Strangeness and its dependency on energy in Heavy Ion Collision

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INTRODUCTION

In ultrarelativistic heavy ion collision the Quantum chromodynamics(QCD) predict that we can have a phase transition from normal hadronic matter of confined state of quarks and gluons to a deconfined state of qurk and gluons called Quark Gluon Plasma (QGP) in a situation either at high baryonic density or high temperature or at both.

In heavy ion collision at RHIC and LHC energy a phase transition from confined state to a deconfined state of Quark Gluon Plasma is expected. Strangeness is a one of the earliest proposed signature of QGP. Strangeness is a important tool to get information about the reaction mechanism of Heavy Ion Collision because it is produced only after collision. In QGP state strangeness could be easily produced from pair production of strange-antistrange quark-pairs. There is two basic mechanism through which this pair production is possible one is through fusion of two gluons and another is a light quark and a light antiquark annihilates and goes to s $\bar{s}$-pairs.

$g + g \rightarrow s\bar{s}$ and $q + \bar{q} \rightarrow s\bar{s}$ (where q=u,d)

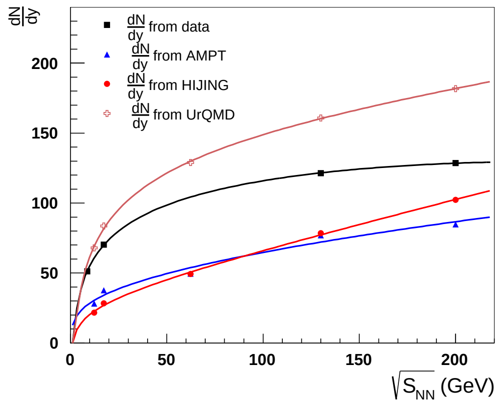
The main interest in strange particle production in Heavy ion collision is the expectation of production rate of strangeness per necleon will be enhanced in comparison to elementary nucleon-nucleon collision if QGP is formed. The study of strange particles multiplicity is also important . In this paper we will study the dependency of all strange particle multiplicity on energy and compare the data [1] with result we have got from the heavy ion simulation from HIJING, AMPT and UrQMD.

We have also studied the antibaryon to baryon ratio in pp collision from model.

RESULTS AND DISCUSSION

Here we have studied all strange particle multiplicity dependence on energy and found that essentially it follows some trend. Inspired from Mishra et all [2] we have fitted a hybrid function which

FIG. 1: All strange particle multiplicity both from data[1] and model are plotted with energy. A hybrid function is fitted to data.



is a combination of logarithmic and power law as given below.

$$\frac{dN}{dy} = A\sqrt{s}^{n} + Bln\sqrt{s}$$

The hybrid function indeed fits well the data.

We have also fitted the same hybrid function for AMPT, HIJING and UrQMD and found good fit.

In earlier strangeness study we have seen hadronic transport model like UrQMD fails to explain the strangeness enhancement of multistrange baryon. So it is natural to expect that hadronic transport model will fail to describe the data here. But interestingly enough here it describe the data well. So it needs further study to comment on this.

Mishra et all [3] have also fitted the same hybrid function to study the behaviour of cahrge particle multiplicity on energy. In same paper they have tried to explain the such type of dependency from a phenomenological model proposed by Sarkisyan et all[4]. The explanation from a phenomenological model of this type of behaviour in all strange particle multiplicity (essentially strangeness) dependency on energy is my plan of future work.

In FIG.2 we have plotted the antibarion to baryon ratio (R) with energy from model. The antibaryon to baryon ratio is sensitive for a given

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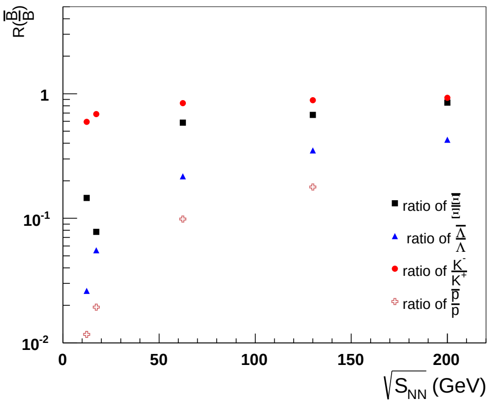
baryon depending on strangeness. Earlier study from data[1] tells that baryon to antibaryon ratio (R) have a clear hierarchy like

$$R(\frac{\bar{\Xi}}{\Xi}) > R(\frac{\bar{\Lambda}}{\Lambda}) > R(\frac{\bar{p}}{p})$$

From model we can clearly see this trend. The antibaryon to baryon ratio is close to 1 for higher strangeness.

Baryon to antibaryon ratio also probes the mechanism of baryon-number transport.

FIG. 2: Ratio of antiparticle to particle is plotted with energy.



Acknowledgments

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