3D VECTOR MAGNETIC FIELD OF TMS COIL FROM MULTIPLE-SLICE *IN VIVO* MR Z-COMPONENT PHASE MAPS, D.E.Bohning, A.Shastri, Z.Nahas, J.Lorberbaum, D.J.Vincent and M.S.George, Medical University of South Carolina, Charleston, SC, USA

Transcranial magnetic stimulation, a technique in which a pulsed magnetic field from a handheld coil is used to create neuron depolarizing currents in the cerebral cortex is finding growing application in the investigation of brain function. Progress with this exciting new technique, though rapid, has been hampered by inexact knowledge of the location and strength of stimulation. Recently, using MR phase mapping, we were able to obtain in-vivo maps of the relative strength of the z-component of the TMS coil's magnetic field with respect to the cerebral cortex of the individual undergoing stimulation. Despite the usefulness of these maps, a full 3D vector representation of the TMS coil's field is required to estimate the induced electric currents which actually depolarize neurons.

In the present work, using in-vivo MR z-component phase maps as input, a point-by-point difference method was used to solve Maxwell's Equations for the x and y components, obtaining the full three dimensional magnetic vector field corresponding to the magnetic field of the TMS coil in-vivo. Knowing the 3D vector magnetic field produced by the TMS coil at any point in the cortex will provide the basis for improved, individualized estimates of the TMS pulse induced electric fields, and significantly improve the ability to relate response to neuron stimulation and/or inhibition.

.