# Momentum reconstruction – systematics studies II

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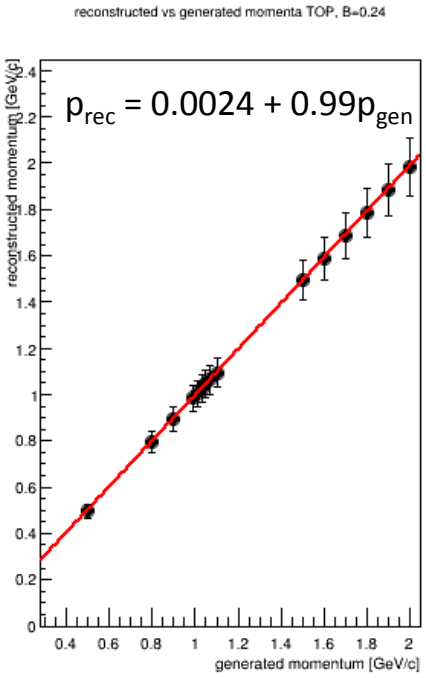
# Systematic studies of reconstruction precision

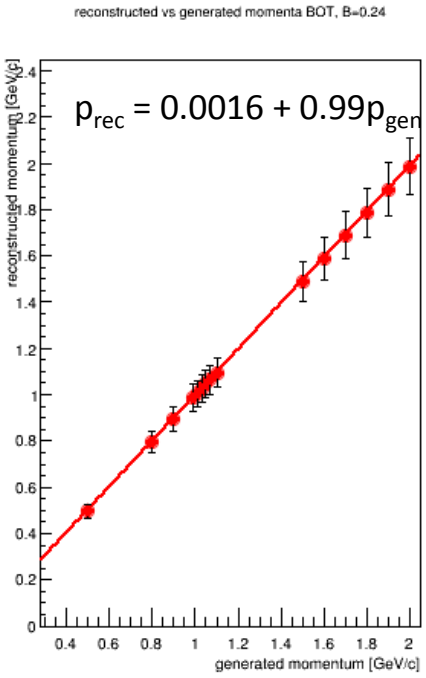
- A few more studies before modifying the global z scale…
  1. Study of minimum systematic error determined by the reconstruction procedure
  2. Study of possible dependencies on magnetic field strength

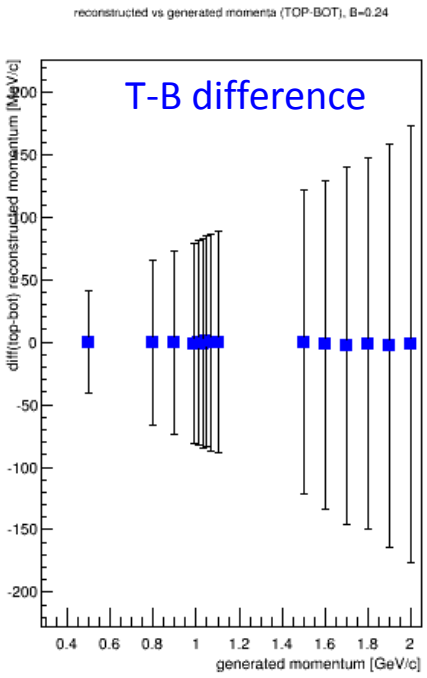
- Generation of electrons with SLIC (single particle gun) in the HPS acceptance with fixed momentum, fieldmap and zero width
  - Several values of injected momentum, from 0.5 to 2.1 GeV/c
  - Beam along z axis with 5 deg dispersion
  - Beamspot parameters: (0.,0.,0.)
  - It (should) include Eloss through materials, multiple scattering (G4 defaults)

- Test: how does the reconstruction and GBL respond for momentum and impact parameters reconstruction?
  - Any momentum dependence?
  -
- Tested geometry: v 5.1 (with my SVT alignment version) + fieldmap 2015 (0.24 T)
- 200000 generated tracks per sample

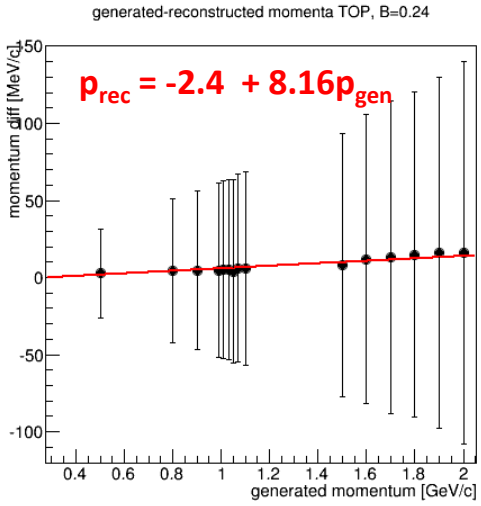
# Momentum reconstruction

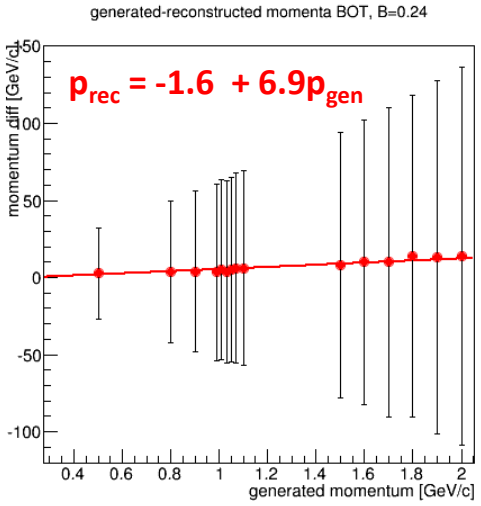


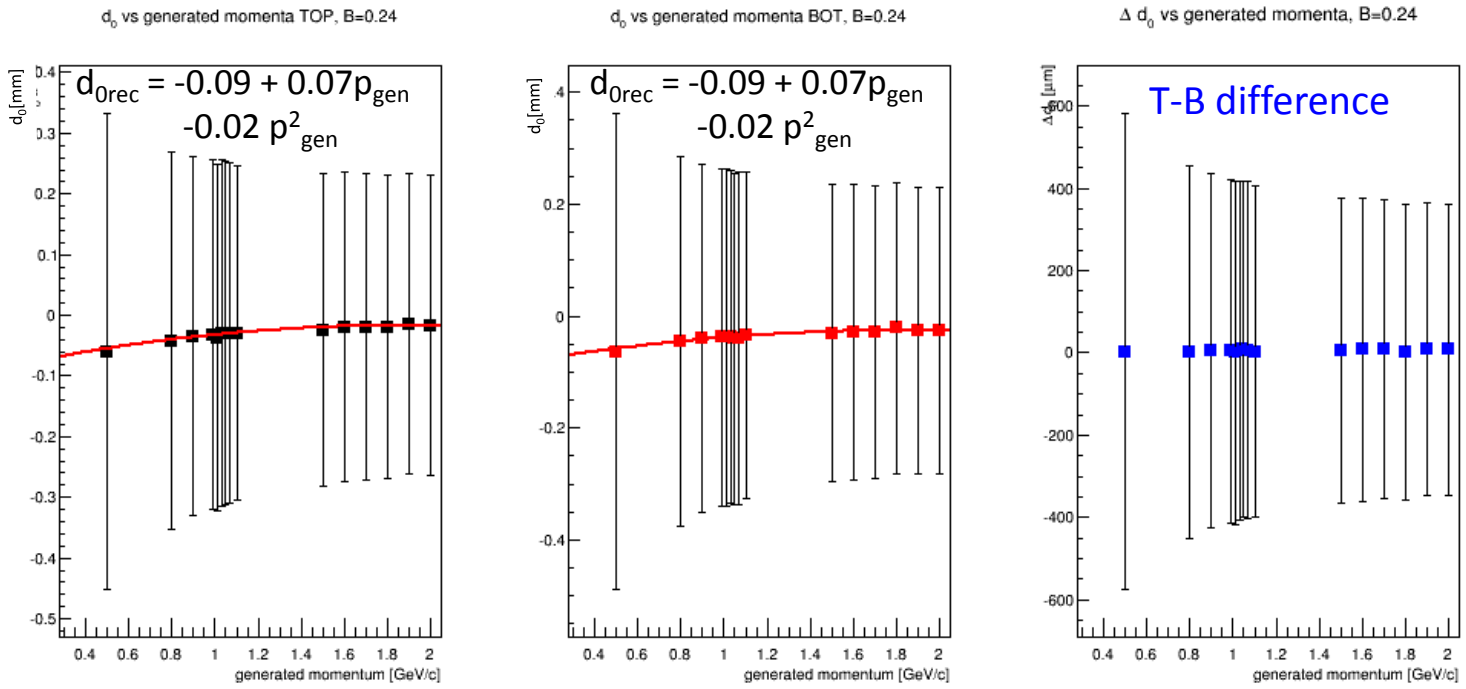

- Errors: sigmas of the distributions
- Linear dependence for T and B
- No remarkable difference btw T,B



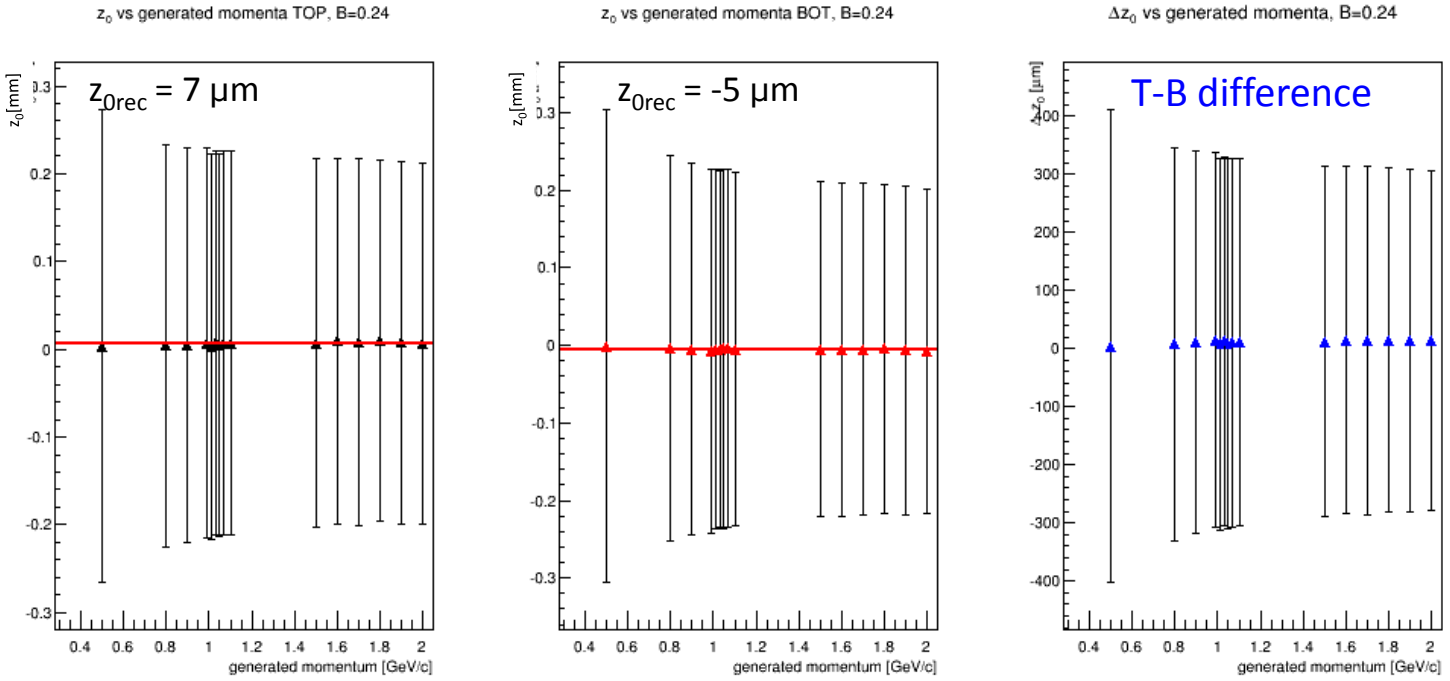

- Slight rise of reconstructed momentum value with increasing momentum
- Distribution sigmas rise with momentum
- Reconstructed momentum always underestimated
- At 1 GeV/c: Δp = 5-6 MeV systematic offset on reconstructed momentum

# $d_0$ reconstruction




- Errors: sigmas of the distributions
- Quadratic dependence on generated momentum for T and B (very large errors if one uses sigmas as errors in the fit)
- No difference btw T,B
- Slight rise of reconstructed momentum value with increasing momentum
- Distribution sigmas  reduce with momentum
- At 1 GeV/c: $\Delta d_0$ = -40 μm minimum systematic offset (for both T&B)

# $z_0$ reconstruction




- Errors: sigmas of the distributions
- No dependence on generated momentum for T and B
  - A better fit can be done using the error on the mean value of the gaussian distribution
- TOP: positive, BOT: negative (well within resolution)
- Distribution sigmas  slightly reduce with momentum
- At 1 GeV/c: $\Delta z_0$ = ~7 μm for TOP, -5  μm for BOT

# Summary

- The effect of Eloss and multiple scattering as on generated electrons is small and not enough to explain the 20 MeV/c offset wrt to nominal elastic peak momentum seen in 2015 data

  - The reconstructed momentum is underestimated by
    - ~5.7 MeV/c for 1 GeV/c tracks
    - ~6 MeV/c for 1.056 GeV/c tracks
    - ~ 14 MeV/c for 2 GeV/c tracks
    - Very similar for top and bottom

  - The $d_0$ impact parameter has a (sort of) quadratic dependence, and is always negative
    - ~ -40 μm for 1 GeV/c tracks
    - ~ -38 μm for 1.056 GeV/c tracks
    - ~ -30 μm for 2 GeV/c tracks

  - The $z_0$ impact parameter is constant
    - ~ 7 μm for top (positive)
    - ~ -5 μm for bottom (negative)

- Next test: what happens if the field normalization is changed?