

Harmonization of MPRAGE and EPI: Data Acquisition Instruction on GE

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To extend our work from the 2023-24 ISMRM Reproducibility Team Challenge into a proper publication, I have updated the MPRAGE and EPI Pulseseq-based sequences to achieve improved fat suppression and correct orientation between Siemens and GE systems.

For cross-vendor harmonization of MPRAGE and EPI data acquisition, our goal is to configure the sequences as similarly as possible between Siemens and GE. The key sequence parameters for MPRAGE and EPI Pulseseq-based scans are outlined below. Please adapt the sequence parameters for GE vendor-based scans, ensuring alignment with the corresponding Pulseseq-based protocol to the greatest extent possible.

Note: Ensure the FOV position and the adjustment shim volume are the same for vendor-based and Pulseseq-based scans.

- **MPRAGE with water excitation and two-fold GRAPPA**
(*writeMPRAGE_grappa_WE_ge.m*)

- ❖ Orientation: Sagittal.
- ❖ Fat suppression strategy: “Water excitation”.
- ❖ Phase encoding direction: from anterior to posterior (A>>P).
- ❖ FOV = 192*240*256 mm³ ([partition, phase, readout]). In the Challenge work, it is 256*256*192 mm³.
- ❖ Matrix size = 192*240*256 ([partition, phase, readout]).
- ❖ Resolution = 1*1*1 mm³ ([partition, phase, readout]).
- ❖ TR = 2500 ms; TE = 3.64 ms; TI = 1100 ms; TA = 5:38 min.
- ❖ Flip angle = 8 degrees.
- ❖ Acceleration: integrated GRAPPA; acceleration factor PE = 2; reference lines PE = 32; acceleration factor 3D = 1.
- ❖ Asymmetric Echo = “off”; readout oversampling = 2.
- ❖ Coil combination: Sum of Squares.
- ❖ Shimming strategy: Siemens-provided automatic “**standard**” shim (if possible, please also use similar vendor-provided automatic shim on GE).
- ❖ Readout Bandwidth = 195 Hz/Px = 1/ADC_duration. ADC bandwidth = 100 kHz = 1/ADC_dwell_time.
- ❖ Echo spacing = 8.94 ms.

❖ Receiver gain: High.

Note: Please turn off all of the vendor-provided image filters and image corrections (e.g., Hamming filter, distortion correction, etc.).

- **EPI with a 3-echo navigator, fat suppression, and ramp sampling**
(*writeEpiRS_label_ge.m*)

- ❖ Number of slices = 48; Slice thickness = 3.0 mm; Slice Distance factor = 0% (no slice overlapping); **Number of repetitions = 30.**
- ❖ Phase Oversampling = 0%. Readout oversampling factor = 2.
- ❖ FOV Read = 220 mm; FOV Phase = 220 mm; FOV in Slice-selective direction = 3.0 * 48 mm.
- ❖ Image matrix size = 80 * 80 * 48 * 30 ([read, phase, slice, repetition]).
- ❖ Image resolution = 2.8 * 2.8 * 3.0 mm³ ([read, phase, slice]).
- ❖ **Orientation = “Transversal”**; Phase Encoding Direction = from anterior to posterior (“A>>P”).
- ❖ TR = 3656.2 ms; TE = 32.34 ms.
- ❖ Flip angle = 90 degrees (slice-selective excitation).
- ❖ **Fat-water contrast = “Fat Saturation”.**
- ❖ Acceleration Mode = “None” (no parallel imaging, no partial Fourier etc.).
- ❖ Multi-slice Mode = “Interleaved” (slice order is interleaved, e.g. 1,3,5,7,...,47, 2,4,6,8,...,48).
- ❖ Coil combination = “Sum of Squares”.
- ❖ Shimming strategy: Siemens-provided automatic “standard” shim (if possible, please also use similar vendor-provided automatic shim on GE).
- ❖ Readout bandwidth = 1562.5 Hz/px = 1/ADC_duration. ADC bandwidth = 250 kHz = 1/ADC_dwell_time.
- ❖ Echo spacing = 0.7 ms.
- ❖ **Receiver gain: High.**

Note: Please disable all vendor-provided image filters and image corrections (e.g., Hamming filter, distortion correction, etc.). In the Challenge work, the matrix size of the reconstructed EPI images is 128*128*48. **Please turn off image interpolation to obtain the original reconstructed EPI images with a matrix size of 80*80*48.**

After completing data acquisition on both a structured phantom and a human brain, please send back the following materials:

- ❖ **DICOM images** of the vendor-based MPAGE and EPI scans (for the phantom and the human brain).
- ❖ **Raw data** of the Pulseq-based MPAGE and EPI scans (for the phantom and the human brain).