DATABASE FOR CONTROL SYSTEM OF J-PARC 3 GeV RCS

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Abstract

The Control System of J-PARC 3GeV RCS is configured based on Database, which is comprised of Component Data Management DB (Component DB) and Data Acquisition DB (Operation DB).

Component DB was developed mainly to manage the data on accelerator components and to generate EPICS records automatically using the data. Presently we are testing the reliability of DB application software at Linac operation. Then, most Linac EPICS records are generated from DB, and we are able to operate Linac with very few problems.

Operation DB collects the two kinds of data. One is EPICS records data, and the other is synchronized data. Now we are testing the reliability of application software for EPICS records data collection, and we have confirmed that EPICS record data are corrected with very few problems. Then, Linac EPICS records data are inserted in Operation DB from Linac Operation start. On the other hand, application software for synchronized data collection is now being developed, and we will test the reliability of this application software from comprehensive information on RCS operation.

This paper shows the status of development for Database for Control System of J-PARC 3 GeV RCS.

INTRODUCTION

The RCS injects each beam pulse of 25Hz into the MLF and the MR in respective demands. Therefore, all 25Hz beams which inject different facilities must be controlled and monitored correctly. To realize this correct control and monitoring, EPICS records must to be created correctly. However, since the number of EPICS record will be about 20,000, it is hard to create and manage these EPICS records. To reduce this workload and not create incorrect EPICS records, Component Data Management DB (Component DB) has been developed.

On the other hand, Data Acquisition DB (Operation DB) has to collect and distinguish the data "MLF beam pulse" from "MR beam pulse". Moreover, this has to collect EPICS records. Therefore, Operation DB needs to collect simultaneously two kinds of data, and DB is necessary to provide a user with these kinds of data which are matched.

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CONTROL SYSTEM LAYOUT

RCS control system is designed based on Database [1]. PostgreSQL is used on this system DB software.

This system mainly consists of HMI (Human Machine Interface), Components (Machines Controller), Component Data Management DB (Component DB) and Data Acquisition DB (Operation DB) [2].

MHI is able to control and monitor the accelerator components (power supply, etc) via EPICS, Reflective Memory and etc.

Component DB stores static component information and generate static parameters for system configurations. Especially, it is important for this DB to generate automatically using stored component information. This generated EPICS records is used to control and monitor components.

Operation DB collects and stores the operation data. This DB is consists of Standard-data DB and Synchronized-data DB.

COMPONENT DB

A Component DB stores the static component information, such as magnet type and maximum voltage of power supply, and so on. Moreover, this DB stores the static control parameters, such as EPICS record names, register maps of PLC and etc. The sample of Component DB table is shown in Table.1.

By using these information, this DB is able to generate EPICS record ".db" files automatically for every machine. And, when EPICS ".db" files are generated, this DB also generates the start-up script ".cmd" files for every IOC. Moreover, the archived EPICS record list for Operation DB is also generated. This Component DB based workflow is shown in Fig.1. And as an example of auto-generated EPICS ".db" files and ".cmd" files is shown in Fig. 2 and Fig. 3.

EPICS record has various "signal type" and these types need different field each. In addition, J-PARC has an extremely large number of EPICS record. Therefore, a large amount of work and time has to be spent to create EPICS record. Moreover, this work has a risk of inputting

Table 1: Component DB table.

facility	area	name	signal0	signal1	desc	used_flag	archive_flag	type	ioc
RCS	IERM	SPMESPS01	SET	R2_CUR	Output Current Set Value	YES	YES	SPMPS	rcsioc11
RCS	IERM	SPMESPS01	OPE	PARAM_CMD	Current Parameter Set	YES	YES	SPMPS	rcsioc11
RCS	IERM	SPMESPS01	STAT	DETAIL	Power Supply Status	YES	YES	SPMPS	rcsioc11
RCS	IERM	SPMESPS01	MON	R_TOTAL_CUR	Output Total Current Monitor	YES	YES	SPMPS	rcsioc11
RCS	IERM	SPMESPS01	MON	R_CUR	Output Current Monitor	YES	YES	SPMPS	rcsioc11
RCS	IERM	SPMESPS01	MON	VOLT	Output Voltage Monitor	YES	YES	SPMPS	rcsioc11
RCS	IERM	SPMESPS01	RB	R_CUR	Output Current Set Readback	YES	YES	SPMPS	rcsioc11
RCS	IERM	SPMESPS01	ILK	DETAIL1	Interlock1	YES	YES	SPMPS	rcsioc11

error. Then, in J-PARC, by adopting the auto-generate EPICS records from Component DB, it is possible to reduce this workload and not create incorrect EPICS records. At Linac Operation from November, 2006 to June, 2007 and RCS Operation in October, 2007, most EPICS record was generated from Component DB, and stable operation was realized.

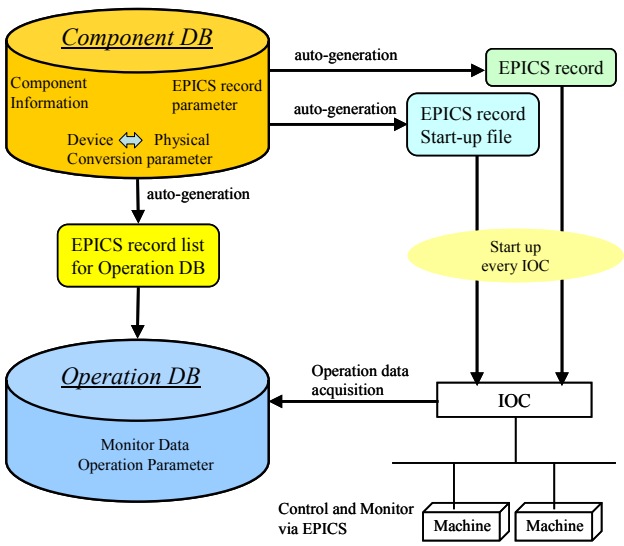


Figure1: Workflow based Component DB.

```
record(mbbi, "RCS_IERM:KMPS01:PILK:DETAIL4")
{
    field(ASG, "DEFAULT")
    field(DESC, "Primary Interlock4")
    field(DTYP, "JAERI PLC2")
    field(INP, "@fam3://10.32.76.64/DEV1I11")
    field(NOBT, "16")
    field(SCAN, "I/O Intr")
    field(SHFT, "0")
}
record(mbbi, "RCS_IERM:KMPS01:PILK:DETAIL3")
{
    field(ASG, "DEFAULT")
    field(DESC, "Primary Interlock3")
    field(DTYP, "JAERI PLC2")
    field(INP, "@fam3://10.32.76.64/DEV1I10")
    field(NOBT, "16")
    field(SCAN, "I/O Intr")
    field(SHFT, "0")
}
```

Figure 2: EPICS ".db" file and field information.

```
#
## IOC NAME 'rcsioc02'
#

# ENV
putenv "EPICS_TIMEZONE=JST::-540:0:0"
putenv "EPICS_TS_NTP_INET=10.16.1.17"

cd "/home/epics/rcs/iocBoot"
< cdCommands

## Load_IOC
ld < /home/epics/rcs/bin/vxWorks-ppc604_long/iocP2.munch

## Load_DefineDatabase
dbLoadDatabase("/home/epics/rcs/dbd/iocP2.dbd");
iocP2_registerRecordDeviceDriver(pdbbase)

## Load_Database
< /home/epics/rcs/kikis/MON/blm/dbAIC-BLMH VPS.rcsioc02
< /home/epics/rcs/kikis/MON/blm/dbP-BLMH VPS.rcsioc02
dbLoadRecords("/home/epics/rcs/SEIGYO/util/vxStats.db","IOC=rcsioc02")

## Parameter
```

Figure 3: EPICS record start-up file ".cmd".

OPERATION DB

Operation DB collects the two kinds of data. One is EPICS records data, and the other is synchronized data. Most RCS operation data is EPICS records data, and these are required about 1 second periodic collection. On the other hand, Synchronized data is required the 25Hz synchronous collection (every 1 beam). In some case, this data is also required distinguishing the data "MLF beam pulse" from "MR beam pulse". As described above, because the different of synchronous required EPICS record data and Synchronized data, it is impossible to collect two kinds of data by a DB. Then, Operation DB is consists of Standard Data DB (collect EPICS record data) and Synchronized-data DB (collect Synchronized data). The outline of Operation Data DB is shown in Fig. 4.

Standard Data DB is using the EPICS monitor function, and data is sent to DB from IOC's when event occurred. In addition, DB collects two kind of way, event process and polling process, according to kinds of EPICS data (Fig. 5). By these methods, the data collection load is able to be reduced [3]. Now we are testing the reliability of application software for EPICS records data collection. First, we have confirmed that EPICS record data are corrected with very few problems at Linac operation from 2006 to 2007. More recently, RCS operation in October, 2007, Standard DB has just been able to collect with few

troubles. An instance of collection data on operation is shown in Fig. 6.

Synchronized data is required every 1 beam (25Hz) synchronous. Then, it is impossible to respond to only using EPICS time stamp. Therefore, it is realized to attach timing information to every 1 beam data using Reflective Memory, Wave Endless Recorder and etc. However, most synchronized data is waveform data and these data size is huger than EPICS record data. Then, it is impossible to collect all synchronized data by a DB. Therefore, DAQ system for synchronized data is decided to configure one DB and some PC for load distribution (Fig. 4). Then some PC collects synchronized data and a DB manages the collected data lists.

For example, BPM position data using Reflective Memory is attached "beam tag", "MLF beam (or MR beam)" and etc. Then, this data is able to be collected 25Hz all data by BPM data server. Therefore, the synchronized BPM position data is able to be monitored by EPICS waveform, which is created to pick up same "beam tag" position data accessing Reflective memory. On the other hand, for Wave Endless Recorder, it is developed the function that collects the same "beam tag" data when the error event is detected.

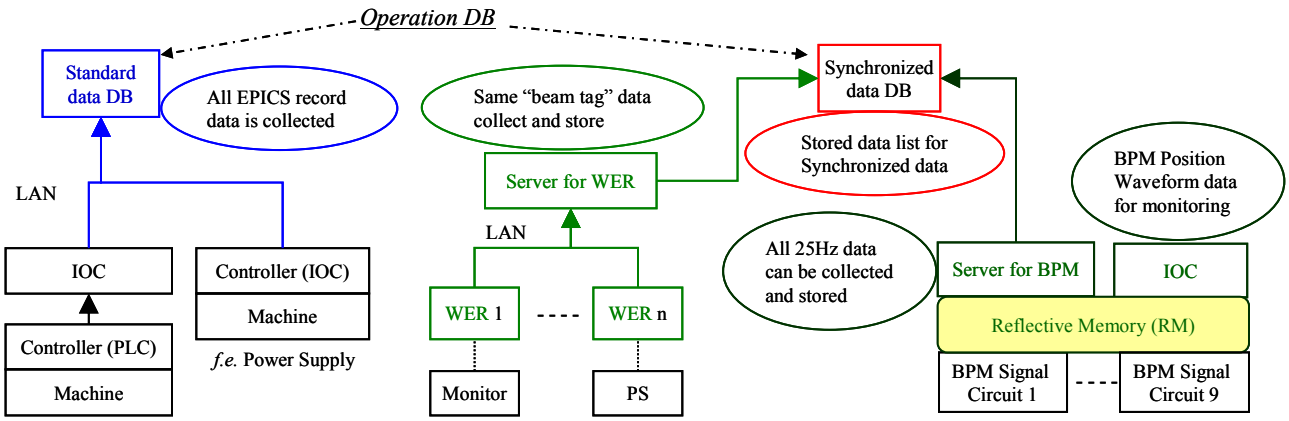
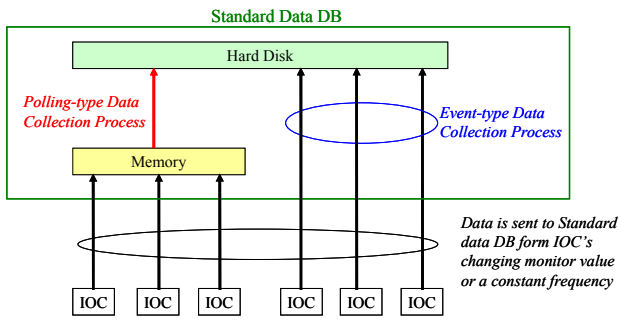


Figure 4: Outline of Operation Data DB.



Polling-type Data Collection Process
Memory data with time stamp is stored HD for a constant frequency
Event-type Data Collection Process
Data with IOC time stamp is stored HD every event

Figure 5: Outline of Standard Data DB.

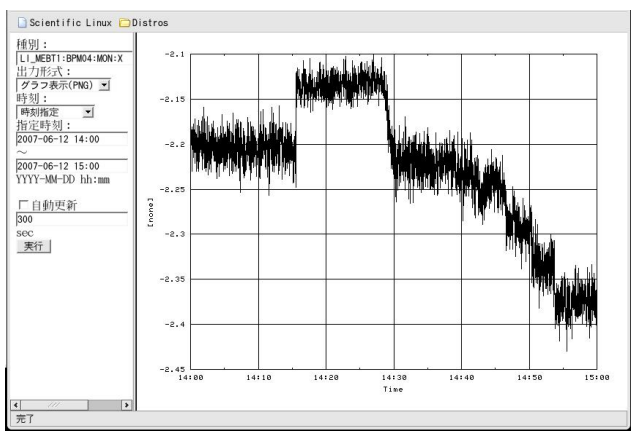


Figure 6: Operation data collected by Standard data.

CONCLUSION

Status of database system for RCS control system is shown in this paper. RCS control system mainly configured with Component DB and Operation DB. Component DB is developed to manage component information and to generate EPICS record definition files automatically. And Operation DB is developed to collect the different kind data. Then, at the Linac and RCS operation, these DB was demonstrated that they were working with few troubles.

After this, Synchronize data DB will be developing additionally. Then, it will be possible to be linked EPICS record data with synchronized data and to be retrieved from the Standard data DB and Synchronized data DB

REFERENCES

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[3] H.Takahashi, *et al.*, "Development Status of Database for J-PARC RCS Control System (2)", Proceedings of the 4th Annual Meeting of Particle Accelerator Society of Japan, Wako, Japan, August 2007.