Max-Planck-Innovation

Technology Offer

Multichannel coil for UHF MRI

File no.: MI 0107-4677-BC-JK

Max-Planck-Innovation GmbH
Amalienstr. 33
80799 Munich
Germany

Phone: +49 (89) 29 09 19 - 0
Fax: +49 (89) 29 09 19 - 99
info@max-planck-innovation.de
www.max-planck-innovation.de

Keywords

Magnetic resonance imaging (MRI), multi-channel coil, RF shimming, high resolution imaging, ultra-high field (UHF)

Background

Exploiting the benefits offered by magnetic resonance imaging (MRI) at ultra-high fields (≥ 7 Tesla) requires optimized radiofrequency (RF) coils. MRI at UHF operates in a regime where the RF wavelength is comparable to the dimensions of the sample size, resulting in an inhomogeneous distribution of the transmit field (B_1^+) and in an impaired image quality. An array of independent transmit coils arranged in multiple rows provides the degrees of freedom to influence the B_1^+ field across the sample in all three scan planes. Receive arrays shaped to the contours of the anatomy increase the signal to noise ratio (SNR) and enhance the parallel imaging capabilities. The advantages offered by separate transmit and receive array techniques can be combined for human brain imaging in high field MR scanners.

Contact
Dr. Bernd Ctortecka
Phone: +49 (89) 29 09 19 - 20
ctortecka@max-planck-innovation.de

Technology

Scientists from the Max Planck Institute for Biological Cybernetics have developed a novel multi-channel coil setup optimized for MR imaging of the human brain at ultra-high fields. The setup combines a 31-channel receive array with a 16-channel dual-row transmit array that is further equipped with TR switches allowing for transmit-only and transceive mode operation. Static and dynamic RF shimming methods can be applied to the transmit array to improve homogeneity and efficiency of the transmit B_1^+ field on arbitrary target volumes. Signal voids, typical for UHF MRI in the lower brain with circularly polarized (CP) transmit phase configuration, could be completely corrected (Fig. 1). Together with the close-fitting 31-channel receive array, this coil setup provides whole brain coverage with unrivalled SNR as illustrated in Fig. 2.

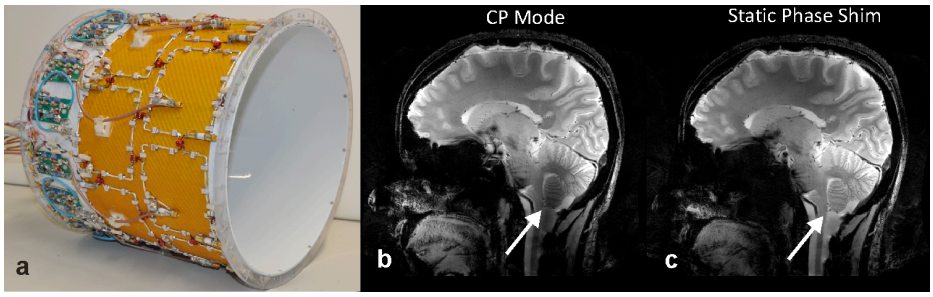

Fig. 1: (a) Dual-row 16-channel transceive / transmit array for imaging at ultra-high fields. (b and c) Performance record: The use of static phase shimming (c) features homogenous excitation of the entire volume in comparison to images taken in conventional CP mode (b) featuring dark areas indicative for inhomogeneous excitation.

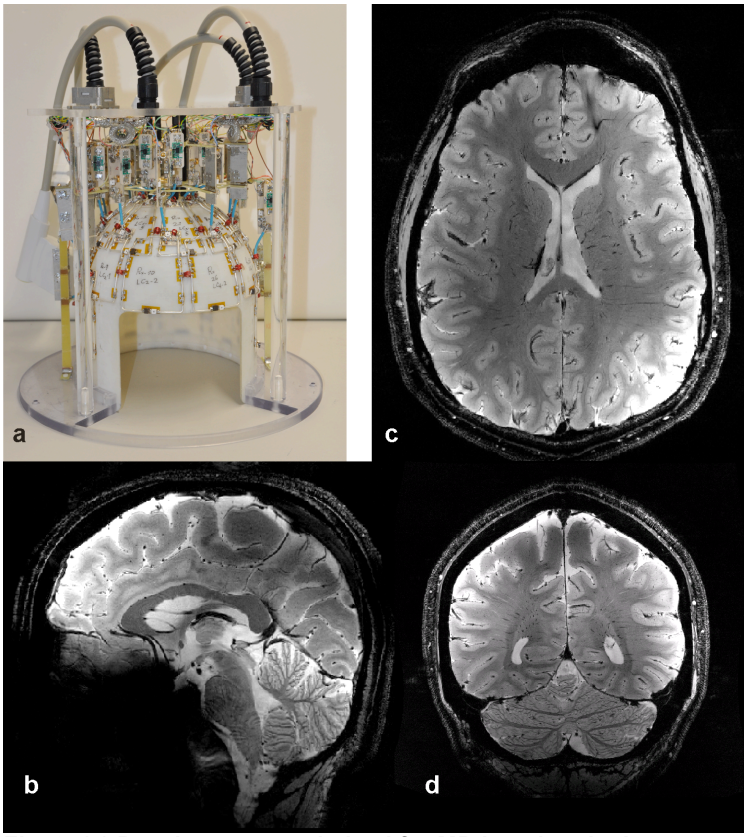

Fig. 2: (a) Receive array optimized for MR imaging the human brain. (b, c, d) Performance record: In-vivo images with high SNR and whole brain coverage.

Advantages

Multi-channel coil optimized for MR imaging of the human brain features

- 16-channel dual-row transmit array with mutually decoupled adjacent elements
- B_1^+ field manipulation using static and dynamic RF shimming methods
- TR switches for transceiver mode operation
- 31 receive elements with a novel coil arrangement for
  - improved decoupling from adjacent elements
  - improved parallel imaging performance
  - unrivalled SNR from the entire brain

Patent Information

- PCT patent pending

Literature

G. Shajan, M. Kozlov, J. Hoffmann, R. Turner, K. Scheffler, and R. Pohmann, *"A 16-channel dual-row transmit array in combination with a 31-element receive array for human brain imaging at 9.4 T"*, Magnetic Resonance in Medicine, Vol **71**(2), p 870–879 (2014)