Azimuthal anisotropy measurements of strange and multi-strange hadrons in U+U collisions at $\sqrt{s_{NN}} = 193$ GeV at RHIC

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Abstract

Quantum Chromodynamics (QCD) predicts that at sufficiently high-temperature (T) and/or baryon chemical potential (μ_B), normal nuclear matter converts into a de-confined state of quarks and gluons, known as Quark-Gluon Plasma (QGP). A hot and dense medium of quarks and gluons is created in relativistic heavy-ion collisions. The dynamics and collective behavior of such strongly interacting medium have been extensively studied at RHIC by measuring azimuthal anisotropy of the produced particles defined by the Fourier coefficients relative to the reaction plane. The mass ordering of elliptic flow (2nd-order flow harmonics) in the low p_T region (≤ 1.5 GeV/c) among various hadron species has been observed, which reflects the hydrodynamic evolution of the medium. Number-of-constituent-quark (NCQ) scaling at intermediate p_T suggests the collective motion of quarks before hadronization. The higher-order flow harmonics reveal that the event-by-event fluctuation of the created QGP fireball transforms into final-state correlations of the produced hadrons. These higher-order flow harmonics provide information on the initial state fluctuations to constrain the initial conditions and precisely extract transport properties of the medium. Strange hadrons, especially multi-strange hadrons would be less affected by hadronic re-scattering in later stage of collisions, due to less hadronic interaction cross-section, and therefore be cleaner probe to study the collective motion in the partonic phase of the medium.

In this work, we report systematic measurements of azimuthal anisotropy for strange and multi-strange hadrons ($K_s^0, \phi, \Lambda, \Xi$ and Ω) at mid-rapidity ($|y| < 1.0$) in collisions of deformed shape U+U nuclei at $\sqrt{s_{NN}} = 193$ GeV. These measurements are compared with the published results from Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV. We will present the centrality and p_T dependence of the flow coefficients (v_2, v_3 and v_4). The NCQ scaling of the flow coefficients in U+U collisions will be discussed. We will also discuss the ratio of v_n scaled by the participant eccentricity ($\varepsilon_n\{2\}$) to explore system size dependence and collectivity in U+U collisions. The results will be compared to hydrodynamics and transport model calculations.