

Kinematics Resolution, Stability and Purity in NC channel

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Kinematics resolution

$$Q^2 = -q^2 = -(k_\mu - k'_\mu)^2$$

Measure of resolution power

$$Q^2 = 2E_e E'_e (1 - \cos \Theta_{e'})$$

$$y = \frac{pq}{pk} = 1 - \frac{E'_e}{E_e} \cos^2 \left(\frac{\theta'_e}{2} \right)$$

Measure of inelasticity

$$x = \frac{Q^2}{2pq} = \frac{Q^2}{sy}$$

Measure of momentum fraction of struck quark

$$\frac{\delta x_e}{x_e} = \frac{1}{y_e} \frac{\delta E'_e}{E_e} \oplus \left[\frac{x_e}{E_e/E_p} - 1 \right] \tan \frac{\theta'_e}{2} \delta \theta'_e$$

$$\frac{\delta y_e}{y_e} = \left(1 - \frac{1}{y_e} \right) \frac{\delta E'_e}{E_e} \oplus \left[\frac{1}{y_e} - 1 \right] \cot \frac{\theta'_e}{2} \delta \theta'_e$$

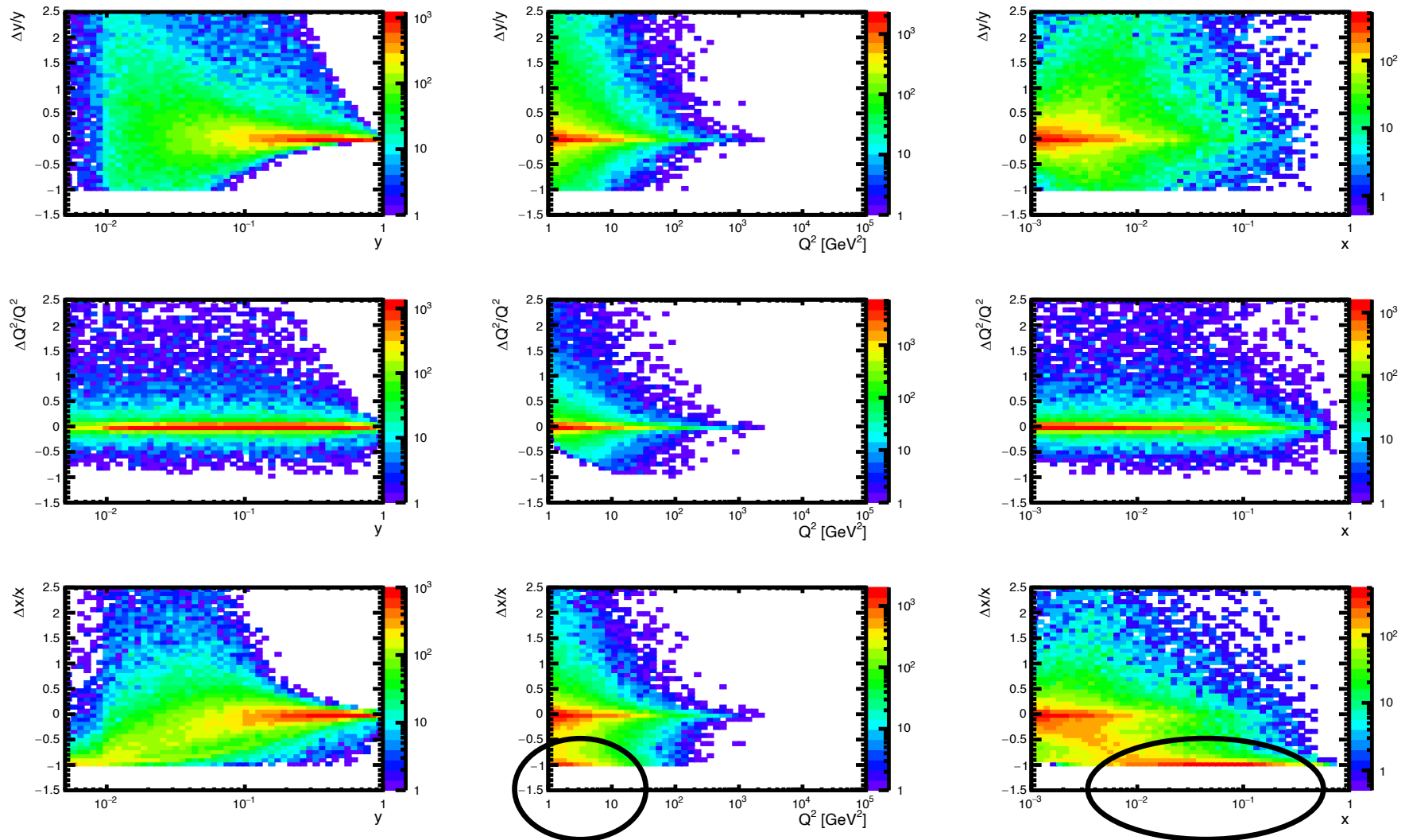
diverges for $y_e \rightarrow 0$
depends on E'_e

$$\frac{\delta Q_e^2}{Q_e^2} = \frac{\delta E'_e}{E_e} \oplus \tan \frac{\theta'_e}{2} \delta \theta'_e$$

diverges for $\theta'_e \rightarrow 180^\circ$
depends on E'_e and θ'_e

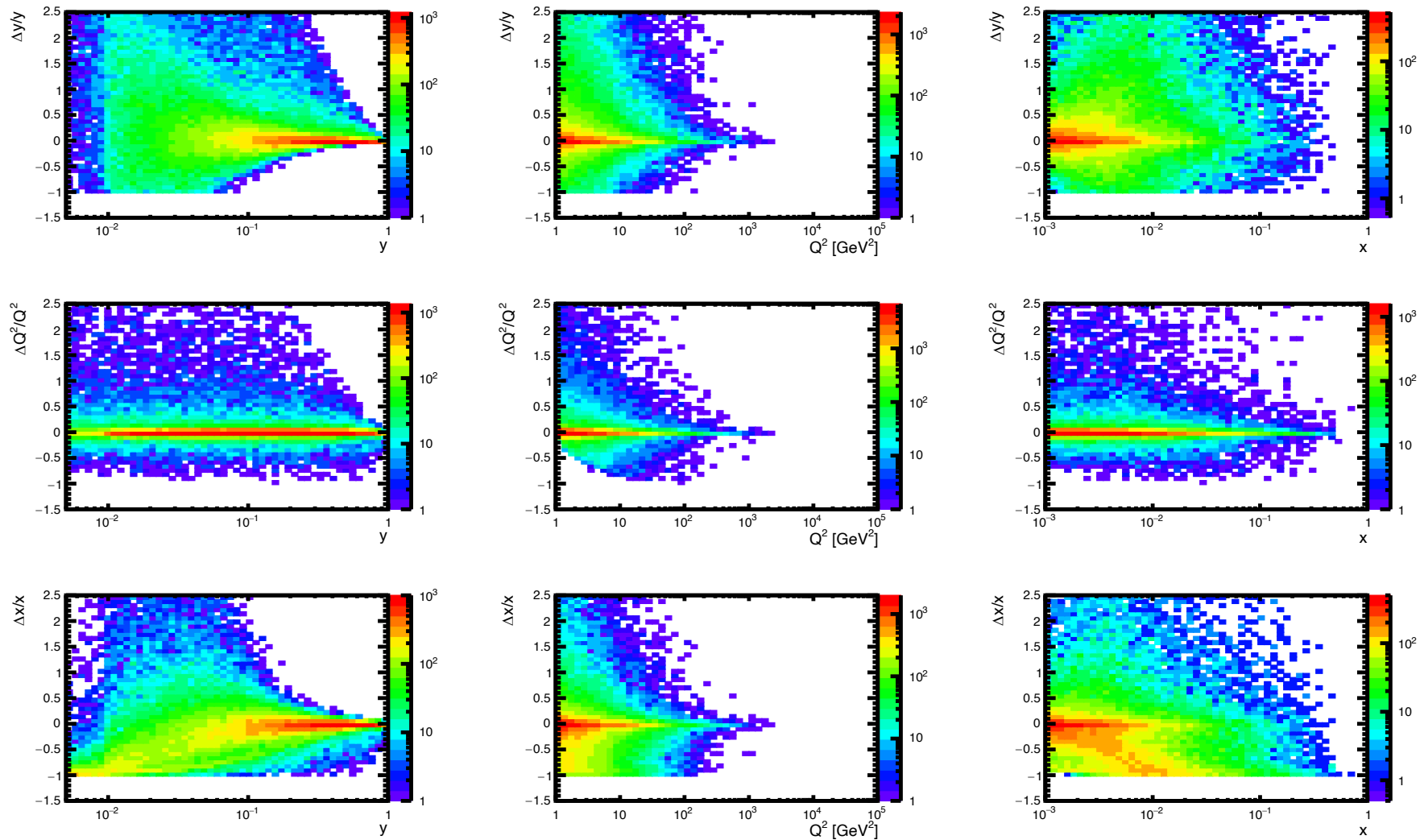
- Reconstructed variables are calculated from the scattered electrons after EIC Smear with Rad effects
- (Rec-True)/True Vs True are shown: $\Delta y/y_T$ vs (y_T, x_T, Q^2_T) , $\Delta x/x_T$ vs (y_T, x_T, Q^2_T) , $\Delta Q^2/Q^2_T$ vs (y_T, x_T, Q^2_T)
- Different y cuts on resolution are studied.
- Max limit y cut is leaded by detector performance, $y < 0.95$ is applied at the first place.

(Rec-True)/True Vs True, $y < 0.95$

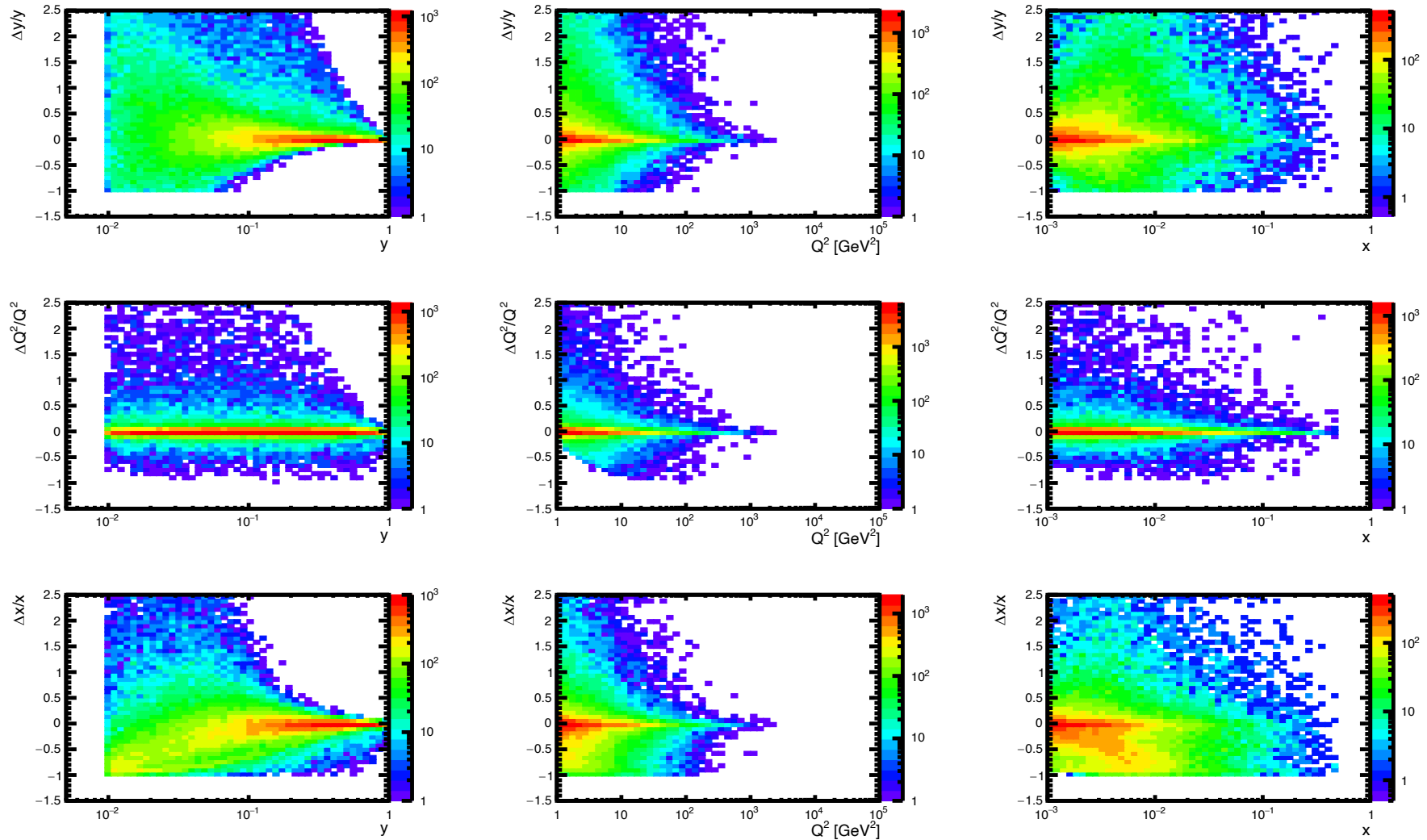


y is very small
Bad x resolution

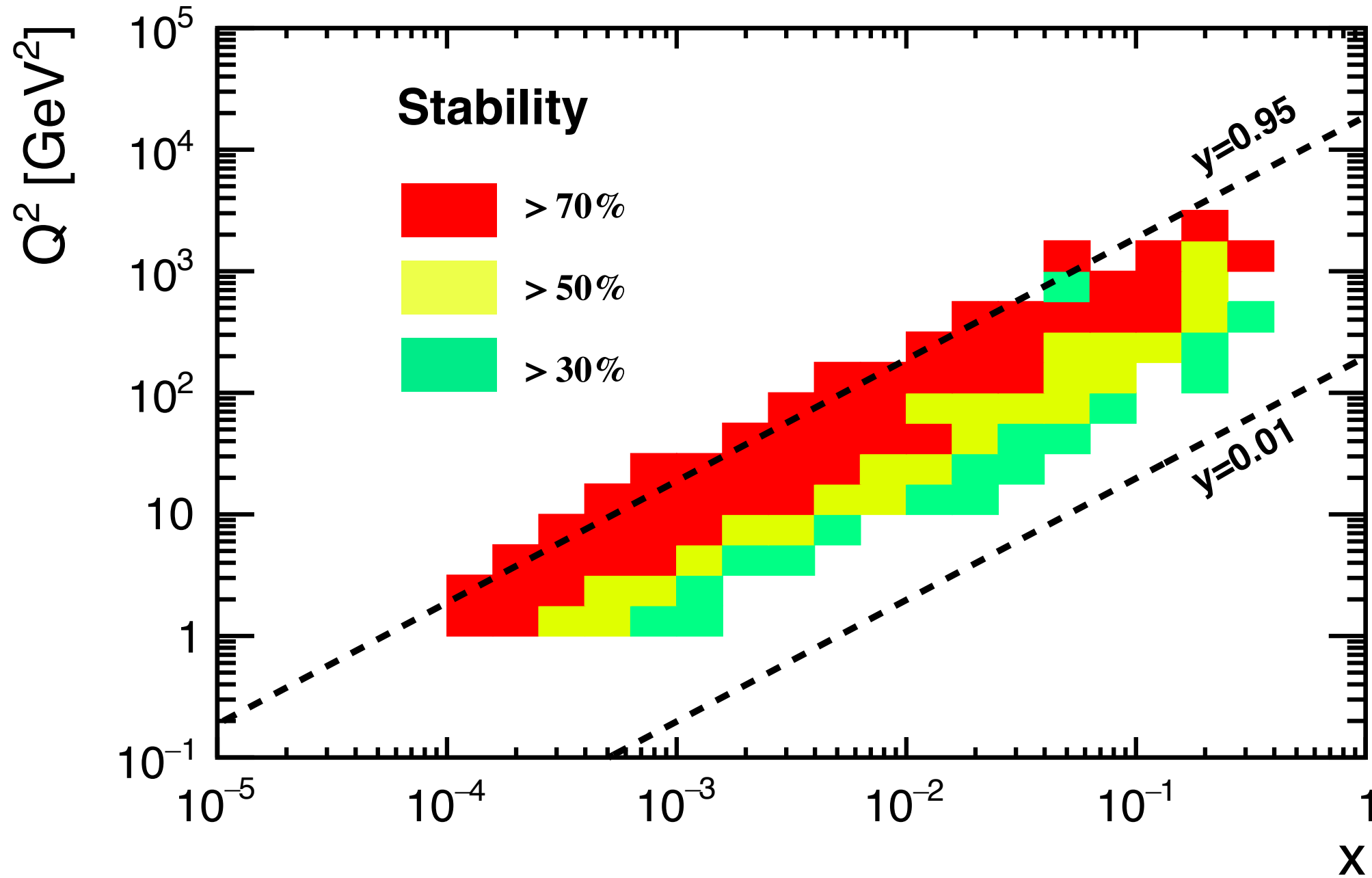
(Rec-True)/True Vs True, $0.005 < y < 0.95$



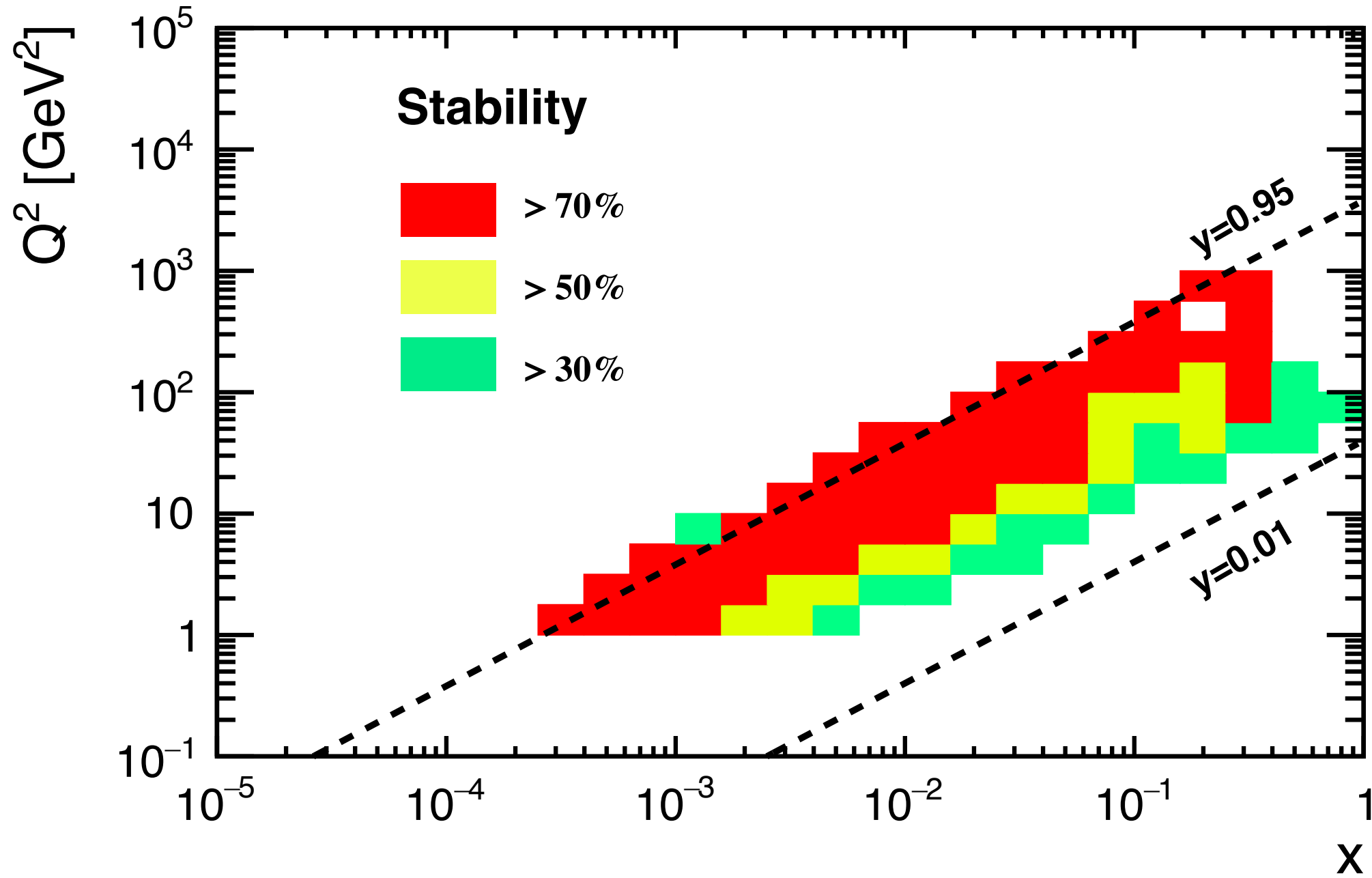
(Rec-True)/True Vs True, $0.01 < y < 0.95$

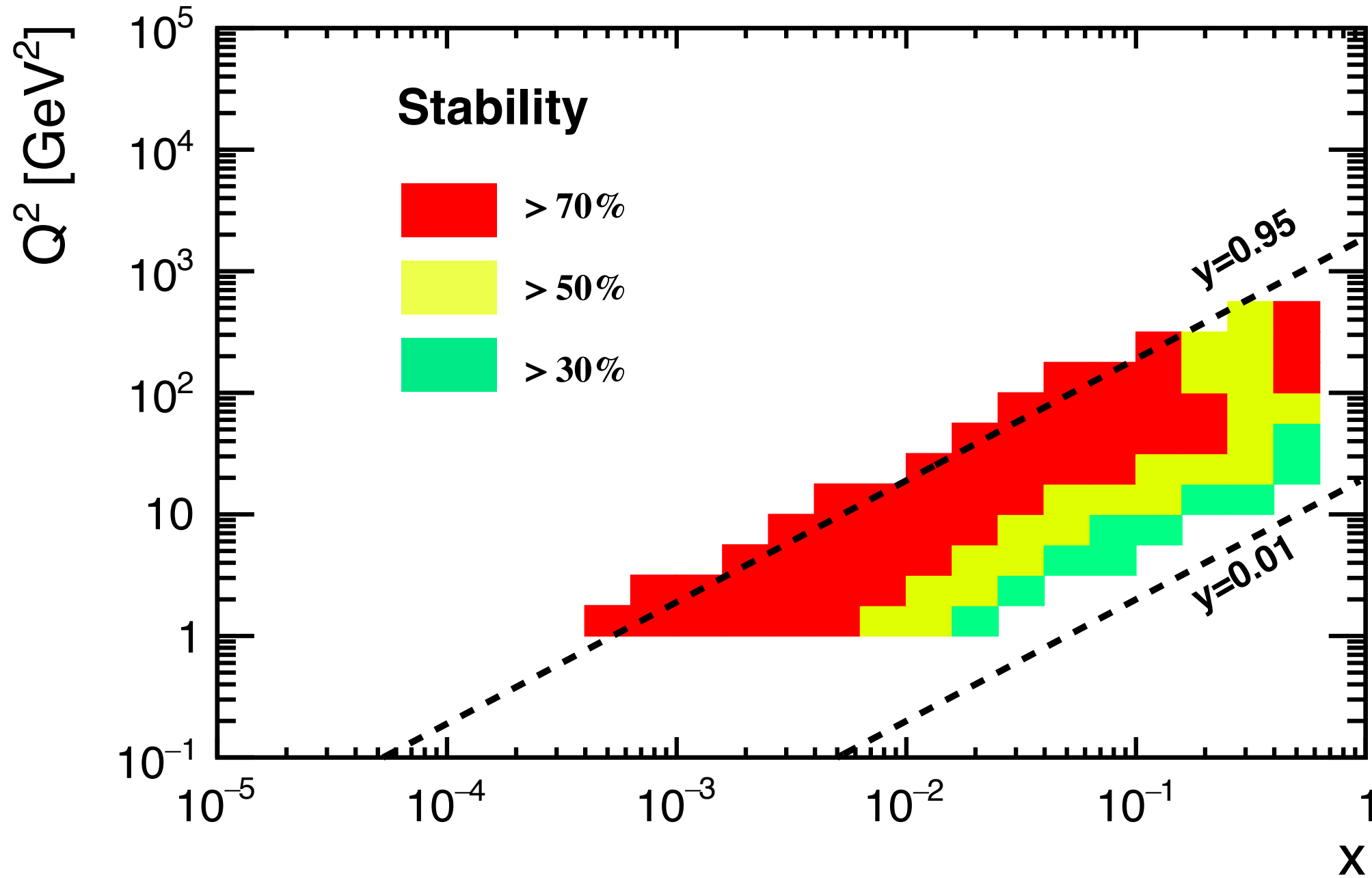


- **Stability:** The fraction of events generated in a given bin i that were reconstructed in the same bin $i \rightarrow S(i) = N_{\text{gen\&reco}}(i)/N_{\text{gen}}(i)$. The stability reflects the bin migration out of a generated bin (y_G, x_G, Q^2_G) .
- Reconstructed kinematics include Radiative and EICsmear effects.
- 5 bins in x and 4 bins in Q^2 per decade.

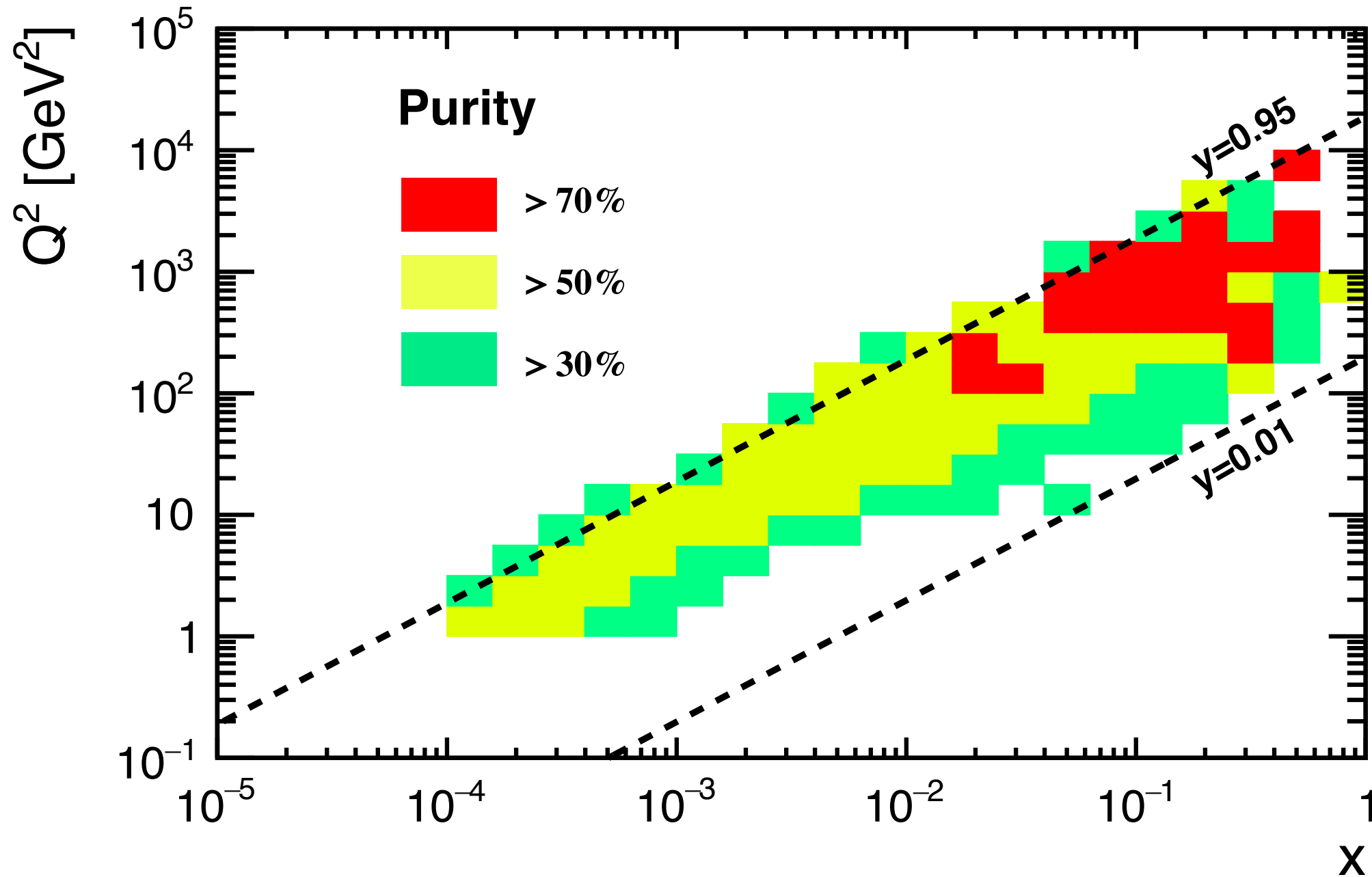


NC 10x100

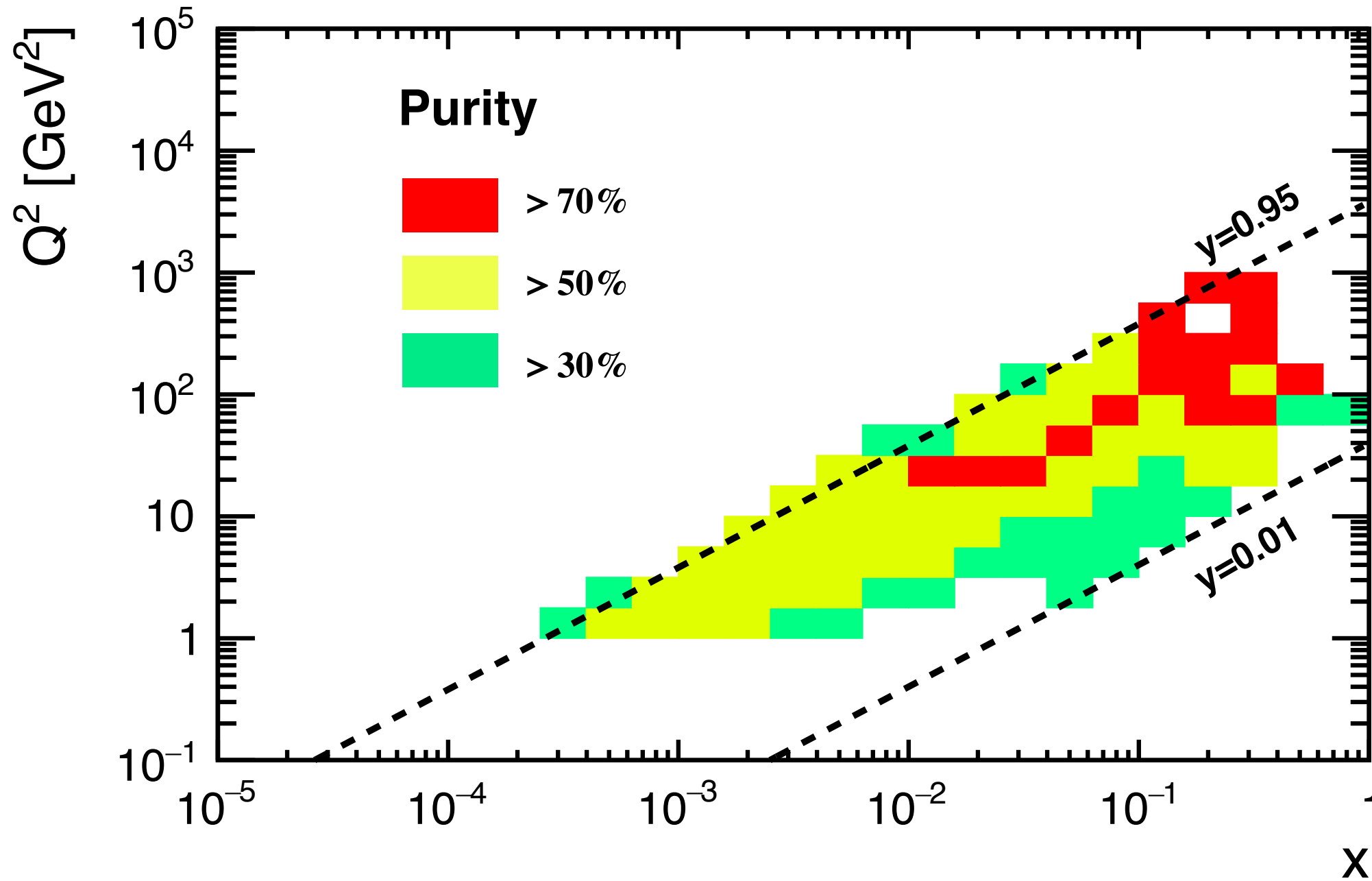




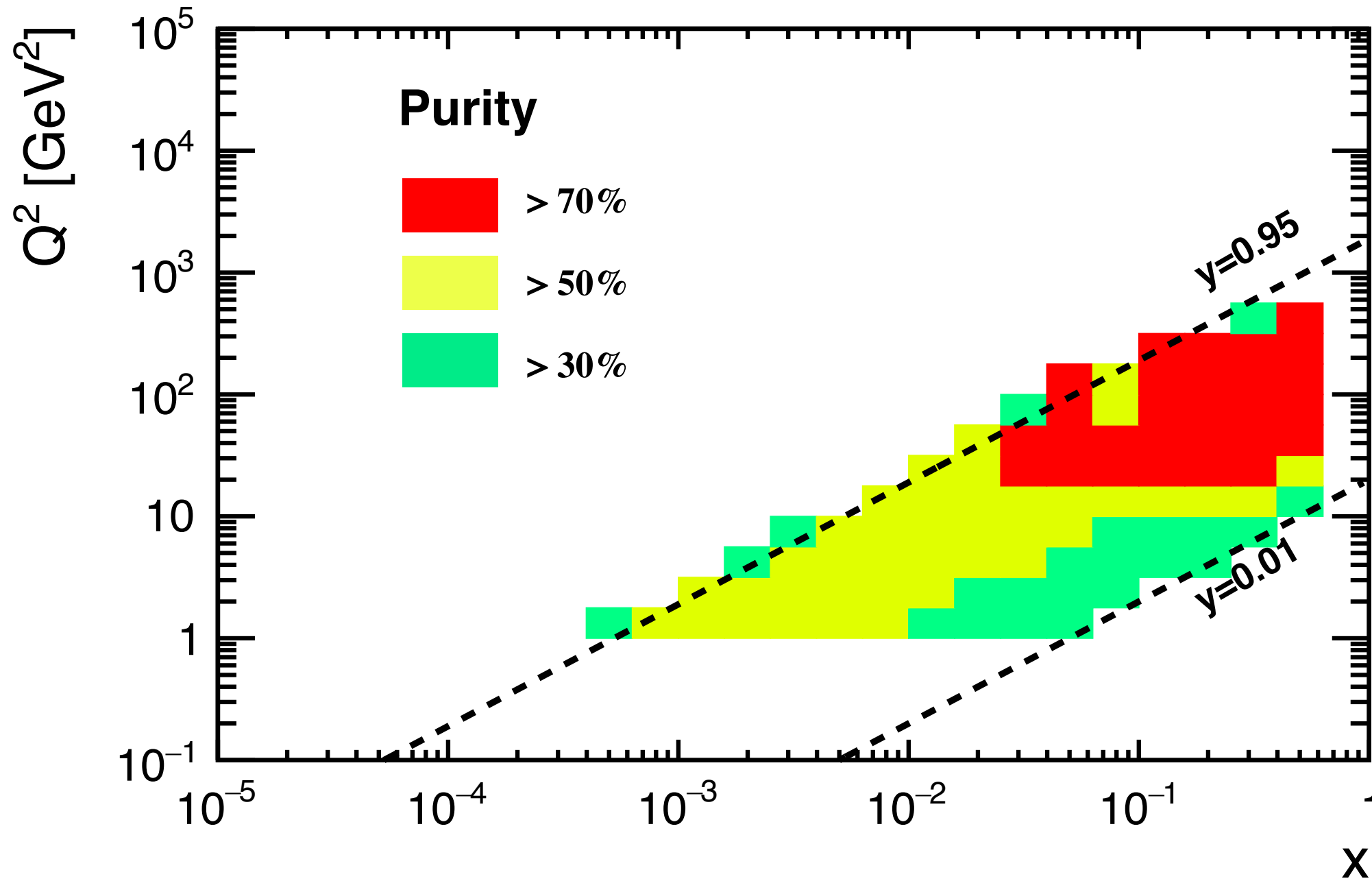
- **Purity:** The fraction of events reconstructed in a given bin i that were generated in the same bin $i \rightarrow P(i) = N_{\text{gen\&reco}}(i) / N_{\text{reco}}(i)$. The purity reflects the bin migration into a reconstructed bin (y_R, x_R, Q^2_R) .
- Reconstructed kinematics include Radiative and EICsmear effects.
- 5 bins in x and 4 bins in Q^2 per decade



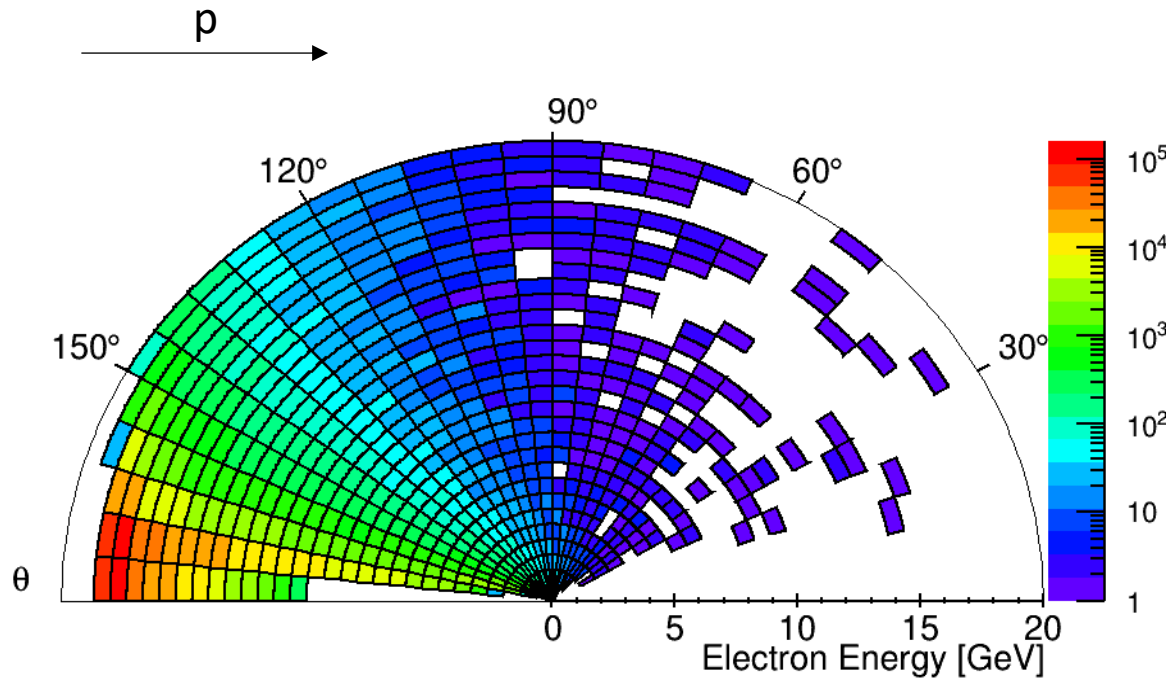
NC 10x100



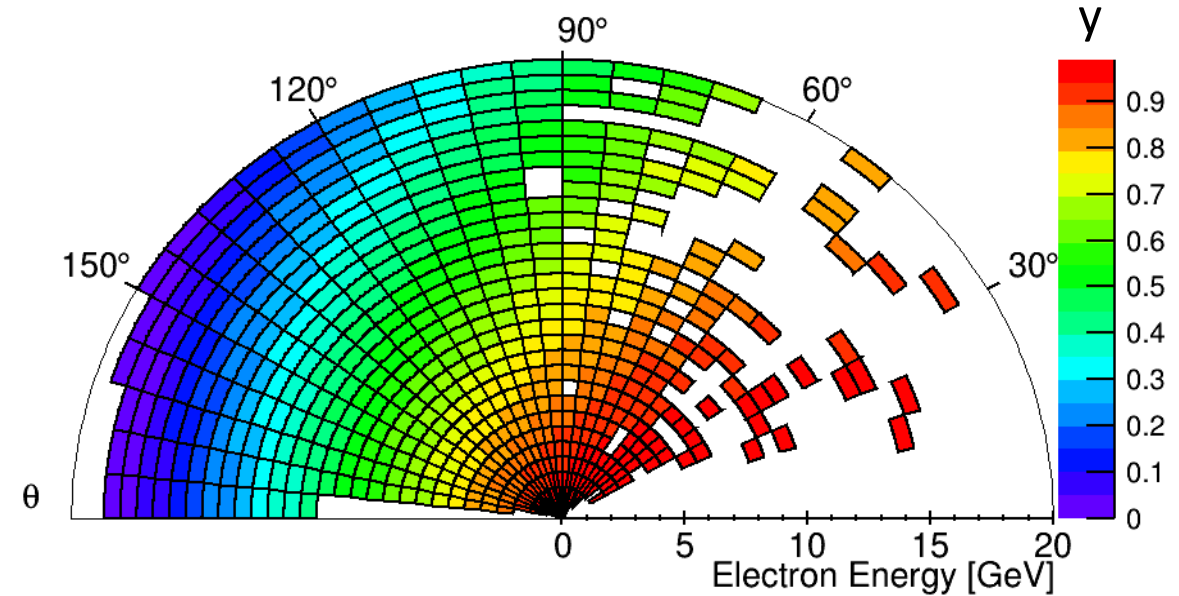
NC 5x100



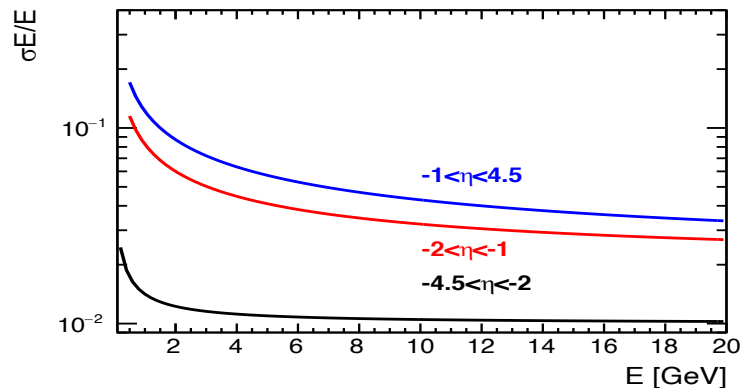
Back up: large Inelasticity y



Outgoing electron hit map

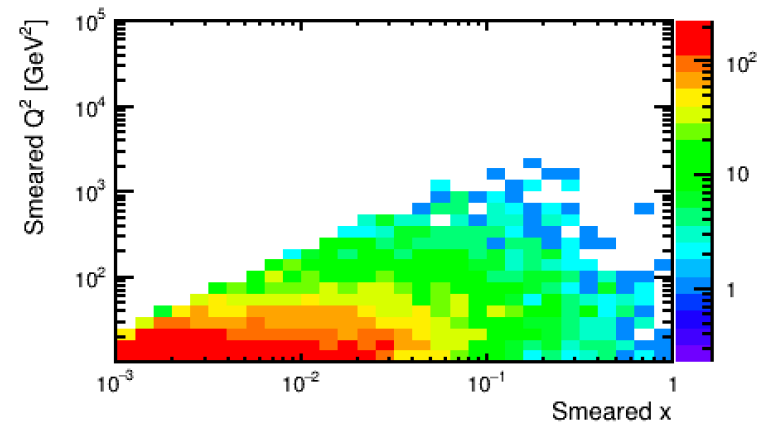
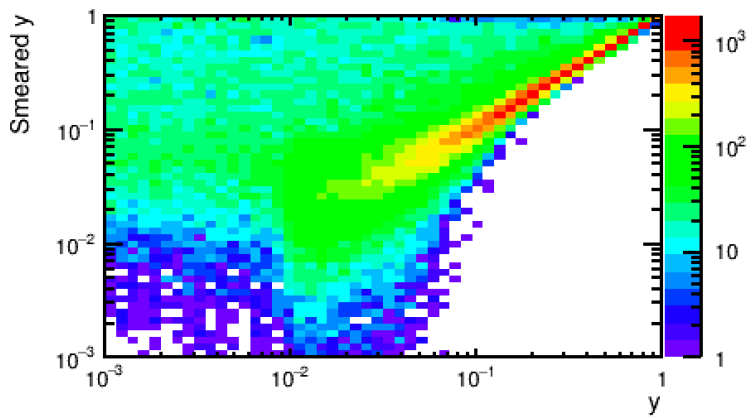
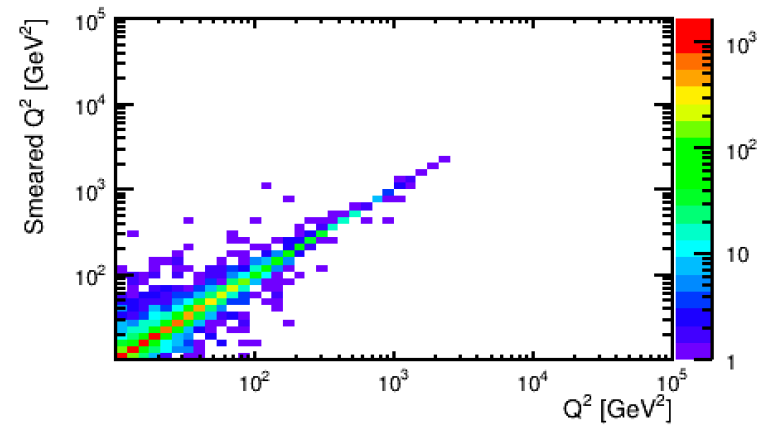
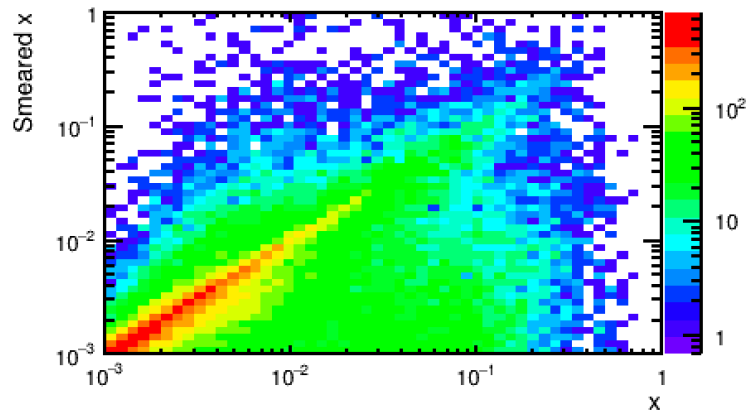


y distribution map on electron



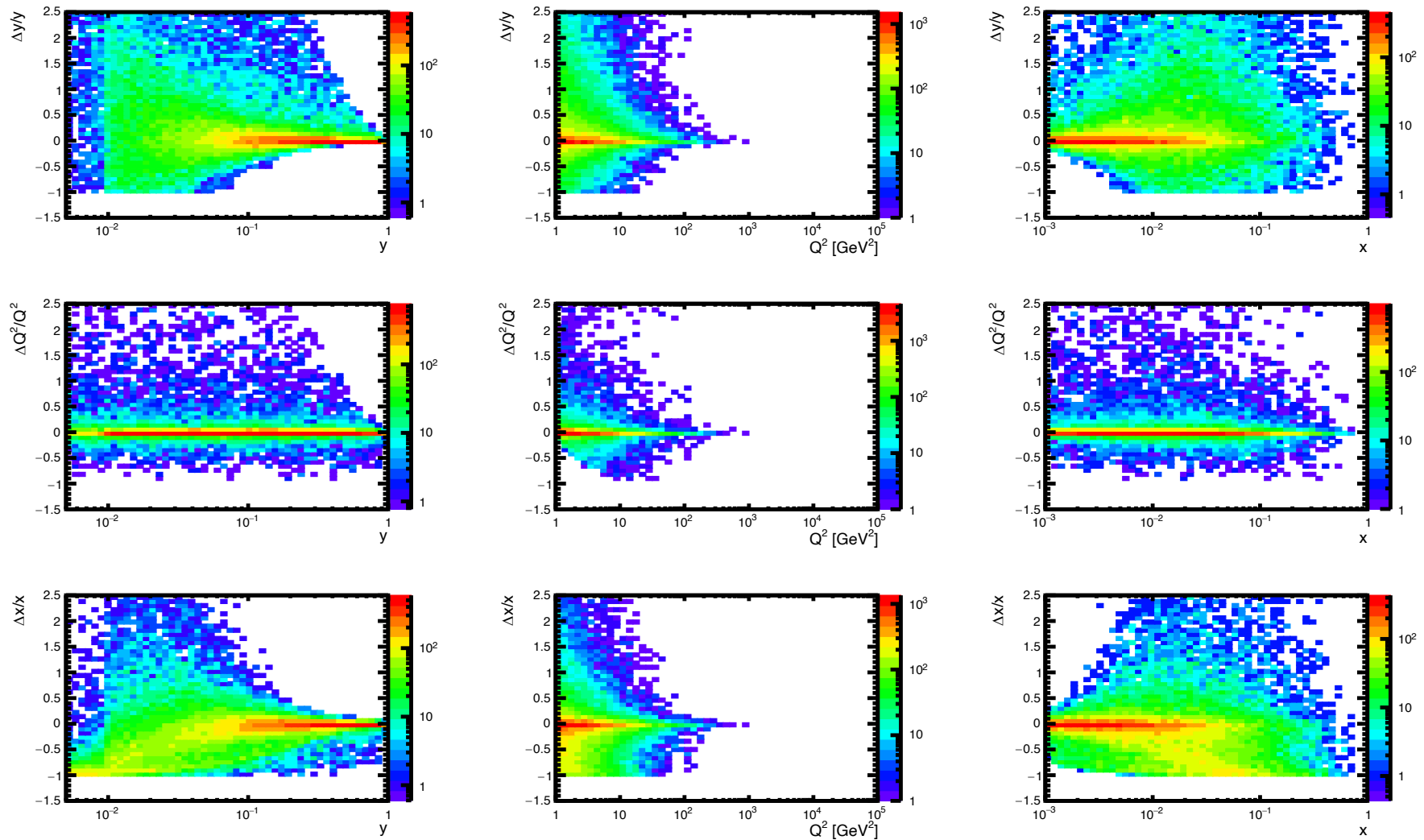
- Large y : electron energy is relatively small and the outgoing direction is forward \rightarrow EMCal resolution is bad, so $y < 0.95$ is applied.

18x275 GeV



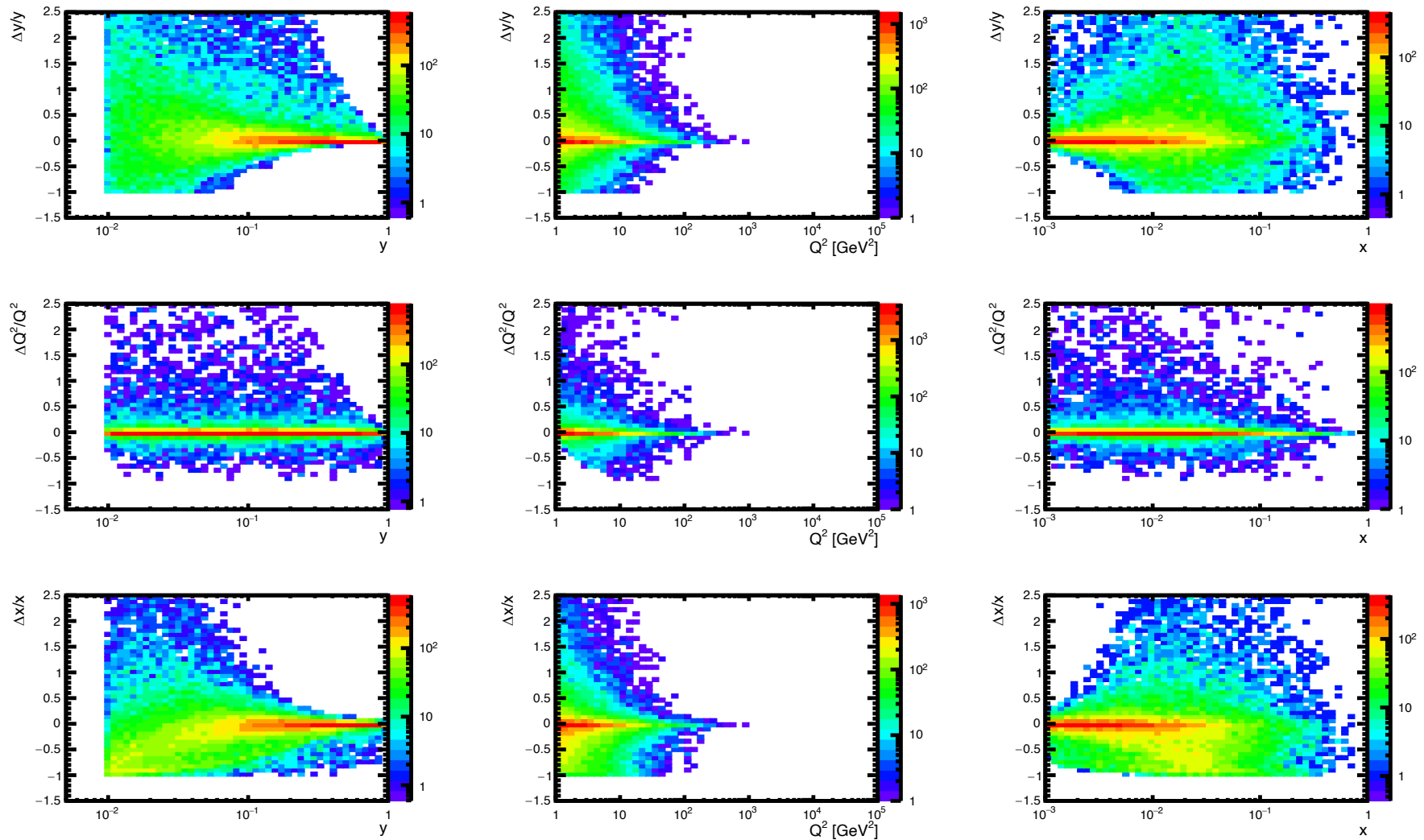
10x100 GeV

(Rec-True)/True Vs True, $0.005 < y < 0.95$



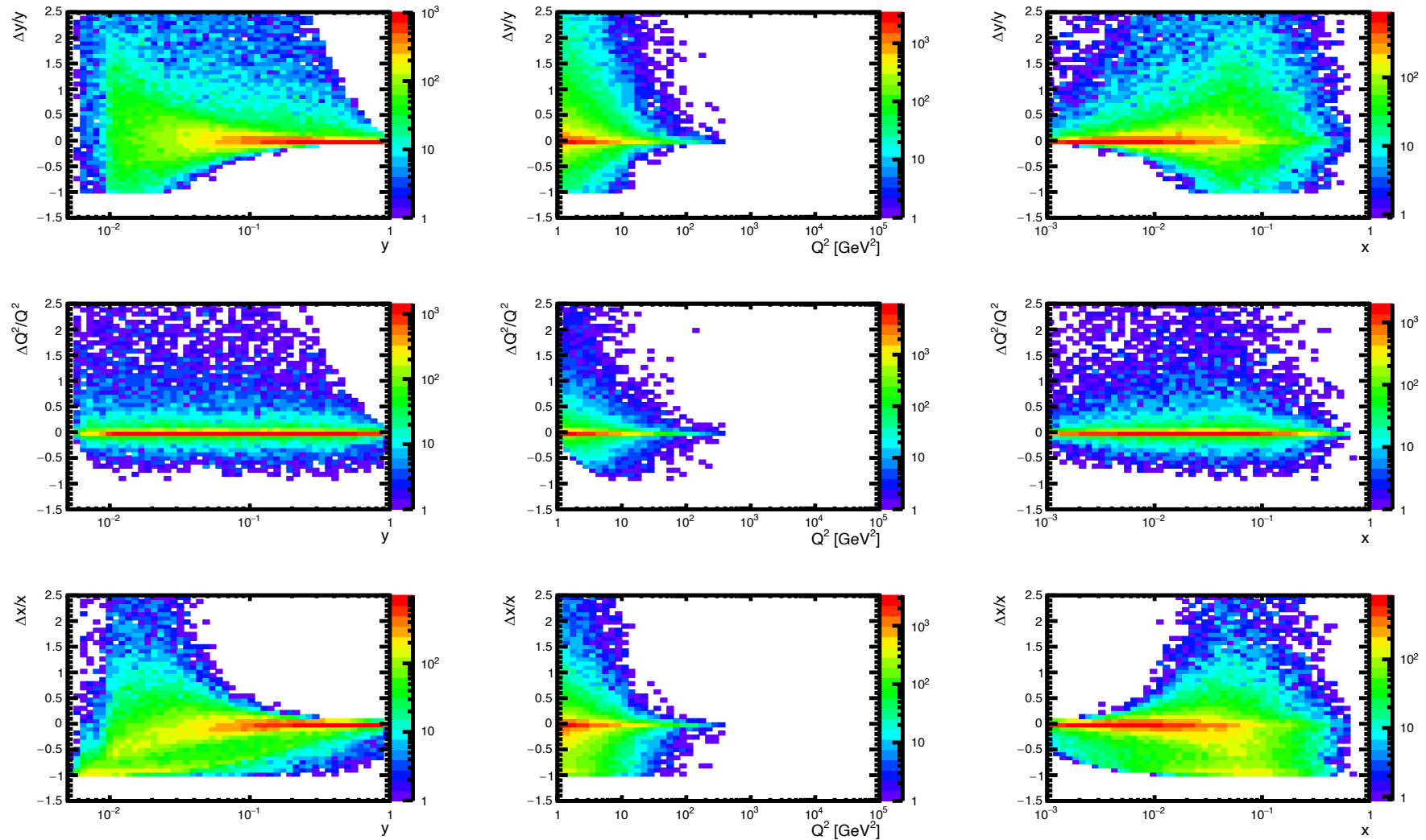
10x100 GeV

(Rec-True)/True Vs True, $0.01 < y < 0.95$



5x100 GeV

(Rec-True)/True Vs True, $0.005 < y < 0.95$



5x100 GeV

(Rec-True)/True Vs True, $0.01 < y < 0.95$

