OPERATING CHARACTERISTICS AND BEAM DYNAMICS IN THE SUPERCONDUCTING CYCLOTRON

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Introduction of superconducting main coils in the cyclotron has had a fundamental implications on the properties and limitations of such a machine as a multiparticle accelerator. The crossover of the region of central fields around 2T, where nonlinearities of the magnetic circuit due to saturation are the limiting factors in improvement of room temperature machines, stresses certain properties of superconducting magnets which strongly influence the operating characteristics and beam dynamics.

The operating characteristics of the superconducting magnet have been studied in a general approach, and limiting regions in the (B_o, η) space analysed. Emphasis has been given to the bending and focusing properties of the superconducting magnet, as well as to limitations arising from the behaviour of the beam at extraction radius.

General properties of beam dynamics in the superconducting magnet have been analysed. Analytical approach, in the frame of Hagedoorn-Verster theory, stresses the importance of the $\nu_r + 2\nu_z = 3$ resonance, which is practically insurmountable for a noncentered beam. An analysis of the effect of the radial cut at extraction on the behaviour of the beam has been made, and regions of critical focusing are discussed.