

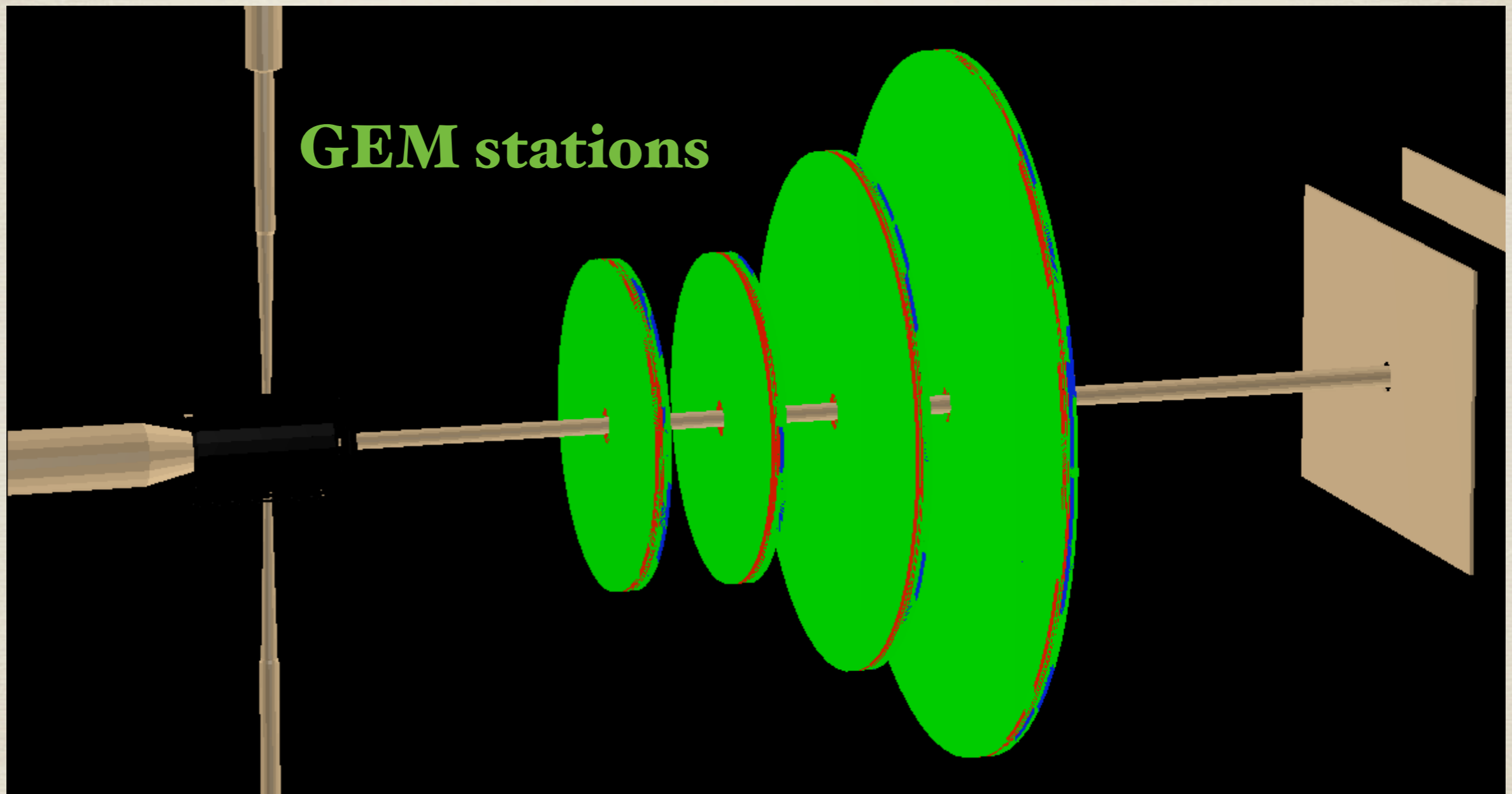
# GEM DETECTORS TRACKING

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# GEM layout

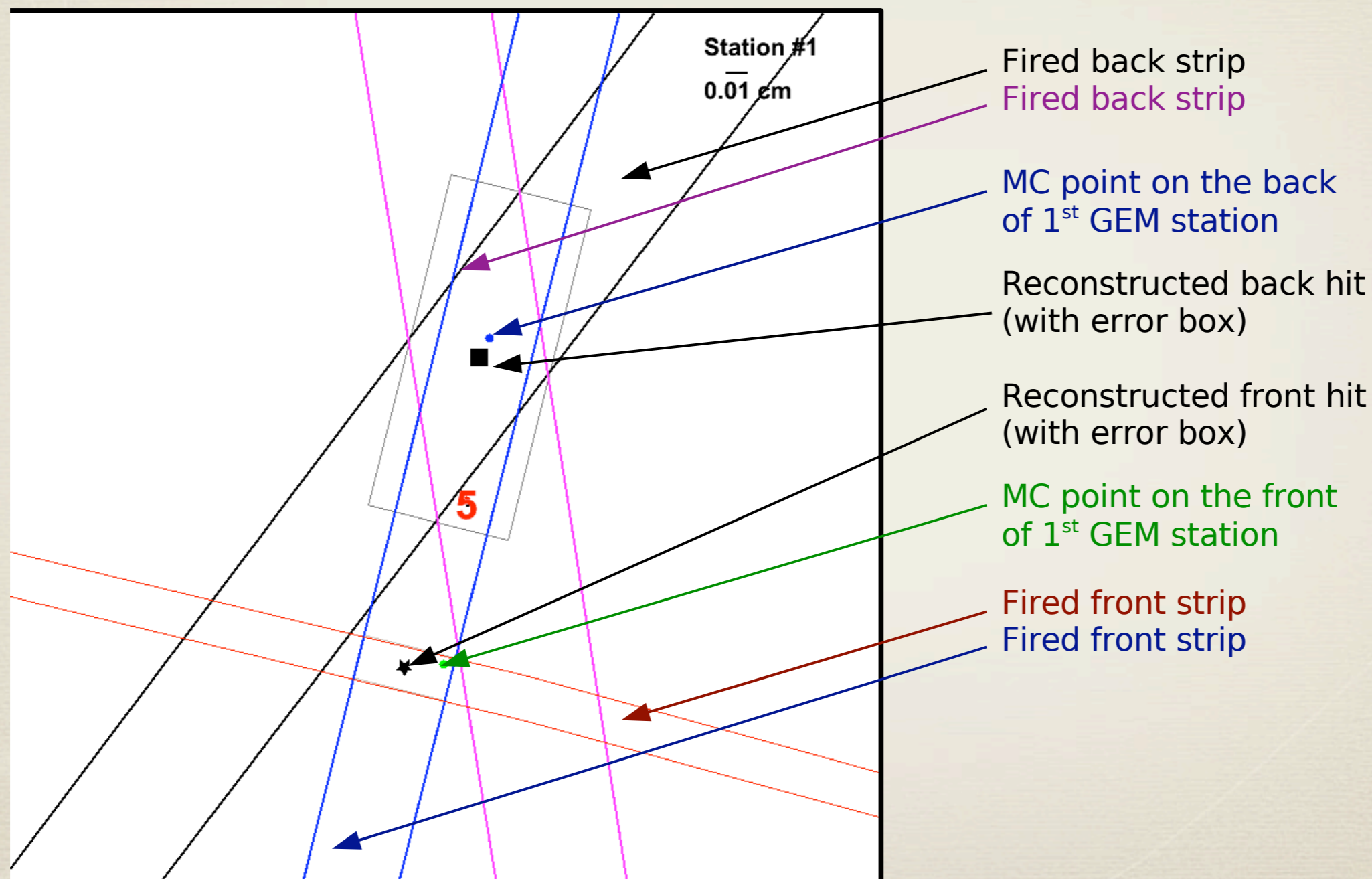
- \* 4 stations positioned at 90, 120, 150, 180 cm from the target
- \* VMC geometry mimics the geometry provided by Bernd Voss
- \* 3 sensitive layers per station

# GEM layout cont'd



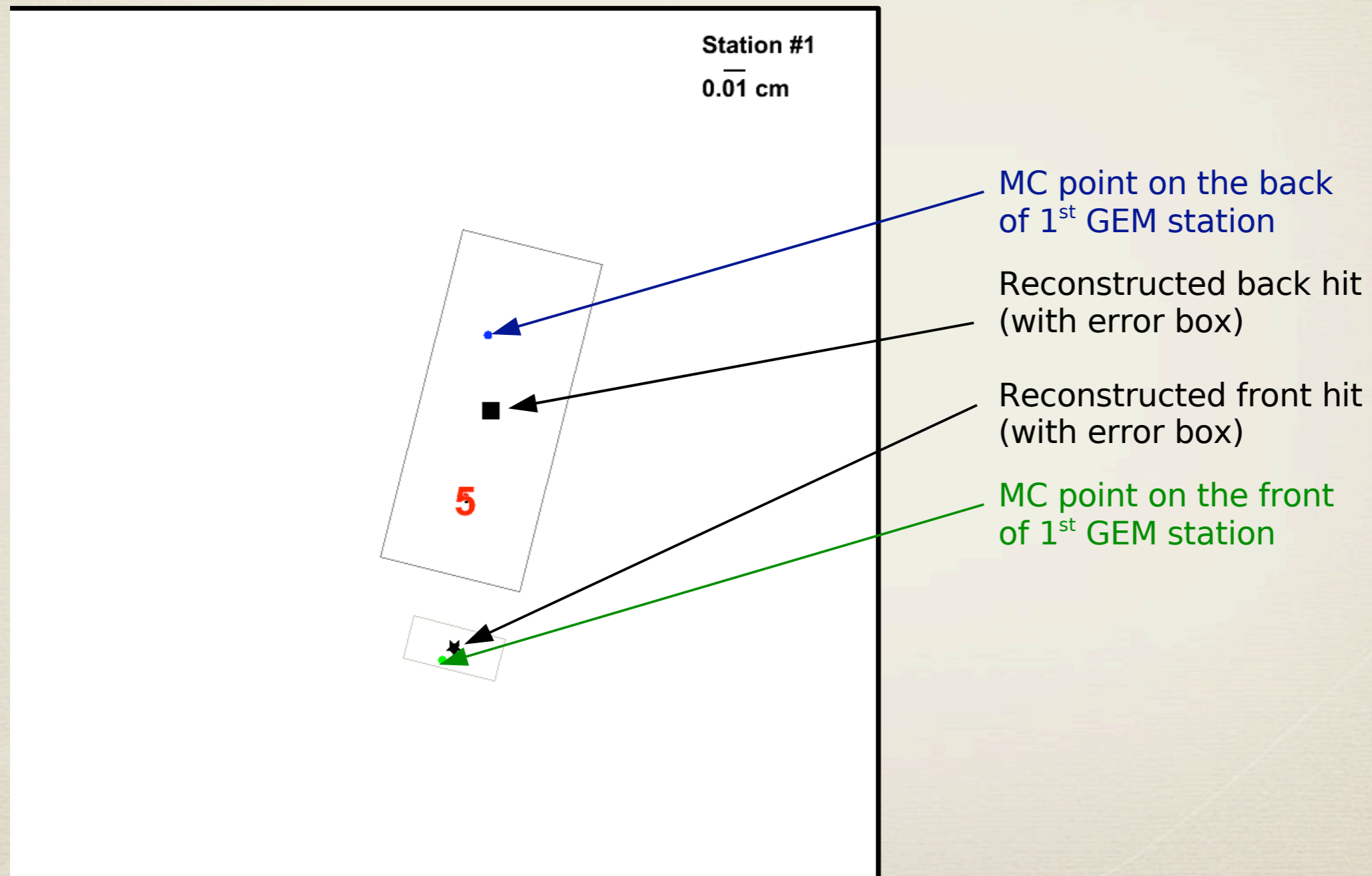
# Hit finding

Digitizer + hit finder for comparison



# Hit finding cont'd

Ideal hit producer performance



# Tracking chain

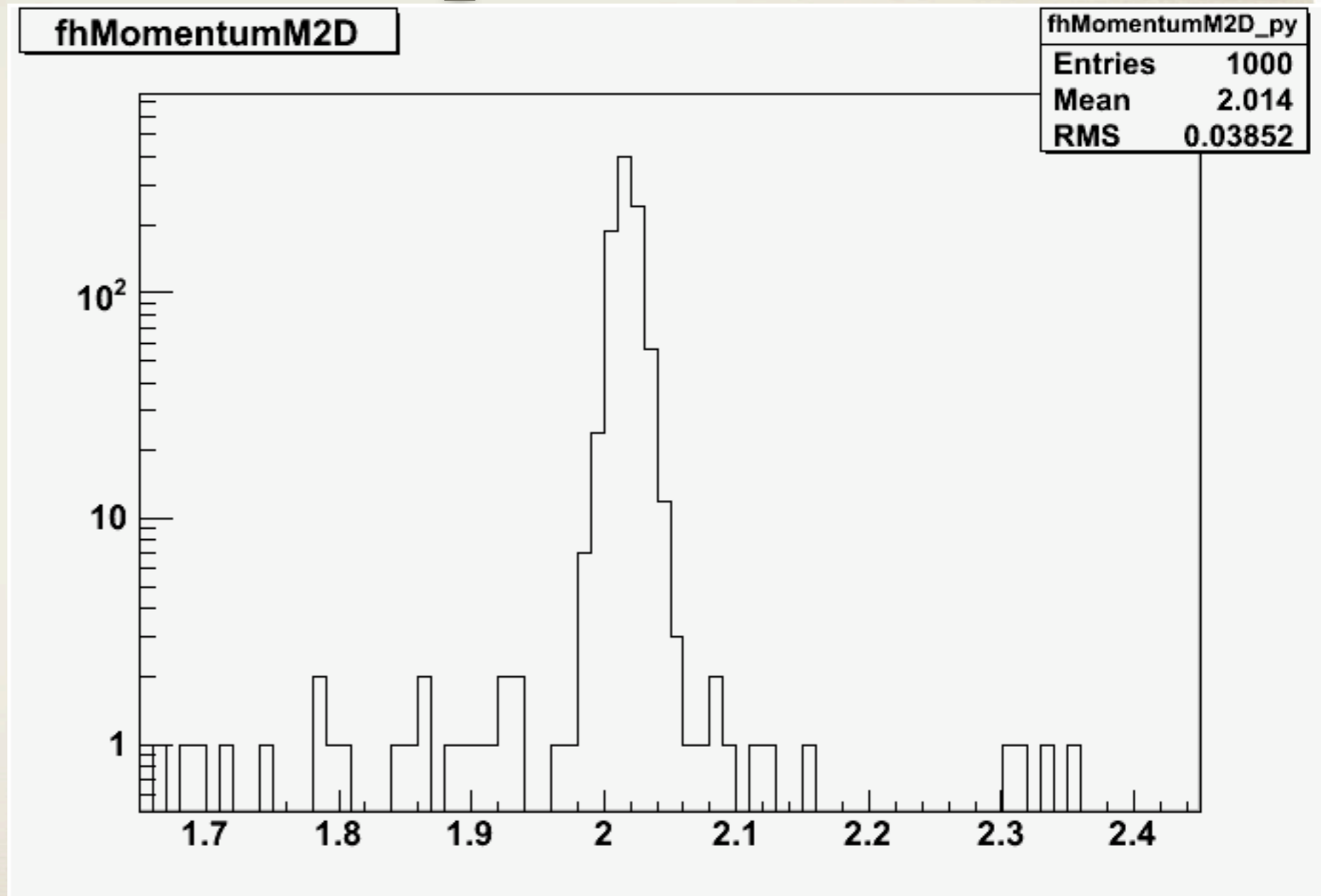
- \* MC simulations with 4 GEM stations
- \* Ideal hit producer with realistic hit smearing and hit errors, one to one correspondence between MC points and hits
- \* Ideal track finder, combining hits belonging to one track into a track
- \* *genfit* track fitter with *GEANE* track representation

# Simulations

- \* 1000 pions, one pion per event
- \* momenta: 0.5, 1.0, 2.0, 4.0, 8.0
- \* different  $\phi$  and  $\vartheta$  bins
- \* track start parameters for the *genfit*:  
MC truth parameters at the target, except of momentum, which is set to  $MCtruth + 0.05 \text{ GeV}/c$

# Reconstruction results - example

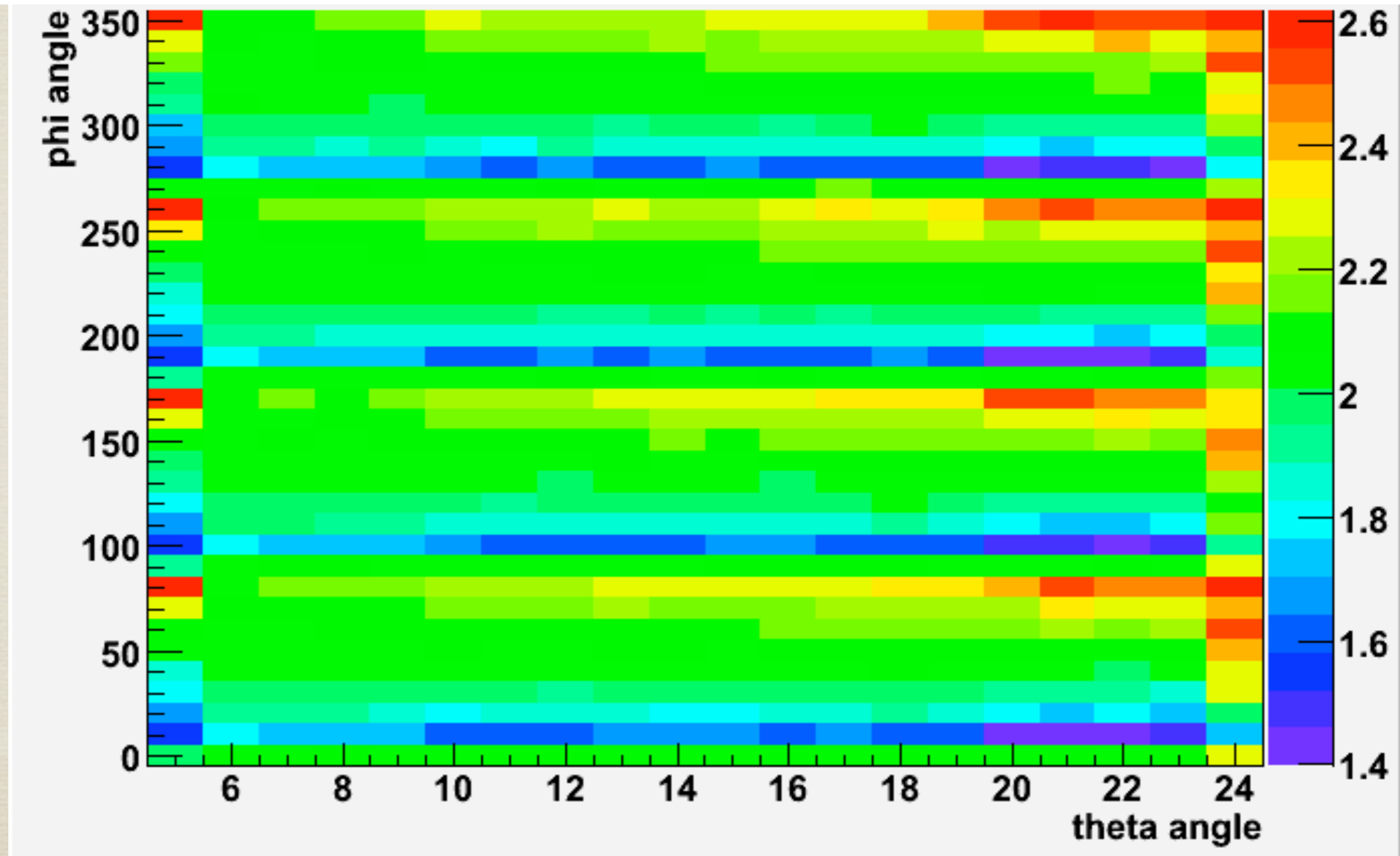
- \* reconstructed momenta for 2 GeV/c pions shot at  $\theta = 0^\circ$  and  $\vartheta = 10^\circ$
- \* initial *genfit* momenta set to 2.05 GeV/c





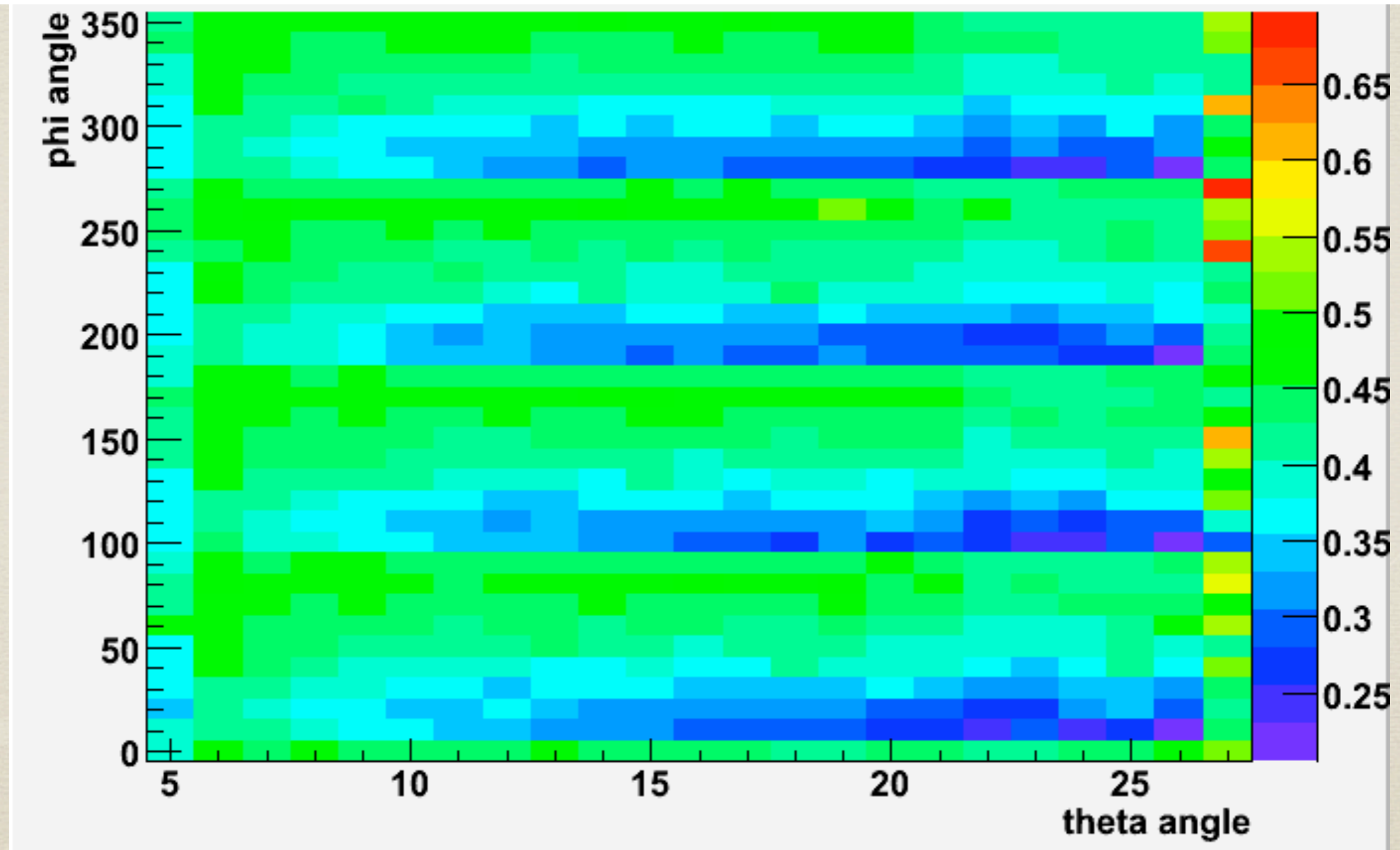
# Reconstruction results

Reconstructed momenta for pions with MC momenta = 2 GeV/c



# Reconstruction results

Reconstructed momenta for pions with MC momenta = 0.5 GeV/c

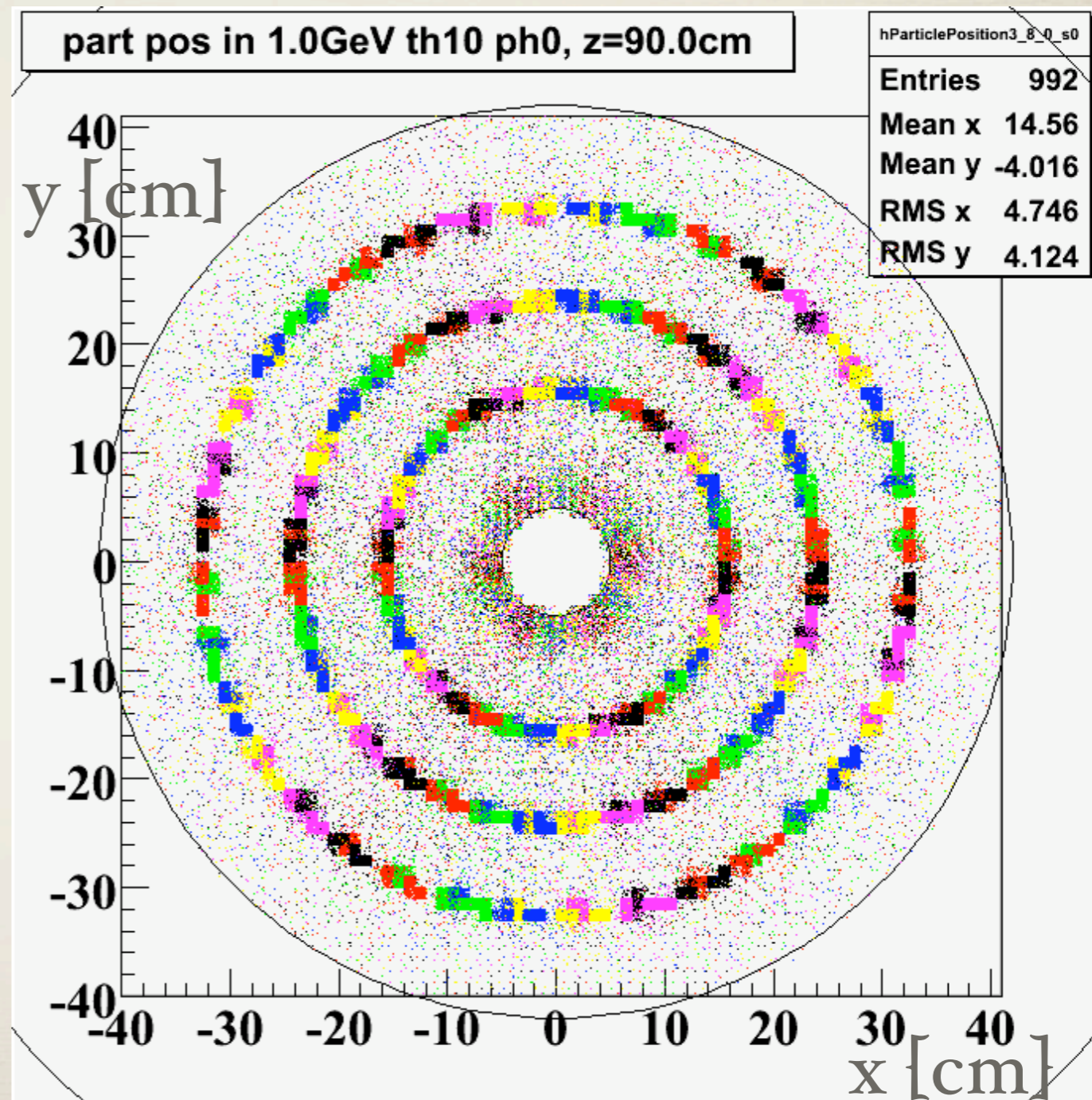


# Track finding

- \* Simplest track finding ever:
  - look for primary tracks with momenta larger than 0.5 GeV/c
  - hit on the first station: defines the track  $\vartheta$  emittance angle
  - search for hits on the second station: the difference in phi between the two hit angles defines momentum and  $\phi$

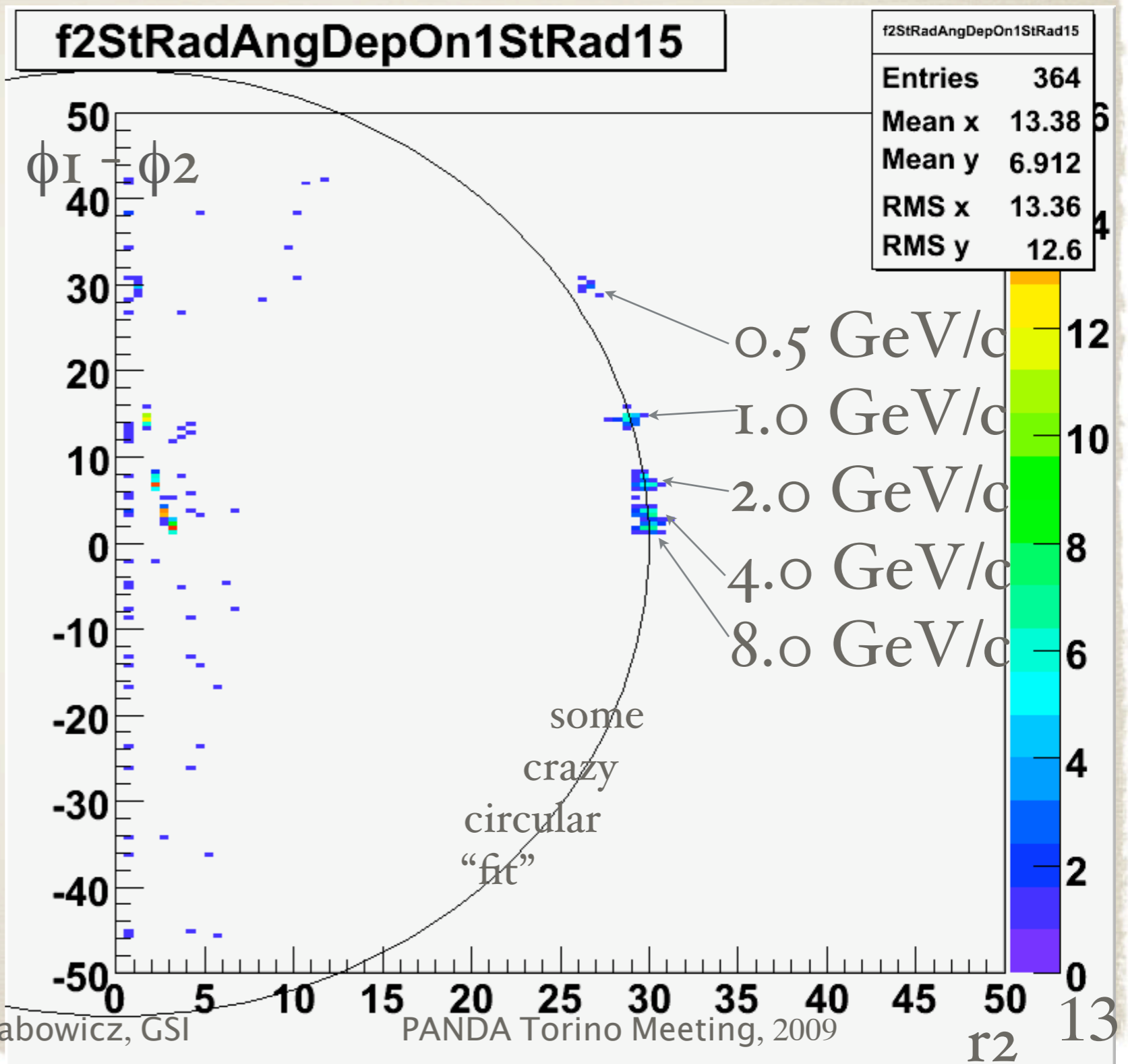
# Hits on first station

- \* 1.0 ÷ 8.0 GeV/c pions  
at all  $\phi$   
and three different  $\vartheta$ :  
 $10^\circ$ ,  $15^\circ$ ,  $20^\circ$



# Hits on second station

- \* dependence of  $\phi$  angle difference vs radius on 2nd station for pions emitted at all  $\phi$  angles hitting 1st station with radius of 15cm



# Track finding results

- \* This is the work of the last one week except of the simulations and thinking efforts
- \* Most of the “fits” have been done by guesstimation, without MINUIT or any other fitting package, only by eye
- \* The results are thus highly preliminary

# Track finding results

\* 1.0 GeV/c pions emitted at  $\phi = 5^\circ$  and  $\vartheta = 15^\circ$

\* one pion per event, 1000 events

\* -----

ALTOGETHER: 1006 tracks:

976 good tracks

30 ghost tracks

0 clone tracks

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# Last few events (no picking)

\* mc: 1 5 15  
reco: 1.02516 4.3603 15.5512

mc: 1 5 15  
reco: 0.995476 4.96915 15.6027

mc: 1 5 15  
reco: 0.986273 5.1101 15.5696

mc: 1 5 15  
reco: 1.00549 4.37362 15.6056

mc: 1 5 15  
reco: 1.00396 4.86113 15.521

mc: 1 5 15  
reco: 0.992548 5.40485 15.6313

mc: 1 5 15  
reco: 0.993335 5.17147 15.5859



# Track finding results

\* 0.5÷6 GeV/c pions emitted at  $\phi \in (0^\circ, 360^\circ)$  and  $\vartheta \in (6^\circ, 16^\circ)$

\* three pions per event, 1000 events

\* -----

ALTOGETHER: 3220 tracks:

2928 good tracks

292 ghost tracks

0 clone tracks

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# Last three events (no picking)

\* mc: 3.69192 156.446 8.3988  
reco: -3.7745 156.526 8.64179  
mc: 4.84186 30.2233 13.7345  
reco: -4.89138 30.2503 14.3671  
mc: 4.00802 172.143 12.6453  
reco: -4.0901 172.13 13.1523

\* mc: 3.71124 170.12 10.1767  
reco: -3.78853 169.982 10.5191  
mc: 1.39809 35.1536 13.156  
reco: -1.45601 35.6859 13.7022  
mc: 5.65133 179.888 9.13893  
reco: -5.76412 179.874 9.42744

\* mc: 3.8004 -10.9546 13.5604  
reco: -3.82452 349.059 14.1592  
mc: 1.43321 -106.687 10.1362  
reco: -1.45531 253.233 10.4191  
mc: 5.29449 22.5063 7.82388  
reco: -5.38758 22.4389 8.03956

# GEM + DCH

- \* Ola Wronska and me started to write the fitter for the ideal track finder and ideal track merger
- \* The results are however not good enough to be shown
- \* However expect results soon

# Summary

- \* Track fitter *genfit* for GEMs “works”, but the results not satisfactory
- \* Track finding for GEMs “working”, but more work (inclusion of the second half of the detector!!!, usage of normal hit finder) and tests essential
- \* Track fitting for DCH and GEM under construction;)
- \* Expect changes in the GEM geometry according to recent findings by Bernd Voss *et al.*

\* Thank you for your attention