Study of K_1 meson production in pp collisions with ALICE

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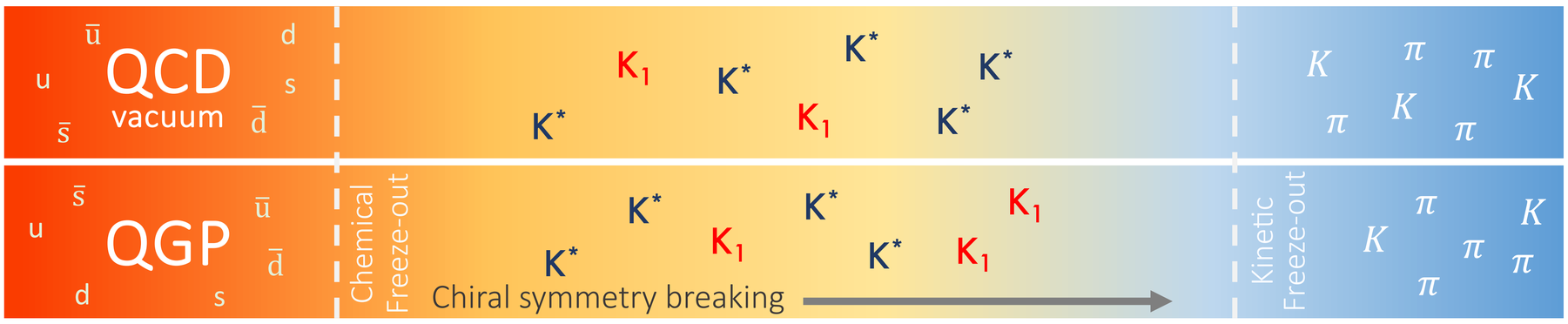
CHIRAL SYMMETRY RESTORATION[1]



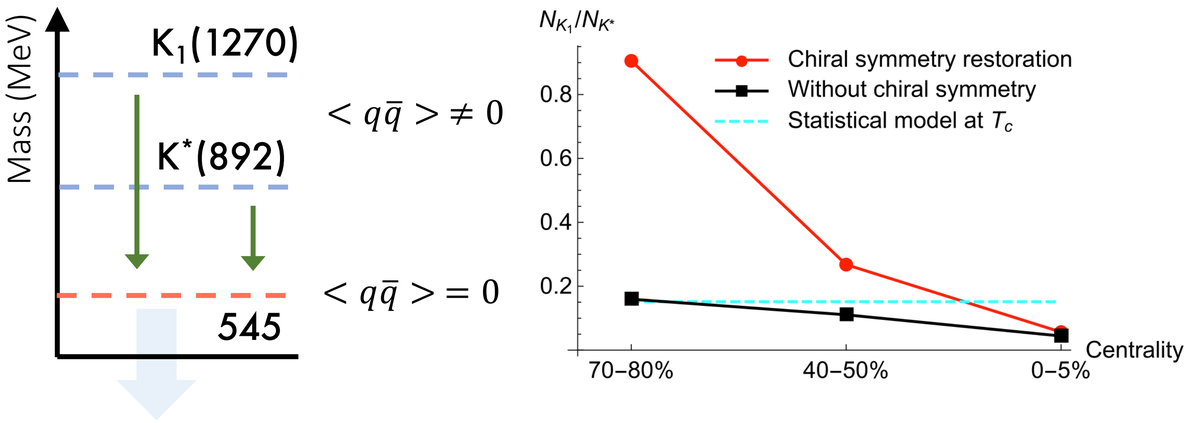
▲ Abundances of hadrons are determined.

Chiral symmtery can be **restored** in **high temperature** and **density**.

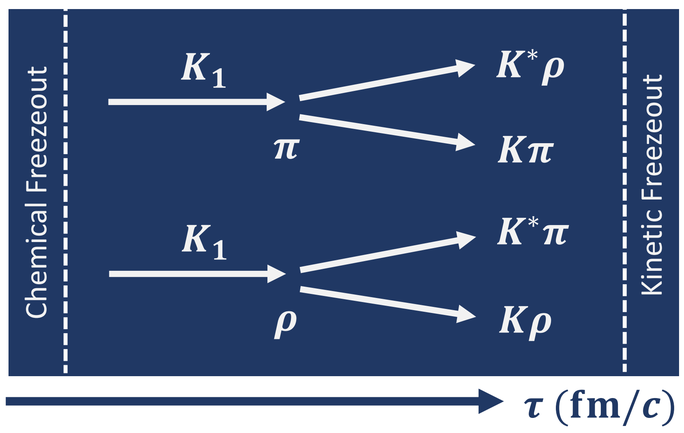
Then **chiral partners** will have much closer **mass** therefore **equal number** of particles will be produced.

QCD chiral crossover is about 156.5 ± 1.5 MeV (around critical temperature of QGP)[2]

OBSERVABLE[1]



Similar yield of $K_1(1270)$ and $K^*(892)$ is produced if masses get similar.
→ K_1/K^* ratio is ideal to study of CSR.



Both K_1 and K^* undergo hadronic interaction.

Inelastic interactions of K_1 during hadronic phase with light hadrons decrease N_{K_1}, possibly increasing $N_{K^{*0}}$.

Chiral symmetry restoration can be investigated in various collision systems.

$K_1(1270)$

Mass: 1253 ± 7 MeV/c^2

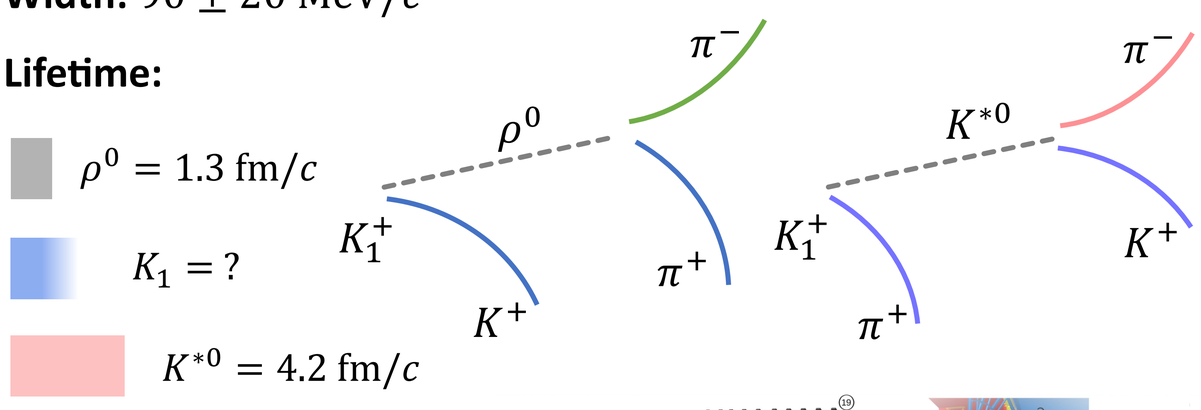
Decay Channels in Interest:

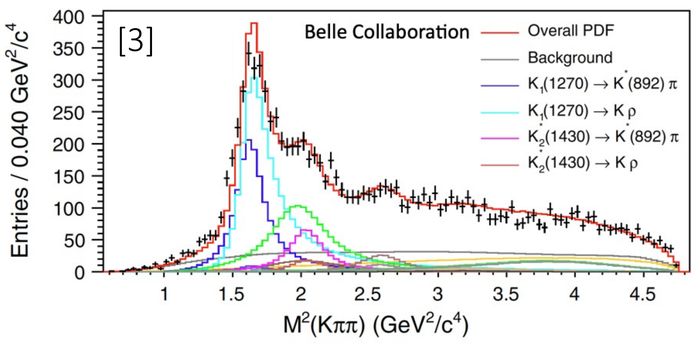
$K_1 \rightarrow \rho^0 K$ $(38 \pm 13\%)$

$K_1 \rightarrow K^{*0}\pi$ $(21 \pm 10\%)$

Width: 90 ± 20 MeV/c^2

Lifetime:





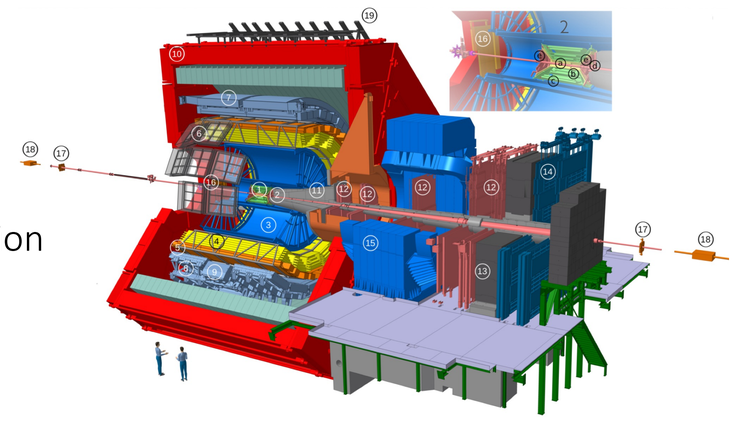
ALICE Detector

ITS – Tracking / Vertexing

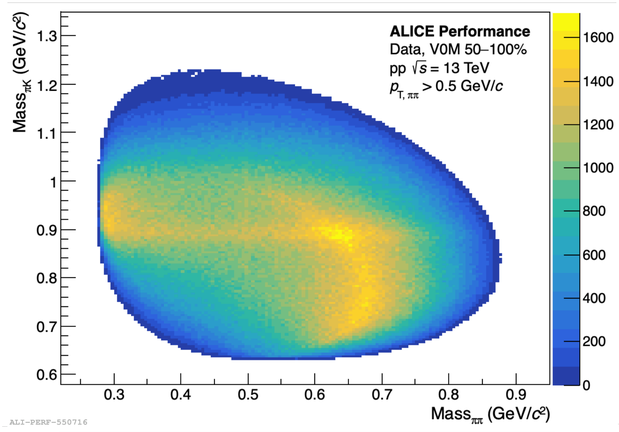
V0 – Multiplicity Determination

TPC – Tracking / PID

TOF – PID



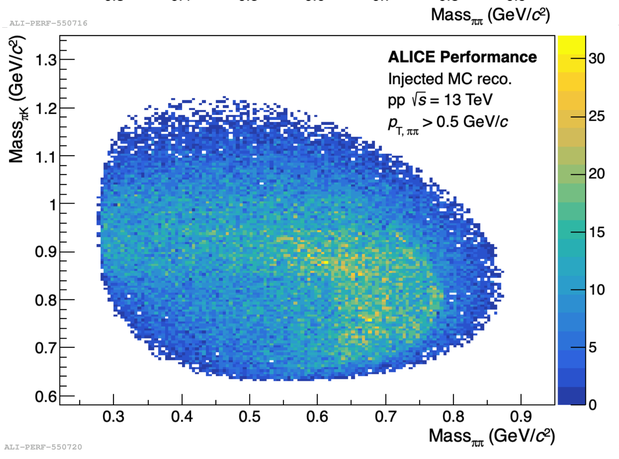
2D INVARIANT MASS DISTRIBUTION

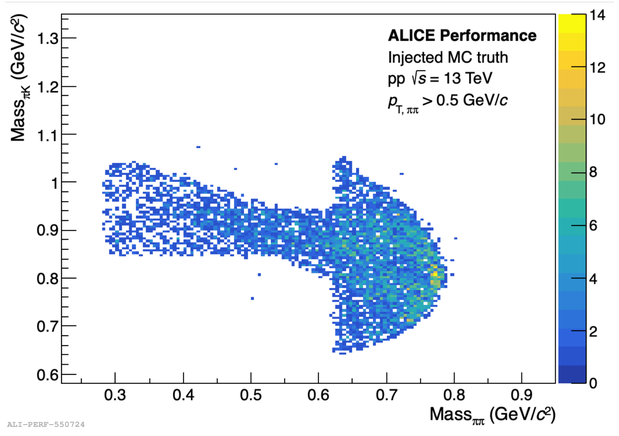


$M_{\pi\pi}$ vs $M_{\pi K}$ 2D invariant mass distribution when $1.170 < M_{\pi\pi K} < 1.370$ GeV/c^2

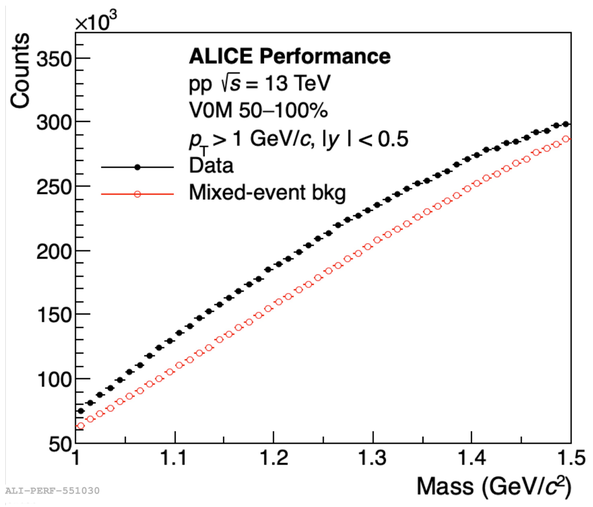
◀ ALICE data

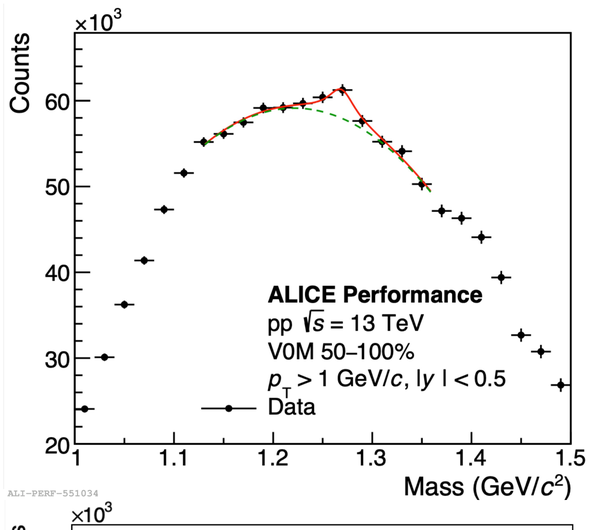
▼ ALICE simulation (left)
▼ MC truth tagging (right)





SIGNAL EXTRACTION





Signal: $\pi^{\pm}\pi^{\mp}K^{\pm}$ pairs

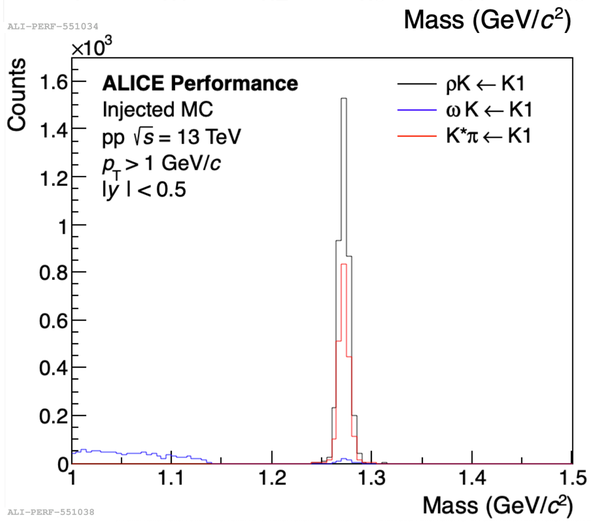
Background:

$\pi^{\pm}\pi^{\pm}K^{\mp}$, $\pi^{\pm}\pi^{\pm}K^{\pm}$

pairs from mixed event

(30 events, $\Delta z_{vtx} \leq 2$ cm)

Fit Function: Breit-Wigner + quadratic fn.



The signal peak is seen at 1270 MeV/c^2 in data.

PLAN

- Further selection criteria variation study is needed to measure K_1 in higher mulitiplicity.
- This analysis will be extended to Run 3 data with better statistics.
- Final goal is to see multiplicity dependent K_1/ K* ratio in various collisions systems.

REFERENCES:
[1] Phys. Lett. B 819 (2021) 136388, [2] Phys. Lett. B 795 (2019) 15–21, [3] Phys. Rev. D 83, 032005 (2011)