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Measurements of neutron kinetic energy with the Highly Granular Neutron Detector prototype in the BM@N experiment

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A Highly Granular time-of-flight Neutron Detector (HGND) is currently under development for the BM@N experiment to measure the yields and flow of neutrons with energies of 0.3–4 GeV [1]. To validate the concept of the full-scale HGND, a compact HGND prototype was constructed and tested in collisions of Xe projectile with energy of 3.8A GeV with a CsI target at the BM@N experiment [2]. Kinetic energy of neutrons is reconstructed using the time-of-flight method. HGND prototype design provides high neutron detection efficiency, good spatial resolution and time resolution of about 270 ps.
The reconstructed kinetic energy spectra of spectator neutrons and neutrons from electromagnetic dissociation (EMD) are compared with the Geant4 modeling in the full geometry of the BM@N setup using the DCM-QGSM-SMM and UrQMD-AMC models as heavy-ion collision generators and the RELDIS model as EMD event generator. Such measurements will provide an opportunity to estimate neutron yields in the HGND prototype acceptance as well as cross-sections by correcting for model-estimated efficiencies for central and semi-central nuclear collisions and for EMD.

1. F. Guber et al., Experiment. Instrum. Exp. Tech., 67, 447–456 (2024).
2. A. Zubankov et al., arXiv:2503.12624 [physics.ins-det] (2025).

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