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Integration of Standalone Control Systems into EPICS-based System at RIKEN RIBF

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Abstract The RIKEN RI Beam Factory (RIBF) was constructed as an extension of our old accelerator facility, the RIKEN Accelerator Research Facility (RARF). The major part of the accelerator components newly developed have been integrated into the Experimental Physics and Industrial Control System (EPICS), but several old standalone con-trol systems were carried over and some new components adopted their own standalone control systems. These non-integrated systems are grouped into two major categories. The first is hard-wired control systems and the other is based on a two-layer remote-control system without a middle layer. From the view point of efficient accelerator operation, the entire control system should be integrated into the middleware . For this reason, we have replaced hard-wired devices with EPICS-compatible devices, namely, the N-DIM (originally designed by the Nishina Center), and the FA-M3 (Yokogawa Electric Corporation, Tokyo, Japan) controllers. Additionally, to access data in a two-layer system from EPICS, we have introduced a MySQL-based system as the middle layer, and have developed a feature to connect the database through the CA protocol. As a result, we were able to successfully integrate the system, and it is now possible to acquire all of the data through EPICS.

The non-integrated systems

- ✓ 18GHz ECR ion source control
- ✓ Beam Faraday cup in RILAC
- ✓ Hyper ECR ion source control
- ✓ Radio-frequency control
- ✓ Other two-layer control

Hard-wired control system MELSEC-A series PLC + SoftGOT OMRON PLC + Wandarware InTouch

Hard-wired control system

LabVIEW, other commercial system, etc.

Method for LabVIEW-based system and other commercial system

• MyDAQ2 (DAQ system developed by SPring-8 [3]) is utilized for two-layer systems (LabVIEW and commercial).

- The MyDAQ2 system can store data into a MySQL-based database by sending a simple ASCII command with
 the socket and allow the viewing of the stored data via a Web application.
- Original MyDAQ2 chart viewer is based on gnuplot . Dygrade JavaScript chart
 It is possible to develop easily a program to for storeing data from other client systems.

The small control systems should be integrated !!

• The operational efficiency of the accelerator depends on the interfaces of the control systems being unified !!



The administrator (LabVIEW-based system, commercial-based system) can store all data successfully !

- First, we attempt to implement prototype simple system (copy the value to EPICS software record) to handle the data from EPICS. Success
- Then, we implement EPICS IOCs in order to handle the data through EPICS device support software. Success



Method for Hyper ECR ion source control Method for 18 GHz ECR ion source control^[1] Method for Radio-frequency control Hyper ECRIS was is usally controlled by using a OMRON PLC and Wanderware InTouch are utilized. Etherne Microsoft Windows-based client PC, located ----- FA LINK Two-layer system without middle layer in the ion source room. Signal Cable · Since the accelerator operators is are already familiar When beam tuning is required, operator used Remote Desktop ork Switch with the InTouch interface, it would not be advisable ¢Pu Main PLC1 It is not easy to replace with EPICS-based controller. beneficial to replace the GUIs Because HyperECR ion source is not manged by RIKEN. Linux IOC RF Power NDIM CPU Main PLC2 FA Profile Monitor -The conventional control method was left as is, and an integration to the EPICS system was supplemented. pping Mortor pping Mortor Extraction PS GUI using InTouch OMRON PLC Two-layer system Stepping Mortor Stepping Mortor Ion Source ROOM Rod Pos Sub PLC FA . Magnet PS PLC for Hyper TE Local Control PC Local High Voltage Stag ECRIS Operation GUI using InTouch OMRON PLC FA Sub PLC Windows7 Both of them LINK 100 MELSEC-A series PICS Device Support Attach are available ent) NetDev FA Sub PLC Sub PLC CSS I INk I INK MIVOC EPICS IOC Operator Micro-Oven Channel Access NetDev For Windows 7 6 Yokogawa F3RP61-2L and FA-M3 as embdded system [2]. MELSEC-A EPICS and Linux run on PLC Monitor using CSS/BOY Rapid development is available New part · Hard-wired controller is replaced by FA-M3-based system.

- [1] A. Uchiyama et al., Rev. Sci. Instrum. 87, 02A722 (2016).
- [2] A. Uchiyama et al., Proc. PCaPAC08, Ljubljana, Slovenia (2008), p. 145.
- [3] T. Hirono et al., Proc. PCaPAC08, Ljubljana, Slove-nia (2008), p. 55.