Field-Off Alignment

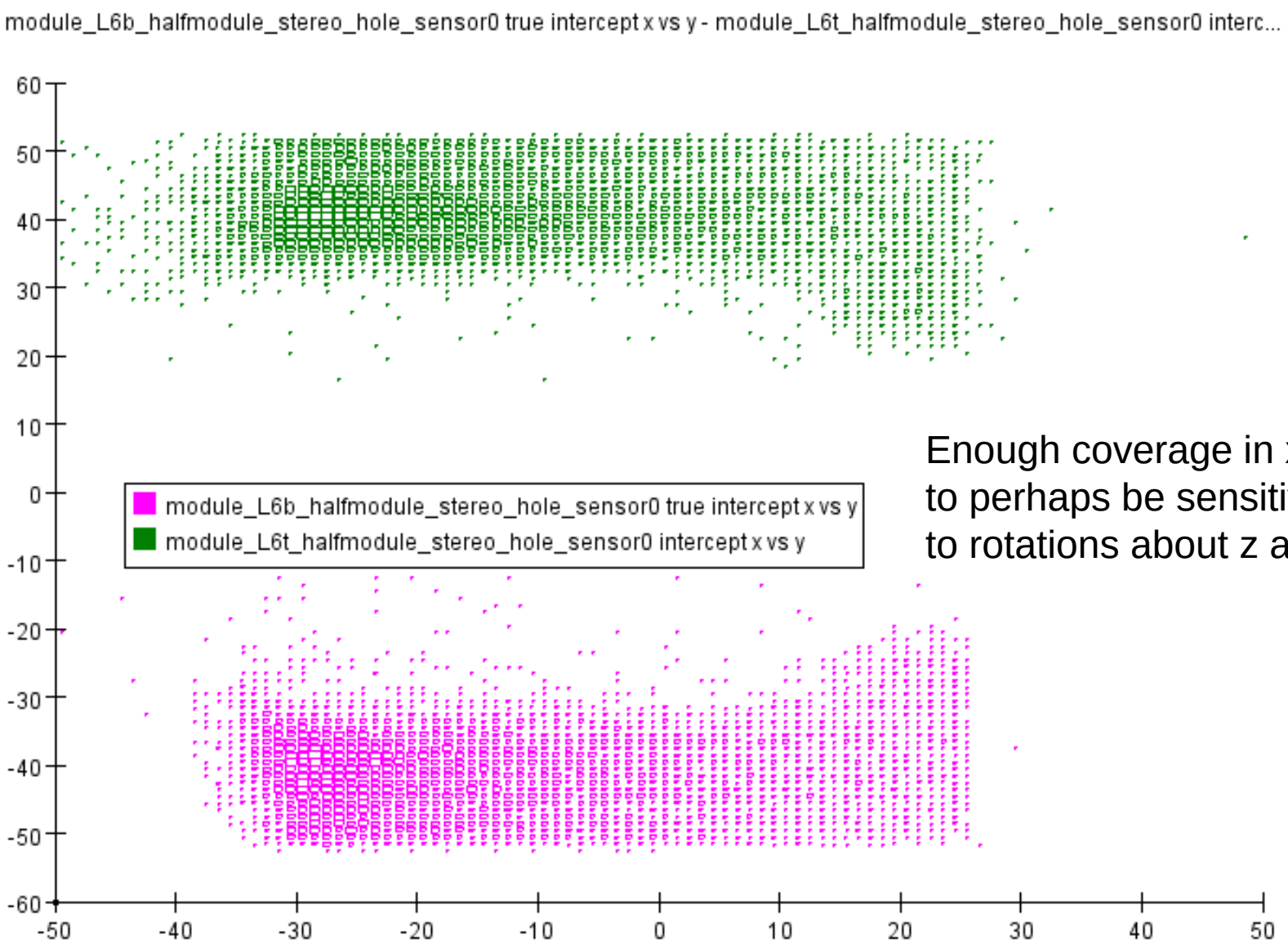
Norman Graf (SLAC)

HPS SVT Meeting, 08/24/15

Alignment Strategy

- Start simple
- Skim off clean FEE events
  - 6 hits on track
  - <20 strip clusters/event
- Fix the “target” position at (-67.23, 0.0, -2337.1)
- Pick one other sensor to fix:
  - L4t_hole_sensor0
  - L4b_hole_sensor0
- Fit straight line to target position and L4 strip hits
- Derive “true” strip residuals for remaining sensors with respect to this line

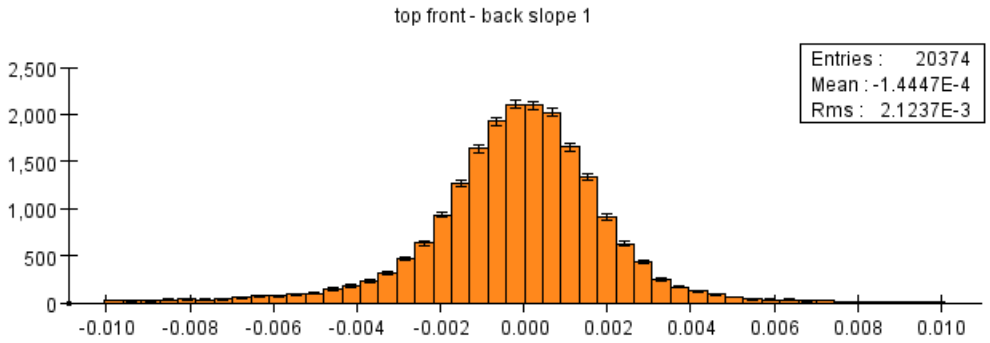
Track Coverage in Layer 6 Axial

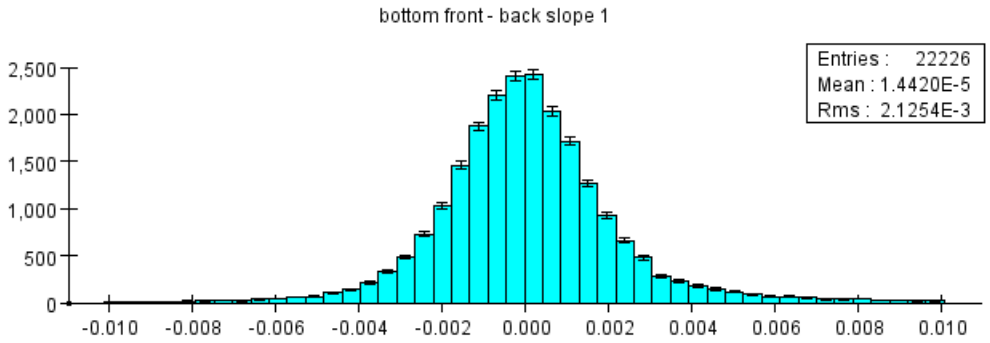


Enough coverage in x to perhaps be sensitive to rotations about z axis

Check for remaining opening angle

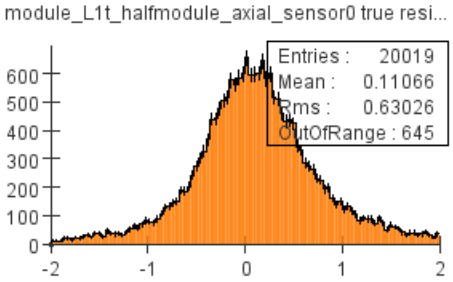
- Compare slope computed from layer 1,2,3 (front) to that computed from 4,5,6 (back)

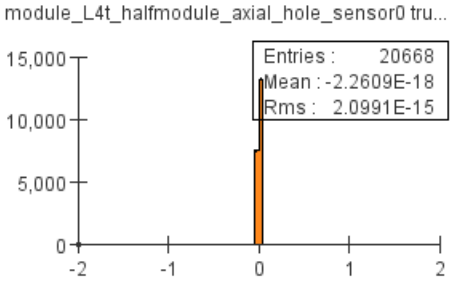


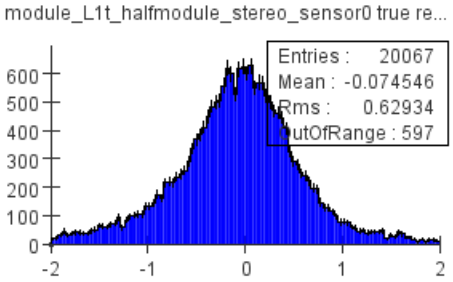


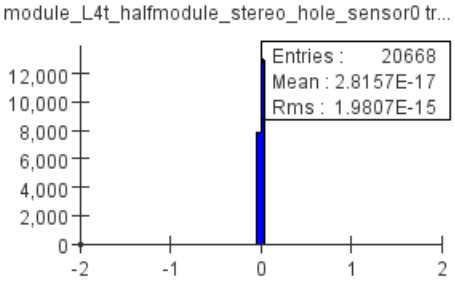
surprisingly good agreement

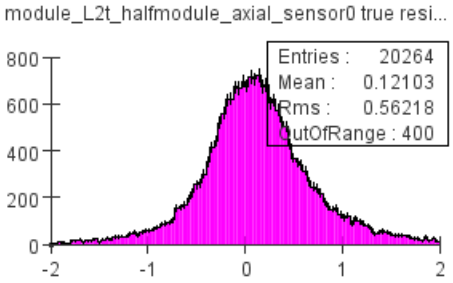
Top “true” residuals (axial / stereo)

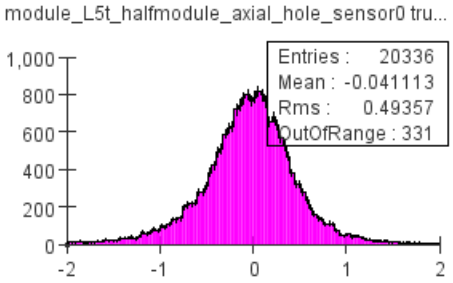


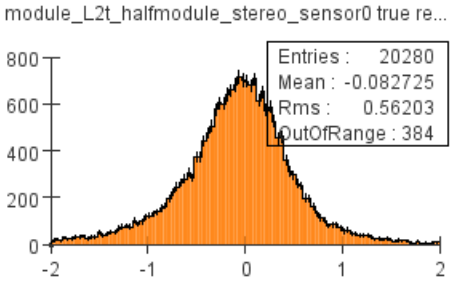


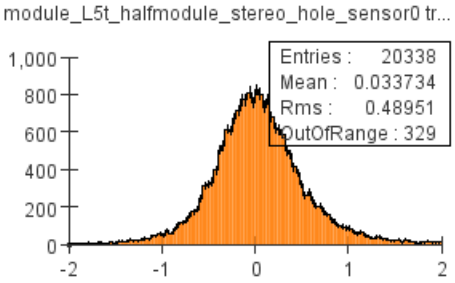


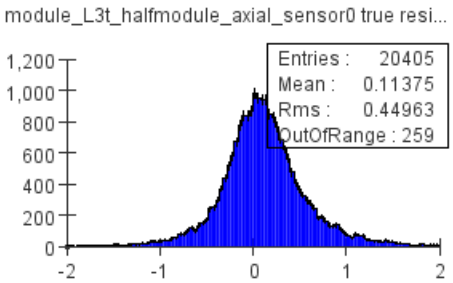


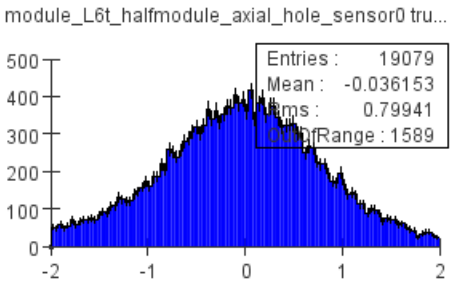


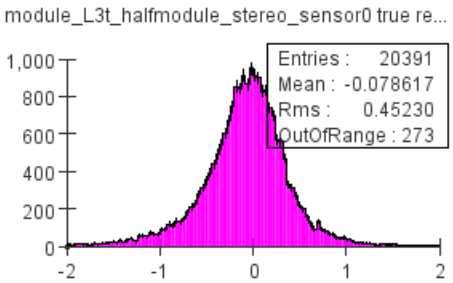


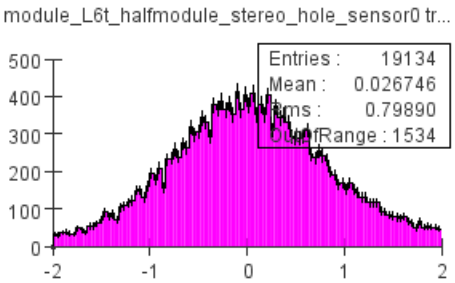




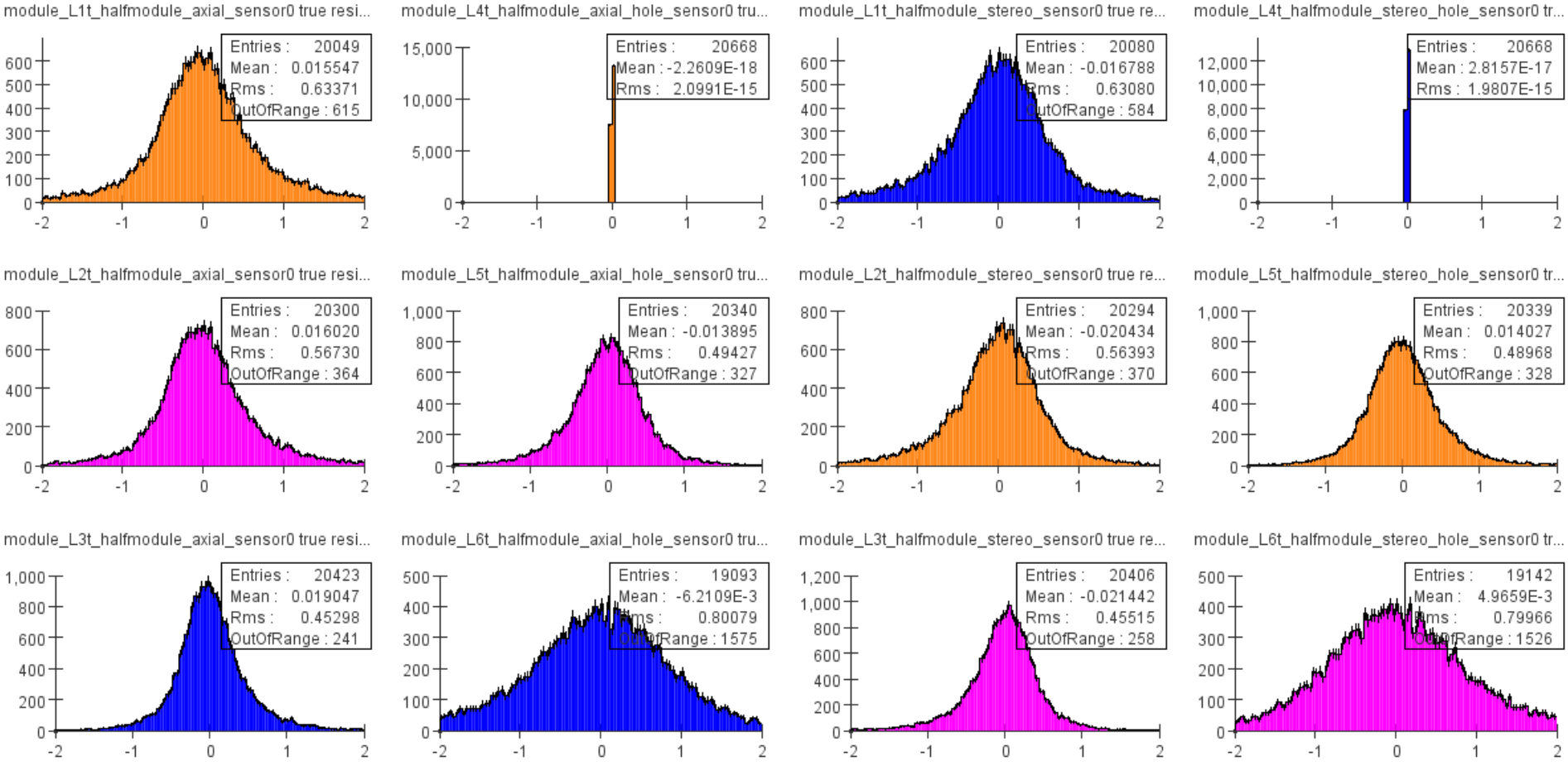




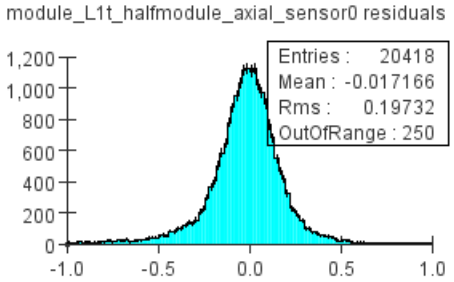


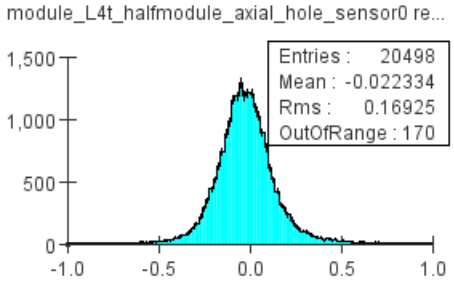


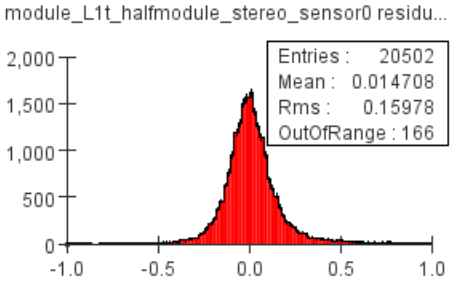
Adjust sensors by residual offsets

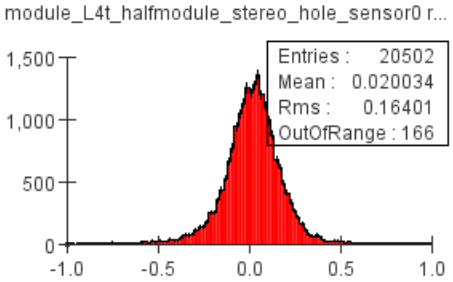


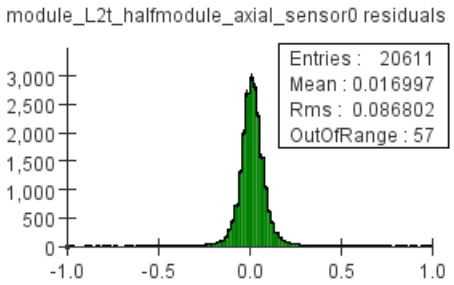
Top Residuals axial /stereo (before)

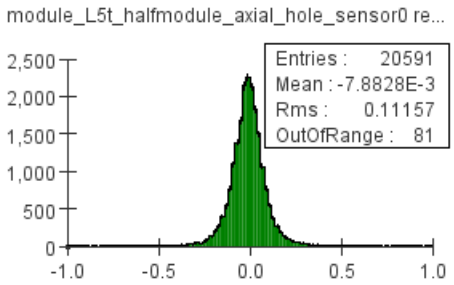


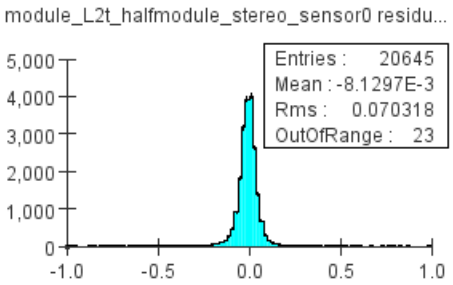


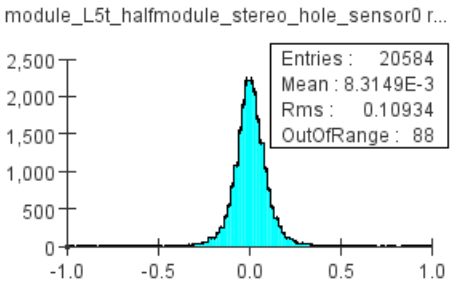


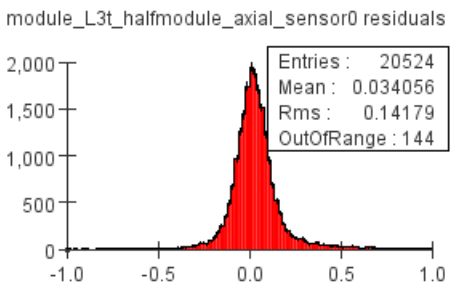


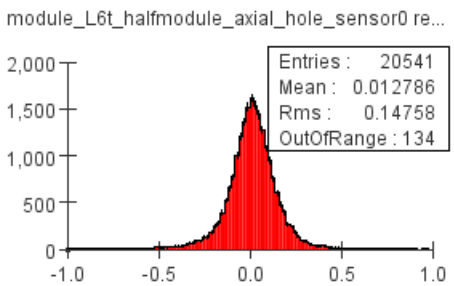


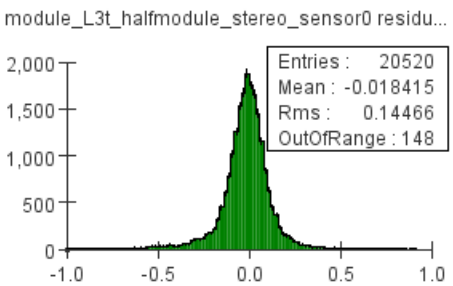


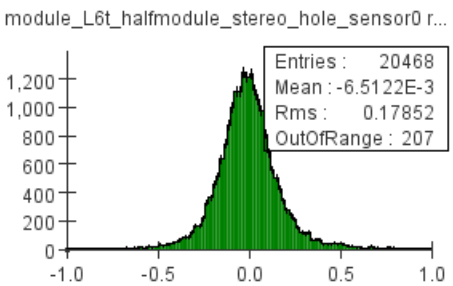




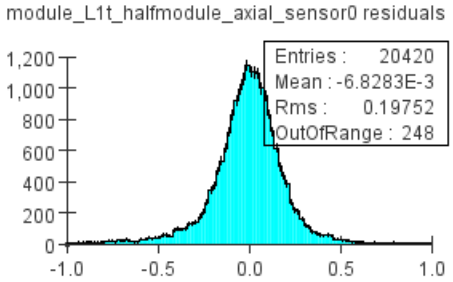


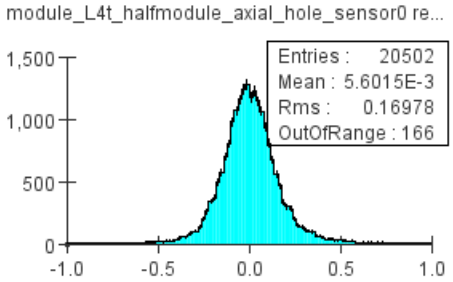


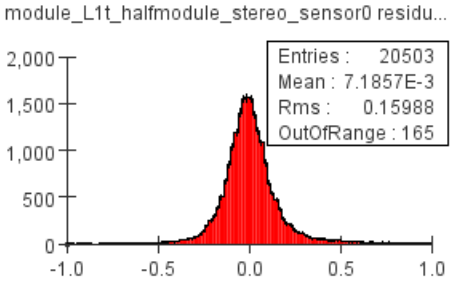


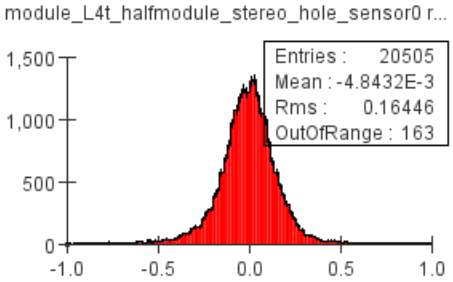


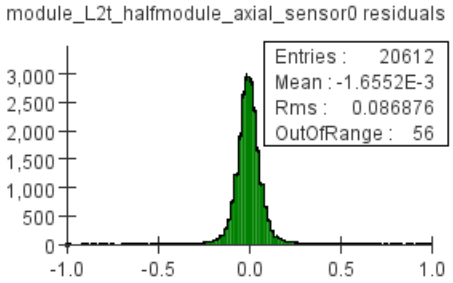
Top Residuals axial stereo (after)

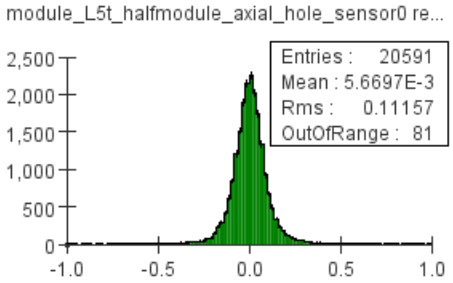


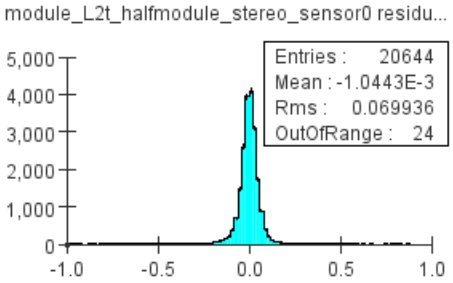


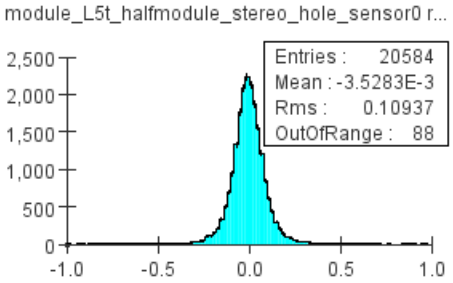


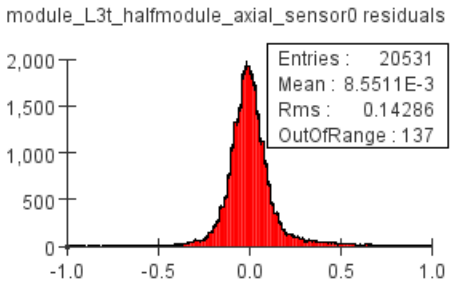


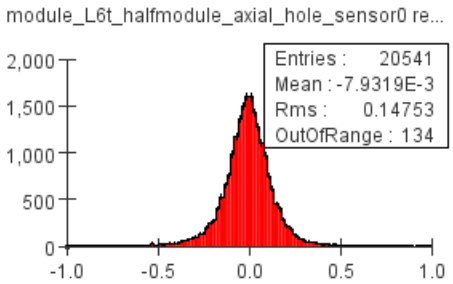


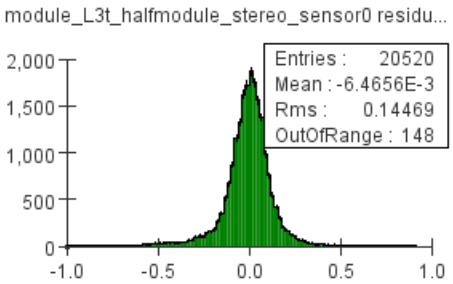


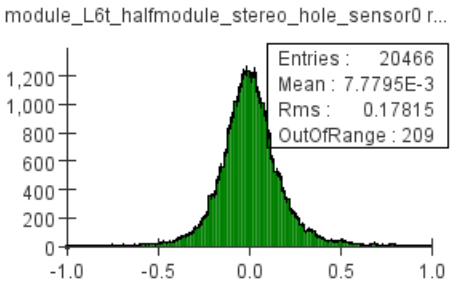






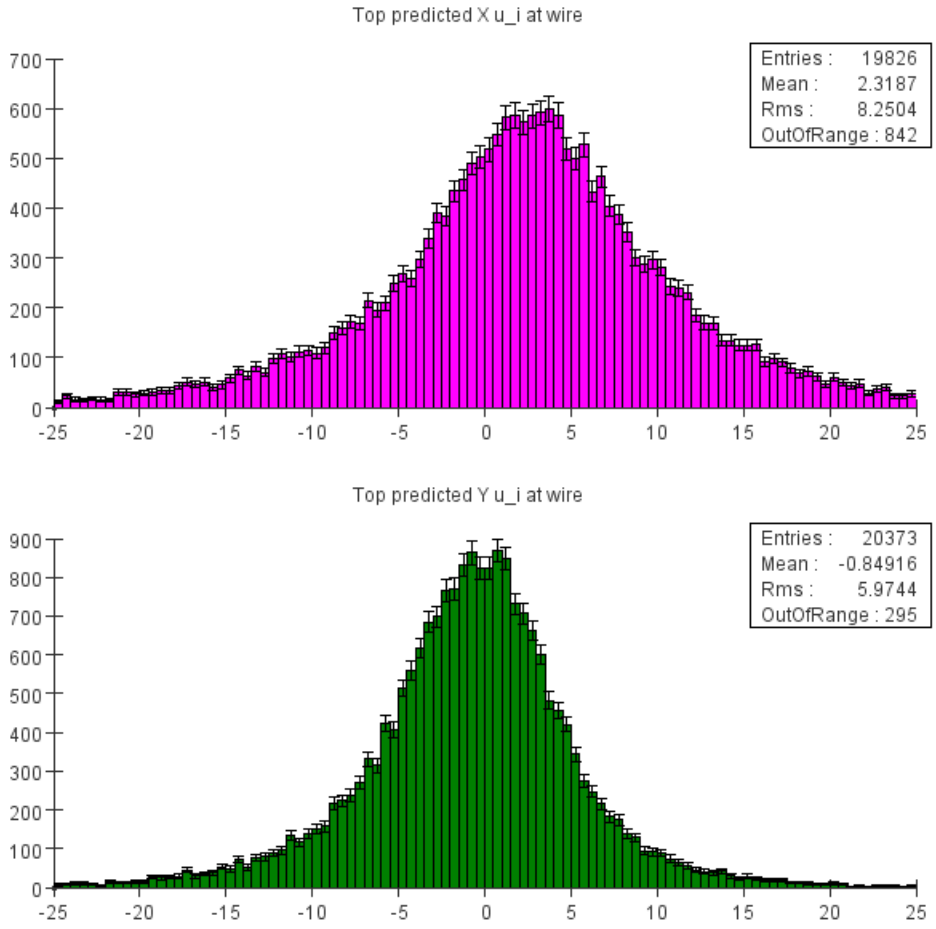






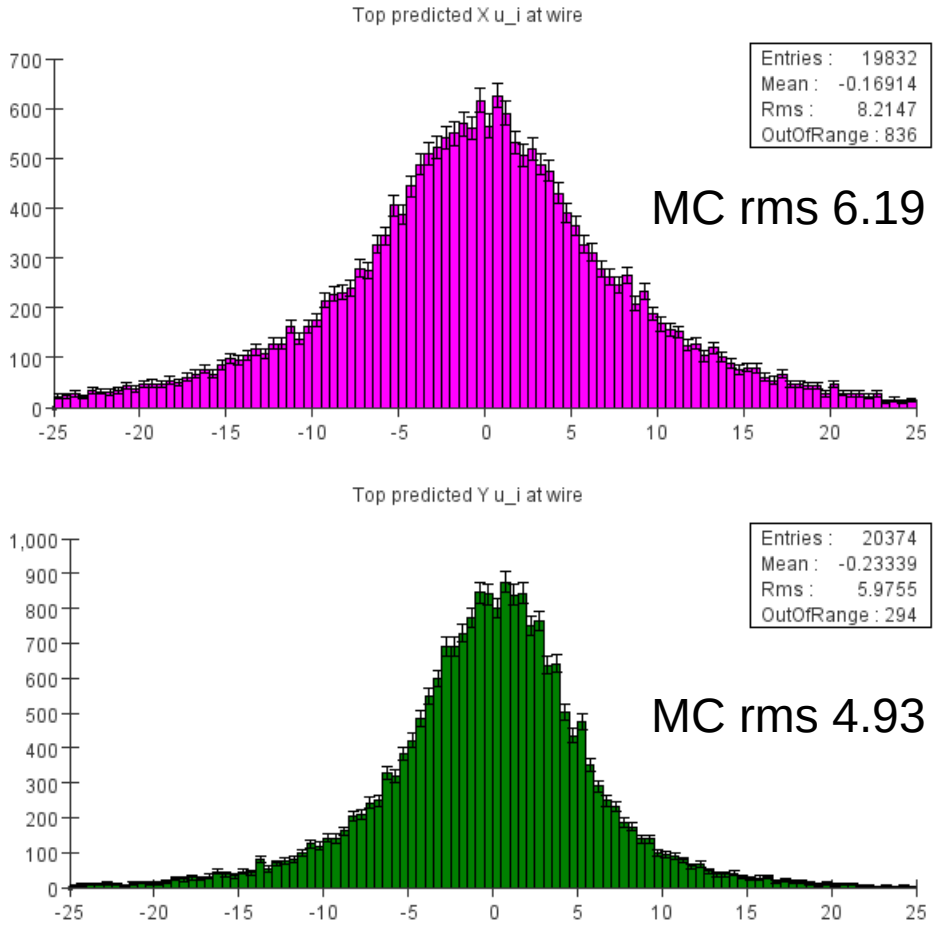
Fit tracks and predict target position

Before

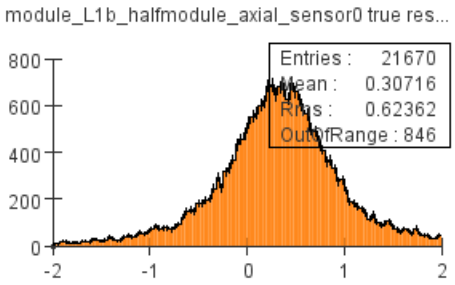


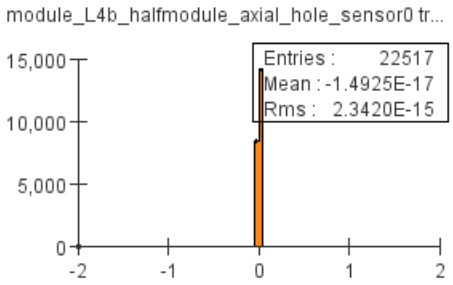
Fit tracks and predict target position

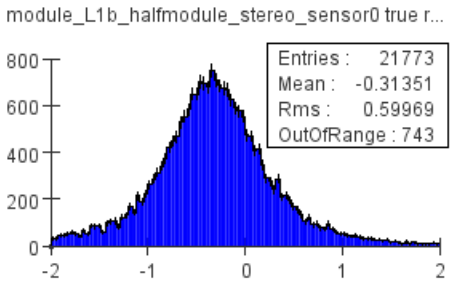
After

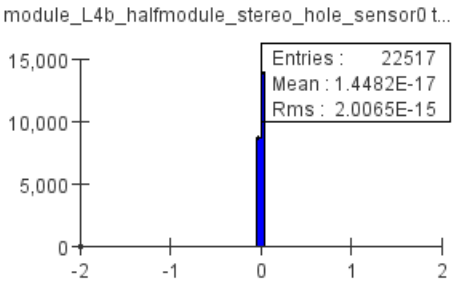


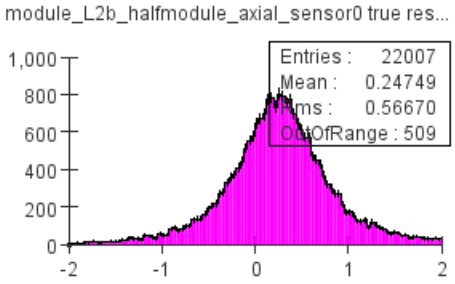
Bottom "true" residuals (axial/stereo)

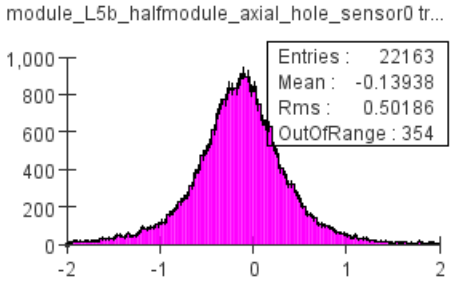


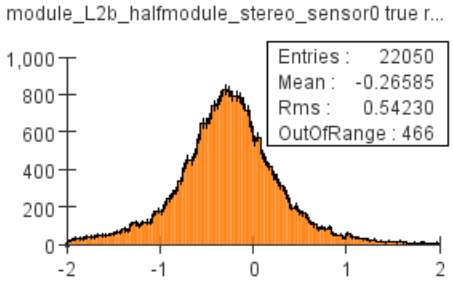


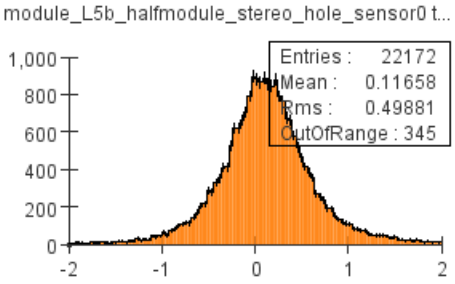


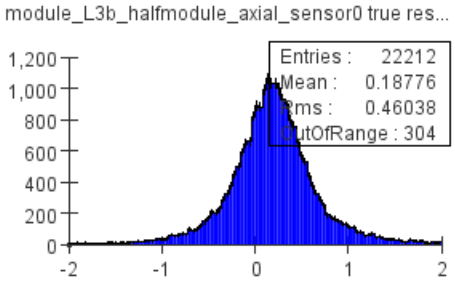


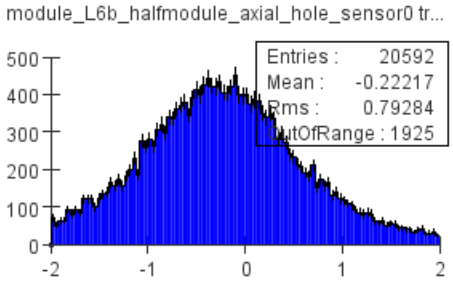


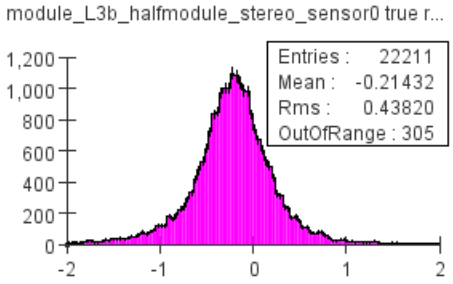


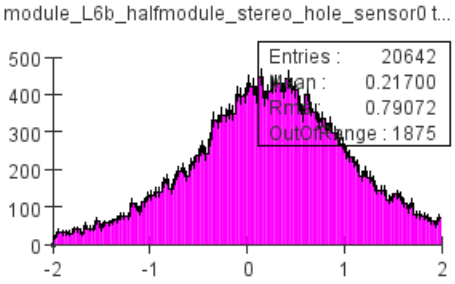




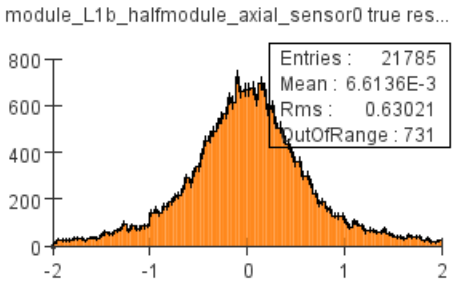


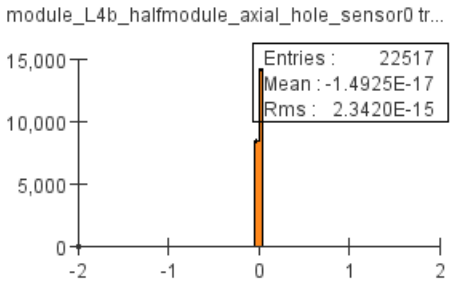


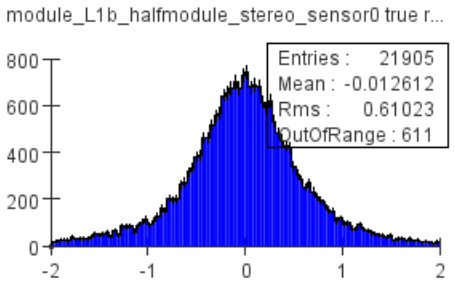


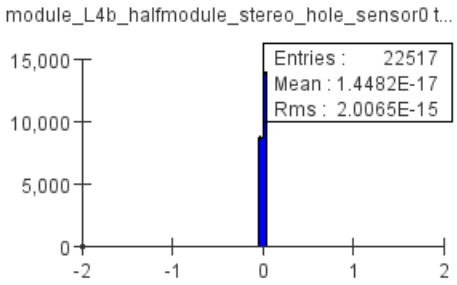


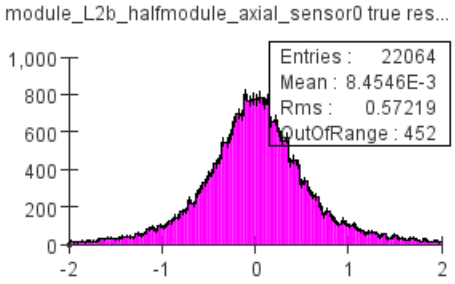
Adjust sensors by residual offsets

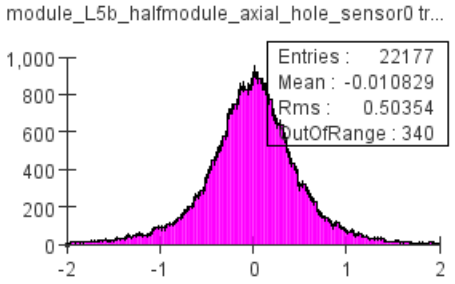


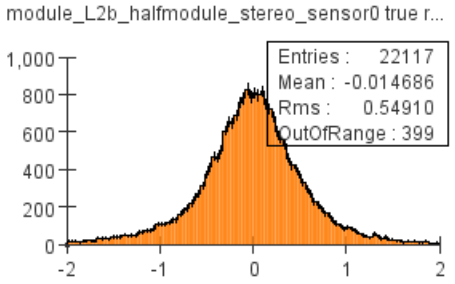


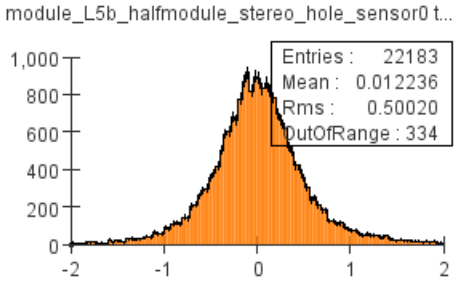


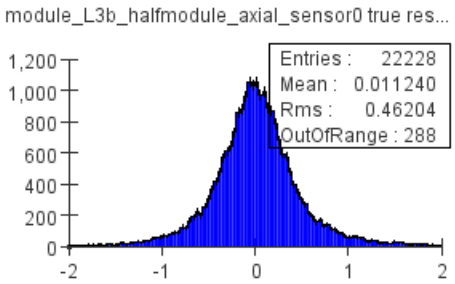


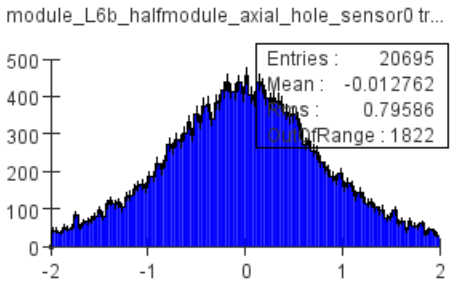


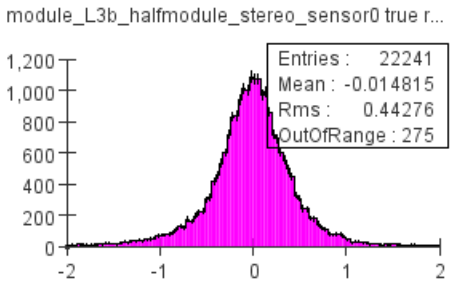


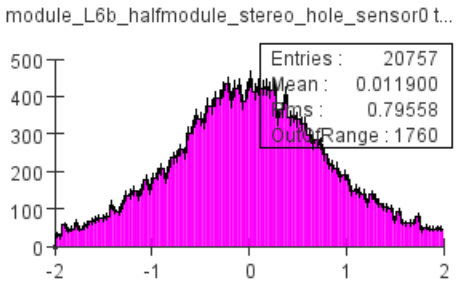




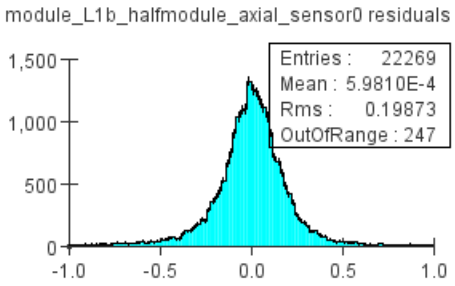


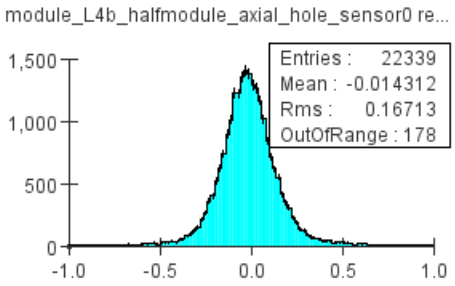


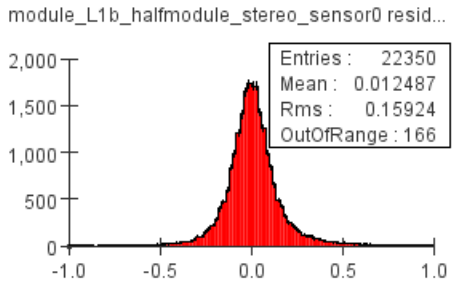


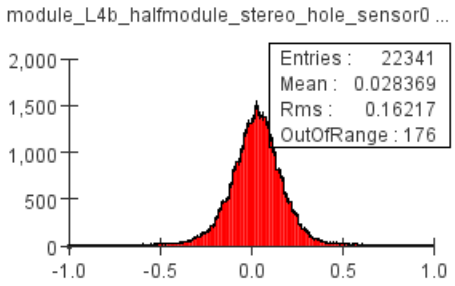


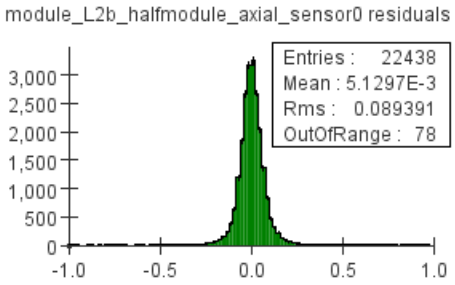
Bottom Residuals axial/stereo (before)

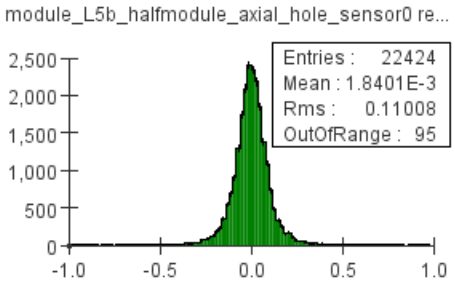


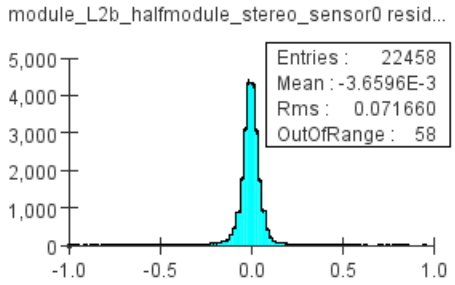


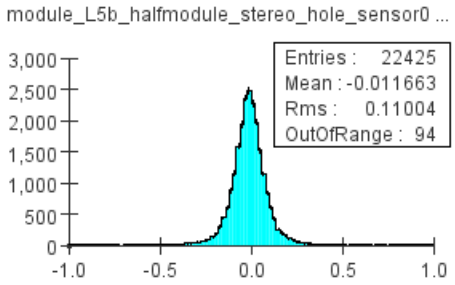


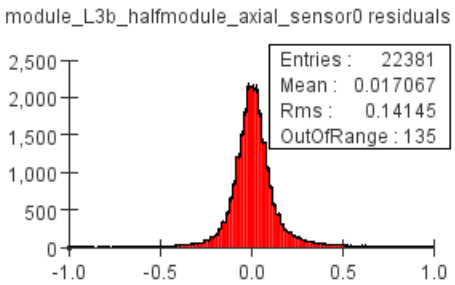


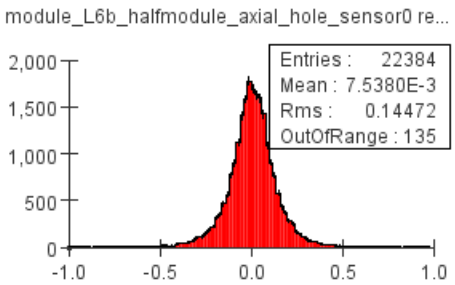


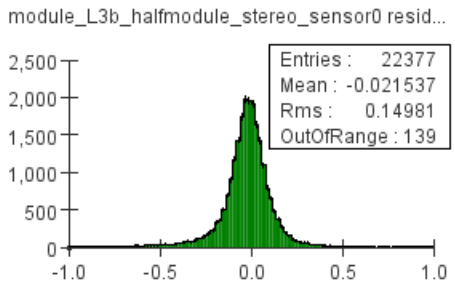


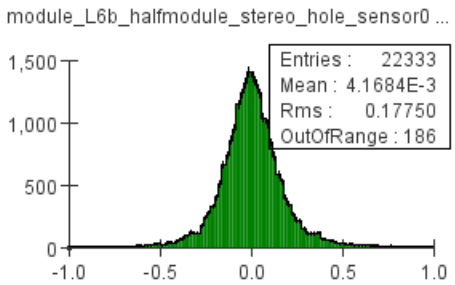




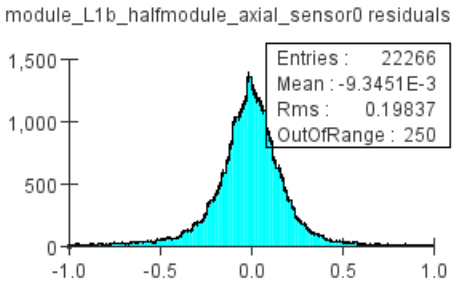


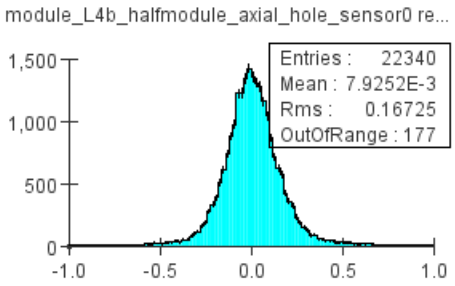


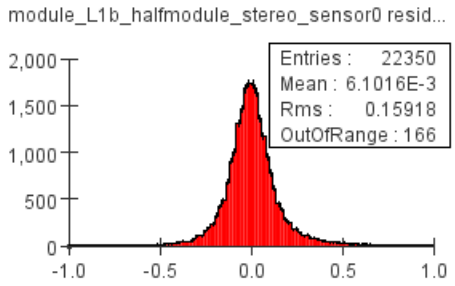


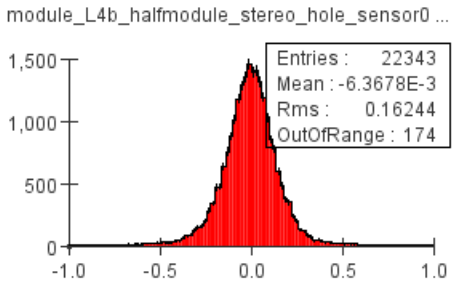


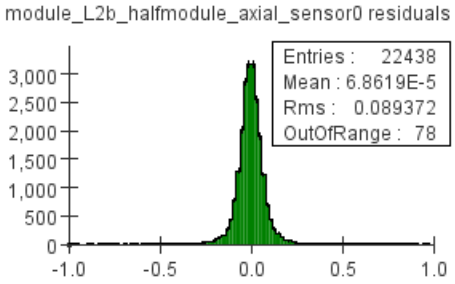
Bottom Residuals axial/stereo (after)

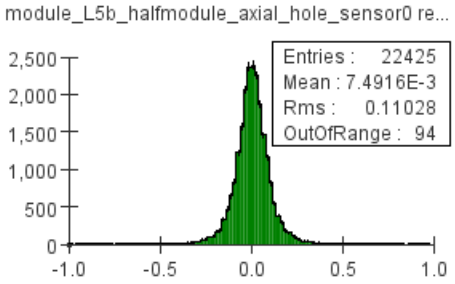


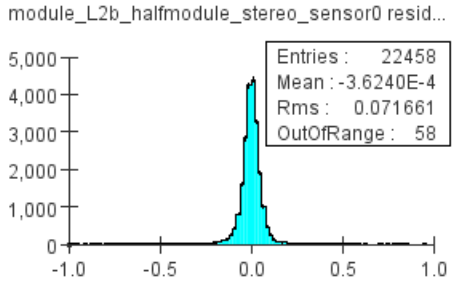


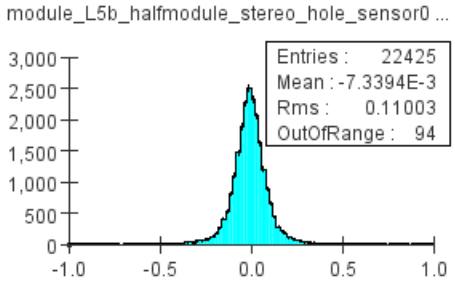


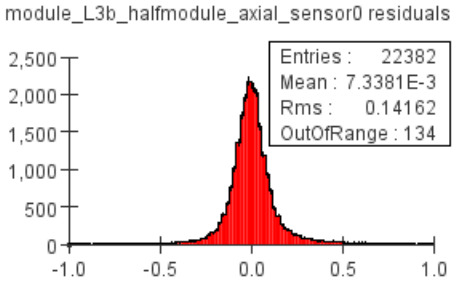


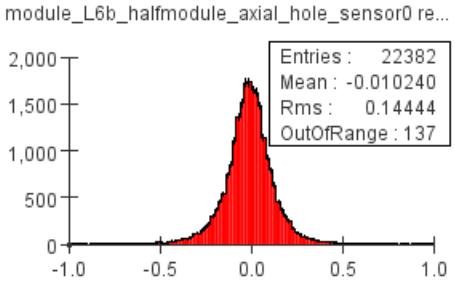


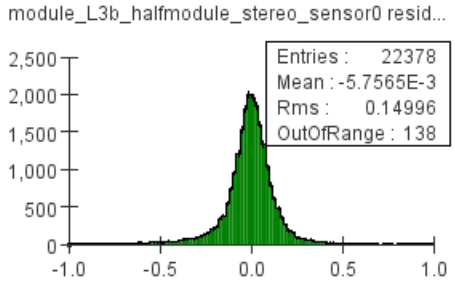


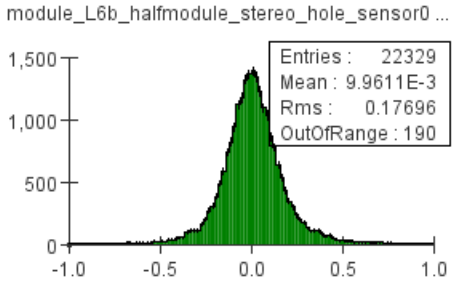






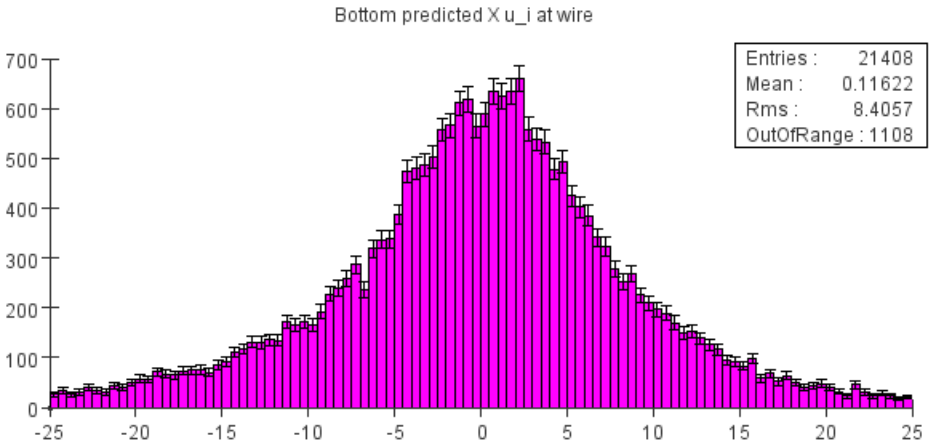


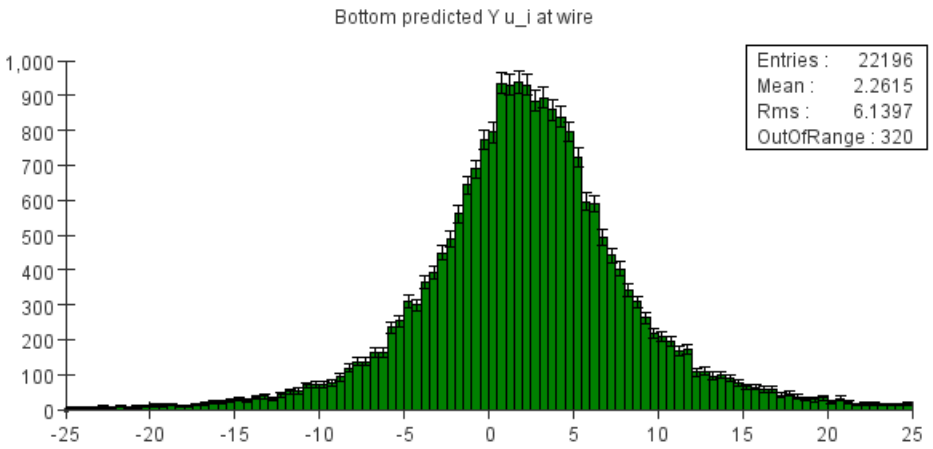




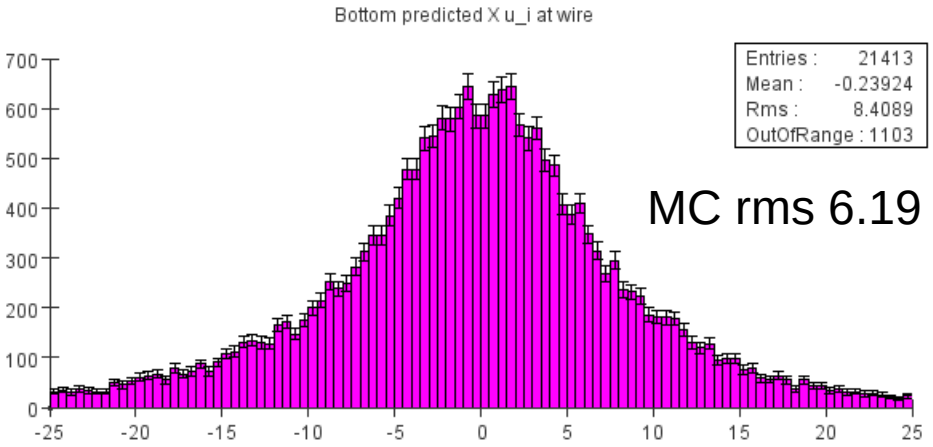
Fit tracks and predict target position

Before

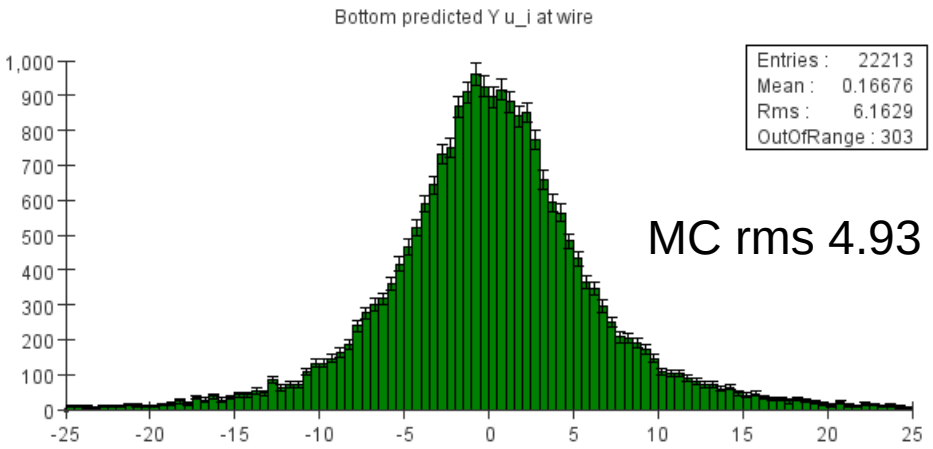




Fit tracks and predict target position



After



MC comparisons

- Turn off field in detector

  HPS-EngRun2015-Nominal-v2_fieldOff.lcdd

- Generate single electron events:

  /generator/select gps

  /gps/particle e-

  /gps/position -67.23 0.0 -2337.1 mm

  /gps/energy 1.056 GeV

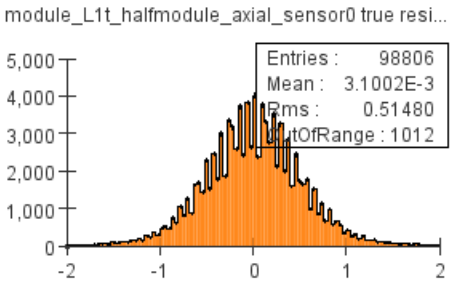
  /gps/direction 0.02 0.008 1

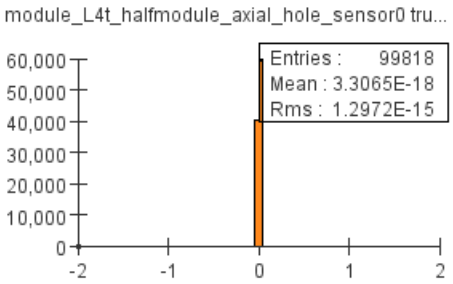
  /random/setSavingFlag true

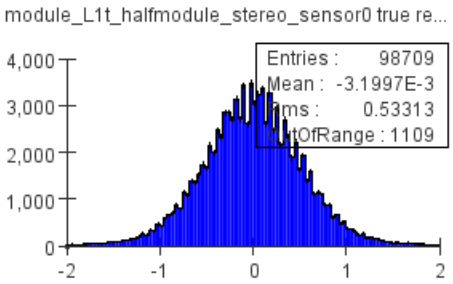
  /lcio/fileExists delete

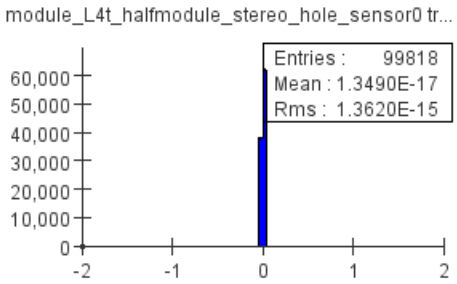
  /lcio/PDGFlag

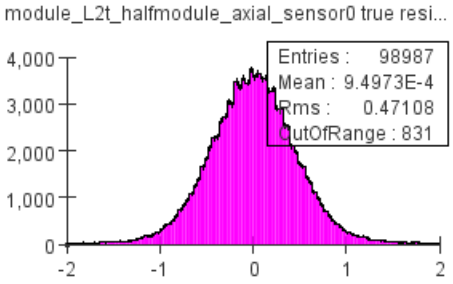
MC “true” residuals (axial / stereo)

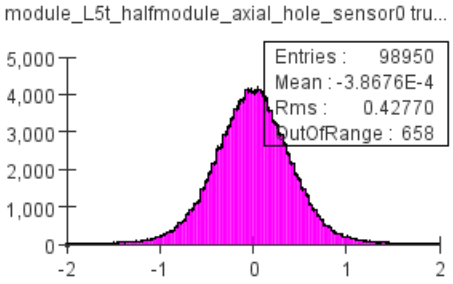


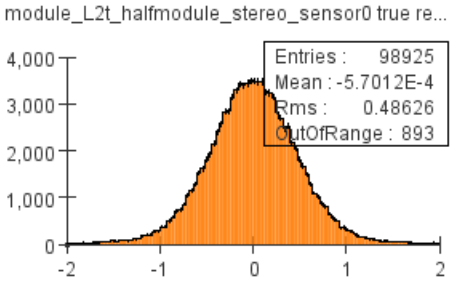


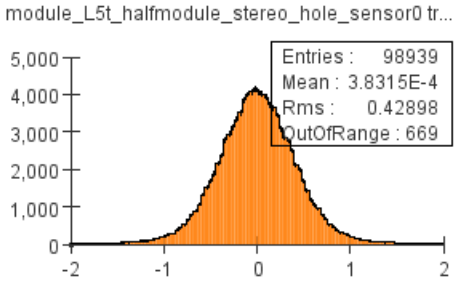


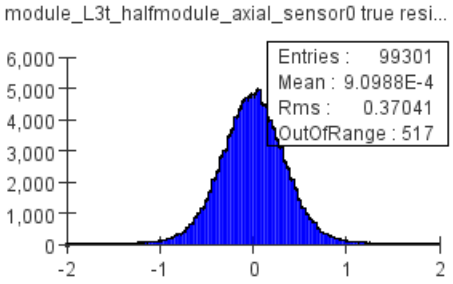


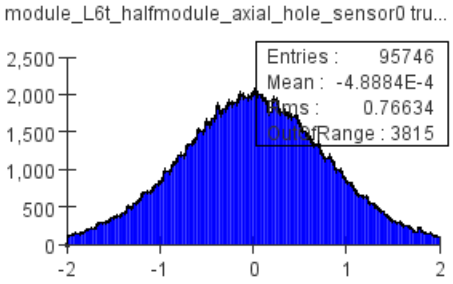


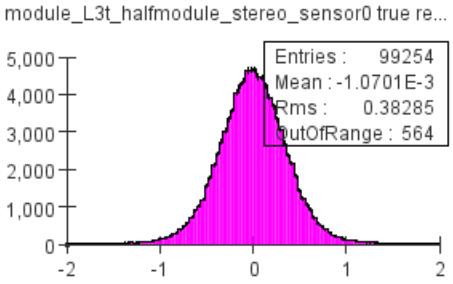


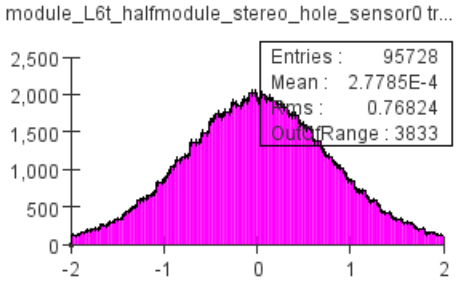




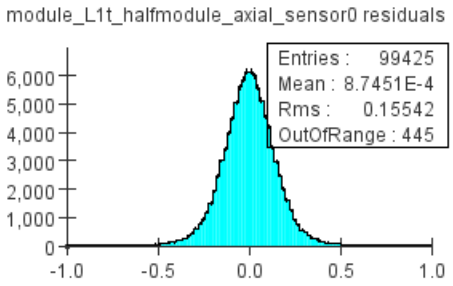


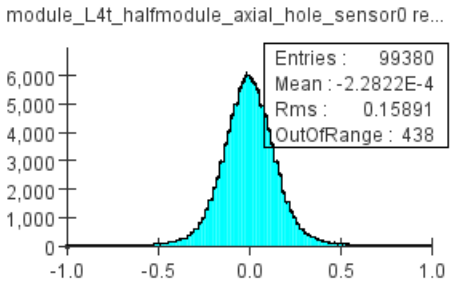


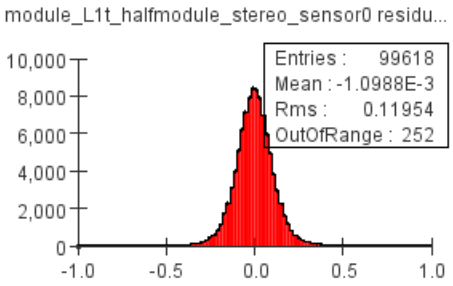


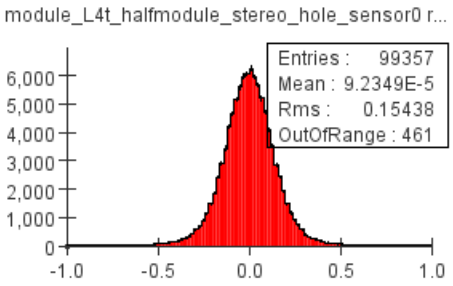


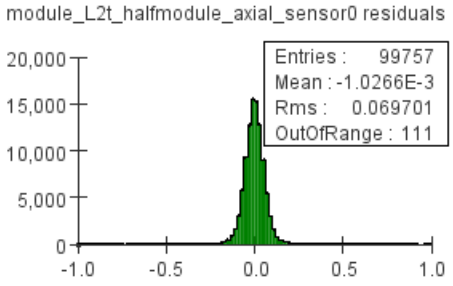
MC Residuals axial/stereo

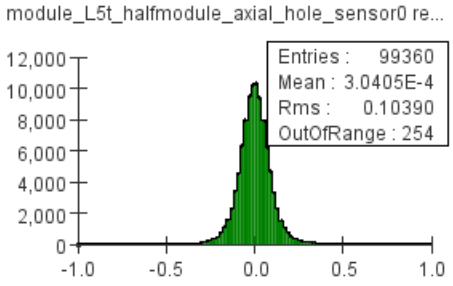


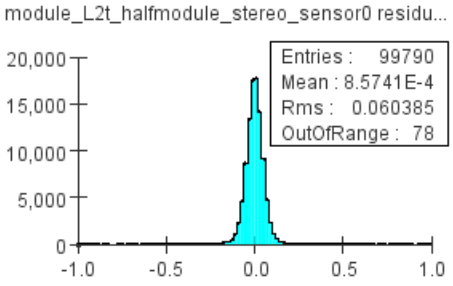


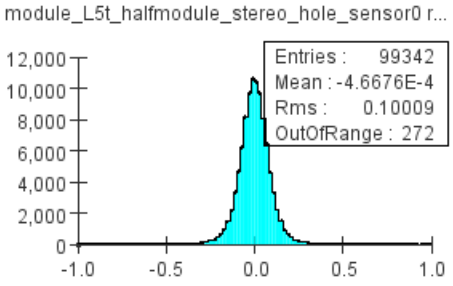


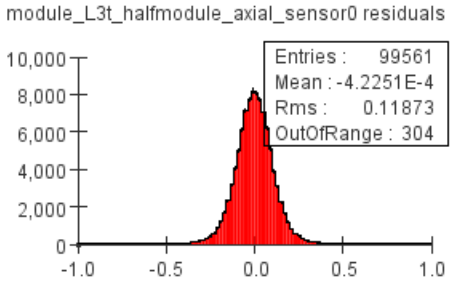


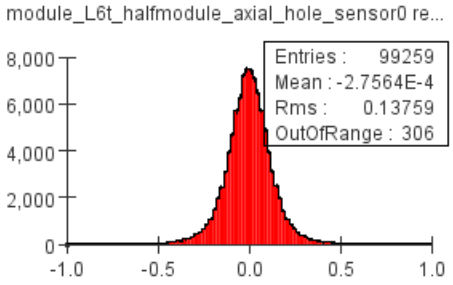


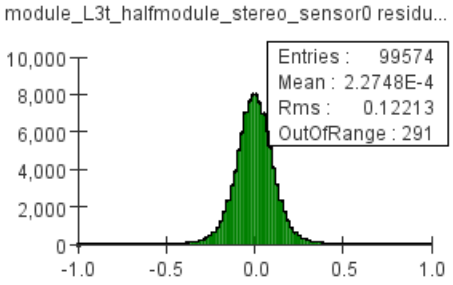


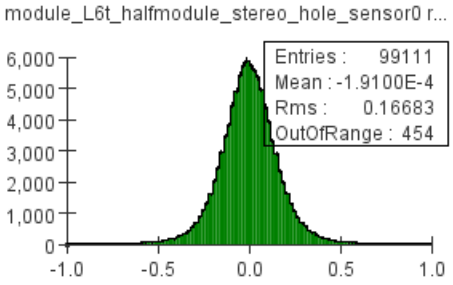




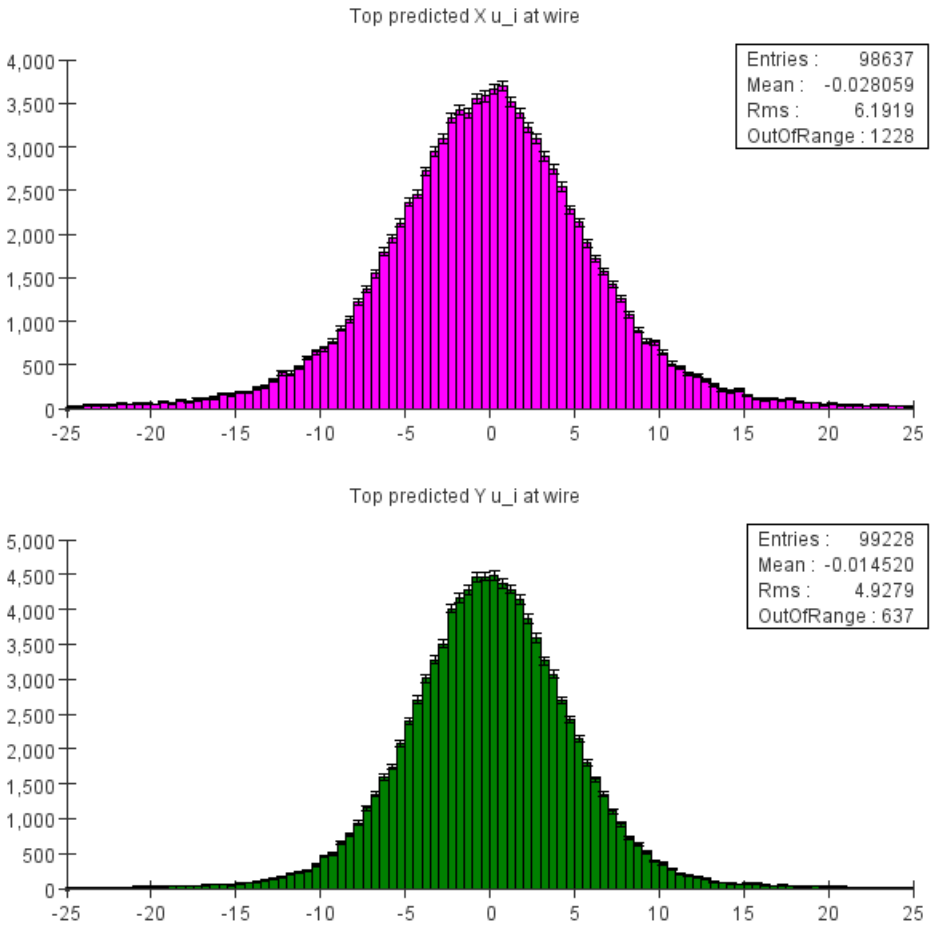








MC predict target position



Current Corrections axial stereo

L1t	0.103	-0.063
L2t	0.111	-0.066
L3t	0.097	-0.059
L4t_hole	0.	0.
L4t_slot	0.	0.
L5t_hole	-0.028	0.020
L5t_slot	0.	0.
L6t_hole	-0.036	0.027
L6t_slot	0.	0.

consistent with translation of all three layers ?

Current Corrections axial stereo

L1b	0.332	-0.327
L2b	0.252	-0.264
L3b	0.182	-0.204
L4b_hole	0.	0.
L4b_slot	0.	0.
L5b_hole	-0.133	0.108
L5b_slot	0.	0.
L6b_hole	-0.259	0.254
L6b_slot	0.	0.

consistent with rotation of all three layers ?

Next Steps

- Keep it simple
- Chew on the results so far to understand geometry shifts
  - Quantify MC/Data comparisons
- Repeat analyses fixing other stations
- Try to understand axial/stereo shifts by constraining stations, not individual sensors
- Implement least-squares fitting for
  - translation $\perp$ to strip direction
  - rotation about z axis (γ)
  - Keep it simple (don't reinvent millepede)
- Put some of the shifts into detector description
  - Run some field-on Fee events
    - check momentum and χ^2
  - Run some field-on Møller events
    - check vertex position and mass
- Finish by Friday (?)