Long-range correlation of V^0 particles in p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV with the ALICE detector

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Measuring correlations in particle production as a function of the azimuthal angular space and rapidity space is very useful for investigating particle production in high-energy nucleus-nucleus collisions. The long-range correlations in the rapidity space in near-side angular pairs of dihadron correlations were first observed in Au-Au collisions at $\sqrt{s_{NN}}$= 200 GeV at RHIC[1,2]. This long-range correlations are derived from the collective expansion of the initial geometry fluctuations. Unexpectedly, a similar structure has also been observed in high-multiplicity pp collisions at $\sqrt{s_{NN}}$ = 7 TeV by the CMS experiment[3]. It is very interesting to study the correlation in p-Pb collisions because the initial gluon density and magnitude of the collective expansion are very different from those in other collision systems. The azimuthal anisotropy parameter v_2 of K, π, and p shows mass ordering at low transverse momentum (p_{T}) and the trend is similar to Pb-Pb collisions[4]. The mass ordering is a characteristic feature of collective expansion. This analysis aims to further explore the partonic collectivity by extracting v_2 of K^0_s and Λ in p-Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV with the ALICE detector. The correlations between the unidentified charged hadrons as trigger particle and K^0_s and $\Lambda(\bar{\Lambda})$ as associated particles at $|\eta|$ <0.8 are measured as a function of the azimuthal angle difference $\Delta\phi$ and pseudo-rapidity difference $\Delta\eta$. K^0_s and Λ decay into $\pi^+ + \pi^-$ and $p^+ + \pi^-$ with a characteristic decay pattern, called V^0. Topological cuts are required to reduce the combinatorial background. The correlation function as a function of $\Delta\eta$ and $\Delta\phi$ between two charged particles is defined as $\frac{1}{N_{\mathrm{trig}}}\frac{\mathrm{d}^2N_{\mathrm{asso}}}{\mathrm{d}\Delta\eta\mathrm{d}\Delta\phi} = \frac{S(\Delta\eta,\Delta\phi)}{B(\Delta\eta,\Delta\phi)}$, where N_{trig} is the total number of triggered particles in the event class and p_{T} interval, the signal distribution $S(\Delta\eta,\Delta\phi) = \frac{1}{N_{\mathrm{trig}}}\frac{\mathrm{d}^2N_{\mathrm{same}}}{\mathrm{d}\Delta\eta\mathrm{d}\Delta\phi}$ is the associated yield per trigger particle from the same event, and the background distribution $B(\Delta\eta,\Delta\phi) = \alpha\frac{\mathrm{d}^2\mathrm{N}_{\mathrm{mixed}}}{\mathrm{d}\Delta\eta\mathrm{d}\Delta\phi}$ accounts for pair acceptance and pair efficiency. B is constructed by taking the correlations between the trigger particles in one event and the associated particles in other events in the same event class. The α factor is chosen so that it is unity at $\Delta\eta \sim 0$ because the acceptance is flat along $\Delta\phi$. This correlation function is studied for different p_{T} intervals and different event classes. The correlation function in peripheral collisions is subtracted from that in central collisions to remove the auto-correlations from jets. Figure 1 shows the projection of the subtracted correlation functions onto $\Delta\phi$. To quantify azimuthal anisotropy (v_2), the Fourier coefficients are extracted by fitting with the function $a_0 + 2a_1\cos(\Delta\phi) + 2a_2\cos(2\Delta\phi)$. The v_{n} coefficient can be obtained as $v_{\mathrm{n}}^{\mathrm{K}^0_{\mathrm{s}},\Lambda} = V_{\mathrm{n}}^{\mathrm{K}^0_{\mathrm{s}},\Lambda}/\sqrt{V_{\mathrm{n}}^{\mathrm{h-h}}}$, where $V_n^i = a_{\mathrm{n}}^{\mathrm{i}}/(a_0^{\mathrm{i}} + \mathrm{b}^{\mathrm{i}})$, in which i is the index of h-h or h-V0 pairs (h denotes undefined hadrons) and b is the baseline determined by averaging over 1.2< $|\Delta\eta|$ <1.6 on the near side of the 60-100% event class. Figure 2 shows the extracted v_2 coefficient for K^0_s and $\Lambda(\bar{\Lambda})$ compared to p and K as a function of p_{T}. Mass ordering between the v_2 of K^0_s and $\Lambda(\bar{\Lambda})$ as well as the kaon and proton is observed.

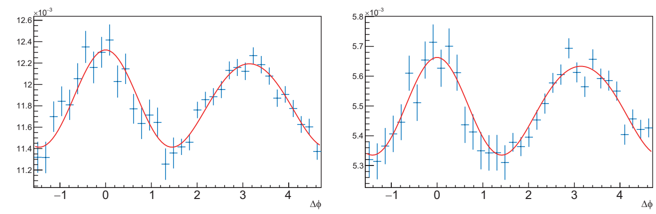

Fig. 1. Projection of the subtracted correlation functions of the associated K^0_s (top) and Λ (bottom) yield per trigger particle with 1.5<$p_{\mathrm{T,trig}}$, $p_{\mathrm{T,asso}}$ <2.5 GeV.

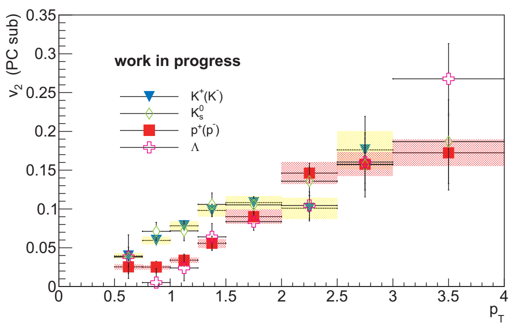

Fig. 2. v_2 of K^0_s, $\Lambda(\bar{\Lambda})$ compared with one of kaon and proton. Error bars and shaded bands show statistical uncertainties and systematic, respectively.

References

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