

LIMITING FACTORS IN THE DESIGN OF ISOCHRONOUS CYCLOTRONS  
IN THE CONVENTIONAL AND SUPERCONDUCTING TECHNOLOGY

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The basic conditions that must be fulfilled by the magnetic field of the isochronous cyclotron are: (1) the conservation of appropriate phase of the accelerated particles in relation to the accelerating field, which is accomplished by isochronating the magnetic field, and (2) axial stabilization of the beam by azimuthally varying magnetic field, which is generated by symmetrically located sectors of the cyclotron magnet.

Apart from the higher magnetic field in the median plane, superconducting magnets of the current generations are very similar to the conventional magnets of the room temperature isochronous cyclotron. The inductions in the median plane in the superconducting cyclotron are of the order of 3-5 T, in relation to the maximum induction of 2.2 T in the conventional version. Differences in the magnitude of magnetic field lead to important differences in the technology of the two types of cyclotron magnets, and also imply differences in the typical performances of the two magnets as solutions to acceleration of a wide spectra of particles (from protons to uranium) to a wide range of energies. Results of comparative study of the performance of superconducting and conventional magnets are discussed.