

Contribution ID: 5

Type: not specified

A robust large area x-ray imaging system based on 100 µm thick Gas Electron Multiplier (GEM)

Thursday 15 September 2016 12:00 (20 minutes)

Imaging applications with Gas Electron Multipliers as amplification devices provide excellent spatial resolution (of the order of hundreds of μ m) for areas as large as 10x10 cm2, making use of discrete channel readout. A drawback is the need for complex and expensive electronic systems. In applications where resolutions of the order of the mm are required, a simpler and cheaper solution is to determine the position of the interaction using the resistive charge division method. This solution requires a minimum of 4 readout channels to achieve 2D imaging over large areas, greatly simplifying the electronic system. A large signal-to-noise ratio is however required with the GEM's operating at high gain, in some cases, near the discharge limit.

We have developed a non-standard GEM, made from a 100 micron thick kapton foil (2-fold thicker than standard GEM's). The 100 micron thick GEM is produced using the same wet etching technique as the standard GEM and is virtually immune to discharges. A robust detector that can safely operate at the high gains necessary to achieve an adequate signal-to-noise ratio for imaging applications was developed.

In this work we present the results obtained with a detector composed by two 100 micron thick GEM and a 10x10 cm2 2D readout electrode with resistive lines. Energy resolution of 21% and charge gains above 104 have been measured, with a 55Fe radioactive source. Results of the detector characterization for imaging applications are also presented.

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Session Classification: Workshop II