Divergent Neural Processing of Self-Referential Stimuli in Orbitofrontal and Ventromedial Cortex Populations

```
% -*- UFT -*-
% Author: behira
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% loading the data
clc
clear
data = readtable('data\stimlock.tsv', FileType='text'); % reading that tabular data
```

Subject and Experimental Condition

```
% create report object
report = stat_report(data, 'data\BHV.json', 'data\FrontalEcogvsSeeg.json'); % stat_report insta
% print some info
Uniq_id = report.report("num_indiv");
```

```
The total number of pt is: 22
```

```
report.report("number_total_elec"); % statistical summary of number of electrodes
```

```
The total number of elec is: 253, in total patients 22
 mean (std) # elec: 11.50(10.60), range =  [1,38]
```

Behavioral Data

Finding out how many trails per conditions have been performed on average.

```
report.report("number_trials"); % statistical summary of number of trials per condition
```

```
EP # trails: mean (std): 24 (1.2)
SJ # trails: mean (std): 24 (1.9)
MTH # trails: mean (std): 39 (1.7)
```

```
report.report("number_true_false") % statistical summary of number of trials responded with tru
```

```
EP true # trails replied with true: mean (std): 9 (4), range = [4,22]
EP false # trails replied with true: mean (std): 15 (4), range = [4,21]
SJ true # trails replied with true: mean (std): 16 (3), range = [8,23]
SJ false # trails replied with true: mean (std): 8 (3), range = [3,14]
MTH true # trails replied with true: mean (std): 21 (4), range = [15,31]
MTH false # trails replied with true: mean (std): 16 (3), range = [9,20]
ans = struct with fields:
     true: {[9 4 4 22]  [16 3 8 23]  [21 4 15 31]}
    false: {[15 4 4 21]  [8 3 3 14]  [16 3 9 20]}
```

```
report.report("reaction_time") % statistical summary of RT responded with true and false
```

```
EP true RT replied with true: mean (std): 3.67 (1.40), range = [1.35,6.48]
EP false RT replied with true: mean (std): 3.62 (1.40), range = [1.38,6.45]
SJ true RT replied with true: mean (std): 3.06 (1.33), range = [0.96,5.49]
```

```
SJ false RT replied with true: mean (std): 3.56 (1.27), range = [1.16,5.86]
MTH true RT replied with true: mean (std): 4.65 (1.84), range = [1.22,8.32]
MTH false RT replied with true: mean (std): 5.37 (2.04), range = [1.34,9.47]
ans = struct with fields:
     true: {[3.6700 1.4000 1.3500 6.4800]  [3.0600 1.3300 0.9600 5.4900]  [4.6500 1.8400 1.2200 8.3200]}
    false: {[3.6200 1.4000 1.3800 6.4500]  [3.5600 1.2700 1.1600 5.8600]  [5.3700 2.0400 1.3400 9.4700]}
```

```
report.report("veridicality") % statistical summary of response veridicality.
```

```
EP true veridicality replied with true: mean (std): 0.47 (0.15), range = [0.24,0.82]
EP false veridicality replied with true: mean (std): 0.70 (0.21), range = [0.11,0.96]
MTH true veridicality replied with true: mean (std): 0.87 (0.11), range = [0.60,1.00]
MTH false veridicality replied with true: mean (std): 0.79 (0.20), range = [0.29,1.00]
ans = struct with fields:
     true: {[0.4700 0.1500 0.2400 0.8200]  [0.8700 0.1100 0.6000 1]}
    false: {[0.7000 0.2100 0.1100 0.9600]  [0.7900 0.2000 0.2900 1]}
```

Self-Referential Neuronal Population Activity in the OFC and vmPFC

```
report.report("ECoGSEEG") % statisitcal summary of number of ECoG and SEEG electrodes as well a
```

```
S01 -- electype: ECOG
S02 -- electype: ECOG
S03 -- electype: ECOG
S04 -- electype: ECOG
S05 -- electype: ECOG
S06 -- electype: ECOG
S07 -- electype: ECOG
S08 -- electype: ECOG
S09 -- electype: ECOG
S10 -- electype: ECOG
S11 -- electype: ECOG
S12 -- electype: ECOG
S13 -- electype: ECOG
S14 -- electype: ECOG
S15 -- electype: ECOG
S16 -- electype: ECOG
S17 -- electype: SEEG
S18 -- electype: ECOG
S19 -- electype: SEEG
S20 -- electype: ECOG
S21 -- electype: SEEG
S22 -- electype: SEEG
ECOG = 13 +/- 11, [2, 38]
OFC = 0.76 +/- 0.33
MPFC = 0.24 +/- 0.33
SEEG = 6 +/- 6, [1, 13]
OFC = 0.50 +/- 0.58
MPFC = 0.50 +/- 0.58
```

Assessing the spatial distribution of self-referntial- and math-activated electrodes on the cortex. The significance has been determined by 5000 permutations Monte Carlo test and stored in Pval_LOC in the data table.

```
R = resultiEEG(data, 'data\BHV.json', 'data\FrontalEcogvsSeeg.json'); % cerate an instance of r
% define the colors for electrode activity in hex
col = ["#0065C1",... blue for self-referential
       "#A63838" ]; % red for math
R.LocalizeSelfMath(col);
```

```
Warning: indxing statrs at zero adding 1 to faces
```

```
Starting parallel pool (parpool) using the 'local' profile ...
Warning: Removing "C:\MatlabToolboxes\spm12\spm12\external\fieldtrip\compat\matlablt2012a" from your path.
See http://www.fieldtriptoolbox.org/faq/should_i_add_fieldtrip_with_all_subdirectories_to_my_matlab_path/
Connected to the parallel pool (number of workers: 8).
observation 1 of 107
observation 2 of 107
observation 20 of 107
observation 19 of 107
observation 18 of 107
observation 17 of 107
observation 16 of 107
observation 15 of 107
observation 3 of 107
observation 26 of 107
observation 25 of 107
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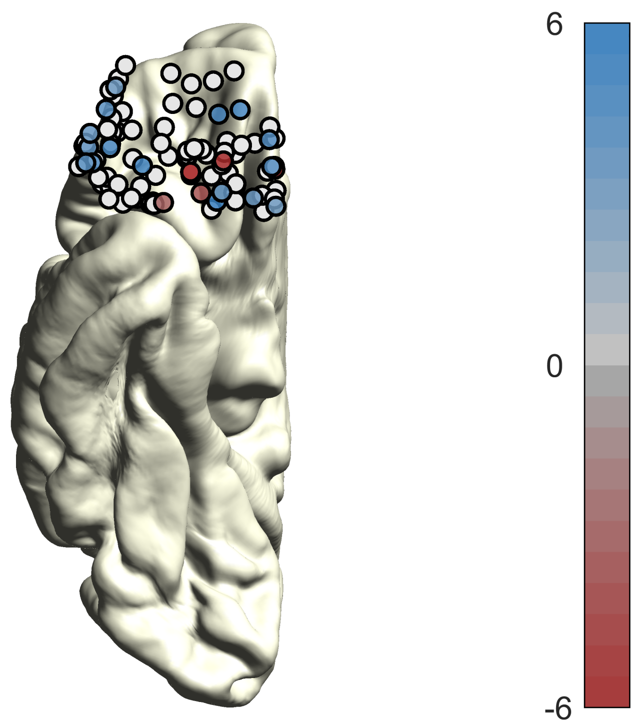

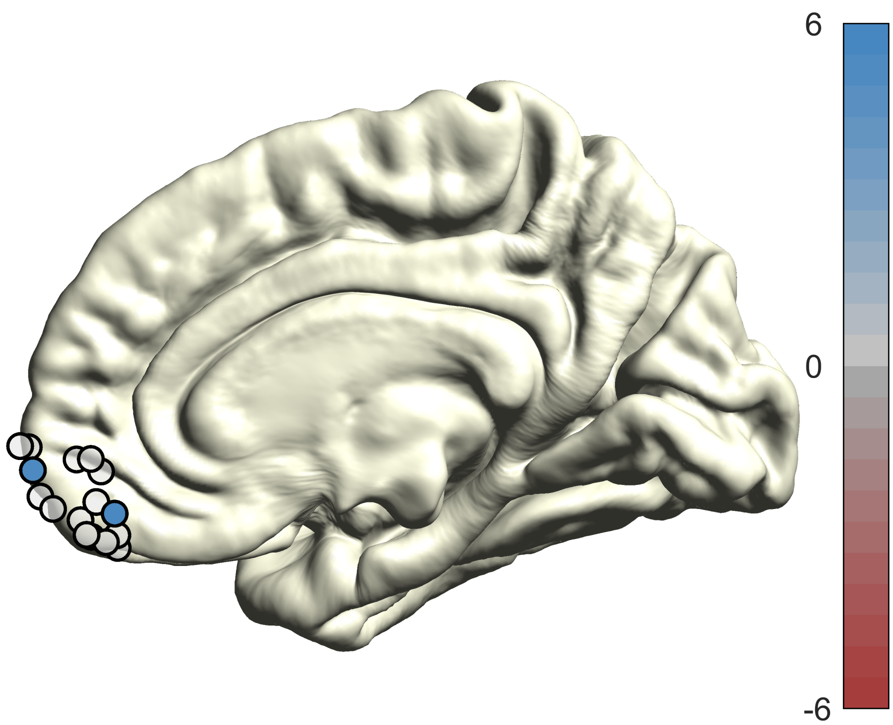


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Warning: indxing statrs at zero adding 1 to faces
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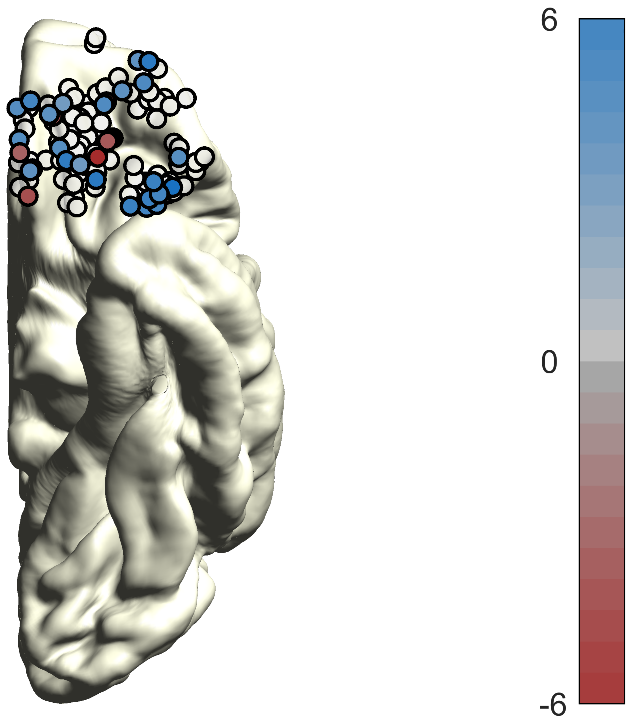
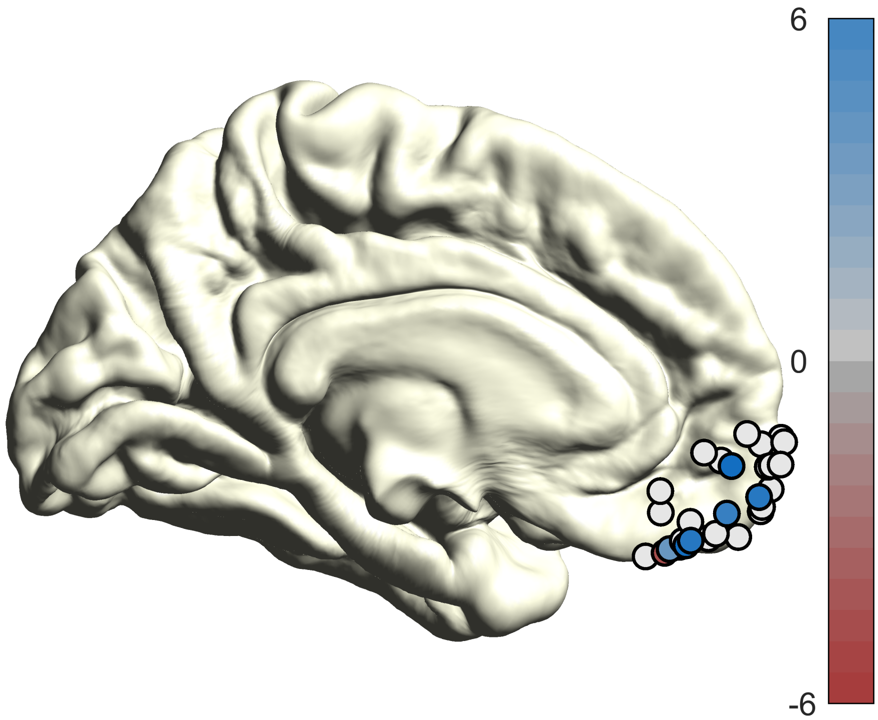
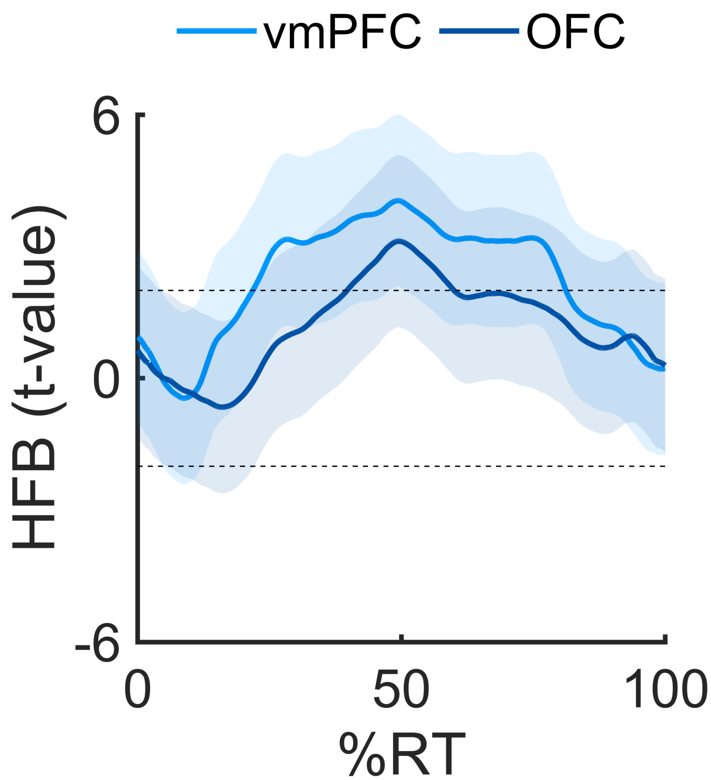





```
% read the time warped HFB envelope
HFB_tw.data  = R.getTimeWarppedHFB('data\Stimlock-TimeWarped_ieeg.dat');
% read labels
HFB_tw.label = readtable('data\Stimlock-TimeWarped.tsv', FileType = 'text');
% trials were warped to 0:100% of RT
HFB_tw.time  = (0:size(HFB_tw.data,2)-1)./512 - .5; % pre = 500ms, fsamp = 512
% define colors
col = ["#0097FB", "#0051A6"]; % light and dark blue
R.plot_HFB(HFB_tw, .1, col) % smoothing .1s
```




```
{
  "Anatomy": [
    "MPFC",
    "OFC"
  ],
  "time": [
    22,
    40
  ],
  "tvalue": [
    2.0582317462587456,
    2.0515793356025762
  ],
  "dof": [
    38,
    207
  ],
  "pvalue": [
    0.046473355236149594,
    0.041469574463316672
  ],
  "CI": [
    [
      -0.052999750339447149,
      0.067882795654500033
    ],
    [
      -0.11636782753021721,
      0.131640396275843
    ]
  ]
}
```

Testing if in the same brain a pattern similar to gourp level can be found. Therefore, we need to first find individuals with electrode implanted both in OFC and vmPFC.

```
[SE, SJ] = R.find_sameBrain(HFB_tw.label, HFB_tw.data, HFB_tw.time); % finds data from same bra
t2p = time2peak(SE, SJ) % create time2peak object
```

```
t2p =
  time2peak with properties:

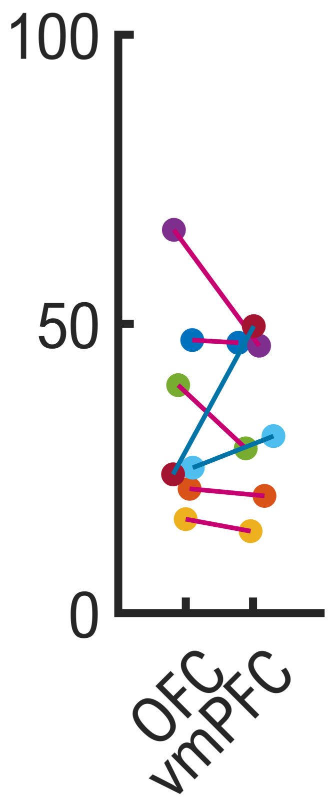
                     SE: [14×18 table]
                     SJ: [14×18 table]
    HFB_response_latencey: [1×1 struct]
```

Peaks were identified using matlab *findpeaks*, the first peak identifed as the peak that had an amplitude larger than 75th percentil and the latency larger 10% of RT.

```
t2p.HFB_response_latencey % caluclates the response latency for HFB in same brain
```

```
ans = struct with fields:
     OFC: [47.2058 21.5072 16.2574 66.2574 39.4157 25.1482 24.0051]
    MPFC: [46.7401 20.2794 14.1829 46.2320 28.4928 30.6097 49.6190]
```

```
% ploting the results (fig1c)
figure
t2p.plot()
```



Now we assess how many percentages of the electrodes were activated during self-referential vs. math.

```
out = report.report("active_total"); % how many electrodes were activated per each condition: s
fprintf('total of %1.0f(%1.0f)%% self-activated\n', mean(cellfun(@(x) x.self, out))*1e2, std(ce
```

```
total of 13(15)% self-activated
```

```
fprintf('total of %1.0f(%1.0f)%% math\n', mean(cellfun(@(x) x.math, out))*1e2, std(cellfun(@(x)
```

```
total of 4(5)% math
```

Performing a paried t-test to assess if the difference between the percentage of self- vs. math-activated electrodes are statistically meaningful.

```
% calculate two-ways, paired ttest to compare the percentages of self- vs. math-activated elect
[~, p, CI, stats ] = ttest(cellfun(@(x) x.self, out), cellfun(@(x) x.math, out));
fprintf('self > math: t(%d) = %1.2f, p < %1.2f, CI = [%1.2f, %1.2f]', stats.df, stats.tstat, p,
```

```
self > math: t(21) = 2.80, p < 0.01, CI = [0.02, 0.16]
```

We further assess if the self-episodic and self-judgment electrodes within the self-referentally activated populations overlaps.

```
out = report.report("percentage");
fprintf('total of %1.0f(%1.0f)%% within self-referental populations weer activated both in EP(S
```

```
total of 3(7)% within self-referental populations weer activated both in EP(SE) and SJ
```

A little anatomical overlap found betweem self-episodic and self-judgment within self-referentailly activated populations.

Performing a linear-mixed effect model (LMM) to follow up if HFB differes for SE and SJ

```
% create a LMM object for SE and SJ
LMM = stat.LMMSESJ(R.data, 'Tval ~ -1 + task:JPAnatomy + (1|subj) + (1|Density)')
```

```
LMM = 
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
  LMMSESJ with properties:

         coeff: []
        coeffl: []
        coeffh: []
    prediction: []
         index: []
      preprocT: [180×19 table]
          data: [1265×15 table]
         model: "Tval ~ -1 + task:JPAnatomy + (1|subj) + (1|Density)"
           mdl: []
```

```
% running bootstarping
LMM = LMM.bootstramp(LMM.preprocT)
```

```
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
```

```
removing non-self-referentially activated electrodes
done!
Bootstrapping, please wait...
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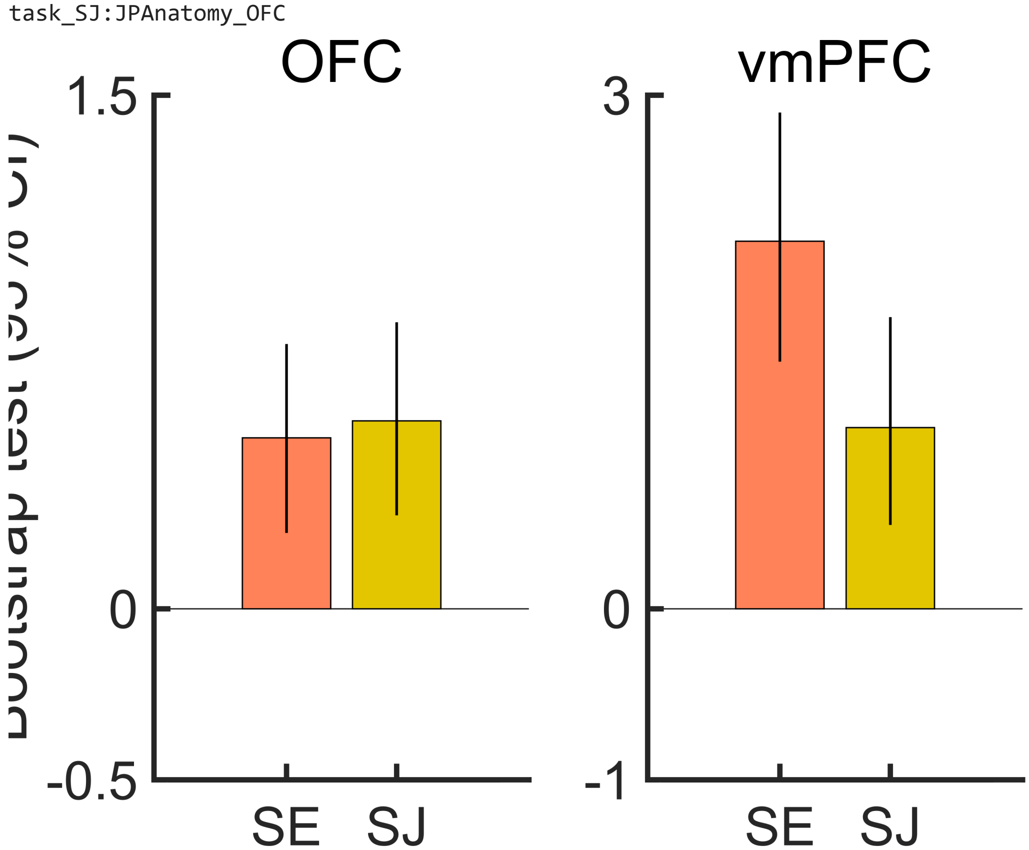
done!
LMM =
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
  LMMSESJ with properties:

         coeff: []
        coeffl: []
        coeffh: []
    prediction: []
         index: []
      preprocT: [180×19 table]
          data: [1265×15 table]
         model: "Tval ~ -1 + task:JPAnatomy + (1|subj) + (1|Density)"
           mdl: [1000×1 struct]
```

ploting the LMM results for SE and SJ among those that showed more activity than distractor condition:

```
LMM.bars()
```

```
task_EP:JPAnatomy_MPFC
task_SJ:JPAnatomy_MPFC
task_EP:JPAnatomy_OFC
task_SJ:JPAnatomy_OFC
```



Now assessing if similar pattern can be found in the same brains. We identife individuals with electrodes in both OFC and vmPFC and assess how the predicted HFB value changes within same brain

```
LMM = LMM.predict; % predic the effects using the fitted LMM model
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removing non-self-referentially activated electrodes
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removing non-self-referentially activated electrodes
done!
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
preprocssing the input table...
```

```
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
```

```
T = LMM.preprocT; % store the preprocessed table into T
```

```
preprocssing the input table...
finding self-referentially activated electrodes for this analysis.
removing non-self-referentially activated electrodes
done!
```

```
T.Tval_pred = LMM.prediction.coeff % add LMM predition to the table
```

T = 180×20 table

	subj	chan	task	X	Y	Z	dof	responseTr
1	S04	'AFS2'	EP	-20.8877	64.1404	-1.3956	25	5
2	S04	'AFS2'	SJ	-20.8877	64.1404	-1.3956	25	18
3	S20	'AFS4'	EP	-0.4511	49.0468	-23.7950	24	11
4	S20	'AFS4'	SJ	-0.4511	49.0468	-23.7950	18	13
5	S20	'AFS9'	EP	-14.8069	68.8244	-2.6074	24	11
6	S20	'AFS9'	SJ	-14.8069	68.8244	-2.6074	18	13
7	S08	'AIH1'	EP	-1.0079	43.2748	-26.4328	24	9
8	S08	'AIH1'	SJ	-1.0079	43.2748	-26.4328	23	15
9	S08	'AIH2'	EP	-0.8073	46.9476	-25.6044	24	9
10	S08	'AIH2'	SJ	-0.8073	46.9476	-25.6044	23	15
11	S08	'AIH3'	EP	-0.5667	48.0048	-24.5656	24	9
12	S08	'AIH3'	SJ	-0.5667	48.0048	-24.5656	23	15
13	S08	'AIH5'	EP	-0.9477	56.0473	-18.5256	24	9
14	S08	'AIH5'	SJ	-0.9477	56.0473	-18.5256	23	15
15	S08	'AIH6'	EP	-4.2984	57.0918	-7.9223	24	9
16	S08	'AIH6'	SJ	-4.2984	57.0918	-7.9223	23	15

	subj	chan	task	X	Y	Z	dof	responseTr
17	S02	'AIHG2'	EP	-1.7056	65.1706	-8.0935	23	6
18	S02	'AIHG2'	SJ	-1.7056	65.1706	-8.0935	24	14
19	S04	'AIHS1'	EP	-14.7978	63.2412	-14.8395	25	5
20	S04	'AIHS1'	SJ	-14.7978	63.2412	-14.8395	25	18
21	S03	'AIHS2'	EP	3.4262	55.9521	-18.6378	25	11
22	S03	'AIHS2'	SJ	3.4262	55.9521	-18.6378	24	20
23	S04	'AIHS2'	EP	-8.9439	68.0389	-7.6002	25	5
24	S04	'AIHS2'	SJ	-8.9439	68.0389	-7.6002	25	18
25	S14	'AOF3'	EP	15.0190	31.3738	-27.5145	21	5
26	S14	'AOF3'	SJ	15.0190	31.3738	-27.5145	23	15
27	S10	'FRO9'	EP	50.3004	37.9667	-14.2826	21	5
28	S10	'FRO9'	SJ	50.3004	37.9667	-14.2826	16	10
29	S06	'FTS3'	EP	41.7868	46.9583	-14.1000	25	9
30	S06	'FTS3'	SJ	41.7868	46.9583	-14.1000	24	15
31	S21	'LOF2'	EP	-9.9278	41.2053	-13.5146	21	10
32	S21	'LOF2'	SJ	-9.9278	41.2053	-13.5146	24	16
33	S22	'LOF6'	EP	-24.3584	33.1424	-7.5481	22	5
34	S22	'LOF6'	SJ	-24.3584	33.1424	-7.5481	23	11
35	S09	'OF5'	EP	-41.9083	33.8113	-16.8085	24	13
36	S09	'OF5'	SJ	-41.9083	33.8113	-16.8085	25	17
37	S18	'ORB10'	EP	33.3791	30.8383	-19.9685	23	3
38	S18	'ORB10'	SJ	33.3791	30.8383	-19.9685	25	12
39	S13	'ORB11'	EP	45.7151	30.3688	-15.5932	18	9
40	S13	'ORB11'	SJ	45.7151	30.3688	-15.5932	24	10
41	S13	'ORB12'	EP	48.4850	34.7368	-15.4151	18	9
42	S13	'ORB12'	SJ	48.4850	34.7368	-15.4151	24	10
43	S08	'ORB14'	EP	-27.5318	50.6935	-13.3126	24	9
44	S08	'ORB14'	SJ	-27.5318	50.6935	-13.3126	23	15
45	S08	'ORB15'	EP	-33.0291	52.7290	-13.6567	24	9
46	S08	'ORB15'	SJ	-33.0291	52.7290	-13.6567	23	15
47	S08	'ORB16'	EP	-36.5267	56.3263	-8.9068	24	9
48	S08	'ORB16'	SJ	-36.5267	56.3263	-8.9068	23	15
49	S08	'ORB17'	EP	-1.3993	38.2953	-27.7790	24	9

	subj	chan	task	X	Y	Z	dof	responseTr
50	S08	'ORB17'	SJ	-1.3993	38.2953	-27.7790	23	15
51	S08	'ORB18'	EP	-11.6520	36.2045	-22.8013	24	9
52	S08	'ORB18'	SJ	-11.6520	36.2045	-22.8013	23	15
53	S08	'ORB19'	EP	-13.3690	33.0232	-24.9368	24	9
54	S08	'ORB19'	SJ	-13.3690	33.0232	-24.9368	23	15
55	S08	'ORB1'	EP	-0.8508	46.2915	-25.7220	24	9
56	S08	'ORB1'	SJ	-0.8508	46.2915	-25.7220	23	15
57	S13	'ORB1'	EP	3.0038	23.0325	-20.9493	18	9
58	S13	'ORB1'	SJ	3.0038	23.0325	-20.9493	24	10
59	S16	'ORB20'	EP	-13.6884	22.2791	-24.3378	24	19
60	S16	'ORB20'	SJ	-13.6884	22.2791	-24.3378	25	22
61	S20	'ORB20'	EP	-16.8610	31.9373	-23.8983	24	11
62	S20	'ORB20'	SJ	-16.8610	31.9373	-23.8983	18	13
63	S08	'ORB22'	EP	-34.4007	23.3124	-21.6968	24	9
64	S08	'ORB22'	SJ	-34.4007	23.3124	-21.6968	23	15
65	S08	'ORB23'	EP	-36.9396	24.5046	-19.4005	24	9
66	S08	'ORB23'	SJ	-36.9396	24.5046	-19.4005	23	15
67	S08	'ORB24'	EP	-40.3325	26.1825	-16.9239	24	9
68	S08	'ORB24'	SJ	-40.3325	26.1825	-16.9239	23	15
69	S08	'ORB25'	EP	-1.1925	32.4449	-27.4374	24	9
70	S08	'ORB25'	SJ	-1.1925	32.4449	-27.4374	23	15
71	S08	'ORB26'	EP	-4.7776	30.8937	-27.1724	24	9
72	S08	'ORB26'	SJ	-4.7776	30.8937	-27.1724	23	15
73	S08	'ORB29'	EP	-29.6037	21.4210	-24.5691	24	9
74	S08	'ORB29'	SJ	-29.6037	21.4210	-24.5691	23	15
75	S08	'ORB2'	EP	-4.2816	48.1203	-25.5578	24	9
76	S08	'ORB2'	SJ	-4.2816	48.1203	-25.5578	23	15
77	S12	'ORB2'	EP	19.2725	30.6874	-25.2233	23	9
78	S12	'ORB2'	SJ	19.2725	30.6874	-25.2233	25	12
79	S16	'ORB2'	EP	-11.5365	40.8790	-25.0670	24	19
80	S16	'ORB2'	SJ	-11.5365	40.8790	-25.0670	25	22
81	S08	'ORB30'	EP	-33.7291	21.1367	-21.7892	24	9
82	S08	'ORB30'	SJ	-33.7291	21.1367	-21.7892	23	15

	subj	chan	task	X	Y	Z	dof	responseTr
83	S08	'ORB31'	EP	-36.3500	21.8642	-18.6425	24	9
84	S08	'ORB31'	SJ	-36.3500	21.8642	-18.6425	23	15
85	S08	'ORB3'	EP	-12.4821	47.4909	-24.2376	24	9
86	S08	'ORB3'	SJ	-12.4821	47.4909	-24.2376	23	15
87	S12	'ORB3'	EP	36.7074	33.2855	-16.4273	23	9
88	S12	'ORB3'	SJ	36.7074	33.2855	-16.4273	25	12
89	S13	'ORB3'	EP	17.9468	24.3071	-25.6277	18	9
90	S13	'ORB3'	SJ	17.9468	24.3071	-25.6277	24	10
91	S10	'ORB4'	EP	13.6341	26.4488	-27.1135	21	5
92	S10	'ORB4'	SJ	13.6341	26.4488	-27.1135	16	10
93	S11	'ORB4'	EP	-30.4734	31.7291	-18.6921	25	3
94	S11	'ORB4'	SJ	-30.4734	31.7291	-18.6921	25	16
95	S12	'ORB4'	EP	44.7663	38.8134	-16.0889	23	9
96	S12	'ORB4'	SJ	44.7663	38.8134	-16.0889	25	12
97	S12	'ORB5'	EP	51.1066	38.9372	-10.5026	23	9
98	S12	'ORB5'	SJ	51.1066	38.9372	-10.5026	25	12
99	S16	'ORB5'	EP	-22.9632	47.1897	-12.7140	24	19
100	S16	'ORB5'	SJ	-22.9632	47.1897	-12.7140	25	22

⋮

```
T.Tval_predL = LMM.prediction.coeffl % add LMM low boundary predition to the table
```

T = 180×21 table

...

	subj	chan	task	X	Y	Z	dof	responseTr
1	S04	'AFS2'	EP	-20.8877	64.1404	-1.3956	25	5
2	S04	'AFS2'	SJ	-20.8877	64.1404	-1.3956	25	18
3	S20	'AFS4'	EP	-0.4511	49.0468	-23.7950	24	11
4	S20	'AFS4'	SJ	-0.4511	49.0468	-23.7950	18	13
5	S20	'AFS9'	EP	-14.8069	68.8244	-2.6074	24	11
6	S20	'AFS9'	SJ	-14.8069	68.8244	-2.6074	18	13
7	S08	'AIH1'	EP	-1.0079	43.2748	-26.4328	24	9
8	S08	'AIH1'	SJ	-1.0079	43.2748	-26.4328	23	15
9	S08	'AIH2'	EP	-0.8073	46.9476	-25.6044	24	9
10	S08	'AIH2'	SJ	-0.8073	46.9476	-25.6044	23	15

	subj	chan	task	X	Y	Z	dof	responseTr
11	S08	'AIH3'	EP	-0.5667	48.0048	-24.5656	24	9
12	S08	'AIH3'	SJ	-0.5667	48.0048	-24.5656	23	15
13	S08	'AIH5'	EP	-0.9477	56.0473	-18.5256	24	9
14	S08	'AIH5'	SJ	-0.9477	56.0473	-18.5256	23	15
15	S08	'AIH6'	EP	-4.2984	57.0918	-7.9223	24	9
16	S08	'AIH6'	SJ	-4.2984	57.0918	-7.9223	23	15
17	S02	'AIHG2'	EP	-1.7056	65.1706	-8.0935	23	6
18	S02	'AIHG2'	SJ	-1.7056	65.1706	-8.0935	24	14
19	S04	'AIHS1'	EP	-14.7978	63.2412	-14.8395	25	5
20	S04	'AIHS1'	SJ	-14.7978	63.2412	-14.8395	25	18
21	S03	'AIHS2'	EP	3.4262	55.9521	-18.6378	25	11
22	S03	'AIHS2'	SJ	3.4262	55.9521	-18.6378	24	20
23	S04	'AIHS2'	EP	-8.9439	68.0389	-7.6002	25	5
24	S04	'AIHS2'	SJ	-8.9439	68.0389	-7.6002	25	18
25	S14	'AOF3'	EP	15.0190	31.3738	-27.5145	21	5
26	S14	'AOF3'	SJ	15.0190	31.3738	-27.5145	23	15
27	S10	'FRO9'	EP	50.3004	37.9667	-14.2826	21	5
28	S10	'FRO9'	SJ	50.3004	37.9667	-14.2826	16	10
29	S06	'FTS3'	EP	41.7868	46.9583	-14.1000	25	9
30	S06	'FTS3'	SJ	41.7868	46.9583	-14.1000	24	15
31	S21	'LOF2'	EP	-9.9278	41.2053	-13.5146	21	10
32	S21	'LOF2'	SJ	-9.9278	41.2053	-13.5146	24	16
33	S22	'LOF6'	EP	-24.3584	33.1424	-7.5481	22	5
34	S22	'LOF6'	SJ	-24.3584	33.1424	-7.5481	23	11
35	S09	'OF5'	EP	-41.9083	33.8113	-16.8085	24	13
36	S09	'OF5'	SJ	-41.9083	33.8113	-16.8085	25	17
37	S18	'ORB10'	EP	33.3791	30.8383	-19.9685	23	3
38	S18	'ORB10'	SJ	33.3791	30.8383	-19.9685	25	12
39	S13	'ORB11'	EP	45.7151	30.3688	-15.5932	18	9
40	S13	'ORB11'	SJ	45.7151	30.3688	-15.5932	24	10
41	S13	'ORB12'	EP	48.4850	34.7368	-15.4151	18	9
42	S13	'ORB12'	SJ	48.4850	34.7368	-15.4151	24	10
43	S08	'ORB14'	EP	-27.5318	50.6935	-13.3126	24	9

	subj	chan	task	X	Y	Z	dof	responseTr
44	S08	'ORB14'	SJ	-27.5318	50.6935	-13.3126	23	15
45	S08	'ORB15'	EP	-33.0291	52.7290	-13.6567	24	9
46	S08	'ORB15'	SJ	-33.0291	52.7290	-13.6567	23	15
47	S08	'ORB16'	EP	-36.5267	56.3263	-8.9068	24	9
48	S08	'ORB16'	SJ	-36.5267	56.3263	-8.9068	23	15
49	S08	'ORB17'	EP	-1.3993	38.2953	-27.7790	24	9
50	S08	'ORB17'	SJ	-1.3993	38.2953	-27.7790	23	15
51	S08	'ORB18'	EP	-11.6520	36.2045	-22.8013	24	9
52	S08	'ORB18'	SJ	-11.6520	36.2045	-22.8013	23	15
53	S08	'ORB19'	EP	-13.3690	33.0232	-24.9368	24	9
54	S08	'ORB19'	SJ	-13.3690	33.0232	-24.9368	23	15
55	S08	'ORB1'	EP	-0.8508	46.2915	-25.7220	24	9
56	S08	'ORB1'	SJ	-0.8508	46.2915	-25.7220	23	15
57	S13	'ORB1'	EP	3.0038	23.0325	-20.9493	18	9
58	S13	'ORB1'	SJ	3.0038	23.0325	-20.9493	24	10
59	S16	'ORB20'	EP	-13.6884	22.2791	-24.3378	24	19
60	S16	'ORB20'	SJ	-13.6884	22.2791	-24.3378	25	22
61	S20	'ORB20'	EP	-16.8610	31.9373	-23.8983	24	11
62	S20	'ORB20'	SJ	-16.8610	31.9373	-23.8983	18	13
63	S08	'ORB22'	EP	-34.4007	23.3124	-21.6968	24	9
64	S08	'ORB22'	SJ	-34.4007	23.3124	-21.6968	23	15
65	S08	'ORB23'	EP	-36.9396	24.5046	-19.4005	24	9
66	S08	'ORB23'	SJ	-36.9396	24.5046	-19.4005	23	15
67	S08	'ORB24'	EP	-40.3325	26.1825	-16.9239	24	9
68	S08	'ORB24'	SJ	-40.3325	26.1825	-16.9239	23	15
69	S08	'ORB25'	EP	-1.1925	32.4449	-27.4374	24	9
70	S08	'ORB25'	SJ	-1.1925	32.4449	-27.4374	23	15
71	S08	'ORB26'	EP	-4.7776	30.8937	-27.1724	24	9
72	S08	'ORB26'	SJ	-4.7776	30.8937	-27.1724	23	15
73	S08	'ORB29'	EP	-29.6037	21.4210	-24.5691	24	9
74	S08	'ORB29'	SJ	-29.6037	21.4210	-24.5691	23	15
75	S08	'ORB2'	EP	-4.2816	48.1203	-25.5578	24	9
76	S08	'ORB2'	SJ	-4.2816	48.1203	-25.5578	23	15

	subj	chan	task	X	Y	Z	dof	responseTr
77	S12	'ORB2'	EP	19.2725	30.6874	-25.2233	23	9
78	S12	'ORB2'	SJ	19.2725	30.6874	-25.2233	25	12
79	S16	'ORB2'	EP	-11.5365	40.8790	-25.0670	24	19
80	S16	'ORB2'	SJ	-11.5365	40.8790	-25.0670	25	22
81	S08	'ORB30'	EP	-33.7291	21.1367	-21.7892	24	9
82	S08	'ORB30'	SJ	-33.7291	21.1367	-21.7892	23	15
83	S08	'ORB31'	EP	-36.3500	21.8642	-18.6425	24	9
84	S08	'ORB31'	SJ	-36.3500	21.8642	-18.6425	23	15
85	S08	'ORB3'	EP	-12.4821	47.4909	-24.2376	24	9
86	S08	'ORB3'	SJ	-12.4821	47.4909	-24.2376	23	15
87	S12	'ORB3'	EP	36.7074	33.2855	-16.4273	23	9
88	S12	'ORB3'	SJ	36.7074	33.2855	-16.4273	25	12
89	S13	'ORB3'	EP	17.9468	24.3071	-25.6277	18	9
90	S13	'ORB3'	SJ	17.9468	24.3071	-25.6277	24	10
91	S10	'ORB4'	EP	13.6341	26.4488	-27.1135	21	5
92	S10	'ORB4'	SJ	13.6341	26.4488	-27.1135	16	10
93	S11	'ORB4'	EP	-30.4734	31.7291	-18.6921	25	3
94	S11	'ORB4'	SJ	-30.4734	31.7291	-18.6921	25	16
95	S12	'ORB4'	EP	44.7663	38.8134	-16.0889	23	9
96	S12	'ORB4'	SJ	44.7663	38.8134	-16.0889	25	12
97	S12	'ORB5'	EP	51.1066	38.9372	-10.5026	23	9
98	S12	'ORB5'	SJ	51.1066	38.9372	-10.5026	25	12
99	S16	'ORB5'	EP	-22.9632	47.1897	-12.7140	24	19
100	S16	'ORB5'	SJ	-22.9632	47.1897	-12.7140	25	22

⋮

```
T.Tval_predH = LMM.prediction.coeffl % add LMM high boundary predition to the table
```

T = 180×22 table

...

	subj	chan	task	X	Y	Z	dof	responseTr
1	S04	'AFS2'	EP	-20.8877	64.1404	-1.3956	25	5
2	S04	'AFS2'	SJ	-20.8877	64.1404	-1.3956	25	18
3	S20	'AFS4'	EP	-0.4511	49.0468	-23.7950	24	11
4	S20	'AFS4'	SJ	-0.4511	49.0468	-23.7950	18	13

	subj	chan	task	X	Y	Z	dof	responseTr
5	S20	'AFS9'	EP	-14.8069	68.8244	-2.6074	24	11
6	S20	'AFS9'	SJ	-14.8069	68.8244	-2.6074	18	13
7	S08	'AIH1'	EP	-1.0079	43.2748	-26.4328	24	9
8	S08	'AIH1'	SJ	-1.0079	43.2748	-26.4328	23	15
9	S08	'AIH2'	EP	-0.8073	46.9476	-25.6044	24	9
10	S08	'AIH2'	SJ	-0.8073	46.9476	-25.6044	23	15
11	S08	'AIH3'	EP	-0.5667	48.0048	-24.5656	24	9
12	S08	'AIH3'	SJ	-0.5667	48.0048	-24.5656	23	15
13	S08	'AIH5'	EP	-0.9477	56.0473	-18.5256	24	9
14	S08	'AIH5'	SJ	-0.9477	56.0473	-18.5256	23	15
15	S08	'AIH6'	EP	-4.2984	57.0918	-7.9223	24	9
16	S08	'AIH6'	SJ	-4.2984	57.0918	-7.9223	23	15
17	S02	'AIHG2'	EP	-1.7056	65.1706	-8.0935	23	6
18	S02	'AIHG2'	SJ	-1.7056	65.1706	-8.0935	24	14
19	S04	'AIHS1'	EP	-14.7978	63.2412	-14.8395	25	5
20	S04	'AIHS1'	SJ	-14.7978	63.2412	-14.8395	25	18
21	S03	'AIHS2'	EP	3.4262	55.9521	-18.6378	25	11
22	S03	'AIHS2'	SJ	3.4262	55.9521	-18.6378	24	20
23	S04	'AIHS2'	EP	-8.9439	68.0389	-7.6002	25	5
24	S04	'AIHS2'	SJ	-8.9439	68.0389	-7.6002	25	18
25	S14	'AOF3'	EP	15.0190	31.3738	-27.5145	21	5
26	S14	'AOF3'	SJ	15.0190	31.3738	-27.5145	23	15
27	S10	'FRO9'	EP	50.3004	37.9667	-14.2826	21	5
28	S10	'FRO9'	SJ	50.3004	37.9667	-14.2826	16	10
29	S06	'FTS3'	EP	41.7868	46.9583	-14.1000	25	9
30	S06	'FTS3'	SJ	41.7868	46.9583	-14.1000	24	15
31	S21	'LOF2'	EP	-9.9278	41.2053	-13.5146	21	10
32	S21	'LOF2'	SJ	-9.9278	41.2053	-13.5146	24	16
33	S22	'LOF6'	EP	-24.3584	33.1424	-7.5481	22	5
34	S22	'LOF6'	SJ	-24.3584	33.1424	-7.5481	23	11
35	S09	'OF5'	EP	-41.9083	33.8113	-16.8085	24	13
36	S09	'OF5'	SJ	-41.9083	33.8113	-16.8085	25	17
37	S18	'ORB10'	EP	33.3791	30.8383	-19.9685	23	3

	subj	chan	task	X	Y	Z	dof	responseTr
38	S18	'ORB10'	SJ	33.3791	30.8383	-19.9685	25	12
39	S13	'ORB11'	EP	45.7151	30.3688	-15.5932	18	9
40	S13	'ORB11'	SJ	45.7151	30.3688	-15.5932	24	10
41	S13	'ORB12'	EP	48.4850	34.7368	-15.4151	18	9
42	S13	'ORB12'	SJ	48.4850	34.7368	-15.4151	24	10
43	S08	'ORB14'	EP	-27.5318	50.6935	-13.3126	24	9
44	S08	'ORB14'	SJ	-27.5318	50.6935	-13.3126	23	15
45	S08	'ORB15'	EP	-33.0291	52.7290	-13.6567	24	9
46	S08	'ORB15'	SJ	-33.0291	52.7290	-13.6567	23	15
47	S08	'ORB16'	EP	-36.5267	56.3263	-8.9068	24	9
48	S08	'ORB16'	SJ	-36.5267	56.3263	-8.9068	23	15
49	S08	'ORB17'	EP	-1.3993	38.2953	-27.7790	24	9
50	S08	'ORB17'	SJ	-1.3993	38.2953	-27.7790	23	15
51	S08	'ORB18'	EP	-11.6520	36.2045	-22.8013	24	9
52	S08	'ORB18'	SJ	-11.6520	36.2045	-22.8013	23	15
53	S08	'ORB19'	EP	-13.3690	33.0232	-24.9368	24	9
54	S08	'ORB19'	SJ	-13.3690	33.0232	-24.9368	23	15
55	S08	'ORB1'	EP	-0.8508	46.2915	-25.7220	24	9
56	S08	'ORB1'	SJ	-0.8508	46.2915	-25.7220	23	15
57	S13	'ORB1'	EP	3.0038	23.0325	-20.9493	18	9
58	S13	'ORB1'	SJ	3.0038	23.0325	-20.9493	24	10
59	S16	'ORB20'	EP	-13.6884	22.2791	-24.3378	24	19
60	S16	'ORB20'	SJ	-13.6884	22.2791	-24.3378	25	22
61	S20	'ORB20'	EP	-16.8610	31.9373	-23.8983	24	11
62	S20	'ORB20'	SJ	-16.8610	31.9373	-23.8983	18	13
63	S08	'ORB22'	EP	-34.4007	23.3124	-21.6968	24	9
64	S08	'ORB22'	SJ	-34.4007	23.3124	-21.6968	23	15
65	S08	'ORB23'	EP	-36.9396	24.5046	-19.4005	24	9
66	S08	'ORB23'	SJ	-36.9396	24.5046	-19.4005	23	15
67	S08	'ORB24'	EP	-40.3325	26.1825	-16.9239	24	9
68	S08	'ORB24'	SJ	-40.3325	26.1825	-16.9239	23	15
69	S08	'ORB25'	EP	-1.1925	32.4449	-27.4374	24	9
70	S08	'ORB25'	SJ	-1.1925	32.4449	-27.4374	23	15

	subj	chan	task	X	Y	Z	dof	responseTr
71	S08	'ORB26'	EP	-4.7776	30.8937	-27.1724	24	9
72	S08	'ORB26'	SJ	-4.7776	30.8937	-27.1724	23	15
73	S08	'ORB29'	EP	-29.6037	21.4210	-24.5691	24	9
74	S08	'ORB29'	SJ	-29.6037	21.4210	-24.5691	23	15
75	S08	'ORB2'	EP	-4.2816	48.1203	-25.5578	24	9
76	S08	'ORB2'	SJ	-4.2816	48.1203	-25.5578	23	15
77	S12	'ORB2'	EP	19.2725	30.6874	-25.2233	23	9
78	S12	'ORB2'	SJ	19.2725	30.6874	-25.2233	25	12
79	S16	'ORB2'	EP	-11.5365	40.8790	-25.0670	24	19
80	S16	'ORB2'	SJ	-11.5365	40.8790	-25.0670	25	22
81	S08	'ORB30'	EP	-33.7291	21.1367	-21.7892	24	9
82	S08	'ORB30'	SJ	-33.7291	21.1367	-21.7892	23	15
83	S08	'ORB31'	EP	-36.3500	21.8642	-18.6425	24	9
84	S08	'ORB31'	SJ	-36.3500	21.8642	-18.6425	23	15
85	S08	'ORB3'	EP	-12.4821	47.4909	-24.2376	24	9
86	S08	'ORB3'	SJ	-12.4821	47.4909	-24.2376	23	15
87	S12	'ORB3'	EP	36.7074	33.2855	-16.4273	23	9
88	S12	'ORB3'	SJ	36.7074	33.2855	-16.4273	25	12
89	S13	'ORB3'	EP	17.9468	24.3071	-25.6277	18	9
90	S13	'ORB3'	SJ	17.9468	24.3071	-25.6277	24	10
91	S10	'ORB4'	EP	13.6341	26.4488	-27.1135	21	5
92	S10	'ORB4'	SJ	13.6341	26.4488	-27.1135	16	10
93	S11	'ORB4'	EP	-30.4734	31.7291	-18.6921	25	3
94	S11	'ORB4'	SJ	-30.4734	31.7291	-18.6921	25	16
95	S12	'ORB4'	EP	44.7663	38.8134	-16.0889	23	9
96	S12	'ORB4'	SJ	44.7663	38.8134	-16.0889	25	12
97	S12	'ORB5'	EP	51.1066	38.9372	-10.5026	23	9
98	S12	'ORB5'	SJ	51.1066	38.9372	-10.5026	25	12
99	S16	'ORB5'	EP	-22.9632	47.1897	-12.7140	24	19
100	S16	'ORB5'	SJ	-22.9632	47.1897	-12.7140	25	22

⋮

```
[SE ,SJ] = resultiEEG.find_sameBrain(T)
```

SE = 10×20 table

	subj	chan	task	dof	responseTr	RT	varRT	Density
1	'S04'	'AIHS1'	EP	25	5	3.1958	0.3921	22
2	'S04'	'AFS2'	EP	25	5	3.1958	0.3921	76
3	'S07'	'RFL3'	EP	23	4	2.7434	0.9802	12
4	'S07'	'RLG59'	EP	23	4	2.7434	0.9802	70
5	'S08'	'AIH1'	EP	24	9	2.9572	1.0299	22
6	'S08'	'ORB14'	EP	24	9	2.9572	1.0299	76
7	'S15'	'RAIH1'	EP	25	7	3.3213	1.0375	12
8	'S15'	'RFG10'	EP	25	7	3.3213	1.0375	70
9	'S20'	'AFS4'	EP	24	11	4.2617	4.3096	22
10	'S20'	'ORB20'	EP	24	11	4.2617	4.3096	76

```
SJ = 10×20 table
```

	subj	chan	task	dof	responseTr	RT	varRT	Density
1	'S04'	'AIHS1'	SJ	25	18	3.0805	0.2697	22
2	'S04'	'AFS2'	SJ	25	18	3.0805	0.2697	76
3	'S07'	'RFL3'	SJ	19	11	3.0262	1.8786	12
4	'S07'	'RLG59'	SJ	19	11	3.0262	1.8786	70
5	'S08'	'AIH1'	SJ	23	15	2.9216	1.8658	22
6	'S08'	'ORB14'	SJ	23	15	2.9216	1.8658	76
7	'S15'	'RAIH1'	SJ	25	15	3.4993	5.2020	12
8	'S15'	'RFG10'	SJ	25	15	3.4993	5.2020	70
9	'S20'	'AFS4'	SJ	18	13	3.9529	2.5807	22
10	'S20'	'ORB20'	SJ	18	13	3.9529	2.5807	76

```
% ploting the result
col = stat.LMMSESJ.colors([1,3], 1); % get two colors with no reptitions
misc.plot_Fig1E(SE, SJ, col)
```

```
valm = 5×1
    2.0960
    2.2828
    1.8438
    2.5132
    2.1568
valo = 5×1
    0.3743
    0.7083
    0.1221
    0.9387
    0.4350
```

```
valml = 5×1
    0.5842
    0.8826
    0.6111
    1.3570
    0.5710
valol = 5×1
   -0.6926
   -0.2469
   -0.6657
    0.2275
   -0.7058
valmh = 5×1
    0.5842
    0.8826
    0.6111
    1.3570
    0.5710
valoh = 5×1
   -0.6926
   -0.2469
   -0.6657
    0.2275
   -0.7058
subjm = 5×1 cell
'S04'
'S07'
'S08'
'S15'
'S20'
subjo = 5×1 cell
'S04'
'S07'
'S08'
'S15'
'S20'
valm = 5×1
    1.0139
    1.2007
    0.7617
    1.4310
    1.0746
valo = 5×1
    0.4253
    0.7593
    0.1731
    0.9897
    0.4860
valml = 5×1
   -0.3846
   -0.0861
   -0.3577
    0.3882
   -0.3978
valol = 5×1
   -0.6554
   -0.2097
   -0.6286
    0.2646
   -0.6686
valmh = 5×1
   -0.3846
   -0.0861
   -0.3577
```

```
    0.3882
   -0.3978
valoh = 5×1
   -0.6554
   -0.2097
   -0.6286
    0.2646
   -0.6686
subjm = 5×1 cell
'S04'
'S07'
'S08'
'S15'
'S20'
subjo = 5×1 cell
'S04'
'S07'
'S08'
'S15'
'S20'
```