Integration of DABC and babirl DAQ

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In knockout measurements and elastic scattering measurements, such as the ONOKORO project[1] and the ESPRI project, the angle of the scattered particles must be measured with high accuracy. These projects use microstrip silicon detectors[2] as position detectors. We use DABC[3] for data acquisition in this silicon detector. DABC is a data acquisition (DAQ) system developed by GSI and established for the DAQ system of readout of these silicon detectors. In the two projects, babirl DAQ,[4] developed at RIKEN, is used for data acquisition, where babirl DAQ is DAQ software that can event-build from multiple sub-DAQ systems. We have developed additional software to link RUN operations of DAQ between DABC and babirl DAQ and merge data event-by-event to realize online analysis.

Figure 1 shows a schematic of the developed system. In this development, we have aimed to integrate and separate DABC and babirl DAQ easily in a simple design. The signals of silicon detectors are read out with analog pipeline ASIC, referred to as APV25,[5] and digitized by the ADC module, referred to as ADCMs,[6] composed of an SFP transceiver module and FPGA. These data were sent to the DABC in response to triggers from backend electronics referred to as TRB3[7] developed by GSI and Technische Universität München. DABC event-builds data from ADCM and saves it to the HLD file format. Here, the ridf-plugin was added as a DABC extension to enable communication with babirl DAQ. The ridf-plugin is a program that streams data over the network. The data event-built by DABC are sent to the *relay* program with two server sockets via the ridf-plugin. The *relay* passes the data to babies, which process this data. The processed data are sent to babirl DAQ, and event data is constructed with data from other modules. In this development, we have designed DABC and babies as clients, and the *relay* connects both. This ensures that both interprocess communications are de-coupled, and their configuration does not affect each other. For RUN synchronization, the start-stop manager referred to as babissm is used. When operating the babirl DAQ, the start/stop command is sent to babies and babissm from babicon, which is the controller of the babirl DAQ. In this case, we have added the start/stop command for DABC to the babissm. This allows both babies and DABC to operate from babicon.

Figure 2 shows a schematic of the conversion from HLD format to RIBF Data Format (RIDF). RIDF is the data format used for babirl DAQ. In RIDF, the data are identified by the segment header. The DABC event-built the data and sends as a single buffer gathering multiple event data. Therefore, developed babies decomposes the data in HLD format, attach a dedicated segment header to each event, and composes it as RIDF. Consequently, the silicon detector data sent to babirl DAQ are written to a file in RIDF along with data from other modules.

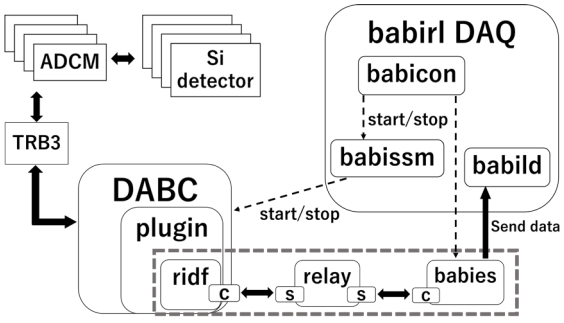

Fig. 1. Schematic of the DAQ integration system, where C and S represent client and server socket, respectively. The dotted box shows the developed part.

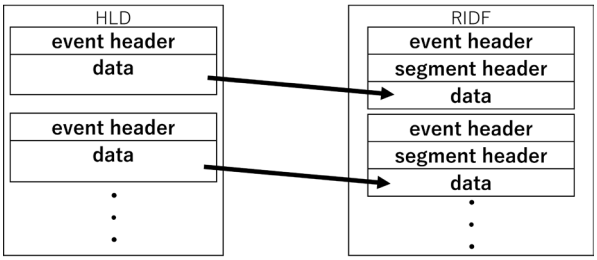

Fig. 2. Schematic of the conversion from HLD format to RIDF.

We used the system in the H424 experiment, conducted in July 2022 and January 2023 at the HIMAC of the QST. We successfully integrated DABC and babirl DAQ in this experiment. In addition, HLD format data could be converted to RIDF and merged on an event-by-event.

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