

Impact of Single and Multiple Trenches as Isolation Structures in TI-LGADs: A Study on Charge Collection and Resistivity of IP region as seen by the fs-laser based TCT

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We presents the findings of a study investigating the impact of single and multiple trenches employed as isolation structures in Trench Low-Gain Avalanche Detectors (TI-LGADs). The focus of this study is to analyze the collection of charge induced by fs-laser at various shooting points along the X-axis and compare the deduced X-profiles derived from the recorded waveform data.

The results reveal a significant increase in charge collection within the isolation region when employing two trenches as isolation structures. However, this enhancement was not observed in the isolation region where only one trench was utilized to isolate the pixels. This discrepancy can be attributed to the proximity of the two trenches and the closer proximity of one trench to the neighboring pixel.

Furthermore, the fabrication and etching processes involved in creating the trenches may introduce additional surface defects, leading to non-uniformity of the electric field and a larger gradient in electric field along the X-axis of the inter-pixel region, particularly in the case of the region with two trenches. For conclusive statement larger pool of prototypes is required.

These findings provide valuable insights into the effects of different isolation structures on charge collection and resistivity in TI-LGADs. They contribute to the optimization of device design and performance, particularly when the sensors are exposed to high-intensity injection of non-Minimum Ionizing Particles.

Your name

Gordana Lastovicka-Medin

Institute

University of Montenegro

Email address

gordana.medin@gmail.com

Authors: LASTOVICKA-MEDIN, Gordana (University of Montenegro (ME)); Dr KRAMBERGER, Gregor (Jozef Stefan Institute); Dr REBARZ, Mateusz (ELI Beamlines, ELI ERIC)

Presenter: LASTOVICKA-MEDIN, Gordana (University of Montenegro (ME))

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