

MODEL STUDIES FOR THE MAGNETS OF THE RING CYCLOTRON PROJECT IN RCNP

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An intermediate energy particle accelerator complex is being designed as a new accelerator facility of RCNP. The proposed facility¹⁾ consists of two separated sector cyclotrons, an injector cyclotron as an injector for light ions and a Wideroe type variable frequency linac as an injector for heavy ions. Magnetic field studies have been started for the 1st and 2nd rings. A 1/3.5-scale model magnet of the 1st ring and a 1/4-scale model magnet of the 2nd ring have been made to study various magnetic field properties. The magnetic field characteristic of these models and the results of orbital analyses are described.

Model Magnet of the 1st Ring

A 1/3.5-scale model magnet of the 1st ring has been prepared to study various magnetic field properties. The model magnet weighs about 8-tons. The radial pole edges are shaped stepwise into a Rogowski's curve with a numerically controlled milling machine. The designed maximum flux density in yoke is about 15 kG. The gap width is 22.9 mm.

A single F.W. Bell Hall probe have been used for magnetic field measurements. The mean temperature coefficient of the probe is quoted as ± 50 ppm/ $^{\circ}\text{C}$. Thus no attempt has been made to regulate temperature of the probe, nor to correct the Hall voltage with the temperature coefficient. The Hall probe is mounted on an end of aluminum arm stretched from probe carriage^{2,3)} to the center line of the model magnet. Magnetic field mapping has been made on a cartesian grid. The mapping hardware is interfaced to a computer for automatic measurements³⁾.

Figure 1 displays a typical map of the magnetic field at a excitation level of 100 A (10 kG). Orbital properties of the 1st ring have been studied using these measured fields. Figure 2 shows the calculated isochronous fields for maximum energies of various ions as a full-scale radius. Figure 3 shows the radial and axial focusing frequencies calculated with fields isochronized except in the region near injection and extraction. We will be free of instabilities caused by the essential resonances. The required radial field gradient for isochronism shown in fig.2 will be produced by trim coils mounted onto the pole faces. The trim coils for a 1/3.5-scale model magnet have been designed and the fields are being measured.

Model Magnet of the 2nd Ring

A 1/4-scale model magnet of the 2nd ring has been also prepared to study various magnetic field properties. Plan and side views of the model magnet, weighing about 5-tons, is shown in fig. 4. The radial pole edges are also shaped into a Rogowski's curve. The gap width is 20 mm. The measuring system of the magnetic fields is same as that for the 1st ring.

Figure 5 shows a typical map of the magnetic field at a excitation level of 100 a (10 kG). Figure 6 shows calculated isochronous fields for various ions as a full-scale radius. Figure 7 shows the radial and axial focusing frequencies calculated with fields isochronized except in the region near injection and

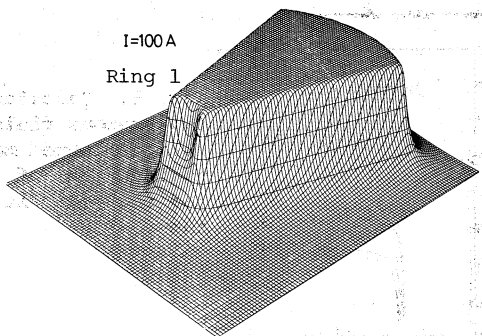


Fig. 1. A three dimensional display of a magnetic field at a excitation level of 100 A (10 kG).

