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A Fast hardware Tracker for the ATLAS Trigger system

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The trigger system at the ATLAS experiment is designed to lower the event rate occurring from the nominal bunch crossing at 40 MHz to about 1 kHz for a designed LHC luminosity of $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$.

To achieve high background rejection while maintaining good efficiency for interesting physics signals, sophisticated algorithms are needed which require extensive use of tracking information.

The Fast Tracker (FTK) trigger system, part of the ATLAS trigger upgrade program, is a highly parallel hardware device designed to perform track-finding at 100 kHz and based on a mixture of advanced technologies. Modern, powerful Field Programmable Gate Arrays form an important part of the system architecture, and the combinatorial problem of pattern recognition is solved by ~8000 standard-cell ASICs named Associative Memories.

FTK provides track reconstruction based on the full silicon detector with quasi-offline resolution in approximately $100 \mu\text{s}/\text{event}$. The availability of the tracking and subsequent vertex information within a short latency ensures robust selections and allows improved trigger performance for the most difficult signatures, such as b -jets and τ s.

We present the architecture of the FTK system, the results from integration tests of a slice of the FTK at CERN and discuss the expected physics performance in the harsh environment of high pile-up and high luminosities expected for LHC run II

Collaboration

ATLAS Collaboration

Primary authors: Dr BOLD, Tomasz (AGH-UST); Ms PASTORE, francesca (CERN)

Presenter: Mr PANDINI, Carlo (LPNHE Paris)

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