



Contribution ID: 435

Type: Poster

Sat-Mo-Po.02-10: Improvement of bending magnet iron yoke design for a compact heavy-ion therapy synchrotron

Saturday 5 July 2025 09:30 (1h 45m)

A project to develop a compact heavy-ion therapy system has been initiated at the National Institutes for Quantum Science and Technology in Japan. This therapy system uses a 430-MeV/u synchrotron with four 90-degree bending superconducting magnets. The bending magnets have been designed to generate central dipole fields from 0.3 T to 3.5 T at the ramping rate of 0.64 T/s, and each magnet is operated by a conduction-cooling system with GM cryocoolers. The magnets are required to provide field homogeneity in the order of 10^{-4} . In the previous study, the NbTi wire alignment and the iron yoke shape were conceptually designed for the required field quality.

To realize stable operation of the conduction-cooled superconducting magnets, it is preferable to lower a maximum energization current and a load line ratio. The iron yoke design has been reviewed to reduce the operation current while keeping the field strength and quality. By optimizing the holes in the cross section of the iron yoke, the maximum energization current could be reduced by 5%. In addition, the eddy current generated in the iron yoke was analyzed, and the slits at the top and bottom of the iron yoke have been introduced to reduce the ac loss due to the eddy current. The improved iron yoke design will be reported as well as the results of the field quality assessment.

Author: MIZUSHIMA, Kota (National Institutes for Quantum Science and Technology)

Co-authors: FUJIMOTO, Tetsuya (Accelerator Engineering Corporation); YANG, Ye; MATSUBA, Shunya (National Institutes for Quantum Science and Technology); Dr MIYATAKE, Tatsuhiko (National Institutes for Quantum Science and Technology); ORIKASA, Tomofumi (Toshiba Energy Systems & Solutions Corporation); TAKAYAMA, shigeki (Toshiba Energy Systems & Solutions Corporation); AMANO, Saki (Toshiba Energy Systems & Solutions Corporation); KAWASAKI, Ryuto (Toshiba Energy Systems & Solutions Corporation); IWATA, Yoshiyuki (National Institutes for Quantum Science and Technology)

Presenter: Dr MIYATAKE, Tatsuhiko (National Institutes for Quantum Science and Technology)

Session Classification: Sat-Mo-Po.02 - Magnets for Other Medical Application III