VOLUME BIRDCAGE COILS OPTIMISED FOR LARGE SAMPLES AT 900 MHZ

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Introduction

The development of the 900 MHZ UWB magnet at the NHMFL generates significant challenges in rf engineering. The construction of relatively large volume coils at such high frequencies provides challenges in terms of tuning and matching, loading, rf inhomogeneities and wave effects, and the tight spatial constraints in *in vivo* studies looking to maximize the full use of the magnet bore. The increased length of the magnet and hence the rf probe also provides non-trivial issues for remote tuning and matching, sample maintenance in *in vivo* studies, and SNR maximization. In this report, we describe our first attempts to construct single tuned birdcage coils at 900 MHz incorporating a novel remote tuning device (1). These coils fit in the conventional wide bore gradients of the 900 system, and act as predecessors for future probes utilizing the full bore of the UWB 900 system when larger diameter gradient sets are delivered.

Experimental

A conventional birdcage coil was constructed to fit on a wide bore probe body constructed at the NHMFL suitable for the 900MHz system. The eight element array was a low pass design (capacitors in the element rungs). To facilitate remote tuning and matching a novel remote circuit was developed that was placed at the end of the probe body (patent pending, (1)). This system provides easy tuning and matching with minimal signal loss. Coils were constructed at 750 and 900 MHz for the two systems and the images and SNR improvements examined using conventional imaging sequences.

Results and Discussion

2.5cm diameter rf coils were constructed for imaging the mouse brain *in vivo*. A prototype probe was constructed at 750 MHz (see figure 1) and performed satisfactorily i.e. gave similar performance characteristics to existing probes. Subsequently a probe was constructed at 900 MHz on a probe body built at the NHMFL and designed to accommodate *in vivo* samples (Figure 1). The increased length of the probe is evident when compared with a 600MHz narrow bore probe body. Phantom images demonstrated excellent image homogeneity both axially (not shown) and longitudinally (Figure 1). The SNR improvement from 750 to 900 MHz was demonstrated as expected at approximately 40%.

Figure 1. 750 MHz probe body (top left) with an enlarged image of the birdcage coil section (top right). The 900 probe is similar but longer (bottom left) as shown next to a conventional probe on its left. Good homogeneity is shown on a longitudinal image (bottom right).

Conclusions

We have constructed a working birdcage coil at 900MHz for an equivalent wide bore system. The image homogeneity and SNR improvements at this high field when compared to data at 750 MHz were good. We are now constructing similar multi-tuned rf coils, particularly for ^{23}Na and ^{13}C applications, and planning similar coils at larger diameters when larger bore gradients become available. At those dimensions wave effects will become significant and will require a rf coil design development and simulation to minimize image inhomogeneities.

References.

(1) D Clark et al., Patent Pending (2007).

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