Contribution ID: **11**

Type: **Oral**

Radiation tolerance study using 8-inch full-wafer silicon sensors for CMS HGCAL

Tuesday 28 February 2023 13:45 (20 minutes)

The CMS detector will be upgraded to face a 10-fold increase in integrated luminosity for the High-Luminosity LHC era compared to that of the current LHC Runs 1-3 combined. Its endcap calorimeters will be replaced by the high-granularity calorimeter (HGCAL). With its unprecedented transverse and longitudinal readout/trigger segmentation, with more than 6M readout channels, HGCAL will facilitate the use of particle-flow calorimetry. Silicon pad sensors will be used for the electromagnetic section as well as for the high-radiation regions of the hadronic section of HGCAL (with fluences above 10^{14} neq/cm^2), covering a total area of 620 m^2. In the highest radiation regions, fluences up to 10^{16} neq/cm^2 and doses up to 1.5 MGy are expected. The silicon sensors are processed on 8-inch p-type wafers with three different thicknesses (300 µm, 200 µm, 120 µm), and cut into hexagonal shape for tiling and for optimal use of the wafer area. Each sensor is segmented into several hundred cells of hexagonal shape of 0.5 to 1.1 cm^2 in size, each of which is read out individually. The talk will focus on bulk radiation-tolerance studies performed in 2020-2022 with full and partial 8-inch sensors irradiated to fluences up to 1.4 x 10^{16} neq/cm^2 at the novel neutron irradiation facility at Rhode Island Nuclear Science Center (RINSC, US). Using the ARRAY system (a customised probe and switch card system), their electrical properties in terms of pad leakage currents and capacitances have been measured for the first time, after neutron irradiation both without and with additional beneficial isothermal annealing. We present the results of those measurements, hereby qualifying the RINSC neutron irradiation facility and showing that the measured electrical properties of the full-sized HGCAL silicon sensors after neutron irradiation meet expectations and are acceptable for the HGCAL.

Primary author: KRAWCZYK, Marta Adamina (CERN)

Co-author: Mr QUAST, Thorben (CERN)

Presenter: KRAWCZYK, Marta Adamina (CERN)

Session Classification: Planar sensors

Track Classification: Planar sensors