Updating Silicon Tracking Performance

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Outline of presentation:

- Introduction.
- Silicon tracker designs and their performances.
- Detector simulation and reconstruction.
- Comparing with CEPC V1 performance.
- To-do list

Introduction

- CEPC SID v4 has been implemented in Mokka by Chengdong.
- Based on CEPC V1 silicon tracker, we simply add additional SIT layers and FTD endcaps to replace the TPC while keeping the same design of VXD.
- This is meant to test the concept using the existing silicon tracking reconstruction code.
- The current design has a better performance than SID in principle.
- But, we may need to re-optimize the design and improve the tracking software.
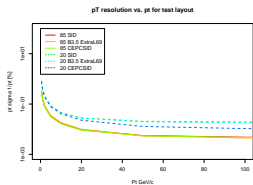
Silicon tracker concept

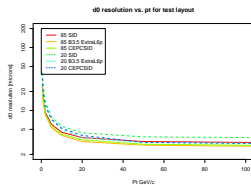- We compared the tracking performance of several design options using a toy MC.
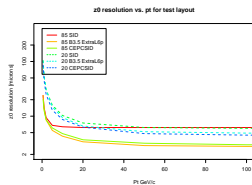

CEPCSID geometry
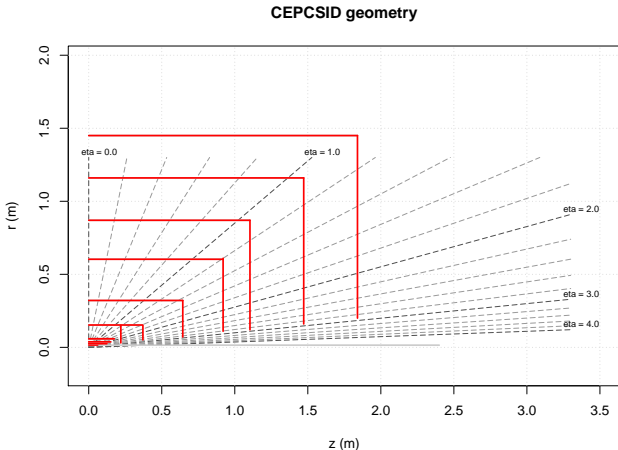
Tracking Resolutions

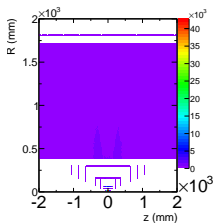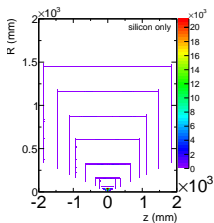- CEPCSID option has comparable resolutions.

(a) pt   (b) d0   (c) z0

Figure: Resolutions for 1/pt, d0, and z0.
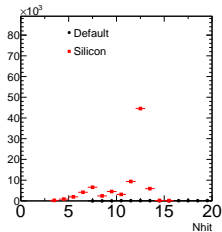
Full Detector Simulation and Reconstruction

- Generated single muon with CEPC V1 and CEPC SID V4
- Reconstructed with Marlin Silicon+TPC and Silicon only.
- Modifying LayersCombination to use extra silicon layers.
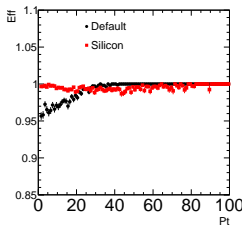

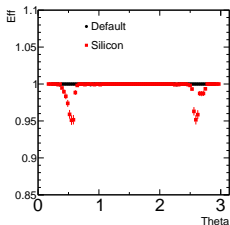(a) CEPC V1   (b) CEPC SID   (c) Nhits

Figure: Hits r vs z from the track and the number of Hits

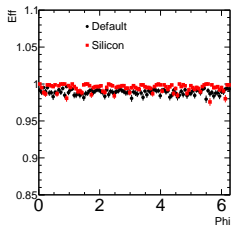# Tracking Efficiencies

- Requiring $P_T > 1.0$ GeV and $2.96 < \theta < 0.18$.
- Tracking efficiency is slight lower in barrel and endcap overlap region.
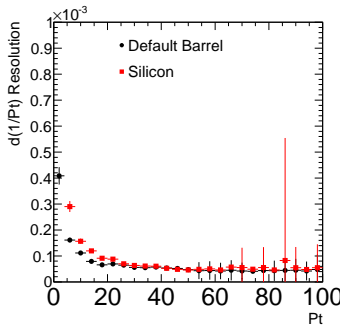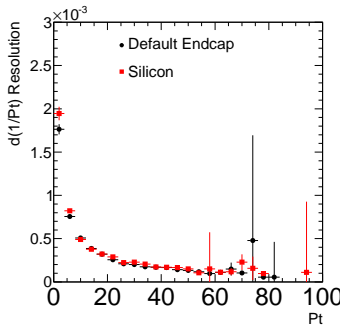

(a) pt

(b) theta

(c) phi

Figure: Efficiencies vs pt, theta and phi

Pt Resolution

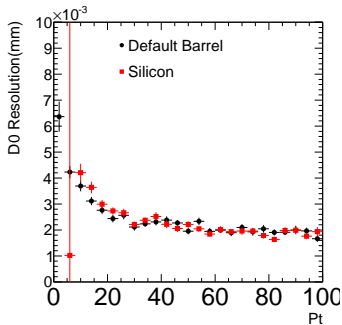- The pt resolution seems comparable.
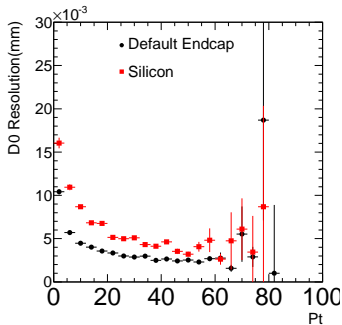

(a) Barrel   (b) Endcap

Figure: Pt resolution in Barrel and Endcap regions

d0 Resolution

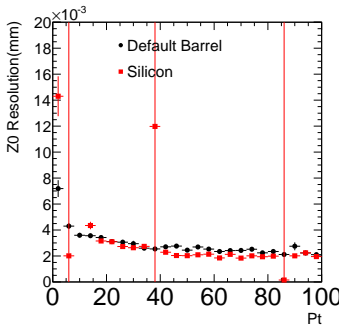- d0 resolution is quite similar.
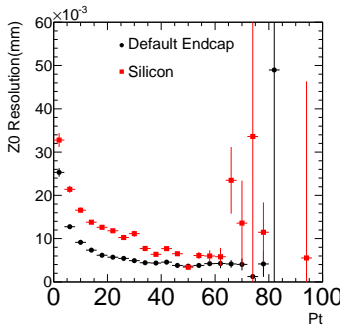

(a) Barrel   (b) Endcap

Figure: d0 resolution in Barrel and Endcap regions

z0 Resolution

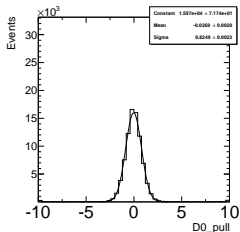- z0 resolution is quite similar.

(a) Barrel
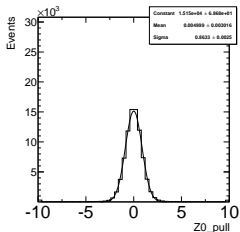
(b) Endcap

Figure: z0 resolution in Barrel and Endcap regions

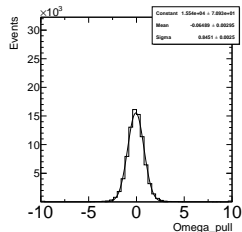# d0, z0, and Omega Pulls

- The width seems around 0.8.
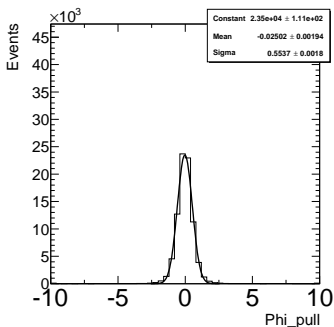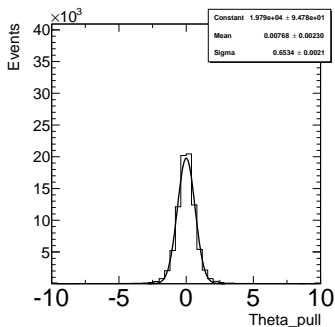

(a) d0   (b) z0   (c) Omega

Figure:

Phi and Theta Pulls

- The width seems smaller than 1, around 0.5-0.6

(a) Theta   (b) Phi

Figure:

To-do List

- The concept of a silicon tracker seems working and its performance is comparable to CEPC V1.
- The tracking efficiency is slight lower in barrel and endcap overlap region, check the tracking.
- The pt resolution is slight worse for low pt tracks, check the material in simulation.
- There are rooms for improvement, especially for silicon clustering and fitting.
- We need to understand some of these differences better.