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New Development of Silicon Drift Detectors for Gamma-ray Astronomy

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In this work we report on a new development of Silicon Drift Detectors (SDDs) for gamma-ray spectroscopy for astronomy applications, an activity supported by ESA. The SDDs are designed as monolithic arrays of 3x3 units, each one of an active area of 64mm² (total array area of 5.76cm²). These arrays will be assembled on a common substrate to be used as photodetector to read out large (2"x2" and 3"x3") LaBr₃ scintillators. The SDDs have been produced at FBK semiconductor laboratories. For the electronics readout of these devices, which do not include a front-end transistor on the detector chip, we have adopted a CMOS charge preamplifier (CUBE), recently developed at Politecnico di Milano. This preamplifier has allowed to achieve state-of-the-art noise performances, even if compared with SDD with on-chip JFET, and it is a suitable solution for this application as it allows to use a relatively standard SDD technology process with very good noise performances. The SDDs have been produced for this application with custom anti-reflective-coatings. A quantum efficiency of about 80% has been measured on these devices at the wavelengths of emission of LaBr₃ (360-380nm). In this work we will report on the design issues of these devices and on the first experimental results obtained in gamma-ray spectroscopy. By coupling a single SDD with a small LaBr₃ scintillator (6mm diameter), we have measured an energy resolution of 5.6% FWHM and 2.7% FWHM respectively at 122keV and 662keV.

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