

**Figure S1** Phantom evaluation. T1 times showed good correlation with the reference IR-SE T1 times (R² > 0.99). Differences were 0.28% ± 3.70% over all 9 vials.



**Figure S2** Maps of all estimated parameter. The estimated effective flip angle was smaller in myocardium smaller (around 4°) compared to the nominal flip angle. This could be caused by non-consideration of the slice profile, B1 inhomogeneity and through-plane motion of the heart during systole. In blood, the effective flip angle was smaller compared to myocardium, possibly because of compensation for inflow effects of spins which have not experienced RF pulses before.