CdZnTe Position-sensitive Drift Detectors

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High-energy resolution position-sensitive CdZnTe (CZT) drift detectors offer unique capabilities for imaging gamma rays and correcting the response non-uniformities caused by crystal defects. The long electron lifetime in today's CZT crystals allows for making CZT drift detectors with much greater thicknesses than those for any other existing detectors. We will present data on detectors up to 50-mm long. Recently, we proposed to develop an array of position-sensitive CZT drift detectors for imaging and spectroscopy of gamma-ray sources. Here, we will present the results from testing of the first prototypes of such arrays. The array prototypes employ 6x6x20 mm^3 and 7x7x20 mm^3 CZT crystals encapsulated into polyester shells with 4-5 mm-wide charge-sensing pads placed new the anode. The pad signals provide X-Y position information, which allow for more accurate corrections of the charge losses caused by crystal defects. The basic array (module) consists of a number of detectors grouped into 2x2 sub-arrays, each having a common cathode made by connecting together the cathodes of the individual detectors. The cathode signals provide position information along Z coordinate. Each module is coupled with its front-end ASIC chip, which captures signals from 36 anodes and 9 cathodes. As we will describe in the talk, this feature can significantly improve the performance of detectors fabricated from typical CZT material and, thus, extend their acceptance boundaries, leading to an increase in the yield and an expected decrease in cost.