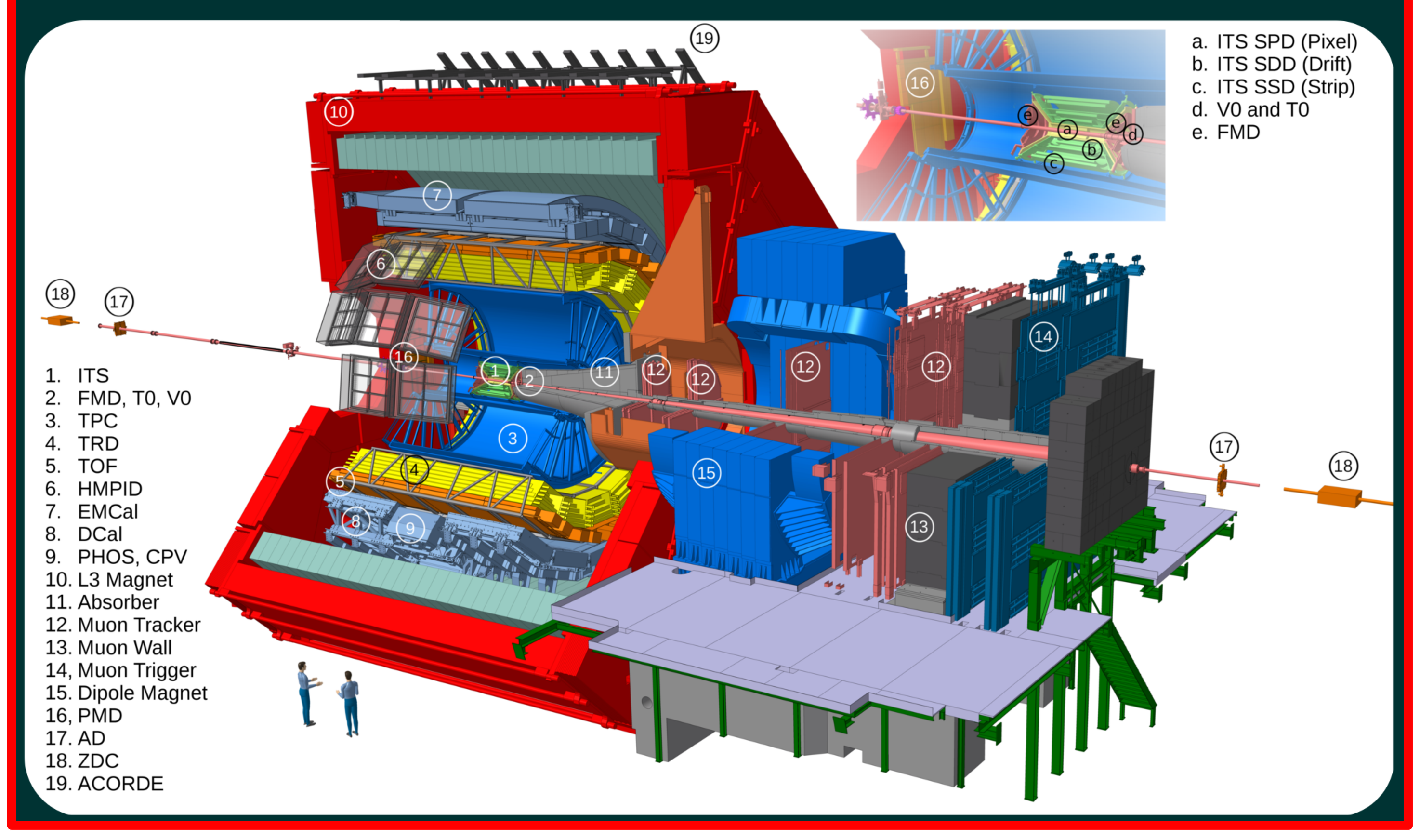
Multiplicity dependence of pion, kaon and proton production in pp collisions at $\sqrt{s}$ = 7 and 13 TeV

Pranjal Sarma *on behalf of the ALICE Collaboration*
Department of Physics, Gauhati University, Guwahati, India

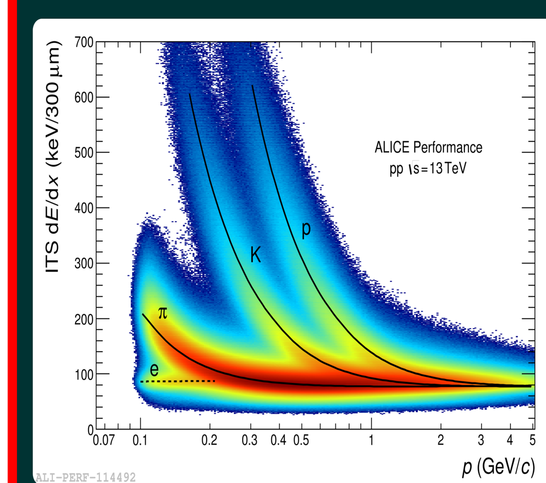
ALICE

Utrecht 2017

ALICE detector



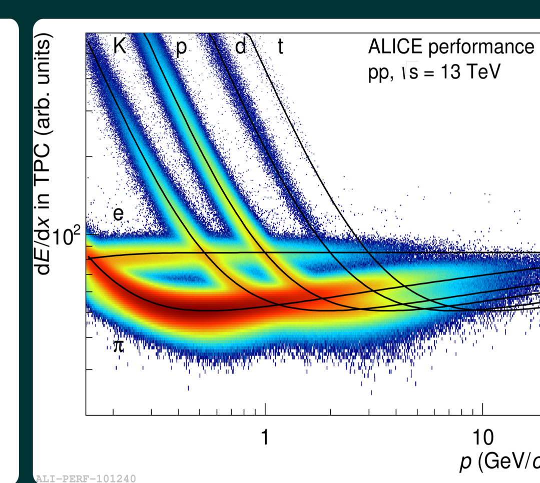
Particle Identification (pp at $\sqrt{s}$ = 13 TeV)



ITS

- Specific energy loss in ITS four outermost layers vs momentum.
- $\sigma_{dE/dx}$ ~ 10%

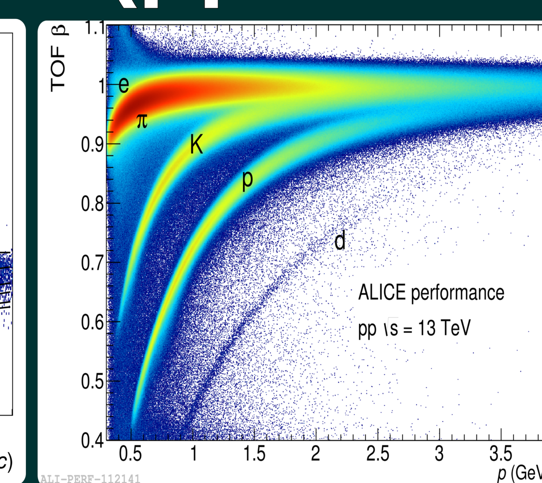
Lines: Parametrisation of the detector response based on a polynomial function at $\beta\gamma \le 0.7$ and a PHOBOS Bethe-Bloch [1] formula at $\beta\gamma > 0.7$.



TPC

- Momentum dependent specific energy loss in TPC.
- $\sigma_{dE/dx}$ ~ 5.5%

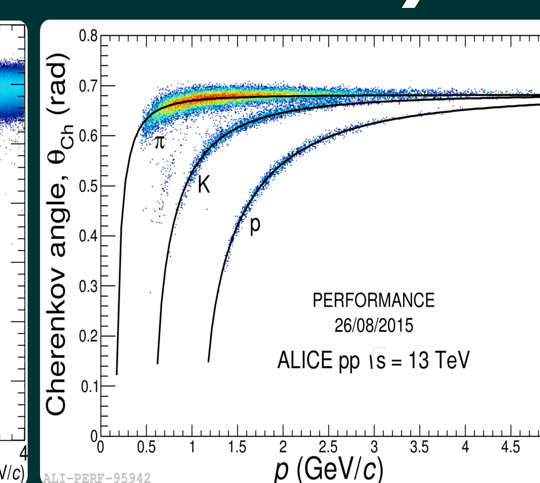
Lines: Bethe-Bloch parametrisation.



TOF

- β vs momentum.
- σ_{TOF} ~ 80 ps

Bands: Different particles species.



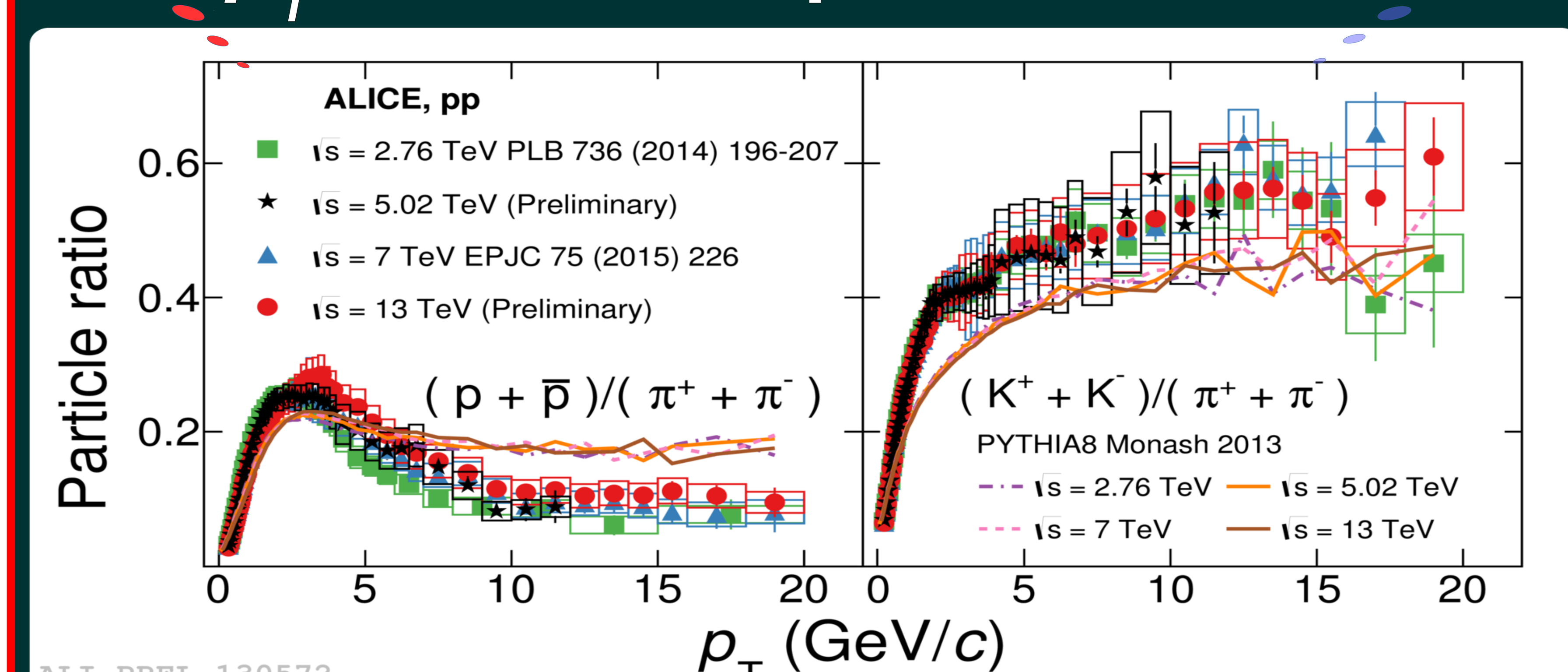
HMPID

- Variation of Cherenkov angle vs momentum.
- $\theta_{Ch} = \cos^{-1}(\sqrt{(p^2+m^2)}/np)$
n = 1.2989

Lines: Expected Cherenkov angle.

p_T-differential particle ratios

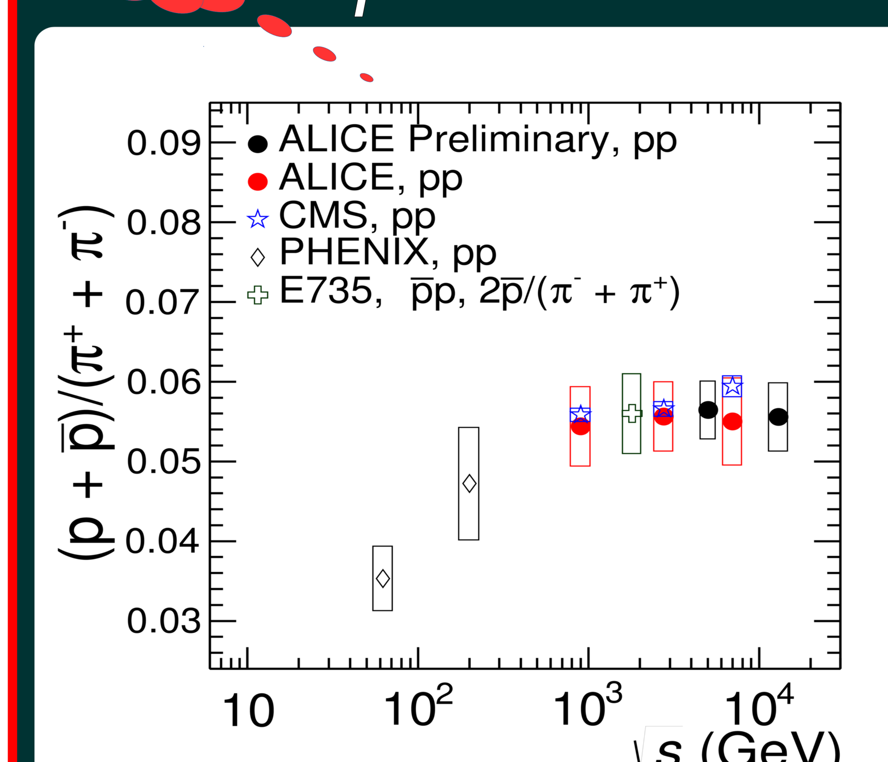
p/π K/π

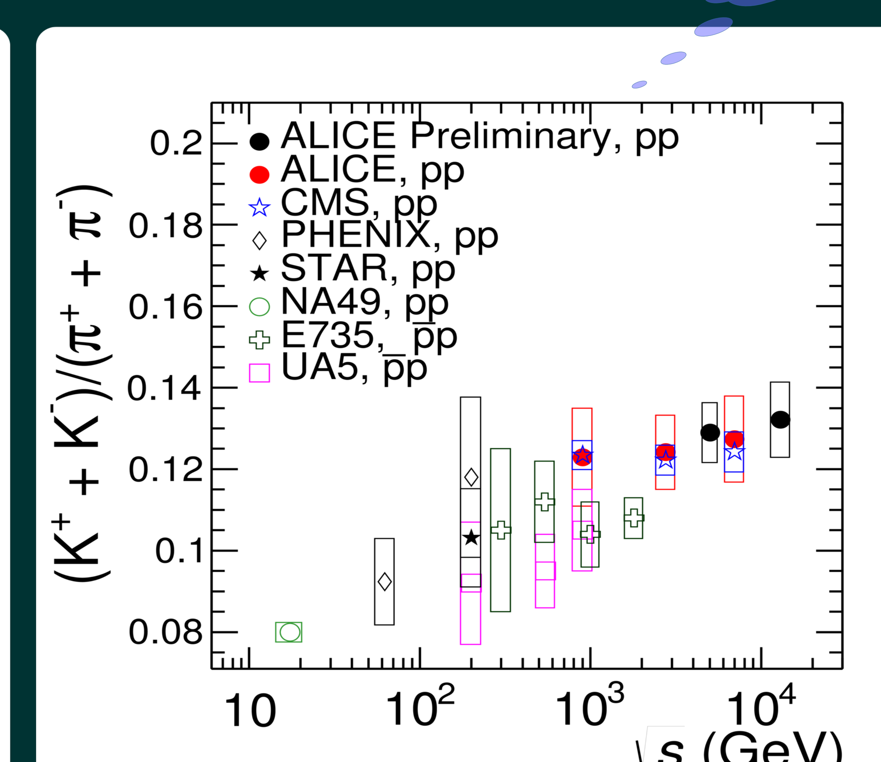


- No significant evolution of p/π and K/π with energy [2, 3].
- The maximum of p/π shifts toward higher p_T, as expected from the multiplicity evolution.
- Models do not satisfactorily describe p/π at high p_T, but qualitatively describe K/π.

p_T-integrated particle ratios

p/π K/π

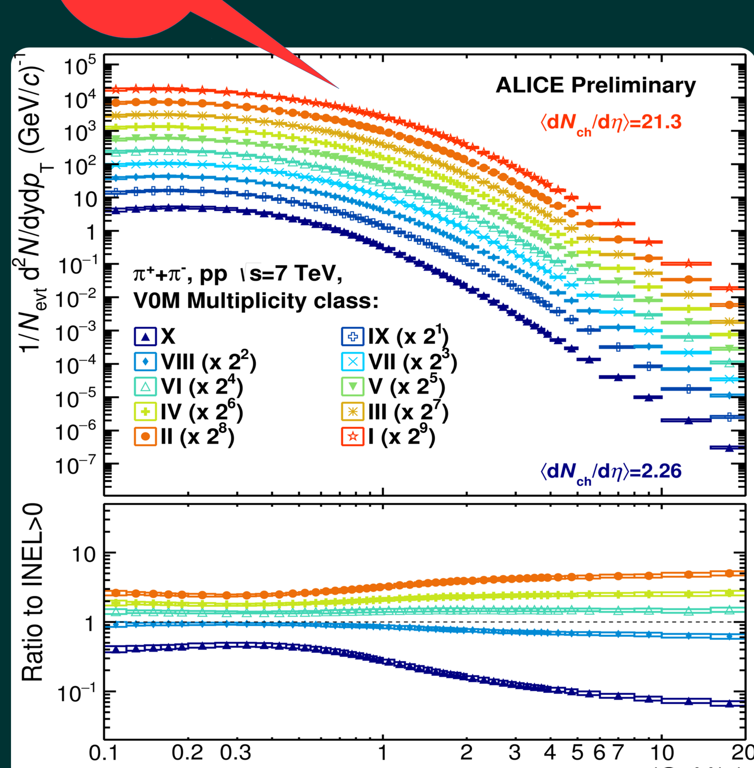


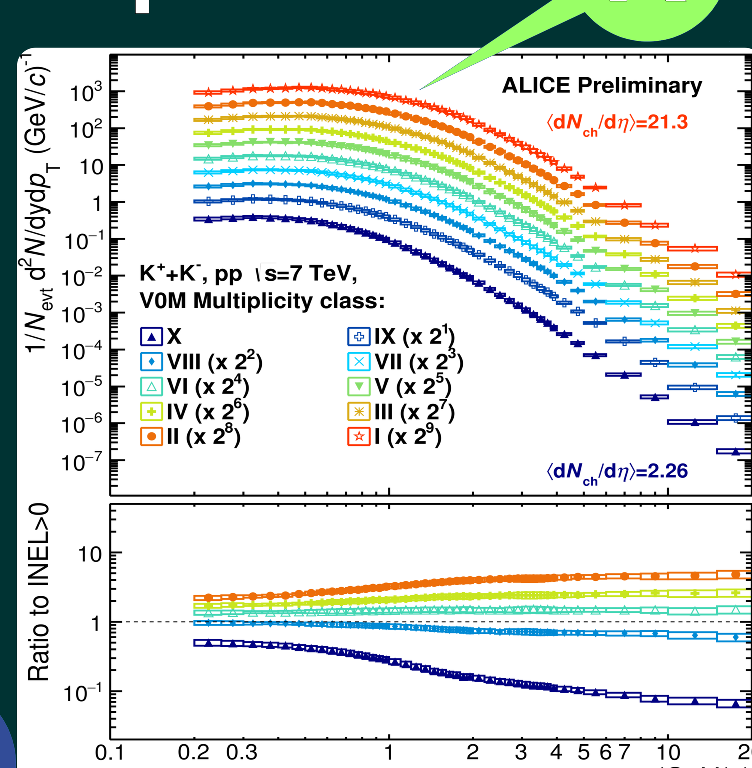


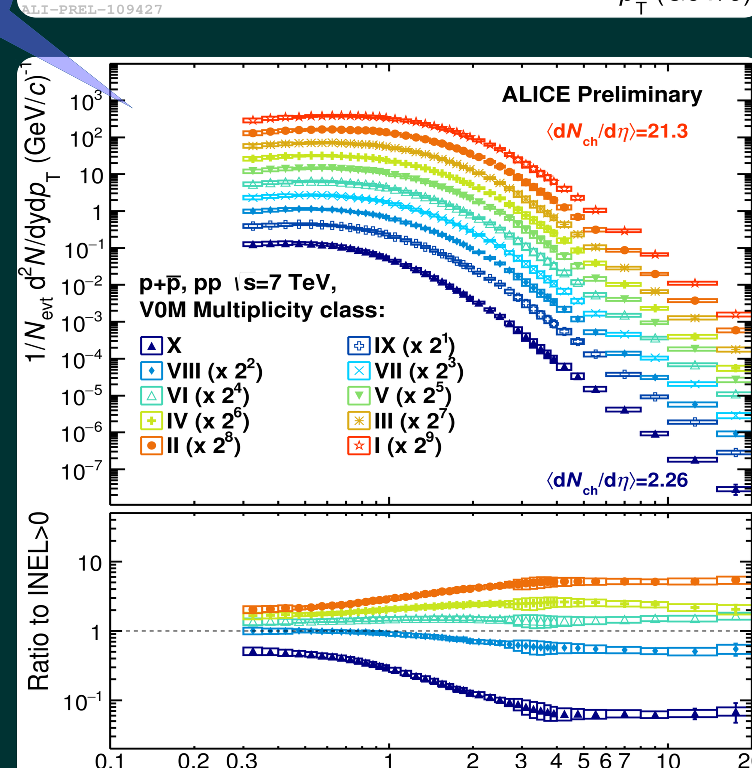
- No significant evolution of the p/π yields ratio at LHC energy.
- Constant above $\sqrt{s}$ = 0.9 TeV.
- Hints of increase of K/π? Not significant given the systematic errors.

p_T spectra for pion, kaon and proton at different multiplicities

π K p





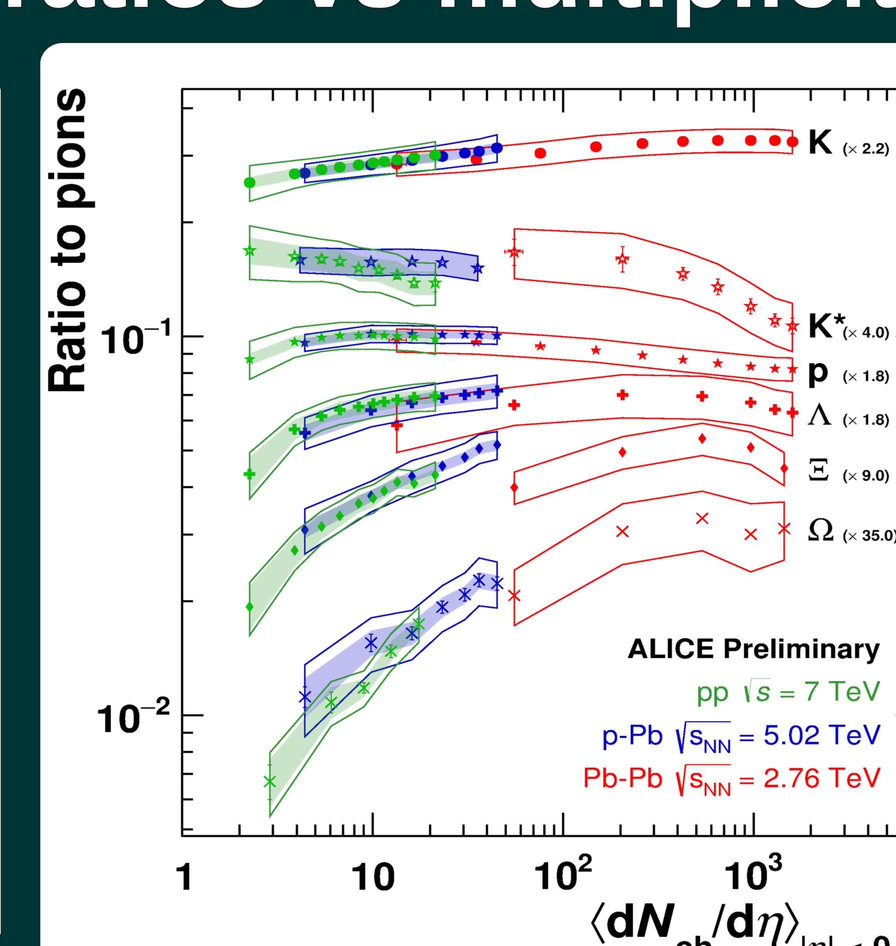


- Forward/Backward multiplicity estimator: V0M (2.8 <η<5.1 & -3.7<η<-1.7)
- Individual spectra obtained by combining PID information from ITS, TPC, TOF and HMPID.

- p_T spectra become harder as multiplicity increases.
- Hardening is more pronounced for higher-mass particles.

Strangeness to π ratios vs multiplicity

- All measured particle ratios exihibit a continuous and smooth trend with multiplicity across different collision systems [4, 5, 6].
- Strange to non-strange particle ratios increase with multiplicity in pp collisions.
- Enhancement increases with strangeness content rather than mass or baryon number of the particles.



Summary & outlook

- At high p_T, p/π and K/π ratios differ significantly from the QCD inspired MC model (PYTHIA 8 Monash [7]).
- Further tuning may be required for models.
- Strangeness production is driven by characteristics of final state rather than initial beam energy or colliding system.
- This work provides additional insights into the collective behaviour in small systems.

••• References •••

[1] PHOBOS Collaboration, Phys. Rev. C 75 (2007) 024910.
[2] ALICE Collaboration, Eur. Phys. J. C 75 (2015) 226.
[3] ALICE Collaboration, Phys. Lett. B 736, (2014) 196-207.
[4] ALICE Collaboration, Nature Physics 13 (2017) 535-539.
[5] ALICE Collaboration, Phys. Rev. C 88 (2013) 044910.
[6] ALICE Collaboration, Phys. Lett. B 728 (2014) 25–38.
[7] T. Sjostrand *et. al.* comp. Phys. Comm. 178 (2008) 852.