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Tue-Mo-Or9-06: Ultra-compact MRI System with High Temperature Superconducting Magnet

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This paper presents the design of a high field and portable MRI magnet system for the rapid and early diagnosis of brain trauma. Early diagnosis and therapy stratification can reduce the risk for critically brain ill patients with the use of near patient imaging, and can aid with precision medicine. High temperature superconductors have the ability to carry large currents at higher temperatures than low temperature superconductors. We wish to fully leverage this ability by employing a flux pump to charge the MRI magnet which we have designed. The higher the current which can be employed the lower the inductance of the magnet for a given field. This has several effects. First it reduces cost by reducing the amount of superconductor (this mitigates against the high cost of HTS). Second it makes the magnet smaller and lighter. Third it reduces the amount of stored energy in the magnet and thereby mitigates against quench.

In summary the key component for compact MRI is a compact and high field superconducting magnet. Using an HTS flux pump provides the means to eliminate the reliance on expensive high current power supplies and thermally wasteful current leads. An HTS based main magnet with 1 ppm uniformity in a 10 × 10 × 5 cm elliptical volume has been designed, for incorporation into an MRI system and will be used in pre-clinical tests.

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