Coupling of UrQMD 3.4 and SMM Models for Simulation of Neutron and Nuclear Fragment Productions in Nucleus-Nucleus Interactions

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The UrQMD model is widely applied for simulation of nucleus-nucleus interactions at high energies. It allows one to generate multi-particle production in the interactions in the so-called "cascade" mode. We check that the model reproduces experimental data by the NA61/SHINE collaboration on $\pi^{\pm}$-meson, K-meson, proton and anti-proton production in $^{40}Ar + {}^{45}Sc$ interactions at P_{lab} = 13, 19, 30, 40, 75, and 150 GeV/c/nucleon. The model results for K^+-mesons are below experimental data. A coupling of the model with the Statistical Multi-fragmentation Model (SMM) allows one to simulate neutron and nuclear fragment productions using the EoS mode. In the mode, molecular type propagation of nucleons is used accounting potential interactions, stochastic scatterings and multi-particle productions. We choose evolution time 100 fm/c. At the end of the evolution, the well-known clustering algorithm is applied for creation of nuclear pre-fragments in the equal velocity reference frame. An excitation energy of a pre-fragment is calculated as a difference between sums of kinetic and potential energies of nucleons, and a ground state mass of the pre-fragment. Then, SMM is starting to work. We check that the combination of UrQMD and SMM allows to describe neutron spectra in the reactions – p+C, Al Fe, In, and Pb [1], [2]. Fragment mass distributions in nucleus-nucleus interactions are also analyzed. The UrQMD model enlarged by SMM can be applied at FAIR and NICA experiments.

References

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