Multichannel Silicon Drift Detectors for High Speed, High Resolution X-ray Spectroscopy Applications

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Silicon Drift Detectors (SDD) are nowadays standard tools for an increasing number of industrial and scientific X-ray spectroscopy applications. They combine the advantages of excellent spectral performance at high count rates (owing the integration of the first FET), high detection efficiency over a large energy range and compact packaging.

Modern synchrotron facilities offer high brilliance photon beams which in combination with nano-focusing techniques enable a completely new generation of experiments. What they all have in common is the need of larger, faster and higher performance x-ray detectors.

Single cell SDDs can accommodate detection areas up to 100 mm^2; their spectroscopic performance has almost reached the Fano limit (FWHM @ Mn-Ka < 122 eV at 1 us shaping time). For applications where larger detection areas are needed or the overall count rate exceeds the capability of one cell, monolithically integrated multi-channels SDDs become the first choice. A variety of such detectors has been built with cell sizes between 10 and 100 mm^2 and numbers of cells between 3 and 77; selected results will be presented.

For nano-beam X-Ray Fluorescence (XRF) experiments, a multi-channel annular detector configuration with a central hole is of special interest as it enables fitting of the detector into the limited space between the sample and the x-ray optics and positioning of the detector very close to the sample. By that a very large solid angle for the incoming X-ray photons is insured. Measurement results with such a detector device will be reported and the perspective of using this detector for beam-line experiments will be discussed.