Purpose: Multi-component T2 is a magnetic resonance imaging technique which allows the quantification of the myelin water fraction (MWF) non invasively in the brain. The MWF is the proportion of the shorter T2 signal arising from water trapped within layers of the myelin sheath and has been shown to be closely related to aberrant white matter microstructure, such as in multiple sclerosis lesions. The purpose of this study was to evaluate the theoretical ability of a new method to calculate the MWF in a two-component model using simulated data and realistic temporal signal to noise (SNR) profiles.

Methods:The signal is sampled at equal intervals using gradient echoes placed symmetrically about multiple spin echoes while they rephase and subsequently dephase. Considering a two component model with a bi-exponential signal decay, a ratio of the signal before and after the spin echo can be obtained which depends on the MWF and a short and long T2 component. Using Matlab, data was generated based on the acquisition of three spin echoes at echo times of 16, 50 and 150ms respectively flanked by 8, 18 and 40 pairs of gradient echoes spaced 1 ms apart. Realistic temporal SNR profiles were generated for the case of zero static dephasing and for a worst scenario case scenario based on realistic expectations at 3T.

Results:Simulation results indicated a slight overestimation of the MWF, but distributions and standard deviations were well behaved at worsening SNR levels.

Conclusions:The ability of this acquisition scheme and simple model to evaluate the contribution of a short T2 component was demonstrated. Future work will focus on the practical implementation of this technique in-vivo which would enable the assessment of white matter microstructure by providing MWF data in a clinically relevant scan time of approximately 10 to 20 minutes.