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Radiation Tests of the ATLAS Inner Detector Opto-Electronic Readout System for SLHC

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The readout system of the ATLAS inner detector for SLHC will need to cope with ten time's higher radiation doses than the current ATLAS inner detector readout system. It is an open question of whether the current opto-electronic readout system could be used at SLHC. We irradiated VCSEL and Si-Pin arrays at a 20 MeV neutron beam up to the levels expected at SLHC and monitored their performance during irradiation and annealing. We performed very low dose irradiations of SIMM fibres at a gamma source. The results of these irradiations are summarized.

Summary

Plans are being formulated at CERN for a luminosity upgrade to the Large Hadron Collider (LHC) machine. The LHC upgrade (SLHC) is being designed to increase the luminosity from 1034cm-2s-1 to 1035cm-2s-1. The expected time-scale would be around year 2015. The fluences at the SLHC will be 10 times higher than at LHC. For radii greater than 20 cm the expected fluence is 1015 hadrons/cm2. It is not clear, if the current opto-electronic components of the inner detector readout system are able to cope with this challenging radiation environment of SLHC.
Previous radiation tests have shown that the opto-electronic components can survive 10 years of LHC operation. Radiation tests by the Pixel group have demonstrated that these components can survive fluences and doses up to a factor of two higher than the SCT values.
Therefore there is an open question of whether this type of opto-electronics could be used on the upgraded SCT detector at the SLHC. This is a critical question for the design of this detector as it will have a major influence on the layout of all the readout services and therefore needs to be answered before the detector design can advance very far.
We irradiated VCSEL and Si-Pin arrays at a 20 MeV neutron beam up to the levels expected at SLHC and monitored their performance during irradiation and annealing. We performed very low dose irradiations of SIMM fibres at a gamma source. The results of these irradiations are summarized.

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