9.4 T

The high chemical shift separation at 9.4 T allows for selective saturation of proton pools in exchange with water protons. For the first time, highly selective and comprehensive chemical exchange saturation transfer (CEST) experiments were performed in the human brain at 9.4 T. This work provides insight into CEST signals in the human brain in comparison with existing animal studies, as well as with CEST effects in vivo at lower field strengths.

A novel snapshot-CEST method for human brain scans at 9.4 T was optimized and employed for highly-spectrally-resolved (95 offsets) CEST measurements in healthy subjects and one brain tumor patient. Reproducibility and stability between scans was verified in grey and white matter after B0, B1, and motion correction of the acquired 3D CEST volumes. Two-step Lorentzian fitting was used to further improve separation of spectrally discernible signals to create known and novel CEST contrast maps at 9.4 T.

At a saturation power of B1 = 0.5 µT most selective CEST effects could be obtained in the human brain with high inter-scan reproducibility. While contrast behavior of previously measured signals at lower field, namely amide-, guanidyl- and NOE-CEST effects, could be reproduced, novel signals at 2.7 ppm, and -1.6 ppm could be verified in healthy subjects and in a brain tumor patient for the first time.

High spectral resolution chemical exchange saturation transfer at 9.4 T allows deeper insights into the Z-spectrum structure of the human brain, and provides many different contrasts showing different correlations in healthy tissue and in tumor-affected areas of the brain, generating hypotheses for future investigations of in-vivo-CEST at UHF [1].

1)
Zaiss M, Schuppert M, Deshmane A, Herz K, Ehses P, Füllbier L, Lindig T, Bender B, Ernemann U, Scheffler K. Chemical exchange saturation transfer MRI contrast in the human brain at 9.4 T. Neuroimage. 2018 Jun 9. pii: S1053-8119(18)30533-0. doi: 10.1016/j.neuroimage.2018.06.026. [Epub ahead of print] PubMed PMID: 29894826.