Twin Shaping Filter Technique for Signals Compensation in CZT Detectors Grown by the Vertical Bridgman Method

N. Auricchio[1], E. Caroli[1], L. Marchini[2], F. Schiavone[1], A. Basili[1], A. Zappettini[2]

[1]IASFBO, INAF, Bologna, Italy
[2]IMEM, CNR, Parma, Italy

CdTe/CdZnTe is a consolidated material to realize detectors for a large variety of applications, such as medical, industrial, and space research. An Italian collaboration, involving the CNR/IMEM and INAF/IASF institutes, was born some years ago with the aim to develop a national capability to produce CZT detectors starting from the material growth to the final detection device. Some important features of these detectors (pulse height, energy resolution, photopeak efficiency) are affected by the charge collection efficiency: the low mobility of the charge carriers (particularly the holes) and trapping/detrapping phenomena can degrade the CdTe/CZT detectors response, depending on the distance between the charge formation position and the collecting electrodes. Several efforts have been made to improve the detection efficiency as well as the energy resolution, using both the optimization of the electrode geometry (drift strip technique, coplanar-grid, small pixel effect) and pulse height compensation methods to overcome the hole trapping problem. We have studied a bi-parametric method that uses a twin pulse shaping active filter to analyze the same signal: one slow, which is proportional to the energy of the photon, and one fast, which depends on the position of the interaction with respect to the collecting electrode. The experimental results obtained with the application of this bi-parametric technique on planar CZT detectors of good quality grown by the Vertical Bridgman method at CNR/IMEM are presented as a function of the bias voltage, photon energy and shaping time pairs.