ON THE OPTIMIZATION OF MAGNETIC FIELD CORRECTION SYSTEM OF THE ISOCHRONOUS CYCLOTRON

R.Ostojić, M. Manasijević, Lj. Milinković, K.Subotić
Boris Kidrič Institute of Nuclear Sciences, Vinča

The flexibility of the isochronous cyclotron as a multipurpose machine strongly depends on the performace of the magnetic field correction system. Since there exist very stringent limitations on the possible trim coil power dissipation, which limit the trim coil power to 3-5 kW, there is an obvious need to improve the efficiency of the magnetic field correction system.

The performance of the magnetic field correction system can be controlled by (1) the choice of the operating point in the (B_o, η) space, and by (2) the geometrical properties of the trim coils as given by their form factor. No systematic study of the magnetic field correction system has been made for the conventional isochronous cyclotron. High non-linearity of the magnetic circuit at magnetic fields near saturation is the reason why the operating point in the (B_o, η) space has been obtained by iterative procedure of shimming the magnetic field. Thus of the two parameters that set the operating point, (1) pole tips shimming, (2) excitation of magnetic circuit, the former has been highly exploited.

Our study of the cyclotrons CGR 680, U-200P and the cyclotron of the University of Milan, shows that the power dissipation of a magnetic field correction system can be minimized by properly shaping the main coils field, and further improved if the main coil is split into indipendently excited sections. A study of the effect of the form factors of the trim coils on power consumption is also made, and optimal form factor is discussed.