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Abstract

Search for jet interactions with quark-gluon plasma

By

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A hot, dense QCD medium is created in heavy ion collisions at the Relativistic Heavy Ion Collider at Brookhaven National Laboratory. This new type of matter is opaque to energetic partons, which suffer a strong energy loss in the medium. Two particle correlations are a powerful tool to study the jet properties in the medium and provide information about the energy loss mechanism and jet-medium interactions. When triggering on high p_T particles, the away-side shape depends strongly on the p_T of the associated particles.

In this analysis, we present the inclusive photon-hadron two particle azimuthal correlations measured in Au+Au collisions at $\sqrt{s_{NN}}$=200 GeV by PHENIX experiment. In order to study jet-medium interactions, we focus on intermediate p_T, and subtract particle pairs from the underlying event. Jet-like correlations appear modified in central Au+Au compared to p+p, in both the trigger and opposing jet. The trigger jet is elongated in pseudo-rapidity (the "ridge"), while the opposing jet shows a double-peak structure ("head"' and "shoulder"). We decompose the structures in $\Delta\eta$ and $\Delta\phi$ to disentangle contributions from the medium and the punch-through and trigger jets. Upon correcting the underlying event for elliptic flow, the ridge is observed for associated particle p_T below 3 GeV/c; it is broad in rapidity and narrow in $\Delta\phi$. The away side correlated particle yield is enhanced in central collisions. The yield of particles in the shoulder grows with centrality while the away side punch-through jet is suppressed. Remarkably, the ridge closely resembles the shoulder in the centrality dependence of particle yield and spectra.

There has been great debate about the origin of the ridge and shoulder. A favored explanation is that the structure is due to features of the collective flow of particles in the underlying event, particularly the fluctuation-driven triangular flow, quantified by the third Fourier component, v_3. We measure higher order Fourier harmonics in two ways, and use the results to give the shape of particle correlations in the underlying event. We decompose the power spectrum for the medium and for jets measured in p+p collisions. The third Fourier coefficient for jets in Au+Au is then consistent with jet suppression.

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