

pass4a: dst data

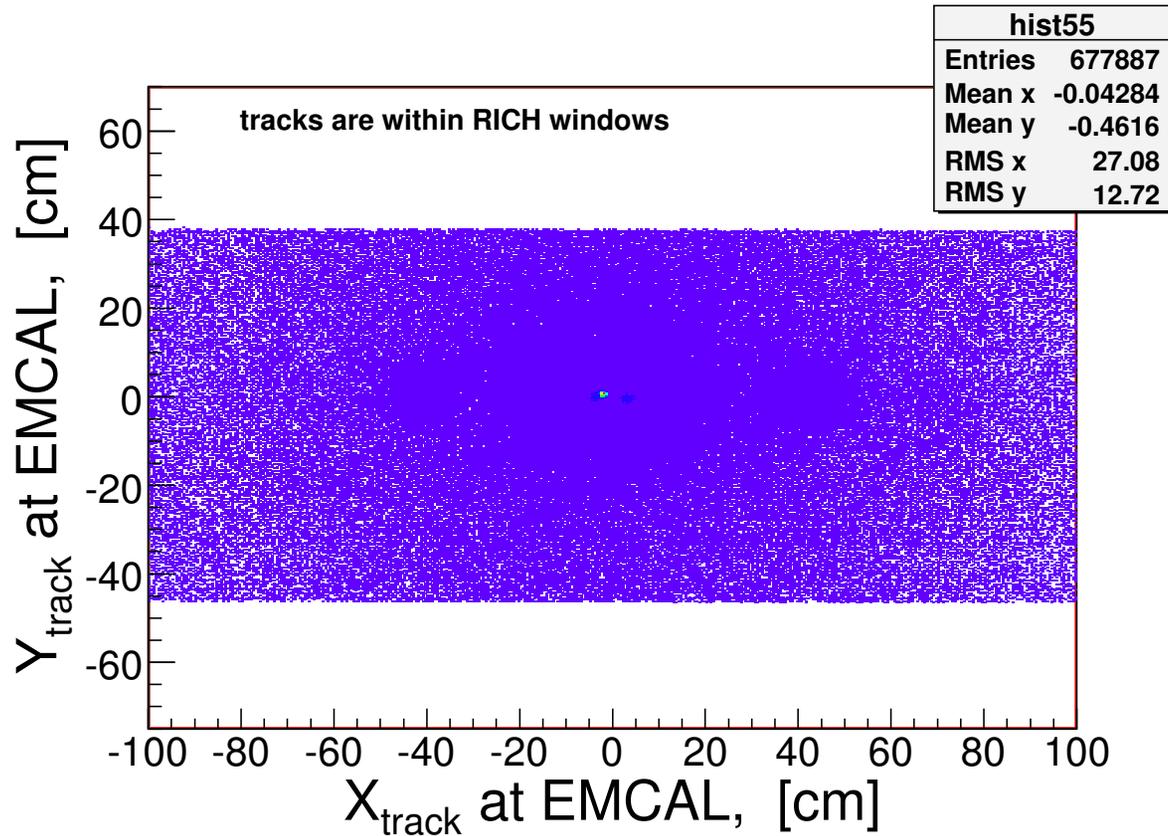
EMCAL alignment test using pass 4a data

actual alignment was done with pass 2 data

Event/track selection cuts for track - emcal matching:

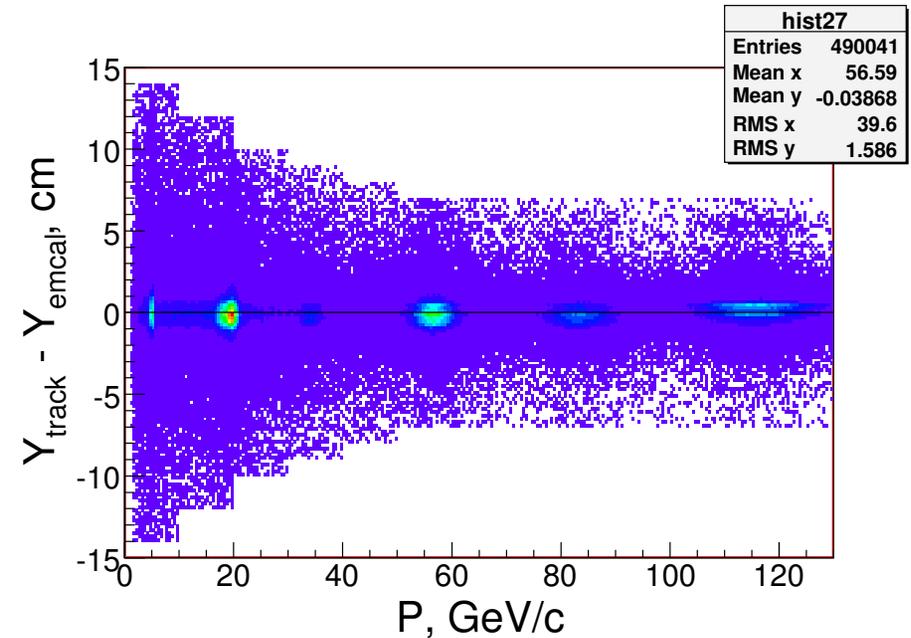
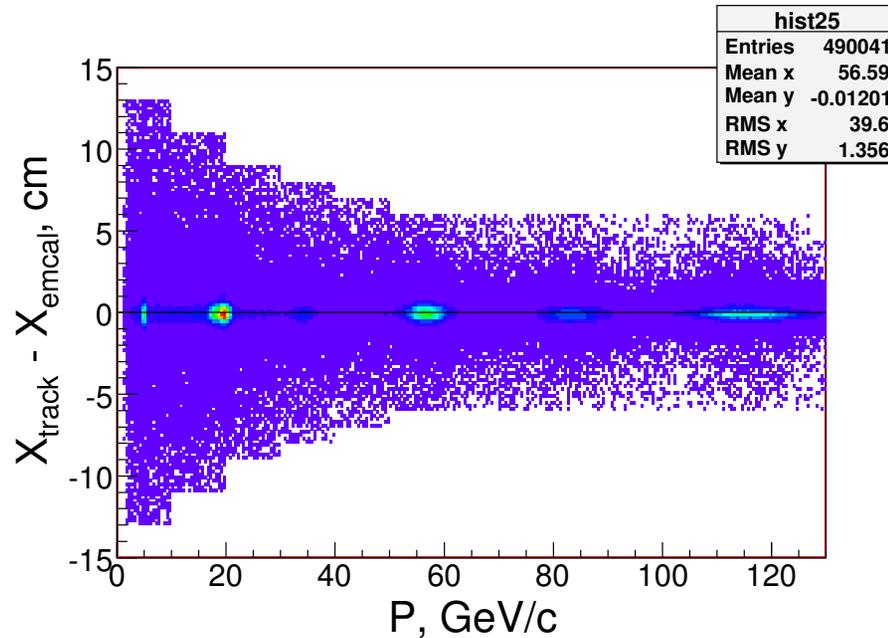
- $n_{\text{TotalTrks}} \leq 20$
- vertexes are within the target location
- tracks are within RICH windows (*new*)
- $20 < N_{\text{TPCPoints}} < 95$
- $-10 < \text{TrkTime} < 50$ ns
- Tracks with the DC4, PWC5 and PWC6 hits
- The track projections are within EMCAL aperture
- matching window depend on track momentum

RICH windows cut



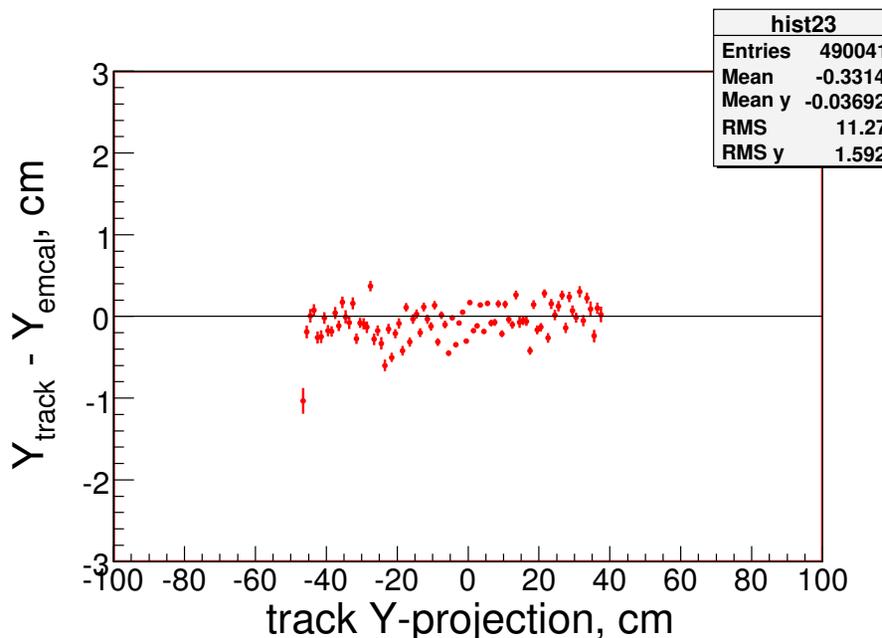
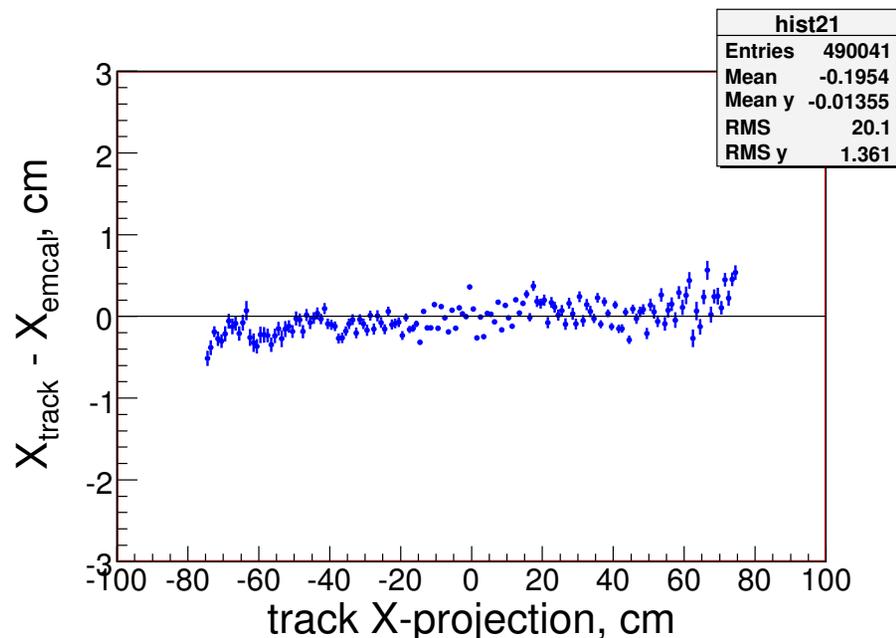
The track projection scatter plot at EMCAL z-position. RICH window cuts were applied: “inrichFwin” for front and “inrichRwin” for rear windows. In cases when tracks are out of RICH window, then multiple scattering in about 4cm thick Al should be taken in account.

matching window vs track momentum



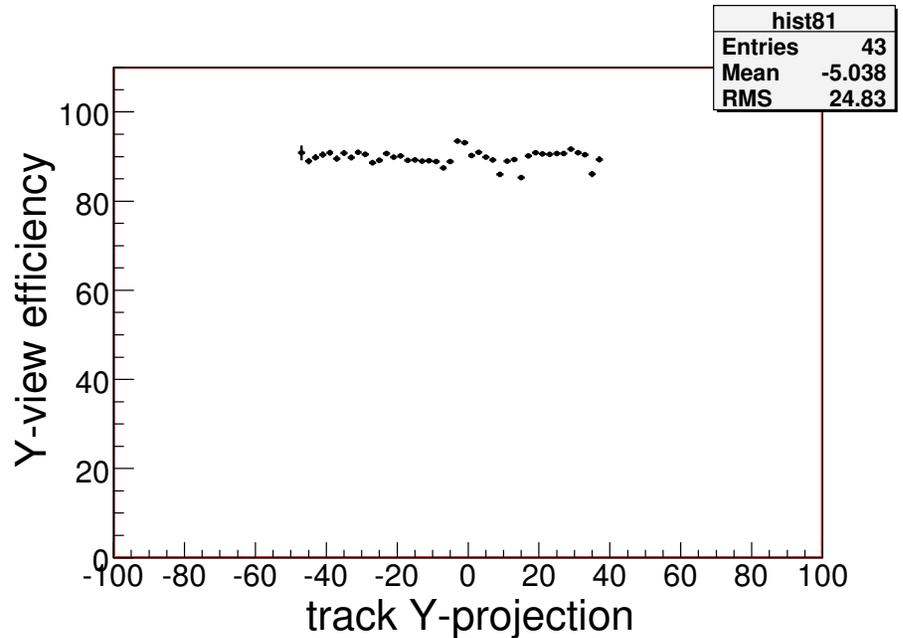
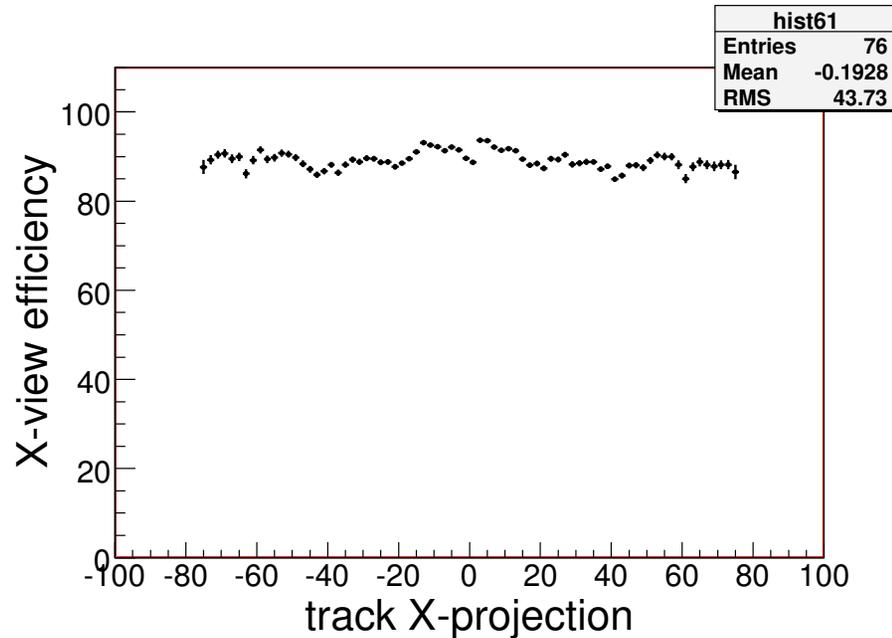
The ΔX and ΔY distributions vs the track momentum. The reason for this feature is due to multiple scattering of particles on: TOF scintillators, CKOV walls and volume, RICH ... Steps on plots indicate the applied window cut for matching. Tracks position accuracy in Y-view is worse than in X-view, due to the matching window being slightly wider.

matching vs track position



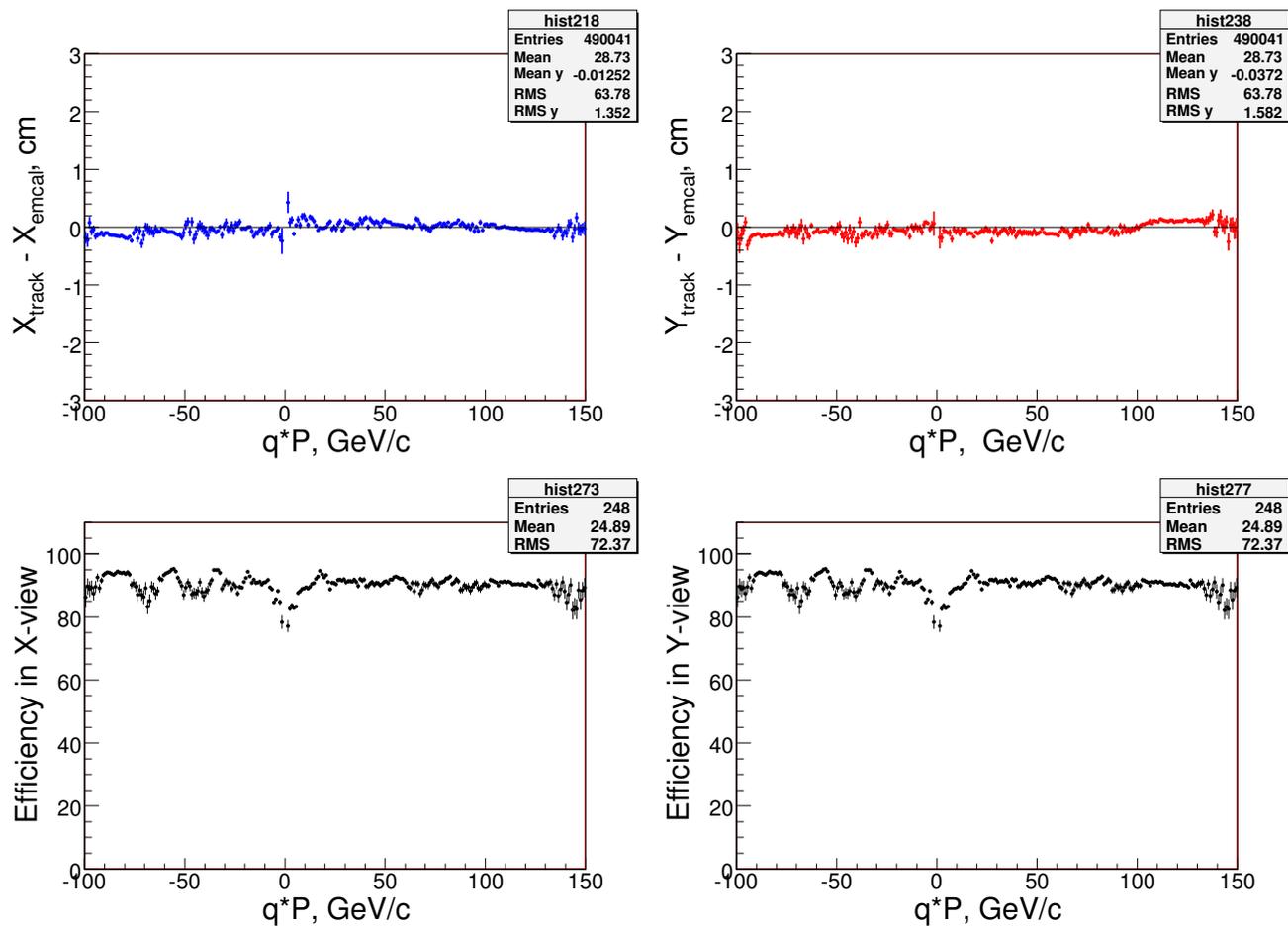
The mean values of ΔX and ΔY distributions vs the track position. Small slope in ΔX data suggests that: a) wire spacing in EMCAL is off or b) B-field of JGG and/or Rosie are off and c) both above. Since the effect is small (about 0.3%) in comparison with the beam momentum uncertainties, it can be neglected for now. Edges in Y-view data are limited by RICH exit window. Dropped point at -47 cm in Y-view indicates that: a) RICH alignment is off or b) track projection is off due to multiple scattering. More safe way: make cut a few cm away from actual window.

matching efficiencies vs position



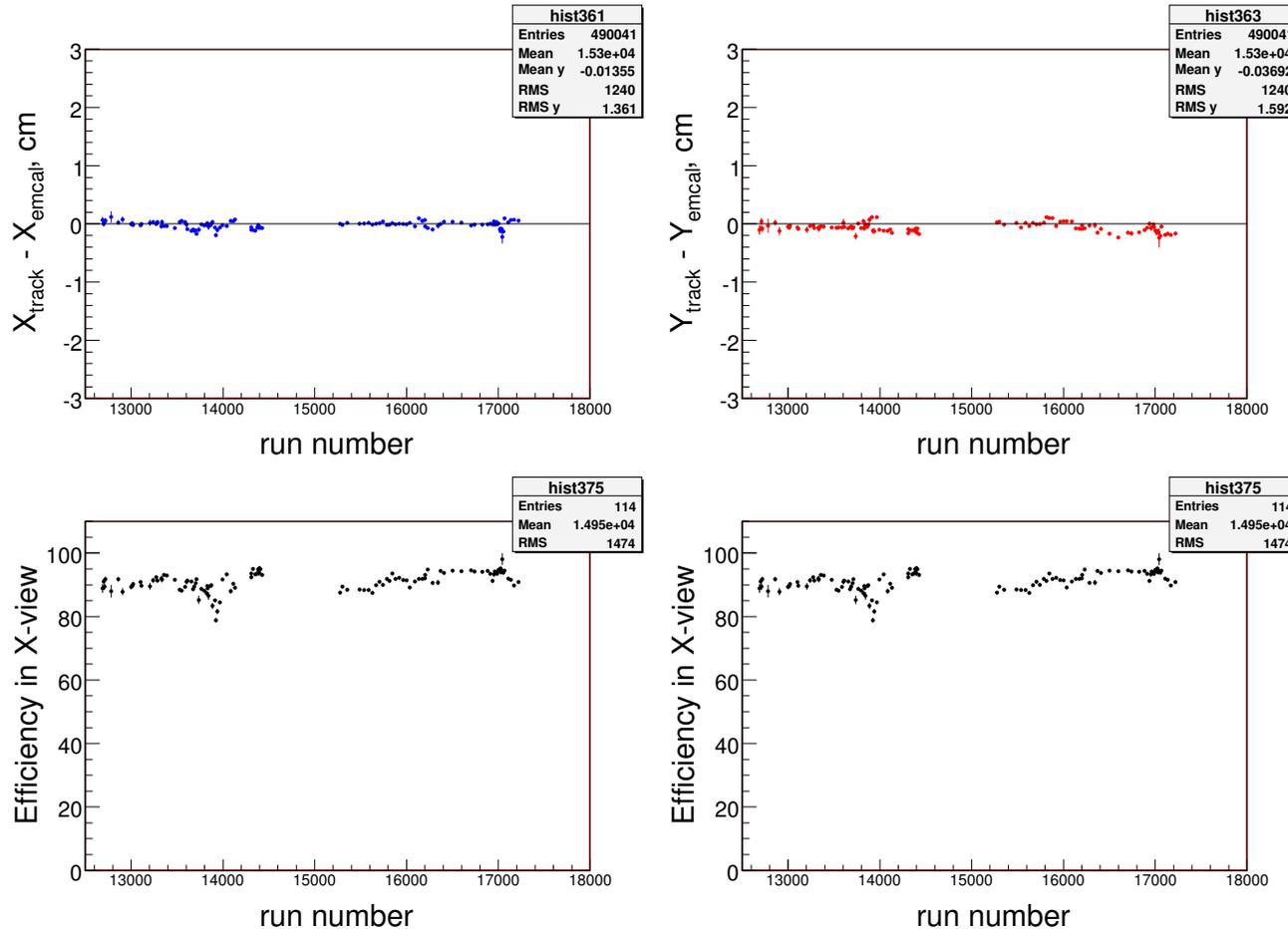
Track - EMCAL matching efficiencies distributions vs track position at EMCAL z-position. Edges in Y-view data are limited by RICH exit window. Efficiencies were calculated for cases, when track matched with EMCAL shower in both views simultaneously.

matching vs $q \cdot P$



Top plots - the mean values of ΔX and ΔY distributions vs the $q \cdot P$ of tracks. Bottom plots - the track - emcal matching efficiencies vs the track momentum. Small drop in efficiency plot at $q \cdot P \approx 0$ indicates that the matching window is tight for particle's momentum less than 3 GeV/c.

matching vs run number



The top plots: the mean values of ΔX and ΔY distributions vs the run number. Bottom - the matching efficiency vs the run number. Empty region around run ≈ 1500 is NuMI target data, they are dropped for these studies. Lowest efficiency run is 13923, where $\epsilon = 0.78 \pm 0.01$

summary

EMCAL's chamber positions were tuned using pass 2 data. Pass 4a data indicates that overall there are no problems with EMCAL's alignment.

The mean values of ΔX and ΔY distributions are well centered and do not indicate any dependencies vs position and momentum of track, and do not depend on run number.

Track - EMCAL matching efficiencies in both views simultaneously are about 90% high and they demonstrate good plateau vs position and momentum of track. Early studies show that on a few runs the efficiencies might be low (HV drop, ...). For this randomly selected set of runs the efficiencies are okay.