

The impact of single and multiple trenches on interpad resistance and hole multiplication in interpad region: The Transient Signal Waveforms and X- Profile Analyses

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In this presentation, we report the findings on the impact of single and multiple trenches employed as isolation structures in TI-LGADs (Trench Low-Gain Avalanche Detectors). Our study focuses on the collection of charge induced by fs-laser at various shooting points along the X-axis, with subsequent recording of waveform data. Subsequently, we compare the deduced X-profiles derived from these waveforms. The results indicate 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, although the inter-pixel distance (IPD) for the configuration with two trenches is slightly wider compared to the IP distance when only a single trench is employed to isolate pixels. This discrepancy can be attributed to the very short distance between the two trenches, as well as the closer proximity of one of the trenches to the neighboring pixel. Also, the fabrication/etching of trenches may produce additional surface defects that are causing non-uniformity of el field and larger gradient in el. field from one to another point along the X-axes of IP region leading to the fast changing in strength of el field in the case of IP region with 2 trenches.

These findings shed light on the effects of different isolation structures on charge collection and resistivity in TI-LGADs and provide valuable insights for further optimization of device design and performance, in particular when sensors are exposed to high intensity injection (case of non MIP particles).

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