DABC data acquisition input for slow control variables

J. Adamczewski-Musch, B. W. Kolb, and S. Linev
GSI, Darmstadt, Germany

The Data Acquisition Backbone Core (DABC) is a software framework to run DAQ with distributed event building on high performance Linux clusters [1]. There are several use cases, especially in test beam times where the setup during data taking is intentionally changed very often, and the interpretation of the acquired detector data depends on the experimental set-up. Usually, the set-up is managed by a slow control system like EPICS [2], which has powerful tools to archive the set-up values. For online analysis, however, a direct access to such values in the DAQ data stream can be very useful, e.g. for a conditional analysis depending on certain settings. Moreover, it is possible to perform a fast scan of detector properties with the control system and record simultaneously the measured data in the same file. Because of this an EPICS data input for DABC was developed.

DABC data input for EPICS

The DABC framework has plug-in interfaces to attach any kind of data sources to the DAQ [3]. Such data-input interface was implemented as Epics-input plug-in for reading a set of slow control process variables from an EPICS IOC server. This implementation is based on the existing Easy Channel Access (ezca) extension library [4], featuring basic C functions to request named variables from any EPICS IOC.

This DABC ezca-plugin can be configured by XML file which contains the names of the process variables to be fetched. Currently an expandable set of integer or double values can be treated, other EPICS records may be implemented in future versions. One special EPICS record defines a ”flag” variable which is polled by DABC with a configurable repetition time, e.g. 100ms. Only if this flag variable shows a specific value, e.g. 0, the complete set of the defined records is acquired from the IOC. Thus by setting this variable, the IOC can decide the refresh rate of the data recorded to the DAQ stream. This can be done by an EPICS timer, or when a change of the set-up is significant for the DAQ.

The ezca::DataInput instance puts each acquired set of EPICS process variables into an MBS event/subevent structure. The order of the EPICS records in the subevent data field is currently defined by the order of records in the DABC configuration file. Additionally, the MBS event identifiers can be specified in the DABC set up.

The processing DABC module, connected to the ezca::DataInput transport, may combine this EPICS subevent with MBS subevents of the DAQ data stream from other data sources, e.g. an external MBS system, or the CBM readout controller (ROC). Since the EPICS data rate is much lower than the usual DAQ data rate, synchronization between EPICS records and the other event data can be done in the subsequent analysis software by means of the system time stamp which is recorded in the ezca subevent payload, and should be also available in the subevents of other data sources.

Application for the CBM test beam at COSY

A CBM test beamtime was performed at COSY in December 2010 [5]. The set-up of detector voltages and motor positions was controlled by one EPICS IOC. The DABC DAQ was configured with the ezca plug-in such that all variables of the IOC were recorded with the full data stream every 10 s. Thus it was possible in the attached Go4 online monitoring analysis [6] to visualize these EPICS variables together with the detector display: for instance, the motor controlled positions of the GEM detectors were shown; also the settings of a beam enclosing ”ROLU” scintillator frame.

During the voltage scan of the STS detectors, the recorded EPICS data allow to directly correlate the detector signals with the settings in the final analysis.

Besides the EPICS data, the DABC data stream also contained a ”spill-on/spill-off” message from a signal directly fed into the ROCs by a beam trigger sensor. This allowed an automatic baseline calibration of the ROCs in the Go4 online analysis whenever the synchrotron beam was paused. Although the mechanism of getting the set-up state was different here, the principle of a conditional analysis steered by slow control variables within the DAQ data stream would be the same for the EPICS records.

References

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