**Introduction:**

Current high field MR systems have no body resonator. Therefore many clinical type applications requiring homogeneous volume excitation in combination with local surface coil reception are not easily implemented at high fields. More recently however, detunable volume coils have been developed to be used with receive-only surface coils for highest SNR gains from a homogeneously excited region [1,2,3]. Ideally such detunable volume coils perform as efficiently as their transmit/receive counterparts at 4T. The high efficiency of the TEM resonator for frequencies above 128MHz was demonstrated previously [4]. Thus a detunable TEM transmit coil was used in conjunction with linear and quadrature surface coils for applications that require whole volume inversion such as FAIR [5] and SE based fMRI.

**Methods:**

We used a 24-element TEM resonator with an outer shield diameter of 39cm and an inner diameter of 32cm (ENON Microwave Inc., Topsfield MA). Surface mounted PIN diodes short-circuited each resonant line element to the coil’s cavity wall (shield) for active transmitter detuning. The receiver surface coils were detuned with a resonant trap circuit using M/A Com MA4PK2000 diodes. All diodes were biased through RF chokes. The DC tune / detune bias for the TEM head coil was –35V / +5V. We built linear and quadrature 8cm surface coils from copper tape and distributed ATC 100E capacitors, to allow for transmit/receive operation of the surface coils for comparative studies. We used a SIEMENS PIN driver board (Erlangen, Germany) controlled by TTL signals from our 4T Varian Unity Inova console (Palo Alto, CA). The cavity wall of the TEM volume coil was coaxially slotted to minimize eddy current propagation thereon. [6].

**Results and Discussion:**

Active PIN diode circuits allow the TEM volume coil to be electronically switched to one of three modes: transmit only, receive only, and transmit / receive. The receiver coils were similarly controlled. The TEM coil was first switched to the “normal” transmit/receive head coil mode and compared to a smaller (27cm i.d.) shielded birdcage of standard high pass design. Both coils registered a 90° pulse power calibration in the head of 200W RF power for a 2ms Gaussian pulse. Both coils produced homogeneous whole head images of comparable SNR at 170MHz. To evaluate the detunable TEM volume coil + surface coil combination in application, we compared their performance in a simple visual stimulation task. Corresponding activation maps with the same confidence thresholds show activation deep in the visual cortex for the transmit/receive surface coil only (a) and the combination coil (b).

**References:**


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**Fig. 1** T1 anatomic image, through the primary visual area, using a 256x256 turbo-flash sequence with an 8cm surface coil only (on the left) and the combination coil (on the right).

**Fig. 2** Time courses from the selected ROI (shown in Fig.1) deep in the visual cortex for the transmit/receive surface coil only (a) and the combination coil (b).

**Fig. 3** Axial image acquired with the TEM resonator in transmit/receive mode (MDEFT, TR=1.2s, 256x256).