

Performance of the ATLAS Transition Radiation Tracker read-out with cosmic rays and first high energy collisions at the LHC

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The ATLAS Transition Radiation Tracker (TRT) is the outermost of the three sub-systems of the ATLAS Inner Detector containing close to 350,000 thin-wall drift tubes (straws) operated with a Xenon-based gas mixture. The characteristics of the TRT data acquisition are exemplified by the front end electronics. These consist of separate analog and digital ASICs, the ASDBLR and DTMROC. The eight-channel ASDBLR (Amplifier, Shaper, Discriminator and BaseLine Restorer) provides a three-level differential digital output for each channel for as long as the signal stays above programmable “low” and “high” thresholds (which are used primarily for tracking and particle identification, respectively). Two ASDBLR chips input into a single, sixteen-channel DTMROC (Digital Time Measurement and ReadOut Chip), which encodes the time over low (high) threshold in 3.125 ns (25 ns) time steps in a programmable depth pipeline awaiting a level 1 trigger. When a level 1 trigger is received, three bunch crossings worth of data (75 ns) are read out. The DTMROC also provides a “Fast-OR” signal of its inputs, which has been utilized to build a level 1 trigger for cosmic rays traversing the ATLAS Inner Detector. This has been extremely useful during the commissioning of ATLAS. With a jitter of less than 1 bunch crossing cycle (25 ns), it allowed to time-in other ATLAS sub-detectors and level 1 triggers. This talk will describe the TRT readout electronics and data acquisition, with emphasis on the experience gained during commissioning. The performance will be illustrated with the excellent results obtained with the TRT for cosmic rays as well as for the first high energy proton-proton collisions provided by the LHC.

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