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Possibility of fast neutron detection with position sensitive pixel detector Timepix

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This paper presents a position-sensitive detection method for fast neutrons by proton recoil in a plastic scintillator. The detector consists of a plastic scintillator with silicon photomultiplier readout and pixel detector Timepix. As a known plastic scintillators are hydrogen-rich materials adopted as neutron to proton convertors by elastic (n, p) scattering. Silicon pixel detector Timepix is used for position-sensitive detection of recoil protons which exit the plastic scintillator. Scintillation light is read out using micropixel avalanche photodiode of type MAPD-3NK from Zecotek Photonics Inc. MAPD-3NK allows to measure the energy loss by protons in the plastic scintillator and to trigger Timepix detector.
Timepix detector is a silicon based hybrid pixel detector which allows obtaining information from each pixel. The detector consists of 256*256 square pixels (55 μm) with pitch size of 55 μm. The active area and thickness of the detector is about 1.96 mm2 and 300 μm, respectively.*
Micropixel avalanche photodiode of type MAPD-3NK is one of silicon based alternatives to common vacuum photomultipliers. MAPD-3NK consists of deeply burned pixels connected in parallel and operating in the Geiger mode. MAPD-3NK has a total photosensitive area of 3.73.7 mm2 and 10000 pixels per mm2. Operating voltage is about 90 V for this photodiode.
Experiments have been carried out with 239Pu-Be radioisotopic neutron source and monoenergetic neutrons from the reaction D(d, n)3He on the EG-5 Van de Graaff accelerator, FLNP, JINR.

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