Study of first-order event plane correlated directed and triangular flow in heavy-ion collisions at high baryon density region

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Anisotropic flow parameters (v_n) are important observables as they provide insight into the collective expansion and transport properties of the medium produced in relativistic heavy-ion collisions. Among these parameters, directed flow (v_1) describes the collective sideward motion of produced particles in heavy-ion collisions. It is an important probe to study the in-medium dynamics as it is predicted to be sensitive to the equation of state (EoS) of the produced medium. Minimum in the slope of directed flow (dv_1/dy) as a function of collision energy has been proposed as a signature of the first-order phase transition between hadronic matter and Quark-Gluon Plasma (QGP). Triangular flow (v_3) typically arises from the initial state fluctuations and is expected to be uncorrelated with the reaction plane. However, recent measurements at lower collision energies (higher μ_B) such as $\sqrt{s_{NN}}$ = 2.4 (HADES) and 3 GeV (STAR), show a correlation between v_3 and the first-order event plane angle (Ψ_1).
In this presentation, we will report the measurements of Ψ_1 correlated v_1 and v_3 for π, K, p, net-kaon, net-proton, d, t, and ^3He in Au+Au collisions at $\sqrt{s_{NN}}$ = 3.2, 3.5, 3.9, and 4.5 GeV taken in fixed-target mode from the second phase of the beam energy scan (BES-II) program at RHIC-STAR. We will show the dependencies of v_1 and v_3 on rapidity, centrality, and collision energy, and subsequently, discuss their physics implications. The experimental measurements will be compared with the results from the JAM transport model to understand the underlying physics mechanisms at low collision energies.