CONSTRUCTION OF A 14-MEV MICROTRON OF NIHON UNIVERSITY

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In Nihon University a 14-MeV Microtron has been under construction.

The principle of a microtron was proposed by V. I. Veksler (1) in 1945 and independently by J. Itoh and D. Kobayashi(2) in 1947. In the microtron a resonant accelerating cavity is mounted at the periphery of a uniform magnetic field as seen in Fig. 1. Electrons are emitted from a LaB_6 hot cathode which is placed at a precisely computed position inside a cylindrical cavity(3). They circulate in the magnetic field everytime after passing the cavity. Those which are nearly in phase and energy conditions of resonance can be continuously accelerated under the phase focusing principle. In a last orbit the electrons are extracted by using an iron tube.

The resonance condition of the electrons is expressed as follows:

$$B\lambda = \frac{2\pi E_0}{ec} \frac{(1 + k)}{(\mu - \nu)} ,$$

where B is the magnetic field, λ the wavelength of an RF field, E_0 the rest mass energy of an electron, KE_0 the injection energy, μ and ν some integers. The designed parameters are shown in Table 1, corresponding to $\mu = 2$ and $\nu = 1$ in the above formula.

Most of the components have been already fabricated, and the whole system has been almost assembled. Small irregularities in the magnetic field cause shift of orbits and beams hit on the lip of the cavity. Therefore, trimming coils are designed to solve it. The oscillator which feeds power into the cavity is 1.9-MW magnetron. This is coupled to a V. S. monitor, a phase shifter, a circulator, a variable attenuator, a directional coupler, a window and a cavity. The resonant frequency and Q - value of the cavity are measured in cold tests.

An accelerator building is under designing, and it will be completed by next spring in the Narashino Campus.

Reference
(1) V. I. Veksler, J. Phys. USSR 9 (1945) 153
(2) J. Itoh and D. Kobayashi, Kagaku 17 (1947) 34
(3) S. P. Kapitza et al, Soviet phys. JETP 14 (1962) 266

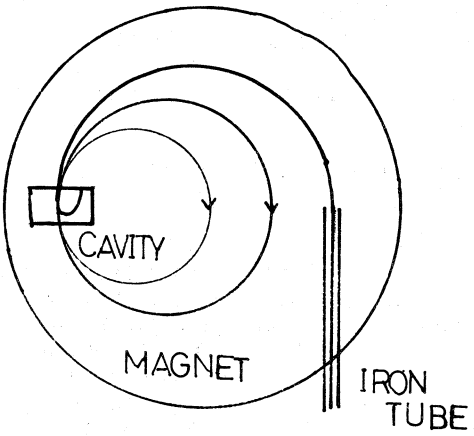

Fig.(1) Orbits in Microtron

Table I

parameters of the microtron

Maximum energy	14 MeV
(Expected) peak current	50 mA
Number of orbits	24 turns
Diameter of the last orbit	80 cm
Injection energy	613 KeV
Equilibrium voltage	563 KeV
Magnetic field	1180 gauss
pole pieces diameter	100 cm
Height of gap	12 cm
Working vacuum	10-6 torr
Cavity diameter	3.80 cm
height	1.67 cm
loaded Q	2500
Resonance frequency	2998 MHZ
Magnetron peak power	1.9 MW
pulse width	4 μS
repetition rate	50/second

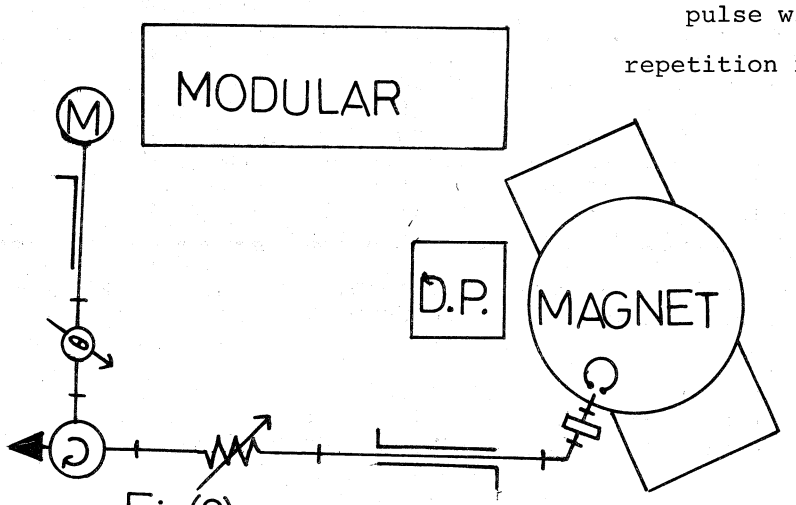

Fig.(2) Whole system