Status of Control System for the JAERI Tandem Accelerator

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Abstract

We have made several improvements on a control system for the JAERI tandem accelerator. They are installation of the second control console, replacement of CAMAC serial highway drivers, an improvement of valuators on the control console, replacement of processor modules of the central multi processor etc. The reliability of the system and efficiency of the accelerator operation was improved by the modifications.

1 Introduction

The control system of the JAERI tandem accelerator is a concurrent processing system using several transputers[1,2]. The system has been in operation since 1992. We made many improvement to the system. The system started as dedicated control system for the JAERI tandem accelerator. But we have a post accelerating super conducting booster today. There is a need to improve efficiency of operation of two accelerators in the connected mode. It is the best choice to build a unified control system for both accelerators, for smooth operation of the two accelerators in the connected mode. In our case, it was difficult because the control systems of the booster have been made independently from the control system of the tandem. As the second choice, we made a satellite console of the tandem control in the RF control room of the booster.

Not only the installation, but also several improvements were made on the control system. Figure 1 shows present configuration of the system.

2 Installation of the second control console

Figure 2 shows a front view of the console. It has a window display, eight assignable meter units and four assignable shaft encoders(valuators). We can control the tandem from the console in the same way as from the main console. The window display is controlled by an engineering workstation. The other part of the console is controlled by a transputer. Both processors are linked to the central processor of the control system through optical fibers. Adding to the fiber link, the workstation has connection to an Ethernet of the control system.

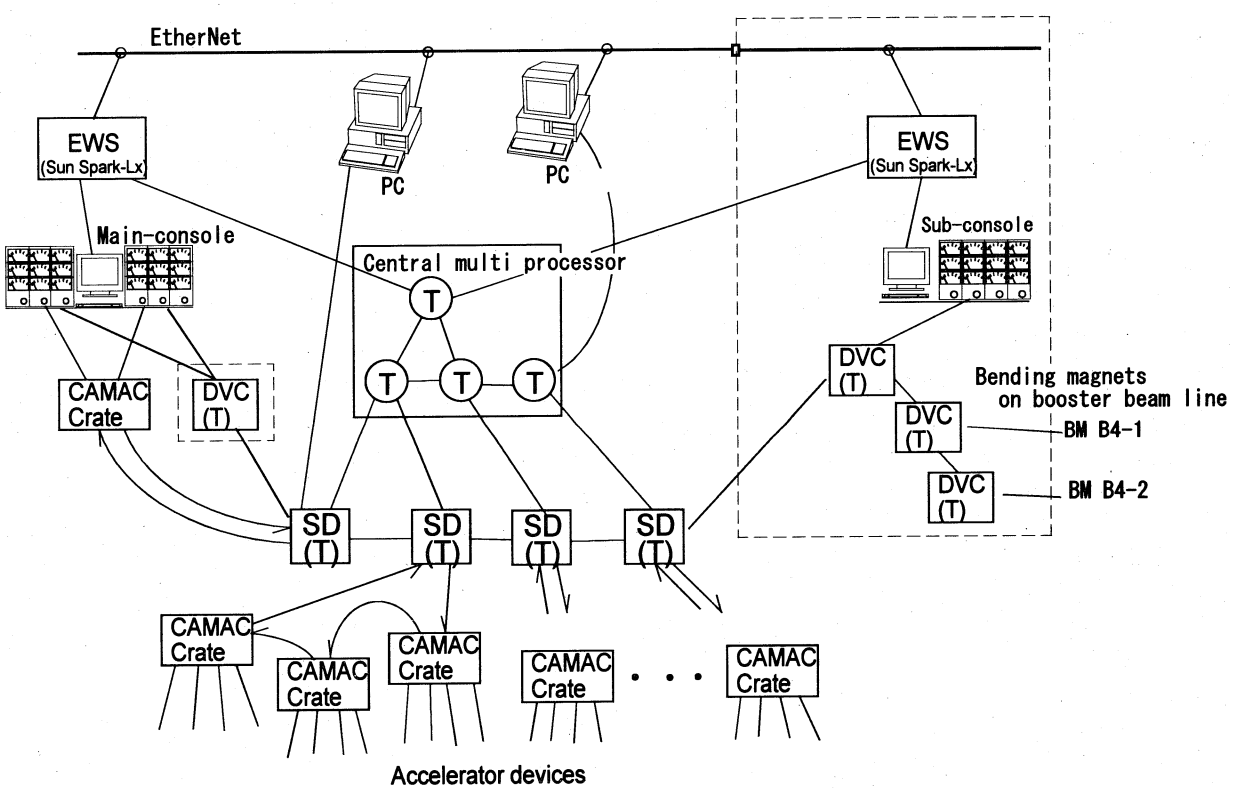

Fig.1 Configuration of control system for JAERI tandem accelerator.

T: transputer, SD:Serial highway driver,
DVC : Device controller. Dashed lines denote present expansion.

In having two control consoles, we must consider how to handle flows of control signals to a same data point from the deferent consoles. We have selected the scheme that allows

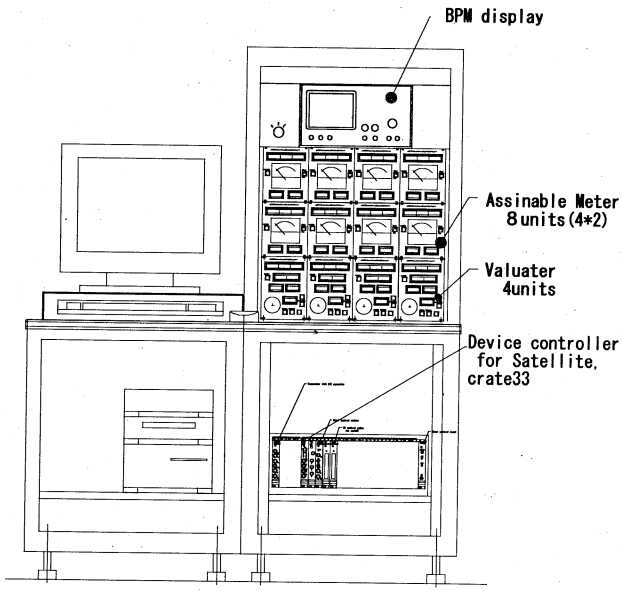

Fig. 2 Front view of the second console.

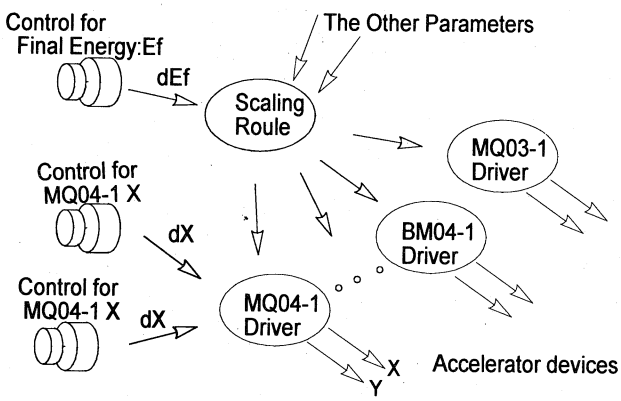

Fig. 3 Signal flows controlling data points.

us to assign plural valuators to the same data point in the same time. Figure 3 shows signal flows of controlling data points. Requests to change values on the valuators are detected as amounts of changes and sent to the processes which maintain current values of the data points. The mechanism works in the same manner, even when the plural valuators are assigned to the same data point. That is, the actions of operators to change value of the same data point are mixed. There is no need to control the collisions. This mechanism has been introduced with a linked control mechanism through virtual data points. In the mechanism, independent controls stand with the linked control in the same time.

3 Replacement of the CAMAC serial highway drivers

The serial highway drivers[3] are located at the front ends of the control processors to CAMAC serial highway system. We have developed a new type of driver to improve reliability and performance. Figure 4.a and 4.b shows the block diagram of the driver. The new drivers are separated into two parts, a control processor and one or more serial highway interfaces. The interfaces do much of which have been done by the software in the old driver. These functions are generation and analysis of message packets and displaying highway error status on the front panels. The control processor controls the interfaces through a simple field bus. We can install several interfaces on the bus. The driver can control byte serial transfer, which our old drivers could not control. The major parts of the logic circuits are implemented in an FPGA(field programmable gate array).

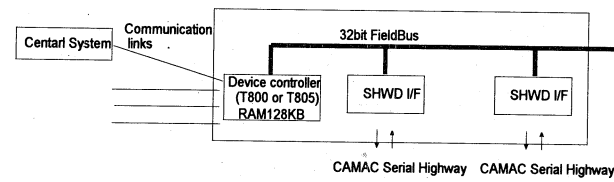

Fig. 4.a Serial highway driver of Accell system.

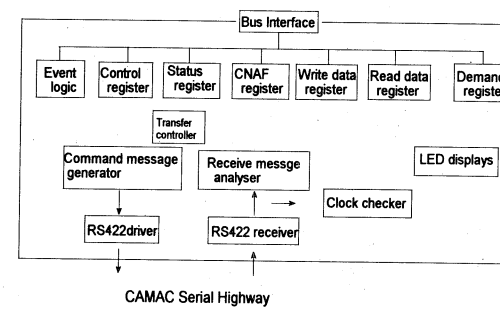

Fig. 4.b Internal block diagram of SHWD I/F board.

4 Modification of valuators on the main control console

The valuators on the control console are modified to accept a change in values crossing zero. A setting value of the valuator follows linearly to the rotation of the dial in the new specification. This modification enables natural control of beam steerers on a beam line of the accelerator. The old ones had an exponential control and could not allow crossing zero. The modification also improves matching of shaft encoders to a function of linked control of the control system.

5 Replacement of processor modules of the central multi processor

The central multi processor is the main engine of real time processing of the control system. Four transputer modules are connected together to construct the multi processor. New modules were made using almost same transputers(T805) as the previous modules, but their reliability on signal connections was greatly improved. The modules are installed on the same case of the device controller. Figure 5 shows the modules installed with the new serial highway drivers.

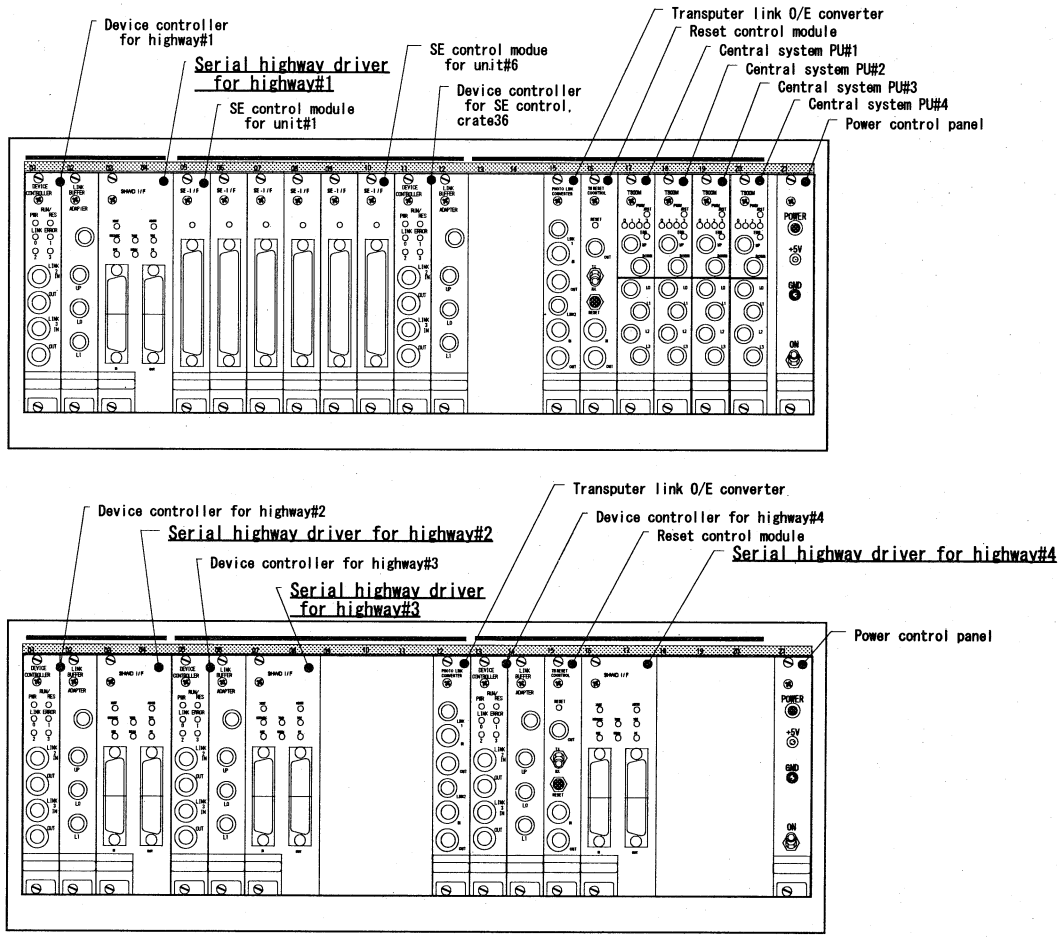

Fig.5 Front view of the central processor modules and serial highway drivers.

6 Addition of control for two bending magnets

Controls of two bending magnets on the booster beam line have been included in the control system. They are controlled through device controllers using transputers. We intend to introduce local feed back control of magnetic fields using the controllers.

7 Software

According to the change of the hardware configuration of the system, software of the system was modified at several points. They are an address scheme of data points of devices around the accelerator, protocols between the central system and the front end processors, programs of serial highway drivers etc. The programs were expanded to accept two control consoles and data points directly controlled by transputers.

8 Conclusion

Recent improvement of the control system for the JAERI tandem accelerator was reported. The second control console was installed in the RF control room of the post accelerating booster for smooth operation of the two accelerators. The replacement of CAMAC serial highway drivers and processor modules of the central processor were made to improve reliability and performance. Introduction of devices controlled by the device controllers using transputers were made. These modifications improve reliability of the system and efficiency of the operation of the accelerators.

References

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