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# Visualize the EEG output from the PREP processing pipeline.

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### Calling directly: prepReport

This helper reporting script expects that EEGReporting will be in the base workspace with an EEGReporting.etc.noiseDetection structure containing the report. It also expects the following variables in the base workspace:

- summaryFile - variable containing the open file descriptor for summary
- consoleID - variable with open file descriptor for console (usually 1 unless the output is redirected).
- relativeReportLocation report location relative to summary

The reporting function appends a summary to the summary report.

Usually the prepReport script is called through the function:

```
publishPrepReport
```

It is not a function itself, to allow the MATLAB publish to dump a nice output.

## Write data status and report header

```
EEGCognitive_Assessment_Baseline_1043.vhdr
Channels: 63
Frames: 68950
Error status: good
Boundary errors: [ ]
Detrend errors: [ ]
Line noise errors: [ ]
Reference errors: [ ]
Prep version: PrepPipeline0.56.0
Data summary: sampling rate 500Hz
Events: 7
Original events: 8
Channels interpolated during reference:
[ 8 11 12 15 18 21 22 39 44 54
 55 59 ]
Channels still noisy after reference:
[ 28 ]
Channels removed during post-process:
[ ]
```

## Line noise removal step

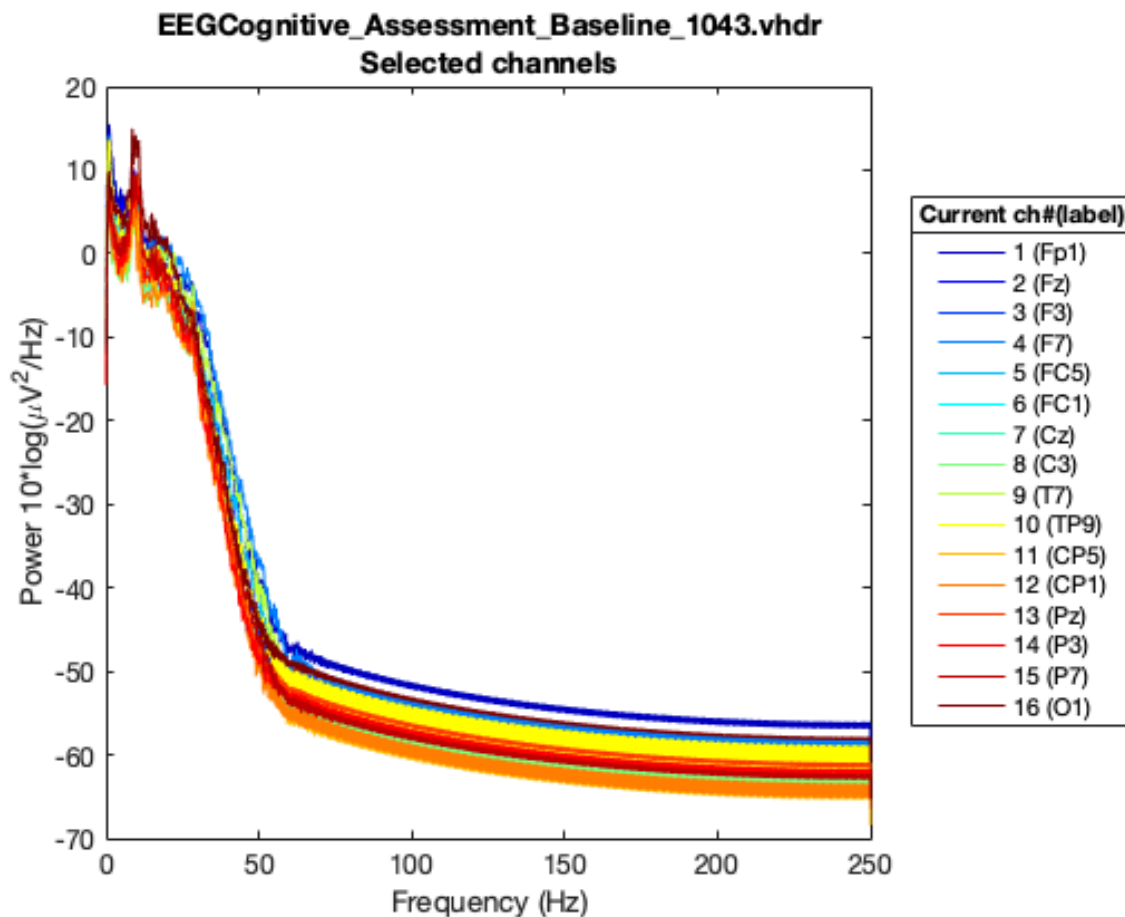
```
Line noise method: clean
Sampling frequency Fs: 500 Hz
Line noise frequencies:
[ 60 120 180 240 ]
Maximum iterations: 10
Significant frequency p-value: 0.01
+/- frequency BW for significant peaks (fScanBandWidth): 2
Taper bandwidth: 2 Hz
Taper window size (seconds): 4
Taper step size (seconds): 1
Sigmoidal smoothing factor (tau): 100
Spectral pad factor: 0
Analysis frequency interval(fPassBand): [ 0, 250 ] Hz
Taper template: [ 1, 4, 1 ]
Line noise channels (63 channels):
[ 1:63 ]
```

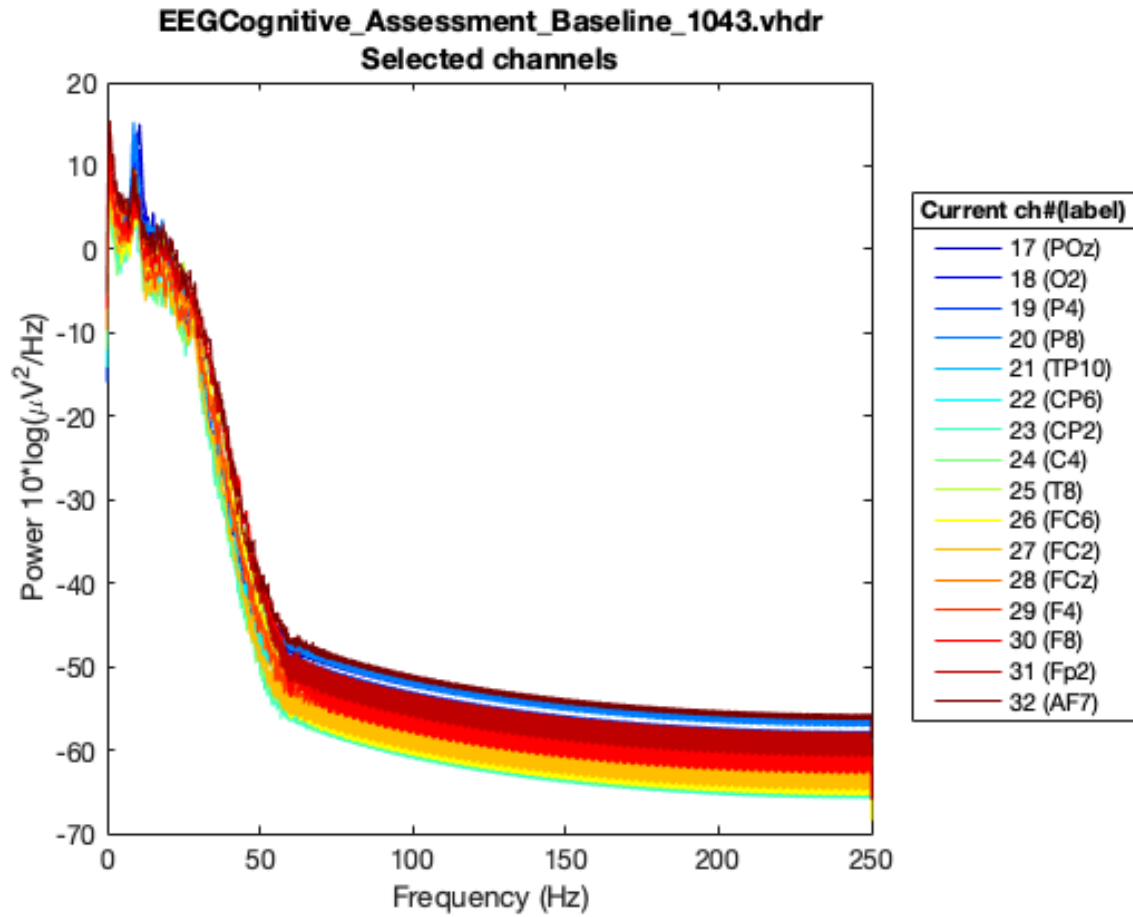
## Initial detrend for reference calculation

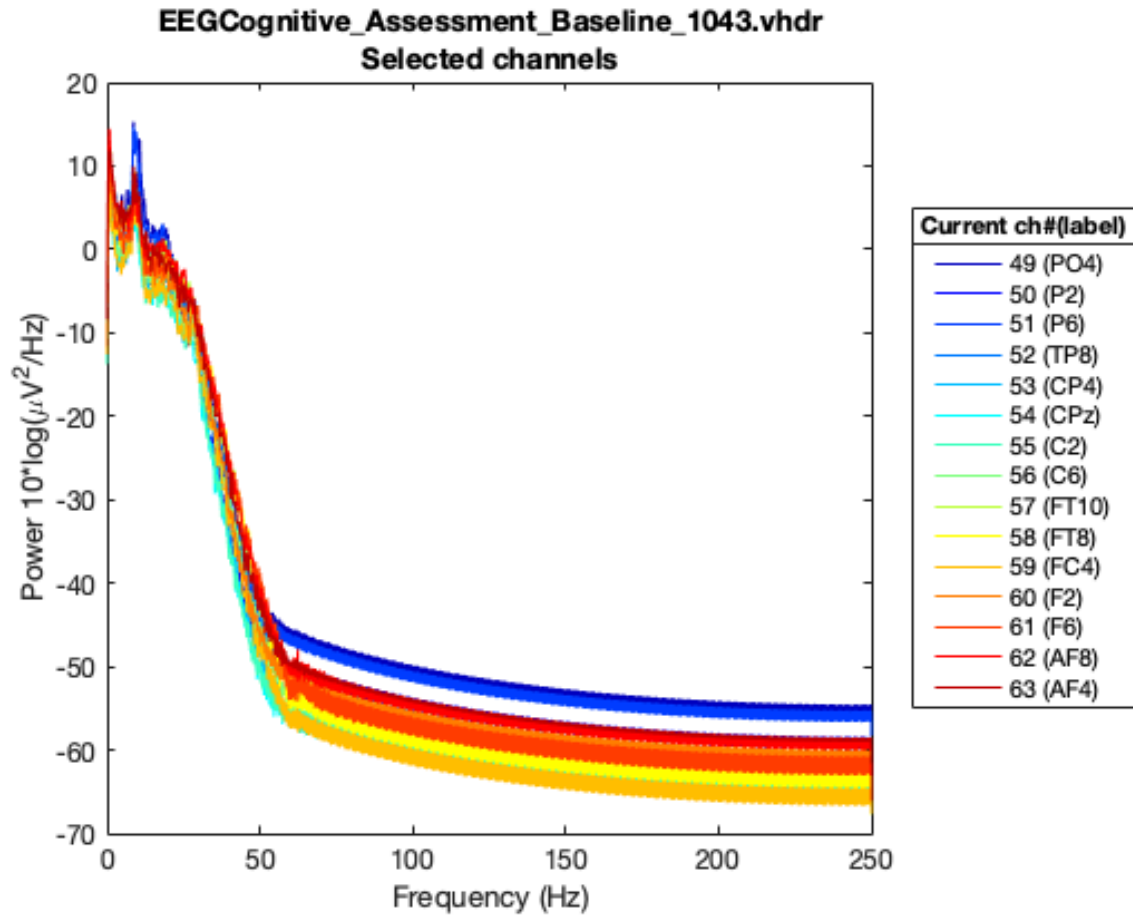
```
Detrend type: high pass
Detrend cutoff: 1 Hz
Detrend step size: 2.000000e-02
Detrend command:
EEG = pop_eegfiltnew(EEG, 'locutoff',1,'hicutoff',[]);
Detrended channels (63 channels):
[ 1:63 ]
```

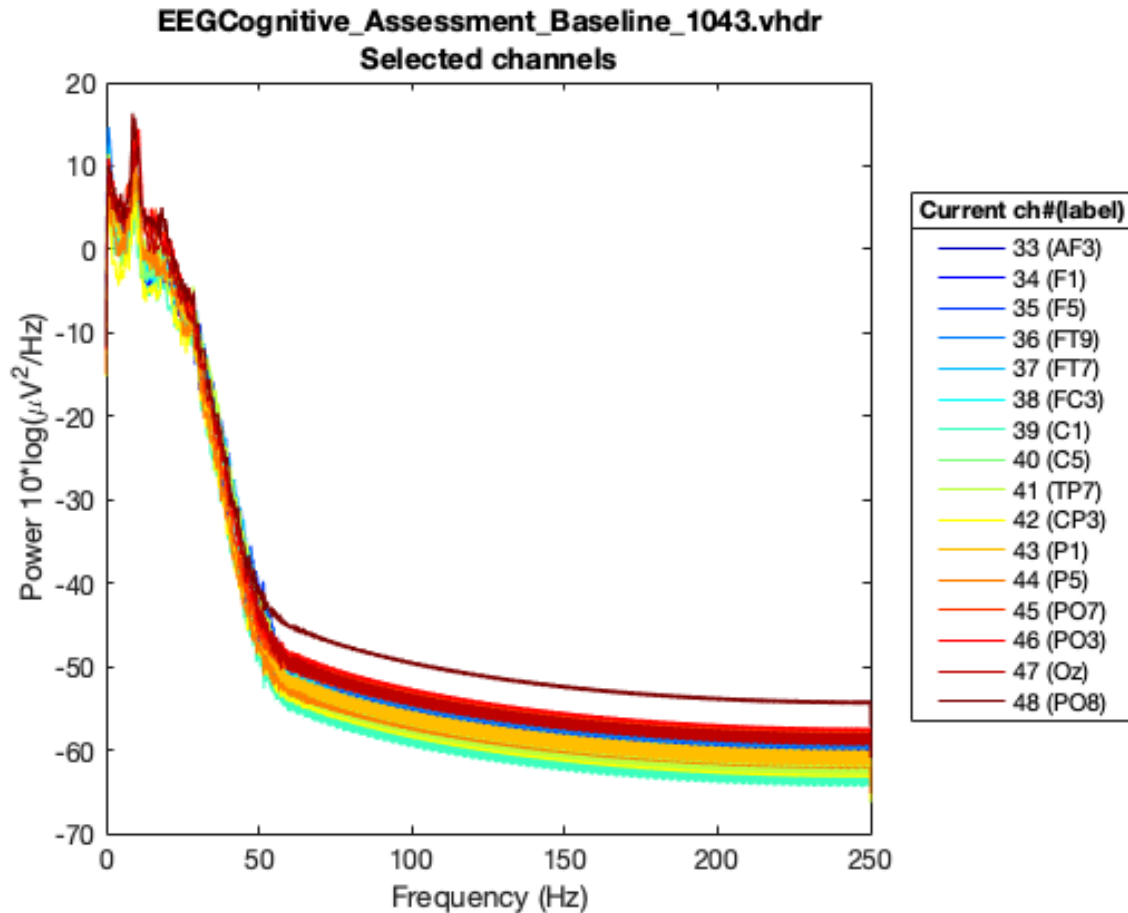
## Spectrum after line noise and detrend

```
pop_eegfiltnew() - performing 1651 point highpass filtering.
pop_eegfiltnew() - transition band width: 1 Hz
pop_eegfiltnew() - passband edge(s): 1 Hz
pop_eegfiltnew() - cutoff frequency(ies) (-6 dB): 0.5 Hz
pop_eegfiltnew() - filtering the data (zero-phase, non-causal)
firfilt(): |=====| 100%, ETE 00:00
```









## Referencing step

*Reference type robust*

*Interpolation order post-reference*

*Reference channels (63 channels):*

[ 1:63 ]

*Evaluation channels (63 channels):*

[ 1:63 ]

*RereferencedChannels (63 channels):*

[ 1:63 ]

*Noisy channel detection parameters:*

*Robust deviation threshold (z score): 5*

*High frequency noise threshold (ratio): 5*

*Correlation window size (in seconds): 1*

*Correlation threshold (with any channel): 0.4*

*Bad correlation threshold: 0.01*

*(fraction of time with low correlation or dropout)*

*Ransac off (if 1 Ransac turned off) : 0*

*Ransac sample size : 50*

(number channels to use for interpolated estimate)  
Ransac channel fraction (for ransac sample size): 0.25  
RansacCorrelationThreshold: 0.75  
RansacUnbrokenTime (input parameter): 0.4  
RansacWindowSeconds (in seconds): 5  
RansacPerformed (if 1, Ransac on and enough channels): 1  
Maximum reference iterations: 4  
Actual reference iterations: 3

Bad channels interpolated:

[ 8(C3) 11(CP5) 12(CP1) 15(P7) 18(O2) 21(TP10) 22(CP6) 39(C1) 44(P5)  
54(CPz)  
55(C2) 59(FC4) ]

Bad because of NaN:

[ ]

Bad because data is constant:

[ ]

Bad because of low SNR:

[ ]

Bad because of drop outs:

[ ]

Bad because of poor max correlation:

[ 8(C3) 11(CP5) 12(CP1) 15(P7) 21(TP10)  
22(CP6) 39(C1) 44(P5) 54(CPz) 55(C2)  
59(FC4) ]

Bad because of large deviation:

[ ]

Bad because of HF noise:

[ ]

Bad because of poor Ransac predictability :

[ 18(O2) ]

Bad channels after interpolation+referencing:

[ 28(FCz) ]

Bad because of NaN:

[ ]

Bad because data is constant:

[ ]

Bad because of low SNR:

[ ]

Bad because of drop outs:

[ ]

Bad because of poor max correlation:

[ 28(FCz) ]

Bad because of large deviation:

[ ]

Bad because of HF noise:

[ ]

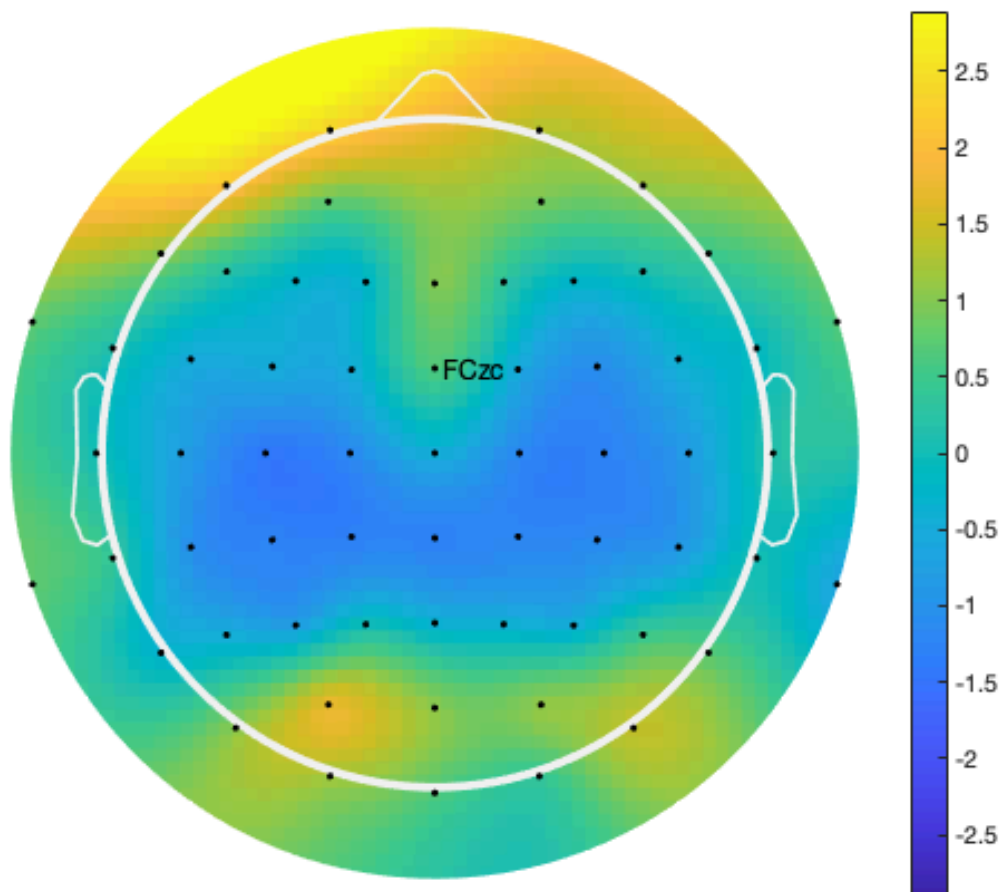
Bad because of poor Ransac predictability :

[ ]

Actual interpolation iterations: 3

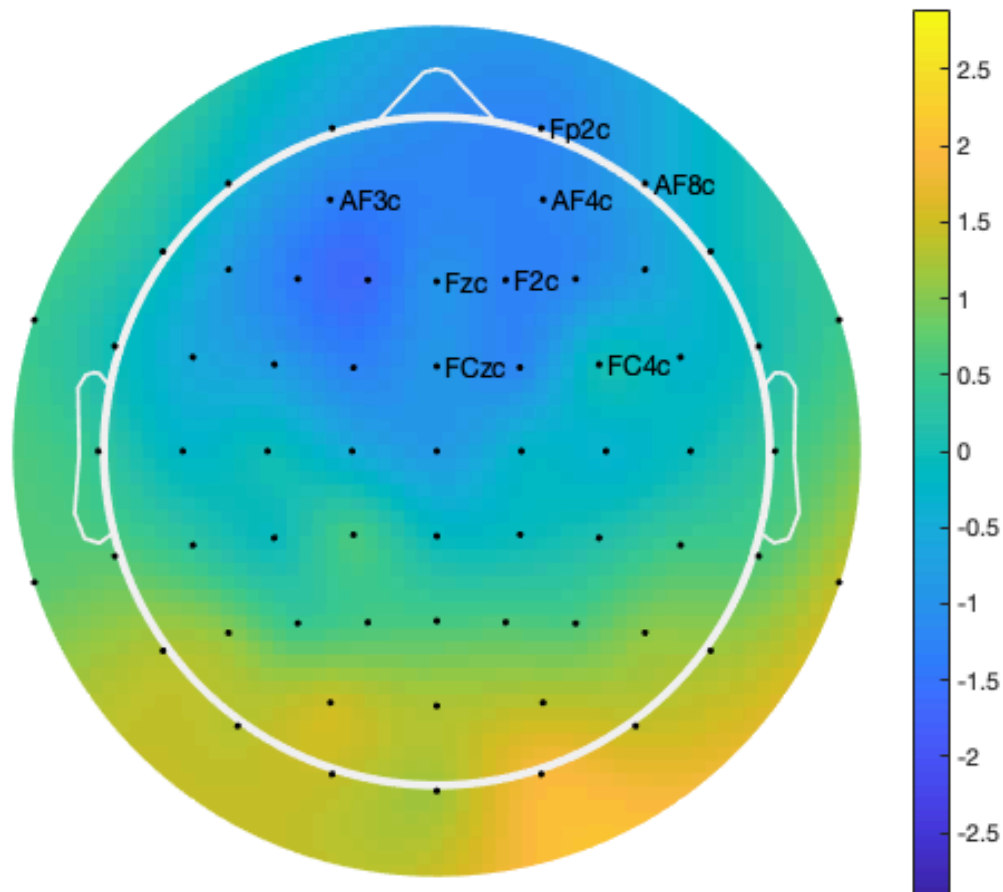
## Robust channel deviation (referenced)

Noisy channel legend: NaN: n  
NoData: z  
LowSNR: s  
Corr: c  
Amp: +  
Noise: x  
Ran: ?

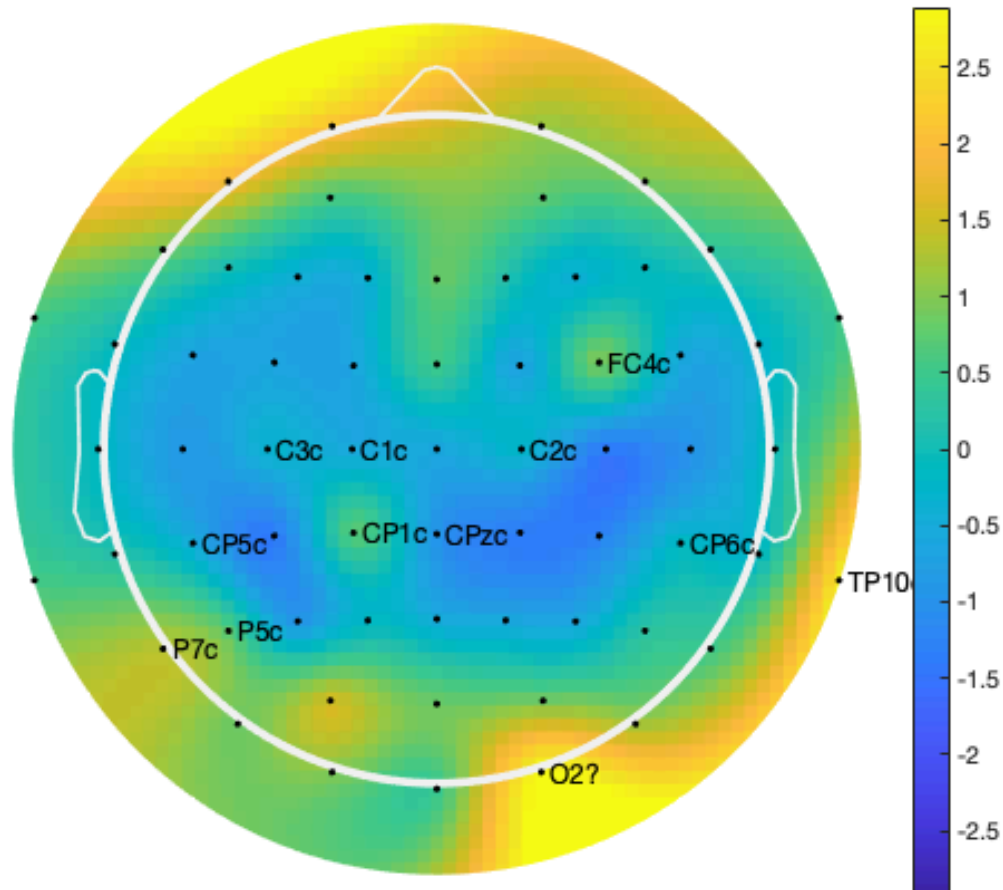




## Robust channel deviation (original)

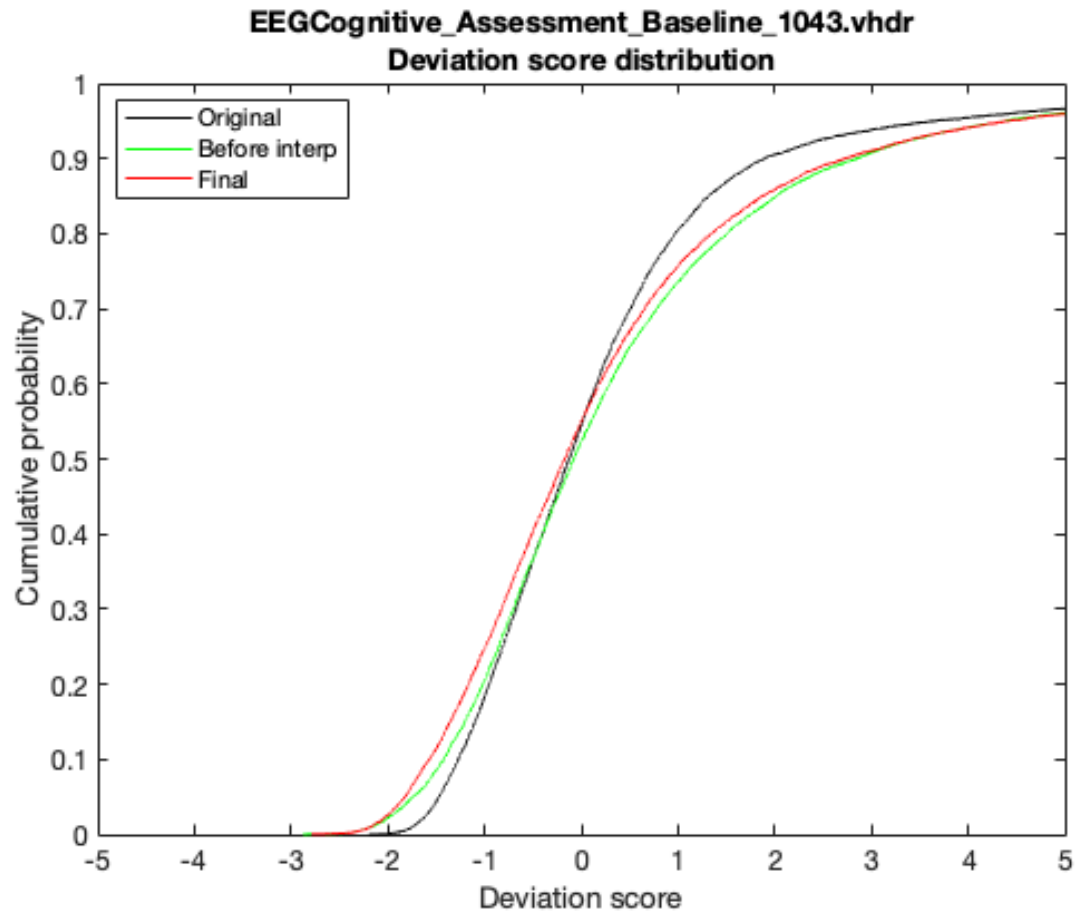


## Robust channel deviation (interpolated)

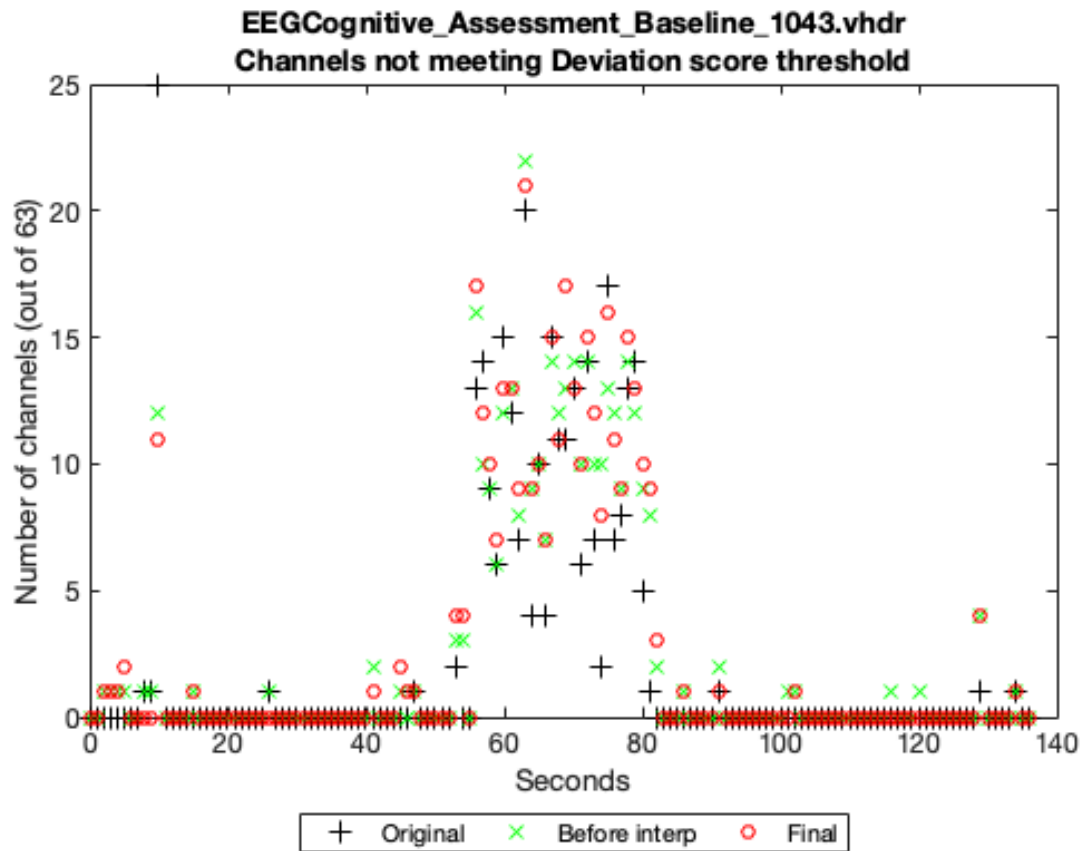


## Robust deviation window statistics

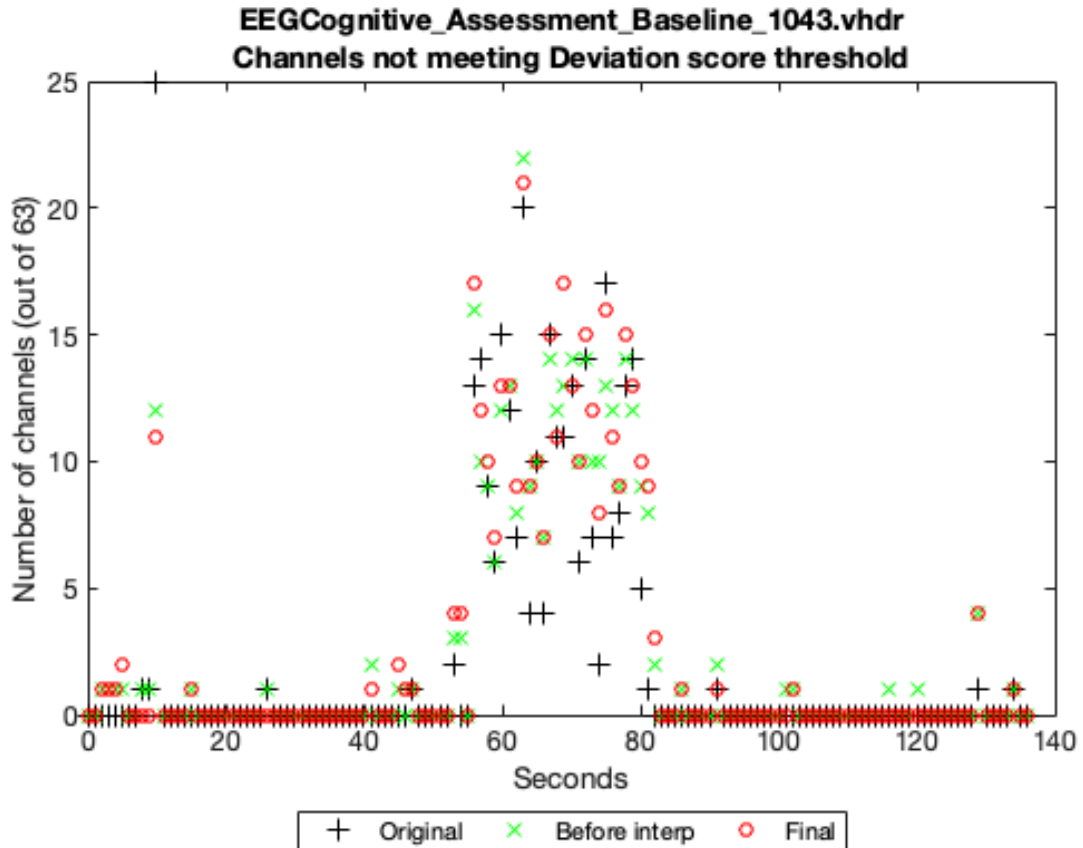
*Deviation window statistics (over 137 windows):*  
*Large deviation channel fraction:*  
[before=0.033832, after=0.040899]  
*Median channel deviation:* [before=8.5754, after=6.0655]  
*SD channel deviation:* [before=3.0951, after=1.5793]  
*Max raw deviation level* [before=61.645, after=46.6051]  
*Average fraction 0.033832 (2.1314 channels)*  
not meeting threshold before in each window  
*Average fraction 0.040899 (2.5766 channels)*  
not meeting threshold after in each window  
*Windows with > 1/4 deviation channels:*  
[before=3, after=3]  
*Windows with > 1/2 deviation channels:*  
[before=0, after=0]  
*Median window deviations:* [before=8.18, after=5.7927]  
*SD window deviations:* [before=3.4321, after=2.175]  
*Channels with dropouts:* None



Visualize the EEG output from  
the PREP processing pipeline.

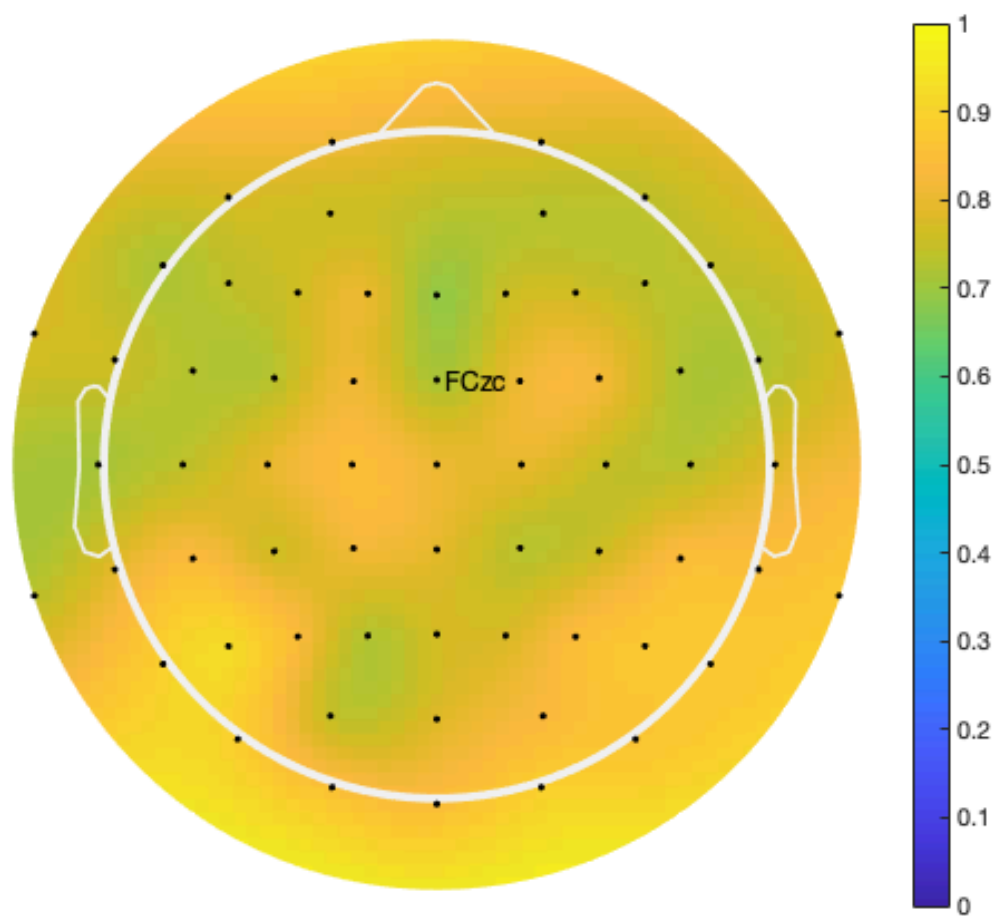


## Median max abs correlation (referenced)

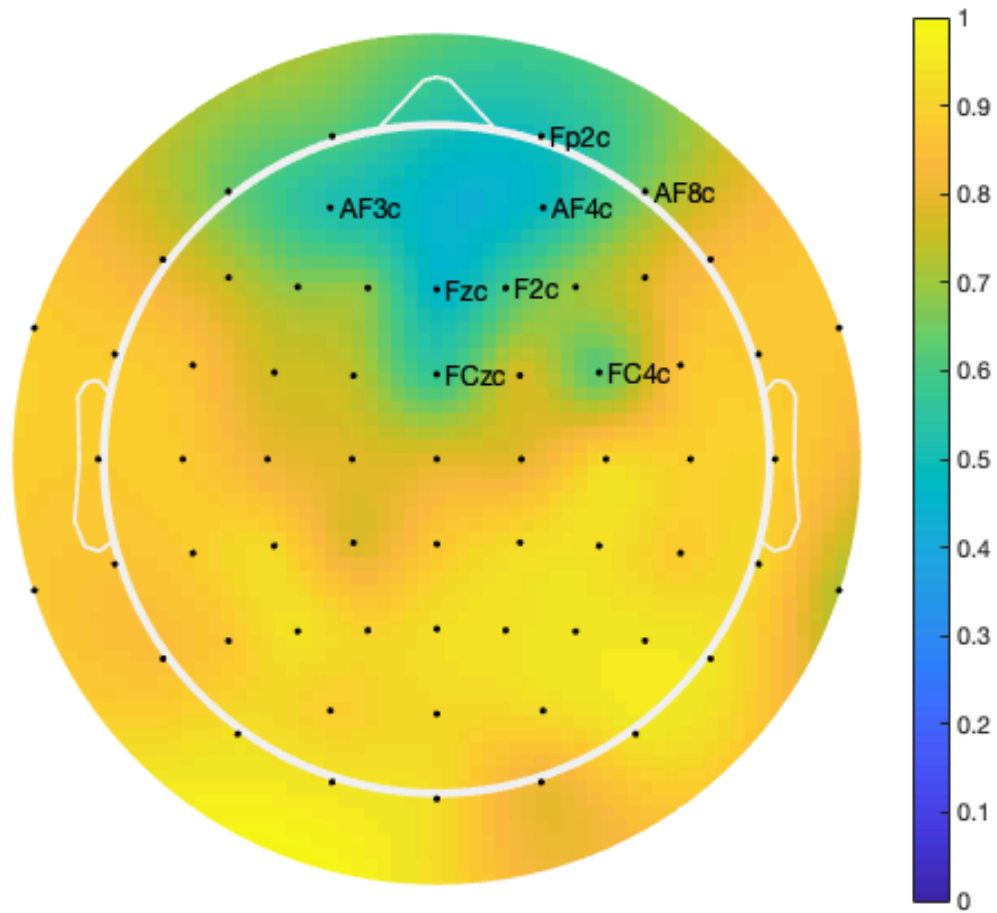


Visualize the EEG output from  
the PREP processing pipeline.

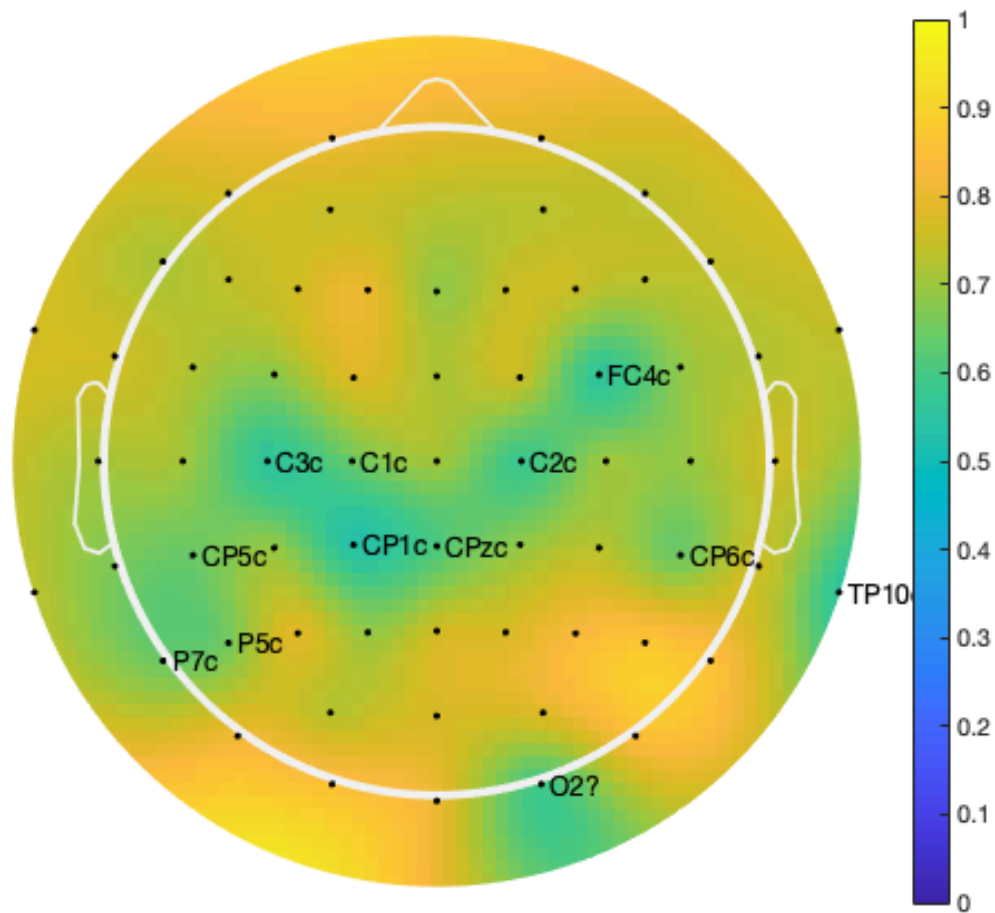
---



## Median max abs correlation (original)

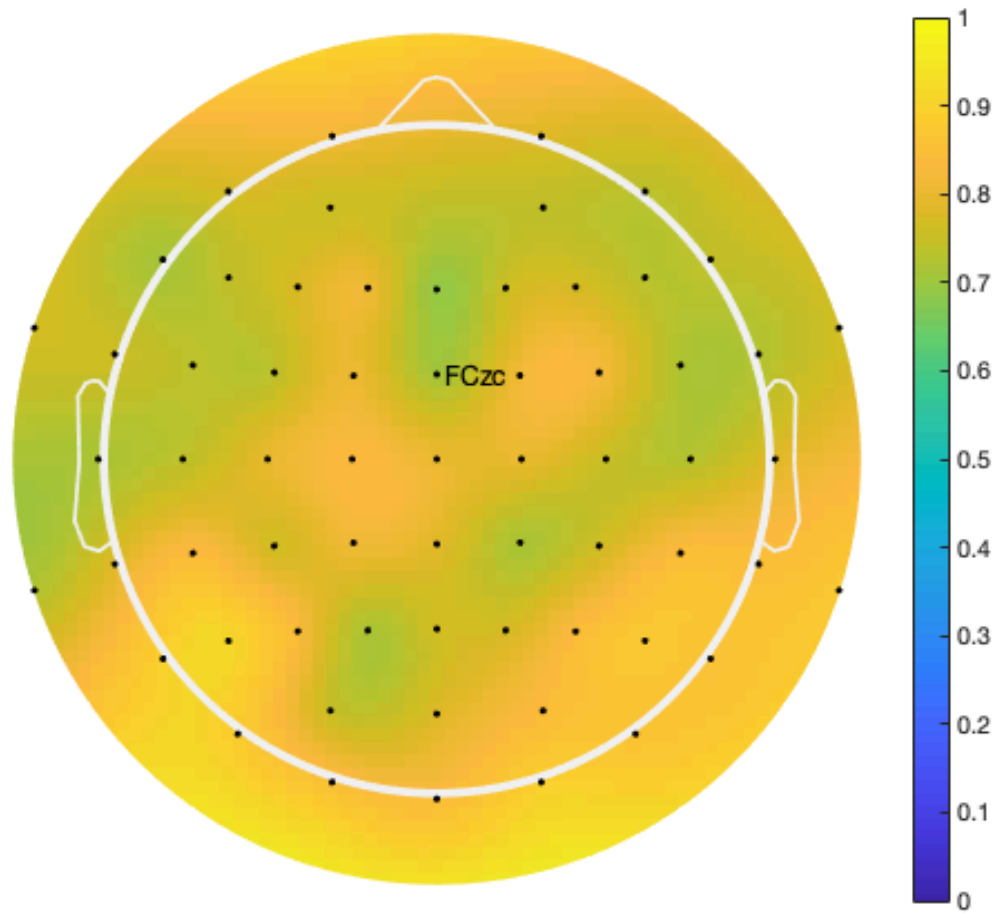


## Median max abs correlation (interpolated)

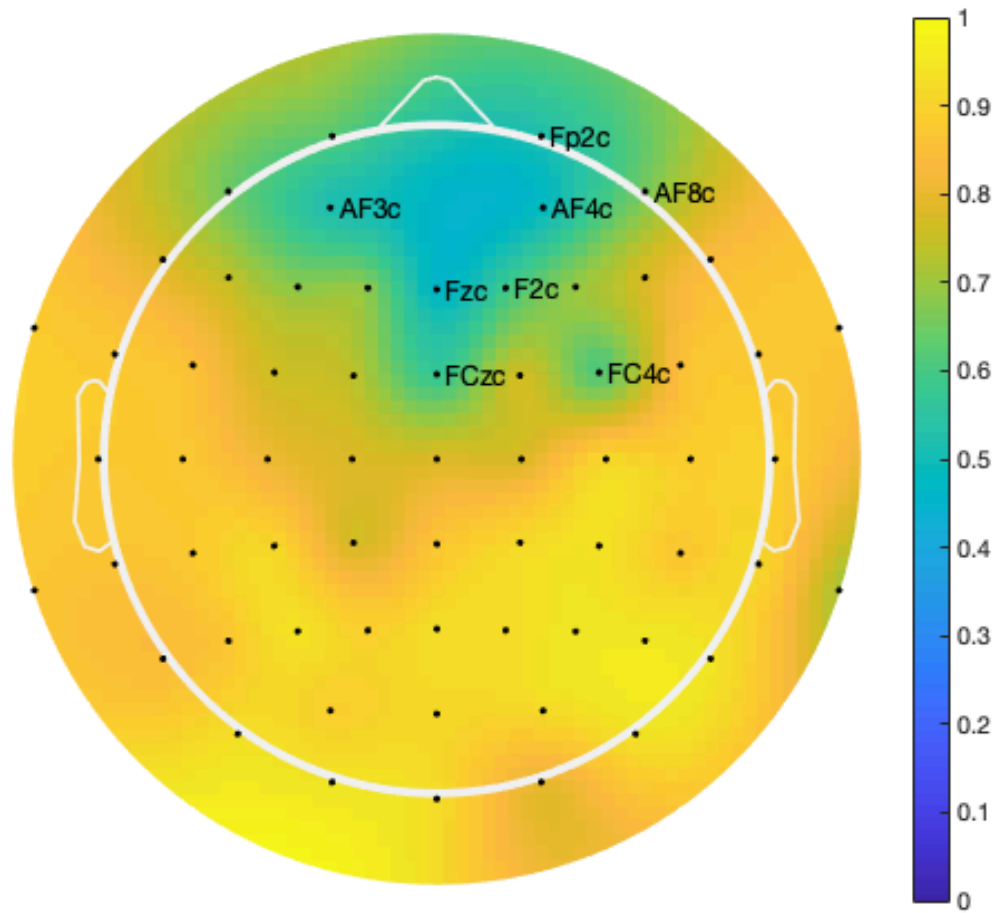




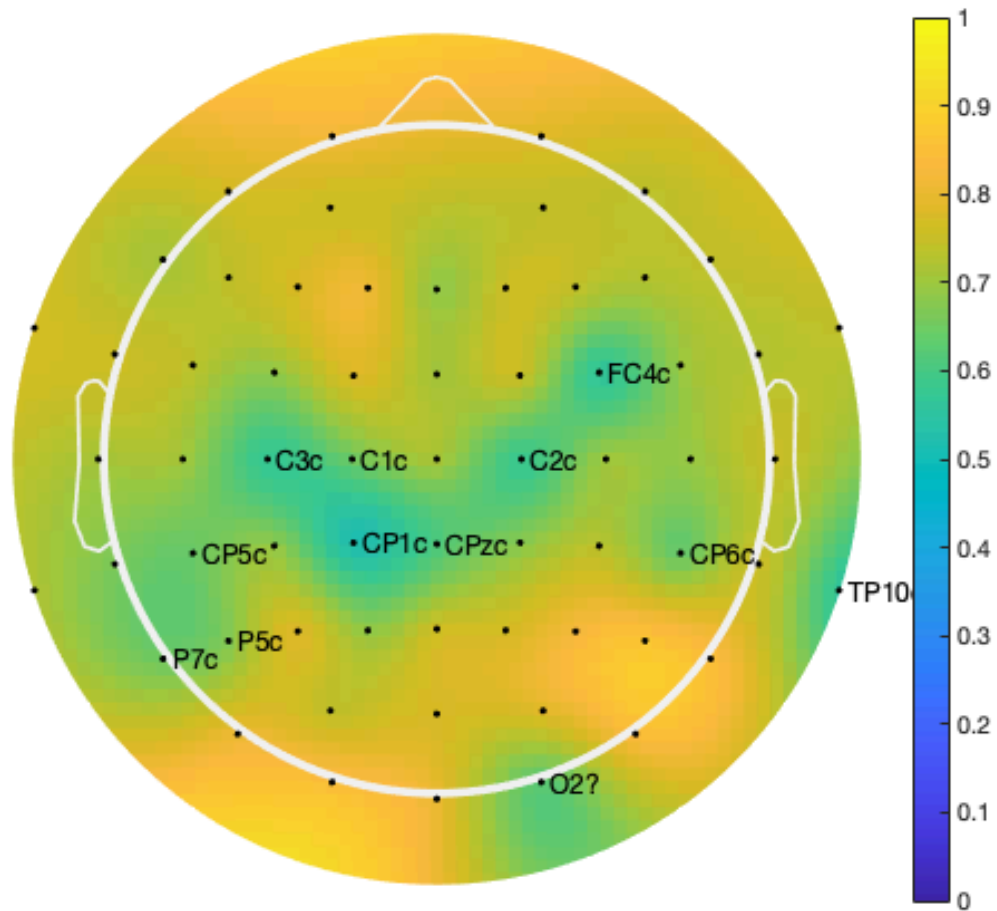
## Mean max abs correlation (referenced)



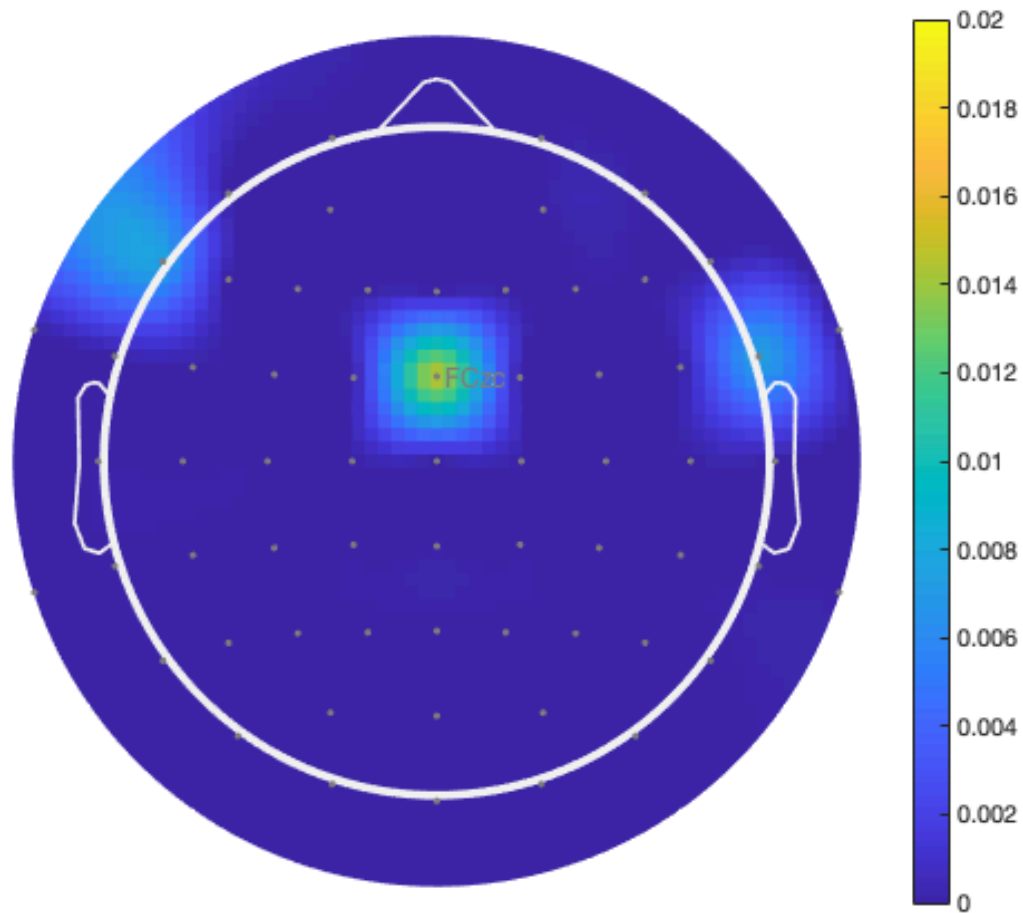
## Mean max abs correlation (original)



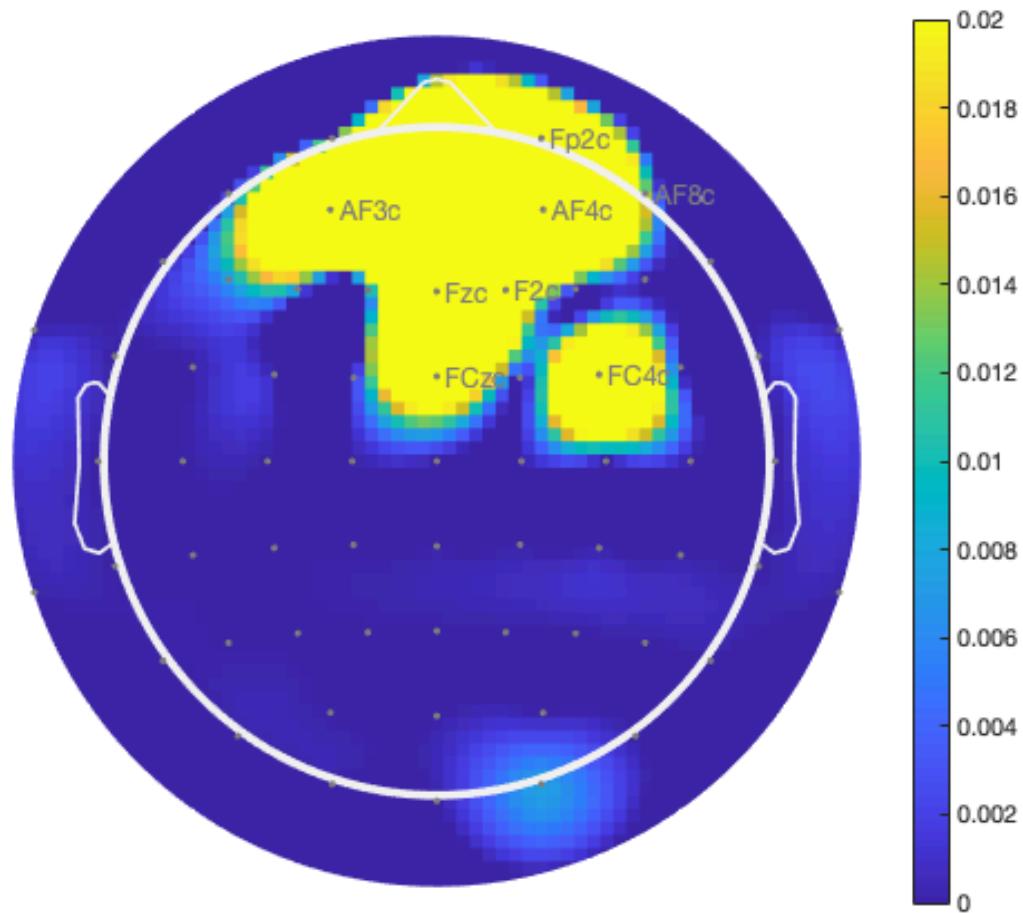
## Mean max abs correlation (interpolated)



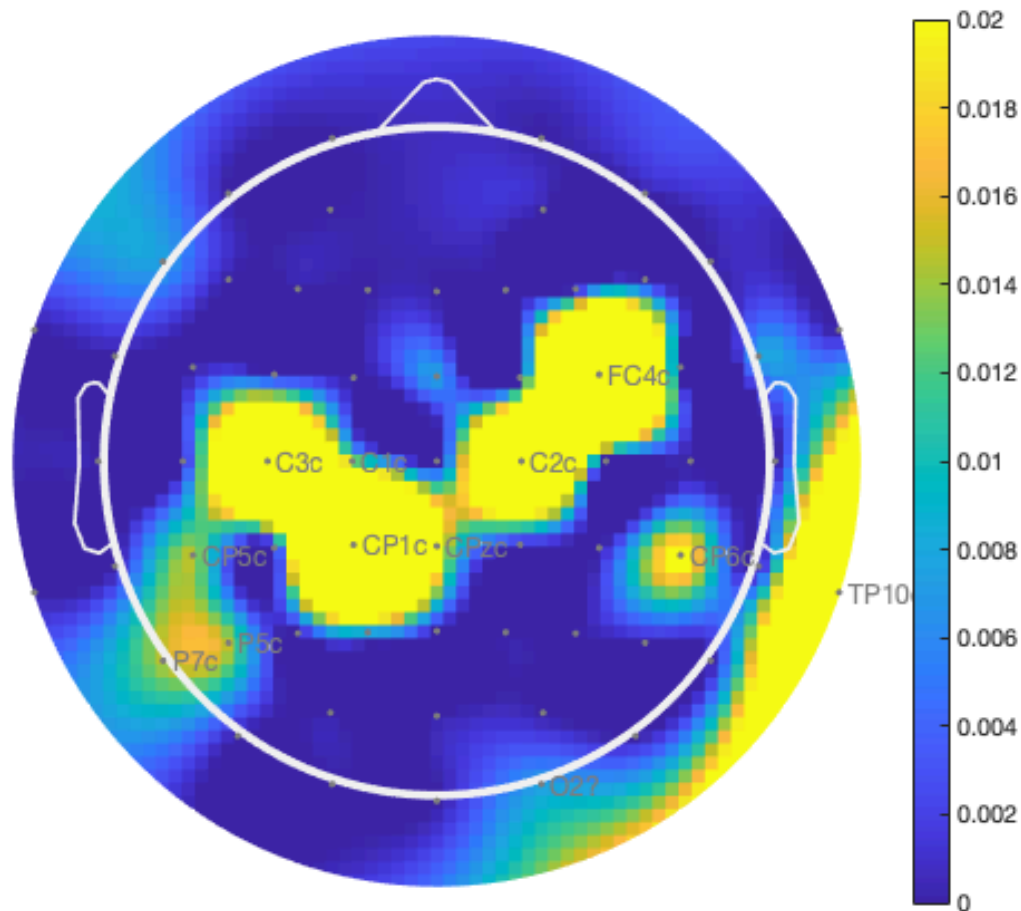
## Bad min max correlation fraction (referenced)



## Bad min max correlation fraction(original)

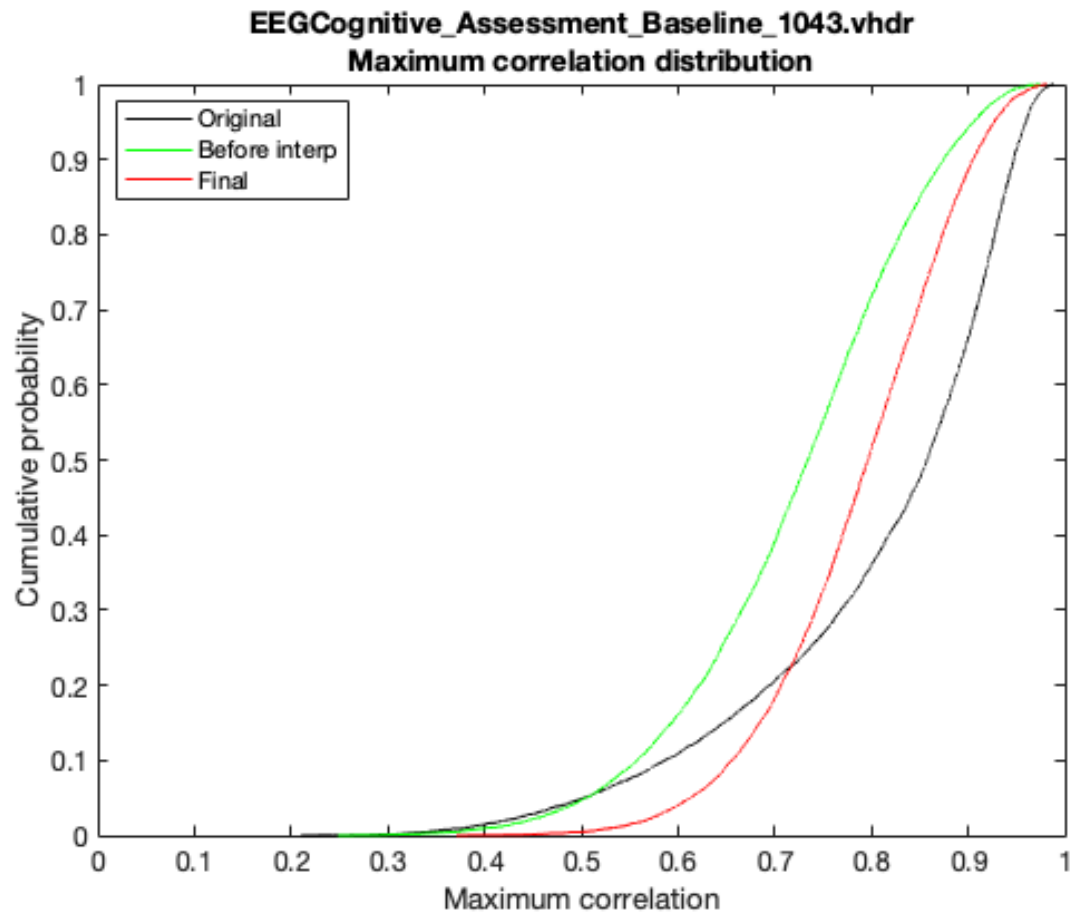


## Bad min max correlation fraction (interpolated)

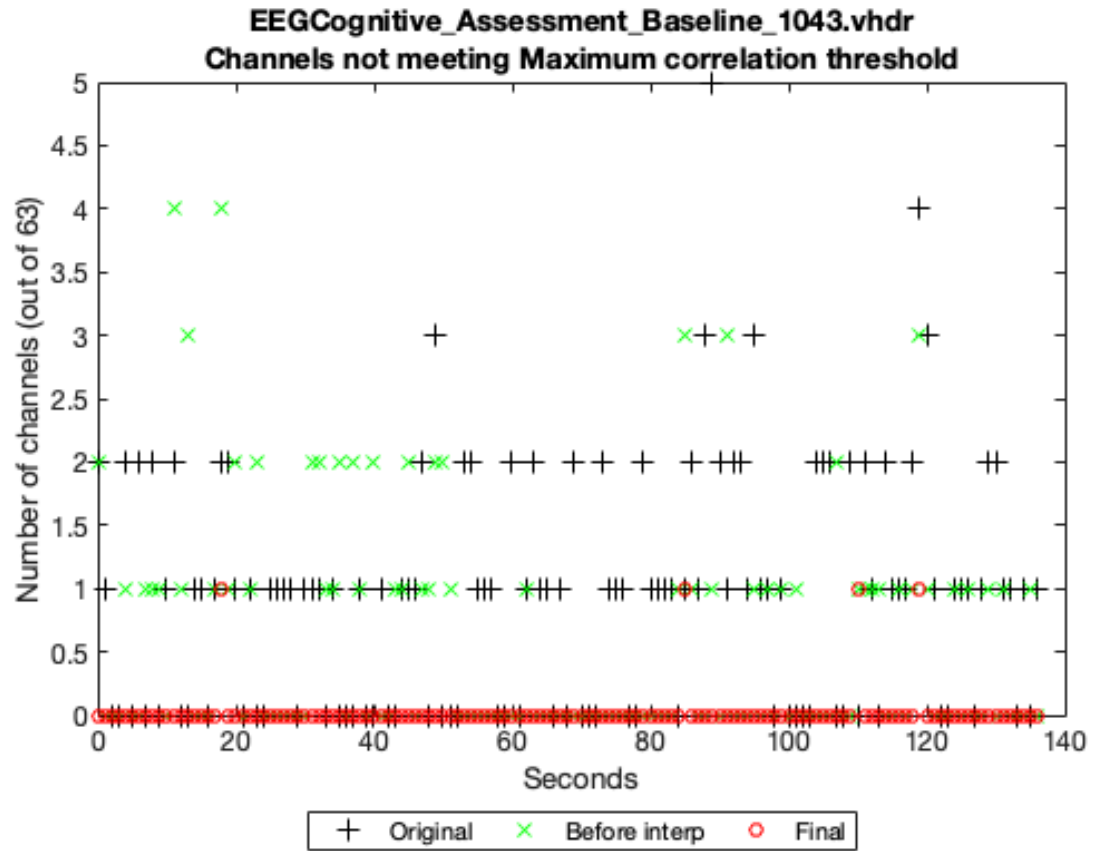


## Correlation window statistics

Max correlation window statistics (over 137 windows):  
Overall median maximum correlation [before=0.87071, after=0.77725]  
Low max correlation fraction [before=0.015178, after=0.00046345]  
Minimum max correlation level [before=0.21032, after=0.3711]  
Average fraction 0.015178 (0.9562 channels):  
    not meeting threshold before in each window  
Average fraction 0.00046345 (0.029197 channels):  
    not meeting threshold after in each window  
Windows with > 1/4 bad channels: [before=0, after=0]  
Windows with > 1/2 bad channels: [before=0, after=0]

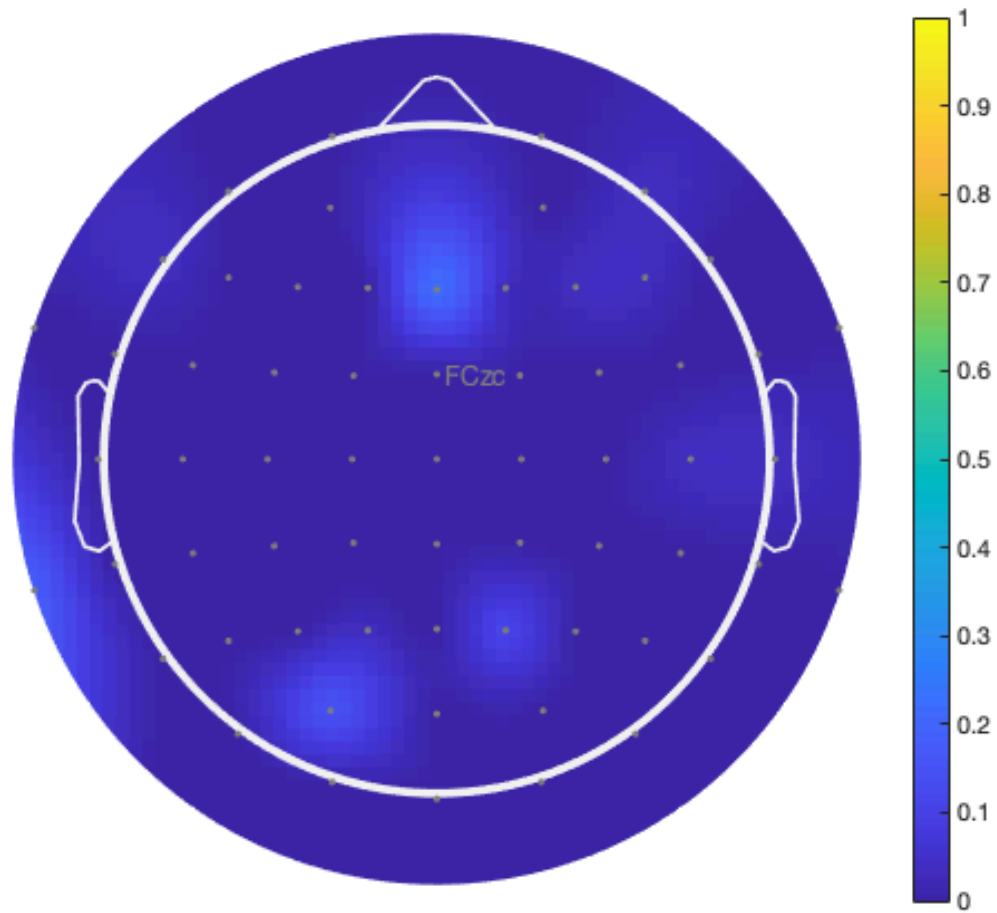


Visualize the EEG output from  
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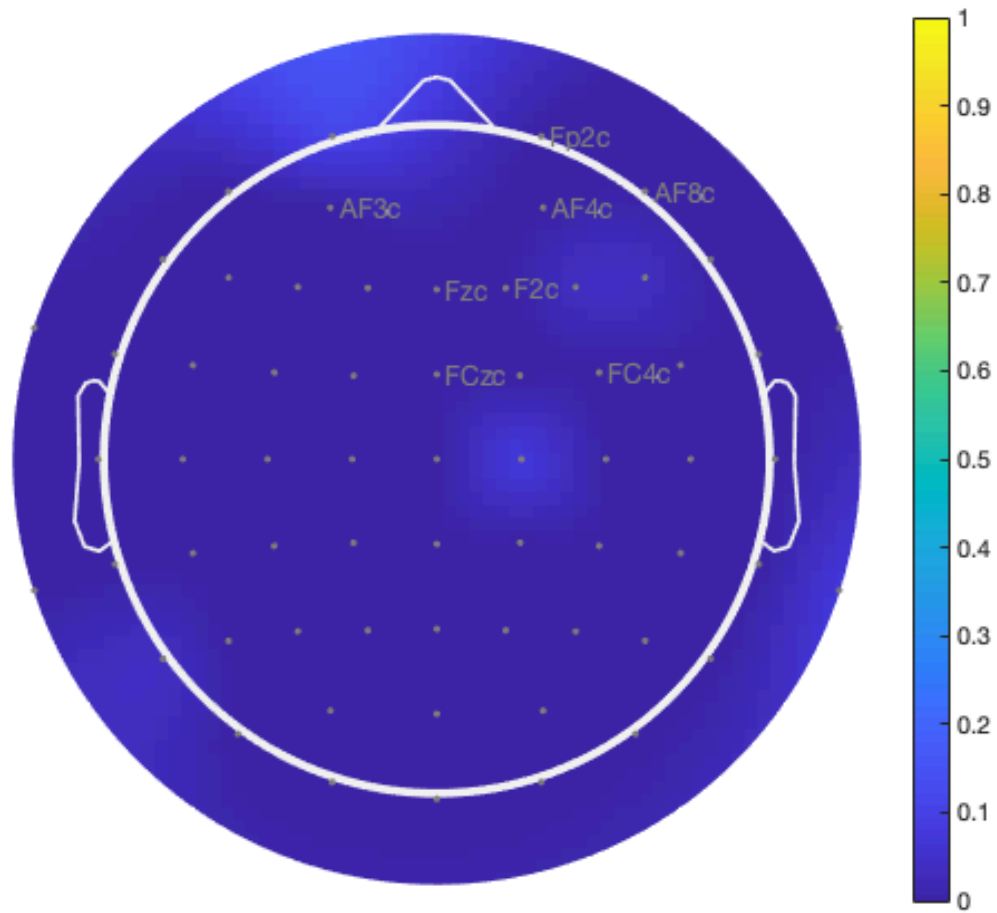




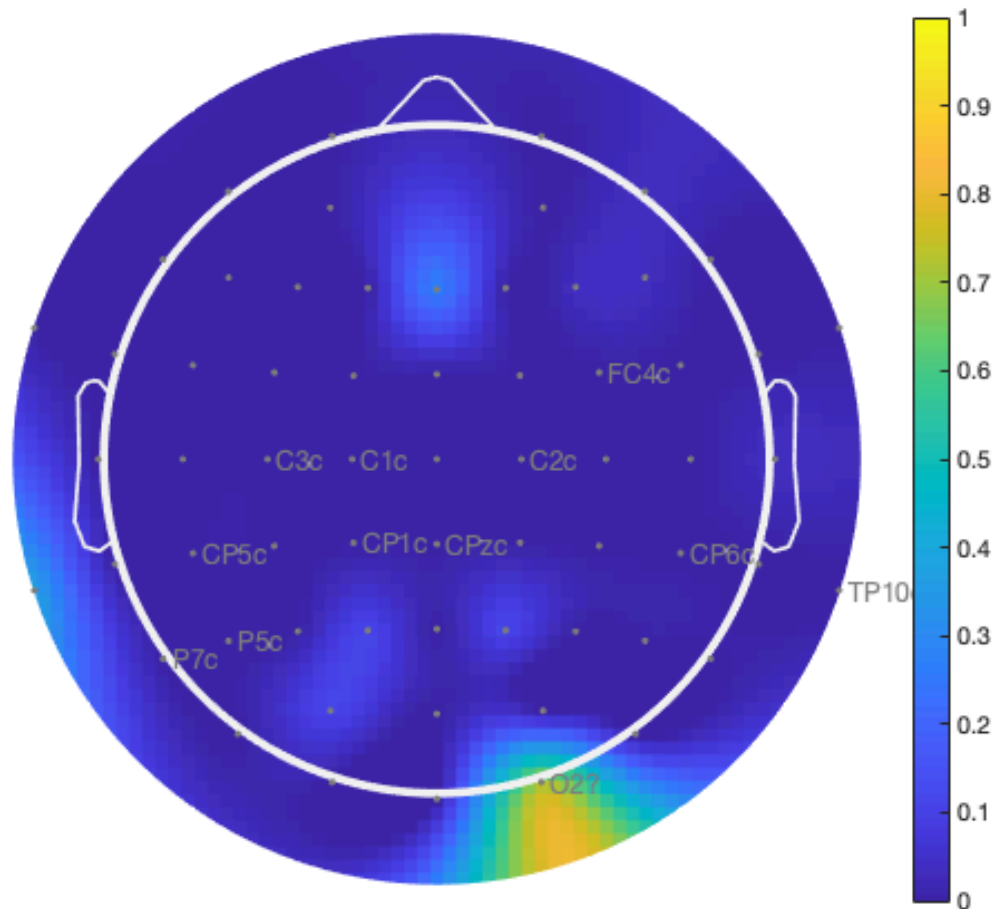
## Bad ransac fraction (referenced)



## Bad ransac fraction (original)

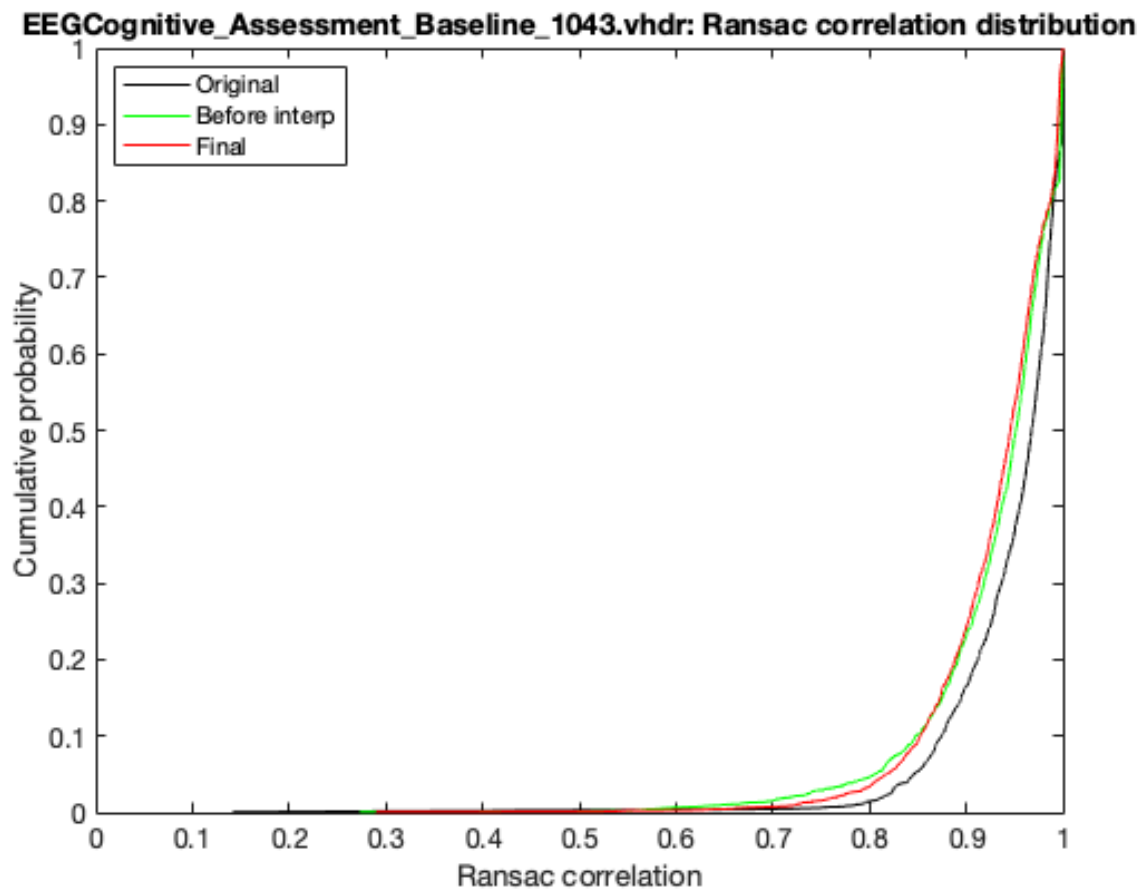


## Bad ransac fraction (interpolated)

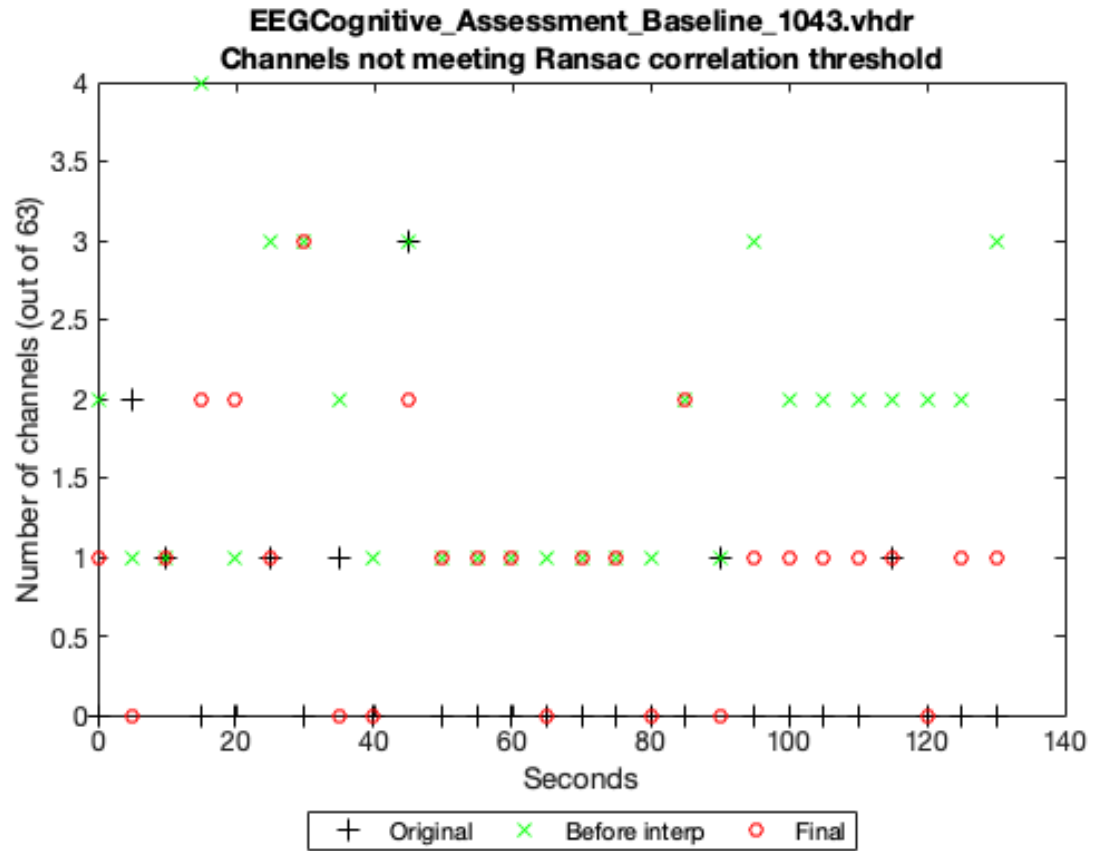


## Channels with poor ransac correlations

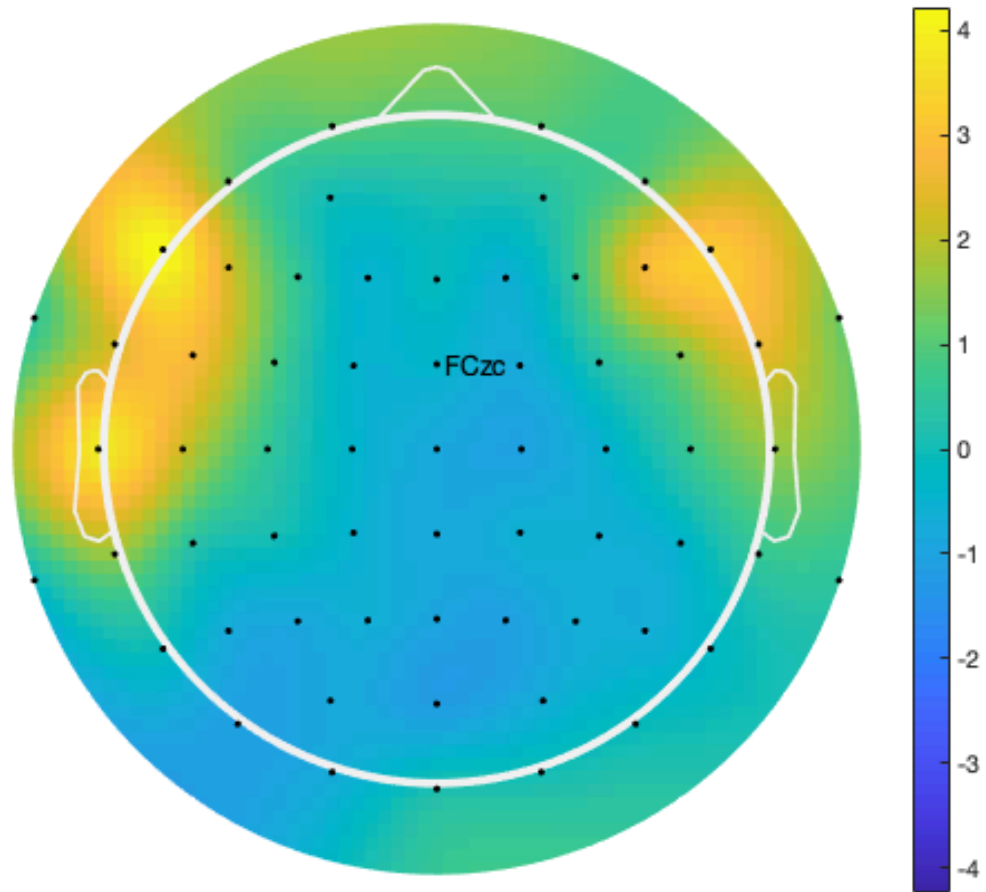
*Ransac window statistics (over 27 windows):*  
*Low ransac channel fraction [before=0.0058789, after=0.015285]*  
*Minimum ransac correlation [before=0.14202, after=0.28993]*  
*Average fraction 0.0058789 (0.37037 channels):*  
    *not meeting threshold before in each window*  
*Average fraction 0.015285 (0.96296 channels):*  
    *not meeting threshold after in each window*  
*Windows with > 1/4 bad ransac channels: [before=0, after=0]*  
*Windows with > 1/2 bad ransac channels: [before=0, after=0]*



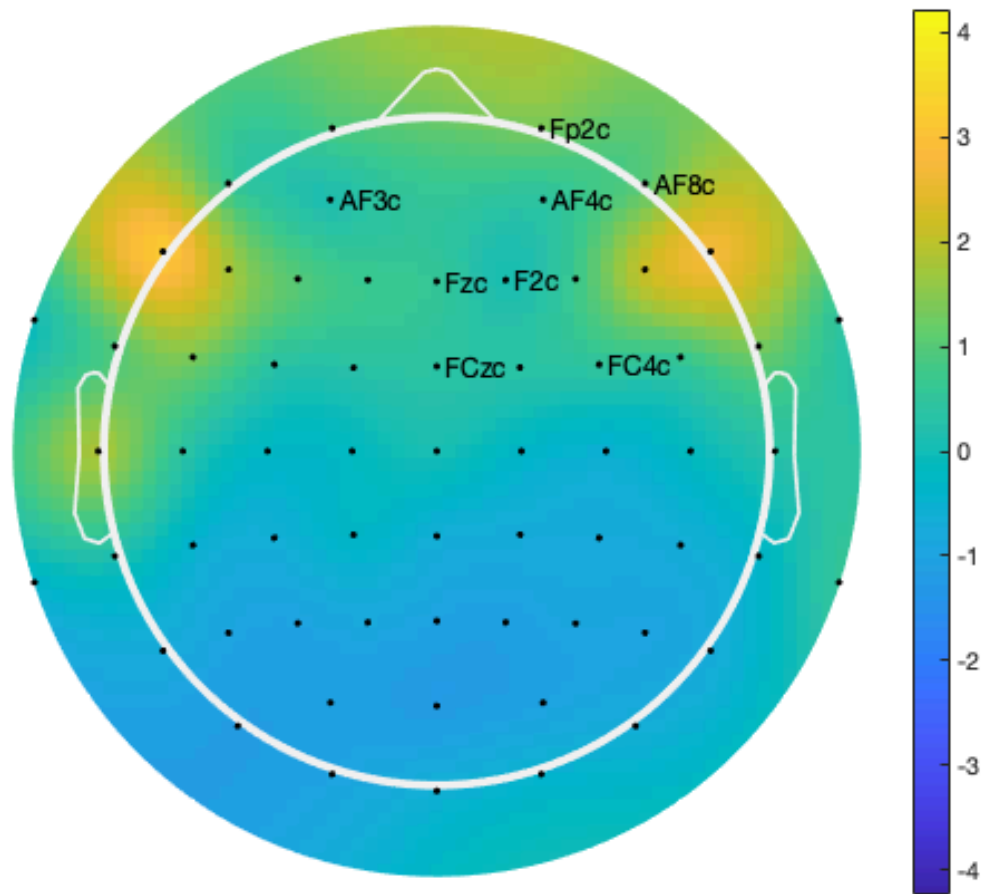
Visualize the EEG output from  
the PREP processing pipeline.



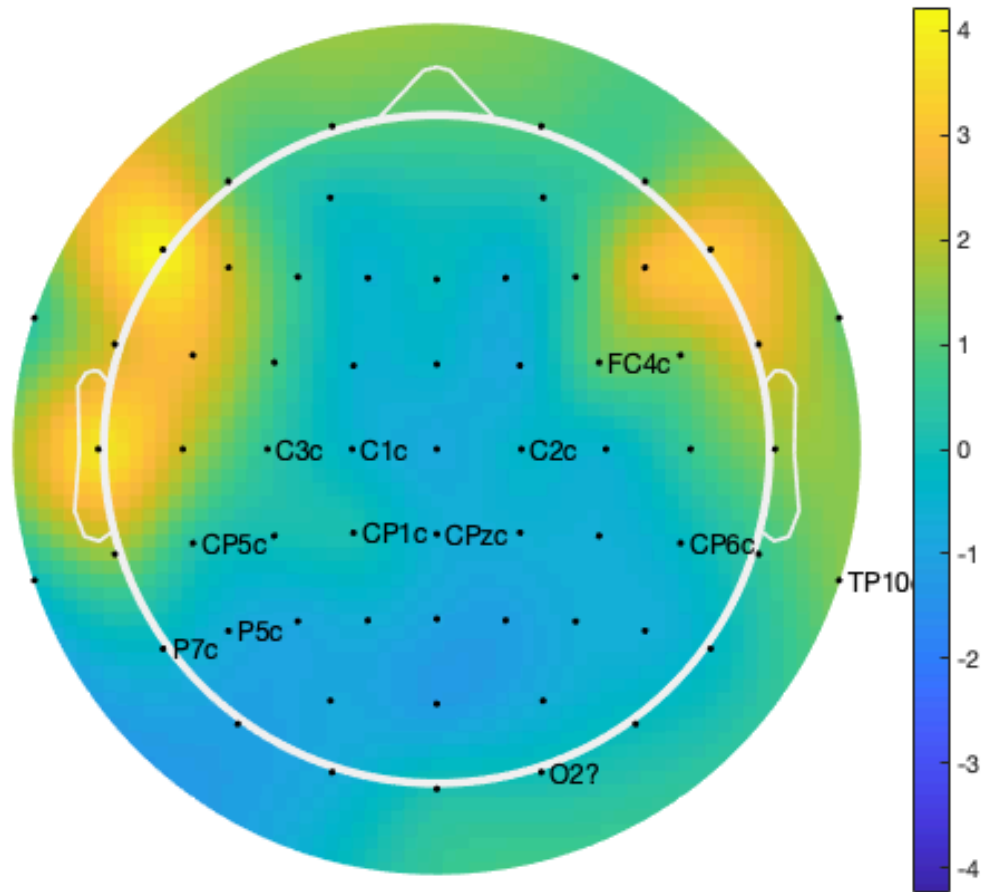
## HF noise Z-score (referenced)



## HF noise Z-score (original)



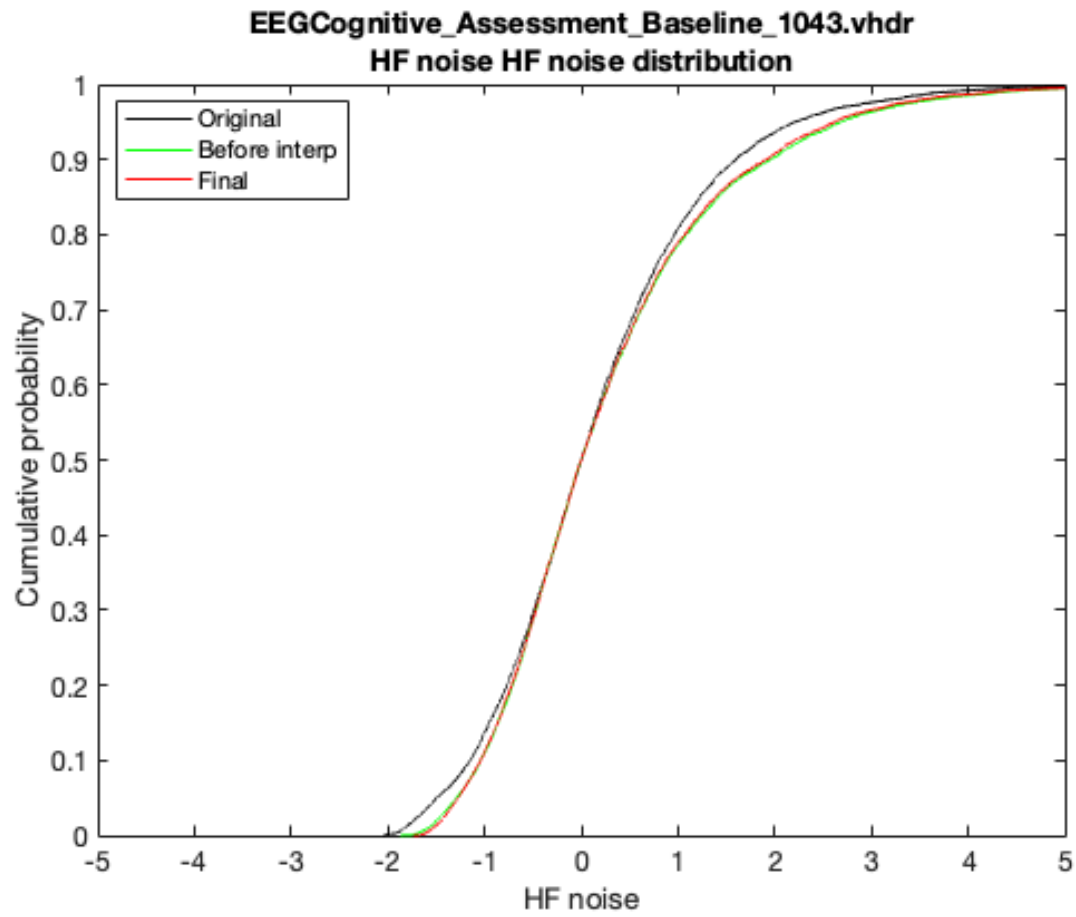
## HF noise Z-score (interpolated)



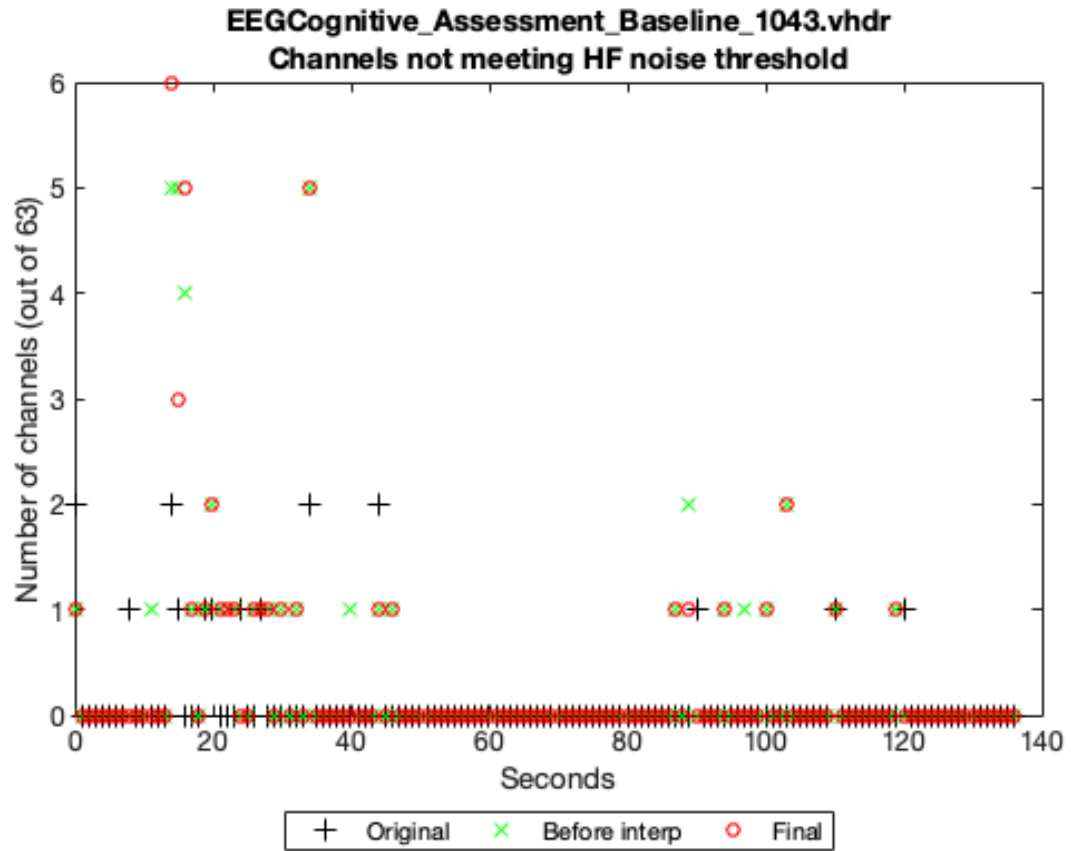
## HF noise window stats

```
Noise window statistics (over 137 windows):  
Channel fraction with HF noise:  
  [before=0.0019696, after=0.0048662]  
Median noisiness: [before=0.0029526, after=0.0026457]  
SD noisiness: [before=0.00082012, after=0.00077696]  
Max HF noise levels [before=0.018441, after=0.015425]  
Average fraction 0.0019696 (0.12409 channels):  
  not meeting threshold before in each window  
Average fraction 0.0048662 (0.30657 channels):  
  not meeting threshold after in each window  
  not meeting threshold after relative to before in each window  
Windows with > 1/4 HF channels:  
  [before=0, after=0]  
Windows with > 1/2 HF channels:  
  [before=0, after=0]  
Median window HF: [before=0.0031067, after=0.0028643]  
SD window HF: [before=0.001207, after=0.0013472]
```

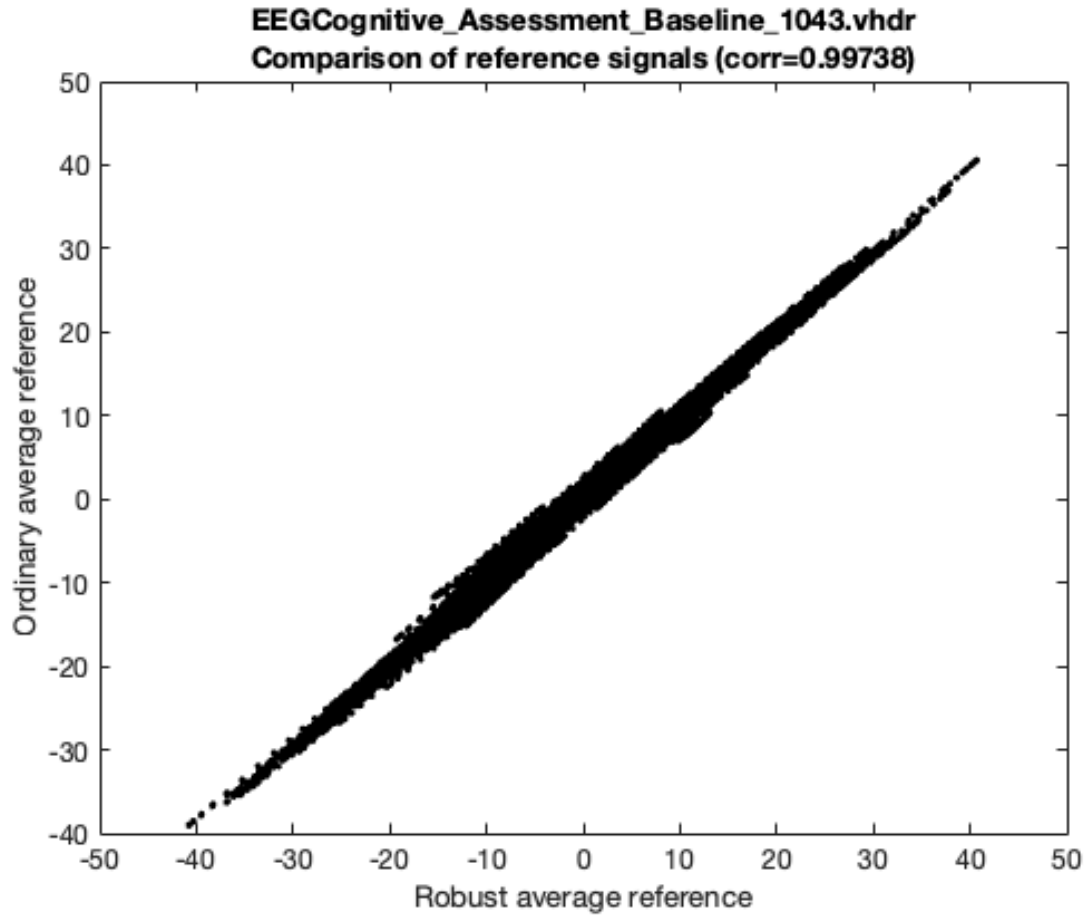




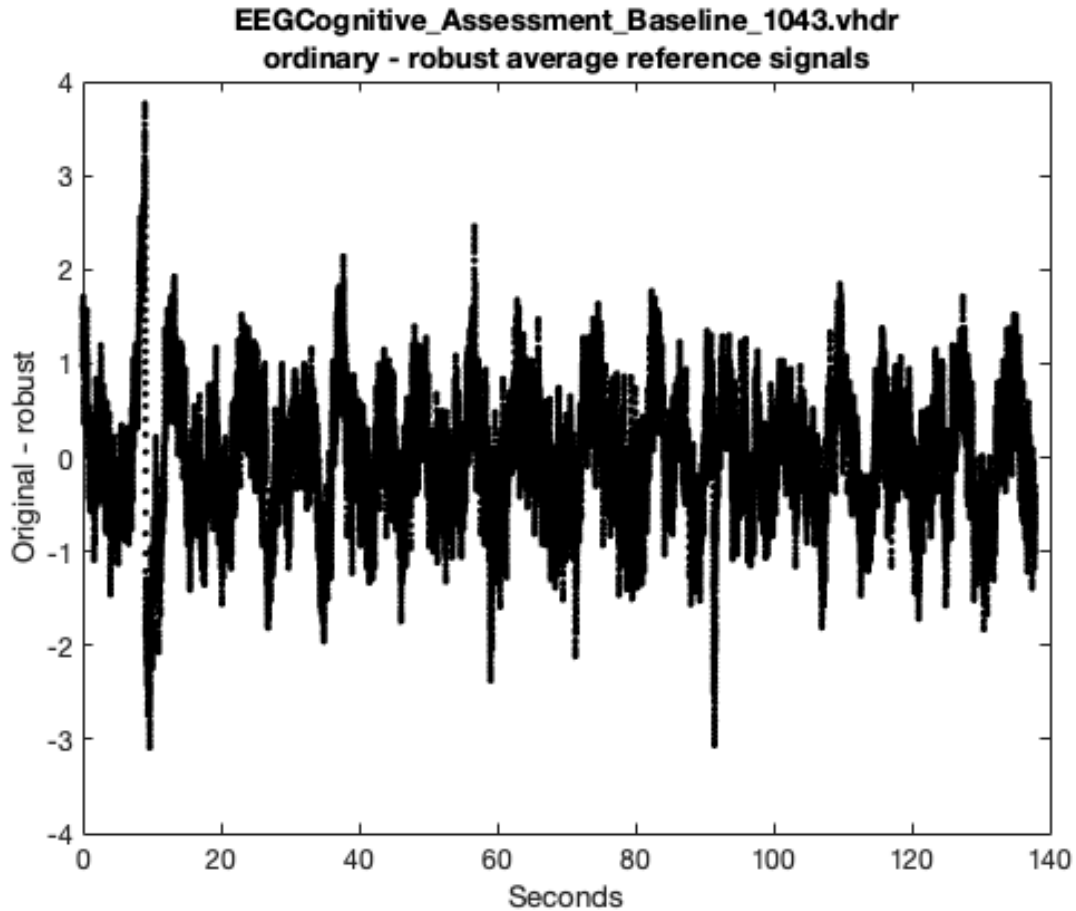
Visualize the EEG output from  
the PREP processing pipeline.



## Noisy average vs robust average reference



## Noisy and robust average reference by time

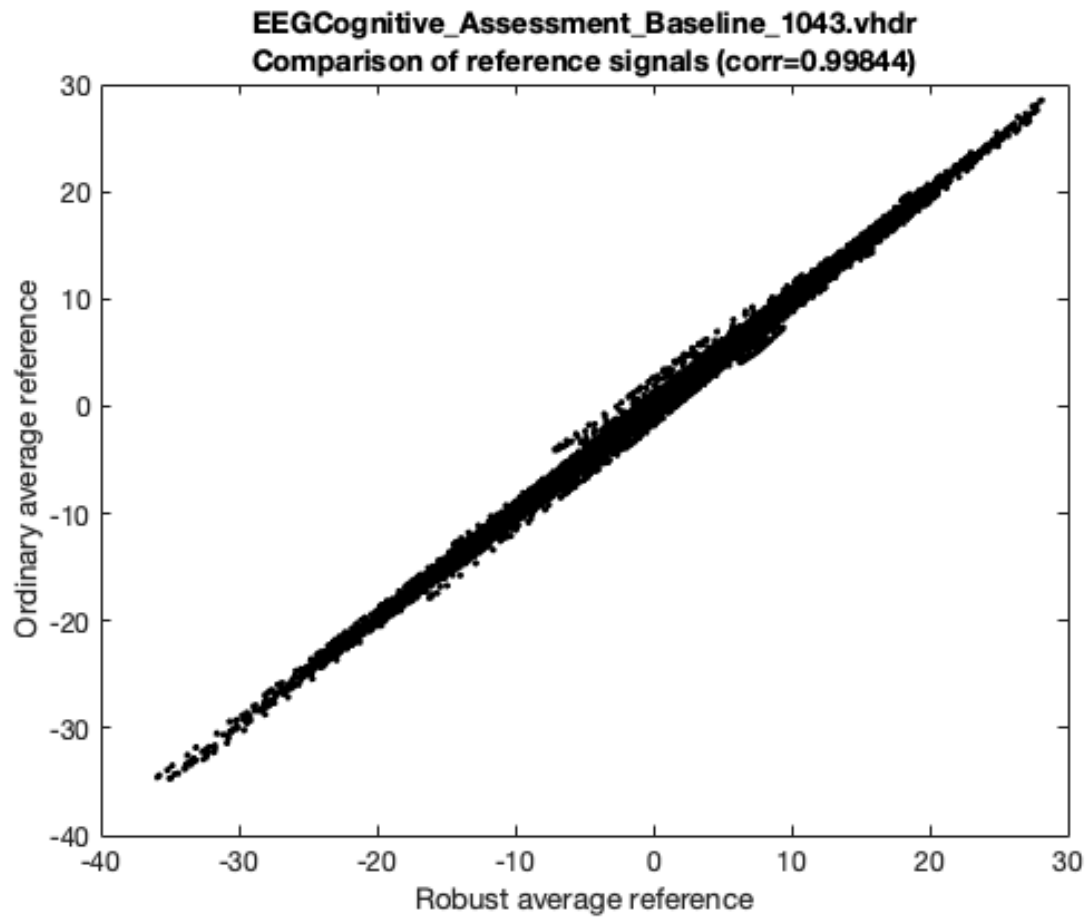


## Noisy vs robust average reference (filtered)

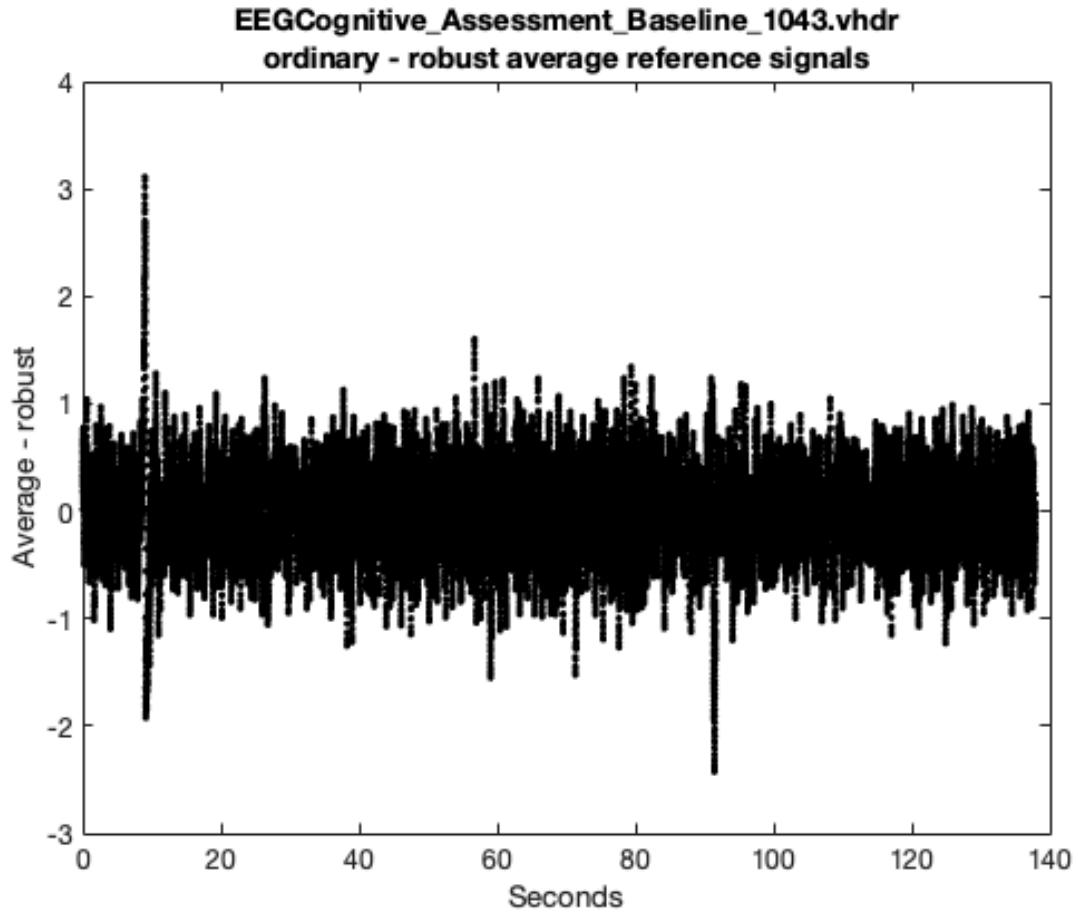
```
pop_eegfiltnew() - performing 1651 point highpass filtering.  
pop_eegfiltnew() - transition band width: 1 Hz  
pop_eegfiltnew() - passband edge(s): 1 Hz  
pop_eegfiltnew() - cutoff frequency(ies) (-6 dB): 0.5 Hz  
pop_eegfiltnew() - filtering the data (zero-phase, non-causal)  
firfilt(): |=====| 100%, ETE 00:00
```

Visualize the EEG output from  
the PREP processing pipeline.

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## Noisy minus robust average reference by time



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