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Tue-Af-Po2.19-12 [51]: Reduction of ac loss in HTS coils of superferric magnets for rapid cycling synchrotrons by changing iron yoke geometry

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We have been studying the potential of energy consumption reduction in rapid cycling synchrotrons (RCSs) by using superferric magnets with high temperature superconductor (HTS) coils. In our previous research, we developed a three-dimensional electromagnetic field analysis model for superferric magnets, and analyses were conducted on superferric magnets in several kinds of RCSs designed for accelerator-driven nuclear transmutation systems. Analysis results of the designed superferric magnets indicate that ac loss is concentrated on the coil ends that are not surrounded by iron yoke.
In this paper, we aim to reduce the ac loss in HTS coils of the superferric magnets designed in previous research by changing their iron yoke geometries. We assumed that the large ac losses in coil ends are caused by leaked magnetic flux density at coil ends. Then, effects of several ac loss reduction approaches will be studied by numerical analyses based on this assumption. For example, using thicker iron yoke may reduce the ac losses at coil ends, because thicker iron yoke has more margin to saturation and therefore leaked magnetic flux will be less. Also, adding field clamps to coil ends is another possible approach to ac loss reduction, as it can guide magnetic fluxes and reduce the magnetic flux density at coil ends. When changing geometry of iron yoke, we will make sure that the changed magnets satisfy the requirements of the RCS (magnetic flux density, field uniformity, magnet size, etc.).

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