

EIROforum School on Instrumentation

May 11th – 15th, 2009

CERN, Geneva, Switzerland

Lecture on

Radiation Hardness Issues on Electronics

May 14th, 15:30 – 17:00

Part 1: Radiation effects on electronic devices and technologies, by F.Faccio¹

Part 2: Quality Assurance for electronics exposed to radiation in ATLAS and in ITER,
by M.Dentan²

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Summary

Part 1: Radiation effects on electronic devices and technologies.

Electronics devices operating in presence of radiation, such as in Space, Nuclear or High Energy Physics applications, are potentially subject to a wide range of effects that can lead to both temporary and permanent failure. This lecture will summarize the main effects induced by radiation on electronics. Amongst cumulative effects, damage caused by Total Ionizing Dose and displacement damage in CMOS and bipolar technologies will be discussed. The basic mechanisms of Single Event Effects and their consequences on device reliability will be illustrated. To close the lecture, summary tables of radiation effects and equivalent damage from different particles will be presented.

Part 2: Quality Assurance for electronics exposed to radiation. The ATLAS experiment of the CERN LHC programme integrates a very large number of electronic Boards which will be exposed to radiation ranging from a few krad and a few 10^{10} n/cm² to several tenth of Mrads and several 10^{14} n/cm², and to energetic particles capable of producing destructive single event effects. ATLAS has developed and implemented a policy which provides guidelines for the selection, procurement and qualification of all its commercial electronic components and radiation-hard ASICs, in order to make sure they will resist to the foreseen radiation constraints. In the same spirit, the ITER International Organization is currently developing a policy which will provide guidelines for the selection, procurement and qualification of all its electronics, to make sure they will resist to the foreseen radiation constraints. This lecture presents the policy developed by ATLAS on electronics submitted to radiation, describes its implementation within the ATLAS collaboration, and introduces the policy ITER is currently developing in the same field.