Current Status of Control System for the SPring-8 Linac

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1. Introduction

The SPring-8 Linac control system has been developed with Data Oriented Approach (DOA) [1], and the first trial has been carried out in May 1995 to test of the prototype software. In this paper, we report the current status, some problems, and a future plan.

2. DOA of the SPring-8 Linac

It is important for DOA to pick up the point at issue in the system. Figure 1 shows the framework of the Linac DOA. To use DOA, we picked

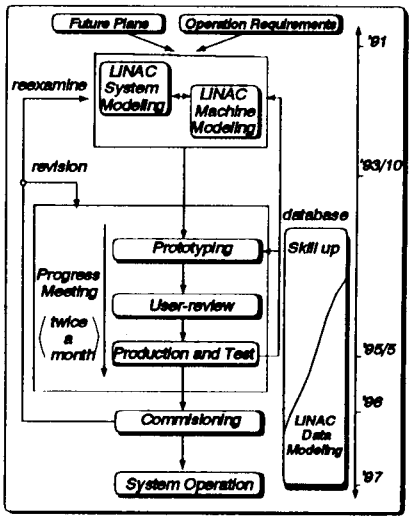

Fig. 1 SPring-8 Linac DOA.

up our system problems as follows. There are three problems [2].

1) **Computer Network speed and reliability:** The Linac control data have to be send quickly and reliably.
2) **High portability of hardware and OS:** The system has to be adapted to the trend of hardware and OS on VME's quickly.
3) **Flexiblity of the control system:** Whatever requests, the control system has to be kept up with an efficient improvement.

As a solution to these problems, we made three keywords. That is " Communication Process", "C language Device Drivers", and "Object Oriented Programing (OOP)" [3]. The Linac control system is constructed on the basis of these keywords.

3. Prototyping and Test

From May 1995, the prototype process has been carried out with the Linac. First, the modulator control prototype process was tested. The prototype process was constructed by "Communication Process" and "Modulator Process" (Fig. 2).

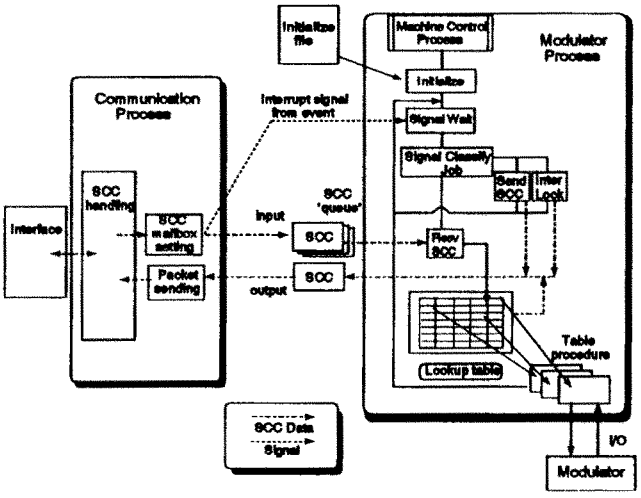

Fig. 2 Prototype test Software.

The Modulator Process inherit the main attribute and behaviors from the Super Class "MACHINE", and this process can recognize the SPring-8 linac Control Command (SCC). At this test, we checked on the remote working which use the SCC. When we sent a SCC into the Modulator Process, "GO STANDBY", "GO RUN" etc., so that the body of modulator worked like one's behavior. These results are reflected more prototypings.

The body of modulator generates the electric discharge noise in the structure. So, we paid attention to the Electric Magnetic Interface (EMI) on the VME side. The VME cage power supply is isolated form the power line using a transformer, and the optical isolation barrier is used to protect the VME-bus from transients caused by ground loops produced by field wiring connections. However, at the

test, the monitor signal stability was about ±15%, because of noise errors. As the modulator works 60 pps, discharge noises was produced periodically (Fig.3). The test was not carried out at the not

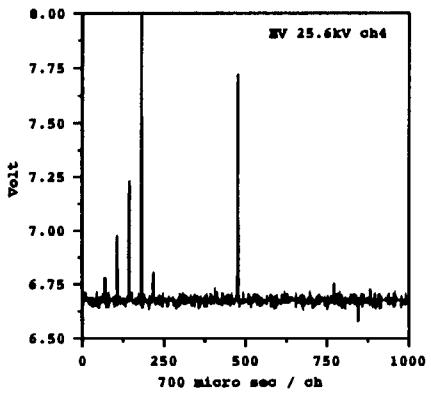

Fig. 3 Normal monitor data of Modulator.

SPring-8 linac bldg., we can not discuss the noise lebel such as the ground earth. Therefore, we re-

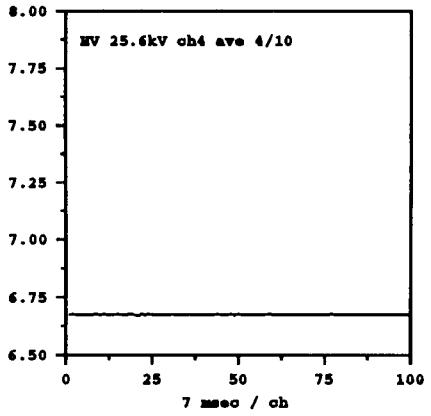

Fig. 4 Calculated monitor data of Modulator.

designed the prototype software by using statistical calculation on VME side. After that, the data becomes stable like figure 4.

4. Artificial Intelligence Control

The commissioning of the Linac will start in August 1996. Until the commissioning starts, all conditioning of the Linac components have to be finished efficiently. For these problems, we design the RF conditioning with Artificial Intelligence(AI) control system, and try to reduce in conditioning hours. We try to control the conditioning of RF system using the experienced sense which is based on fuzzy logic, and thus the conditioning of RF system may achieve the high efficiency [4]. The RF conditioning was simulated using these fuzzy production rules and membership functions. Figure 5

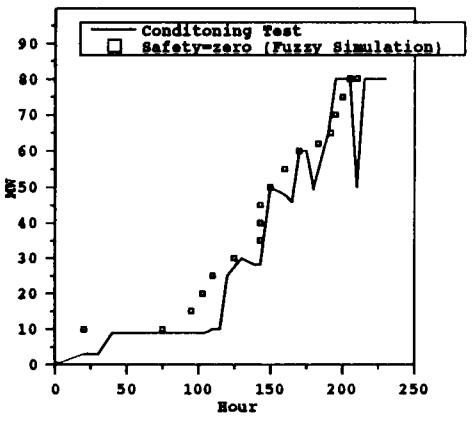

Fig. 5 Result of the fuzzy inference.

shows the result of fuzzy inference. The simulation requested a passage time and the peak power. Using these fuzzy production rules and membership functions, simulation is quite in agreement with the RF conditioning curve.

5. Database and Operation

The Linac has run toward easy operation. For the operation, we have developed the data logging system, including the database structure. The implemention will be done using relational database techniques, hypertext techniques, and WWW sever techniques.

Now, on the WWW, a new browser technology has come. That is the Java-age browser (HotJava). The browser brings the interactivity between the operater and the Linac. After the commitioning, we will design GUI to use this browser for the control.

References

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