

RD50 Project proposal: Partial Activation of Boron to enhance the radiation tolerance of the gain implant –PAB

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The partial activation of the boron atoms implanted in the gain layer region will be investigated to mitigate the effect of radiation on the gain implant in LGAD sensors. Atoms of boron in the gain layer volume left as interstitials can interact with other impurities present in the silicon lattice, preventing the removal of boron atoms from substitutional positions.

The goal of the project is to investigate the effect of partial activation of boron (PAB) to mitigate the boron removal due to irradiation and to extend by more than a factor of 2 the radiation tolerance of the LGAD sensors.

Different concentrations of implanted boron need to be explored, together with different times and temperatures of activation, to define a standard procedure for the PAB. Different combinations of active/total concentrations of boron will be investigated, such as 1/4, 1/2, 2/3, and more.

The project foresees the process simulation and design of the boron implant with different activation strategies, together with the device simulation and the design of the structures that will be included in the batch. Irradiation of sensors with different types of radiation, such as neutrons and protons, is foreseen. Characterisation of the devices before and after irradiation will test the resilience to irradiation of the PAB design.

The ultimate goals of the project are to find the best combination of boron dose and activation parameters, enhance the gain implant resistance to radiation, and define a standard process with easy-to-use production parameters for LGAD sensors with PAB.

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