

Momentum calibration – magnetic field studies

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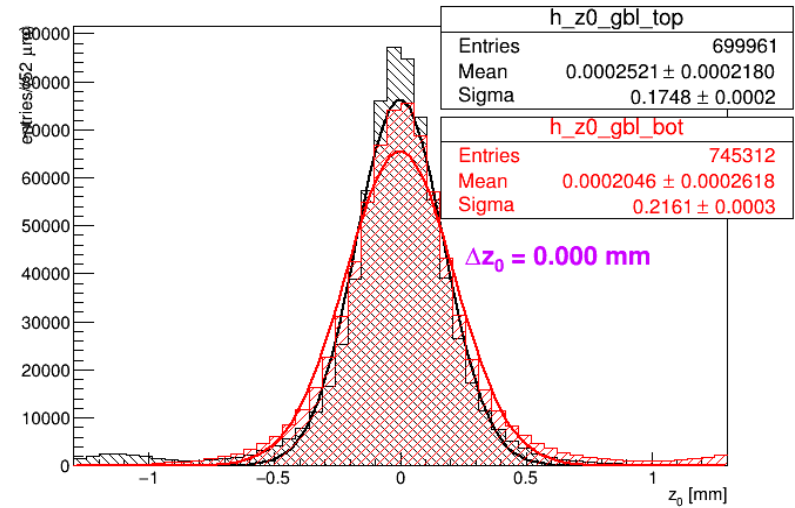
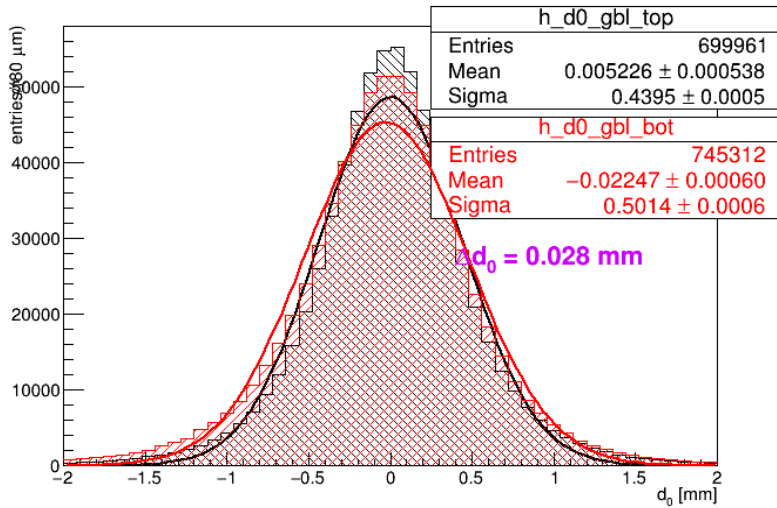
Apr 10, 2016

Momentum calibration, 2015 data

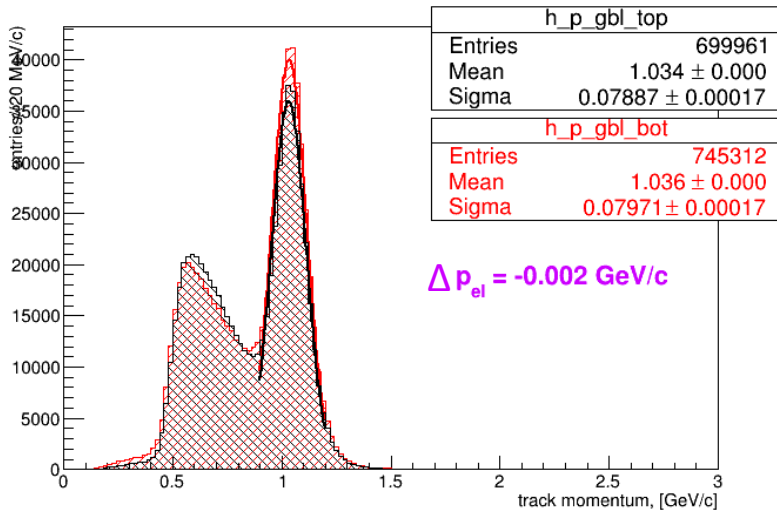
- Where we are:
 - Internal alignment: satisfactory for u residuals, res u vs u coordinate
 - global alignments:
 - tuning for d_0, z_0 -> convergence to 0
 - Elastic peak calibration:
 - Underestimation of ~ 20 MeV/c
 - Consistency between top and bottom within 2 MeV/c
- Montecarlo tests:
 - At 1.056 MeV/c incident momentum:
 - Systematic uncertainty on d_0 : ~ -40 μm (negative)
 - Systematic uncertainty on z_0 : top 7 μm , bot -5 μm
 - Reconstructed momentum systematic underestimation: 6 MeV/c
- Question: how to recover ~ 20 MeV/c?
 1. Stretch global z coordinate (ongoing – but it seems hard to get more than 10 MeV/c overall)
 2. Magnetic field map effects?

Assumption: the track curvature radius (i.e. the alignment as it is) is correct

V 5-1 geometry w fieldmap – 2015 data

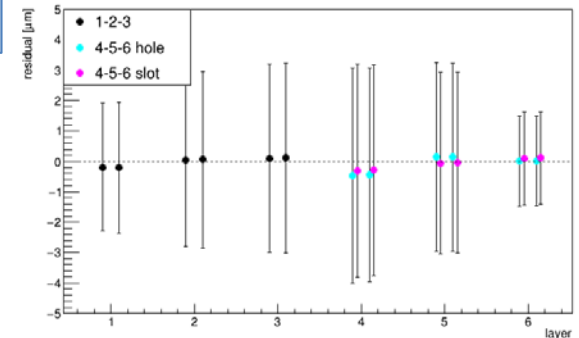
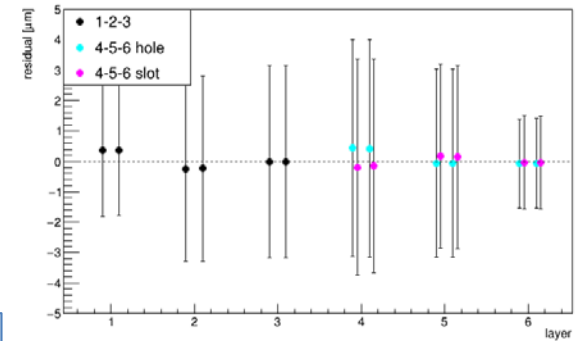


My best alignment - reference

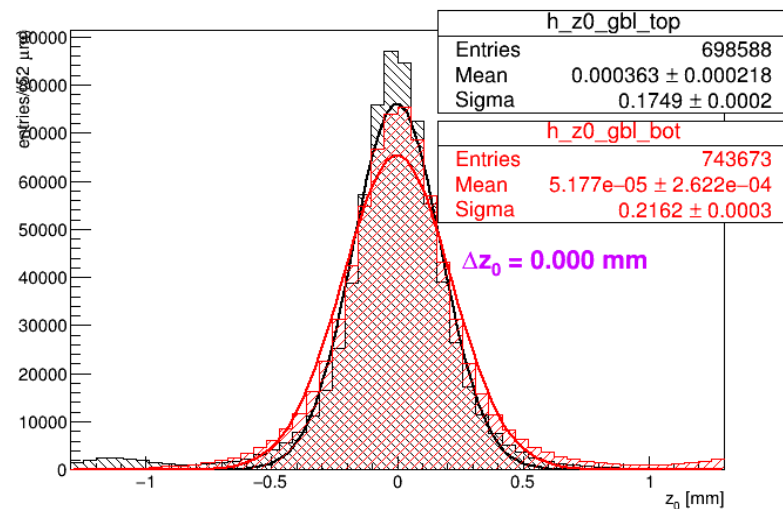
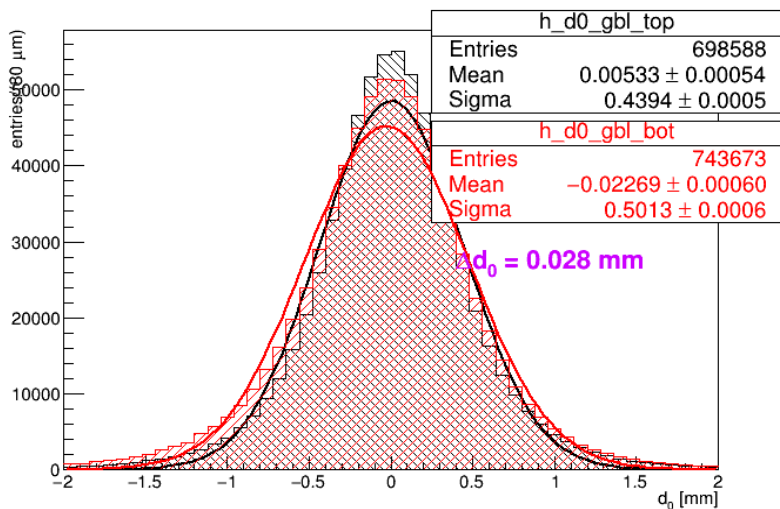


T/B diff
 $\Delta d_0 = 28 \mu\text{m}$
 $\Delta z_0 = 0 \mu\text{m}$
 $\Delta p = -2 \text{ MeV/c}$

$p_{top} = 1.034 \text{ MeV/c}$
 $p_{bot} = 1.036 \text{ MeV/c}$

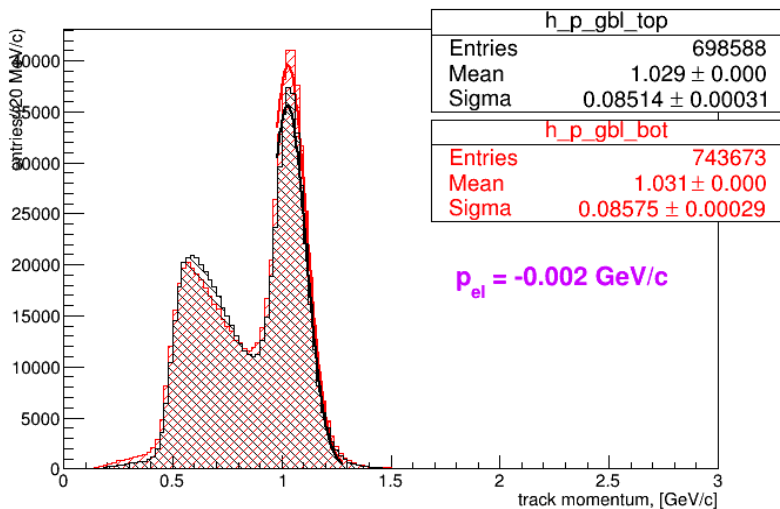
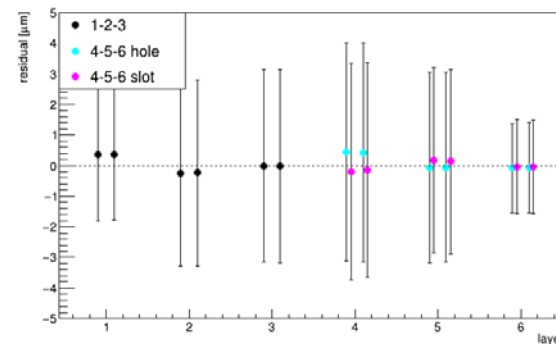


V 5-1 geometry with B=-0.24 T constant – 2015 data



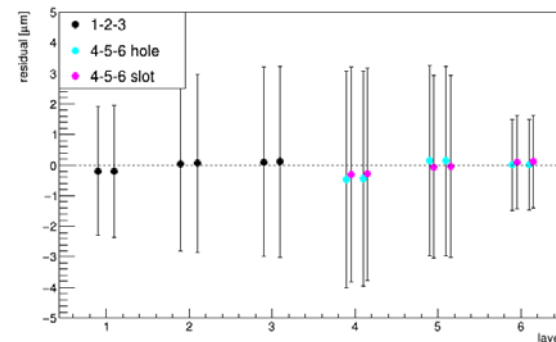
My best alignment +
constant field -0.24T

T/B diff
 $\Delta d_0 = 28 \mu\text{m}$
 $\Delta z_0 = 0 \mu\text{m}$
 $\Delta p = -2 \text{ MeV}/c$

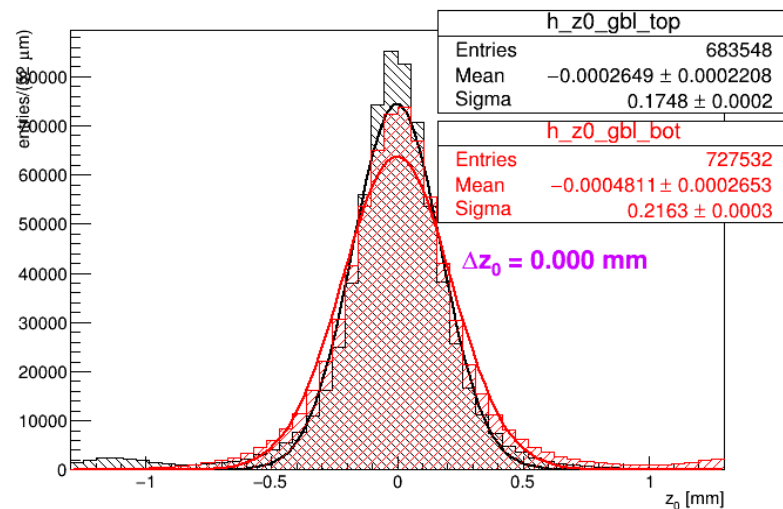
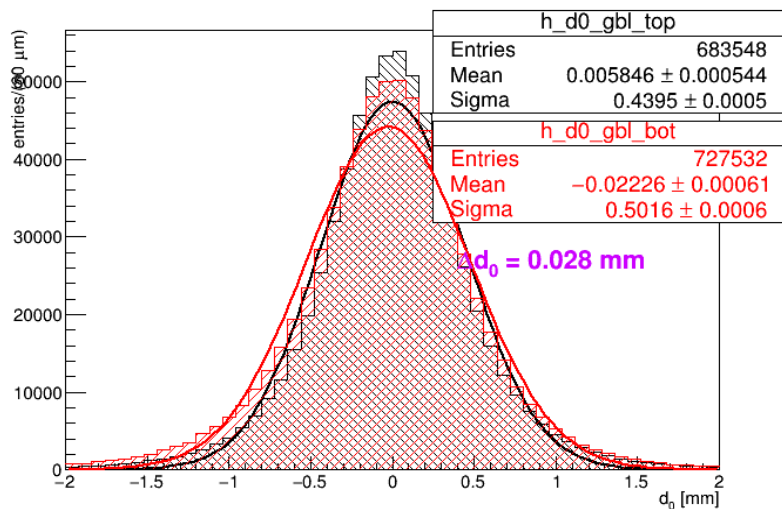


$p_{top} = 1.029 \text{ MeV}/c$
 $p_{bot} = 1.031 \text{ MeV}/c$

Slightly less efficient

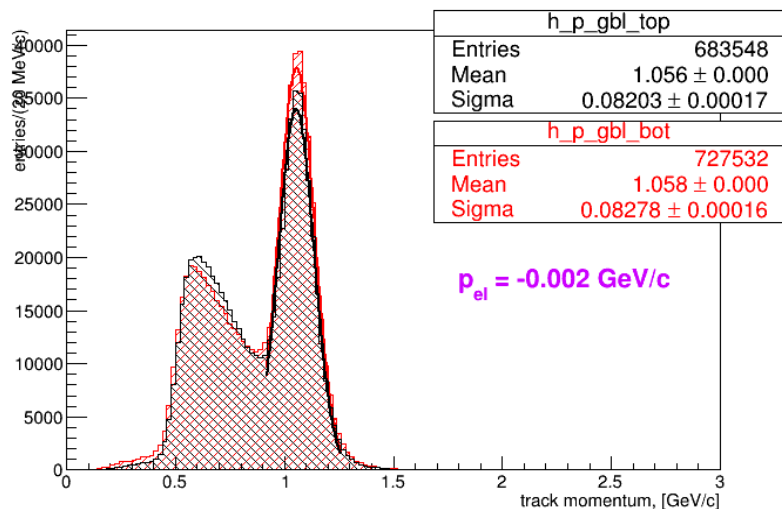
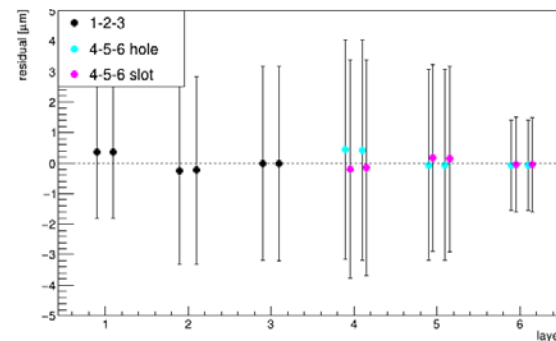


V 5-1 geometry with B=-0.245 T constant – 2015 data

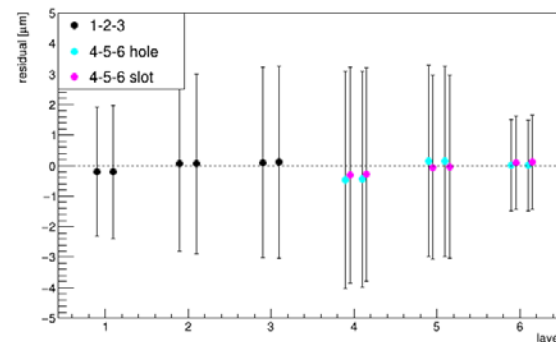


My best alignment +
constant field + 50 G

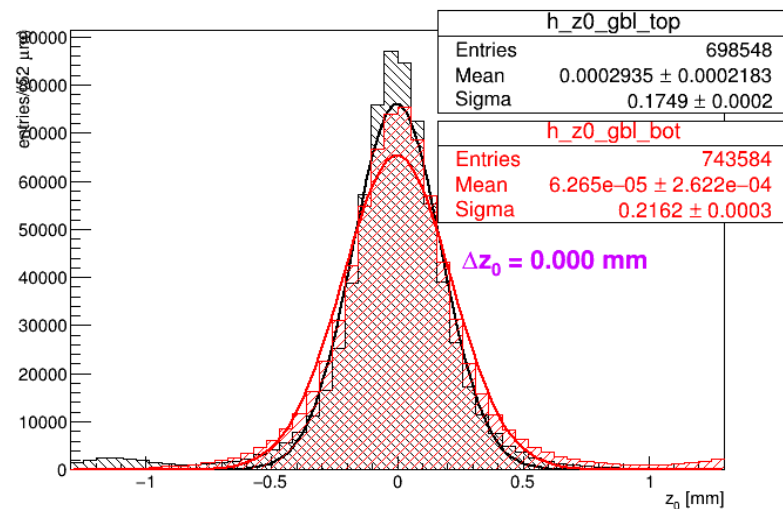
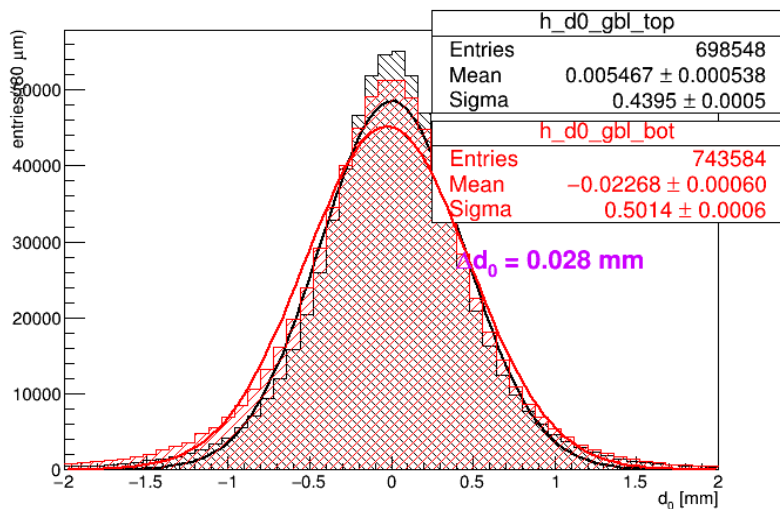
T/B diff
 $\Delta d_0 = 28 \mu\text{m}$
 $\Delta z_0 = 0 \mu\text{m}$
 $\Delta p = -2 \text{ MeV/c}$



$p_{top} = 1.056 \text{ MeV/c}$
 $p_{bot} = 1.058 \text{ MeV/c}$

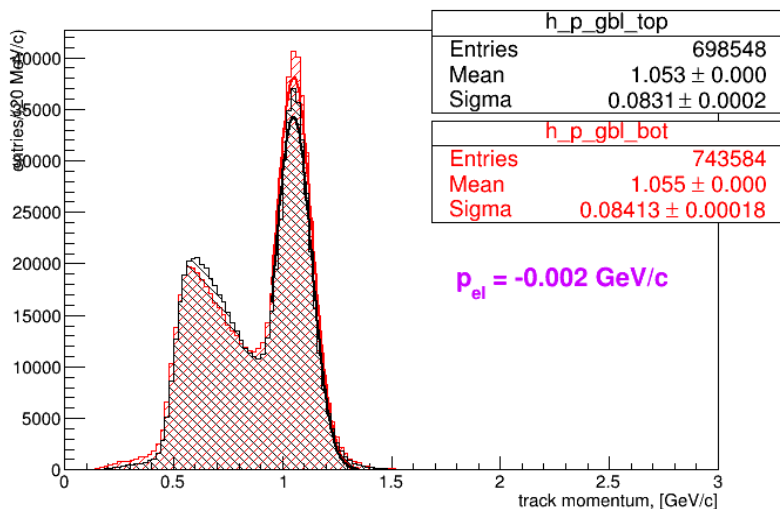


V 5-1 geometry with B=-0.244 T constant – 2015 data

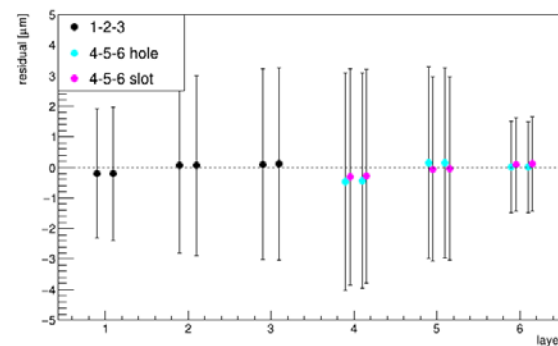
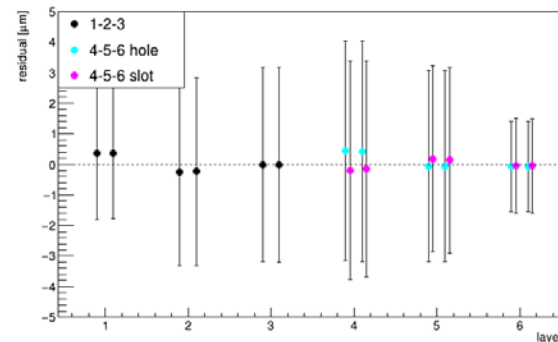


My best alignment +
constant field + 40 G

T/B diff
 $\Delta d_0 = 28 \mu\text{m}$
 $\Delta z_0 = 0 \mu\text{m}$
 $\Delta p = -2 \text{ MeV}/c$



$p_{\text{top}} = 1.053 \text{ MeV}/c$
 $p_{\text{bot}} = 1.055 \text{ MeV}/c$



MC: test of different gen/rec configurations

- Electron tracks at 1.056 GeV/c (sigma 0)
- 150000 tracks generated
- Constant reconstruction efficiency: ~18%

Gener field	Recon field	p_{el} top (GeV/c)	p_{el} bot (GeV/c)
Fieldmap	Fieldmap	1.051	1.051
Fieldmap	B const -0.245 T	1.073	1.075
B const -0.245 T	B const -0.245 T	1.05	1.05
B const -0.245 T	Fieldmap	1.029	1.029

- If reconstructed with 50 G more than nominal : +20 MeV/c
- If reconstructed with 50 G less than nominal: -27 MeV/c

Summary

- 40-50 additional Gauss improve the momentum calibration scale
- A change of the max field intensity could be a way to achieve a calibration of the momentum scale without changing global and internal alignment, but:
 - Is a variation of the magnetic field intensity orthodox/likely/acceptable/possible?
 - How reliable is the fieldmap overall normalization? Can it be easily rescaled in the code?