Checking GENFIT effects on reconstructed tracks

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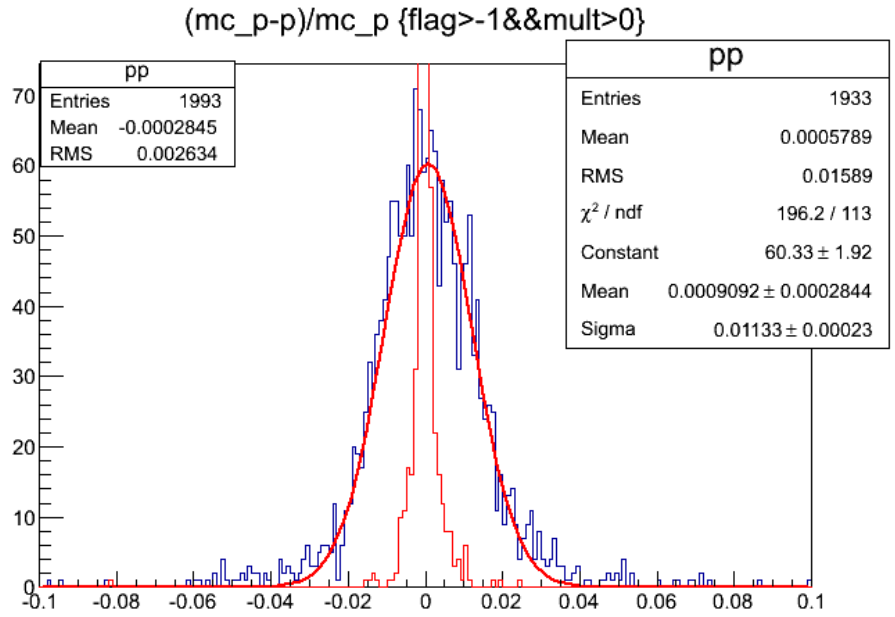
6/4/2013

What is the GENFIT bias on reco tracks?

Strategy

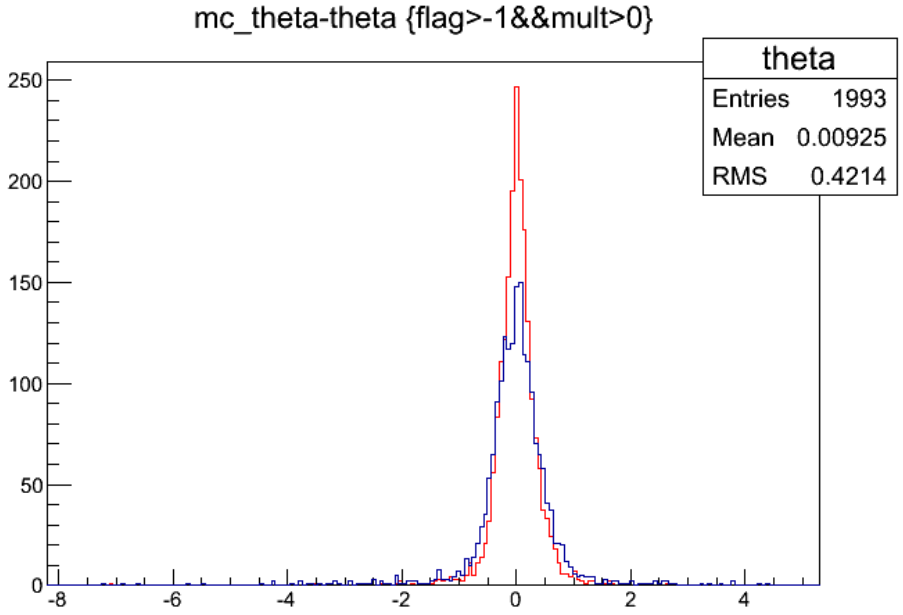
- Simulate muons at different momenta, ϑ [20°, 140°]
- Use ideal track finder PndSttMvdGemTrackingIdeal
- Put no momentum/vertex smearing ➔ MC momentum
- Let the Kalman Filter (GENFIT) fit the tracks (1 iteration)
- Compare the results w/ and w/o genfit (only fitted tracks)

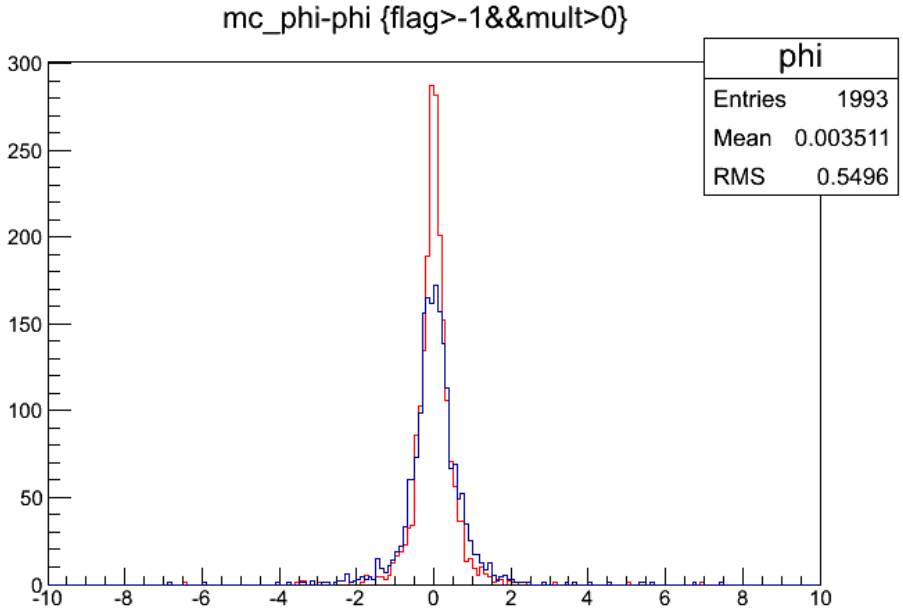


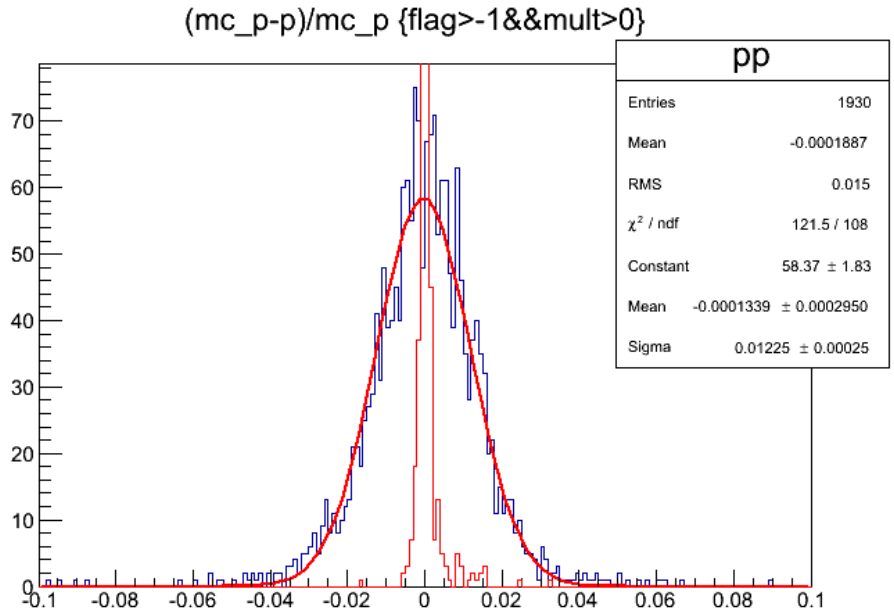
0.3 GeV/c muon ϑ [20°,140°]

IDEAL 1993

KALMAN 1933



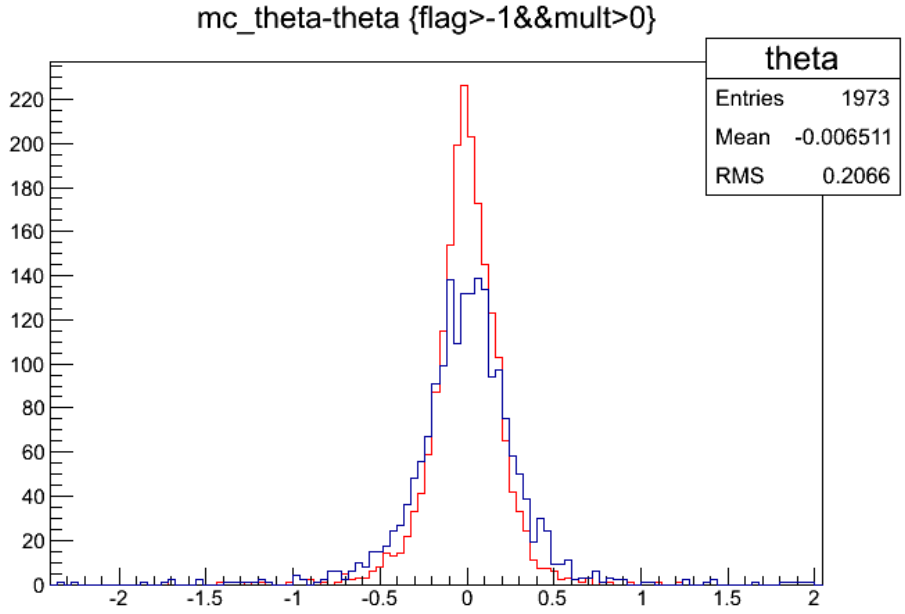


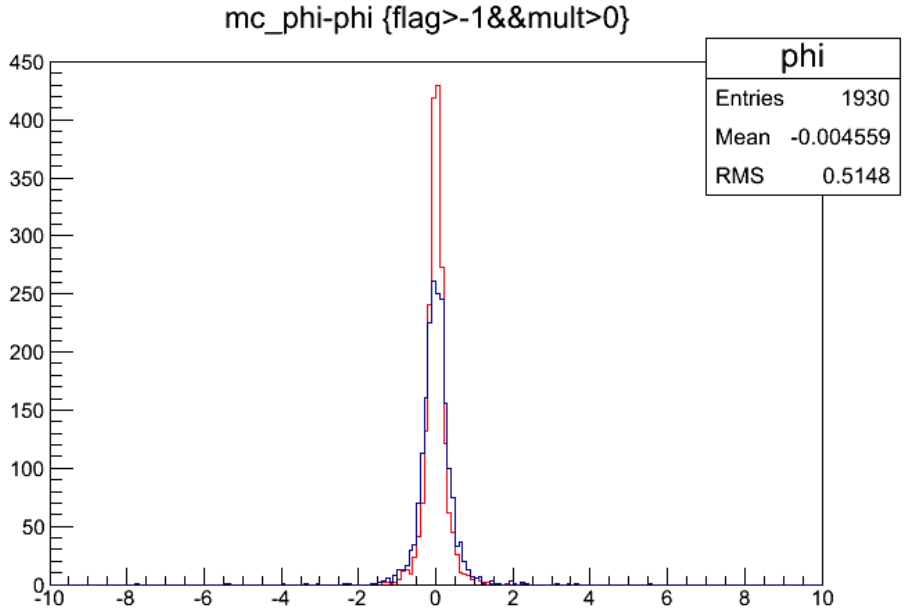


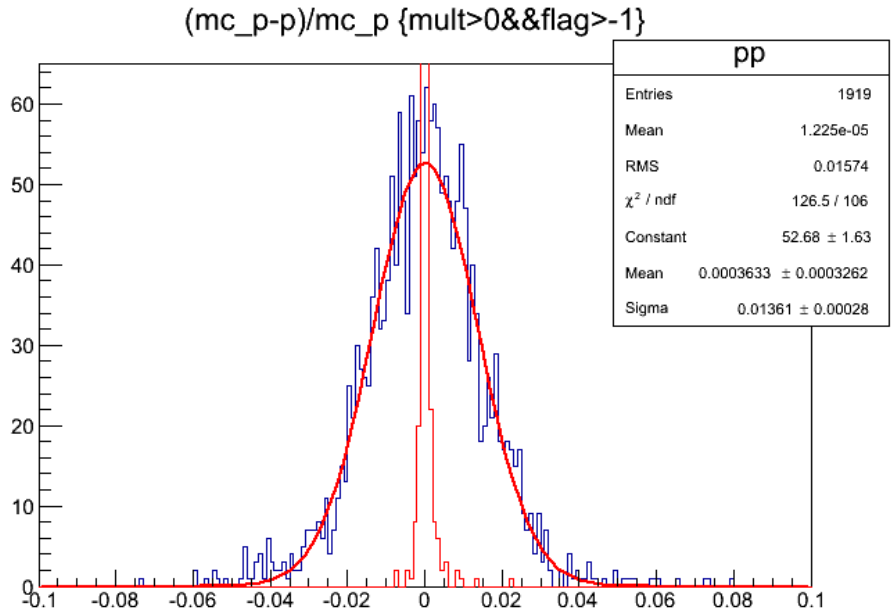
0.5 GeV/c muon ϑ [20°,140°]

IDEAL 1973

KALMAN 1930



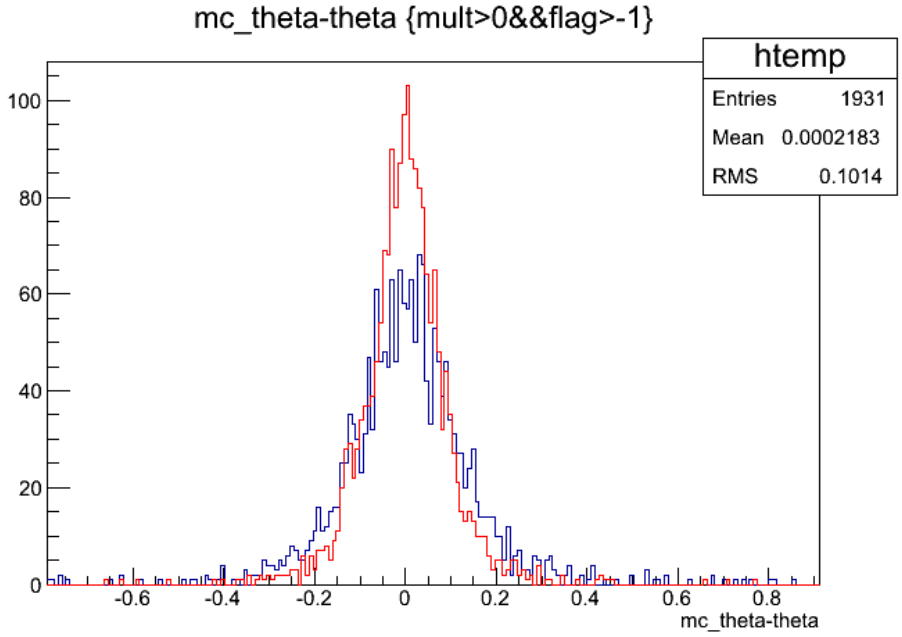


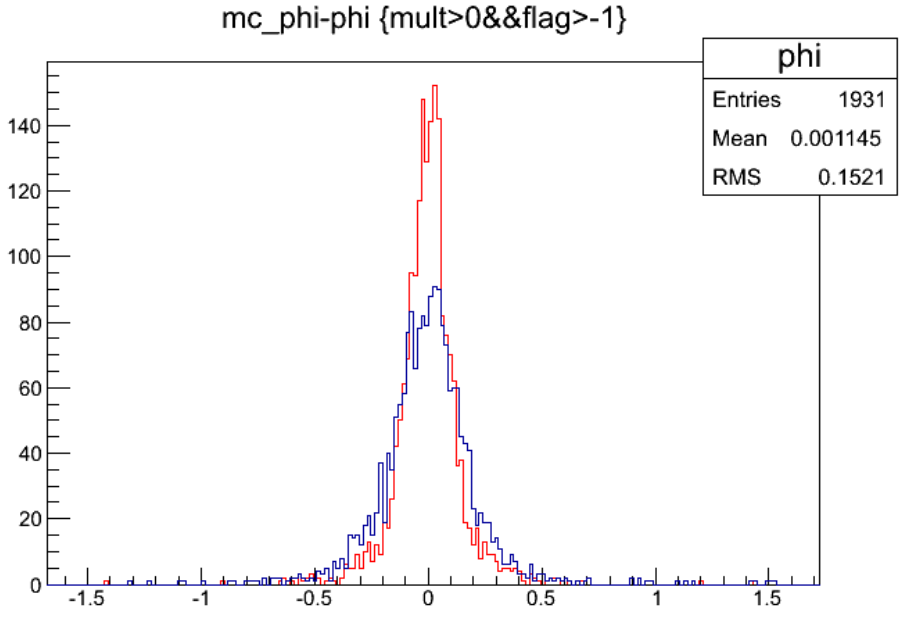


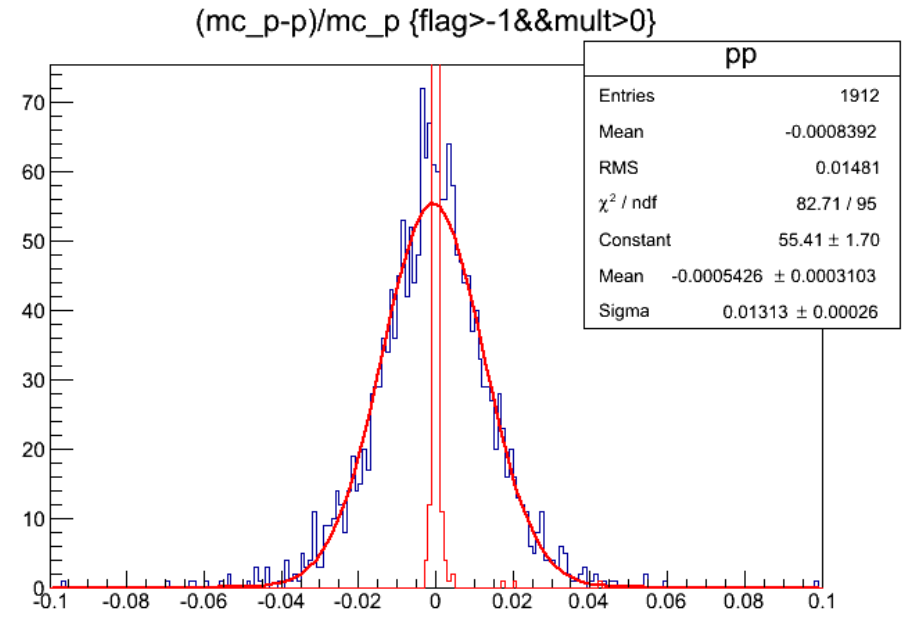
1 GeV/c muon ϑ [20°,140°]

IDEAL 1931

KALMAN 1919



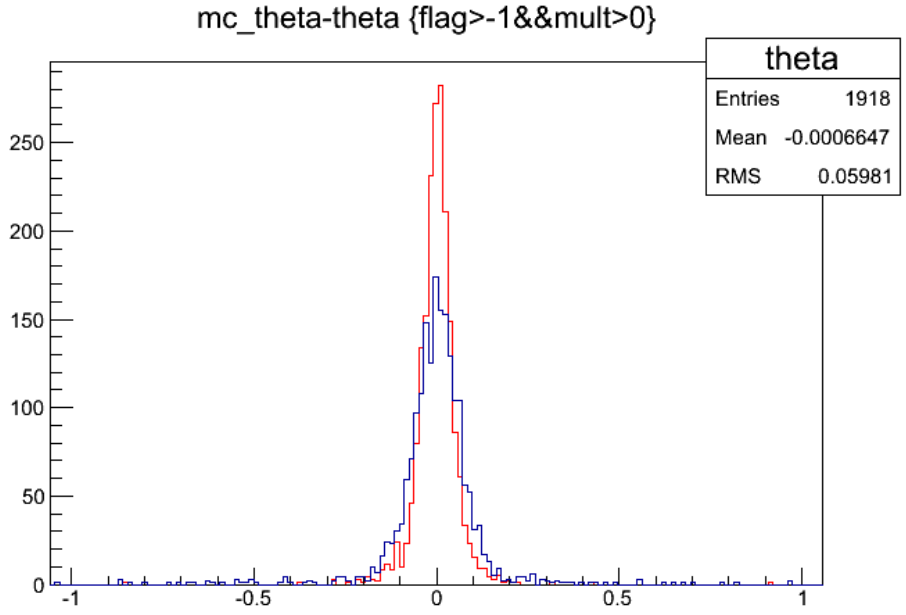


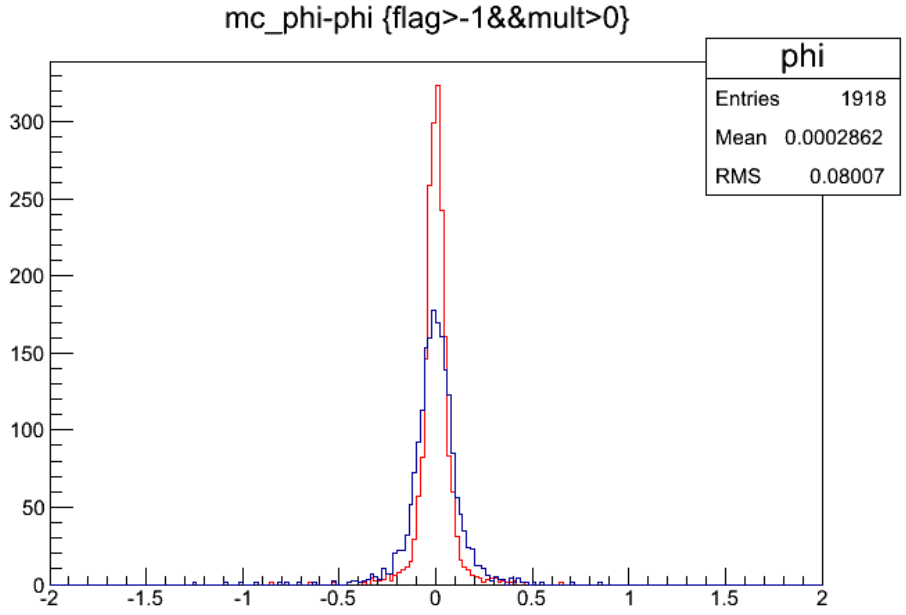


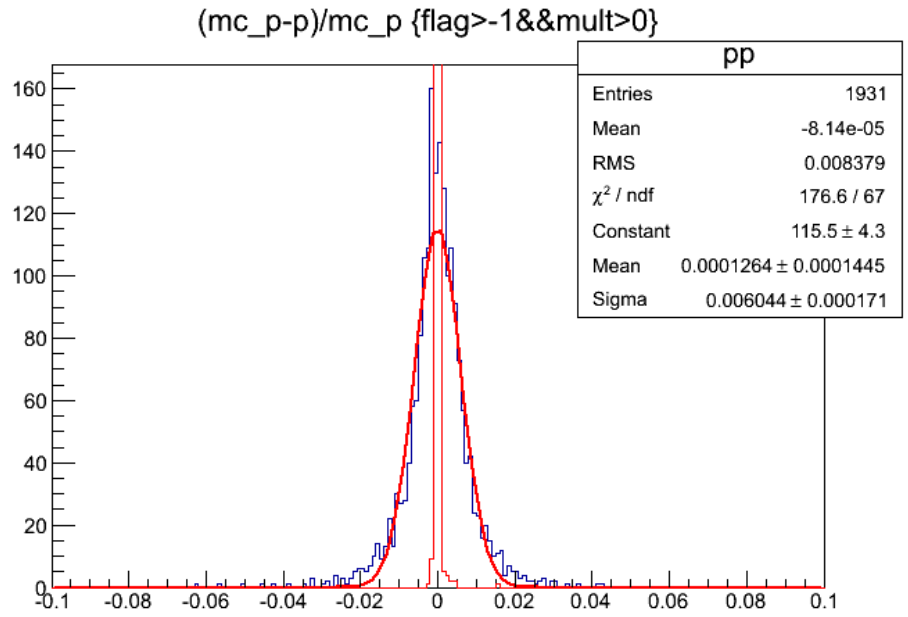
2 GeV/c muon ϑ [20°,140°]

IDEAL 1918

KALMAN 1912



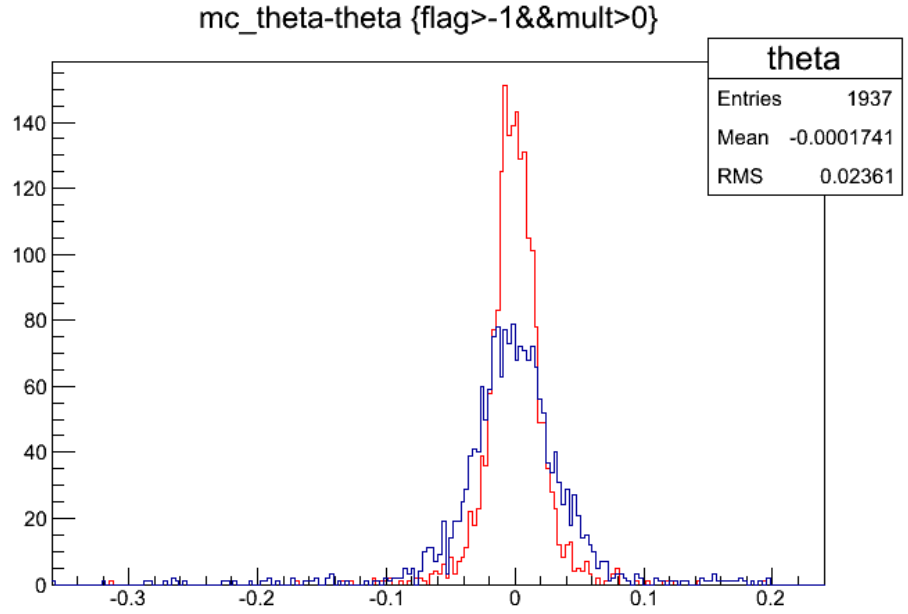


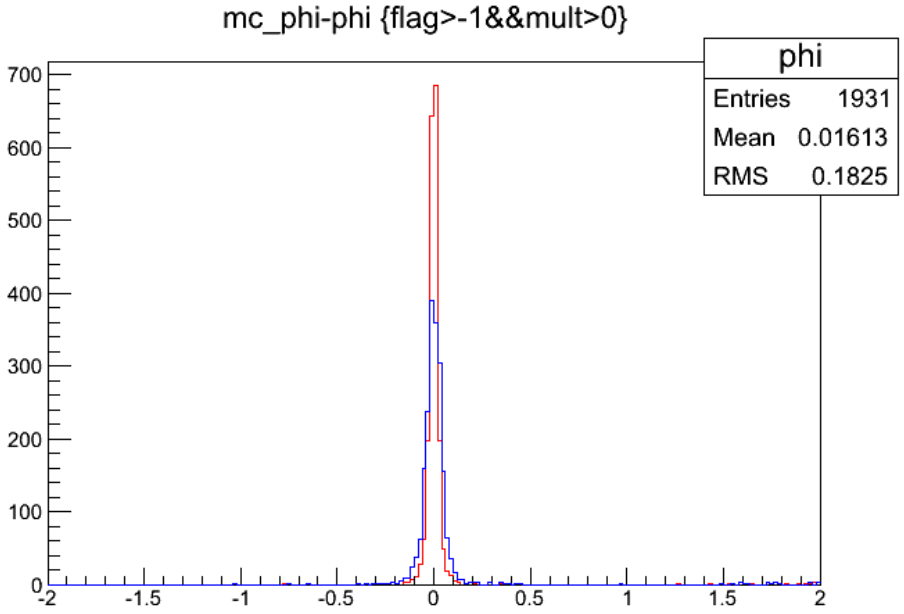


5 GeV/c muon ϑ [20°,140°]

IDEAL 1937

KALMAN 1931





Considerations

- GENFIT reconstructs > 97% of the tracks
- Reconstruction efficiency does not depend on momentum
- Momentum resolution does not depend on momentum (mostly)
- Even with “perfect” initial momentum, reconstructed tracks have ~1.3% momentum resolution

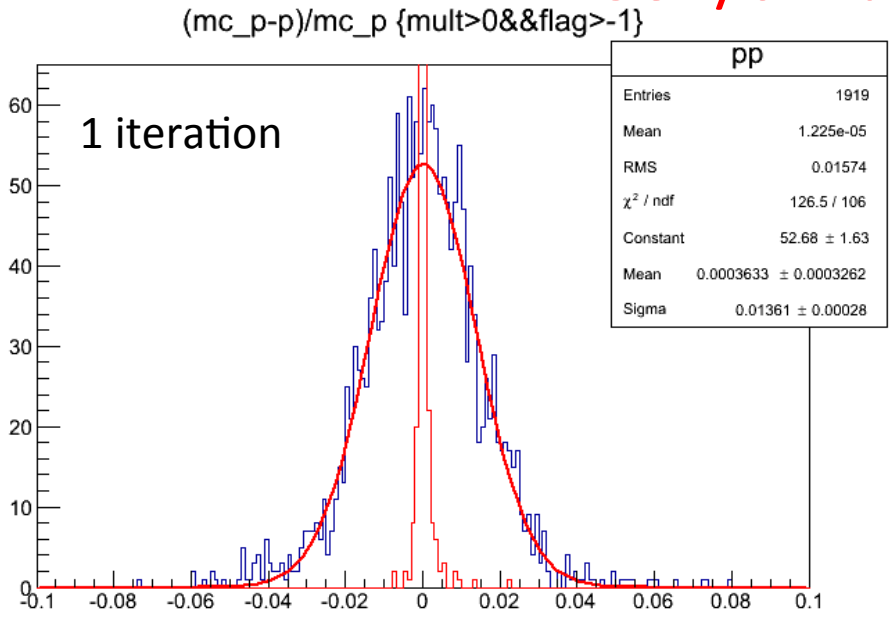
No relevant bias in reconstruction, neither for low momentum tracks

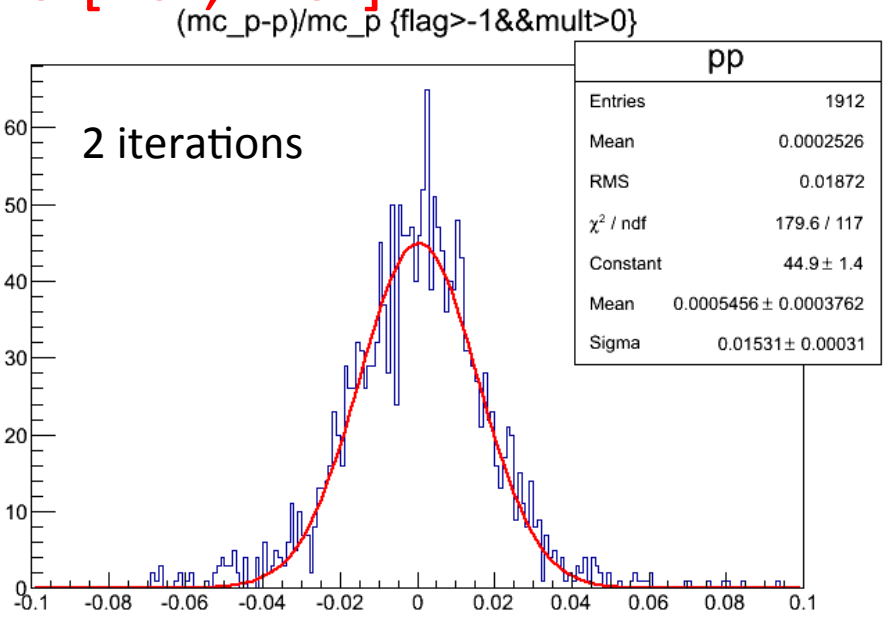
How performance depends on number of iterations?

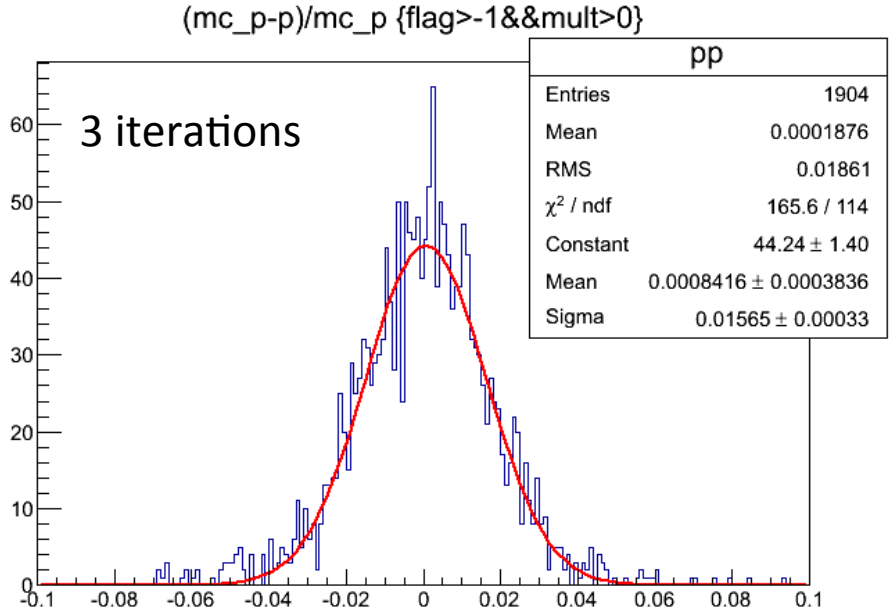
Strategy

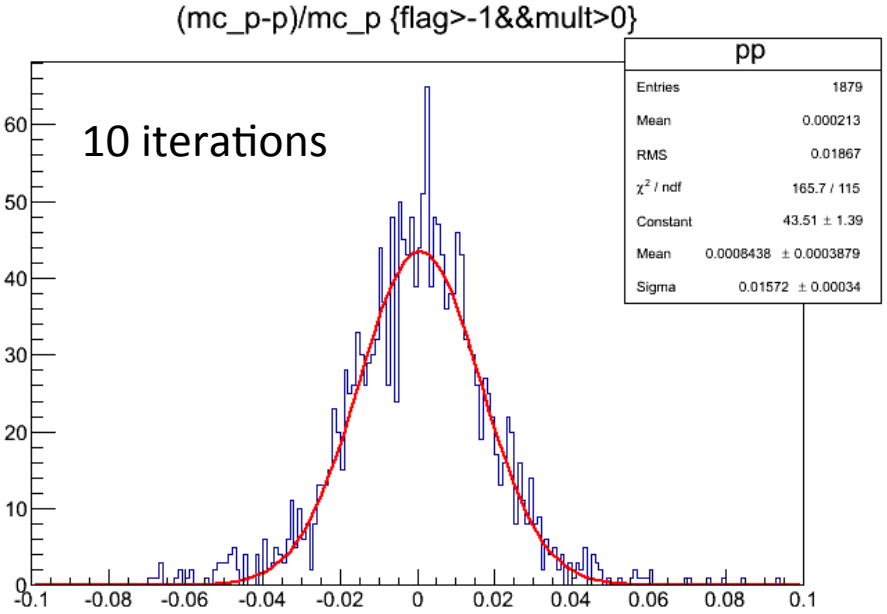
- Simulate muons at 1 GeV/c, ϑ [20°, 140°]
- Use ideal track finder PndSttMvdGemTrackingIdeal
- Put no momentum/vertex smearing ➔ MC momentum
- Let the Kalman Filter (GENFIT) fit the tracks with different iterations
- Compare momentum resolution w/ different number of iterations

1 GeV/c muon ϑ [20°,140°]









Considerations

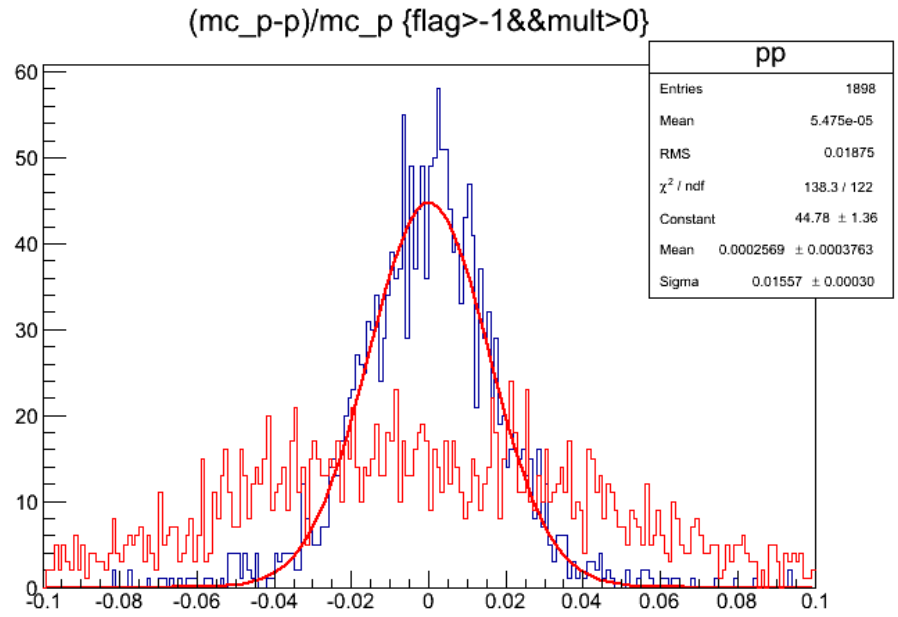
- Momentum resolution does not depend on number of iterations, ~1,5%
- Increasing the number of iterations the efficiency decreases

1 iteration in the Kalman is enough for us

What if we start with smeared momentum?

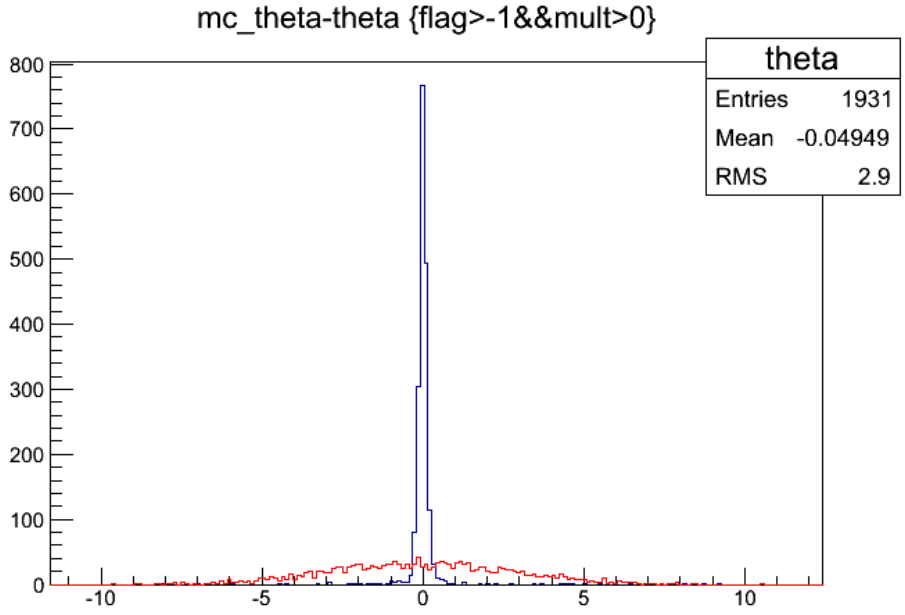
Strategy

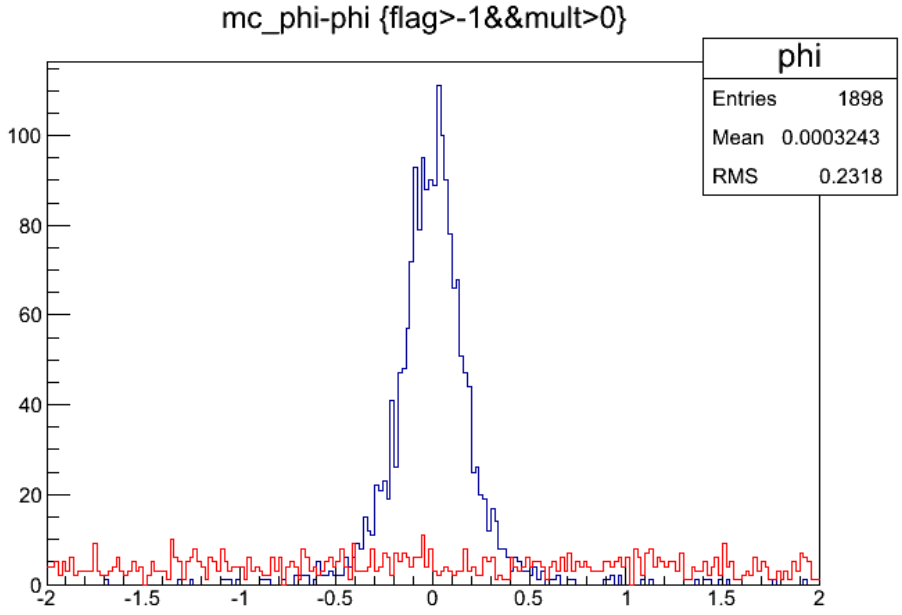
- Simulate muons at 1 GeV/c, ϑ [20°, 140°]
- Use ideal track finder PndSttMvdGemTrackingIdeal
- Put momentum/vertex smearing
- Let the Kalman Filter (GENFIT) fit the tracks
- Compare momentum resolution w/ and w/o smearing (slide 5)

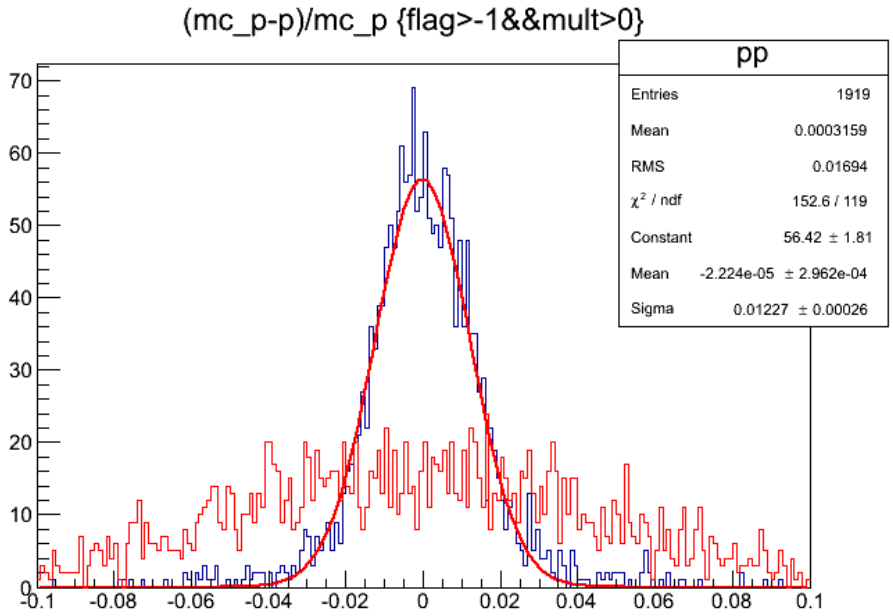


1 GeV/c muon ϑ [20°,140°]

5% momentum smearing
0.05 vertex smearing

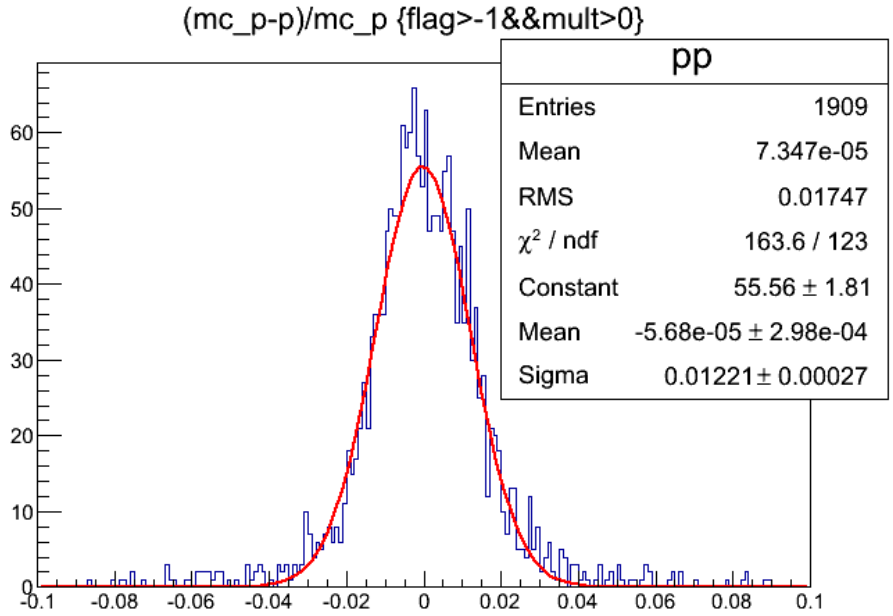






0.3 GeV/c muon ϑ [20°,140°]

5% momentum smearing
0.05 vertex smearing



0.3 GeV/c muon ϑ [20°,140°]

5% momentum smearing
0.5 vertex smearing

Considerations

- Momentum resolution does not depend on initial smearing, ~1,5% @ 1 GeV
- Efficiency decreases from 99.4% to 98.3%, reasonable @1 GeV/c
- At low momentum (0.3 GeV/c) no great effects
- Increasing the position smearing resolution is still the same

Performance is not decreasing so much starting from “realistic” seed

Conclusions

- GENFIT is stable for reconstruction of barrel tracks
- GENFIT loss in efficiency is ~1%, negligible
- The minimum momentum resolution is ~1.5%, not possible to go below this number (material effects? field? hit resolution?)
- By using “realistic” momentum/position smearing the performance is stable, no big effects
- No need to increase the number of iterations to obtain better results
- No systematic problems at low momentum