



Paramagnetic shimming for high-field MRI

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The diamagnetism of biological tissues reduces the homogeneity of the magnetic field and may limit the number of samples in multi-sample gradient-recalled echo (GRE) experiments. This study aims to 1) evaluate the magnetic field distortions and signal loss artifacts in GRE images of proximal water samples, and 2) develop a passive shimming device to overcome this limitation. The magnetic field distribution produced by a diamagnetic

H₂O sphere and a paramagnetic CuSO₄ disk in a secondary phantom were mapped using GRE experiments and the phase reference method, and compared to the corresponding magnetostatics models. The water sphere produced a pronounced signal loss artifact in amplitude images. This artifact was significantly reduced when the paramagnetic disk was placed symmetrically between the water sphere and the secondary spherical phantom. The present study suggests that the use of paramagnetic shimming devices can help to minimize susceptibility-related

MRI signal losses and to increase the number of samples in multi-sample MRI experiments. The volume susceptibility and the shape of paramagnetic shimming devices could be optimized for particular setups and samples accordingly.

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