Contribution ID: **110** Contribution code: **POS-BLK-09** Type: **Poster**

Directed flow of identified particles in Au+Au collisions at $\sqrt{s_{\rm NN}}$ = 14.6 and 19.6 GeV

Tuesday 14 June 2022 17:27 (1 minute)

Determination of equation of state for the nuclear matter at high baryon density region is one of the most important motivations for RHIC Beam Energy Scan program. Directed flow (v_1), which is the first harmonic coefficient in the Fourier expansion of the final state azimuthal distribution of produced particles relative to the collision reaction plane, is one of the sensitive probes for the early stages of collision dynamics.

The first phase of RHIC Beam Energy Scan (BES-I) program covers collision energies from $\sqrt{s_{\rm NN}}$ = 7.7 GeV to 200 GeV. We observed that v_1 slopes ($dv_1/dy|_{y=0}$) at mid-rapidity region for net-proton and net-Λ show a minimum when collision energy is around $\sqrt{s_{\rm NN}}$ = 10-20 GeV [1]. The slope of ϕ-meson v_1 has a hint of sign change between 11.5 and 14.5 GeV [2]. In this talk, we will present precision measurements of v_1 for pions, kaons, protons, and ϕ-mesons using high statistics RHIC BES-II data for Au+Au collisions at 14.6 and 19.6 GeV. The corresponding v_1 slopes will be studied as a function of transverse momentum, rapidity, and collision centrality. The data will constrain the model calculations and provide important insights on the possible first order QCD phase transition.

[1] L. Adamczyk et al.(STAR Collaboration), Phys. Rev. Lett. 112, 162301 (2014).
[2] L. Adamczyk et al.(STAR Collaboration), Phys. Rev. Lett. 120, 062301 (2018).

Present via

Online

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Session Classification: Poster

Track Classification: Bulk matter phenomena, QCD phase diagram, and Critical point