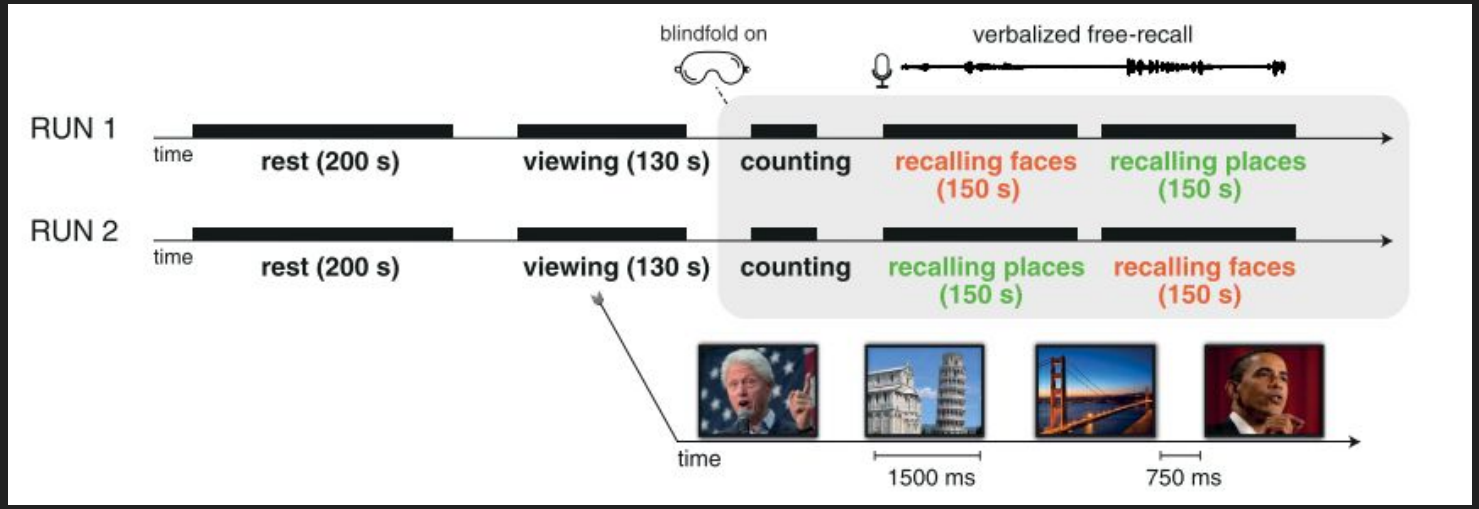
Complexity and causality in ECoG

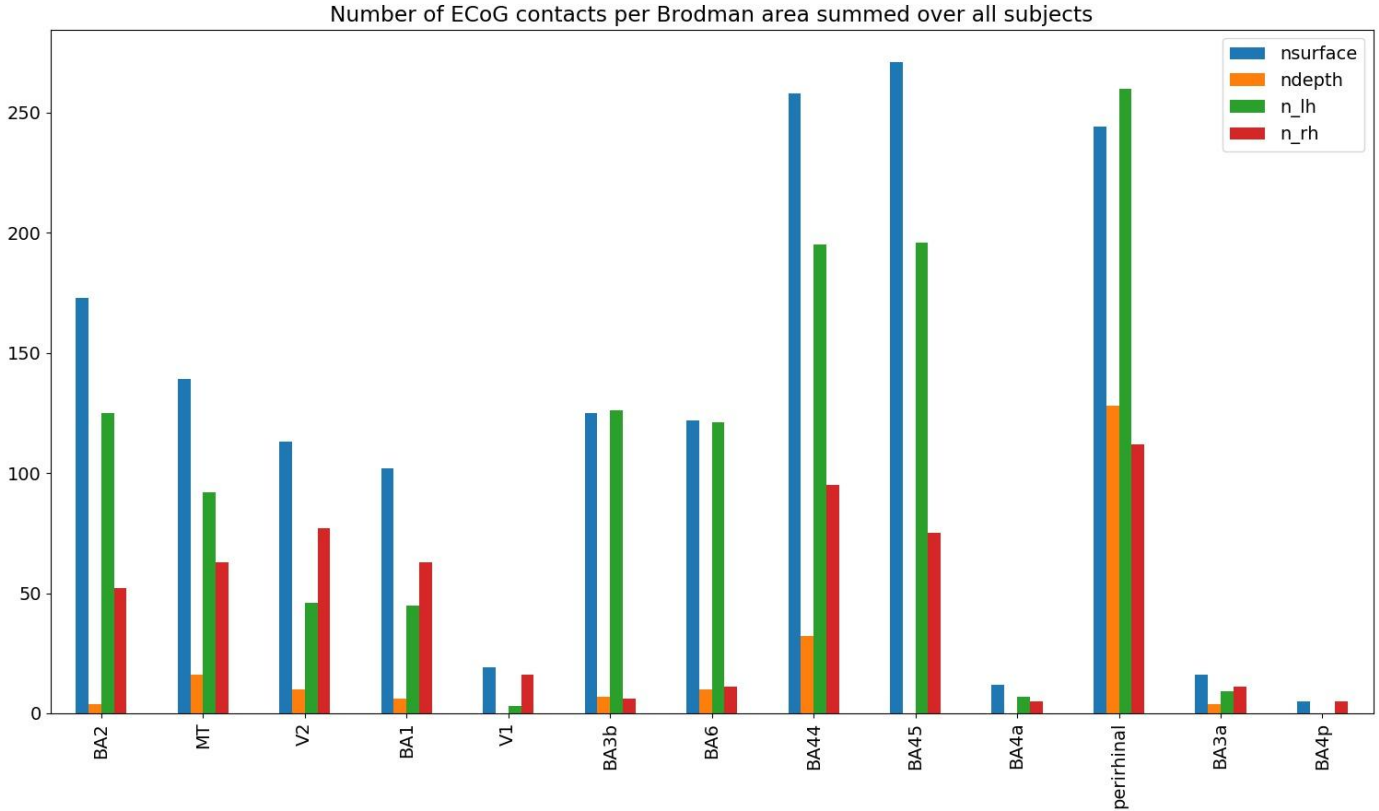
CIFAR report, June 2020

Task and data



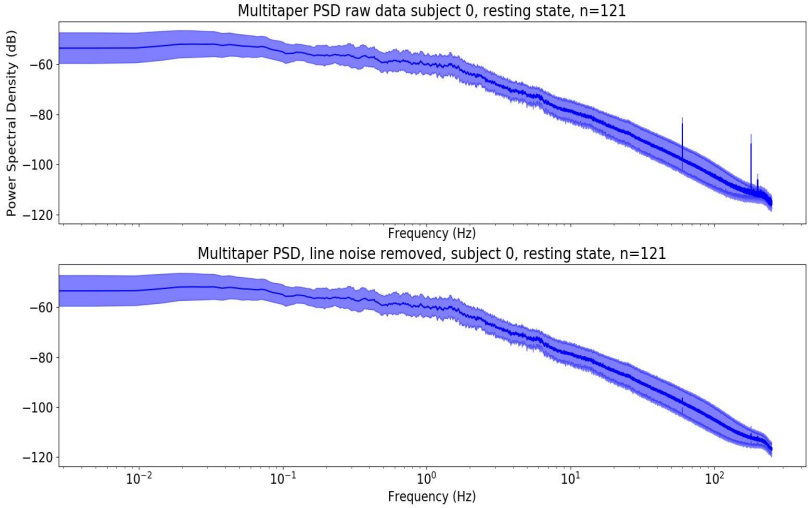
- N=10 patients
- Eyes closed during resting state
- In addition, have 6 hours of sleep data per subject recorded before experiment

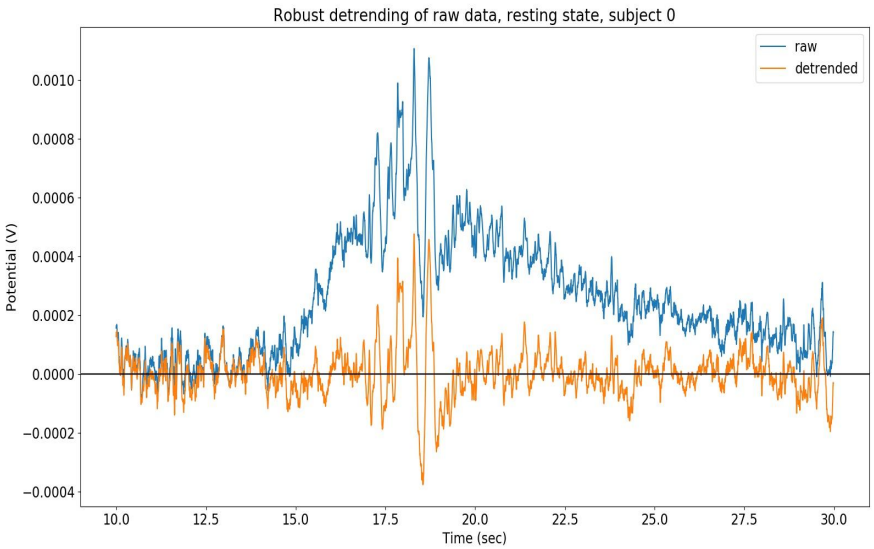
Distribution of electrodes across differents ROIs



Preprocessing

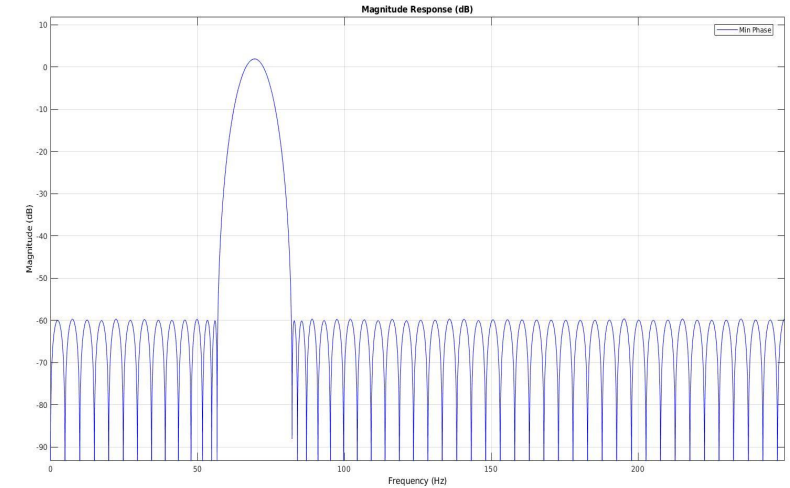
- Bipolar montage
- Line noise removal, n=121 electrodes

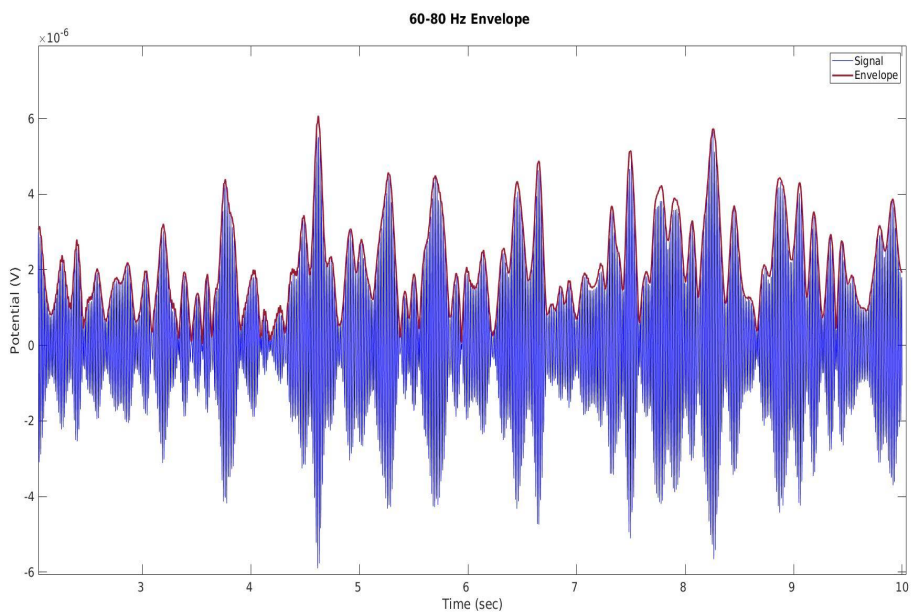




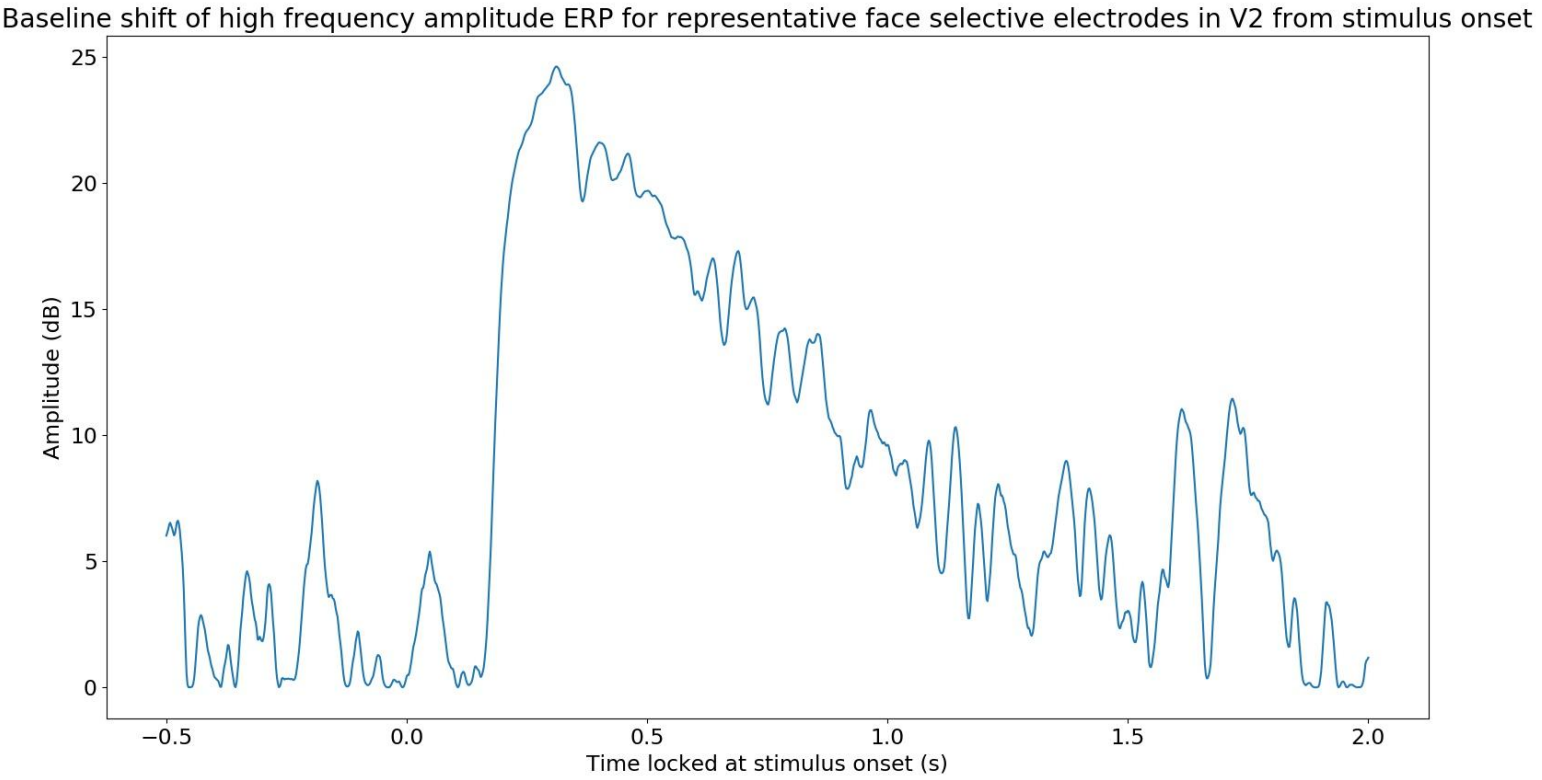
- Robust detrending for resting state LFP (improve stationarity for parametric GC estimation)

High frequency band (HFB) envelope extraction with Generalized Remez FIR minimum phase filter of order 100

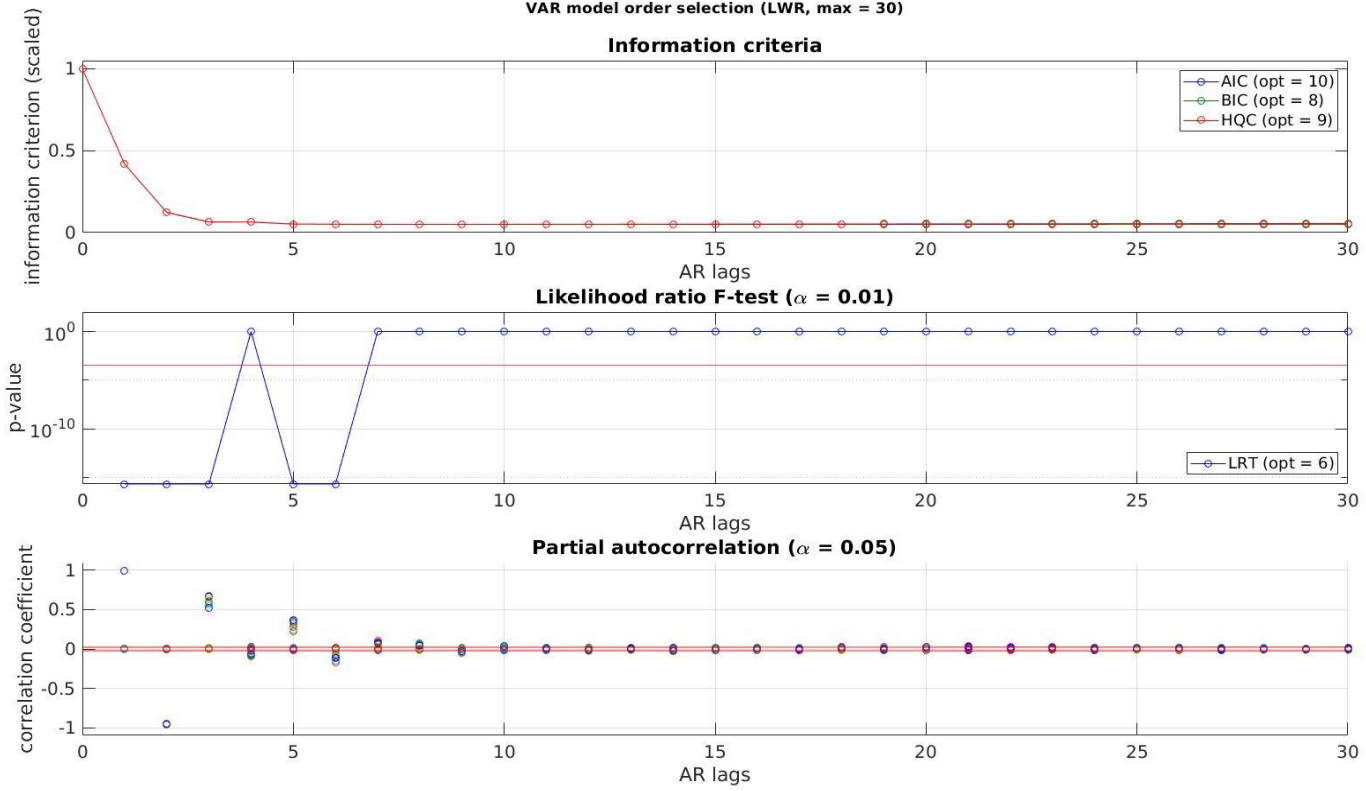




HFB amplitude baseline shift after stimulus presentation

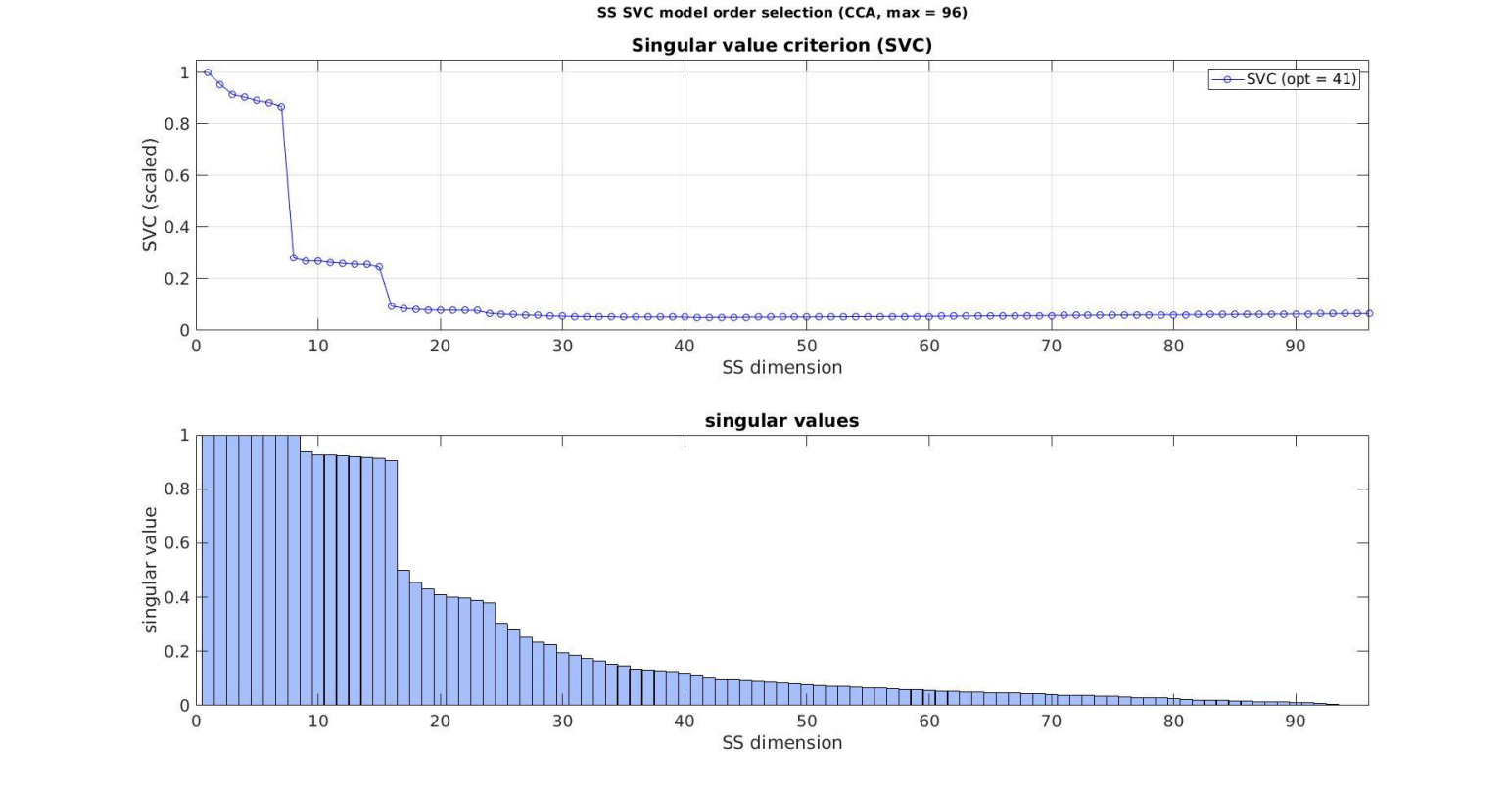


Multivariate VAR model of visually responsive HFB envelope



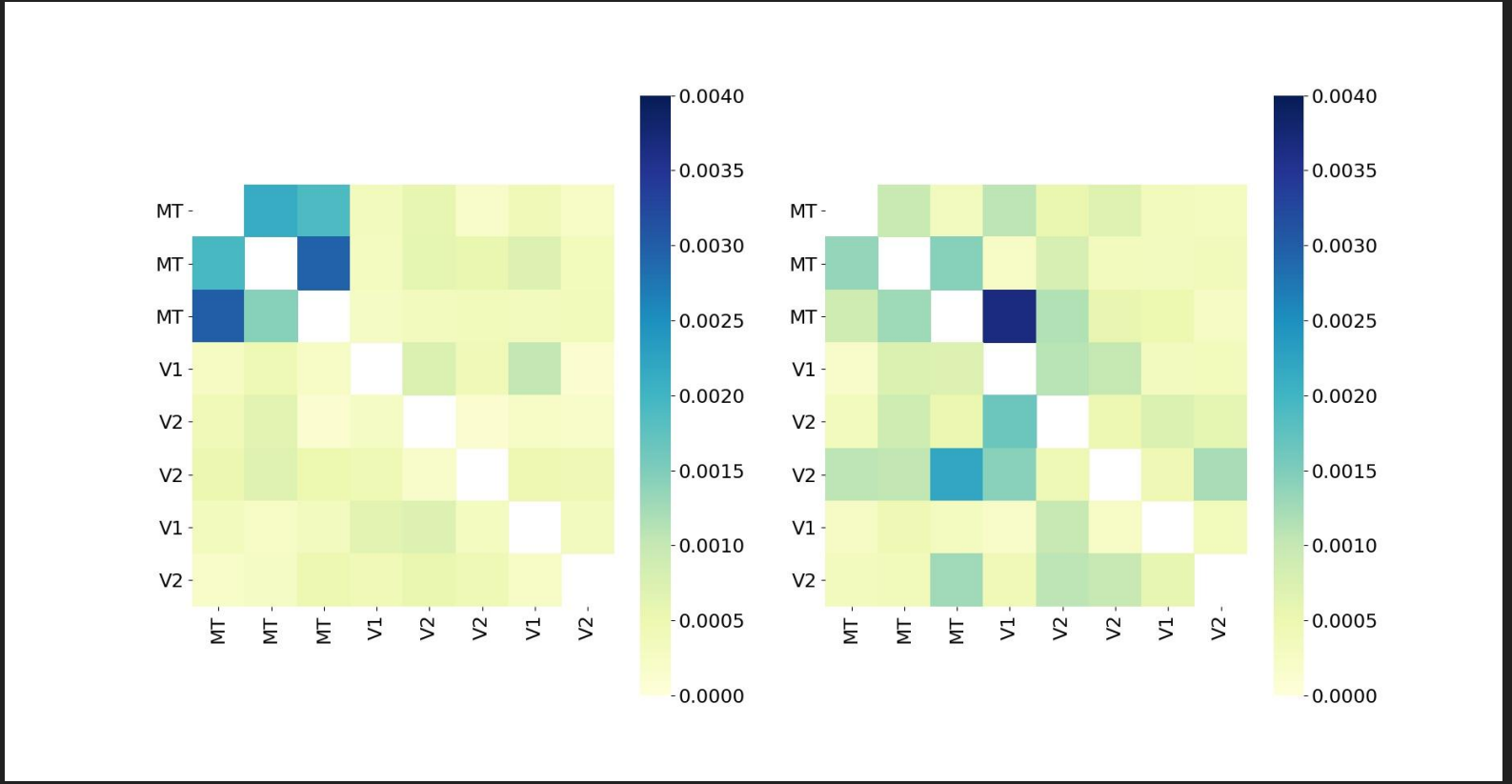
- 8 visual electrodes, N=28 trials, 1252 observations (2.5 s)
- Stable models in rest (spectral radius ~ 0.982) and stimuli (~ 0.991)

State space model N=28 trials, visually responsive HFB envelope



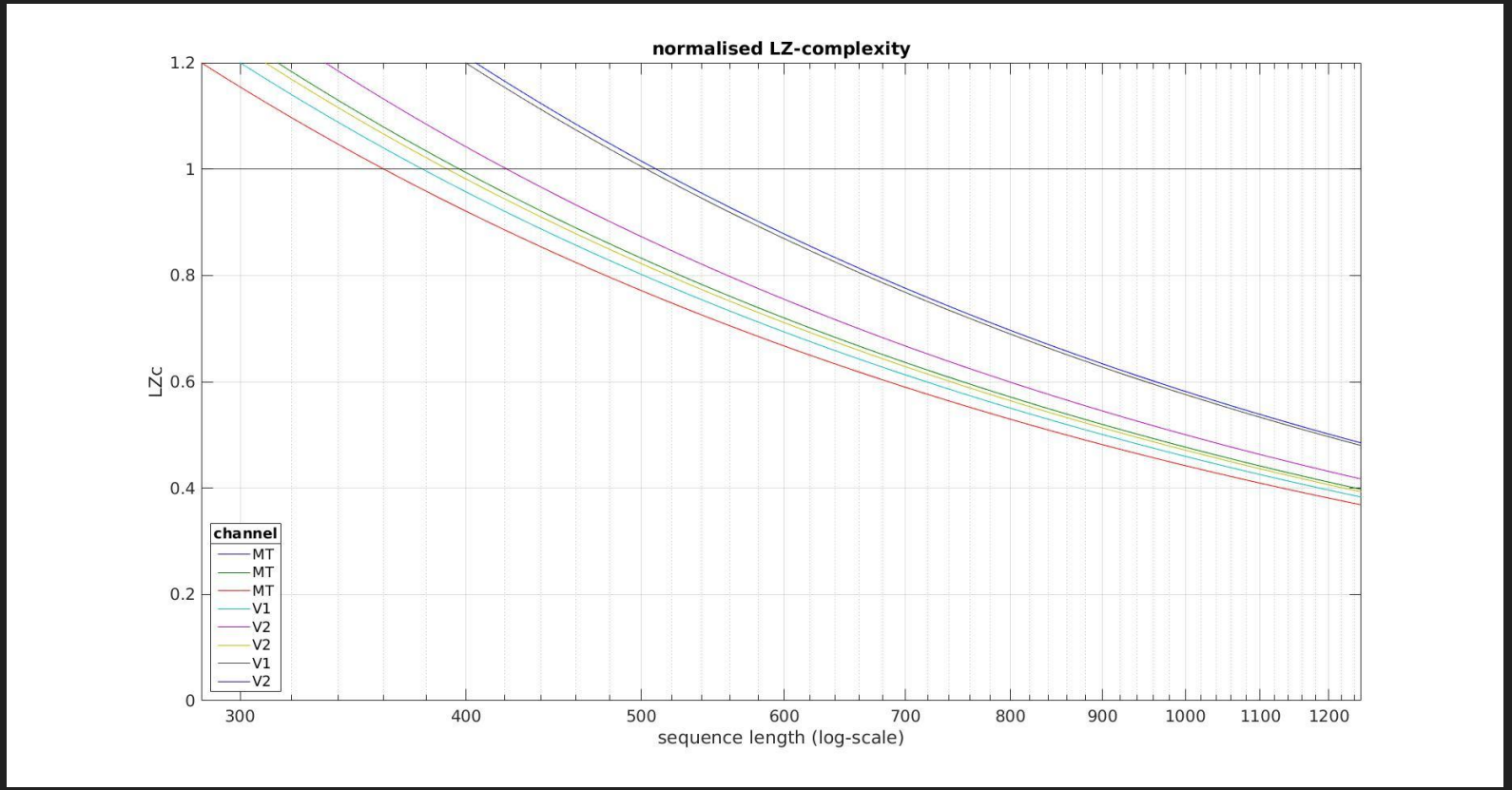
- 8 visual electrodes, N=28 trials, 1252 observations (2.5 s)
- Stable models in rest and stimuli (spectral radius ~0.98)

Granger causality of HFB envelope , stimuli (left), rest (right)



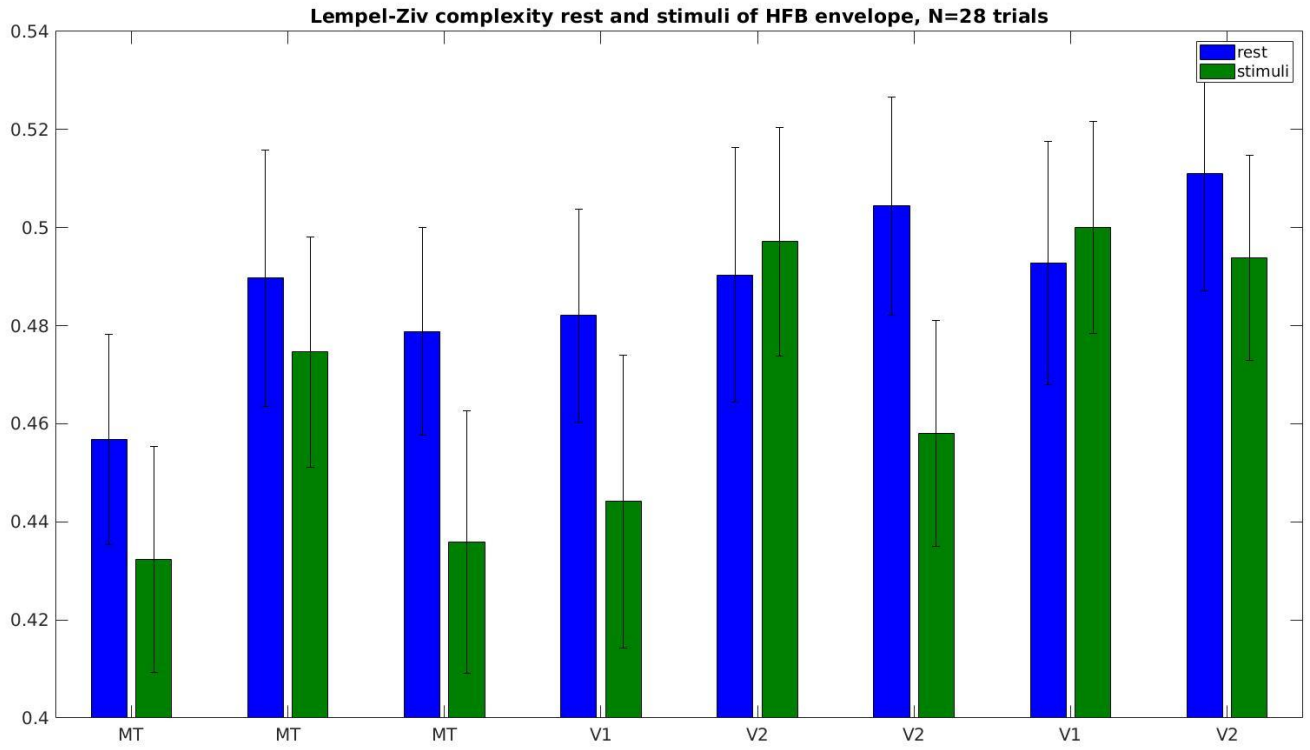
Information flows from bottom to left of connectivity matrices

Lempel Ziv complexity of visually responsive electrodes



Rank of normalised LZc channels is constant as sequence length increases

Lempel Ziv complexity estimate for visual electrodes



Comparison of resting state vs stimulus visualisation normalised LZc of 8 visual electrodes over N=28, 2.5s, trials during