The Role of Gas-Based Photon Detectors in Synchrotron Experiments

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Gas-based photon detectors form an important component of the varied radiation sensors used in synchrotron experiments. They offer excellent signal to background in counting applications, and possess good position resolution, high rate capability and large area coverage for imaging applications. Their relative efficiency for very soft X-rays is as good as any technology. We will review briefly the characteristics that limit position resolution and count rate, two key properties of gas-based detectors that are sometimes not easy for users to quantify.

In some synchrotron applications, gas-based detectors have largely been superceded by newer devices. Protein crystallography is a prime example: twenty years ago, large area multi-wire devices were commonplace on crystallography stations, and now scintillator screens or solid state pixel sensors are the norm. Nevertheless, gas-based detectors continue to flourish and provide unequalled performance in other applications. X-ray diffraction and X-ray microscopy are just two examples that will be examined.

Micro-pattern gas detectors, developed largely in the last ten years, contain electron multiplying structures fabricated on a substrate by lithography, and have provided a wider range of detector options to the standard wire chamber. Key characteristics of the most successful micro-pattern detectors will be described.