

Abstract 680

In vivo human brain imaging at 0.2 T with a whole body fast field-cycling system

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Purpose / Introduction

Fast Field-Cycling (FFC) instruments change the main magnetic field strength B_0 during the pulse sequence. With FFC it is possible to obtain image contrast from the dispersion of T_1 over a range of field strengths¹. In a typical pulse sequence the field strength is switched from a polarising field, B_{0p} , to an evolution field B_{0e} , at which relaxation processes of interest occur, before switching to a detection field B_{0d} . FFC requires bespoke magnets, power supplies and ancillary equipment.

Subjects and Methods

A number of FFC instruments are presented in the literature²⁻⁶. Most are dual magnet designs in which B_{0d} is supplied by one magnet, the second magnet providing offset for B_{0e}



Fig. 1: our magnet consists of three copper coils, co-wound on a cylindrical former, and potted in epoxy resin (Tesla Engineering Ltd, Storrington, UK). At 2040 mm long, 500 mm bore, it is suitable for human subjects. The magnet has a bare inductance of 5 mH and resistance of 85 m Ω per channel, each requiring 650 A to attain the 0.2 T field specified. The current is supplied by a purpose-built bank of high-power gradient amplifiers (International Electric Co. Oy, Helsinki, Finland).

Results

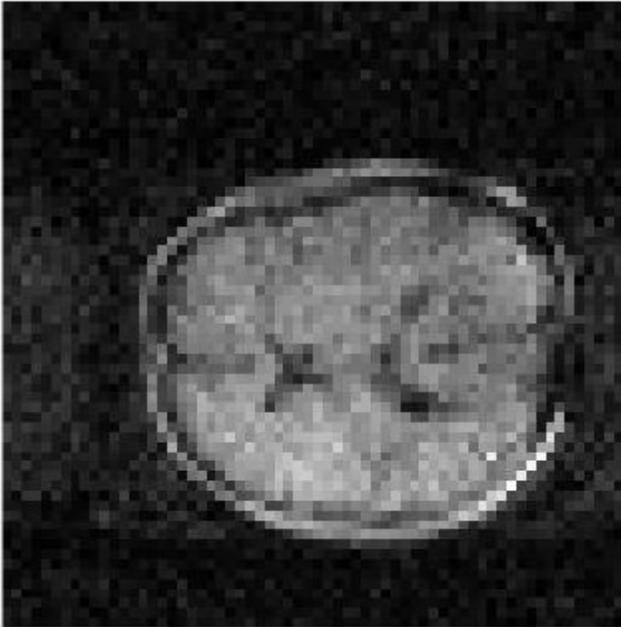


Fig. 2: shows a transaxial spin-echo FFC image of the brain of a healthy volunteer. Acquisition parameters were: 64x64, field-of-view 300 mm , slice thickness 10 mm, TE 10 ms, TR 1500 ms, field ramp time 20 ms, polarization time 500 ms, $B_{0p} = B_{0e} = B_{0d} = 196$ mT (8.34 MHz proton frequency).

Discussion / Conclusion

Fig. 2 shows some evidence of ghosts in the phase-encode direction that are attributable to magnetic field fluctuations during acquisition. We are currently exploring methods to improve field monitoring and current control systems. In the present work we have developed an image correction system which adjusts the phase of each line in k-space until optimal image quality is attained.

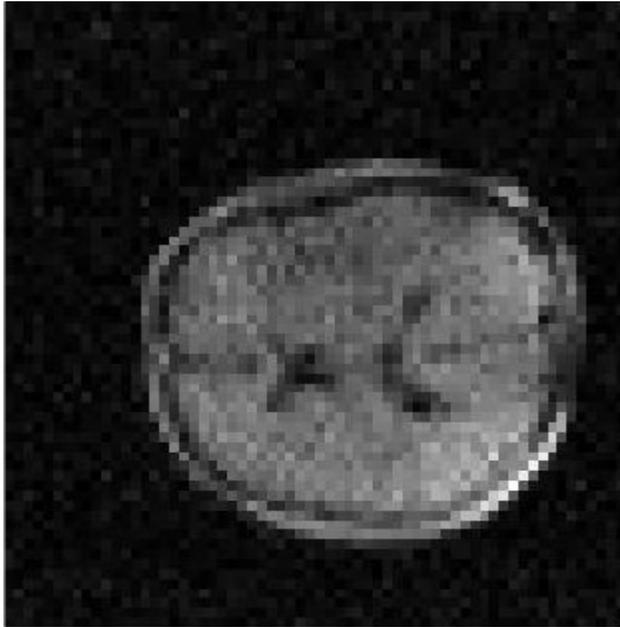


Fig. 3: Shows the image of Fig. 2 following correction.

Our next step is to employ B_{0e} control to obtain images with T1-dispersion contrast. We are also working on methods of compensating for environmental magnetic fields, including use of the external correction coils visible in Fig. 1.

References

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