Field studies

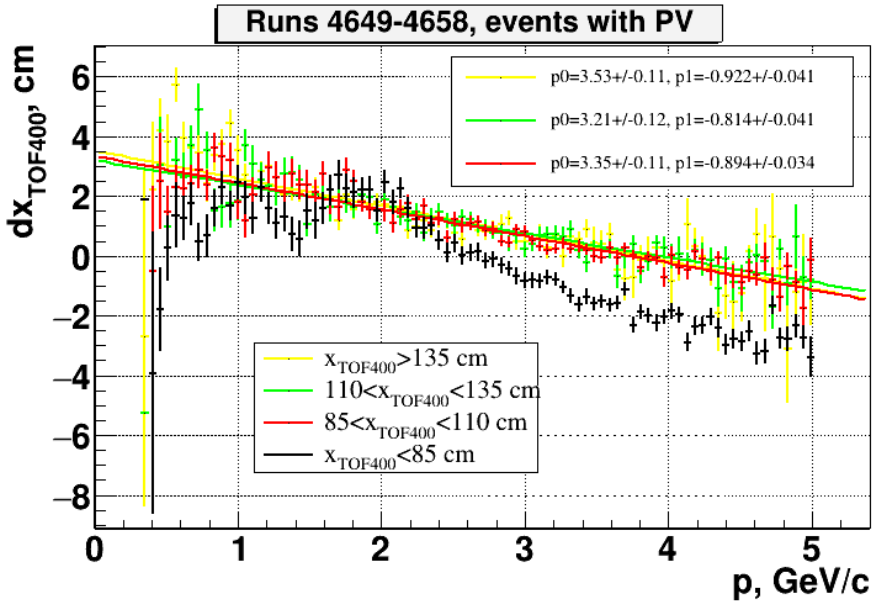
Definitions

$$dx_{TOF400} = x_{extrap} - x_{TOF400}$$

$$dy_{TOF400} = y_{extrap} - y_{TOF400}$$

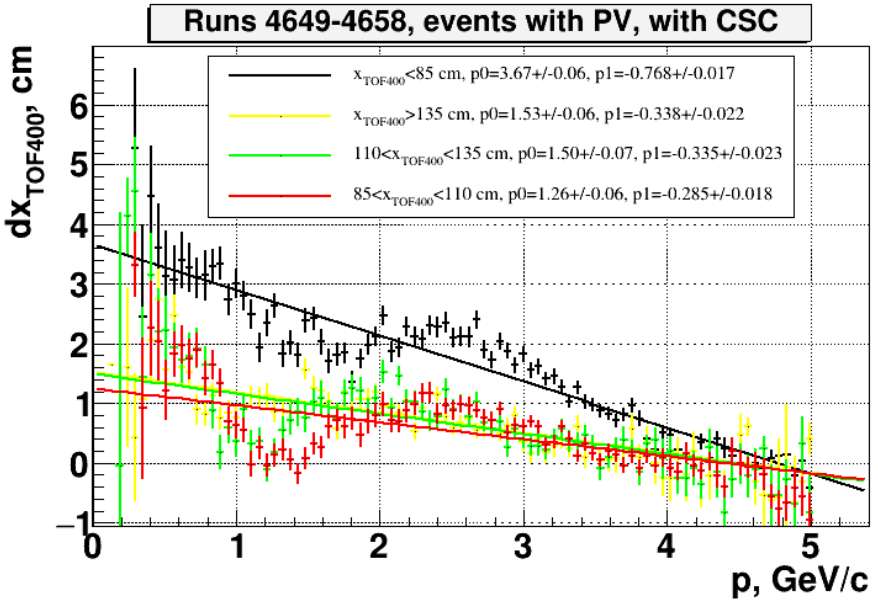
dx_{TOF400} vs p

Without CSC



- For x_{TOF400}>85 cm, the distributions are fitted well by the pol1
- For x_{TOF400}<85 cm, the distribution shape changes. The difference between the real magnetic field and its description for this region is maximum

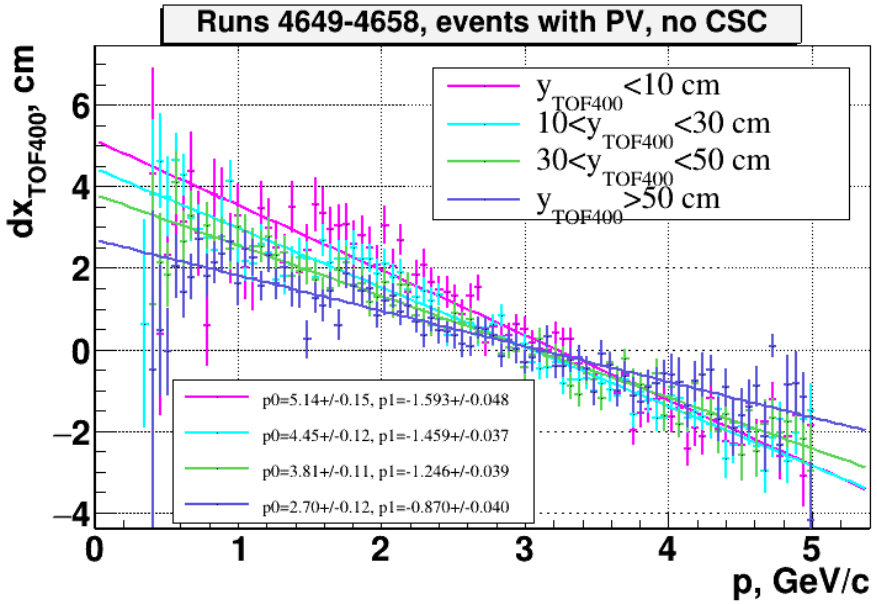
With CSC



- CSC hit distorts distributions
- But the distributions are getting more horizontal
- The region for x_{TOF400}<85 cm differs significantly

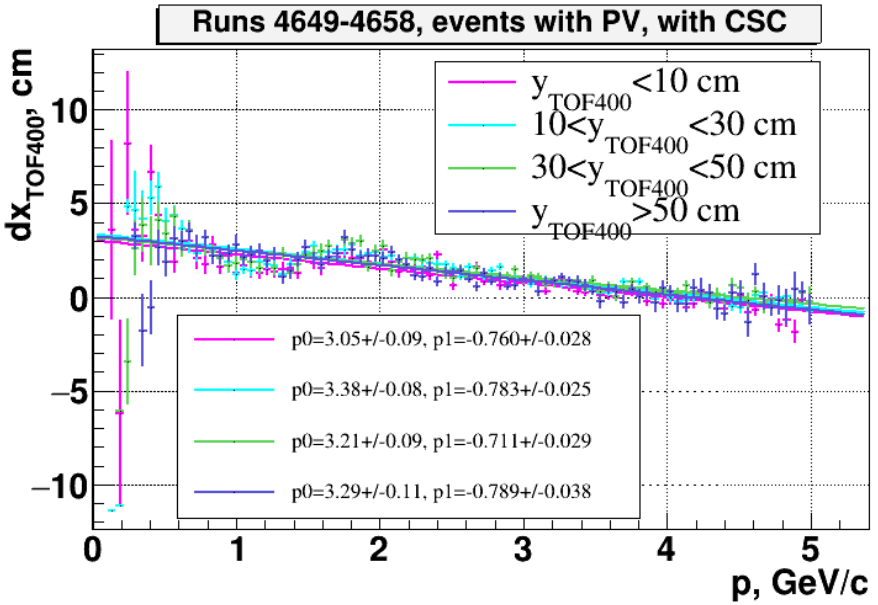
dx_{TOF400} vs p

Without CSC



- For all y_{TOF400} regions, the distributions are fitted well by the pol1
- The absolute value of the pol1 slope decreases with increasing y_{TOF400}

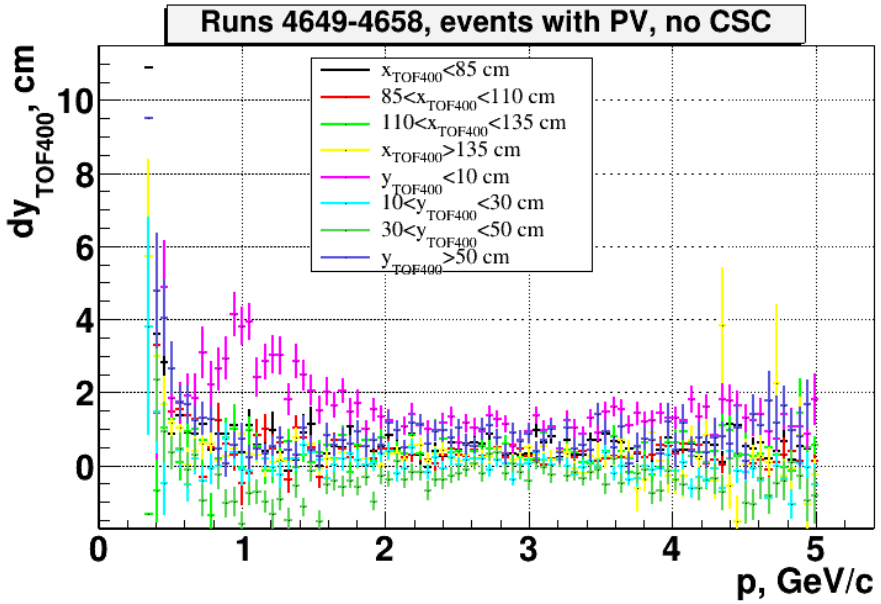
With CSC



- For all y_{TOF400} regions, the distributions are fitted with the close lines
- The distributions are getting more horizontal

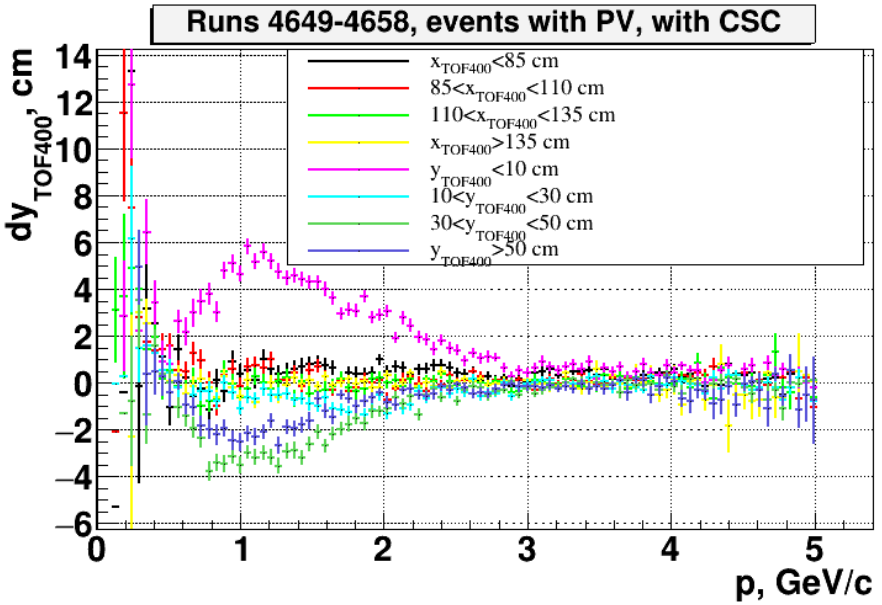
dy_{TOF400} vs p

Without CSC



- There is no significant dependence of dy_{TOF400} on p for different x_{TOF400}
- There is dependence of dy_{TOF400} on p for y_{TOF400}<10 cm and 30<y_{TOF400}<50 cm

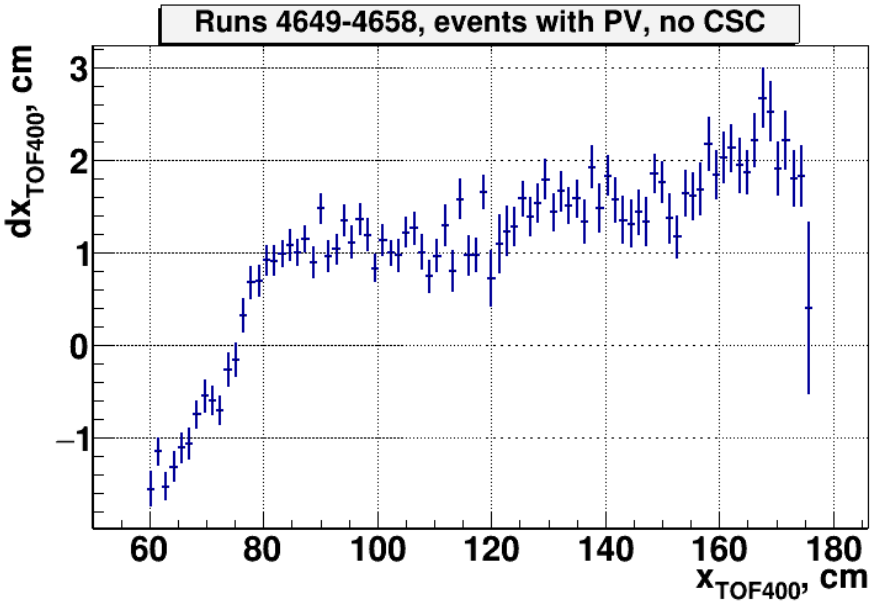
With CSC



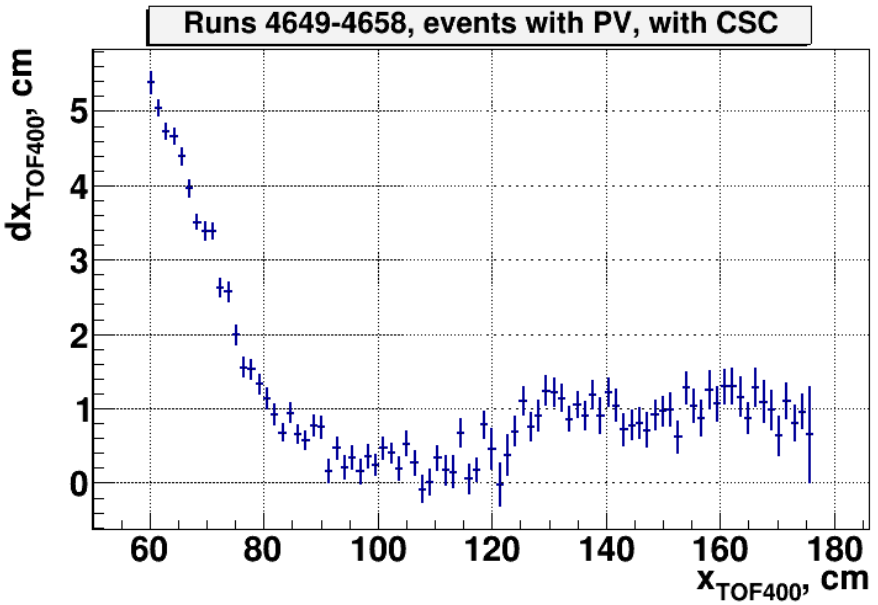
- CSC hit distorts distributions due to a wide matching window (50 cm) and further refitting of the track
- However, it should be noted that there is dependence of dy_{TOF400} on p for y_{TOF400}<10 cm and y_{TOF400}>30 cm
- There is no significant dependence of dy_{TOF400} on p for different x_{TOF400}

dx_{TOF400} vs x_{TOF400}

Without CSC



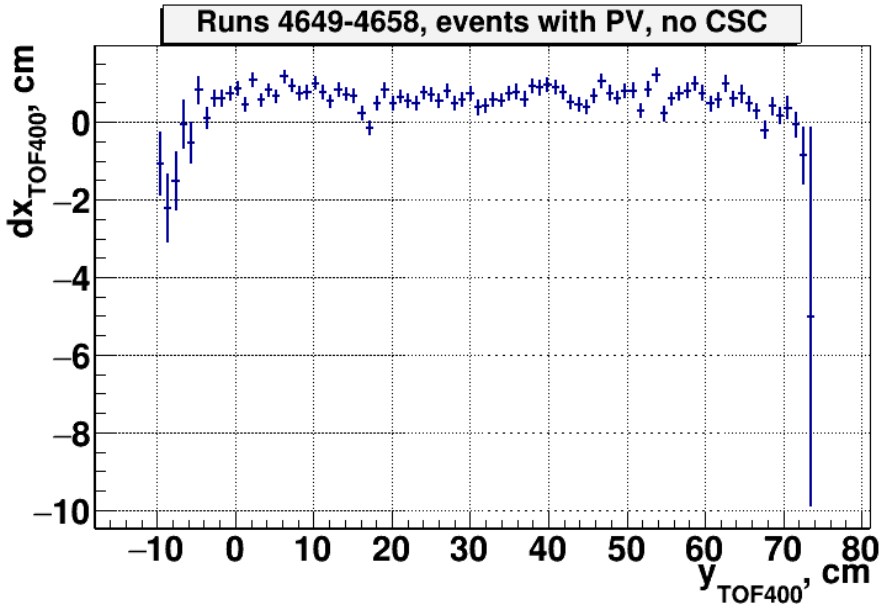
With CSC



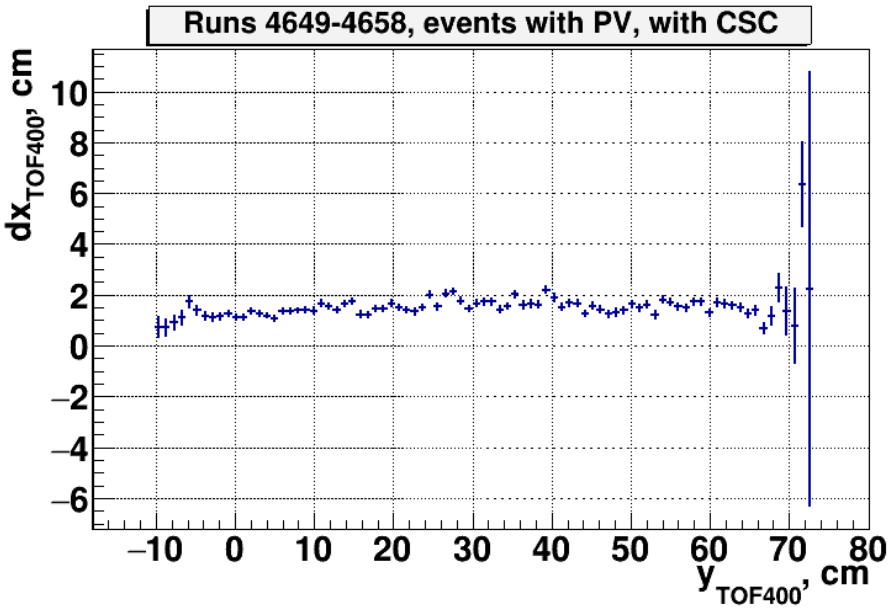
- Specific behavior is obtained when x_{TOF400}<80 cm for both sets of tracks
- For the tracks with CSC, this may be related with the broken electronics at the low x side

dx_{TOF400} vs y_{TOF400}

Without CSC



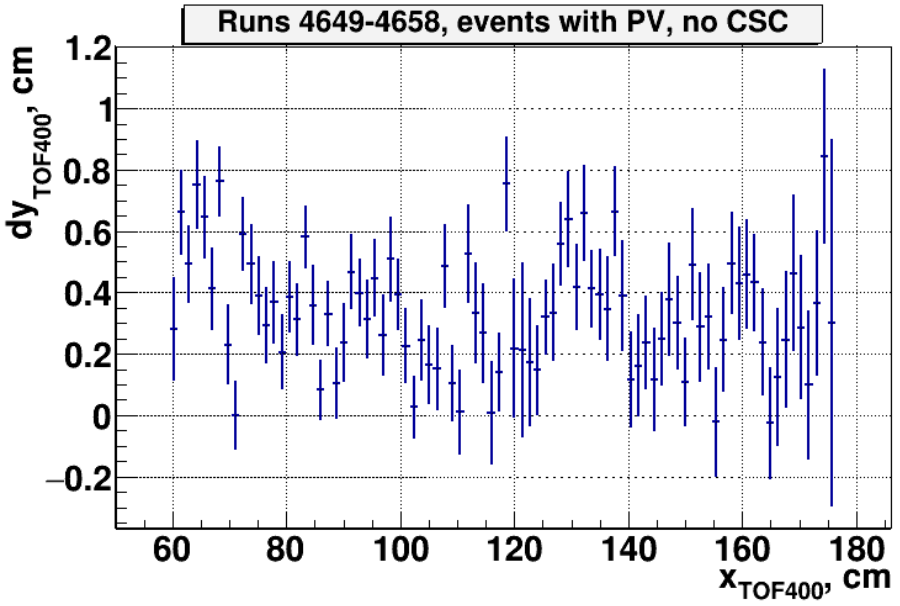
With CSC



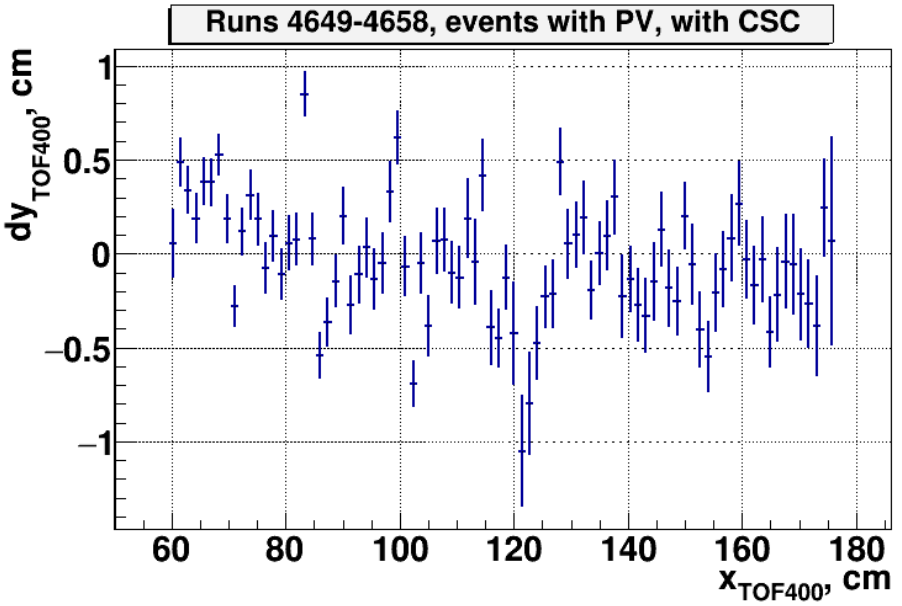
- There is no significant dependence of dx_{TOF400} on y_{TOF400} for both sets of tracks

dy_{TOF400} vs x_{TOF400}

Without CSC



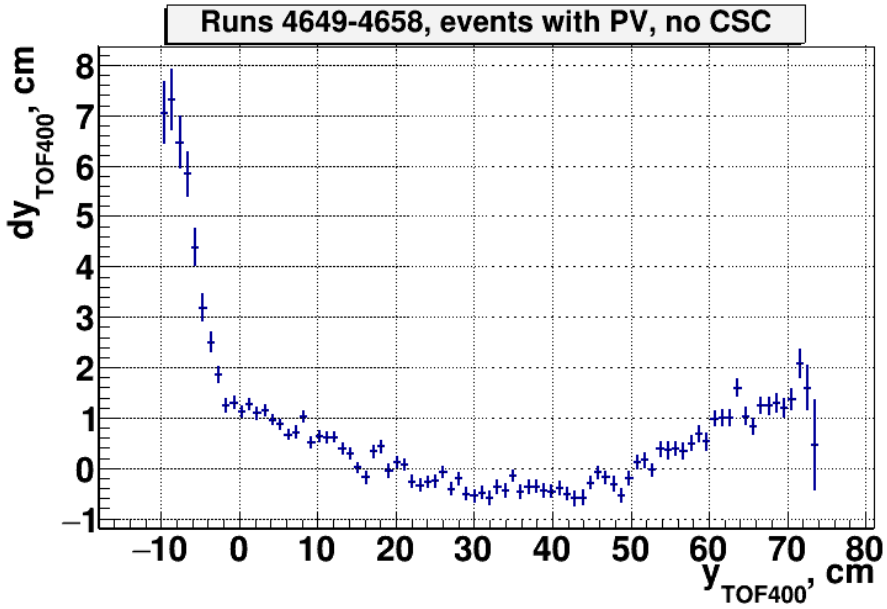
With CSC



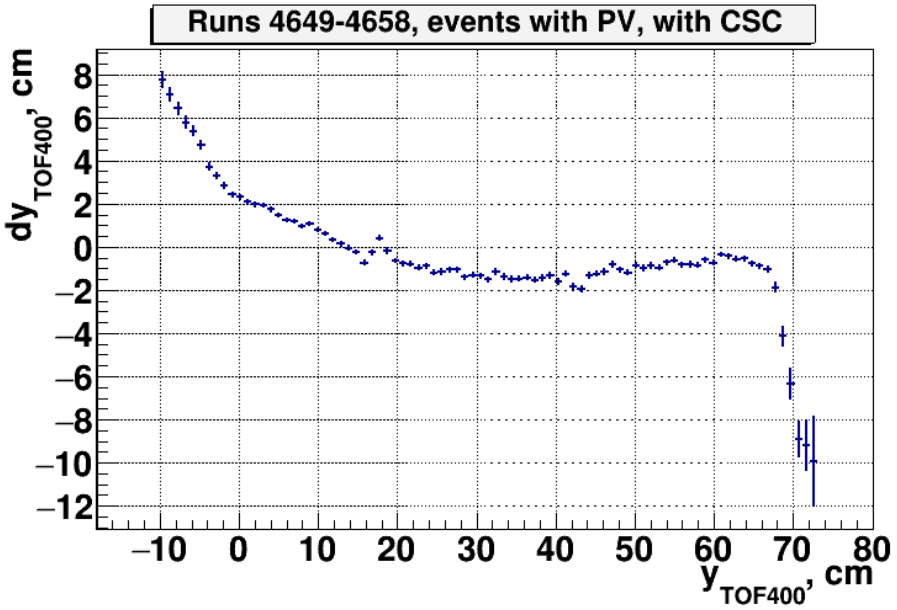
- There is no significant dependence of dy_{TOF400} on x_{TOF400} for both sets of tracks

dy_{TOF400} vs y_{TOF400}

Without CSC



With CSC

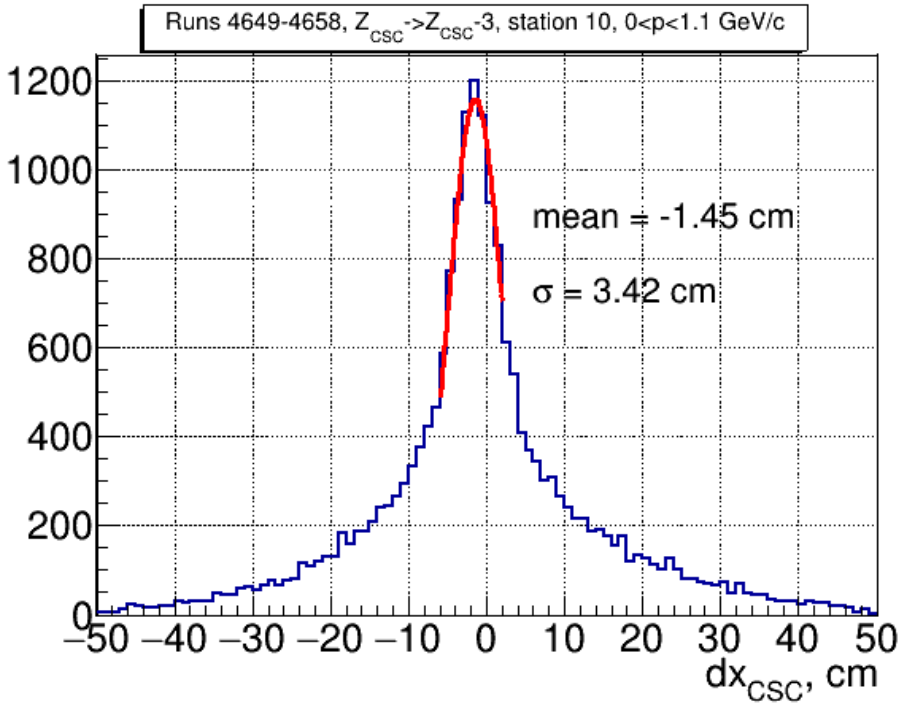


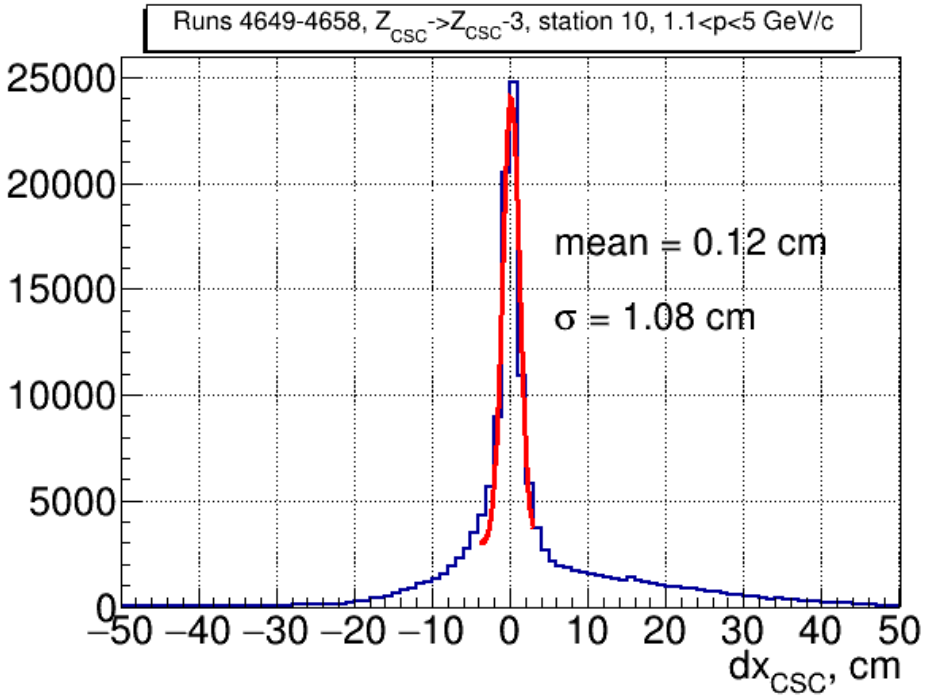
- The similar behavior is observed for both sets of tracks except of largest y_{TOF400}

Backup

CSC residuals

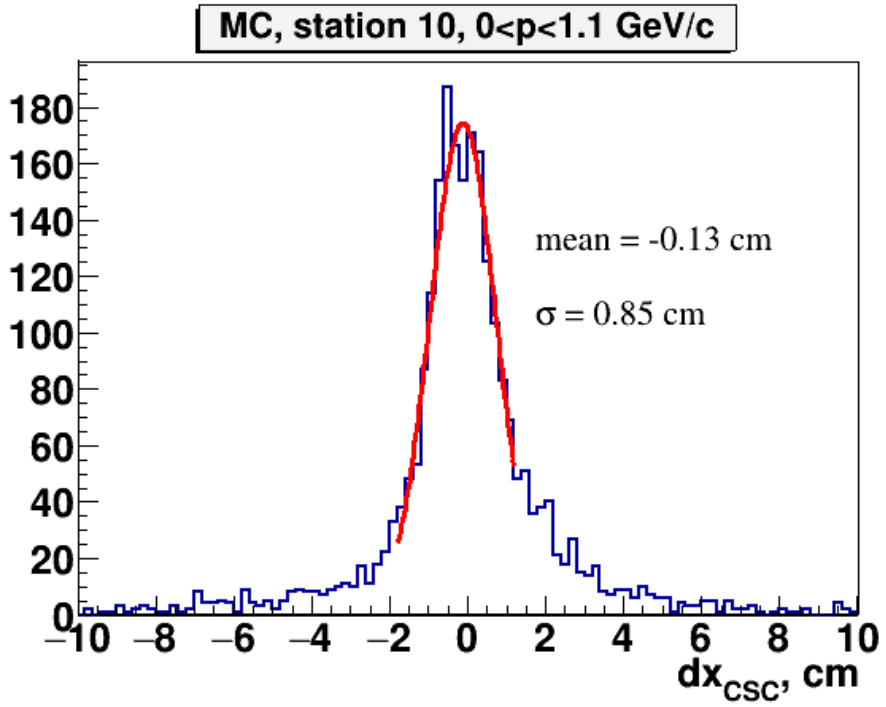
CSC residuals for Data

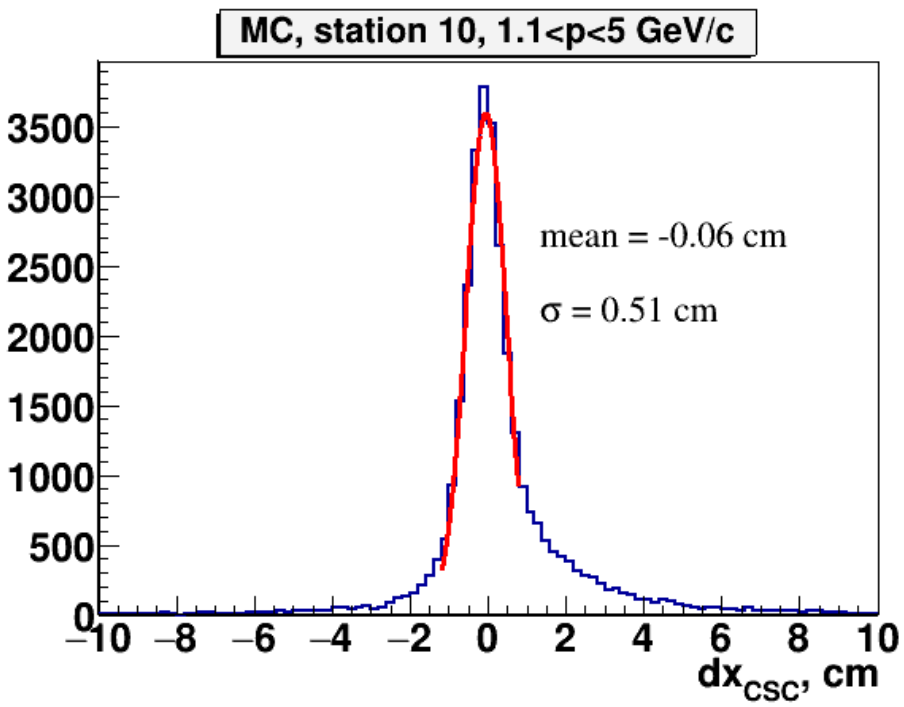




- The CSC residuals not Gaussian. The tails are very wide. Especially for 0<p<1.1 GeV/c
- $|mean_{0<p<1.1}-mean_{1.1<p<5}|$~1.5 cm
- $\sigma_{0<p<1.1}$~$3\sigma_{1.1<p<5}$
- The number of low momentum tracks (0<p<1.1 GeV/c) <10% of all tracks (0<p<5 GeV/c)

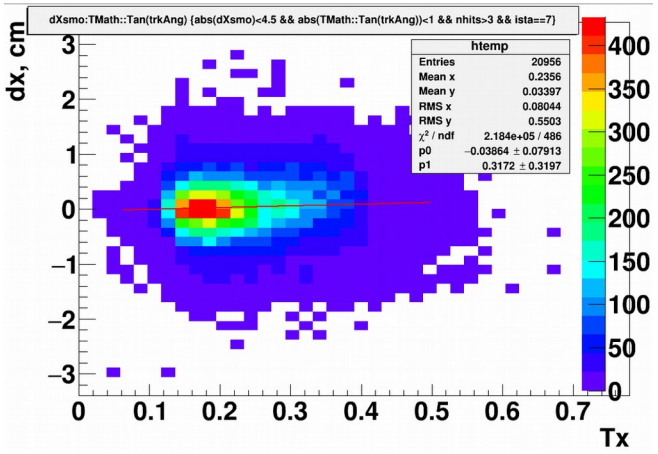
CSC residuals for MC

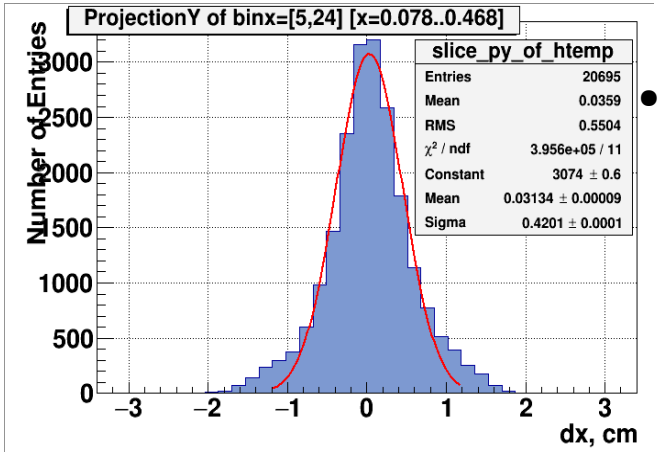




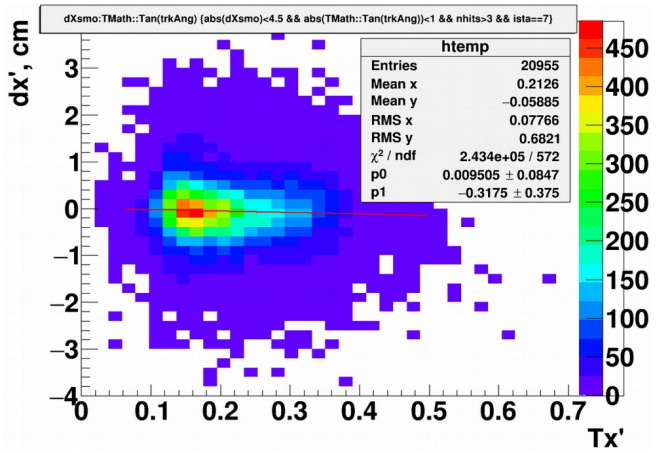
- The CSC residuals close to Gaussian
- Peaks for 0<p<1.1 GeV/c and for 0<p<5 GeV/c are aligned
- $\sigma_{0<p<1.1} \sim 1.5\sigma_{1.1<p<5}$
- The Kalman Filter works well to extrapolate traks from thr GEMs to CSC
- Something wrong with CSC residuals for the Data!

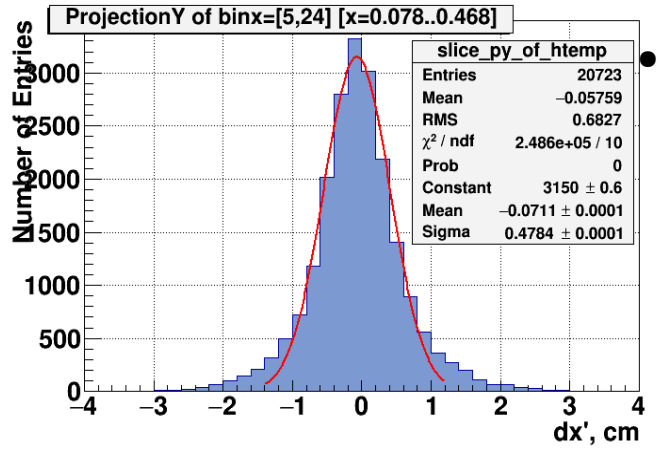
CSC alignment without field





- $p0_{dx}$=-0.039±0.079
- $p1_{dx}$=0.317±0.320
- $mean_{dx}$=0.0313 cm
- σ_{dx}=0.420 cm



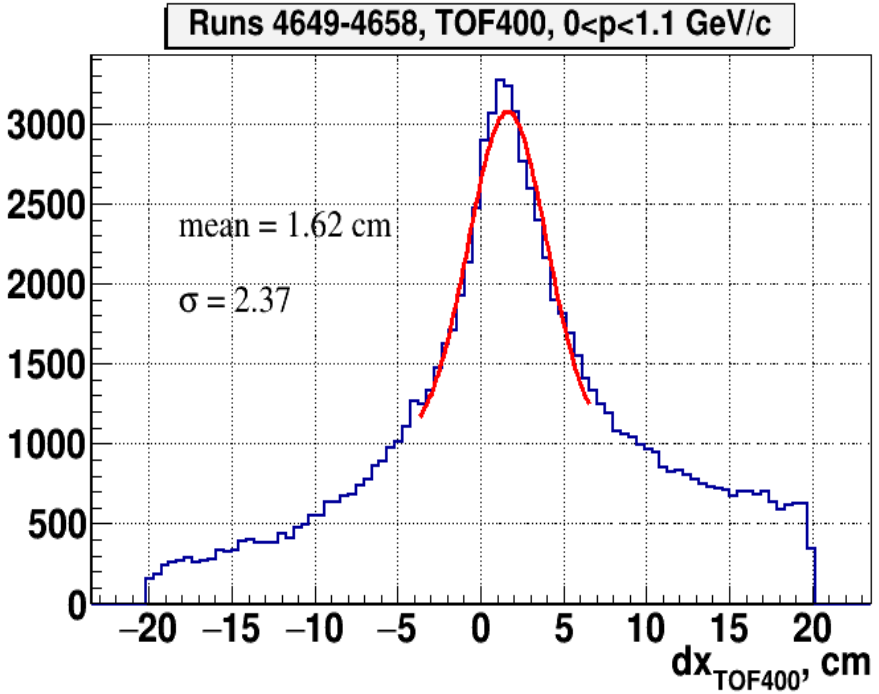


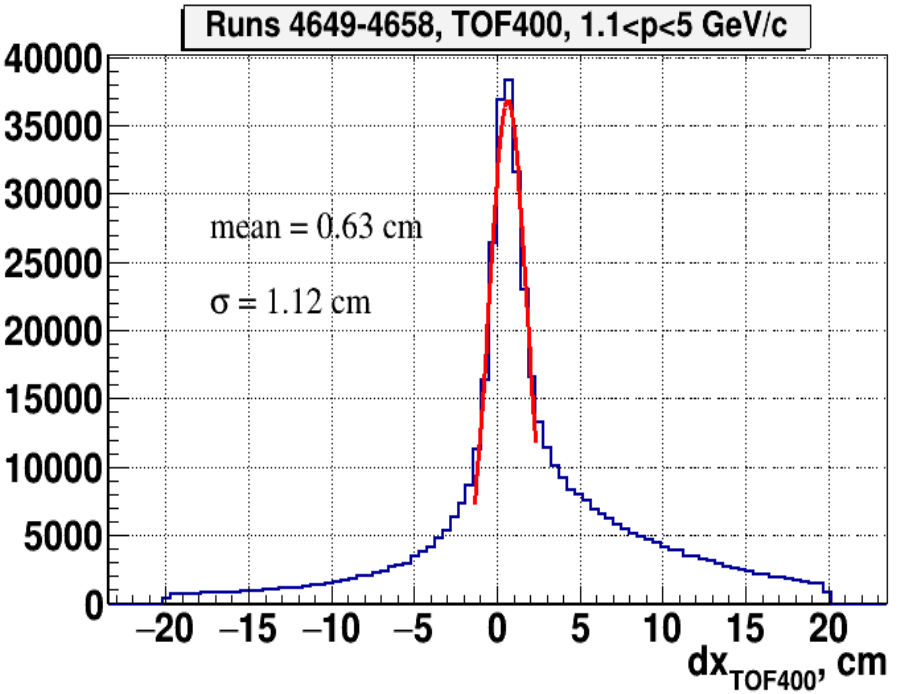
- $p0_{dx'}$=0.010±0.085
- $p1_{dx'}$=-0.318±0.375
- $mean_{dx'}$=-0.0711 cm
- $\sigma_{dx'}$=0.478 cm

- 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

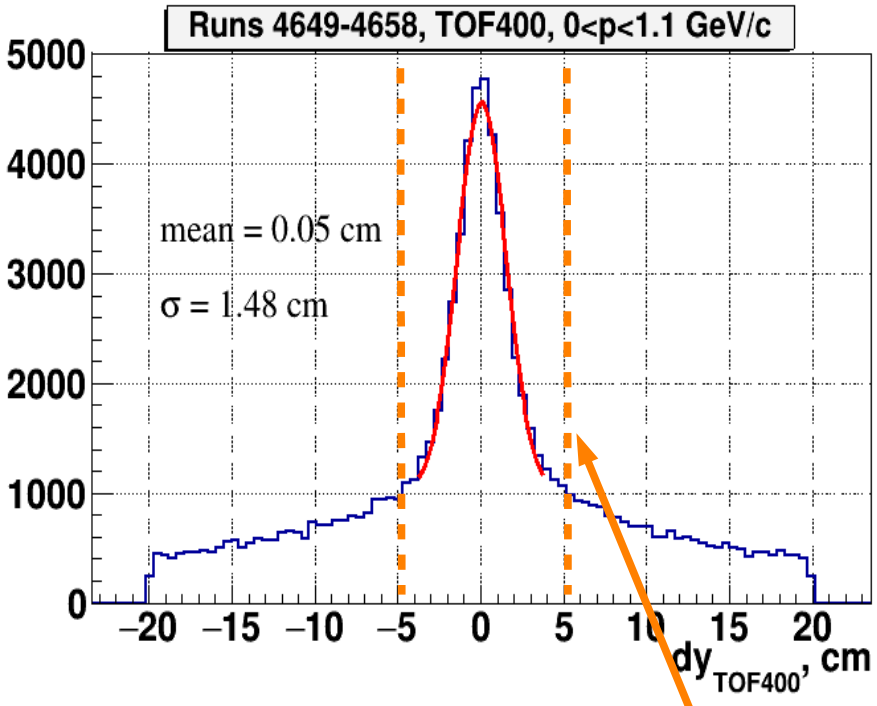
TOF400 residuals for Data

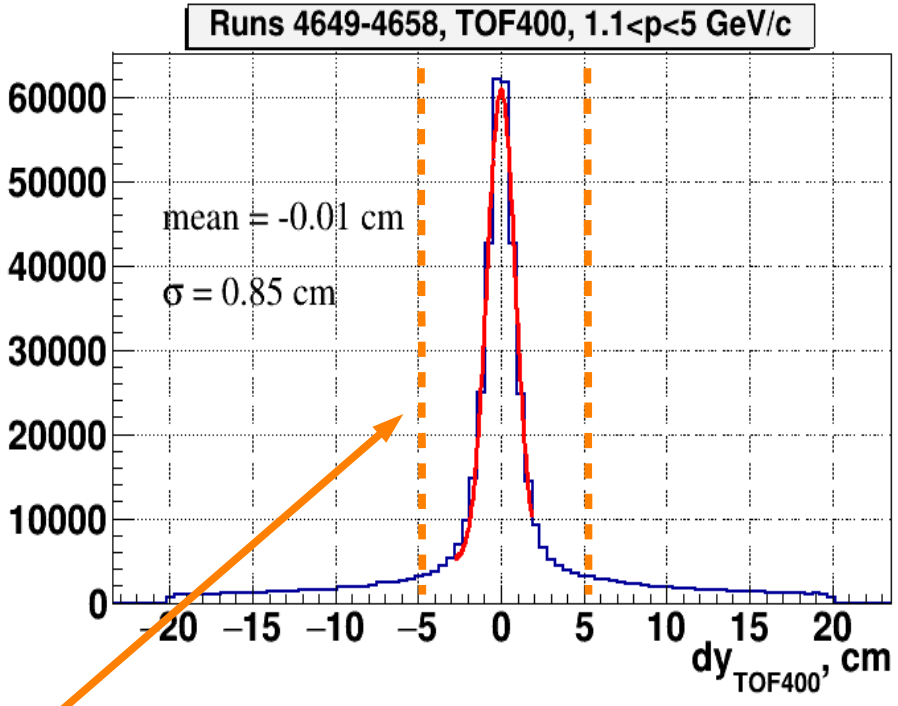




- Used tracks with confirmation by CSC. Residuals without confirmation are wider
- The TOF400 residuals not gaussian. The tails are very wide. Especially for 0<p<1.1 GeV/c
- $|mean_{0<p<1.1}-mean_{1.1<p<5}|$~1 cm
- $\sigma_{0<p<1.1}$~$2\sigma_{1.1<p<5}$

TOF400 Y residuals for Data

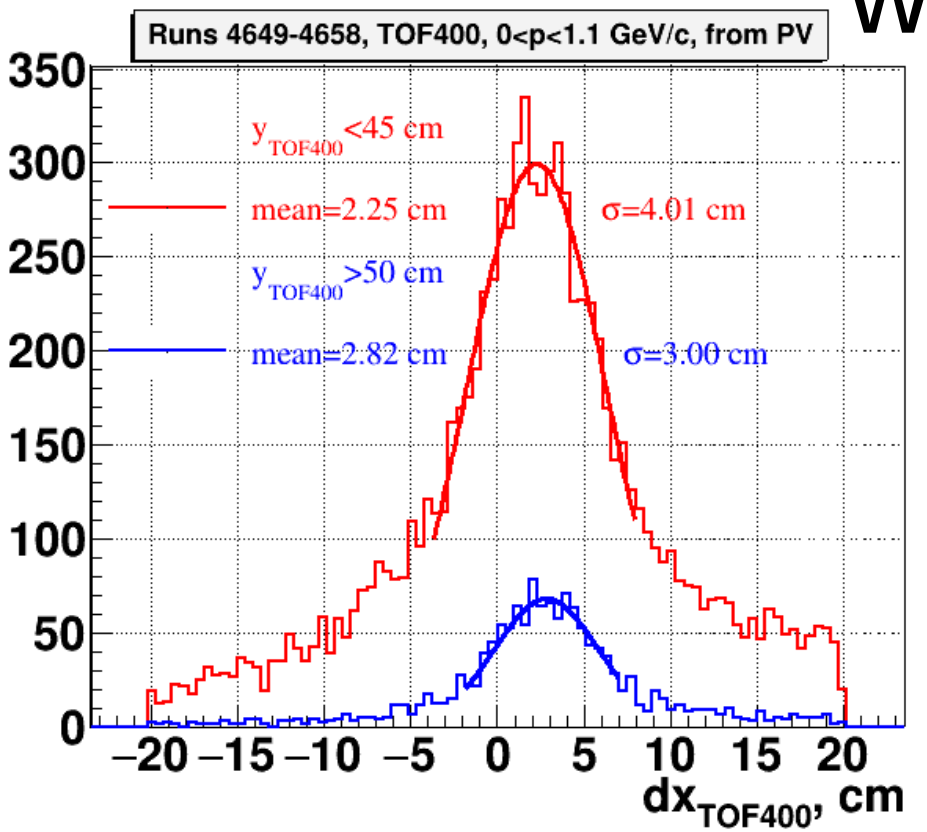




- TOF400 Y residuals are symmetrical and well aligned
- We can use $|dy_{TOF400}|<5$ cm cut to improve X residuals

TOF400 residuals.
Y<45 cm and Y>50 cm

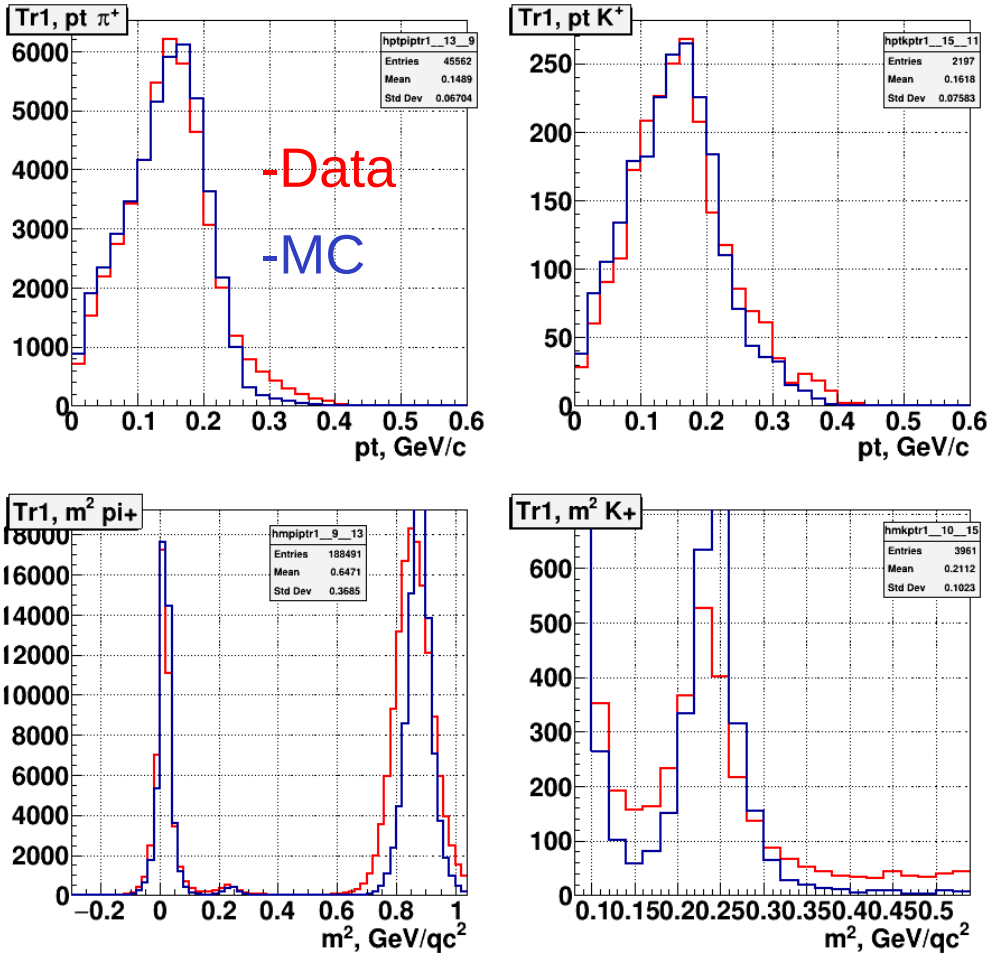
TOF400 residuals for Data with Y cut



- $|mean_{y<45}-mean_{y>50}|$~0.6 cm
- $\sigma_{y<45}$~$1.3\sigma_{y>50}$
- Y>50 cm region plays a minor role

Raw spectra for Data vs MC

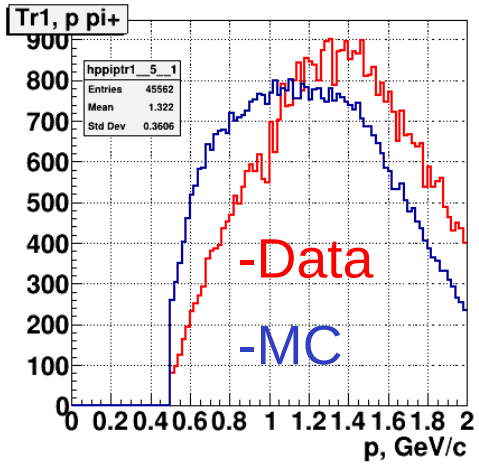
Results of identification comparison for Data and MC with efficiencies

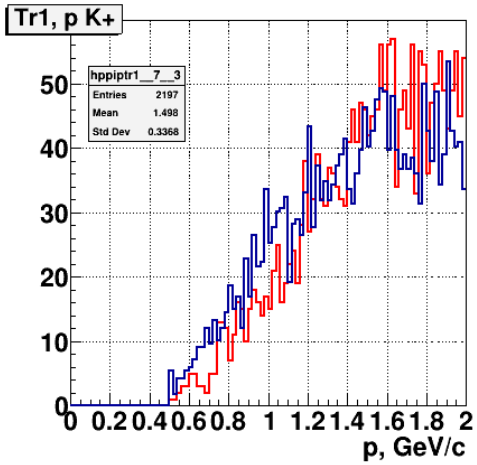


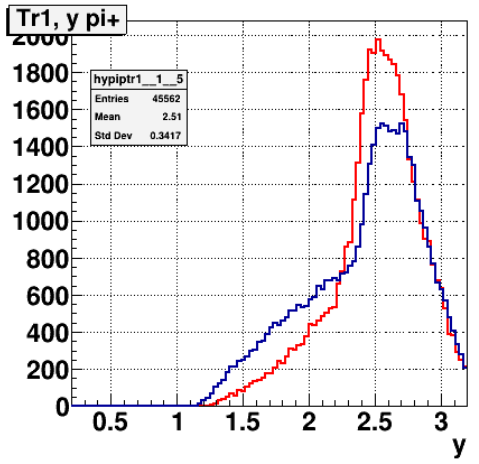
- Left m^2 distribution is normalized to the π^+ peak
- Other distributions are normalized to the integral
- S/B for Data significantly lower than for MC
- m^2 distributions for Data and MC close to each other in (π^+, K^+) region

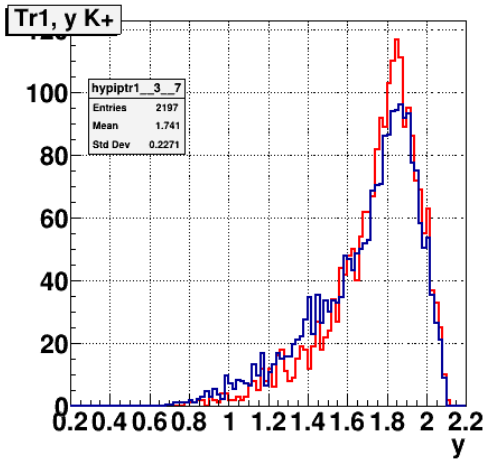
- Pt spectra of π^+ and K^+ for Data and MC close to each other

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