Measurement of strange baryonic resonances in pp and p–Pb collisions with ALICE

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Introduction

The interpretation of heavy-ion (AA) collision results depends crucially on the comparison with results from proton-proton (pp) or proton-nucleus (pA) collisions. At the LHC, the pseudo-rapidity densities at mid rapidity of final state charged particles ($\langle dN_{ch}/d\eta_{lab}\rangle$) in high multiplicity pp and pA collisions are similar to those in peripheral Au–Au collisions at RHIC energy and peripheral Pb–Pb collisions [1]. For the investigation of the hadronic phase, multiplicity-dependent measurements in pp and pA collisions are important to study the onset of final state dense matter effects [2]. In addition, several measurements in pA collisions indicate the presence of collective effects [3]. For instance, in p–Pb collisions, the evolution with multiplicity of the transverse momentum spectra of identified particles suggests the presence of radial flow [4]. Recent results from ALICE [5] on multi-strange particles in pp and p–Pb collisions show an increase of the hyperon to pion ratios with $\langle dN_{ch}/d\eta_{lab}\rangle$. The rate of increase is more pronounced for particles with higher strangeness content, and it is related indeed to strangeness.

Short-lived hadronic resonances are used to probe the hadronic phase of AA collisions, and they also contribute to the systematic study of strangeness production. Interactions during the hadronic phase in pA and AA collisions may influence the yields of resonances. The re-scattering of the decay products of resonances in the medium may prevent the detection of a fraction of the resonances, whereas pseudo-elastic hadron scattering can regenerate resonances. Therefore, the hadronic phase can be studied by comparing yields of short lived resonances of different lifetimes to yields of stable particles [6].

In this contribution we focus mainly on the measurement of baryonic resonances, such as $\Lambda(1520)$, $\Sigma(1385)^{\pm}$, $\Xi(1530)^0$, etc., in pp and p–Pb collisions at $\sqrt{s_{NN}}$ = 7 TeV and 5.02 TeV, respectively. The p_T spectra and $\langle p_T\rangle$ of these resonances will be presented and discussed in comparison to other particles. The effect of hadronic scattering in the medium on their yields will be presented. The yield ratios of resonances to π will be discussed to show the effect of strangeness on yield enhancement with $\langle dN_{ch}/d\eta_{lab}\rangle$. The collective expansion of the medium in p–Pb collisions has been studied using the Blast Wave fits to identified particle spectra, including $\Lambda(1520)$.

Results and Discussion

The data samples analysed in this paper were recorded during the LHC pp run in 2010 and p–Pb run in 2013. In pp colli-

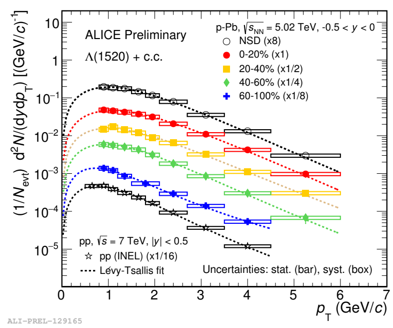

FIG. 1: (Color online) p_T-spectra of $\Lambda(1520)$ measured in the rapidity range $|y| < 0.5$ in pp collisions at $\sqrt{s} = 7$ TeV and -0.5 $< y < 0$ in p–Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV for NSD and different V0A multiplicity classes. Dashed lines represent Lévy-Tsallis fits [8].

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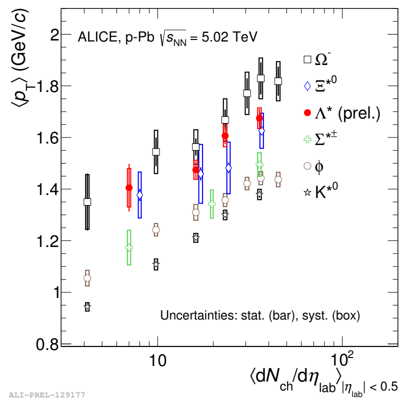

FIG. 2: (Color online) Multiplicity dependence of the $\langle p_{\mathrm{T}} \rangle$ of identified particles measured by ALICE in p–Pb collisions.

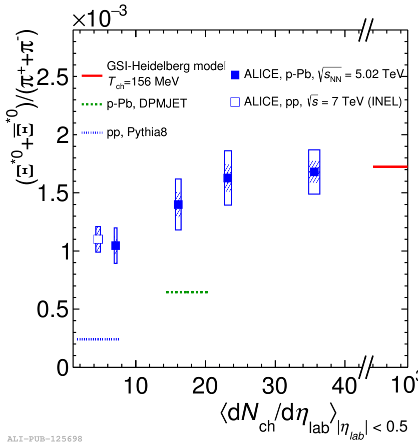

FIG. 3: (Color online) Ratio of Ξ^{*0} to $\pi^{\pm}$ in pp and p–Pb collisions as a function of the average charged particle density measured at midrapidity. Statistical uncertainties (bars), total systematic uncertainties (hollow boxes) and systematic uncertainties uncorrelated across multiplicity (shaded boxes) are shown.

sions the yields are normalised to the number of inelastic collisions, whereas for minimum bias (MB) p–Pb collisions, the yields are normalised to the number of non-single diffractive (NSD) events. In p–Pb, events are further divided into multiplicity classes according to the charge deposited in the forward V0A detector positioned along the direction of the Pb beam. For the V0A multiplicity dependent study, the yields are normalised to visible cross-sections.

The MB and multiplicity-dependent p_{T}-spectra of $\Lambda(1520)$ are shown in Fig. 1. Each spectrum is fitted with a Lévy-Tsallis function [8] to extrapolate spectra in the p_{T} range where they are not measured, to extract $\mathrm{d}N/\mathrm{d}y$ and $\langle p_{\mathrm{T}} \rangle$. Fig. 2 shows the $\langle p_{\mathrm{T}} \rangle$ of different hadrons plotted against $\langle \mathrm{d}N_{\mathrm{ch}}/\mathrm{d}\eta_{\mathrm{lab}} \rangle$. This shows the baryon resonances follow mass ordering in $\langle p_{\mathrm{T}} \rangle$, and their $\langle p_{\mathrm{T}} \rangle$ values increase with $\langle \mathrm{d}N_{\mathrm{ch}}/\mathrm{d}\eta_{\mathrm{lab}} \rangle$. Fig. 3 shows the ratio of the Ξ^{*0} yield to π measured in different multiplicity classes. This shows the yield ratio of an excited state of a strange hyperon to π increases with increasing size of the system created in the collisions. Many other results related to strange baryonic resonance production and their model predictions will be discussed in detail in the conference presentation.

Acknowledgments

DAE is acknowledged for financial support.

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