Studies of Angular and Momentum Resolutions

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About Angular and Momentum Resolutions...

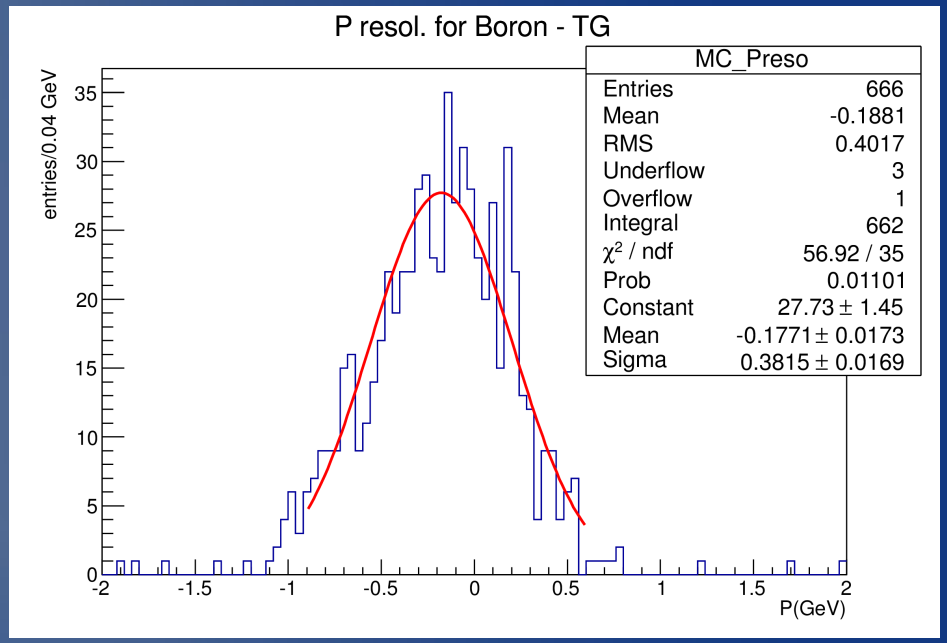
- We can calculate the resolution of each physical observable X of our interest (momentum, charge, energy, angle, ...) as the difference between the value of the MC truth and the one reconstructed from data, track by track:

reso_X = X_mc – X_rec

- Taking as an input for the reconstruction the output of the MC (instead of a data file) we can check the validity of the global reconstruction respect to MC

The bias in the momentum resolution

- In the last meeting we showed the existence of a shift in the momentum resolution: reconstructed momenta are greater than MC momenta
- In the right the case for the boron

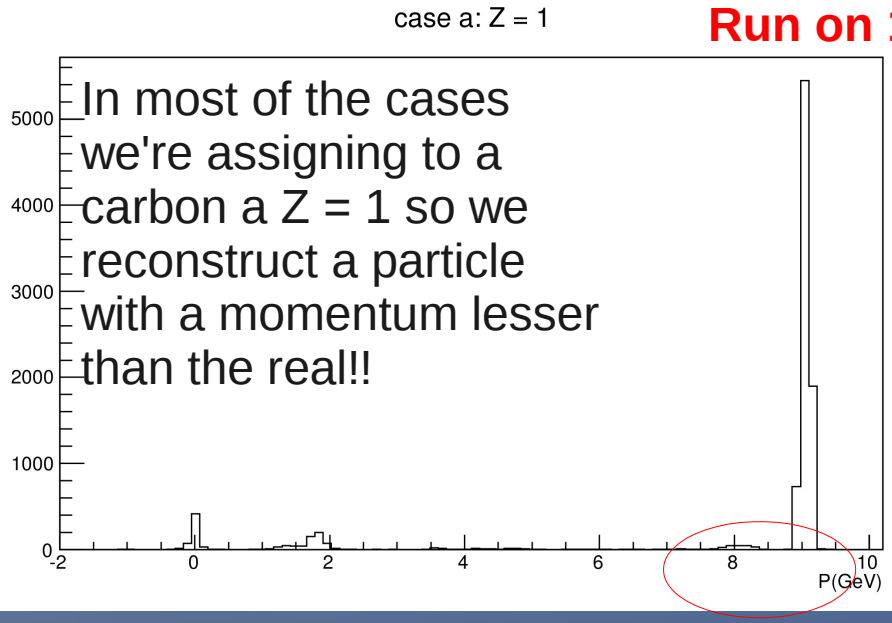


- A double check in the reconstruction algorithm and in the simulation has been done
- V. Monaco has found a problem of the simulation in the propagation in the magnetic field=>New MC production v66
- This was actually responsible for the bias in the momentum resolution that we measured

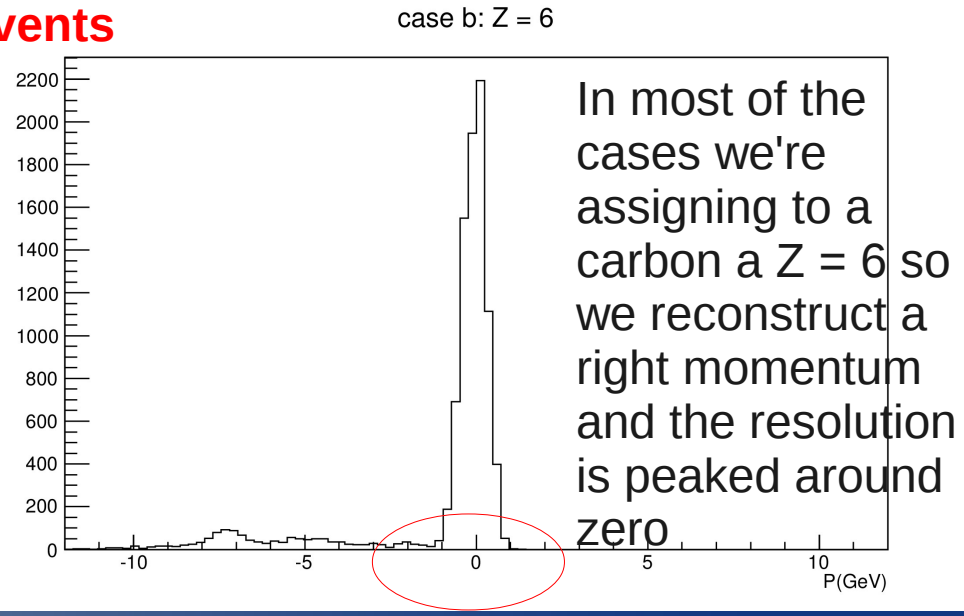
Momentum Resolution | wrong initial ZID guess

- Checking the reconstruction algorithm we studied the effects of a wrong initial ZID guess on the momentum resolution
- Momentum reconstruction comes from:
  - TAGactGlobalTracking
  - GlobalTrack
- We did run the reconstruction in the MC making two different guesses on the starting charge: Z = 1 (case a) and Z = 6 (case b) for ALL the events to check the final result
- since 93% of the events are straight carbons, the carbon hyp is expected to work well for those tracks, while to create problems for the remaining 7% of the cases
- The momentum resolution has been computed in both cases to check if we can rely on the global recontruction or if the charge assigment is driving completely the final momentum (and mass) of the particle

Momentum Resolution | wrong initial ZID guess



Run on 10k events



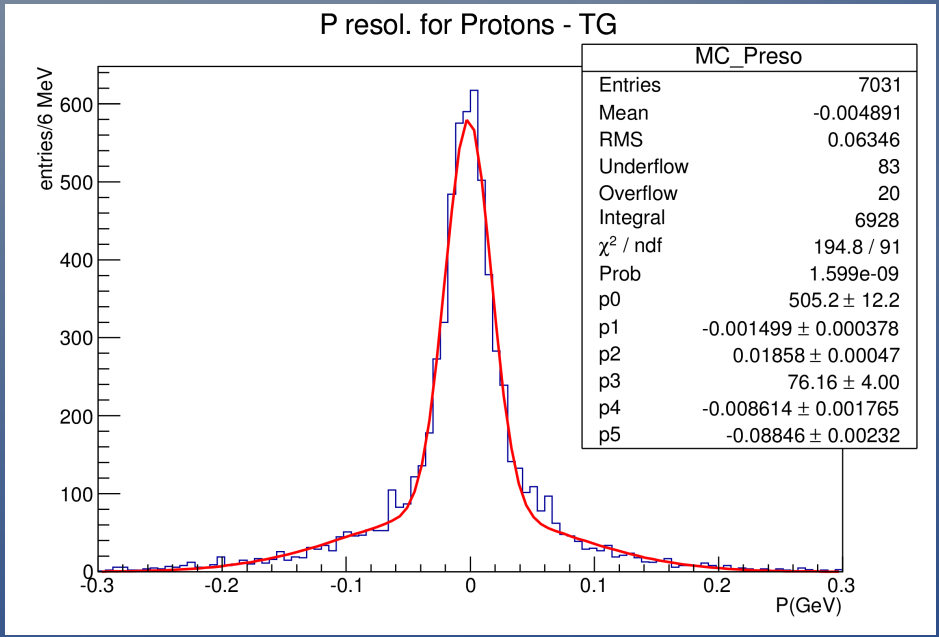
- Once we make a mistake in the initial guess, the momentum (mass) comes out completely off: our algorithm just alter the momentum in order to have the same rigidity p/Z
- We only rely on the charge assignment from the Zid algorithm of Tof and some small help from vertex for protons and helium to build the momentum and mass spectra
- A proper evaluation of the systematic errors due to incorrect charge assignment is mandatory!!

Angular and Momentum Resolution

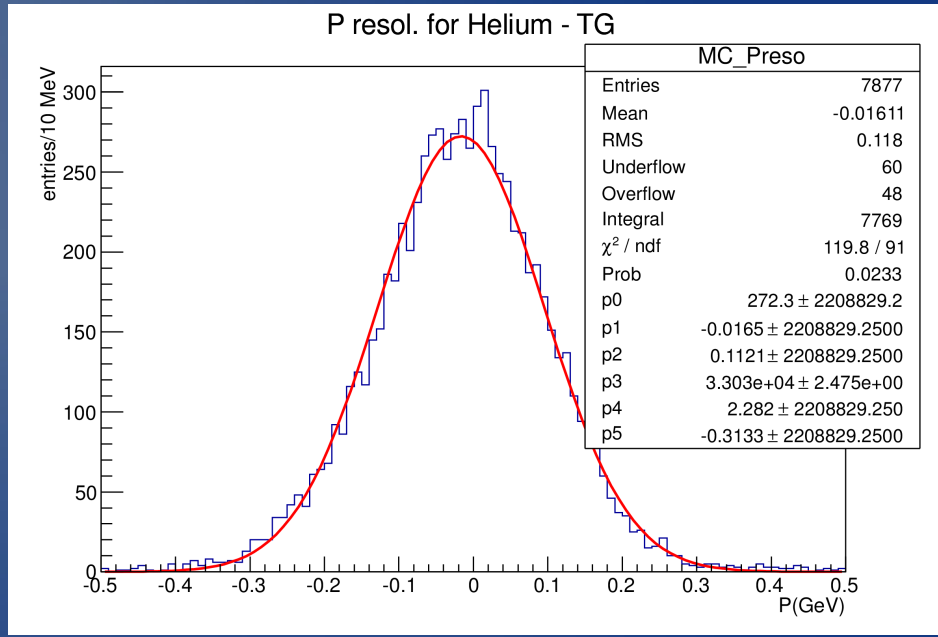
- Used last MC version: production v67 for a high density carbon target (the results that follows are similar for production v66 with the ordinary carbon TG)
- The HL reconstruction has run on 300K events
- Studied angular and momentum resolution for the different fragments using HD carbon TG events
- Fragments selected using the MC charge information
- Only fragments produced in the TG are considered
- Studied the reconstructed momentum and angle vs the MC momentum and angle associated with pixels (clusters) in different sensors of the vertex detector

Momentum resolution: protons and helium

Protons



Helium

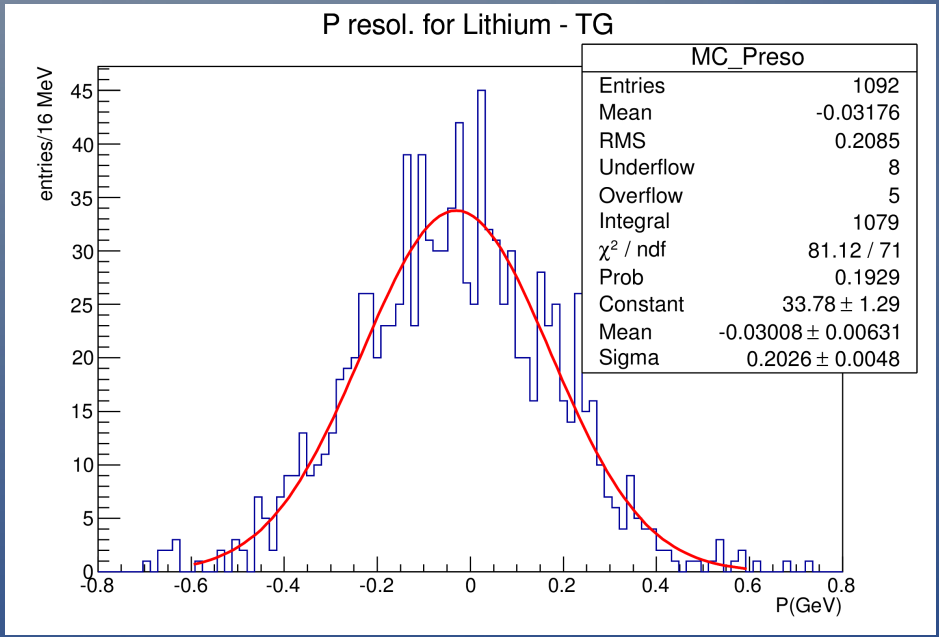


Reso ~ 20 MeV

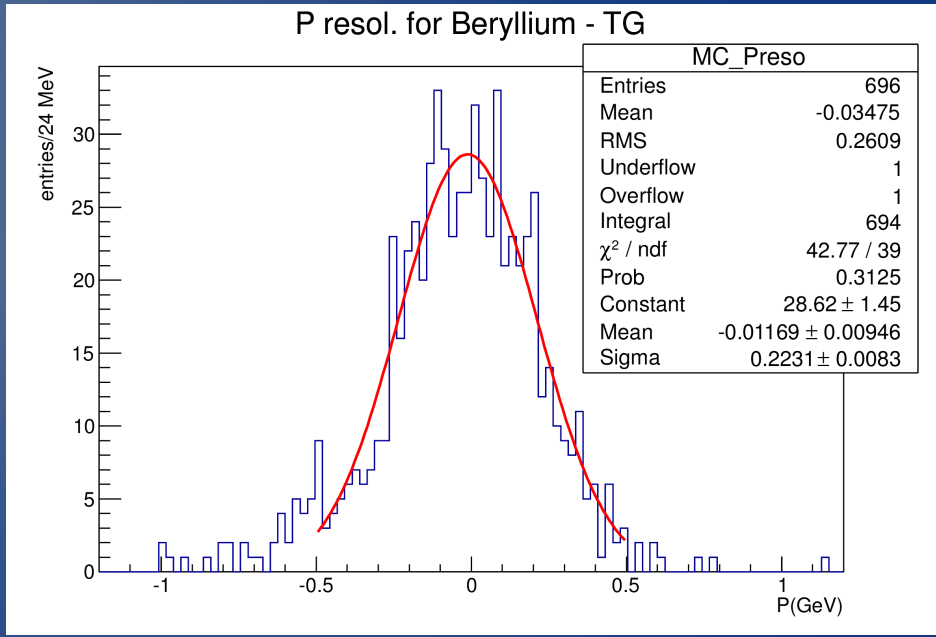
Reso ~ 110 MeV

Momentum resolution: lithium and beryllium

Lithium



Beryllium

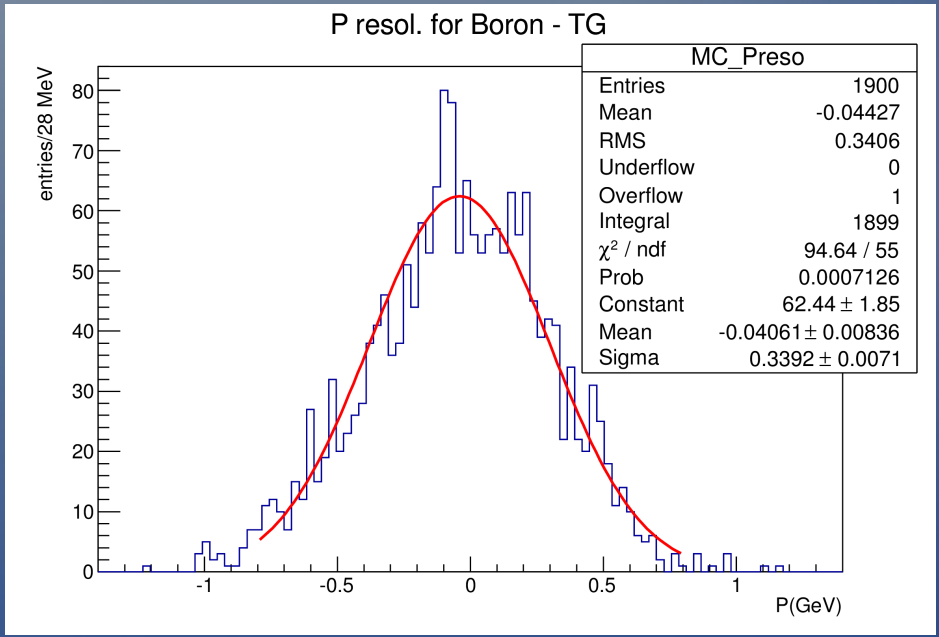


Reso ~ 200 MeV

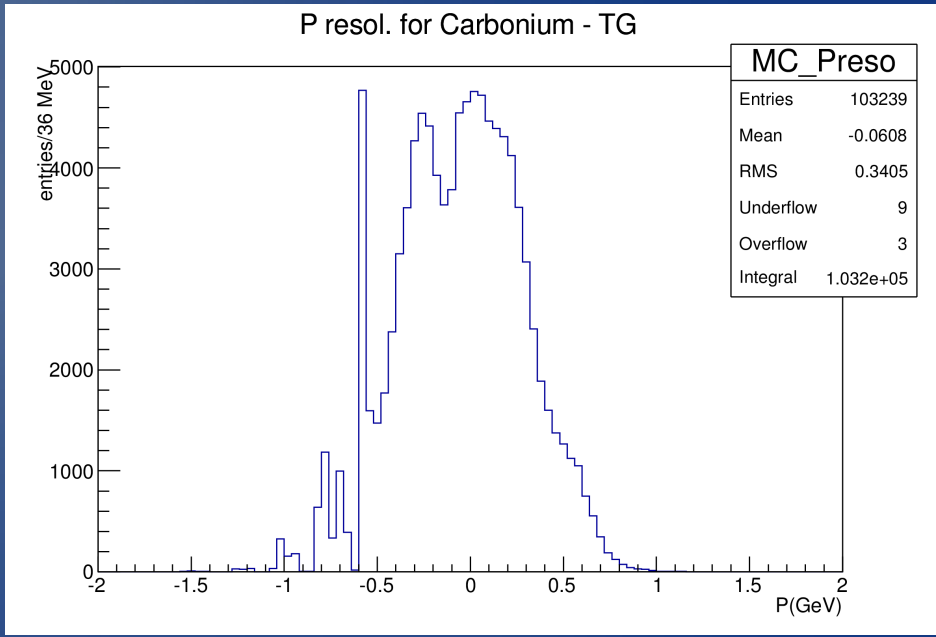
Reso ~ 220 MeV

Momentum resolution: boron and carbonium

Boron



Carbonium

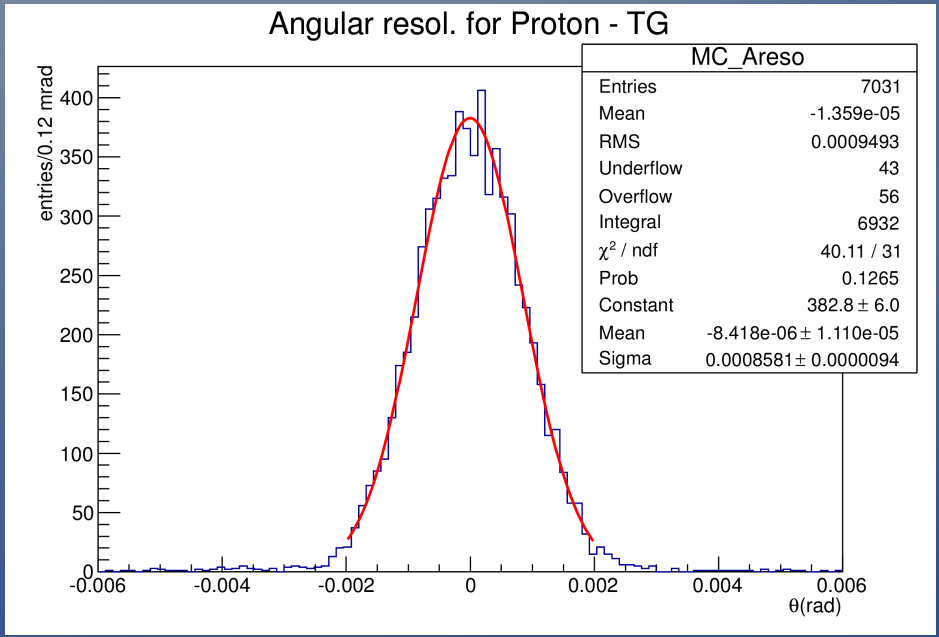


Reso ~ 340 MeV

The momentum structure here is due to the resolution in x coordinate on the Tof Wall

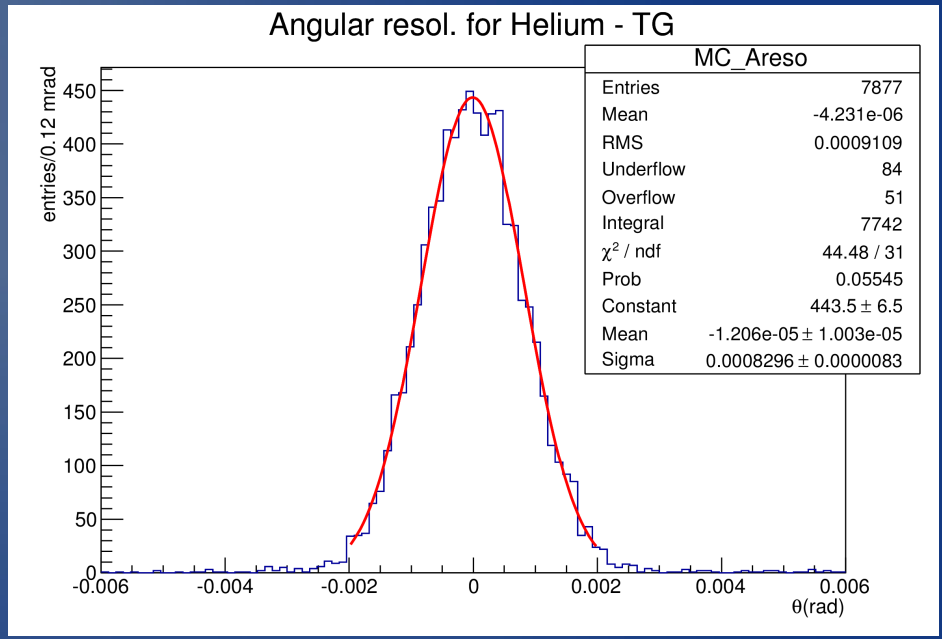
Angular resolution: protons and helium

Protons



Reso ~ 0.05°

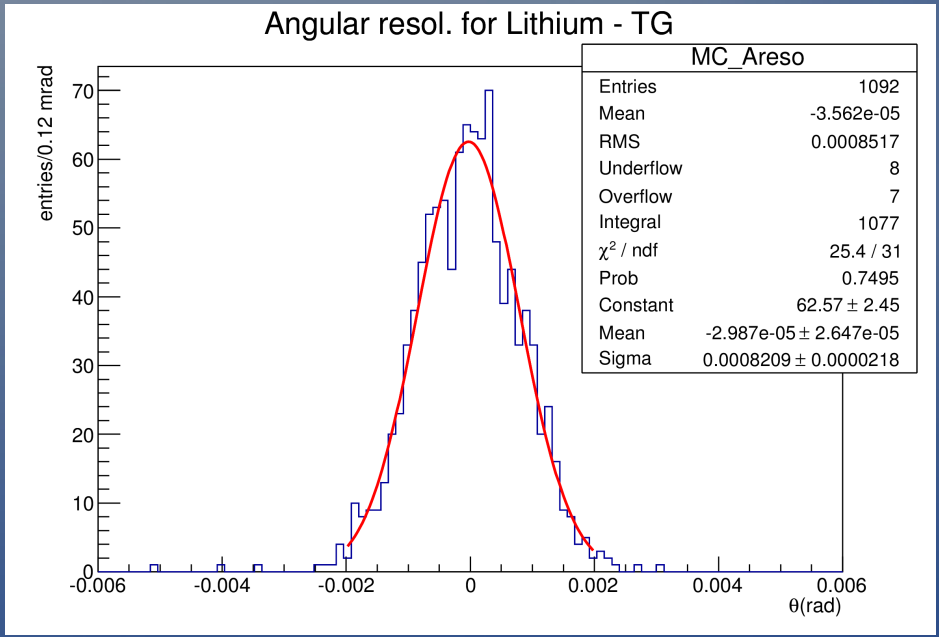
Helium



Reso ~ 0.05°

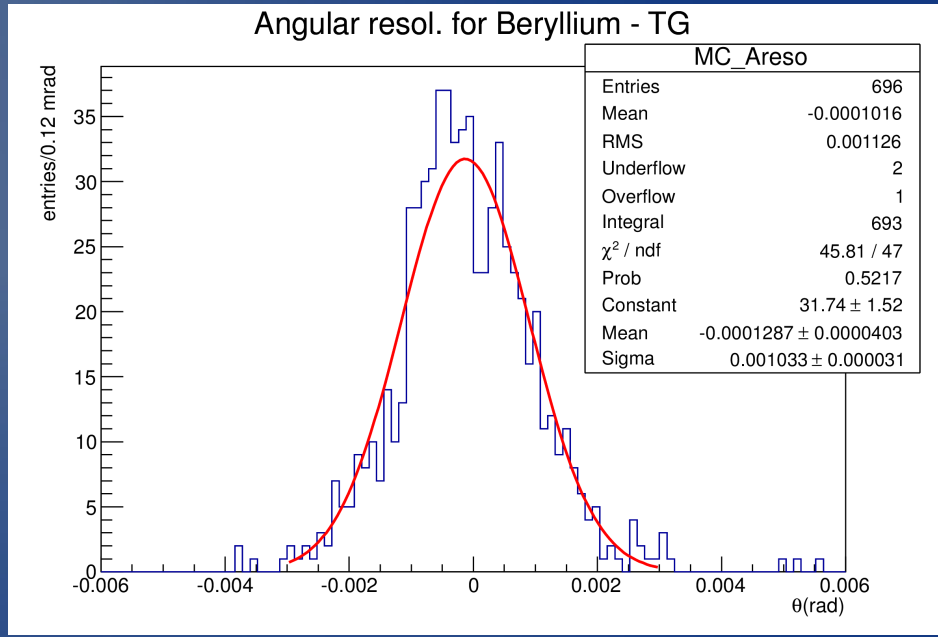
Angular resolution: lithium and beryllium

Lithium



Reso ~ 0.05°

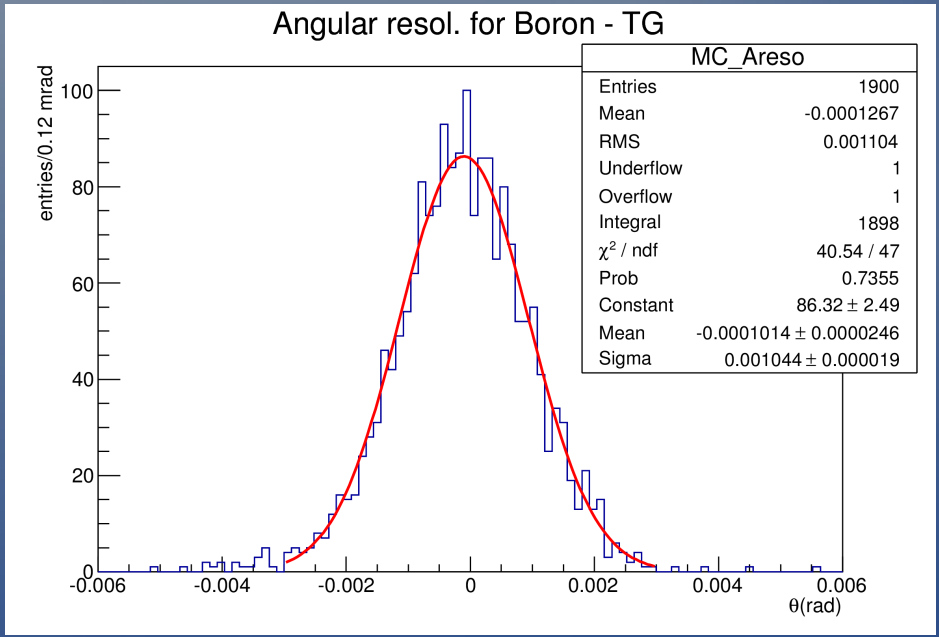
Beryllium



Reso ~ 0.06°

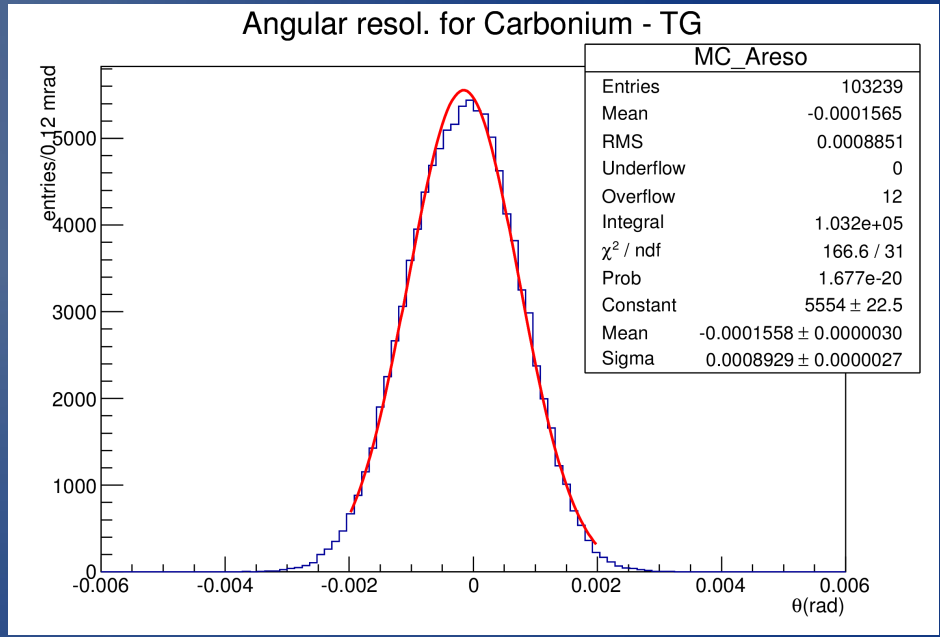
Angular resolution: boron and carbonium

Boron



Reso ~ 0.06°

Carbonium



Reso ~ 0.05°

Conclusions

- Studied angular and momentum resolutions for the different fragments in the case with high density carbon TG
- Angular resolution ~ 0.05° for all fragments except for beryllium and boron (~ 0.06°)
- The bias in momentum resolution is disapperead thanks to the correction of the propagation in the magnetic field in the simulation (MC production v66 and following)
- We've shown also the importance to keep under control the systematics due to the incorrect charge assigment
- Next Step: we're already working on the reconstrucion efficiency of our global track algorithm, a fundamental parameter for calculating cross sections!