PLAN OF CYCLOTRON RESEARCH CENTER, HIROSHIMA UNIVERSITY

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Abstract: Plan of the center in Hiroshima University is described. The accelerator is an injector AVF cyclotron of k=100 MeV and a separate sector cyclotron of k=300 MeV. The cyclotrons which accelerate mainly light ions will be used to study many fields of science.

Purpose of the Cyclotron Research Center is to study various fields of physics, chemistry, biology, engineering, agriculture and medicine, and also to supply short-lived radioisotopes. The center will be placed at new campus of Hiroshima University.

The accelerator consists of the first and the second cyclotrons. The first one is an AVF cyclotron of k=100 MeV, which is commercially available. The second one is a separate sector cyclotron of k=300 MeV (4 sector) as shown in Fig. 1. The specifications of the cyclotrons are shown in Table 1.

The first cyclotron accelerates protons, light ions and light heavy ions. The accelerated beam is split into two parts, one of which is injected to the second cyclotron and the other is led to experimental area. The second cyclotron accelerates mainly the proton beam, but it is also designed for other light ions. The beam from the second cyclotron is again split into two parts, which are led to experimental rooms and a medical irradiation room. Then three irradiations can be performed at the same time. Plan view of the cyclotron building is shown in Fig. 2.

Main apparatus for experiments are an on-line mass spectrometer, radioisotope production systems, a vertical irradiation system for medicine and a deta handling computer system.

Users of this accelerators are expected to be in various fields of science at Hiroshima University and also other

Table 1. Specifications of the cyclotrons

	First cyclotron	Second cyclotron
Type	Ordinary AVF	Separate sector
Particle energy		
Protons	8∿ 80 MeV	140∿250 MeV
Alphas	15∿100 MeV	130∿300 MeV
Magnet		
Number of sector	4	4
Weight	200 ton	220 x 4 ton
Extraction radius	93 cm	300 cm
Main power	300 kW	120 x 4 kW
Oscillator		
Number of oscillator	2	2
Frequency	11∿22 MHz	11∿22 MHz
Power	240 kW	150 x 2 kW

universities. The proton energy of 250 MeV fits studies of very neutron-deficient nuclei and π-meson produced nuclear reactions, and the medical tomography.

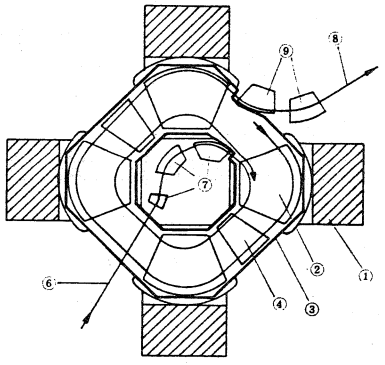
Following characteristic experiments are expected, and other experiments are also acceptable.

a) Study of very short-lived nuclides. Atomic masses of short-lived nuclides are determined with the on-line mass spectrometer. Nuclear spectroscopy and Laser spectroscopy are performed with the on-line mass spectrometer and a He jet system. Short-lived nuclides are also chemically separated by means of the electrophoresis.

b) Solid state physics and chemistry. Lattice defect and colour center are investigated by using the channeling effect and the ion implantation. Radiation damage for semiconductor and Mössbauer effect of chemical compounds are also studied.

c) Trace analysis of environmental samples. The particle induced X-ray emission method is applied to analysis of air and water pollution samples by using beams accelerated with the first cyclotron. The activation analysis is also adopted for trace analysis of elements C, N, O, Mo, Pb and Bi.

d) Medical study and treatment. The 150 MeV proton beam and the 300 MeV alpha beam are used for radiotherapy of cancer. The proton tomography will be developed by using the 250 MeV proton beam. Many kinds of radioisotopes for the nuclear medicine are produced with the first cyclotron.



1. Magnet yoke
2. Magnet pole
3. Vacuum chamber
4. Dee
5. Oscillator
6. Injection beam
7. Injection magnet
8. Extraction beam
9. Extraction magnet

Fig. 1 Layout of the separate sector cyclotron

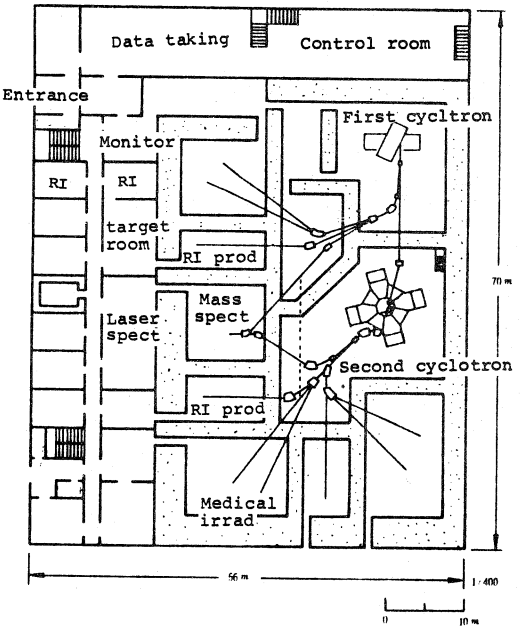


Fig. 2 Plan view of the cyclotron building