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HEXITEC-MHz: A Spectroscopic X-ray Imaging Camera System with 1 MHz Frame Rate Continuous Readout

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The HEXITEC_{*MHz*} detector system is the latest generation of the STFC's HEXITEC spectroscopic X-ray imaging detector systems. When coupled to Cd(Zn)Te sensor material the original HEXITEC system was capable of delivering high resolution X-ray spectroscopy (50 electrons RMS) per 250 μ m pitch pixel for hard X-rays with energies 2 - 200 keV. The major limitation of this technology is that the combination of a 10 kHz frame rate and the need to identify charge sharing events limits its application to photon fluxes of ~ 10⁴ ph s⁻¹ mm⁻². With many photon light sources currently undergoing major upgrades to diffraction limited storage rings, these expected increases in flux have motivated the development of the next generation of the HEXITEC technology.

The HEXITEC_{*MHz*} system is targeted at delivering the same high-resolution spectroscopy as the original ASIC but targeting much higher photon fluxes. While the ASIC maintains the same 250 μ m pixel pitch, the new integrating architecture delivers a 1 MHz frame rate meaning it is possible to operate the system at ~ 10⁶ ph s⁻¹ mm⁻² for spectroscopic X-ray imaging applications at synchrotron light sources. At pulsed sources, a maximum of 30 × 10 keV photons (dynamic range = 300 keV) can be measured in each frame and these are readout at the continuous 1 MHz frame rate. In this paper the first results of Cd(Zn)Te sensors bonded to the ASIC will be presented including an evaluation of the energy resolution of these devices and their linearity at high flux.

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