MEASUREMENT OF PICOSECOND PULSES OF 35 MeV TODAI-LINAC (I)

T.Ueda, Y.Katsumura, S.Tagawa, Y.Tabata, K.Hasegawa, and J.Tanaka*

Nuclear Engineering Research Lab., Univ. of Tokyo
National Lab. for High Energy Physics*

Single picosecond pulse operation of a S-band linear accelerator at Nuclear Engineering Research Laboratory, Tokai. The pulse width has been confirmed to be less than 18 ps by using a streak camera (Hamamatsu TV). Bunching process of the picosecond pulse is mentioned. The characterization of the picosecond pulses has been made.
Fig.1 shows a simplified schematic RF timing system. The electrons generated by the gun are synchronized with the RF energy applied to the bunching system and a sufficiently short triggering pulse is provided to the cathod of the gun.

A subharmonic(1/6 RF of 2856 MHz) buncher is added to the linac system, in order to bunch electrons from the gun into a 350 ps domain as possible. Then the bunched beam is compressed further into a 20 ps domain by the prebunching system. As the result, an intense (~1 nC) and narrow (less than 18 ps) pulse could be obtained.

Fig.2 shows one of the shortest pulses without the sub-harmonic prebuncher. A train of fine pulses can be seen in the same pulse by using the streak camera. This is the short pulse emitted from the gun (the half width : 1.3 ns).

A single picosecond pulse obtained is shown in Fig.4. No satellite pulse is observed.

Characteristics of one single pulse are summarized in Table 1.

To perform efficiently the picosecond pulse radiolysis study, we need a high local concentration of active species. A high electric charge and narrow width of the pulse, and the sharp beam focusing must be realized.

Fortunately, all these conditions have been successfully satisfied by our machine, as shown in the Table.

Beam currents (average and peak) were measured as a function of the phase shift between emission pulse from the gun and RF of the subharmonic buncher. The results are shown in Fig.5. It has been made clear that there exist some correlations between the intensity and shape of picosecond pulse and the beam current. In other words, the most intense pulse without satellite pulses can be achieved at the maximun current. It is interesting to note that the machine can be ajusted very easily to find the optimum condition.

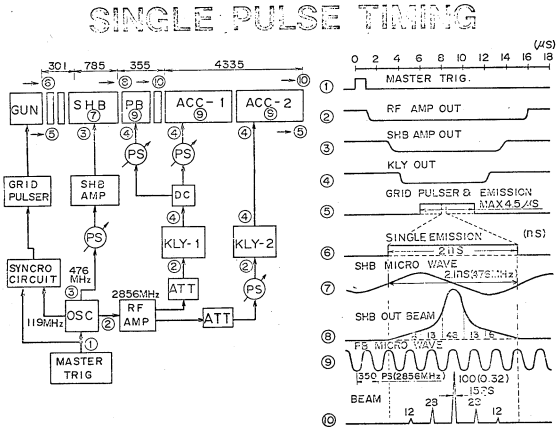

Fig. 1

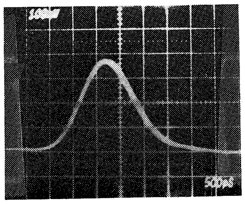

Fig. 2

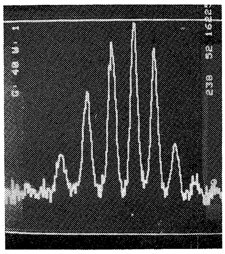

Fig. 3

Table 1

1	pulse width	< 18 ps
2	charge	1 ns
3	beam dia.	2 mmϕ
4	energy	36.6 MeV
5	stability	7 %/10 min
6	pulse repetition	7 ~ 200 pps
7	trigger	intern. trig. extern. trig.

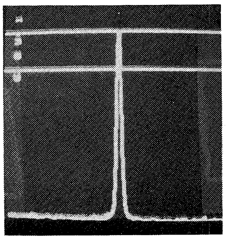

Fig. 4

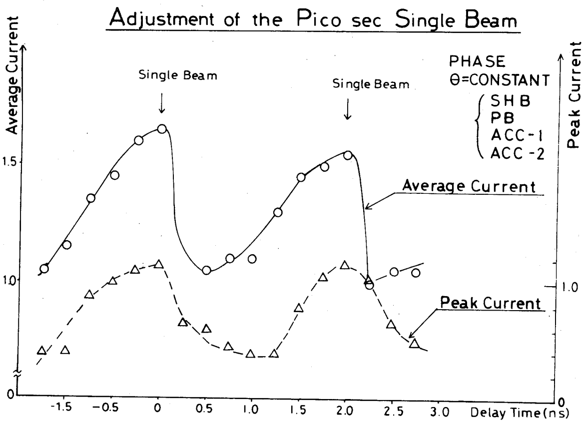

Fig. 5