

A Gas Avalanche Chamber Operated with a Secondary Electron Emitter in Radiation Detection

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Abstract

A columnar CsI secondary electron emitter has been coupled to a conventional microstrip chamber. The characteristics of a columnar CsI with gas multiplication was investigated by using beta rays from a ^{90}Sr source. This layer is intended for use as the primary electron source in any gas avalanche microdetector to avoid severe performance loss by the oblique angle of the incident charged particle. It was initially thought that the columnar structure might provide a larger detection efficiency than a planar CsI layer, because of the many surface crossings of incident particle for the columnar geometry. The efficiency measurement of a columnar CsI layer was performed in a thin parallel-plane structure, which has a 50-500 mm gas gap between a columnar CsI cathode and metal anode. We discuss the secondary emission and electric fields in the columnar structure, and explain why, based upon field simulation and experimental results, this approach does not succeed in this case. New ideas are presented for driftless gas avalanche detectors insensitive to the angle of incidence.