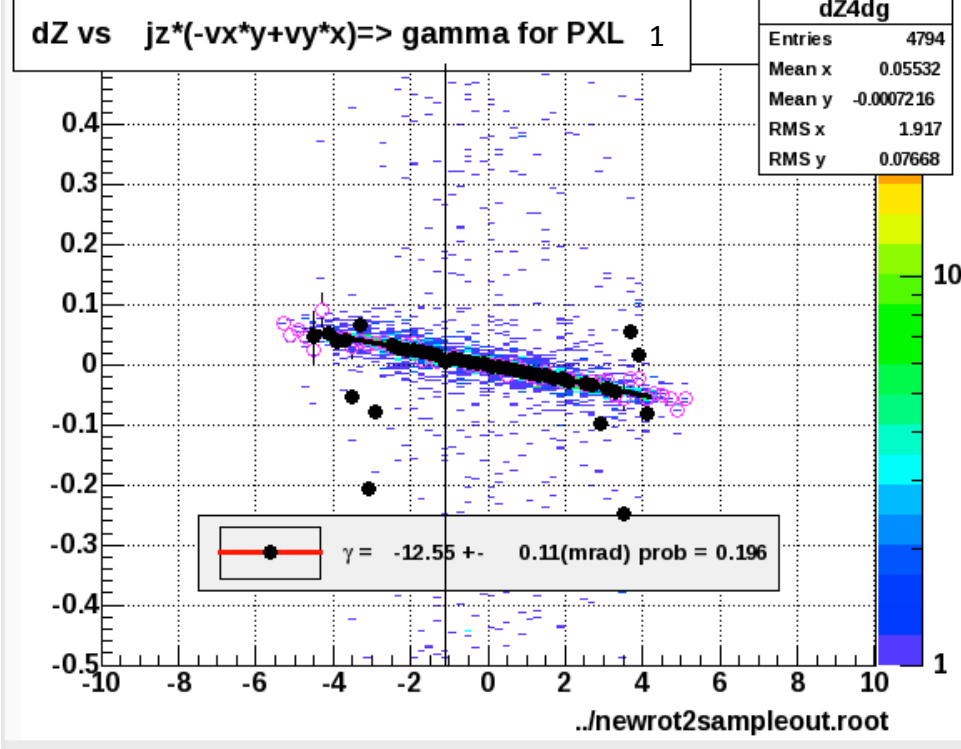
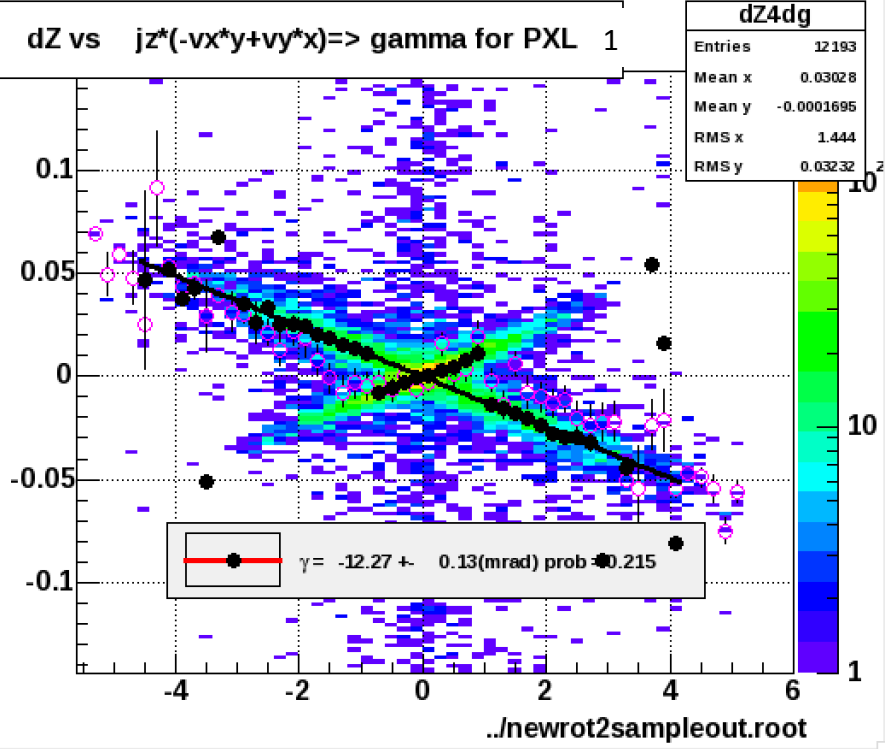


Alignment

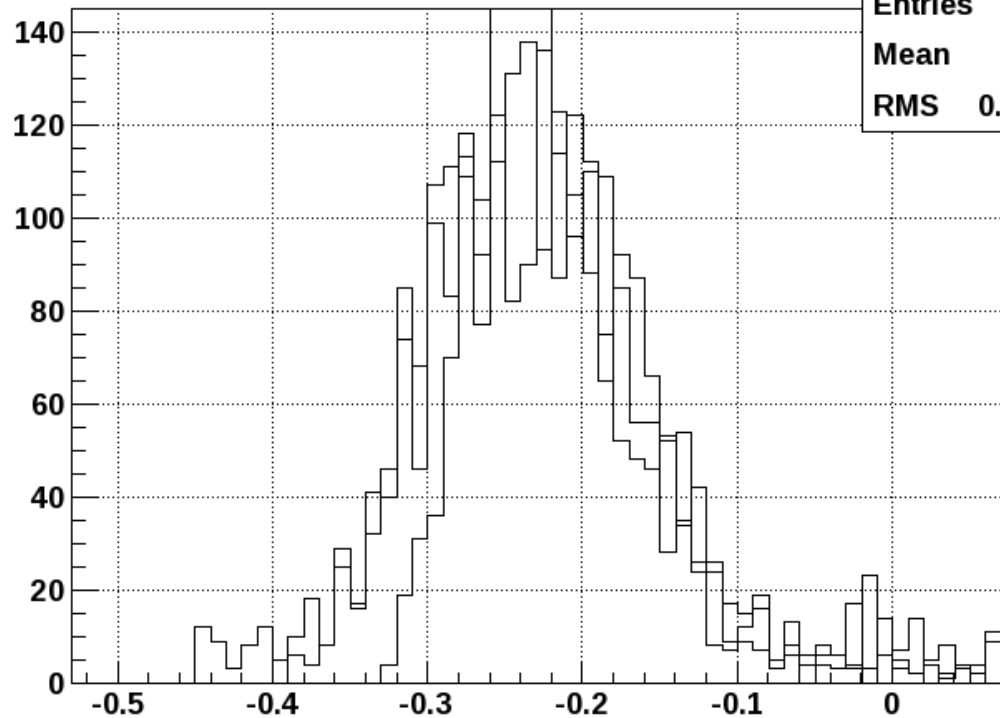
- Global-rotation tests of whole SECTORS were done with simulations to check procedures (not the best choice to start as it turns out!)
- Finding -1: Inner Ladder's Inverted Coordinate system (due to physical inversion) results in complicated output (sign inversion etc)
 - See slide-2 upper-left histo for example
 - We have (testing now) a scheme to undo this. Seems o.k. so far (effective inversion in alignment), see Slide-5
 - We will have the same "problem" with IST/SSD (facing inwards)
- Finding-2: Results (Global/Local) are for individual Ladders. G/L refers to coordinates used NOT to the results.
 - Global translations will be common to all. The same with gamma rotation due to parallel ladders. See slide-3 (data !) and slide-2 upper-right histogram
 - Global alpha or beta rotations (around x or y axes) introduce both ladder-local alpha/beta rots depending on the individual ladder orientation (slide-4)
- There is Math (and it seems we already have the histos, e.g. slide-4 upper left histogram) to do solid object (sector) alignment as a whole but for now results from individual ladders are going to be used first.
- We need more thorough tests and clarification



SIMULATION

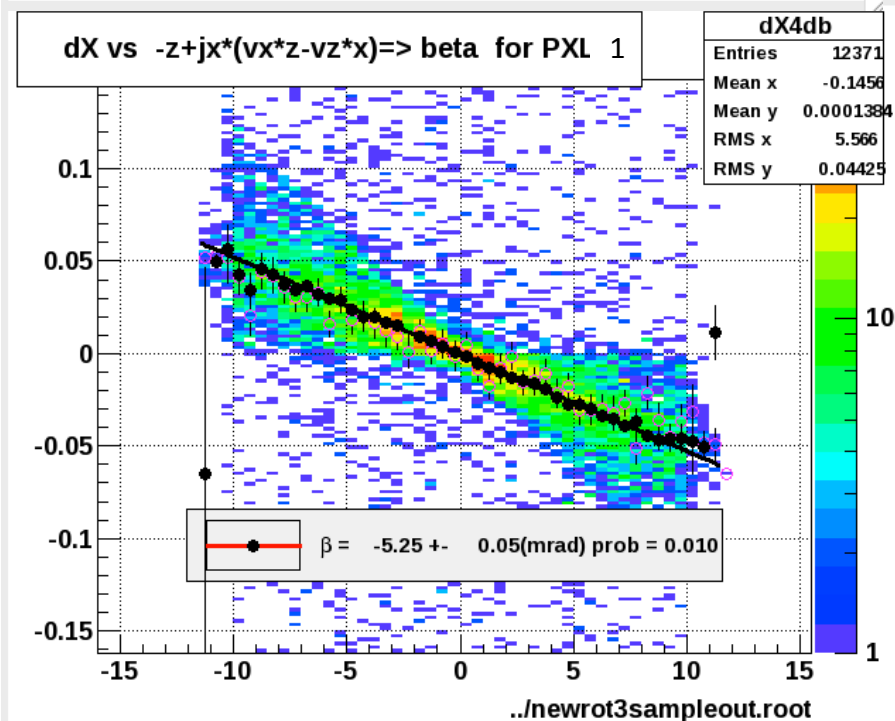
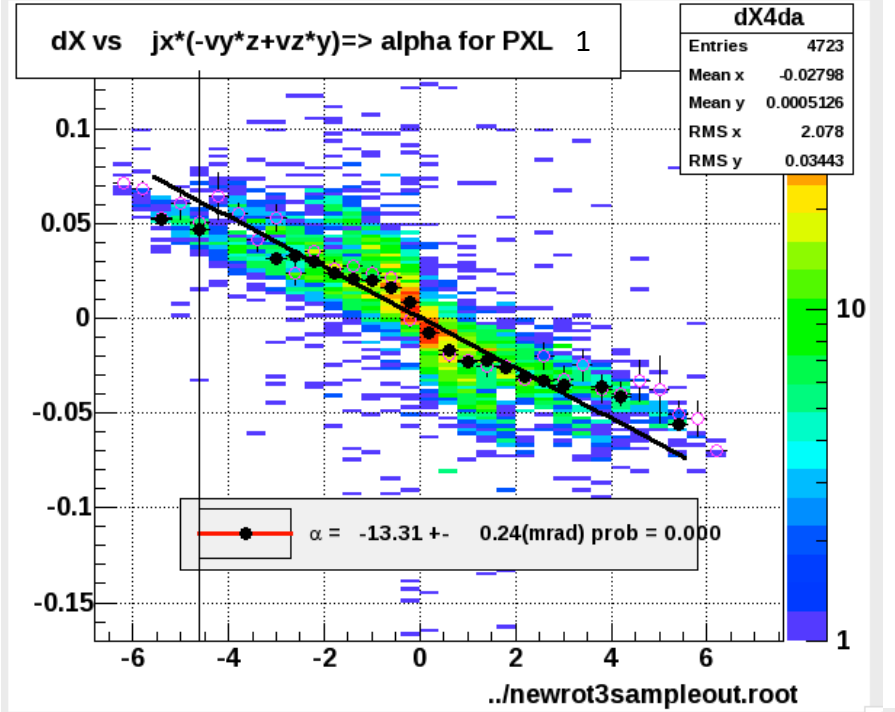
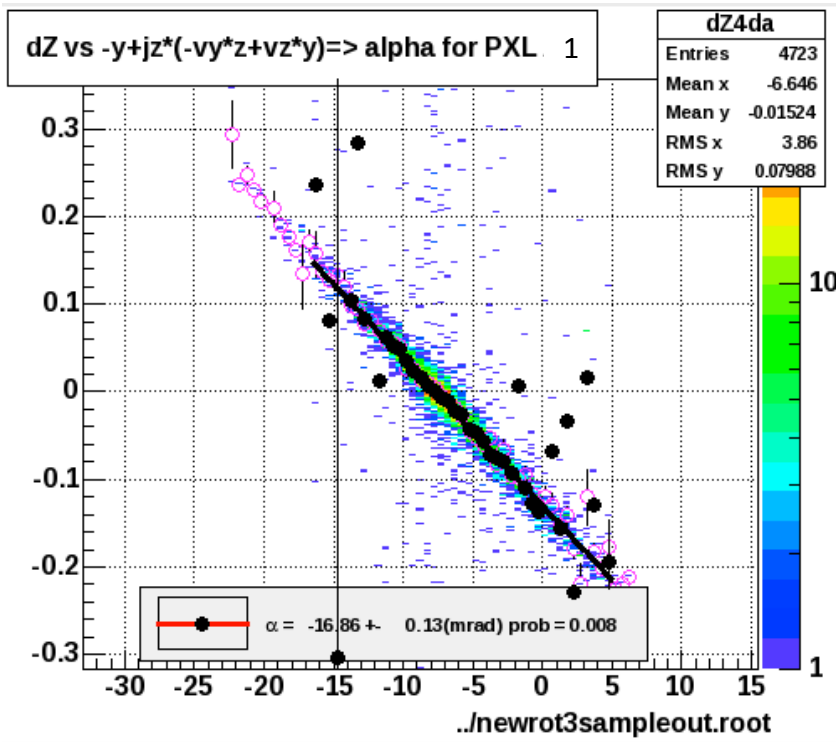
- Jonathan's Input: Sector-1 d-gamma (around z-axis) = -0.75 degrees = **-13 mrad**
- Left histogram: Result is fine but inner/outer ladder effect is obvious. Right histogram w/out inner
- I get from histo: **~-13 mrad OK**
- Comment: Since all ladders are parallel to z-axis this rotation is the easiest to get

dX versus -z => beta for layer 2 ladder 20



DATA : Day152

- “Demonstrating” that Global DX, DY common to all ladders in sector
- Sector-4 Global dX ~ 0 . ($\sim 100 \pm 50$ microns)
- Sector-7 Global dX -2.3 ± 0.01 mm
- Sector-4 Global dY -200 to -400 microns
- Sector-7 Global dY -1.1 to -2.8 mm



Jonathan's SIMU Input: Sector 1 $\text{dalpha} = -1^\circ = -0.017$

I get from upper-left histo: ~ -0.017 **OK** This histo seems immune to ladder #

Upper right shows the three effective Ladder-local alpha bands

Lower histo shows the three effective ladder-local dbeta bands

Changes made:

- Updated geometry used by runHftTree.C: Inverted directions of u and w axis (in local coordinates) for the inner ladders.
- Inverted the value of booked u coordinate for hits in inner ladders.
- Tested with single muon tracks hitting ladders 1 and 3 (nearly parallel) in sector 7.

| Original | | Inverted | | |
|------------|----------------------------|------------|----------------------------|--------------------------------------|
| fHits.xG | = 2.25001, 6.72389 | fHits.xG | = 2.25001, 6.72389 | ← Global coords. unchanged |
| fHits.yG | = -1.53955, -4.66978 | fHits.yG | = -1.53955, -4.66978 | |
| fHits.zG | = 0.388505, 0.936435 | fHits.zG | = 0.388505, 0.936435 | |
| fHits.xGC | = 2.25001, 6.72389 | fHits.xGC | = 2.25001, 6.72389 | ← Local u and prediction uP inverted |
| fHits.yGC | = -1.53955, -4.66978 | fHits.yGC | = -1.53955, -4.66978 | |
| fHits.zGC | = 0.388505, 0.936435 | fHits.zGC | = 0.388505, 0.936435 | |
| fHits.xL | = 0.150404, 0.0429167 | fHits.xL | = -0.150404, 0.0429167 | |
| fHits.yL | = -0.624495, -0.076565 | fHits.yL | = -0.624495, -0.076565 | |
| fHits.zL | = 1.0129, 1.01309 | fHits.zL | = 1.0129, 1.01309 | |
| fHits.u | = 0.150404, 0.0429167 | fHits.u | = -0.150404, 0.0429167 | |
| fHits.v | = -0.624495, -0.076565 | fHits.v | = -0.624495, -0.076565 | |
| fHits.w | = -9.51337e-05, 9.4154e-05 | fHits.w | = -9.51337e-05, 9.4154e-05 | |
| fHits.tuP | = -0.40176, -0.302984 | fHits.tuP | = -0.40176, -0.302984 | |
| fHits.tvP | = -0.107452, 0.104182 | fHits.tvP | = 0.107452, 0.104182 | |
| fHits.uP | = 0.15075, 0.0394916 | fHits.uP | = -0.15075, 0.0394916 | |
| fHits.vP | = -0.625426, -0.0809184 | fHits.vP | = -0.625426, -0.0809184 | |
| fHits.wP | = 0, 0 | fHits.wP | = 0, 0 | |
| fHits.pT | = 1.00389, 1.00389 | fHits.pT | = 1.00389, 1.00389 | |
| fHits.pMom | = 1.00887, 1.00887 | fHits.pMom | = 1.00887, 1.00887 | |
| fHits.xPG | = 2.25025, 6.72653 | fHits.xPG | = 2.25025, 6.72653 | |
| fHits.yPG | = -1.53927, -4.66759 | fHits.yPG | = -1.53927, -4.66759 | |
| fHits.zPG | = 0.387574, 0.932082 | fHits.zPG | = 0.387574, 0.932082 | |
| fHits.cxPG | = 0.817932, 0.813303 | fHits.cxPG | = 0.817932, 0.813303 | |
| fHits.cyPG | = -0.566695, -0.573319 | fHits.cyPG | = -0.566695, -0.573319 | |
| fHits.czPG | = 0.0992144, 0.0992144 | fHits.czPG | = 0.0992144, 0.0992144 | |
| fHits.wGu | = -0.550422, 0.615152 | fHits.wGu | = 0.550422, 0.615152 | |
| fHits.wGv | = 0.834886, -0.788408 | fHits.wGv | = -0.834886, -0.788408 | |
| fHits.wGw | = 0, 0 | fHits.wGw | = 0, 0 | |
| fHits.xPL | = 0.15075, 0.0394916 | fHits.xPL | = -0.15075, 0.0394916 | |
| fHits.yPL | = 0, 0 | fHits.yPL | = 0, 0 | |
| fHits.zPL | = 0.387574, 0.932082 | fHits.zPL | = 0.387574, 0.932082 | |