Energy and system size dependence of hadronic resonance production with ALICE at the LHC

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Introduction

The study of the hadronic resonance production serves as a unique tool to understand the properties of matter created in heavy-ion collisions. Due to their short lifetime (∼ 10^{-23} sec), resonances are used as a sensitive probe to investigate the dynamical evolution of the hadronic medium produced in heavy-ion collisions. The resonances whose lifetime are comparable with the timespan of the hadronic phase (the time interval between chemical and kinetic freeze-out) are suited candidates for studying the regeneration and re-scattering processes. The resonance yields and particle ratios are expected to get modified due to the interaction of their decay daughters within the hadronic medium. Recent measurements in p-Pb collisions at \( \sqrt{s_{NN}} = 5.02 \) TeV and in pp collisions at \( \sqrt{s} = 7, 13 \) TeV as a function of multiplicity have uncovered various bulk properties similar to those seen in heavy-ion collisions [1], [2].

Analysis details

The \( K^*(892)^0 \) and \( \phi(1020) \) vector mesons are reconstructed through invariant mass analysis using their hadronic decay channels. The signals of \( K^*(892)^0 \) and \( \phi(1020) \) in different \( p_T \) intervals are obtained by subtracting combinatorial background from “unlike-sign charged-particle invariant-mass distributions” for the various multiplicity classes. The combinatorial background is estimated by using mixed event technique. After combinatorial background subtraction a residual background remains which mainly arises from other sources of correlated pairs and misidentified particle decay products. The extracted \( K^*(892)^0 \) signal is fitted with a Breit-Wigner function and the \( \phi(1020) \) signal is fitted with a Voigtian function (which is a convolution of Breit-Wigner and Gaussian function) and a polynomial function describing the residual background. The raw yields are obtained from the area under the curve reproducing the signal invariant mass distribution in each of the \( p_T \) intervals for the various multiplicity classes. To measure the corrected transverse momentum \( (p_T) \) spectra the raw yields are corrected for detector acceptance, reconstruction efficiency and decay branching ratio. The recent measurements of \( K^* \) and \( \phi \) mesons are performed in p-Pb, Pb-Pb and Xe-Xe collisions at \( \sqrt{s_{NN}} = 8.16, 5.02 \) and 5.44 TeV respectively.

Results and Discussion

The particle yield \( (dN/dy) \) is obtained by integrating the \( p_T \) spectrum in the measured \( p_T \) region and estimating the yield in the unmeasured region using a Levy-Tsallis fit function. Figure 1 shows the \( dN/dy \) normalized...
FIG. 1: The scaled $dN/dy$ of $K^*$ as a function of $<dN_{ch}/dy>$ for $|y|<0.5$ in pp collisions at $\sqrt{s} = 7$, 13 TeV and in p-Pb collisions at $\sqrt{s_{NN}} = 5.02$, 8.16 TeV respectively.

FIG. 2: Nuclear modification factor of $K^*$ as a function of $p_T$ in Xe-Xe collisions at $\sqrt{s_{NN}}$ 5.44 TeV and Pb-Pb collisions at $\sqrt{s_{NN}}$ 5.02 TeV for a similar charged particle multiplicity.

FIG. 3: The particle yield ratios $\rho/\pi$, $K^*/K$, $\Lambda(1520)/\Lambda$, $\Sigma^*/\Lambda$, $\Xi^*/\Xi$ and $\phi/K$ as a function of $<dN_{ch}/dy>$ for pp, p-Pb and Pb-Pb collisions.

the LHC energies are also compared the EPOS model (with and without UrQMD) [3].

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**References**

