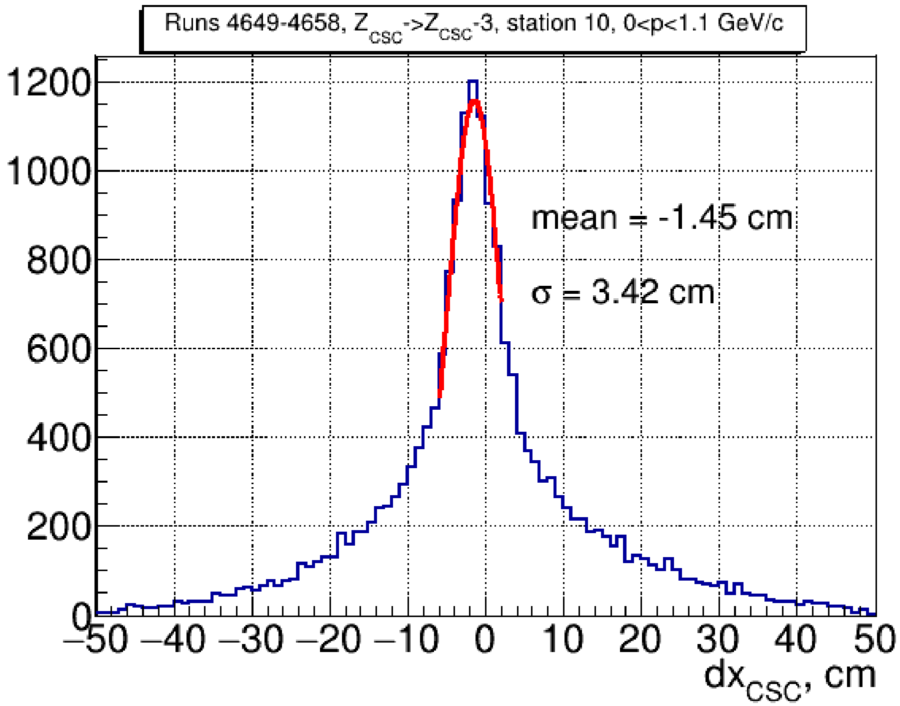
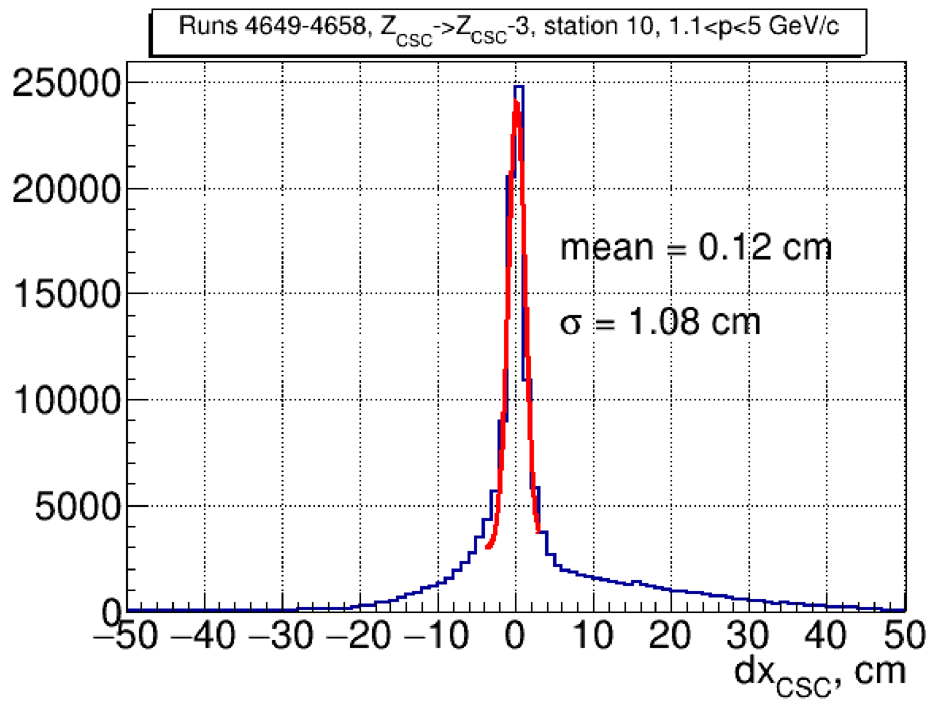
CSC residuals & detailed GEM geometry

- CSC residuals for Data
- CSC residuals for MC
- CSC Y residuals for Data
- CSC residuals for Data with $|dy_{CSC}|<4$ cm cut
- Additional CSC alignment for Data
- CSC alignment without field
- TOF400 residuals
- Taking into account detailed GEM geometry

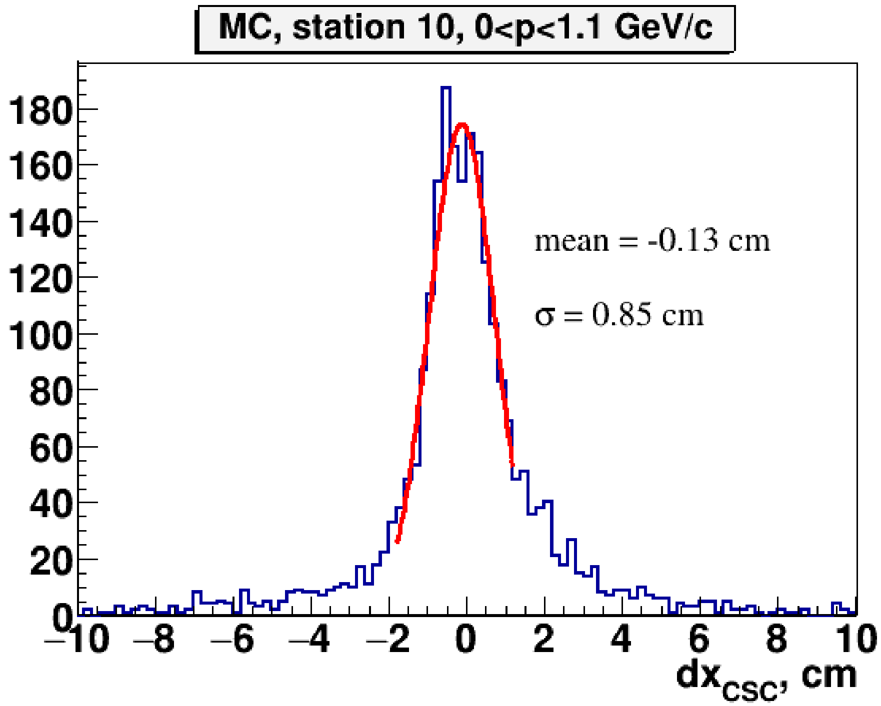
CSC residuals for Data

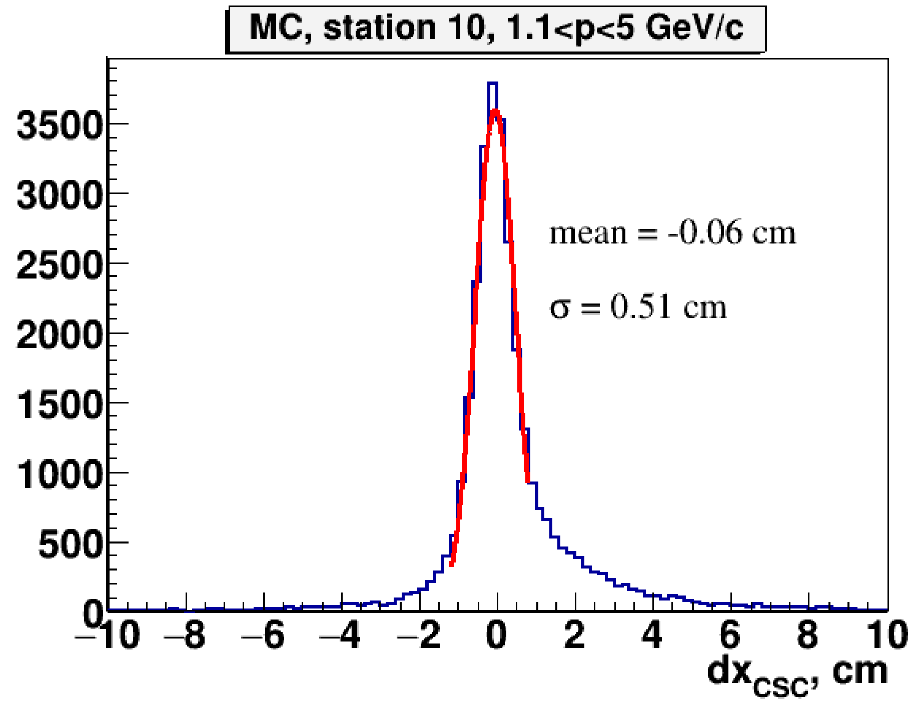




- The CSC residuals not Gaussian. The tails are very wide. Especially for 0<p<1.1 GeV/c
- $|\text{mean}_{0<p<1.1}-\text{mean}_{1.1<p<5}|\sim 1.5$ cm
- $\sigma_{0<p<1.1}\sim 3\sigma_{1.1<p<5}$
- The number of low momentum tracks (0<p<1.1 GeV/c) <10% of all tracks (0<p<5 GeV/c)

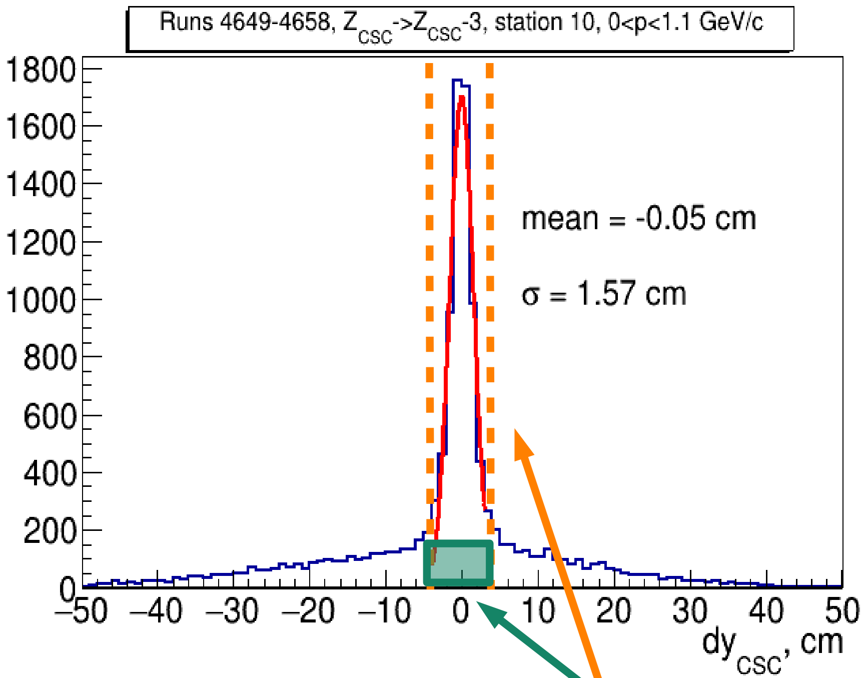
CSC residuals for MC

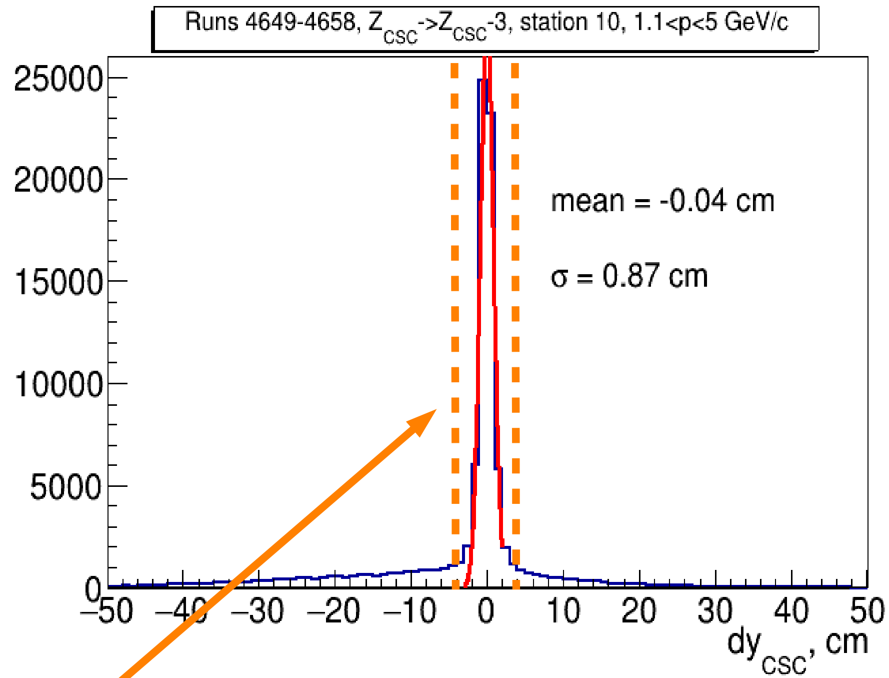




- The CSC residuals close to Gaussian
- Peaks for 0<p<1.1 GeV/c and for 0<p<5 GeV/c are aligned
- $\sigma_{0<p<1.1} \sim 1.5\sigma_{1.1<p<5}$
- The Kalman Filter works well to extrapolate traks from thr GEMs to CSC
- Something wrong with CSC residuals for the Data!

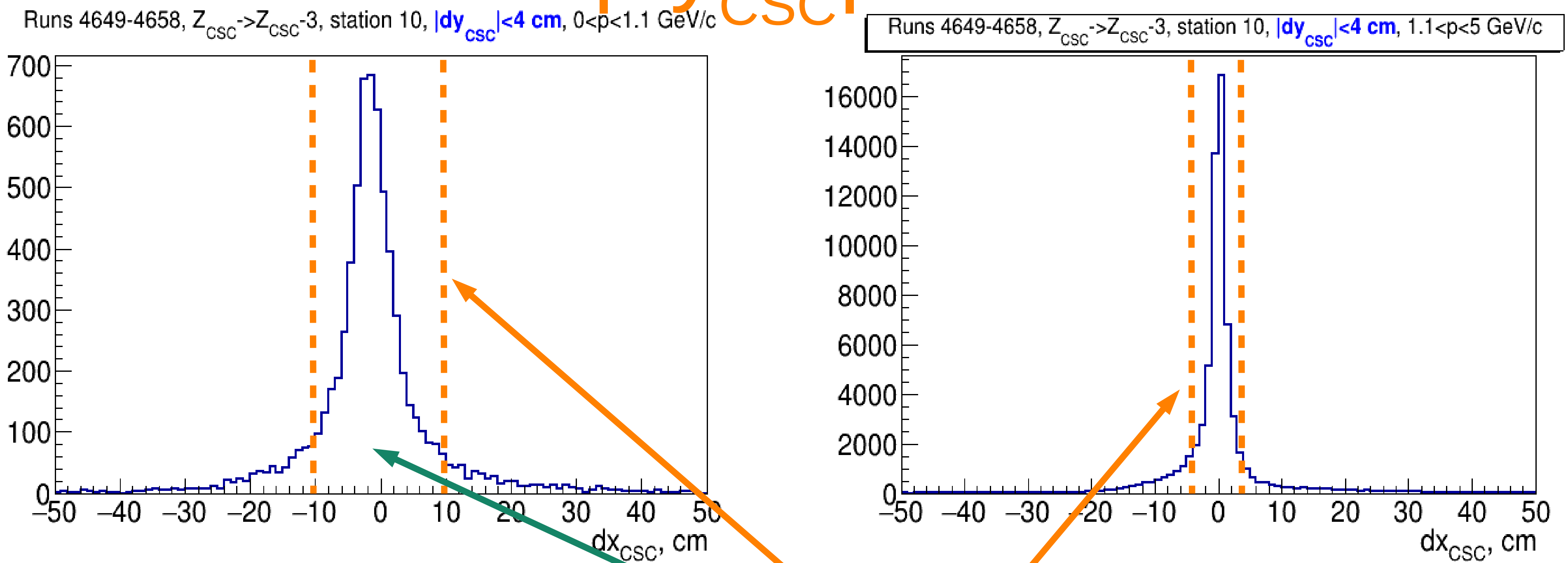
CSC Y residuals for Data





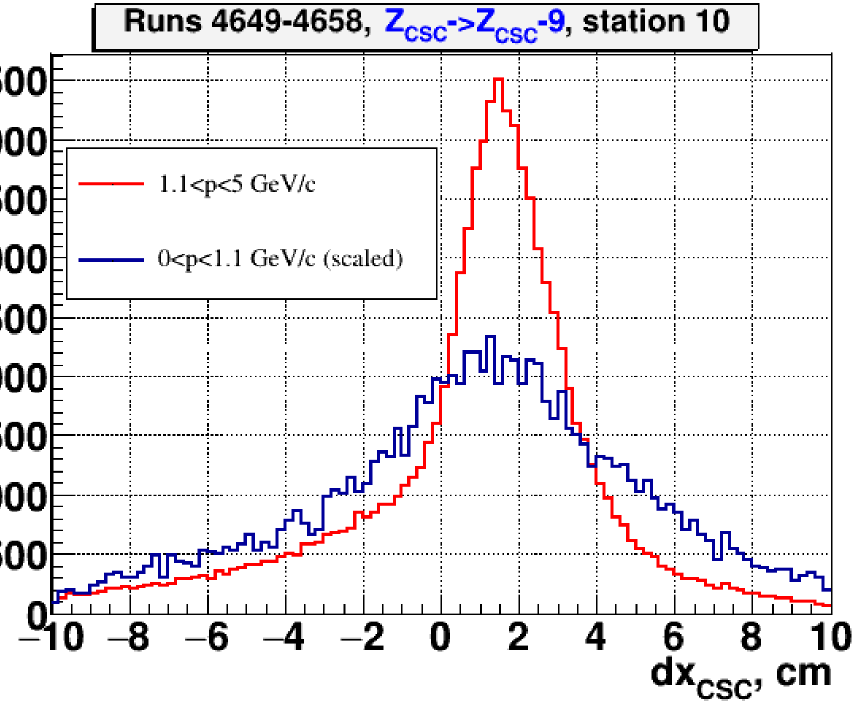
- The CSC Y residuals close to Gaussian
- Peaks for 0<p<1.1 GeV/c and for 0<p<5 GeV/c are aligned (this indirectly confirms that the CSC is well aligned)
- We can use $|dy_{CSC}|<4$ cm cut to improve X residuals
- The background under the peak <20%

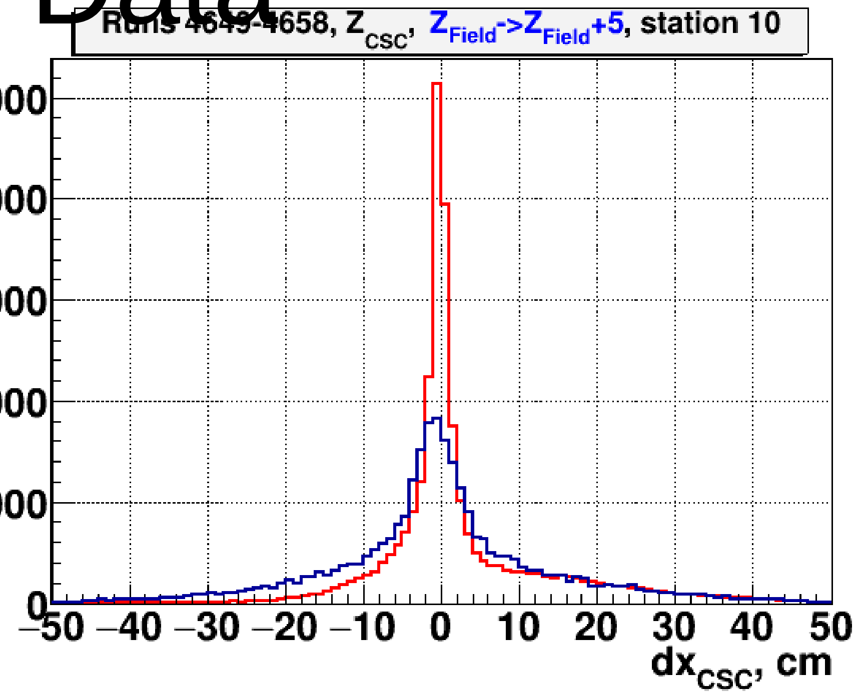
CSC residuals for Data with $|dy_{CSC}|<4$ cm cut



- We need to use at least $|dx_{CSC}|<10$ cm cut for $0<p<1.1$ GeV/c and at least $|dx_{CSC}|<4$ cm cut for $1.1<p<5$ GeV/c
- We do not no how the background ( ) is spread under the peak

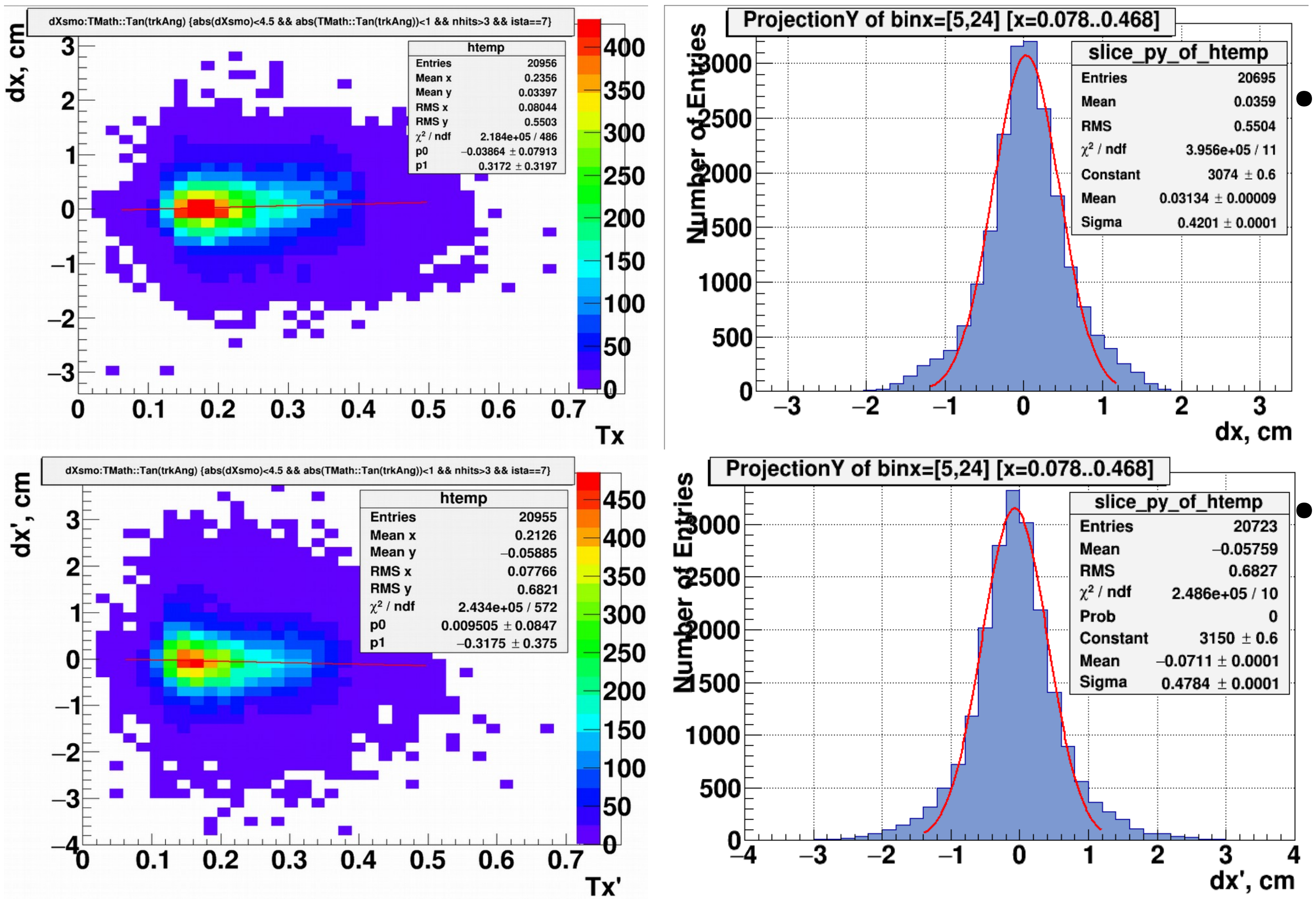
Additional CSC alignment for Data





- Two procedures of alignment were tested: z_{CSC} shift and z_{Field} shift
- $z_{CSC} \rightarrow z_{CSC}$-9 cm (closer to the target) or $z_{Field} \rightarrow z_{Field}$+5 cm (magnet pole at ~7 cm distance from the measured position)
- Peaks widths stay wide

CSC alignment without field



- $p0_{dx}$=-0.039±0.079

  $p1_{dx}$=0.317±0.320

  $mean_{dx}$=0.0313 cm

  σ_{dx}=0.420 cm

- $p0_{dx'}$=0.010±0.085

  $p1_{dx'}$=-0.318±0.375

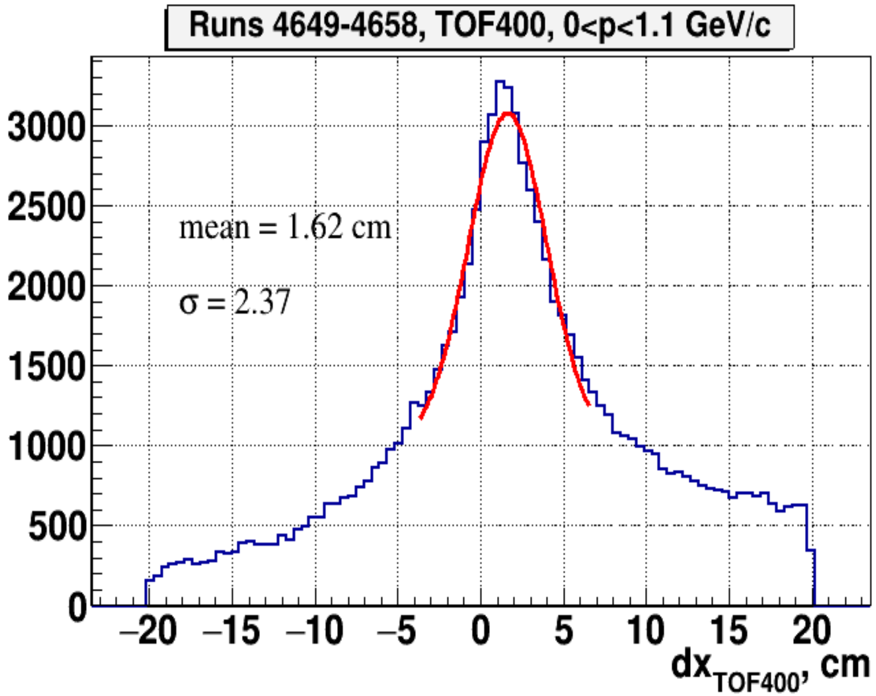
  $mean_{dx'}$=-0.0711 cm

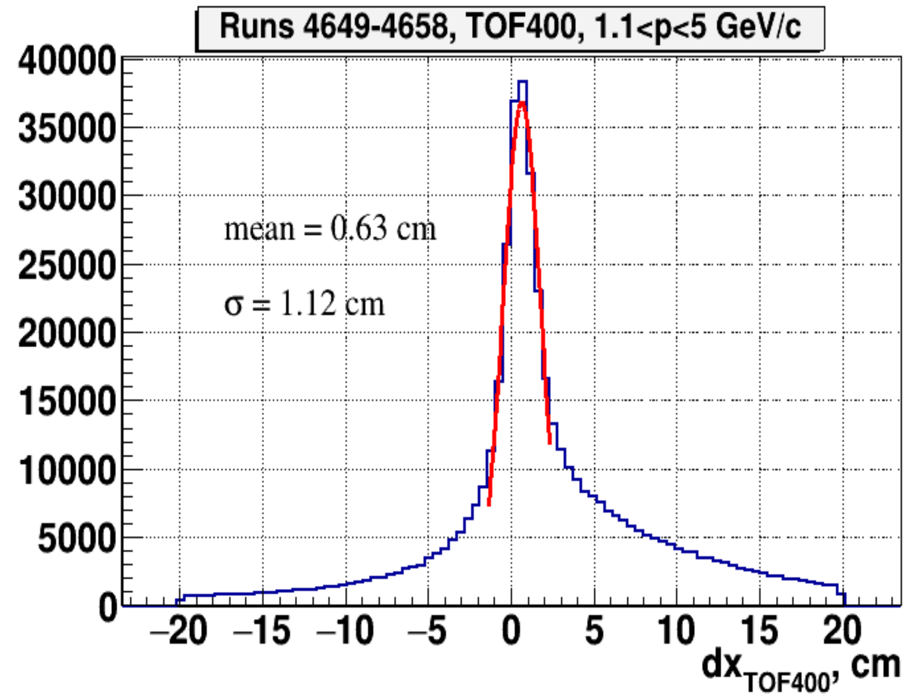
  $\sigma_{dx'}$=0.478 cm

- Good alignment without magnetic field was implemented
- The value of the residuals correlates with the results obtained by Igor Rufanov
- The $p1_{dx}$ and $p1_{dx'}$ values indicate that we need to implement a more realistic CSC hit reconstruction procedure

TOF400 residuals

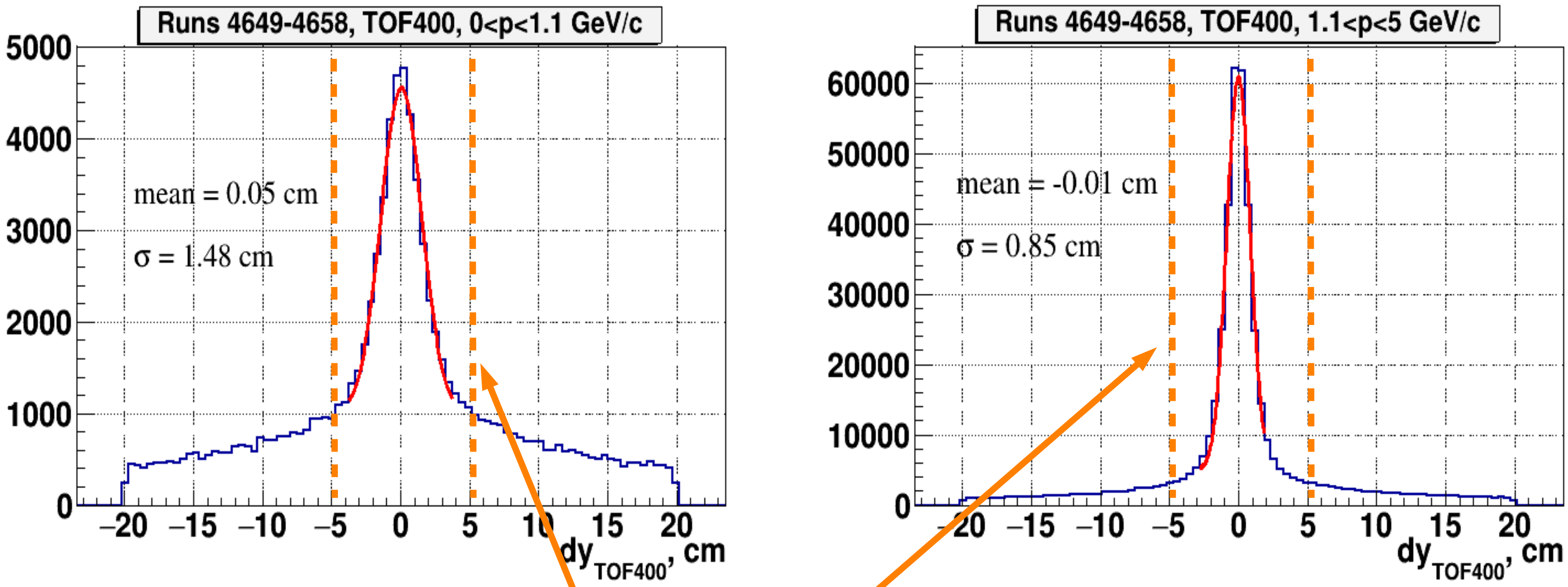
TOF400 residuals for Data





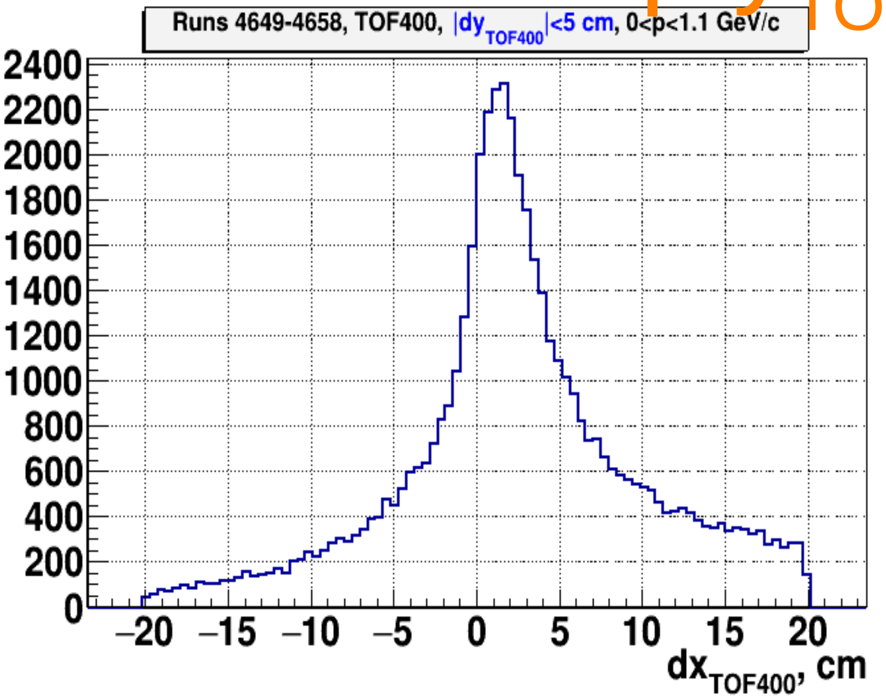
- Used tracks with confirmation by CSC. Residuals without confirmation are wider
- The TOF400 residuals not gaussian. The tails are very wide. Especially for 0<p<1.1 GeV/c
- $|mean_{0<p<1.1} - mean_{1.1<p<5}| \sim 1$ cm
- $\sigma_{0<p<1.1} \sim 2\sigma_{1.1<p<5}$

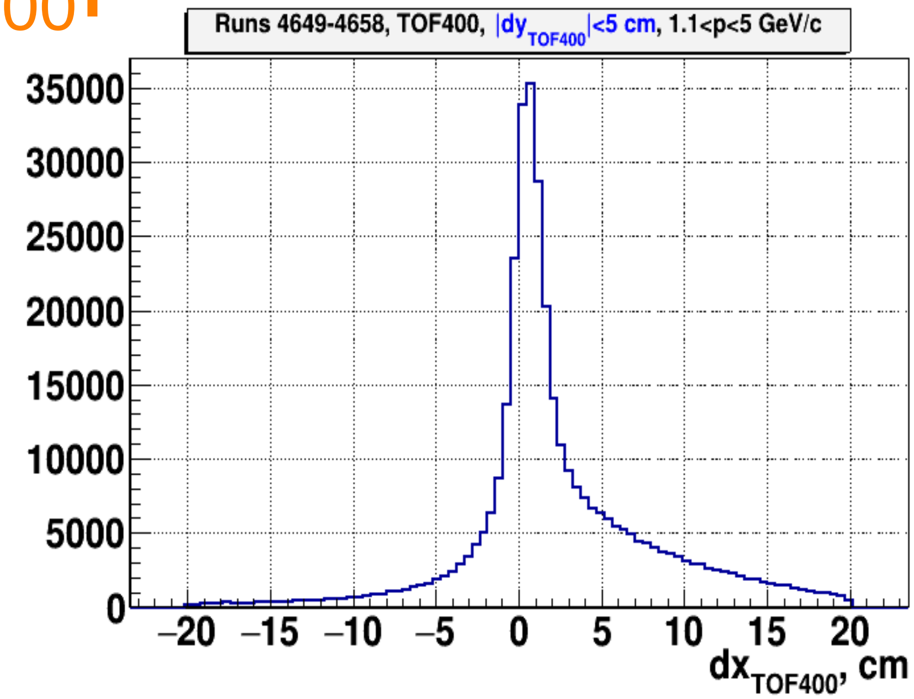
TOF400 Y residuals for Data



- TOF400 Y residuals are symmetrical and well aligned
- We can use $|dy_{TOF400}|<5$ cm cut to improve X residuals

TOF400 residuals for Data with $|dy_{TOF400}|<5$ cm cut

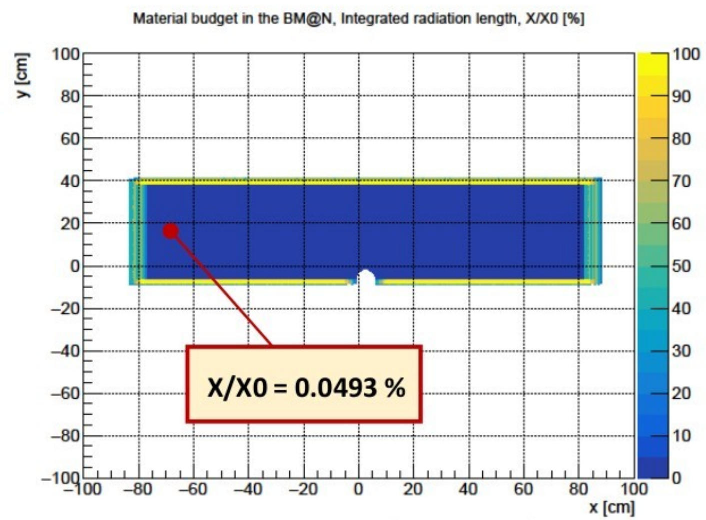




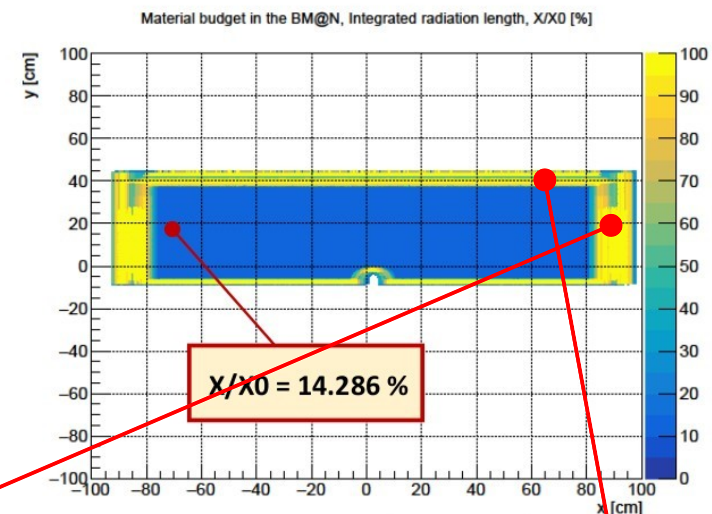
- TOF400 residuals with dy_{TOF400} cut stay wide

Detailed GEM geometry

Taking into account detailed GEM geometry



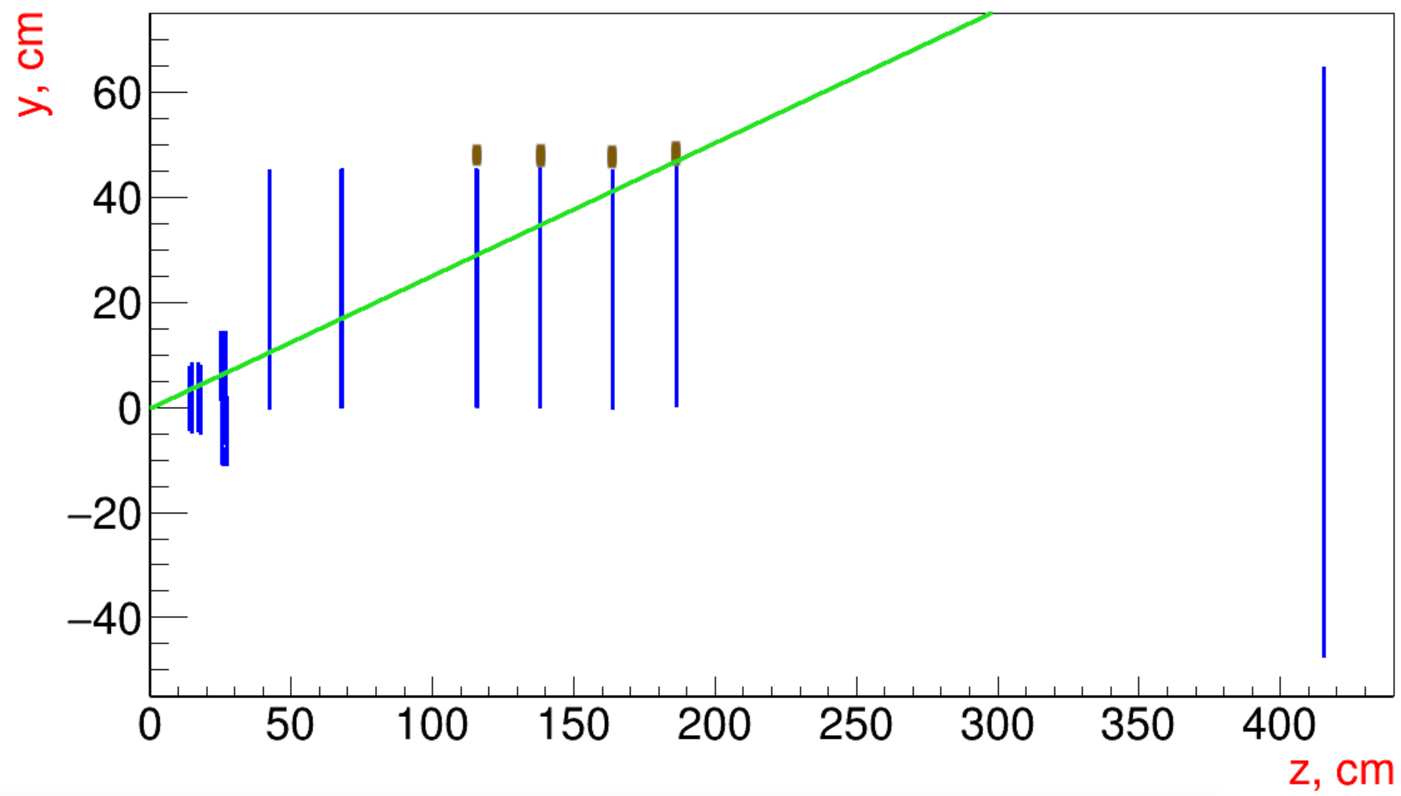
Material budget of six stations for tracks parallel to Z axis (simplified geometry)



Material budget of six stations for tracks parallel to Z axis (detailed geometry)

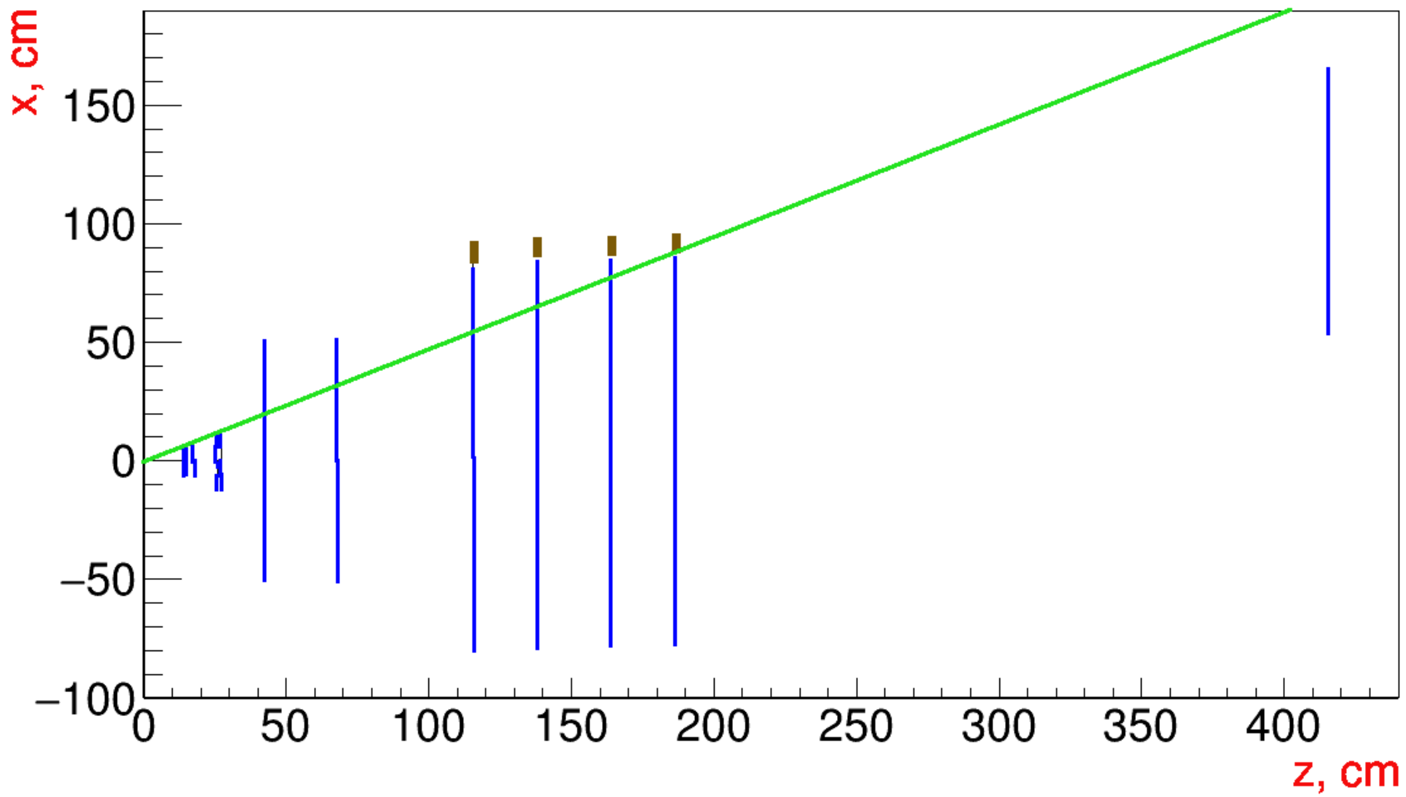
- We are interested in passive material on the top and on the side border of GEMs (according to the CSC position)

The top border of GEMs



- In the YZ plane the tracks are almost straight lines
- They start at the Primary Vertex
- They cannot simultaneously pass through both top passive material of GEMs and the CSC

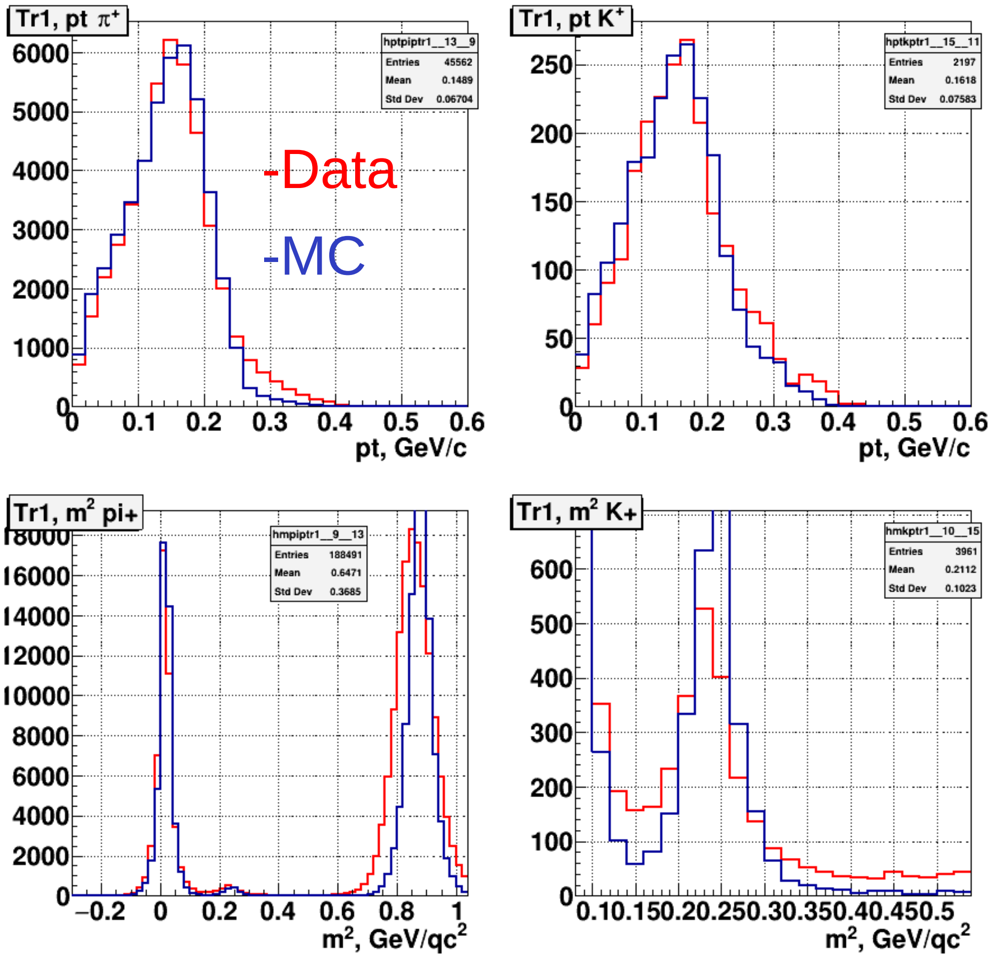
The side border of GEMs



- In the XZ plane the high momentum tracks are almost straight lines and the low momentum **positive tracks** (π^+, K^+) are bending left (to the larger x values)
- They start at the Primary Vertex
- They cannot simultaneously pass through both side passive material of GEMs and the CSC

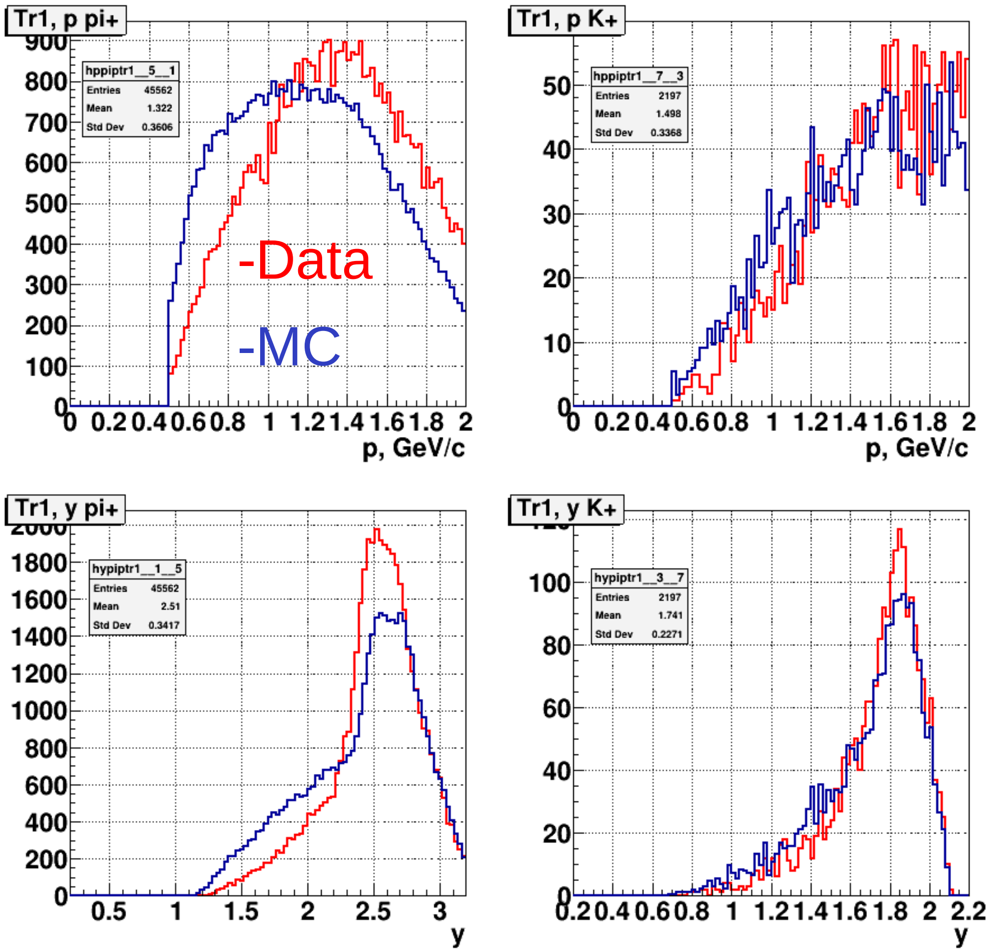
Backup

Results of identification comparison for Data and MC with efficiencies



- Left m^2 distribution is normalized to the π^+ peak
- Other distributions are normalized to the integral
- S/B for Data significantly lower than for MC
- m^2 distributions for Data and MC close to each other in (π^+, K^+) region
- Pt spectra of π^+ and K^+ for Data and MC close to each other

Results of identification comparison for Data and MC with efficiencies



- All spectra are normalized to the integral
- P and Y spectra of K^+ for Data and MC close to each other
- P and Y spectra of π^+ for Data and MC significantly different