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Design of 1.0T conduction cooled superconducitng magnet for intraoperative magnetic resonance imaging

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MRI provides exquisitely detailed images of brain and spinal cord anatomy and pathology. MR images are multi-planar, radiation free and have a greater sensitivity and specificity than either CT or ultrasonography. Although an engineering challenge, the placement of MRI systems in the operating room will revolutionize neurosurgical care. Surgical navigation was repeatedly updated by iMR images able to detect brain shift resulting from CSF leakage. iMRI has also identified a significant number of patients who harboured unsuspected, residual tumour at the end of surgery, thus sparing them the discomfort and expense of reoperation. Newer MRI techniques such as DTI and fMRI were bought into the operating room allowing for locating vital tracts and areas during the surgical process with the concomitant brain shift.
A 1.0T conduction cooled superconducting magnet has been designed for intraoperative MRI. The warm bore of the magnet is 700mm in diameter and 1200mm in length, the magnet with a high homogeneity of a magnetic field in a DSV of300mm. Total weight of the magnet is 1.8 ton,two 4K cryocoolers are applied for cooling the magnet,the magnet is installed in a mover, and still at field during movement.In this paper,electro-magnetic design,quench simulation,eddy current simulation and test results of the magnet are presented.

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