

## A COMPARISON OF METHODS FOR T2-MAPPING OF THE MYOCARDIUM

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**Introduction:** T2-weighted imaging in acute myocardial infarction has been suggested for detecting regions of edema. The need to account for variations in coil sensitivity patterns has been noted with these techniques. An alternate approach is to generate quantitative T2 maps. In this work we compare 3 different myocardial T2 mapping methods; multi-echo double-IR FSE (MEFSE), segmented T2-prepared SSFP (T2pSSFP) similar to [1] and T2-prepared spiral (SpiralT2) [2] in both healthy volunteers and cardiac MR patients.

**Methods:** Details for each sequence are as follows:

**MEFSE** 256x256 matrix, 34x27cm FOV, ASSETx2, etl=32, 62.5kHz RBW, total scan time of 16 heart-beats for one slice.

**T2pSSFP** 256x128, 34x34cm FOV, ASSETx2, 2NEX with RF chopping via an inversion pulse on even excitations to preserve image contrast, VPS=32, total scan time of 16 heart-beats for 3 slices.

**SpiralT2** 12 spiral interleaves of 3072 points each, 125kHz RBW (approx in-plane resolution of 1.5mm), free breathing, respiratory compensation using the

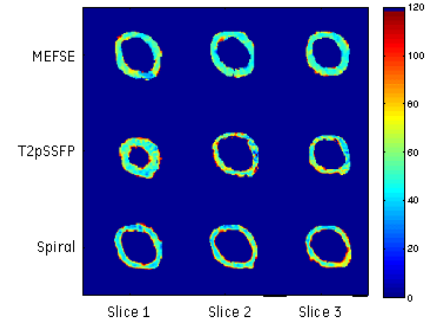
Diminishing Variance Algorithm with 4 overscans, total scan time of 5-7 minutes for 3 slices.

All sequences acquired 4 echo times in the stated scan time. Each sequence was used to generate T2 maps on 3 consecutive 8mm short-axis slices. Imaging was performed on 4 volunteers and 5 patients undergoing cardiac MR for a variety of indications (acute myocardial infarction, early diabetic remodelling, suspected sarcoidosis). To compare sequences, regions of interest were traced manually encompassing the myocardium on each slice and T2 values computed using a 2-parameter or a 3-parameter (including a baseline offset) exponential fit.

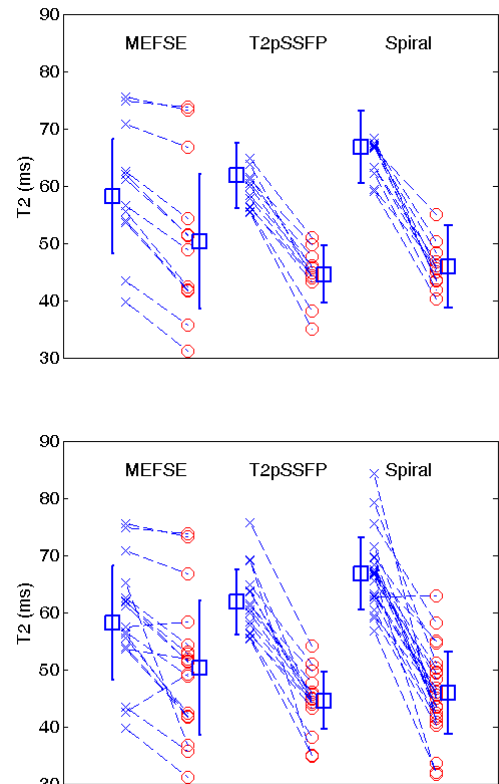
**Results:** Example T2 maps from a representative volunteer are given in Figure 1. A qualitative comparison of the sequences is given in Table 1. Quantitative T2 measurement results are illustrated in Figure 2 (healthy volunteers only) and 3 (all subjects).

**Discussion:** Two parameter fits generally had less intra-subject variability but with higher values than 3-parameter fits. This may be attributed to noise and fitting bias, suboptimal TE's, and B1-errors. MEFSE had the highest source image signal-to-noise and least in-slice T2 variability, but with the highest inter-subject T2 variability. T2pSSFP and SpiralT2 had higher in-slice T2 variability with T2pSSFP variations dominated by noise contributions and SpiralT2 by regions affected by residual blur and spiral imaging artifacts. These 3 mapping techniques have unique strengths and weaknesses. This suggests that the specific requirements of the application may dictate which technique to use. Further investigation of these in the context of clinical applications, such as identification of myocardial edema, is being explored.

**References:** [1]Huang et al,MRM,57:2007, [2]Foltz et al,MRM,49:2003.



**Figure 1:** T2 maps of the myocardium for 3 consecutive SAX slices using the 3 mapping methods (multi-echo FSE, T2prep SSFP, spiral T2) and a 2-parameter fit from one



**Figure 2:** T2 values from 2-parameter fits (x's) and 3-parameter fits (o's) across all slices for the 4 healthy volunteers (top) and all subjects (bottom). Mean T2 and one SD of values are indicated for each sequence.

|                             | Spiral T2 | T2pSSFP | MEFSE |
|-----------------------------|-----------|---------|-------|
| <b>Max # slices</b>         | ++        | +       | -     |
| <b>Acquisition Window</b>   | ++        | +       | -     |
| <b>Scan Time (4 Echoes)</b> | -         | +       | +     |
| <b>Spatial Resolution</b>   | +         | +       | ++    |
| <b>Image Quality</b>        | -         | -       | +     |
| <b>Signal to Noise</b>      | +         | -       | ++    |

**Table 1:** Qualitative comparison of 3 different T2-mapping techniques.