



# Gaseous detector chapter towards CEPC TDR

Huirong Qi and Linghui Wu

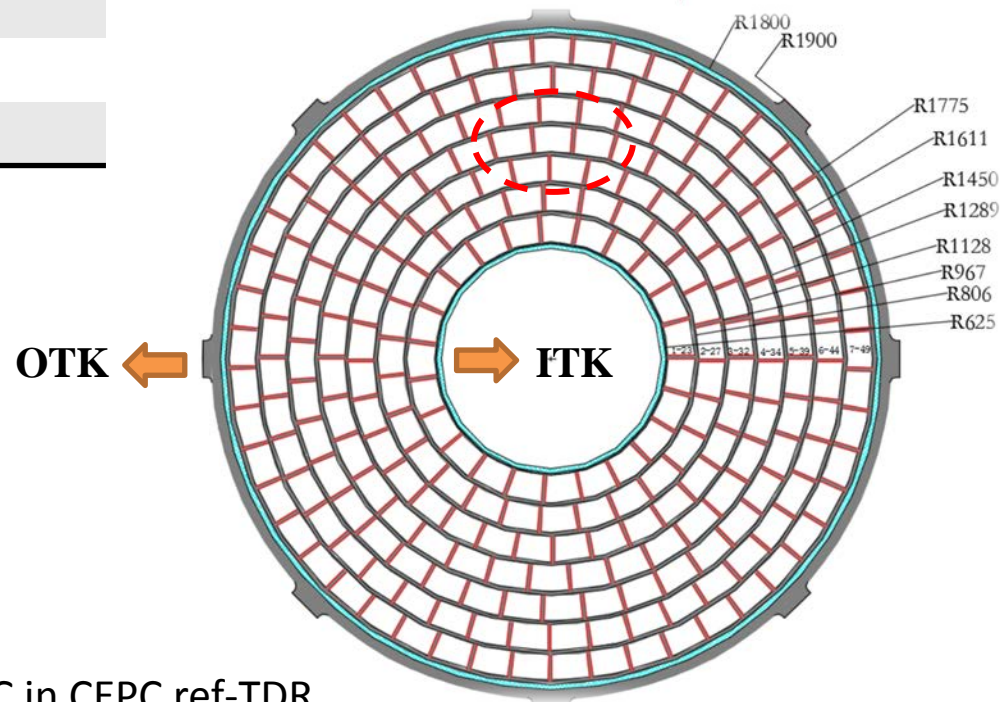
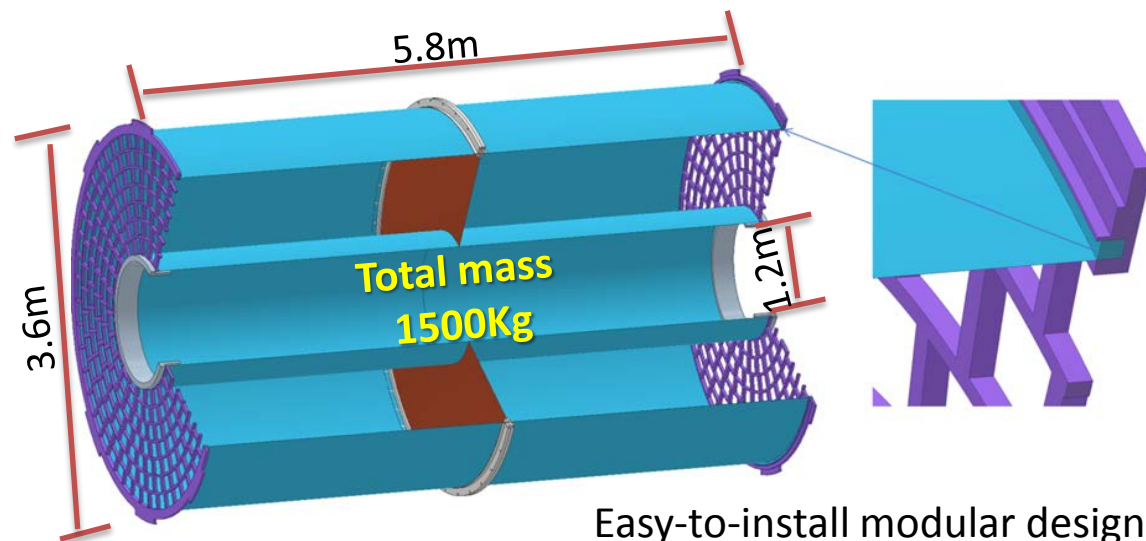
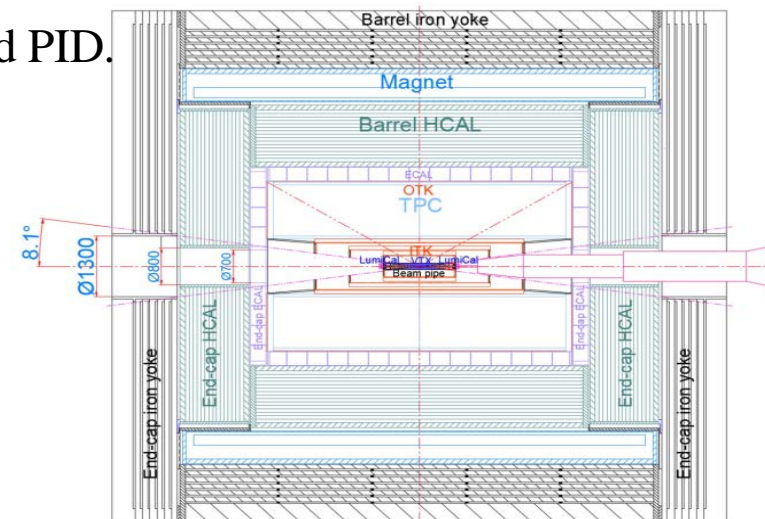
Weekly meeting of CEPC TDR Group, September 23, 2024

- **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.

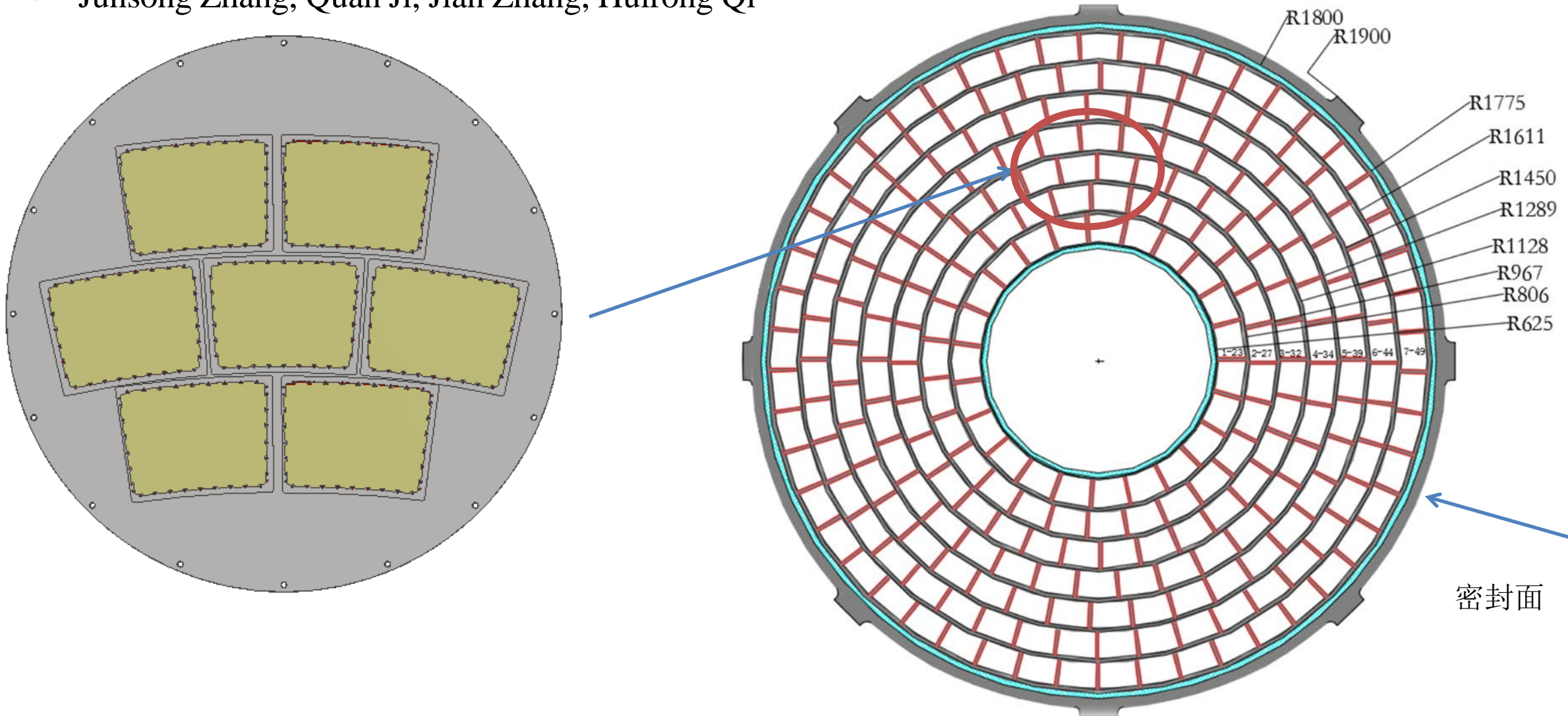
TPC detector	Key Parameters
Modules per endcap	248 modules /endcap
Module size	206mm × 224mm × 161mm
Geometry of layout	Inner: 1.2m Outer: 3.6m Length: 5.9m
Voltage of Cathode	- 62,000 V
Operation gases	T2K: Ar/CF <sub>4</sub> /iC <sub>4</sub> H <sub>10</sub> =95/3/2
Total drift time	34μs @ 2.75m
Detector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



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

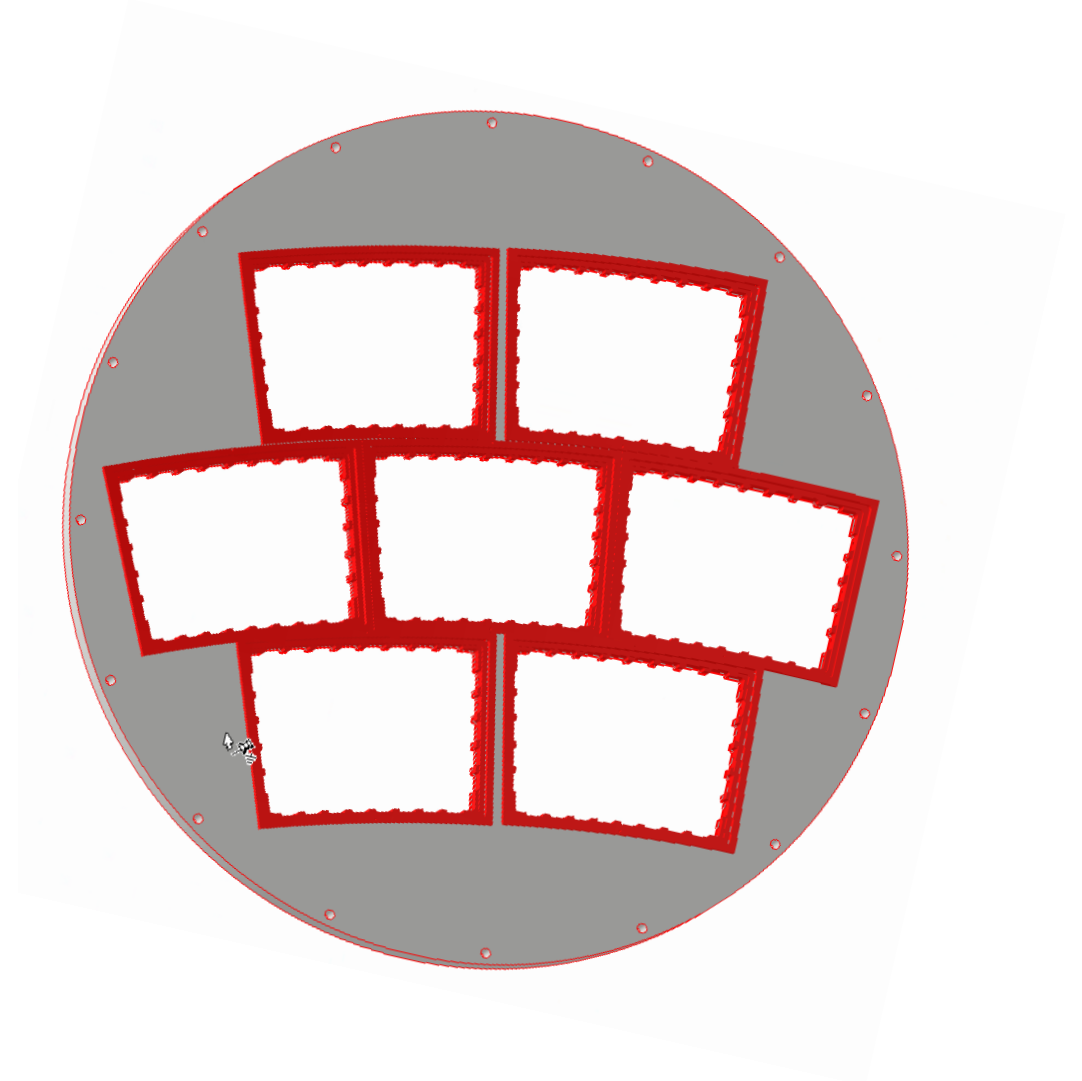
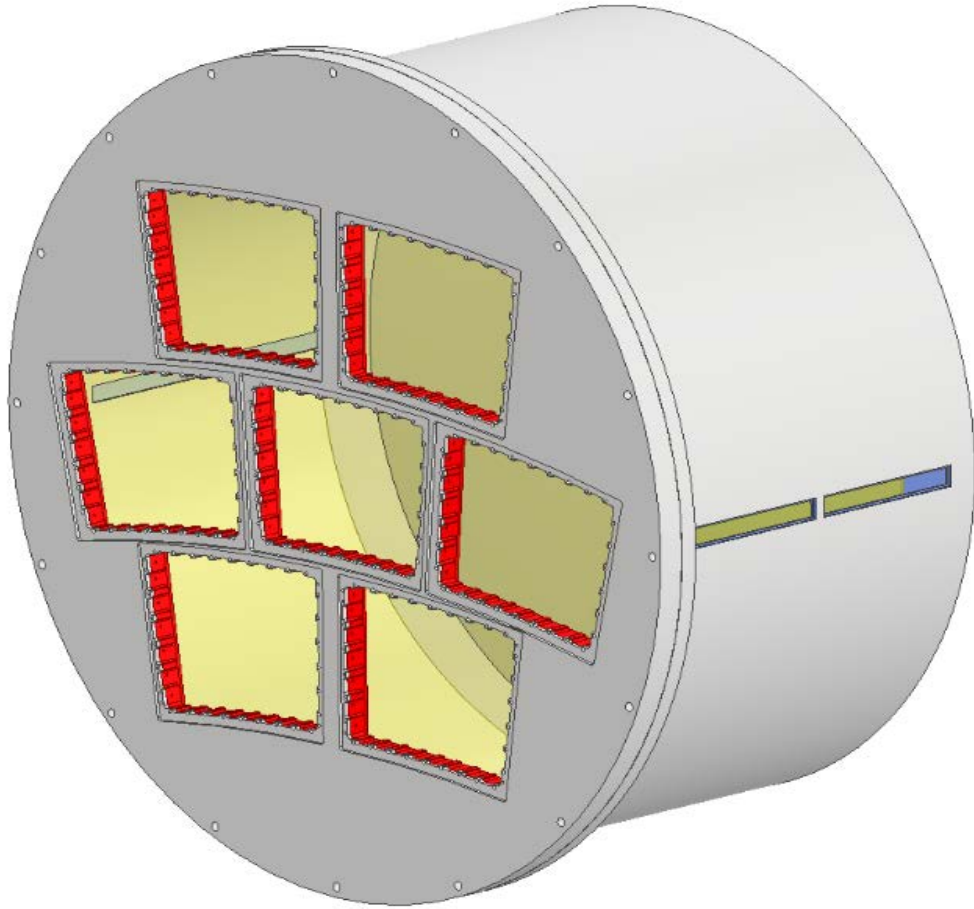
# Preparation for Beam test - multi modules validation

- Detailed design validated the final design of TPC readouts modules.
  - Junsong Zhang, Quan Ji, Jian Zhang, Huirong Qi



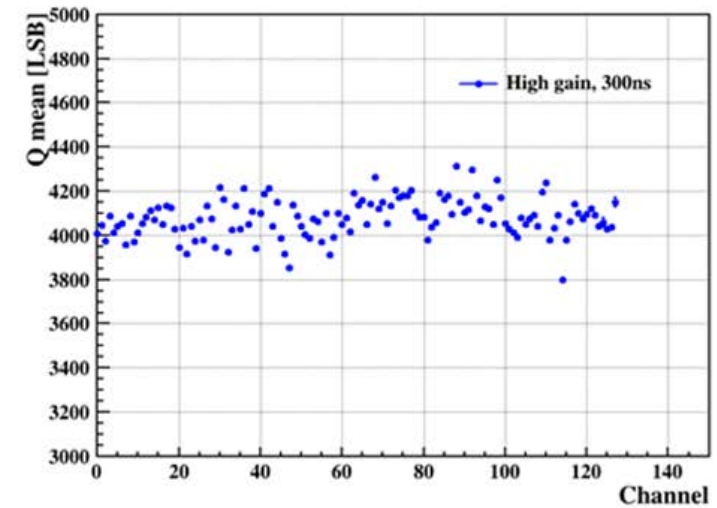
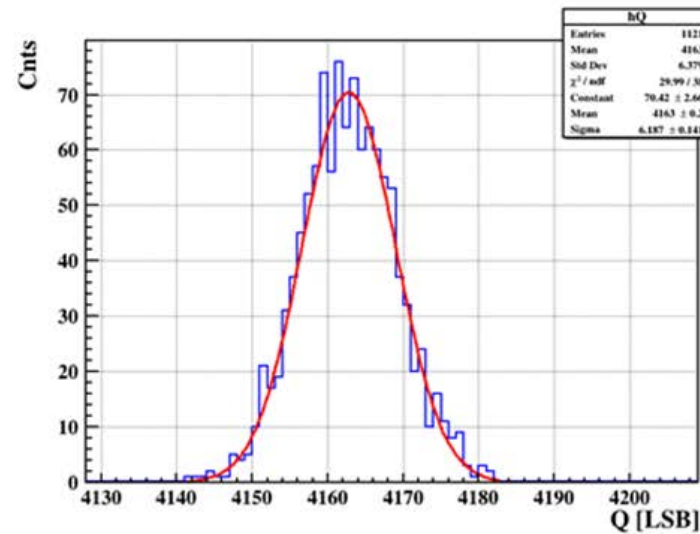
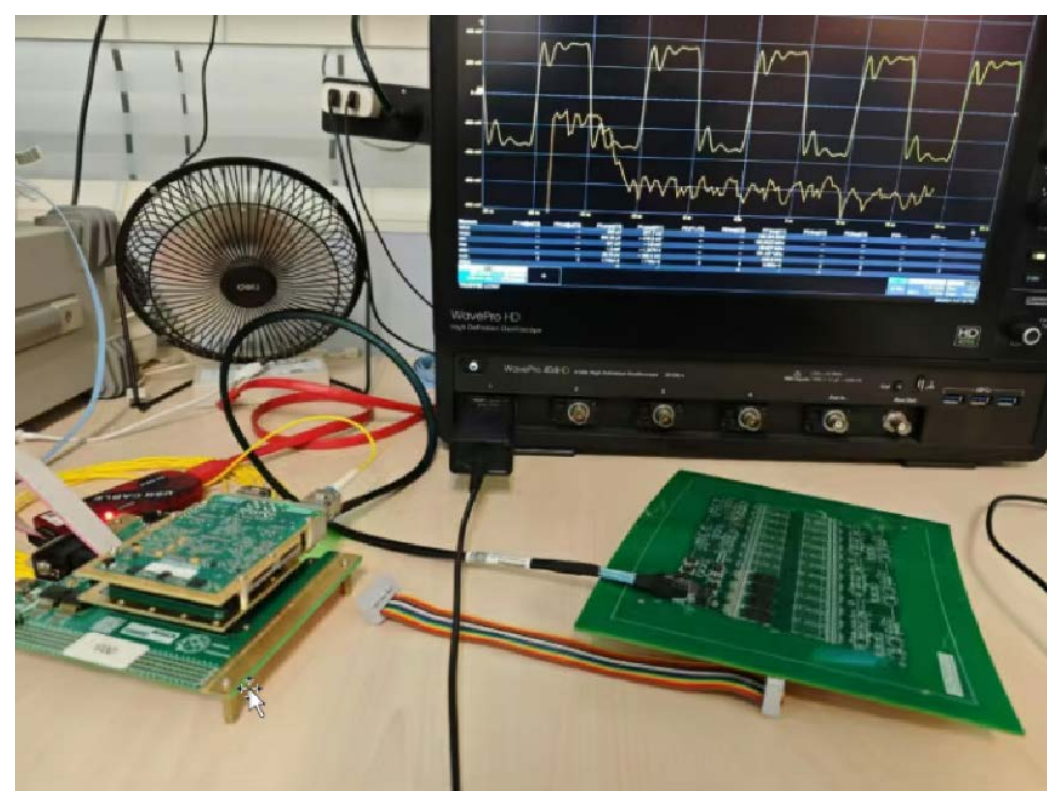
# Preparation for Beam test - multi modules validation

- Detailed design will be done in this week.
  - Junsong Zhang, Quan Ji, Jian Zhang, Huirong Qi



# Updated results of the TPC module testing

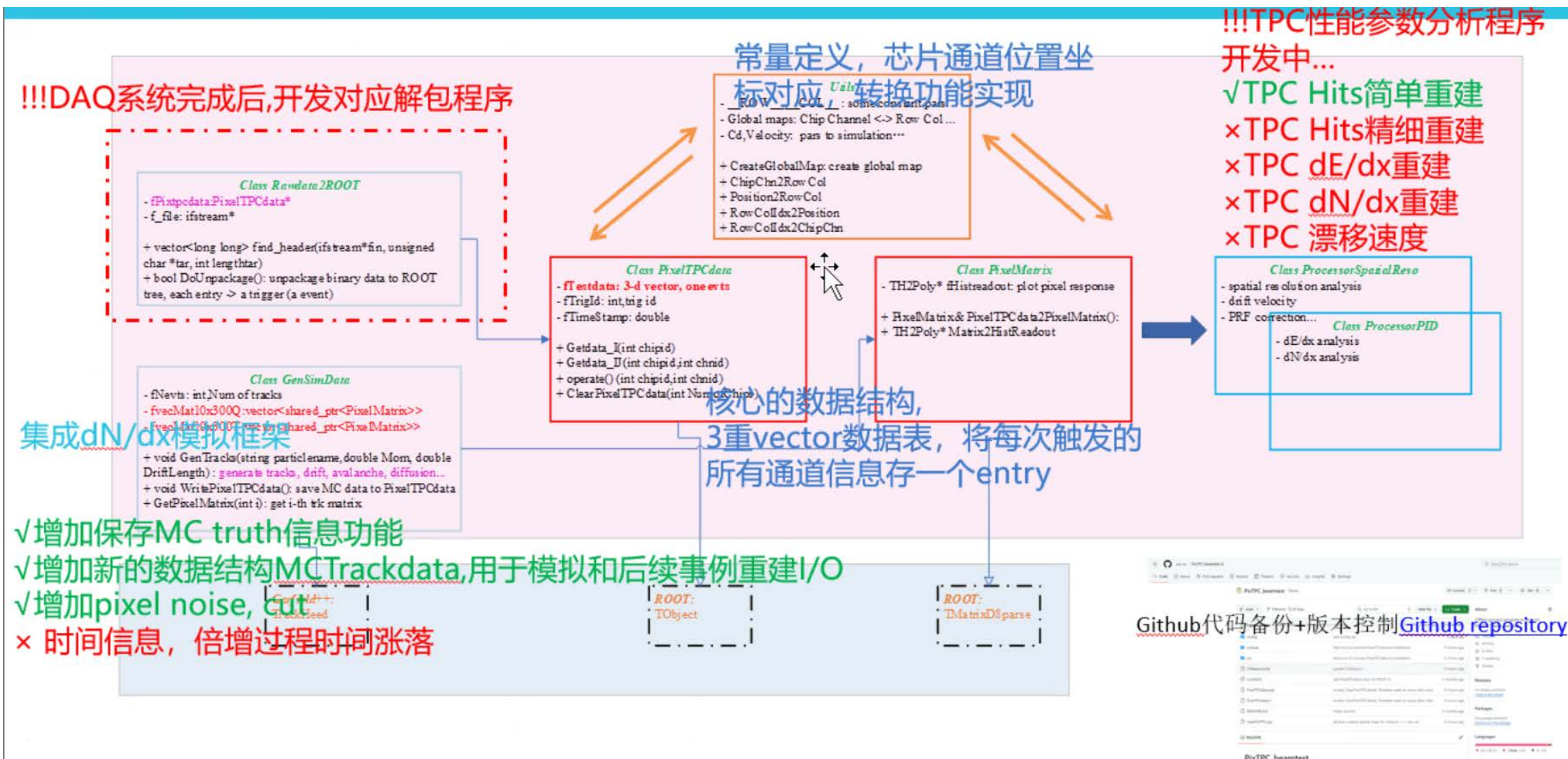
- Completed testing of TEPIX, a pixel-based readout chip to **determine that the chip is operational.**
  - Inputted square wave signals, external trigger mode
  - Chip outputs data functional and the data taking per channel.



Amplitude distribution per channel(left) and Uniformity per channel (right)

# Development of the data analysis

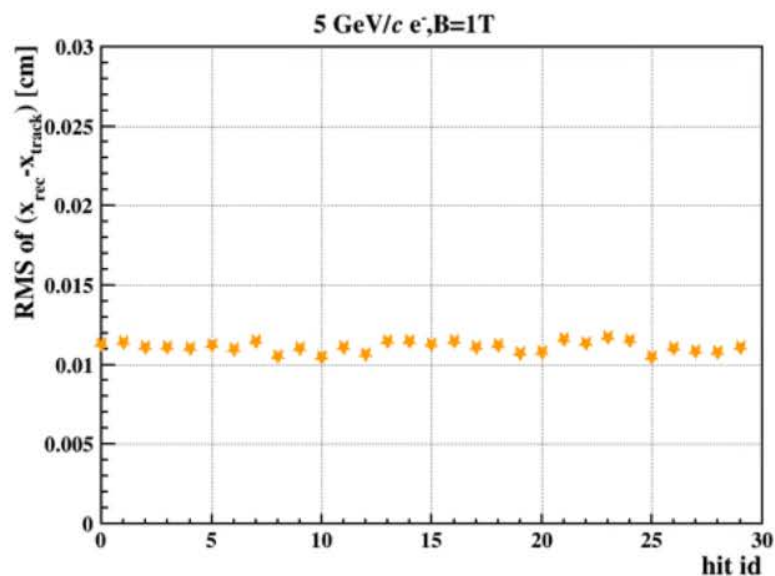
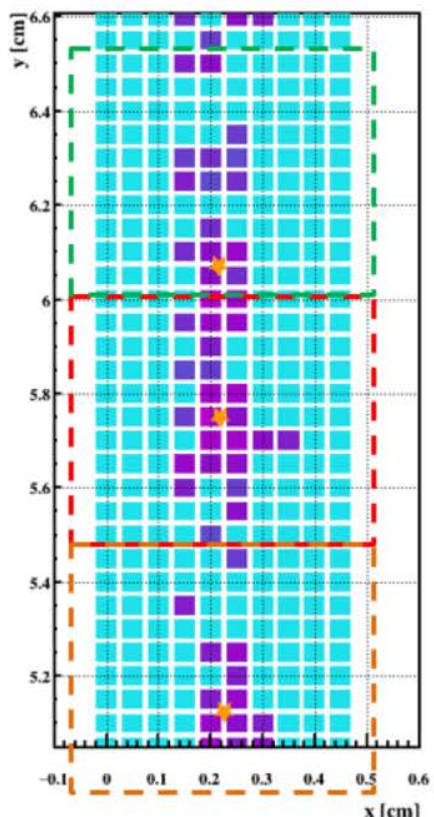
- Firmware construction block diagrams and data structures are defined.
  - The data analysis are under development. (Kalman filter and CEPCSW)



# Development of the data analysis: Hits reconstruction

- The preliminary simulation data analysis are under development including the drift, diffusion and avalanche of the detector.

➤ **Method1:** y向每10列, 利用所有响应pixel重建一个hit, 共30hits, 重建位置坐标( $x_{rec}, y_{rec}$ )由重心法计算;



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

$$x_{rec} = \sum_{i=0}^9 \sum_{j=0}^9 \frac{Q(i, j) x_i}{\sum_{i=0}^9 \sum_{j=0}^9 Q(i, j)}$$

$$y_{rec} = \sum_{i=0}^9 \sum_{j=0}^9 \frac{Q(i, j) y_i}{\sum_{i=0}^9 \sum_{j=0}^9 Q(i, j)}$$

$$\sigma_{hit} = \sqrt{\sigma_0^2 + C_d^2 Z / N_{eff}}$$

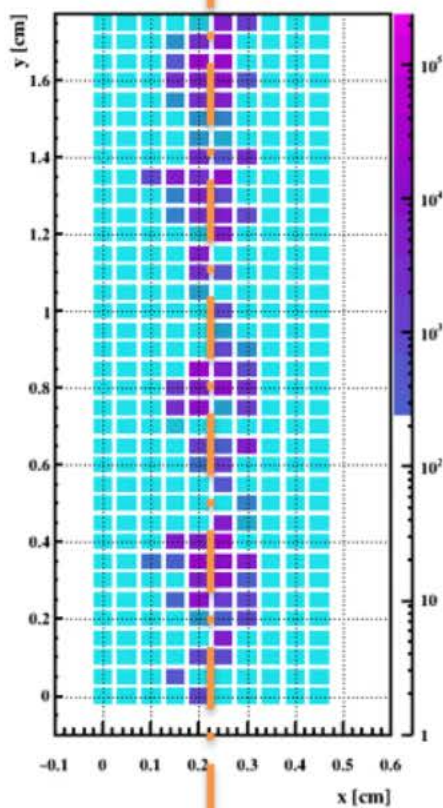
$B=1T$ , 20cm漂移距离下, 有效电子数20, 扩散项~86um  
 $\sigma_0$ 取50um,  $\sigma_{hit}$ ~100um, 与重建的hit分辨基本符合



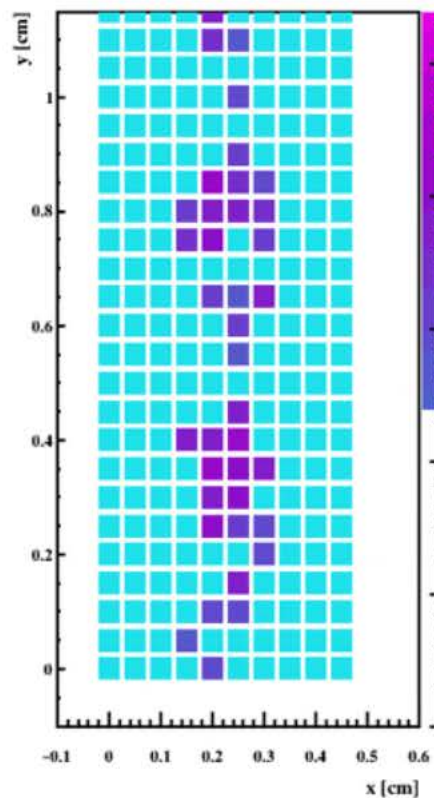
# Development of the data analysis: Cluster Finding

- The preliminary simulation data analysis are under development including the drift, diffusion and avalanche of the detector.

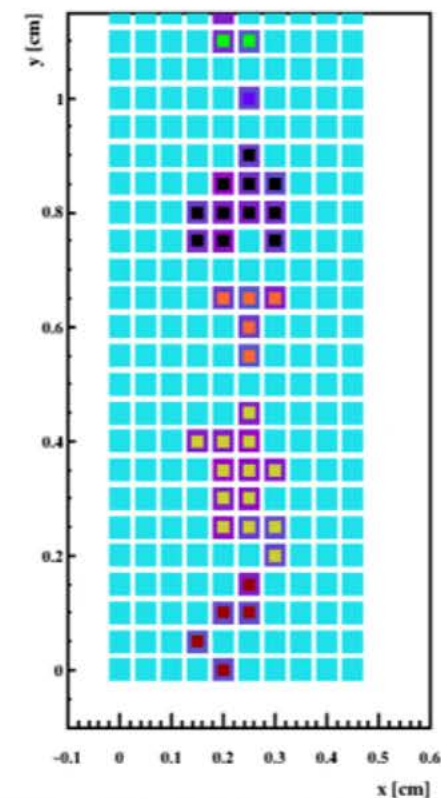
1、不加noise.cut前pixel响应



2、加noise.cut后pixel响应, active pixels降低



3、简单聚类过程实现, ClusterFinder



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

一个pixel, 周围一圈有响应, 合并一个cluster

## IHEP Seminar in October

### 1. Title of talk

- Maxim Titov
  - Spokesperson of the **CERN-DRD1** Collaboration
    - “Gaseous Detectors Technologies”
  - 高能物理研究所科技创新论坛报告
    - **10月18日 上午**

“What’s Next in Particle Physics? - Experimental Perspective”

**Name of presenter:** Maxim Titov (CEA Saclay, Irfu, France)



**Many thanks!**