Simulation of Jet Production at the EIC

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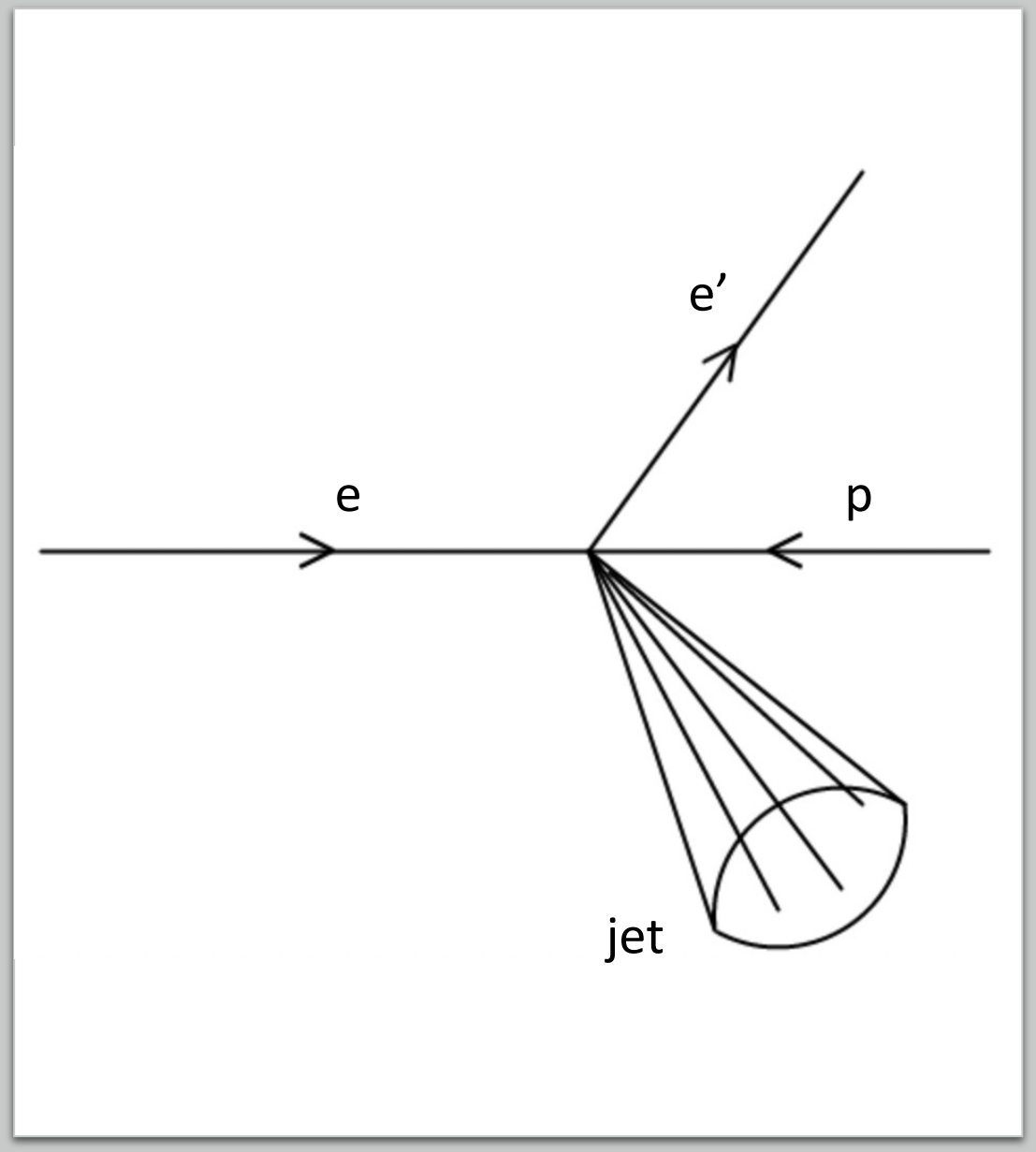
Motivation

- The EIC will study transverse momentum dependent distributions in deep inelastic scattering
- Jets in high energy particle collisions allow for detailed studies of quantum chromodynamics (QCD)
- Jets can be used to study transverse momentum dependent distributions
- My longer-term goal is to study quarks and gluons in the initial and final state using jet probes



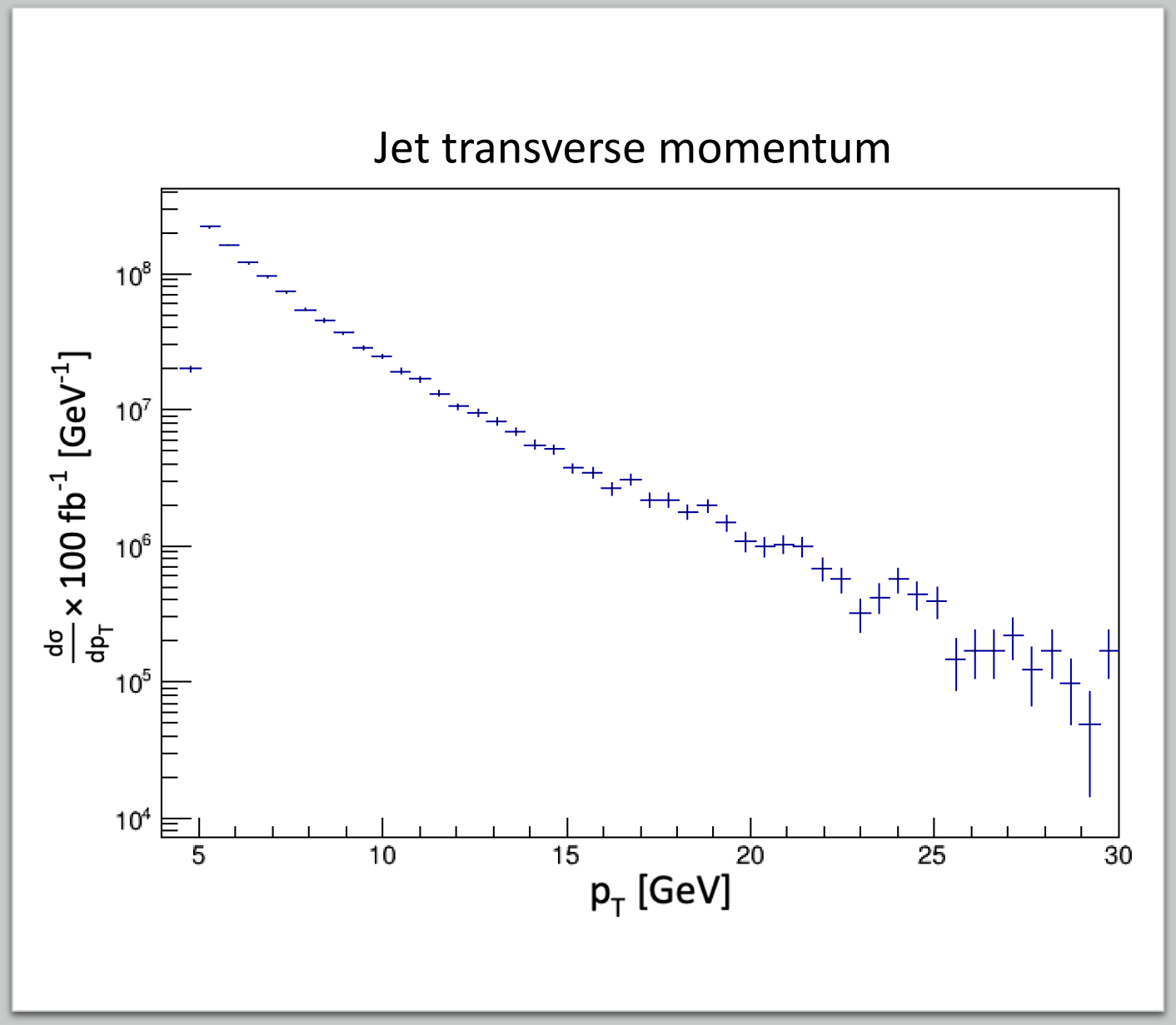
Method

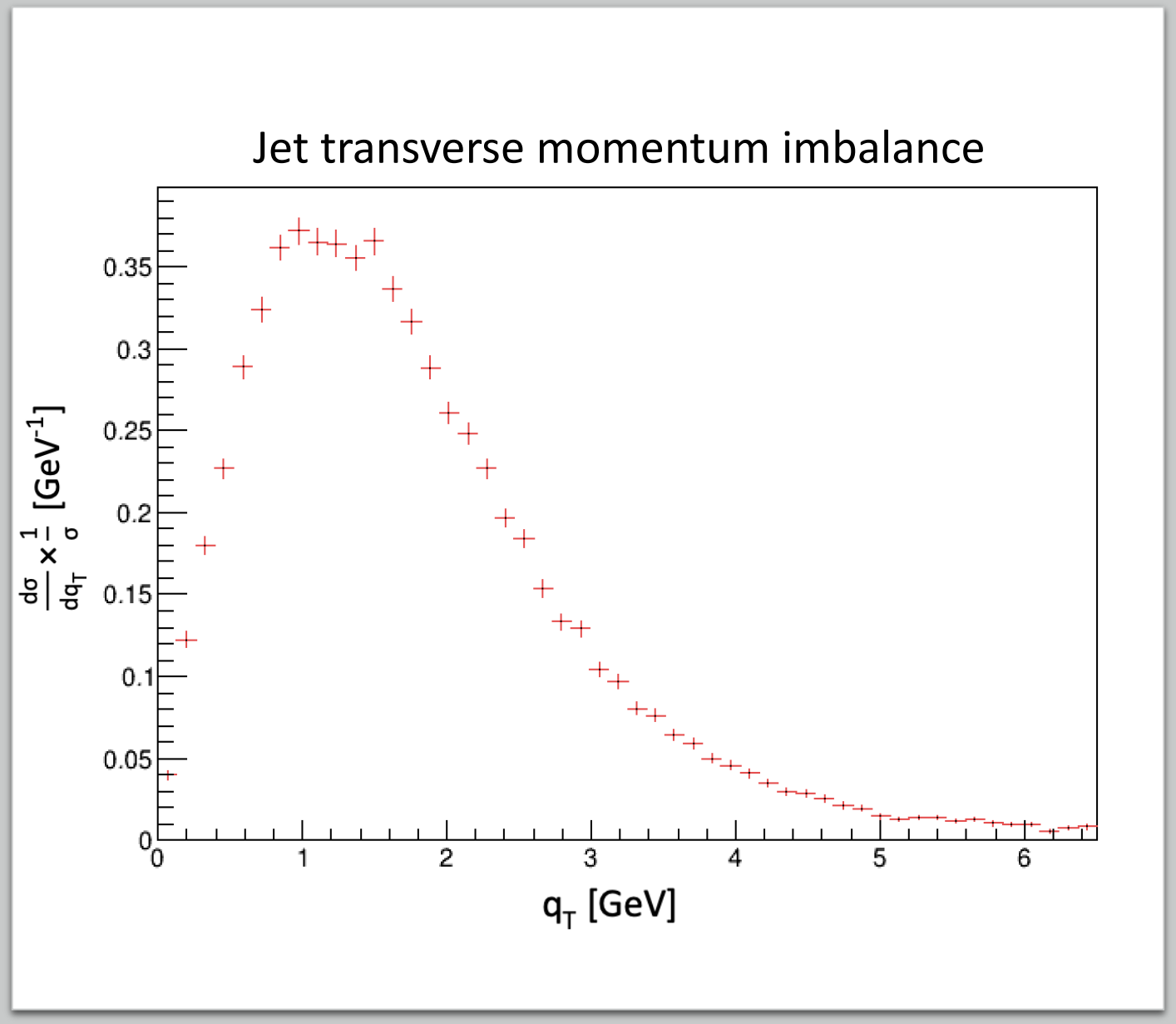
- Pythia 8 is used to simulate electron-proton collisions with collision energy of 105 GeV (EIC electron energy of 10 GeV, proton energy of 275 GeV)
- Fastjet algorithm used with radius 0.5 and anti-k_T clustering sequence used to reconstruct jets
- Transverse momentum and transverse momentum imbalance of jets with $p_T > 5$ GeV are extracted from simulation

Initial Results

- Jets reconstructed with anti-kt cluster sequence and jet radius of 0.5
- Distribution of transverse momentum with respect to beam axis of jets generated over 3×10^5 collision events
- Normalized to 100 fb^{-1} integrated luminosity
- Distribution of transverse momentum is near exponential

$$p_T^2=p_x^2+p_y^2$$





Initial Results

- Transverse momentum imbalance distribution for jets reconstructed with anti-kt cluster sequence and jet radius of 0.5
- Distribution of transverse momentum imbalance of jets generated over 3×10^5 collision events
- Transverse momentum imbalance extracted from the same simulation as jet transverse momentum
- Demonstrates the expected Gaussian behavior centered around 1.2 GeV with an extended tail into values of $q_T > 3$ GeV

$$q_T = \left|\vec{p}_T^{\,e} + \vec{p}_T\right|$$

Next Steps

- Using jet charge to differentiate between quark flavors
- Continuing previous work done using jets to probe nucleon structure
- Demonstrating the use of jet charge to increase *u*- and d-quark flavor sensitivity

Thank you!

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