The global hyperon polarization and the forward-backwards flow in Bi+Bi collisions at the NICA complex energies

N. Tsegelnik [a,*], E. Kolomeitsev [a,b], V. Voronyuk [c]

[a,*]Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, RU-141980 Dubna, Russia
tsegelnik@jinr.ru
[b]Matej Bel University, SK-97401 Banska Bystrica, Slovakia
evgeni.kolomeitsev@umb.sk
[c]Laboratory of High Energy Physics, Joint Institute for Nuclear Research, RU-141980 Dubna, Russia
Vadim.Voronyuk@jinr.ru

Abstract

The Bi-Bi collisions at $\sqrt{s_{NN}} = 9.0$GeV are simulated within the PHSD transport model. The multiplicities, transverse momentum and rapidity spectra are calculated for different centrality classes and various types of hyperons with and without detector acceptance ($|y| < 1$ and $0.2 < p_T < 1.5\ GeV/c$). The spectra agree well with the data from other experiments. The multiplicity with account of the detector acceptance is approximately twice smaller than without it. At each time step, the spectators are separated and the fluidization procedure is performed. Then, the global polarization for different hyperon species is evaluated and its dependence on the momentum, rapidity, and centrality is analyzed with/without acceptance. Particles are more sensitive to the detector effects than antiparticles due to broad rapidity distributions. To increase the polarization signal for the hyperons we propose to use a smaller rapidity window. There is no dependence of the global polarization on the transverse momentum. The feed-down contribution for the Λ hyperons is also taken into account. The polarization dependence on the different centrality binning is analyzed and the optimal one is proposed.

Finally, the correlations of the polarization and forward-backward flow are shown and possibilities for increasing the polarization signal are discussed.

Keywords: heavy-ion collisions, hydrodynamics, vorticity, hyperon polarization, vortex rings, dynamical freeze-out, NICA, PHSD, MPD