NEW SPring-8 CONTROL ROOM: TOWARDS UNIFIED OPERATION WITH SACLA AND SPring-8 II ERA

A. Yamashita*, R. Fujihara, N. Hosoda, Y. Ishizawa, H. Kimura, T. Masuda, C. Saji,
T. Sugimoto, S. Suzuki, M. Takao, R. Tanaka, JASRI/SPring-8, Hyogo, Japan.
T. Fukui, Y. Otake, RIKEN/SPring-8, Hyogo, Japan

Abstract

We have renovated the SPring-8 control room. This is its first major renovation since its inauguration in 1997. In 2011, the construction of the SACLA (SPring-8 Angstrom Compact LAser) was completed. Plans are to control it from the new control room for it to work in close cooperation with the SPring-8 storage ring. It was expected that the upcoming SPring-8 II project would require more workstations than the current control room could accommodate. We have therefore extended the control room area for these anticipated requirements. In this renovation, we employed new technologies that did not exist 14 years ago, such as a large LCD and silent, liquid-cooling workstations for a comfortable operation environment. We have incorporated many ideas which were obtained during the 14 years experience of the operation. Operations in the new control room were started in April 2011 after a short period of construction.

INTRODUCTION

The SACLA (SPring-8 Angstrom Compact free electron LAser) [1], which has been constructed in the SPring-8 campus, successfully generated 0.12 nm wavelength X-ray laser in June 2011, three months after the start of its commissioning run. The SACLA has an unique feature that allows experimentalists to use synchrotron radiation from SPring-8 and an X-ray laser from the SACLA simultaneously and perform an experiment such as a pump-and-probe experiment. And also, the SACLA is designed to act a high performance injector for SPring-8. Therefore, it is planned that SPring-8 and the SACLA will be controlled from the same SPring-8 control room for a closely coupled and unified operation. They are controlled from separate control rooms during the commissioning period. We are also planning major upgrade for SPring-8 which is named SPring-8 II [2] to be implemented over the next decade. We expect SPring-8 II will require more workstations to control. The previous control room did not satisfy this requirement. For this purpose, we decided to renovate the SPring-8 control room. Fig. 1 shows a view of the new control room.

When the old control room was constructed in 1997, there were no liquid crystal displays (LCD), water-cooled, silent workstations, or large LCD panels for display wall, which are popular for use in modern control rooms. We renovated the control room to take advantage of the those modern technologies that did not exist in 1997.

* aki@spring8.or.jp

DESIGN GUIDELINES

Before the design, we set the design guidelines as follows.

- SPring-8 and SACLA should be controllable from the same control room.
- The control room should be scalable for implementing SPring-8 II.
- The control room should be such as that there is no partition between the two accelerators.
- The control room should have function in cooperation with the safety and facility systems.
- The control room should have consoles and the numbers of machine control CPUs (e.g. VME) should be as low as possible for quiet environment.

We designed the new control room according to the design guidelines.

FLOOR LAYOUT

Fig. 2 shows the floor layout of the new control room. We divided the control room area and the back area using the display wall. Approximately half of the old control room was the back area and was filled with racks for servers and workstations. Extenders were used to connect workstations in the back area with keyboards, mouses and displays in the control area. This arrangement helped reduce the noise generated by workstation and keep the control area quiet for maintaining a good working environment. We had to place each workstation at the back of the control desk in the new control room because the extender and the long and thick cables resulted in a maintenance problem. The use of a silent type of workstation solved the noise-related problem. We reduced the size of the back area and moved the servers to the newly constructed dedicated server room.

Twenty-four control workstations could be distributed among five desk *islands*. One island in front of the display wall had four main terminals for an overall SPring-8 accelerator control and one safety interlock panel with the emergency stop button, access keys, and a display panel for displaying interlock status. Terminals from the other islands were needed to monitor and control individual accelerator components. The fish-shaped desk islands design enabled the operators at the main terminals to view information related to all the terminals at a glance and have face-to-face communication with to all the other operators. In addition, the fish-shaped design is scalable as required by the design guidelines and it can be extended by adding extra desks.

The number of consoles was selected based on current usage for SPring-8 and the SACLA plus the expected re-

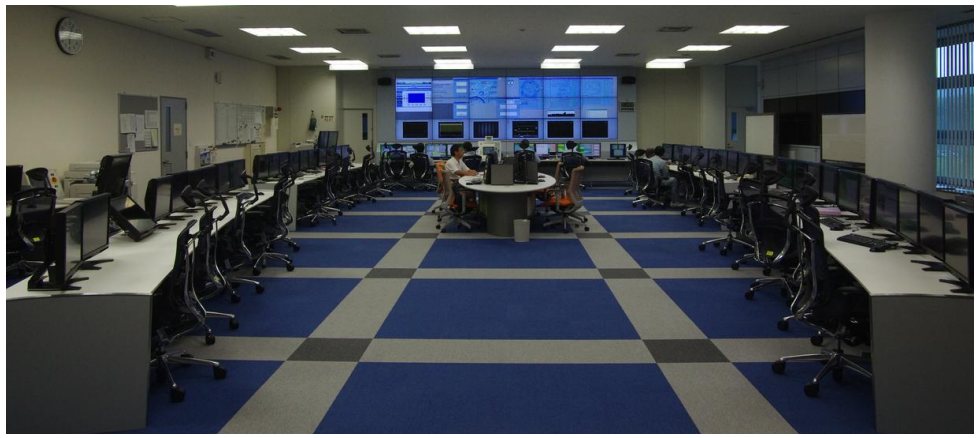

Figure 1: View of the new SPring-8 control room.

quirement in the future. Currently, SPring-8 accelerators and beam lines are controlled by less than 17 workstations in the control room. There are more than 7 spare spaces for workstations.

In the center oval table accommodated six PCs. They were used for office work. We accommodated six thin client terminals on the side desk island. These terminals were used for monitoring the data acquisition status and the alarm. They were also used for program development.

Control Desk

Each control desk measured 1150 mm (Width)×855 mm (depth) for one operator. The depth was reduced for LCD screen because the old desk had a depth to fit a large CRT display. The width was sufficient to place for setting two 24" diagonal LCD displays side by side. The desks were built such that they were jointed with each other. The desk had space for a workstation at the back. The back panel could be removed without using any tools for workstation maintenance (Fig. 3). The workstation was water cooled and of the silent type for reduced noise. There were sufficient space at the back for a typical middle tower type case. In addition to the two LCDs, the desk was designed to fit four panels. Two holes on the side supported the poles for LCD stand. Fig. 4 shows the four panel setup.

Meeting Space

There was no dedicated meeting space in the old control room. We created meeting space with 12 chairs. Sometimes access to the accelerator was required during meetings. For this reason, the meeting space and the control section were not separated by a partition. The table had AC power sockets for note PCs belonging to individual participants.

Center Table

The oval table in the center had six PCs, which were used for office work such as for writing reports, reading documentations, and a simple analysis. We added a shelf under the oval table to place recent logbooks and manuals. The shelf helped to minimize the number of papers scattered on the desks.

Figure 3: Back view of the control desk. A workstation is built in. Two lines of AC power are supplied. One is stabilized by UPS for the workstation and the other is not stabilized.

Monitoring Space

The alarm and data acquisition systems were monitored from the side island. The thin client terminal displayed the processes performed at servers. Thin client terminals occupy very little spaces but their graphic display performance is poor. Tasks that do not require very good display performance are performed with the help of thin client terminals.

Back Area

Currently, the back area has very few components unlike the old control room, which was filled with server and

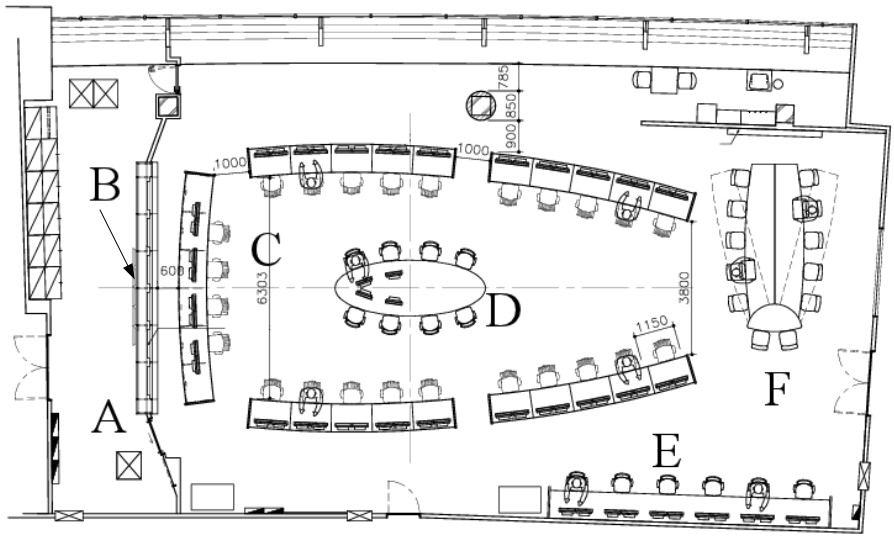

Figure 2: Floor plan of the new SPring-8 control room. A: Back area. B: Display wall, C: Control desks, D: Oval desk, E: Monitoring desks and F: Meeting space.

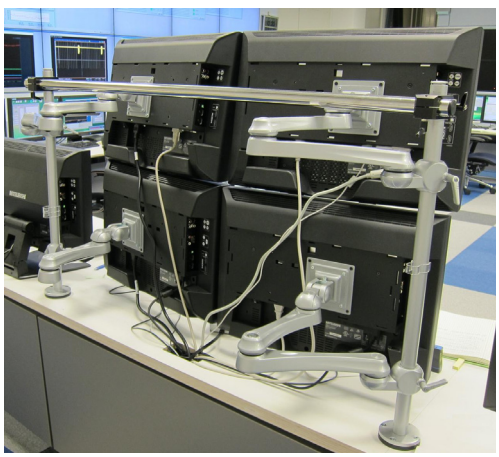

Figure 4: A desk has two poles to support 4 LCD panels.

workstation racks. The current back area is almost empty space aside from the three racks for networking and interlocks and sliding shelves for document archives. The operator sometimes resets the interlock signal on the rack, but this is relatively rare. Placing interlock equipment in the back area is convenient for the operator and satisfies the design guideline, which require the number of machines to be as low as possible.

Cabling

The control room was constructed on a 50 cm height raised floor to enable easy cabling. We removed almost all the cables that has been accumulated in the old control table like stratum, set cable ladder under the raised floor and routed cables.

TECHNOLOGIES

Built-in Workstations

In the old control room, workstations were placed in the back area and connected to the keyboard, video monitors and the mouse via an extender and thick cables to reduce the noise in the control section. Workstations were placed at the back in the control desk to allow easy maintenance. The use of the water-cooled, silent but high-performance workstation eliminated the noise-related problem owing to its noise level of less than 30 dB. The reliability of the water-cooled workstation is quite acceptable, given that none of the twenty workstation have experienced any water leakage problem even after half a year operation. The specifications of the workstations are shown in Table 1 Those workstations are suitable for SPring-8 control tasks.

Table 1: Workstation Specifications

Item	Value
CPU	Intel®Xeon®X3450 2.66 GHz Quad core
Memory	4 GB
Disks	250 GB × 2 Raid1

Networks

SPring-8 networks are classified as office LAN, DMZ LAN, control LAN and SACLA control LAN. Firewalls between them control the data flow. In the control room, we limited the use of the wired control LAN, wired SACLA LAN and the wireless office LAN. None of workstations are connected to more than one LAN simultaneously. PCs used for office work are connected to the office LAN using wireless connection even when they are desktop PC. Dividing the network into wired and wireless simplifies network cabling and reduces the chance of incorrect wiring. We concealed network ports inside the desk to avoid the problems due to an unexpected PC connection.

New Display Wall

In the previous ICALEPCS 2009, we presented a display wall hiring a 6x2 configuration[3]. We have designed another 6x3 configuration display wall to display more information that will be required in SPring-8 and the SACLA combination operation. The old display wall has been shifted to the side of the room. The new display wall employs an ultra-narrow bezel (7 mm between the screen and the next screen) 46" diagonal LCD[1] . The previous display wall was driven by a cluster consisting of seven PCs. On the other hand, the 18 panels of the new display wall are driven by just one PC equipped with three graphics cards. Each graphics card has 6 mini-DisplayPort sockets[2] , Currently MS-Windows is installed on the driver PC, because its display driver software has better stability and usability than that of the Linux OS. As shown in Fig. 1, the display wall displays accelerator status, alarm status, video images and more to share information between operators.

Analog TV Signal Viewer

Previously we monitored the screens of oscilloscopes, spectrum analyzers, and beam monitors which installed close to the accelerators after converting their information to analog NTSC video signals. In the renovation, thee control room was designed to use only digital data and analog signals were removed from the control room. Camera servers[3] that converts NTSC signals to motion JPEG are attached to the source of the video signals and video images are transmitted using the HTTP protocol. Although standard web browsers can display such images, we developed a dedicated viewer using web APIs provided by vendors [4] and used widget libraries [5] for easy operation and to save the display area and the ability of motion JPEG files to record data.

[1] NEC LCD-X462UN
[2] ATI Firepro™ V9800
[3] AXIS 24x series

CONSTRUCTION

The construction for the renovation was carried out during the spring shutdown period of 2011 so as to not affect the SPring-8 operation. We reduced the duration of construction by completing as many tasks as possible before the construction.

Cable ladders were installed under the raised floor during the summer shutdown period of 2010. In addition, equipment for interlocks was moved during the same period. We also examine cables which were unrecorded their end points before the construction.

Approximately 40 days were required for removing old furniture and cables, replacing the old display walls, painting walls, refurbishing the floor, constructing new display walls, installing new furniture, changing the lighting and etc. The construction was complete on schedule, and we have been operating SPring-8 from the new control room since April 2011.

SUMMARY

The new SPring-8 control room has been constructed within a short period. We conformed to the design guidelines as follows. The fish-shaped desk islands met the scalability requirement for the SACLA and SPring-8 II, The interlock panel placed at the center of the consoles and the interlock signal at the back area enabled close coordination between the safety systems and the accelerators operations, and the division between the control area and the back area helped to create an environment specific to the control area.

ACKNOWLEDGMENT

The authors would like to thank Mr. T. Hamano for his effort in constructing the display wall.

REFERENCES

[1] H. Tanaka, "Status Report on the commissioning of the Japanese XFEL at SPring-8," Proceedings of IPAC 2011, San Sebastion, Spain, 2011.

[2] T. Watanabe et al., "Current Status of SPring-8 Upgrade Plan," Proceedings of IPAC 2011, San Sebastion, Spain, 2011.

[3] T. Hamano et al., "Development of large high-resolution display for SPring-8 central control room," P.111, Proceedings of ICALEPCS2009, Kobe, Japan, 2009.

[4] Axis VAPIX Version3 manual, `http://www.axis.com/files/manuals/VAPIX_3_HTTP_API_3_00.pdf`.

[5] wxPython, `http://www.wxpython.org/`.