BEAM BUNCHER AND CHOPPER OF THE RIKEN VARIABLE FREQUENCY LINAC, RILAC

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Since accelerating frequency of the RILAC is varied according to the charge to mass ratio of the ions to be accelerated, the beam buncher and chopper also have to be designed as frequency variable unlike other linacs hitherto built. Figure 1 shows a cross sectional view of the buncher. It is a quarter-wave coaxial structure loaded with a drift tube and a vacuum variable capacitor. Tuning of the resonant frequency is made by adjusting the capacitor remotely. Length of the stem is kept constant and radio-frequency power is fed at a fixed point near the short end. Exciter is a wide band amplifier having a low output impedance. The coupling point is chosen so that variation of the input impedance seen from this point permits smaller power reflection at low frequency operation than at high frequency. The shunt impedance across drift tube gaps is much less for low frequencies than for high frequencies in this method of frequency tuning. Figure 2 is the results of measurements. For 3 kV amplitude, which is the maximum, necessary power consumption is 300 W and 60 W for low and high frequencies respectively. Rating of the variable vacuum capacitor was chosen with due care as to the current-frequency characteristics rather than to the voltage limits.

By chopping injector beam incident to the buncher into narrow segments, so that phase compression can be made at the linear portion of buncher wave form, we can expect sharpening of the bunch width and improvement of the energy resolution. Of course that accompanies decrease of intensity.

The chopper also ought to work in the variable frequency mode. We have designed a wide-band amplifier which has a peak slicing circuit in the last stage. Figure 3a shows some examples of wave forms at the chopper plate and Figure 3b is the signal of the beam modulation picked up by a bunch signal probe set 6 m downstream of the chopper.

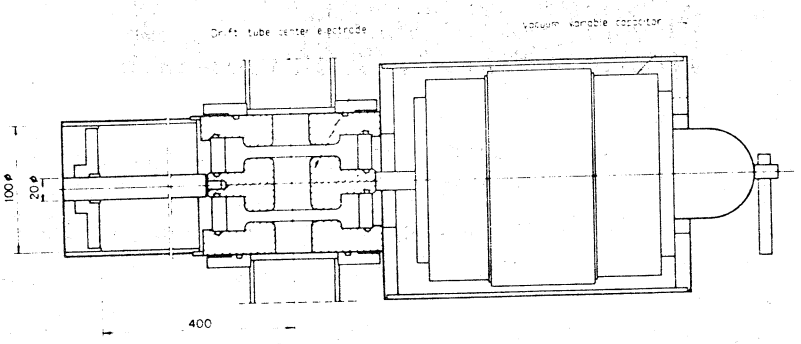

Fig. 1. Cross section of the proto-type buncher.

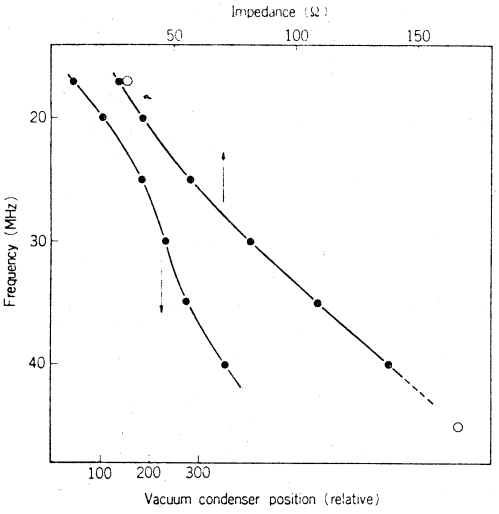

Fig. 2 Change of the input impedance at the coupling point and vacuum condenser position with frequency. Closed circles show measured values; open circles show calculated ones.

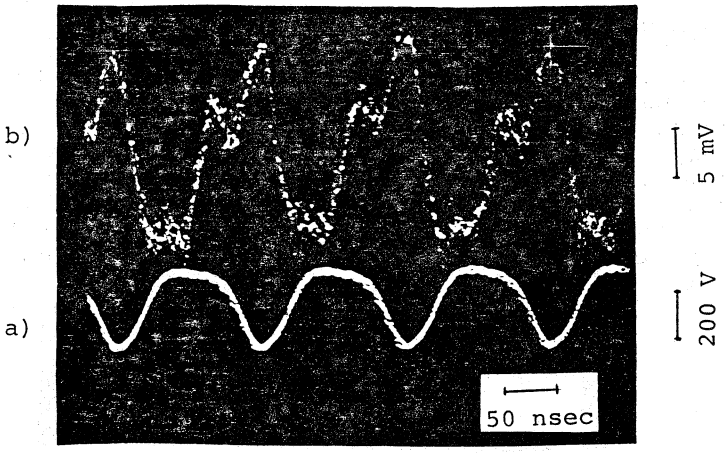

Fig.3 a) Voltage wave form at the chopper plate. f = 7 MHz

b) Output signal of the bunch picking up probe.