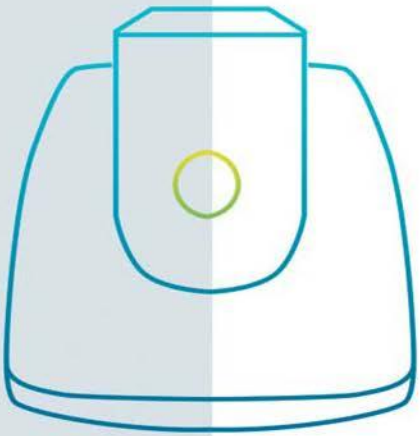
White Paper

An In-Depth Look at BrainsWay Technology (Deep TMS)



BrainsWay®

Deep Transcranial Magnetic Stimulation (Deep TMS) using BrainsWay's H-coils is a novel development in non-invasive neuromodulation.

The ability to stimulate deeper neuronal structures than any other commercially available TMS system is based on science and engineering.

BrainsWay holds the exclusive rights to the Deep TMS technology, which was originally patented by the NIH, with subsequent patents by BrainsWay. Deep TMS H-coils feature a complex coil geometry designed to enhance the depth penetration of TMS.

Transcranial magnetic stimulation (TMS) is delivered using an electromagnetic coil placed against the scalp surface. The coil generates brief but powerful magnetic field pulses, which pass unimpeded through the scalp and skull and induce an electric field in the brain. Electric currents are induced by TMS at points where the coil is tangential to the scalp. Non-tangential coil elements cause the accumulation of surface charge, which counteracts the induced field resulting in faster dissipation.1,2

TMS is typically delivered using a rigid figure-8-shaped coil. BrainsWay's Deep TMS H-coils feature a unique design in which multiple coil elements are oriented tangentially with respect to the scalp surface, and non-tangential coil elements are minimized (Figure 1). A flexible base allows the coil to conform to the curvature of the scalp for maximal magnetic coupling. When the coil is discharged, various elements act in concert, and locally induced fields combine to form a deeper and broader total electric field whose rate of decay is considerably slower compared to other TMS coils.3-5

What is the significance of the rate of decay of the induced electric field?

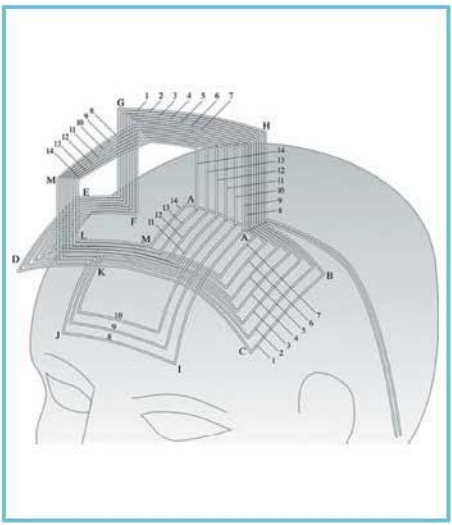


FIGURE 1. *Sketch of the H1-coil near a human head. The coil position and orientation shown in the figure are designed for activation of deep neuronal targets in lateral and medial prefrontal regions, with left hemispheric preference. Figure taken from [5].*

Slow and Steady Wins the Race

All TMS protocols are bound by the same safety guidelines, permitting the same maximal field strengths to be produced at the cortical surface (in depression protocols, this is equal to 120% of the patient's individual's resting hand motor threshold [MT]).6 The magnitude of the induced electric field is always stongest at the scalp and it diminishes with increasing distance from the coil.1,2,7-9 The threshold intensity required to achieve neural stimulation in the motor cortex is on the order of 100 V/m.10 The depth of effective stimulation depends on the rate at which the electric field decreases with distance.

This rate of decay was measured (see Section 2: The Math of Deep) for the BrainsWay H1-coil and the figure-8 TMS coil.5,11 The H1-coil was found to have a much slower rate of attenuation, allowing the stimulation to penetrate deeper into the brain at the same safe stimulation levels (Figure 2). To reach similar depths with the figure-8 coil, stimulator output would have to be increased beyond safety limits, causing pain and increasing risk of seizure.

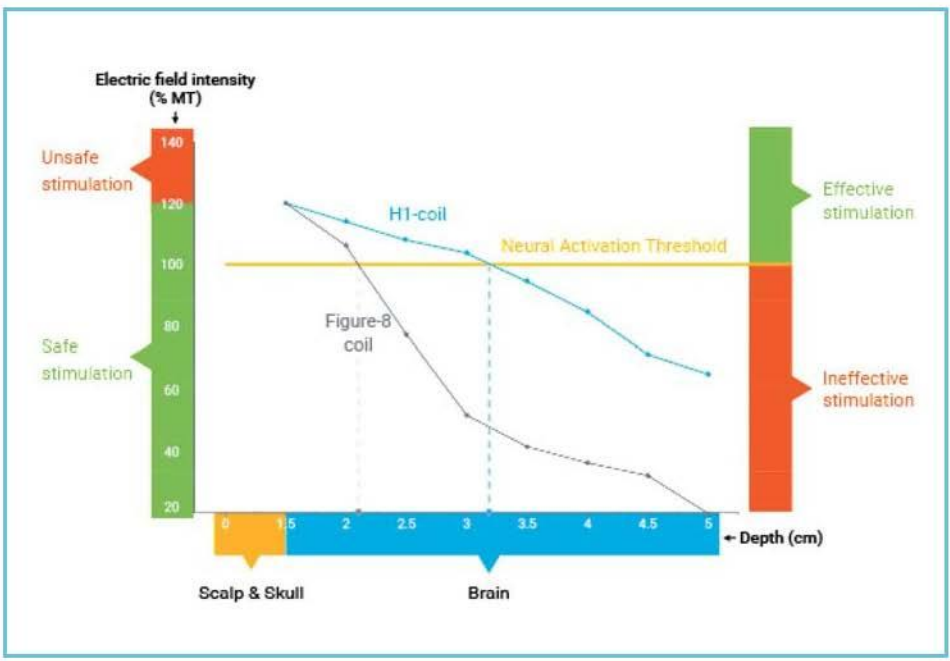


FIGURE 2. *Decay profiles of the electric fields produced by the H1-coil and figure-8 coil. The maximal depth of effective penetration can be read off the graph at the points of intersection of the decay curves with the threshold for neuronal activation. Thanks to its slower rate of decay, the field induced by the H1-coil remains above this threshold at greater distances from the coil. Figure based on data from [11].*