

SimNIBS coil models according to

Deng ZD, Lisanby SH, Peterchev AV.

Electric field depth-focality tradeoff in transcranial magnetic stimulation: simulation comparison of 50 coil designs.

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The SimNIBS coil models were created by importing the CAD files supplied by Zhi-De Deng into Comsol, which was then used to simulate the magnetic vector potential. Alternatively, some of them were created directly in Comsol using the information about the winding geometry stated in the supplementary material from the paper published by Zhi-De Deng (Brain Stim 2013) (indicated by the Comment “own drawing” in the following table). The workflow to create the SimNIBS coil models is briefly summarized in the following flow chart:

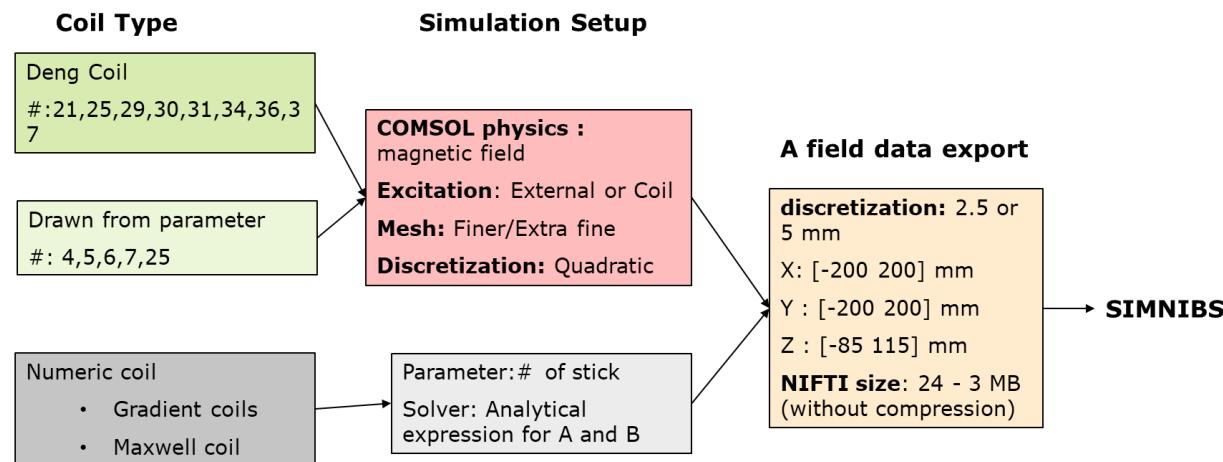
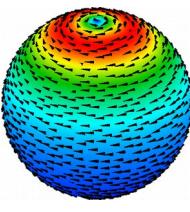
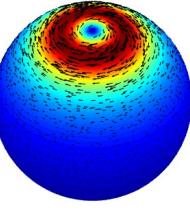
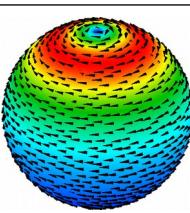
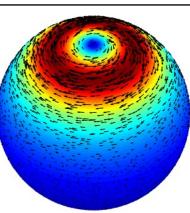
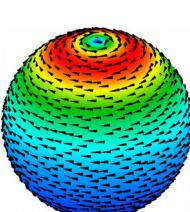
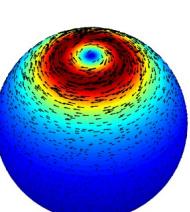
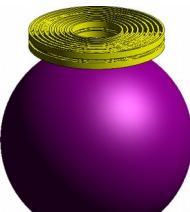
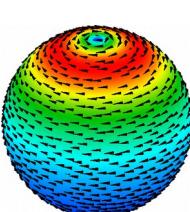
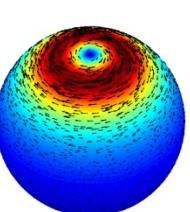
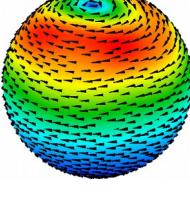
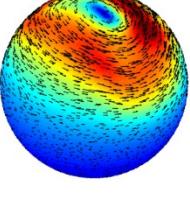
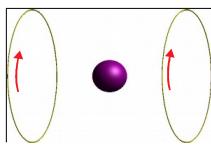
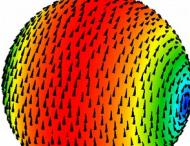
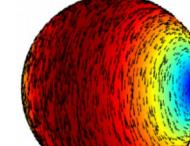
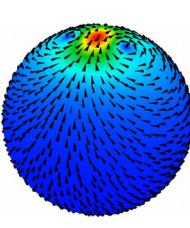
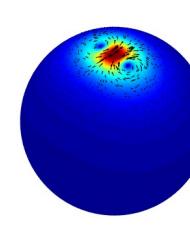
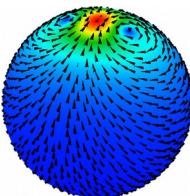
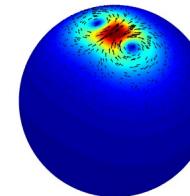
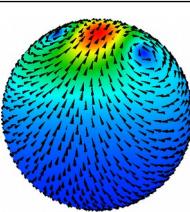
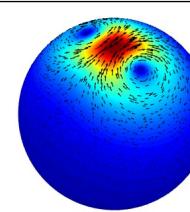
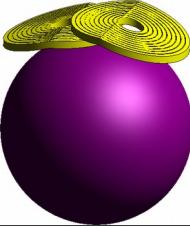
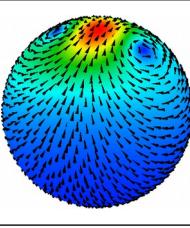
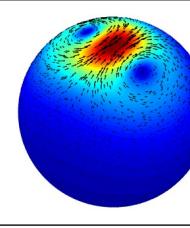
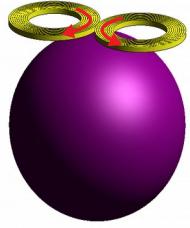
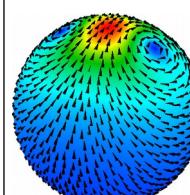
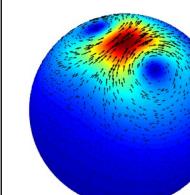
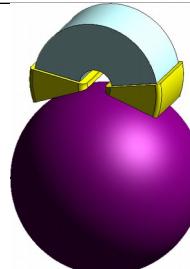
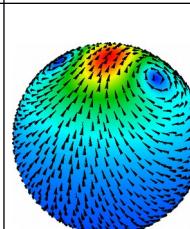
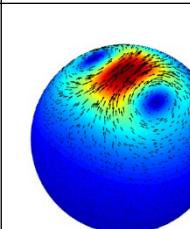
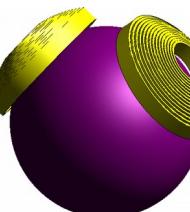
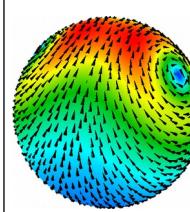
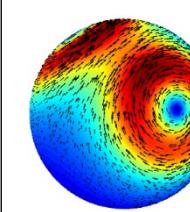
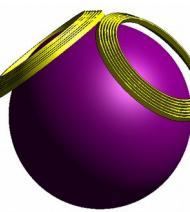
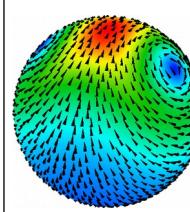
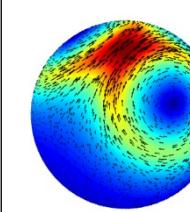
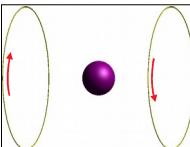
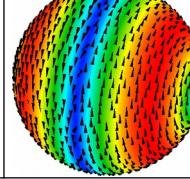
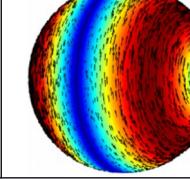


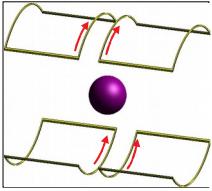
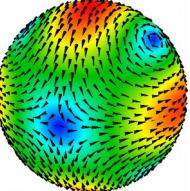
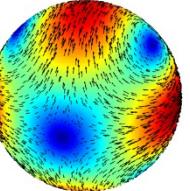
Table: This table was adapted from the table in the suppl. material from Deng (Brain Stim 2013) to show the coils which have been converted to SimNIBS:

Coil #	Coil model/ Manufacturer, Parameter	Simulation configuration	Electric field distribution†		Emax [V/m]	$d_{1/2}$ [cm]	$S_{1/2}$ [cm ²]	Comment	Ref
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4	70 mm circular (P/N 9762)/Magstim, Flat spiral winding OD = 94 mm ID = 40 mm WC = 1.75 mm × 6 mm N = 15 turns				2.72	1.44	66.0	Own Drawing 2
5	Flat spiral winding OD = 123 mm ID = 66 mm WC = 1.75 mm × 6 mm N = 14 turns				2.74	1.74	87.4	Own Drawing 2
6	MST animal circular/ Magstim, Double layer flat spiral winding OD = 97.5 mm ID = 47 mm WC = 1.75 mm × 6 mm N = 9 turns/layer×2 layers = 18 turns				2.89	1.53	72.7	Own Drawing —
7	MST human circular (S/N MP39)/ Magstim, Double layer flat spiral winding OD = 120 mm ID = 44 mm WC = 1.75 mm × 6 mm N = 9 turns/layer×2 layers = 18 turns				2.81	1.72	86.4	Own Drawing —
9	H1/ Brainsway, Wire segments 4–12 cm in length WC = 1 mm × 1 mm				2.54	2.14	113	Redrawn from CAD. Electric current is employed instead of Coil Physics 5-10

20	MRI z-gradient coil parallel-current (Helmholz) mode, Coil diameter = 0.7 m Coil length = 0.8 m				0.043	3.49	273	Implemented as Numerical Coil	16
21	3-layer double coil/ experimental Stacked flat spiral winding OD = 30 mm ID = 8 mm WC = 0.7 mm × 7.1 mm (stranded) N = 13 turns/layer × 3 layers × 2 wings = 78 turns				2.75	0.87	5.07	2.5 mm discretization for A field.	
25	25 mm figure-8 (P/N 1165)/ Magstim, Flat spiral winding OD = 42 mm ID = 18 mm WC = 0.75 mm × 6 mm N = 14 turns/wing × 2 wings				2.88	0.96	6.46	Own Drawing	2,23
29	C-B60 butterfly/ MagVenture, Flat spiral winding OD = 75 mm ID = 35 mm WC = 1.75 mm × 11 mm (stranded) N = 5 turns/wing × 2 wings × 2 layers				2.13	1.33	12.9	From available CAD	26
30	MC-B70 butterfly/MagVenture Bent spiral winding OD = 108 mm ID = 24 mm WC = 3.5 mm × 6 mm (stranded) N = 10 turns/wing × 2 wings				2.82	1.35	13.9	From available CAD	26-28

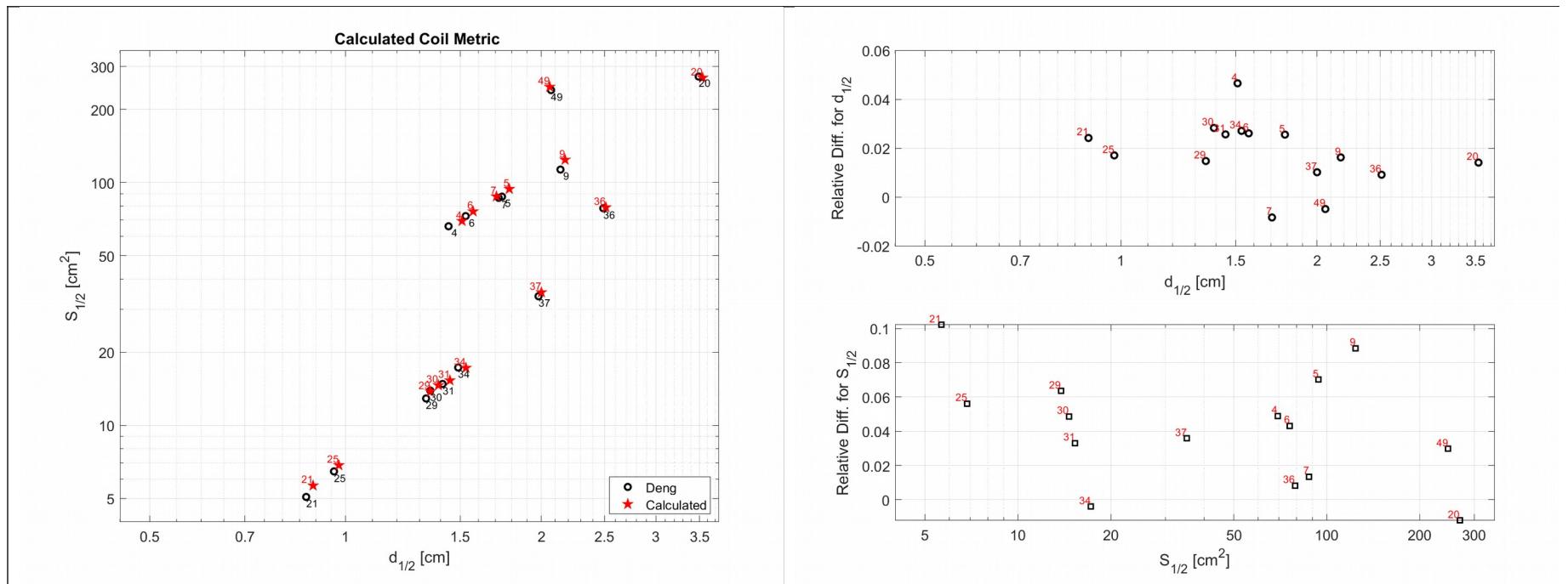
31	70 mm figure-8 (P/N 9925, 3190)/ Magstim, Flat spiral winding OD = 87 mm ID = 56 mm WC = 1.75 mm × 6 mm N = 9 turns/wing × 2 wings				3.02	1.41	14.8	From available CAD	2,23,27
34, 34*	Iron-core figure-8/ Neuronetics, Core OD = 30.6 mm Core ID = 116 mm Wire wrapped around cross-section of the core N = 5 turns/wing (stranded)				4.91	1.49, 1.33*	17.3, 12.9*	From available CAD	31,32
36	Twin coil/ MagVenture, Stepped spiral winding OD = 119 mm ID = 40 mm H = 30 mm N = 15 turns/wing WC = 15 mm × 2.5 mm (stranded) Opening angle from origin = 100°				3.65	2.49	78.3	From available CAD	—
37	Double cone (P/N 9902)/ Magstim, Stepped spiral winding OD = 125 mm ID = 96 mm N = 7 turns/wing WC = 1.75 mm × 6 mm 100° between the wings				4.20	1.98	34.0	From available CAD	2
49	MRI z-gradient coil opposing-current (Maxwell) mode See #20 for coil dimension				0.008	2.07	240	Implemented as Numerical Coil	16

50	MRI x- (or y-) gradient (Golay) coil, Coil diameter = 0.7 m Coil length = 0.8 m				0.015	2.02	158	Implemented as Numerical Coil, separation is 0.1 m Theta: pi/3	40
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† Electric field magnitude on brain surface plotted with color map normalized to field maximum (red). Arrows indicate field direction.

†† “Same current direction” means that the current direction is clockwise in all loops or is counterclockwise in all loops

Repeating the FEM simulation in SimNIBS for a spherical head model with identical properties as those used in Deng (Brain Stim 2013) shows a reasonable match between the focality and depth values reported in the original paper:



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