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Optical transceivers for event triggers in the ATLAS phase-I upgrade

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The ATLAS phase-I upgrade aims to enhance event triggers in the Liquid Argon (LAr) calorimeter and the forward muon spectrometer. The trigger signals are transmitted with customized optical transceivers at ˜5 Gbps per channel in a radiation hazard. We report on the design, quality control in production and ageing tests of the transceivers fabricated with the LOCld laser driver circuits and multi-mode 850 nm vertical-cavity surface-emitting laser (VCSEL). The modules are packaged in customized miniature formats of dual-channel transmitter (MTx) and transceiver (MTRx) for the LAr. The transmitters are also packaged in the commercial small form-factor pluggable (SFP) format for the muon spectrometer. The LOCld is configurable for laser bias and modulation of outputs. In production, the LOCld chips, the 10 Gbps VCSELs and photodiodes in TOSA/ROSA format were measured and selected for uniformity in quality. Each channel is tested for 10 Gbps Bit-Error with the eye-diagrams recorded for analysis. The average light power and modulation amplitude of transmitters are distributed with standard deviations in 5 %. The production yield is better than 99 % for the total of about 5k modules. Ageing effects are monitored in burn-in of a small batch of transmitter modules in room condition. The eye-diagrams are measurements periodically and the observables are stable within the 5% systematic uncertainty over a period of more than 4k hours.

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