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Wed-Mo-Po3.04-05 [25]: Lightweight design of superconducting magnets for a rotating gantry with active shielding

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A rotating gantry enables charged particles to be delivered to a tumor with great accuracy in heavy particle therapy. Hence, cancer therapy that does not damage a patient can be realized with a rotating gantry. The world's first rotating gantry composed of superconducting magnets was developed in the National Institutes for Quantum and Radiological Science and Technology in 2015. Using superconducting magnets instead of conventional magnets, it became possible to make a lighter, smaller rotating gantry.
The superconducting magnet for the rotating gantry consists of a cosine-theta superconducting coil surrounded with an iron yoke which is the heaviest part of the magnet's weight. The weight of one superconducting magnet reaches several tons, and the rotating gantry is composed of ten superconducting magnets. Accurate rotation control is required under the condition that the magnets of several ten tons are mounted on the frame of the rotating gantry. In this study, a superconducting magnet composed of an active shield coil for the gantry has been proposed for the purpose of simplifying the control system and the frame structure of the rotating gantry by reducing its weight. The magnet's weight can be reduced by using an active shield coil instead of an iron yoke to shield the leakage magnetic field. The lightweight design of a superconducting magnet with active shielding for a rotating gantry is presented.

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