2. Control System

1. Status

In FY2020, we continued to improve the control system for SPring-8 and SACLA. Several components of the control system were replaced.

- The Libera SPARK beam position monitor readout was replaced by the MTCA.4 system with event-driven data acquisition.
- The Cameralink screen monitor image grabber was replaced by the GigE camera system. It allows the control cable between a grabber and a camera to be extended up to 100 m [1].
- The Online Database server for the SACLA was upgraded to an 84-node server system with the Cassandra 3.1 database management software. This system can keep online data for more than one year, whereas the previous system could do so for only half a year.

The functions of the NewSUBARU accelerator area and L3 beam transport area in the SPring-8 safety interlock system were removed. This is because the SPring-8 Linac is no longer an injector for NewSUBARU.

2. Development of the framework for the accelerator control system

The control system is working well, but several parts need further modification [2].

- Management of the signal registration of the parameter database
- Replacement of the graphical user interface (GUI) from the X-mate to Qt base GUI builder
- Support the RestAPI frame to access the database

We released a web application to manage the signal registration of the parameter database for operators. The web application is used to manage the signal registration workflow. The signal registration involves several steps.

1. User upload of SVOC files
2. Execution of SVOC syntax check for the uploaded files
3. Registration of the signal to the test DB
4. Registration of the signal to the operational DB

When the parameter is registered, a rollback procedure is also created.

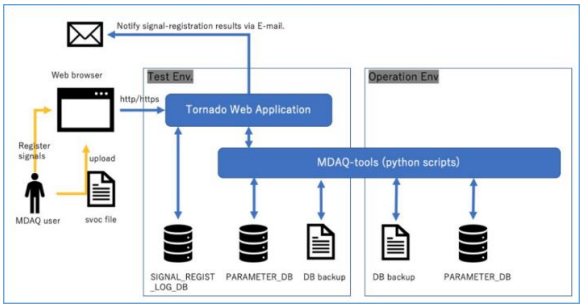

Fig. 1. Schematic of the signal registration for the parameter database.

For the GUI to the control accelerator, we decided to use the Qt framework. The X-mate was designed with X-window, so it is independent of any window manager and difficult to port other operating systems. The Qt frame has a very rich presentation but not as many functions as the X-mate for accelerator control. We developed several library or Qt plug-ins.

- Messaging between processes
- Creating forms
- Several graphs
- Drawing basic shapes
- Importing drawing from SVG format

Because of SACLA and SPring-8 being in

operation, we have started to implement the Qt frame for alarm surveillance and screen monitor. They are independent of machine operation.

We provide the standard web interface to access a database and maintain various data expressions. For operation, we need more flexible access and various data presentations. RestAPI is used to access data and to manipulate figures for the operator and researcher.

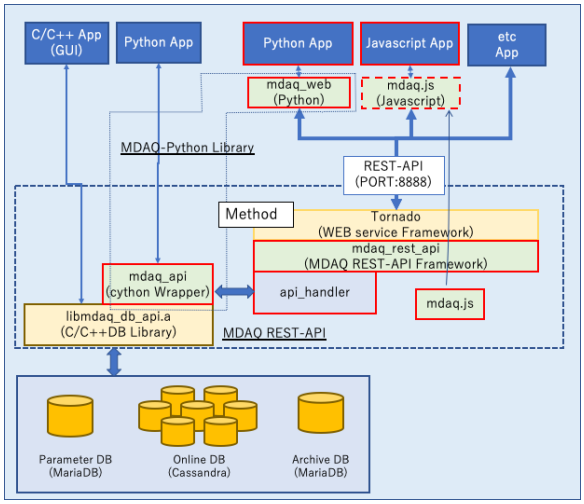

Fig. 2. RestAPI frame.

3. Development of equipment for the accelerator control system

We developed an I/O board to control the magnet power supply. At SACLA, we use OPT-CC and the OPT-RMT iDIO card. OPT-CC and OPT-RMT iDIO communicate via an optical fiber. Unfortunately, the production of optical transmitter and receiver have been discontinued. We have designed an iDIO card with the EtherCAT protocol, which is to be used for new-generation accelerator control. This card was designed to be compatible with OPT-RMT Type-B+, which is used for the sextuple magnet power supply of SPring-8. The functions of the two cards are very similar, but the pin assignment differs. We use a mezzanine card to change the pin assignment. This card will be tested at SACLA next year.

Fig. 3. I/O card with EtherCAT, red box shows Type-B+ setting and blue box shows iDIO mode.

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[2] Okada, K. et al. (2021). Proceedings of the 18th Annual Meeting of Particle Accelerator Society of Japan, Japan, Aug. 2021.