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The effect of baryon conservation and nucleon-nucleon correlation on the light nuclei production at $\sqrt{s_{NN}} = 3\ GeV$

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The yield ratio of light nuclei produced in heavy-ion collisions, defined as $N_t \times N_p / N_d^2$, is a promising probe for the critical endpoint in the QCD phase diagram. In the coalescence model of light nucleus production, the triton yield N_t and deuteron yield N_d are sensitive to the relative distance Δr between each pair of nucleons in the Wigner function. However, the effect of the two-nucleon distribution $\rho(\Delta r)$ in the colliding nucleus on the yield ratio has not been extensively investigated. In this work, we developed a method to sample nucleons in the ^{197}Au nucleus satisfying both the single-particle distribution $f(r)$ and the two-nucleon distribution function $\rho(\Delta r)$. Using these sampled ^{197}Au nucleus, we calculated the proton, deuteron and triton yields in Au+Au collisions at $\sqrt{s_{NN}} = 3 GeV$ using the SMASH transport model simulations. The calculated yield ratios, differential p_T distributions and mean transverse momentum $\langle p_T \rangle$ different centrality regions and rapidity windows agree well with experimental measurements from the STAR experiment. Our results suggest that initial nucleon-nucleon correlations have a visible effect on light particle production, indicating that the yield ratio of light nuclei in heavy ion collisions might provide a good probe for nucleon-nucleon correlation in the nuclear structure.

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