

# Design of Accelerator Operation Using FUZZY Control System

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When an accelerator is operated, the parameter becomes not so much the result of theoretical expectation as the experienced sense. If an automatic control system can succeed all of the manual (the experienced sense) control system, a experienced sense shall insert just in an automatic system, so that the system shall be more intellectual. However the most of experienced sense are stored many kind of know-how that is suited for the present machine status for the long time. And they are expressed by the unclear meaning parameters which are hard to set up the computer. For this reason, it is difficult for a automatic control system to rework of a manual control.

Now, the SPring-8 Linac try for the automatic control system. So many kinds of know-how have been stored through operations, and we need to set up it simply into the automatic control system. In short, we would like to swap the system for the unclear linguistic control system like FUZZY control. This report presents about storing many kinds of know-how for the Linac operations and the concept of our automatic control system.

In an intelligence control, as stated above, it is indispensable that the experienced sense is fused. Few control theories is worked out for intelligence control. On this situation, FUZZY theory has been adopted for the breakthrough of the intelligence control. And now, FUZZY control do be one of the tools which is established for the intelligence control.

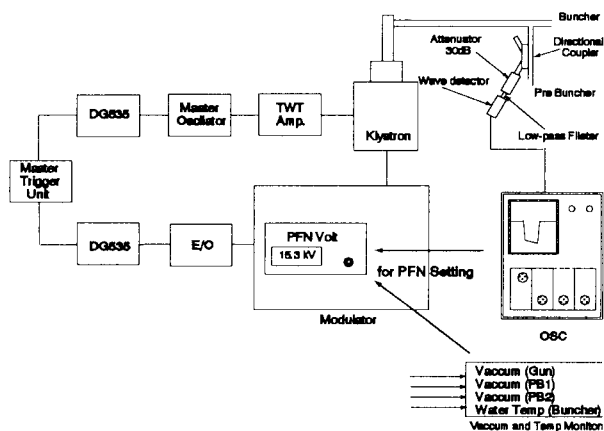


Fig.1. Aging Process for RF system

Fast of all, two type of operations in Linac operation procedures are investigated and stored for the data of the intelligence control, which these were carried out at the injector test bench in JAERI Tokai. One was the quantitative operation. All accelerator

devices were generally designed by the theoretical formulas which from accelerator science, so that we can use this formulas in the quantitative operation repeatedly. The computer system was good in these quantitative operation. The other was the qualitative operations. These cases depend on not only multiple operation factors but also unsolved mechanism parameters. For example, the stability of devices, the stability of vacuum, the effect of weather, etc. Figure 1 shows the aging process of the RF system at the injector test bench. We investigated the automatic control that includes the latter operations.

The aging process which is one of the qualitative operations would like to improve efficiently at the commissioning, which this process is considered to be one of the easy target of FUZZY control. We had two type of aging processes, the electron gun aging process and the RF test system, in the injector test bench. Fig.2 shows the data of the electron gun aging process. It have not been analyzed yet, however it will give some hint for the vacuum discharge mechanism and the effective improvement at the aging process. For FUZZY control system, these data must give some rules and membership functions.

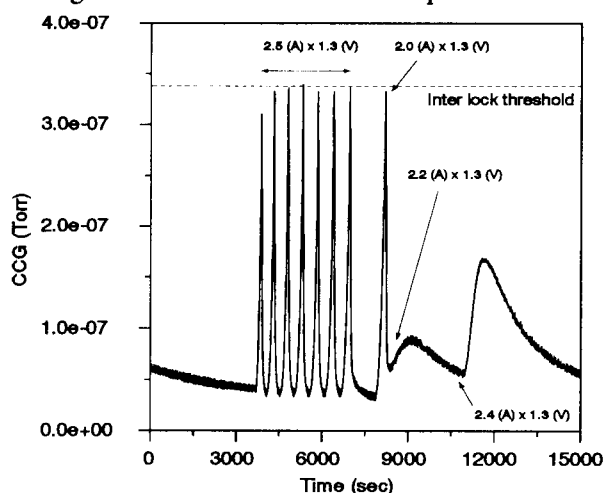


Fig.2. Gun Aging data

And now, some FUZZY engine boards put on the VME bus market. It is able to calculate FUZZY theory at high speed. We are going to adopt one, EVME-FZY21, for our VME remote control system, and it will try to make our intelligence system. The test of this system will be started at next year.

## Reference

- [1] S.Kawaji and N.Matsunaga, Interface, Vol.19 No.9, P137 (1993)