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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 64mm^2 (total array area of 5.76cm^2). 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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