2. Control System

1. Status

In FY2022, we continued to improve the control system for SPring-8 and SACLA. Several components of the control system were replaced.

- The Online Database server for the Test-Stand was upgraded with a 24-node server system with the Cassandra 3.1 database management software during the summer shutdown period. The Archive Database server for the Test-Stand was installed. Those servers were also aimed at checking the configuration as a prototype for the NanoTerasu database system.
- The file server for waveforms and image data files was upgraded with 120-TB storage. This server is separated from the main file server to avoid consuming disk space.
- The firewall system between the office network and the accelerator control network was replaced with the aim of avoiding deterioration.
- The control system for ID17 was replaced because of the installation of the new insertion device.

2. Development of the framework for the accelerator control system

The control system is working well, but several parts need further modification [1].

- Brush up the user interface for the management of the parameter for an accelerator with the parameter database.
- Develop the Grafane plug-in to access the database.

Last year, in the web application, the function to manage the parameter workflow was updated to take into account the operator's feedback. We released a web application to manage parameters, such as parameters of operation and a calibration constant, for accelerator operators (Fig. 1). The web interface uses similar management to that of signal registration.

Fig. 1. User interface of a web application to manage the ParamSet DB registration page.

We released the plug-in for Grafana, which is used to visualize data to access the database of accelerators and for figure manipulation by an operator or a researcher. Figure 2 shows the Grafana dashboard.

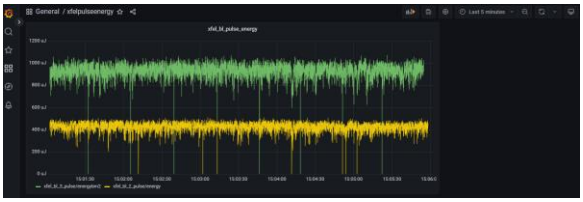

Fig. 2. Graphical presentation with Grafana dashboard.

3. Development of the equipment for the accelerator control system

We developed a next-generation control system for the insertion device with EtherCAT protocol. We added new functions for the synchronized control of

the upper and lower positions of magnets. We used a gap controller, rotary encoders, electromagnet power supply, temperature measurement units, and a display unit for the encode position. The display unit was used for slave-to-slave communication to determine the encoder position and pulse count of the motor controller. Figure 3 shows a schematic view of the control system. This will be used at SPring-8 and NanoTerasu next year.

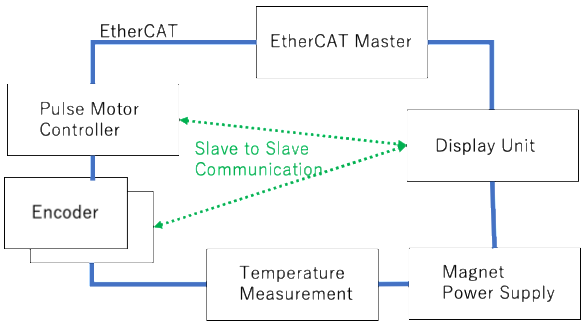

Fig. 3. Schematic view of the control system for an insertion device.

We developed a new alarm voice generation system, called VOICE Server, using the Speech API developed by Microsoft. VOICE Server uses the RESTful API, and we released a library for C/C++. Figure 4 shows the user interface to tell the time by voice. This is also used for surveillance for VOICE Server.

Fig. 4. User interface for VOICE Server to tell time.

We developed a new beam abort request interconnect system (ARIS) using the optical fiber between the RF station and node units. RS485 is used for interconnection of the node unit to BPM and Front-End system. This system will be used at NanoTerasu next year and in the SPring-8 upgrade.

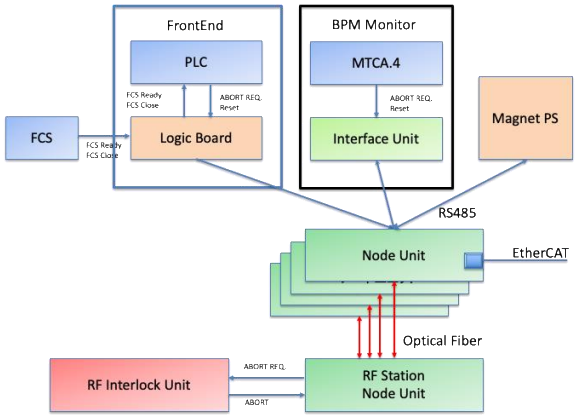

Fig. 5. Implementation of ARIS for NanoTerasu [2].

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[2] Hosaka, Y. et al. (2022). *Proc. 19th Annual Meeting of Particle Accelerator Society of Japan*.