Tracking Status

COT+ISL+SVX+L00

Current Status

- COT has basic calibration
- Error matrix not accurate
- dE/dx not included

- Basic Rϕ SVX alignment
- No ‘z’, stereo, ISL, L00

Problems pointing, drift velocity, geometry, electrostatics

Add multiple scattering and scaling

Adhoc dE/dx correction & fiddle B field too!

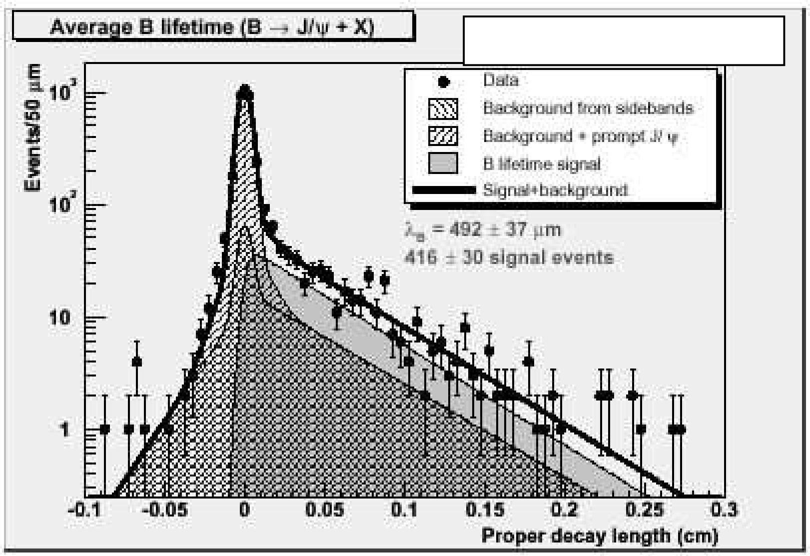
by mapping COT tracks onto SVX, and performing unphysical deformations

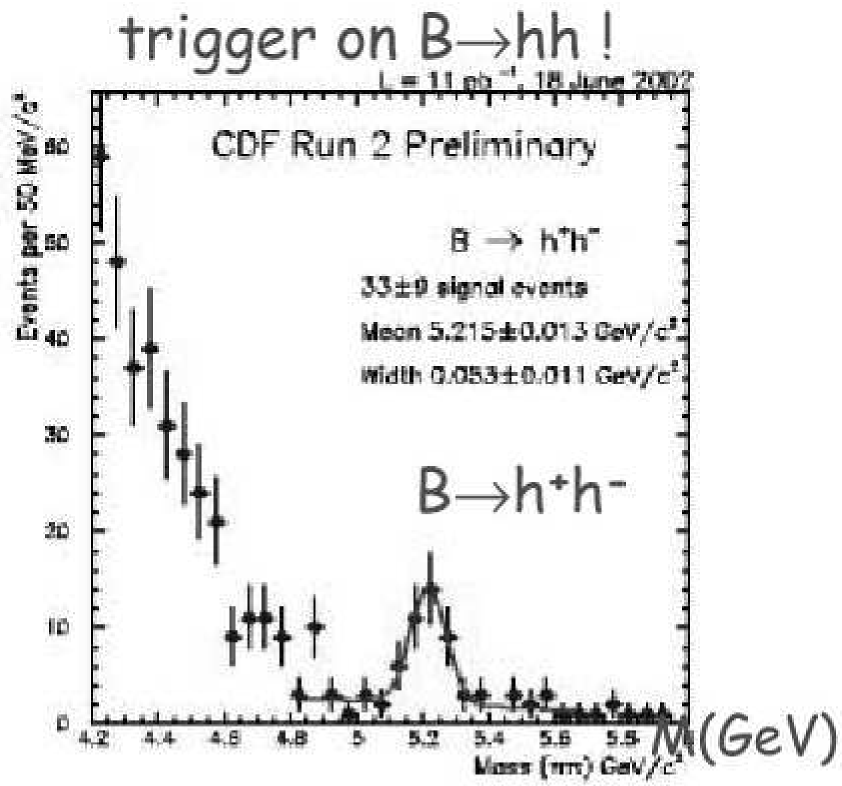
L00 is not in pattern recognition

Need to break detectors Silicon survey inaccurate

Having said all that…

….. Maybe it doesn’t matter for “*most physics*”.





Current Philosophy

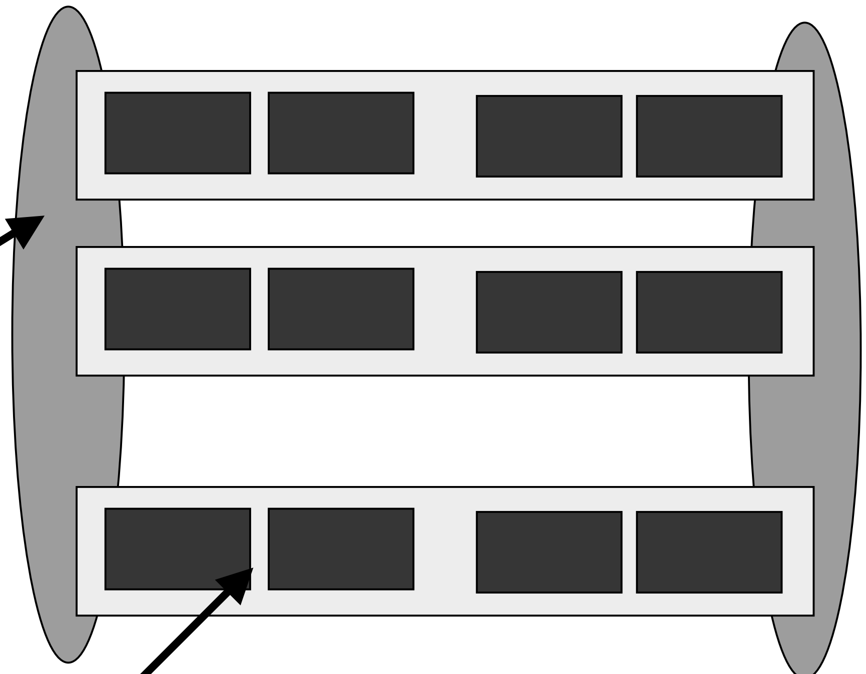
- Stay with effective solution while…
  - Internal unbiased solution sorts out:
    - SVX
    - ISL
    - L00
    - COT

SVX

Mechanical Survey Numbers

CMM measures ladders on bulkheads to 10um.

Constuction good to 15um



Beware the Bows:

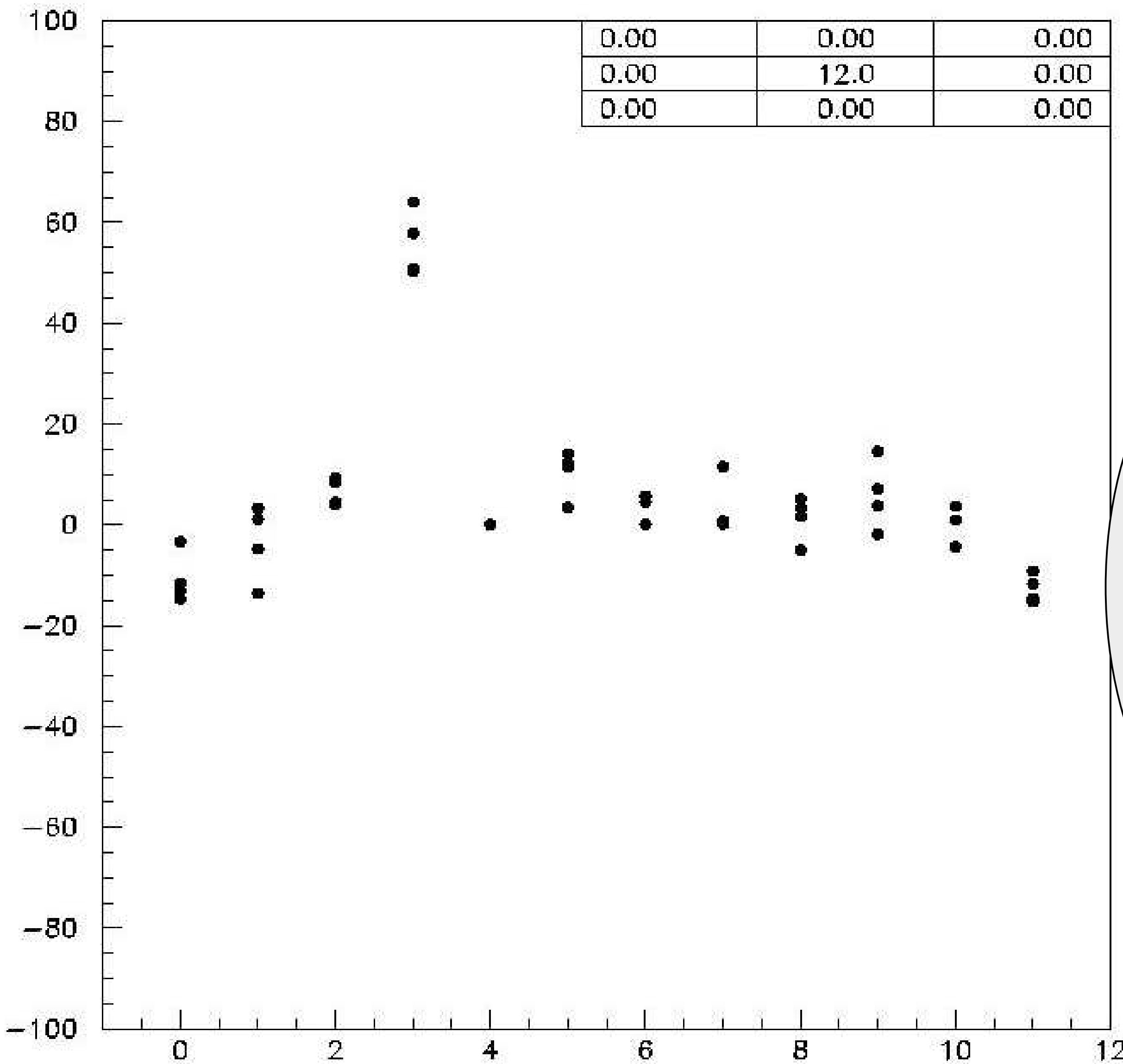
CMM and OGP disagree 25% of the time

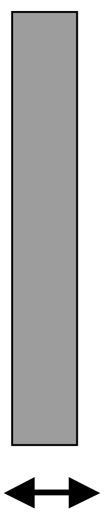
CMM measures to 40um

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

Apply Alignment to Nominals

Transverse Shift (um)





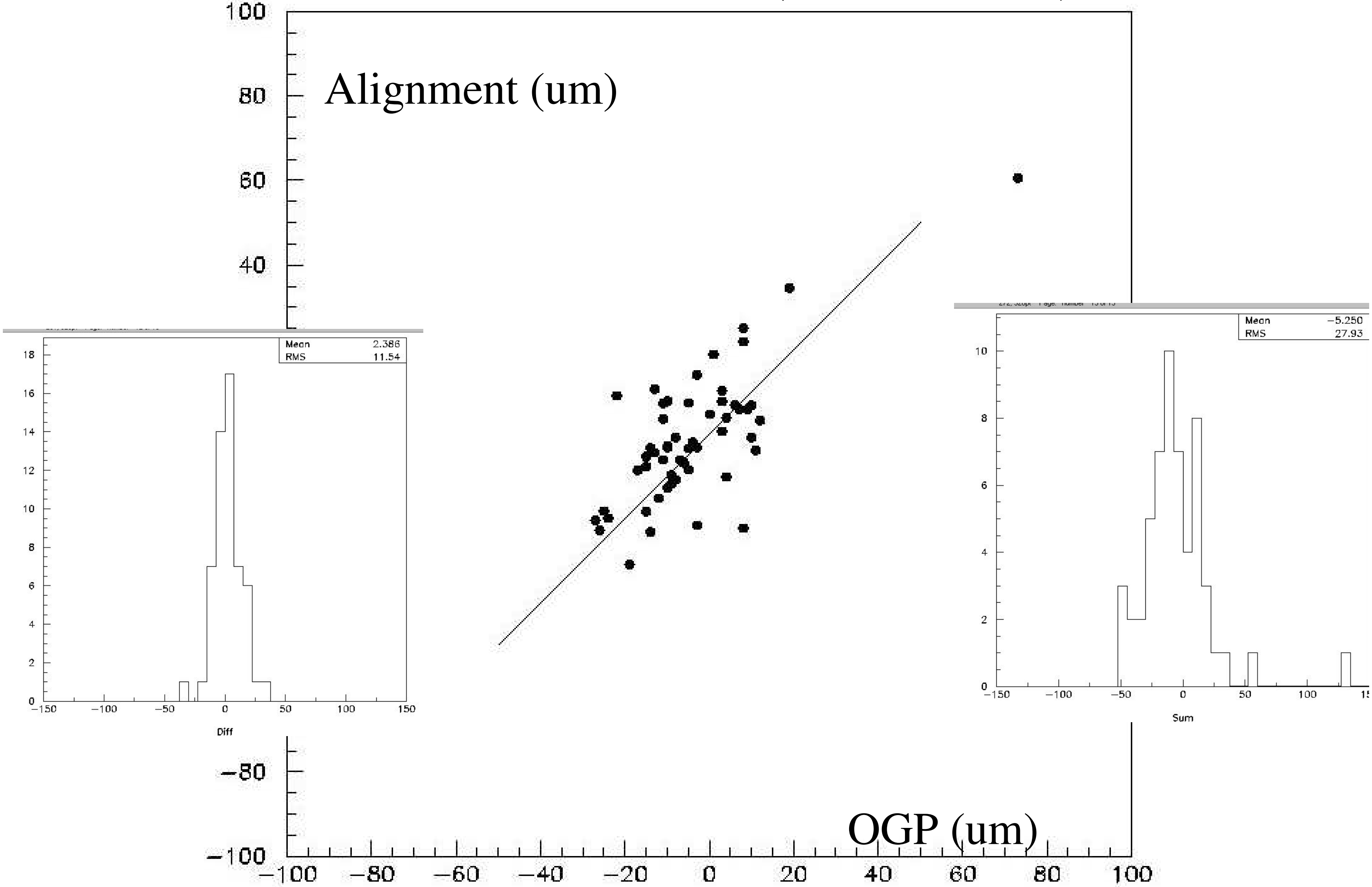
Wedge number

Note:

Wafer to wafer agreement

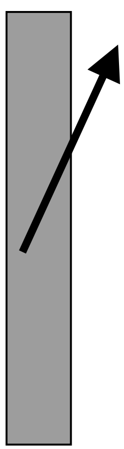
Outlier

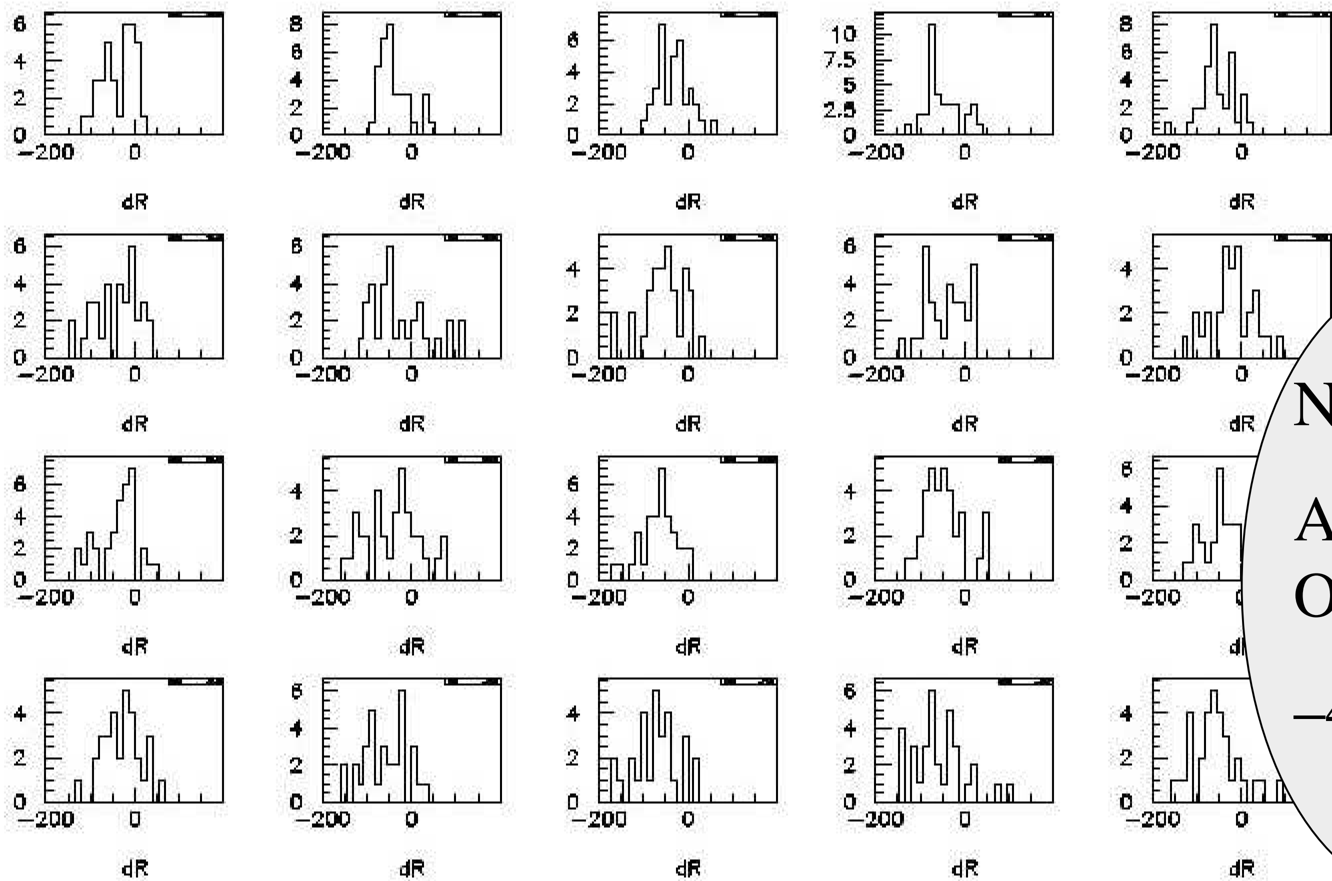
Ladder Shifts (Barrel 1)



Apply Alignment to Nominals

Radial
Shifts
(um)

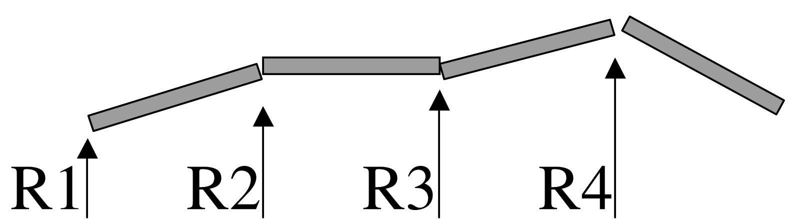




Note:

Average
Offset is

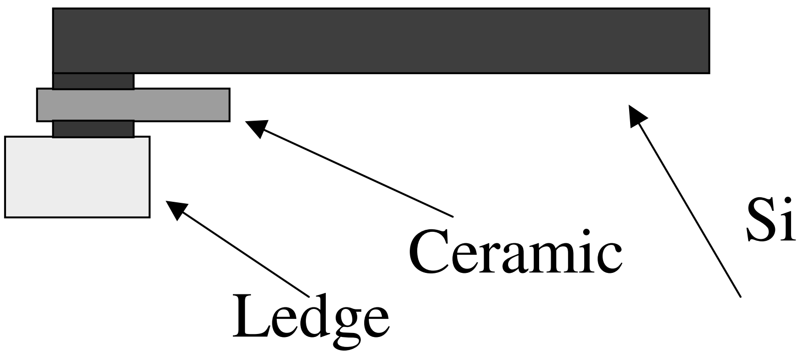
–45um



Rows are shifts R1-R4

Columns are Layers 1-5

OGP measurement of height from ledge



Ceramic ordered = 508um

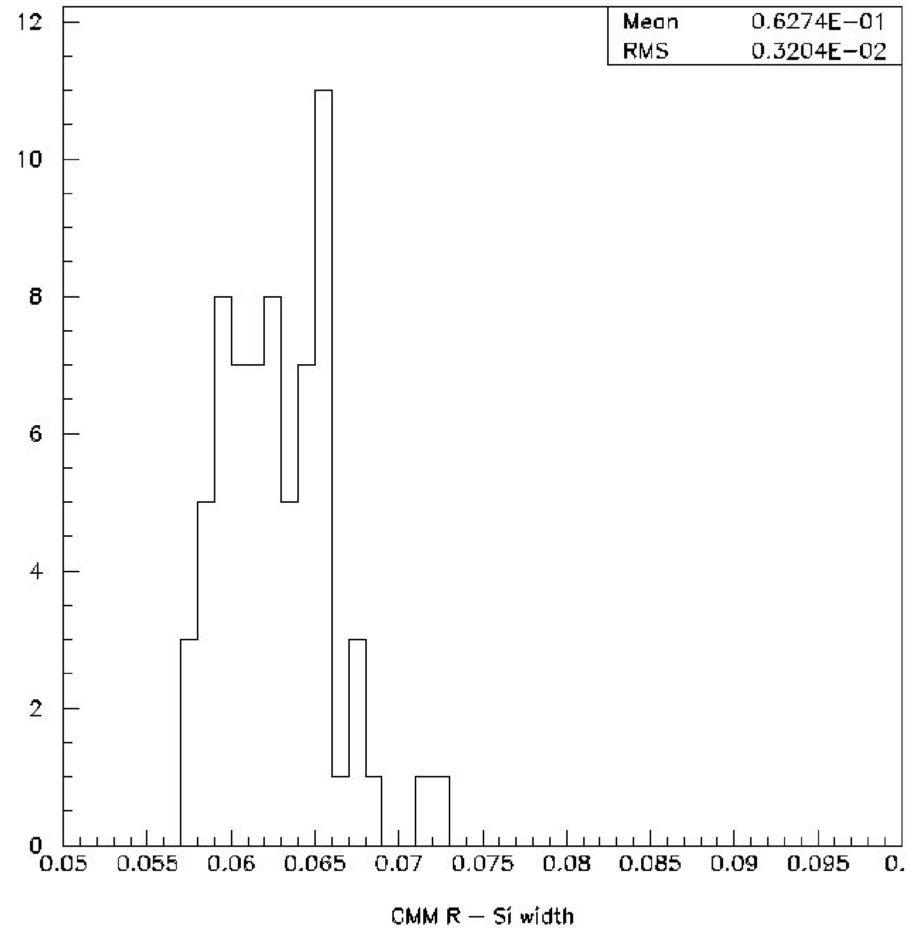
Glue = ?

CDF code assumes 675um

CMM measured <627um>

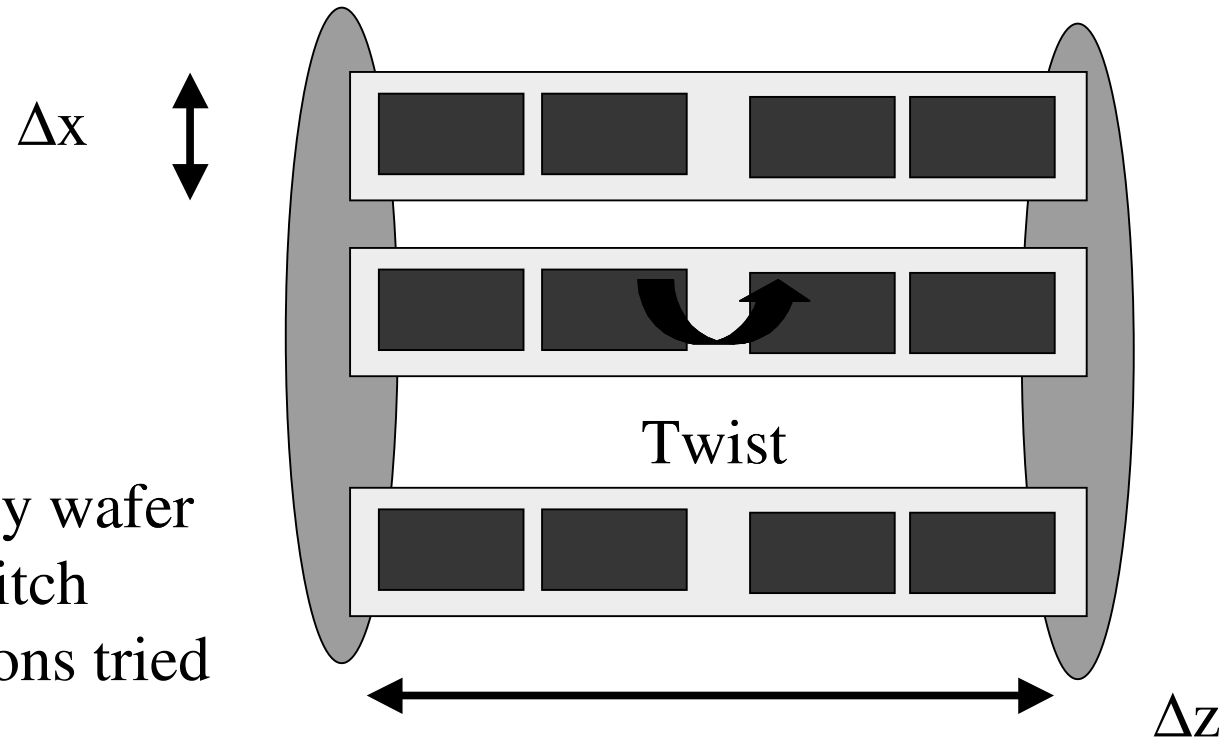
Delta of -48um

…. in agreement with alignment



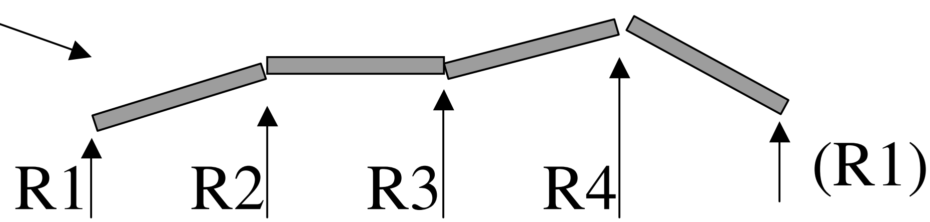
Diff ledge and Si bottom (mm)

Alignment Parameters



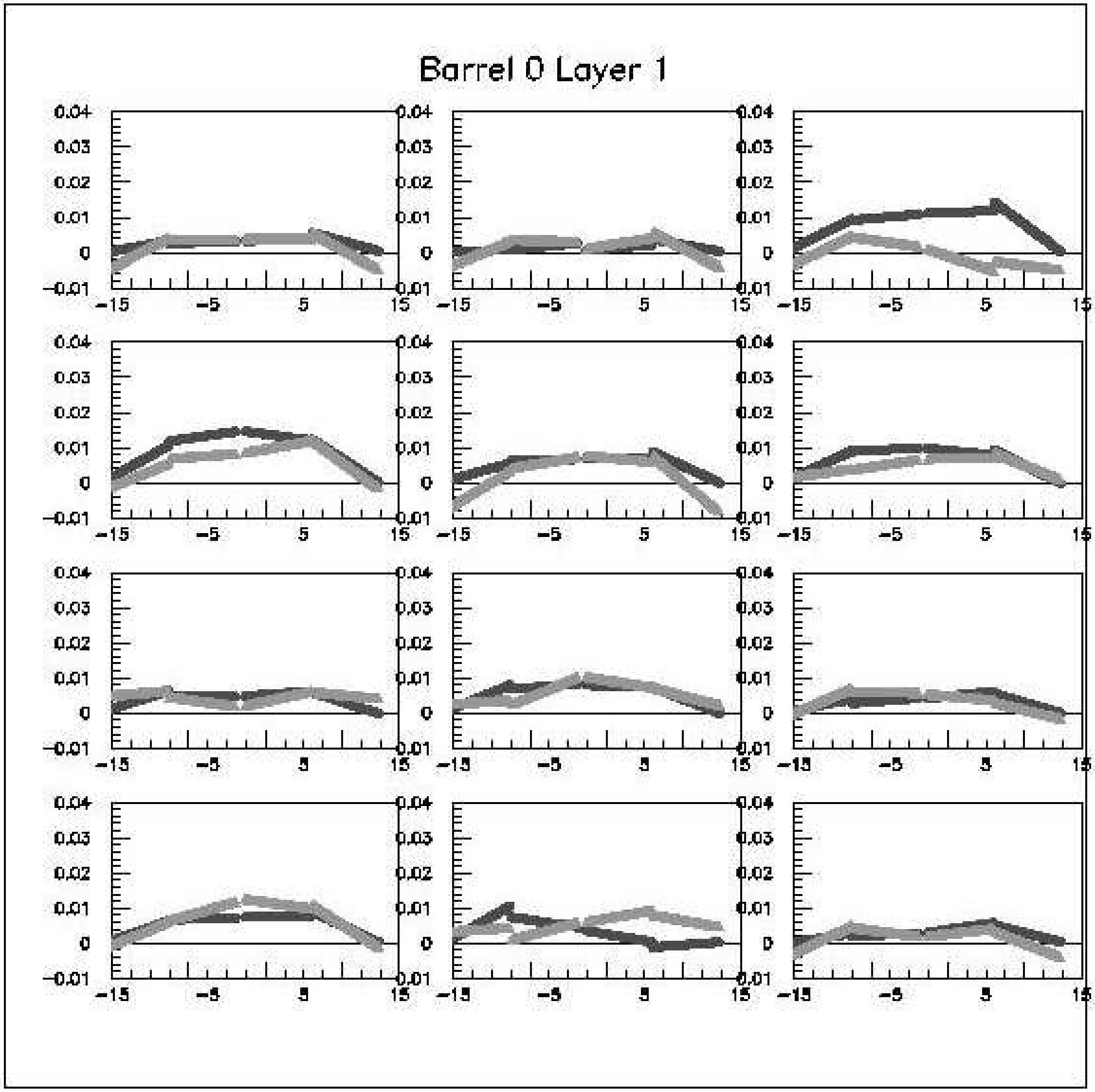
Wafer by wafer R and pitch corrections tried

Less parameters similar results



More physical?

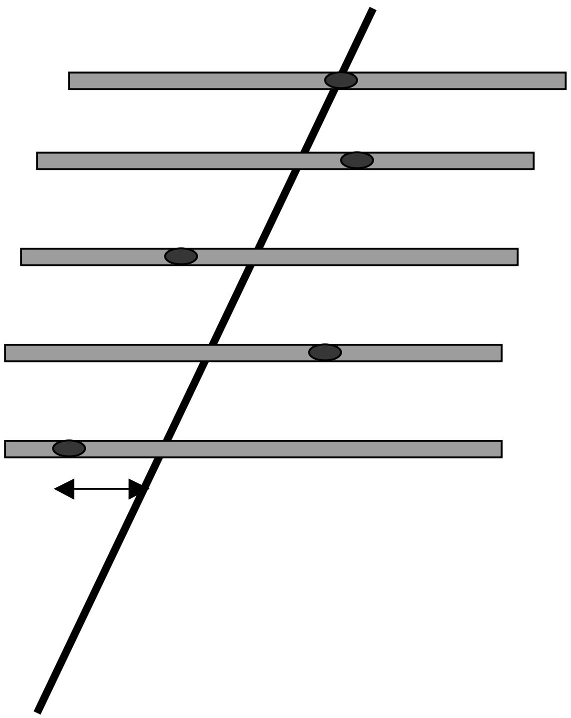
Subjective choice

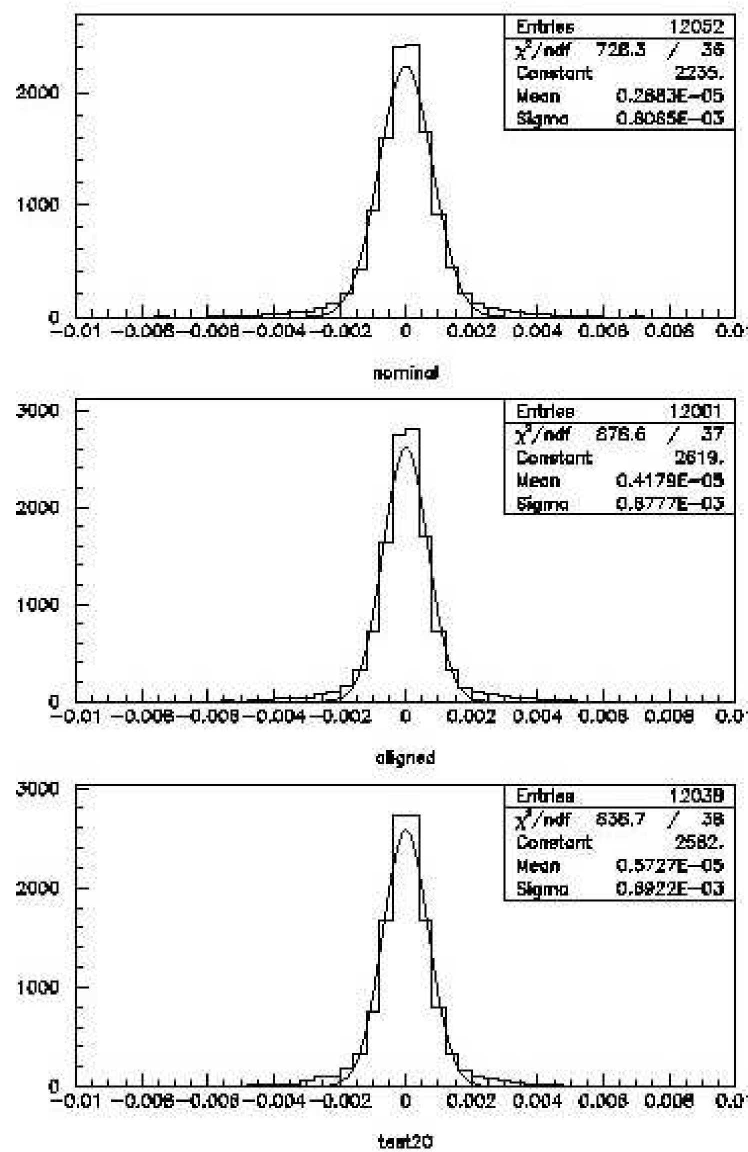


Barrel 0 Layer 1
0.04
0.03
0.02
0.01
0
-0.01
-15
-5
5
15

Biased Residuals (Layer 1)

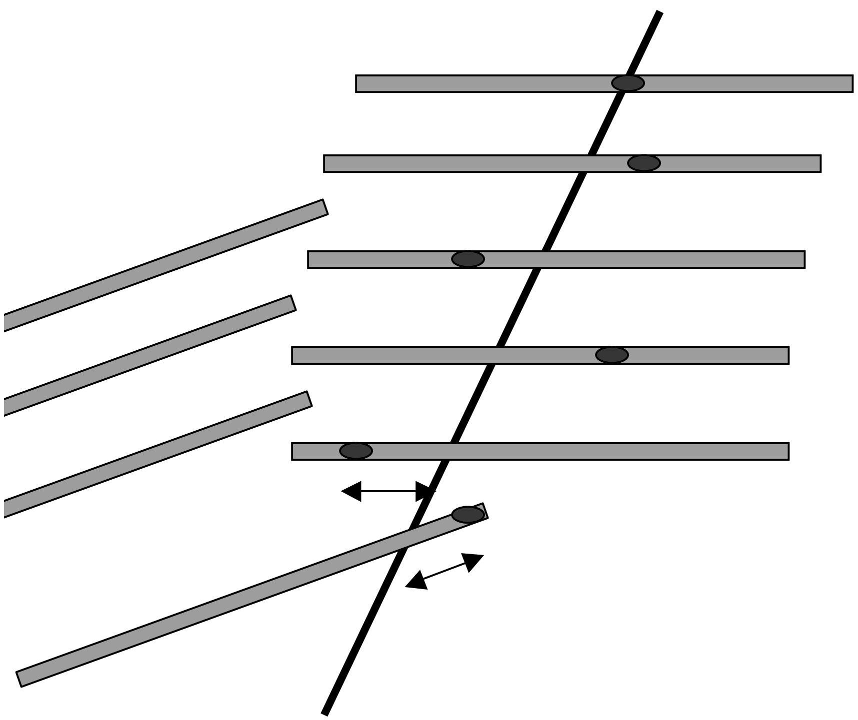
- Choose tracks with hits in all layers
- Perform circle fit

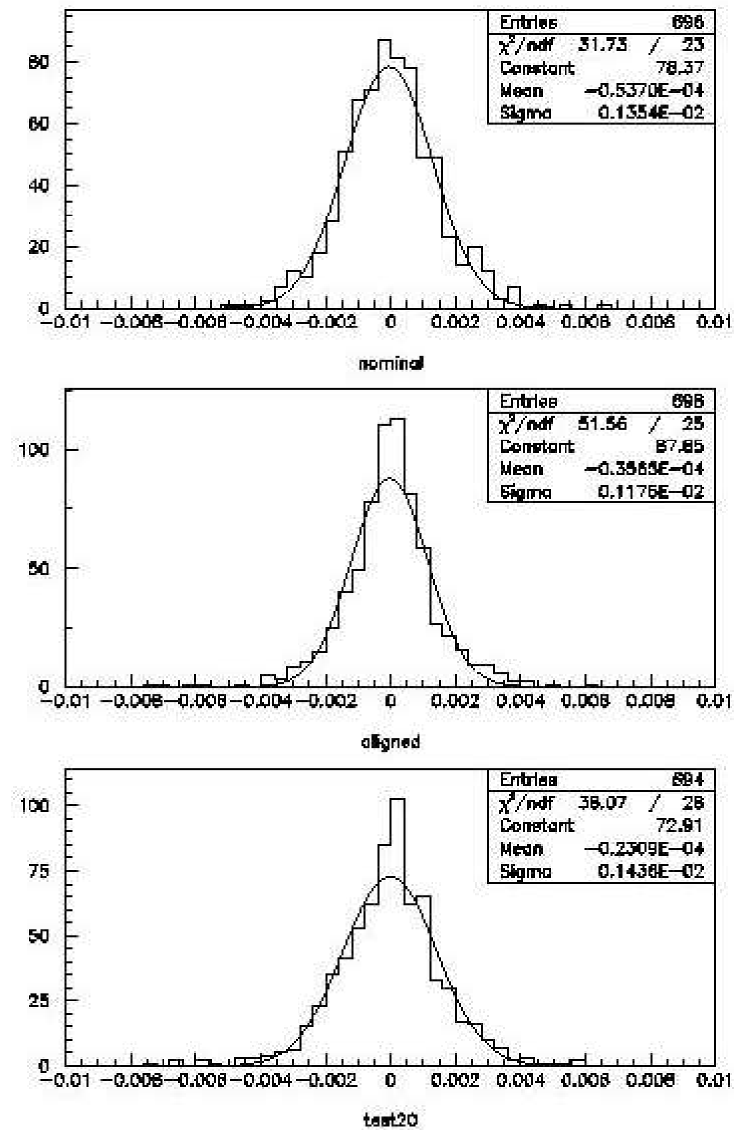




Overlap Biased Residuals (Layer 1)

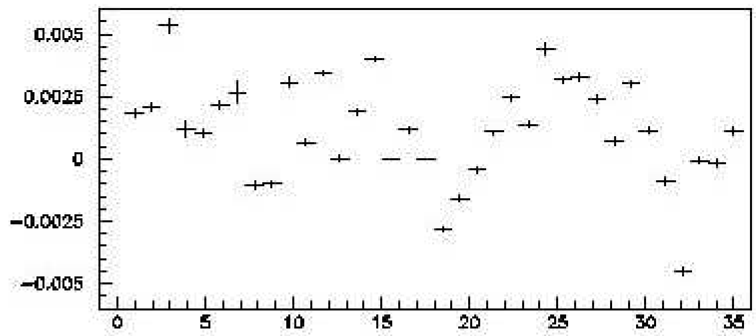
- Choose tracks with hits in all layers
- Perform circle fit



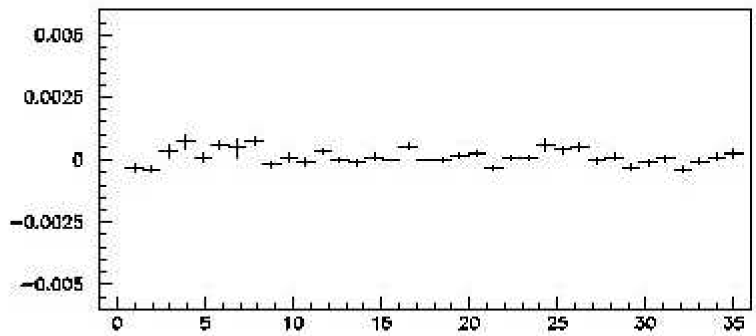


Impact Parameter v Phi

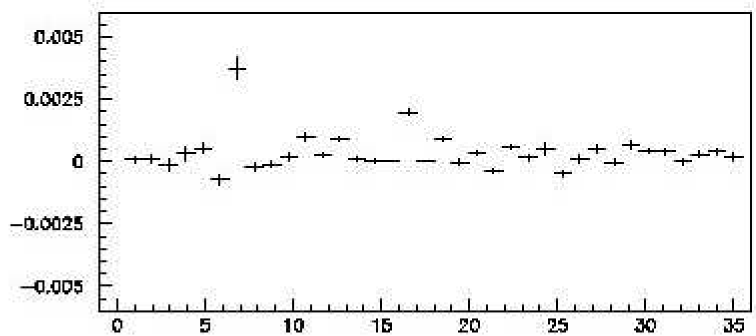
Survey



This
Alignment

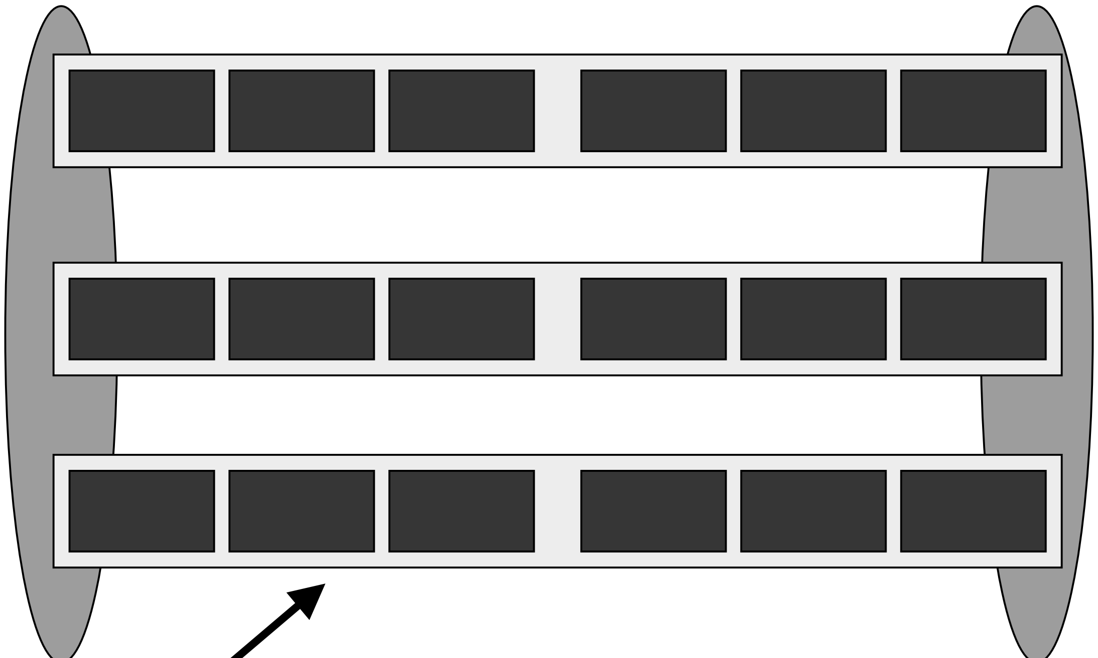


Align_20



ISL

Mechanical Survey Numbers

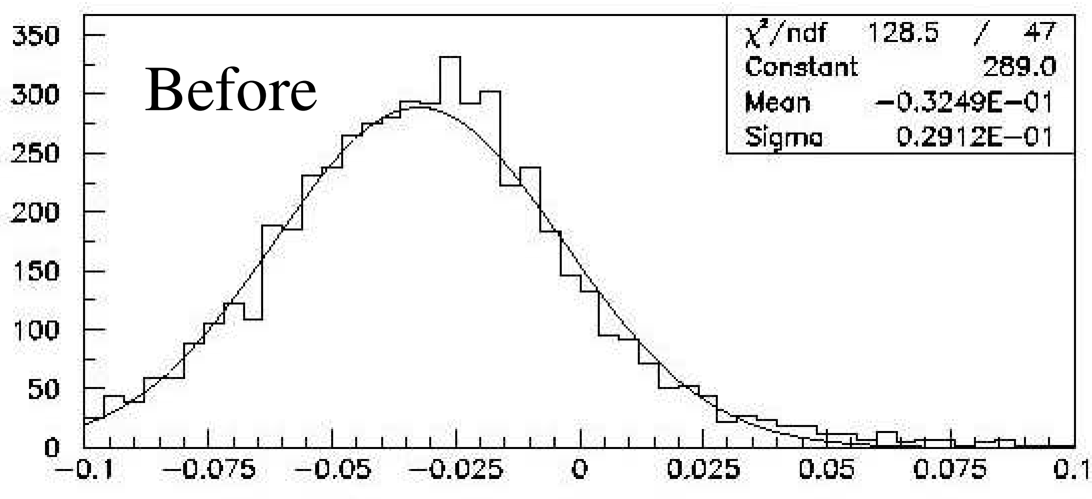


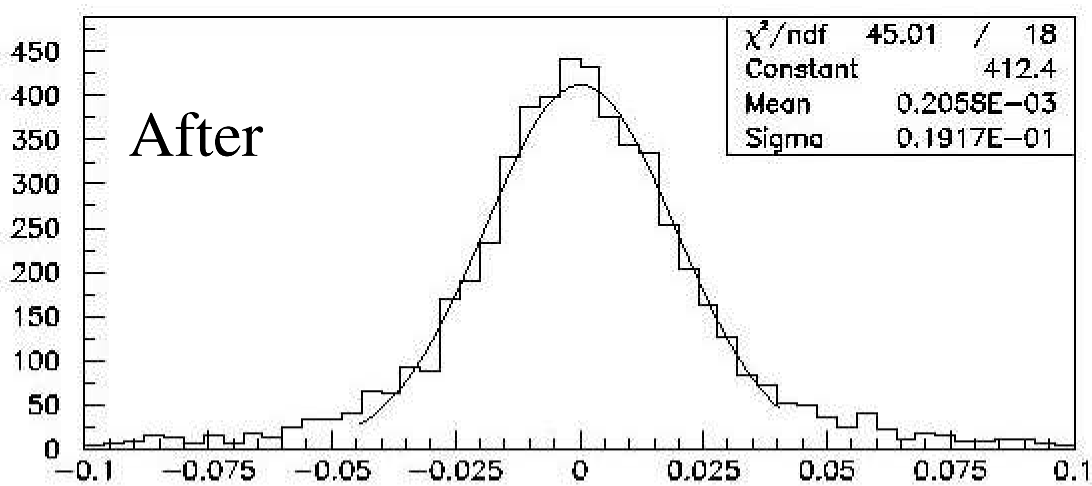
Half Ladder to
Ladder and
Ladder to
Bulkhead
Assembley
good to <100um

Half Ladder Construction good to few microns

Alignment Technique: Extrapolate SVX to ISL and align HL.

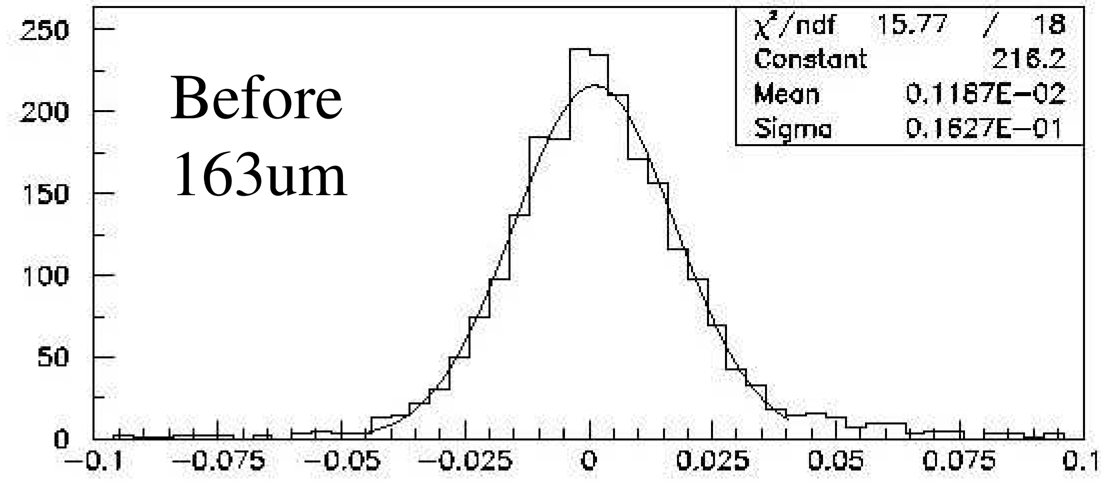
Global Barrel Alignment

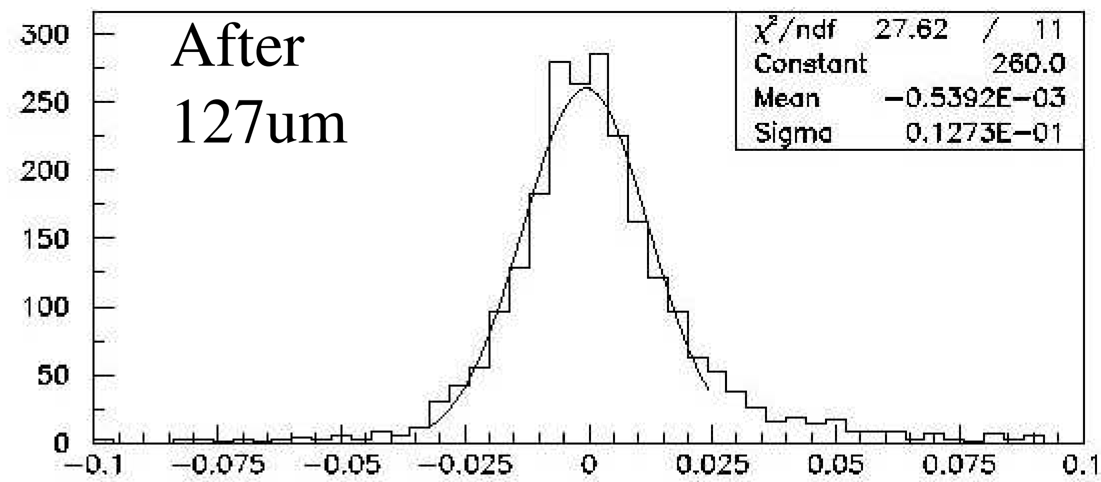




Rotations of 1.2,2.2,3.3 mrad in B0,1,2 and shifts of ~100um

Residuals (pT>2GeV)





In principle:

σ_{SI} = 40um

σ_{ISL} = 30um

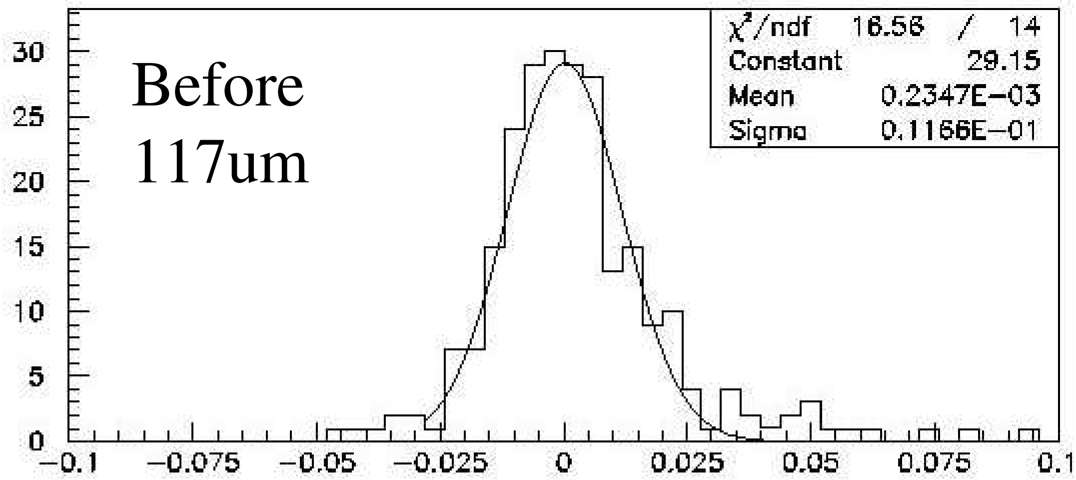
σ_{pt} = 20um

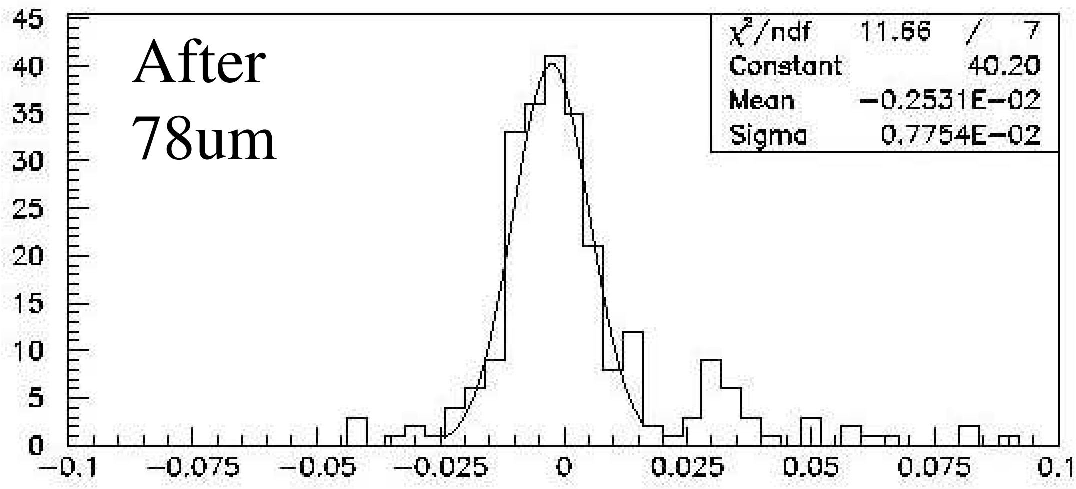
$\sigma_{MS}{}^{*}$ = 80/pt um

$\sigma_{TOT} = 55 \oplus 80/pt$
=~100 um

(* Just Si, not hybrid)

Residuals (pT>5GeV + away from hybrids)





In principle:

σ_{SI} = 40um

σ_{ISL} = 30um

σ_{pt} = 20um

σ_{MS}^{*} = 80/pt um

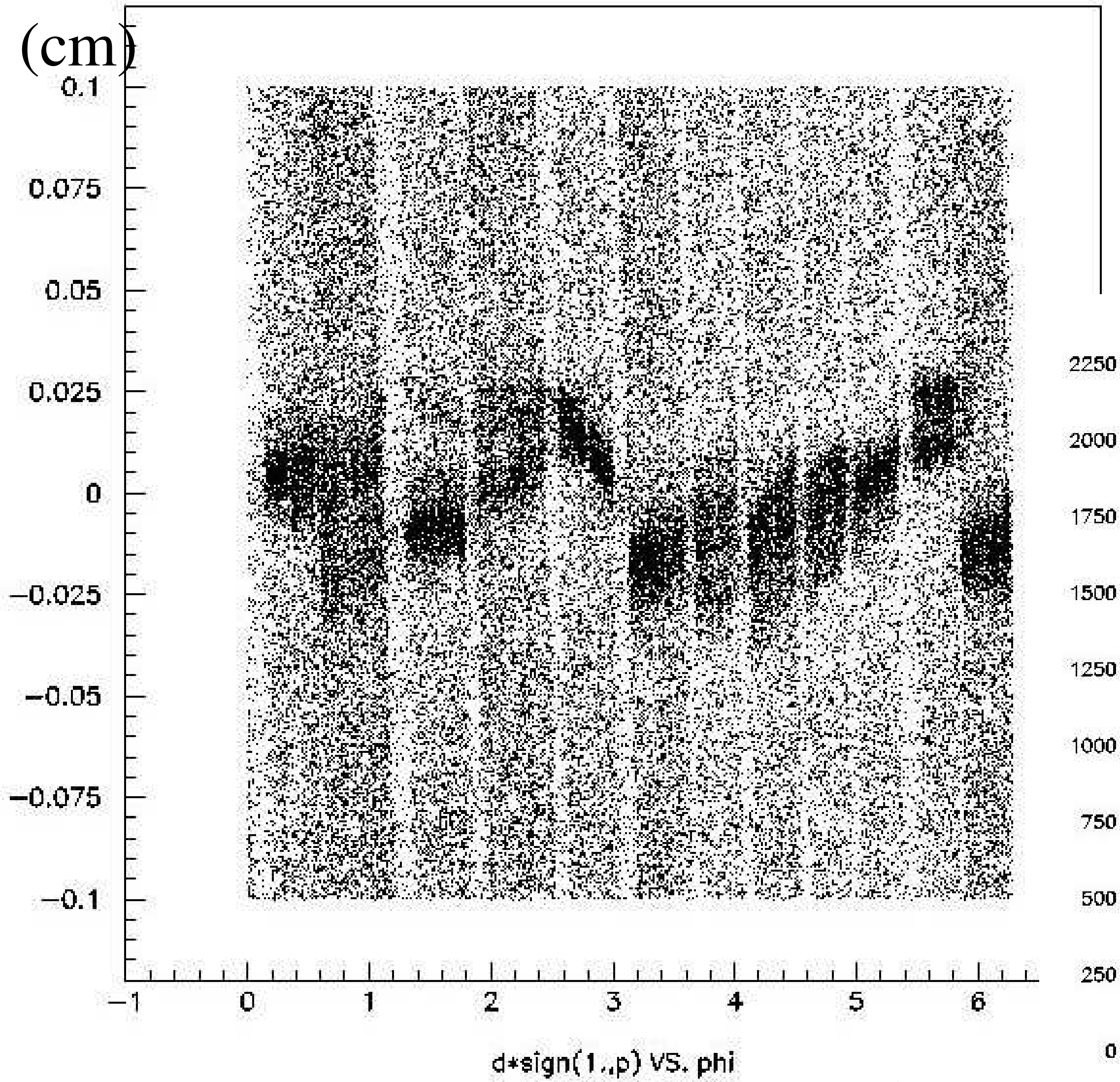
σ_{TOT} ~ 55 um

(* Just Si, not hybrid)

L00

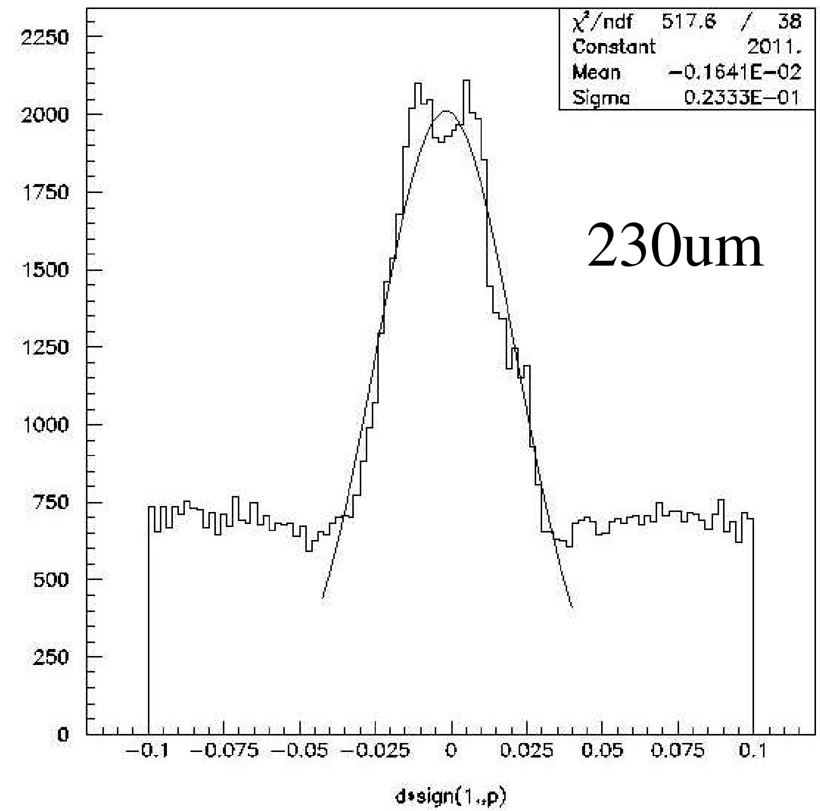
Global Alignment

Residual (cm)



Phi

Move default position
x:300um y:300um
ϕ:2mrad

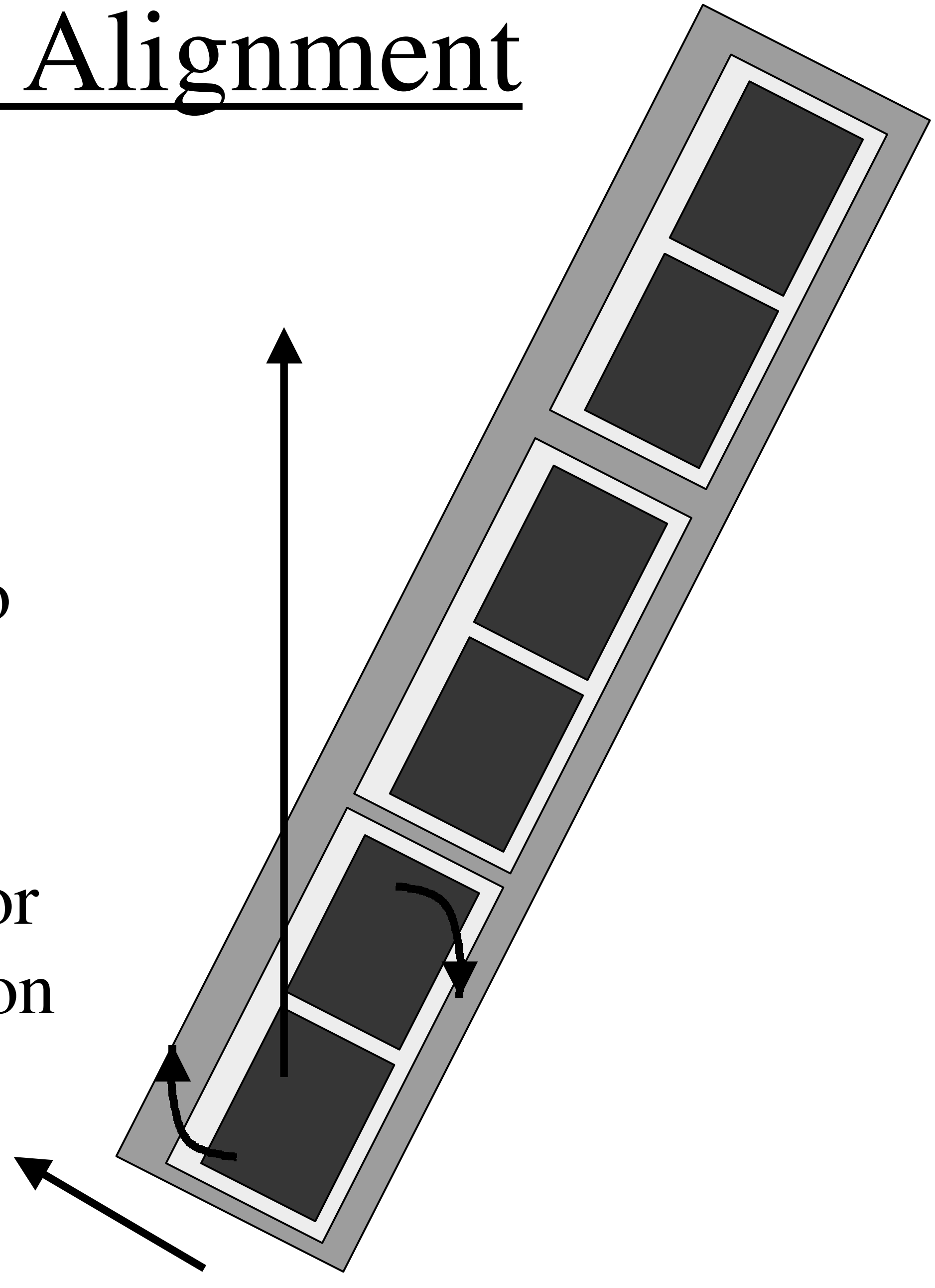


230um

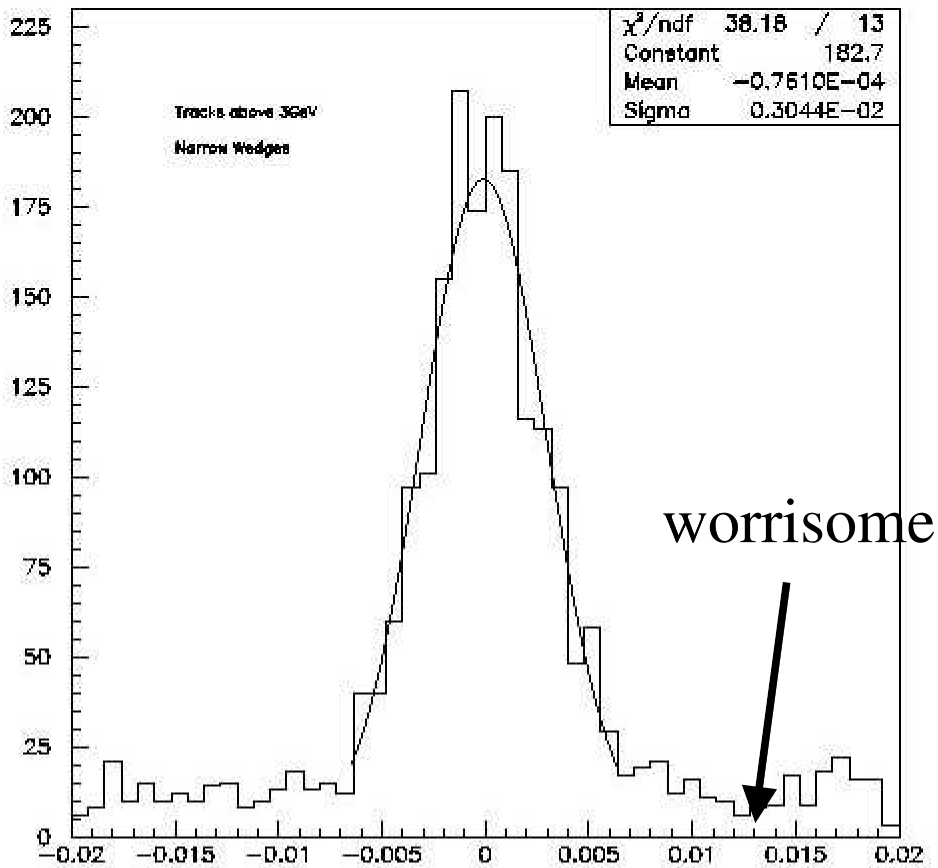
Residual (cm)

Local Alignment

- Consider three motions for each readout section (two physical wafers)
- No bow correction or wafer level correction



Resolution



Narrow Sensors (SGS)

Resolution 30um (pt>3GeV)

Narrow Sensors (Micron)

Resolution 28um (pt>3GeV)

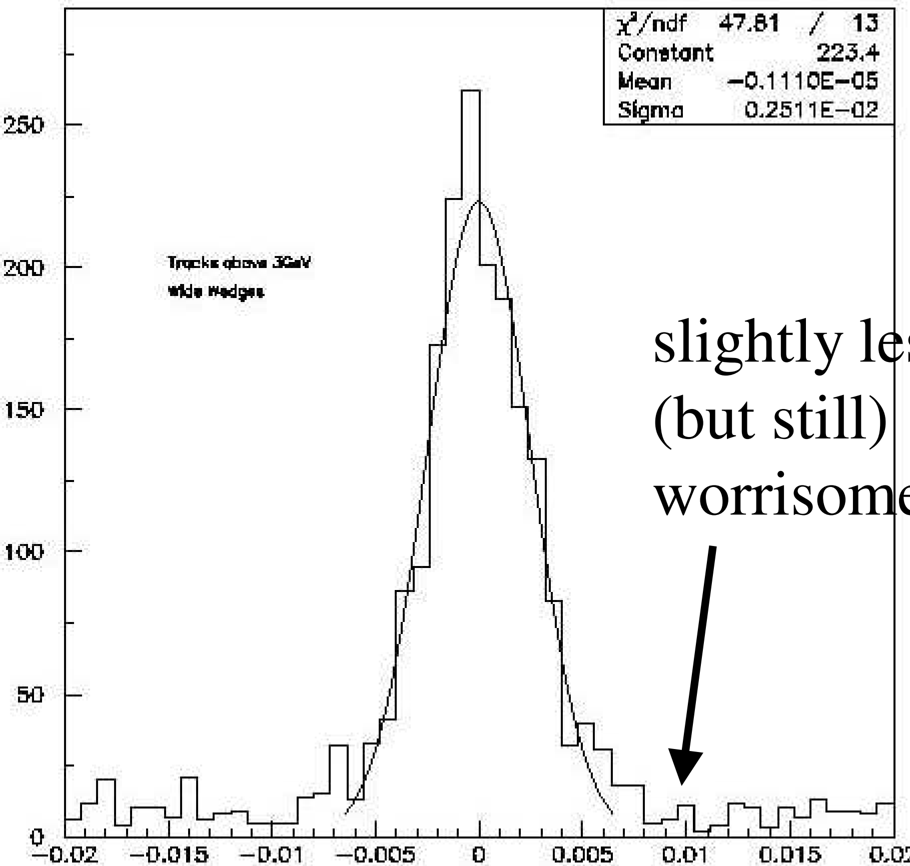
Residuals

Wide Sensors

(Hamamatsu)

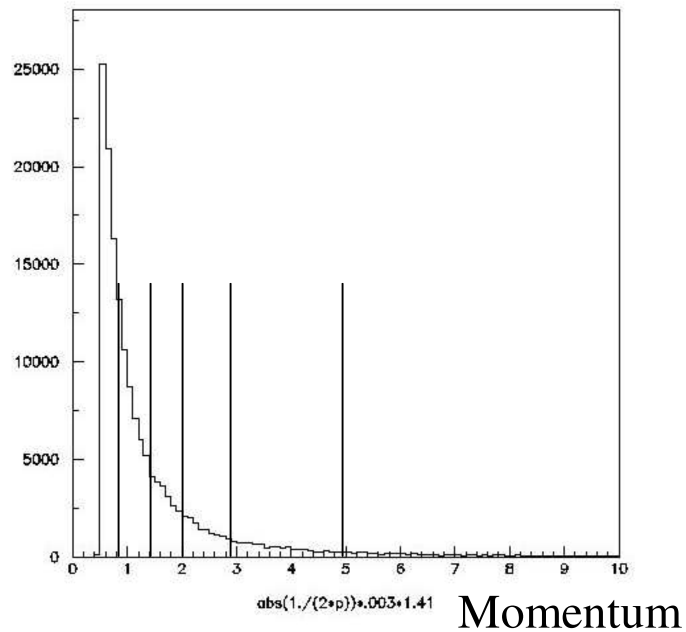
Resolution 25um

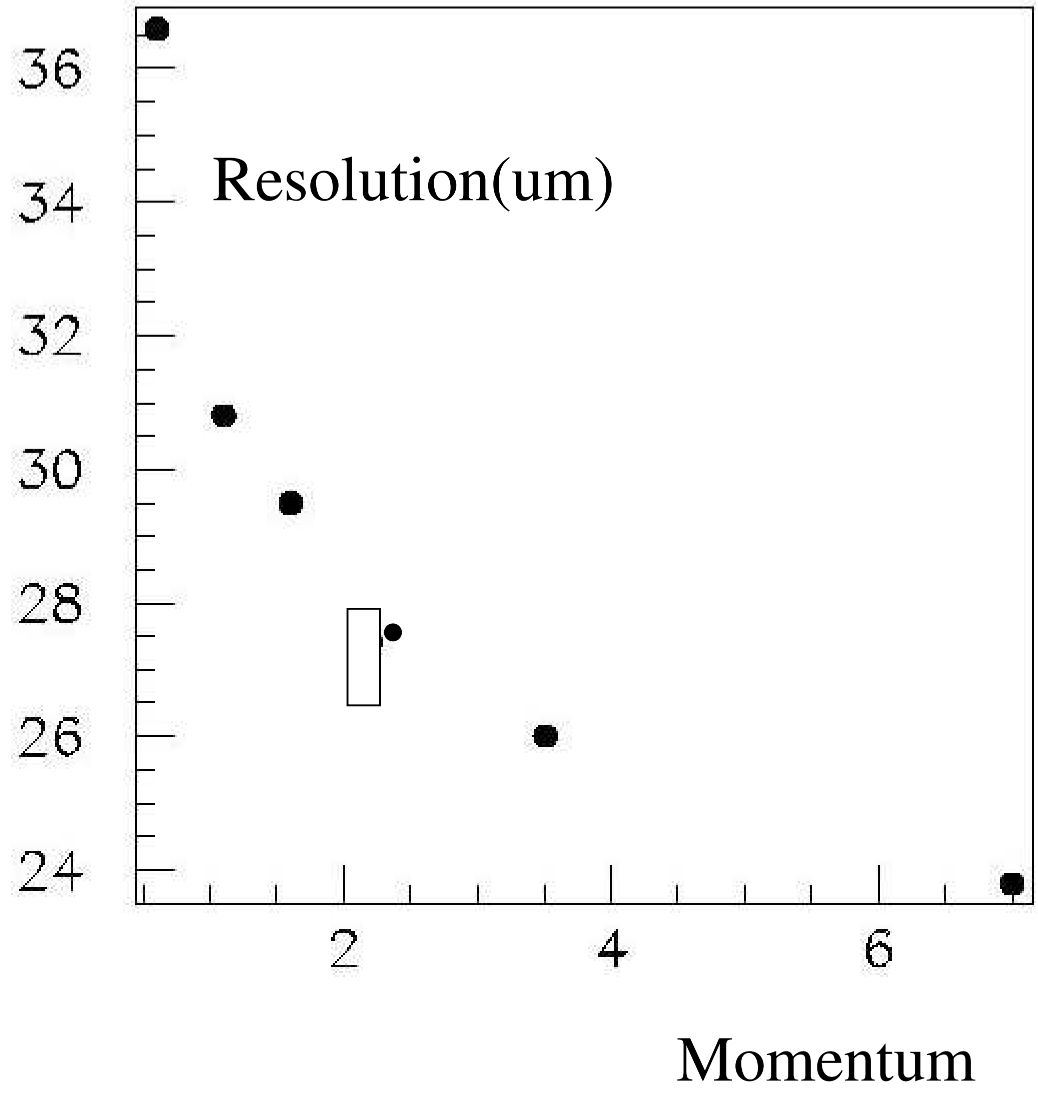
for pt>3GeV



slightly less
(but still)
worrisome

Intrinsic Resolution (Wides)





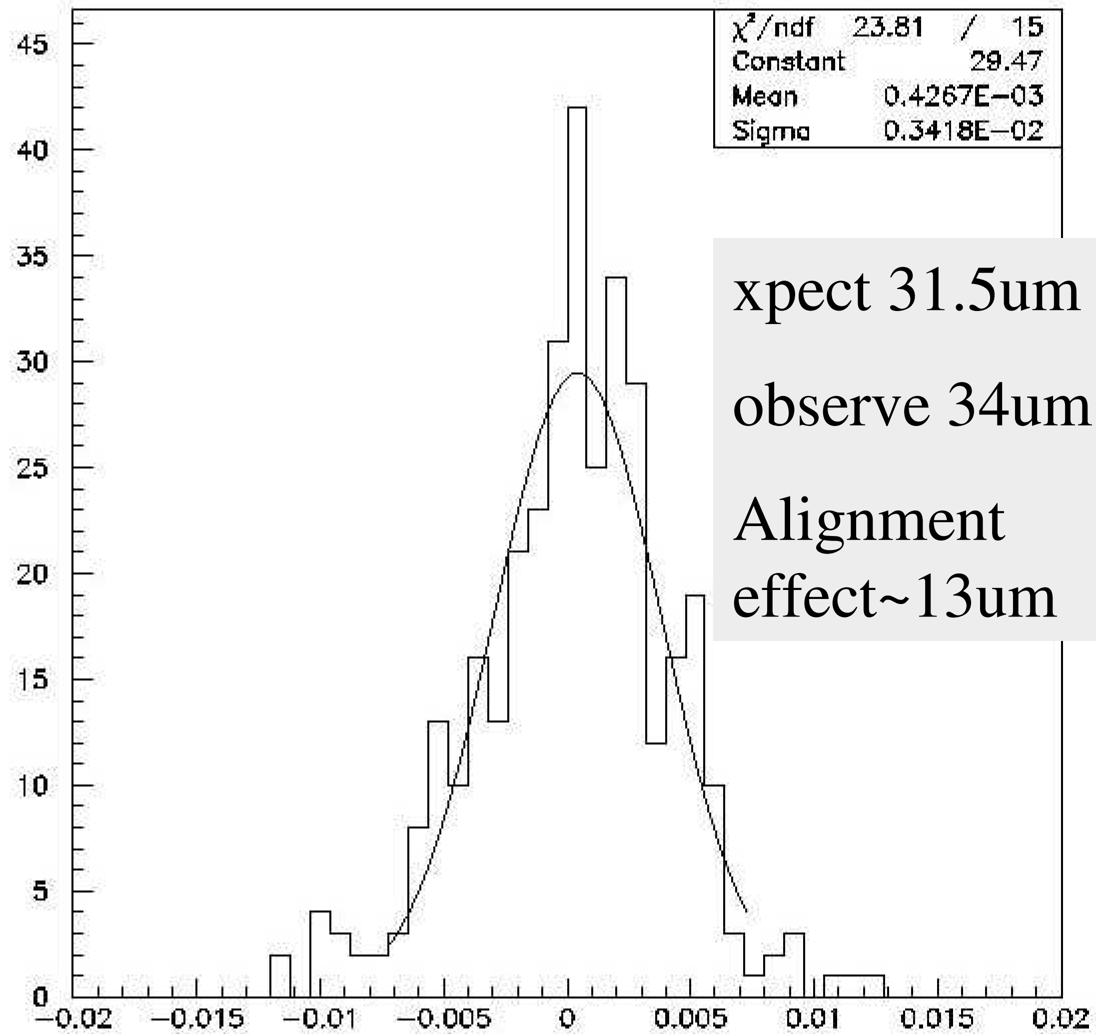
Total Resolution 23.5um

Xtrap ~ 15um

=>Silicon Resolution 18um

Pitch/Root(12) = 14.5um

Overlaps



xpect 31.5um

observe 34um

Alignment effect~13um

Overlaps not explicitly in alignment.

Plot is crosscheck

Wide+Narrow

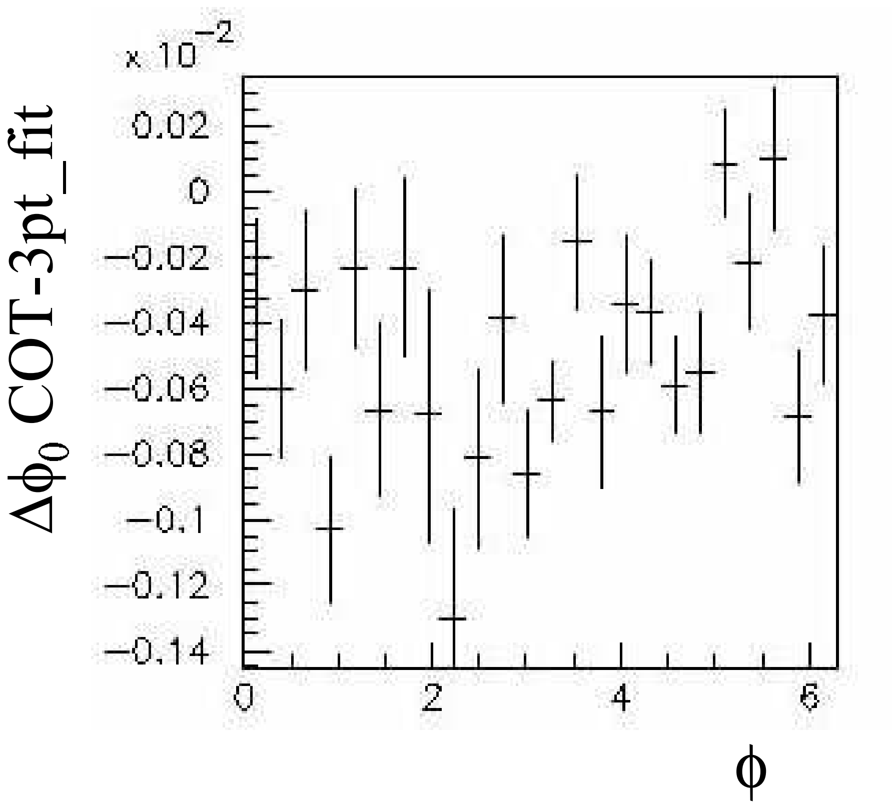
34um/root(2)

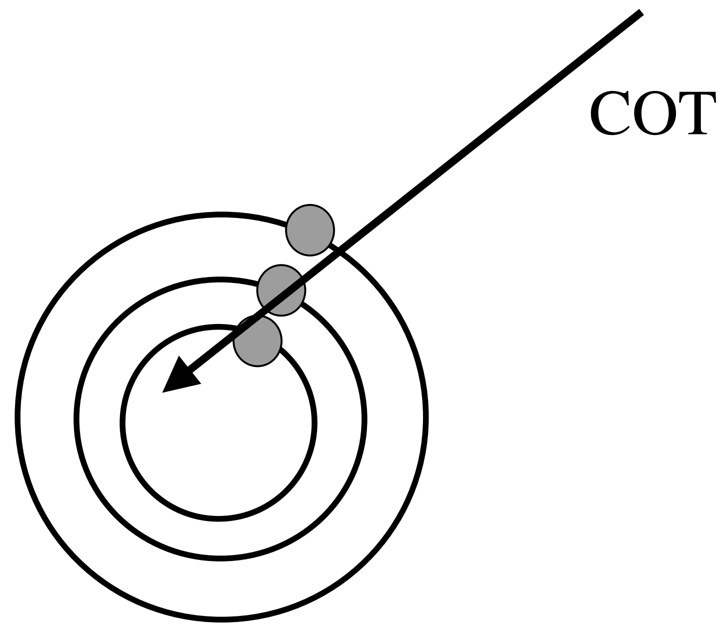
24um on average

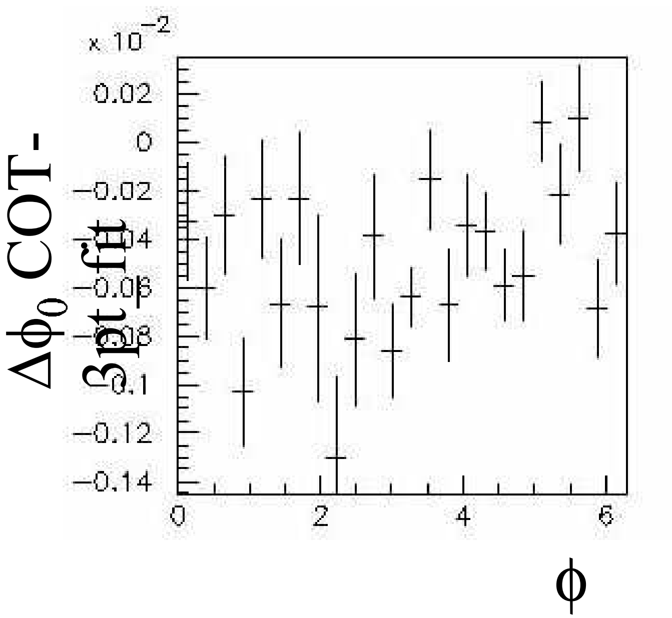
….Consistent

COT

- Alignment 100027 is unbiased and consistent with mechanical survey
- …… however it doesn't line up inside COT

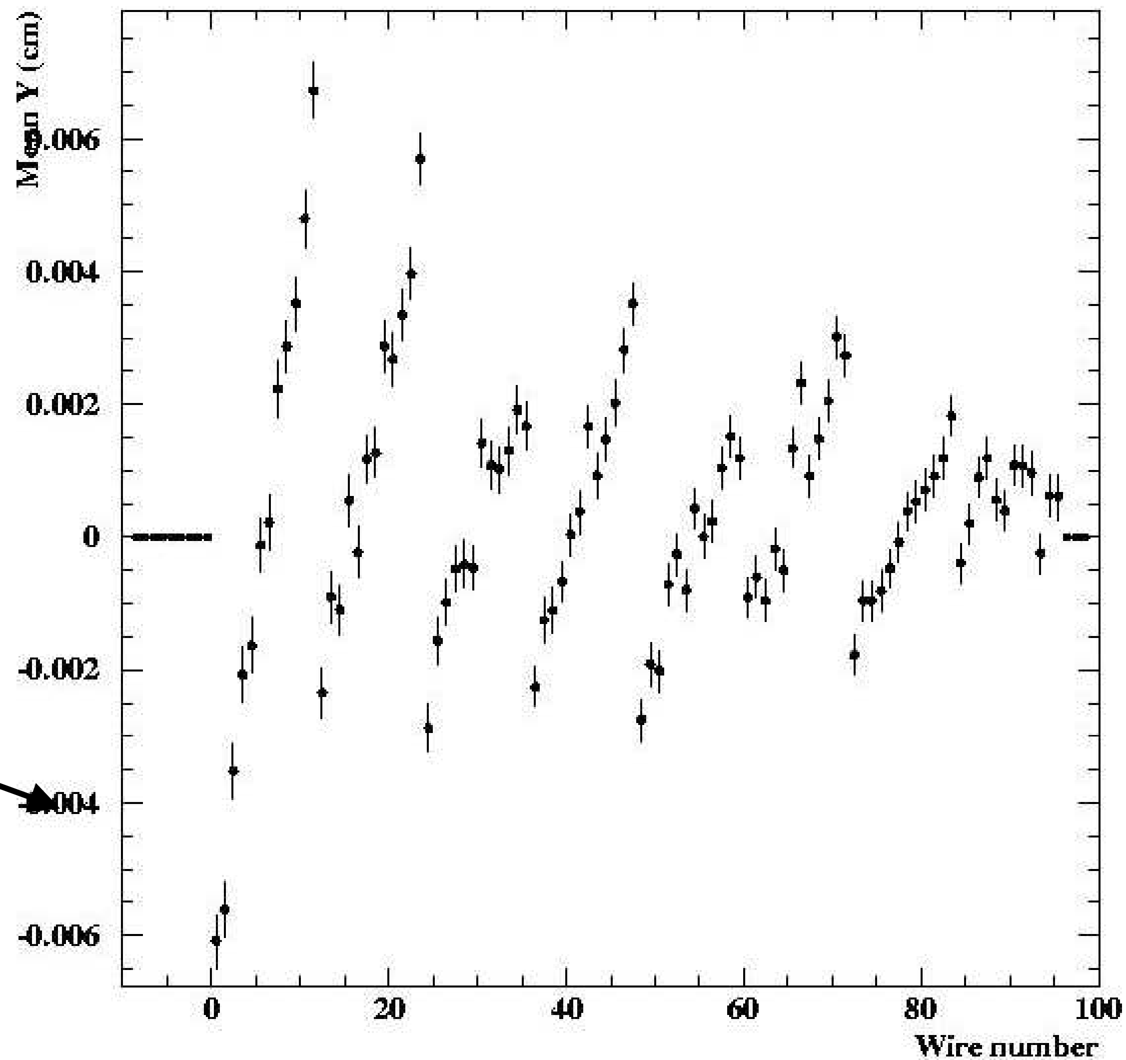






Known problem #1

Known problem #2
(for 2 years)

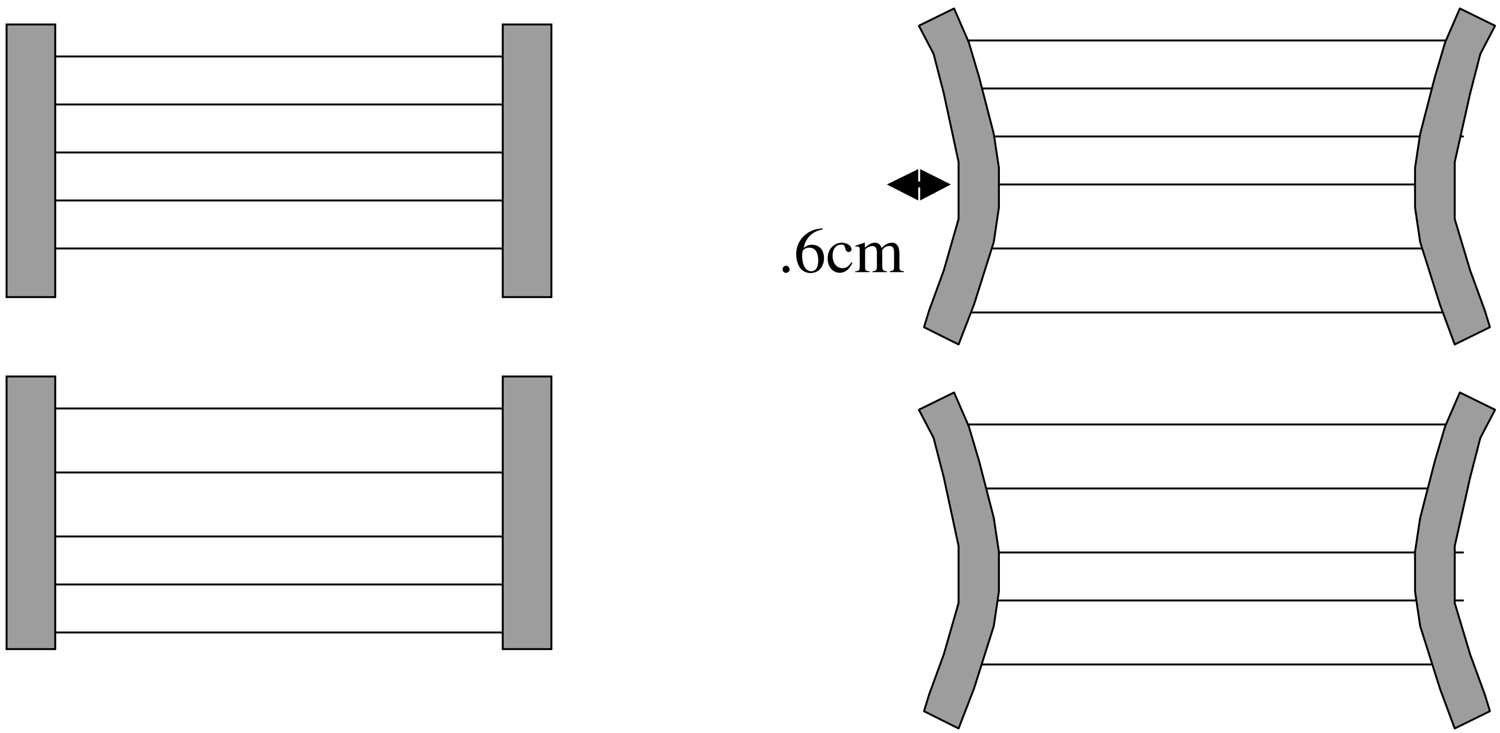


Are they related ?

COT: Back to basics.

- Review construction and survey of COT with Aseet.
- Number of features
  - Slot convex
  - CNC milling drift
  - Gravitational sag of wires
  - Twist of stereo wires
  - Rvz deformation of endplates
  - Phi deformation of endplates
  - Electrostatic effect

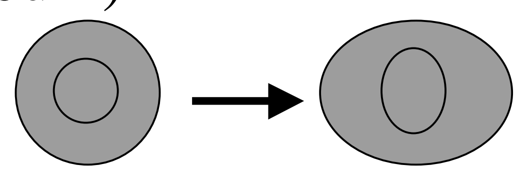
Deformation of End Plate



Centre of plate moves out/in at in/outside (30um)

Edge of plate moves in/out at in/outside (500um)

Phi deformations too. Need FEA model



Conclusions

For data already taken (low stats)

….. Most analyses are likely to be insensitive