Contribution ID: **28** Type: **Invited Talk**

FTK status and perspectives for track trigger in ATLAS at HL-LHC

Friday 30 September 2016 09:00 (22 minutes)

The expected instantaneous luminosities delivered by the Large Hadron Collider will place continually increasing burdens on the trigger systems of the ATLAS detector. The use of tracking information is key to maintaining a manageable trigger rate while keeping a high efficiency. At the same time, however, track finding is one of the more resource-intensive tasks in the software-based processing farms of the high level trigger system. To support the trigger, ATLAS is building and currently installing the Fast TracK Finder (FTK), a hardware-based system that uses massively parallel pattern recognition in Associative Memory to reconstruct tracks above transverse momenta of 1 GeV across the entire detector at 100 kHz with a latency of ˜100 microseconds. In the first-stage of track finding, FTK compares hits in ATLAS silicon detectors against ˜1 billion pre-computed track pattern candidates. Track parameters for these candidates, including goodness-of-fit tests, are calculated in FPGAs using a linear approximation, leading to nearly offline-quality efficiency and resolution with a low fake rate.

In order to prepare for the future high-luminosity environment, ATLAS is also studying upgrades to the hardware-based track trigger capabilities of the detector. The FTK++ upgrade will expand on the power of the FTK system, with newer and faster FPGAs and a significantly larger number of patterns, allowing the upstream software-based trigger system access to full-scan tracking at 100 kHz, even with an average of up to 200 overlapping proton-proton interactions.

The L1Track upgrade will use shared hardware technologies with FTK++ and provide regional tracking for confirmation of the earliest stage muon and calorimeter trigger systems, particularly for single electron triggers, with a latency of only 6 microseconds. L1Track is expected to maintain high efficiency (>= 95%) and low fake rate for tracks with transverse momenta above 4 GeV at a rate of 1 MHz. In an alternative upgrade model in which the full 1 MHz rate is passed to a computing farm, FTK++ will continue to provide the full-scan tracking at 100 MHz, and L1Track will be replaced by the EFTrack system, which will similarly provide fast regional tracking to the computing farm.

This contribution will describe the parameters of the FTK system and the status of installation and commissioning of the hardware, as well as future, longer-term, plans for hardware-based track triggers at ATLAS.

Author: ADELMAN, Jahred (Northern Illinois University)

Presenter: ADELMAN, Jahred (Northern Illinois University)

Session Classification: B15-Online and offline tracking and vertexing

Track Classification: Online and offline tracking and vertexing