Evolution of jet shapes in Au+Au collisions at √s_{NN} = 200 GeV with the STAR experiment at RHIC

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Introduction

- Control path-length of jet quenching with centrality and event plane angle
- Path-length dependence of medium modifications can be studied by reconstructing jets relative to second-order harmonic event plane. Average path length OUT > average path length IN.

Jet shape function, \( \rho(\Delta r) \)

- Radial annulus size: \( \Delta r = \sqrt{(\eta - \eta_0)^2 + (\phi - \phi_0)^2} \)
- Inner and outer radius: \( r_i = r_0 - 5r_2 \) \( r_o = r_0 + 5r_2 \)
- Transverse momentum of track and jet: \( p_t \), \( \eta \)
- Normalization of trigger jets, annulus size: \( N_{\text{jet}} \), \( \delta r \)

Motivation:

- Sensitive probe: differential jet shape
- Radial momentum distribution of the constituents
- Discriminate quenching models

Event plane resolution:

- Similar procedure as [4] - Modified Reaction Plane (MRP) method
- Randomized sub-events (expected to be similar estimates of the event plane)

Background subtraction

- Uses mixed minimum bias (MB) events matched in centrality, event plane, z-vertex

Results

- The differential jet shape at low-\( p_t \) (0.1-2.0 GeV/c) is dominated by background particles
- With increased associated transverse momenta, the jet shape changes from a relatively flat distribution across \( \Delta r \) to a sharply falling distribution at high-\( p_t \)

Event plane dependent differential jet shapes

- More low-\( p_t \), associated hadrons at large \( \Delta r \) for out-of-plane jets relative to in-plane jets

Detector setup

- The Solenoidal Tracker At RHIC (STAR)
  - Time Projection Chamber (TPC): \( |z| < 1.0, 0 < \phi < 2\pi \)
  - Tracking, momentum, dE/dx
  - Barrel Electromagnetic Calorimeter (BECM):
    - |\( \eta \)| < 1.0, |\( \phi \)| < 2\( \pi \)
    - Resolution: 0.05x0.05
    - Study high \( p_t \), processes, triggering

Event plane reconstruction

- Reconstructed with charged tracks excluding \( p_t \) from 2 randomized sub-events (expected to be similar estimates of the event plane)
- Similar procedure as [4] - Modified Reaction Plane (MRP) method
  - Improvement over traditional TPC and BCB methods
  - Event plane resolution:
    - Trigger jets labeled by following conditions:
      - In-plane: \( 0 < |\phi_{jet} - \phi_{in-plane}| < \pi/6 \)
      - Mid-plane: \( \pi/6 < |\phi_{jet} - \phi_{in-plane}| < \pi/3 \)
      - Out-of-plane: \( \pi/3 < |\phi_{jet} - \phi_{in-plane}| < \pi/2 \)

References

[6]The RooUnfold package and documentation are available from:
http://hepunx.rl.ac.uk/~adye/software/unfold/RooUnfold.html

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