Light-flavoured particle production in pp collisions at 13.6 TeV with ALICE at the LHC

Dhrubajyoti Choudhury[1],* Banajit Barman[1], and Buddhadeb Bhattacharjee[1] (on behalf of ALICE Collaboration)
[1] *Nuclear and Radiation Physics Research Laboratory, Department of Physics, Gauhati University, Guwahati-781014, INDIA*

Introduction

In nucleus-nucleus collisions at LHC energies, a deconfined state of matter, the quark-gluon plasma (QGP) is found to be formed [1]. Generally, proton-proton (pp) collisions are used as a reference to study heavy-ion collisions [2]. However, at the highest LHC Run 2 p+p collision energy (i.e 13 TeV), high-multiplicity pp events exhibited signatures of collective phenomena similar to those observed in heavy-ion collisions [3]. The study of the multiplicity-dependent light flavour particle yields ratio shows a gap at intermediate multiplicities while going from small to large systems. LHC Run 3 high luminosity pp collisions is expected to bridge this gap, besides it will also help to study the rare probes of HIC with better statistics.

This contribution aims to discuss the first results on pion, kaon, and proton production measured with ALICE in Run 3 pp collisions at $\sqrt{s}$ = 13.6 TeV. The results have been obtained within the newly developed ALICE analysis framework (online and offline system) for Run 3. Yield ratio as a function of the transverse momentum of different light flavour particles to pions will also be shown.

Analysis details

The identification of pions, kaons, and protons was done with the Time Projection Chamber (TPC) and Time Of Flight (TOF) detectors [4]. The specific energy loss (dE/dx) method is used in the TPC for particle identification, whereas the time-of-flight information is used in the case of TOF analyses. Identified particle spectra were measured independently with TPC and TOF and combined in the final stage of the analyses. Event selection has been performed via standard event selection criteria which helps in selecting good events. In addition, the events are selected having a reconstructed vertex within $|z| < 10$ cm from the nominal interaction point. Tracks produced from the primary vertex only are selected. All tracks are within $|\eta| \leq 0.8$ cm and a p_T-dependent DCAxy cut is used in the analysis. Estimates of the primary fraction and tracking efficiency are obtained using the PYTHIA8 event generator [4].

Results and discussion

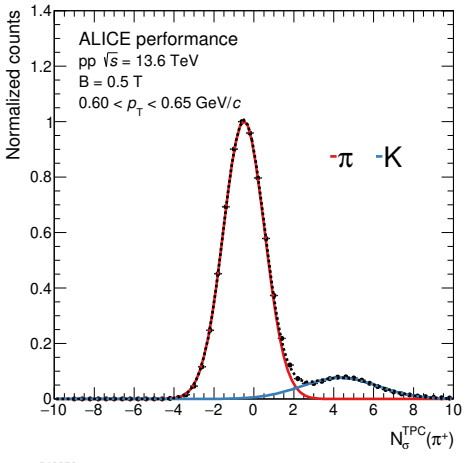

FIG. 1: Deviation of the TPC signal from the expected value for π^+ in terms of the number of sigma in pp 13.6 TeV together with fits to the peaks of pions and kaons.

*Electronic address: dhrubajyoti.choudhury@cern.ch

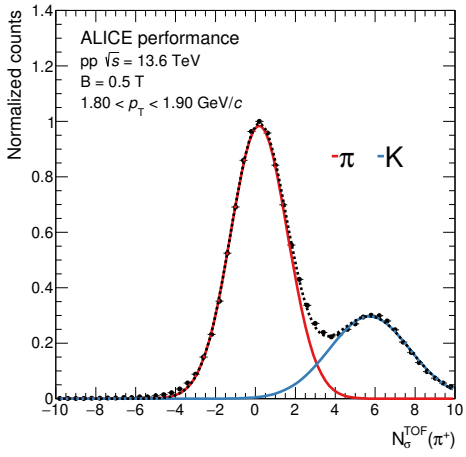

FIG. 2: Deviation of the TOF signal from the expected value for π^+ in terms of the number of sigma in pp 13.6 TeV together with fits to the peaks of pions and kaons.

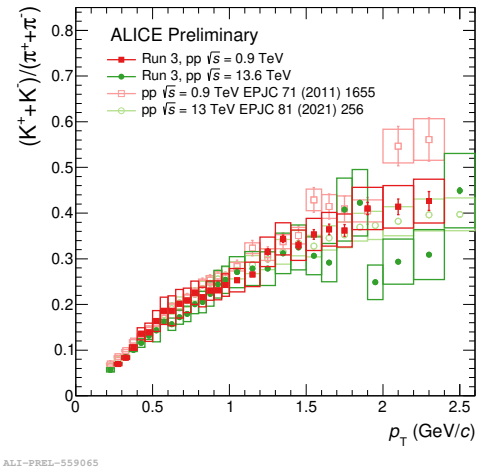

FIG. 3: k/π ratio as a function of transverse momentum in pp collisions at 13.6 TeV.

Fig.1 and Fig.2 show the signal distributions for TPC and TOF detector respectively. The well-separated peaks of different particle species show good performance of the detectors after being upgraded in RUN 3.

Fig.3 and Fig.4 represent the K/π and p/π ratios respectively as a function of p_T in pp

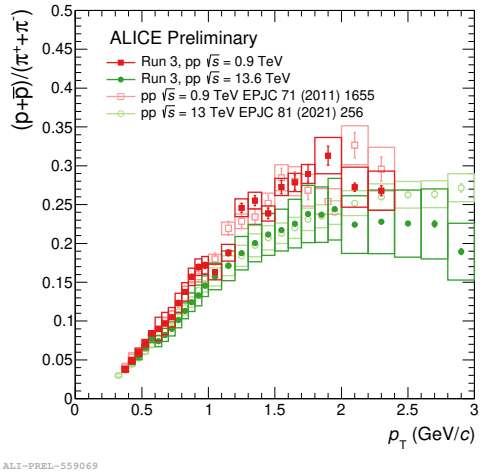

FIG. 4: p/π ratio as a function of transverse momentum in pp collisions at 13.6 TeV.

collisions at 13.6 TeV. Both the K/π and p/π ratios show an increasing trend as a function of transverse momentum. This same trend was also observed in Run 2 pp results which are included in Fig.3 and Fig.4 as open symbols. However, p/π ratio seems flatten off after $\sim$ 2 GeV/c.

Acknowledgments

The authors acknowledge financial support of DST, New Delhi through a project grant No. SR/MF/PS-02/2021-GU(E-37122). One of the authors (DC) acknowledges the financial assistance of CSIR in the form of fellowship.

References

[1] B. Abelev et al., Phys.Rev.C88,044910 (2013).
[2] W. Busza, K. Rajagopal and W. van der Schee, Ann.Rev. Nucl. Part. Sci. 68, 339 (2018).
[3] Adam, J et al., Nature Physics 13,535-539 (2017).
[4] T. Sjostrand, S. Mrenna, P.Z. Skands, PYTHIA 6.4 physics and manual. JHEP 0605, 026 (2006).