

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

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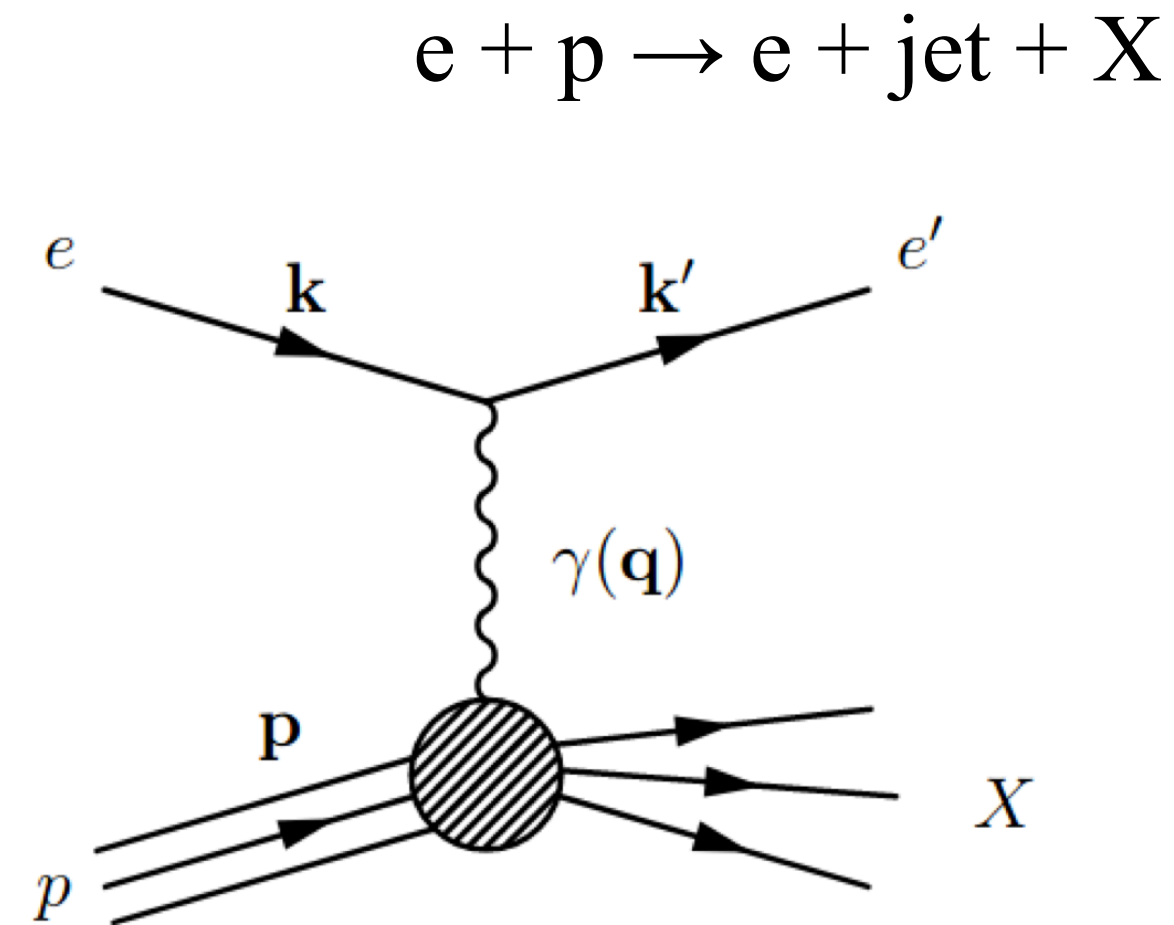
IISER Tirupati, India



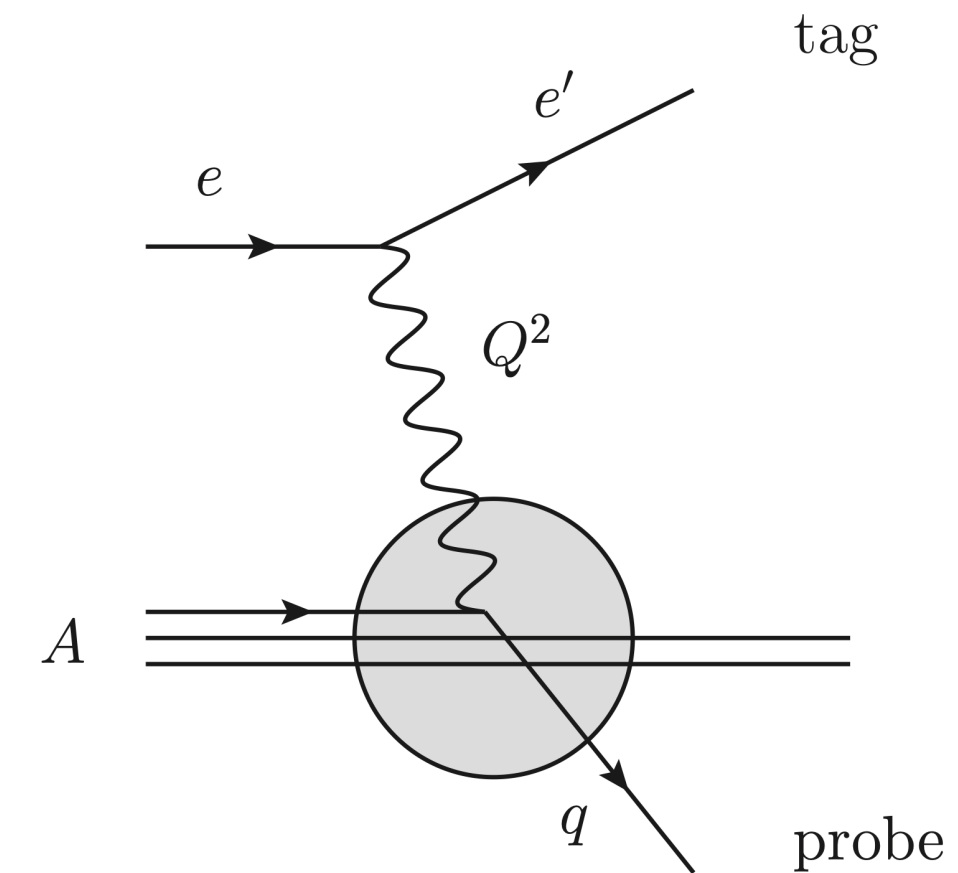
Scattered Electron-jet azimuthal correlation

ep DIC NC process

- No strong interaction from electron side
- Electron provided calibrated reference
- Cleaner environment

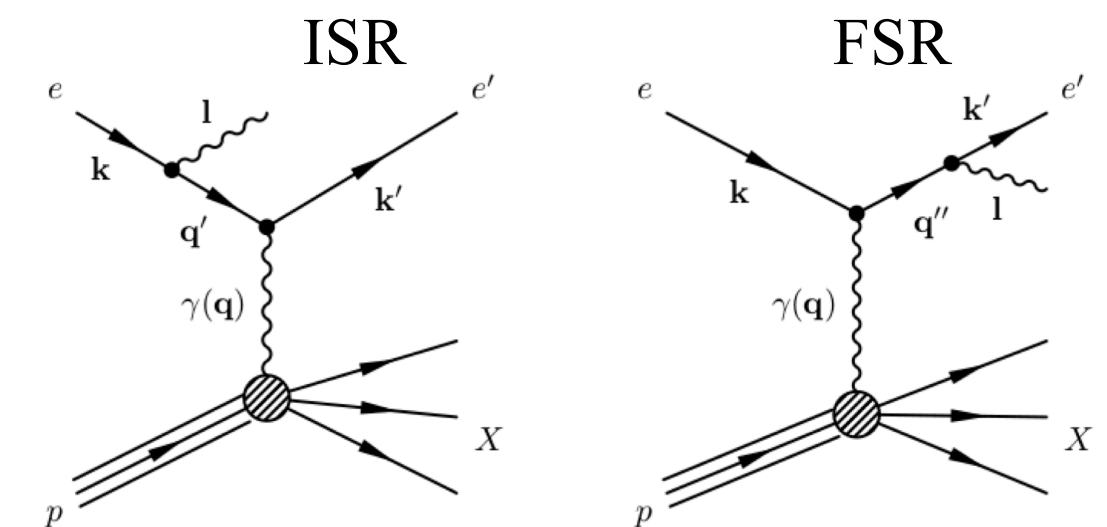


$e + A \rightarrow e + \text{jet} + X$



PRC 101, 065204 (2020)

- **In ep:**
 - QCD radiation controls the decorrelation
 - LO produces back-to-back topology, $\Delta\phi (\phi^e - \phi^{\text{jet}}) = \pi$
 - 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)
- **In eA:**
 - multiple scattering broadens
 - Sensitive to cold nuclear matter
 - constraining transverse momentum broadening and $\hat{q}$

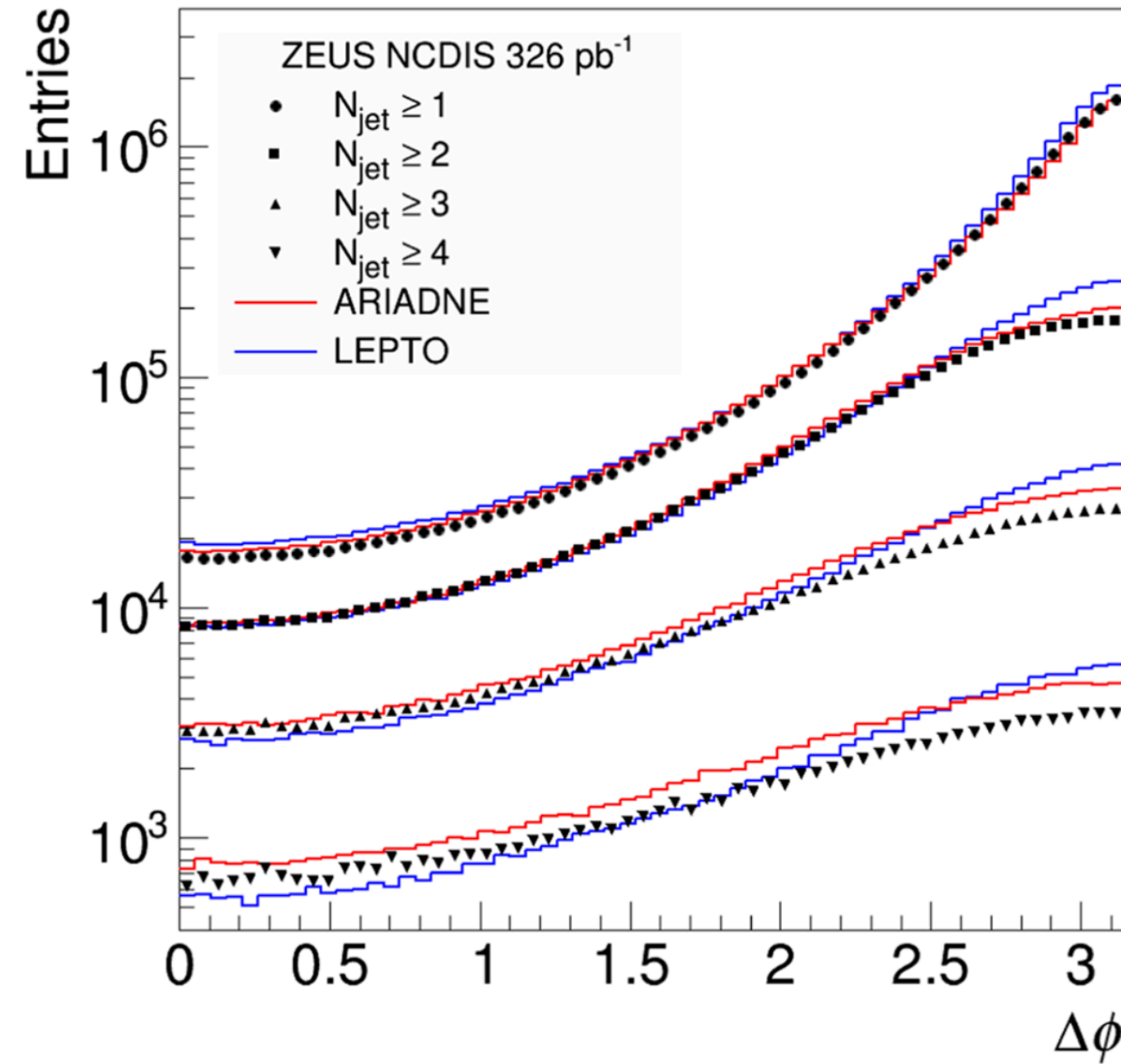


HERA Data: electron–jet azimuthal correlation

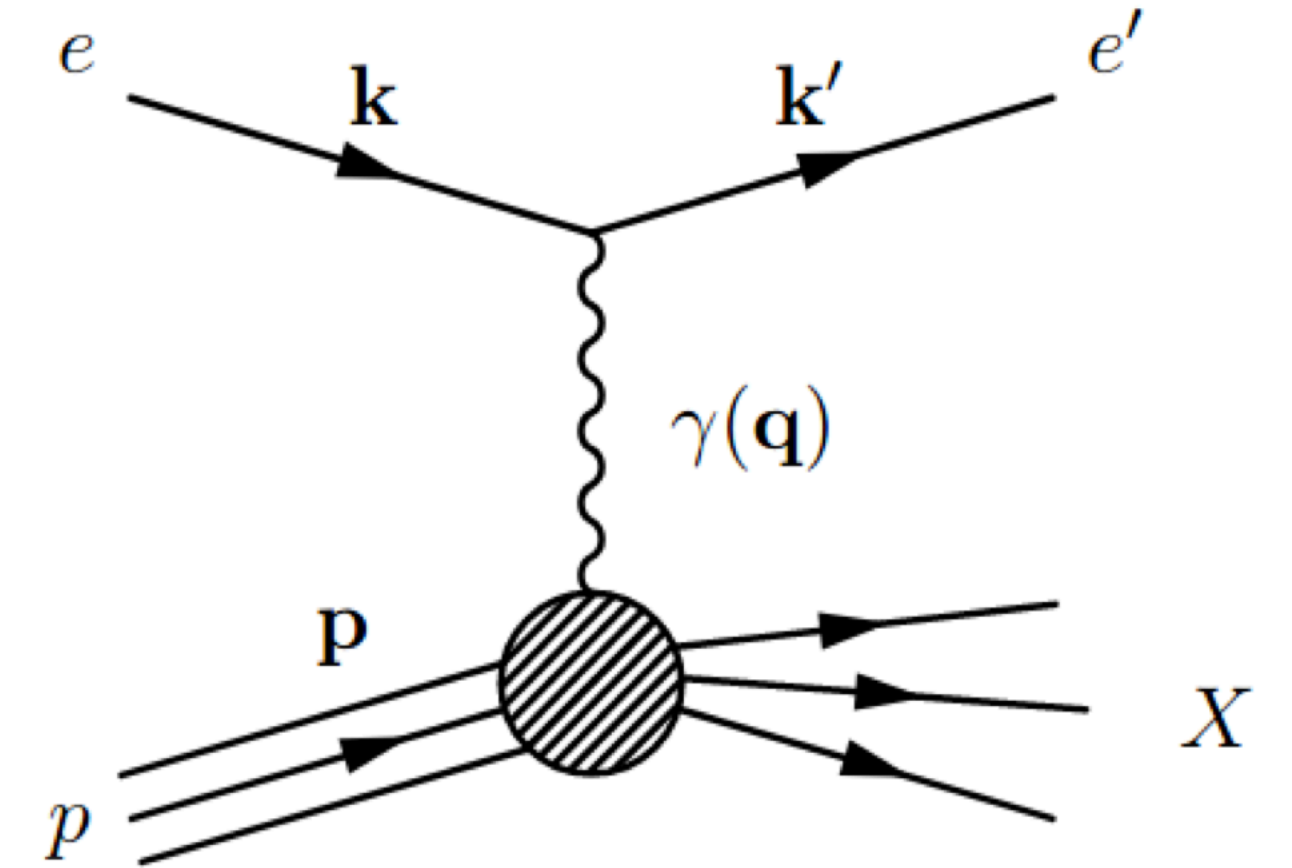
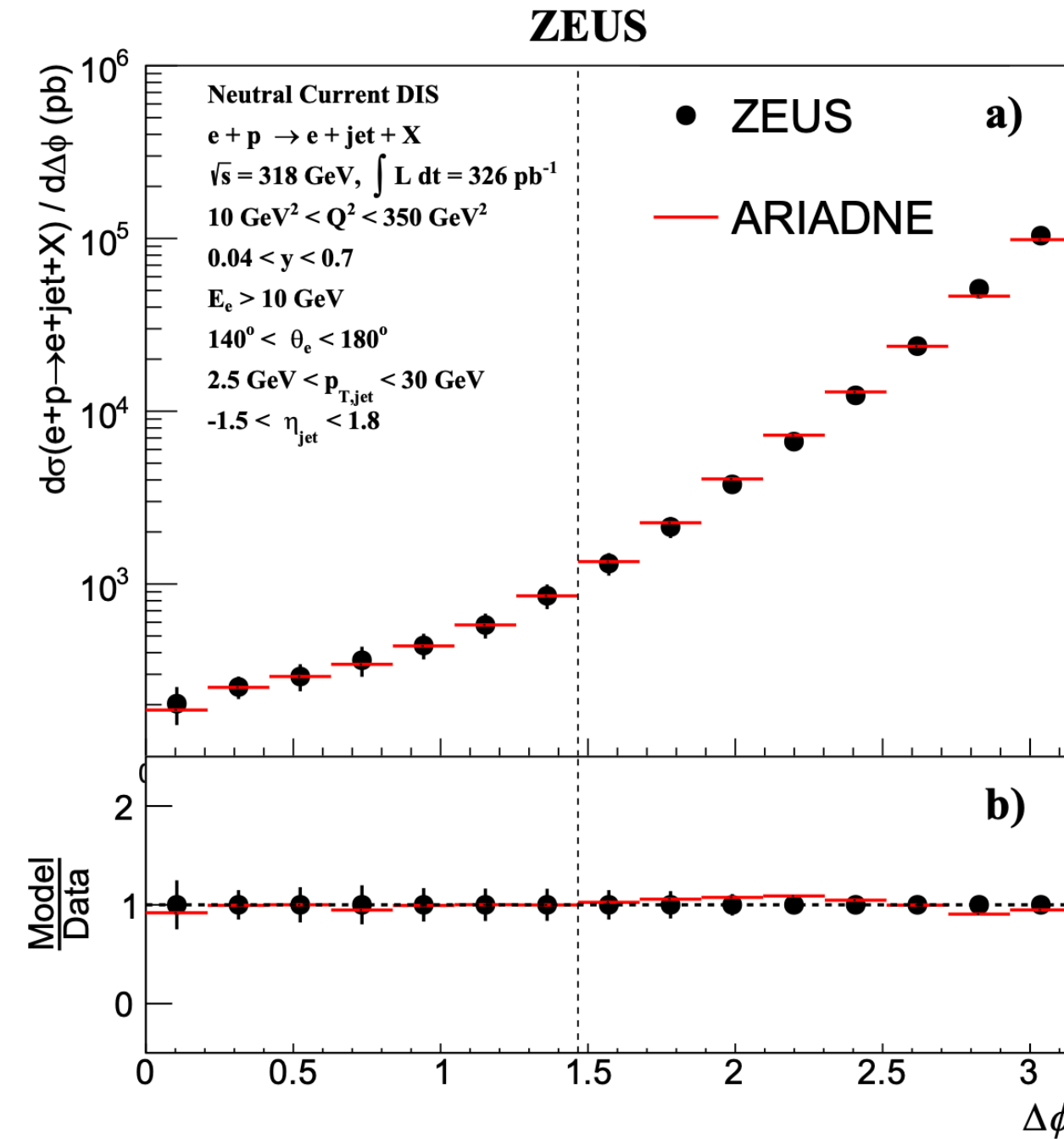
ZEUS: EPJC (2024) 84

ep DIC NC process $e + p \rightarrow e + \text{jet} + X$

For different jet-multiplicity (N_{jet})
ZEUS



k_T algorithm with the E -scheme with $R=1.0$



- HERA established the first precision measurement of electron–jet azimuthal correlations in DIS.
- Measurement validates higher-order QCD calculations and parton-shower models describing QCD radiation.
- Provides the essential ep baseline for future EIC measurements of nuclear broadening and cold nuclear matter effects in eA collisions (higher luminosity and broader kinematic coverage).

Requirement for this study

HEPMC files:

- DIS: e+p @ 9x130 PYTHIA 8.316, NC, $Q^2 > 1$
/eic/u/rongrong/gpfs02/SC_requests/D0/PYTHIA8_ep_NC_9x130_Q2min1/ab_hepmc
[required ~10M events]
- BeAGLE v1.03.02 e+Au, 9x100 $Q^2 > 1$

https://docs.google.com/presentation/d/1BjcQn_sHX-IUJkSsNQ7wg_EcIin7B2X1_pY9iGn7_nI/edit?slide=id.g3ec6738cac8_2_0#slide=id.g3ec6738cac8_2_0

We plan to perform scattered electron-jet azimuthal correlations measurement in ep (and eA) collisions.

- reconstruct scattered electron.
- reconstruct anti- k_T jets.
- plan to measure at different Q^2 , x , jet R , $p_{T,jet}$

These measurements in EIC to address

- effect higher order QCD radiation in wider scale
- measure nuclear broadening in eA collisions
- constrain cold nuclear matter transport properties
- develop electron–jet correlations as a precision probe for future EIC jet and substructure (Lund plane) measurements.
- new observables

ARRATIA, SONG, RINGER, et al., PRC 101, 065204 (2020)

Thank you, Rongrong and Shyam, for these information and support!