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New Developments in the "Event-by-Event" Fast Neutron Radiography

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A new generation of the Lintech's neutron imaging device is under development, extending the capabilities of the previously patented solution [1]. Our device implements general design of the fast neutron imager, previously demonstrated spatial resolution just under 0.5 mm [2]. It operates in the event-by-event readout mode, acquiring energy, timing, and pulse shape information for all detected radiation events, and achieving good separation from backgrounds. New hardware includes the next generation of Hamamatsu position sensitive photomultiplier tubes (PSPMT) with enhanced characteristics, an improved readout electronics, and a new fast data acquisition module that is capable of acquiring of up to 20-50 MHz of neutron interaction events. The design of the readout and DAQ allows to build detectors either with a single PSPMT or with an array of PSPMTs in various configurations (such 2x2, 3x3, 2x4, etc.). The new version of the hardware may be used, with an appropriate scintillator, for imaging with thermal and ultra-cold neutrons, in neutron scattering and interferometry. Using pulse shape discrimination, it is also suitable for joint multimodal imaging of neutrons and photons.

[1] V. Popov, P. Degtiarenko and I. Musatov, "Fast neutron imaging device and method" U.S. Patent No. 8,648,314, (2014).

[2] V. Popov, P. Degtiarenko and I. Musatov, "New detector for use in fast neutron radiography", doi:10.1088/1748-0221/6/01/C01029, (2011).

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