

Status of the Λ^0 hyperon analysis in the carbon beam

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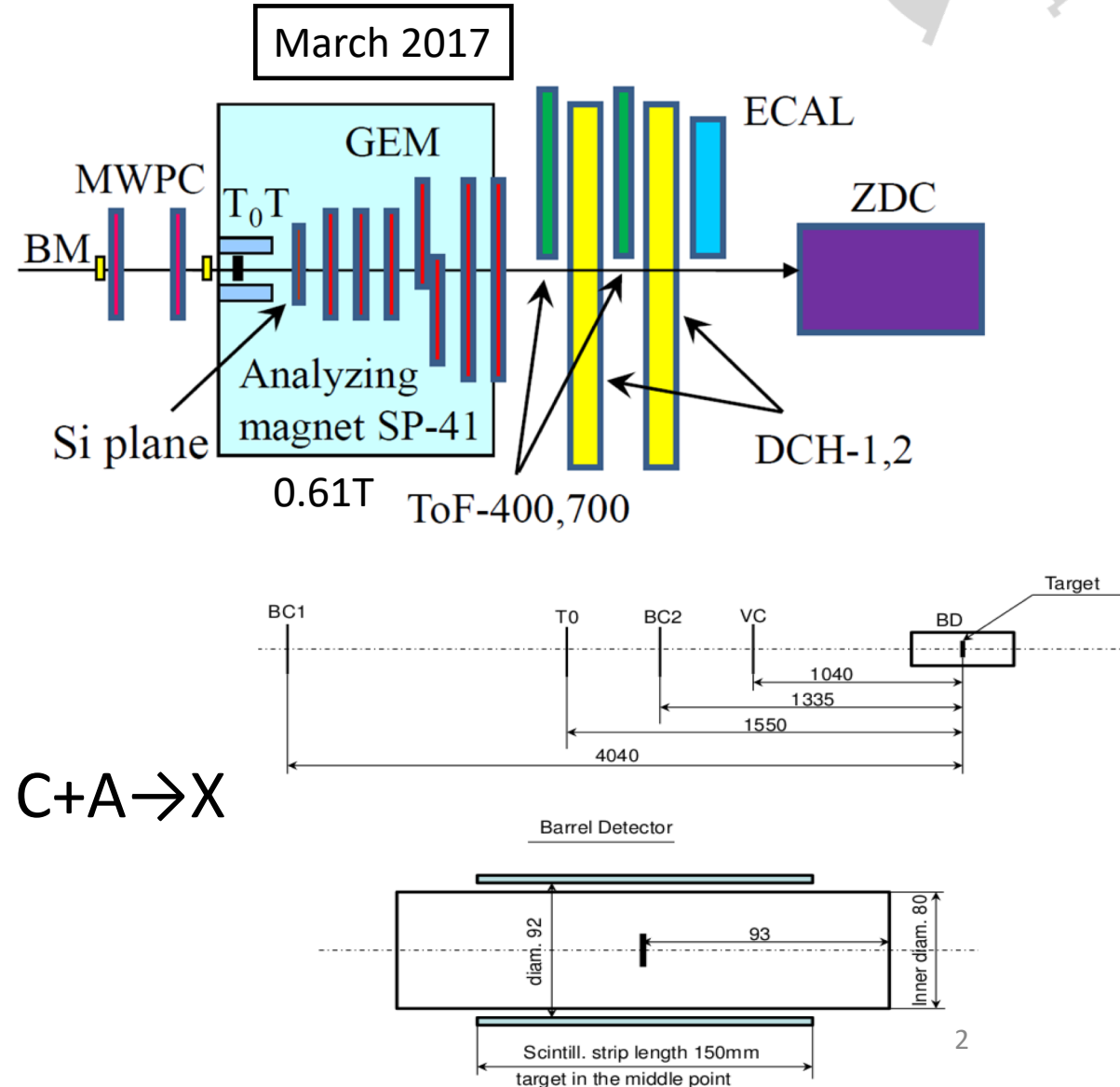


6th Collaboration Meeting of the BM@N Experiment at the NICA Facility
26-27 October 2020

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 $E_{kin}=4.0$ and 4.5 GeV
 - Intensity 10^5 per spill
 - Spill duration 2-2.5 sec.
- Physics: measure inelastic reactions $C+A \rightarrow X$
 - Targets: C, Al, Cu, Pb



Analysis flow & current status



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

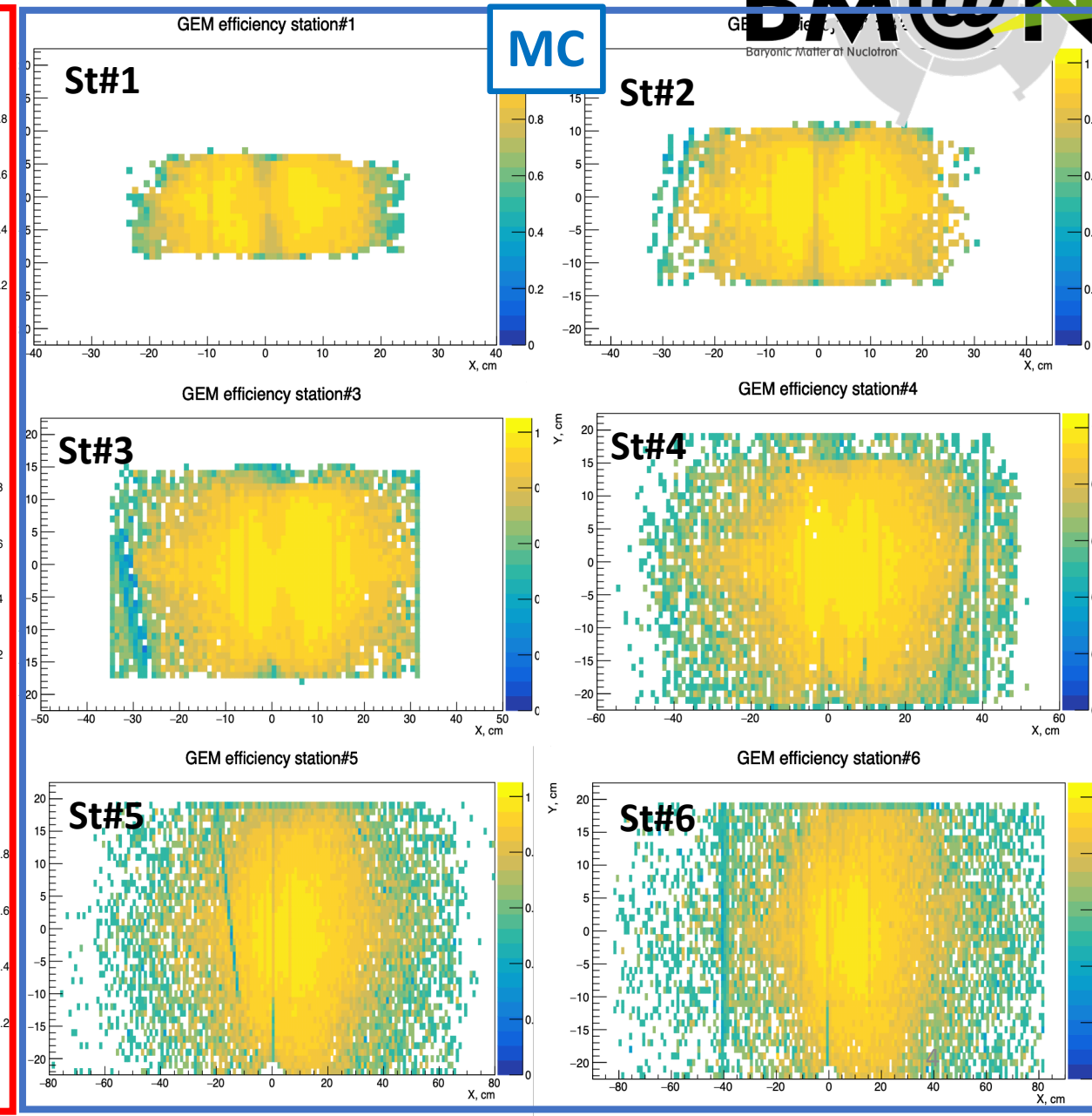
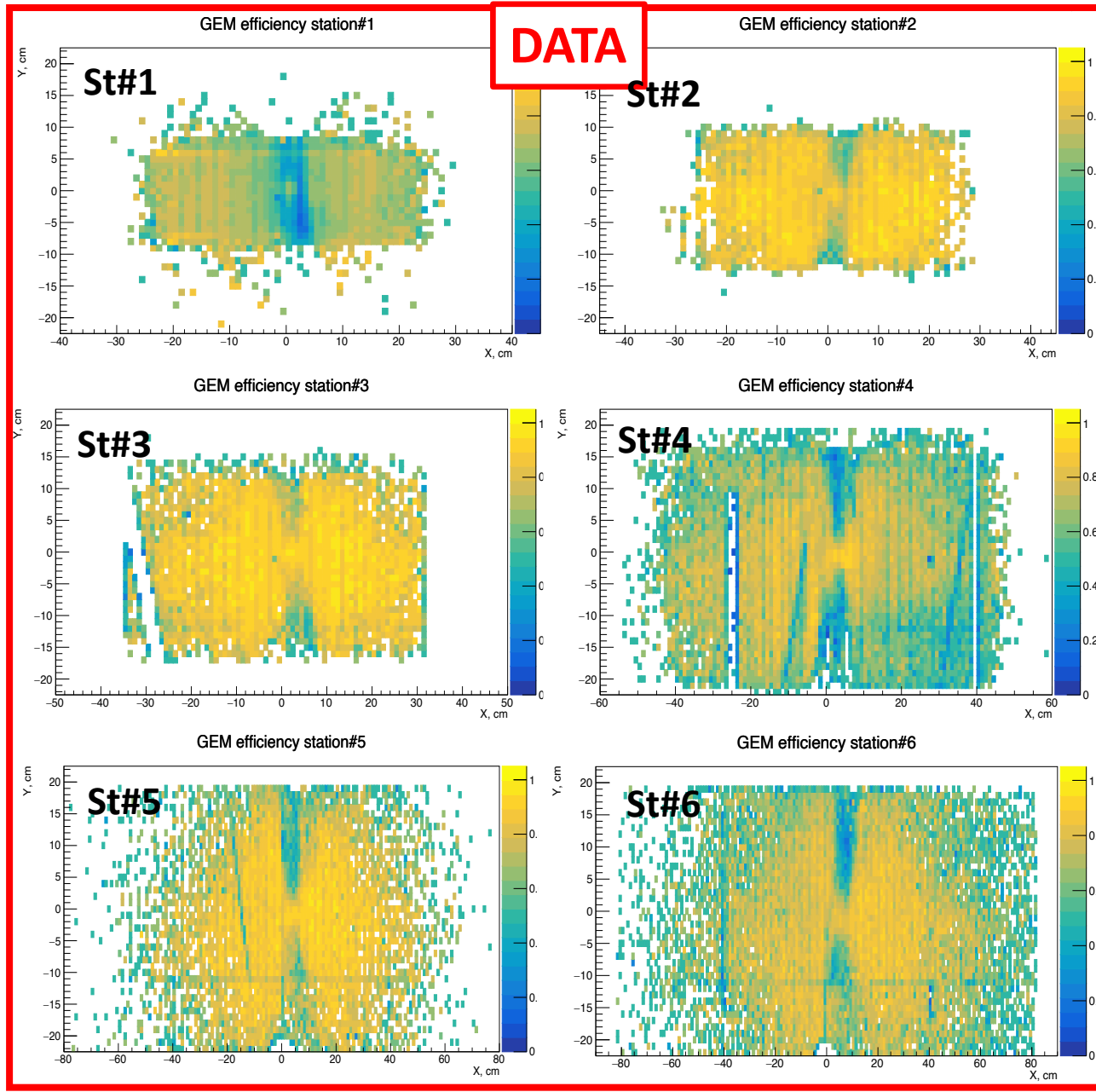
- **Embedding procedure:**

- Extract Primary Vertices (PV) from data
- Simulate DQGSM events from extracted data PV
 - Create set of events for the PV
 - Find event in set with at least one Λ^0 to be reconstructed
- Insert digits from the Λ^0 events in the data events

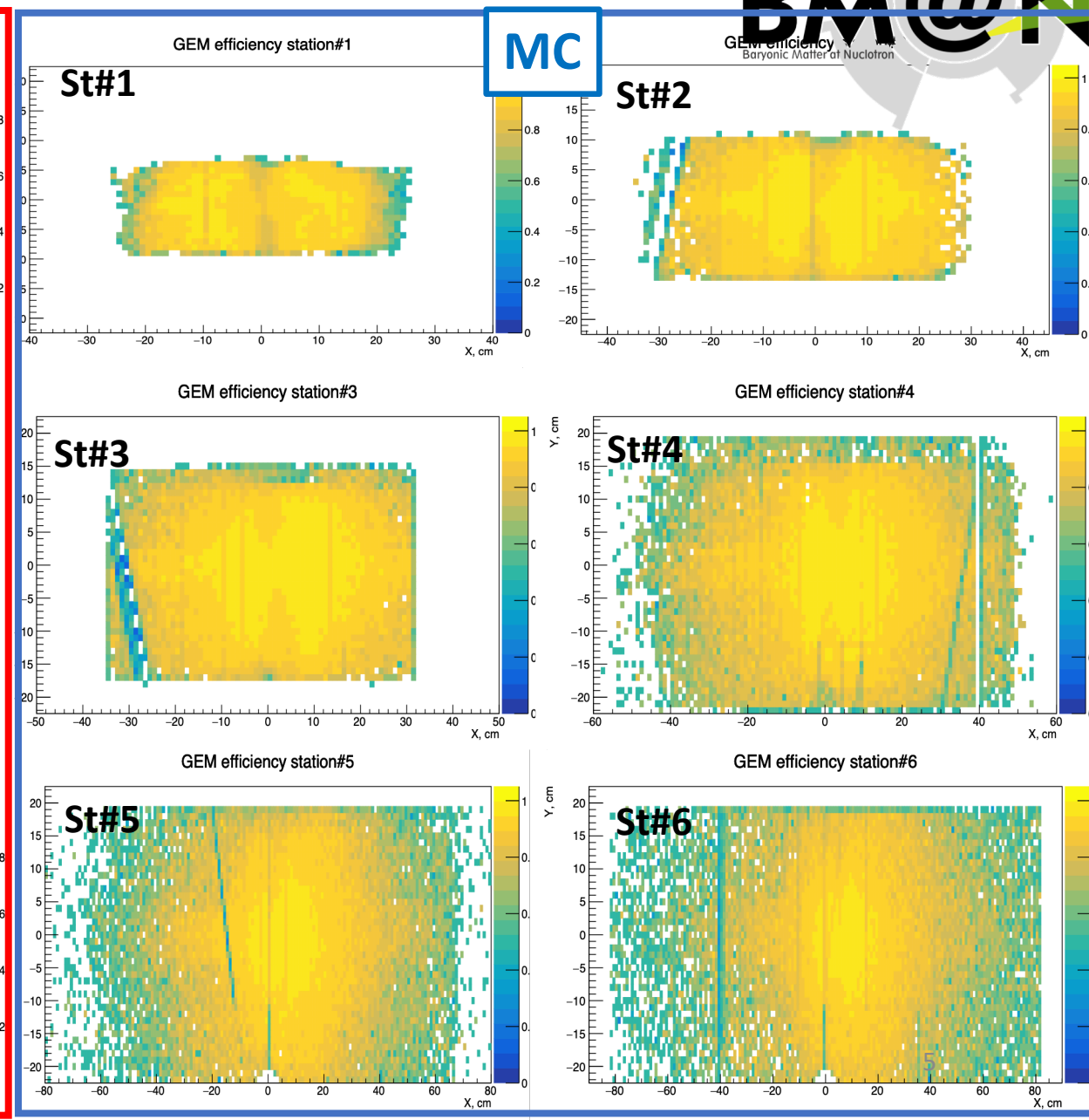
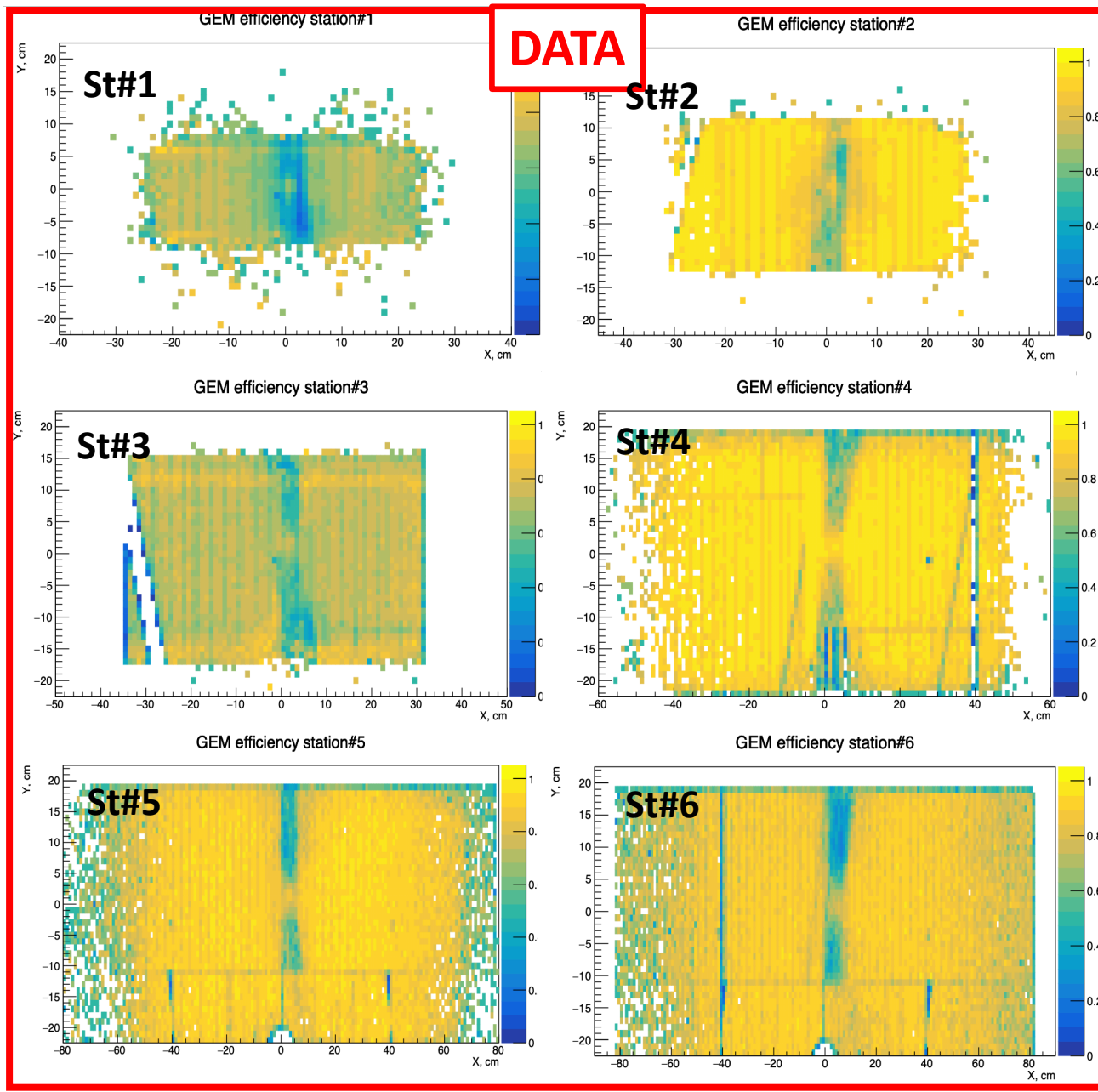
**Please contact me for
more detailed info**

- **Data reconstruction & analysis <= now we are here!!**
 - Apply detectors efficiencies to embedded events
 - Make control plots, calculate embedding efficiency, calculate cross-sections of the Λ^0 's & etc...

GEM efficiencies comparison (C+C, 4.0GeV)



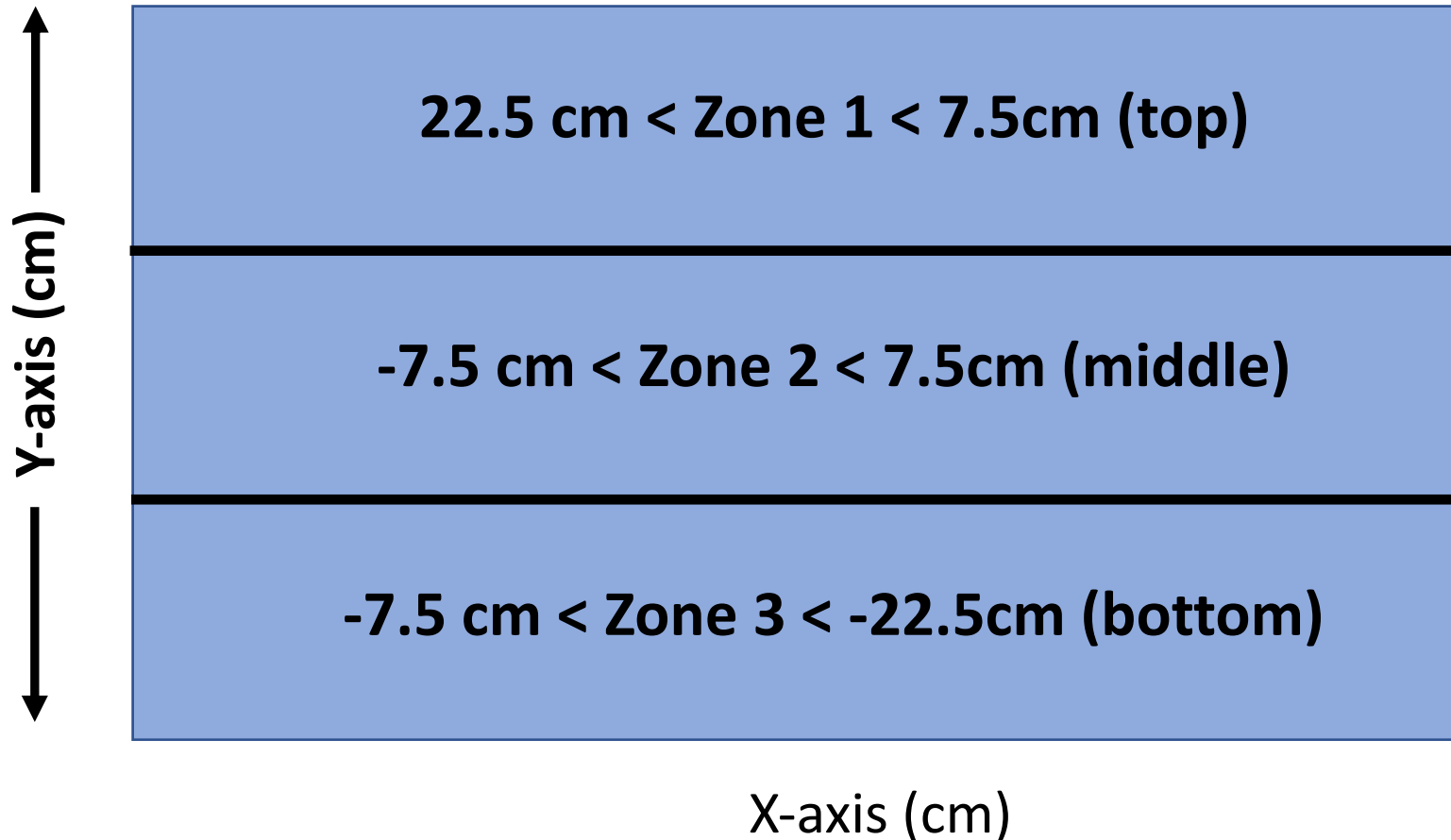
GEM efficiencies comparison (C+Cu, 4.5GeV)



Apply efficiencies (check)



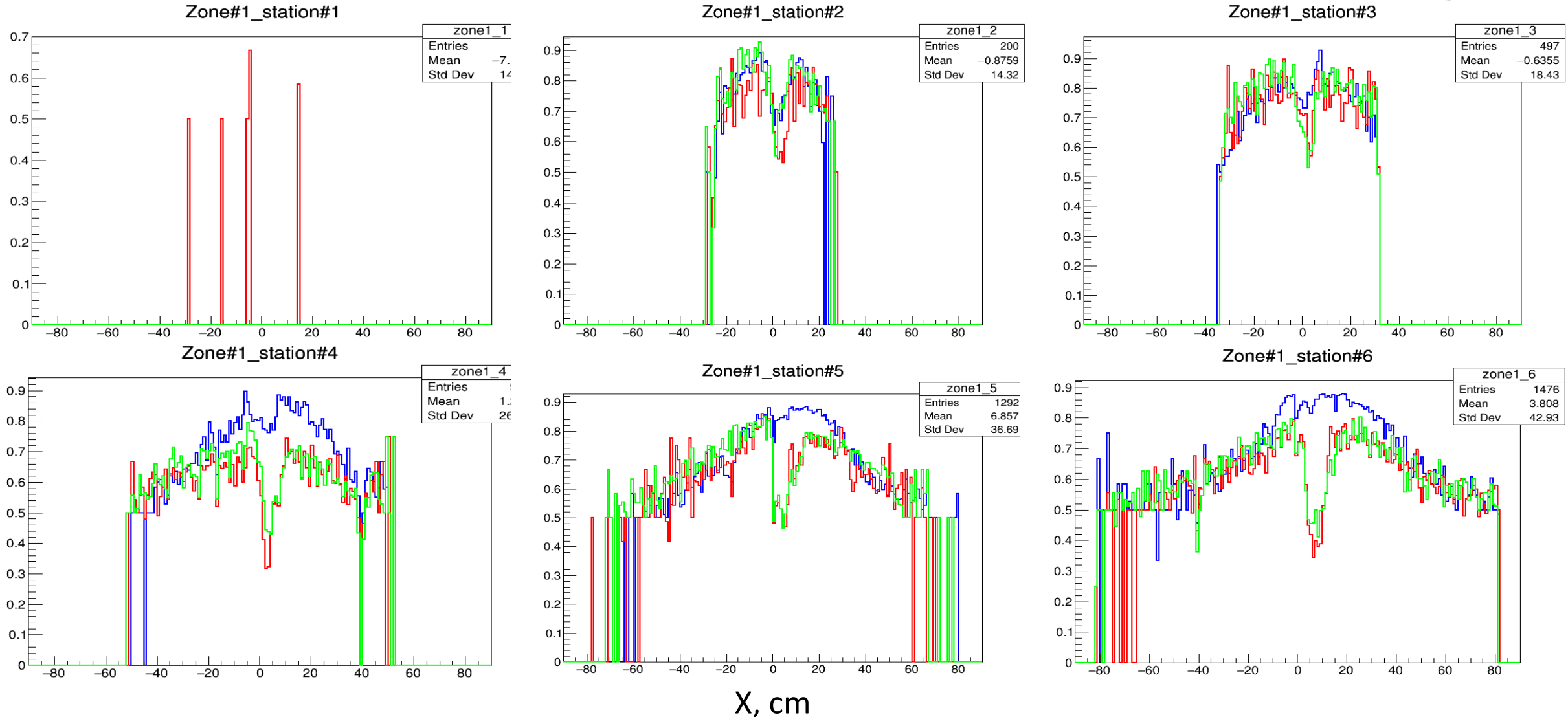
- Each GEM plane was divided into to 3 regions along Y-axis
 - Compare integral for efficiencies at each regions



Apply efficiencies (C+C, 4.0GeV, top)



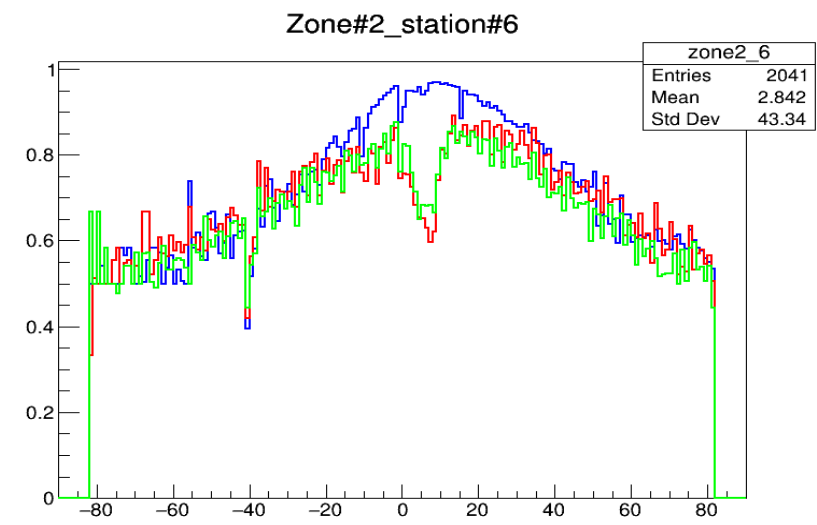
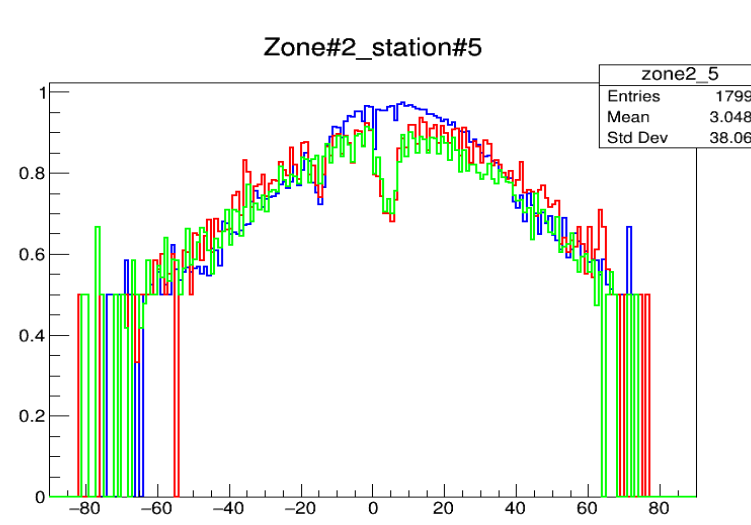
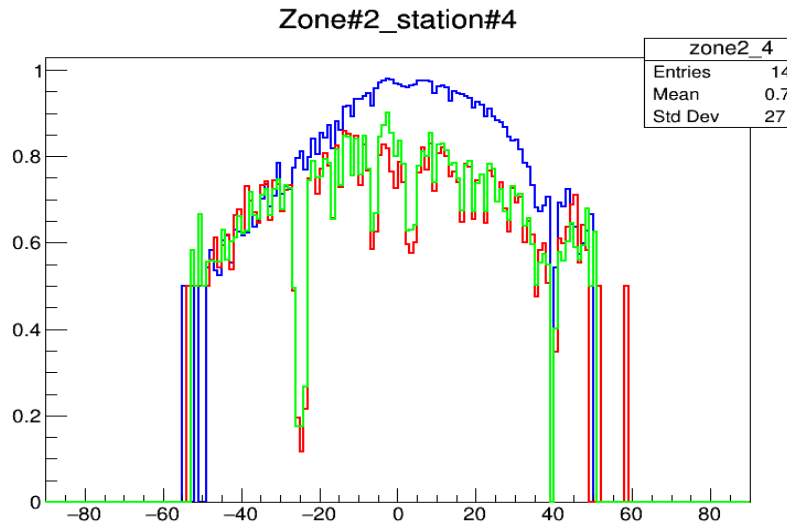
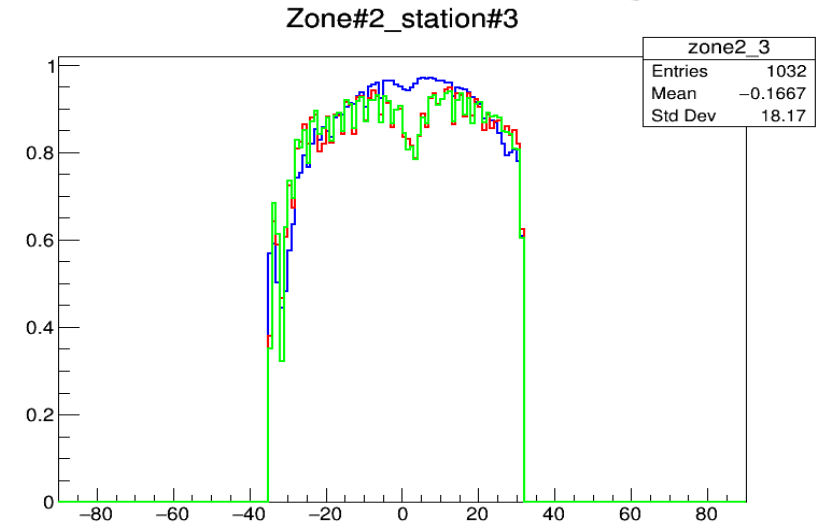
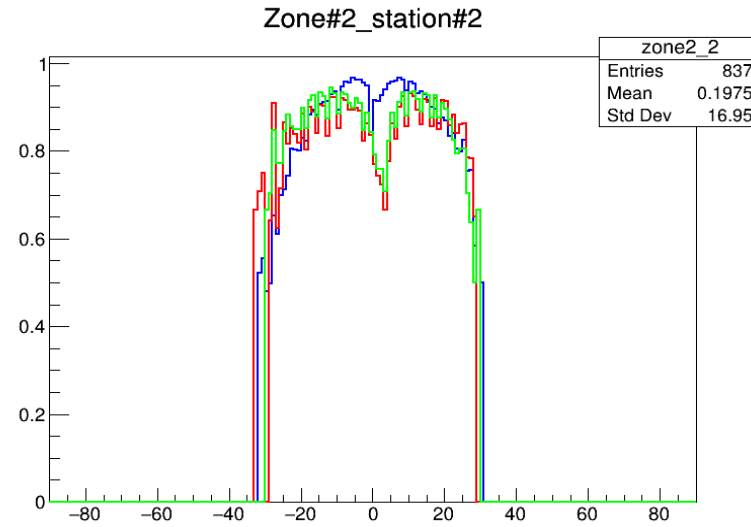
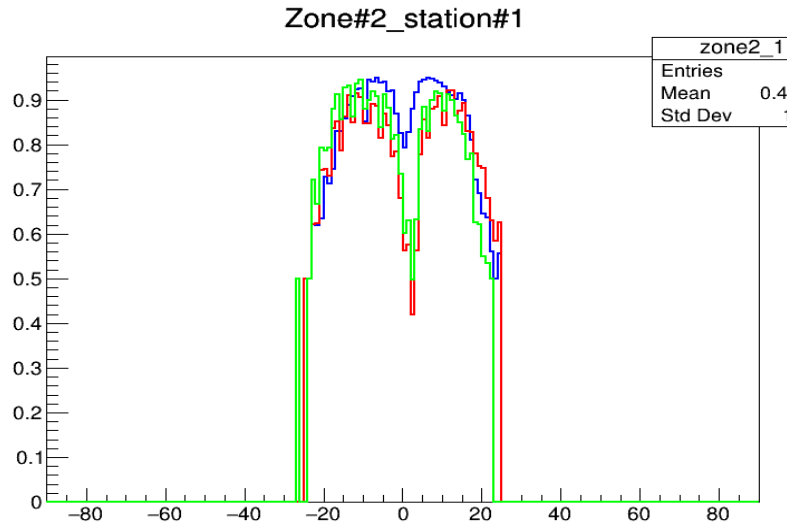
Red: Data; Blue: pure MC; Green: Data EMB (22.5 cm < Zone 1 < 7.5cm (top))



Apply efficiencies (C+C, 4.0GeV, middle)



Red: Data; Blue: pure MC; Green: Data EMB ($7.5 \text{ cm} < \text{Zone 2} < -7.5 \text{ cm}$ (middle))

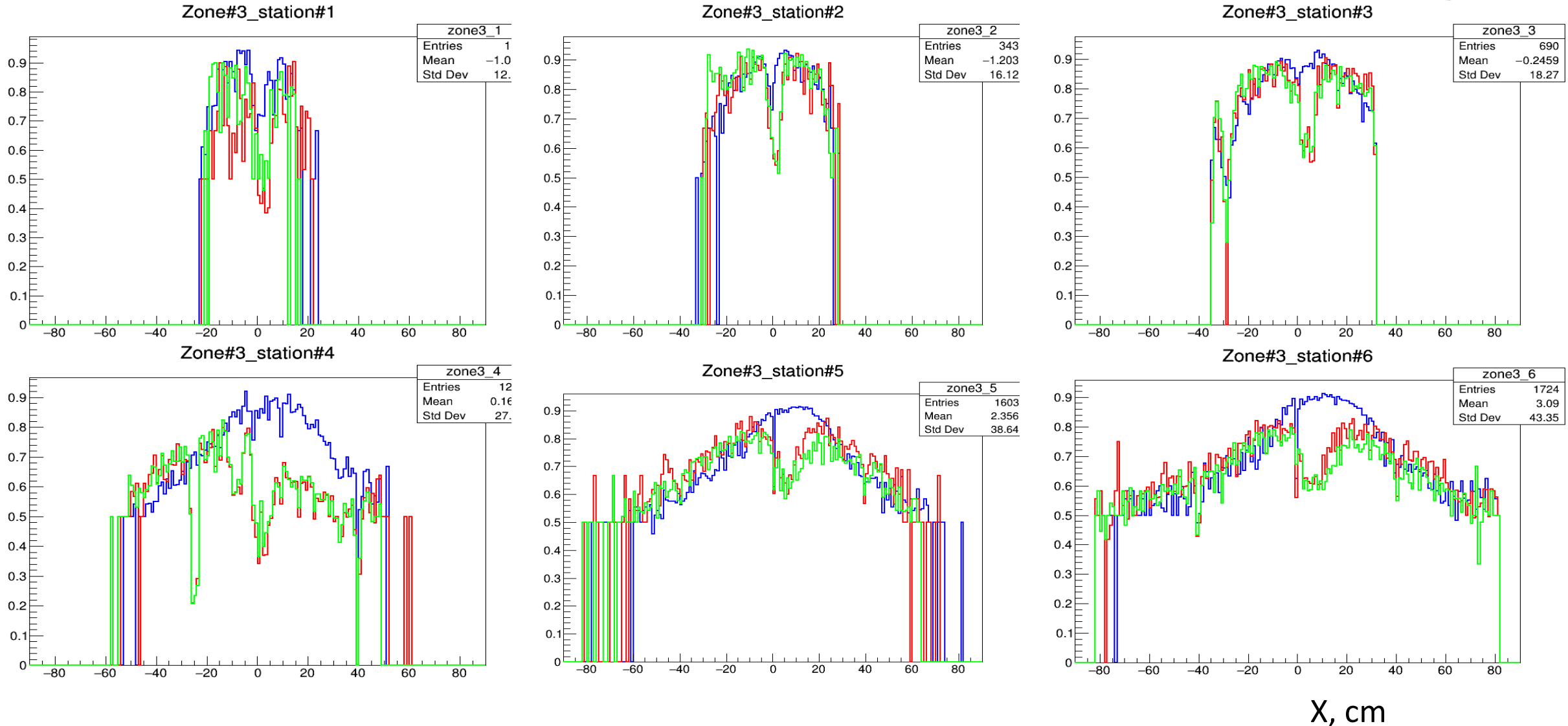


X, cm

Apply efficiencies (C+C, 4.0GeV, bottom)



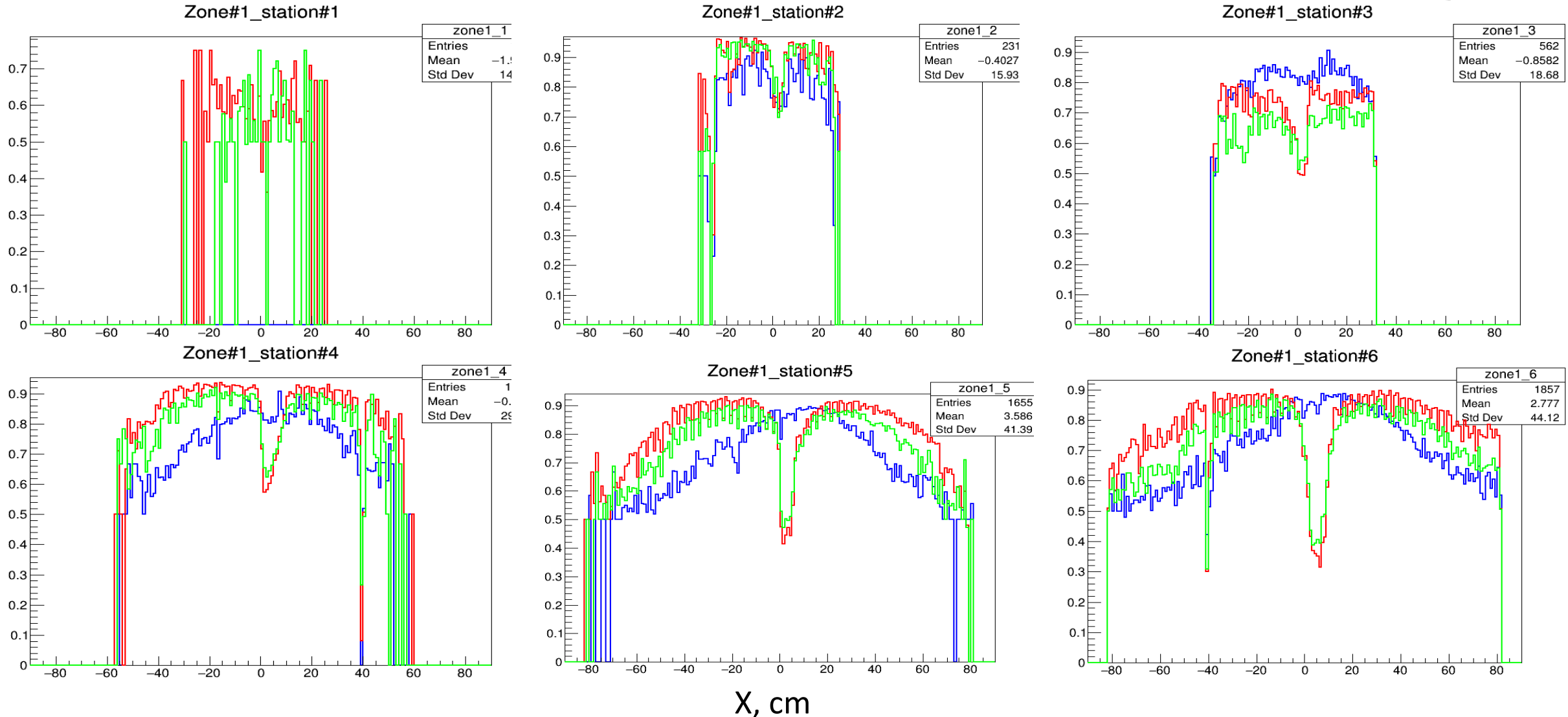
Red: Data; Blue: pure MC; Green: Data EMB (-7.5 cm < Zone 1 < -22.5cm (bottom))



Apply efficiencies (C+Cu, 4.5GeV, top)



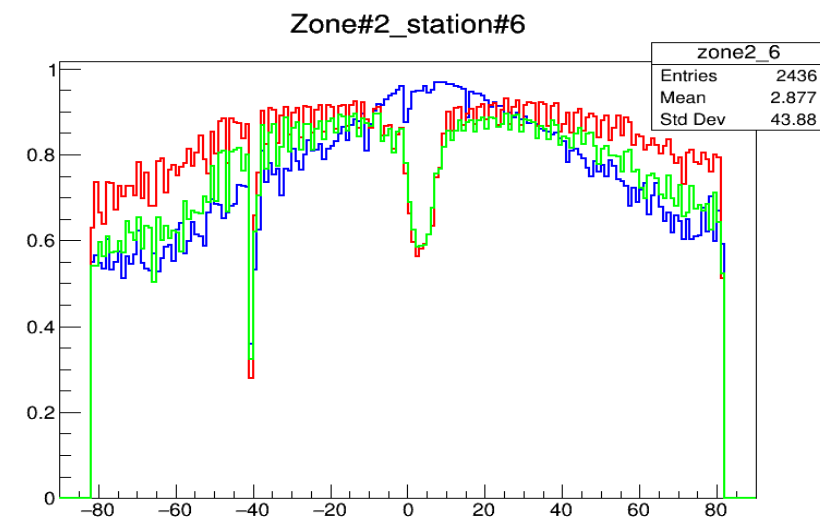
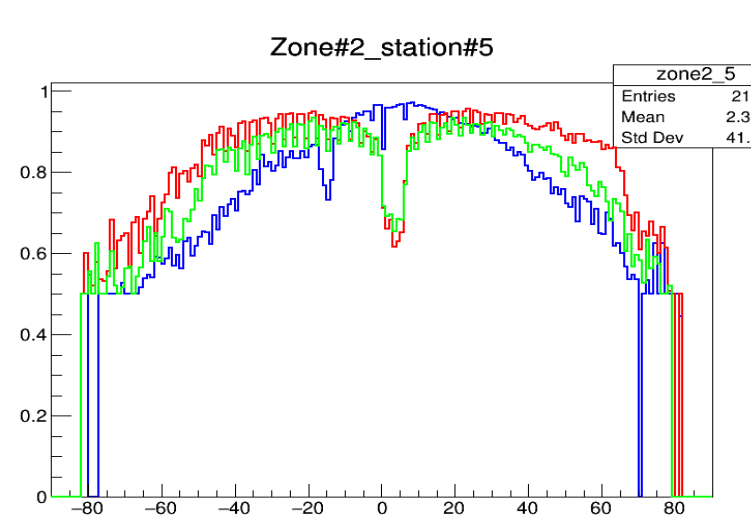
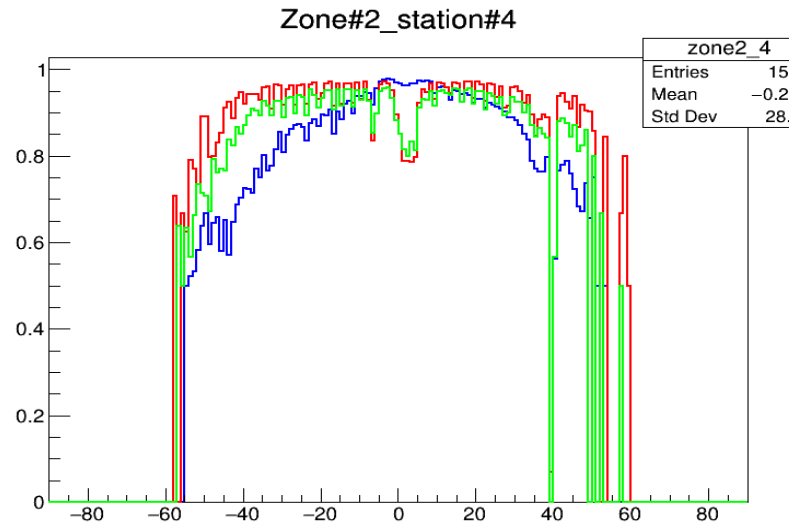
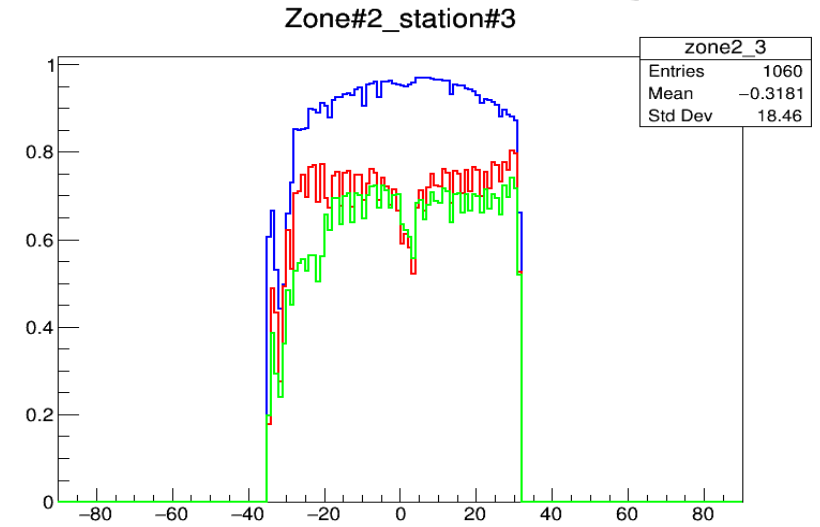
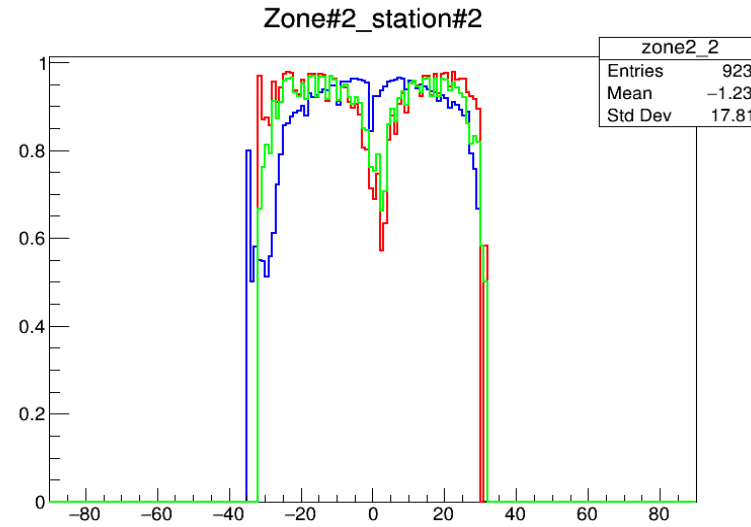
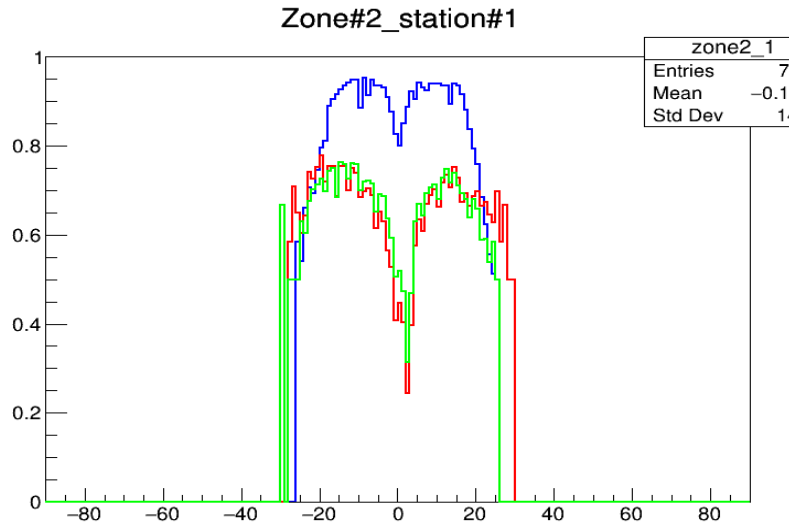
Red: Data; Blue: pure MC; Green: Data EMB (22.5 cm < Zone 1 < 7.5cm (top))



Apply efficiencies (C+Cu, 4.5GeV, middle)



Red: Data; Blue: pure MC; Green: Data EMB ($7.5 \text{ cm} < \text{Zone 2} < -7.5 \text{ cm}$ (middle))

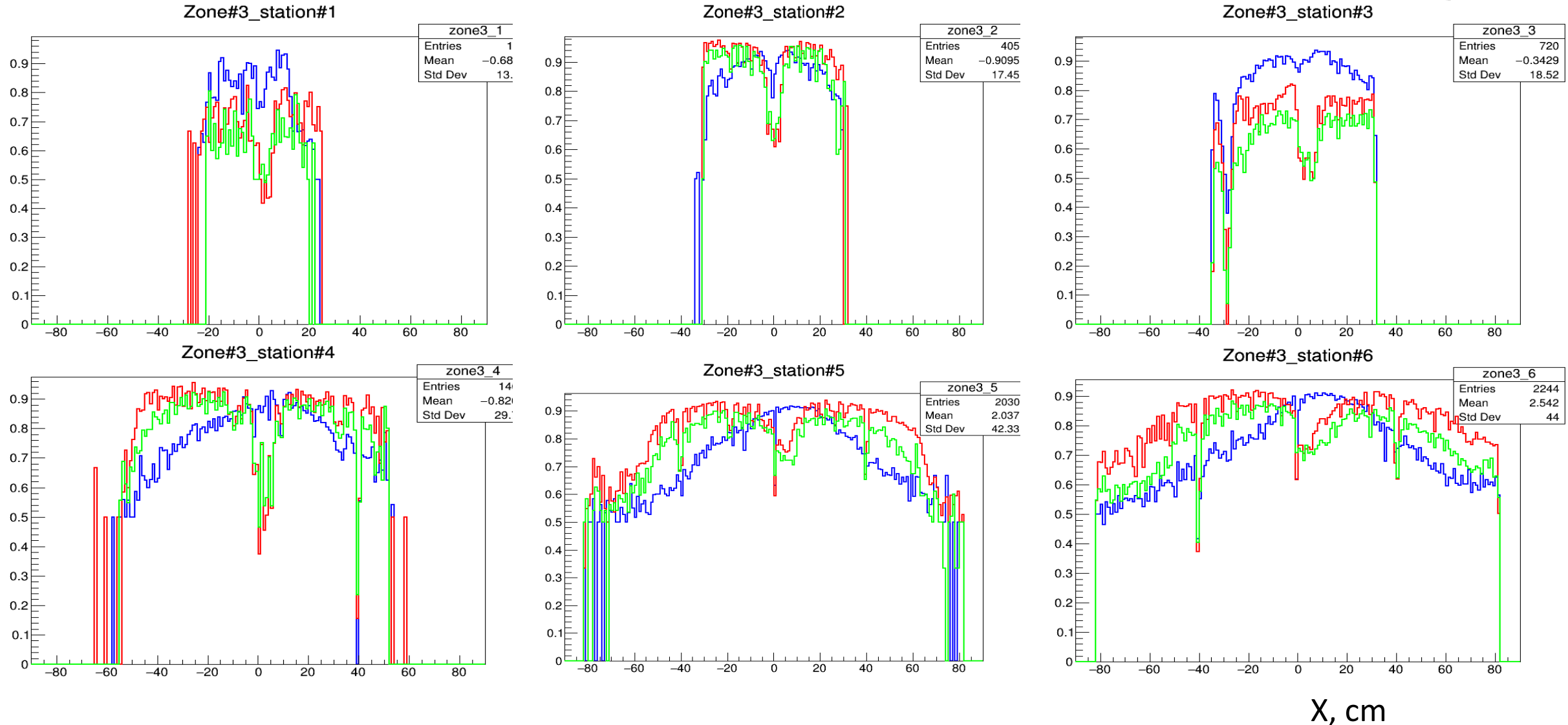


X, cm

Apply efficiencies (C+Cu, 4.5GeV, bottom)

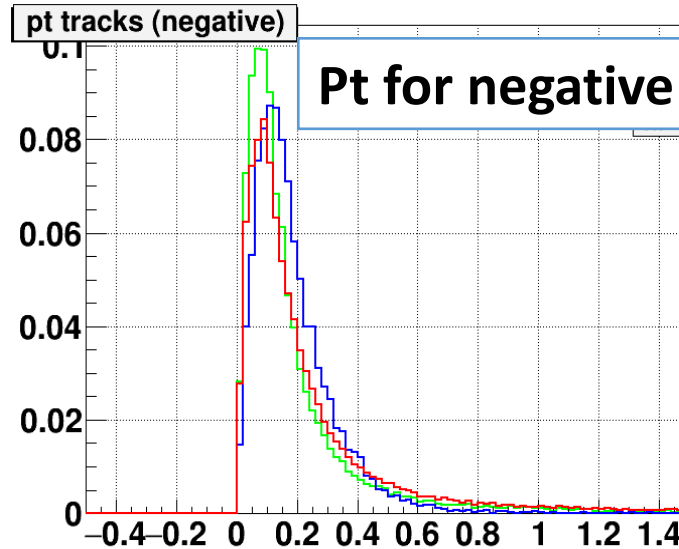
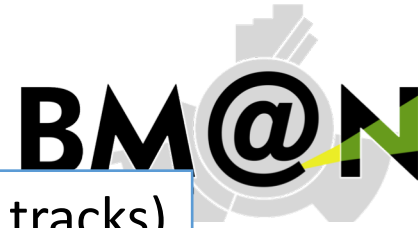


Red: Data; Blue: pure MC; Green: Data EMB (-7.5 cm < Zone 1 < -22.5cm (bottom))

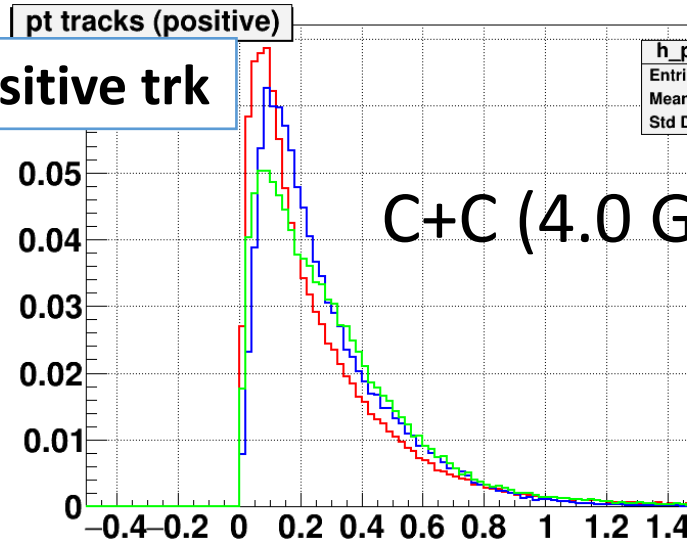


Control plots (Pt for negative & positive trk)

Red: Data; Blue: pure MC; Green: Data EMB



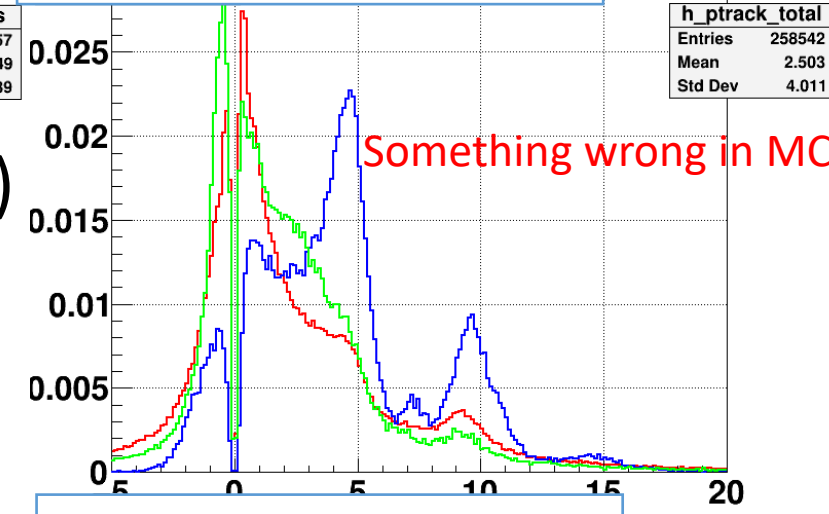
Pt for negative & positive trk



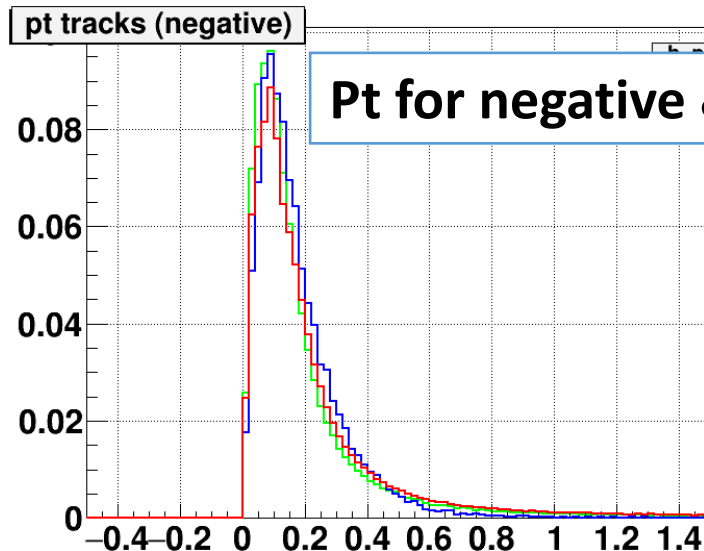
C+Cu (4.0 GeV)

h_pttrack_pos	
Entries	17975
Mean	0.254
Std Dev	0.23

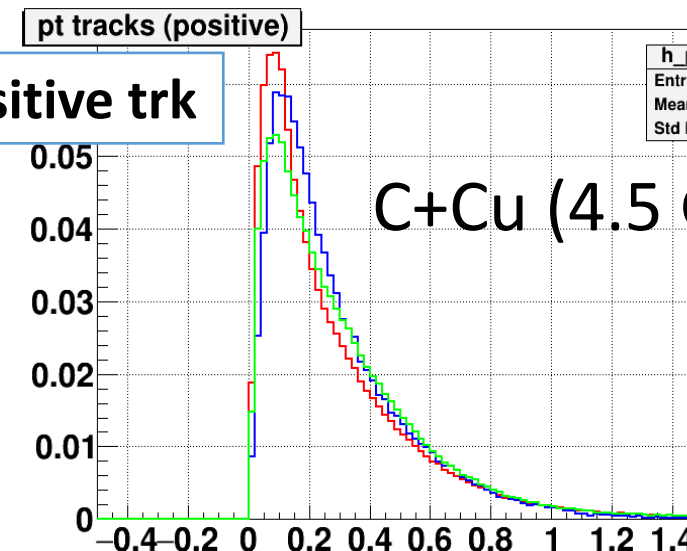
Momentum (all tracks)



h_pttrack_total	
Entries	258542
Mean	2.503
Std Dev	4.011



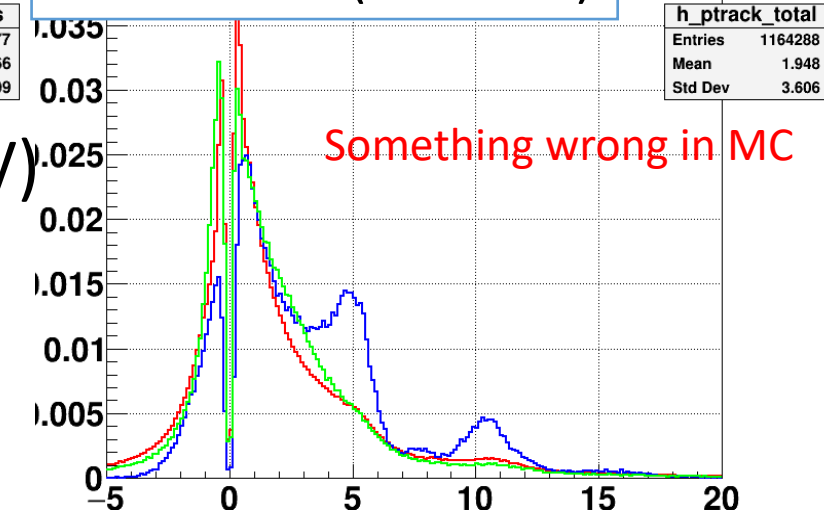
Pt for negative & positive trk



C+Cu (4.5 GeV)

h_pttrack_pos	
Entries	797677
Mean	0.2766
Std Dev	0.2499

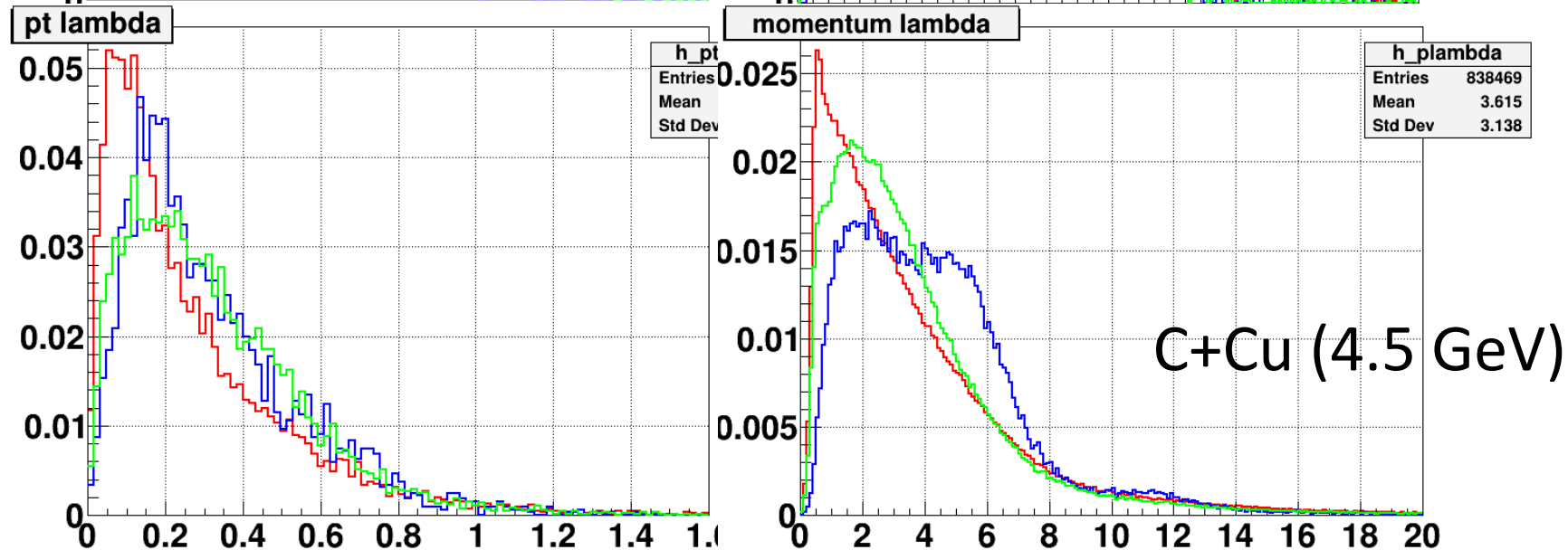
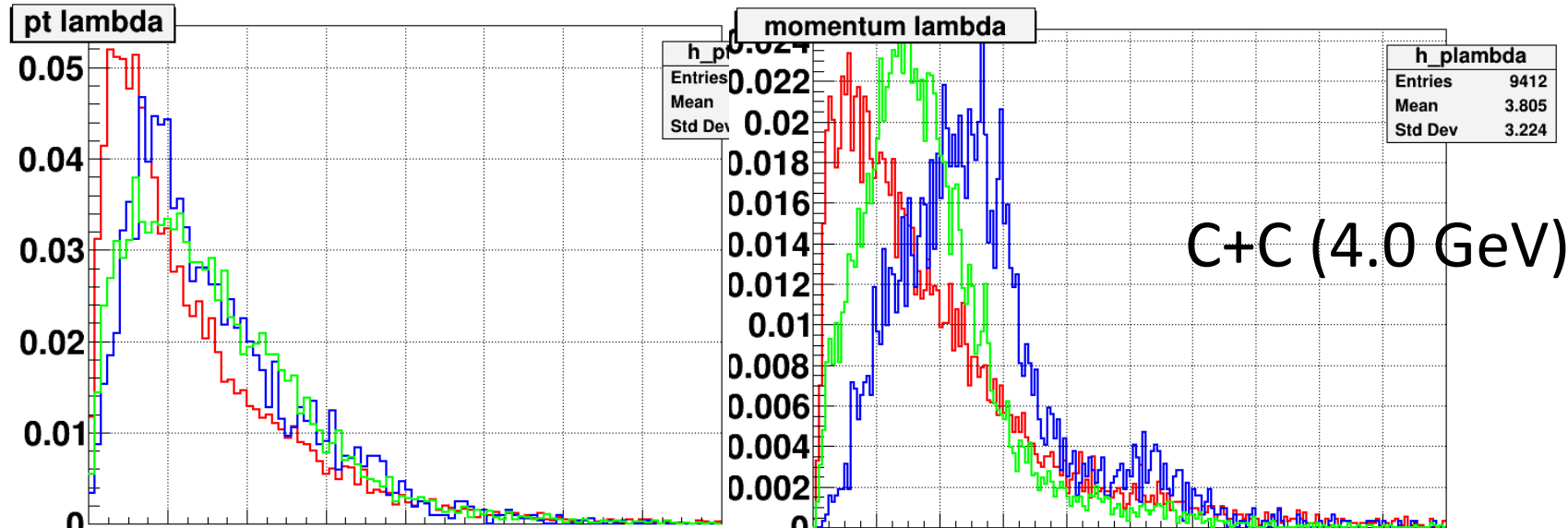
Momentum (all tracks)



h_pttrack_total	
Entries	1164288
Mean	1.948
Std Dev	3.606

Control plots (Pt & full momentum of Lambda)

Red: Data; Blue: pure MC; Green: Data EMB



Something wrong in
MC simulation
need to check the MC
generation!!

Next steps...

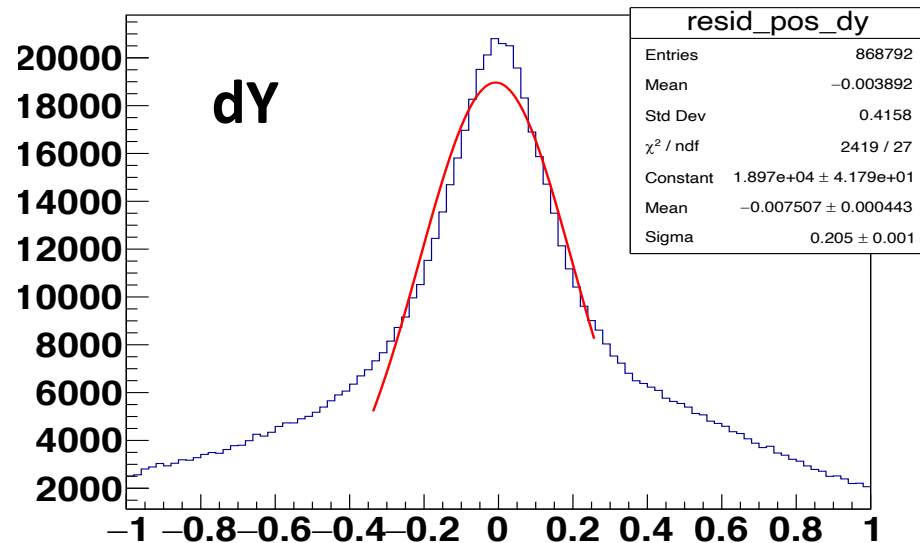
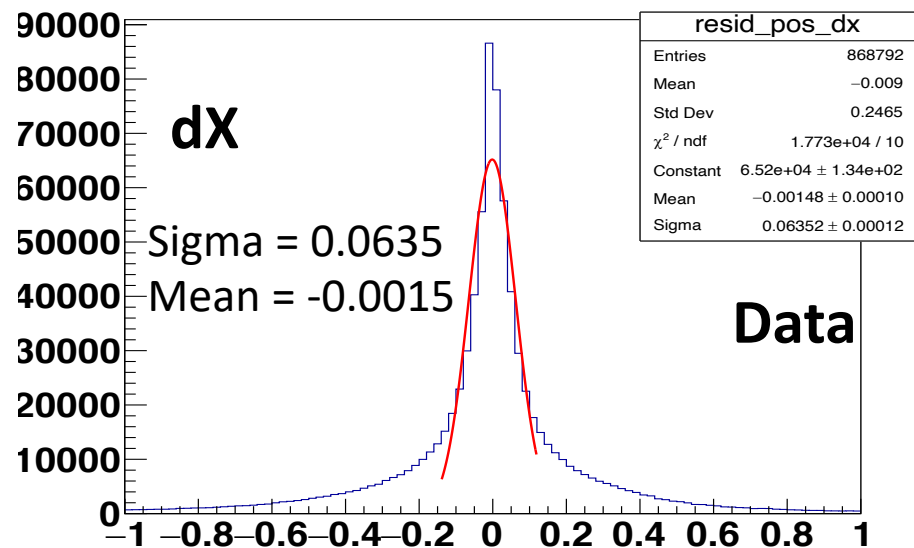


- Try to understand where is mistake in analysis !?
 - Compare MC simulation engines:
 - **Geant3** (used in previous analysis)
 - **Geant4** used for MC generation in current analysis
 - Need to check each step of the MC events generation for embedding
 - Control residuals for “right” geometry (<=in progress now)
 - Compare control distributions MC/Data/Data+Emb for pt/momentum/etc.
- Calculate embedding efficiency
- Measure cross-sections of the Λ^0 's hyperon

Thank you for your attention!

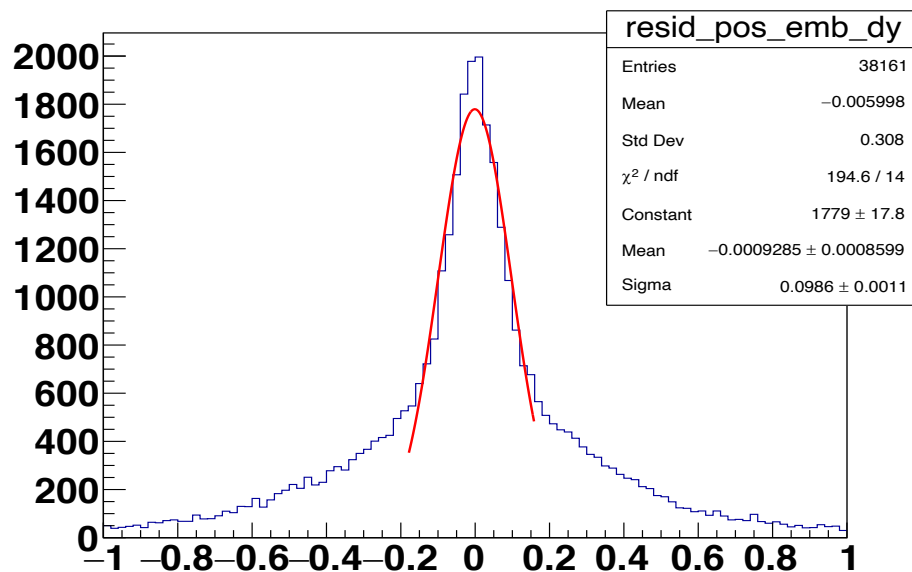
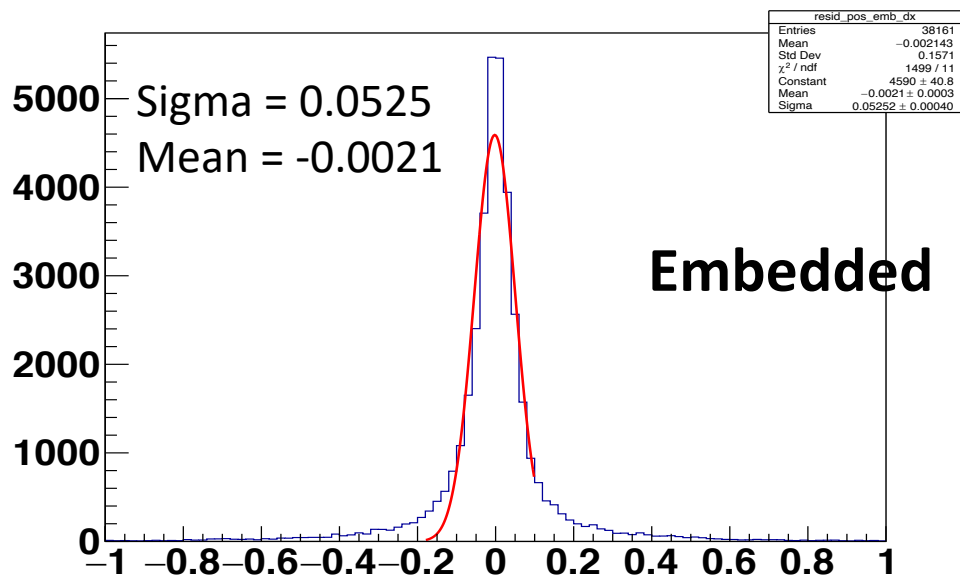


Residuals all positive tracks (preliminary)

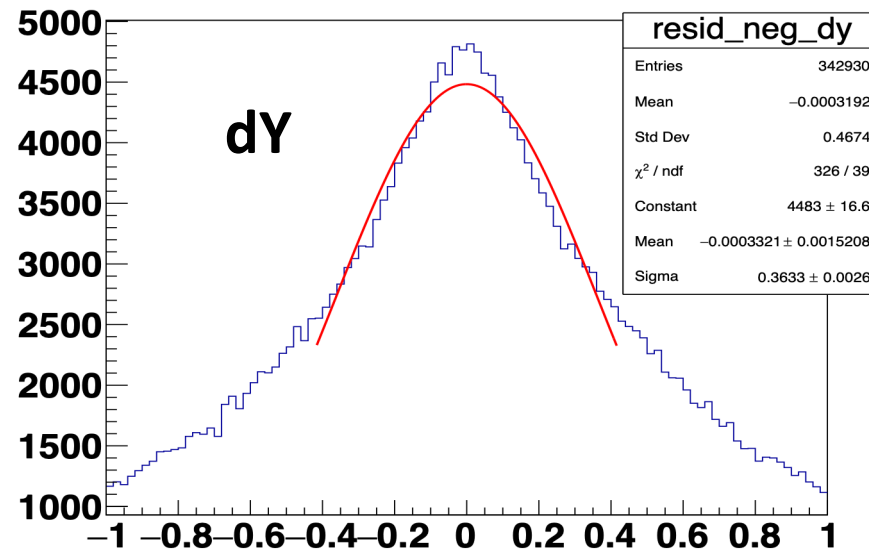
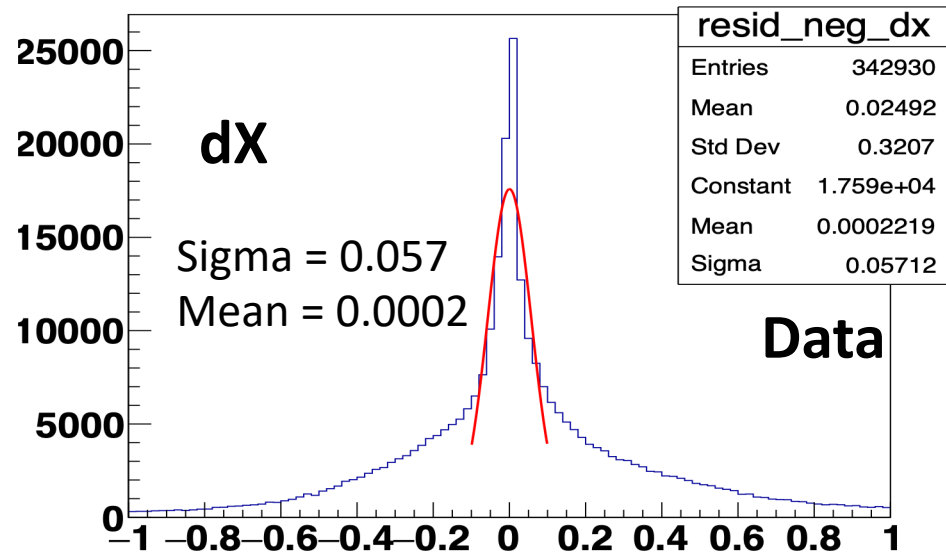


Sigma = 0.205
Mean = -0.007

C+C (4.0 GeV)

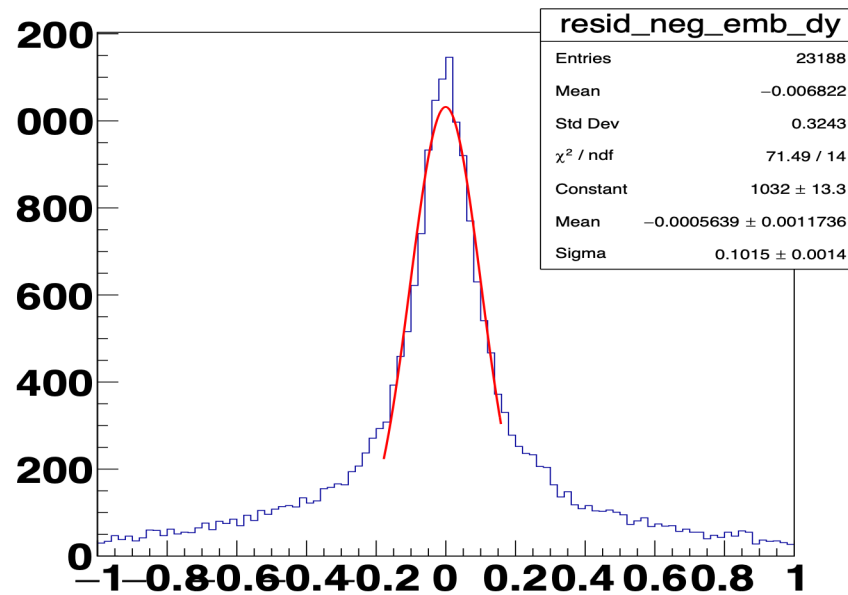
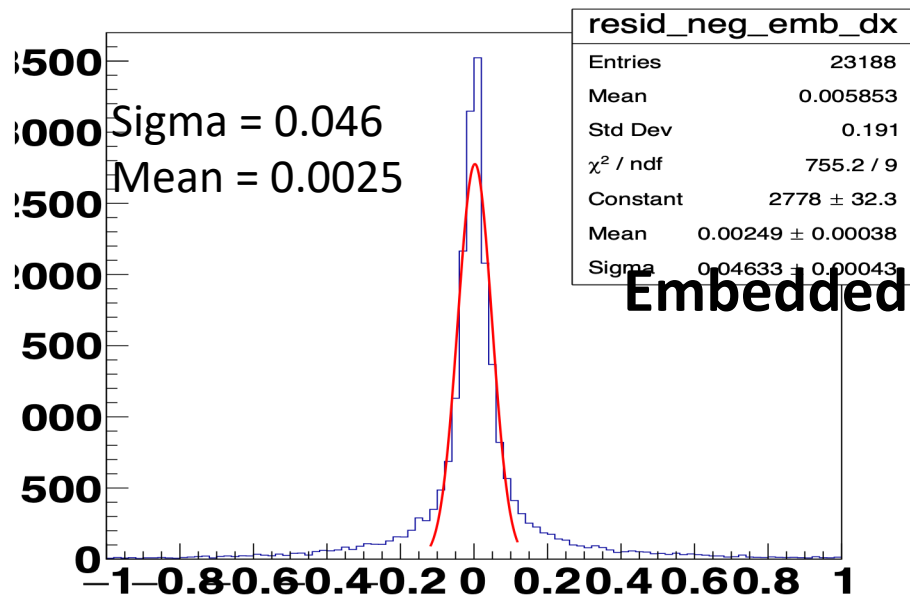


Residuals all negative tracks (preliminary)



Sigma = 0.3633
Mean = -0.0003

C+C (4.0 GeV)



Sigma = 0.1015
Mean = -0.0006