REPLACE OF THE CAMAC CONTROL SYSTEM

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Abstract

The ERL-FEL control system for Japan Atomic Energy Research Institute (JAERI) uses a CAMAC interface for machinery control such as an electromagnetic power supply and RF. Computers for machinery control uses NEC's PC9801 and Windows95 of OS.

Since sales for PC-9801 and software support are over, the system needs to be renewed.

ND-MCU of NICHIZOU Electronic & Control Corporation was replaced with the PC9801 and the CAMAC was not renewed.

ND-MCU is a diskless insertion computer which has an SH4 CPU and three PCI slots. The OS in ND-MCU is iTRON. PCI card for CAMAC interface is installed in the ND-MCU.

TCP/IP is used for PC and it controls ND-MCU.

Other PCs are used for operation terminal. All PC communicate with CORBA (Common Object Request Broker Architecture).

Since the renewed system changes the device I/O list and parameter file defined by the CAMAC module, it can be activated without changing the program.

OVERVIEW

The ERL-FEL control system for JAERI [1] uses a CAMAC interface for machinery control such as an electromagnetic power supply and RF. System maintenance becomes difficult with the end of sales for machinery control's computer and software support. The existing CAMAC interface is applied and the ERL-FEL control system is renewed with considering extension and maintenance of system.

STRUCTURE OF ERL-FEL CONTROL SYSTEM

System structure before renewal

The ERL-FEL has been put into effect since 1992. The basic part of it has not been changed but it has been operating with having repeated major changes. However, system maintenance has been difficult with the end of sales for machinery control's computer and software support. Fig.1 shows structure of ERL-FEL accelerator. Fig.2 shows the ERL-FEL control system structure before renewal.
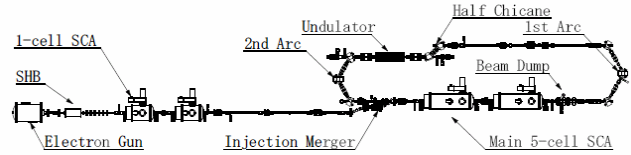

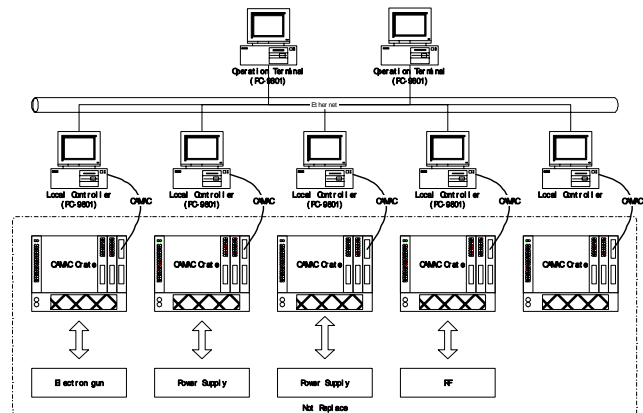Figure 1: Structure of ERL-FEL accelerator.

Figure 2: Structure of ERL-FEL control system before renewal.

SYSTEM STRUCTURE AFTER RENEWAL

When the control system is renewed, including the CAMAC interface used with the ERL-FEL control system, the CAMA interface is applied to that because many times are need to wire between machineries and confirm action, and upper computer system renewal is considered concept. Fig.3 shows structure of ERL-FEL control system after renewal.

The ND-MCU of NICHIZOU Electronic & Control Corporation [2] was replaced as computer for CAMAC control, which takes the place of PC9801. ND-MCU is a diskless insertion computer which has three PCI slots, and uses SH7751(SH4) for the CPU and iTRON for OS. In addition, it can turn off the power supply without having to specially shut down. ITRON is a real time OS for insertion machinery. Table 1 shows specifications of ND-MCU and Fig.4 shows its image.

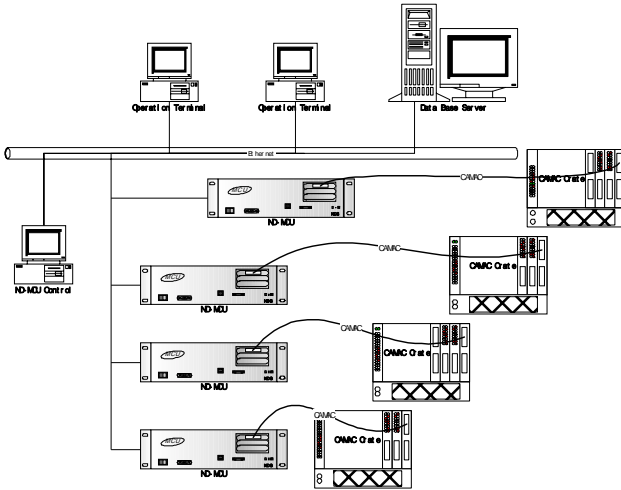CC/7700 of Toyo Corporation [3] is used for CAMAC crate controller.

Figure 3: Structure of ERL-FEL control system after renewal.

Table 1: Specifications of ND-MCU

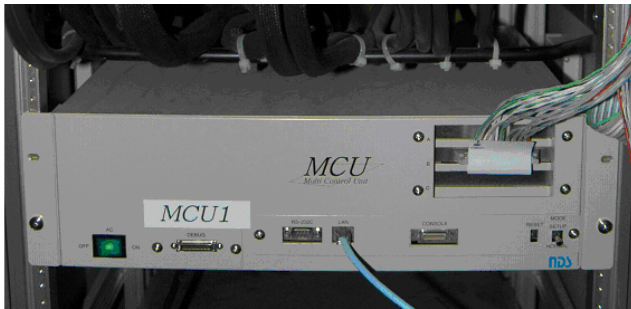| FEATURES	DESCRIPTION
CPU	SH7751(SH4) 200MHz
Memory	SDRAM : 64MB Battery Backup SRAM:4MB Flash ROM:16MB
Network	Ethernet 10/100Mbps(1port)
Expansion Slot	3slot/PCI
Form Factor	19inch rack mount/3U

Figure 4: Image of ND-MCU.

SOFTWARE STRUCTURE

CORBA for middle ware of communication layer and Java[4] for operation monitor are used in software. CORBA is a dispersion object technique which is defined by OMG[5], and defines software specifications (called ORB) to exchange messages between objects on different type of machines dispersion environment.

This CORBA is used between the ND-MCU control computer and operation monitor. Since there is no CORBA which is operated by iTRON between ND-MCU and ND-MCU control computer, a TCP/IP protocol is used for communication.

Java is a programming language which points to an object and has a slight dependence on type of machines. ABeans of COSY-LAB [6] is used for operating display that is worked with the operation terminal. ABeans is the software that performs various basic functions at accelerator control while using Java as a package, and it has many utilized results in institutes.

Table 2 shows software structure of control system after renewal.

Table 2: Software structure

ND-MCU	OS	iTRON
	Programming Language	C Language
Operation Terminal	OS	Windows XP
	Programming Language	Java 1.4.2_01
	CORBA	JacORB1.4.1[7]
	JDBC Driver	mysql-connector-java-3.0.9
	Other	ABeans
ND-MCU Controller	OS	Windows XP
	Programming Language	VC++ Ver6.0
	CORBA	ACE5.3 + TAO1.3[8]
	ODBC Driver	Myodbc3.51.06
DataBase Server	OS	Windows XP
	DataBase	Mysql4.0.18

SYSTEM FUNCTION

In order to make changes/addition/removal, which is control target for machinery, and a number of ND-MCU easy, renewed ERL-FEL control system's structure can be coped pliably without program change by filing these information and reading in the file at system starting. (1) Machinery name, (2) I/O information of CAMAC interface, (3) conversion value of analog input/output, and (4) IP address of ND-MCU are defined in this file.

The system has a restoration setting function which is set for control machinery with the content of last setting when power supply of ND-MCU turned on. This function set for control target machinery when the MCU starts by the newest information which is saved at battery backup memory loading in ND-MCU.

Machinery is operated from the operation monitor.

The operation instruction information is sent to the ND-MCU through ND-MCU's control computer, and the machinery is operated by the NC-MCU 's CAMAC crate controller. Fig.5 shows operation monitor image.

Operation monitor can change size of display element on window dynamically, with change of window size, by using layout manager of Java.
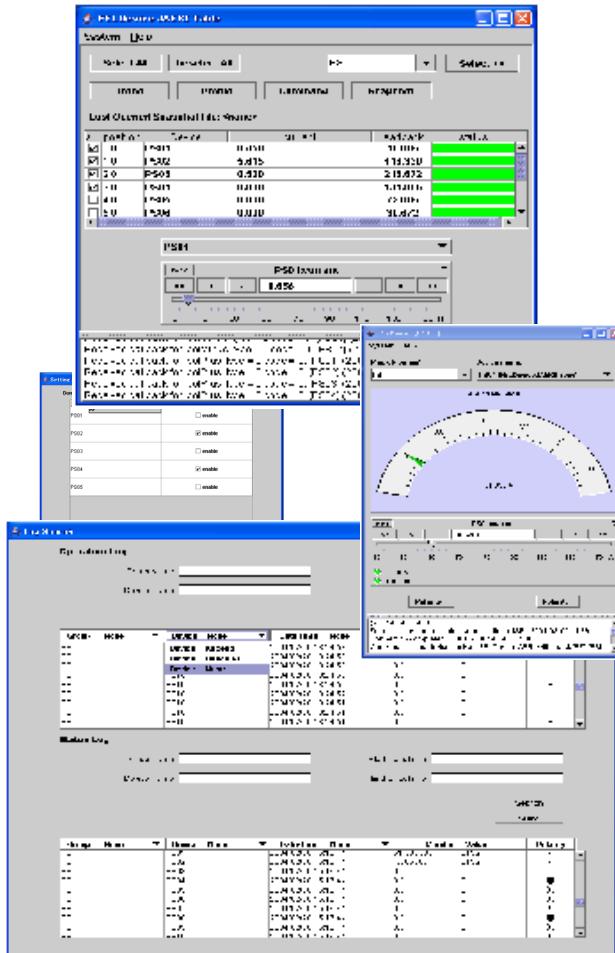

Figure 5: Image of operation monitor.

The database was also added when this system was changed. Measured data were saved on the hard disc of PC 9801 and referred with network sharing before renewal, however, volume of the data were increased and the data could not be searched efficiently. Operation log of machinery and status log are saved in data base after renewal ERL-FEL control system. Each operation of machinery, concerning operation log, and when the user needs it, concerning status log are saved in the data base.

CONCLUSION

When the ND-MCU uses the iTRON, which is a real time OS used for inserting machinery, it has more reliability and improved real time control than the PC9801.

The machinery which is used when experimenting and change and restriction of ND-MCU become can be redefined without changing program by filing machinery IO information of control target and information of ND-MCU number.

The operation terminal can be changed and added easily by installing Java and CORBA

REFERENCE

[1] JAERI(Japan Atomic Energy Research Institute)
http://www.jaeri.go.jp/
[2] NICHIZOU Electronic & Control Corporation
http://www.ndssf.co.jp/
[3] TOYO Corporation
http://www.toyo.co.jp/
[4] Java
http://java.sun.com/
[5] OMG(Object Management Group)
http://www.omg.org/
[6] COSY-LAB
http://cosylab.com/
[7] JacORB
http://www.jacorb.org/
[8] ACE TAO
http://www.cs.wustl.edu/~schmidt/TAO.html