

Construction of Personal Computer Control System for the JAERI AVF Cyclotron

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Abstract

The computer control system for the JAERI AVF cyclotron has been operated over ten years. In FY1998, the three mini-computers (VAX, DEC) were replaced to personal computers (PC) based on the Windows NT in the control system for the AVF cyclotron. 'InTouch' was mainly used as programming language for useful GUI (Graphic User Interface) in the new control system.

1 Introduction

The JAERI AVF cyclotron has been constructed since 1988. The first beam was successfully extracted from the cyclotron in March 1991. And, the computer control system for the JAERI AVF cyclotron [1] has been also operated smoothly without any serious troubles over ten years. Recently, the computer control system gradually had become worse condition, which was needed to renew and upgrade as described follows. Many components consisted of the control system had deteriorated and malfunctioned for the long term operation, we could not be received the components enough because of the cessation of production and company bankruptcy. The capacity of the computers will be insufficient because many additional functions for new ECR ion source (HYPERNANOAGAN) have to be assembled into the control system.

2 Renewed Region of the Control System

The computer control system is divided into three layers, as shown in Fig.1. In the top layer, the central computer named system control unit (SCU) manages the whole system and serves operators with man-machine interface and operation function. In the middle layer, sub-computers named group control unit (GCU) execute the control sequences of device groups. In the bottom layer, a lot of single-board computers named universal device controller (UDC) control specifically each device. The computer of the SCU, the GCU#1 and the GCU#2 were manufactured by Digital Equipment Corporation (DEC). The UDC was developed originally by Sumitomo Heavy Industries, Ltd (SHI). In regard to the DEC computers, it became difficult to be supplied the several components such as the graphics terminals built in the control console, the interface unit for graphics terminal and so on. Therefore, we decided to replace the DEC computers with several personal computers (PC). We also decided to renew the computers of top and middle layer. This renewal of the system could save us a lot of time and cost.

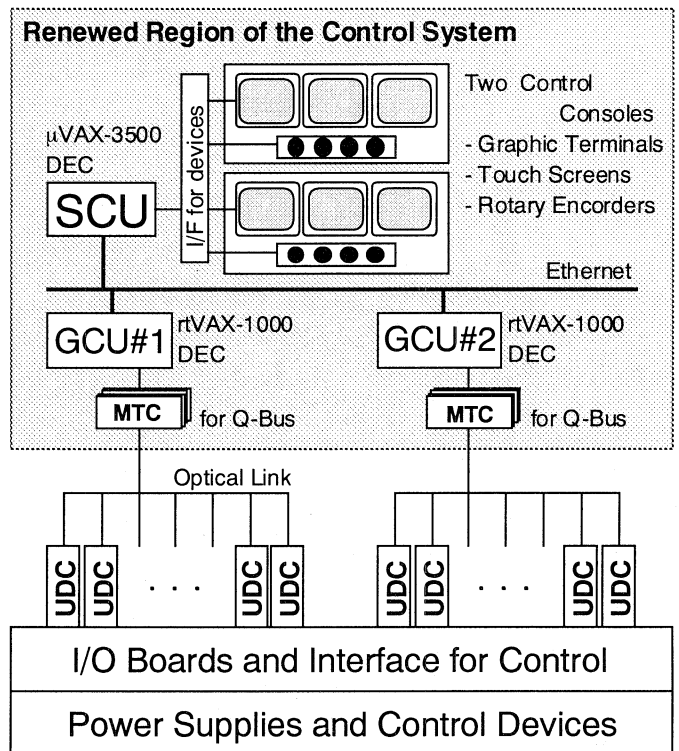


Fig.1 The hardware configuration and renewed region of the old control system.

The SCU is consisted of VMS as OS, 560MB hard disk, 16MB RAM and Q-Bus. The GCU is consisted of VAXELAN as OS, no hard disk, 16MB RAM and Q-Bus. The MTC is modified for Q-Bus. The programming language is used mainly 'C'.

3 New Control System

3.1 Computers

The hardware configuration of the new control system is shown in Fig.2. The new SCUs and GCUs consist of seven computers based on the Windows NT. For the new ion source, the control system was reinforced with one set of the GCU. The SCU has a touch screen of 21 inches assigned to 1280 x 1024 pixels. A size of the screen is 17 inches for the GCU. New computers are contained Intel's 450MHz Pentium II processor with 128MB RAM and 6.4GB hard disc drive. The new computer's network is constructed by the Ethernet of 100BASE-T connection.

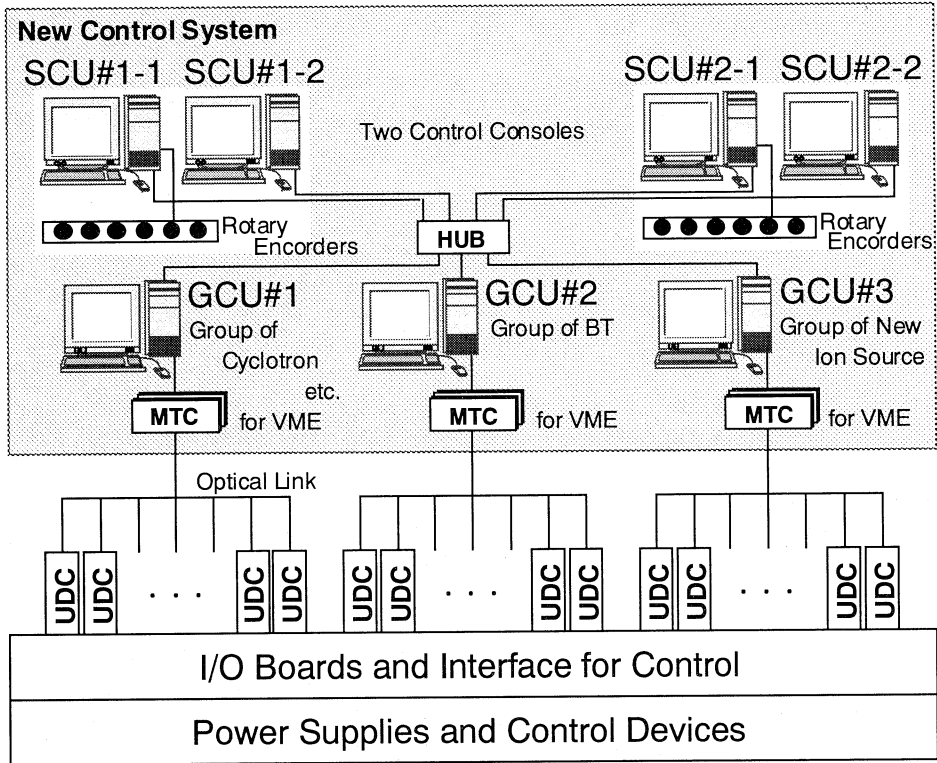


Fig.2 Architecture of the new control system.

The new GCU is communicated with many UDCs through the new message tree communicator (MTC) boards for VME using PCI-VME bus converter as shown in Fig.3. The new MTC for VME was also manufactured by SHI.

3.2 Control Console

The three graphics terminals including man-machine interface were used in the old control system, but two computer displays of the SCU were adopted in the new system. The main input devices in the new control system are the rotary encoders, a computer's mouse, a keyboard entry and the touch screen. Response of the touch screen, which was used as the switch for operation, became worse condition within not so long term. Therefore, we adopt the computer's mouse as the switch for operation in the new system. From our experience of the cyclotron operation, the four units of rotary encoder were insufficiency to adjust the many operation parameters. Therefore the number of rotary encoder increased to six units in the new system. The photograph of the new control console is shown in Fig.4.

3.3 Software

All of the programs for the control system were rewritten newly using InTouch, Delphi and C language. InTouch, which is principal language for the control program is process control GUI (Graphic User Interface) tool, manufactured by Wonder Ware Corporation.

The new control sequences were reconstructed by reflecting our many experiences for the cyclotron operation. The operation sequences designed graphically succeeded in quick selecting the device and its parameter as shown in Fig.5. It is also easy to adjust the parameter of the device by the rotary encoder. As shown in Fig. 5, an arrangement

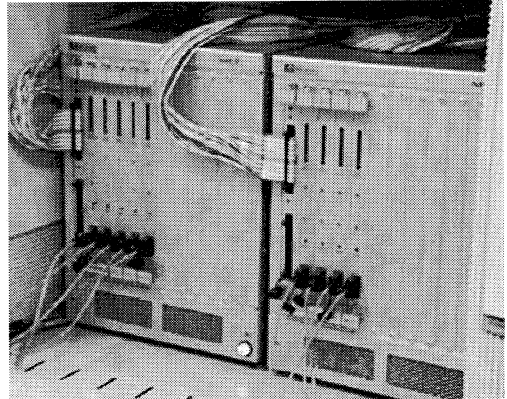


Fig.3 The MTCs mounting in the VME-Bus.



Fig.4 The photograph of new control console.

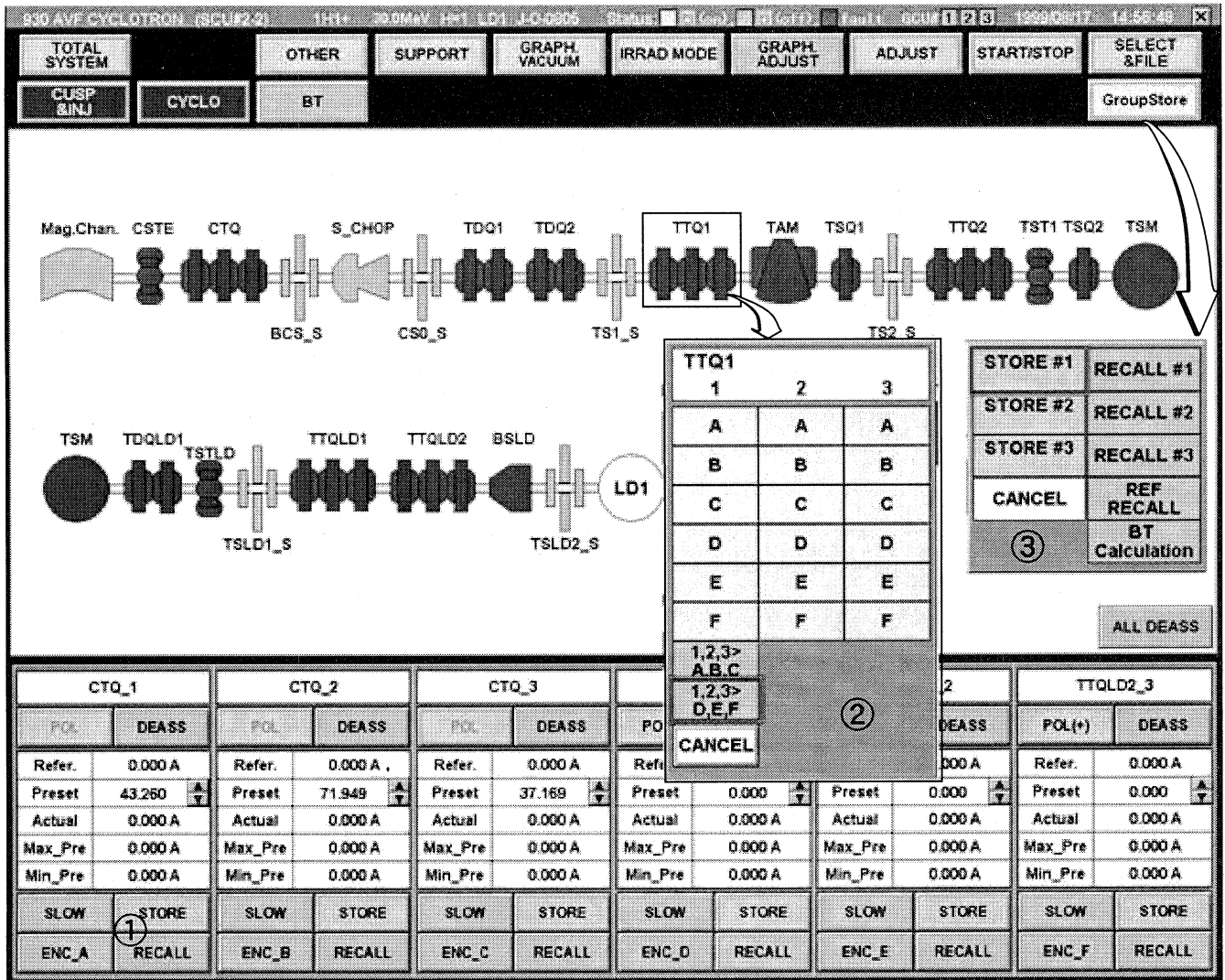


Fig.5 The graphical display for selecting and assigning the parameters for the beam transport group.
 ① The Store/Recall function switch of the parameter. ② The popup menu for assigning the parameters with the mouse. ③ The expanded Store/Recall function menu for all parameters of the adjustment term.

of the each devices in the graphic sequences is realized the actual order. Therefore operator is easy to selects the parameters of the devices. The function of the temporarily store/recall available only one parameter in the old system. New function of temporarily store/recall realized to accept the many parameters during adjustment term. We are not necessary to remember the any parameters before and after adjustment in the cyclotron tuning. We upgraded all of the function in the system.

4 Conclusion

In FY 1998, the three old control computers (VAX, DEC) were successfully replaced to the personal computers (PC) based on the Windows NT in the control system for the AVF cyclotron.

Reference

[1] S. Okumura et al., "Control system of JAERI AVF Cyclotron", The 8th Sympo. On Accel. Sci. and Tech., Saitama, Japan (1991) 356