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## HEXITEC 2x2: Tiled Hard X-Ray Spectroscopic Imaging Detector System

HEXITEC is a spectroscopic imaging x-ray detector technology developed at STFC Rutherford Appleton Laboratory for high energy x-ray and gamma ray applications. Each module has 80x80 pixels on a 250µm pixel pitch, and has been implemented successfully in a number of applications [1]. This paper presents the HEX-ITEC 2x2 detector system, a tiled array of 4 HEXITEC modules in a 2x2 formation, which achieves an active area of 16cm2 read out simultaneously. The system has been developed with 1mm thick Cadmium Telluride (CdTe) and 2mm thick Cadmium Zinc Telluride (CZT) detector materials. Here the system [2,3] and data processing methods are presented, and the performance of the first completed systems evaluated.

The detectors were calibrated, and three types of charge sharing correction were applied to the data - charge share addition (CSA), charge share discrimination (CSD), and energy curve correction (ECC) which compensates for energy lost to the inter-pixel region. ECC adds 20.77% to the 59.5keV peak height in CdTe, improving the detector's performance in photon-starved applications. Due to the high frame rate (6300fps) end of frame (EOF) corrections were applied to 5.6% of all events.

The energy resolution of the detector system was measured on the 59.5keV peak of an Am-241 sealed source. Both detector materials were found to have excellent spectroscopic performance with mean energy resolution (FWHM) of 1.05keV in CdTe and 1.20keV in CZT.

This paper demonstrates the potential to tile larger arrays of HEXITEC modules to be read-out simultaneously in order to achieve larger area imaging.

[1] Veale et al., Synchrotron Radiation News 31 (2018), pg.28—32

[2] Zannoni et al., Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment 981 (2020), pg. 164531

[3] Van Assche et al., Sensors 21 (2021), pg. 563

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