Elliptic Flow of Identified Particles in Pb+Pb Collisions at 2.76 TeV within a Multiphase Transport (AMPT) Model

P. R. Pujahari[1],* D. K. Mishra[2], and B. K. Nandi[1]

[1] *Department of Physics, Indian Institute of Technology Bombay, Mumbai - 400076, INDIA and*
[2] *Deptartment of Nuclear Physics, Bhabha Atomic Research Center, Mumbai - 400005, INDIA*

Introduction

The measurement of azimuthal anisotropy resulting from non-central nuclear collisions is one of the most informative directions to study the nature and properties of matter created in high energy nuclear collisions. The main interest in anisotropic flow is due to its sensitivity to the system properties very early in its evolution [1].

The experimental data on identified particles elliptic flow in Pb+Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV from the Large Hadron Collider (LHC) by the ALICE Collaboration have recently become available [2]. Using a multiphase transport (AMPT) model, the elliptic flow of identified particles produced in Pb+Pb collisions at the center of mass energy $\sqrt{s_{NN}}$ = 2.76 TeV is studied. The results obtained for the differential elliptic flow as well as the centrality dependence of the differential elliptic flow for various identified particles will be discussed in the conference. Furthermore, the results obtained for the short-lived hadronic resonances like ϕ-meson and K^*-meson elliptic flow will also be presented.

The AMPT Model

The AMPT model [3] is a hybrid model with the intial particle distributions generated by the HIJING model of the version 1.383. In the version of string melting which is used in the present study, hadrons produced from HIJING model are converted to their valence quark and antiquarks. Then, their evolution in time and space is modeled by the ZPC parton casade model with the differential scattering cross section

$$\frac{d\sigma}{dt} = \frac{9\pi\alpha_s^2}{2\left(t-\mu^2\right)^2} \quad (1)$$

where t is the standard Madelstam variable for four momentum transfer, α_s is the strong coupling constant and μ is the screening mass in the partonic matter. Quarks and antiquarks are converted via a spatial coalescence model to hadrons and this is followed by hadronic scatterings via the ART model.

In the present study of heavy collisions at LHC, a resonable description of the measured identified particles elliptic flow at mid-pseudorapidity is achieved if the default HIJING values of a = 2.2 and b=0.5 GeV^{-2} are used in the Lund string fragmentation function. Also, a QCD coupling constant α_s=0.33 and a screening mass μ=3.2 fm^{-1}, corresponding to 10 mb parton cross section, are also needed to reproduce the observed elliptic flow.

Methods and Results

The elliptic flow v_2 is calculated by using the standard event plane method [4]. This method is based on the distribution of particle yields as a function of azimuthal angle Φ with respect to the event plane angle. For the time being, we have calculated the v_2 for identified particles with respect to the real reaction plane ($i.e.\Psi = 0$) which is known a priori in our model calculation. The v_2 extracted from the real reaction plane will be compared with the result from the estimated event plane and will be discussed in the conference.

Fig. 1 and Fig. 2 show the elliptic flow for $\pi^\pm$ and $K^\pm$ respectievely, which is calculated using the initial conditions discussed above.

*Electronic address: prabhat@phy.iitb.ac.in

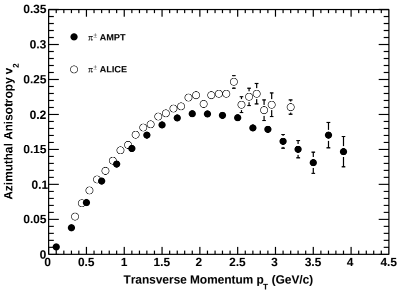

FIG. 1: Charged pion elliptic flow from 40-50% centrality in Pb+Pb collisions. The results from AMPT is compared with the ALICE published result.

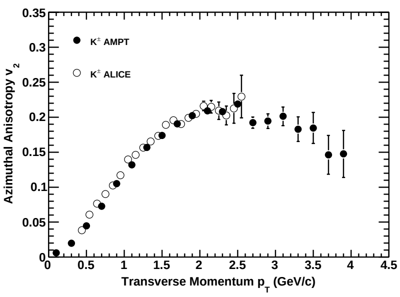

FIG. 2: Charged kaon elliptic flow from 40-50% centrality in Pb+Pb collisions. The results from AMPT is compared with the ALICE published result.

The AMPT results are compared with the ALICE experimental data for the same centrality (40-50% Pb+Pb collisions).

Fig. 3 represents a typical K^+K^- invariant mass distribution after the mixed-event background subtraction. The yield of such mass peak can be extracted by fitting the distribution with a Breit-Weigner function which is shown as the solid line in the figure. Also, the v_2 parameters for the short-lived resonances (i.e. ϕ and K^*) will be discussed in the conference.

Summary

In summary, a study of elliptic flow of identified particles along with short-lived resonances in Pb+Pb collisions at 2.76 TeV in a multiphase transport model with string melting scenario will be presented. Along with this the number of constituent quark (NCQ) scaling of v_2 will be discussed in the conference.

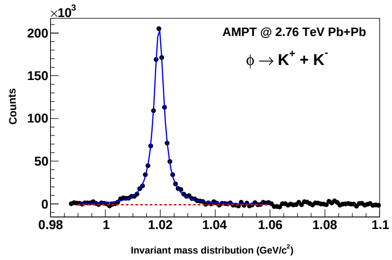

FIG. 3: K^+K^- invariant mass distribution from 40-50% centrality Pb+Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV. The solid line is a fit of Breit-Wigner function plus a linear background. The dashed line represents the linear background.

Acknowledgments

We would like to thank Zi-Wei Lin, Che Ming Ko, Bao-An Li, Bin Zhang and Subrata Pal for the AMPT model.

References

[1] H. Sorge, Phys. Lett. B **402**, 251 (1997); Phys. ReV. Lett. **78**, 2309 (1997); **82**, 2048 (1997).
[2] arXiv:1107.0080v1 [nucl-ex].
[3] Z. W. Lin, C. M. Ko, B. A. Li, B. Zhang, and S. Pal, Phys. ReV. C **72**, 064901 (2005).
[4] J. Adams et al., Phys. Rev. Lett. **95**, 122301 (2005).