Supporting Information

Calibration-Free Parallel Transmission of the Cervical, Thoracic, and Lumbar Spinal Cord at 7T

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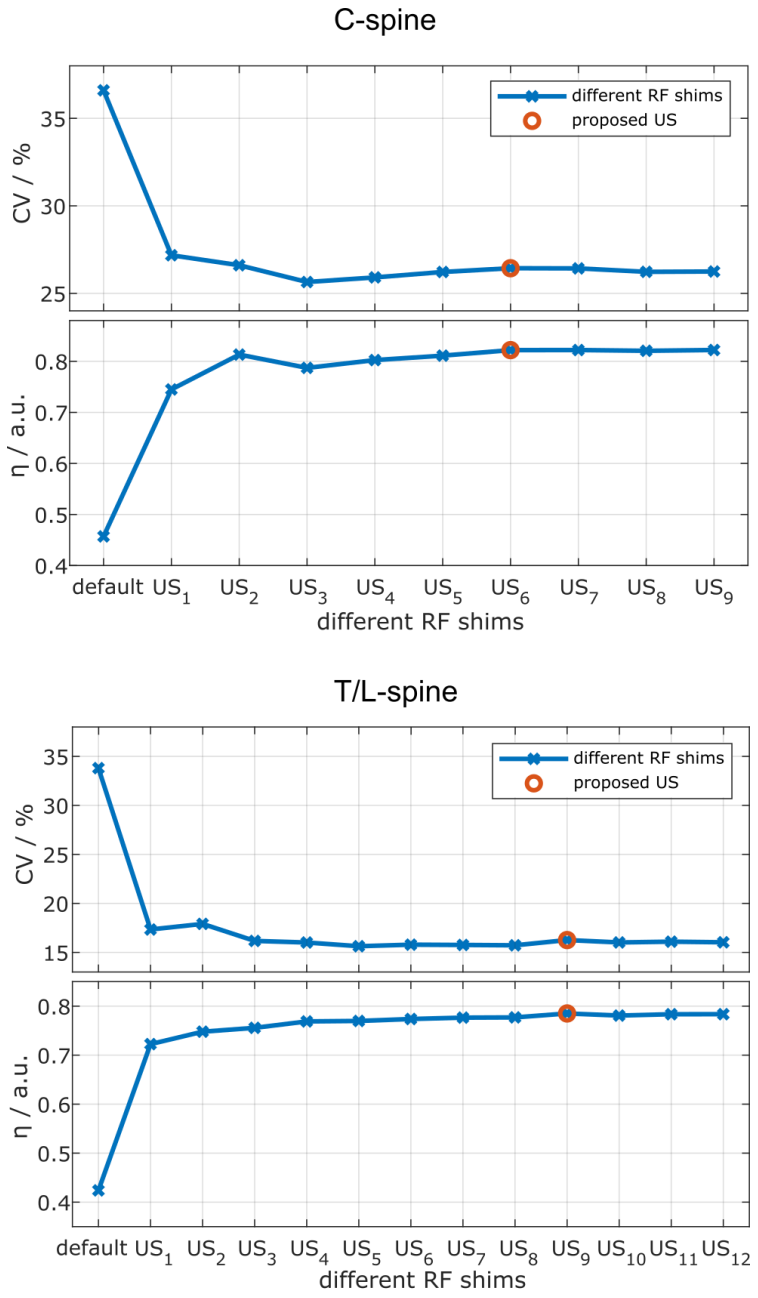
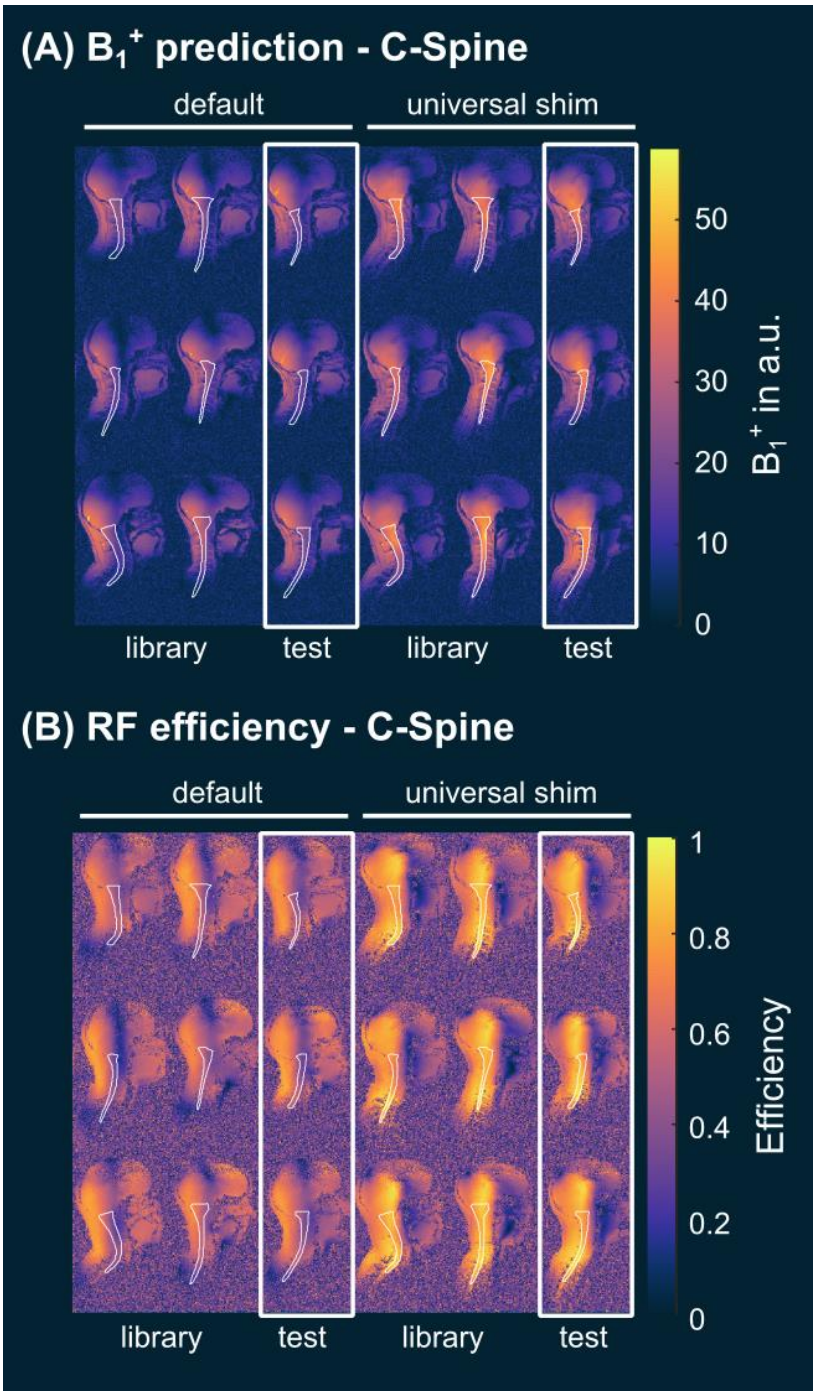
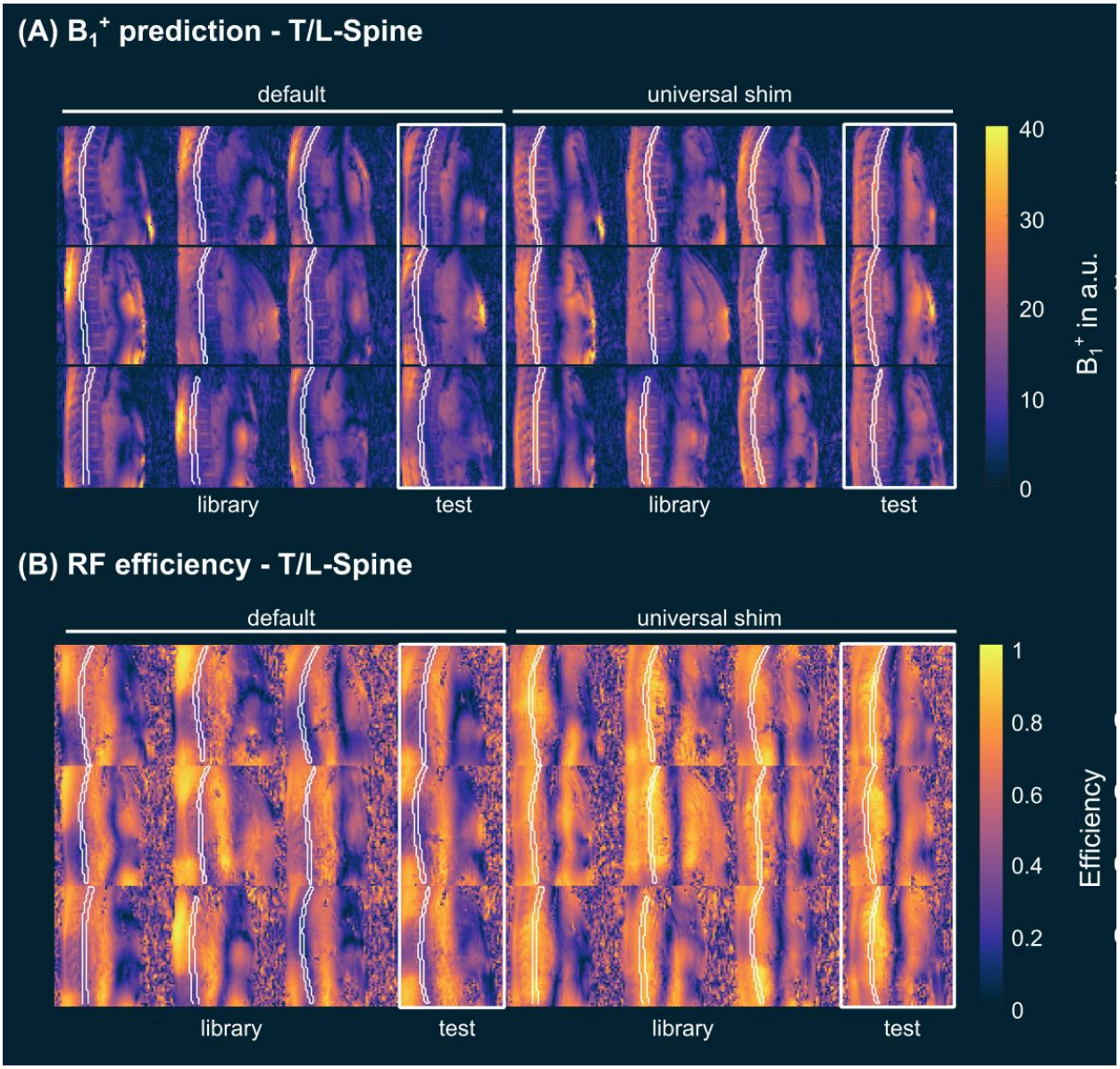


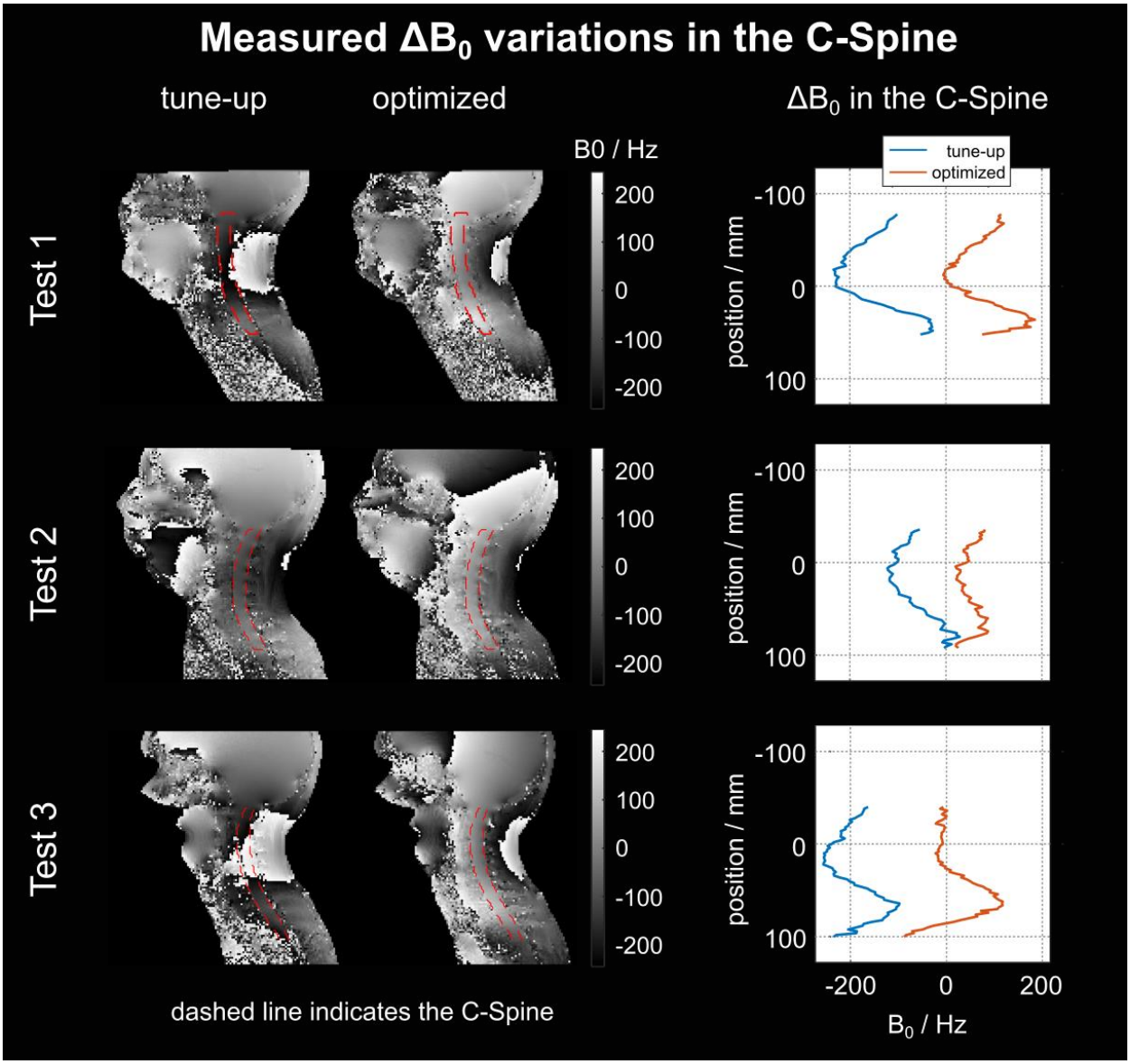
Supporting Information Figure S1: Retrospective simulation study that shows the impact of different library sizes on the RF shim performance in terms of $\boldsymbol{B_1^+}$ transmit homogeneity measured by the Coefficient of Variation (CV) and the $\boldsymbol{B_1^+}$ transmit efficiency (η). The subscript indicates how many different subjects were included in the pulse design. All RF shims were evaluated on all subjects (9 for the C-spine and 12 for the TL-spine). In the experimental validation, we measured the absolute B1+ maps with the two proposed universal shims (US6 for the C-spine and US9 for the TL-spine) and the two default RF shim configurations.



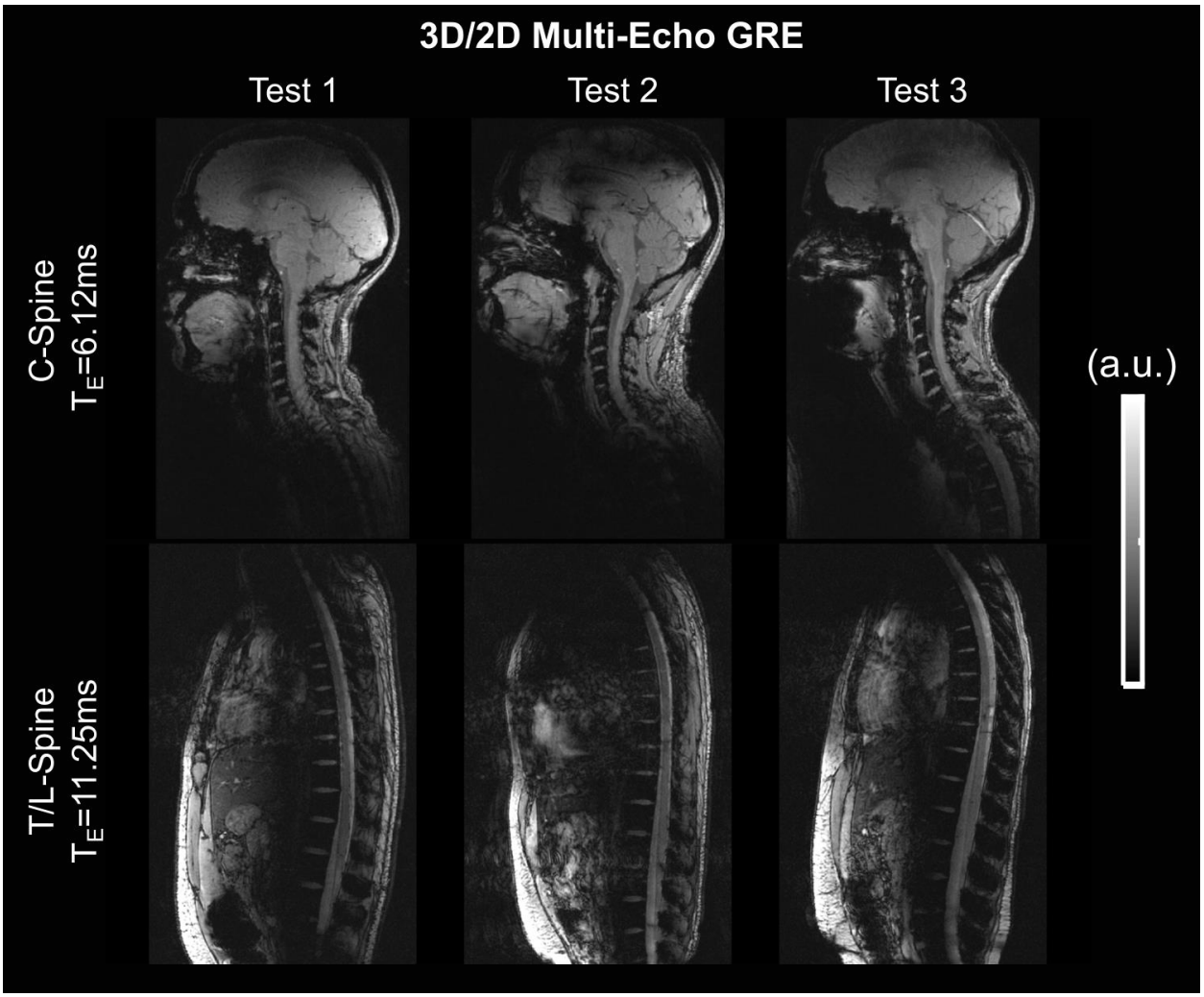
Supporting Information Figure S2: Prediction (A) and RF efficiency (B) in a single sagittal slice utilizing the default shim setting and the optimized universal phase shim specifically designed for the six C-spine regions from the library. The Universal Shim (US) outperforms the default shim with lower coefficient of variation (CV) (36% vs. 26%) and significantly increased RF efficiency (0.46 vs. 0.82) across the library and test cases, resulting in nearly a two-fold increase in the $\boldsymbol{B_1^+}$ values.



Supporting Information Figure S3: $\boldsymbol{B_1^+}$ prediction (A) and RF efficiency (B) in a single sagittal slice utilizing the default shim setting and the optimized universal phase shim specifically designed for the nine TL-spine regions from the library. The Universal Shim (US) outperforms the default shim with lower coefficient of variation (CV) (34% vs. 16%) and significantly increased RF efficiency (0.42 vs. 0.78) across the library and test cases, resulting in nearly a two-fold increase in the $\boldsymbol{B_1^+}$ values.



Supporting Information Figure S4: Measured GRE-based field map of a single sagittal slice, selected from a 3D volume, utilizing the Universal Shim setting in the C-spine of the three test cases, both before and after 2nd order B0 shimming to address magnetic field inhomogeneities within the spinal cord. The shim volume is outlined with a dashed line and was performed for the entire 3D SC volume using the SC Shimming Toolbox. The unshimmed and shimmed field maps unveil persistent high-frequency field distortions along the cord, particularly near the intervertebral junctions.



Supporting Information Figure S5: 2D and 3D multi-echo GRE data in the C-spine and TL-spine at a later echo time compared to the data shown in Figure 7. The TL-spine data presents a single 2D slice acquired during a breath-hold (1mm in-plane resolution; 2mm slice thickness), while the C-spine is imaged during free-breathing in 3D with a 1mm isotropic resolution.