13th International "Hiroshima" Symposium on the Development and Application of Semiconductor Tracking Detectors (HSTD13), Vancouver, Canada

Contribution ID: **46** Type: **Oral**

Long-Distance Signal Propagation in AC-LGAD

Tuesday 5 December 2023 12:00 (20 minutes)

We investigated the signal propagation in AC-LGAD (aka RSD), which are LGAD with a common N+ layer and AC-coupled readout contacts, by measuring the interstrip/interpad capacitances and resistances and by IR laser injection on a large selection of AC-LGAD with either strips or pads. The interest for this topic derives from the realization that while large charge sharing between strips/pads is essential for good position resolution, large sharing beyond the next two neighboring contacts generates background signals which in general are detrimental to the sensor goal of low occupancy. The observed signal is composed of the sum of the induced signal from the moving collected charge on neighboring contacts and the pick-up of the signal conducted on the N+ layer common to all contacts.
To characterize the signal propagation, we determined the interstrip/interpad capacitance and resistance using CV measurements between the contacts separated by distances of up to more than 10x the pitch values. In addition, scans of IR laser signals were added to confirm the results with charge collection.
The sensors from a variety of manufacturer had variations of the following parameters:
readout dimensions: strip/pad metal contact size (length, width), pitch,
sensor production details: N+ layer resistivity, dielectric specs (thickness, value of permittivity), bulk thickness, doping of the gain layer.
The initial data suggest that the length of the strip plays a dominant role in determining the distance the pick-up extends. On the other hand, the N+ layer resistivity influences the strength of the picked-up signal. Our study compares the effect of all parameters listed above, including comparison of different manufacturers.
Of special interest is the difference in long-distance pick-up between strip sensors and pad sensors.

Submission declaration

Original and unplublished

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Session Classification: Day 2 - Session 2

Track Classification: Avalanche-based sensors