Mars Lab

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Department of Imaging Physics

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MEP Project

Phase Based T_2 mapping in the myocardium

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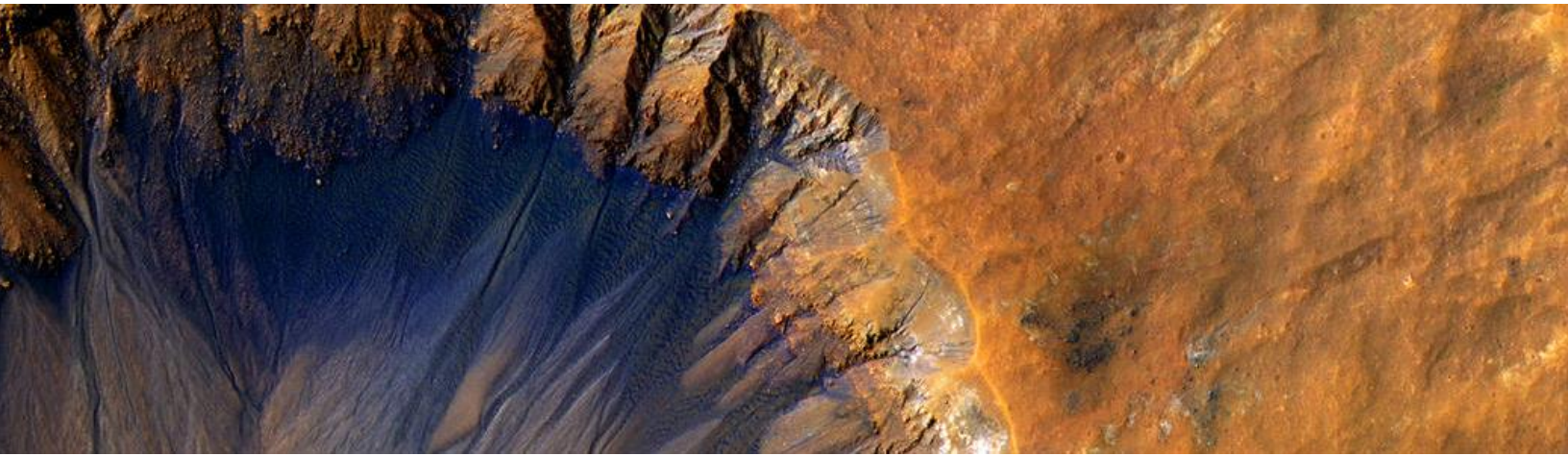
Description

Due to its non-invasive, non-ionising nature, magnetic resonance imaging (MRI) is a crucial tool in cardiac imaging. Moreover, it can also provide quantitative parameters with diagnostic value. In cardiac imaging, the T_2 relaxation time is used to assess edema (fluid retentions). However, current T_2 mapping techniques require long scan times which limits their use in clinical practice. In a novel approach, so-called Phase Based T_2 mapping (PB-T_2), the T_2 time can be encoded in the signal phase accelerating the measurement up to five times.
In this project, we want to better understand the underlying physical principles of PB-T_2. In addition, we want to improve the present method by implementing corrections for residual sensitivity to B_1, T_1 and off-resonance artefacts.

Steps & Goals

- Familiarize yourself with the theory of phase based T2 quantification and the sequence development environment
- Perform numerical simulations to investigate the physical process and sources of artifacts
- Implement a new phase based T2 mapping sequence and validate in phantom experiments
- Perform in vivo experiments and benchmark against reference methods



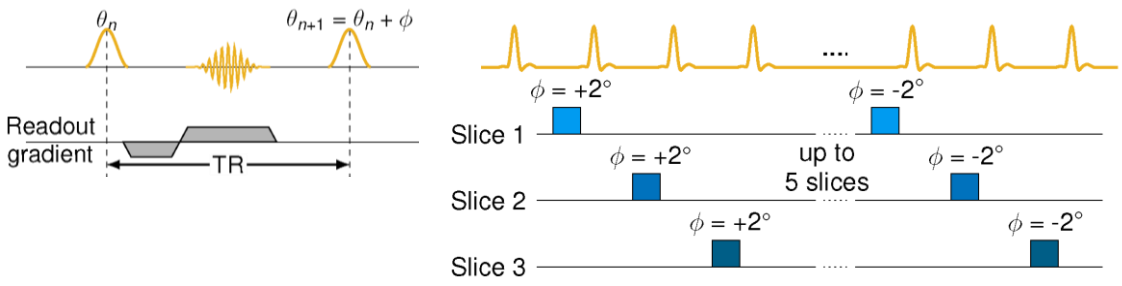


Figure 1: The sequence diagram for the measurement of multiple slices triggered to the end-diastolic phase for positive and negative phase increment. First all slices with positive phase increment are acquired followed by the negative phase increment in order to start with approximately the same initial magnetization.

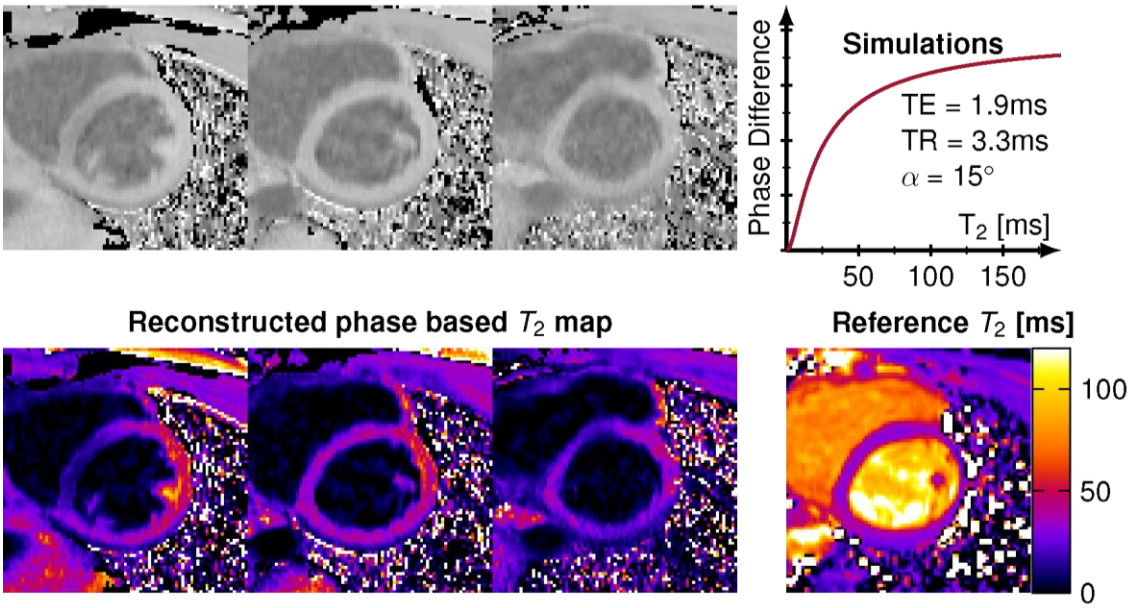


Figure 2: The in vivo phase difference is shown for three slices (top left). Simulated phase difference calculated from T_2 time estimates for the given sequence parameters (top right). The reconstructed phase based T_2 map for three slices are depicted together with a reference T_2 map (bottom right), showing a homogeneous myocardium for the three slices. One slice suffered from signal loss in the septal region likely due to B_1^+ inhomogeneities.