

P 60 – Computational modelling and imaging in DBS. Contact: thomas-samuel.binns@charite.de; julian.neumann@charite.de

Invasive mapping of cortico-subthalamic connectivity in Parkinson's disease

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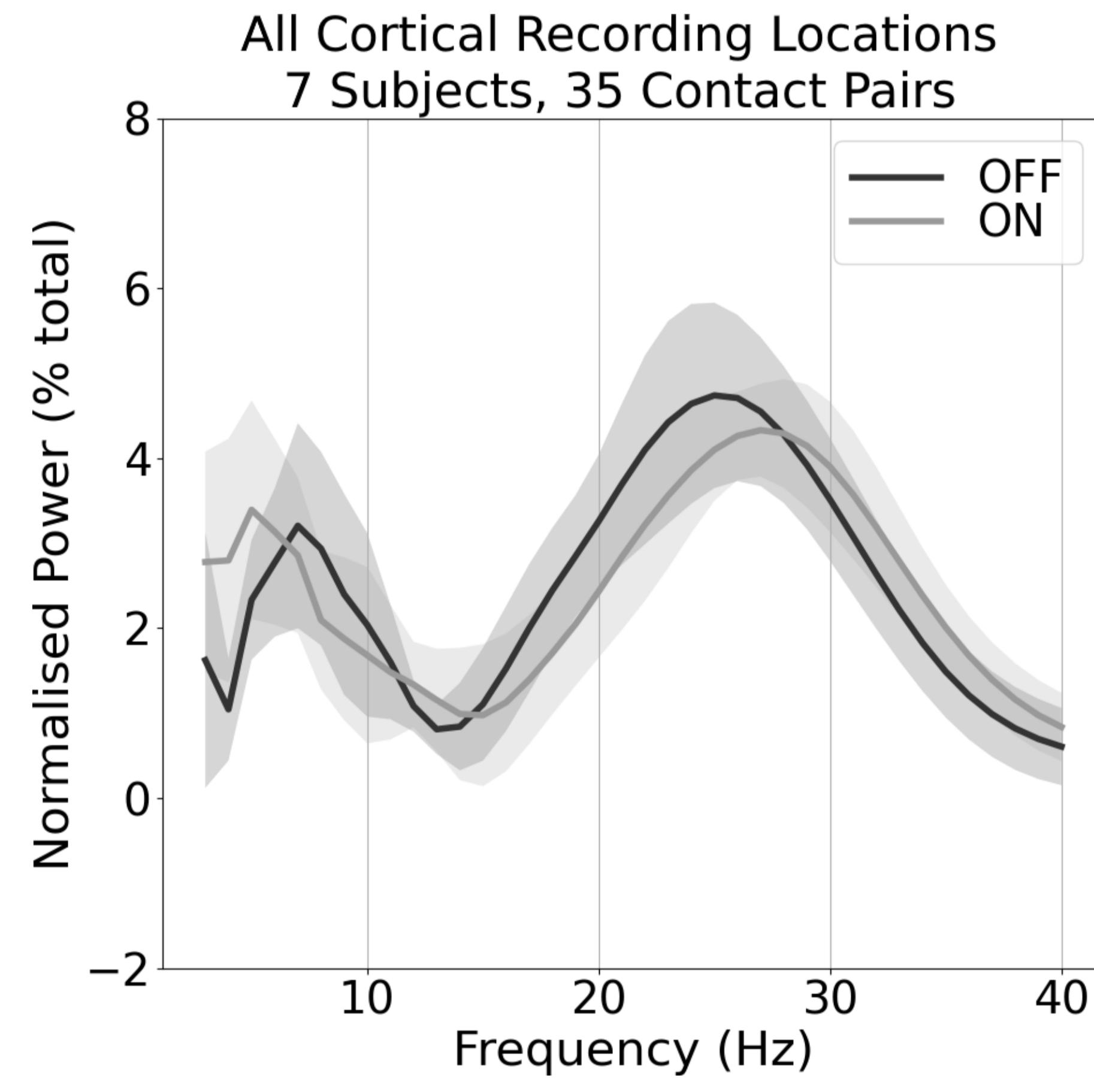
INTRODUCTION

- Beta oscillations in the basal ganglia are a hallmark of Parkinson's disease (PD).
- The effect of dopamine on cortico-subthalamic coupling is under debate [1, 2].
- Here, we report the effect of dopamine on electrocorticography (ECOG) and subthalamic nucleus (STN) local field potential (LFP) activity.

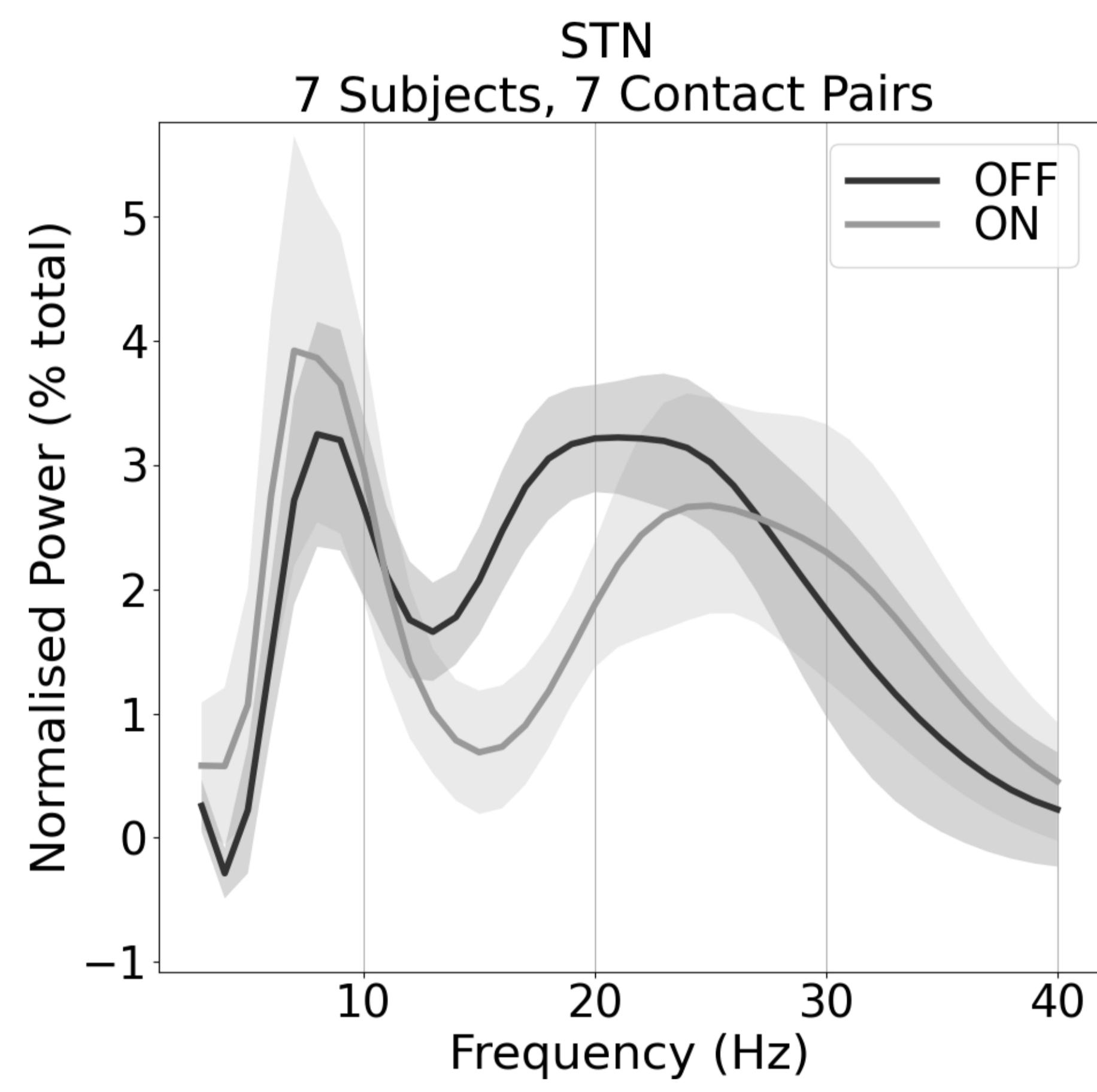
METHODS

- Externalized recordings of ECoG and LFP signals after deep brain stimulation electrode implantation in 7 patients with PD OFF and ON levodopa at rest.
- Bipolar re-referencing of signals and parameterisation of wavelet spectra with FOOOF, with normalisation to % total power.
- Connectivity estimated as the imaginary part of coherence, a measure of phase and amplitude coupling immune to volume conduction artefacts.

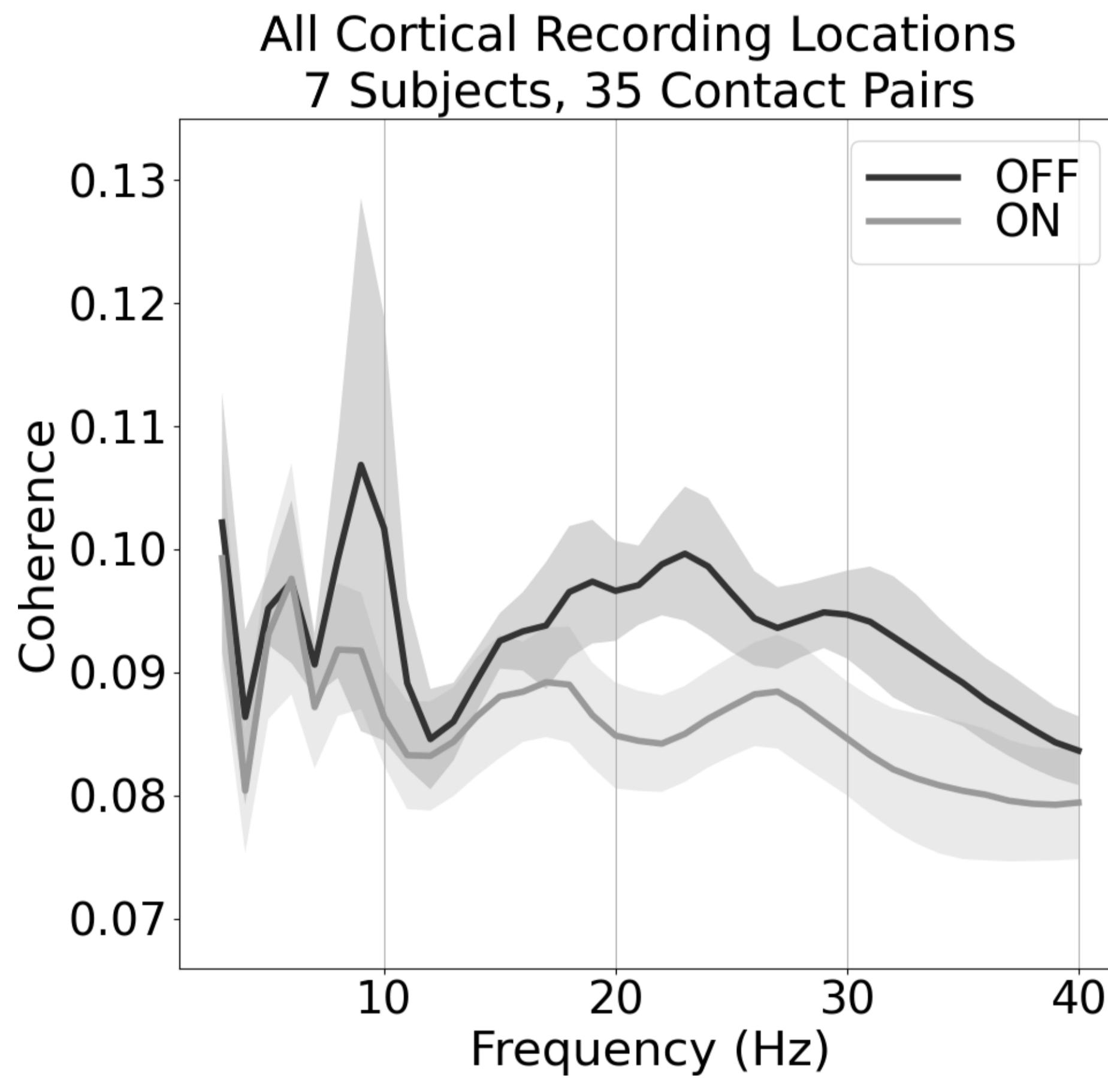
Cortical Power Spectra



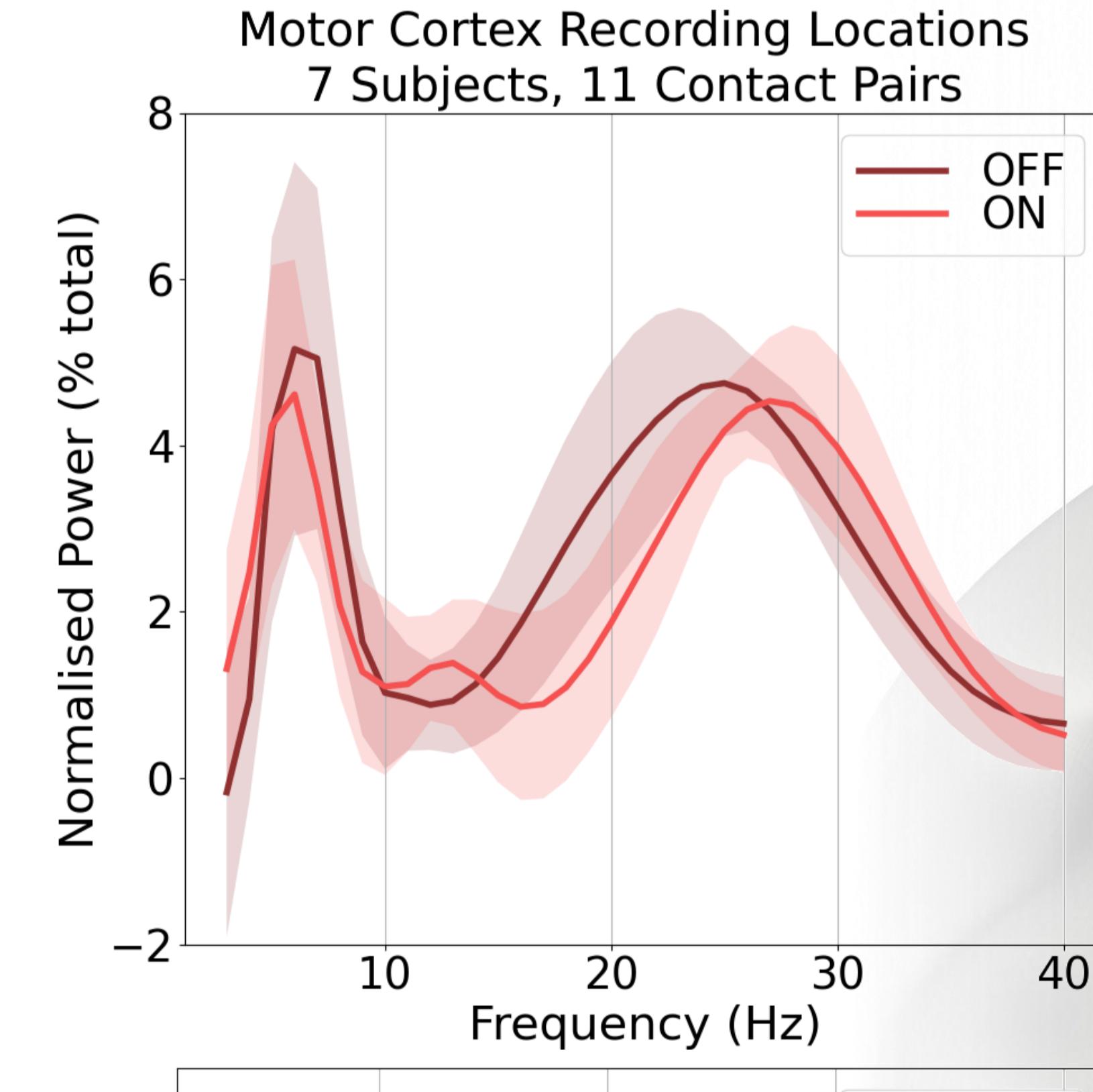
STN Power Spectra



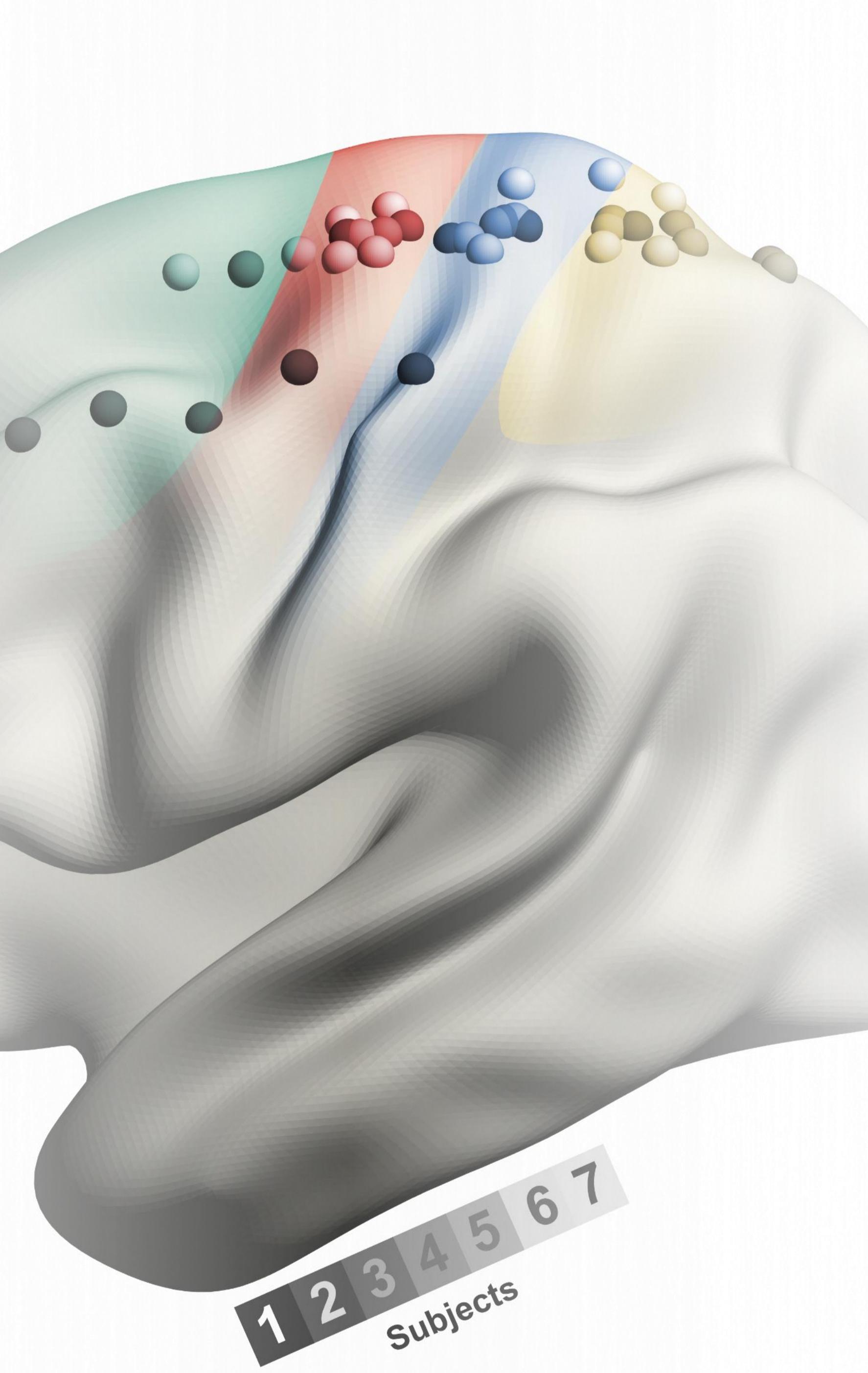
Cortex-STN Coherence



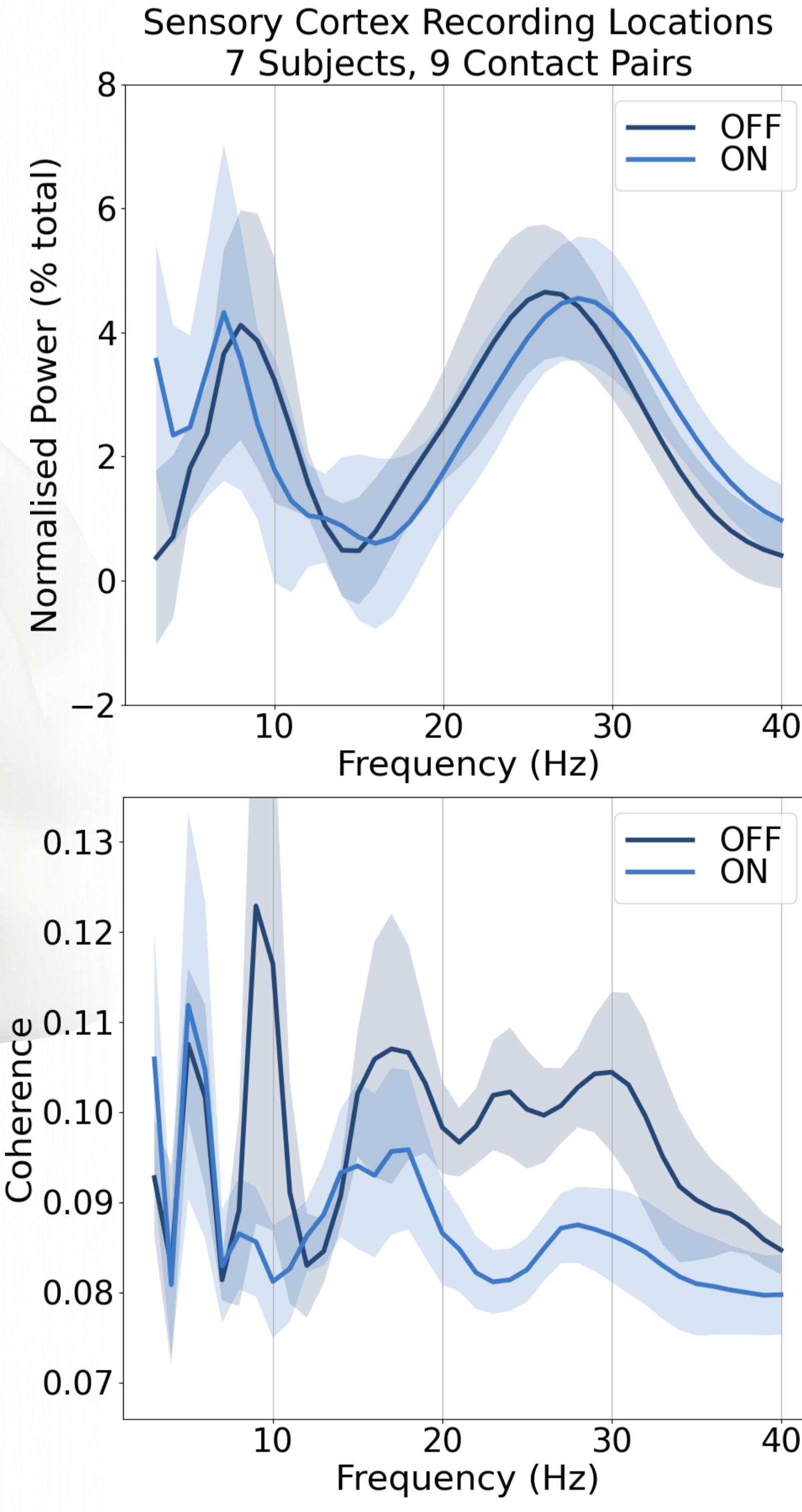
Motor Cortex



ECoG Locations



Sensory Cortex



RESULTS

- Similar periodic power in the cortex OFF and ON. Higher periodic STN power OFF vs. ON in the low-beta band (13-20 Hz).
- Unique spectral and spatial patterns of cortico-subthalamic coupling, with coherence in the low- and high-beta (20-35 Hz) bands generally higher OFF vs. ON.

DISCUSSION

- Cortico-subthalamic coupling in alpha (8-12 Hz) and beta frequencies was increased in the PD OFF state, and suppressed by levodopa.
- Spatio-spectral coherence estimation showed: low-beta band modulation for motor cortex; alpha and high-beta band modulation for sensory cortex.
- Multi-site connectivity measures may serve as biomarkers for next-generation, adaptive deep brain stimulation treatments [3].