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Hypernuclei studies in heavy-ion collisions with the CBM experiment at FAIR

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Under the extreme conditions of relativistic heavy-ion-collisions hypernuclei are created with large abundancies. Hypernuclei measurements provide insights into the equation-of-state of hadronic matter at high net-baryon densities, as well as into hyperon-nucleon and hyperon-hyperon-interactions. The Compressed Baryonic Matter (CBM) experiment at the future Facility for Anti-Proton and Ion Research (FAIR) in Darmstadt offers the perfect conditions to explore the production of hypernuclei. The excitation function of hypernucleus production exhibits its maximum in the FAIR energy range. In combination with the foreseen high interaction rates of up to 10 MHz, an exceptionally high amount of hypernuclei such as e.g. ${}^{4}_{\Lambda}\mathrm{H}$ and ${}^{5}_{\Lambda}\mathrm{He}$ will be created, and even very rare double hypernuclei like ${}^{6}_{\Lambda\Lambda}\mathrm{He}$ are expected with sizeable statistics.
The reconstruction of the hypernuclei-3-body-decay was implemented into the CBM reconstruction software and optimized with respect to important performance indicators. In addition, the reconstruction was performed with a neural network. Expected efficiencies and signal-to-background-ratios were calculated with both approaches for a reliable estimation of the number of reconstructable hypernuclei. Systematical uncertainties were estimated based on simulations with different transport models (e.g. PHQMD), taking into account the signal extrapolation to the full rapidity and transverse momentum range. The experimental sensitivity to properties of hypernuclei, such as their lifetime, was evaluated. Results for ${}^{3}_{\Lambda}\mathrm{H}$ will be discussed in detail. Reconstructed mass spectra for ${}^{4}_{\Lambda}\mathrm{H}$, ${}^{4}_{\Lambda}\mathrm{He}$ and ${}^{5}_{\Lambda}\mathrm{He}$ will be shown in addition. (Work supported by DFG-grant BL 982/3-1)

Category

Experiment

Collaboration (if applicable)

CBM

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