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Gas-filled Neutron Imager Operating in Ionization Mode

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We describe the development of a new position-sensitive detector for neutrons that uses He-3 as the neutron sensing element and operates in ionization mode, without any electron multiplication. The electrons created by the thermal neutron - He3 interaction are collected by discrete anode pads, each connected to an input channel of an ASIC mounted on the back of the anode pad plane. The custom 64 channel ASICs and their readout board can process events up to 25k/s. Using this concept, we have designed and constructed a large area detector for small angle neutron scattering with nearly 40,000 channels, yielding a total count rate of 10^{**8} cps over an area of 1m x 1m. Early results demonstrate excellent, stable performance for small-angle scattering. The detection technique also allows the observation of ionizing tracks from recoil nuclei created by fast neutrons.

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