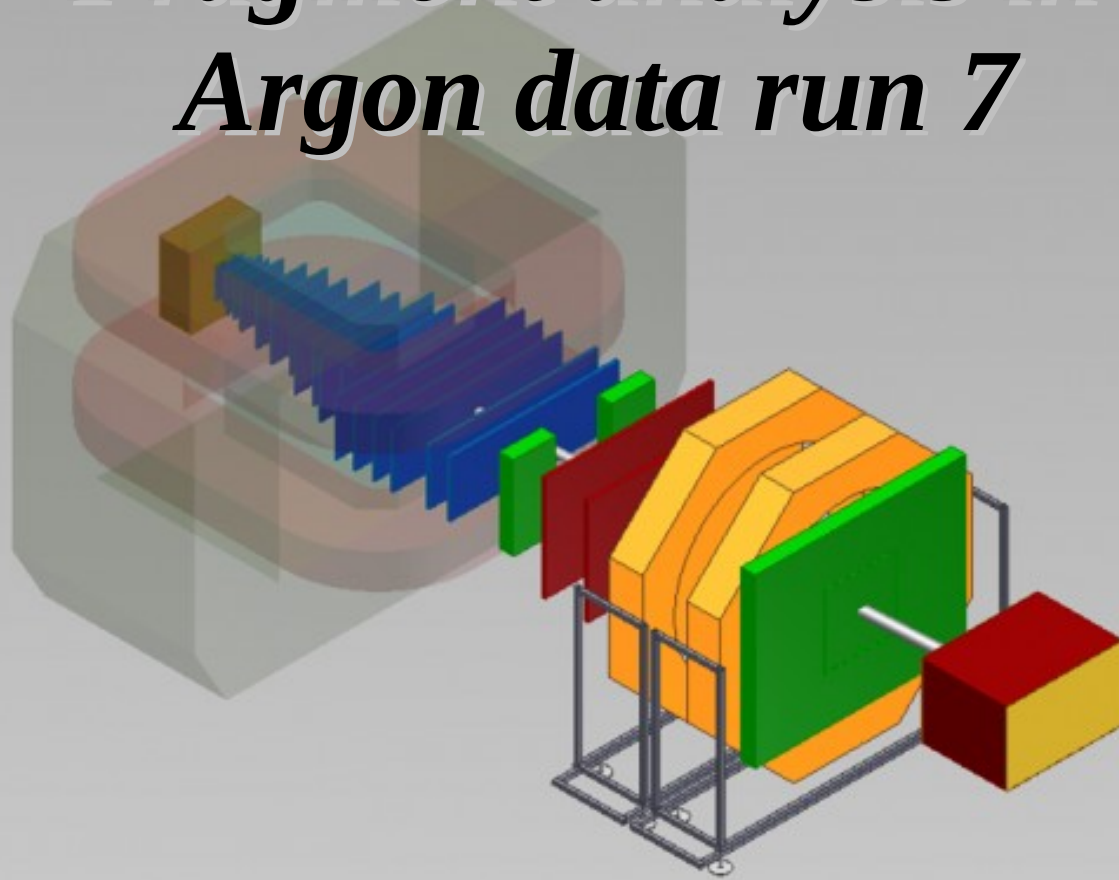


Current Progress in TOF700 Fragment analysis in Argon data run 7



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Outline

1. Previous results

2. New results

- Gem Efficiency
- DCH Efficiency
- TOF700 Efficiency
- Protons distributions
- Deutrons Distributions

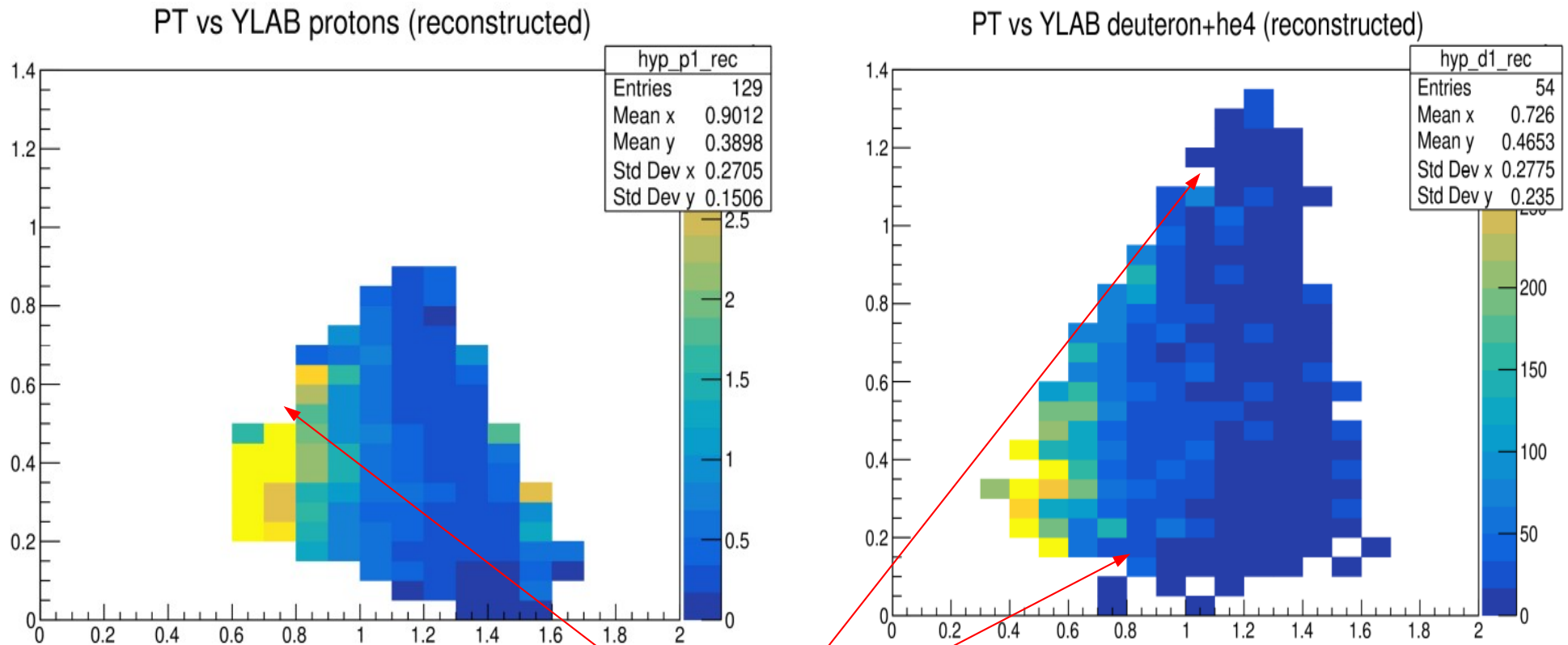
3. Energy losses methodology

- Preparations
- Truncated mean method
- Energy loss results

4. Conclusions

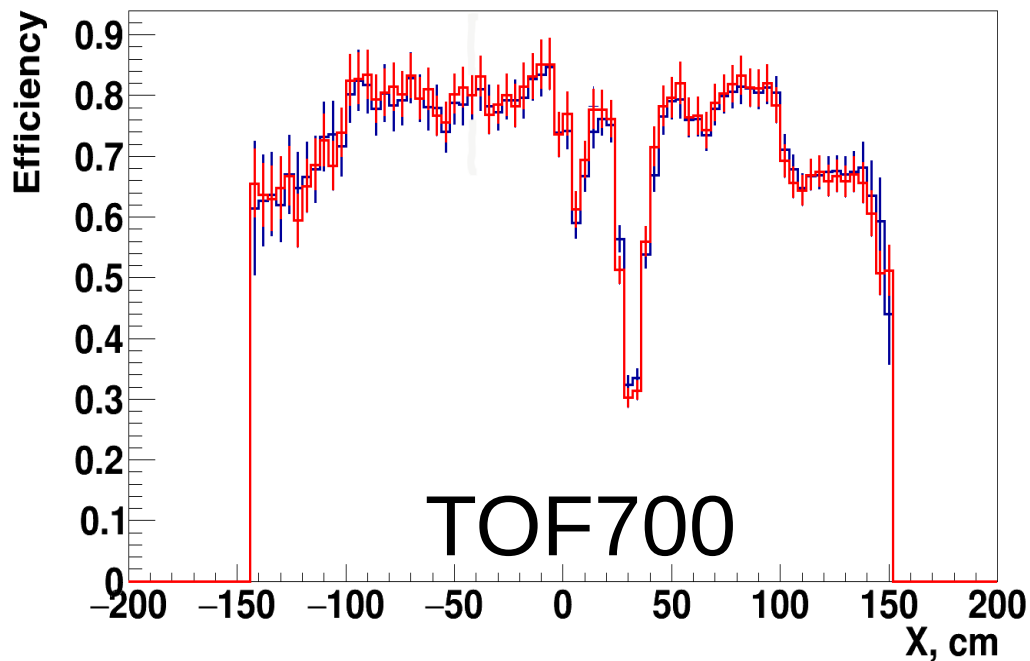
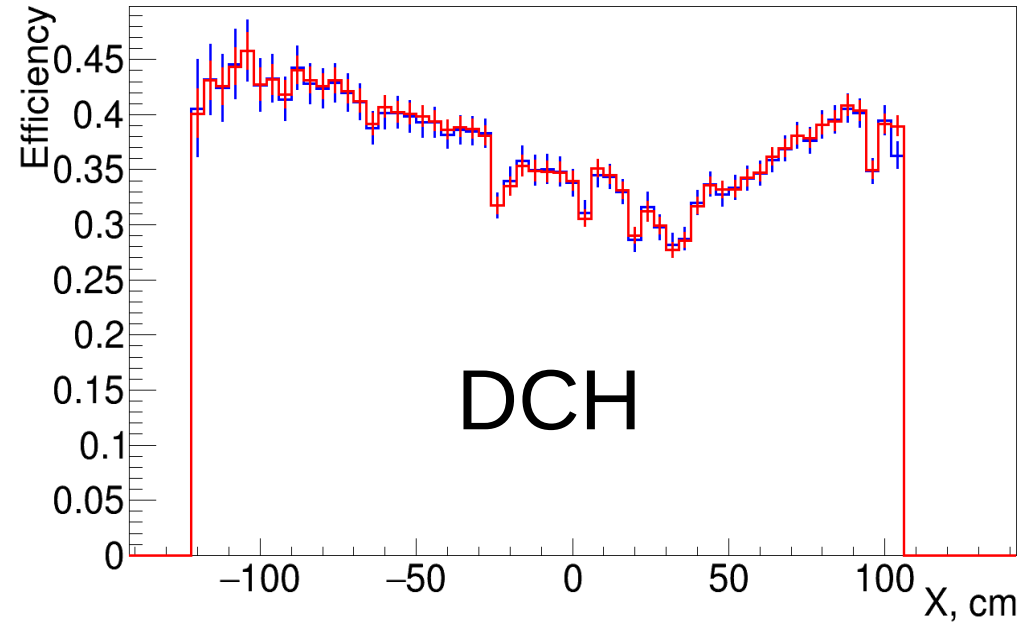
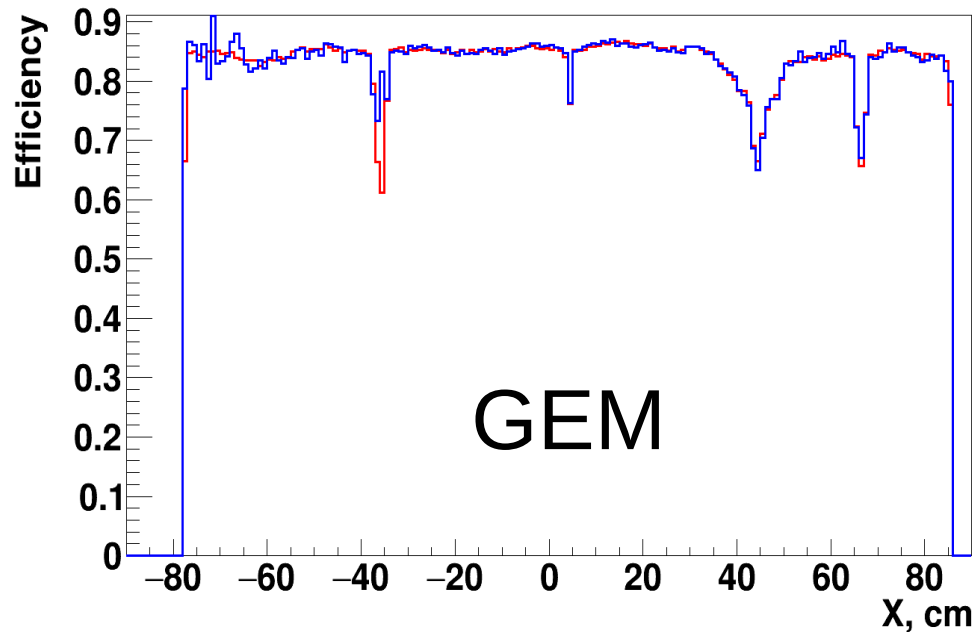
Previous Results

Phase space for **Efficiency corrected Data**
for protons and deuterons



Some bins along the edge of the area
are missing due to low statistics in MC sample

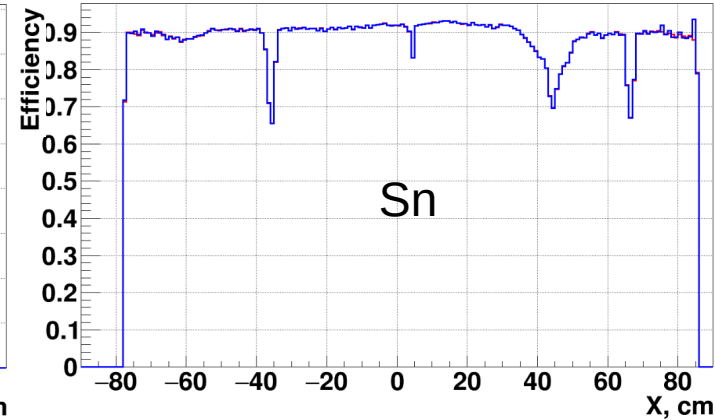
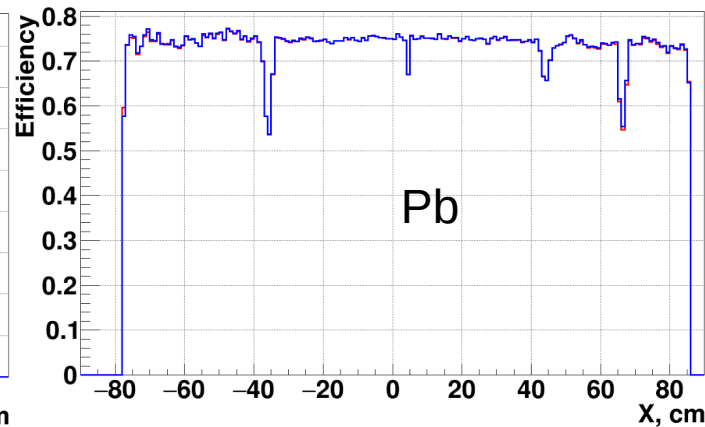
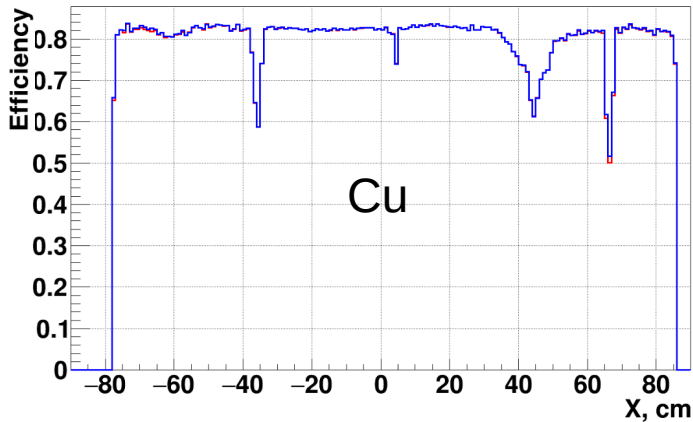
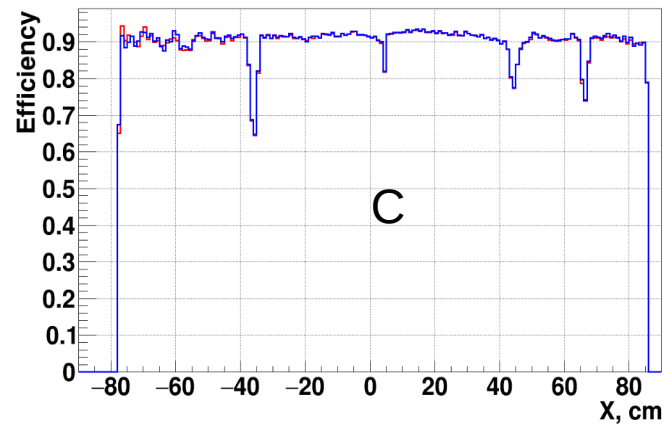
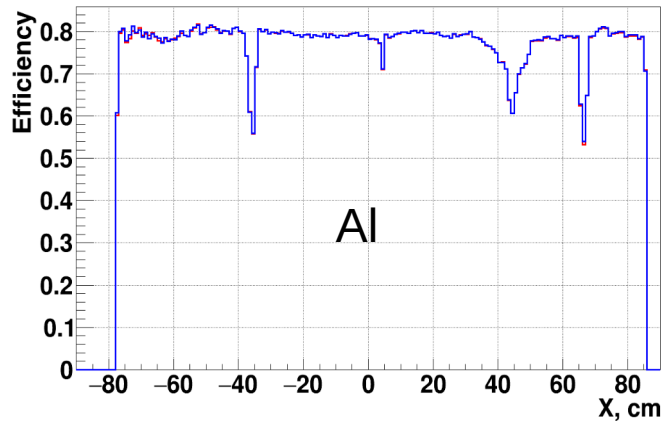
Previous Results



Data MC

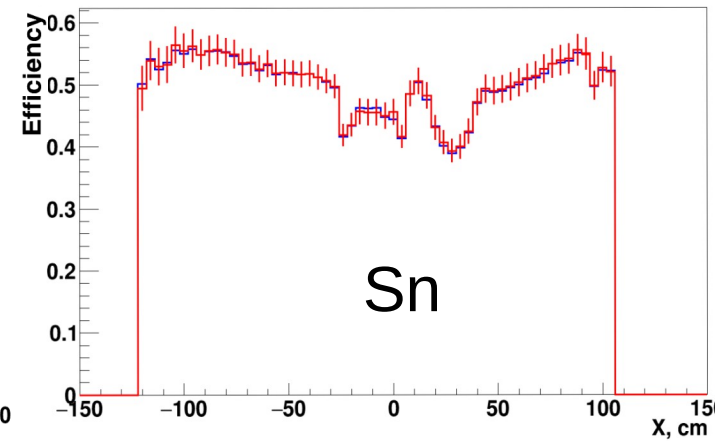
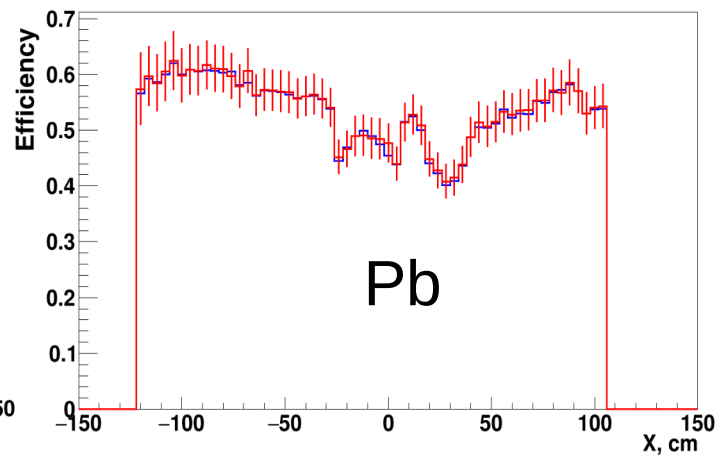
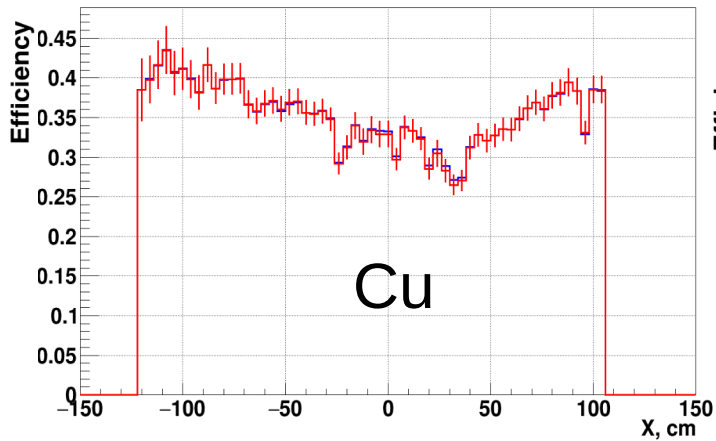
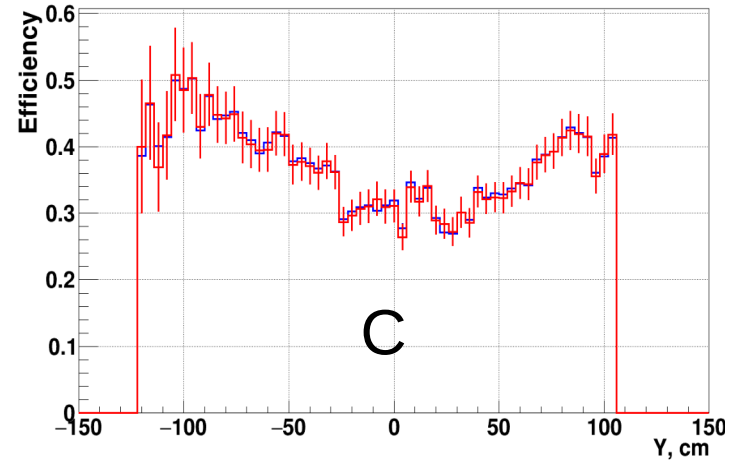
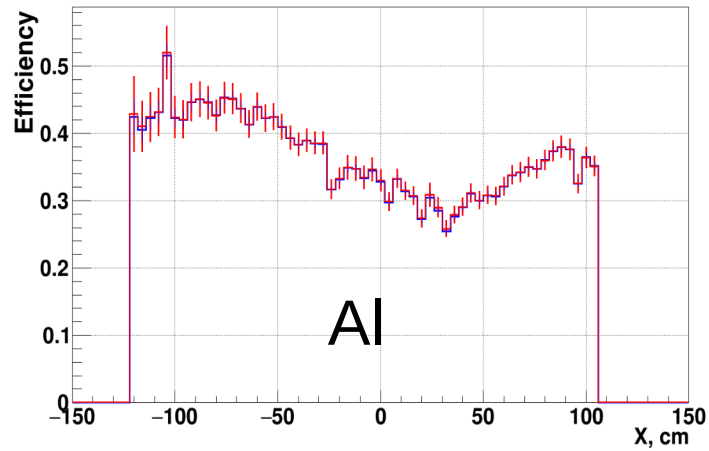
Good efficiency agreement,
but calculated for all targets
together!

New GEM Efficiency



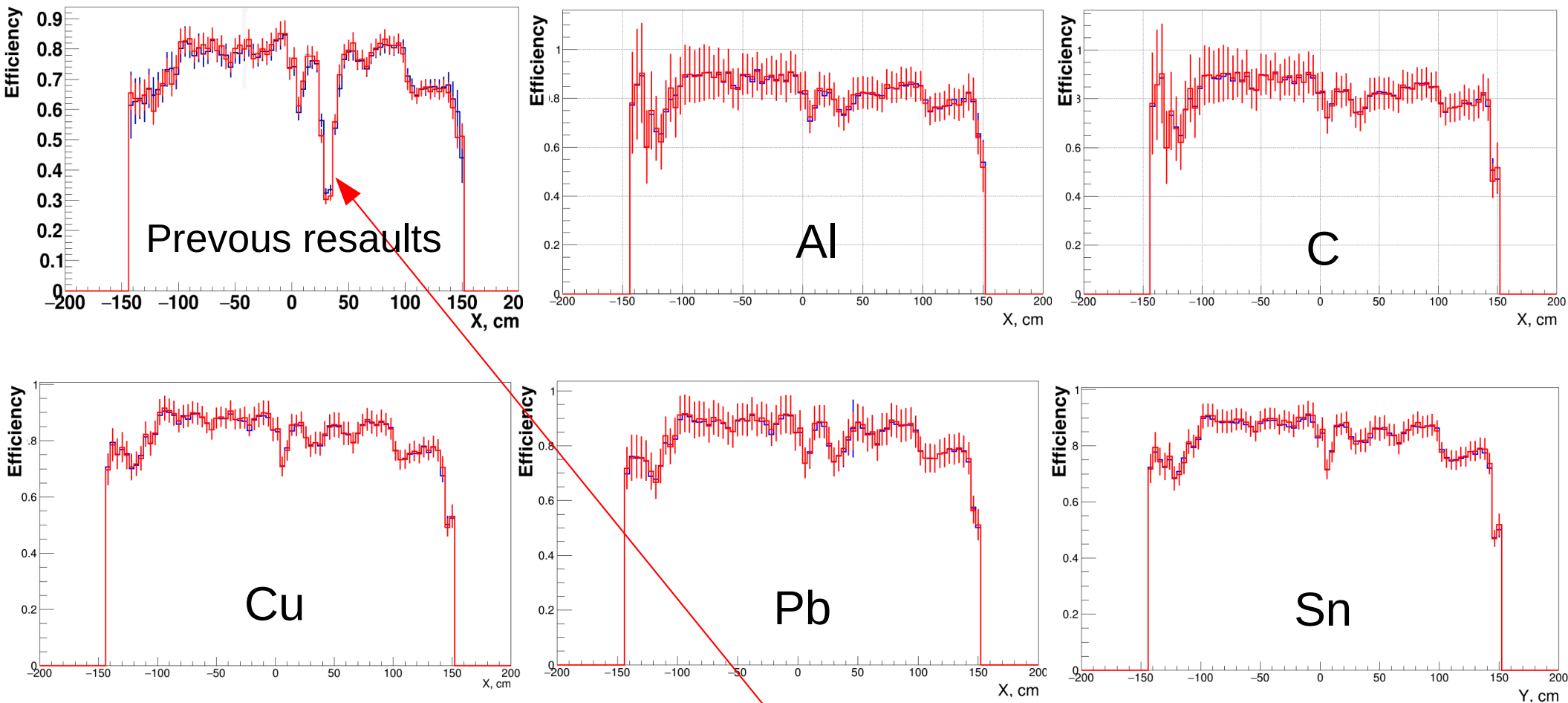
Good efficiency agreement between
MC and Data by target!

New DCH Efficiency



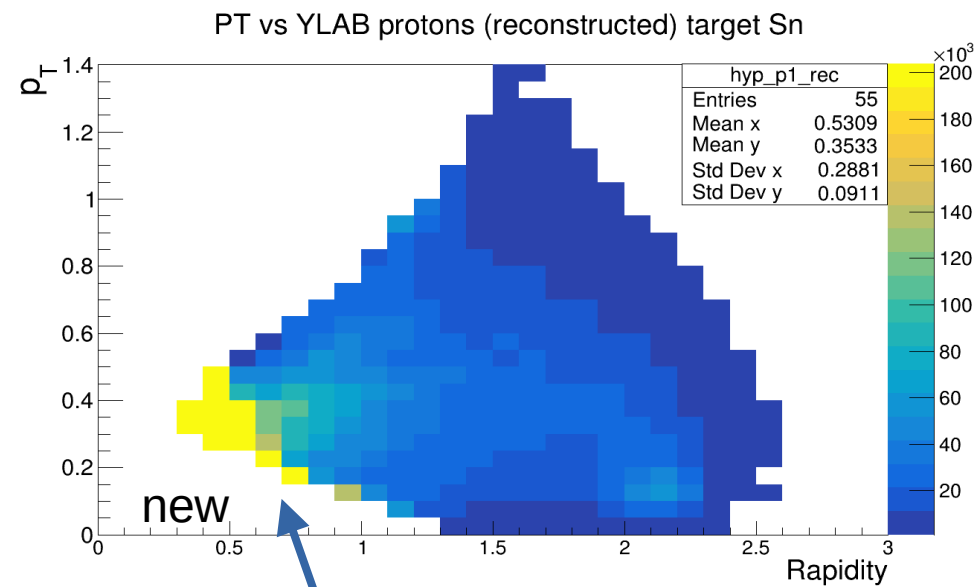
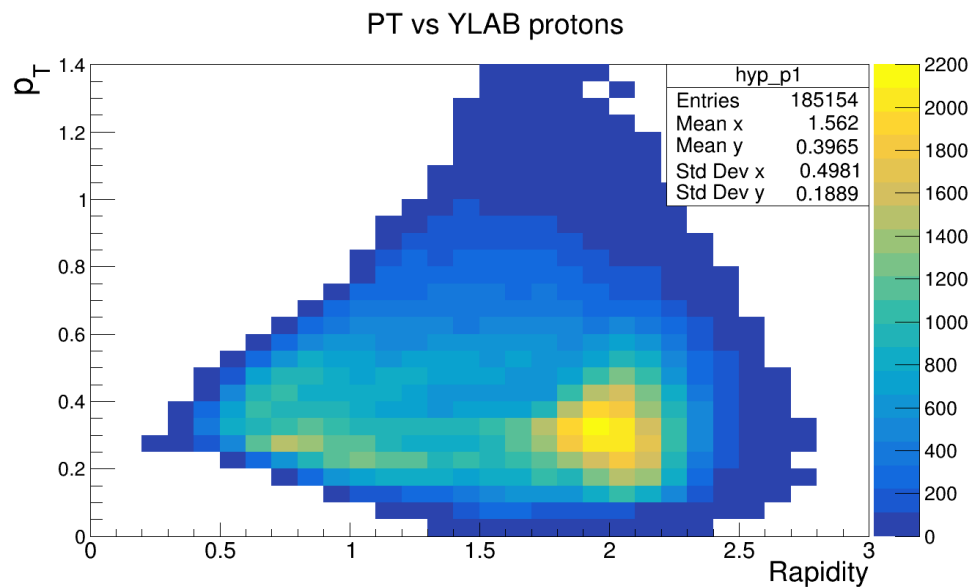
Good efficiency agreement between
MC and Data by target!

New TOF700 Efficiency

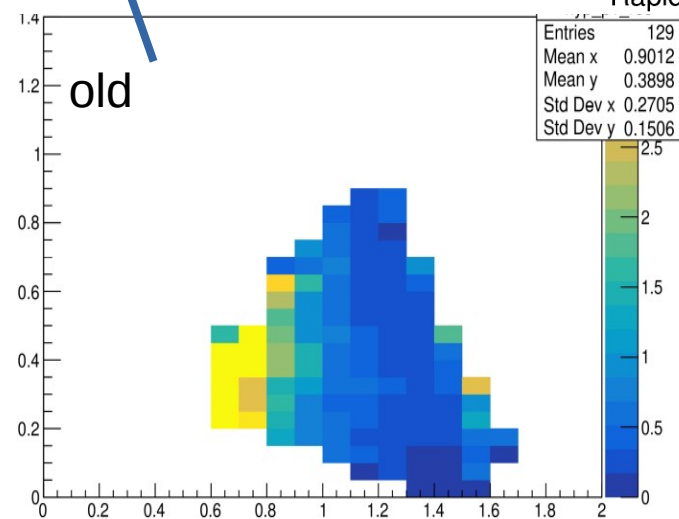


Ineffective area due to the incorrect work of chamber 5.1 was solved.
Good efficiency agreement between
MC and Data by target!

Phase space for protons for *Data* and *Efficiency corrected Data Sn target*

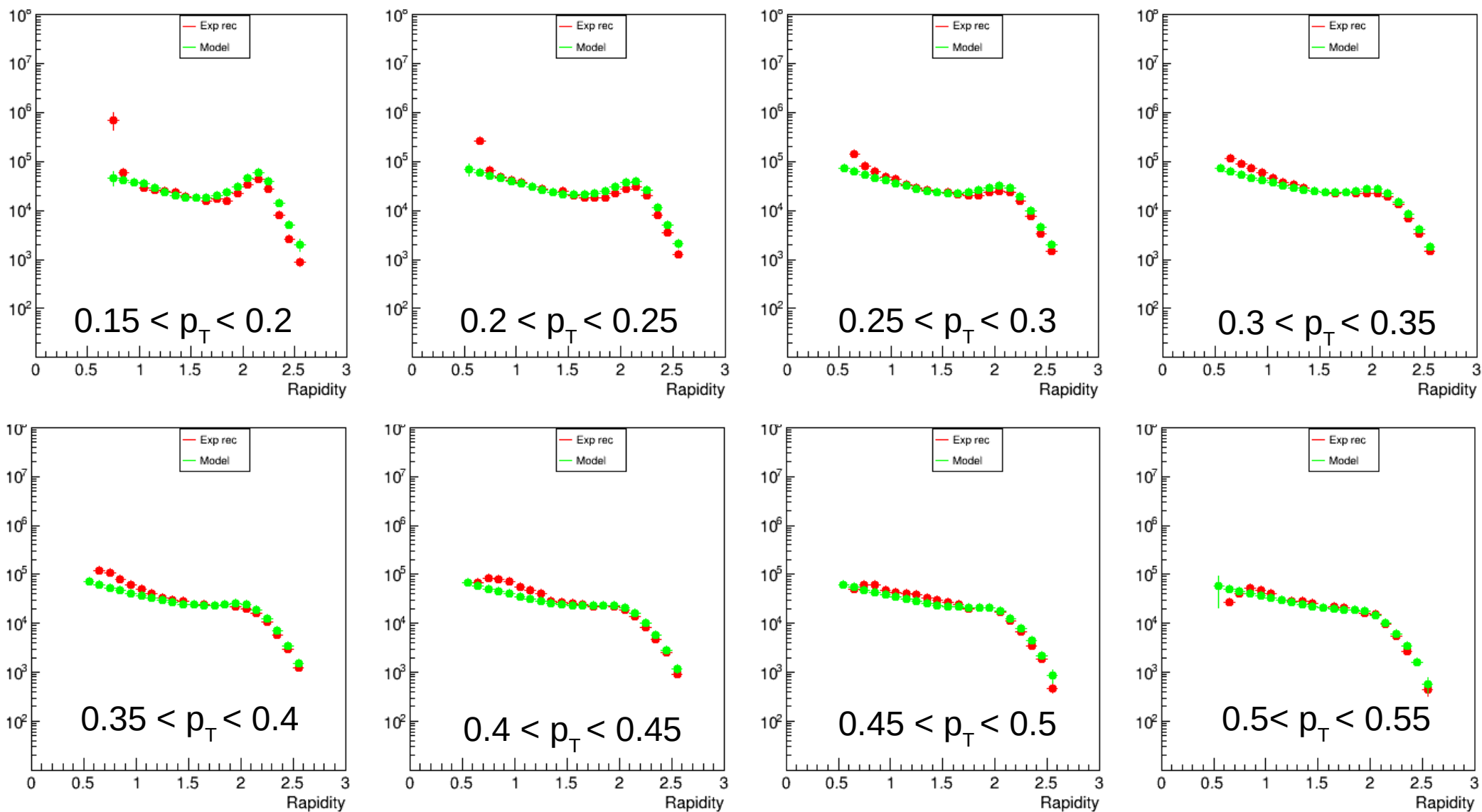


new



After increasing the MC statistics we no longer have empty bins.

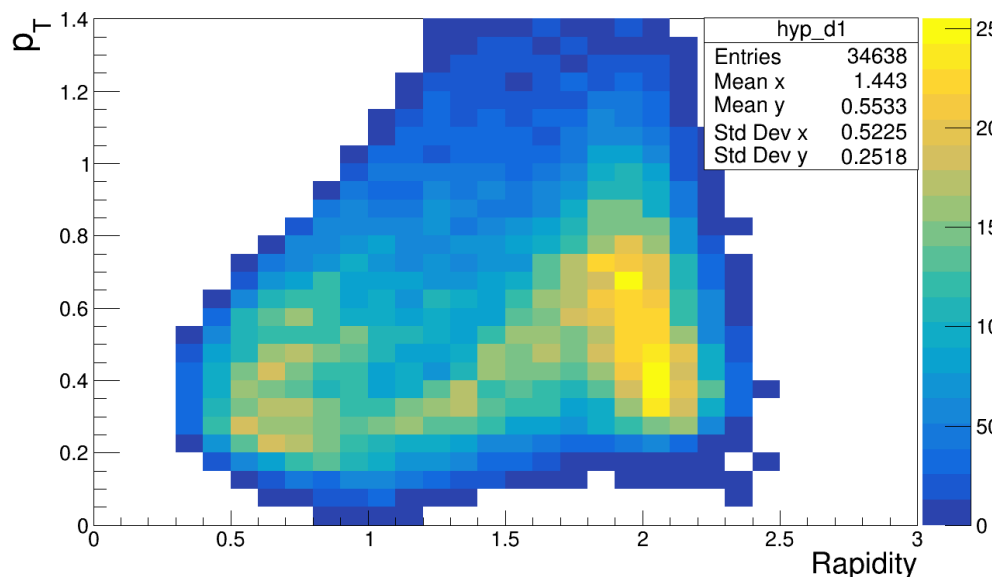
Rapidity distributions for protons in different intervals on p_T for **MC model** and **efficiency corrected Data**, Sn target



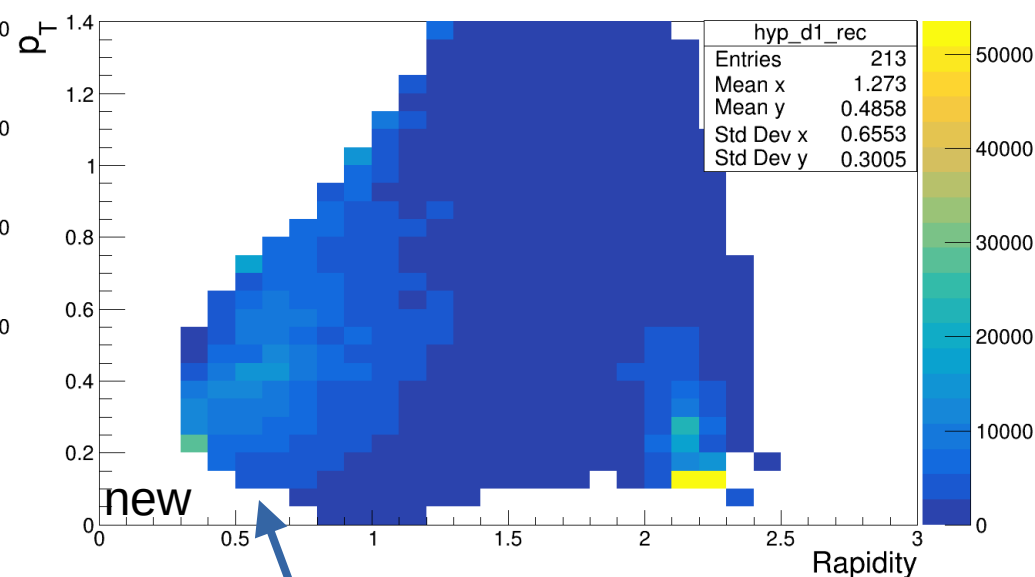
There are no significant differences between the behavior of **MC** and **Data**.

Phase space for deuterons for **Data** and **Efficiency corrected Data Sn target**

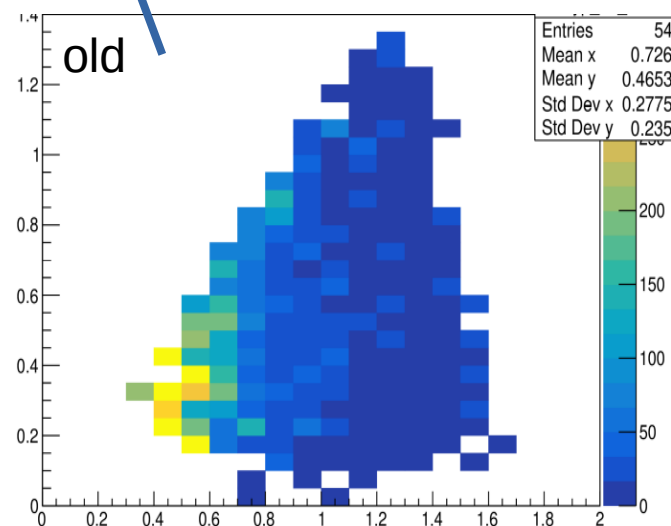
PT vs YLAB deuteron+he4



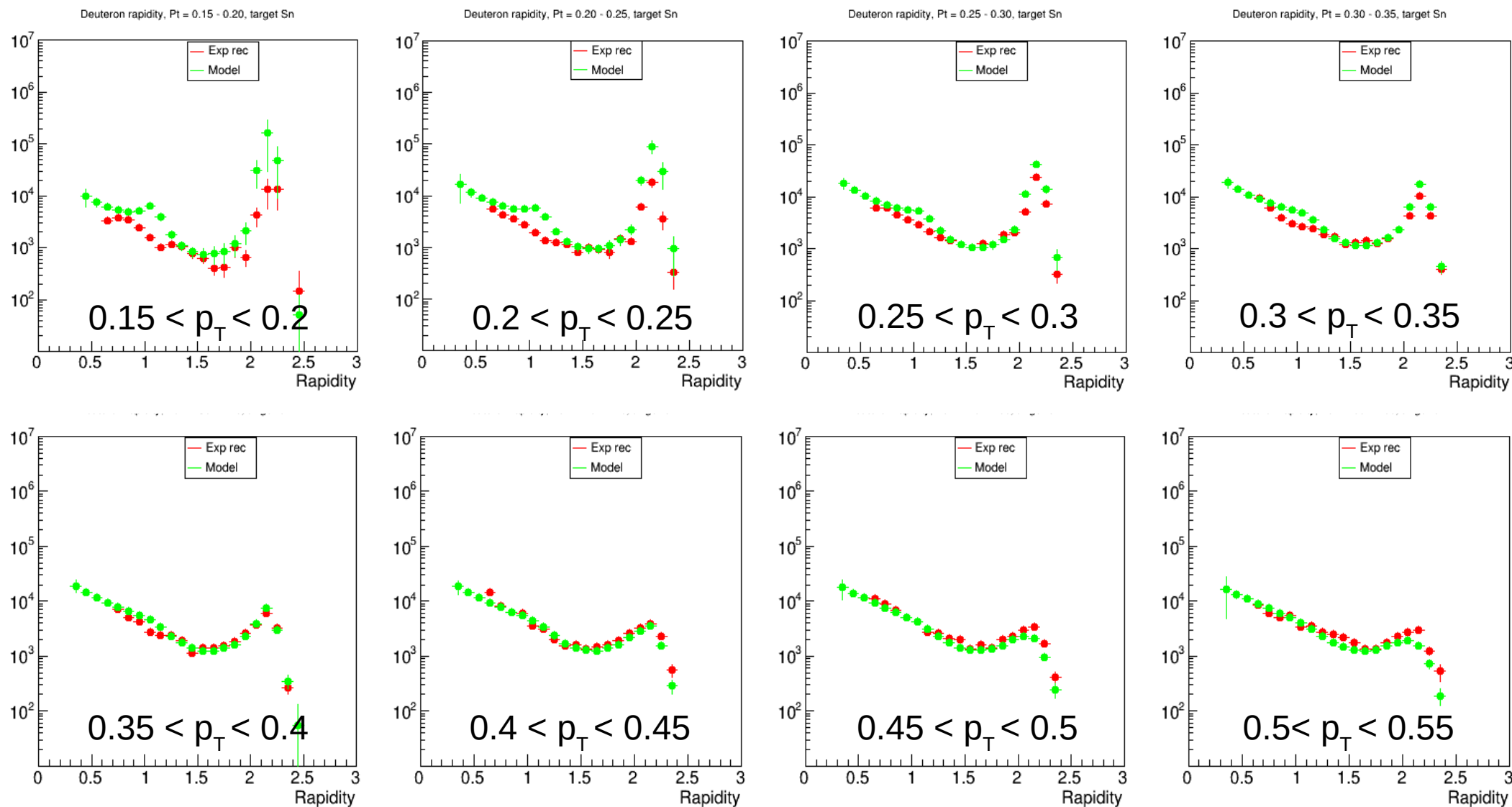
PT vs YLAB deuteron+he4 (reconstructed) target Sn



After increasing the MC statistics we no longer have empty bins.



Rapidity distributions for deuterons in different intervals on p_T for **MC model** and **efficiency corrected Data**, Sn target



We have some differences between the behavior of **MC** and **Data**

Energy loss methodology

In order to separate deuterium from helium-4 an additional procedure was developed:

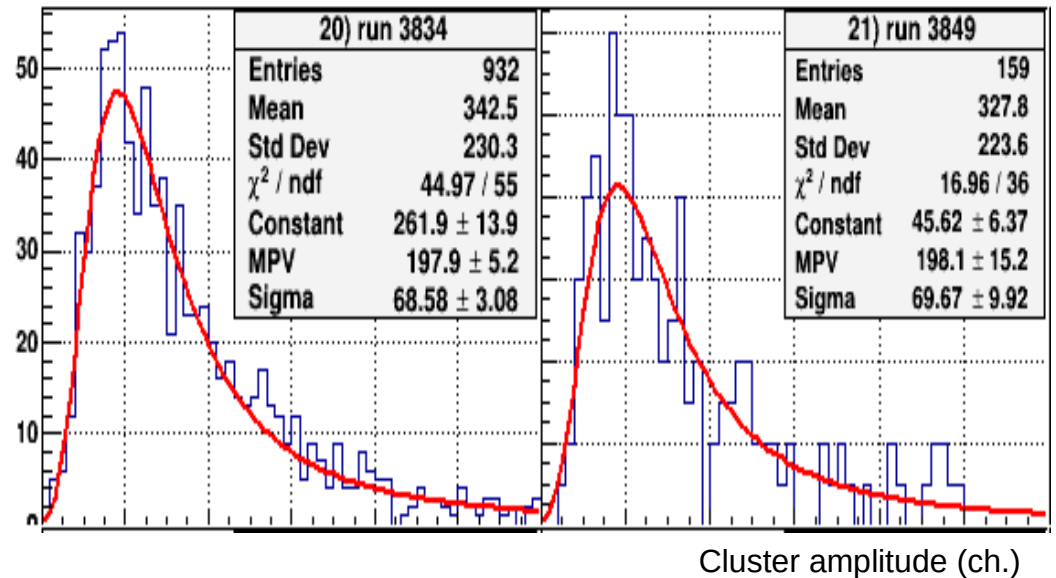
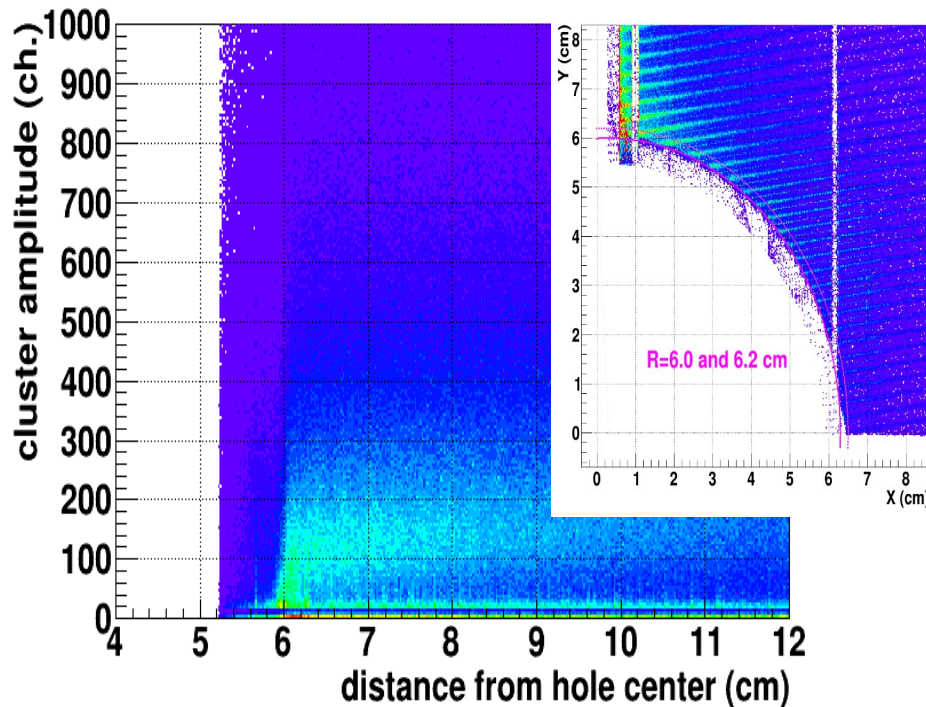
- Calibration
- Pass Cut Selection
- Truncated mean method
- Energy loss results

Preparation of GEM cluster amplitude for track energy loss analysis

Removing clusters with reduced amplitude:

- near HV pads separators
- near dead strips
- near sensitive area edges

Run dependent gain correction
(30% increase of gain with 5° gas warming)

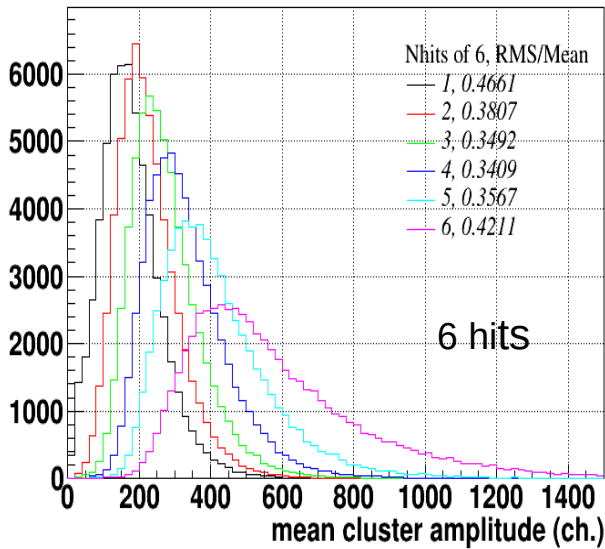
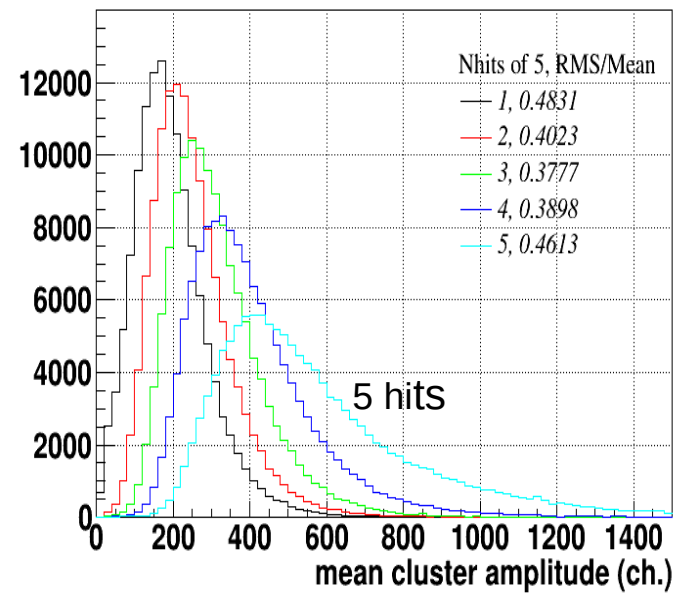
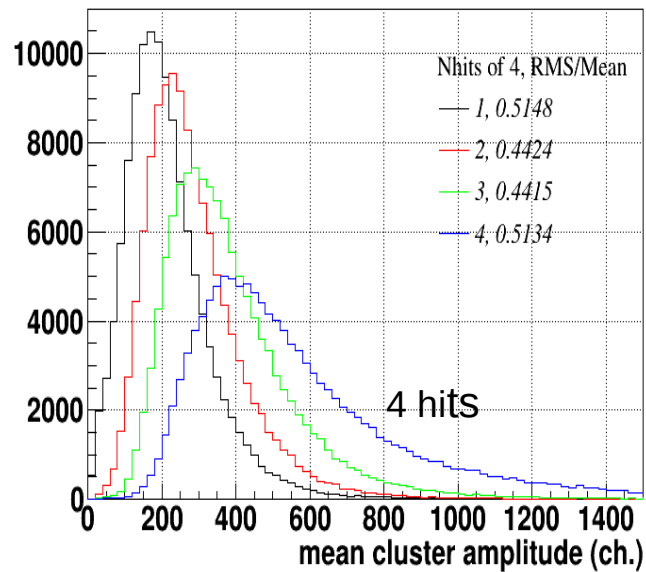
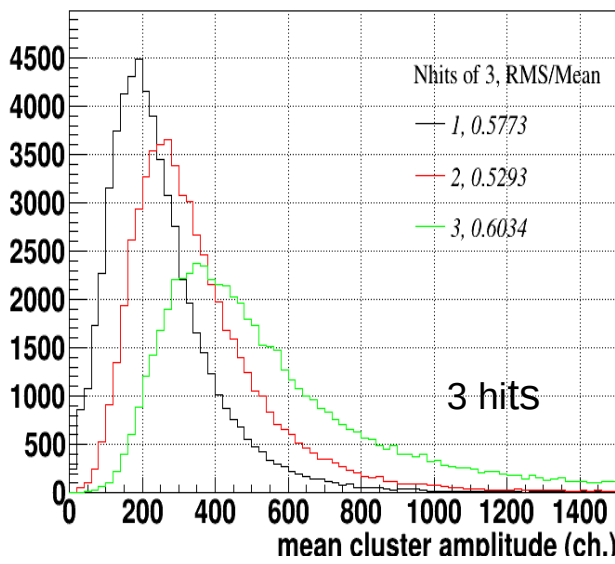


The corrections were made by Igor Rufanov

~15% of clustrers are lost for dE/dx

Choice of hit fraction for "truncated mean" method

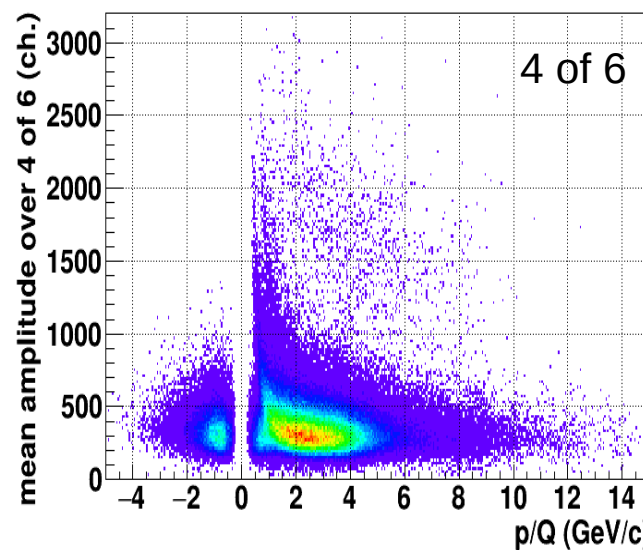
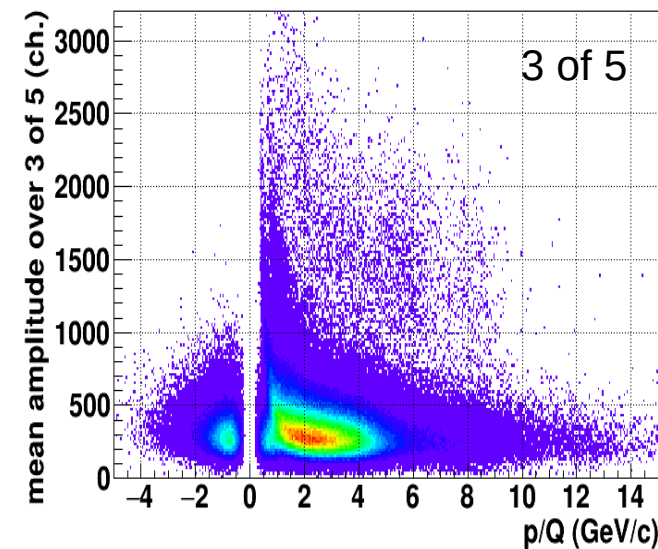
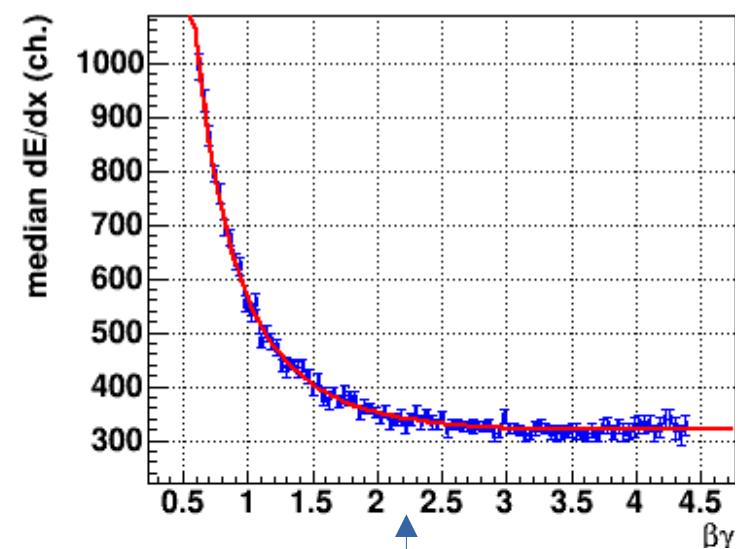
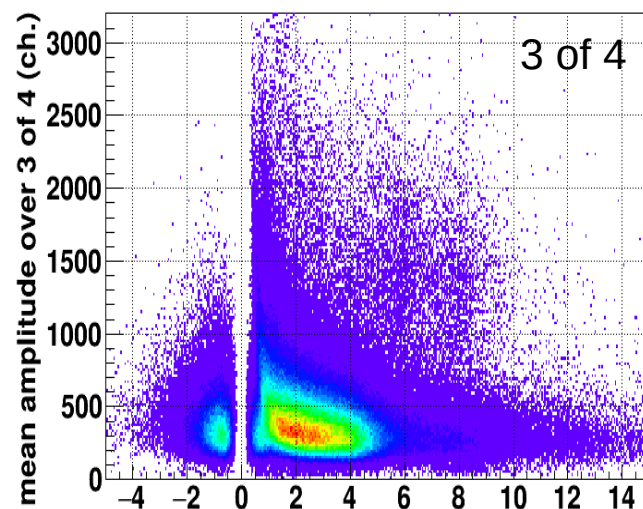
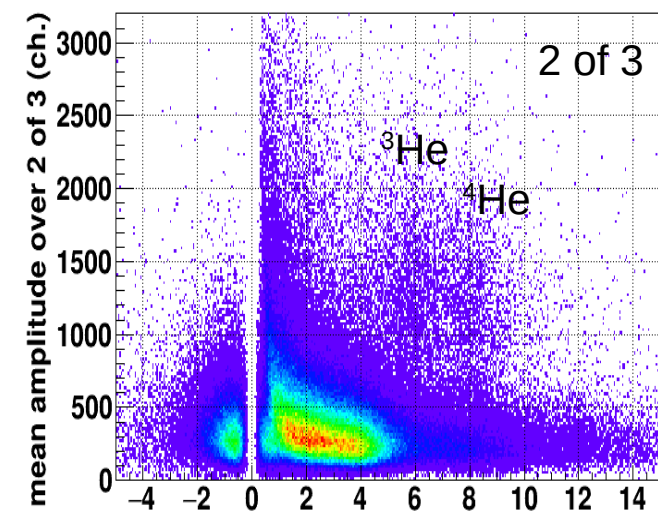
The distribution of energy losses in thin layers of material has an extremely long high energy tail. Because of this, the average value of a given fraction of clusters (usually 60-70%) with the smallest amplitudes is used to estimate track losses.



Minimal ratio RMS/Mean of track dE/dx for $2.5 < p/Q < 3.5$ (GeV/c)

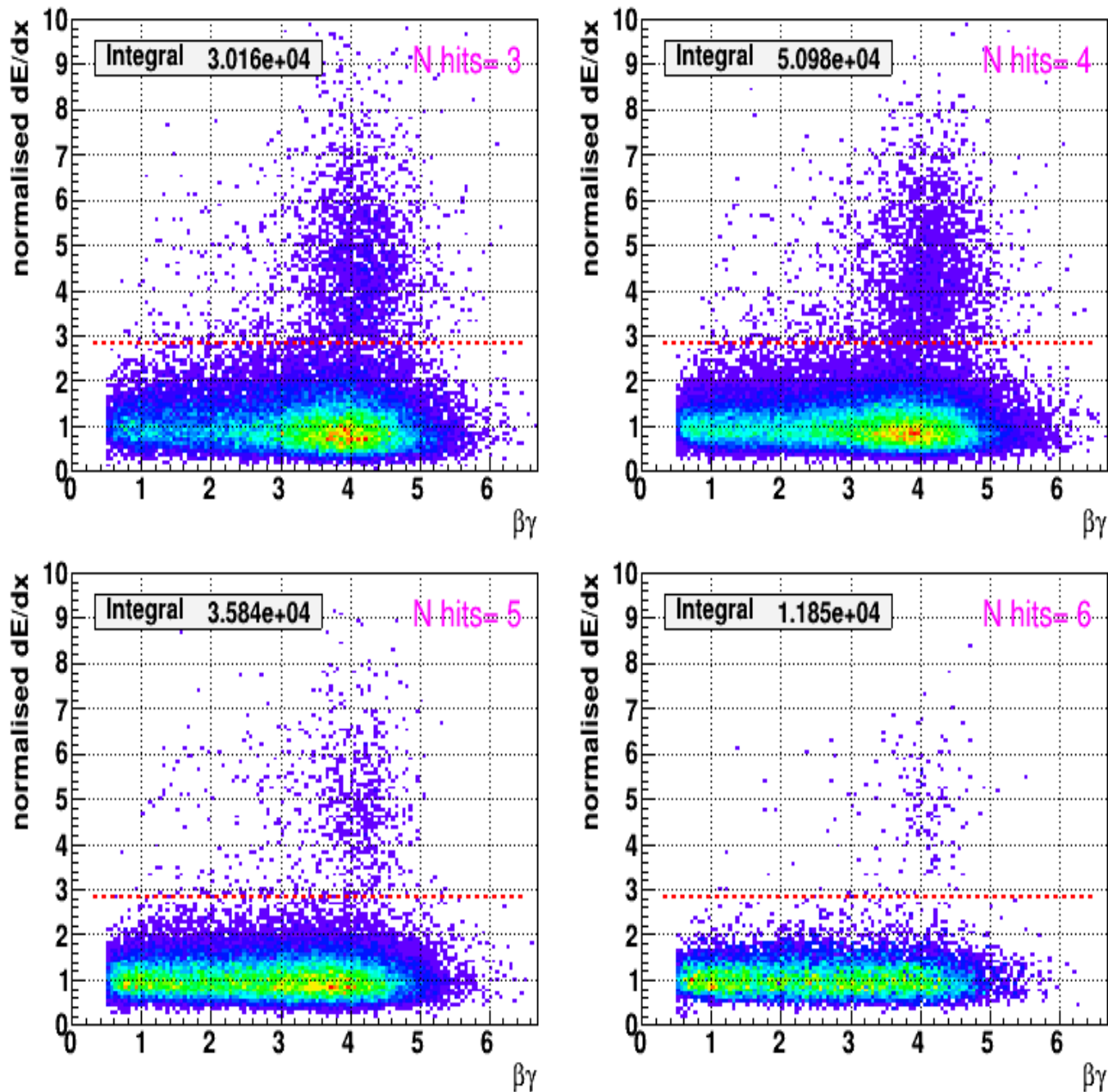
- 2 amplitudes for 3 hit tracks
- 3 amplitudes for 4 hit tracks
- 3 amplitudes for 5 hit tracks
- 4 amplitudes for 6 hit tracks

Truncated mean dE/dx for 3, 4, 5 and 6 hits tracks



Slices in energy loss in $\beta\gamma = p/m$ - distributions are fit and the median value from the fit is used for normalisation

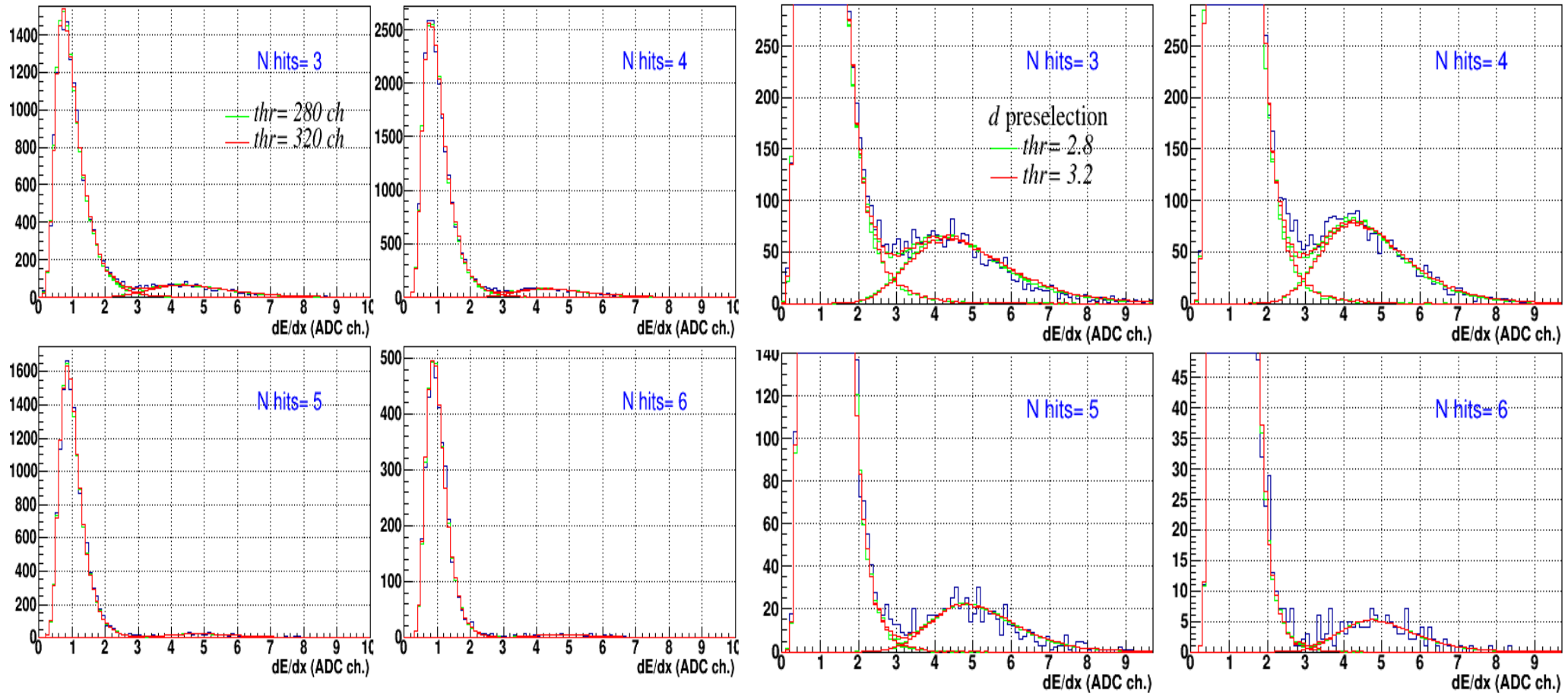
Normalised dE/dx for d^4He tracks (TOF-700 $2.5 < m^2 < 4.5$ (GeV/c^2)²)



Using $\beta\gamma$ allows us to analyze energy losses independently of particle type
Unit of dE/dx is a median value for deuterons.

Data driven simulation of track dE/dx distributions for d and ^4He

Track selection: $3.3 < \beta\gamma < 5.0$, $2.5 < m^2 < 4.5 \text{ (GeV}/c^2)^2$

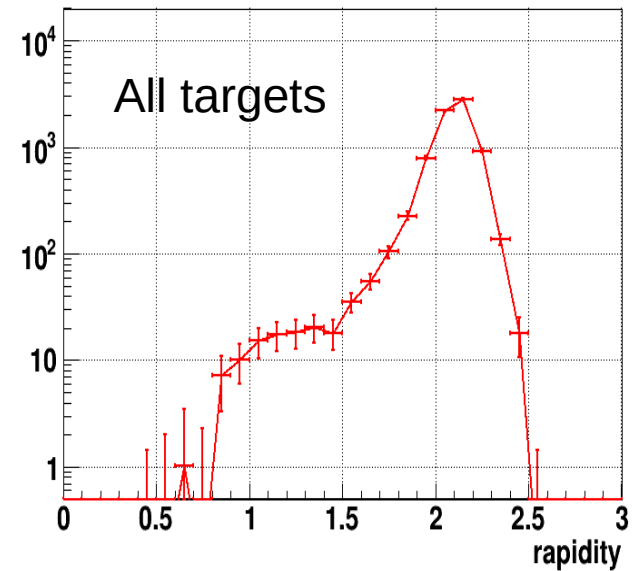
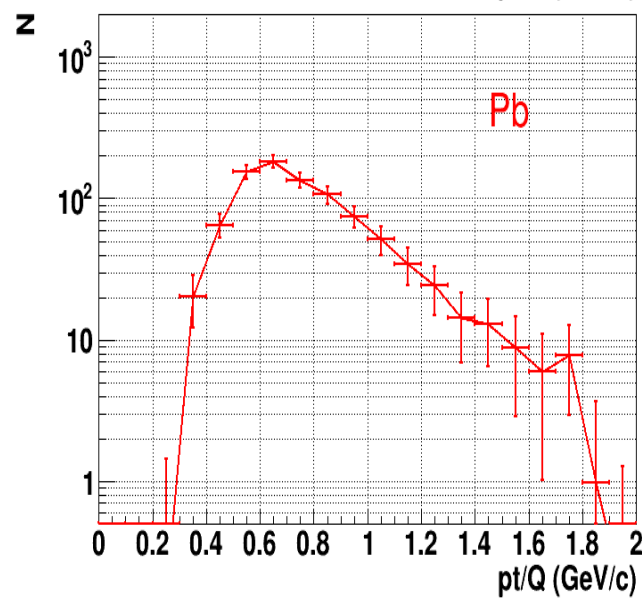
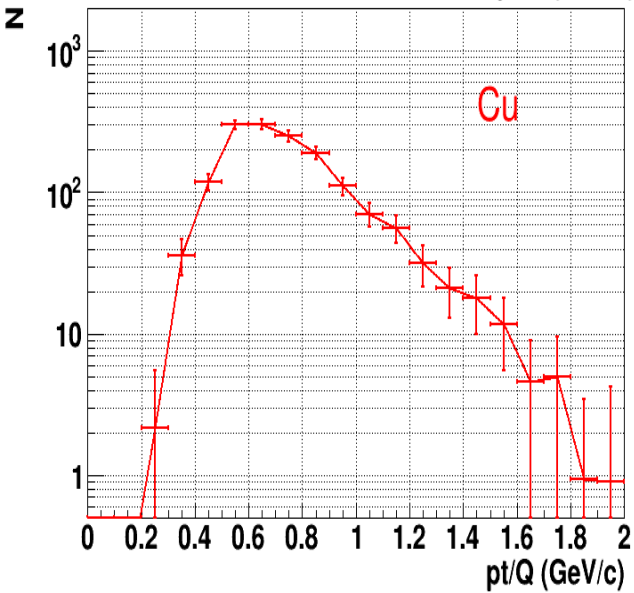
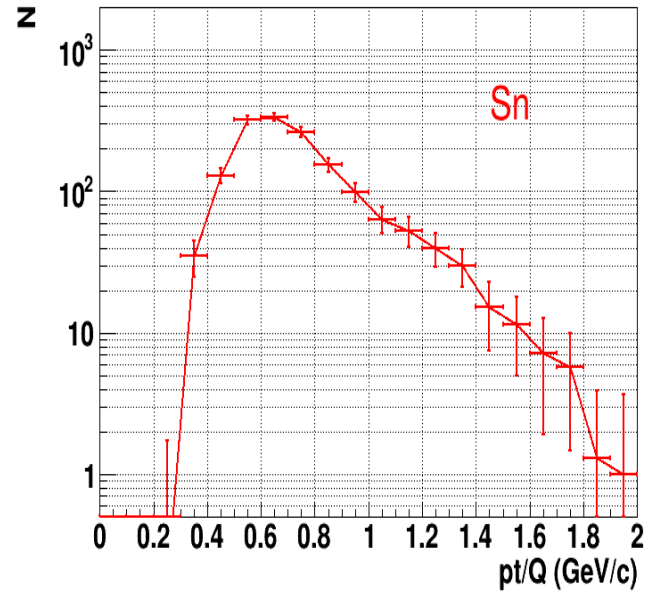
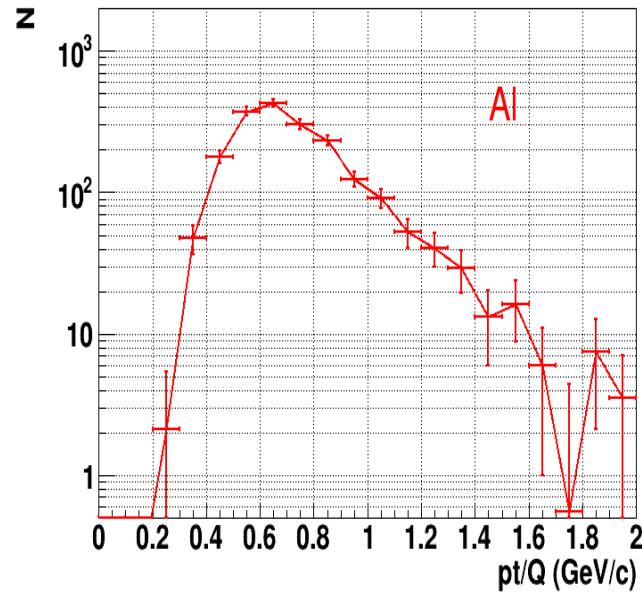
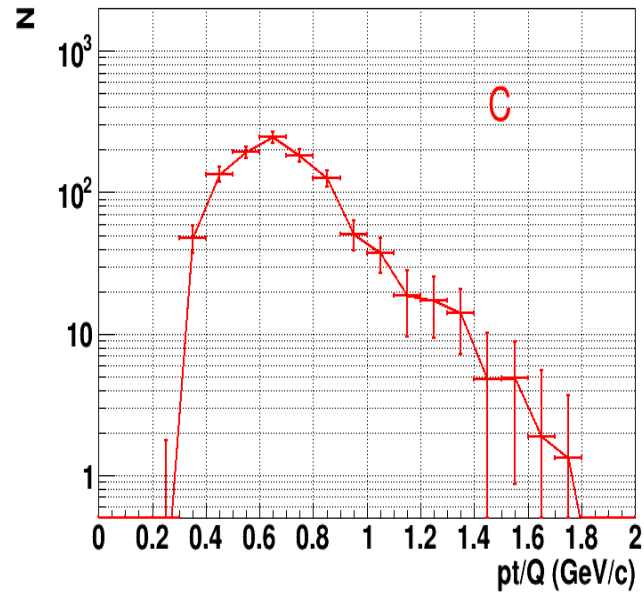


dE/dx distributions for tracks are modeled with random sets of experimental amplitudes of singly charged clusters with the same parameter $\beta\gamma=p/m$.

The energy loss distribution of a doubly charged particle is equivalent to the sum of the losses of four singly charged. This approach is used to simulate cluster amplitudes.

The simulation allows to estimate the contributions of deuteron and He in the region of overlap of their dE/dx distributions.

Detected p_t/Q distributions of ${}^4\text{He}$ at rapidity $1.7 < y < 2.4$



Very preliminary estimation of ${}^4\text{He}$ statistics in the beam fragmentation region.
 ${}^4\text{He}$ selection: $2.5 < m^2 < 4.5$ (GeV/c²)², $dE/dx > 4$ median dE/dx of deuteron.

Conclusion:

- * MC simulation with realistic effects reasonably describes experimental Data in GEM, DCH, TOF700
- * Agreement between Data and realistic MC allows us to perform physics analysis to get fragment yields in dependence on transverse momentum and Rapidity
- * Experimental data from GEM detectors are studied and prepared for dE/dx analysis
- * “truncated mean” method for estimating energy losses of tracks is successfully implemented
- * d and He⁴ differ significantly in dE/dx even for tracks with three hits
- * Data driven simulation allows to estimate the contributions of deuteron and He
- * Preliminary estimation of ⁴He statistics in the beam fragmentation region on different targets has been presented

Outlook:

- * Need to compare the measured yields with different models

Thank you for your attention !

BACKUP

