

Update on the RD50-SiC-LGAD Project

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Silicon carbide (SiC) detectors have recently undergone a resurgence of research interest due to significant industry improvements in production and processing. The material's favorable characteristics, including extremely small leakage currents, a high breakdown voltage, and high charge carrier velocities, make it a promising candidate for replacing silicon detectors in the future. One disadvantage of SiC, however, are still the limitations of commercially obtainable material quality. The production of thick 4H-SiC epi-layers ($>100 \mu\text{m}$) is particularly challenging and costly, and the required depletion voltages can be considerable. Together with the fact that the ionization energy of 4H-SiC is higher than that of silicon, this results in very small signals for MIPs.

One potential solution to address this issue is the use of low-gain avalanche diodes (LGADs), which can significantly enhance the signal-to-noise ratio through charge carrier multiplication. For an adequate signal-to-noise ratio (SNR), thin SiC-LGADs ($\leq 50 \mu\text{m}$) would enable an excellent timing performance, potentially even surpassing that of Si-LGADs.

This talk offers an update to the status of the RD-50-SiC-LGAD project, which aims to develop a demonstrator SiC-LGAD and evaluate its performance in terms of gain, timing, and radiation hardness. The design of the mask has recently been completed and will be presented, with a particular focus on the gain layer termination structures. In addition to the status of the LGAD design, updates will also be provided on the laboratory characterization infrastructure for electrical characterization of future SiC-LGADs. Finally, the radiation hardness of SiC-LGADs (e.g., the donor removal in the gain layer) will be discussed based on simulations applying the radiation damage model developed for planar 4H-SiC detectors.

Type of presentation (in-person/online)

in-person presentation

Type of presentation (I. scientific results or II. project proposal)

I. Presentation on scientific results

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