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Investigation of the amplitude decrease in subsequent pulse detection in irradiated silicon sensors

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During edge- and Top-TCT measurements using subsequent laser pulses with a pulse repetition time of several microseconds, a significant decrease in the measured signal amplitude has been observed.
The charge created during the pulses has severe effects on the electrical configuration of the sensor. This can be explained by either trapping of charge carriers which alter the charge distribution and in turn the electric field profile –known as the polarization, or in case of non-depleted bulk as a consequence of dielectric relaxation, when the almost-intrinsic irradiated bulk restoration after the charge perturbation of the steady state electrical configuration is relatively slow –often described with time dependent weighting field.
This study investigates different dependencies of the decrease on voltage, fluence, laser intensity, type of created carrier and time between pulses. It includes simulations of the electric field change and a fit model for trying to discriminate between trapping induced polarization and relaxation effects.

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