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Development status of the Highly Granular Neutron Detector for the BM@N Experiment

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A new highly granular time-of-flight neutron detector (HGND) is being developed and constructed for the BM@N (Baryonic Matter at the Nuclotron) experiment to identify neutrons and measure their energies in heavy-ion collisions at beam energies of up to 4 AGeV. The HGND consists of two arms, each with 8 active layers, each of 11×11 plastic scintillator cells $4 \times 4 \times 2.5$ cm³ with direct light readout by silicon photomultipliers EQR15 11-6060D-S and copper absorber plates with thickness 3 cm in between. The detector readout electronics is based on a custom-developed board featuring a 100 ps FPGA-based time-to-digital converter (TDC). The complete HGND readout system will comprise eight such boards, each equipped with three Kintex-7 FPGAs and capable of reading out 248 channels. A fully functional 34-channel detector prototype, corresponding to one quarter of a single active layer, was tested using cosmic muons and the LPI electron beam. In addition, a two-channel prototype was integrated into the BM@N data-acquisition system, including full-chain readout functionality, and tested during the run in April of this year. Details of the HGND development, readout topology and test results will be presented.

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