



Contribution ID: 533

Type: Talk

Real-time pattern recognition with FPGA at LHCb, an $O(n)$ complexity architecture

Thursday 24 October 2024 13:48 (18 minutes)

Abstract: The LHCb collaboration is planning an upgrade (LHCb “Upgrade-II”) to collect data at an increased instantaneous luminosity (a factor of 7.5 larger than the current one). LHCb relies on a complete real-time reconstruction of all collision events at LHC-Point 8, which will have to cope with both the luminosity increase and the introduction of correspondingly more granular and complex detectors.

After an intensive R&D programme, LHCb proposed to build an FPGA-based system to reconstruct tracks in the SciFi detector during Run 4, as an intermediate step towards a system that could be extended to other tracking detectors. Based on an extremely parallel architecture, the so-called ‘artificial retina’, this system has an $O(n)$ complexity, which is a crucial feature for high luminosity scenarios.

In this talk we describe why this system scales linearly with luminosity and how much it can accelerate the LHCb High Level Trigger in Run 4.

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Session Classification: Parallel (Track 2)

Track Classification: Track 2 - Online and real-time computing