



Central European Institute of Technology
BRNO | CZECH REPUBLIC

Simultaneous fMRI/EEG: Artefacts

Martin Lamoš

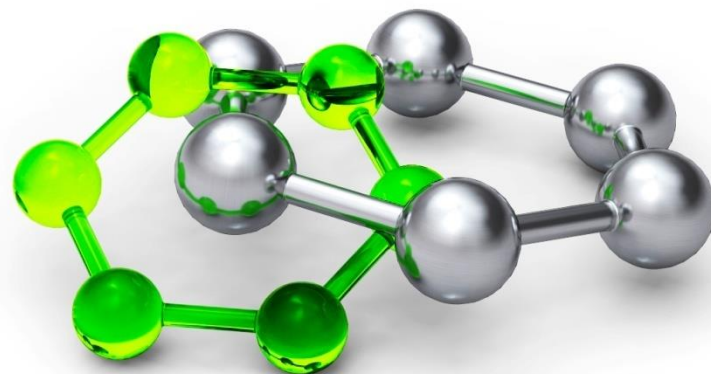
Brno, November 15th 2016



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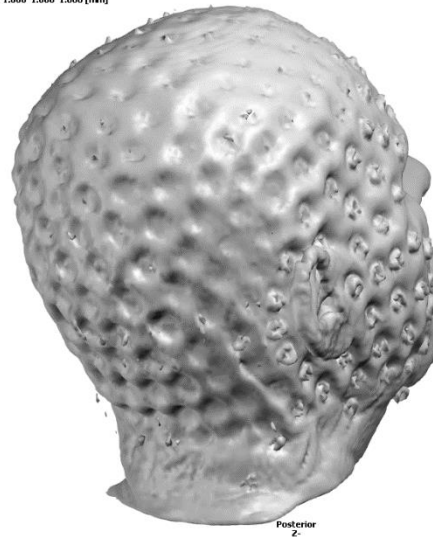


Artefacts caused by EEG in MRI data



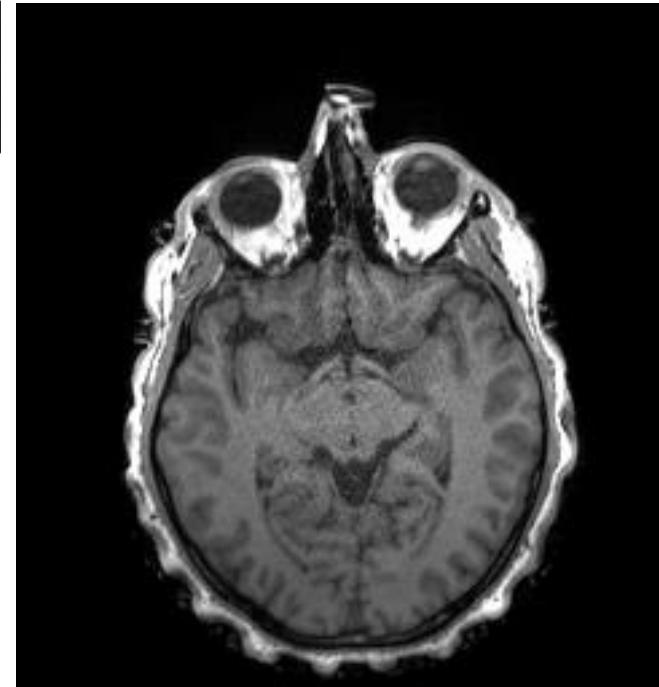
Full head
Data are positive
Volume size: 240 256 256 [Voxel]
Context size: 193.0 244.0 246.0 [Voxel]
Origin: 0.00 0.00 0.00 [Voxel]
Voxel size: 1.000 1.000 1.000 [mm]

Anterior
Z+



Posterior
Z-

66



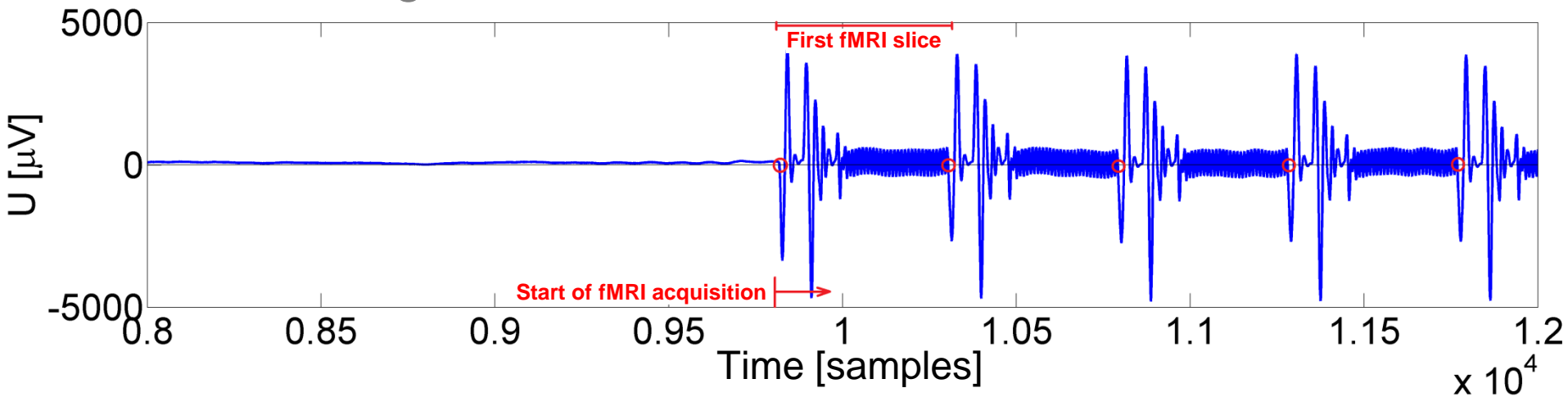
Artefacts caused by MRI in EEG data



Artefacts caused by MRI in EEG data

- Gradient artefacts

- Caused by fast rhythmic changes of magnetic field gradients during acquisition of functional MR images
- Magnitude of artefacts is approximately 100x bigger than useful signal
- Spectrum is overlapped with the frequency band of useful signal



Subtraction of average artefact

Acquisition of fMRI scans is stable and repetitive procedure



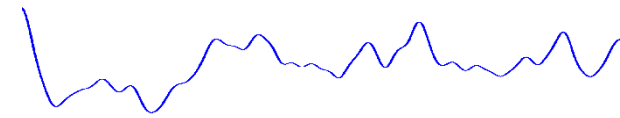
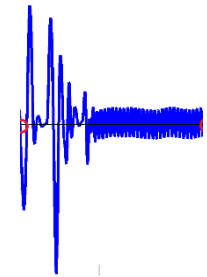
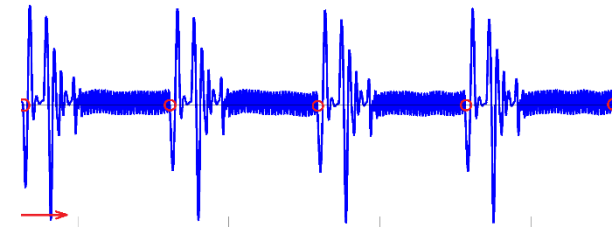
Similar shape of artefacts (ideally)



Average artefact

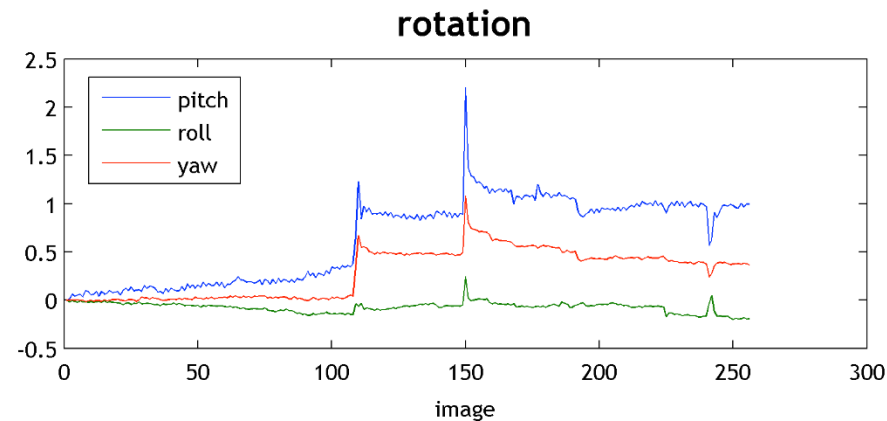
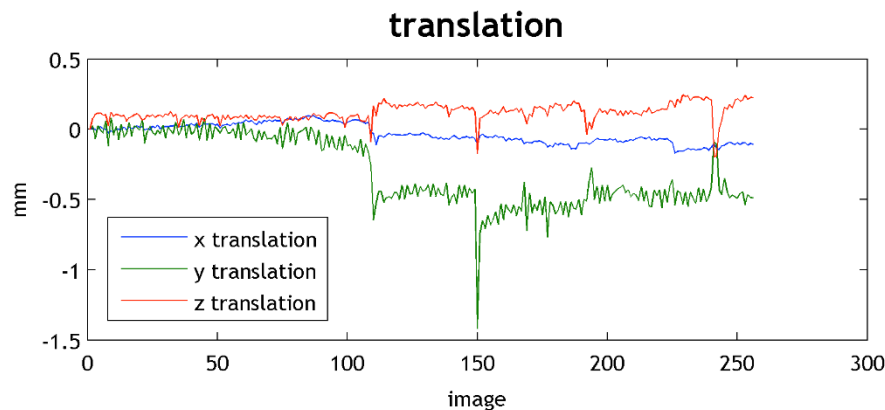


Subtraction



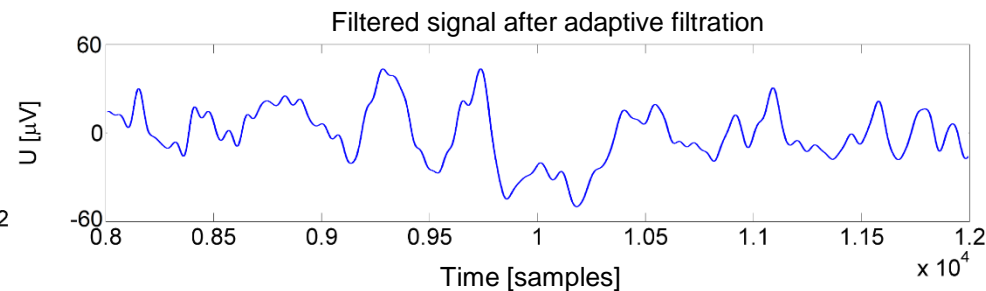
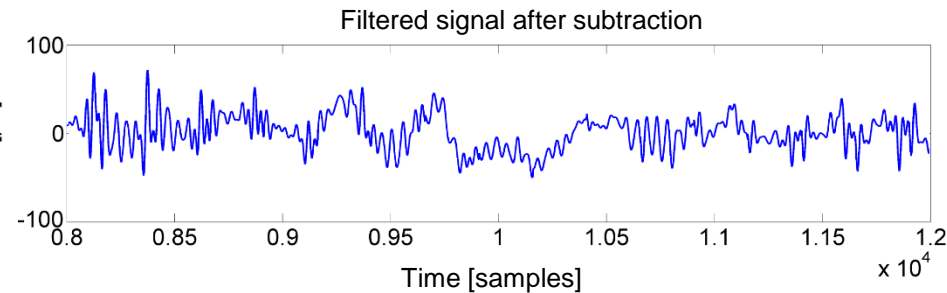
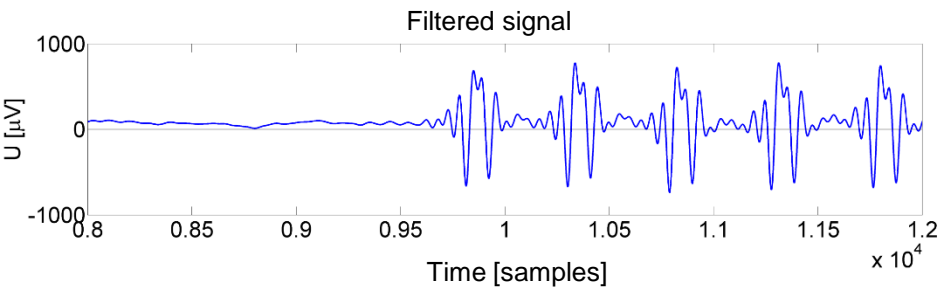
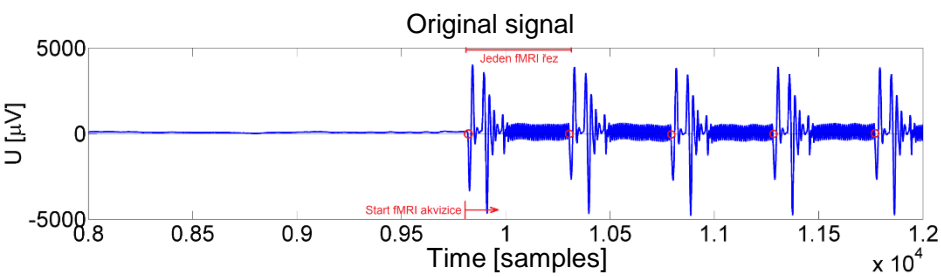
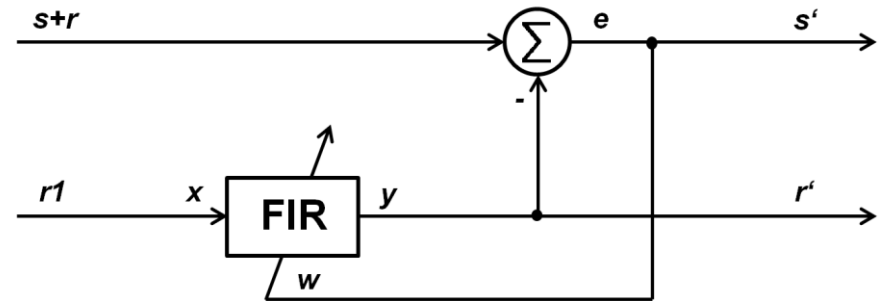
Variations of the method

- Number of repetitions for average
 - All repetitions
 - Specific constant
- Weighting
 - Uniform
 - Exponential
- Using information from realign procedure of fMRI scans



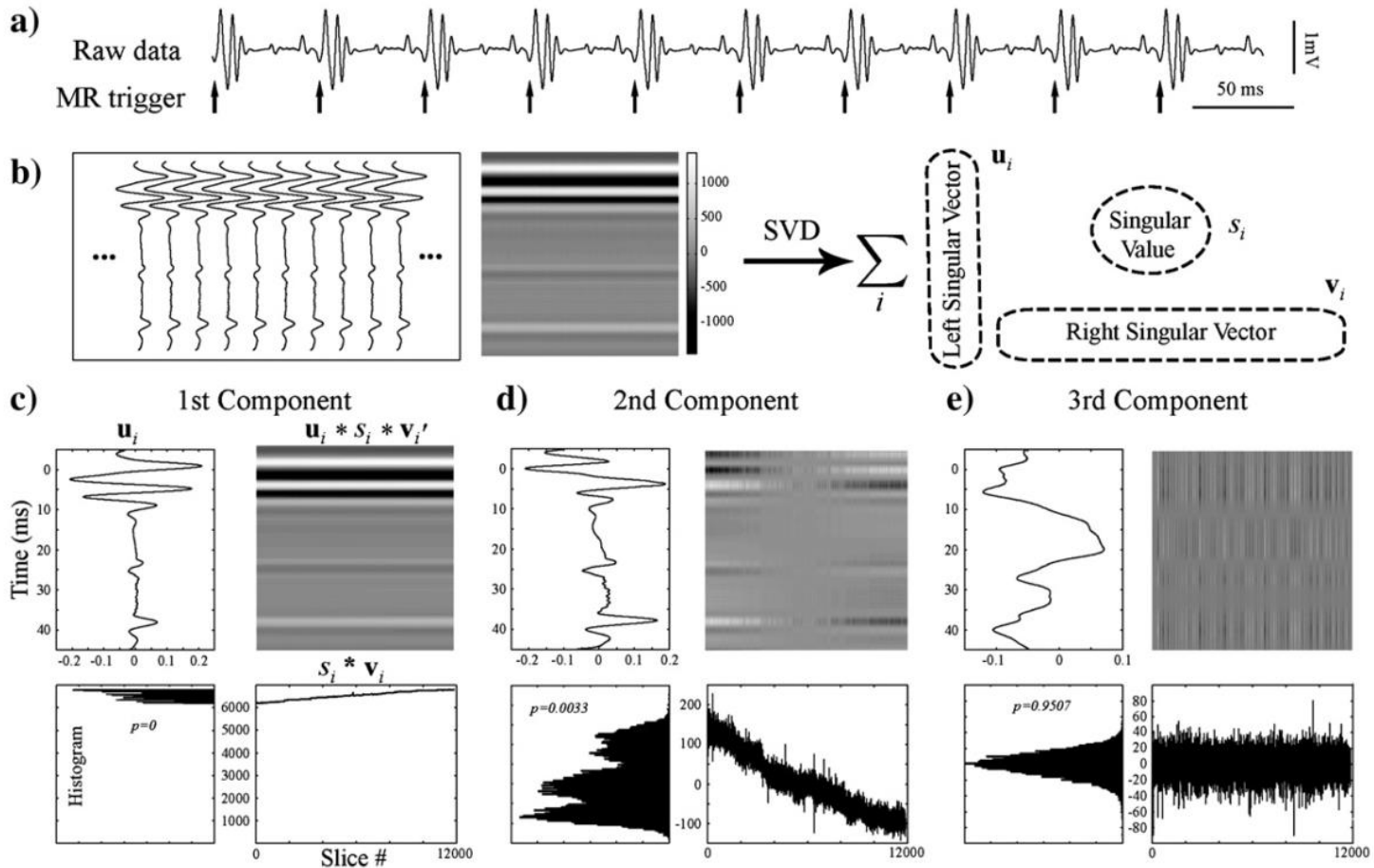
Variations of the method

- Adaptive filtration



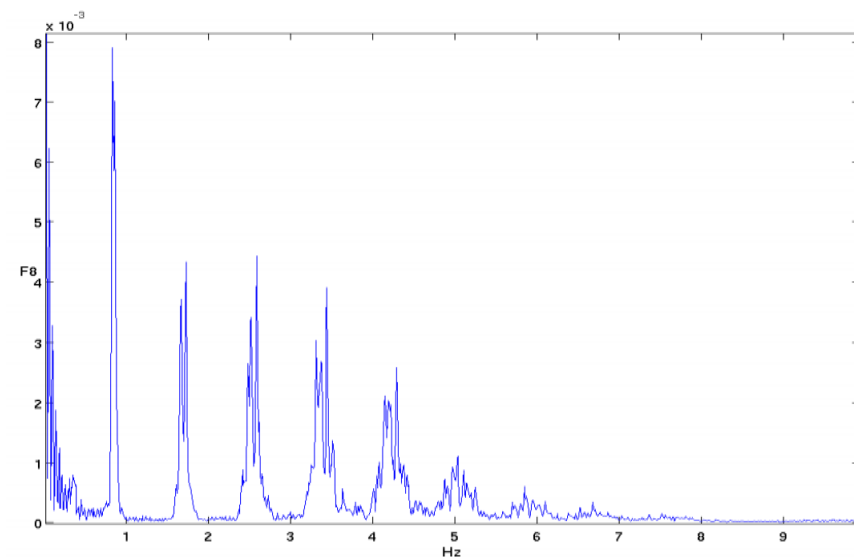
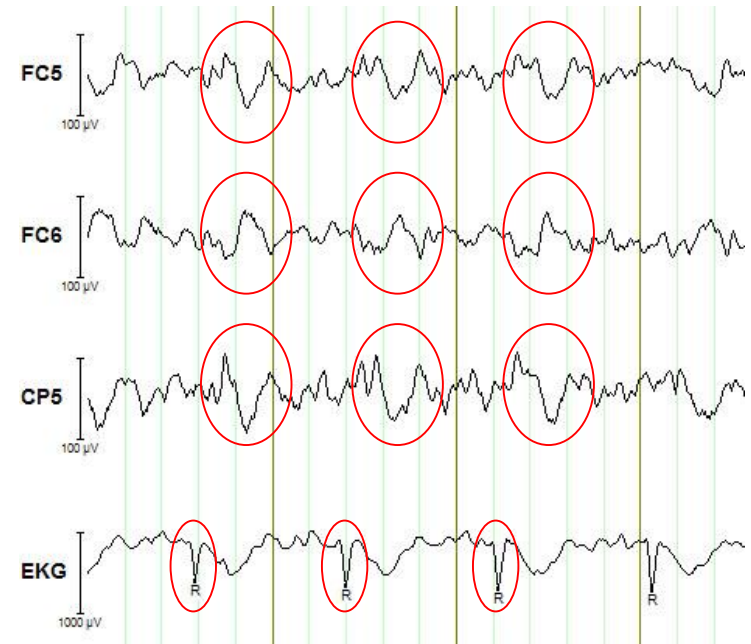
Artefacts caused by MRI in EEG data

- Gradient artefacts suppression using SVD method



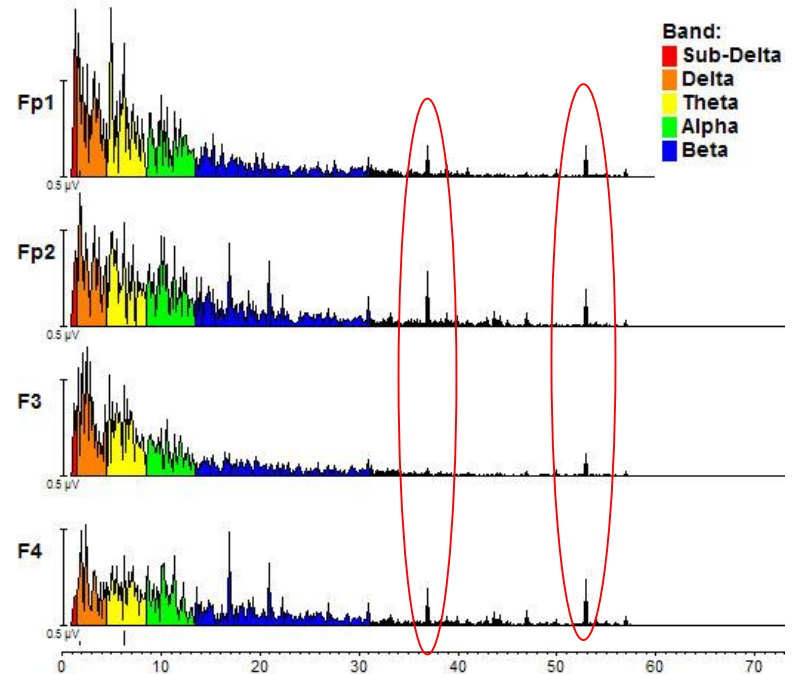
Artefacts caused by MRI in EEG data

- Pulse artefacts
 - Head movement in the heart beat rhythm
 - Vessel movement under electrodes
 - Zero correlation with EEG
 - Quasiperiodic
- Correction by subtraction, ICA



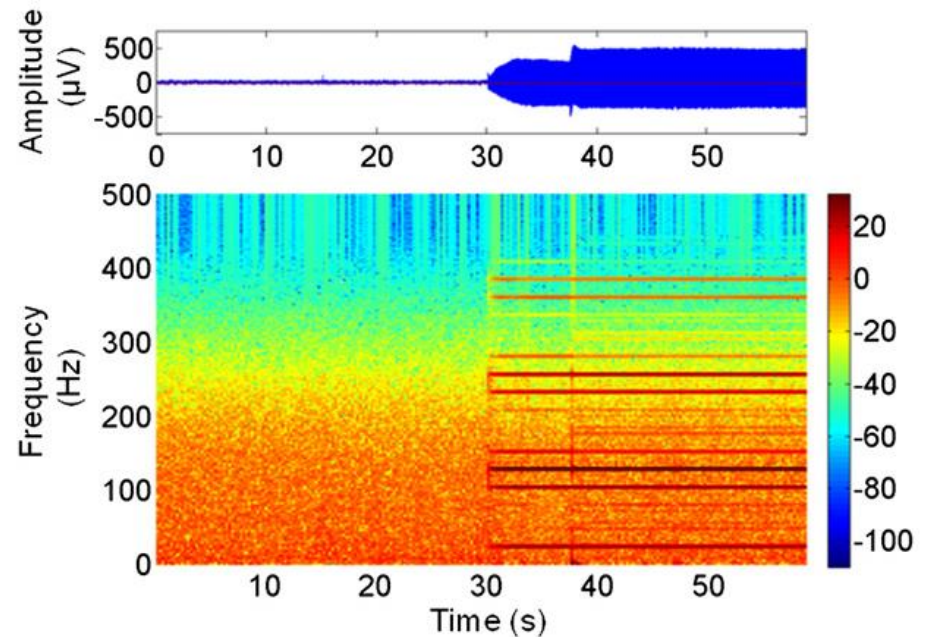
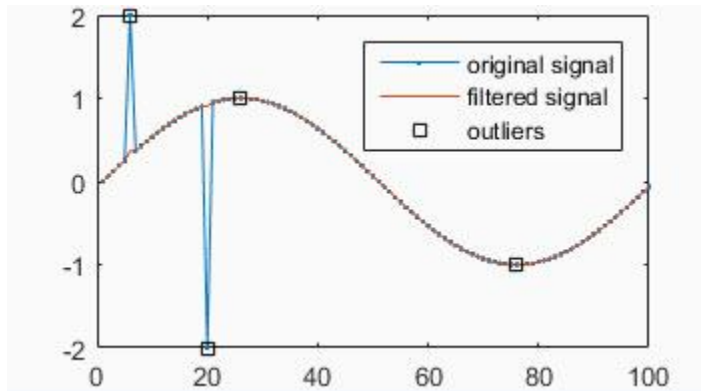
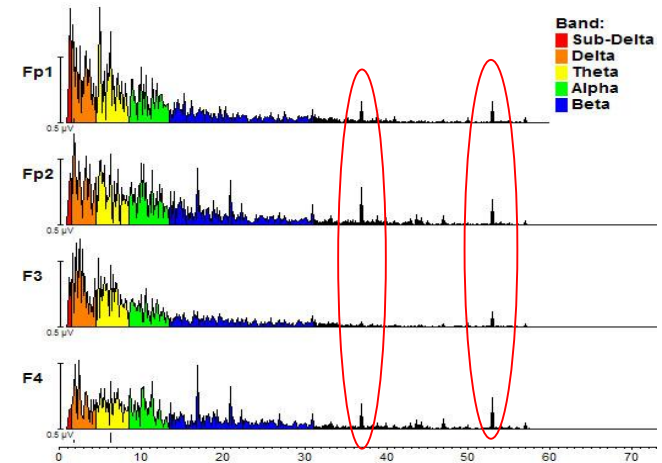
Artefacts caused by MRI in EEG data

- Helium pump
- Wires movement
- Movement artefacts
- Correction by filtration, hardware configuration, ICA,...

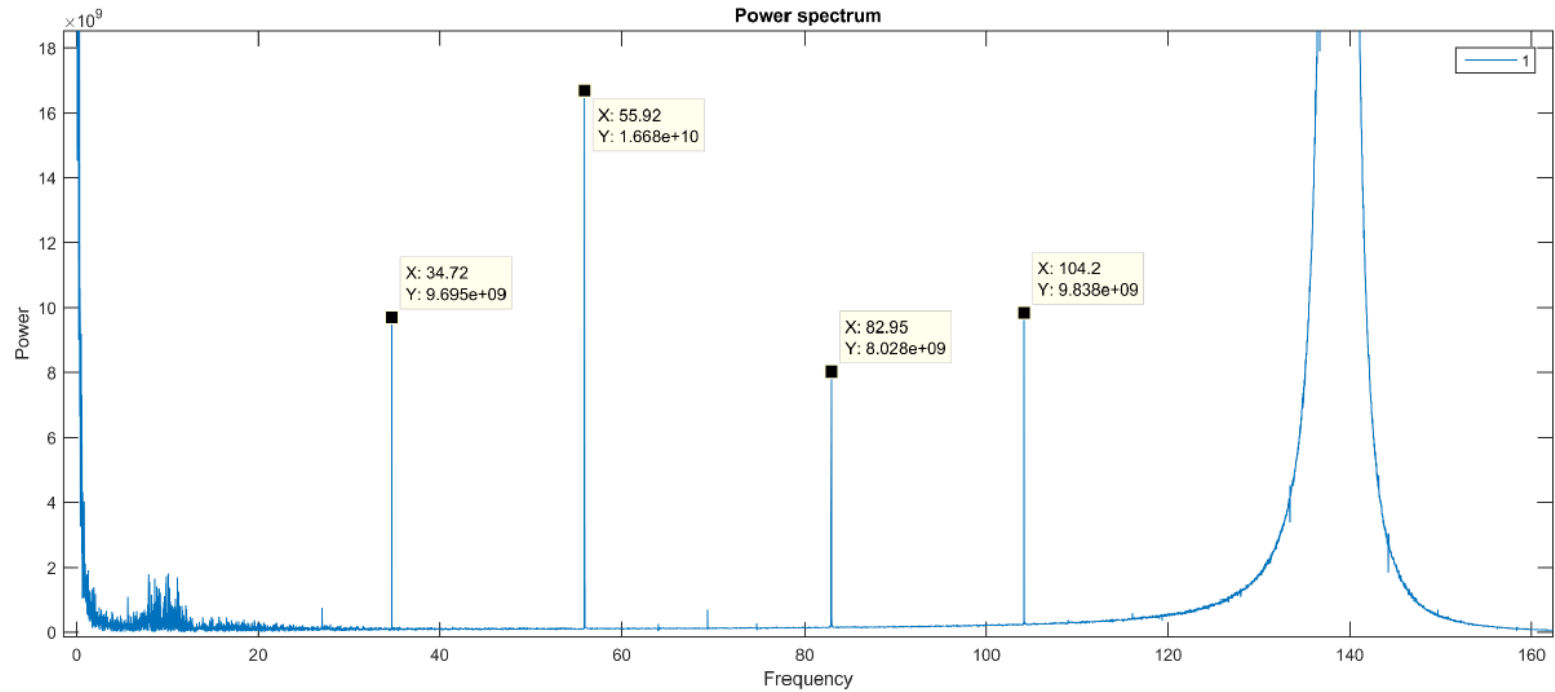


Artefacts caused by MRI in EEG data

- Helium pump
 - Hampel filter used in spectral domain



DBS stimulation with Kinetra



Power spectrum computed from signal in scalp electrode E100 (left parietal area) – same artefacts are in other electrodes.

Stimulation parameters: 3.3/4.3V, 140 Hz, 90us, contacts 1 and 5

Thank you for your attention



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