Abstract No: P22

Title: **Ultra-low field NMR relaxometry on biological samples: calibration method and acquisition of T1-dispersion curves below 1000 Hz**

Authors: Vasileios Zampetoulas, Lionel M. Broche, David J. Lurie

Institutions: Aberdeen Biomedical Imaging Centre, University of Aberdeen

Abstract:

Introduction

Fast Field-Cycling (FFC) NMR is a readily applicable technique that is used for the investigation of properties of a wide range of materials including polymers, liquid crystals, and biological samples, with applications in chemistry, oil industry and medicine to cite a few. A graph of T1 versus the magnetic field (known as a T1 -dispersion curve) is obtained via FFC NMR measurements and can be developed into a new diagnostic tool thanks to the information about molecular dynamics which it provides.

Methods

FFC measurements were performed using a commercial FFC-NMR relaxometer (Stelar S.r.l., Italy). In order to make measurements at low- and ultra-low magnetic fields, calibration is necessary for the compensation of external stray magnetic fields in the environment, including the Earth's field. This involves the application and calibration of correction magnetic fields. The results acquired show the precession frequency of the magnetisation from which the magnitude of the stray magnetic field is deduced, for the range of the correction magnetic fields applied. The successful calibration is then verified according to the T1 -dispersion curves obtained from samples of polybutadiene in the region of μT.

Results

After successful calibration, ultra-low-field FFC measurements can be performed, as shown from the T1-dispersion curves obtained from samples of human liver. (Figure 1). The minimum measurement frequency of 800 Hz (1H Larmor frequency) corresponds to a magnetic field of ca.18 μT.

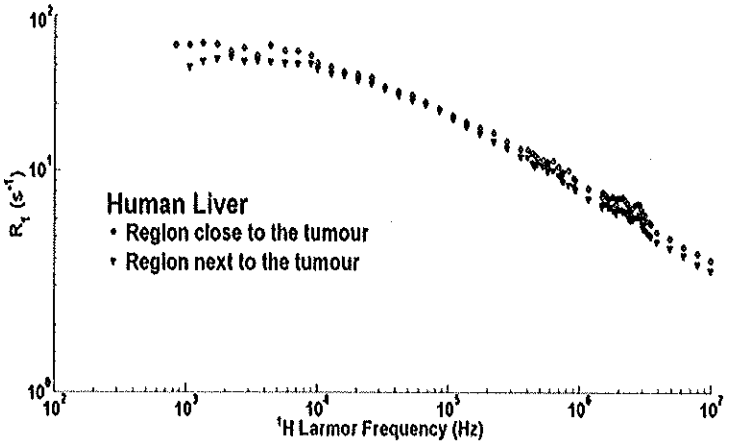

Figure 1. *R1-dispersion curves (R1=1/T1) of samples of human liver obtained from the same patient, from regions next (triangles) and close (circles) to the liver tumour.*

Conclusions

This work shows that it is possible to calibrate an FFC-NMR relaxometer so that T1-dispersion in the μT range can be measured. Experiments performed at these low fields are expected to provide clinically-relevant information on slow dynamic processes in tissues.

Acknowledgements: The author acknowledges funding from the EPSRC through the Centre for Doctoral Training in Integrated Magnetic Resonance

Corresponding Author: Vasileios Zampetoulas

Contact Address: Aberdeen Biomedical Imaging Centre
Biomedical Physics Building
University of Aberdeen

Email: v.zampetoulas@abdn.ac.uk