Analysis Studies for GSI2021 campaign

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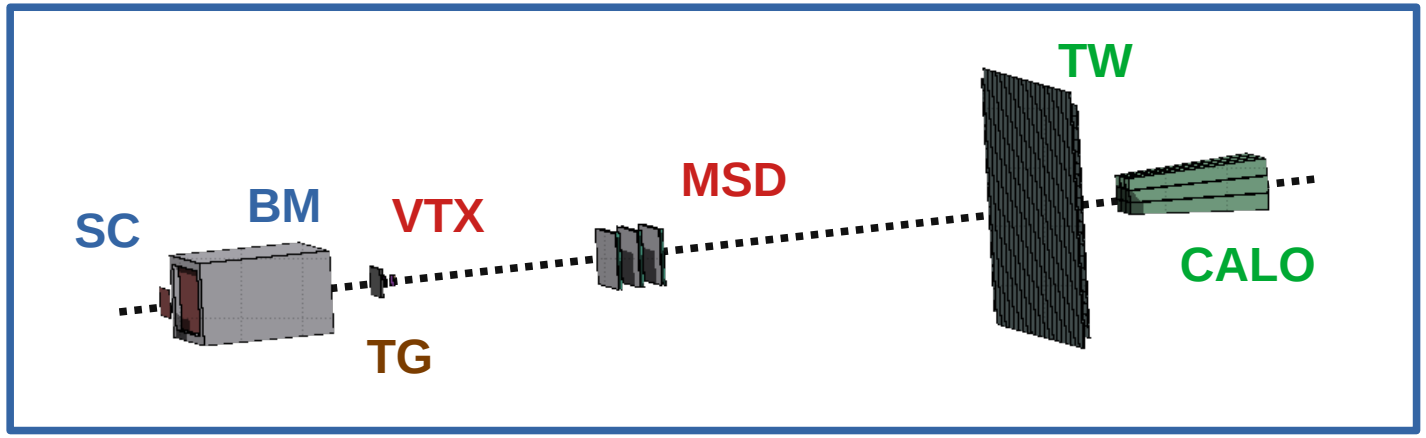
Goal

- Analysis of data taken at **GSI** in 2021 of **^{16}O 400 MeV/u** and **200 MeV/u** against **C** as target
- Analysis integrated in **SHOE** and optimization for specific data



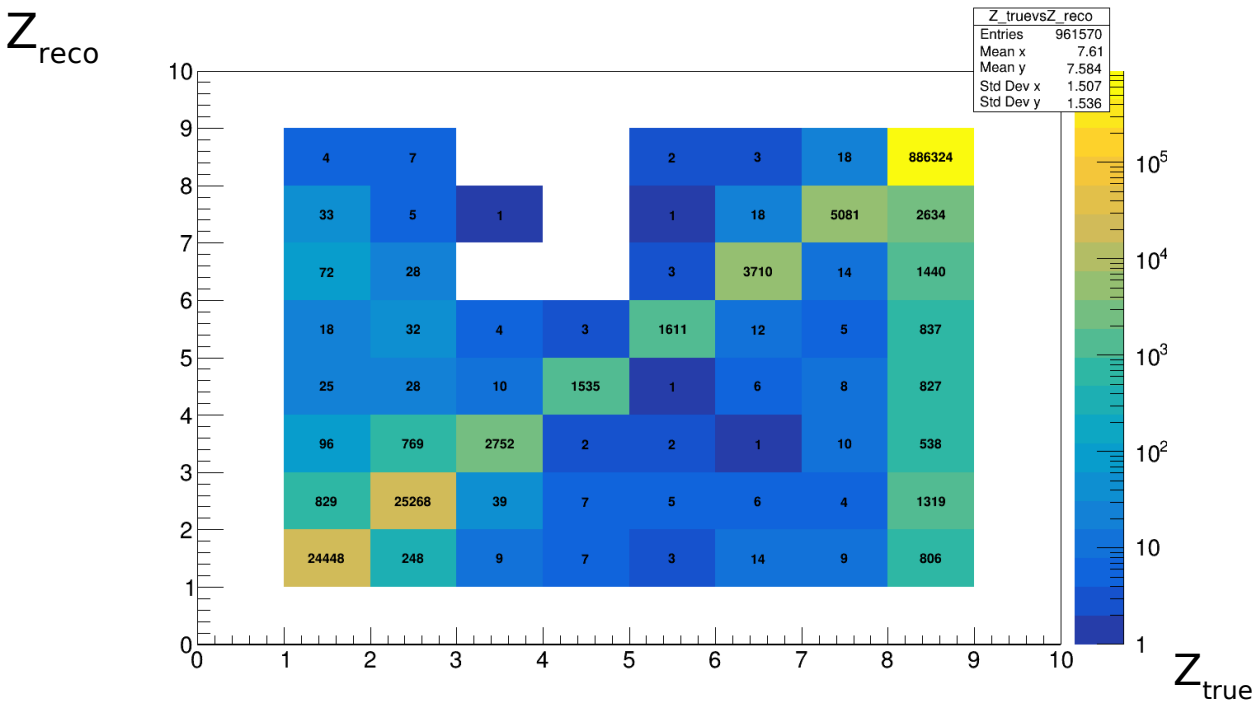
Specific goal:

- Elemental fragmentation cross section
- Angular differential cross section

Reconstruction

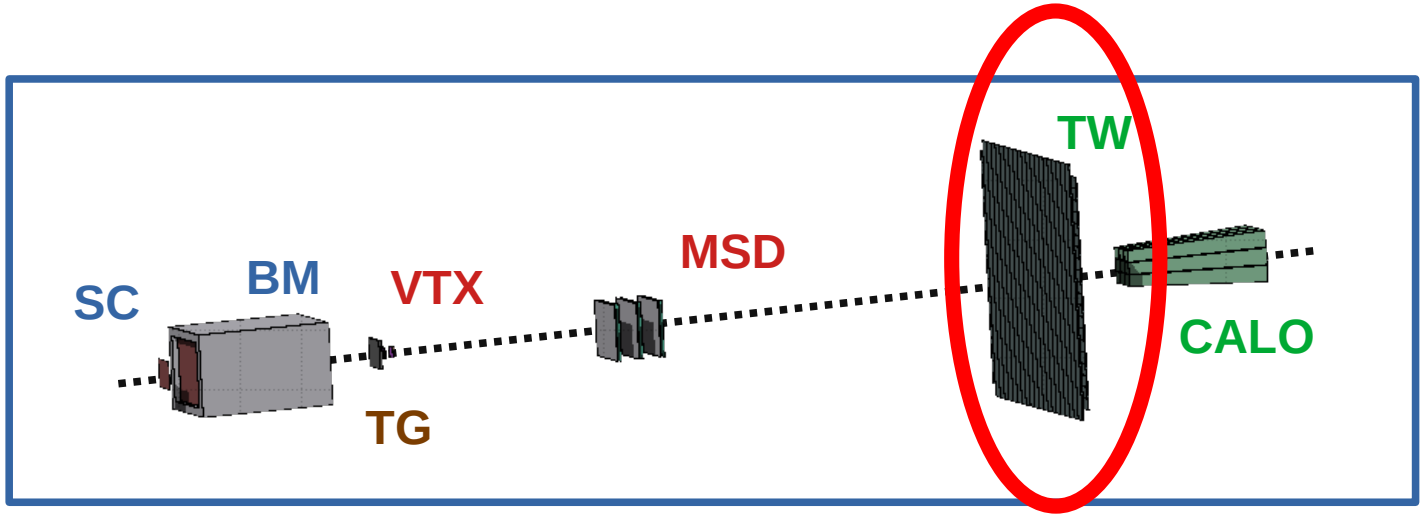
- Starting with MC data reconstructing fragment charge
- Study of the **MC tracks** reconstructed by **tracking algo**

  - **Migration Matrix diagonal + misreconstruction**



- Global mis-reconstruction around 1%
- Main contribution of misreconstructed charge for **Z=8** and Z=**1,2 → where the statistics is high**

Reconstruction, cuts

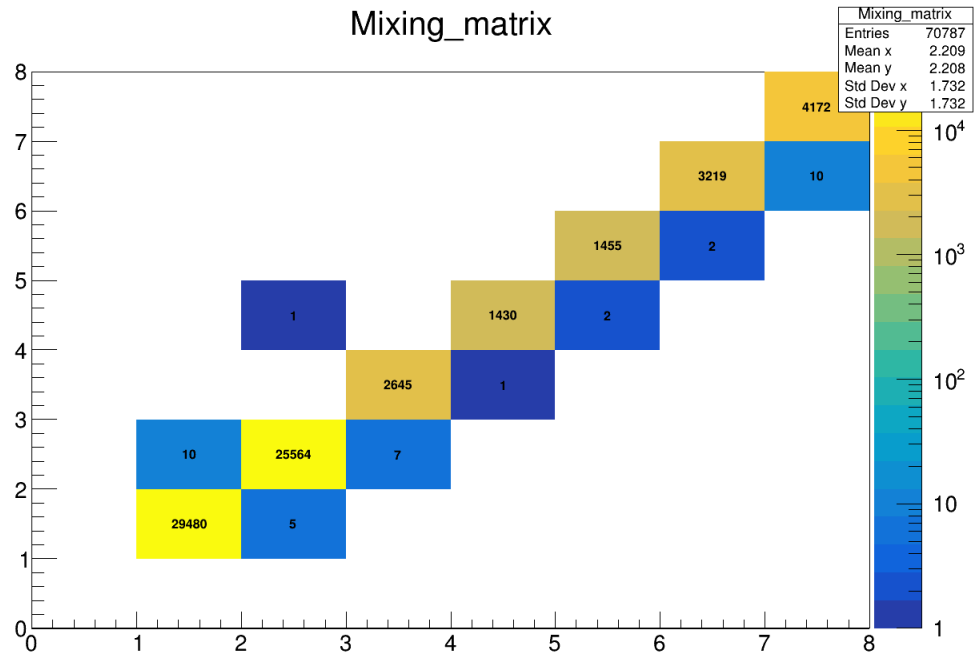


- Cuts can be applied in order to make the migrant matrix more diagonal
- Let’s inspect how charge is reconstructed in TW

Reconstruction, TW Algo

- Let's study the **MC particle**, directly generated by the simulation
- **MC** particles generated in TARGET which arrives after the TW → what can be detected by my apparatus
- Z_{MC} vs $Z_{TW-ALGO}$

Z_{TW}



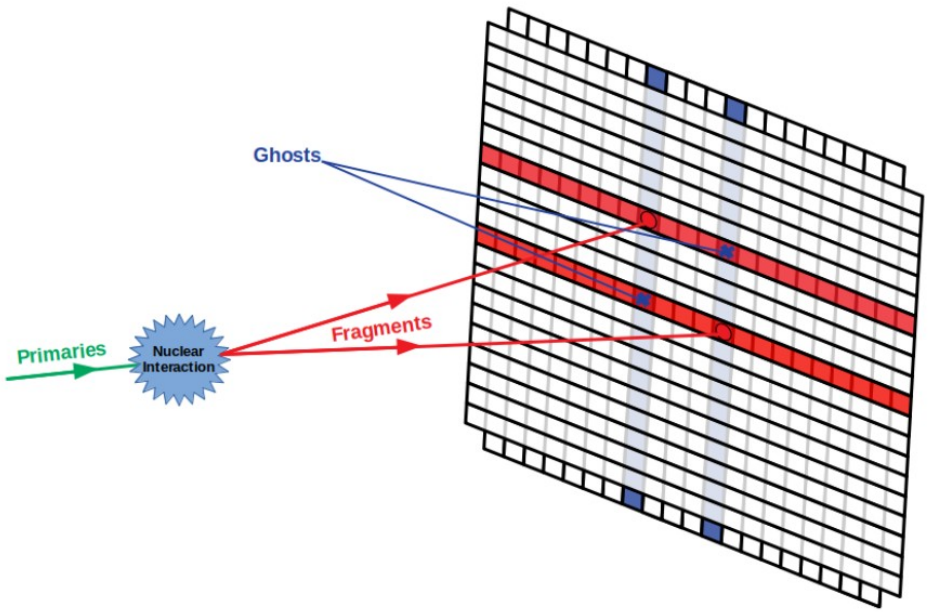
Z_{true}

- Much more diagonal
- TW algo systematic is not the main problem

Reconstruction, Track Algo

- One source of systematics could be the presence of Pile up / Ghost hits in the TW point of the track

twp→GetMcTracksN() > 1 :

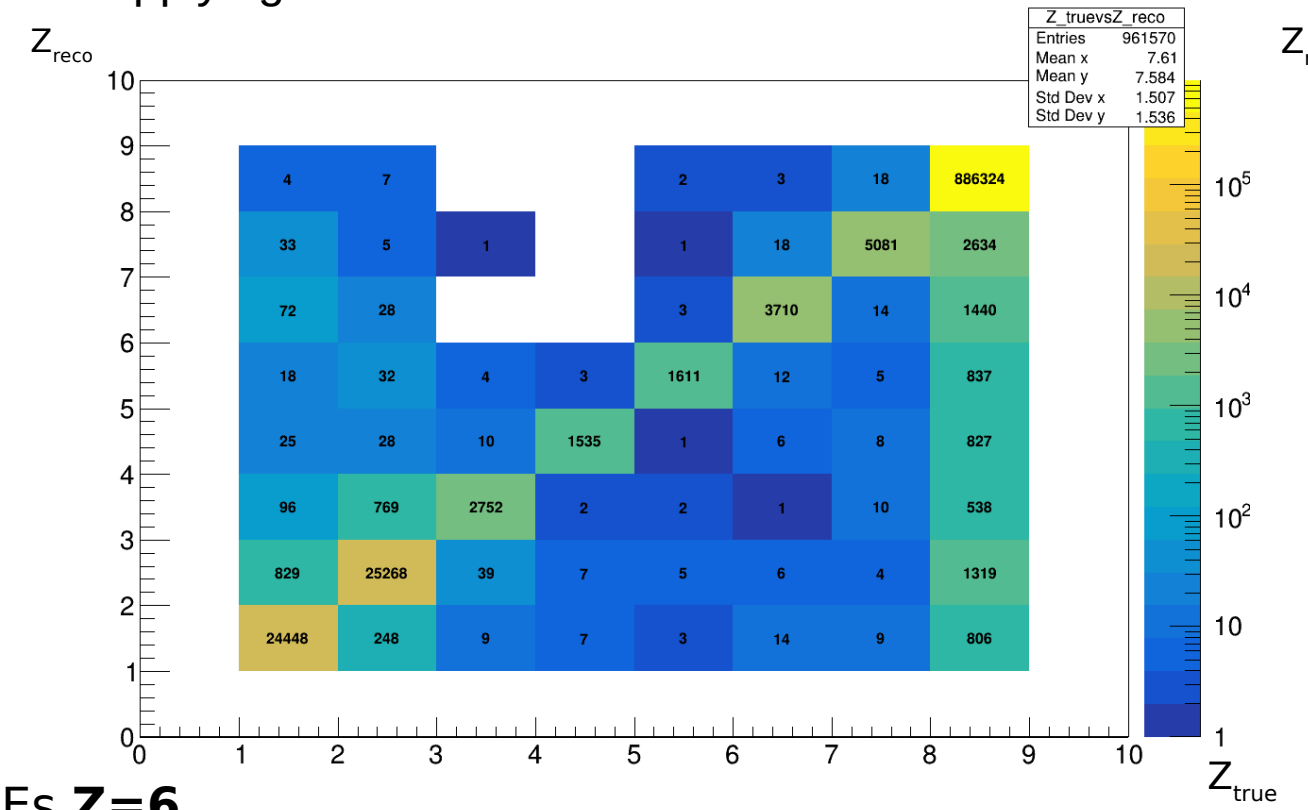


- The object TATWPoint is the superimposition of the Hit_x and Hit_y on the rispective bars
- It is possible that every bar is hitted with more than a particle at the same time:
  - **Pile up**
  - **Ghost hits**
- The reconstructed charge is then wrong because of a wrong hits input

→ remove them asking **GetMcTracksN() == 1**

Reconstruction, Track Algo

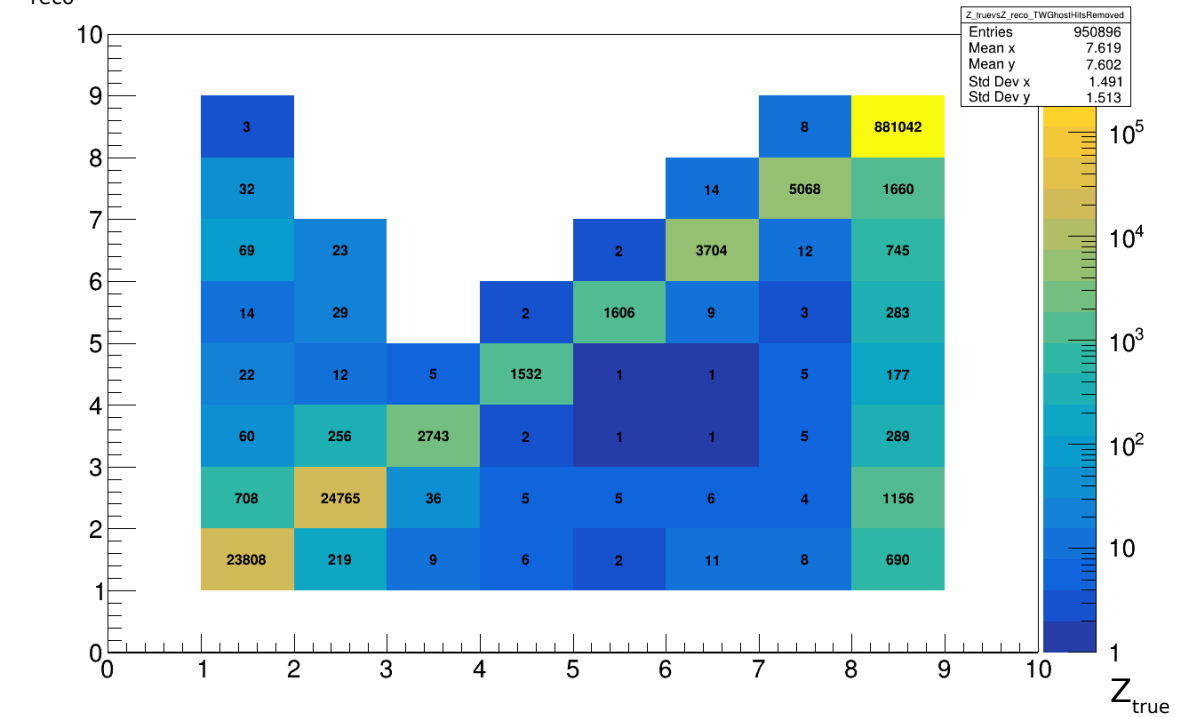
- Applying the TW Ghost Hits cut:



Es **Z=6**

Mis-reconstructed: 30% (27% from Oxygen)

After cut:



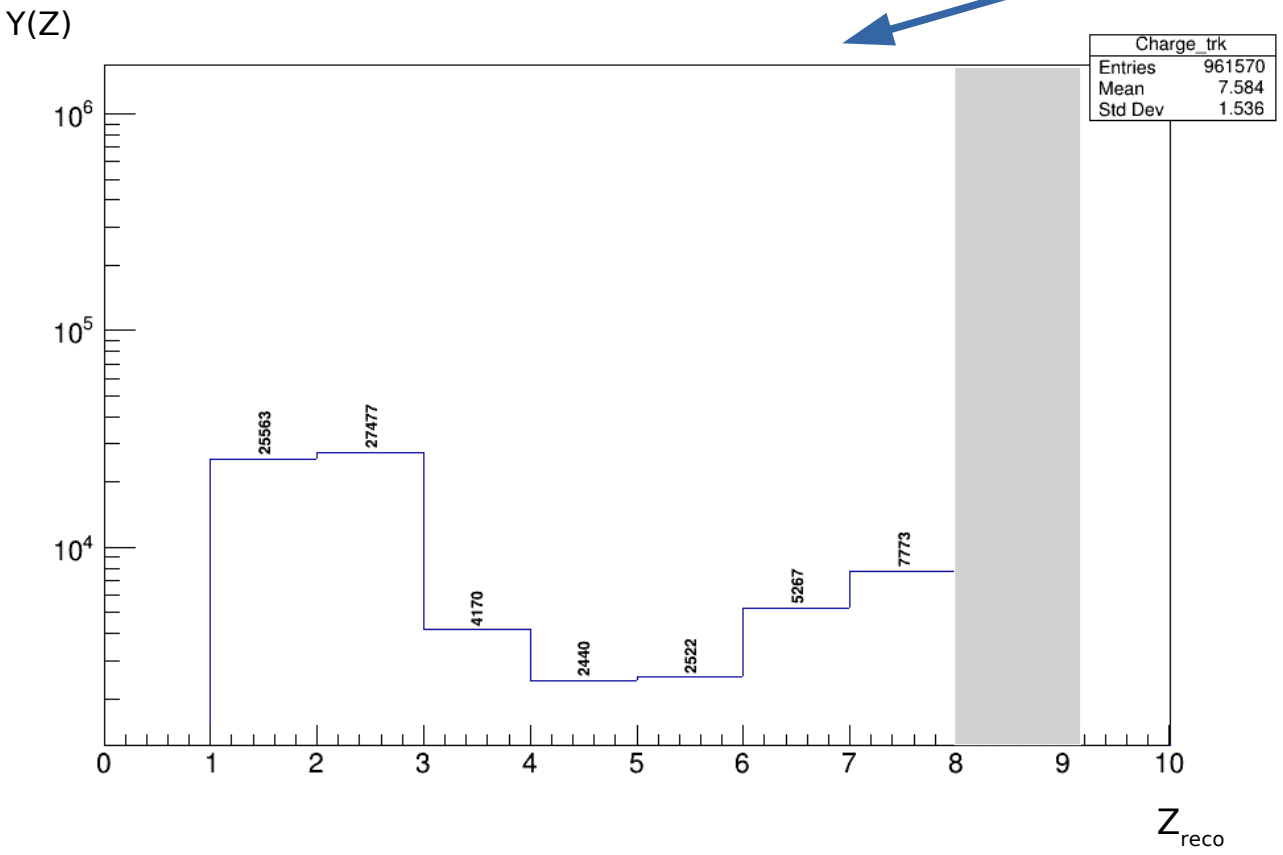
Mis-reconstructed: 19% (16**%** from Oxygen)

Reconstruction

$$\sigma = \frac{Y_f \cdot}{N_{beam} \cdot N_{target} \cdot \epsilon}$$

Reconstruction, Yield

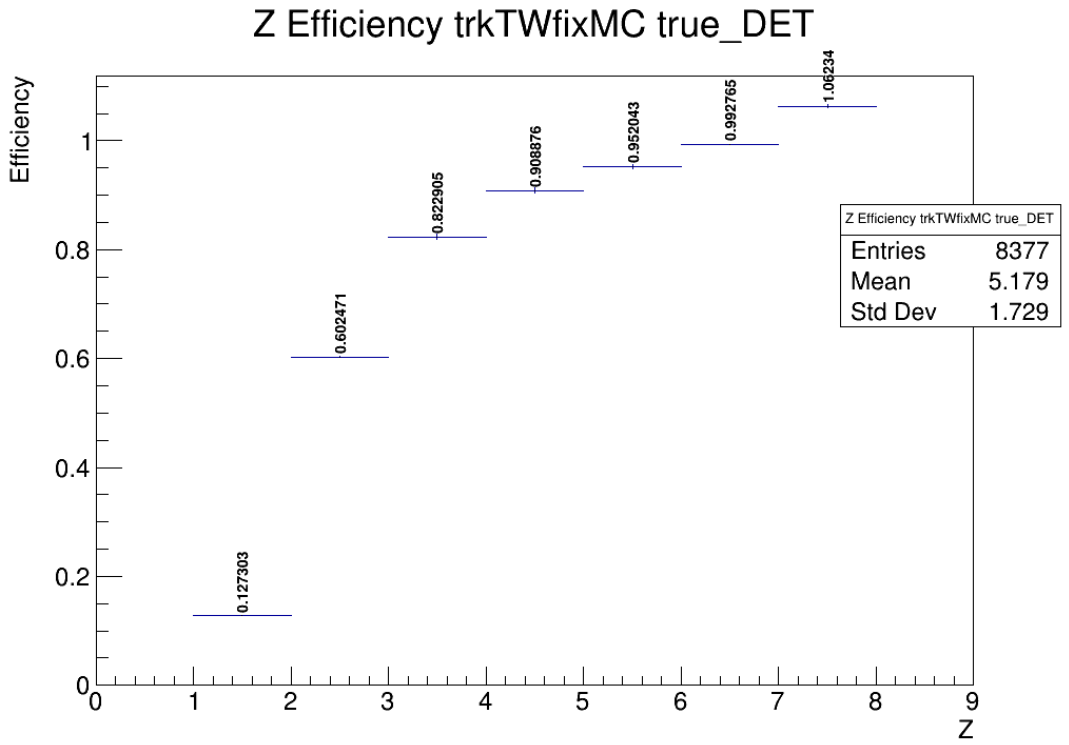
$$\sigma = \frac{Y_f}{N_{beam} \cdot N_{target} \cdot \epsilon}$$



Reconstruction, efficiency

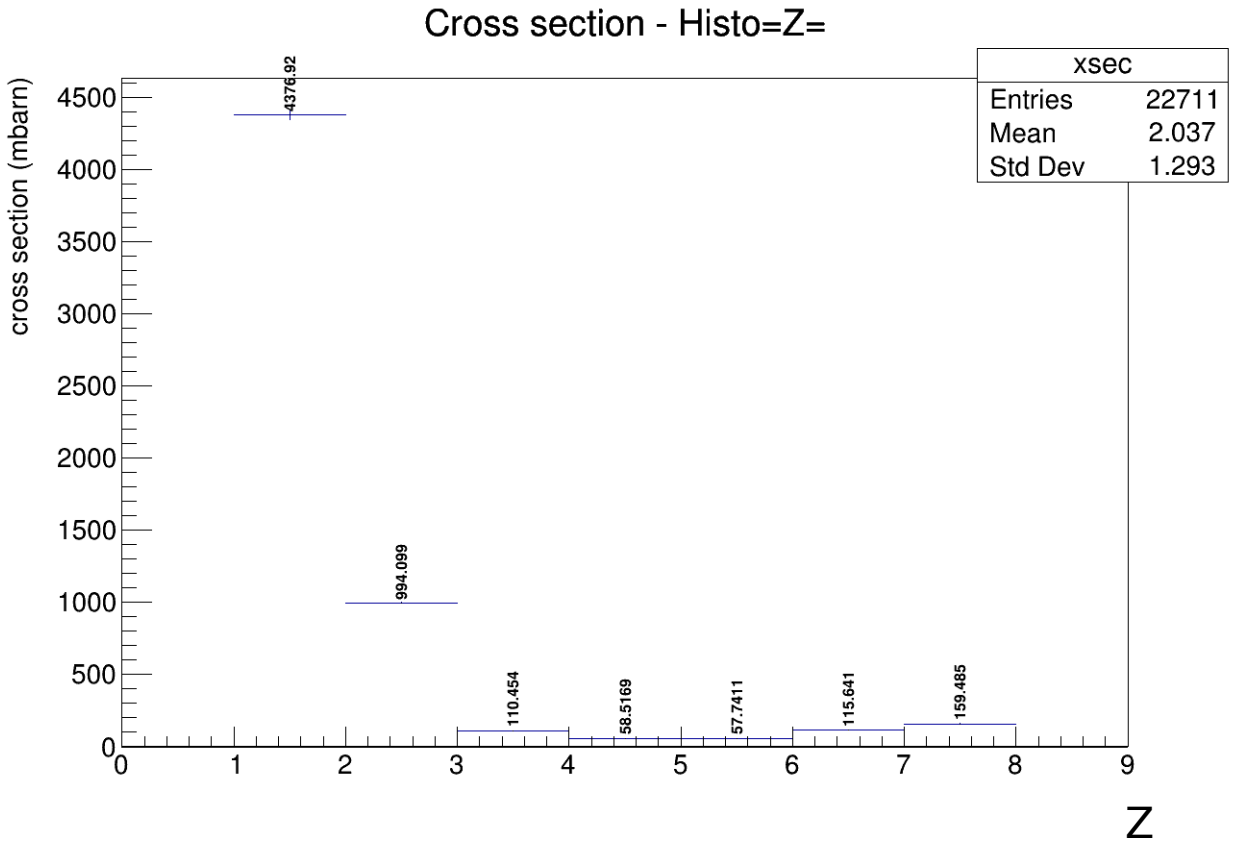
$$\sigma = \frac{Y_f}{N_{beam} \cdot N_{target} \cdot \epsilon}$$

- **Reconstruction efficiency**
  reco tracks / simulated particles



Elemental frag. cross section

$$\sigma = \frac{Y_f}{N_{beam} \cdot N_{target} \cdot \epsilon}$$

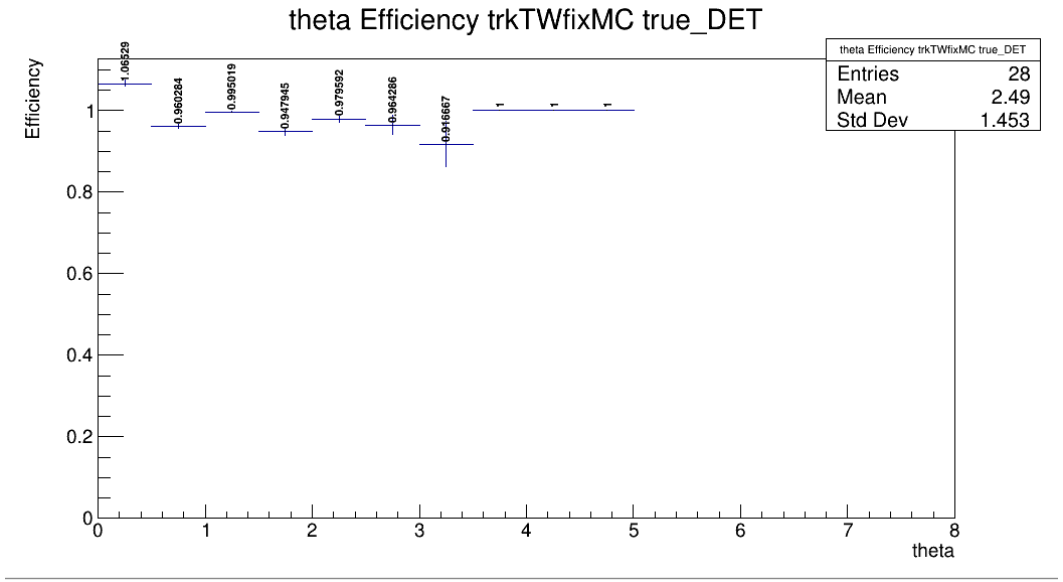


- Values of Z=1,2 depends on the cut MC (es. angular acceptance)

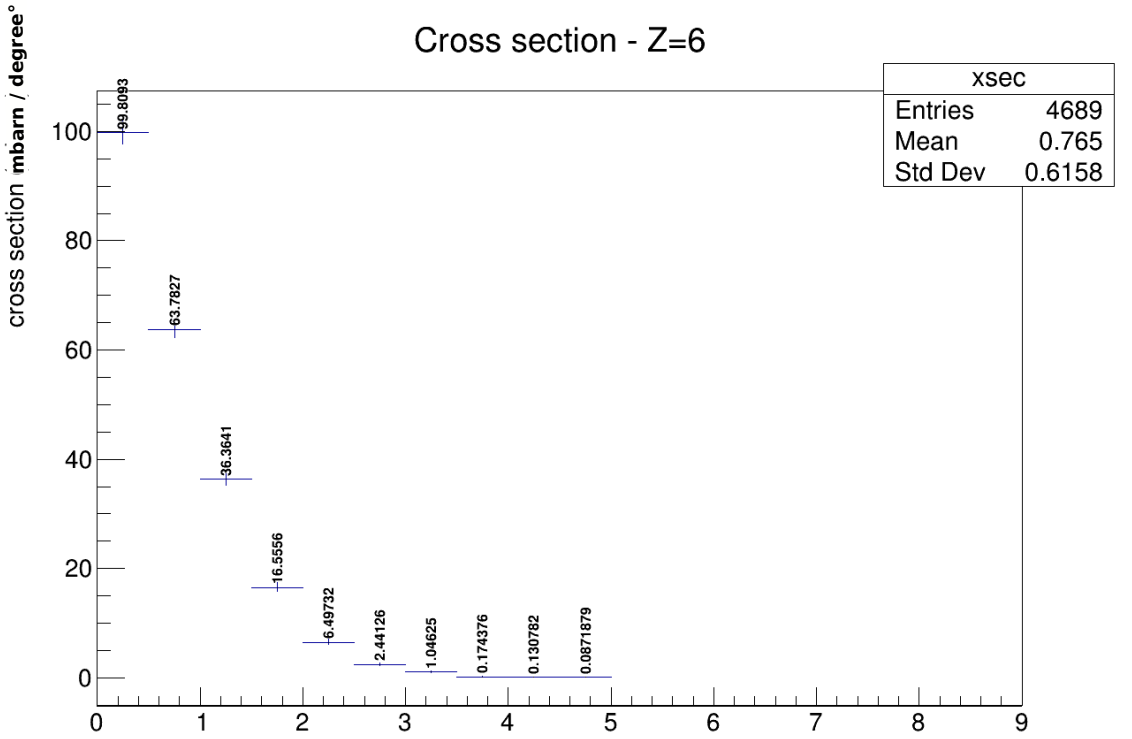
Angular differential cross section

$$\frac{d\sigma}{d\theta} = \frac{Y_f \cdot}{N_{beam} \cdot N_{target} \cdot \Delta\theta \cdot \epsilon}$$

Es **Z=6**



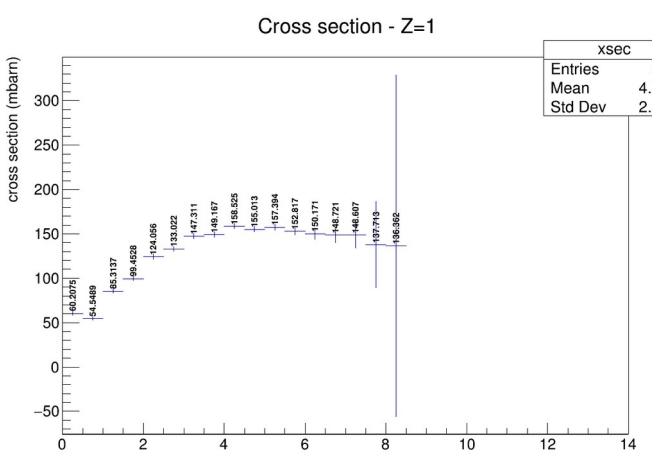
Track efficiency

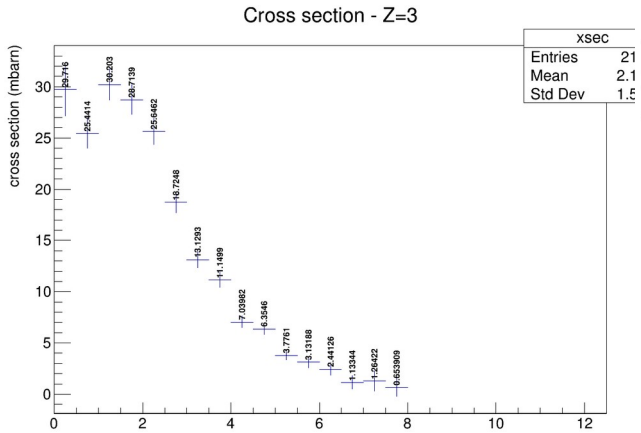


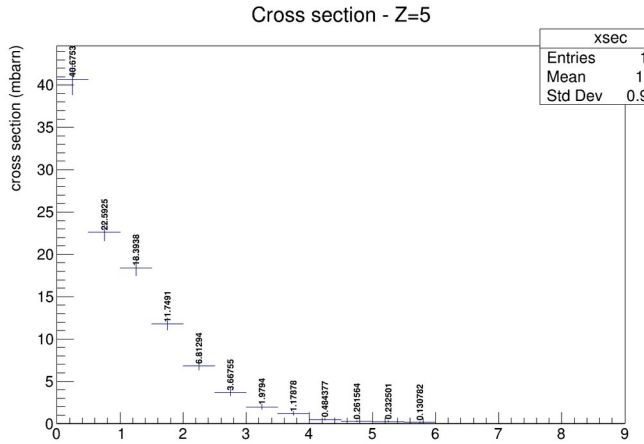
Theta (°)

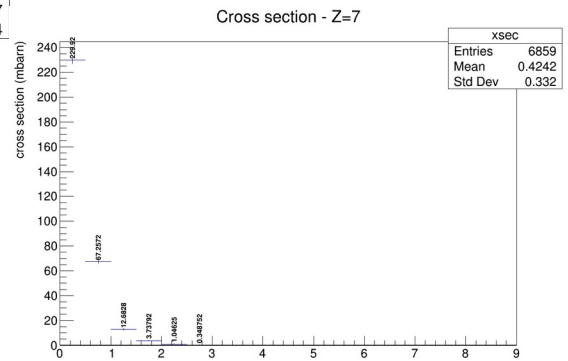
Angular differential cross section

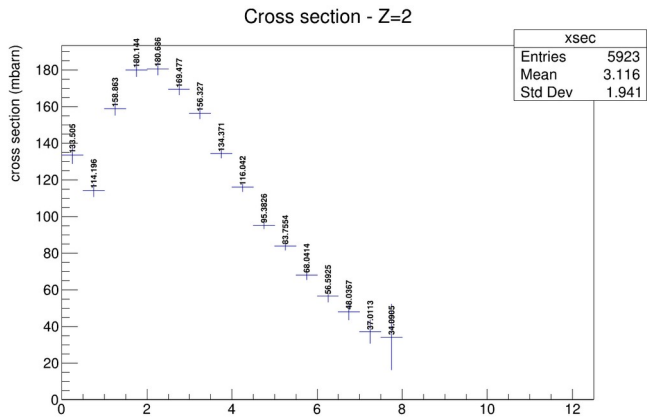
$$\frac{d\sigma}{d\theta} = \frac{Y_f \cdot}{N_{beam} \cdot N_{target} \cdot \Delta\theta \cdot \epsilon}$$

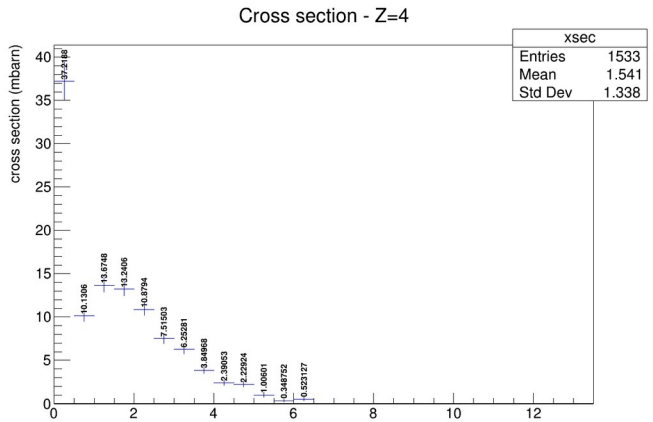


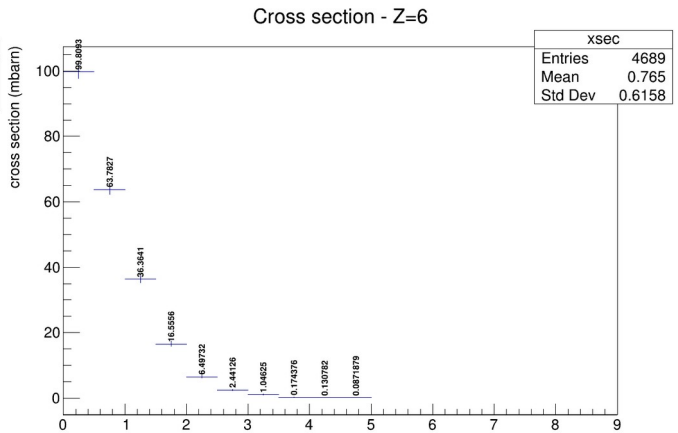












Conclusions

- First preliminary results based on MC events with a **reasonable order of magnitude**

To do:

- Study of further efficiency and systematics due to TW and Track algorithm
- Background to be considered: es fragmentation after target
- Need to study triggered data

- Apply cross section “recipe” to real data