Contribution ID: **229** Type: **not specified**

Dosimetry for ultra-high particle fluence and challenges for irradiation experiments at FCC radiation levels

Thursday, April 12, 2018 11:24 AM (18 minutes)

Current solid-state devices for radiation measurement are not capable of integrating the radiation levels expected in certain sectors of the FCC tunnel (tens of KGy with >1015 particles/cm2) and even more in the experiments of the FCC (tens of MGy, with >1017 particles/cm2). In order to overcome these measurement limitations, we have focused our research on metal nanolayers, as a solution for Ultra High Fluence monitoring. The technology consists of thin film resistive structures deposited on silicon wafers, where sensitivity to displacement damage, measurable in a variation of their electrical properties, can be trimmed by variating geometrical (thickness, width, length) and physical (material) properties of the nanolayers. The prototypes of these Radiation Dependant Resistors have been fabricated at EPFL Centre of Micronanotechnology, and specific high-fluence irradiation tests (with gamma, protons, neutrons) have been carried out in CERN facilities and outside CERN. The fabrication and characterization of the RDRs as well as the results of the irradiation tests performed during 2017 are presented.

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Session Classification: Special Technologies

Track Classification: STP