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Versatile Transceiver Developments

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SLHC experiment upgrades will make substantial use of optical links to enable high-speed data readout and control. The Versatile Link project will develop and assess optical link architectures and components suitable for deployment at SLHC. The on-detector element will be bidirectional opto-electronic module: the Versatile Transceiver (VTRx) that will be based on a commercially available module type minimally customized to meet the constraints of the SLHC on-detector environment in terms of mass, volume, power consumption, operational temperature and radiation environment. This paper will bring together the status of development of the VTRx in terms of packaging, environmental testing and functional testing.

Summary

Optical data transmission will be a key enabling technology for the experiment upgrades at SLHC. The development of optical links and the qualification of their commercially available constituent components represent a significant amount of effort that is being shared by the collaborative Versatile Link project that unites link builders across several SLHC collaborations. The goal is to provide a bi-directional optical link to connect the front-end electronics of SLHC detectors to the back-end counting rooms. Sufficient bandwidth should be made available to allow the different traffic types (be it timing, readout and/or control data) to share the same transmission link. Different link flavours will be developed that are capable of operating over the installed single-mode or multi-mode fibre plants of the (S)LHC experiments. The component that will be placed at the front-end is the Versatile Transceiver (VTRx), which is a bi-directional optical module based upon a commercially standard transceiver module with minimal customization to make it suitable for use in SLHC detector front-ends. This customization includes the following: choice and assessment of components for environmental tolerance (e.g. radiation, temperature, magnetic field) and minimization of material, mass and power. In addition, functional testing is required to ensure that the VTRx will operate correctly when used in the Versatile Link.

The VTRx is based upon the commercial SFP+ module standard. The SFP+ standard was chosen because it covers the target data-rate of the VTRx (4.8 Gb/s) that is set by the GBT serializer chipset. The VTRx will use the radiation tolerant laser driver (GBLD) and receiver amplifier (GBTIA) sourced from the GBT chipset development. The GBLD will be housed on the VTRx circuit board and attached to a laser housed in a TOSA package that will be soldered to the circuit board via a flex cable. On the receiving side the GBTIA will be inserted into a ROSA package with the chosen photodiode. The VTRx circuit board has been designed and results of its testing will be shown, both with a commercial laser driver and with the GBLD. The GBTIA ROSA is also being prototyped and results will be shown for standalone testing as well as when mounted on the prototype VTRx. We will also highlight key aspects of the specification that has been developed, showing that the VTRx will indeed function when inserted into a Versatile Link.

Finally, we will show results of SEU testing of candidate photodiodes as well as the GBTIA-based ROSA. The results will be used to assess the ability of the chosen Forward Error Correction protocol to mitigate the effects of single-event upsets and provide feedback the GBTIA designers on the SEU performance of the ASIC.

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