Contribution ID: **188**　　　　　　　　　　　　　　　　　　　　Type: **ORAL**

Radiation-Hard ASIC for High-Speed VCSEL Array Data Transmission at HL-LHC

Wednesday 13 December 2017 12:10 (20 minutes)

The LHC has recently been upgraded to operate at higher energy and luminosity. In addition, there are plans for further upgrades. These upgrades require the optical links of the experiments to transmit data at much higher speed in a more intense radiation environment. We have designed a new optical transceiver for transmitting data at 10 Gb/s. The device consists of a 4-channel ASIC driving a VCSEL (Vertical Cavity Surface Emitting Laser) array in an optical package. The ASIC is designed using only core transistors in a 65 nm CMOS process to enhance the radiation-hardness. The ASIC contains an 8-bit DAC to control the bias and modulation currents of the individual channels in the VCSEL array. The settings are stored in SEU (single event upset) tolerant registers. Several optical transceivers were irradiated with 24 GeV/c protons up to a dosage of 74 Mrad to study the radiation hardness of the high-speed optical links. The irradiated devices have been extensively characterized. The performance of the devices is satisfactory after the irradiation. We will present a comparison of the performance of the devices before and after the irradiation. We have also designed an equalizer circuit to correct for the degradation of the signal received after transmission via a long/small cable. The result from simulation of the design will be presented.

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Session Classification: Session10

Track Classification: ASICs