Study of Resonance Production using Run 3 pp Collisions with ALICE

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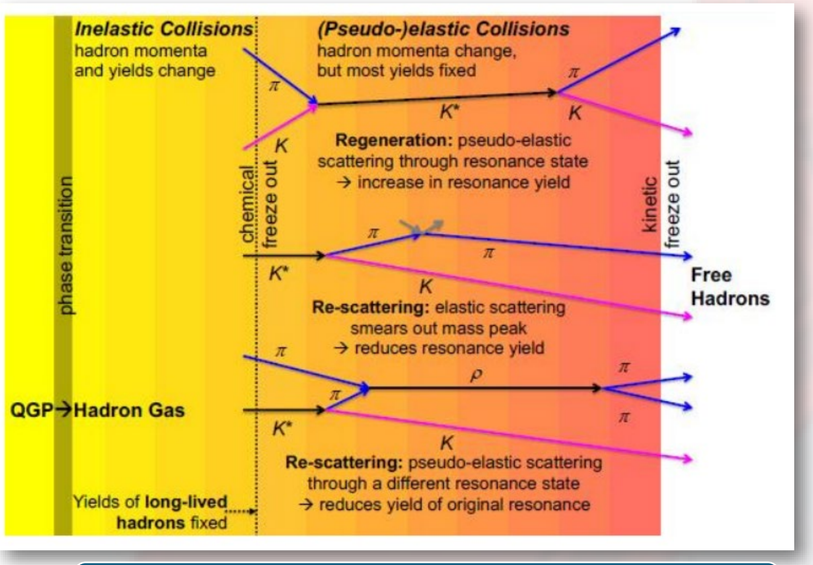
Physics Motivation

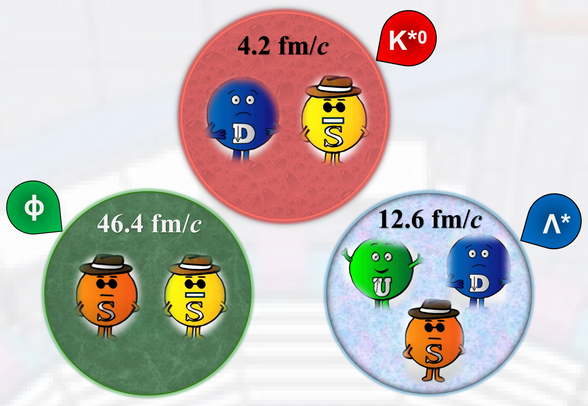


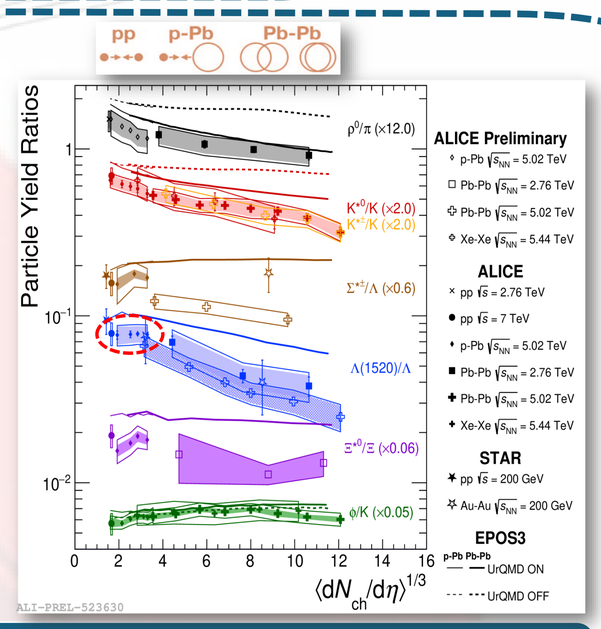
Final resonance yields depend on:

- Chemical freeze-out temperature
- Lifetime of hadronic phase
- Lifetime of resonance
- Scattering cross sections of decay products

Hadronic resonances:

- Good probes to investigate the hadronic phase in high-energy nuclear interactions
- Lifetime comparable to that of the hadronic phase ⟶ offers unique insights into the characteristics of the evolution of the medium
- Sensitive to **re-scattering** and **regeneration** processes



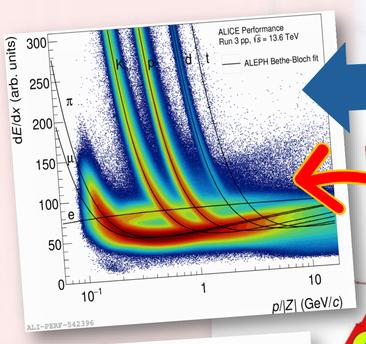


Measurements of ratio between yields of resonance and its ground state:

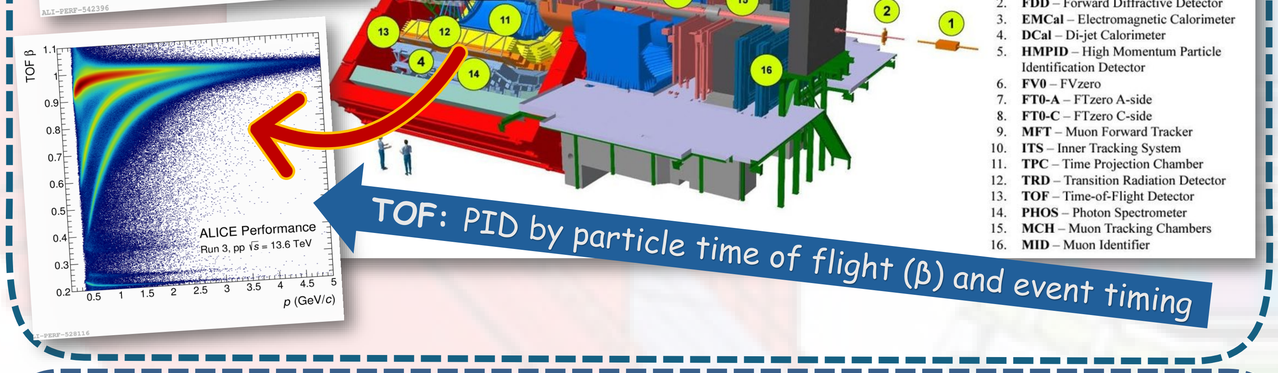
- Significant suppression of **K*(892)** [1, 4] and **Λ(1520)** [2, 3] in high multiplicity
- No suppression for **ϕ(1020)** [1, 4]
- Smoothly evolves across different collision systems

Objective and ALICE Detector in Run3

- **900 GeV: Lowest multiplicity region**
  - ✓ Unique opportunity to study **canonical suppression** of strangeness at low multiplicity
  - ✓ First measurements of **K*(892)**, **Λ(1520)** in this region
- **13.6 TeV: Largest data sample available**
  - ✓ Enables differential resonance studies (e.g. **h-resonance correlation, resonance flow** ...)
  - ✓ Yield measurements as initial confirmation for the analysis framework

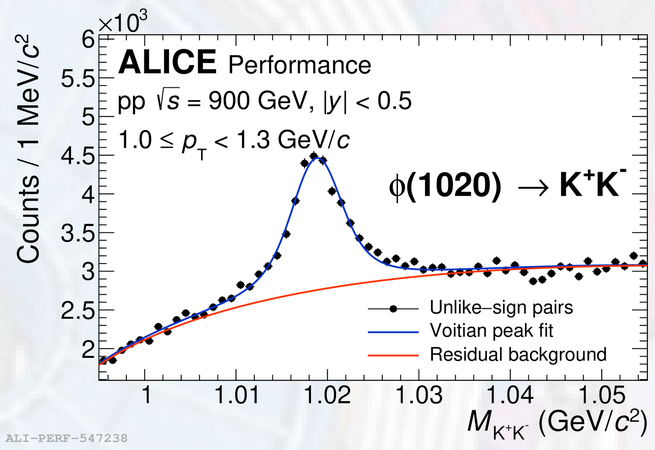


TPC: Tracking and PID by ionization energy loss (dE/dx)



TOF: PID by particle time of flight (β) and event timing

Signal Extraction: Invariant-Mass Distribution of ϕ(1020)



Mass: 1019.461 ± 0.016 MeV/c^2

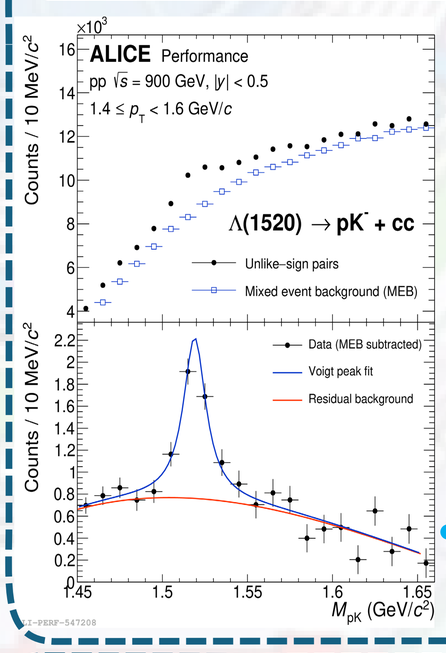
Investigated Decay Channel:

$\phi \rightarrow K^+K^-$

Branching Ratio: 49.2 ± 0.5 %

Width: 4.249 ± 0.013 MeV/c^2

Signal Extraction: Invariant-Mass Distribution of Λ(1520)



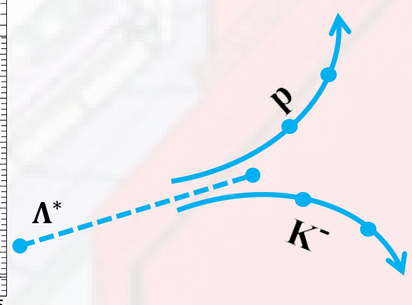
Mass: 1519.54 ± 0.17 MeV/c^2

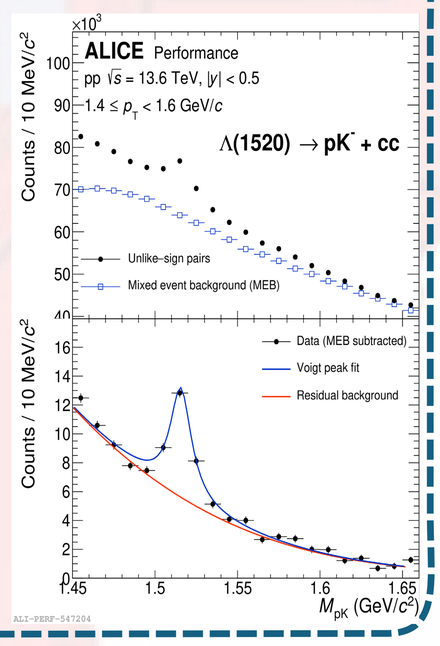
Investigated Decay Channel:

$\Lambda^{*0}(\overline{\Lambda}^{*0}) \rightarrow pK^-(\bar{p}K^+)$

Branching Ratio: 22.5 ± 0.5 %

Width: 15.73 ± 0.29 MeV/c^2





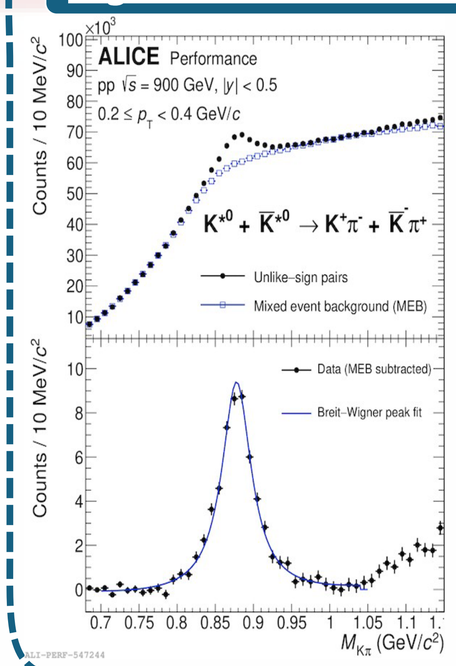
Analysis Details

❖ **Invariant mass distribution from unlike-sign pair:**
- **K*(892):** π+K decays
- **ϕ(1020):** K+K decays
- **Λ(1520):** p+K decays

❖ **Background:**
- **K*(892):** Mixed-event
- **Λ(1520):** Mixed-event
- **ϕ(1020):** Background fit

❖ **Signal Fit:**
- **K*(892):** Breit-Wigner + 2nd order polynomial
- **ϕ(1020):** Voigtian + background fit ($a + b*M_{PDG} + c*(M_{PDG}-M_{KK})$)
- **Λ(1520):** Voigtian + 3rd order polynomial

Signal Extraction: Invariant-Mass Distribution of K*(892)



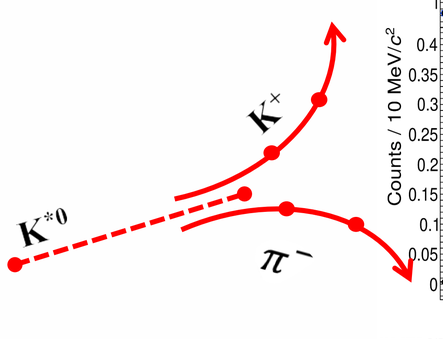
Mass: 895.55 ± 0.20 MeV/c^2

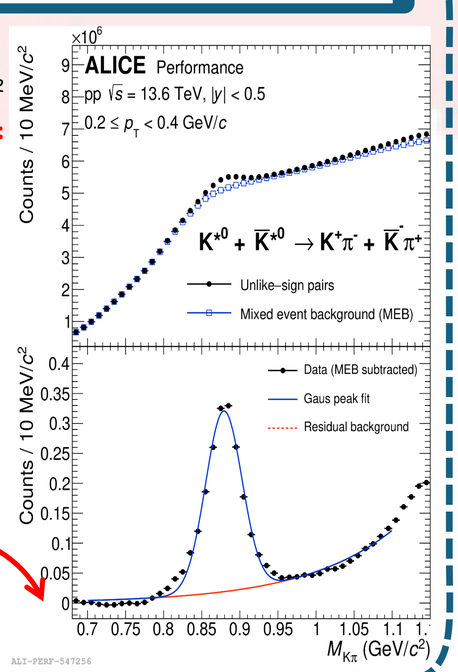
Investigated Decay Channel:

$K^{*0}(\overline{K}^{*0}) \rightarrow K^+\pi^-(K^-\pi^+)$

Branching Ratio: ~ 66.6 %

Width: 47.3 ± 0.5 MeV/c^2





Summary and outlook

- Production of **K*(892)**, **ϕ(1020)** and **Λ(1520)** are studied for the first time using Run3 pp collisions at $\sqrt{s}$ = 0.9 and 13.6 TeV
- ALICE shines in Run 3 with its good performance and analysis framework has been developed for both energies
- Final goal is to obtain **multiplicity-dependent spectra** and to study **QGP properties**

STAY TUNED FOR NEW RESULTS !!

References

[1] Phys. Rev. C 106, 034907 (2022)
[2] Phys. Rev. C 99, 024905 (2019)
[3] Eur. Phys. J. C 80, 160 (2020)
[4] Phys. Rev. C 91, 024609 (2015)
[5] https://pdg.lbl.gov/2023/listings/contents_listings.html

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