Status of the HADES Run Control ◊

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The High Acceptance DiElectron Spectrometer HADES set up at GSI Darmstadt has performed its first physics run in November / December 2002. With the ATM based data aquisition and the multilevel trigger system roughly 2.1×10^8 events (1.2 TByte of data) were written to tape. For the first time the second level trigger was used to enrich the electron / positron content of the data. While the experiences gained during this experiment (results are not yet available) are summarised in reference [1] we report here on the run control system and its present status.

The readout electronics consists of more than 1 000 front end and about 125 VME boards with a large number of different tasks and layouts. The system is read out with the `hadaq` software package developed by M. Münch [2] which is also responsible for the data transport via ATM and for eventbuilding. The VME modules and all the processes of the DAQ software are distributed over a number of VME crates equipped with Motorola 68k or PowerPC CPUs, running the operation system LynxOS. Two processes do the eventbuilding on a dedicated Intel based two processor computer, running Linux.

To operate this complex system during experiment we have developed a run control [3,4] based on the EPICS [5] package. It consists of four major parts:

1. The **agent** is running on each node and contains the low level functionality to control and monitor each hardware and software item that resides in its subsystem. To reduce the number of binaries needed, it is highly configurable. Three flavours of the agent cover the whole range of different subsystems. To improve performance of the system as well as to maintain the accessibility of monitoring information, the agent is a multithreaded application. It is developed in a distributed manner by separating the core functionality from the hardware dependent part with a well defined interface. In this way, hardware routines can be tested without using the whole agent. Transparent network access to the agents functionality is done via EPICS channel access.
2. The **sequencer** is a collection of state machines that takes care of calling the atomic control functions of the agents in proper order. It is also responsible for reacting failed actions and other error conditions.
3. The **manager** is a Tcl/Tk based GUI that allows to
   (a) operate the system with only few buttons
   (b) watch the state of the system by accessing the agent and provide detailed views
   (c) change the configuration very fine grained by accessing the central parameter source
4. The **database** (an Oracle SQL server) holds the configuration and allows read and write access through a well defined interface that allows to easily replace the data source with e.g. a text file. The modular parameter access is also needed to allow running the small hardware routine tests mentioned above without employing the database to hold all the temporary parameters.

While the development of the first three parts is rather complete already for quite a while, we focussed our work last year on the design of the database. This included interconnects to all relevant parameters stored in the database for analysis purposes of all detectors.

Meanwhile the database delivers roughly 50 000 single parameter items which are grouped in approximately 150 tables. There are more than 200 different parameter types, each of them computed using dedicated and partly complex algorithms. Some of these algorithms involve many parameter tables introducing an overall computing time of up to 60 seconds. In order to save time we have invented and implemented a multistage caching mechanism which allows to reduce the number of parameter recomputations to the necessary minimum. In this way the newest approved parameter set for each application can be provided within 1 second in nealy all cases.

In a first step, the run control of the RICH subsystem was completed. For the RICH, the whole path necessary for the pulse height calibration and the production of thresholds for its read out electronics has been included in the Oracle database and in the run control. By this, the correct pedestal values downloaded to the front ends of all 28 800 channels can be transfered without any further user interaction to the HADES analysis package HYDRA and allows automatic calibration of each data file. The RICH part of the run control package could be successfully tested before the beam time.

Implementation of the remaining detector systems has meanwhile been completed and first tests are under way. The whole software project including documentation will likely be finished until the mid of this year.

References

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