PPA With A Four Channel Transmit/Receive Microstrip Array For 17.6 T

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INTRODUCTION:

Phased arrays[1] can achieve an increased SNR over large volumes or an reduction in imaging time by sampling fewer k-space lines. These arrays become more complicated at high field applications due to the lack of space in the magnet and the more complicated decoupling of the single coils. An interesting approach for a transmit/receive array [2,3] using microstrip coils was recently introduced, which can potentially overcome these limitations. This abstract shows the first GRAPPA reconstructions with our four channel microstrip array for 17.6 T[4].

METHODS:

The four channel microstrip array was built for a proton frequency of 750 MHz. Each of the four coils were oriented in 0, 90, 180, 270 degree position around an inner diameter of 43 mm. In order to achieve the correct phasing of the channels for a homogeneous transmit profile, each coil was fed with a cable of a specific length after a power splitter. No additional decoupling mechanism, such as overlap or preamplifier decoupling was used to decouple the single coils.

Figure 1: The four channel microstrip array coil

Imaging experiments were performed on our Bruker Avance 750 WB spectrometer. The used phantom was a 29 mm diameter piece of bacon.

RESULTS:

All four coils could be impedance matched both unloaded and with saturated NaCl-solution. No splitting in resonance peaks was observed. The average decoupling of neighboring coils with a 250mM NaCl load was 20.4 dB while for two opposing coils it was -30.2 dB. The Q_0/Q_l – ratio was approximately 220/130. Imaging experiments confirmed the good isolation of the coils as well as the relatively homogeneous transmit profile (Fig. 2). Figure 3 shows a sum of squares reconstruction of the single coil images.

The aquired data was used to retrospectively calculate parallel imaging reconstructions using the GRAPPA[5] reconstruction algorithm (Fig. 4).

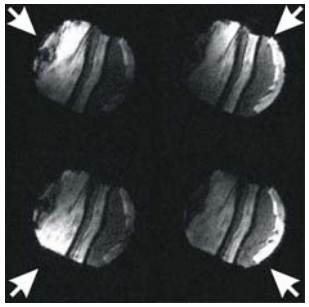

Figure 2: Images of the single coils. In transmission all four coils were used.

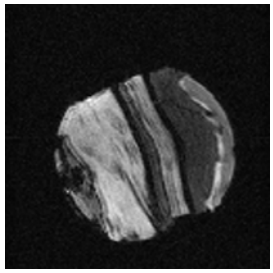

Figure 3: Sum of squares reconstruction of the single coil images.

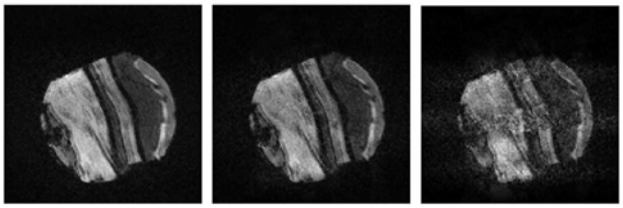

Figure 4: Retrospectively calculated parallel imaging reconstructions from the four channel array from R=2 (left) to R=4 (right) using the GRAPPA reconstruction algorithm. 8 extra reference lines were used for the 2x and 3x reconstructions, while 12 lines were used in the 4x reconstruction

DISCUSSION:

The four element transmit/receive microstrip array appears to be a promising coil arrangement for high field microscopy experiments. The primary benefit is the lack of a need for a homogeneous transmit coil. This is especially critical in small-bore microscopy experiments where the limited space is the constraining factor for all coils. The microstrip array is especially promising in this regard since it is relatively thin and can therefore be used on large samples. The array shows also good PPA-results up to a reduction factor of three with four coils.

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ACKNOWLEDGEMENTS:

Funded by the Deutsche Forschungsgemeinschaft (Ha 1232/13-3) and the Alexander v. Humboldt Foundation (Wolfgang Paul Award)
I would like to thank RAPID Biomedical for their support.