SVX Alignment

Tracking Meeting

10th July '02

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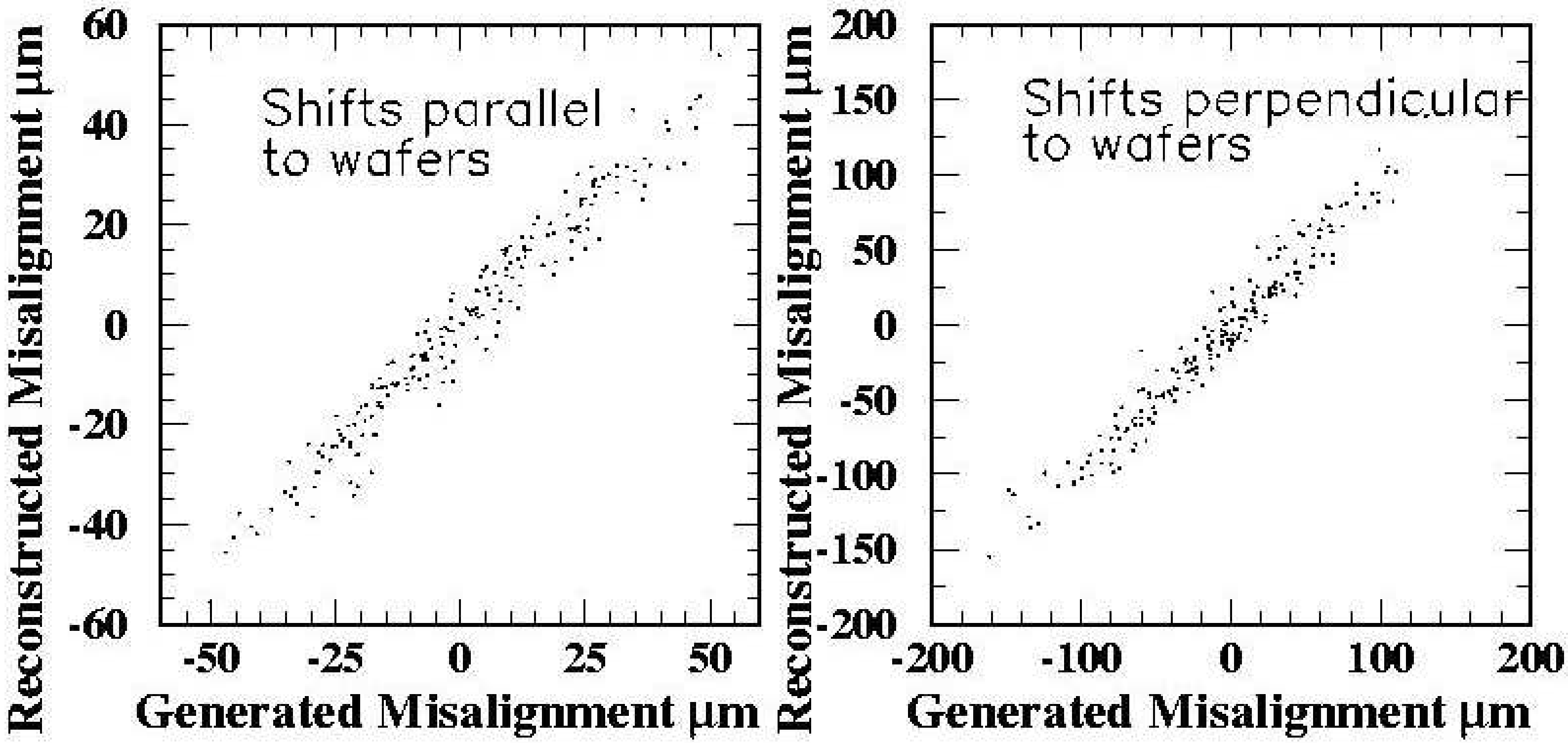
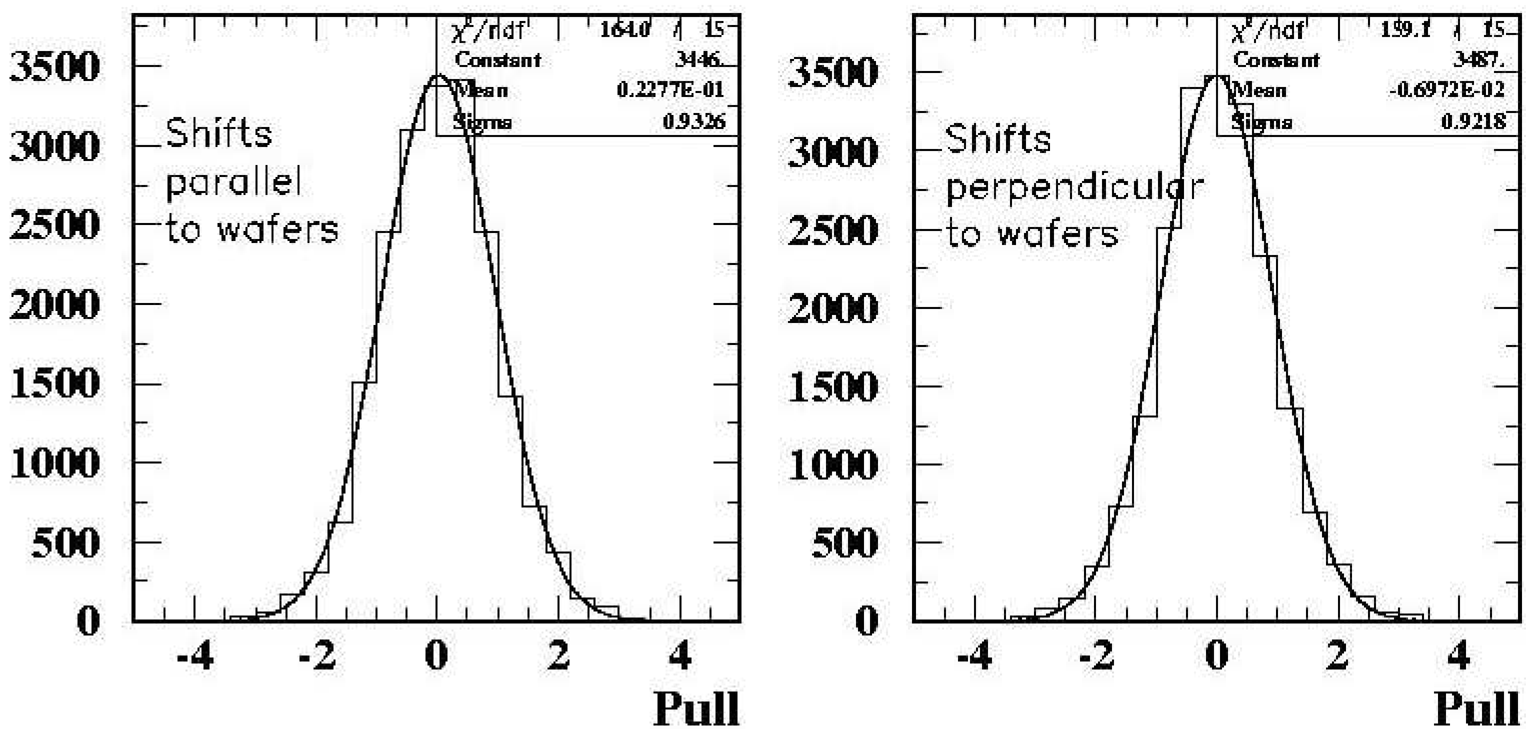
University of Liverpool

Proof of Principle
(CDF Note 5700)



- Procedure Tested and Validated with Simulation

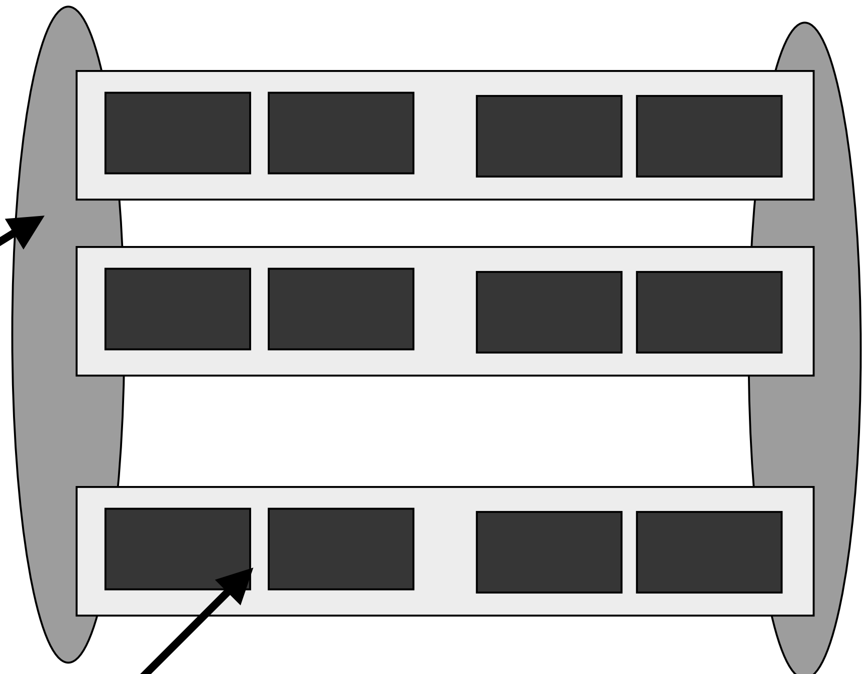
Convergence Correct.
Error Estimate Correct.
Robust Procedure



Mechanical Survey Numbers

CMM measures ladders on bulkheads to 10um.

Constuction good to 15um



Beware the Bows:

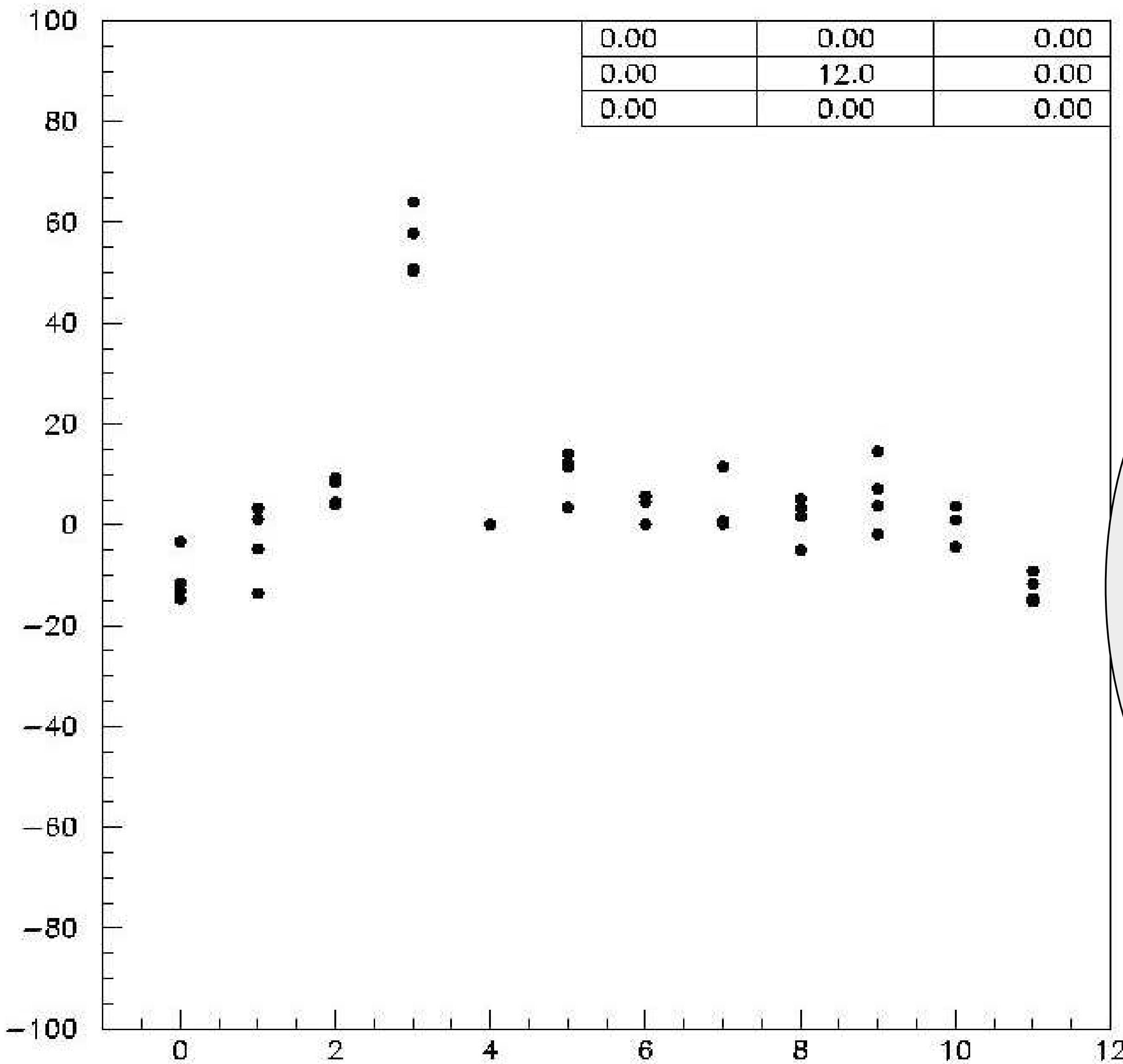
CMM and OGP disagree 25% of the time

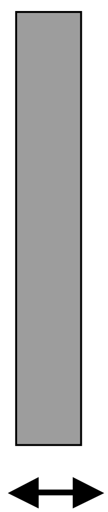
CMM measures to 40um

OGP measures sensors on ladder to 1um.
Construction good to 3um

Apply Alignment to Nominals

Transverse
Shift (um)





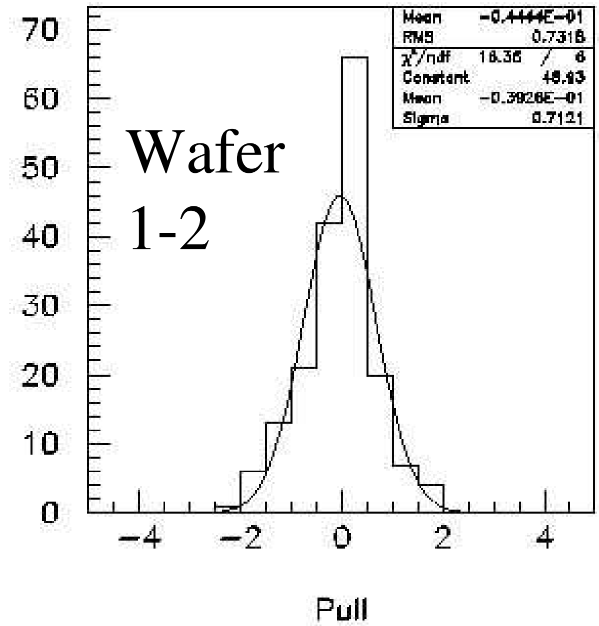
Wedge number

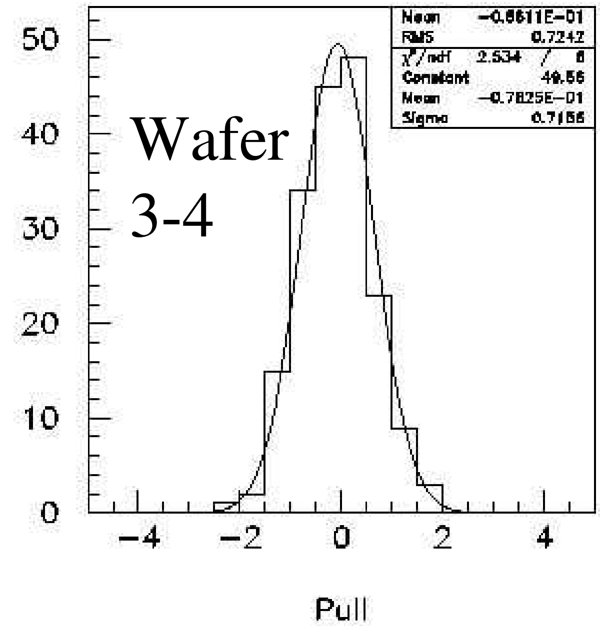
Note:

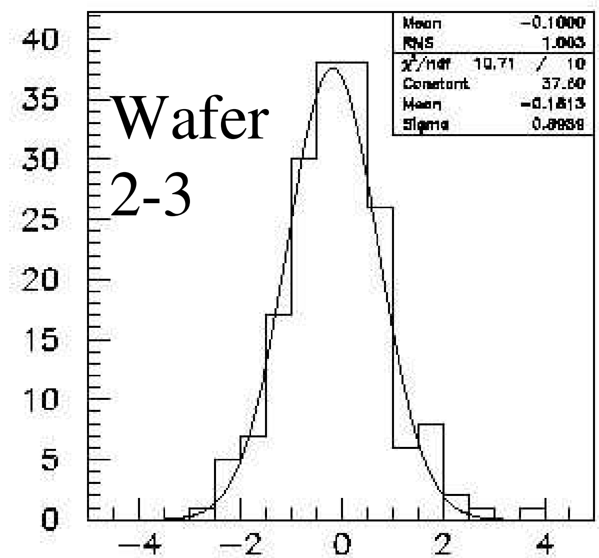
Wafer to wafer agreement

Outlier

Wafer to wafer (OGP)



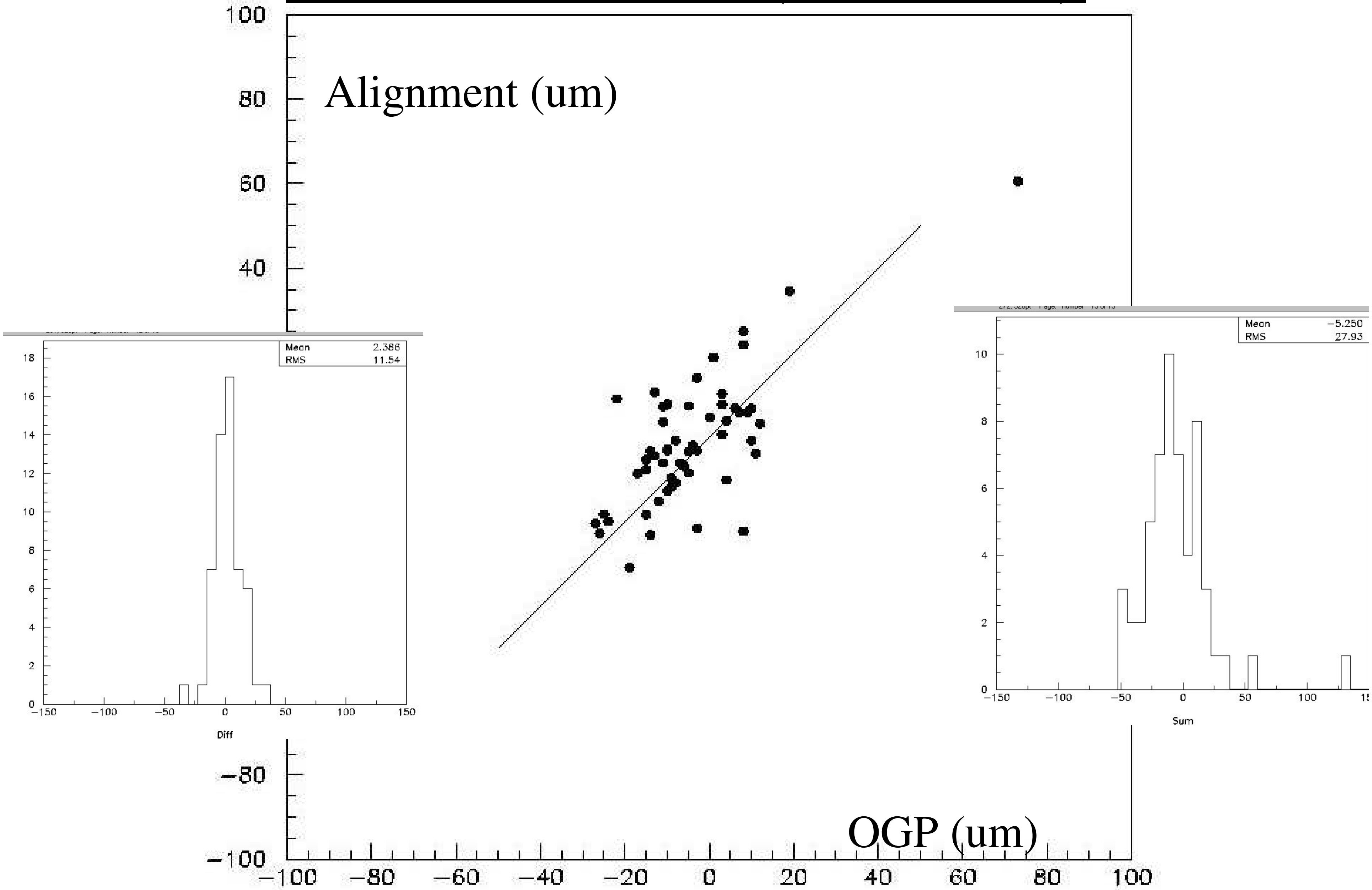




Little sensitivity to OGP measurements

Within alignment precision OGP true and better, so only move LADDERS

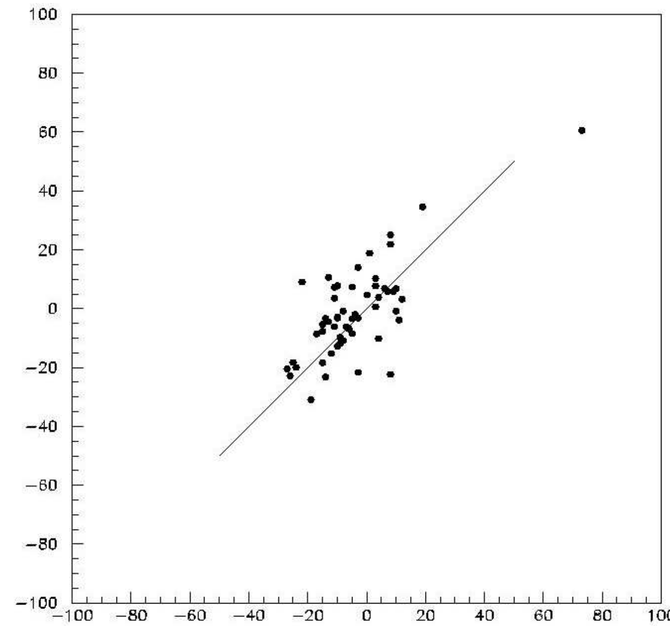
Ladder Shifts (Barrel 1)

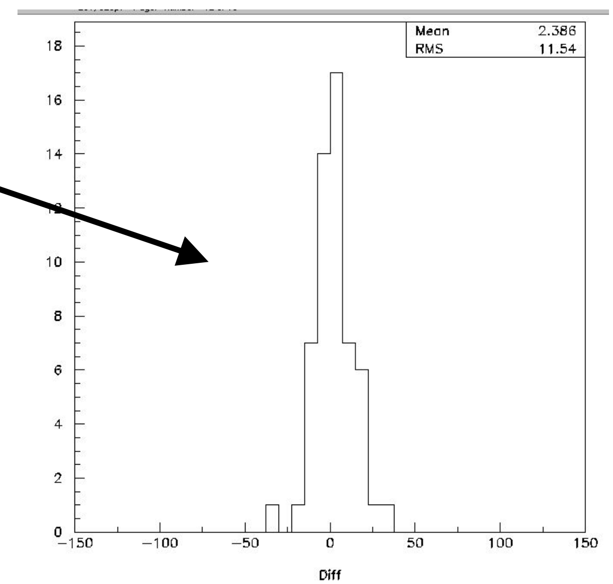


Ladder Shifts (Barrel 1)

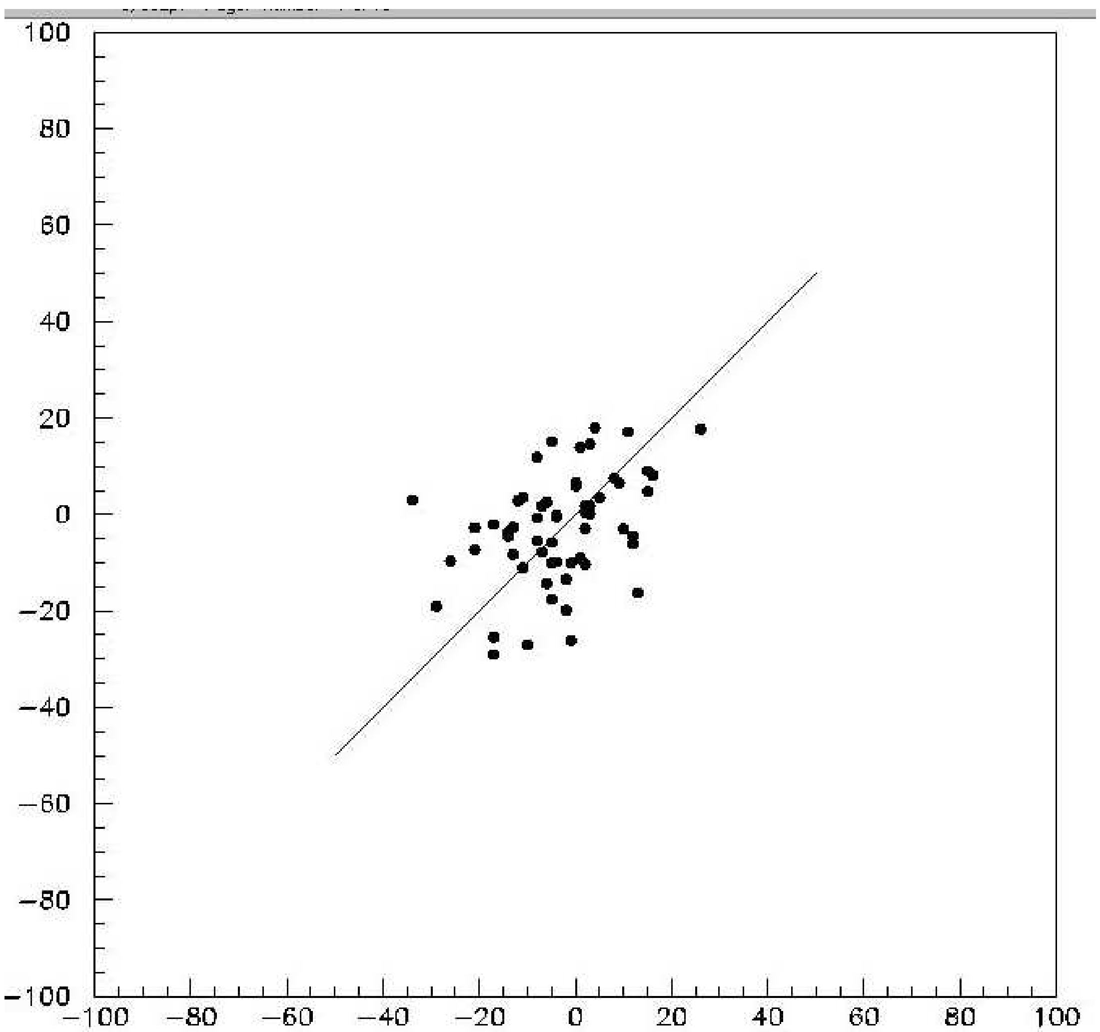
- CMM and Alignment Agree on Size of Shift
- Precision of Alignment better than CMM
- Resolution agrees with CMM precision

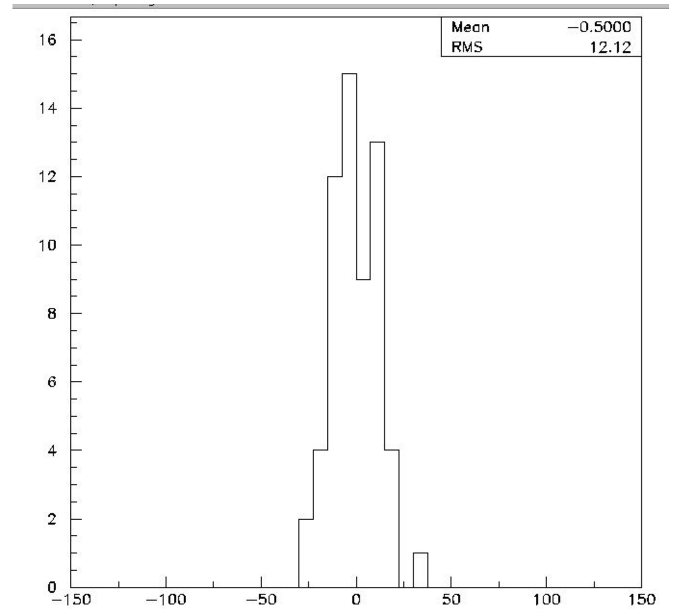
- Problem: Signs are Opposite !!! (not yet understood; talking to Andy)

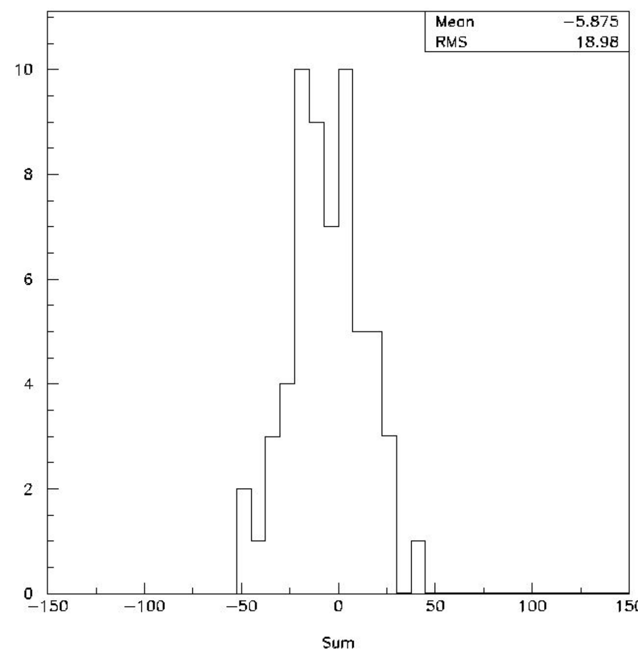




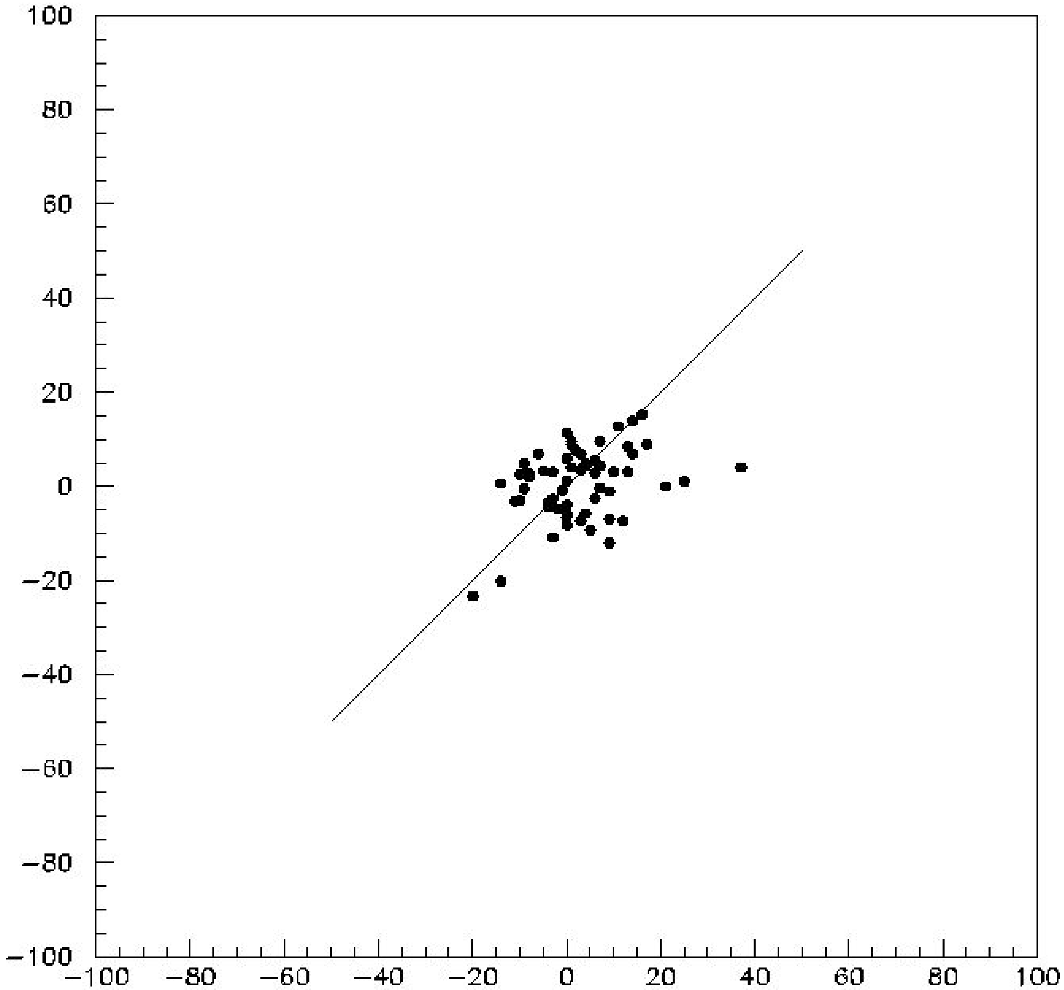
Ladder Shifts (Barrel 0)

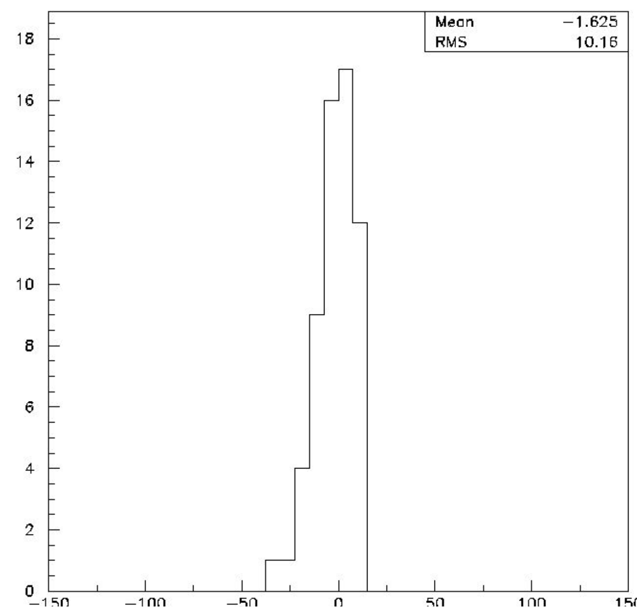


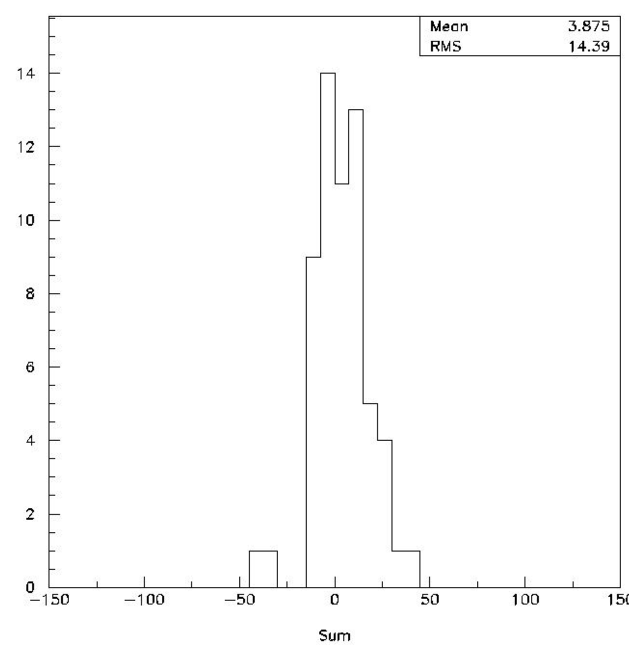




Ladder Shifts (Barrel 2)

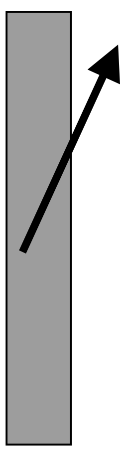


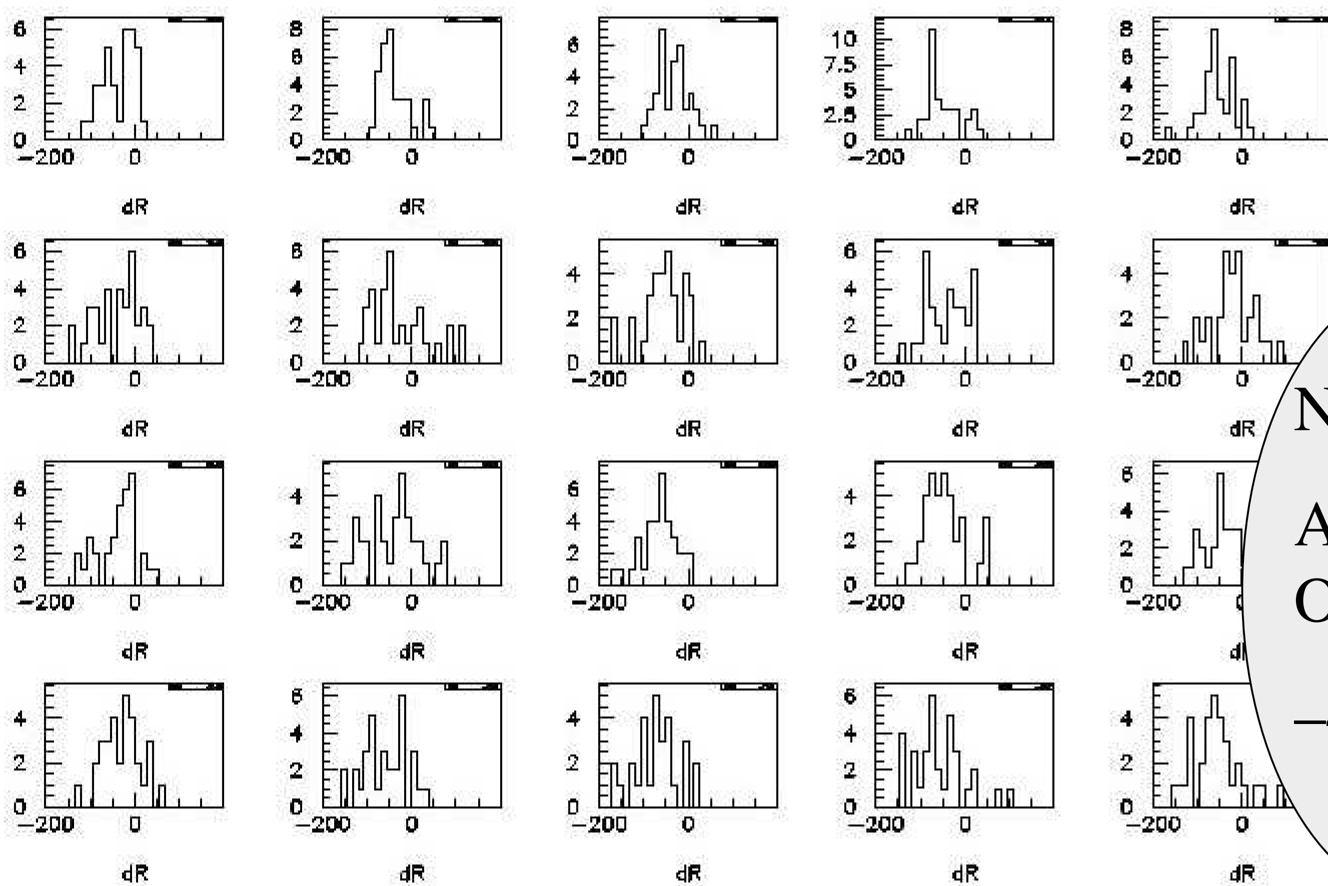




Apply Alignment to Nominals

Radial
Shifts
(um)

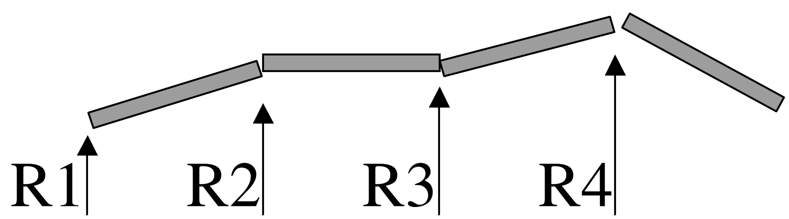




Note:

Average Offset is

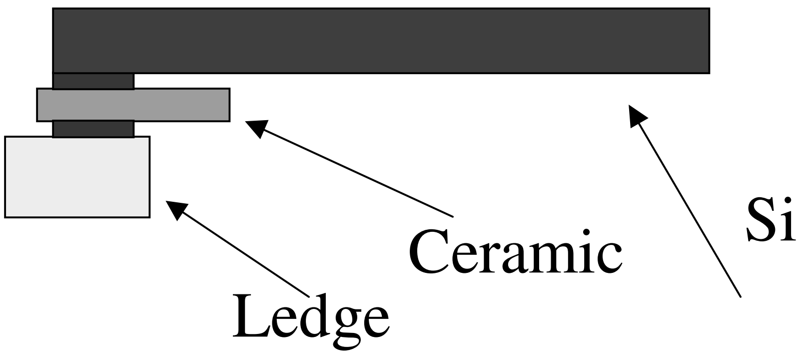
–45um



Rows are shifts R1-R4

Columns are Layers 1-5

OGP measurement of height from ledge



Ceramic ordered = 508um

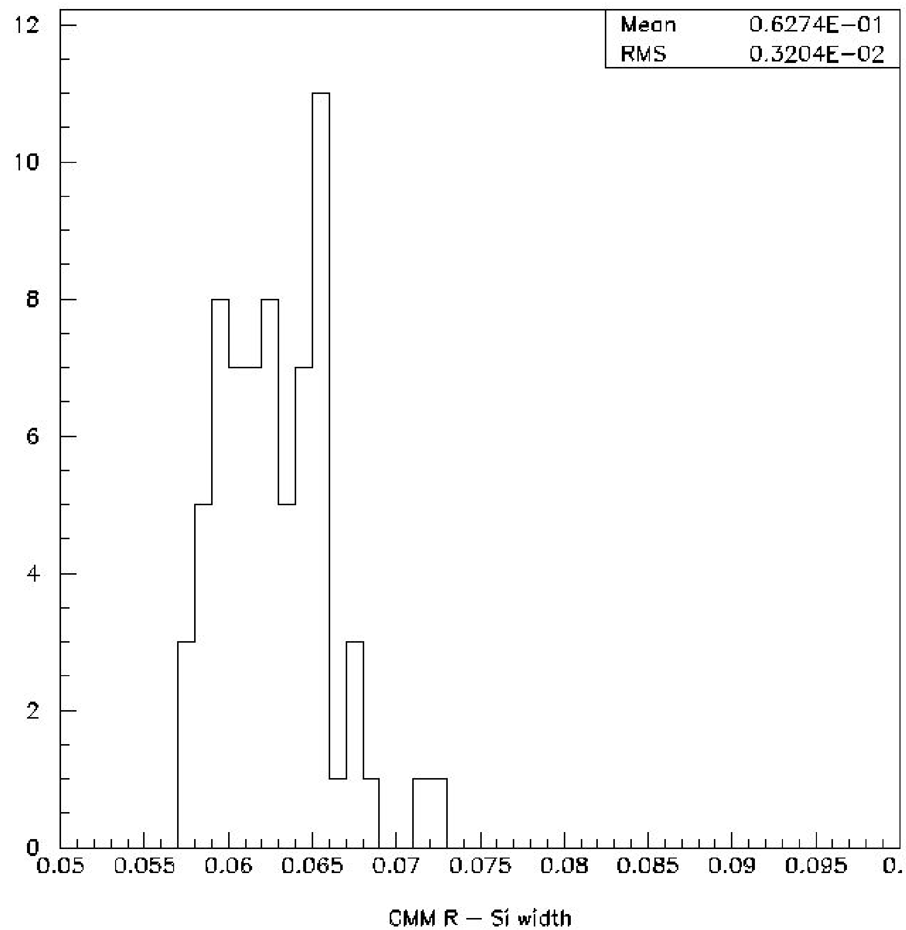
Glue = ?

CDF code assumes 675um

CMM measured <627um>

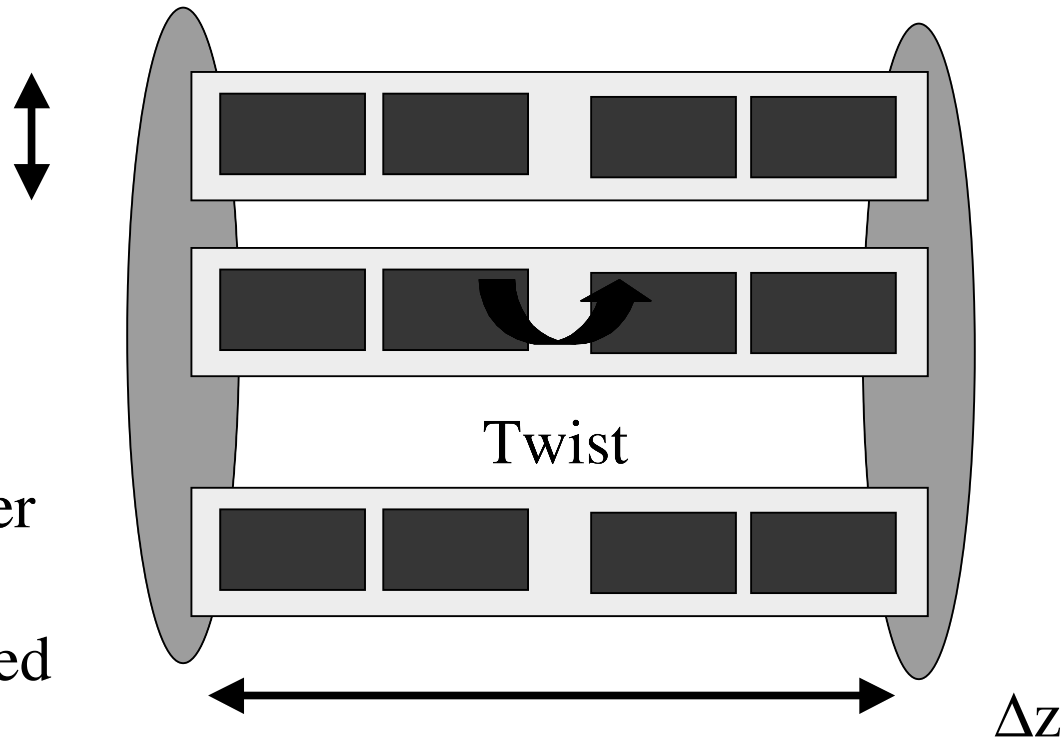
Delta of -48um

…. in agreement with alignment



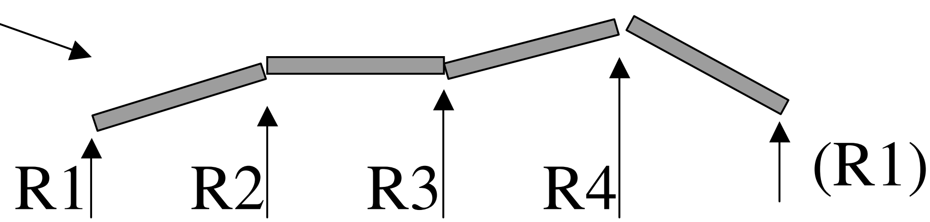
Diff ledge and Si bottom (mm)

Alignment Parameters



Wafer by wafer R and pitch corrections tried

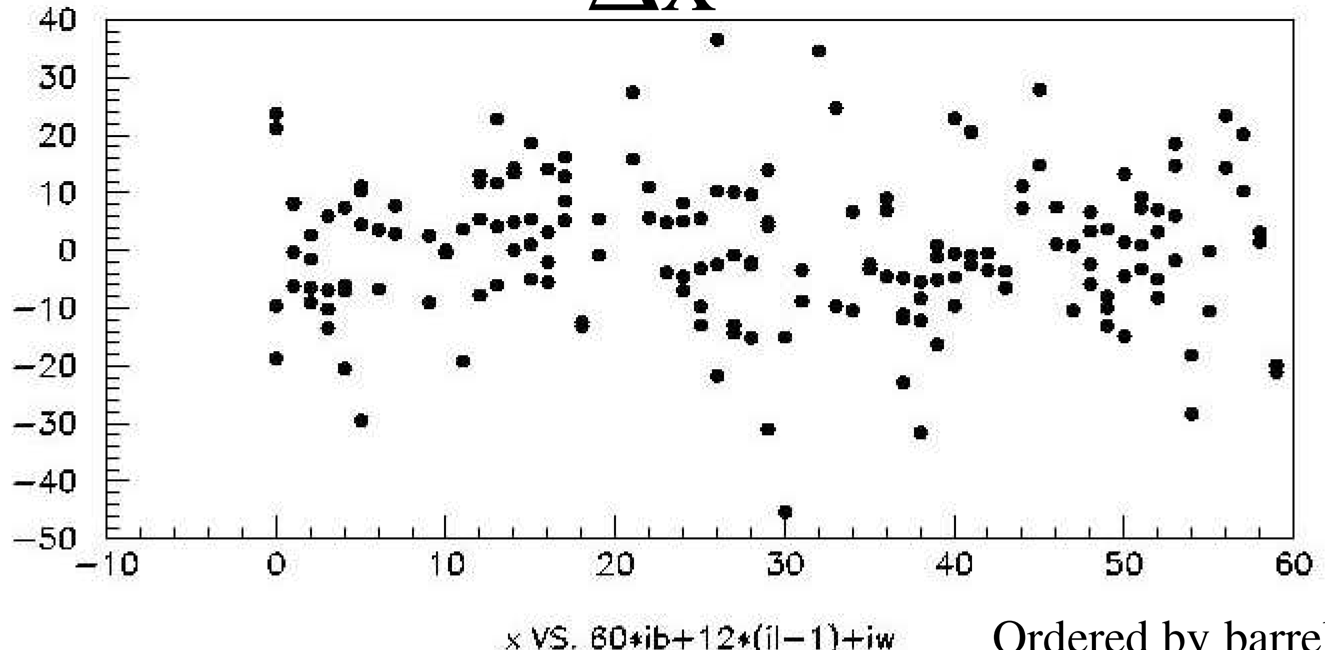
Less parameters similar results



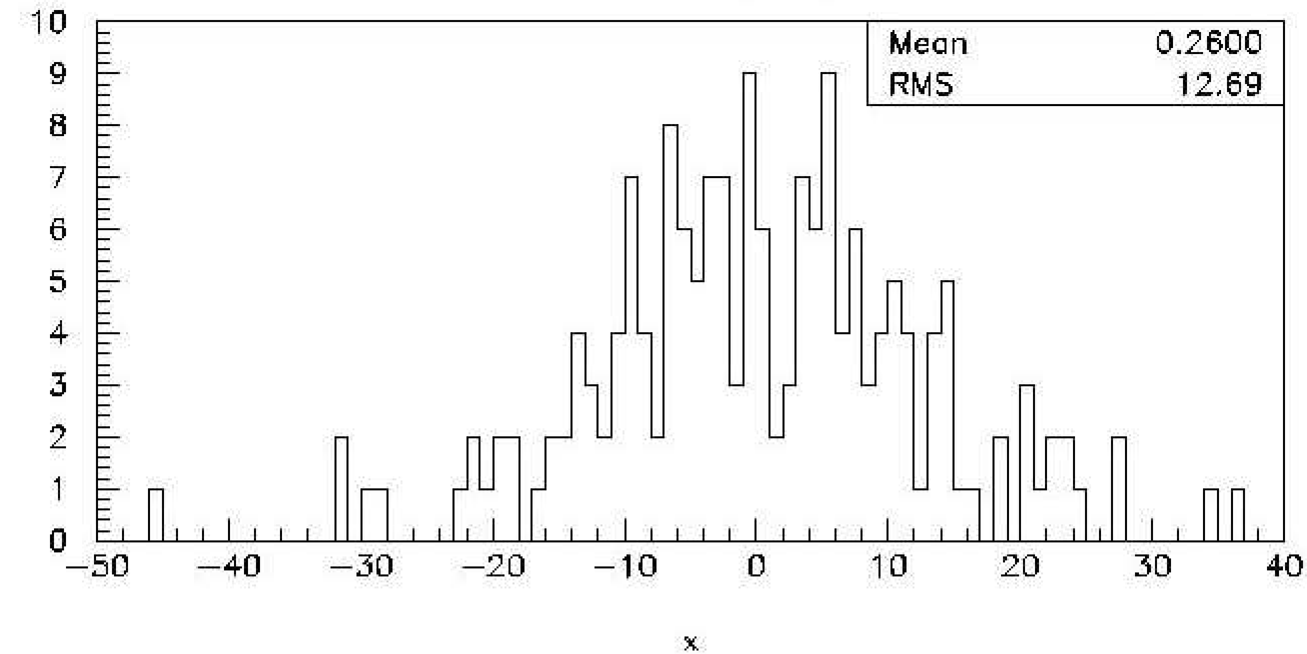
More physical?

Subjective choice

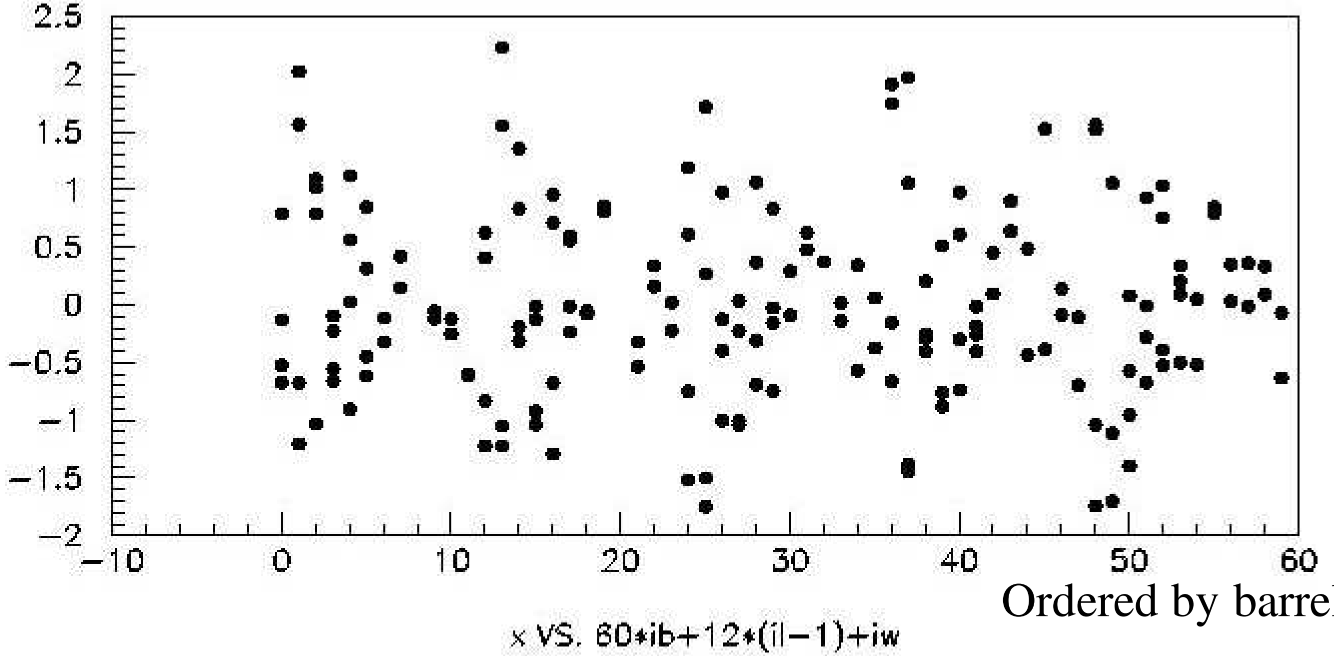
Δx



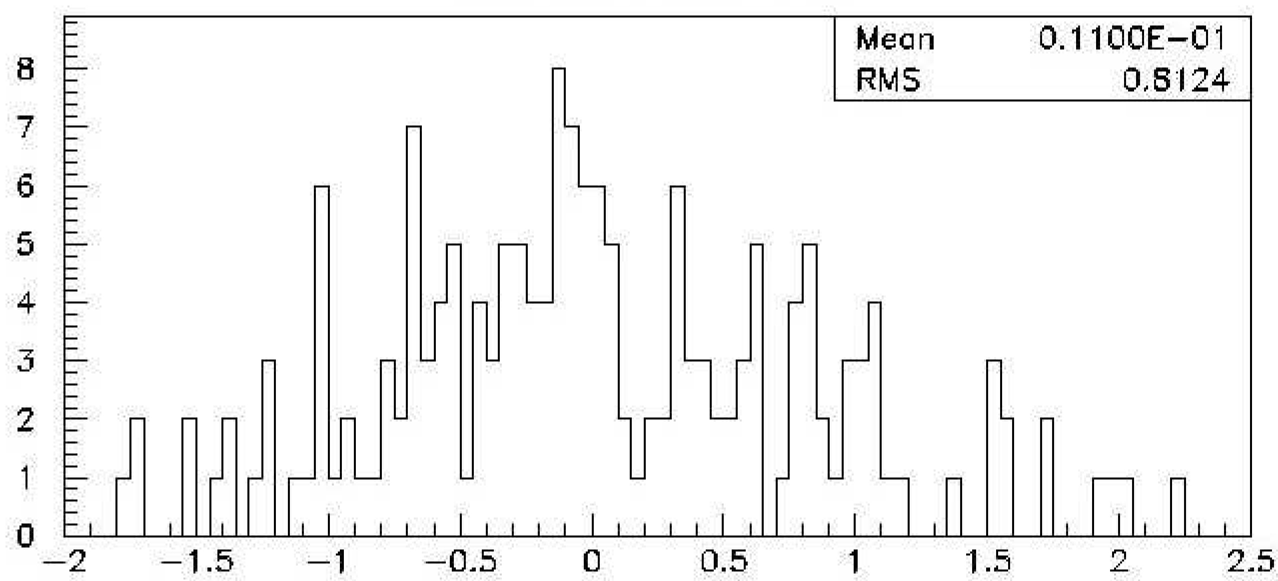
Ordered by barrel,layer, wedge



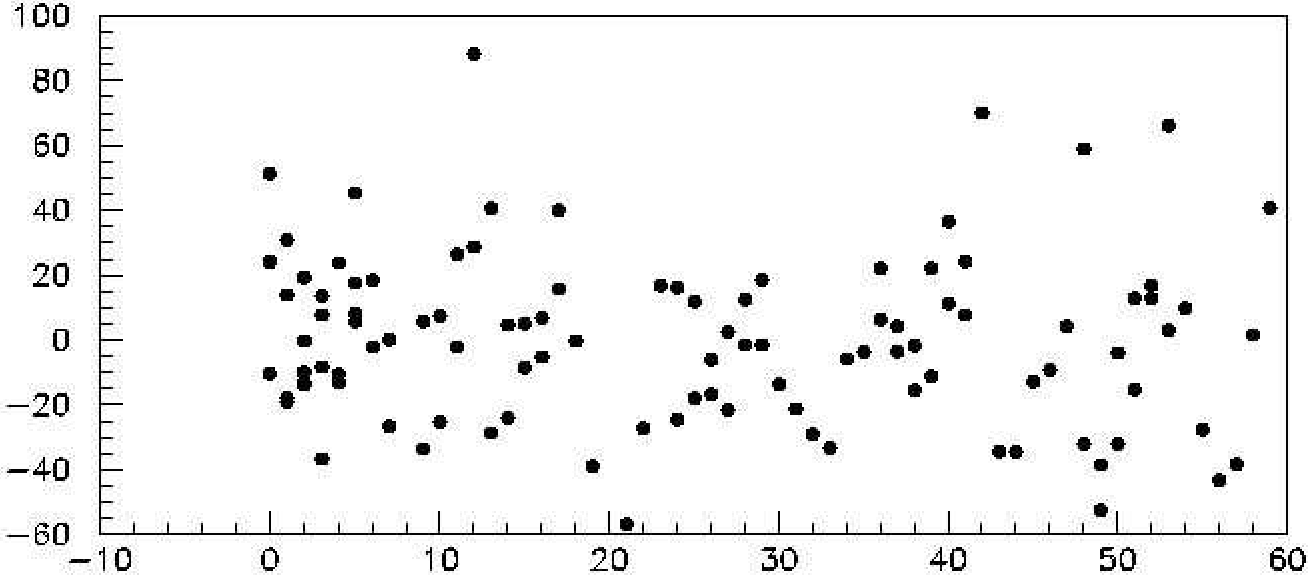
Rot xz



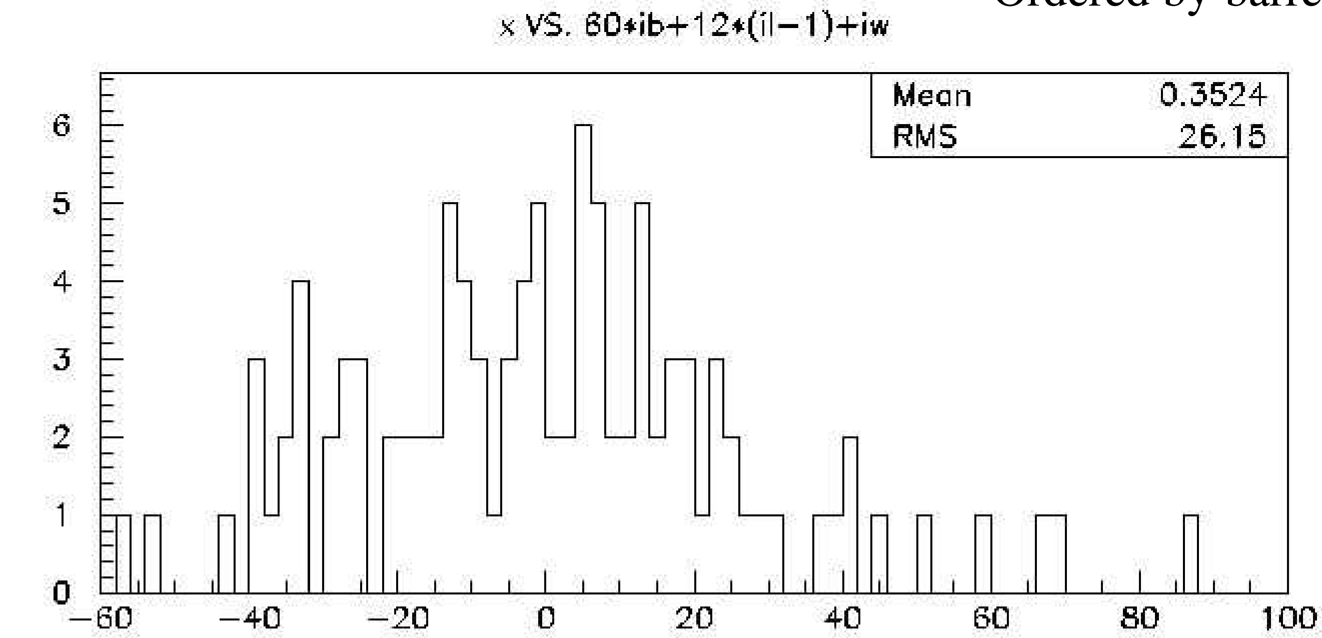
Ordered by barrel,layer, wedge



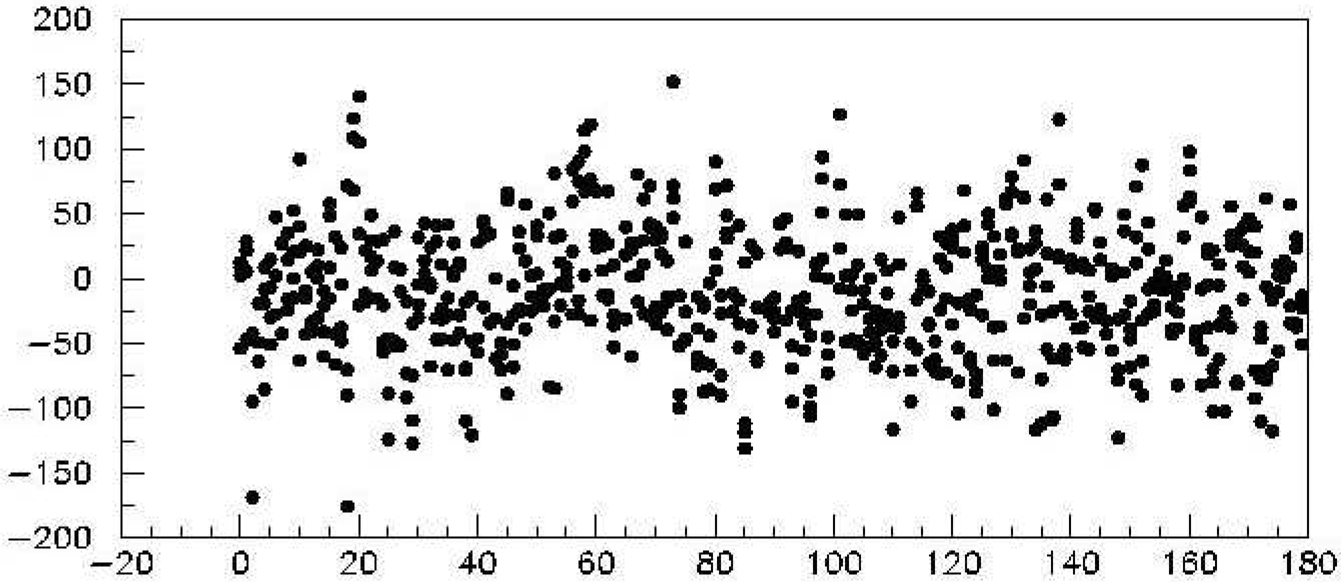
Δz



Ordered by barrel,layer, wedge

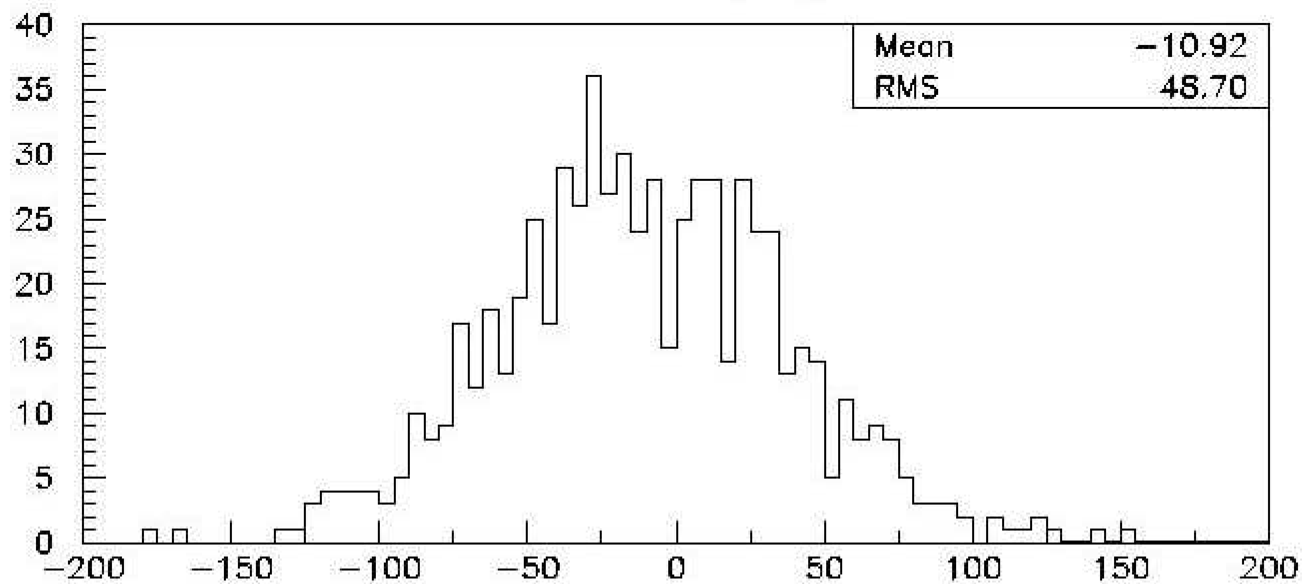


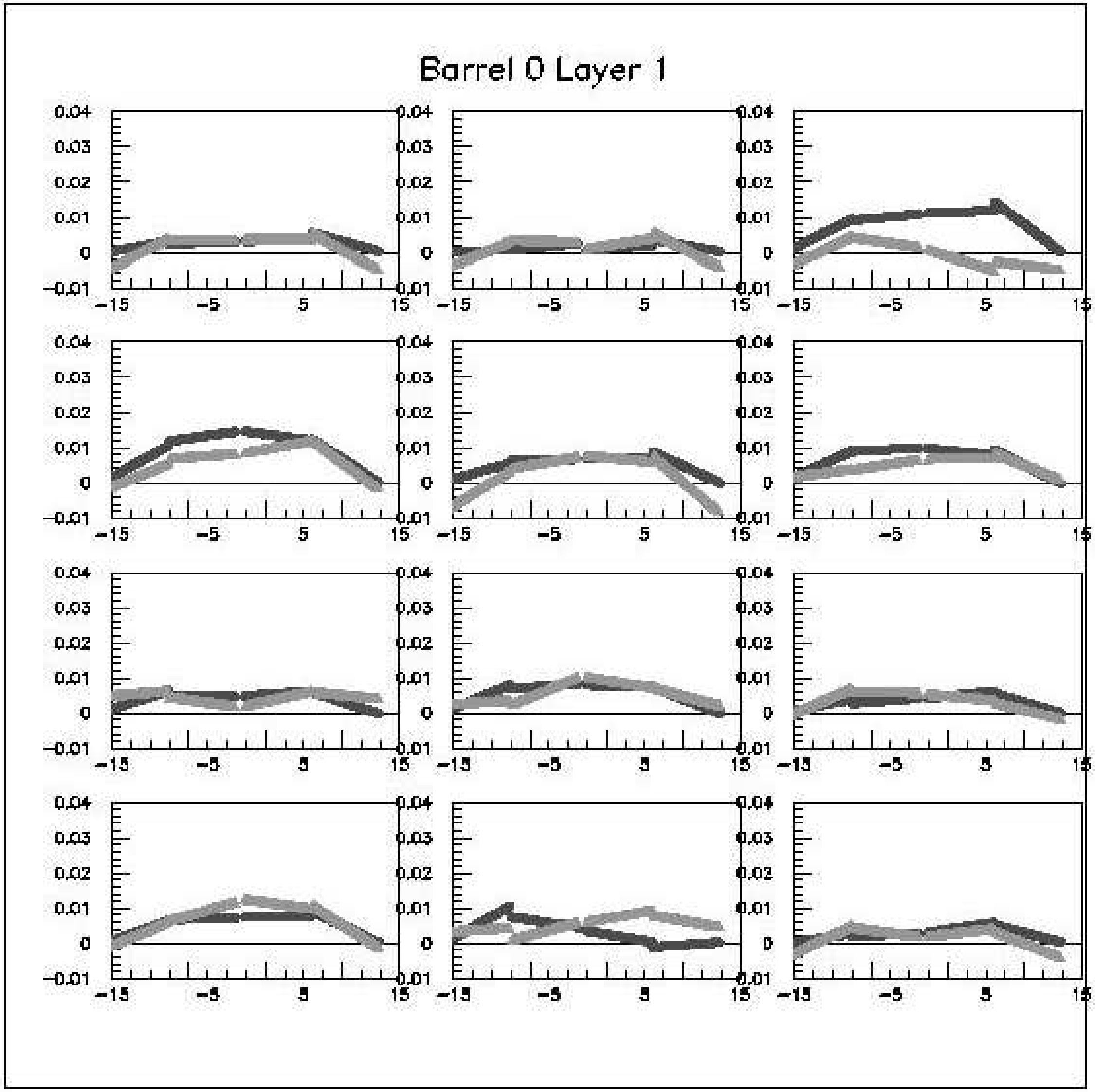
ΔR



Ordered by barrel,layer, wedge

x VS. 60*ib+12*(il−1)+iw

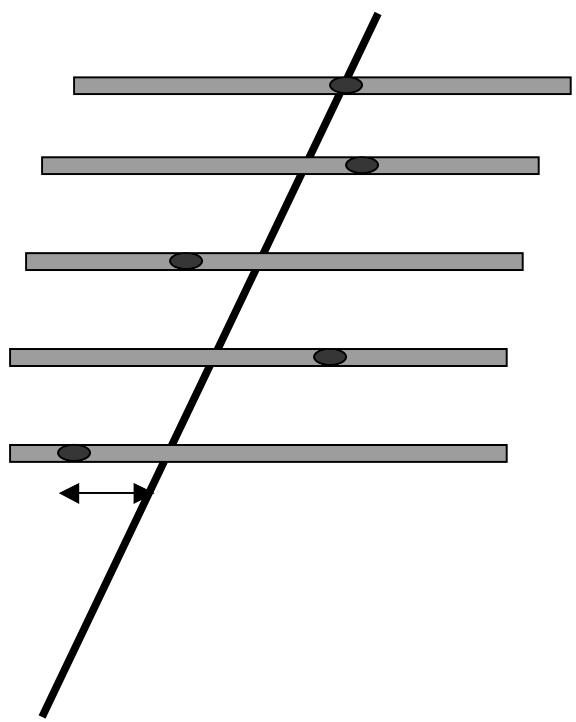


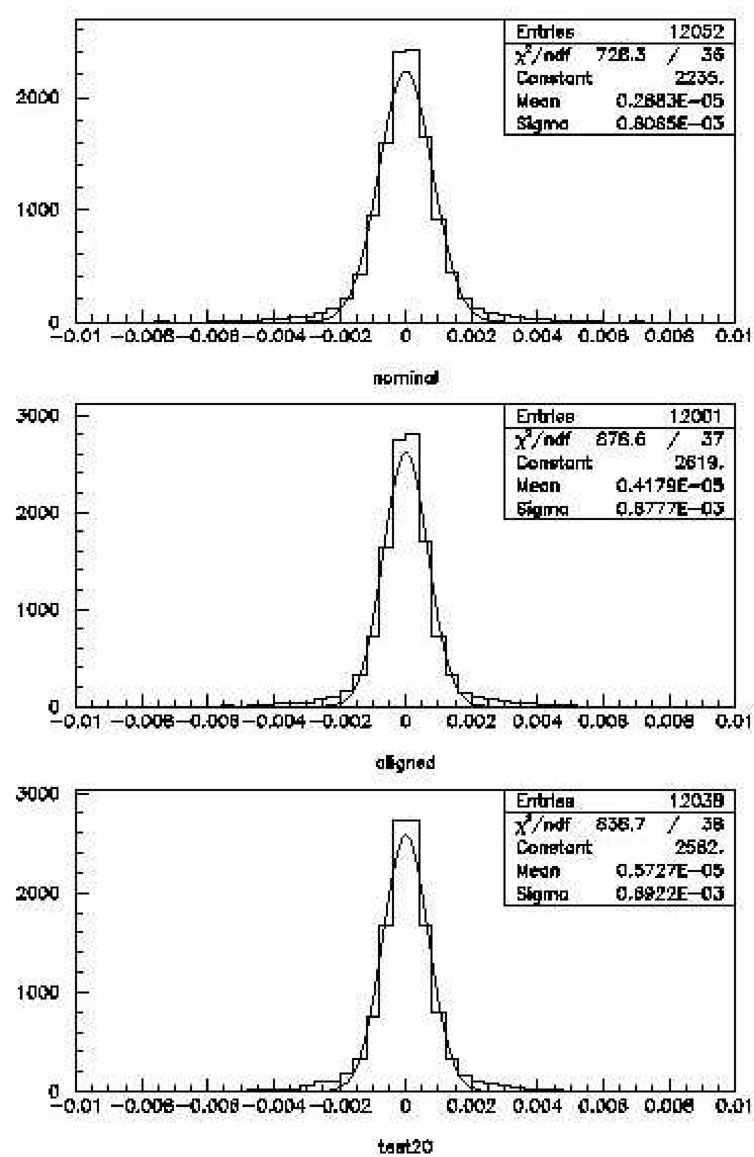


Barrel 0 Layer 1
0.04
0.03
0.02
0.01
0
-0.01
-15
-5
5
15

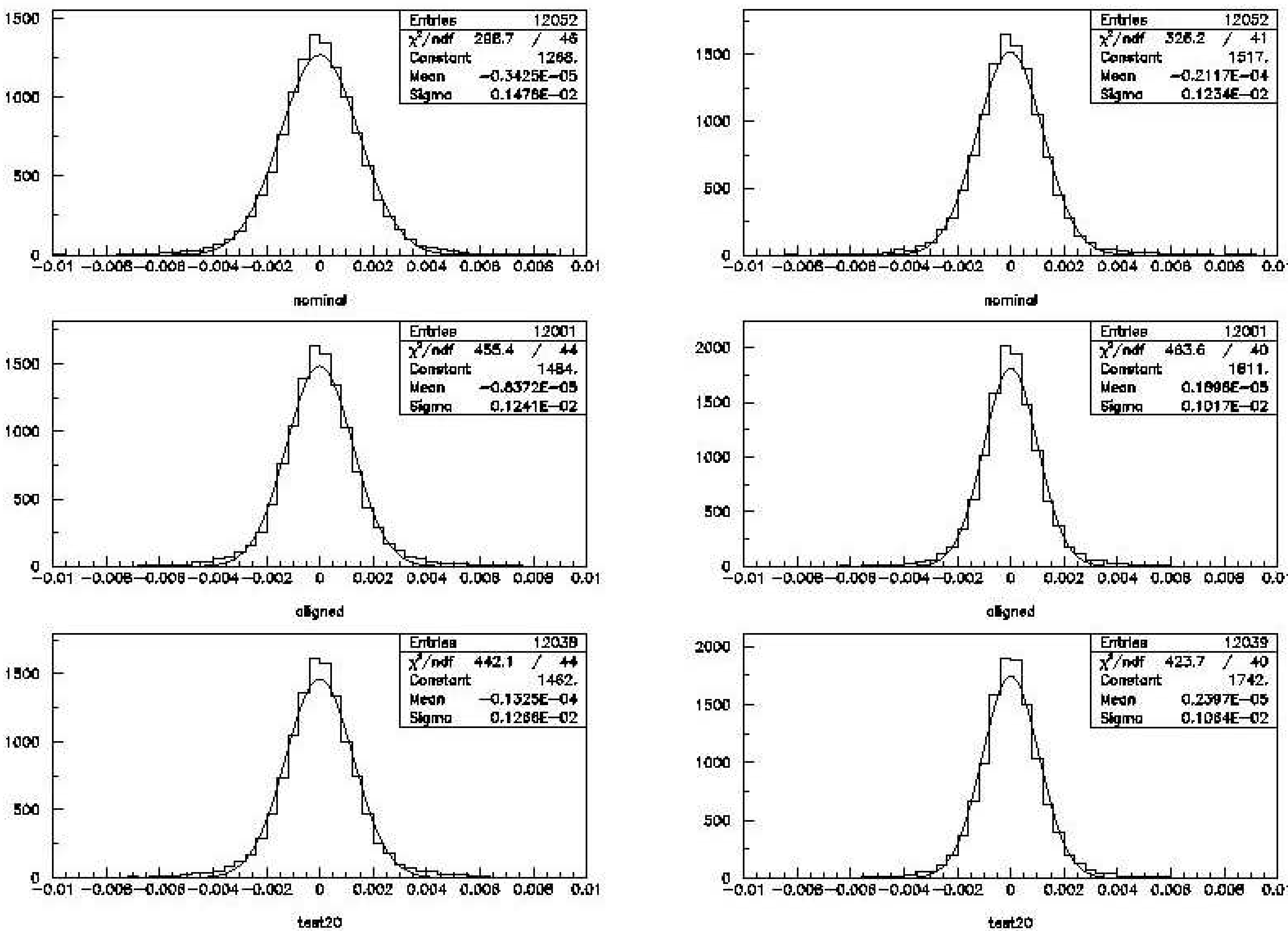
Biased Residuals (Layer 1)

- Choose tracks with hits in all layers
- Perform circle fit

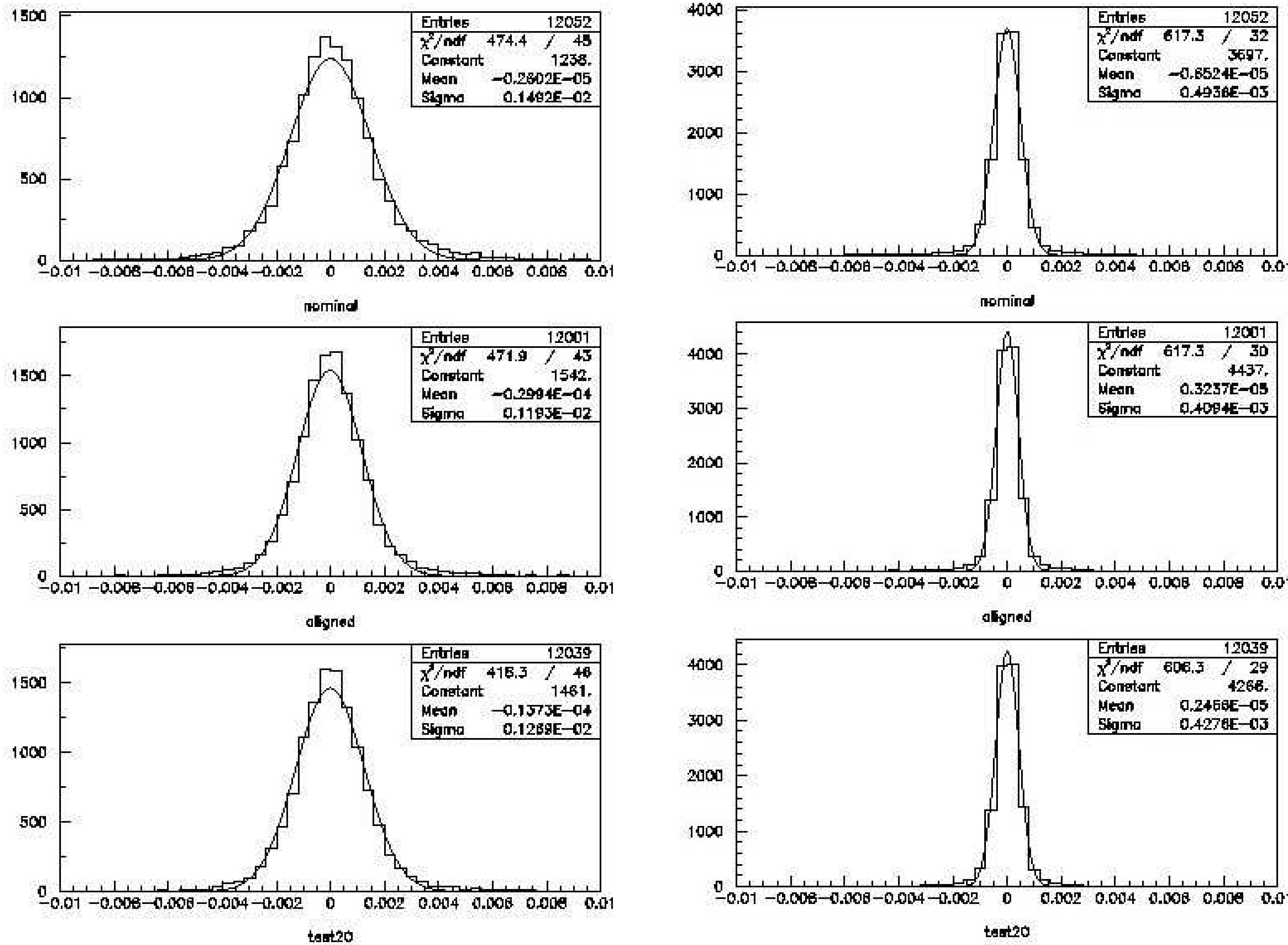




Biased Residuals (Layer2 and 3)



Biased Residuals (Layer4 and 5)

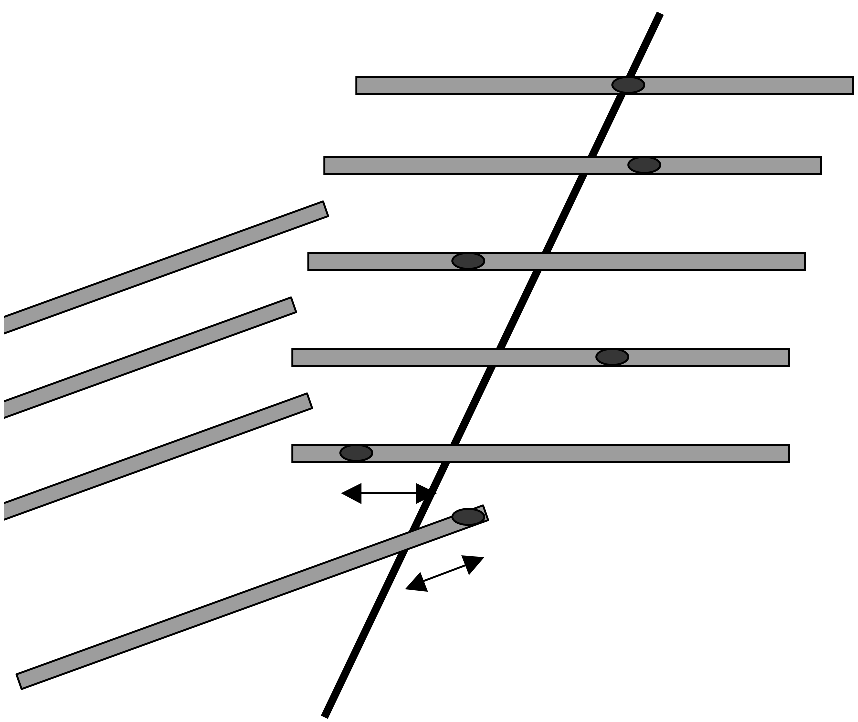


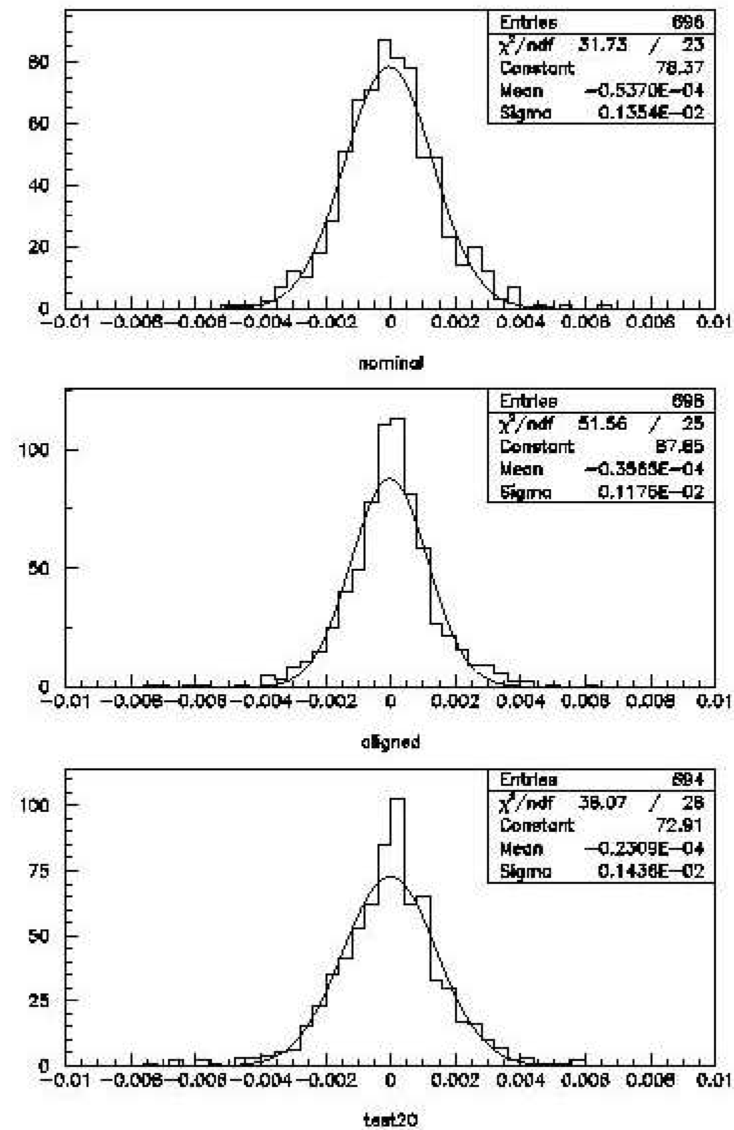
Biased Residuals

- Better than nominals by 0.7 - 3.4um
  - Tribute to construction!
- Slightly better than align_20 by 0.2-0.7um
- (These numbers require unfolding to get point precision: $\sigma=\sigma_{extrap}+\oplus\sigma_{silicon}\oplus\sigma_{align}$)

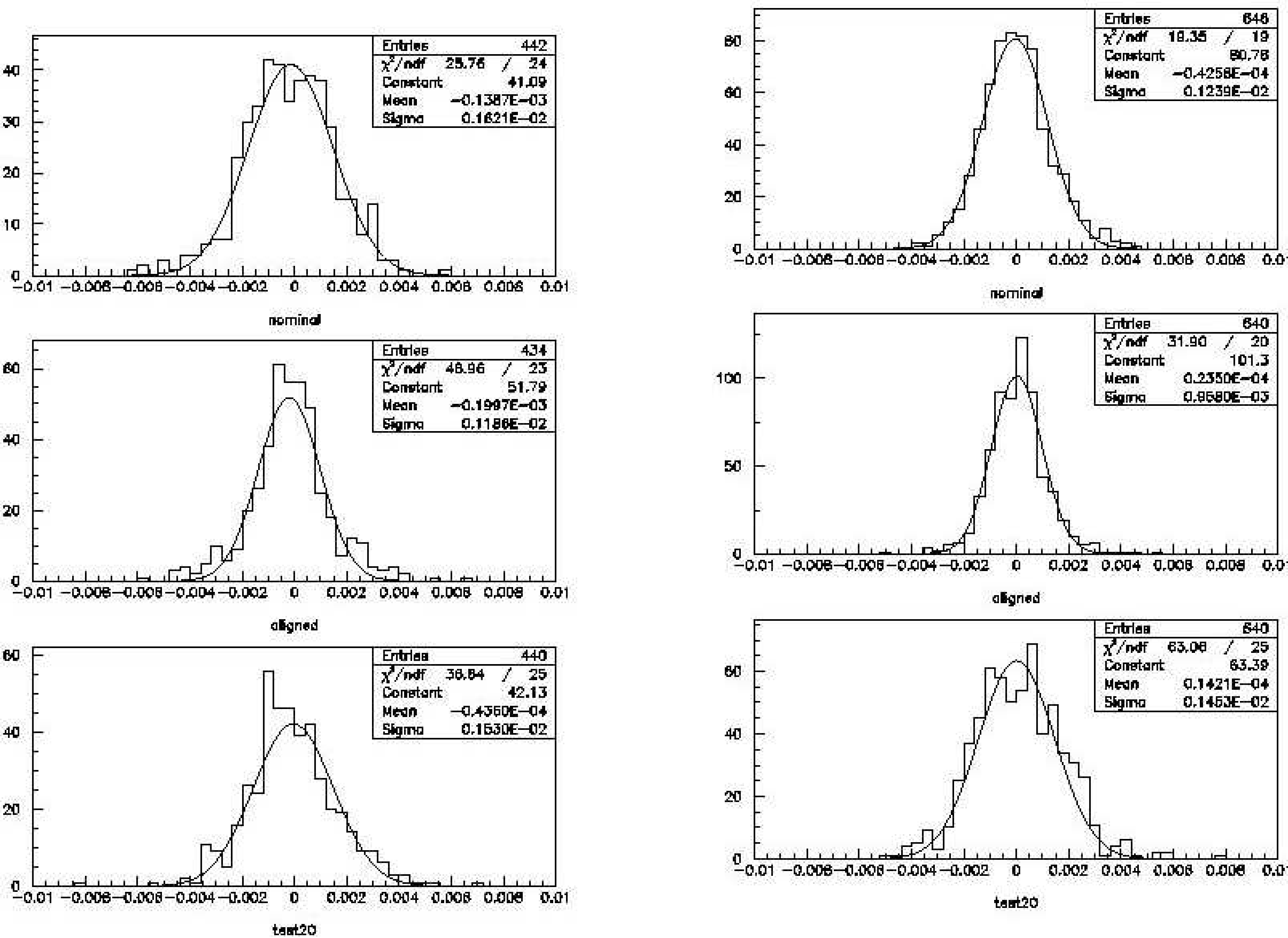
Overlap Biased Residuals (Layer 1)

- Choose tracks with hits in all layers
- Perform circle fit

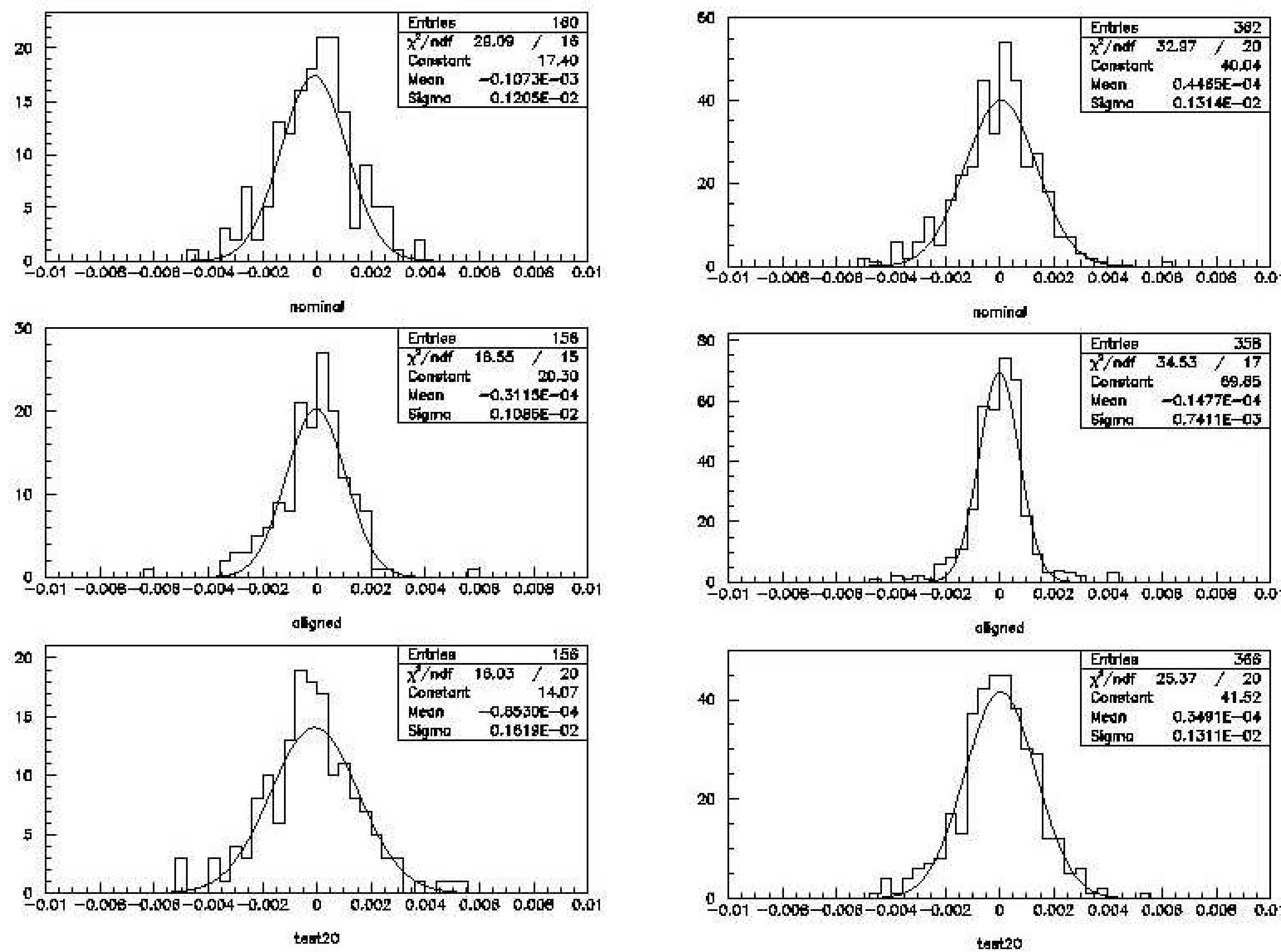




Overlap Biased Residuals (L2 and 3)



Overlap Biased Residuals (L4 and 5)

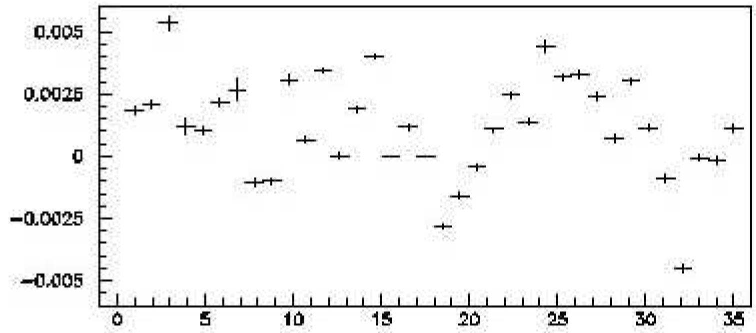


Overlap Biased Residuals

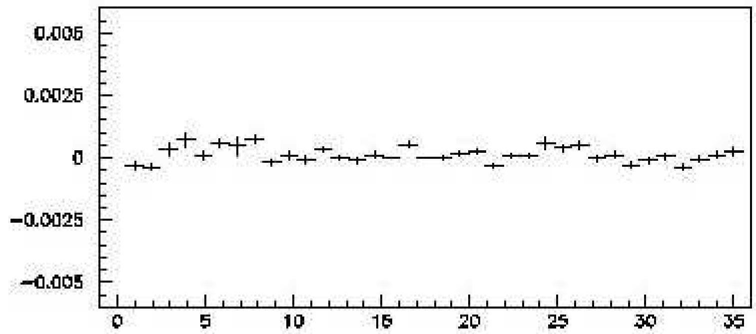
- Better than nominals by 1.2 - 5.7um
  - Tribute to construction!
- Better than align_20 by 2.6 - 5.7um
  - Not surprising (no constraint on olaps)
  - (Align_20 slightly worse than nominals)
- (These numbers require unfolding to get point precision: $\sigma=\sigma_{\text{extrap}}+\oplus\sigma_{\text{silicon}}\oplus\sigma_{\text{align}}$)

Impact Parameter v Phi

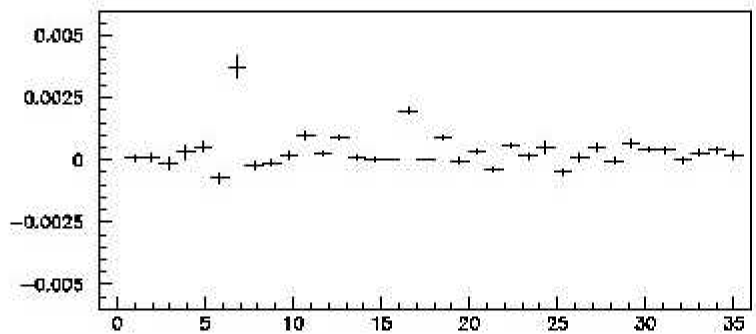
Survey



This Alignment



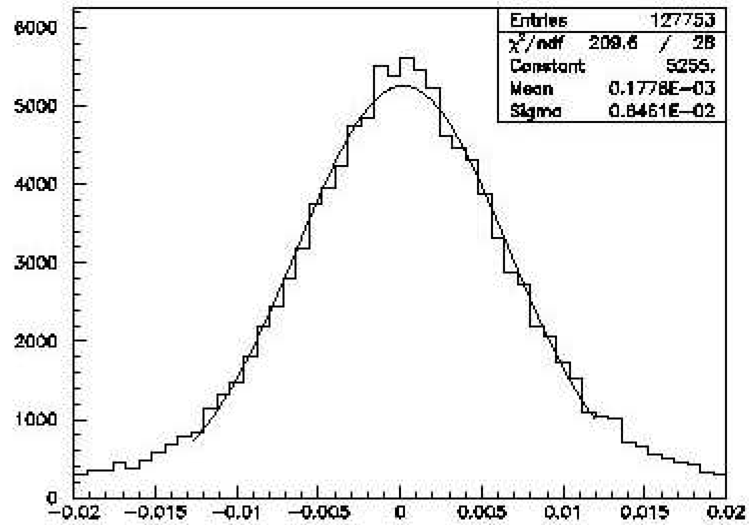
Align_20



Impact Parameter

I.P for 1<pt<1.25 GeV

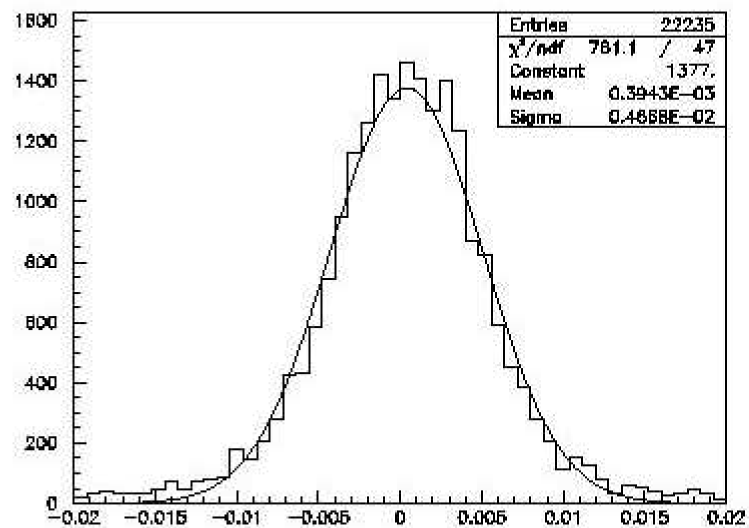
Resolution = 65um



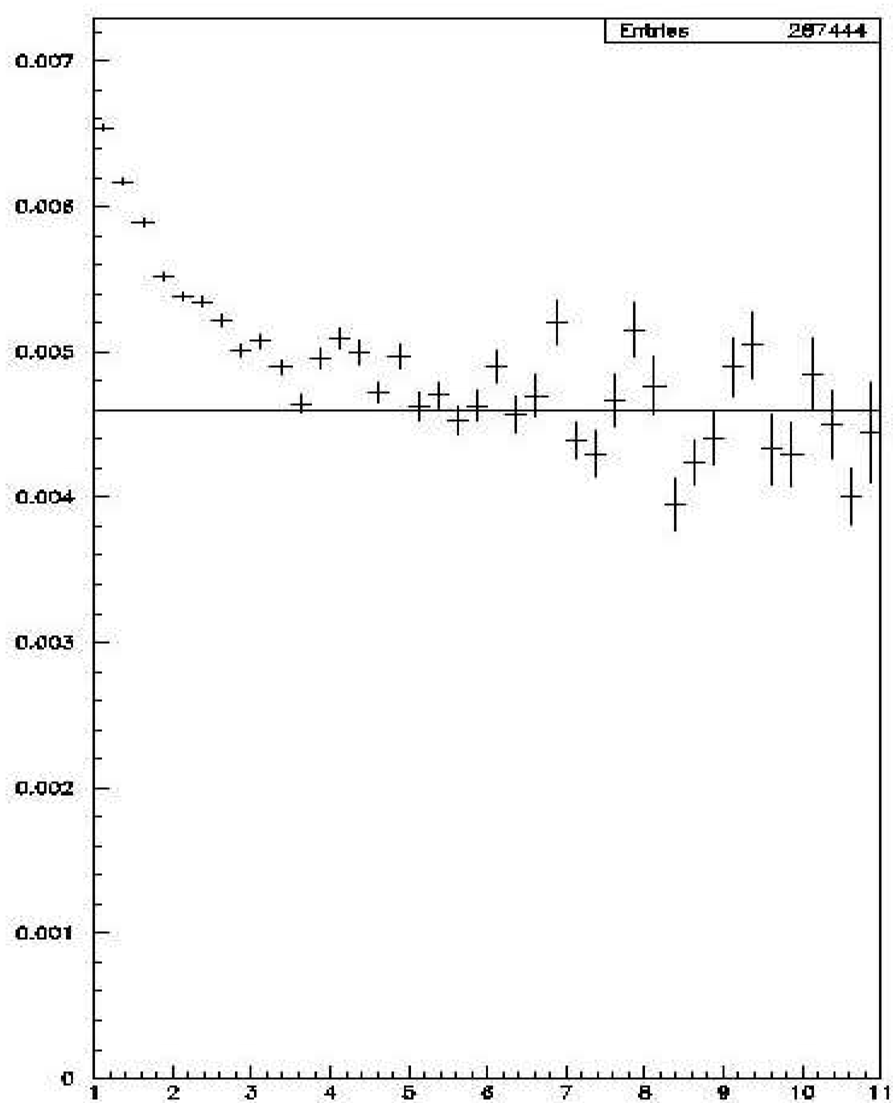
I.P for pt>5 GeV

Resolution = 47 um

(dominated by beamspot)



Pt dependence



Conclusions

- This alignment procedure gives consistent results with the mechanical surveys
- Point resolutions better than survey
- Some improvements on align_20 particularly in overlaps.

- Action: Create alignment table and let others test. Confront with more data challenges.