Tracking Issues with Mokka Models LDC01_06Sc & LDCPrime_02Sc (Chapter II)

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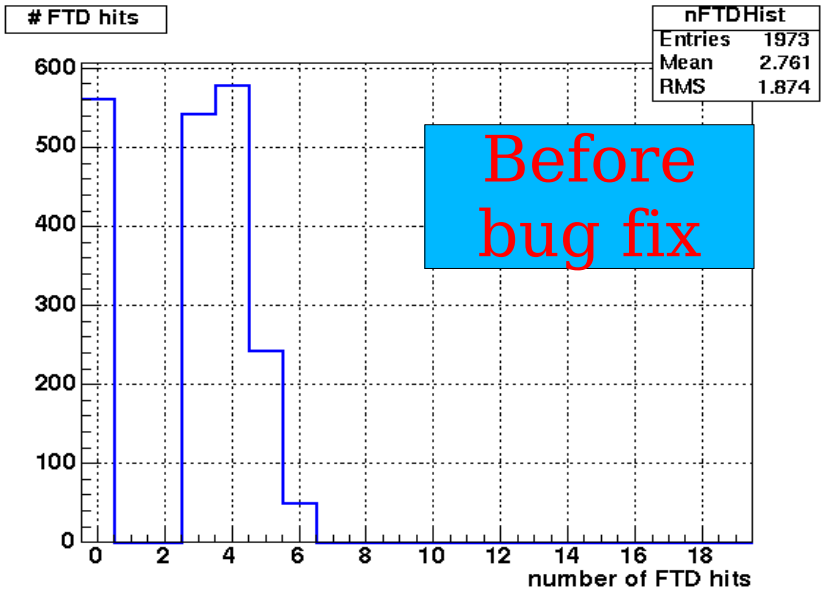
- Problems reported last week
  - Missing FTD & VTX hits in the forward tracks
  - Poor p_T resolution for central tracks
- Newly detected problem : systematic shift in ϕ and d_0 for TPC tracks ⇒ bias in p_T reconstruction of LDC tracks

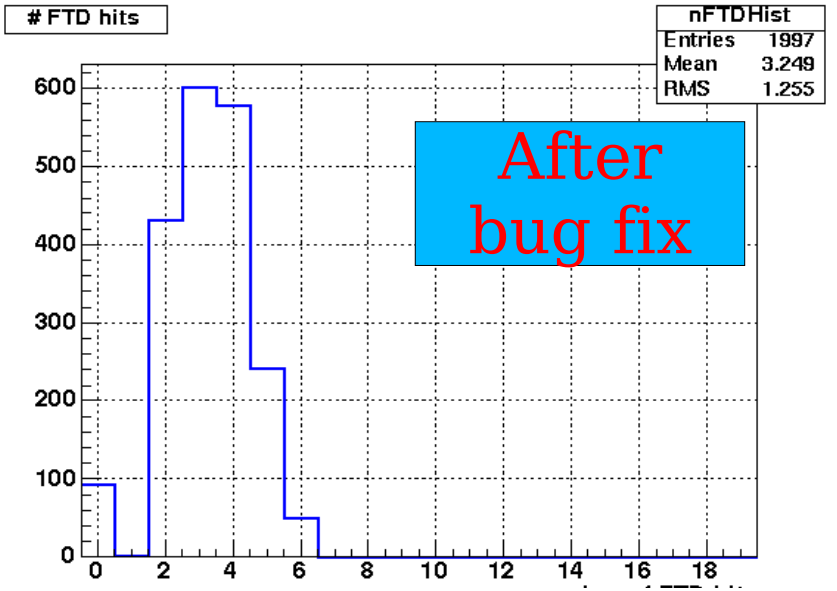
Missing FTD & VTX Hits in Forward Tracks

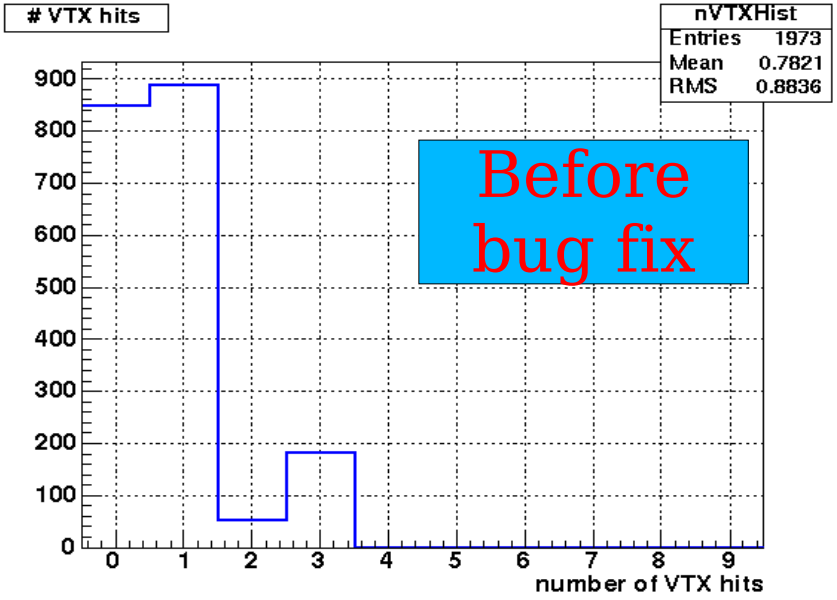
- Large fraction of forward tracks, containing only TPC hits; VTX & FTD hits are present in detectors but not found tracks
- Two bugs have been spotted in `SiliconTracking` & `FullLDCTracking` which prevented full reconstruction of Si segments and/or assignment of left-over Si hits to the found TPC tracks at $\theta \leqslant 20^{o}$
- Bugs fixed; changes committed to MarlinReco CVS Repository

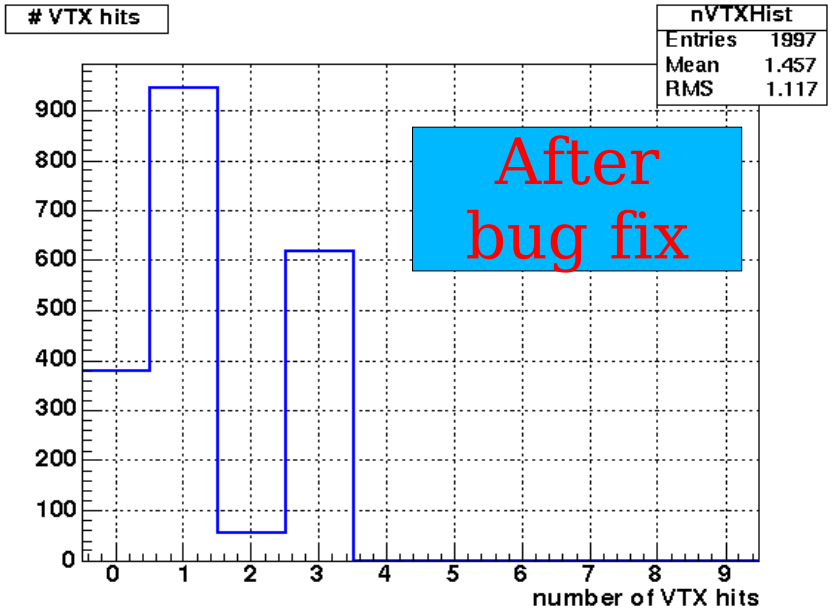
Forward Tracks
Situation before & after Bug Fix

Single muons, p=200GeV, θ=15°

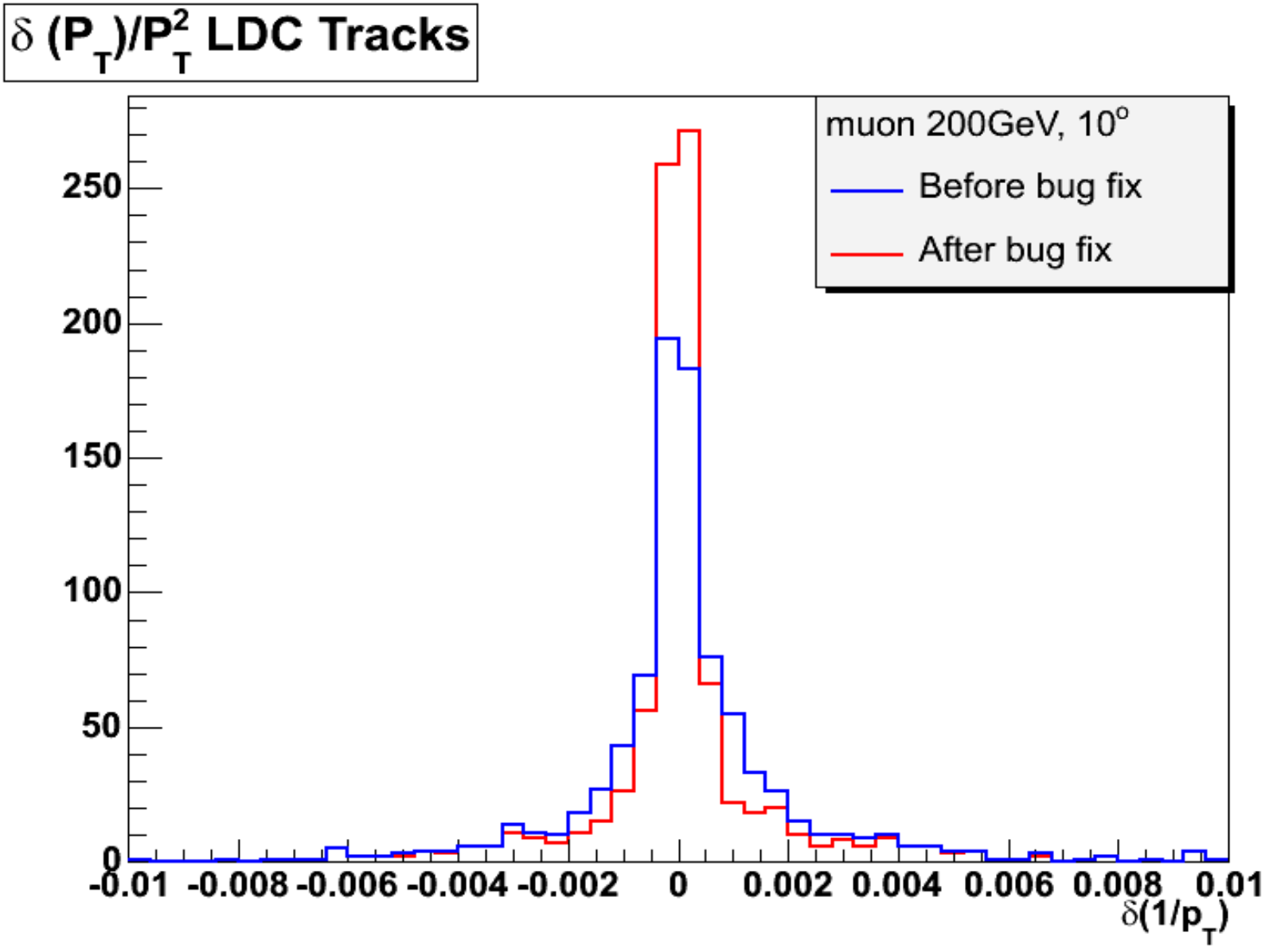






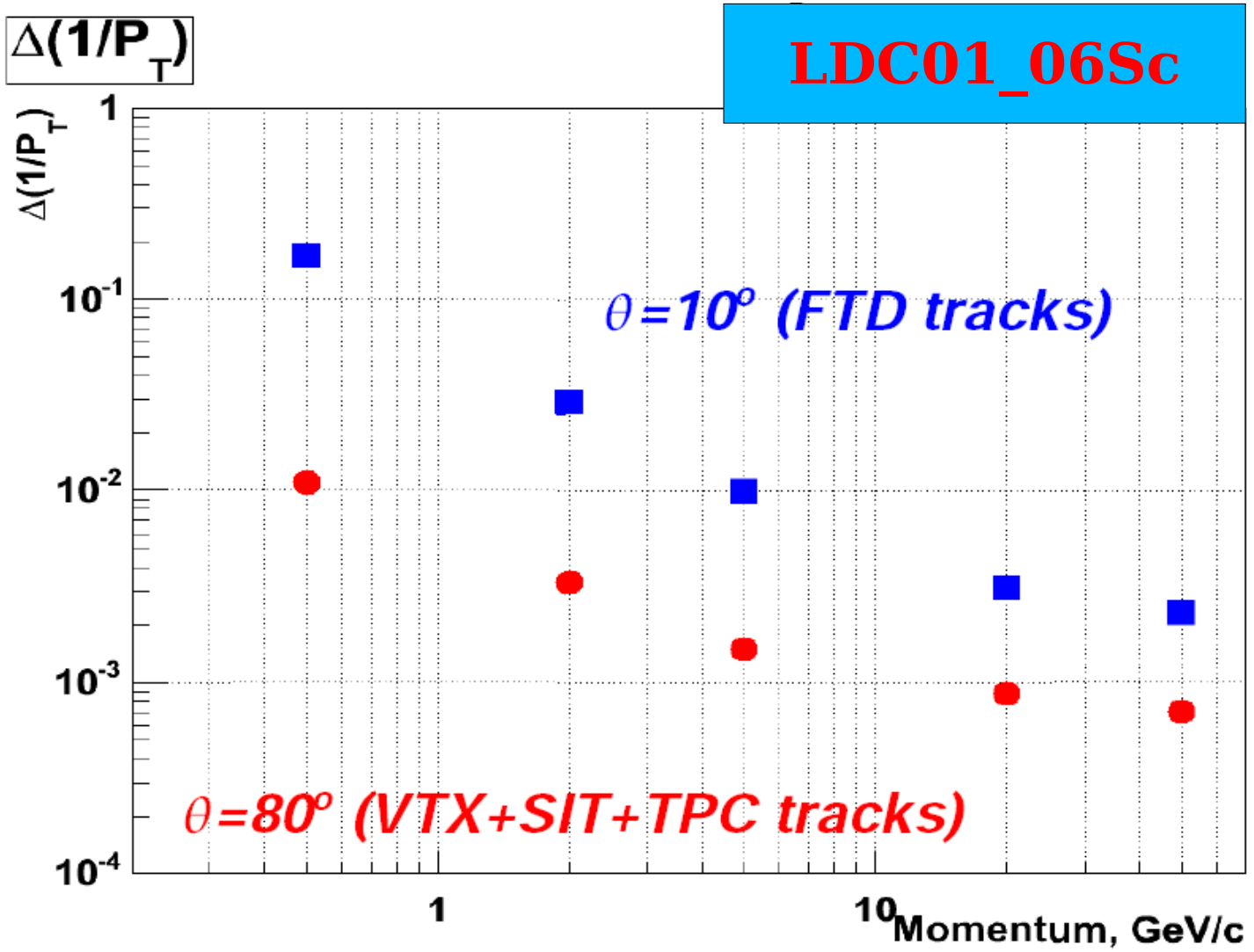


Forward Tracks : p_T Resolution



P_T Resolution for Central Tracks

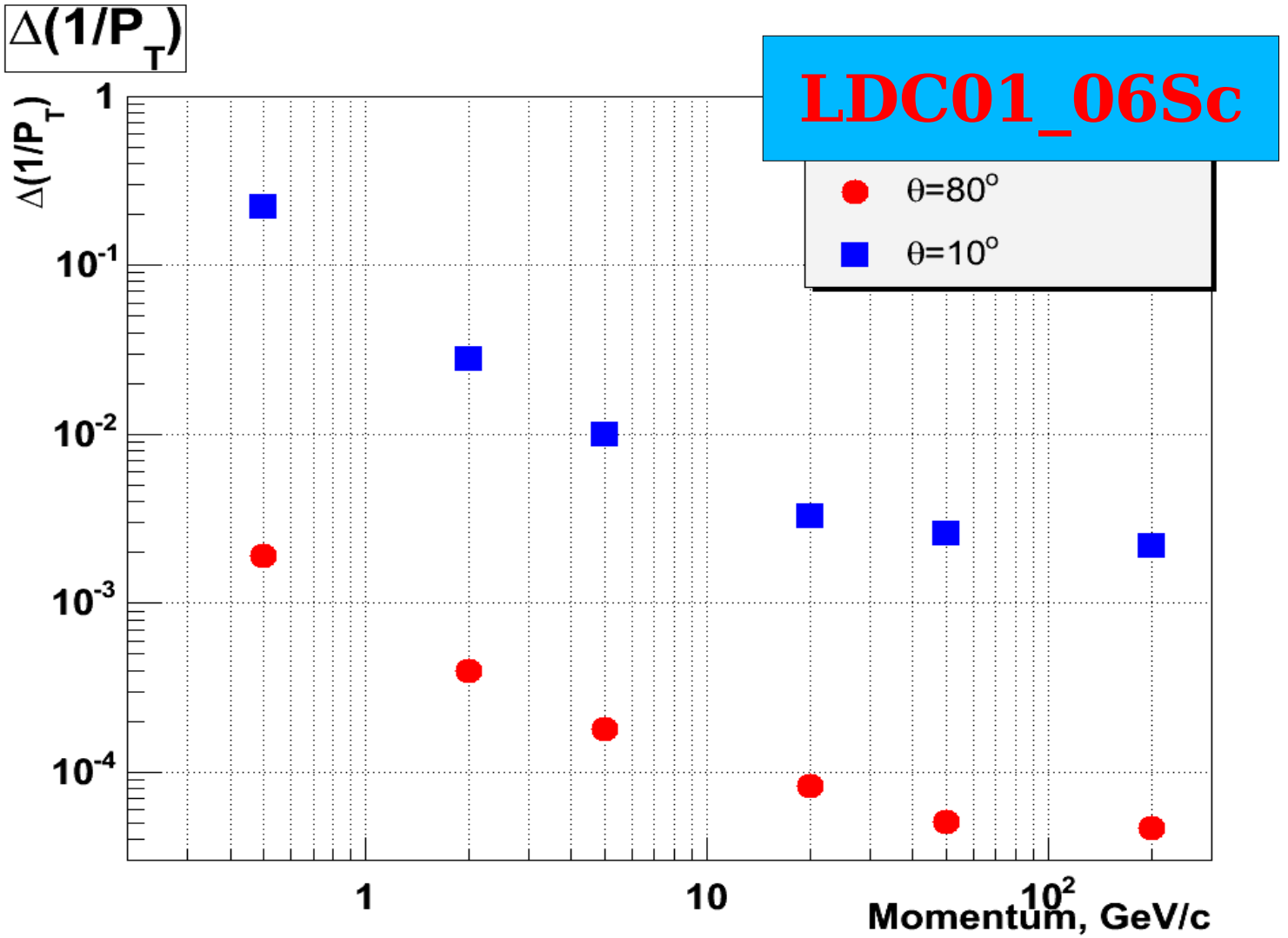
Plot shown at the previous meeting….



corresponds to **Si** track segments (**not full LDC tracks**)

P_T Resolution for Central Tracks

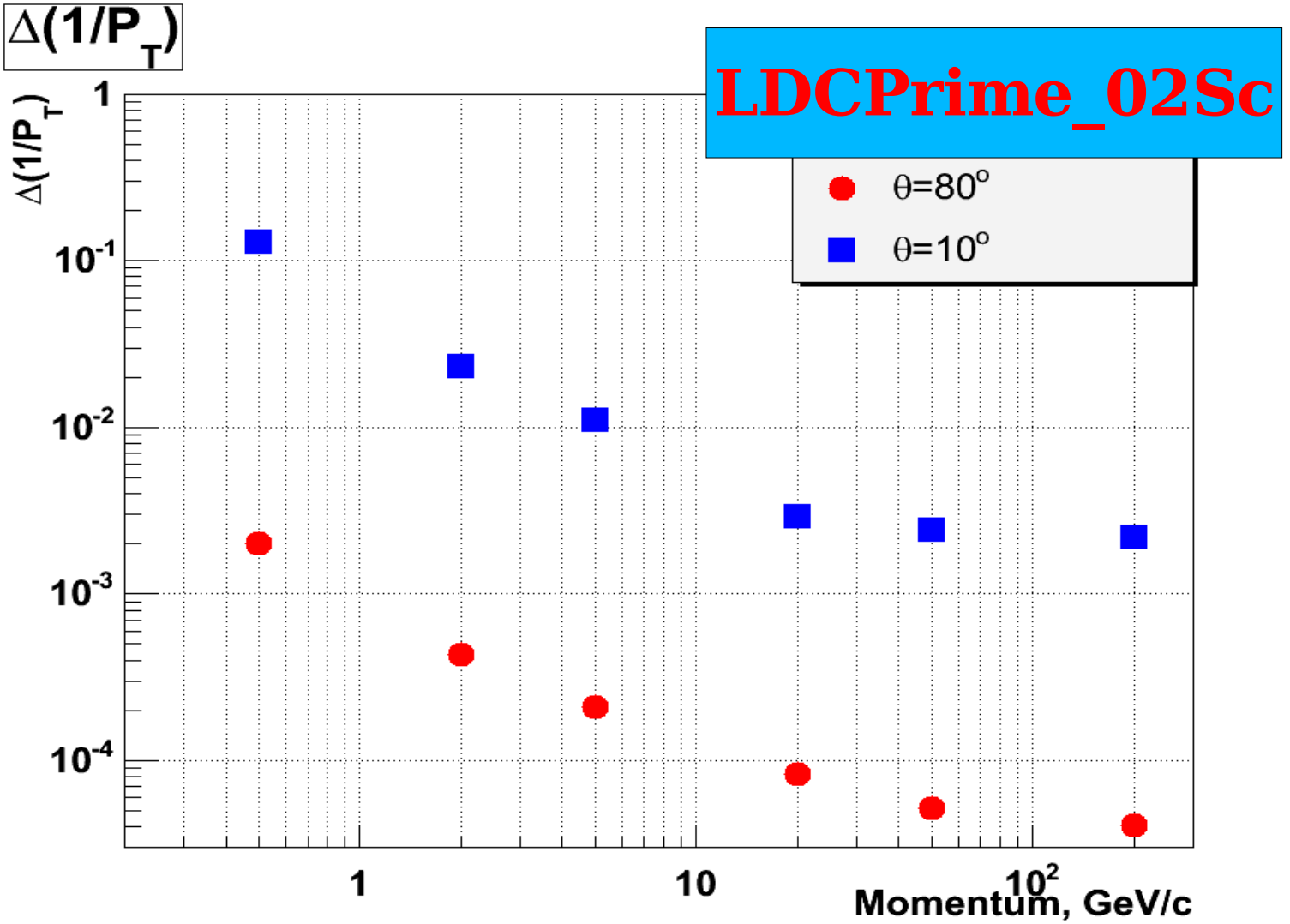
Full LDC Tracks



$\delta(1/p_T) \leqslant 5 \cdot 10^{-5}$ at p>100GeV for central tracks

P_T Resolution for Central Tracks

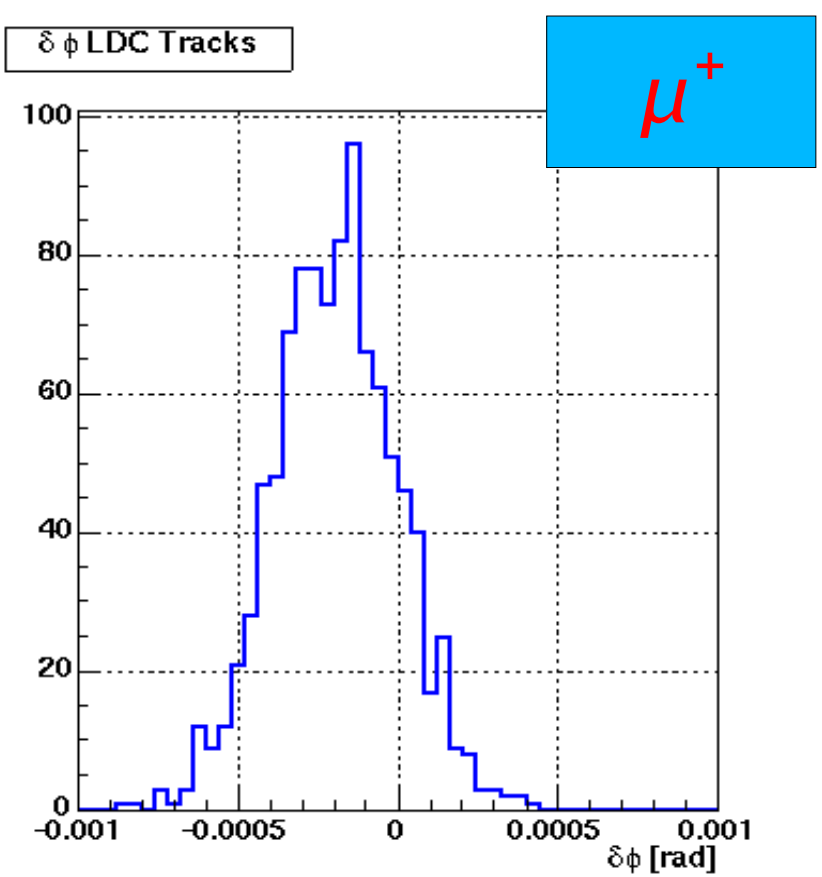
Full LDC Tracks

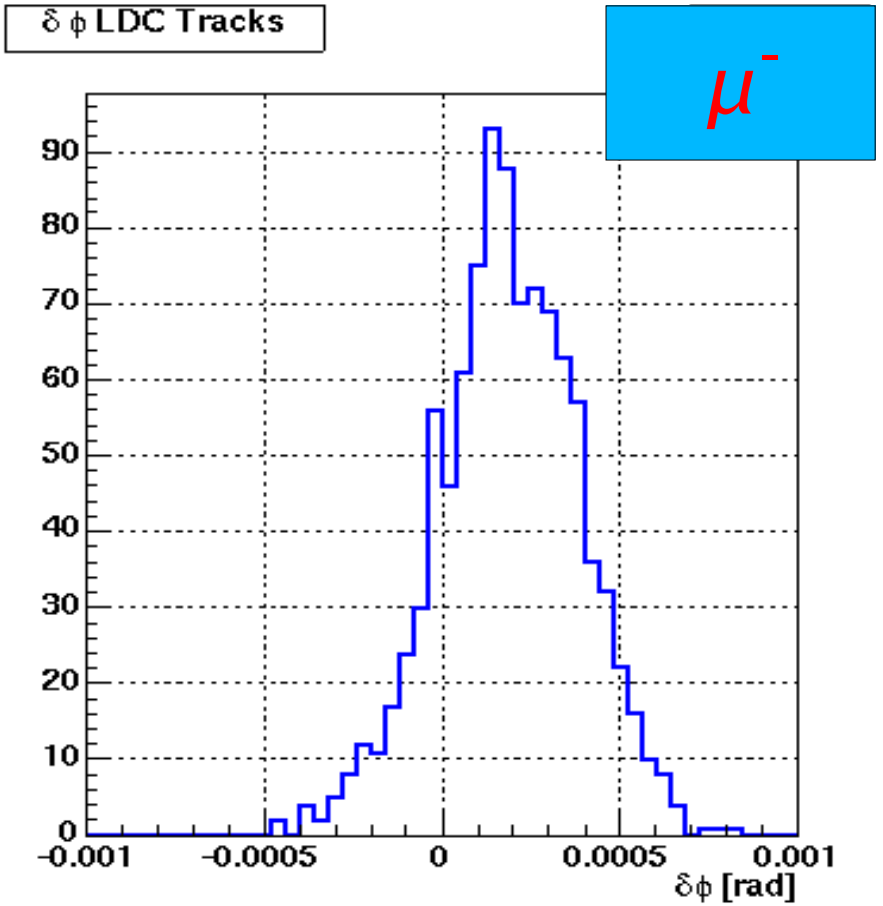


LDCPrime_02Sc model has comparable performance with LDC01_06Sc

Newly Detected Features

- Bias in the reconstructed track parameters ϕ for the TPC tracks

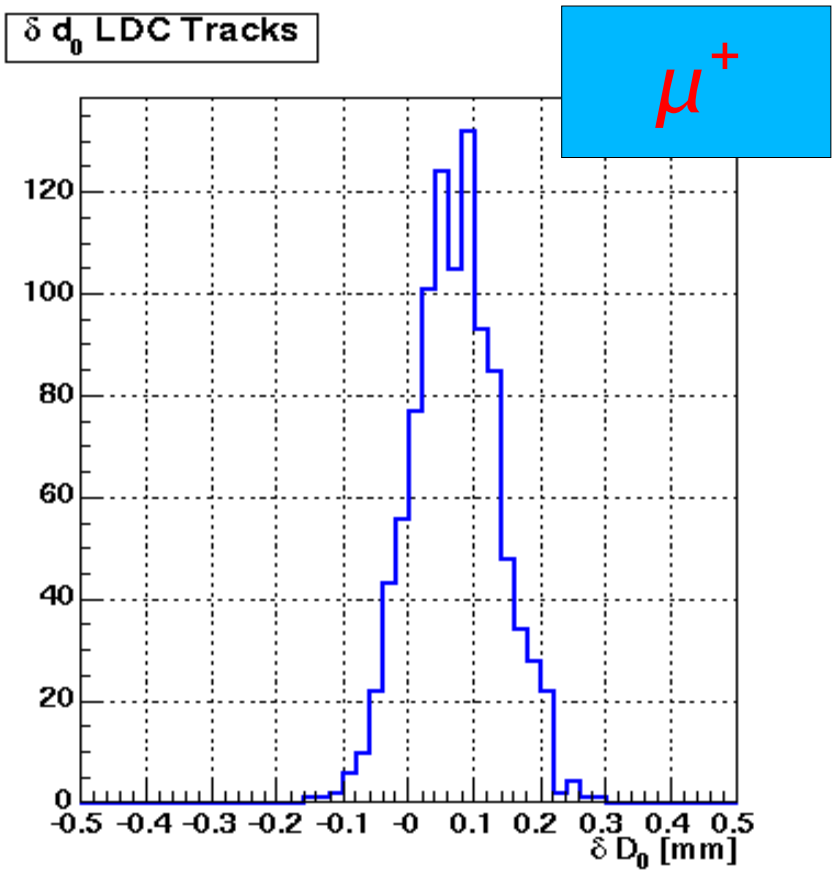


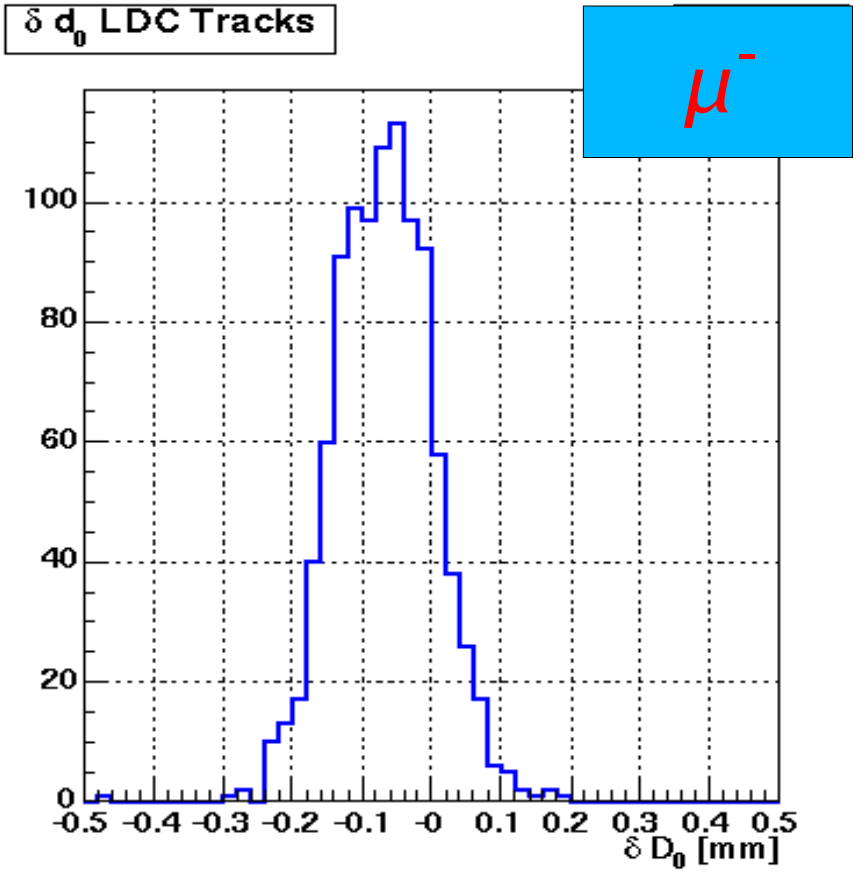


- Shifts have opposite signs for positively / negatively charged particles
- Observed in models containing new TPC driver tpc08

Newly Detected Features

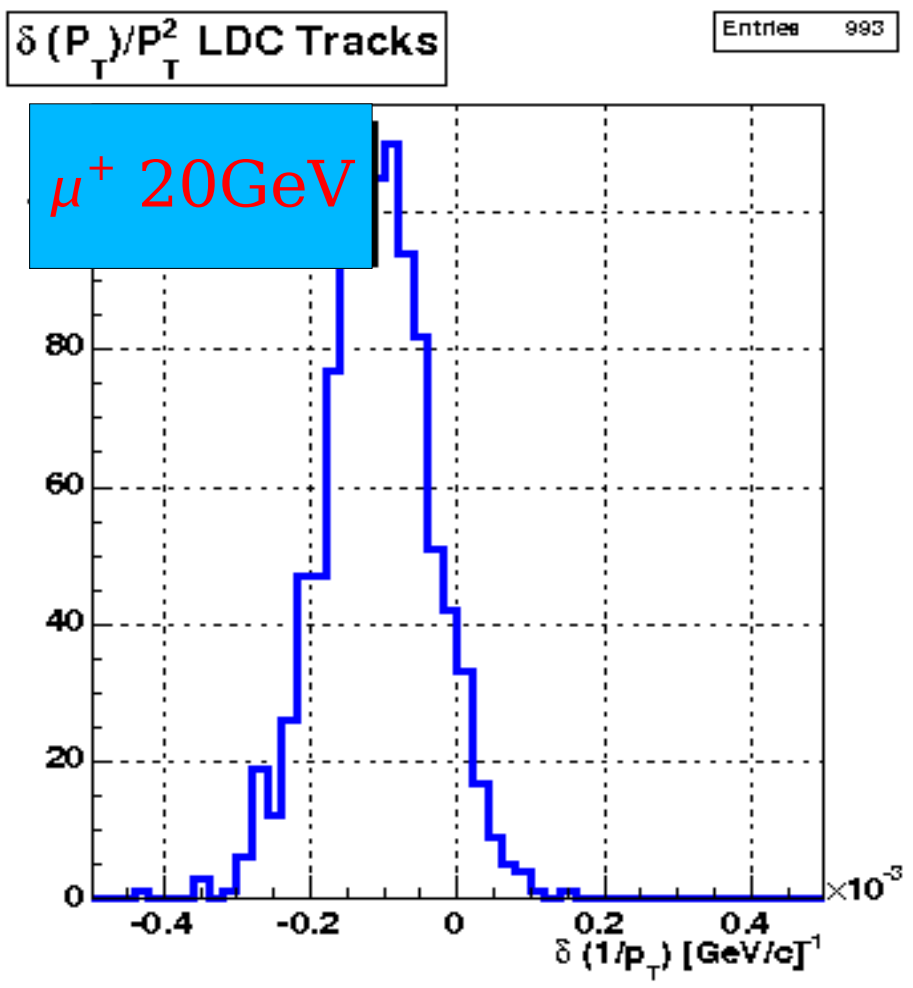
- Bias (presumably of the same origin) in the reconstructed track parameter d_0 (TPC tracks)

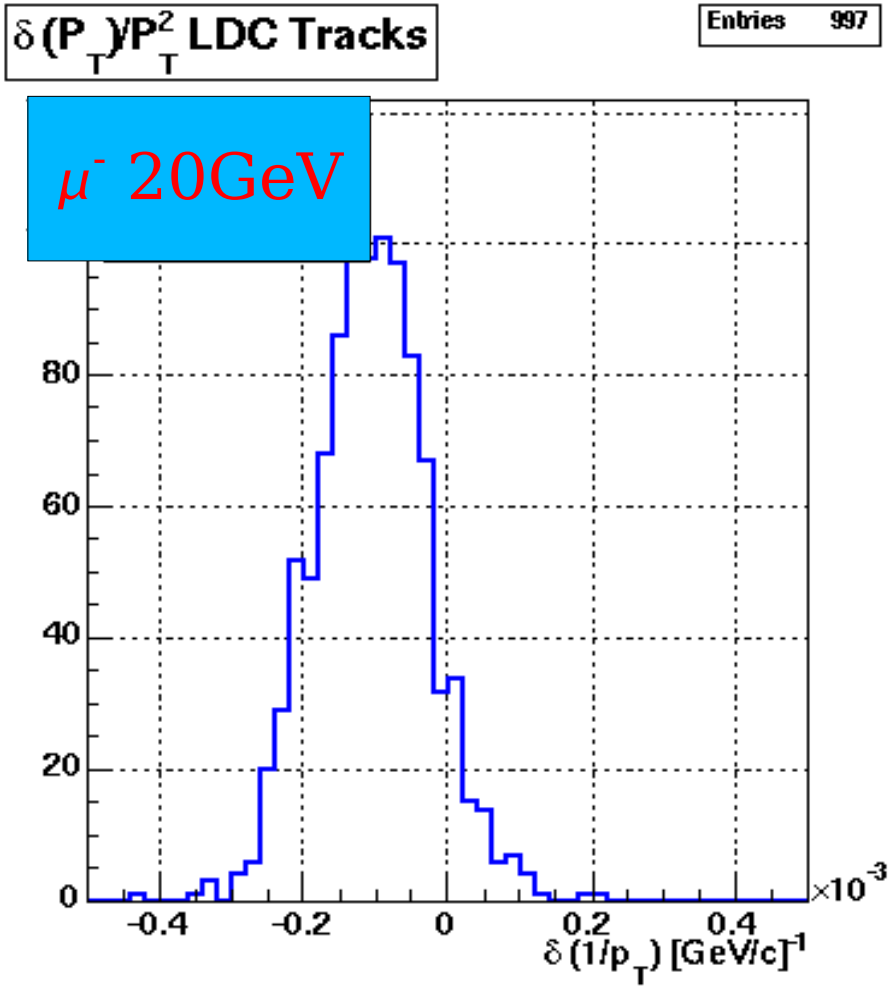




- Shifts again have opposite signs for positively / negatively charged particles

Bias in p_T for the Full LDC Tracks



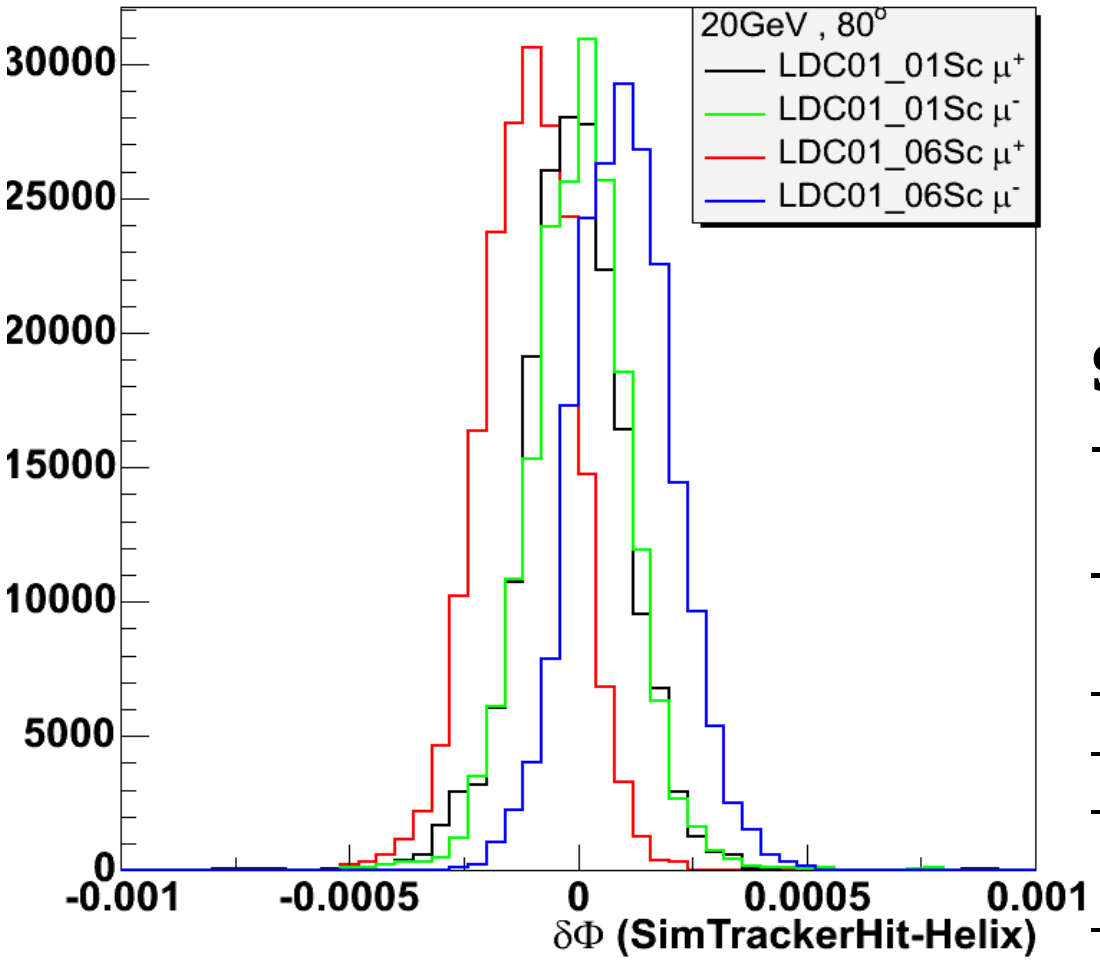


Bias in the reconstructed TPC tracks propagates to full LDC tracks

Checks at the SimTrackerHits Level

- `SimTrackerHit` positions are compared to the helix predictions
- Helix is constructed from vertex and momentum of the `MCParticle` associated with a given track
- Compared quantities
  - `SimTrackerHit` azimuth angle : $\phi = \mathrm{atan2}(y_{hit}, x_{hit})$
  - Azimuth angle of the track intersection point with the cylinder defined by the radius of the hit $r = \mathrm{sqrt}(x^2_{hit} + y^2_{hit})$

Checks at the SimTrackerHit level



Bias is present already at the SimTrackerHit level!

The reason still unclear

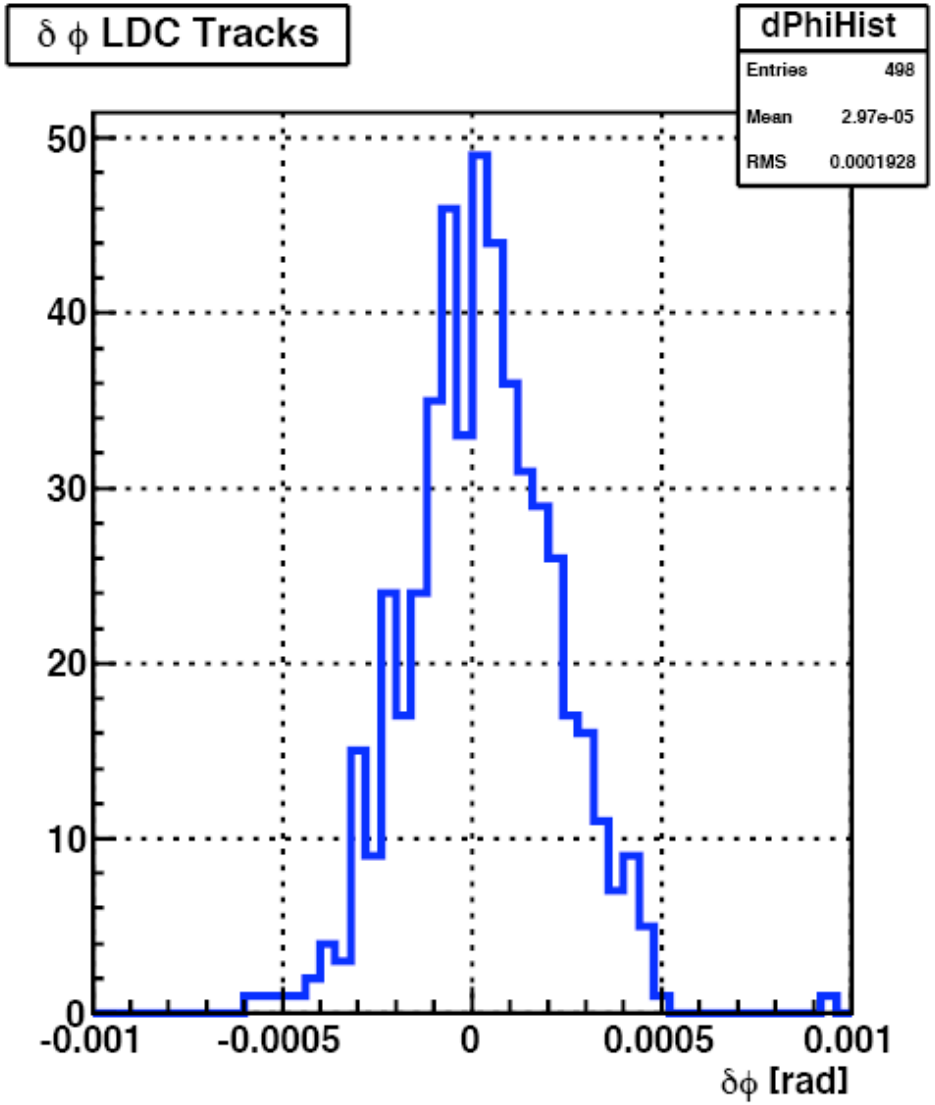
Solution by Steve:

- start with “healthy” driver TPC02.cc (as used in LDC01Sc)
- implement the logic of TPC06.cc in TPC02.cc
- use TPCSD02.cc to create hits
- sequentially add materials
- find out at which step bias is reproduced
- if no bias reproduced, include resulting TPC driver in the new Mokka models

“Hybrid” TPC driver

- “Hybrid” TPC driver
  - old implementation of scaling geometry based on TPCC02.cc
  - new sensitive detector driver, repeating the logic of TPC06.cc
- No bias is found in TPC track reconstruction

⇒ light is seen at the end of the tunnel



Summary

- Extensive tests of the new Mokka models with the LDC Tracking package are performed
- Many problems, initially encountered, are solved
- The only remaining problem is biased reconstruction of TPC tracks. Solution expected end of this week.
- Tests helped to debug Tracking code
  - Improved and debugged versions of SiliconTracking and FullLDCTracking are committed to MarlinReco CVS repository