



# Gaseous detector chapter towards CEPC TDR

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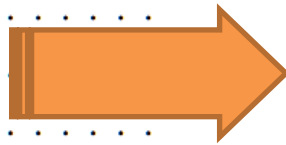
Weekly meeting of CEPC TDR Group, July 16, 2024

# Gaseous detector chapter for CEPC TDR

- Updated contents of the gaseous track detector chapter in CEPC TDR
  - Includes issues from physical requirements, selection, simulation, performance and cost.

## Chapter 4 Gaseous trackers

4.1	Physics requirements and detection technology . . . . .
4.1.1	Physics requirements of Higgs and Tera-Z . . . . .
4.1.2	Technology options of the gaseous chamber . . . . .
4.1.3	Choice and the baseline main track detector . . . . .
4.2	Pixelated readout TPC tracker . . . . .
4.2.1	TPC detector and readout electronics . . . . .
4.2.2	Mechanical and cooling design . . . . .
4.2.3	Critical R&D . . . . .
4.3	Performance of TPC tracker . . . . .
4.3.1	Overall of simulation framework . . . . .
4.3.2	Spatial resolution and particle identification . . . . .
4.3.3	Potential for improving resolution . . . . .
4.4	Costs estimation . . . . .



## Chapter 5 Gaseous trackers

5.1	Physics requirements and detection technology . . . . .
5.1.1	Physics requirements of Higgs and Tera-Z . . . . .
5.1.2	Technology choice and the baseline track detector . . . . .
5.2	Pixelated readout TPC detection . . . . .
5.2.1	TPC detector and readout electronics . . . . .
5.2.2	Mechanical and cooling design . . . . .
5.2.3	Challenges and critical R&D . . . . .
5.3	Performance of TPC tracker . . . . .
5.3.1	Overall of simulation framework . . . . .
5.3.2	Spatial resolution and particle identification . . . . .
5.3.3	Potential for resolution improvement . . . . .
5.4	Alternative track detector of Drift Chamber in Tera-Z . . . . .
5.4.1	PID for high luminosity Z pole at 2T . . . . .
5.4.2	Performance and critical R&D . . . . .
5.5	Cost estimation . . . . .

# Writing Team of gaseous detector chapter – Weekly meeting

- **Core of the writing team**
  - IHEP: Huirong Qi, Linghui Wu, Guang Zhao, Mingyi Dong, Yue Chang, Xin She, Jinxian Zhang, Junsong Zhang
  - Tsinghua: Zhi Deng, Canwen Liu, Guanghua Gong, Feng He, Jianmeng Dong, Yanxiao Yang
- **Collaboration groups of the writing team**
  - CIAE (原子能院): Xiaomei Li, Jing Zhou
  - Shandong University (山东大学): Chengguang Zhu
  - Nankai University (南开大学), Zhengzhou University (郑州大学) and Liaoning University (辽宁大学)
  - LCTPC collaboration and DRD1 collaboration



Shared editing  
chapter from overleaf

- **Organization of team**
  - Regular weekly meeting on **10 July**
  - ILD Collaboration meeting on **12 July** after LCWS
  - DRD1 WP4 kick-off meetings on **15 July**

# Updated material budget of TPC barrel and endcap

- **Low material of the TPC endcap**

15% $X_0$  in total, including

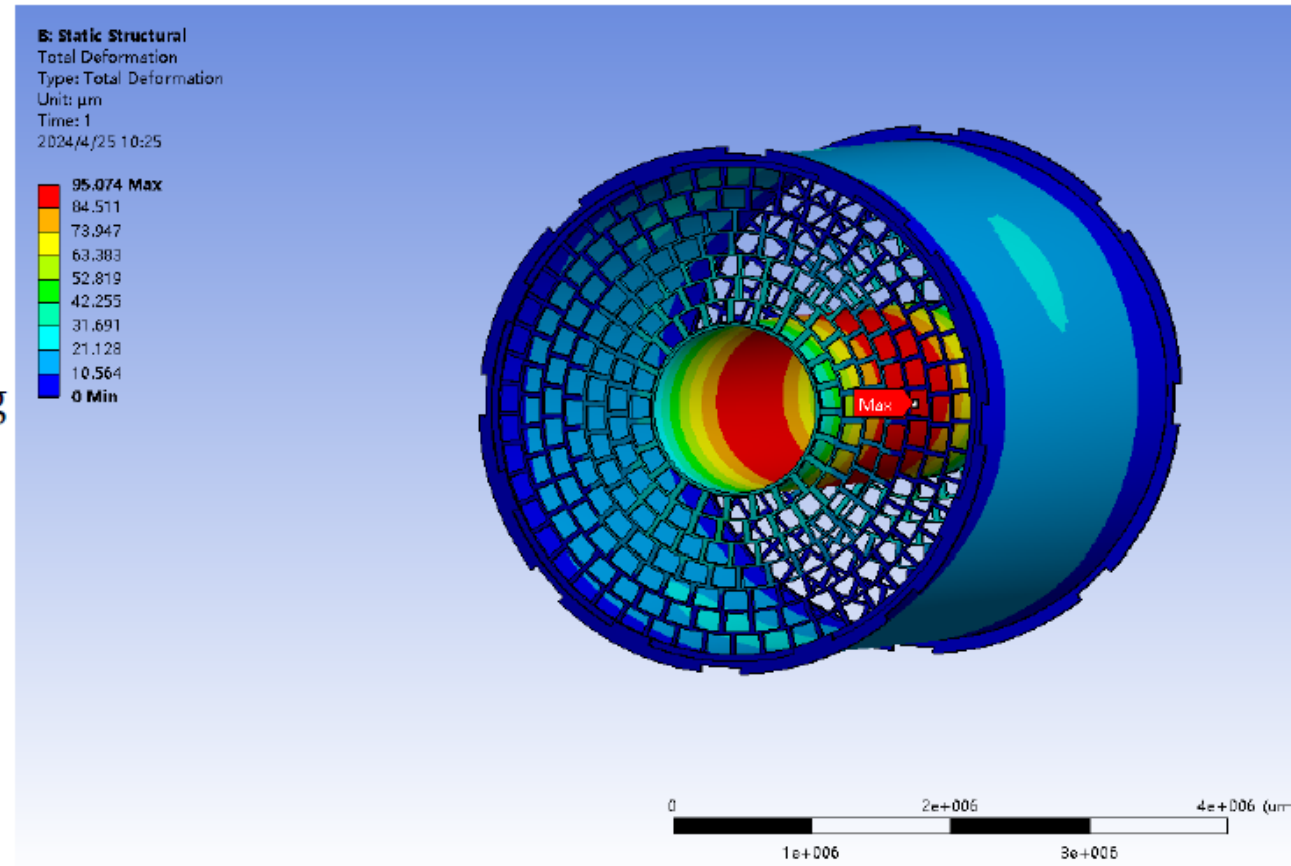
Readout plane, front-end-electronics	4%
Cooling	2%
Power cables	9%

- **Low material of the TPC barrel**

0.59%  $X_0$  in total, including

Material budget of TPC barrel

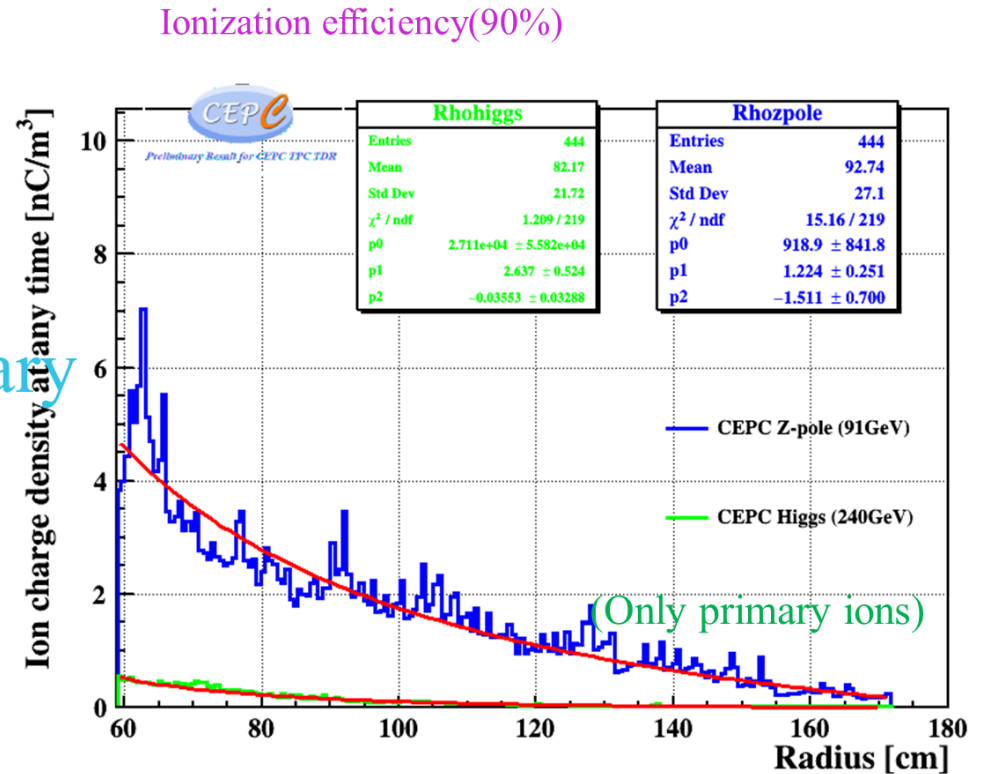
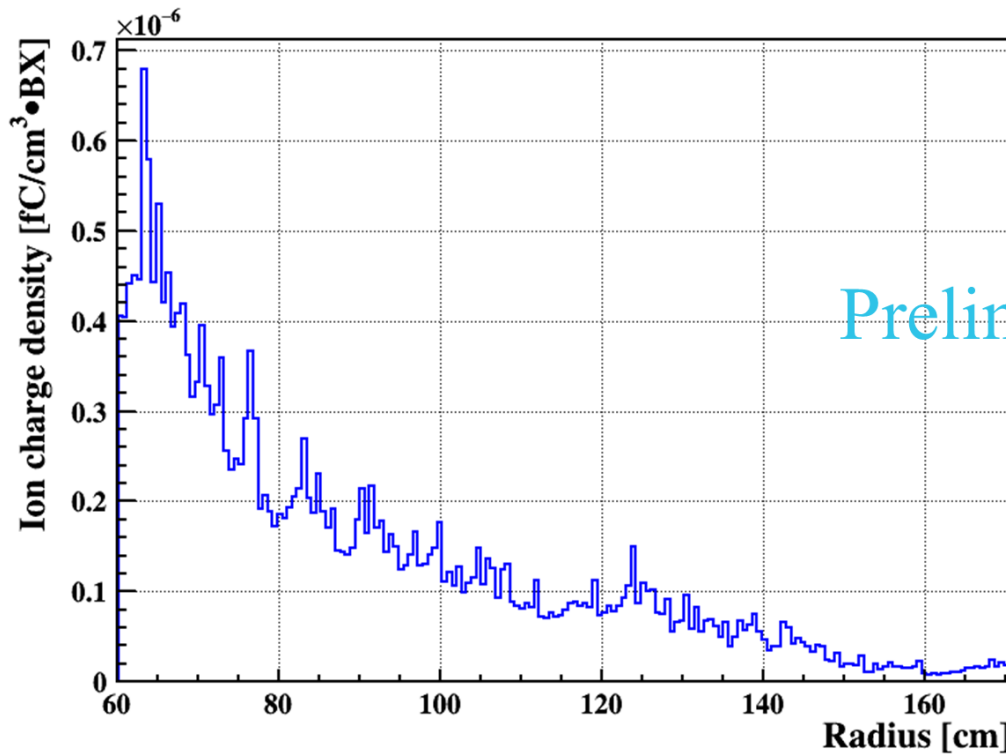
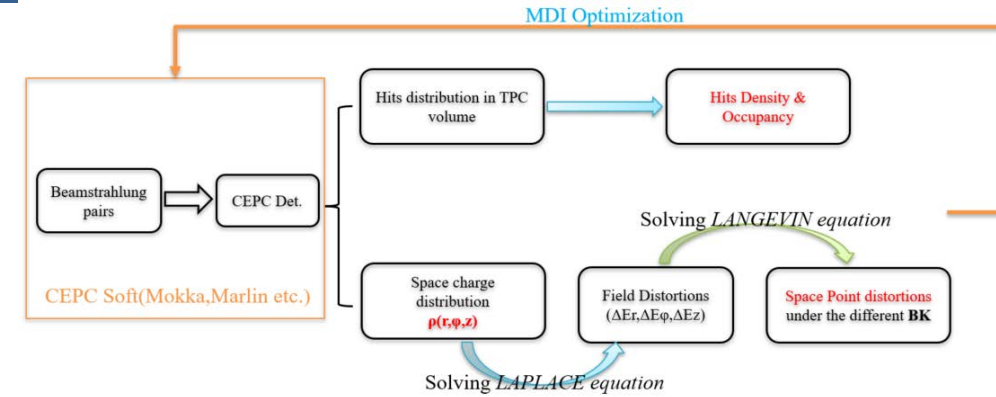
Layer of the barrels	D[cm]	$X_0$ [cm]	$d/X_0$ [%]
Copper shielding	0.001	1.45	0.07
CF outer barrel	0.020	25.28	0.08
Mirror strips	0.003	1.35	0.19
Polyimide substrate	0.005	32.65	0.02
Field strips	0.003	1.35	0.19
CF inner barrel	0.010	25.28	0.04
<b>Sum of the material budget</b>			<b>0.59</b>



# Updated of the hits density & occupancy at Tera-Z with BK

- Updated simulation results from CEPCSW

- Single BX ,  $\rho_{sc}(\text{single BX}) \sim 0.6e-6 \text{ nC/m}^3/\text{BX}$  @Z-pole
- $\rho_{sc}(\text{steady state}) \sim \rho_{sc}(\text{single BX}) \times \text{BX freq.} \times \text{max. drift time} \times 50\% \times \eta = 5.46 \text{ nC/m}^3$  (r=60cm) @Z-pole
  - $\times 5$  smaller than FCCee -91



$\rho_{sc}(r)$  (single BX) distribution Left &  $\rho_{sc}(r)$  (steady state) Right

**Many thanks!**