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Fri-Mo-Po.04-03: Design and Optimize of Gradient and Shim Coils for 1T Halbach Magnets

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The Halbach magnets are assembled from multiple magnetic pole modules according to certain rules. Due to its small size, it can be made into desktop magnetic resonance equipment and have wide applications in food composition testing and chemical composition detection areas. Because of the use of permanent magnetic materials and assembly processes, the magnetic field uniformity of Halbach is relatively low. After manual field shimming, the uniformity within a 1 cm sphere radius is about 300 ppm. After room-temperature field auto shimming, it can reach within 10 ppm. This paper will introduce the design and analysis of the shim coil and gradient coil based on the separated conductor method and target field optimization method. The magnetic field uniformity after field uniformization is better than 10 ppm, and the gradient field intensity reaches 25 Gs/cm. By introducing a current density penalty factor to optimize the power consumption of the gradient coil, this paper will introduce the design and optimization process of the gradient and field uniformization coils and the subsequent test results.

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