Hadronic resonance production in small collision systems with ALICE at the LHC

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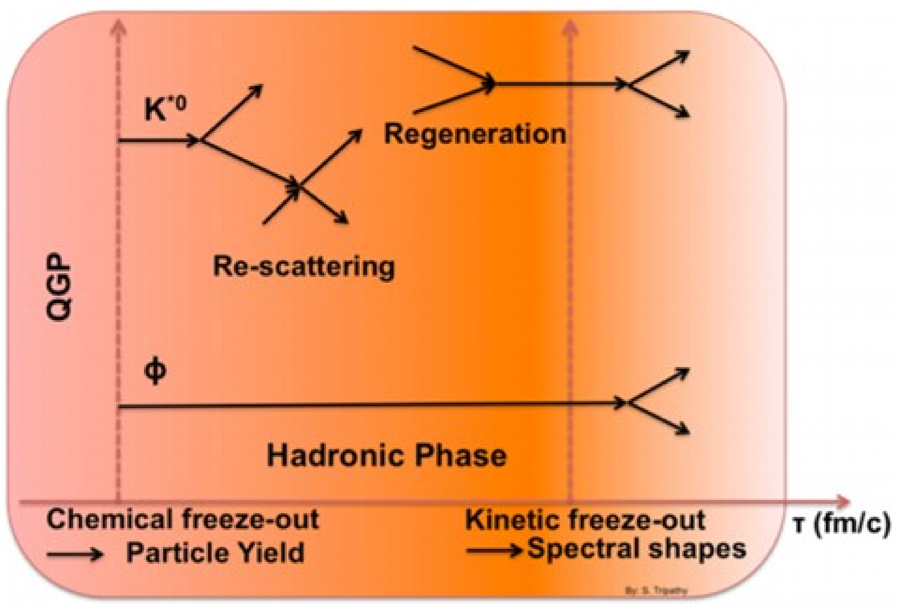
Introduction

- **Hadronic resonances** → ideal probes to characterize heavy-ion collisions
- **Resonances** with a **lifetime comparable** to the one of the **hadronic phase** (~ 1-10 fm/c) are particularly interesting because they may be **sensitive** to the competing **rescattering** and **regeneration** effects

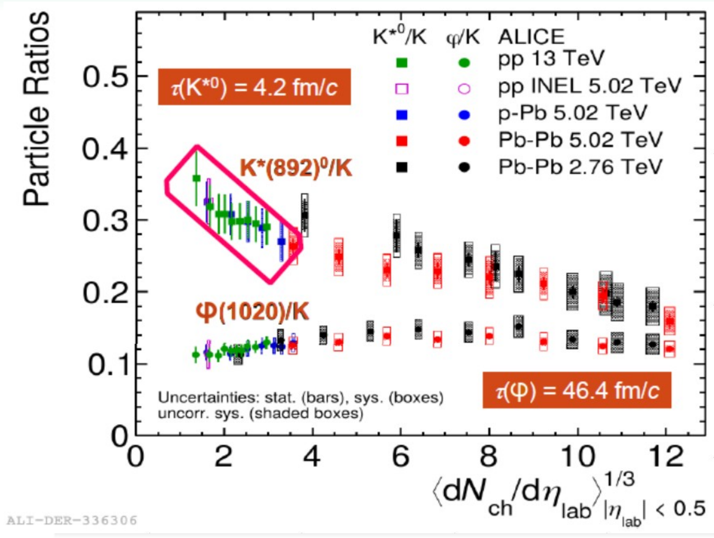


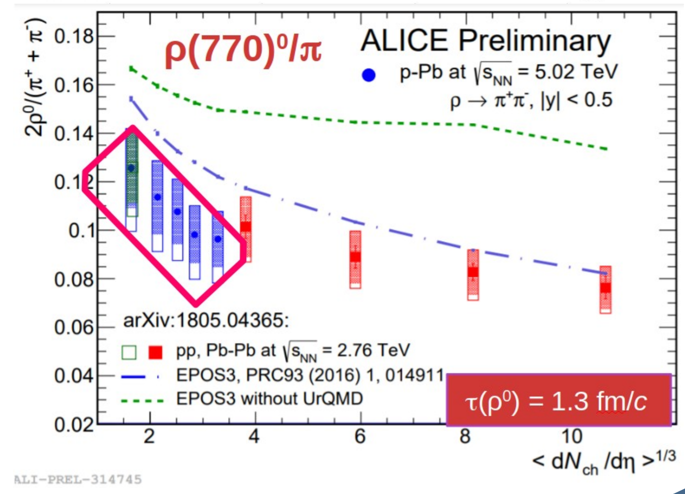
- **Small** collision systems:
  - used as a **baseline** for heavy-ion collisions
  - **Recent results** on resonance production show some **typical phenomena of heavy-ion collisions**, like collective behaviour and suppression of the resonance measured yield.

Particle yield ratios

Resonance yields compared to ground-state hadrons with similar quark content (such as K^{*0}/K and ρ^0/π)

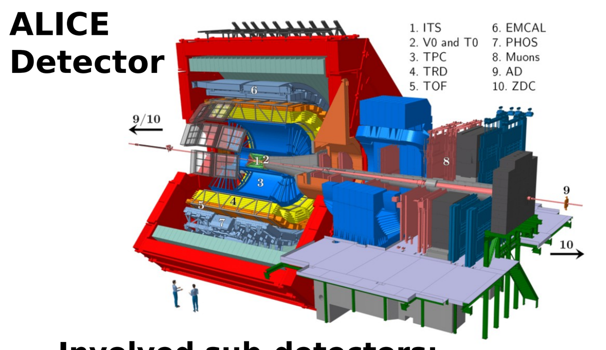
- Goal in heavy ion collisions: characterize the properties of the hadronic phase
- Same study in pp and p–Pb collisions → smooth trend across multiplicity
- Long-lived resonances (like φ) → no evidence of multiplicity evolution
- K^{*0} and ρ^0 → hint of decreasing trend
- Some QCD-inspired event generators, like PYTHIA 8 [1] and EPOS-LHC [2] can reproduce the suppression without a hadronic phase → colour reconnection and core/corona effects



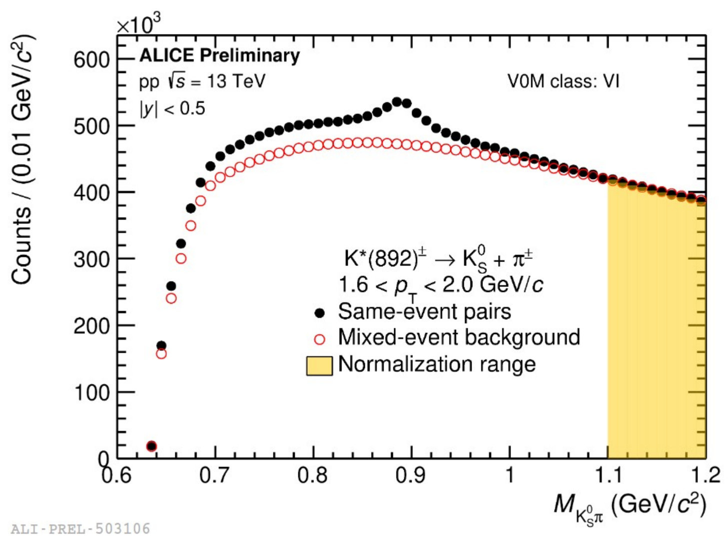


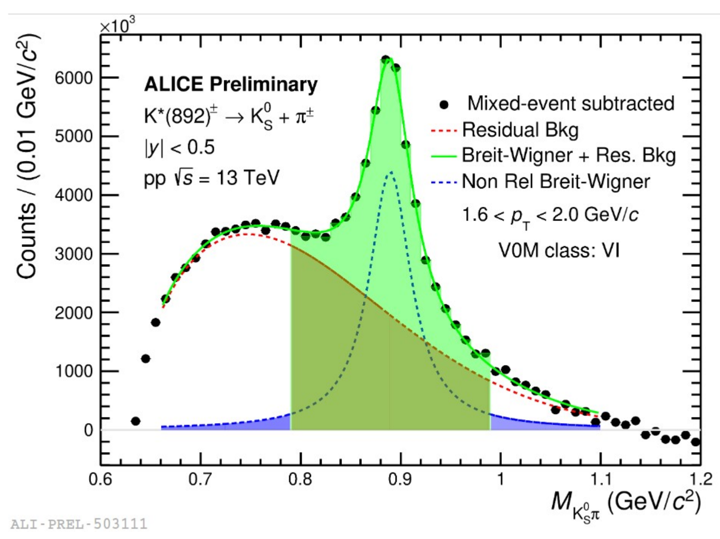
Resonance reconstruction

- **Resonance yield extraction** from invariant mass distribution of the decay daughters identified with TPC/TOF and topological selection criteria
- Uncorrelated background calculated via event mixing technique or like-sign pair method
- Remaining distribution fitted with a Breit-Wigner or a Voigtian (signal) + polynomial (residual background)



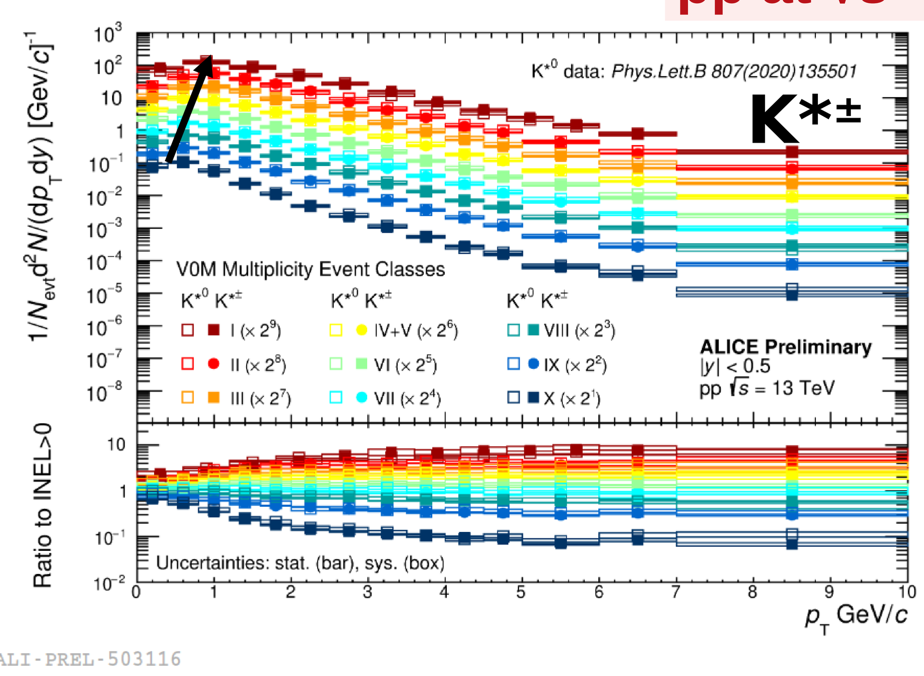
Involved sub-detectors:
- **ITS** – Tracker / Trigger / Vertexer
- **TPC** – Tracker / PID (dE/dx)
- **V0** – Trigger / Multiplicity estimator



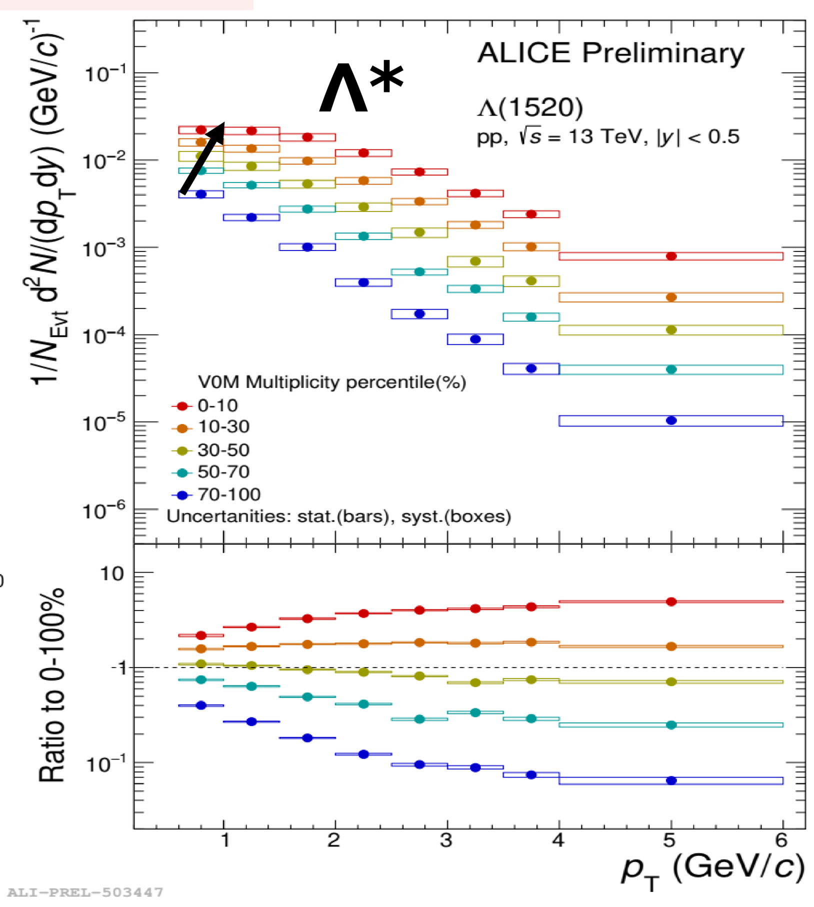


p_T distributions vs multiplicity

pp at √s = 13 TeV

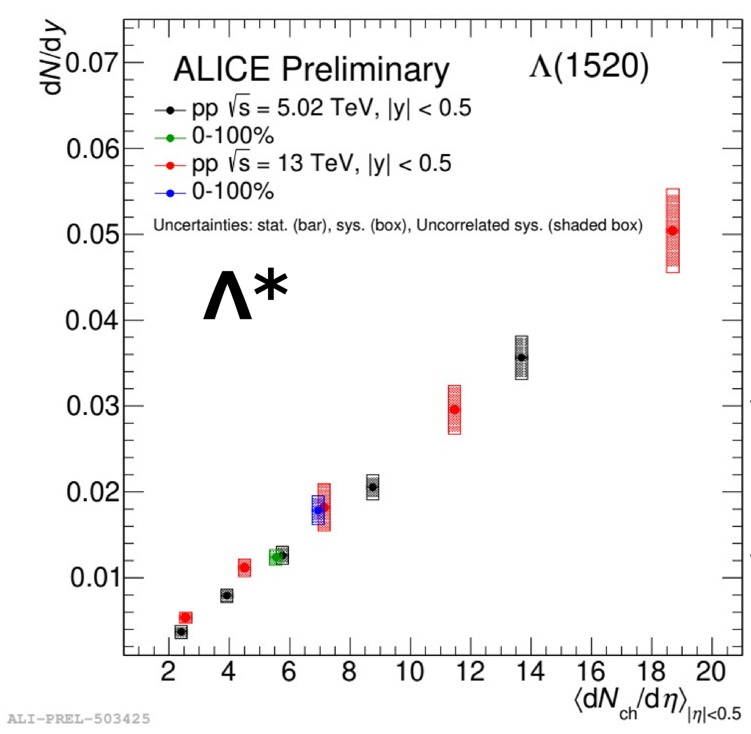


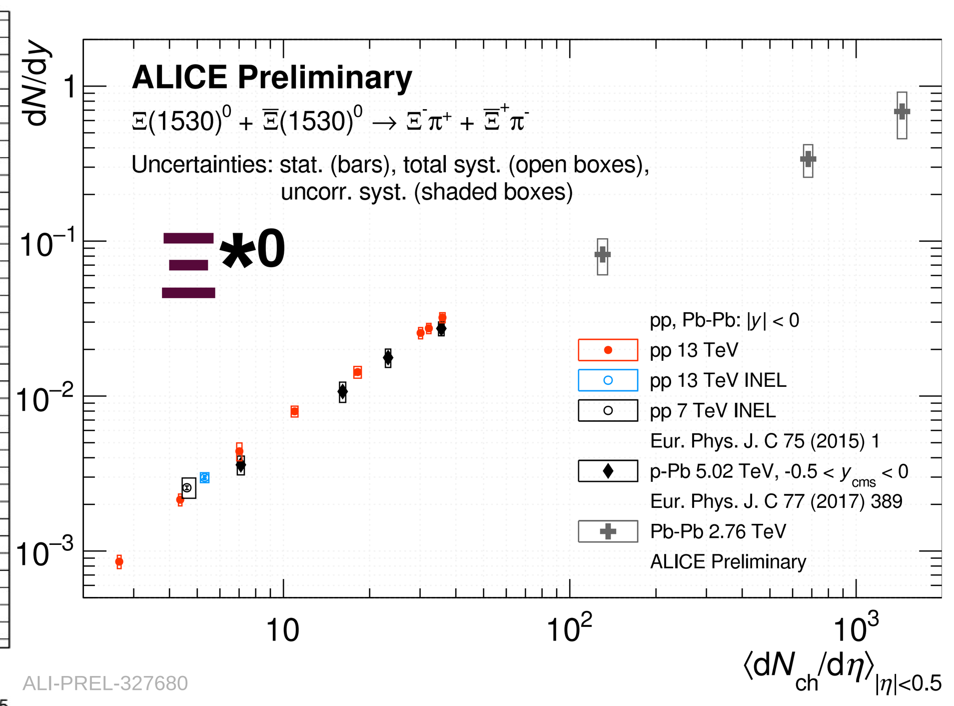
- p_T spectra **get harder** with increasing multiplicity and **maximum shifts** towards higher p_T → **flow-like** effect



- **Lower panel:** ratios of p_T spectra to INEL>0 For p_T < 5 GeV/c spectra increase from low to high multiplicity classes. Same spectral shape for p_T > 5 GeV/c → Process dominant at low p_T

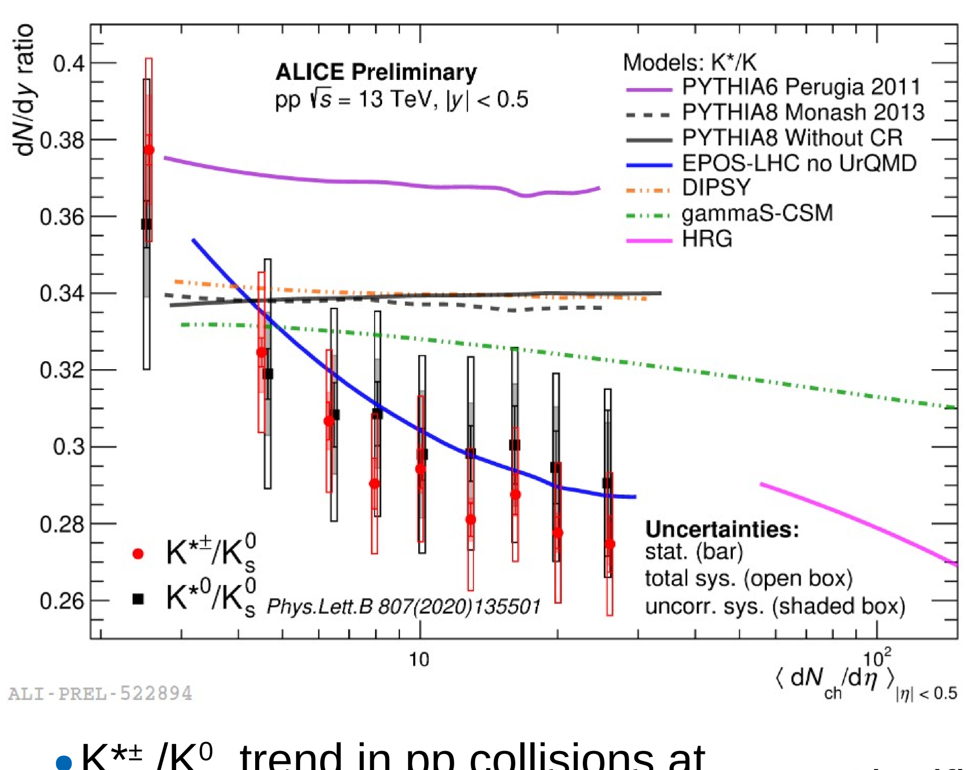
dN/dy: Λ* and Ξ*0

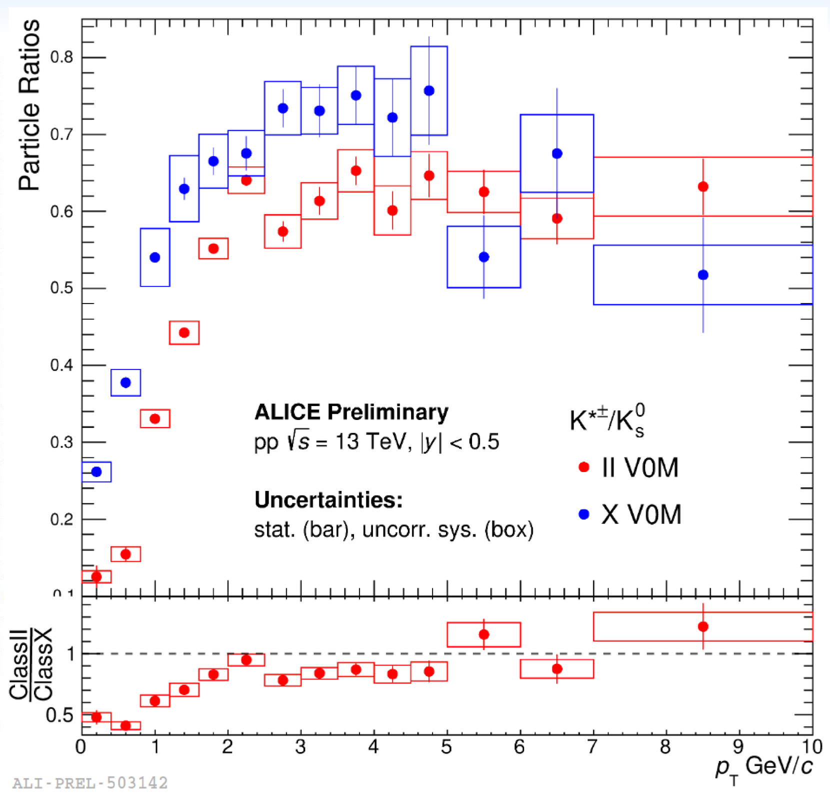




- dN/dy spectra exhibit a linear increase with increasing $\langle dN_{ch}/d\eta \rangle$
- As observed for other hadron species, resonance production rate does not depend on collision energy → it is driven by the event multiplicity

Ratio of particle yields: $K^{*\pm}/K^0_S$





- $K^{*\pm}/K^0_S$ trend in pp collisions at √s = 13 TeV confirms the K^{*0}/K^0_S suppression even accounting for the systematic uncertainties
- Significant $K^{*\pm}/K^0_S$ suppression for p_T < 2.5 GeV/c
- Results consistent with those obtained for K^{*0} and with the hypothesis of rescattering effects (suppression of low p_T particles)

EPOS-LHC: same treatment for pp, p–A, and A–A collisions → It is able to reproduce the decreasing trend without UrQMD. Is suppression actually due to rescattering? Must also consider core/corona effects

References

[1] R. Acconcia et al., Phys. Rev. D 97, 036010 (2018)
[2] T. Pierog et al., Phys. Rev. C 92, 034906 (2015)