I－3 PRESENT STATUS OF JAERI LINAC

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Abstract

Major modifications to the linac are summarized which have been made since the completion of the accelerator in 1972. Systems and parts modified are, (1) the electron gun pulser, prebuncher, and beam transport of the injector, (2) accelerating waveguides including a buncher, (3) RF circuits for the first few accelerator sections and (4) beam transport and vacuum systems.

1. Instroduction

It is six years since the completion of the 120 MeV JAERI linac in 1972. Various modifications to the linac have been made during this period, only part of which were previously reported.[1) 2) 3)] Its major modifications so far made are described in this report. Expreriments which are made with the linac will be first briefed.

Two kinds of research were mainly performed so far, one being neutron physics, with TOF (time of flight) method various neutron cross sections have been measured in the neutron energy region of a few volts to about five hundred kilovolts using the linac as a pulsed neutron source. In β-γ spectroscopy nuclear structures of radioisotopes produced with the linac have been studied by measuring β, γ rays and conversion electrons. Other studies made are (1) neutron diffraction study, (2) reactor physics and (3) radioisotope production.

2. Major Modifictions

The systems and parts modifed are sumarized in Table 1. Details of these modifications are presented in other papers. So, they will be described only briefly here.

Table 1 Major modifications of JAERI linac

System	Modified parts
Injector	Gun pulser, Prebuncher, Beam transport
Accelerating waveguides	Buncher, 1st Accelerator, 2nd Accelerator (in plan)
Beam transport, Vacuum	That for buncher, Achromatic Transport That for waveguides
Modulator, Conlrol	That for buncher, PFN Switch, Timming ccircuits

2.1 Injector

Arrangement of the modified injector is shown in Fig.1. Main parts changed concern the electron gun and the prebuncher. Purpose of the modification is to obtain higher currents particularly at short pulse widths. It is advantageous for the gun to be near the accelerator and the drift distance of the prebuncher to be short, using the existing gun. Higher RF power is then required for the prebuncher, so that a prebuncher was newly designed, parameters of which are shown in Table 2.

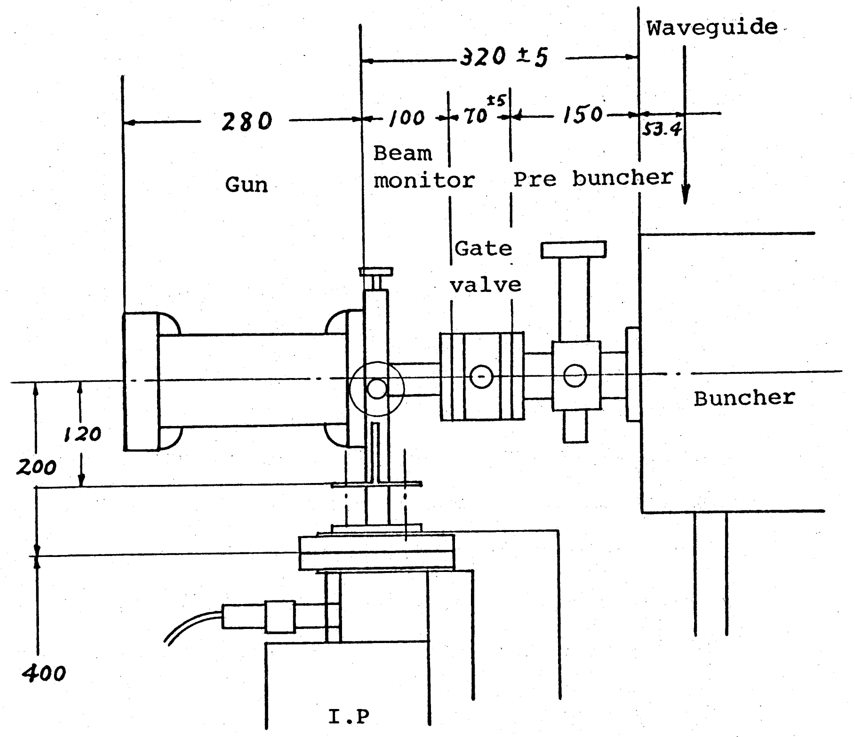

Fig. 1 Arragement of the present injector

2.2 Accelerating Waveguides

The first few accelerator sections are shown in Fig.2 together with the RF waveguides.

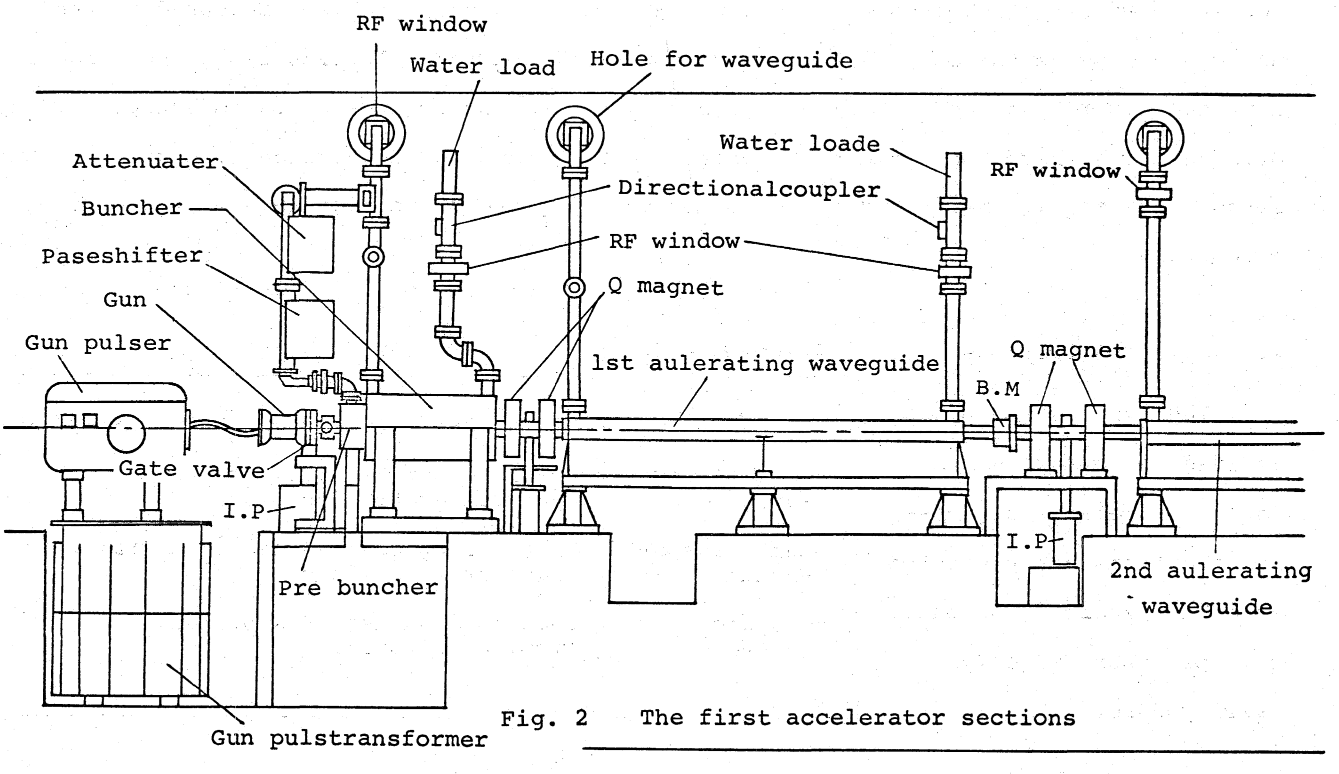

Fig. 2 The first accelerator sections

The most important modification of the accelerator system is the installation of an independent buncher section, which is already reported in refs. 1 and 3. The first accelerating waveguide was replaced last year by a new one, the characteristics of which are shown in Table 3. In the waveguide, hole diameter 2a of the discs changes in four steps, smaller toward the waveguide end, leading to more efficient use of the RF power and higher current by lessening the beam blow up problem.

Table 2 Specifications of prebuncher

1.	Frequency	2856.75 ± 10 MHz
2.	Max RF power	
	peak	50 KW
	Auerage	60 W
3.	Q-Value	500
4.	Cooling	Water,
5.	Temperature	40 °C
6.	Total Length	150 mm

The accelerating waveguide is cooled efficiently with a water jacket for the waveguide and the input and output couplers also cooled.

An accelerating waveguide of the same specifications as in Table 3 is being construed which will replace the existing second accelerating waveguide made in trial because of its inadequate cooling.

2.3 RF system

Corresponding to the new arrangement of the first few accelerator sections and prebuncher, the high power RF waveguides were largely modifed as shown in Fig.2. An RF system with the maximum power of 10 MW was newly made, from which an RF power with the maximum of 40 KW is divided to feed the prebuncher.

The waveguide windows were repositioned from just above the input couplers of the accelerating waveguides to the place where the windows cannot be directly seen from the couplers. The output waveguide windows were also repositioned further away from the output couplers.

Table 3 Specifieations of accelerating waveguide

1.	Type	Approximate constant gradient (four steps)
2.	Number of cavities	61 cavities + 2 couglers
3.	Mode	$2\pi/3$
4.	Frequency	2856.75 ± 0.05 MHz (40°C, Vac)
5.	Phase variation	± 3°
6.	VSWR	≤ 1.05 (at 2856.75 MHz)
		≤ 1.1 (± 1.2 MHz)
7.	Qvalue	≥ 13000
8.	RF power	22 MW (peak)
		25 kW (average)
9.	Disc hole (2a)	26.8, 26.2, 25.4, 24.6 mmϕ
10.	Total length	2300 m

The RF oscillator currently used is a solid-state oscillator as already reported.[2)]

2.4 Beam transport and vacuum systems

Besides the solensid coils required for the buncher, a doublet of quadrupole magnets and a pair of beam steering coils are inslalled between the buncher and the first accelerating waveguide.

At the end of an electron beam line for the neutron experiments a deflection magnet is installed to bend the beam to a neutron producing target. This arrangement, however, suffers from instability of the beam current due to the variation of beam energy in long time measurements. To reduce the instablity, an achromatic beam transport system with two deflection magnets is under construction.

References

1. A.Asami et al., Proceedings of the 1976 Linac Conference at Tohoku Univ. p.3
2. K.Mashiko et al., Preceedings of the 1976 Linac Conference at Tohoku Univ. p.6
3. K.Mashiko et al., Preceedings of the 1977 Lianc Conference at KEK.