K*(892)$^{\pm}$ multiplicity dependent analysis in pp collisions at $\sqrt{s}$ =13 TeV with ALICE

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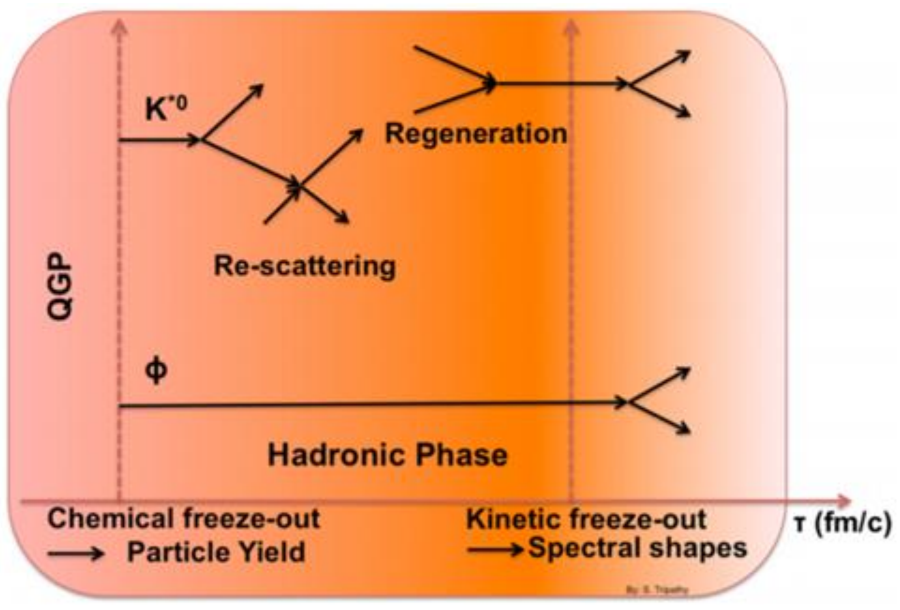
Introduction

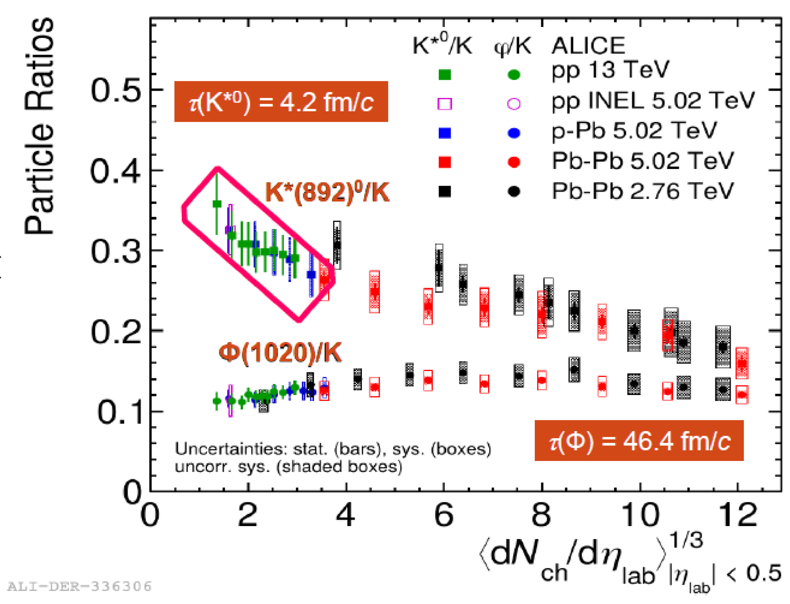
- **Resonances** are the perfect probes to characterize the system formed in heavy-ion collisions at ultrarelativistic energies
- **K*±** resonance is particularly interesting because of its **very short lifetime** (~ 4 fm/c), comparable to the one of the hadronic phase → it may be **sensitive** to the competing **rescattering** and **regeneration** effects



- **Small** collision systems:
  - used as a **baseline** for heavy-ion collisions
  - **Recent results** on resonance production show the onset of phenomena **typical of heavy-ion collisions**, like collective behaviour and suppression of the yield ratios of resonances to stable particles

Motivation for studying K*(892)$^{\pm}$

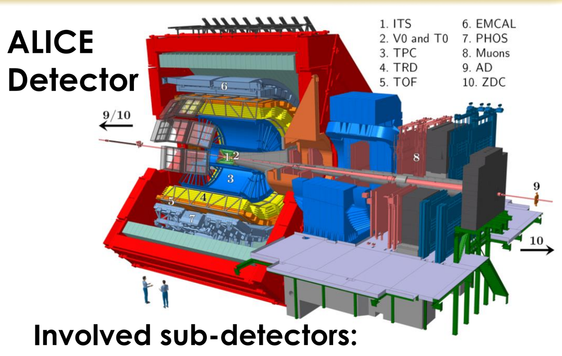
- **K*⁰** multiplicity dependent analysis in **pp** collisions at **13 TeV** [1] shows **a hint of suppression** for **K*⁰/K** with increasing multiplicity → **hadronic phase even for small systems?**
- **K*±** reconstructed via $K^{*\pm} \to \pi^{\pm} + K^0_S$
  - K^0_S identified via $K^0_S \to \pi^+ + \pi^-$
  - $\pi^{\pm}$ identified through dE/dx in the TPC
- **K*⁰** reconstructed via $K^{*0} \to K^{\mp} + \pi^{\pm}$
  - $K^{\mp}$ and $\pi^{\pm}$ **directly identified** by TPC and TOF detectors



- Inclusive analysis of **K*±** production in pp collisions [2] **shows lower systematic uncertainties** on K*± measurement **than K*⁰** due to the different strategies used for K^0_S and K± identification in ALICE
  → K*± measurements can complement previous K*⁰ results **with smaller systematic uncertainties**

$K^{*\pm}$ resonance reconstruction

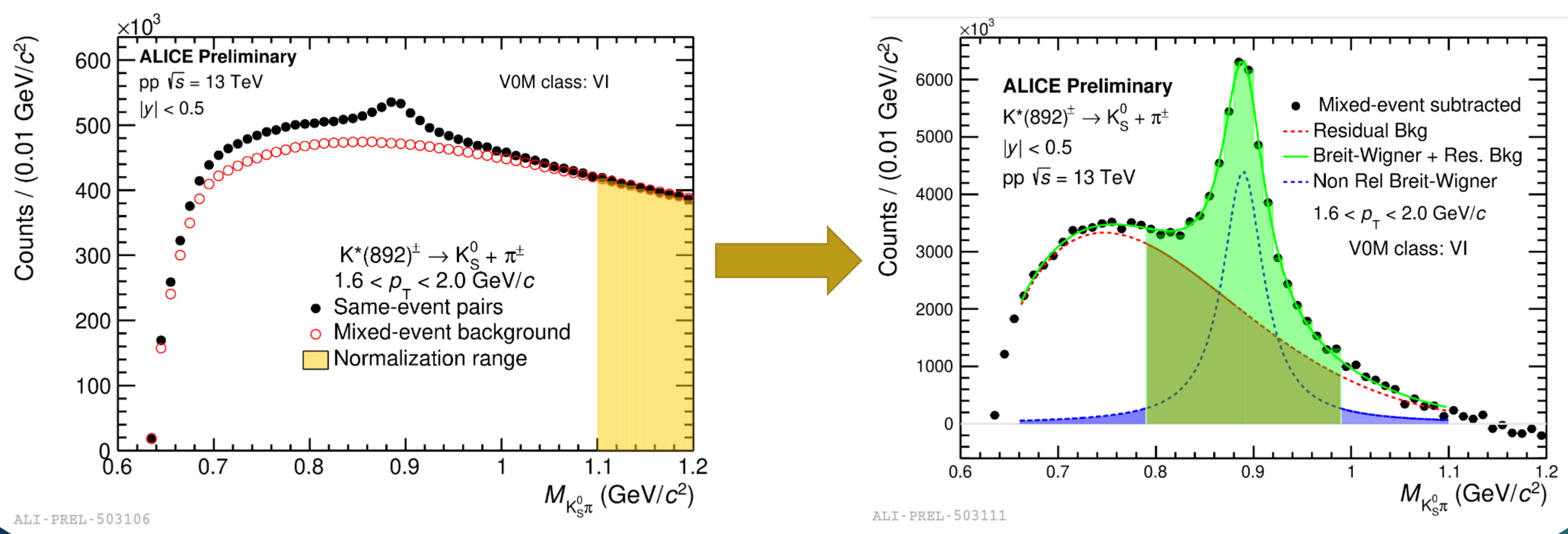
- Signal reconstructed via **invariant mass distribution** of the decay daughters
- **Uncorrelated background** estimated via event mixing technique
- After the uncorrelated background subtraction, the remaining distribution is fitted with a **NR Breit-Wigner + residual backgroud** (expol) function F_{BG}:



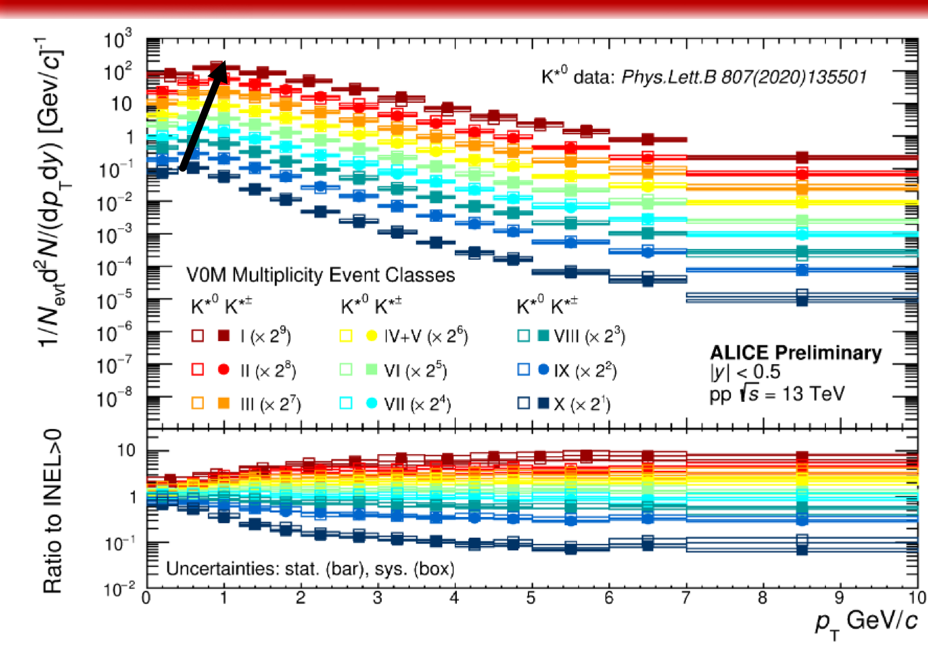
Involved sub-detectors:
- **ITS** – Tracker / Trigger / Vertexer
- **TPC** – Tracker / PID (dE/dx)
- **V0** – Trigger / Multiplicity estimator

$$\frac{A}{2\pi}\frac{\Gamma_0}{(M_{K\pi}-M_0)^2+\frac{\Gamma_0^2}{4}}+F_{BG}$$

$$F_{BG}(M_{K\pi}) = [M_{K\pi}-(m_\pi+m_K)]^n exp(A+BM_{K\pi}+CM^2_{K\pi})$$

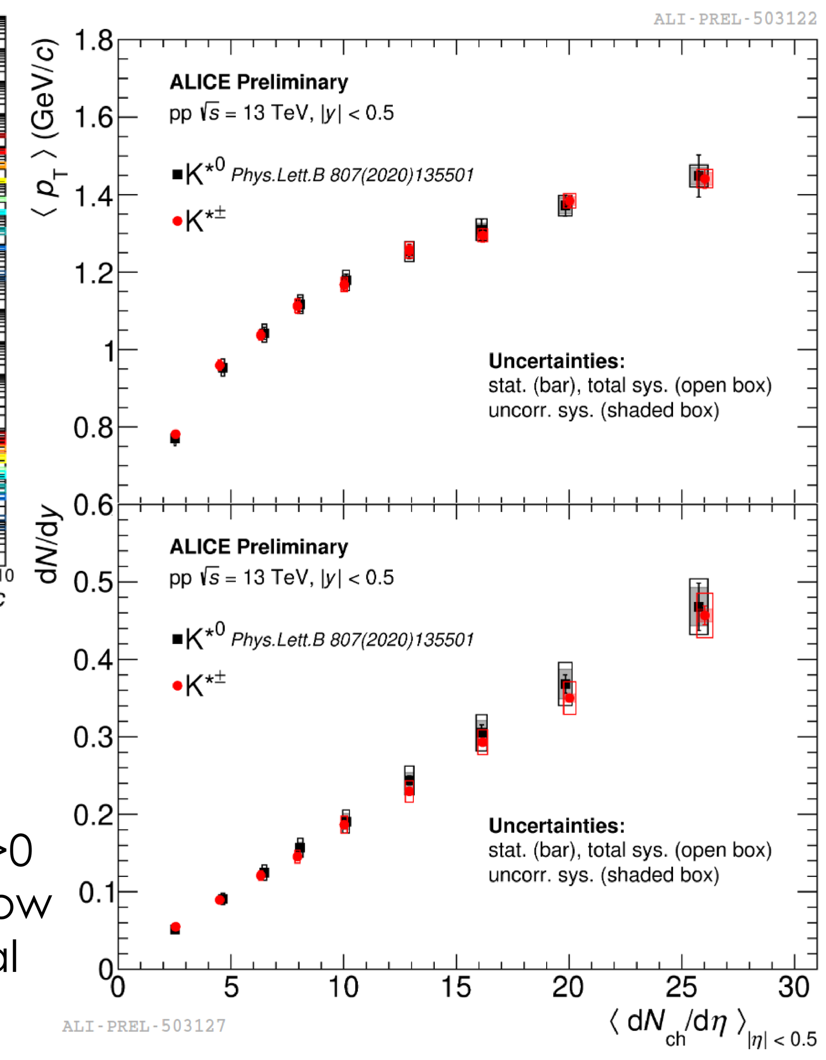


$K^{*\pm}$ p_T spectra, $\langle p_T \rangle$, and dN/dy



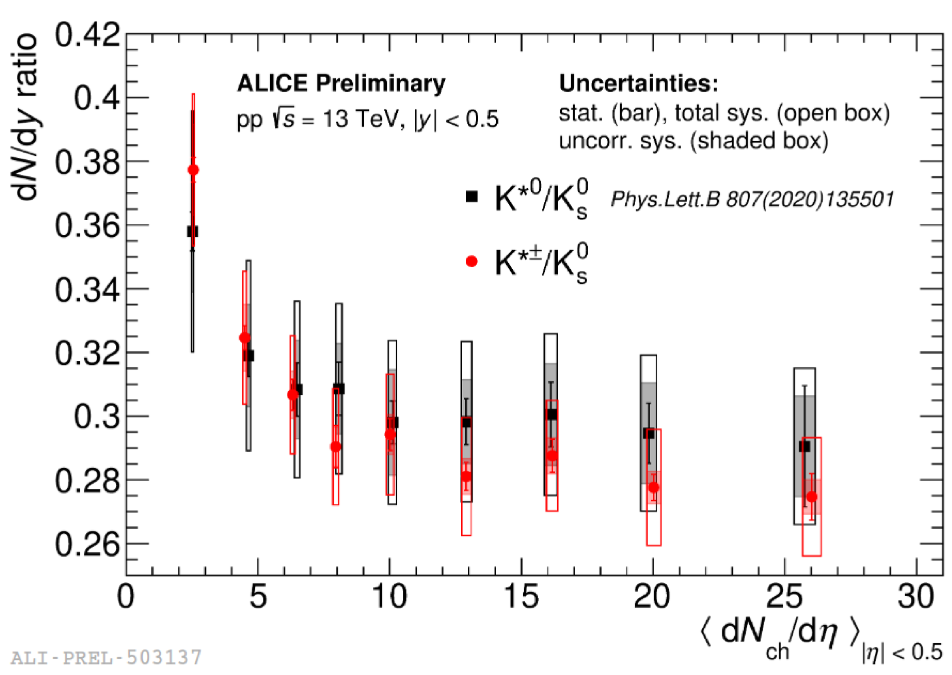
- p_T spectra **get harder** with increasing multiplicity and **maximum shifts** towards higher p_T → **flow-like** effect
- **Lower panel:** ratios of p_T spectra to INEL>0. For p_T < 5 GeV/c spectra increase from low to high multiplicity classes. Same spectral shape for p_T > 5 GeV/c

→ Process dominant at low p_T



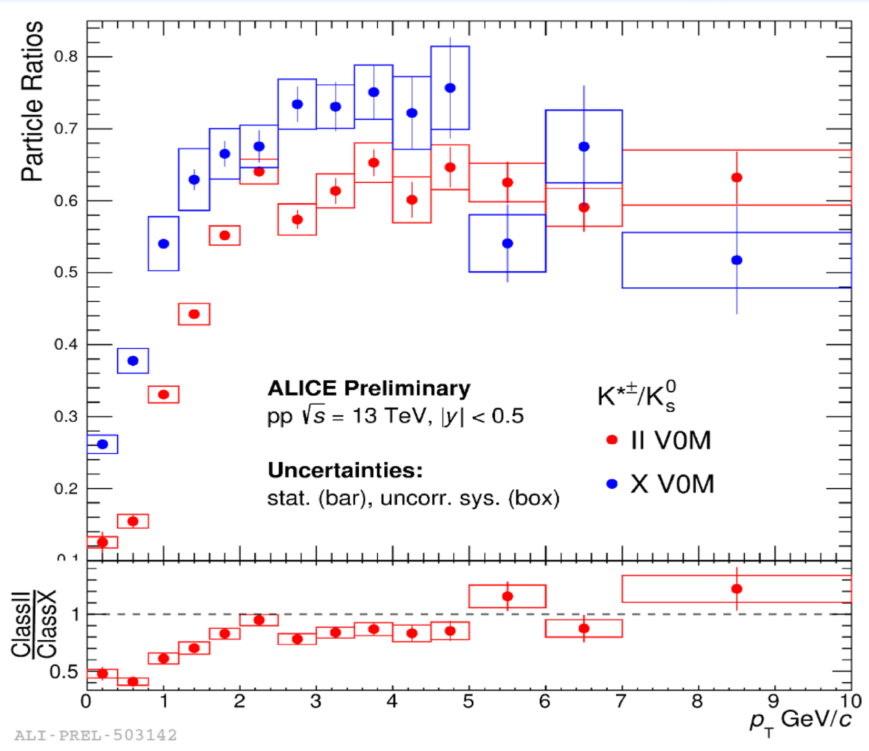
Comparable results for K*± and K*⁰ with **lower systematic uncertainties** for K*± measurements

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



- $K^{*\pm}/K^0_S$ **trend** in pp collisions at $\sqrt{s}$ = 13 TeV **confirmes** the K^{*0}/K^0_S **suppression** even **within the systematic uncertainties**

→ **rescattering effects in small systems?**



- **Upper panel:** p_T dependence of particle ratios $K^{*\pm}/K^0_S$ for **low (X)** and **high (II)** multiplicity classes
- **Lower panel (double ratios):** high multiplicity values divided by the low multiplicity ones
- $K^{*\pm}/K^0_S$ **suppression** clearly noticeable for p_T < 2.5 GeV/c

Summary

- First measurements of K*± production at |y| < 0.5 in pp collisions at $\sqrt{s}$ =13 TeV for different multiplicity classes have been reported here.
- **Clear** evidence for **K* suppression** is now obtained for pp collisions (results for p-Pb and Pb-Pb collisions can be found in [3]) thanks to reduced uncertainties on K*± measurements than K*⁰ results.
- Preliminary results show the typical onset of **collective-like phenomena** (hardening of the p_T spectra) → possible **hadronic phase** (suppression of $K^{*\pm}/K^0_S$) in **small systems** too?

References

[1] ALICE Collab., Phys. Lett. B 807 (2020) 135501
[2] ALICE Collab Phys. Lett. B 828 (2022) 137013
[3] ALICE Collab Phys. Lett. B 802 (2020) 135225

Quinto Incontro Nazionale di Fisica Nucleare (INFN 2022)
9-11 May 2022 LNGS - Assergi (AQ), Italy
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