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A system-level model for high-speed,radiation-hard optical links in HEP experiments based on silicon Mach-Zender modulators [1]

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Silicon Mach-Zehnder modulators have been shown to be relatively insensitive to displacement damage beyond a 1-MeV-equivalent neutron ?uence of 3 · 1016 n/cm2. Recent investigations on optimized device designs have also led to a high resistance against total ionizing dose levels of above 1 MGy. Such devices could potentially replace electrical and/or optical links close to the particle interaction points in future high energy physics experiments. Since they require an external continuous-wave light source, radiation-hard optical links based on silicon Mach-Zehnder modulators need to have a di?erent system design when compared to existing directly modulated laser-based optical links. 10 Gb/s eye diagrams of irradiated Mach-Zehnder modulators were mea-sured. The outcomes demonstrate the suitability for using these components in harsh radiation environments. A proposal for the implementation of silicon Mach-Zehnder modulators in CERN?s particle detectors was developed and a model to calculate the system performance is presented. The optical power budget and the electrical power dissipation of the prop
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