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Studies of LGAD performance limitations, Single Event Burnout and gain suppression, with fs-laser and ion beams

Over the last few years, the intense R&D has resulted in the emergence of mature LGAD technology for timing detectors. However, LGAD has limitations. A highly irradiated LGAD is vulnerable to a loss of gain due to the acceptor removal mechanism; this limitation has been mitigated by an increase in high bias voltage. Unfortunately, this approach is not without limitations; fatalities due to the Single Event Burnout (SEB) event impose upper limits on the LGAD's safe bias voltage. Gain in LGAD also depends on multiple parameters including the impinging particle's energy and radiation type or laser intensity. So it is important to understand these limitations, in particular in experiments with heavily ionizing particles where space charge screening effects affect gain suppression in LGAD. Ions of different masses and energies could be a valuable probe to study the anomalous behavior of gain in LGAD. Investigating the role of screening in determining the charge collection dynamics is best performed by altering the density of the electron-hole pairs along the ion track in a quantifiable manner. This can be best achieved by choosing different ions and their respective energies in such a way that either their Bragg peaks correspond to the same depth in the active region of LGAD, or by mapping the LGAD active volume by conducting experiments with the same species of ion but probing different depths of LGAD. In this presentation we will highlight the results of the studies of LGAD performance limitations, Single Event Burnouts, and gain suppression, with fs-laser at ELI Beamlines and ion beams at the RBI.

Primary experiment

Primary author: LASTOVICKA MEDIN, Gordana (University of Montenegro (ME))

Co-authors: REBARZ, Mateusz (Extreme Light Infrastructure); KRAMBERGER, Gregor (Jozef Stefan Institute (SI)); LASTOVICKA, Tomas (Czech Academy of Sciences (CZ)); ANDREASSON, Jakob (Extreme Light Infrastructure); KROLL, Jiri (Czech Academy of Sciences (CZ)); KROPIELNICKI, Kamil (Extreme Light Infrastructure); JAKSIC, Milko (R. Boskovic Institute, Zagreb, Croatia); RODRIGUEZ RAMOS, Mauricio (AAI@EduHr Single Sign-On Service); CRNJAC, Andreo; MANOJLOVIC, Milos (University of Montenegro (ME))

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

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