

Method Development for High field MRI

Our department is highly active in the development of new methods for MR imaging at different field strength. Together with our industrial partners we implement and test new imaging methods on our high field MRI system. Currently we are using a Bruker BioSpin 94/20 (9.4T field strength) with a gradient system capable of 600mT/m.

Project Overview

The projects include:

- Optimization of RARE and Single Shot RARE Acquisition
- EPI Distortion Correction
- DCE MRI
- Toolbox for Relaxation Time Measurement (RTMT)
- Multi-Echo bSSFP imaging
- Multi-Echo EPI
- Fat/Water-Separation

For further information on these or other projects, don't hesitate to contact us.

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RARE Optimization

In this project the gradient calculation of conventional RARE imaging method was optimized in order to reduce echo spacing (ESP) and hence be able to acquire single shot RARE images. The method is planned to be a standard method in the next ParaVision release (PV5).

The image below (T2w, no FatSat) shows an in-vivo example in mice.

EPI Distortion Correction (DiCo)

Due to field inhomogeneities EPI often show geometric distortions. The main goal of this project is to evaluate an image correction method based on Point Spread Function (PSF) mapping. The PSF mapping is performed using a EPI method with an additional gradient in phase encoding direction. To reduce scan time for PSF mapping different speeding techniques like reduced Field of View (rFOV), parallel acquisition (e.g. GRAPPA) and Half Fourier can be applied.

First results on a phantom (see figure below) show the improved image quality. Images in the left column (a) are normal (distorted) EPI acquisitions. Images in the mid row (b) show the EPI images after distortion correction. In the right column (c) Pixel Shift Maps (PSM) are given, which shift for every pixel inside the object.

Dynamic Contrast Enhanced (DCE) MRI in Mice

DCE-MRI is often used in clinical and preclinical research in order to test anti-angiogenic and anti-vascular drugs in early stages of development. DCE-MRI is based on measuring the signal evolution of tissue after intravenous injection of a paramagnetic contrast agent by dynamic mapping of the relaxation time T1. Using dedicated tracer kinetic models (e.g. Tofts-model) in post-processing

procedures, several parameters including vessel wall permeability, tumor blood volume, and extra-cellular, extra-vascular leakage space can be derived from this data.

Inversion Recovery (IR) TrueFISP for T1 mapping was proposed before providing a high signal to noise ratio (SNR) and high temporal and spatial resolution.

Together with our partner, the MRDAC (www.mrdac.com), we can provide a complete infrastructure for DCE-MRI in mice and rats including IR-TrueFISP sequence and optimized imaging protocol as well as a GUI-based evaluation software (see image below).

Toolbox for Relaxation Time Measurement (RTMT)

We are highly active in developing target specific MRI contrast agents. In this context we often need to estimate relaxation times (T1, T2 or T2*) in our samples. For this we implemented a complete toolbox including an imaging method with automatic TI or TE setting and a Matlab-based evaluation software.

If you are interested in this toolbox for your work, please let us know!

Partners

- Bruker Dr. Franek Hennel

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