Physikalisch-Technische Bundesanstalt
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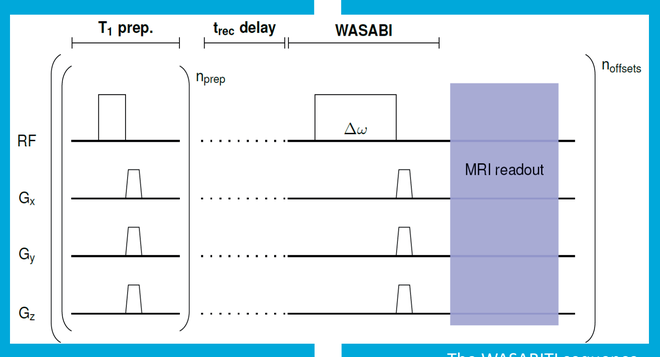
Simultaneous mapping of B_0, B_1 and T_1 for the correction of CEST-MRI contrast

Summary

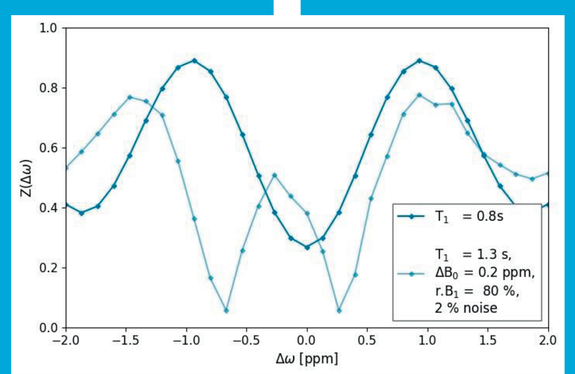
Chemical Exchange Saturation Transfer (CEST) enables imaging of low-concentrated molecules. A big challenge in the field is the signals susceptibility to field inhomogeneities (B_0 and B_1) and T_1 relaxation times. To ensure the reliable interpretability of CEST-MRI, these parameters need to be mapped and the data corrected for their influences.

We showcase the feasibility of a new method for simultaneous mapping of B_0, B_1 and T_1, as opposed to the conventional individual scans. We adapted the WASABI[1] sequence to obtain the T_1 information using a neural network (NN). Virtual phantom experiments yield good results compared to the ground truth and demonstrate a successful application for CEST correction. Recent scanner experiments show this method as comparative to conventional approaches. Furthermore, we developed the WANTED framework for CEST correction, which provides the tools needed for the optimal use of the presented method.

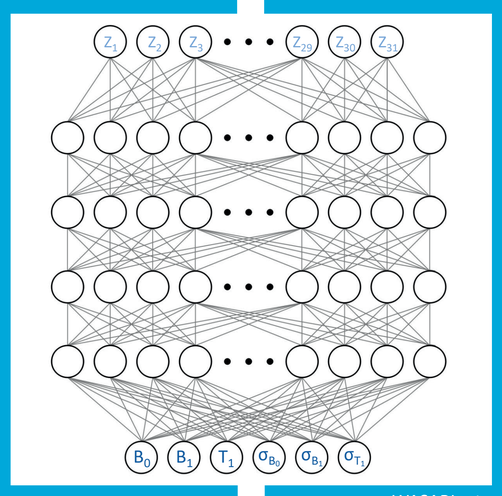
1 Scan



The WASABITI sequence



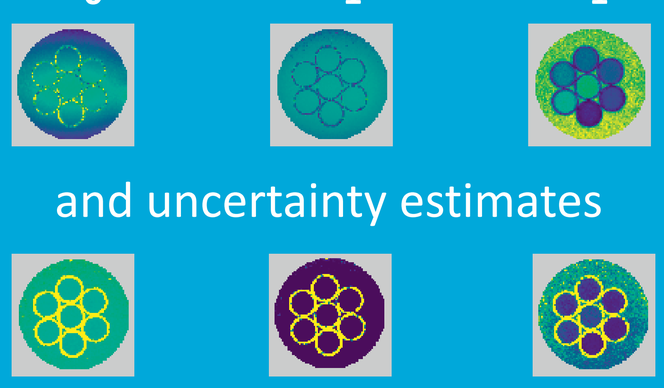
Exemplary WASABITI spectra



WASABInet

3 Parameters

B_0 B_1 T_1



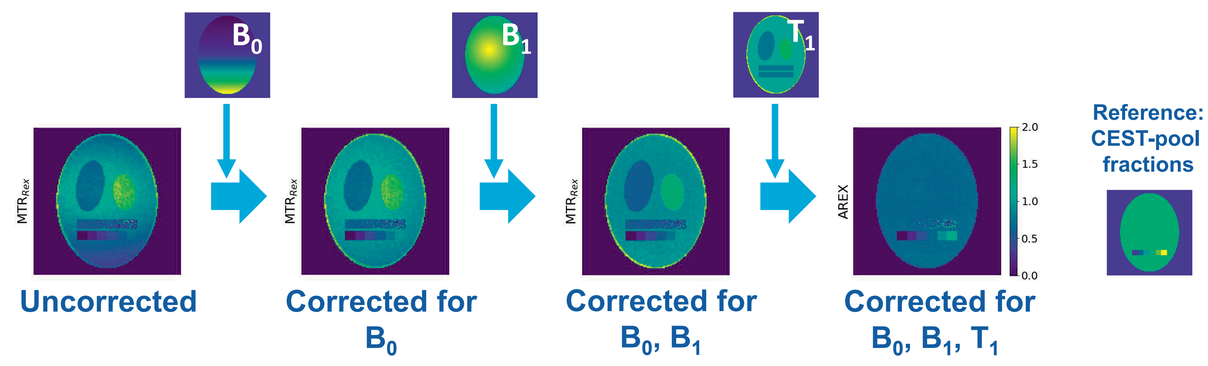
and uncertainty estimates

NN output from a phantom scan with different T_1 times per vial

The WANTED framework for CEST correction

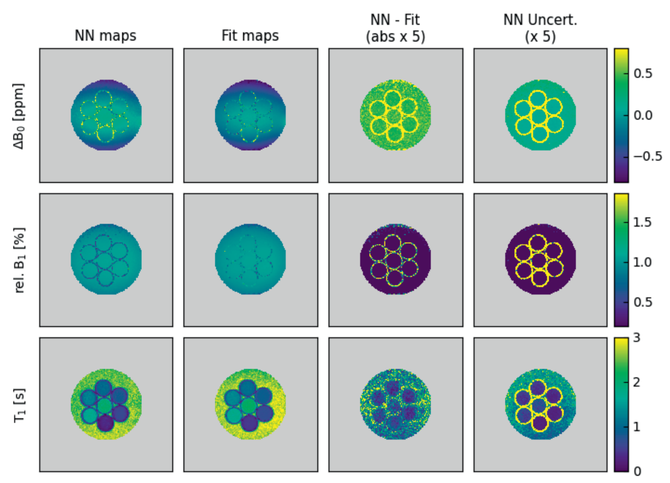
The **W**ASABI **A**nalysis **N**etwork with **T**$_1$ **E**valuation for **D**ata post-processing combines the tools needed for the design and analysis of CEST experiments:

- The **WASABITI sequence** with T_1 preparation to enable parameter mapping
- Open-source simulation tools: BMCTool[2] and pypulseq-CEST[3,4]
- An adaptable virtual phantom
- The **WASABInet** for quick, robust analysis of WASABITI spectra
- A pipeline for the **correction of CEST-MRI data** with CEST contrasts[5]



Performance & Recent developments

Virtual experiments have already shown a proof-of-concept: the NN maps are similar to the ground truth and the uncertainties reflect the errors well.[6] Recent adaptions of the WASABITI sequence with partial variations of the recovery time and optimization of the NN architecture further improved especially the T_1 maps. Below we show the comparative results to analytical WASABI and saturation recovery fits of a phantom with different T_1 times per vial, scanned at 3T. Further experiments are underway.



References

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