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The CMS BRIL Data Acquisition system

(BRIL) Beam Radiation Instrumentation and Luminosity is a new project within CMS. It consists of several independent sub-detectors for measuring the luminosity, monitoring the beam conditions, and the protection of CMS from serious radiation damage. It is beneficial for the project in the long run to use a single software infrastructure for data acquisition.

Similar to CMS central daq, BRIL daq manages distributed and heterogeneous subsystems.
The difference is that it has no event building and requires less data throughput.
We present the design of the BRIL DAQ system build on the XDAQ and RCMS framework in CMS.

XDAQ is the C++ framework for distributed data acquisition system. Its event-driven architecture enables large numbers of loosely coupled software components and services to exchange information in near real-time.

A BRIL DAQ component is a XDAQ process containing several applications. There are three tiers of BRIL DAQ components: sources, processors and central processors. A source is the hardware readout unit, a processor is responsible for local data aggregation and reduction, and a central processing component aggregates and further reduces data from all subsystems. Different central processors serve different purposes such as data storage, luminosity selection or online data quality monitoring.

XDAQ b2in eventing in publish/subscribe mode is used as data transport mechanism between components. The publish/subscribe model is chosen because it guarantees maximum decoupling of data senders and receivers.

RCMS is the run-control framework in CMS. It is written in Java and with built-in web and database supports. To write a RCMS component means to implement a function manager(FM) with a state machine, state transitions and event callbacks. Some state inputs are visible to the run control and monitoring web page allowing external intervention. State inputs, configurations or other parameters of choice can be stored in the database.

There are about 15 to 20 XDAQ processes running in the BRIL linux cluster. The global configuration and control of them is achieved by a single generic function manager driven by several configuration groups. The division of such groups is decided by the life cycle pattern of the processes. This design is simpler than function manager hierarchy used in the CMS central daq but is sufficient to control BRIDAQ processes which are stateless.

The fact that each XDAQ process containing a HTTP server allows the data acquisition and the control system to collaborate seamlessly via SOAP messaging.

Finally, we present some first experience of using the new BRIL daq system.

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