

Endcap Tracking

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CEPC Tracker of reference-detector TDR

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Outline

- Preliminary geometry of tracker
- Dimension of endcap tracker
- Preliminary performance of endcap tracking
- Discussion

Preliminary Geometry of Tracker

■ Beam pipe

- 0.2mm(Be)+0.3mm(Water)+0.15mm(Be)
- 0.2% of X_0

■ Vertex: temporary

- Long barrel
- $r = 12\text{mm}, 32\text{mm}, 55.5\text{mm}$
- 2.5mm CFRP strengthen cylinder

■ Barrel tracker

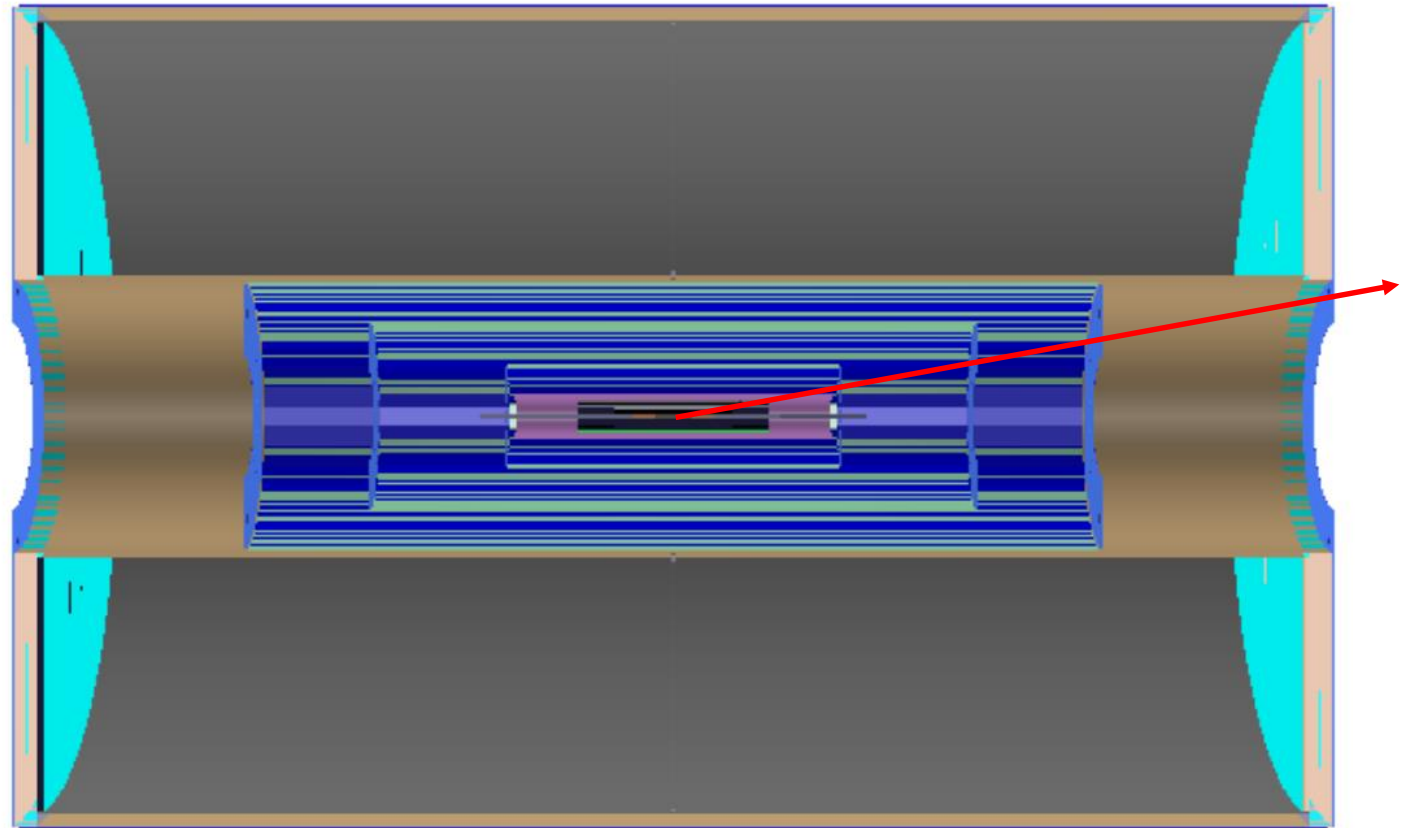
- ...

■ Endcap tracker: temporary

- $z = 740\text{mm}, 1340\text{mm}, 1890\text{mm}, 2915\text{mm}$
- 200 μm thickness silicon
- 1 mm thickness CFRP
- 0.6% of X_0 per layer for vertical incidence

■ Typical material budget include air in path

- $\theta = 10^\circ$ & $\phi = 0^\circ$: 16.9% of X_0
- $\theta = 10^\circ$ & $\phi = 45^\circ$: 21.1% of X_0



Dimension of Endcap Tracker for Comparison

■ Ideal structure

■ Petals

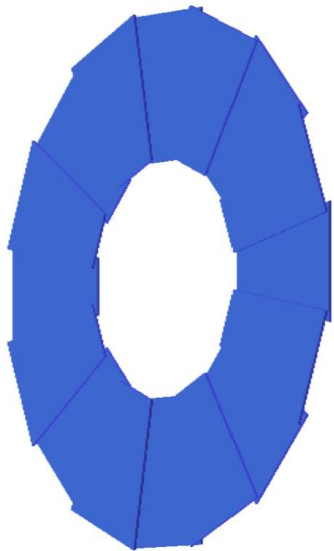
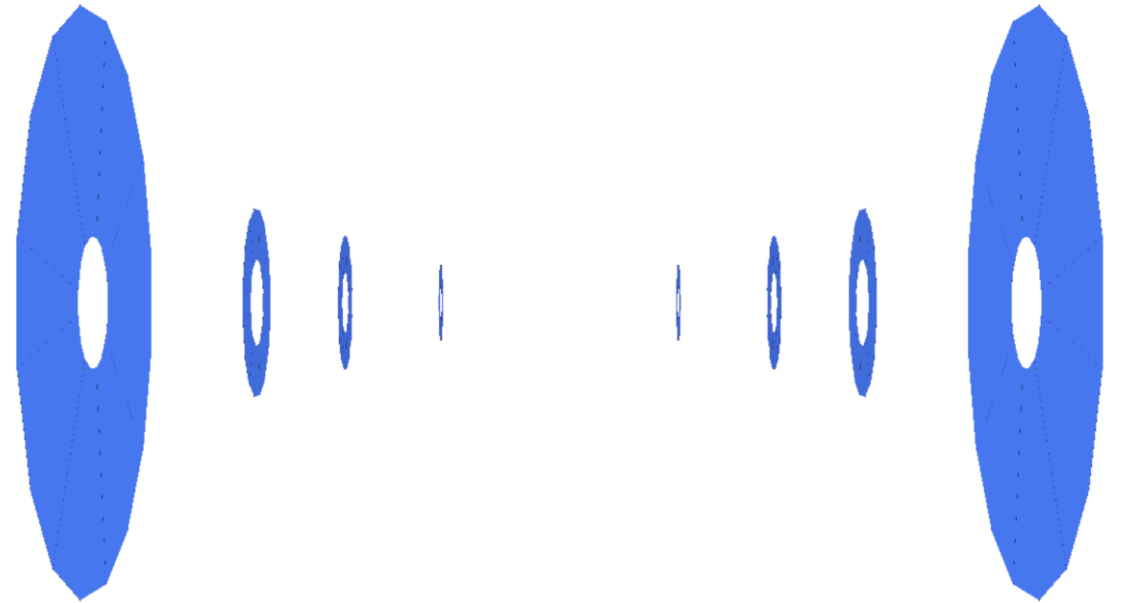
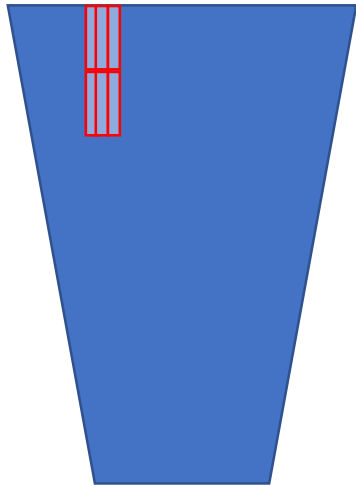
● P16: 16

● P08: 8

■ Sensor

● VertexBarrel

● Endcap tracker



Sun-detector		sensor	$\sigma_{r\phi}$	$\sigma_{r,z}$
VertexBarrel			4 μ m	4 μ m
Endcap tracker	previous	25 μ m x 300 μ m	7.2 μ m	86 μ m
	rectangle	25 μ m x 400 μ m	7.2 μ m	115 μ m
	square	100 μ m x 100 μ m	28 μ m	28 μ m

Preliminary Performance of Endcap Tracking

Single particle gun:

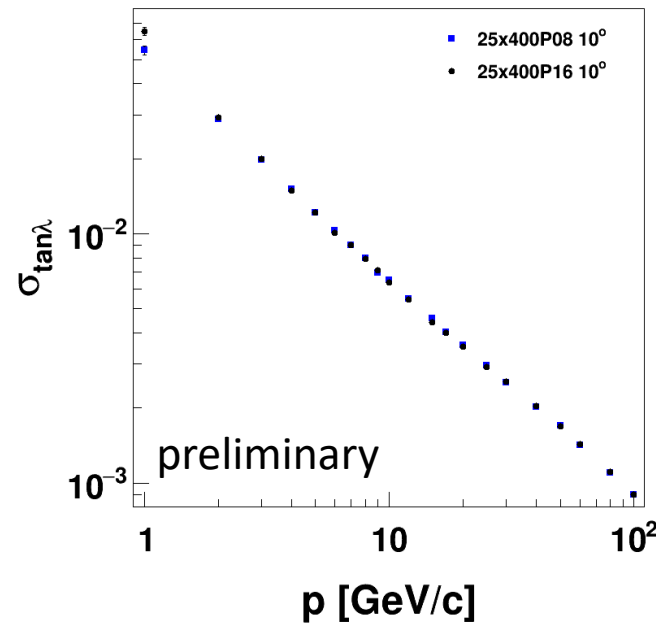
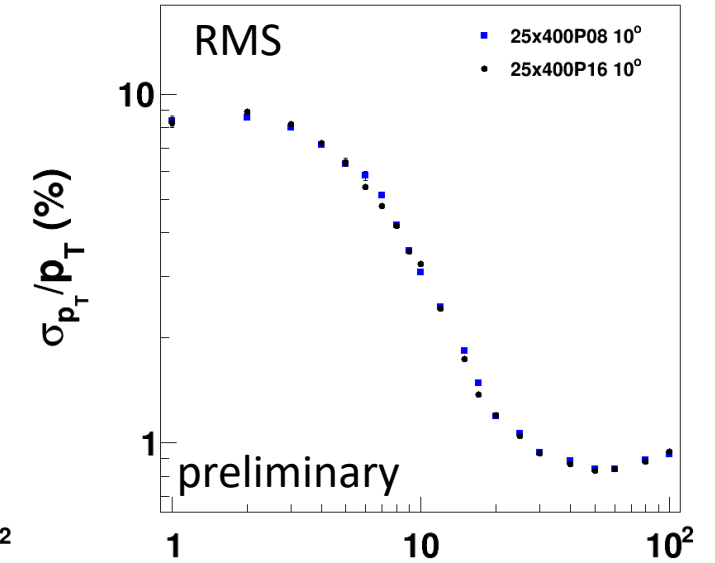
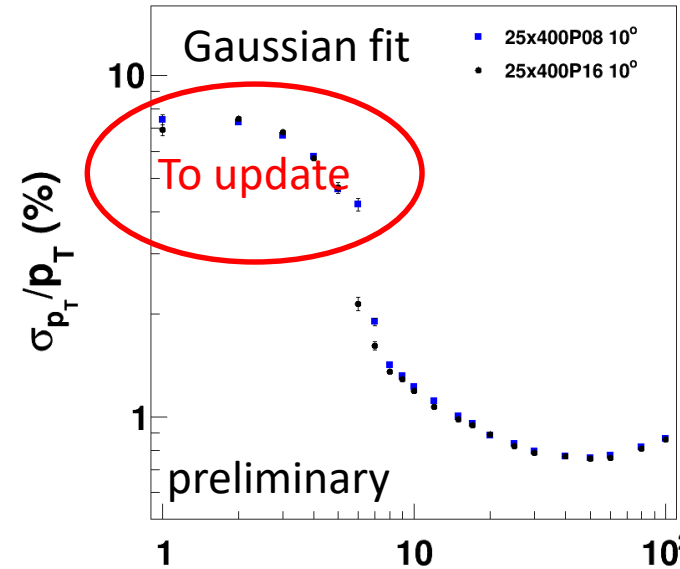
- μ^-
- IP: (0,0,0)
- σ_{IP} : (15 μ m, 36nm, 2.8mm)
- $\theta = 10^\circ$ (larger than 11.7° , pass TPC)
- $\phi \in [0, 360]$

■ Lose hit while track finding partly, to cause double gaussian distribution, single gaussian fit not so good

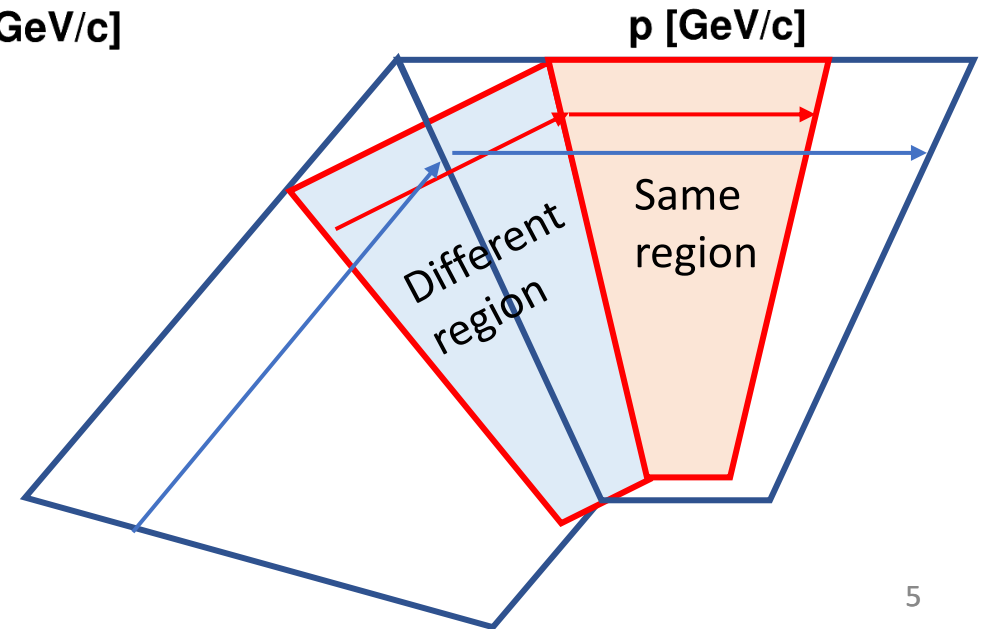
Petal number: 8 VS 16

■ Close angle resolution

■ P_T resolution a little different, only those tracks pass the different region

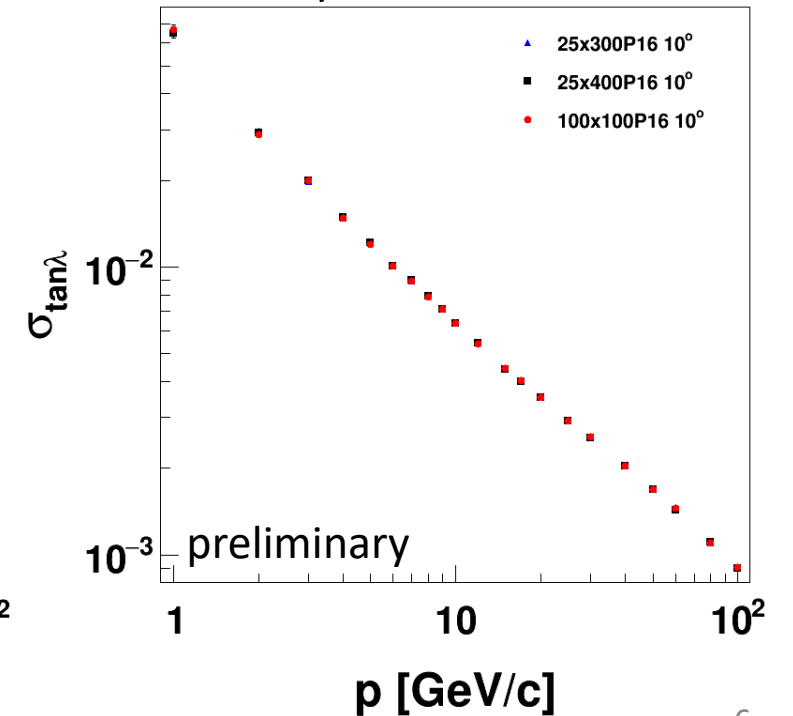
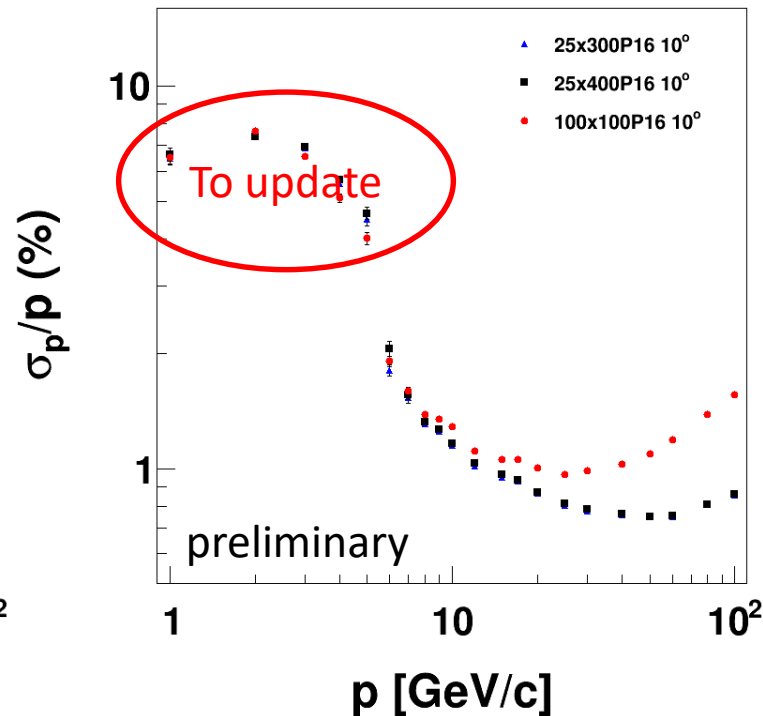
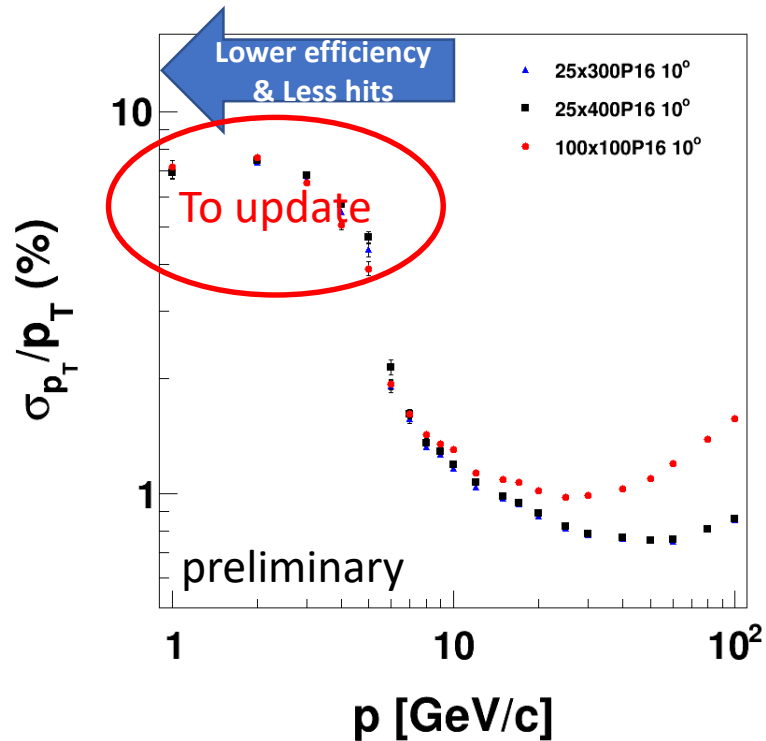
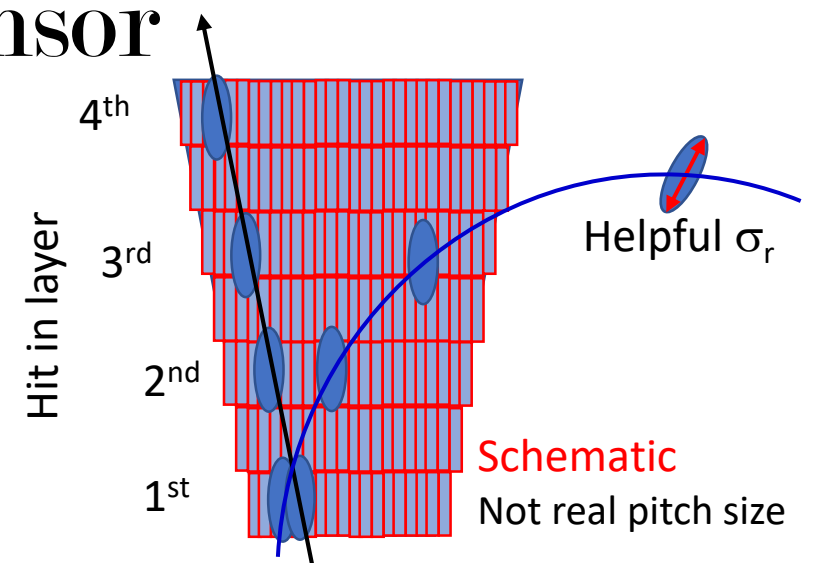


p [GeV/c]



Effect of Dimension of Endcap Sensor

- $\sigma_{r\phi}$: $25\mu\text{m} \rightarrow 100\mu\text{m}$
 - Momentum resolution worse
- σ_r : $300\mu\text{m} \rightarrow 400\mu\text{m} \rightarrow 100\mu\text{m}$
 - Not observable on angle resolution, similar with SET
 - Improve momentum resolution at low momentum



Discussion

- 1% level momentum resolution with three layer endcap tracker + one outer tracker
 - Smaller inner radius than $|\cos\theta| < 0.99$ is helpful improve hits at low momentum
 - $r = 2\sin\left(\frac{z\text{tg}\theta}{4\pi R}\right) < z\text{tg}\theta$
- $\sigma_{r\phi}$ 、 σ_r affect on resolutions differently at low-high momentum
 - $\sigma_{r\phi}$ is important for momentum resolution at high momentum, similar with barrel
 - σ_r is helpful for momentum resolution at low momentum
 - ✓ but not observable for angle resolution, and momentum resolution at high momentum, similar with σ_z of SET
- Mechanics & cable
- Larger polar angle to keep more hits for low momentum
- Tracker design

