Strangeness enhancement in Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV and Pb+Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV using HYDJET++

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Introduction

Relativistic heavy-ion collisions provide a unique way to investigate the behaviour of QGP matter formed under extreme conditions of temperature, pressure and energy density. Over the last three decades, many different signatures have been proposed for the possible observation of the QGP matter. Strangeness enhancement was among the first signatures proposed for the possible observation of QGP medium. Recent results from ALICE collaboration show a steady increase in strange hadron production with increasing system size (N_{part}) and with increase in strange quark content [1]. The ALICE results are in accordance with the results of STAR and NA57 collaborations [2, 3]. In this article, we have used HYDJET++ [4] model to study strangeness enhancement in Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV and Pb+Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV.

Model description

HYDJET++ model generates a heavy ion event as a superposition of the soft, hydro-type state and the hard state resulting from multi-parton fragmentation. Hard multi-parton production is based on PYTHIA and PYQUEN partonic loss model which simulates parton-parton collisions, radiative and collisional energy loss and hadronization. The soft part of HYDJET++ is based on the thermal production of hadrons with predefined chemical and thermal freezeout hypersurface. The hadron multiplicities are generated using the effective thermal volume approximation and Poisson multiplicity distribution around its mean value. Final state interaction of two and three body decay of resonances and their branching ratios are taken from SHARE particle decay table. Generally, a phase suppression factor (γ_s) is employed as a possible indicator for the deviation of strange quarks from equilibrium in describing the chemical freezeout. For the present study, γ_s is treated as a free parameter and is same for both RHIC and LHC energies.

Results and Discussions

Strangeness enhancement factor may be defined as:

$$E(i) = \frac{Yield^{AA}(i)/ < N_{part}^{AA} >}{Yield^{NN}(i)/ < N_{part}^{NN} >} \quad (1)$$

In FIG.1 and FIG.2, we have shown strangeness enhancement factor E(i) for (multi-) strange baryons as a function of $< N_{part} >$ in Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV and Pb+Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV, respectively. The yield of strange hadrons in p+p collisions are taken from STAR and ALICE collaborations. From FIG.1, we observe that strangeness enhancement factor obtained by HYDJET++ for (multi-) strange baryons increases with increase in N_{part} and with increase in strange quark content. HYDJET++ results are in good agreement with the experimental data for peripeheral collisions but it underestimates the experimental data towards central collisions. The results from HIJING, AMPT and UrQMD models [5] fail to describe the experimentally observed strangeness enhancement

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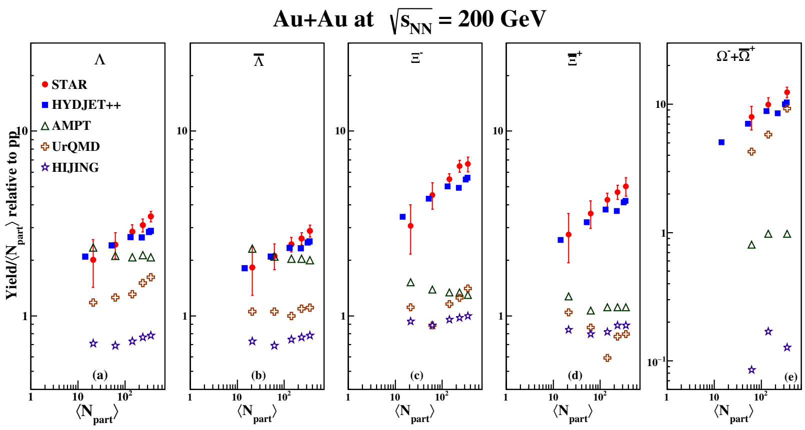

FIG. 1: Strangeness enhancement as a function of $< N_{part} >$ in Au+Au collisions. STAR data is taken from ref. [2].

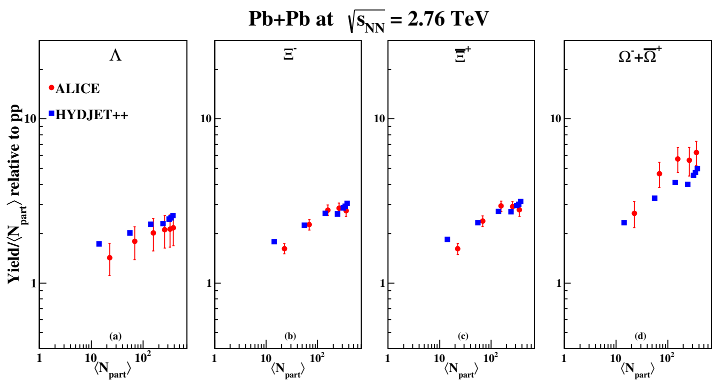

FIG. 2: Strangeness enhancement as a function of $< N_{part} >$ in Pb+Pb collisions. ALICE data is taken from ref. [1, 6].

and mass hierarchy in Au+Au collisions. In FIG. 2, we observe that the HYDJET++ provides a good description of the experimental data for Λ and Ξ. However, it underestimates the enhancement factor for Ω. We also observe that the enhancement factor for anti-baryons are lower in comparison with the corresponding baryons in Au+Au collisions because of non vanishing baryon chemical potential at RHIC energy regime.

Acknowledgments

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