Measurement of $K^{*}(892)$ and $\phi(1020)$ production in p-Pb collisions at $\sqrt{s_{NN}}$ = 8.16 TeV with ALICE at the LHC

Dukhishyam Mallick[1], Sandeep Dudi[2] on behalf of the ALICE Colloboration

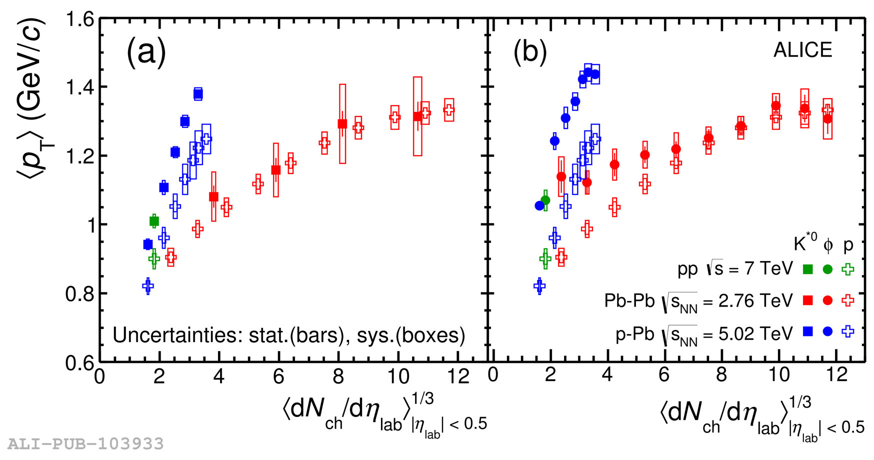
[1]National Institute of Science Education and Research, HBNI, Jatni, India

[2]Physics Department, Panjab University, Chandigarh, India

1. Motivation

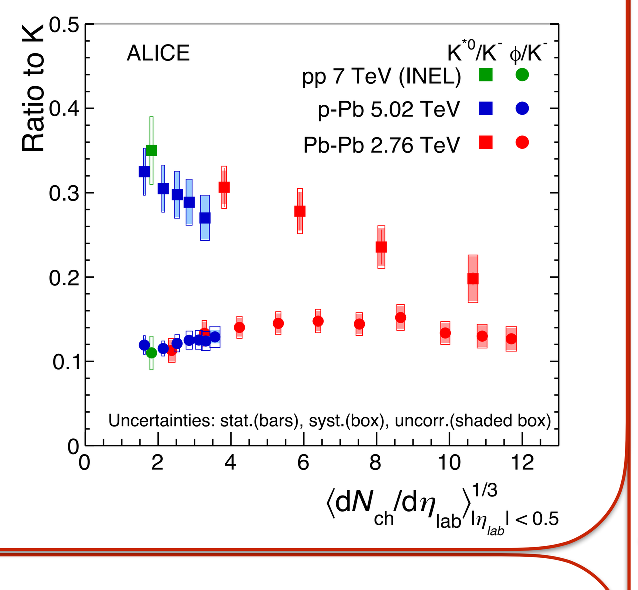
- Recent measurements of highest multiplicity pp and p-Pb collisions exhibit behaviour similar to peripheral Pb-Pb collisions [1].

- Do p-Pb collisions exhibit collective behaviour as seen in A-A collisions ?



- Decreasing K^{*0}/K ratio and flat ϕ/K ratio as a function of multiplicity [1,2].

-> Can small system (p-Pb) of higher $\langle dN_{ch}/d\eta \rangle$ show similar re-scattering effect as observed in heavy-ion collisions ?



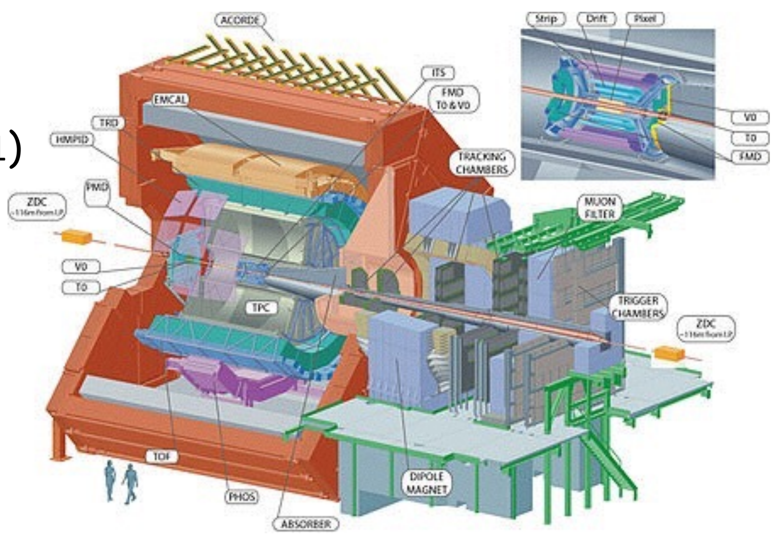
2. Experiment and analysis details

Data : p-Pb sample at $\sqrt{s_{NN}}$ = 8.16 TeV collected in 2016

MC : Dpmjet

Multiplicity estimator : Using V0A multiplicity classes ($2.8 < \eta_{lab} < 5.1$)

PID : TPC + TOF

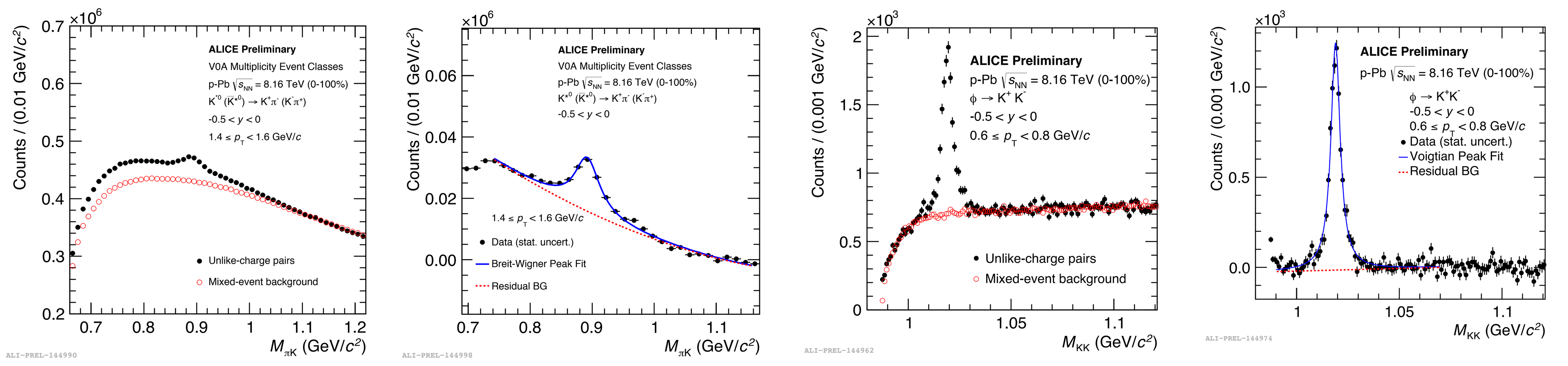


K^{*0} and ϕ are reconstructed via their hadronic decay channels by Invariant mass method.

$$K^{*0}(\bar{K}^{*0}) \to K^{+} + \pi^{-}(K^{-} + \pi^{+})$$

$$\phi \to K^{+} + K^{-}$$

1. Invariant mass method : For each event, the invariant mass $M_{\pi K}$ (M_{KK}) distributions of πK (KK) are constructed using all unlike charge combinations of π and K for K^{*0} (K^{+} and K^{-} for ϕ -meson).
2. Combinatorial background: Event mixing technique is used to estimate the combinatorial background.
3. Event Mixing: (5 events, z-Vertex difference < 1 cm, V0A Multiplicity difference (%) < 10).
4. Combinatorial background normalization: Combinatorial background distribution is normalized to the region outside the mass peak (1.10 -1.15, 1.04-1.15) (GeV/c^2) - for K^{*0} and ϕ-meson respectively.
5. Signal = Same event invariant mass distribution – scaled mixed event invariant mass distribution.
6. Combined fit:
   - K^{*0} - Breit -Wigner for signal + 2nd order polynomial for residual background.
   - ϕ - Voigtian (which is a convolution of a Breit -Wigner peak to describe the ideal signal and a Gaussian to account for detector resolution) for signal + 2nd order polynomial for residual background.



✓ Invariant mass distribution of πK pairs before and after background subtraction (for p_T bin $1.4 < p_T < 1.6$ GeV/c).

✓ Invariant mass distribution of KK pairs before and after background subtraction (for p_T bin $0.6 < p_T < 0.8$ GeV/c).

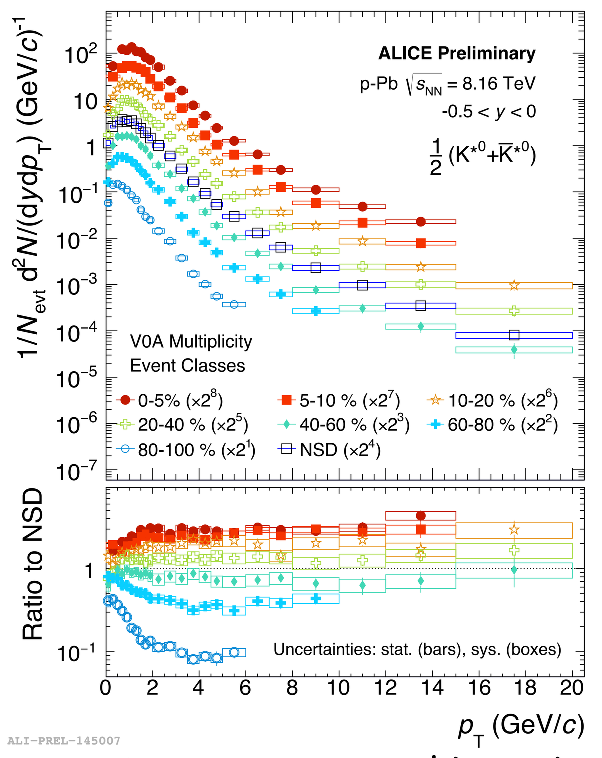
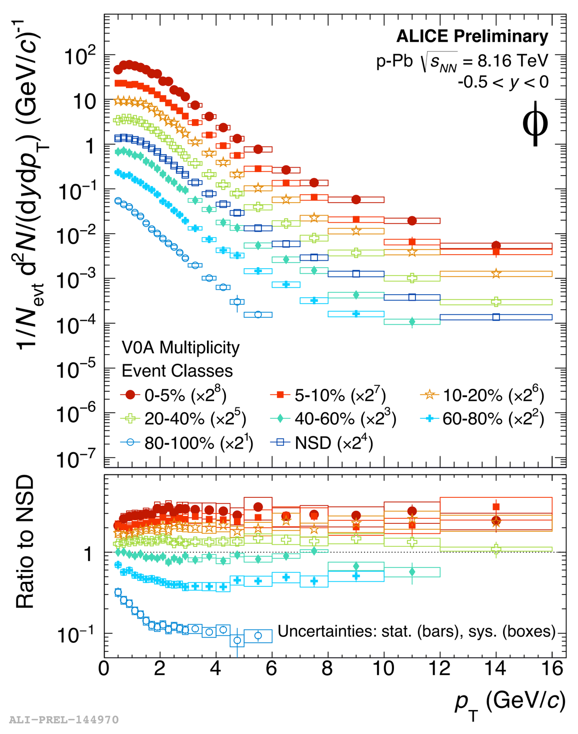
Raw yield counts : area under the peak.

Efficiency x Acceptance correction = N^{rec}/N^{gen}

Analysis is performed in 8 multiplicity classes.

(0-5 %, 5-10 %, 10-20 %, 20-40%, 40-60 %,60-80%, 80-100%)

3. p_T spectra

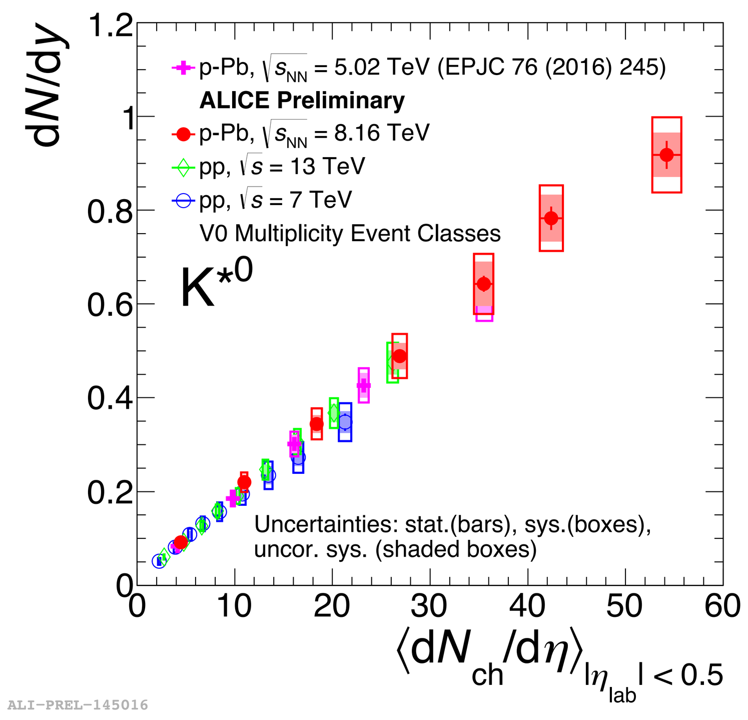
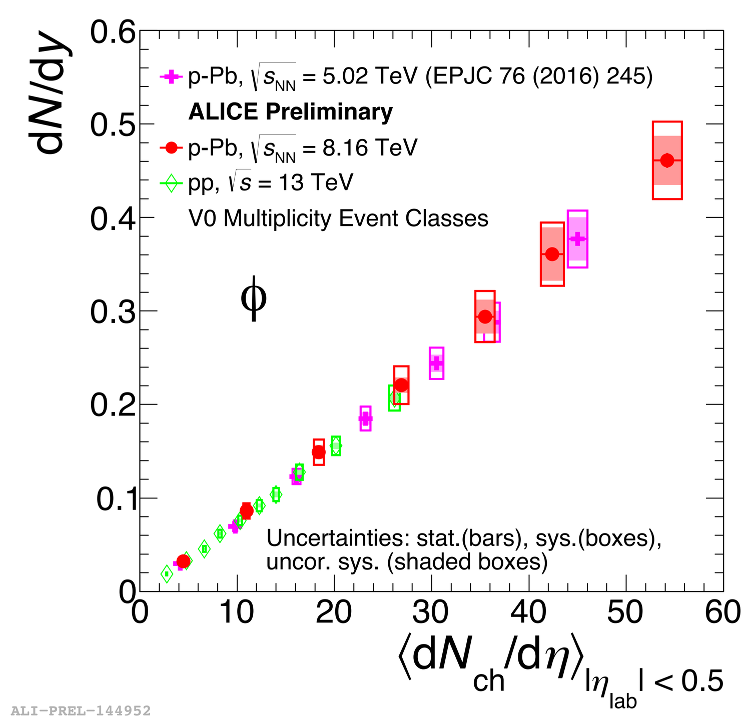
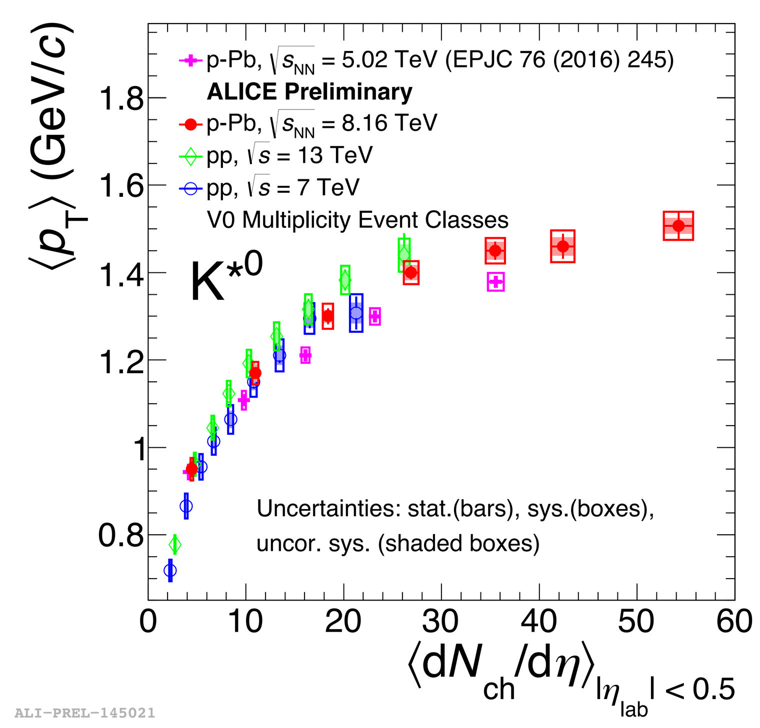
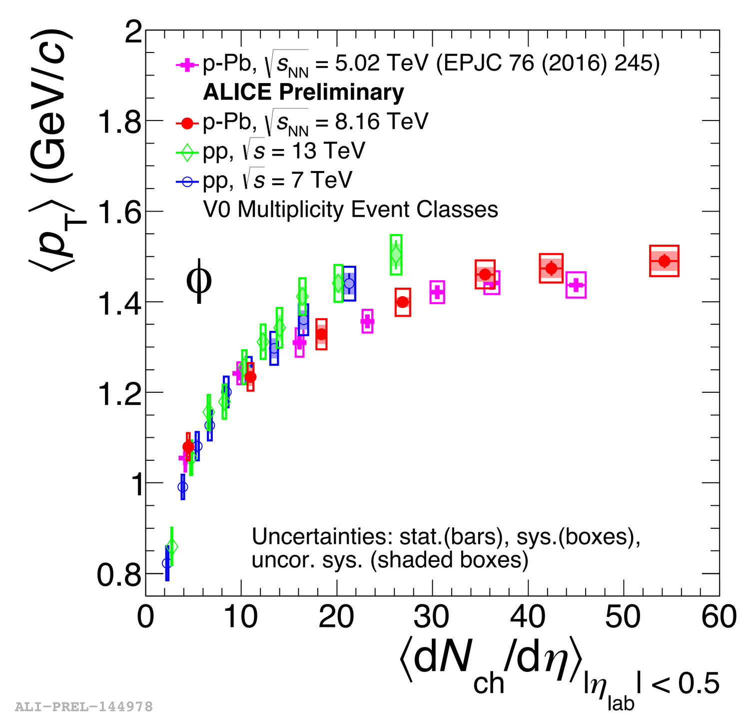



✓ p_T spectra are measured in various multiplicity classes using V0A multiplicity estimator.

✓ Lower panels show ratio of spectra in a given multiplicity class to NSD(0-100%).

✓ Inverse slope of p_T spectra increases with increasing multiplicity for low p_T.

4. dN/dy and $\langle p_T \rangle$

✓ dN/dy (Integrated yield) is obtained in various multiplicity classes.

✓ It increases approximately linear with average charged particle multiplicity.

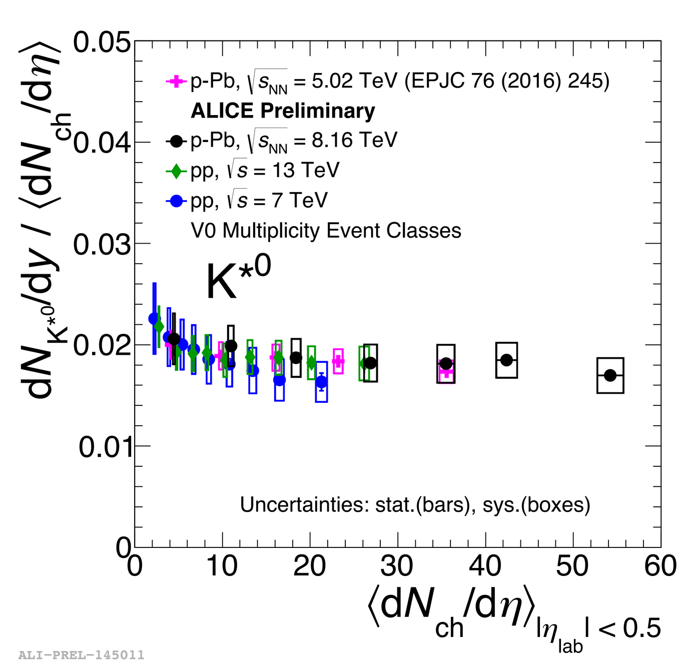
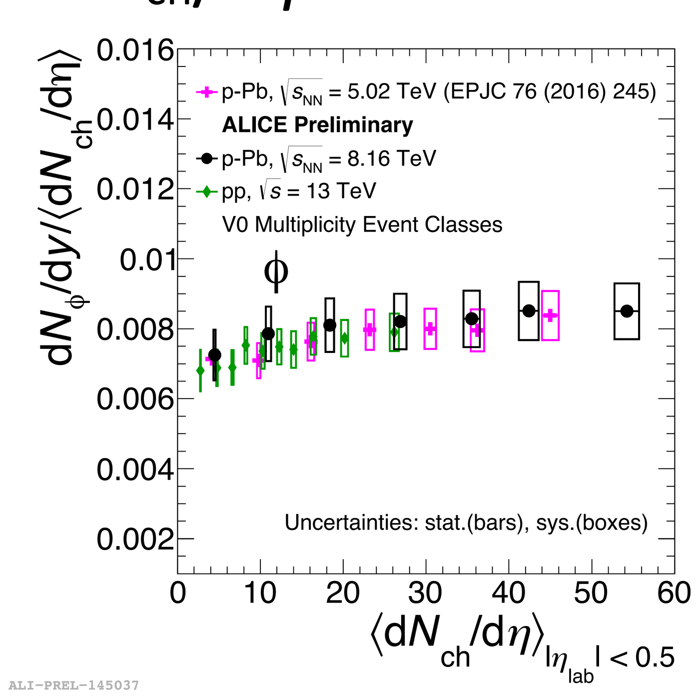
✓ The dN/dy values of K^{*0} and ϕ are consistent with the measurements from other energies and systems for a given $\langle dN_{ch}/d\eta \rangle$.

✓ $\langle p_T \rangle$ (Mean transverse momentum) is obtained in various multiplicity classes.

✓ It increases with average charged particle multiplicity.

✓ At low multiplicity, $\langle p_T \rangle$ of K^{*0} and ϕ increases rapidly, but seems to be saturated at high multiplicity.

5. dN/dy/$\langle dN_{ch}/d\eta \rangle$

✓ To test how the dN/dy scales with multplicity, the results have been normalized to the charged particle multiplicity in a given multiplicity class for the various energies and systems.

✓ Results for various energies and systems show multiplicity independent trend as a function average charged particle multiplicity.

6. Summary

- K^{*0} and ϕ mesons have been measured in p-Pb collisions at 8.16 TeV with ALICE detector at the LHC.
- p_T spectra for high multiplicity events are observed to be harder .
- dN/dy of K^{*0} and ϕ is observed to rise approximately linear with charged particle multiplicity.
- $\langle p_T \rangle$ of K^{*0} and ϕ in low multiplicity change rapidly whereas high multiplicity, no significant increase with charged particle multiplicity.
- Ratio dN/dy/$\langle dN_{ch}/d\eta \rangle$ are seen to be multiplicity independent and show a good agreement with results for pp and p-Pb collisions.

References

1. Adam, J., Adamová, D., Aggarwal, M.M. et al. Eur. Phys. J. C (2016) 76: 245(2016)
2. B. Abelev et al., (ALICE Collaboration), Phys. Rev. C 91, 024609 (2015)