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The Fast Tracker - A hardware track processor for the ATLAS trigger system

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The Fast Tracker (FTK) is a hardware upgrade to the ATLAS trigger and data acquisition system providing global track reconstruction to the High-Level Trigger (HLT) with the goal to improve pile-up rejection. The FTK processes incoming data from the Pixel and SCT detectors (part of the Inner Detector, ID) at up to 100 kHz using custom electronic boards. ID hits are matched to pre-defined track patterns stored in associative memory (AM) on custom ASICs and data routing, reduction and parameter extraction is achieved with processing on FPGAs. With 8000 AM chips and 2000 FPGAs, the FTK provides enough resources to reconstruct tracks with transverse momentum greater than 1 GeV/c in the whole tracking volume with an average latency below 100 microseconds at collisions intensities expected in Runs II and III of the LHC. The tracks will be available at the beginning of the trigger selection process, which allows development of pile-up resilient triggering strategies to identify b-quarks and tau-leptons, as well as providing the potential to devise new selections to look for particular signatures (e.g. displaced vertices) in the search for New Physics phenomena.

This presentation describes the FTK system, with a particular emphasis on its massive parallelization capabilities, its installation and commissioning in 2016 and 2017, and the first data-taking experience including performance measurements.

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