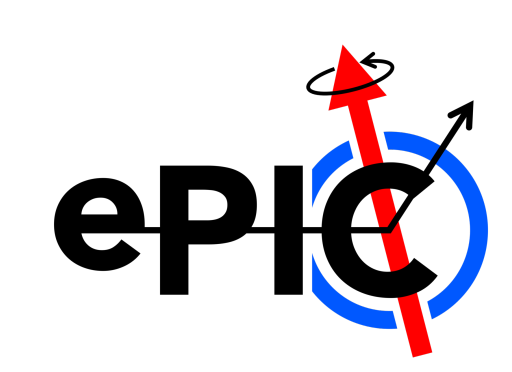




Scattered Electron-jet azimuthal correlations in $e+p$ and $e+A$ collisions

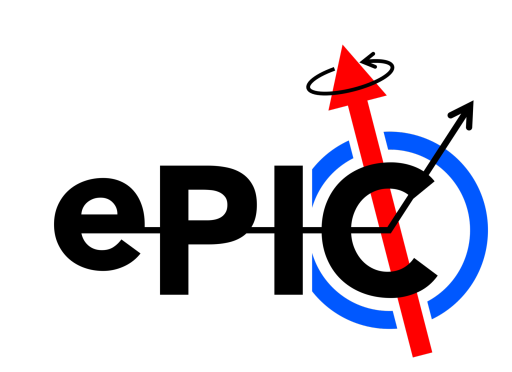
Mounika Choppalli (PhD student)

Nihar Ranjan Sahoo

IISER Tirupati, India



Jets-HF Working Group, 14 Jul 2026



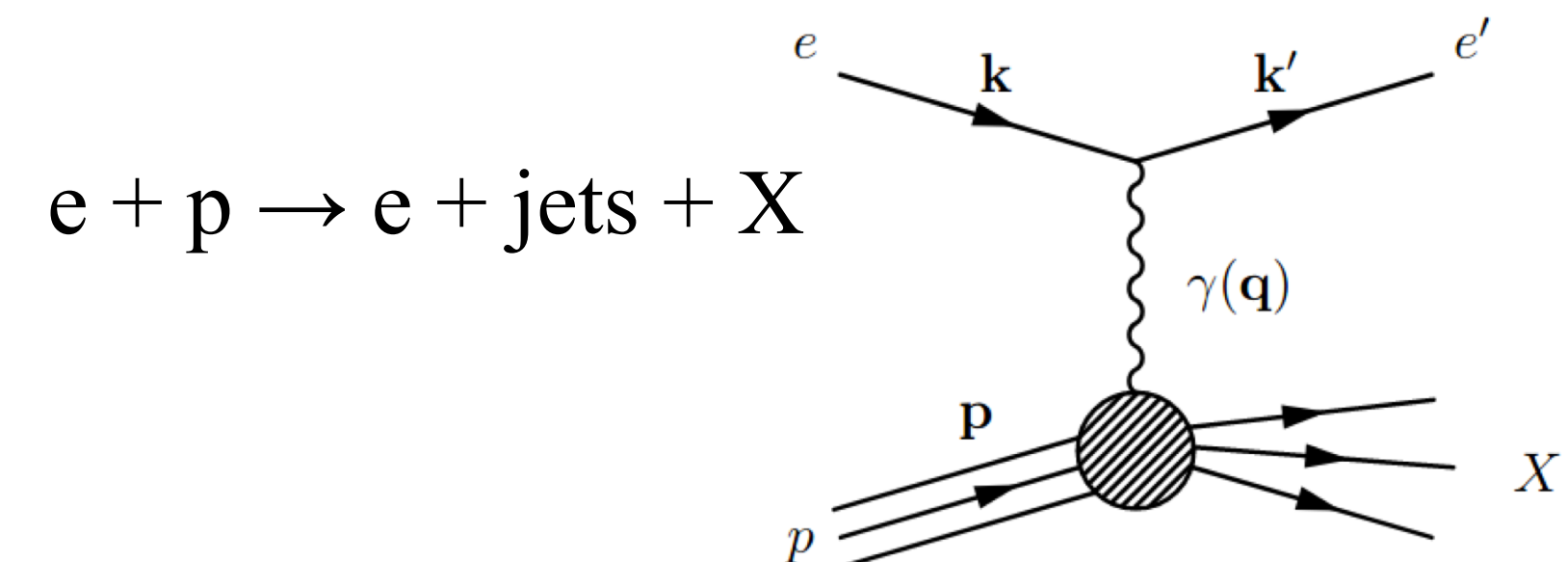
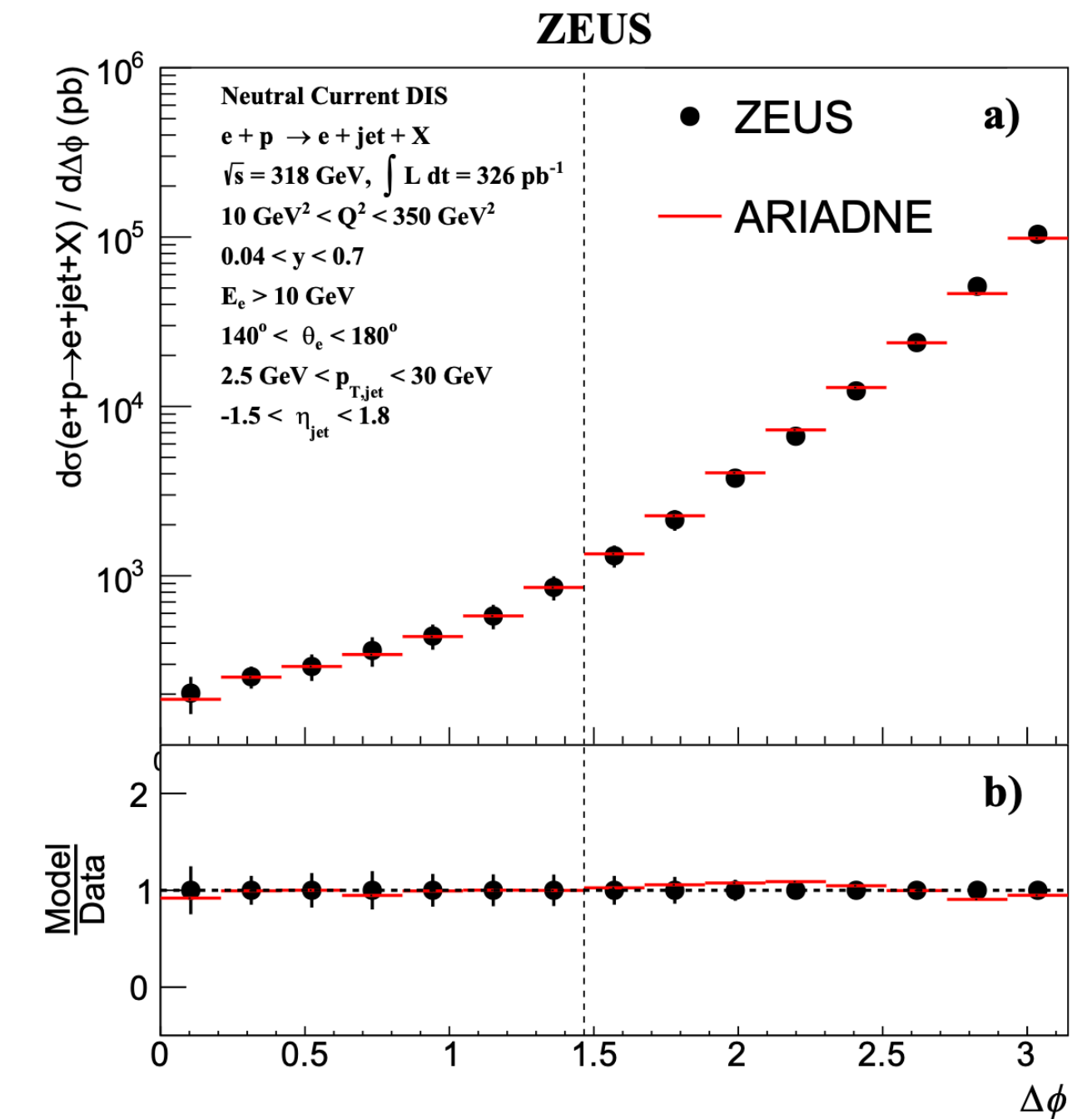
Scattered electron–jet azimuthal correlations

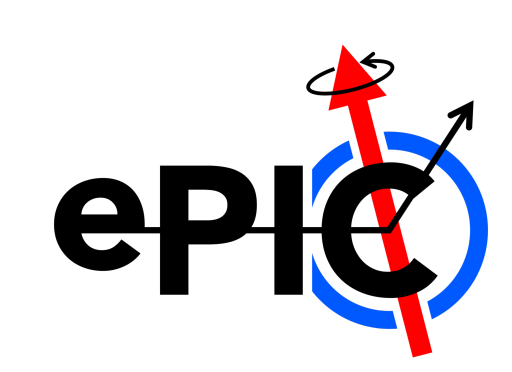
- In ep:
 - QCD radiation controls the decorrelation
 - LO produces back-to-back topology, $\Delta\phi (\varphi^e - \varphi^{\text{jet}}) = \pi$
 - Soft and hard gluon emissions (multiple gluon emissions) make deviation from back-to-back topology
 - Information on higher-order QCD like ISR, FSR, color coherence effects etc.
 - TMD physics (width of $\Delta\phi$ is sensitive to intrinsic quark transverse momentum)
 - HERA established the first precision measurement of electron–jet azimuthal correlations in DIS; validates higher-order QCD calculations and parton-shower models describing QCD radiation.
- In eA:
 - multiple scattering broadens
 - Sensitive to cold nuclear matter
 - constraining transverse momentum broadening and $\hat{q}$
 - eA measurements at EIC is crucial

See 30th Jun 2026 presentation:

https://indico.bnl.gov/event/30270/contributions/126495/attachments/71070/121775/EICJetAndHF_30Jun2026.pdf

ZEUS: EPJC (2024) 84:1334





Simulated events and analysis details

Event generator and energy: PYTHIA 8.316, 9x130 GeV

$10 < Q^2 < 100 \text{ GeV}^2$

epic:/RECO/26.06.0/epic_craterlake/DIS/pythia8.316-1.0/NC/noRad/ep/9x130/q2_10to100

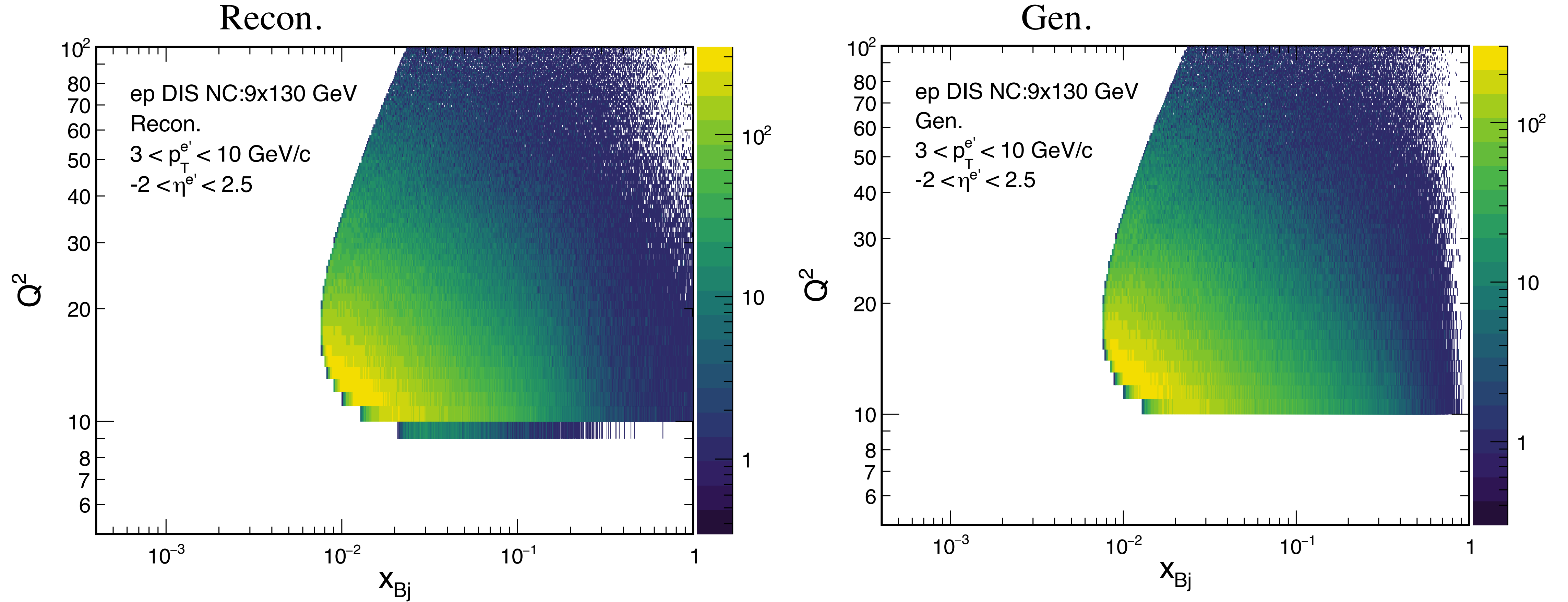
Jet reconstruction information:

- Jet algorithm: anti- k_T
- Recombination scheme: E-scheme
- Jet resolution parameter, $R = 1.0$
- Minimum constituent p_T : 0.2 GeV/c
- Active area
- Ghost Max Rapidity: 3.5

Dener De Souza Lemos's <https://github.com/denerslemos/CHJetsReCluster>

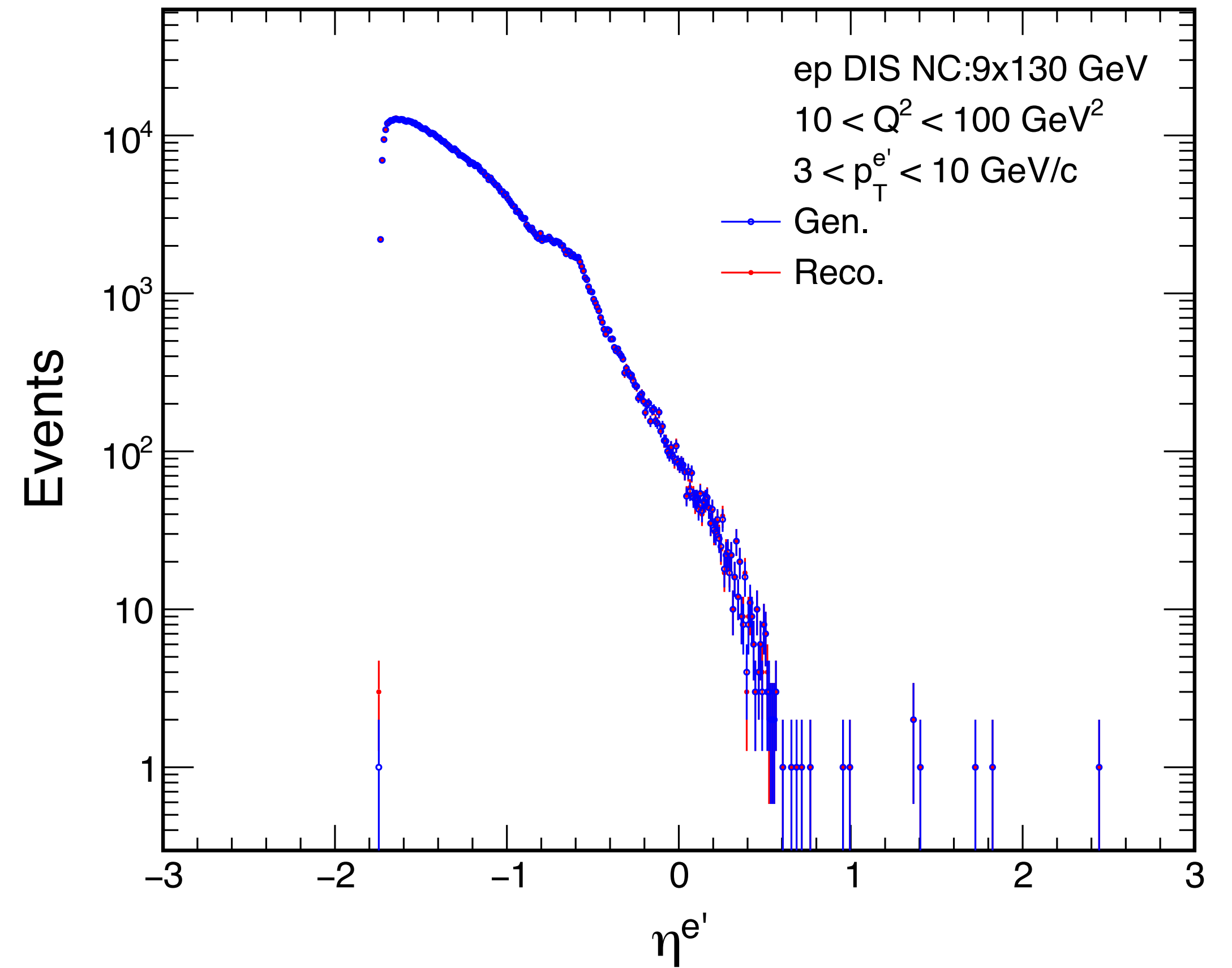
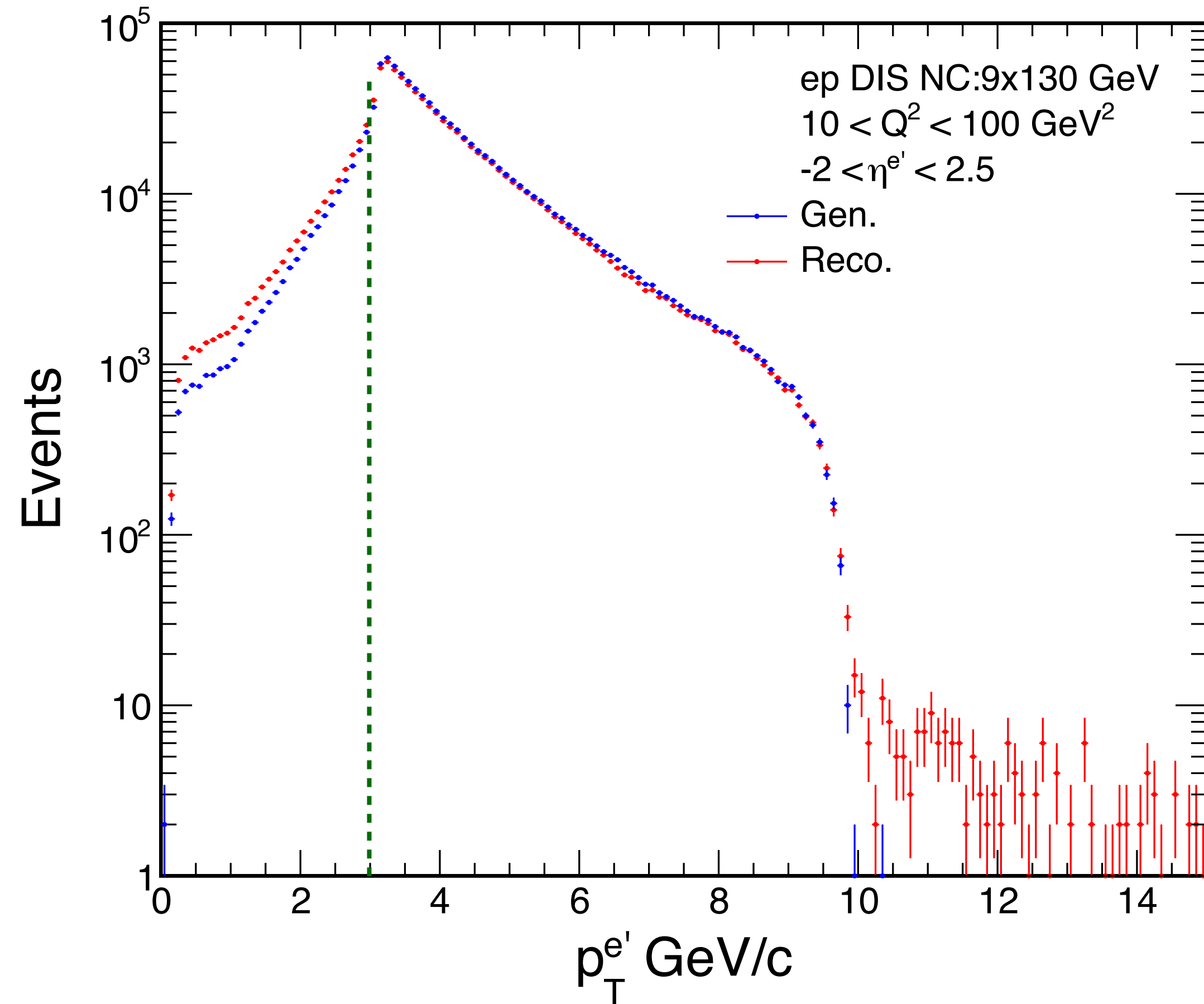
Thank you, Shyam and Rongrong, for providing information and support

Q^2 vs. x : Generator and Reconstruction level



With scattered electron $3 < p_T^{e'} < 10 \text{ GeV/c}$ and $-2.0 < \eta^{e'} < 2.5$

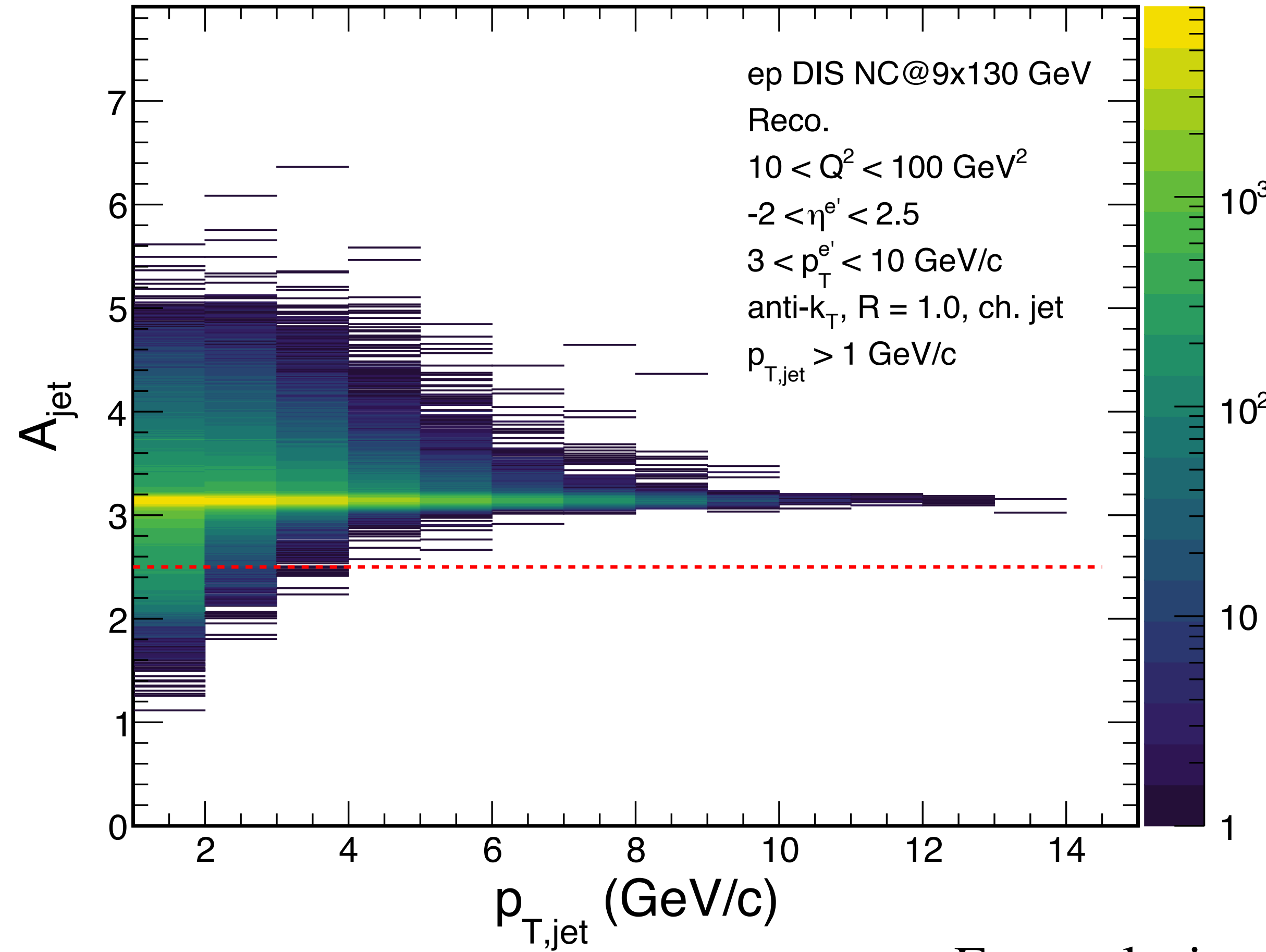
Scattered Electron Kinematics



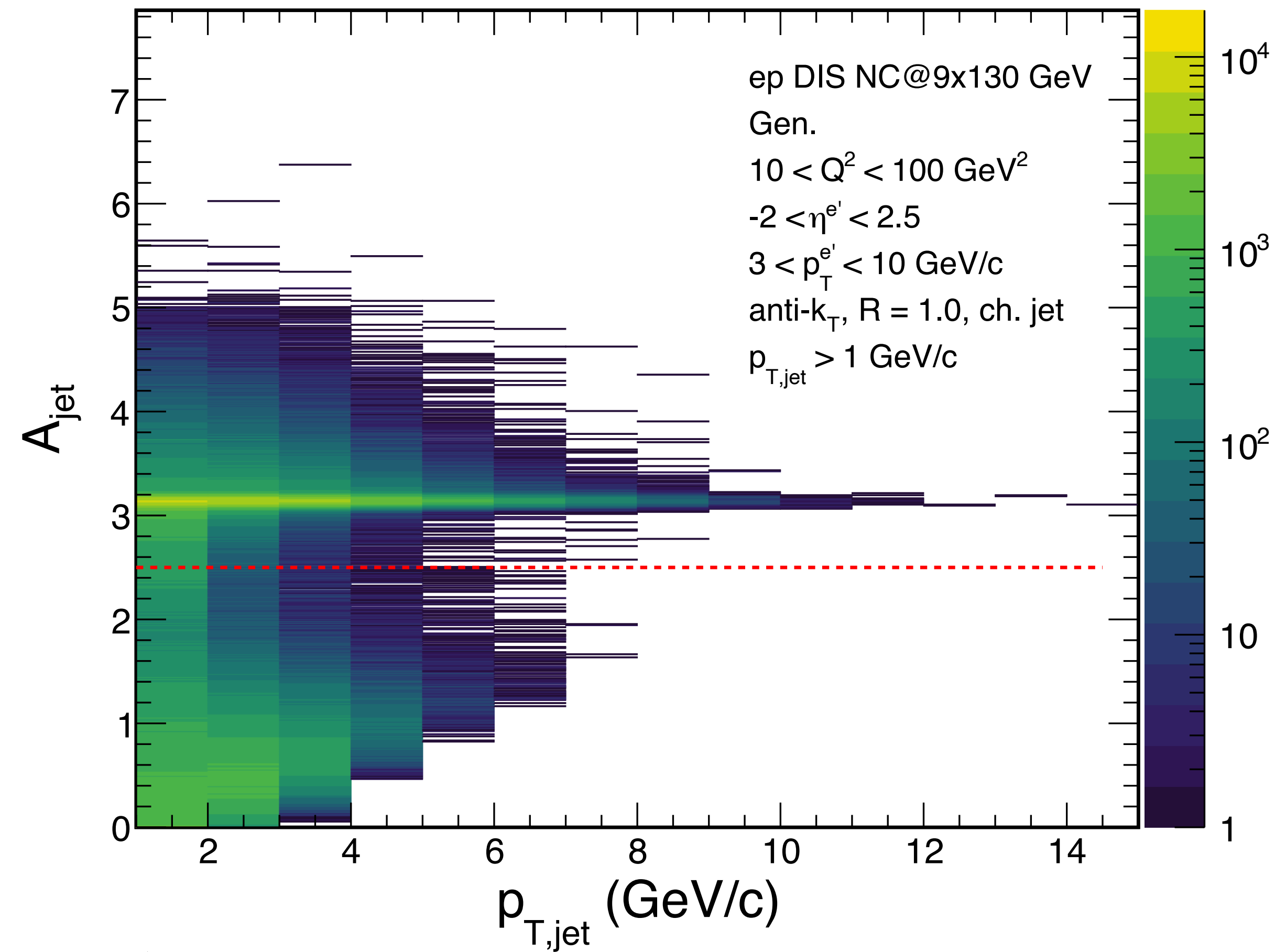
Scattered electron selected within $3 < p_T^{e'} < 10 \text{ GeV/c}$

Jet area vs. jet p_T

Recon.

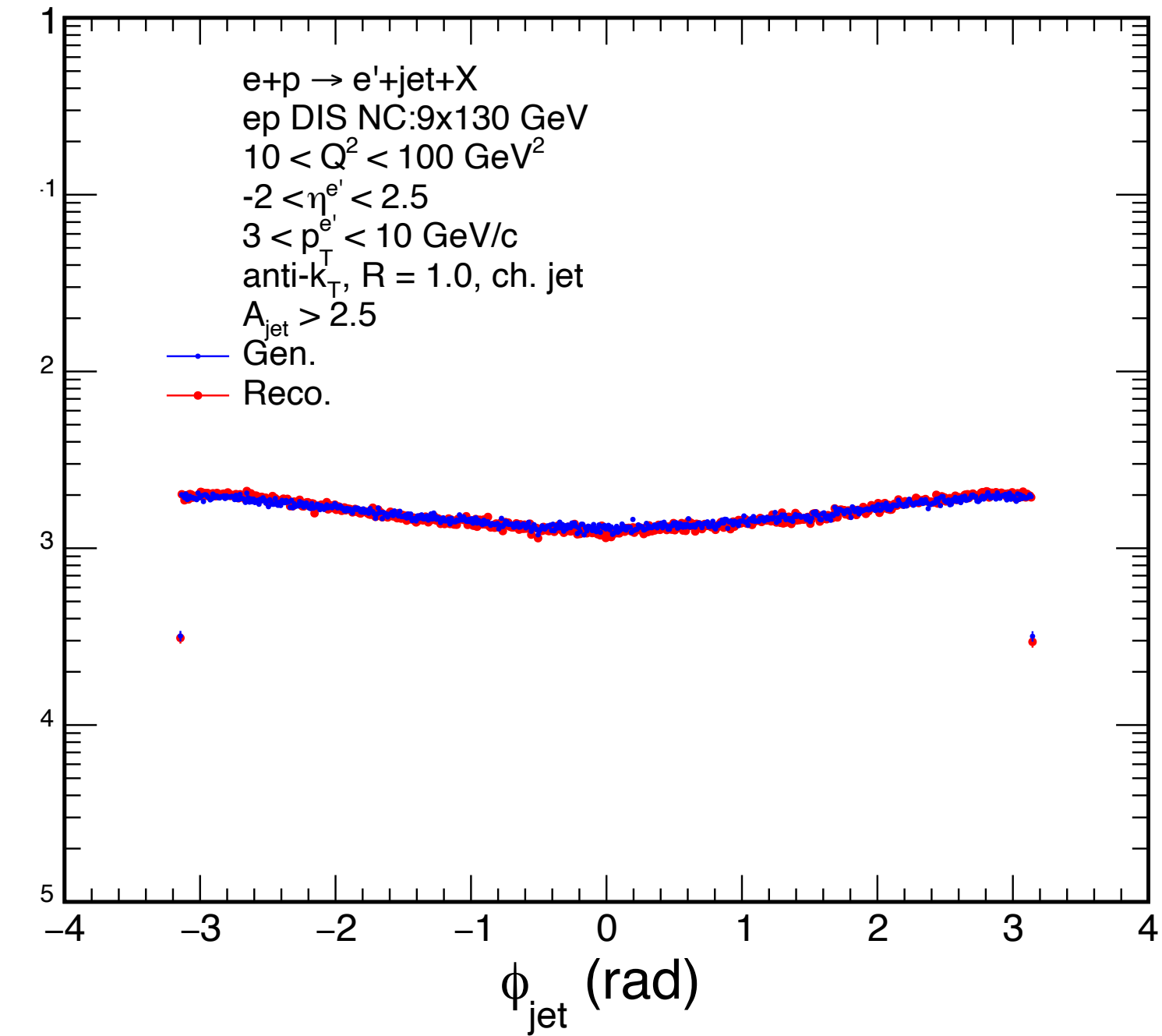
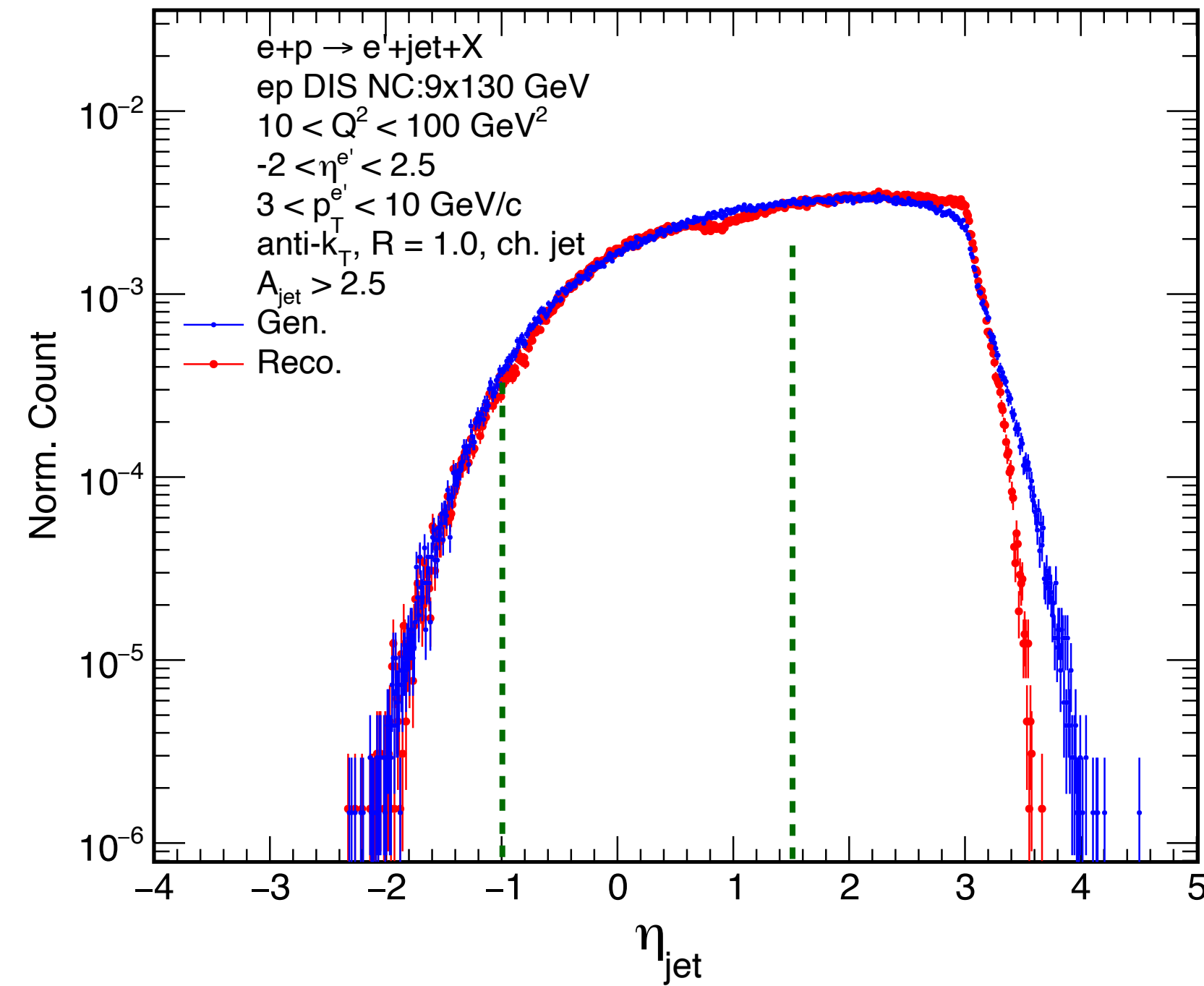
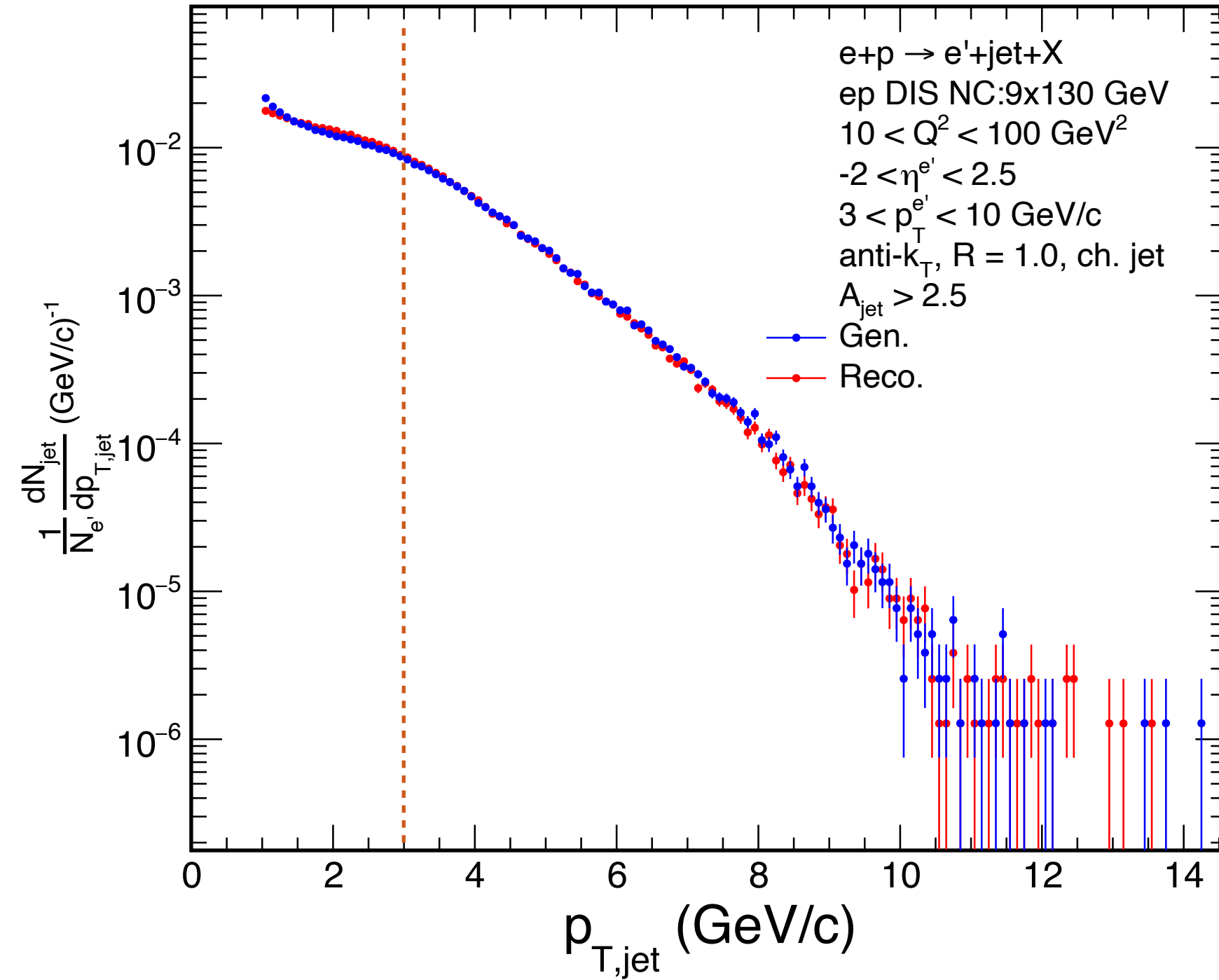


Gen.



For analysis, $A_{jet} > 2.5$ is used

Jet kinematics: Gen. and Reco. Level

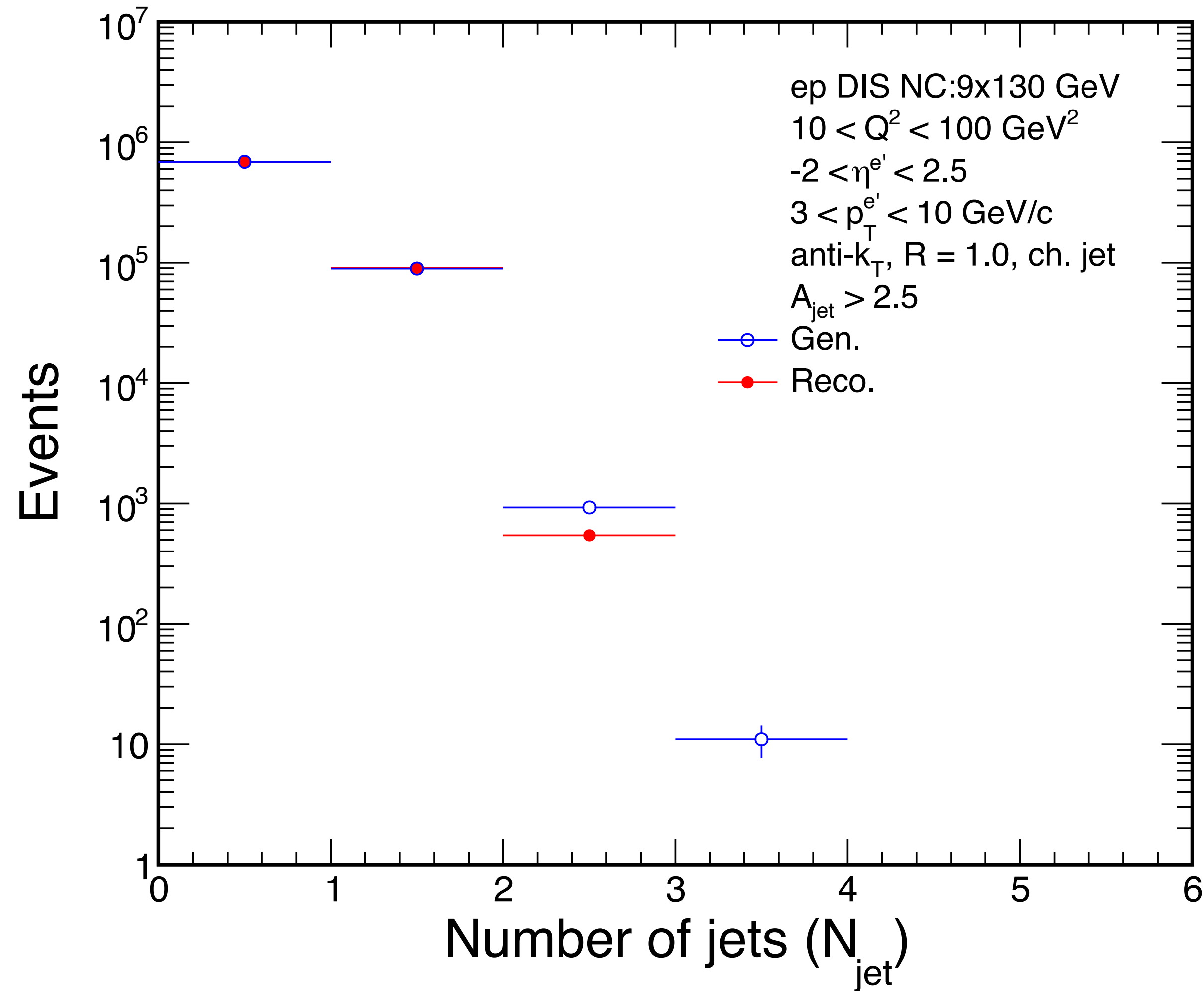


$3 < p_{T,jet} < 10 \text{ GeV}/c$ used

With fiducial cut: $-2.0 + R < \eta_{jet} < 2.5 - R$

Here $R = 1.0$

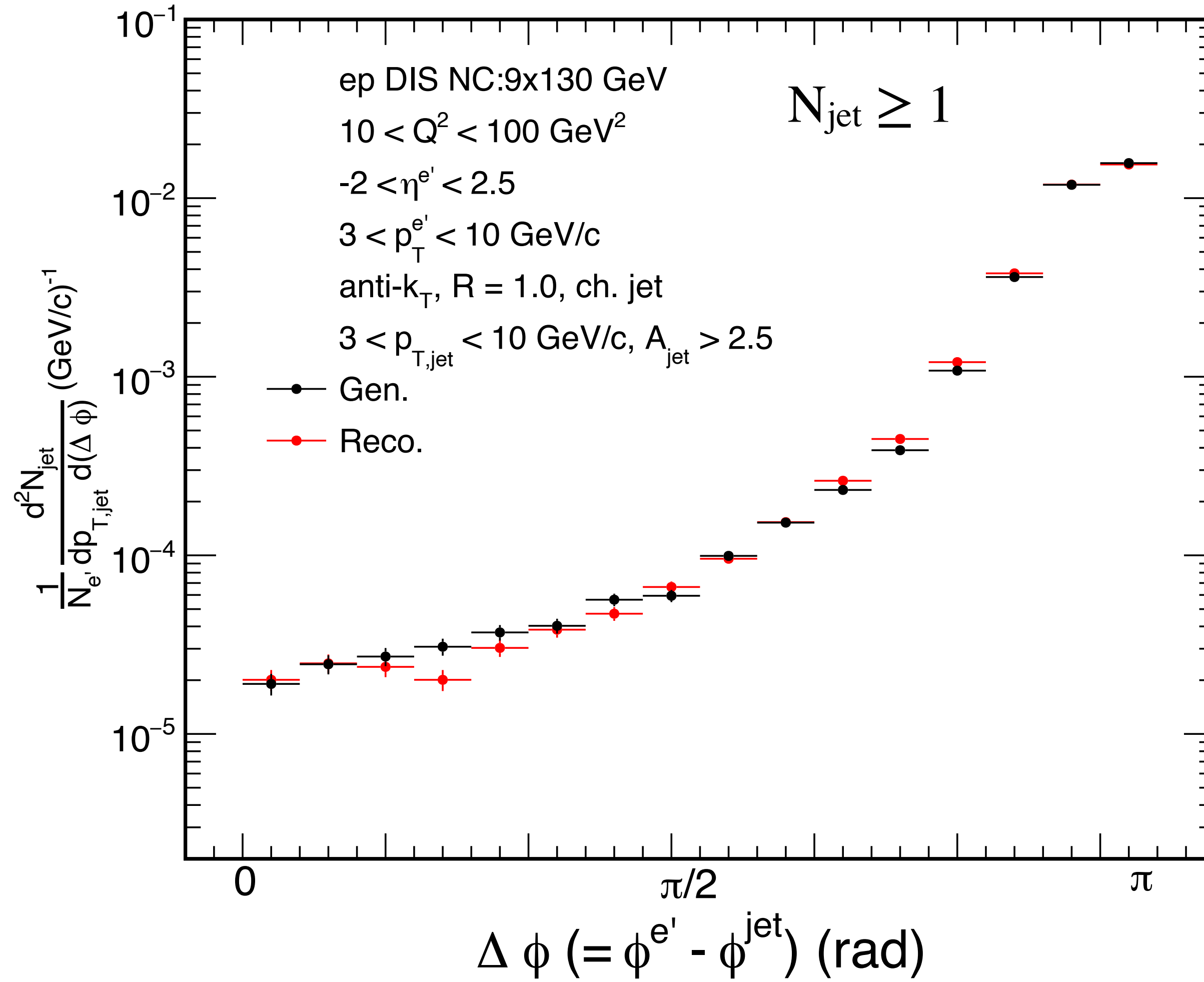
Number of jets in Gen. and Reco. Level



$3 < p_{T, \text{jet}} < 10 \text{ GeV}/c$ used

With fiducial cut: $-2.0 - R < \eta_{\text{jet}} < 2.5 - R$

Scattered e+jet azimuthal correlations (Gen. and Reco. Level)

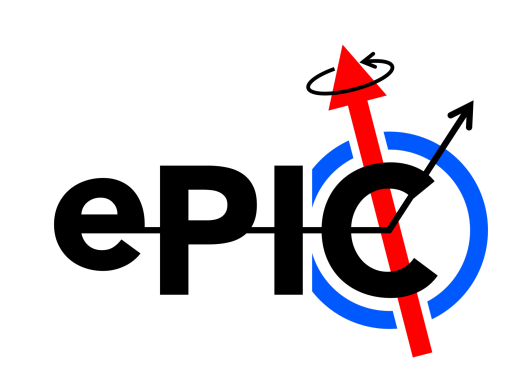


$3 < p_{T,\text{jet}} < 10 \text{ GeV}/c$ used

With fiducial cut: $-2.0 - R < \eta_{\text{jet}} < 2.5 - R$

$N_{\text{jet}} \geq 1$

(For different N_{jet} , correlation study ongoing)



Summary and outlook

- Aiming for ep @ 9x130 GeV results for different N_{jet} ($\geq 1, 2, 3$)
Different Q^2 and x region in ep (and eA) events for NIM A special issue
- Ongoing validation studies: jet matching efficiency, jet energy/angular resolution, and related performance checks, etc.
- Request the production of eA events @ 9x100 GeV with the same setup.
- Comparison of electron–jet azimuthal correlations in ep and eA at the same Q^2 and x provides a key physics benchmark for the special issue.