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Design of the conduction-cooled HTS coils for rotating gantry

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The carbon ion cancer therapy is widely spreading because of its high curative effects and low burdens on patients. The carbon ions are delivered to patients through some electromagnets on the rotating gantry. A rotating gantry is an attractive irradiation equipment, because the carbon ions can be irradiated to a tumor from any direction without changing the posture of the patient. On the other hand, because of the high magnetic rigidity of carbon ions, the weight of the rotating gantry for the carbon cancer therapy is about 3 times heavier than one for the proton cancer therapy, according to our estimation. Downsizing the rotating gantry for the carbon cancer therapy is considered by applying high temperature superconducting (HTS) magnets. The weight target is less than 200 t that is equivalent to the weight of the disseminated rotating gantry for the proton cancer therapy. In this study, magnet constitutions of the rotating gantry and superconducting magnets were designed from beam optics. When applying the high temperature superconductors to accelerator magnets, some problems should be considered, for example, influence of tape magnetization and manufacturing accuracy on the field quality, the thermal stability of the conduction-cooled HTS coils under alternating magnetic field, and the coil protection methods from thermal runaway caused by anomaly thermal input such as beam loss. Firstly, the thermal stability of conduction-cooled HTS coils was simulated numerically, and the thermal runaway current was calculated in static situation. The calculated results will be presented.

Primary author: TAKAYAMA, Shigeki (Toshiba Corporation)

Co-authors: Ms YAMAGUCHI, Akiko (Toshiba Corporation); Mr KOYANAGI, Kei (Toshiba Corporation); Dr TASAKI, Kenji (Toshiba Corporation); Prof. AMEMIYA, Naoyuki (Kyoto University); Prof. OGITSU, Toru (KEK); Dr KURUSU, Tsutomu (Toshiba Corporation); Mr ISHII, Yusuke (Toshiba Corporation)

Presenter: TAKAYAMA, Shigeki (Toshiba Corporation)

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