B-Field Problems

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ILD Optimisation Meeting

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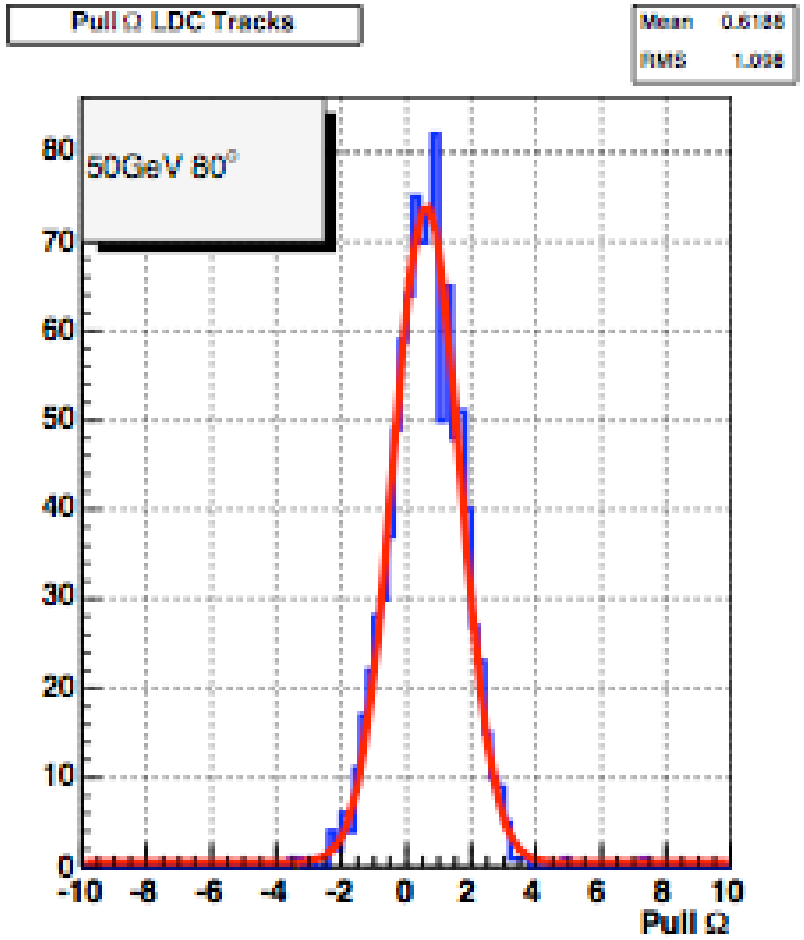
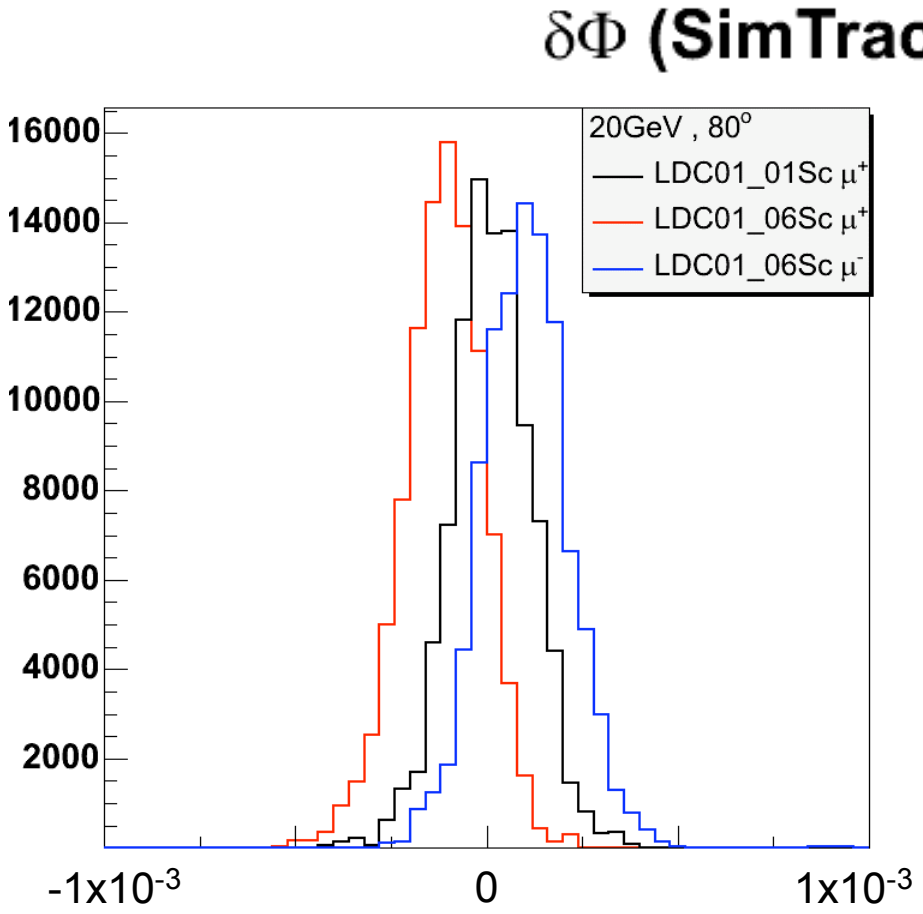
Introduction

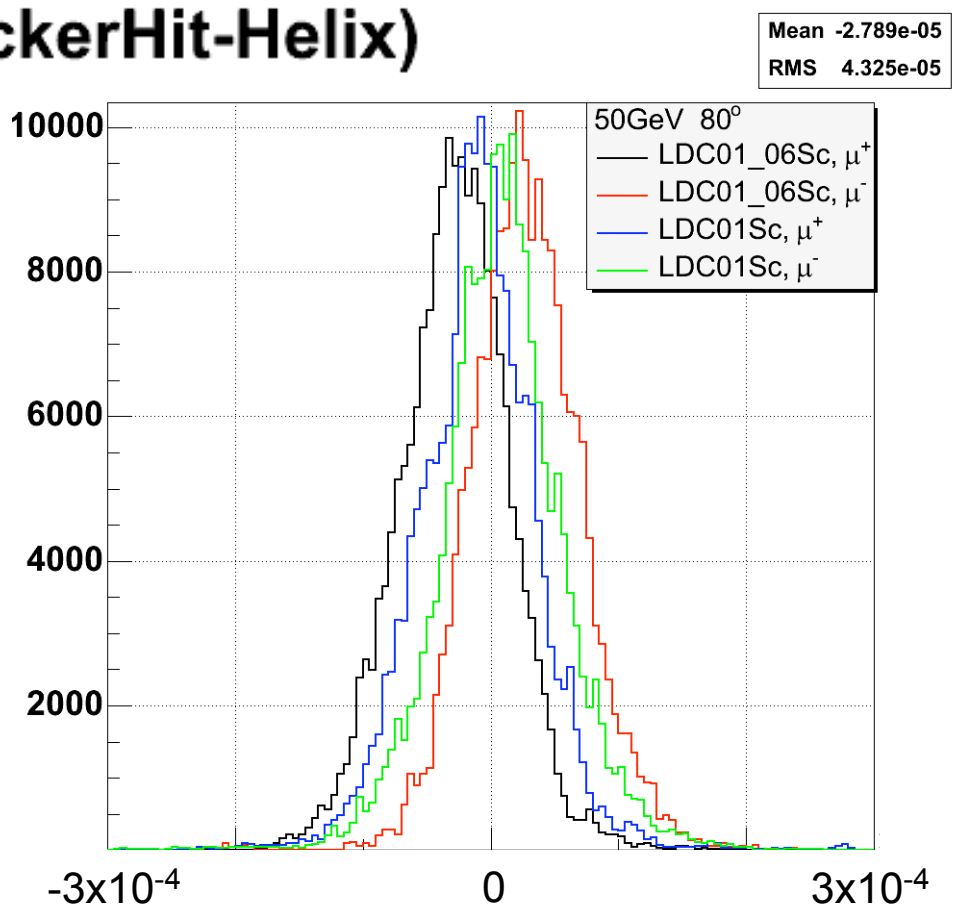
- Observations of drift in the Omega Pulls distribution for high momentum tracks
- Similar behaviour as that caused by the 10mm value for the MaxStepLength at lower momentum -- a significant difference between the helix model from MC truth and the track trajectory


Pull Ω LDC Tracks
Mean 0.6185
RMS 1.038
50GeV 80°
80
70
60
50
40
30
20
10
0
-10 -8 -6 -4 -2 0 2 4 6 8 10
Pull Ω

Helix Track Differences



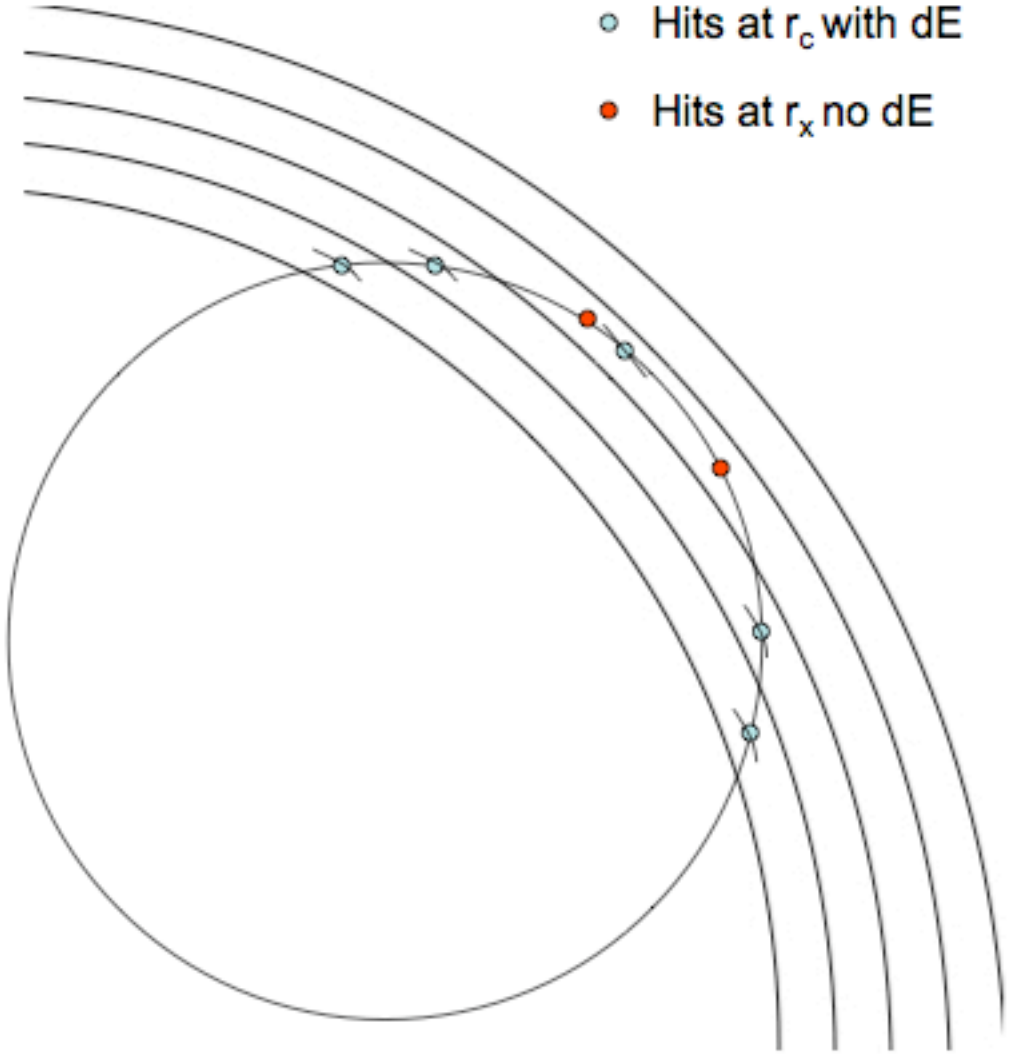
TPCMaxStepLength = 10mm



Twice the No. of PadRing Volumes in LDC01_06Sc
TPCMaxStepLength = 10000mm

TPC06.cc

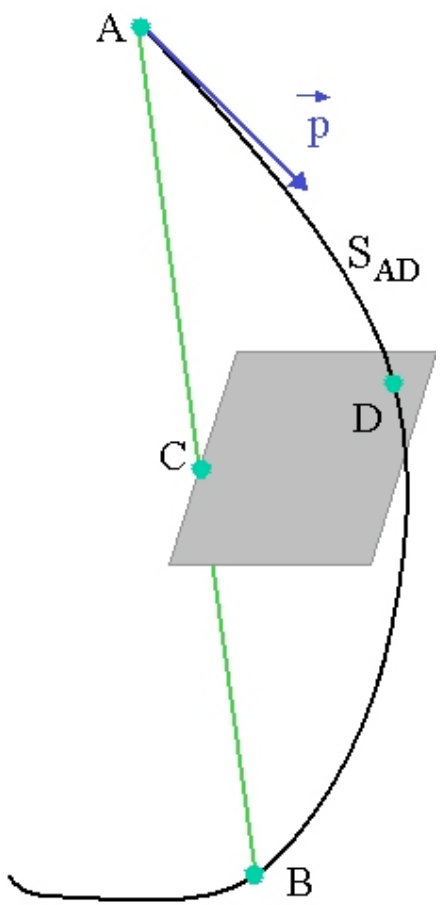
- Pad-rings are divided into two half pad-rings
- This creates a G4 logical volume boundary within the pad-ring at the central radius
- Any track crossing this boundary will have a step ending on it
- This point is used as the coordinate of the hit
- All other steps within this pad-ring have their dE added to this hit



Charged Particle Propagation in B-Field - G4

From Geant 4 Application Developers Guide

The distance between the calculated chord intersection point C and a computed curve point D is used to determine whether C is an accurate representation of the intersection of the curved path ADB with a volume boundary. Here CD is probably too large, and a new intersection on the chord AD should be calculated.



Charged Particle Propagation in B-Field - G4

From Geant 4 Application Developers Guide

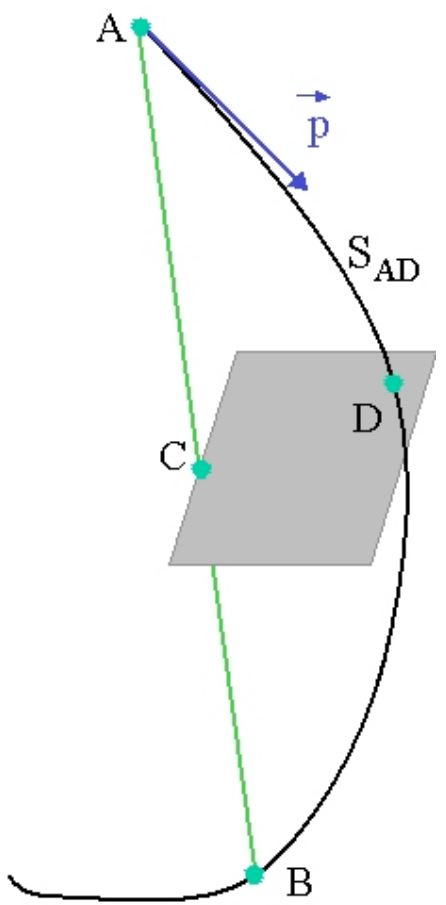
As such, the intersection point is always on the 'inside' of the curve.

CD is checked against **delta intersection** which should be set by the field manager e.g. :

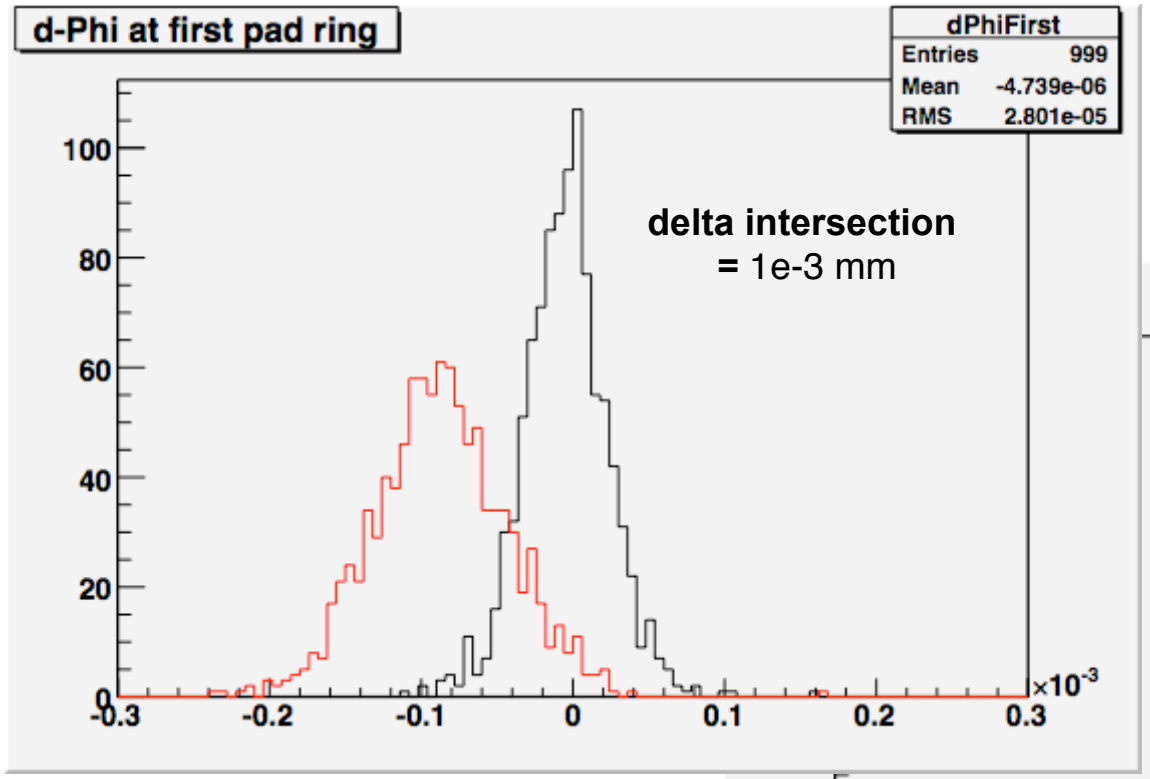
```
fieldMgr->SetDeltaIntersection(1e-5 * mm);
```

The default value is too large:

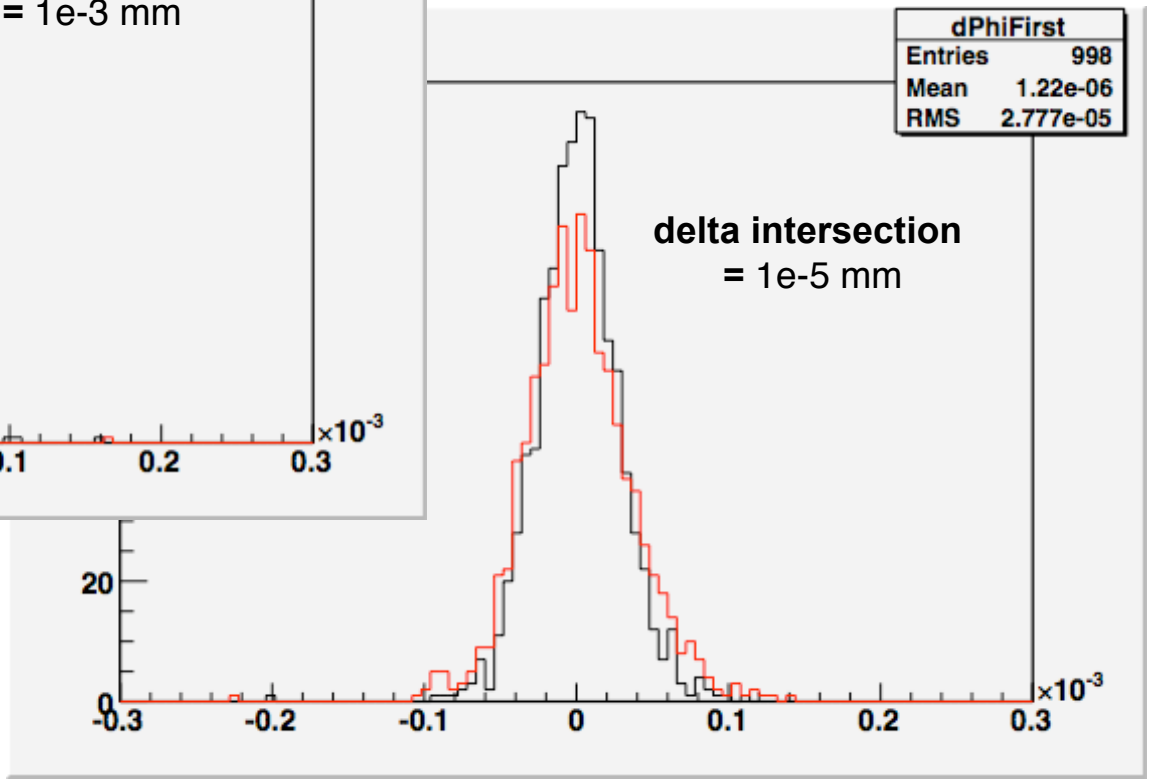
"The bias addressed by *delta intersection* is clearly correlated with potential systematic errors in the momentum of reconstructed tracks. Thus very strict limits on the intersection parameter should be used in tracking detectors or wherever the intersections are used to reconstruct a track's momentum."



Fixed ?

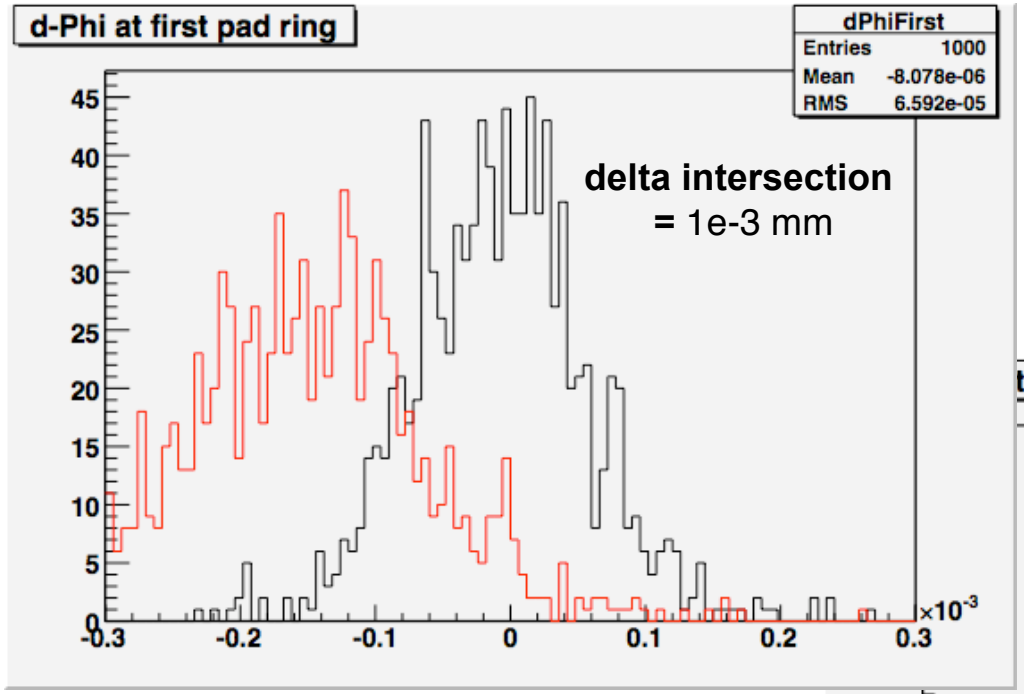


LDC01_06Sc_p02
50 GeV mu+
85 degrees

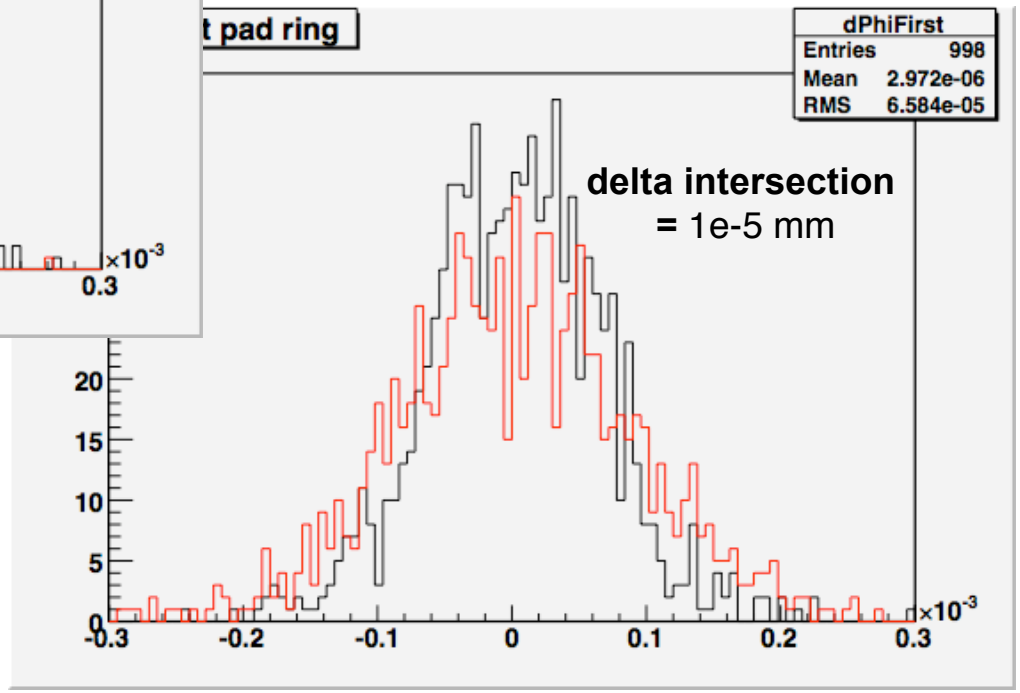


First Pad Ring
Last Pad Ring

With TPCMaxStepLength = 10mm



LDC01_06Sc_p02
20 GeV mu+
85 degrees



First Pad Ring
Last Pad Ring

Conclusion

- Change defaults values in Field00.cc:
  - fieldMgr->SetDeltaIntersection(1e-5 * mm);
  - fieldMgr->SetDeltaOneStep(1e-4 * mm);
- Reset TPCMaxStepLength back to 10mm
  - this will bring back the space points for curlers
- Check impact on performance and tune precision values accordingly:
  - for 5 Z->ddbar @500GeV events
    - 6min 40s for Default Values
    - 7min 12s for New Values