Abstract

Measurement of the centrality dependence of jet production in 200 GeV copper-gold (Cu+Au) collisions are presented. Jets are reconstructed as function of centrality for spectra measured over the kinematic range of jet transverse momentum $12 < p_T < 42$ GeV/c and within a pseudorapidity acceptance of $|\eta| < 0.3$. The nuclear modification factor, $R_{AA}$, is evaluated and jets are found to be suppressed by approximately a factor of two in central collisions compared to p+p collisions. The $R_{AA}$ shows no significant dependence in $p_T$.

PHENIX detector

- Charged particle tracks are reconstructed using the Drift Chamber (DC), the Pad Chamber (PC) and the collision point.
- Neutral clusters are measured in the Electromagnetic Calorimeter (EMCal). EMCal measures $m_T$, $\gamma$, and some hadrons (with lower efficiency).
- The Beam Beam Counters (BBCs) are used as the minimum bias (MB) trigger and for determining the collision vertex (2) position.

Jet reconstruction

- Track selection criteria: $p_T > 500$ MeV + various cuts optimized to reject high $p_T$ background
- Cluster selection criteria: Energy $> 500$ MeV + various cuts optimized to reject high $p_T$
- Cluster/cluster association cut: Discard any cluster which is associated with a track
- The resulting yield is "fake" jets.

Fake jet subtraction

Data driven method of statistically subtracting fake jet contribution is implemented as:
- For events in which jet is not reconstructed, the position ($t_1$, $\phi$) of tracks and the position ($t_1$, $\phi$) of clusters are randomly swapped. Positions of clusters are swapped independently to insure that tracks/clusters don't fall in the dead/inefficient areas during the swapping process. Also, the random swapping is performed for east and west arm separately.
- Jet reconstruction is performed in these swapped tracks and clusters and then all the jet-level cuts are applied to the reconstructed jets.
- The resulting yield is "fake" jets.

Results

Expected jet production in p+p and Cu+Au collisions is shown in Figure 2. Figure 3 shows the jet purity for different centralities of Cu+Au collisions. As expected, fake jet contribution is both $p_T$ and centrality dependent; the contribution being largest for central collisions and at low $p_T$.

Figure 4 shows the measured per-event yield in p+p different centralities of Cu+Au collisions. The yields are arbitrarily normalized. The vertical bars indicate the statistical uncertainties and the shaded bands indicate the systematic uncertainties. The data of Figure 5 and 6 show the measured jet $R_{AA}$ and $R_{CP}$ for different centrality classes, respectively. The vertical bars indicate the statistical uncertainties and the shaded bands indicate the systematic uncertainties. The overall normalization uncertainties are shown as vertical band on the left side at $y = 1$ mark.

Conclusion

The ratios of jet spectra from different centrality selections of Cu+Au collisions show a strong modification of jet production at all $p_T$, as a result, jets are found to be suppressed by approximately a factor of two in Cu+Au collisions as compared to p+p collisions. The dependence of Cu+Au jet $R_{AA}$ on $N_{part}$ is higher than $R_{ind}$ for both Cu+Cu and Au+Au collisions at the same collision energy.

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