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Investigation of an irradiated CCD device: building and testing a Charge Transfer Inefficiency correction pipeline using the Pyxel framework

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Pyxel is a powerful end-to-end detector simulations framework with the aim of being reusable, reliable and help facilitate knowledge transfer between a wide range of related fields. To show how beneficial Pyxel can be, we present an investigation into the effect of Charge Transfer Inefficiency (CTI) on an irradiated CCD-273 device produced by Teledyne-e2v, the type of detector used for the Euclid VIS instrument. This requires production of two pipelines. Firstly, a calibration pipeline to search the parameter space and obtain best fitting trap parameters based upon the CTI within the detector. Secondly, a pipeline correcting the CTI-induced data using these trap parameters, trying to obtain a nominal correction efficiency better than the required 99.5%. The following presents work conducting in building, testing and validating the correction pipeline using Pyxel and the CTI model ArCTIC. This involves data from the un-irradiated portion of a CCD-273 device using the scene projection system at the labs at the European Space Agency (ESA). The images are computationally altered by varying parameters such as background levels and readout noise, and by synthetically producing CTI trails from known trap parameters. The resulting images are corrected and analysed to understand how noise affects the correction efficiency at varying image background levels.

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