D0 resolution in fast simulation

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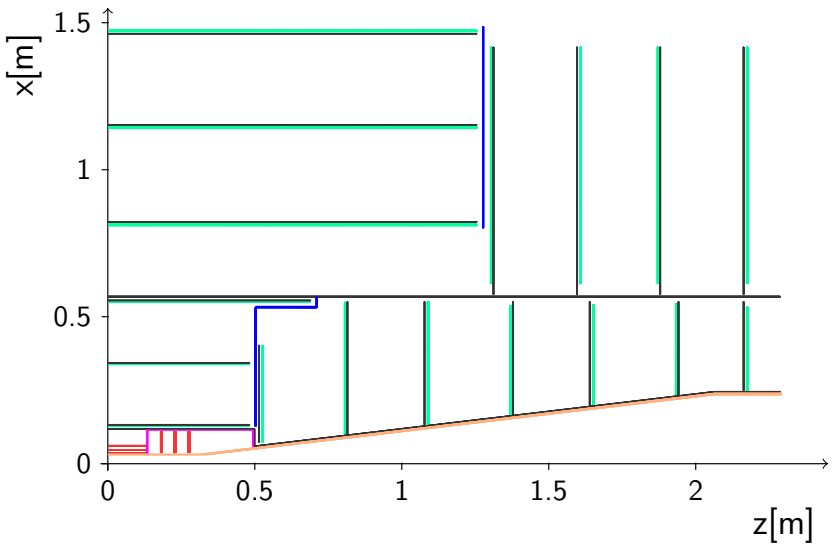
Detector model

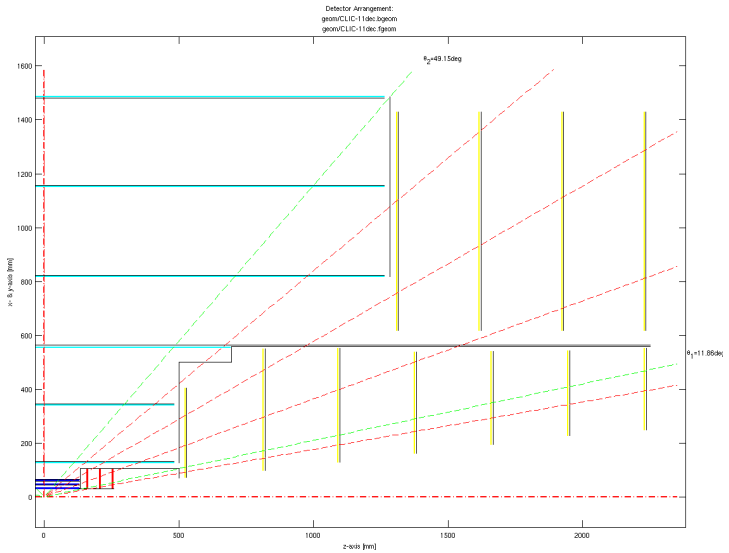
- Compare CLIC_o3_v08 to fast simulation model
- Both models include the most recent changes on the vertex cable routing as discussed end of last year

Full simulation



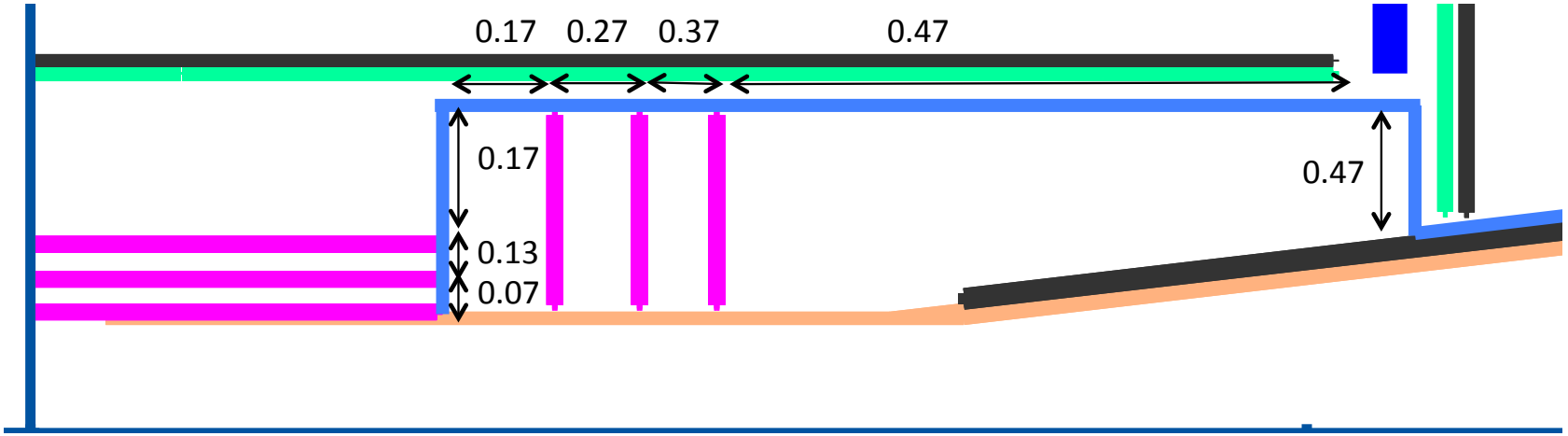
- Spiral vertex endcap geometry

Fast simulation

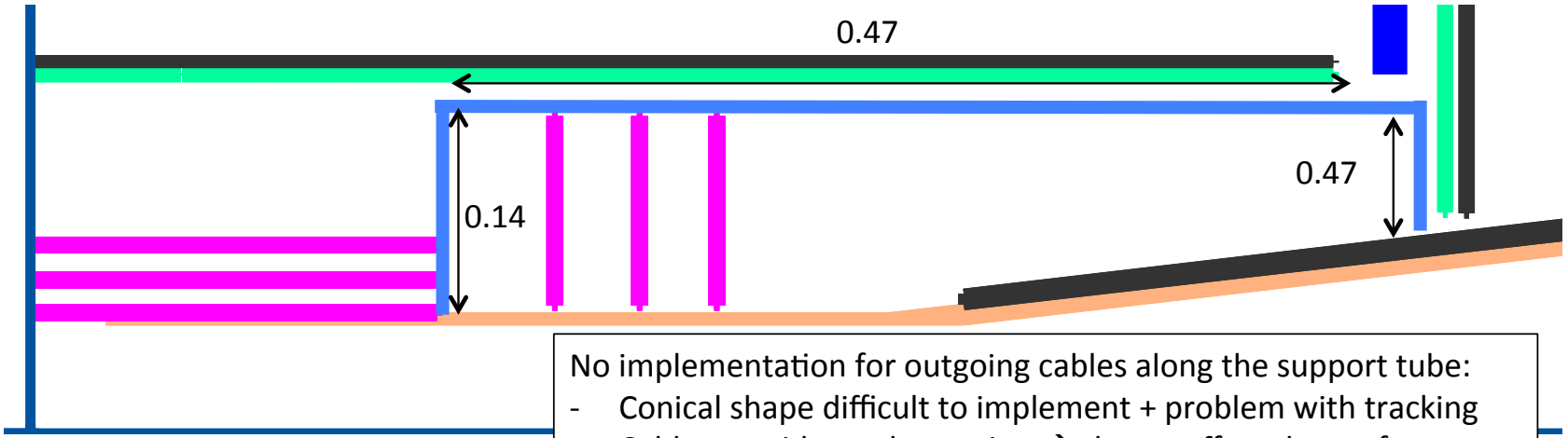


- More detailed material description for the services
- → CLICdp Gitlab repository

Numbers (in %X0) for each cable element

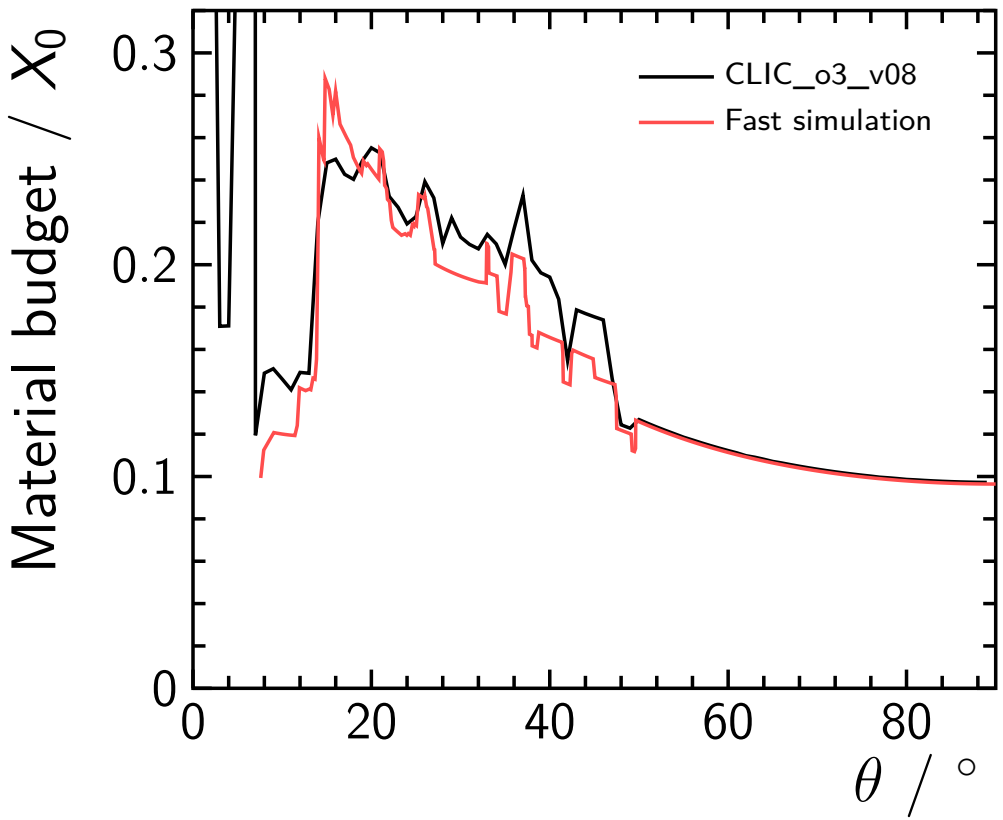


Average / conservative numbers (to be implemented in full simulation)



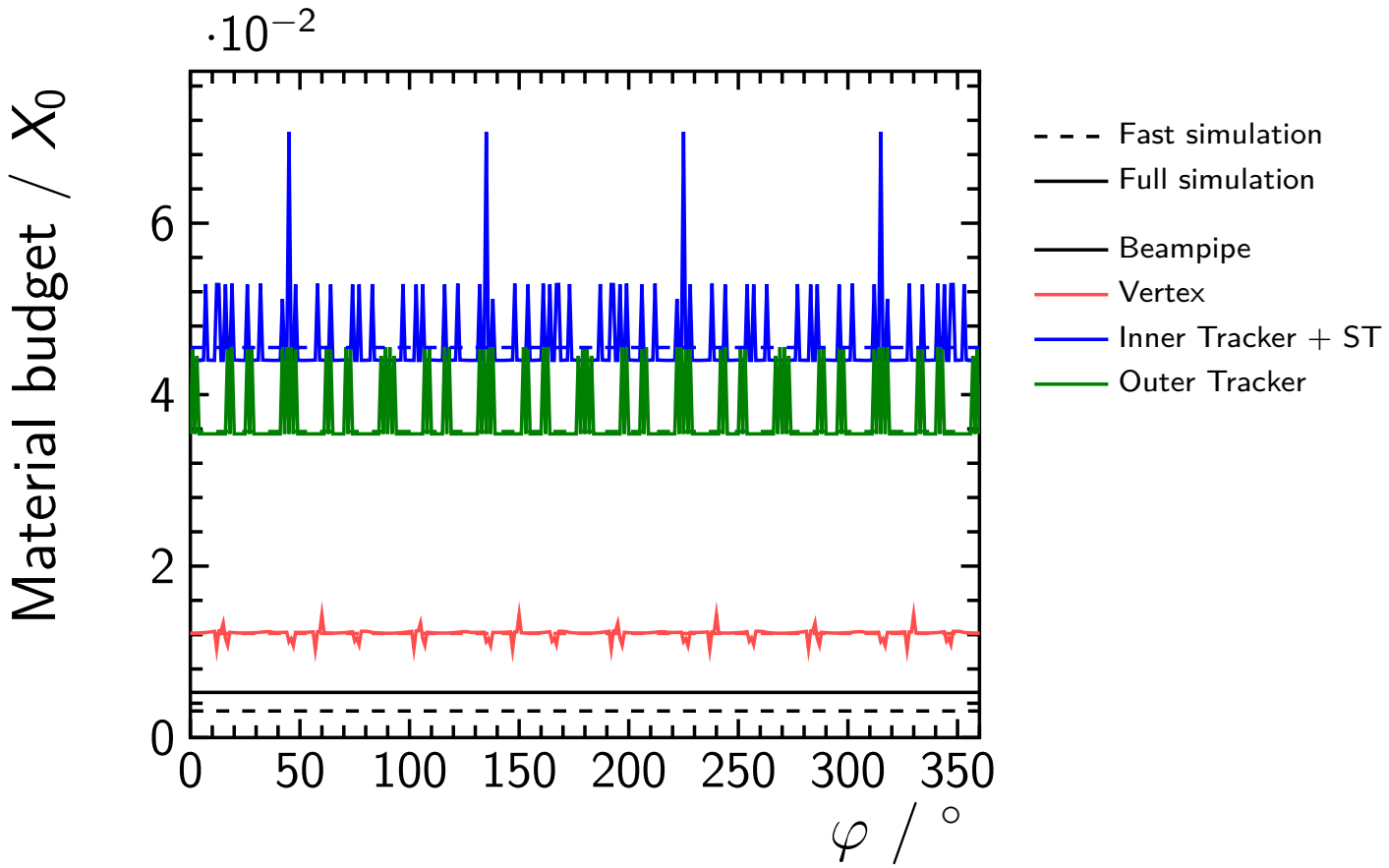
No implementation for outgoing cables along the support tube:
- Conical shape difficult to implement + problem with tracking
- Cables outside tracker region → do not affect the performance

Material budget, vertex + tracker region



- Good agreement

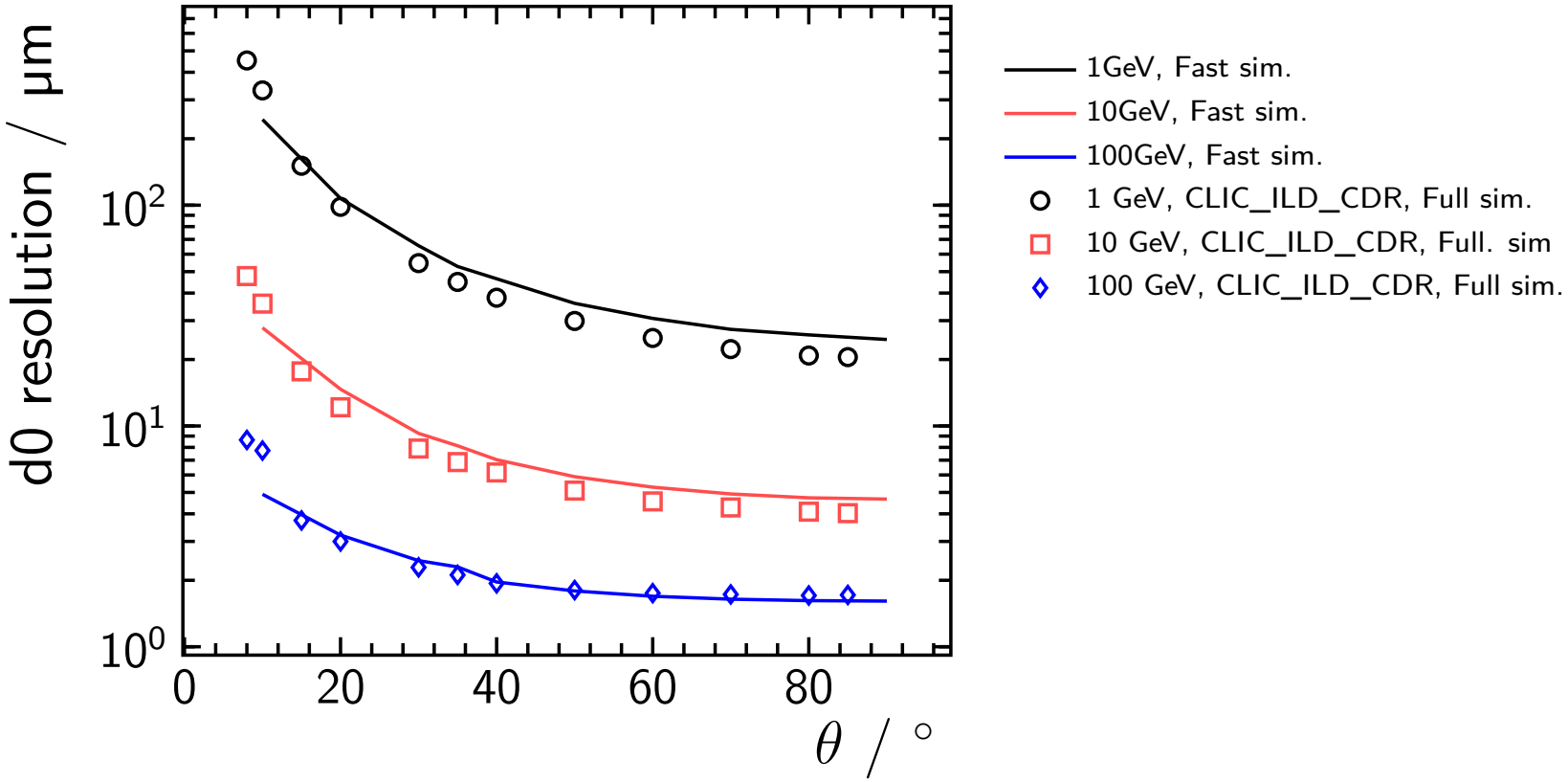
Material budget, vertex + tracker region



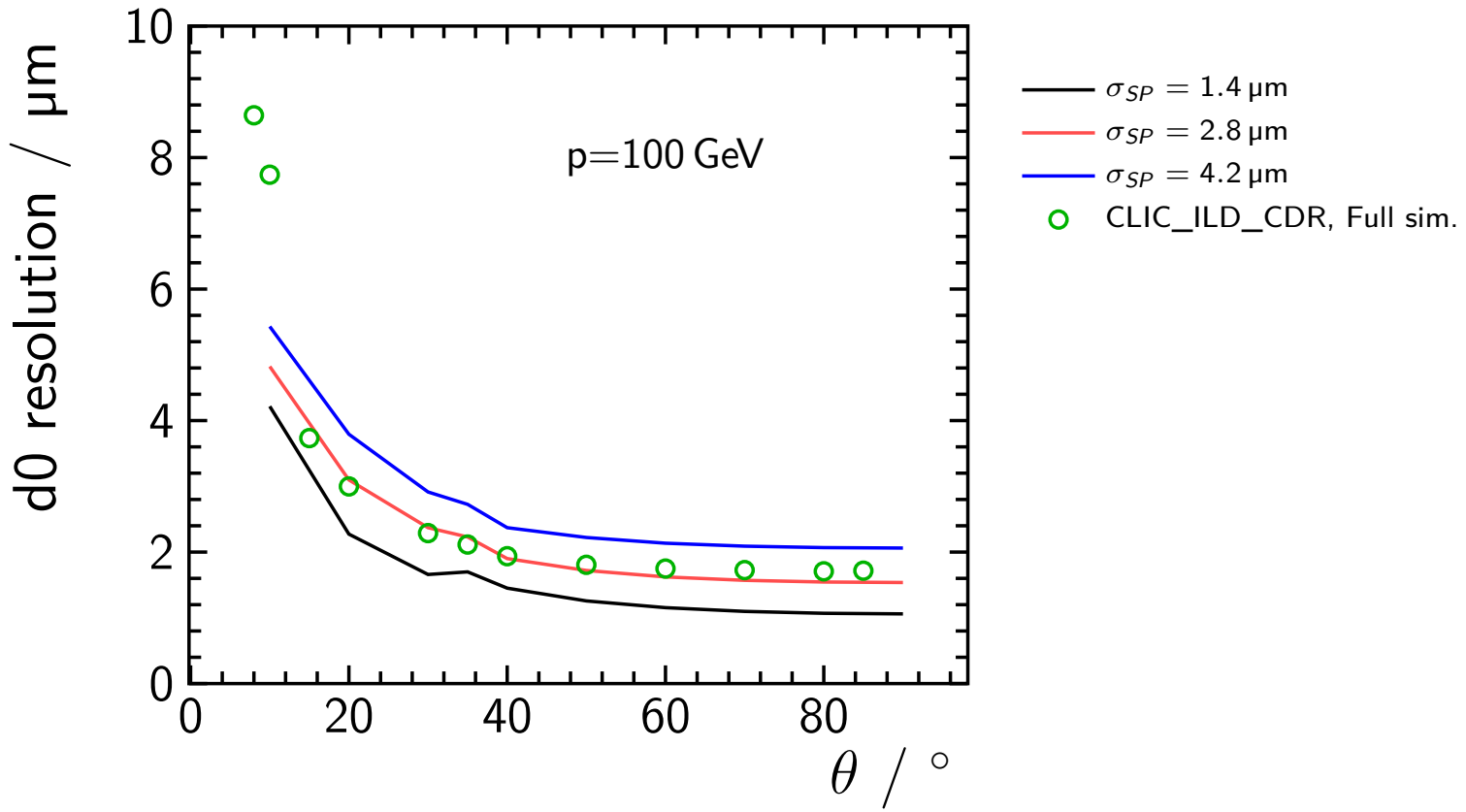
- $\theta = 90°$, φ-overlaps only in full simulation
- Vertex air-shell accounted in beampipe (full sim) or inner tracker (fast sim)

D0 resolution

- Comparison to CLIC_ILD_CDR
- Slight degradation expected from thicker vertex layers, esp. at low momentum
- Similar performance at 100 GeV

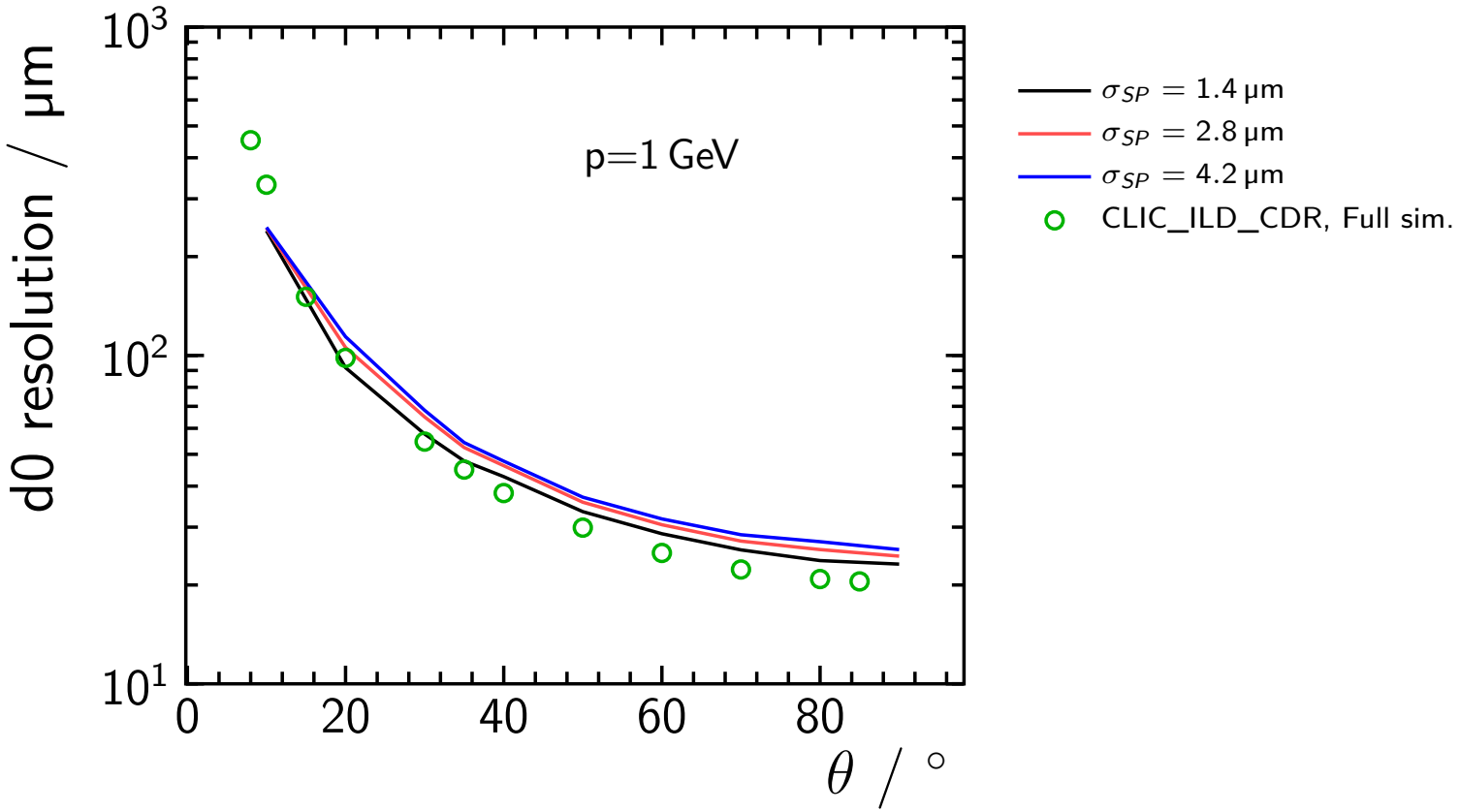


D0 resolution vs. single point resolution



- Similar d0 resolution for p=100 GeV

D0 resolution vs. single point resolution

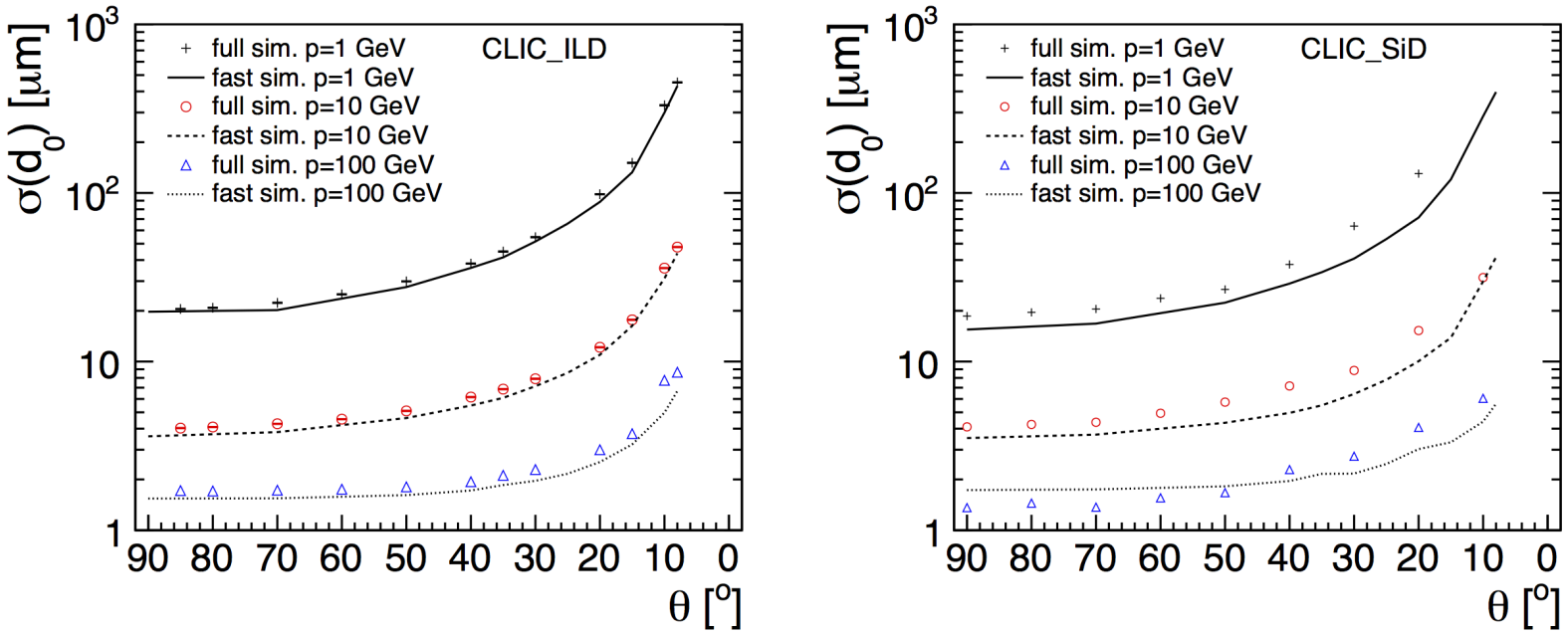


- Slightly worse d0 resolution for p=1 GeV

Full simulation studies & Summary

- Full simulation study of d0 resolution started recently by Peter (CERN summer student) and Emilia
- Tracking and fitting procedure (Gaussian fit, RMS, RMS90,. . .) to extract resolution currently under study
- Fast simulation gives quick estimation on achievable resolution for the new detector model
  - Slightly reduced resolution for low momentum tracks compared to CLIC_ILD_CDR
  - Similar performance at high momentum
  - Overall expected behavior form the additional material in the vertex detector
- Flavor tagging performance under study by Nacho (see next talk)

Backup

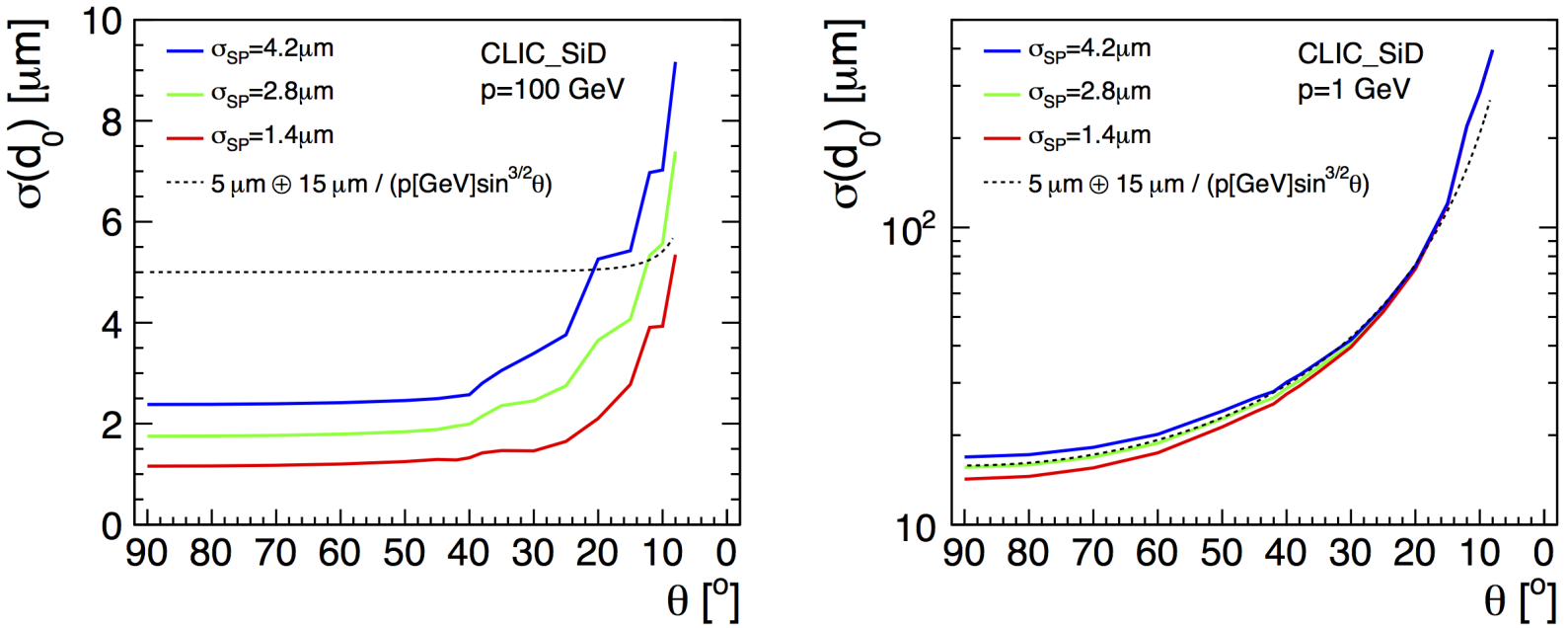


(a) CLIC_ILD

(b) CLIC_SiD

Fig. 4.4: Transverse impact-parameter resolutions, obtained with the baseline vertex detector layouts for CLIC_ILD (a) and for CLIC_SiD (b), for tracks with momenta of 1, 10, and 100 GeV. The markers correspond to the full GEANT4 detector simulations, while the lines give the results for the fast LDT simulation. The differences between the simulation results are discussed in the text.

CDR



(a) (b)

Fig. 4.5: Transverse impact-parameter resolution as function of the polar angle θ for three different values of the single-point resolution of the CLIC_SiD pixel layers, as obtained from the fast LDT simulation. Shown are the resolutions for 100 GeV tracks (a) and for 1 GeV tracks (b). Also shown is the parametrisation from Equation 4.1 with the target values $a = 5$ μm and $b = 15$ μm.