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ATLAS HGTD ALTIROC

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Timing measurements are critical for the detectors at the future HL-LHC, to resolve reconstruction ambiguity when the number of simultaneous interactions reaches up to 200 per bunch crossing. The ATLAS collaboration therefore builds a new High-Granularity Timing detector for the forward region. A customized ASIC, called ALTIROC, has been developed, to read out fast signals from low-gain avalanche detectors (LGADs), which has 50 ps time-resolution for signals from minimum-ionizing particles. To meet these requirements, a custom-designed pre-amplifier, a discriminator, and TDC circuits with minimal jitter have been implemented in a series of prototype ASICs. The pre-production unit, ALTIROCA, preceded by 4 main prototypes, is designed to contain full functionality. Hybrid assemblies with ALTIROCA ASICs and LGAD sensors have been characterized with charged-particle beams at CERN-SPS and with laser-light injection. The time-jitter contributions of the sensor, pre-amplifier, discriminator, TDC, and digital readout are evaluated.

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