



# Faster MRI Acquisition with Motion Robustness

## MRI Volumetric Excitation Using Frequency Modulated RF Pulses

Frequency-swept excitation can be used for 3D imaging to obtain broad bandwidth and sharp slab profiles. Quadratic phase modulation along the slice encoding direction imparts additional spatiotemporal encoding, which better distributes signal content in the slice direction and enables higher acceleration rates robust to slice under-sampling. Sliding the quadratic phase across the slice-encoding direction achieves synergy when combining frequency-swept excitation with Fourier encoding, which has inherent optimal noise-properties. The R-value describing the shape of the quadratic phase in the frequency swept pulse is selected to match the resolution desired in the slab direction of the 3D volume, thus spreading out the signal in acquisition domain and allowing for a spatially localized measurement.

## Spatially Aligns Data; Features Higher SNR

Current techniques for image acceleration in the so-called slab direction do not work well. Less efficient 2D acquisitions are typically used for high resolution imaging since 3D cannot be effectively combined due to long scan times. When 3D is the only option, motion may necessitate reacquiring data and thereby extending scan time or producing blurred images. This frequency swept pulse sequence is implemented on an MR scanner for image excitation. The technology features compressed sensing-based under-sampling techniques and is able to spatially align data to address motion misalignment prior to final image reconstruction. Another benefit of the Slice Quadratic Phase with HS<sub>n</sub> Encoding and Reconstruction (SQUASHER) method is that it boasts a higher signal-to-noise ratio (SNR), since all frequency encoding steps have similar SNR. The encoding allows co-registration of data (since the signal is available) and also accelerated acquisition along the slab direction. Current methods that acquire lower SNR data use a Fourier encoding, which has very low SNR for high frequency encoding steps.

### BENEFITS AND FEATURES:

- 2x image acceleration
- Motion robustness
- Faster acquisition of conventional high-resolution clinical images
- Compatible with standard parallel imaging sequences. e.g., GRAPPA (Siemens), ASSET (GE) and SENSE (Philips)
- Pulse sequence and reconstruction implemented on MR scanners
- Higher signal-to-noise ratio (SNR)
- Compressed sensing-based under-sampling techniques
- Spatially aligns data to address motion misalignment prior to final image reconstruction

### APPLICATIONS:

- Magnetic resonance imaging (MRI)
- Obtaining anatomical and functional information of the brain
- Low resolution (fast acquisitions) and high resolution (slow) acquisitions

**Phase of Development** - Prototype developed

### Technology ID

20170230

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