

Fast-Field Cycling MRI: A new tool for enhanced diagnosis

Lionel Broche, University of Aberdeen, Scotland, United Kingdom

Fast Field-Cycling MRI (FFC MRI) is a major shift in MRI technology. It aims to explore how relaxation rates change with the magnetic field strength, an idea that has been successfully exploited in NMR for more than half a century and which is known to provide unique structural information on materials, non-invasively.

Scaling up FFC NMR to whole-body MRI systems is a difficult technical challenge that has maintained a lock on this area of research for many years. Our research group has successfully lifted this lock and developed two whole-body FFC MRI scanners: one with a field range of 0.1 mT to 59 mT that has been used in clinical trials for several years and the other with a range of 20 μ T to 0.2 T still under development.

Our pilot studies, which use both FFC MRI and FFC NMR, have discovered new biomarkers in a range of diseases such as osteoarthritis, breast carcinoma, musculoskeletal sarcoma, obesity, liver fibrosis, thrombosis and others. These FFC MRI biomarkers can differentiate tissues that appear similar on conventional MRI devices thanks, in part, to the greater endogenous contrast present at lower magnetic fields but also due to patterns that emerge from the overall relaxation dispersion curves of these tissues. The latter provides unique insight into the structure of materials and is, we believe, a promising tool to characterise tissue remodelling.

This presentation will focus on FFC MRI technology, how it differs from conventional MRI and the results obtained so far from our pilot studies.