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Coalescence parameter study and source characterization in the production of (anti)nuclei in high energy collisions

In this work, I investigated in depth the coalescence model, which is widely used in the literature to describe the formation of both light (anti)nuclei in high-energy collisions in accelerators and cosmic antinuclei, with applications to indirect searches for dark matter in the Universe.
Specifically, I studied the coalescence parameter of (anti)nuclei with mass number A<=4; using a fit to the data on the size of the proton source in pp collisions at $\sqrt{s} = 13$ TeV from the ALICE experiment, I attempted to explicate the dependence of the coalescence parameter on the transverse momentum.
Comparing the predictions of the model obtained this way with the coalescence parameter measurements collected by ALICE, it can be observed that the coalescence parameter of d and 3He does not follow the expected trend. This result therefore highlights the need to revise the adopted source model or its application limits to different collision systems.
In view of a possible implementation of the coalescence mechanism in Monte Carlo generators for the simulation of antinuclei formation, I tried to characterise the proton source using 10^5 pp collisions in the PYTHIA 8.3 generator.
The distributions obtained show that the source is essentially isotropic.

Title

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