Hadron-In-Jet Collins for TDR

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Target Plot:

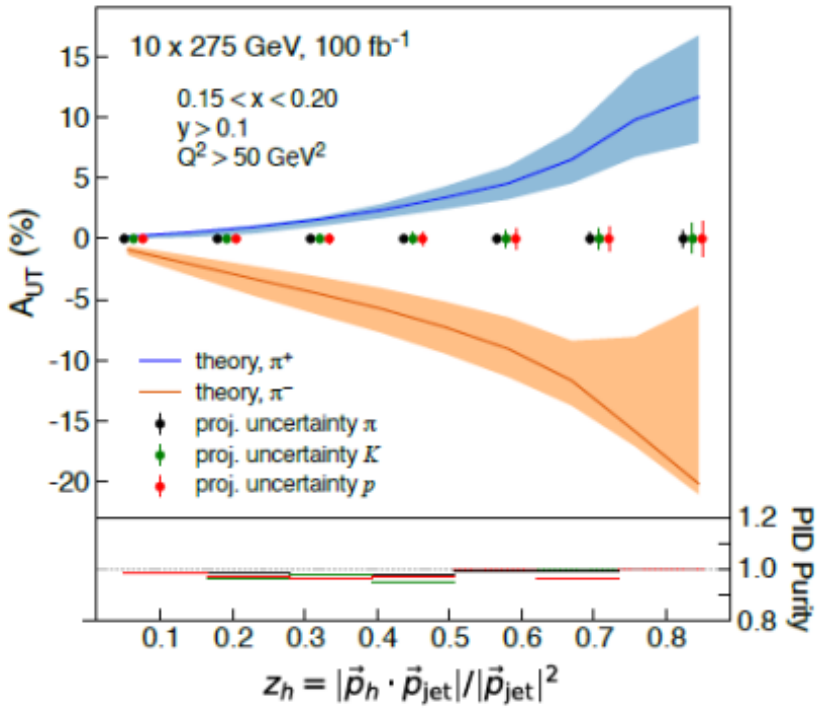


Figure 35: Projection for hadron-in-jet Collins asymmetry measurement for charged pions, kaons and protons. This is representative of the class of jet substructure measurements (FastSim).

Introduction

- Collins effect connects initial proton spin to final state azimuthal distribution of hadrons in a jet (pions, kaons, protons)
- Simulation is without polarization
  - Randomly assigned a spin state for use in calculating the angles that appear in the sinusoidal modulation
    - ϕ_S is related to the jet scatter direction
    - ϕ_H is the azimuthal angle of a hadron in the jet
    - $\phi_C = \phi_S - \phi_H$ is the "Collins angle"

$$d\sigma \approx F_{UU}\left\{1 + A_{UT}^{\sin(\phi_S - \phi_H)} \sin(\phi_S - \phi_H)\right\}$$

Introduction Cont.

- Isolate the asymmetry by exploiting the full 2π azimuthal coverage with the “cross ratio method”

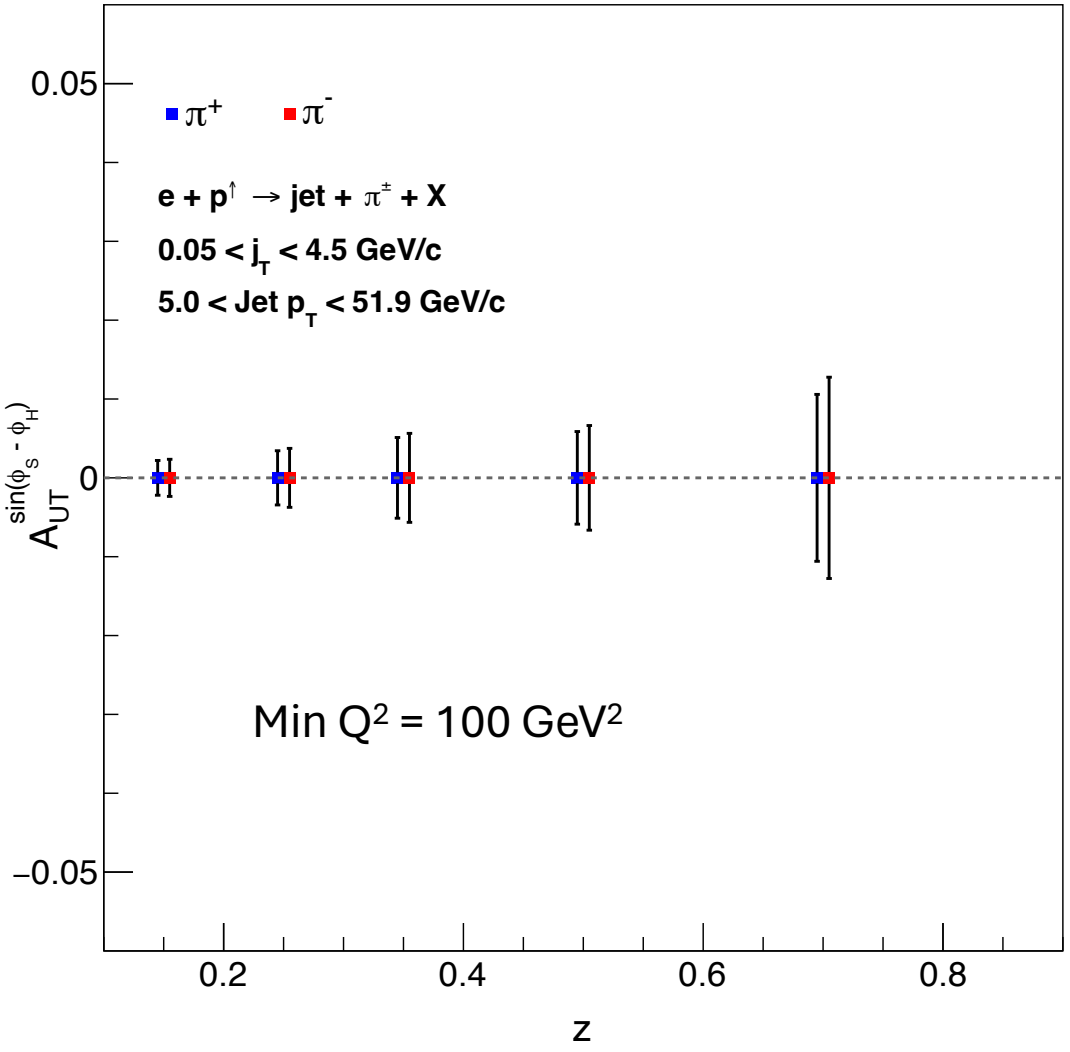
$$\epsilon = P \times A_{UT}^{\sin(\phi_S - \phi_H)} = \frac{\sqrt{N_U^+ N_D^-} - \sqrt{N_U^- N_D^+}}{\sqrt{N_U^+ N_D^-} + \sqrt{N_U^- N_D^+}}$$

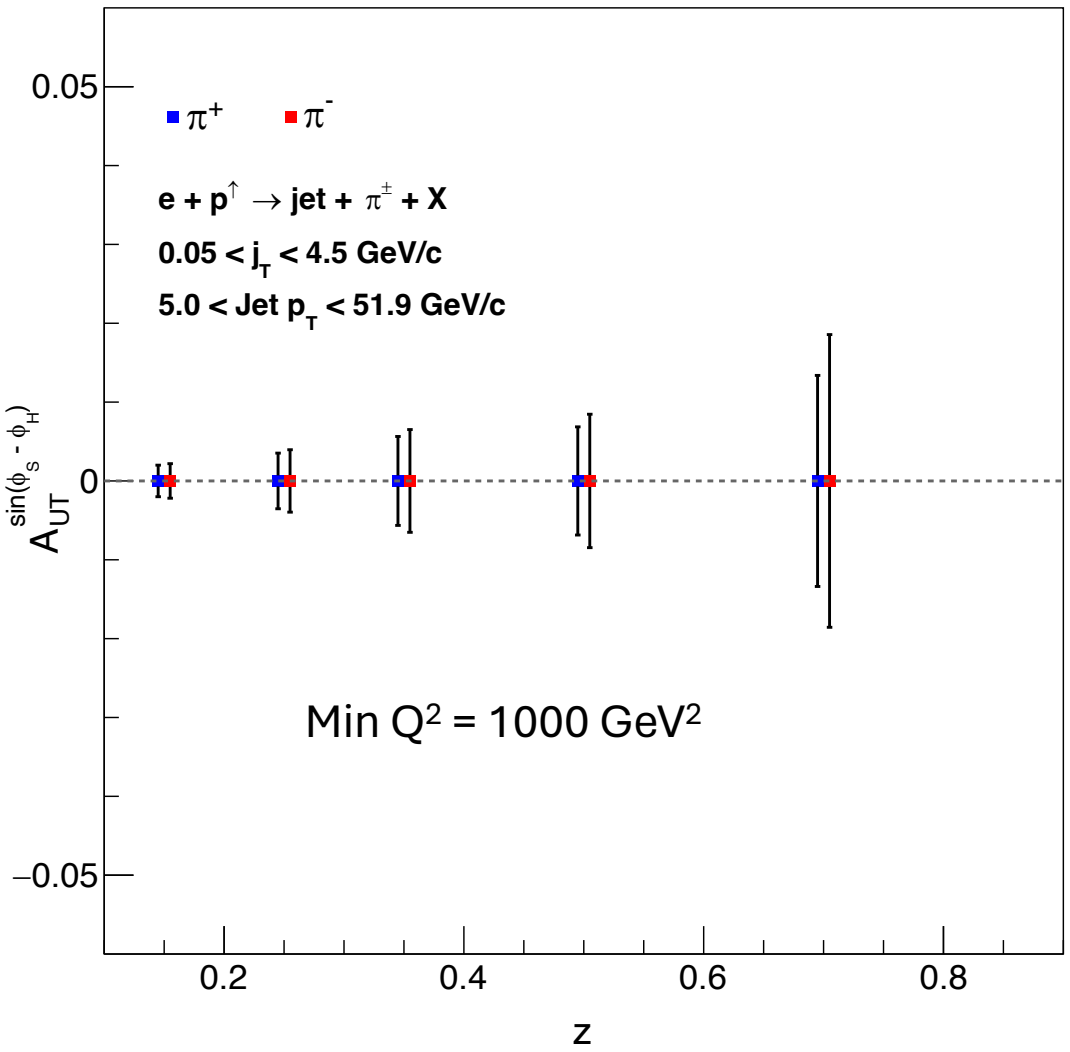
  - N is the number of hadrons that scatter into the upper (U) and lower (D) halves of the detector resulting from protons with spin up (+) and down (-)
  - Each N is binned in two dimensions: ϕ_C and {z, j_T, jet p_T}

Analysis Basics

- Sample: 18x275 GeV, campaign: 23.12.1, NCDIS
- 1M events for minimum $Q^2 = 100\ GeV^2$ and $Q^2 = 1000\ GeV^2$
- Basic cuts:
  - Jet E > 5 GeV
  - 5 < Jet p_T < 51.9 GeV/c (binning may need to be adjusted for final plot, started with previous STAR binning)
  - $|\eta| < 2.5$
  - $0.05 < j_T < 4.5$ GeV/c
  - $0.1 < z < 0.8$
  - Jets containing the original electron are rejected

Current Status of TDR Plots





To Do

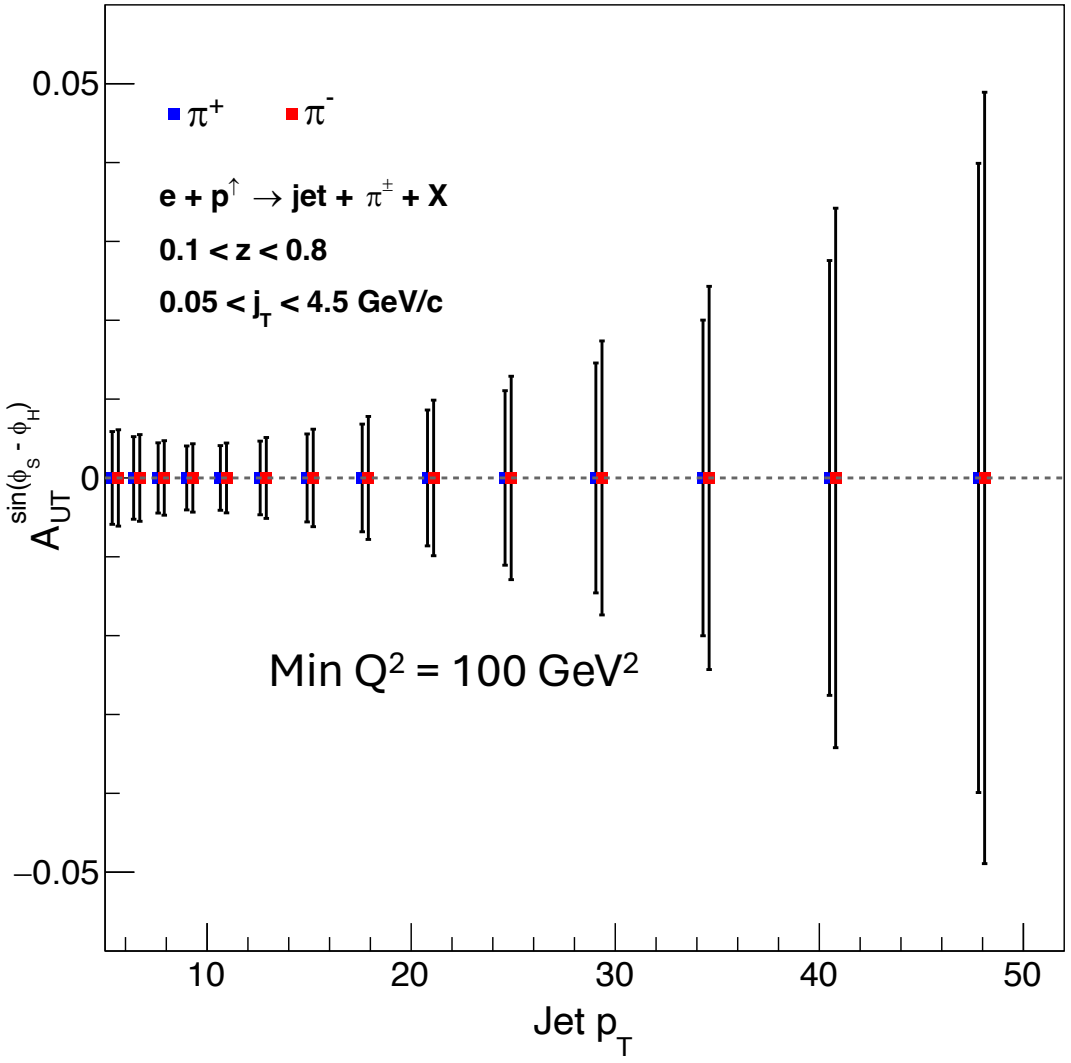
1. Add pi+ and pi-?
2. Add proton and kaon asymmetry (quick) – combine charges?
3. Make the plots “pretty”
4. Run over all events

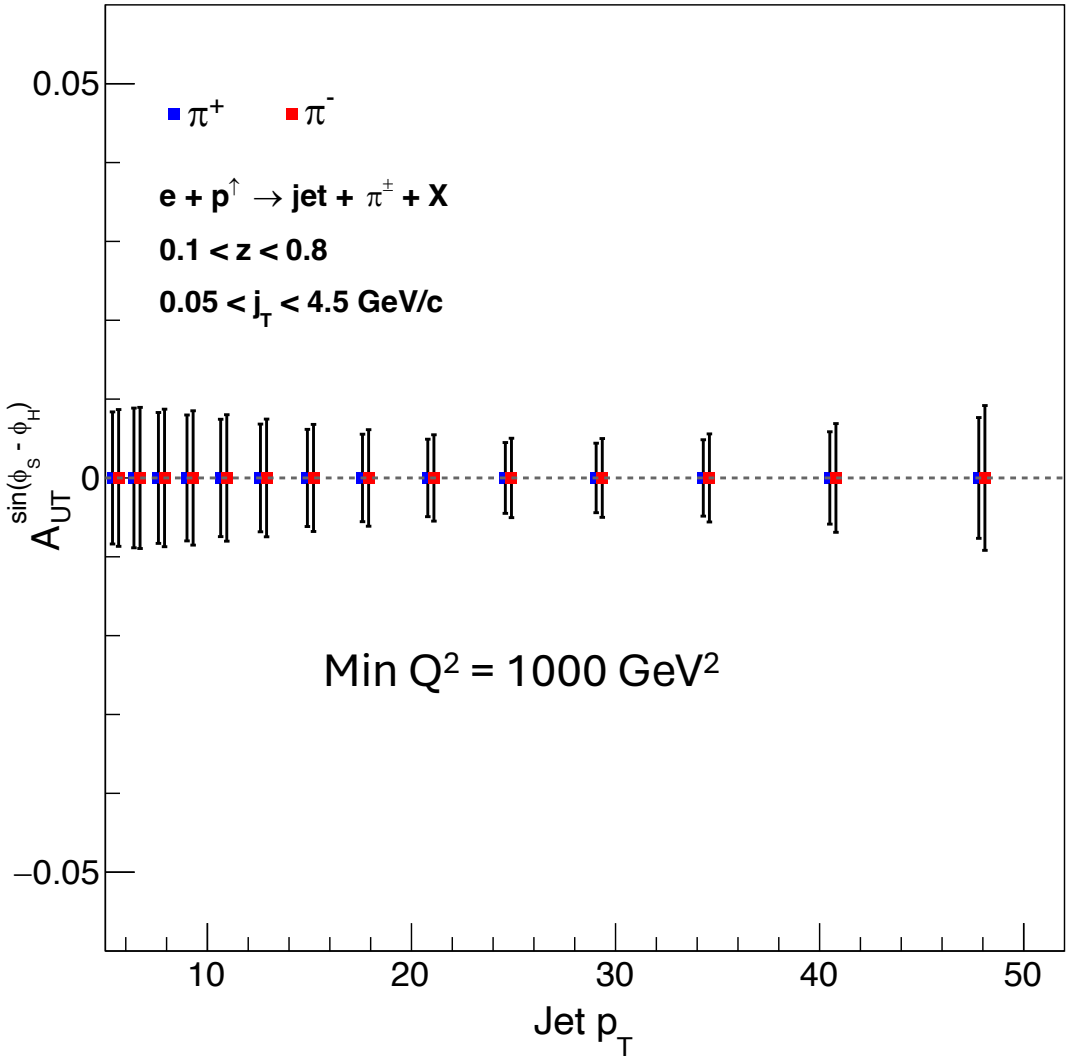
Questions

- What is the best way to run over ALL events?
- Where can I find the cross sections for each min Q^2 sample?
- What is the projected polarization?
  - Should be factored into the projected statistical error plot

Backup

Current Status (Jet p_T)





Current Status (j_T)