A determination : more realistic simulation

A determination with the constrained fit performed by Vincenzo

8 Fragments studied

Z	1	2	3	4	5	6	7	8
A	1	4	7	9	11	12	14	16

A determined by:

- **TOF - TRACKER**
- **TOF – CALO**
- **TRACKER - CALO**

Realistic simulation for

- **beta (TOF)**
- **Total kinetic Energy (CALO)**
- **momentum (TRACKER)**

Fit the Total Kinetic Energy, the tof and the momentum with the 3 constraints on the mass (Augmented Lagrangian Method)

Franchini - Spighi

Reconstructed quantities

For each fragment

- **TRUTH**
  - **generate Ekin_nucl with Gaussian (μ=200 MeV, σ=10 MeV)**
  - **generate theta and phi**
  - **evaluate all the other quantities**
- **RECO**
  - **Ekin_reco = Gaussian (μ= Ekin_truth, σ=3%)**
  - **Theta_reco = Gaussian (μ= Theta_truth, σ=0.004)**
  - **Phi_reco = Gaussian (μ= Phi_truth, σ=0.004)**
  - **P_reco = Gaussian (μ= P_truth, σ=3%)**
  - **Tof_reco = Gaussian (μ= Tof_truth, σ=100 ps)**
- **ADDITION**
  - **Ekin and Tof multiplied by a random number generated by the ratio**
    - **Ekin → E_depo/Ekin_truth**
      - **E_depo = energy deposit in SCINT + CALO**
    - **Tof → Beta_tof/beta_gen**
      - **Beta_tof = track_length/((time_SCINT – time_SC)*c)**

Vincenzo

Total Kinetic Energy, Beta, Momentum

take care of the "detector effect" in the Giuseppe simulation
Input: /gpfs_data/local/foot/Simulation/16O_C2H4_mag_highThres.root

Selected tracks that pass all the subdetectors

KINETIC ENERGY

$E\downarrow kin_truth - E\downarrow depo\ (scint+calo) / Ekin_truth$

→ **how much the peak is far from 0**

$E\downarrow depo\ (scint+calo) / Ekin_truth$

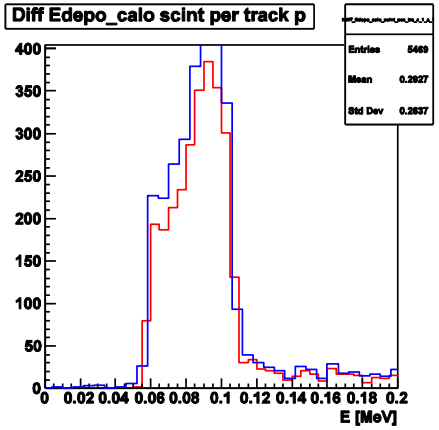
→ **how many events underestimate kinetic energy**

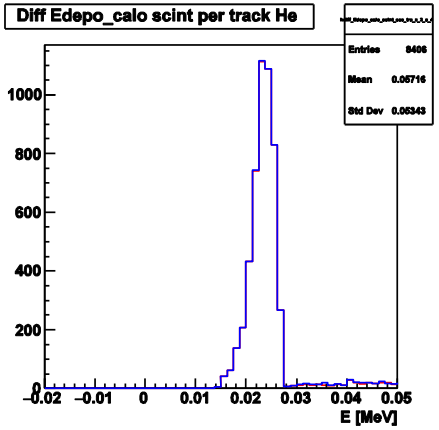
Primary + 1 secondary inside 3 cm from the primary (not sure on the correctness)

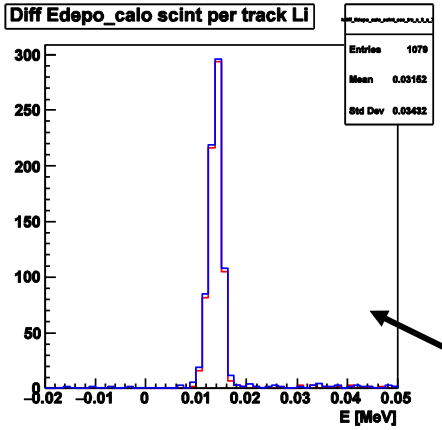
TOF

$track\downarrow lenght\ / c * (Tofscint - Tofcalo)\ /$ Betatruth

MOMENTUM still not implemented

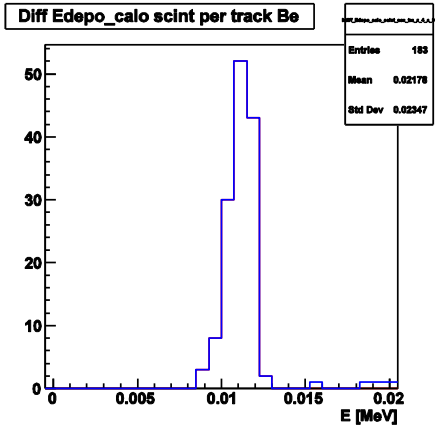


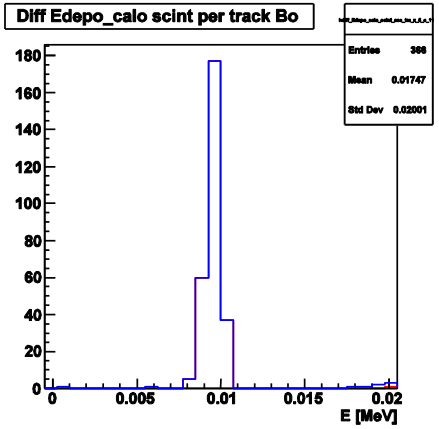


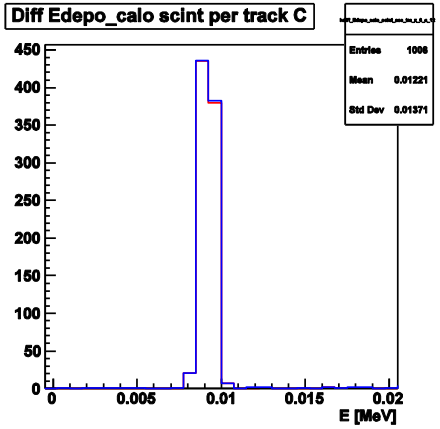


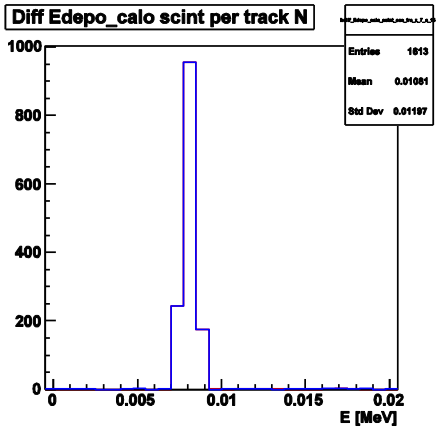
E_kin_nucl

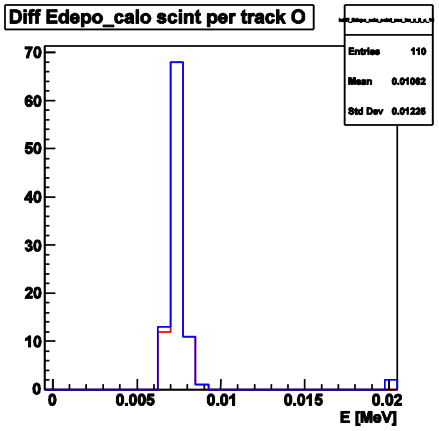
Events in the peak (%)







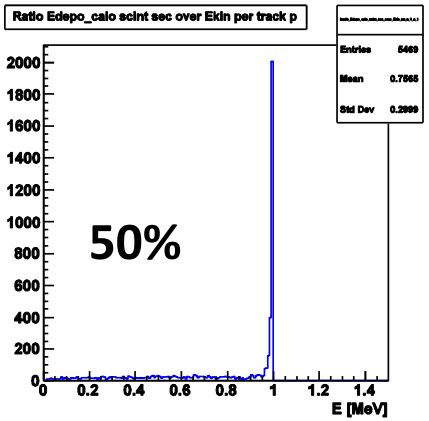


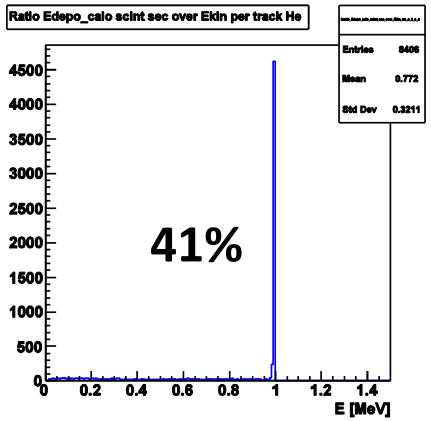


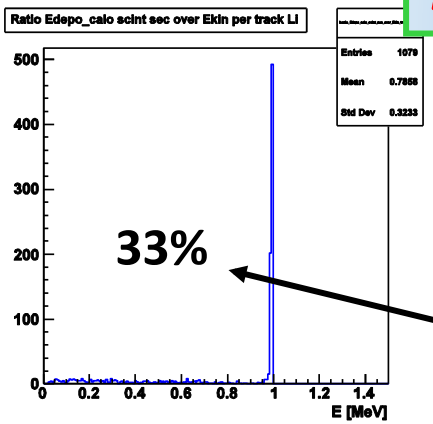
Peak expected at zero
Proton: peak at ~ 5-10%
He – Li: peak at 1-2 %
Be – O: peak <= 1%

The secondary do not improve (probably an error in my code)

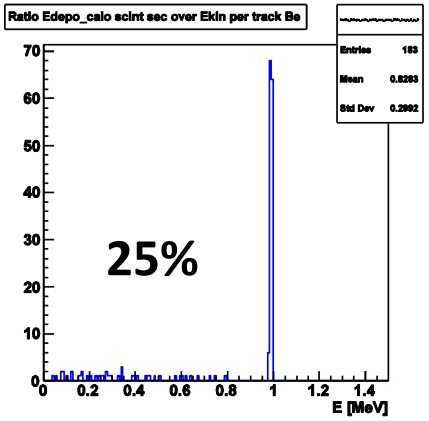
Edepo/E_kin_truth

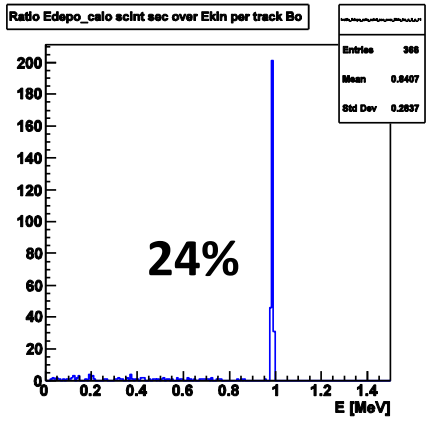


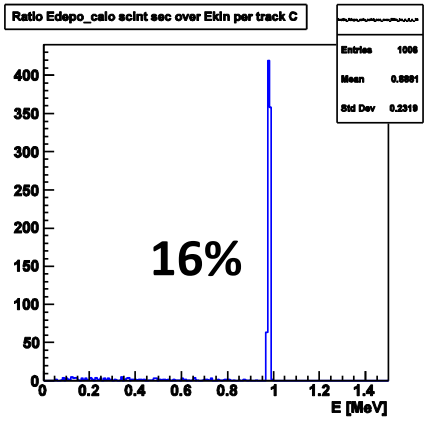


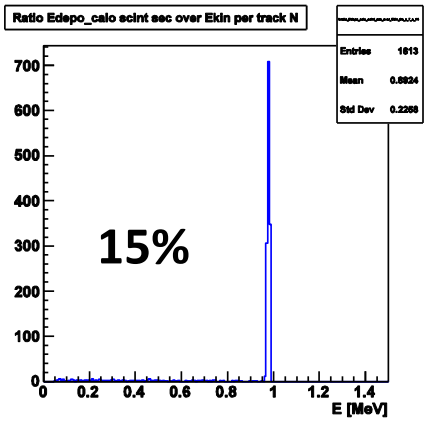


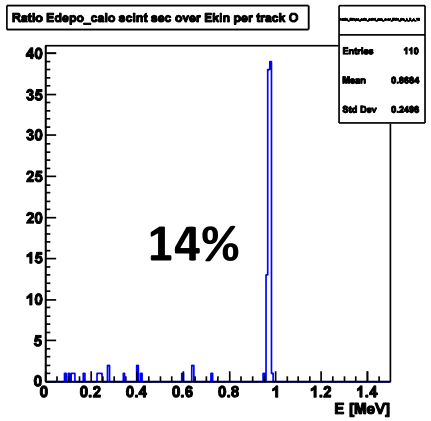
Events outside peak





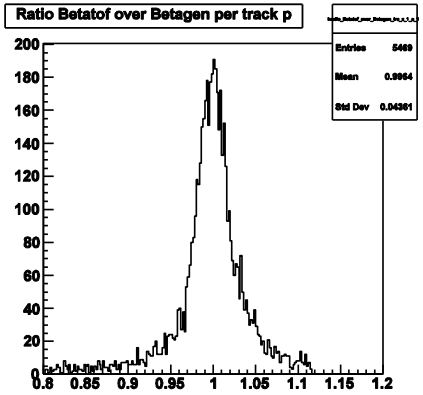


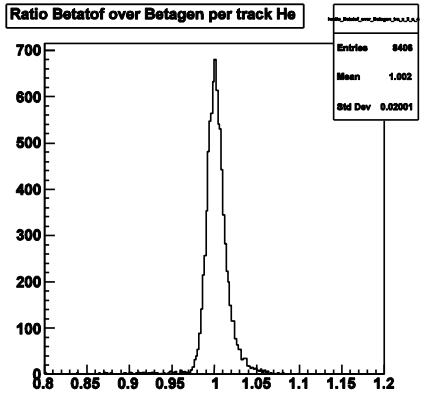


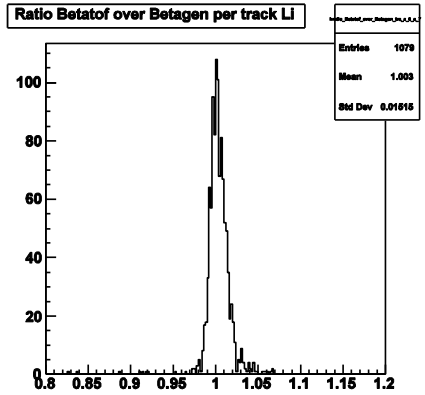


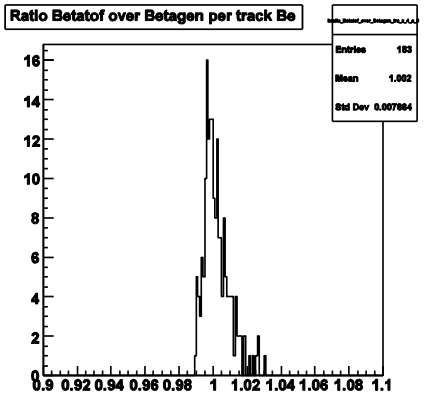
To consider in the simulation

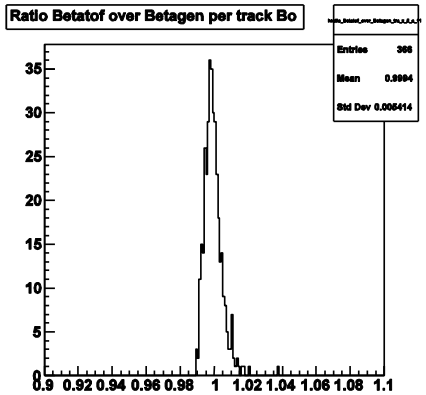
Beta_tof/Beta_truth

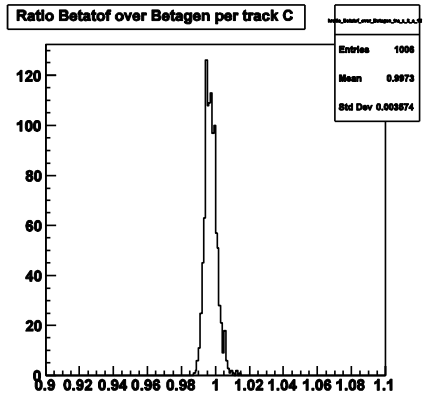


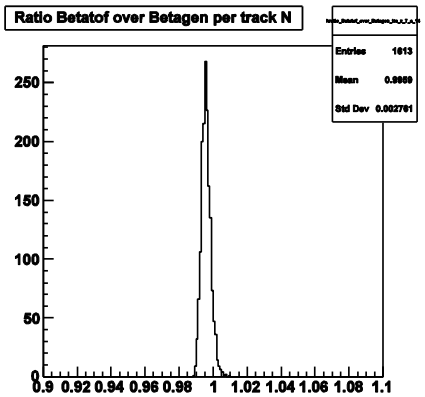


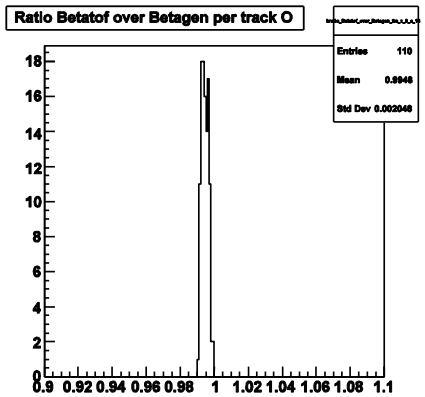




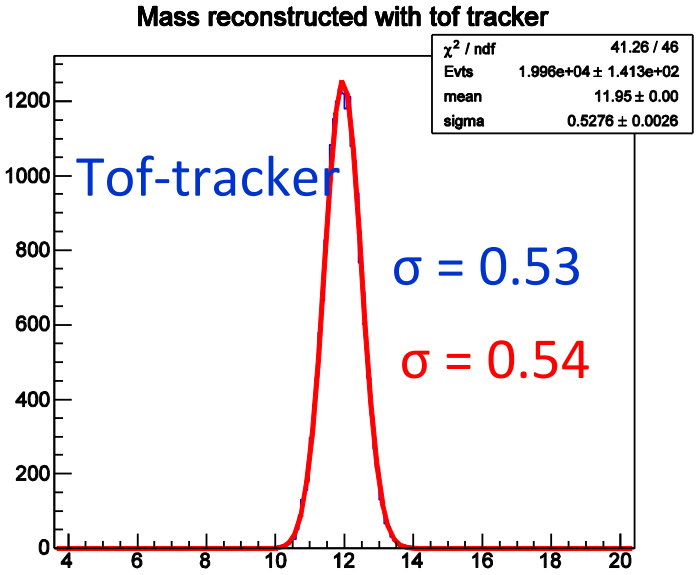


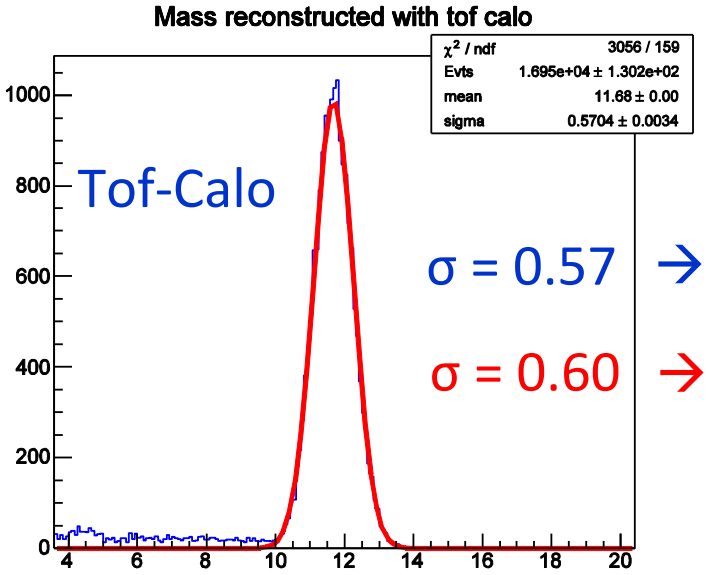


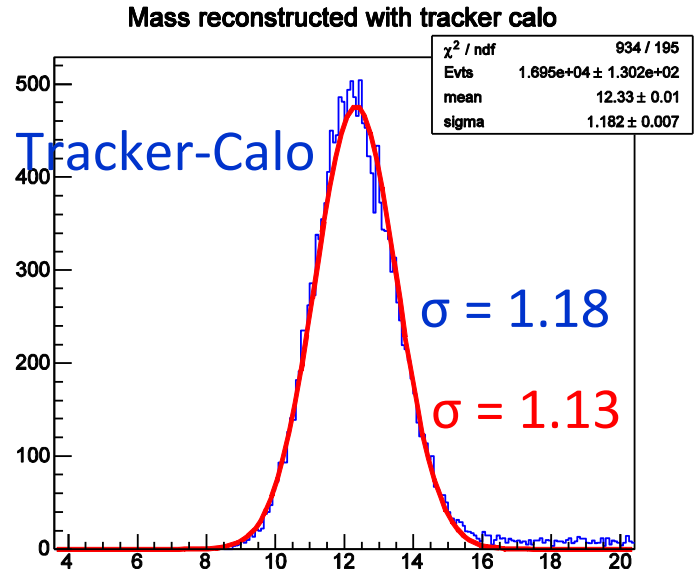


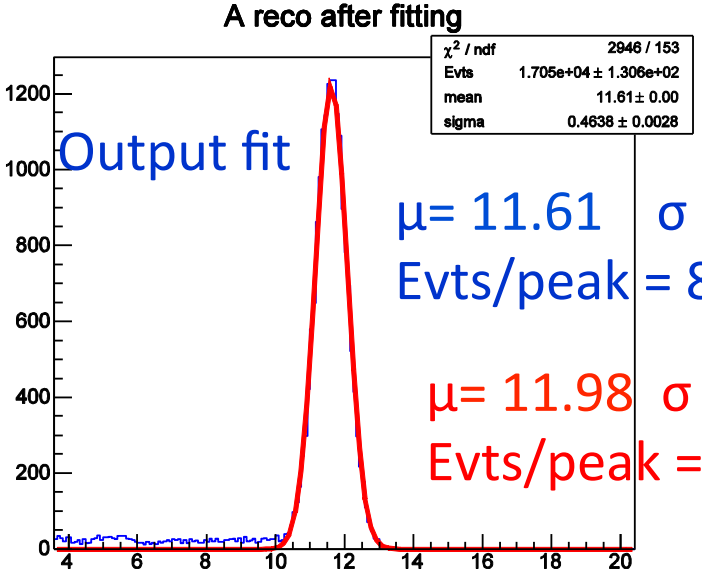


Fit outputs: A fragment 5

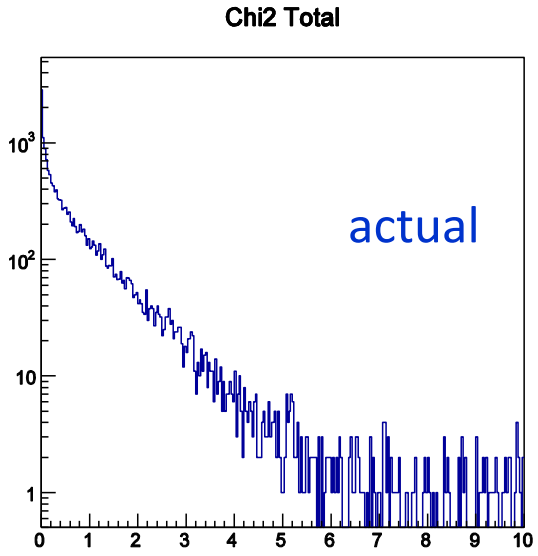


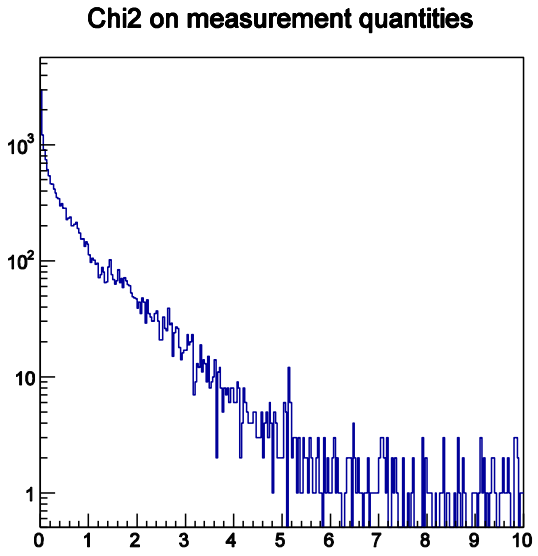


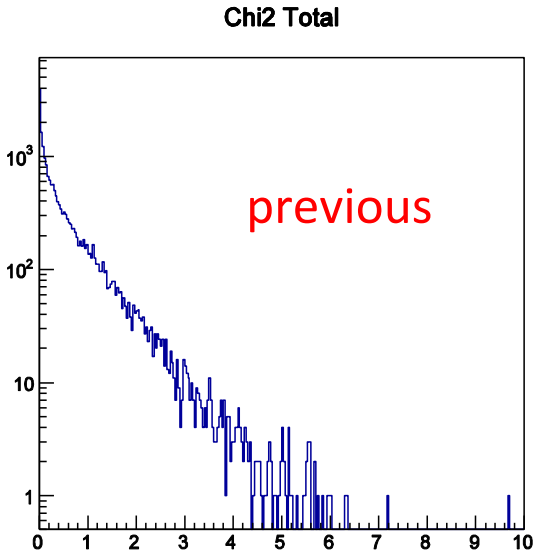


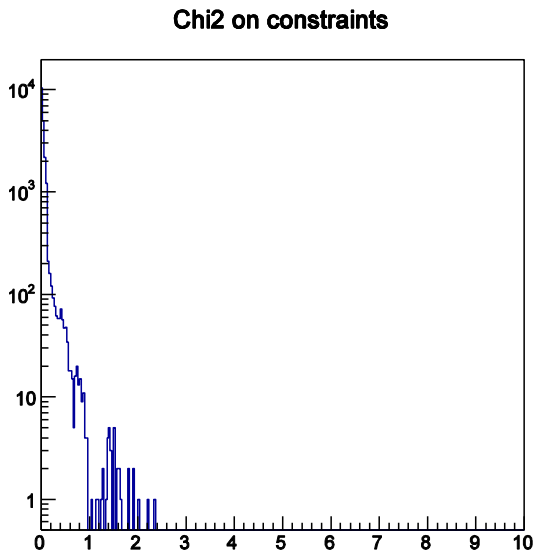


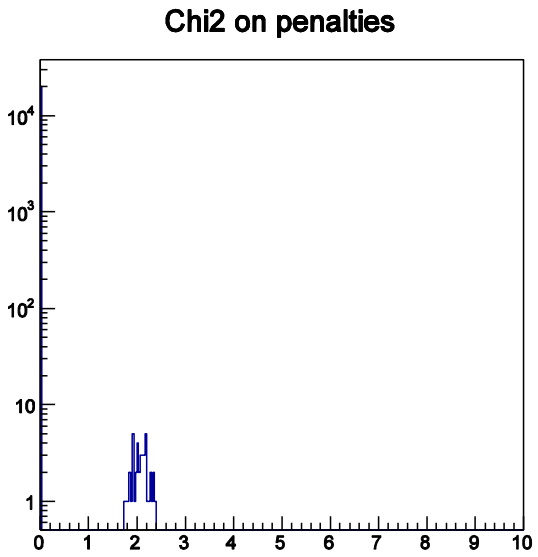
Fit outputs: Chi2 fragment 5



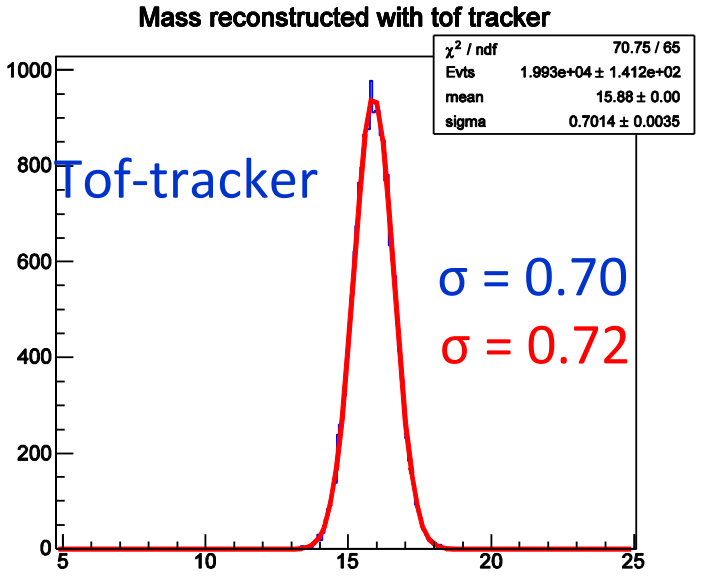


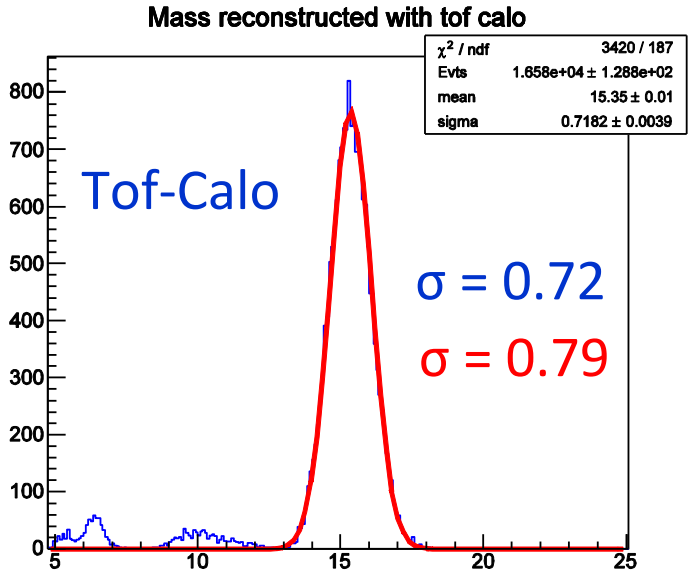


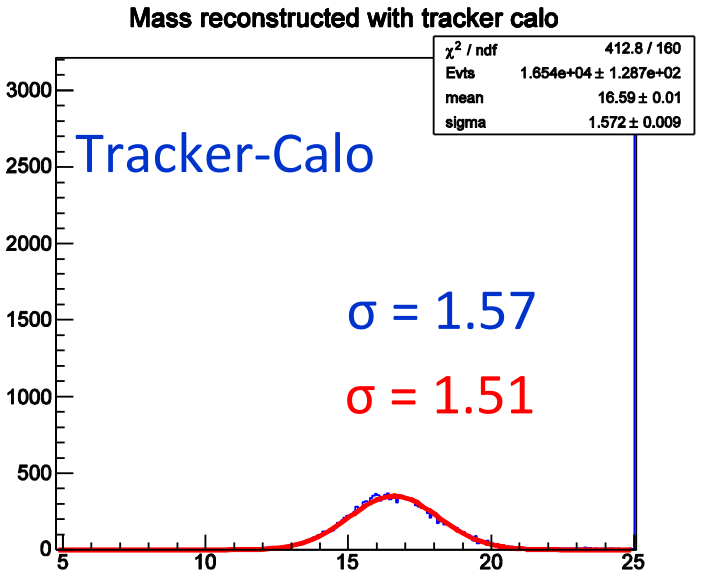


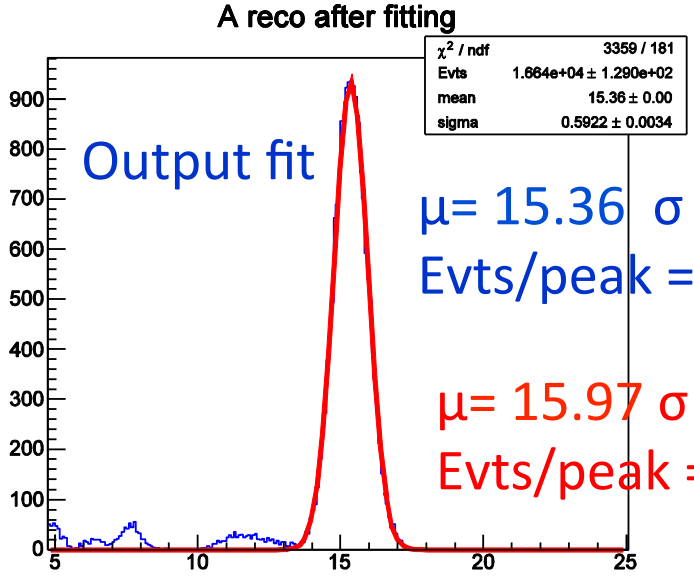


Fit outputs: A fragment 7

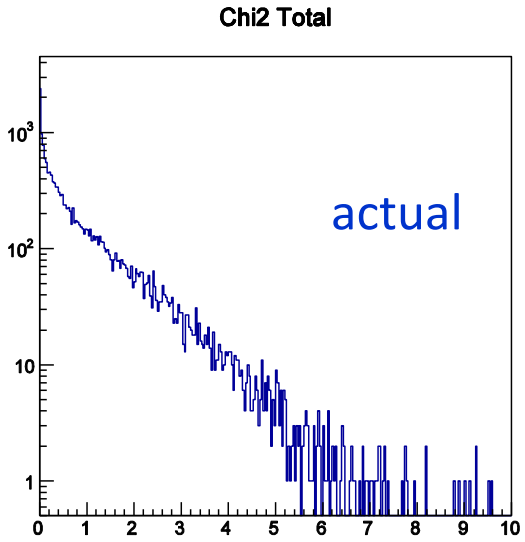


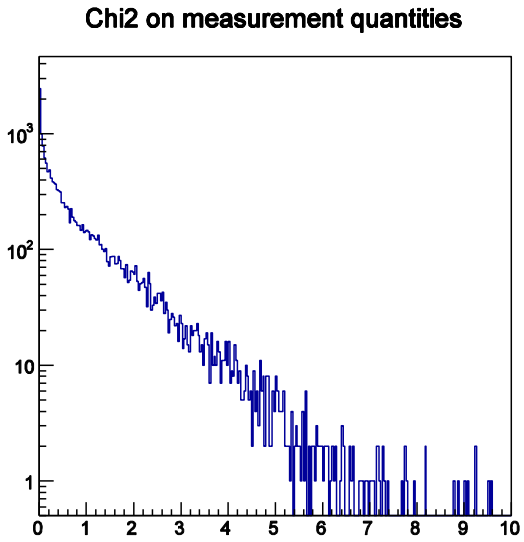


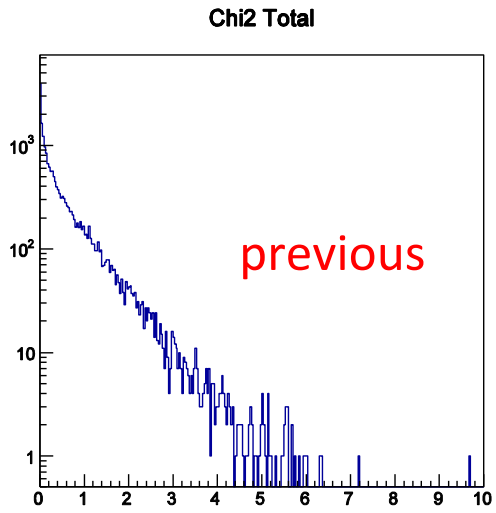


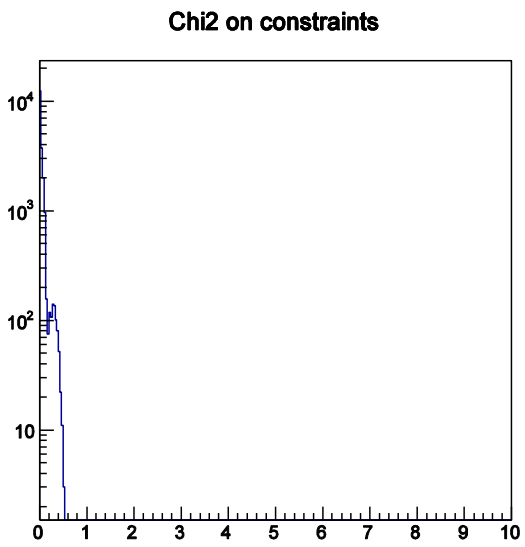


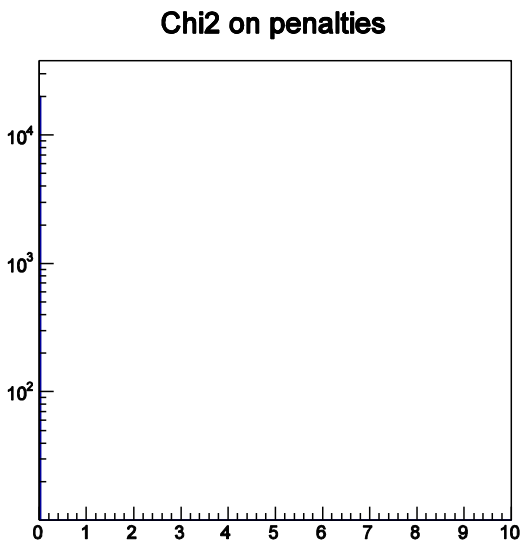
Fit outputs: Chi2 fragment 7











Conclusion

Keeping into account

- loose of kinetic energy + resolution at 3%
- tof mis-measurements + resolution of 100 ps
- momentum resolution at 4%

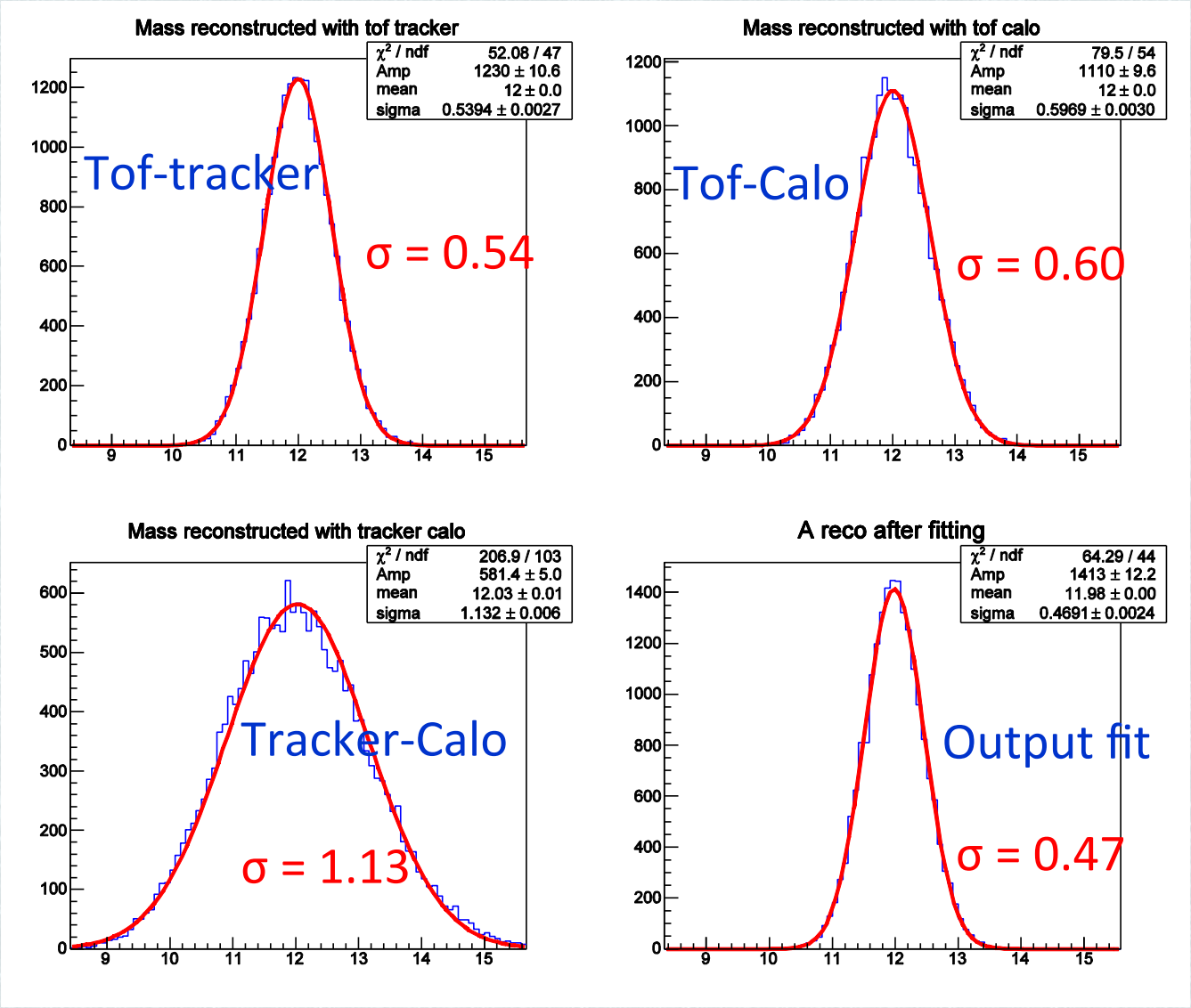
- Loose 15-20% of events
- Underestimate A

Future

- Keep into account momentum mis-measurements
- Include de/dx
- Test a normal chi2 fit

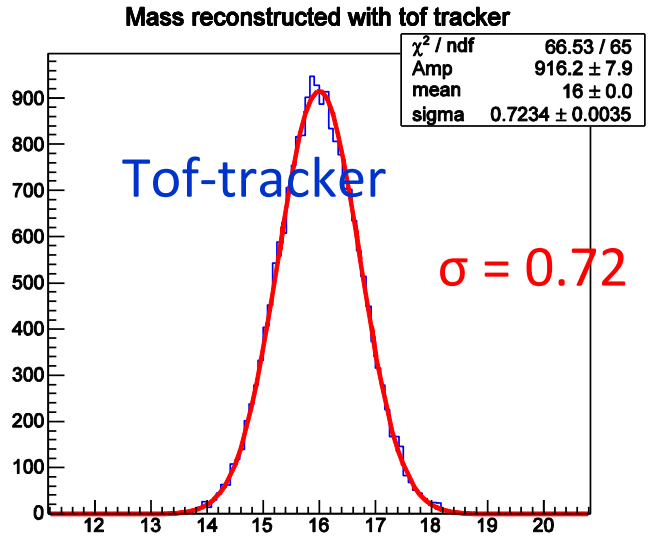
Backup

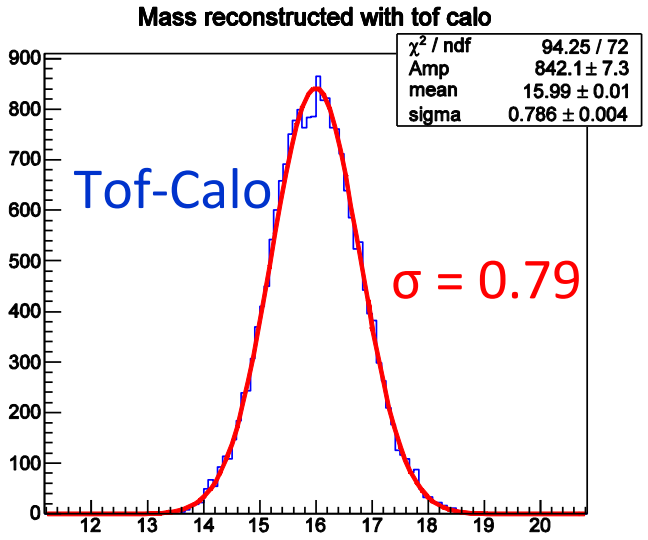
Fit outputs: A fragment 5

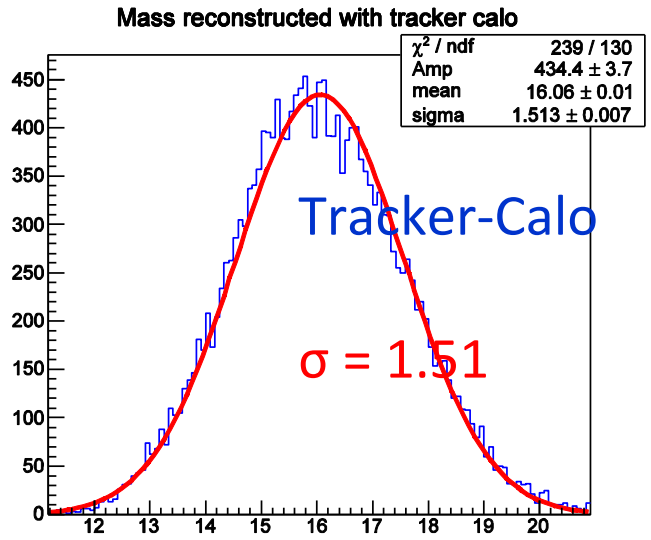


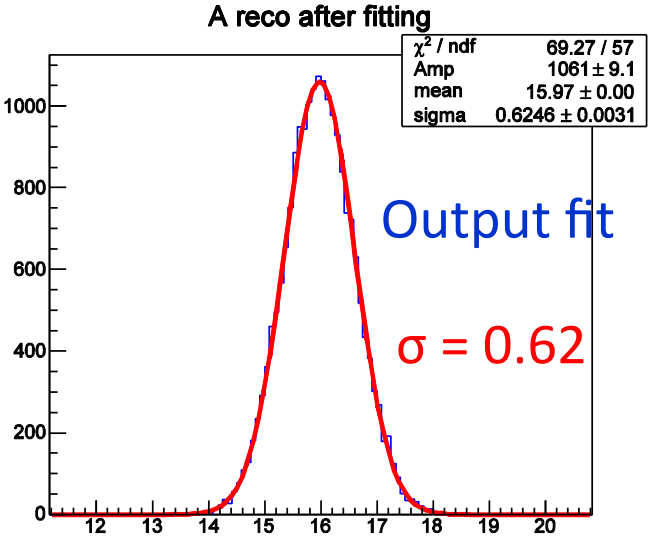
The fit improve the precision

Fit outputs: A fragment 7









The fit improve the precision