

Comparison	Test statistic	Value	DF	p-value	Power	Fig
ESTT Group Ch1: P1 10V	FDR t	7.7	319	2×10^{-13}	1	1C
ESTT Group Ch2: P1 10V	FDR t	8.5	319	6×10^{-16}	1	1C
ESTT Group Ch3: P1 10V	FDR t	10.4	319	6×10^{-22}	1	1C
ESTT Group Ch4: P1 10V	FDR t	10.6	319	1×10^{-22}	1	1C
ESTT Group Ch2: P1 5V	FDR t	1.1	319	0.0065	0.78	1C
ESTT Group Ch3: P1 5V	FDR t	2.7	319	0.0045	0.81	1C
ESTT Group Ch1: N1 10V	FDR t	9.4	319	8.5×10^{-19}	1	1C
ESTT Group Ch2: N1 10V	FDR t	6.5	319	2.7×10^{-10}	1	1C
ESTT Group Ch3: N1 10V	FDR t	9.4	319	8.6×10^{-19}	1	1C
ESTT Group Ch4: N1 10V	FDR t	7.9	319	4.5×10^{-14}	1	1C
ESTT Group Ch1: N1 5V	FDR t	6.0	319	5.2×10^{-9}	1	1C
ESTT Group Ch2: N1 5V	FDR t	5.1	319	6.4×10^{-7}	1	1C
ESTT Group Ch3: N1 5V	FDR t	3.8	319	0.00014	0.97	1C
ESTT Group Ch4: N1 5V	FDR t	5.3	319	2.3×10^{-7}	1	1C
STN BOLD stim vs. non-stim	FDR t	4.0	241	0.00009	1	2C
STN BOLD stim vs. non-stim	FDR t	3.2	186	0.0015	1	S3
RT: FI3 vs. FI12	t	5.9	10	0.0004	1	S4
RT:F12 OR vs. Fig 4 DBS ON	Bayes	1.12	10	>0.5		S4
Granger: 20 Hz vs. shuffle	paired t	2.8	12	0.02	1	3G
Granger MFC vs. STN 20 Hz	paired t	2	12	0.08	0.91	3G
Granger: 4 Hz vs. shuffle	paired t	3	12	0.002	1	3G
Granger MFC vs. STN 4 Hz	paired t	2.4	12	0.04	0.91	3G
RT vs. Firing Rate	t	3	20	0.006	0.83	S6
Spike-field coherence: 4 Hz	t	2.1	34	0.04	0.98	4C
Linear Mixed-Effects Model:	t	3.4	1026	0.006	1.0	5F

Midfrontal power ~ DBS		7				
Linear Mixed-Effects Model:	Interval	11.4	1023	10^{-27}	1.0	5H
RT~STN-DBS*Interval Length						
	DBS	2.1	1023	0.04		
	Interval x DBS	2.9	1023	0.004		
s366 ESTT 10V Ch1: N1	FDR t	3.8	39	0.0004		S2
s366 ESTT 10V Ch2: N1	FDR t	3.0	39	0.004		S2
s366 ESTT 10V Ch3: N1	FDR t	4.4	39	0.0001		S2
s366 ESTT 10V Ch1: P1	FDR t	7.1	39	1.7×10^{-7}		S2
s366 ESTT 10V Ch2: P1	FDR t	9.2	39	2.8×10^{-11}		S2
s366 ESTT 10V Ch3: P1	FDR t	3.2	39	0.0027		S2
s367 ESTT 10V Ch3: P1	FDR t	4.6	39	3.9×10^{-5}		1B
s367 ESTT 10V Ch4: P1	FDR t	13.4	39	3.4×10^{-16}		1B
s367 ESTT 10V Ch1: N1	FDR t	3.4	39	0.0016		1B
s367 ESTT 10V Ch3: N1	FDR t	4.5	39	0.0001		1B
s367 ESTT 10V Ch4: N1	FDR t	3.3	39	0.0023		1B
s368 ESTT 10V Ch1: P1	FDR t	6.4	79	1.1×10^{-8}		S2
s368 ESTT 10V Ch2: P1	FDR t	6.3	79	1.8×10^{-8}		S2
s368 ESTT 10V Ch3: P1	FDR t	4.2	79	6.5×10^{-5}		S2
s368 ESTT 10V Ch1: N1	FDR t	13.4	79	1.2×10^{-6}		S2
s368 ESTT 10V Ch2: N1	FDR t	13.4	79	0.012		S2

s368 ESTT 10V Ch4: N1	FDR t	13.4	79	1.0×10^{-4}	S2
s377 ESTT 10V Ch1: P1	FDR t	11.6	79	1.9×10^{-18}	S2
s377 ESTT 10V Ch2: P1	FDR t	18.8	79	6.9×10^{-31}	S2
s377 ESTT 10V Ch3: P1	FDR t	25.1	79	2.1×10^{-39}	S2
s377 ESTT 10V Ch4: P1	FDR t	24.9	79	4.3×10^{-39}	S2
s377 ESTT 10V Ch1: N1	FDR t	11.1	79	8.9×10^{-18}	S2
s377 ESTT 10V Ch2: N1	FDR t	13.8	79	8.3×10^{-23}	S2
s377 ESTT 10V Ch3: N1	FDR t	15.8	79	4.2×10^{-26}	S2
s377 ESTT 10V Ch4: N1	FDR t	12.0	79	1.7×10^{-19}	S2
s383 ESTT 10V Ch1: P1	FDR t	3.5	79	0.0008	S2
s383 ESTT 10V Ch1: N1	FDR t	3.0	79	0.0039	S2
s383 ESTT 10V Ch2: N1	FDR t	2.7	79	0.0085	S2
s383 ESTT 10V Ch3: N1	FDR t	4.6	79	1.5×10^{-5}	S2
s383 ESTT 10V Ch4: N1	FDR t	3.3	79	0.0017	S2

91

92

93

94 **Supplementary Table 2: ESTT, es-fMRI, and ECoG demographics**

Experiment	Patient ID	Age	Gender	Clinical indication
ESTT 1	366	55	M	PD
ESTT 2	367	67	M	PD
ESTT 3	368	39	M	PD
ESTT 4	377	62	M	PD
ESTT 5	383	51	M	PD
es-fMRI	292	53	F	Epilepsy
es-fMRI	314	33	F	Epilepsy
ECoG	322	29	F	Epilepsy

95

96 **Supplementary Table 3: Human STN intraoperative demographics**

Patient ID	Age	Diagnosis	Gender	STN Side
291	50	PD	F	R & L
297	69	PD	F	L
304	72	PD	M	L
306	62	PD	M	L
309	62	PD	F	L
312	55	PD	M	L
313	64	PD	F	L
317	65	PD	M	L
326	57	PD	M	L
349	61	PD	M	R & L

97

98

99 **Supplementary Table 4: STN-DBS EEG demographics**

Patient ID	Age/gender	Medications	Levodopa equivalent dose	Left treatment setting (contact #, voltage, pulse width/Hz)	Right treatment setting (contact #, voltage, pulse width, Hz)	UPDRS (OFF/ON)	VHI
ST01	59/F	(1) Amantadine 100 mg bid (2) Comtan 200 mg qid (3) Sinemet 50-200 mg x11/d	1650	Case + 2-, 1, 60/130	Case + 10-, 1, 60/130	43/26	60
ST02	62/M	(1) Xanax 1 mg prn	0	Case + (1,2)-, 3.5, 60/150	Case + (9,10)-, 3.8, 70/150	31/19	83
ST03	66/M	(1) Amantadine 100 mg tid (2) Klonopin 0.5 mg qhs (3) Requip 2 mg tid (4) Requip 5 mg qid (5) Rytary 48.75-195 mg x13/d (6) Xanax 0.25 mg tid	2341	Case + 8-, 1.6, 60/135	Case + 9-, 1.5, 60/135	23/7	52
ST04	76/M	(1) Namenda 28 mg qd (2) Sinemet 25-100 mg half qid	200	Case + 2-, 1.1, 60/120	Case + 10-, 1.1, 60/135	27/24	68
ST05	61/F	(1) Amantadine 100 mg bid (2) Azilect 1 mg qd (3) Requip 8 mg qd (4) Sinemet 50-200 mg tid	1260	Case + 1-, 1.7, 60/135	(8,10)+ 9-, 2.2, 60/135	9/3	15
ST06	51/F	(1) Klonopin 1 mg bid (2) Sinemet 25-100 mg x9/d	900	Case + 2-, 2.2, 120/130	Case + 10-, 2.7, 140/130	31/11	32
ST07	68/M	(1) Parcopa 25-100 mg prn (2) Rytary 23.75-95 mg x8/d	656	3+ 2-, 3.6, 140/130	3+ 2-, 3.5, 100/130	8/2	30
ST08	64/M	(1) Amantadine 100 mg qd (2) Klonopin 0.5 mg half tid (3) Stalevo 18.75-75-200 mg x5/d	665	Case + 8-, 3.7, 120/130	Case + 0-, 3.6, 120/130	34/24	68
ST09	72/M	(1) Amantadine 100 mg bid (2) Sinemet 25-100 mg x6/d	700	Case + 3-, 2.7, 60/130	Case + 8-, 3.5, 90/130	21/8	41
ST10	69/F	(1) Sinemet 25-100 bid (2) Xanax 0.5 mg prn	200	Case + 0-, 2.5, 60/130	Case + 10-, 2.5, 60/130	21/16	25

100

Supplementary Table 5: Linear mixed-effects model

RESPONSE TIME (SEC)						
Fixed effect					Confidence interval (95%)	
Name	Estimate	SE	t-value	p-value	Lower limit	Upper limit
(Intercept)	8.95	1.28	6.99	0.00	6.44	11.46
Midfrontal EEG*	0.38	0.17	2.25	0.02	0.05	0.72
DBS**	0.01	0.00	8.33	1.50E-16	0.01	0.01
Random effect						
Group	Name	std			Lower limit	Upper limit
Subject	(Intercept)	4.03			2.59	6.26
Error		3.70			3.59	3.82

*1-4Hz midfrontal EEG power at 300-500ms (n=1956 trials)

**ON; OFF; ON_4HZ