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Stability of irradiated LGAD sensors in the Fermilab high-rate proton beam facility

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Low Gain Avalanche Diodes (LGADs) will be employed in the CMS MTD and ATLAS HGTD upgrades to mitigate the high levels of pileup expected in the High Luminosity phase of the LHC. Over the last several years, much attention has focused on the development of radiation tolerant gain implants that successfully provide gain even after the fluences expected at the HL-LHC, in excess of 1 x 10ˆ15 neq/cmˆ2. However, it has been observed that highly-irradiated sensors operated at large bias voltage can be susceptible to single event burnout (SEB) when exposed to highly ionizing particles. The SEB mechanism has previously been studied in detail by CMS using the low-rate proton beam at Fermilab. We present the results of a new campaign using a high-intensity proton beam that demonstrates the successful operation of irradiated LGADs exposed to an extreme charged particle flux comparable a year at the HL-LHC. We find that the SEB mechanism is mitigated by a slight reduction in bias voltage, with little to no impact on the CMS MTD performance.

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