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Non-identical particle femtoscopy in Pb−Pb collisions at $\sqrt{s_{\rm NN}} = 2.76$ TeV measured with ALICE

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Two-particle femtoscopic correlations between non-identical charged particles for different charge combinations are measured in Pb-Pb collisions at $\sqrt{s_{\rm NN}}$ = 2.76 TeV with ALICE at the LHC. The three-dimensional two-particle correlation functions are studied in different centrality bins. The femtoscopic source size parameter (R_{Out}) and emission asymmetry (μ) are extracted. It is observed that the average source size of the system and emission asymmetry between particles increase from peripheral to central events.

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1. Non-identical particle femtoscopy

Due to Final State Interactions (FSI) among the particles, the two-particle correlations for non-identical pairs are sensitive to space−time coordinates of the particle emission points as well as the difference in average emission points (emission asymmetry) of different particle species.

2. Method

The experimental correlation function is constructed as $C(\mathbf{k}^*) = N(\mathbf{k}^*)/D(\mathbf{k}^*)$ where k^* is the momentum of the first particle in the Pair Rest Frame (PRF), $N(\mathbf{p}_{\rm a}, \mathbf{p}_{\rm b})$ and $D(\mathbf{p}_{\rm a}, \mathbf{p}_{\rm b})$ are the distributions when both particles coming from the same event and from two different events, respectively. The emission point spatial distribution was parametrized by the functional form described in the reference [1].

3. Analysis details

The present measurements are based on the study of pion-kaon femtoscopic correlations in Pb−Pb collisions measured at $\sqrt{s_{\rm NN}} = 2.76$ TeV by the ALICE detector [2] in 2011. Tracks with a transverse momentum within 0.19 GeV/c < $p_{\rm T}$ < 1.5 GeV/c measured in the pseudo-rapidity range $|\eta| < 0.8$ are selected . Combined information from TPC and TOF is used to identify charged tracks as pions and kaons. The uncorrelated pair background is constructed by pairing tracks from different events in same trigger class.

4. Results

Using the source function as described in reference [1], one can numerically integrate the Koonin-Pratt equation with the corresponding wave function to calculate the correlation function. The method is decribed in [1].

One observes that the system size and the extracted emission asymmetry increase with event multiplicity . This implies that pions are emitted closer to the centre of the source. The results are compared to the predictions from the Therminator2 model [**?**] and it was found that an introduction of a time delay of 2.1 fm/c in kaon emission time, the result [**?**] is in good agreement with the experimental measurement.

5. Conclusion

The first measurements of pion-kaon femtoscopic correlations in Pb−Pb collisions at $\sqrt{s_{\rm NN}} = 2.76$ TeV have been performed. The radius of the source $R_{\rm out}$ and an observed finite emission asymmetry show a decreasing trend from central to peripheral collisions.

References

[1] Pion-kaon femtoscopy in Pb−Pb collisions, **arXiv:1807.10072**

[2] K. Aamodt *et al*. The ALICE experiment at the CERN LHC. JINST, 3:S08002, 2008.