

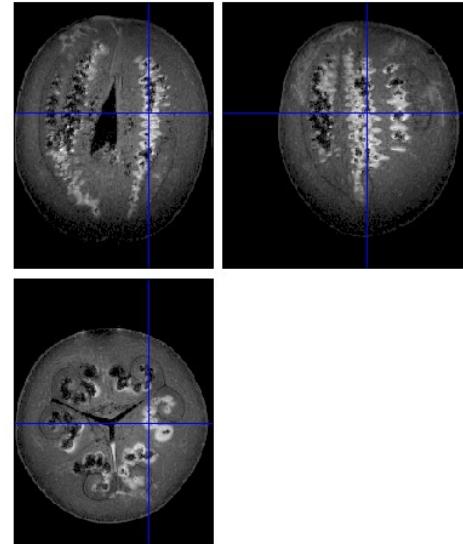
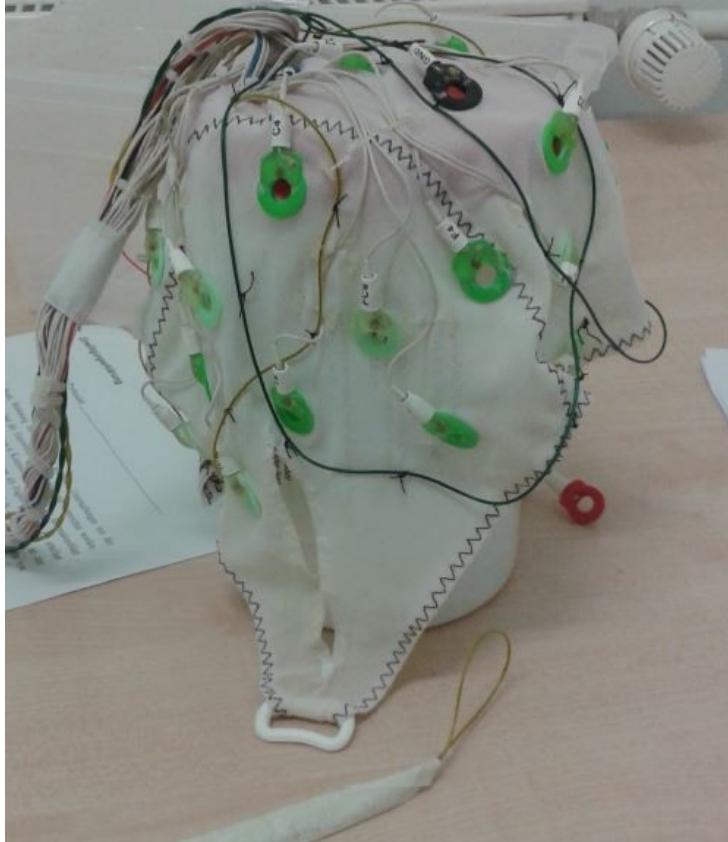
Carbon Wire Loops in EEG-fMRI



CLINICAL
AFFECTIVE
NEUROIMAGING
LABORATORY



MAX-PLANCK-INSTITUT
FÜR KOGNITIONS- UND NEUROWISSENSCHAFTEN



24 November 2020
Johan van der Meer

- Systems Neuroscience
- QIMR Berghofer Medical research Institute
- Real-time EEG; mobile/portable EEG
 - <https://www.youtube.com/watch?v=d6YJpZBx4X8>
- Brain state transitions during movies (fMRI)
 - <https://www.nature.com/articles/s41467-020-18717-w>
- EEG-fMRI

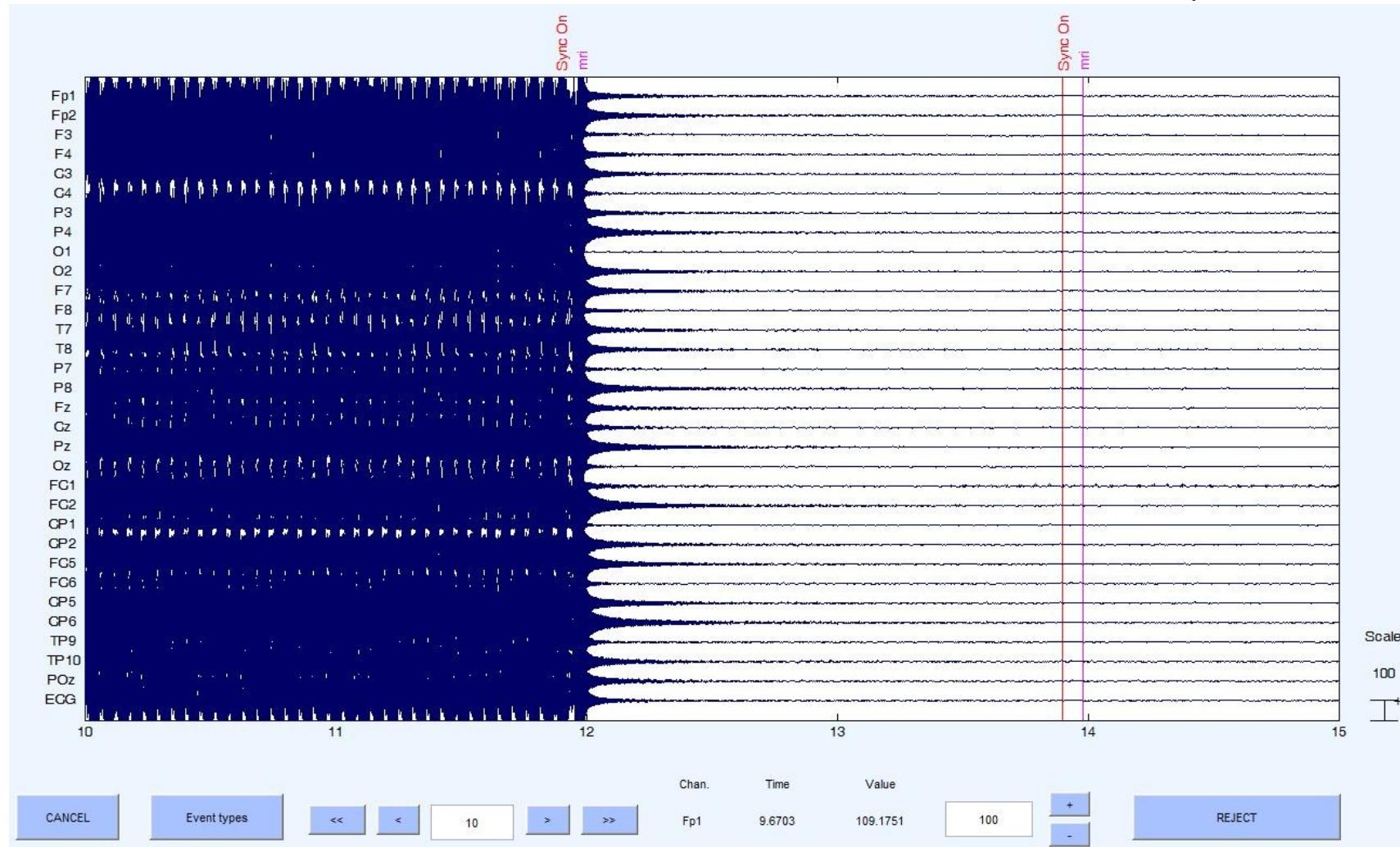
Normal EEG =



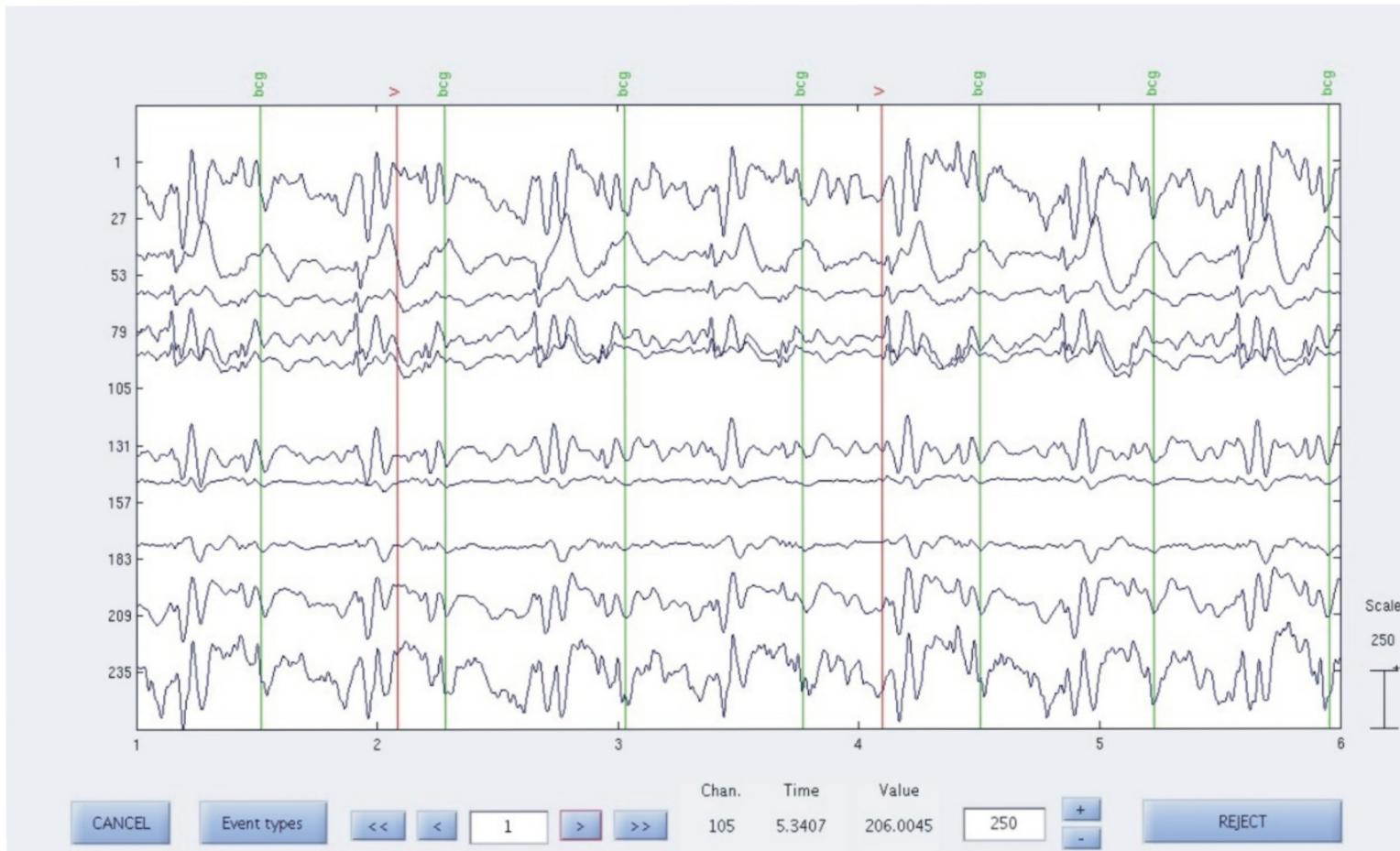
EEG-fMRI =



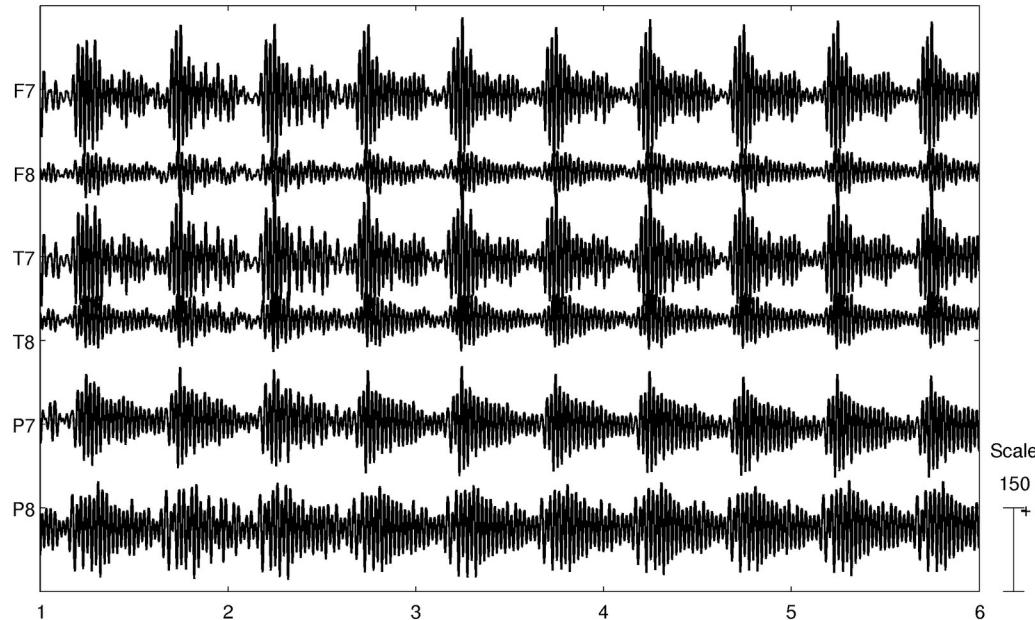
We have ‘solved’ the Gradient Artifact, but...



Heart Beat Artifacts (BCG)



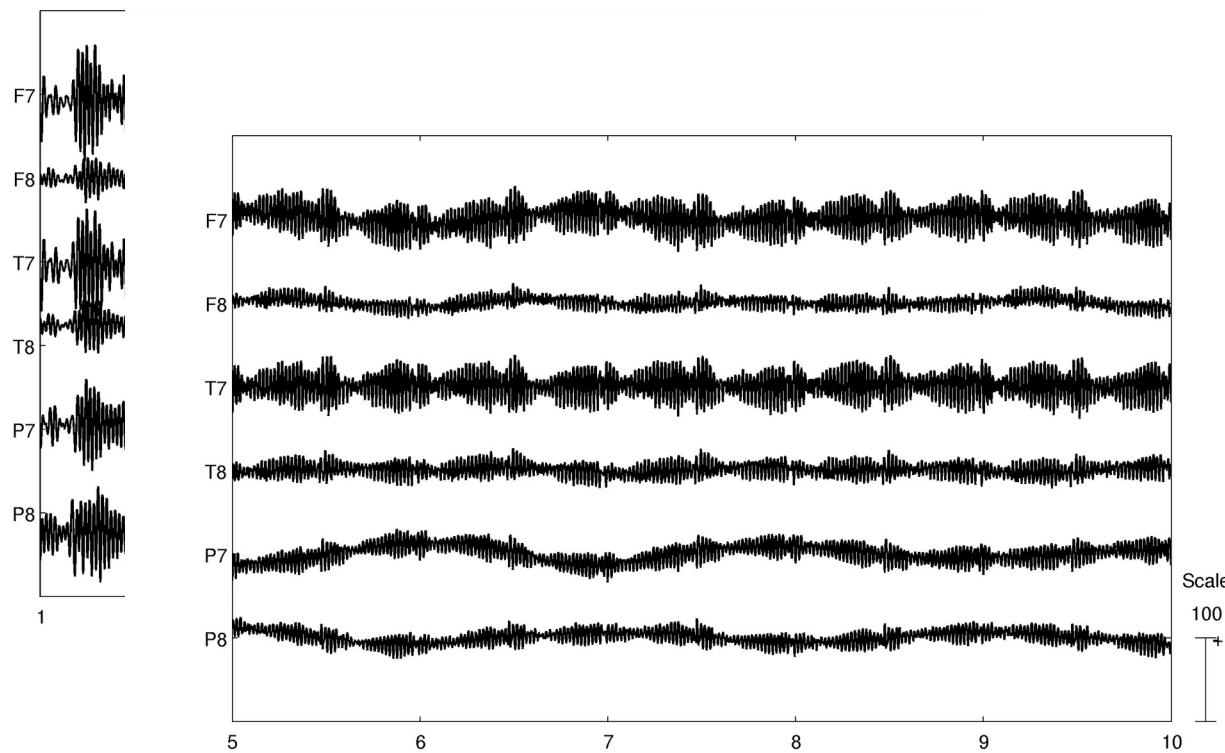
Helium Pump



TRIO 3T

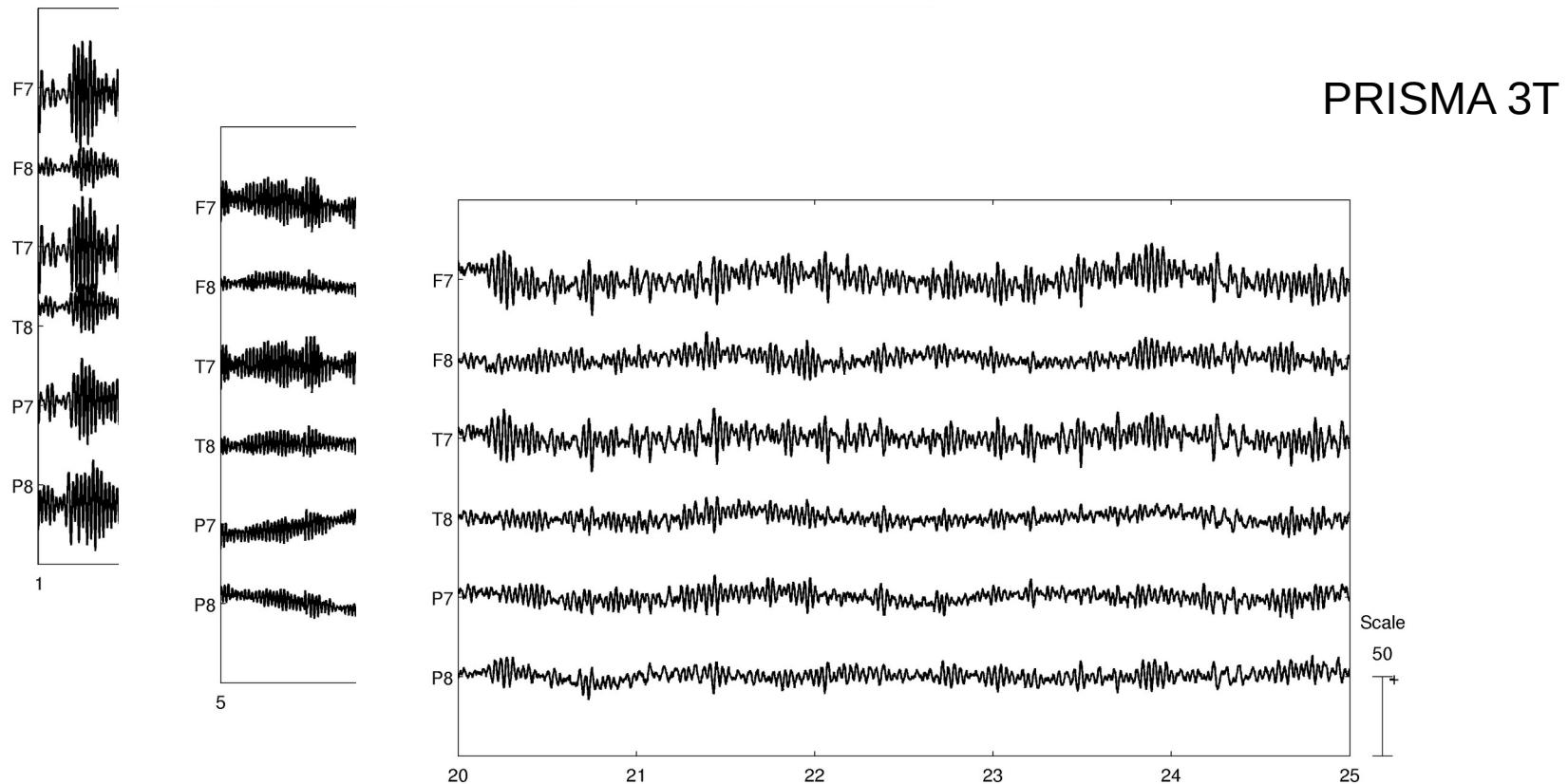
Nierhaus et al. *Neuroimage*, 2013
Rothlübbers et al. *Brain Topography*, 2015

Helium Pump

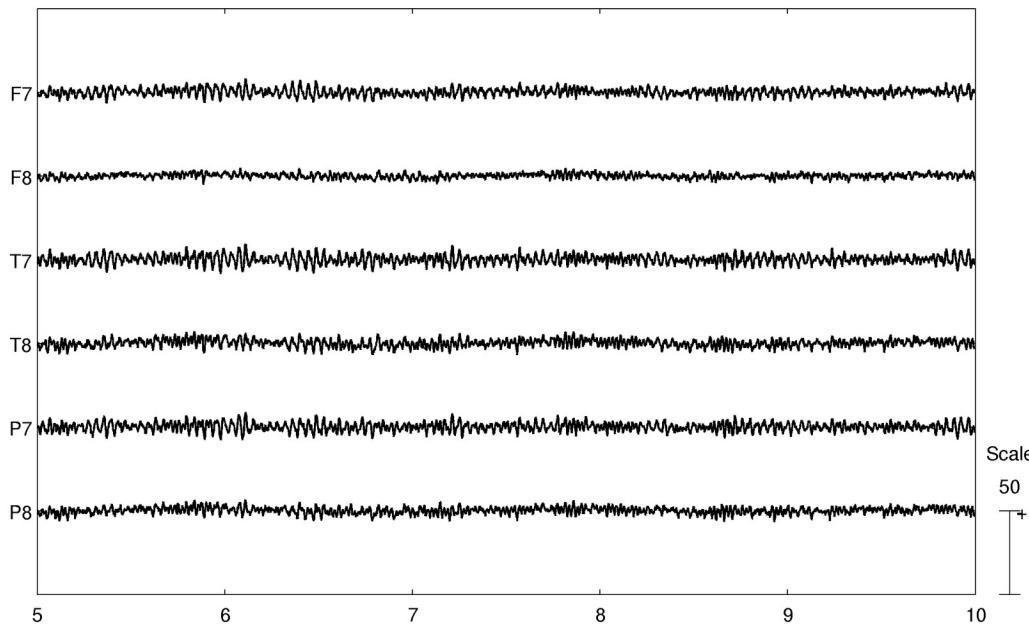


VERIO 3T

Helium Pump

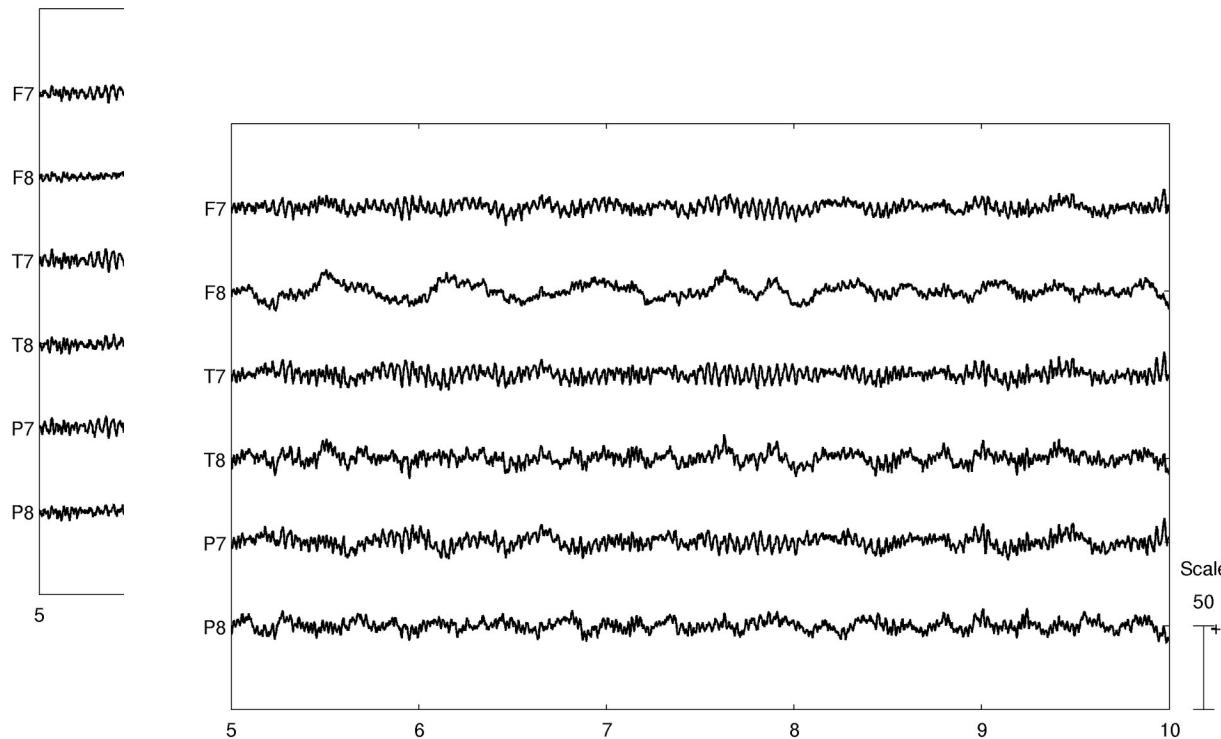


Ventilator



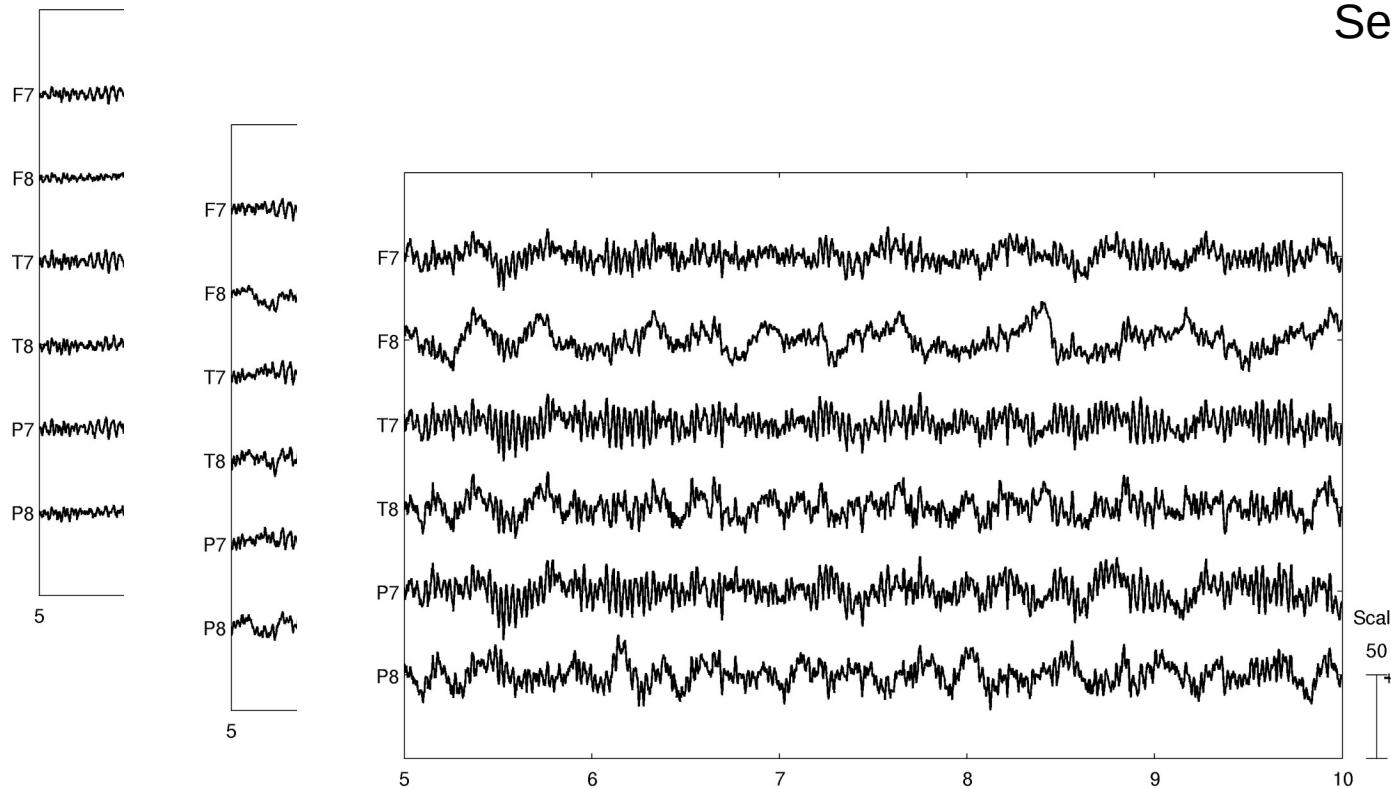
OFF

Ventilator

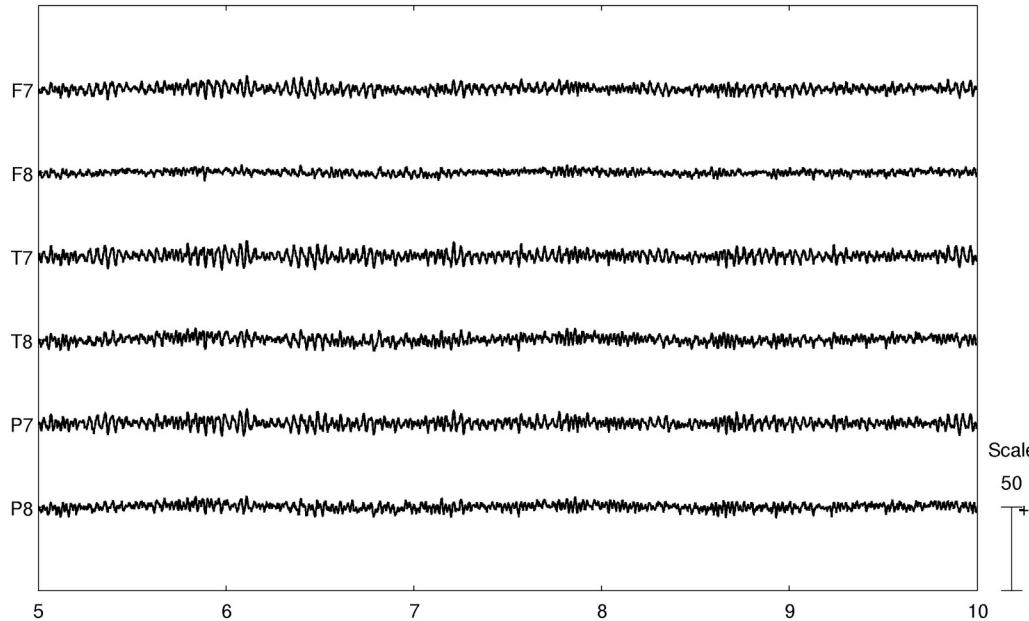


Setting 3

Ventilator

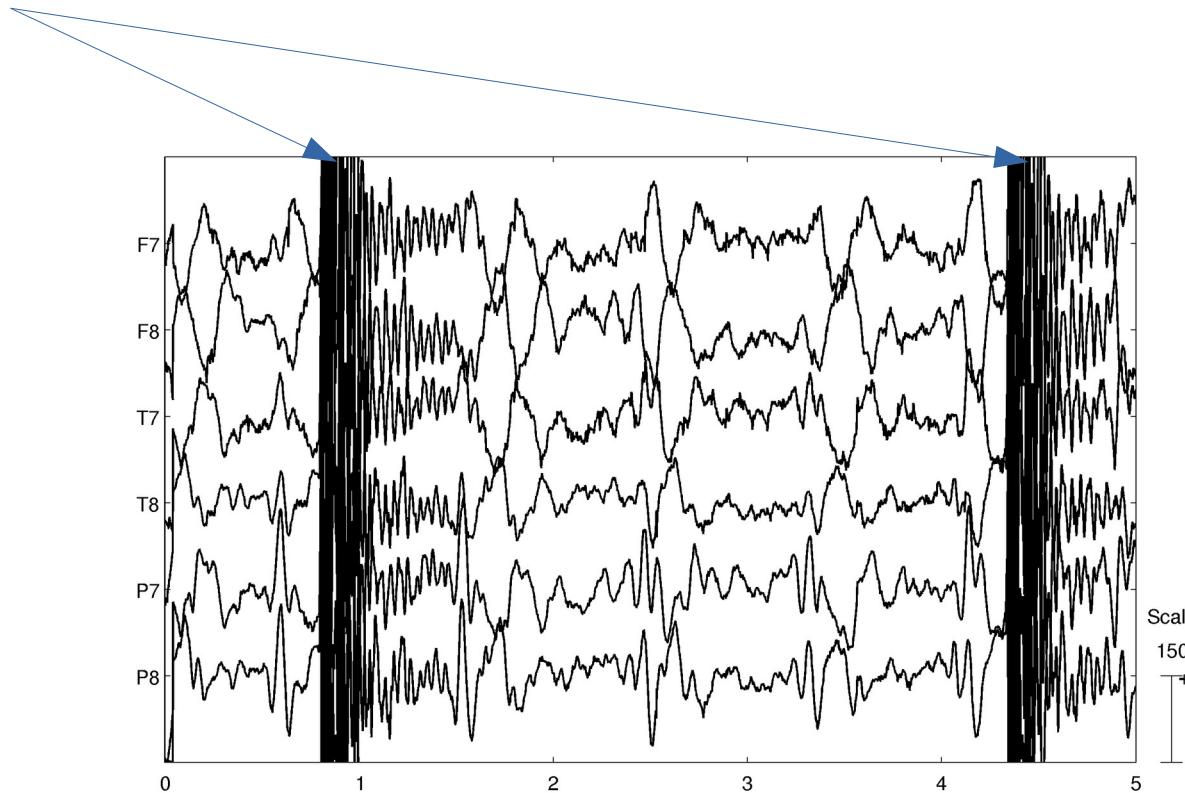


Electrical Ventilator (Direct Amplification)

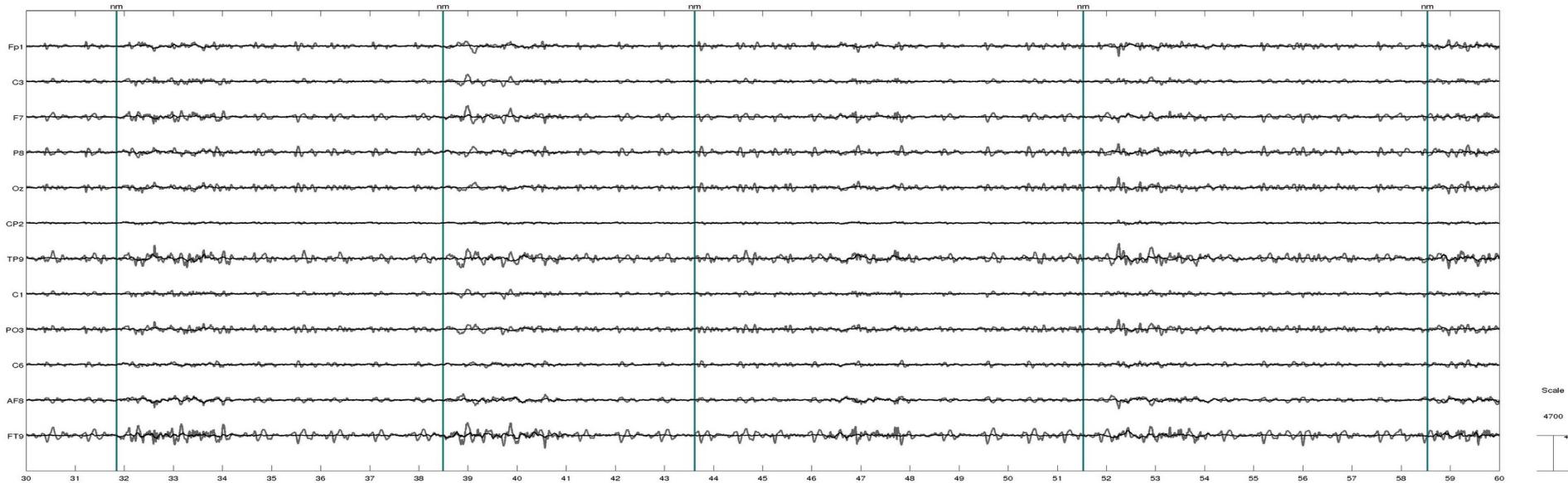


Sudden Movements

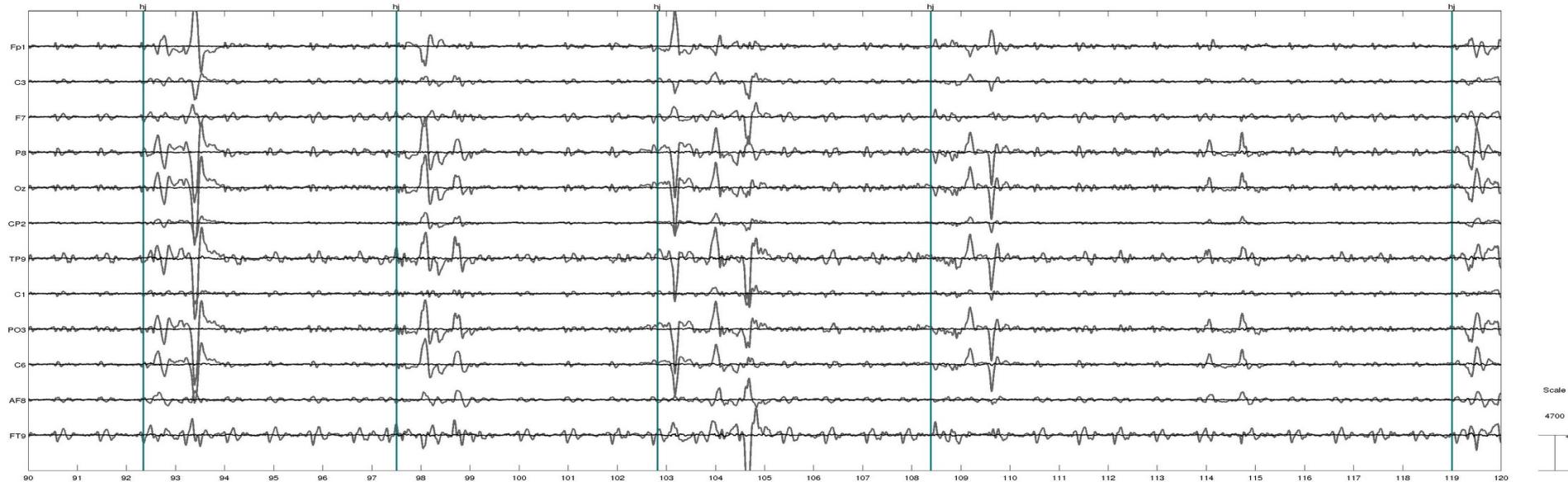
'hit' backside of MRI table while subject in MRI scanner OR Stomping Feet



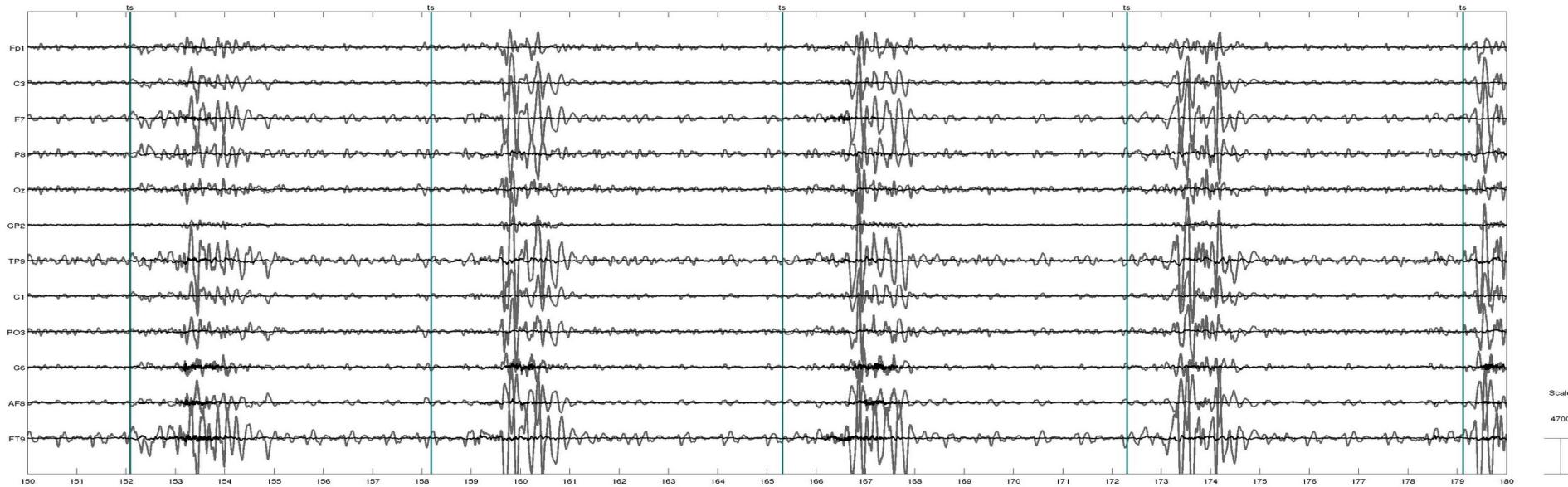
Nose Movements



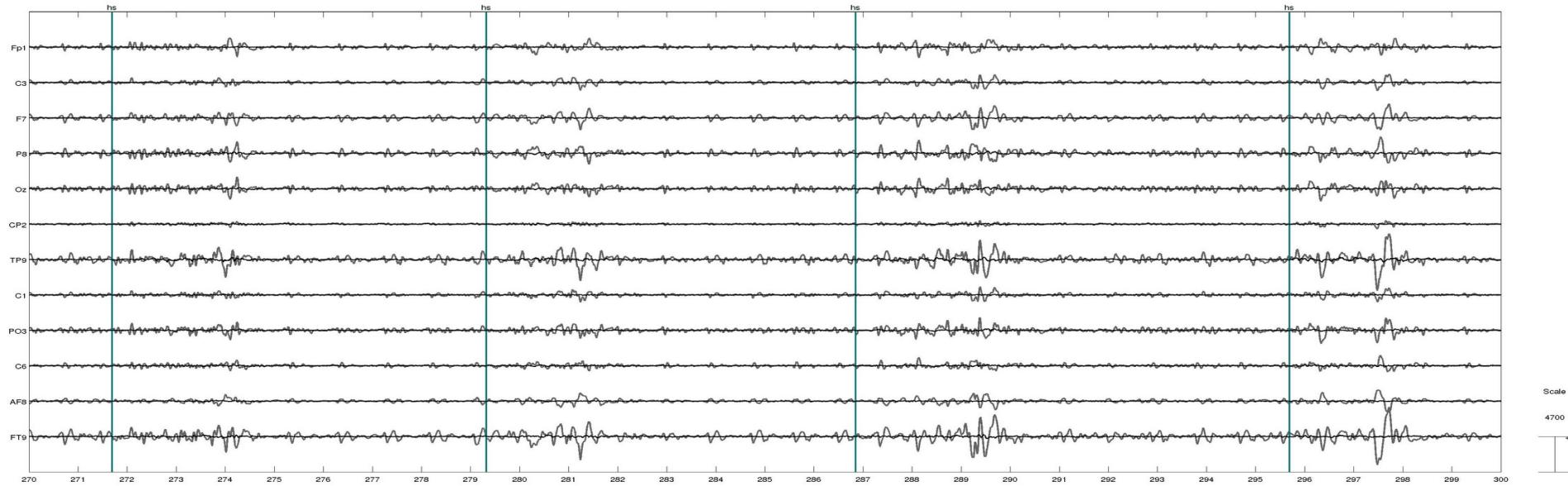
Head Movements



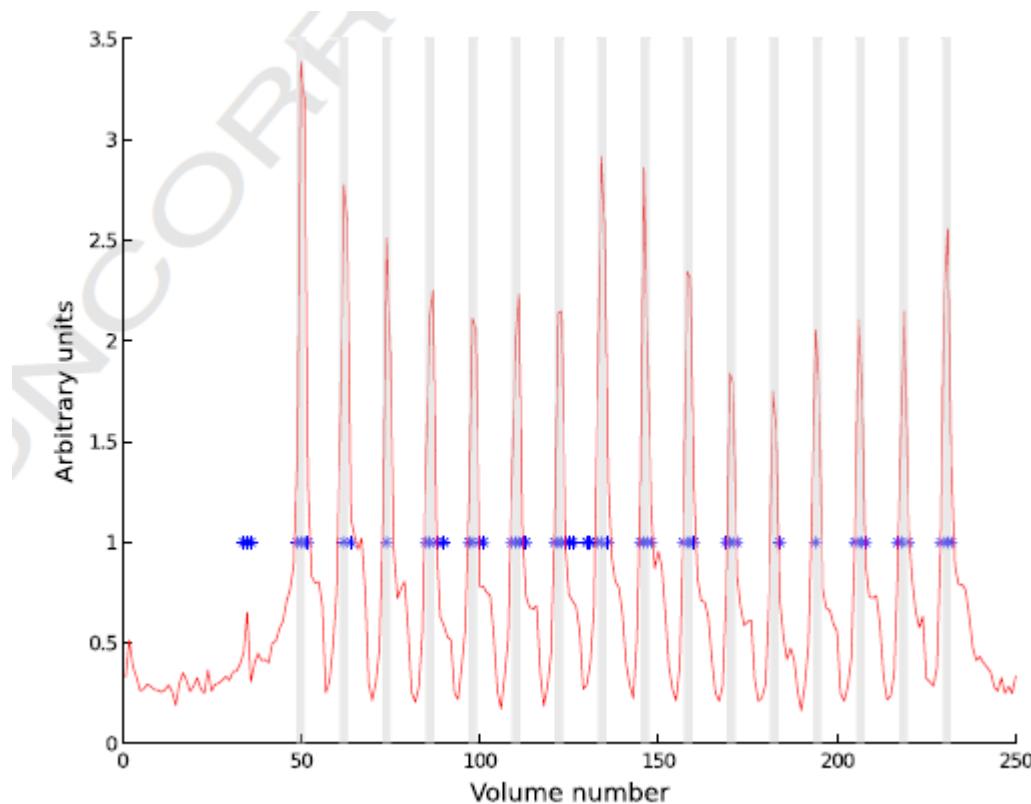
Scraping throat



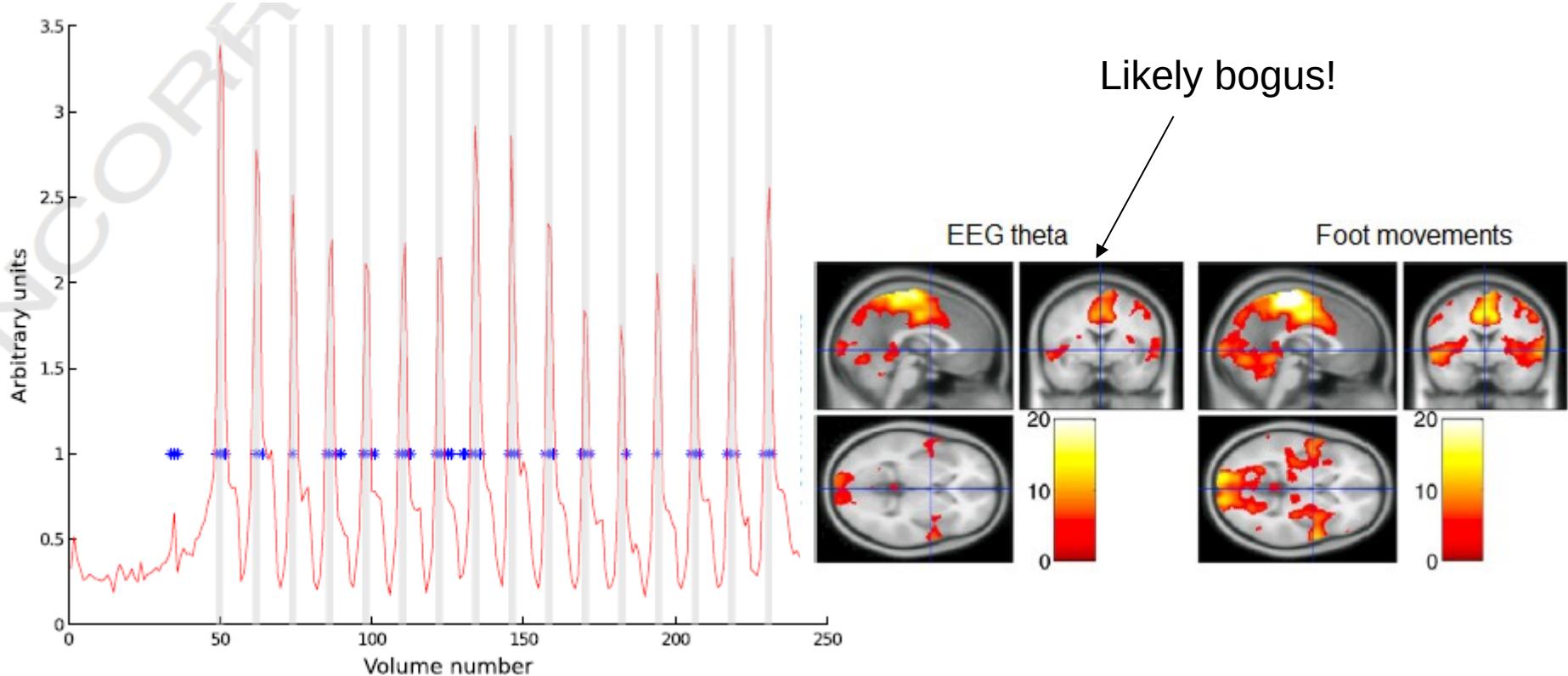
Heavy Sighing



Movements yield ‘plausible’ EEG/fMRI outcomes

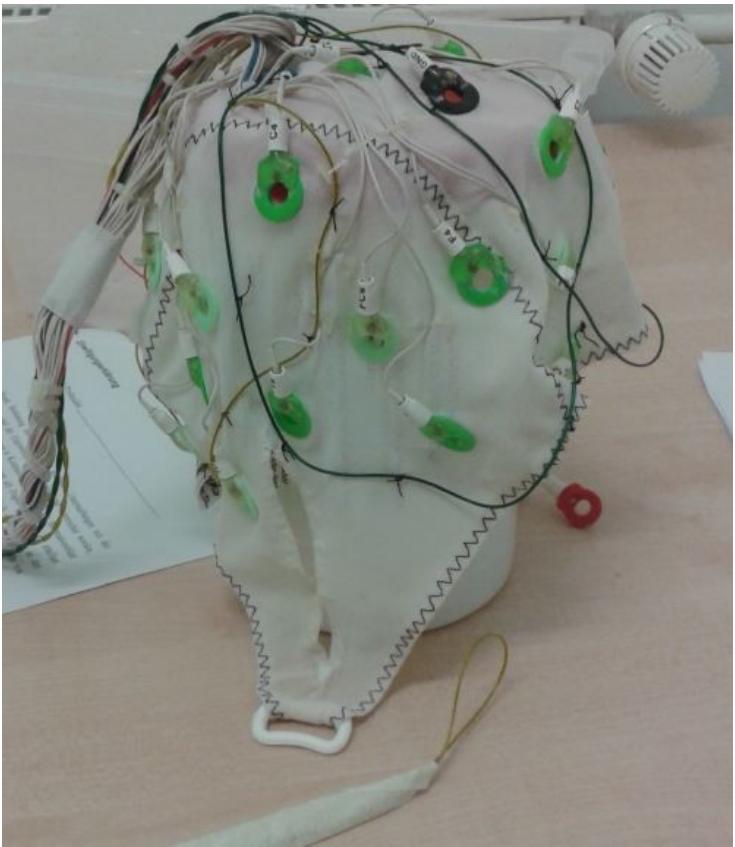


Movements yield ‘plausible’ EEG/fMRI outcomes



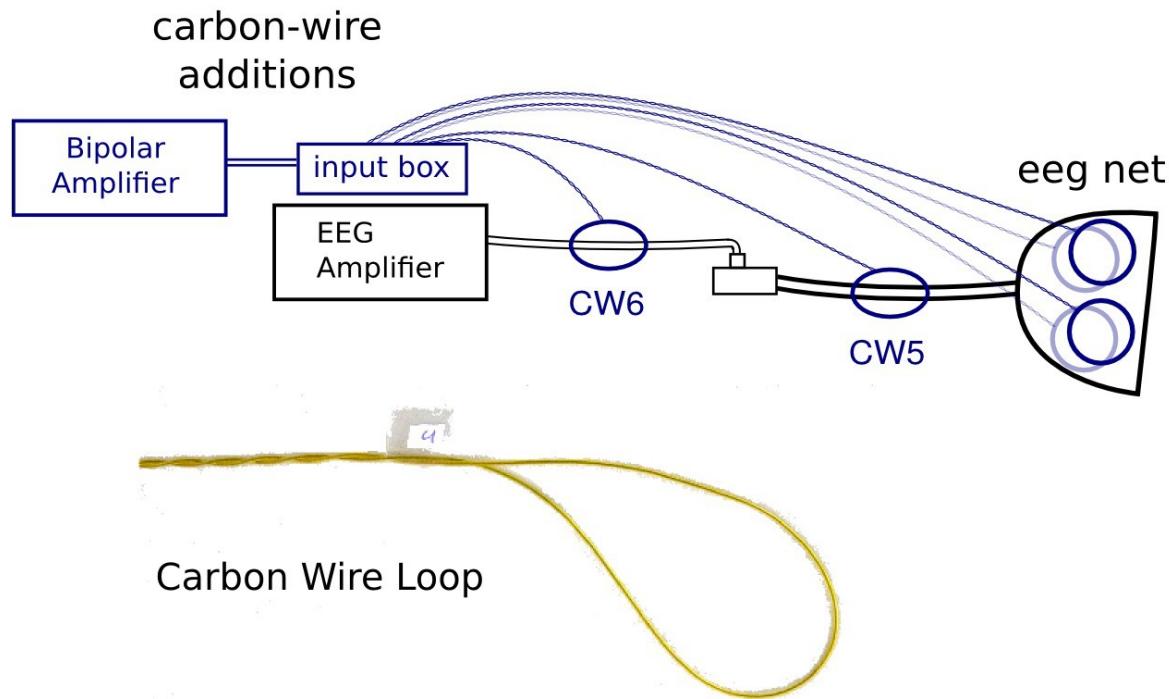
EEG-fMRI Advice

- 1) Think about the EEG signal
- 2) Pilot Outside
- 3) Optimize EEG/fMRI Removal for 1)
- 4) Calibrate each Measurement

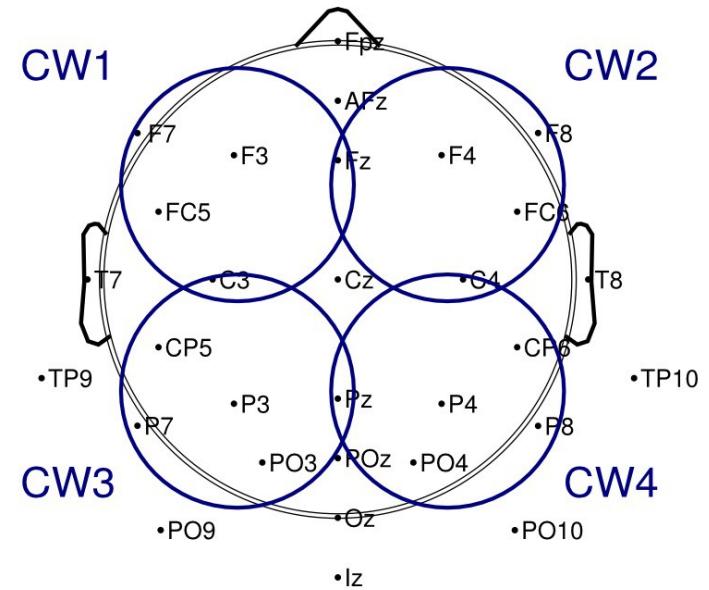


Fit EEG Loops Directly to EEG Cap

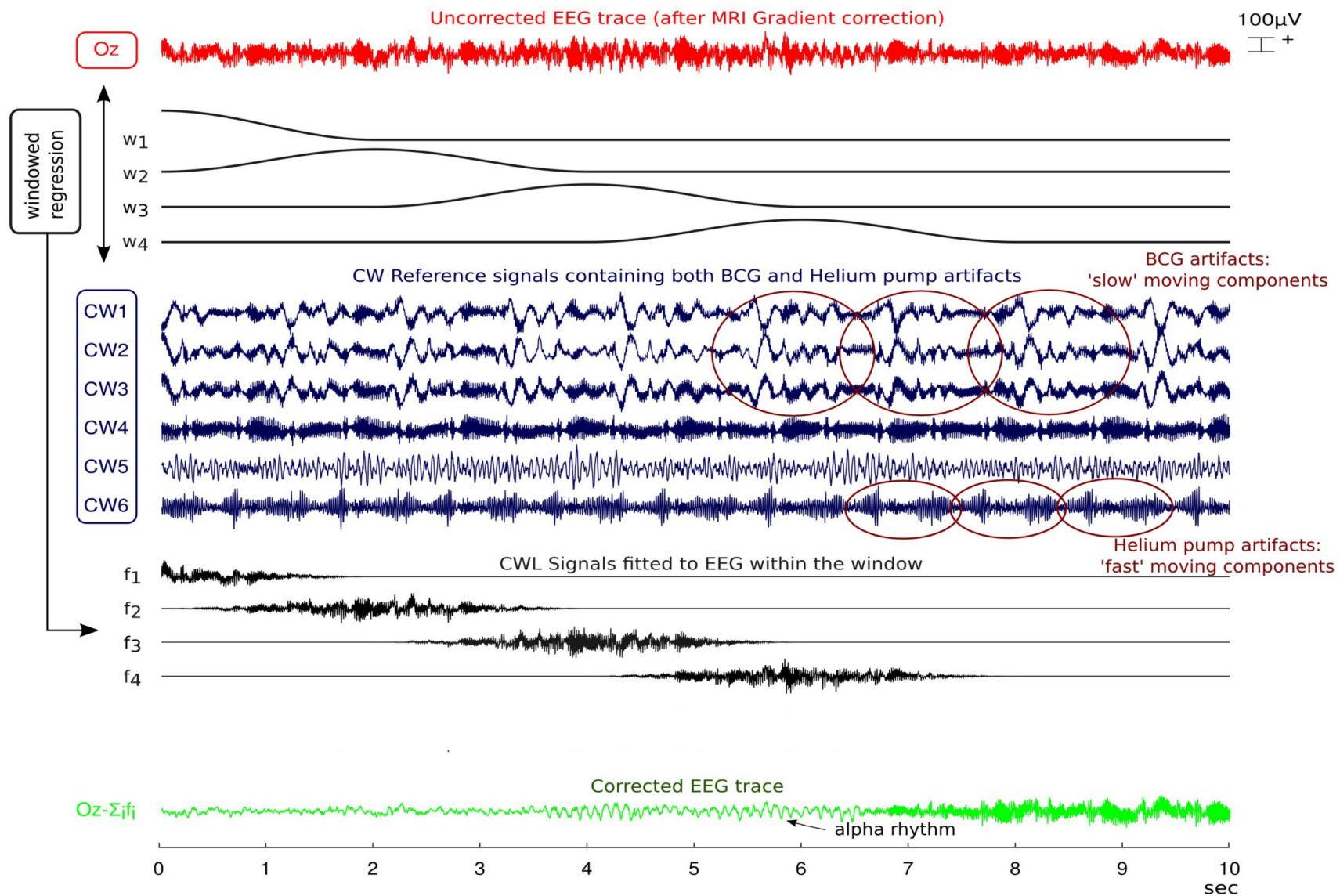
Masterton, et al. *NeuroImage* 37, 202-211 (2007)
Negishi, et al. *J Neurosci Methods* 173, 99-107 (2008)

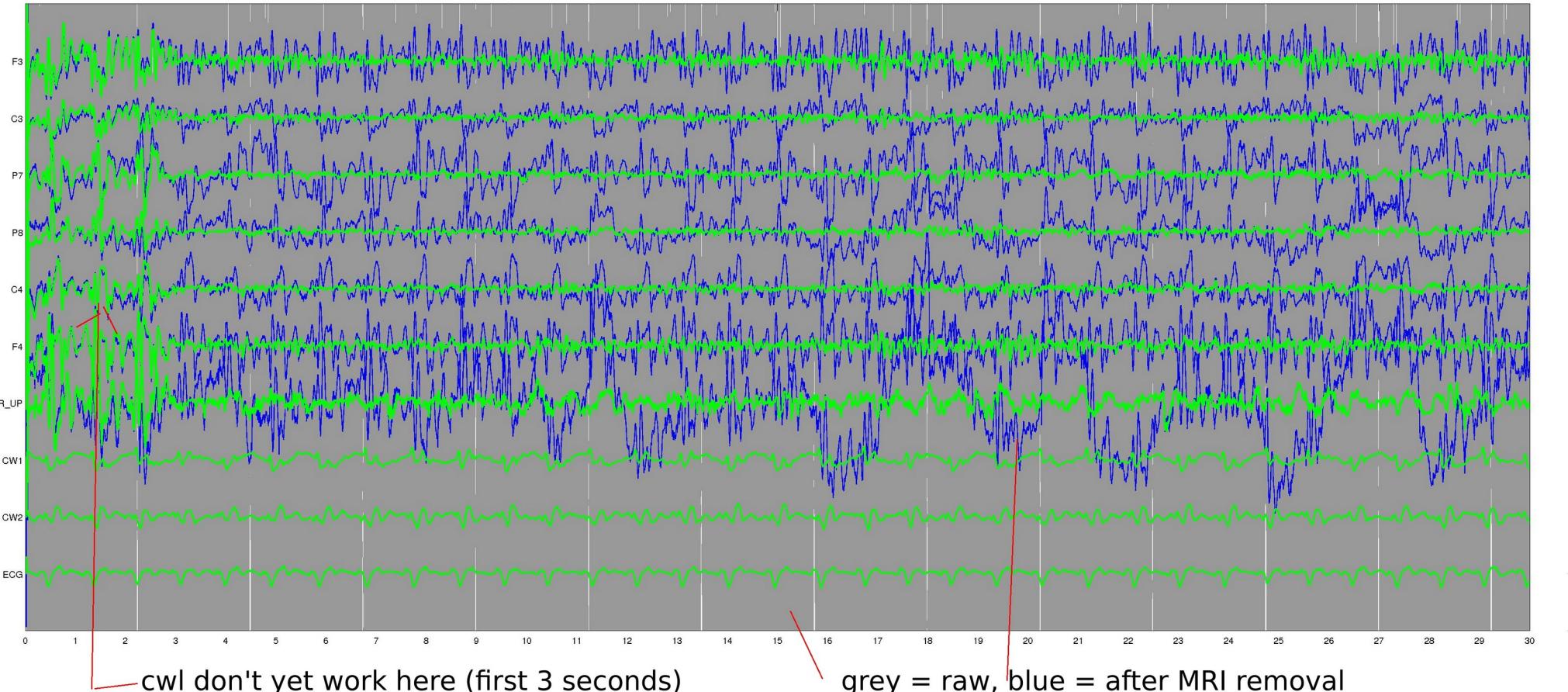


Location of 4 Carbon Wire Loops
in EEG net

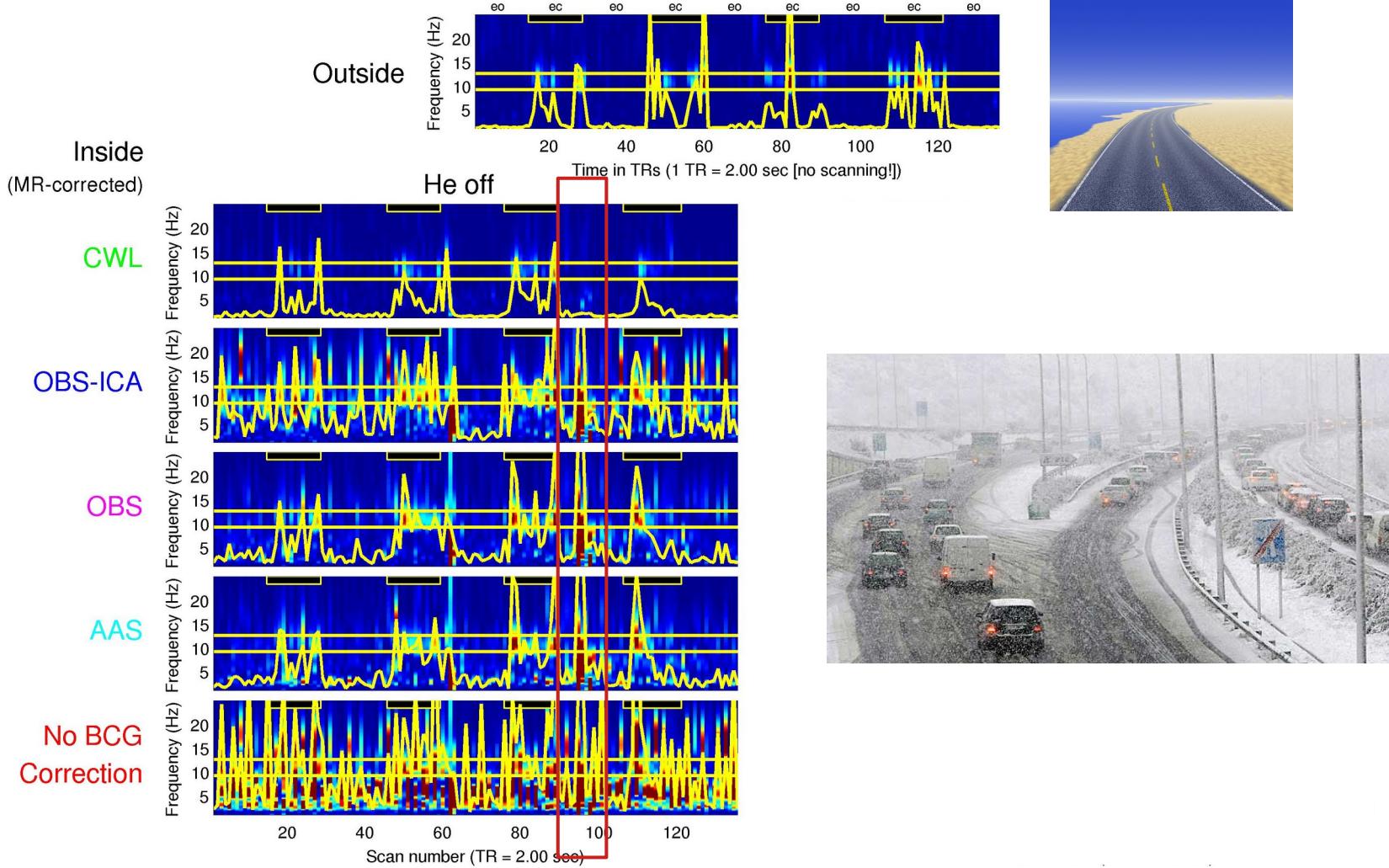


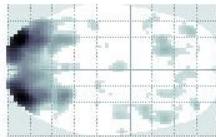
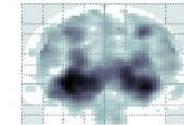
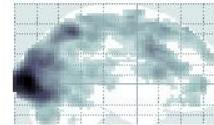
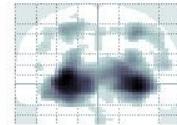
van der Meer, et al. *NeuroImage* **125**, 880–894 (2016)
van der Meer, et al. *Data in Brief* **7**, 990–994 (2016)



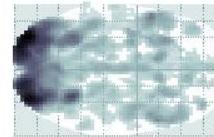


Spectrograms and alpha regressor subject 6 (VERIO), alpha boundaries: 9.15 - 12.57 Hz

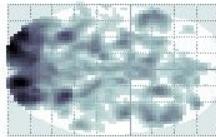
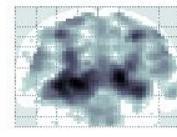
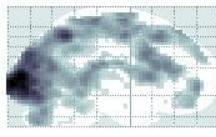




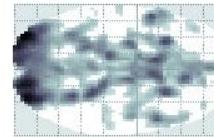
CWL



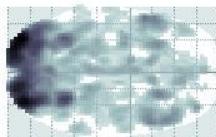
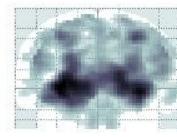
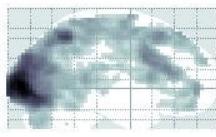
AAS



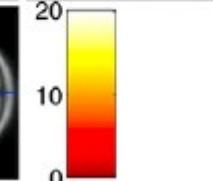
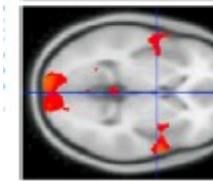
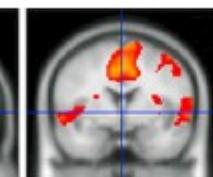
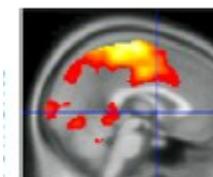
OBS-ICA



No BCG
Correction



OBS

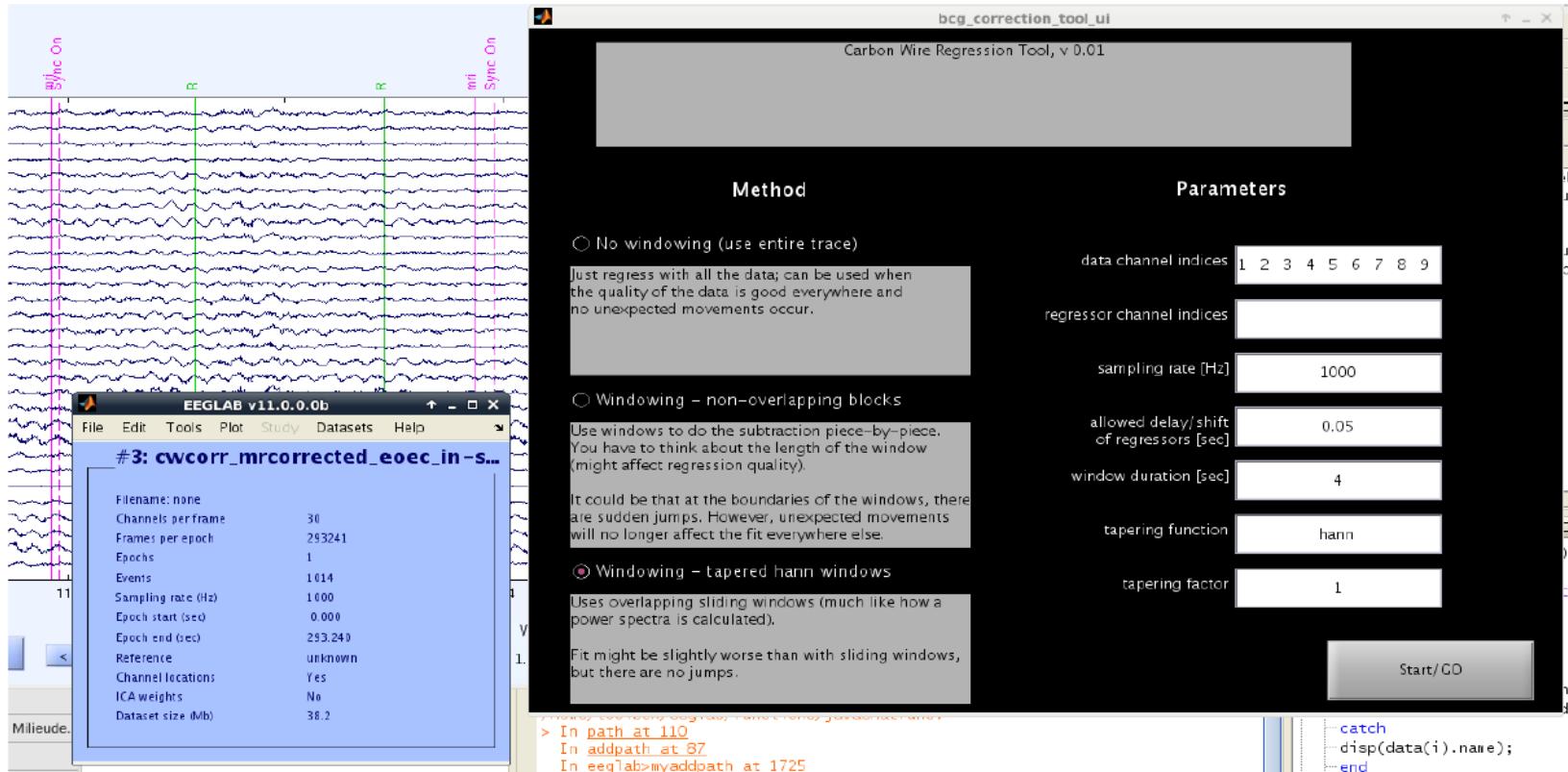


EEG theta

Foot movements



CW Loop Regression Plugin (EEGLAB)



<https://github.com/jnvandermeer/CWRegrTool>

Toolbox and Data

- Toolbox:

https://www.nitrc.org/projects/cwl_eeg_fmri

(<https://github.com/jnvandermeer/CWRegrTool>)

- Data:

https://www.nitrc.org/projects/cwleegfmri_data