

CLD tracker studies

Lessons learned from running the CLD full simulation

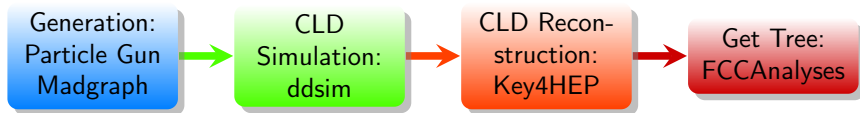
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FCC-PED-SoftwareAndComputing-Full-Simulation, June 2023

Introduction and motivation

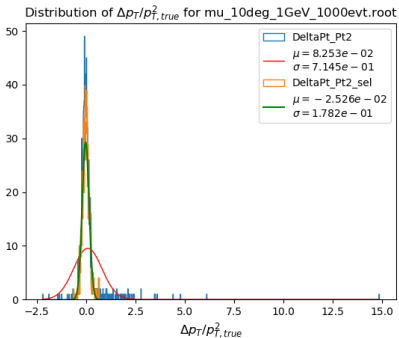
Objectives:

- Define different geometries and design options of Vertex Detector
- Candle for physics performance : increasing level of complexity (Tracking, Vertexing, flavour tagging, full analysis)
- Chosen approach: full simulation, for more precise results, use of CLD here. Starts with particle Reco and tracking
 - ▶ Determine Reco-MC matching
 - ▶ Implement estimations of performance plot : resolution, performances.
- What has been done:

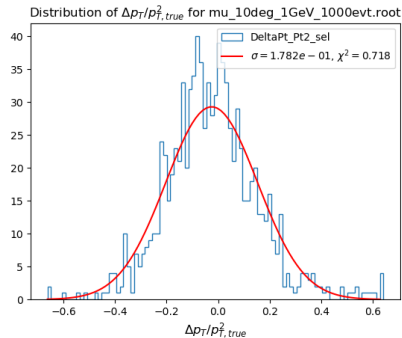


Selection

Distribution of $\Delta p_T/p_{T,true}^\dagger$ with the p_T of Reconstructed Tracks and MC particles, the selection was done by removing values above 3 sigma from the mean, repeat the selection 3 times.



(a)

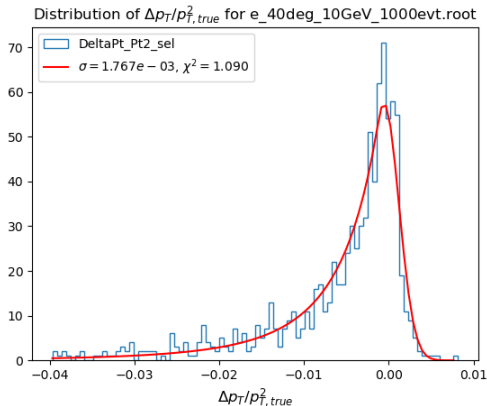


(b) after selection

$$\dagger \Delta p_T = \text{Reco} - \text{MC}$$

electrons

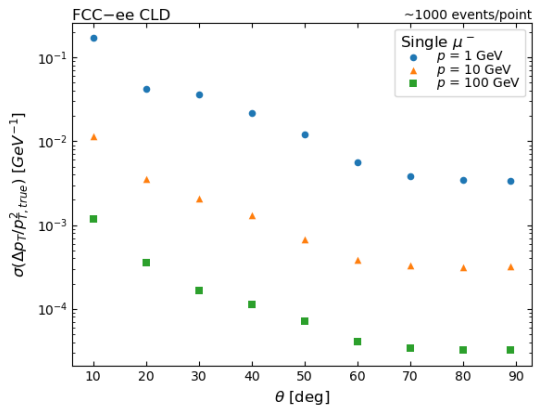
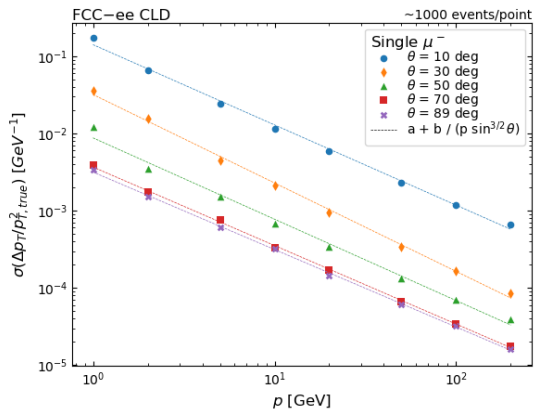
Fit Distribution of $\Delta p_T/p_{T,true}^{\dagger}$ for electrons with a Gaussian function combined with a power-law tail, due to bremsstrahlung tail.



$$\dagger \Delta p_T = \text{Reco} - \text{MC}$$

Performance plots

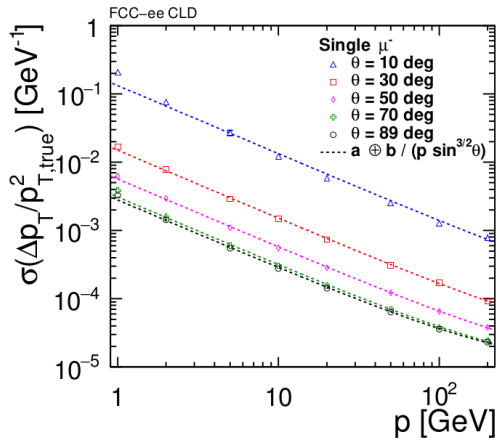
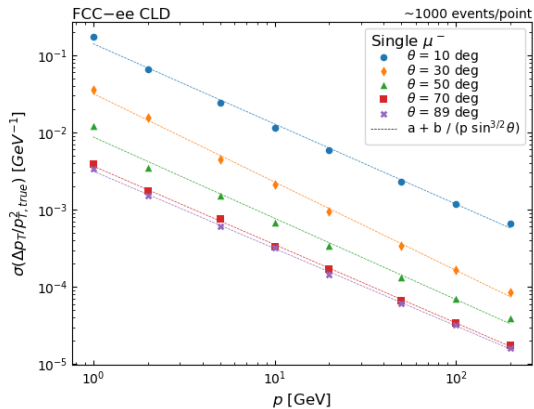
Momentum resolution – single μ^- – FCCee_o1_v04



The procedure used to produce these plots can be found
github.com/gaswk/FullSim/TrackingPerformance

Performance plots

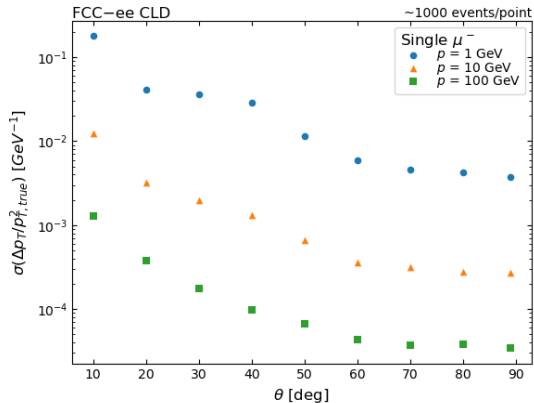
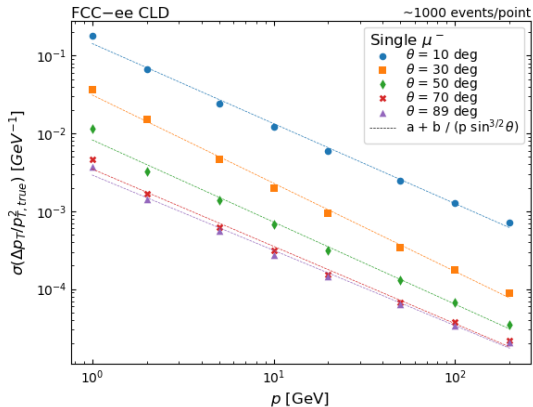
Momentum resolution – single μ^- – FCCee_o1_v04



Comparison with plot made in [arXiv:1911.12230v3](https://arxiv.org/abs/1911.12230v3)

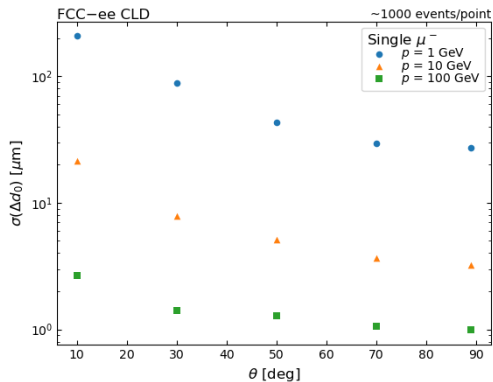
Performance plots

Momentum resolution – single μ^- – FCCee_o2_v02

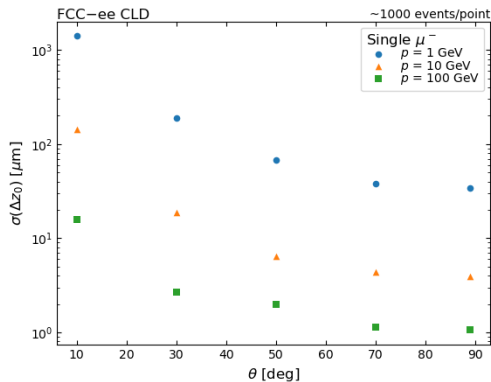


Performance plots

Impact parameter resolution – single μ^- – FCCee_o2_v02



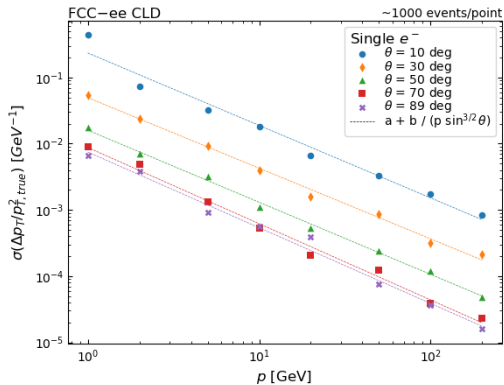
(a) d0



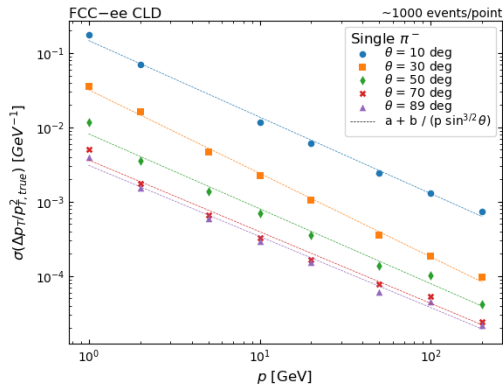
(b) z0

Introduction and motivation

Momentum resolution for electrons(3a) and pions(3b) – FCCee_o2_v02



(a) electrons



(b) pions

Comments on FCCAnalyses usage

- Matching → need to be done via the collectionID:
 - ⚠ FCCAnalyses only support the matching between Reco and MC if they are two collections
 - ▶ Particles
Several collections for Reconstructed and MC Particles...
(see example of Reco–MC Matching github.com/gaswk/FCCAnalyses/)
 - ▶ Tracks
4 TrackSates for each tracks → Keep only the one at (0,0,0) (see example github.com/gaswk/FCCAnalyses/)
Several collections for Reconstructed Tracks and MC Particles
MC–Tracks Matching: example github.com/gaswk/FCCAnalyses/

Thanks to E.Perez for the help

Conclusion

- What has been done:
 - ▶ Simulation and reconstruction for CLD
 - ▶ MC - Reco matching
 - ▶ Tracking resolution plots
- What is next:
 - ▶ study change of tracker design and evaluation impact on resolution