Studies of Angular and Momentum Resolutions

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About Energy and Angular Resolutions...

- Among the various parameters we need to measure the DDCS:

$$\frac{d\sigma_i}{dE,d\theta} = \frac{Y_i}{N_{12C} \times N_{t,S} \times BW_E \times BW_\theta \times \Omega(\theta) \times \varepsilon_{rec}(E,\theta) \times \varepsilon_{sel}(E,\theta)}$$

  we can choose the bin widths in energy (BW_E) and angle (BW_θ) via energy and angle distributions and their respective 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

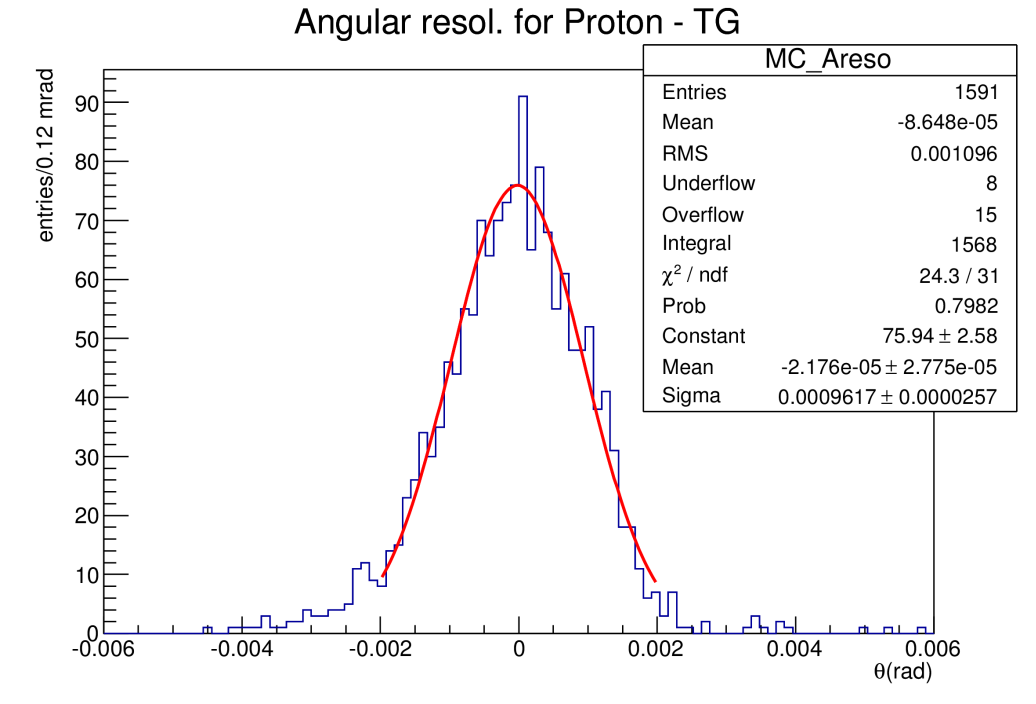
- Taking as an input for the reconstruction the output of the MC (instead of a data file) we can check the validity of the global reconstruction respect to MC

Angular Resolution

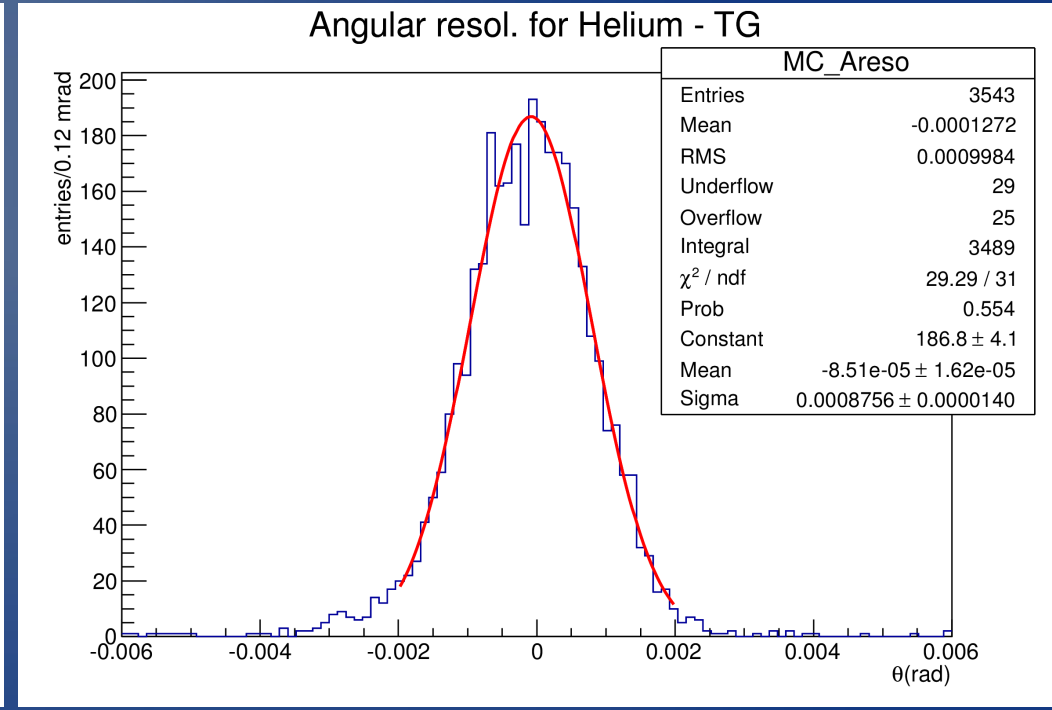
- Used last MC version
- Studied angular resolution for the different fragments in the case with carbon TG
- Fragments selected with a cut in the MC charge:
  - the new ZID algorithm will be used in next step
- Angular resolution comes only from VTX: everything is fixed by TAVTactNtuTrack.
- So we studied the reconstructed angle from vertex vs angle from the MC momentum associated with pixels (clusters) in different sensors of the vertex detector
- This study has been done both at low and high level reconstruction with the same results in resolution (~ 0.05°)

Angular resolution: protons and helium

Protons



Helium



Reso ~ 0.05°

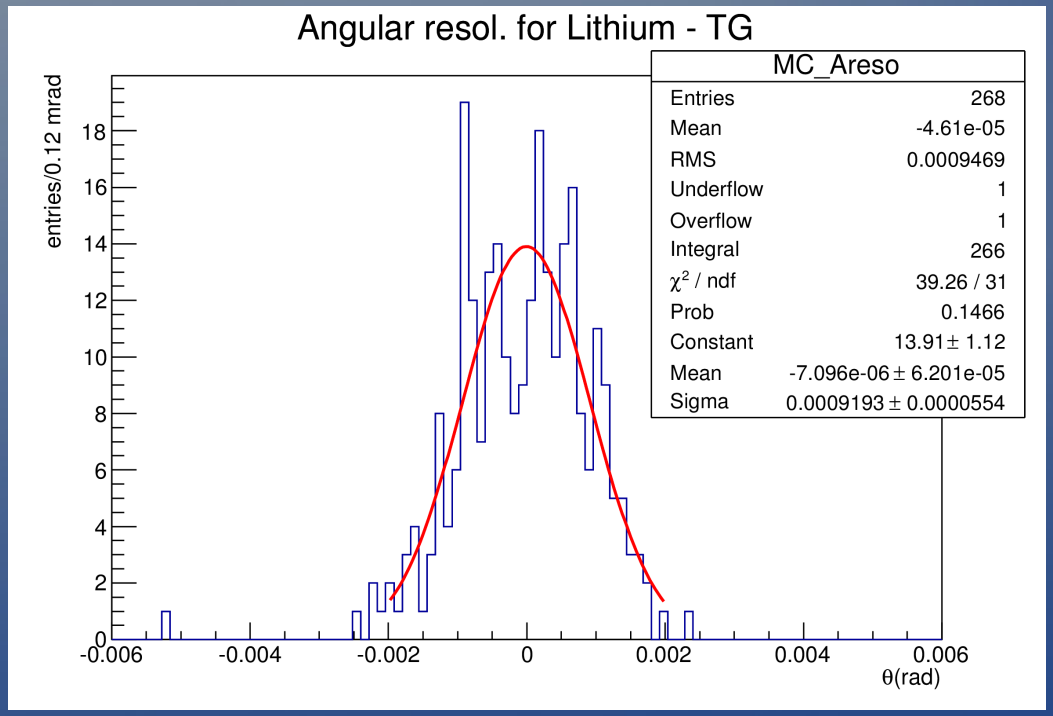
Bias = Mean/Sigma ~ 2.3%

Reso ~ 0.05°

Bias ~ 9.7%

Angular resolution: lithium and beryllium

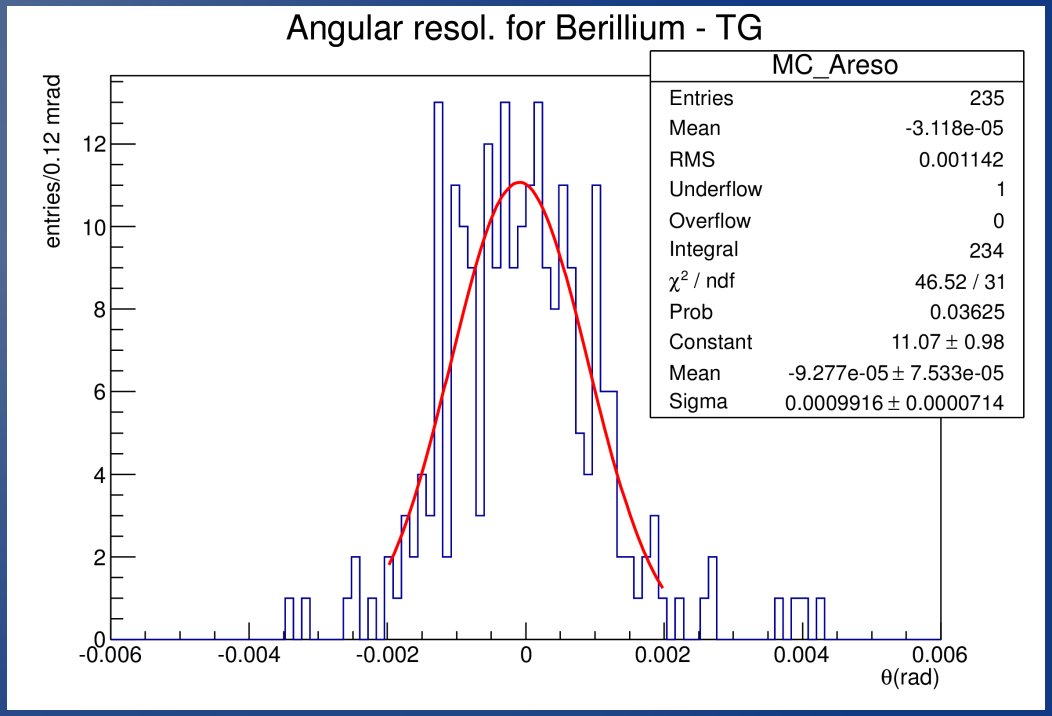
Lithium



Reso ~ 0.05°

Bias ~ 0.8%

Beryllium

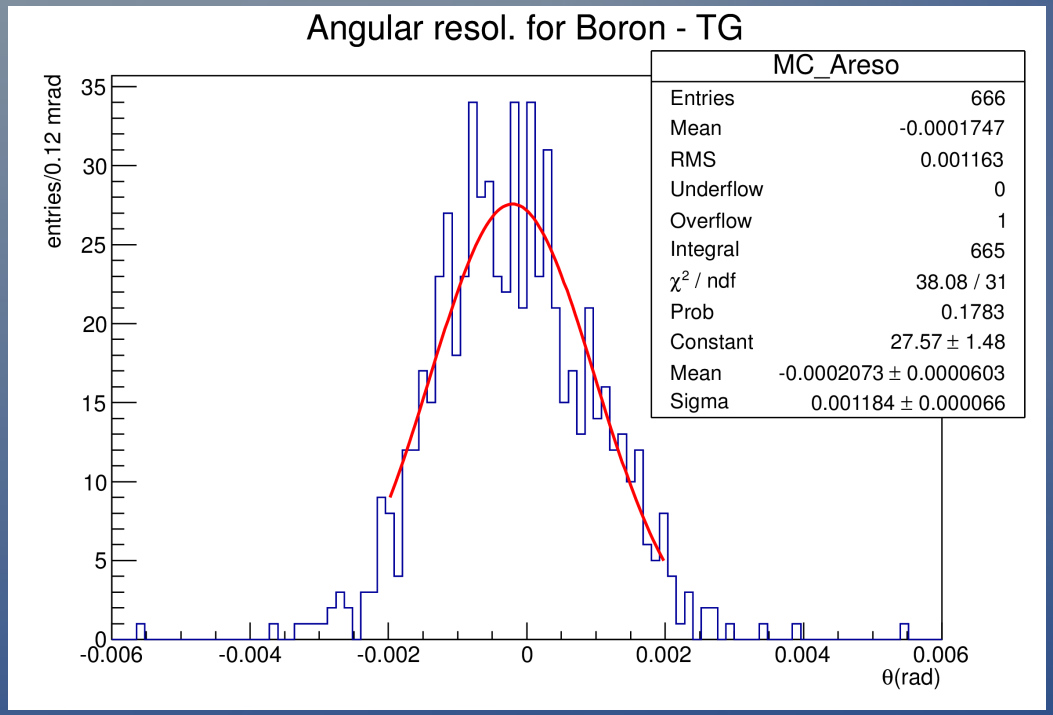


Reso ~ 0.05°

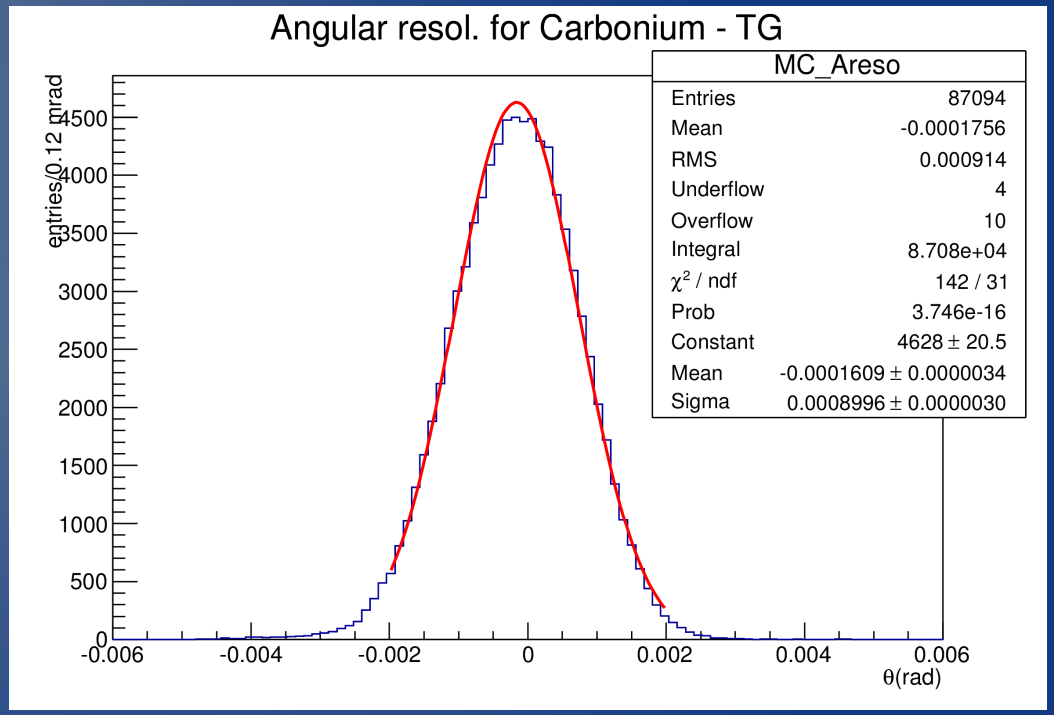
Bias ~ 9.3%

Angular resolution: boron and carbonium

Boron



Carbonium



Reso ~ 0.06° Bias ~ 17%

Reso ~ 0.05° Bias ~ 17%

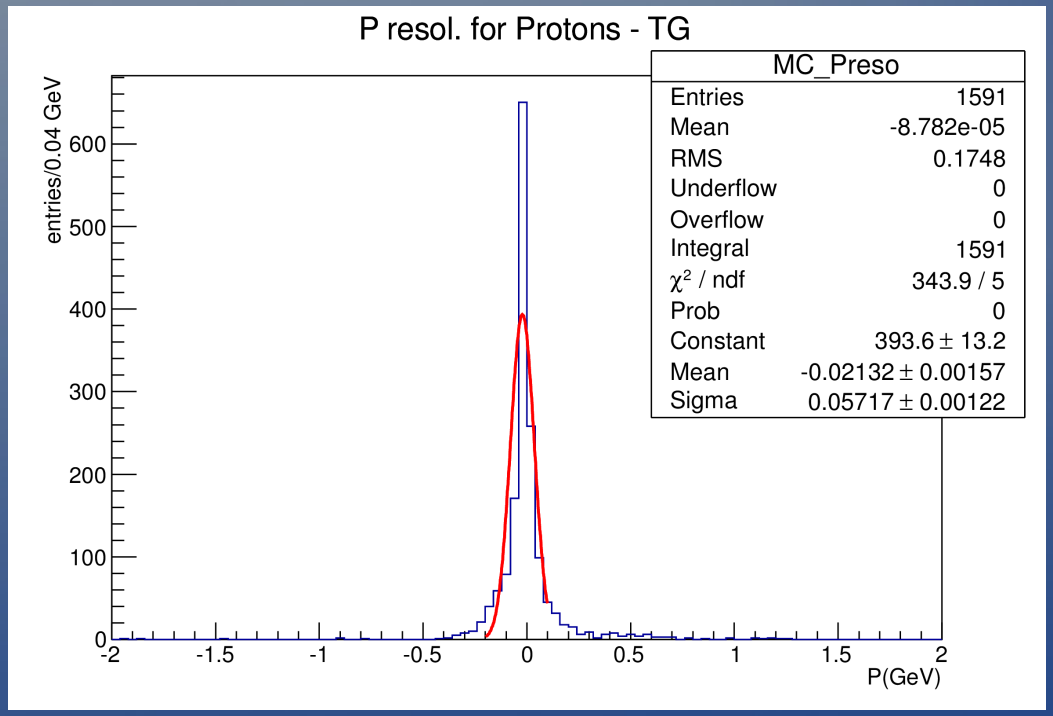
For all fragments a small bias exists: the reconstructed angle is greater than the MC angle. The situation becomes worse in the case of momentum resolution...

Momentum Resolution

- Before studying energy resolution we started from momentum resolution for the different fragments in the case with carbon TG
- Momentum recontruction comes from:
  - TAGactGlobalTracking
  - GlobalTrack
- We studied the reconstructed momentum vs
  - The MC momentum associated with pixels (clusters) in different sensors of the vertex detector
  - The MC momentum associated with hits in the Tof Wall
- In both cases we obtain the same results

Momentum resolution: protons and helium

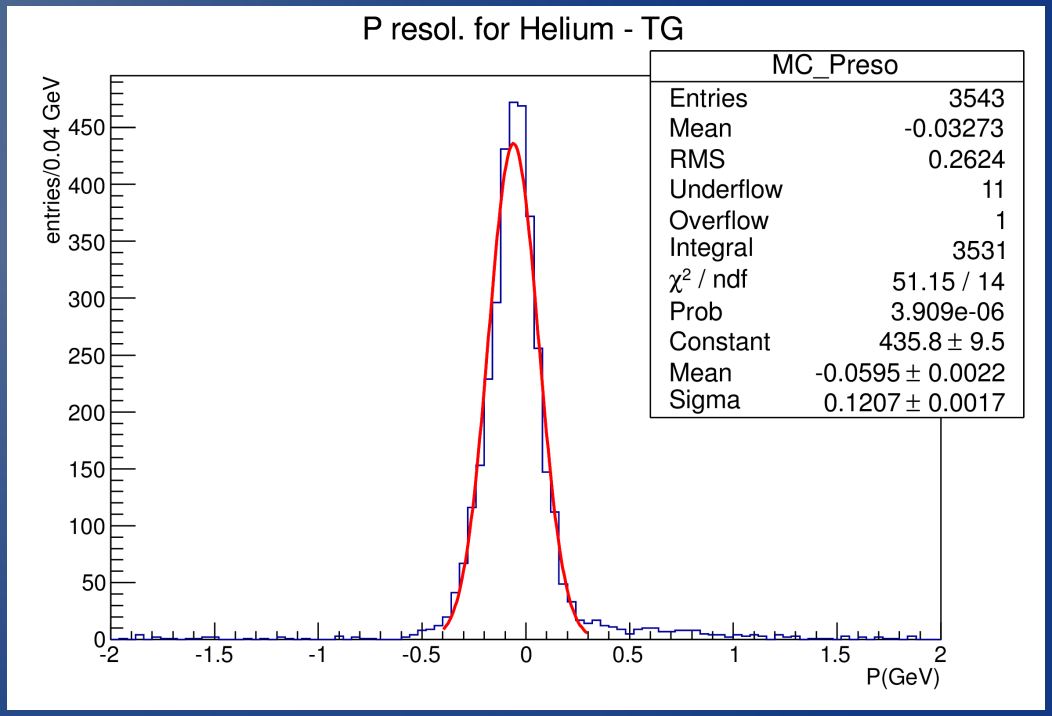
Protons



Reso ~ 40 MeV

Bias ~ 37%

Helium

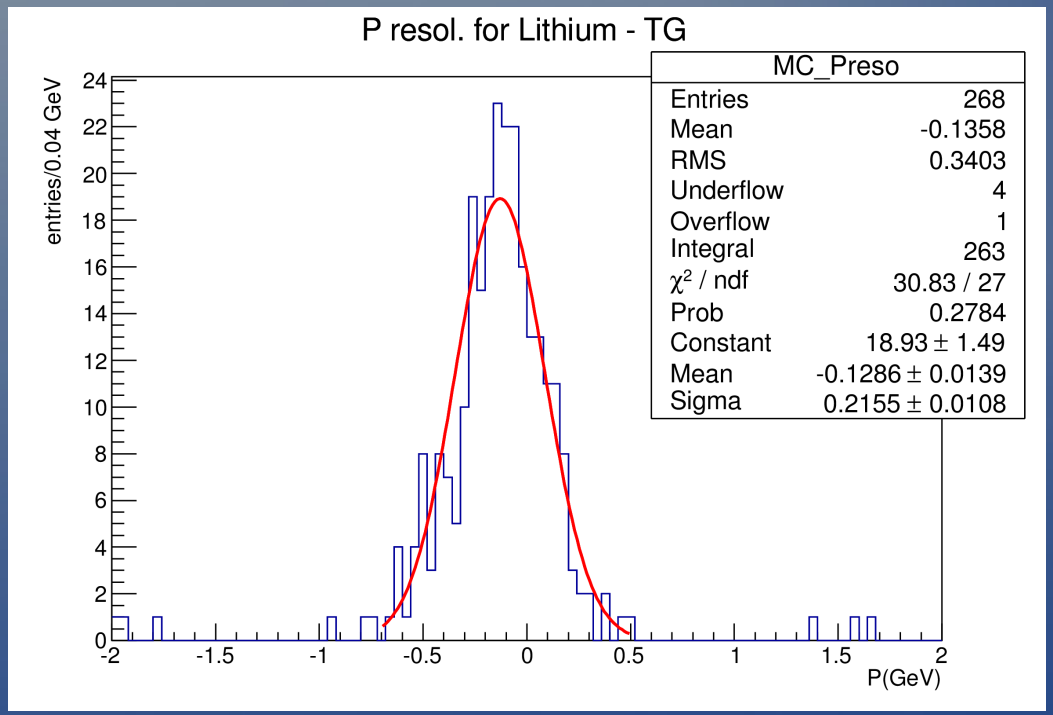


Reso ~ 120 MeV

Bias ~ 49%

Momentum resolution: lithium and beryllium

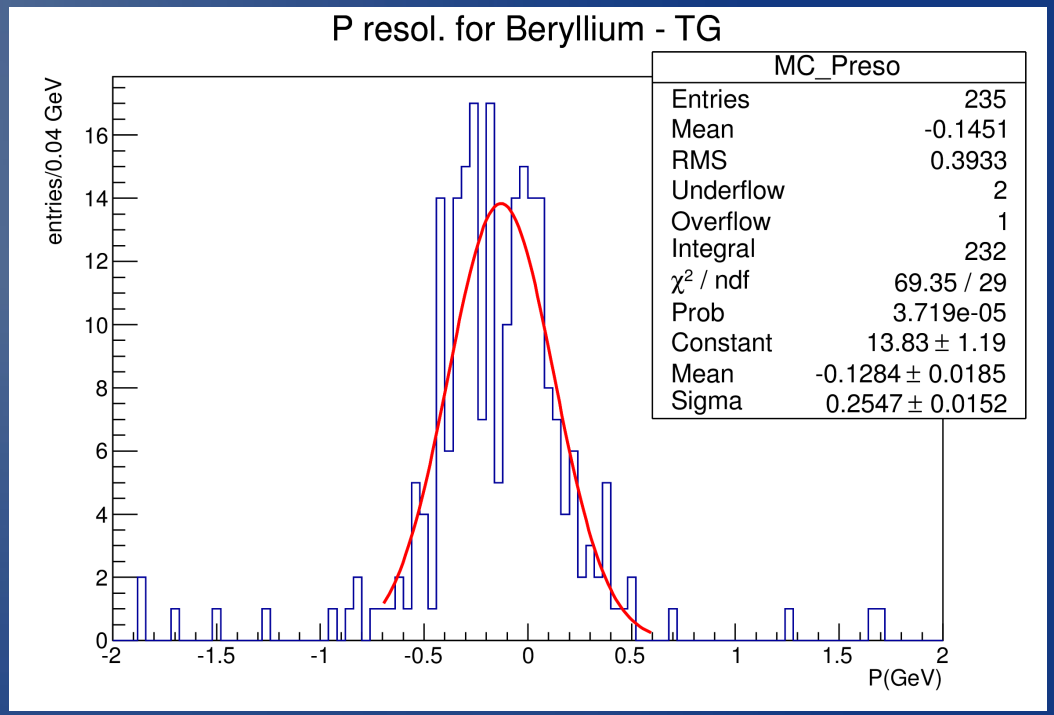
Lithium



Reso ~ 210 MeV

Bias ~ 60%

Beryllium

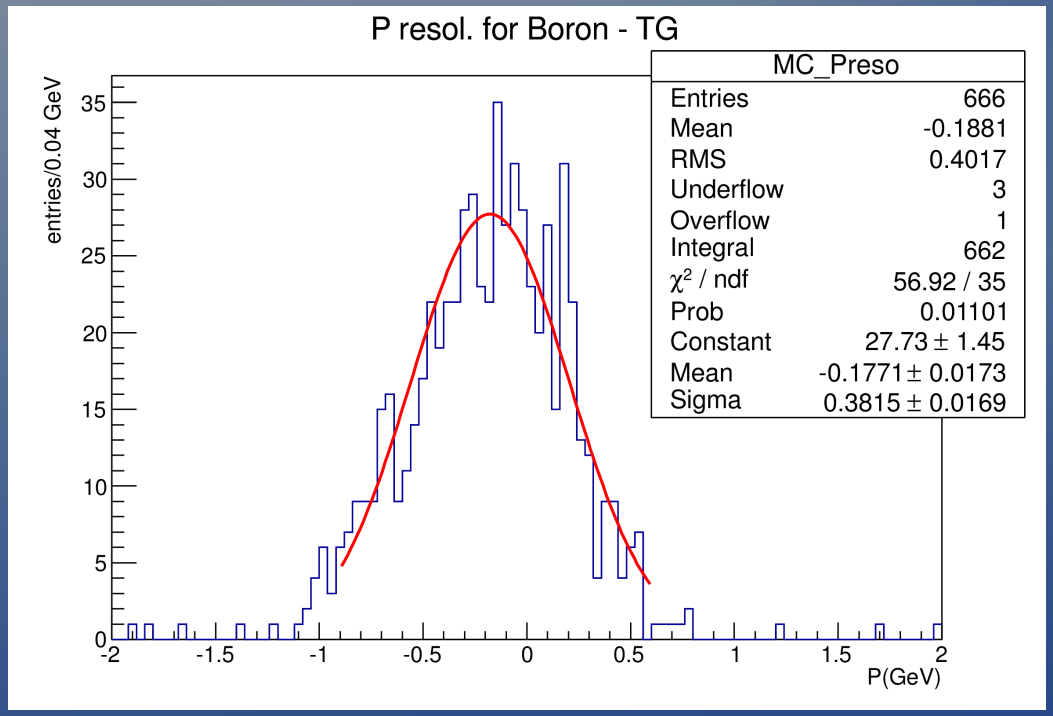


Reso ~ 250 MeV

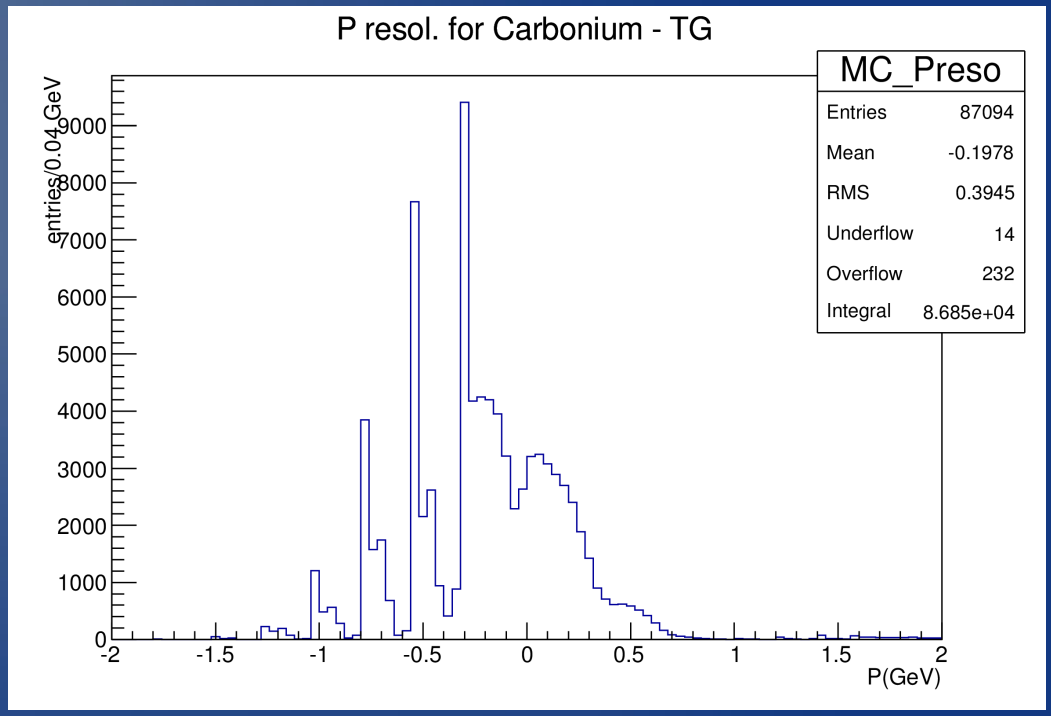
Bias ~ 50%

Momentum resolution: boron and carbonium

Boron



Carbonium



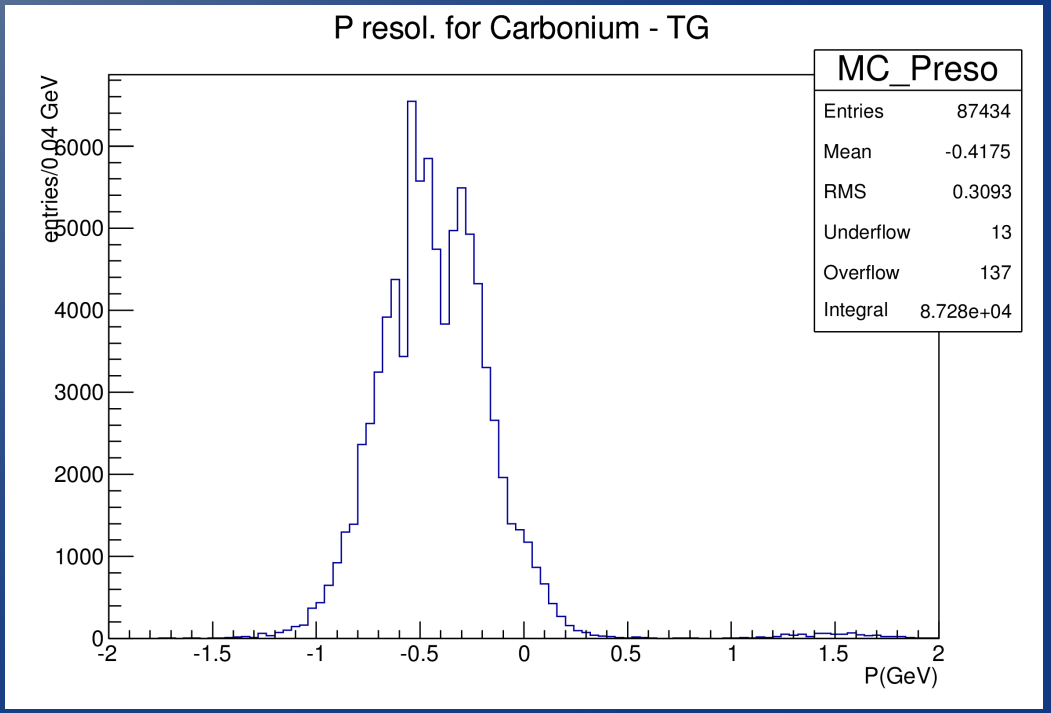
Reso ~ 380 MeV

Bias ~ 46%

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

Conclusions

- Studied angular and momentum resolutions for the different fragments in the case with carbon TG
- Angular resolution ~ 0.05°
- It appears that we reconstruct always a momentum “harder” than the one from MC: It's necessary to understand what is happening...
- Taking the position of the Tof wall hits from MC instead of the reconstructed ones, the situation is about the same for all fragments except for carbonium:



Energy resolution for carbonium