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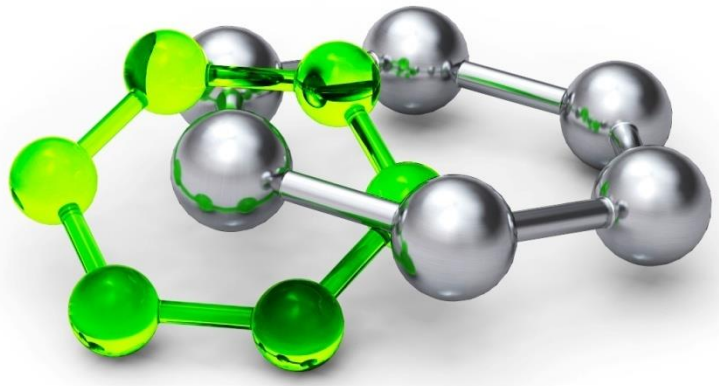
Advanced methods for EEG data analysis

Martin Lamoš

Brno, November 15th 2016



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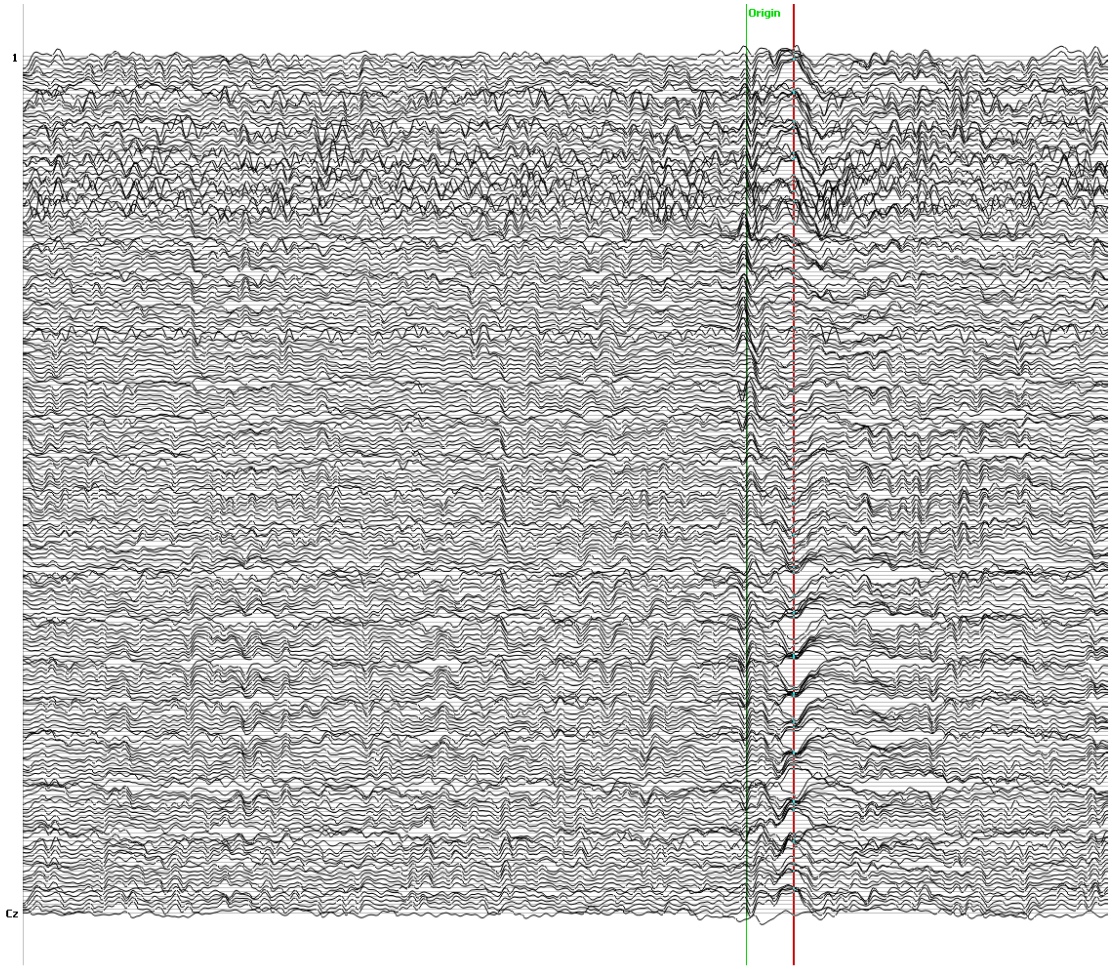
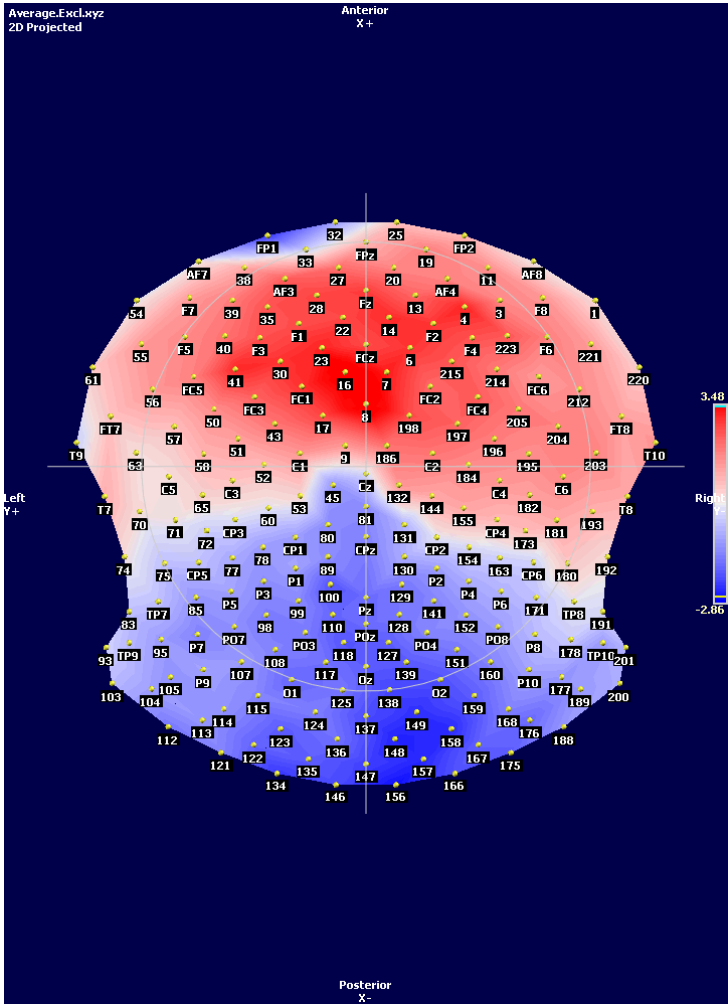
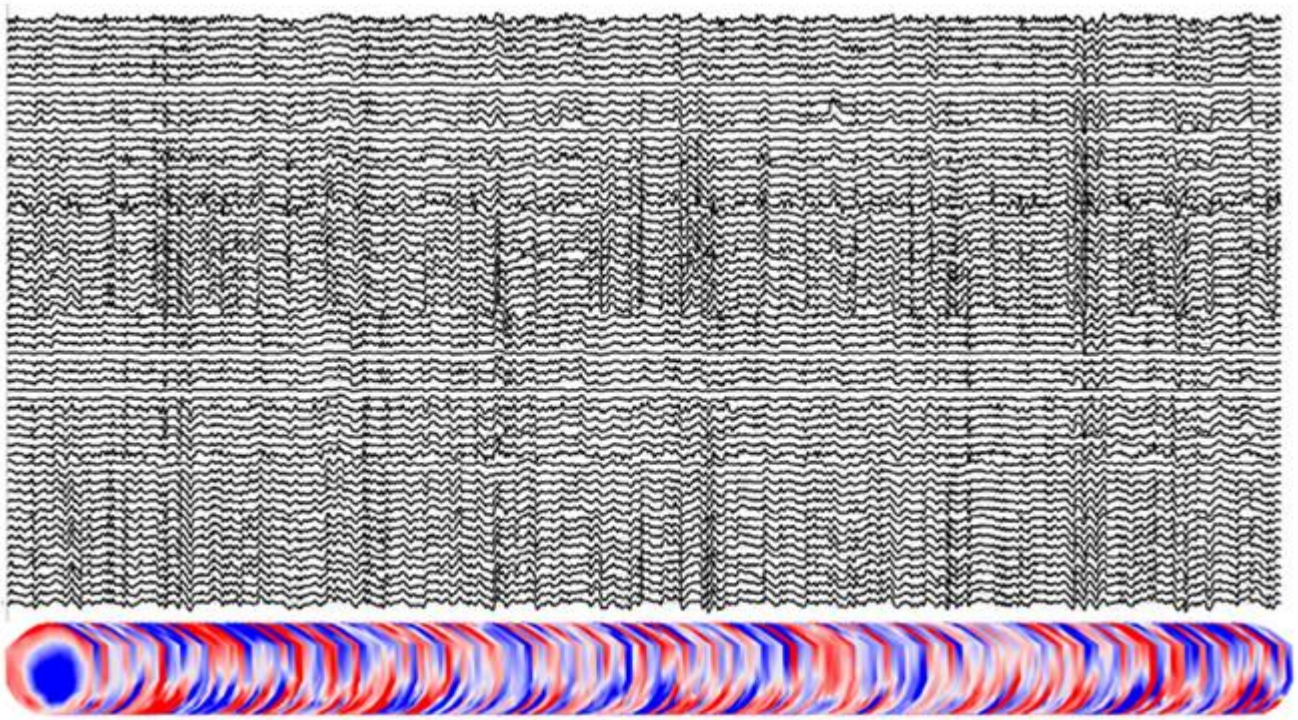
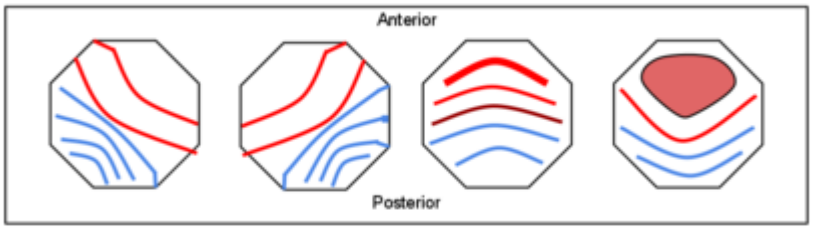
EEG microstates



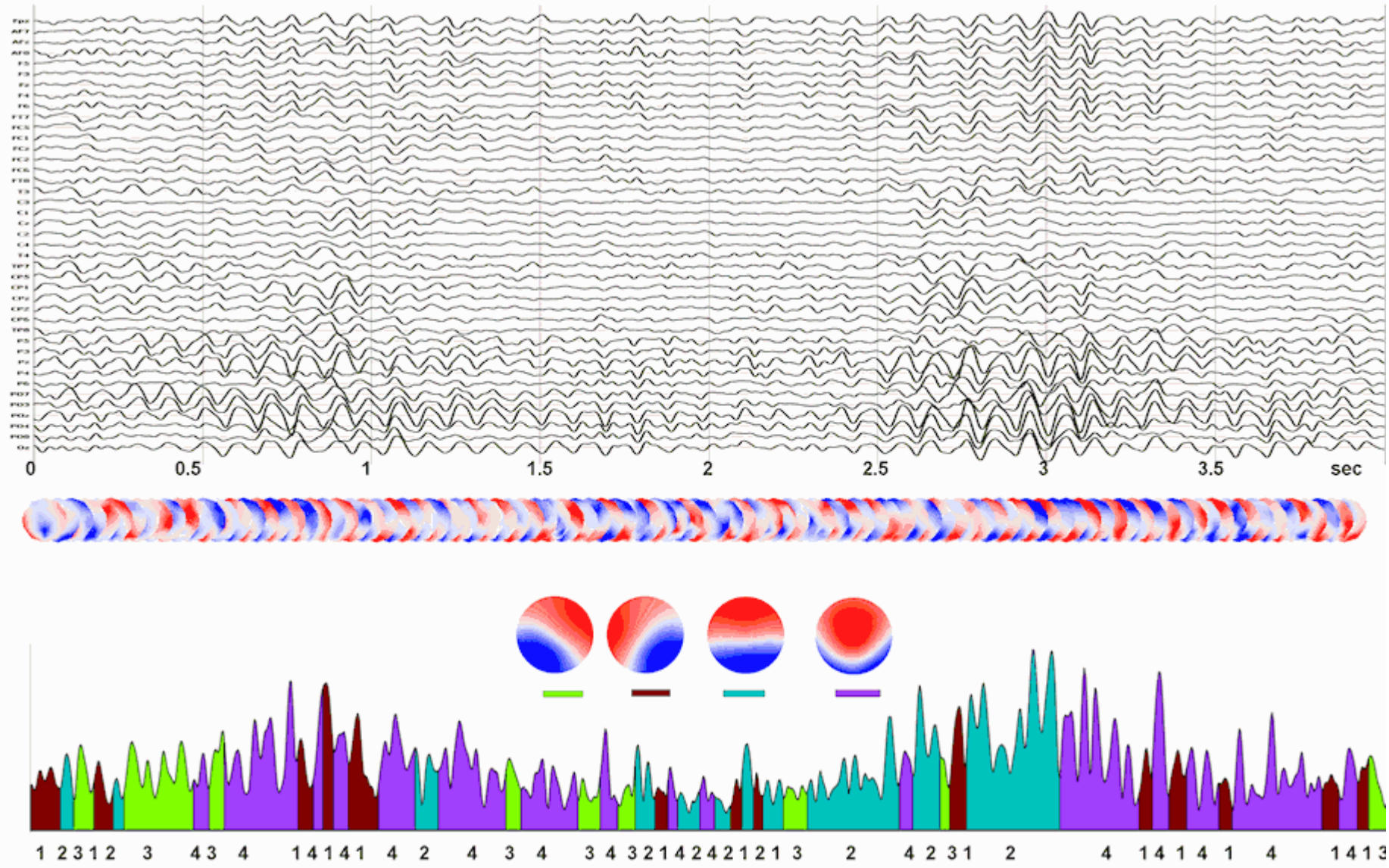


EEG microstates





EEG microstates



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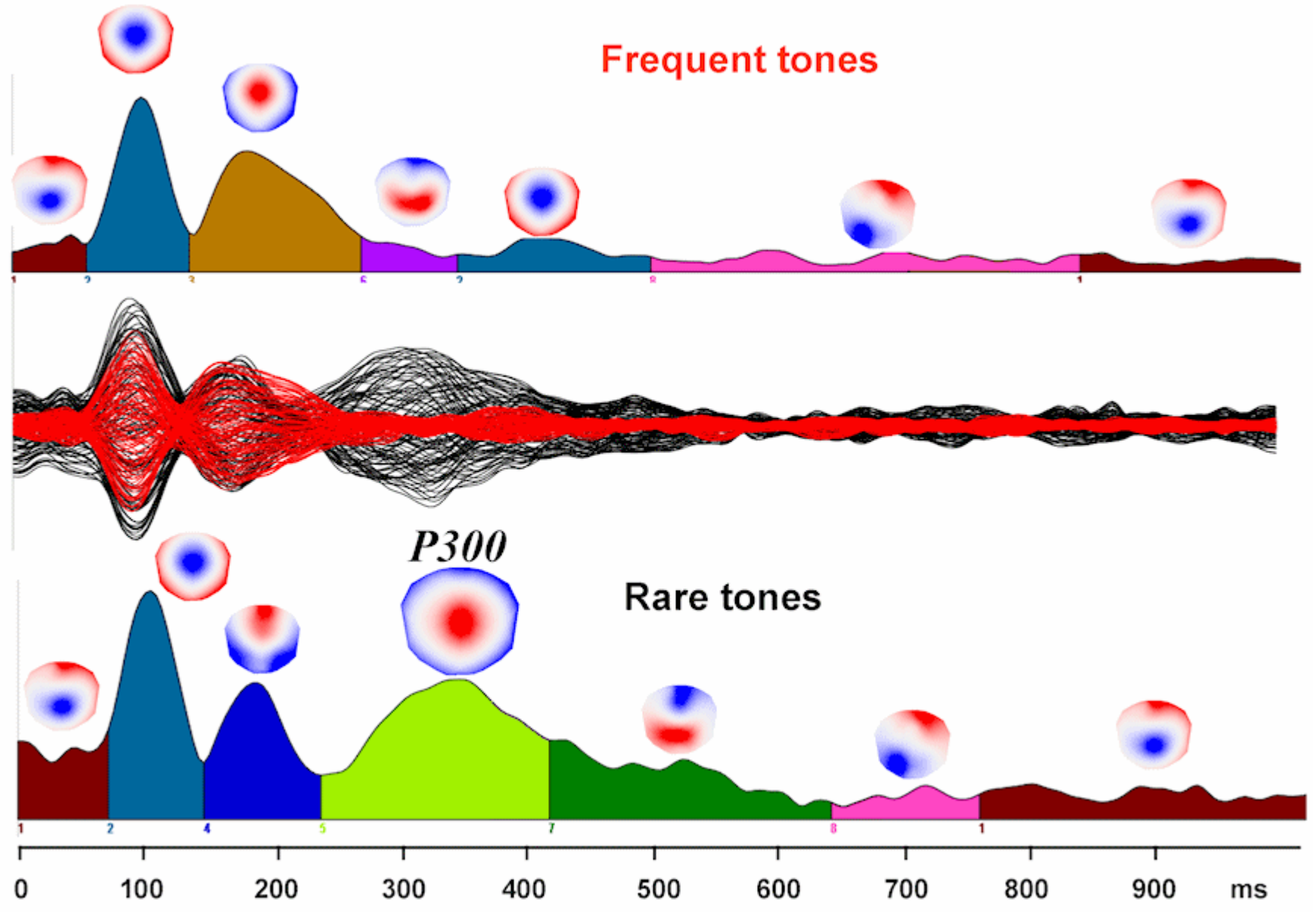
EEG microstates



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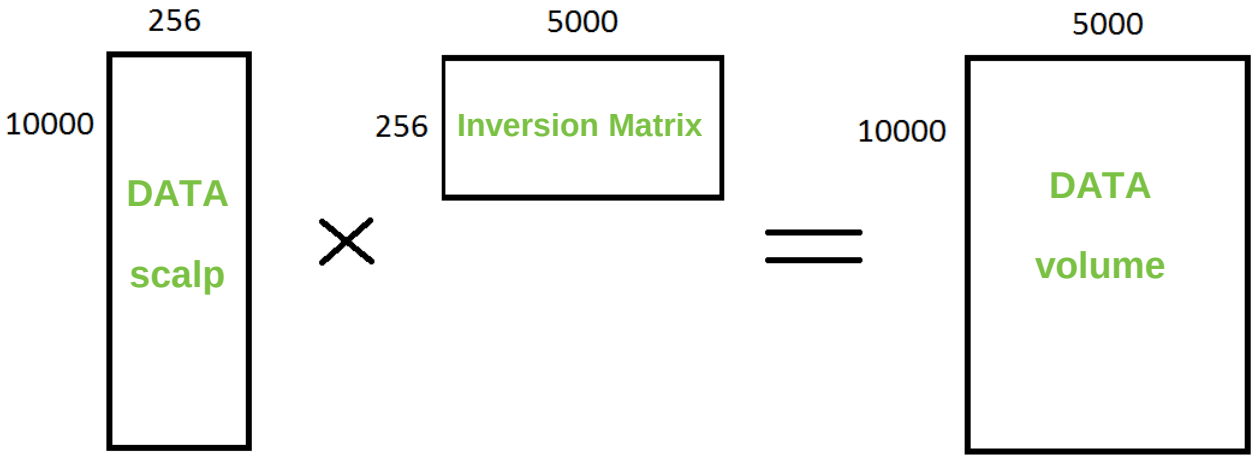
Source Localization of Brain Activity

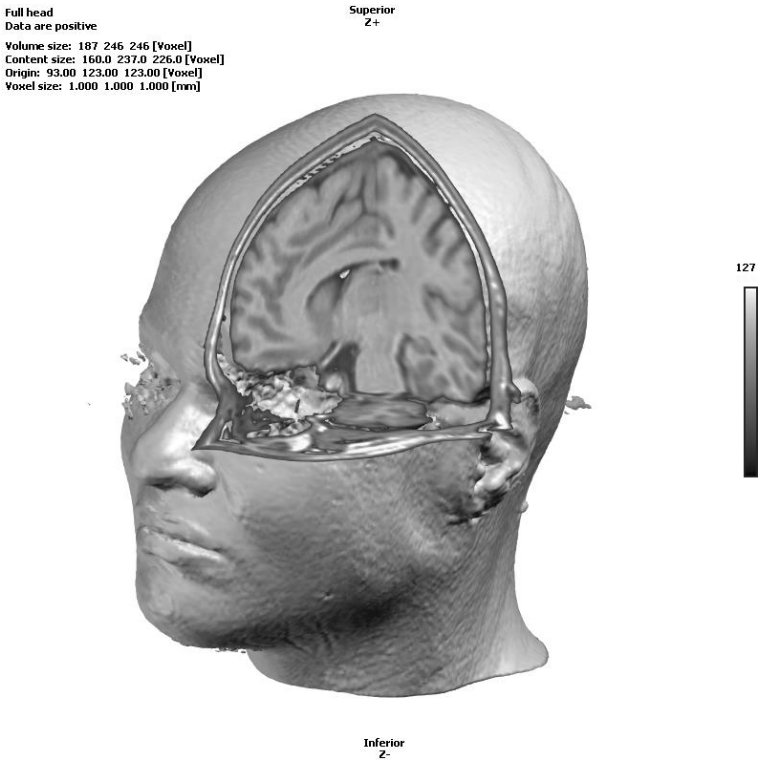
- **Effort to reconstruct sources of the brain activity in the volume (3D) from the scalp EEG measurement (2D).**

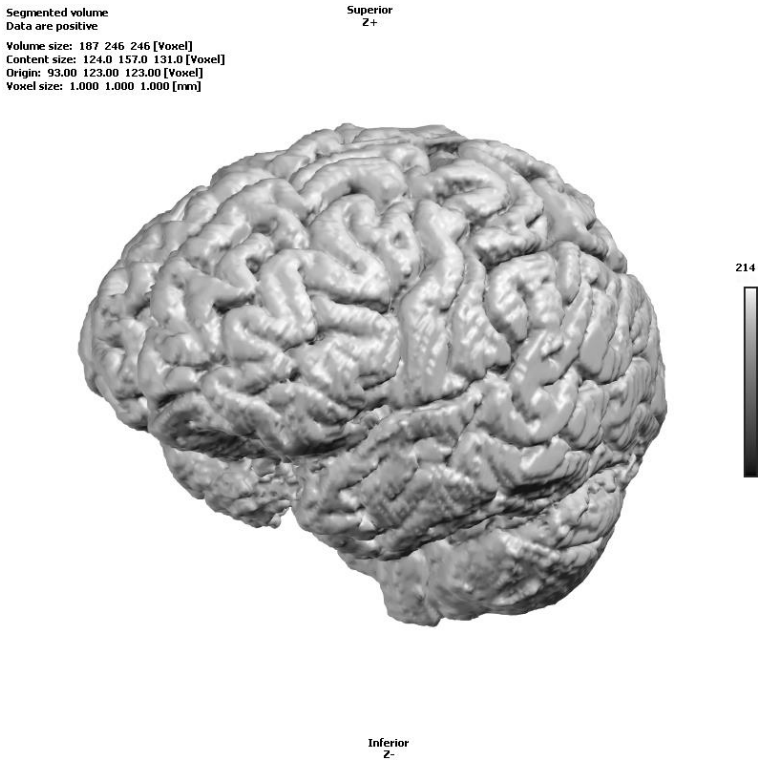
- Reconstructed signals are weaken and „blurred“ (distance and attenuation in the tissue)
- Many of necessary constants are not described or known well yet (conductance of skull)
- Mathematical and computation issues

- Practically – **fixed positions in the brain** (solution points - SP) and **inversion matrix** for the calculation from scalp data to signals localized in SP

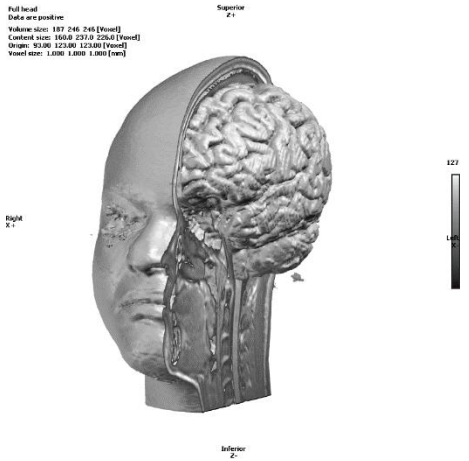


MRI





- **Noise Filtration**
- **Bias Field Correction**
- **Optimal orientation of the scan**



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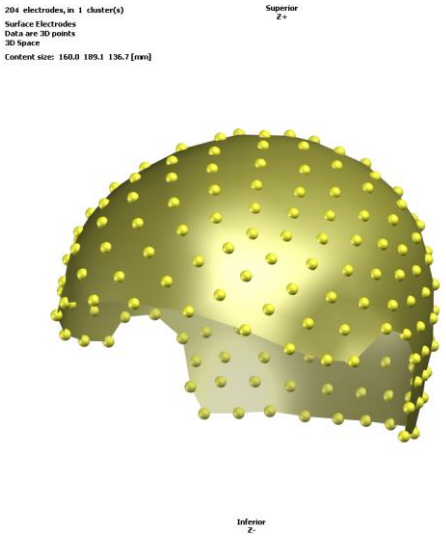
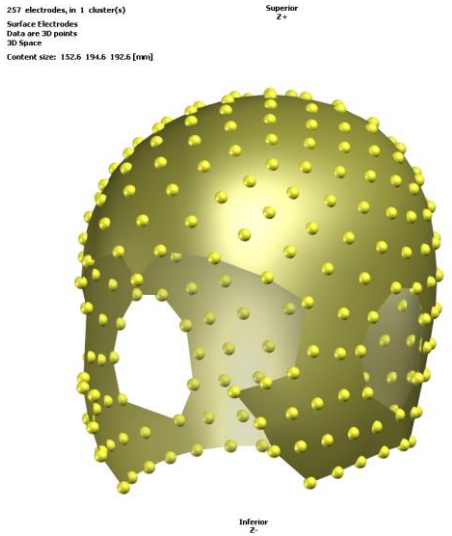
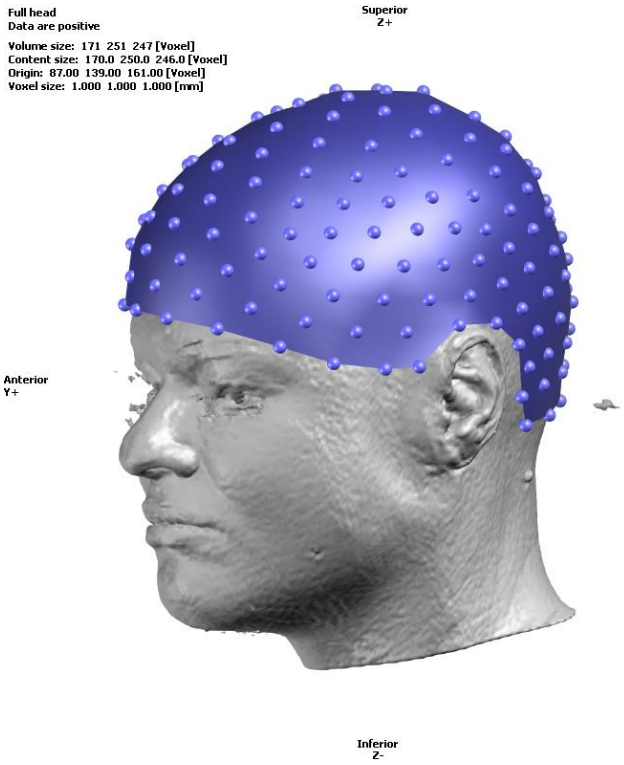
Electrodes

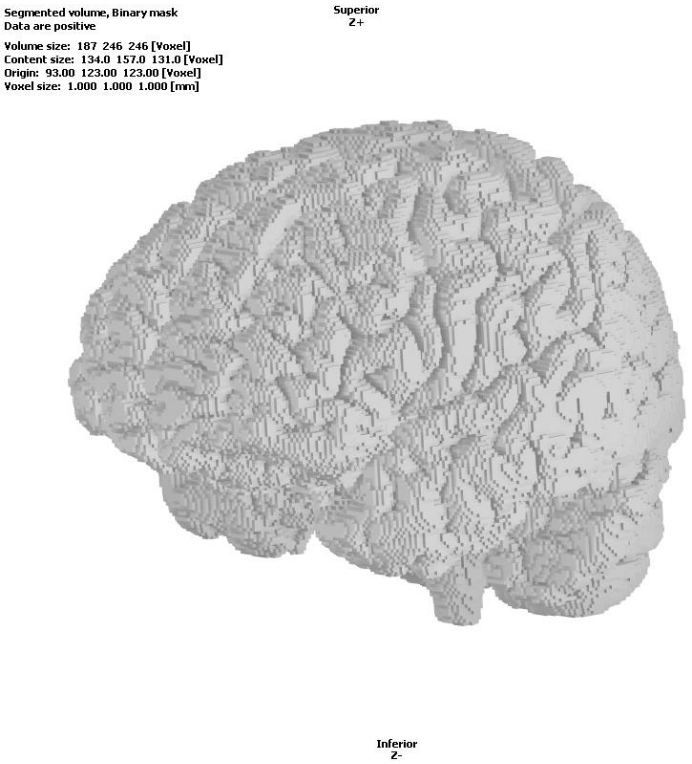


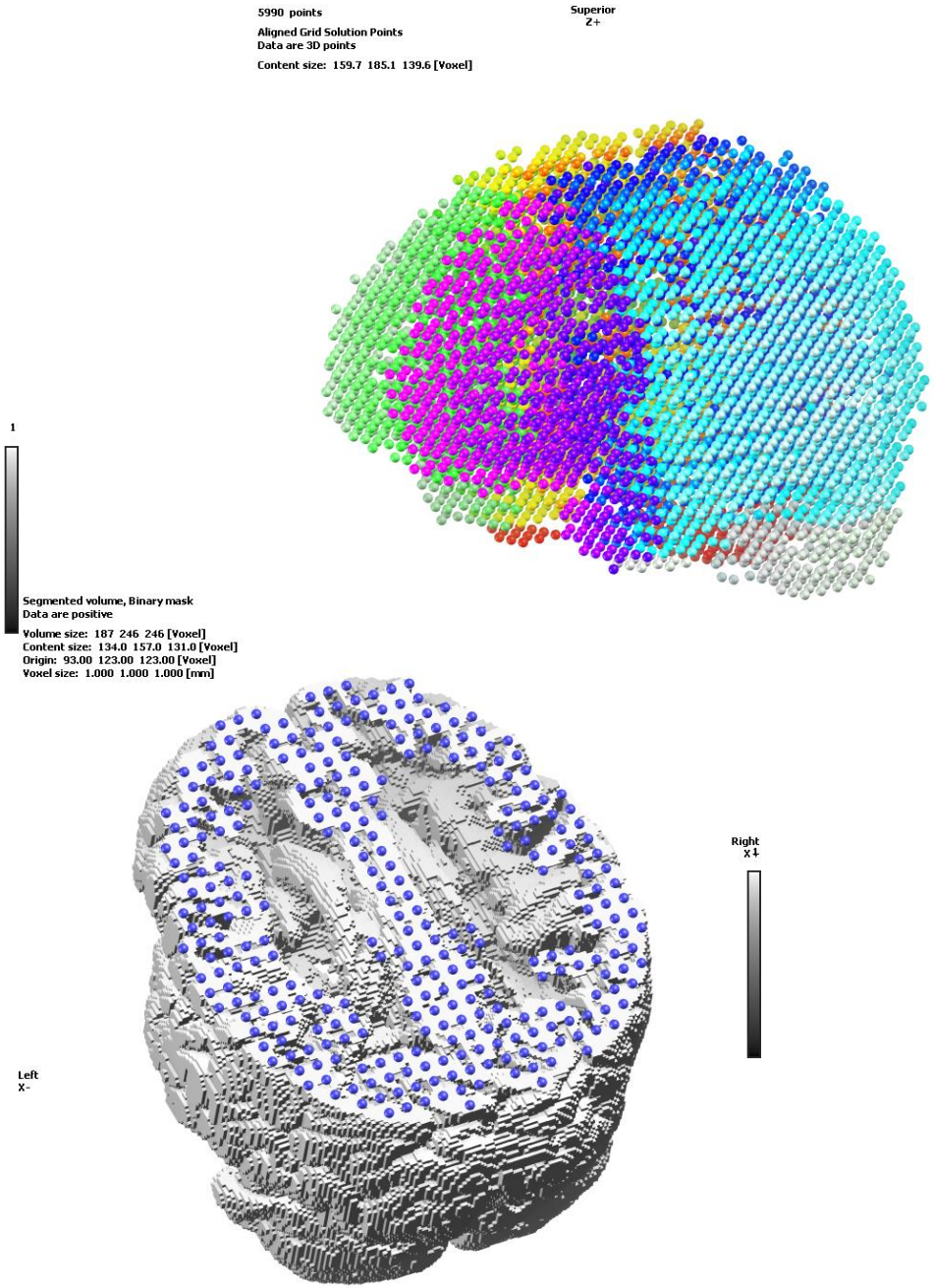




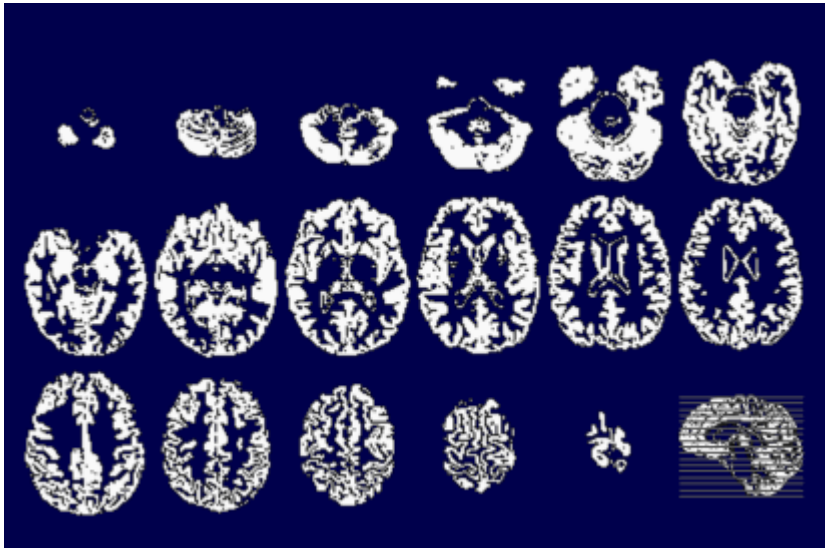
Registration of electrodes with MRI scan

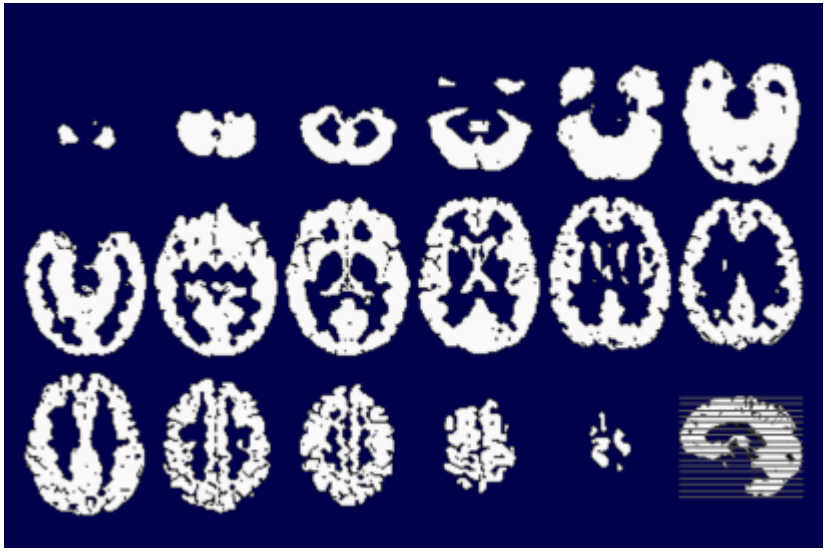
Solution Points





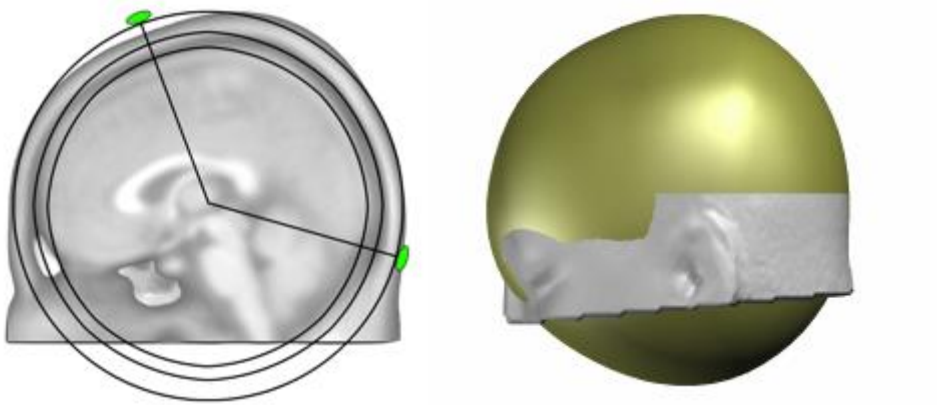
Gray matter vs Mask of gray matter



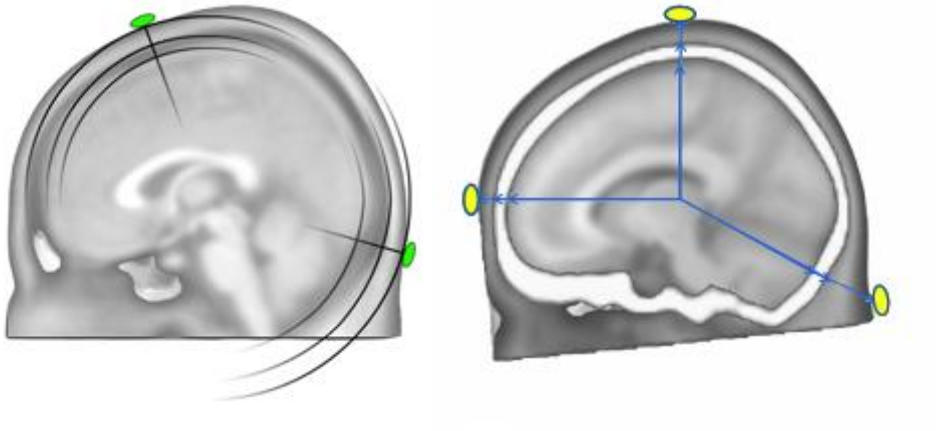


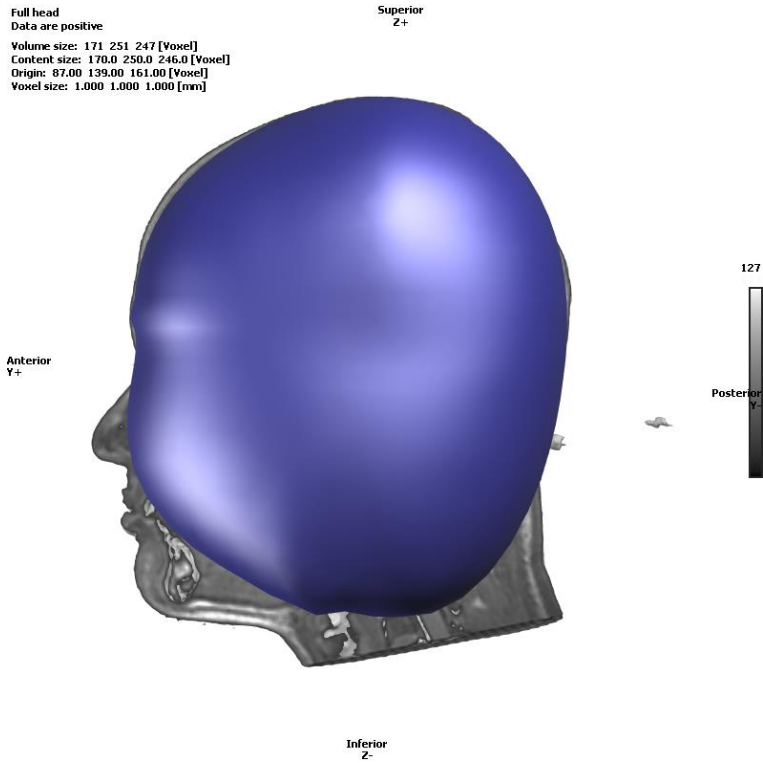
Forward model

SMAC - Spherical Model with Anatomical Constraints



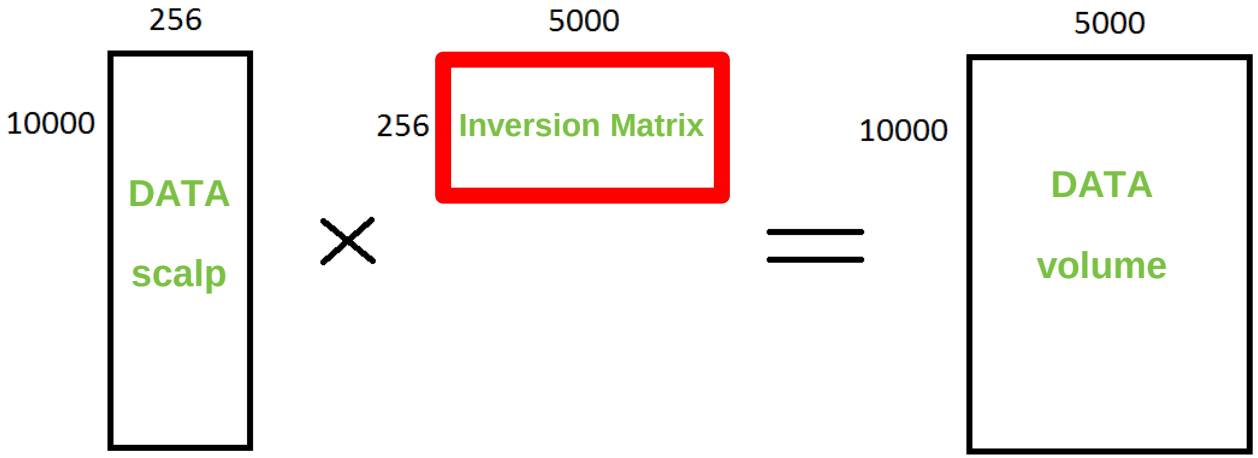
LSMAC - Locally Spherical Model with Anatomical Constraints

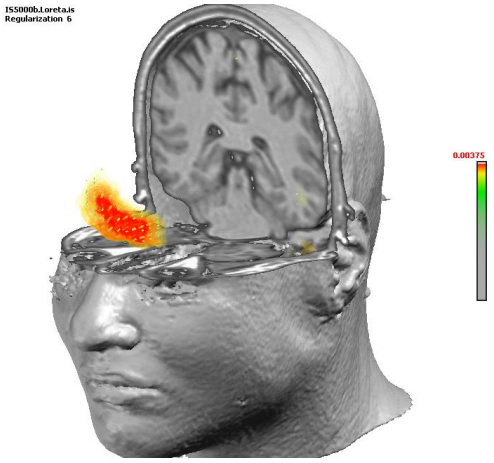




Inverse solution

LORETA, LAURA, EPIFOCUS, …





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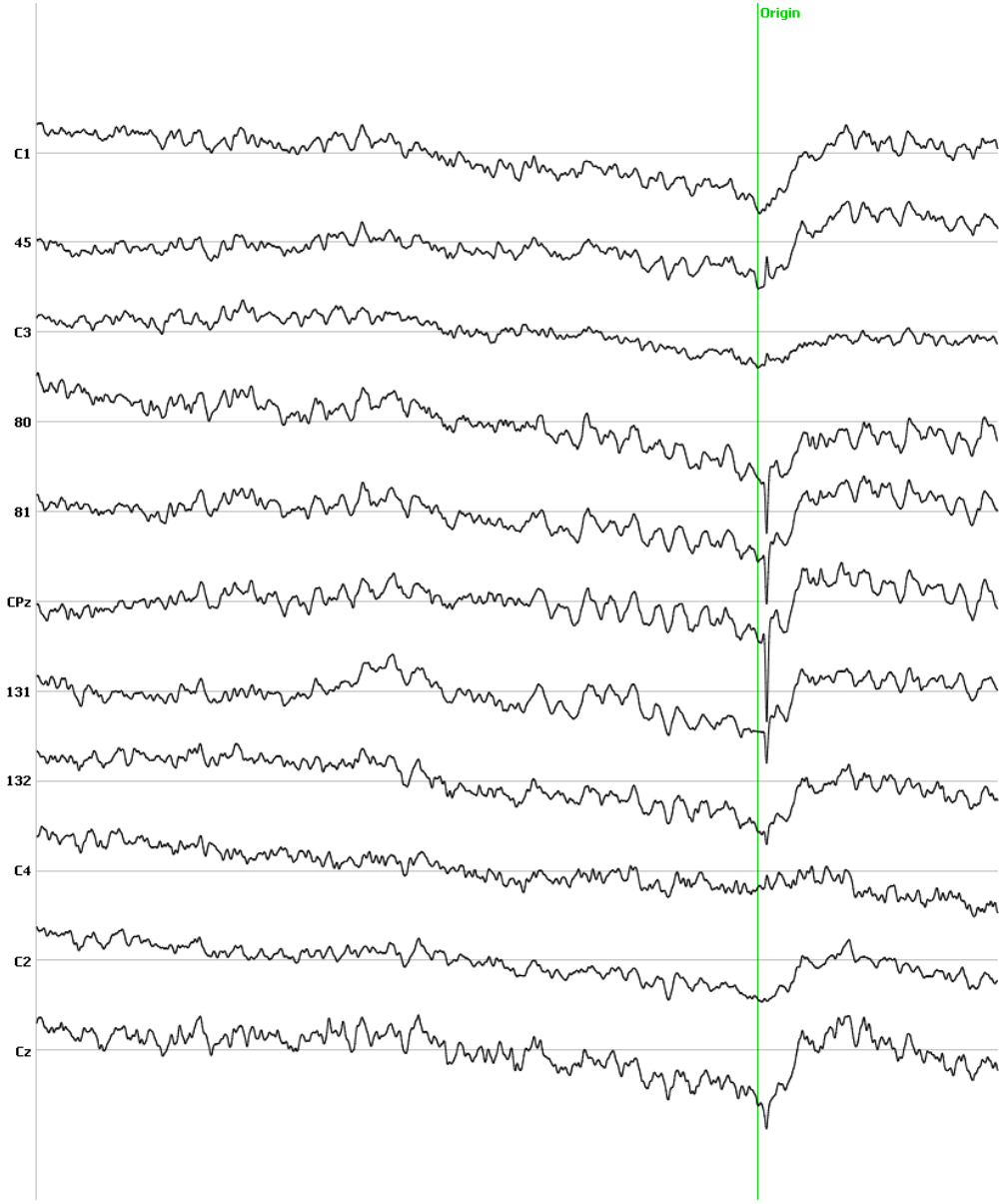
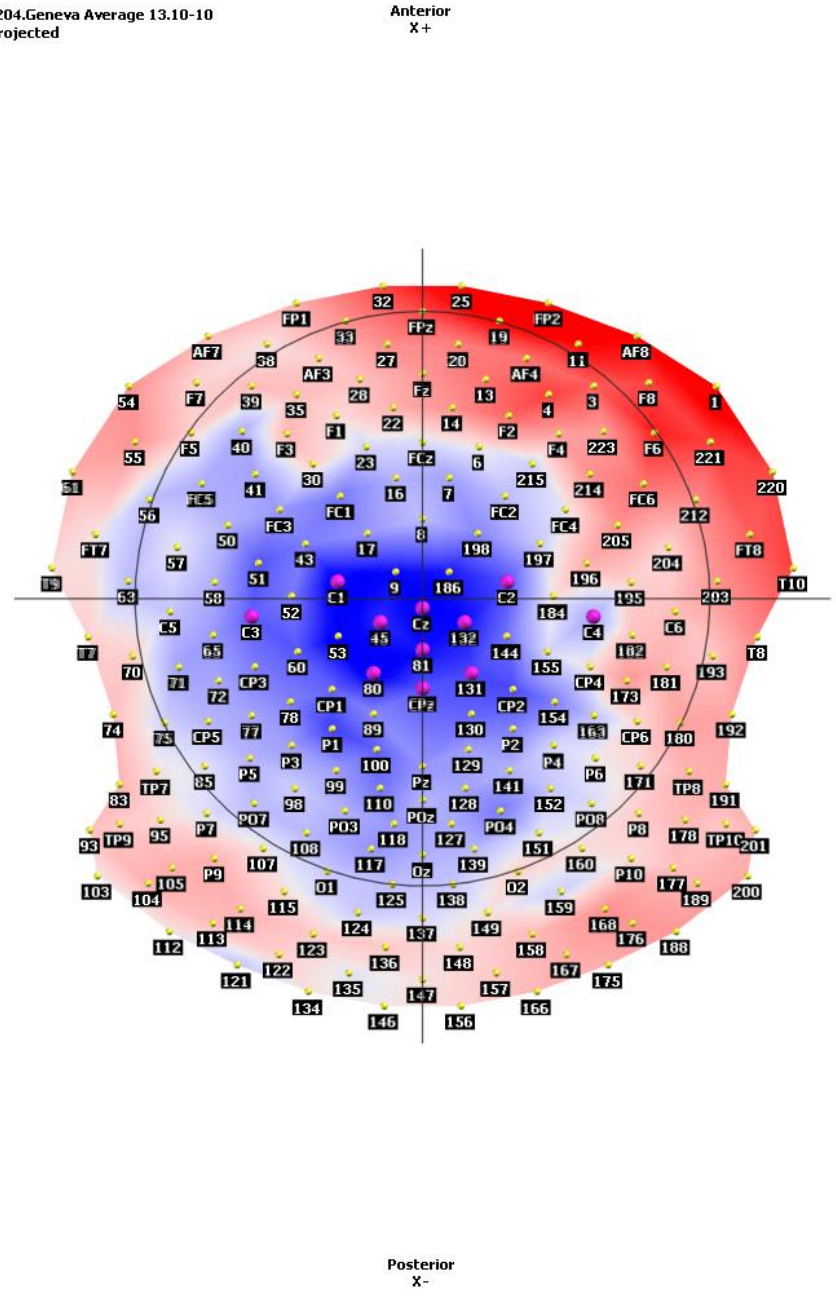
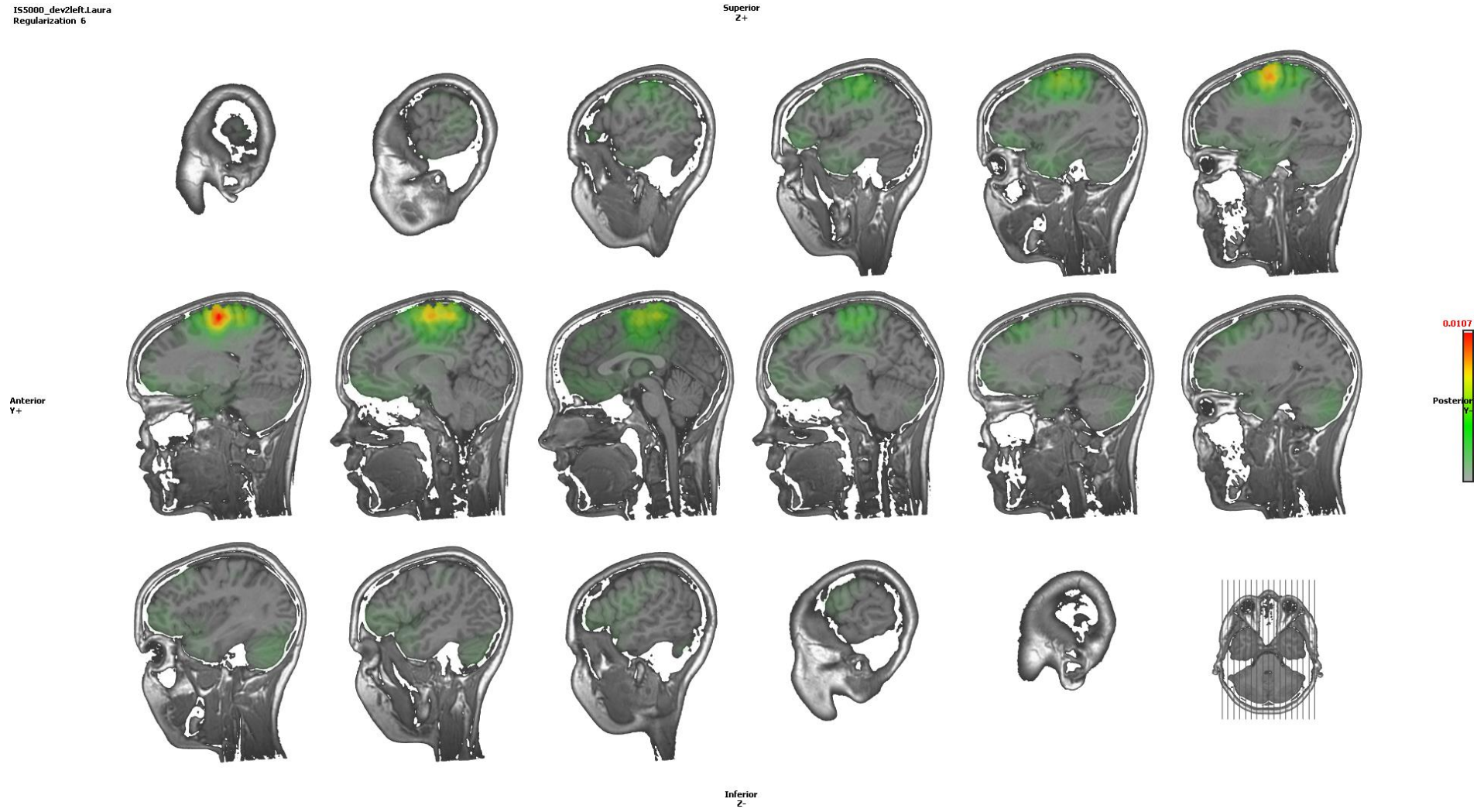
Readiness potential

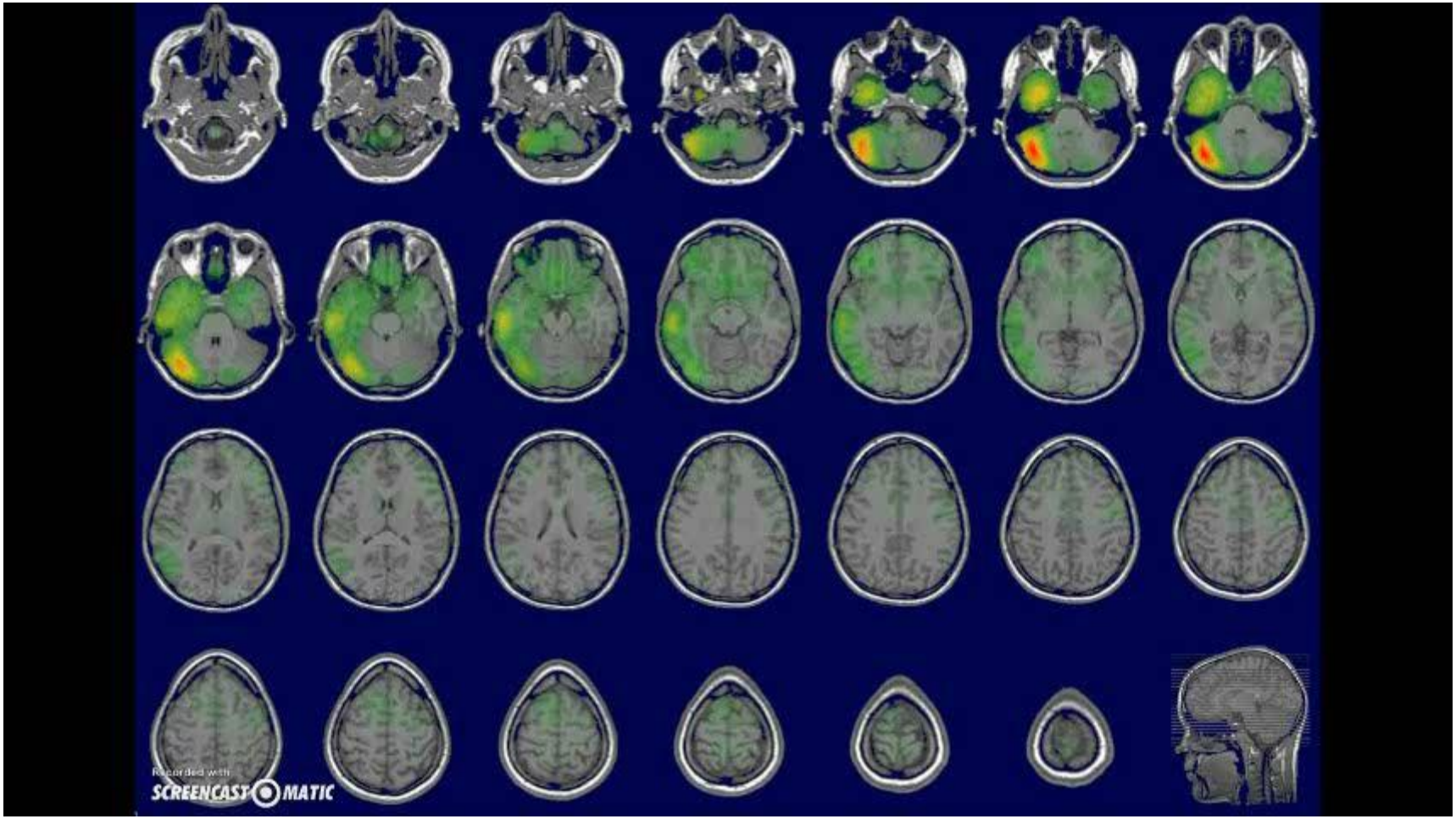




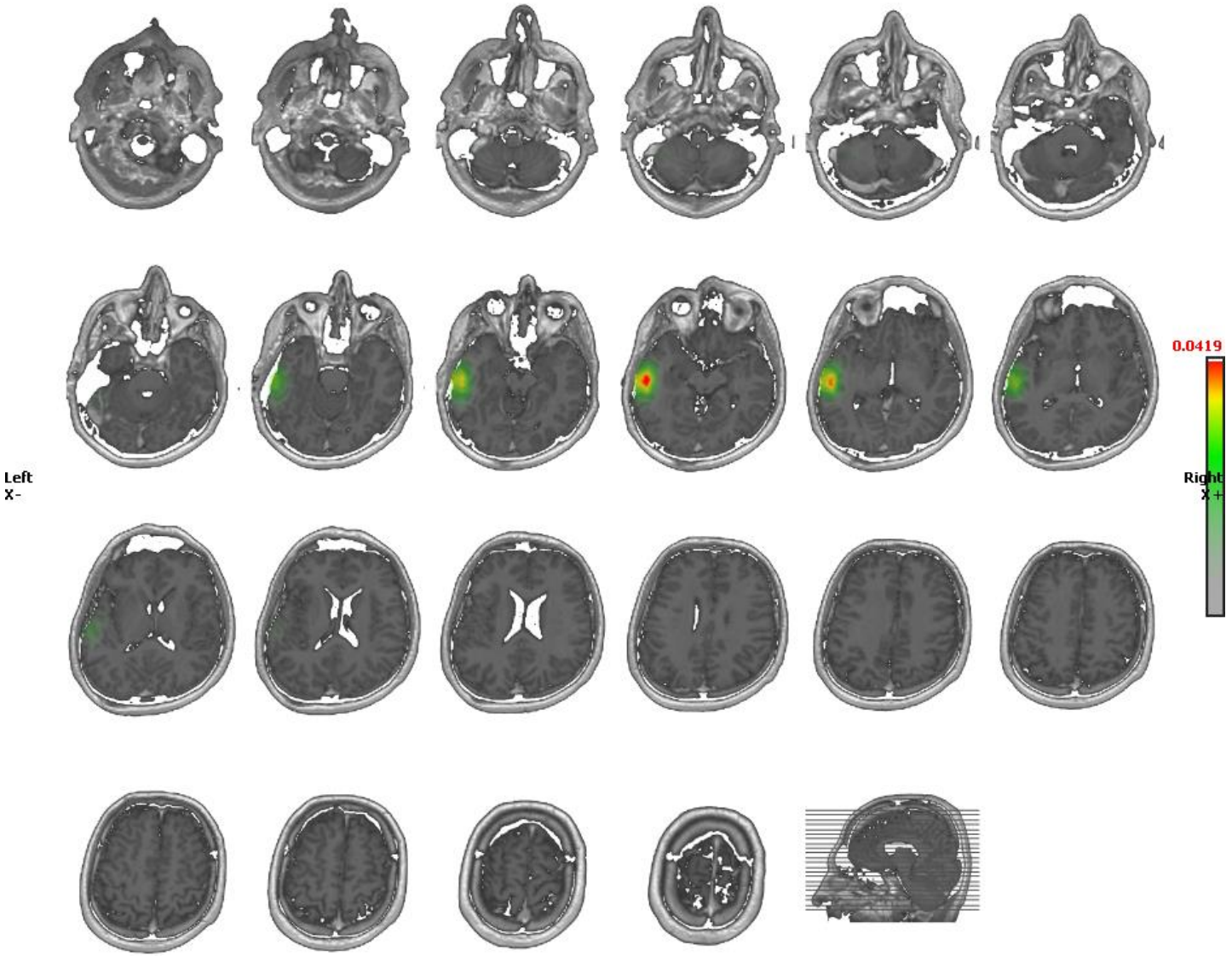
Readiness potential



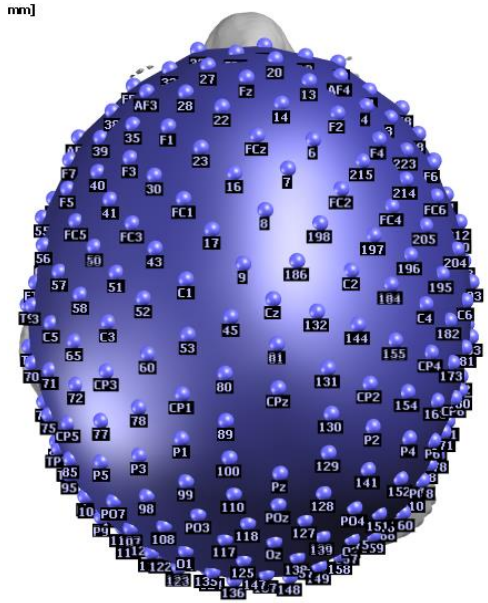
Readiness potential

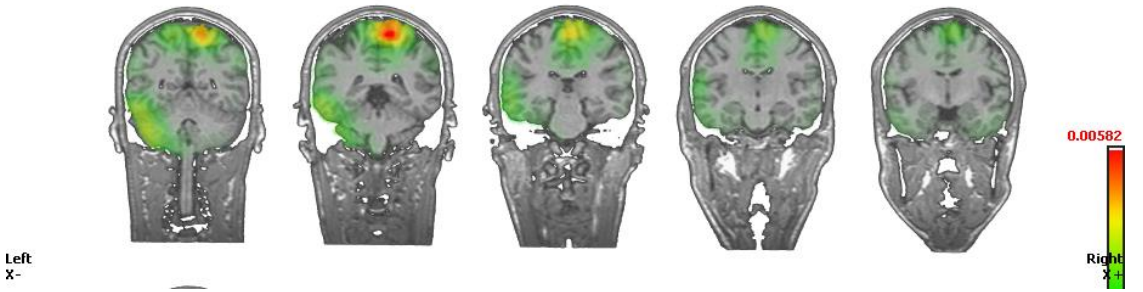


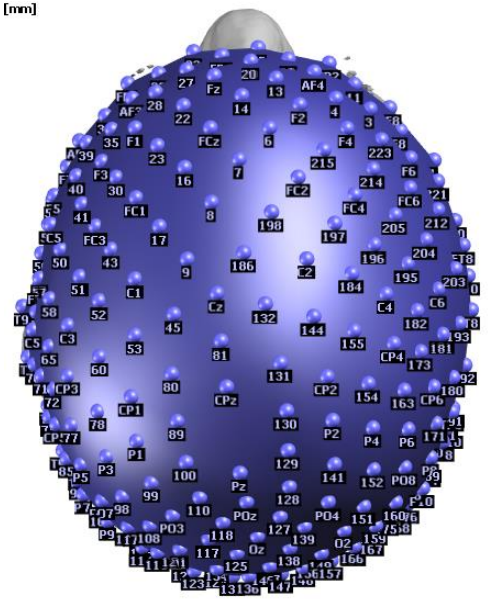
Epilepsy focus localization

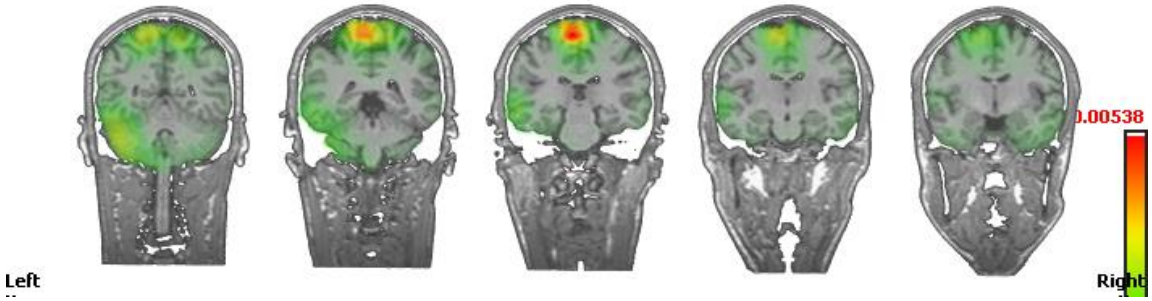


Electrodes Position









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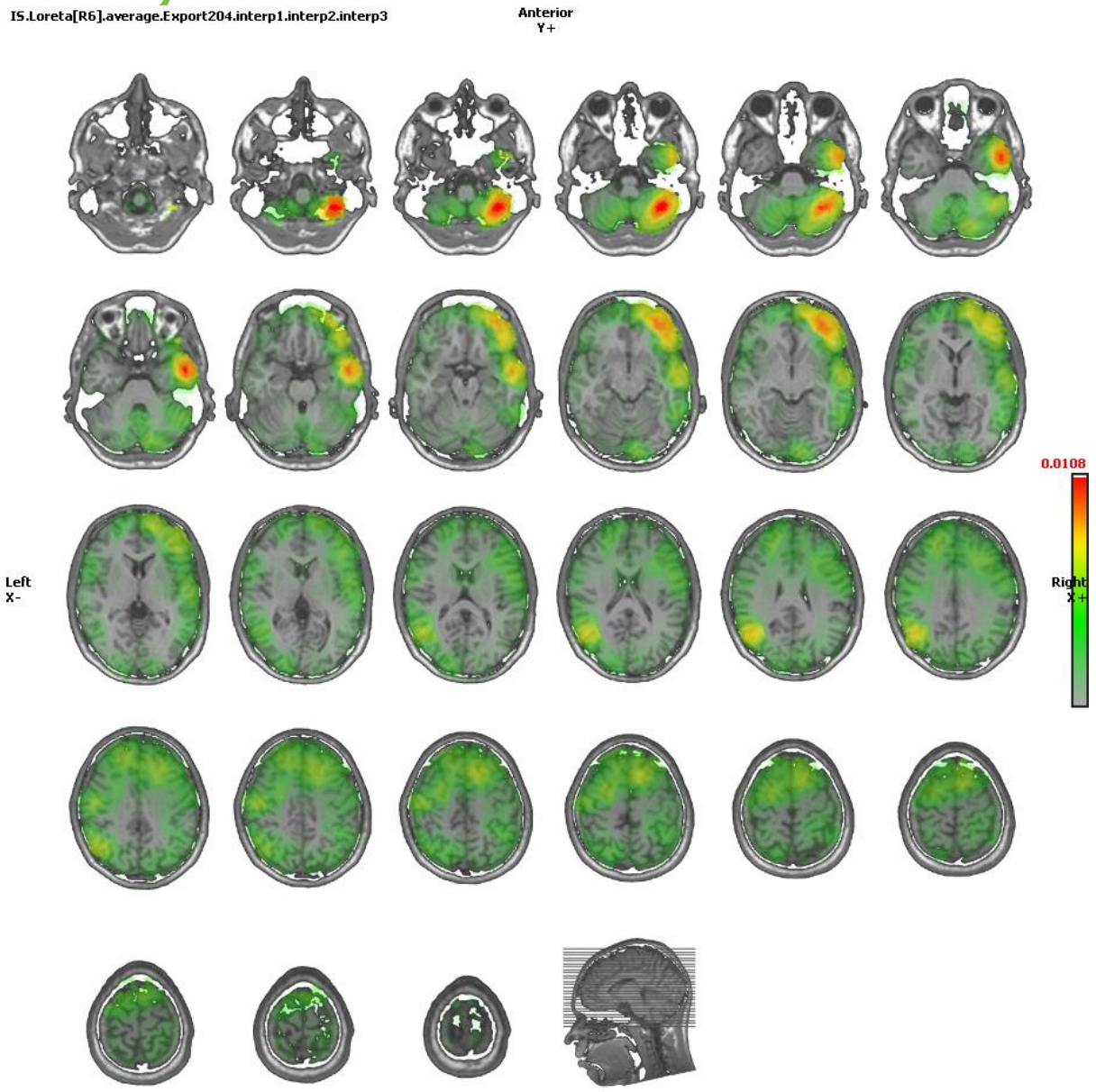
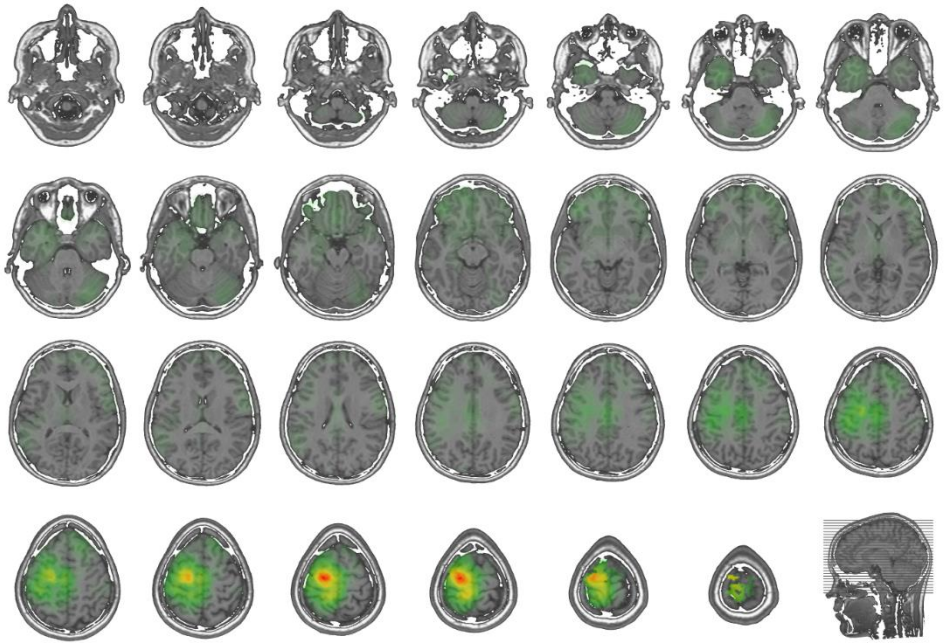
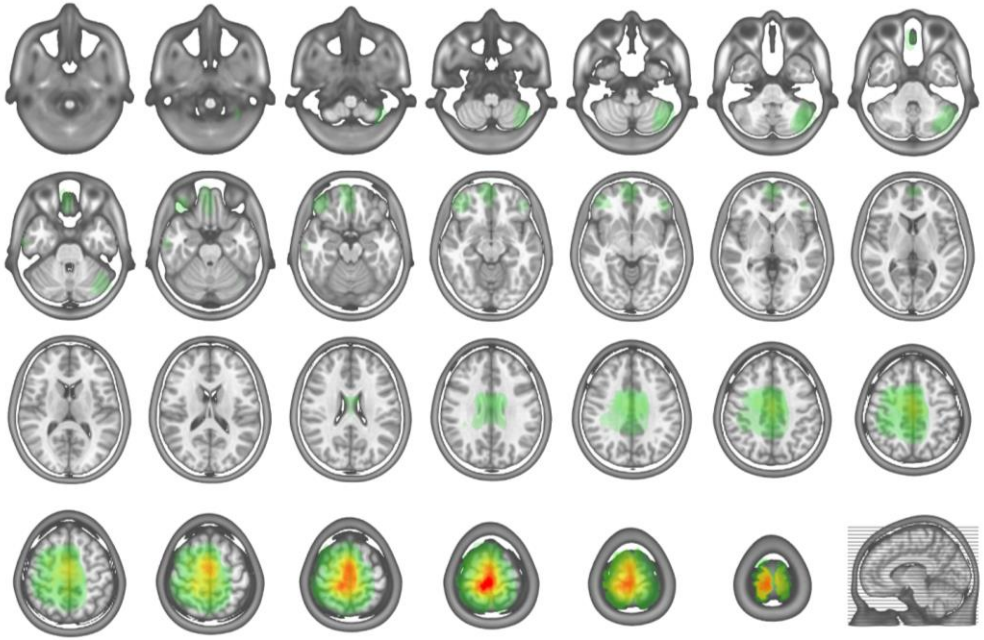
Data Quality

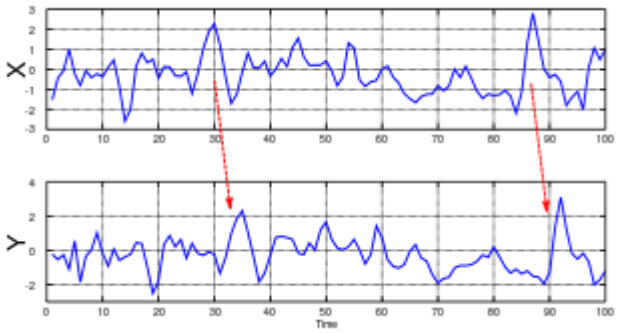


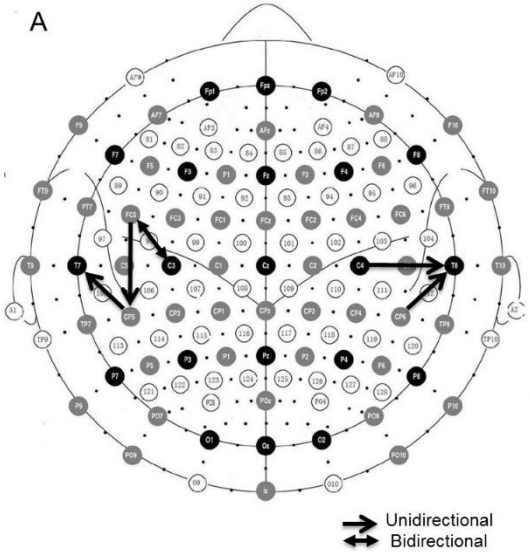
Forward model - MRI vs MNI template

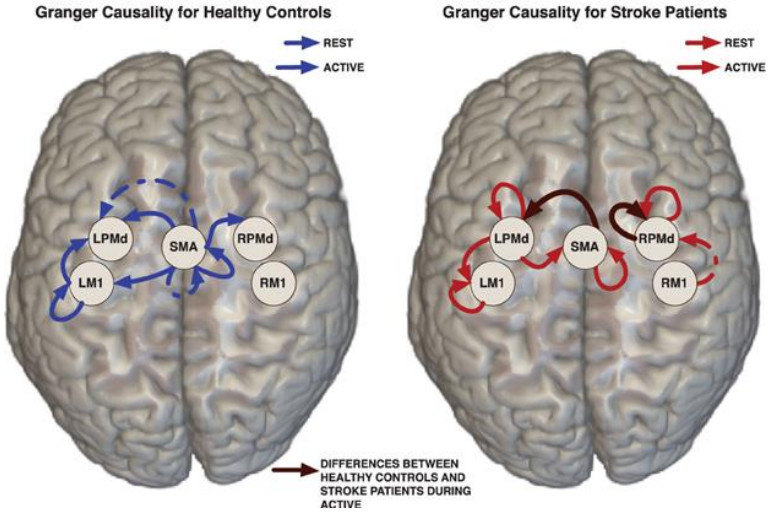




Effective Connectivity – Granger Causality







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Thank you for your attention

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