Perspectives of strangeness study at NICA/MPD from realistic Monte Carlo simulation

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Relativistic heavy-ion collisions provide a unique opportunity to study nuclear matter under extreme density and temperature. The study of the strangeness production is of particular interest. Since strange hadrons are initially not present but created during the heavy-ion collision, the strangeness is one among the most sensitive probes for the deconfinement phase transition as well as for the in-medium effects in dense nuclear matter.

The Nuclotron-based Ion Collider fAcility (NICA) is a new flagship project aimed in the construction at JINR (Dubna) a modern machine providing beams of heavy ions with the highest intensity ever achieved in the energy range from 4 to 11 GeV per nucleon [1]. The main scientific goal of the NICA project is the experimental exploration of a yet poorly known region of the QCD phase diagram of the highest net-baryon density with an emphasis on the nature of the deconfinement phase transition, study of hadron properties in dense baryon matter, and search for the critical end point (CEP).

Hyperon identification and reconstruction should be one of the most important tasks of experiments at NICA. The MPD/NICA start version's characteristics for measuring hyperons (Λ, $\bar{\Lambda}$, $\Xi^{\mp}$, $\Omega^{\mp}$,) obtained on Monte Carlo simulated event samples of gold-gold collisions at NICA energies will be presented.

For the present study the Parton-Hadron-String Dynamics (PHSD) model was used, based on a microscopic off-shell dynamical transport approach incorporating the partonic degrees-of-freedom in terms of strongly interacting quasi-particles, their hadronization and further of-shell dynamics for the hadronic stage [2]. The deconfinement phase is realized to reproduce the lattice QCD Equation-of-State with a crossover phase transition at high temperature and small chemical potential. The PHSD has been successfully applied to describe many observables measured from low to very high energies [3].

Particles produced by the event generators were transported through the detector using the GEANT3 transport package. Track and vertex reconstruction methods [4] were based on the Kalman filtering technique. (Multi)strange hyperons were reconstructed by combining charged tracks found in the TPC, first to select a V0-candidate (a characteristic topology of two oppositely charged daughter tracks) and then to match it with one of the secondary pion candidate.

It will be shown that the MPD start version will provide a good opportunity to perform such measurements and the current status of the event reconstruction algorithms and software is adequate for a study of the strangeness production at NICA (achieved mass resolution 2-3 MeV/c2 with high enough yields). The reliability of the conclusions is assured by the realistic simulation of the detector response as will be described for the MPD TPC (Time Projection Chamber).

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