# SOME HIGH FREQUENCY CHARACTERISTICS OF THE ACCELERATING STRUCTURE OF THE VARIABLE FREQUENCY LINAC

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## Abstract

To realize acceleration of heavy ions by the variable frequency scheme the accelerating cavity must fulfil certain requirements for its high frequency characteristics. Results from study by the models and measurements on the real cavities are discussed.

## Requirements on the cavity

1) Firstly its resonant frequency must be adjustable in the wide range. The adjustment has to be very fine and resonant frequency must be stable so as to be able to operate multiple cavities in parallel for number of hours.
2) Relative strength of the electric field at the accelerating gaps ought not change very much when the resonant frequency of the cavity is varied from the minimum to the maximum.
3) Power dissipation must not be excessive in spite of the variable frequency structure
4) Spectrum of resonant frequencies of the cavity must be simple enough to allow discrimination of wanted from unwanted modes feasible.

## Results from models and real cavities

A quarter-wave coaxial cavity loaded with drift tubes at its open end is adopted as the accelerating structure. Fig. 1 shows the 1/2.5 scale resonator model. Note that the way of loading is different from those of Wideröe cavities of the UNILAC of West Germany or the ALIL of France. In their cavities the drift tubes are attached along the length of the resonator where the rf potential difference between conductors is changing according to the standing wave voltage distribution in a quarter-wave transmission line. In our case, the drift tubes are loaded at positions of the constant potential in principle. How far it is satisfied is shown in Fig. 2. Coarse tuning of frequency is made by a shorting plane and fine tuning by two capacity compensators. In the highest frequency, position of the shorting plane is so near to the open end that the distribution of the electric and magnetic field in the cavity becomes similar to that in the H-type resonance of a cylindrical cavity. Sags of voltage in the both extremes of the drift tube array in the higher frequencies reveal the effect. It can be compensated partly by adjusting the diameters of the drift tubes at the ends.

Fig. 3 shows frequency spectrum as the function of position of the shorting plane and Fig. 4 the effective shunt impedance of the second cavity as the function of the frequency used. Recent measurements on the real cavities installed have substantiated those results obtained for the models.

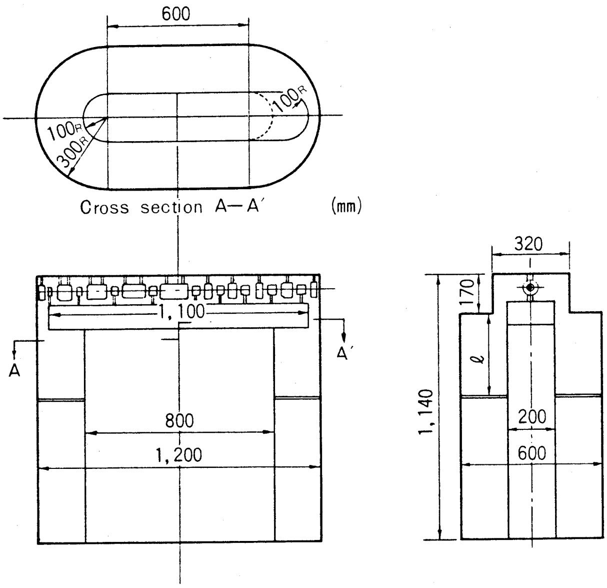


Fig. 1 1/2.5 scale resonator model.

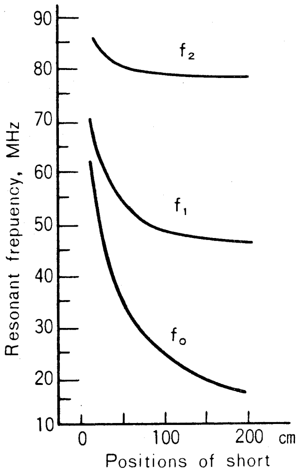


Fig. 3 Change of resonant frequencies as the functions of position of shorting plane.

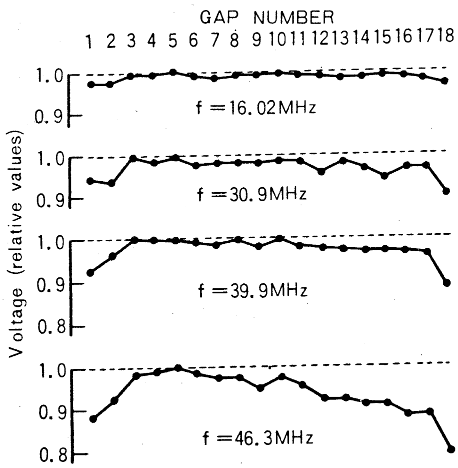


Fig. 2 Change of relative field strength in the gaps according to resonant frequencies.

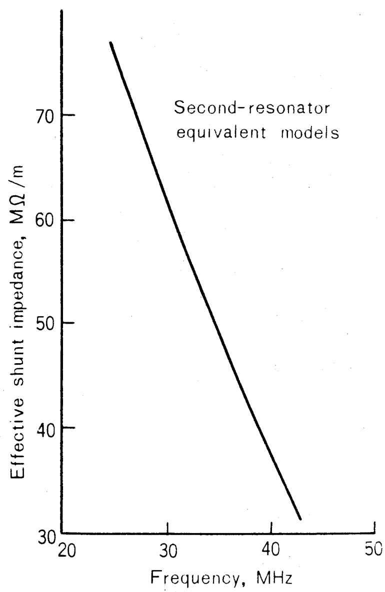


Fig. 4 Effective shunt impedance