

OPERATION OF THE ELECTRON SYNCHROTRON WITH A PERSONAL COMPUTER

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Abstract

A computer control system of the electron synchrotron with a personal computer has been constructed at Institute for Nuclear Study, University of Tokyo and a preliminary test operation has been performed.

1. Introduction

The beam intensity of the electron synchrotron fluctuates and decreases gradually unless the synchrotron is under the control of the operator for a long period of time because of the small fluctuations in all the power sources for the synchrotron and variation of the temperature in the micro wave components. In the usual running, the operator has to adjust several parameters as indicated in the figure to maintain the constant intensity of beam. The present aim of the control system with a personal computer (PET) is not starting operation of the synchrotron but the operation in the usual running and data logging.

2. Hardware

The block diagram of the system is shown in the figure. The system consists of the personal computer, a CAMAC pulse motor controller, NIM pulse motor drivers, a CAMAC digital volt meter (or A/D converter with 32 inputs) and a beam monitoring system. The computer is linked to the CAMAC modules through an N-decoder and a PET-CAMAC interface¹⁾.

The beam intensity picked up by the current transformer²⁾ is read into the computer through a sample-hold circuit³⁾ and the digital volt meter. The command from the computer is sent to the pulse motor driver with the pulse motor controller. Since the controller has six sub addresses, six drivers can be linked to one controller. The direction of rotation of the pulse motor, up or down, and the number of pulse can be set to the driver with one command of eight bits in which one bit is for the direction and the other seven bits are for the number of pulse. The driver can be switched to "manual" mode which is capable for the manual operation of the synchrotron or to "computer" mode by the selector. The number of step per one command and the integrated number of step are indicated in two scalers respectively.

In future, the personal computer will be linked to the satellite computer TOSBAC-40c and the central computer FACOM M180IID.

3. Software

The program can be written in BASIC language. The beam intensity at the final stage of the acceleration is determined mainly by the characteristics of the linac beam. In the present test operation, only two parameters have been controlled, the injection time of the linac beam to the synchrotron and the inflector voltage. These two parameters are the most effective to compensate the small fluctuation of the linac beam. The repetition

rate in the synchrotron is 21 cycle. If the A/D converter is used, the data in every cycle can be read by the computer with this system. The program is similar to the one for the χ^2 minimum searching. The beam intensity has been read for a proper period of time and compared with that of preceding period. The two parameters have been controlled so as to keep the beam intensity. The weight and the response time of two parameters have been set previously by considering the correlation and response time of each parameter to the beam intensity.

References

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- 2) R. Yamada, Japanese Journal of Applied Physics, Vol. 1, No. 2 (1962) 92
- 3) S. Asaoka, K. Shiino, M. Yoshioka and K. Norimura, INS-TH-128 (1980) (In Japanese)

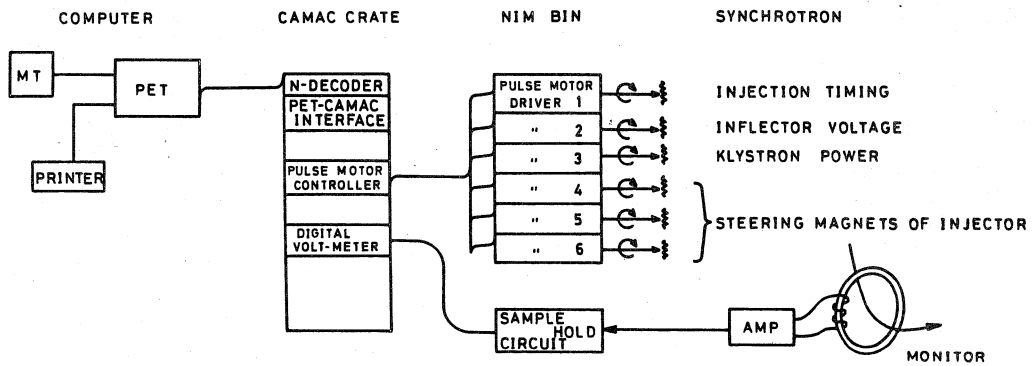


Figure: Block diagram of the computer control system