

Fast Field-Cycling MRI

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The use of fast field-cycling (FFC) in magnetic resonance imaging (MRI) has so far been limited to relatively few applications, carried out in a small number of laboratories, but is gradually increasing.

The majority of work on FFC-MRI has been accomplished using dual magnet systems, where a homogeneous, stable magnet is used to read out NMR signals, while a less homogeneous magnet is used to boost (or reduce) the applied field during the evolution period. In our lab we have built a whole-body FFC-MRI system using a 59 mT permanent magnet for detection, with a coaxial resistive magnet for field offset [1]. This has the advantage of little or no eddy currents during field switching, as the ferrite permanent magnet is non-conductive. Our next-generation system used a 0.45 T superconducting magnet for readout, with an actively-shielded resistive field-offset magnet [2]. We are currently building a new FFC-MRI system that will employ a single magnet for polarisation, evolution and detection, which should afford significantly more flexibility in the design and execution of FFC-MRI pulse sequences.

Over recent years the range of applications of FFC-MRI has increased. Relaxometric imaging was first demonstrated by Carlson in 1992 [3], and since then relaxometric imaging methods have been implemented by the groups in Aberdeen [5], Stanford [6] and Ontario [7]. We have recently implemented localised, image-guided FFC relaxometry, whereby T_1 dispersion curves can be obtained from well-defined regions of a sample pre-selected from pilot images [8]. Another application of FFC-MRI being pursued in our lab is the combination of FFC-MRI with magnetisation transfer contrast (MTC) imaging [9].

This presentation will survey some of the methods and applications of FFC-MRI, in our own and other laboratories. Details of many aspects of this work from our laboratory can also be found on a number of posters at this meeting.

References:

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