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Dynamical freeze-out criterion in event-by-event hydrodynamics

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In hydrodynamical modeling of the ultrarelativistic heavy-ion collisions the freeze-out is typically performed at a constant temperature. In this work we introduce a dynamical freeze-out criterion, which compares the hydrodynamical expansion rate with the pion scattering rate [1]. Previous studies [2] have shown that differences between constant temperature and dynamical freeze-out criteria are small in the transverse momentum spectra, but the effect on flow anisotropies has not yet been studied. Recently many calculations have been done using event-by-event hydrodynamics, in which case the expansion rate does not necessarily behave as nicely as in the case of smooth initial conditions. Thus it is interesting to check how the dynamical freeze-out changes hadron distributions with respect to the constant temperature freeze-out.

In this contribution we present hadron spectra and elliptic and triangular flow calculated using (2+1)-dimensional ideal hydrodynamics, and show the differences between constant temperature and dynamical freeze-out criteria. First we discuss the systematics of the dynamical freeze-out, and for simplicity these calculations have been performed using smooth initial states. Finally dynamical freeze-out condition is applied to event-by-event calculations to evaluate v_2 and v_3. We find that in event-by-event calculations, pion v_2 is sensitive to the freeze-out criterion.

[1] C. M. Hung and E. V. Shuryak, Phys. Rev. C 57, 1891 (1998).
[2] K. J. Eskola, H. Niemi and P. V. Ruuskanen, Phys. Rev. C 77, 044907 (2008).

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