

# MOVING TO HIGH DETECTION EFFICIENCY, LOW BACKGROUND SILICON DRIFT DETECTORS

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In the recent years the Silicon Drift Detectors (SDD) have become standard detectors for Energy Dispersive X-ray Fluorescence Spectroscopy (ED-XRF) instrumentation. Their advantage of having a very small input capacitance which is independent on the sensitive active area makes them indispensable for applications requiring good energy resolution at very high input count rates.

The SDD detectors manufactured by the companies PNDetector and PNSensor in Munich combine the advantage of the SDD principle with the monolithical integration of the first amplification FET directly onto the detector chip. Thus, the overall input capacitance is kept free of large interconnection capacitances and by that, its noise contribution to the detector noise being reduced to minimum. Furthermore, the ultra-pure fabrication technology entirely dedicated to detector fabrication leads to very low levels of detector leakage current and therefore greatly reducing the effort for the detector cooling. This becomes more significant when considering the general trend of going for larger detector areas.

While in terms of spectroscopic performance the detectors have almost reached their theoretical limit, much work has been done by diverse groups in optimizing the detector package.

One recent objective for the package optimization is reduction of the background radiation which can be realized by carefully choosing the materials used in the mounting parts (e.g. ceramic substrate, Peltier cooler) with regard to contaminants which could contribute to the background fluorescence peaks in a measured spectrum, but also by using an appropriate shielding (by means of a graded shielding technique) of those parts which are susceptible for producing fluorescence peaks. Background measurements with optimized detector modules will be presented, they will be compared with simulations and the results as well as further improvements will be discussed.

Another important component of the detector module is the radiation entrance window. This has become obvious especially in the last year. Measurements with diverse types of windows like Beryllium or AP3-type windows, including recent alternatives will be presented. Features like quantum efficiency, light shielding, mechanical, thermal and environmental (e.g. humidity) stress will be analyzed in detail.