Status of the Λ^0 hyperon analysis in the carbon beam at the BM@N experiment

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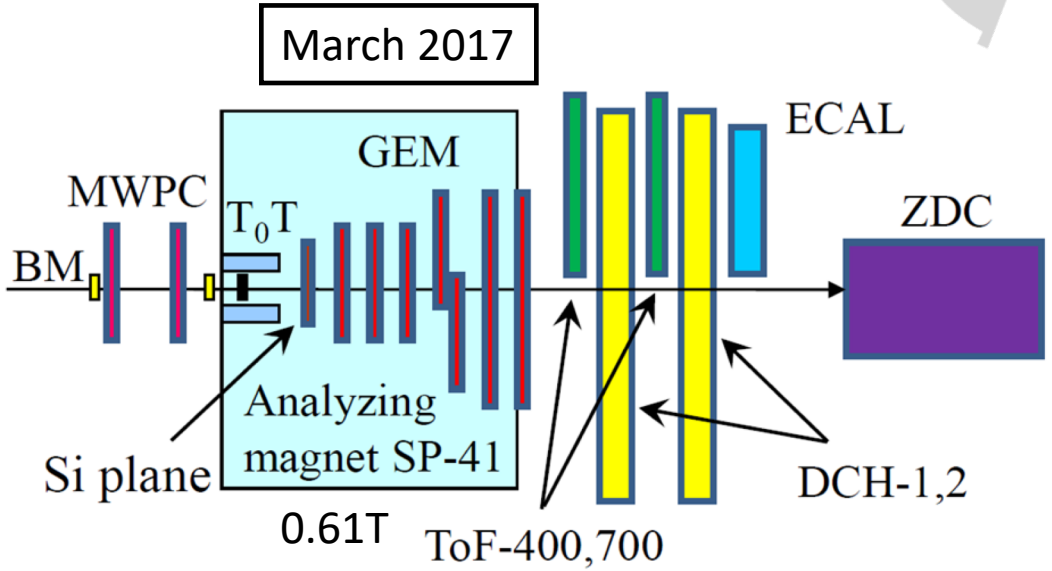
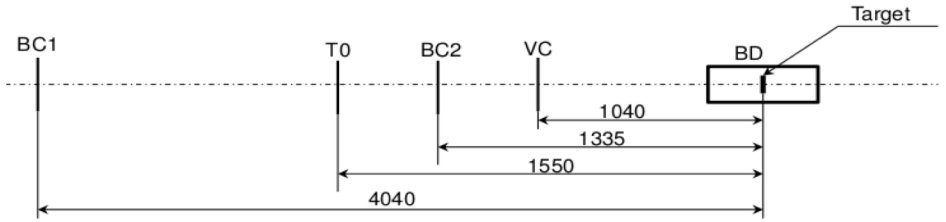
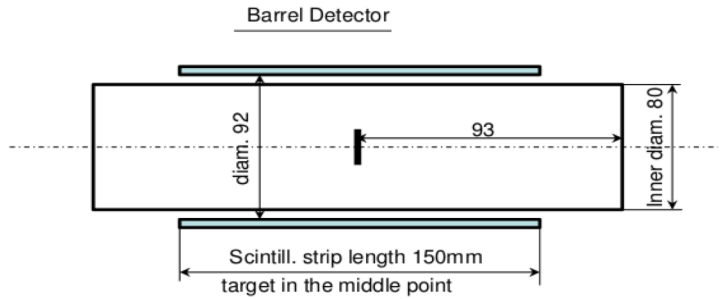
BM@N configuration in Run6

- Central tracker
  - One plane of a forward Si detector
  - 6 GEM stations
    - 5 GEM detectors (66x41 cm2)
    - 2 GEM detectors (163x45 cm2)
- Triggers: BD, BC1, BC2, T0, VETO
- Beam Ekin=4.0 and 4.5 GeV
  - Intensity 10^5 per spill
  - Spill duration 2-2.5 sec.
- Physics: measure inelastic reactions C+A→X
  - Targets: C, Al, Cu, Pb







Analysis current status

- **Main goal of current analysis** – cross-check with previous analysis (was performed by Gleb Pokatashkin)

- **From previous analysis status:**
  - Check residuals for MC & Data ✅
    - Make corrections for residuals in Data & MC (see Ksenia & Anastasia talks) ✅
    - Momentum smearing procedure for MC simulation ✅
  - Check GEM efficiencies for MC & Data ✅
    - Apply efficiencies for MC simulation ✅

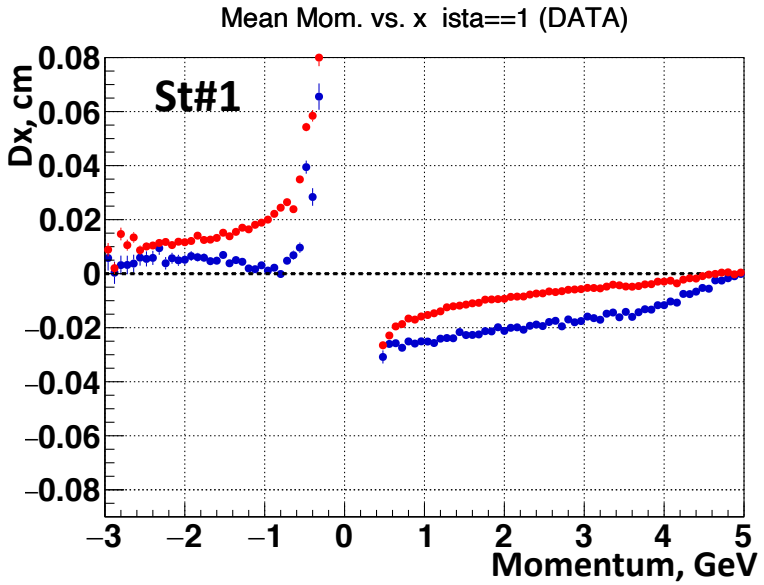
In this talk

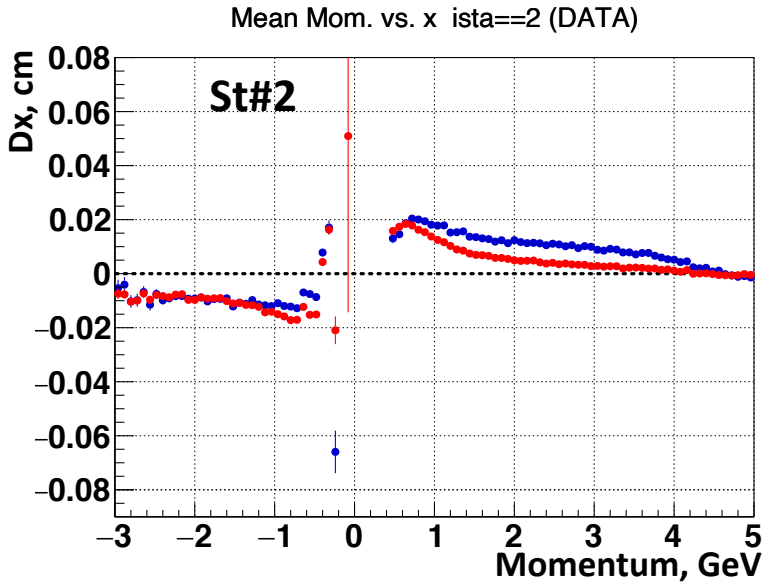
- **Analysis:** compare distributions MC/Data for pt/momentum/etc. (in progress) ⚠️
- **Measure cross-sections of the Λ^0's hyperon**

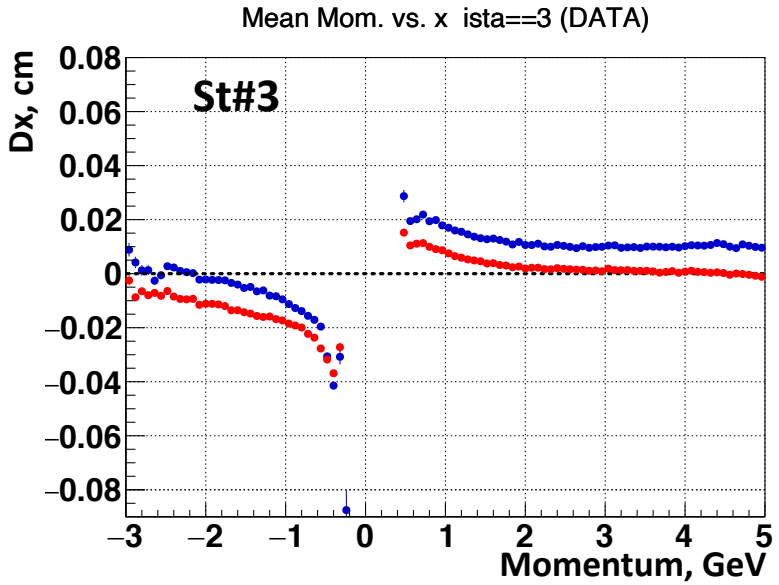
June-July 2021

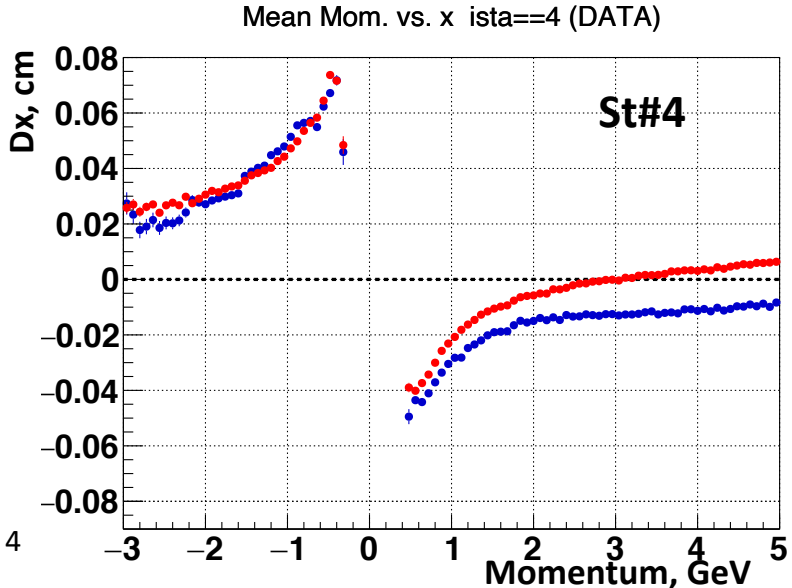
Blue: before corrections
Red: after corrections

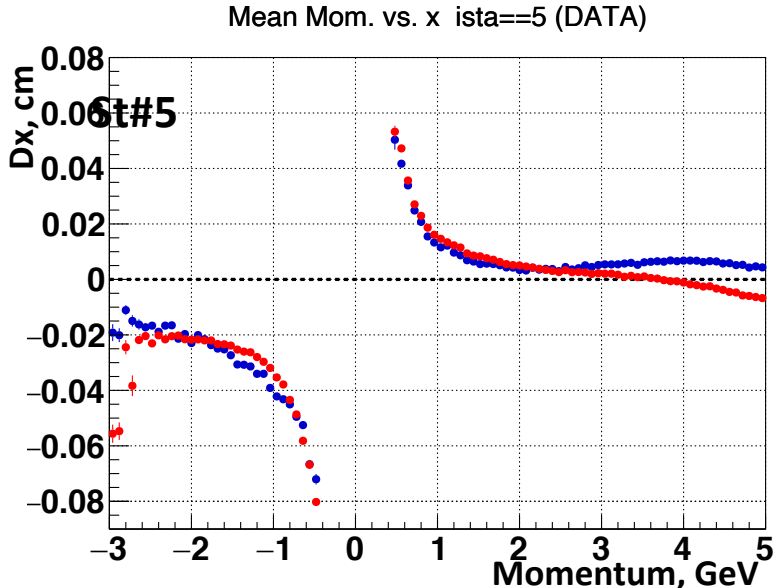
Mean Dx vs Momentum (DATA 4.0GeV C+Cu)

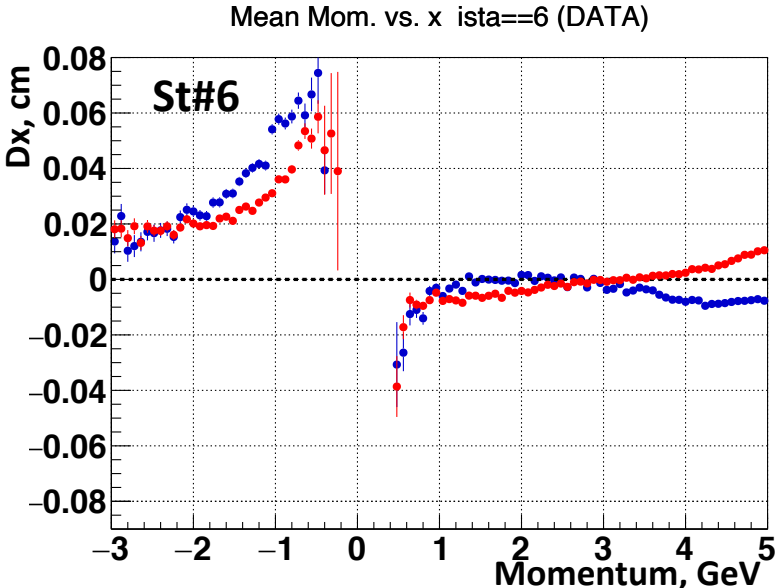






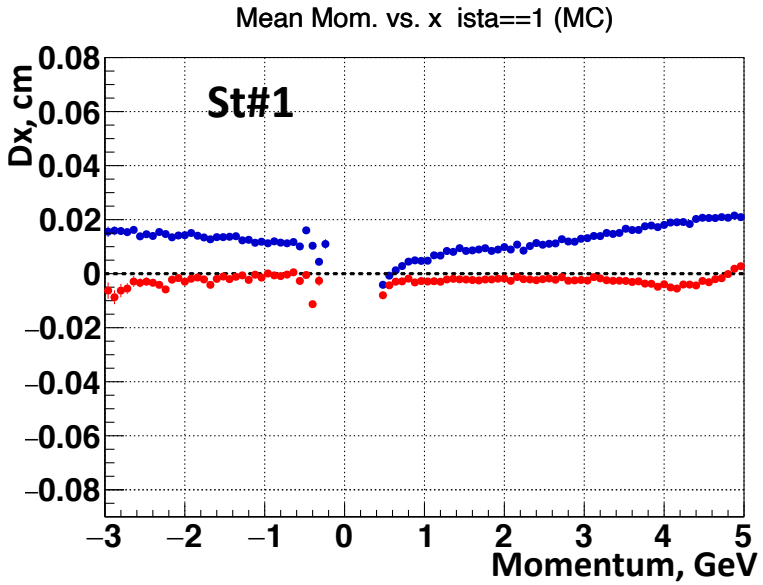


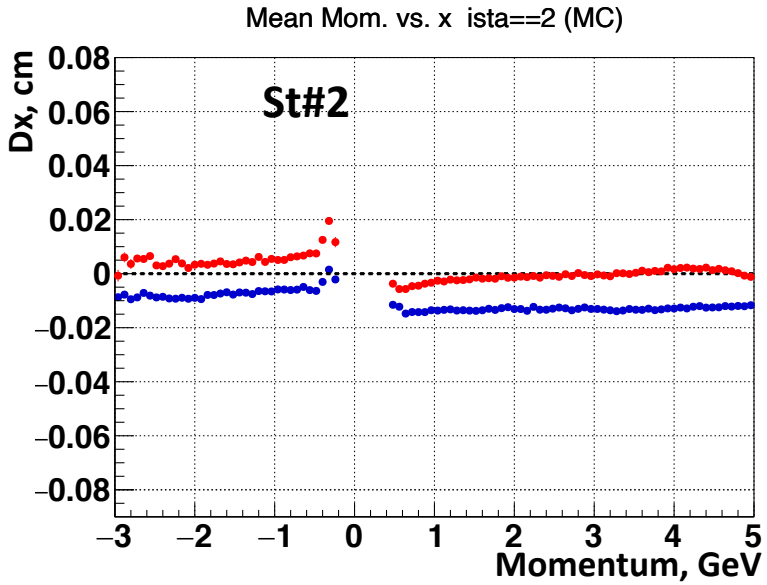


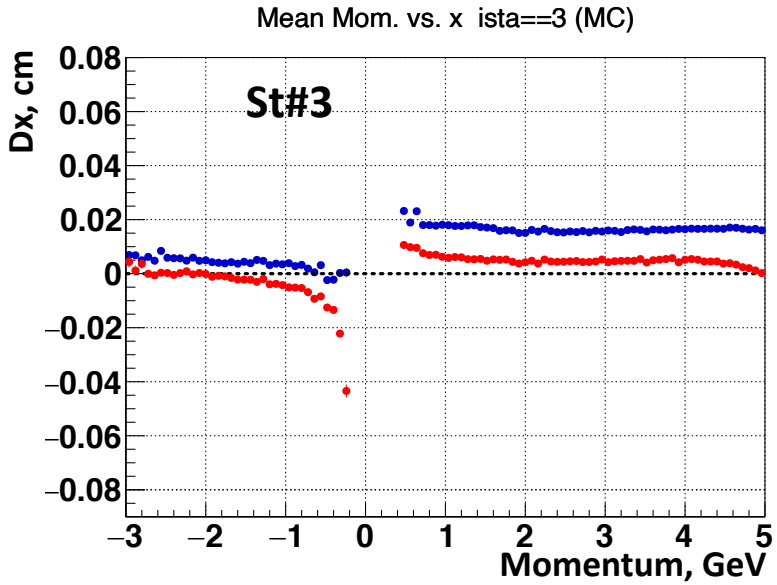


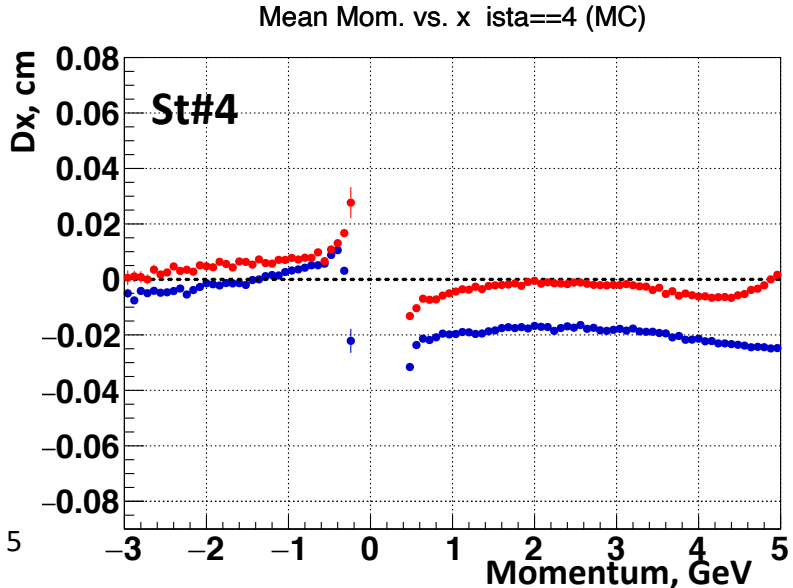
Blue: before corrections
Red: after corrections

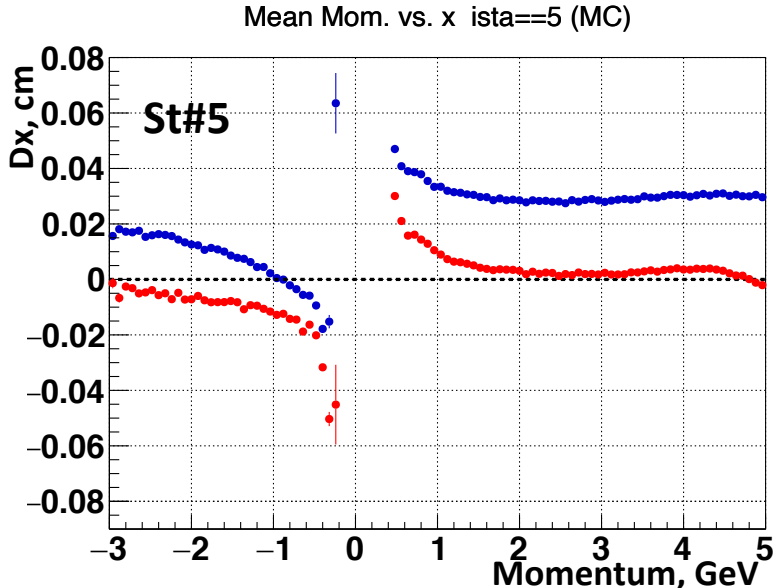
Mean Dx vs Momentum (MC 4.0GeV C+Cu)

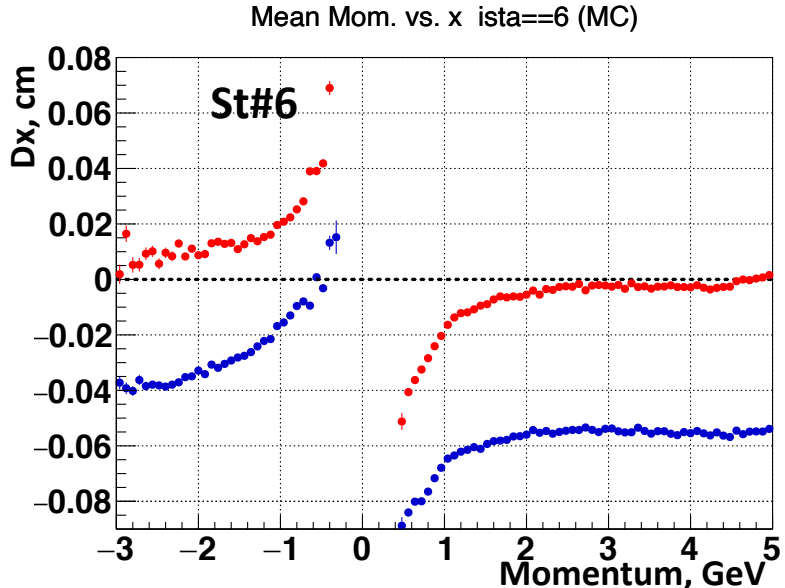






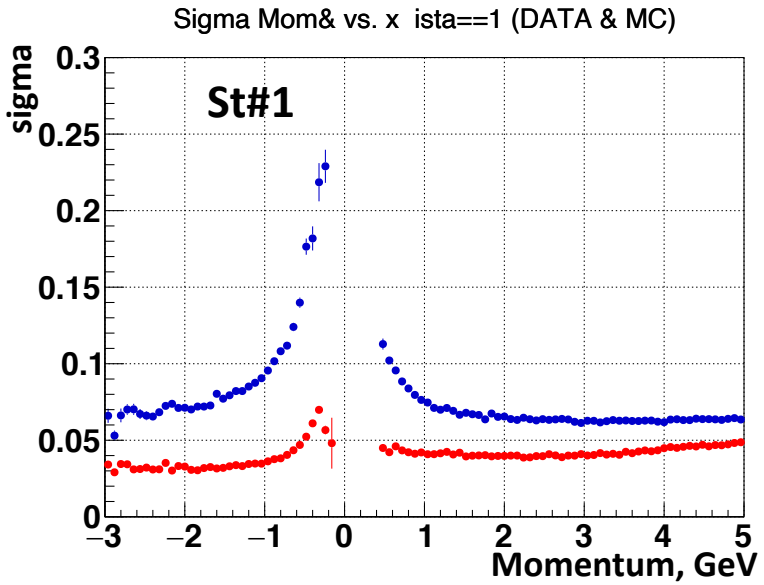


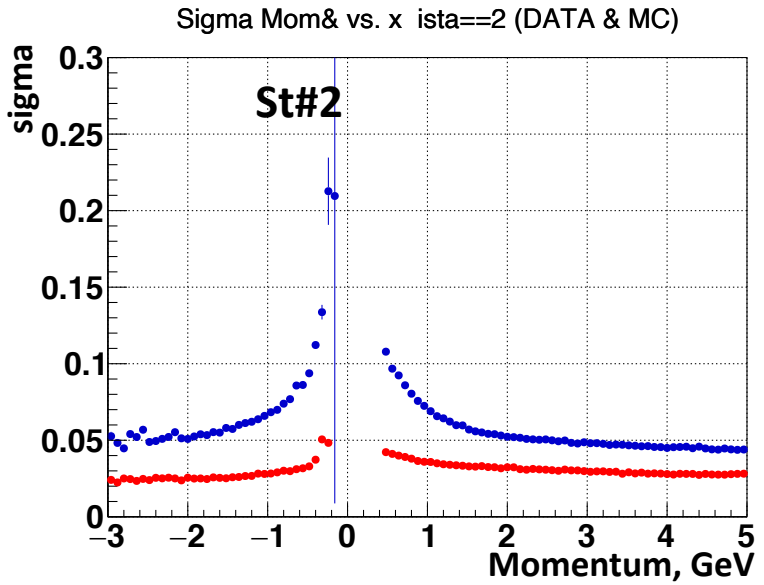


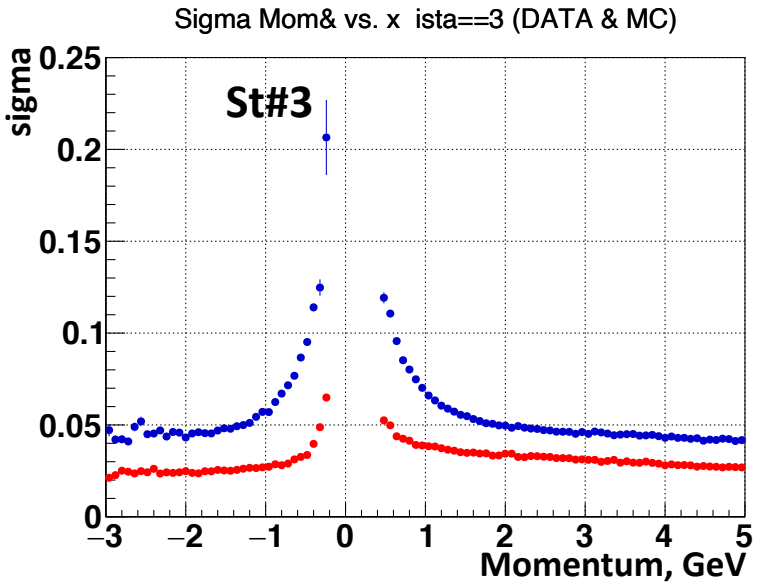


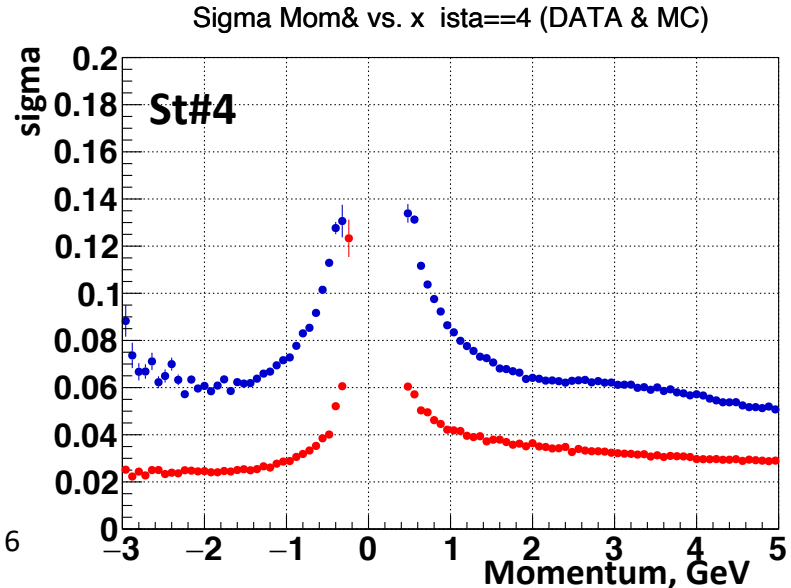
Blue: DATA
Red: MC

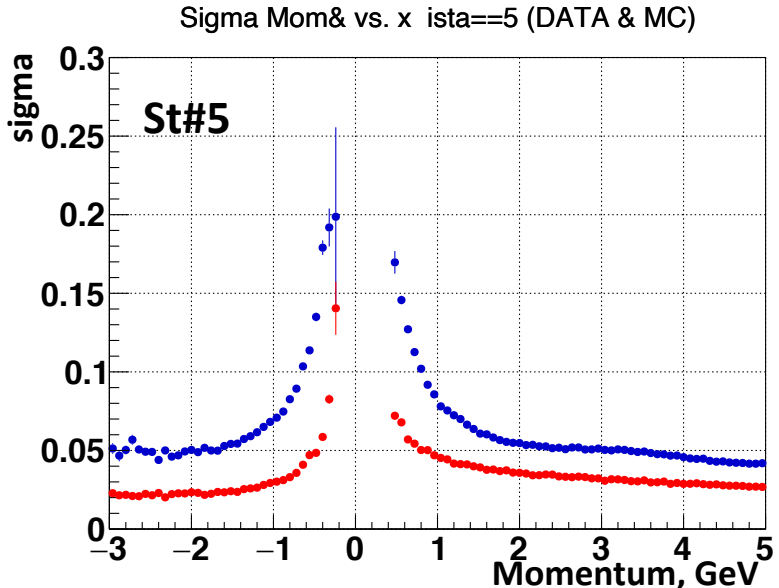
Sigma Dx vs Momentum (MC & Data 4.0GeV C+Cu)

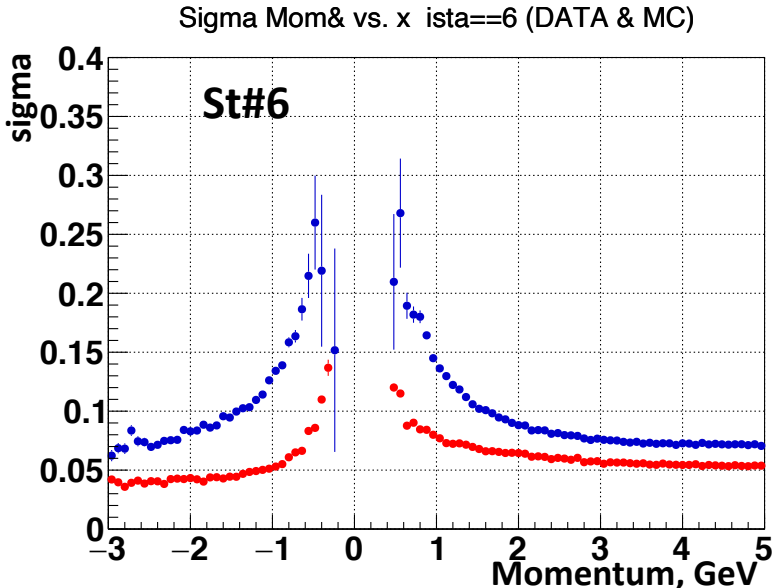




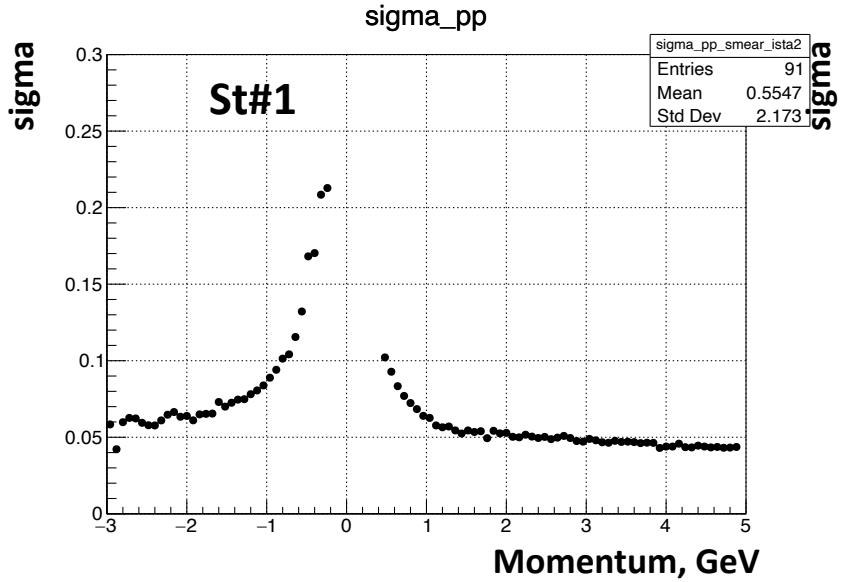


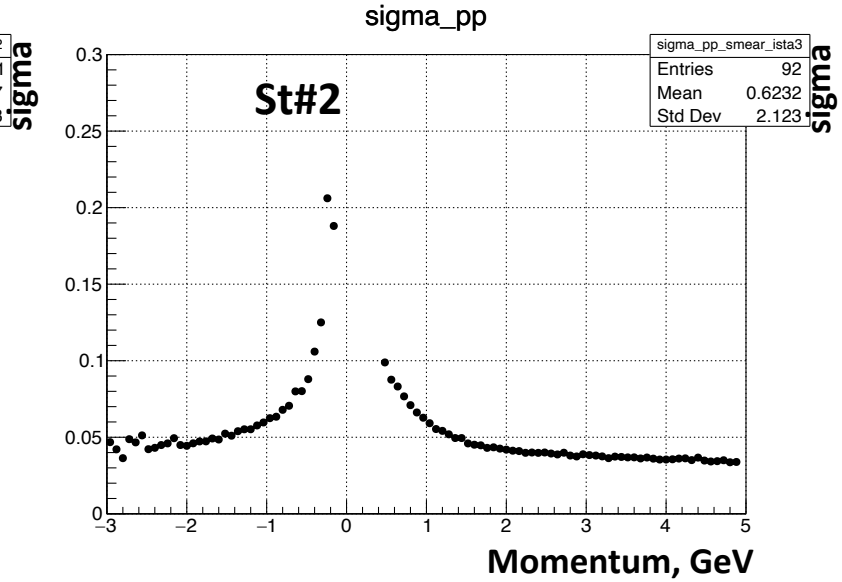


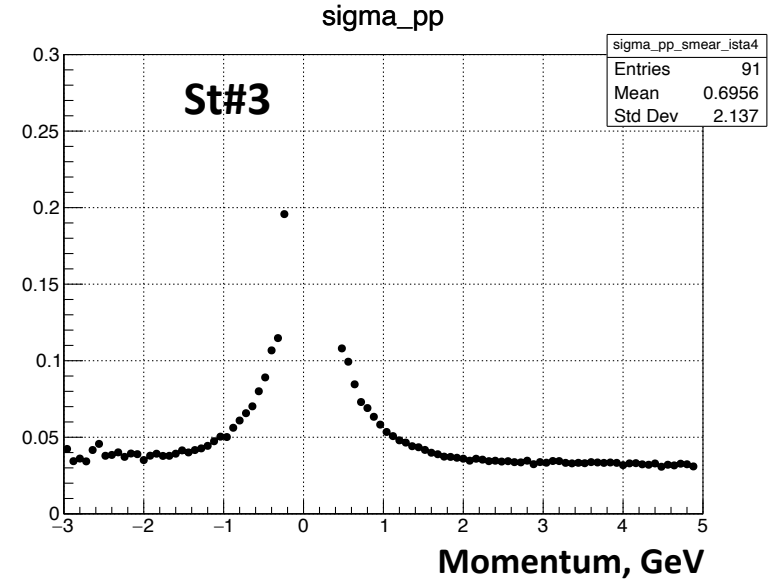


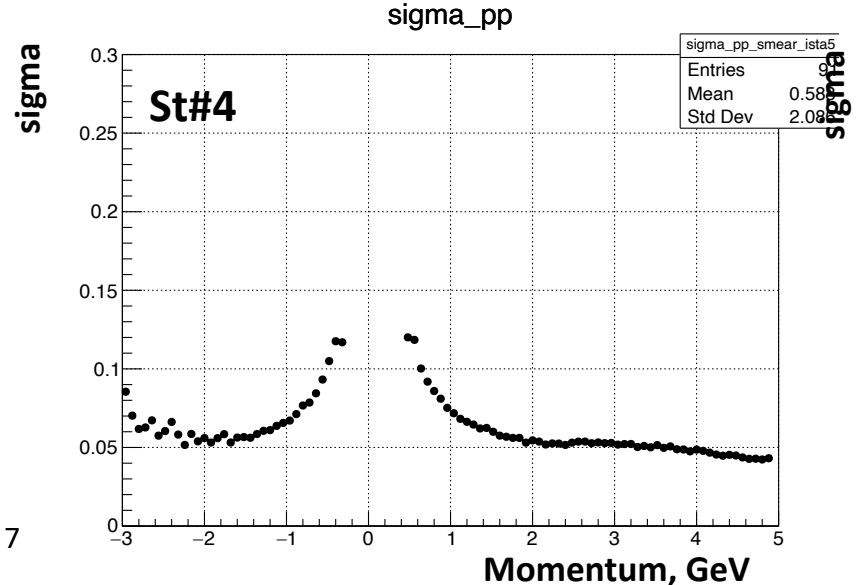


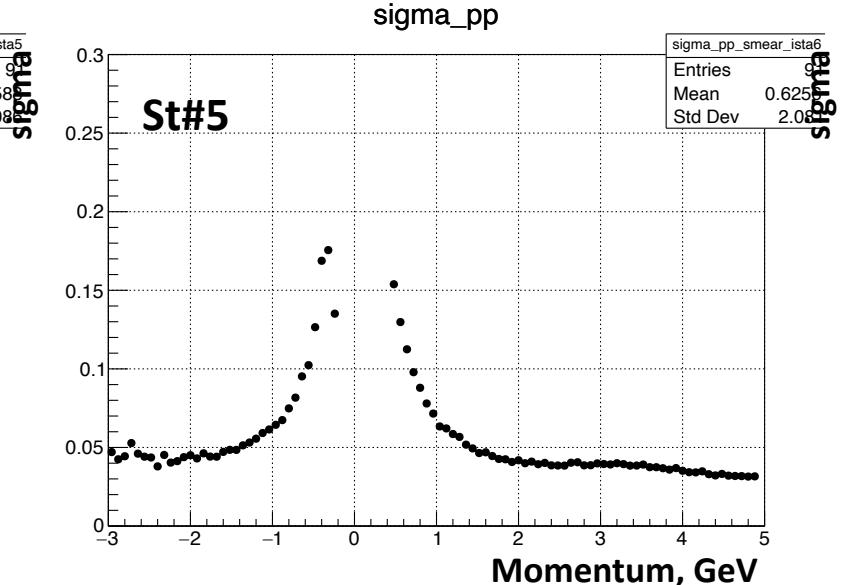
MC Smearing functions (Sigma Dx vs Momentum): $\sigma_{SMEAR} = \sqrt{\sigma^2_{DATA} - \sigma^2_{MC}}$

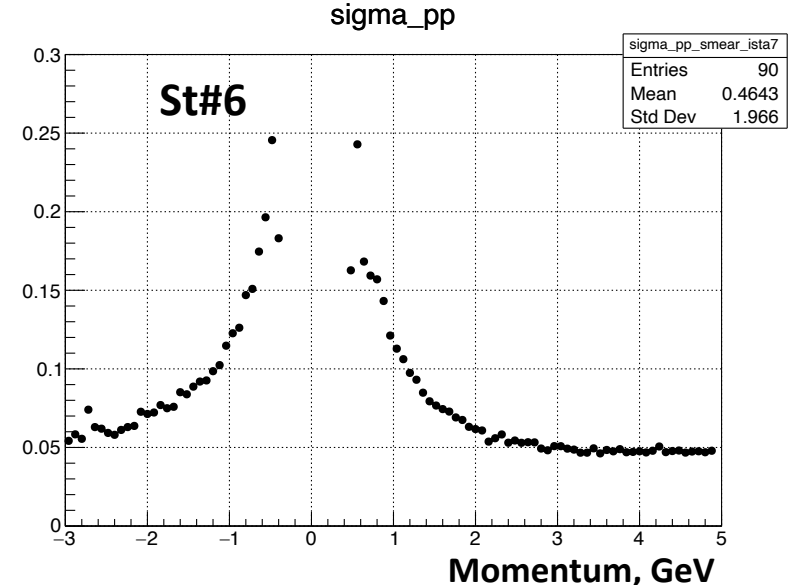




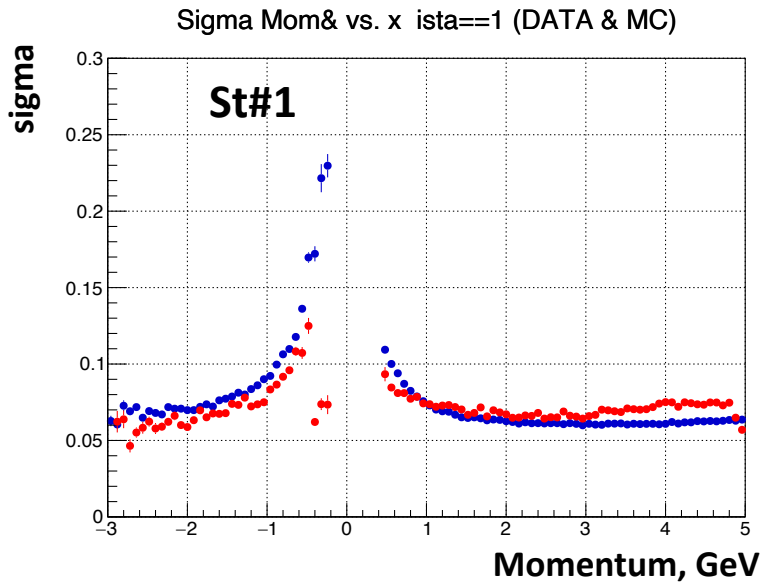


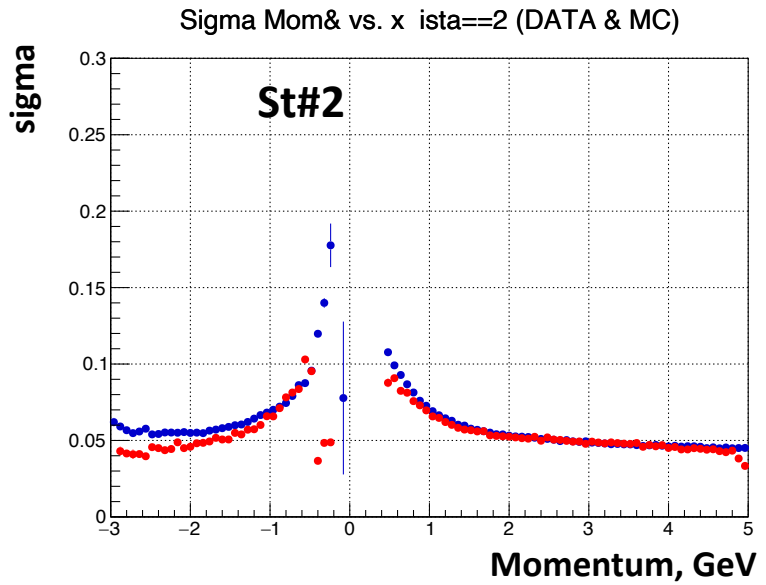


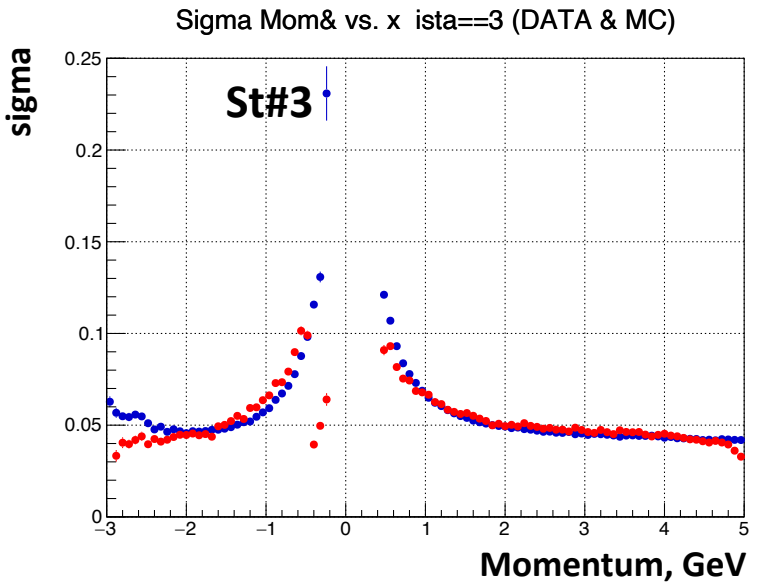


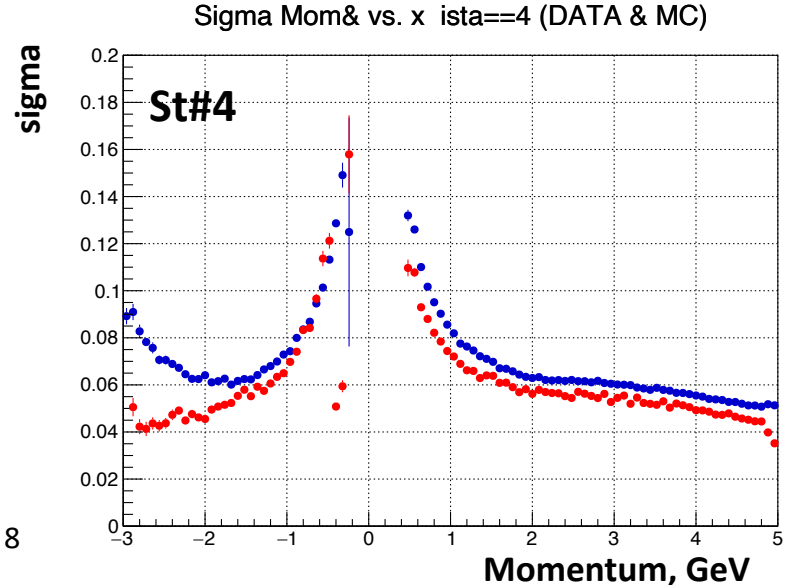


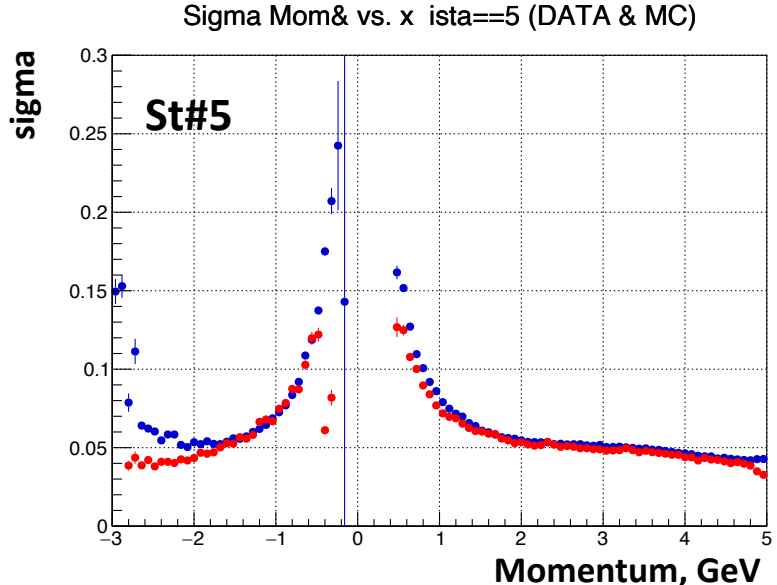
Sigma Dx vs Momentum after smearing (MC & Data 4.0GeV C+Cu)

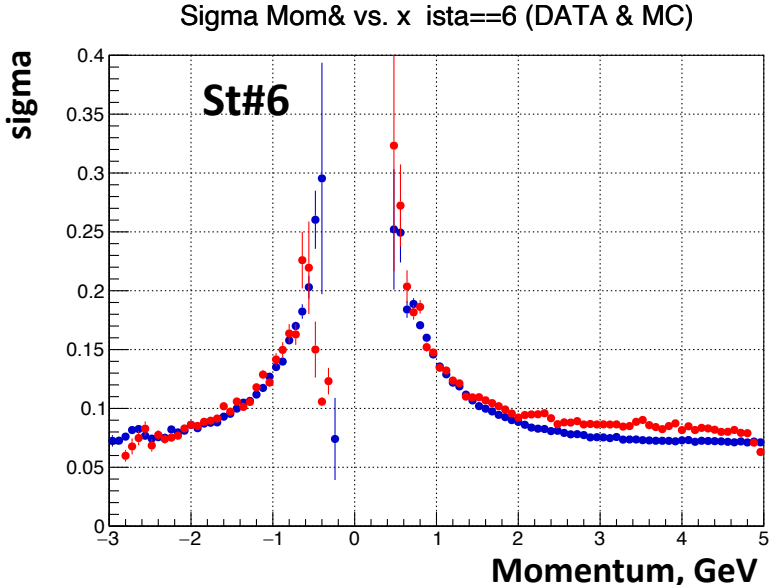








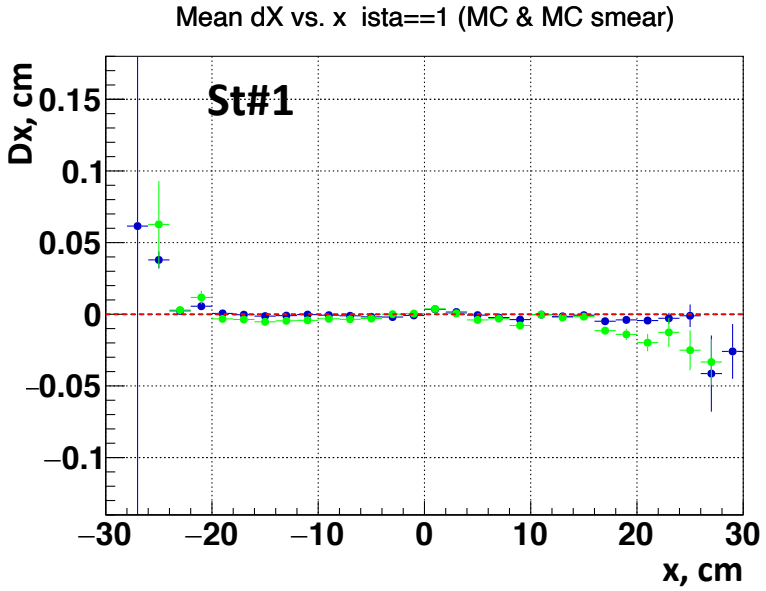


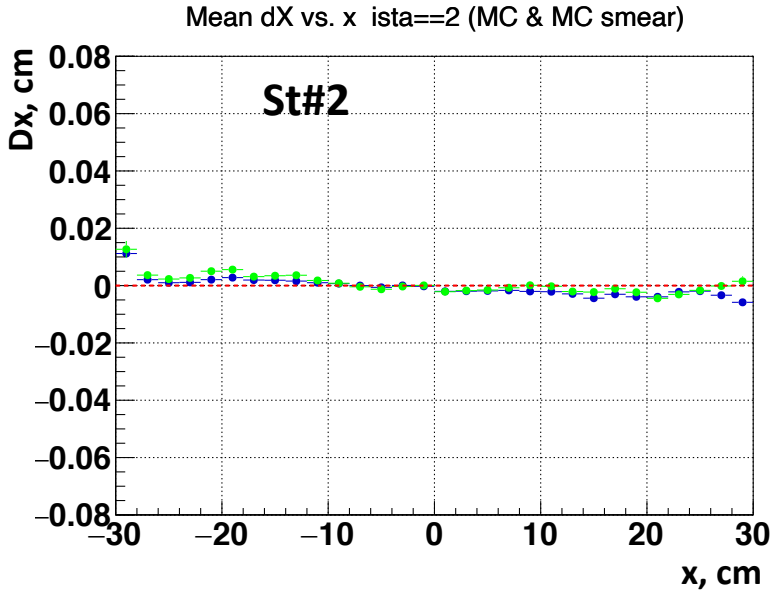


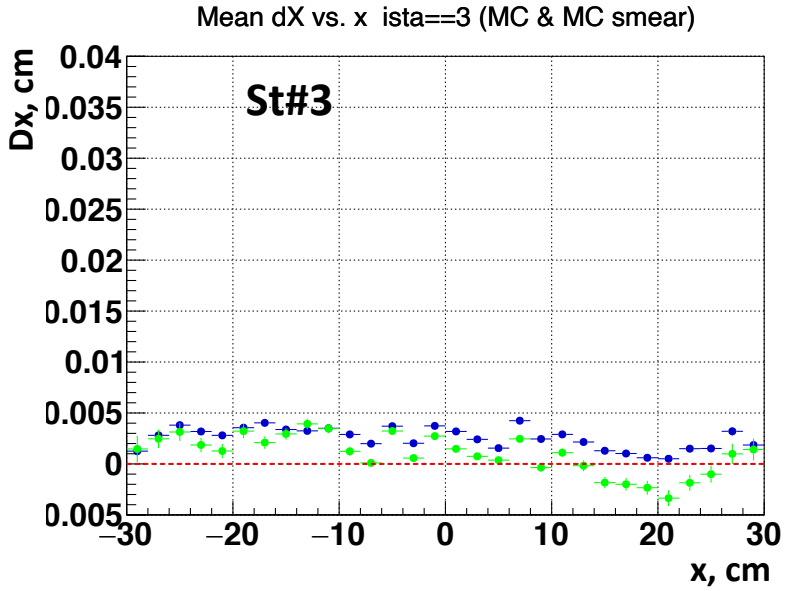
Mean Dx vs x after/before smearing (MC 4.0GeV C+Cu)

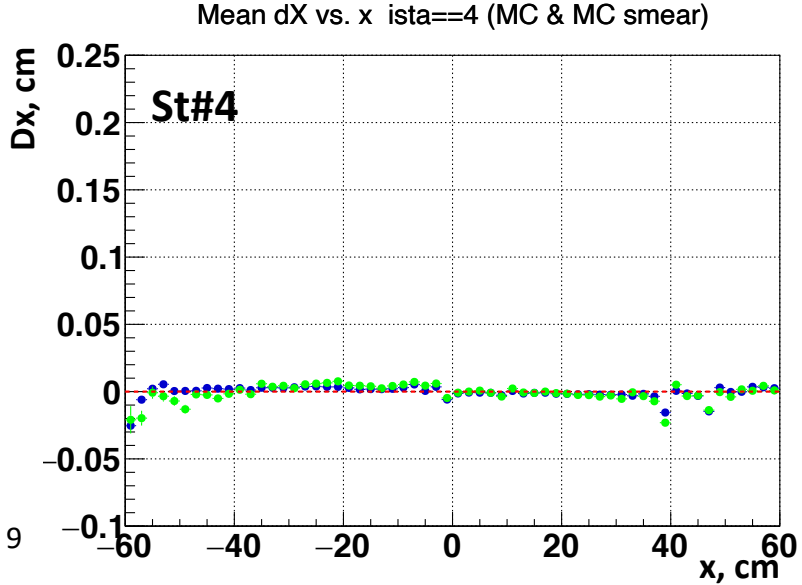
Blue: MC before smear

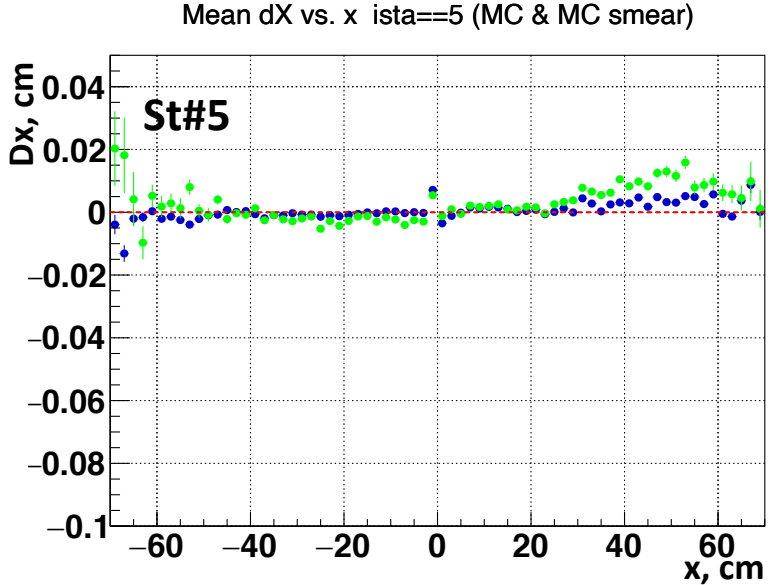
Red: MC after smear

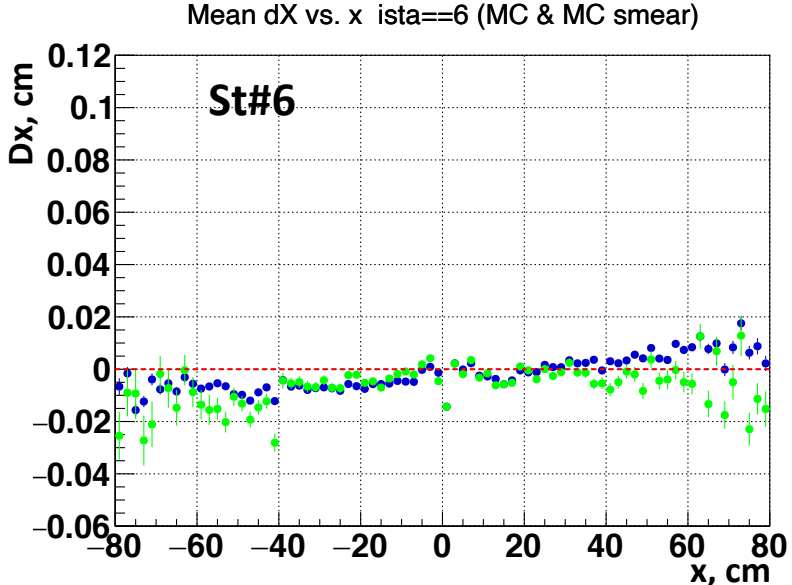








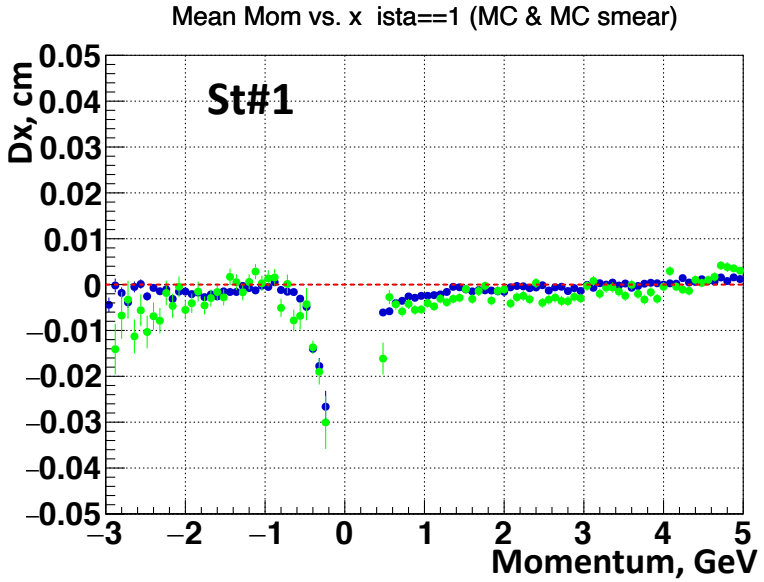


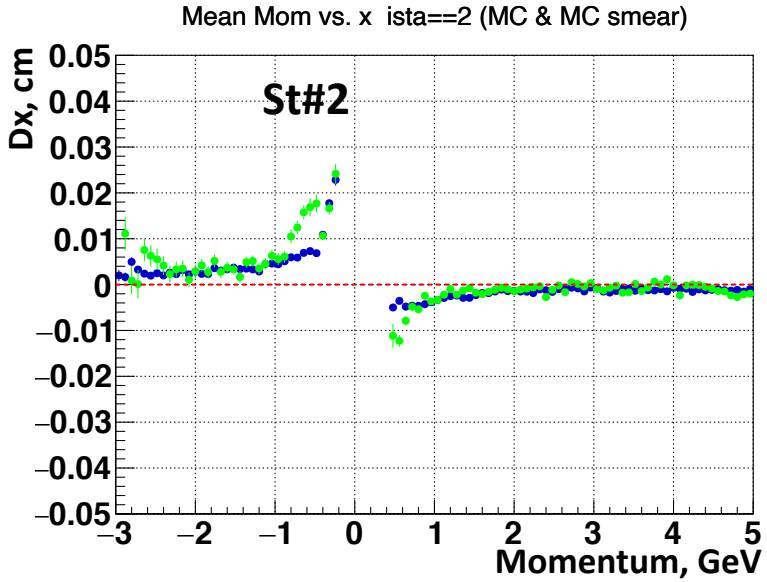


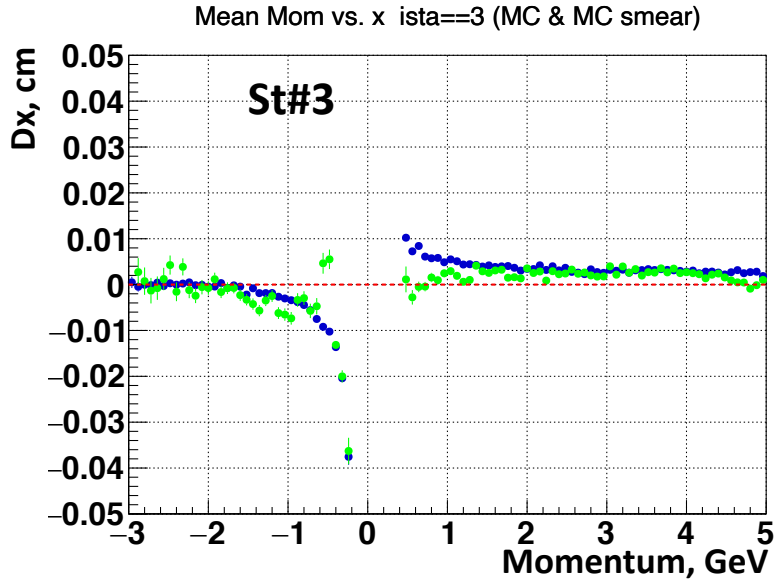
Mean Dx vs Mom after/before smearing (MC 4.0GeV C+Cu)

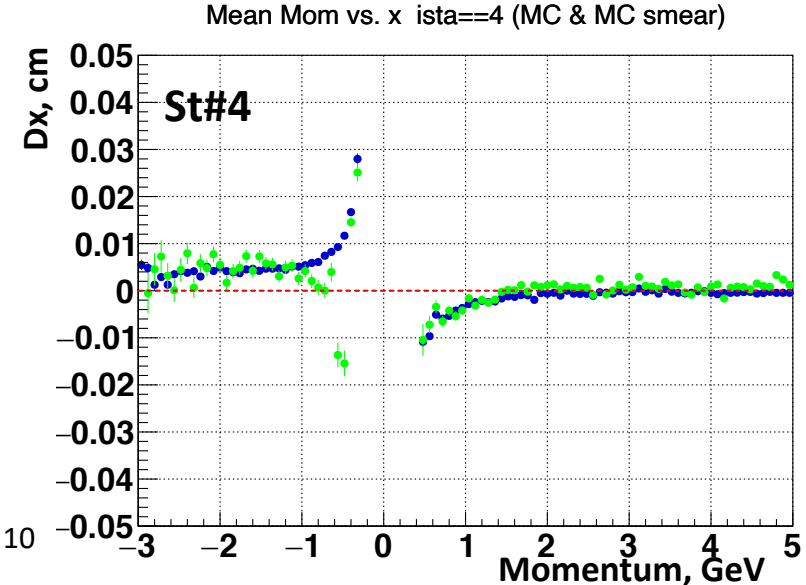
Blue: MC before smear

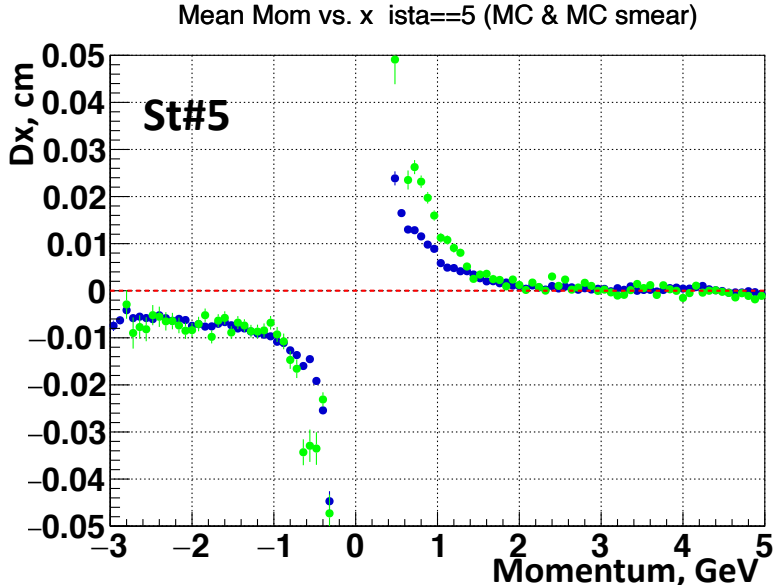
Red: MC after smear

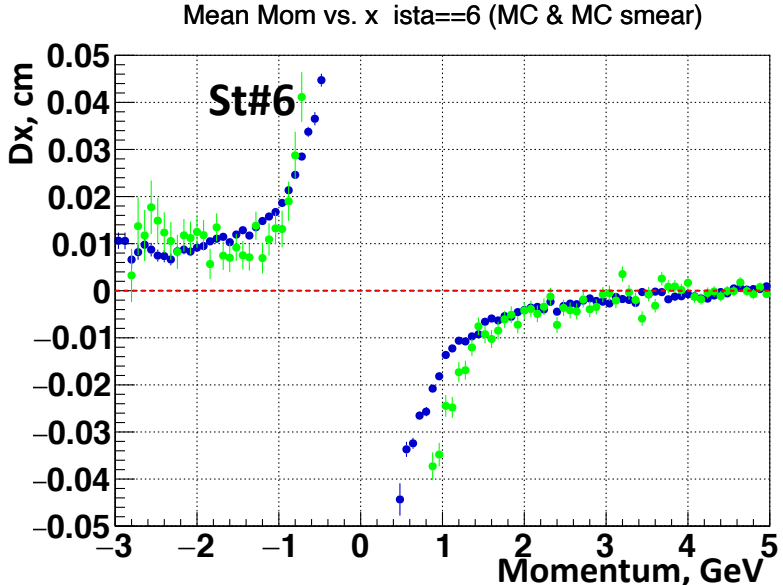






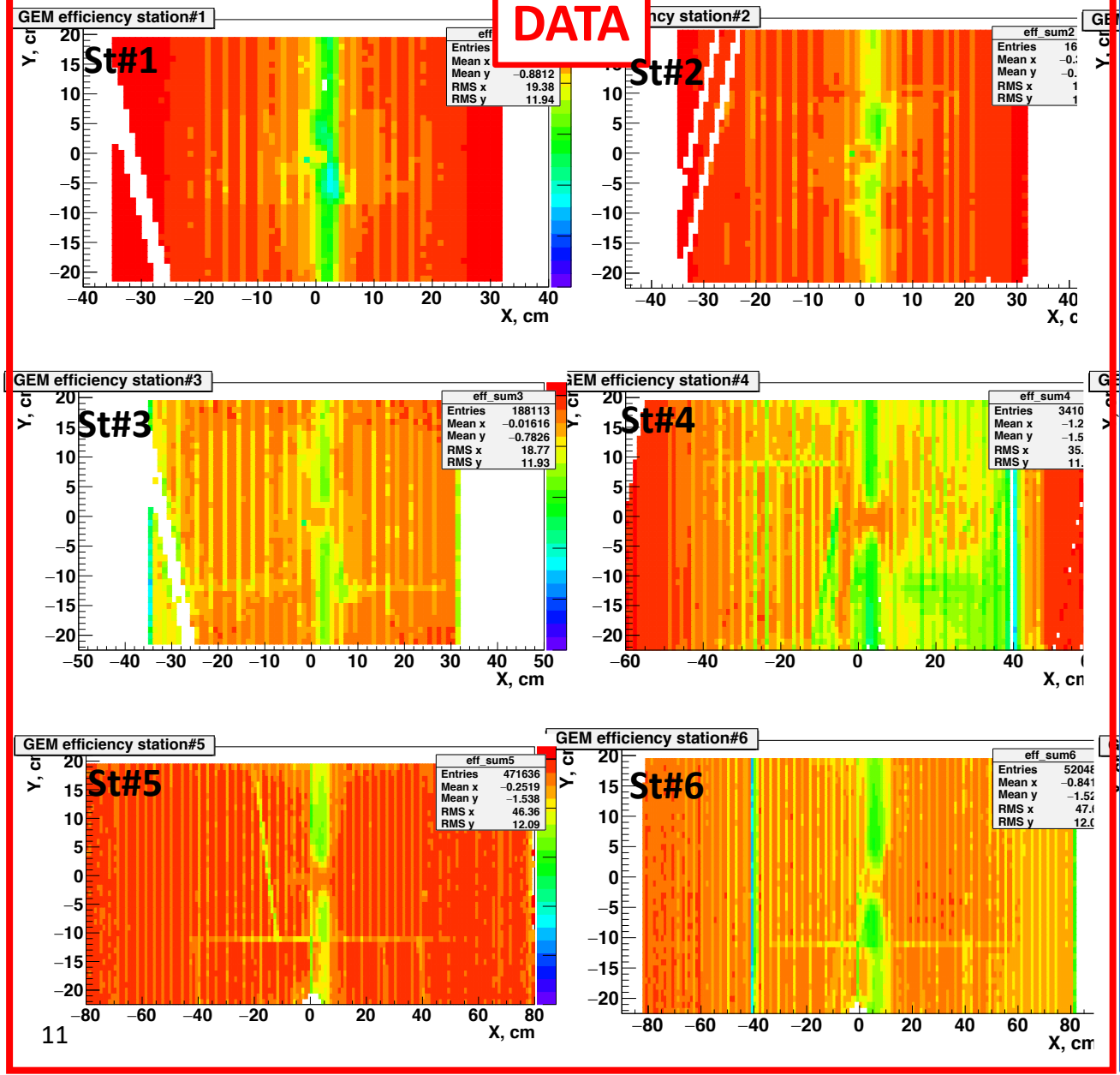




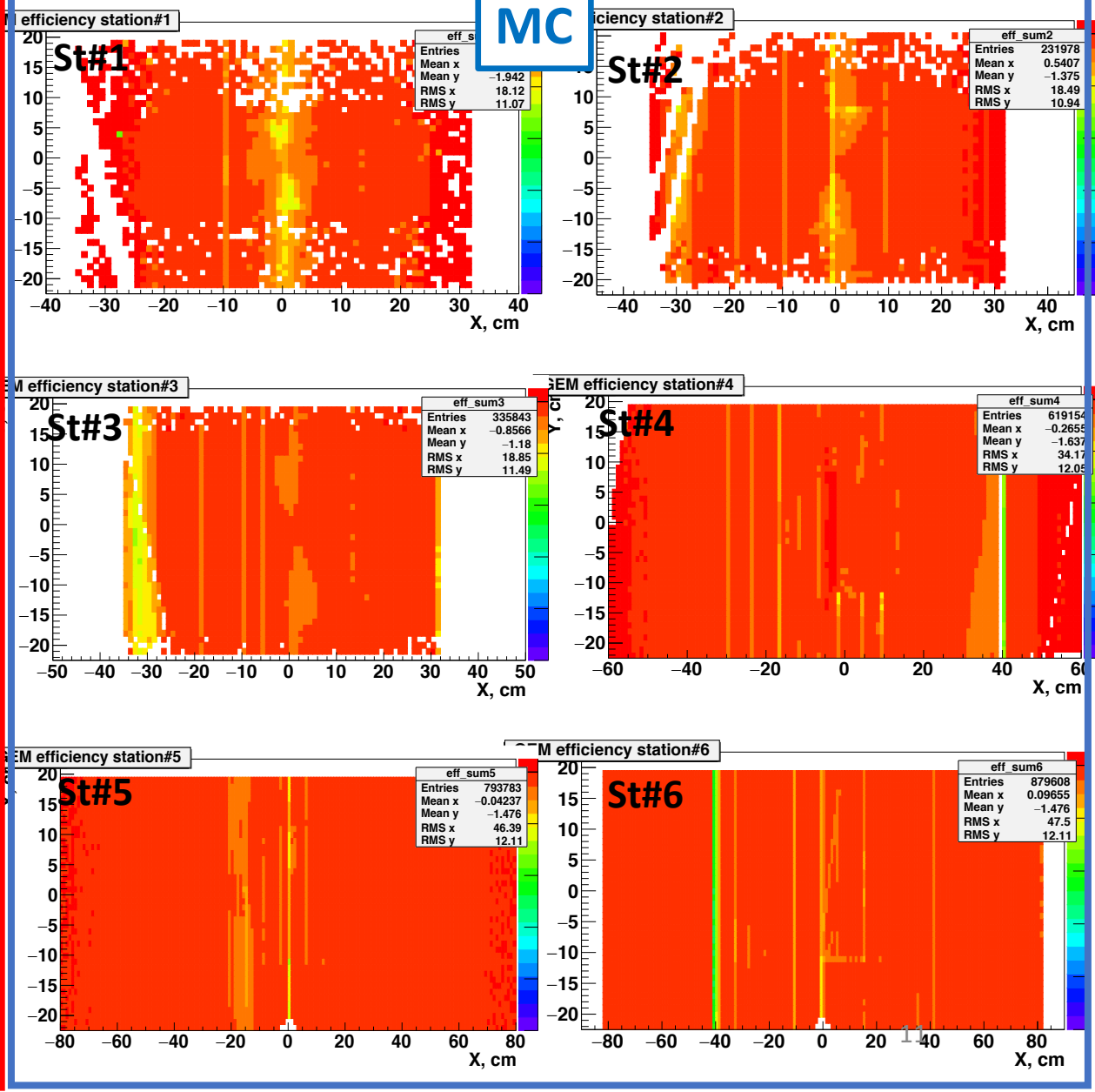


GEM efficiencies comparison Data/MC (4.0GeV all)

DATA

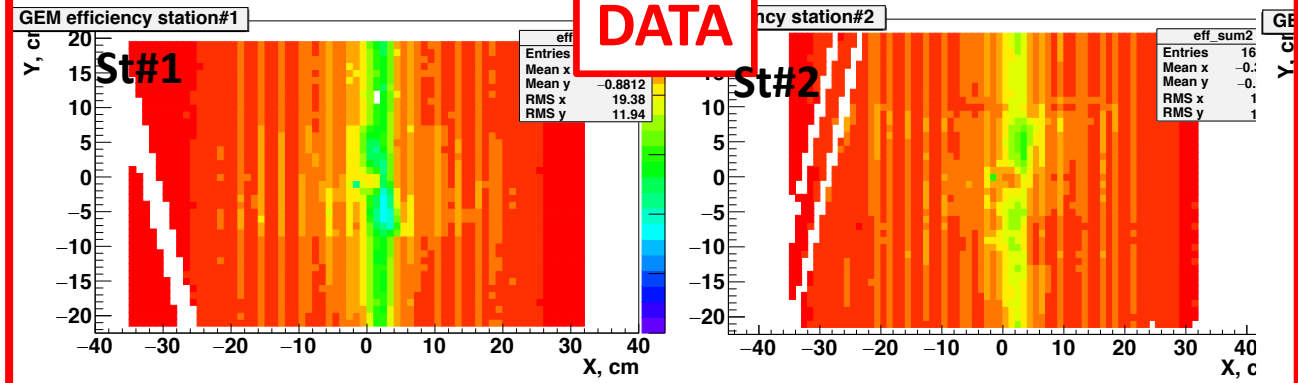


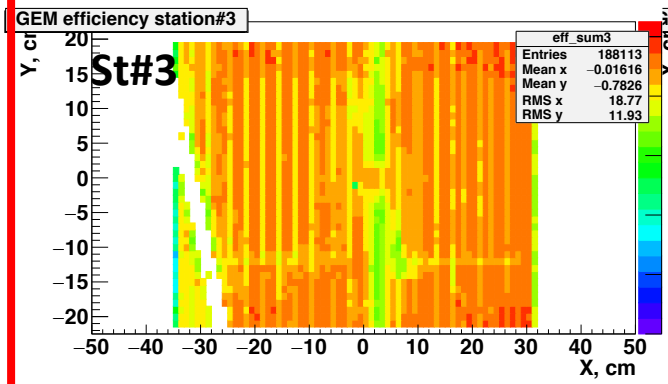
MC

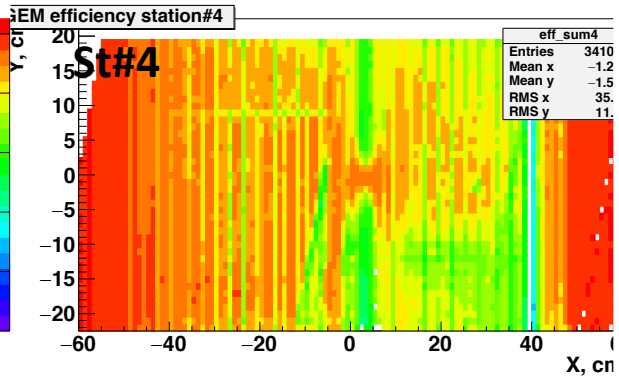


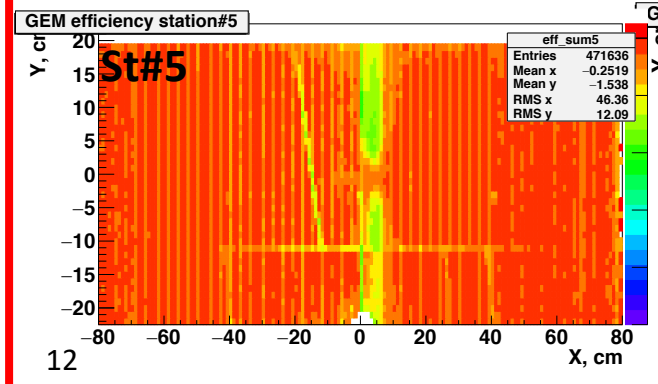
GEM efficiencies: Apply efficiencies to MC (4.0GeV all)

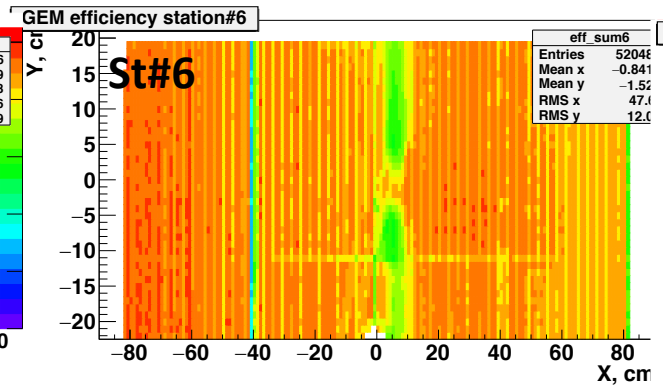
DATA



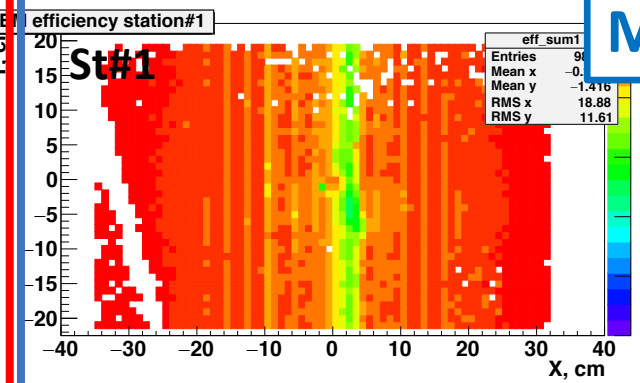


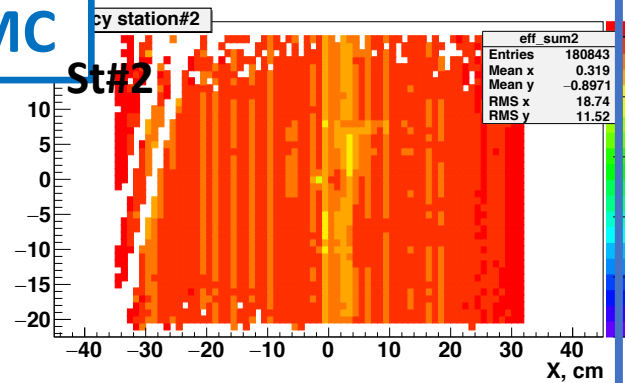


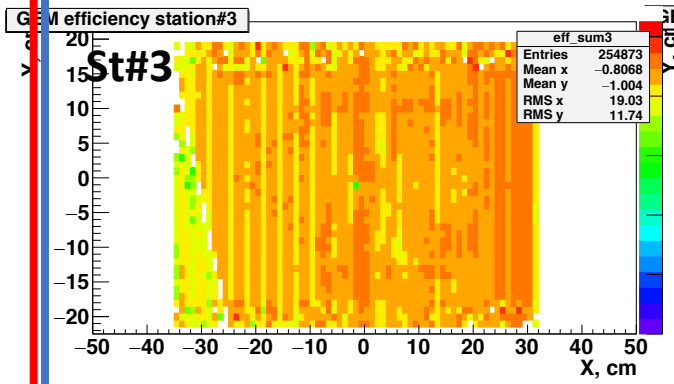


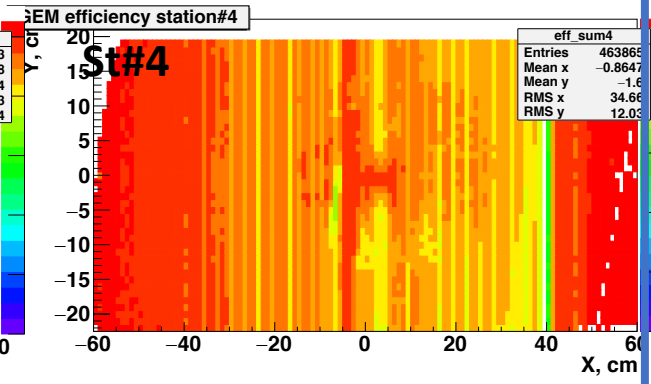


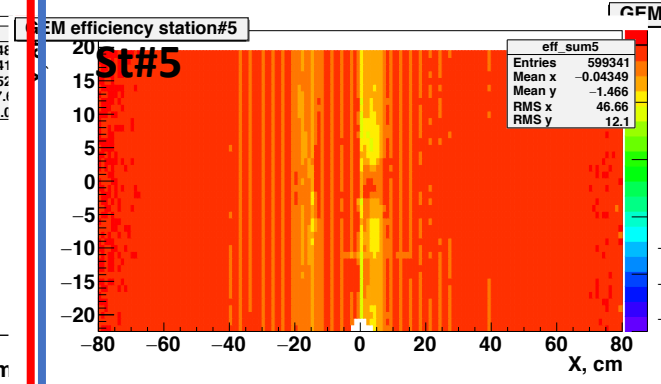
MC

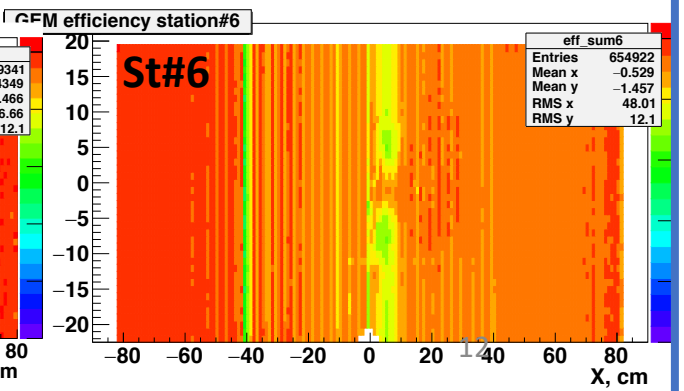








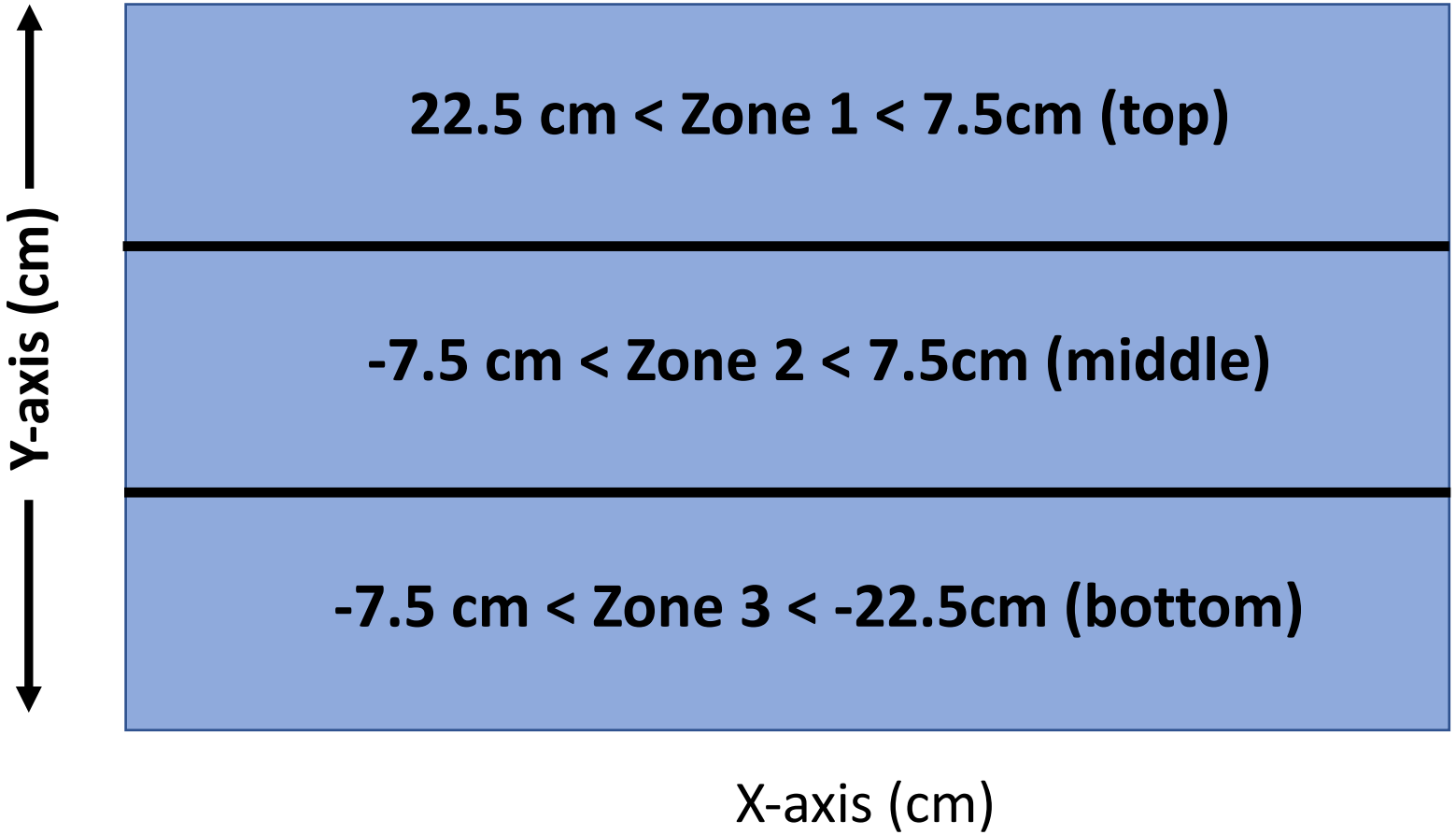




12

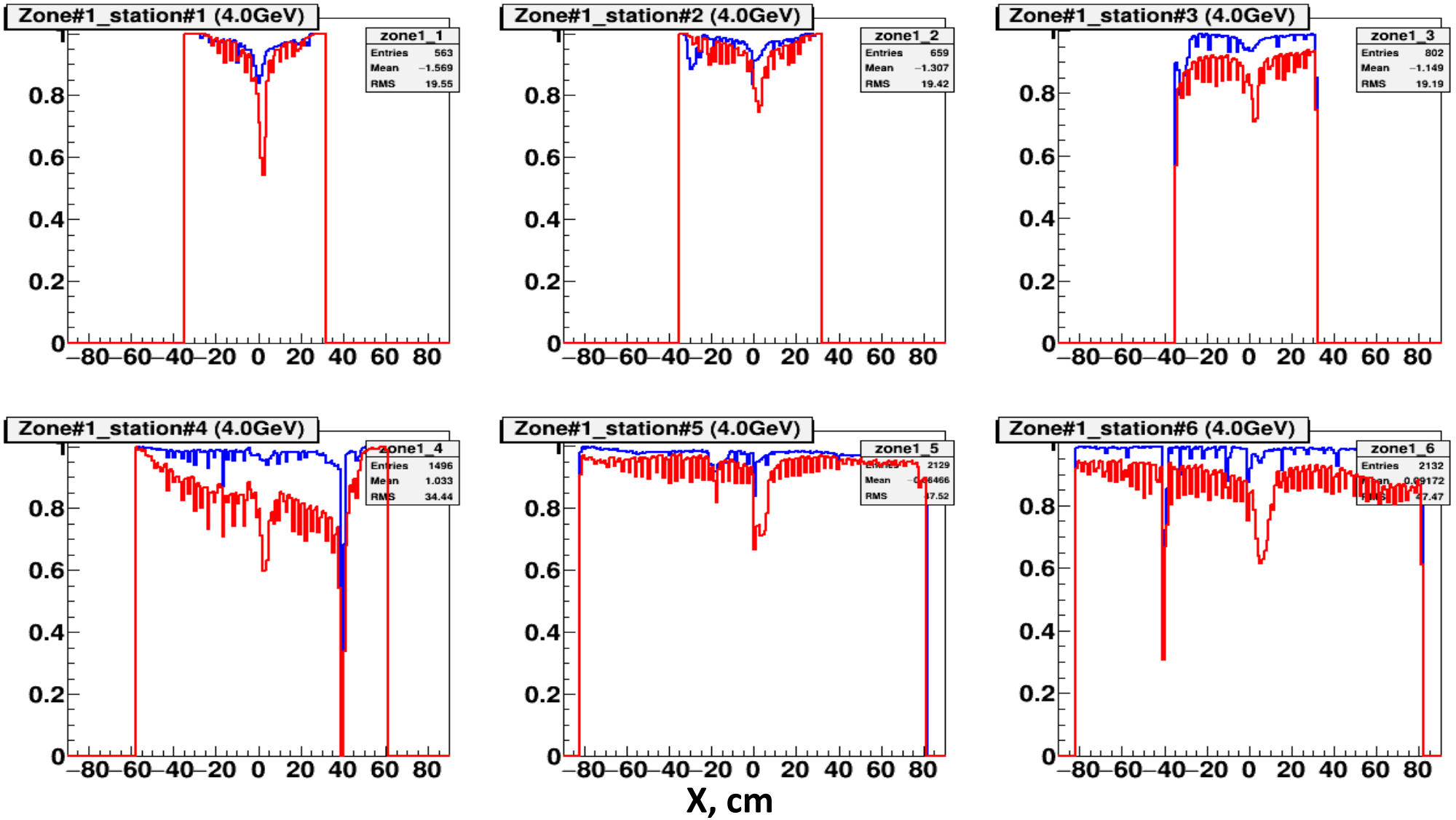
Apply GEM efficiencies to MC (check)

- Each GEM plane was divided into to 3 regions along Y-axis
  - Compare integral for efficiencies at each regions



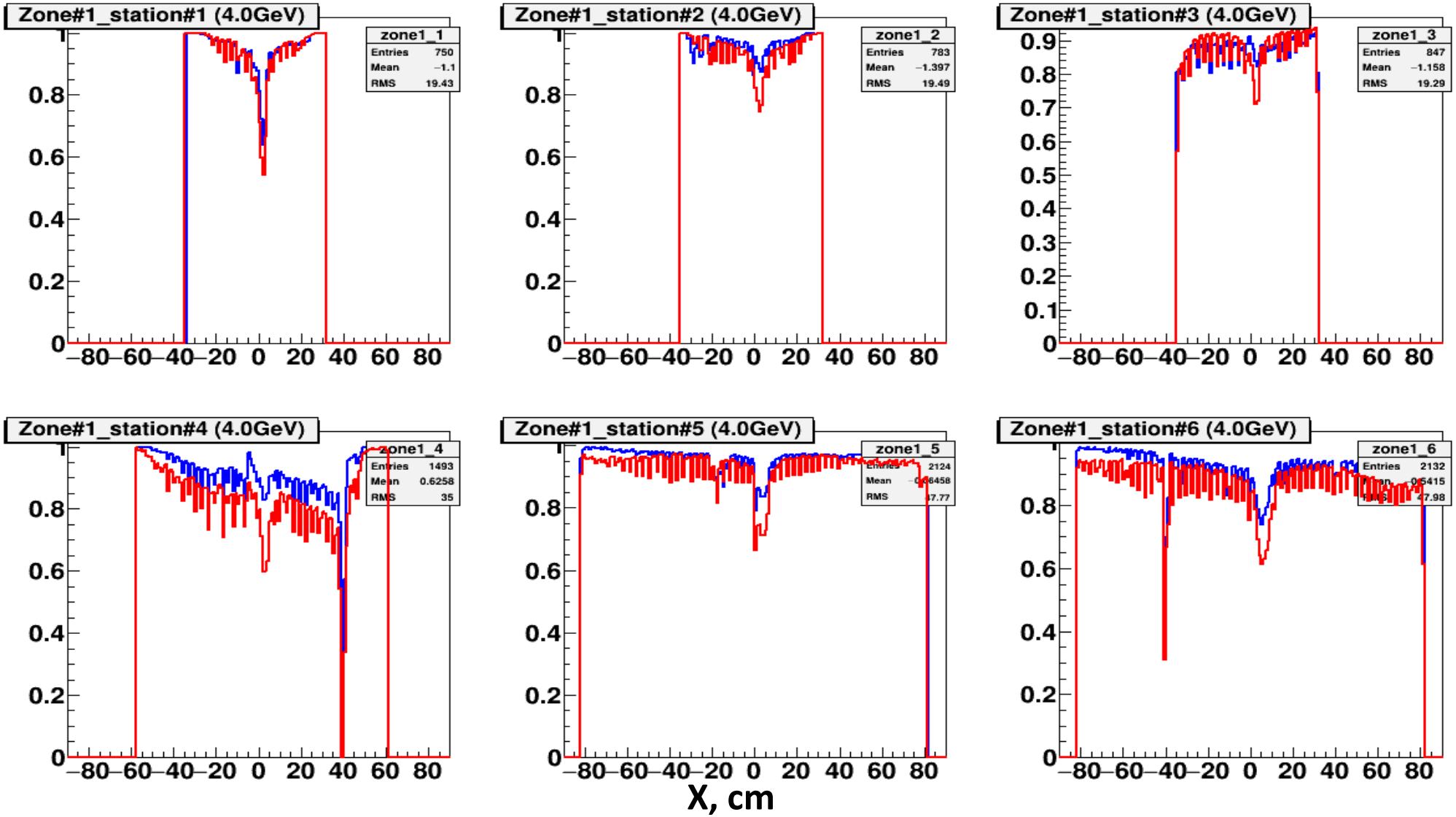
GEM efficiencies (4.0GeV all, top)

Red: Data; Blue: MC; (22.5 cm < Zone 1 < 7.5cm (top))



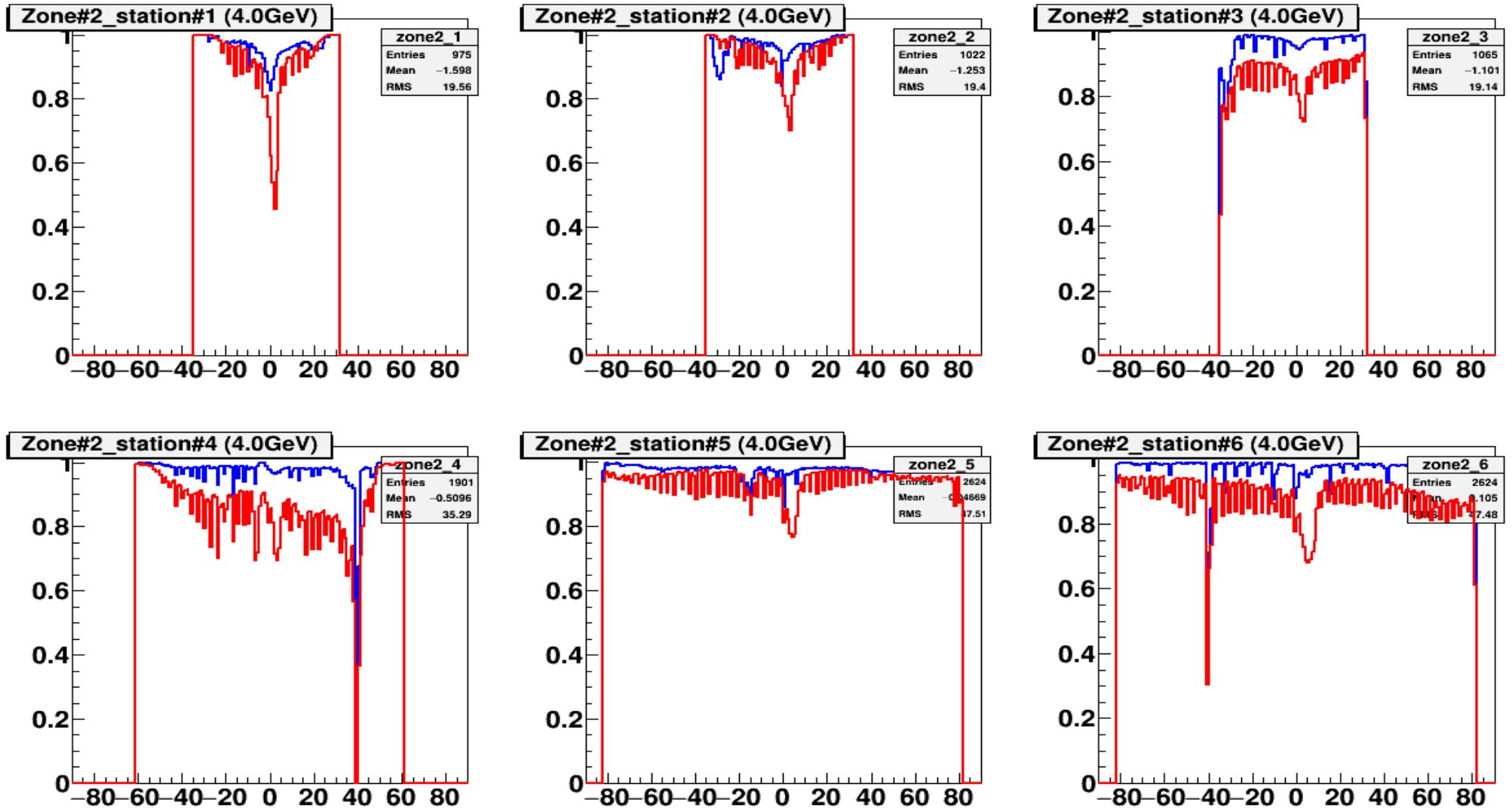
GEM efficiencies: Apply efficiencies to MC (4.0GeV all, top)

Red: Data; Blue: MC; (22.5 cm < Zone 1 < 7.5cm (top))



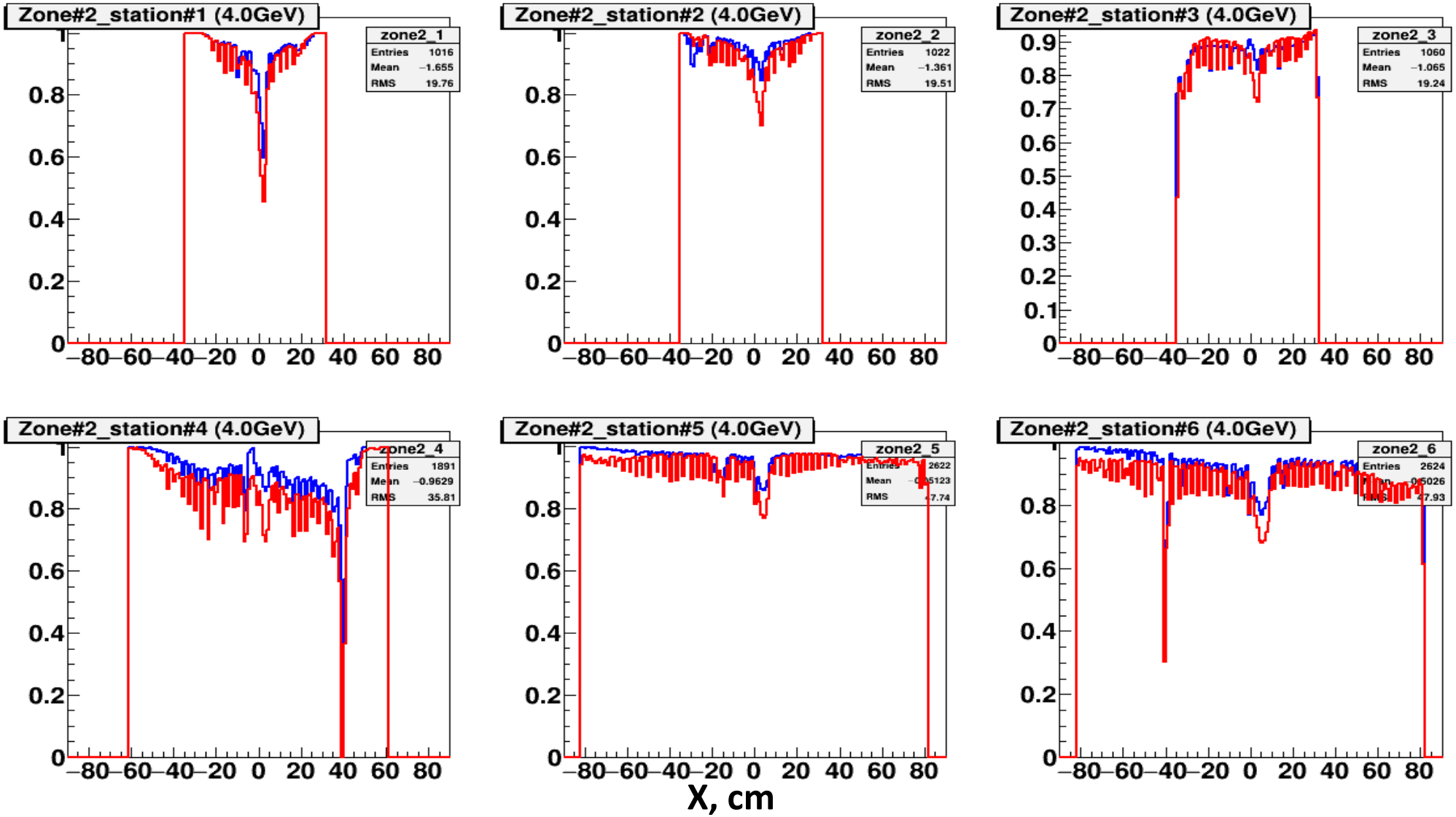
GEM efficiencies (4.0GeV all, middle)

Red: Data; Blue: MC; (7.5 cm < Zone 2 < -7.5cm (middle))



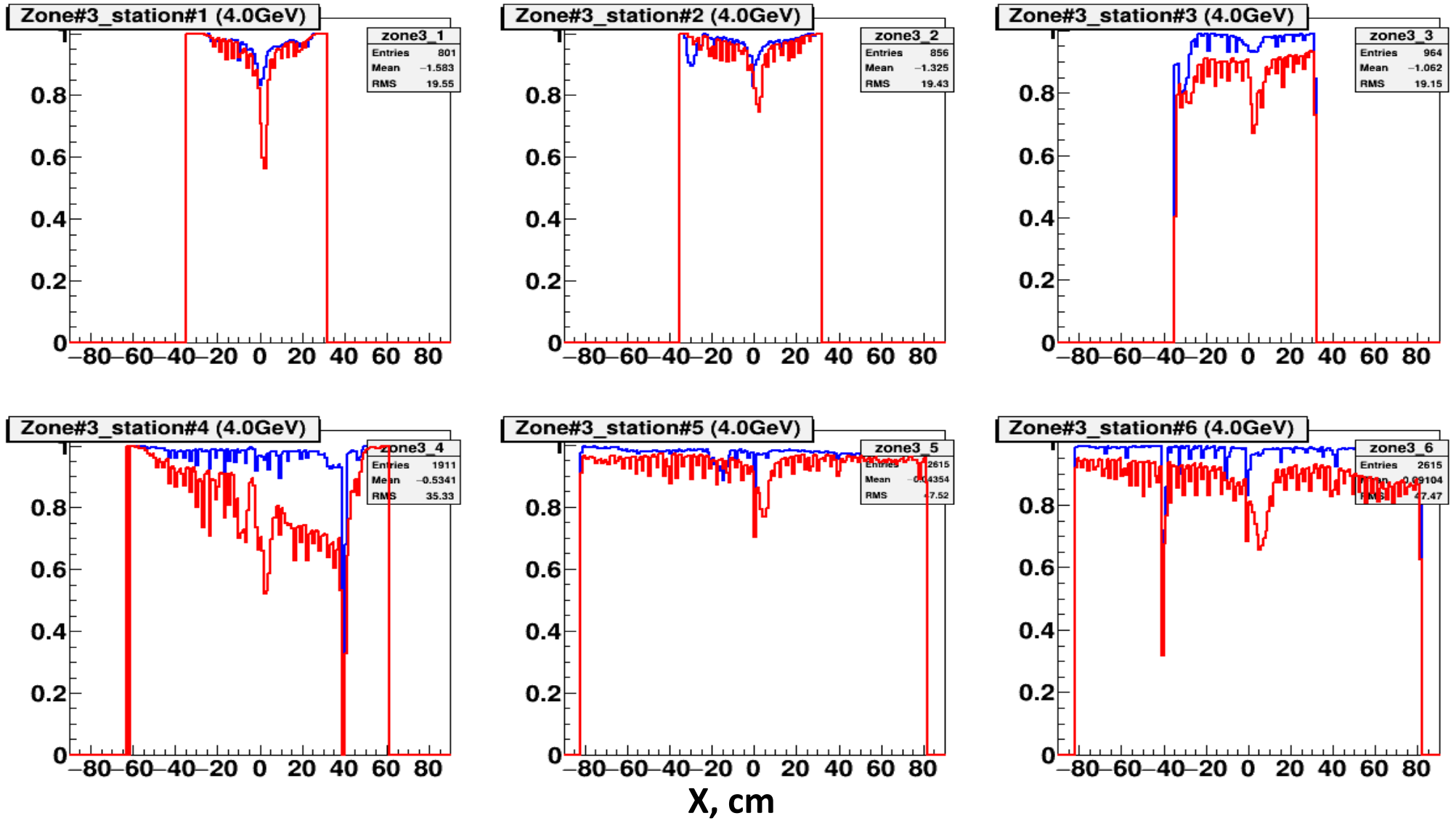
GEM efficiencies: Apply efficiencies to MC (4.0GeV all, middle)

Red: Data; Blue: MC; (7.5 cm < Zone 2 < -7.5cm (middle))



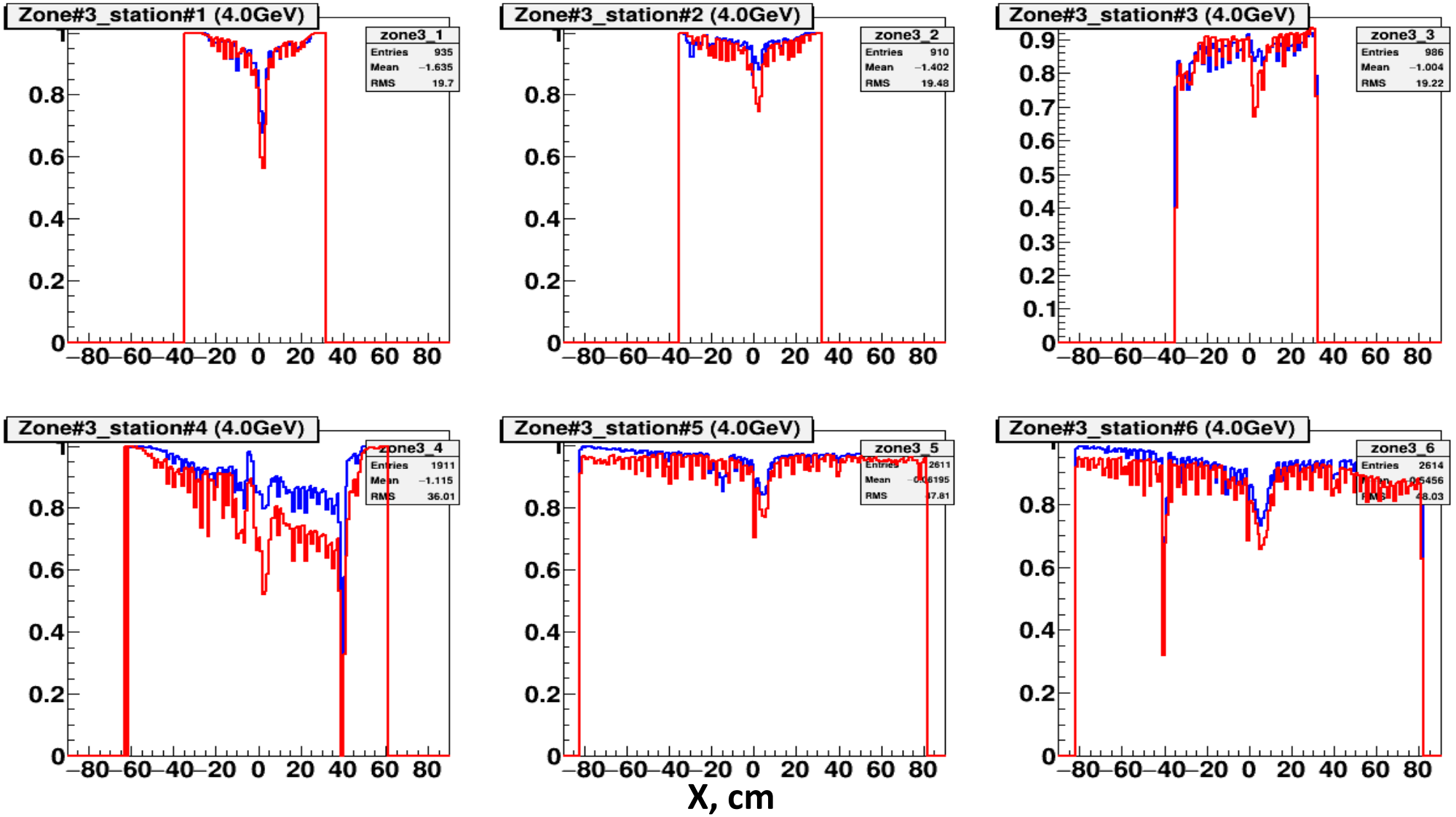
GEM efficiencies (4.0GeV all, bottom)

Red: Data; Blue: MC; (-7.5 cm < Zone 1 < -22.5cm (bottom))



GEM efficiencies: Apply efficiencies to MC (4.0GeV all, bottom)

Red: Data; Blue: MC; (-7.5 cm < Zone 1 < -22.5cm (bottom))



Next steps…

- Applying more precisely momentum smearing for MC
- Appling GEM efficiencies to MC simulation according energies/targets/periods
- Comparing distributions MC/Data for pt/momentum/mass/etc…
- Measuring cross-sections of the Λ^0's hyperon

Plan to finish Run6 analysis to the end of July 2021

Thank you for your attention!