DIPARTIMENTO DI SCIENZE
DI BASE E APPLICATE
PER L'INGEGNERIA

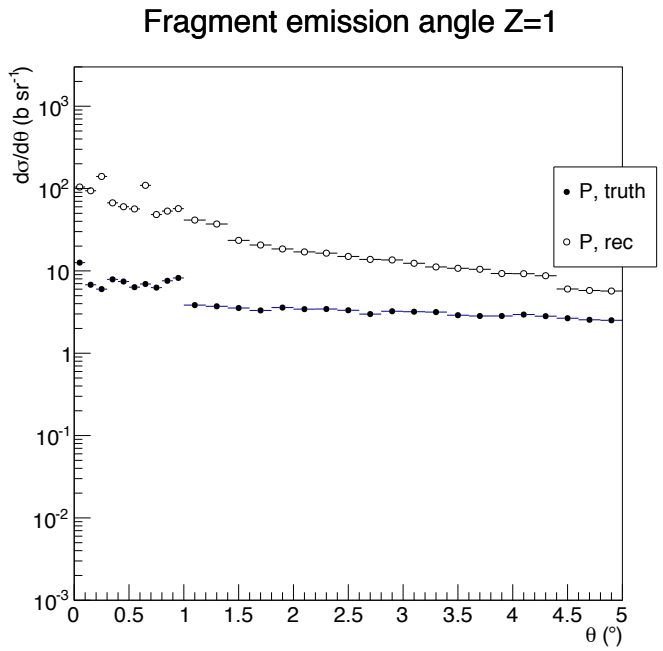
SAPIENZA
UNIVERSITÀ DI ROMA

Activity since last General Meeting

A. S.

Why we are not yet writing a paper?

- 'cause we need **before** to have the full exercise done on MC
  - Reconstruct the fragments
  - Correct for efficiencies
  - Get back what you have generated from reconstruction!



Where were we 1 month ago.

Problem solving

- What can cause that?
  - Wrong efficiency evaluation
  - Wrong Xfeed correction
- Ruled out
  - Bin, angular and yield problems.

- And when we come to data we will need to **additionally** check the total number of 12C ions normalization!

MC simulation

- Large production:
  - 150 M events of High density carbon are stored under /lustre. Xfeed matrix results, in bins of Ekin and Angle are done using this large stat sample
- Biased production:
  - Few million of events produced shooting P,He,Li,Be,Bo,C from the target (without any other fragment/track in the event) are available as well.
- Pile up events:
  - being deployed: process slowed by the computing problems at GSI. I plan to launch a "small" production of events with pileup in the next weekend.

Efficiency

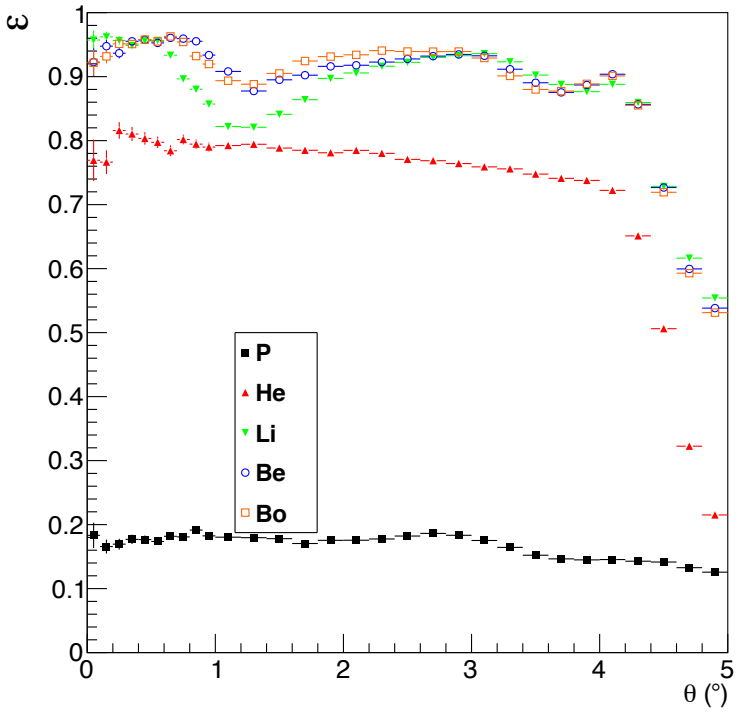
- Define the testing sample: what is "reconstructible" in the FIRST experiment? A particle that
  - has a positive charge
  - originates from the target
  - originates from the fragmentation of a carbon ion
  - traverses the Vtx detector (checked using the MC scoring on the vtx)
  - traverses the ToF detector (checked using the MC scoring on the ToF) (in the last analysis this was not ensured, anyway it has a small impact)
    - **At this point the GEOMETRICAL cut should be removed.**
- Those are the measured tracks that we need to CORRECT for the reconstruction and tracking efficiencies.

Caveat

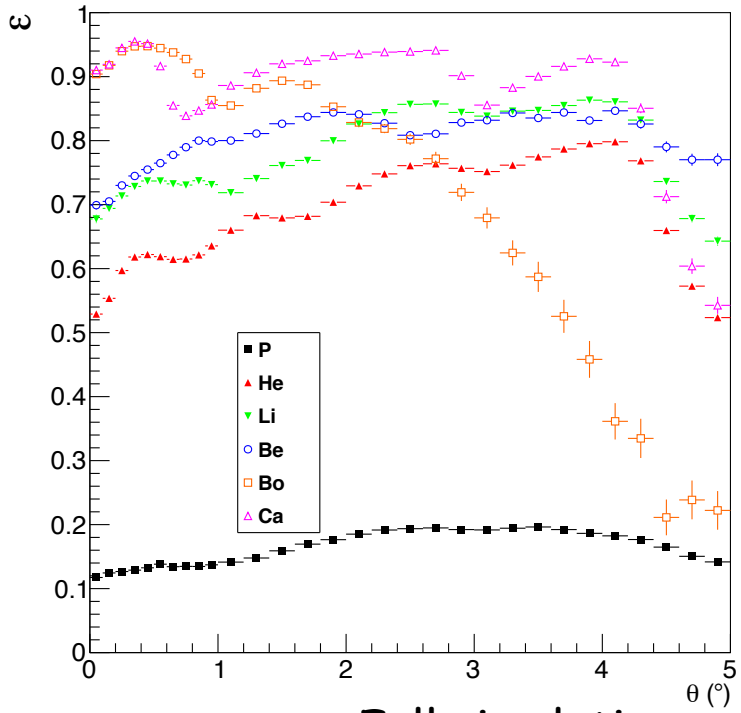
- In the definition reported on the previous slide:
  - I do not enforce to have a reconstructed charge that matches the truth! The efficiencies are given as a function of the TRUE charge, the mis-assignment is corrected by the Xfeed, but I am not correcting now for the charge efficiency!
- A detailed study of how much we can gain by using the charge of the vtx is ongoing.

Comparing biased/unbiased sim

- Redone the full study to measure the efficiencies.
  - Now the Biased/Unbiased agree: there was a problem with the threshold cut on the ToF hit reconstruction
  - Remaining discrepancies: B. Liu MC was processed with OLD reco algorithm (rating based) while new effi use the TofClustering algo (see later)



Biased MC (from B. Liu)

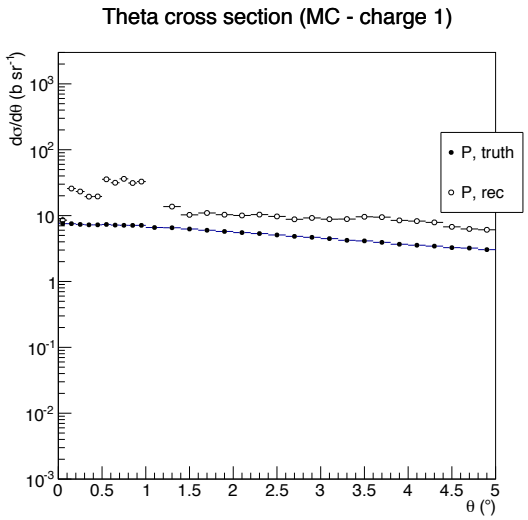


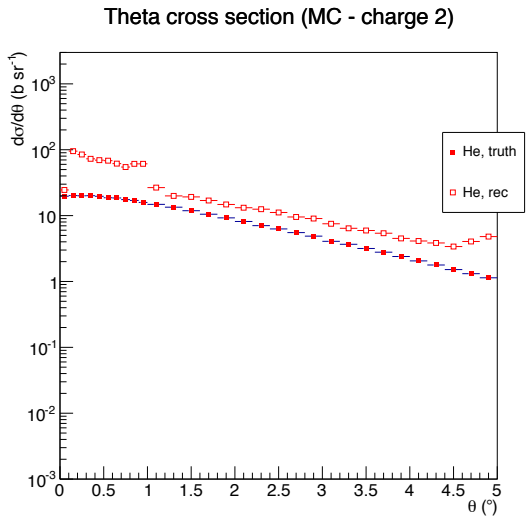
Full simulation

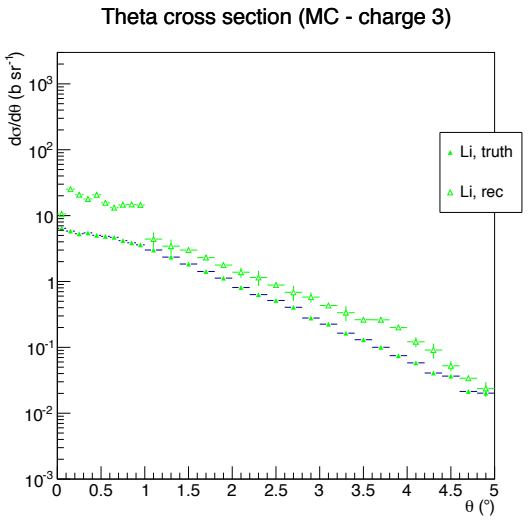
New comparison (I)

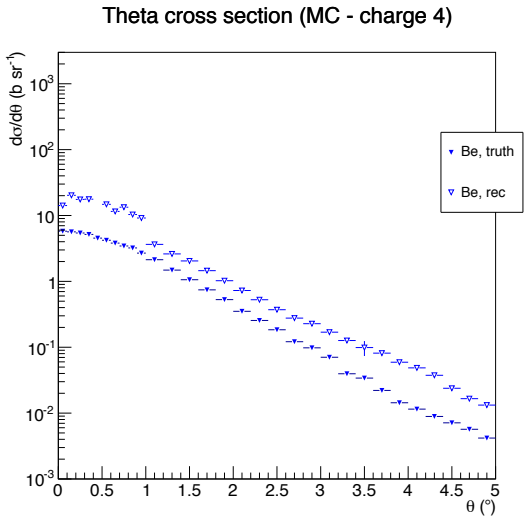
- without Xfeed correction, let's have a look at how reco and generated compare

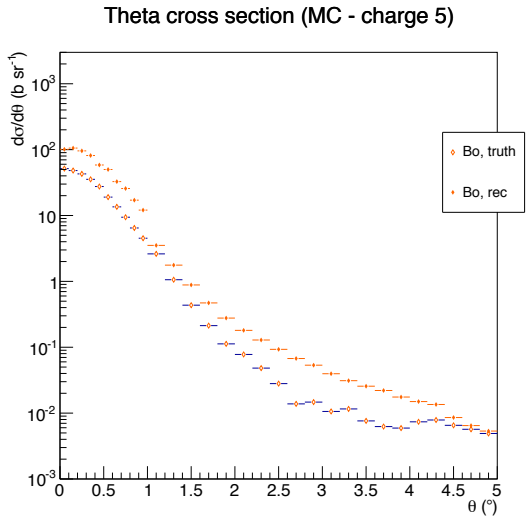
Plots obtained using the Biased efficiency from Ben's MC







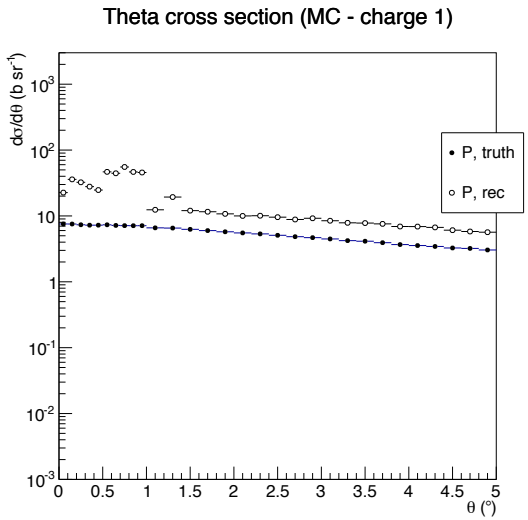


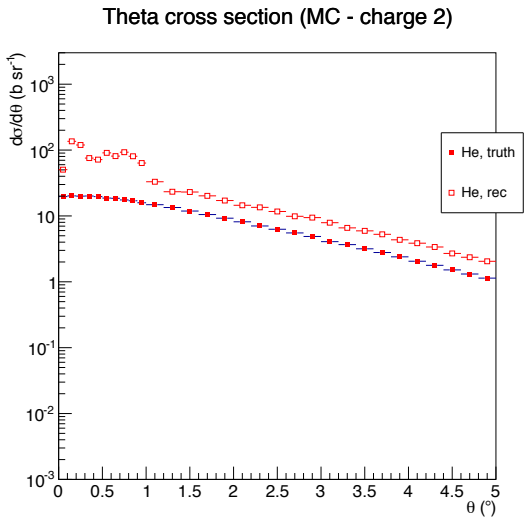


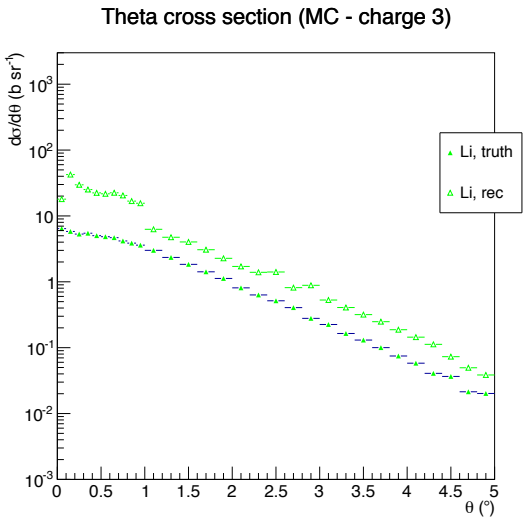
New comparison (II)

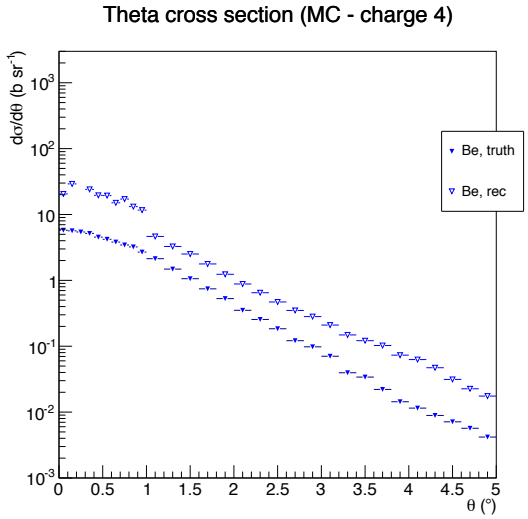
- without Xfeed correction, let's have a look at how reco and generated compare

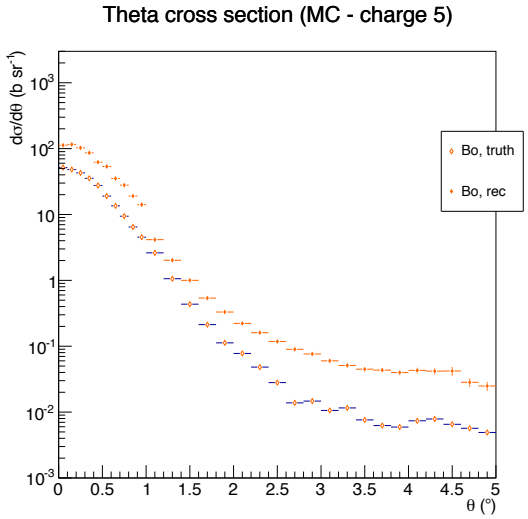
Plots obtained using the efficiency from Full simulation MC







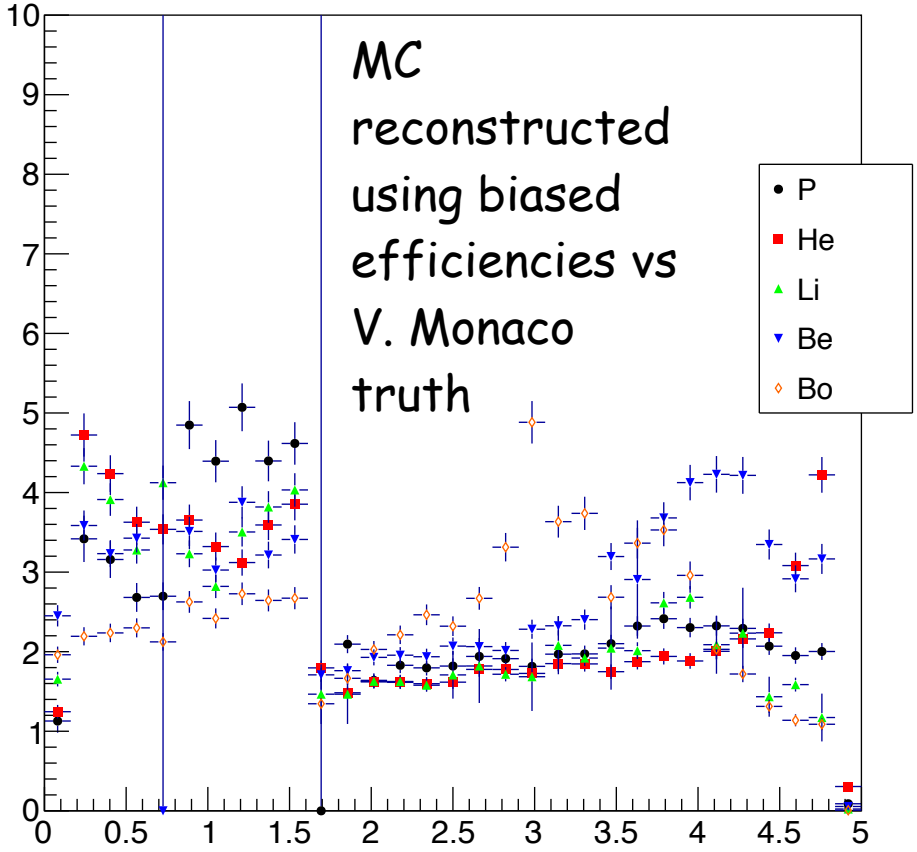




Efficiency conclusion

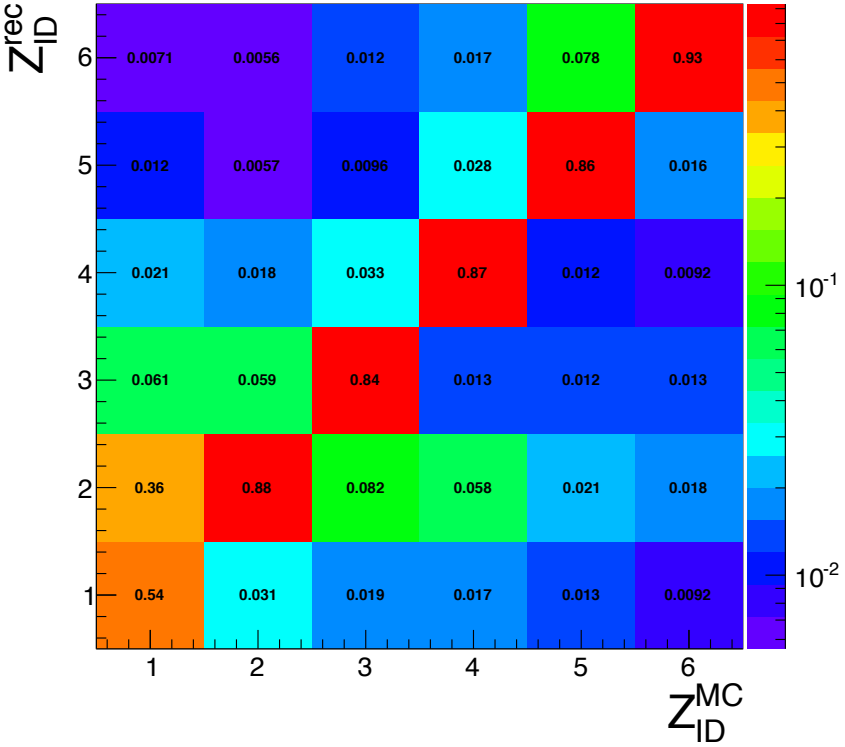
- We start to reach the level in which we are able to
  - Correct the efficiency for the bias we see
  - Assign the difference btw different evaluation methods as a systematic uncertainty

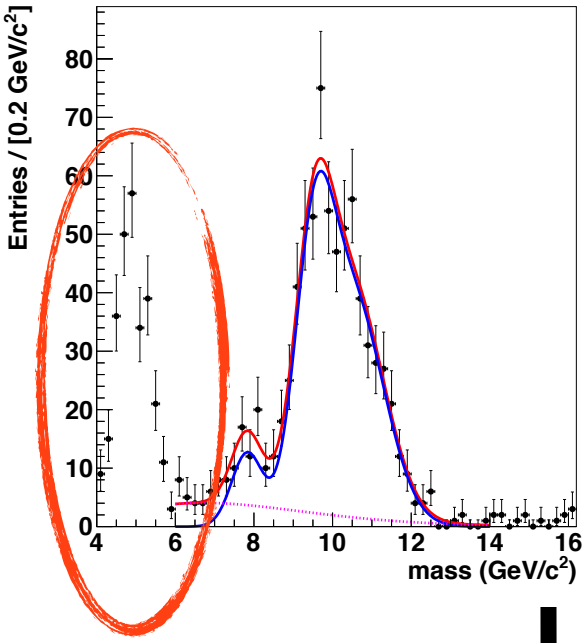
- Of course there is still room for debugging... :) A factor "2" ~ constant seems to be suspicious..



Xfeed evaluation

- How it is currently done
  - On fully reconstructed tracks one computes the following matrix: A(rec,true) = P(recX | trueY)
  - Then the true fragment X section can be obtained by: Xsc(true) = A-1(rec,true) Xsc(rec). : this implies that the reconstructed yield for a given fragment charge depend on the yields of ALL the other Z_i fragments.
- While I get the yields in the Fitted mass range, I apply the matrix that is computed in the full mass range! (To be fixed asap)





Global tracking

Preselection

- Reconstructed ToF wall hits are preselected
  - if ((p_traw->tof<=0) || ((p_traw->tdct<=0) || (p_traw->tdcb<=0)) || (!p_traw->stat)) continue;
  - Only hits with positive charge are added to the "matching list": we loose all the hits for which we are not able to assign a charge.
- Tracks from mimo are required to go inside aladin:
  - Presel requires track angle < 10°
  - Track line is extrapolated to collimator, and a radial cut is placed on the distance wrt beam direction. Params taken from the gsi_geo.h
    - const Double_t AL_CO1_RAD_I =7.5;// Reduced the radius according to technical design
    - Coll z: 141.43 cm

Algorithm inputs

- Uses as charge what comes from the ToF wall (Newton Raphson algo)
- Uses as ToF what comes from the ToF wall
- Uses as x the slat position (randomized with +/- slatwidth/2, uniform distribution, **to avoid stepped momentum dist.**)
- Uses as y the Y from the times (not from the ADC, that will have a better resolution)
- Uses as x the slat position from the geometry
- Matches ALL the tracks from any vtx in the mimo to ALL the hits in the ToF wall

No requirement on vertex validity NOR on BM matching is requested.

Tracking algo

- Once a match btw an hit and a vtx track is found a track candidate is added to a given list [fTrackListIr]
- Cluster ToF is enabled [for details see 26/09 prese of Vmonaco]
  - Take reconstructed tracks, ALL tof and ALL vtx tracks
  - The RefitClusters produce the final lists of tracks.
    - 1) Search for the best VTX/TOF matching looking at minimum Yvtx-Ytof for all the global track candidates (like before but looking at all the VTX-TOF combinations)
    - 2) Loop over the other global track associated to the same VTX track but with a hit in the opposite plane, if any (best selection could be based using all possible quantities, including reconstructed variables). Cluster the two hits in a single one, and repeat the tracking.
    - 3) Continue the loop excluding the selected TOF hits and VTX track.

ToF clustering features

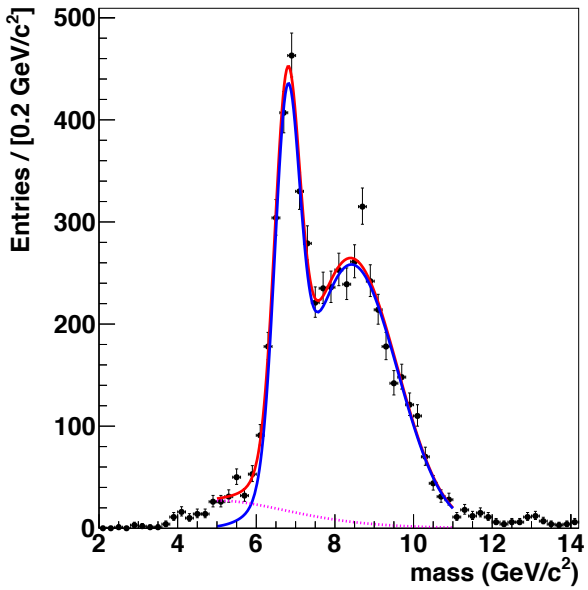
- Advantages:
  - TOF hits belonging to the same track in different planes can not be associated to different global tracks.
  - no discrimination between VTX tracks (all the combinations are tested for each VTX track)
  - the TOF cluster can provide more precise information for the reconstruction
  - TOF/VTX matching and clustering criteria can be easily changed (including reconstructed quantities or i.e. adding the VTX charge informations for the TOF/VTX matching).

Ongoing work

- Validation of TofClustering performed by V. Monaco
  - Done!
- Implementation of charge from Vtx ongoing
  - Turin (Abdul)
  - Strasbourg C. Finck
  - M. Toppi
- Integration of Charge Rating and TofClustering + TofClustering improvement
  - C Finck / Juan Pablo
- Deployment of Y_ADC
  - Large impact expected on reconstruction.
- Implementation of BM matching / PU veto
  - Validation on MC is mandatory

Ekin

- The ekin we show, and that we use for the cross section evaluation, is defined as Ekin/per nucleon
  - Total ekin comes from P,M: Double_t rec_Ekin = ((std::sqrt(std::pow(rec_P, 2)+std::pow(rec_Ma, 2)))-rec_Ma)*1000.; //MeV. Fragment Kinetic Energy
  - the number of nucleon is measured from the fit to the mass distributions
- No way to bin the Ekin/nucleon BEFORE fitting the mass ditribution:
  - my approach: build the Ekin (total), bin it, find A and then build the Ekin/A distributions rescaling Ekin..
- Concerning M vs Ekin correlation, see V. Monaco slides.



Summary

- Before showing ANY distribution
  - we have to fix the MC true/reco disagreement && / || assigna systematic uncertainty for it
  - re-check the #(12C) estimate.
- To do list:
  - Introduce the Y from ADC! Much better resolution and improved tracking.
  - Integrate Clustering AND Charge Rating
  - Study Pileup cut/MC
  - Bring forward the Ekin analysis
- We are not that FAR!