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The acceptance and efficiency of the Highly Granular Neutron Detector prototype in the BM@N experiment

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The Highly Granular Neutron Detector (HGND) has now been developed and constructed for the measurements of neutron yields and flow in nucleus-nucleus collisions in the BM@N experiment at the NICA accelerator complex. Its compact prototype was first used in the BM@N experiment to study collisions of 3.8A GeV ^{124}Xe with a CsI target. The HGHD prototype consists of longitudinally alternating layers of absorber and scintillator with high transverse granularity to ensure an efficient detection of neutrons. Each scintillator layer consists of a 3x3 array of scintillator detectors (40x40x25 mm^3) with SiPM individual readout. The time resolution of detectors is about 150 ps, and it allows the measurement of the kinetic energy of neutrons traveled the distance of 8.3 m from the target via the time-of-flight technique providing a good energy resolution. In this work, the calculated efficiency and geometric acceptance of the HGND prototype in detecting spectator neutrons from hadronic interactions and electromagnetic dissociation (EMD) of ^{124}Xe are presented. The DCM-QGSM and UrQMD models coupled with the SMM and AMC codes, respectively, to simulate decays of excited spectator matter left after the first fast stage of nucleus-nucleus collisions were used as primary event generators for nucleus-nucleus collisions. The RELDIS model was used to generate EMD events. The systematic uncertainties of the calculated efficiency and acceptance of the HGHD prototype have been estimated and discussed.

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