Jet-Like Correlations in *pp* collision in the ALICE detector at the LHC*

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Introduction

Jet-like correlations can provide insights into the physics of jets. Partonic jets are calculable in pQCD; however, jet fragmentation cannot be calculated through current methods. In *pp* collisions, jet-like correlations can be used to study jet fragmentation. Jet-like correlations in *pp* collisions also provide a reference for heavy-ion collisions. In heavy-ion collisions these correlations can be used to study the modification of the jet by the medium and the modification of the medium by the jet. The ALICE experiment will study jet-like correlations at the LHC. Data from *pp* collisions at $\sqrt{s_{NN}} = 10$ TeV is expected to be available first; therefore this report will primarily discuss jet-like correlations in *pp* collisions.

Jet-Like Correlations

In jet-like correlations a trigger particle is chosen to increase the selection of jets. All intermediate and high transverse momentum, p_T, particles are used as trigger particles. The trigger particles are binned according to their transverse momentum to give different jet selections and trigger biases. The associated particles are plotted using their angle relative to the trigger particle angle. For high p_T triggers the trigger particle p_T is approximately the jet p_T and the trigger particle direction is approximately the direction of the jet-axis.

In these correlations some particles may not be jet-like correlated with the trigger. These particles must be subtracted to obtain the true jet-like correlation. This background can be constructed by taking trigger particles and associated particles from different events. The level of the background from these mixed events may not be correct for two reasons. If minimum bias are used in the event mixing there is a trigger bias to the trigged events increases the multiplicity of these events. Secondly some of the particles in the triggered events are jet-like correlated so the background level should be lower then the average of the triggered events. An assumption must be made about the level of the background since the true level is unknown. A zero yield at minimum (ZYAM) assumption is used. Figure 1 shows the raw correlation in azimuth in circles. The mixed event distribution is shown in diamonds and the distribution normalized to ZYAM in is shown in squares. The final correlation is obtain by subtracting the normalized background distribution from the raw correlation. Alternatively Gaussian fits can be used in *pp* collisions; however in heavy-ion collisions this is not as helpful due to the complexity of the correlation function. The analysis code is written in ALIROOT and running on the GSI computer farm in the analysis train.

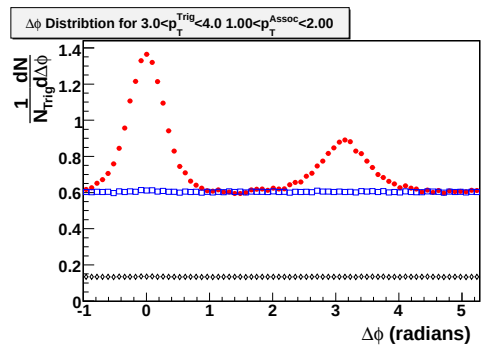

Figure 1: Two-particle jet-like correlation in azimuth for $3 < p_T^{Trigger} < 4$ GeV/c and $1 < p_T^{Associated} < 2$ GeV/c. Circles: Raw correlation. Diamonds: Background from mixed events. Squares: Normalized background. Reconstructed events in a simulation of the ALICE detector from the PYTHIA event generator of *pp* collisions at $\sqrt{s_{NN}} = 10$ TeV.

Results and Conclusions

The background subtracted correlation function can be obtained from Fig. 1 by subtracting the normalized mixed events from the raw distribution. Particles near $\Delta\phi = 0$ radians are from the same jet as the trigger particles, near-side peak. Particles around $\Delta\phi = \pi$ are from the other jet since the events are predominately di-jet events, away-side peak. There must be at least 2 jets due to momentum conservation. The difference in width of the near-side and away-side peaks is due to the initial transverse momentum of the partons within the colliding hadrons. This gives a broadening to the correlation as it is the average of many events where the center of the away-side peak can be shifted from π radians.

By changing the trigger and associated p_T ranges one can study the fragmentation by studying both the spectra, yields, and widths of these peaks. One should be able to perform this analysis using particles detected in the ALICE TPC. With only a few days of data taking this can be done to a moderately high trigger p_T of about 10 GeV/c. With additional statistics the p_T reach is increased. In heavy-ion collisions additional care must be taken on the background subtraction, but this method can be used to study the created medium though the modification of the jet-like correlations.

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