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The BADG3R prototype on board of a stratospheric balloon flight in the framework of the HEMERA program. Preliminary flight results

Future instruments for hard X/soft γ ray astrophysics require detectors with very high performance. A challenging way to achieve the required performance is the development of modular thick CZT spectrometers with spatial resolution in three dimensions. In this perspective, we have realized a laboratory demonstrator of a 3D spectroscopic-imager able to achieve both fine spectroscopy ($< 1\%$ FWHM at 511 keV) and 3D spatial resolution ($< 300 \mu\text{m}$), polarimetric capabilities ($Q > 0.5$), timing ($< 10 \text{ ns}$) and Compton imaging capabilities (< 10 degrees). This prototype is based on an innovative 3D CZT sensor configuration and on a digital approach for signal readout. 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.

Primary author: DEL SORDO, Stefano (INAF)

Co-authors: Dr CAROLI, Ezio (INAF); Prof. ABBENE, Leonardo (UNIPA DIFI)

Presenter: DEL SORDO, Stefano (INAF)