Momentum calibration – magnetic field studies

Alessandra Filippi

Apr 10, 2017

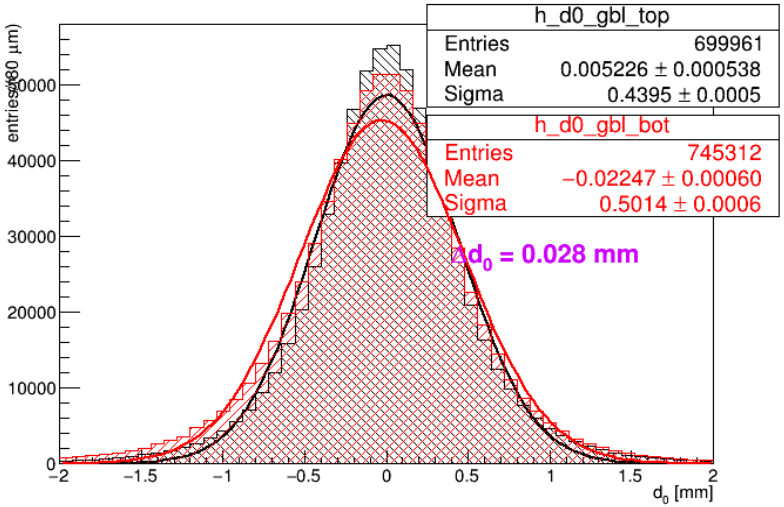
Momentum calibration, 2015 data

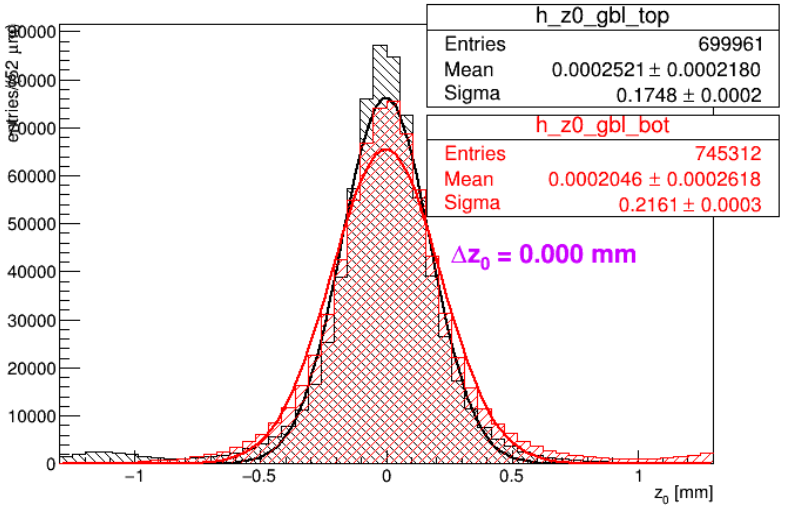
- Where I am:
  - Internal alignment: satisfactory for u residuals, res u vs u coordinate
  - global alignments:
    - tuning for d_0, z_0 -> convergence to 0
    - Elastic peak calibration:
      - Underestimation of ~20 MeV/c
      - Consistency between top and bottom within 2 MeV/c
- Montecarlo tests:
  - 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

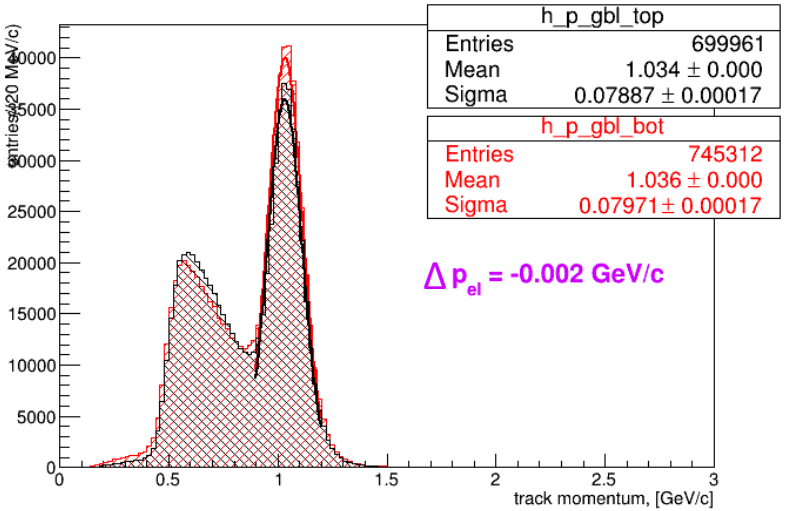


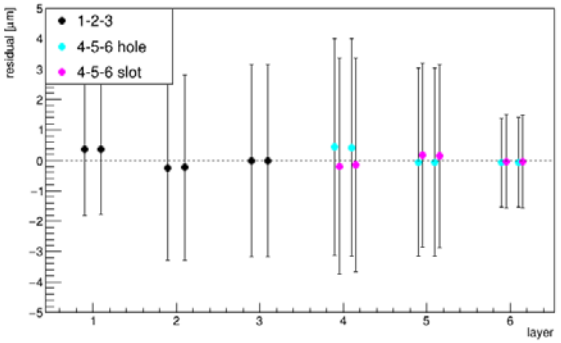


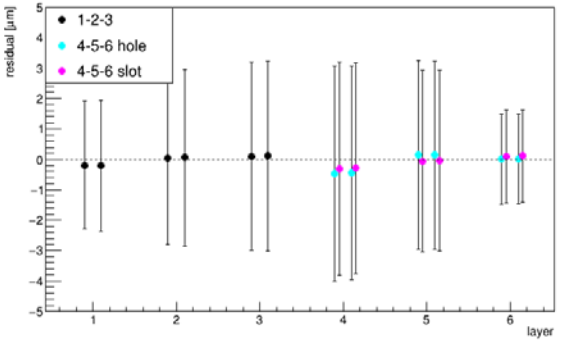
My best alignment - reference

T/B diff
Δd_0 = 28 µm
Δz_0 = 0 µm
Δp = -2 MeV/c

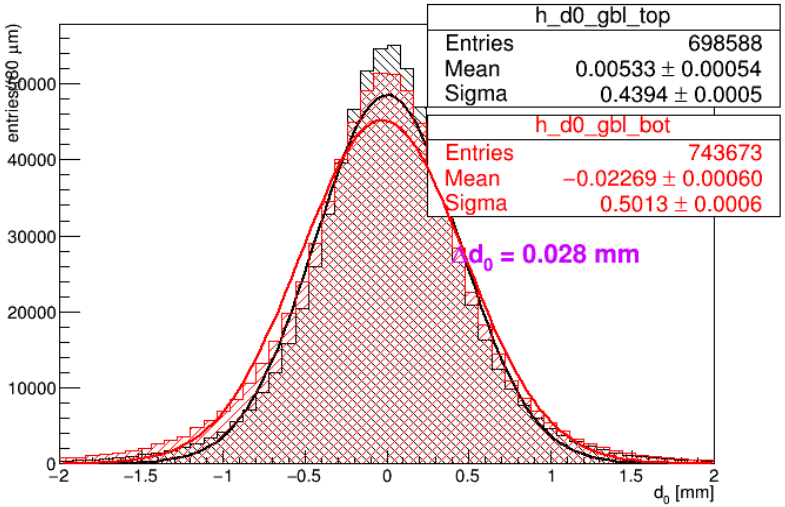
p_{top} = 1.034 MeV/c
p_{bot} = 1.036 MeV/c

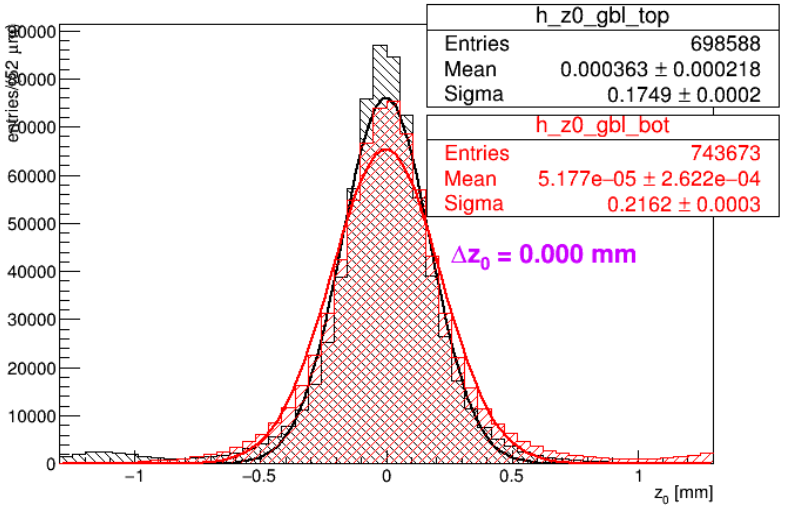






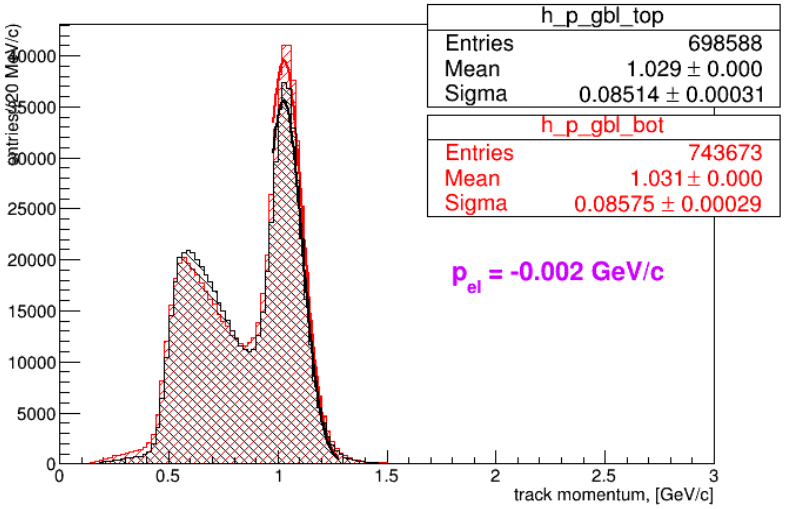
V 5-1 geometry with B=-0.24 T constant – 2015 data





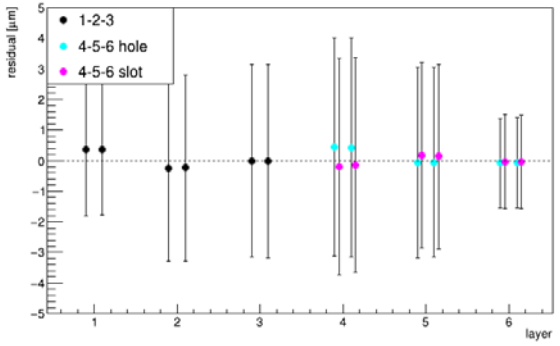
My best alignment + constant field -0.24T

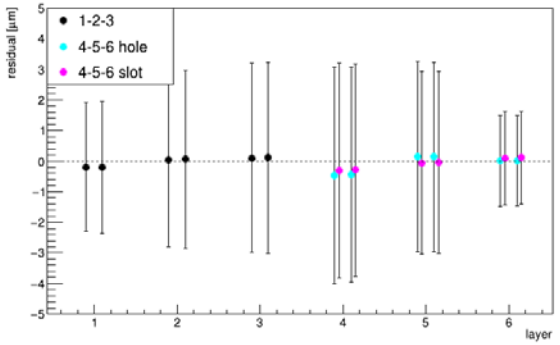
T/B diff
Δd_0 = 28 µm
Δz_0 = 0 µm
Δp = -2 MeV/c



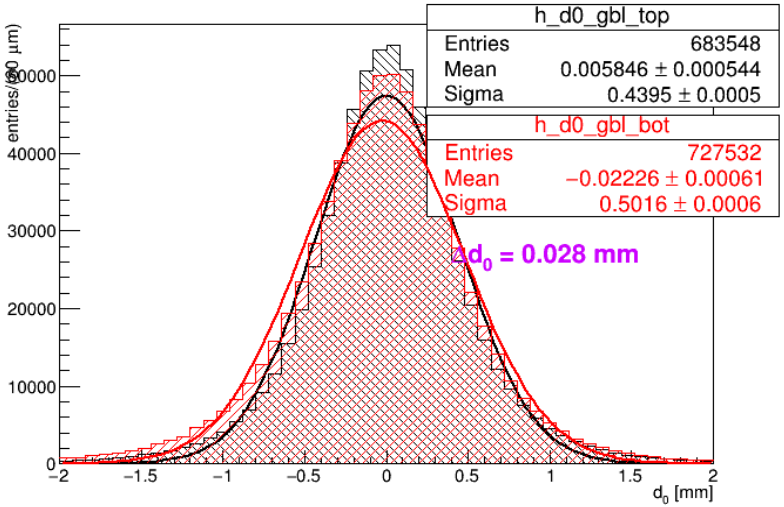
p_{top} = 1.029 MeV/c
p_{bot} = 1.031 MeV/c

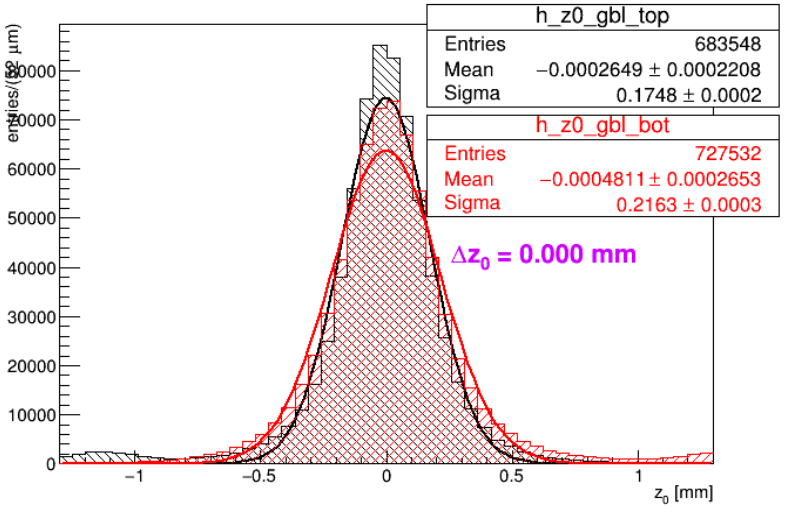
Slightly less efficient





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

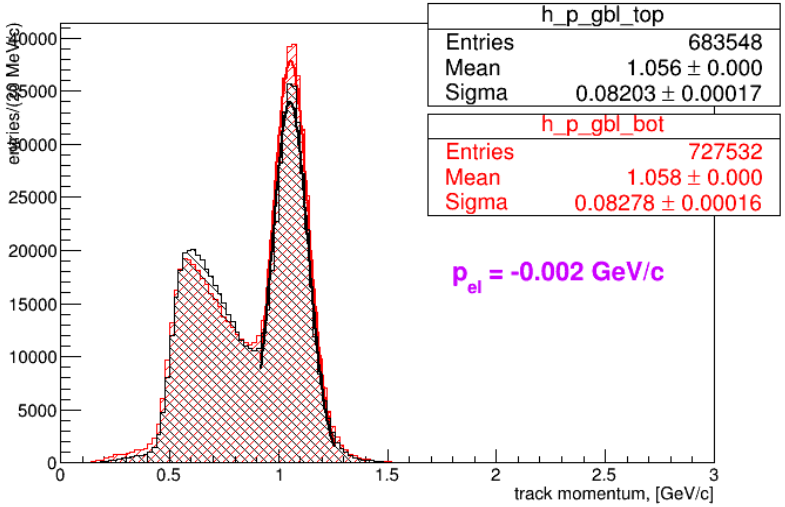


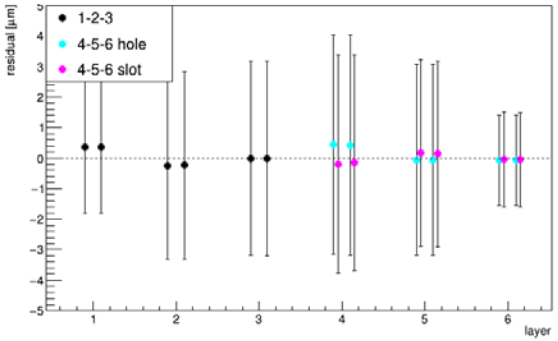


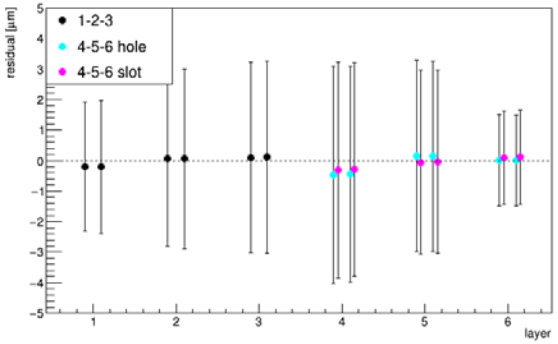
My best alignment + constant field + 50 G

T/B diff
Δd_0 = 28 μm
Δz_0 = 0 μm
Δp = -2 MeV/c

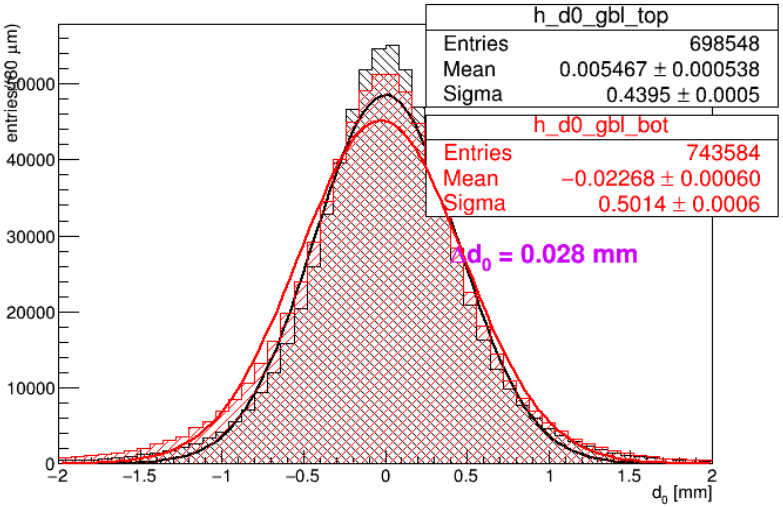
p_{top} = 1.056 MeV/c
p_{bot} = 1.058 MeV/c

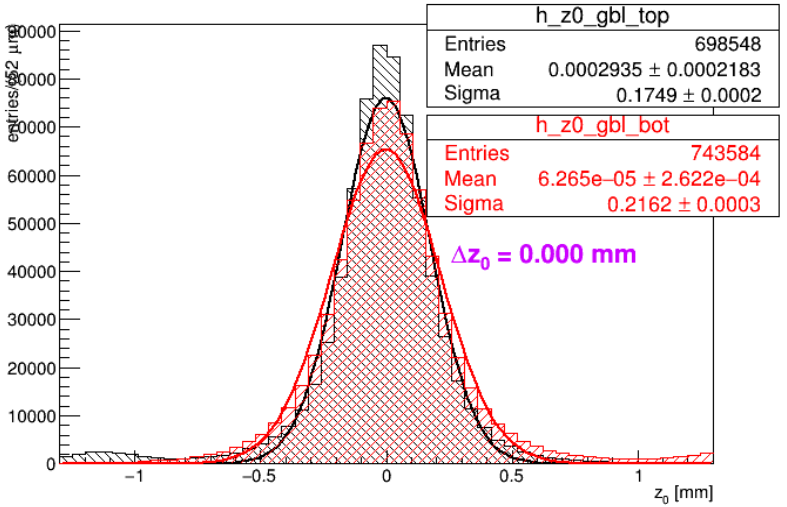






V 5-1 geometry with B=-0.244 T constant – 2015 data

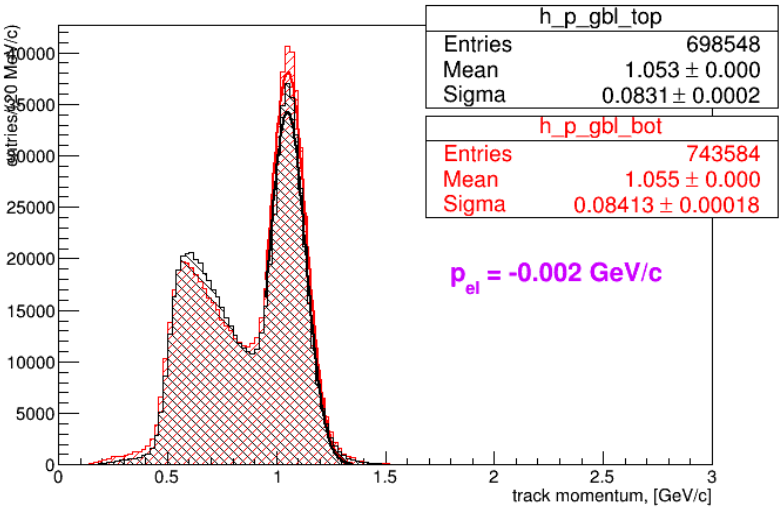


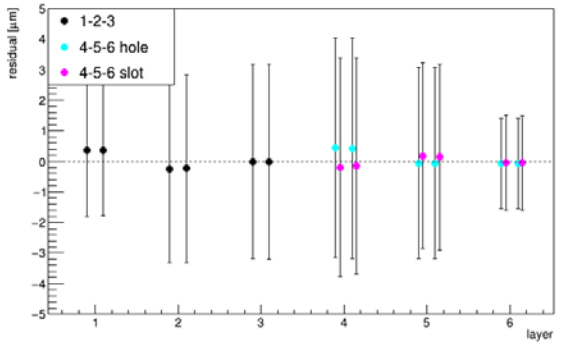


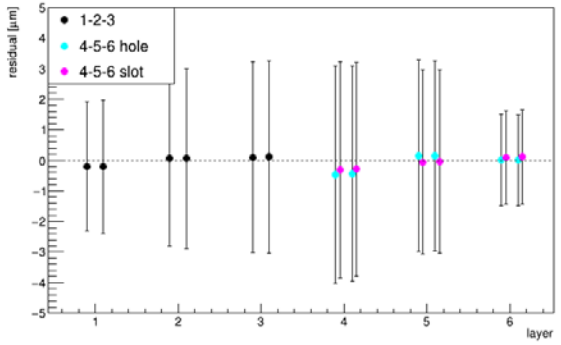
My best alignment + constant field + 40 G

T/B diff
Δd_0 = 28 μm
Δz_0 = 0 μm
Δp = -2 MeV/c

p_{top} = 1.053 MeV/c
p_{bot} = 1.055 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?