

Millepede w rotations
starting from geo v4.4
on 2016 data (run 7798)

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Floating w rotations

- Start from v4.4 geo on 2016 data with fieldmap
- A study was already done one sensor at a time on 2015 data
 - Sensors 4 and 5 are the most sensitive
- Try to float w rotations for the stack of three sensors: 1-2-3, 4-5-6 slot, 4-5-6 hole, axial+stereo (together)
 - 6(x2) free parameters to be adjusted by Millipede at a time
- Procedure
 - Leave parameters free, keep all translational offsets unchanged
 - Apply Millepede
 - Verify improvement/changes of residuals, kinks, scatter distributions of angle vs residuals, effect on the momentum, ...
 - Decide the direction to follow for the following step
- Tracking strategy
 - All strategy combinations under test
 - Reference reconstruction strategy: 3-4-5, 2 control, 1-6 extension
 - Sample: ~45k reconstructed tracks (250000 processed events)

Module	Offset (mrad)	Error (mrad)
12301	-4.56	0.29
12302	2.76	0.20
12303	-1.10	0.10
12304	0.86	0.08
12305	-0.34	0.04
12306	0.34	0.04

Module	Offset (mrad)	Error (mrad)
12309	0.03	0.03
12310	0.03	0.03
12313	-0.28	0.06
12314	0.13	0.06
12317	-0.25	0.11
12318	0.11	0.11

Module	Offset (mrad)	Error (mrad)
12307	0.30	0.01
12308	-0.27	0.01
12311	0.22	0.02
12312	-0.18	0.02
12315	0.25	0.04
12316	-0.03	0.04

Module	Offset (mrad)	Error (mrad)
22301	-2.65	0.19
22302	-3.82	0.20
22303	-1.60	0.08
22304	-0.78	0.10
22305	-0.82	0.04
22306	0.49	0.04

Module	Offset (mrad)	Error (mrad)
22309	0.13	0.03
22310	-0.02	0.03
22313	-0.16	0.06
22314	-0.12	0.06
22317	0	0.11
22318	0	0.11

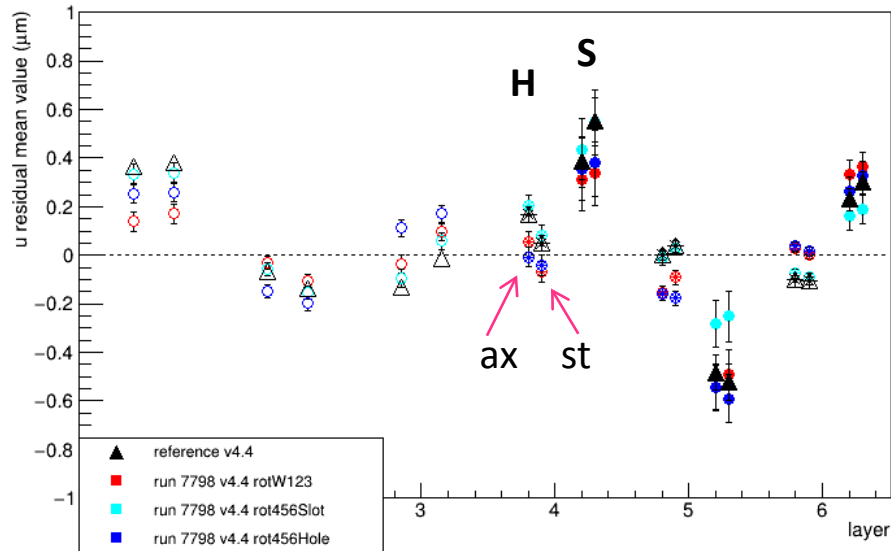
Module	Offset (mrad)	Error (mrad)
22307	0.11	0.01
22308	0.06	0.01
22311	-0.12	0.02
22312	-0.13	0.02
22315	-0.21	0.04
22316	0.24	0.04

MillePede offsets

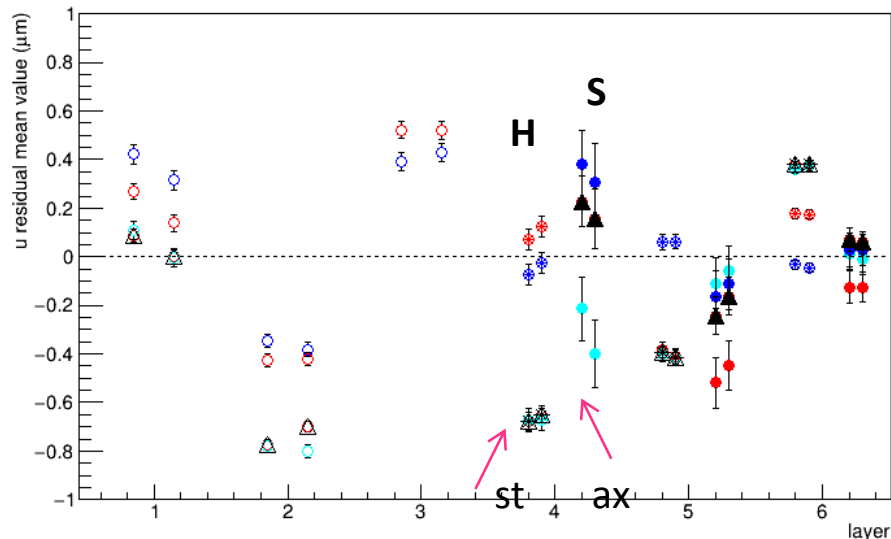
- Rot w 1-2-3:
 - Offsets < O(1) mrad
 - All meaningful
- Rot w 4-5-6 Slot
 - Offsets < O(0.1) mrad
 - For some of them the error is larger
 - Equivalent to zero
- Rot w 4-5-6 Hole
 - Offsets < O(0.1) mrad
 - Most of them are meaningful

u residuals after GBL, mean

top residuals, mean value (μm)



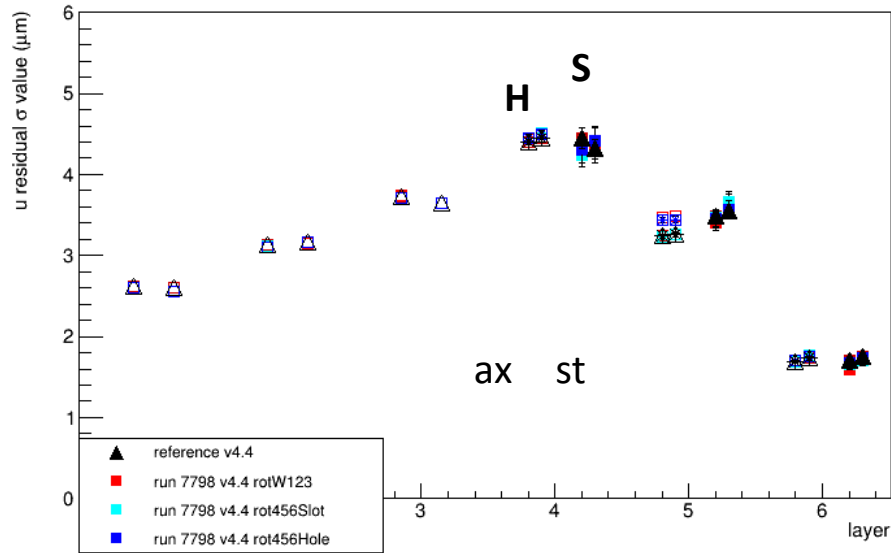
bottom residuals, mean value (μm)



- Triangles: no rotations
- Improvements (smaller mean):
 - TOP:
 - L1, L2, L3ax, L4H, L4S, L5S, L5H, L6S
 - BOTTOM:
 - L1, L2, L3, L4H, L4S, L5H, L5S, L6H, L6S
- 123w & 456Hw rotations improve the u residual mean
- Marginal improvement for 456Sw

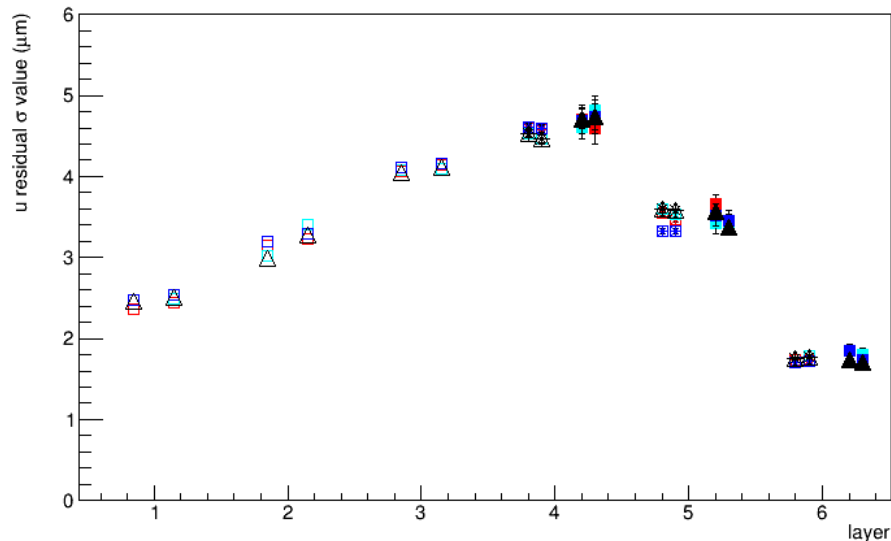
u residuals after GBL, sigma

top residuals, σ (μm)



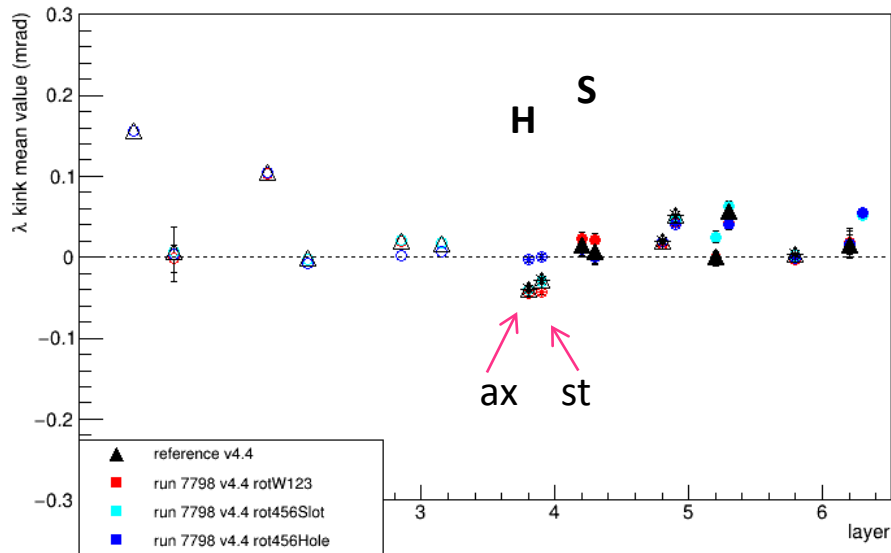
- Triangles: no rotations
- No remarkable difference among the different geometry versions (in a few cases, possibly slightly worse)

bottom residuals, σ (μm)

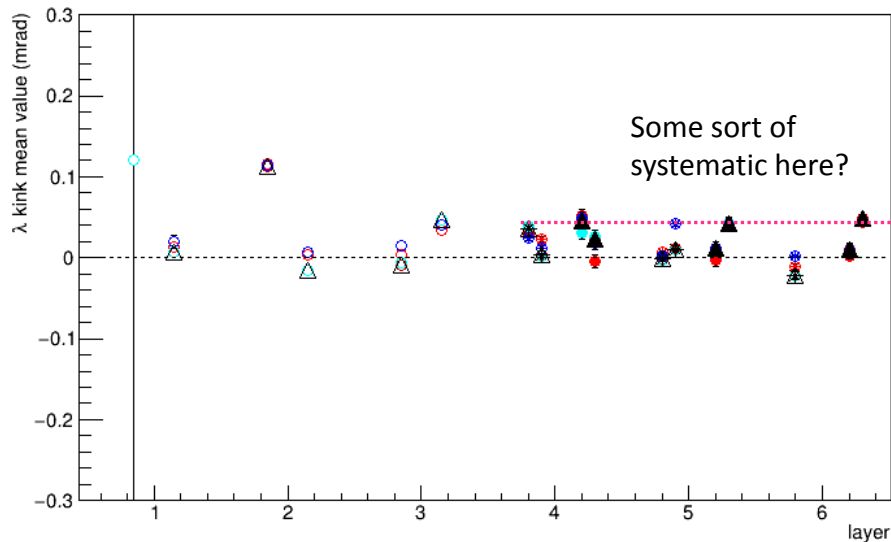


λ kinks, mean

top λ kinks, mean value (mrad)



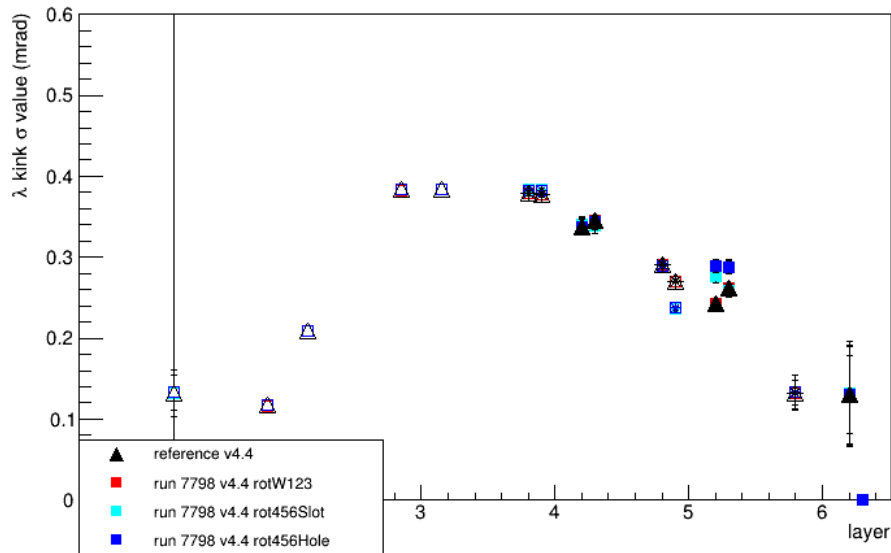
bottom λ kinks, mean value (mrad)



- Triangles: no rotations
- Small improvements
 - L123:
 - Small improvement for bottom layers
 - L456 TOP:
 - Improvement for L4H
 - L456 BOT:
 - Improvement for L4S, L6H

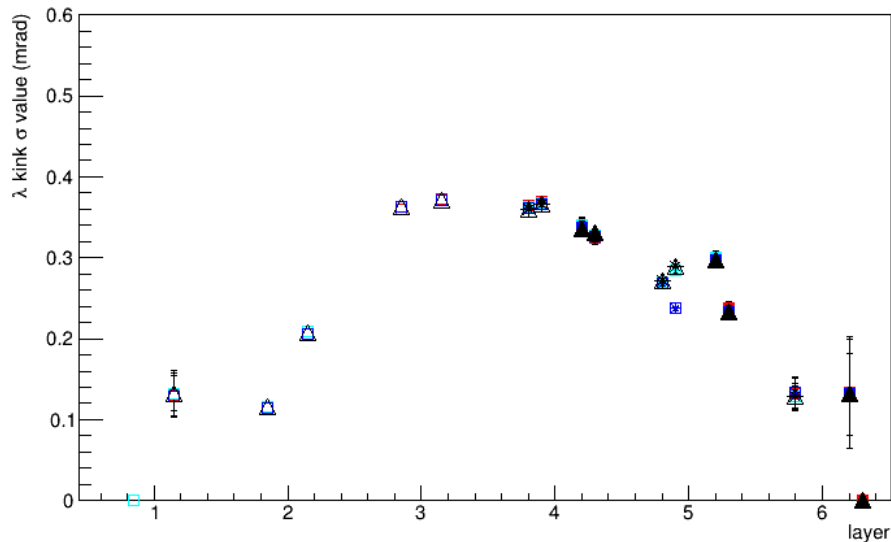
λ kinks, sigma

top λ kinks, σ (mrad)



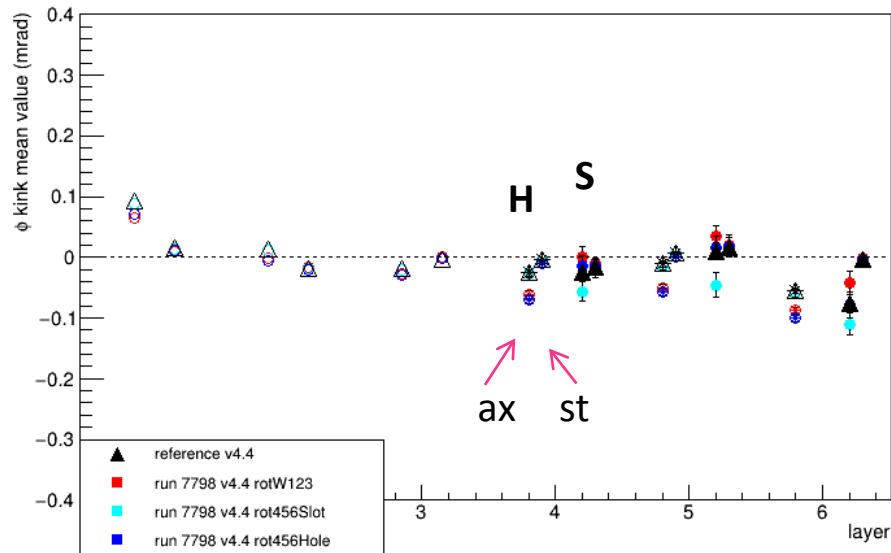
- Triangles: no rotations
- No remarkable change
- A few gaussian fits fail

bottom λ kinks, σ (mrad)

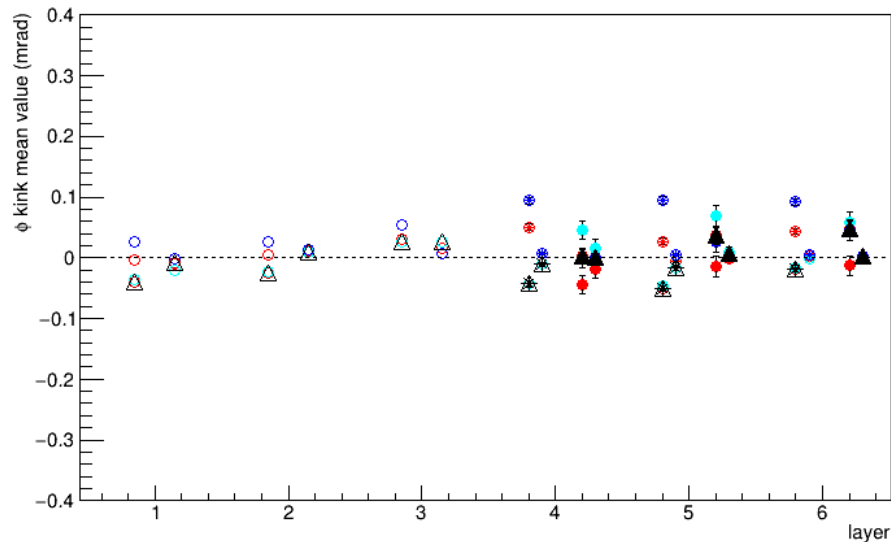


ϕ kinks, mean

top ϕ kinks, mean value (mrad)



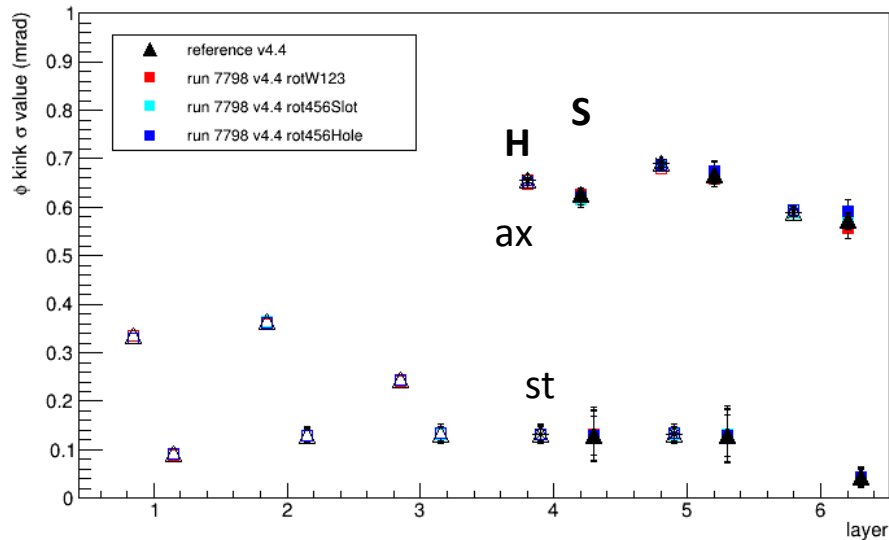
bottom ϕ kinks, mean value (mrad)



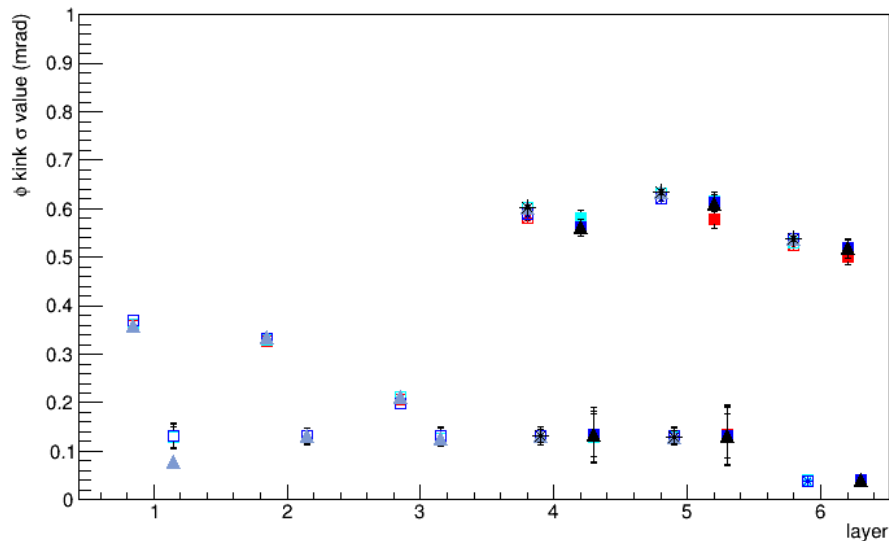
- Triangles: no rotations
- Small improvements for L123 inserting **123w** rot
- L456:
 - Slight overall worsening
 - Slight improvement for 456Slot bottom

ϕ kinks, sigma

top ϕ kinks, σ (mrad)

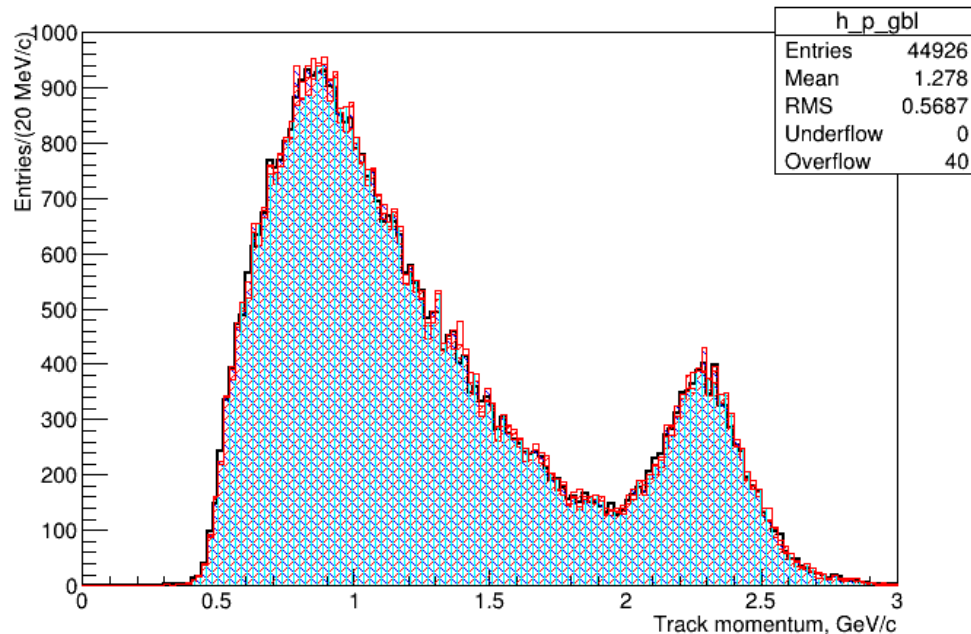


bottom ϕ kinks, σ (mrad)



- Triangles: no rotations
- No remarkable deviation with rotations
- Same sort of alternate behavior already observed
 - The second layer of each pair bear smaller sigma

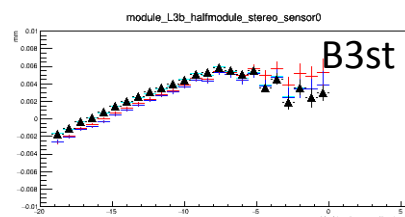
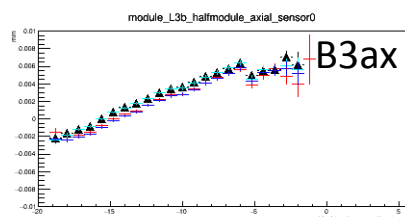
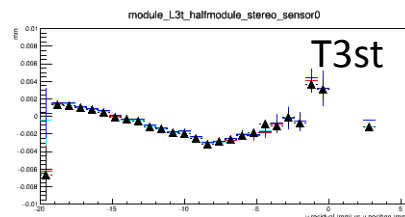
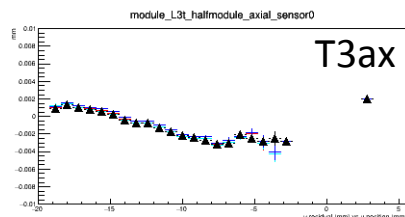
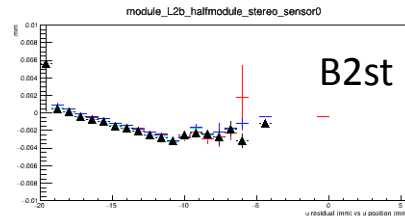
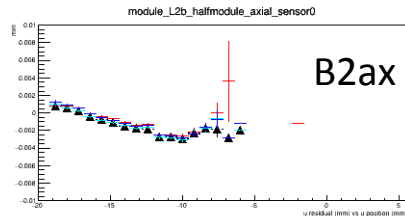
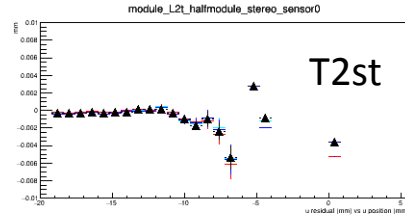
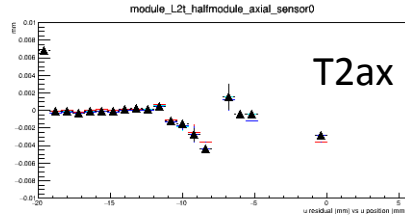
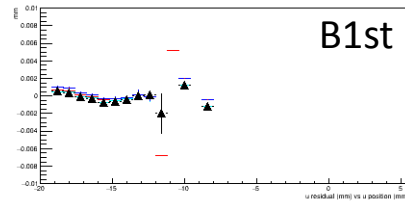
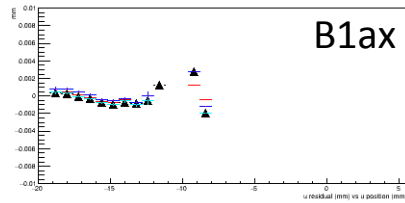
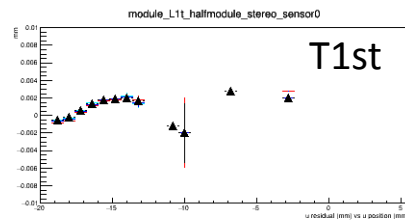
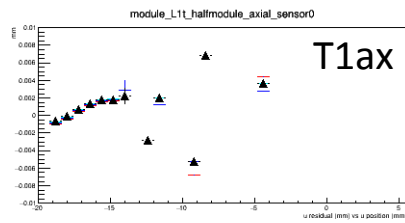
Compare momentum resolution on 2.3 GeV peak

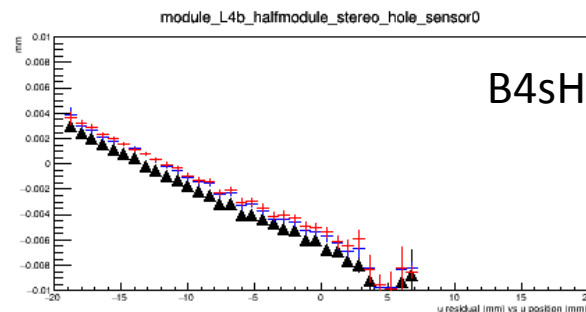
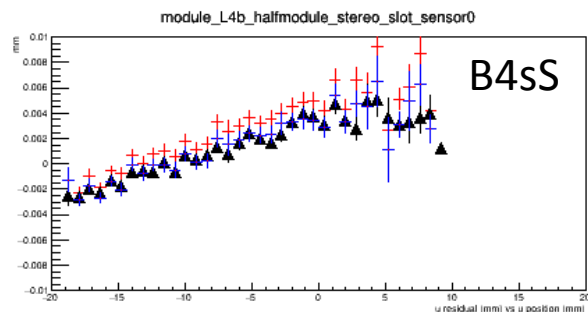
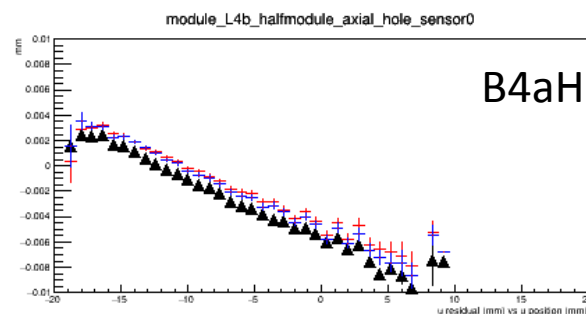
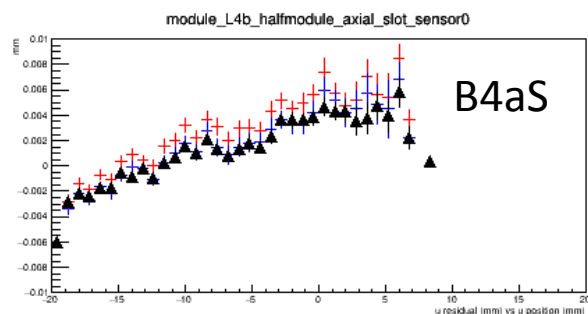
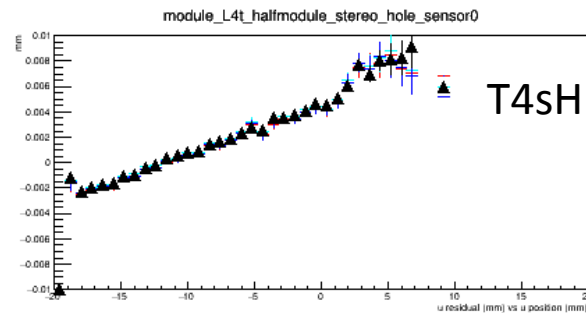
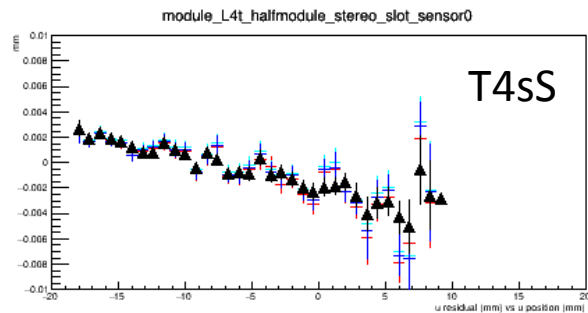
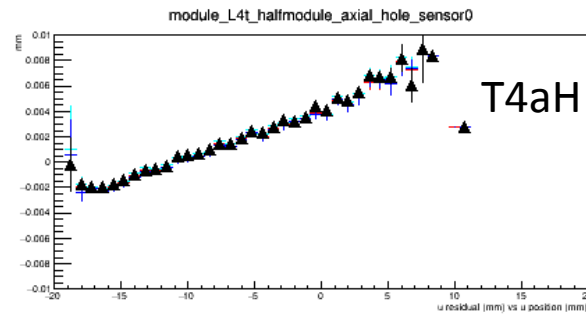
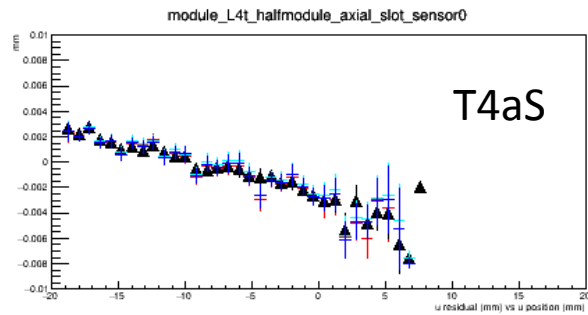


- No visible effect on momentum resolution (after GBL)
 - Mean: 2.27 GeV/c
 - Sigma: 175 MeV/c
- Need cleaner track sample (no selections here)

u residuals vs u profiles, layers 123

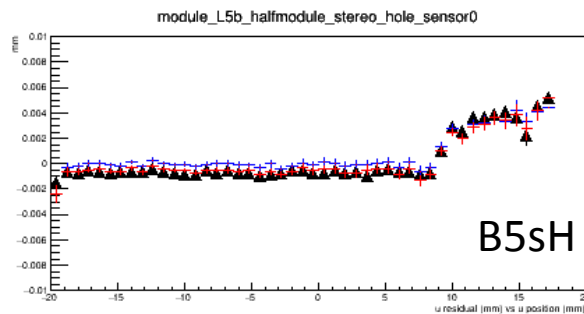
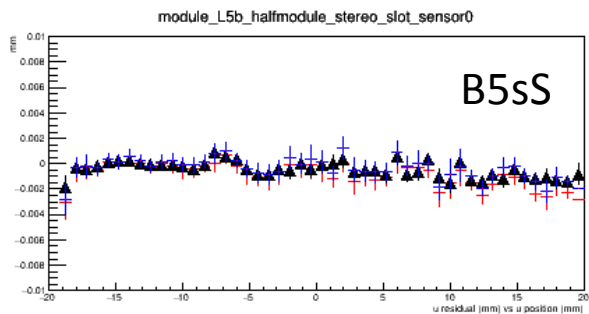
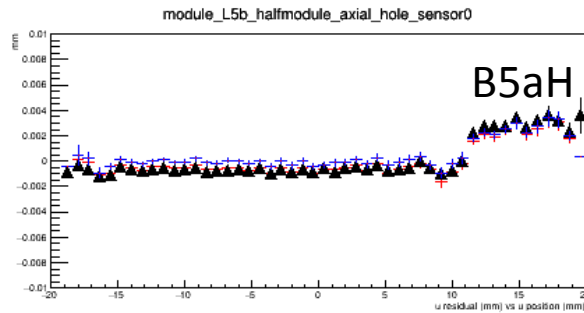
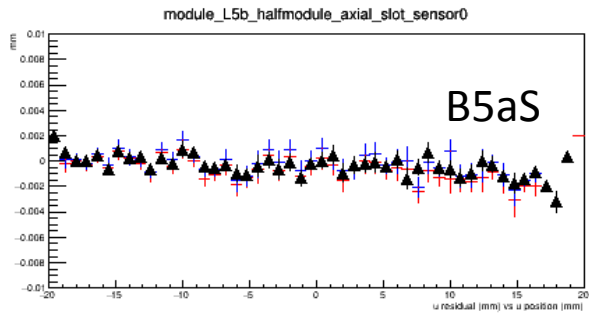
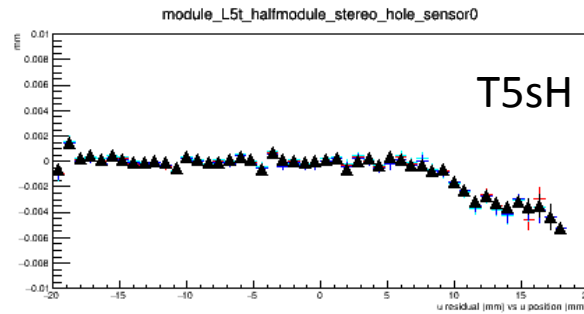
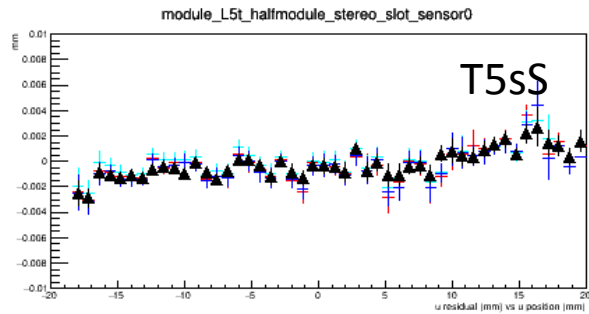
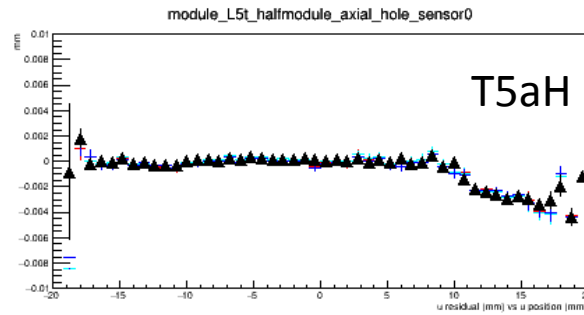
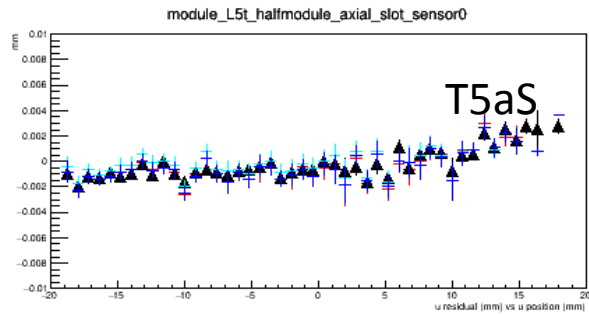
- No sizeable effect in any distribution





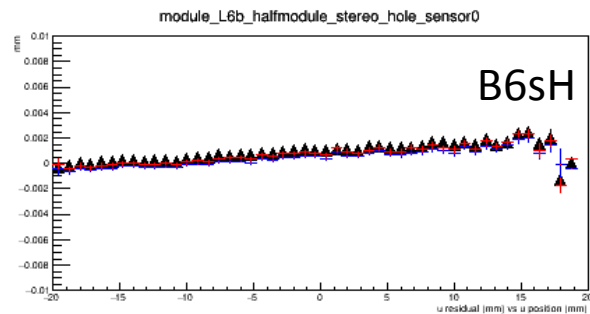
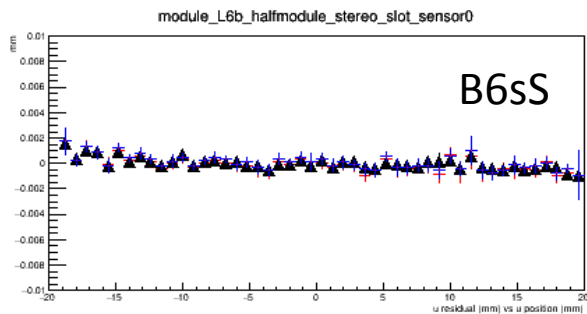
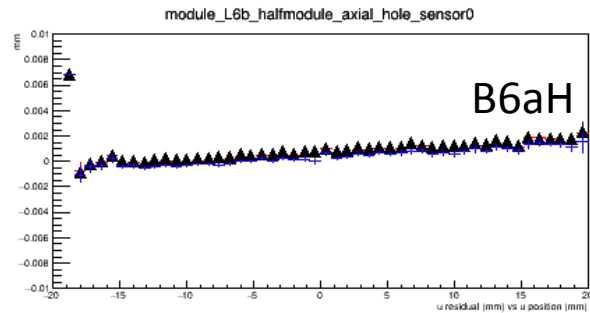
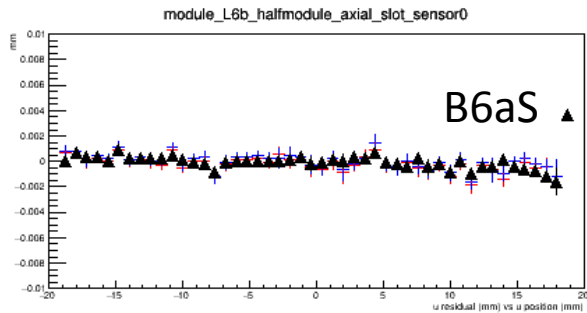
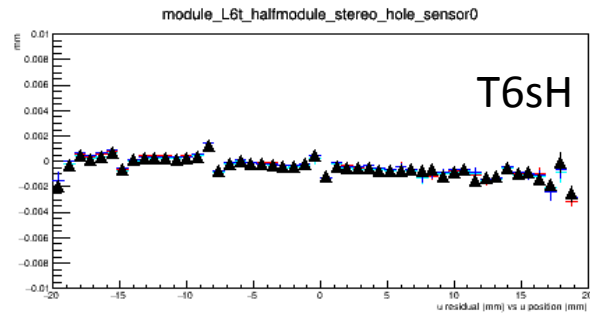
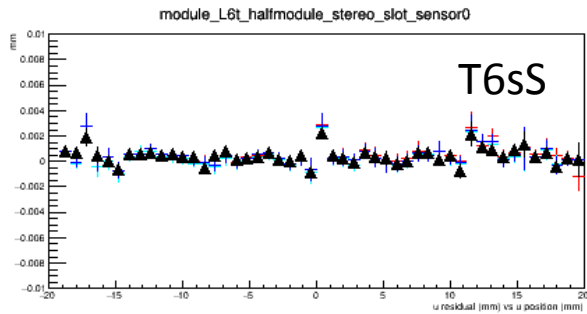
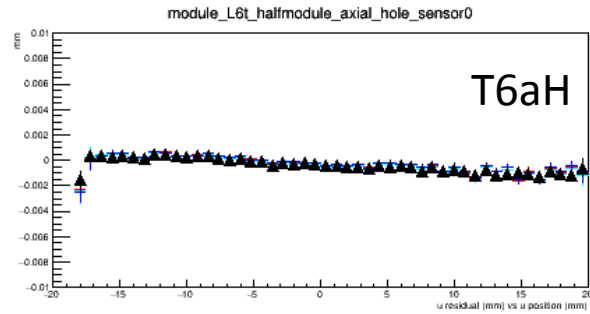
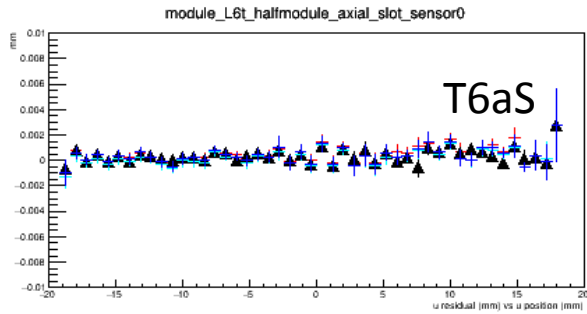
u residuals vs
u profiles,
layers 4

- No sizeable effect



u residuals vs
u profiles,
layers 5

- No sizeable effect



u residuals vs
u profiles,
layers 6

- No sizeable effect

MP w rotations round 1 – wrap up

- From overall chisquare it looks like the largest improvement is obtained rotating L123 and L456Hole stacks
- No sensible improvement on momentum resolution (but no track selection is applied)
- No sensible improvement of u res vs u scatter plots – there is a macroscopic effect that is not solvable with w rotations
- Next MP configurations to test:
 - L123 fixed + L456Hole w-rot floating
 - L456Hole w-rot fixed + L123 w-rot floating
- Apply MP corrections to selected tracks slcio (beware: different magnetic field) to check changes in momentum resolution