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A fast method to compute conserved charge cumulants in hydrodynamic simulations

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We propose and test a fast method to compute cumulants in hydrodynamic simulations of heavy-ion collisions. They comprise one of the promising tools to investigate the existence and location of the QCD critical point, as fluctuations should diverge near it. However, evaluating these from event-by-event hydrodynamic simulations is a time-consuming task, since it requires very large statistics. As a consequence, systematic analyses of the behavior of cumulants as a function of beam energy, parametrizations of bulk and shear viscosities, values of the baryon diffusion coefficient, become prohibitive. Our method is based on separating the contributions to the final fluctuations into before and after the hydrodynamical evolution, and determining the latter analytically, which reduces the number of full hydro runs required –along with the total runtime. The method is tested in the NeXSPHeRIO code and leads to reasonable results for the proton, anti-proton and net-proton cumulants of Au+Au collisions at $\sqrt{s_{NN}} = 200$ AGeV.

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