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SET setups at the Australian and Canadian pulsed laser facilities in the chase of the critical parameters for direct comparison

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Single Event Effects are potentially catastrophic electric and electronic effects created in analog and digital electronic devices exposed to ionising radiation. They are particularly dangerous in Space, and so a radiation hardness qualification procedure is often required for electronic devices to be considered Space safe. Qualification requires the use of hadron accelerators but alternative techniques are emerging to reduce testing costs and facilities overcrowding issues. Implementation of laser based Single Event Effects testing methods requires careful consideration of the critical physical parameters responsible for charge generation within electronic devices. Comparisons of Single Event Transient amplitudes generated within the well-known operational amplifier LM124 between SEE laser facilities in Australia, Canada and results found in literature identified charge generation dependence on multiple parameters. Wavelength and pulse energy have well known effects on charge generation through the photoelectric effect, however focusing position and temporal pulse width show significant impact. Focusing position errors quickly lead to significant beam width dilation and shifting causing significant charge loss to insensitive volumes. Variation of the pulse width affects the total charge collection efficiency due to processes such as Auger recombination and variation of carrier mobility in diffusion regions. Reduction of pulse widths helps to mimic the timing characteristics of interaction of charged particles but charge collection becomes more sensitive to pulse energy. This introduces non-linear errors in methods which compare device response to pulse energy and not deposited charge. The Single Event Transient study presented highlights the importance of control of each of these parameters for accurate charge generation within a targeted volume using pulsed laser methods.

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