New Detector Architectures with Silicon Drift Detectors for XRF Applications

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Silicon Drift Detectors (SDDs) are currently used in a considerably increasing number of applications. As a result of the continuous improvements in the detector technology, the SDD with integrated FET fabricated by PNSensor and PNDetector in collaboration with the Semiconductor Laboratory of the Max-Planck-Institutes in Munich have established themselves as state-of-the-art detectors for X-ray spectroscopy.

With energy resolution values down to 123 eV at Mn-K line, P/B ratio values up to 20,000 measured at moderate operation temperatures (e.g. -20°C) and input count rates up to 10^6 cps, SDDs with integrated FET are capable of performance values unequaled by any other silicon based detector system.

The very flexible design and architecture of different SDD chips and modules allows a whole variety of new applications for XRF with special needs and geometric boundary conditions. Beside the design of the sensors themselves the SDD mounting is very flexible and accounts the small amount of space which is often available in a detection system. Additionally, the fact that for SDDs with integrated FET an external bulky cooling mechanism is not necessary to reach optimum performance becomes very important.

Apart from the standard SDD modules with active areas of 5, 10, 20 and 30 mm², larger areas SDDs become very attractive for applications requiring short measuring time. Measurement results with single cell SDDs with active area of 100 mm² as well as multi-cell SDDs with a total active area of up to 6x100 mm² will be reported.

For WDXRF applications multi-channel SDDs with special geometry adapted to the various WDS instruments (flat or curved optics geometries) are fabricated and tested. Test results with a 3x20 mm² SDD module or a 3x1 cm² SDD module will be presented.

Besides a larger detection area, the detector geometry can also be optimized. This is for example the case of the 4-channel SD3 detector with a total area of 60 mm² and a central hole for the exciting beam. In this configuration the detector can be placed very close to the probe allowing a large collection angle for the incoming X-ray photons.