



Contribution ID: 183

Type: Poster

## Board-mount miniature optical transmitters and transceivers for detector readout in particle physics experiments

*Tuesday, 29 September 2015 18:01 (1 minute)*

MTx is a dual-channel optical transmitter. MTRx is a transceiver. They are custom developed, small form-factor, low mass and radiation tolerant for detector front-end in particle physics. A custom light-coupling fixture connects fibers of LC ferrules. MTx and MTRx are board-mount and 5.9 mm tall. The driver ASIC is LOClD developed for the ATLAS Liquid Argon Calorimeter trigger upgrade. The receiver uses GBITA developed in the GBT project. The transmitting and receiving data rates are 8 Gbps and 4.8 Gbps. Designs of LOClD, MTx and MTRx together with test results will be presented.

### Summary

MTx and MTRx are developed for the ATLAS Liquid Argon Calorimeter (LAr) trigger upgrade. Based on the hermetically sealed LC packaged TOSA and ROSA we expect high module reliability. The custom made light-coupling fixture (called the Latch) plus the pluggable board-mount electrical connection makes this module also small form-factor, low mass and suitable for converting the fast electrical signal where it's generated (for example at the output of a serializer) into optical. Each MTx module consumes 0.4 W when operated at 8 Gbps per channel. MTx working with the dual channel serializer ASIC LOCx2 makes the detector side optical link with the highest data density ever built for calorimeter readout. The Latch couples TOSA and ROSA with fibers that have standard LC ferrules and flanges. The LC ferrule and the LC TOSA and ROSA ensure the coupling efficiency. Routing multiple optical signals from MTx to the front panel with a custom designed LC-to-MPO fiber patch cord greatly simplifies signal connection and transmission on detector front-end electronics boards. In the case of the LAr trigger upgrade the design is to transmit over 200 Gbps data from one trigger digitizer board to the back-end. The driver ASIC LOClD and the GBTIA loaded ROSA make MTx and MTRx also suitable for operations in the radiation environment of LHC detectors. MTx and MTRx may be used in other detector readout systems. MTx is being considered for the ATLAS muon system phase-1 upgrade as well.

The VCSEL driver ASIC LOClD has two channels especially designed to match the dual channel serializer ASIC LOCx2 (also submitted to this conference). It will also work with any other serializers that have match electrical interface. The input to LOClD is SLVS with a minimal 200 mV VP-P. The output is CML with a minimum 6 mA VP-P. LOClD has a design data rate of 8 Gbps per channel. LOClD is configured and controlled through I2C interface, in particular the bias and modulation to the VCSEL as well as the peaking strength can be remotely controlled.

Both the LOClD ASIC and the optical modules (MTx and MTRx) are fully evaluated to meet the design specs including the required radiation tolerance for operations in the LAr detector front-end. Detailed and complete design information (both the ASIC and the modules) and the test results will be reported. We hope to find more applications of these custom optical transmitter and transceivers in particle physics, and in particular in the detector upgrades for LHC.

**Primary authors:** Mr LIU, Chonghan (a Department of Physics, Southern Methodist University, Dallas, TX 75275, USA); GONG, Datao (Southern Methodist University); Mr ZHAO, Xiandong (a Department of Physics, Southern Methodist University, Dallas, TX 75275, USA)

**Co-authors:** GUO, Di (University of Science and Technology of China); Prof. HUANG, Guangming (b Department of Physics, Central China Normal University, Wuhan, Hubei 430079, P.R. China); Ms HE, Huiqin (a Department of Physics, Southern Methodist University, Dallas, TX 75275, USA); YE, Jingbo (Southern Methodist University, Department of Physics); Prof. CHEN, Jinghong (d Department of Electrical Engineering, University of Houston, Houston, TX 77004, USA); TENG, Ping-Kun (Academia Sinica); HOU, Suen (Academia Sinica (TW)); LIU, Tiankuan (Southern Methodist University); SUN, Xiangming (Lawrence Berkeley National Lab. (US)); LI, Xiaoting (Central China Normal University, Southern Methodist University); XIANG, annie (Southern Methodist University)

**Presenter:** GONG, Datao (Southern Methodist University)

**Session Classification:** Poster

**Track Classification:** Opto