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Short induction gap Gas Electron Multiplier (GEM) for X-ray Spectroscopy

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Abstract: Experimental work was carried out to evaluate the performance of a Gas Electron Multiplier (GEM) operated with a Micromesh readout plane that enabled the induction gap to be set at 50 microns. We measured the essential operational parameters of this system using Ar(75%)-isobutane (25%) as the counter gas mixture. The measurements included the effective gain (signal-to-noise ratio), effective gain stability, X-ray energy resolution and the risetime of the detector output pulses using a 5.89 keV X-ray source. These studies demonstrated several advantages of the current system such as lower operational voltages, higher effective gains, improved effective gain stability and faster detector output pulses.

1) Introduction: The conventional Gas Electron Multipliers (GEMs) operation usually employs the induction gap (Distance between the bottom GEM electrode and the readout plane) set at 1 mm or more. This may lead to effective gain shifts of the detector if the GEM foils sags due to counter gas absorption and moisture. One obvious way to circumvent this is to introduce dielectric pillars between the GEM foil and the readout plane. In the present study, we have used a standard GEM (hole diameter 55 microns, hole pitch 140 microns) coupled with a micromesh with 50 microns tall, 150 microns diameter kapton pillars. The short induction gap had several distinct operational advantages. For example, better effective gain stability owing to a good induction gap definition, the absolute voltages needed to sustain a particular induction field were lowered and faster output pulses were observed.

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