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Studies of surface radiation damage with CMS HGCAL test diodes

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Studies of the silicon dioxide (SiO_2) passivation layer in HGCAL's n-on-p sensors are important for qualifying their performance at the High-Luminosity LHC and for optimising the operation of future high-energy physics experiments. This work presents a novel method to evaluate the impact of the surface radiation damage on the inter-pad isolation in HGCAL sensors, by measuring the threshold voltage for inter-electrode isolation ($V_{th,iso}$). For this study, diode test structures were irradiated with X-rays, and their characteristics were measured at -20°C. Three measurement techniques: CV, IV, and inter-strip like measurements, were employed to extract the $V_{th,iso}$. The results show an unexpected dependence of $V_{th,iso}$ on the ionising dose, as well as correlation between the surface properties after irradiation and the bulk properties before irradiation. Such behavior has not been observed previously. Possible explanations are being investigated with the help of TCAD simulations.

Type of presentation (in-person/online)

in-person presentation

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

I. Presentation on scientific results

Authors: FIALOVA, Eva (CERN); DEFRANCHIS, Matteo (CERN)

Presenter: FIALOVA, Eva (CERN)

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