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Event-by-event comparison of initial state models with momentum space information in a hybrid approach

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The initial state of heavy-ion collisions has a short lifetime and cannot be directly measured. As a result, various initial condition models exist. Although averaged event observables with different initial condition models give comparable results, event by event analysis can help to identify systematic differences. To determine the initial conditions is crucial to assess systematic uncertainties of Bayesian analysis, that aim at the extraction of transport coefficients from experimental data. The qualitative impact of the choice of initial conditions in hydrodynamical simulations is studied on an event-by-event basis in the hybrid approach SMASH-vHLLE-Hybrid^{1}, composed of the hadronic transport approach SMASH^{2} and the (3+1)d viscous hydrodynamic code vHLLE^{3,4}. Event-by-event correlations are studied for SMASH IC as well as for IP-Glasma and TRENTO, with and without early time out-of-equilibrium dynamics, for Au-Au collisions at $\sqrt{s_{NN}} = 200$ GeV in different centrality classes.
We observe that the initial state eccentricities ϵ_2 and ϵ_3 are, depending on the setup and the model, not independent and show correlations which also result due to the assumed linear response of flow to eccentricity^{5} in correlations between the elliptic and triangular flow. Additionally, we also study initial momentum space information present in the SMASH and IP-Glasma initial condition models. We find that for very spherical events, the initial state momentum anisotropy significantly contributes to the final state momentum anisotropy, which means that the description of such events is especially sensitive to the choice of the initial state model.

References:
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Category

Theory

Collaboration (if applicable)

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