VTX cluster size in simulation

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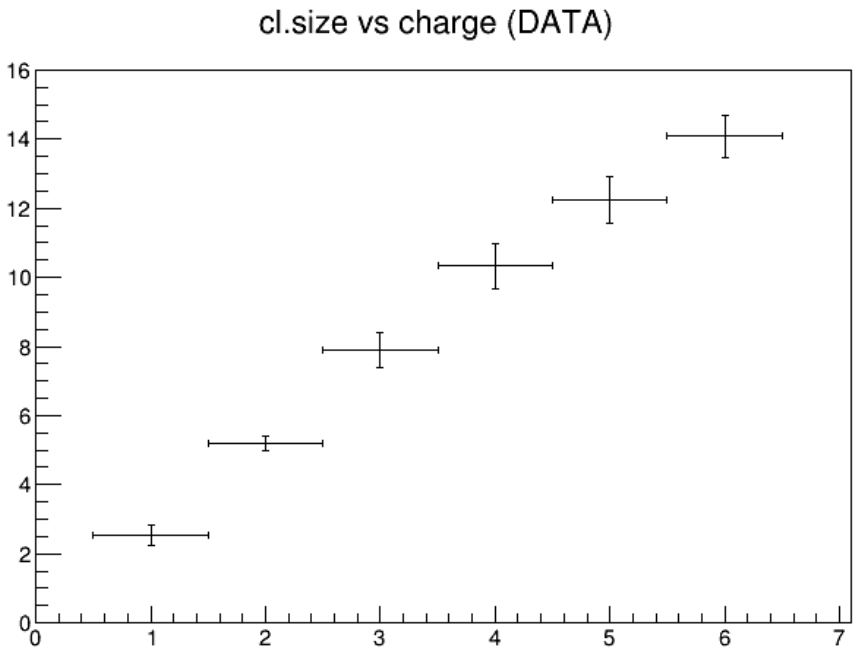
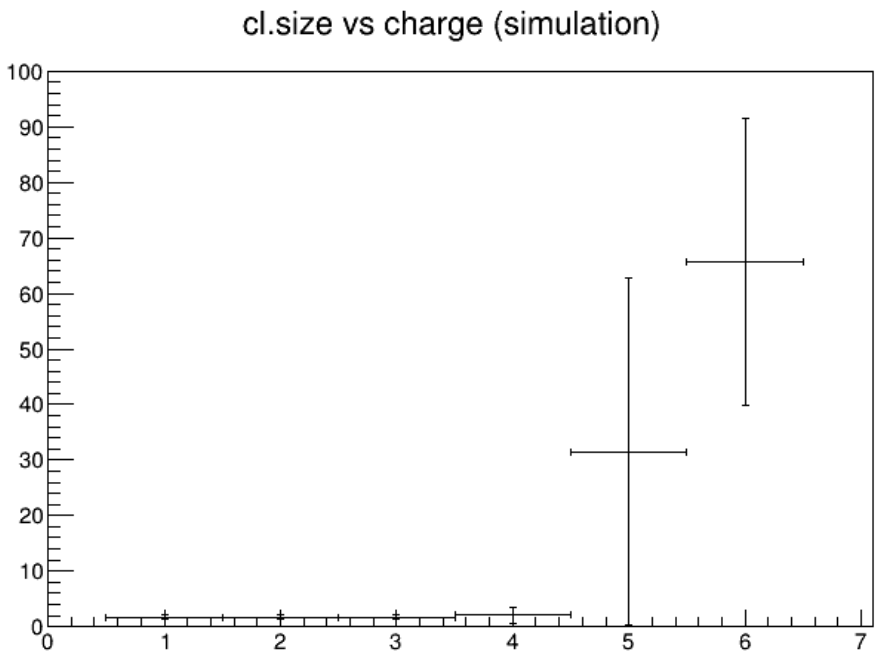
FIRST analysis meeting, 24/10/2013

VTX cluster size





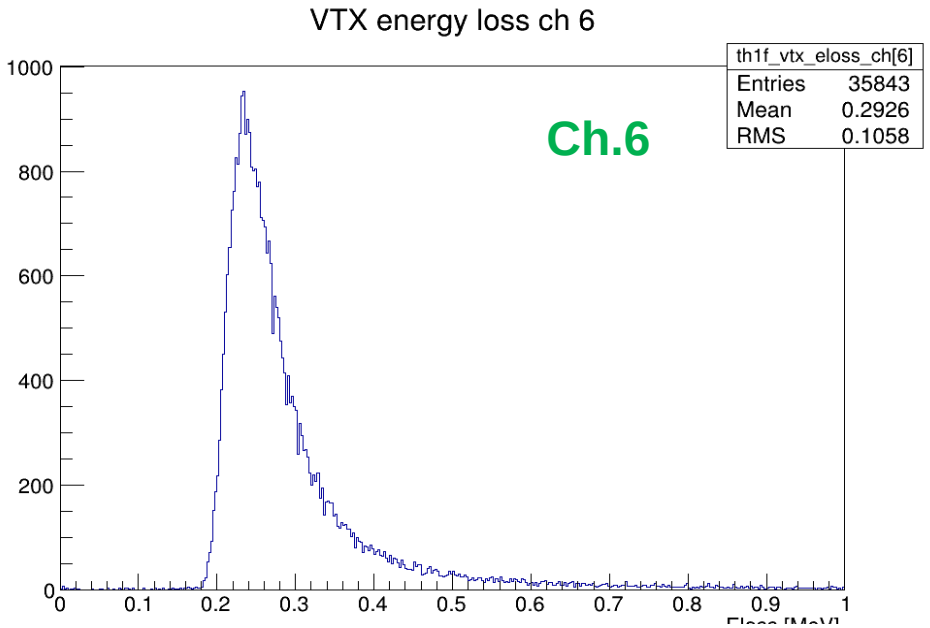
The vertex cluster size dependence on the charge is not reproduced in the simulation.

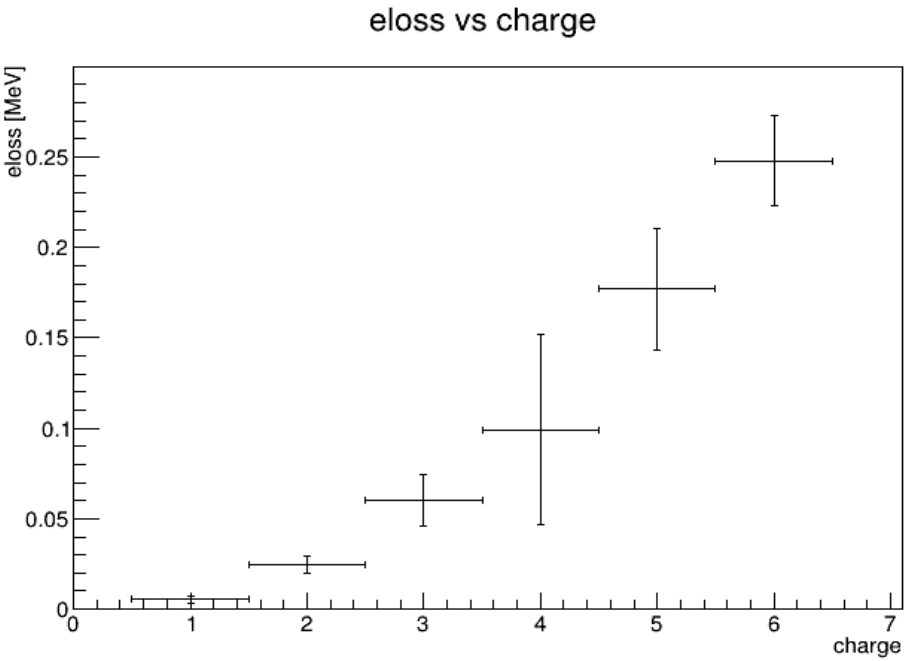
Algorithm currently implemented in Segnale.cpp:

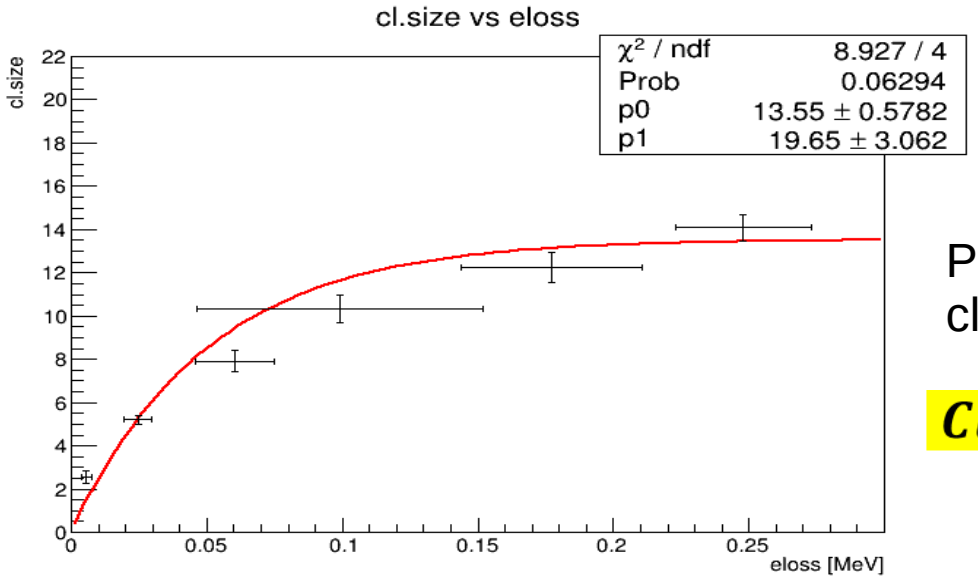
A MC particle deposits energy dE in one VTX plane and fires one cluster:

1) dE is randomly changed within +-10 %
2) if dE<0,06 MeV only one pixel is left
3) if dE>0,06 MeV the energy distribution is spread-out in the surrounding pixels with fixed sigma of 36,23 um (gaussian distribution)
4) the new energy deposited in each pixel is changed with a gaussian within +-10%
5) If dE>0,12 MeV the pixel is saved (threshold too high).

Energy released in VTX plane (from fluka) as a function of charge (from reconstruction) in fragmentation events.







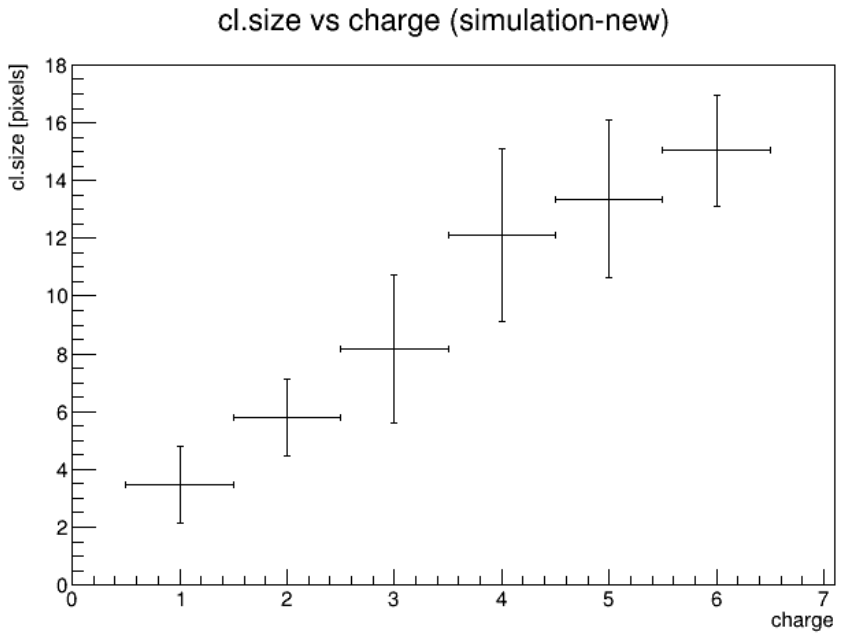
Possible parameterization of cluster size vs eloss (dE):

$$Cluster\_size(dE) = p0 \cdot (1 - \exp(-p1 \cdot dE))$$

Given a VTX pixel corresponding to a MC track releasing energy dE,
a cluster is built adding the pixels with a radius:

$$R = \sqrt{\frac{cluster\_size(dE)}{\pi}}$$ (pixel number units)

where cluster_size(dE) is evaluated from the parameterization shown before.



First attempt with very low statistics !
The study has to be repeated and fine tuned with higher statistics.

Analysis of data

Calculation of efficiencies and purities from MC:

For each charge **Z** and for each bin **B** in theta/K.E./theta+K.E.

gene(Z,B) = N.of generated particles (at the interaction point in the target) with MC charge Z in bin B.

reco(Z,B) = N.of reconstruced particles with reconstructed charge Z in bin B (bin defined according to reconstructed variables))

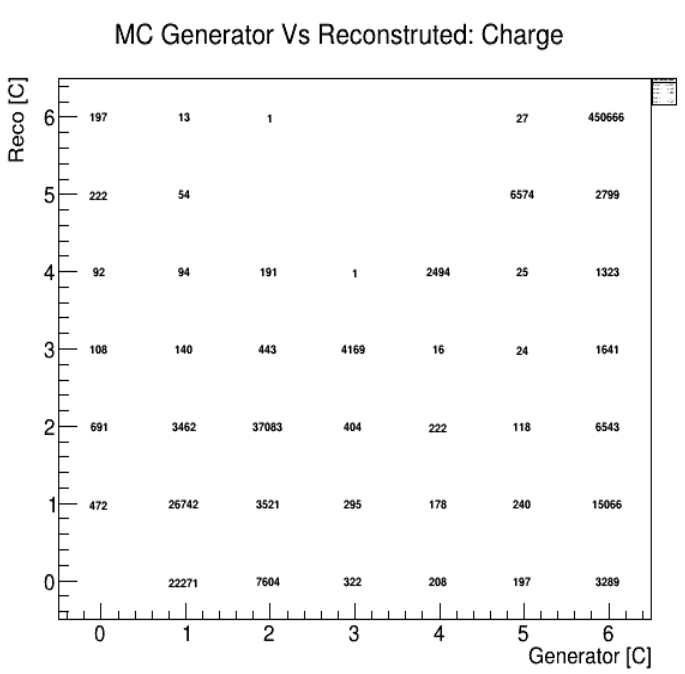
reco+gen(Z,B) = N.of particles reconstruced with the same Z and in the same bin B as the MC track (correlation by navigating in the MC list from VTX to TGT).

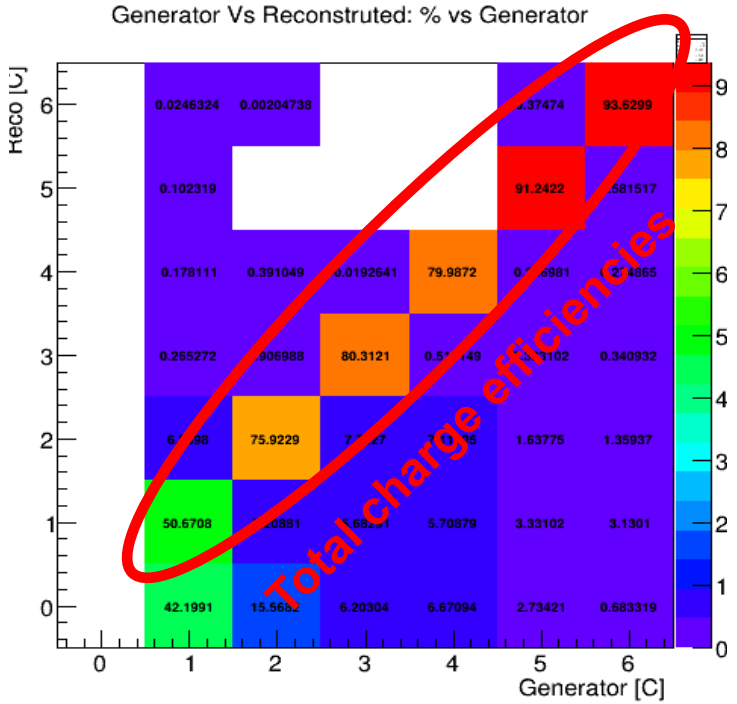
$$\text{efficiency}(Z,B) = \frac{\text{reco+gene}(Z,B)}{\text{gene}(Z,B)}$$

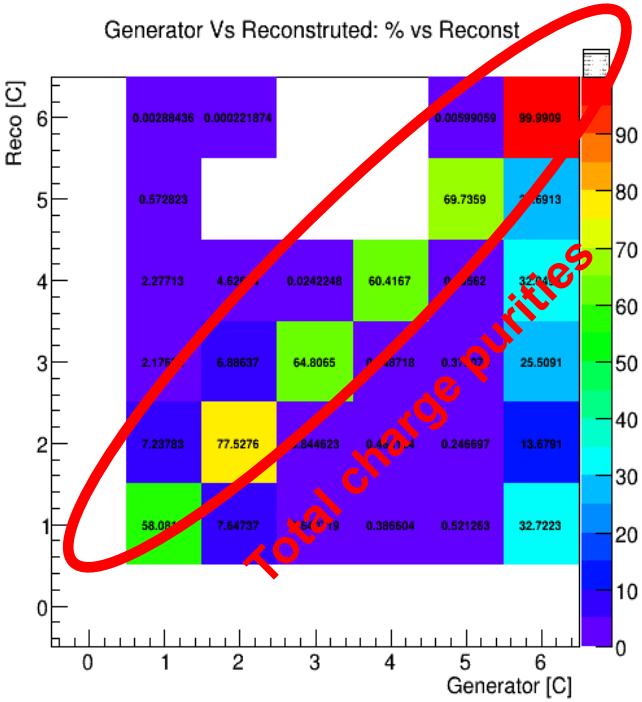
$$\text{purity}(Z,B) = \frac{\text{reco+gene}(Z,B)}{\text{reco}(Z,B)}$$

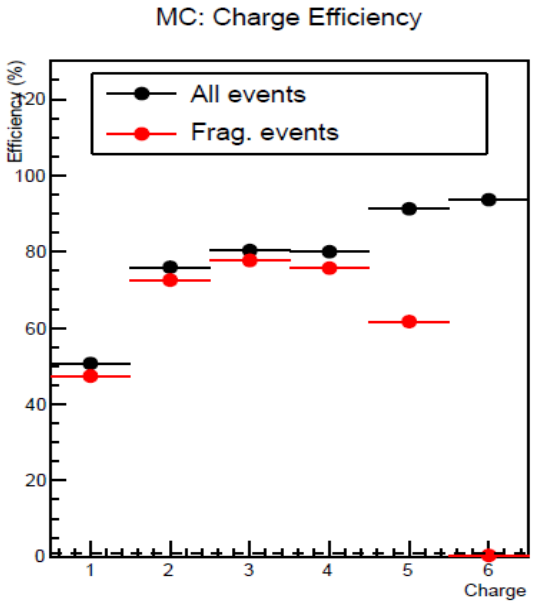
Total charge efficiencies/purities:

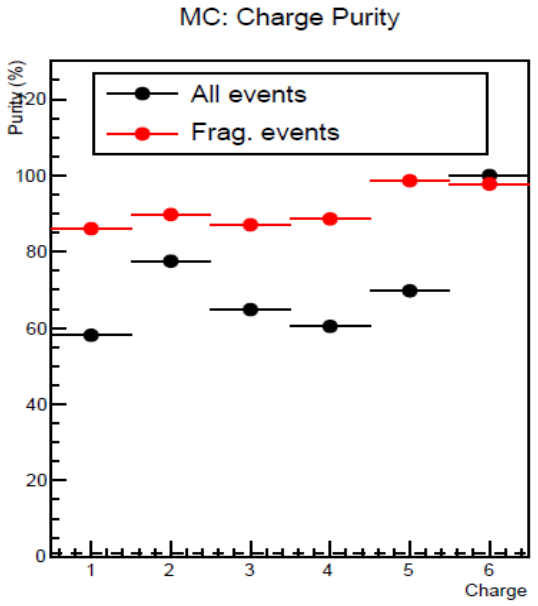
Fragmentation events.











Naive eff/pur correction applied for now:

$$Ncorr(Z, bin) = \frac{pur(Z, bin)}{eff(Z, bin)} \cdot N(Z, bin)$$

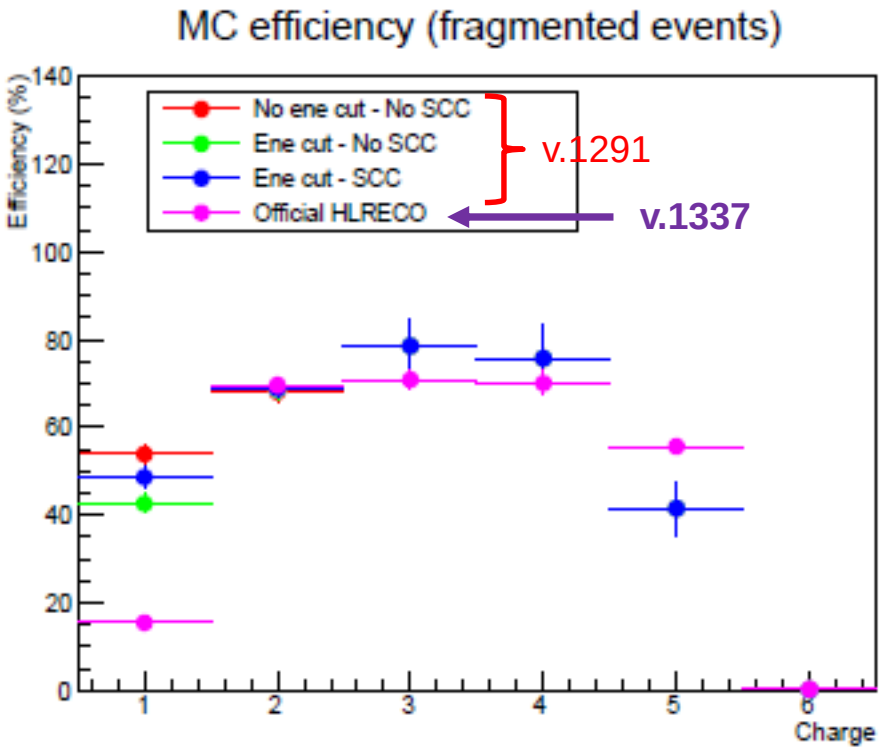
↓

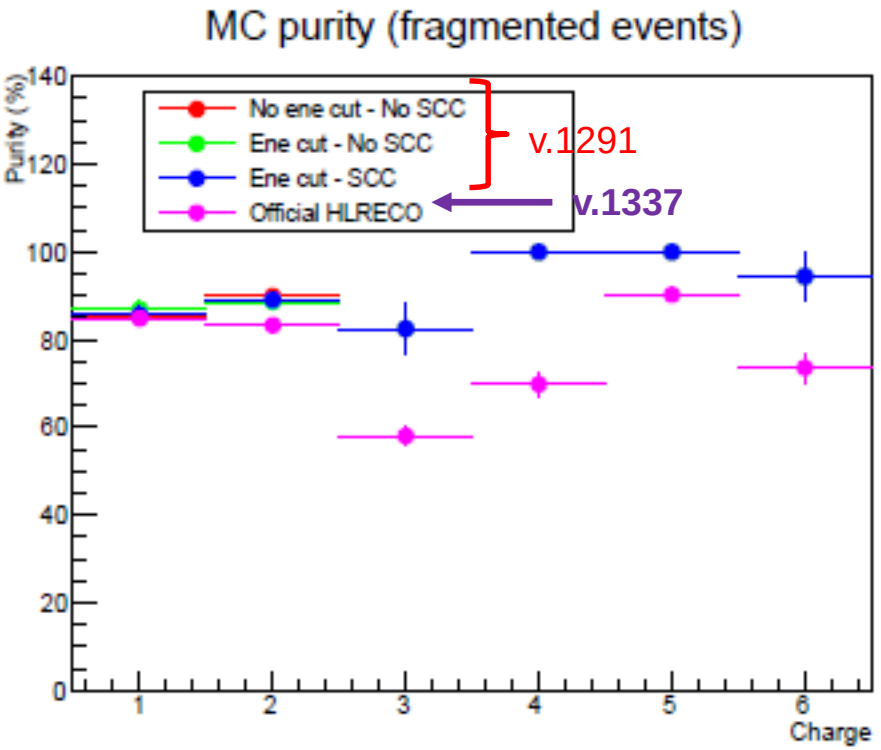
Cross section

Checked on MC.
Matrix inversion ready and checked on MC (counts/distributions at generator level after matrix inversion)

Problem on efficiency evaluation

With the last MC/reconstructed files produced with the more recent versions of the First software the efficiency for protons drops to very low levels.

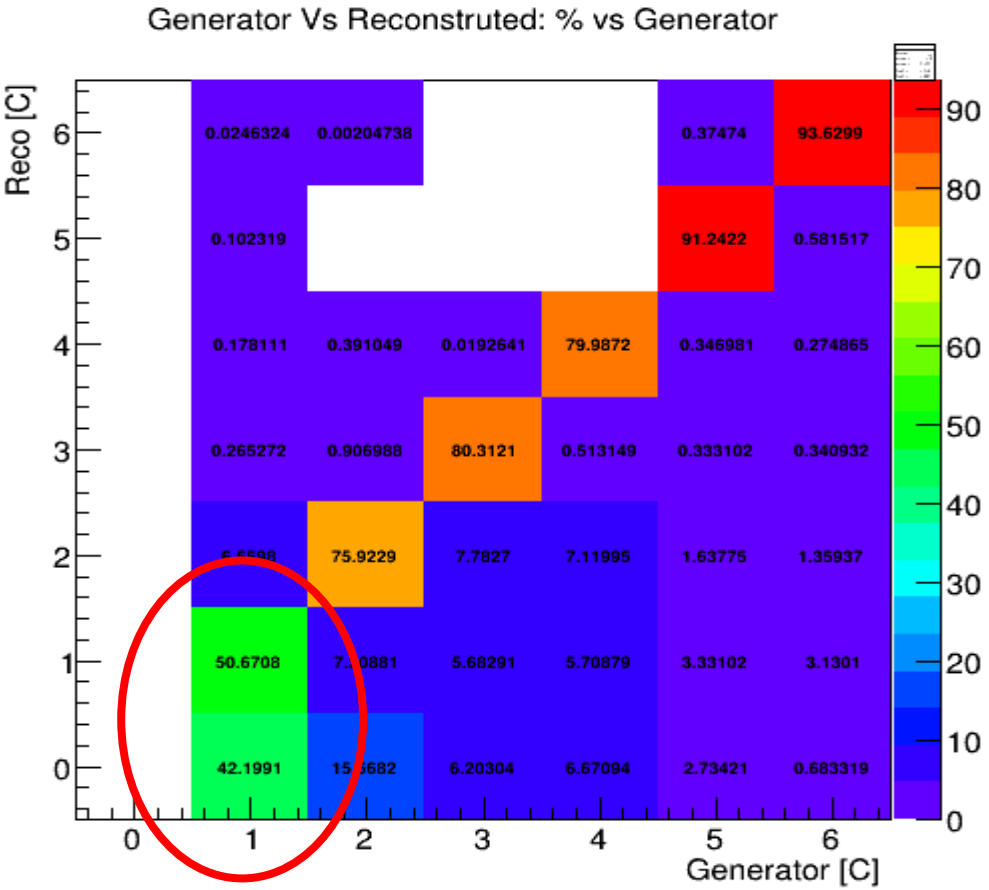




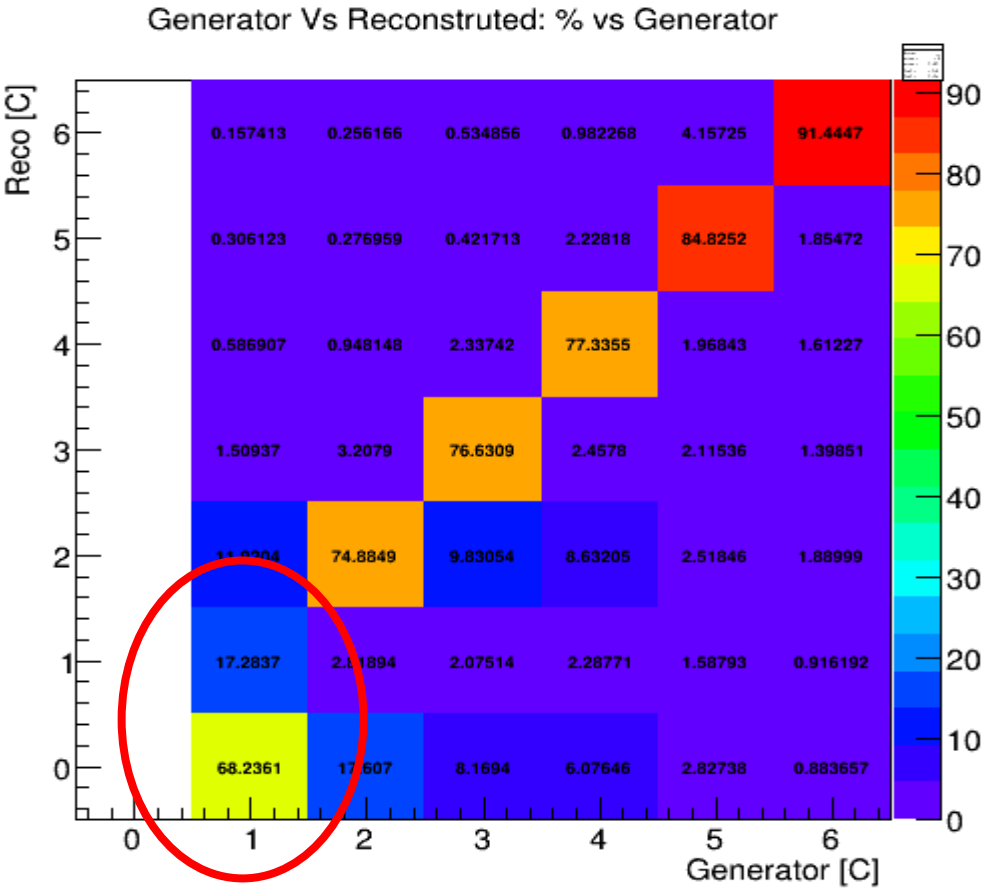
LAST NEW from Alessio:

Error in version < 1295: the reconstruction was using the true MC charge instead of the charge reconstructed from the TOF. To be confirmed.

OLD CODE ver <= 1291



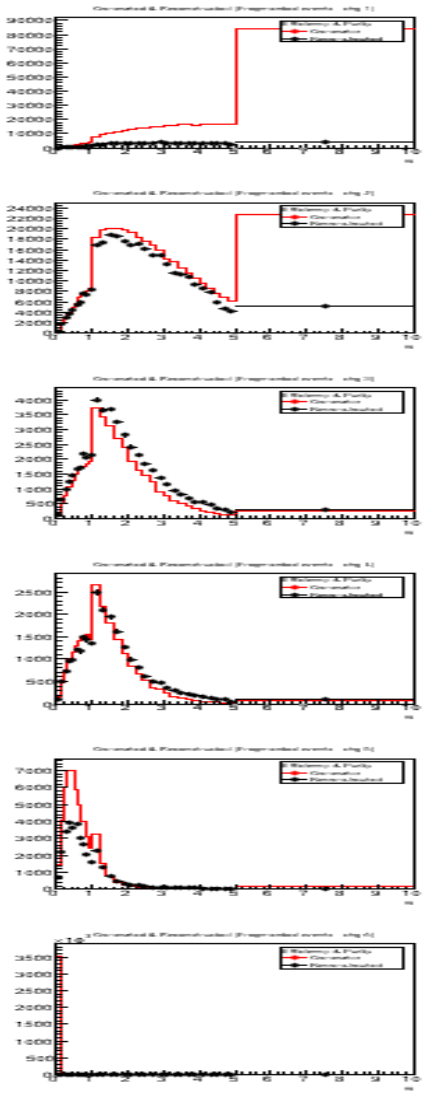
NEW CODE ver > 1291

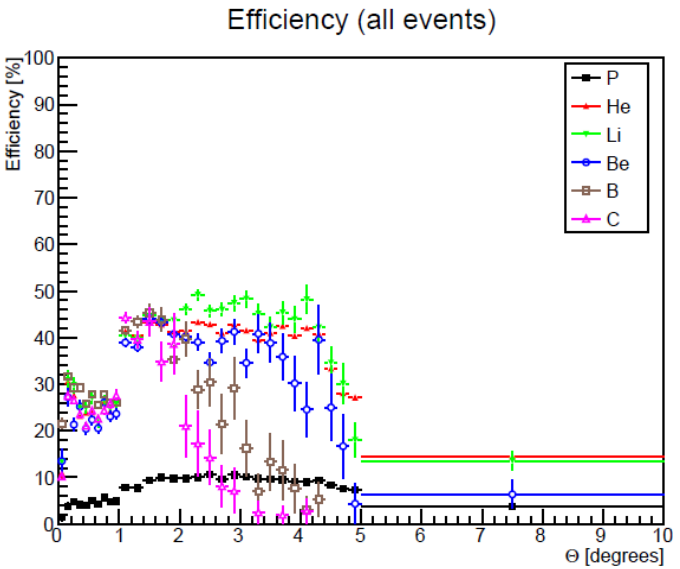


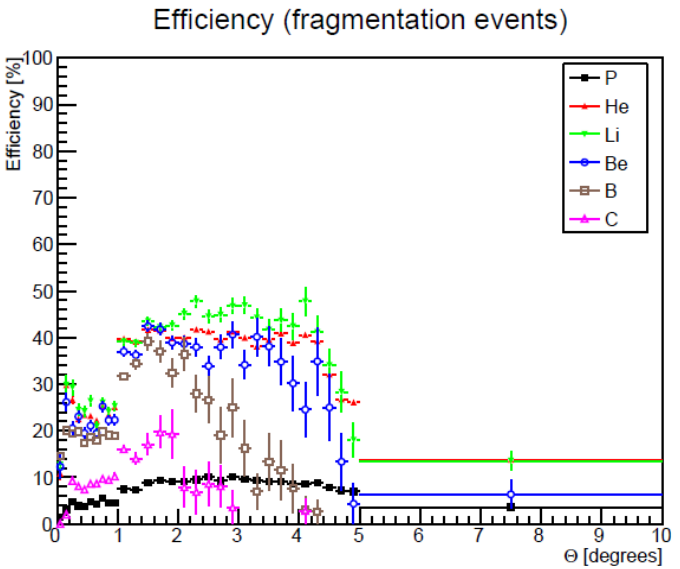
In both the cases the «naive» correction and the corrections based on the matrix inversion produce the same correct values (as expected from generator) when applied to simulated events.

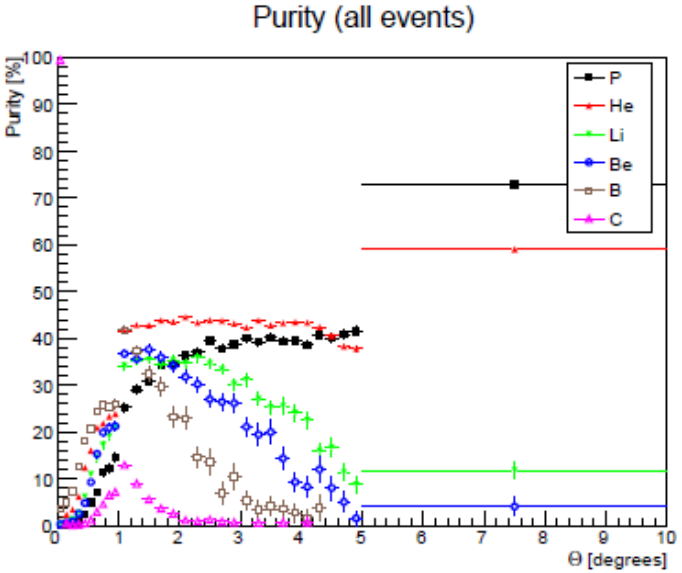
On data the results are different when using the pur/eff simple correction or matrix inversion.

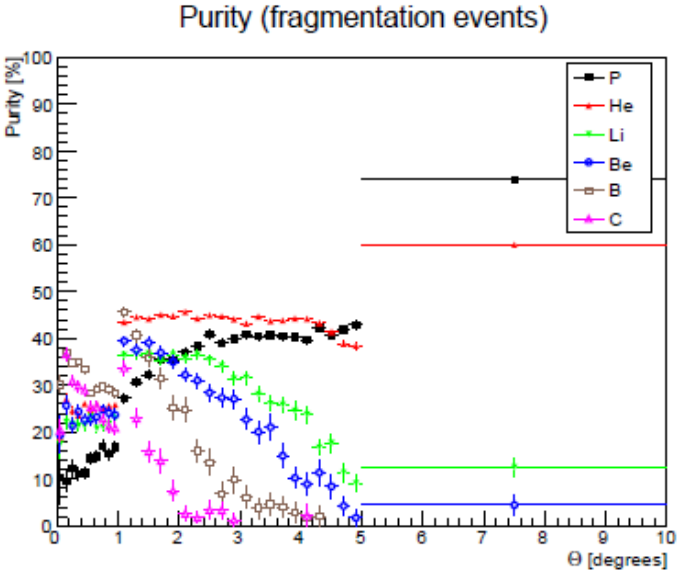
Efficiencies and purities calculated for each bin in **theta** (fragmentation events, files produced with last software version used, low proton efficiency)





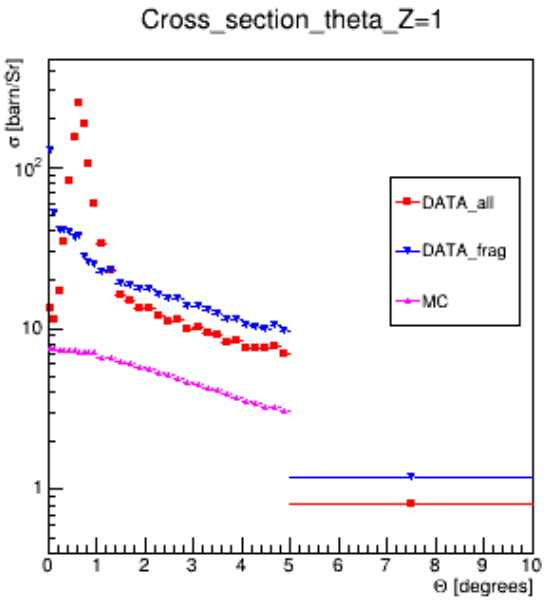


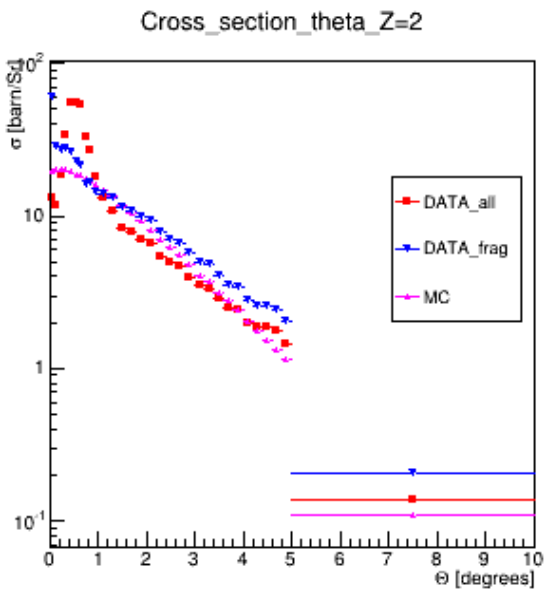


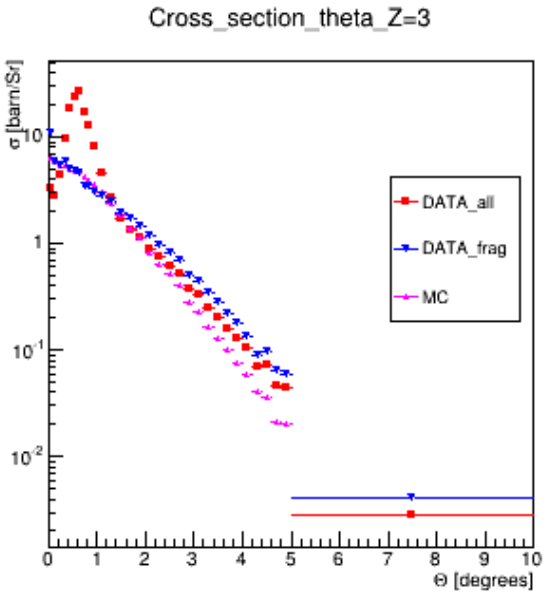


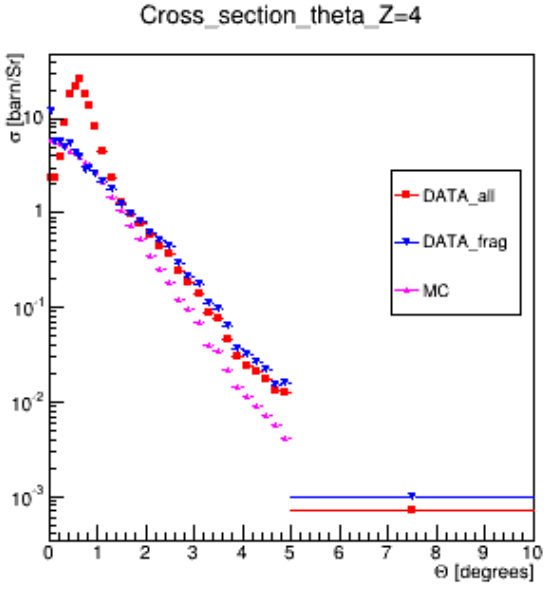
Bin efficiencies lower than total charge efficiencies (bins too small ?)

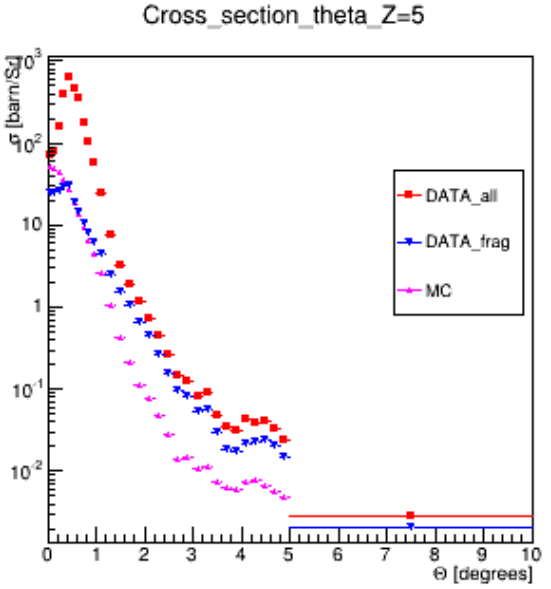
«Simple» calcolation of cross sections vs theta (low p efficiency sample)

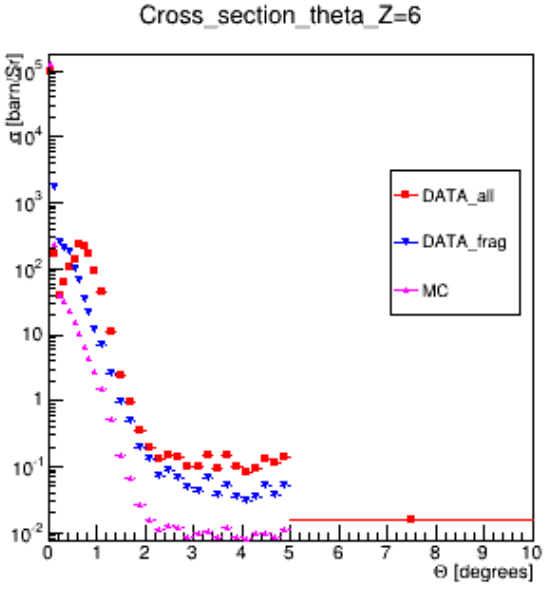


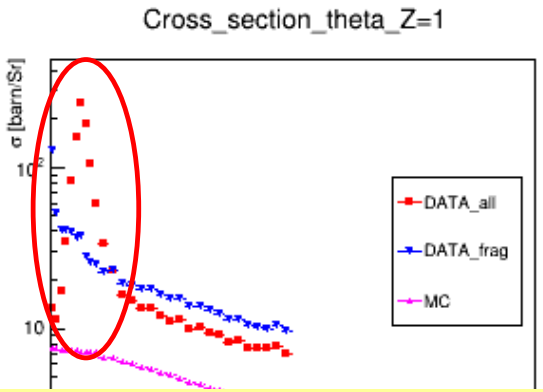


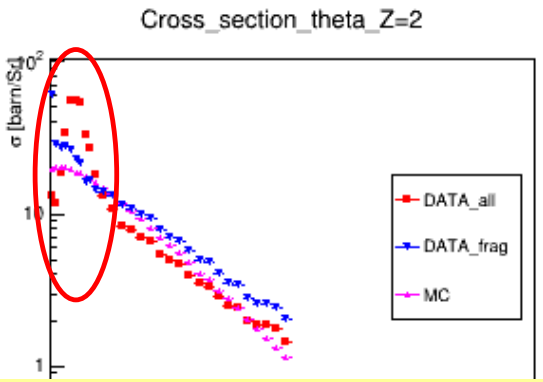


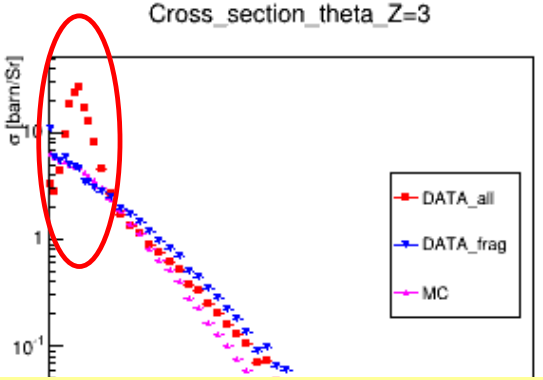






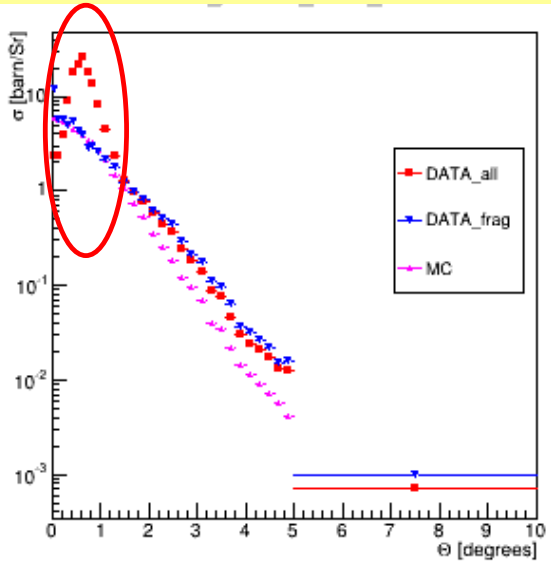


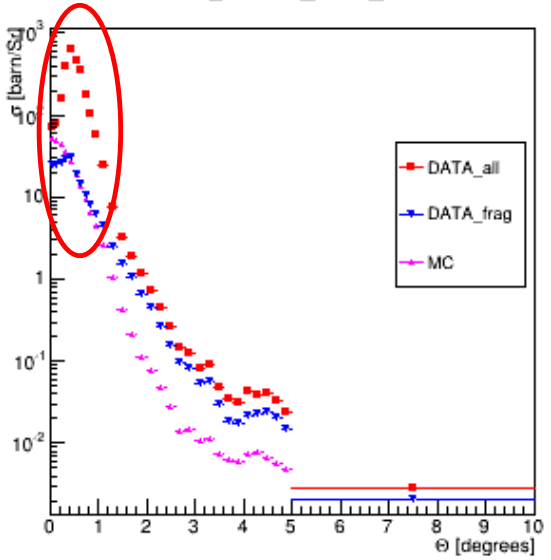


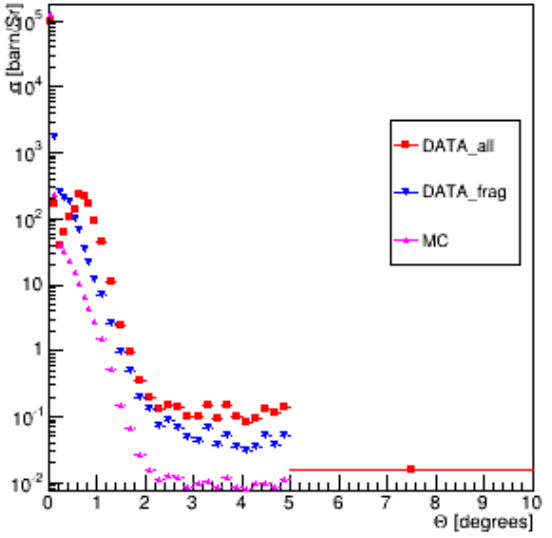


See our presentation of 25/9 for our doubts on:

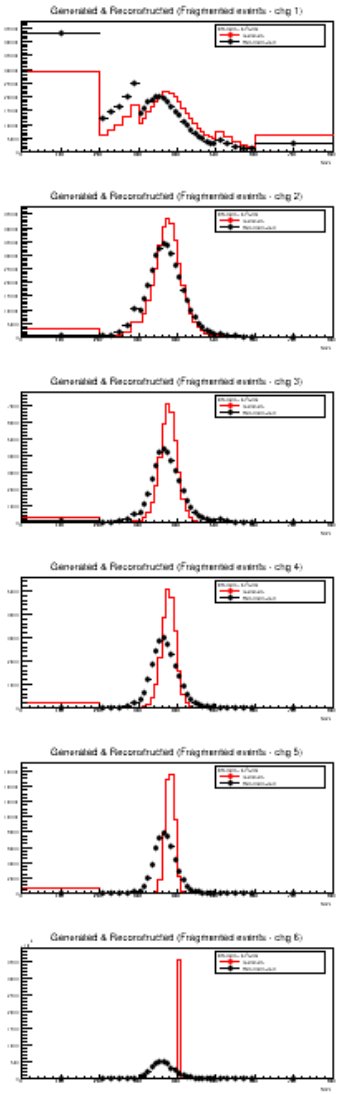
- behavior at the central slats (fragmentation and wrong charge assignment)
- pile-up events (not handled in the reconstruction code, not simulated).

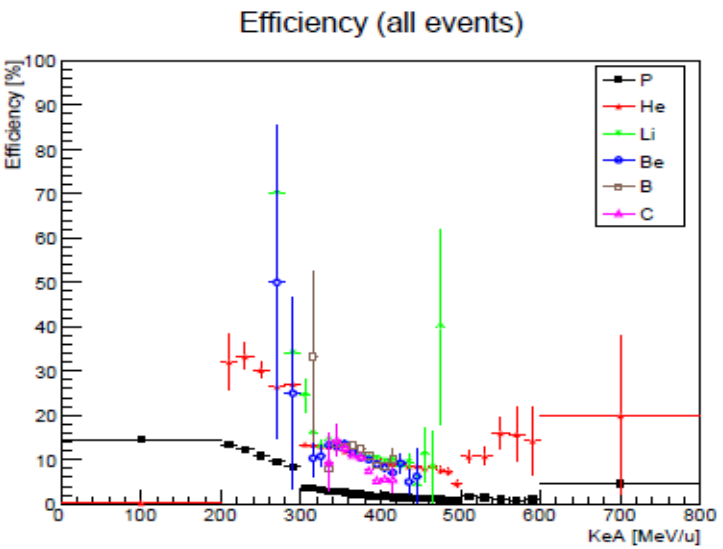


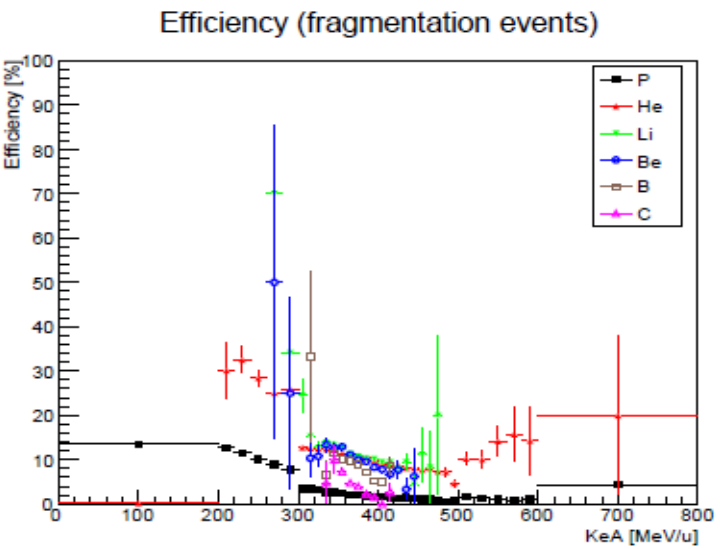


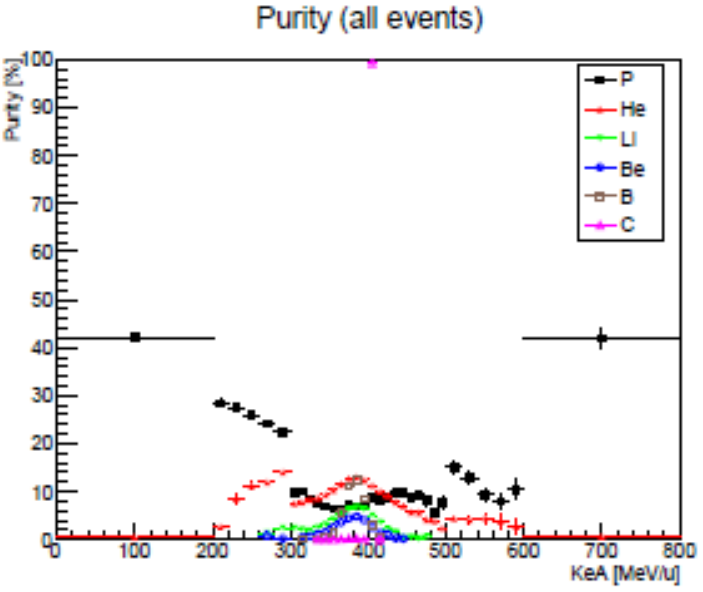


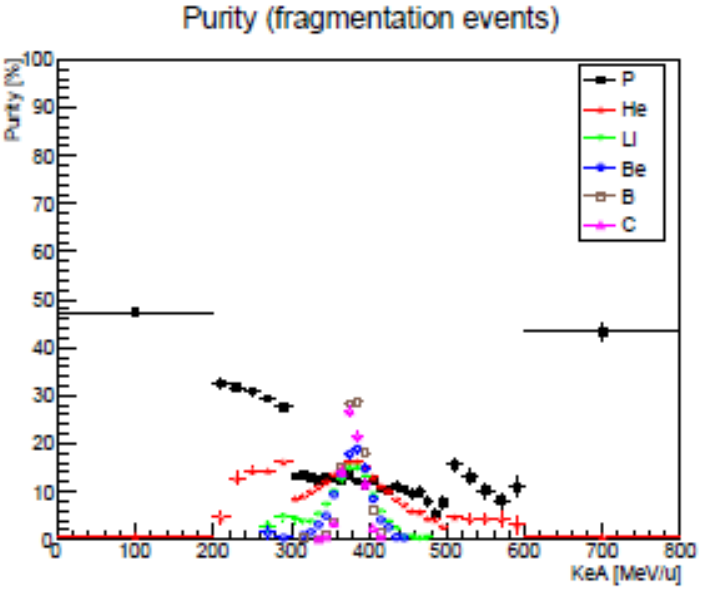
Efficiencies and purities calculated for each bin in **KE/Mass** (low p efficiency sample)



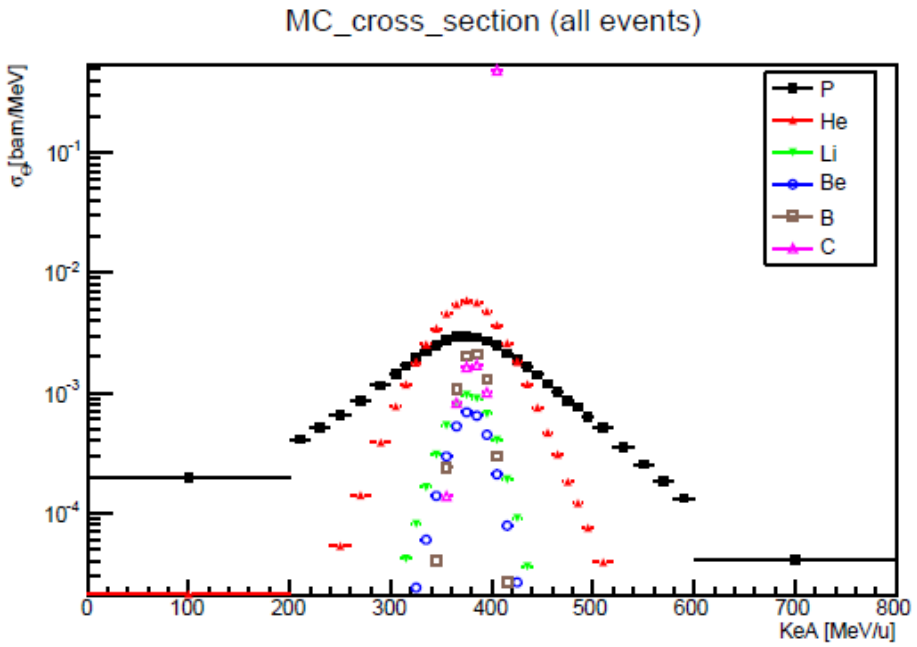


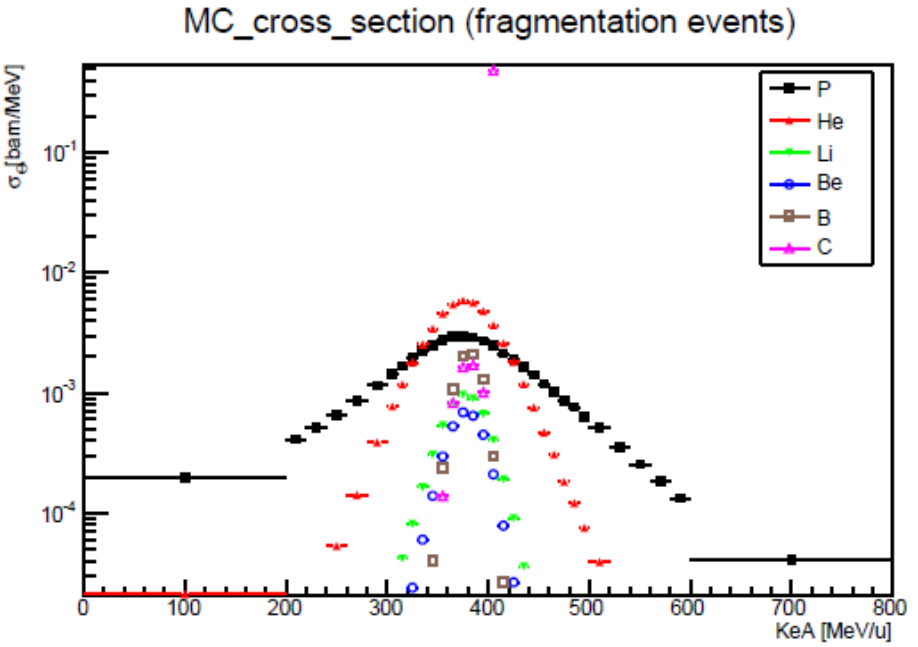


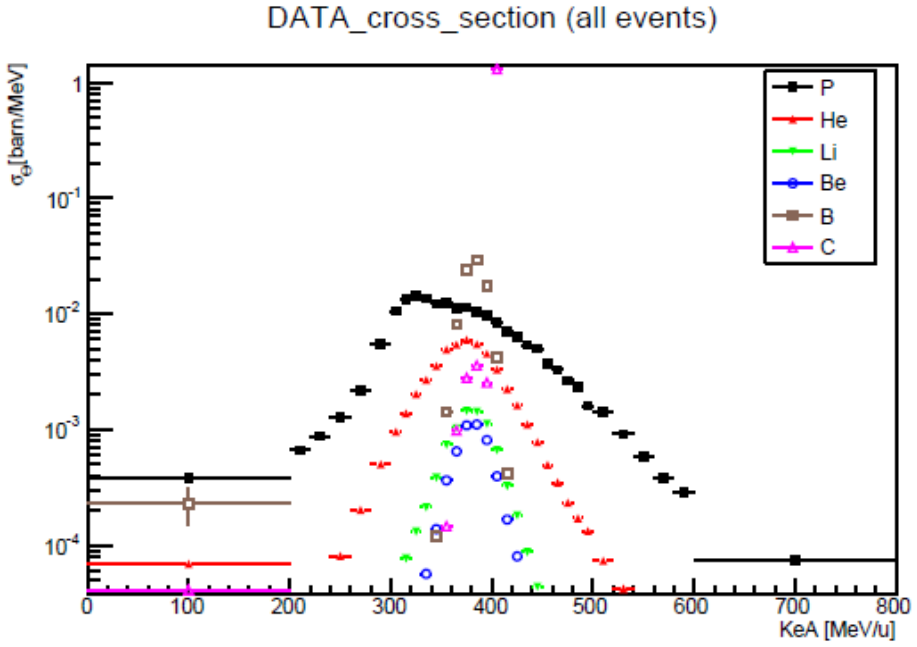


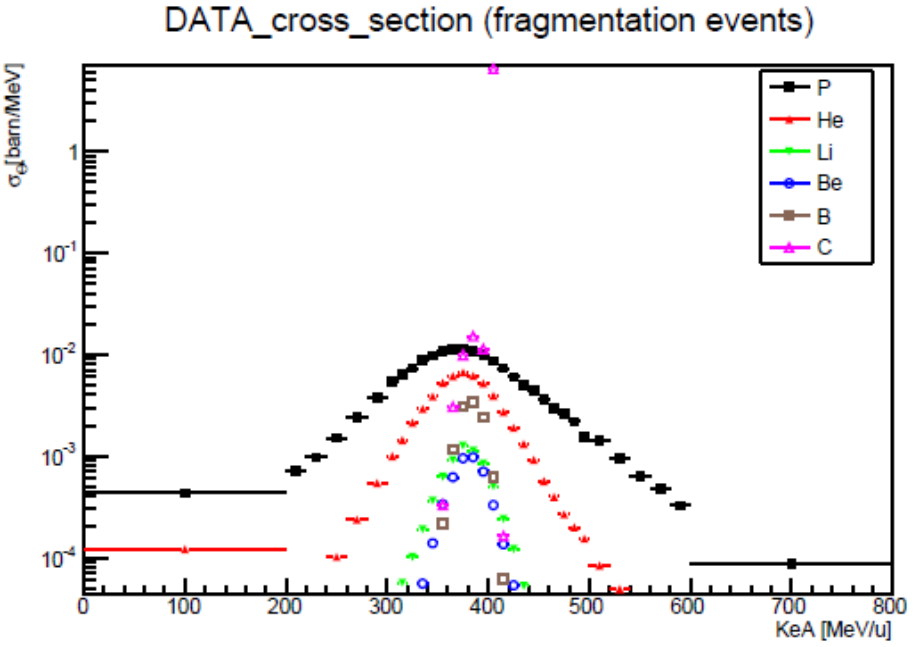


Bin migrations degrade the efficiencies to ~10-20%.
Bin too small ? Reco/gene shifts to be fixed ?
Doubts on the opportunity to use KE/mass for the cross section.


MC_cross_section (all events)
P
He
Li
Be
B
C
KeA [MeV/u]


MC_cross_section (fragmentation events)
P
He
Li
Be
B
C
KeA [MeV/u]


DATA_cross_section (all events)
P
He
Li
Be
B
C
KeA [MeV/u]


DATA_cross_section (fragmentation events)
P
He
Li
Be
B
C
KeA [MeV/u]