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Performances of a Medium-Size Boron-coated GEM detector for thermal neutrons at the ISIS Neutron and Muon Source

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Experiments at neutron spallation sources require detectors with specific features such as capability to sustain high count rates and high detection efficiency.
Gas detectors based on Gas Electron Multiplier (GEM) technology distinguish themselves from other gaseous detectors thanks to their good spatial resolution, good detection efficiency, large surface covering and very high rate capability (>MHz/mm2). Moreover, coupling a GEM detector with a custom electronic readout, high rates are sustained avoiding dead time and pile-up phenomena. This system makes GEM detectors very attractive for facilities where a high neutron flux rate is expected, such as the European Spallation Source (ESS). Future experiments will need detectors with more stability and higher detection efficiency today available ones; in this work, the measurements of a detector based on GEM technology optimized for thermal neutrons, jointly developed by UNIMIB and ISTP-CNR, are shown.
The detector is characterised by the exploitation of the innovative double-sided boron-coated GEM foils (BGEM). The presence of multiple BGEM foils, at least 6, will allow us to increase the detection efficiency with respect to the single-layer boron-coated GEM detector. This work presents the measurements performed with thermal and epithermal neutrons at the ISIS Neutron and Muon Source at the VESUVIO beam line.
The Medium Size Boron-GEM (I-MS-BGEM) detector has been characterised in terms of counting rate stability and capability to discriminate gamma rays from neutrons and it has shown a detection efficiency of 16% at 1.8Å.
Starting from these results, future boron GEMs will be developed with different anode configurations, in order to also perform imaging with good spatial resolution.

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