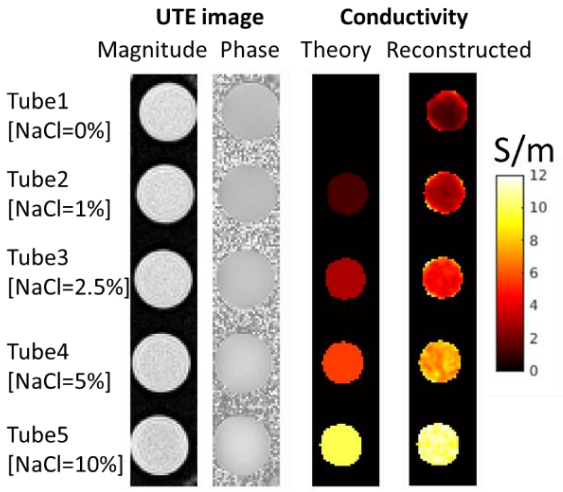
Post-doctoral position
Electrical property imaging by MRI

IADI, Nancy, France

Summary

A 12-month (possible extension to 24 months) post-doctoral position is available in IADI (Inserm U1254, Université de Lorraine), Nancy, France. The position is open for candidates with strong background in MRI physics, applied mathematics or image processing, starting from January 2022.

The objective of the project is to develop novel acquisition and reconstruction methods for imaging electrical properties (i.e. conductivity and permittivity) in-vivo in humans. MR-EPT (MR electrical property tomography) relies on the fact that electrical property changes throughout the patient result in a small - yet measurable - spatial modulation of the transmit and receive radiofrequency fields (B_1^+ and B_1^-). Various methods have been proposed based on B_1^+ mapping, phase images (spin-echo or bSSFP sequences), or ultra-short echo time sequences (UTE/ZTE). In previous work we have developed a new method based on a UTE sequence and a generalized reconstruction framework[1]. This involved solving a modified Helmoltz equation of the form $\frac{\Delta\mathcal{B}}{\mathcal{B}}\kappa^{-1} + \frac{\nabla\mathcal{B}}{\mathcal{B}} \cdot \nabla(\kappa^{-1}) \approx i\mu_0\omega$, with $\mathcal{B}^2$ the complex UTE image and $\kappa = \sigma + i\omega\varepsilon_0\varepsilon_R$ the complex admittivity (σ the conductivity, ε_R the relative permittivity). The aim of the project is to improve and further validate the technique for in-vivo application. In particular the following aspects can be investigated: robust denoising of the input data prior to Laplacian calculation, region-wise reconstruction using a prior segmentation from another imaging contrast (e.g. T_1-weighted or T_2weighted), source separation methods to eliminate spin-density contrast in the raw UTE images.



[1] P Soullié et al., Magn Reson Med. 2021;85(2):762–76.

Work environment

This project is part of the ANR-funded project ELECTRA (Electrical property imaging by MRI: application to the MR-safety of medical devices). IADI has expertise in MR image reconstruction, and has access to a Siemens 3T Prisma scanner. A vector network analyser and relevant instrumentation are available for ground truth electrical property measurements in phantoms. Ethics protocols are available to test the methods in healthy subjects and patients.

Application

Applicants are invited to send their CV, motivation letter and references to Freddy Odille (freddy.odille@inserm.fr) and Pauline Lefebvre (pauline.lefebvre@univ-lorraine.fr).

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