PRESENT STATUS OF THE TOKYO INSTITUTE OF TECHNOLOGY HEAVY-ION LINAC SYSTEM

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ABSTRACT

In the last year we have concentrated ourselves to understand how the local concentration of RF power loss has occured and have modified the design of cooling devices in the accelerating structure. Since September 1986 the CW operation has been very stable and reliable.

1. INTRODUCTION

The accelerating structure of IH type is well known for its high shunt impedance at low beta values and for the low construction cost. Keeping these advantages we have designed two IH structures: The one has a high energy gain, and the other a low energy gain. These two linacs are connected in cascade to bridge over the energy gap between the 1.6-MV tandem (β=0.02) and an Alvarez (β=0.08) for our future plan.

We had to, however, overcome many technical problems from the design work until the beginning of operation. Experiences with operating the linac system are reported in the following sections.

2. TROUBLES AND MODIFICATIONS

As reported at the 11th Meeting on Linear Accelerators, Helicoflex-type silver pipes have been used for the RF contacts between the ridge plates and the inner wall of the cavity (see Fig. 1). The silver pipes have melted down at an input RF power of 40 kW. We have found out that the copper ridge plates have shrunk up due to overheating. The pressure of contact was reduced, and the bad contact triggered overheating of the Helicoflex-type silver pipes. Additional silver strips were inserted

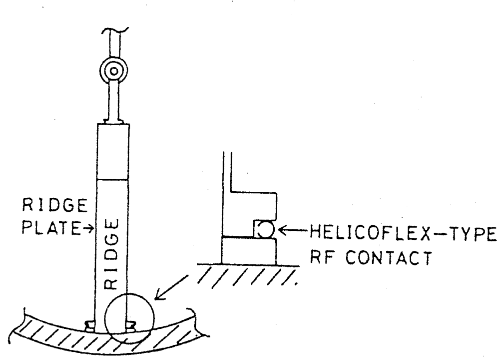

Fig. 1 RF contacts between the ridge plates and the inner wall of the cavity.

into the gap between the ridge plates and the silver pipes to raise the contact pressure. The deterioration cycle of the bad contact and temperature rise of the contact has been stopped.

We have tried to augment the input RF power. At 50 kW we observed that the inverse L-formed part of the ridge was glowing. This part introduces an additional electromagnetic inductance to the high energy section of the cavity to raise the accelerating voltages. In the following discription we call this part 'magnetic-flux inducer'.

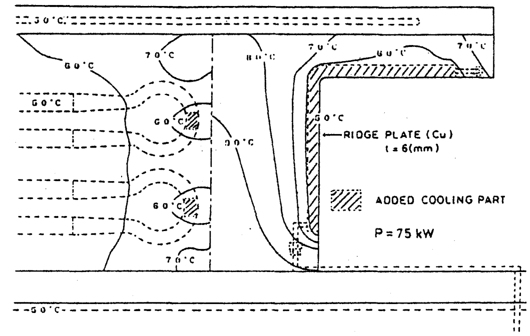

Fig. 2 The modified structure of the magnetic-flux inducer. The inverse L-formed part is water-cooled. The U-formed return parts of the water-cooling pipes are connected with ridge plates by welding.

Figure 2 illustrates the modified structure: (1) The inverse L-formed magnetic-flux inducer is water-cooled. (2) The U-formed return parts of the water-cooling-pipes for the ridge plates have been connected with the copper ridge plates by welding. Through a design mistake, the U-formed returns were free and had no direct contribution to cool this section of the ridge plates. A calculation result of temperature distribution is shown for an input RF power of 75 kW. Good agreement was obtained between the theoretical prediction and the experimental result.

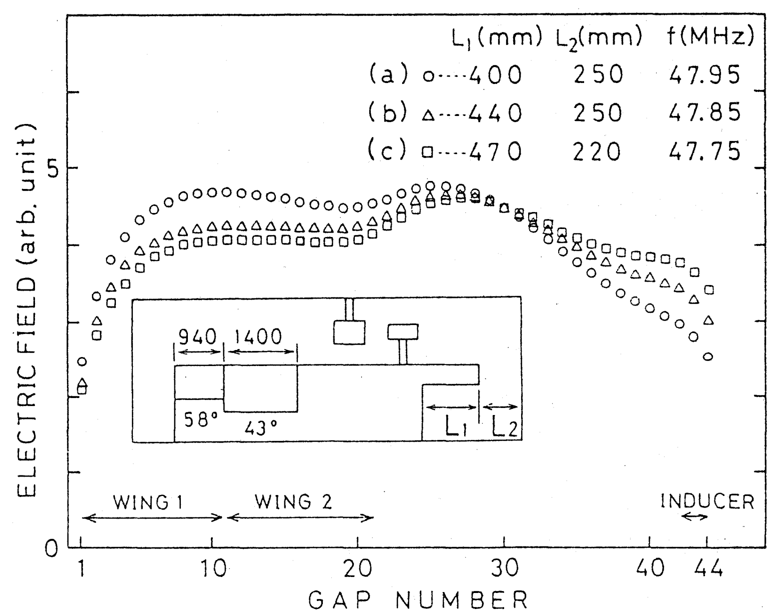

Fig. 3 Accelerating-field distributions measured by means of perturbation method. The parameters are the length of the magnetic-flux inducer L_1 and the distance between the inducer head and the end wall L_2. The normalization was performed to obtain the same total accelerating voltage.

Figure 3 shows accelerating-field distributions measured by means of the perturbation method. The parameters are the length of the inducer L_1 and the distance between the inducer head and the end wall L_2.

The angles and lengths of both pairs of short-circuit wings have been adjusted to obtain a flat field distribution in the low energy section (see the inset).

The form of accelerating field in the high energy section has been adjusted by changing L_1 and L_2. An almost uniform field (c) was obtained.

Figure 4 shows, as an example, a momentum spectrum of ^{35}Cl ions accelerated by the first linac with an RF input power of 72 kW. In addition to the object beam of $^{35}Cl^{9+}$, a beam of $^{35}Cl^{8+}$ is also observed on a pedestal which is caused by the DC beam injection.

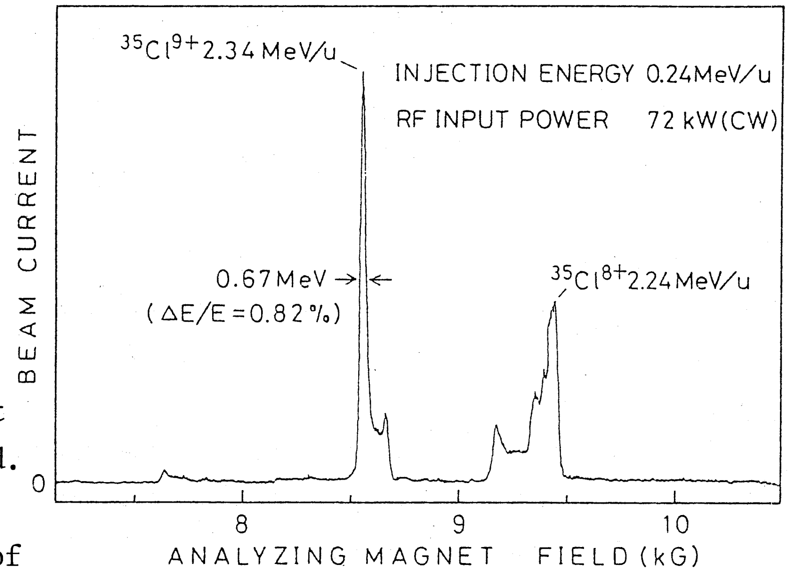

Fig. 4 Momentum spectrum measured using a beam analyzing magnet. A sharp peak of $^{35}Cl^{9+}$ ions was observed at an RF input power of 72 kW. A $^{35}Cl^{8+}$ beam was also seen on a pedestal caused by the DC beam injection.

3. SOME RECENT BREAKDOWNS

Some recent breakdowns which have their origin in the manufacturing process are as follows:

* One of the quadrupoles in the drift tubes has got open circuit. We have opened the drift tube and have found out that the soldering has been broaken between one of the electric leads and the spiral-plate coil.
* The freon flow has been blocked in another drift tube during an RF test operation.
* Two diaphragms which are used for vacuum seal between the cavity wall and drift-tube stems have got pin holes in the welding.
* A copper water-cooling pipe soldered on one of the first short-circuit wings has got a pin hole.

All defects have been or will be removed until the end of July 1987, and we will resume experiments in August to test the synchronized operation between the first and the second linacs.