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

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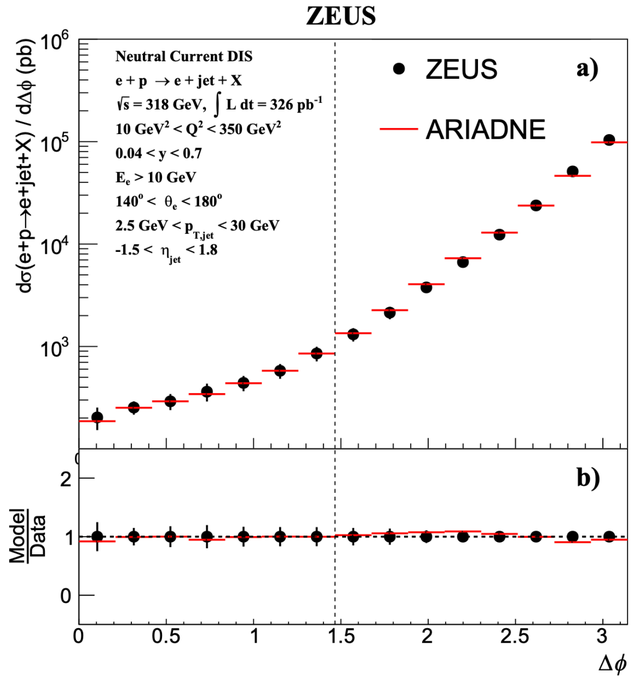
Scattered electron–jet azimuthal correlations

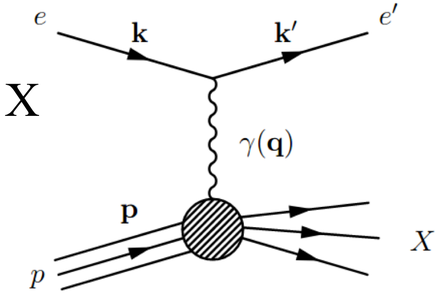
ZEUS: EPJC (2024) 84:1334



- **In ep:**
  - QCD radiation controls the decorrelation
    - LO produces back-to-back topology, $\Delta\varphi\ (\varphi^{e} - \varphi^{jet}) = \pi$
    - 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 $\Delta\varphi$ 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

$$e + p \rightarrow e + jets + X$$



Previous presentations

30th Jun 2026 presentation:
https://indico.bnl.gov/event/30270/contributions/126495/attachments/71070/121775/EICJetAndHF_30Jun2026.pdf

14th July 2026:
https://indico.bnl.gov/event/30271/contributions/126853/attachments/71318/122252/EIC_eJetCorr_14Jul2026_NRS.pdf

Simulated events and analysis details

Event generator and energy: PYTHIA 8.316, 9x130 GeV

$10 < Q^2 < 100\ GeV^2$

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

Jet reconstruction information:

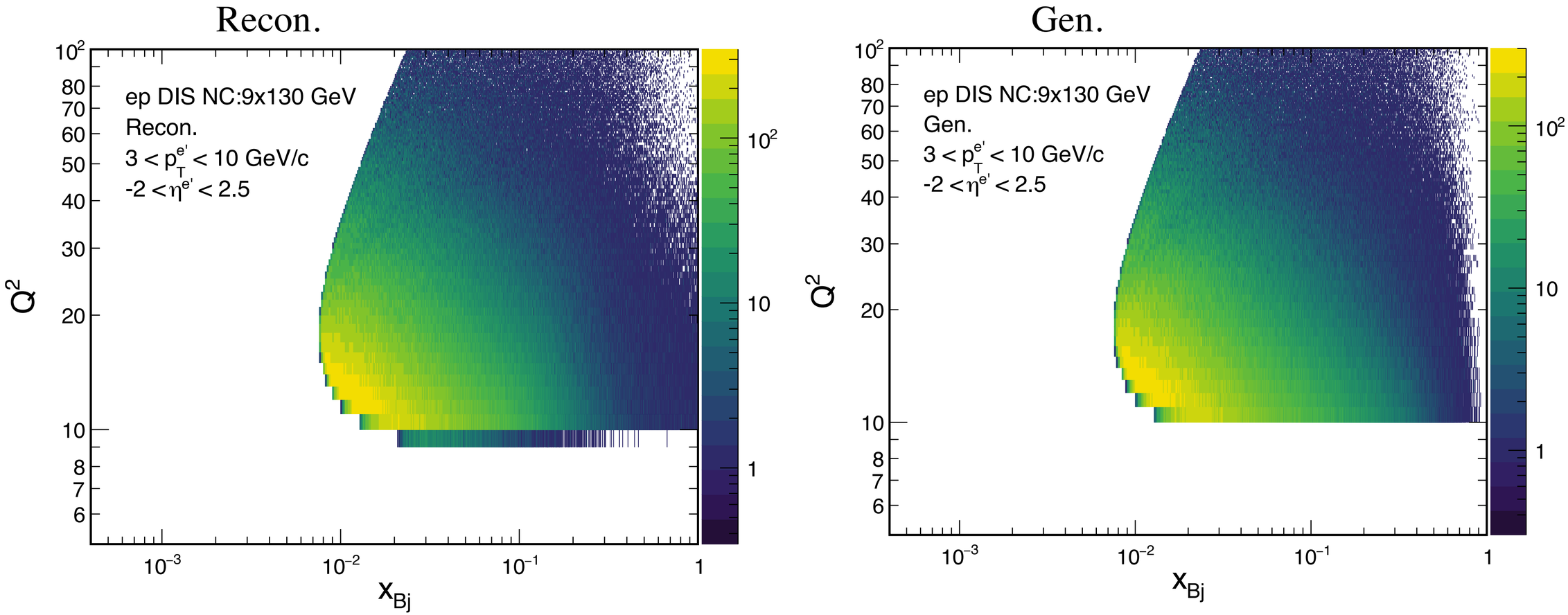
- Jet algorithm: anti-k_T
- Recombination scheme: E-scheme
- Jet resolution parameter, R = 1.0
- Minmum constituent p_T: 0.2 GeV/c
- Active area
- Ghost Max Rapidity: 3.5

Reconstructed track: nhits > 4

In this analysis, we fixed reco and gen level event selection

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

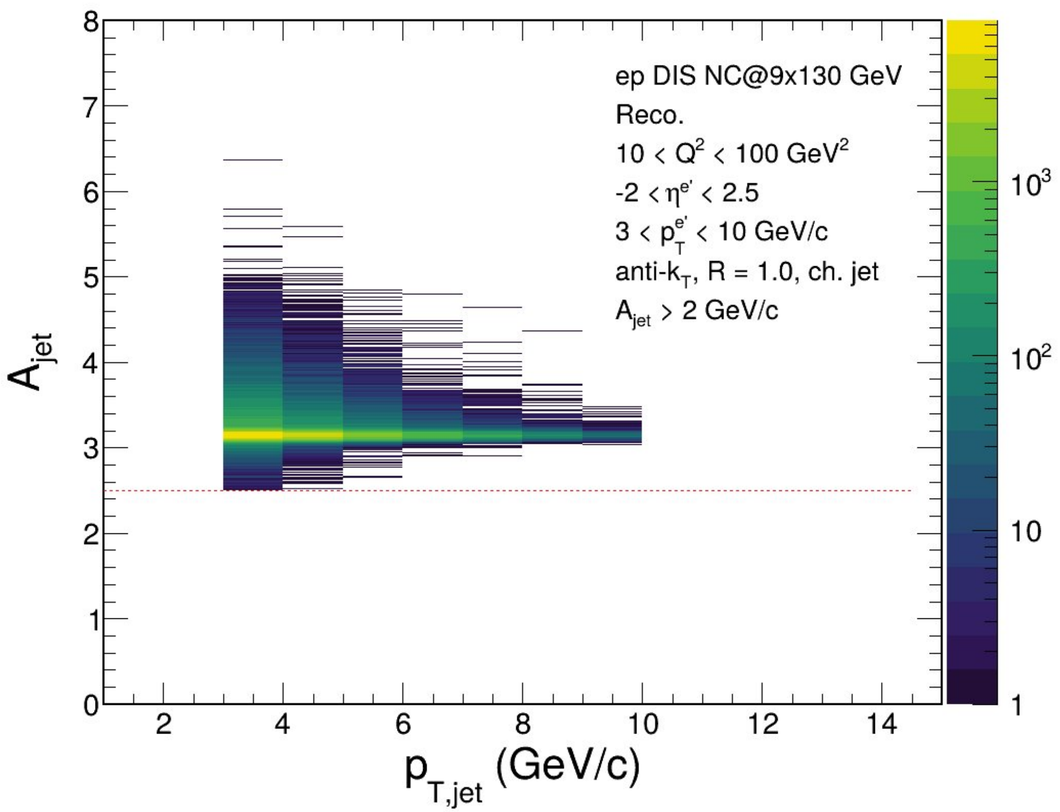
Q^2 vs. x_{Bj} : Generator and Reconstruction level



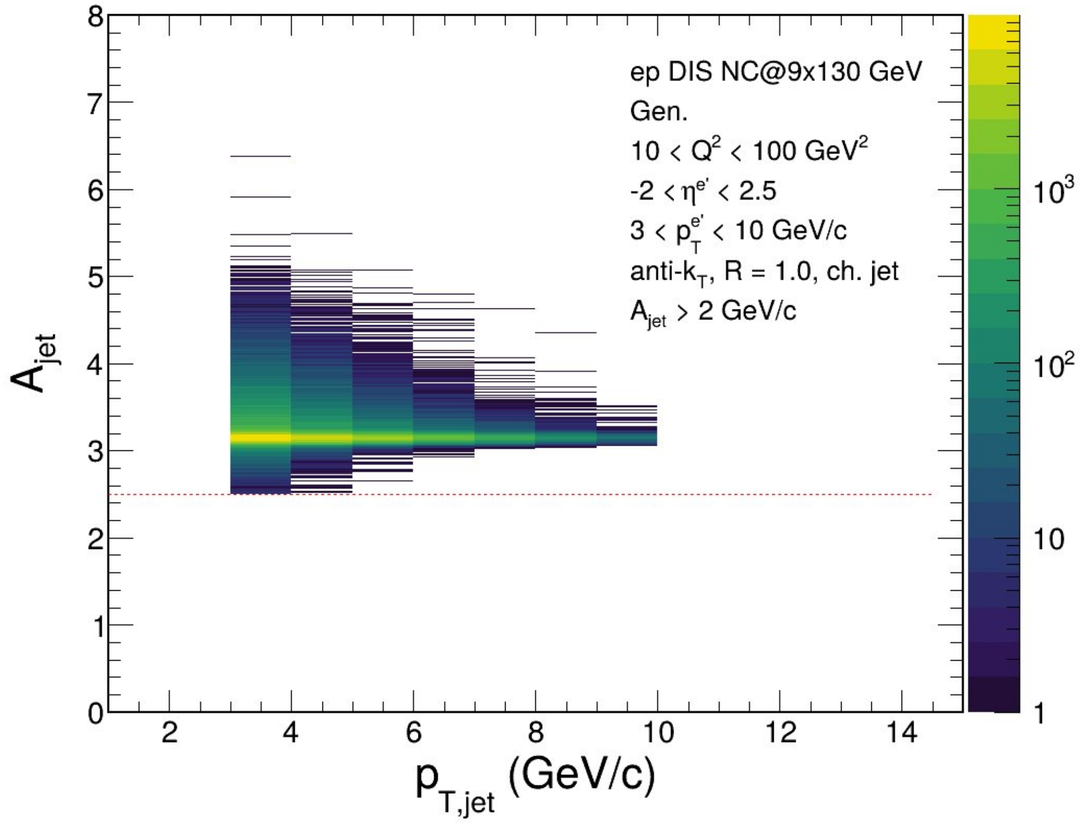
With scattered electron $3 < p_{\mathrm{T}}^{e'} < 10$ GeV/c and $-2.0 < \eta^{e'} < 2.5$

Jet area vs. jet p_T

Recon.

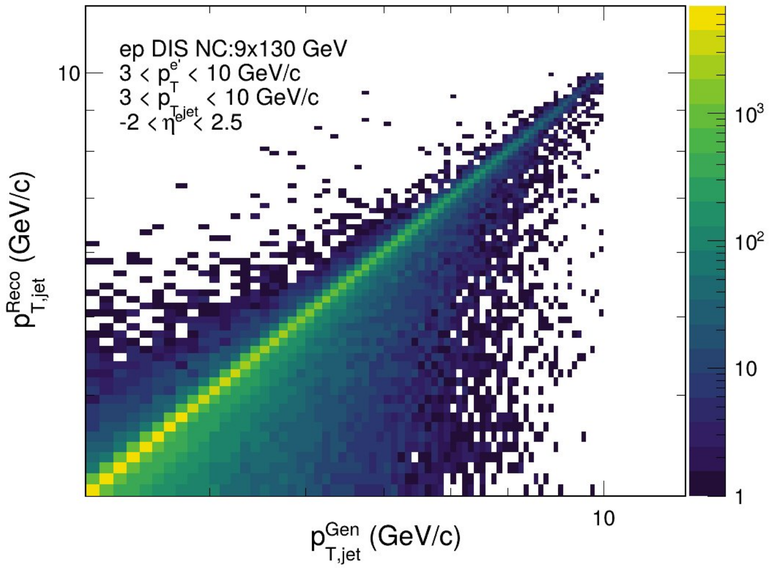


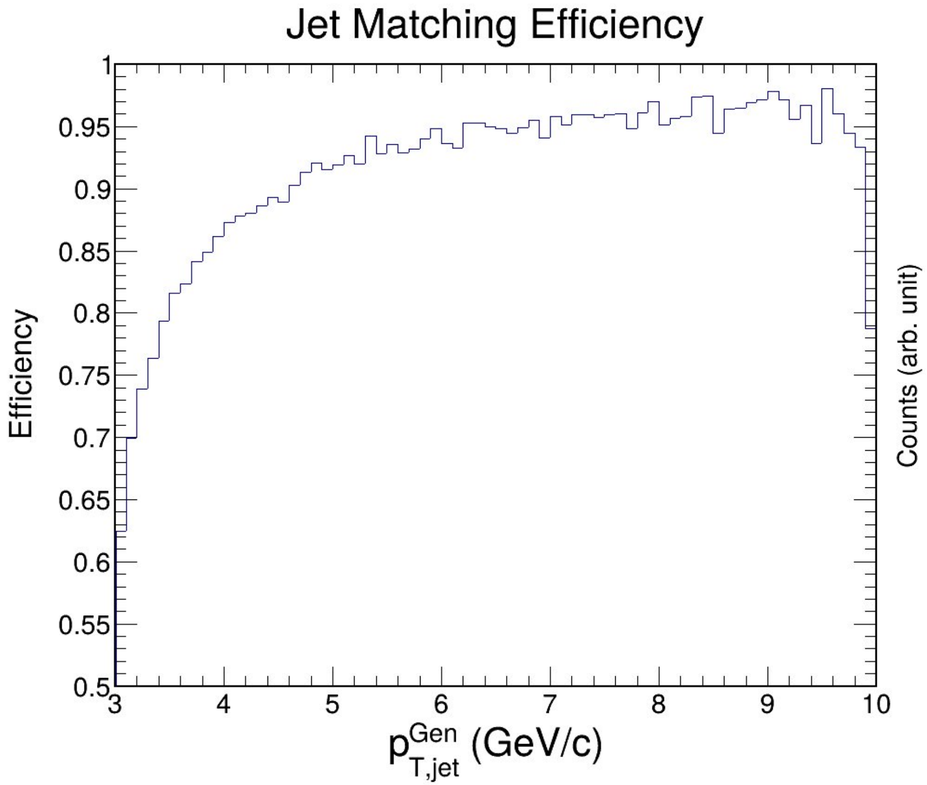
Gen.

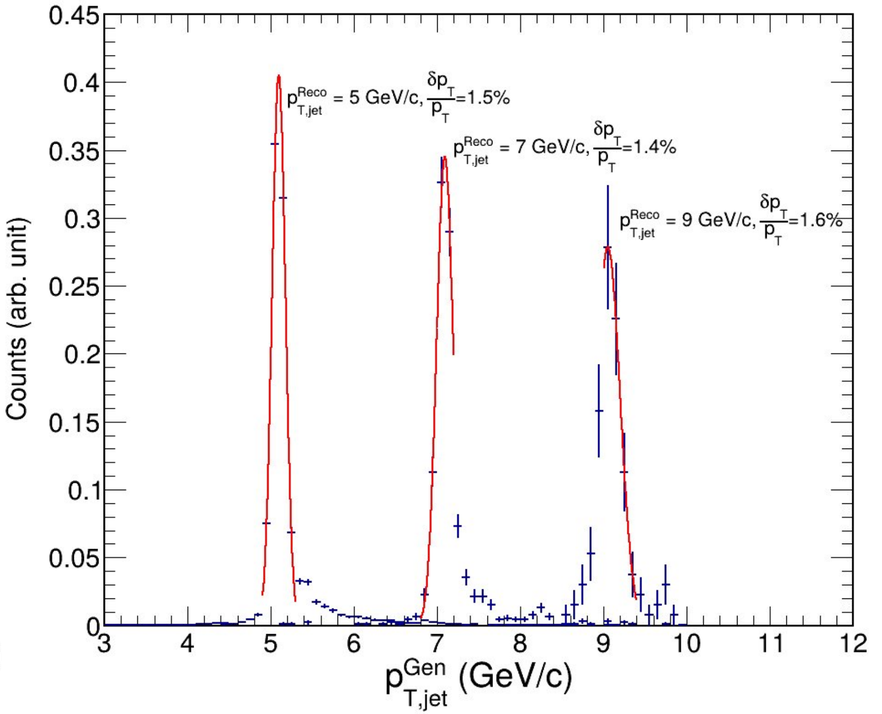


After applying scattered electron and jet p_T and η acceptance cuts

Gen. vs. Reco jet







Jet p_T above 5 GeV/c, jet matching efficiency > 90%

Jet energy resolution ~ 1.5%

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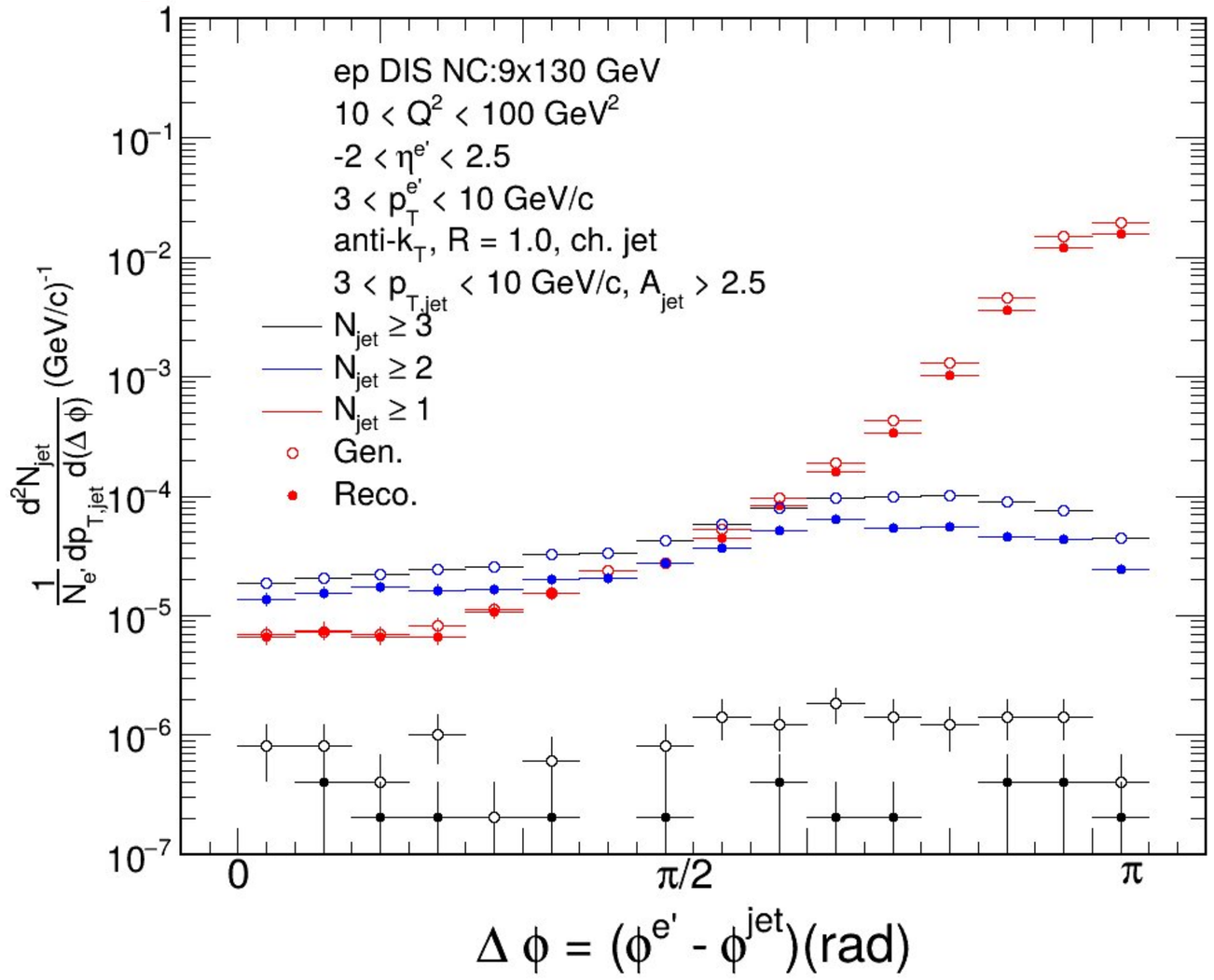
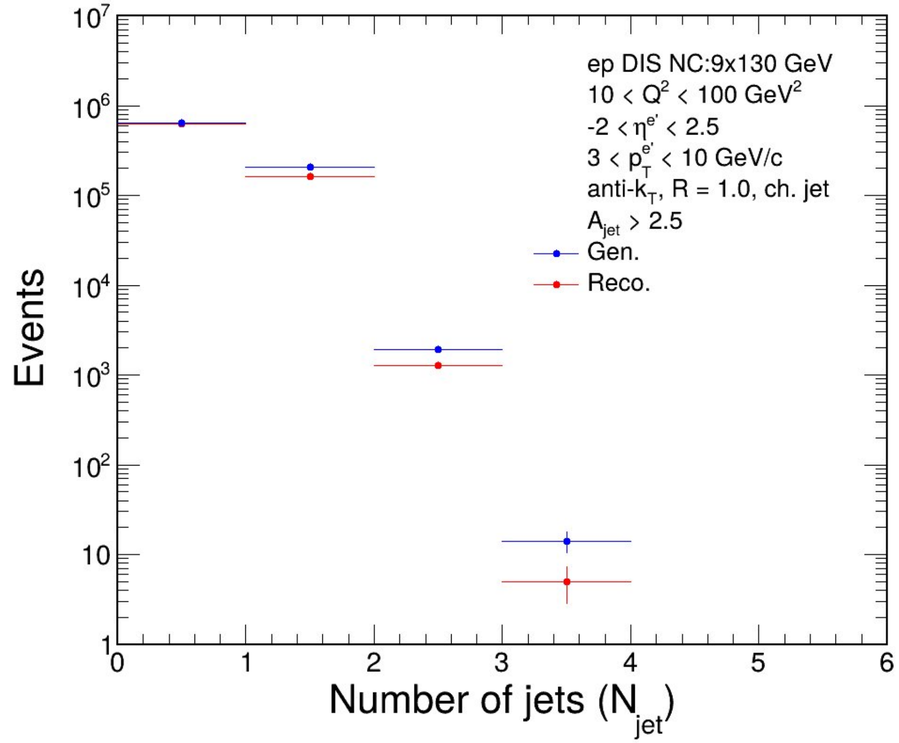
Scattered e+jet azimuthal correlations (Gen. and Reco. Level)

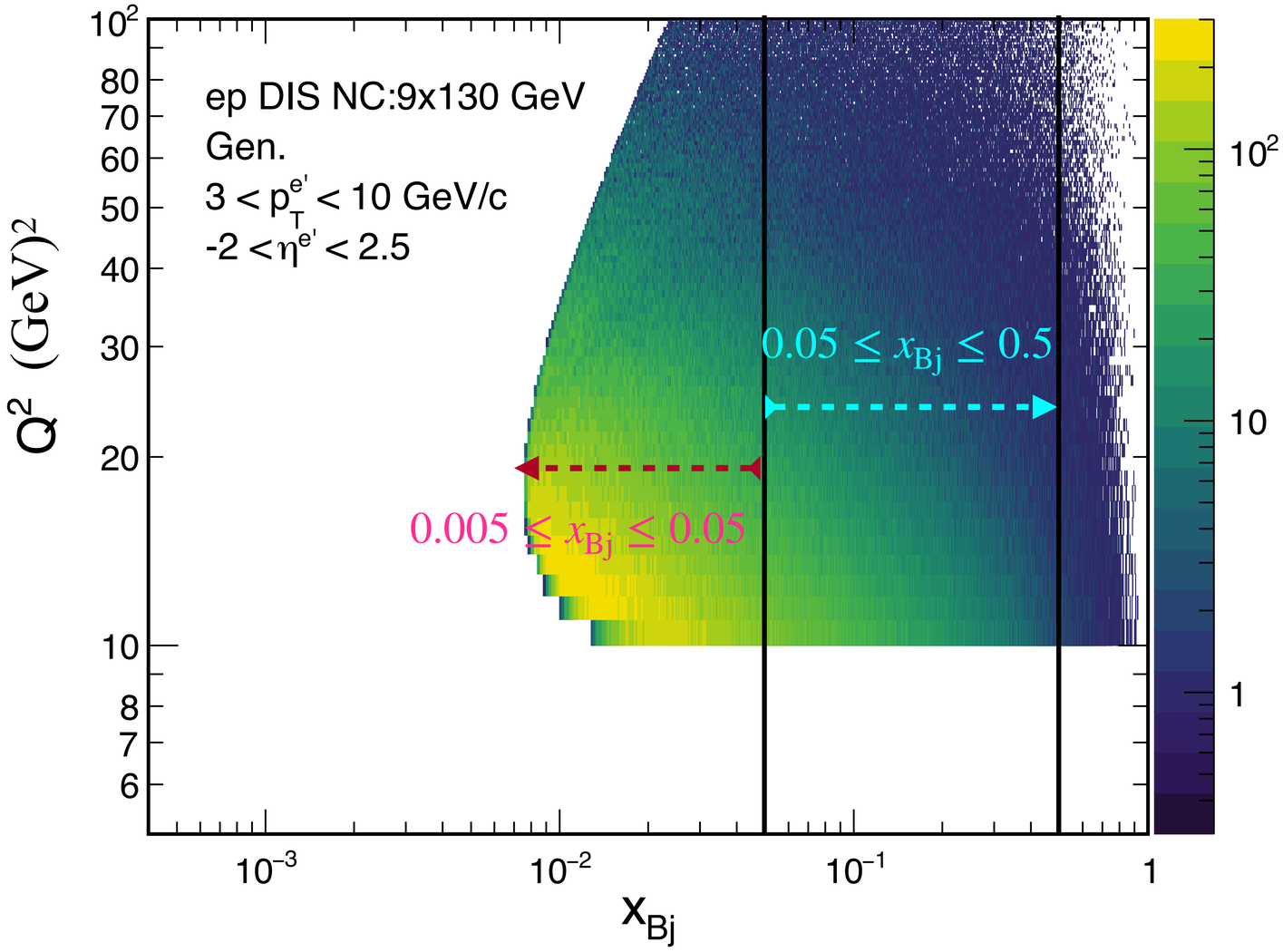




$3 < p_{T,jet} < 10$ GeV/c:

- e+jet azimuthal correlations strongly depend on jet multiplicity (N_{jet})
- Show deviation from back-to-back topology with increasing in N_{jet}

Selected for two x_{Bj} regions (Gen.)



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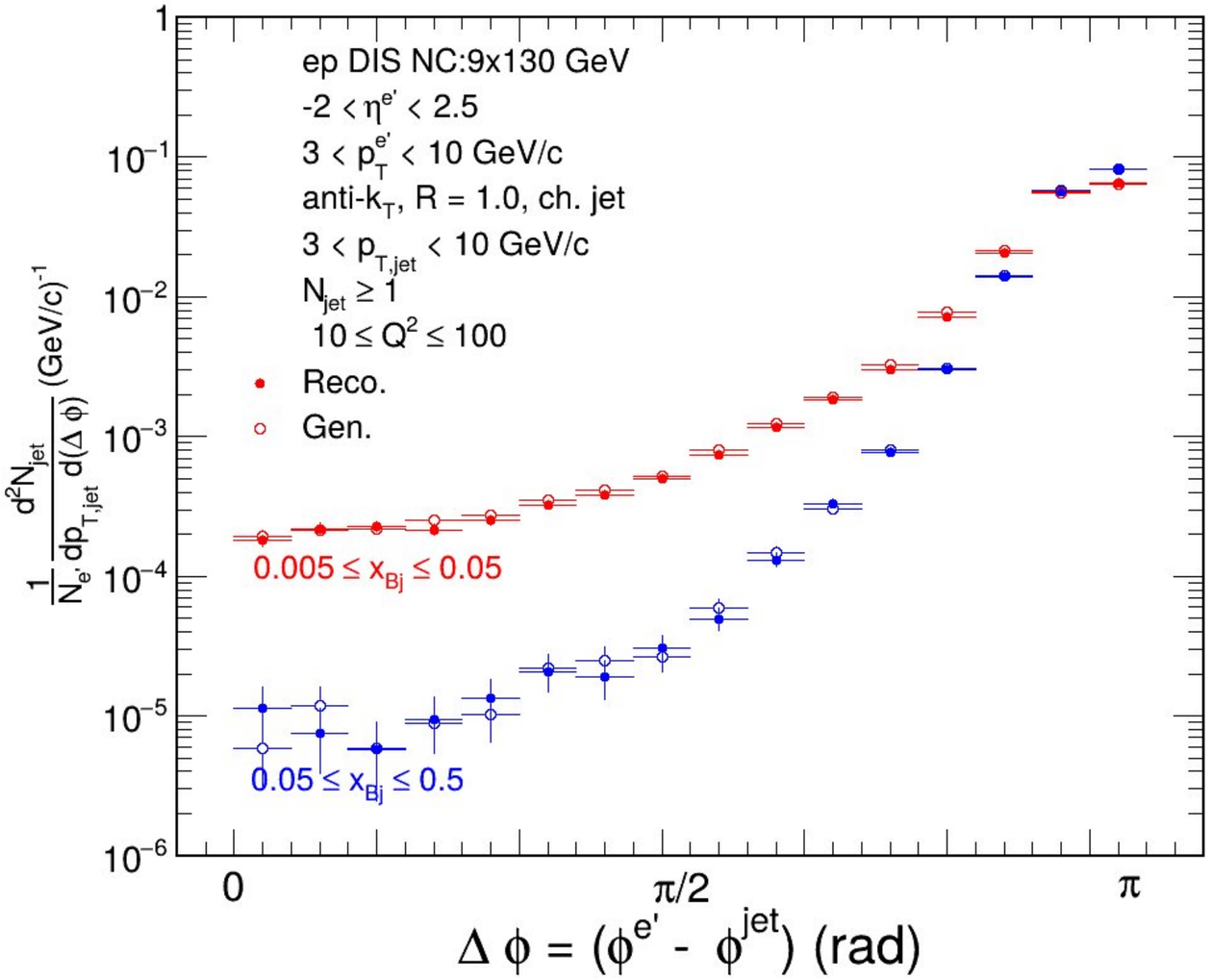

$3 < p_{T,jet} < 10$ GeV/c

Smaller x_{Bj} shows wider $\Delta\phi$ distribution relative to larger x_{Bj}

Summary and outlook

In e+jet correlation in ep:

- $\Delta\phi$ azimuthal correlations strongly depend on jet multiplicity (N_{jet})
- smaller x_{Bj} shows wider $\Delta\phi$ distribution relative to larger x_{Bj}

Working on the plots that can go to special issue

Looking forward to eA generated and reco. events