

Beam energy dependence of the event-plane angular correlations as probes for initial state of heavy-ion collisions

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Abstract

Recent studies of event-plane angular correlations with the $\langle \cos(a_1 n_1 \Psi_{n_1} + \dots + a_k n_k \Psi_{n_k}) \rangle$ correlators [1] have indicated its weak sensitivity to final state effects in heavy-ion collisions, suggesting that the correlator is a sensitive probe for the initial state of heavy-ion collisions [2]. These investigations suggest that conducting detailed measurements over a broad range of beam energies can provide additional constraints on the initial conditions and medium properties of the theoretical calculations. In this work, we used the two- through six-particle correlations to extract the beam energy dependence of the higher-order event-plane angular correlations. Our new results will be presented and discussed for several transverse momentum selections and centrality intervals for Au+Au collisions at top RHIC energies. The results will be compared with similar studies performed at the LHC [3]. The measurements will also be compared to several viscous hydrodynamic calculations to understand the initial and final state effects.

$$[1] \langle \cos(a_1 n_1 \Psi_{n_1} + \dots + a_k n_k \Psi_{n_k}) \rangle = \frac{\langle v_{n_1}^{a_1} \dots v_{n_k}^{a_k} \cos(a_1 n_1 \Psi_{n_1} + \dots + a_k n_k \Psi_{n_k}) \rangle}{\sqrt{\langle v_{n_1}^{2a_1} \rangle \dots \langle v_{n_k}^{2a_k} \rangle}},$$

[2] Niseem Magdy "Characterizing initial- and final-state effects of relativistic nuclear collisions", Phys.Rev.C 107, 024905 (2023), arXiv:2210.14091

[3] ALICE Collaboration "Symmetry plane correlations in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV", arXiv:2302.01234