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CMOS technologies and power distribution components for HL-LHC: radiation strikes back

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The first decade of the century was characterized by a very successful development of radiation-tolerant ASICs in a commercial quarter micron CMOS process, and very promising measurements on commercial-grade 130nm technologies. A straightforward path for the design and integration of ASICs tolerant to ultra-high radiation levels seemed to be wide open. This was without counting on the appearance of new effects at very high radiation levels, and on the resilience of known effects that promptly strike back whenever strict hardness assurance practices are relaxed.
This talk presents recent experiences in 130nm technologies where radiation-induced leakage current or latch-up were found in supposedly production-ready (or already deployed) ASICs, and summarizes the most recent understanding of effects in the 130 and 65nm technologies qualified for HL-LHC applications. An appendix is devoted to the development of radiation- and magnetic field-tolerant power distribution converters. The complexity of radiation-induced mechanisms emerges from this overview and suggests, as in science-fiction movies, never to under-estimate the power of the dark side (of radiation).

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