

ePIC 24.06.0, Pythia8 NC DIS

Kinematic cuts:

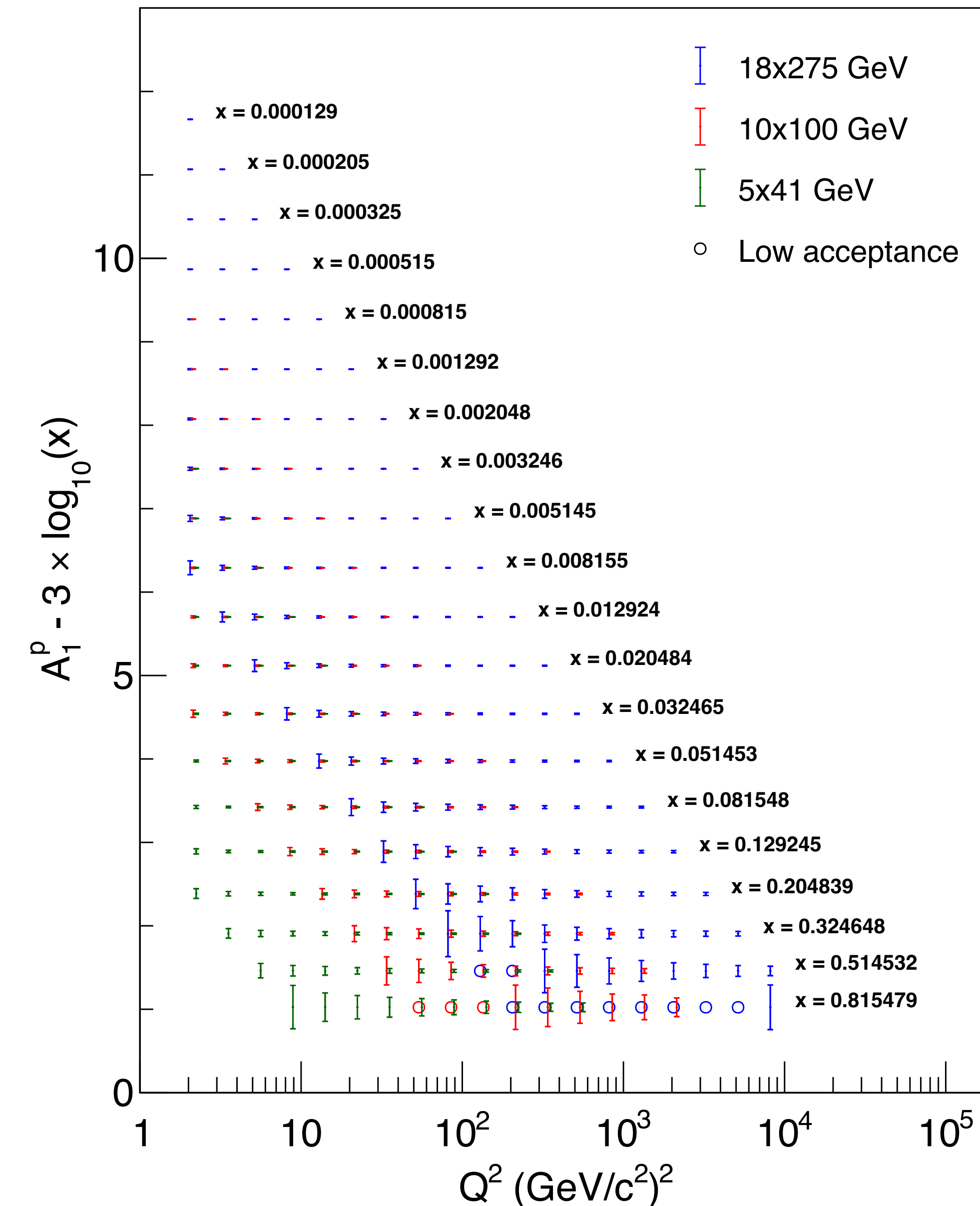
$$0.01 \leq y \leq 0.95$$

$$Q^2 \geq 2, W^2 \geq 4$$

Assume luminosity:

$$\mathcal{L} = 10 \text{ fb}^{-1}$$

(Without modifying my current code,
this takes 2 - 3 days to generate)



Raw data from simulation campaign

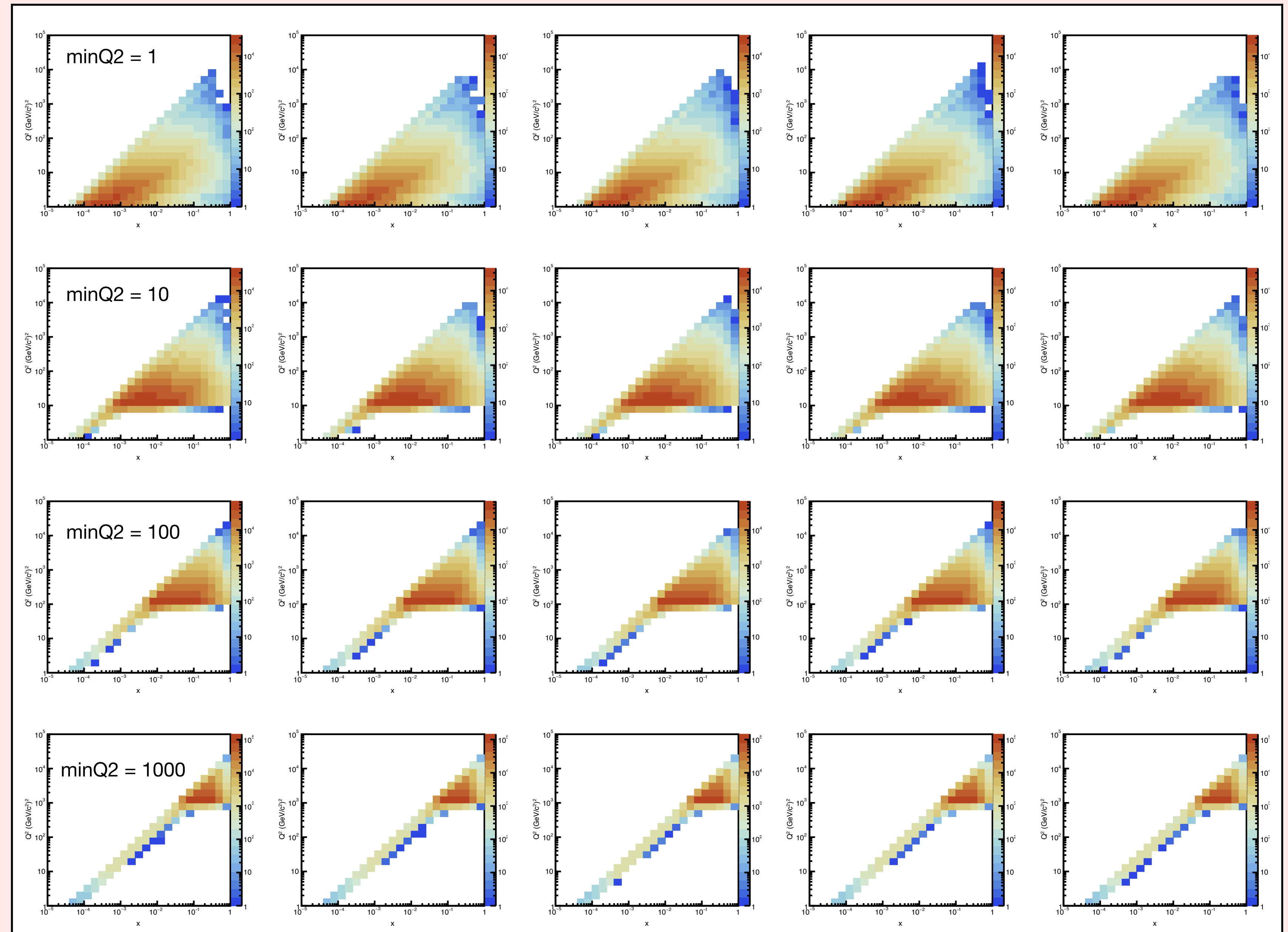
ePIC 24.06.0

ep 18 x 275 GeV

Pythia8 NC DIS

No cuts

Plots are Q_{rec}^2 vs x_{rec}
distribution from
“InclusiveKinematicElectron”
from the edm4eic.root file



ePIC 24.06.0

ep 18 x 275 GeV

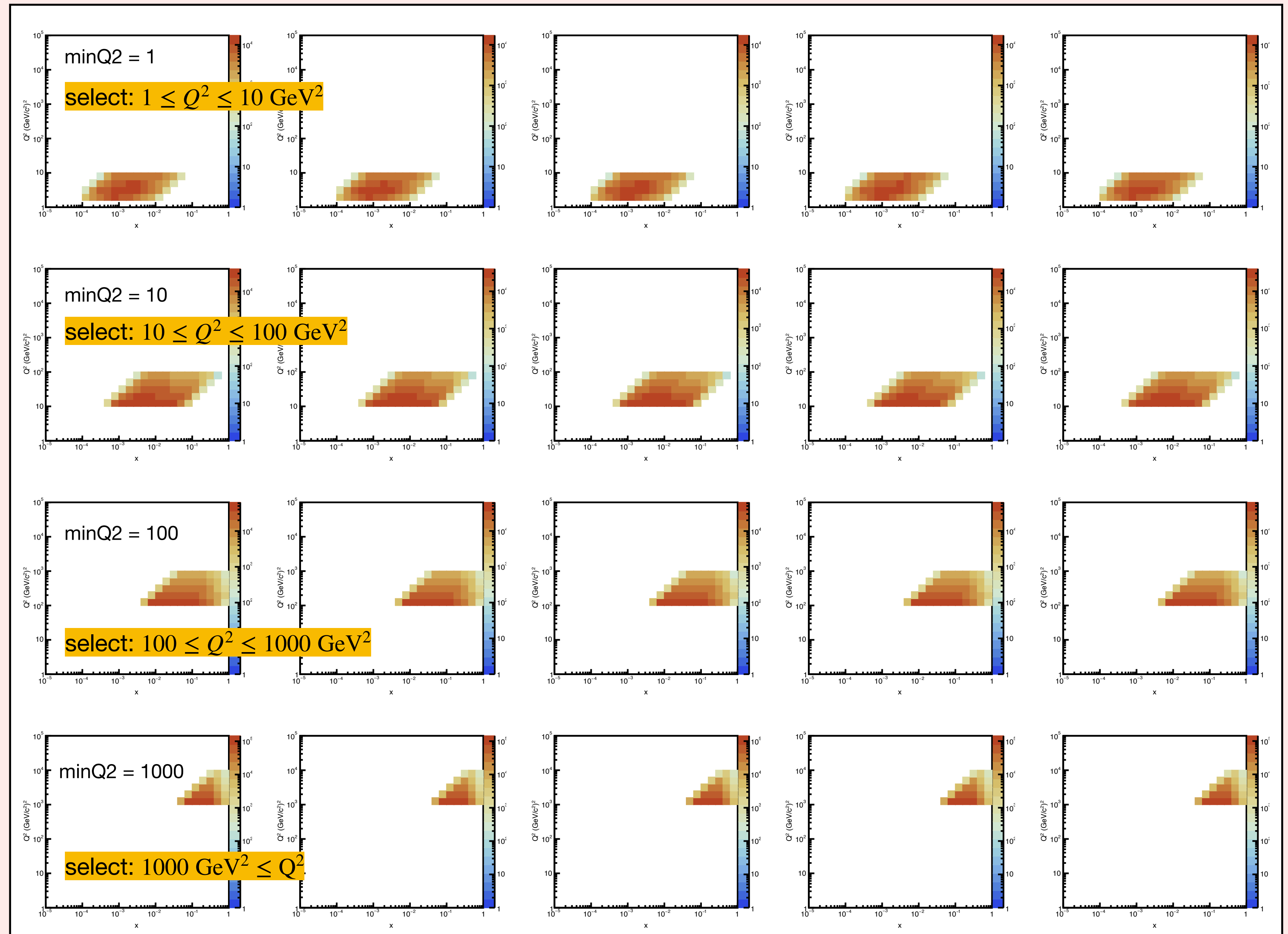
Pythia8 NC DIS

Apply cuts to avoid over counting
when combining files

In addition, apply kinematic cuts:

$$0.01 \leq y \leq 0.95$$

$$Q^2 \geq 2, W^2 \geq 4$$



Cross section from simulation files

$$\frac{d\sigma}{dx_B dQ^2} = \frac{N}{C_{acc} \cdot C_{bin} \cdot L \cdot \Delta x_B \Delta Q^2}$$

- Acceptance and bin migration corrections from simulation

$$C_{acc} = \frac{N_{rec}(x_{gen}, Q_{gen}^2)}{N_{gen}(x_{gen}, Q_{gen}^2)} \quad C_{bin} = \frac{N_{rec}(x_{rec}, Q_{rec}^2)}{N_{rec}(x_{gen}, Q_{gen}^2)}$$

$$\sigma_{red} = \left(\frac{d\sigma}{dx_B dQ^2} \right) \cdot \frac{Q^4 x_B}{2\pi\alpha^2 Y_+ \hbar^2 c^2}$$

$$Y_+ = 1 + (1 - y)^2$$

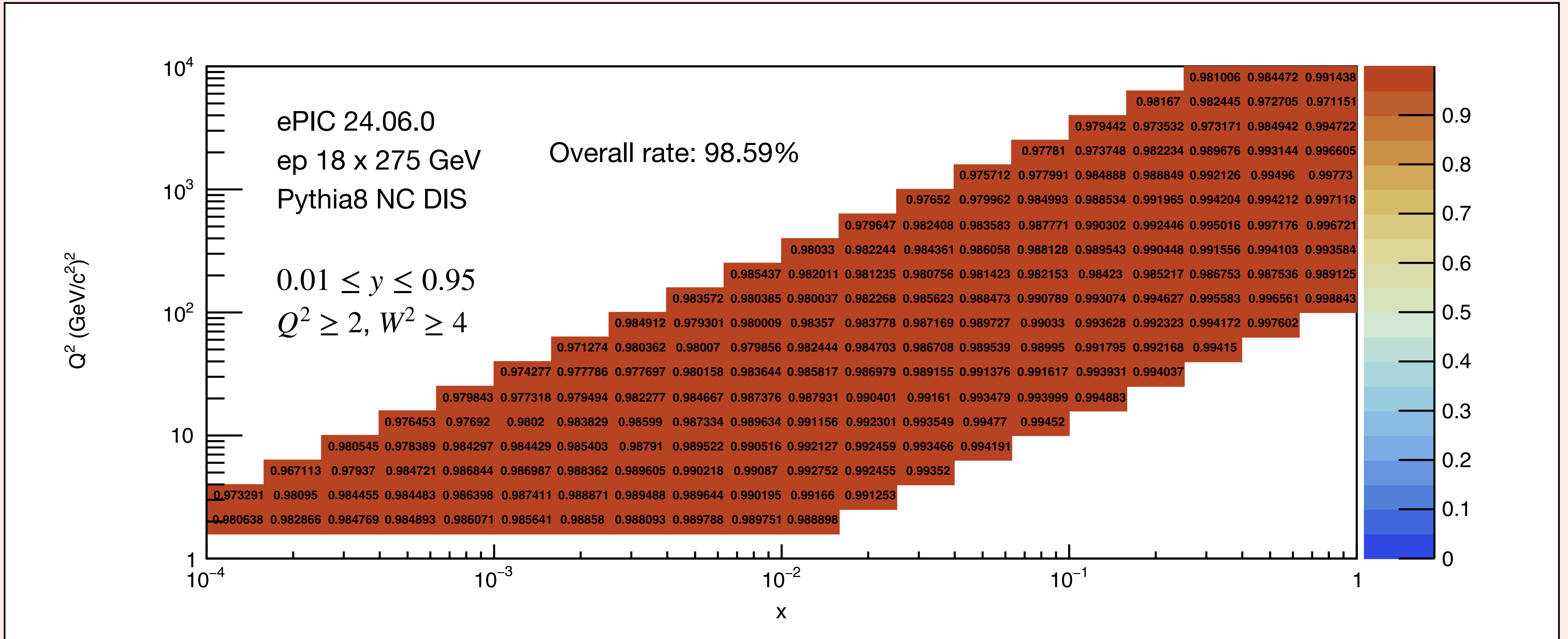
- Scale counts to integrated luminosity of $L = 10 \text{ fb}^{-1}$.
- Bin volumes $\Delta x_B \Delta Q^2$ from Monte Carlo (account for cuts)
- Using same simulated events for analysis and corrections...
by definition will obtain the generated distributions
- Detector and reconstruction performance determines
size of the corrections

Calculation follows Tyler's slide:

https://indico.bnl.gov/event/23598/contributions/92158/attachments/55526/94970/inclusive_joint_physics_sw_2024June26.pdf

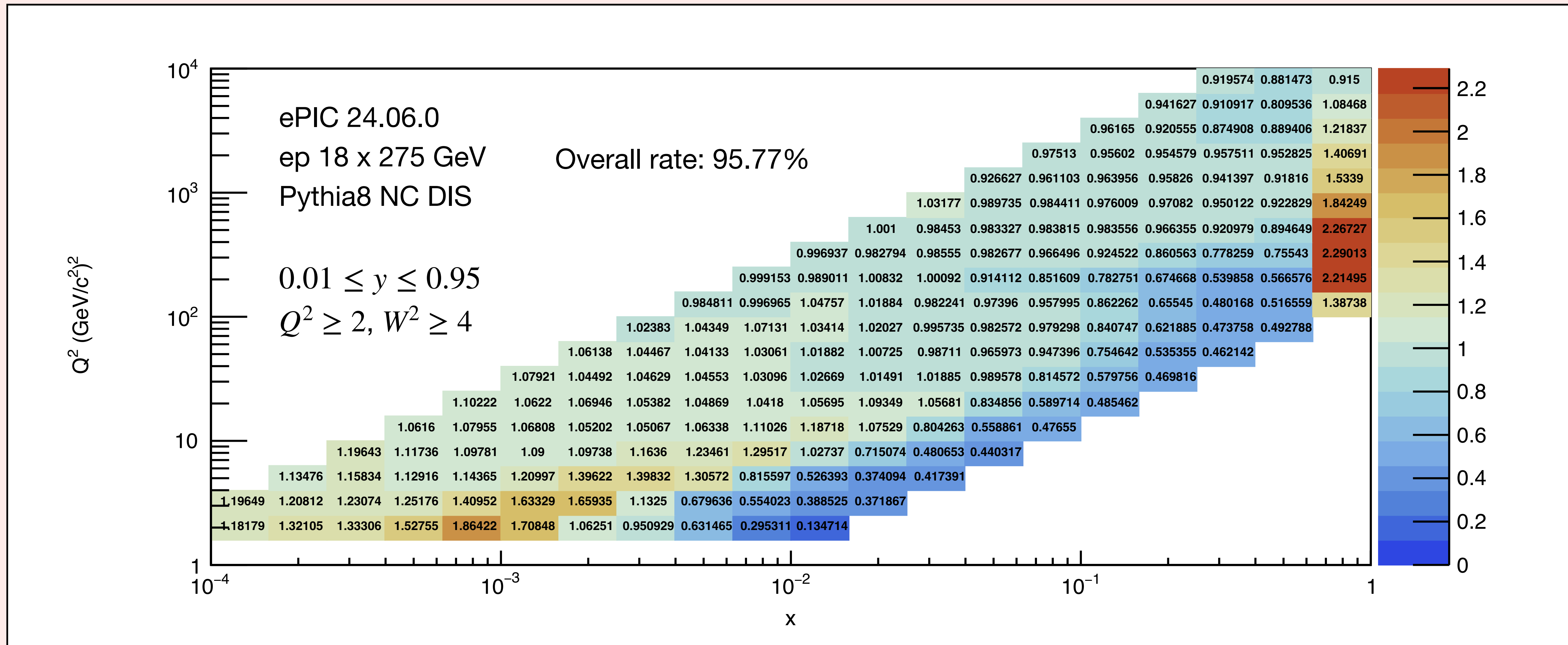
$$C_{acc} = \frac{N_{rec}(x_{gen}, Q_{gen}^2)}{N_{gen}(x_{gen}, Q_{gen}^2)}$$

- generated particle info is taken from the “MCParticles” branch in the edm4eic.root file
- x_{gen} and Q_{gen}^2 are calculated from the momentum and mass information from “MCParticles”



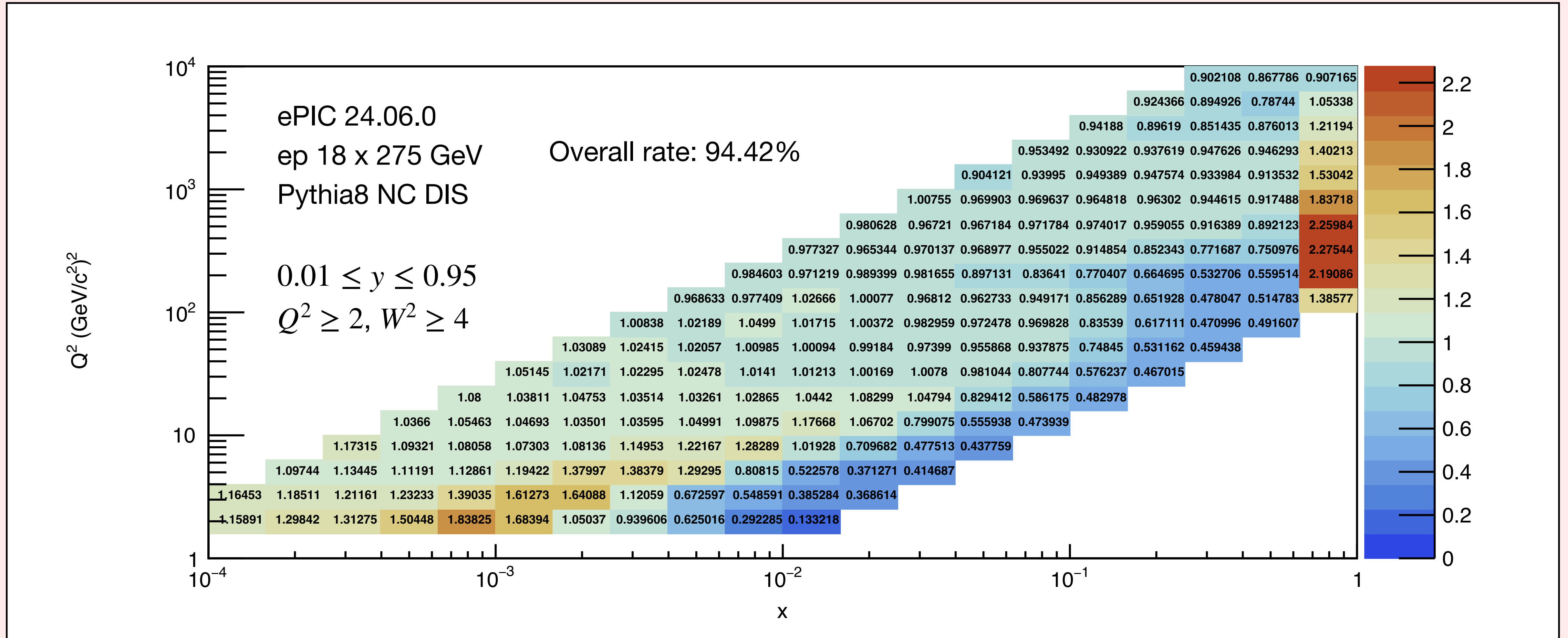
$$C_{\text{bin}} = \frac{N_{\text{rec}}(x_{\text{rec}}, Q_{\text{rec}}^2)}{N_{\text{rec}}(x_{\text{gen}}, Q_{\text{gen}}^2)}$$

- reconstructed particle info is taken from the “InclusiveKinematicElectron” branch
- x_{rec} and Q_{rec}^2 are taken directly from “InclusiveKinematicElectron”



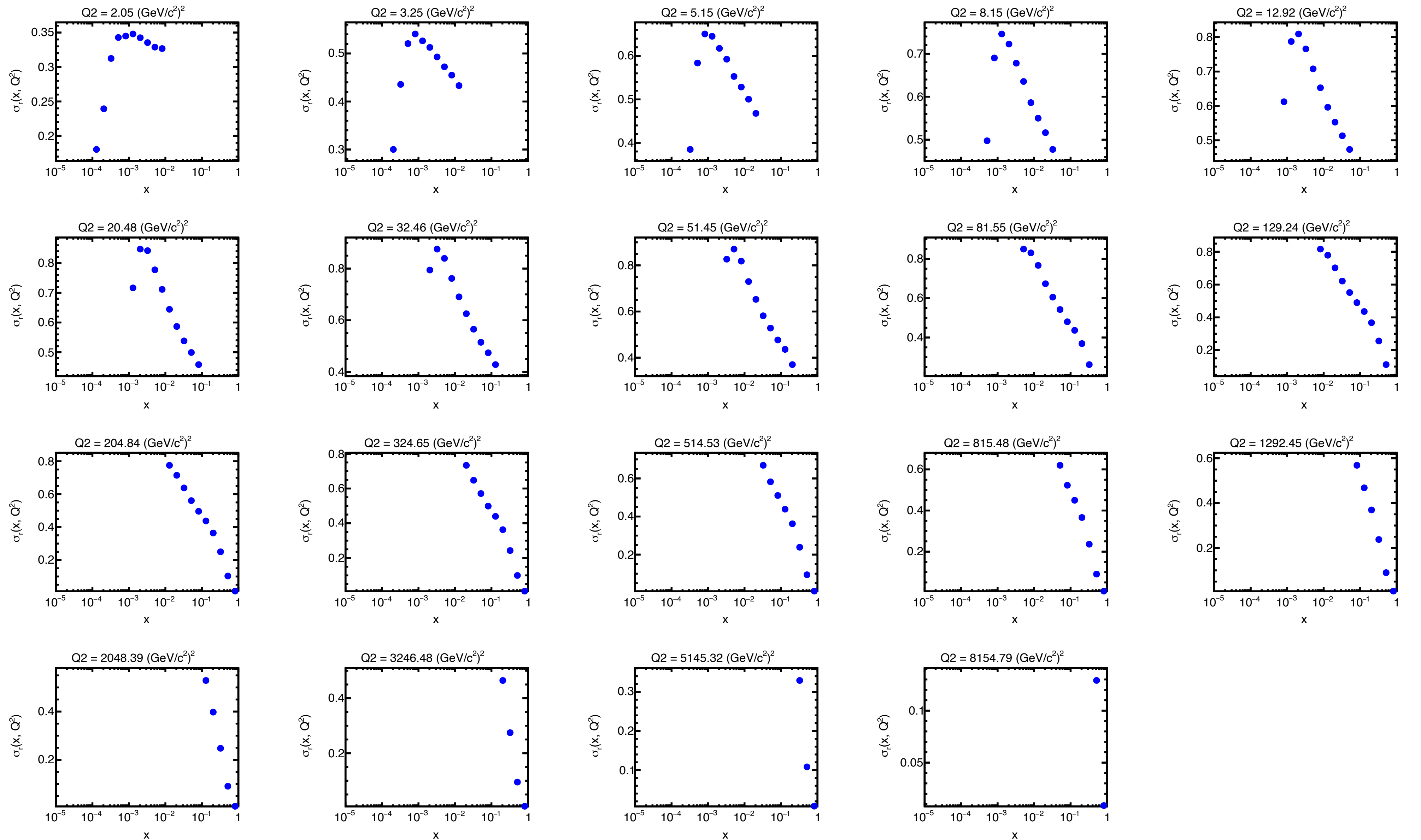
Bin overall efficiency

$$C_{\text{tot}} = C_{\text{acc}} \cdot C_{\text{bin}} = \frac{N_{\text{rec}}(x_{\text{rec}}, Q_{\text{rec}}^2)}{N_{\text{gen}}(x_{\text{gen}}, Q_{\text{gen}}^2)}$$



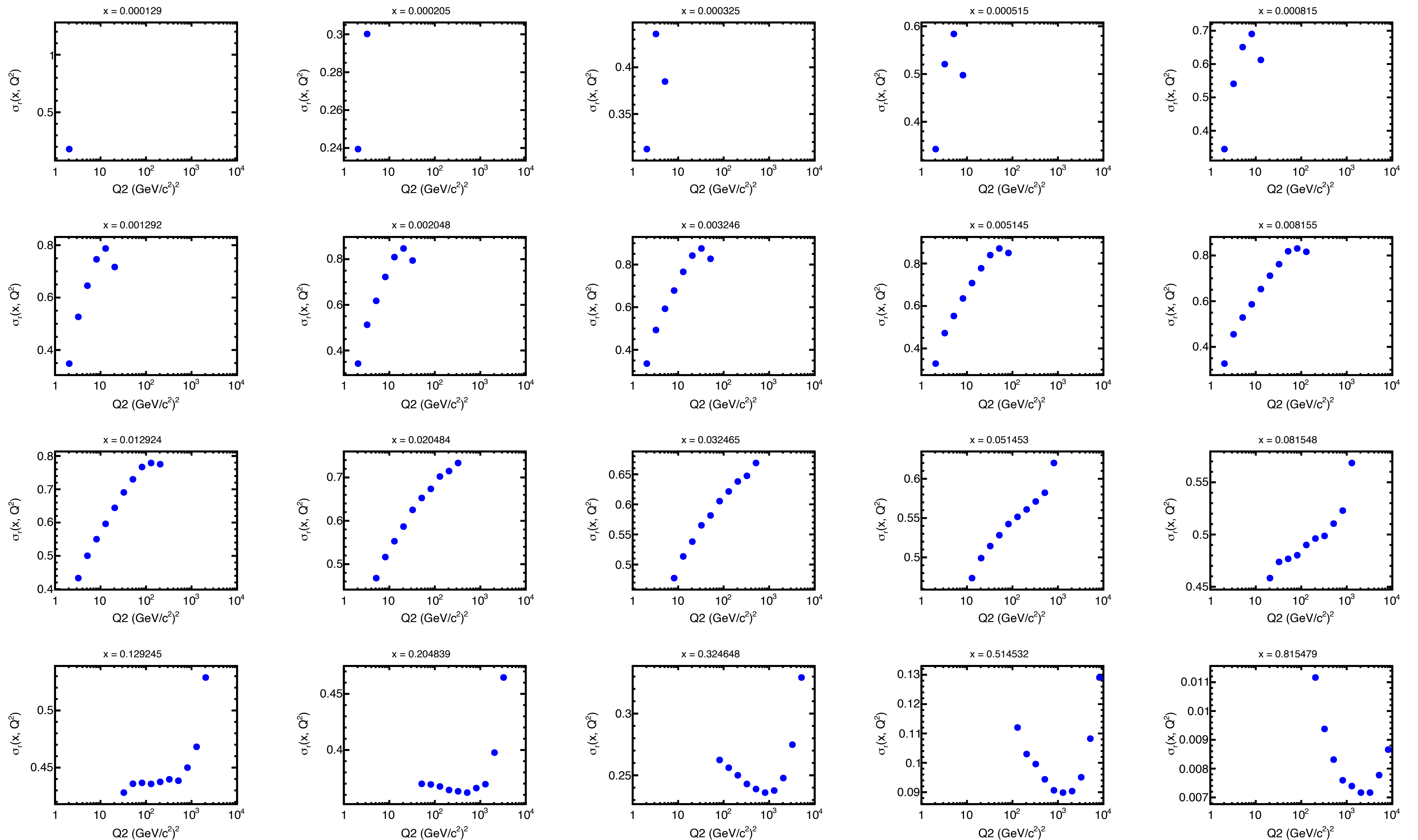
Reduced cross sections

ePIC 24.06.0
ep 18 x 275 GeV
Pythia8 NC DIS
 $\mathcal{L} = 10 \text{ fb}^{-1}$

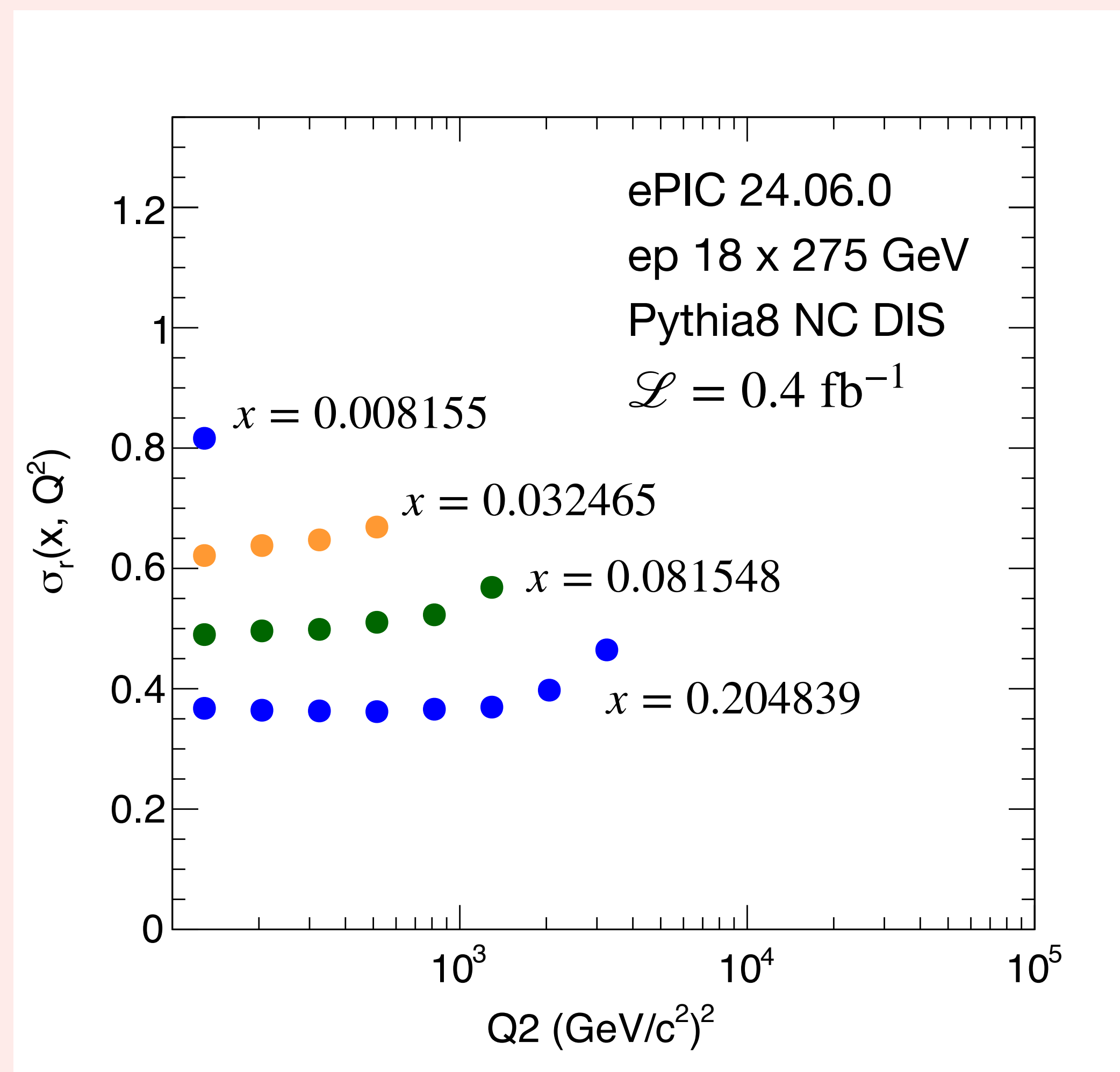
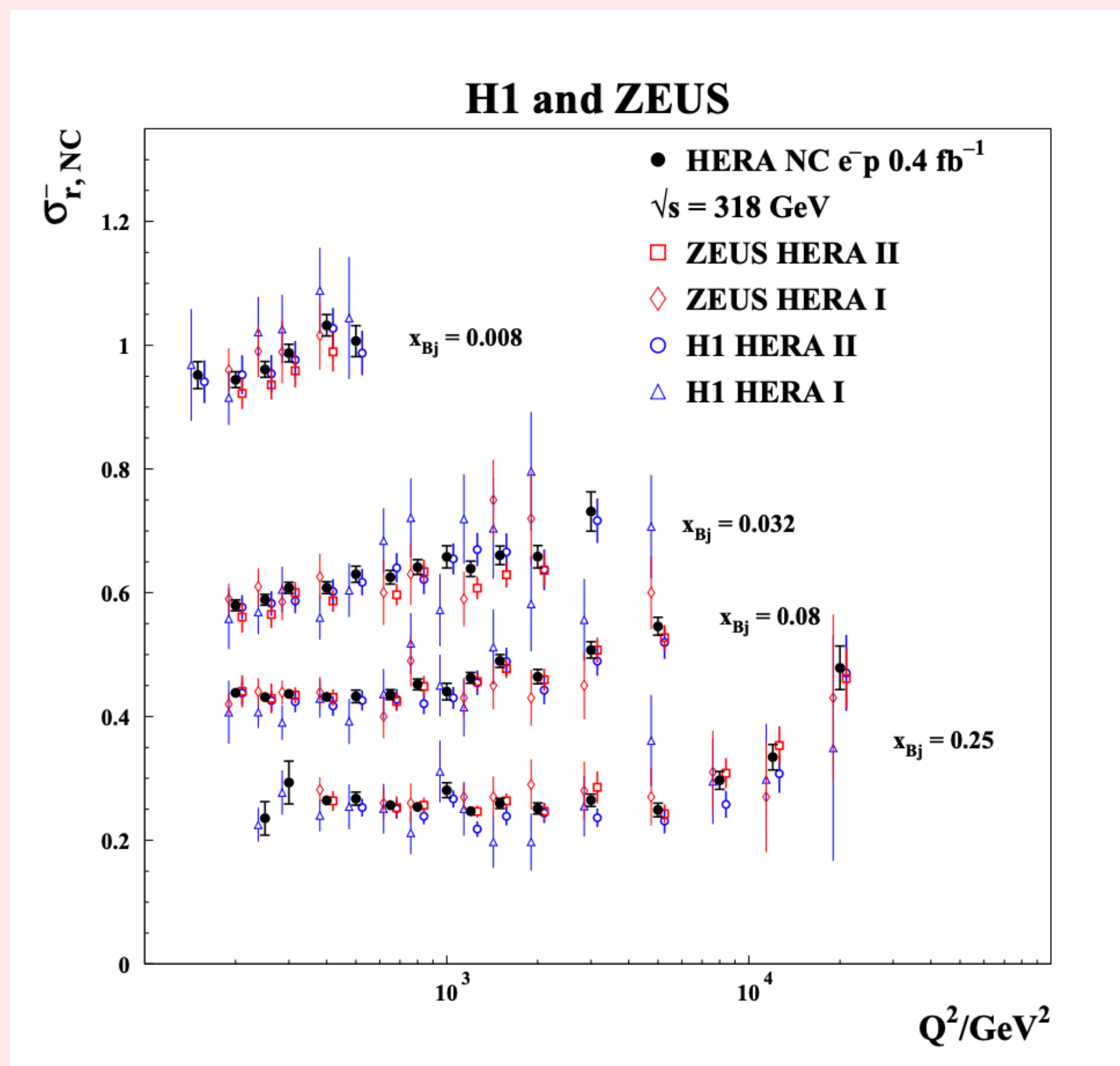


Reduced cross sections

ePIC 24.06.0
ep 18 x 275 GeV
Pythia8 NC DIS
 $\mathcal{L} = 10 \text{ fb}^{-1}$



Not the same bin size/center! Not with the same kinematic cuts!



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Kinematic cuts:

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Assume luminosity:

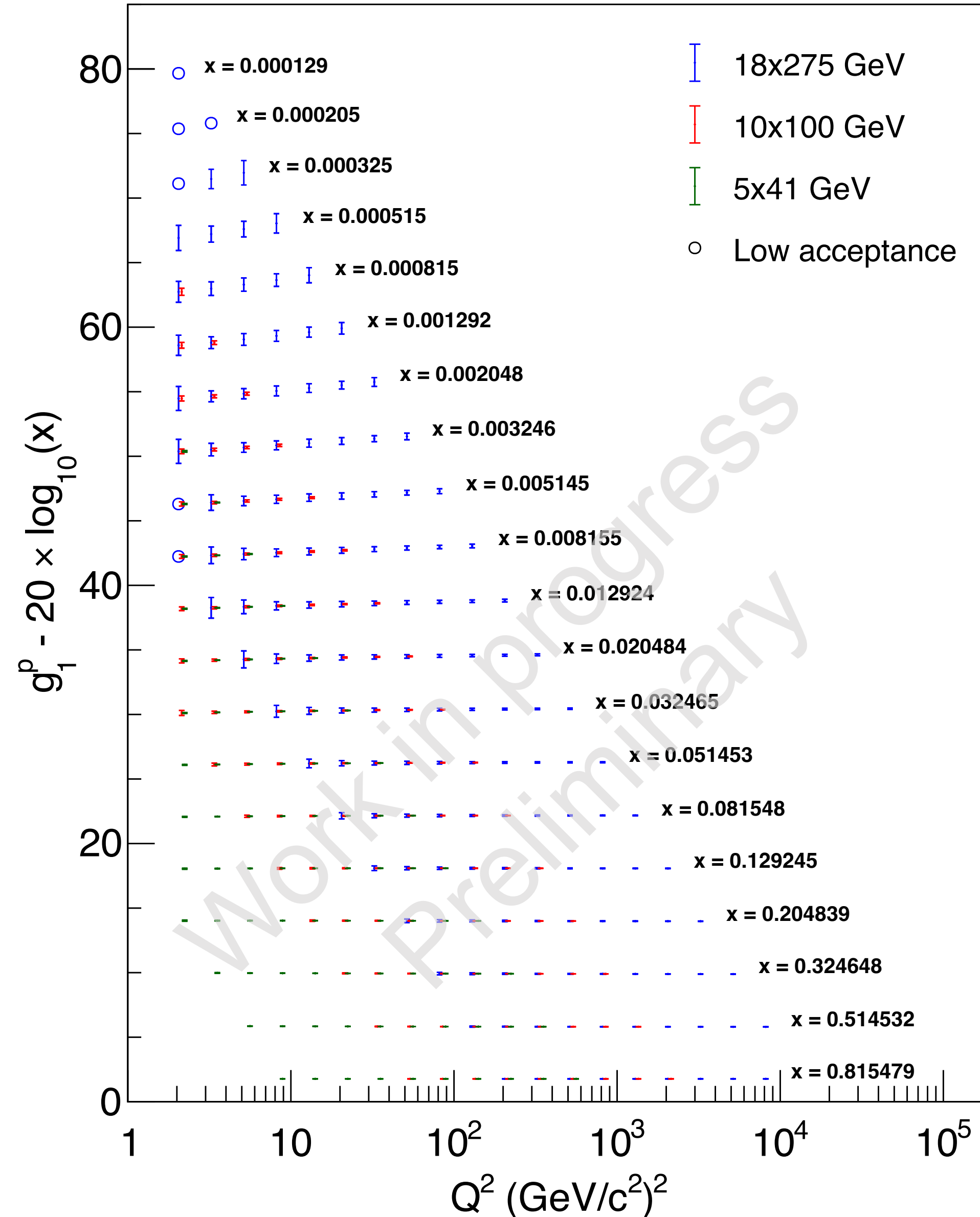
$$\mathcal{L} = 10 \text{ fb}^{-1}$$

A1 is calculated using parameterization

from: [X. Zheng, Doi: 10.2172/824895](https://doi.org/10.2172/824895)

$$A_1^p \approx g_1^p / F_1^p$$

Using HERAPDF20_LO_EIG for F_1^p



- Use BeAGLE to generate $e + {}^3\text{He}$ scattering events
- Use afterburner to add crossing angle and beam smearing
- Use eicsmear and hepMC3ascii2root to convert data format
- epic simulation:

epic_craterlake, Initialization time: 309.589417869 s, Per event time: 6.24880 s

- eicrecon error ...

[WARN] Status: 58 events processed at 0.0 Hz (0.4 Hz avg)

[WARN] Status: 59 events processed at 1.0 Hz (0.4 Hz avg)

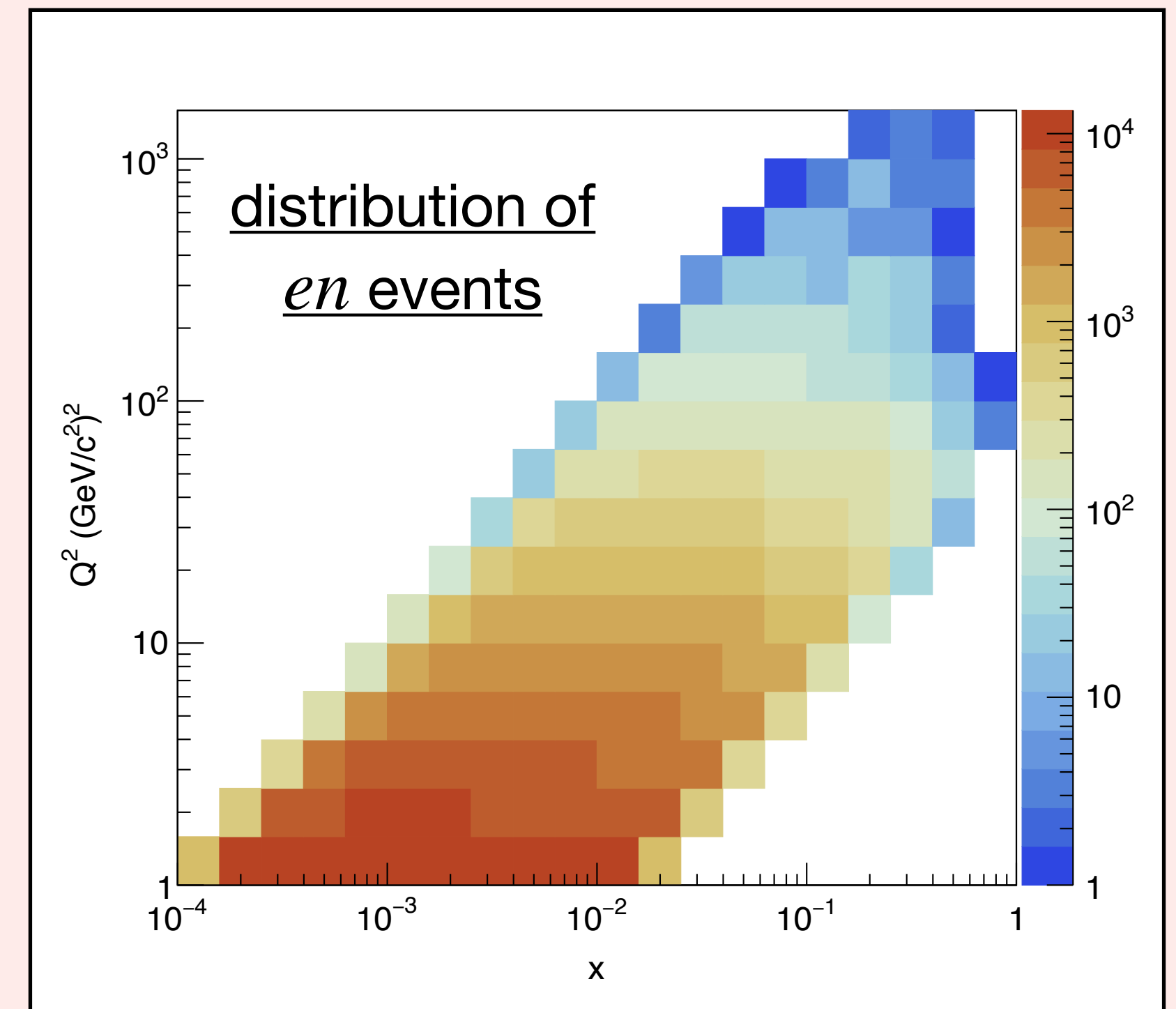
[FOFFMTRK:ForwardOffMRecParticles] [error] No beam protons to choose matrix!! Skipping!!

[RPOTS:ForwardRomanPotRecParticles] [error] No beam protons to choose matrix!!

Skipping!!

- (Send request to the simulation team to generate large data set)
- Analysis

BeAGLE $e + {}^3\text{He}$:



Total of 1M $e + {}^3\text{He}$ events (33.3% are *en*)

$$0.01 \leq y \leq 0.95$$

- Use BeAGLE to generate $e + {}^3\text{He}$ scattering events
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Using eAu config

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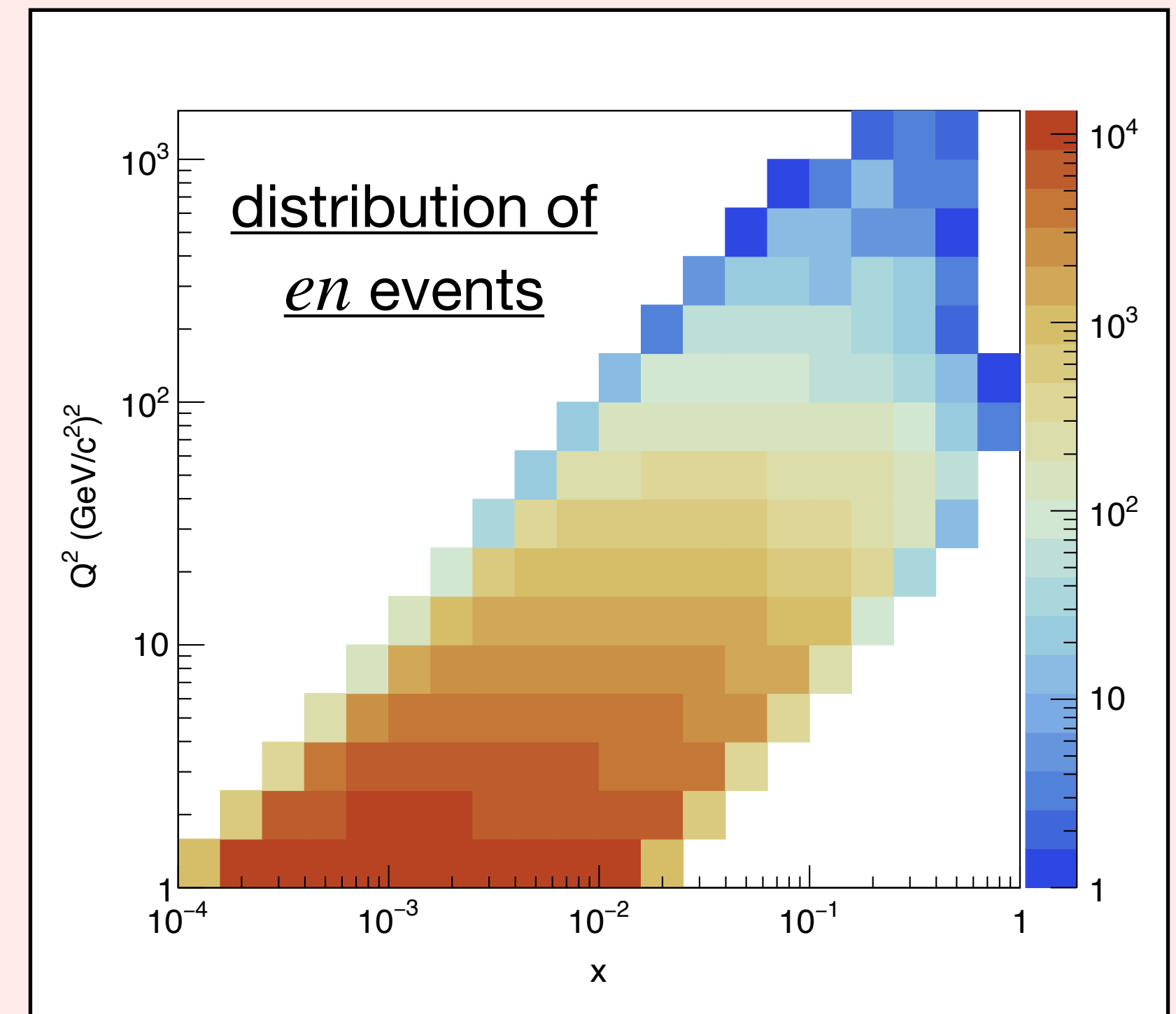
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Using eAu config

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- eicrecon error ...

He3 breakup is not ready for the Roman pots and Off-momentum Detectors

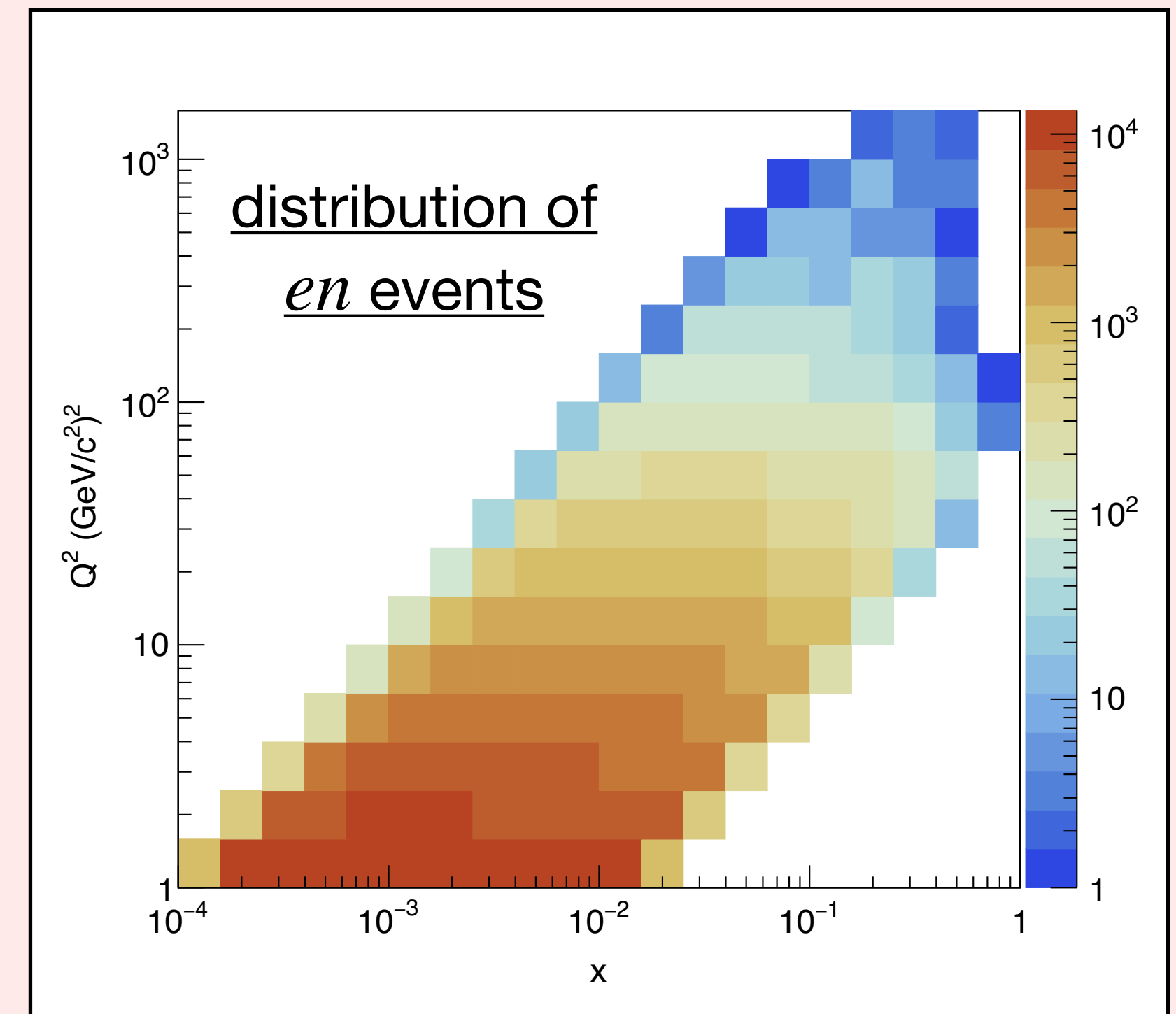
... this will take a while to be implemented

But for now ...

Check hits in RP for the proton double tagged events

- (Send request to the simulation team to generate large data set)
- Analysis

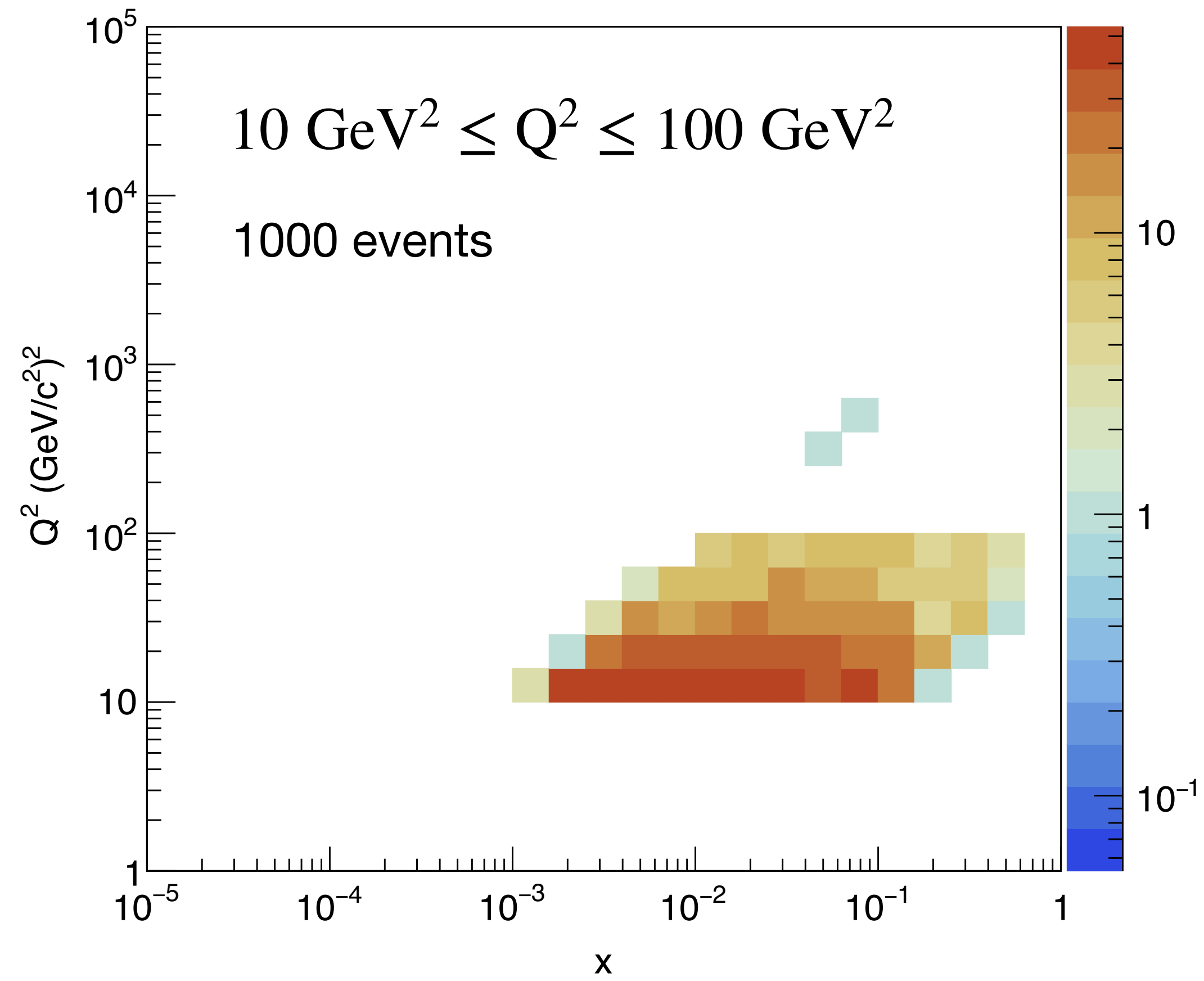
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Total of 1M $e + {}^3\text{He}$ events (33.3% are *en*)

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EPIC simulation



EIC Recon

