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Digital Signal Filtering For Low Noise CCD Readout

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The need for reducing CCD readout noise is highly relevant in X-Ray astronomical detectors such as those proposed for the ESA XEUS mission.

Digital sampling and filtering of a CCD's output using an ADC and DSP or FPGA is presented to reduce the effects of readout noise and lower system complexity. Correlated double sampling is used to resolve individual pixel charge values, with the serial clock control signals determining accurate timing for the sampling of the output signal. This avoids sampling undesirable feed through voltages present on the analogue output caused by reset and serial clocks, leaving the remaining noise components to be digitally filtered out. Experimental results for the readout of a CCD collecting X-Ray photons from an Fe55 source using the ADC-DSP method are presented and evaluated against those obtained from a laboratory based scientific camera system. The usefulness of the technique for practical applications is discussed.

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