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The GAP Project: GPU applications for high level trigger and medical imaging

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The aim of the GAP project is the deployment of Graphic Processing Units (GPU) in real-time applications, ranging from high-energy physics online event selection (trigger) to medical imaging reconstruction. The final goal of the project is to demonstrate that GPUs can have a positive impact in sectors different for rate, bandwidth, and computational intensity. Most crucial aspects currently under study are the analysis of the total latency of the system, computational algorithms optimisation, and integration with the data acquisition systems. In this contribution we are focusing on the application of GPUs in asynchronous trigger systems, employed for the high-level trigger of LHC experiments. In particular we discuss how specific trigger algorithms can be naturally parallelized and thus benefit from the implementation on the GPU architecture, in terms of the increased execution speed and more favourable dependency on the complexity of the analyzed events. Such improvements are particularly relevant for the foreseen LHC luminosity upgrade where highly selective algorithms will be crucial to maintain a sustainable trigger rates with very high pileup. We will give details on how these devices can be integrated in a typical LHC trigger system and benchmarking their performances. As a study case, we will consider the Atlas experimental environment and propose a GPU implementation for a typical muon selection in a high-level trigger system.

Primary authors: BAUCE, Matteo (ROMA1); MESSINA, andrea (roma1)

Presenter: BAUCE, Matteo (ROMA1)

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