Energy dependence of particle production and R_{AA} in Pb–Pb collisions with ALICE

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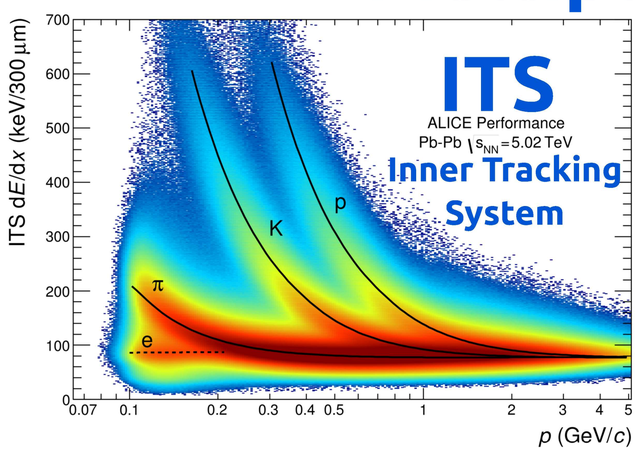
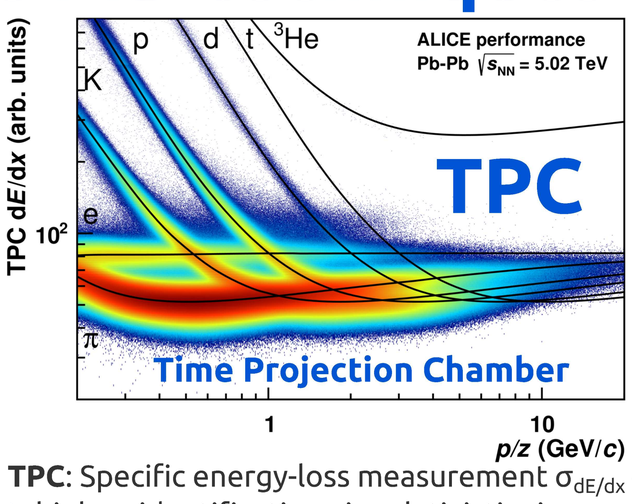
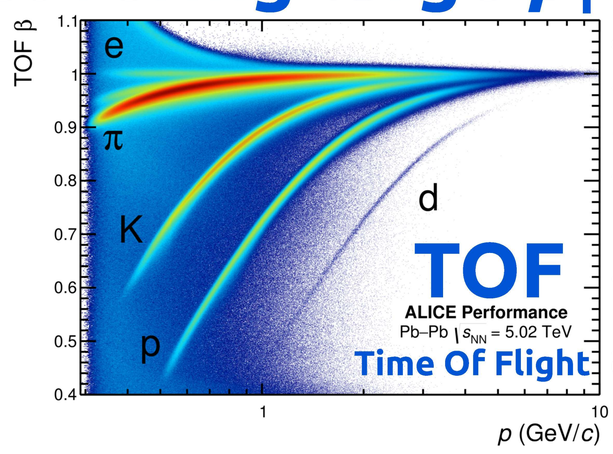
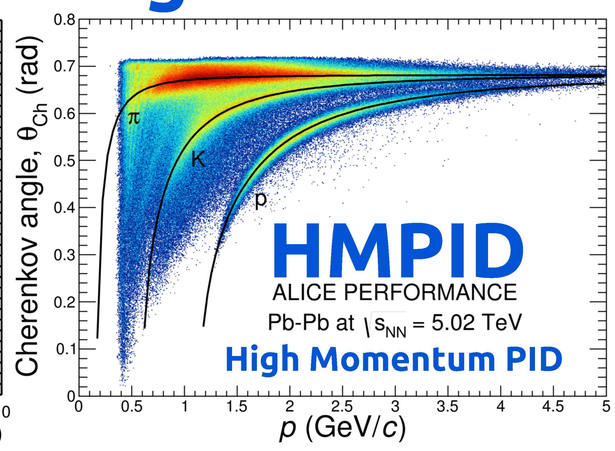
Multiple PID techniques covering large p_T range









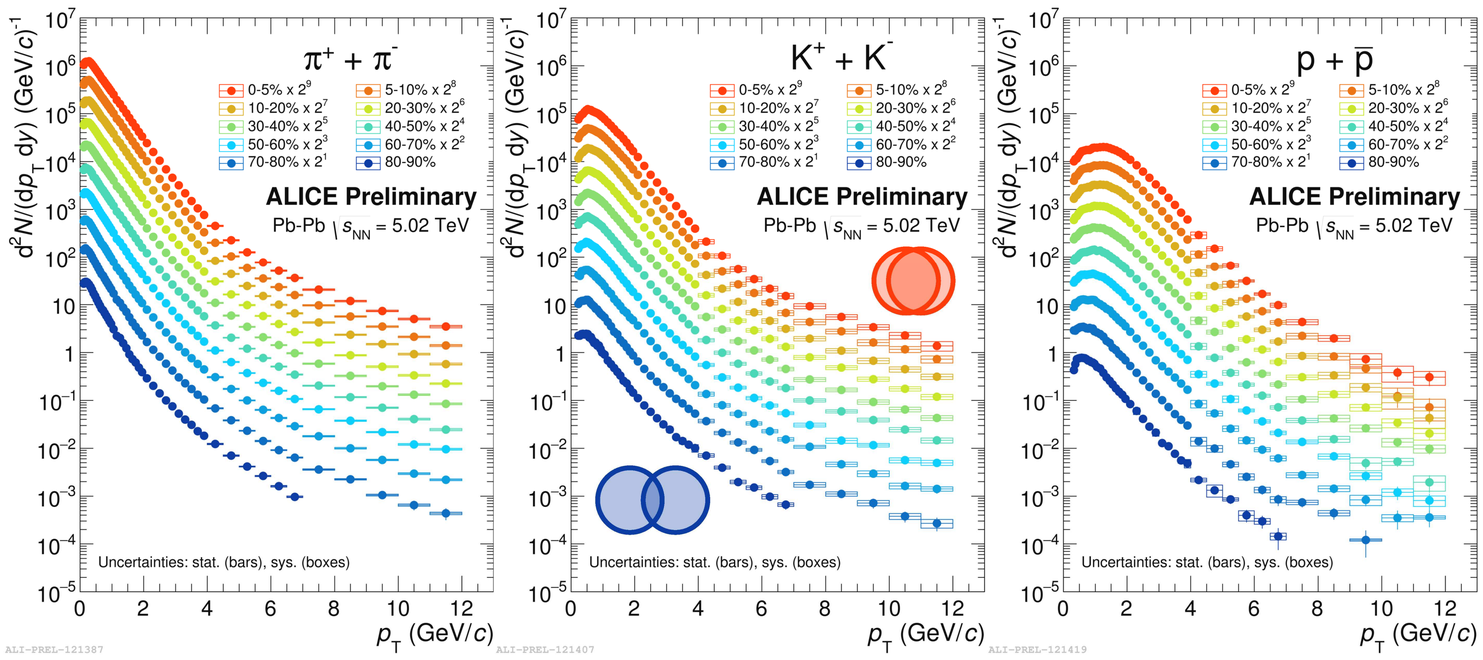
ITS: Specific energy-loss measurement
- 4 measurements, one per sensible layer
- $100 < p_T < 600$ MeV/c

TPC: Specific energy-loss measurement $\sigma_{dE/dx} \sim 5\%$
- high-p_T identification via relativistic rise
- $200 < p_T < 600$ MeV/c, $4 < p_T < 12$ GeV/c

TOF: identification via β measurement
- $\sigma_{TOF} \sim 60$ ps
- 500 MeV/$c < p_T < 4.5$ GeV/c

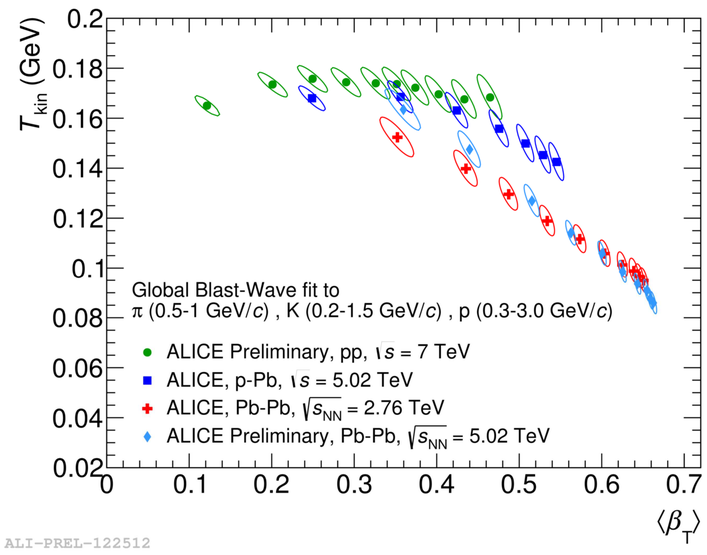
HMPID: measurement of the Cherenkov angle for identification at high p_T
- $1.5 < p_T < 6$ GeV/c

Identified particle spectra



Spectra become progressively harder as centrality increases.
Heavier particles show harder spectra (mass ordering) as expected from hydrodynamics
→ **Effect of the *Radial flow***

Blast-Wave fits



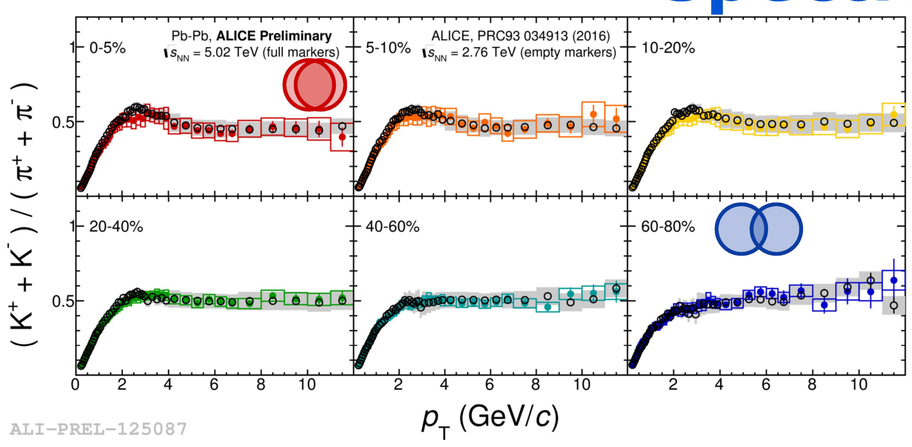
$$E\frac{d^3N}{dp^3} \propto \int_0^R m_T I_0\left(p_T \sinh(\rho)/T_{Kin}\right) K_1\left(m_T \cosh(\rho)/T_{Kin}\right) r dr$$

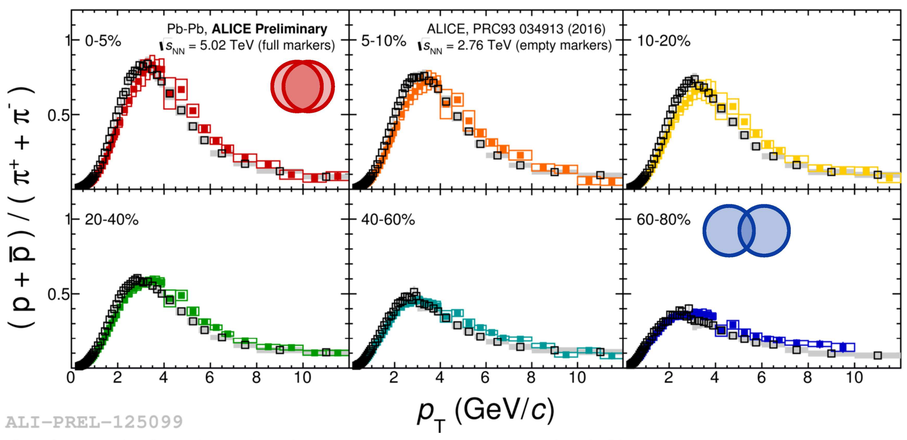
$$m_T = \sqrt{m^2 + p_T^2} \quad \rho = \tanh^{-1}(\beta_T) \quad \beta_T = \beta_s (r/R)^n \quad [1]$$

3 parameter simplified hydrodynamic model:
- β_T → radial expansion velocity
- T_{Kin} → kinetic freeze-out
- n → velocity profile

- Largest radial flow measured for central collisions at $\sqrt{s_{NN}} = 5.02$ TeV
- Events at similar energy show similar flow at the same multiplicity

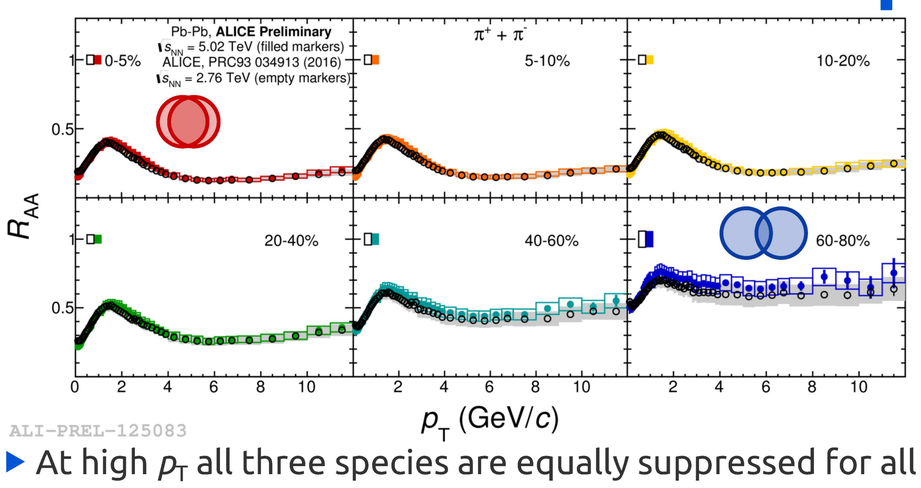
Spectra ratios

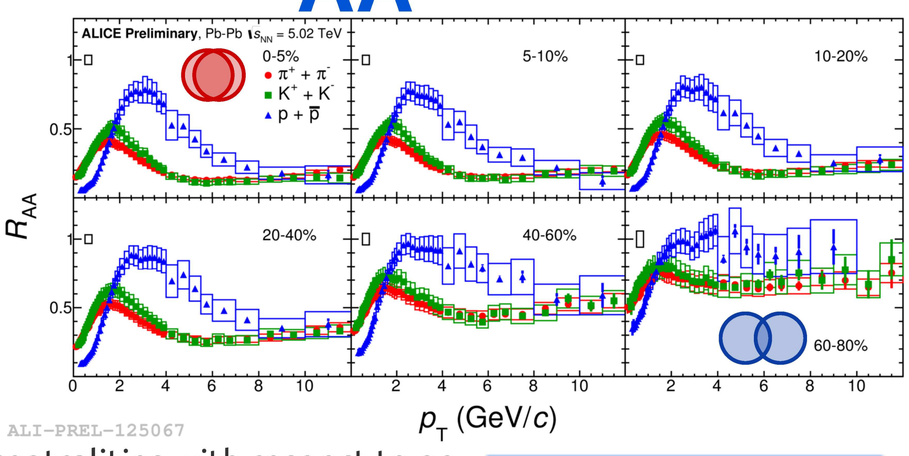




No significant change between the two energies, but the maximum of p/π is shifted to higher p_T → **Larger radial flow**

Identified particle R_{AA}

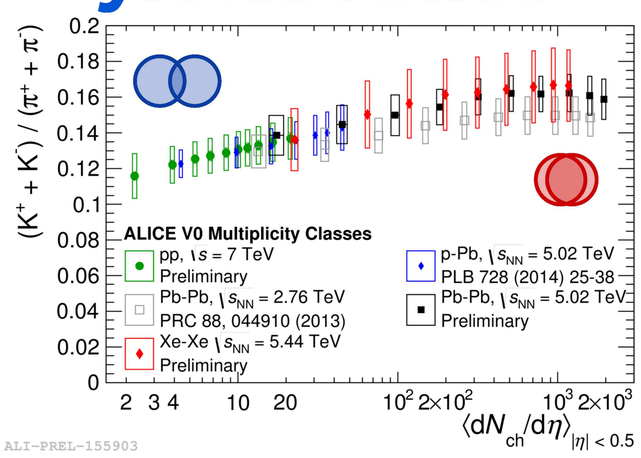


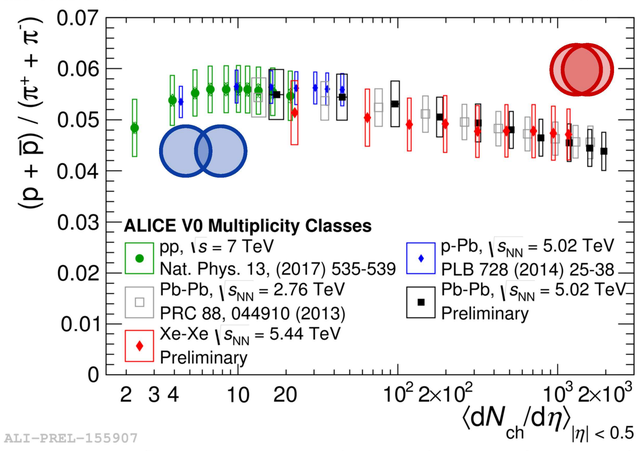


- At high p_T all three species are equally suppressed for all centralities with respect to pp
- High p_T (light–)flavor independent energy loss already observed at $\sqrt{s_{NN}} = 2.76$ TeV

$$R_{AA} = \frac{1}{N_{coll}^{AA}} \frac{dN^{AA}/dydp_T}{dN^{pp}/dydp_T}$$

NEW! Integrated yields ratios





- No significant energy dependence observed
→ **same trends observed at 2.76 TeV**
- Hint of increase in the K/π ratio not significant given the present uncertainties
→ **Xe-Xe measurements agree with Pb-Pb**
- Consistent K/π and p/π measured in peripheral Pb–Pb and high-multiplicity pp and p–Pb collisions
→ **multiplicity is a common scaling quantity**

References

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2. J. Adam et al. Phys. Rev. C 93, 034913 (2016)
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4. Abelev, B. et al. Phys. Rev. C 88, 044910 (2013)
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