Strangeness production associated to a high-$p_T$ particle in Pb-Pb collisions with ALICE

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17/09/14
Outline

- Motivation
- ALICE detector
- Strange particle reconstruction.
- $h^\pm$-V0 correlations
  - Jet-like production
  - Bulk production
- Summary

$\Lambda/K_0^S$ in bulk and peak
Motivation

Is the baryon/meson enhancement a consequence of bulk collectivity? (radial flow or/and parton coalescence, ...?)

PRL 111, 222301 (2013)
More about $\Lambda/K^0_S$

- **Low $p_T$**

- **Intermediate $p_T$**
  - Recombination model
    Overestimates the $\Lambda/K^0_S$ enhancement. R. Fries, V. Greco, P. Soresnen, Annu. Rev. Nucl. 58, 177 (2008).

- **EPOS**
  Interaction between jets and a hydrodynamical expansion of the system.

- **High $p_T$**
  - Parton fragmentation regime
    Values are similar to the ones in proton-proton collisions
We want to understand the origin of the $\Lambda/K^0_S$ enhancement by separating the hadrons produced in correlation with a high-$p_T$ particle from the ones produced in the thermalized bulk.

Is the baryon/meson enhancement related to the collectivity effects in the plasma phase or is there also an effect due to jet fragmentation modification in the medium?
**ALICE**

**VZERO**
- Trigger
- Centrality

**ITS**
- Vertexing
- Tracking

**TPC**
- Vertexing
- Tracking
Strangeness in ALICE

The strange hadrons ($K^0_S$, $\Lambda$, $\Xi$, $\Omega$) are reconstructed using the kinematical and topological properties of their decays products.

$K^0_S \rightarrow \pi^+\pi^- \text{ (B.R. 69.2%)}$
$\Lambda \rightarrow p\pi^- \text{ (B.R. 63.9%)}$

Single reconstruction technique allows for:
- Reconstruction of both strange mesons and baryons
- Wide transverse momentum range
- Good control of systematic uncertainties

arXiv:1307.5530 [nucl-ex]
Hadron-V0 correlations

\[ \Delta \phi = \phi_{\text{Trig}} - \phi_{\text{Assoc}} \]
\[ \Delta \eta = \eta_{\text{Trig}} - \eta_{\text{Assoc}} \]

**Trigger particle:**
all charged particles within 
5 < \( p_T \) < 10 GeV/c

**Associated particle:**
\( K^0_S \) and \( \Lambda \) in the range 
2 < \( p_T \) < 7 GeV/c

Detector acceptance is taken into account with the mixed-event correction.
Hadron-V0: bulk and jet

\[
\frac{1}{N_{\text{Trig}}} \frac{d^2 N_{\text{assoc}}}{d\Delta \phi d\eta} = \frac{S(\Delta \phi, \Delta \eta)}{B(\Delta \phi, \Delta \eta)}
\]

\[
S(\Delta \phi, \Delta \eta) = \frac{1}{N_{\text{Trig}}} \frac{1}{\epsilon(p_T)} \frac{d^2 N_{\text{same}}}{d\Delta \phi d\eta}
\]

\[
B(\Delta \phi, \Delta \eta) = \alpha \frac{d^2 N_{\text{mixed}}}{d\Delta \phi d\eta}
\]

Jet production:
1) Projection in \( \Delta \eta \)
2) Projection in \( \Delta \phi \)

Bulk production:
We can test several samples according to the physics involved: ridge, away-side area.
Summary

- It is possible to compare the $\Lambda/K^0_S$ associated to the bulk and the $\Lambda/K^0_S$ obtained with particles produced in association to a high-$p_T$ particles.

- This study can help to understand better the origin of the baryon/meson enhancement.
Back Up
Hadronization mechanisms

- **Parton coalescence**
  - The hadronization by coalescence requires that two (three) partons from the QGP are close in phase-space to form a meson (baryon).

- **Parton fragmentation**
  - At high values of $p_T$, partons are produced from initial hard processes.
More hadronization mechanisms

At intermediate $p_T$:

A more advanced model of coalescence allows for the recombination between partons from jets with partons from the thermalized bulk.


Au-Au collisions at $\sqrt{s_{NN}} = 200$ GeV