

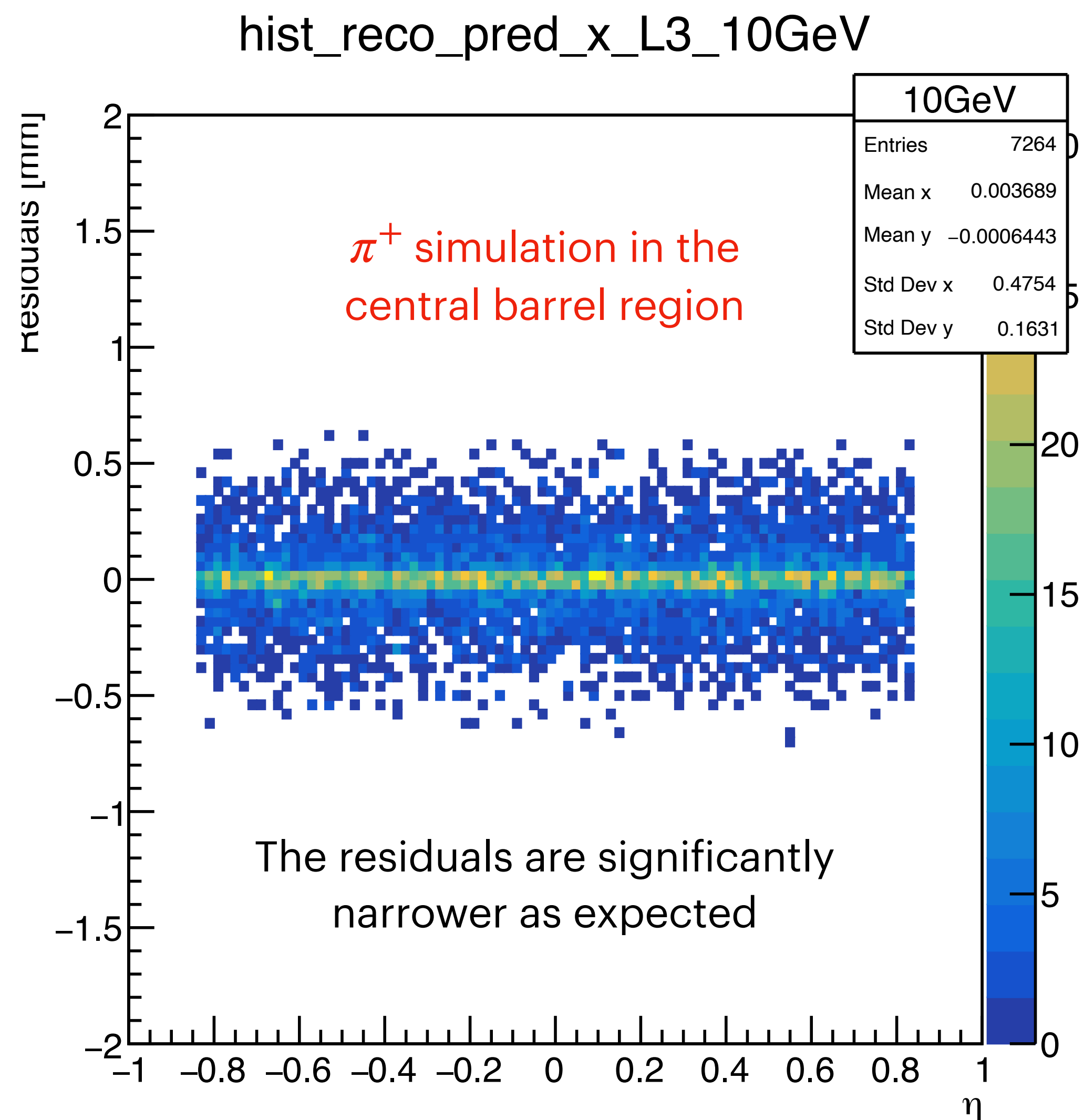
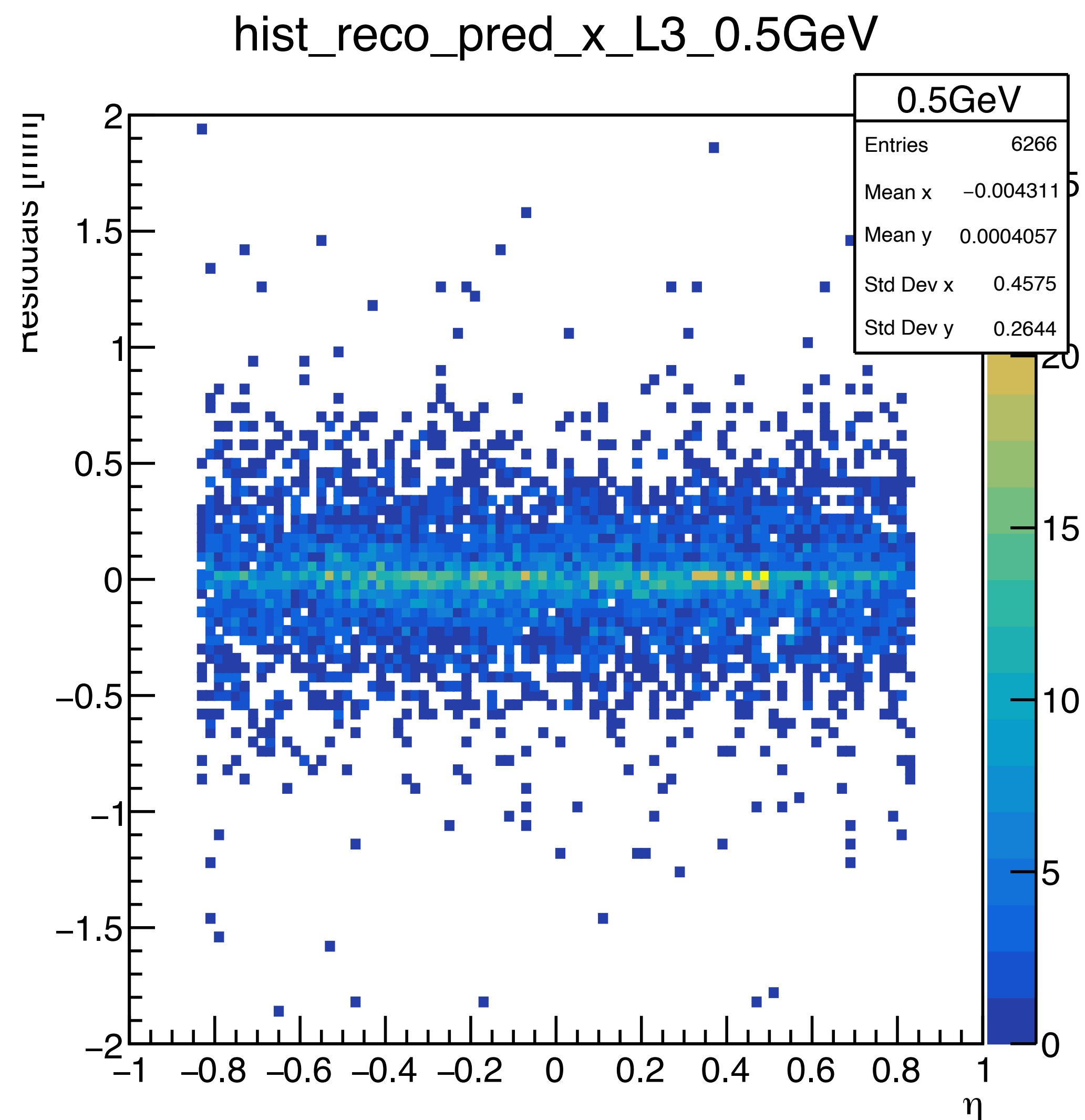
EIC Tracking Update

Vassu Doomra

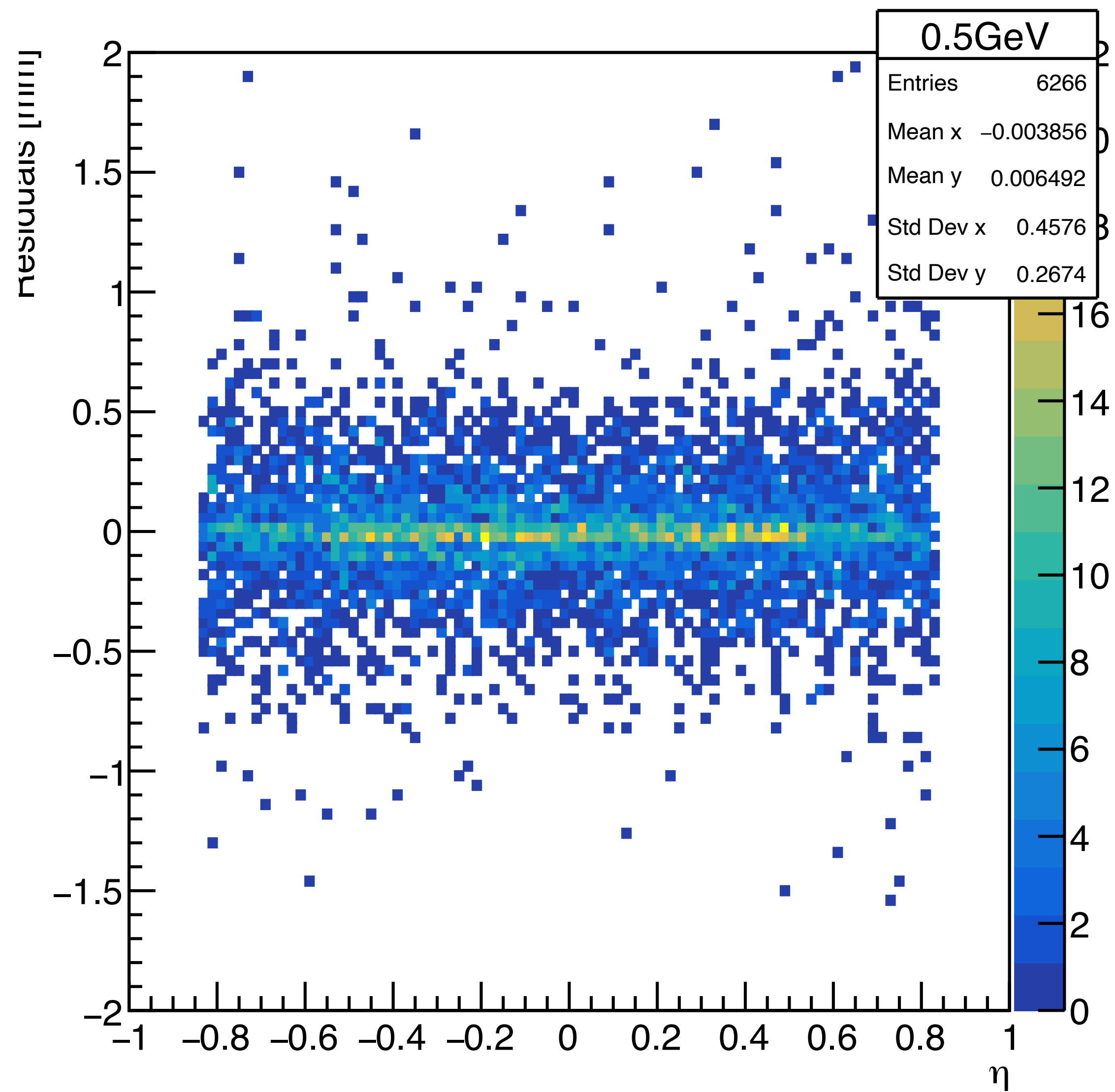
Lawrence Berkeley National Lab

December 2, 2025

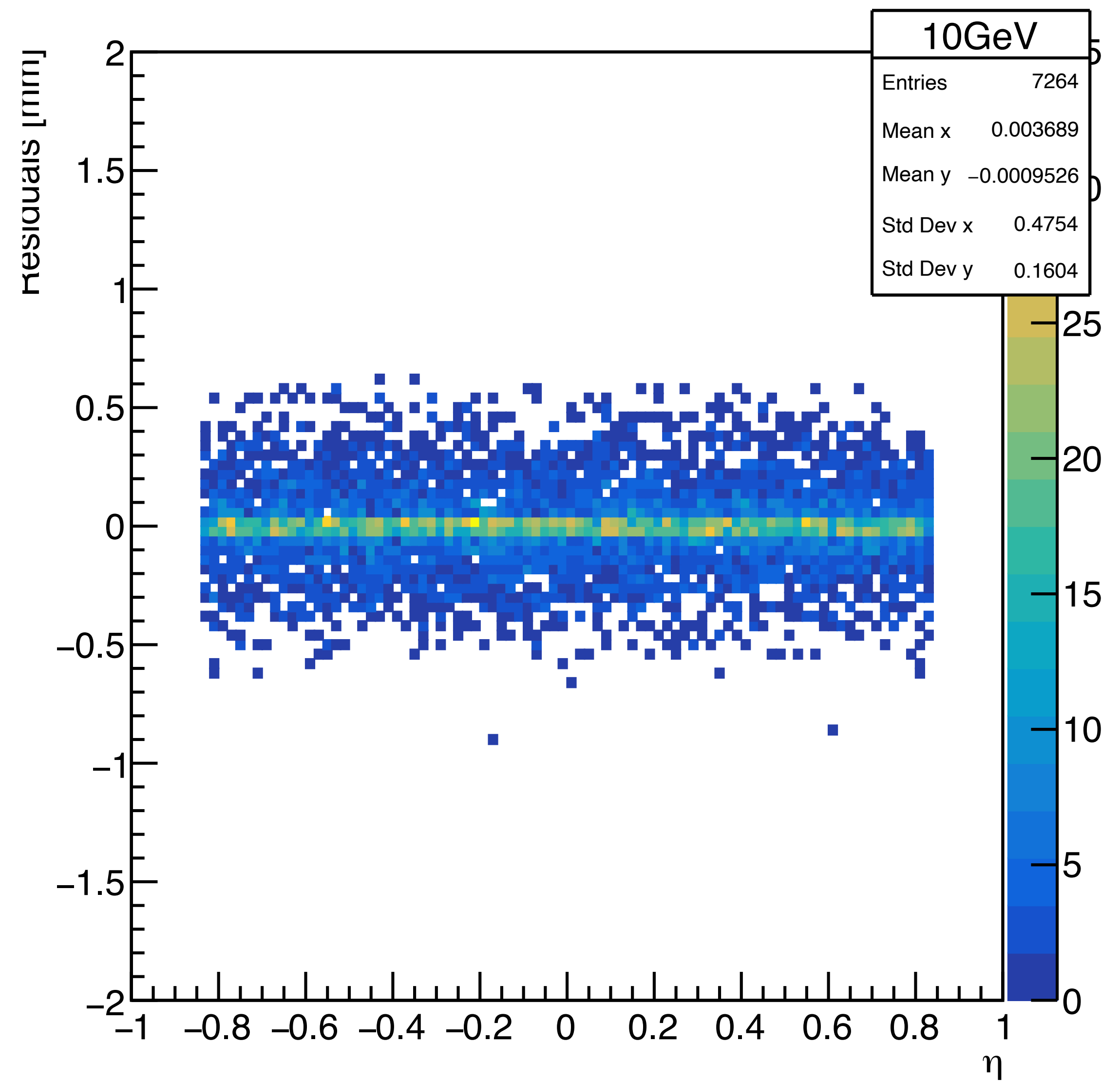
Comparing the residual distributions at the barrel tracking layers L3 and L4



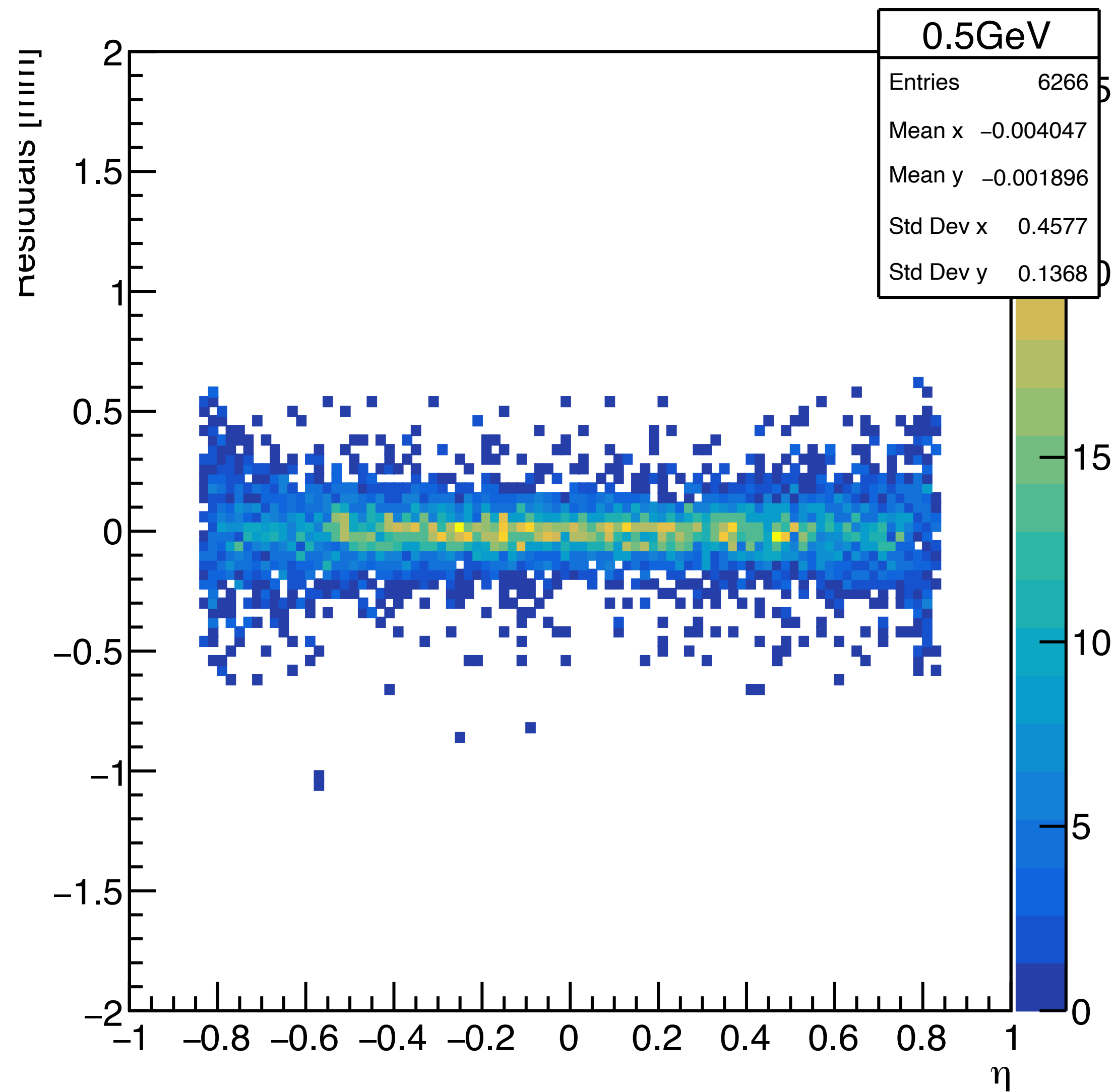
hist_reco_pred_y_L3_0.5GeV



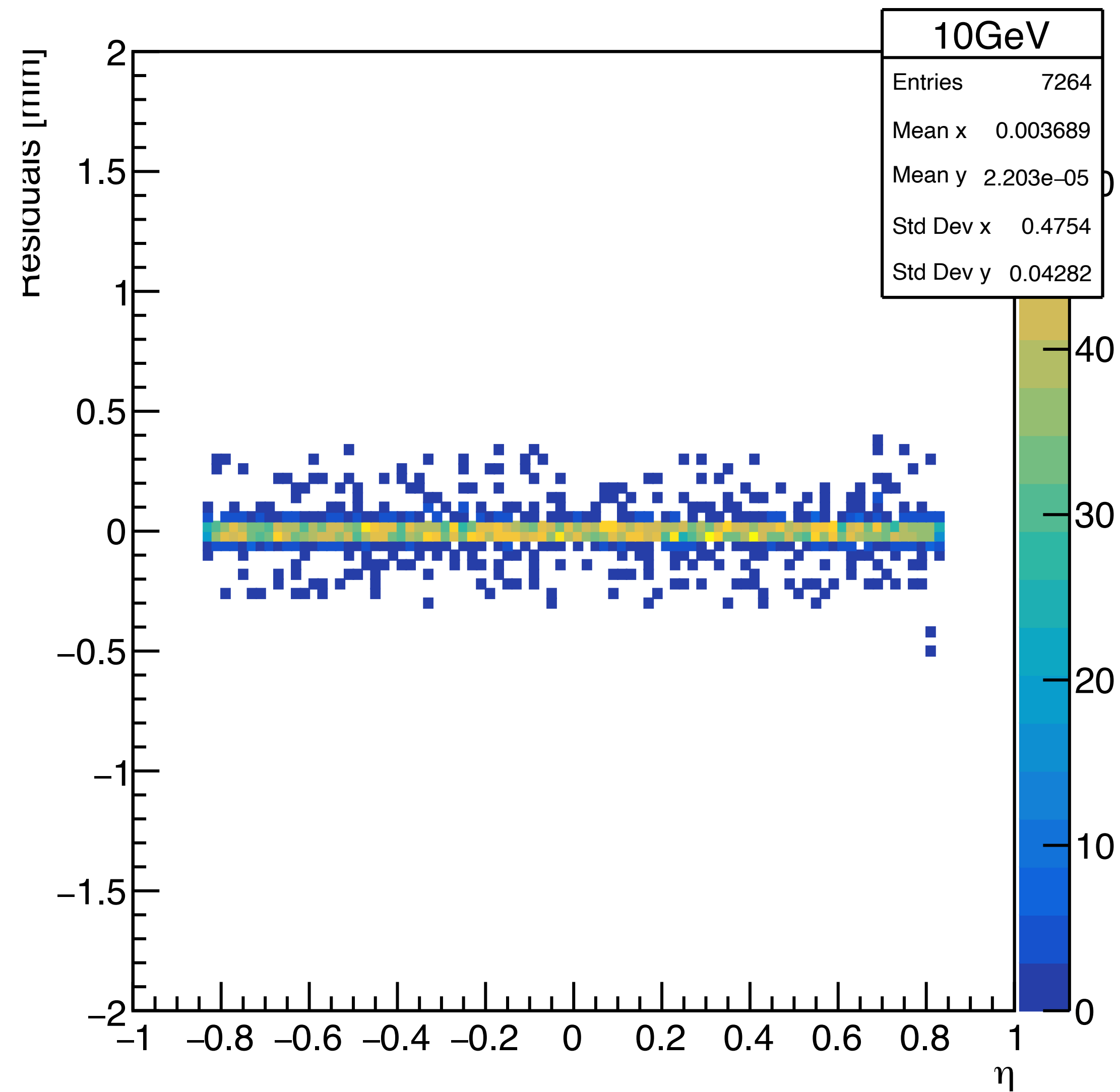
hist_reco_pred_y_L3_10GeV



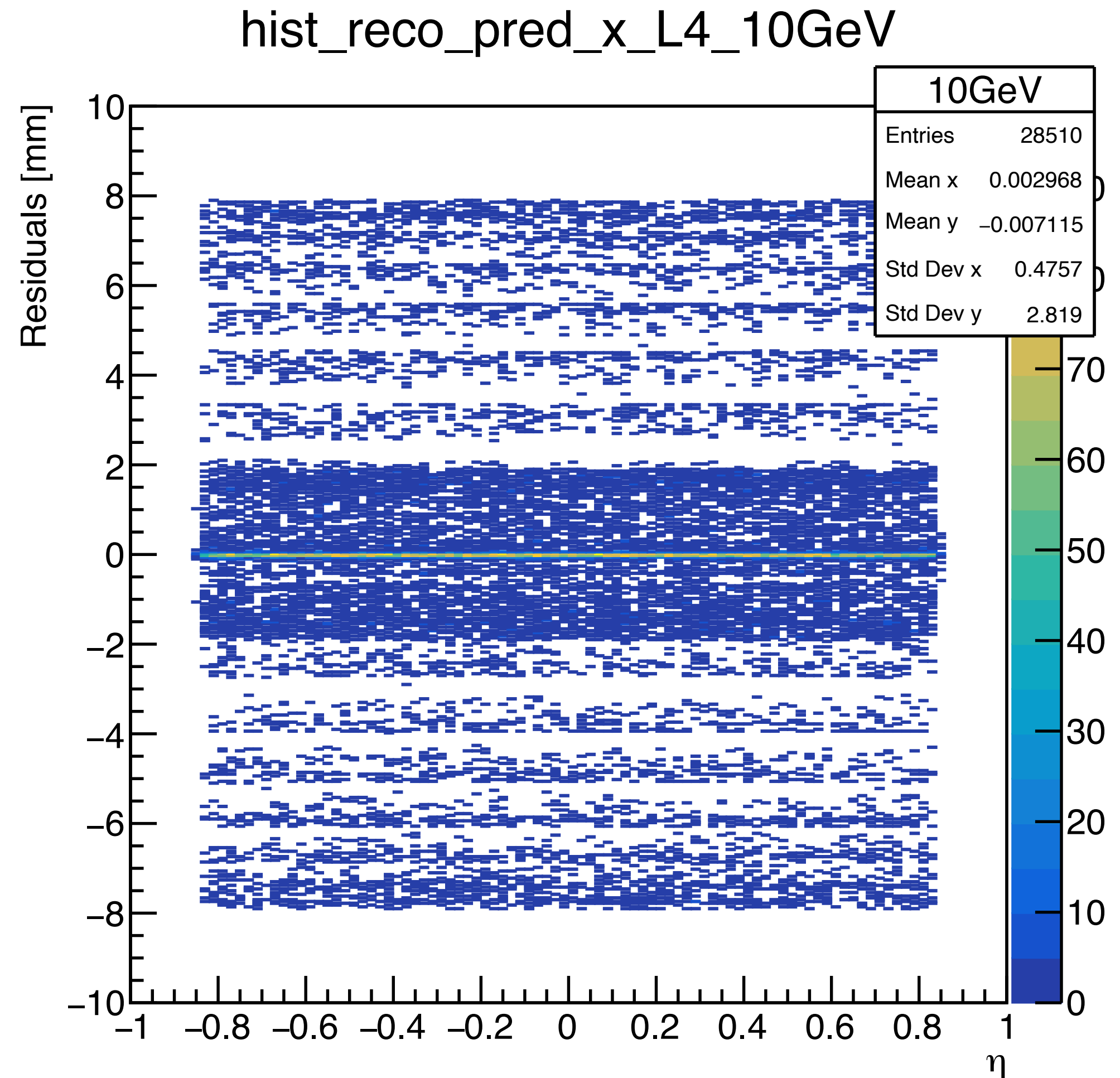
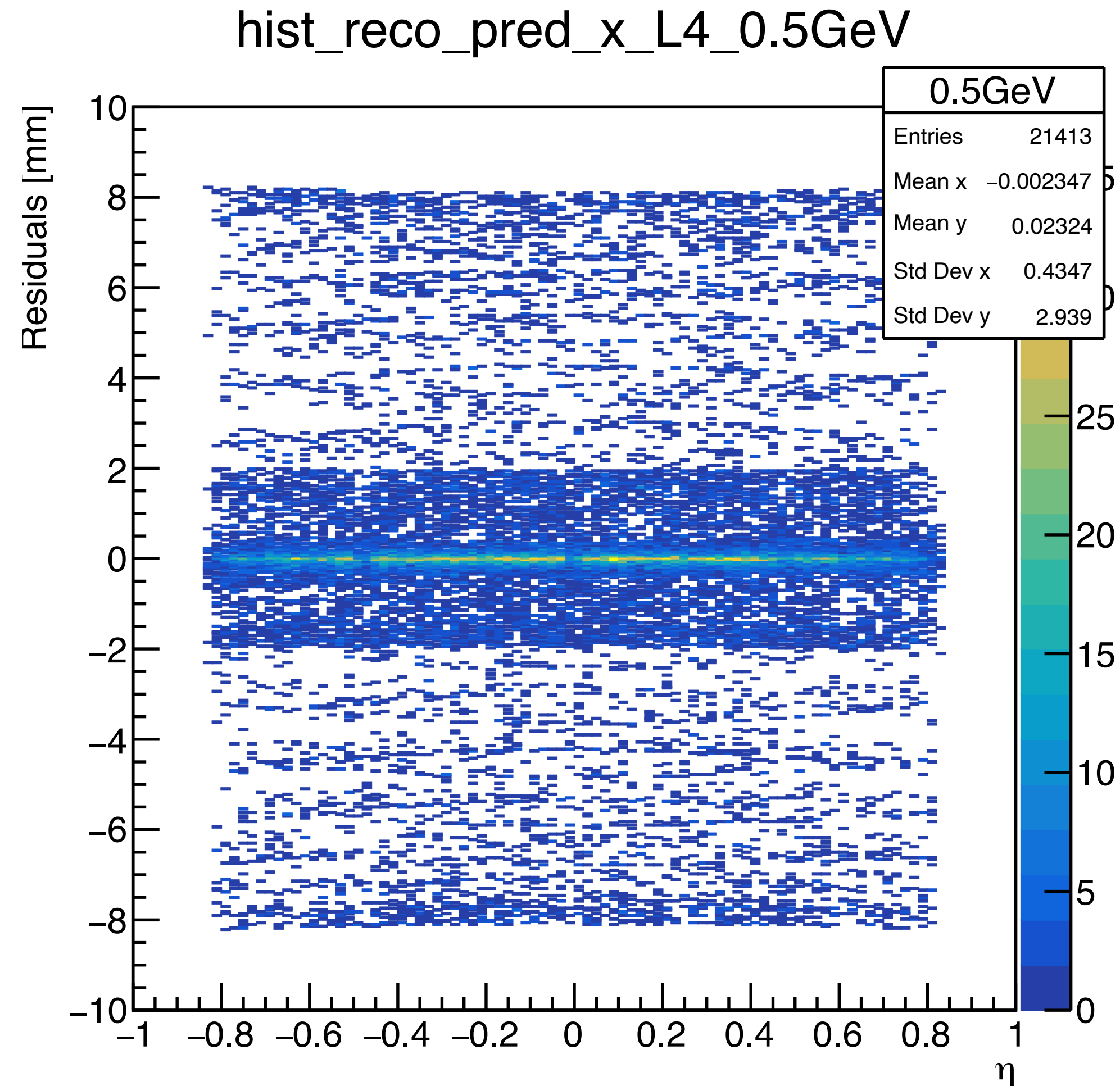
hist_reco_pred_z_L3_0.5GeV



hist_reco_pred_z_L3_10GeV

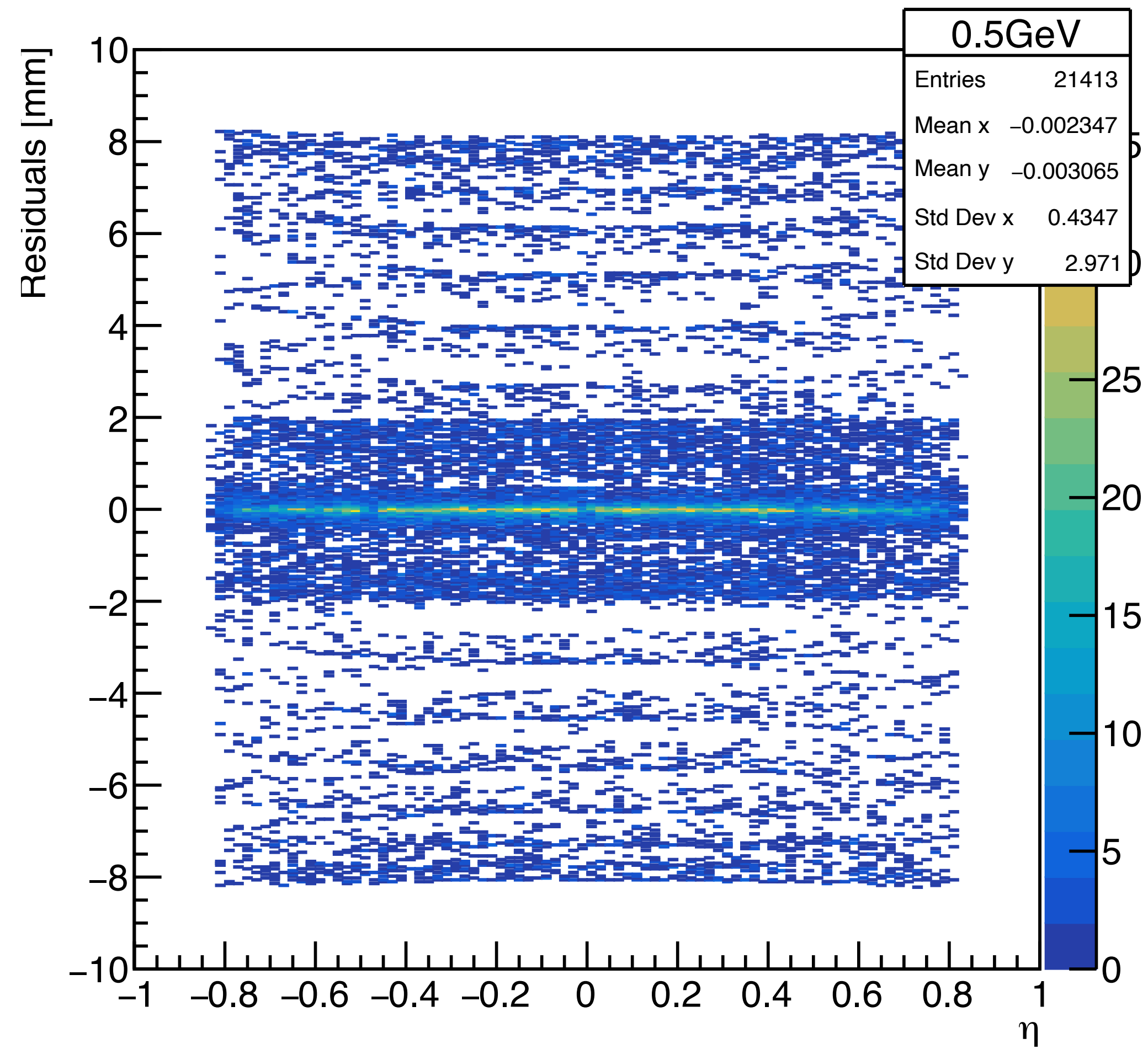


Layer L4: Outer layer in the outer barrel

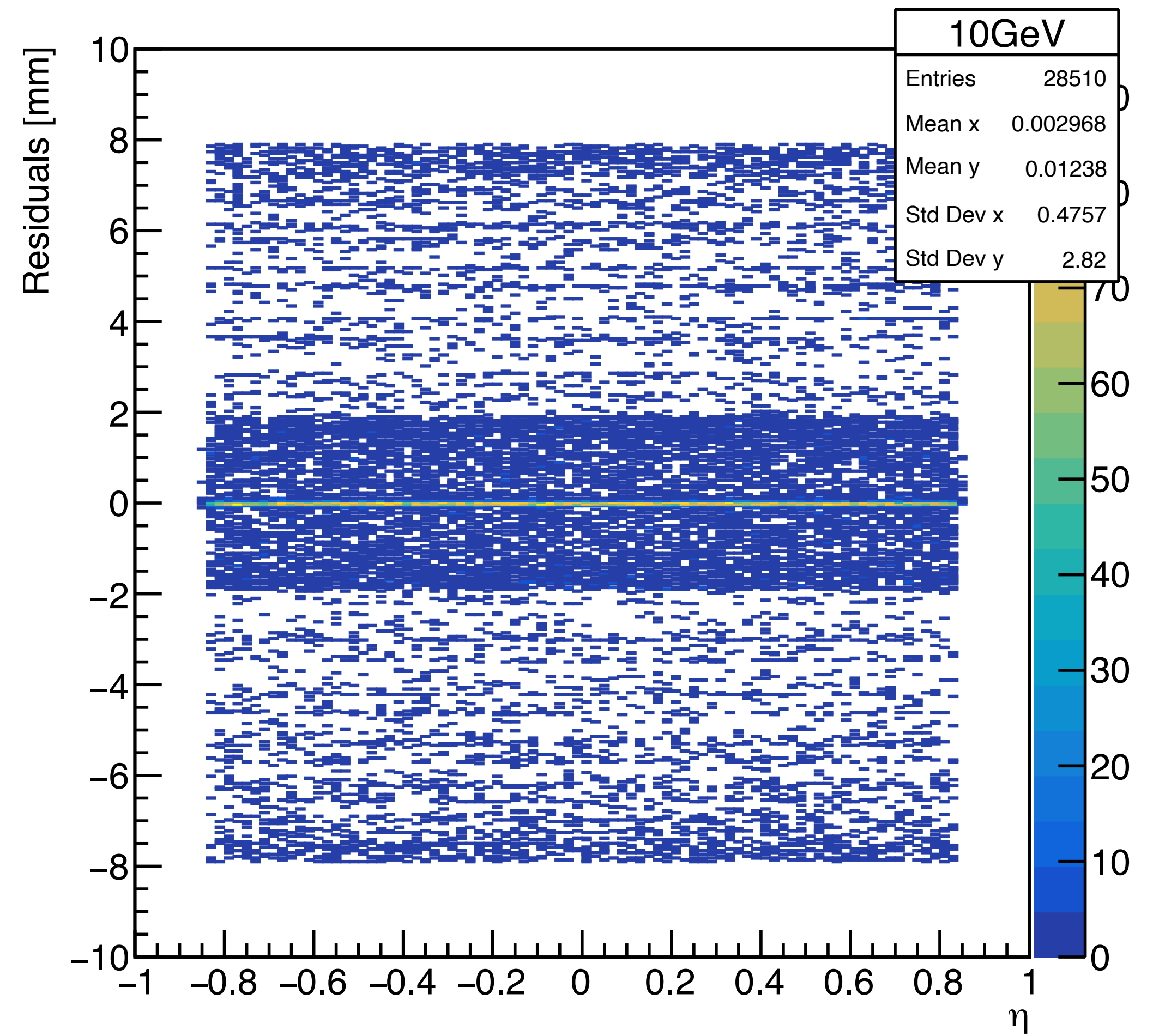


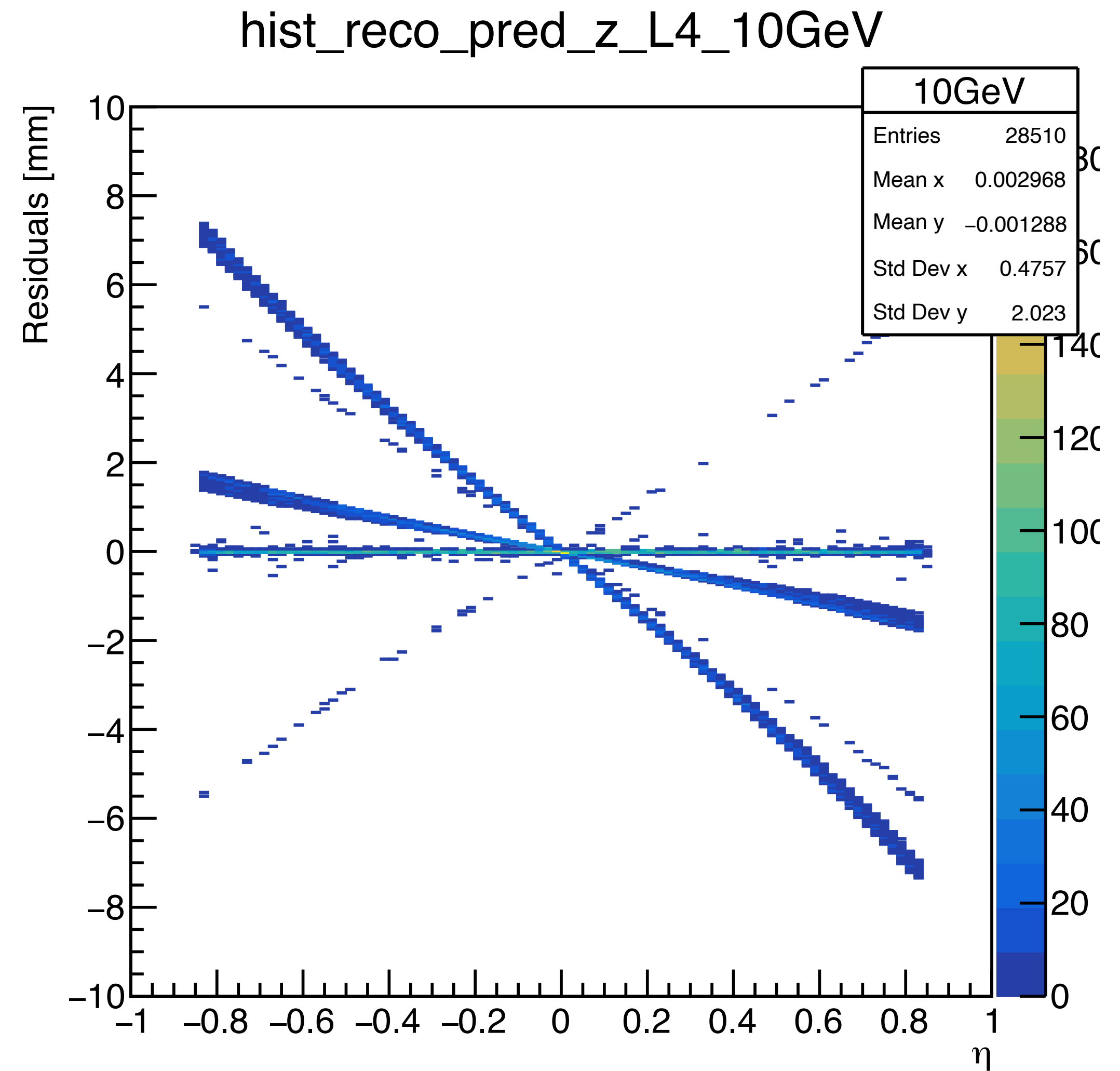
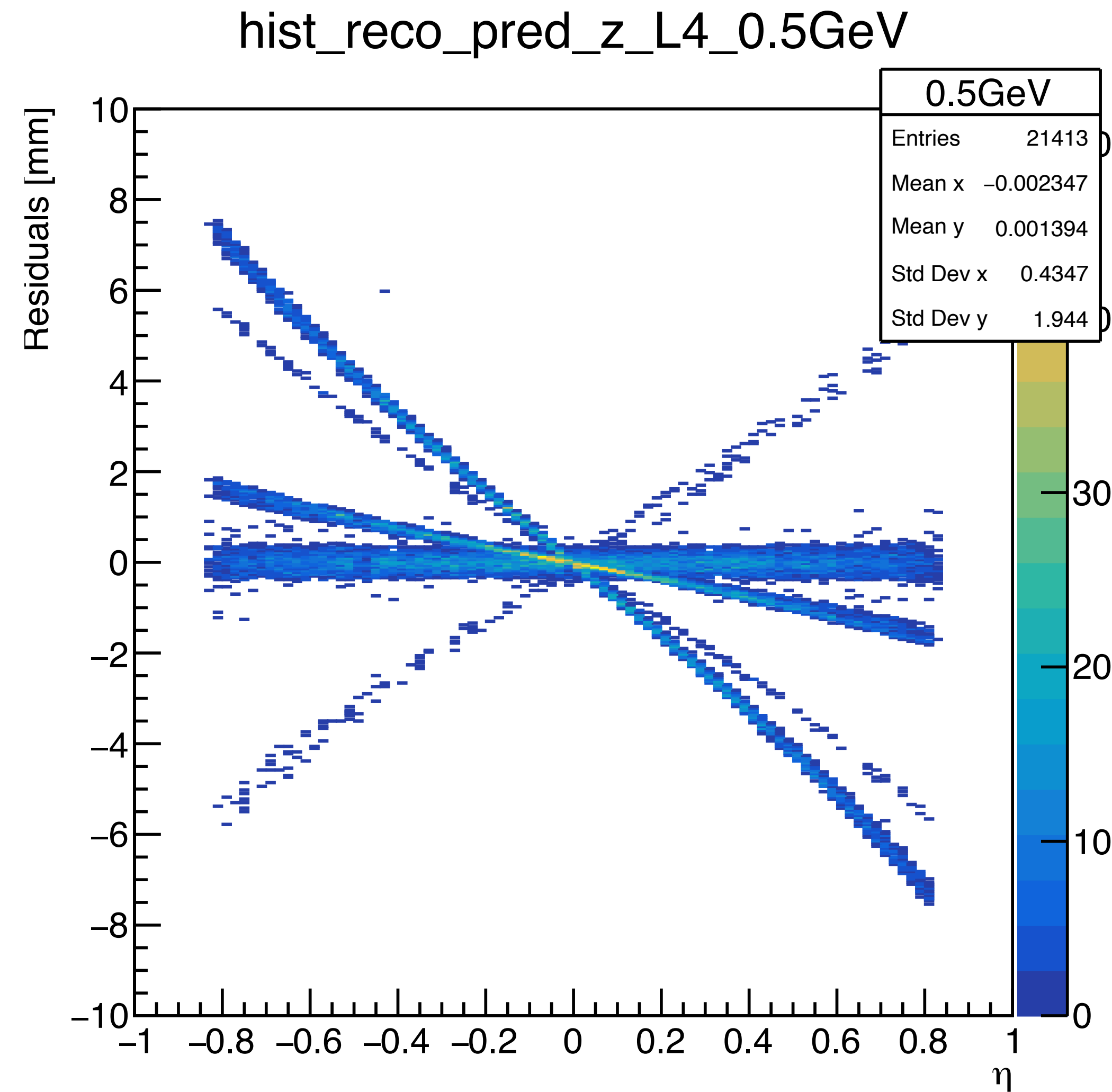
We still have those band structure in the outliers! Prob not some material effect.

hist_reco_pred_y_L4_0.5GeV



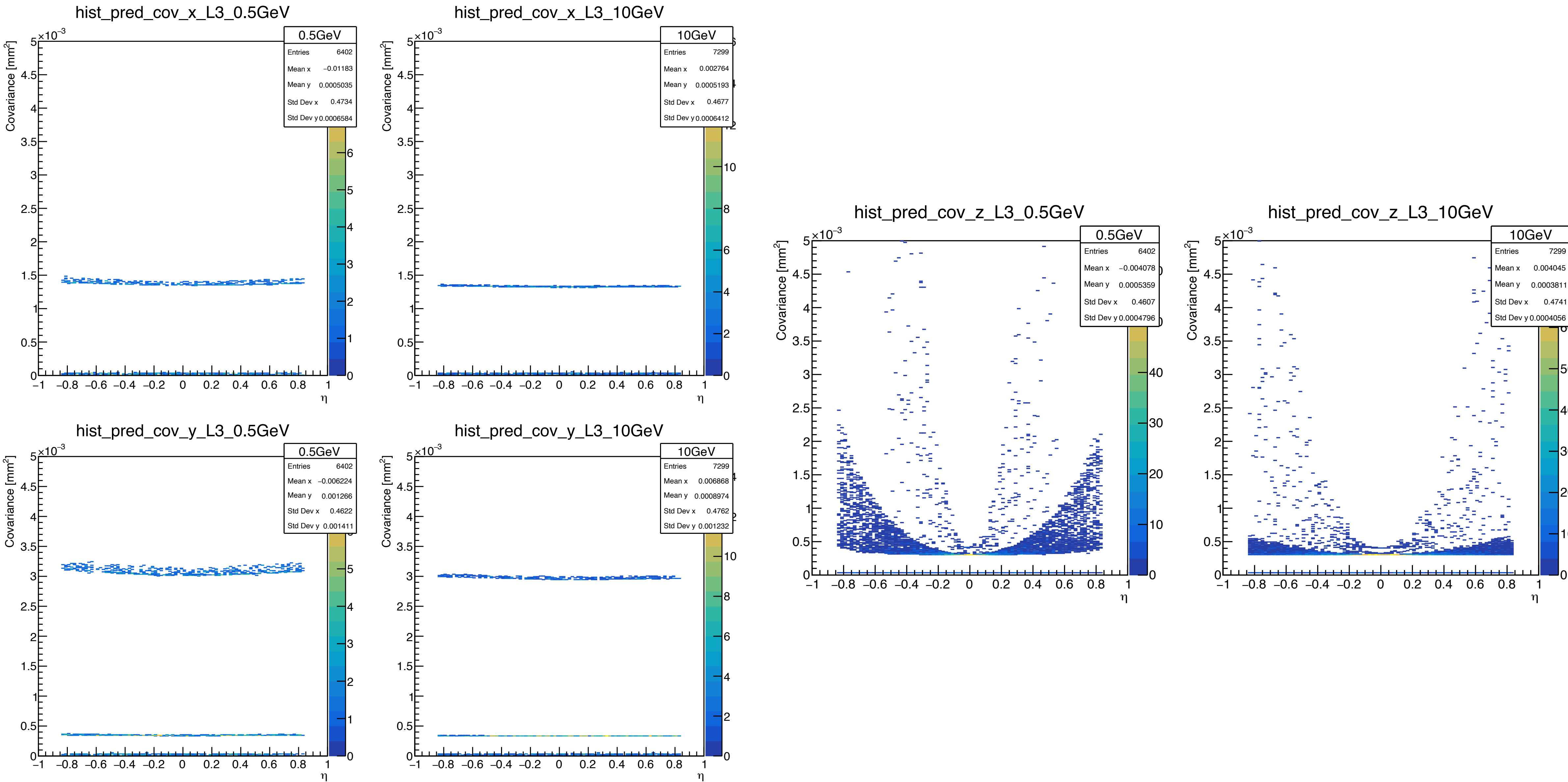
hist_reco_pred_y_L4_10GeV



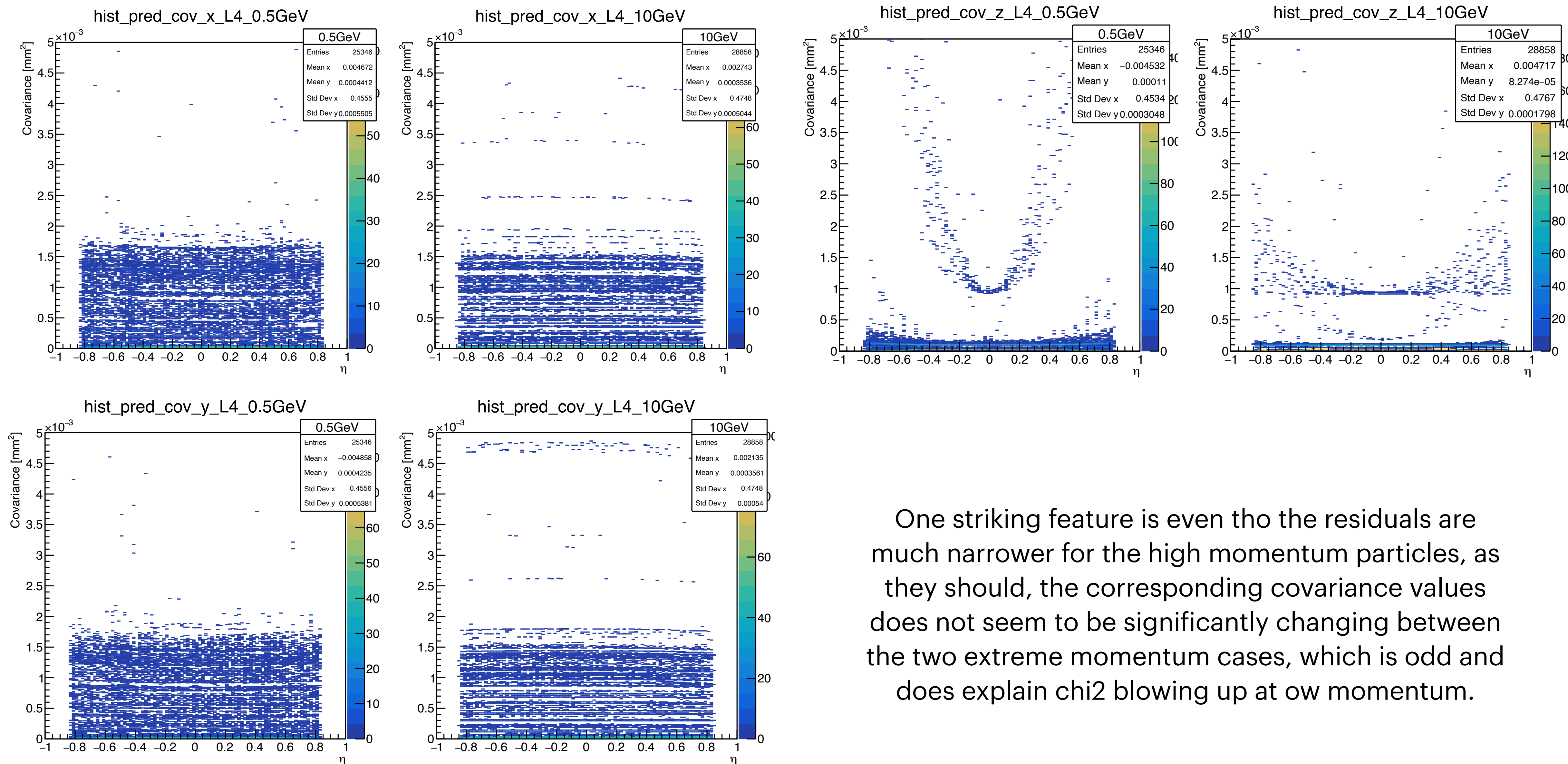


Residuals are def getting a lot more narrower in going from low momentum to high momentum tracks.

Corresponding Covariances at L3 Layer

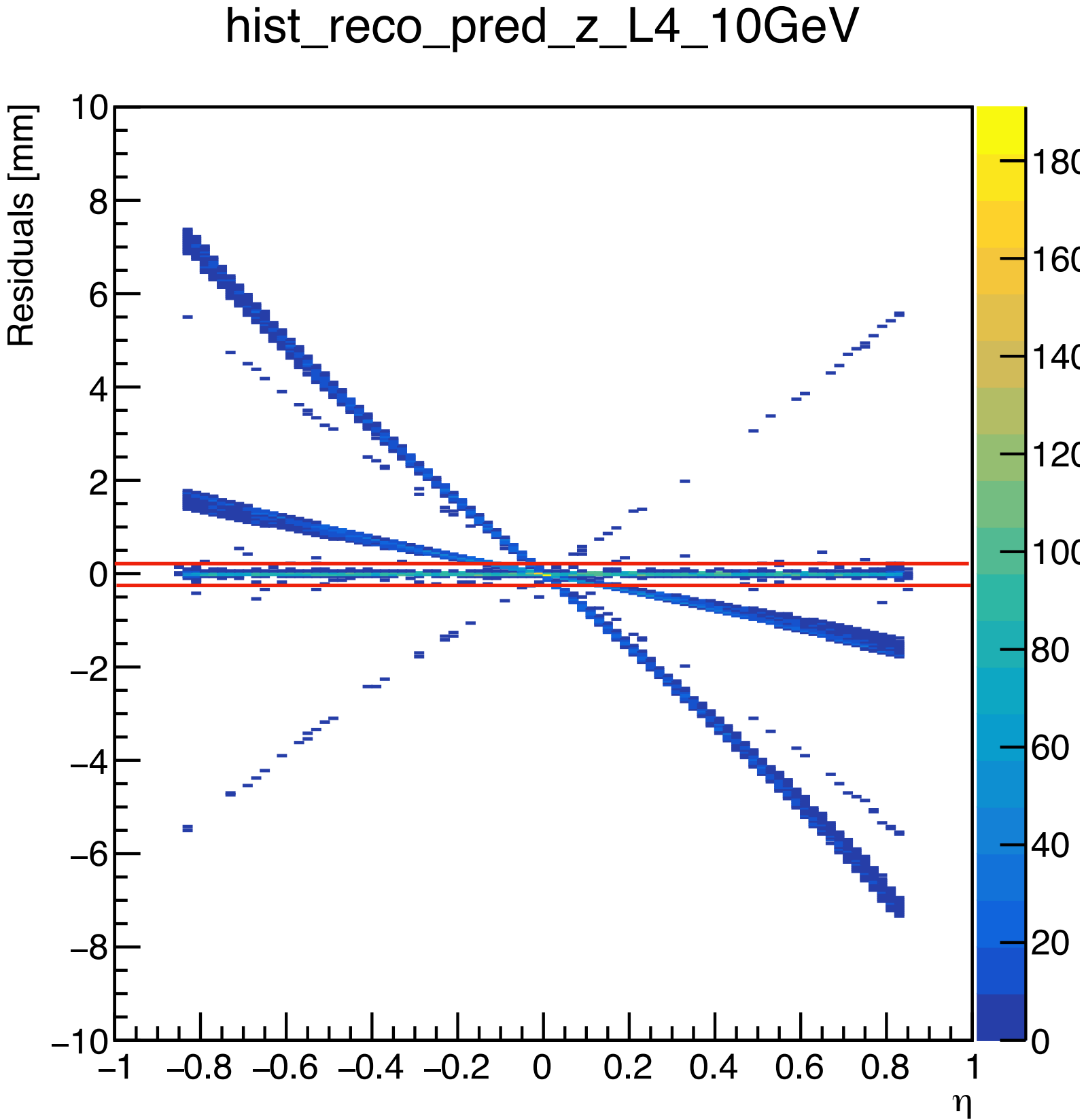


Corresponding Covariances at L4 Layer



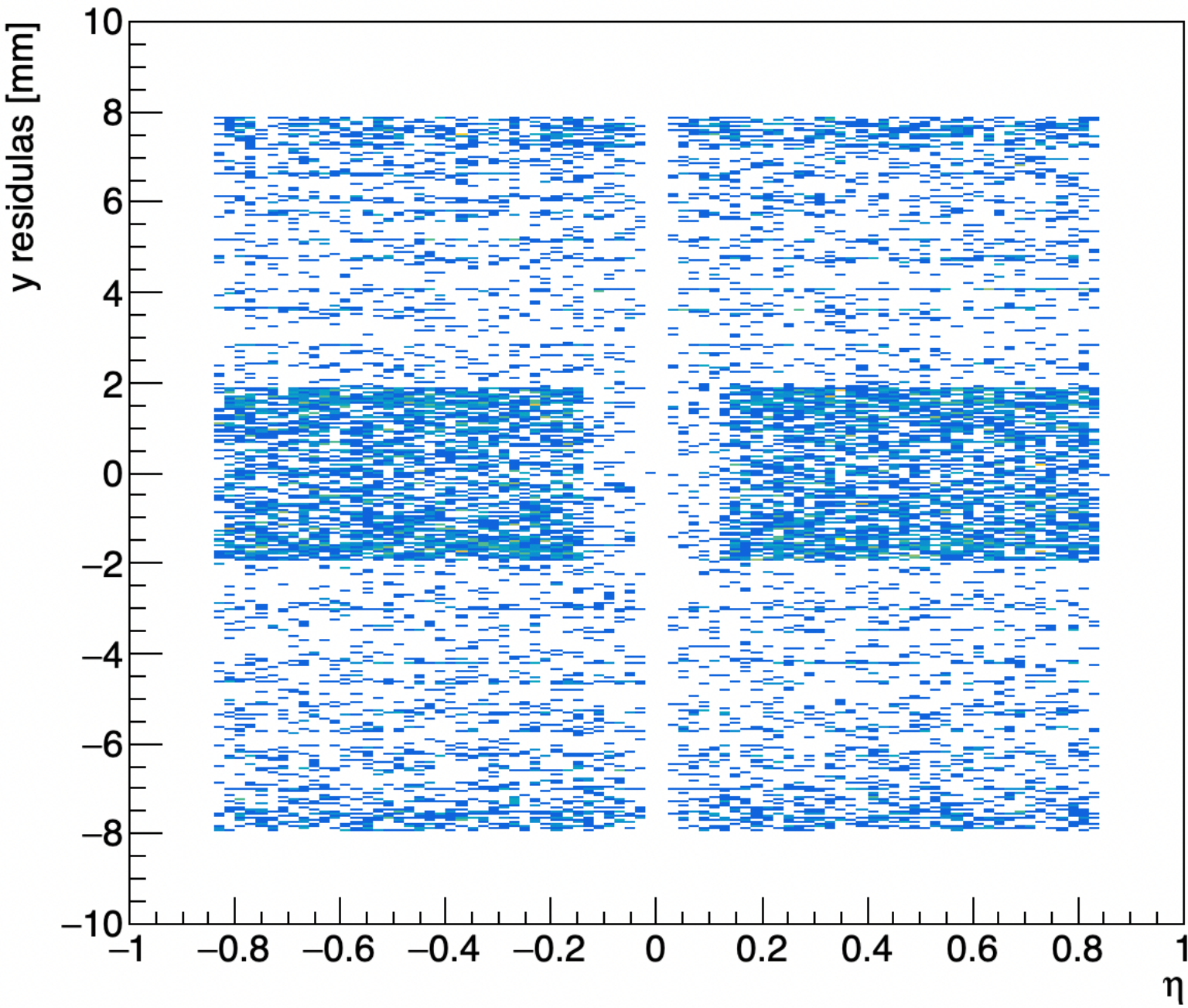
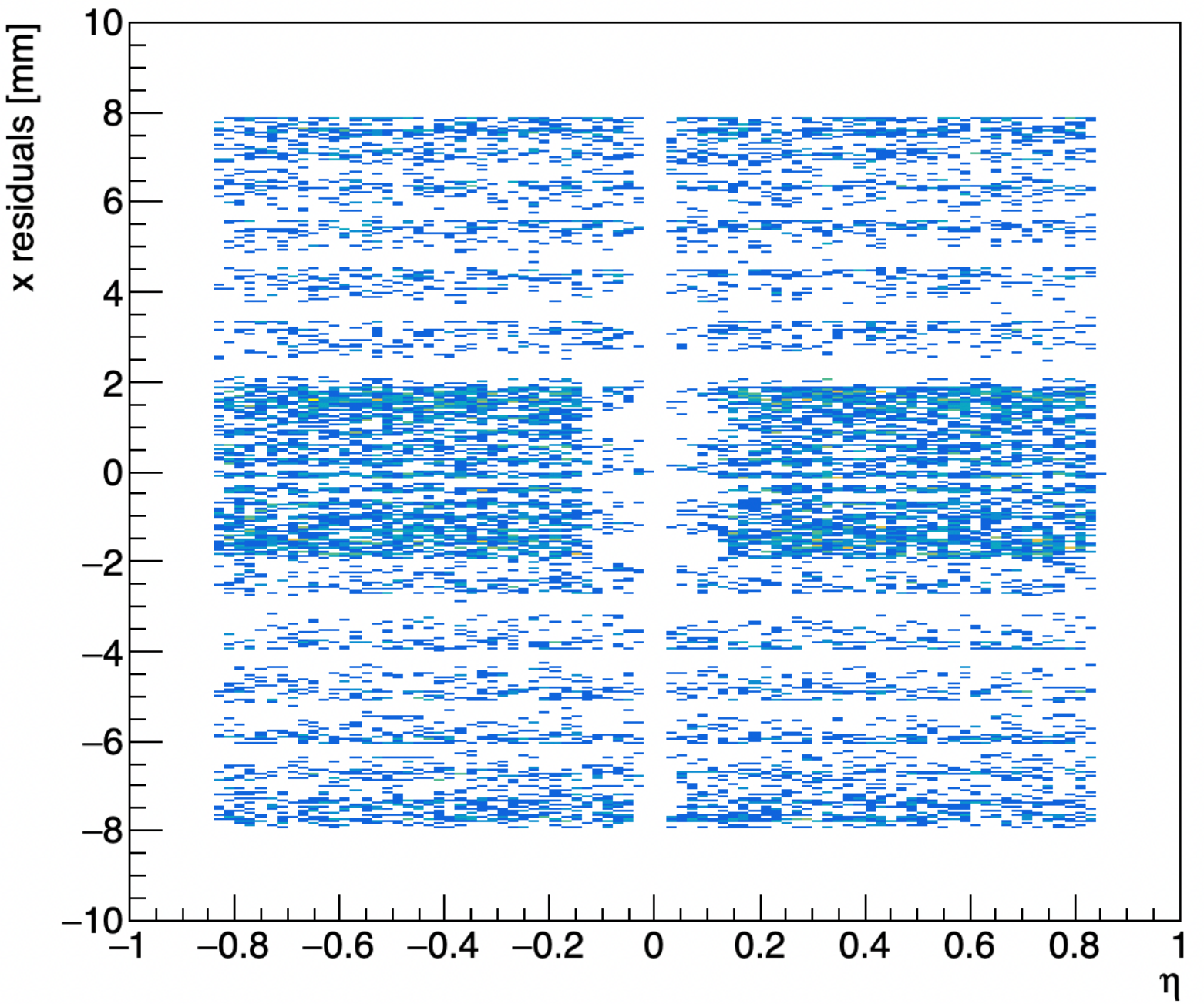
One striking feature is even tho the residuals are much narrower for the high momentum particles, as they should, the corresponding covariance values does not seem to be significantly changing between the two extreme momentum cases, which is odd and does explain chi2 blowing up at ow momentum.

Lets look at the outliers for 10 GeV tracks

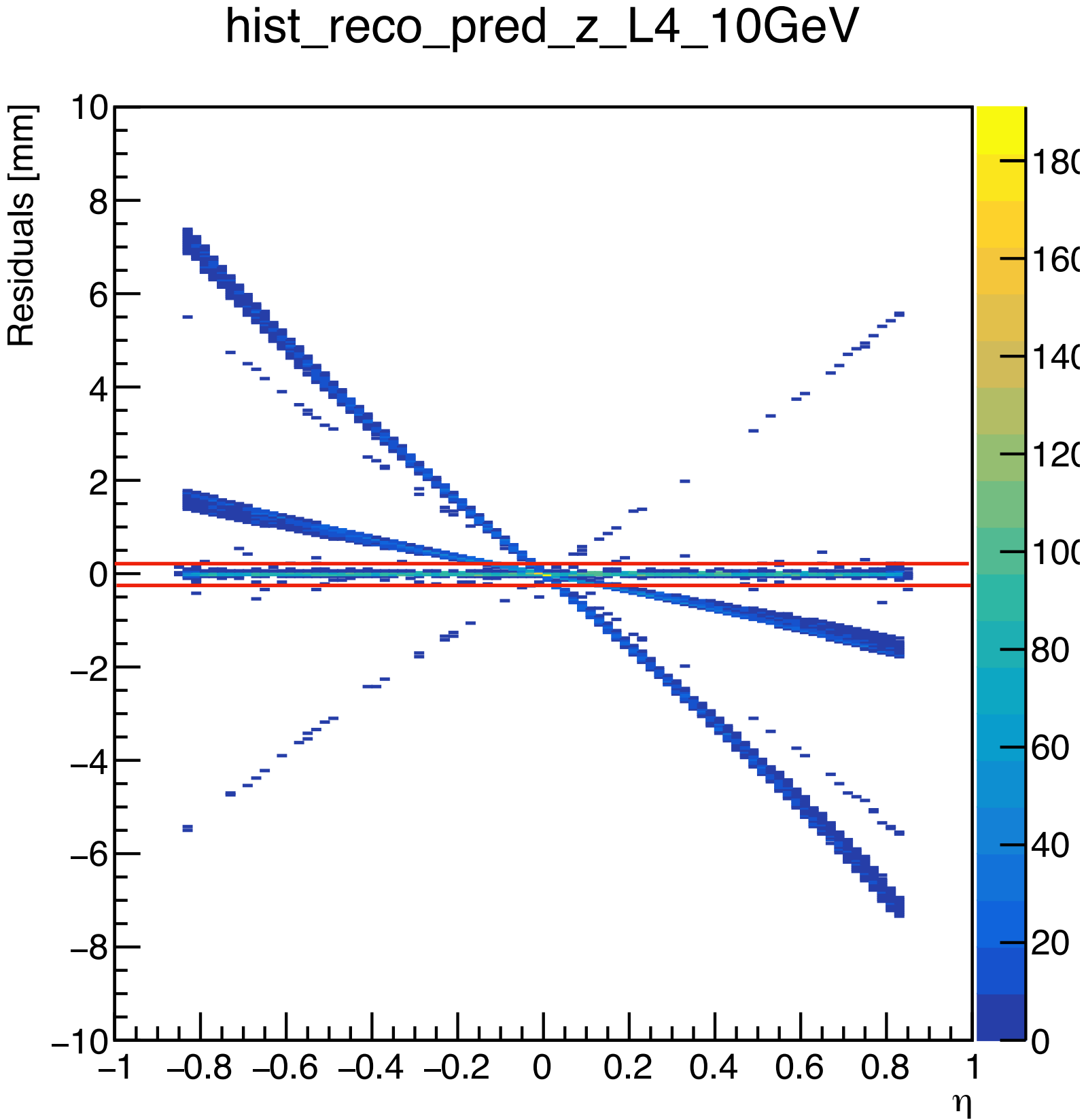


For $|z \text{ residuals}| > 0.25 \text{ mm}$

These outliers does seem to be correlated



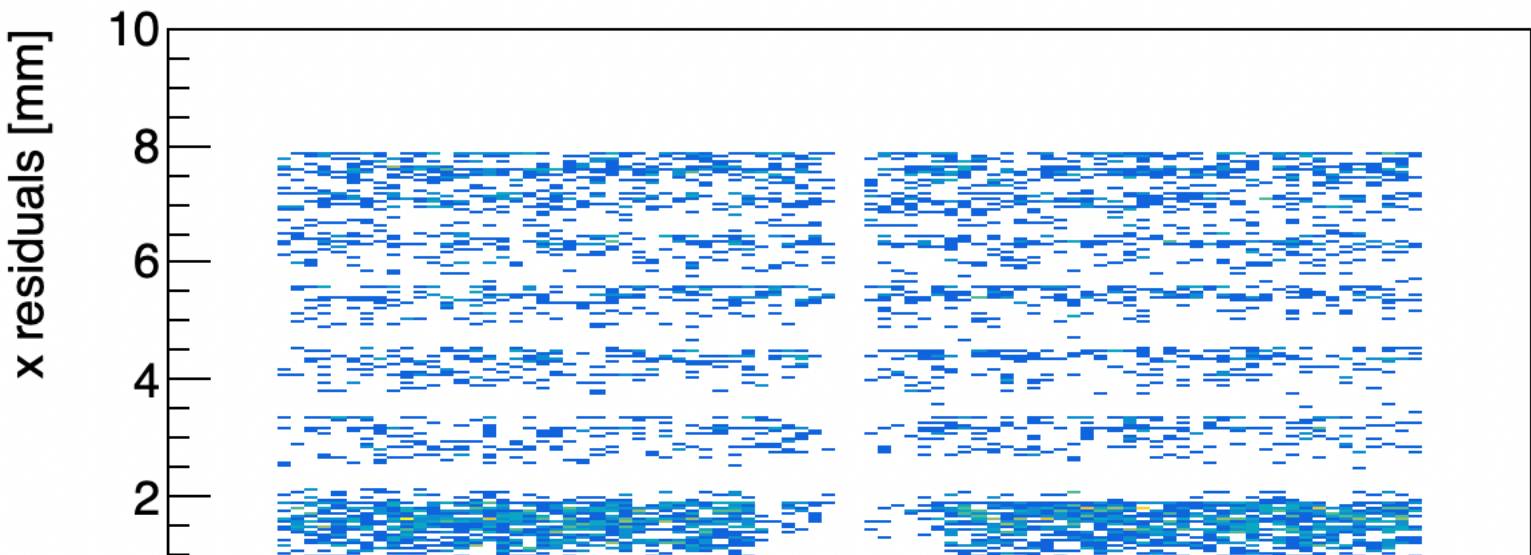
Lets look at the outliers for 10 GeV tracks



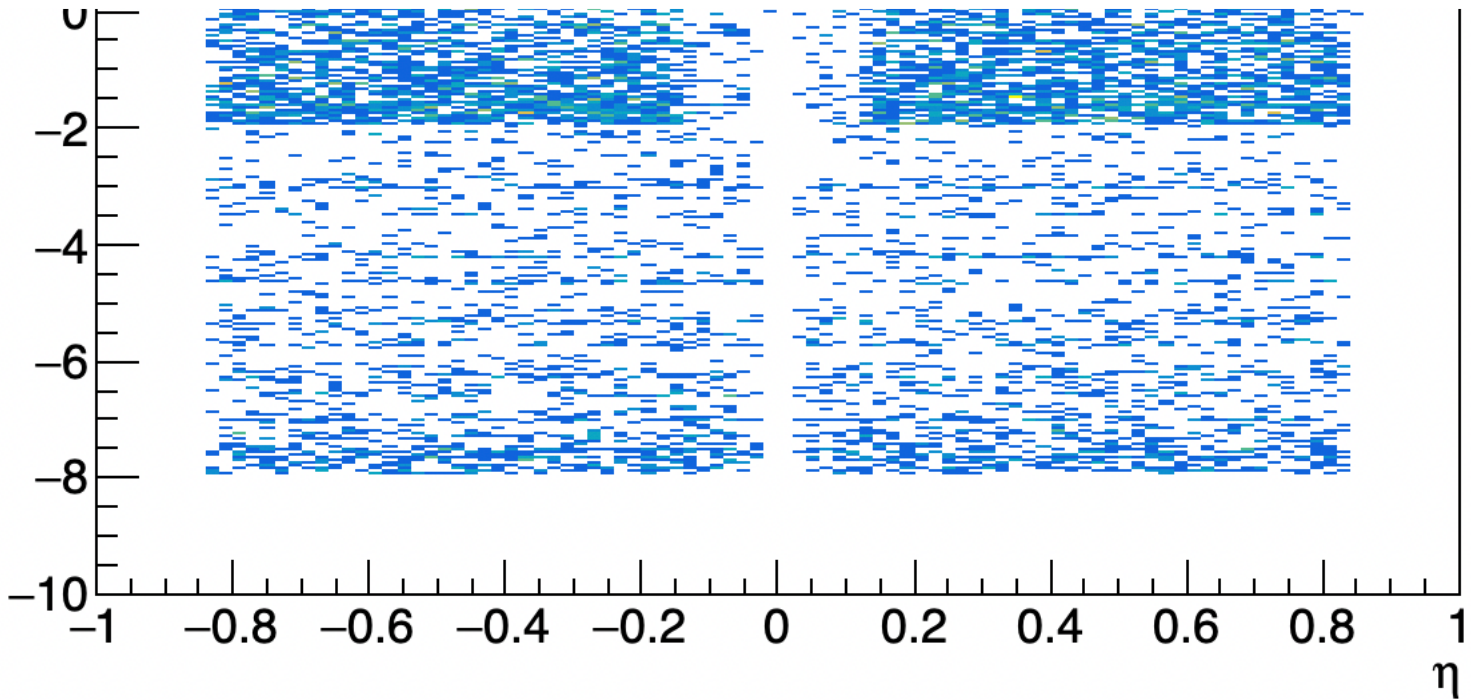
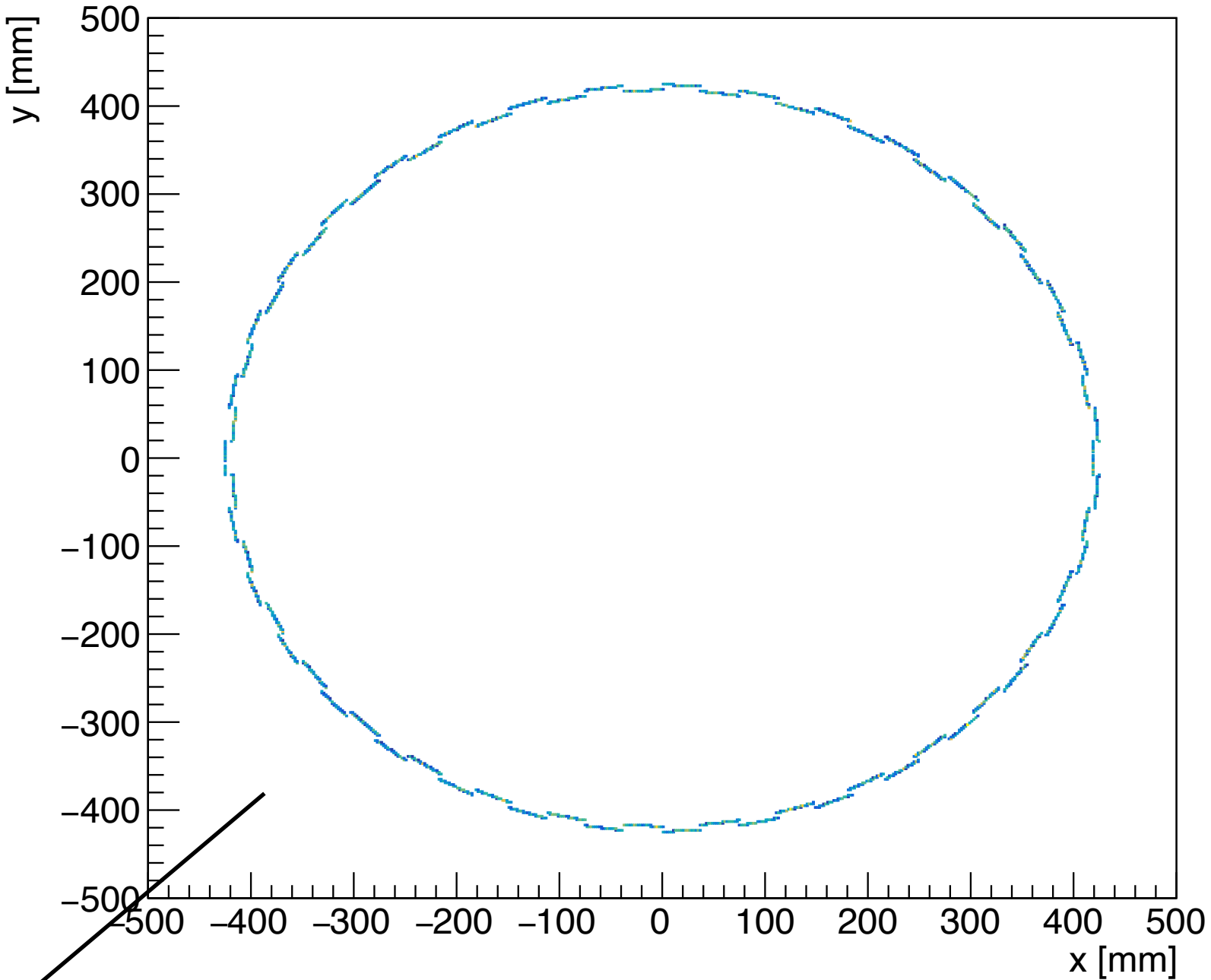
For $|z \text{ residuals}| > 0.25 \text{ mm}$

These outliers does seem to be correlated

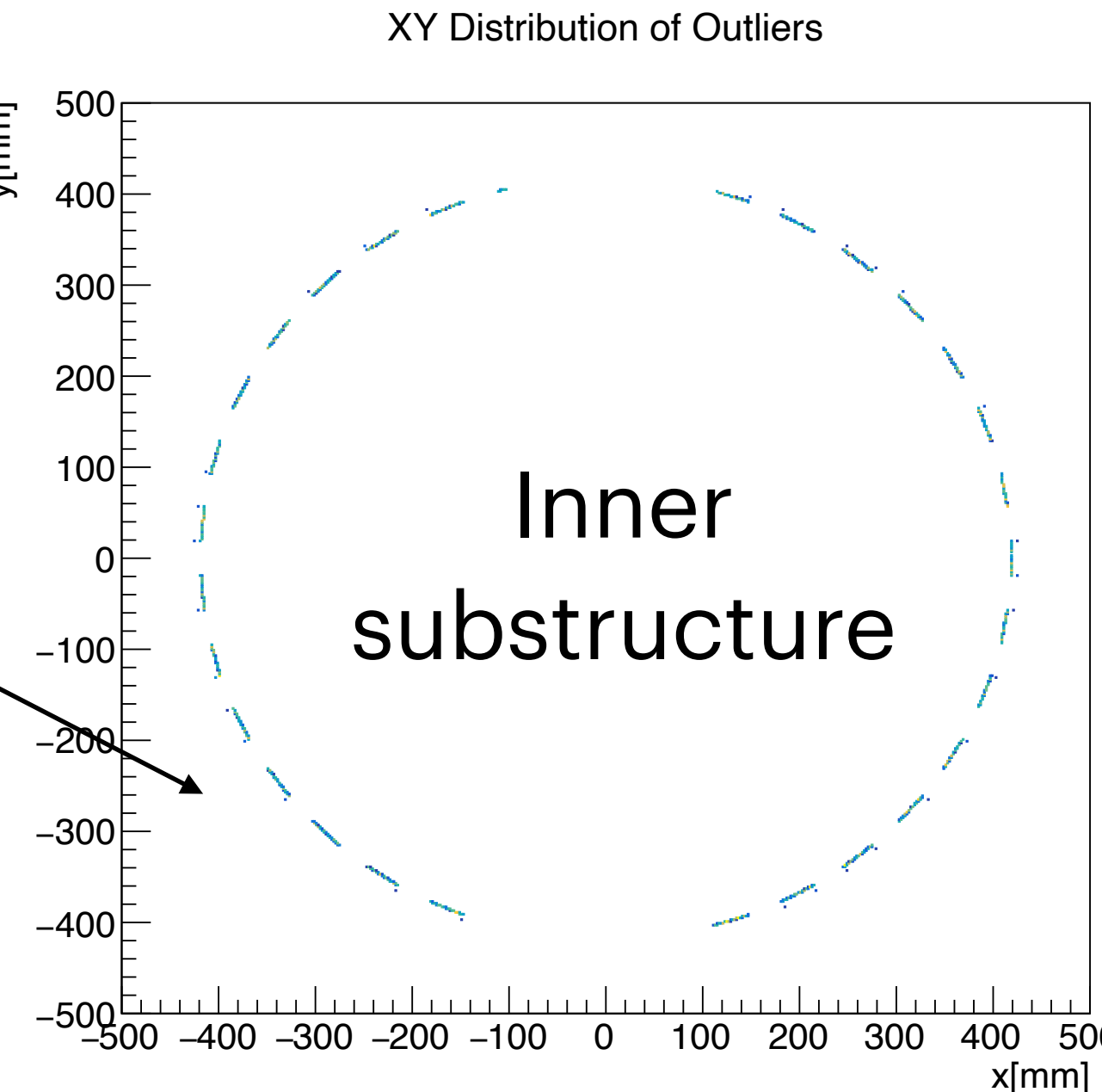
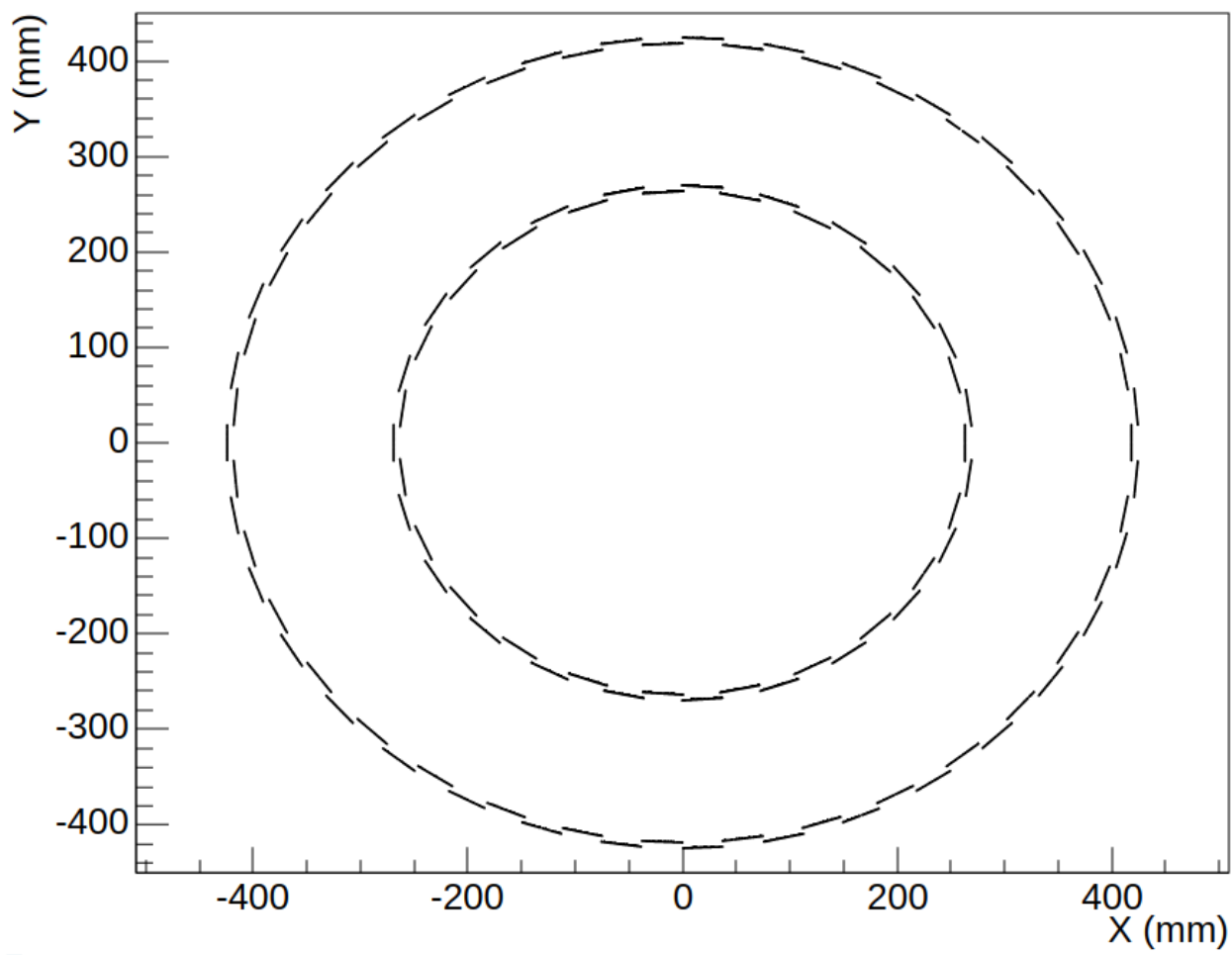
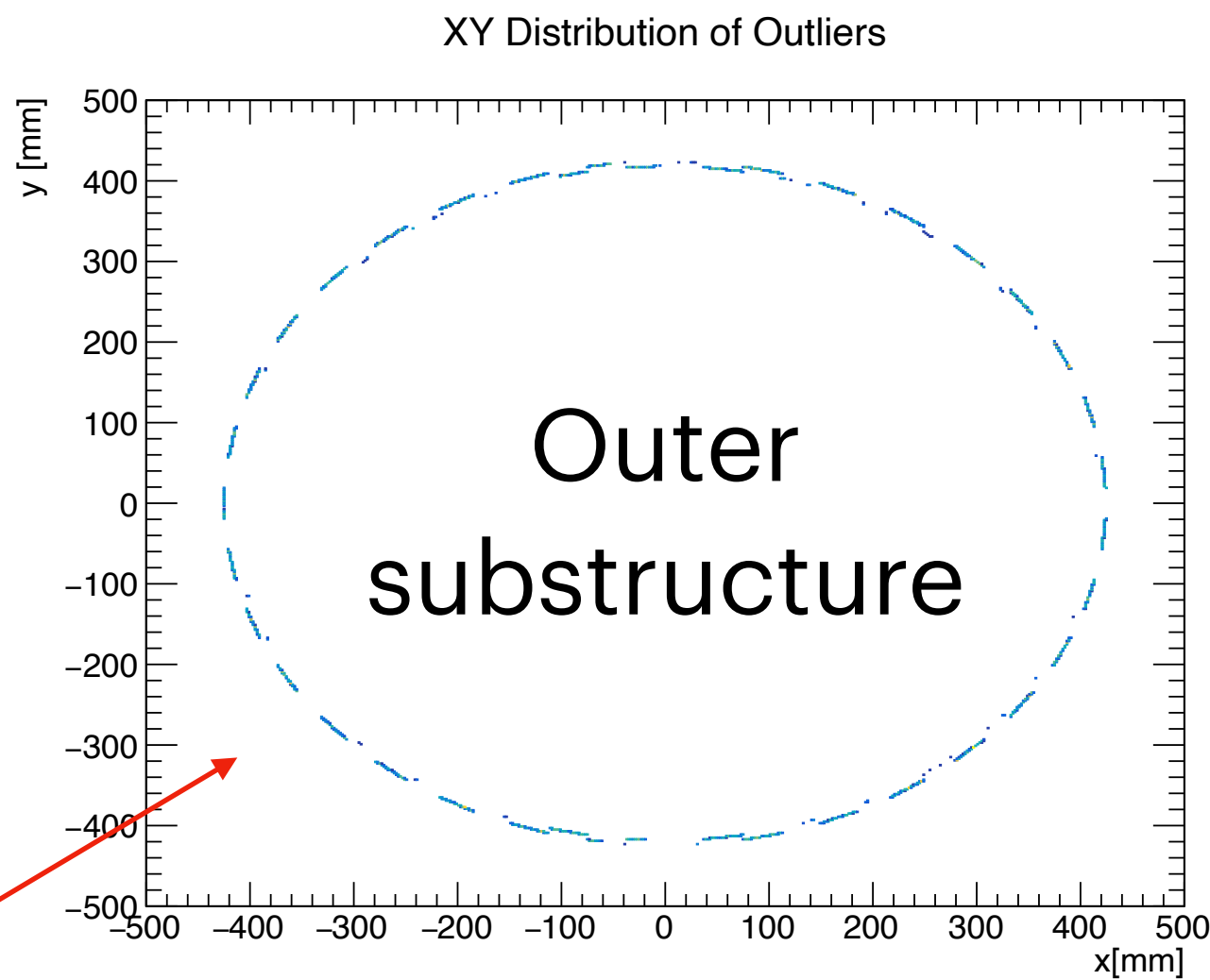
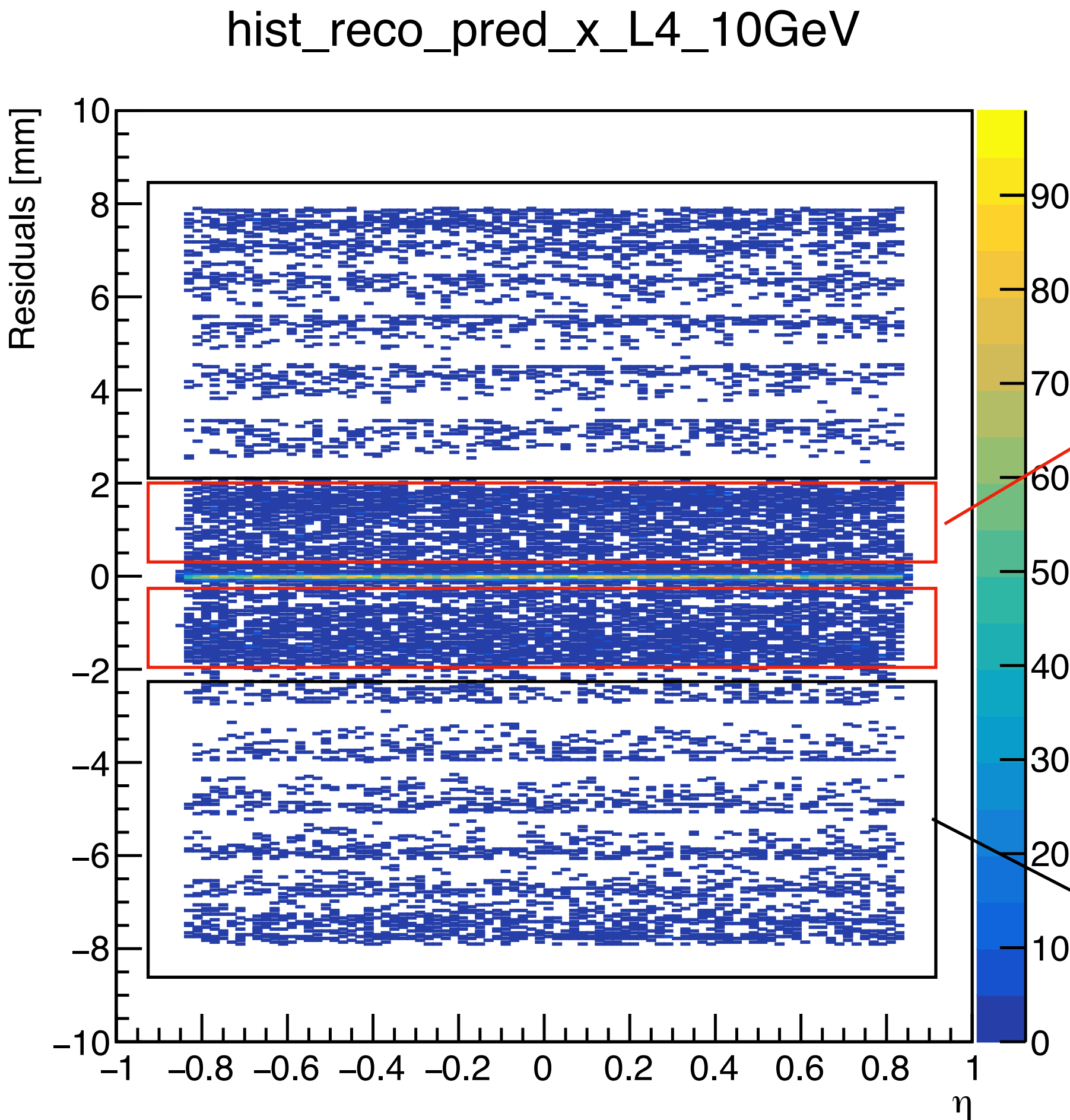
Seems to be uniformly distributed in phi. Does not reveal any significant information



XY Distribution of Outliers



Looking at the two bands in the residuals separately

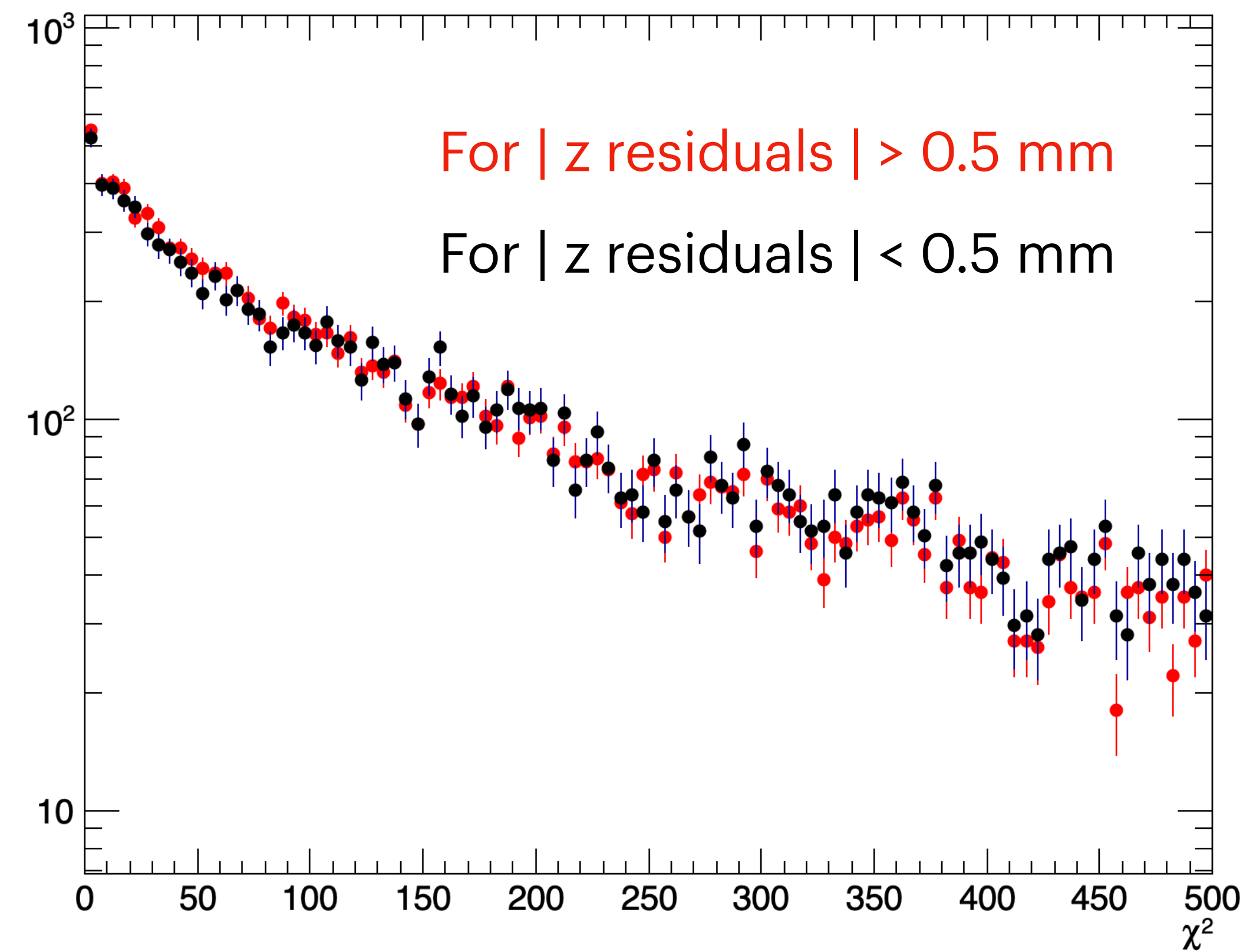
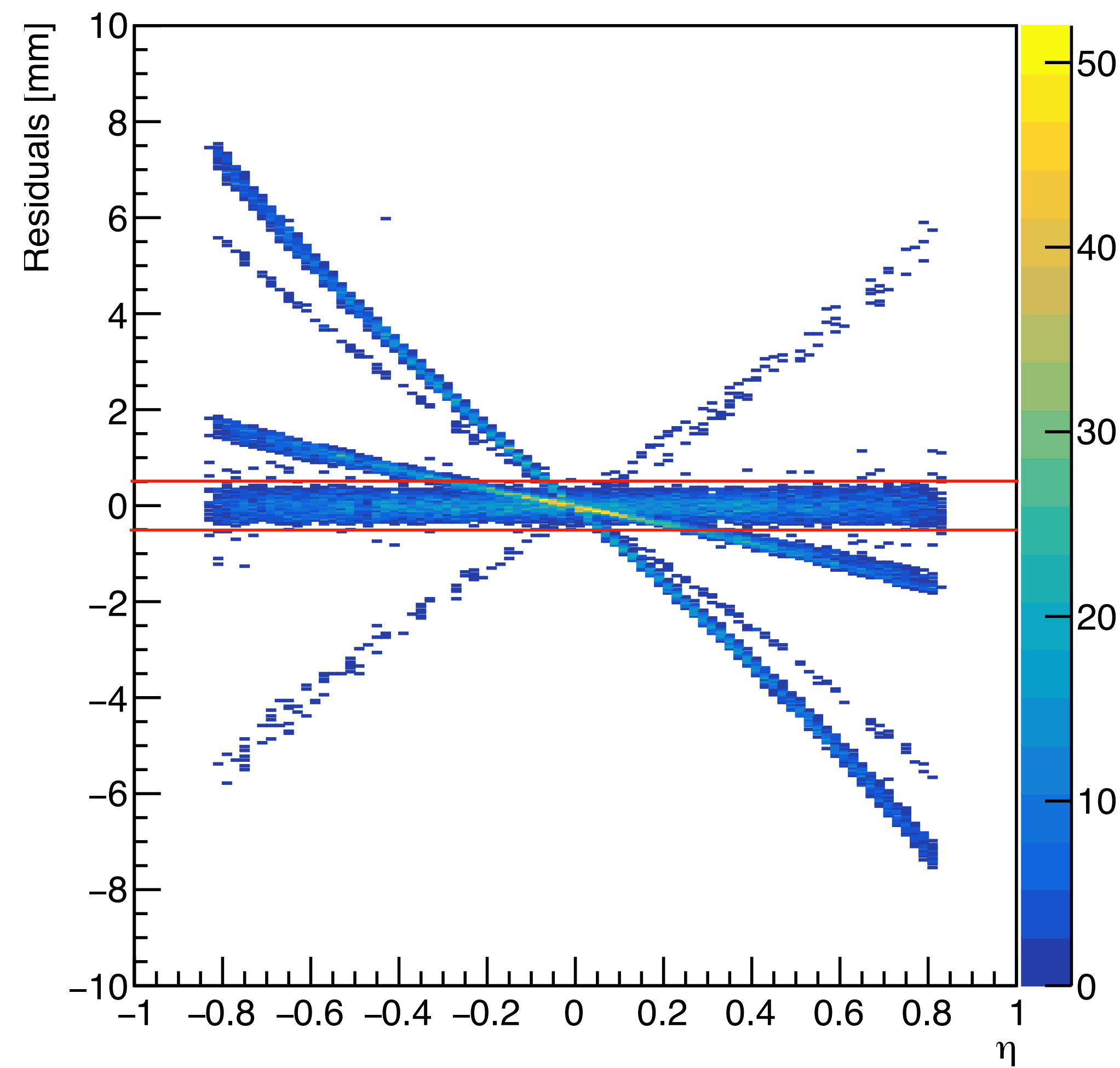


New geometry implementation
(Castellated Structure)

	L3	L4
Previous version 25.08	27 cm	42 cm
New geometry version 25.10	26.5 cm (Average Radius)	42 cm (Average radius)

Lets look at the outliers for 0.5 GeV tracks

hist_reco_pred_z_L4_0.5GeV



This study leads to 2 observations

- Residuals become much narrower in going from low momentum to high momentum tracks but the corresponding covariance values does not shrink at least proportionately and that could explain why χ^2 is blowing up at low momentum. The way χ^2 has been defined, it should more or less stay the same between low and high momentum tracks.
- The χ^2 distribution between the outliers (in the residuals) and the inliers is the same. This means as far as the χ^2 distributions are concerned, these outliers are not our problem. The problem is covariances evolution at low momentum relative to the high momentum case.