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Performance and Qualification of CdTe Pixel Detectors for the Spectrometer/Telescope Imaging X-rays

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The Spectrometer/Telescope Imaging X-rays (STIX) is a remote sensing instrument developed to perform X-ray imaging and spectroscopy of solar flares. The imaging is realized by a Fourier-imaging technique using tungsten grid collimators in front of CdTe pixel detectors.
The detectors are used for an X-ray spectrometer unit based on the IDeF-X HD ASIC front-end to perform high resolution spectroscopy in the 4-150 keV energy range (< 1 keV @ 6 keV). 32 of such detector modules are mounted inside the Detector Electronics Module of the instrument. STIX will fly on-board the Solar Orbiter satellite to be launched in 2017.

1 mm thick Acrorad CdTe detectors with a plane Aluminum Schottky contact are used as basis for a subsequent patterning process into eight big (9.8 mm2) and four small (1 mm2) pixels. A guard ring is surrounding all twelve pixels. The anode patterning is done by means of microfabrication technologies. The cathode, a thin Platinum plane electrode operates as radiation entrance window. The size of the STIX CdTe pixel detectors is 10 x 10 x 1 mm3.

Test equipment has been developed in collaboration with ETH for selecting the best detectors in terms of performance prior shipment to CEA and for qualification purposes. The vacuum setup allows serial dark current measurements pixel by pixel at low temperature. The knowledge of the pixel dark current is the most important parameter since currents higher 60 pA create excess noise in the ASIC. Best pixels show dark currents below 10 pA at -300V bias and -20°C. Spectroscopic measurements with Ba-133 sources confirm the detector operation.

For the qualification model more than 60 CdTe pixel detectors have been processed, characterized, and partially delivered to CEA. We show in this paper the CdTe pixel detector performance meeting flight model requirements. Qualification measures including some results will be presented.

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