Contribution ID: **803** Type: **Poster Presentation**

C2Po1E-03 [27]: A 3T MRI magnet based on MgB2 strand for cryogen free operation –magnetic, mechanical and thermal FEM modeling

Tuesday, 23 July 2019 09:00 (2 hours)

We performed magnetic, mechanical, and thermal modeling of a 3T, actively shielded, conduction-cooled, whole-body MRI magnet. The design had a magnet length and conductor length comparable to NbTi helium-bath-cooled, 3 T designs. The design had a magnetic field homogeneity better than 10 ppm within a DSV of 49 cm. A new class of MgB2 strand especially designed for MRI applications was considered as a possible candidate for winding such a magnet. The magnet design was a segmented coil type optimized to minimize conductor length while hitting the standard field quality and DSV specifications as well as a standard, compact size 3 T system. Unlike the frequently used Helmholtz-like coil pair design (even number of coils, typically 8 or 10 coils in total) we used a Maxwell-like configuration (an odd number of coils, containing 9 coils in total). This Maxwell-like coil design is advantageous for a number of reasons, in particular because it can allow a higher inner winding diameter in the central part of the MRI magnet. Gaining an extra space in central part of MRI magnets is extremely advantageous because this is the space needed for placing other parts of MRI systems such as, e.g. RF coils, detection coils, shimming coils etc. The total winding length is 1.37 m, and the total conductor length is 109.3 km. The operational current is 287 A, and based on a 4.2 K Ic = 383 A, this gives I/Ic = 0.75. Maximum strain in the winding was less than 0.4 % (wire strain tolerance). The magnet can be cooled down to 4.2 K using 2 cryocoolers. This work represents the first magnetic design for a whole-body 3 T MgB2-based MRI magnet for a short (1.37 m length) magnet which uses the performance parameters of existing MgB2 wire. This result represents a strong step towards a viable 3 T, whole body, conduction cooled MRI based on MgB2 conductor.

Primary authors: MAJOROS, Milan (The Ohio State University); SUMPTION, Mike (The Ohio State University); RINDFLEISCH, Matthew; DOLL, David (Hypertech); Mr TOMSIC, Michael (Hyper Tech Research); Mr COLLINGS, Edward (The Ohio State University)

Presenter: MAJOROS, Milan (The Ohio State University)

Session Classification: C2Po1E - Medical and Biological Applications