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Field Mapping System for a 230 MeV Superconducting Cyclotron

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A superconducting cyclotron is designed and under construction at China Institute of Atomic Energy to provide 230 MeV proton beam for cancer therapy. The fine machining of the main magnet will be finished soon and then the iterative shimming process is normally performed to get the ideal isochronous field, which requires the relative measured field error should be within 10-4. A searching coil sensor mapping system is established to satisfy the measurement accuracy requirements, including a nuclear magnetic resonance (NMR) probe to measure the field at the cyclotron center precisely and a moving searching coil to obtain the field differences. Moreover, a hall probe is integrated in the system to verify the field data. A measurement apparatus is designed to move the searching coil and hall probe in the median plane, focusing on the positioning accuracy and mechanical stability. A highly automated control software is developed to complete the movement and data collecting with operator interface and data storage. In this paper, the field measurement requirements are listed, the field mapping devices selection are described with reasons and the field mapping system, including mechanical structure and control system, are presented in detail.

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