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Effects of soft/hard correlation and initial state geometry on heavy quark observables

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Heavy quarks observables, such as the nuclear modification factor R_{AA} and the elliptic flow coefficient v_2, are sensitive to the transport properties and space-time evolution of the quark-gluon-plasma. Generally this connection is made via transport calculations of the time-evolution of the collision. However, how the choice of the initial condition model for the QGP medium as well as spatial correlations between the medium and the initial production vertices of the heavy quarks affect these observable is still unclear. Of particular interest is the effect of initial correlation between heavy quark production vertices with the underlying event (referred as soft-hard correlation). Experimentally, open charm production in pp collisions is found to increases with charged particle multiplicity, indicating a strong correlation between the heavy quark production with sub-nucleonic fluctuation of soft matter density, which is often overlooked in existing initial conditions.

In this work, we focus on the response of heavy quark observables to various initial condition models with different hard-soft correlation behavior and soft matter geometry. We study D meson R_{AA} and v_2 in AA collision with TRENTo, a recently developed effective model for initial entropy deposition, and a Langevin transport model. Comparing calculations with and without initial sub-nucleonic hard-soft correlations, and for different modes of entropy deposition, we assess the sensitivity of heavy quark observables to these correlations. Results will be presented for Pb+Pb collisions at LHC energies.

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