PyRASA - Spectral parameterization in Python based on IRASA

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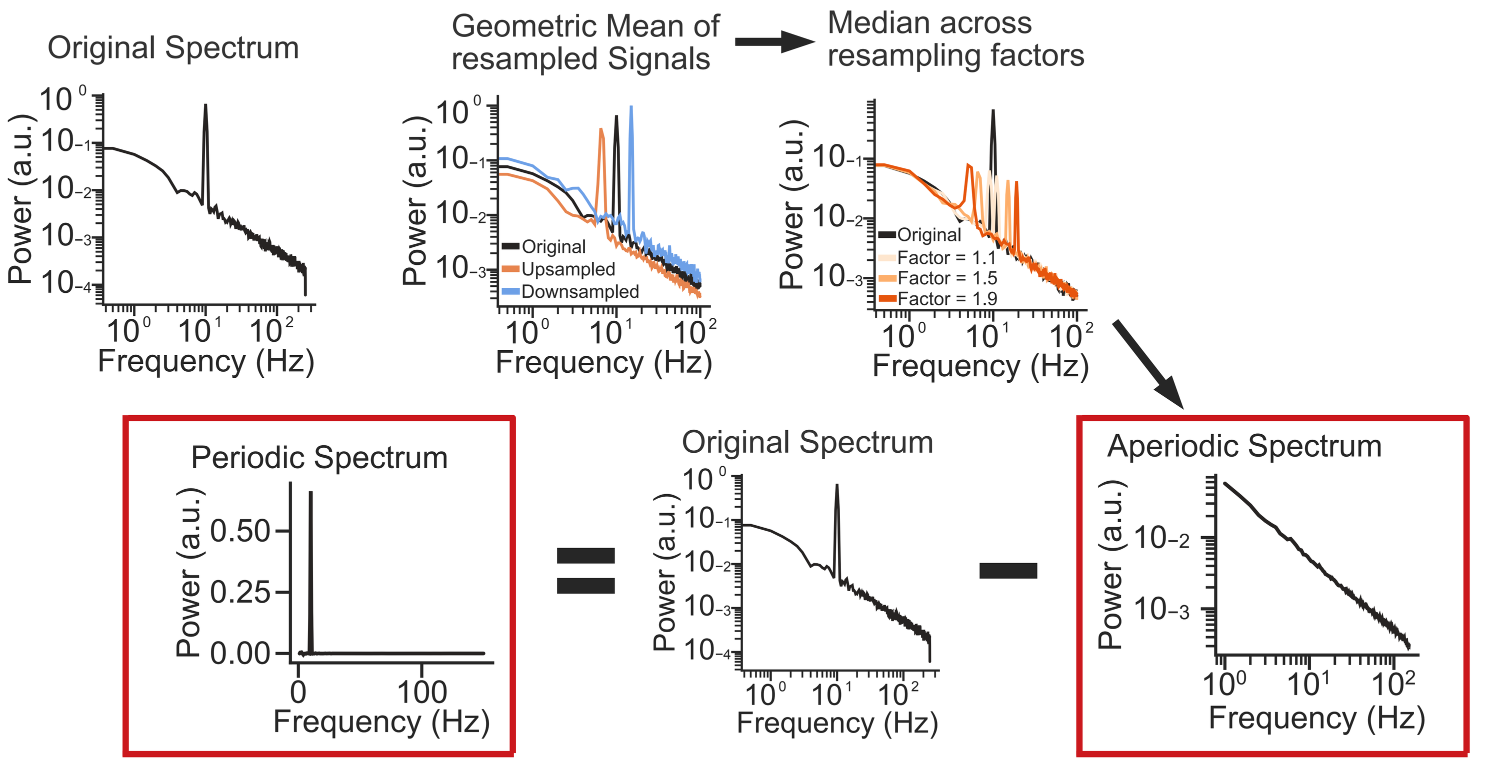
CCNS Centre for Cognitive Neuroscience

PARIS LODRON UNIVERSITY SALZBURG

FWF Österreichischer Wissenschaftsfonds

Get in Touch

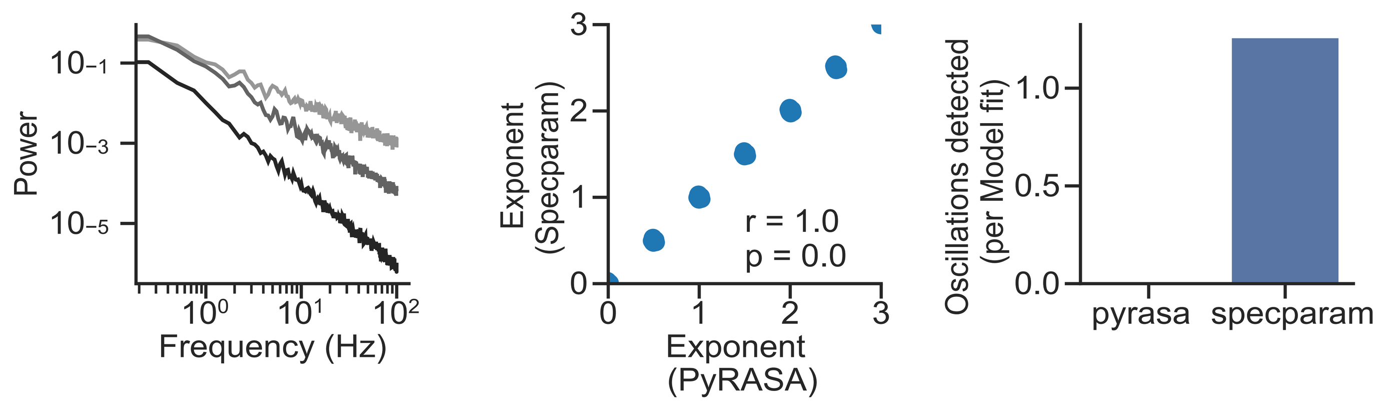
1 Separating periodic from aperiodic components using the IRASA algorithm



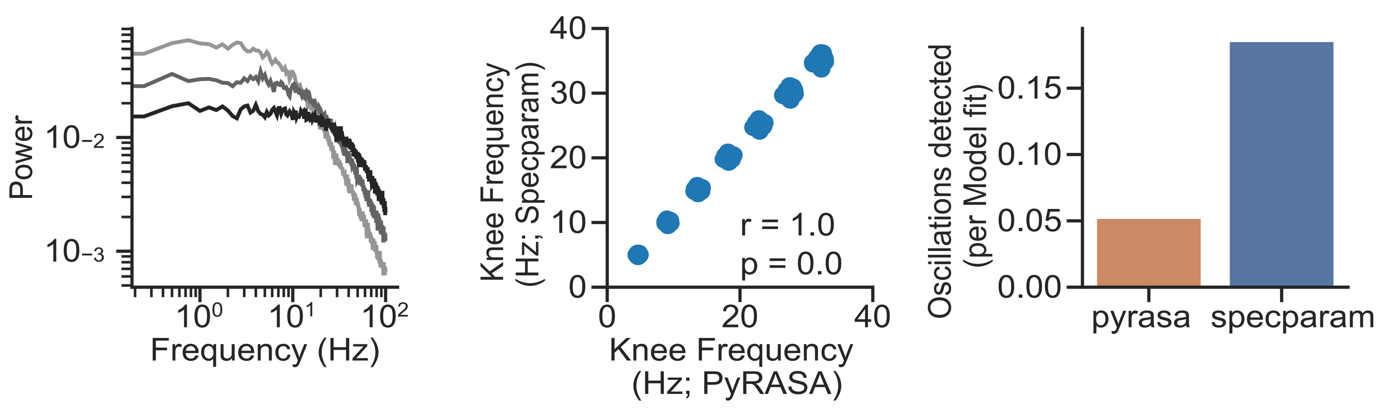
Wen H, Liu Z. Separating Fractal and Oscillatory Components in the Power Spectrum of Neurophysiological Signal. Brain Topogr. 2016 Jan;29(1):13-26. doi: 10.1007/s10548-015-0448-0. Epub 2015 Aug 29. PMID: 26318848; PMCID: PMC4706469.

2 PyRASA accurately detects parameter specific changes in simulated power spectra

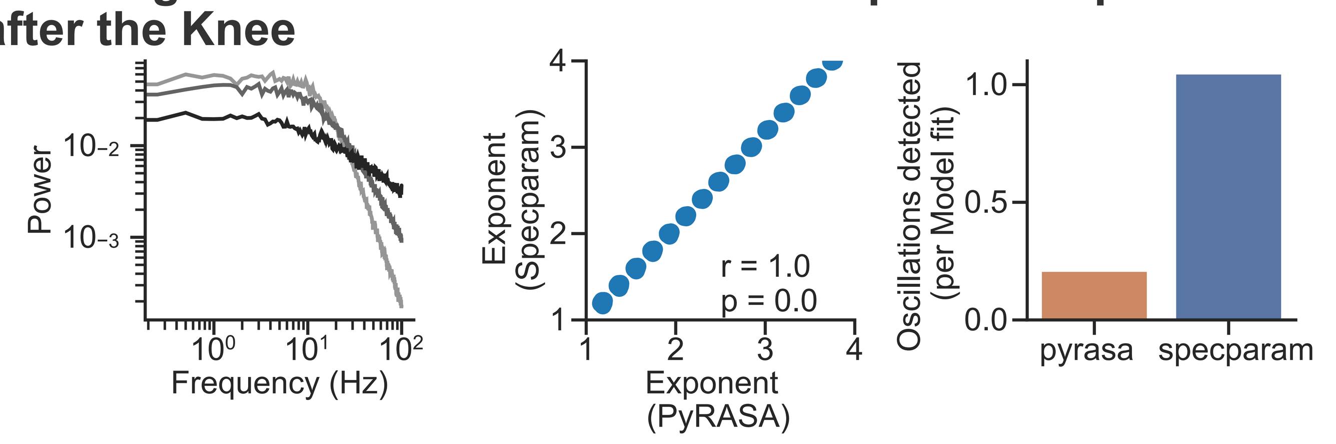
Challenge #1: Detect variations in the Spectral Exponent



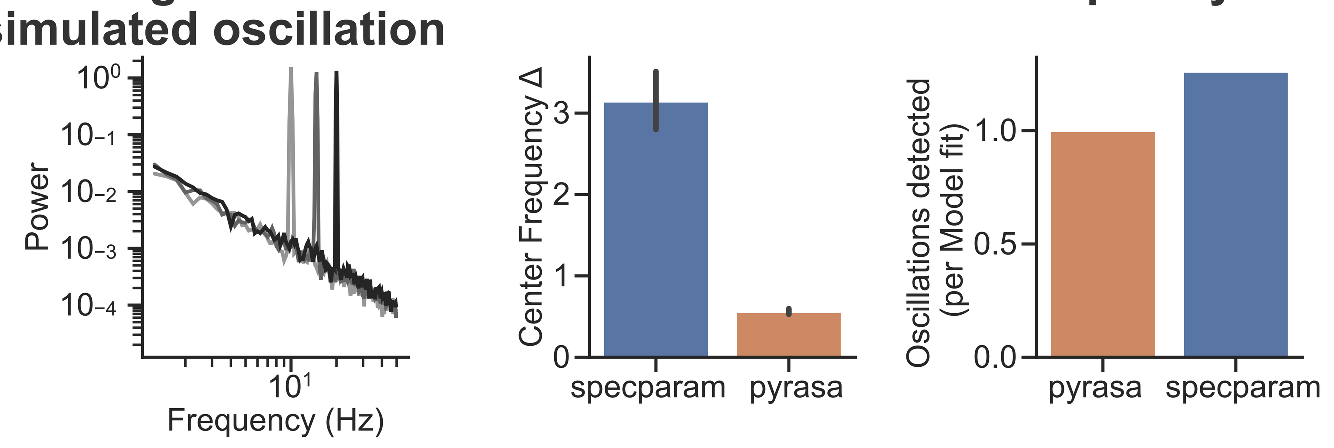
Challenge #2: Detect variations in the Knee Frequency



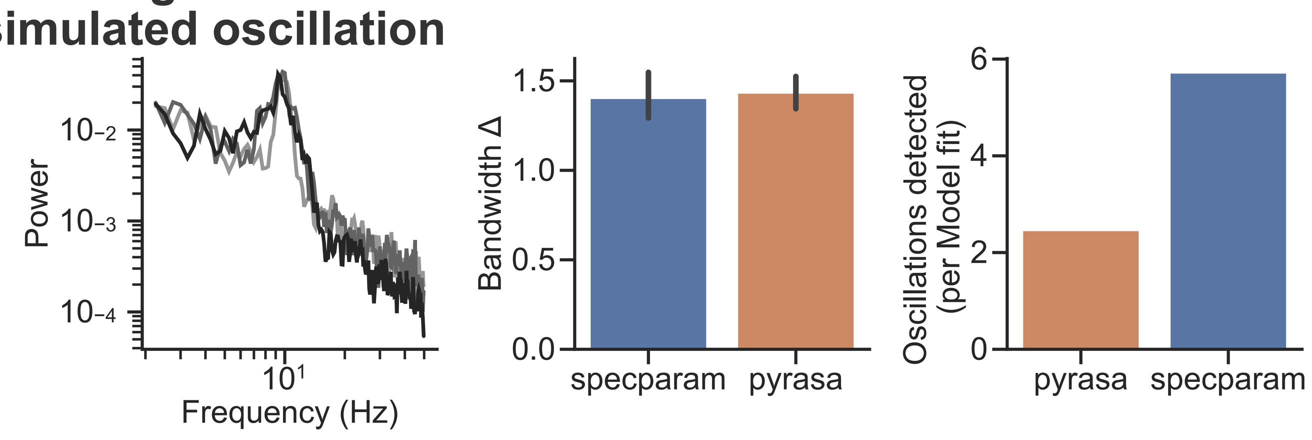
Challenge #3: Detect variations in the Spectral Exponent after the Knee



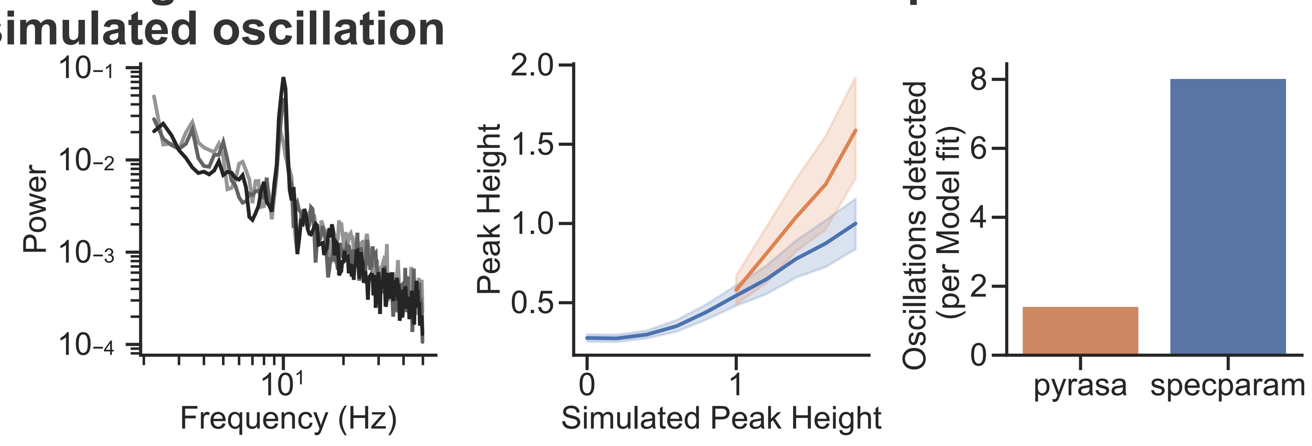
Challenge #4: Detect variations in the Center Frequency of a simulated oscillation



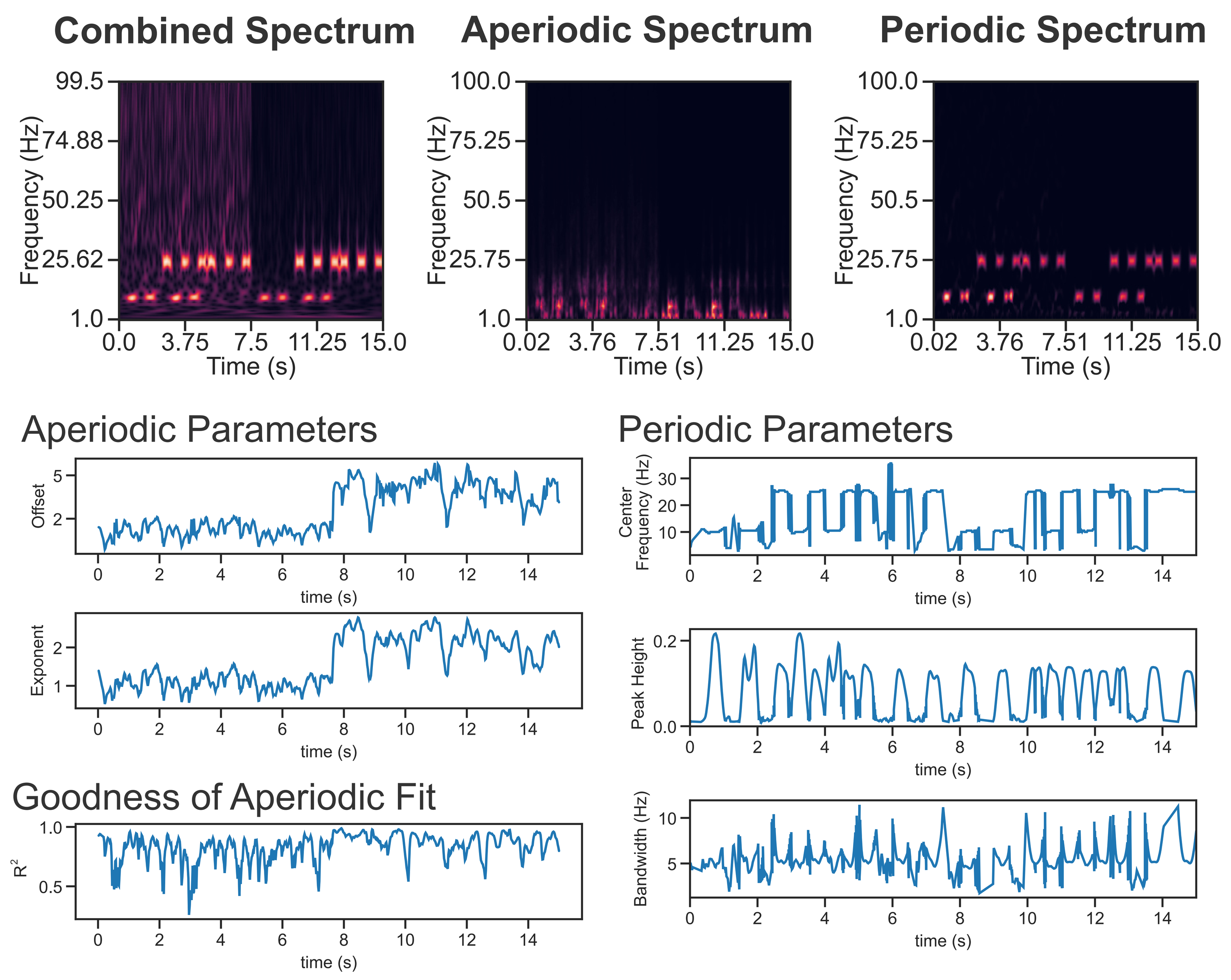
Challenge #5: Detect variations in the Bandwidth of a simulated oscillation



Challenge #6: Detect variations in the Amplitude of a simulated oscillation

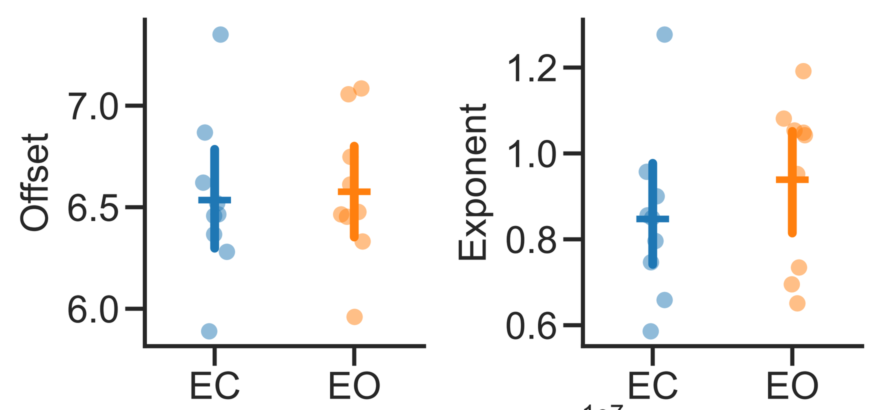


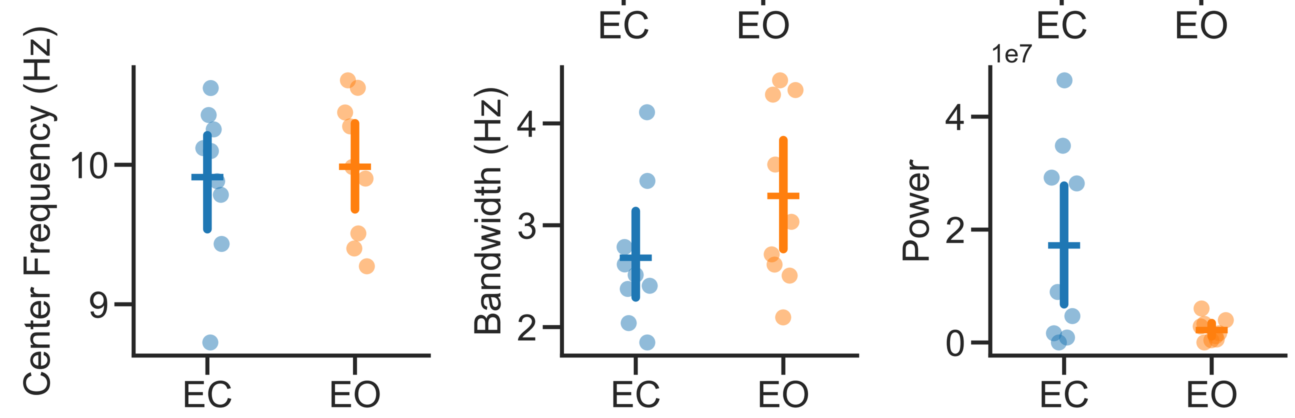
3 Time resolved spectral parametrization using PyRASA



4 Sanity-Checks on real EEG data Eyes-Open/Eyes Closed

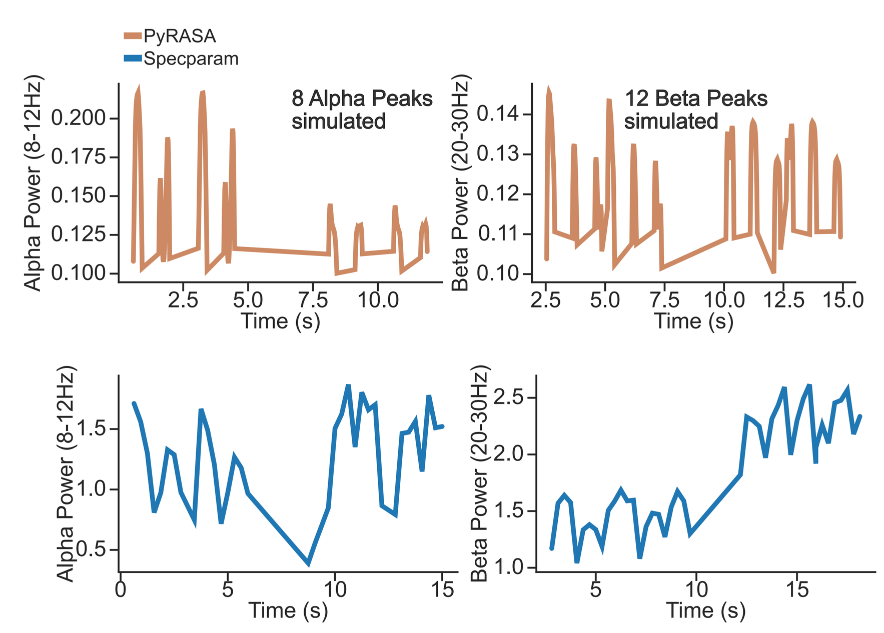
- N = 10 Subjects
- 5min resting state
- 2.5 min Eyes Open (EO)
- 2.5 min resting state Eyes Closed (EC)





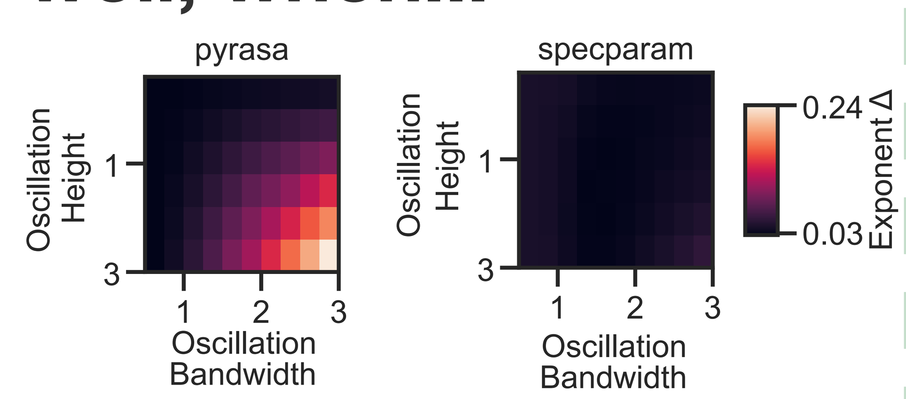
5 Benefits of PyRASA

- Decouples the analysis of periodic and aperiodic parameters
- More stable in detecting oscillations in data with a low SNR
- Less parameters to specify during model fitting
- Aperiodic model comparison using information criteria (e.g. BIC/AIC)
- Fitting functions that include two varying exponents



PyRASA works not so well, when...

- You have broad and very large peaks in your spectra. In these situations the exponent estimation is biased making specparam the better choice



- You are having a "Knee" in your spectrum and care about the exact values of your aperiodic parameters e.g. Knee Frequency