Light Flavour Hadron Production in pp Collisions at 13 TeV with ALICE at the LHC

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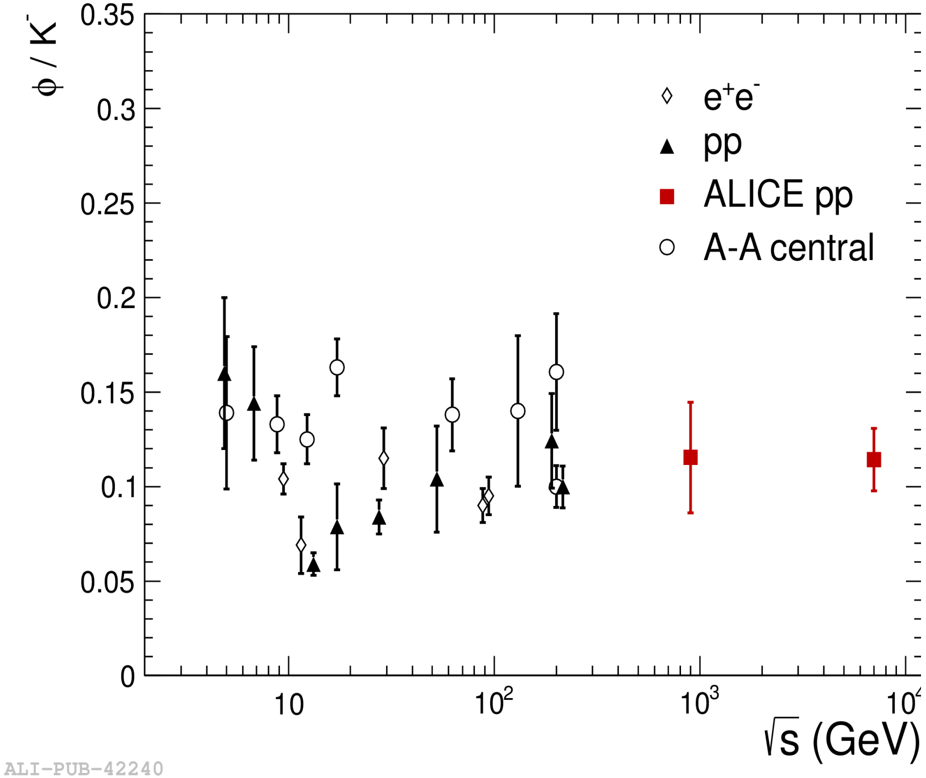
Outline

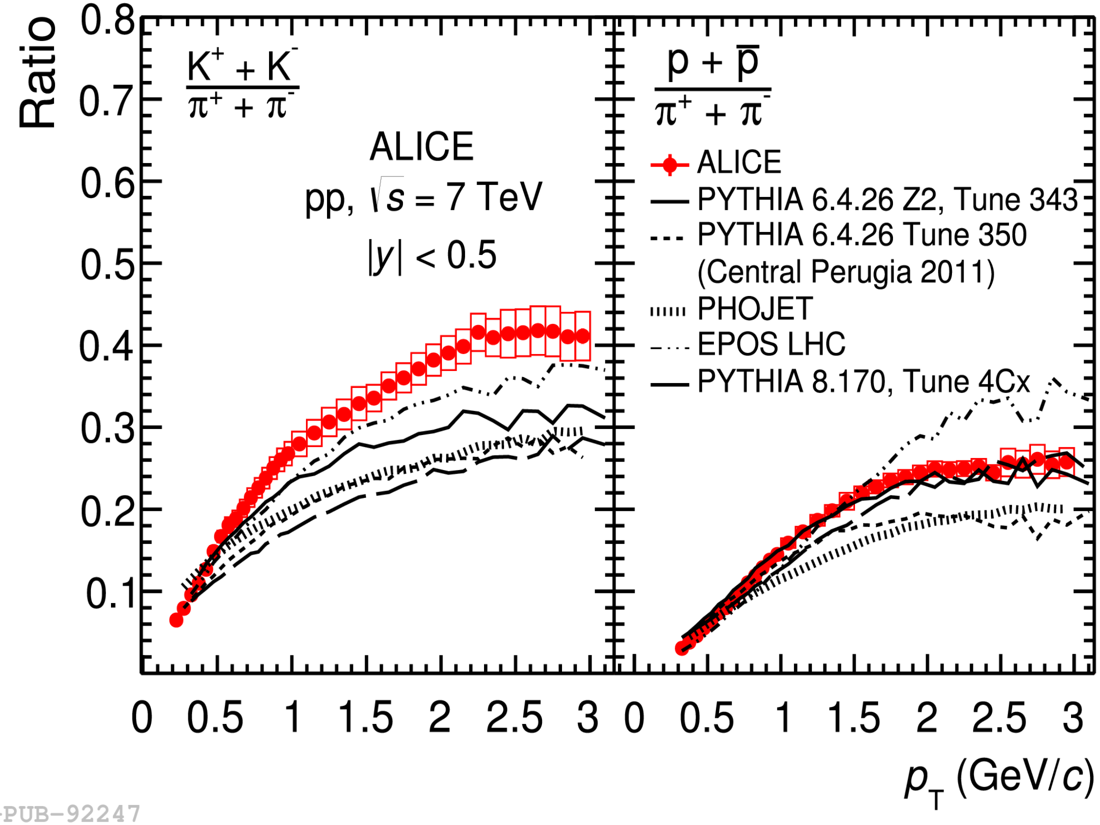
- Motivation
- ALICE Detector
- Particle Identification and Signal Extraction
- Results
  - --Particle Ratios vs. $\sqrt{s}$
  - --Particle Ratios vs. p_T
- Summary

INPC, 11 – 16 September, 2016

Motivation



EPJC 72 (2012) 2183



EPJC 75 (2015) 226

- ϕ/K ratios are observed to be independent of $\sqrt{s}$ in pp collisions at the LHC up to 7 TeV

- It is interesting to determine if this $\sqrt{s}$ independence will continue at 13 TeV

- Event generators describe the shape of the K/π and p/π ratios as a function of p_T but fail to describe these ratios quantatively

ALICE Detector

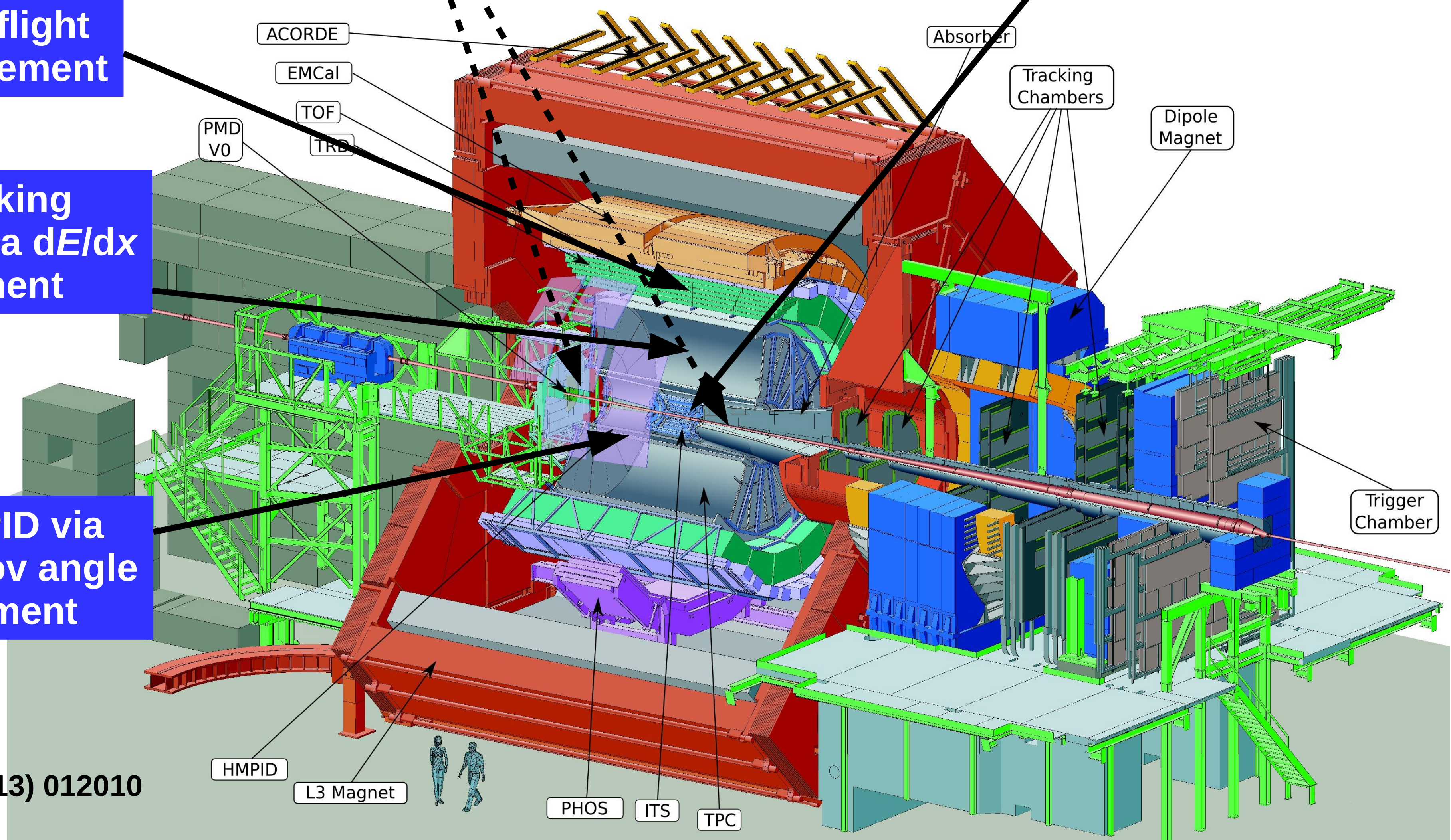
V0: Triggering and multiplicity estimation

ITS: Tracking, vertexing and PID via dE/dx measurement

TOF: PID via time of flight measurement

TPC: Tracking and PID via dE/dx measurement

HMPID: PID via Cherenkov angle measurement



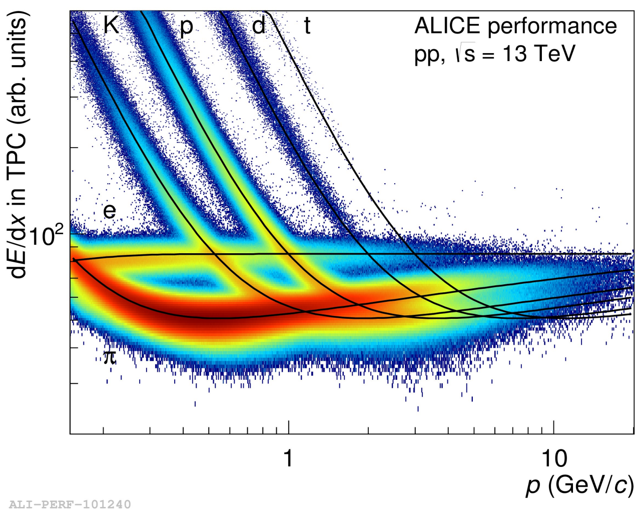
JPCS 455 (2013) 012010

Identification of π, K, p

ITS

dE/dx ∝ $1/\beta^2$

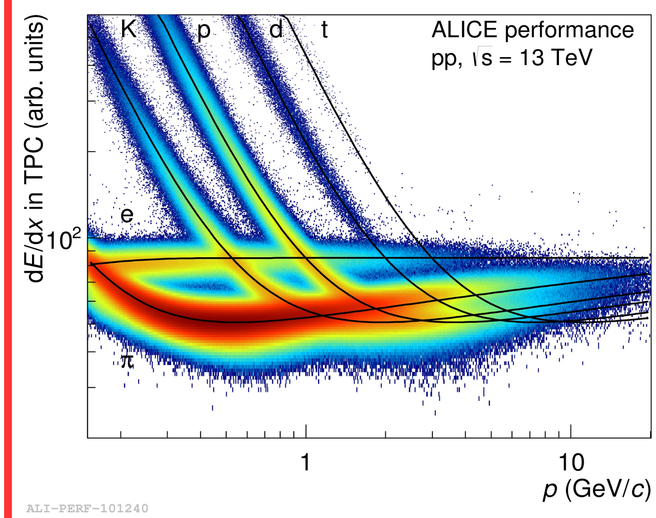
$\beta = 1/\sqrt{(1+m^2/p^2)}$



TPC

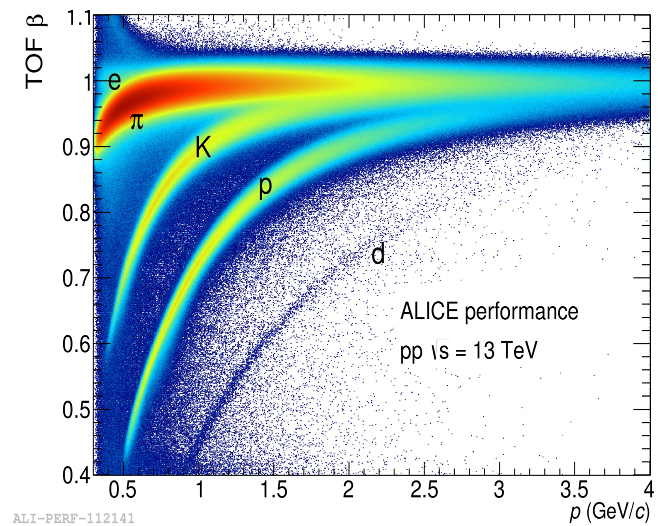
dE/dx ∝ $1/\beta^2$ (low p_T)

dE/dx ∝ log(βγ) (high p_T)



TOF

β = *L*/*t*



Data Set:

pp 13 TeV

Run II (2015)

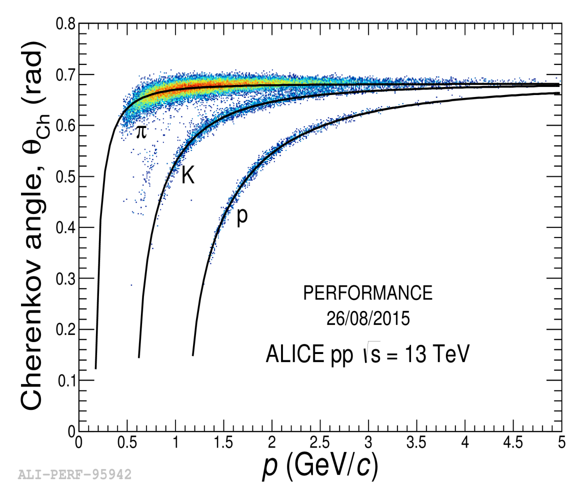
Trigger: Minimum Bias

Analyzed events: ~48M

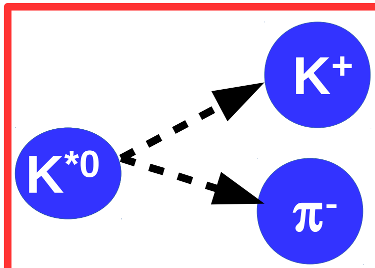
HMPID

$\cos\theta_{ch}$ ∝ 1/nβ

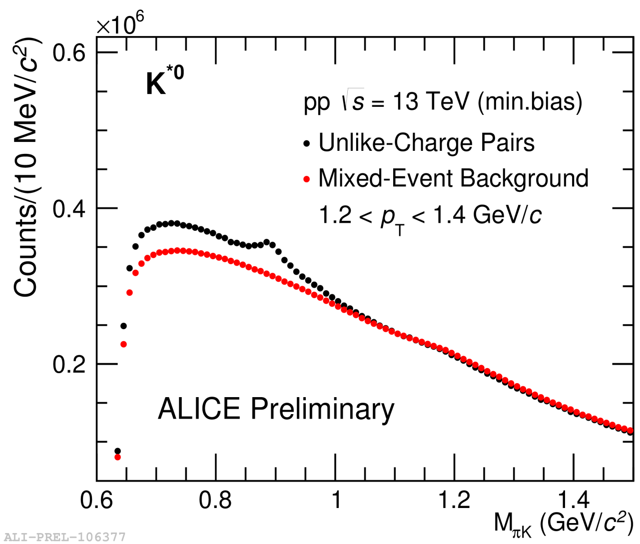
n = refractive index

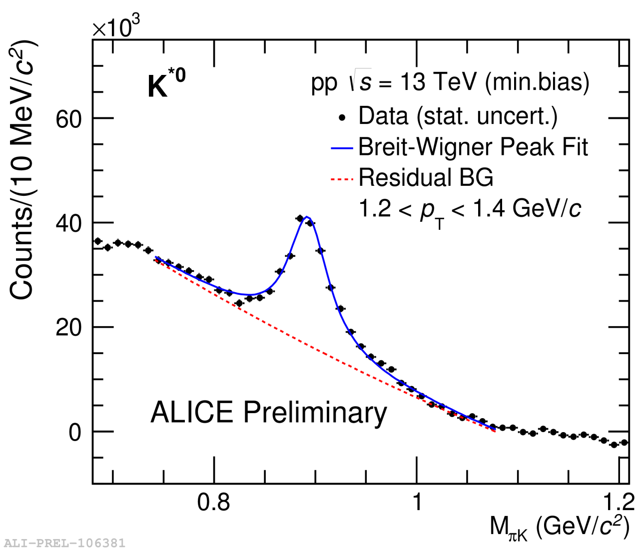


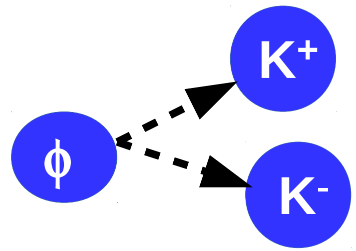
Invariant Mass Reconstruction



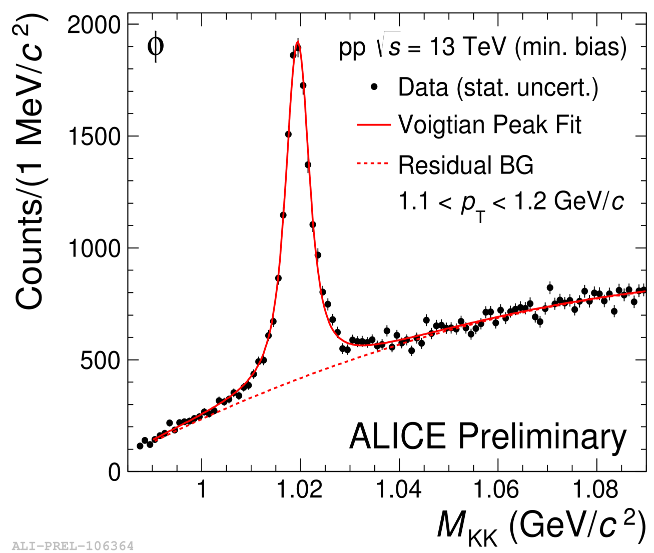
BR: 66.6%
M = 0.896 GeV/c^2

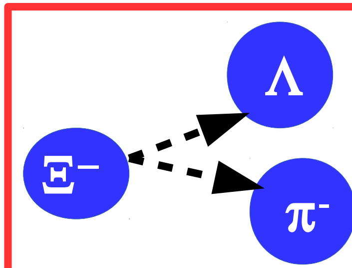




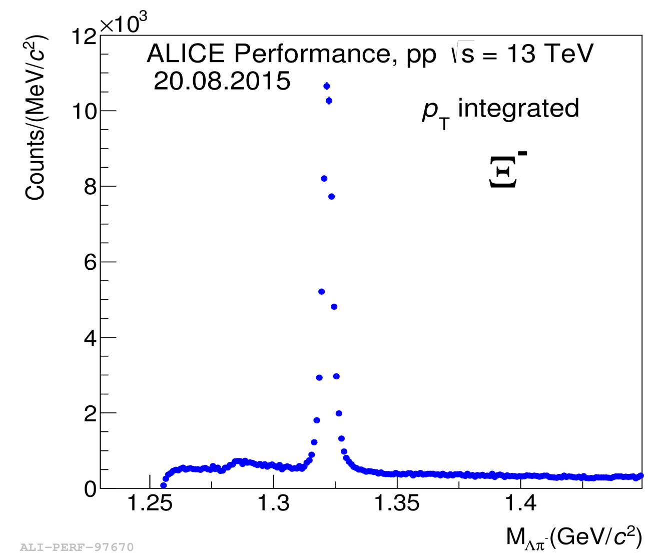


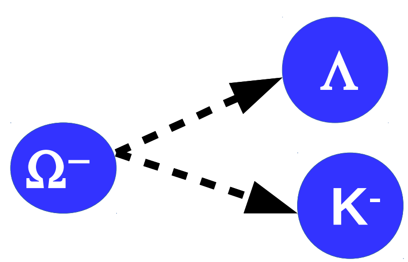
BR: 48.9%
M = 1.019 GeV/c^2



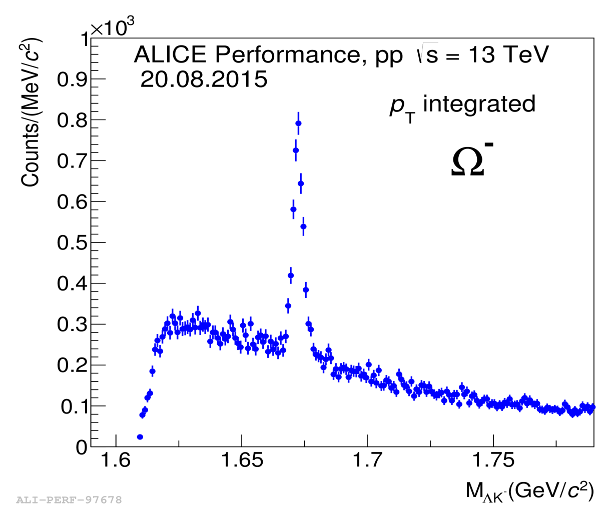


BR: 99.9%
M = 1.3217 GeV/c^2

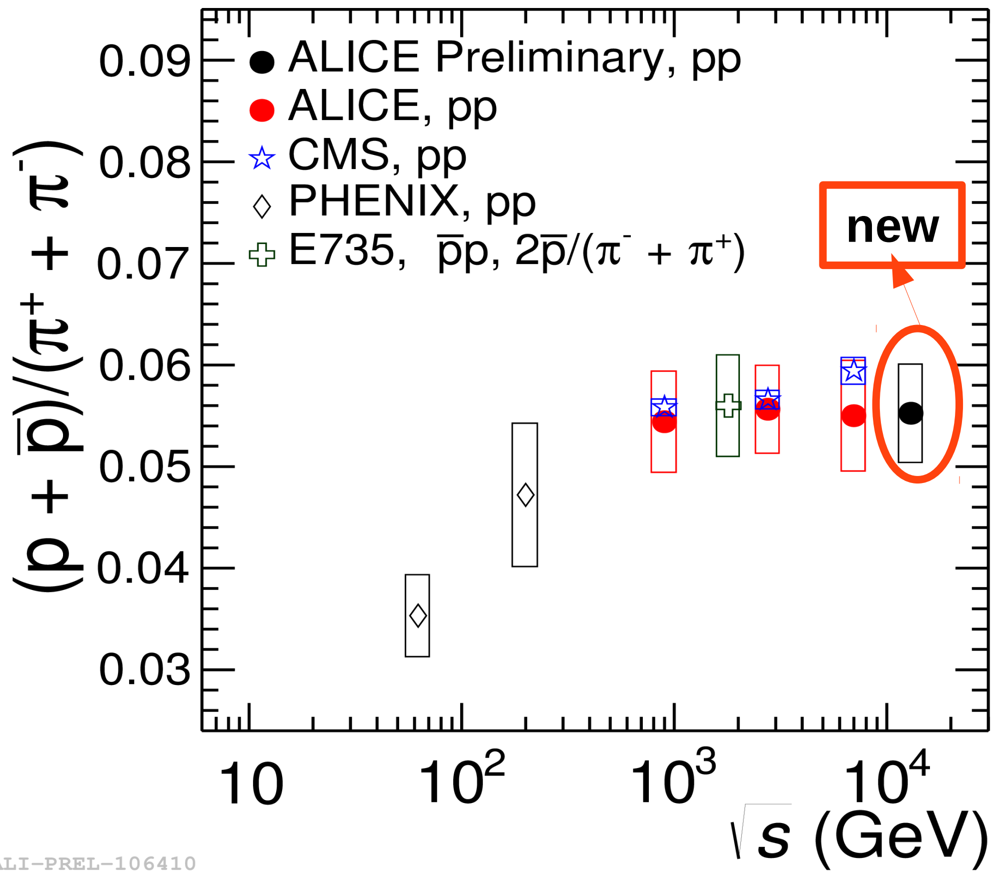


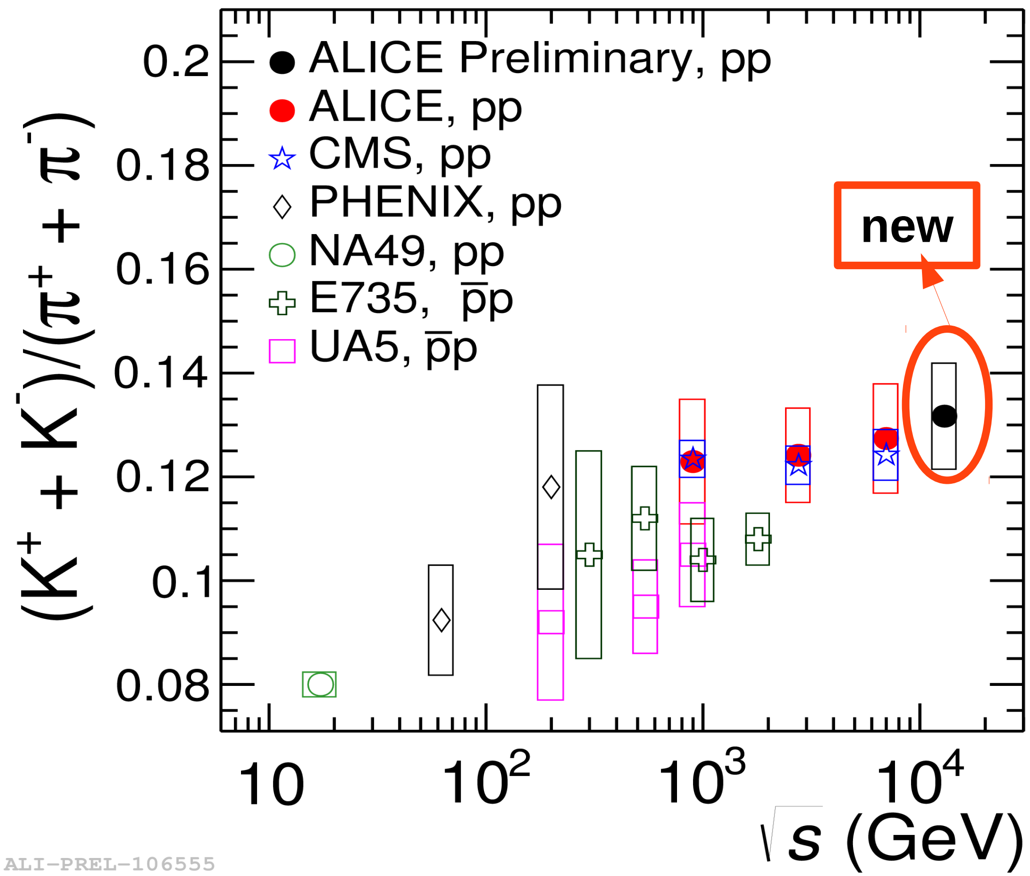


BR: 67.8%
M = 1.67245 GeV/c^2



Particle Ratios vs √s

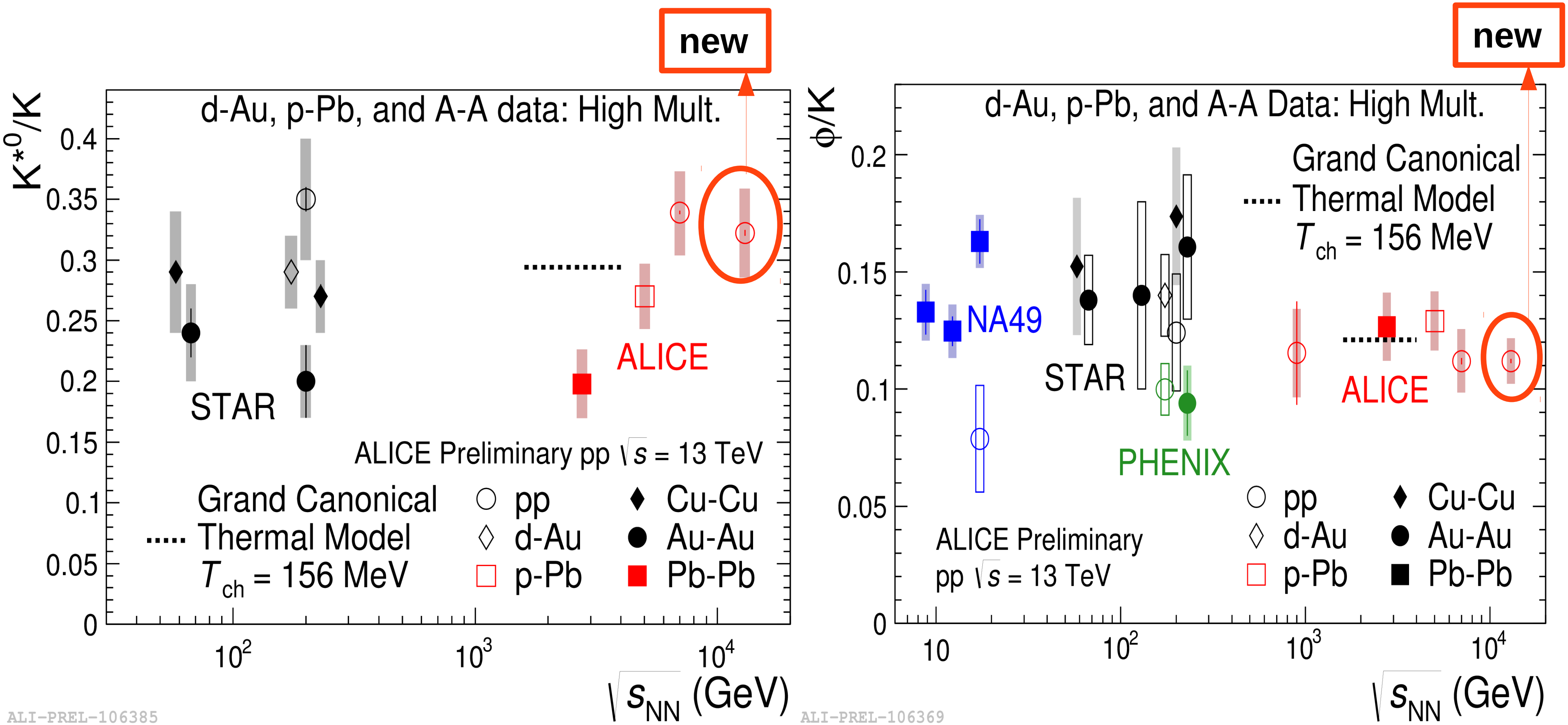




EPJC 71 (2011) 1655
PLB 736 (2014) 196
EPJC 75 (2015) 226

- K/π and p/π ratios remain constant for √s ≥ 900 GeV

Particle Ratios vs √s

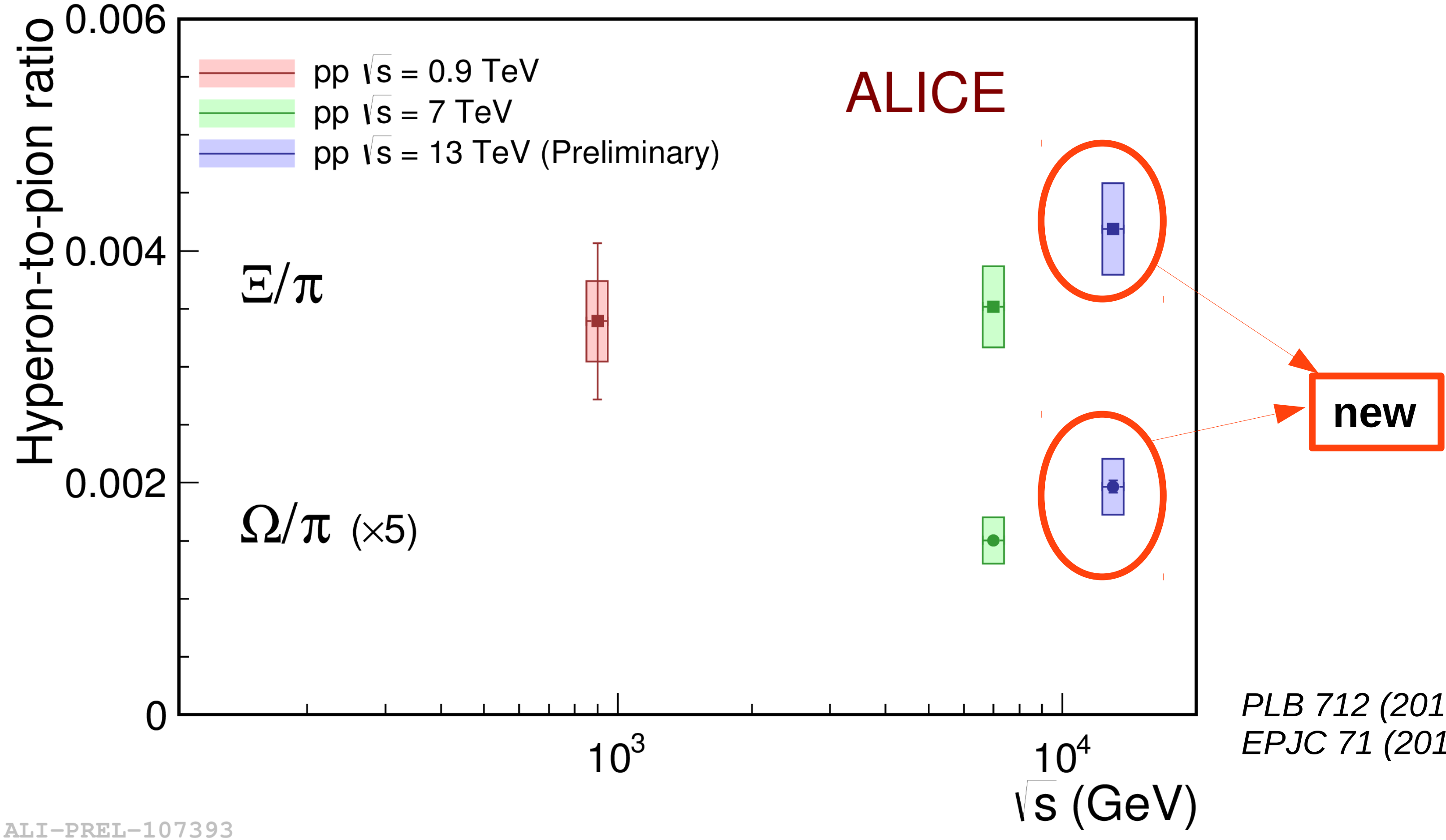


- Resonance to stable hadron ratios remain constant as a function of √s in pp collisions

- Decrease of K^{*0}/K ratio in heavy-ion collisions with respect to pp collisions can be understood as hadronic medium effect

EPJC 71 (2011) 1594
EPJC 72 (2012) 2183
PRC 91 (2015) 024609
EPJC 76 (2016) 245

Particle Ratios vs √s



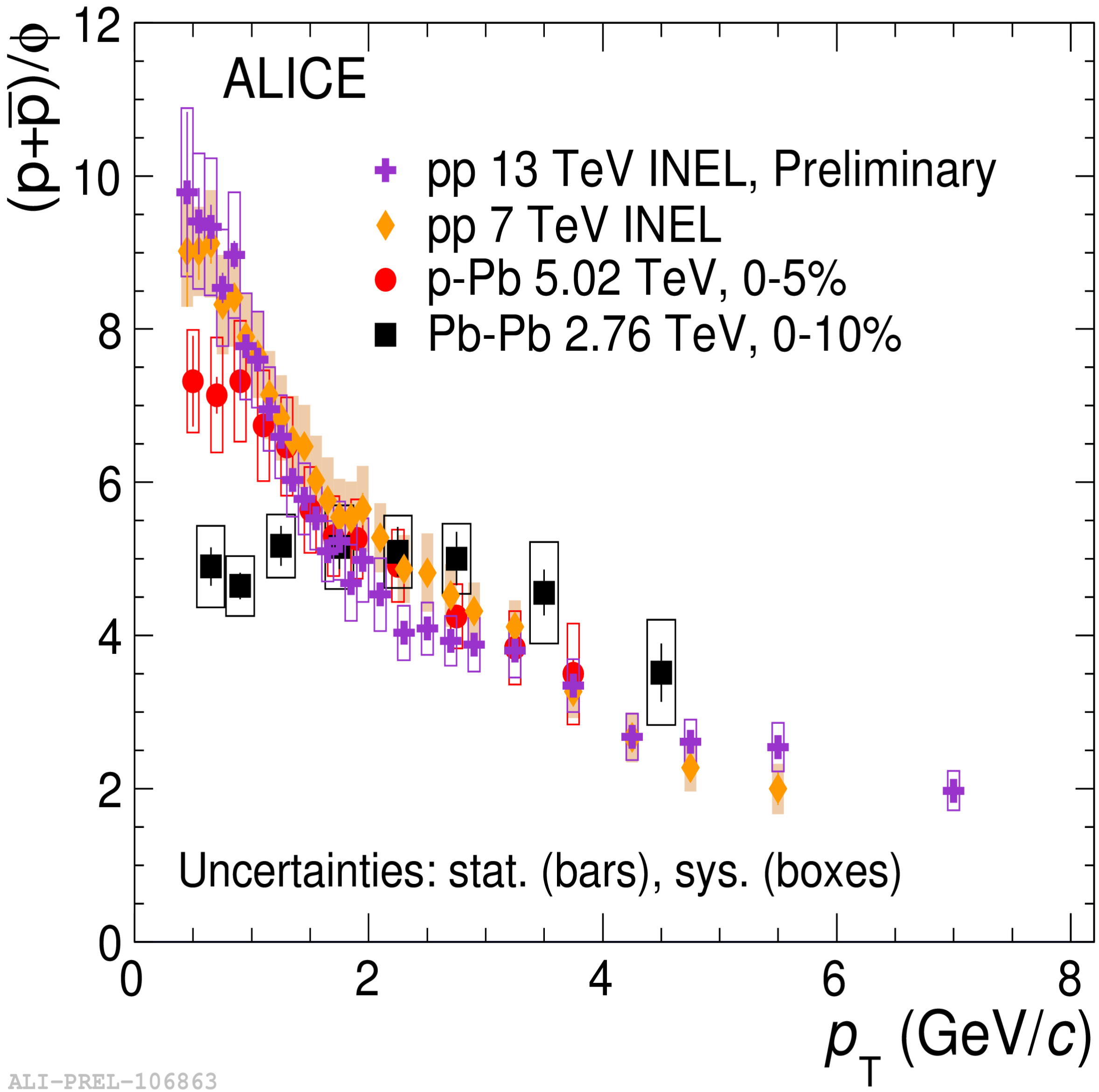
PLB 712 (2012) 309
EPJC 71 (2011) 1594

- The increase of hyperon-to-pion ratios as a function of multiplicity has been observed in pp collisions at √*s* = 7 TeV *arXiv:1606.07424*
- In minimum bias pp collisions at √*s* = 13 TeV ratios are slightly larger compared to lower energies

➔ Is it due to the increase in $<N_{ch}>$?

--- Investigated further by studying multiplicity dependence of ratios in pp collisions at √*s* = 13 TeV

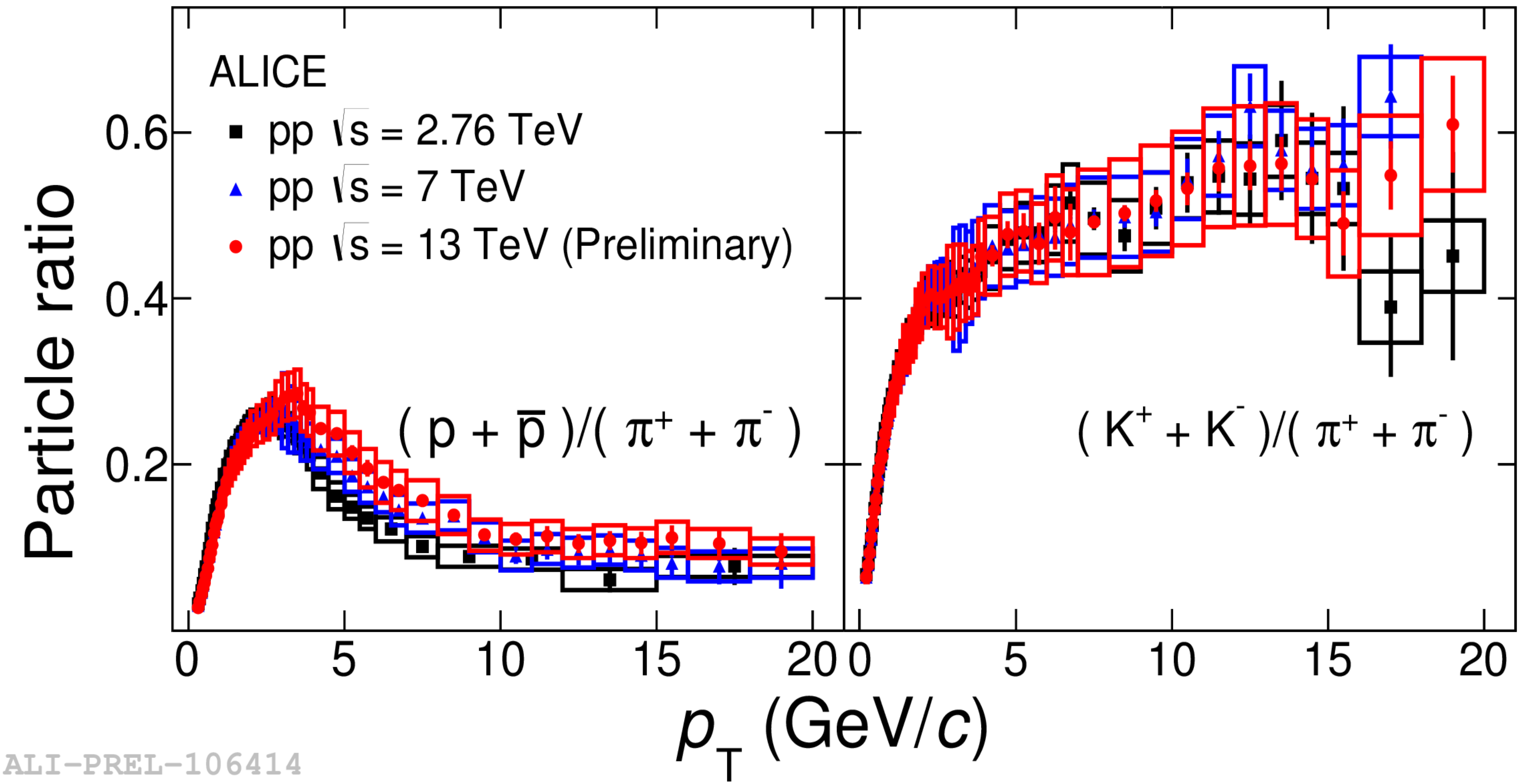
Particle Ratio vs p_T



- pp collisions:
  - -- p/ϕ ratios are similar at $\sqrt{s}$ = 7 TeV and 13 TeV
  - -- Decrease with increasing p_T
- Pb-Pb central collisions:
  - -- p/ϕ ratio is flat for p_T < 4 GeV/c
  - -- Consistent with hydrodynamic evolution
- High-multiplicity p-Pb collisions:
  - -- Same p/ϕ ratio as in pp collisions for p_T > 1 GeV/c
  - -- Flattening for p_T < 1 GeV/c
  - (hint of collective behaviour in small systems like p-Pb?)

PRC 91 (2015) 024609
EPJC 76 (2016) 245

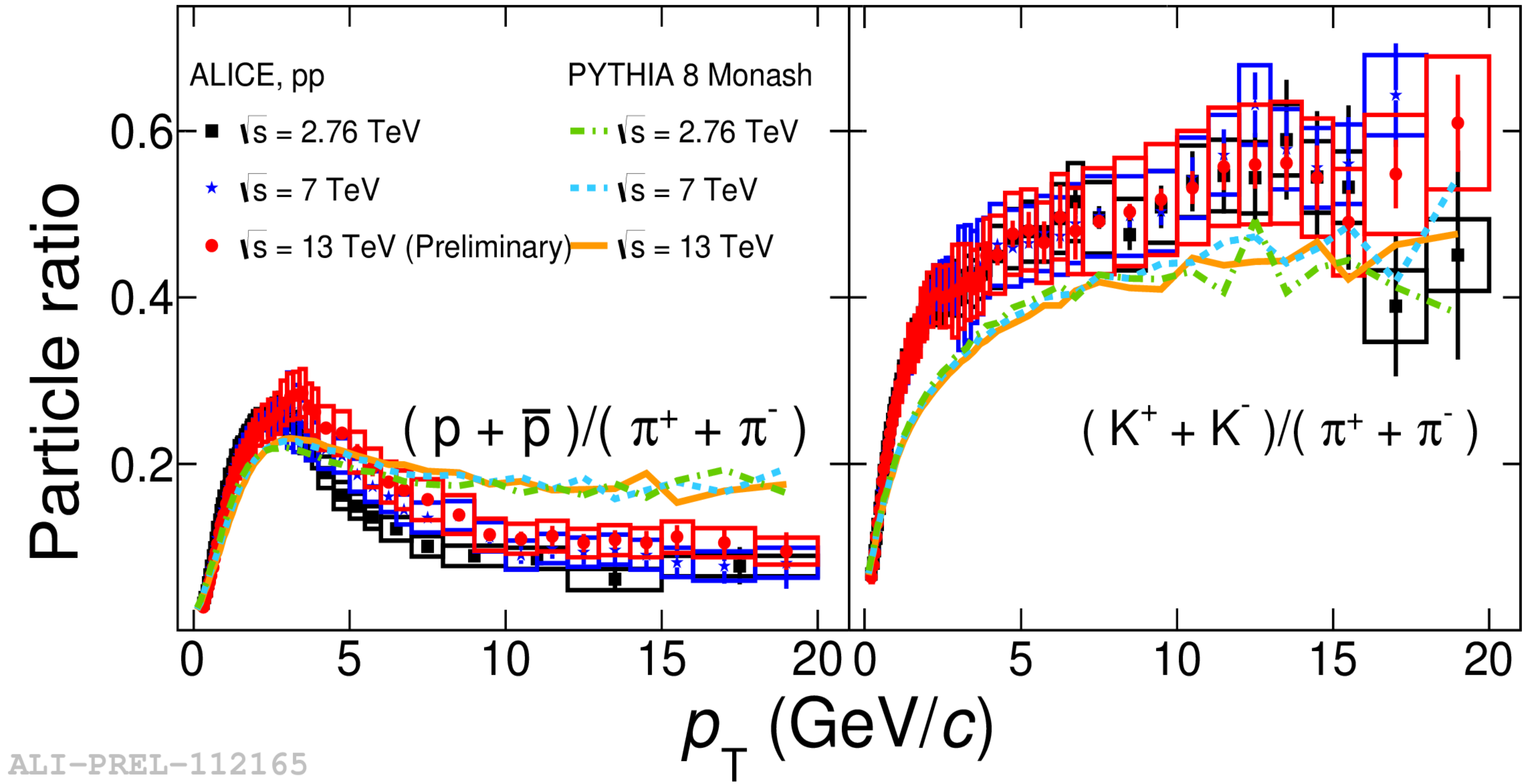
Particle Ratios vs p_T



PLB 736 (2014) 196
EPJC 75 (2015) 226

- p/π ratio shifts towards higher p_T for higher √s
- K/π ratio shows no significant modification

Model Comparison



PLB 736 (2014) 196
EPJC 75 (2015) 226

- Pythia 8 describes the p_T dependence of ratios qualitatively

Summary

- First identified particle measurements in pp collisions at $\sqrt{s}$ = 13 TeV

- p/π, K/π, K^{*0}/K, ϕ/K ratios do not show any significant energy dependence for $\sqrt{s} \geq 900$ GeV

- Ξ^-/π and Ω^-/π ratios show a slight increase compared to lower energy measurements

- No flattening is observed for p/ϕ ratio as a function of p_T in inelastic pp collisions

Next steps:

- Study the multiplicity dependence of particle production in pp at 13 TeV, with special focus on the strangeness sector where ALICE has recently observed an increase of strange particle production with multiplicity *arXiv:1606.07424*

THANK YOU