$K^*{}^0$ production in Pb-Pb and pp collisions at LHC

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Outline
- Motivation
- $K^*{}^0$ resonance reconstruction in ALICE
- Results
  - Nuclear modification factor
- Summary

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Resonances in heavy ion collision

Resonances have very short lifetimes about few fm/c:

τ resonance \sim τ fireball

- **Yield:**
  - Information about regeneration and re-scattering

- **Nuclear modification factor:**
  - Parton energy loss in the medium

- **Comparison with particles that have similar mass, baryon number and strangeness content:**
  - Particle production mechanisms

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**Basic properties of K^0**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>0.89594 ± 0.0022 (GeV/c^2)</td>
</tr>
<tr>
<td>Width</td>
<td>0.0487 ± 0.008 (GeV/c^2)</td>
</tr>
<tr>
<td>Decay modes</td>
<td>K^+\pi^-, K^-\pi^+</td>
</tr>
<tr>
<td>Lifetime</td>
<td>\sim 4 fm/c</td>
</tr>
<tr>
<td>Quark content</td>
<td>d\bar{s}, \bar{d}s</td>
</tr>
</tbody>
</table>

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Particle Identification in ALICE

VZERO scintillator detector:
- centrality determination in Pb-Pb

Energy loss (dE/dx) in the gas medium of TPC

Vertex position determination
Event characterization

- Impact parameter can't be determined experimentally.
- By fitting the data with Glauber model number of participant nucleons is extracted which is related to impact parameter.

**K*⁰ invariant mass**

**Data Set:** Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV collected in 2011.

- Higher statistics for central and semi-central events with respect to the 2010 dataset.
- Mixed event background subtraction
- Signal is fitted with Breit-Wigner + Quadratic residual background

Higher statistics for central and semi-central events with respect to the 2010 dataset.

Finer centrality binning

High-$p_T$ reach

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**K^*(892) p_T spectra in Pb-Pb collisions**

**ALICE Preliminary**

- **2010 Pb-Pb data**: \( p_T \leq 5 \text{ GeV/c} 

- **New results**: 2011 Pb-Pb data extend \( p_T \) reach of measurement up to 10 GeV/c

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K*⁰ nuclear modification factor: $R_{AA}$

$$R_{AA} = \frac{1}{<T_{AA}>} \frac{d^2 N_{AA}/dp_T dy}{d^2 \sigma_{pp}/dp_T dy}$$

At high $p_T$:
- For all centralities $R_{AA} < 1$
- Larger suppression in most central collisions

$R_{AA}$ of $K^0$ and charged hadrons at low-$p_T$

Low $p_T$ (<2 GeV/c): $R_{AA}(K^0) < R_{AA}$ (charged hadron) --> may be due to re-scattering effect


$R_{AA}$ of $K^*$, $\pi$, $K$, $p$ at moderate $p_T$

Moderate $p_T$ ($2 < p_T < 5$ GeV/c) $\rightarrow$ $K^*$ suppression is similar to $K$ (identical strangeness content)

\( R_{AA} \) of \( K^*, \pi, K, p \) at high-\( p_T \)

- High-\( p_T \) (5 < \( p_T \) < 8 GeV/c) --> \( K^0 \) suppression is similar to \( \pi, K \)
- High-\( p_T \) (> 8 GeV/c) --> All hadrons have similar suppression

K*⁰ resonance production has been measured in a wide momentum range in Pb-Pb collisions in different centrality intervals with the ALICE experiment at LHC.

High-\( p_T \) reach and finer centrality bins in 2011 data as compared to 2010.

Centrality evolution of K*⁰ \( R_{AA} \) is observed.

In central collisions, \( R_{AA}(K^*) < R_{AA}(\text{ch. had}) \) at low-\( p_T \) may be due to rescattering effect.

At intermediate-\( p_T \): K*⁰ suppression is of similar order to that of the K meson, with identical strange content.

For 5<\( p_T <8 \text{ GeV/c} \), K*⁰ suppression is similar to K and \( \pi \).

For \( p_T > 8 \text{ GeV/c} \) all hadrons are similarly suppressed.
Thank You