

Microsymposium

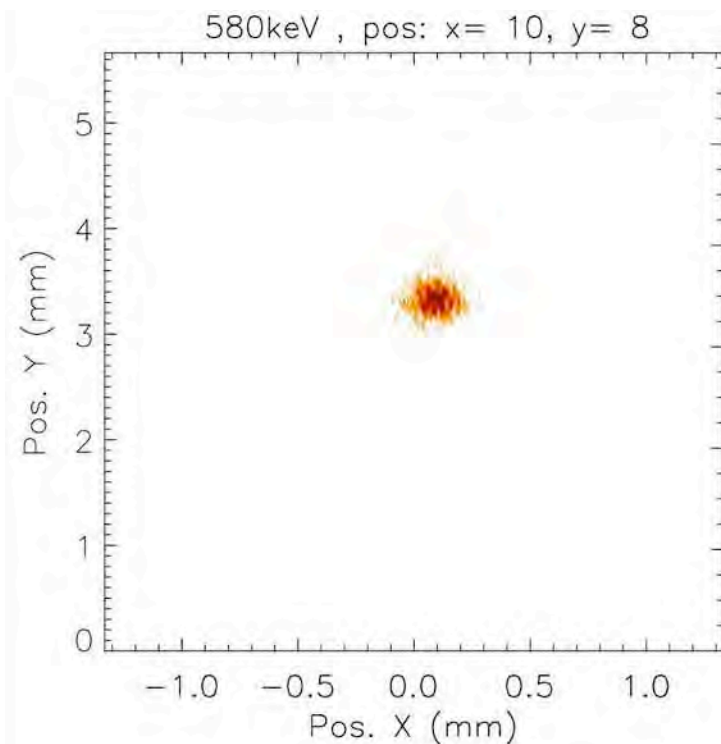
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A 3D CZT High Resolution Detector for X-and gamma-ray applications.

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A high resolution three dimensional (3D) position sensitive CdZnTe-based detector was developed to detect high energy photons (10 keV-1MeV). The design of the 3D CZT detector, developed at DTU Space, is based on the CZT Drift Strip detector principle. The prototype detector contains 12 drift cells, each comprising one collecting anode strip with 3 drift strips, biased such that the electrons are focused and collected by the anode strips. The anode pitch is 1.6mm. The position determination perpendicular to the anodes, the X-direction, is performed using a novel interpolating technique. The position determination along the detector depth direction, Y-direction, is made using the depth sensing technique. The position determination along the anode strips, Z-direction is made with the help of 10 cathode strips orthogonal to the anode strips. REDLEN CZT crystals (20 mm x 20 mm x 5 mm) were used for the proto type detectors. IMEM-CNR fabricated the proto type detectors using a special surface treatment method and electrode attachment process. A novel method was applied to reduce the surface leakage current between the strips. The proto type detector was investigated at the European Synchrotron Radiation Facility, Grenoble which provided a fine 50 x 50 μm^2 collimated X-ray beam covering an energy band up to 600 keV. At 400 keV we measured position resolutions of 0.2 mm FWHM in the X- and Y-direction and 0.6 mm FWHM in the Z-direction. The measured energy resolution of the detector was ~ 5.5 keV FWHM at 400 keV. The electronic noise contribution of the detector setup was 3.7 keV FWHM. The detector provides 3D position with very good spatial resolution as well as high resolution energy information and is therefore a well suited candidate e.g. as a Compton telescope detector, or for any application fields (medicine, security, science) where imaging and spectroscopy of high energy photons in the 10keV-1MeV range are required.



Keywords: X-ray detector, gamma-ray detector, 3D detector