Measuring strange particles in ALICE

ALICE Performance

Time Projection Chamber (TPC, |y|<0.9)
- Timing
- Momentum measurement
- Particle identification (dE/dx)
- Inner Tracking system (ITS, |y|<0.9)
- Tracking and vertexing
- Vertex resolution better than 100 μm

Candidates are reconstructed via their decay topology, through the following steps:
1. Charged tracks are reconstructed in the ITS and TPC
2. Specific ionisation (in the TPC) is used to identify daughter particles
3. Candidates are selected combining reconstructed tracks and applying loose cuts on geometry and kinematics
4. Selection cuts are finally tightened to reduce background at the analysis level
5. Invariant mass spectrum of the candidates is used for signal extraction

Sample
- pp: about 180×10^6 minimum bias collisions at √s = 5.02 TeV taken in 2015

Signal extraction
1. Polynomial+gaussian fit of the signal region in invariant mass region to extract the value of the mean and σ
2. Bin counting in the signal region (± 3 σ)
3. Fit background sampled on both sides of the signal region
4. Integral of background fit function in the signal region

Ve + neutral particle decaying weakly into a pair of charged particles
Cascades → decay of charged particle into one charged and νe particle

RESULTS

Invariant mass distributions for VKn and Cascades reconstructed for selected pT bins
- Clear signal observed for all strange hadrons KΣΛΞ in minimum bias data sample

 Significant enhancement of strange to non-strange particle yields for high-multiplicity pp
- Consistent pattern between pp, p-Pb and Pb-Pb, with agreement in the overlapping multiplicity regions
- Models do not describe experimental observations satisfactorily

Detector efficiency dependence on pT was estimating with QCD-inspired MC model, namely PYTHIA8 with Monash tune (3)

SUMMARY AND OUTLOOK

- Enhancements of strange and multi-strange hadron production is observed towards high multiplicity pp events
- Results from pp@5.02 TeV will complement the current trends observed in the other energies and colliding systems
- Stay tuned for high-statistics data in pp@5.02 TeV from 2017

Introduction and Physics motivations

- A-A collisions: evolution and QGP
  - Reaching sufficient high energy densities (∼1 GeV/fm³), it becomes possible to create a state of partonic matter, the so-called Quark-Gluon Plasma, where quarks and gluons are not confined in hadrons. [1]
  - Strangeness enhancement
    - Higher yields per participant nucleon for strange and multi-strange particles relative to those in pp collisions has been predicted as a signature for QGP. [1]
    - Rapid strangeness enhancement with ALICE at √s = 5.02 TeV
    - Significant enhancement of strange hadron yields in Pb-Pb collisions with respect to pp collisions [1, 2, 3], consistent with QGP expectations

- Importance of pp collisions
  - Proton-proton collisions have been used extensively as a reference for the study of interactions of larger colliding systems at the LHC.
  - The systematic study of identified particle production as a function of charged particle multiplicity in pp has demonstrated to provide further insights into dynamics of small systems.
  - pp collisions can provide additional constraints to parton energy loss models
  - They allow for further insights into hadronisation processes and QGP conditions

References: