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GPU for Real Time processing in HEP trigger systems

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We describe a pilot project for the use of GPUs (Graphics processing units) in online triggering applications for high energy physics experiments. Two major trends can be identified in the development of trigger and DAQ systems for particle physics experiments: the massive use of general-purpose commodity systems such as commercial multicore PC farms for data acquisition, and the reduction of trigger levels implemented in hardware, towards a pure software selection system (trigger-less).
The very innovative approach presented here aims at exploiting the parallel computing power of commercial GPUs to perform fast computations in software both in early trigger stages and in high level triggers. General-purpose computing on GPUs is emerging as a new paradigm in several fields of science, although so far applications have been tailored to the specific strengths of such devices as accelerator in offline computation. With the steady reduction of GPU latencies, and the increase in link and memory throughputs, the use of such devices for real-time applications in high-energy physics data acquisition and trigger systems is becoming ripe.
We will discuss in details the use of online parallel computing on GPU for synchronous low level trigger with fixed latency. In particular we will show the preliminary results on a first field test in the CERN NA62 experiment. The use of GPUs in high level triggers will be also considered, the CERN ATLAS experiment (and in particular the muon trigger) will be taken as a study case of possible applications.

Primary author: LAMANNA, Gianluca (CERN)

Co-authors: LONARDO, Alessandro (Universita e INFN, Roma I (IT)); BIAGIONI, Andrea (Universita e INFN, Roma I (IT)); MESSINA, Andrea (CERN); ROSSETTI, Davide (INFN Rome Section); Dr SIMULA, Francesco (Università e INFN, Roma I (IT)); RESCIGNO, Marco (Universita e INFN, Roma I (IT)); SOZZI, Marco (Sezione di Pisa (IT)); FIORINI, Massimiliano (CERN); VICINI, Piero (INFN Rome Section); FANTECHI, Riccardo (Sezione di Pisa (IT)); AMMENDOLA, Roberto (INFN); GIAGU, Stefano (Universita e INFN, Roma I (IT))

Presenter: AMMENDOLA, Roberto (INFN)

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