Gas Gain Measurements from a Negative Ion TPC X-ray Polarimeter

Z. Prieskorn, J. E. Hill, P. E. Kaaret, J.K. Black, K. Jahoda

(Submitted on 15 Jul 2011)

Gas-based time projection chambers (TPCs) have been shown to be highly sensitive X-ray polarimeters having excellent quantum efficiency while at the same time achieving large modulation factors. To observe polarization of the prompt X-ray emission of a Gamma-ray burst (GRB), a large area detector is needed. Diffusion of the electron cloud in a standard TPC could be prohibitive to measuring good modulation when the drift distance is large. Therefore, we propose using a negative ion TPC (NITPC) with Nitromethane (CH3NO2) as the electron capture agent. The diffusion of negative ions is reduced over that of electrons due to the thermal coupling of the negative ions to the surrounding gas. This allows for larger area detectors as the drift distance can be increased without degrading polarimeter modulation. Negative ions also travel ~200 times slower than electrons, allowing the readout electronics to operate slower, resulting in a reduction of instrument power. To optimize the NITPC design, we have measured gas gain with SciEnergy gas electron multipliers (GEMs) in single and double GEM configurations. Each setup was tested with different gas combinations, concentrations and pressures: P10 700 Torr, Ne+CO2 700 Torr at varying concentrations of CO2 and Ne+CO2+CH3NO2 700 Torr. We report gain as a function of total voltage, measured from top to bottom of the GEM stack, and as a function of drift field strength for the gas concentrations listed above. Examples of photoelectron tracks at 5.9 keV are also presented.

Comments: 6 pages, 6 figures, accepted for publication in IEEE Trans Nucl Sci

Subjects: **Instrumentation and Methods for Astrophysics (astro-ph.IM)**; Instrumentation and Detectors (physics.ins-det)

Cite as: **arXiv:1107.3079 [astro-ph.IM]**

(or **arXiv:1107.3079v1 [astro-ph.IM]** for this version)

Submission history

From: Zachary Prieskorn [view email]

[v1] Fri, 15 Jul 2011 14:42:24 GMT (277kb)

Which authors of this paper are endorsers?