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The ALICE DAQ Detector Algorithms framework

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ALICE (A Large Ion Collider Experiment) is the heavy-ion detector studying the physics of strongly interacting matter and the quark-gluon plasma at the CERN LHC (Large Hadron Collider). The 18 ALICE sub-detectors are regularly calibrated in order to achieve most accurate physics measurements. Some of these procedures are done online in the DAQ (Data Acquisition System) so that calibration results can be directly used for detector electronics configuration before physics data taking, at run time for online event monitoring, and offline for data analysis.

A framework was designed to collect statistics and compute calibration parameters, and has been used in production since 2008. This paper focuses on the recent features developed to benefit from the multi-cores architecture of CPUs, and to optimize the processing power available for the calibration tasks. It involves some C++ base classes to effectively implement detector specific code, with independent processing of events in parallel threads and aggregation of partial results. We present benchmarks showing the performance improvements, and some results of investigations conducted with CUDA and GPUs to push the speed-up further.

The Detector Algorithm (DA) framework provides utility interfaces for handling of input and output (configuration, monitored physics data, results, logging), and self-documentation of the produced executable. New algorithms are created quickly by inheritance of base functionality and implementation of few ad-hoc virtual members, while the framework features are kept expandable thanks to the isolation of the detector calibration code. The DA control system also handles unexpected processes behavior, logs execution status, and collects performance statistics.

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