

Study of the correlation function between cells in the HGND at the BM@N experiment

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The BM@N experiment (JINR, Dubna) studies heavy-ion collisions at energies up to 4.5 GeV per nucleon. To expand the physics program of BM@N, the Highly Granular Neutron Detector (HGND) [1] is being developed for the measurements of neutron spectra in the range 0.3–6 GeV. The HGND design comprises two arms, each with 7 layers of plastic scintillator cells with a copper converter in between. An additional scintillator veto layer placed in front of the detector suppresses charged particles. Each scintillator layer is an 11×11 matrix of cells with individual readout. The time-of-flight base is 7 m, and the time resolution is about 150 ps.

A single particle hitting the HGND causes several cells to fire simultaneously. Multiple particles can also be registered in a single event. Hits from one particle are correlated in time, whereas hits from different particles show independent time distributions. By studying pairwise correlations between detector cells, one can determine the time resolution of individual cells and the geometric patterns of particle hits.

This talk presents an algorithm for determining the mutual correlation function between HGND cells. The mixed-event method was used to account for the uncorrelated background. The algorithm was validated with data from Monte Carlo simulations of the BM@N setup. It is shown that the algorithm can be applied to the time calibration of the detector under real experimental conditions.

References

1. S. Morozov [et al.], Nucl. Instrum. Meth. A **1072**, 170152 (2025).