Dipartimento di Scienze di Base e Applicate per l'Ingegneria

Sapienza Università di Roma

Last month activity

A. S.

Work done

- Focused on Fragments
  - Carbon analysis for now on hold: mass fits are indeed hard, as well as Xfeed determinations
- Focused on getting the full exercise done on MC
  - Know what you have generated (from Vincenzo P.)
  - Fit the mass peaks to get the yields
  - correct for efficiencies
  - correct for crossfeed
  - get back what you have generated from reconstruction!

Reconstruction efficiencies

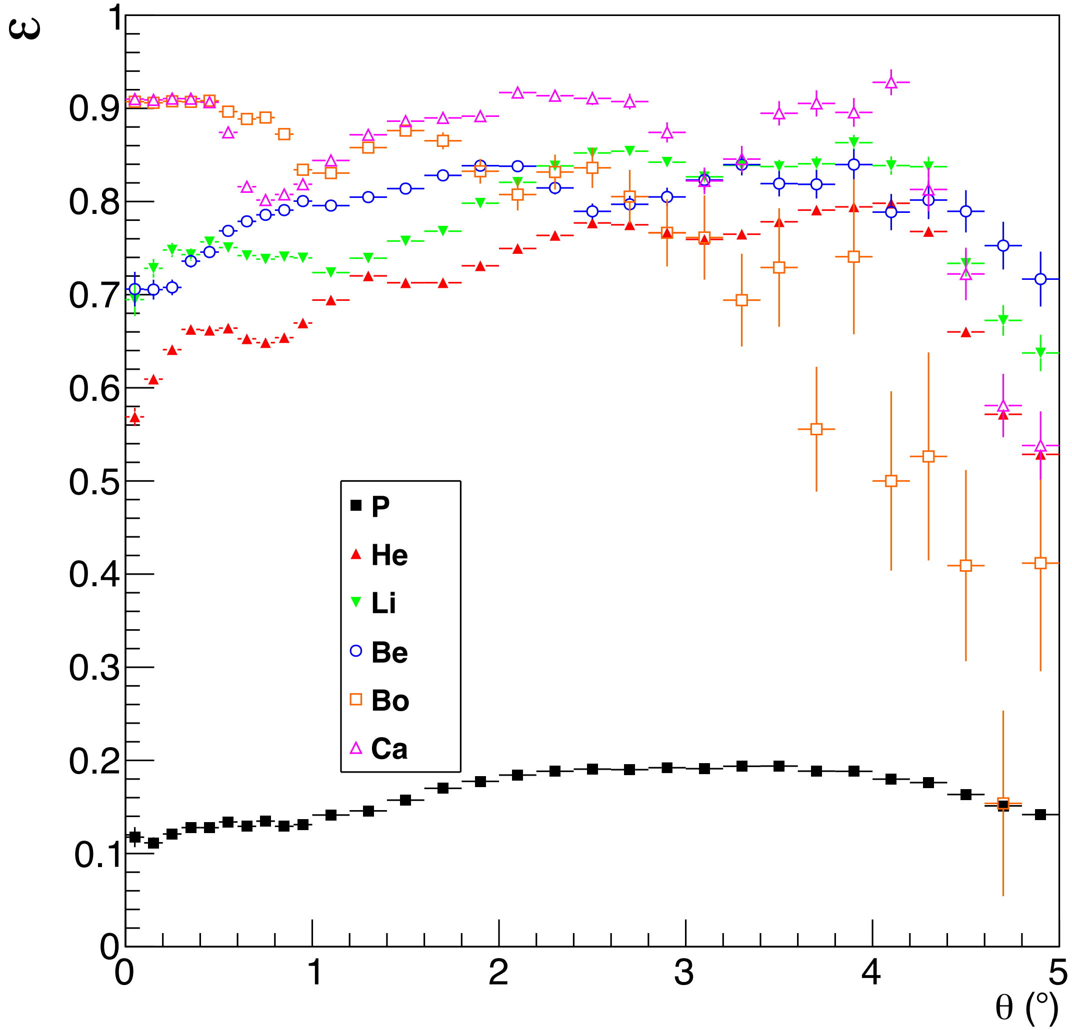
- Once we have a track in our MC how good are we at reconstructing it?
- Efficiency definition:
  - Test sample (denominator): ALL the charged particle in each event with Z_ID btw 1 and 6, **produced inside the target** [this preselection cuts is done using true MC info]. We do require the particle to **exit** the target by asking a scored hit in the mimo for the track we are looking at! [The efficiency of this request is neglected for now (we assume that all the tracks we are using for the efficiency measurement **have** a scored hit in the VTX, checked that this is true at 0.1% level]. We also require that the track **points in the magnet region when it is produced** [that's what the mimo info is used for].
  - **So far: we are not ensuring that the track "makes it to the ToF wall".. I am currently implementing this check to avoid underestimation of the eff.**
  - matched tracks (numerator): found only when rec track is made from a **true vtx track** and a **true tof hit** belonging to the track under study!
- The efficiency is studied as a function of **true angle and true Ekin**

Definition of MC matching

- So the efficiency that we compute is not only the tracking efficiency but also the
  - Vtx reconstruction * ToF reconstruction * Tracking efficiency and **we also keep into account the possible mismatching when making the combinatorial of tracks and hits:** we "find" a matched track only if both vtx track and tof hit come from the true track under study. If we mixed up the track with another ToF hit, we count it as "inefficiency"... [I need more time to understand if we do really want to treat this case in this way]
  - **Pretty much what we need to convert the yield in a cross section measurement!**
- This efficiency heavily depends on
  - The energy the on the ToF (for protons)
  - How much is an event crowded

ε vs θ distributions (all tracks)

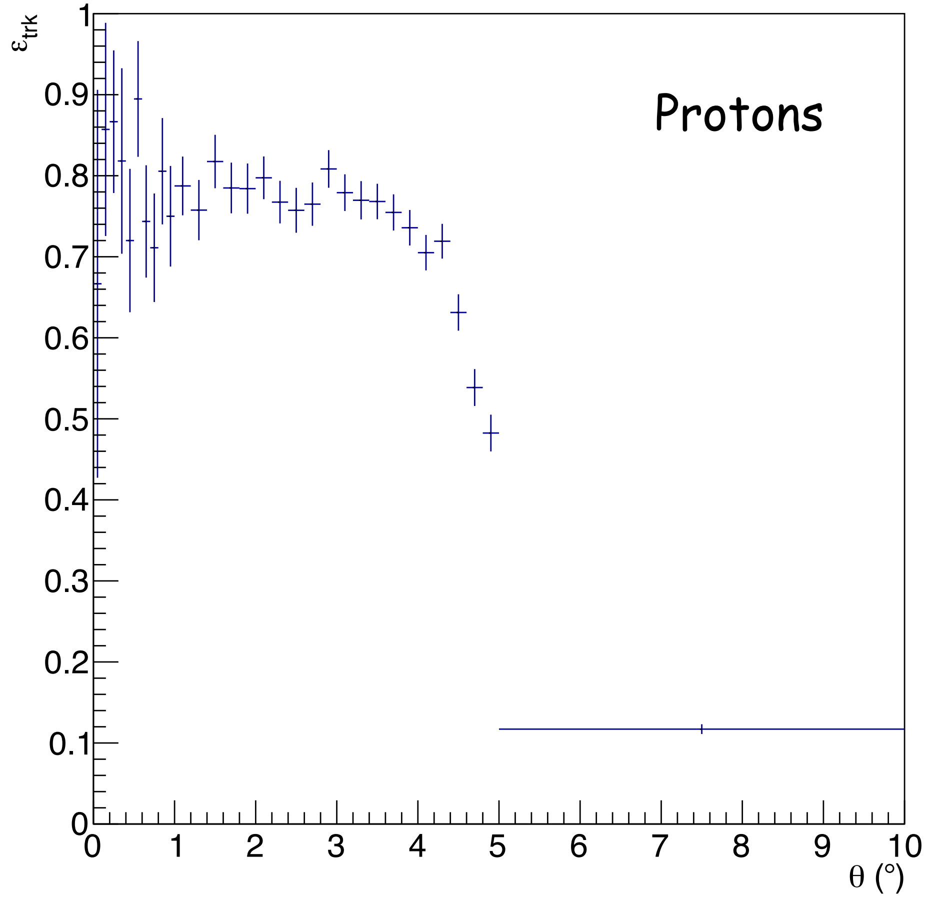
- Results using "biased" events from FULL simulation of carbon fragmentation
- Statistical uncertainty only
  - Proton spectra is being checked right now
  - Strategies to assess systematics are being investigated
  - High stat sample being processed



ε vs θ distributions (unbiased)

- Protons production :
  - fragment from target with flat Ekin, theta dist
  - NO other fragment produced

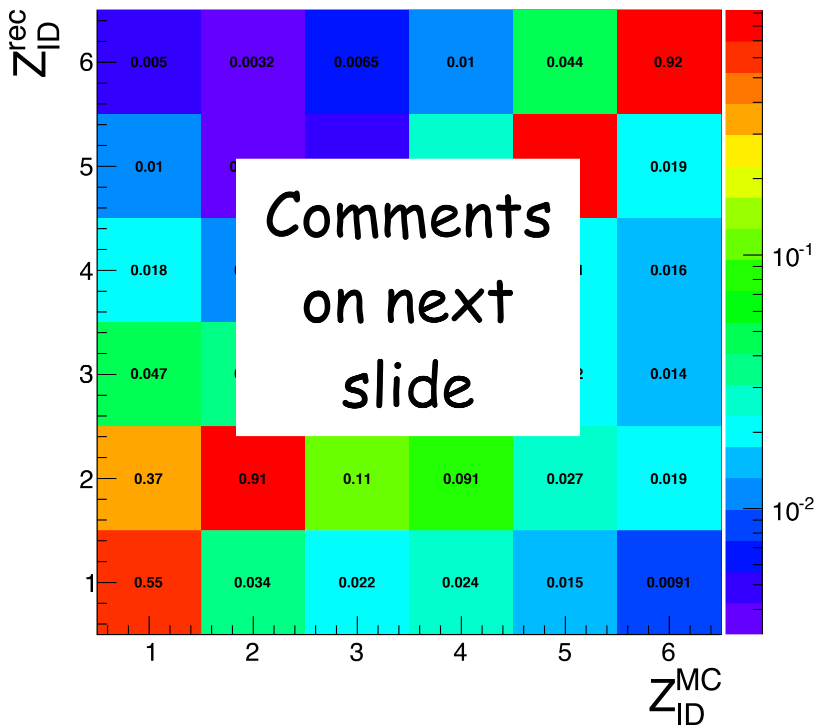
- Huge difference observed:
  - here the events are MUCH MORE clean: no mismatching (1 track per event) and this the "pure" tracking component (folded with geometrical acceptance above 5) becomes evident.



ZID efficiency AND Xfeed

- Trying to evaluate the **tagging** efficiency of our algorithms and the Xfeed in our mass spectra **directly using reconstructed tracks.**
  - For each reconstructed track I do look at what was the TRUE charge of the fragment and this is how this matrixes are filled. [**beware of the LOG z scale**]
  - **Normalization is done to the column [eff.] or the row [Xfeed]**
  - ***Most important info comes from the ROW [how many times what I reconstruct as an X fragment is really X and how many times is some Y or Z]***

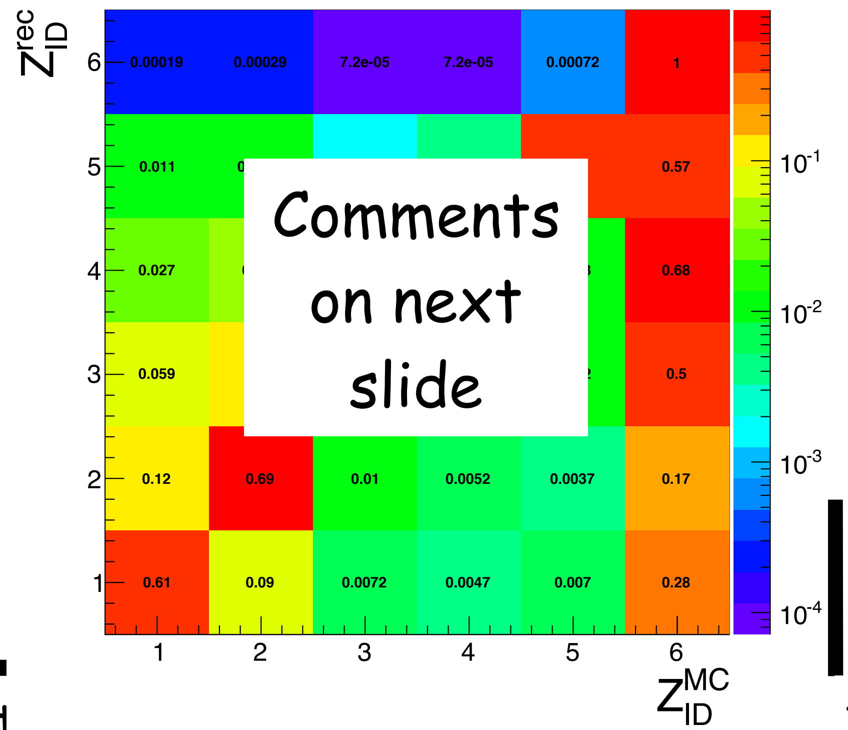
ZID efficiency!



ALL tracks!

True charge comes from the MC block using pixels associated to the reconstructed track!

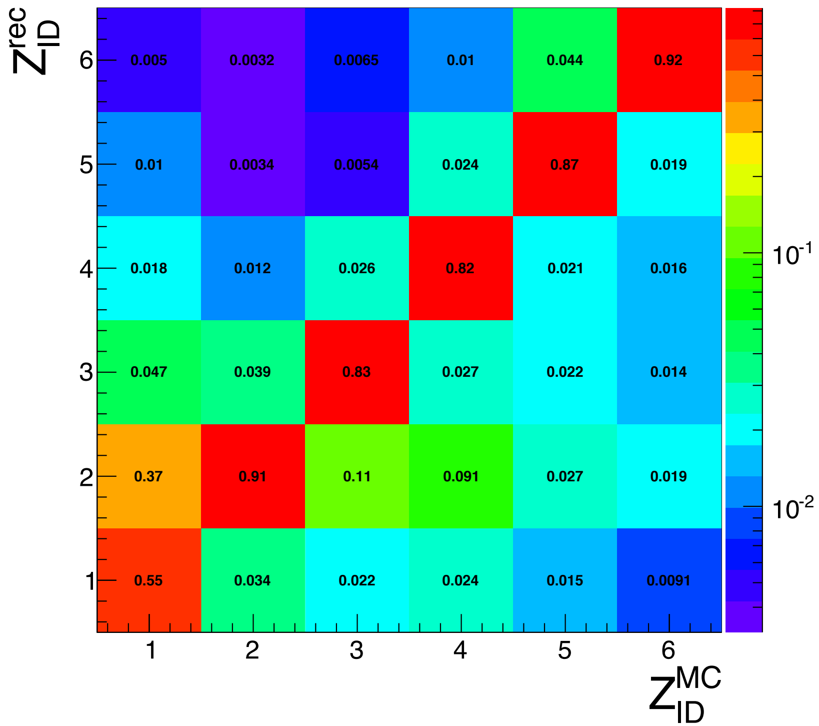
X feed



ZID efficiency AND Xfeed

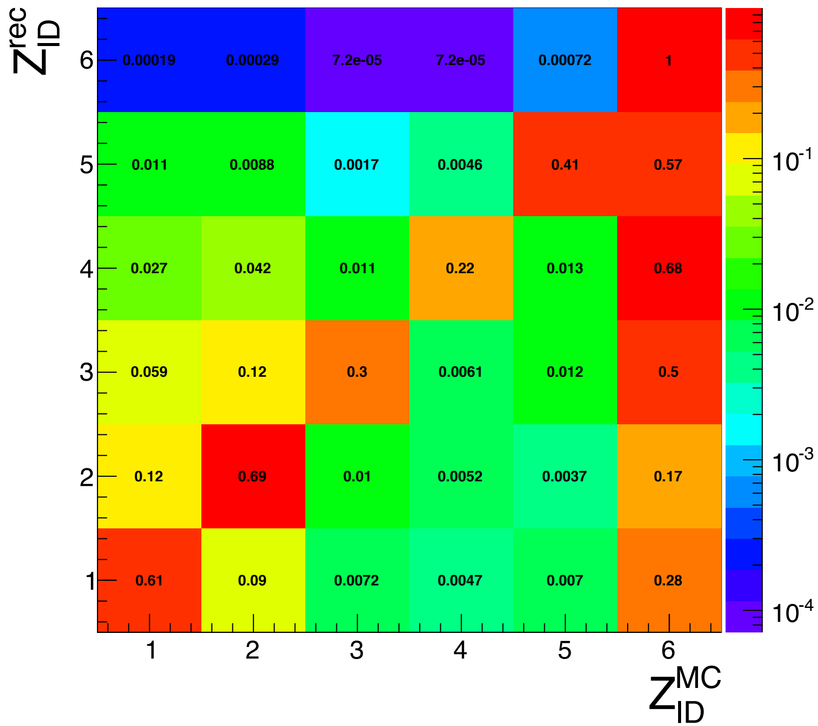
- Charge ID efficiency is around 90% (except for protons where we are @ 50% level)
- The X feed for **all tracks** is quite high: we end up with a large pollution from carbons everywhere

ZID efficiency!



ALL tracks!

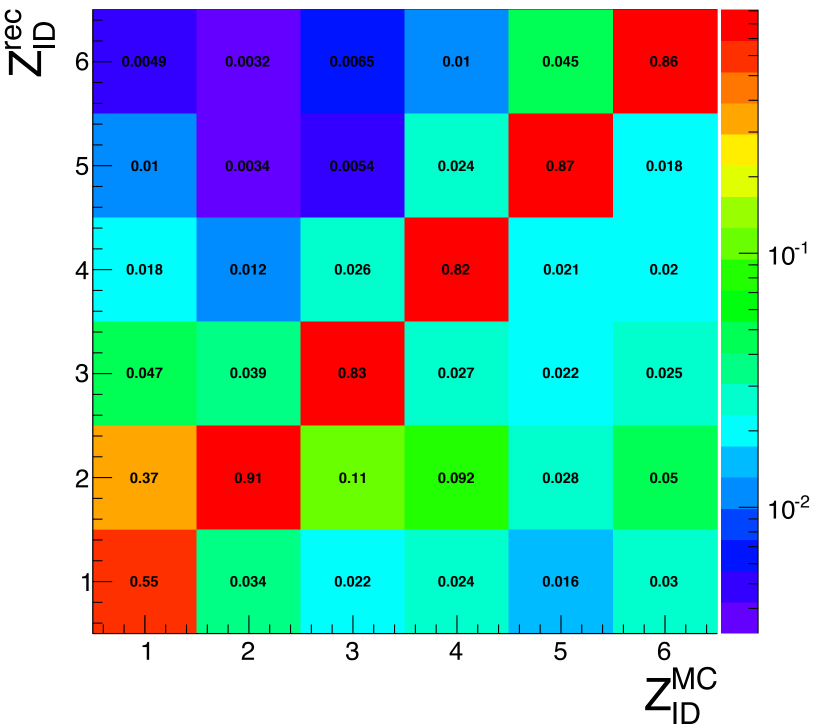
X feed



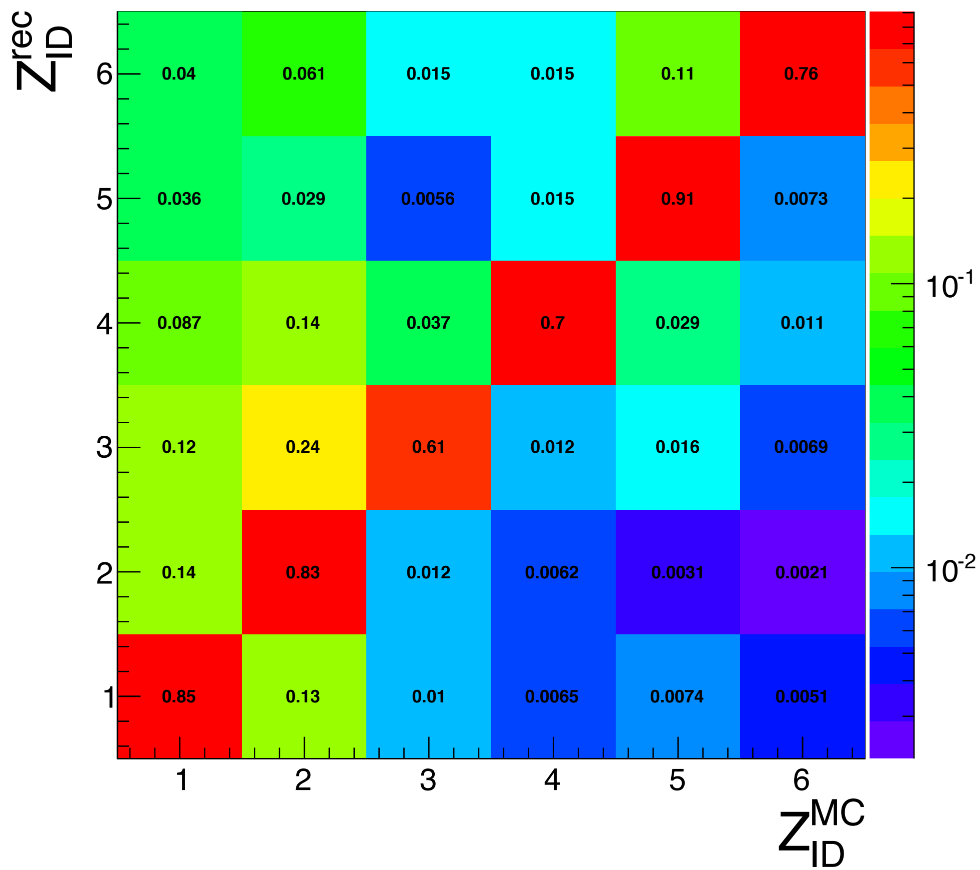
ZID efficiency AND Xfeed (II)

- Situation is greatly improved for "fragmented" events:
  - Same efficiency
  - Xfeed is greatly reduced
- **Fragmented event is flagged using the track multiplicity of the Vertex object associated to a given tr**

ZID efficiency!

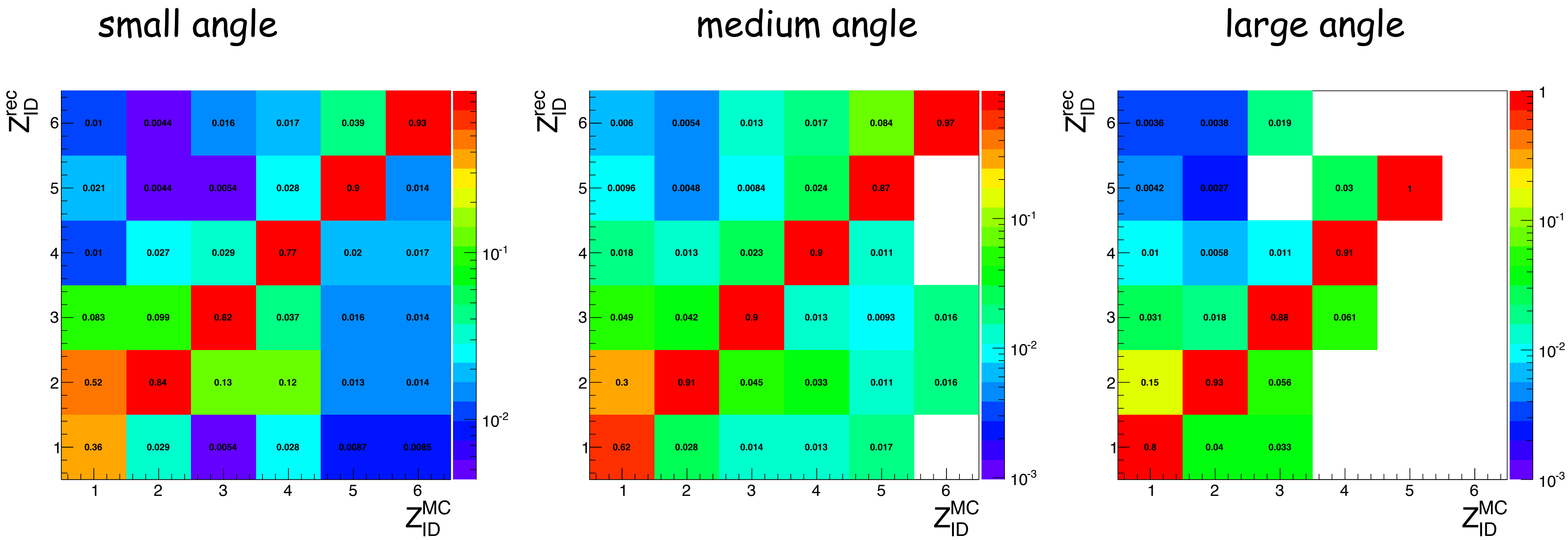


Fragmented events



Xfeed correction

- The idea:
  - From the MC I know how many TRUE protons are reconstructed as Pr, He, etc etc. Then I can INVERT this matrix to know how many TRUE Pr, He, etc were produced once I RECONSTRUCT #REC_Pr, #REC_He etc etc
  - Rainbow matrixes have been inverted and applied to measured rates.



Matrix inversion: an example

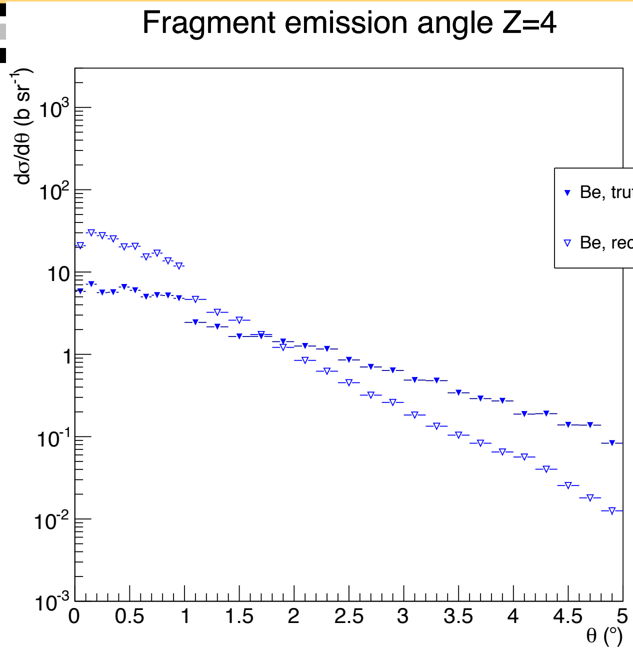
- The reference matrix comes from MC (Prob that a true X_ID frag is reconstructed as a Y_ID frag), and then it is inverted.

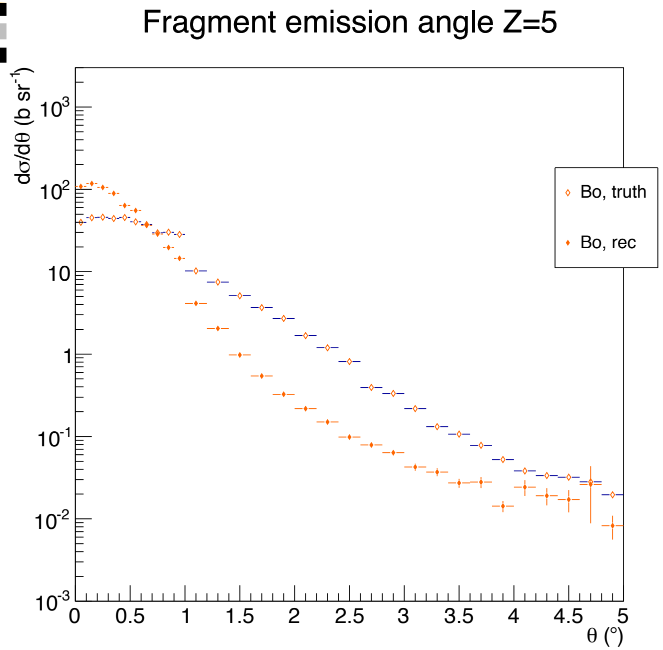
	0	1	2	3	4	5
0	0.3594	0.0288	0.005362	0.02799	0.008724	0.008486
1	0.5156	0.8368	0.1287	0.1175	0.01336	0.01436
2	0.08333	0.0986	0.815	0.03731	0.01554	0.01371
3	0.01042	0.02705	0.02949	0.7724	0.01963	0.01697
4	0.02083	0.004363	0.005362	0.02799	0.9035	0.01436
5	0.01042	0.004363	0.01609	0.01679	0.03926	0.9321

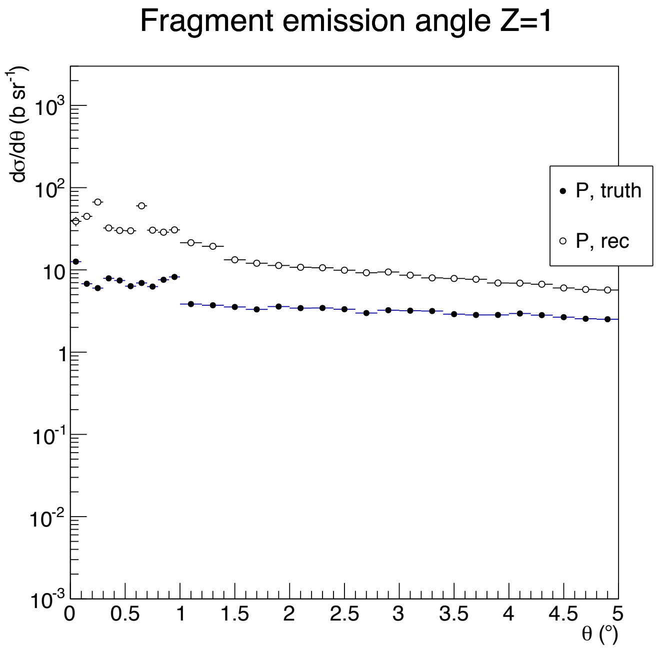
	0	1	2	3	4	5
0	2.927	-0.09758	1.405e-05	-0.08984	-0.02387	-0.02314
1	-1.794	1.283	-0.1864	-0.1214	0.004136	0.001457
2	-0.08212	-0.1434	1.252	-0.03474	-0.01723	-0.01455
3	0.02844	-0.03804	-0.04071	1.303	-0.02634	-0.02239
4	-0.0589	-0.001888	-0.004954	-0.03718	1.109	-0.01577
5	-0.02093	-0.001674	-0.01979	-0.01973	-0.04569	1.074

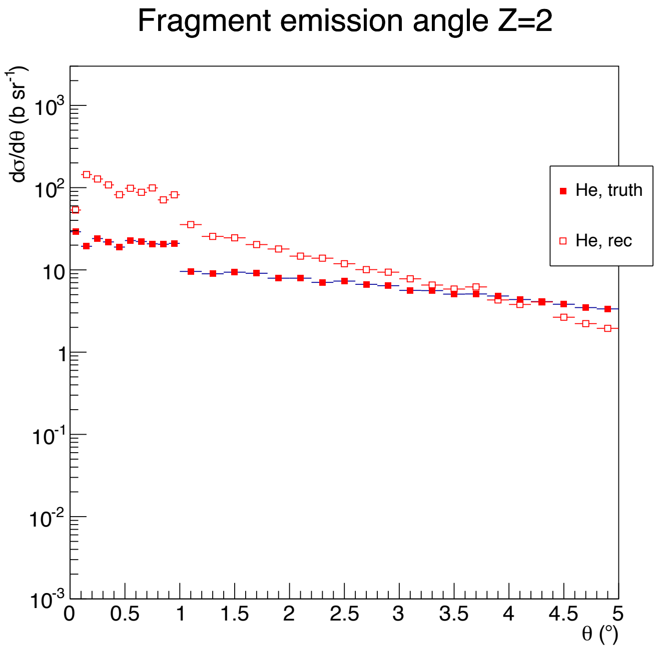
Cross section, status

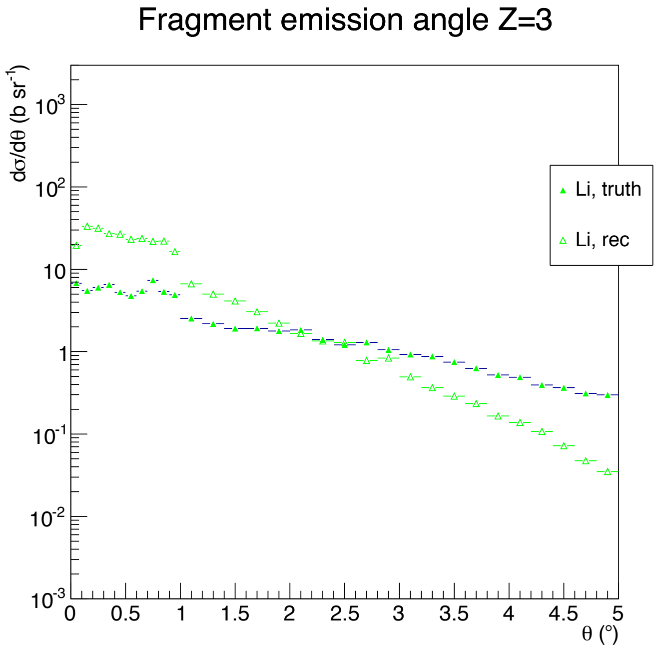
- Checking on MC to see where we are
  - No xfeed corr





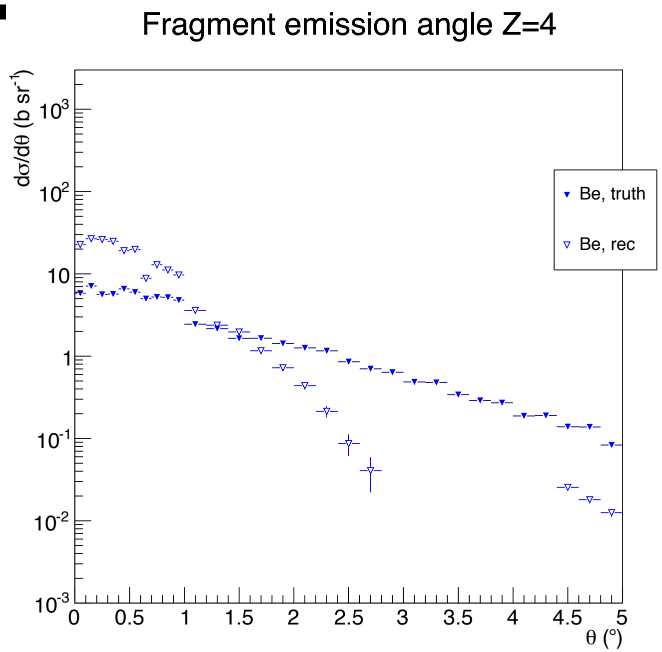


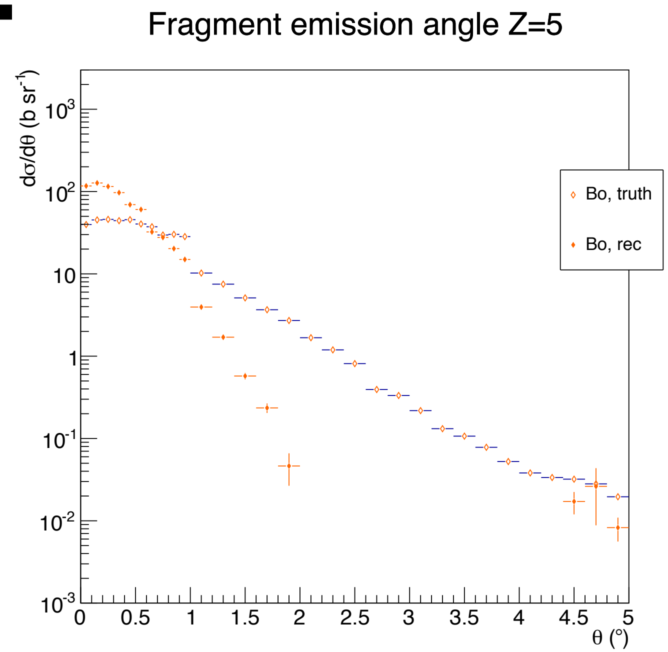


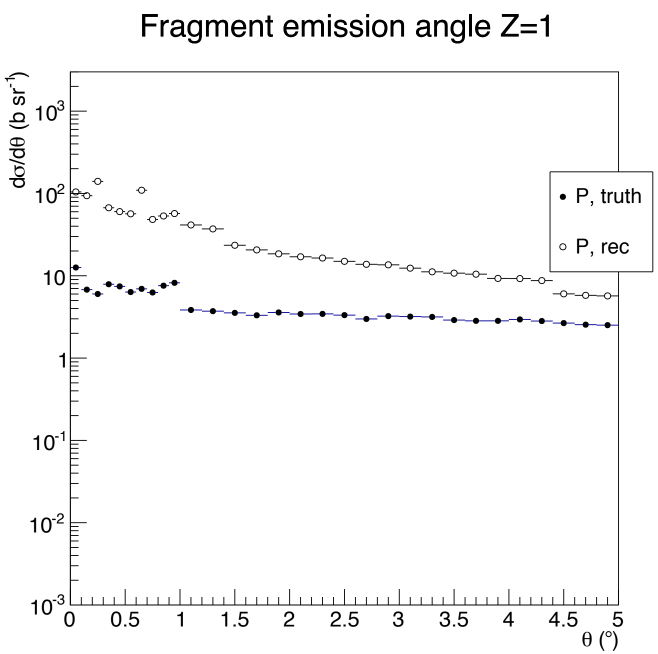


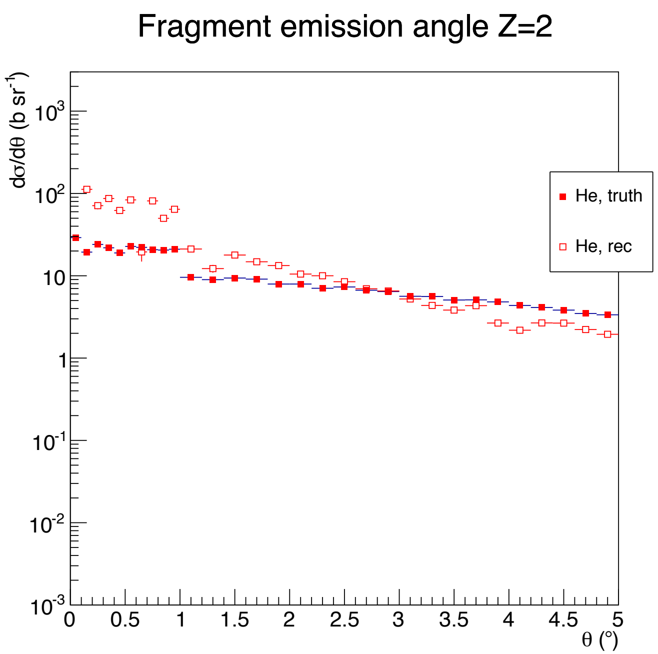
Cross section, status

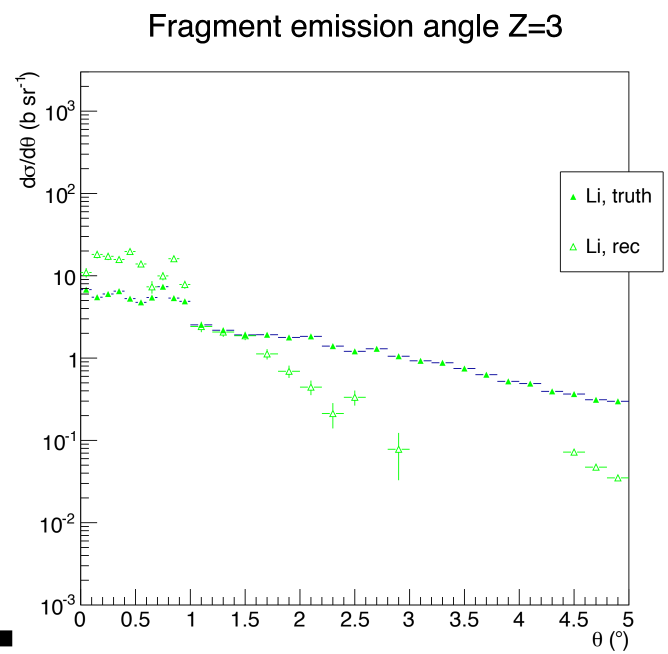
- Checking on MC to see where we are
  - Xfeed correction applied











Summary

- Before showing ANY distribution
  - we have to fix the MC true/reco disagreement
- To do list:
  - Introduce the Y from ADC! Much better resolution and improved tracking.
  - Validate the clustering on the ToF: anything that would help us cleaning our samples will help us!
  - Validate the use of chg from vtx
  - Start in parallel to work on Energy fits