

COMPUTER CONTROL OF CLINICAL CYCLOTRON "CYPRIS"

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1. Introduction

Recently the positron emitters (^{11}C , ^{13}N , ^{15}O and ^{18}F) become very important in the nuclear medicine, because of their annihilation γ rays and short lives. The small in-house cyclotron is needed in order to produce these short life isotopes. This type of cyclotron should be reliable and easy to operate so as to use in hospital, and the beam current should be stable for continuous suppling of radio isotopes.

In our small cyclotron "CYPRIS", these demands are achieved by a control system based on two sets of micro-computer. The system presents the following features.

- (1) Guided operation by push-buttons and lamps
- (2) Well stabilized beam current by three kinds of closed loop control
- (3) Easy maintenance by troubleshooting system

2. Control

The block diagram of the control system is shown in Fig 1. Two sets of micro computers are located in the console desk. One is for the control of cyclotron.

We adopted three kinds of closed feed-back loop in order to stabilize beam current automatically.

(1) Magnetic field control

The magnetic field is controlled to obtain the maximum extracted beam current by trimming the auxiliary coil current, for compensation RF frequency drift.¹⁾

(2) Current control of ion source filament

The filament of ion source is damaged in operation, and the beam current depend on the filament condition sensitively. The filament current is controlled to get the optimum condition of ion source as shown in Fig 2.

(3) Arc current control

The arc current is controlled to stabilize the extracted beam current.

These three controls work in time schedule mode. Finally the extracted beam current is stabilized within $\pm 1\%$ as shown in Fig 3.

3. Monitoring and troubleshooting

The all active components of CYPRIS are monitored by another computer every 100 msec and 10 msec, and their conditions are displayed on the CRT. If any trouble happened, the computer tells the anomalous point and instructions to find the origin of trouble.

Reference

- 1) K. Fujii and Y. Kumata : RADIO ISOTOPES, 31, 33, (1981)

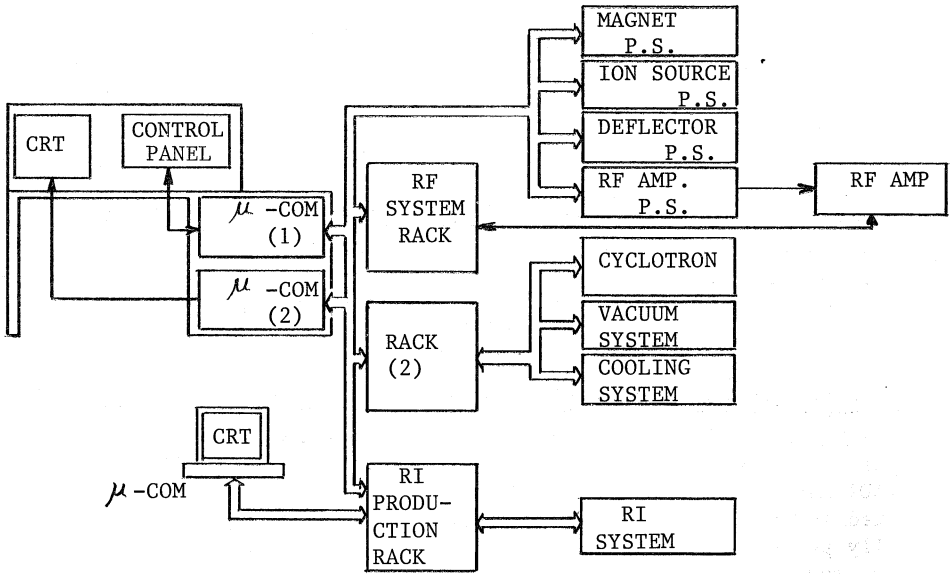


Fig 1. Block diagram of control system.

Fig 2. Current control of ion source filament. The filament current is controlled to get the maximum beam current. There is no difference of final filament current between automatic control and manual one. Abscissa denotes time.

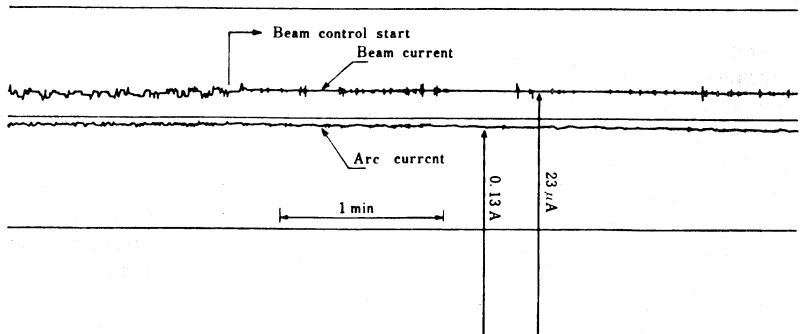
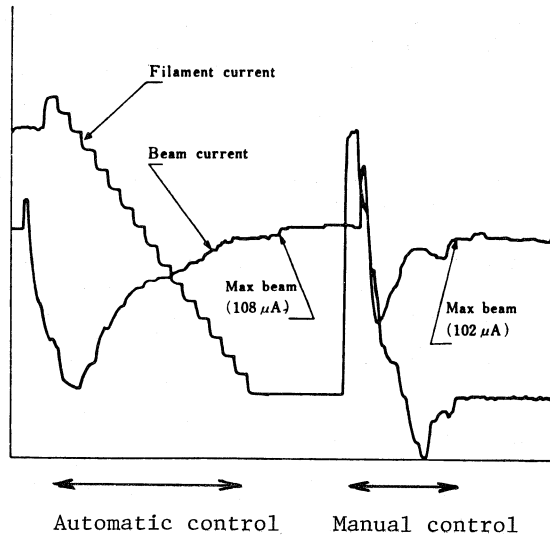


Fig 3. The stability of extracted beam current