Mars Lab

ImPhys
Image to insight
Insight in imaging
Department of Imaging Physics

Master's End Project (MEP)

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Improving RF Pulse Design for Quantitative MRI

Description

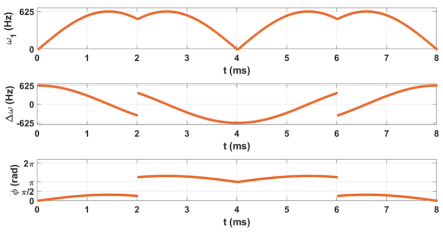
Quantitative MRI techniques allow the spatial assessment of tissue characteristics based on specific properties measured by the scanner. Parameter maps of these properties can be generated by acquiring multiple images with different contrasts. These contrasts can be generated and manipulated by applying different radiofrequency (RF) pulses, which will modify the signal magnetization. Relaxation Along a Fictitious Field (RAFF) is a recently proposed RF pulse that has shown sensitivity to slow molecular changes in the tissue - a potentially important biomarker for a wide range of diseases (e.g. myocardial infarct). However, RAFF is still sensitive to off-resonance artifacts, which significantly impact quantification and hamper clinical use.

In this project, we will design and investigate the performance of new RF pulses to reduce the susceptibility to off-resonance artifacts. Simulations, phantom, and in vivo measurements will be performed.

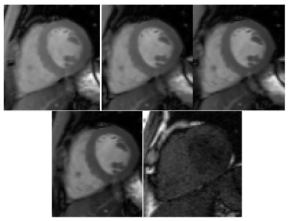
Steps & Goals

- Familiarize with general MR physics and RF pulse design;
- Perform numerical simulations to investigate the performance of the new RF pulses (Matlab/Python);
- Implement new RF pulses in the scanner software (C++);
- Perform phantom and in vivo experiments and benchmark against reference methods.

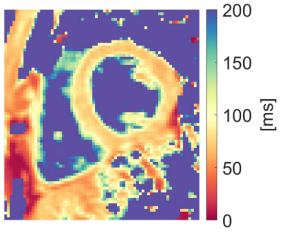
RAFF RF Pulse

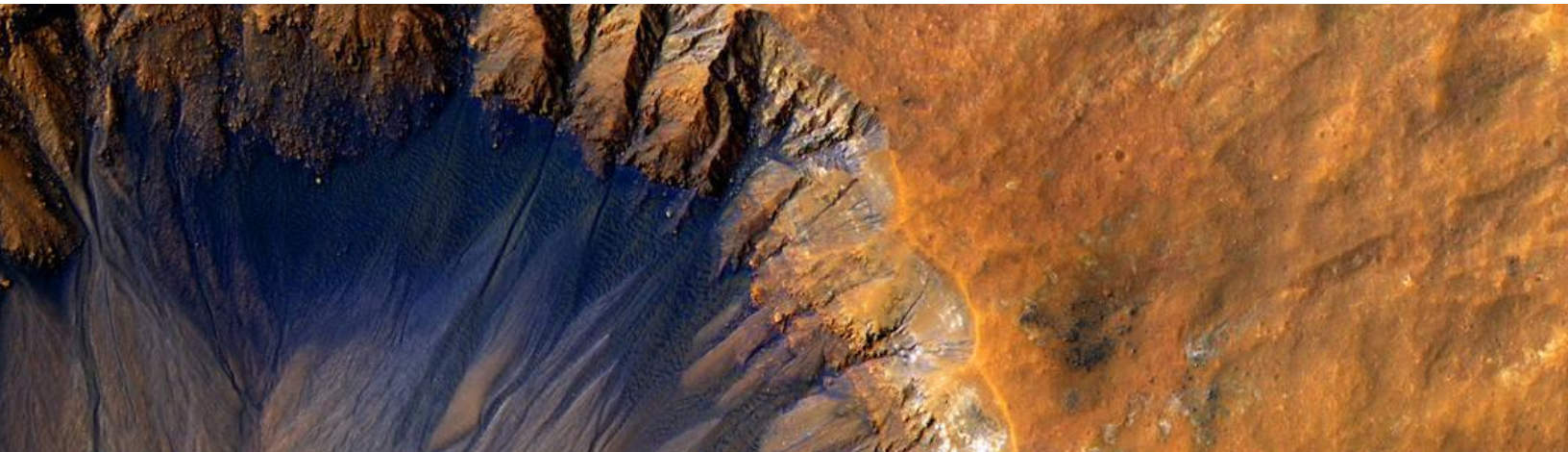


RAFF-weighted images



T_{RAFF} Map





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