MAINTENANCE EXPERIENCE FOR PERSONNEL SAFETY SYSTEM AT SSRF *

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Abstract

To improve reliability and reduce faults of Personal Safety System (PSS) at Shanghai Synchrotron Radiation Facility (SSRF), two types of system maintenances were carried out since SSRF completion in 2009. The maintenances include maintenance during machine operation and that during shutdown period. The failures of the PSS are summarized for last 3 years operation, and the causes of these failures are analysed. Main failures were occurred in the access control system and UPS power-supply mode during last 3 years operation. To treat these failures, detail maintenance plan and system upgrading schemes were carried out. After the maintenance and system upgrading, the numbers of beam shutdown which caused directly by the PSS failures are obviously reduced. It was 4 times beam shutdown in 2009 and 0 in 2011.

INTRODUCTION

Shanghai Synchrotron Radiation Facility, SSRF, Up to now, is the biggest scientific platform for science research and technology development in China, and more than hundreds of scientists and engineers from universities, institutes and industries in domestic and even overseas can do research, experiments and R&D by using SSRF each day. The key work of operators who do the maintenance work is to guarantee the stable operation of SSRF. The stable running of Personal Safety System (PSS), the indispensable part of SSRF, is the base of doing R&D by using SSRF. Two types of system maintenances were introduced since SSRF completion in 2009. The failures of the PSS are summarized during last 3 years operation, and the cause of these failures is analysed. The failures are focusing on access control system and UPS. In view of the above problems, system upgrading schemes were carried out. Figure 1 shows a schematic overview of the radiation working areas at SSRF [1].

MAINTENANCE

According to the accelerator running statue, two types of system maintenances were carried out, including maintenance during machine operation and that during shutdown period. The former mainly completed by the personnel for PSS implementation, through daily patrol and inspection on the operation of the system, and the latter would do relatively comprehensive inspection and maintenance for PSS, especially shutdown period in the summer and the winter, a detailed facilities maintenance plan was made, and PSS was maintained according to the detailed plan.

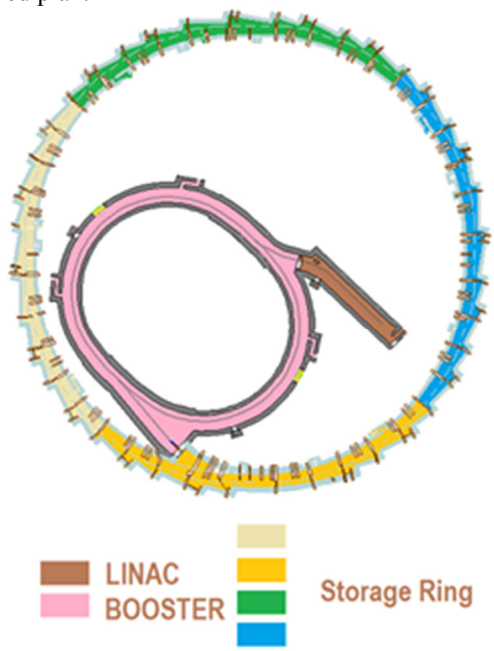

Figure 1: Radiation working areas at SSRF.

Make PSS Facilities Maintenance Plan, Supervise the Implement According to Plan [2-4].

On the basis of PSS actual work, the department of PSS pertinently established the daily maintenance work plan---'the scheme for routine maintenance, regular checking and installation for PSS facilities at SSRF', and assigned for the maintenance work accordance with maintenance task and staff expertise. In order to keep maintenance work routine and effective, tech transfer was completed from designer to operator by maintaining together under technical director of each subsystem guidance. The director of maintained work and Department meeting regular checked the progress of the work, supervised staff to do work as they planned.

Maintenance for PSS During Accelerator Operation [2-4]

Accordance with maintenance feature for PSS during accelerator operation, routine inspection form for PSS was formulated, which facilitated daily patrol and system checking. Every year more than 50 routine forms were completed.

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Maintenance for PSS During Accelerator Operation [2-4]

when the accelerator was shut down in the summer and winter, on the one hand, PSS handled the safety work well, such as aeration and dose measurement in the accelerator tunnel, opening the shielding door and barrier and so on; on the other hand, PSS was tested, checked and maintained in the round according to the detailed plan and the maintenance work was summarized at last. There was a final report abort PSS maintenance experience every year.

In addition, system upgrading work was done when the accelerator was shut down in the summer. So the faults detected by maintenance were removed. It increased the reliability of the system and reduced failure rate.

STATISTIC AND ANALYSIS FOR FAILURE

The failures of the PSS are summarized for last 3 years operation from 2009 to 2011. For more details, please see Figure 2, Figure 3 and Figure 4.

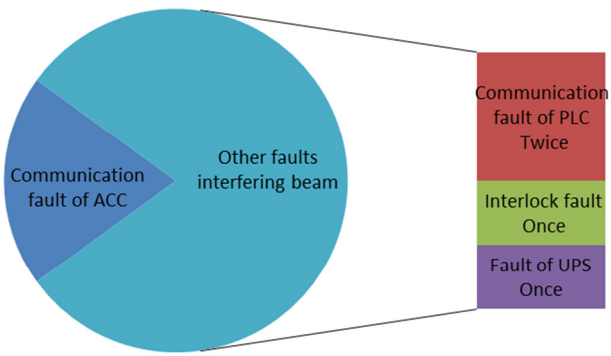

Figure 2: Failure statistic in 2009 [2].

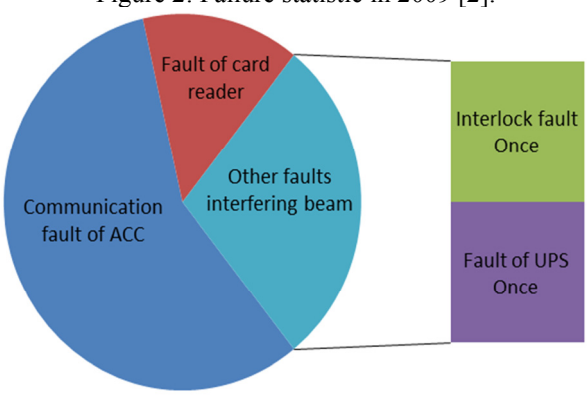

Figure 3: Failure statistic in 2010 [3].

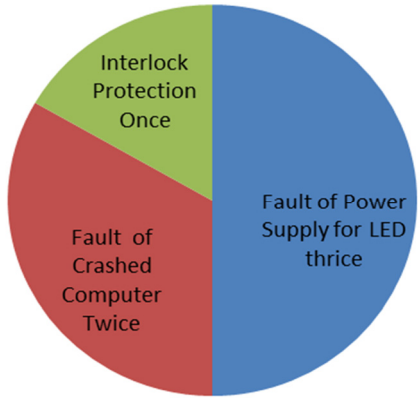

Figure 4: failure statistic in 2011 [4].

From Figure 2, Figure 3 and Figure 4, we can see that there are three groups of issues, they are fault of UPS and communication fault of ACC and PLC. From maintenance experience for PSS, the communication fault of ACC occurred out of doors, the cause was that the waterproofing work control cabinets for ACC was not in place. The rain seeped through the cabinet, and the communication models were decomposed. The fault of UPS was caused by itself, because power supply for PSS device must be transferred by UPS, if UPS has some problems, PSS device will lose power. Up to now, we do not have any idea why the PLC goes into died statue suddenly, this problem needs to be observed PLC by operator for a long time. As for other issues, it can be solved by standardized management.

UPGRADING FOR PSS

In order to solve the communication fault of ACC and the fault of UPS, upgrading scheme was carried out after the scheme was audited.

Upgrading for UPS [4]

After investigation and research, an APC product named AP7723 (see figure 5) was detected. If this device can be installed for every UPS, the problem of PSS device losing power when UPS has faults will disappear. This advantage is that: Dual Input Power Sources Supplies redundant AC power to connected equipment. Two AC lines power the unit and if the primary AC power fails, the unit will automatically switch to the alternative power source. Dual Input Power Sources are UPS and electric supply. After installing AP 7723, the fault of UPS is avoided and system stability is improved greatly.

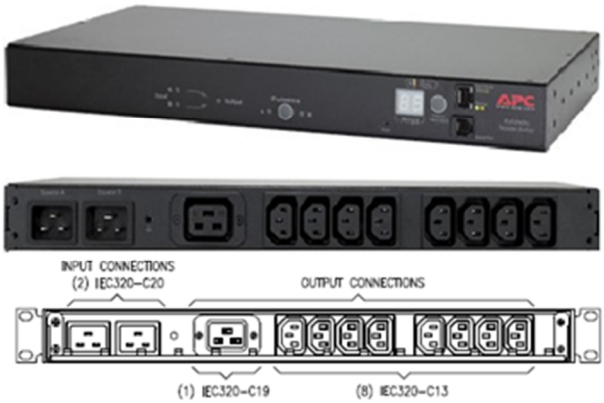

Figure 5: APC AP7723.

Upgrading for ACC [3]

Control cabinets for ACC out of doors were changed, not only the material but also the shape of cabinet. The new material was stainless steel, not iron, which could prevent water corrosion. The roof shape could prevent rain water from entering the box. And, a card reader was installed on the box which can be opened by the person who was authorized. At last communication model was installed in the box, not on the wall. Through these efforts, the communication fault of ACC also disappeared. Figure 6 is the new cabinet.

Figure 6: Control Cabinet.

CONCLUSIONS

The number of beam shutdown which caused directly by the PSS failures is counted from 2009 to 2011 (see Figure 7). We can see that the number was reduced year by year, even it is zero in 2011. The number displays that maintenance and upgrading for PSS is very important, which increases system stability greatly. While, the cause of some fault is not found yet, such as the communication fault of PLC. It is cause by PLC quality or program logic that cannot be proved to be true. So the maintenance work need to be further studied to find out the real reason and solve it.

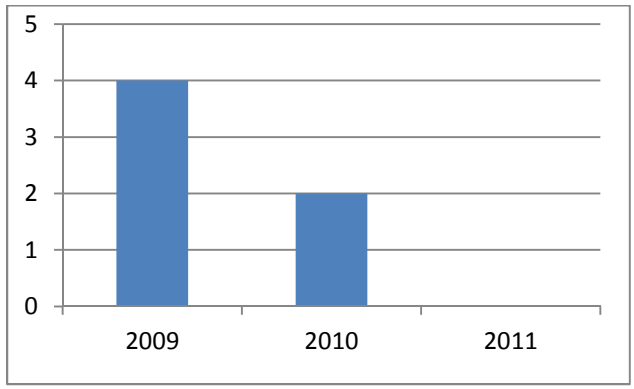

Figure 7: Beam shutdown times caused by PSS.

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