Re-engineering of the SPring-8 Radiation Monitor Data Acquisition System

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INTRODUCTION

SPring-8 radiation monitoring system
- consists of 81 RMs including 17 ILK RMs used for ARSIS,
- comprised two independent systems, main system for 79 RMs and subsystem for 2 RMs.
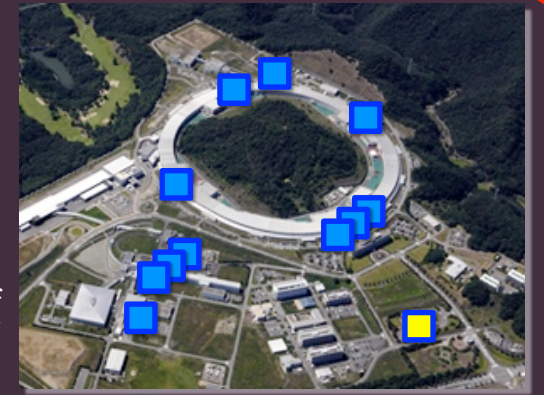- became complicated because of patched update one after another.

- ARSIS : accelerator radiation safety interlock system
- RM : radiation monitor
- ILK RM : interlock radiation monitor
- DICM : digital indicator/controller module

The main system consisted of
- 79 RMs,
- 79 DICMs,
- 11 embedded PCs with GPIB and Ethernet I/F,
- 3 PLCs to evaluate 1-h integrated dose for 17 RMs,
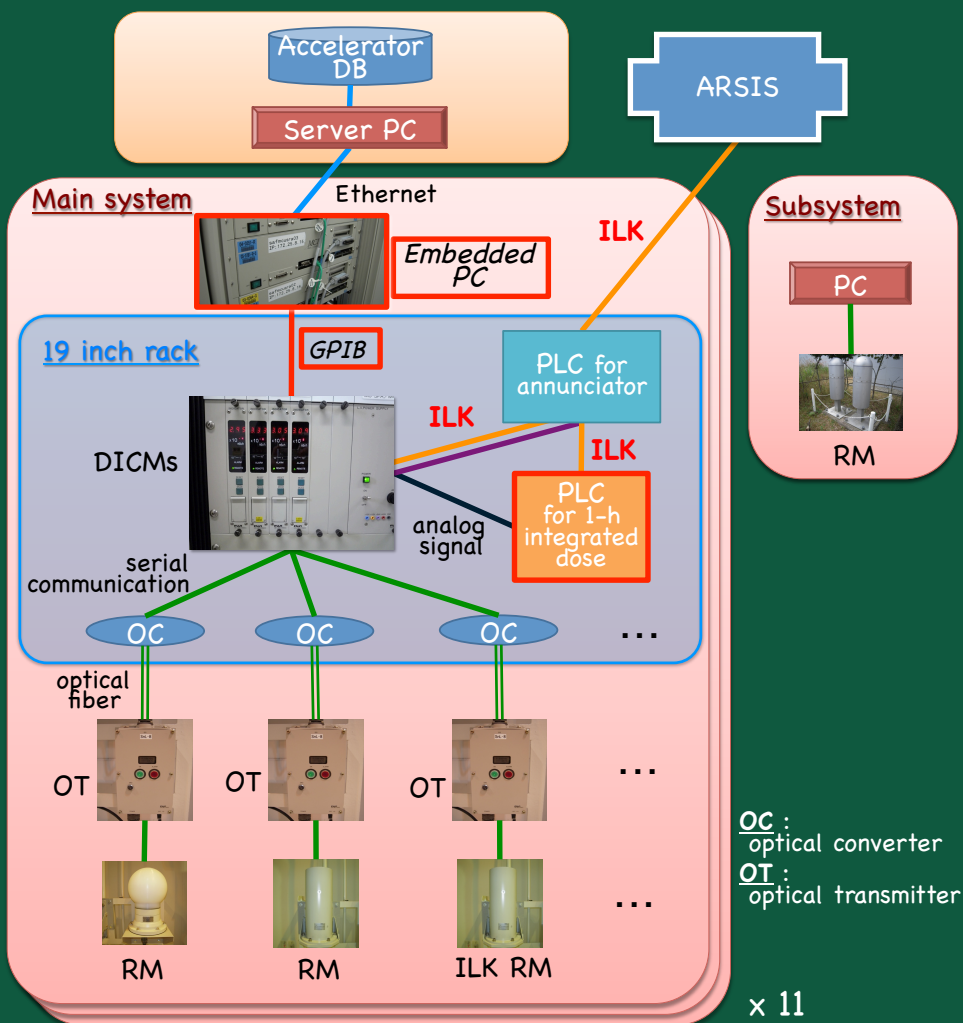- 3 PLCs for annunciator and I/F with ARSIS.

- DICMs monitored the radiation data on the basis of established alert/warning thresholds (low / high / high-high)
- DICMs were mounted on eleven 19-inch racks.

■ 19" racks for main system
■ 19" rack for subsystem

PREVIOUS DAQ SYSTEM

Accelerator DB
Server PC
ARSIS

Main system
Ethernet
Embedded PC
ILK
Subsystem
PC
RM

19 inch rack
GPIB
PLC for annunciator
ILK
ILK
DICMs
PLC for 1-h integrated dose
analog signal
serial communication
OC   OC   OC   ...
optical fiber
OT   OT   OT   ...
RM   RM   ILK RM   ...

x 11

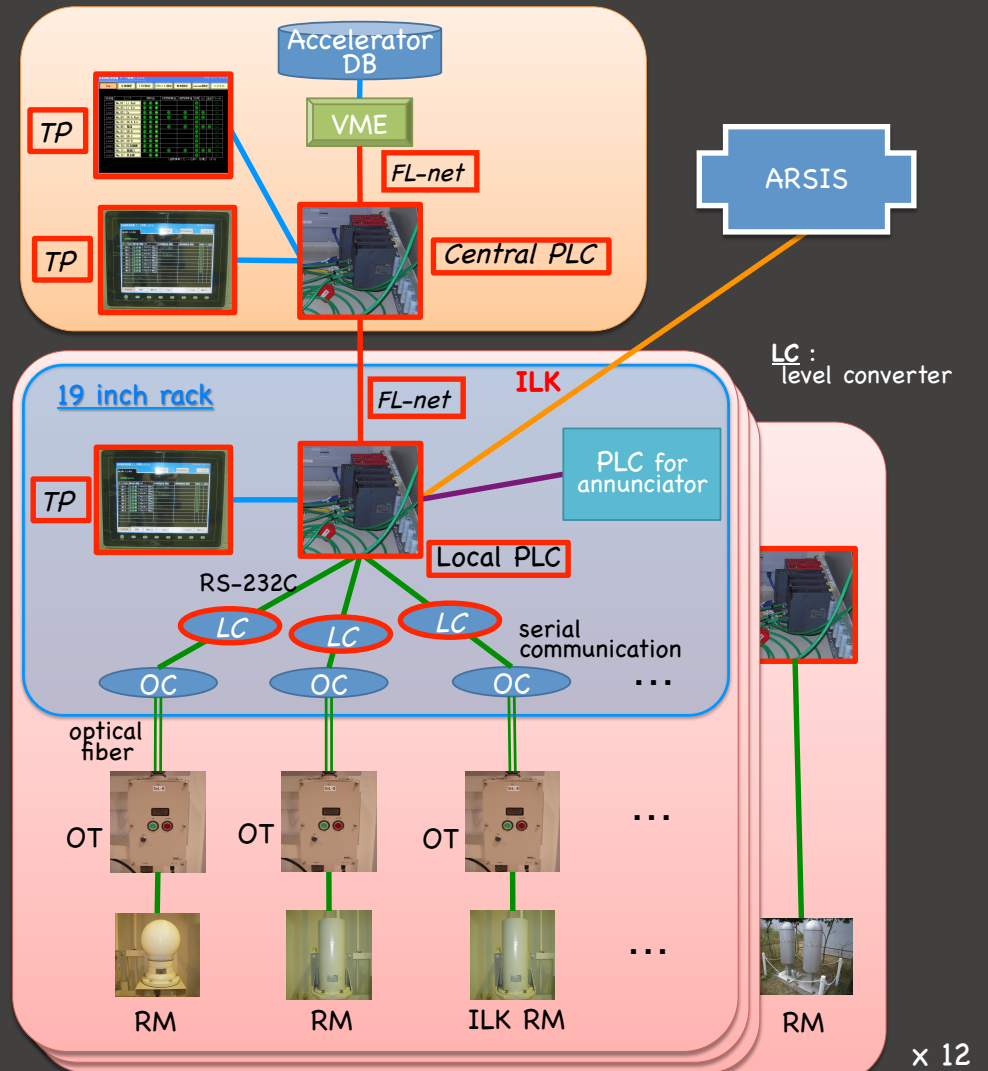OC : optical converter
OT : optical transmitter

Problems

- The GPIB interface was not reliable enough for continuous use.
- The software that periodically collected data via the GPIB in the embedded PCs was black-boxed. It was necessary to improve the software because there was no way of knowing whether or not the software was running normally.
- Accelerator operators were unable to access the 1 h-integrated dose data used for radiation control, because these data were integrated by PLCs that were independent from the data acquisition system.

NEW DAQ SYSTEM

Accelerator DB
TP
VME
FL-net
TP
Central PLC
ARSIS

LC : level converter

19 inch rack
FL-net
ILK
TP
PLC for annunciator
Local PLC
RS-232C
serial communication
LC   LC   LC
OC   OC   OC   ...
optical fiber
OT   OT   OT   ...
RM   RM   ILK RM   ...   RM

x 12

FEATURES

- Deployed local PLCs to enhance the system reliability and to reduce the number of black boxes as much as possible.
- Introduced a central PLC for centralized management of all the RMs.
- Integrated the independent subsystem into the new system.
- All the PLCs were equipped with TPs for user-friendly operations.

- Assigned the integration function for dose data to the local PLCs.
- Newly introduced 1-week integrated dose to the local PLCs.

- Adopted FL-net, which was widely used in the SPring-8 and SACLA control system, to connect all the local PLCs and the central PLC.
- The central PLC was provided with an additional FL-net to enable connection with a VME computer that collects all RMs data and incorporates them into the common database of the accelerator control system using the MADOCA framework.

- All the critical processes concerned with ARSIS are carried out by the local PLCs. The central PLC is not used for ARSIS.
- The interlock signals originating from the local PLC are sent directly to ARSIS. The existing PLCs are not used for interlock processing to simplify the system.

SUMMARY

- We have re-designed the data acquisition system for the SPring-8 radiation monitors. The new system is a PLC-based system and is simpler, more comprehensible, and is more reliable than to the previous system.
- The introduction of the central PLC enables the centralized monitoring and management of all the radiation monitors.
- The new system has been employed in the practical use since the end of March 2011 and has been working well without any issues after a minor problem was fixed in May 2011.
- In August 2011, we succeeded in adding the same setup functions to the radiation monitors as those employed in the DICMs. These functions are mainly used for maintenance work during long shutdown intervals.