

Performance of A Full Silicon Tracker

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Outline of presentation:

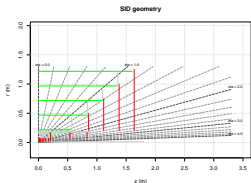
- Introduction.
- Silicon tracker designs and their performances.
- Detector simulation and reconstruction.
- Comparing with CEPC V1 performance.
- To-do list

Introduction

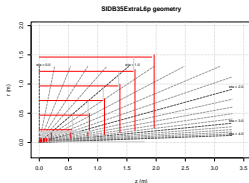
- A full silicon option has been implemented in Mokka by Chengdong.
- Based on CEPC V1 silicon tracker, we simply add additional SIT layers and FTD endcaps to replace the TPC while keeping the same design of VXD.
- This is meant to test the concept using the existing silicon tracking reconstruction code.
- 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

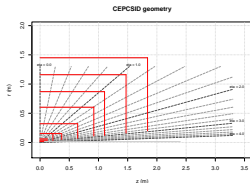
- We compared the tracking performance of several design options using a toy MC.



(a) SID



(b) ExtraL6p

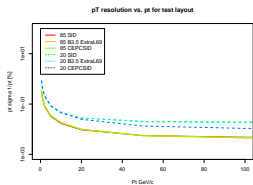


(c) CEPCSID

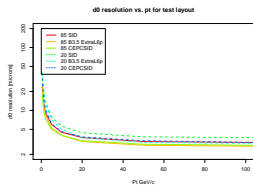
Figure: Three full silicon tracker design options considered.

Tracking Resolutions

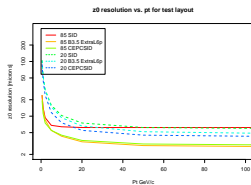
- CEPCSID option has comparable resolutions.



(a) pT



(b) d0

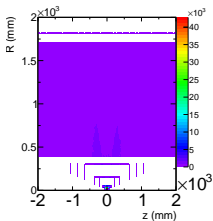


(c) z0

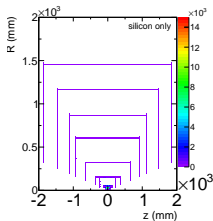
Figure: Resolutions for $1/p_T$, d0, and z0.

Full Detector Simulation and Reconstruction

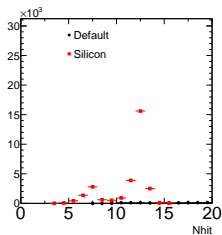
- Generated single muon with CEPC V1 and CEPC SID
- Reconstructed with Marlin Silicon+TPC and Silicon only.



(a) CEPC V1



(b) CEPC SID

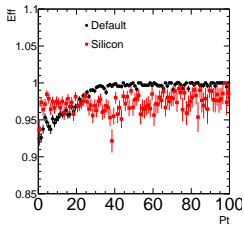


(c) Nhits

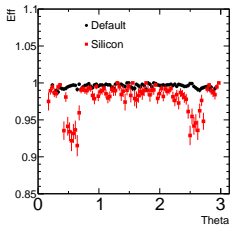
Figure: Hits r vs z from the track and the number of Hits

Tracking Efficiencies

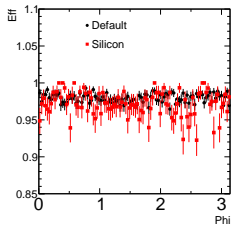
- Tracking efficiency is low in barrel and endcap overlap region.



(a) pt



(b) theta

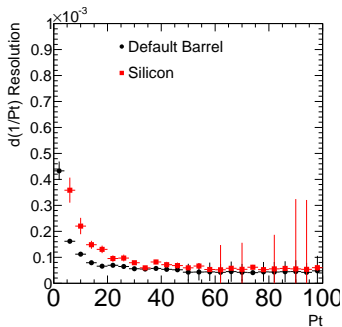


(c) phi

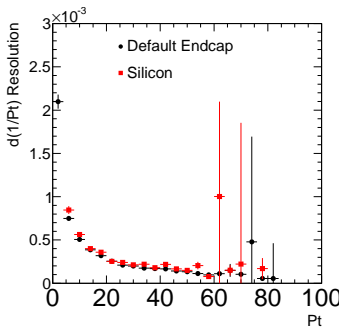
Figure: Efficiencies vs pt, theta and phi

Pt Resolution

- The pt resolution is worse for low pt tracks in Barrel due to extra materia ?



(a) Barrel

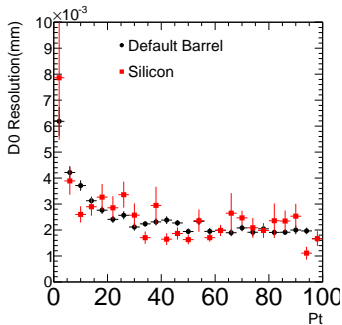


(b) Endcap

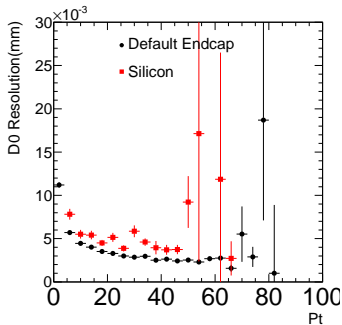
Figure: Pt resolution in Barrel and Endcap regions

d0 Resolution

- d0 resolution is quite similar.



(a) Barrel

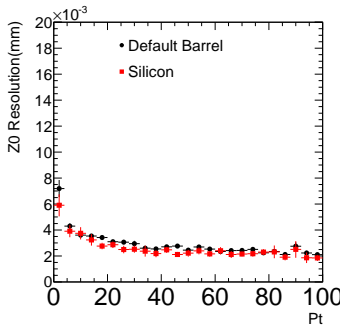


(b) Endcap

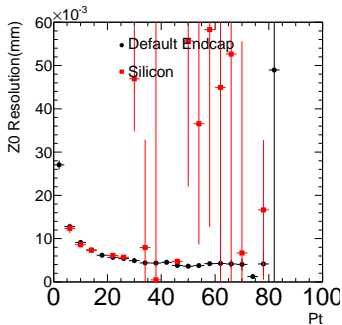
Figure: d0 resolution in Barrel and Endcap regions

z0 Resolution

- z0 resolution is quite similar.



(a) Barrel



(b) Endcap

Figure: z0 resolution in Barrel and Endcap regions

To-do List

- The concept of a silicon tracker seems working and its performance is comparable to CEPC V1.
- The tracking efficiency is lower in barrel and endcap overlap region, check the tracking.
- The pt resolution is worse for low pt tracks, check the materia in simulation.
- Check the track efficiency for photon conversion or large radius tracks.
- Improving the tracking and speed up.
- Checking the secondary and PFO performances
- Checking the tracking performance in dense jet.
- Review the design options for hardware and support materia.