$K^{*0}(892)$ resonance production with ALICE experiment at the LHC

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Abstract

Short lived resonances are good probes to study the properties of strongly interacting matter produced in high-energy heavy-ion collisions. In particular, the K^{*0} resonance is important because of its very short lifetime which is comparable to that of the fireball. The decay daughters are expected to undergo re-scattering and re-generation processes. In addition, the yield of K^{*0} at high p_T may be suppressed in Pb-Pb relative to pp collisions due to the effect of the hot and dense medium formation. We report the measurement of the K^{*0} resonance in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV and pp collisions at $\sqrt{s}$ = 2.76 TeV via its hadronic decay channel with the ALICE detector. The nuclear modification factor (R_{AA}) is presented to study the effect of parton energy loss on K^{*0} production. The centrality evolution of K^{*0} R_{AA} in Pb-Pb collisions is studied.

Basic properties of $K^{*0}(892)$ [1]

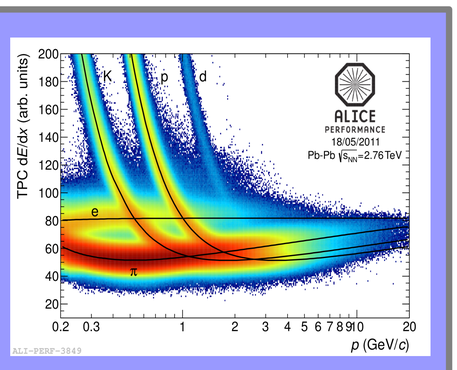
Mass	$0.89594 \pm 0.0022 (GeV/c^2)$	Decay mode	$K^+ \pi^-$ and $K^- \pi^+$
Width	$0.0487 \pm 0.008 (GeV/c^2)$	Branching ratio	~ 0.66 $(K\pi)$
Life time	~4 fm/*c*	Quark content	$particle: d\bar{s}$ $anti-particle: \bar{d}s$

Particle identification

- **Data Set:** Pb-Pb, $\sqrt{s_{NN}}$ =2.76 TeV (2011)
- Total number of events: ~40 millions
- PID through TPC.

$$N\sigma = \frac{1}{R}\left[\left(\frac{dE}{dX}\right)_{theo} - \left(\frac{dE}{dX}\right)_{exp}\right]$$

- $|N\sigma| < 2$ for both pion and kaon.
- p_T > 0.15 (GeV/*c*)
- With reference to the black lines which refer to Bethe-Bloch parametrization, pions and kaons are selected.

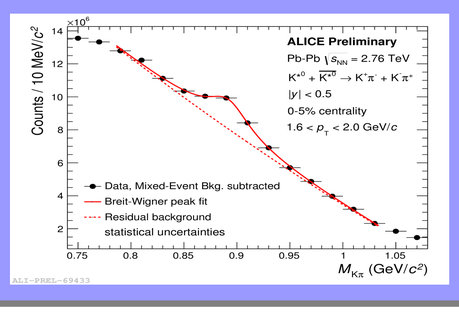


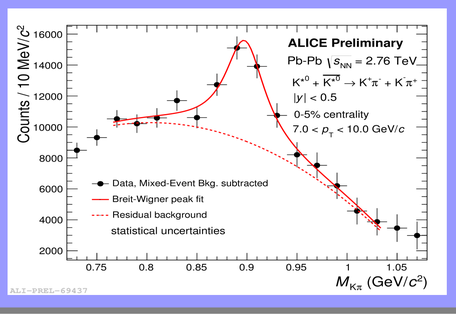
Signal Extraction

- K^{*0} reconstruction via $K\pi$ invariant mass : $M_{K^{*0}} = \sqrt{(E_K + E_\pi)^2 - (\vec{p}_K + \vec{p}_\pi)^2}$
- Background subtraction by event mixing.
- K^{*0} signal is fitted with:

$$\frac{Y}{2\pi}\frac{\Gamma_0}{(M_{K\pi} - M_0)^2 + \frac{\Gamma_0^2}{4}} + AM_{K\pi}^2 + BM_{K\pi} + C$$

Y, M_0, Γ_0 are K^{*0} yield, mass and width.



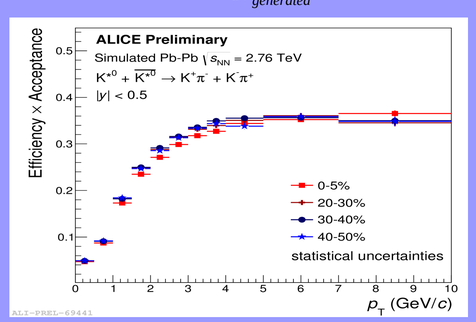


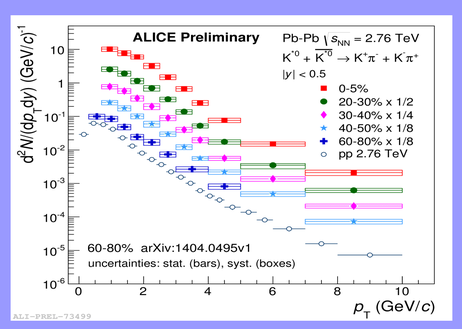
Efficiency and p_T spectra

K^{*0} reconstruction efficiency:

$$\epsilon_{eff} = \frac{N_{reconstructed}}{N_{generated}}$$

$$\frac{d^2N}{dp_T dy} = \frac{Raw\ counts}{N_{evt} \times dp_T \times dy \times BR \times \epsilon_{eff}}$$

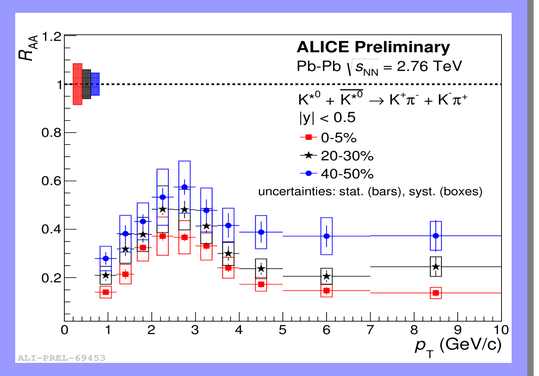


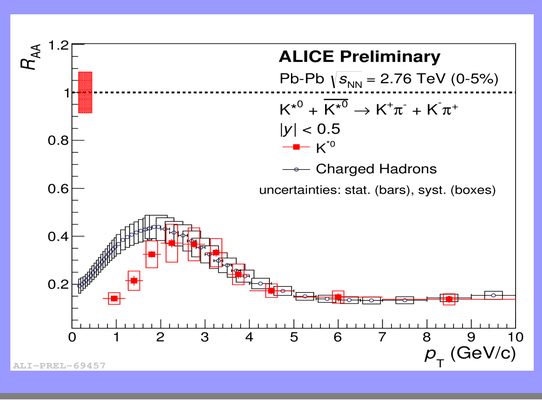


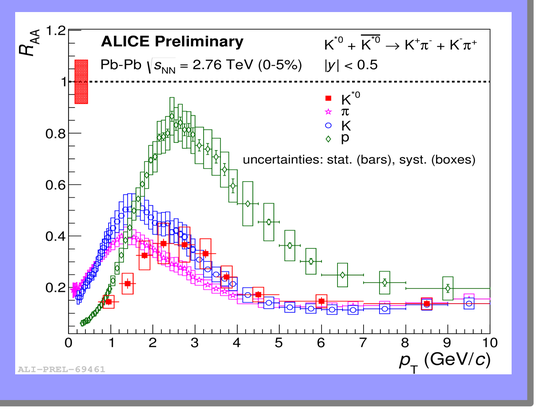
Nuclear modification factor

$$R_{AA} = \frac{1}{\langle T_{AA} \rangle}\frac{(d^2N/dydp_T)_{AA}}{(d^2\sigma/dydp_T)_{pp}}, \qquad \langle T_{AA} \rangle = \frac{N_{coll}}{\sigma_{inel}}$$ is nuclear overlap function [2]

- Larger suppression in central collisions.
- **Low p_T (< 2 GeV/*c*):** Larger K^{*0} suppression compared to charged hadrons [3] may be due to re-scattering effect.
- **Intermediate p_T (2 to 5 GeV/*c*):** K^{*0} suppression is similar to kaon.
- **High p_T (> 5 GeV/*c*):** K^{*0}, pion and kaon[4] suppression are of similar order.







Summary

- K^{*0} spectra and nuclear modification factor (R_{AA}) in various collision centralities are presented.
- The centrality dependence of K^{*0} R_{AA} is observed.
- Suppression of K^{*0} R_{AA} at low p_T with respect to charged hadrons is observed. This may be due to re-scattering effect.
- Proton R_{AA} is different from K^{*0} in intermediate p_T.
- R_{AA} of K^{*0}, pion and kaon are of similar order for p_T > 5 GeV/*c*.

References

- [1] J. Beringer *et al.* (Particle Data Group) Phys. Rev. D 86, 010001
- [2] ALICE Collaboration: B.Abelev,*et al.* Phys. Rev. C 88, 044909 (2013)
- [3] ALICE Collaboration: B.Abelev, *et al.* Physics Letters B 720 (2013)
- [4] ALICE Collaboration: B.Abelev, et al. arXiv:1401.1250v1 [nucl-ex]

XXIV QUARK MATTER DARMSTADT 2014