Study of $C_2(\Delta\phi)$ azimuthal correlation in central Au+Au collisions at CBM

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One of the signatures of a hot dense medium is the modification of properties of jets originating from hard scattering of partons. The study of two-particle azimuthal correlations allows to extract the jet signal from the soft background because the jet particles are strongly correlated in azimuth. Recent RHIC results [1, 2] on high p_T di-hadron correlations confirmed that this approach can be used to study the properties of the nuclear medium. At CERN SPS energies the so called hole-jet transition in di-hadron correlations has been observed [3]. Such investigations can be performed at CBM at SIS-100 energies.

The simulation were performed for 10000 central Au + Au UrQMD 2.3 events at 10 A·GeV. The standard STS geometry and the magnetic field map for an electron version of CBM as well as the Kalman filter procedure for momentum reconstruction in the STS were used (release JUN10). Particle identification was done using time-of-flight information from the RPCs.

Pions were selected using the $m^2 - p$ correlation with a symmetrical graphical cut [4]. The pion with the highest transverse momentum p_T (larger 1.5 GeV/c) in the event is considered as a "trigger" particle. Its direction in the transverse momentum plane is defined as ϕ_0. All other pions in the event are considered as the "associated" particles. $\Delta\phi$ is the difference between the angle of the "associated" pion ϕ_{ass} and the angle of the "trigger" pion ϕ_0: $\Delta\phi = \phi_{ass} - \phi_0$. The distribution on the angle difference

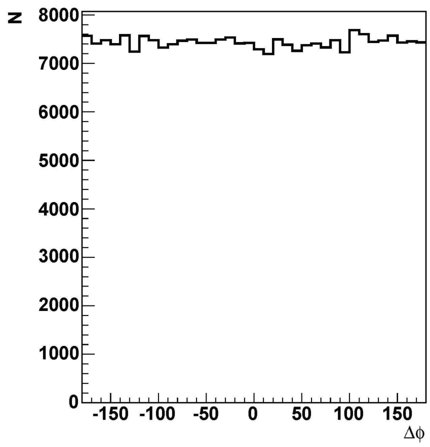

Figure 1: Number of "associated" particles (pions) as a function of $\Delta\phi$

$\Delta\phi$ for the selected pions is shown in Fig. 1. The shape of the distribution is flat as expected from UrQMD 2.3.

The azimuthal correlation $C_2(\Delta\phi)$ is defined a ratio of the normalized $\Delta\phi$ distributions of the "associated" particles in the events with the "trigger" pion, $N_{corr}(\Delta\phi)/\int N_{corr}(\Delta\phi')d(\Delta\phi')$, and obtained from the mixing procedure, $N_{mix}(\Delta\phi)/\int N_{mix}(\Delta\phi')d(\Delta\phi')$:

$$C_2(\Delta\phi) = \frac{N_{corr}(\Delta\phi) \cdot \int N_{mix}(\Delta\phi')d(\Delta\phi')}{N_{mix}(\Delta\phi) \cdot \int N_{corr}(\Delta\phi')d(\Delta\phi')}. \quad (1)$$

For the mixing procedure the ϕ_0 is defined from the event with the "trigger" pion, while the "associated" particles are taken from the next event.

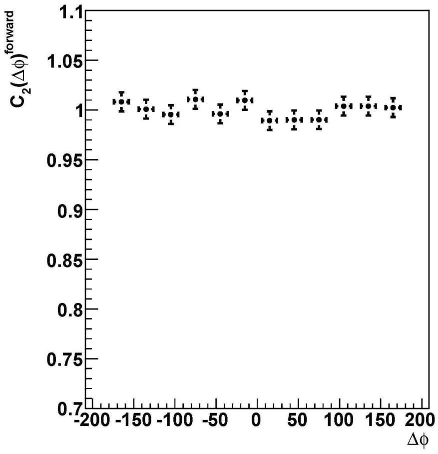

Figure 2: Azimuthal correlation C_2 for pions for $Au + Au$ UrQMD 2.3 central events at 10 A·GeV as a function of $\Delta\phi$

The azimuthal correlation $C_2(\Delta\phi)$ for the selected pions obtained for 10k central Au + Au UrQMD 2.3 events at 10 A·GeV is presented in Fig. 2. The $C_2(\Delta\phi)$ distribution is close to the unity. One can expect the away-side enhancement for systems with smaller size (for instance, Si + Si [3]). The feasibility studies for the energy dependence of $C_2(\Delta\phi)$ (hole-jet transition) at CBM require the improvement of the π^+ identification at high momenta.

References

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