

Development of a Novel Position-Sensitive Radiation Detector Using a Gaseous Photomultiplier and a Vacuum Ultraviolet Scintillator

We have developed a novel position-sensitive radiation detector that consists of a large-size position-sensitive gaseous photomultiplier with a vacuum ultraviolet (VUV) sensitive CsI photocathode and a VUV scintillator. Although the VUV detector itself can be applied to material analysis and to liquid Ar/Xe scintillators, in order to obtain hard X-ray images with higher detection efficiency than gaseous detectors, we have used a VUV scintillator. Our prototype gaseous photomultiplier consists of a MgF2 window with a transmissive CsI photocathode layer, two Gas Electron Multipliers (GEMs), and a position-sensitive gaseous detector named Micro Pixel Chamber (μ -PIC). The detector was filled with argon (90%) and ethane gas (10%) at 1 atm. The GEMs and μ -PIC had effective areas of 10 cm x 10 cm. The VUV scintillator, LaF3(Nd), with a volume of 2 cm x 2 cm x 2 cm was coupled to the MgF2 window. We succeeded in obtaining images by irradiating 5.5 MeV alpha particles from an Am-241 source to the LaF3(Nd) at a gas gain of $\sim 7 \times 10^5$. We have also developed the reflective type which uses a reflective CsI photocathode layer on top of the first GEM instead of the MgF2 window, and the quantum efficiency of the reflective type was a few times higher than the transmissive type. We obtained an image using the reflective type and the same LaF3(Nd) by irradiating with alpha particles from the same source at a gas gain of $\sim 1 \times 10^5$.

Summary (Additional text describing your work. Can be pasted here or give an URL to a PDF document):

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