



Contribution ID: 59

Type: **Poster**

The GEM-based Neutron detector

Tuesday 2 September 2008 15:10 (20 minutes)

The development and testing of a large area high count rate position-sensitive neutron detector based on Gas Electron Multiplier (GEM) is reported. With the use of $^3\text{He}:\text{CF}_4$ gas mixture at atmospheric pressure, the detector is anticipated to have ~50% efficiency for cold neutrons, 5-10 mm spatial resolution, and to handle up to $10^6 \text{ cm}^{-2}\text{s}^{-1}$ count rates, sufficient for intended applications with thermal and cold neutrons at IUCF Low Energy Neutron Source. A $10 \times 10 \text{ cm}^2$ prototype detector with a cascaded triple-GEM structure and two-dimensional crossed-strip readout electrode giving a $4 \times 4 \text{ mm}^2$ readout pixel size has been fabricated using industrially produced GEM foils and readout PCB. The prototype detector has been tested with electron and X-ray sources and demonstrated spatial resolution of 4 mm (single pixel). Tests of the prototype with neutron sources are on the way. This work has been supported by the National Science Foundation (under grants DMR-0220560 and DMR-0320627) and the 21st Century Science and Technology Fund of Indiana (Indiana University).

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Session Classification: Poster Session 1 - Astrophysics, Space, Gaseous and Novel Photon detectors

Track Classification: Novel Gas-based Detection Techniques