«GEM residuals study in Monte-Carlo simulation for Run 6 at the BM@N experiment»

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SCIENCE BRINGING NATIONS TOGETHER

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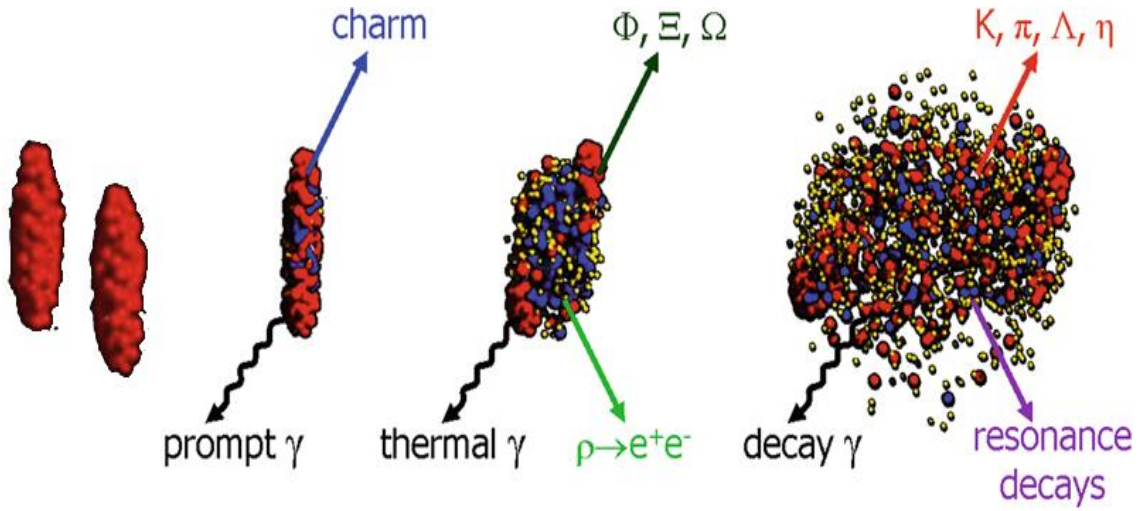
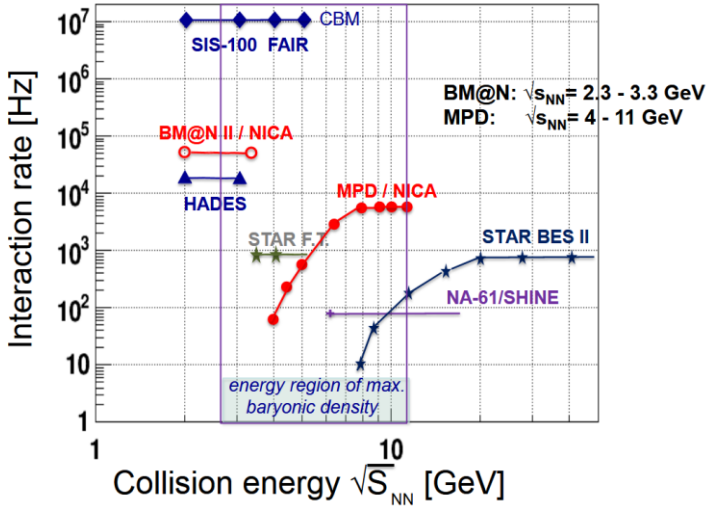
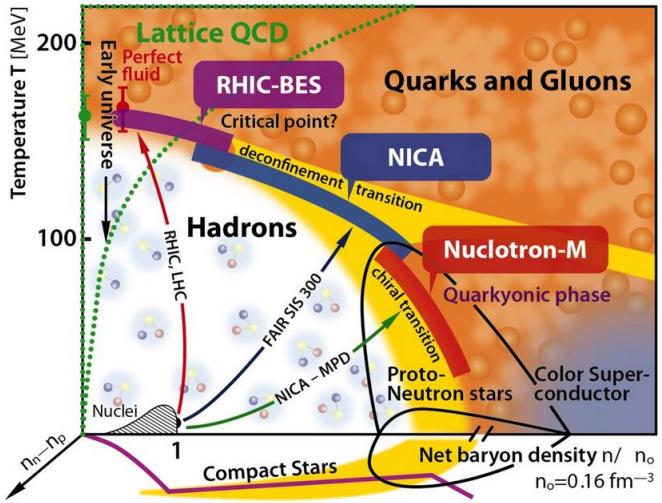
Motivation of the BM@N experiment

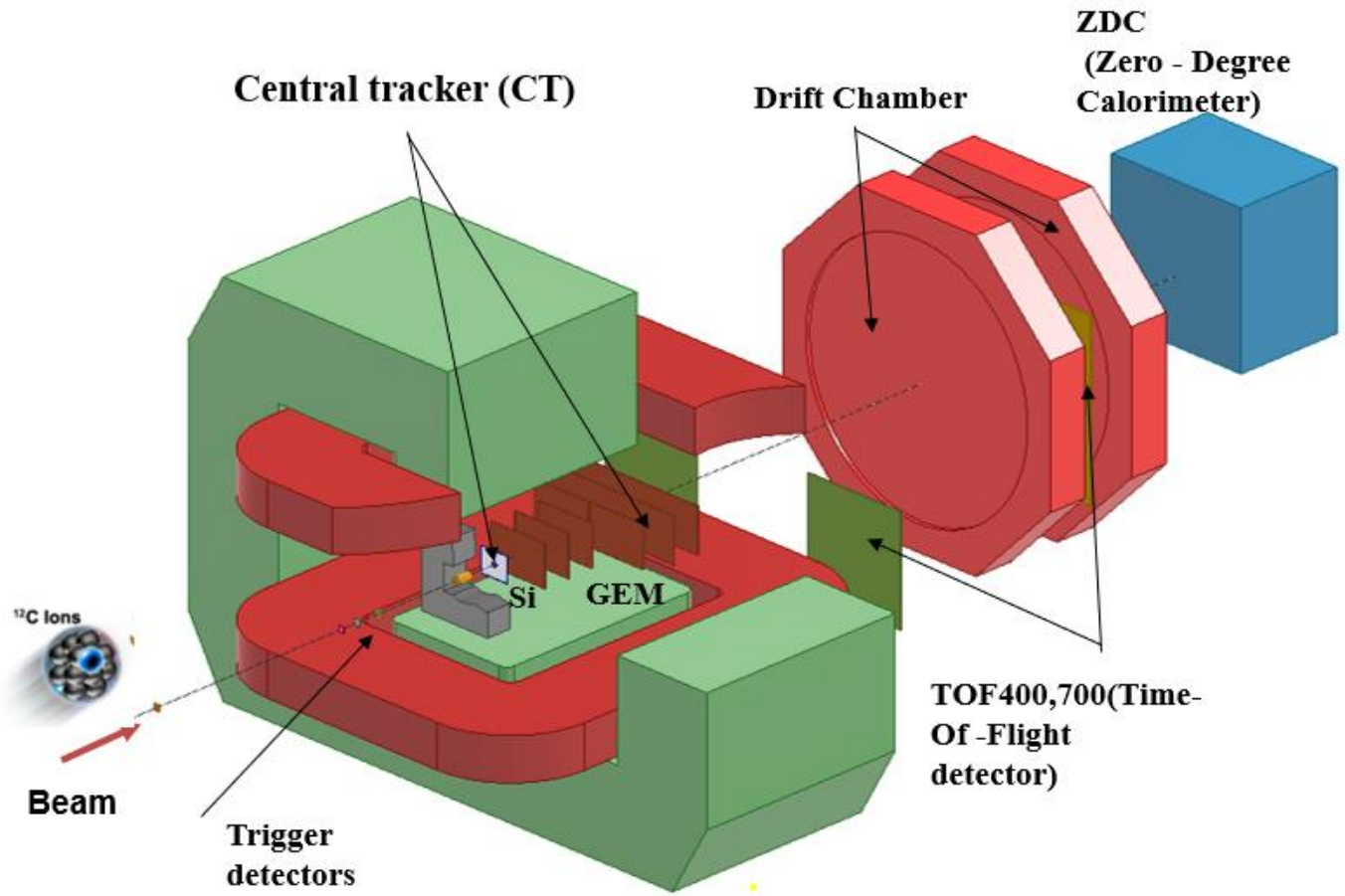


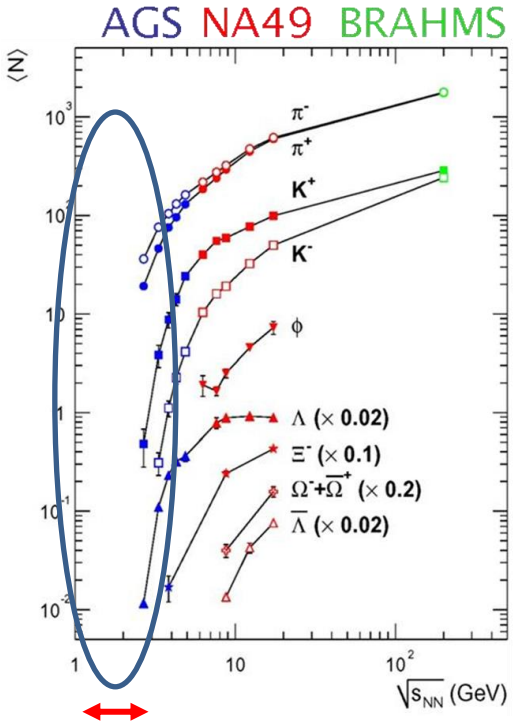


- At √s energies of **2 - 4.5 GeV**, nucleon densities in a collision zone exceed the saturation density by the factor of **3-4.**
- At these densities, nucleons start to overlap and form a fireball.
- Hadrons with strangeness are early produced in the collision and not present in the initial state of two colliding nuclei.
- Heavy-ion collisions are a rich source of **strangeness**, and the coalescence of kaons with lambdas or of lambdas with nucleons will produce a vast variety of **multi-strange hyperons** or of light hypernuclei.
- Even the production of light double-hypernuclei or of double-strange dibaryons is expected to be measurable in heavy-ion collisions at Nuclotron energies.



Run 6 BM@N configuration





Nuclotron energy

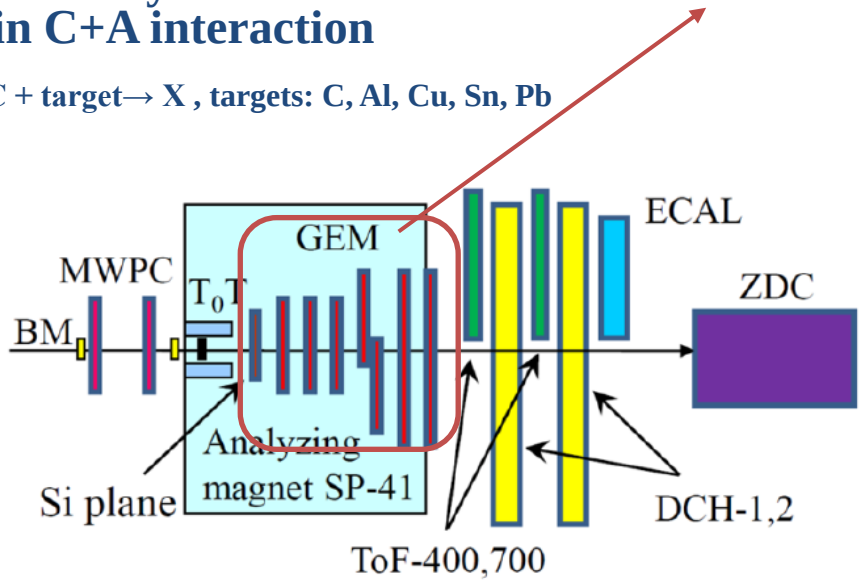
$\sqrt{s_{NN}}$=2.3 - 3.5 GeV

RUN-6 was held in spring 2017

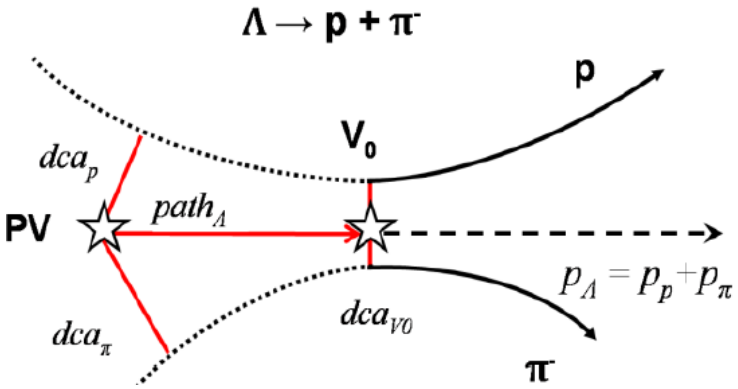
Analysis scheme

Λ^0 decay reconstruction in Central tracker in C+A interaction

C + target→ X , targets: C, Al, Cu, Sn, Pb



Selection of events with Λ^0 hyperon



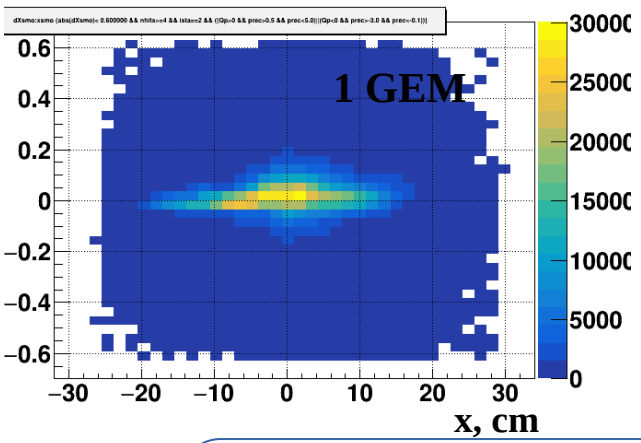
Gas Electron Multiplier (GEM) system:
To measure momenta of a charged particle and reconstruct the interaction point.

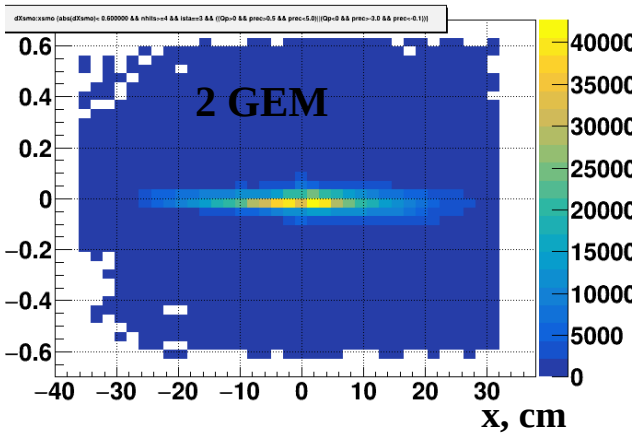
Event topology:
PV – primary vertex
V_0 – vertex of hyperon decay
dca – distance of the closest approach
path – decay length

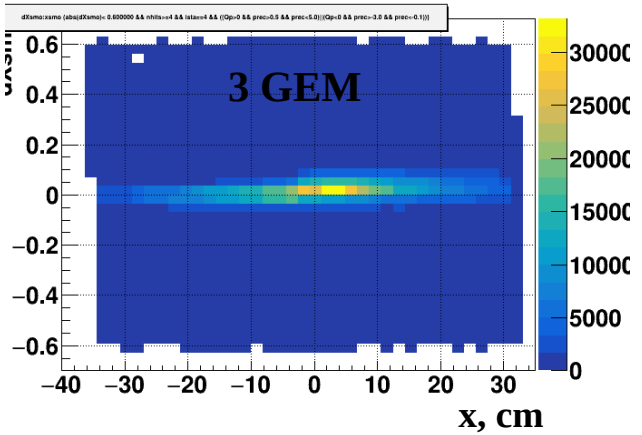
Current task: Check residuals for MC & Data

- Residuals in MC → **was done**
- Residuals in DATA. (See presentation Khukhaeva Anastasia)

MC residuals vs. x per station
Before correction

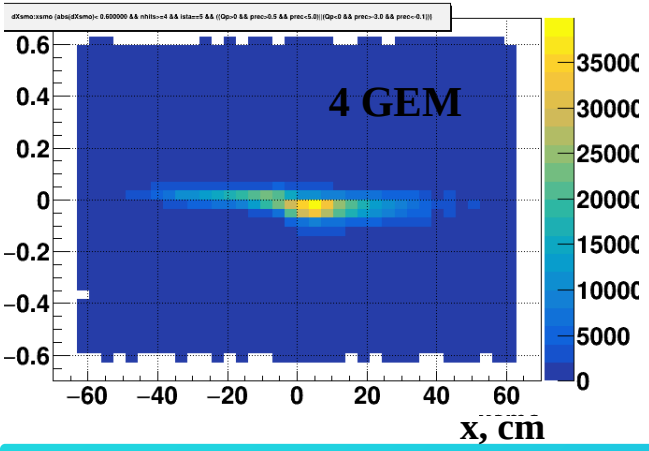


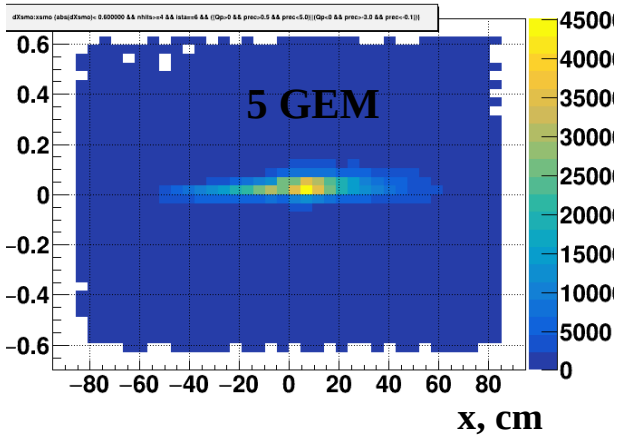


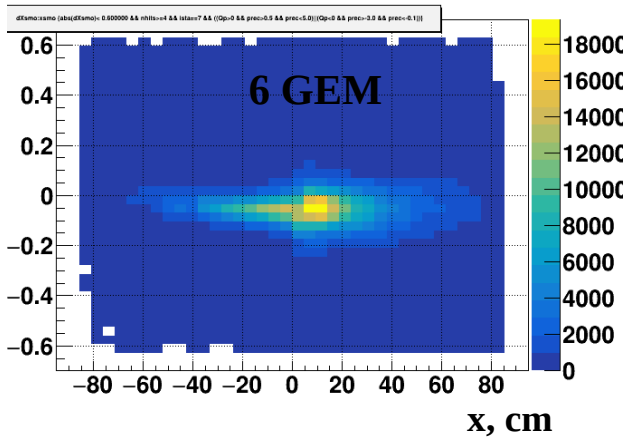


Residual is the distance between the extrapolated track and the hit

Hit is the reconstructed point of the detector

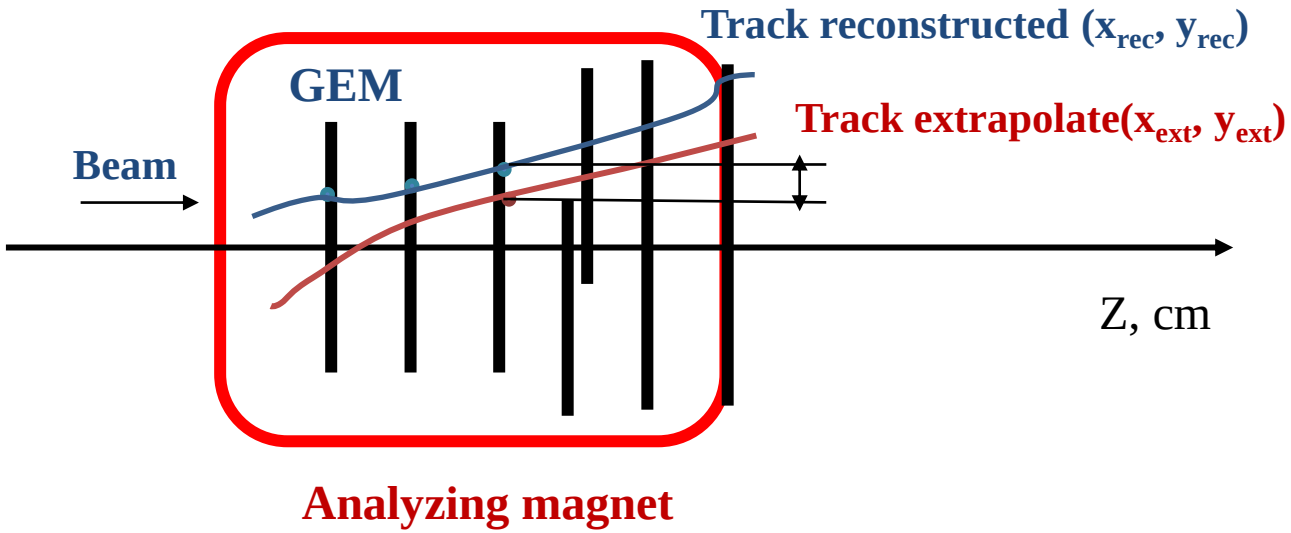




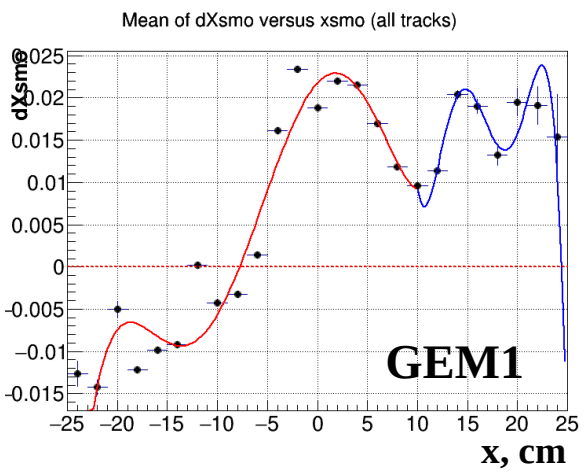


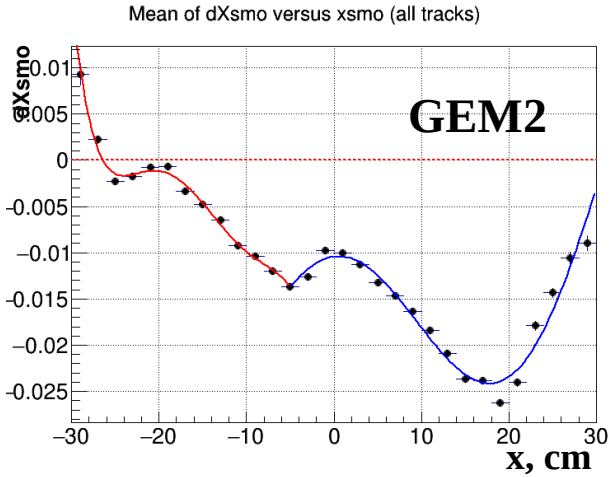
Residuals corrections procedure flow for MC

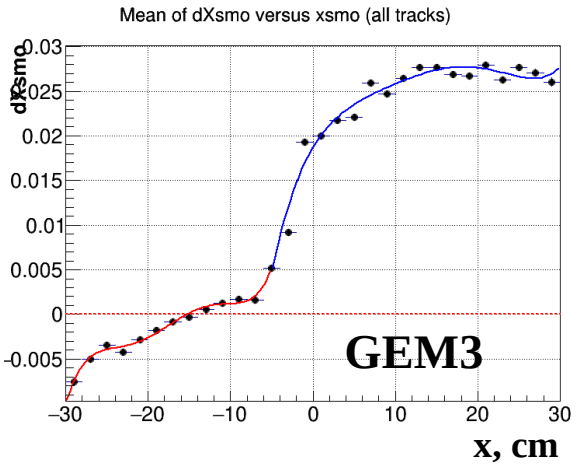
Correction procedure:
1) Get slices along x GEM coordinate: dx(x)
2) Fit each slice using Gaus+ pol2 function
3) Get Mean & Sigma from the fit
4) Make plots: dependencies Mean dx(x), Sigma dx(x) for each GEM station
5) Fit Mean DX(x) distributions using pol5 functions for negative & positive x
6) Apply corrections using pol5 fit functions
7) Check results after first correction
8) Make refit procedure (points 1-7)
9) Check and compare distributions for MC: Mean dx(x), Sigma dx(x), Mean dx(Mom), Sigma dx(Mom)



MC mean vs. x per station before correction

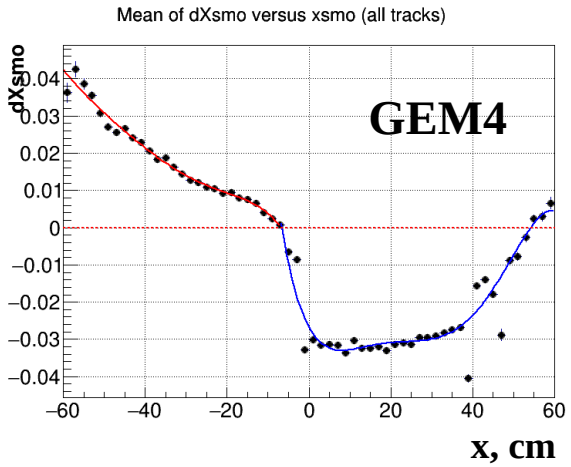


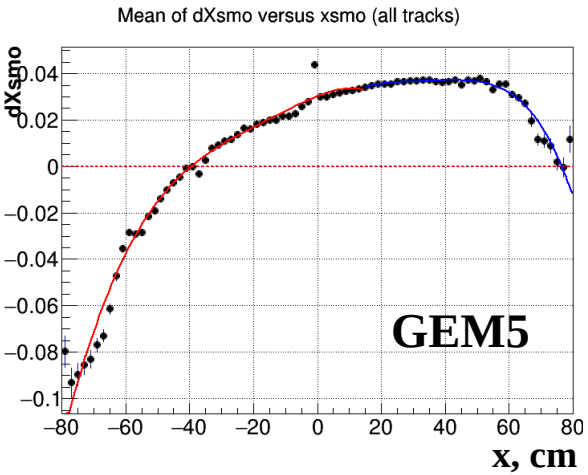


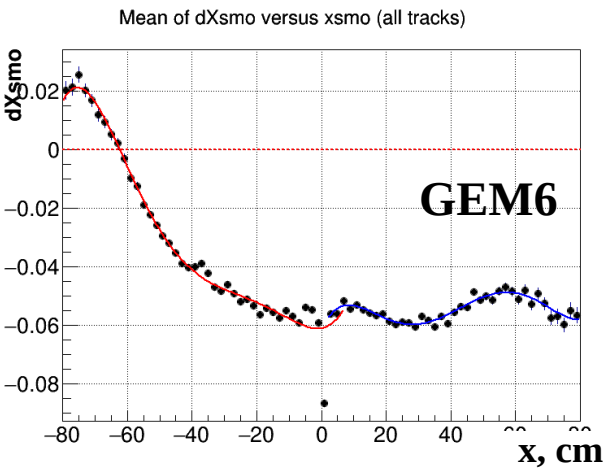


- Red **line - Fit pol5(neg area)**
- Blue **line - Fit pol5(pos area)**

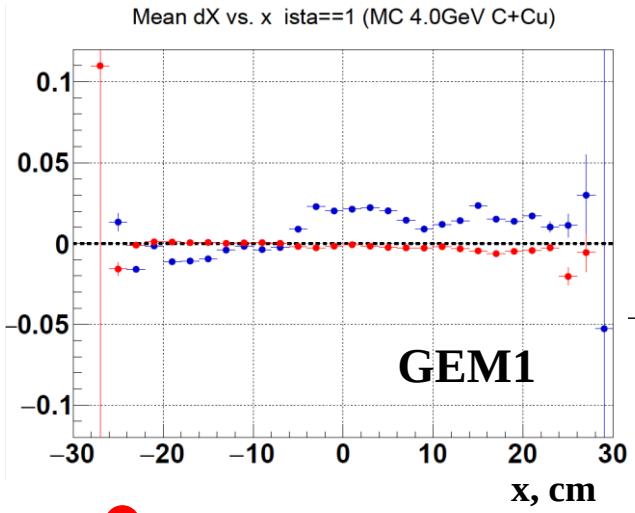
C+Cu, 4.0 GeV

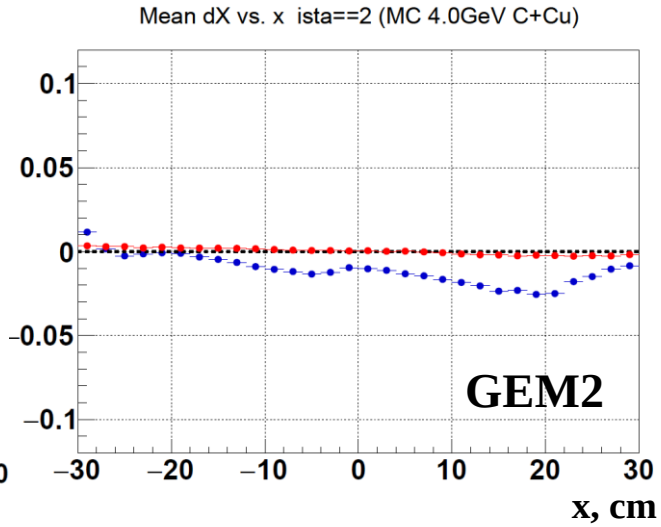


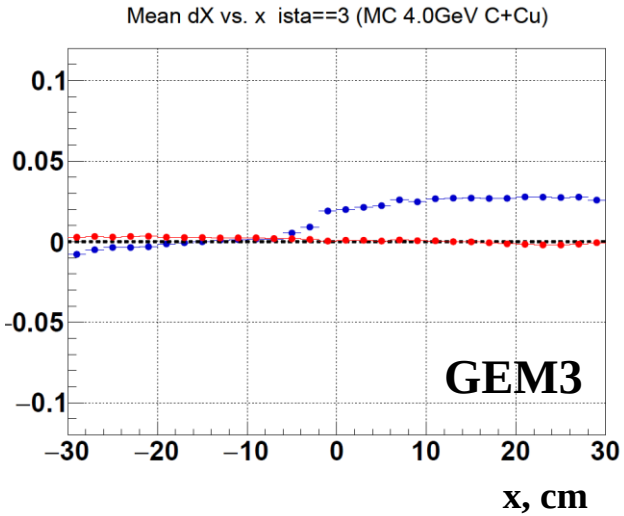




MC mean vs. x per station for all iterations

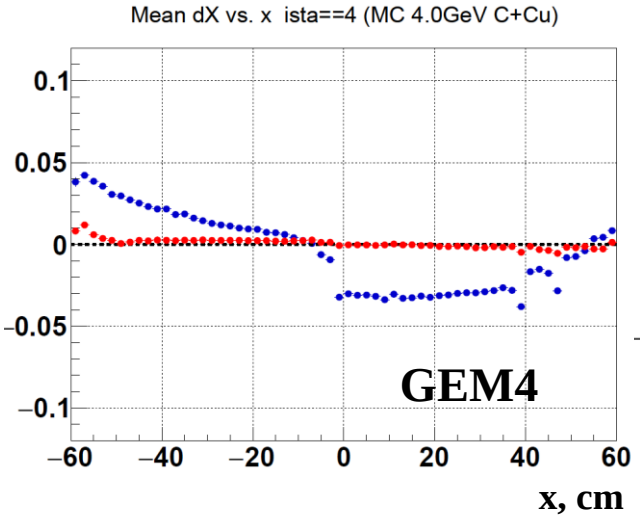


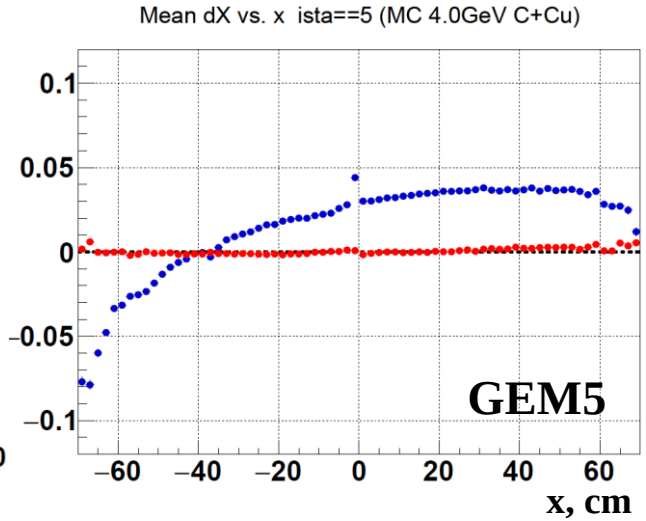


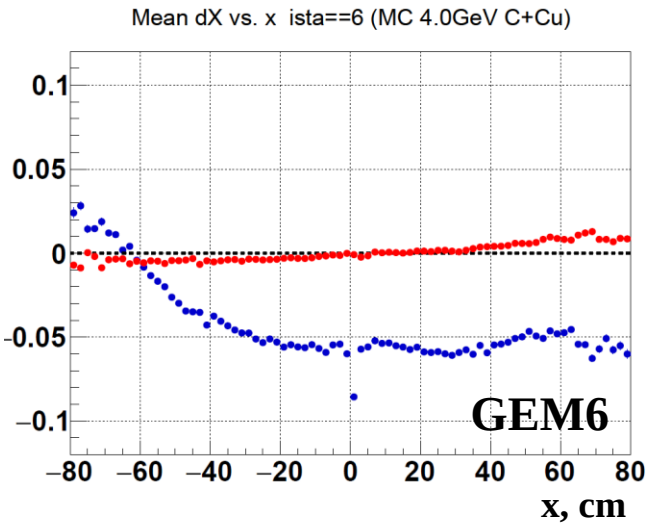


- **Mean refit pol5+Gaus**
- **Mean before correction**

C+Cu, 4.0 GeV

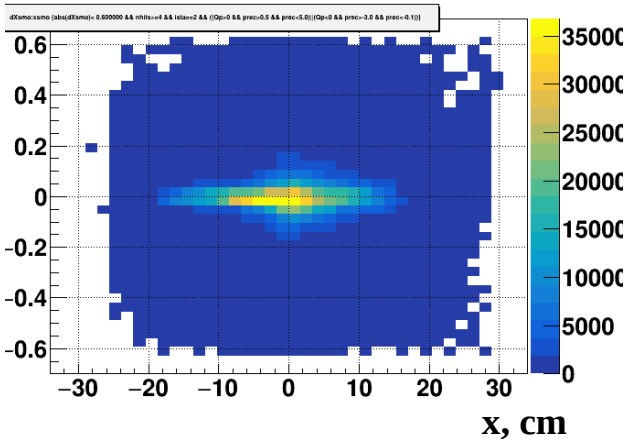






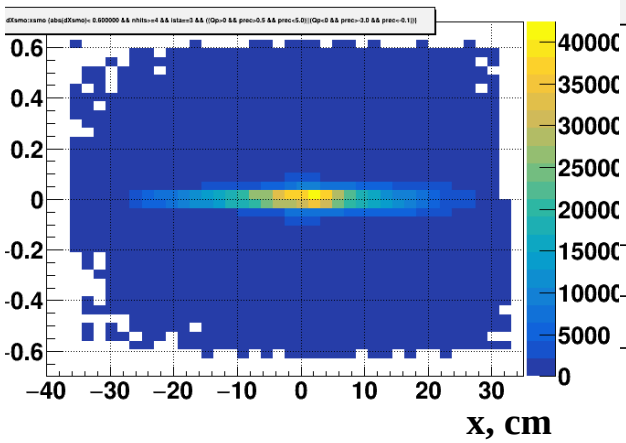
MC residual vs. x per station after correction

1 GEM



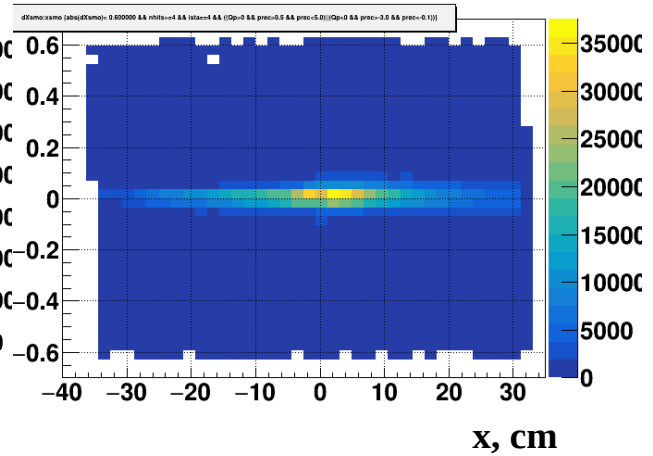
x, cm

2 GEM



x, cm

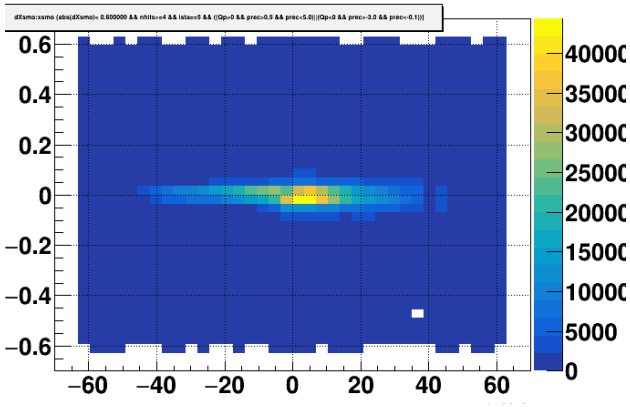
3 GEM



x, cm

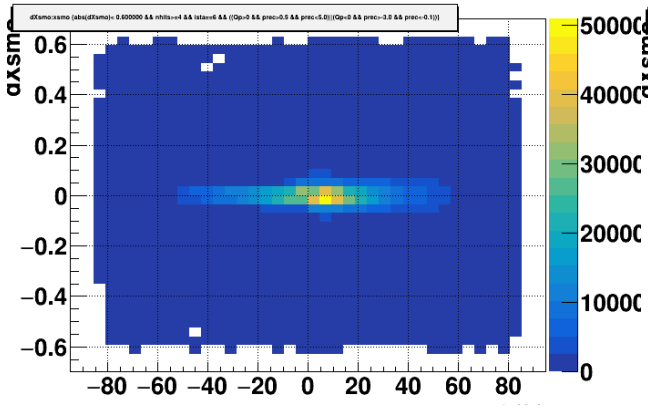
C + Cu, 4.0 GeV

4 GEM



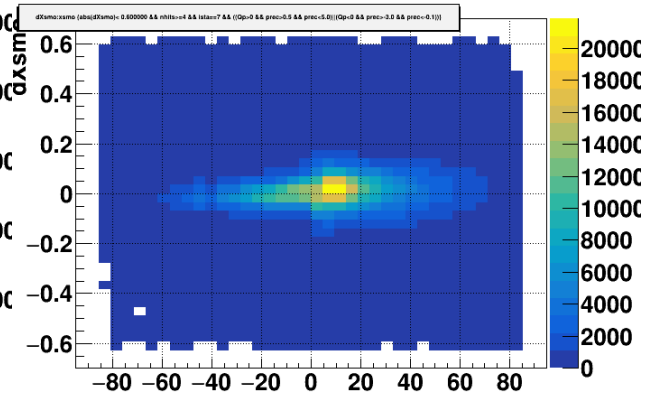
x, cm

5 GEM



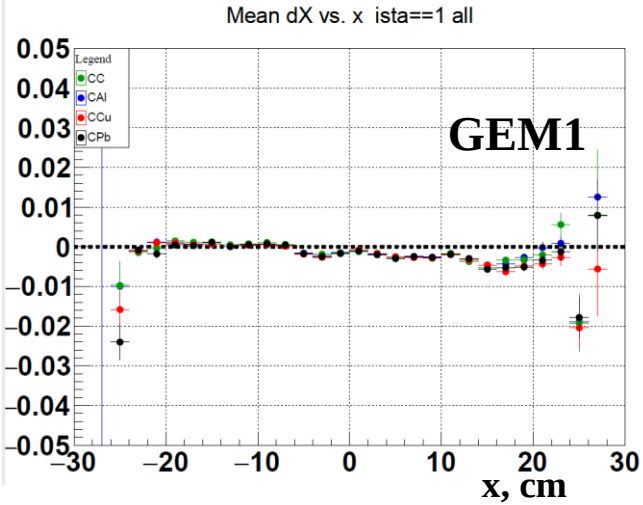
x, cm

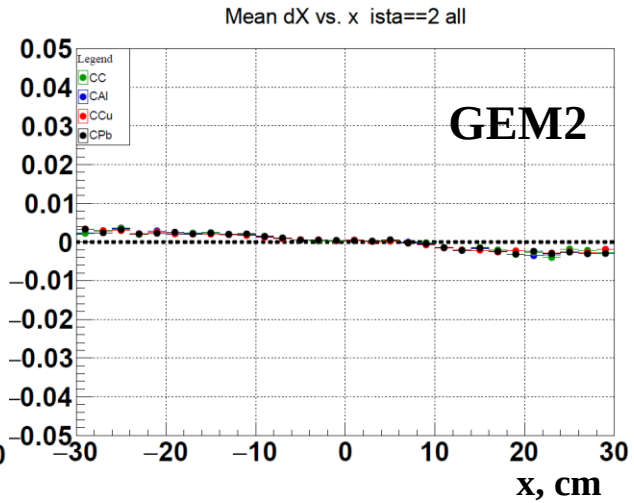
6 GEM

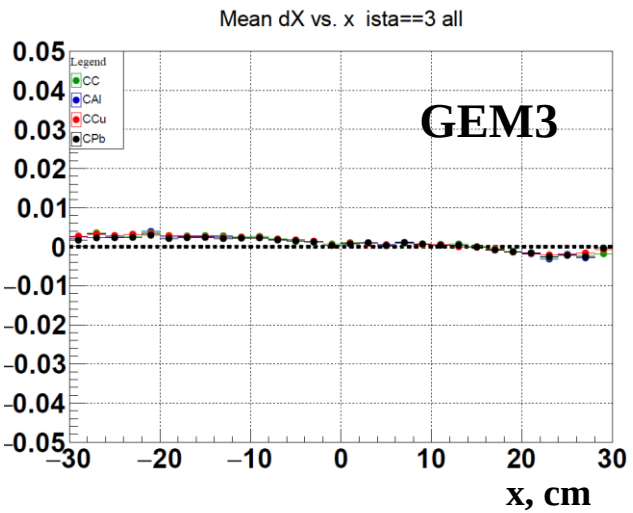


x, cm

MC mean vs. x per station all targets

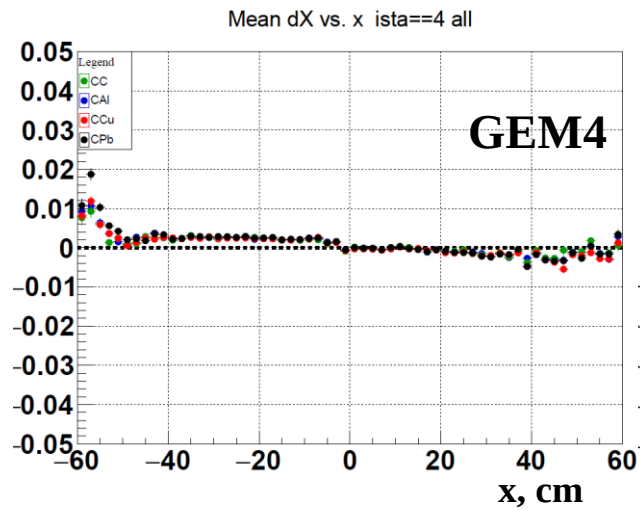


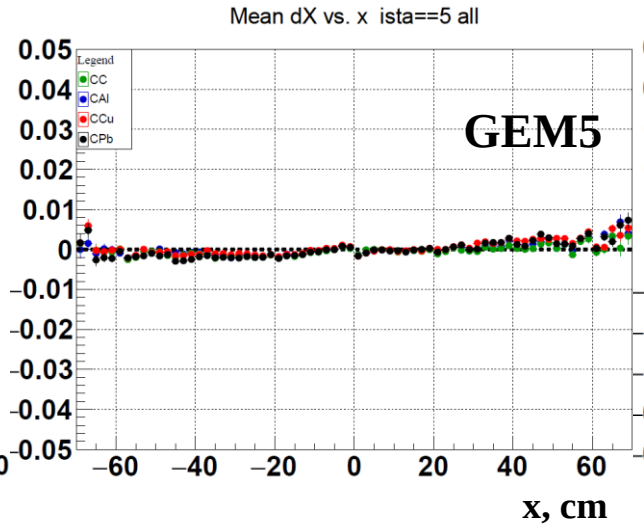


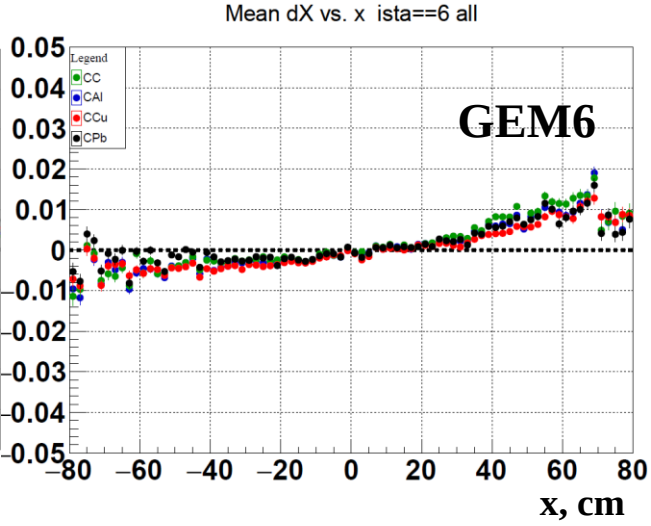


● - mean Pb target
● - mean Al target
● - mean Cu target
● - mean C target

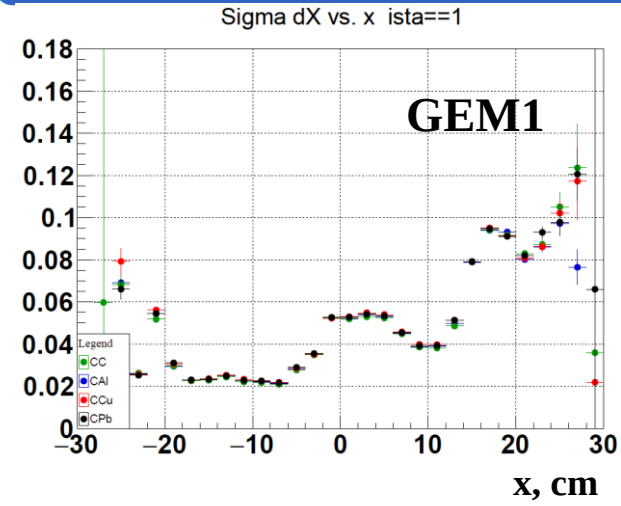
C + target, 4.0 GeV

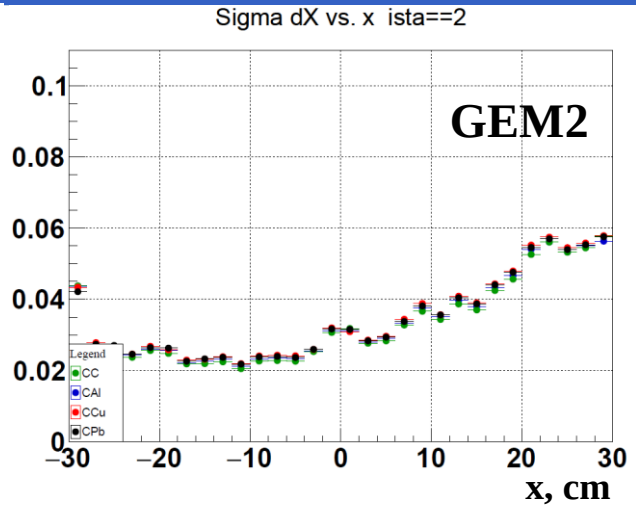


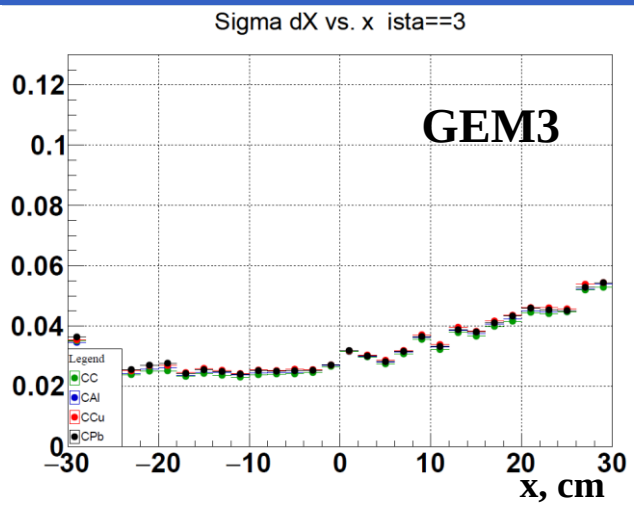




MC sigma vs. x per station all targets

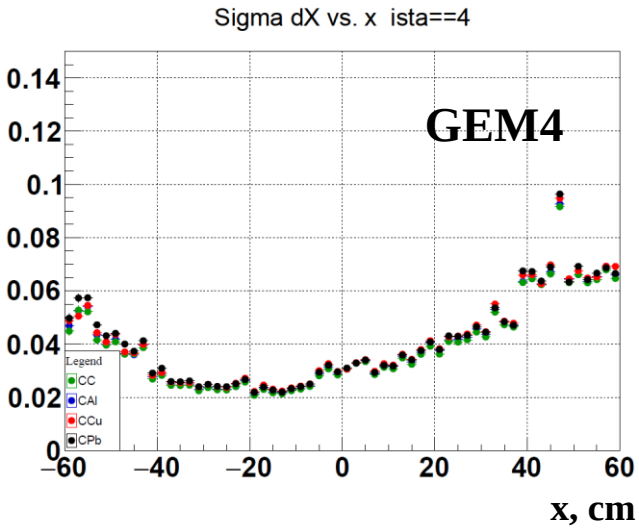


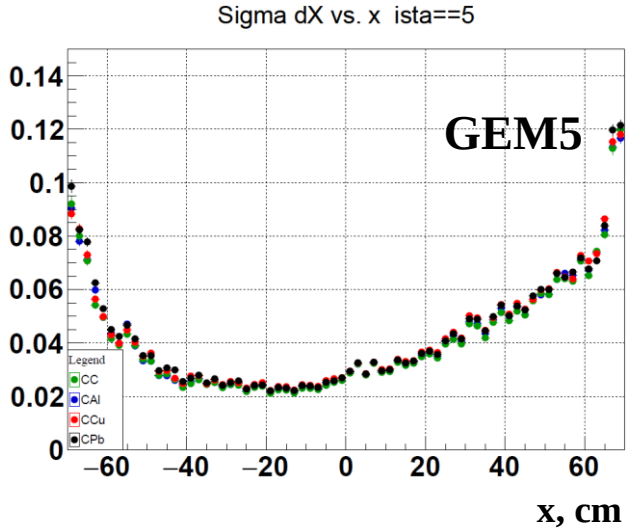


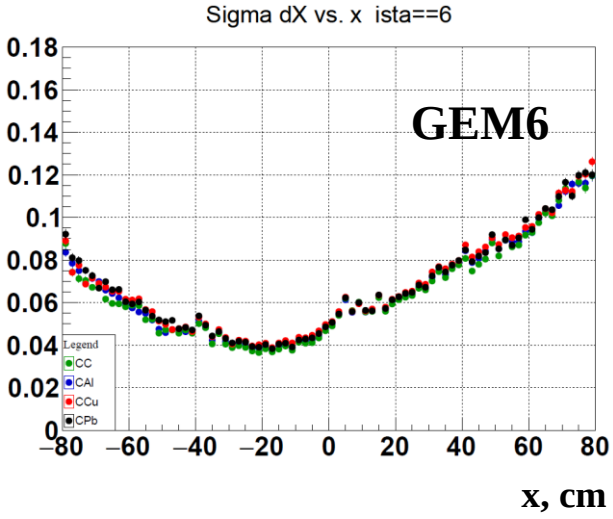


- sigma Al target
- sigma Cu target
- sigma Pb target
- sigma C target

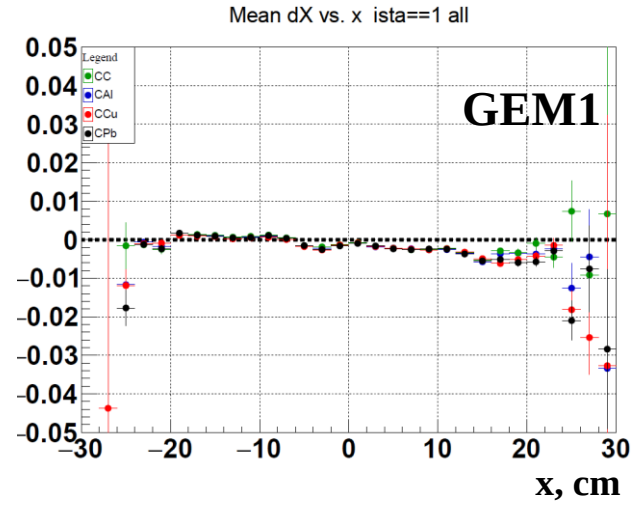
C + target, 4.0 GeV

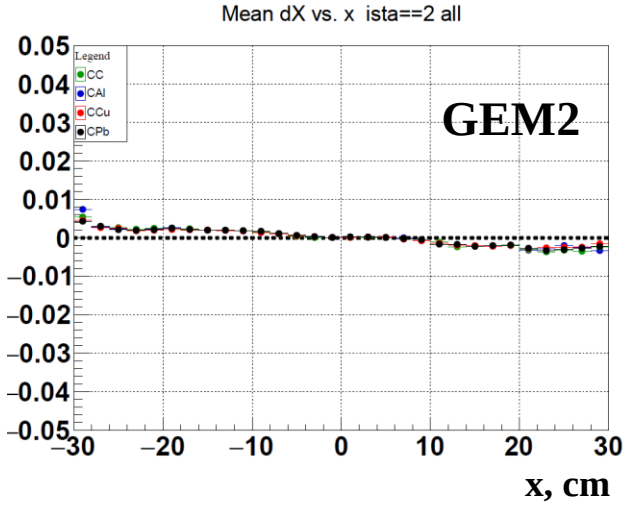


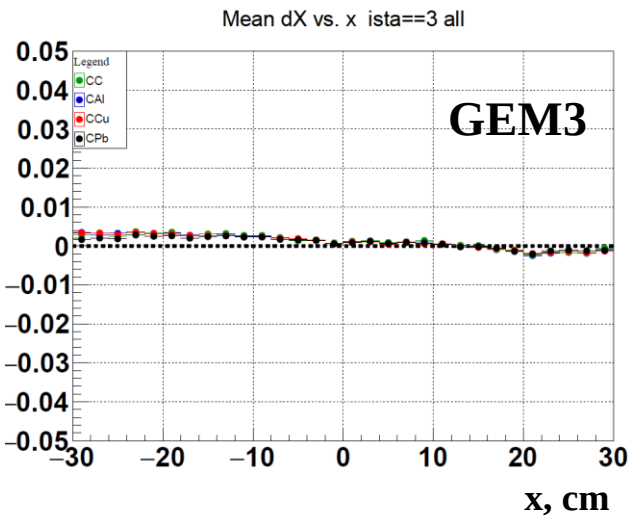




MC mean vs. x per station all targets

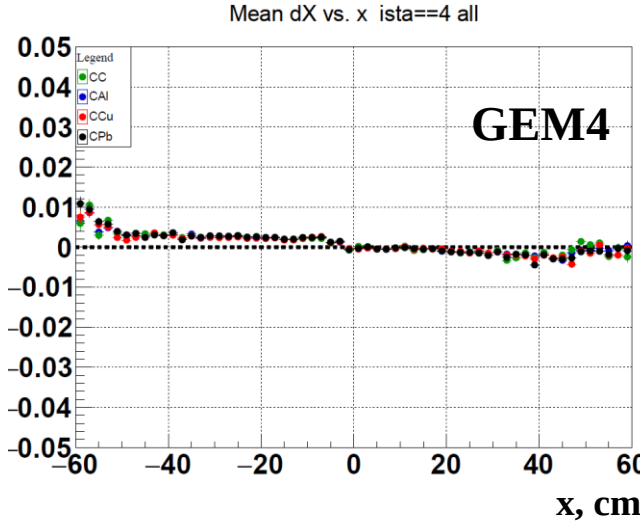


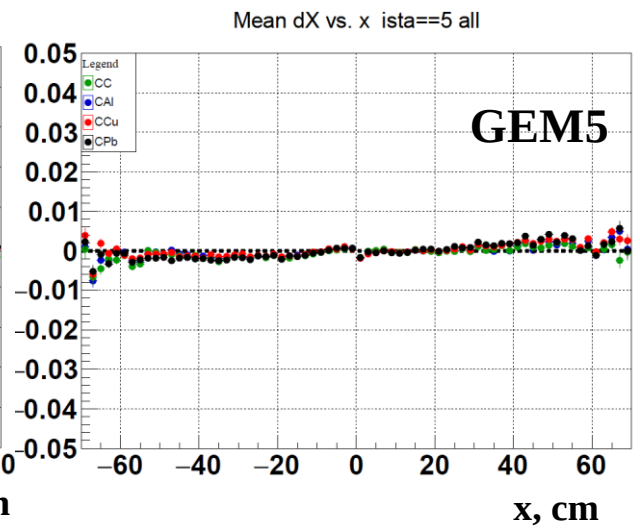


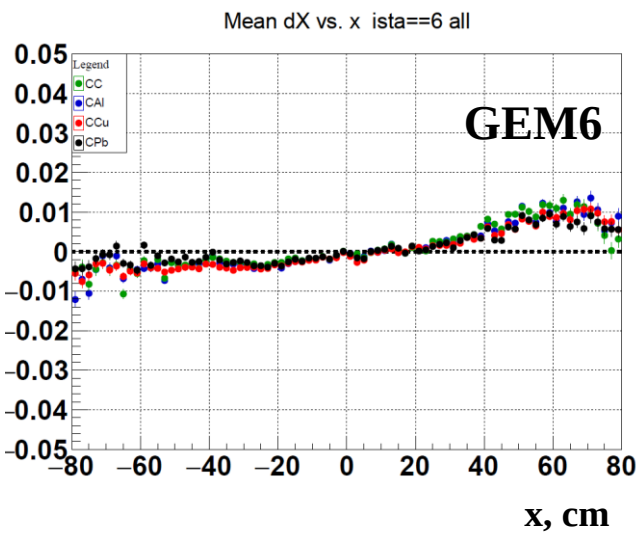


- -mean Al target
- -mean Pb target
- - mean Cu target
- -mean C target

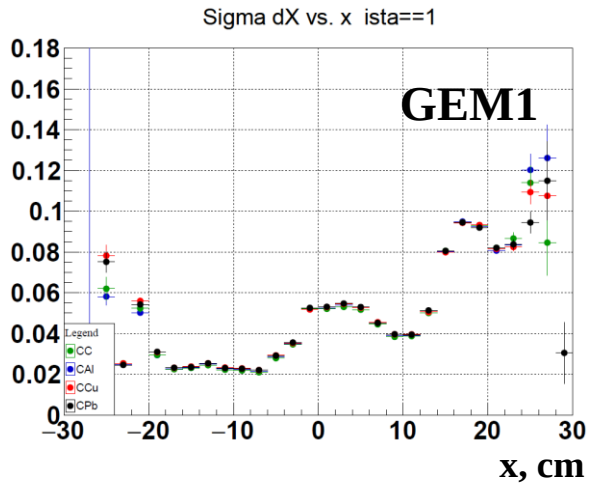
C + target, 4.5 GeV

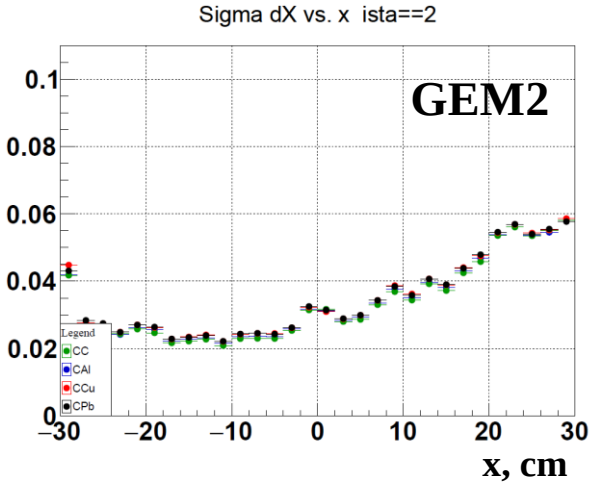


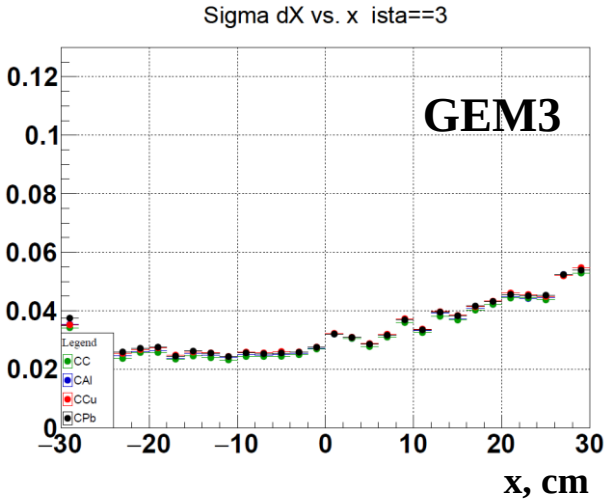




MC sigma vs. x per station
all targets



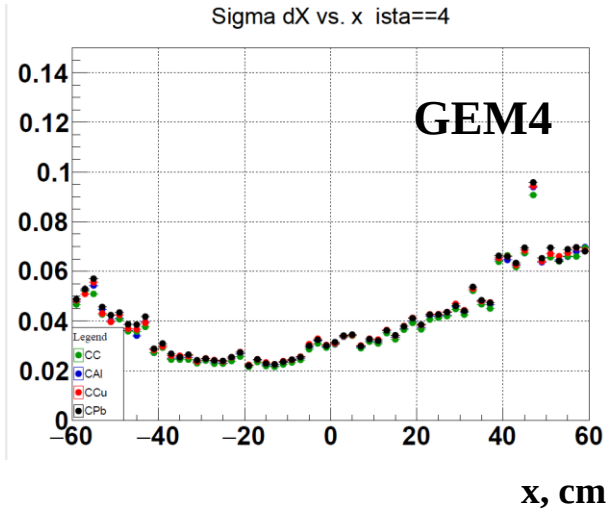


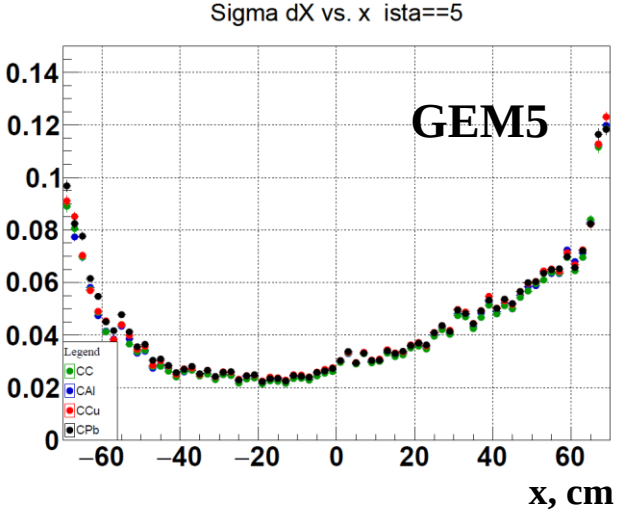


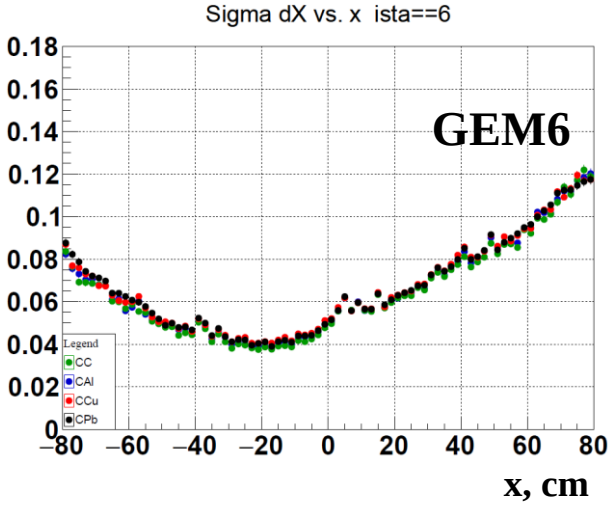
● - sigma Al target ● - sigma Pb target

● - sigma Cu target ● - sigma C target

C + target, 4.5 GeV

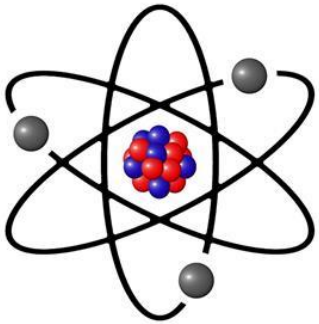






Summary

- **The residuals were verified for MC at beam energies of 4 and 4.5 GeV for all targets (Al, Cu, Pb, C)**
- **The residual correction procedure was carried out using polynomials of the 5th order**
- **Correction the positions of the peaks of the distributions of residues in the range from -0.01 to +0.01 cm**
- **The correction procedure did not change the width of the error (from fit pol 2+ Gaus)**



Thank you for attention!