中国科学院高能物理研究所
Institute of High Energy Physics
Chinese Academy of Sciences

Status of CEPC ref-TDR Chapter06

Huirong Qi and Linghui Wu

On behalf of the gaseous tracker group

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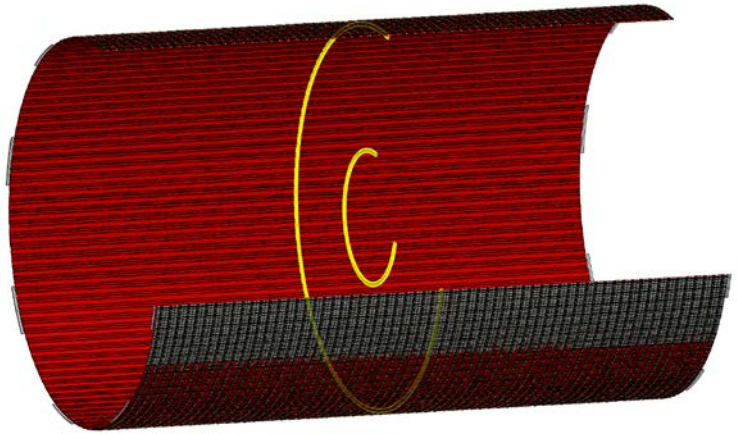
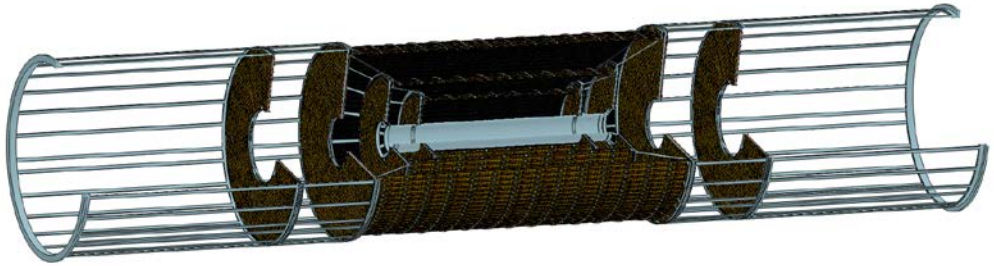
Content

- **Update design of TPC**
- **BG source and estimation**
- **Status of Chapter6**

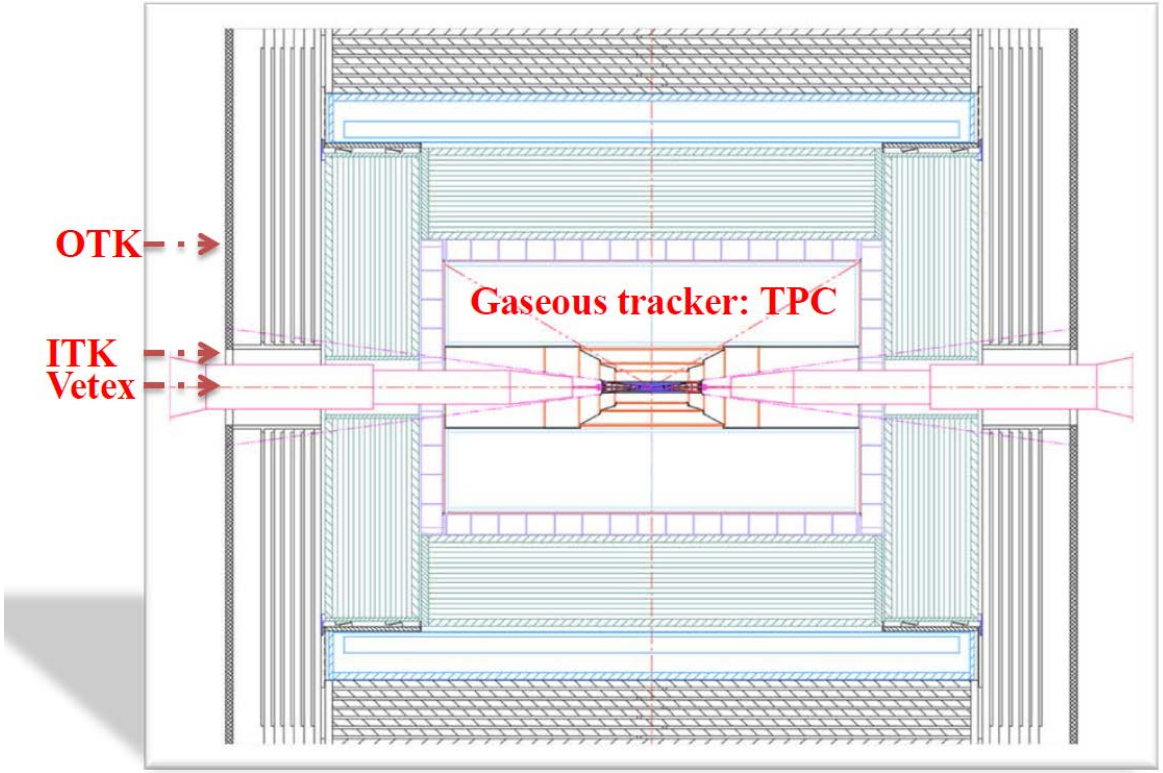
Update design of TPC



OTK （300kg）

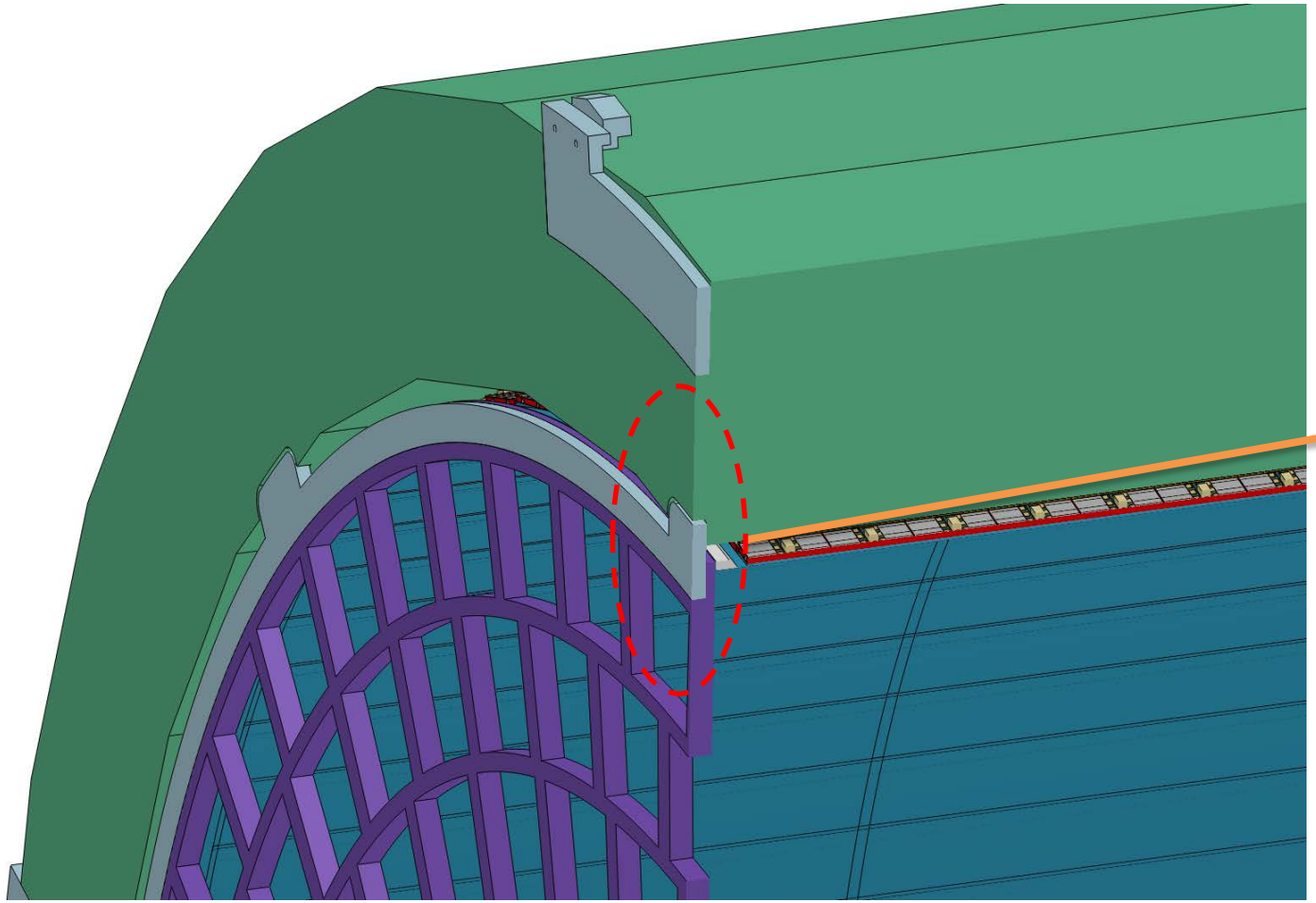


ITK （80kg）

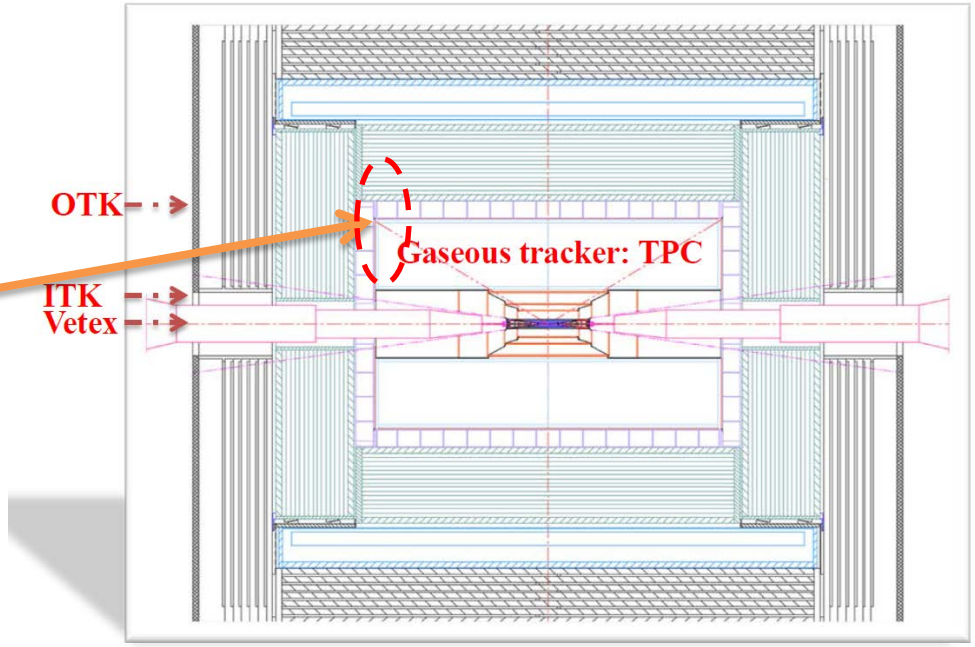


Schematic diagram of the detector

Update design of TPC with ECAL

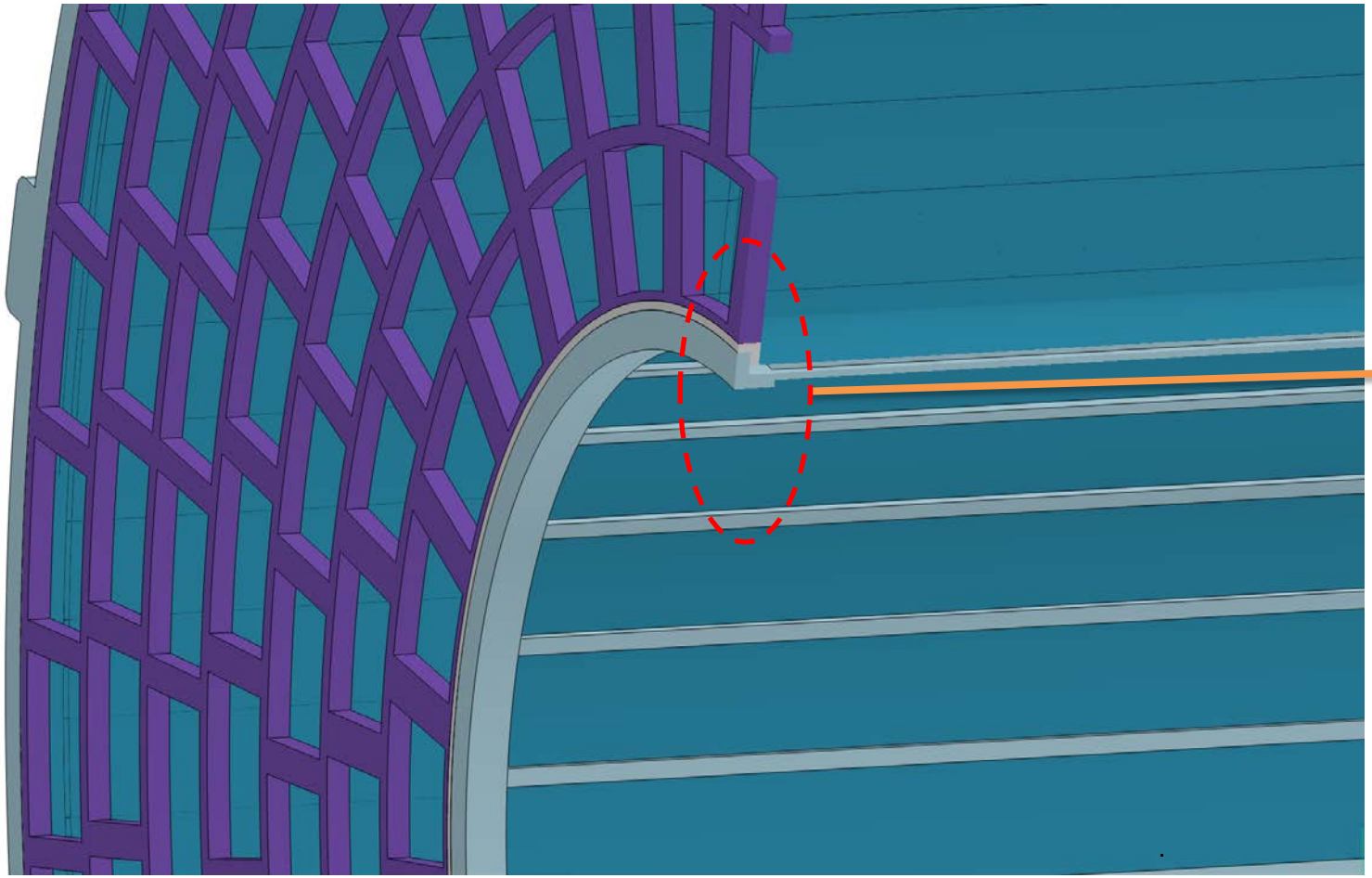


The connection design between ECAL and TPC
(Confirmed)

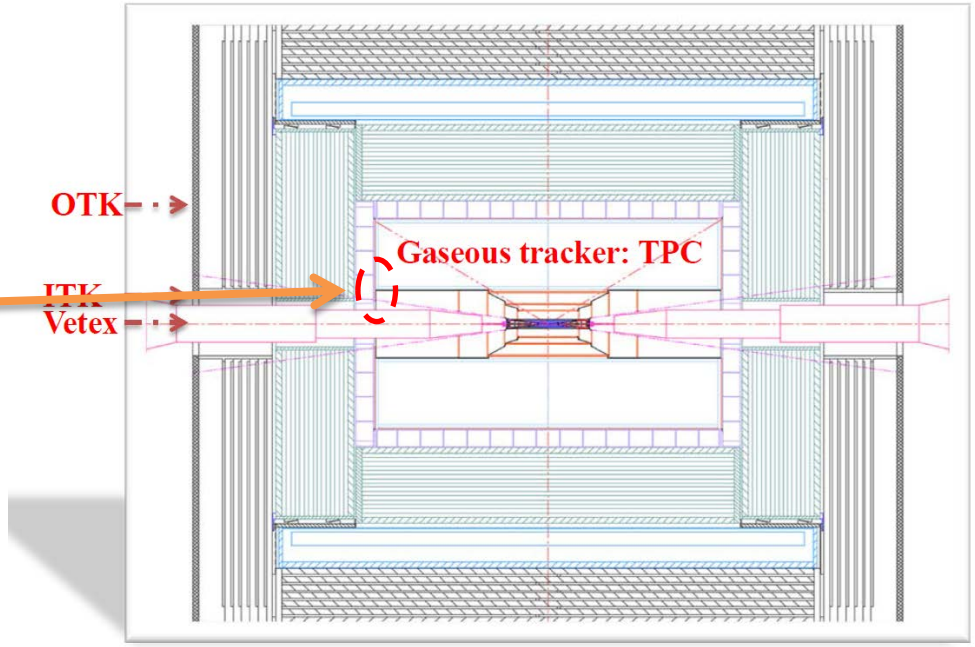


Schematic diagram of the detector

Update design of TPC with ITK

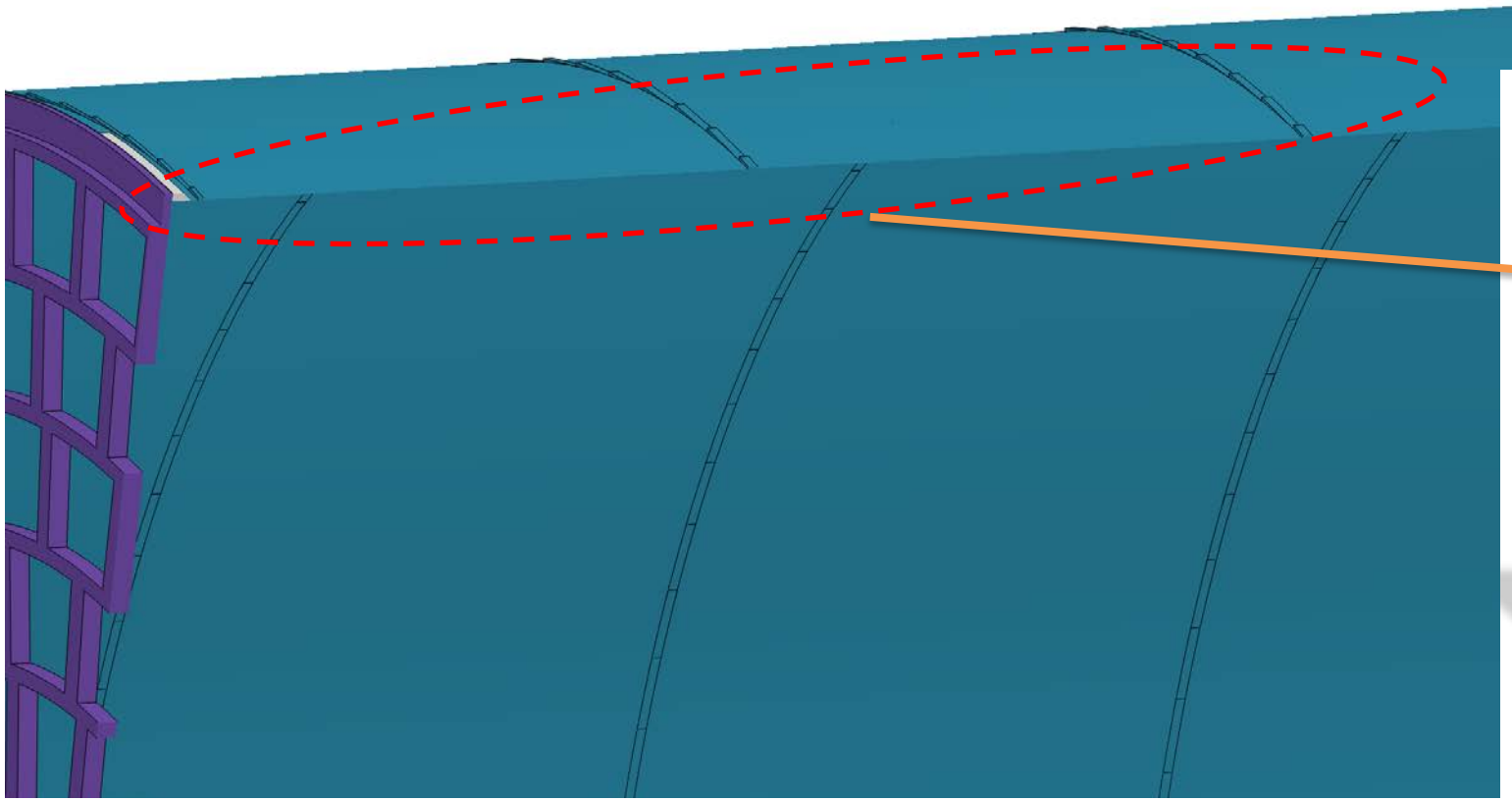


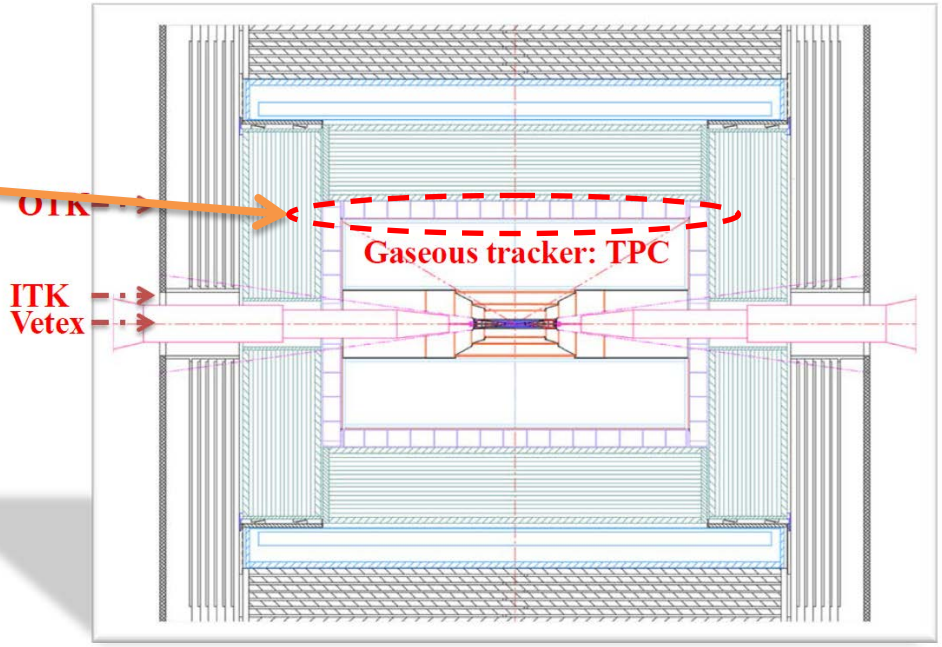
The connection design between ITK and TPC
(Confirmed)



Schematic diagram of the detector

Update design of TPC with OTK



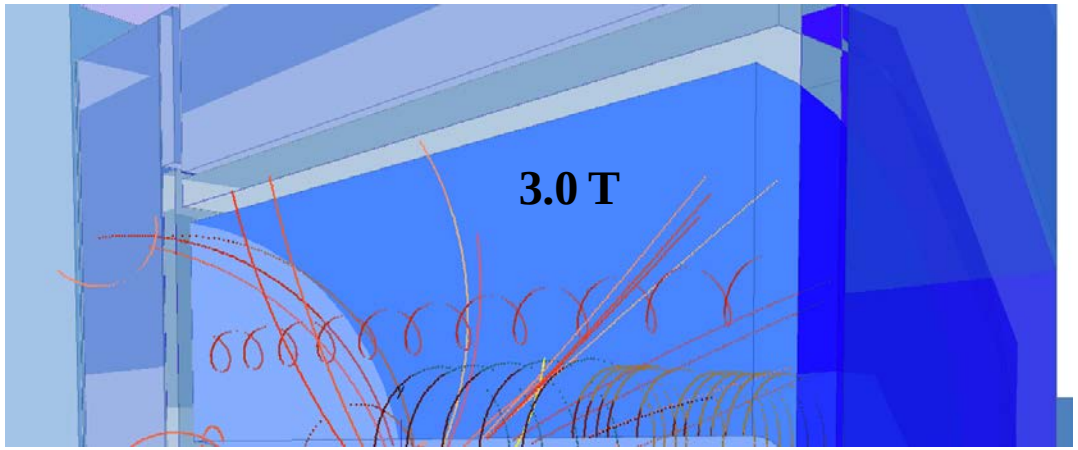


Schematic diagram of the detector

The connection design between OTK and TPC (Confirmed)

Background Sources at Higgs/ Low luminosity Z @3T

- Higgs/Z background sources
  - I. Pair production (Luminosity related)
  - II. Single Beam (BGB, BGH,Touschek Scatter…)
  - III. Synchrotron Radiation
  - IV. Injection background



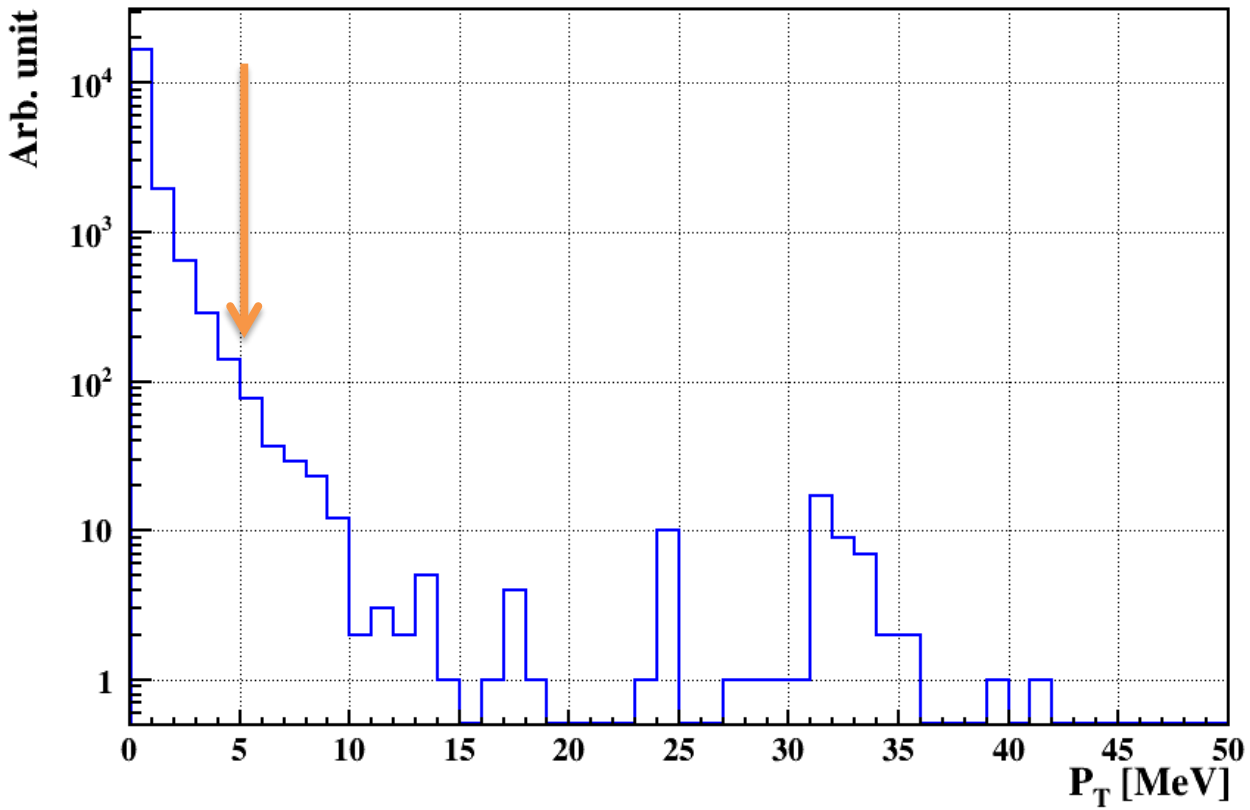
Low-momentum particles circling within a magnetic field

IBF×Gain=1, same primary ion level

Bkg type	Space charge density(steady)	Remark	Optimization strategy
Pair + Single Beam	ρ_{sc0} ~ 0.04nC/m^3 (R=60cm) 8um, 2.75m Drift Length @ inner radius	Without low P_T e^-/e^+ (<10MeV) in TPC caused by ~MeV γ	**Acceptable**
Pair + **Single Beam**	ρ_{sc1} ~ 60×ρ_{sc0}	With low P_T e^-/e^+ (<10MeV) in TPC caused by ~MeV γ	Analysis initial position distribution of ~MeV γ (Main contributions) and Add shielding

Distribution of the different Pt of BG

- Low momentum accounts for more than 90% of the total BG
- 1MeV → 1.14mm （circling）
  - Only cover several pixel readout
- It’s necessary to **optimize the MDI to shield** gamma rays of approximately MeV level.



Distribution of the different Pt (e) of BG

1. 能量转换：

$$1\ \text{MeV} = 1 \times 10^6\ \text{eV} = 1 \times 10^6 \times 1.602 \times 10^{-19}\ \text{J} = 1.602 \times 10^{-13}\ \text{J}$$

2. 电子质量：

$$m = 9.109 \times 10^{-31}\ \text{kg}$$

3. 电子电荷：

$$q = 1.602 \times 10^{-19}\ \text{C}$$

4. 磁场强度：

$$B = 3\ \text{T}$$

5. 计算电子速度：

$$E = \frac{1}{2}mv^2$$

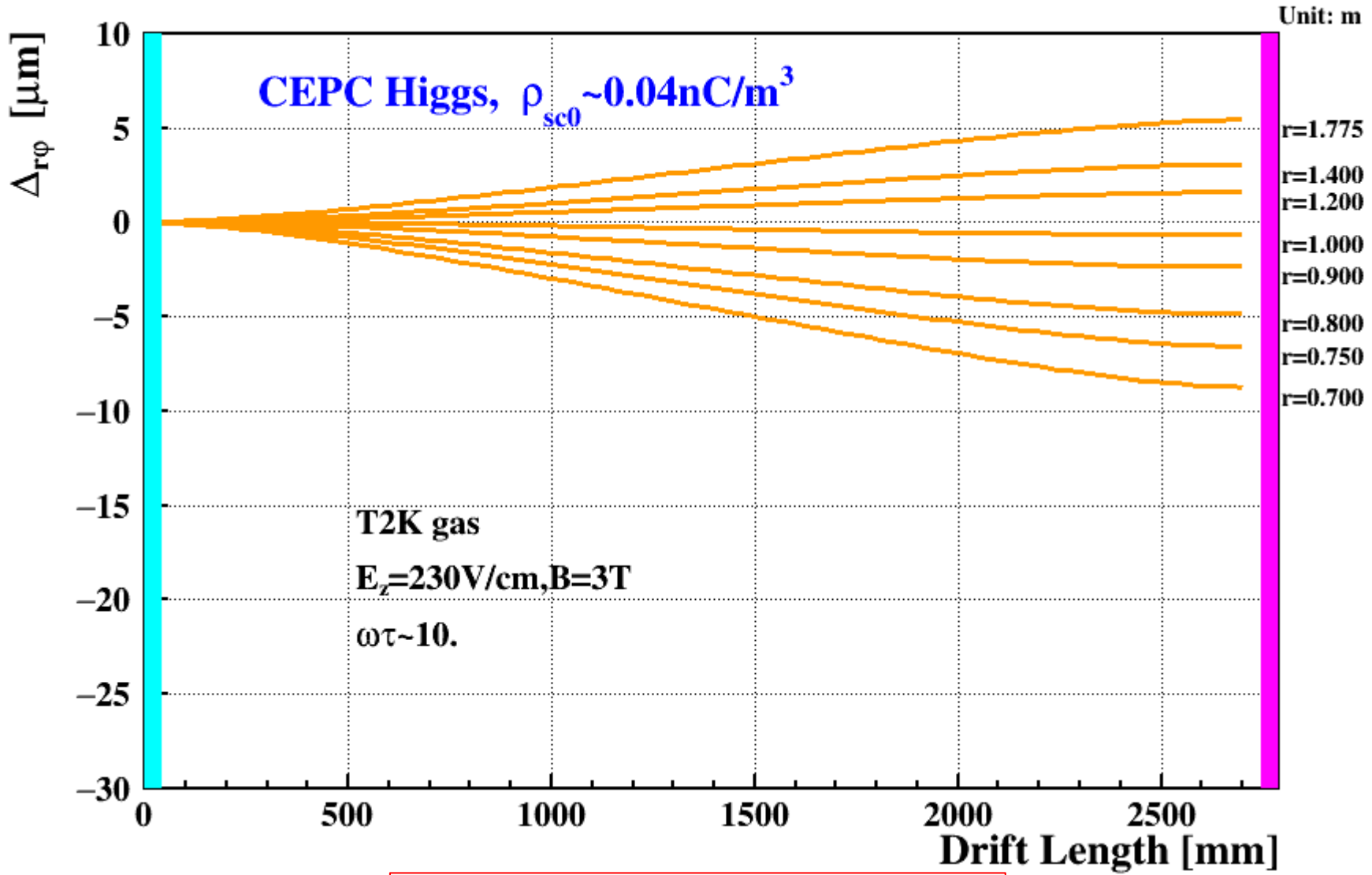
$$v = \sqrt{\frac{2E}{m}} = \sqrt{\frac{2 \times 1.602 \times 10^{-13}\ \text{J}}{9.109 \times 10^{-31}\ \text{kg}}} \approx 5.93 \times 10^8\ \text{m/s}$$

6. 计算偏转半径：

$$r = \frac{mv}{qB} = \frac{9.109 \times 10^{-31}\ \text{kg} \times 5.93 \times 10^8\ \text{m/s}}{1.602 \times 10^{-19}\ \text{C} \times 3\ \text{T}} \approx 0.00114\ \text{m}$$

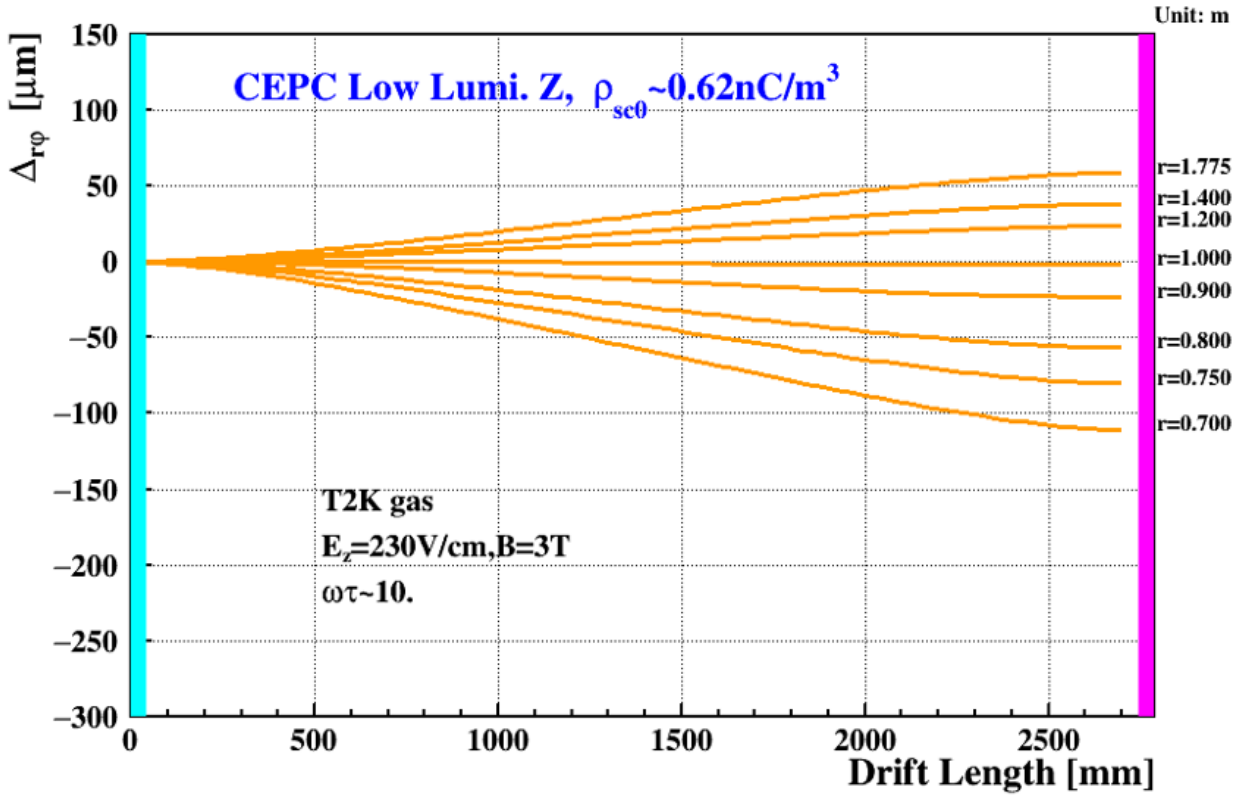
因此，1 MeV电子在3 Tesla磁场中的偏转半径大约是0.00114米，或者1.14毫米。

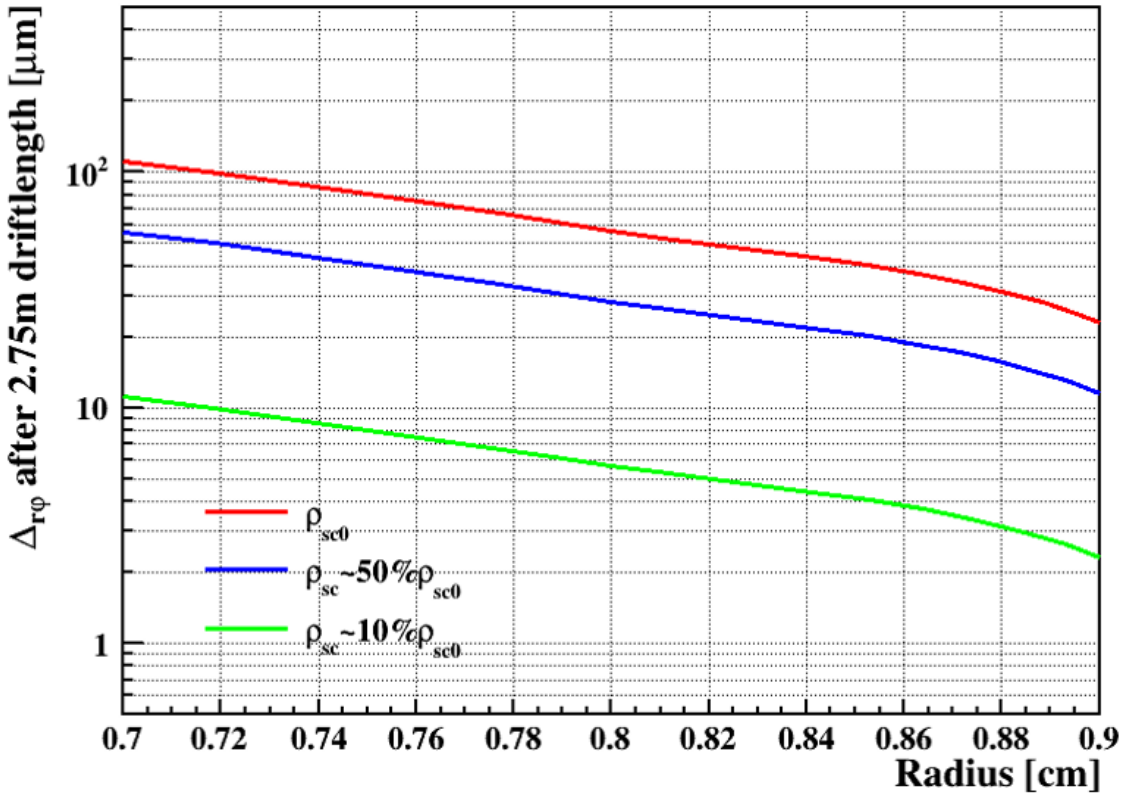
Optimization of the shielding low Pt@3T Higgs run



IBF×Gain≤1, less than primary ion level

Optimization of the shielding low Pt@3T Low luminosity Z run





IBF×Gain≤1, less than primary ion level

Status of Chapter6

- 整体文档40 页（上周）
- 已整合入IHEP Overleaf文本内
- 计划到50页（Draft version）

- 整体文档46页（本周）
- 已整合入IHEP Overleaf文本内
- 下周计划（Draft version）

Details of the few subsections

6.3.3 Design of mechanical and cooling
6.3.4 Commissioning and validation of prototype
6.3.5 Challenges and critical R&D
6.3.6 Costs

- **Shared with 6 members of ILD and LCTPC collaboration**
- **Cooling for the electronics**
  - **Baseline technology： Water cooling (to room temperature)**
  - **Alternative technology: CO_2 cooling (to room temperature)**
  - **Consistent with the overall cooling design of the mechanical design**
- **Costs**
  - **Detailed sub-item inquiries starting based on the baseline design**

Many thanks!