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Individually optimized dynamic parallel transmit pulses for 3D high-resolution SPACE imaging at 7T

Gian Franco Piredda[1], Emilie Sleight[2,3], Thomas Yu[1,4,5], Antoine Klauser[1], Natalia Pato Montemayor[1,4,5], Jocelyn Philippe[1,4,5], Lina Bacha[1,5], Tommaso Di Noto[1,4,5], Bénédicte Maréchal[1,4,5], Patrick A. Liebig[6], Dominik Nickel[6], Tobias Kober[1,4,5], Tom Hilbert[1,4,5], Robin M. Heidemann[6], Jürgen Herrler[6]

[1]Advanced Clinical Imaging Technology, Siemens Healthineers International AG, Lausanne, Switzerland, [2]Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland, [3]CIBM Center for Biomedical Imaging, Lausanne, Switzerland, [4]Department of Radiology, Lausanne University Hospital and University of Lausanne, Lausanne, Switzerland, [5]LTS5, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland, [6]Siemens Healthineers AG, Erlangen, Germany.

BACKGROUND

Although clinical 7T scanners offer remarkable technical advancements compared to lower field strengths[1], achieving uniform B_1^+ fields remain a challenge[2]. This is especially significant in 3D SPACE sequences[3,4], where a long train of refocusing pulses with varying flip angle (FA) is needed to obtain different clinically useful contrasts[5].

AIMS

In this study, we investigate non-parametrized and scalable dynamic pTx pulses, obtained as a combination of universal pulses and a fast online-customization (FOCUS)[6], for SPACE imaging at 7T and compare them to routinely used circularly polarized[7] (CP) pulses.

METHODS

The proposed workflow for individually optimized scalable pTx pulses is presented in Figure 1. Non-parametrized pTx pulses were designed for inversion, and, with symmetric RF and gradient shapes, for excitation and refocusing. The pulses are then individually optimized online within a clinically acceptable computation time. T_1-weighted, T_2-weighted, FLAIR and DIR SPACE images were acquired in five healthy subjects at 7T (MAGNETOM Terra.X, Siemens Healthineers, Forchheim, Germany) using both CP and dynamic pTx pulses for comparison.

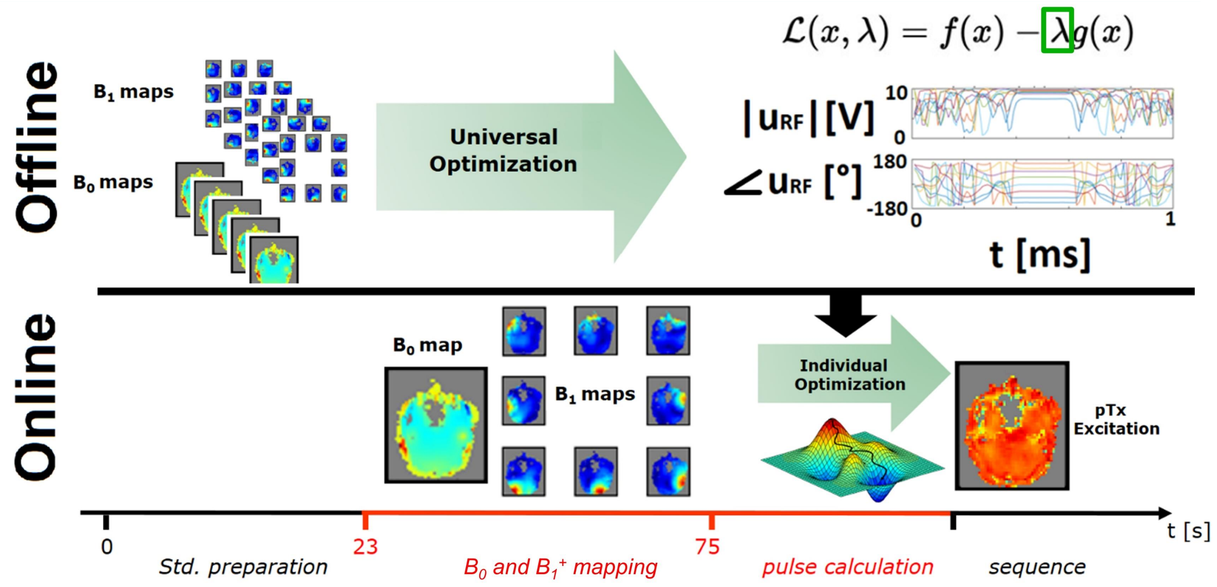

***Figure 1**: Proposed workflow for individually optimized scalable pTx pulses.*

RESULTS

Improved SNR and reduced B_1^+ field inhomogeneity could be visually appreciated in all the acquired images with proposed solution for individually optimized dynamic pTx pulses in comparison to CP.

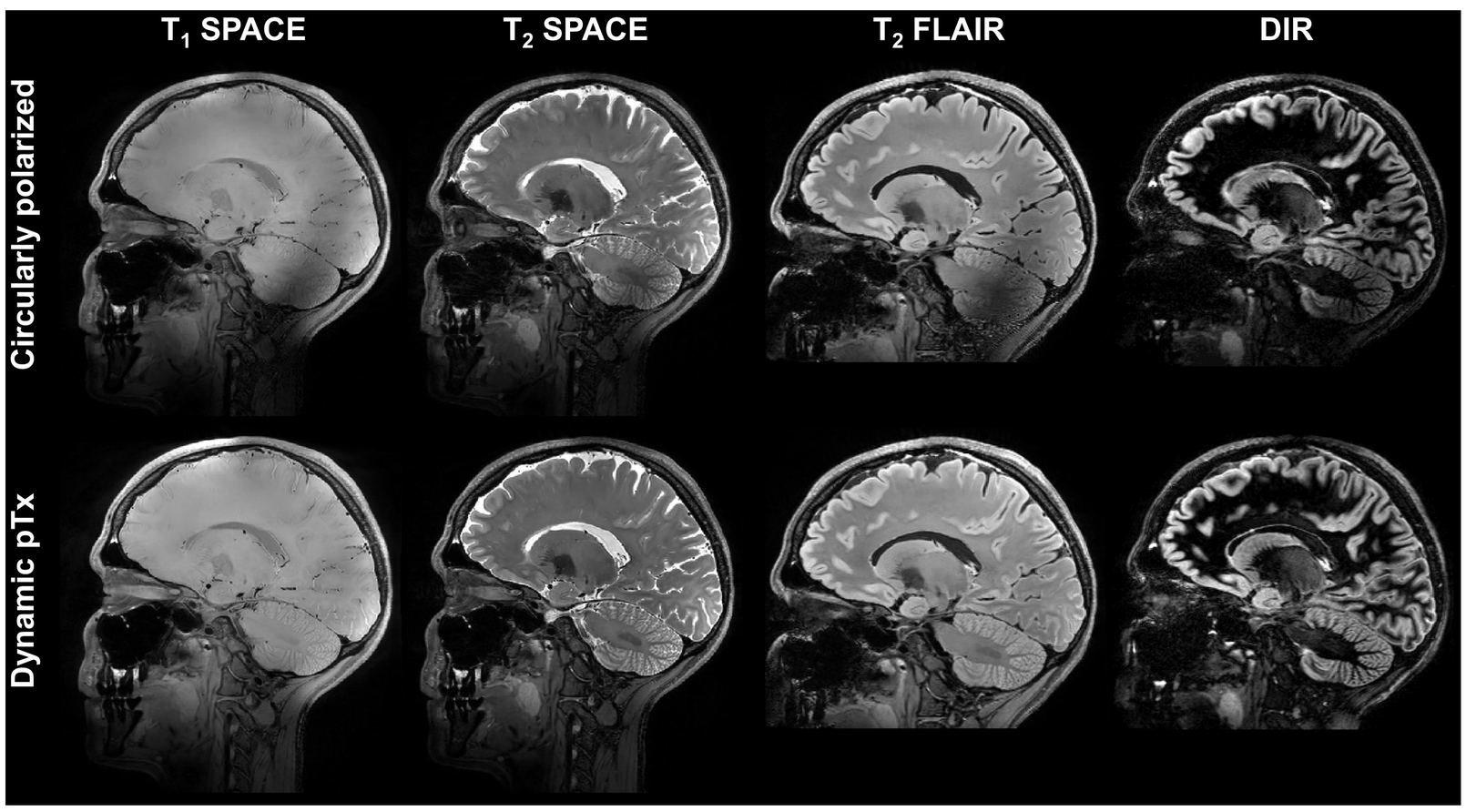

***Figure 2**: Representative T_1-weighted, T_2-weighted, FLAIR, and DIR SPACE images acquired using circularly polarized (CP) pulses or the proposed solution for individually optimized dynamic pTx pulses.*

CONCLUSION

Individually optimized dynamic parallel transmit pulses for 3D high-resolution SPACE imaging at 7T achieve clinically acceptable image homogeneity and acquisition time, enabling the application of widely used clinical contrasts at 7T.

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