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Development and tests of the 100 ps FPGA-based TDC readout board for high granular time-of-flight neutron detector at BM@N experiment.

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The new high granular time-of-flight neutron detector (HGND) is being developed for the BM@N (Baryonic Matter at Nuclotron) experiment to identify neutrons and to measure their energies in heavy-ion collisions at ion beam energies up to 4 AGeV. The HGND consists of about 2000 scintillator detectors (cells) with a size of $40\times40\times25$ mm^3 and with individual light readout with EQR15 11-6060D-S photodetectors. The readout board with a 100 ps FPGA-based TDC (Time to Digital Converter) is currently under development. The HGND will consist of eight such readout boards, each comprising three Kintex 7 FPGAs for reading out 252 channels. The TDC operates on the standard LVDS 4x asynchronous oversampling and is synchronized with the experiment timestamp using the White Rabbit link. The full functional readout board prototype operating with 39 TDC channels was assembled and is under testing. The measurements show channel precision on the level of 40 ps. The FPGA-TDC principle of operation and tests results, readout board topology, and the readout software architecture will be discussed.

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