3D Printed Micro Patterned Gas Electron Multiplier

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Multi Wire and Gas Electron Multiplier (GEM) are both gas ionization detectors used in high energy physics research. A prototype detector using principles from both devices was fabricated. Gas electron multiplication occurs when electrons travel through an array of wire grids. The prototype was constructed using 3D printing technology. Carbon loaded plastic was used to create electrically conductive wires while a nonconductive plastic was used as the frame. A detector stack was created using four XY wire grid arrays allowing for eight multiplication stages. The detector was printed as a single process creating a monolithic device. A Paschen curve was measured to determine the ideal operating voltages. The detector output was analyzed using an Open Source Multi Channel Analyzer. Gamma ray spectroscopy was used to compare background radiation with that of a published gamma ray spectrum. A 3D printed hybrid Multi Wire and GEM detector has been realized and successfully tested using a 3D printer. Commercial 3D printers could greatly increase the active area of the detector while decreasing the circumference and spacing of the wires which would increase the detector efficiency.

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