

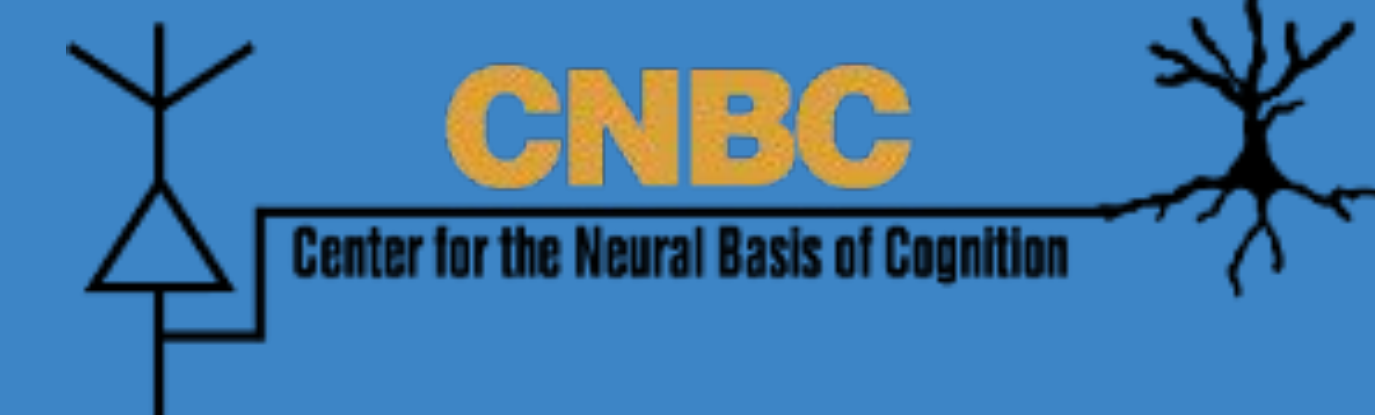
Indexing slow changes in neuronal and behavioral variability with EEG



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Background

- Activity of neurons within a population fluctuate together over short time scales
- Little work has been done to assess shared fluctuations over the course of hours
- Previous work in our laboratory (Cowley et al., in preparation) identified slow fluctuations in V4 activity during decision-making tasks

Methods

Visual orientation-change detection task and signal detection theory

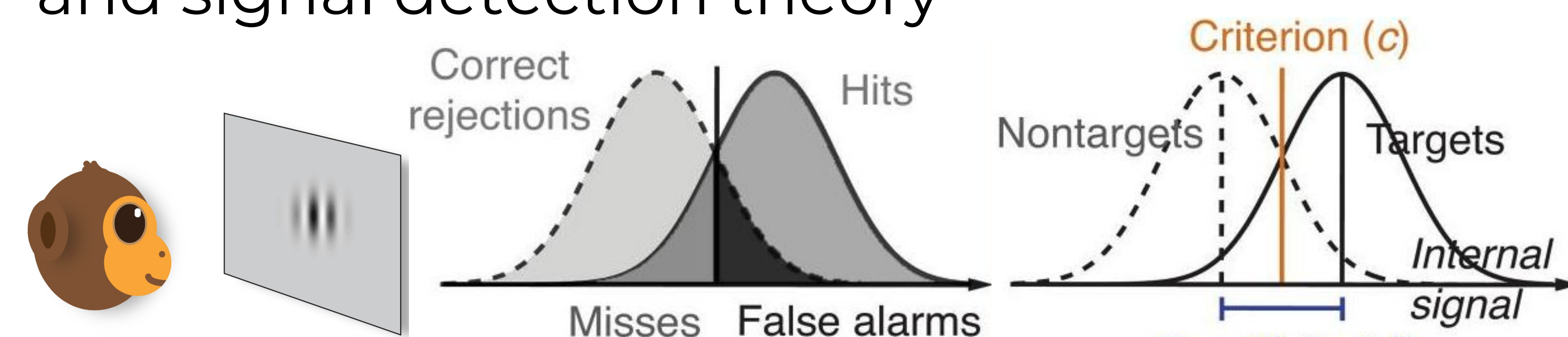
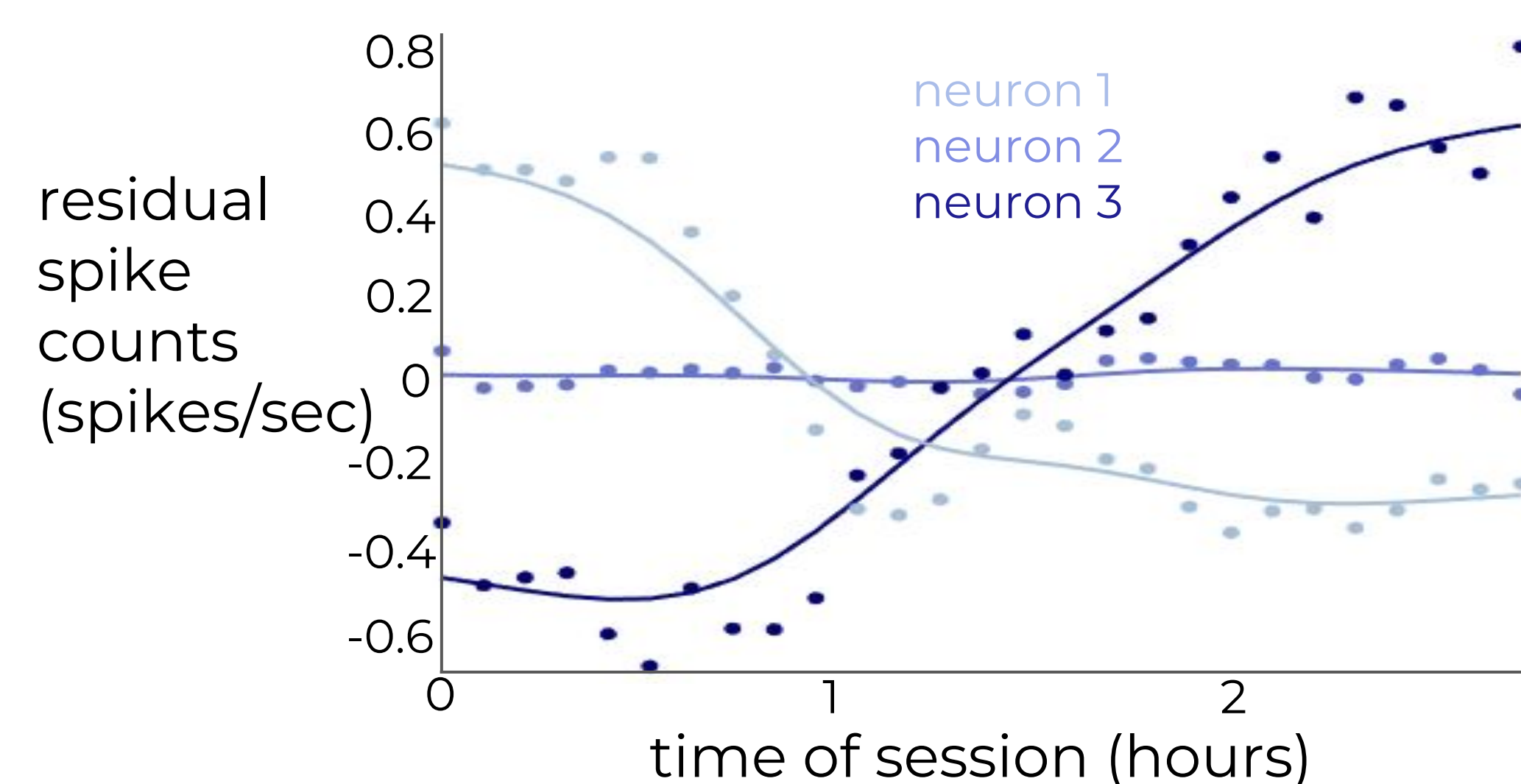


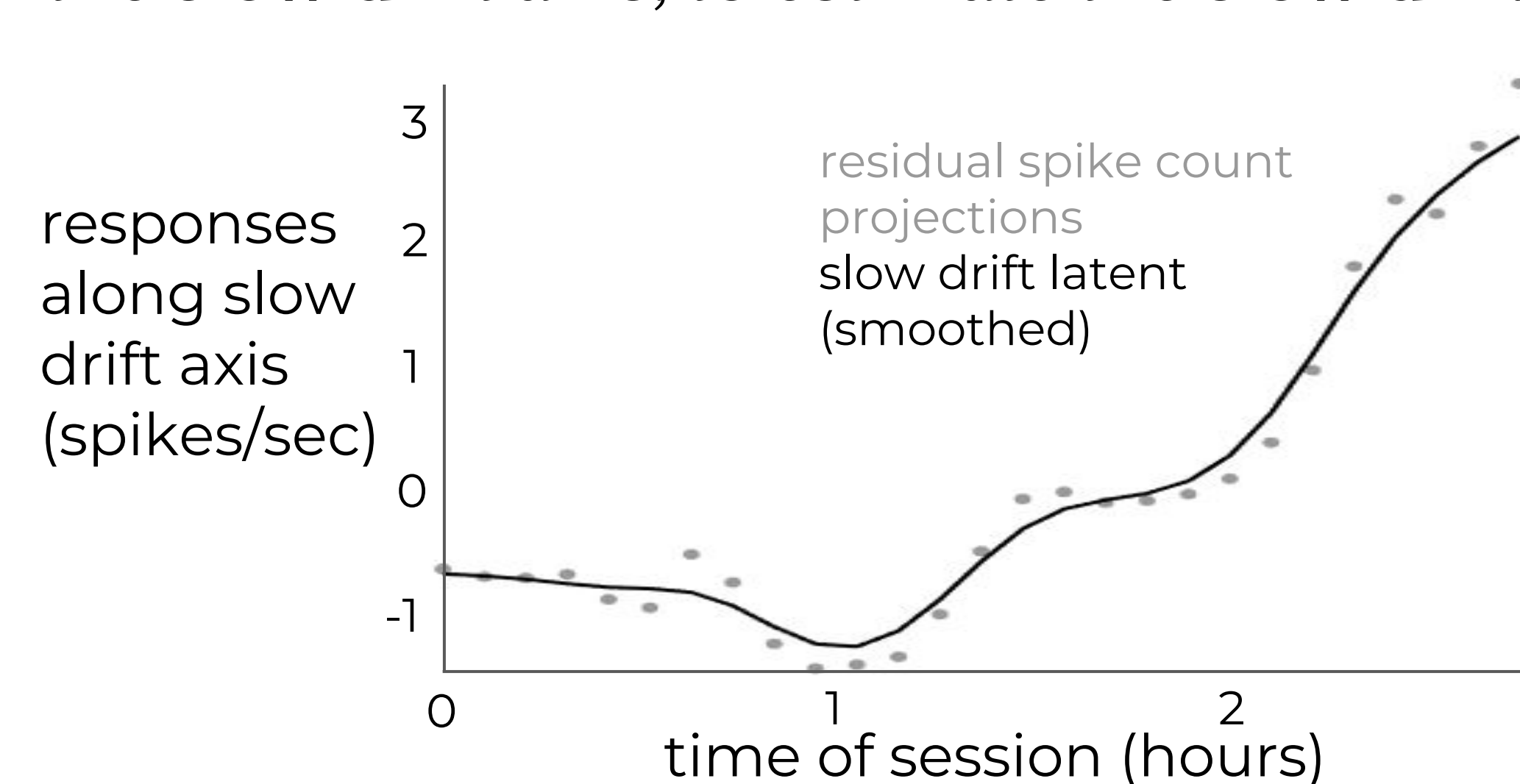
figure from Luo and Maunsell, *Neuron*, 2015

Microelectrode arrays were implanted in V4 of two monkeys.

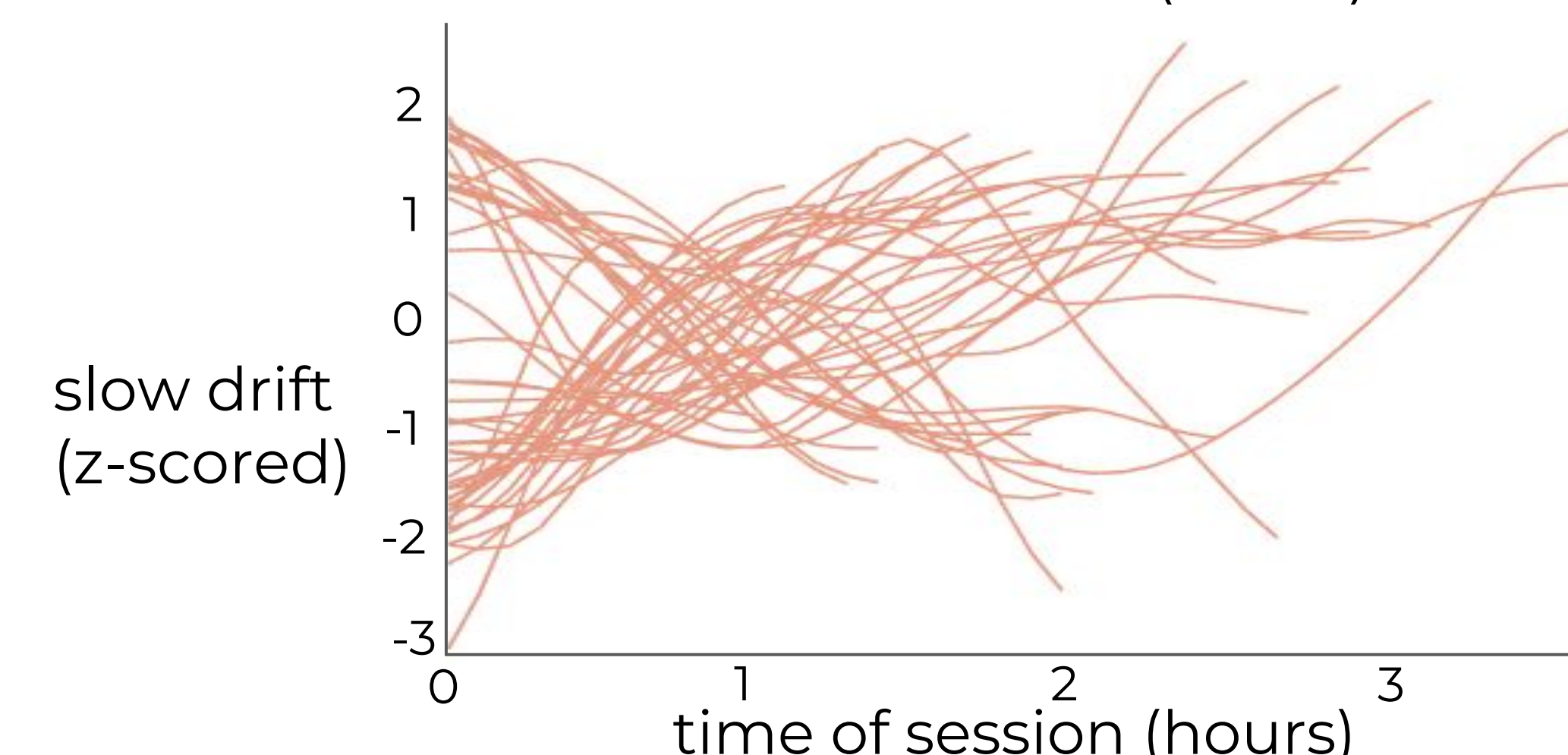


Residual activity of neurons drift over a recording session

Principal Component Analysis (PCA) was performed on the residual activity (binned in 30 minutes). The residual activity was projected onto the top principal component, defined to be the *slow drift axis*, to estimate the slow drift.



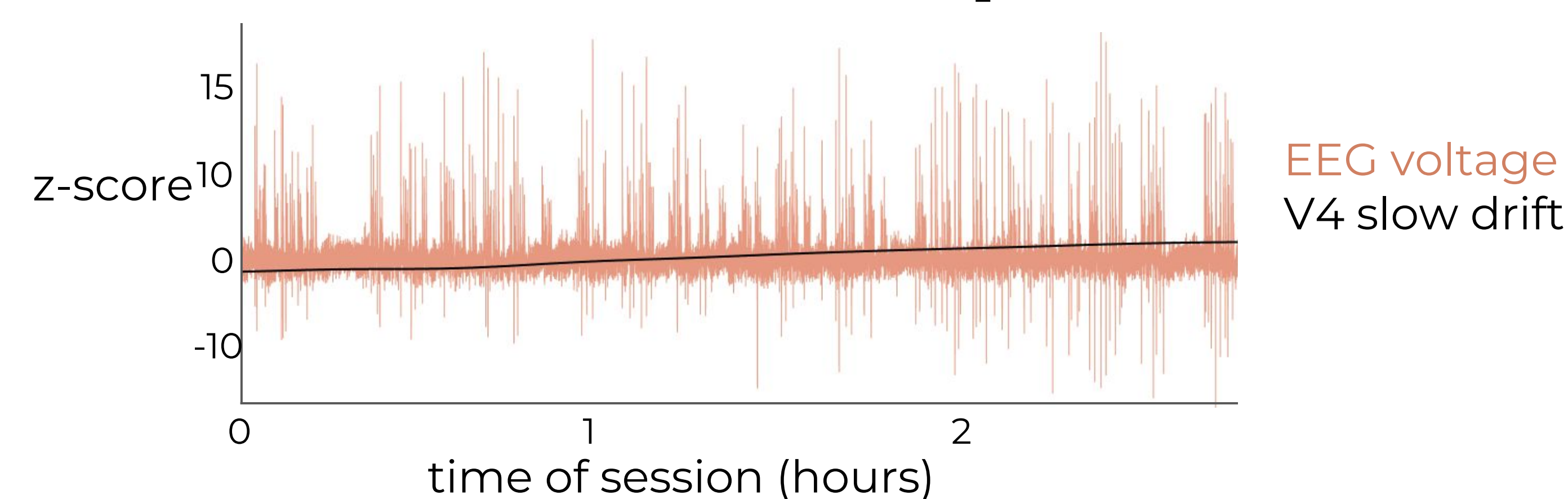
Slow drift is estimated from a linear combination of the residual activity of all neurons



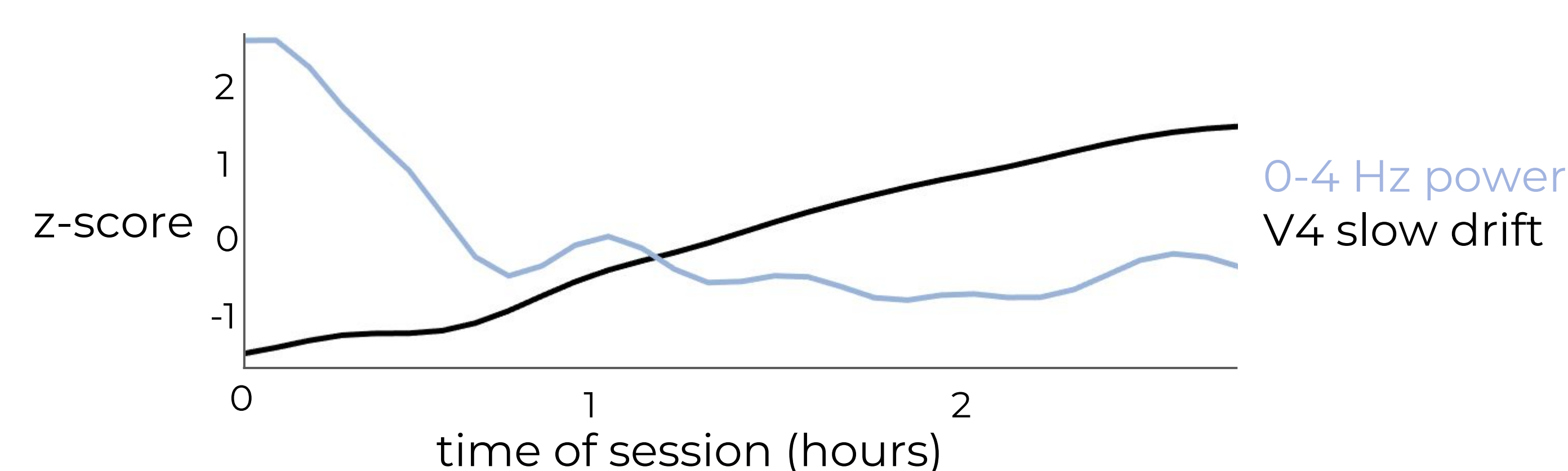
Slow drifts were kernel smoothed for each session (47 sessions total)

Can slow drift be accessed with a non-invasive device?

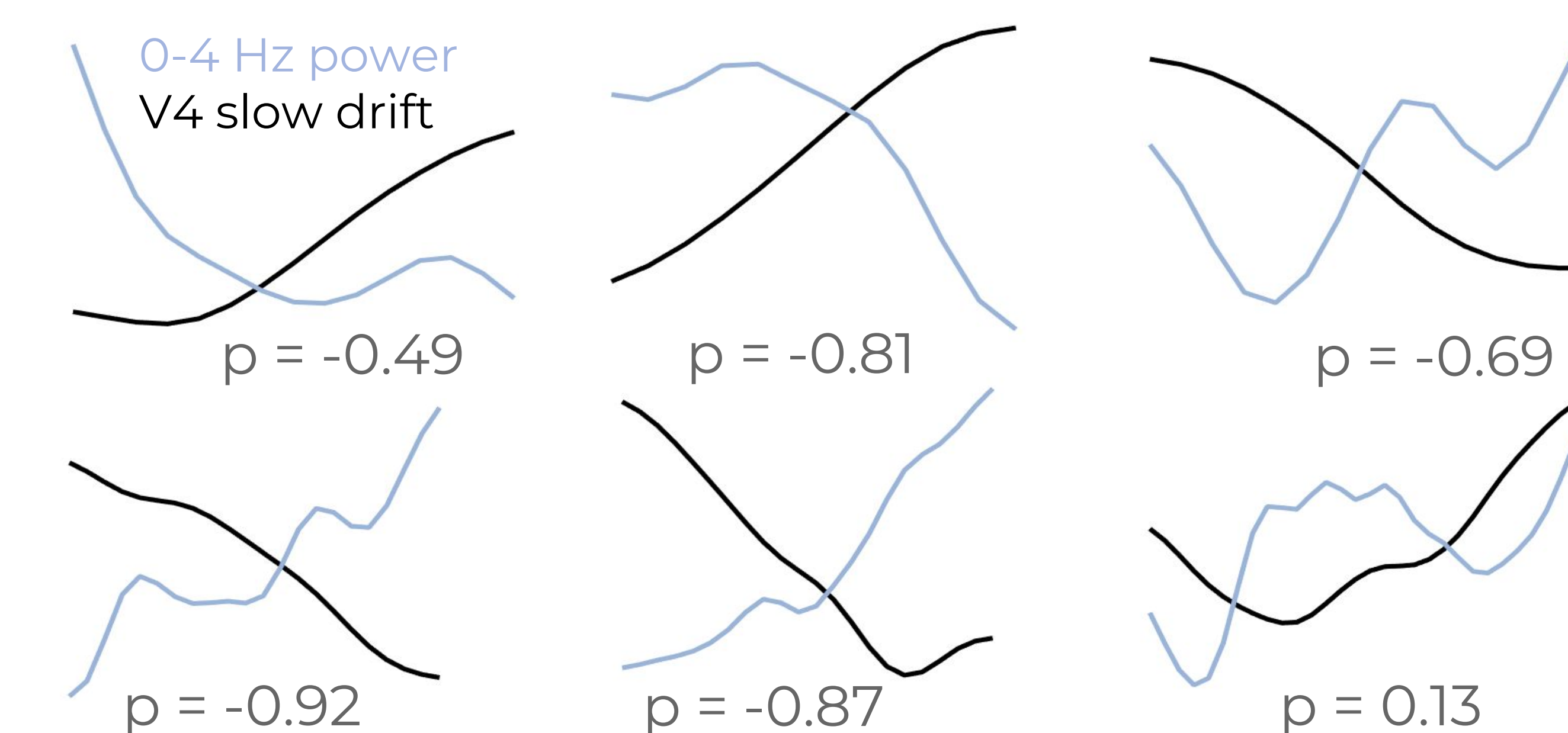
Electroencephalogram (EEG) was recorded over each session from 8 locations on the scalp.



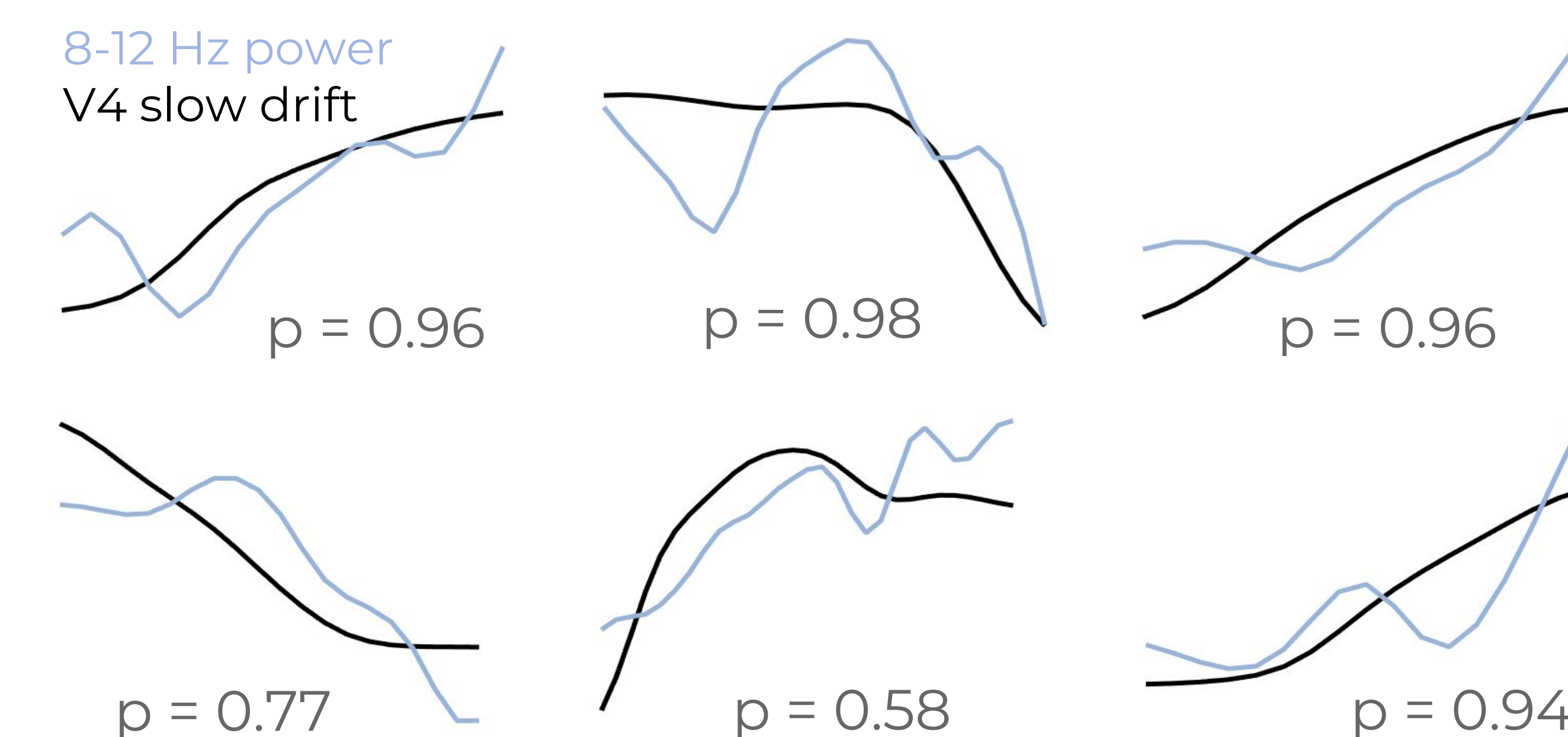
A Fast Fourier transform was applied to the EEG to determine power in multiple frequency bands over time.



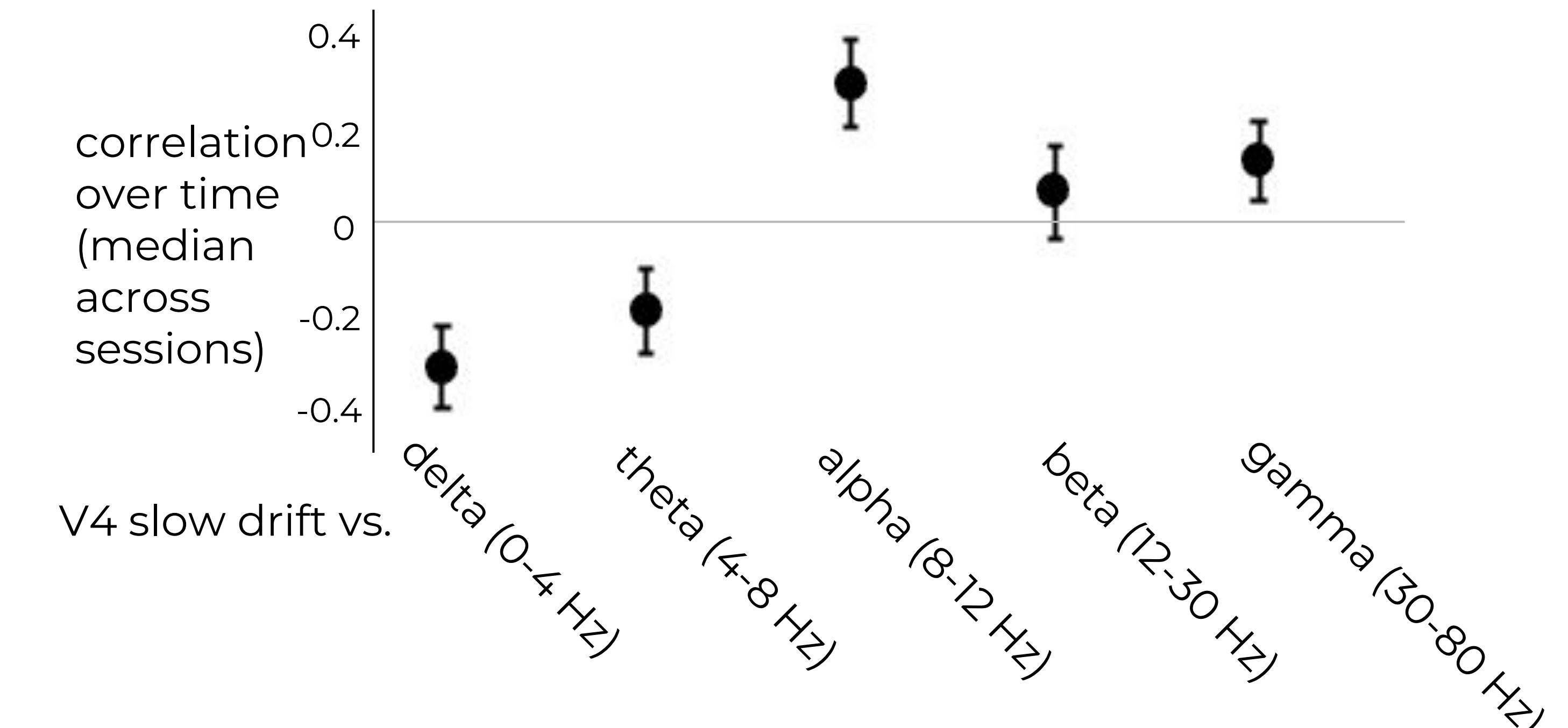
Example sessions of V4 slow drift and power in delta frequency band over time



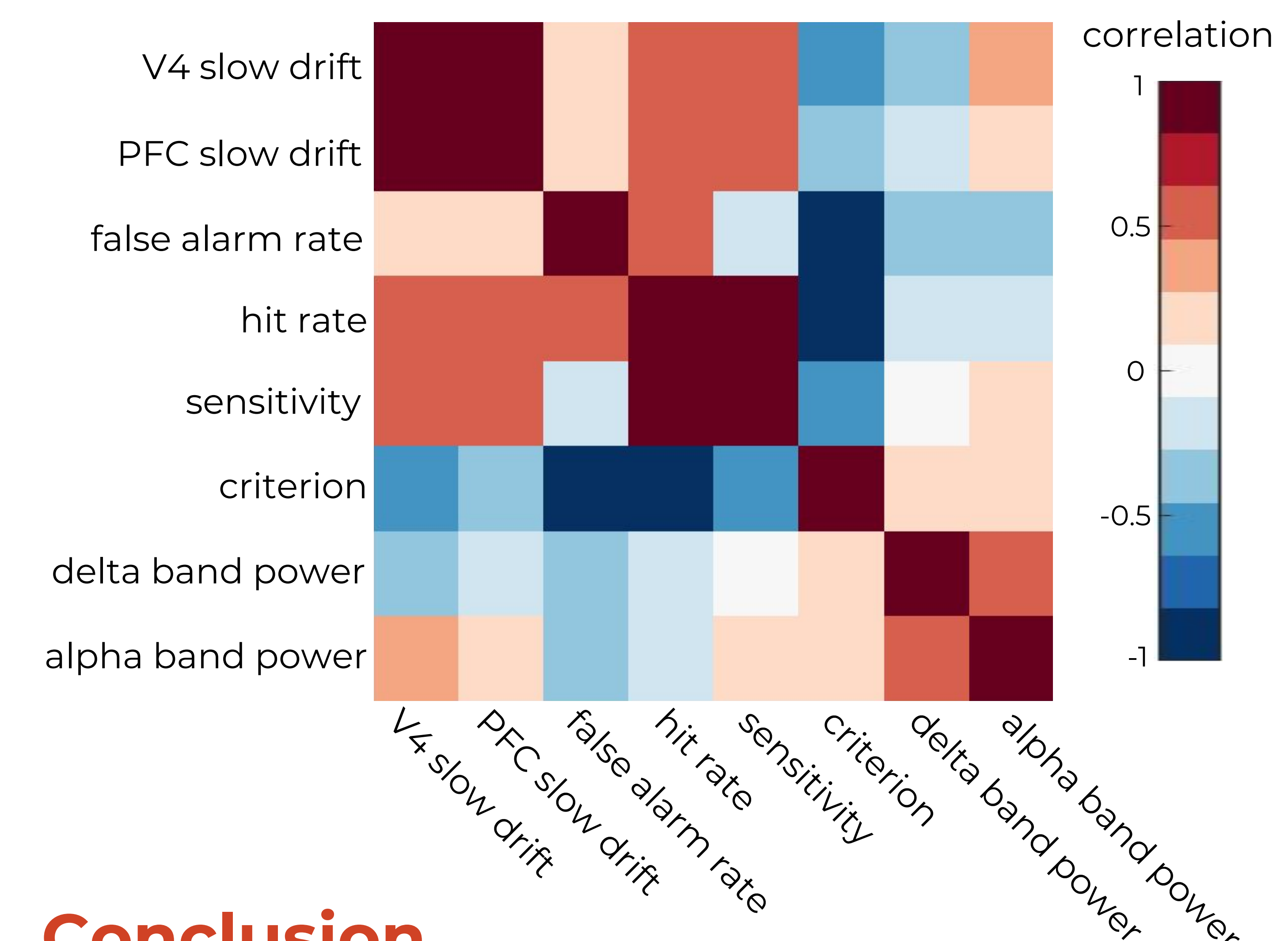
Example sessions of V4 slow drift and power in alpha frequency band over time



Power in EEG frequency bands are correlated with V4 slow drift



Fluctuations in EEG and behavioral variables are correlated



Conclusion

Slow drift may be a global signal associated with arousal

- V4 and PFC slow drifts are highly correlated
- Correlated with EEG frequency powers
- Covaries with criterion shifts

EEG can access the slow drift signal

- Non-invasive, inexpensive
- Means to measure on humans

Acknowledgements

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