

Radiation Tolerant Power Converter Design for the LHC

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The equipment of the Large Hadron Collider (LHC) at the European Organization for Nuclear Research (CERN) must be designed taking into consideration its reliability and availability during operation. In the case of LHC, the biggest contributors to unavailability of the machine are the Cryogenics, Quench Protection System (QPS), Power Converters and Radio Frequency (RF) [1].

This paper will present failures of power converters recorded during run 1 of the LHC (2011-2012) and will show extrapolations to the future including High-Luminosity LHC (HL-LHC) era.

The paper will cover on-going developments of reliable power converters and their controls that will be exposed to the radiation environment of the LHC. Real-world example of a sub-system will be used to show how to assure certain level of reliability of a large system based on Commercial-Off-The-Shelf (COTS) components whose failure rate is dominated by both electrical and radiation-induced faults. From this example, a general design methodology will be derived.

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References: [1] B. Todd, Evian 2012.