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Changes of the particle detection properties of irradiated silicon microstrip sensors after room and elevated temperature annealing.

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The changes of the electrical properties of hadron irradiated silicon detectors take place over several years at room temperature.

This annealing can be accelerated or decelerated by lowering or elevating the temperature at which the sensors are kept. This fact is used by the scientists involved in the development of the silicon sensors for the LHC experiments: elevated temperatures (up to

80 °C) have been used to accelerate the effect of the annealing to study their performances after several years in the experiments, and

low temperatures are actually used to retard the undesired effect of annealing during the times when the detectors are not operated.

The acceleration factors with respect to nominal room temperature (RT = 20°C) have been established monitoring the changes of the capacitance-voltage characteristics (CV) with time at various temperatures. It remains to establish if the acceleration factors are also valid

for the reverse current (IR) and the charge collection characteristics (CC(V)), that are more relevant to the operations of silicon sensors in high energy

physics experiments. In fact in the experiments, the maximum high temperature envisaged out of operation cannot exceed much the 20°C.

It is important to assess the exact amount of expected annealing in view of planning the operation scenario (i.e. the bias voltage

and temperature) of the

silicon sensors in order to have efficient charge collection and controlled reverse current (responsible for power dissipation).

In fact it is well known that substantial reduction of the reverse current (more than 50%) can be achieved by annealing.

We show here the comparison of elevated and room temperature annealing of the IR and the CC(V) characteristics

of detector irradiated to doses expected in the future upgrade of the LHC at CERN (sLHC).

Primary author: Dr CASSE, Gianluigi (University of Liverpool)

Co-authors: Dr AFFOLDER, Anthony (Uni. Liverpool); Prof. ALLPORT, Philip (Uni. Liverpool)

Presenter: Dr CASSE, Gianluigi (University of Liverpool)

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