Understanding the rescattering effect on $\Lambda(1520)$ resonance production in different systems and collision energies with ALICE at LHC

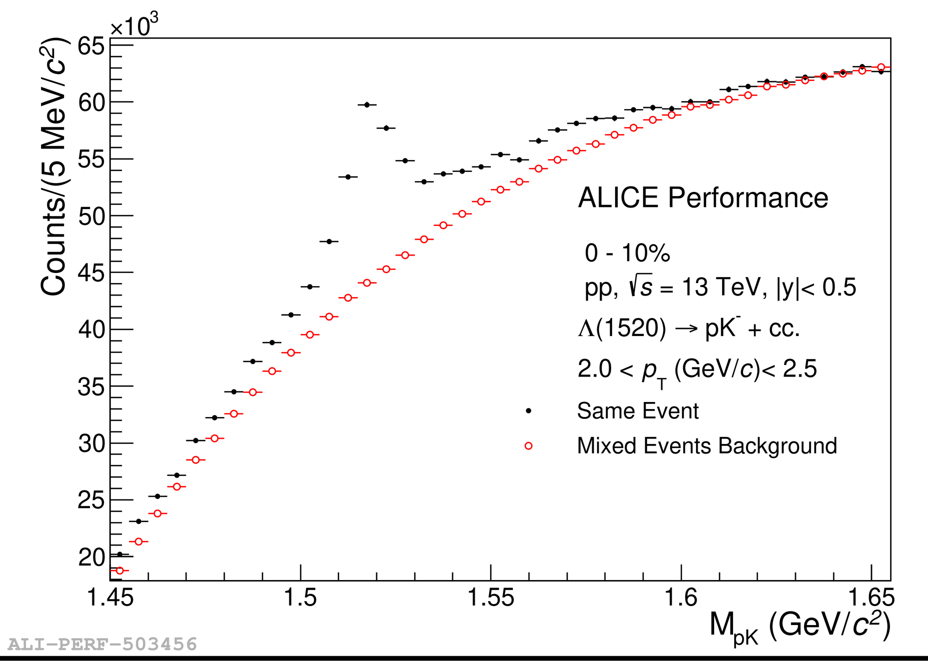
Sonali Padhan (On behalf of ALICE Collaboration)
Indian Institute of Technology Bombay, India
Email- sonali.padhan@cern.ch

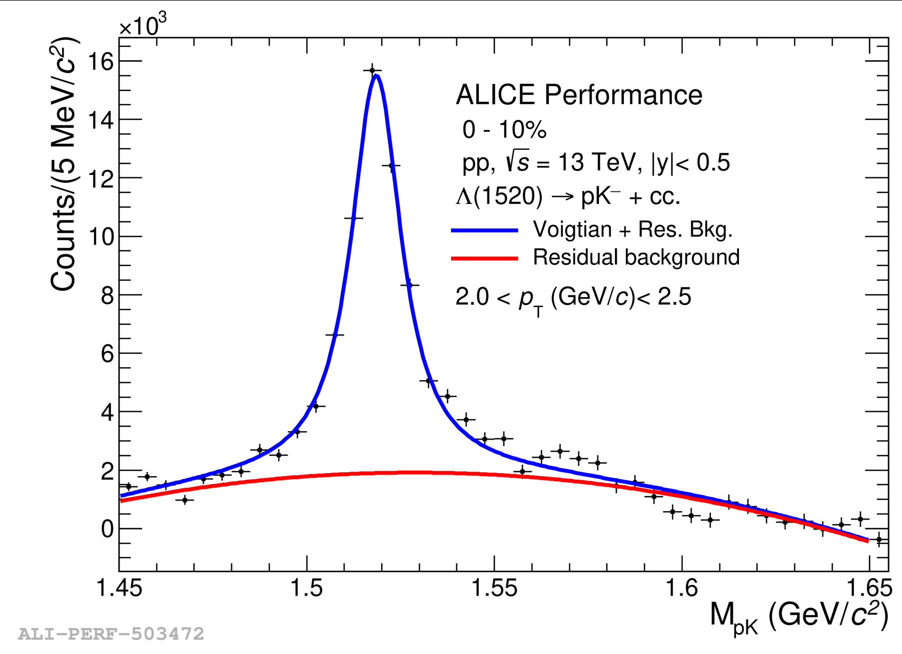
1. Introduction

- Hadronic resonances are effective tools for studying the hadronic phase in ultrarelativistic heavy-ion collisions.
- In fact, their lifetime is comparable to that of the hadronic phase, and resonances are sensitive to effects such as rescattering and regeneration processes, which affect the resonance yields and shape of the transverse momentum spectra.
- Recent results from ALICE shows a significant suppression of K^{*0} and $\Lambda(1520)$ yield in central Pb—Pb collisions, while such effect is not observed for $\phi(1020)$ resonance. In small systems, K^{*0} shows suppression, whereas no suppression is observed for $\Lambda(1520)$ and $\phi(1020)$ resonances. $\Lambda(1520)$ resonance whose lifetime ($\sim 13\ \mathrm{fm}/c$) lies between $K^{*0}(\sim 4\ \mathrm{fm}/c)$ and $\phi(\sim 42\ \mathrm{fm}/c)$ offers unique insights into the characteristics of the hadronic phase [1][2][3].

2. Resonance reconstruction

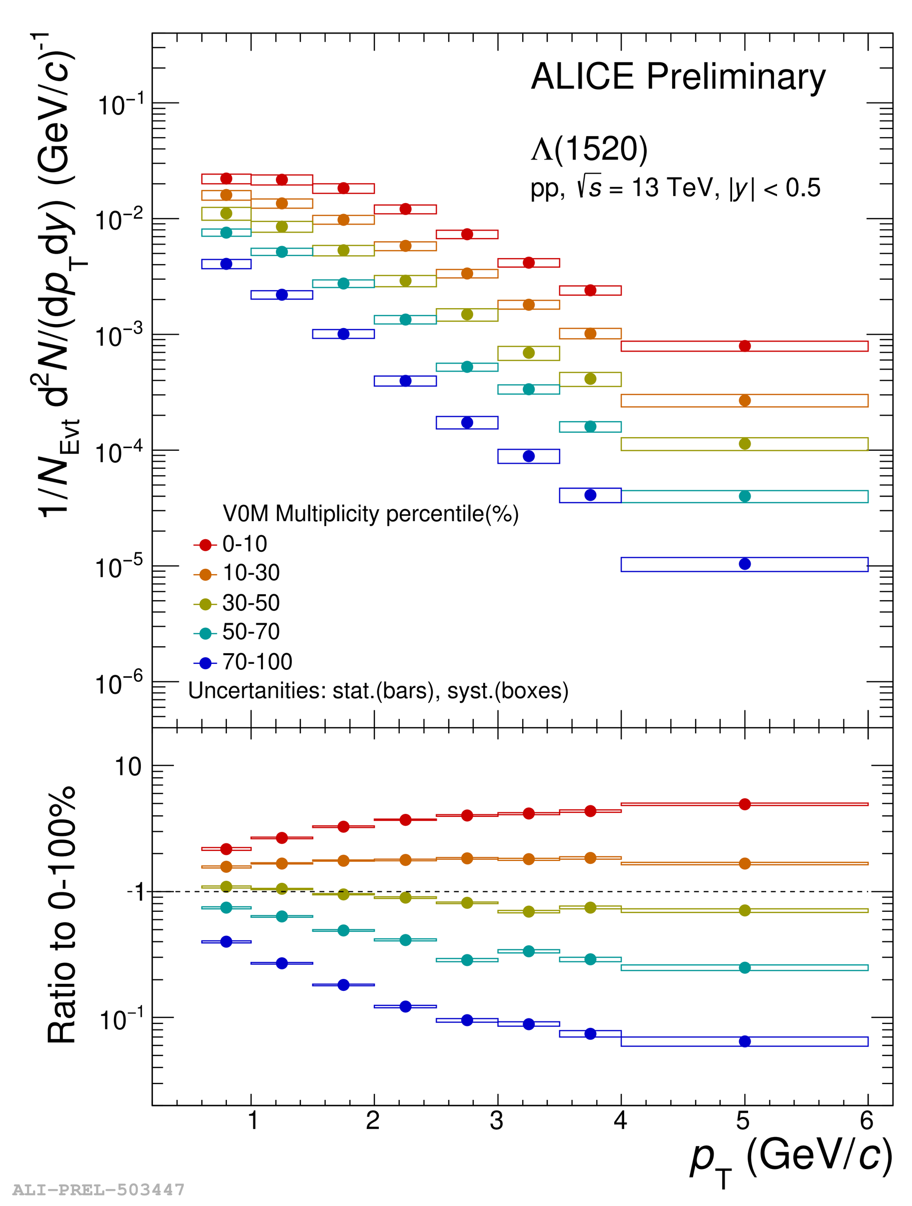
- $\Lambda(1520)$ is reconstructed via the invariant mass analysis in the decay channel $\Lambda(1520)(\bar{\Lambda}(1520)) \rightarrow pK^-(\bar{p}K^+)$
- Uncorrelated background is calculated via event mixing.
- After subtracting the event mixing background, the remaining distribution is fitted with signal (Voigtian function) and a polynomial for residual background.

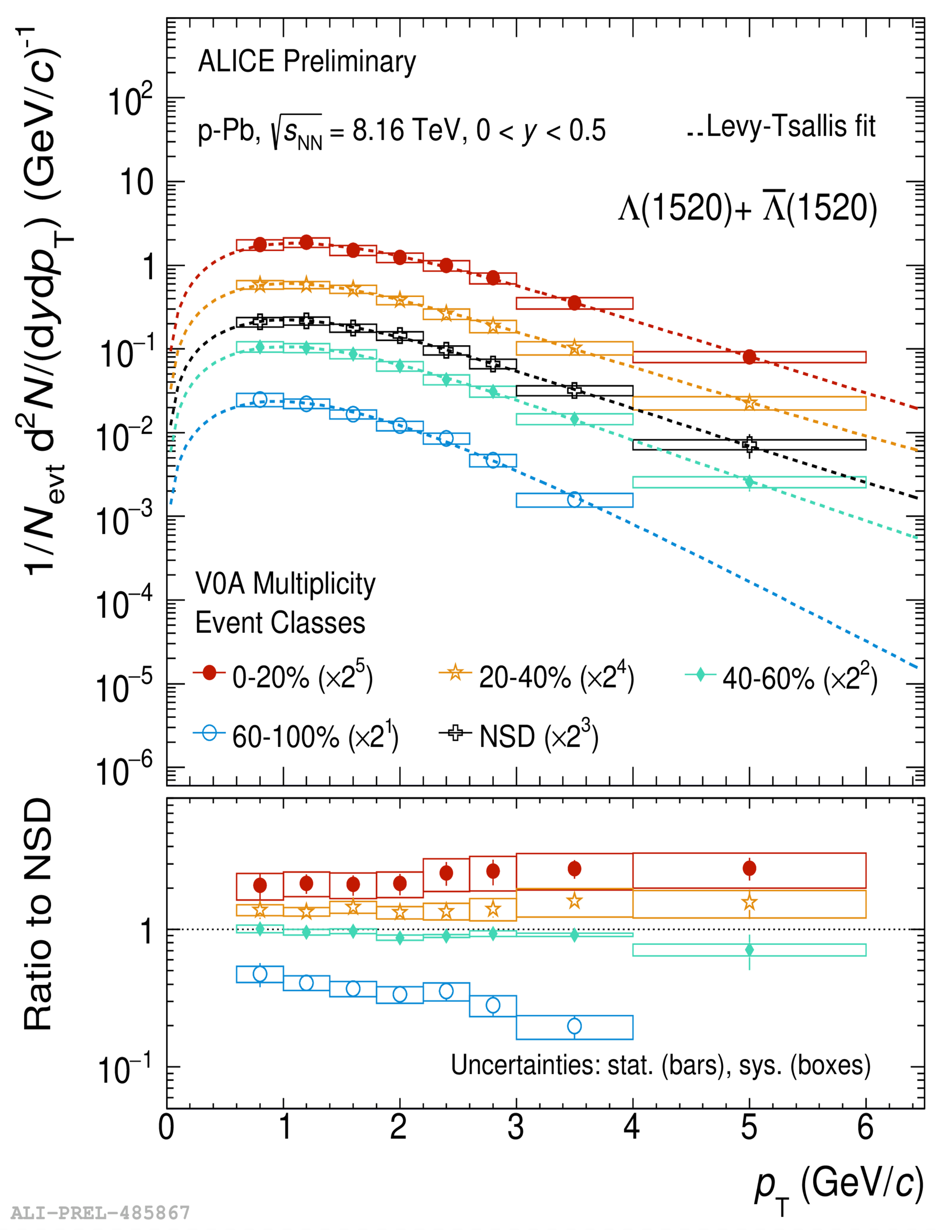


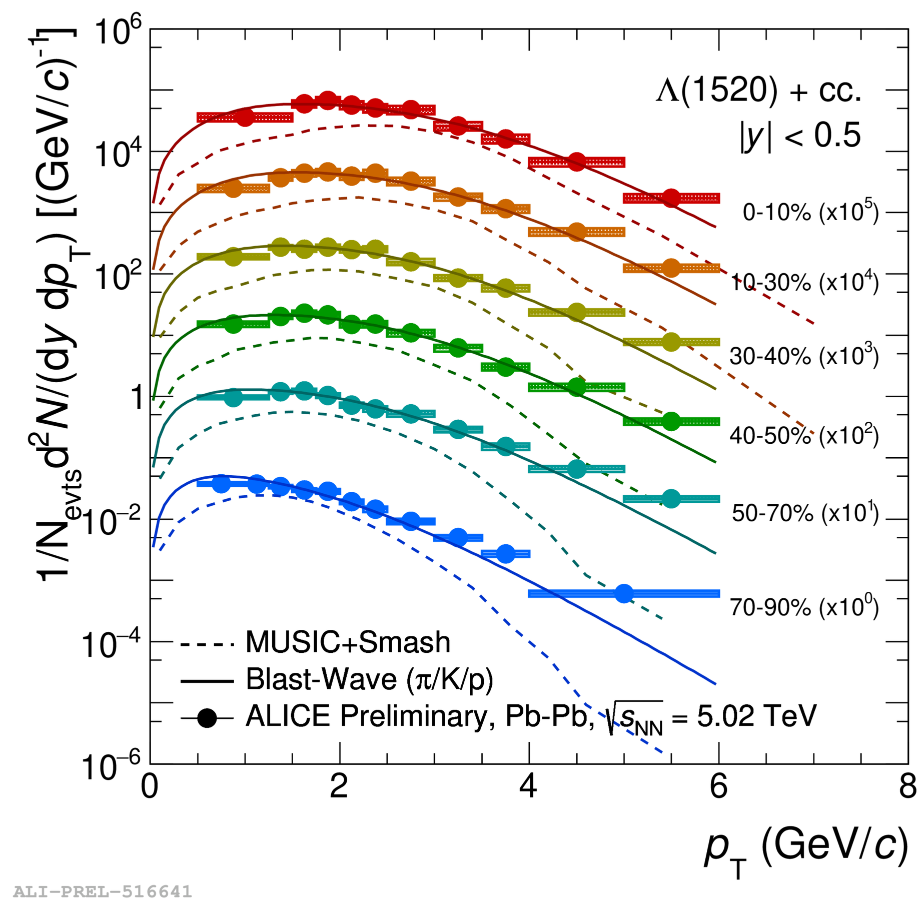


3. Results

a) p_T spectra

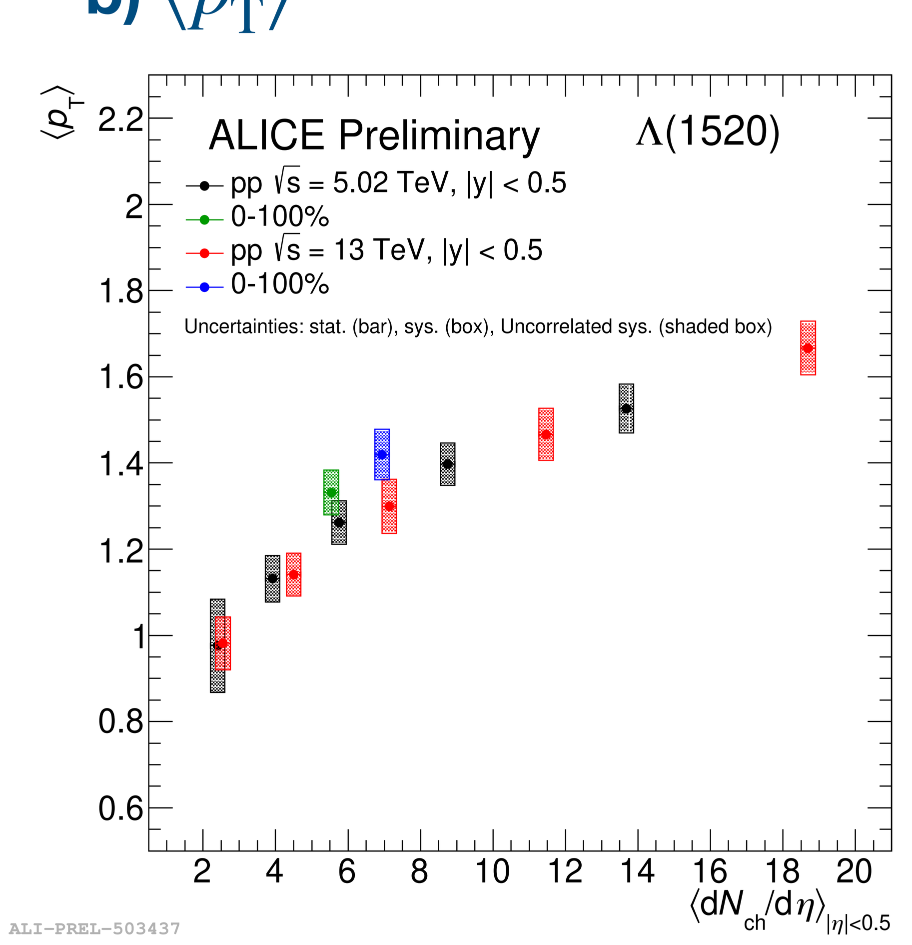


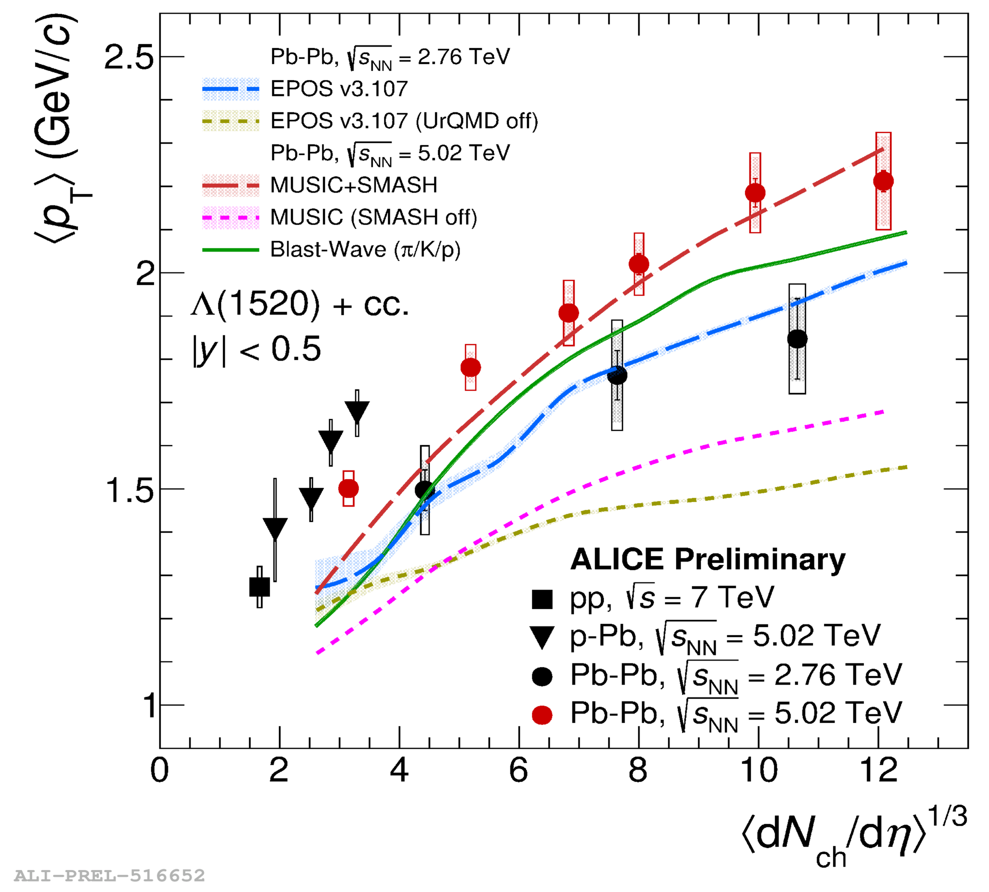




- In Pb—Pb 5.02 TeV the spectral shapes show good agreement with the Blast-Wave fit [4] and and are close to MUSIC with SMASH afterburner prediction [5] in low p_T, while they diverge at high p_T.
- In small system, the spectral shape changes and gets harder with increasing multiplicity. These effects are similar to those observed in heavy-ion collisions that are typically interpreted as flow-like effects.

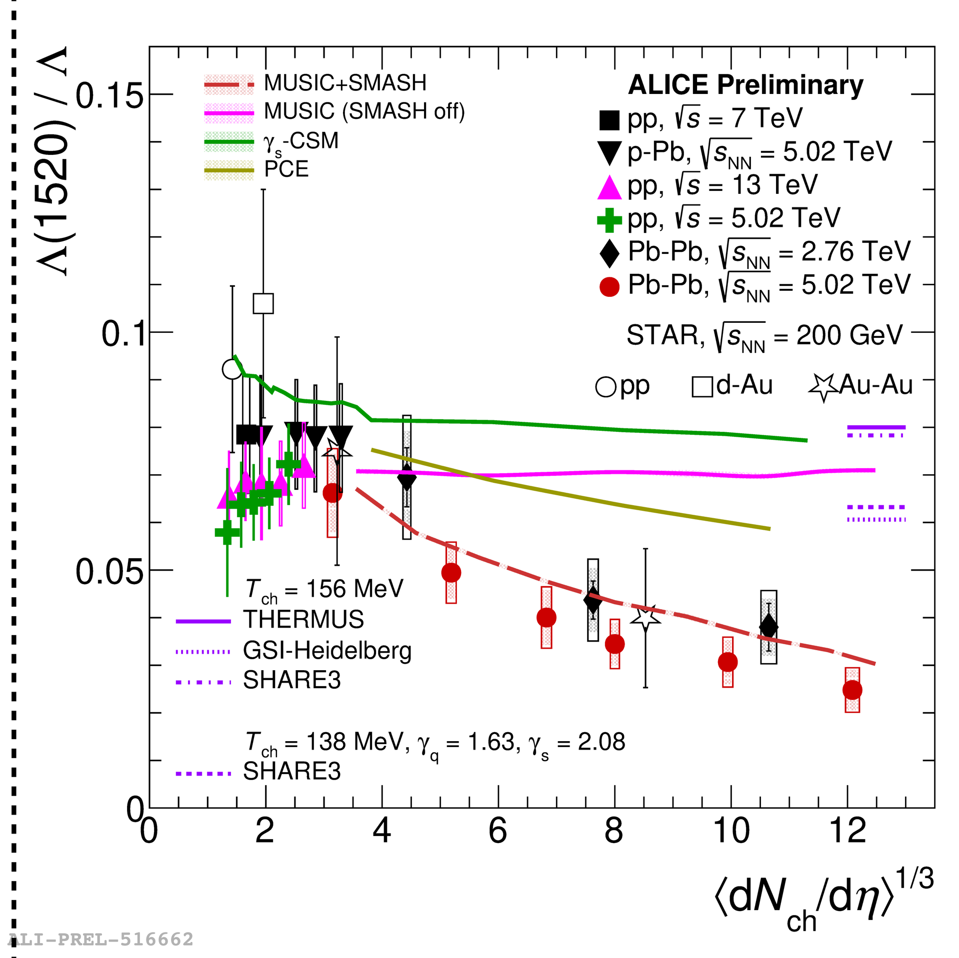
b) $\langle p_T \rangle$





- The $\langle p_T \rangle$ in pp increases with event multiplicity and also increases from peripheral Pb—Pb to central Pb—Pb collisions (~47% higher in 0-10% than in 70-90% centrality class). Steeper increase in small systems with respect to Pb—Pb at 2.76 TeV [2].

c) Particle yield ratio



- The $\Lambda(1520)/\Lambda$ ratio is suppressed in central Pb—Pb collisions with respect to pp and peripheral Pb—Pb collisions.
- No such suppression is observed in p—Pb collisions.
- No suppression is observed in $\Lambda(1520)/\Lambda$ ratio for pp collisions at $\sqrt{s}$ = 5.02 and 13 TeV.

4. Conclusions

- The spectral shape of $\Lambda(1520)$ changes and gets harder with increasing multiplicity irrespective of the collision system and collision energy.
- Suppression is observed for K^{*0}/K ratio but not for $\Lambda(1520)/\Lambda$ in the small systems , whereas $\Lambda(1520)/\Lambda$ is suppressed in central Pb—Pb collisions . This might be due to rescattering effects which suppress the resonance yield.

5. References

[1] Phys. Rev. C 106 , 034907 (2022)
[2] ALICE: Phys. Rev. C 99, (2019) 024905
[3]ALICE: Eur. Phys. J. C 80, 160 (2020)
[4] ALICE: Phys.Rev.C 101 (2020) 044907
[5] MUSIC: arXiv:2105.07539

Large Hadron Collider Physics Conference Belgrade, Serbia, 22-26 May 2023