MAGNET MODEL STUDY FOR A PROPOSED RING CYCLOTRON AT RCNP

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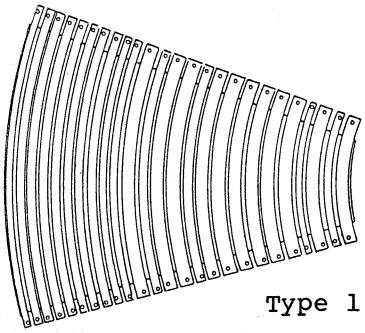
Abstract

An intermediate energy particle accelerator complex is being designed as a new accelerator facility of RCNP. A 1/3.5-scale model magnet with trimming coils for a 4-sector separated cyclotron was made. The effective field characteristics of the trimming coils are presented and isochronous fields produced by the trimming coils are discussed.

Trimming coils A 1/3.5-scale model magnet[1] of the proposed 4-sector separated cyclotron(SSC)[2] was made to study various magnetic field properties. The magnetic field characteristics of the model and the results of orbital analyses were presented elsewhere[1]. In order to accelerate various ions and to provide various energies, the required radial field gradients for isochronisms are produced by trimming coils which are mounted onto the pole faces. We made two types of 25 trimming coil pairs which are circular trimming coil pairs (type 1) and Gordon-type trimming coil pairs (type 2). The plan views are shown in fig. 1. The trimming coil pairs were made by Cu-sheets of 2mm in thickness. The sheets were stuck on epoxy resin plates of 2mm in thickness. The radial width of each coil is either 20mm or 30mm.

Effective fields of trimming coils The effective fields of each trimming coil of type 1 at several base fields were measured radially in the middle of the sector magnet with a single Hall generator. On the other hand, the effective fields of each trimming coil of type 2 were measured with a probe assembly consisting of 6 Hall generators in order to keep the time of measurement to minimum, because it was necessary to measure 50,000 mesh points for a trimming coil pair at a base field.

Figure 2 shows the effective field of each coil of type 1 at a base field of 14.8 kG. These were plotted radially in the middle of the sector. Figure 3 shows the mean effective field of each coil of type 2 at a base field of 10 kG. There was a problem in matching the isochronous field by using the effective field data of trimming coils at a base field which has no radial field gradient, because the effective fields of trimming coils vary with the strength of the base field. Figure 4 shows the modified effective field data of type 1 trimming coils at a base field which has radial field gradient corresponding to 193 MeV-proton isochronous field. In order to provide the isochronous field of 193 MeV protons, the trimming coil currents were calculated using the modified effective fields. Figure 5 shows a comparison of the measured field with the ideal isochronous field. In the same method, we are trying to provide isochronous fields using the type 2 trimming coils.



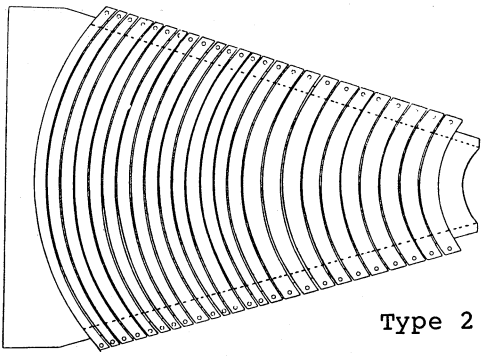
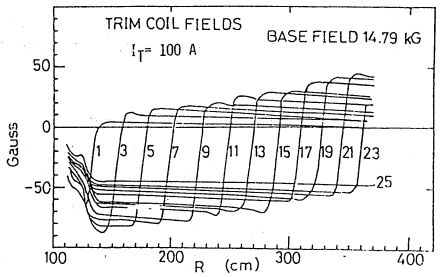


Fig. 1 Plan views of two types of trimming coils.



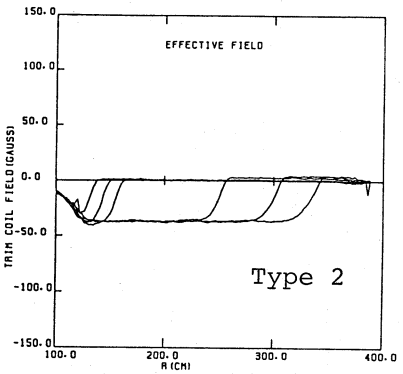


Fig. 2 Effective fields of trimming coils at a base field which has no radial field gradient.

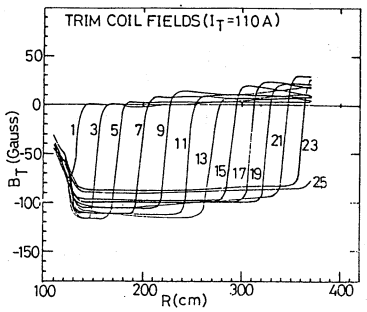


Fig. 3 Effective field of trimming coils at the base field with radial field gradient.

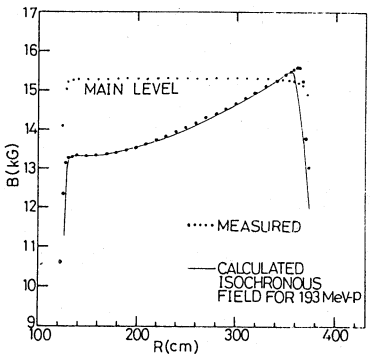


Fig. 4 A comparison of the measured field with the ideal isochronous field for 193 MeV-p.

References:
1) K. Hosono et al., Proc. 9th Int. Conf. on cyclotron and their applications, Caen (1981) p. 379
2) I. Miura et al., Proc. 9th Int. Conf. on cyclotron and their applications, Caen (1981) p. 89