Contribution ID: **121** Type: **Oral**

Versatile Transceiver Development Status

Thursday, 29 September 2011 12:15 (25 minutes)

The Versatile Link common project is developing optical link architectures and components to be used for readout and control in future HL-LHC experiments. The on-detector opto-electronic module, the Versatile Transceiver (VTRx), is derived from an industry standard module type and is adapted through minimal customization to the requirements dictated by the HL-LHC-specific front-end environment. In this contribution we present the methods and results of the functional tests carried out on the transceiver components. We summarize the development status of the different VTRx variants and we show the results obtained using the packaged VTRx module.

Summary 500 words

Future HL-LHC experiments will deploy high-speed optical links in large quantities in order to meet the increasing bandwidth requirements. Bi-directional functionality will be required to support detector data readout and transmission of timing and control information on the same optical link. The development of such an optical link requires a large effort that is shared between several groups that participate in the Versatile Link project.

The Versatile Transceiver (VTRx) is the bi-directional opto-electronic module which will be installed on the front-end side of the Versatile Link. The VTRx module will be based on a widely accepted industry standard (SFP+) and has been tailored to the HL-LHC detector environment. The customized module uses fewer components than commercial devices and is packaged using low-mass material. The transmitter path consists of a laser driver and a Transmitter Optical Sub-Assembly (TOSA). On the receiver side the Receiver Optical Sub-Assembly (ROSA) includes a PIN photodiode and the radiation-tolerant transimpedance and limiting amplifier (TIA/LA). Due to the need for radiation tolerance the ASICs are to be sourced from the GBT project.

Several commercial TOSA components from different vendors have been tested to verify that they meet the Versatile Link specifications. The functional tests include static and dynamic measurements in both time and frequency domain. The test methods will be presented and the measurement results will be shown. The results of the environmental tests will be presented in other papers at the same conference.

The final version of the VTRx module will use radiation hard ASICs which are being developed in the framework of the GBT project. However, to help early adopters to build system and architecture demonstrators, module prototypes based on commercial off-the-shelf components have been developed first while the GBT chipset ASIC designs are being fully proven. The printed circuit board of each prototype version has been designed using techniques that guarantee a good match between components over the frequency range required to operate at the target 5 Gb/s data rate. The paper will summarize the development of the different variants as well as the testing of the fully assembled modules.

The total mass of the VTRx module can be reduced by removing metallic parts from the package and by using a plastic connector latch. A prototype version of this latch has been made using 3D printing techniques. The comparison of the results obtained with various materials including radiation resistant polymers will be presented.

The design phase of the VTRx will be over by September 2011 and the project will be ready to move into pre-production readiness. The paper will therefore conclude with a brief summary of the roadmap for taking the VTRx module into production in a form suitable for use in several upgrade programmes of the HL-LHC experiments.

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Session Classification: B5b - Optoelectronics and Links

Track Classification: Opto