

Tracking simulation in non-uniform magnetic field

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Motivation

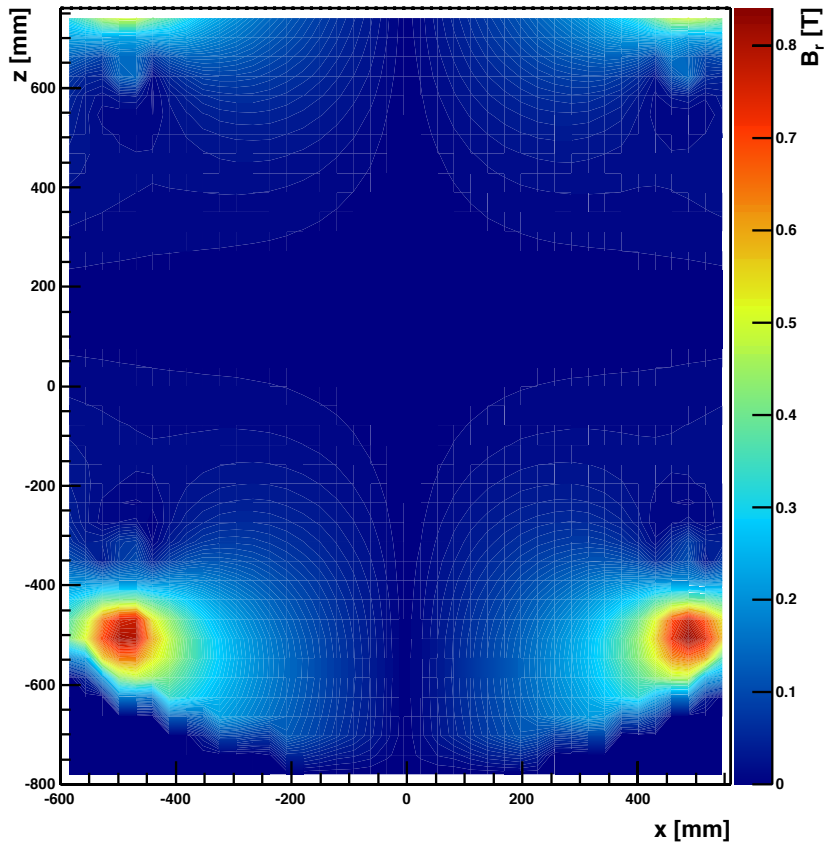
- To achieve better momentum resolution, the non-uniformity of magnetic field for large prototype should be taken into account.
- The MC tracks need to be simulated for the test non-uniform tracking program. And the momentum resolution can also be expected by from the reconstructed tracks.

Track generation

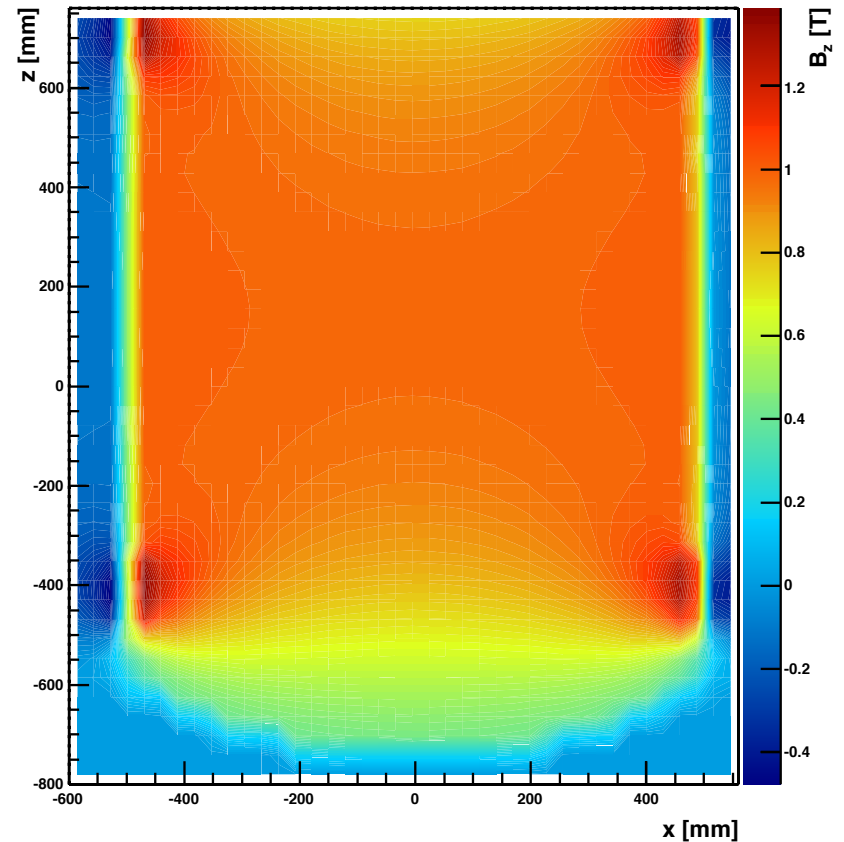
- Update the PrimaryIonisationProcessor in MarlinTPC to generate track in non-uniform magnetic field:
 1. The original helix track propagator is taken place by the Runge-Kutta track propagator, which is implemented by the class TEveTrackPropagator in ROOT.
 2. The magnetic field can be accessed by the GlobalFieldProcessor, also in MarlinTPC. We are using the field map of PCMAG.

PCMAG field map

B_r [T]

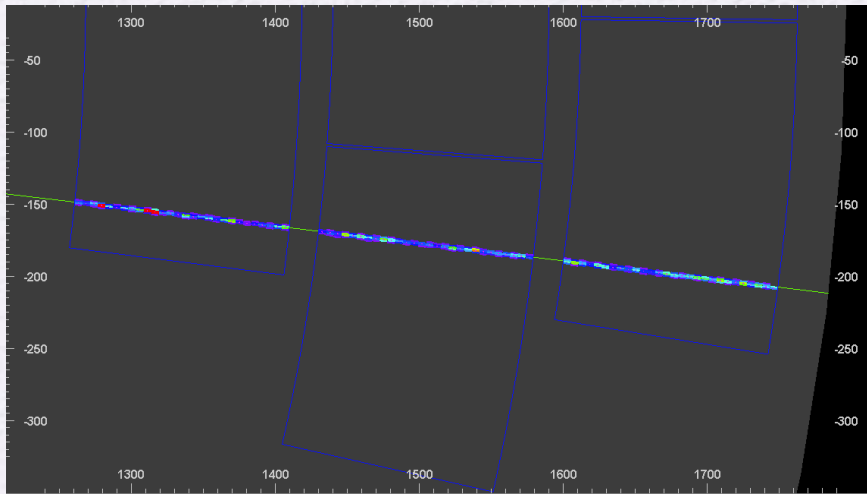


B_z [T]

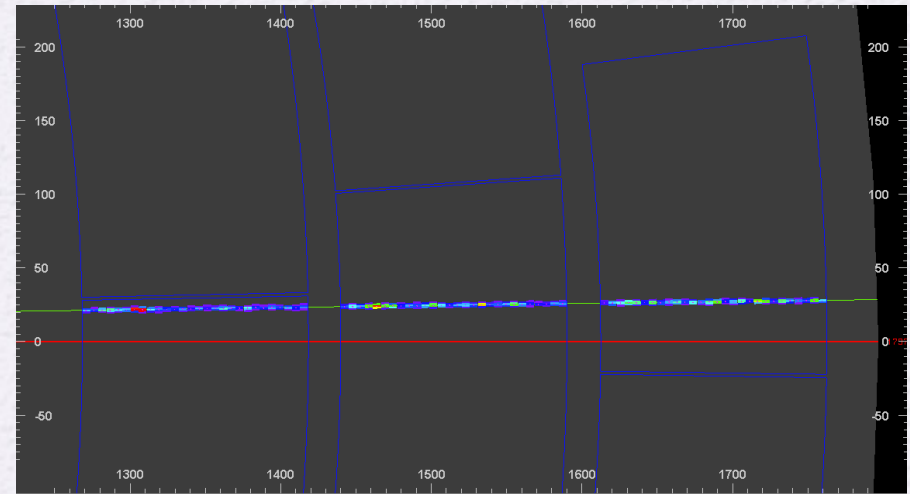


Simulated tracks

- Simulation with the Large Prototype layout.



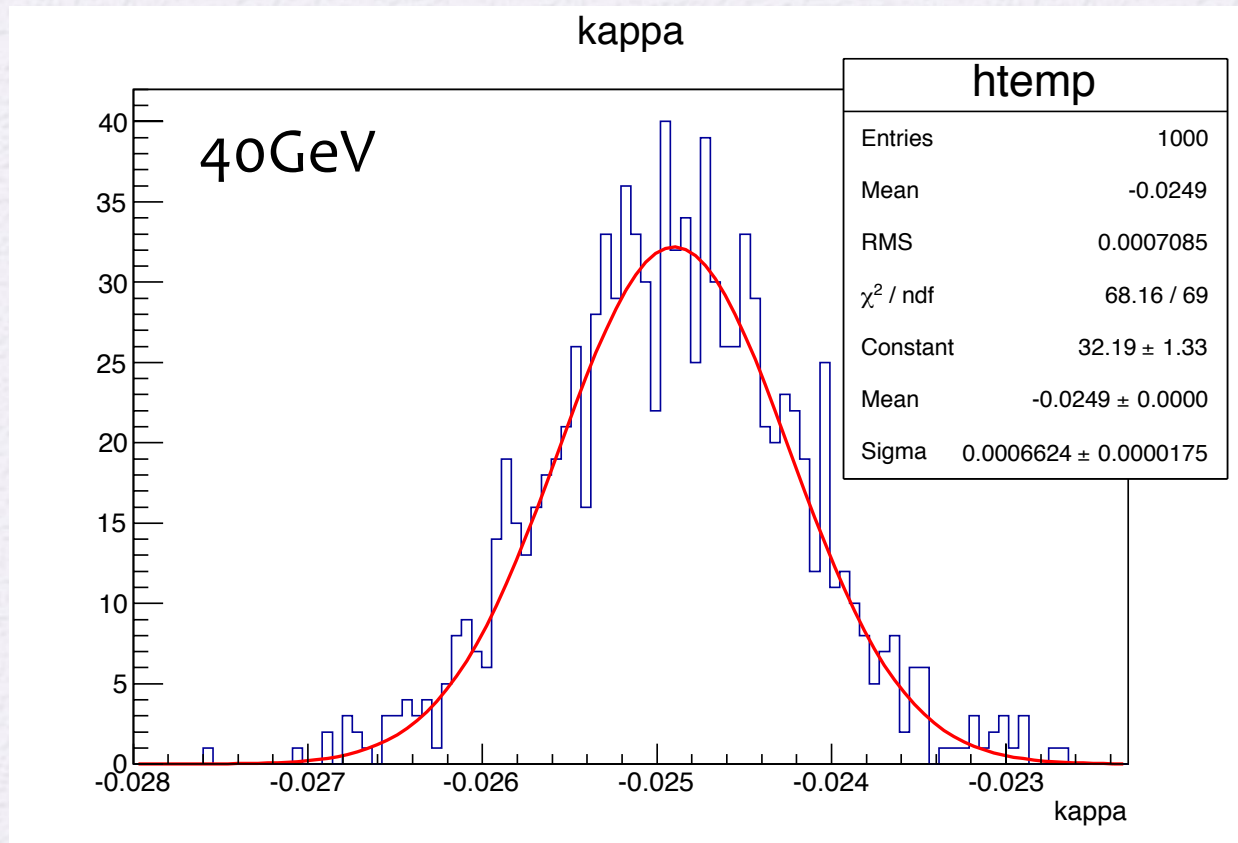
40GeV



50GeV

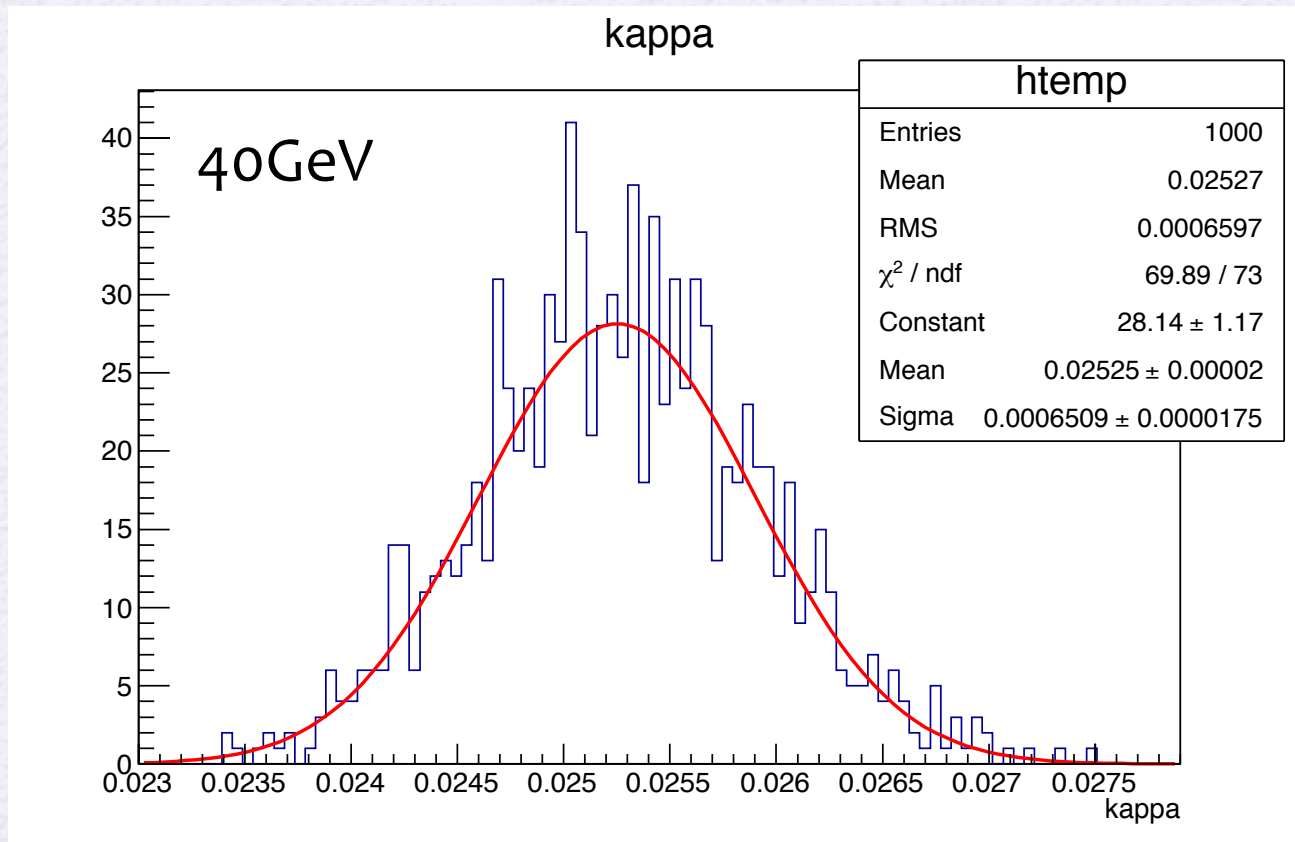
Momentum resolution(1)

Uniform magnetic field + original helix propagator



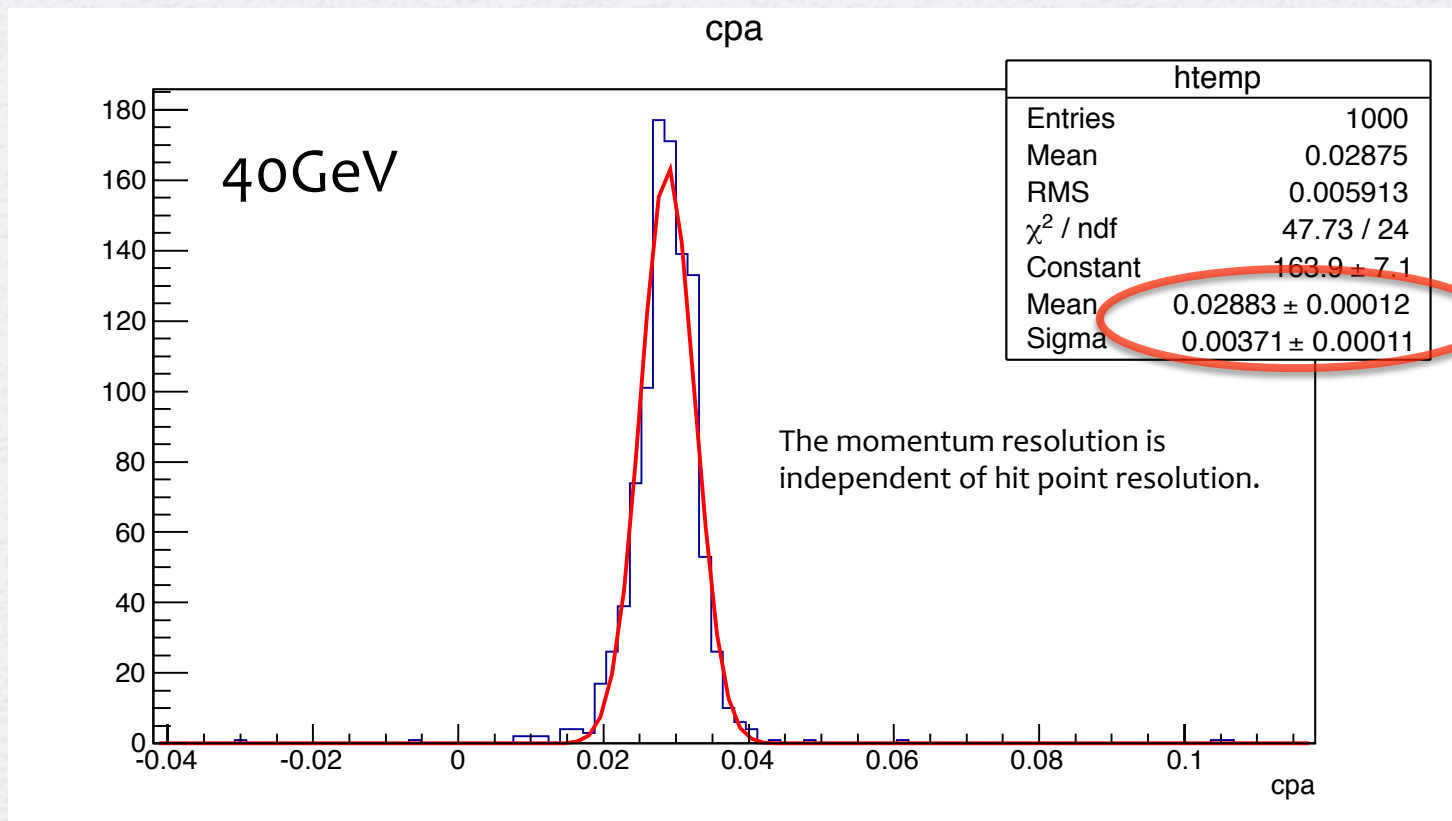
Momentum resolution(2)

Uniform magnetic field + RK propagator



Momentum resolution(3)

Non-uniform magnetic field + RK propagator
but still using uniform B field for tracking



→ we need a non-uniform field version of Kalman filter.

Update the Kalman filter

- Based on the current Kalman tracking program Kaltest, and assuming the field is uniform between two nearby hits, we can update the tracking algorithm by rotating the coordinate system. The magnetic field in MarlinTPC is used.
- The update of non-uniform magnetic field to KalTest has been done. It will be tested with the simulated tracks.