HEAVY ION SOURCE FOR IPCR CYCLOTRON

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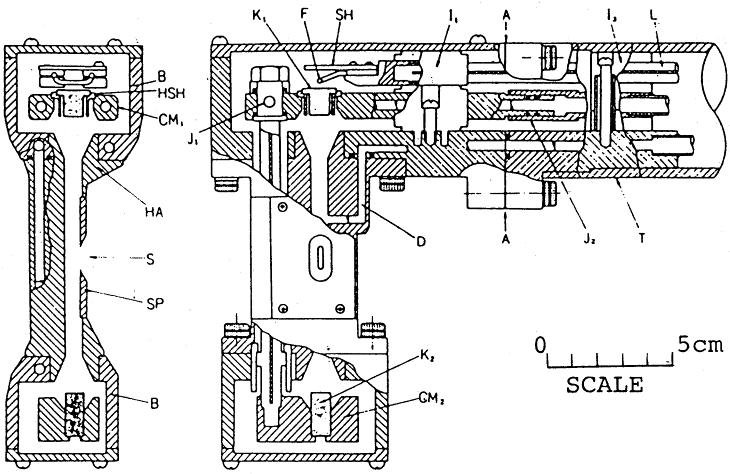
In the IPCR Cyclotron some multiply-charged heavy ions are accelerated for 4000 hours in a year at present. In order to produce the multiply-charged ions two kinds of ion source have been developed: a heavy ion source for a gaseous material to charge and ion source for a metallic material to charge. Fig. 1 shows a cross sectional view of the source for a gaseous material. This source is supported by a single supporting tube (T) and the head part can be removed from the supporting tube at a position indicated by A in Fig. 1. When the life time of the source is over, the head part is exchanged to new one in several minutes and the necessary time to revive the source is about 30 minutes. The source for a metal material was described in the previous sysmposium.[1)]

A gas-feed system consists of two gas-feed lines having a gas flow controller, respectively. Two gas-feed lines are joined near the ion source to feed stably a sample gas mixing two kinds of gas. In Fig. 2 a block diagram of a gas flow controller system is shown. This system is composed of a piezo-electric valve PV-10 made by VEECO, a gas flow controller made by RIKEN and a mass flow meter by HASTING. The valve PV-10 is operated by an electric pulse with a repetition rate of 300 Hz and an amplitude of 80 $\sim$ 100 V supplied by a controller. By varying the pulse duration from 0 to 20 %, one gas flow controller



K_1: hot cathode (W or Ta)
K_2: reflector (W)
F: filament (W)
SH: electron shield (Mo)
CM_1, CM_2: cathode mount (copper, water-cooled)
HSH: cathode heat shield (W)
SP: slit plate (Mo)
J_1, J_2: cooling channel joint
I_1, I_2, I_3: insulator (ceramic)
D: distribution plenum
S: source aperture
L: leading tube
T: suporting tube (stainless steel)
B: anode box (copper)
HA: hot anode (copper)

Fig. 1. Cross-sectional view of the source.

can be remotely controlled over a range of 0 to 10 cc/min and the other from 0 to 5 cc/min.

A method of mixing gas is applied in the production of heavy ions such as C^{4+}, O^{5+}, N^{5+} or Ne^{6+}, to increase beam intensity and stability of source operation. In that case the main gas is fed to the source through one gas-feed line and the supporting gas is fed through the other line. Rare gases, such as Ne, Ar, Kr and Xe are mainly used as the supporting gas.

Reference

1) I. Kohno et al., Proc. 3rd symposium on accelerator science and technology, Osaka, p 71 (1980).

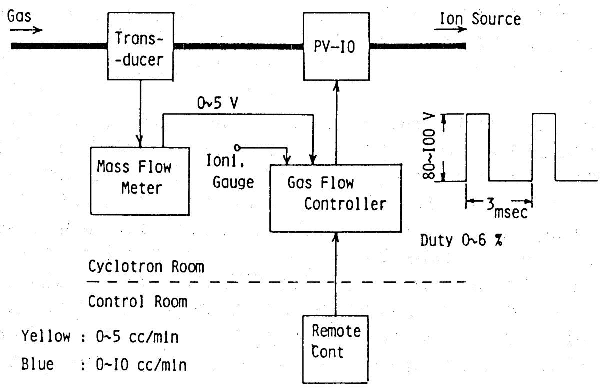


Fig. 2. A block diagram of the gas flow controller system.

Table 1. Particles, energy ranges and particle yields.

Particle	Energy (Mev)	Extracted beam current
C^{4+}	49 - 100	3.0μA
N^{4+}	57 - 100	3.0μA
N^{5+}	57 - 125	0.5μA
F^{5+}	80 - 130	0.3μA
F^{5+}	80 - 150	0.1μA
O^{5+}	65 - 125	0.5μA
O^{6+}	65 - 150	* 0.5μA
$^{20}Ne^{6+}$	82 - 160	* 0.3μA

* Pulsed operation.