Master's Thesis:
Implementation of a Spiral Sequence for MRI

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Overview

Magnetic Resonance Imaging (MRI) acquires data in the so called "k-space" which is linked to the image via the Fourier transform. Historically, MR signals were acquired line by line to obtain the k-space on a Cartesian grid (A) which can be computationally efficient transformed to an image by 2D-FFT.

The spatial encoding of the MR signal is defined by the gradients of the pulse sequence and is not restricted to a Cartesian grid. We can dynamically choose at which points we want to sample the k-space and define here the so-called *trajectory*. Combined with developments in image reconstruction, the application of different trajectories such as radial (B) and spiral (C) sampling is possible. Spiral trajectories have the advantage of covering large regions in the k-space within a short time.

The aim of this thesis is to implement a spiral imaging sequence, define appropriate corrections for the imperfections and compare the reconstructed images to existing Cartesian and radial sequences.

Specific tasks

- Literature review
- Sequence programming
- Image reconstruction
- Phantom simulations, comparison to existing method
- MRI measurements and quantification
- Documentation and illustration of the results

Recommended Knowledge

- C/C++ programming experience
- A good grasp of fundamental MRI theory
- Basic git workflow

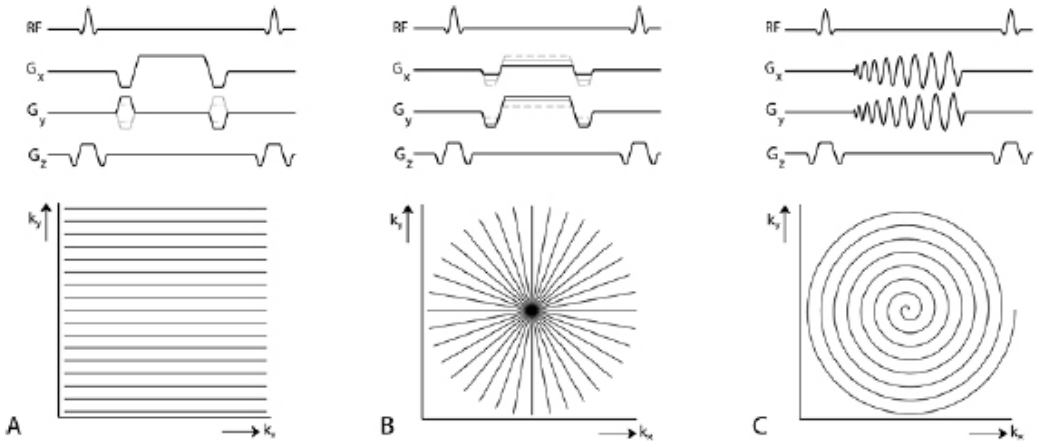

Illustration of Cartesian, radial and spiral readouts in the pulse sequence (top) and the filled k-space (bottom), modified from Stemkens et al. (2018).

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