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Thu-Mo-Po4.12-07 [94]: Research Magnets with High-Field Uniformity

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Magnets with good field uniformity in a good-field region (GFR) of a certain volume are of interest for various research and calibration applications. Due to their simplicity and relatively low cost, Helmholtz coils have been the preferred magnet system for such projects. With air cooling, the magnetic flux density possible with Helmholtz coils is limited to typically 1 mT or below, and field uniformity in the GFR is about one percent. A novel design based on patented double-helix (DH) or Constant-Cosine-Theta (CCT) winding configurations offer better field uniformity in the GFR (order of 1×10^{-4}) and enable much higher levels of flux density due to a much higher transfer function. The novel systems can reach flux density levels of 10 mT with air cooling based on a cooling design in which all parts of the conductor are in direct contact with the airflow. The systems can be built with one, two or all three magnetic axes. The coil configurations and complete designs of such systems with superior performance than Helmholtz coils are presented.

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