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Fast Field-Cycling (FFC) MRI: Biomarkers through T_1-Dispersion

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Much of the contrast in MRI arises from differences in T_1 between normal and diseased tissues. Studies on small tissue samples have shown that extra information could be obtained from T_1-dispersion measurements (T_1 versus magnetic field), but this information is invisible to standard MRI scanners, which operate only at fixed magnetic field (e.g. 1.5 T, 3.0 T). We have developed Fast Field-Cycling Magnetic Resonance Imaging (FFC-MRI) to exploit T_1-dispersion as a potential biomarker, with the aim of increasing diagnostic potential.

In FFC, the magnetic field is switched rapidly between levels during the pulse sequence. In this way, a single instrument can be used to measure T_1 over a wide range of magnetic field strengths. FFC-MRI obtains spatially-resolved T_1-dispersion data, by collecting images at a range of evolution fields. We have built a range of FFC-MRI equipment, including a whole-body human sized scanner, operating at a detection field of 0.2 T.

Our lab is investigating a range of applications of FFC relaxometry and FFC-MRI. We have recently begun exploring clinical applications and have imaged patients who have had an ischaemic stroke; the stroke-affected brain tissues are seen as hyper-intense regions in ultra-low-field (200 µT) FFC images.

This presentation will cover the main techniques used in FFC-MRI and will summarise current and potential bio-medical applications of the methods. Information on FFC-MRI and copies of publications are available at www.abdn.ac.uk/research/ffc-mri.

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