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Rotating gantry for heavy ion therapy mounted with superconducting bending and focusing magnets

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This paper describes the design and the test result of the world's most compact rotating gantry for heavy ion therapy system mounted with superconducting bending and focusing magnets that is successfully installed in East Japan Heavy Ion Center Faculty of Medicine, Yamagata University, Japan. Rotating gantry is a cylindrical irradiation equipment with magnets for beam transport and beam scanning that delivers energetic carbon ions up to 430 MeV/u precisely to a tumor from any direction without changing the posture of the patient. On the other hand, because of the high magnetic rigidity of therapeutic carbon ions, the size of rotating gantry was too huge to install in general hospitals. Therefore, the first superconducting rotating gantry had been developed and installed in collaboration with QST-NIRS. At Yamagata University, a project to construct a heavy ion therapy facility has been started from 2015, which includes a rotating gantry port with superconducting magnets in addition to the fixed horizontal port. In the project of Yamagata University, to achieve further downsizing of the rotating gantry, the length of scanning irradiation system is shortened and the magnetic field of the superconducting magnet is increased from the first superconducting gantry at QST-NIRS. As a result, the gantry is downsized to 2/3 of the first superconducting rotating gantry. This next generation small superconducting rotating gantry has already been installed and is working for preclinical commissioning at Yamagata University. In this study, we will report this next generation small superconducting rotating gantry and its superconducting magnet.

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