Light vector meson production in p-Pb and Pb-Pb collisions measured with the ALICE detector

Alessandro De Falco for the ALICE collaboration
Università degli Studi di Cagliari/INFN Cagliari
alessandro.de.falco@cern.ch

Motivations for the study of vector mesons:
- \( \rho, \omega \) and \( \phi \) provide key information on the hot and dense state of strongly interacting matter produced in high-energy heavy ion collisions
- Strangeness production investigated through \( \phi \) meson
- In-medium modification of hadron properties accessed through \( \rho \) spectral function
- Measurement in dileptons: negligible final state effects
- Measurement in pp and pA: reference for heavy ions, soft particle production in cold nuclear matter

The ALICE detector

Vector mesons can be detected through their decays in muon pairs with the muon spectrometer.

Analyzed data were collected in 2010 in pp collisions at \( \sqrt{s} = 7 \text{ TeV} \), in 2011 in Pb-Pb collisions at \( \sqrt{s_{\text{NN}}} = 2.76 \text{ TeV} \) and in 2013 in pp at \( \sqrt{s} = 2.76 \text{ TeV} \) and in p-Pb collisions at \( \sqrt{s_{\text{NN}}} = 5.02 \text{ TeV} \)

Motivations for the study of vector mesons:

- Combinatorial background evaluated through event mixing
- 2.5 < \( \eta_{\mu} \) < 4 and 2.5 < \( y_{\mu\mu} \) < 4
- muon tracks are required to match the muon trigger
- cuts for beam-gas interactions
- muon trigger introduces a selection \( p_T \mu > 0.5 \text{ GeV/c} \)

Low mass dimuons in p-Pb and Pb-p collisions at 5.02 TeV

- Fit to the dimuon mass spectrum after background subtraction
- free parameters of the fit are the normalization of \( \eta \rightarrow \mu\mu, \omega \rightarrow \mu\mu, \phi \rightarrow \mu\mu \) and open charm
- other processes normalized with ratios between cross sections or branching ratios
- Fair agreement between data and hadronic cocktail+heavy flavors

The ALICE experiment is dedicated to the study of QGP in heavy ion collisions.

Yield larger when the Pb beam is directed towards the muon arm (-4.46 < \( y_{\text{CM}} \) < -2.96)

Similar shapes in the common range 2.96 < \( |y_{\text{CM}}| \) < 3.54

Flat forward/backward ratio in this \( |y_{\text{CM}}| \) range

R \( \text{pPb} \) vs \( p_T \) for the \( \phi \) meson

- pp cross section at \( \sqrt{s_{\text{NN}}} = 5.02 \text{ TeV} \) obtained through interpolation of the measurements in pp at \( \sqrt{s_{\text{NN}}} = 2.76 \text{ TeV} \) and \( \sqrt{s_{\text{NN}}} = 7 \text{ TeV} \)
- At forward rapidities, R \( \text{pPb} \) increases monotonically from ~0.5 at \( p_T \approx 1 \text{ GeV/c} \) to ~1 at 3-4 GeV/c
- Maximum R \( \text{pPb} \) at \( p_T = 3-4 \text{ GeV/c} \)
- R \( \text{pPb} \) larger at backward rapidities
- The value approaches 1 at high \( p_T \)

Dimuon mass spectrum in Pb-Pb collisions at \( \sqrt{s_{\text{NN}}} = 2.76 \text{ TeV} \)

- Trigger threshold at \( p_T \approx 1 \text{ GeV/c} \)
- Mass spectra in different centrality bins for dimuon \( p_T > 2 \text{ GeV/c} \)
- Background (blue line) described as an empirical continuum

\( \phi \) yield and R \( \text{AA} \)

- Yield vs centrality increases from peripheral to semipерipheral collisions and tends to saturate for central events
- For each point, the measurements in KK at midrapidity and in \( \mu\mu \) at forward rapidity are compatible within the errors
- On the other side, different slopes for R \( \text{AA} \) vs centrality in the two data set for 2<\( p_T \)<5 GeV/c are observed
- Hint for a different hydrodinamic push in the two rapidity regions?