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A new linear and ring neutron scintillation detector based on SiPM and lightguides

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We developed linear neutron detectors based on ZnS/LiF scintillators and solid-state photomultipliers (SiPM) for neutron intruments. The developed detectors use for light readout a lightguide with diffuse reflection. The light readout by this method is more effective than the wavelenght shifting fibers - up to 80 photoelectrons. These detectors are successfully tested on time-of-flight diffractometers at spallation sources IN-06 and RADEX of INR RAS. The efficiency of thermal neutrons registration can reach 70%. Due to the miniaturized sizes of photodetectors, these detectors can be connected to systems with a large sensitive area, including curved ones. It is also possible to create multi-layer detectors to increase efficiency. The proposed schemes will make it possible to create highly efficient, compact and lightweight detectors that do not require high voltage (because used solid-state photomultipliers).

A ring neutron detector for time-of-flight diffractometers with minimal blind areas has been developed based on this linear scintillation detectors. Also we developed neutron counters with trapezoidal lightguide. A ring detector based on these counters has no blind areas.

These detectors have proved to be an effective and inexpensive alternative to helium-filled detectors.

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