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Exploring Interpixel Layouts in Ti-LGADs: Insights into Ghosts and Avalanche Multiplication using fs-Laser and SPA-TCT and TPA-TCT at ELI Beamlines

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In this report we present the latest results from our comprehensive study on Ti-LGAD interpixel region under low and high charge injection, using fs-laser and SPA-TCT and TPA-TCT experimental techniques at ELI Beamlines, ELI ERIC. Samples have been investigated using probe station at the Institute of Physics of the Czech Academy of Science, and IV/CV distributions will be presented. All samples exhibit very strong ghost signals not synchronized with laser pulses and beside normal IP signal we recorded an extraordinary strong signal synchronized with normal IP signal produced by laser in IP region. Pixels are not affected by ghosts. No strong signal was observed in pad region.

Scanning at different depths using TPA and across the pad and interpixel region revealed the most sensitive region to the highest occurrence rate of the strong signals. Moreover, the dependence of signal characteristics on bias voltage and laser power at different temperatures is explored and tentative explanations for the observed behavior are offered. Furthermore, the occurrence rate of ghost signals with laser switched off and occurrence rate of strong signals vs shooting position of laser were systematically studied. The bias threshold for ghosts and laser pulse energy threshold vs bias for strong IP signals are viewed too.

Beside conventional way of presenting experimental data we recorded some videos to give better insight how the sensors behaves under TPA. and to show evolution of the signals (normal, strong, and ghosts) when scanned through the sensor (Z depth scan). Scans are done in 3 positions. pad, center of the IP and trench position. Interpixel region was also microscopically inspected.

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