Discussion topics

SIDIS meeting
June 21

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Status

- Test production for SIDIS highq2 output is available (*eicS3/eictest/ECCE/MC/ana.14/5f210c7/SIDIS/pythia6/ep_18x100highq2*):
  - ~3.8 M DIS events, Q2>100 GeV
- Nearly EventEvaluator output (all clusters combined, vertex set to origin for cluster eta calculation)
- PID is still using true PDG values (→ still need to address this)
- For Hadronic final states use: charged particles + Calorimeter clusters (currently chose neutrals either via PDG or reject charged via Barcode → needs to be adjusted for track projections)
- Currently use tracking information for all charged particles (→ there may be regions where EMCal info is better for electrons)

Kinematic reconstructions using hadrons

- JB method: use only hadronic final state

$$y_{JB} = \frac{E_p \sum_h E_h - p_{z,p} \sum_h p_{z,h} - m_p^2}{E_p E_e - p_{z,p} p_{z,e}}$$

$$Q^2_{JB} = \frac{\sum_h p^2_{x,h} + \sum_h p^2_{y,h}}{1 - y}$$

$$x_{JB} = \frac{Q^2}{ys}$$

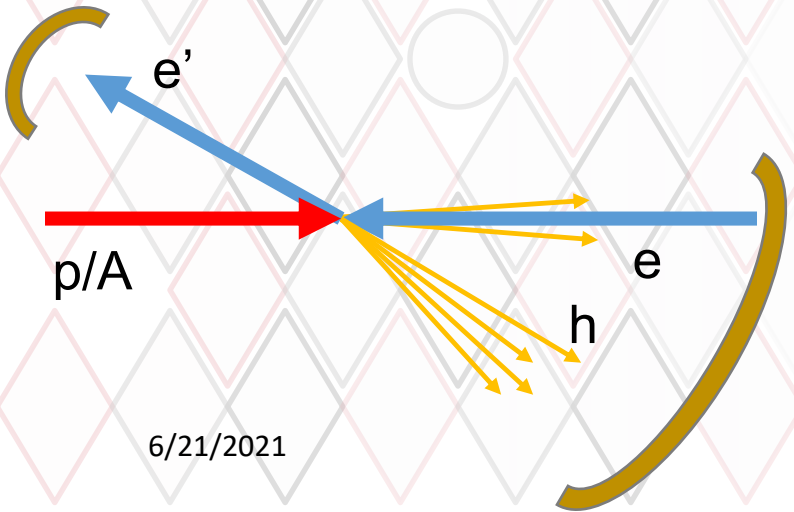
- DA method: use both

$$y_{DA} = \frac{\tan\theta_h/2}{\tan\theta_e/2 + \tan\theta_h/2}$$

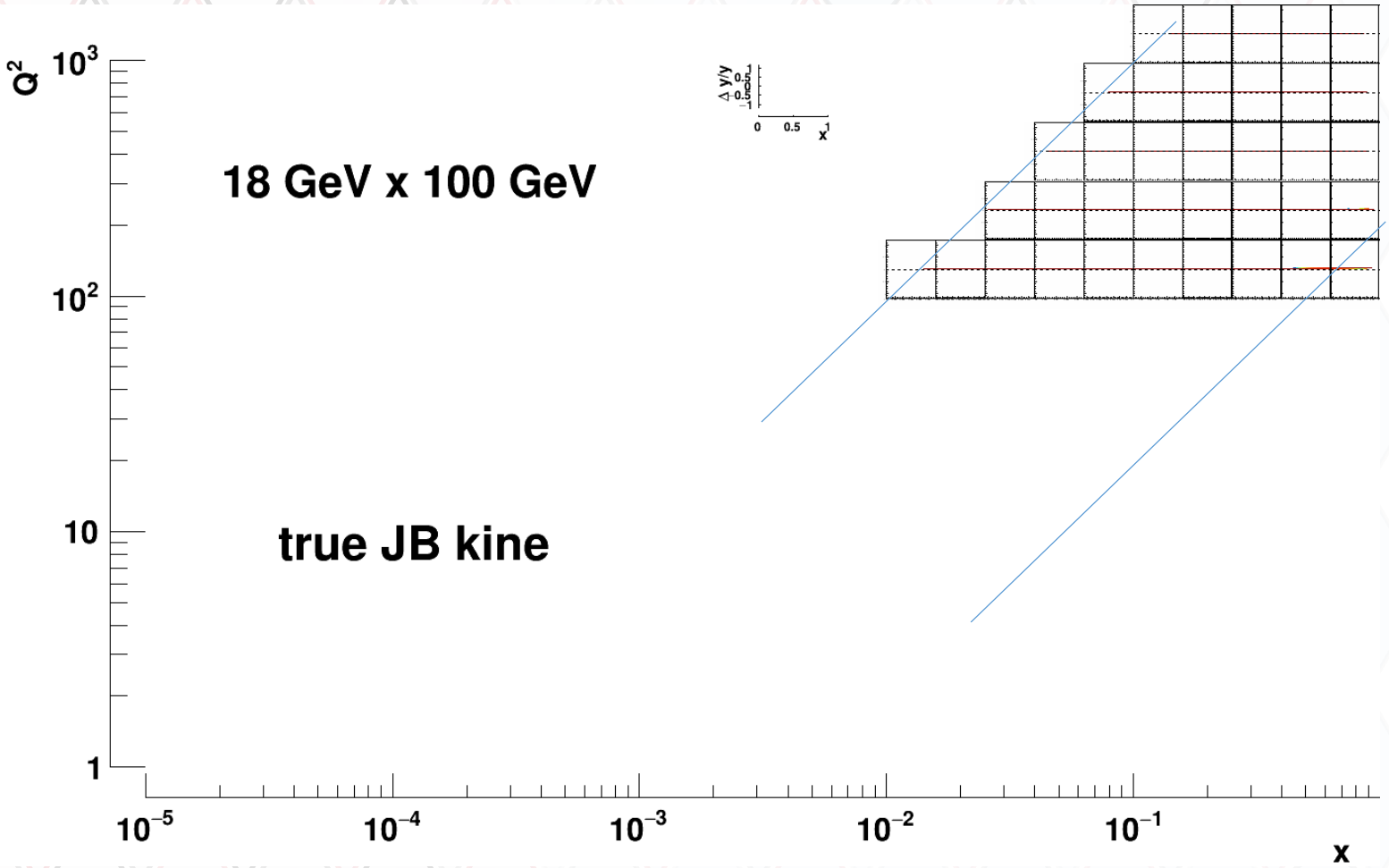
$$Q^2_{DA} = \frac{4E_2^2}{\tan\theta_e/2\,(\tan\theta_e/2 + \tan\theta_h/2)}$$

$$x_{DA} = \frac{Q^2}{ys}$$

$$\tan\theta_h/2 = \frac{\sum_h E_h - \sum_h p_{z,h}}{\sqrt{\sum_h p^2_{x,h} + \sum_h p^2_{y,h}}}$$

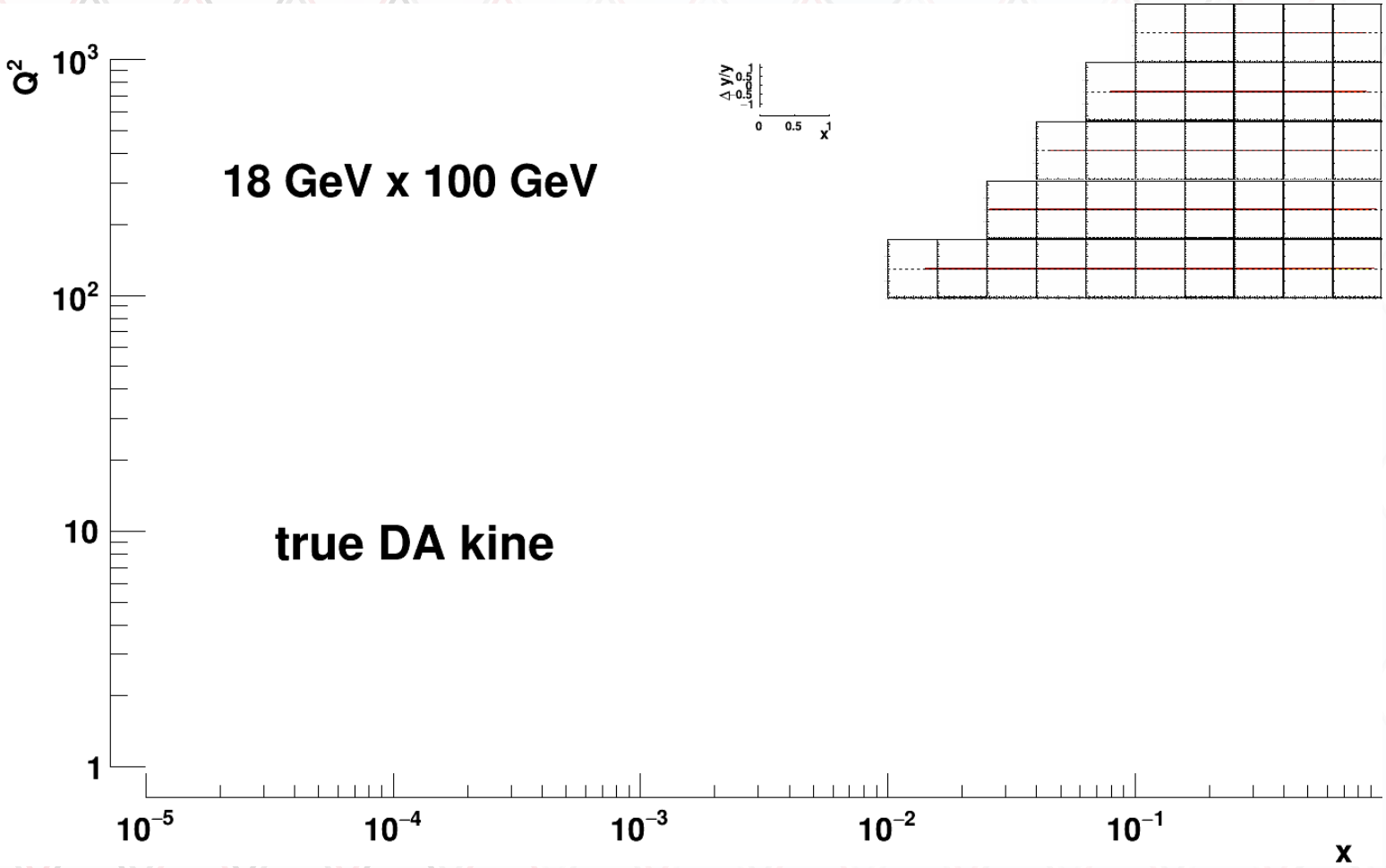


y resolution JB method (true particles)



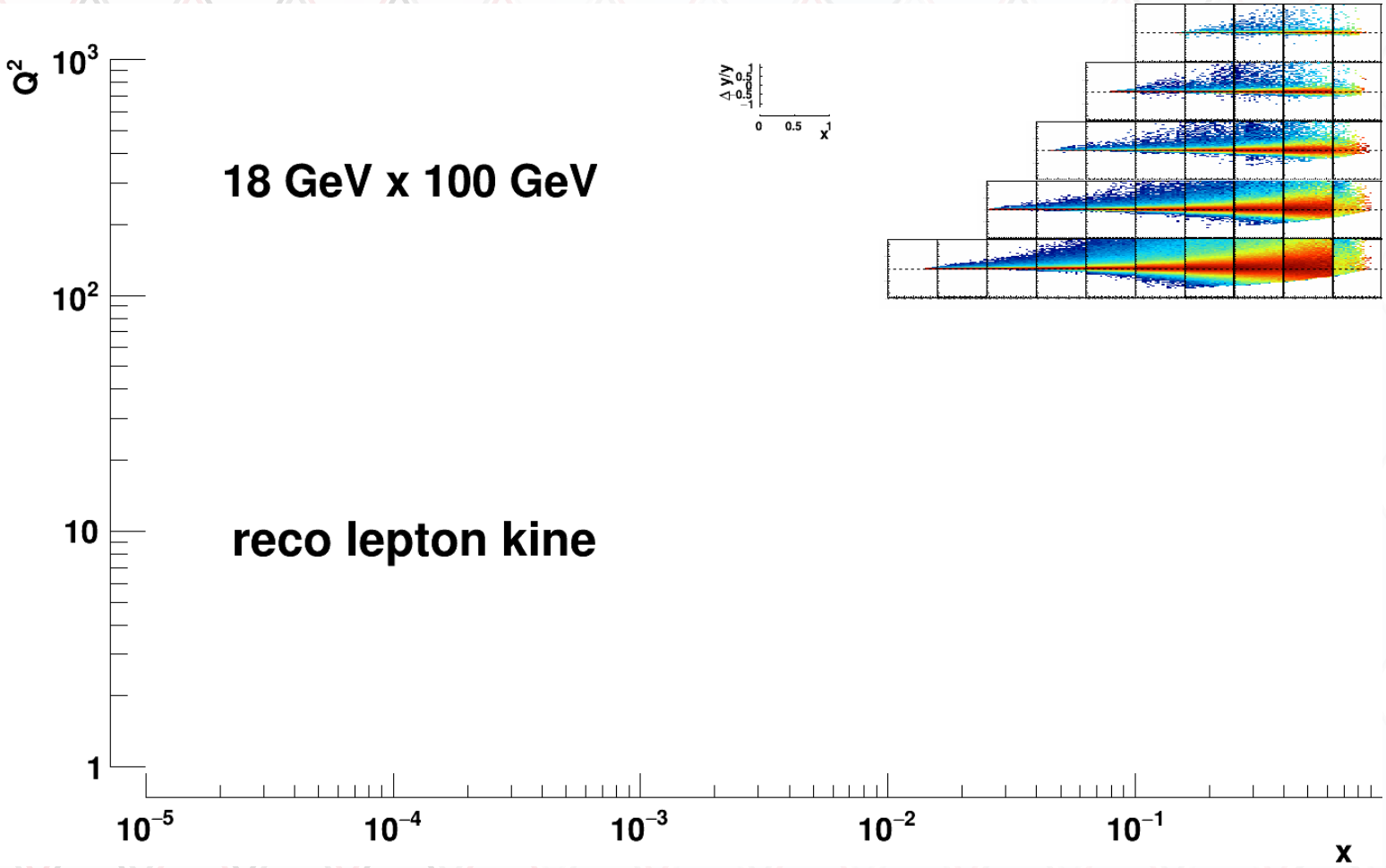
Consistency check that JB method equivalent

y res DA method (true particles)



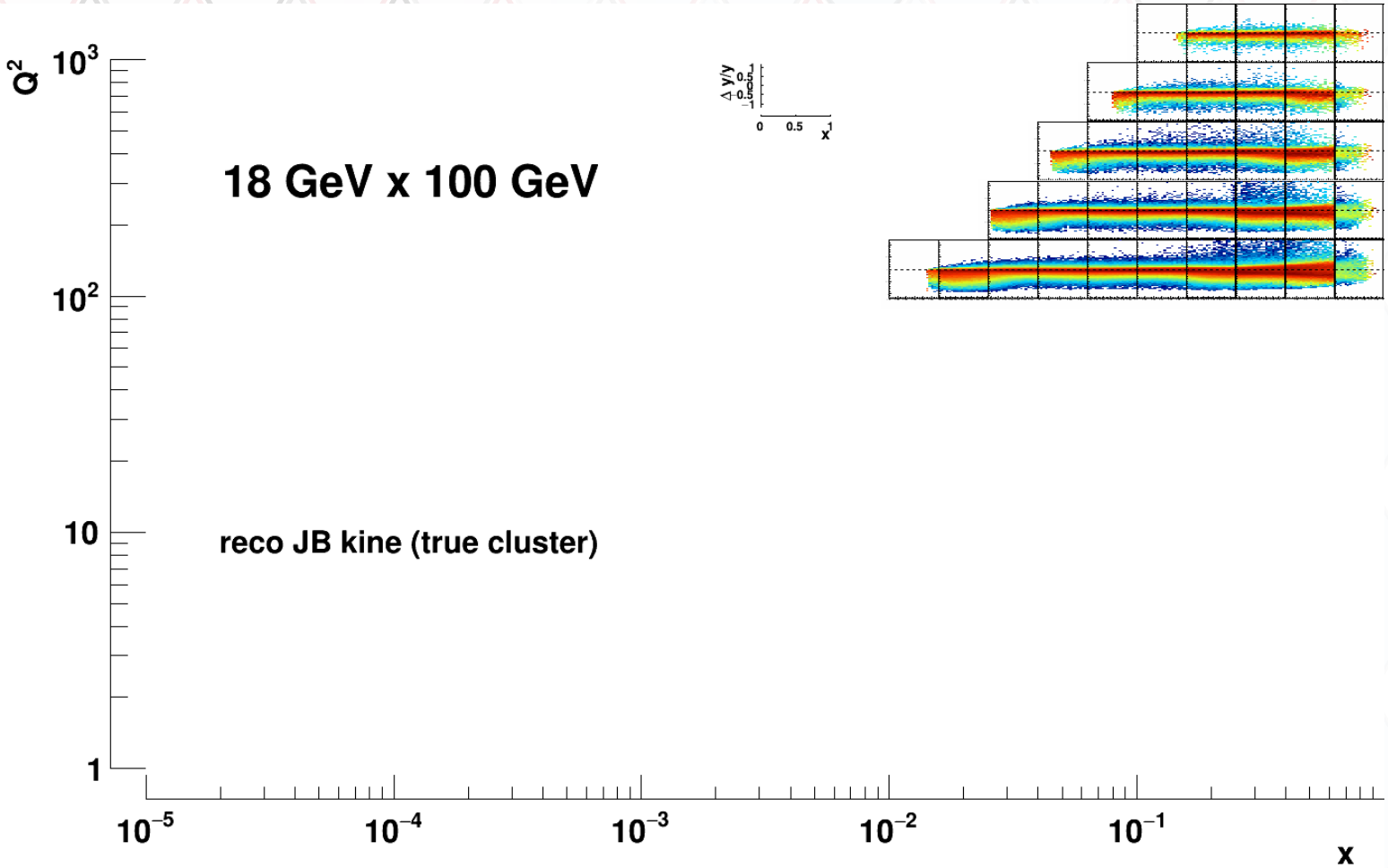
Consistency check that DA method equivalent

y resolution using scattered lepton



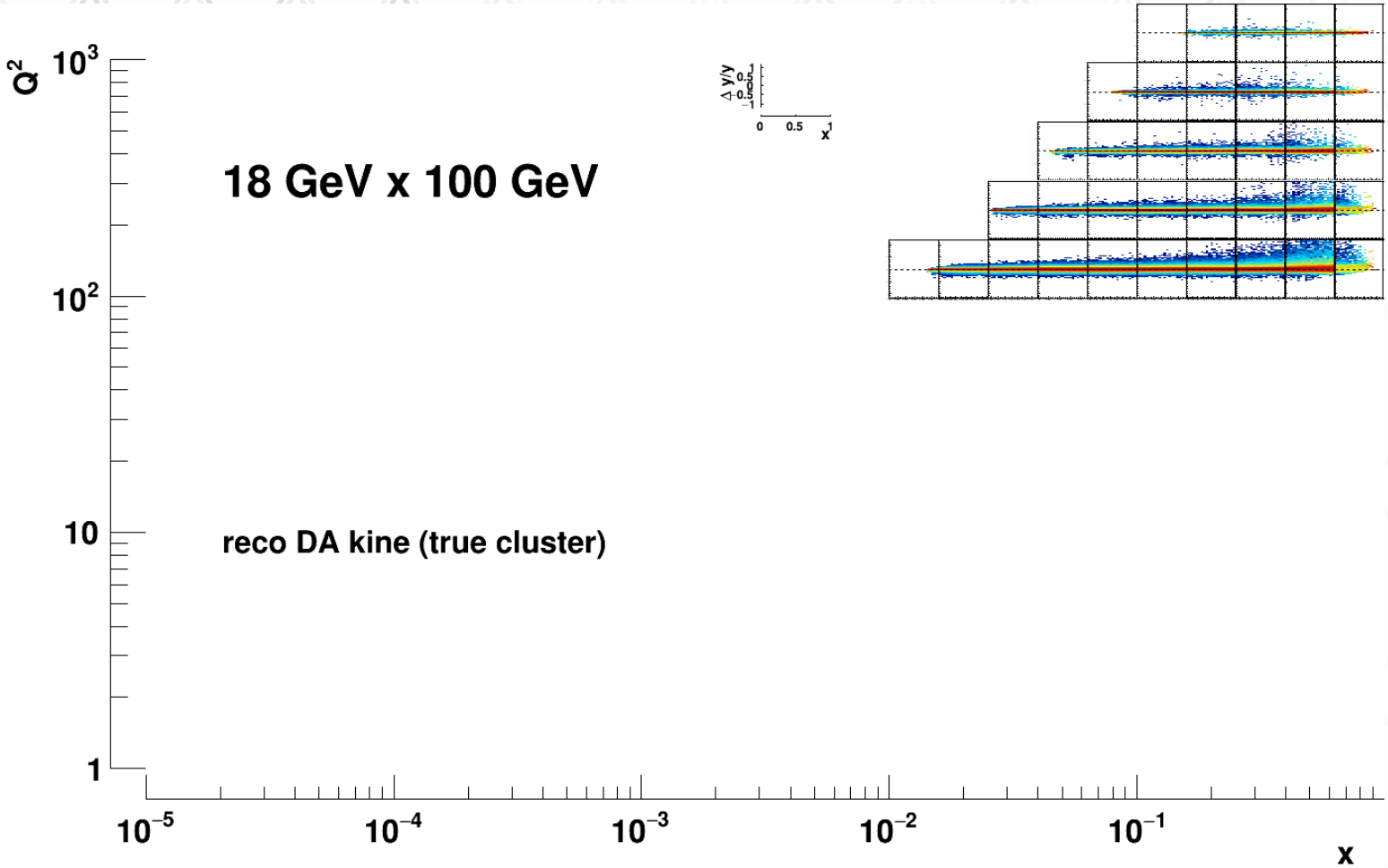
Good resolutions at high y, larger uncertainties at low y

y resolution JB true neutral clusters (use PDG)



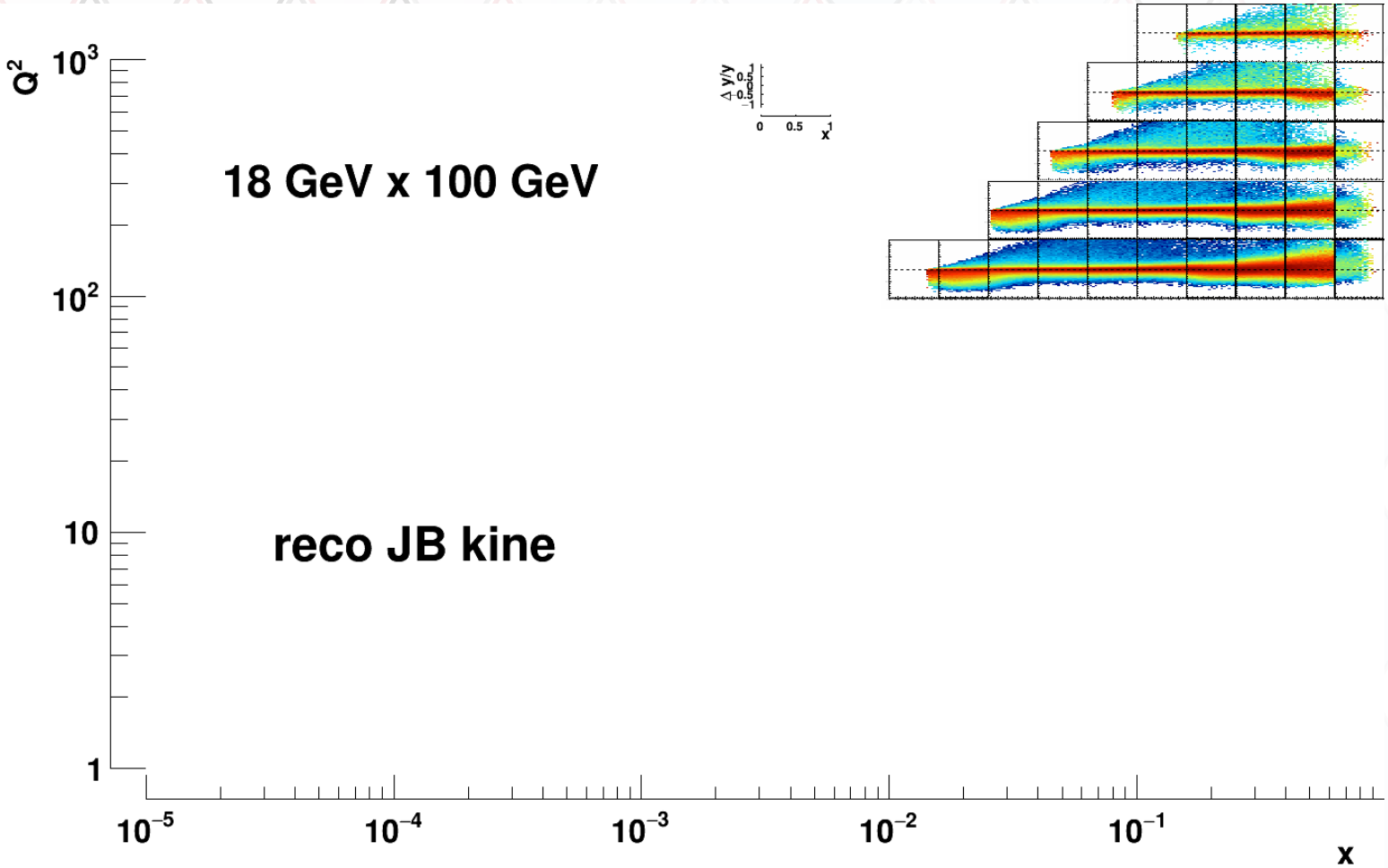
Better at low y

Y resolution DA true neutral clusters (use PDG)

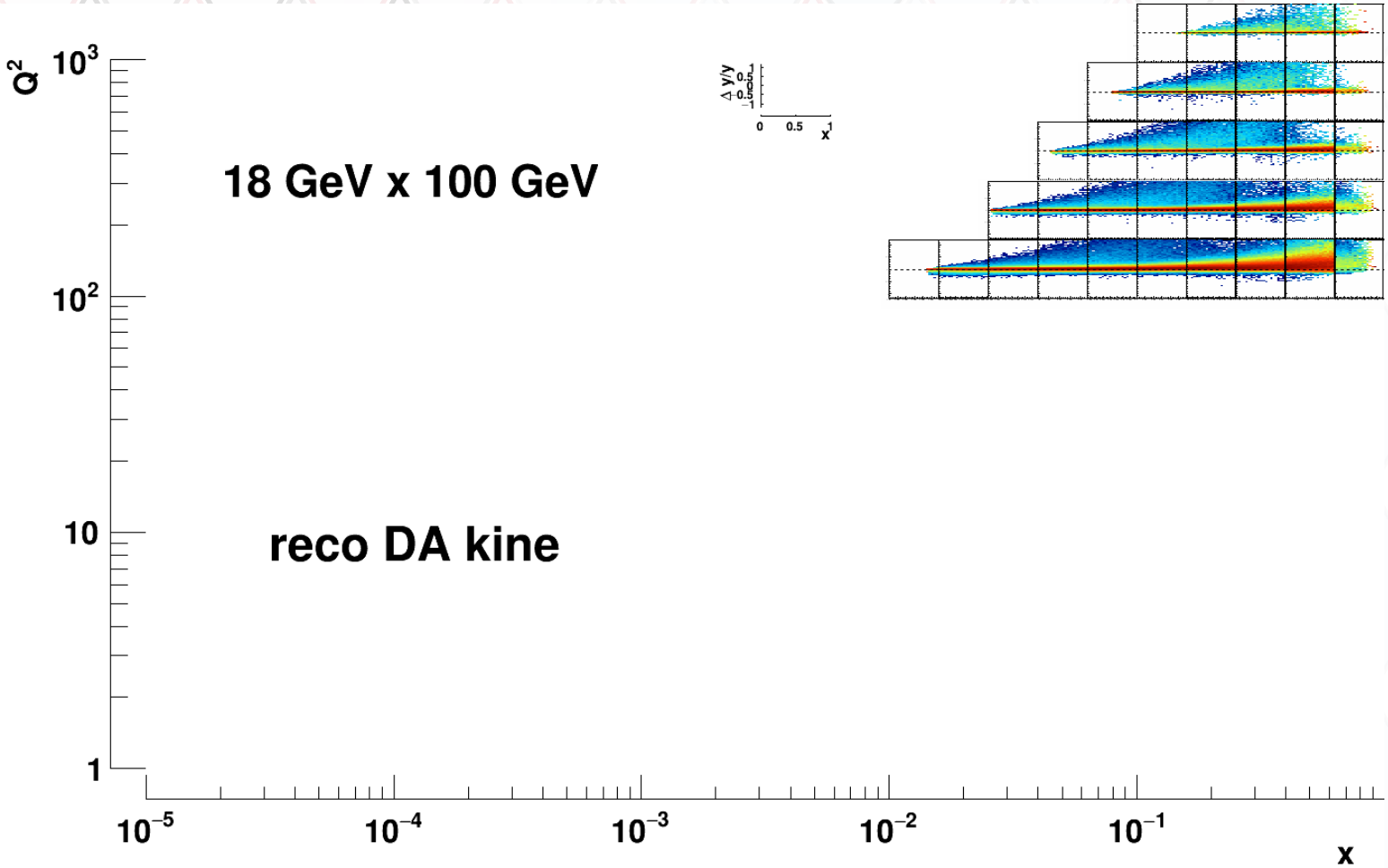


Double angle with best overall resolution

y resolutions JB using Barcode for neutrals

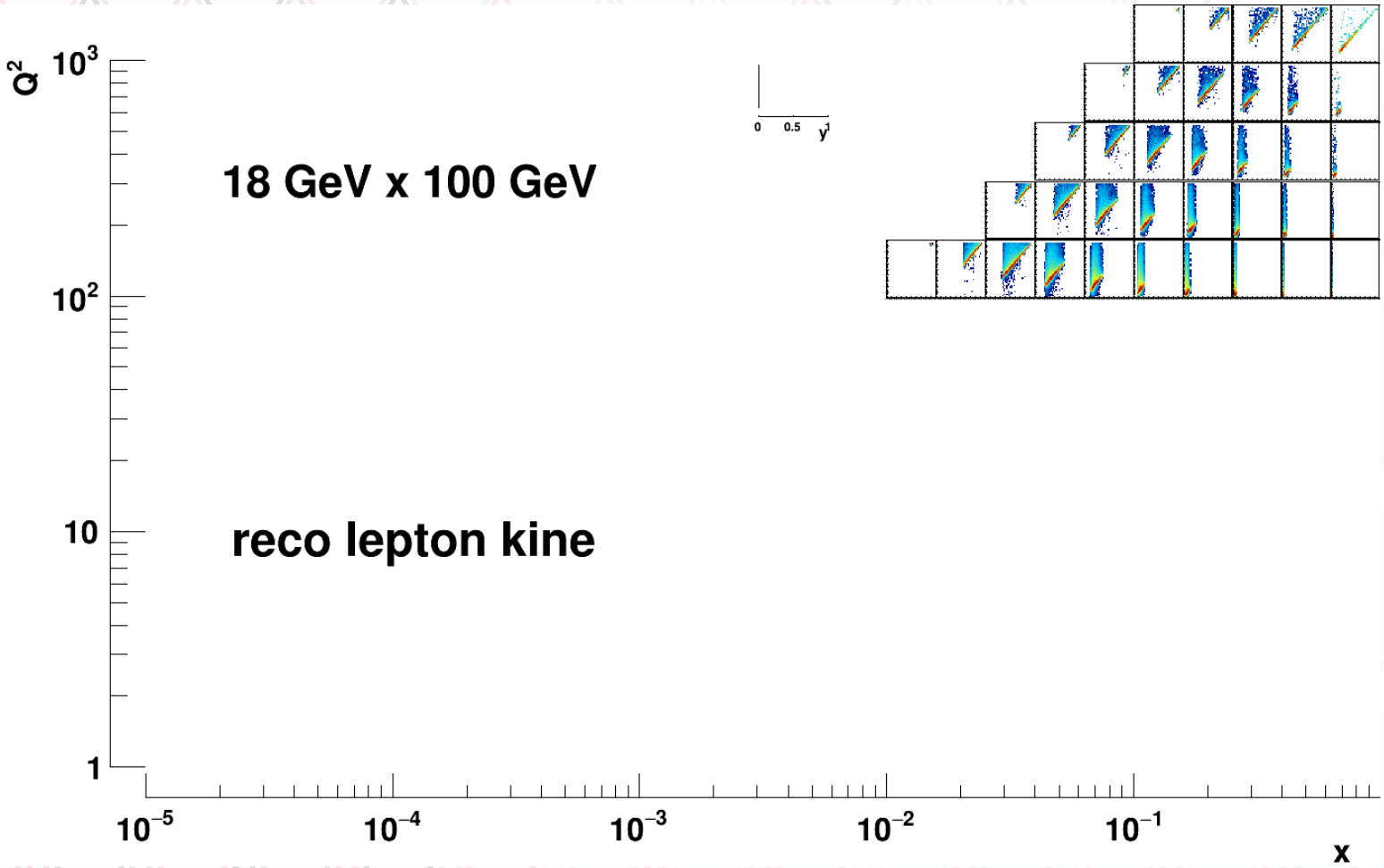


Y resolutions DA using Barcode for neutrals

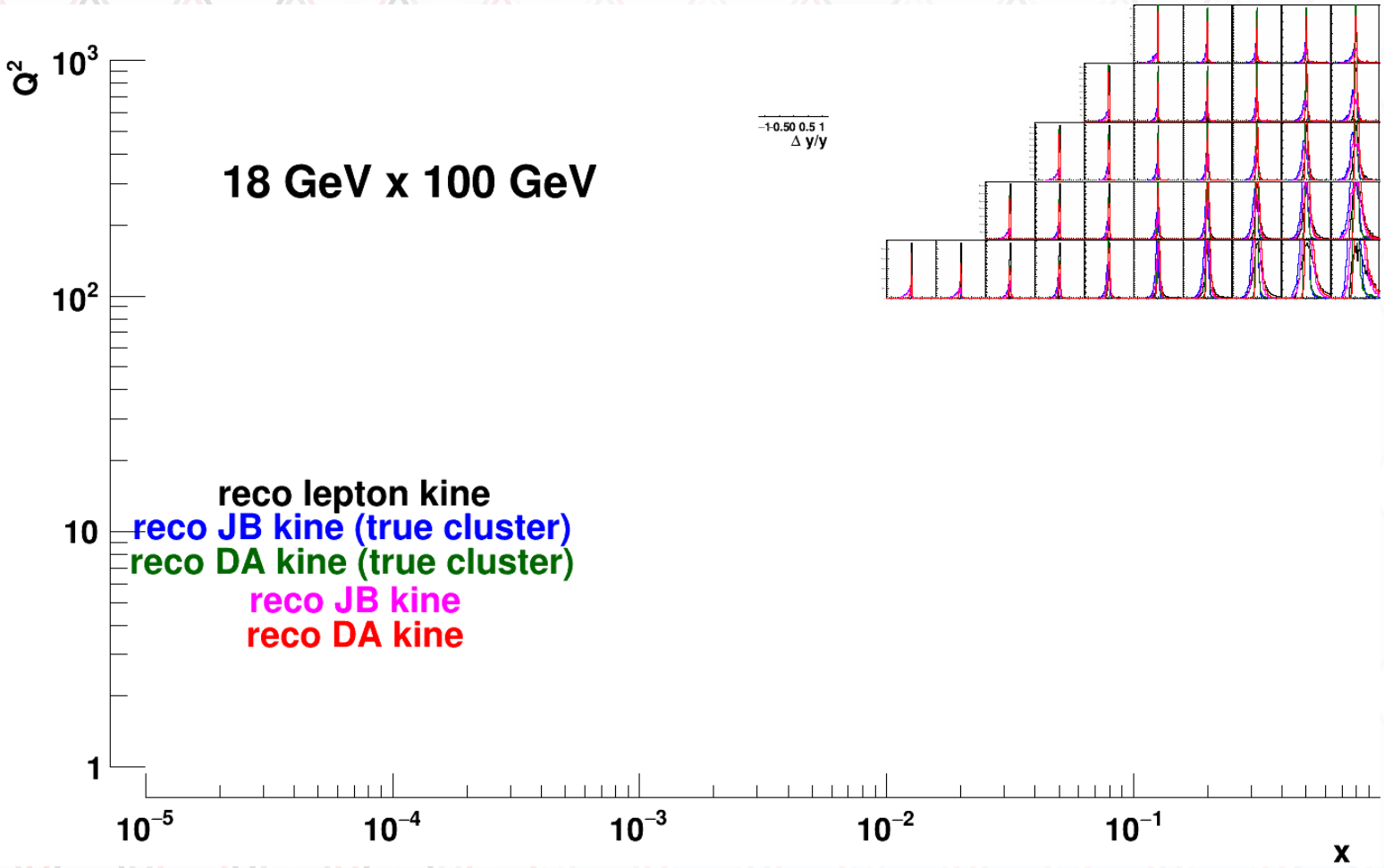


Good resolutions at high y, larger uncertainties at low y

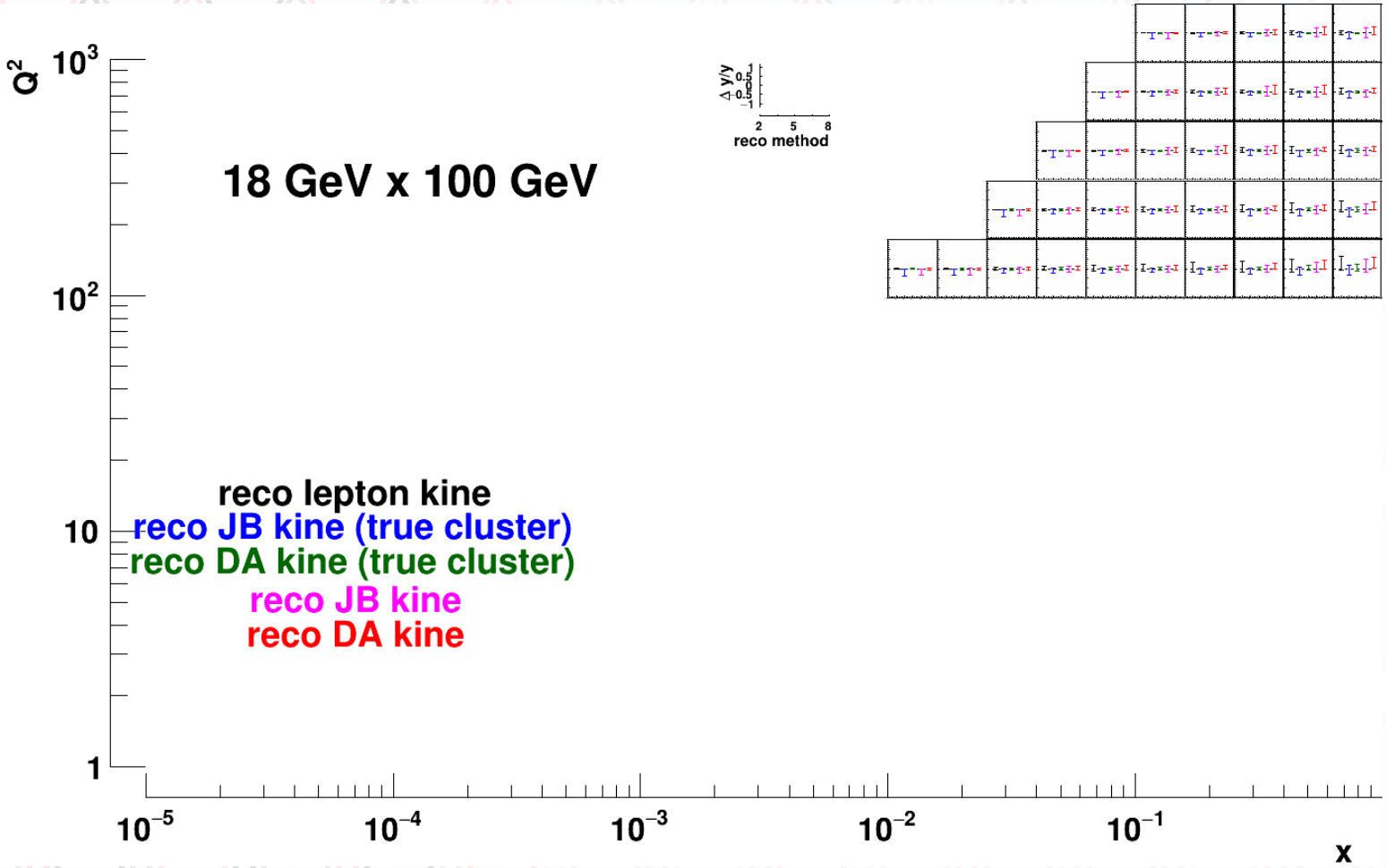
y distributions true vs reco for lepton method



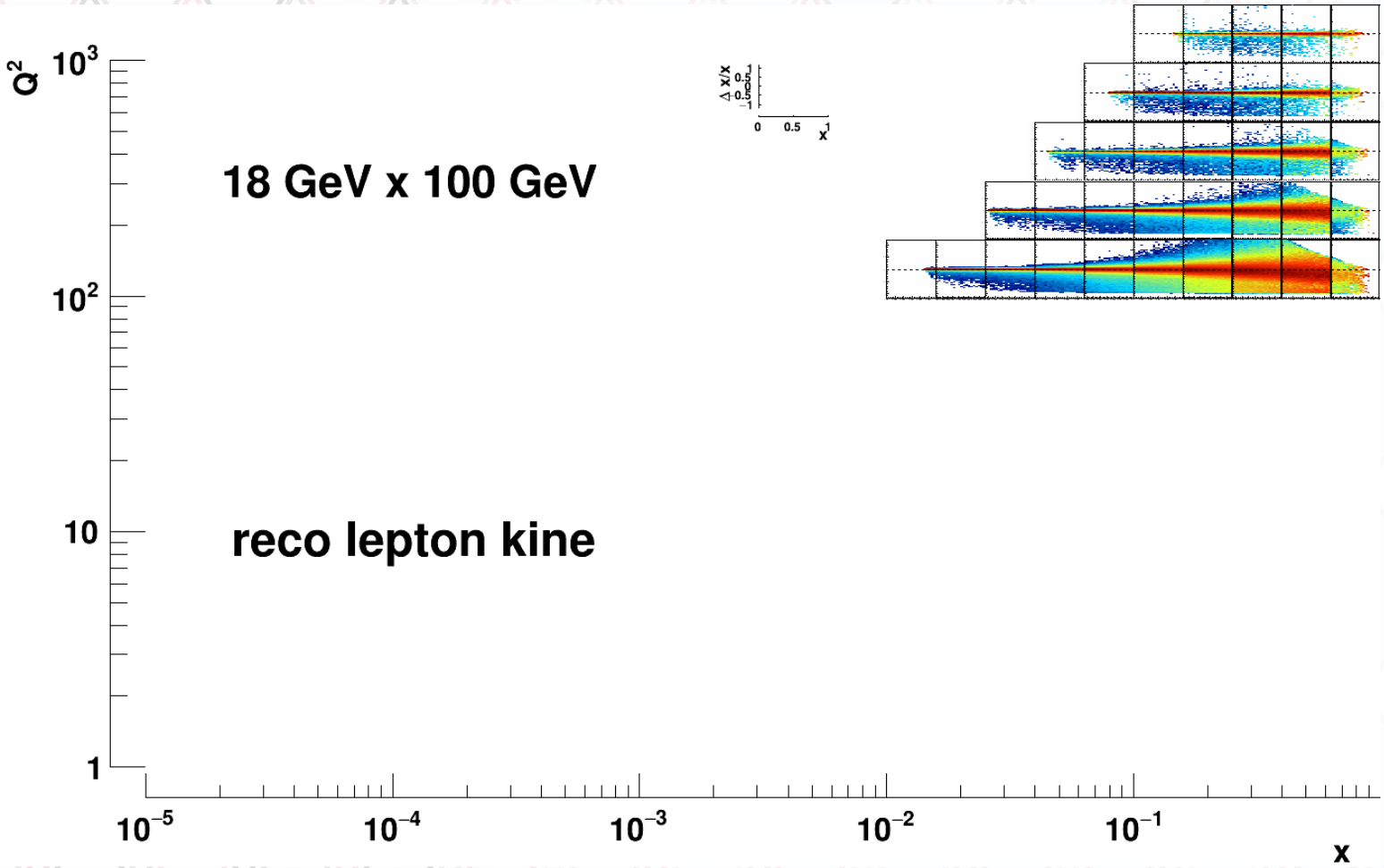
Accumulated resolutions



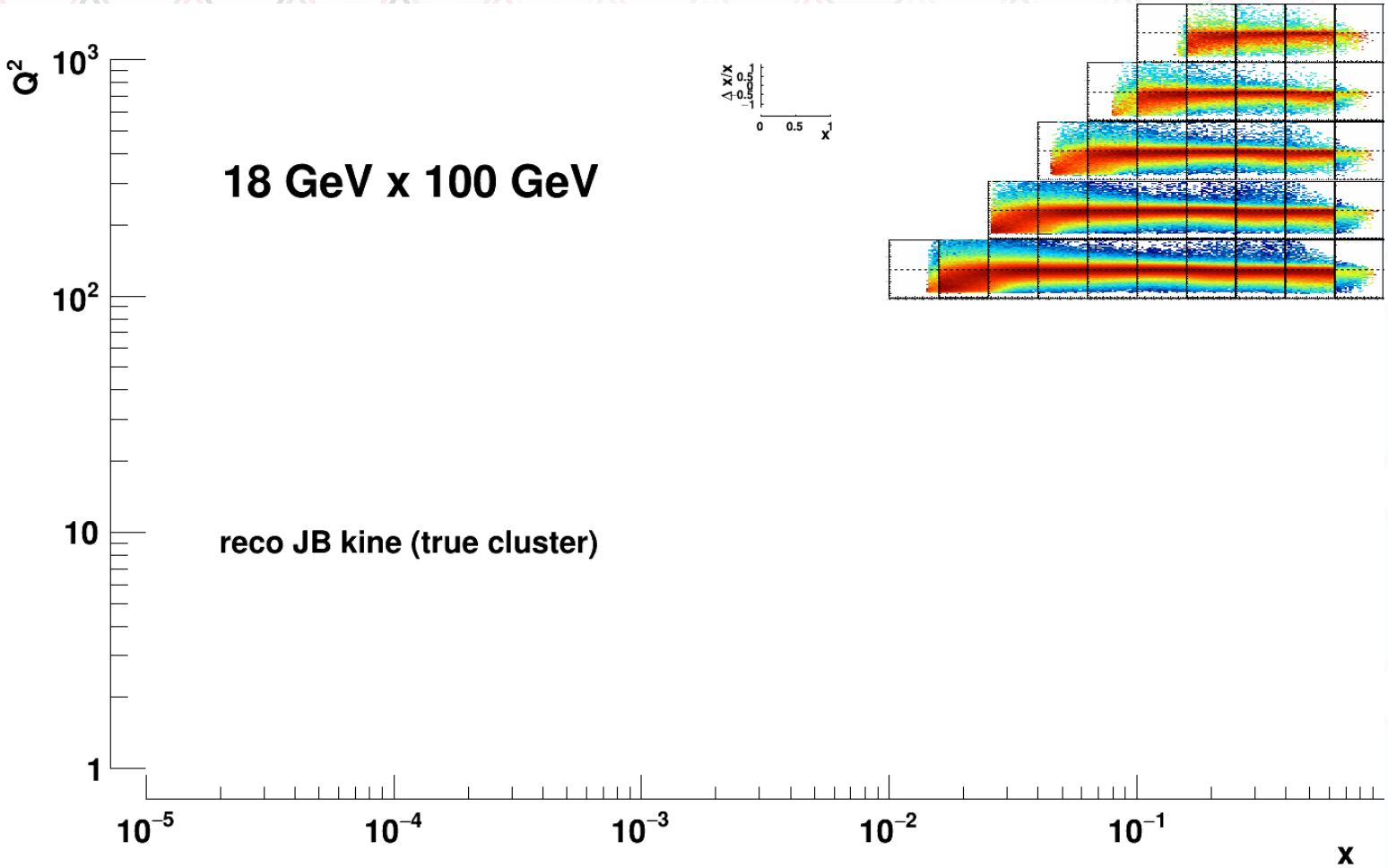
All y resolution widths and means



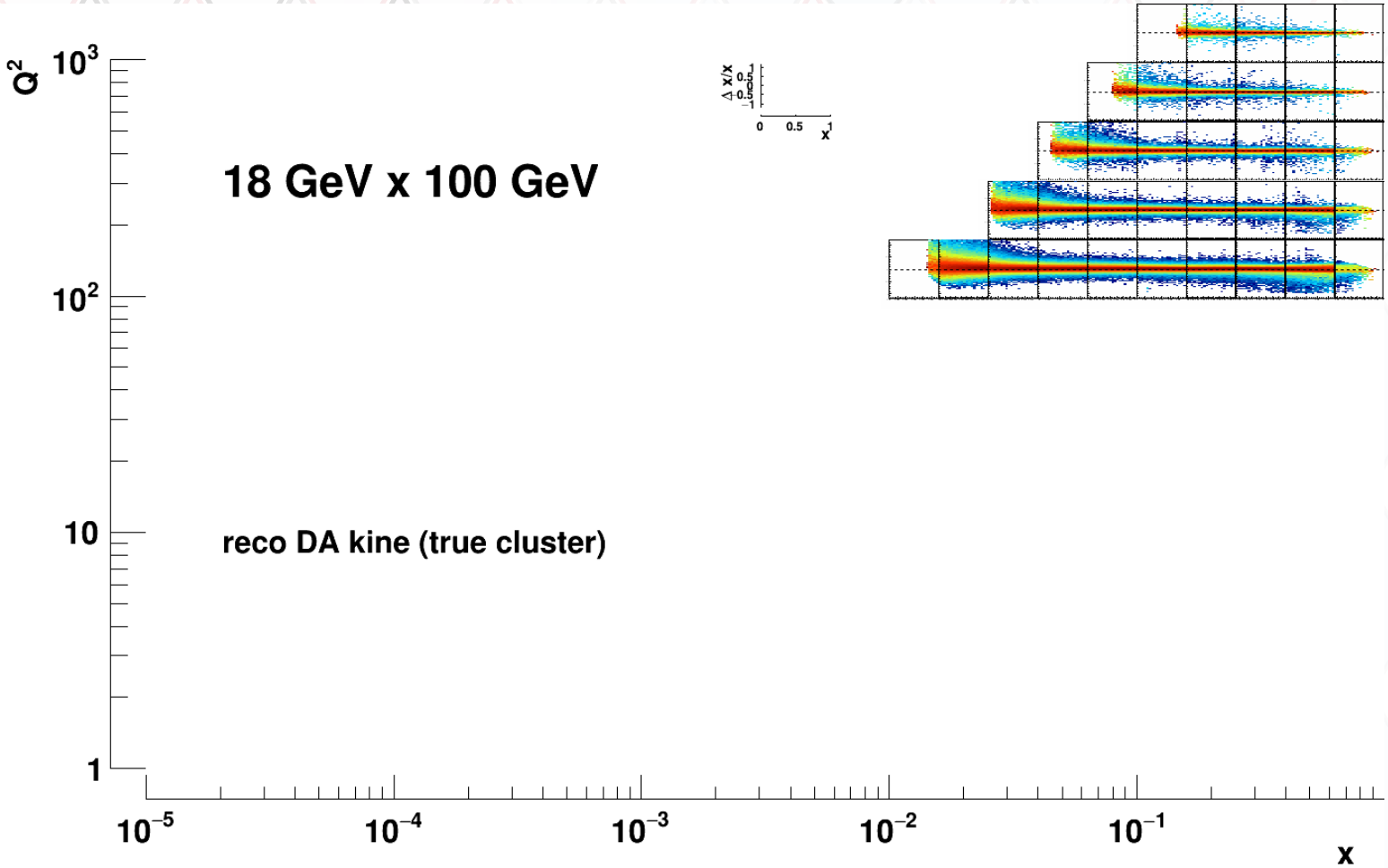
x resolution, lepton method



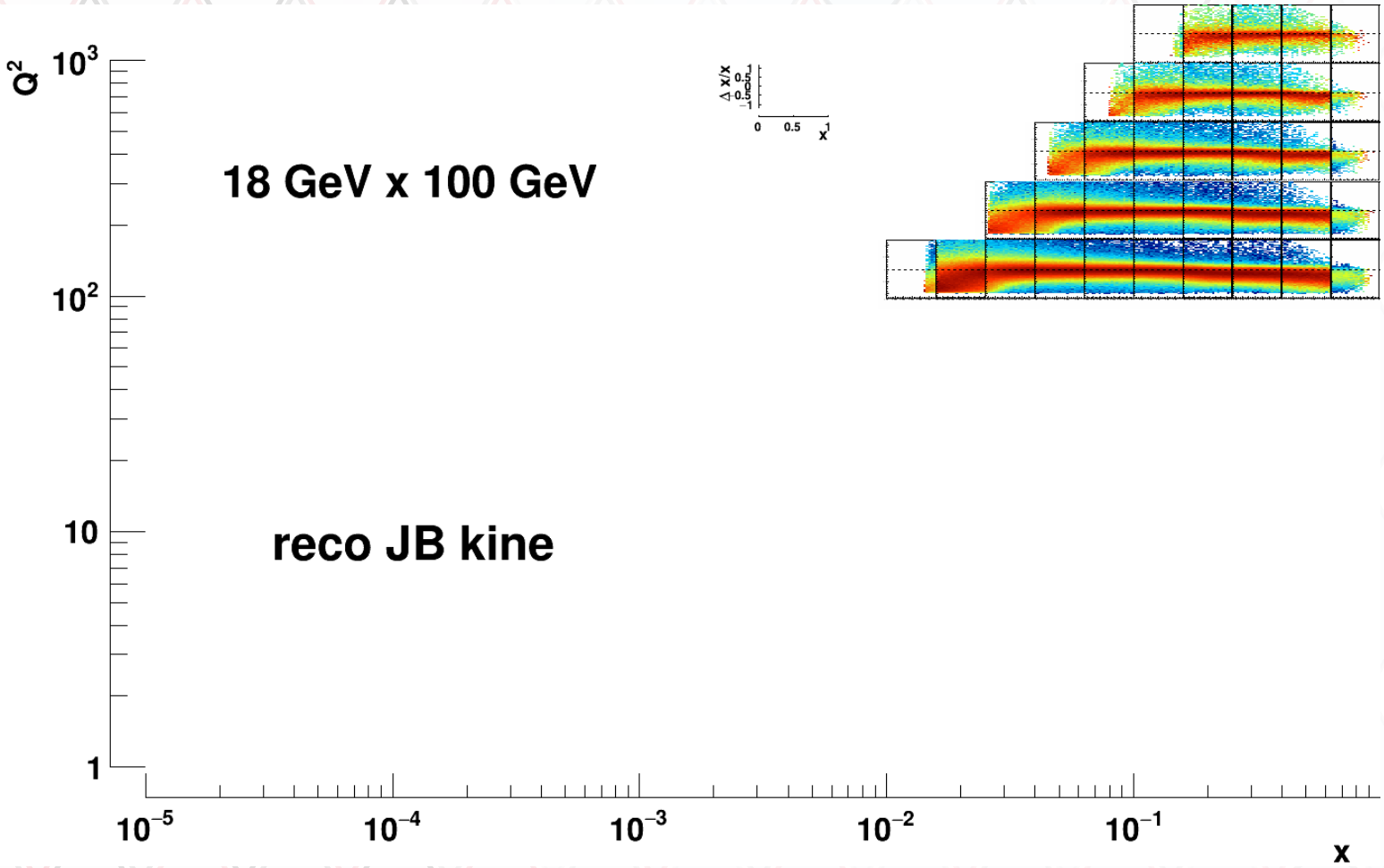
x resolution JB, reco tracks, true clusters



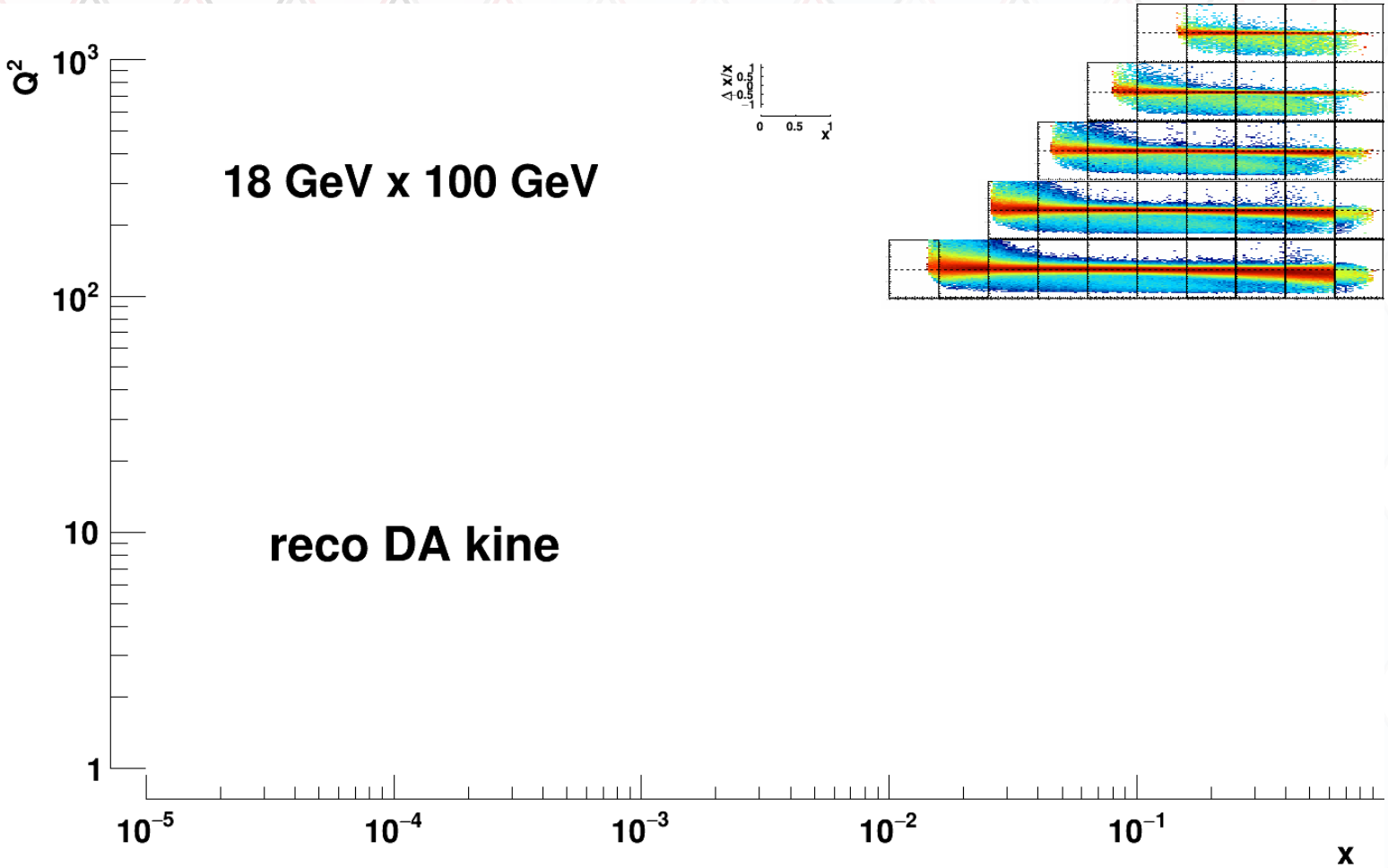
x resolution DA, true clusters



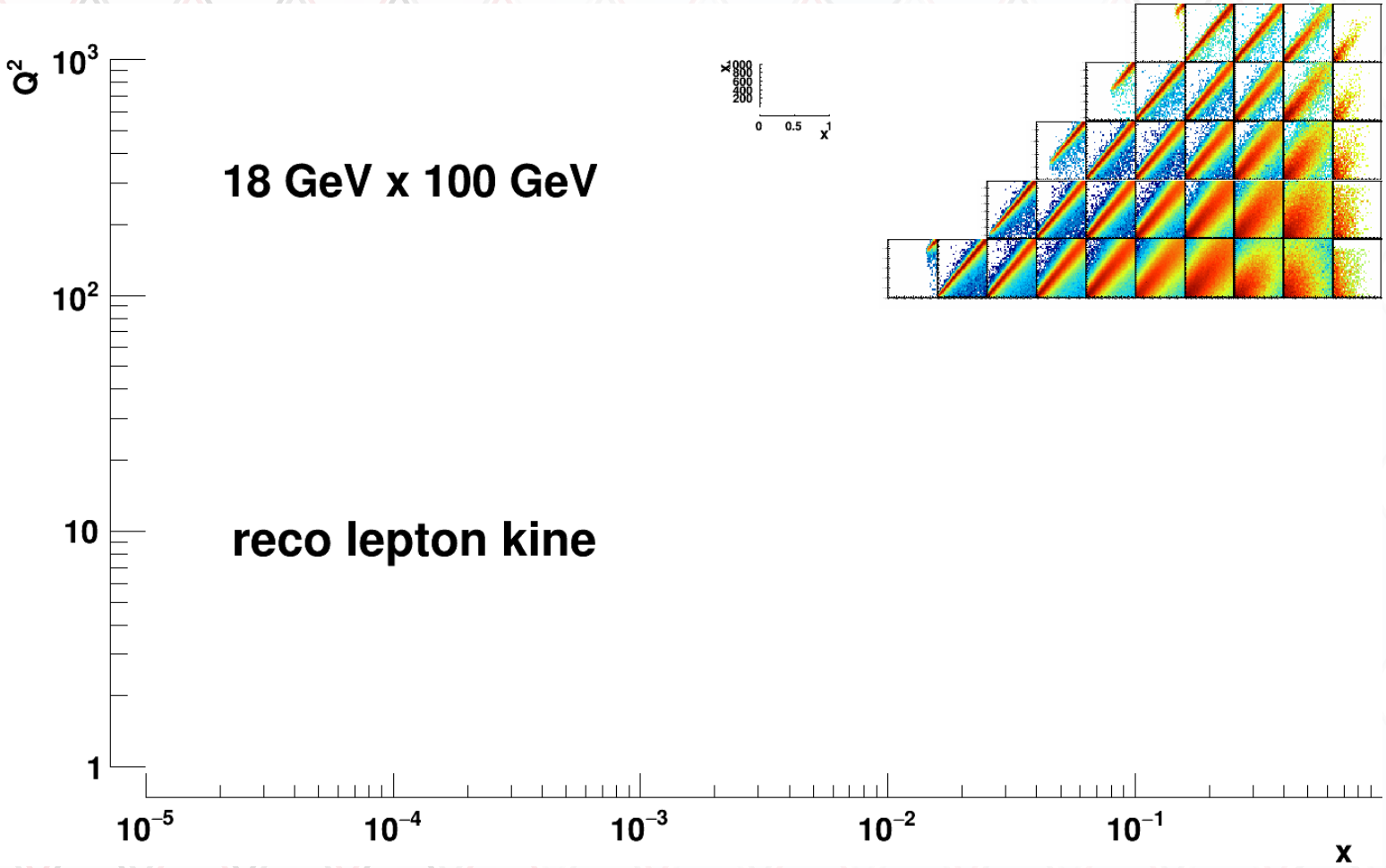
Reco JB, clusters via Barcode



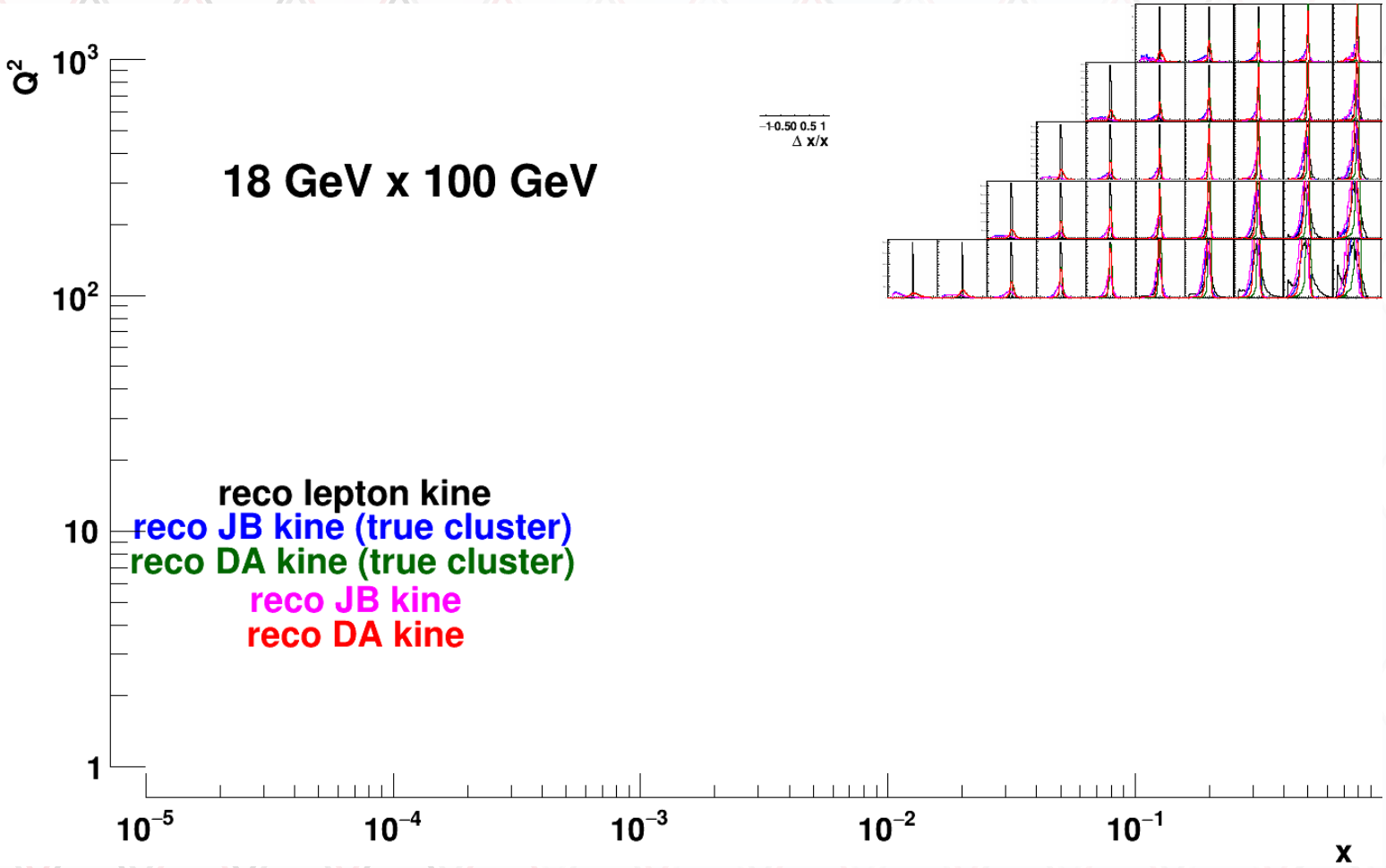
Reco DA, clusters via Barcode



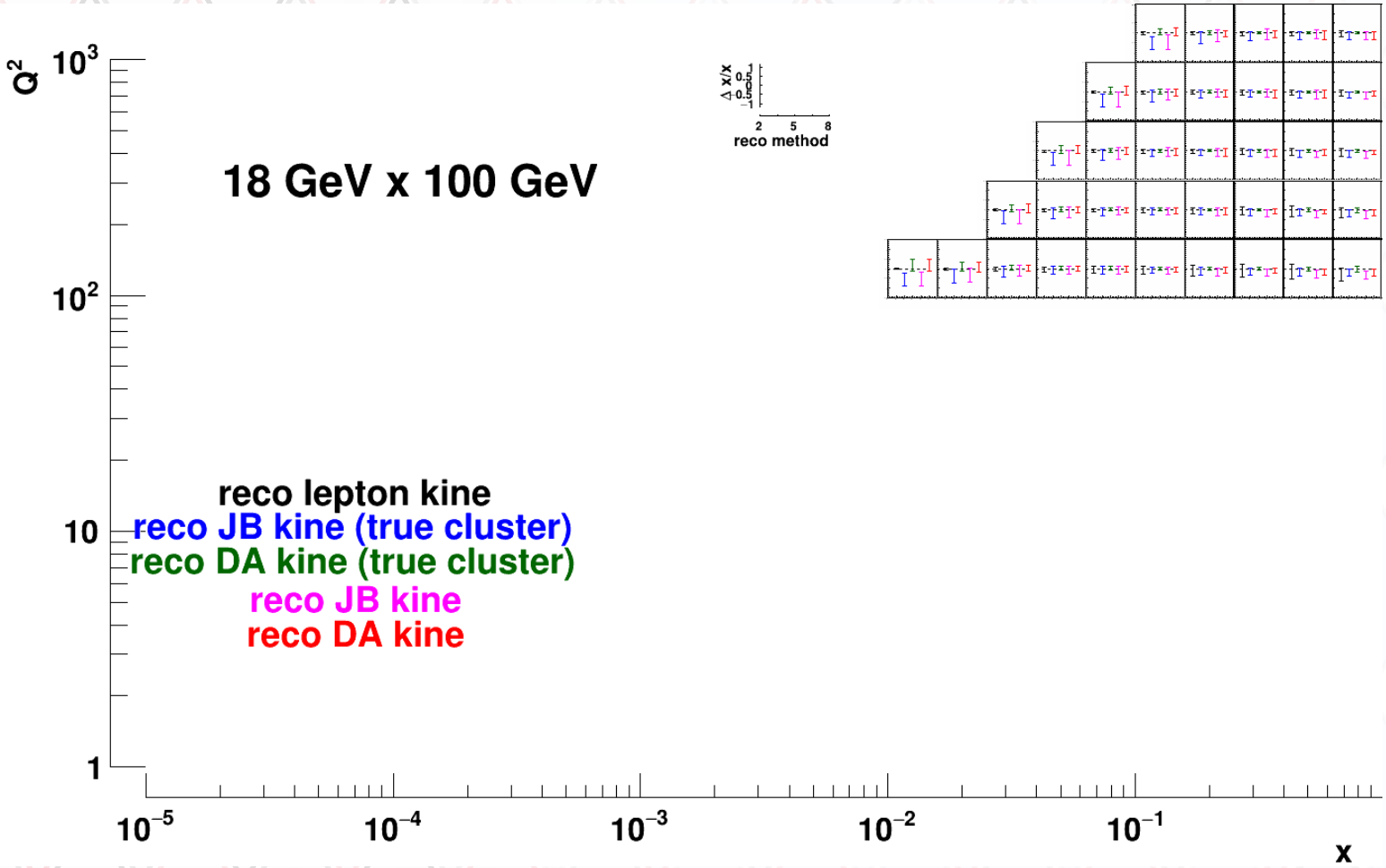
Distributions x true vs reco lepton reco



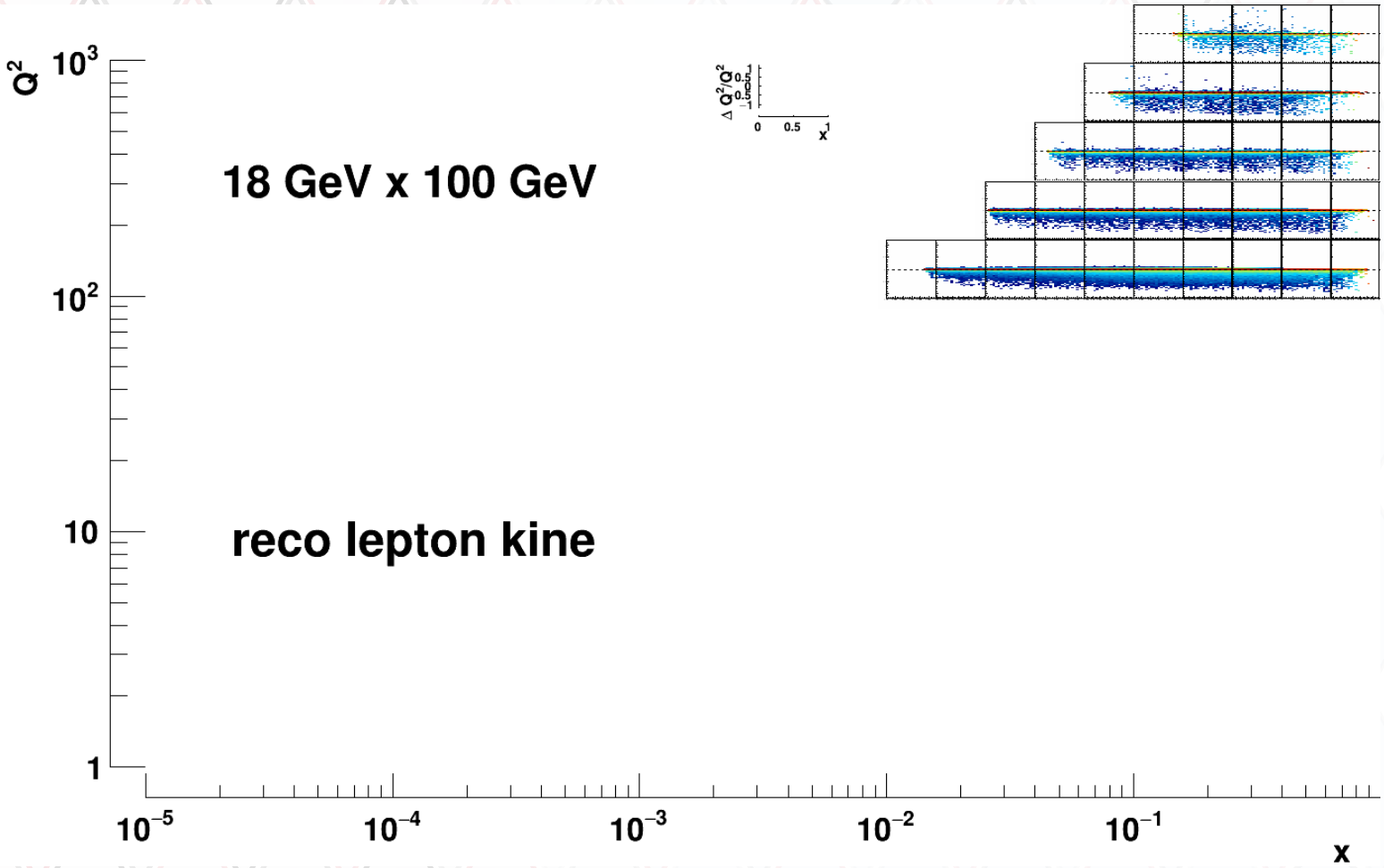
All reco x distributions



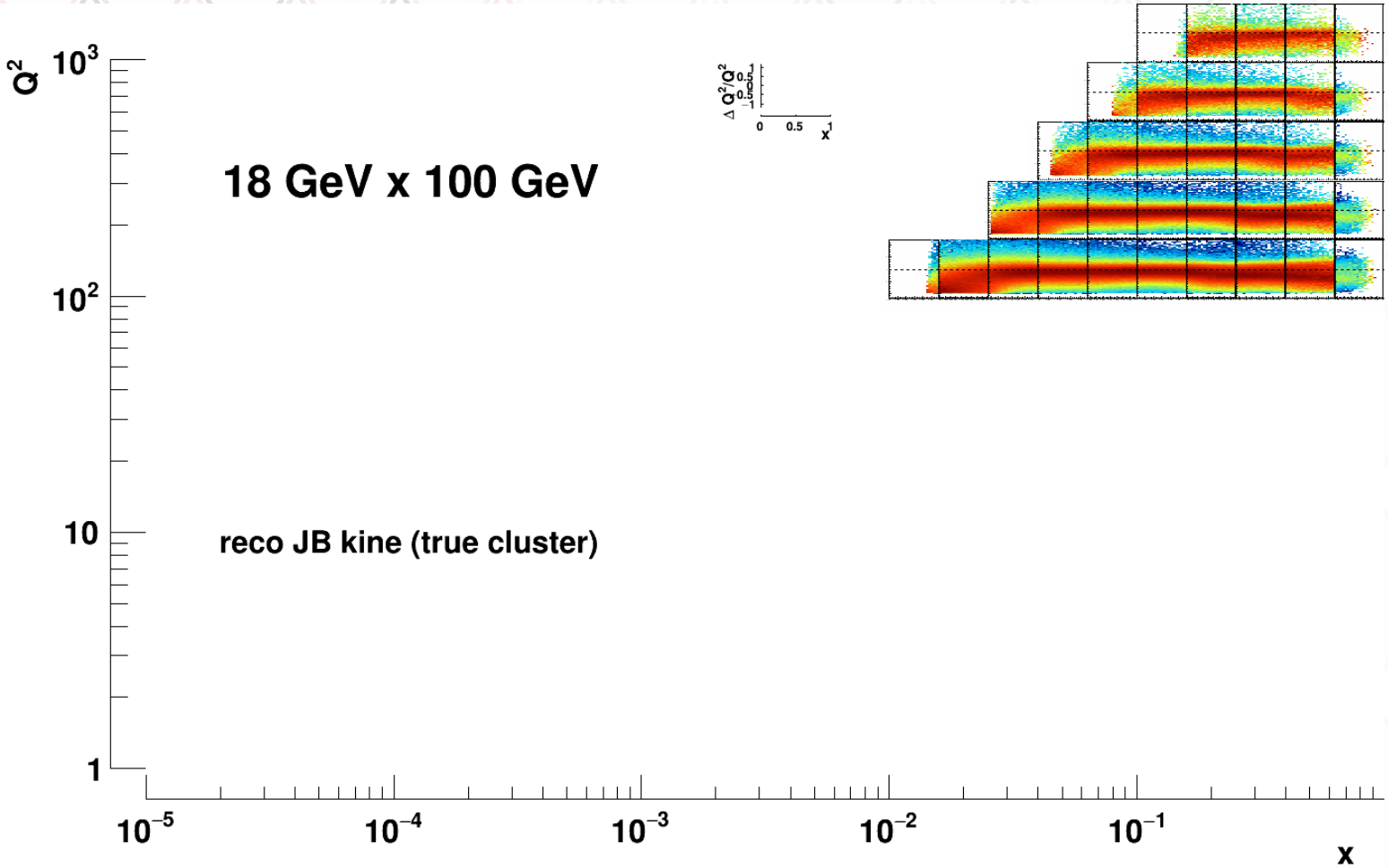
All x resolution widths and means



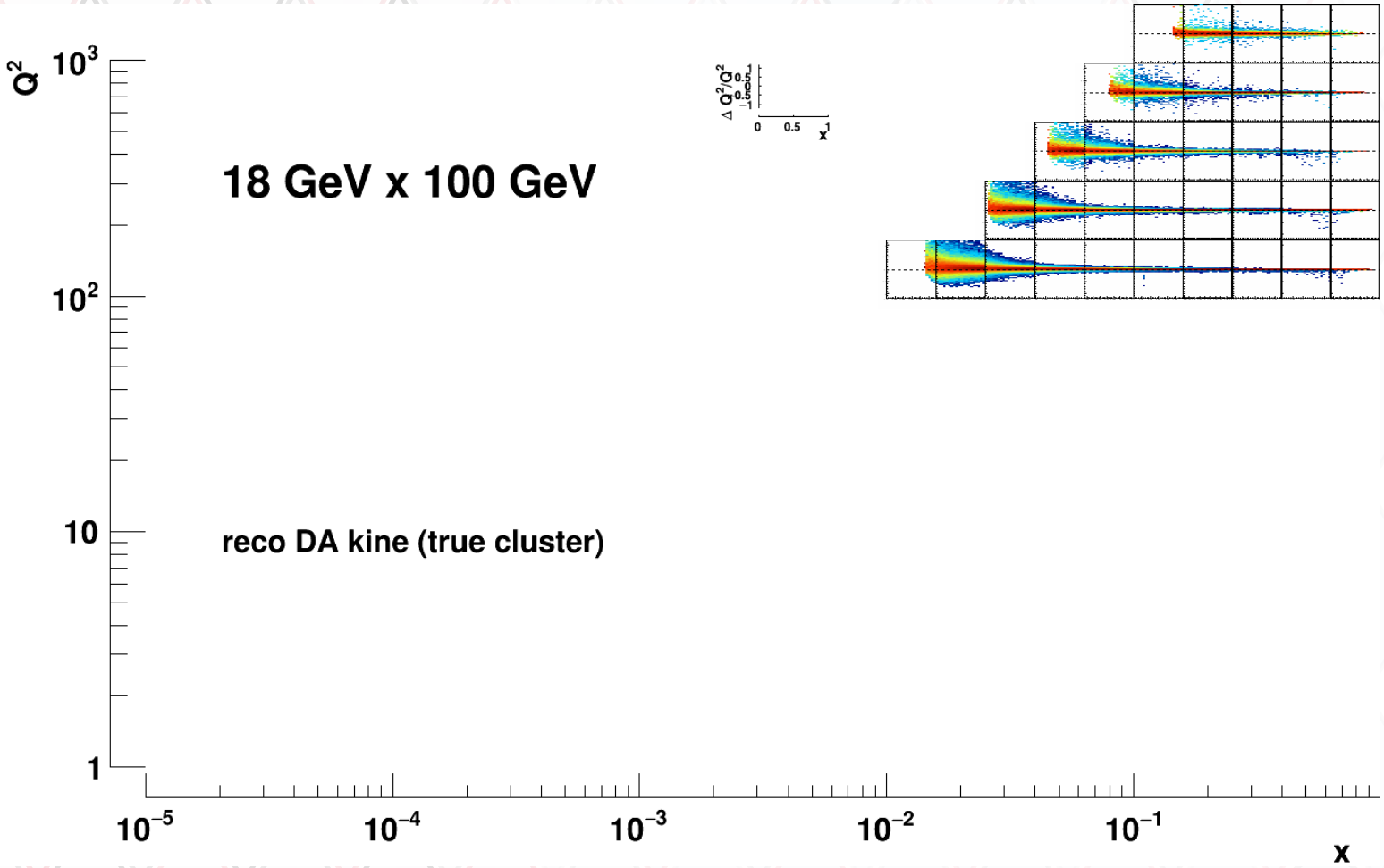
Q2 res lepton method



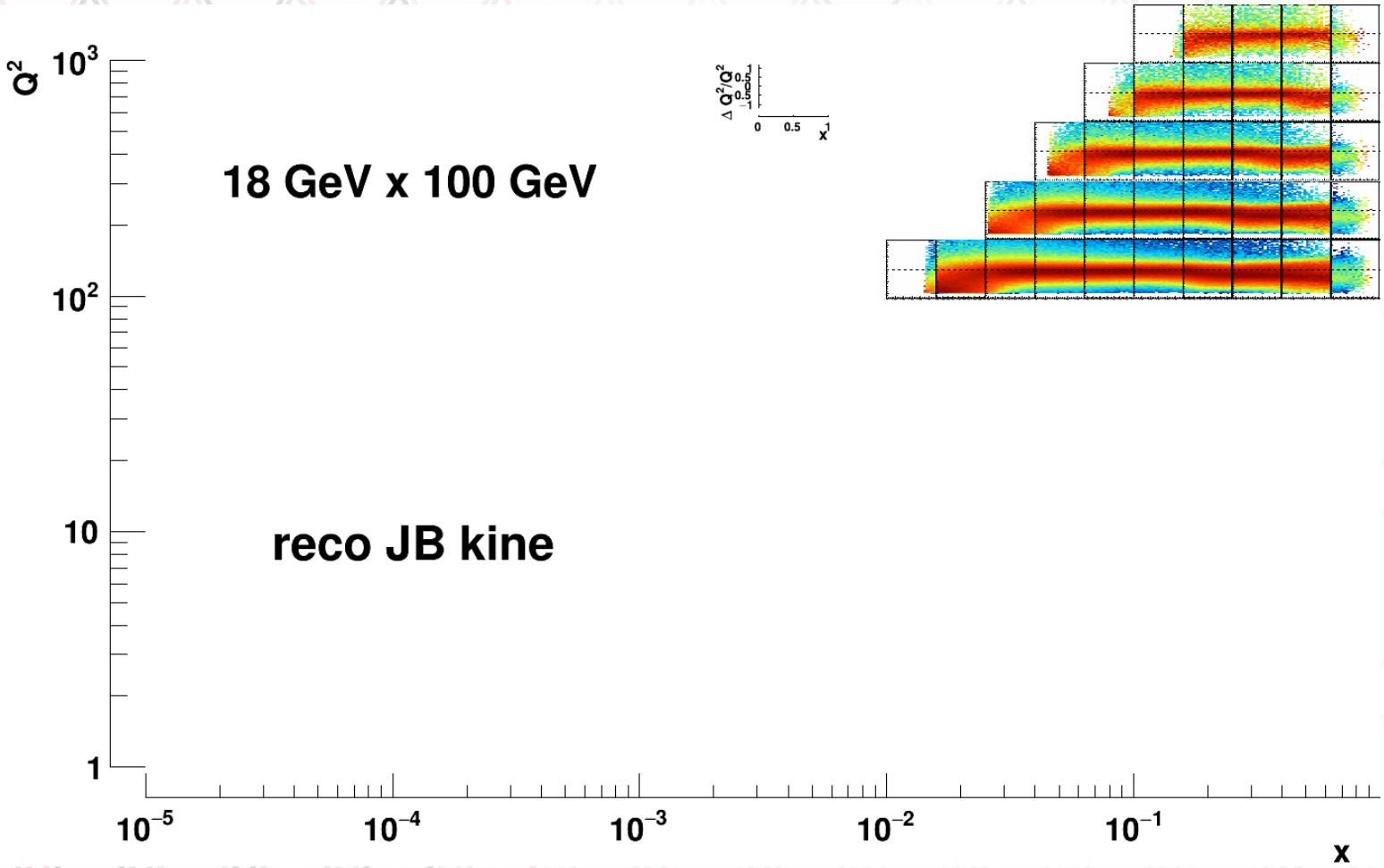
Q2 resolutions JB true cluster (use PDG)



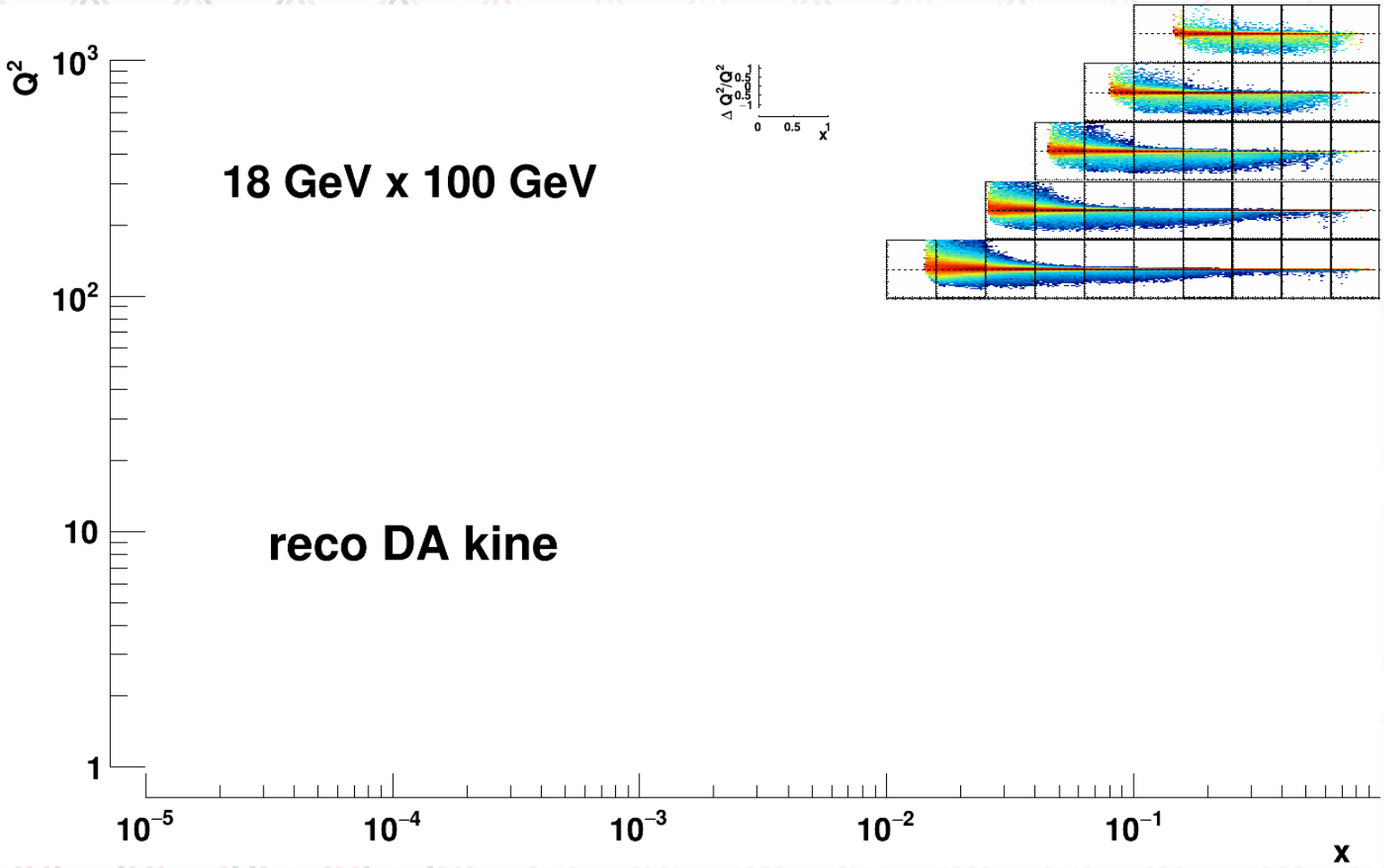
Q2 resolutions DA true cluster (use PDG)



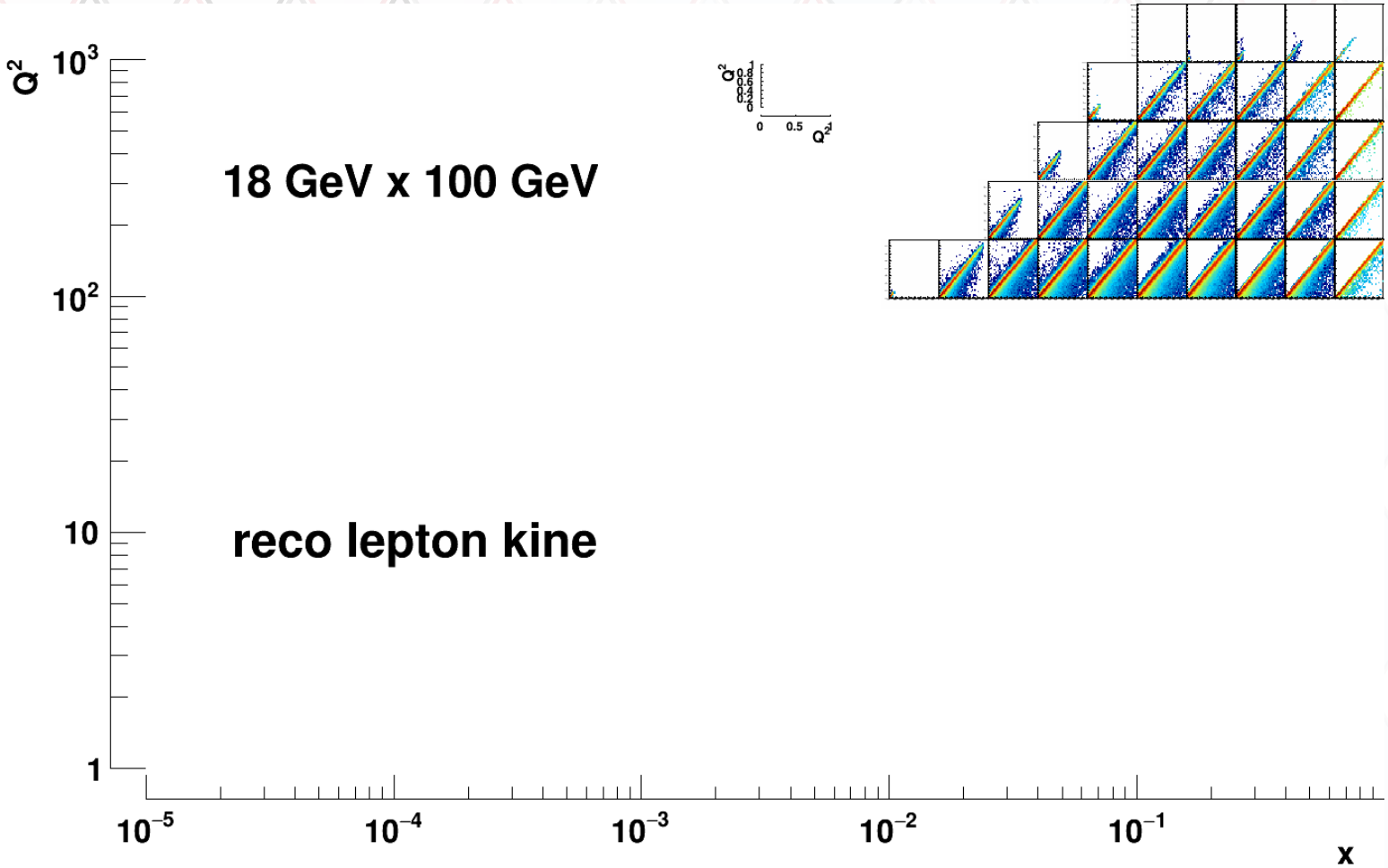
Q2 resolutions JB



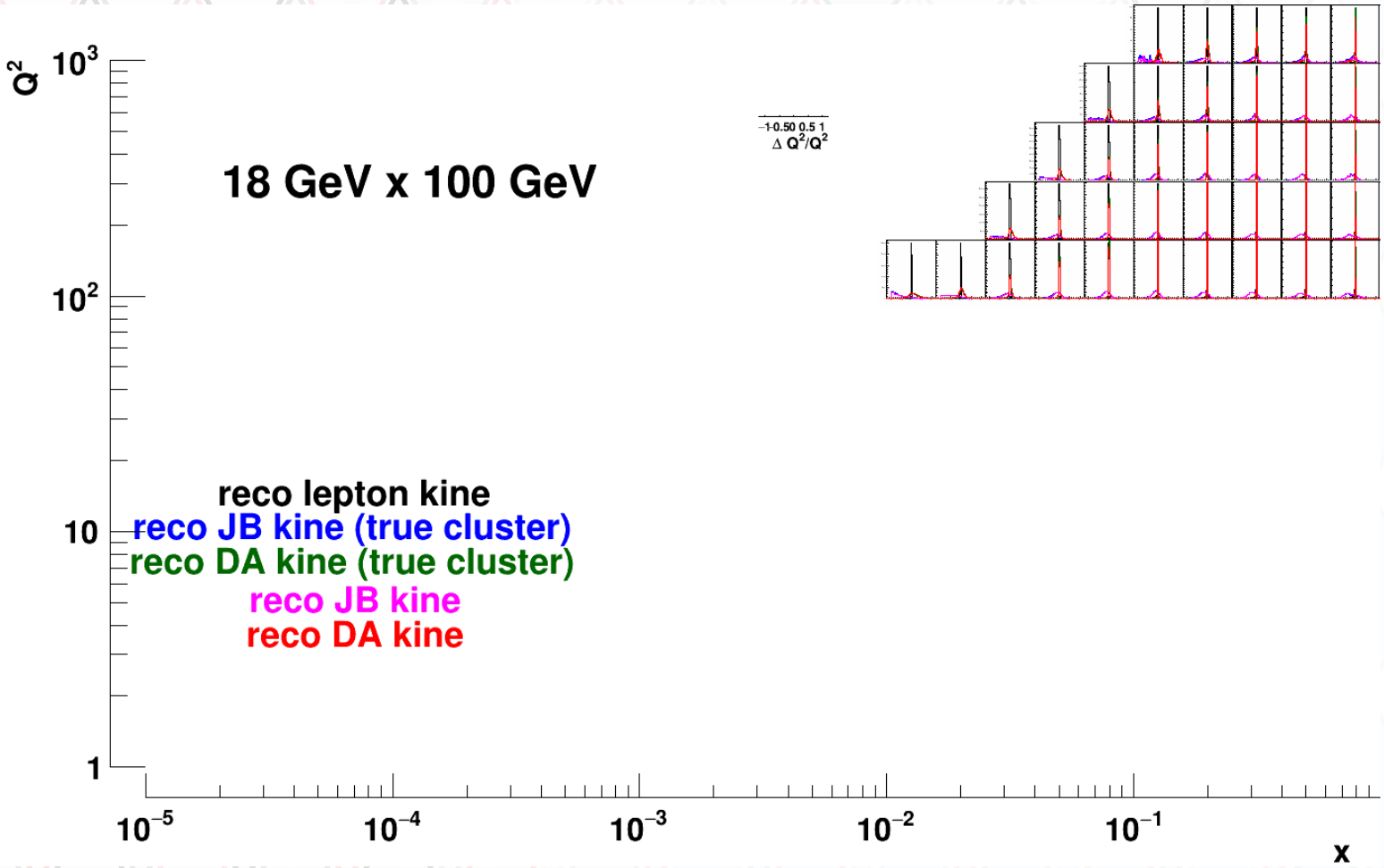
Q2 resolutions DA

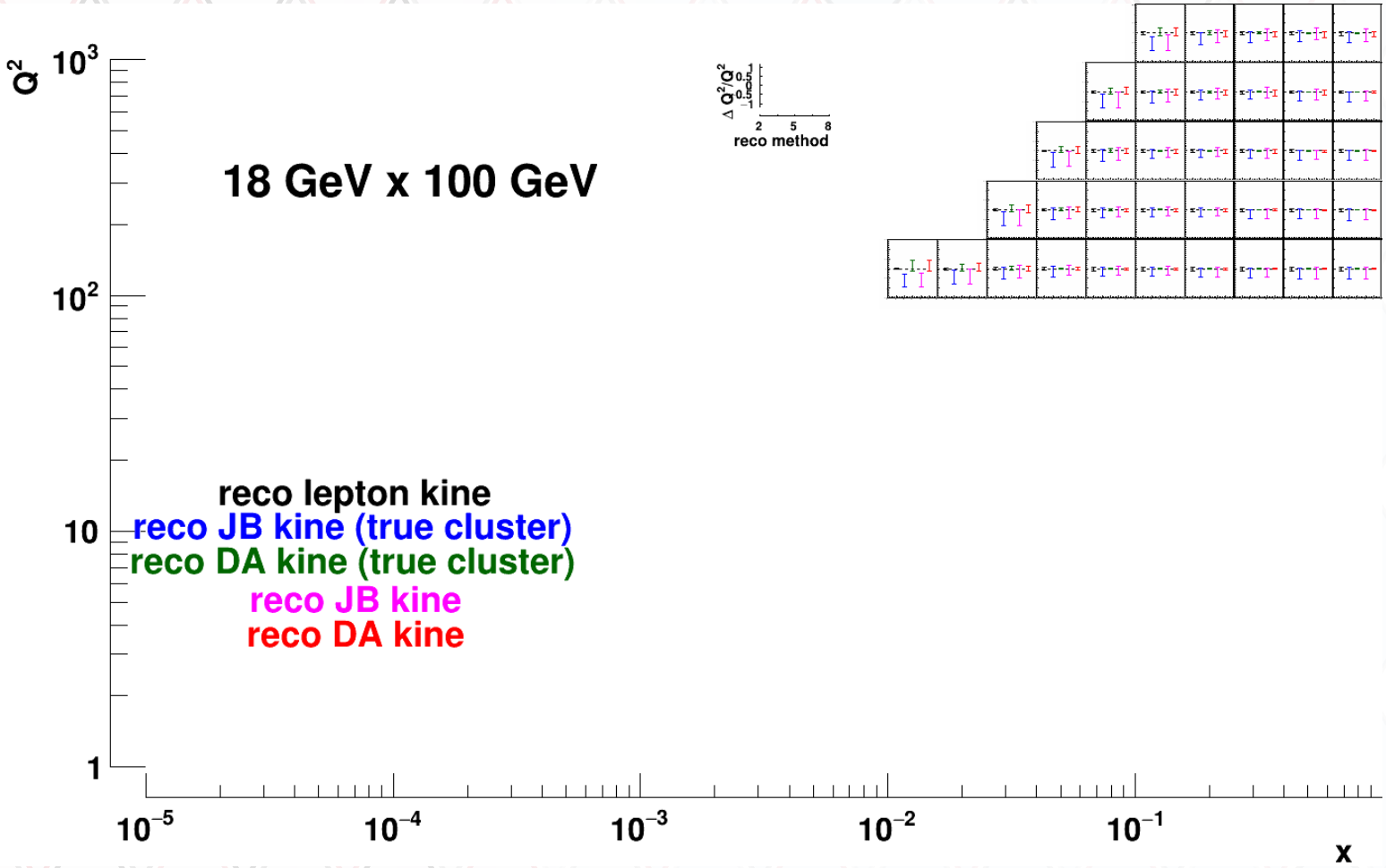


Q2 true vs reco distributions



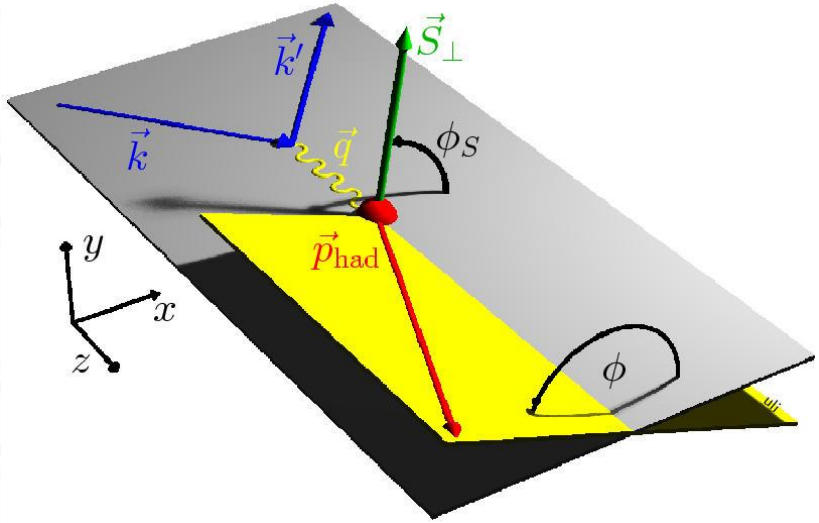
All Q2 resolution widths and means




18 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
reco lepton kine
reco JB kine (true cluster)
reco DA kine (true cluster)
reco JB kine
reco DA kine
$\Delta Q^2/Q^2$
reco method

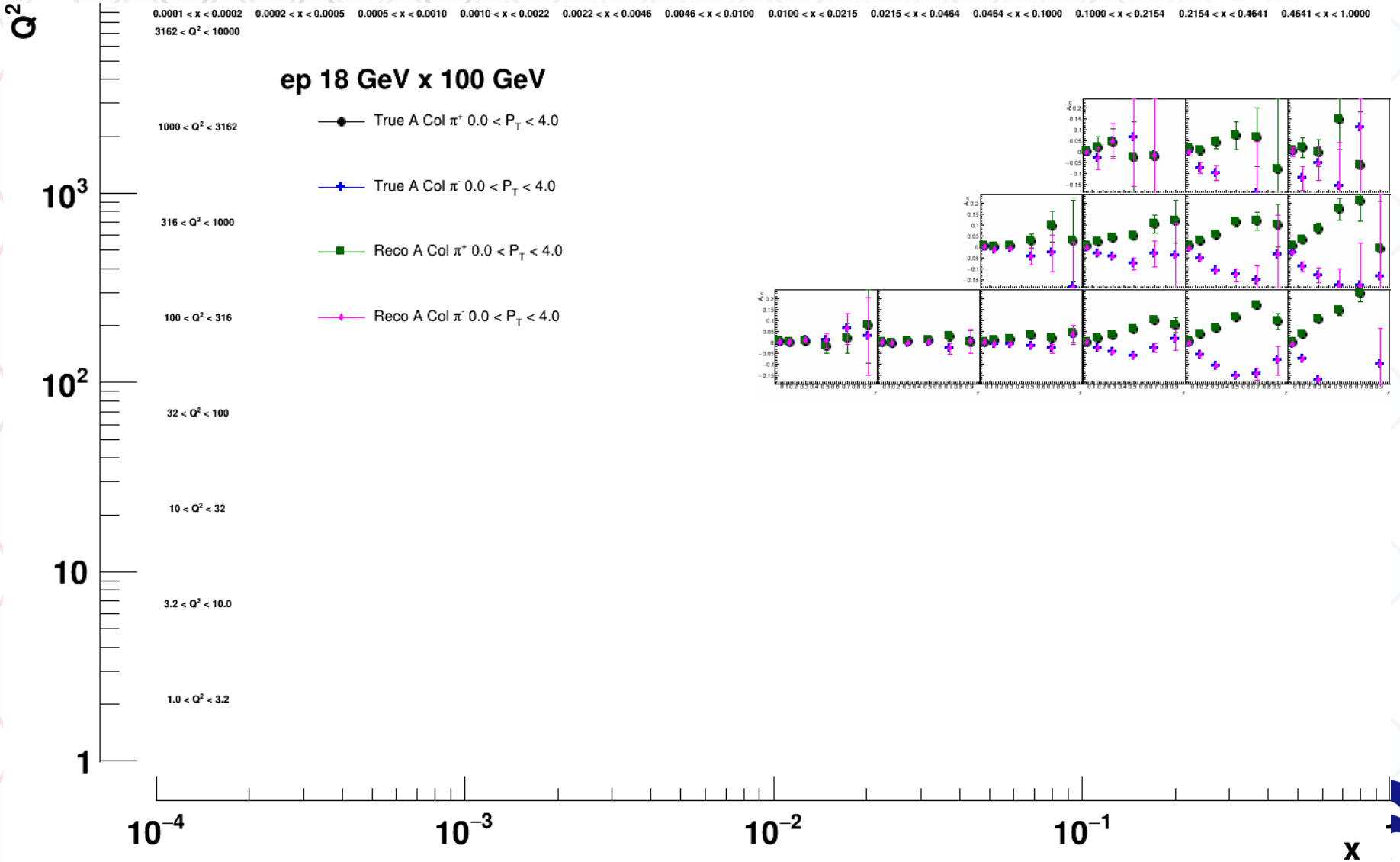
Sivers/Collins measurements in SIDIS

- Use test production output and calculate Sivers and Collins asymmetries
- Reweight events according to true parton flavor q, hadron h, x, z, Q^2, P_{hT}, azimuthal angles and random spin orientiation
- $ep^{\uparrow} \rightarrow e'hX$
- A_{UT} asymmetries (Unpolarized lepton beam, Transversely polarized target)
- Different azimuthal modulations related to Sivers effect ($\sin(\phi-\phi_s)$) and Collins effect ($\sin(\phi+\phi_s)$)
- Fit simultaneously in the reconstructed events and calculate asymmetries

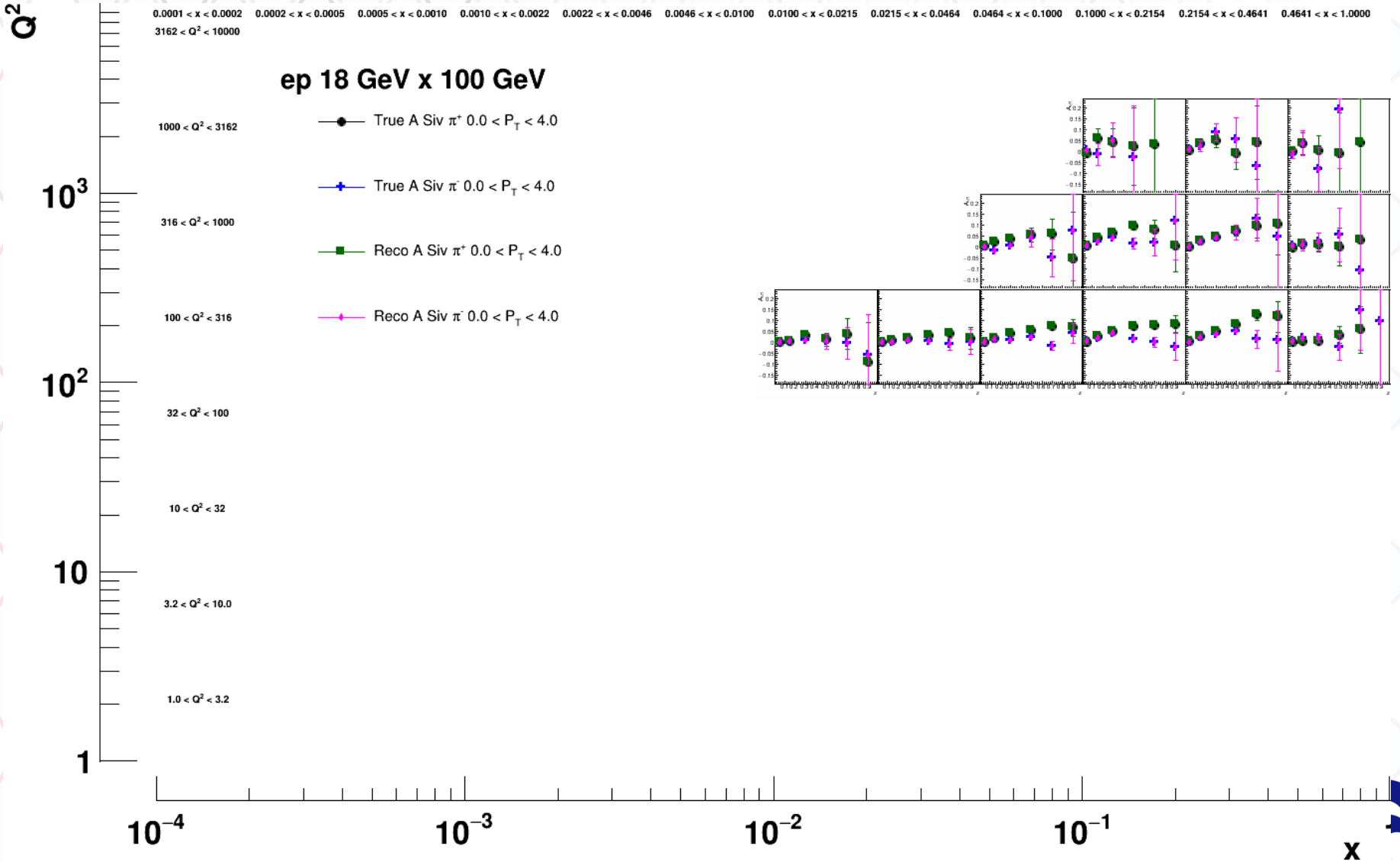


- Currently still true PID used,
- input asymmetries (structure functions) from Torino global fits

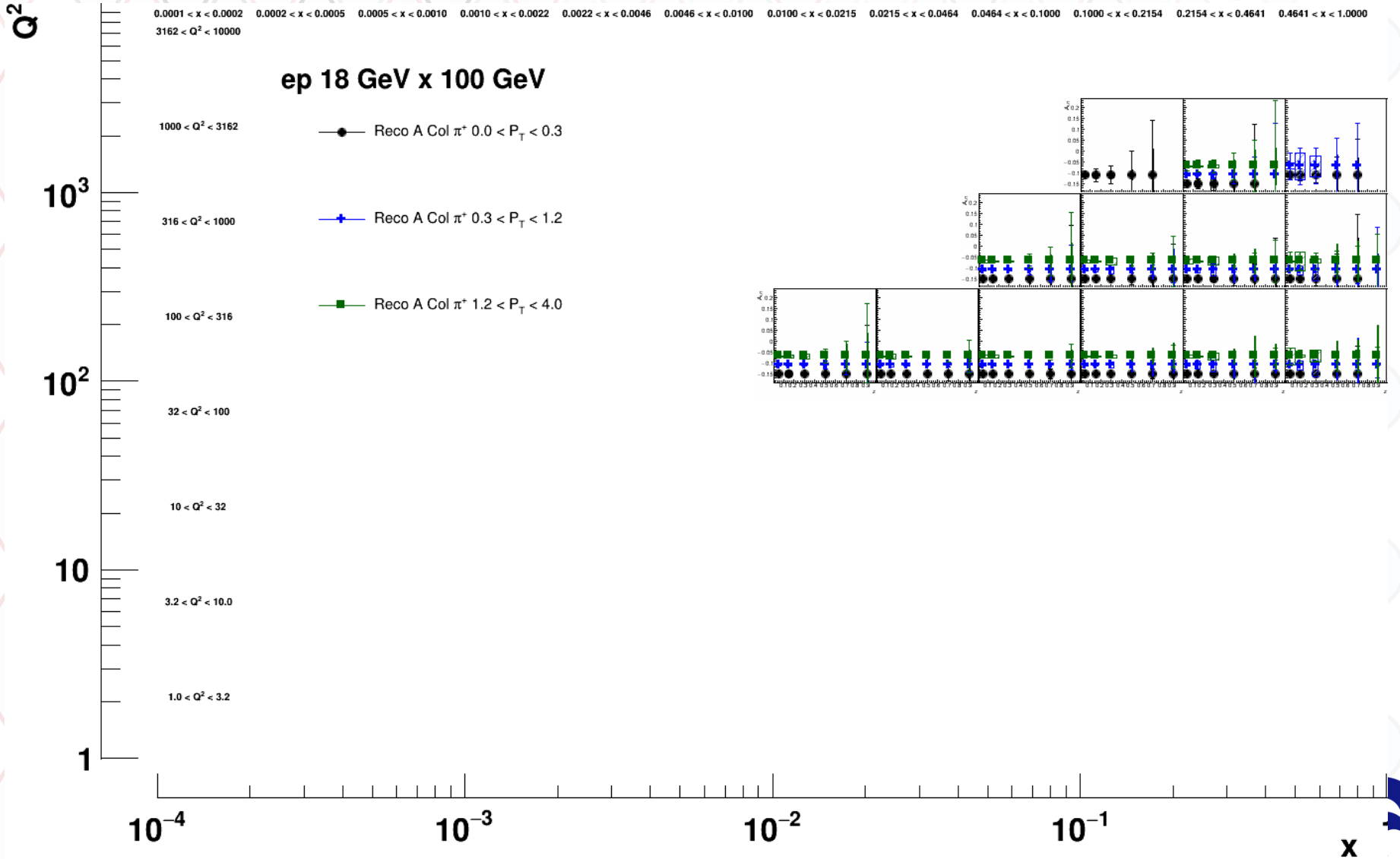
A_{UT} calculations (Testoutput ~2fb^{-1}@high Q^2, scattered lepton method), Torino parameterization



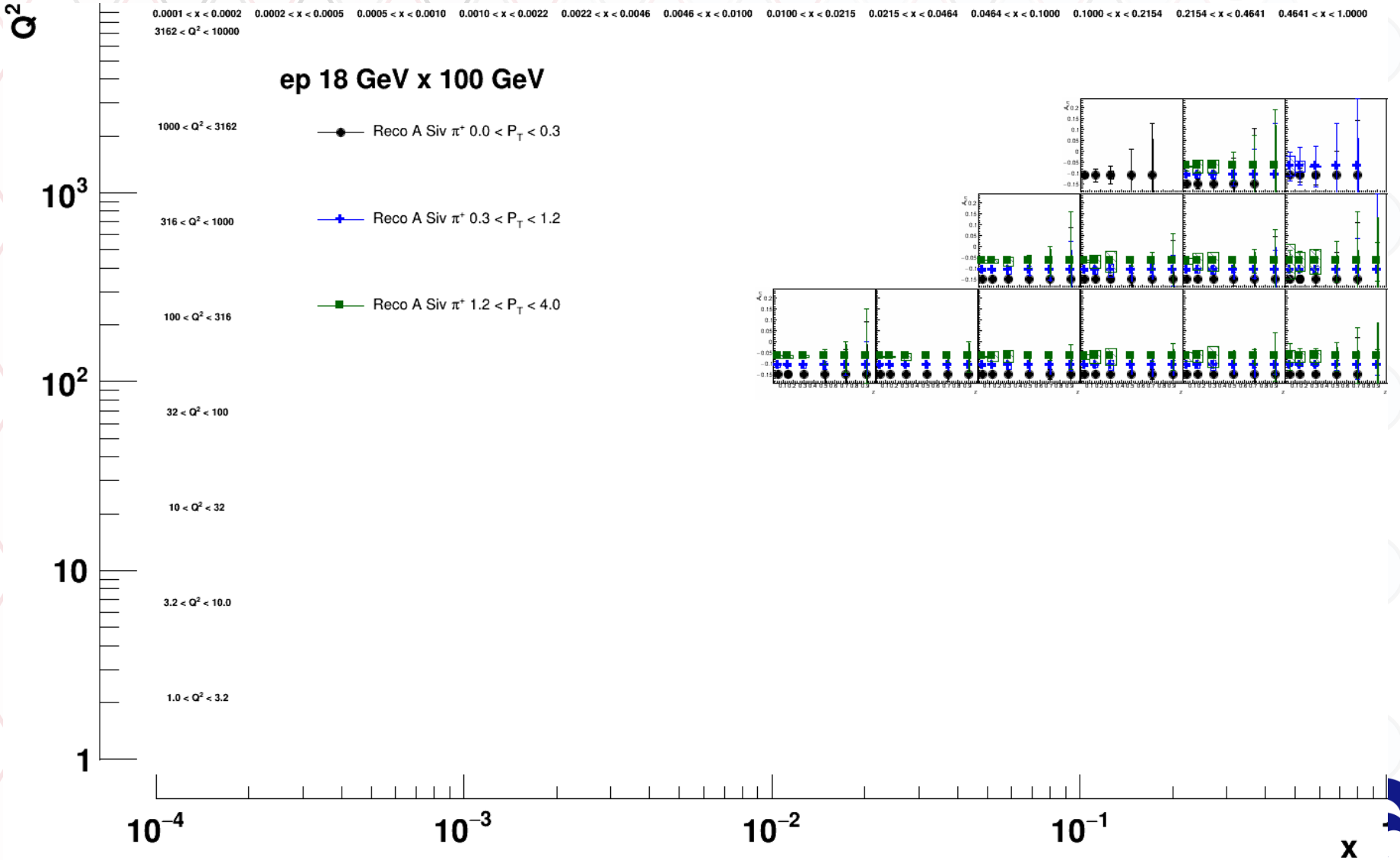
A_{UT} calculations (Testoutput ~2fb^{-1}@high Q^2, scattered lepton method), Torino parameterization



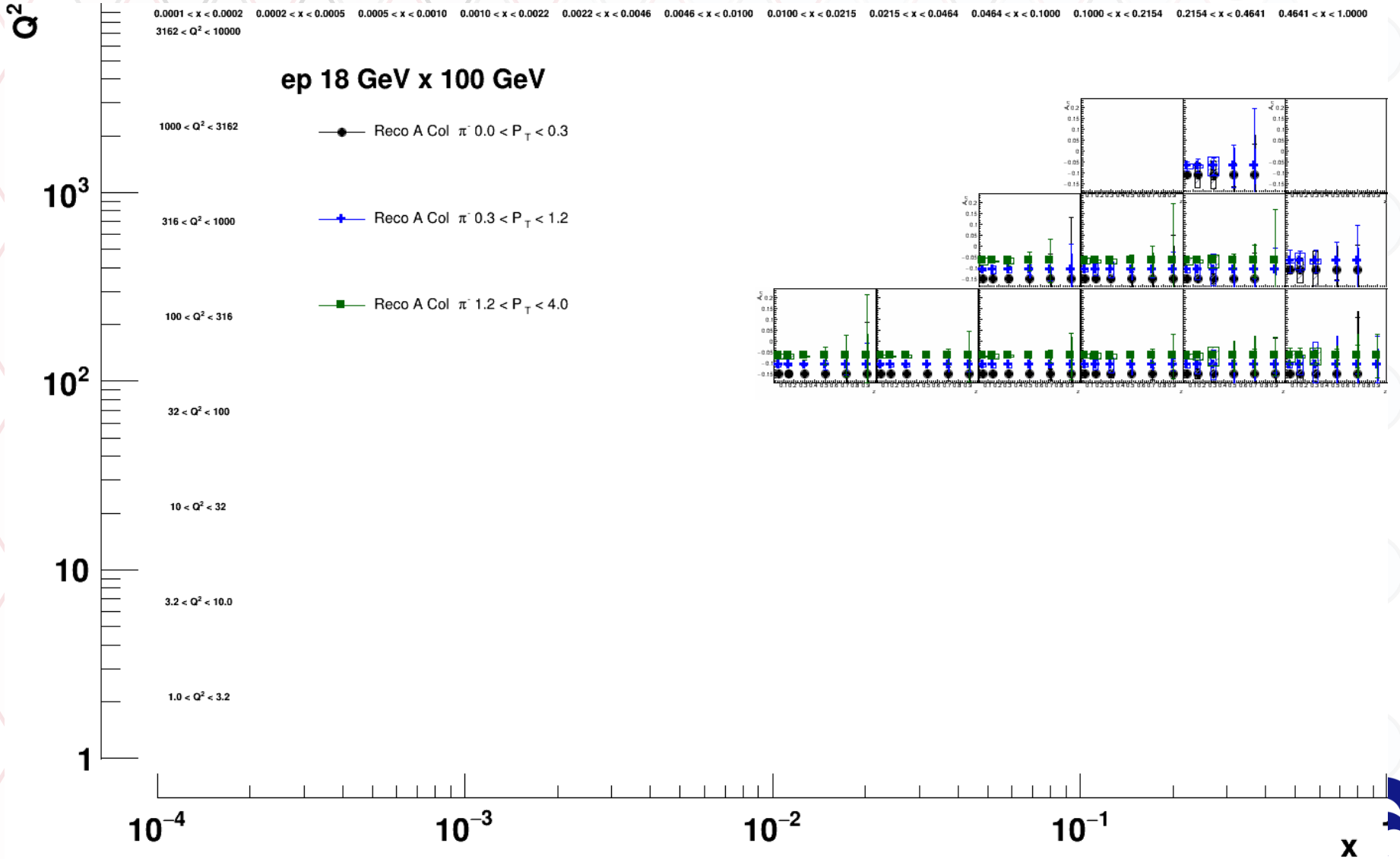
A_{UT} projections 10fb^{-1}



AUT projections 10fb^{-1}



AUT projections 10fb^{-1}



Conclusions

- Test production output from 18 x 100 high Q^2 simulations already available (almost 4M events corresponds to ~$2fb^{-1}$)
- Kinematic reconstruction methods look reasonable, qualitatively better than ePHENIX production test (but different statistics, kinematic regions)
- Calculation of corresponding azimuthal asymmetries also prepared for first production output:
  - Pretty reasonable output, not too large deviations from in put asymmetries seen (ie small systematics)
- Eagerly waiting for lowq2 production output to fill full phase-space for 18 x 100