

Operational experience with the new CMS DAQ expert

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The data acquisition (DAQ) system of the Compact Muon Solenoid (CMS) at CERN reads out the detector at the level-1 trigger accept rate of 100 kHz, assembles events with a bandwidth of 200 GB/s, provides these events to the high level-trigger running on a farm of 26000 cores and records the accepted events. Comprising custom-built and cutting edge commercial hardware and several 1000 instances of software applications, the DAQ system is complex in itself and failures cannot be completely excluded. Moreover, problems in the detectors, in the first level trigger system or in the high level trigger may provoke anomalous behaviour of the DAQ system which sometimes cannot easily be differentiated from a problem in the DAQ system itself. In order to achieve high data taking efficiency with operators from the entire collaboration and without relying too heavily on the on-call experts, an expert system, the DAQ Expert, has been developed that can pinpoint the source of most failures and give advice to the shift crew on how to recover in the quickest way. The DAQ Expert constantly analyzes monitoring data from the DAQ system and the high level trigger by making use of logic modules written in Java that encapsulate the expert knowledge about potential operational problems. The results of the reasoning are presented to the operator in a web-based dashboard, may trigger sound alerts in the control room and are archived for post-mortem analysis - presented in a web-based timeline browser. We present the design of the DAQ Expert and report on the operational experience since 2017, when it was first put into production.

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