Influence of Holder Quality on Radiation Hardness of SI GaAs Detector

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Abstract. Semi-insulating (SI) GaAs detectors irradiated by 5 MeV electrons to doses lower than 100 kGy exhibited different behaviour when considering their electrical and spectrometric properties. The detectors prepared by the same technology using one GaAs wafer might be divided into two groups according to the type of holder used to wire bond the detectors. The detectors applied to a ceramic holder did not exhibit any significant changes in their properties up to a maximum dose applied (83 kGy). The second group of GaAs detectors utilizing a PVC (PolyVinylChloride) holder underwent dramatic changes of both the electric and spectrometric properties and none of the detectors was able to work at a dose higher than 51 kGy. As the radiation hardness of GaAs detectors should approach 1 MGy according to recently published results, the obtained results imply an important influence of chosen type of holder. The study of bare detector holders irradiated by 5 MeV electrons under the same conditions as the investigated detectors proved their different radiation hardness. The ceramic holders exhibited just minimum changes up to a maximum applied dose of 139 kGy, while the current flowing through PVC holder under applied bias increased more than 10-times at a dose of 104 kGy and more than 100-times after 139 kGy applied.