

# Status of KaTest for ILD non-uniform magnetic field

Bo Li

Center for High Energy Physics,  
Tsinghua University

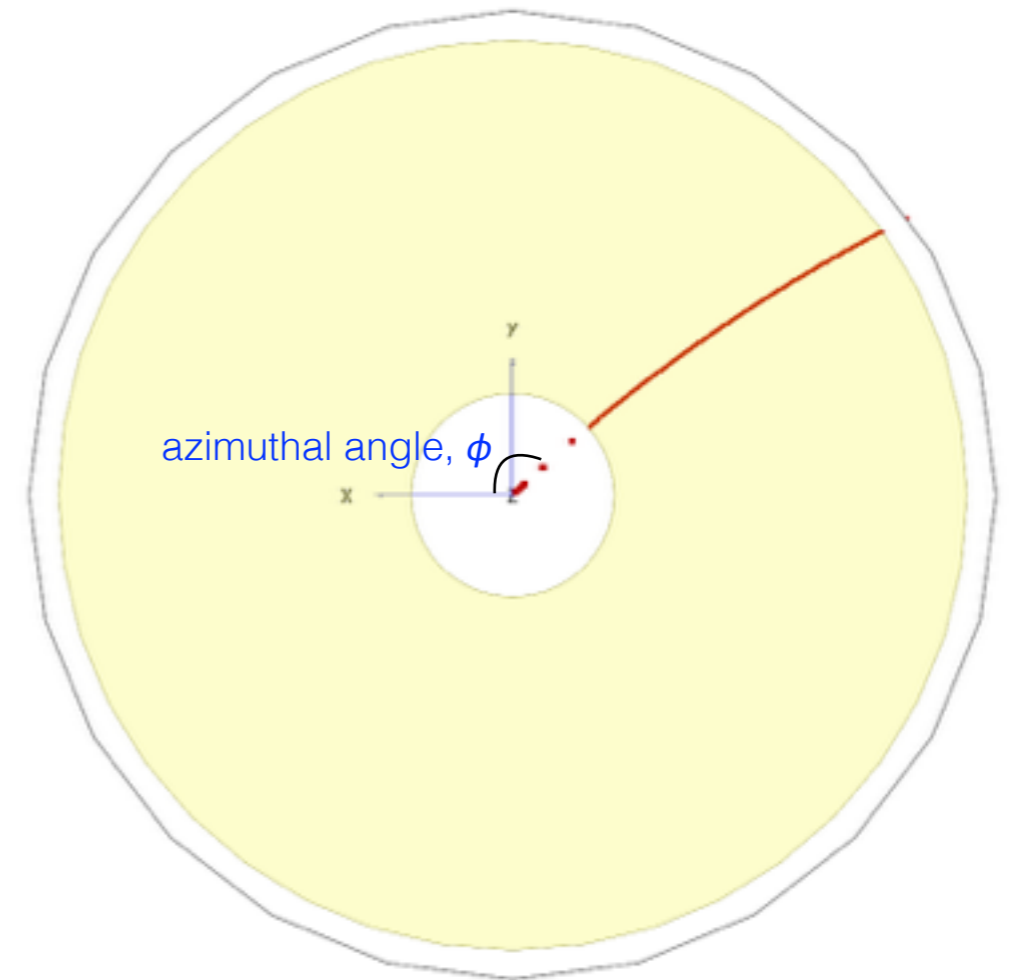
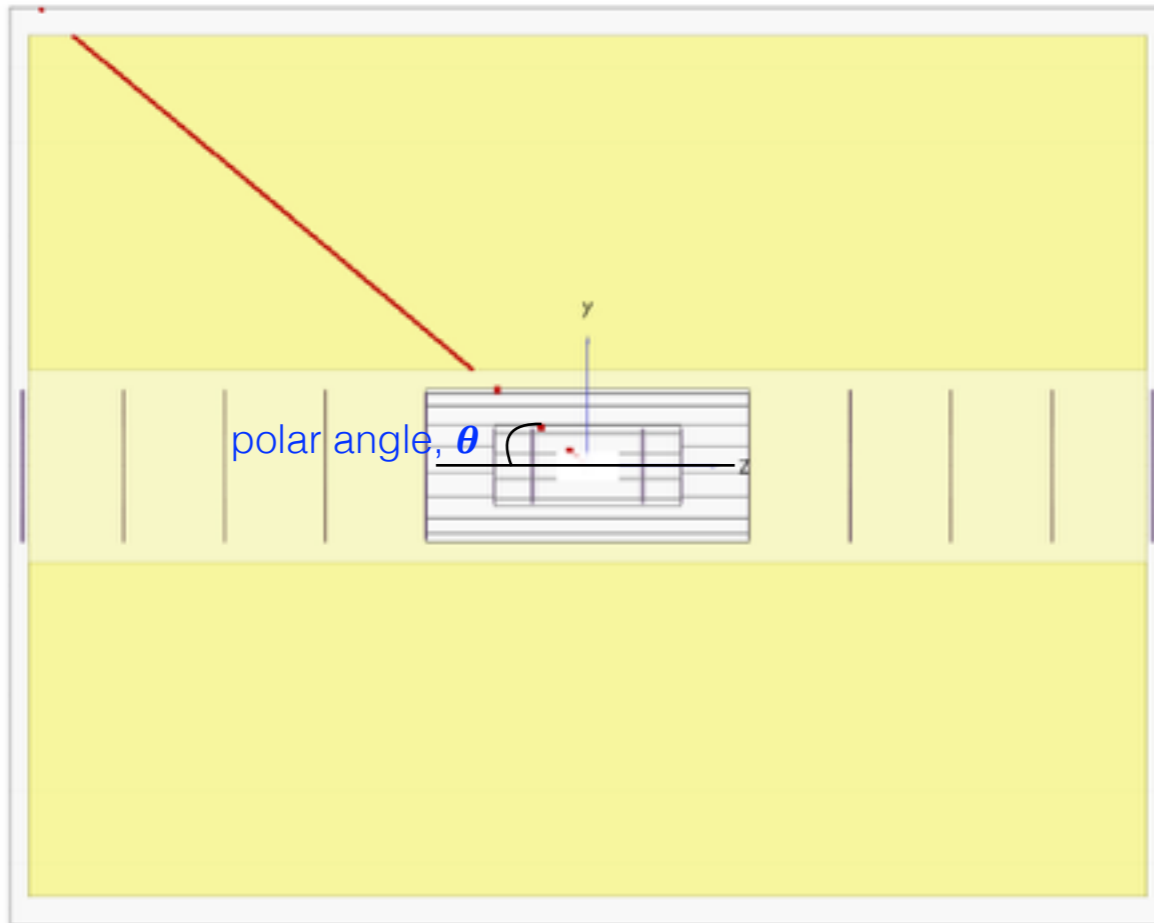
ILD Analysis/Software Meeting  
Jan. 21, 2015

# Introduction

- Study the influence of non-uniformity in ILD magnetic field on track reconstruction results from original KalTest, such as momentum resolution.
- KalTest for non-uniform magnetic field was developed in my SVN branch. Now the implemented functionalities are merged into the code from trunk, and we can choose to use the original or new fitting by the static function `SetUseUniformBfield()` in KalTest.
- Use the Anti-DID field for pair background simulation as the non-uniform field (thanks to Frank) in Mokka:  

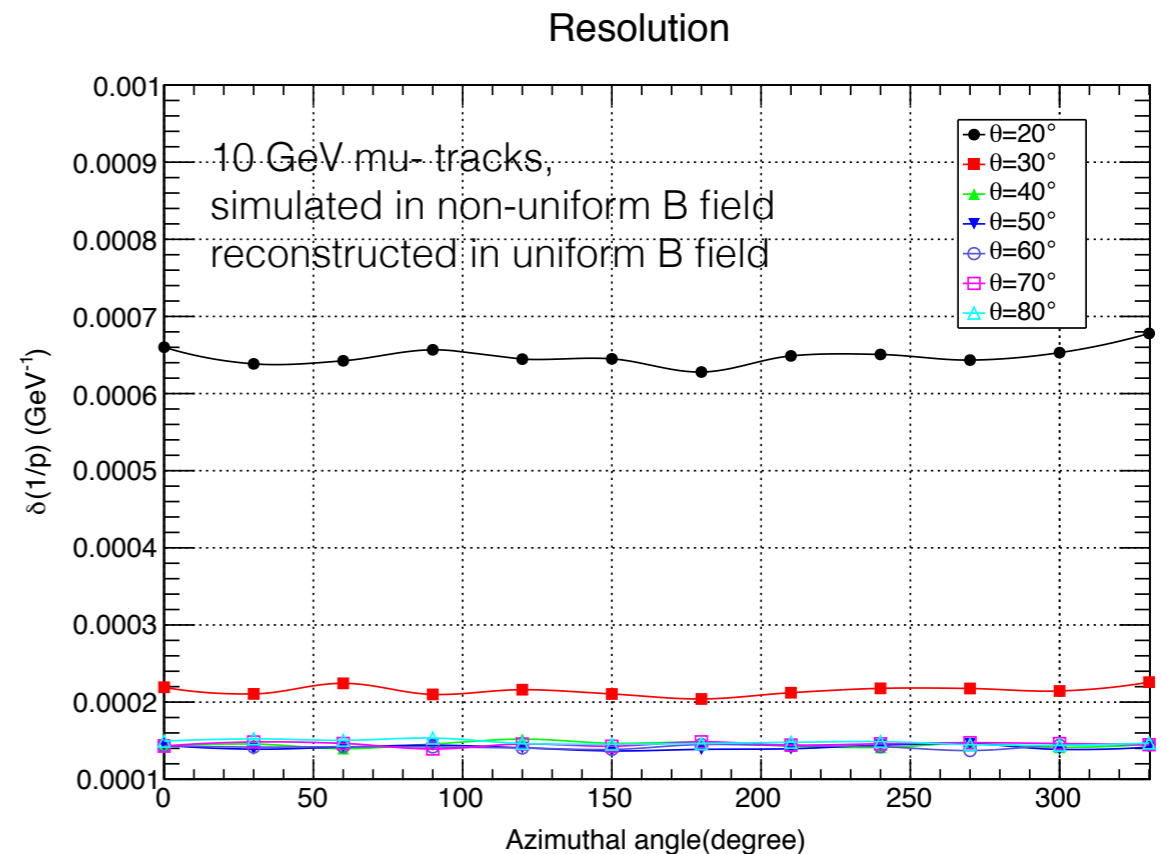
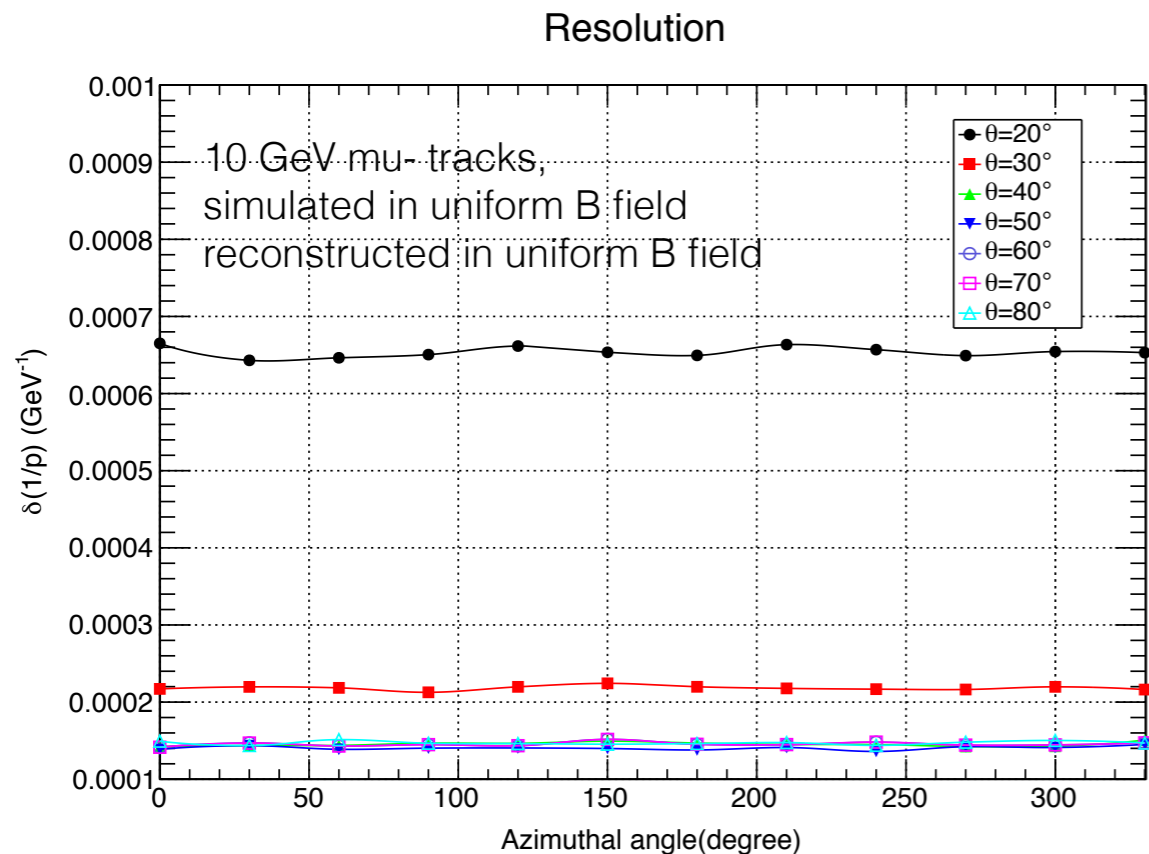
```
/Mokka/init/EditGeometry/rmSubDetector SField01  
/Mokka/init/EditGeometry/addSubDetector fieldX03 1000
```
- In my test, the non-uniform field map in Mokka database is dumped to a local file which then can be used by KalTest.

# Track angle



# Momentum resolution

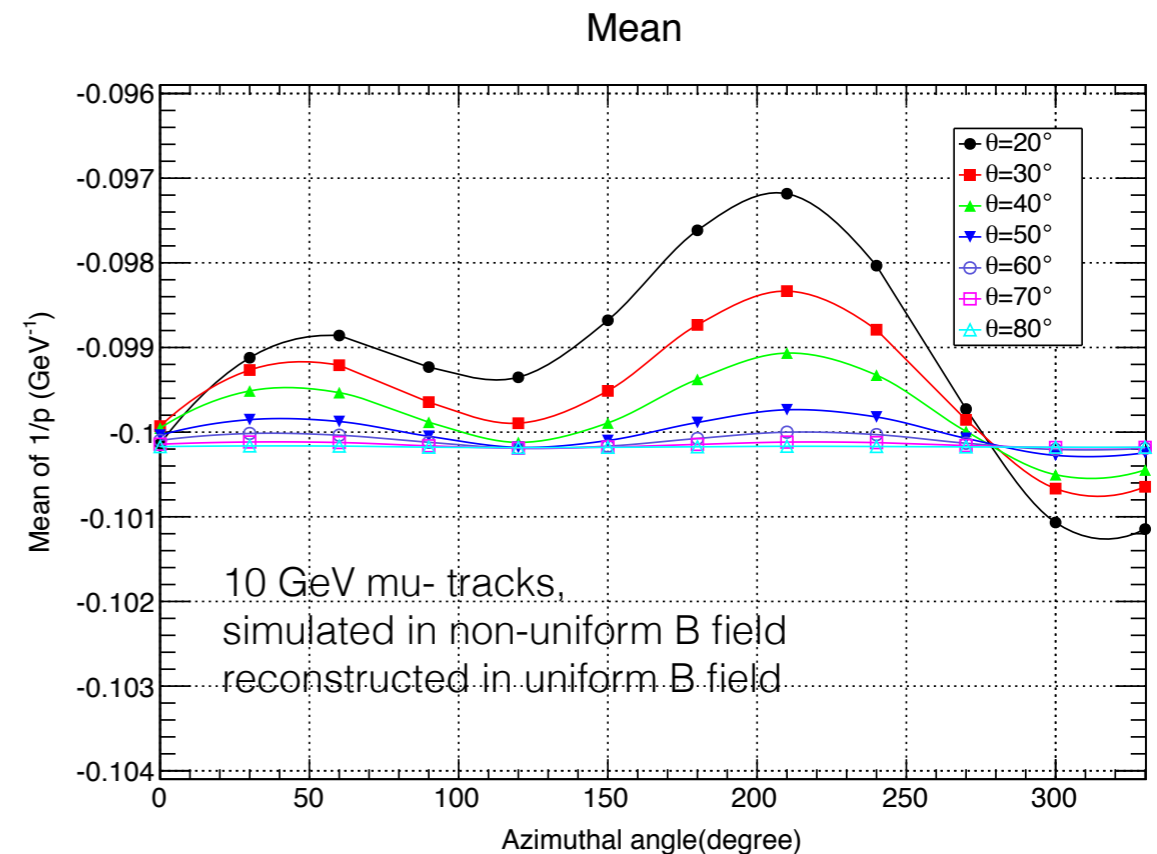
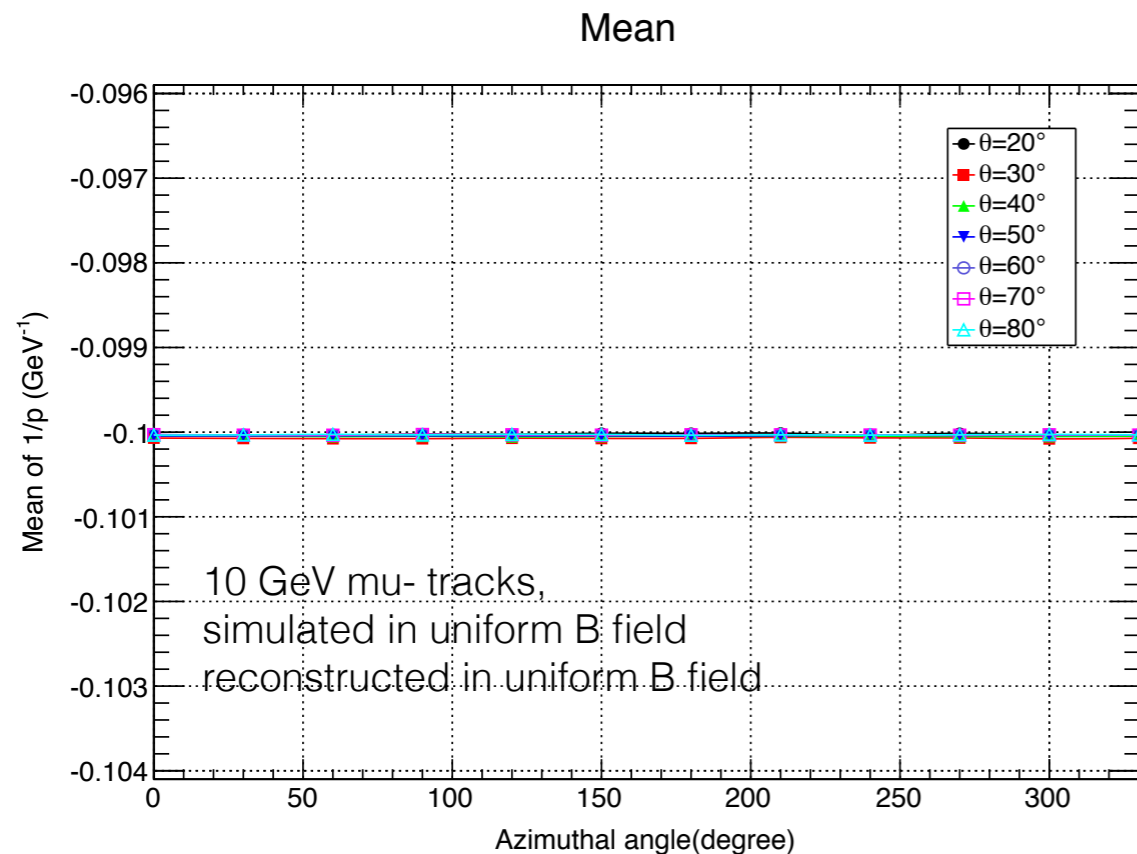
- Momentum resolution at different track angle (i.e. track with fixed phi and theta angle):



- Therefore, the momentum resolution does not affected although the non-uniformity is not taken into account.

# Mean

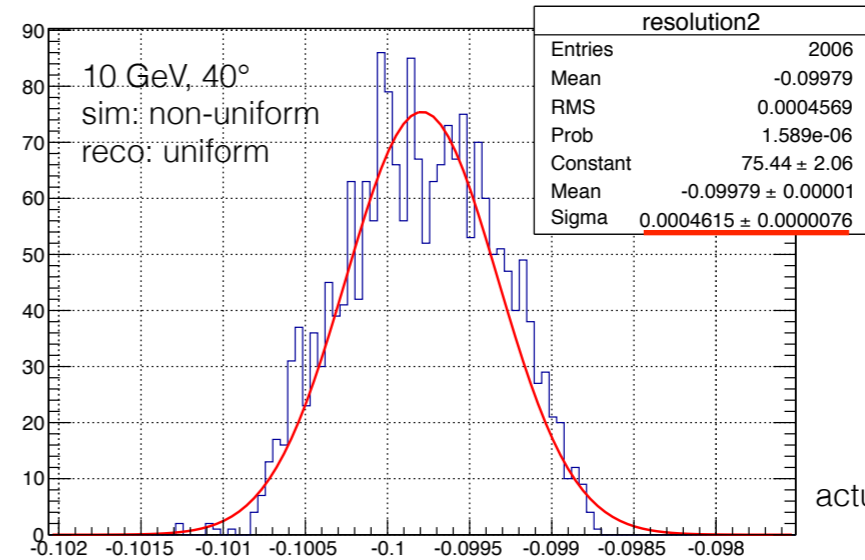
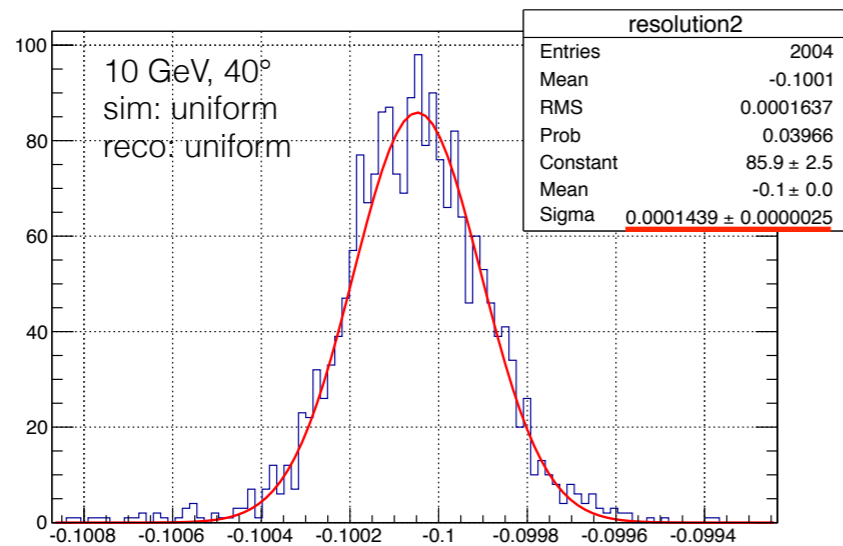
- Mean of  $1/p$  at different track angle:



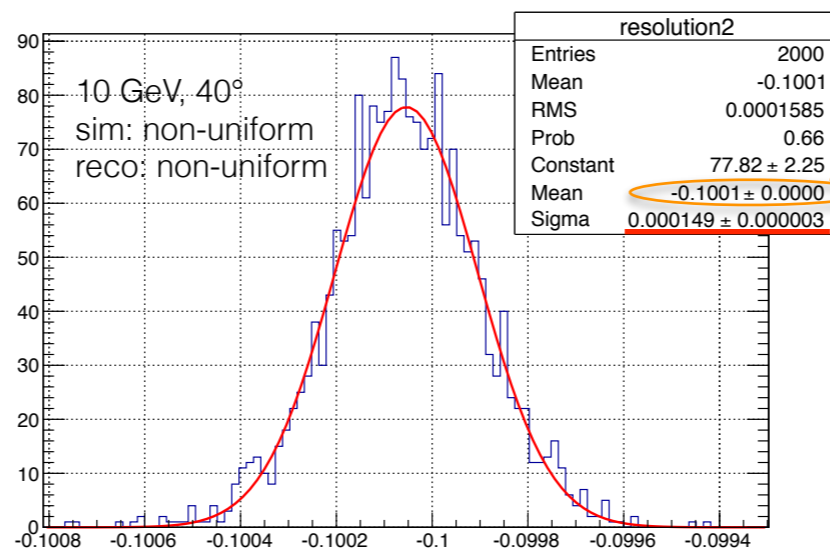
- The mean of momentum is shifted by the anisotropic magnetic field, and it seems that inner region of detector has bigger non-uniformity.

# The effective momentum resolution

- If checking momentum resolution at a fixed polar angle, the bias of mean will go into it, i.e., getting bigger effective momentum resolution:



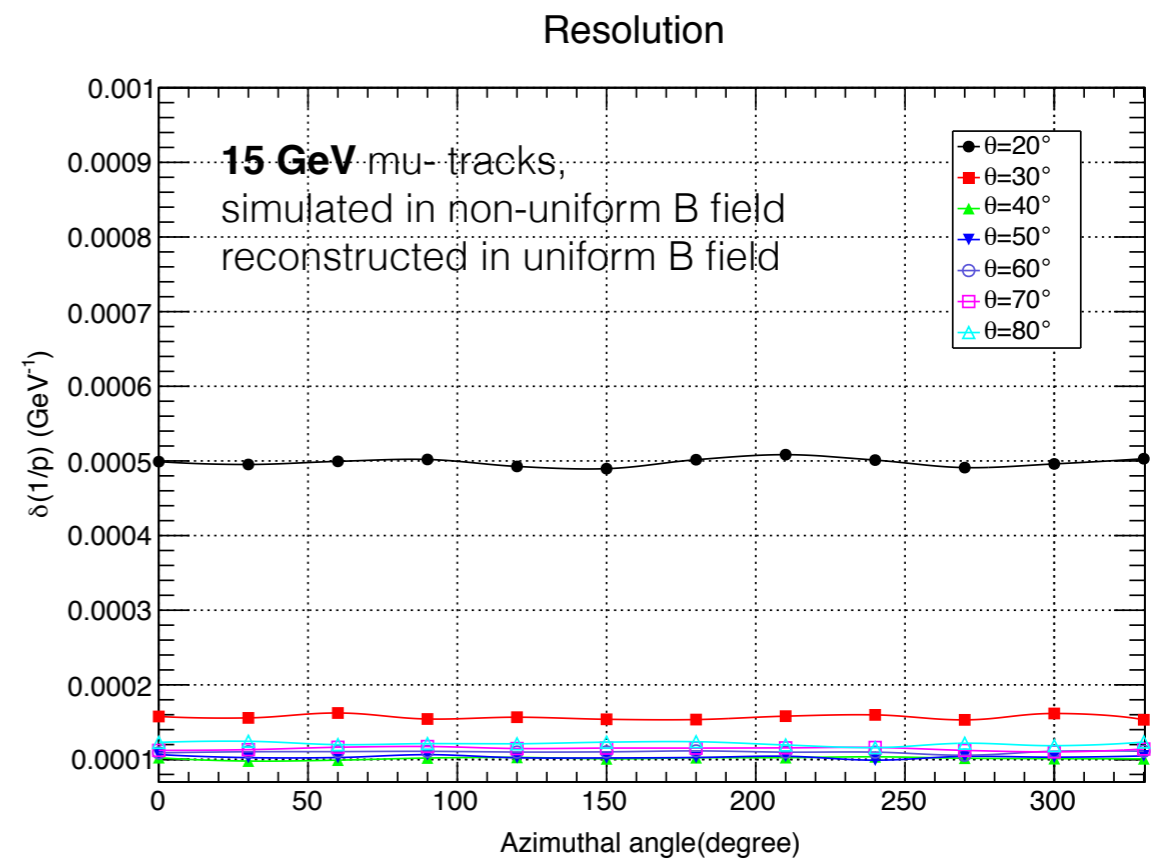
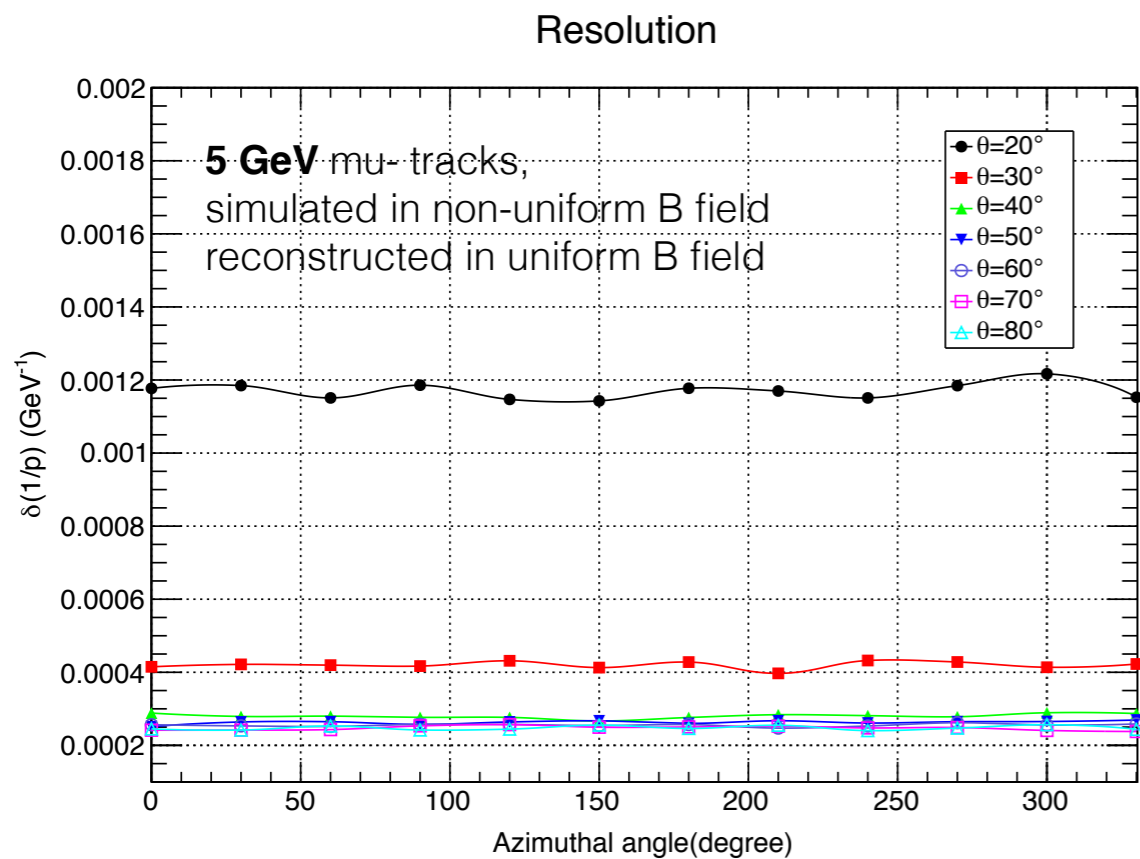
- The track fitting by the updated KalTest can recover the momentum distribution in non-uniform magnetic field



The momentum is what we expect 😊

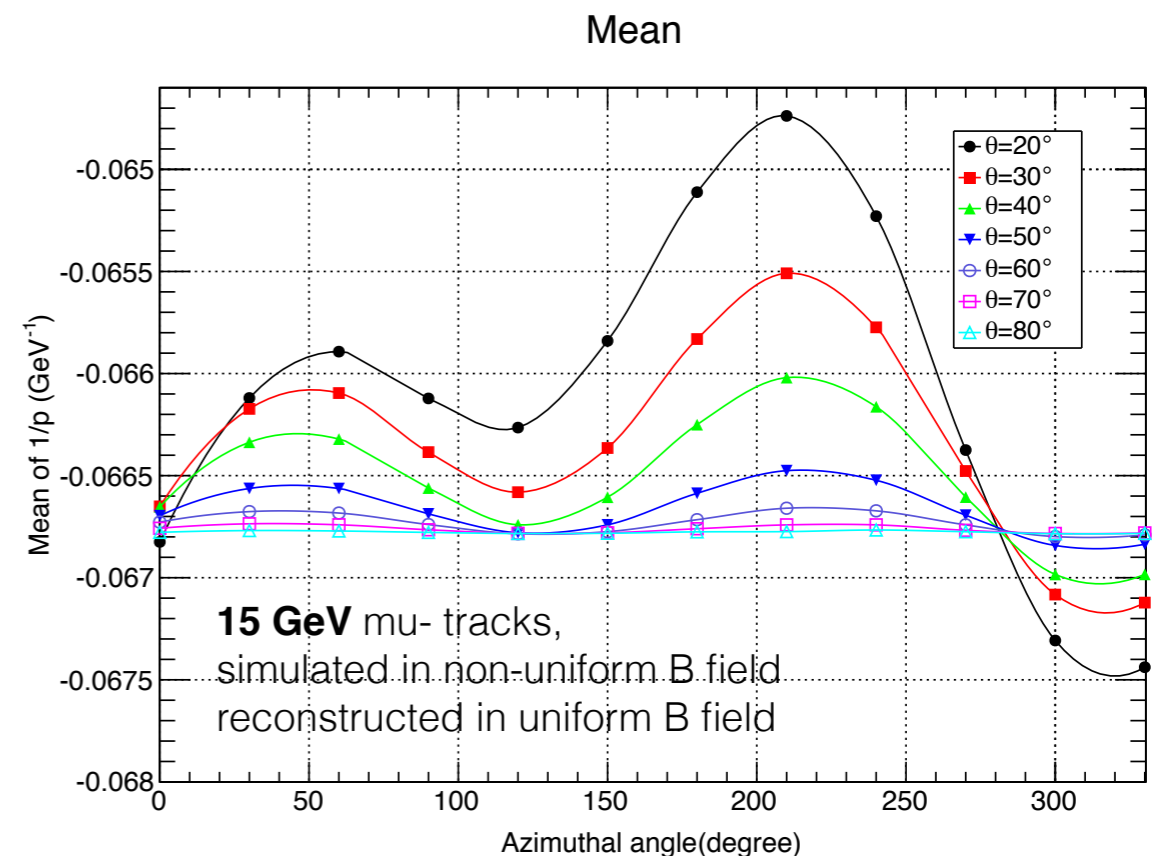
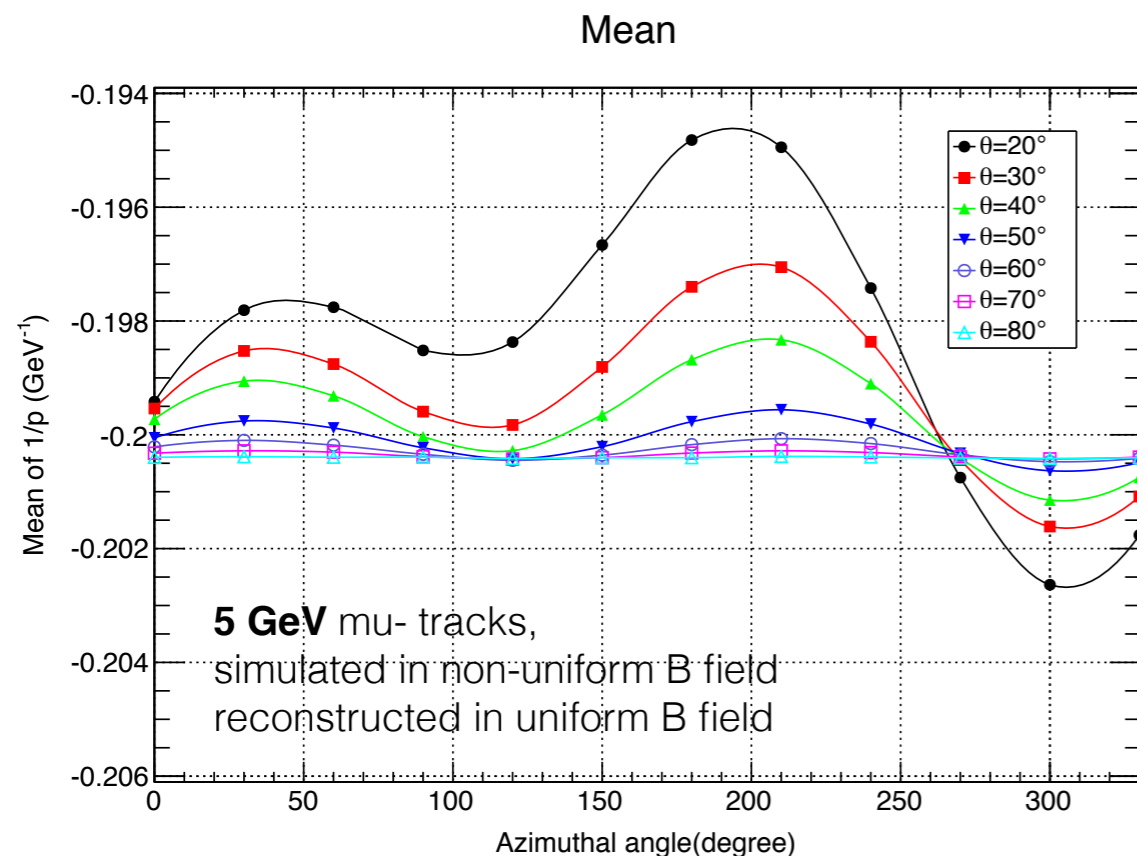
# Momentum dependency of momentum resolution

- Momentum resolution decreases with the increment of momentum, due to the reduction of multiple scattering:



# Momentum dependency of mean

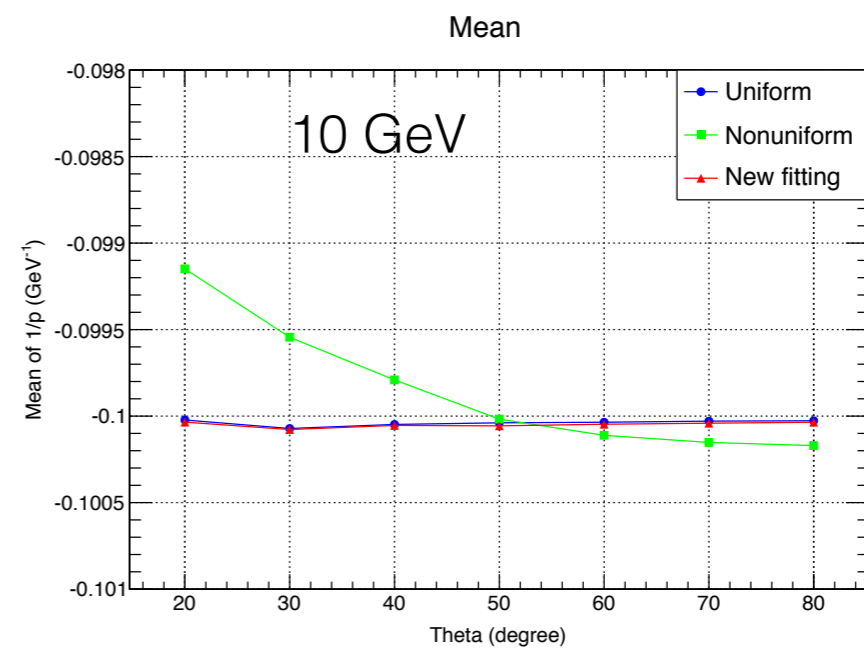
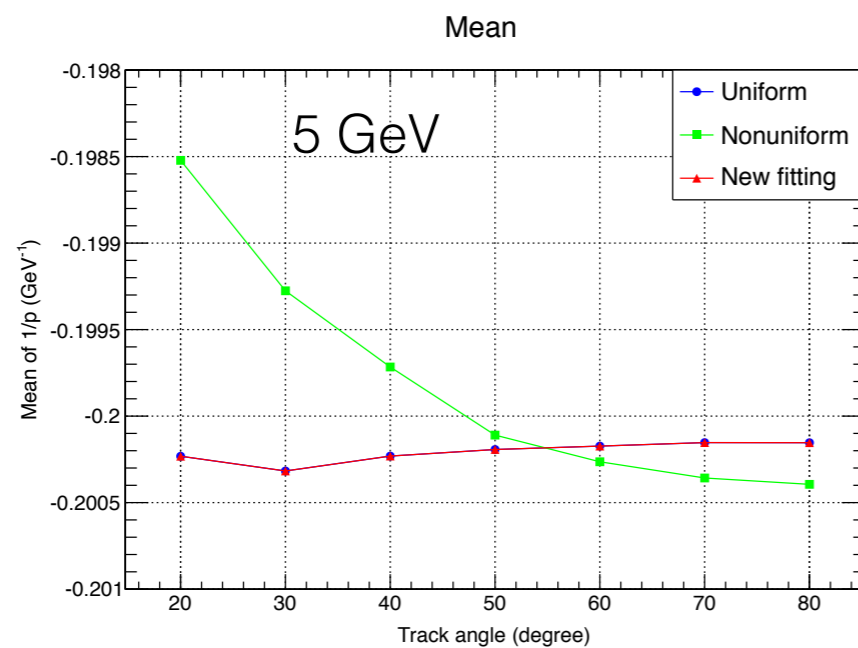
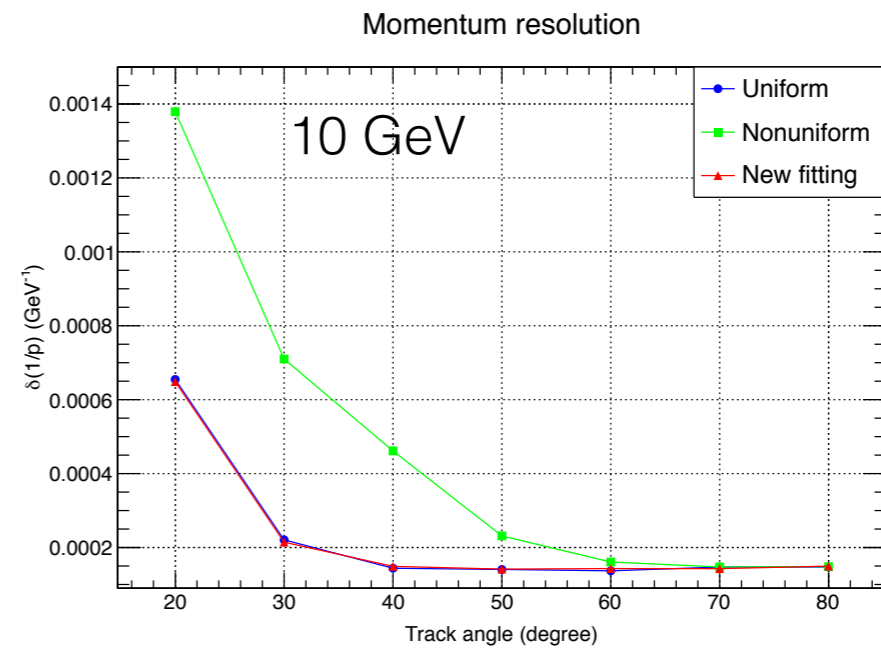
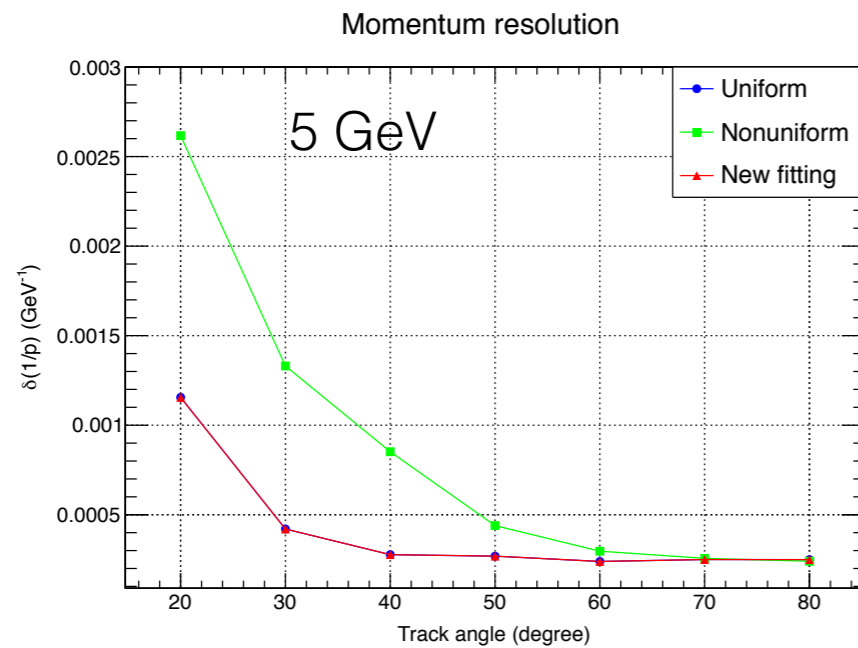
- The mean value of track at a fixed track angle for different momentum has a similar shape:



- Then in order to reconstruct track with proper momentum resolution at different momenta, we'd better to use the fitting functionality of KalTest for non-uniform magnetic field.



# Comparison of track fitting results



- By taking field non-uniformity into account, the updated KalTest can obtain consistent track fitting results as the original one for uniform magnetic field.

# Conclusion

- The non-uniform magnetic field in ILD is anisotropic to azimuthal angle.
- The mean of track momentum is affected by this kind of non-uniformity, and the effective momentum resolution is degraded accordingly.
- The updated KalTest package can well deal with the non-uniformity in the existing ILD field map.