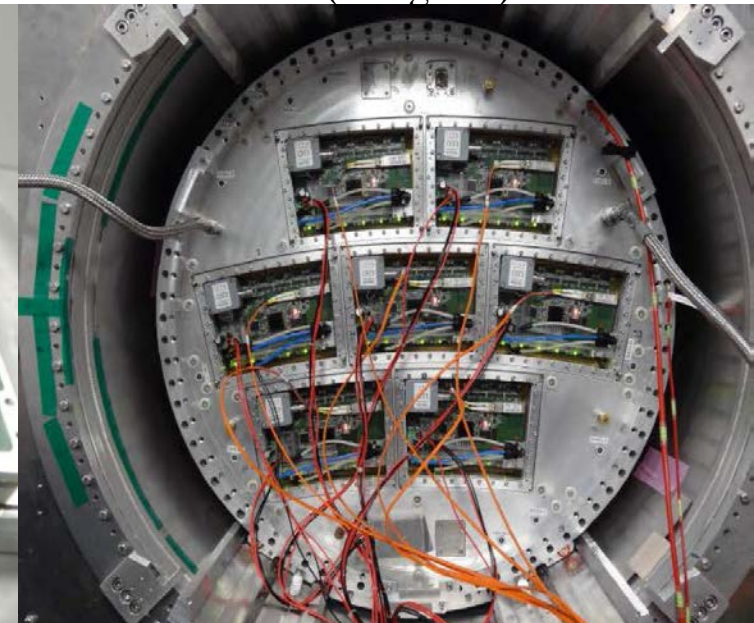
- Front-end electronics has been tested for consistency in progress and is ready to be completed. (Tsinghua + IHEP)
- DAQ and BEE electronics collaboration are smooth and pushed quickly.
- Module of Aluminum backframe and the readout done and received
 - Pre-assembled started and ongoing



Aluminum backframe
(Zhang Jian)



Readout PCB
(Chang Yue)



Beamtest module
(She Xin)

Optimization of TPC barrel : Carbon Fiber

Junsong Zhang

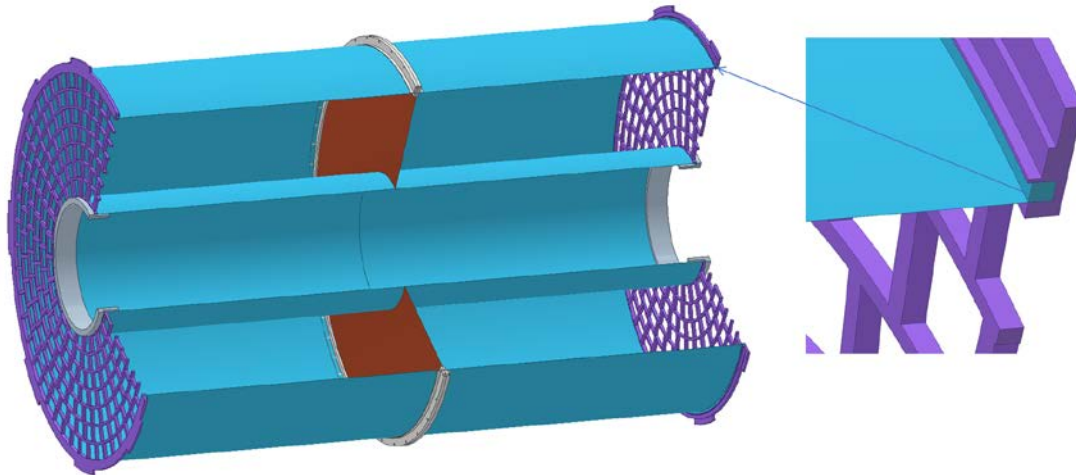
- Consideration of new Carbon Fiber barrel instead of the honeycomb barrel
- **Ultra-light material** of the TPC barrel
 - Investigation and selection: High-strength carbon fiber material QM55

碳纤维种类	东丽M55J	东丽M55J	CCM55J	CCM55J	中筒 M55	宁波所QM55	宁波所QM55
树脂种类	环氧树脂	氰酸酯	双马树脂	环氧树脂	环氧树脂	氰酸酯	环氧树脂
°拉伸强度 (MPa)	1500	1800	1780	1525	1600	2150	1851
0°拉伸模量 (GPa)	280	300	295	286	290	332	318
0°压缩强度 (MPa)	600	600	/	/	600	734	735
0°压缩模量 (GPa)	240	250	/	/	240	320	312
0°弯曲强度 (MPa)	1000	1000	1300	/	900	1135	1044
0°弯曲模量 (GPa)	250	260	280	/	250	271	288
层间剪切强度 (MPa)	55	53	54	53	43	58	61
纵横剪切强度 (MPa)	/	/	52.8	/	/	55.4	43
纵横剪切模量 (GPa)	/	/	4.55	/	/	3.89	3.2
准各向同性 拉伸强度 (MPa)	500	500	/	/	/	509	392
准各向同性 拉伸强度 (GPa)	90	95	/	/	/	116	104

Optimization of TPC barrel : Carbon Fiber

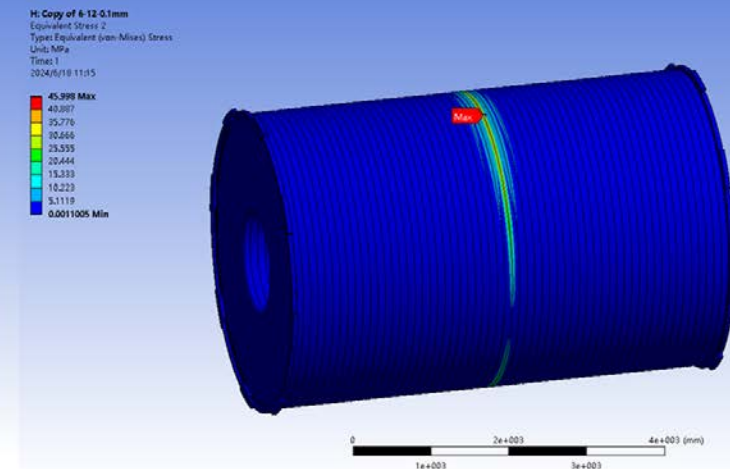
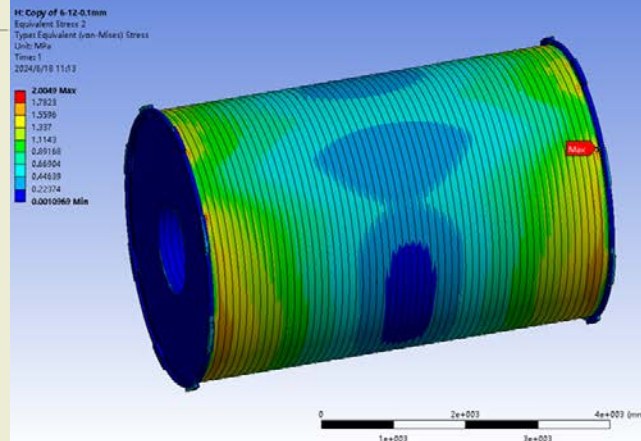
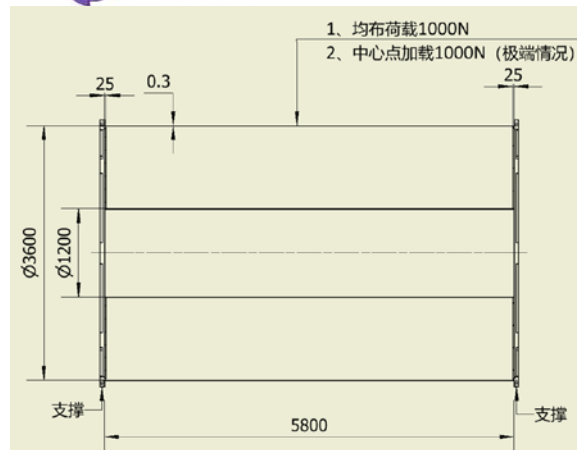
Junsong Zhang

- Consideration of new Carbon Fiber barrel instead of the honeycomb barrel
- **Ultra-light material** of the TPC barrel : **0.63% X_0** in total, including
 - FEA preliminary calculation: 0.2mm carbon fiber barrel can tolerant of LGAD OTK (**100Kg**)
- Optimization of the connection back frame of the endcap (on going)



Material budget of TPC barrel

Layer of the barrels	D[cm]	X_0 [cm]	d/X_0 [%]
Copper shielding	0.001	1.45	0.07
CF outer barrel	0.020	25.28	0.08
Mirror strips	0.003	1.35	0.19
Polyimide substrate	0.005	32.65	0.02
Field strips	0.003	1.35	0.19
CF inner barrel	0.020	25.28	0.08
Sum of the material budget			0.63



FEA analysis results

- Preliminary conclusion
 - **Ultra-light material** of the TPC barrel can be choose.
 - High-strength carbon fiber material QM55
 - For thin-walled structures, the shear stresses (剪切应力) from deformations of 0.2-0.3mm may occur that exceed the shear stress of the carbon fiber to lead **a risk of fracture**.
- **Requirements of OTK**
 - Mass and distribution of OTK detector
 - Need **more feedback and discussion** from Yunyun

