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Reconstruction Procedure for $\Lambda\Lambda$ Pairs in Xe + CsI Collisions at 3.8A GeV in the BM@N Experiment

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Abstract

Subthreshold production of $\Lambda\Lambda$ pairs in nucleus–nucleus collisions is largely unexplored and is of particular interest for studying strangeness-production mechanisms in dense baryonic matter.

In 2023, the fixed-target BM@N experiment at the NICA–Nuclotron accelerator complex collected data from Xe + CsI collisions at a beam kinetic energy of 3.8A GeV. This work presents the procedure used to reconstruct Λ hyperons and extract the $\Lambda\Lambda$ signal from these data.

Λ hyperons are reconstructed via the weak decay $\Lambda \rightarrow p\pi^-$ using a displaced-vertex topology, with the secondary decay vertex separated from the primary interaction vertex. Events containing two Λ candidates are analysed using the two-dimensional distribution of the invariant masses of the two $p\pi^-$ combinations. The number of events containing $\Lambda\Lambda$ pairs is determined by estimating the contribution from combinatorial background in the two-dimensional invariant-mass plane. The stability of the extracted $\Lambda\Lambda$ signal is assessed by varying the Λ -candidate selection criteria and the methods used to model the combinatorial background.

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