

# Charge multiplication in radiation-damaged epitaxial silicon detectors

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Charge multiplication (CM) effects emerging after heavy irradiation in thin silicon diodes were studied as an option to overcome charge carrier trapping, which is the limiting factor for silicon pixel detectors at SLHC fluences in the order of  $10^{16} \text{ cm}^{-2}$ . Using the Transient Current Technique (TCT) with radiation of different penetration (670, 830, 1060 nm laser light and 5.8 MeV alpha-particles with different absorbers), charge collection was measured in highly proton-irradiated 75, 100 and 150  $\mu\text{m}$  n-type epitaxial diodes. The charge collection efficiency (CCE) of shallowly-penetrating radiation was found to be higher than the one with deeper penetration. Thus, the CM region could be localised near the front surface. The collected charge was measured to be linear to the deposited one, which indicates proportional mode as opposed to Geiger mode. The normalised width of the charge spectrum measured with laser light was observed to be almost independent of CM, which shows that statistical fluctuations in the CM process are not dominant. By performing an x-y-scan over the entire illumination window of the diode with a 20  $\mu\text{m}$  laser spot, the spatial homogeneity of collected charge in the CM regime was found to be very good with deviations of maximal 1%. CM turned out to be stable in time over several days with micro discharges as the limiting factor at high voltages.

## Summary (Additional text describing your work. Can be pasted here or give an URL to a PDF document):

[http://www.desy.de/~jlange/summary\\_Vienna10\\_Joern\\_Lange.pdf](http://www.desy.de/~jlange/summary_Vienna10_Joern_Lange.pdf)

**Primary authors:** Mrs JUNKES, Alexandra (Hamburg University); LANGE, Jörn (University of Hamburg)

**Co-authors:** Ms PIRVUTOIU, Cristina (Hamburg University); FRETWURST, Eckhart (University of Hamburg); Mr FRETWURST, Eckhart (Hamburg University); Mr LINDSTRÖM, Gunnar (Hamburg University); LINDSTRÖM, Gunnar (University of Hamburg); Mrs PINTILIE, Ioana (NIMP, Bucharest, Romania); BECKER, Julian (University of Hamburg); Mr LANGE, Jörn (Hamburg University); KLANNER, Robert (University of Hamburg); Mr PÖHLSSEN, Thomas (Hamburg University); Mr KHOMENKHOV, Volodymyr (Hamburg University)

**Presenter:** LANGE, Jörn (University of Hamburg)

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