Investigating the ridge structure in Δη-Δφ correlations at STAR

L. Chanaka De Silva, for the STAR Collaboration (University of Houston)

Abstract

Studies of 2-dimensional (Δη, Δφ) di-hadron correlations associated with selected high p_T trigger particles in 200 GeV Au+Au collisions recorded by STAR have revealed a novel "ridge-like" structure [1]. Similar structure was also observed in inclusive di-hadron correlations of all particle pairs (no p_T cut) condition [2]. In this work we study the evolution of angular correlations with systematic increase of a lower p_T cut on charged hadrons used in the analysis. The measured correlations evolve smoothly with p_T cut toward the shape reported in the high p_T trigger measurements appearing appreciably at p_T ≥ 2.5 GeV/c. We further quantify the correlation structure evolution by fitting a 2D model function. The model function includes harmonic components \( v_n(1,2,3,4,5,6) \), some of which may relates to possible initial-state fluctuation contributions. A "remainder" assumed in that context to represent jet-related information: certain peak structure is modelled via an asymmetric 2D Gaussian. Extracted harmonic parameters are compared to model predictions [3,4], and the remainder peak is compared to p+p data at 200 GeV. This analysis describes 0-19% central Au+Au collisions at 200 GeV.

2. [2] [STAR Collaboration], STAR preliminary

Model parameter evolution - Comparison to p+p 200 GeV

- Relative evolution of resulting harmonic structure \( v_5/v_3 \) and \( v_4/v_3 \)
- Shows the asymmetric 2D Gaussian ("remainder") component p_T > 0.3 GeV/c evolution after higher harmonic subtraction

- Related data compared to the AMPT Monte Carlo
- Compare to a theory prediction by Gombeaud and Ollitrault
  
  - Harmonics ratios follow centrality trends in agreement with the AMPT Monte Carlo

Model parameter evolution - Higher order harmonic scaling

- Certain harmonic ratios follow centrality trends in agreement with the AMPT Monte Carlo

Summary and conclusions

- Near-side correlations of charged hadron pairs on Δη-Δφ show a smooth evolution as a function of p_T. The data are fitted with 2D model that represents the near-side peak structure with a combination of five Fourier harmonics and an asymmetric 2D Gaussian.
- The analysis includes higher-order harmonics which could theoretically be related to effects from initial-state density fluctuations, and the 2D Gaussian may represent a modified jet-related peak.
- The extracted harmonic amplitudes are found to reproduce scaling trends predicted by hydrodynamics both as a function of centrality and p_T.

The parameters of the 2D Gaussian are compared with p+p data at the same collision energy. Observed differences may represent medium-induced jet modification.

The STAR Collaboration: http://drupal.star.bnl.gov/STAR/presentations