Evaluation of T2 mapping with stimulated echo compensation

For muscle imaging T2 relaxation time measurements are an important diagnostic tool. To obtain the T2 relaxation map we use a multi echo readout with a fitting algorithm that takes into account a muscle and fat compartment. The T2 relaxation time is calculated with a EPG-fit that takes into account B1 inhomogeneity's and slice profiles but assumes a fixed value for fat T2 relaxation times [1-2]. However we don't know how well this method is robust to noise and wrong estimations of fat T2. In this project real MRI data as well as simulated data will be used to evaluate the performance of the methods used. The goal is to identify with which assumptions and noise levels the method is valid and at which point the method fails. Furthermore we want to investigate how the method can be improved.

Methods for simulations and data processing are available within DTITools for Mathematica [github.com/mfroeling/DTITools]. For the project basic knowledge of MRI and programing in Mathematica is preferred.

1. Marty B, Baudin PY, Reyngoudt H, Azzabou N, Araujo ECA, Carlier PG, de Sousa PL. Simultaneous muscle water T2 and fat fraction mapping using transverse relaxometry with stimulated echo compensation. NMR Biomed. 2016:431–443. doi: 10.1002/nbm.3459.

2. McPhee KC, Wilman AH. Transverse relaxation and flip angle mapping: Evaluation of simultaneous and independent methods using multiple spin echoes. Magn. Reson. Med. 2017;77:2057–2065. doi: 10.1002/mrm.26285.

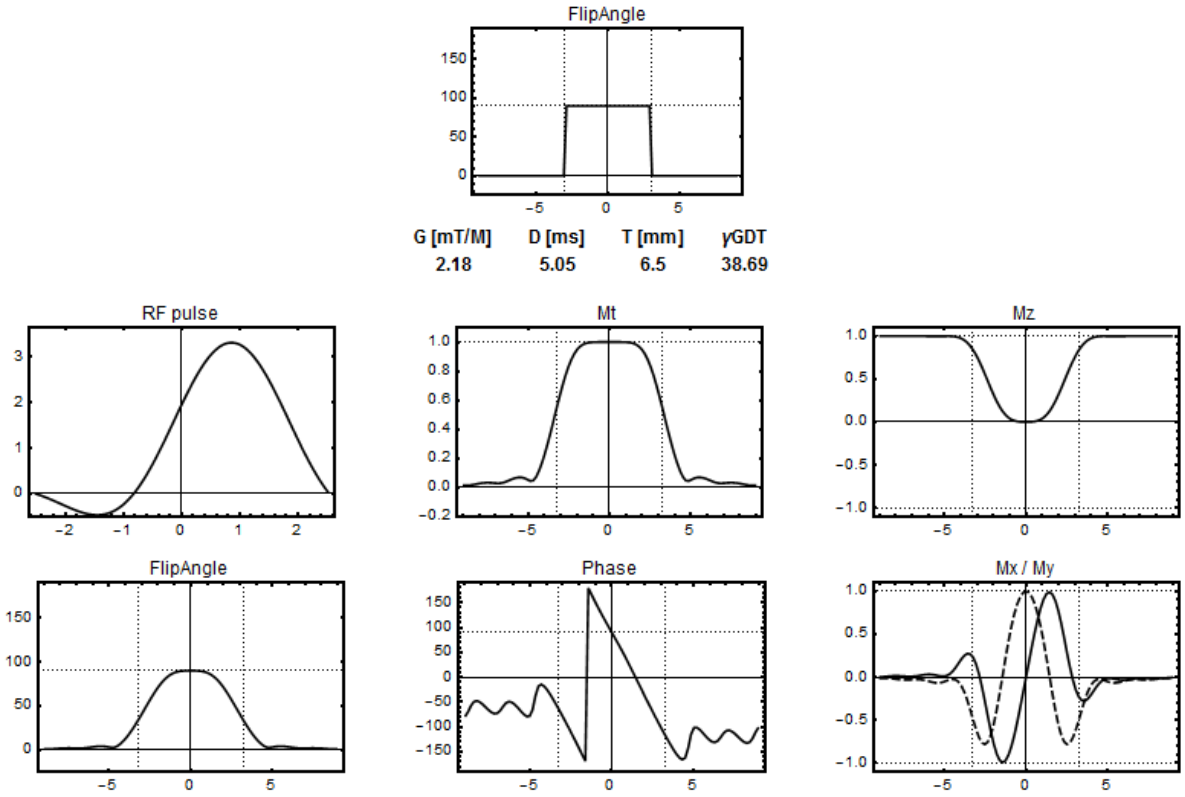

Figure 1: Bloch simulations of flip angle profiles over a imaging slice

T2 [ms]	B1 [%]	echos	ΔTE [ms]
35.	120.	17.	7.6

lin T2 nor	lin T2 slice	{EPG T2 nor, b1, watFr}	{EPG T2 slice, b1, watFr}
45.5	49.5	{35., 80., 100.}	{35., 121.3, 100.}

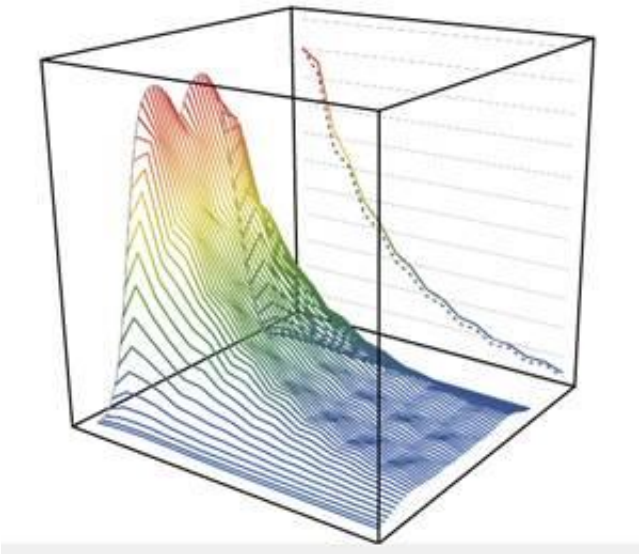

Figure 2: simulation of the EPG signal over the slice that builds up the T2 relaxation curve

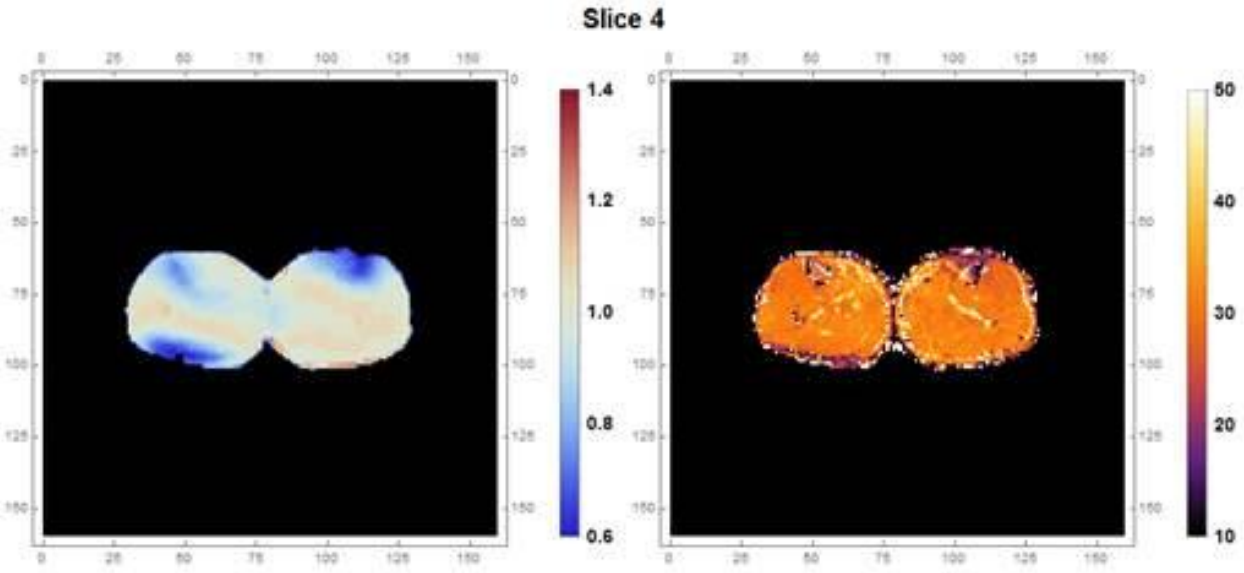

Figure 3: Fitted B1 and T2 relaxation maps of data of the lower extremities.