

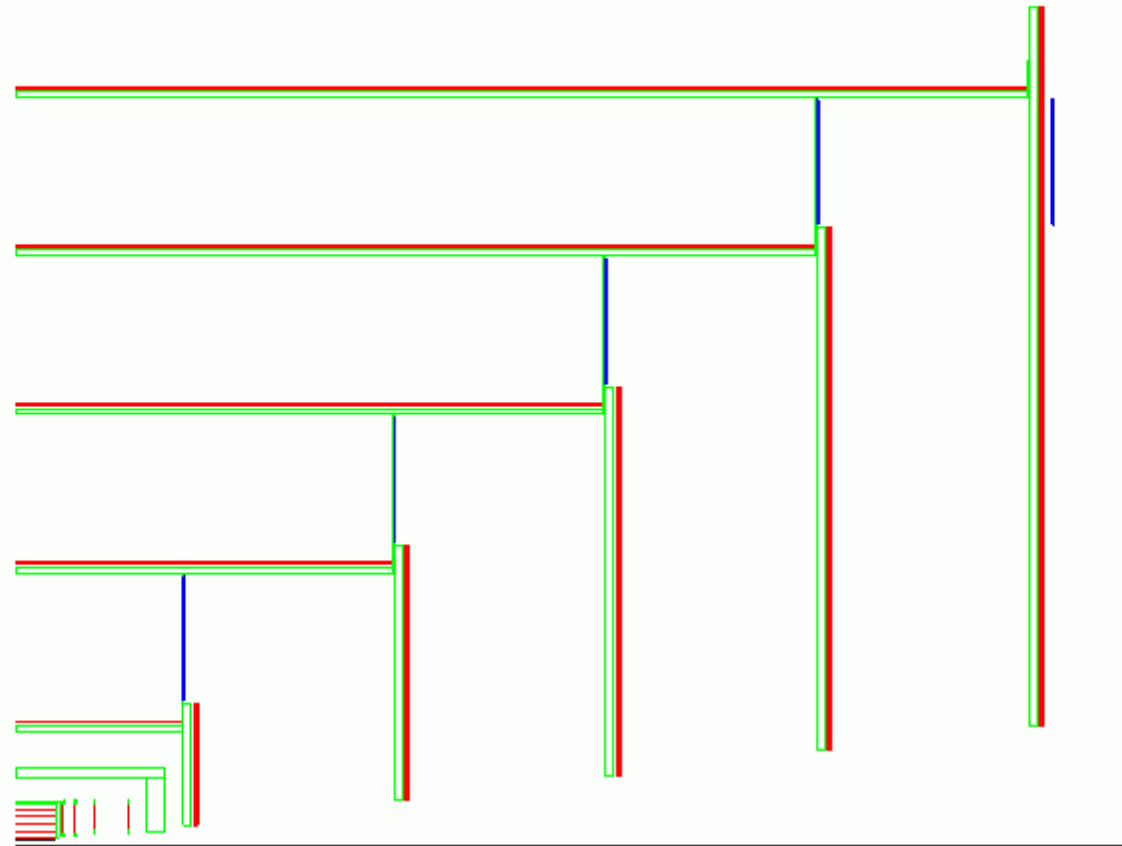
# Tracking resolution

Nick Sinev, University of Oregon

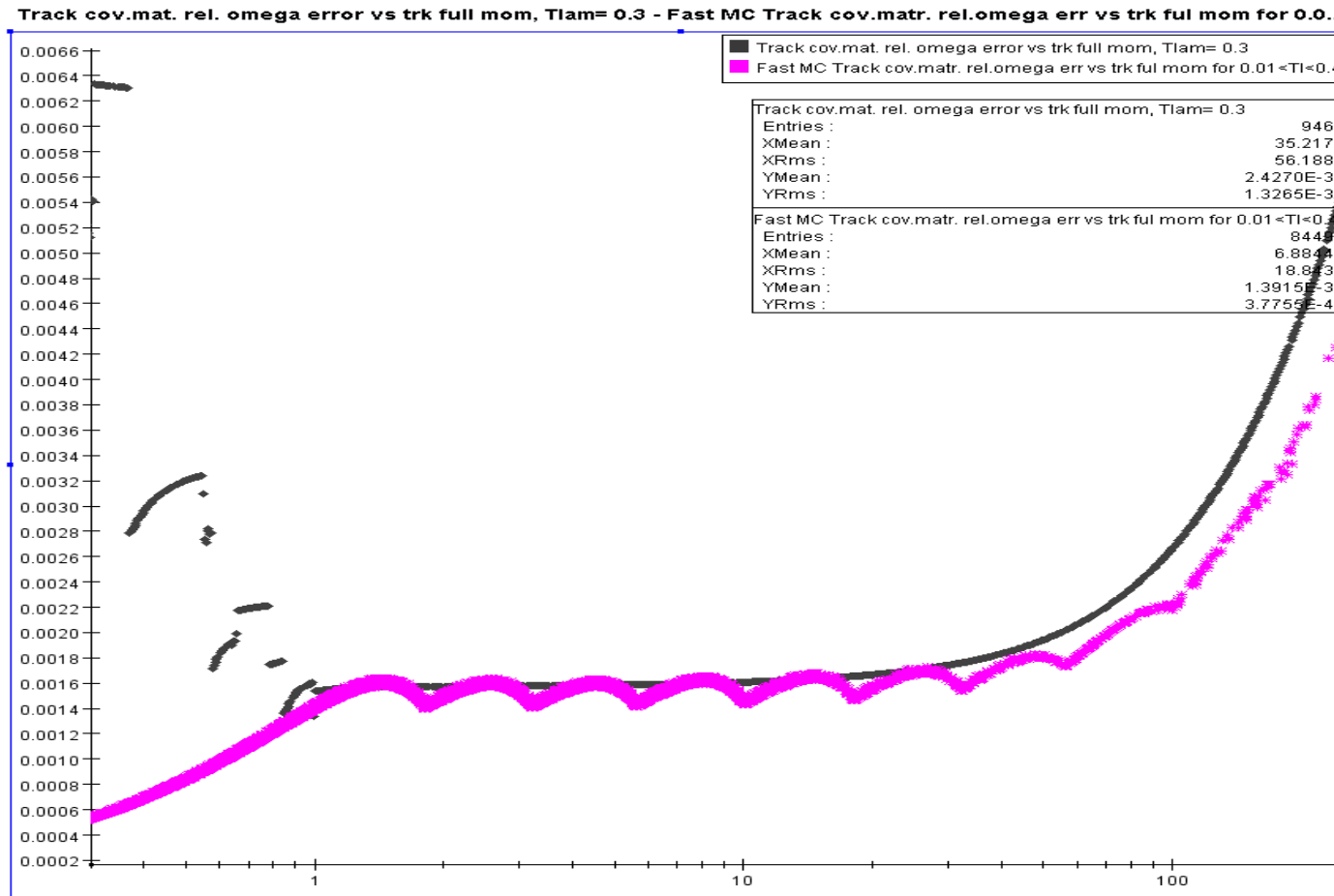
# Software tools

- Fitter – SLD type weight matrix based.
  - Gives covariance Matrix for fitted track
  - Can calculate covariance Matrix without hits – simulate hits itself and use only detector geometry description (compact.xml file)
- Hits smearing
  - First combine hits (SimTrackerHit) from the same particle in the detector layer (there may be few of them because Geant generates many hits along track)
  - Smear resulting TrackerHit and assign measurement matrix to it according to given detectors resolutions

# SiD00 detector

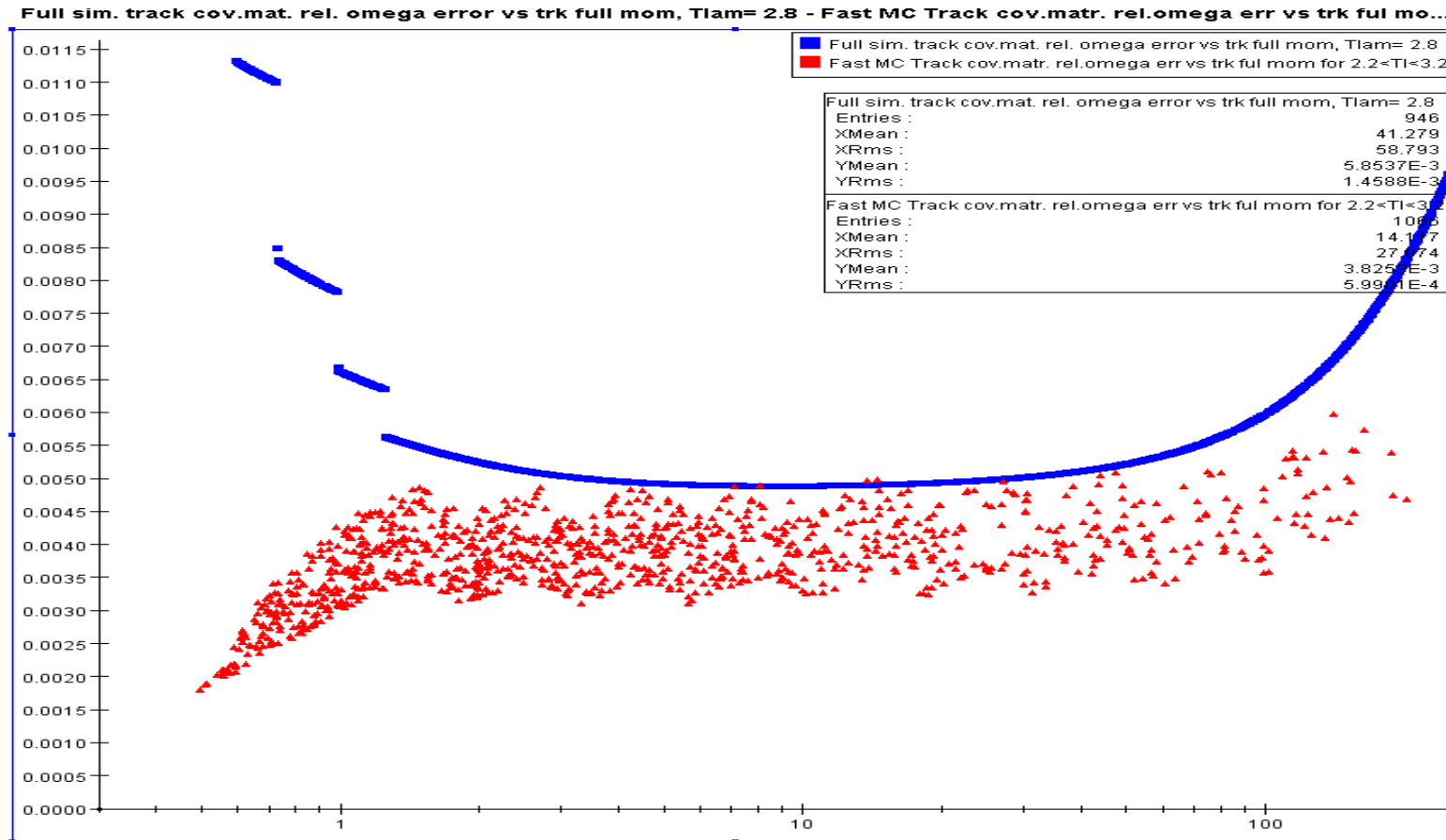


# Momentum measurements- Pt resolution vs full momentum of the track



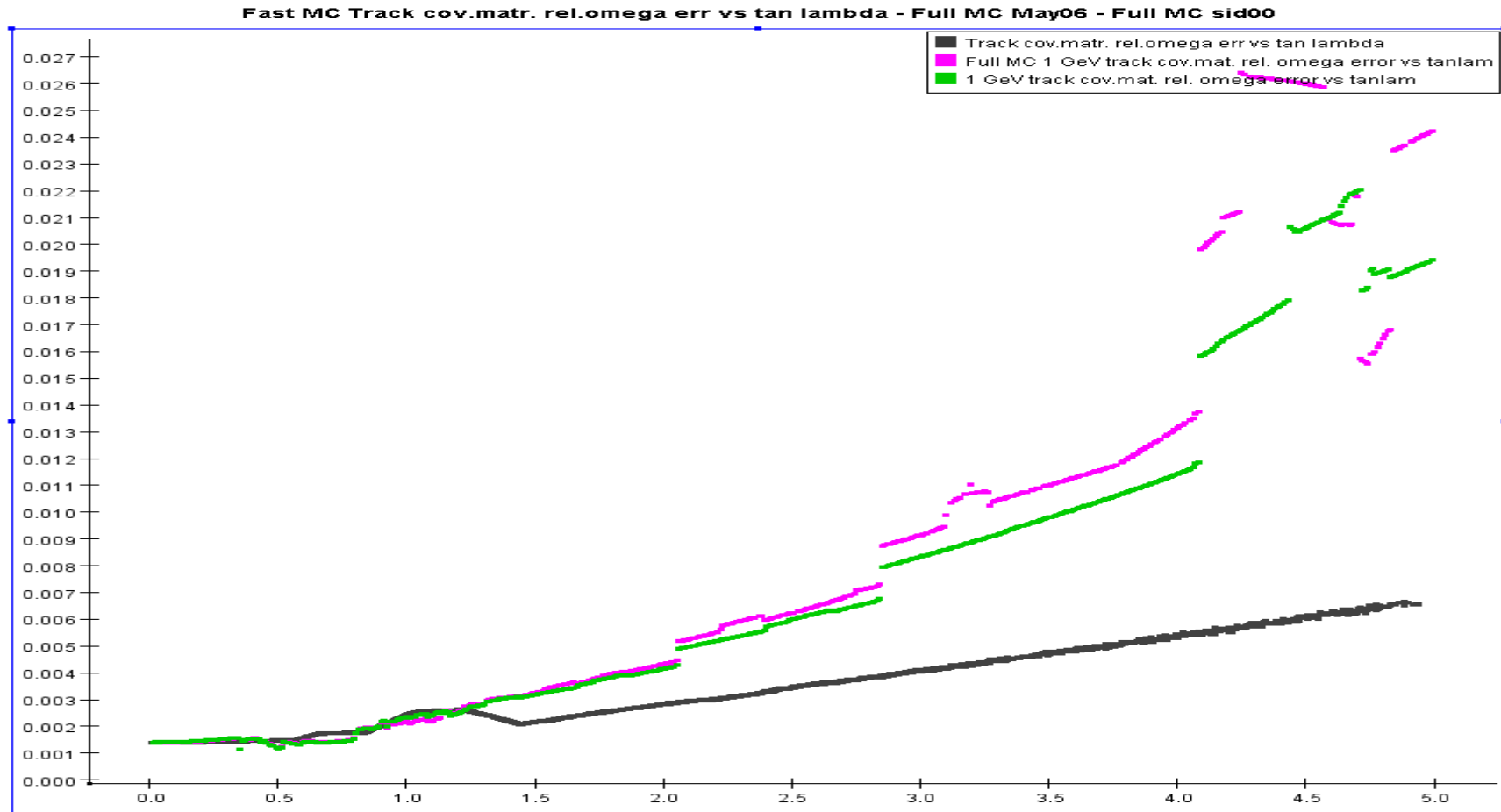
Comparison of Fast (magenta) and full MC for SiD detector for  $\text{Tan}(\lambda) = 0.3$

# Momentum measurements- Pt resolution vs full momentum of the track



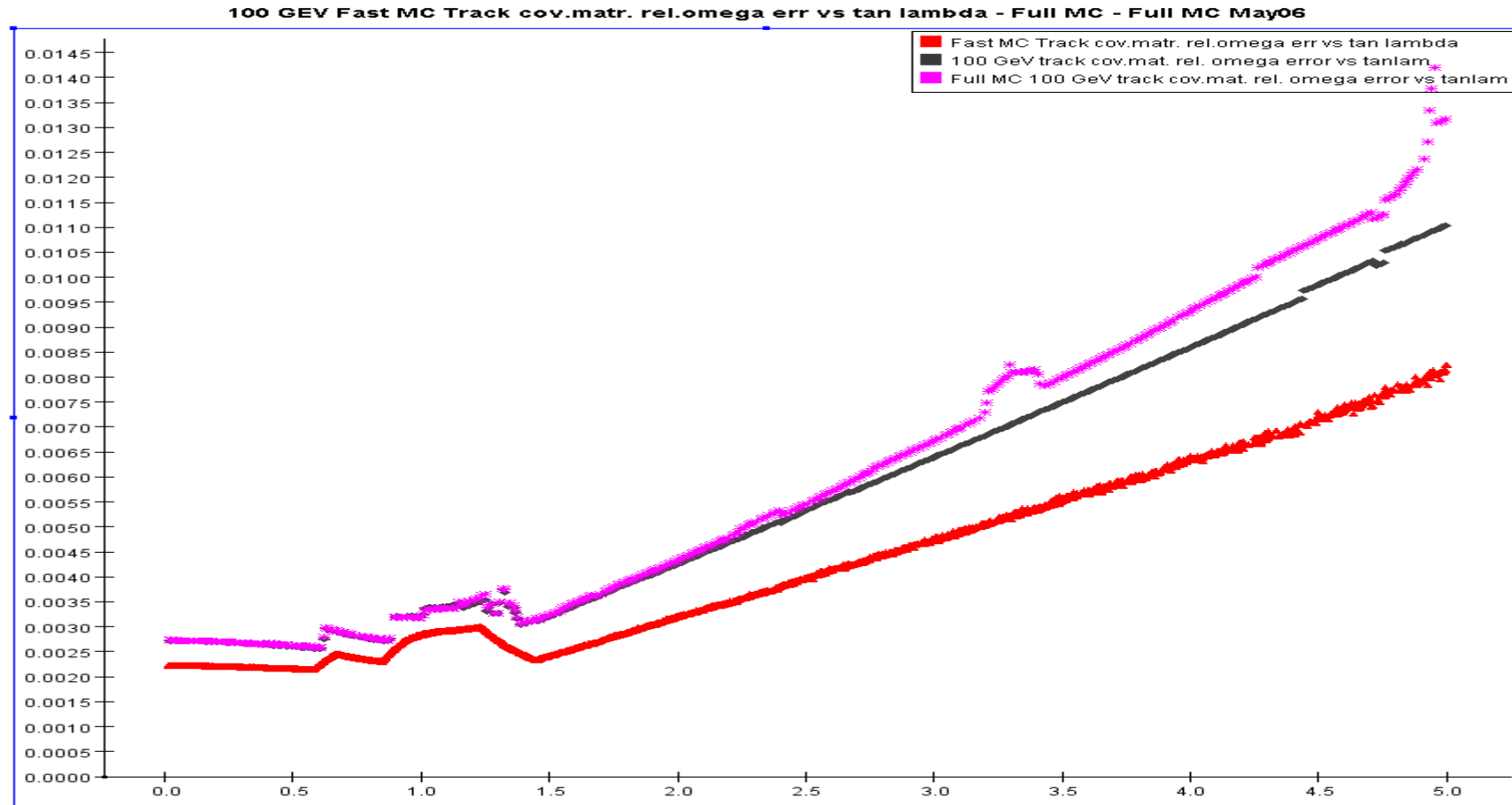
Comparison of Fast (red) and full MC for SiD detector for  $\text{Tan}(\lambda) = 2.8$

# Momentum measurements-1 Gev



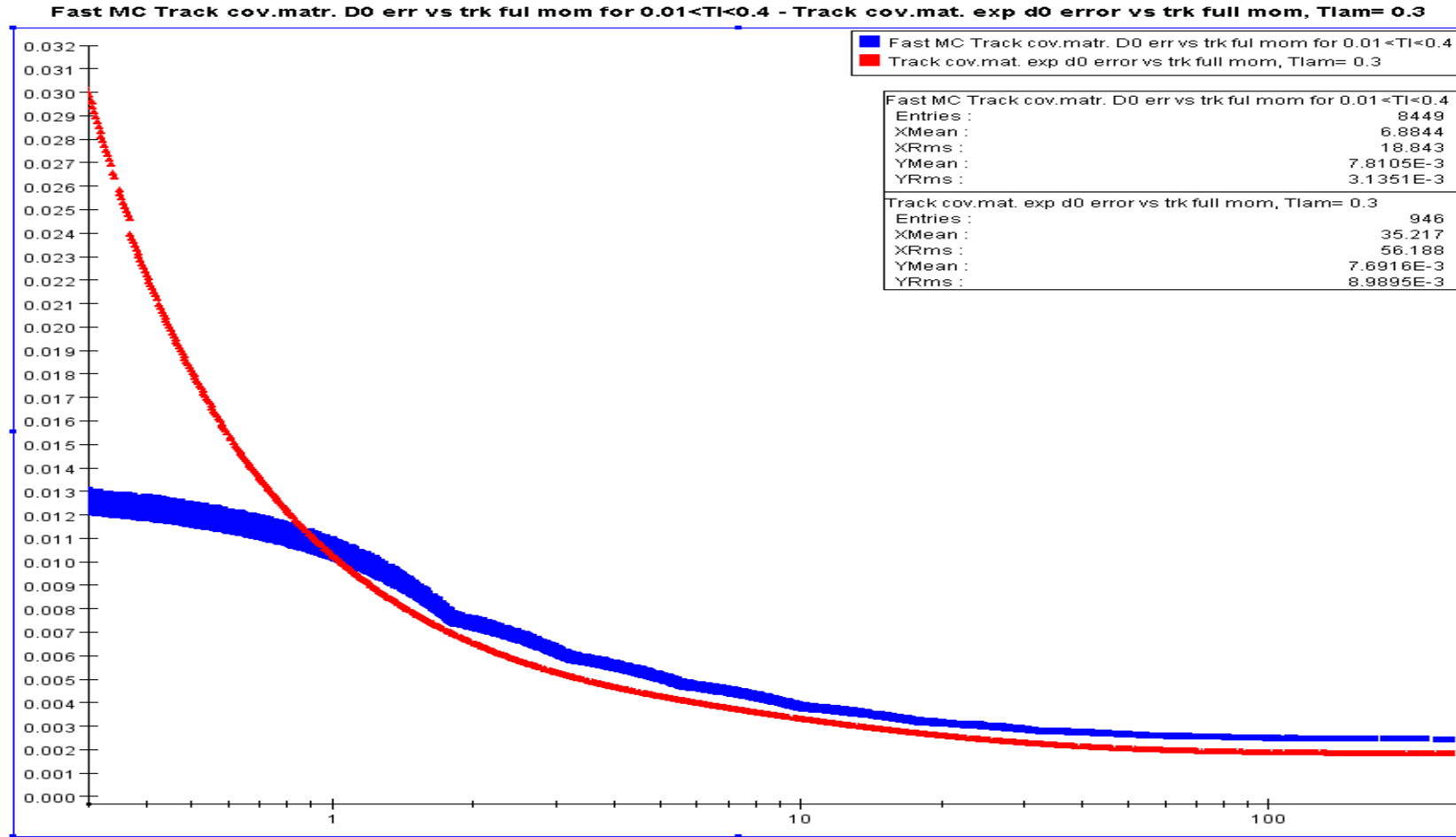
Very low momentum tracks Pt resolution vs Tan( $\lambda$ ) in Fast MC (black), SiD00 (green) and SiDMay06 (magenta).

# Momentum measurements-100 Gev



High momentum tracks Pt resolution vs Tan( $\lambda$ ) in Fast MC (red), SiD00 (black) and SiDMay06 (magenta). Why such large difference with Fast MC? Does Fast MC include sensors resolution?

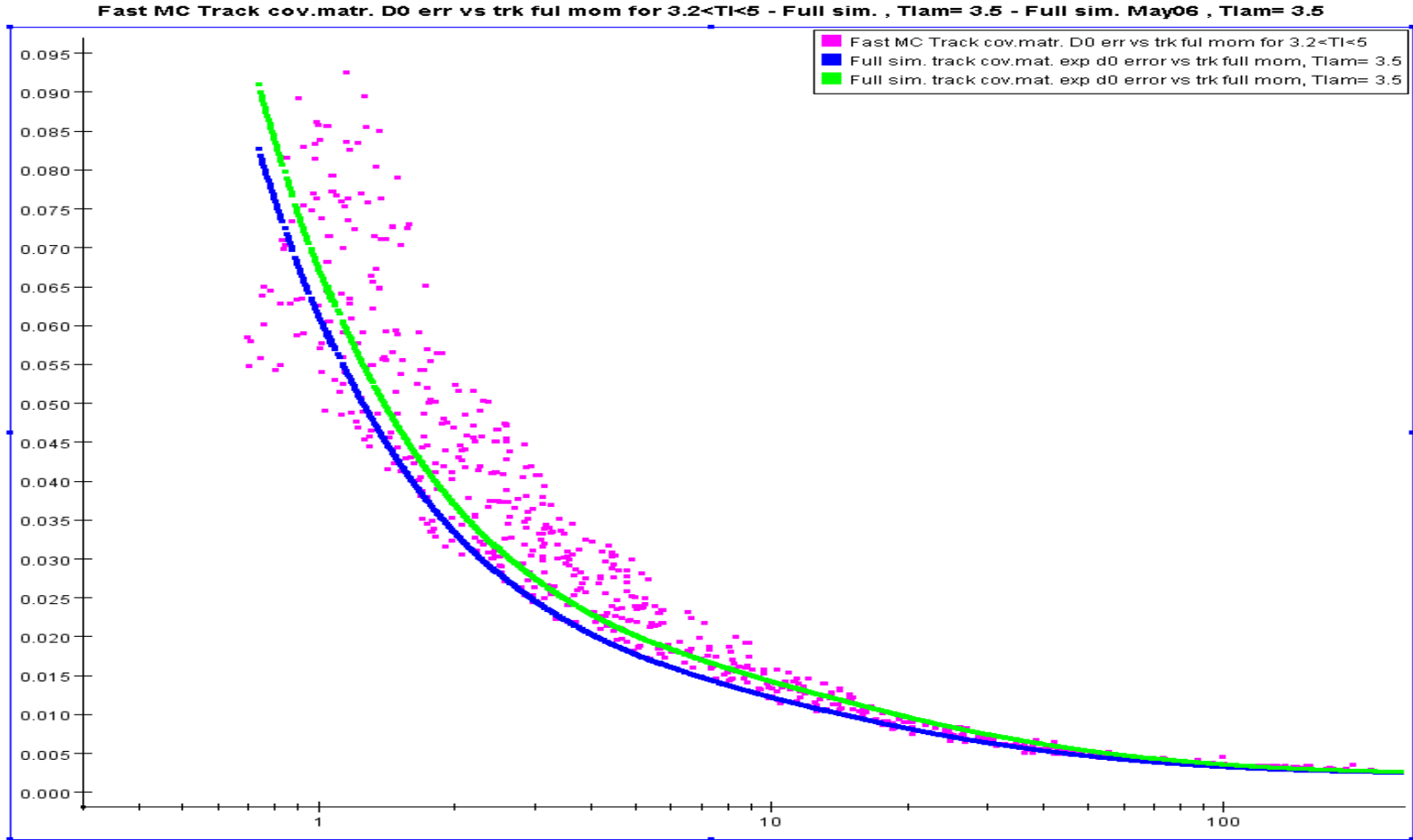
# Impact parameter D0 resolution vs momentum



Fast MC – blue, full MC – red.  $\tan(\lambda) = 0.3$  (exactly for full MC and average for Fast MC).

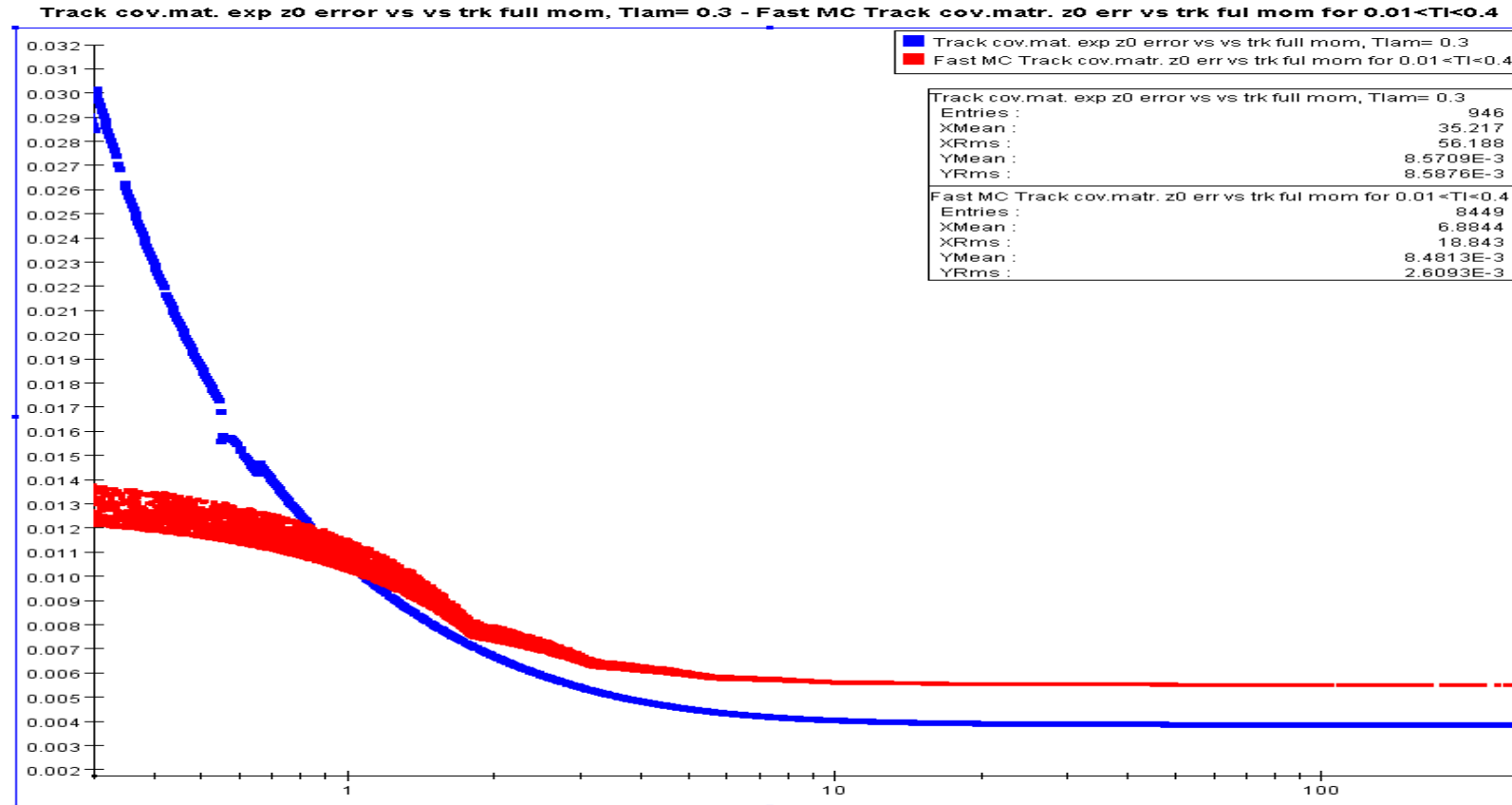


# Impact parameter D0 resolution vs momentum



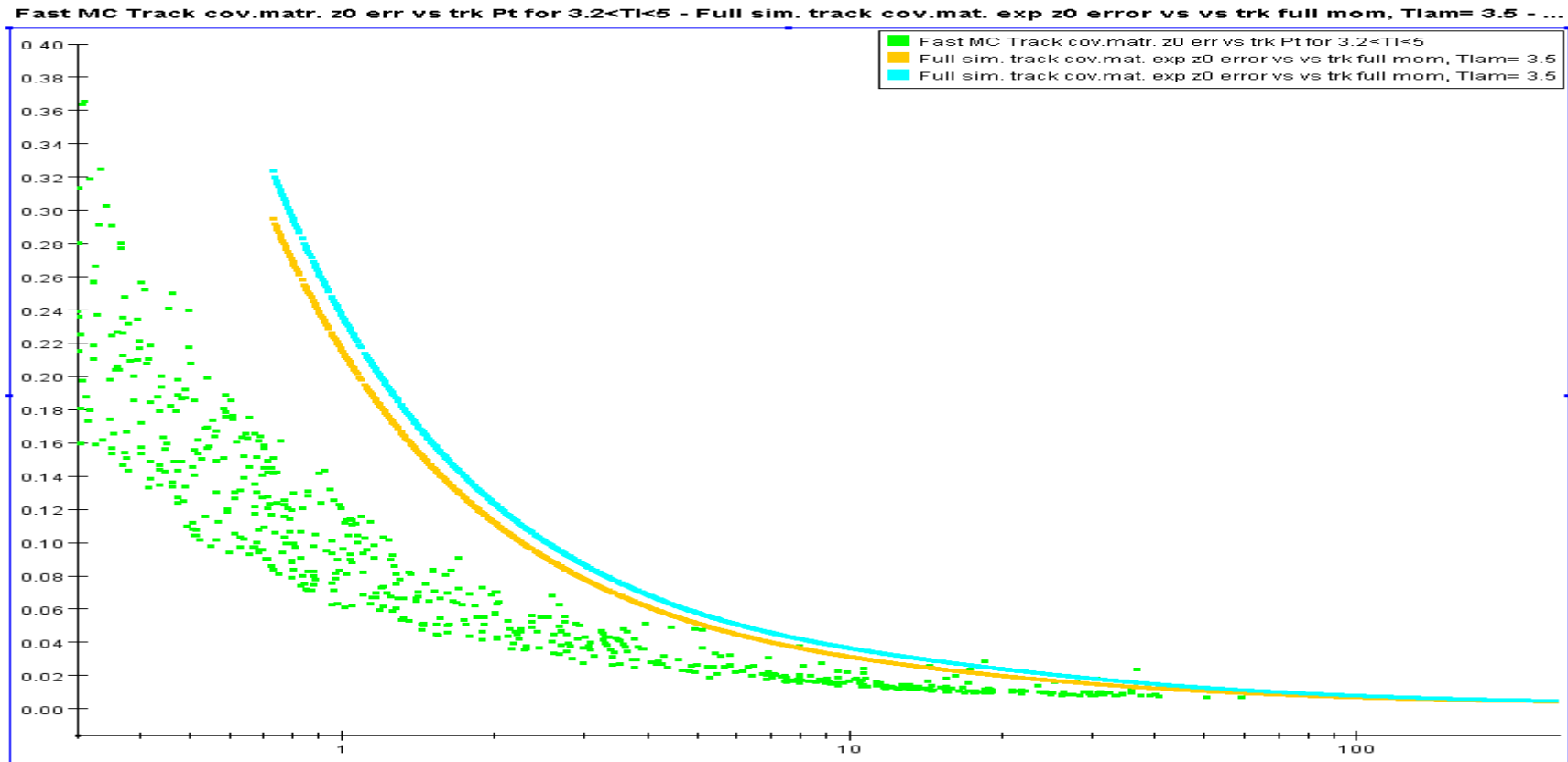
Tan ( $\lambda$ ) = 3.5 Fast MC (magenta), full MC SiD00 – blue, SiDMay06 - green

# Impact parameter Z0 resolution



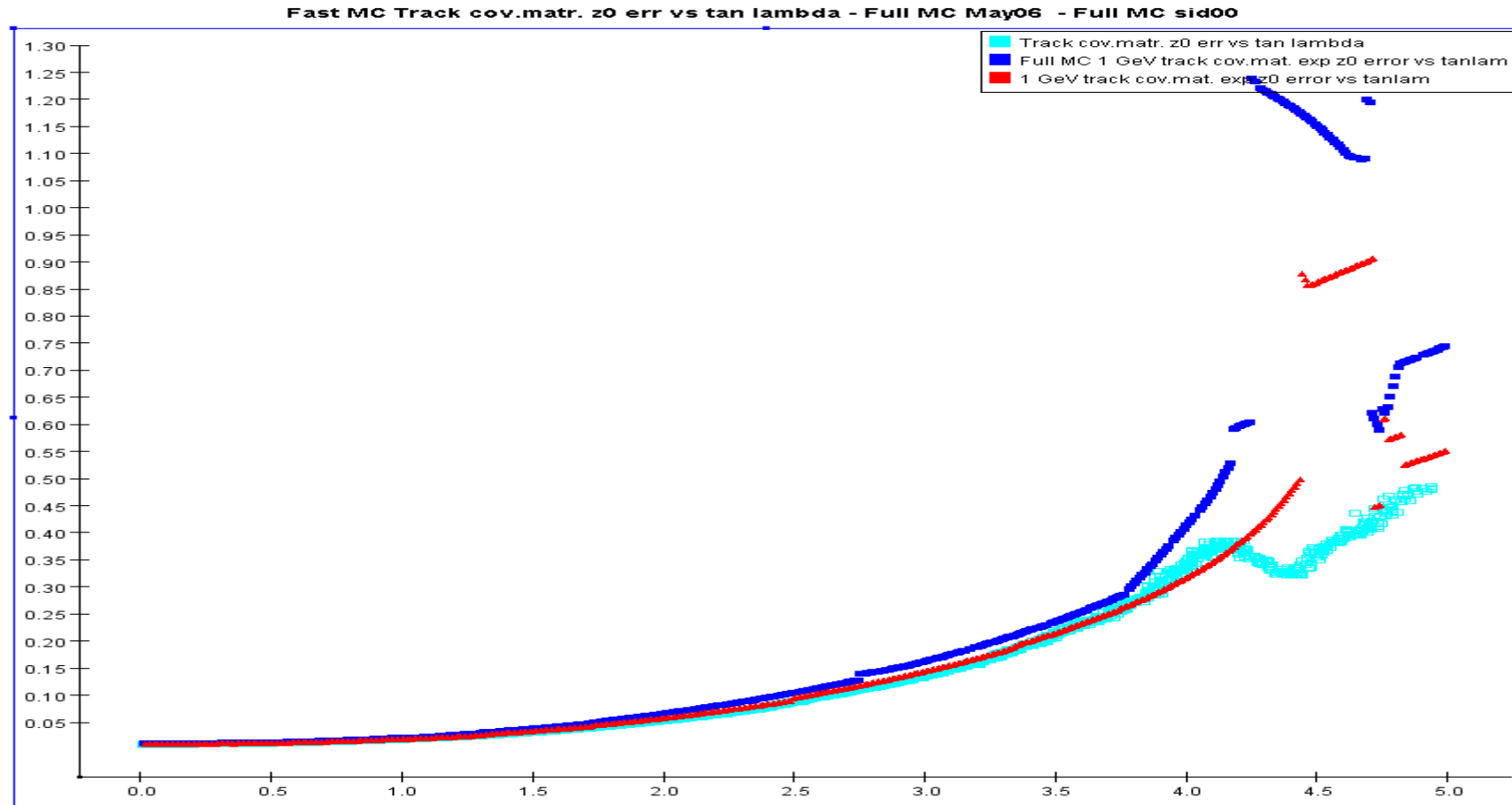
- $\tan(\lambda)=0.3$  Fast MC (red) full MC, SiD00 –blue. What is the reason for bad Fast MC resolution at high momentum?

# Impact parameter Z0 resolution



- $\tan(\lambda)=3.5$  Fast MC –green, full MC, SiD00 –yellow, full MC, SiDMay06- blue.

# Impact parameter Z0 resolution



- 1 GeV full momentum. Fast MC –cyan, full MC, SiD00 –red, full MC, SiDMay06- blue.

# Conclusions

- We have tool which allows to study effects of detector design on tracking resolutions with full detector simulation, but without running Geant. Geometry description in the form of xml file is enough.
- I hope Kalman fitter can do even better job. I still not completely satisfied with weight matrix fitter performance at low momentum (overestimates resolution by few %) and in ec region – underestimates (by 5-8%) resolution. I am eager to compare it with Kalman fitter.