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FTK AMchip05: an Associative Memory Chip Prototype for Track Reconstruction at Hadron Collider Experiments

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The Fast TracKer (FTK) trigger project is an upcoming upgrade for the ATLAS trigger system currently under installation. A first reduced-coverage FTK is expected to participate in data taking by the end of 2015, while full detector coverage will be reached in 2016 and more processing power will be added in 2017-2018.
The ATLAS FTK is a dedicated supercomputing processor based on FPGAs and a custom ASIC: the Associative Memory chip (AMchip). The AMchip is the core processor in charge of the real-time pattern recognition stage of the FTK algorithm. It is based on Content Addressable Memory elements connected by advanced computation logic that adds the unique feature to look for correlated hits forming tracks.

The AMchip05 is the latest AMchip prototype before the final FTK production. It is functionally identical to the upcoming production chip with the only difference of pattern capacity. We will show the AMchip05 architecture, the design, implementation and the in-depth performance analysis under different working conditions (power supply voltage and operating frequency). We will discuss the impact on physics performance enabled by the new features with respect to the previous AMchip generation, in particular the possibility to have variable resolution patterns. We will also address the impact on LHC Phase-2 tracking applications of the current chip and the foreseen developments.

Author: TDAQ SPEAKERS COMMITTEE, ATLAS (ATLAS)

Presenter: CRESCIOLI, Francesco (Centre National de la Recherche Scientifique (FR))

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