The study of heavy-flavour decay lepton production as a function of charged-particle multiplicity in p-Pb collisions at $\sqrt{s}_{NN}$ = 5.02 TeV

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INTRODUCTION

The Heavy quarks are produced at the initial stages of the relativistic hadronic collisions via hard scattering processes. A stringent test of perturbative QCD calculations in p-p collisions could be done using heavy-flavour (HF) hadron probes and this study also helps in disentangling cold nuclear matter (CNM) effects in the study of p–Pb collisions. The LHC results obtained from the analysis of charm production as a function of charged-particle multiplicity offers insights about the role of multiparton ineractions (MPI), color-reconnection (CR) mechanisms, and the interplay between the hard and soft particle production in p-p and p–Pb collisions. These results indicate about the presence of collective nature of the QCD matter in small collision systems as well. The production of electrons from semileptonic decays of heavy-flavour hadrons (HFE) in p-Pb collisions has been studied at collision energies $\sqrt{s_{NN}}$ =5.02 and 8.16 TeV [1, 2]. The production of HFE as a function of self-normalized charged-particle multiplicity for the p-Pb collisions and also for the p-p collisions have been studied at $\sqrt{s_{NN}}$ =8.16 TeV and $\sqrt{s}$ =13 TeV respectively. In ALICE experiment, the production of heavy-flavor (charm and bottom quarks) decay electrons (HFE) and muons (HFM) are measured at mid- ($|y| < 1$) and forward- ($2.5 < y < 4$) rapidity regions respectively. The charged-particle multiplicity (N_{ch}) is estimated at $|\eta| < 1$. The multiplicity dependence of HFE and HFM production could be studied using PYTHIA8 event generator also. The recent studies on the HFM and charged particles production in small and heavy mass colliding systems in a single framework have been done using PYTHIA8 based Angantyr model at LHC energies [3, 4]. In this work, we have studied HFE production as a function of p_T. The p_T-differential production cross-section in p-Pb collision at $\sqrt{s_{NN}}$ =5.02 TeV at mid-rapidity ($|y_{lab}| < 0.60$) in four multiplicity classes have been calculated using Angantyr model. The standard statistical uncertainty is computed for each case as $\sqrt{N}_{yield}$.

THE ANGANTYR MODEL AND ANALYSIS METHODOLOGY

The Angantyr based on PYTHIA8 is a versatile model with which the analysis of p-p and heavy-ion collisions could be done. In this work, the simulated inelastic, non-diffractive component of the total reaction cross section is generated using the tuning "SoftQCD:all=on" without Color Reconnection and MONASH 2013 (Tune:pp = 14). We have generated 50 million events at center-of-mass energy $\sqrt{s_{NN}}$ =5.02 TeV in p–pb collision system. The multiplicity classes have been evaluated using data guided method where we have used ALICE data for pseudo-rapidity den-

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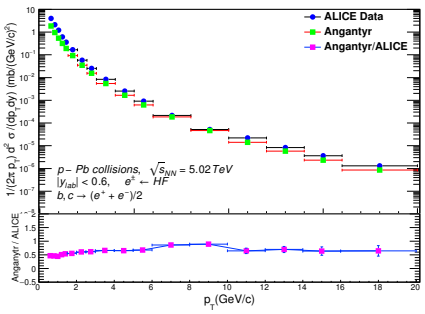

FIG. 1. The simulated p_T-differential cross-section for leptons from the heavy-flavor hadron decays in p-Pb collision at $\sqrt{s_{NN}}$ =5.02 TeV at mid-rapidity $|y_{lab}| < 0.6$ is shown in the comparison of Angantyr model calculation and ALICE data [1].

sity of charged-particle multiplicity at different centrality classes in p-Pb collision system at $\sqrt{s_{NN}}$ =5.02 TeV in the rapidity region $|y_{lab}| < 0.6$ [5]. The p_T-distribution has been extracted from the correlated results of HFE p_T-distribution as a function charged-particle multiplicity obtained from Angantyr model.

RESULTS

In this section, we have presented a comparative study between the Angantyr model calculation and ALICE data. The vertical error bars represent the statistical errors in all the figures. Figure 1 presents p_T-differential cross section for HFE in the p-Pb collision at $\sqrt{s_{NN}}$ =5.02 TeV at mid-rapidity $|y_{lab}| < 0.6$. and shows nice matching with ALICE data. Similarly, Fig. 2 depicts p_T-differential cross section for HFE in p-Pb collision at $\sqrt{s_{NN}}$ =5.02 TeV ($|y_{lab}| < 0.6$) in four different multiplicity classes. As we go from lower multiplicity class (0-20) to the highest multiplicity class (60-100), collision geometry goes from peripheral to central collisions. Further study is under progress to examine the possible collective e

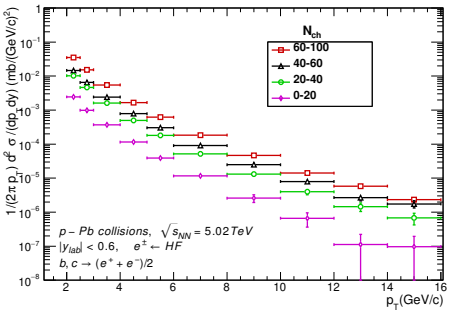

FIG. 2. The simulated results with Angantyr model calculation in four multiplicity classes (0-20, 20-40, 40-60 & 60-100) for p_T-differential cross-section of HFE in p-Pb collision at $\sqrt{s_{NN}}$ =5.02 TeV at $|y_{lab}| < 0.6$ is shown.

SUMMARY

The geometric quantities (N_{part}, N_{coll}, b) in different centrality classes using Monte Carlo Glauber (MCG) model, Nuclear modification factors in four multiplicity classes for HFE is in progress. In addition, using CR mechanism, one can study the collectivity in small system (p-Pb collisions).

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