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Initial results from a cryogenic proton irradiation test campaign of P-channel CCD204s

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This paper details the characterisation of a P-channel and N-channel e2v Teledyne CCD204 before and after simultaneous cryogenic (153 K and 203 K) 6.5 MeV proton irradiation to 7.66×10^8 protons/cm². Detailed trap location and energy analysis was performed pre- and post-irradiation, at a range of temperatures between 156 K and 203 K, highlighting formation, migration and annealing of traps within the 10⁻² – 10⁻⁵ s emission time regime (at the above temperatures) during cryogenic (i.e. operational) irradiation. The results detailed here highlight the potential for improvement of performance of devices for critical metrics (especially Charge Transfer Inefficiency) at specified operating conditions in P-channel CCDs when compared to N-channel. Several new effects are found in the initial presentation of the data and discussed, for example, history dependent annealing, and a low-level continuum of trap emission time constants across the measured time base.

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