SOME IMPROVEMENTT OF RF MEASUREMENT SYSTEM ON ELECTRON LLINEAR ACCELERATOR

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This paper presents the two recently succeeded improvements of RF measurement on electron linear accelerator.

1) In electron linac, it is necessary to produce a trigger signal having the characteristics of fast rise time and small gittering. In addition, it must synchronize with the S band microwave. A trigger signal of this sort will give a better performance both in generating and in monitoring a single bunch as well as trains of bunches. In conventional methods, the trigger signal which usually generated independently of accelerating frequency does not satisfy these requirement.

A new method to produce such a trigger was proposed and tested by using some pulse-modulated wave in phase with accelerator RF. In our case, since the sub-harmonic buncher was driven by 1/6 of S band frequency, the UHF wave (ex.476 Mc) was chosen as the trigger. A double balanced mixer was available to slice the UHF wave into buckets of which the first wave was used as a triggering pulse. This stable triggering enabled a successful measurement of the shape of a single bunch on a sampling oscilloscope. This method is also applicable to observe the successive bunches in a pulse by varying the trigger delay time.[1] Fig.1 shows the schematic of measuring system used for the electron linac at the Nuclear Engineering Research Laboratory, Tokyo University.

The single bunch operation of electron gun especially requires the trigger signal to be in phase with the accelerating frequency. At present, the electron linac uses 1/4 frequency of the UHF as trigger because of the limitation of electronic circuits. However the use of 476 Mc as the trigger signal supplied to the electron gun makes the triggering not only simple but reliable in single bunch operation.

2) It is necessary to measure the frequency rapidly and accurately in order to fablicate a number of accelerator waveguides. The tolerance of less than 10 Kc at 2856 Mc is required for electron linac. A marker system which satisfies this requirement was developed recently. This applies the principle that the harmonic mixer generates beat frequency between the sweeped S band frequency and the integer-multiplied synthesized UHF. This provides both 0 beat signal and double signals around the 0 beat frequency. The interval of the double signals is determined from the resonance frequency of LC circuit, conseqently arbitrary fixed frequency interval is available. (ex. Δf = 150 Kc ∿ 500 Kc, 6 step, in our case). This enables us to monitor a few Kc change at 2856 Mc. Fig.2a shows resonance curve of accelerator cavity (upper) and 0 beat signal (lower). Similary Fig.2b shows the same one and the double marker of which interval is 200 Kc. This method is effective for the rapid and accurate inspection in the production of the waveguide components.

Reference

1) M. Washio et al., "Bunch Monitor of Linear Accelerator", in this proceeding.

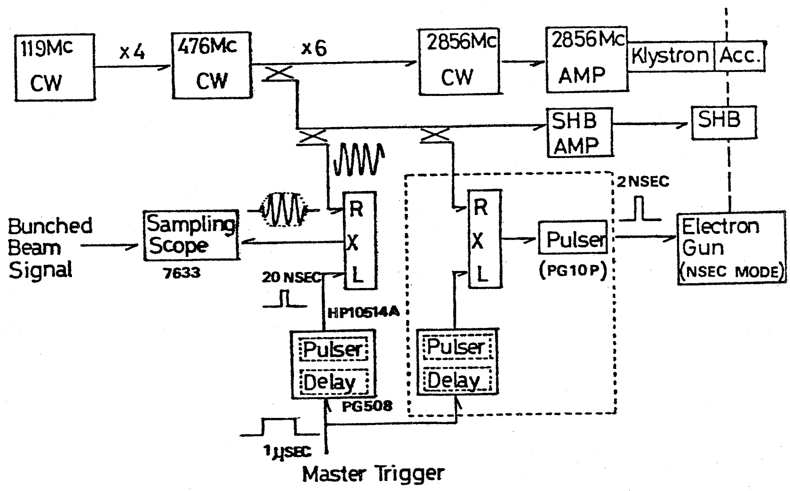

Fig. 1 Schematic diagram of triggering system.

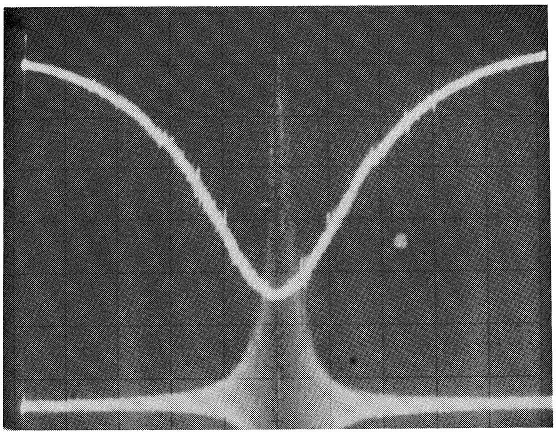

Fig. 2a

Resonance curve of the S band cavity and 0 beat marker. f_o = 2855.540 MHz. 100kHz/div. for horizontal axis.

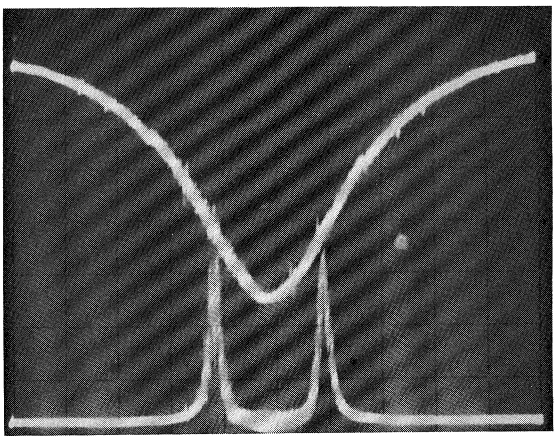

Fig.2b

Resonance curve of the S band cavity and the double markers. f_o = 2855.540 MHz. 100kHz/div. for horizontal axis.