THE RCNP INTERMEDIATE ENERGY PARTICLE ACCELERATOR COMPLEX

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An intermediate energy particle accelerator complex has been proposed as a new accelearator facility of Research Center for Nuclear Physics. This variable energy accelerator complex covers a wide energy range above the present RCNP cyclotron and acceleartes ions from proton through uranium with high intensity and good beam quality. Nuclear sound wave velocity (20MeV/amu.) will be cleared by this accelerator complex. Proton of 550 MeV are available for the Meson Factory.

The proposed facility[1)2)3)] consists of two ring cyclotrons, an ordinary AVF cyclotron (light ion injector) and a Wideröe type variable frequency linac (heavy ion injector). The layout of the facility is shown in Fig.1. The characteristics of the cyclotrons are given in Table 1.

The construction period of this complex can be divided into three phases. In the phase 1, the injector cyclotron and the first ring will provide energies up to 190 MeV and 56 MeV/amu for protons and light ions, respectively. The second ring is added in the phase 2, and the energy range will be extended up to 550 MeV and 118 MeV/amu for protons and light ions, respectively. Finally the injector linac will increase the energies and intensities of the heavy ions. Uranium ions will be accelerated up to 12.6 MeV/amu. Fig.2 shows expected maximum energies of this proposal on the phase 1,2 and 3 with several major projects.

For the first phase a ordinary AVF cyclotron has been proposed as a light ion injector. However, more sophisticated injector is desirable to get high intensity and high quality beams a connected sector magnet cyclotron with an axial injection and a separated sector cyclotron with a Cockcroft-Walton preinjector have been examined[4)] as alternative of the ordinary AVF cyclotron. These alternative with powerful external heavy ion sources can be used as the heavy ion injector of this compoex.

The plan view of the 1st ring and the 2nd ring is shown in Fig.3. Both the ring magnets have 8 cm gaps and the Rogowski's edges. The 1st ring has four 33° radial sectors. The 2nd ring has eight spiral sectors. Variable frequency single gap cavities are used for accelerations. The maximum acceleration voltages for the 1st ring and the 2nd ring are 0.8 MV/turn and 2 MV/turn, respectively. The turn separations at the extraction radii are 8 mm and 5 mm for the 1st ring and the 2nd ring, respectively. Each injection system of the rings consists of magnetic injection shim and electrostatic

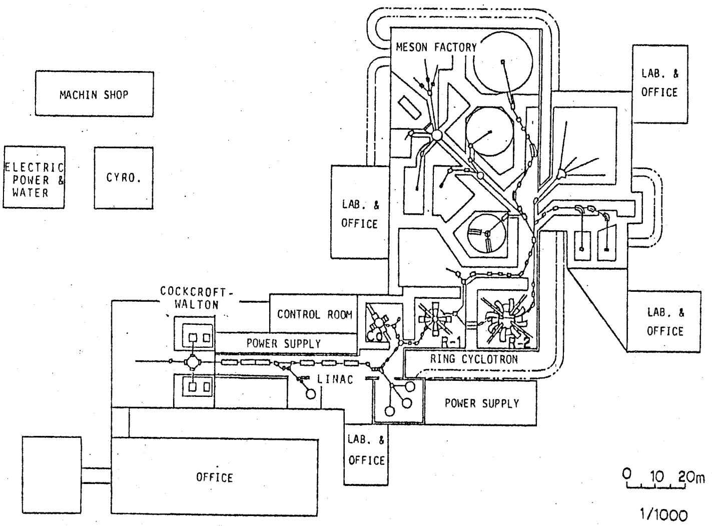

Fig. 1 Layout of the proposed accelerator complex.

Table 1

Characteristics of the cyclotrons

	INJECTOR CYCLOTRON	1st RING	2nd RING
No. OF MAGNETIC SECTOR	4	4	8
MAGNET FRACTION	1.0	0.37	~ 0.42
SECTOR ANGLE		33°	~19°
INJECTION RADIUS		1.3 m	3.4 m
EXTRACTION RADIUS	0.65 m	3.4 m	4.7 m
MAGNET GAP	18.5 cm	8 cm	8 cm
MAX. MAGNETIC FIELD	18.5 kG(8)	16 kG	18.3 kG
K-VALUE(INJ) FOR H.I.		30 MeV	230 MeV
K-VALUE(EXT) FOR H.I.	70 MeV	230 MeV	460 MeV
MAGNET WEIGHT	160 Ton	1200 Ton	1600 Ton
MAIN COIL POWER	200 kW	400 kW	600 kW
No. OF TRIMMING COILS	5	30	60
TRIMMING COIL POWER	20 kW	150 kW	200 kW
No. OF CAVITY	2	2	4
RF FREQUENCY	20 ~ 32 MHz	20 ~ 32 MHz	20 ~ 32 MHz
MAXIMUM VOLTAGE	50 kV	400 kV	500 kV
RF POWER	30 kW × 2	150 kW × 2	200 kW × 4

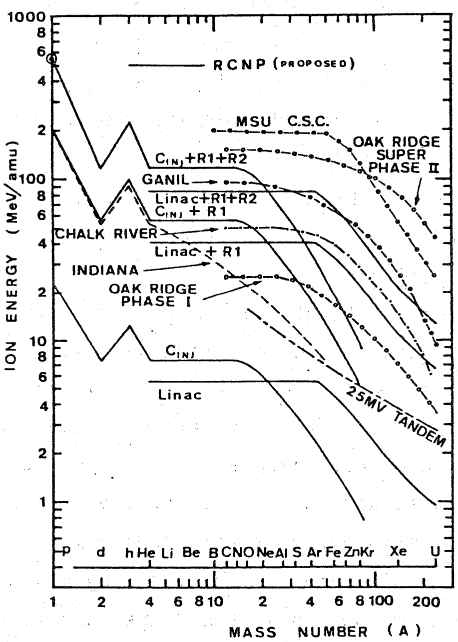

Fig. 2 Expected maximum energies of various ions for this proposal and several major projects.
C_{inj} : injector cyclotron.
R1 : 1st ring. R2 : 2nd ring.

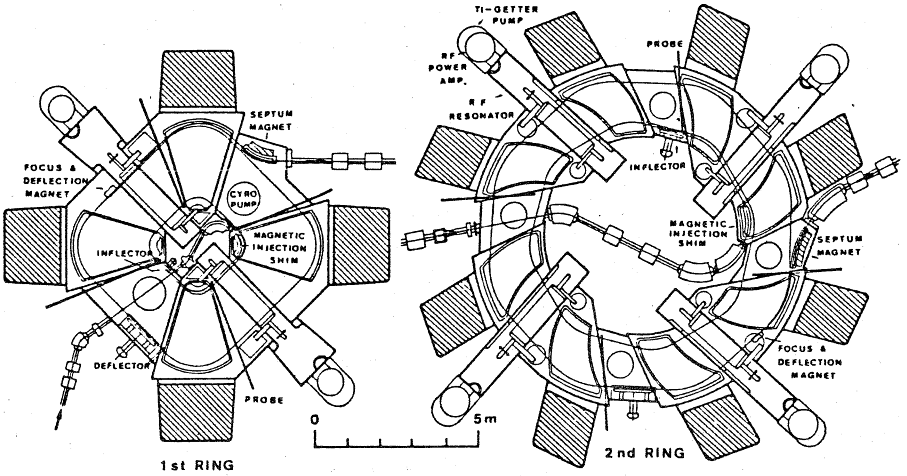

Fig. 3 Plan view of the 1st and 2nd ring.

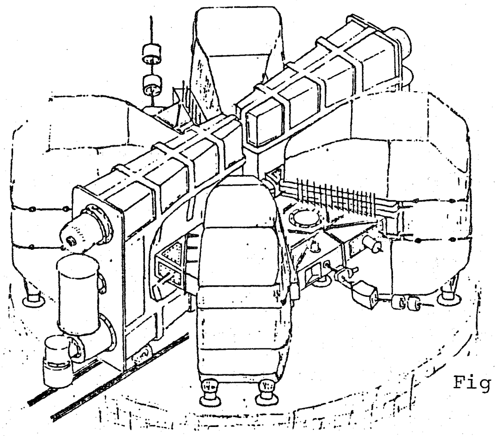

Fig. 4 Layout of the 1st ring.

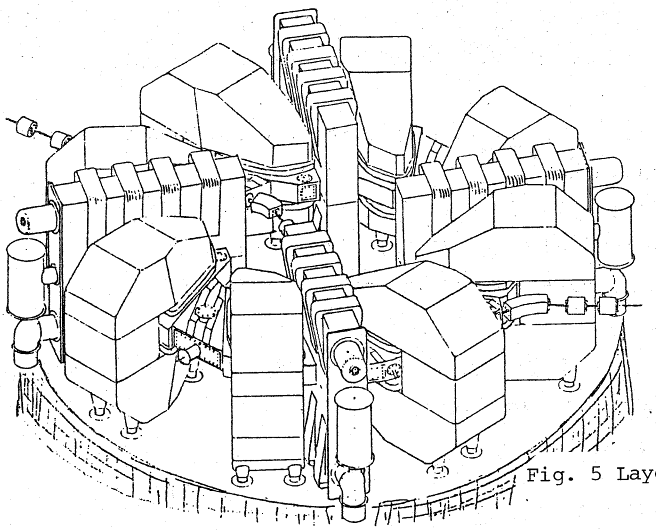

Fig. 5 Layout of the 2nd ring.

inflector. Each extraction system of the ring consists of electrostatic deflector, septum magnet and auxiliary focus-deflection magnet.

A 1/3.5 scale model magnet of the 1st ring and a 1/4 scale model magnet of the 2nd ring are used to study various magnetic field properties[5]. Preliminary analysis based on the measured magnetic field shows a good agreement with the prediction of the modified Spy-Ring code[6][7][2] which was used with the code TRIM on the initial design of this proposal. However several corrections on the shape of the sector must be done for the 2nd ring to accelerate protons up to 550 MeV. Studies on injection and extraction systems of the rings are being also studied with these model magnets[8].

A preliminary study of variable frequence single gap cavities for the 1st and 2nd ring was done with 1/10 scale models. Each model covers the proposed frequency range of model (200∿320 MHz). These radially offset single gap cavities with tuning plate, shown in Fig. 3, produce radially increasing RF voltage[9].

Fig. 4 and Fig. 5 show the layout of the 1st and the 2nd ring respectively. The Details of the design studies[4][5][8][9] are presented at this symposium.

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