



Gaseous detector chapter towards CEPC TDR

Huirong Qi and Linghui Wu

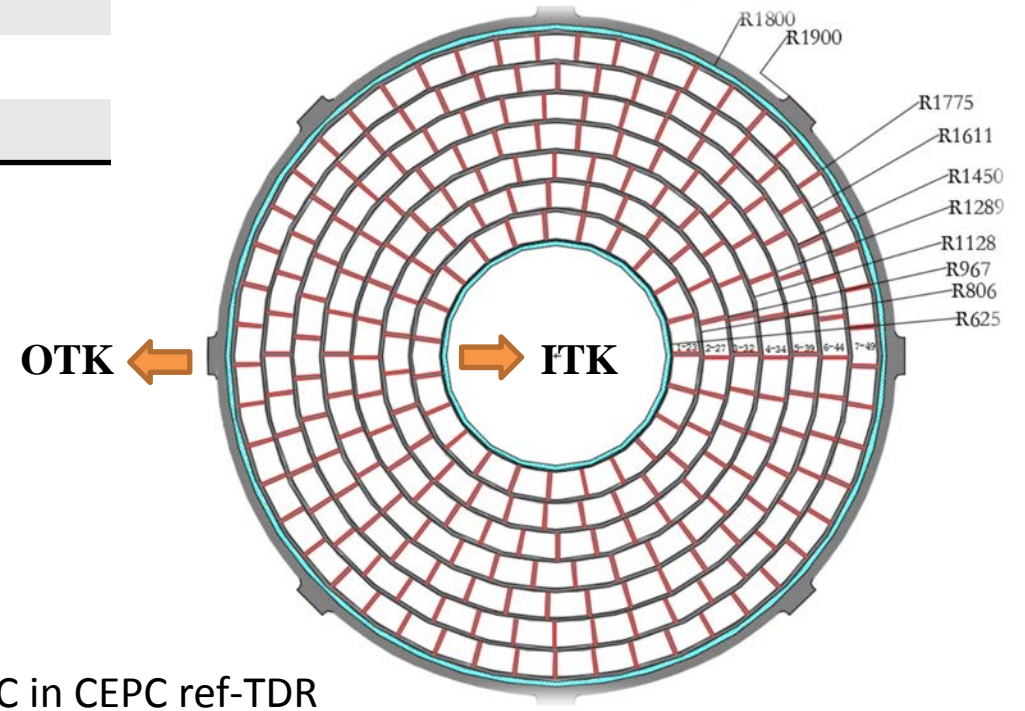
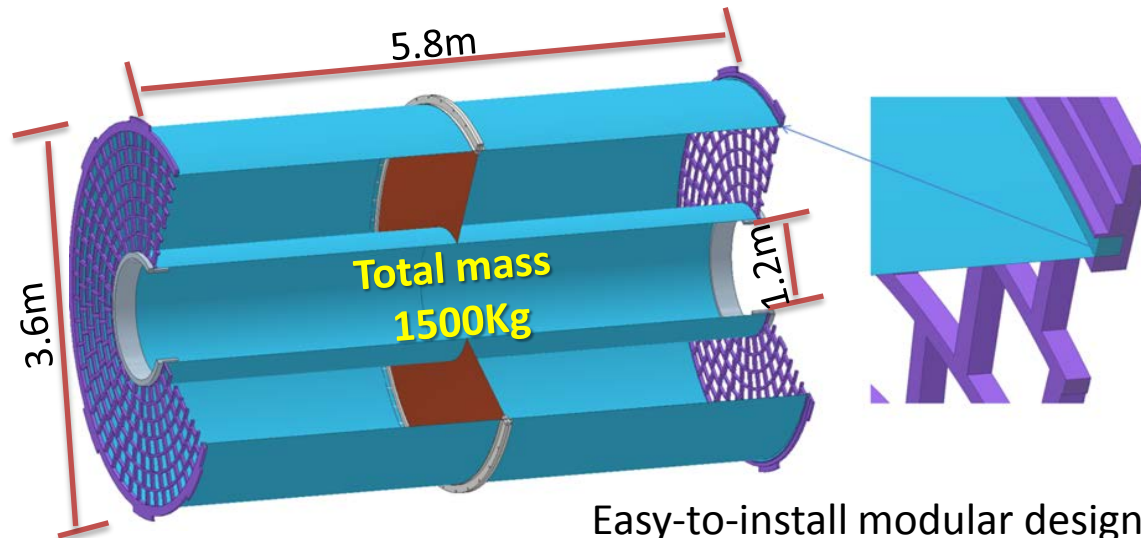
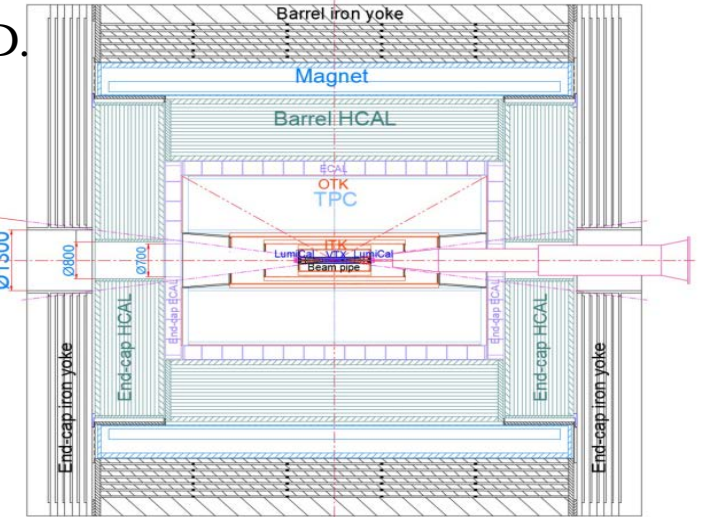
Weekly meeting of CEPC TDR Group, September 10, 2024

- **Updated gaseous detector part in TDR**
- **Preparation for Beam test**

Updated design of TPC mechanics for ref-TDR

- Track detector system: **Silicon combined with gaseous detector** as the tracker and PID.
 - Pixelated readout TPC is as the baseline track detector in CEPC ref-TDR.

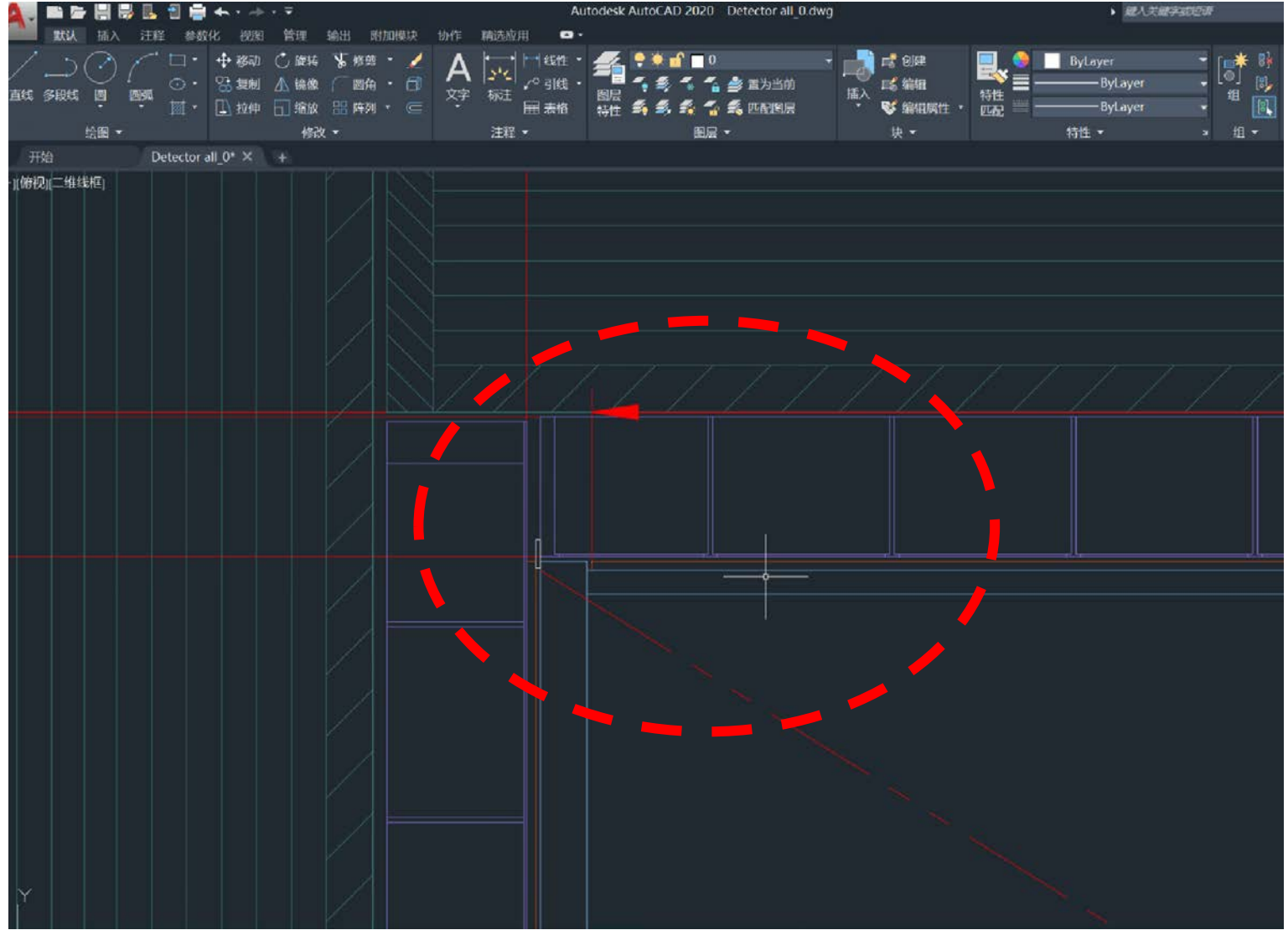
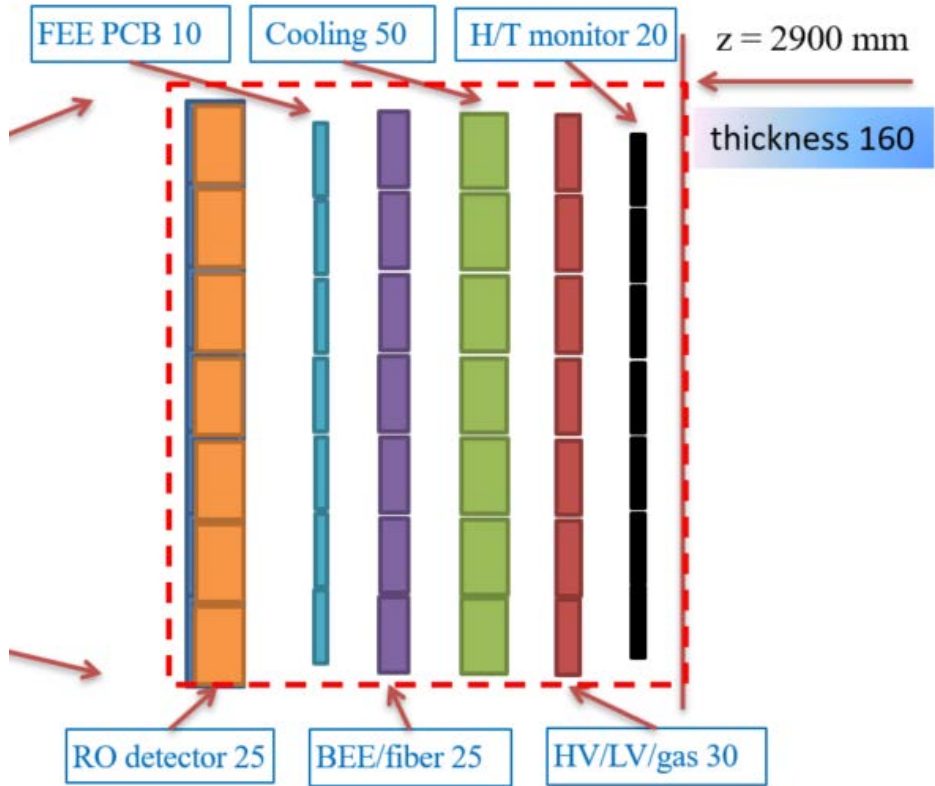
TPC detector	Key Parameters
Modules per endcap	248 modules /endcap
Module size	206mm × 224mm × 161mm
Geometry of layout	Inner: 1.2m Outer: 3.6m Length: 5.9m
Voltage of Cathode	- 62,000 V
Operation gases	T2K: Ar/CF ₄ /iC ₄ H ₁₀ =95/3/2
Total drift time	34μs @ 2.75m
Detector modules	Pixelated Micromegas



Easy-to-install modular design of TPC in CEPC ref-TDR

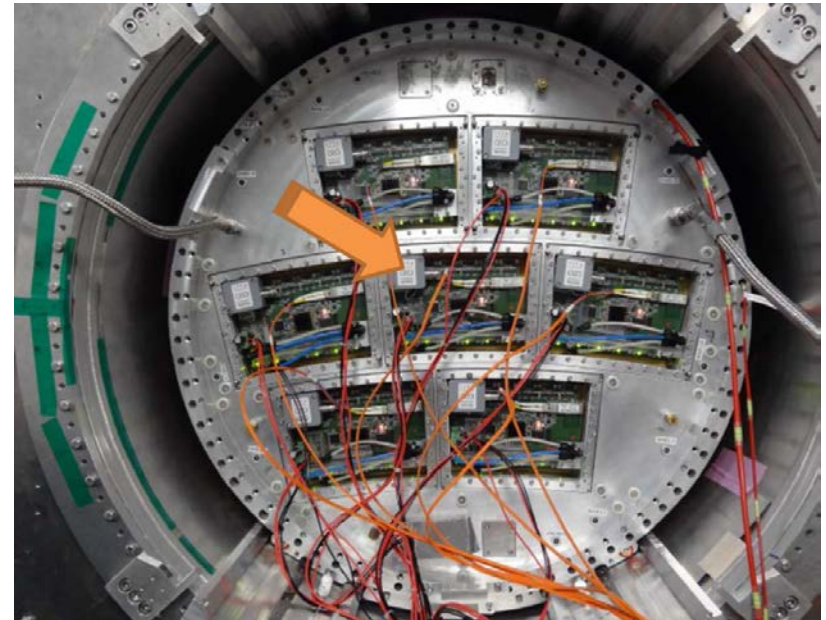
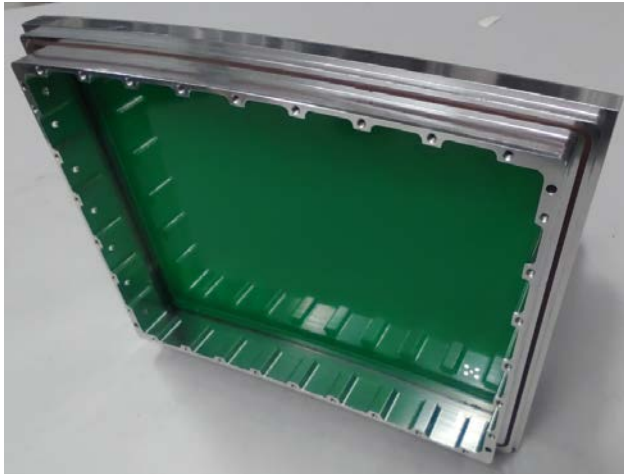
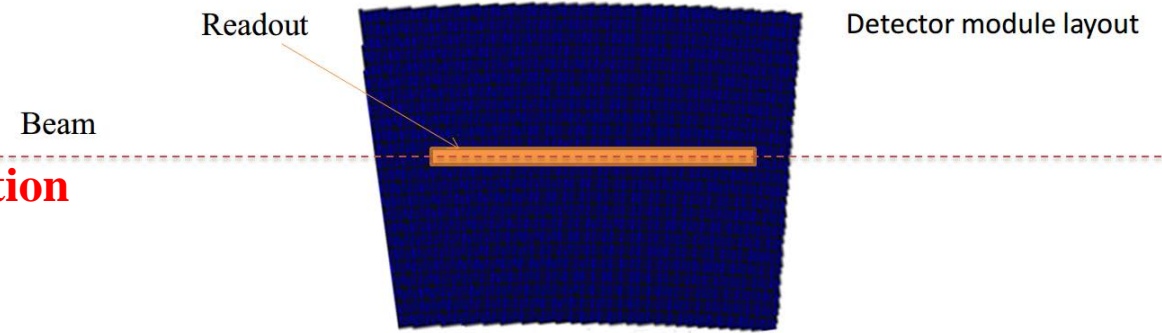
Collaborative discussions with OTK and mechanics

- Discussion of TPC and OTK detector boundaries based on existing overall detector benchmark CAD design.
 - Fan yunyun, Zhang Junsong
Zhangjian, Ji Quan, Huirong



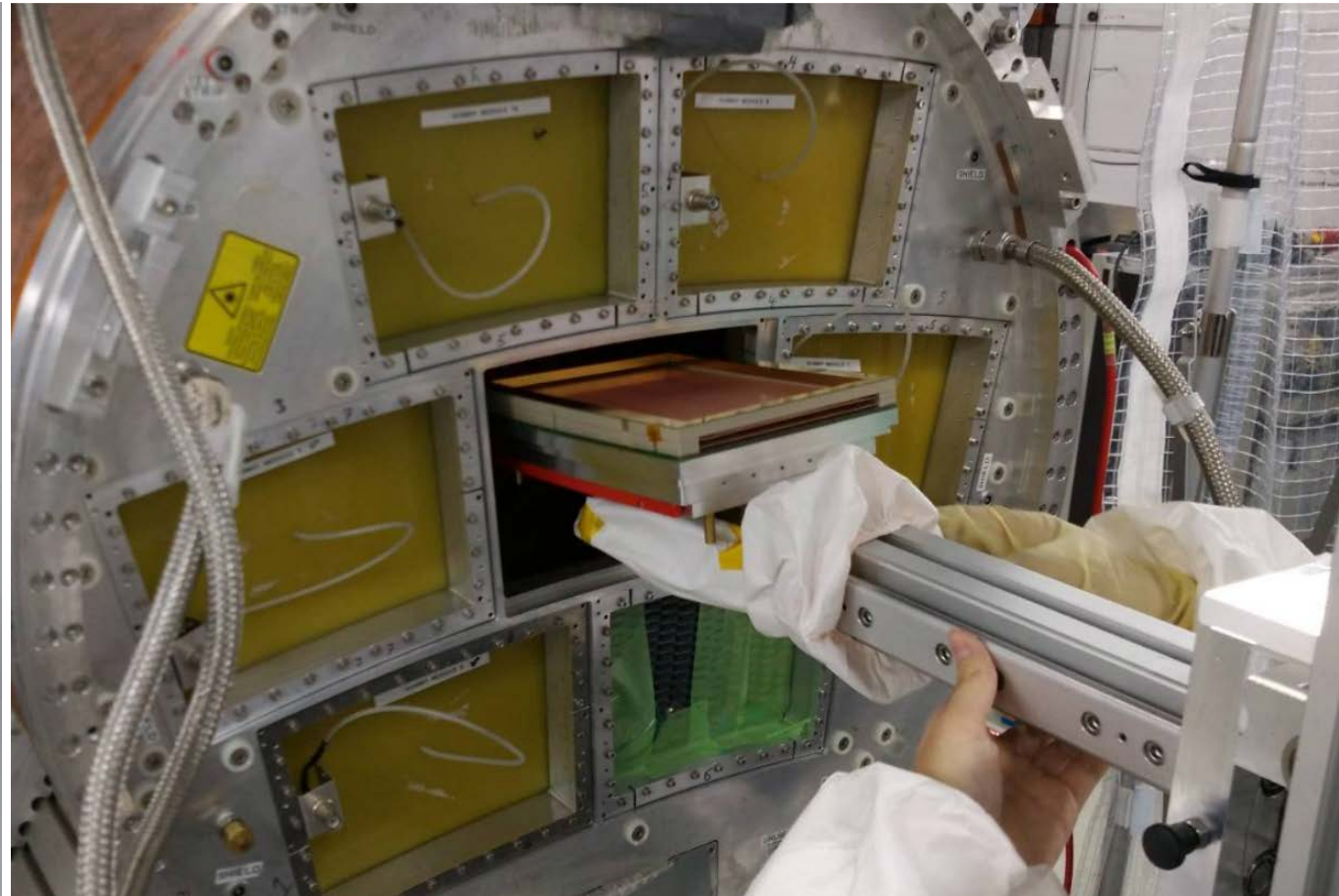
Some critical simulation and validation

- Pixelated readout TPC can be as a **realistic and promised** track detector in CEPC TDR, some key issues will be simulated and validated.
 - Occupancy and hit density
 - **Improved $dE/dx+dN/dx$**
 - Ion backflow suppression
 - **Reasonable channels and power consumption**
 - Running at 2 Tesla
 - Beamstrahlung and distortion
- LCTPC (Lepton Collider Time Projection Chamber) collaboration will continue to push this technology to e+e- collider.



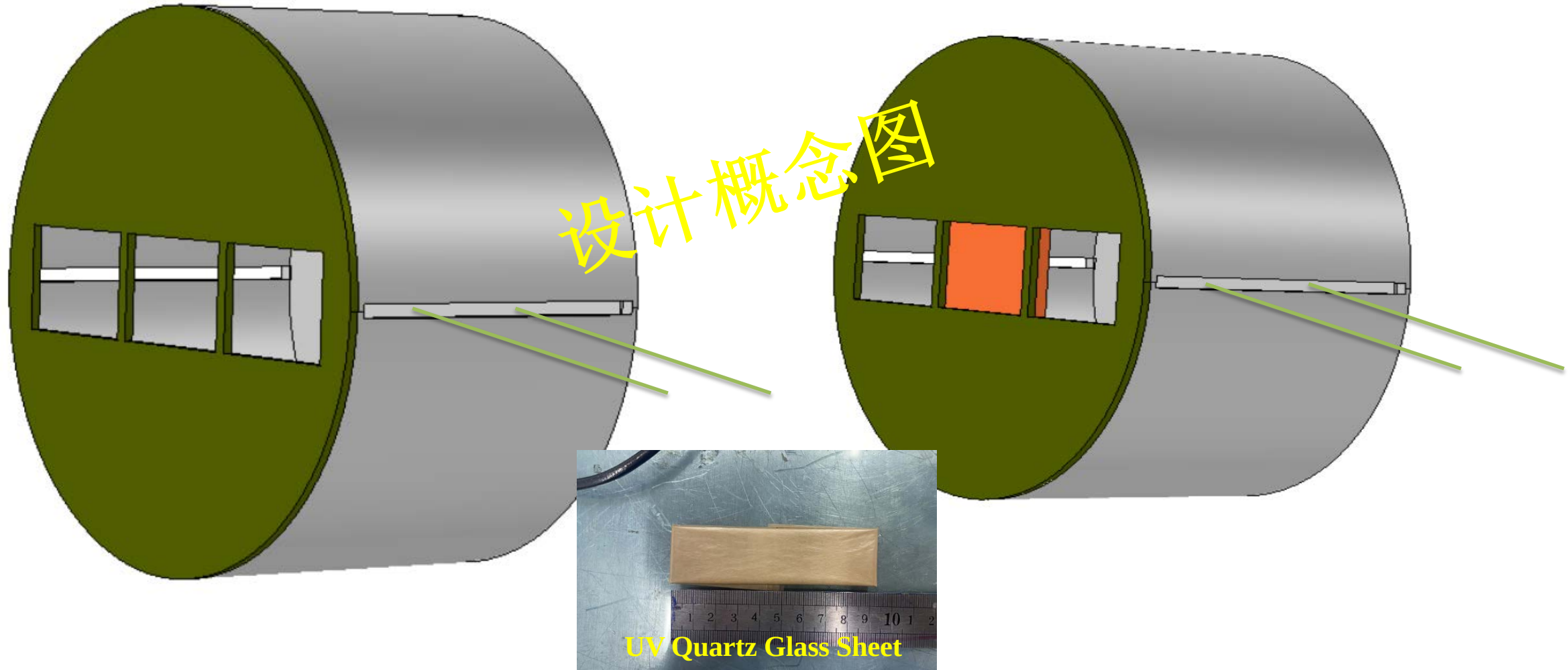
Assembled module of the beam test

- Two Aluminum backframes have been done.
 - One assembled module delivered to Tsinghua.
 - **O ring has been selected using 2.3mm**



Updated plan before the beam test

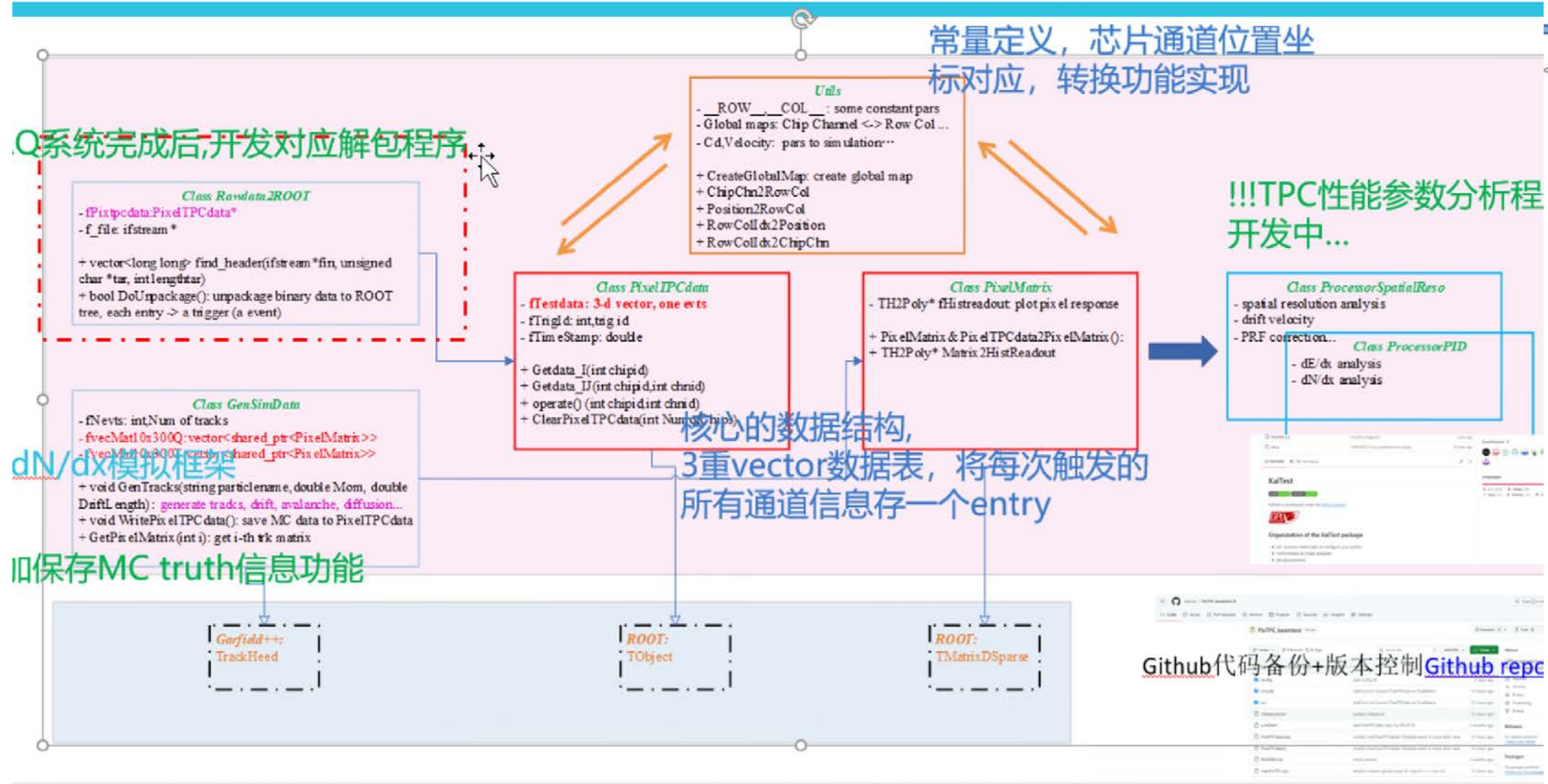
- The new TPC prototype will be designed and assembled in this month.
 - **We began to start design and mechanic.**
 - Junsong Zhang, Jian Zhang, Yue Chang, Xin She, Jinxian Zhang



Development of the data analysis

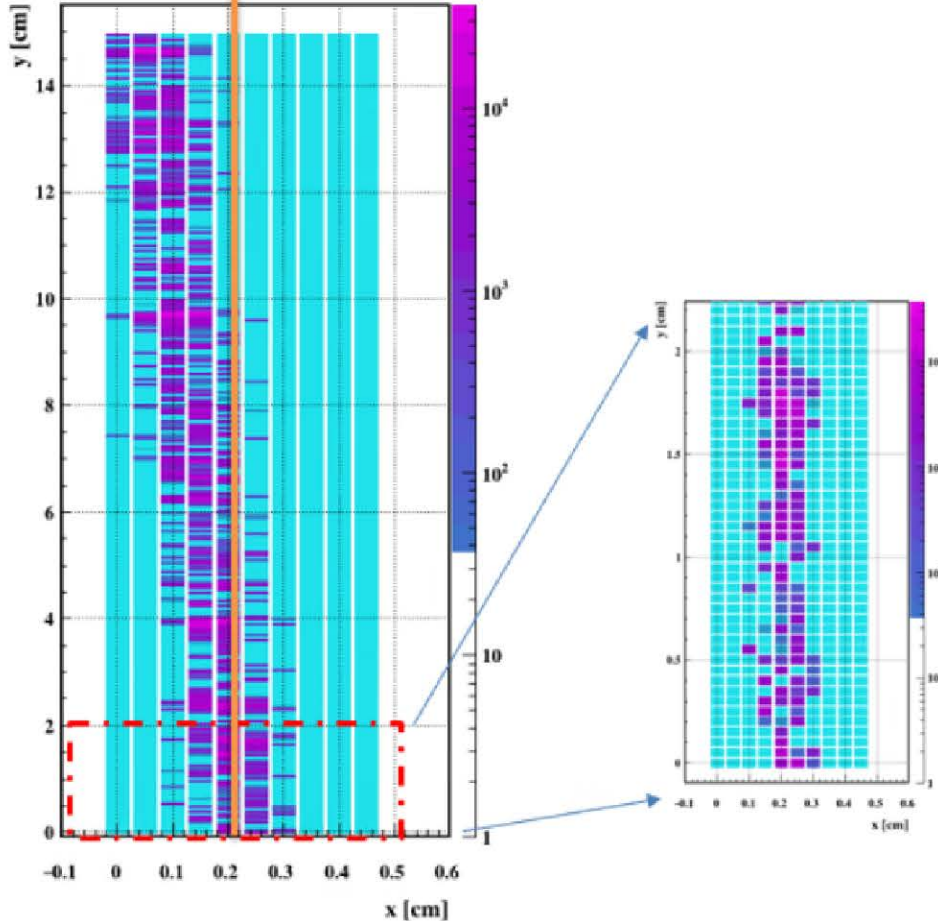
- Firmware construction block diagrams and data structures are defined.
 - The data analysis are under development.(Kalman filter and CEPCSW)

Head	Channel number	timestamp	Trigger number	Payload data
0xff	4MSB->port, 4LSB->chip	64b	32b	Vary length

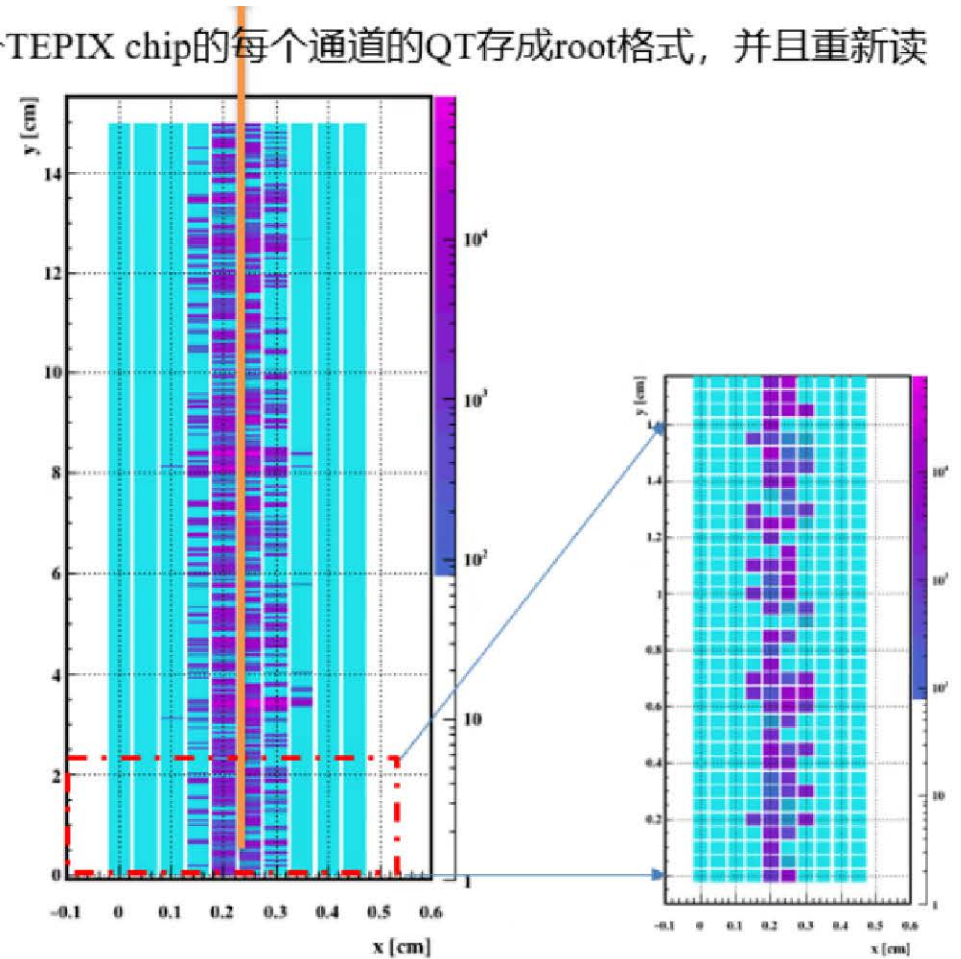


Development of the data analysis using simulation

- The preliminary simulation data analysis are under development including the drift, diffusion and avalanche of the detector.
- 初步实现由Garfield++产生一条径迹，经过漂移，扩散，倍增后，将每个TEPIX chip的每个通道的QT存成root格式，并且重新读



2.7 GeV e- @ B=1T, 20cm drift length



5.0 GeV e- @ B=1T, 20cm drift length

Many thanks!