

New instruments for high energy astronomy require detectors exploiting high dynamics to cover a large energy band and very high performance in terms of efficiency, spectroscopy, imaging, and, in particular after the launch of IXPE satellite, high polarimetric capabilities. Recently, ASI funded a project (“3D-CZT Module for spectroscopic imaging, timing and polarimetry in hard X-/soft γ -rays satellite mission - 3DCaTM”) dedicated to develop a prototype demonstrator based on an innovative CZT drift strip sensor unit (3DCZT) and implementing an innovative digital readout of signals to obtain unprecedented performance with three-dimensional spatial resolution (<0.5 mm), fine spectroscopy (1% FWHM at 511 keV), and high response uniformity (few %) with a limited number of electronics channels.

Furthermore, in the framework of the European HEMERA program for stratospheric balloon flights we successfully launched in September 2022, from the ESRANGE base the BADG3R (BALloon Detector for Gamma ray with three-dimensional Resolution) payload consisting of a detection system based on one of the 3DCZT developed sensor. Herein, we present the principles on which the 3DCZT sensors are based, the state of their development and the prospects for their use in future satellite missions for high energy astrophysics. We conclude describing the stratospheric balloon payload BADG3R and the preliminary results obtained from the performed flight.