Contribution ID: **172** Type: **Oral**

Gain suppression mechanism observed in Low Gain Avalanche Detectors

Wednesday, 17 February 2021 15:50 (20 minutes)

Low Gain Avalanche Detectors (LGADs) is one of the most promising sensing technologies for future 4D-tracking applications and recently it has been qualified to be used in the ATLAS and CMS timing detectors for the HL-LCH upgrade. LGADs are able to achieve an excellent timing performance by the presence of an internal gain that improves the signal-to-noise ratio leading to a better time resolution.

These detectors are designed to exhibit a moderate gain with an increase of the reverse voltage. Also, the value of the gain strongly depends on the temperature. Thus, these two values must be kept under control in the experiments to maintain the gain within the required values. A reduction in the reverse bias or an increase in the temperature will reduce the gain significantly.

In this talk, we present a new mechanism of gain suppression observed in LGADs. It was observed that the gain measured in these devices highly depends on the charge density generated by a laser or particle in the bulk. Measurements performed with different detectors under different conditions showed that ionizing processes that induce less charger density in the detector bulk lead to an increase in the detector's measured gain.
Therefore, measurements conducted with IR-laser and Sr-90 in the lab confirm this mechanism and will be presented in this talk.

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Session Classification: Session 8: LGAD 1

Track Classification: LGAD