Towards an Internal TRT Alignment

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Outline:

- TRT Resolution
- Residuals Vs R
- The Case of the Anomalous Phi Structure

* All results shown are from run 91800 and reconstruction in rel 14.5.0

TRT Resolution

- Compare TRT – only tracks to Combined Tracks

TRT Only: > 45 TRT hits

d0 < 100 mm (inside outer pixel layer)

Combined: > 45 TRT hits

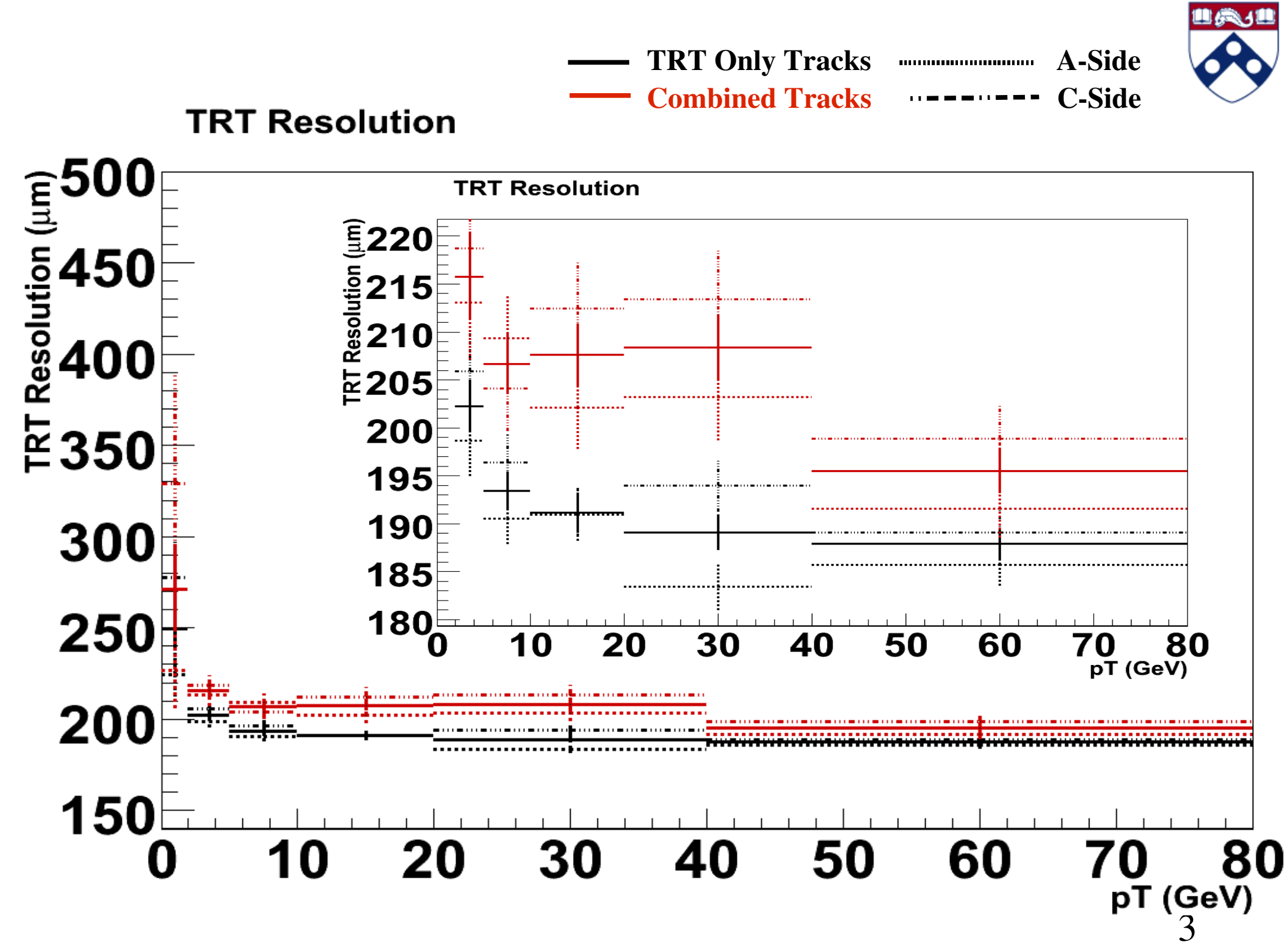
> 9 SCT hits

> 2 Pixel hits

- Fit TRT Unbiased Residual Distribution (-0.3 – 0.3) with Gaussian

Gaussian sigma and its error is plotted

- After L1 TRT wrt Si alignment


TRT Only Tracks
Combined Tracks
A-Side
C-Side
TRT Resolution
TRT Resolution (μm)
pT (GeV)
TRT Resolution
TRT Resolution (μm)
pT (GeV)

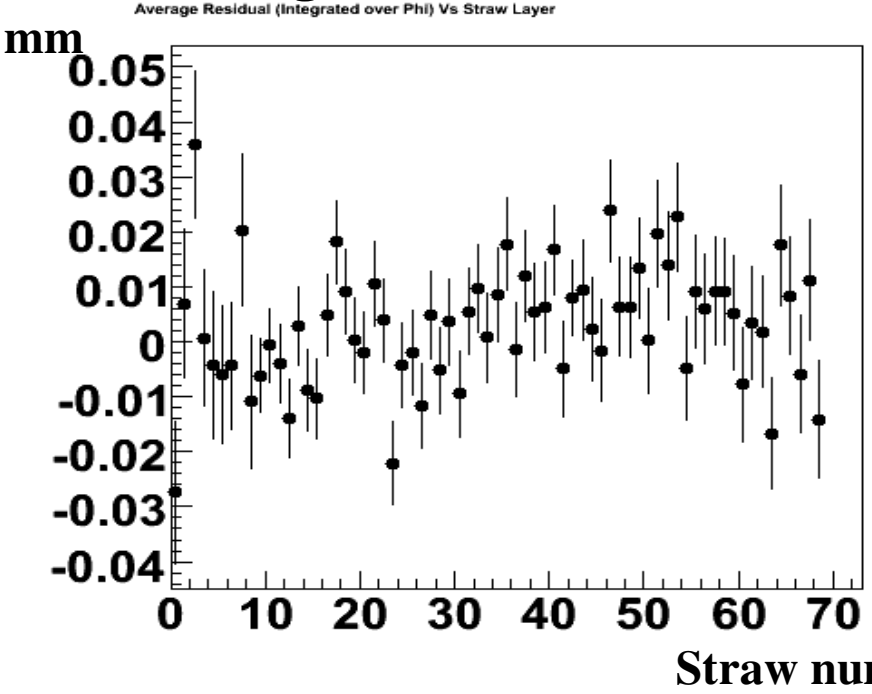
Comments

- Worse C-Side resolution not a product of differing pT distributions
- Combined tracks worsen resolution.
    - residual TRT L1 misalignment ?
    - L2 TRT misalignment at the scale of the Si resolution ?
    - Si internal misalignment ?
    - material corrections at scale of Si resolution ?

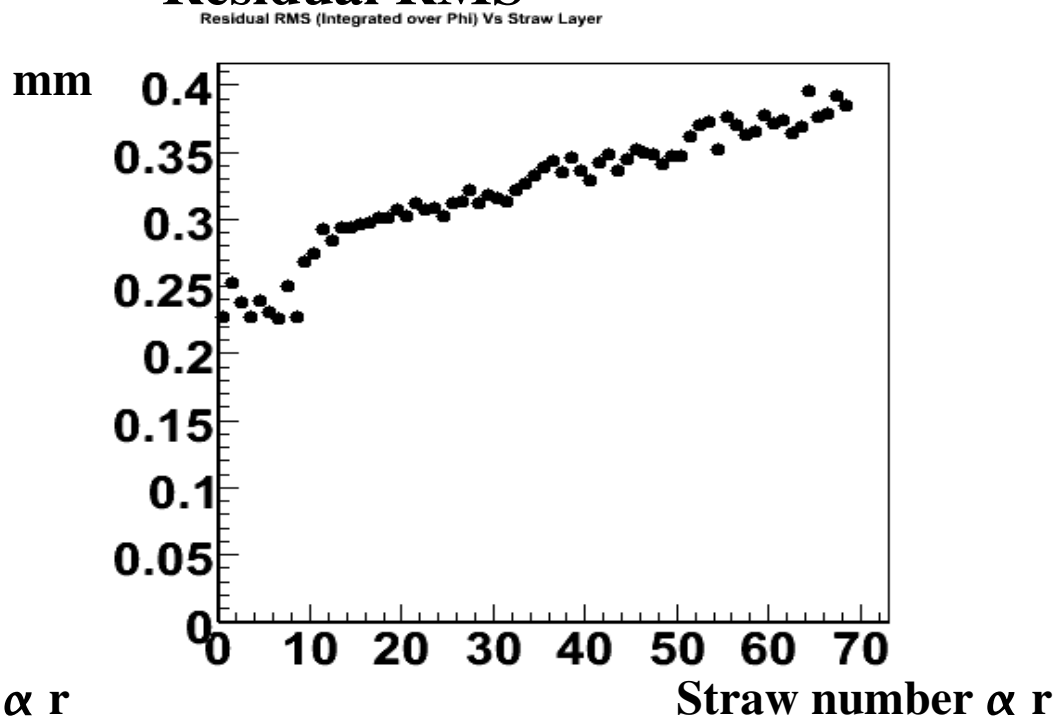
Residual RMS Vs R

- Find that for Combined Tracks, Resolution Degrades with r
- Following plots have residual RMS not a fit to the peak

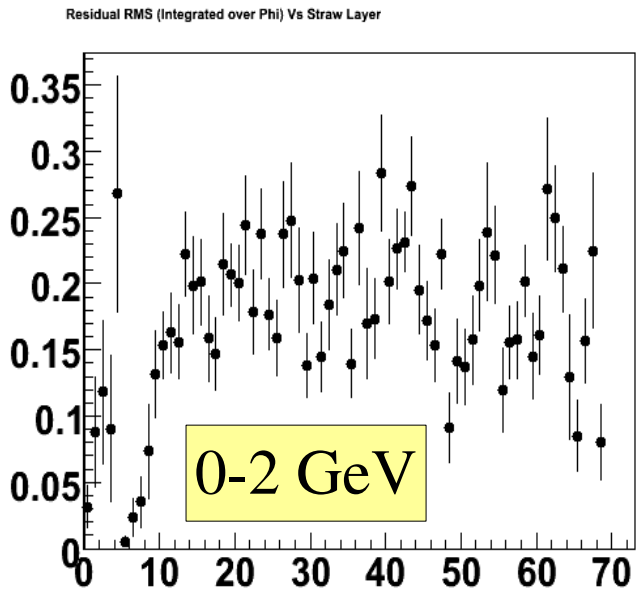
Average Residual

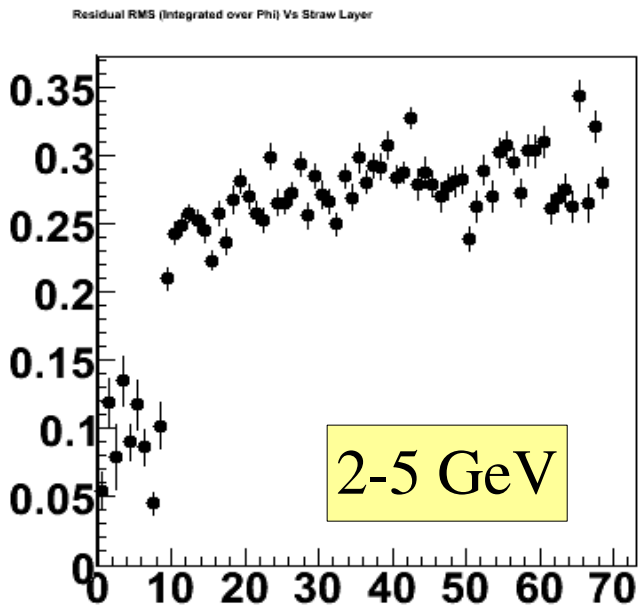


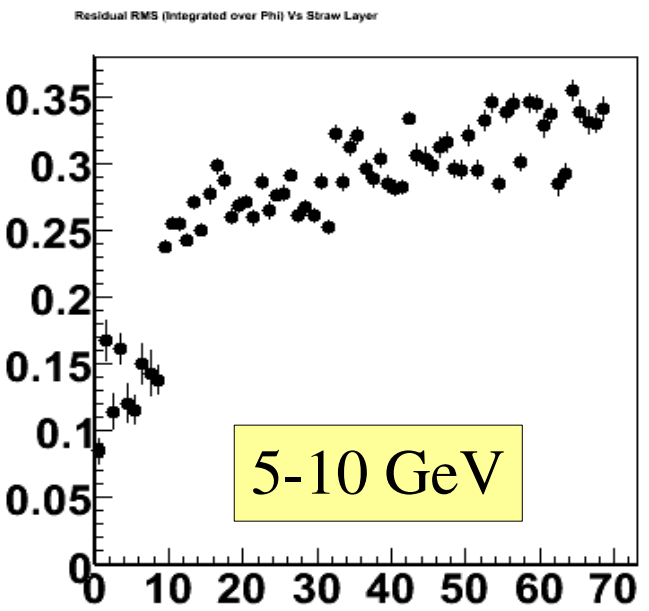
Residual RMS

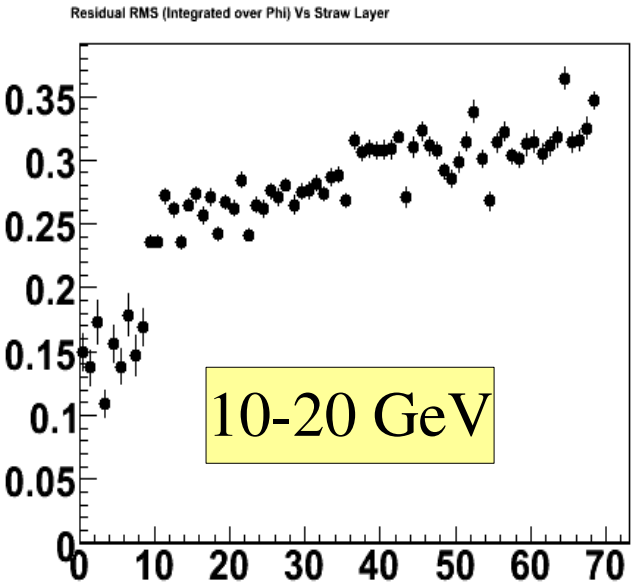


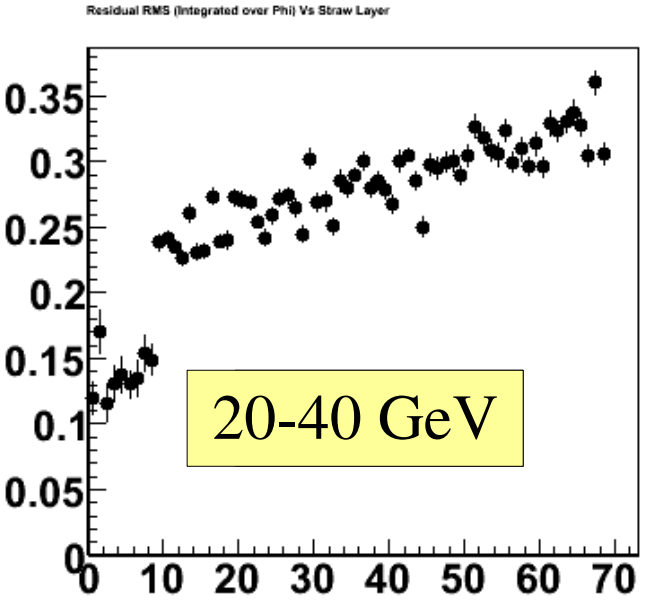
Residual RMS vs R

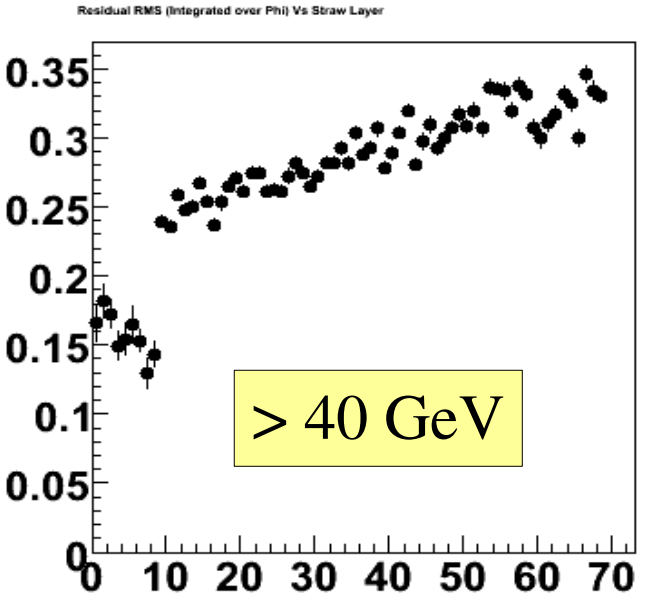




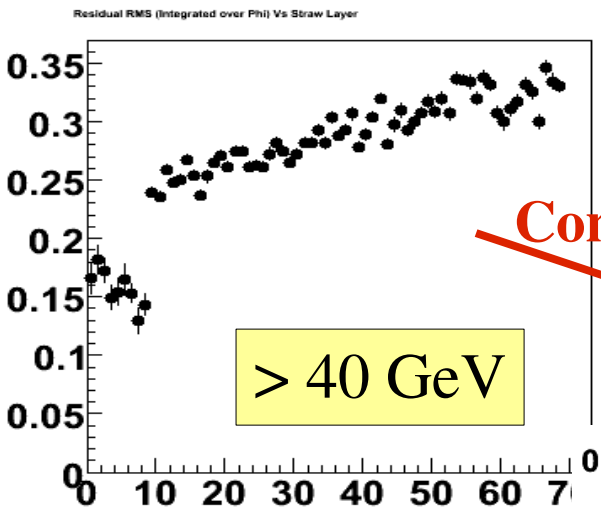






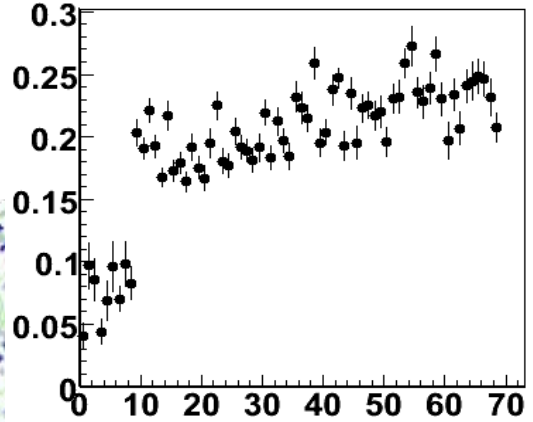


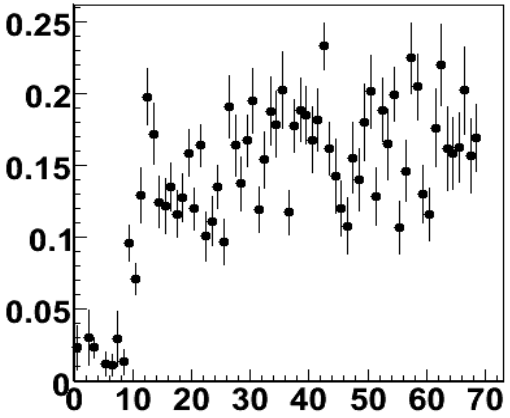
Residual RMS vs R

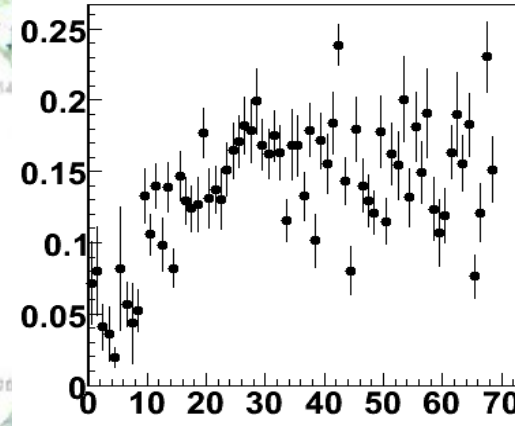


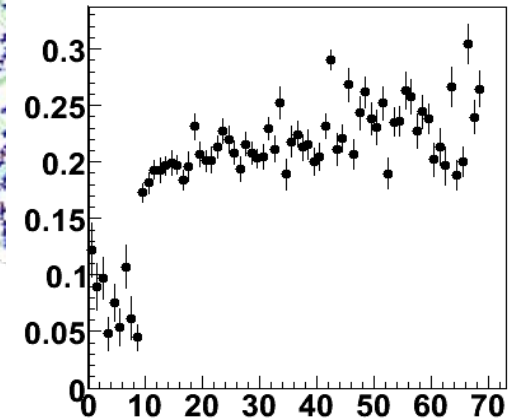
> 40 GeV

Components







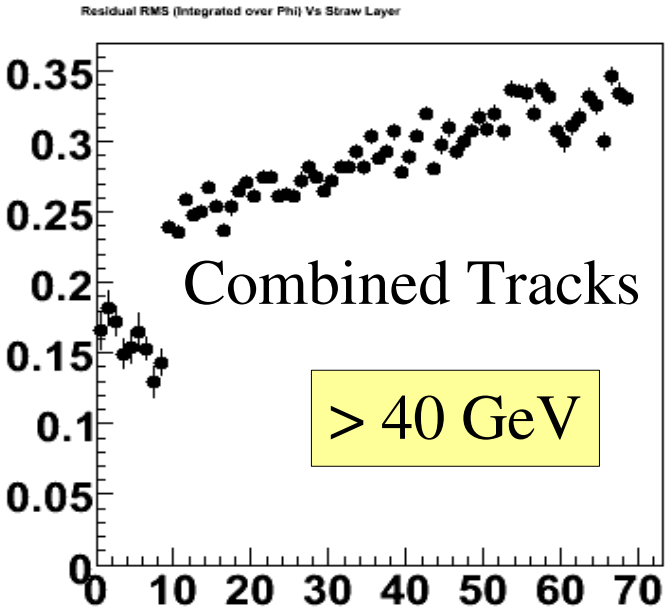


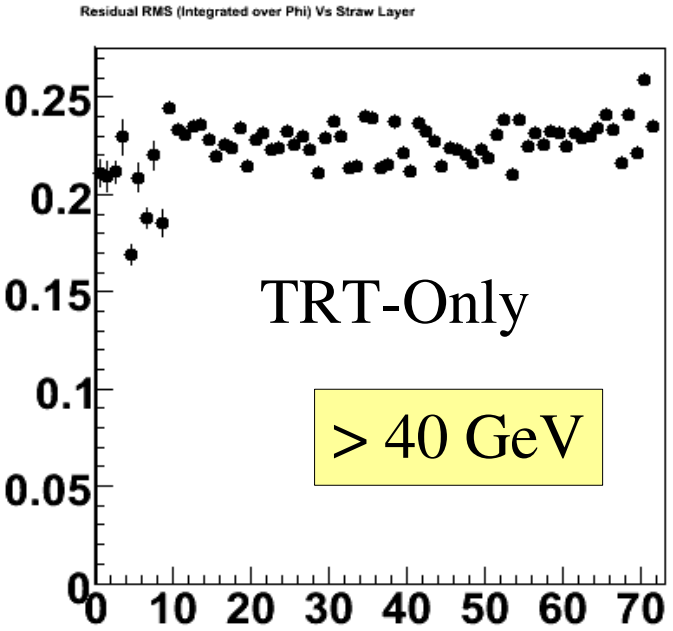
Residual RMS vs R

Rotation of TRT wrt Si ?
- Would expect average residual to also depend on r

Problem with material effects ?
- expect discrepancy mainly in lower modules

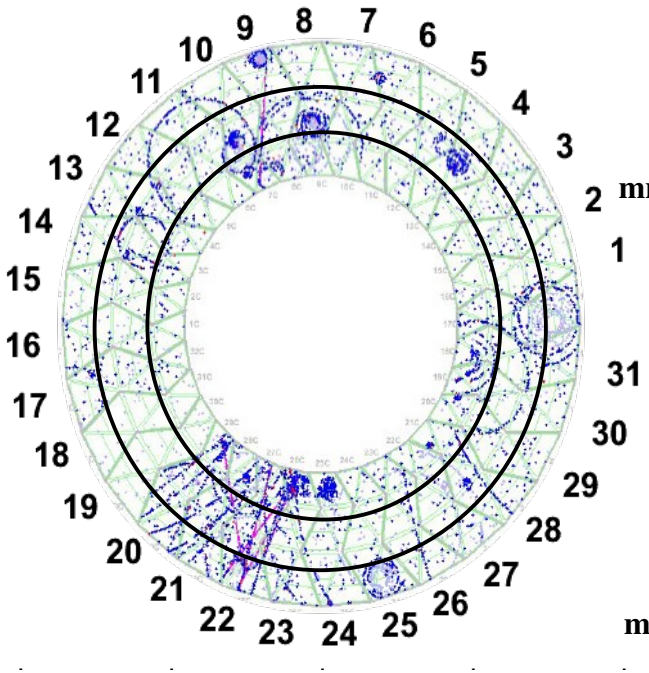
Not present in TRT only tracks.

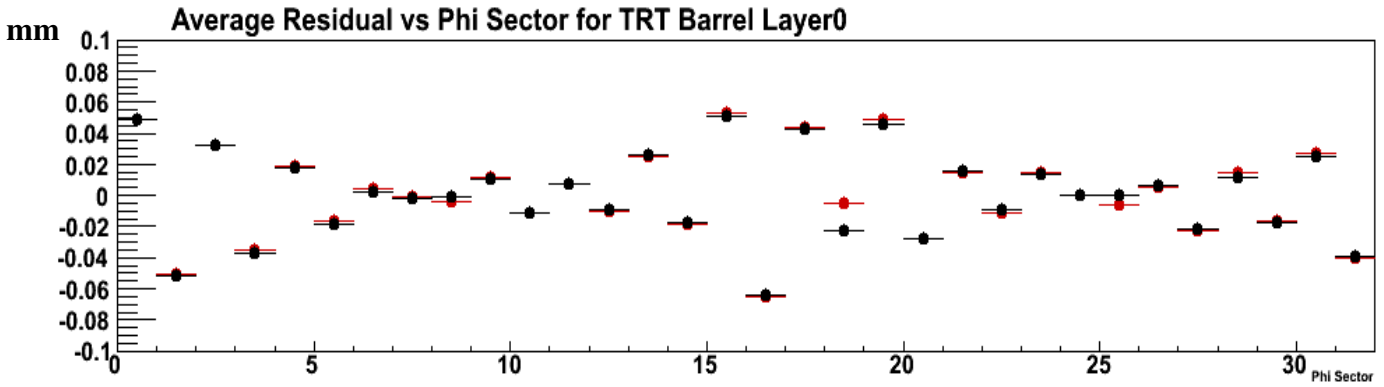


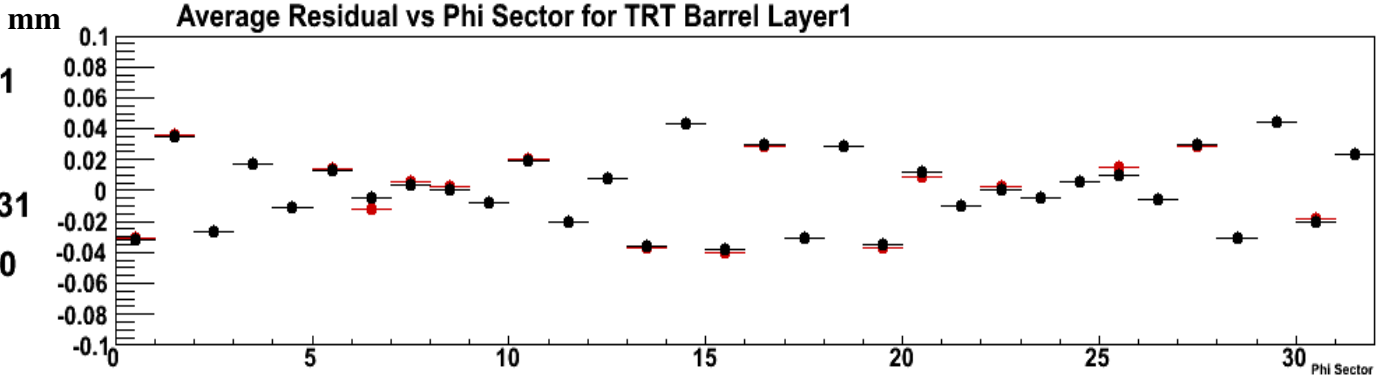


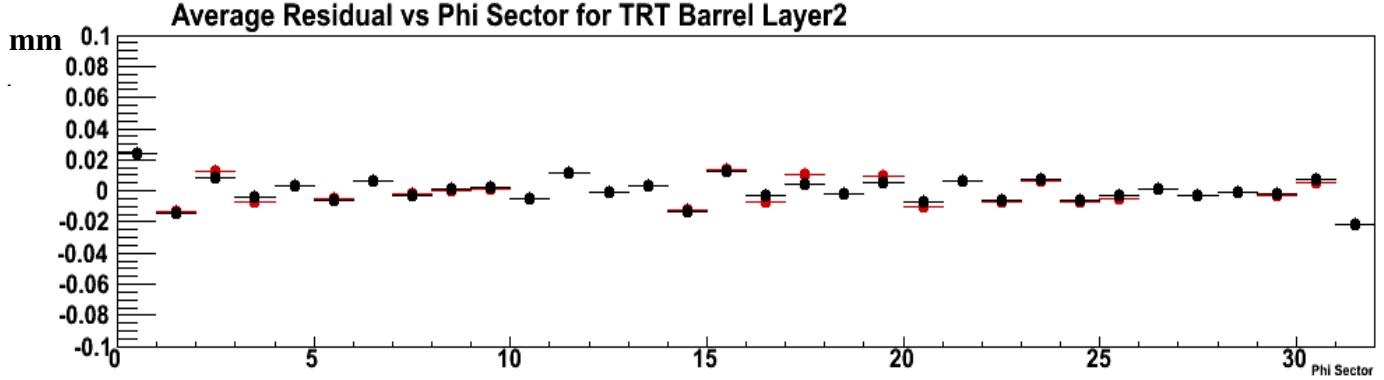
TRT Phi Residual Structure.

- After L1 Alignment
- After preliminary L2 Alignment



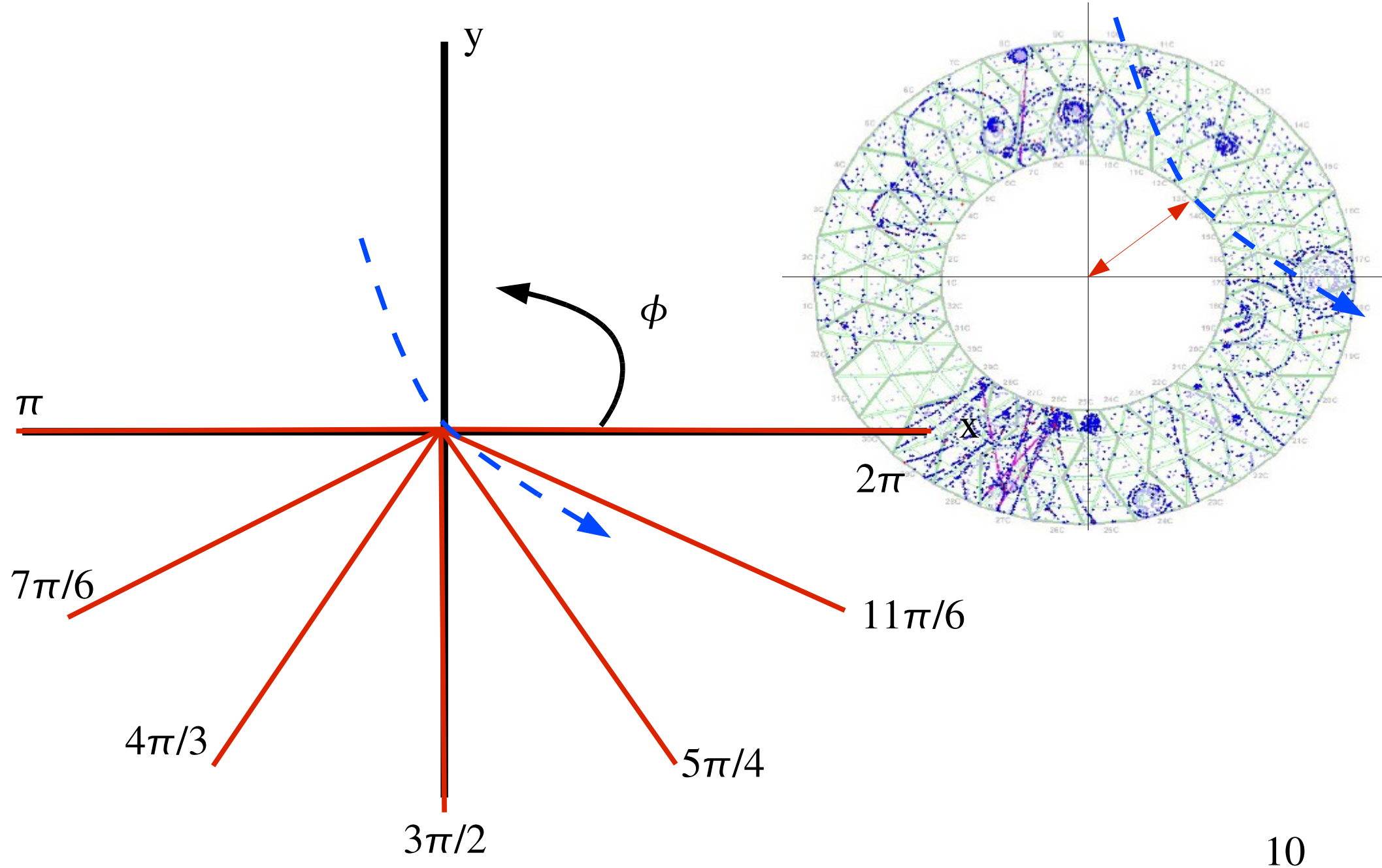




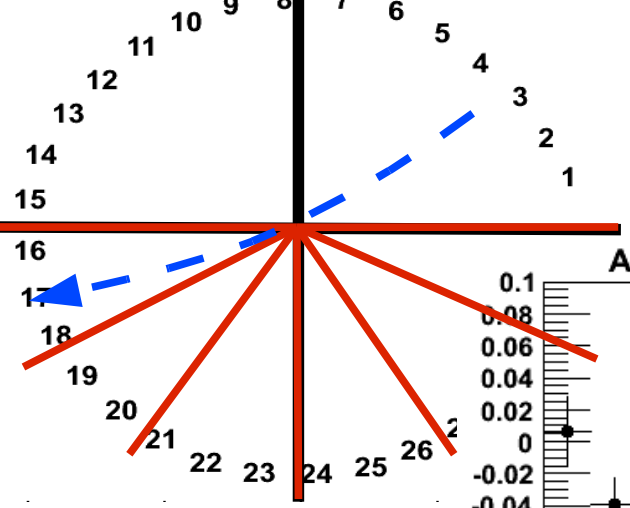


Track Selection:
TRT-only tracks (CTB)
> 30 TRT hits
> 2 GeV

Definition of Phi0



Phi0: Pi - 7Pi/6


1
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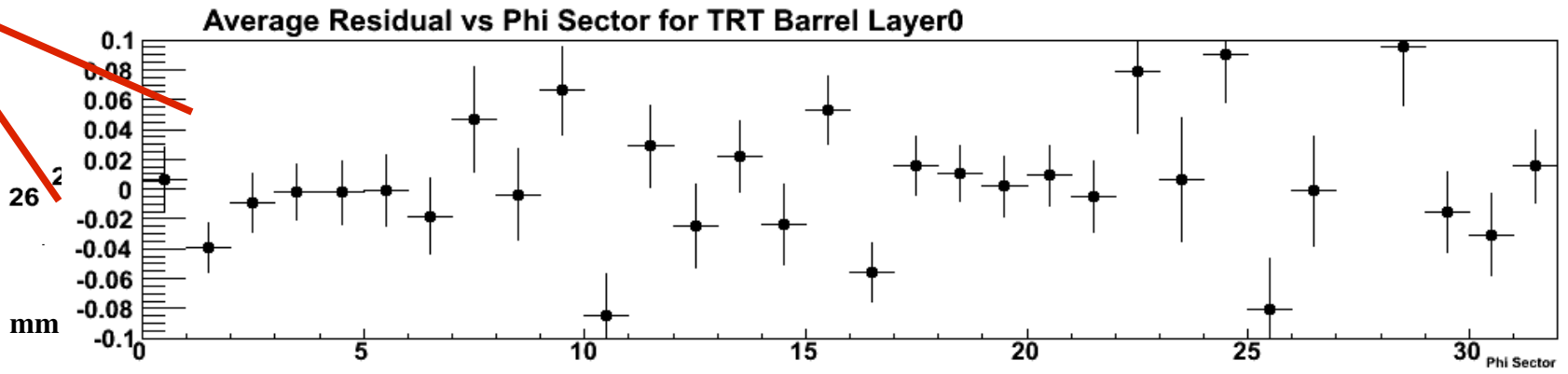
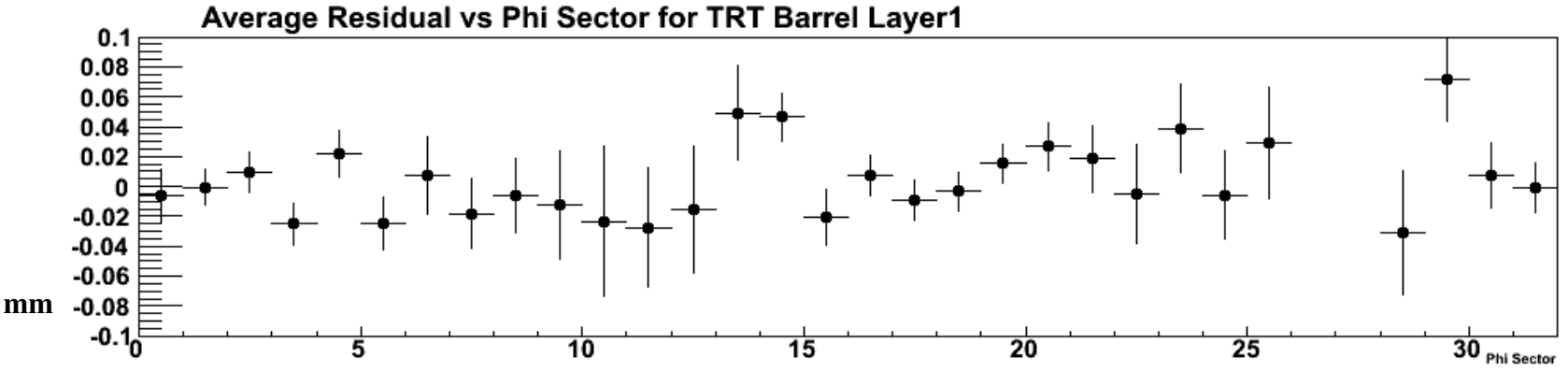
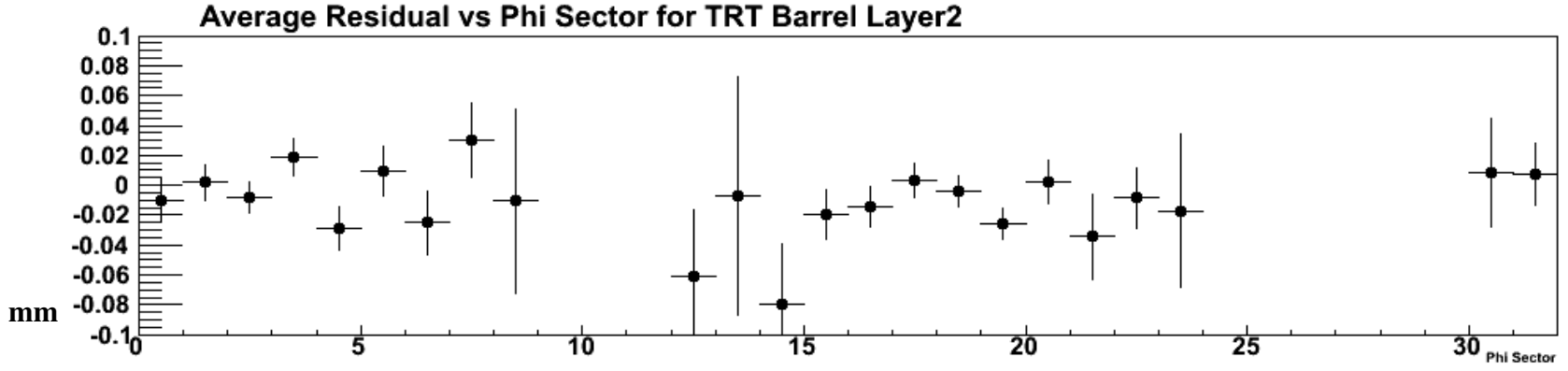
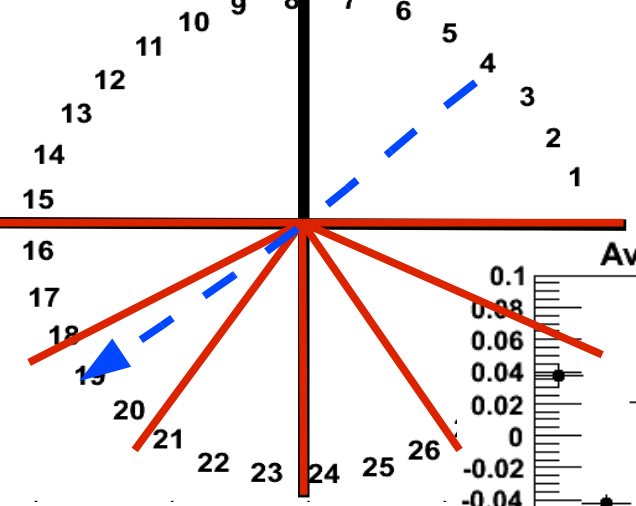
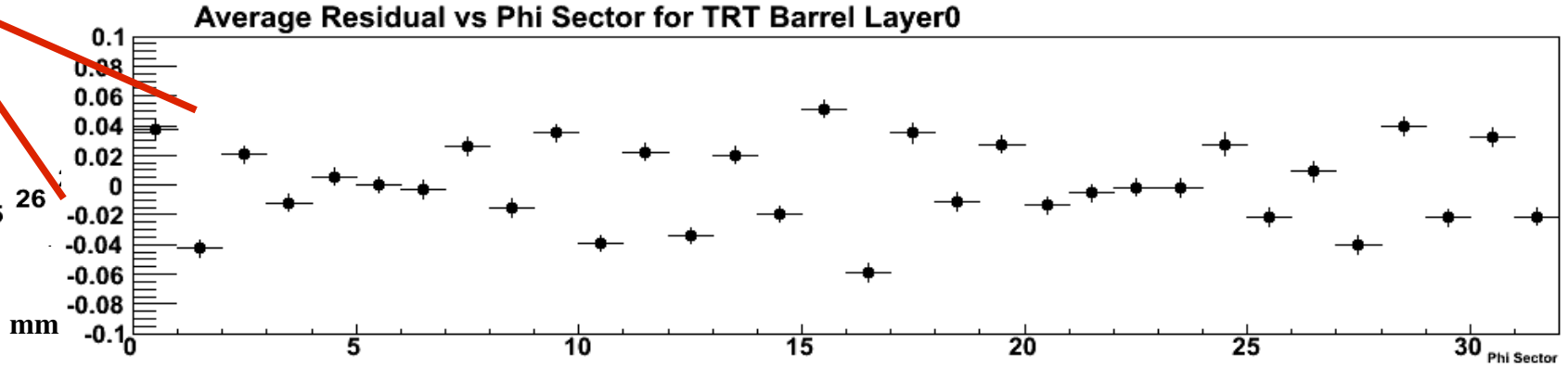

Average Residual vs Phi Sector for TRT Barrel Layer0
mm
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
0
5
10
15
20
25
30
Phi Sector

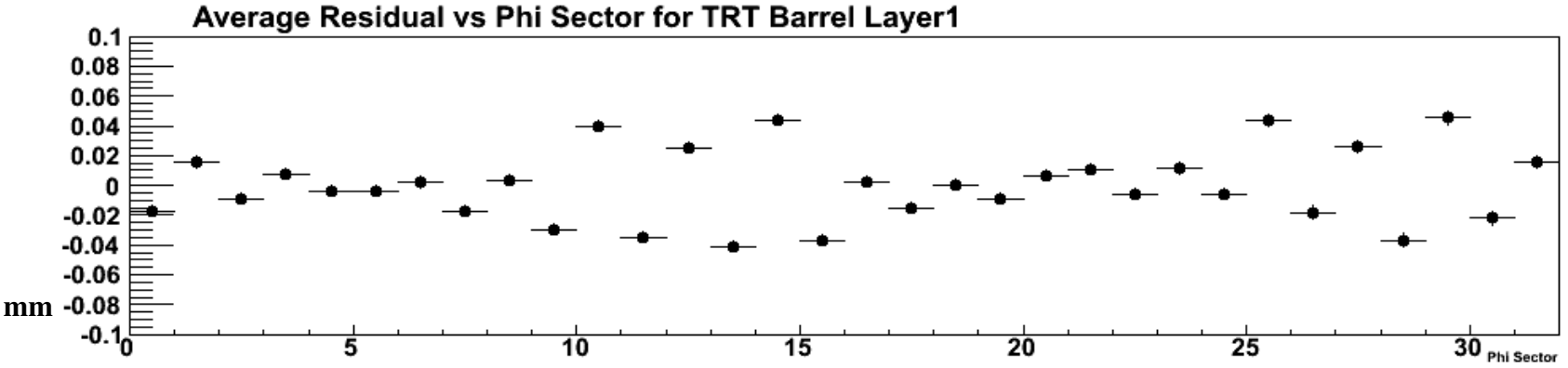

Average Residual vs Phi Sector for TRT Barrel Layer1
mm
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
0
5
10
15
20
25
30
Phi Sector

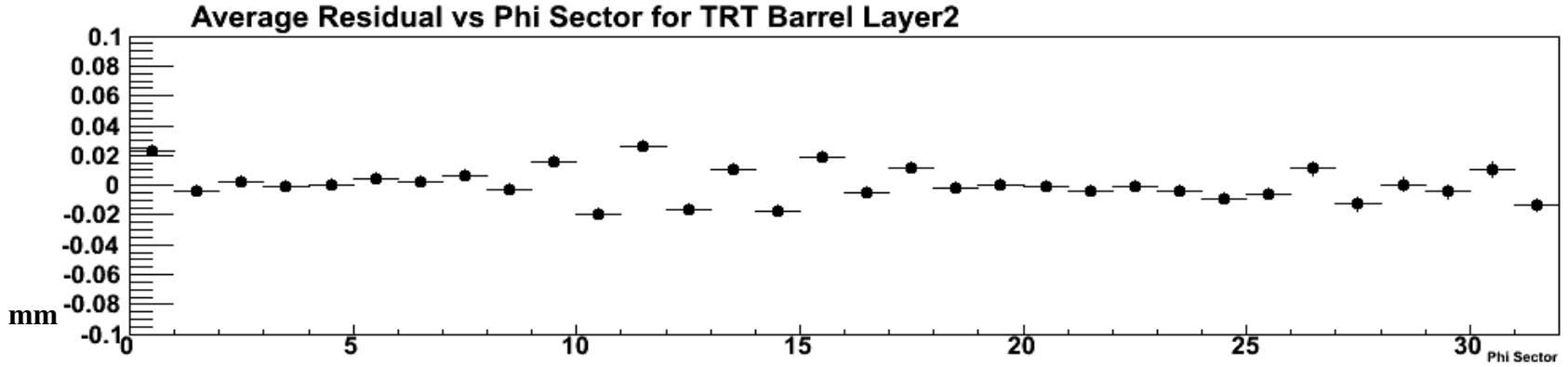

Average Residual vs Phi Sector for TRT Barrel Layer2
mm
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
0
5
10
15
20
25
30
Phi Sector

Phi0: 7Pi/6 - 4Pi/3

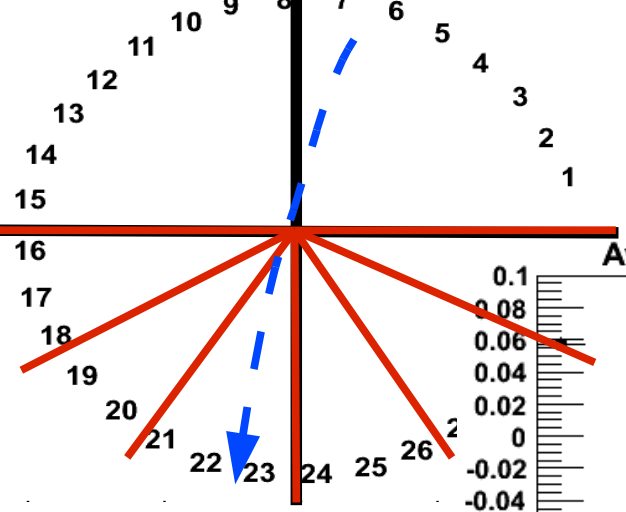


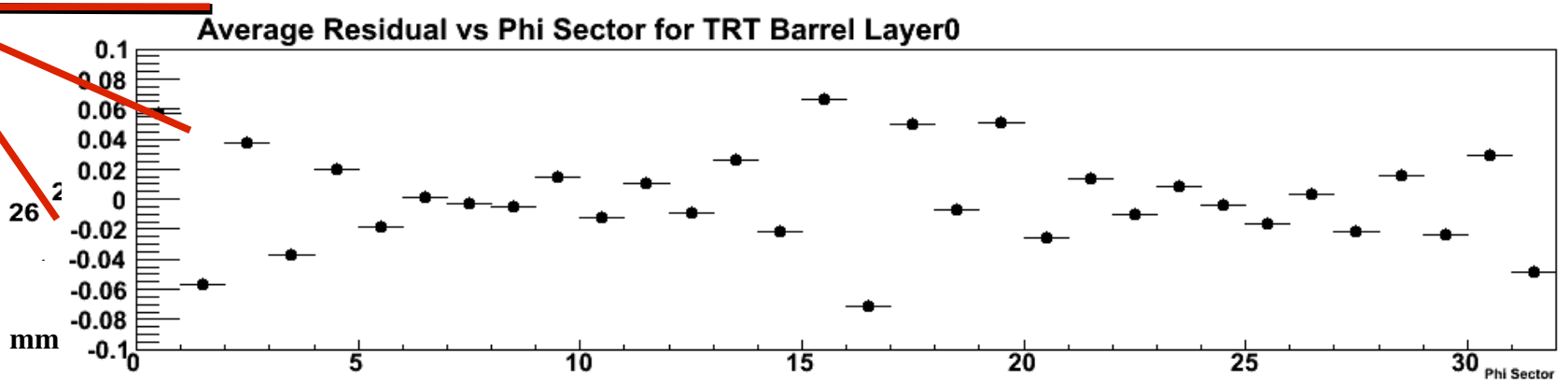


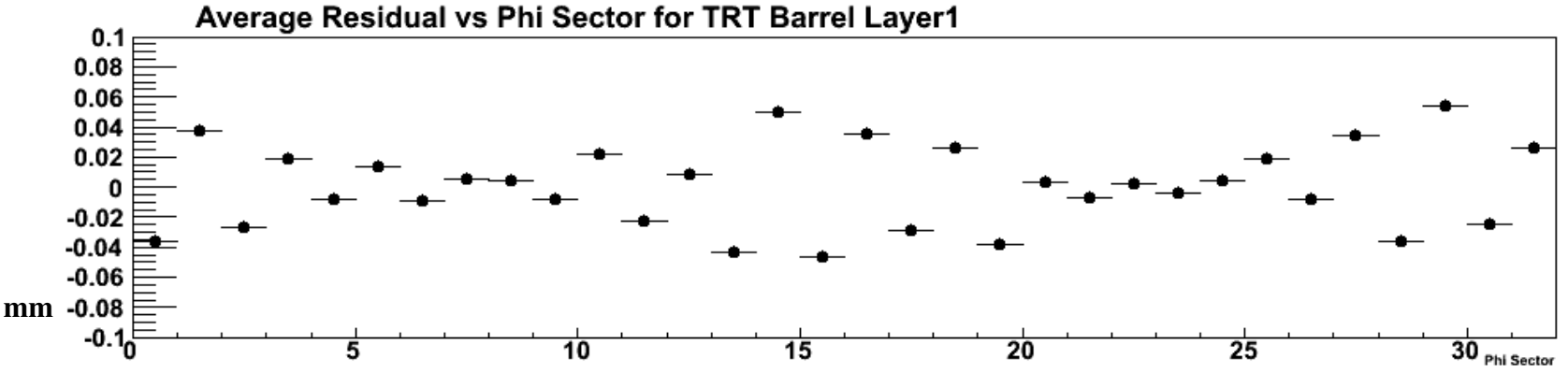


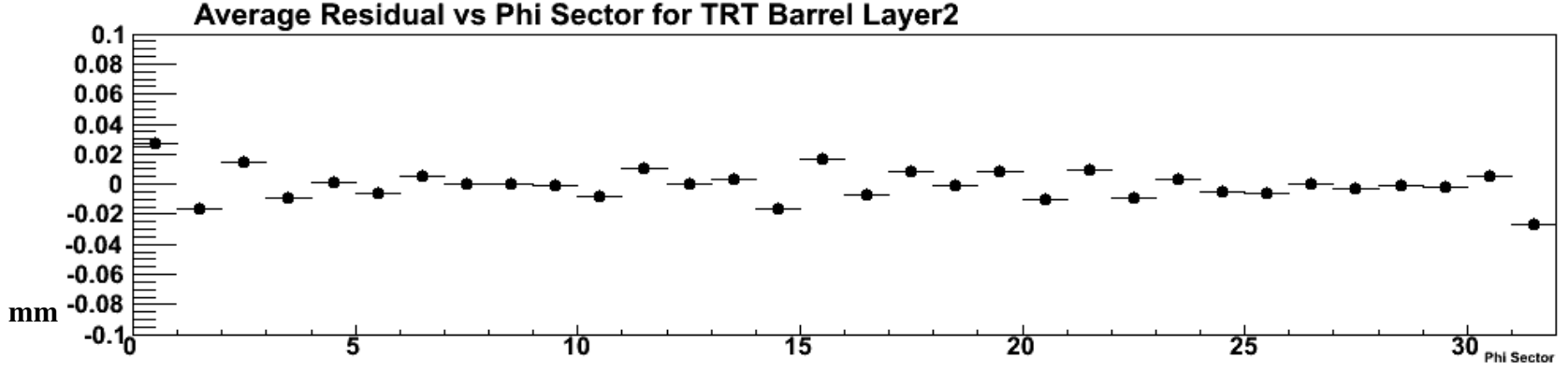


Phi0: 4Pi/3 - 3Pi/2

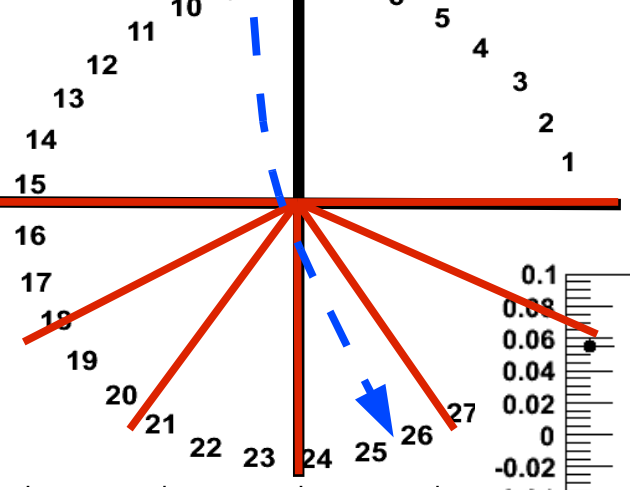


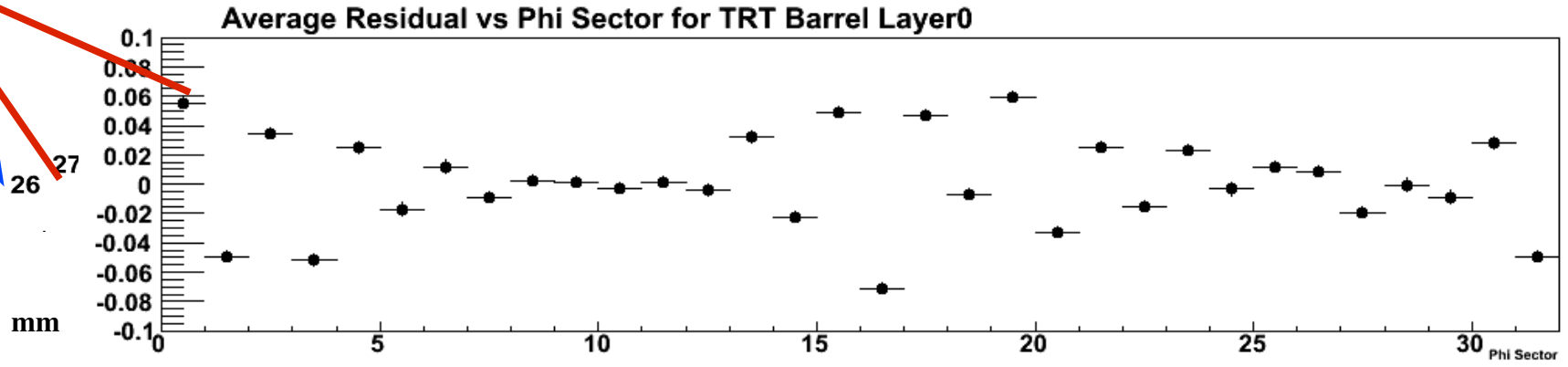


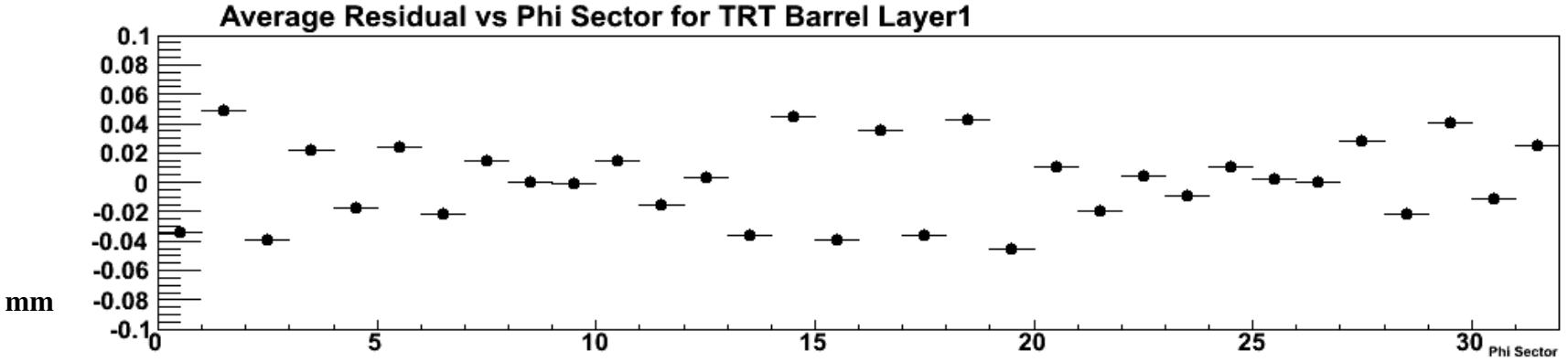


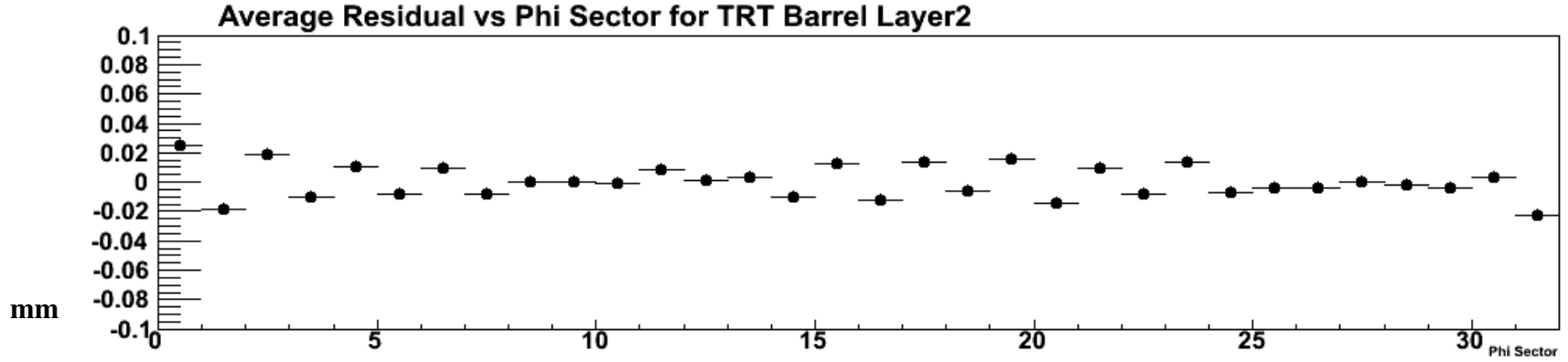


Phi0: 3Pi/2 - 5Pi/4

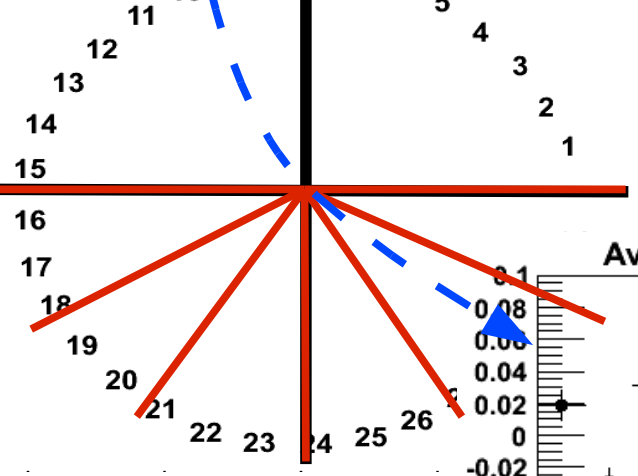


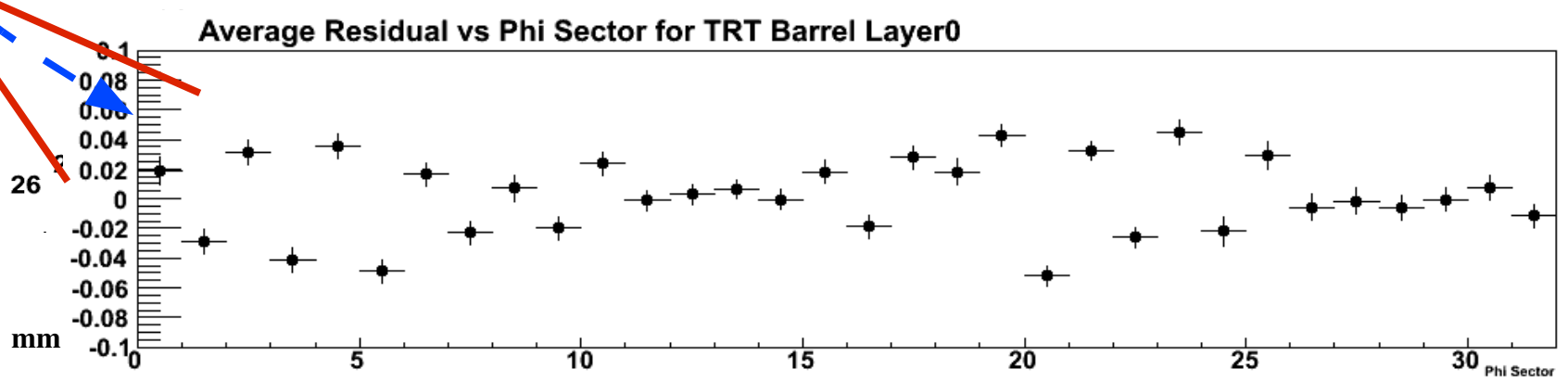


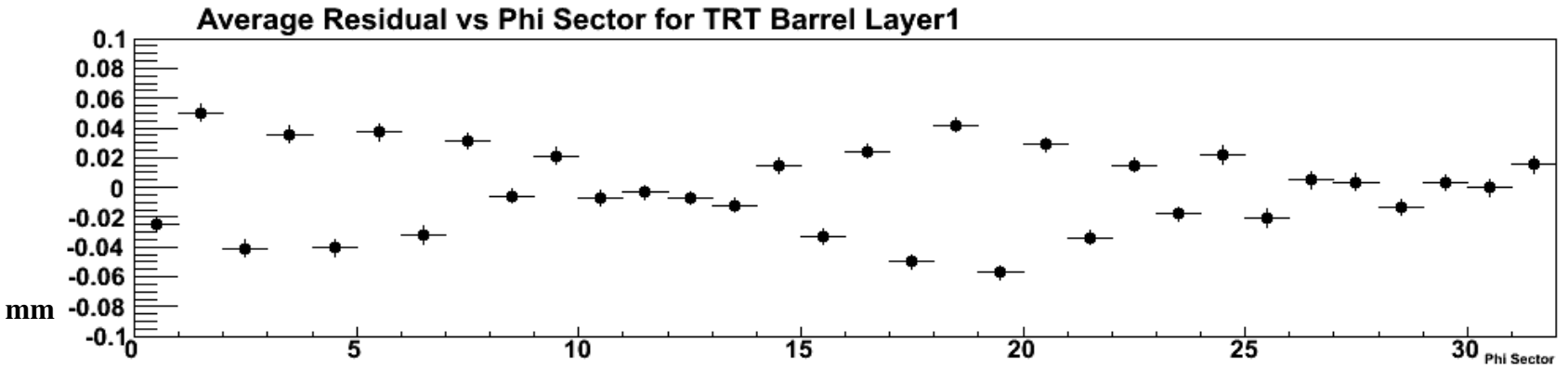


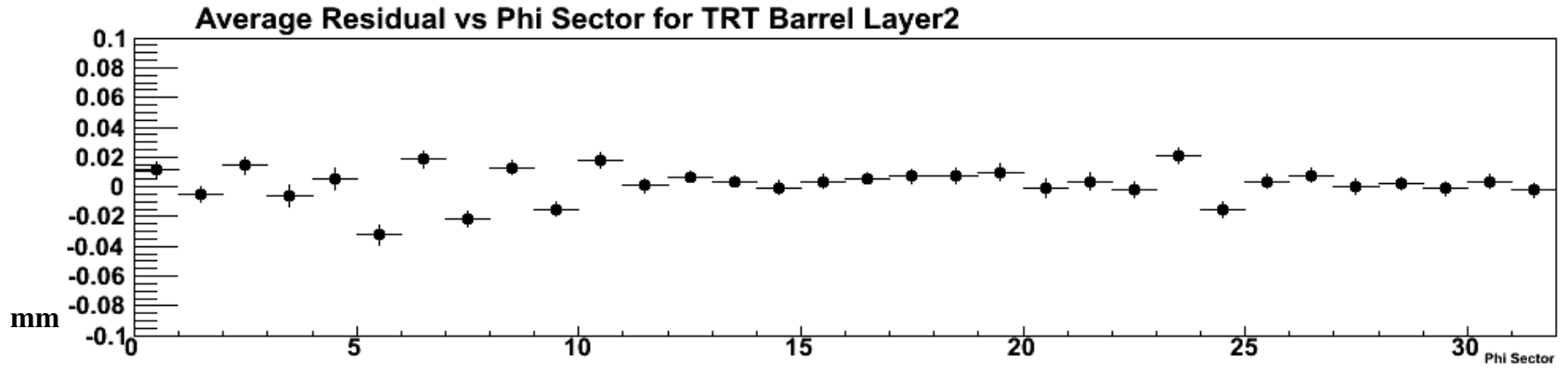


Phi0: 5Pi/4 - 11Pi/6

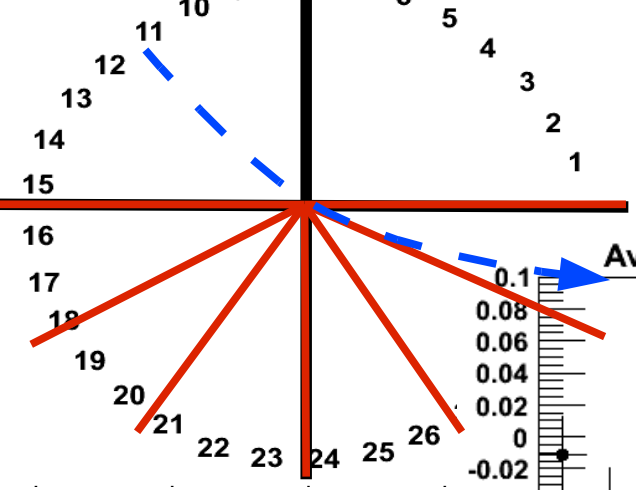


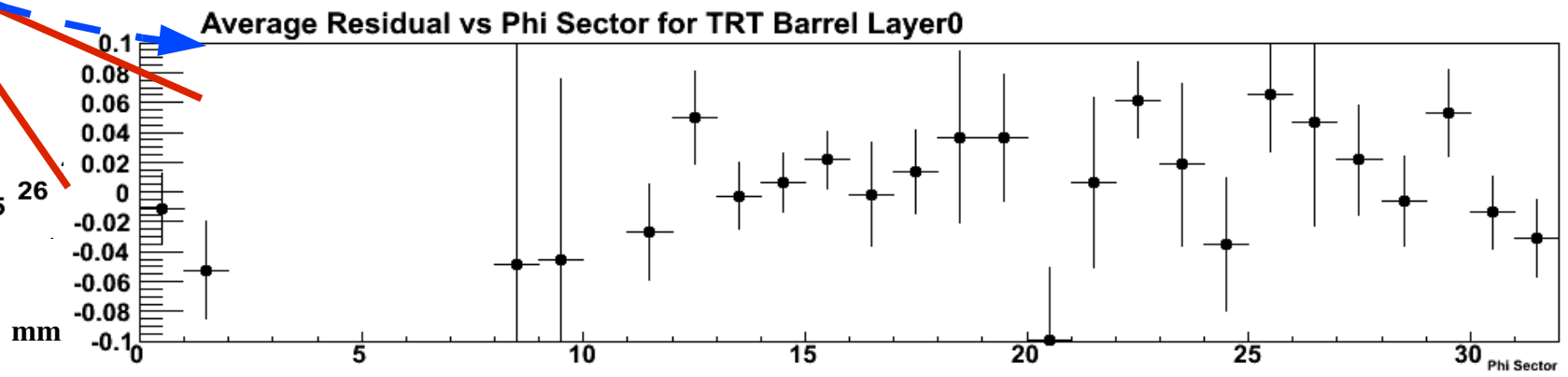


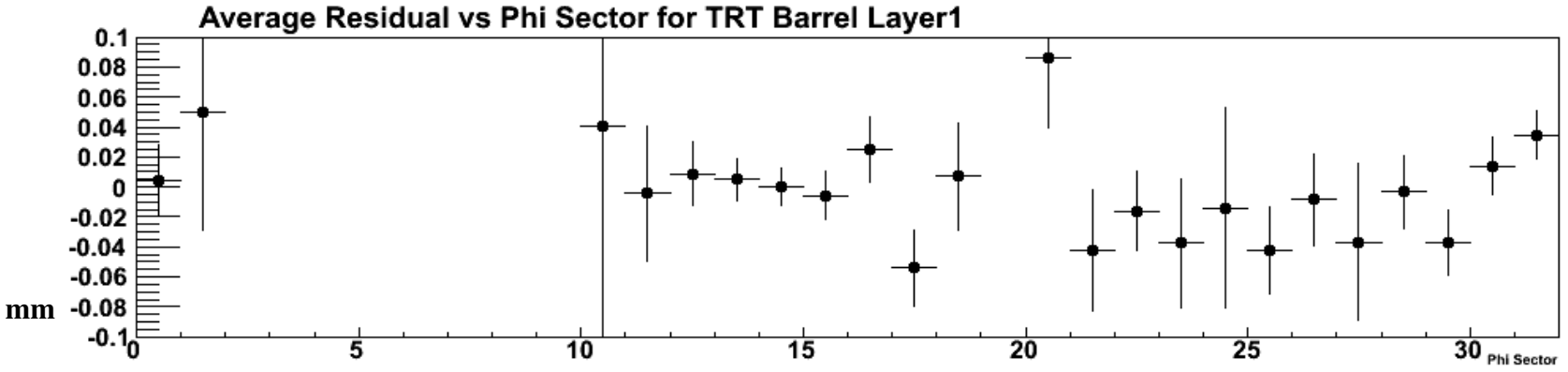


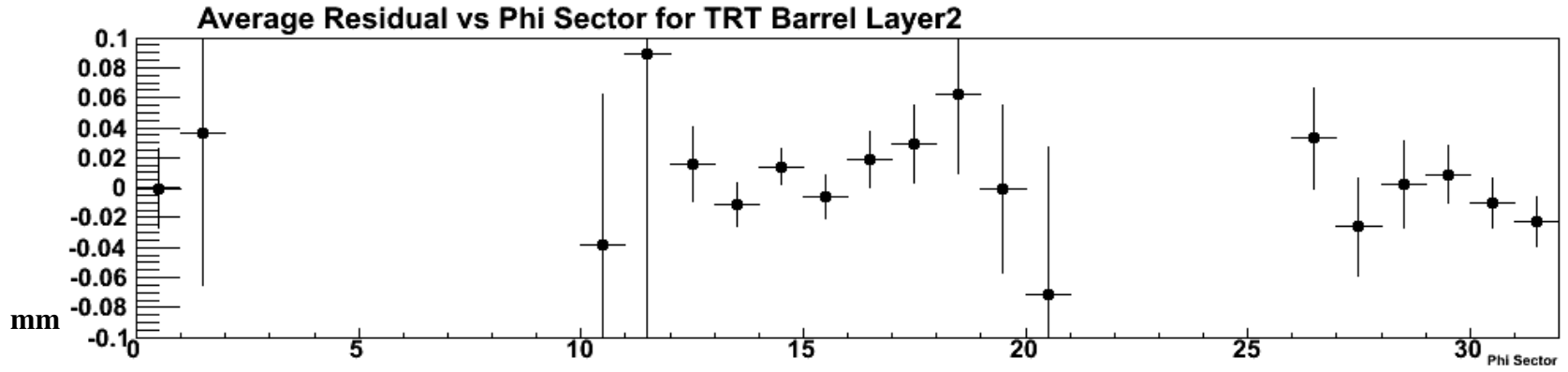


Phi0: 11Pi/6 - 2Pi





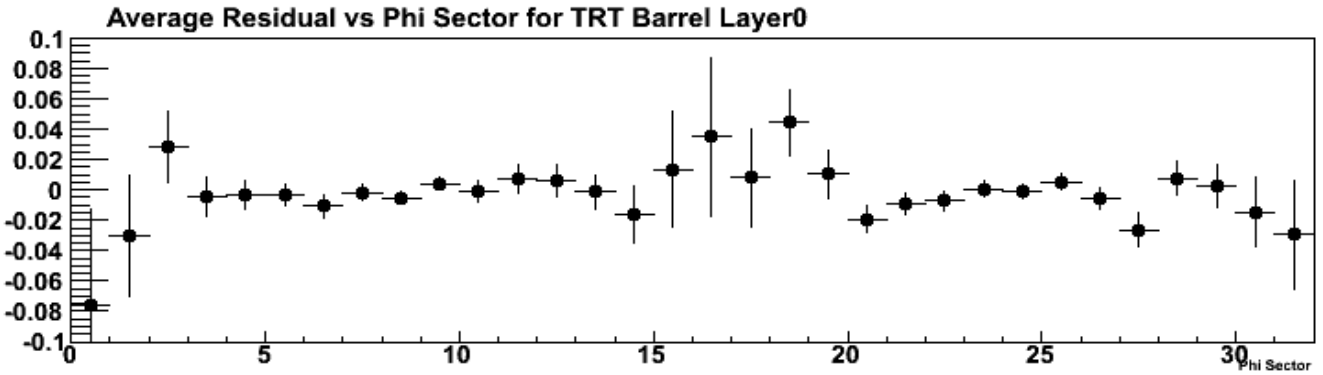


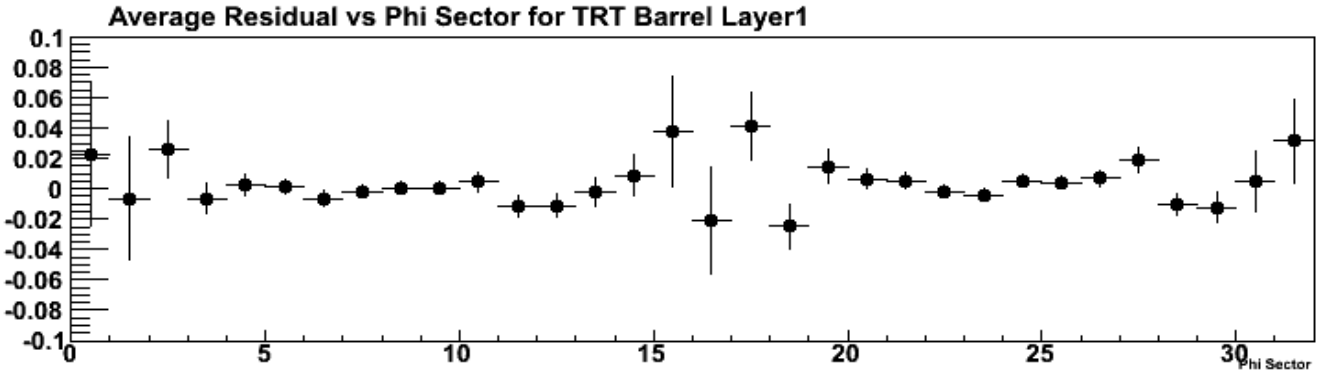


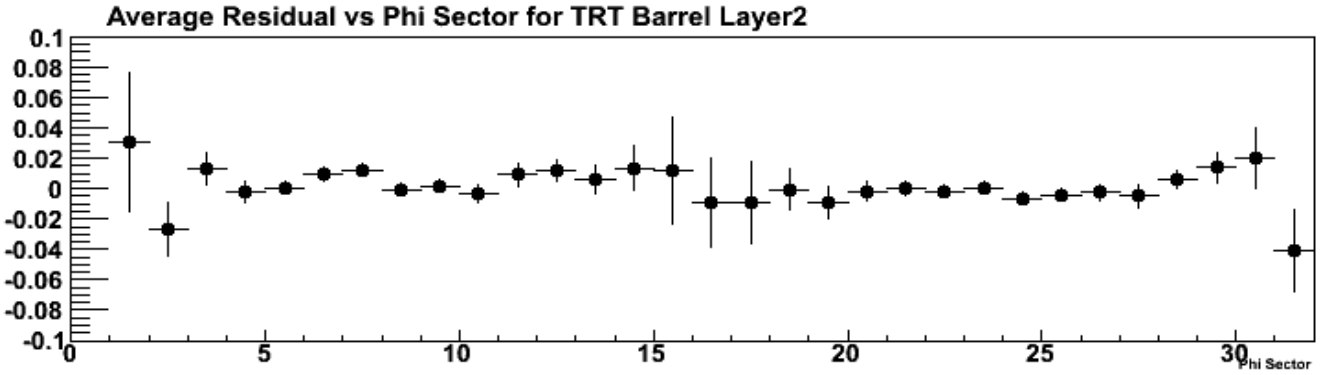
TRT Phi Residual Structure.

- **TRT – Only Tracks**
- **Full Phi0 acceptance**
- **impact paramter cut**
  < 100 mm (inside pixel)

Problem with tracks away from the interaction point

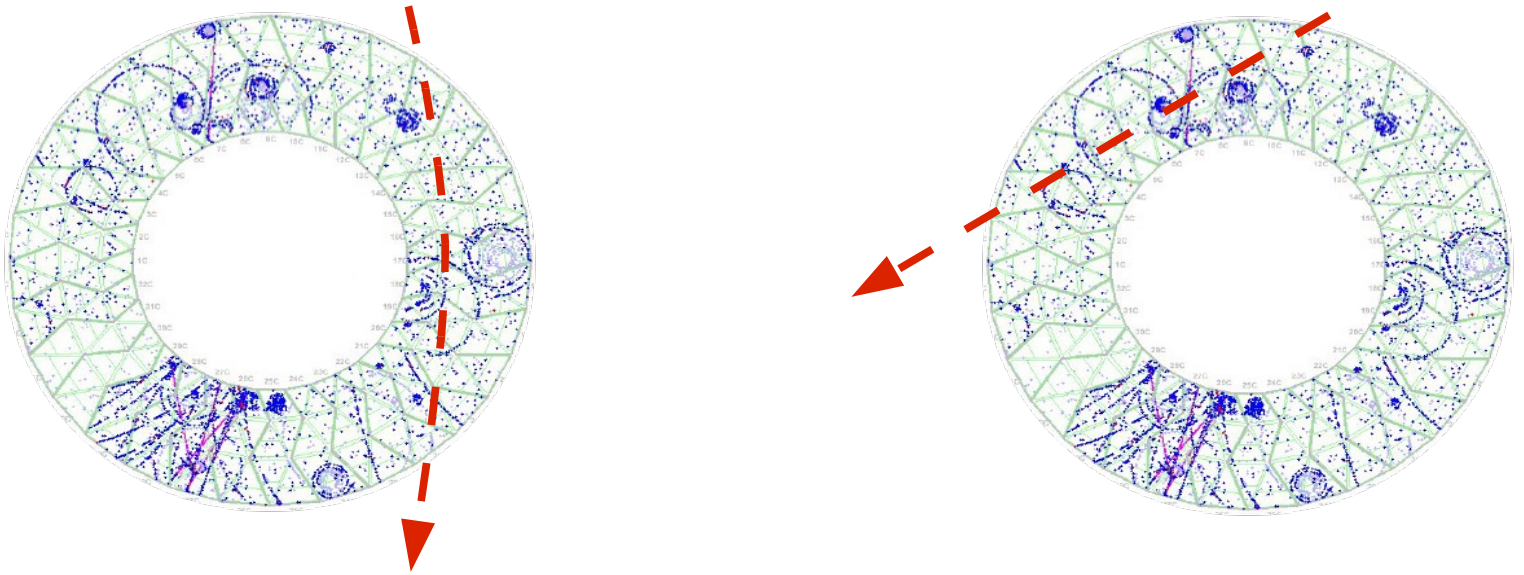






Thoughts ...

- Radial misalignment ?
  Would have expected alignment to correct this.
  CSC misalignment radial corrected by MC cosmics.
- Tracking problems for “non-collision-like tracks” ?

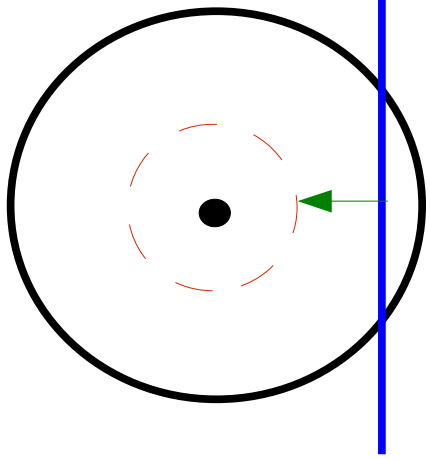


- “non-collision-like“ tracks crucial for internal TRT alignment
  - provide non trivial module correlations
  - kill potential weak modes
  - statistics !

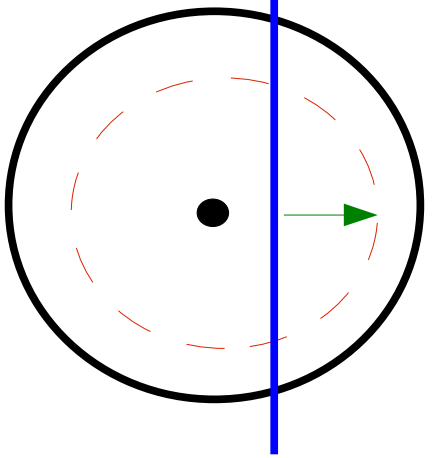
TRT Residual in Alignment Monitoring

residualR = hitR – perdictedR
*both hitR and perdictedR are signed the same.

4 Cases to Consider

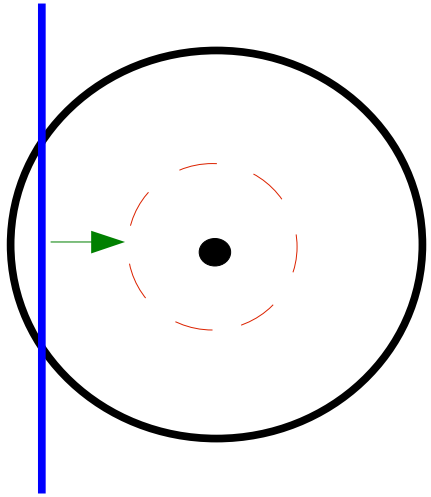


hitR && perdictedR > 0

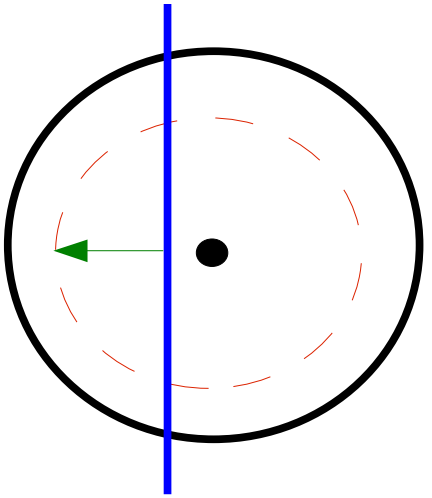


hitR && perdictedR > 0

Straw
Straw Center
Measured Drift Circle
Reconstructed Track
Residual (arrow indicates sign)

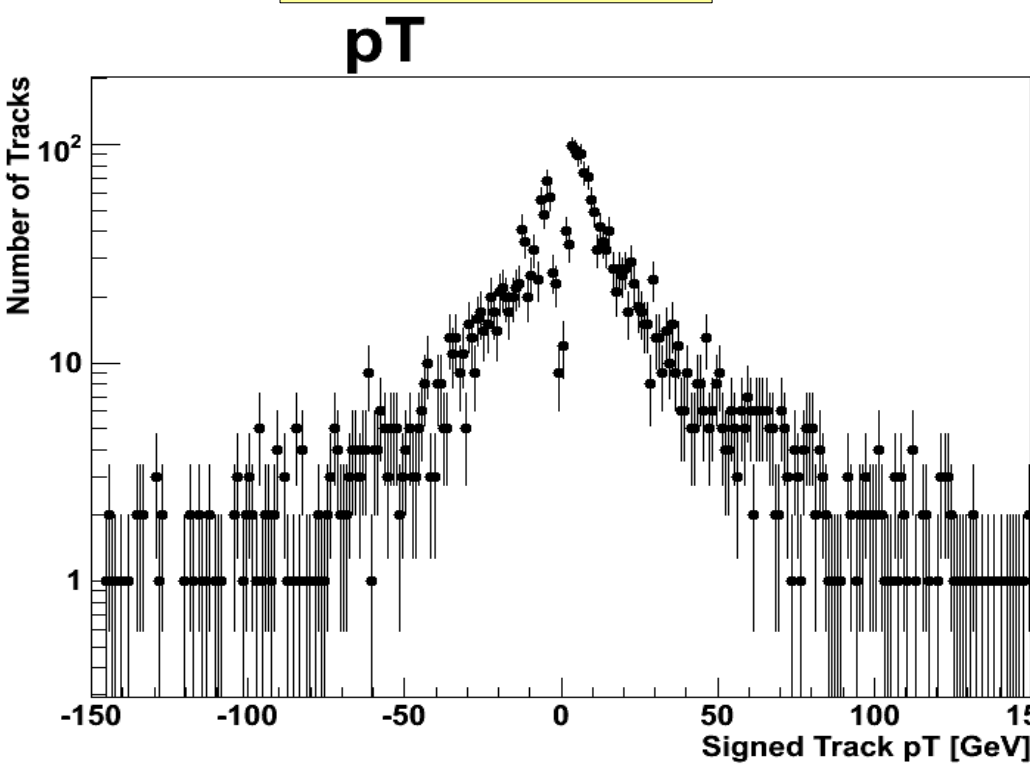


hitR && perdictedR < 0



hitR && perdictedR < 0

TRT Only



Combined