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Optimising Gas Electron Multiplier for improved detector performance using ANSYS and Garfield++

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Micro-Pattern Gas Detectors (MPGDs) are a type of gaseous ionization detector that use microelectronics. They are characterized by a very small gap between the anode and cathode electrodes, which are maintained at high voltage and are usually filled with gaseous medium. When a high-energy particle interacts with the gas, it produces ions and electrons that are propelled in opposite directions by the electric field in the detector region. The electrons that are deflected can induce further ionization,resulting in more electron-ion pairs through an avalanche effect. These resulting particles can be detected with high precision at the readout stage.

One specific kind of MPGD is the Gas Electron Multiplier (GEM), which is made from a polyimide film sandwiched between two conductive layers of copper under a high voltage difference. Tiny holes in the foil allow for electron avalanches to occur. However, the current design of the GEM detector, used in various experiments is suboptimal for achieving maximum gain and performance. This study aims to achieve the best possible configuration of GEM foil to get optimal electric field, higher gain and lesser back-flow of ions without compromising the detector's capability. In this research, we have modified the geometry of the GEM detector to improve gain, minimize ion back flow and enhance overall performance. This geometry has been modeled in ANSYS and additional analyses have been conducted using Garfield++.

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