A new 13-element SDD array cooled with a Pulse-Tube cooler with very high count rate capability at the SAMBA and MARS beamlines: The X-PIPS™ SXD13

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Abstract—Key performance results from the first 13-element SDD array (X-PIPS™, model SXD13) cooled with a Pulse-Tube cooler are presented with an expected total output count rate of 60 MCPS. The new detector array is based on an proven 7-element Silicon Drift Detector (SDD) design; The X-PIPS™, model SXD7, and has been built for the SAMBA and MARS beam lines at the SOLEIL Synchrotron.

The quality of the spectroscopic signal depends on the peak to background of the detector and the possibility of new detectors of preserving P/B at high count rates will make experiments shorter: an element of foremost importance for synchrotron usage.

However, even the bare output count rate per detector channel is constrained by a few factors, for example charge collection time in the element, the rise time of the preamplifier and the signal processing time in the read-out electronics.

The main solution to get to a high output count rate is to perform parallel processing of multiple detector channels, while limiting the dead space between the elements and maximizing the solid angle covered by the array detector.

Individual SDD elements were chosen with special attention to minimizing the total dead area. Individual elements guarantee an extremely low cross talk with neighboring pixels and easier maintenance than monolithic detector types. 13 independent SDD's of 100mm² each, collimated to 80mm², with a thickness of 500µm are individually mounted in an array geometry with an inter distance of 14 mm, fitting in a nose with outer diameter of 70mm.

The operating temperature of the SDD of -80°C is achieved thanks to the Pulse Tube cooler. State of the art spectroscopic performance are achieved at this temperature with signal rise times well below 50ns and an expected performance of output count rate per channel in excess of 4.5MCPS and a total output count rate of 60 MCPS.