Internal alignment with new version (v2) – work in progress part 3

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2016 data 0.5 mm, v2-series alignment steps – summary

These are pseudo-χ^2 expressing the departure of residuals from zero (ideal case)

average pseudo-χ^2 value over residuals and φ and λ kinks (6 distributions)

test #	start from #	floats	Delta p (T-B) MeV/c	chi2 res top	chi2 res bot	mean chi2 tot	
0	-	-	40	33.62	71.77	20.14	
1	0	tu 3+4+5 T&B	81	11.01	31.97	7.9	
2	0	tu 2+3+4+5 T&B	20	9.7	31.9	7.59	
3	2	tu 3+4 T&B	3	3.58	8.14	2.44	
4	3	tu+tw 3+4 T&B	7	2.76	2.62	1.37	
5	4	ru+rv+rw 3+4 T&B	23	4	3.73	1.63	
6	5	tu 2+3+4+5 T&B	30	3.75	7.92	2.88	
7	5	tu+tw 3+4 T&B	38	3.34	2.77	1.83	
8	0	tuw 4+tuw3+tuw 2 T&B 3 steps in row	101	351.7	422.3	150.8	BAD check buildcompact
9	0	as 8 curved tracks only	-	-	-	-	BAD out of acceptance check buildcompact
10	0	tuw 4TB + tuw 3 + 2 tuw T&B	95	13.8	20.96	8.78	
11	0	tu 2+3+4+5 T&B curved only	101	41	7.95	11.4	
12	4	tu 1+6 T&B	0	0.56	2.13	0.7	GOOD
12F	4	" with new fieldmap	3	0.56	2.15	0.7	"
13	12	global alignment (check compact)	153			14.7	BAD check compact
14	12	ru+rv+rw 3+4 T&B	9	0.59	4.17	1.06	
15	14	tu 3+4 B + rurvrw 4HB	33	0.56	4.18	1.08	
16	15	rurvrw 4H+5H B	33	0.56	2.77	0.86	
17	15	ru+rv+rw 3+4H B	26	0.56	2.5	0.82	GOOD
17F	15	" with new fieldmap	26	0.56	2.48	0.81	"
18	15	ru+rv+rw 3+4S B	30	0.56	0.57 8 dof	1.48	BAD 4SB out of acceptance

Usage of updated field map brings a slight improvement

2016 v2-17 w NEW fieldmap, 0.5mm - all curved tracks
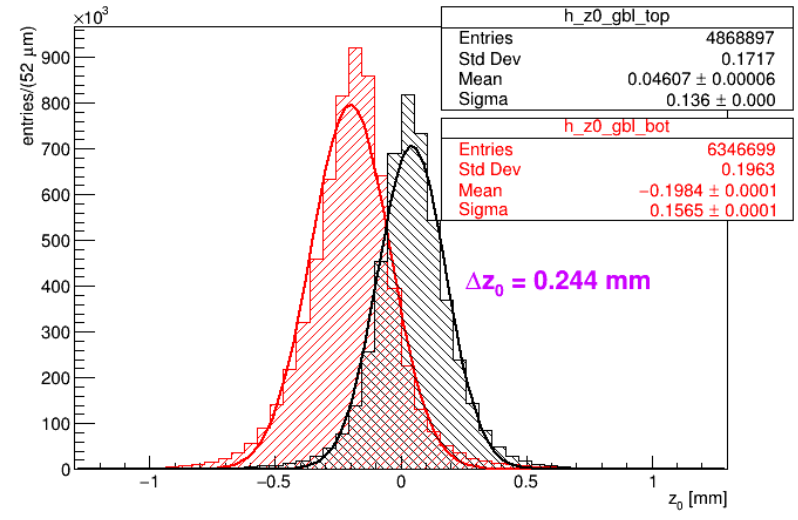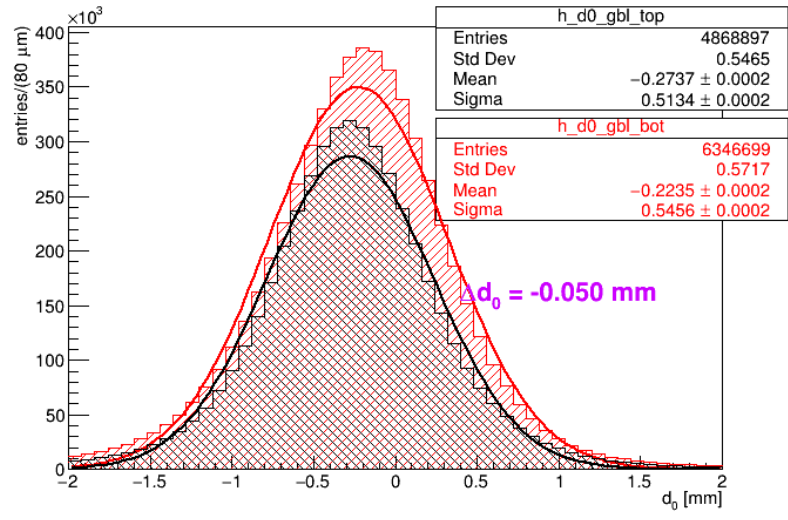
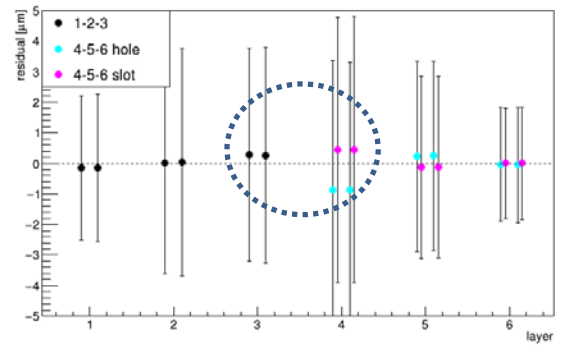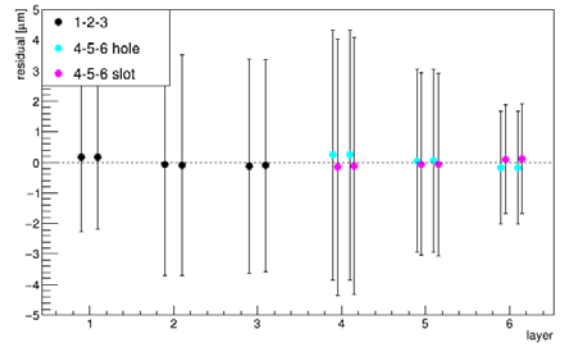d_0 t/b are no more aligned (top moves away, about twice the distance)

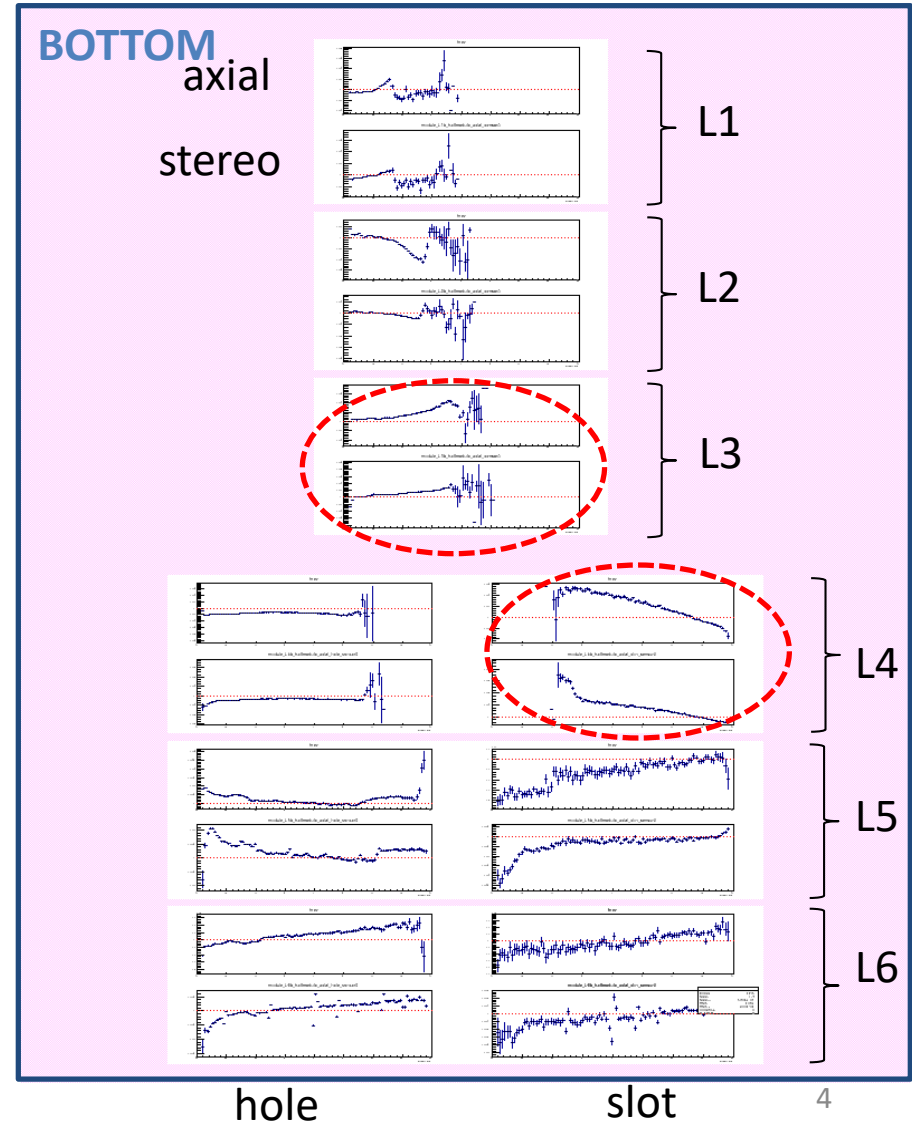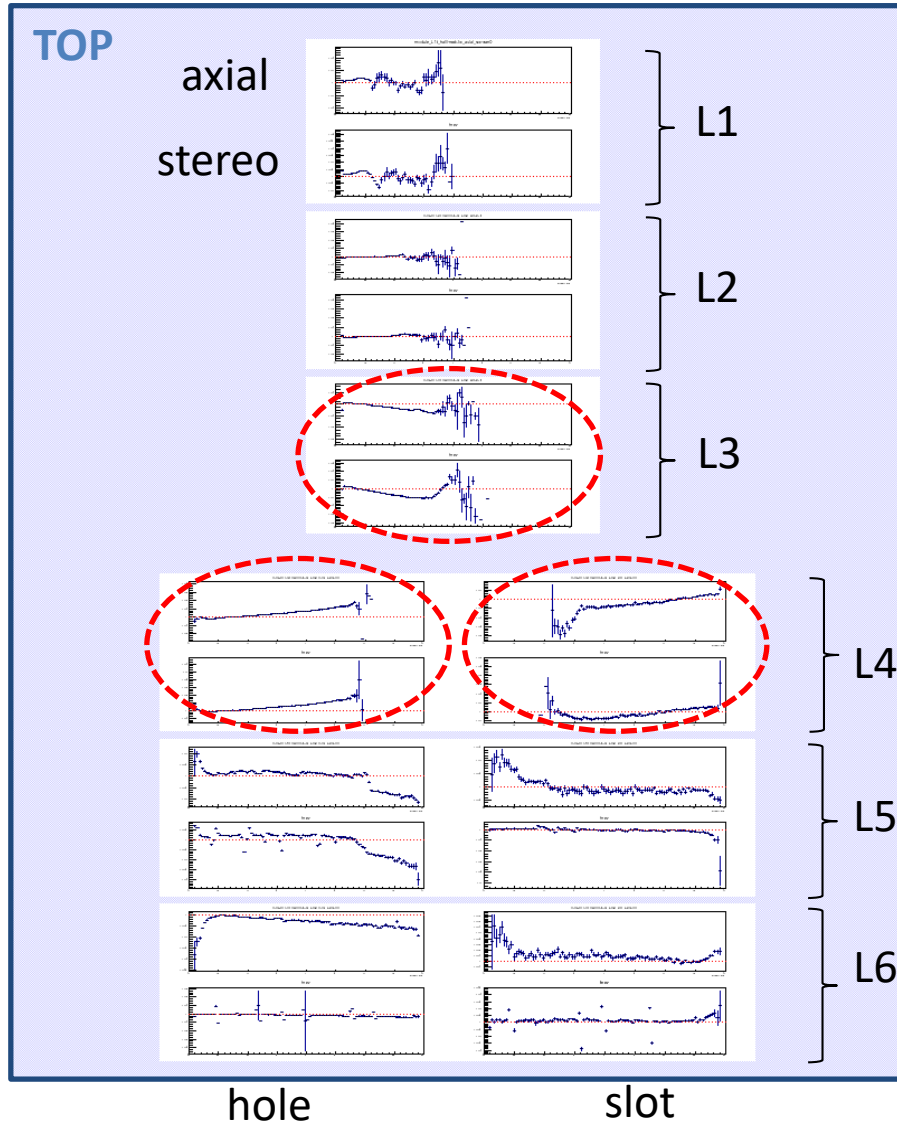T/B diff
Δd_0 = 50 μm
Δz_0 = 244 μm
Δp = 22 MeV/c
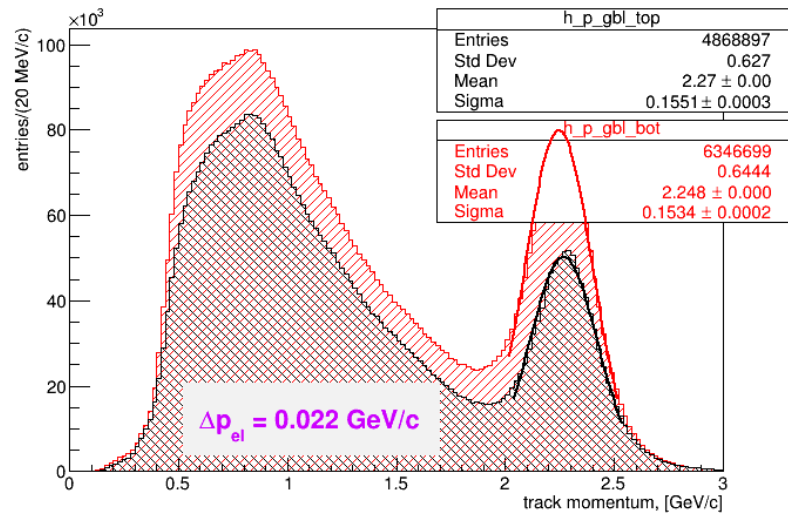
p_{top} = 2.27 MeV/c
p_{bot} = 2.248 MeV/c

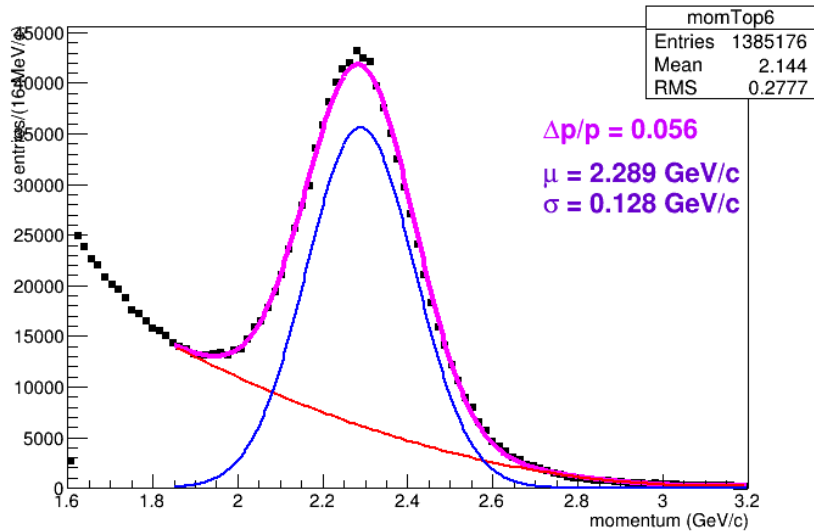The elastic peak momentum is aligned, but slightly lowered

GBL u residuals vs v position, curved tracks more tuning on rotations still needed
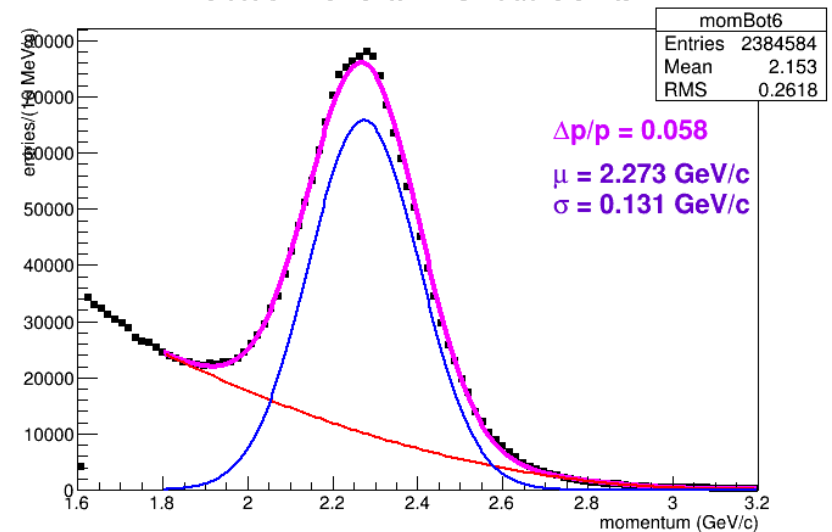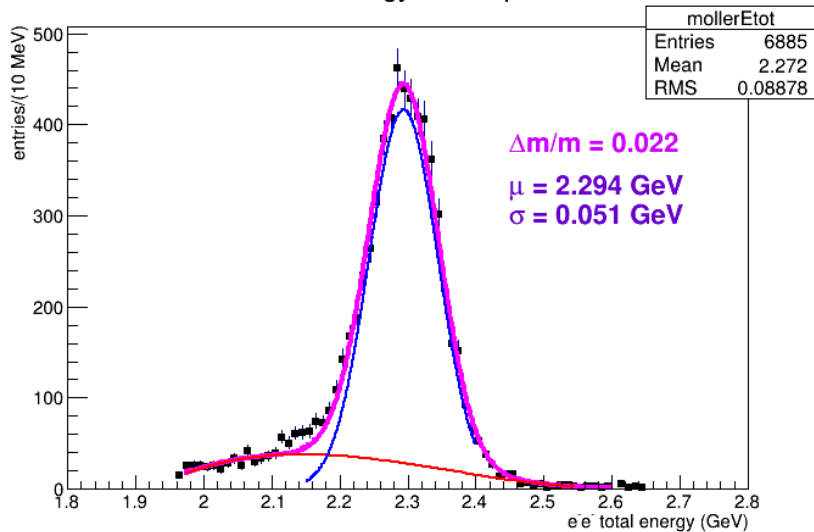
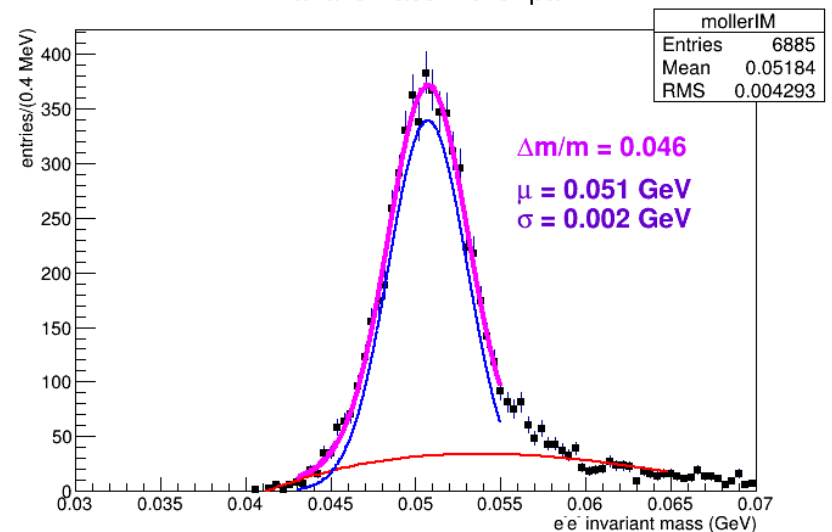# FEE/Moller resolutions

electron momentum TOP tracks 6 hits

momTop6	
Entries	1385176
Mean	2.144
RMS	0.2777

$\Delta p/p = 0.056$

$\mu = 2.289$ GeV/c
$\sigma = 0.128$ GeV/c

electron momentum BOT tracks 6 hits

momBot6	
Entries	2384584
Mean	2.153
RMS	0.2618

$\Delta p/p = 0.058$

$\mu = 2.273$ GeV/c
$\sigma = 0.131$ GeV/c

total energy Moller pair

mollerEtot	
Entries	6885
Mean	2.272
RMS	0.08878

$\Delta m/m = 0.022$

$\mu = 2.294$ GeV
$\sigma = 0.051$ GeV

invariant mass Moller pair

mollerIM	
Entries	6885
Mean	0.05184
RMS	0.004293

$\Delta m/m = 0.046$

$\mu = 0.051$ GeV
$\sigma = 0.002$ GeV

Momentum components, vertex position Moller events

Moller unc top track X momentum

molUncPXtop	
Entries	102702
Mean	0.03308
RMS	0.01904

Moller unc top track Y momentum

molUncPYtop	
Entries	102702
Mean	0.02635
RMS	0.00948

bottom spectra (violet) are slightly harder than the top ones

Moller unc top track Z momentum

molUncPZtop	
Entries	102702
Mean	1.033
RMS	0.2752

Moller Vertex unc X

molUncVX	
Entries	102702
Mean	−0.3313
RMS	0.5134
χ^2 / ndf	106 / 23
Constant	4890 ± 22.8
Mean	−0.2783 ± 0.0016
Sigma	0.3822 ± 0.0019

Moller Vertex unc Y

molUncVY	
Entries	102702
Mean	−0.1249
RMS	0.365
χ^2 / ndf	75.03 / 11
Constant	8820 ± 41.9
Mean	−0.1443 ± 0.0009
Sigma	0.2064 ± 0.0010
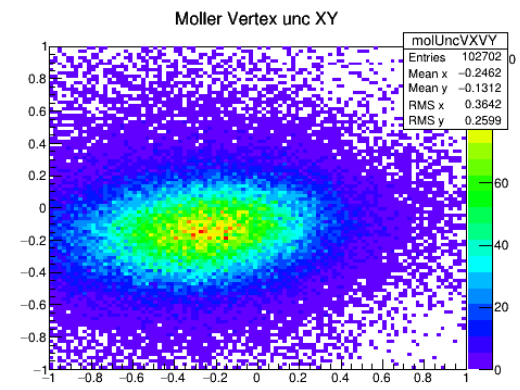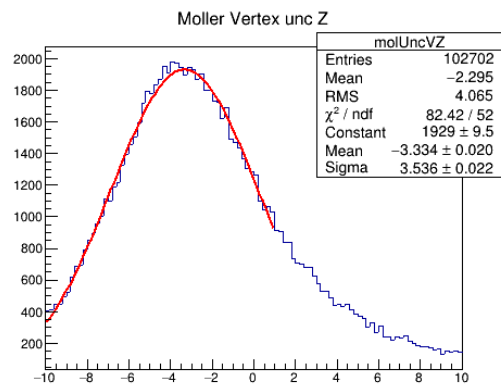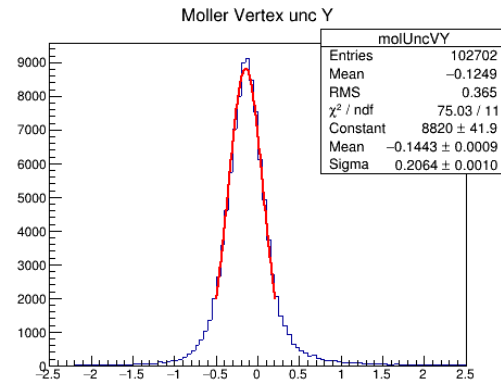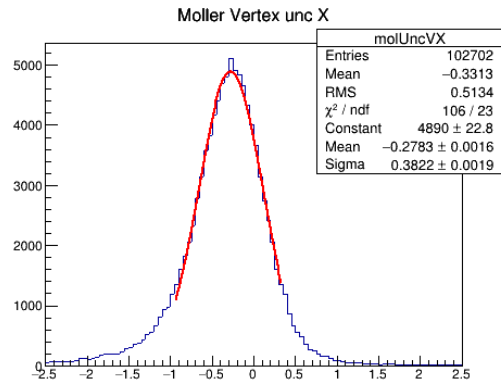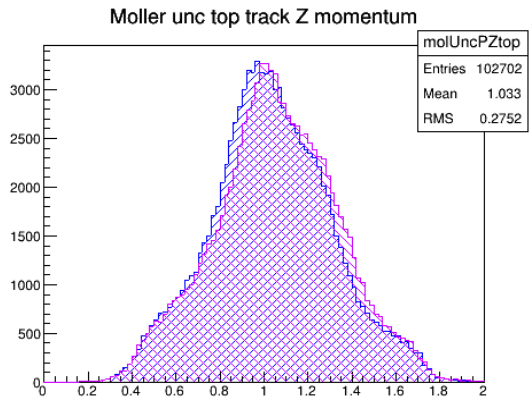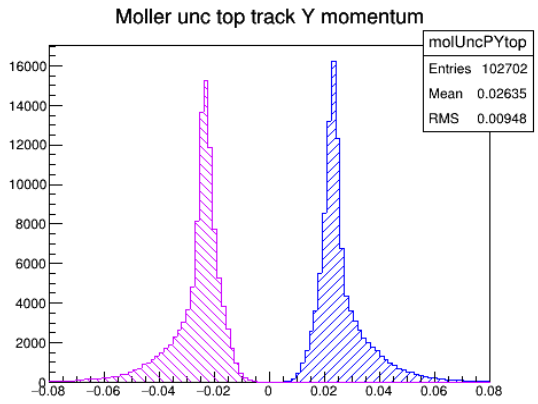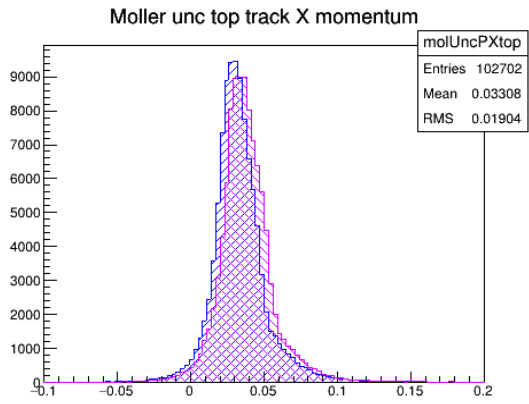
Z_{target} = -3.33 mm

X_{target} = -0.28 mm

Y_{target} = -0.14 mm

Moller Vertex unc Z

molUncVZ	
Entries	102702
Mean	−2.295
RMS	4.065
χ^2 / ndf	82.42 / 52
Constant	1929 ± 9.5
Mean	−3.334 ± 0.020
Sigma	3.536 ± 0.022

Moller Vertex unc XY

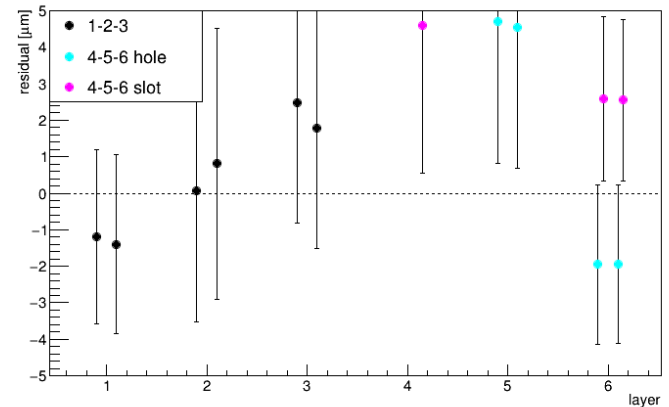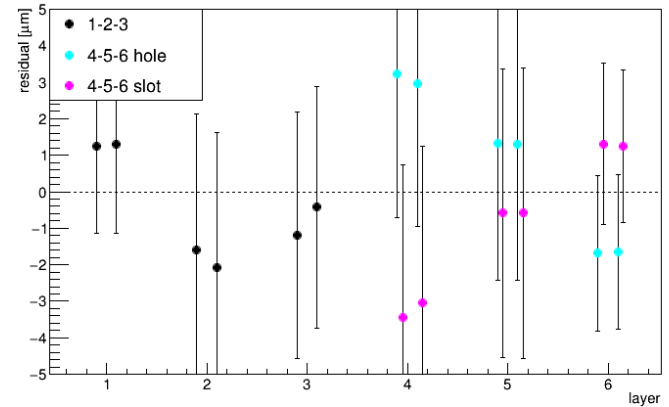| molUncVXVY	
Entries	102702
Mean x	−0.2462
Mean y	−0.1312
RMS x	0.3642
RMS y	0.2599

Straight tracks?

- The latest versions (from v2-7 on) were optimized on curved tracks only
- Straight tracks residuals are not good (as expected), but better than without any internal alignment
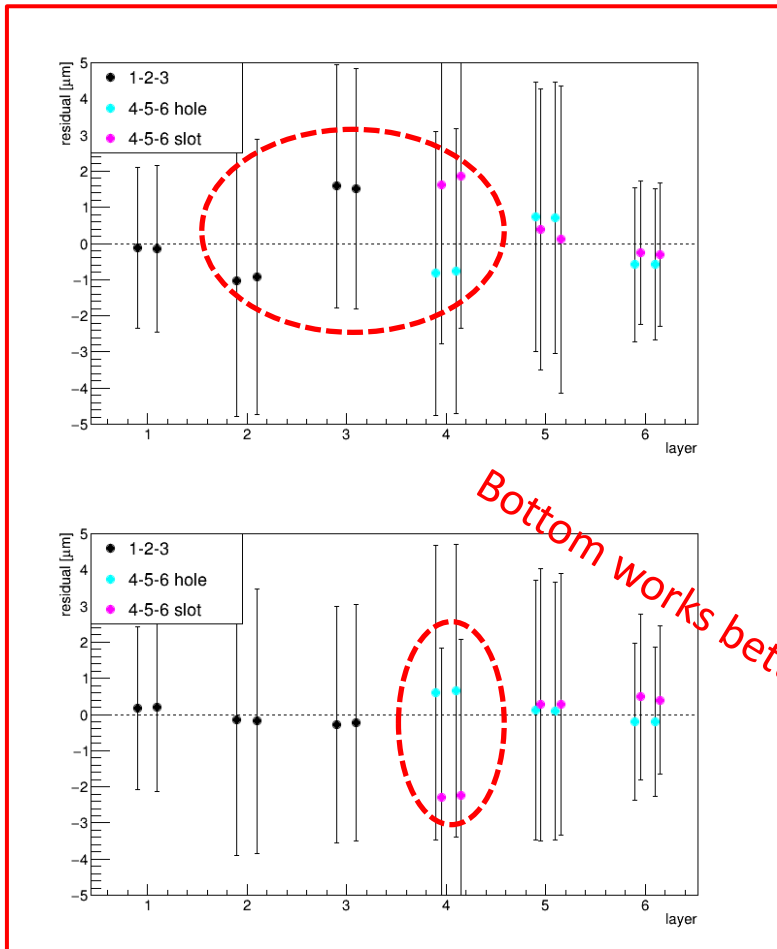
v2 (start – as it was)

Summary

- New fieldmap tested: it has slight effects on aligment quality

- V2-17 good – try some extensive tests
  - Room for improvement: bottom layer 3-4 hole side, 4 top (try z translations with constraints, same for axial and stereo)

- To be done:
  - Include global alignment (impact parameters) offsets (attempt unsuccessful - check needed)
  - Straight tracks quality improvement?