

Fourth BigBrain Workshop: Launch of the Helmholtz
International BigBrain Analytics Learning Laboratory (HIBALL)
- 26 June 2020



Workflow integrating The Virtual Brain (TVB) with data features of the BigBrain

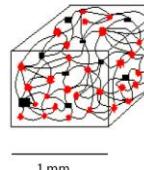
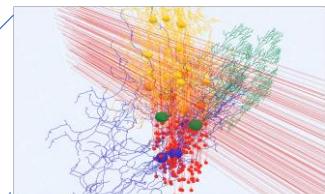
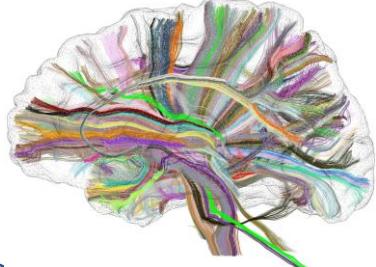
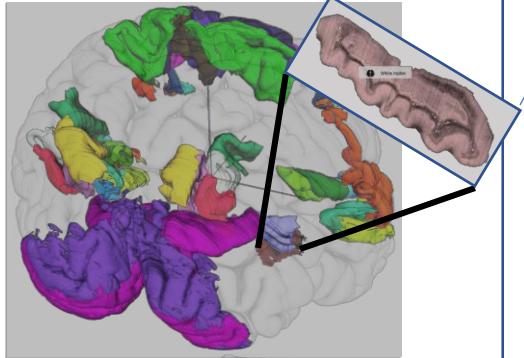
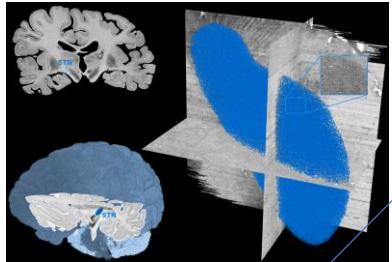
Huifang Wang



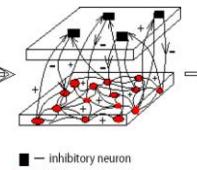
Institut de
Neurosciences
des Systèmes

Aix-Marseille
université

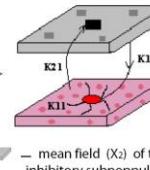
Inserm



1 mm



■ — inhibitory neuron
● — excitatory neuron



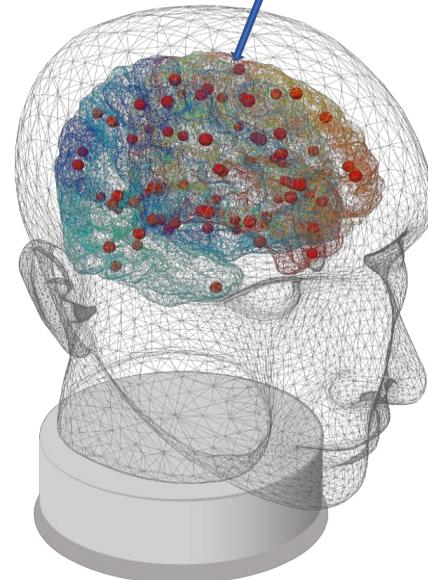
— mean field (X_2) of the inhibitory subpopulation
— mean field (X_1) of the excitatory subpopulation

$$\dot{x}_i = f(\theta_i, x_i, C_i^l, \sum C_{ij}^g x_j)$$

PROOF OF CONCEPT

Region specific information from the Big Brain Atlas changes the network dynamics sufficiently to improve the model inversion of human brain imaging data.

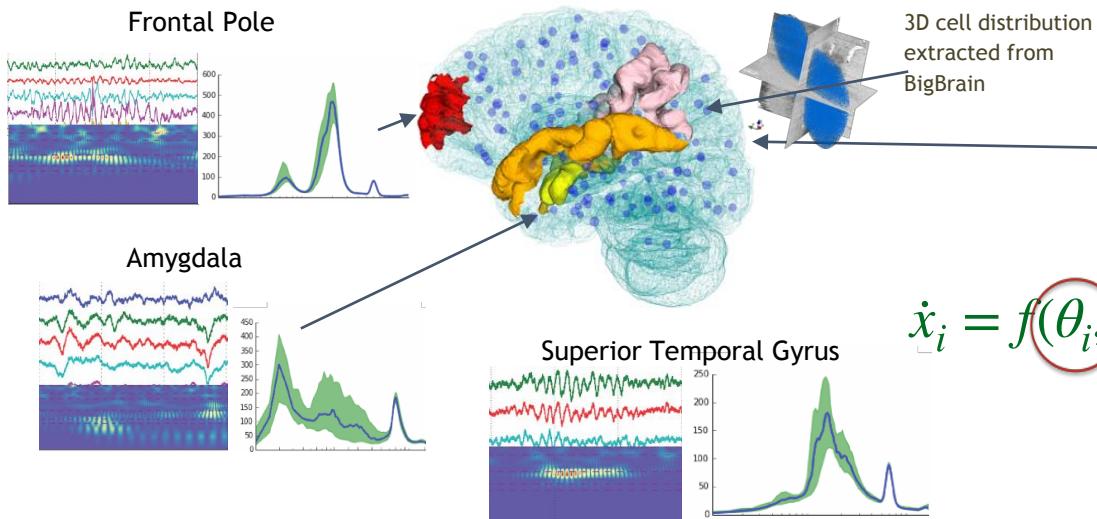
The workflow integrates Big Brain data as a prior into a Bayesian Inference frame work.



SGA2 SGA3
CDP3 WP1

April, 2020

Outline: Today's talk



$$\dot{x}_i = f(\theta_i, x_i, C_i^l, \sum C_{ij}^g x_j)$$

- VEP Atlas --- Anatomic and functional
- Functional regional variance :
 - Mapped upon neural mass parameters enabling TVB simulations/inference
 - Validation of anatomical region variance
- VEP pipeline --- ongoing trial to find EZ
 - VEP – region variance version: Showcases 2 of WP1 in SGA3 of HBP

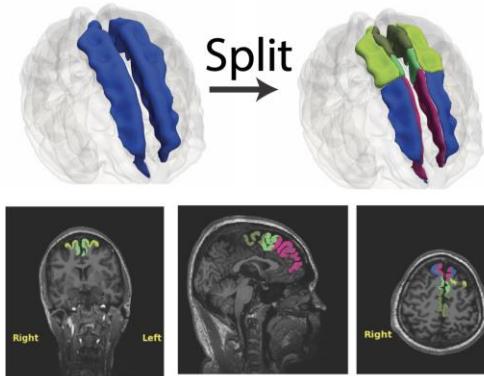


VEP anatomical Atlas



Destrieux atlas VEP atlas

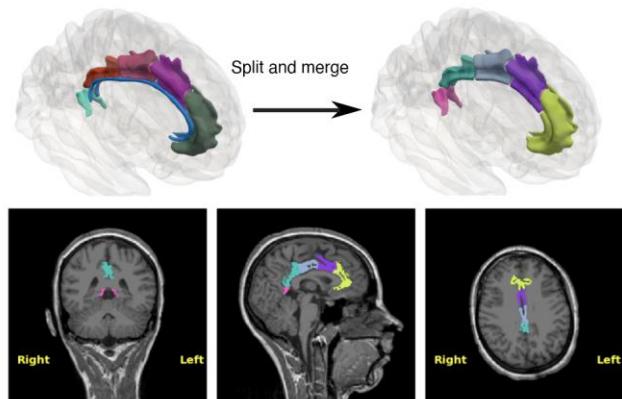
Split



SMA
PreSMA
F1-mesial-prefrontal
F1-lateral-premotor
F1-lateral-prefrontal

Destrieux atlas VEP atlas

Split and merge

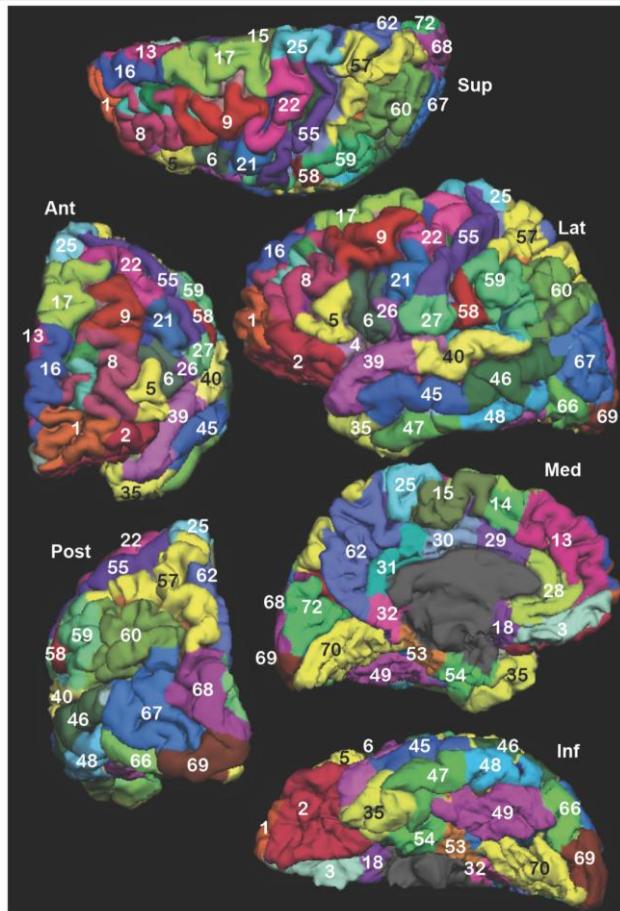


Posterior-cingulate-cortex-retrosplenial-gyrus
Posterior-cingulate-cortex-dorsal

Middle-cingulate-cortex-posterior-part
Middle-cingulate-cortex-anterior-part
Anterior-cingulate-cortex

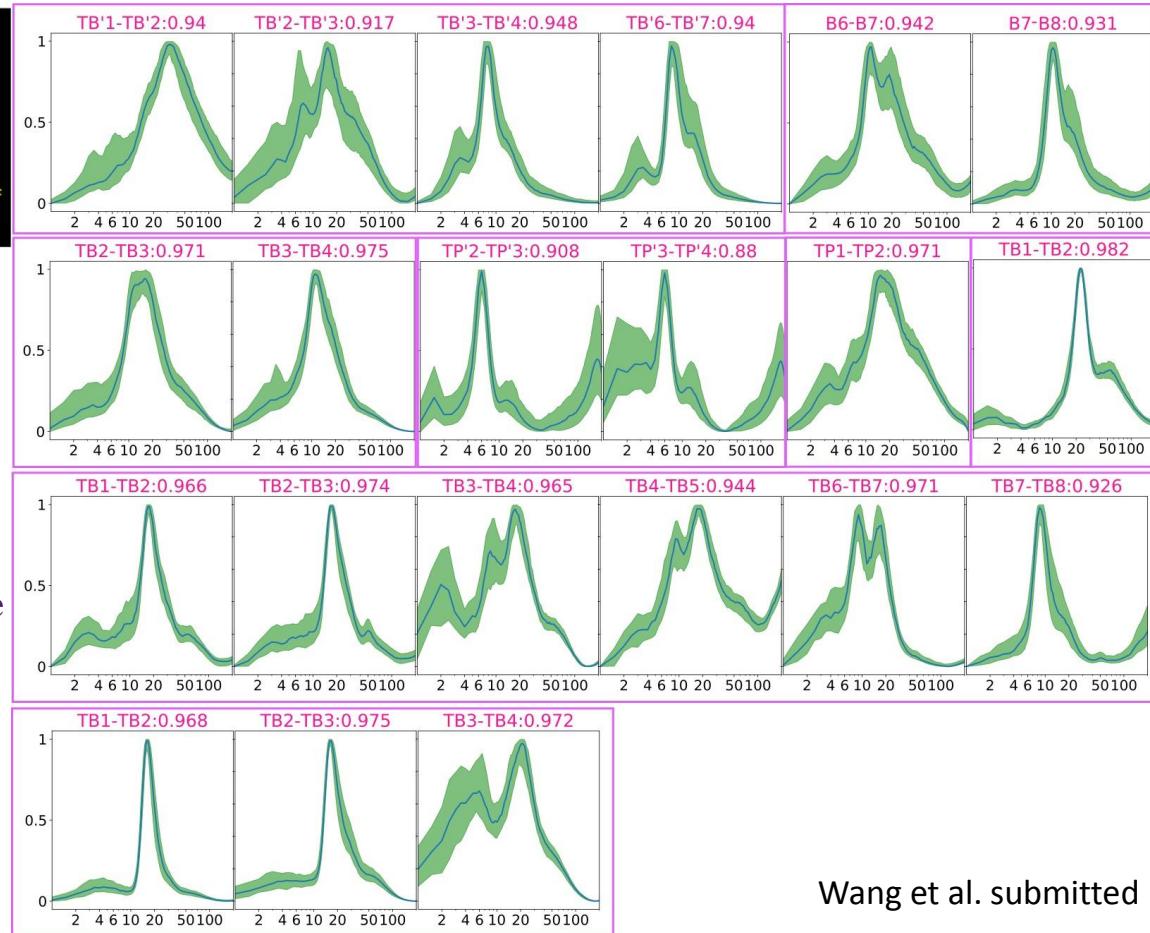
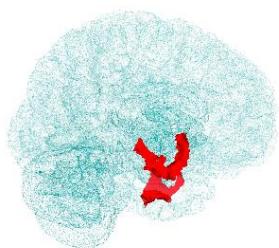
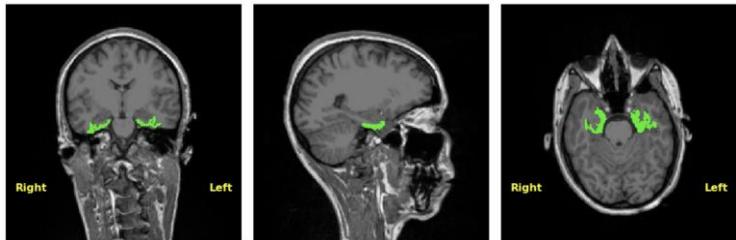
- Automatic labelling, personalization
(Based on Freesurfer Destrieux atlas)
- Modified to match clinical practice
- Improved the forward model
- Number of regions: 162
- 50 cohort patients
- 400 Trial patients
- Routine use in Marseille

Wang et al. submitted





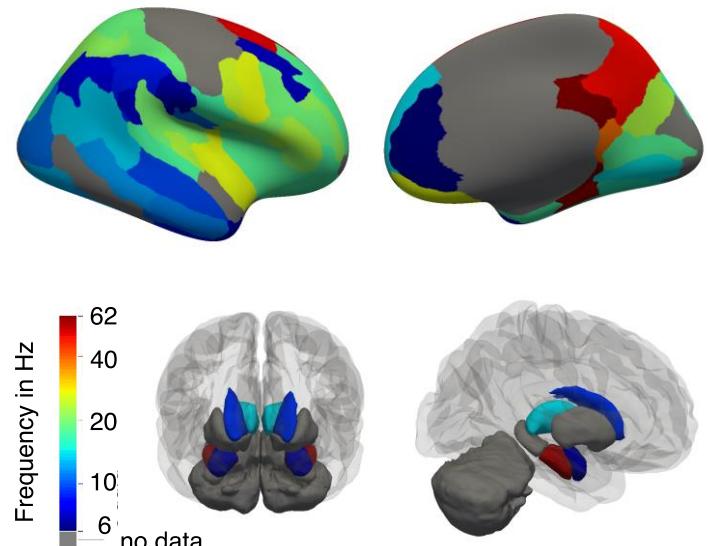
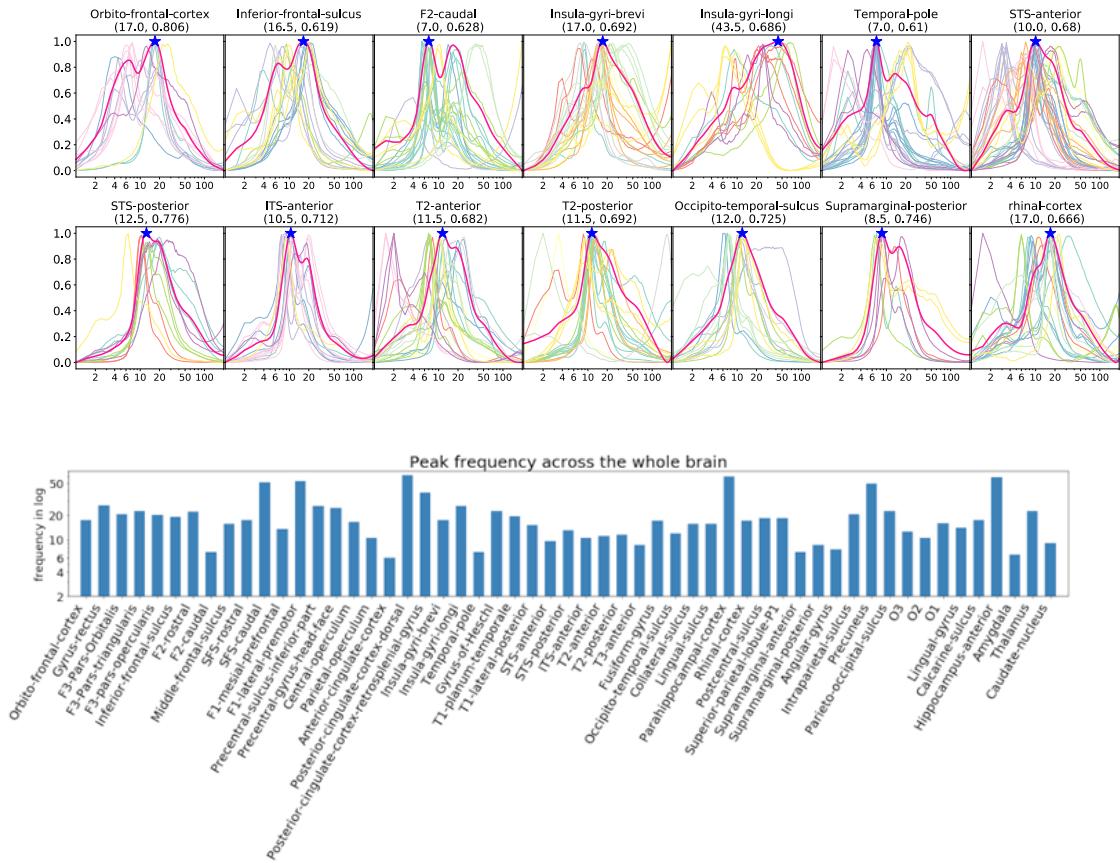
Example: Rhinal cortex



The power spectral density was stable over time
but may vary between different depths of
the same electrodes



VEP functional Atlas



Spectral regional variation of resting state activity in SEEG

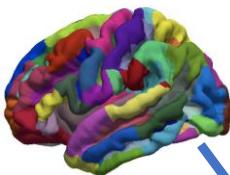
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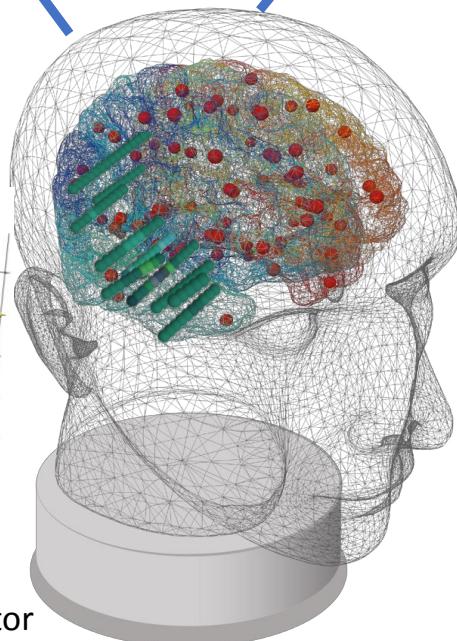
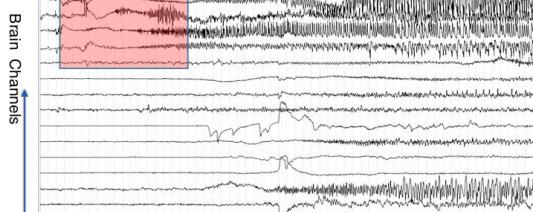
Workflow of VEP



VEP atlas



connectivity



no seizure

seizure

x_0

2D Epileptor

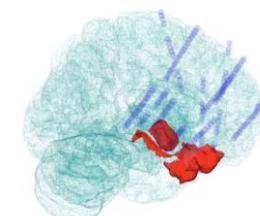
Clinical trial:

randomized parallel-group study trial
(Coordinator F. Bartolomei; Scientific Director V. Jirsa)

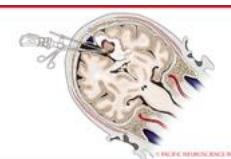


13 French clinical centers

400 prospective patients during 2019 – 2022

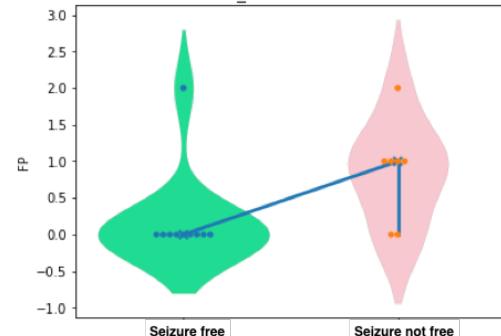


Epileptogenic zones



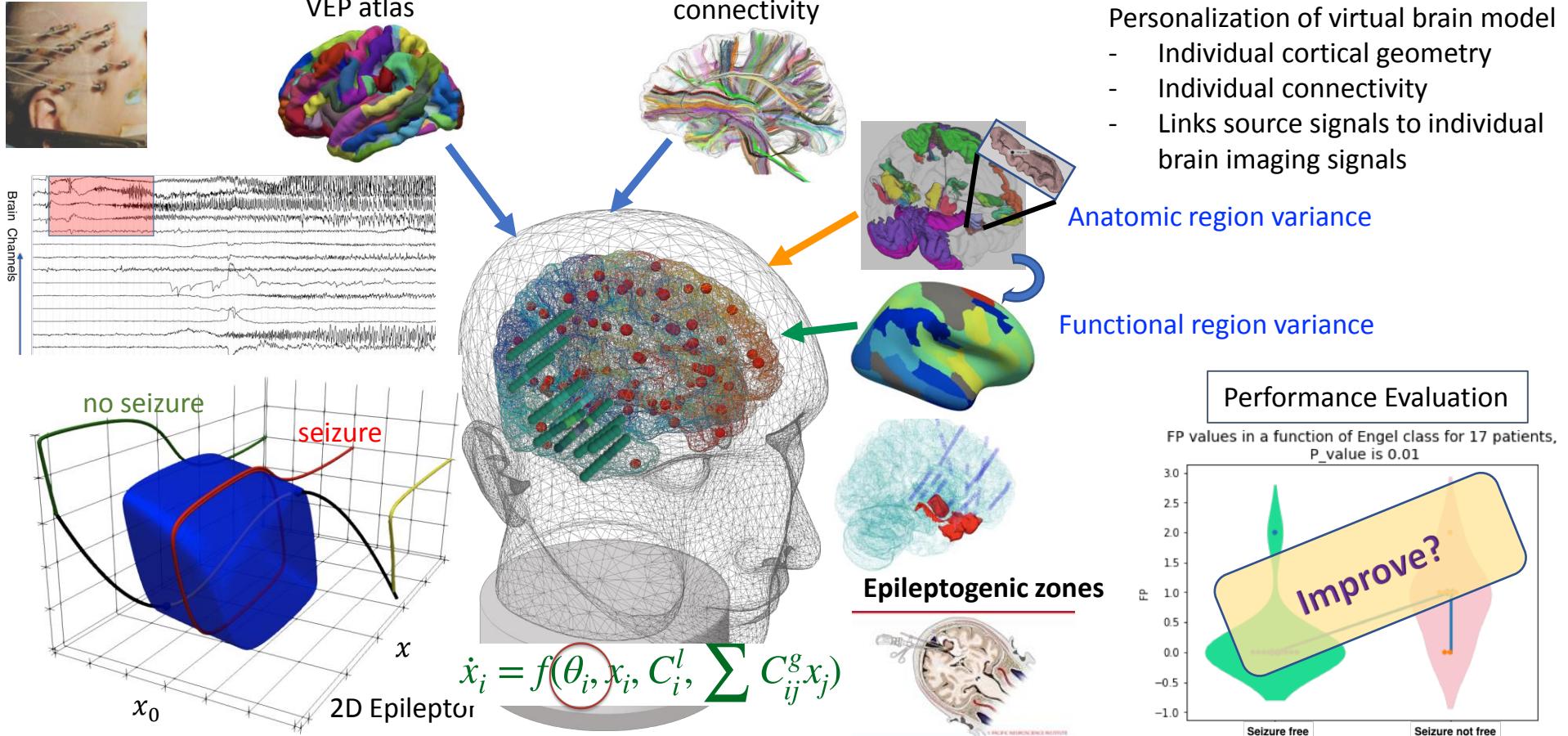
Performance Evaluation

FP values in a function of Engel class for 17 patients,
 P_{value} is 0.01





VEP : Region variance version





THANK YOU!

Viktor Jirsa

Randy McIntosh

Katrin Amunts

Timo Dickscheid

Egidio D'Angelo

Fabrice Bartolomei

Patrick Chauvel

Maxime Guye

Christian Bénar

Julia Scholly

Paul Triebkorn

Marmaduke Woodman

Viktor Sip

Spase Petkoski

Francesca Melozzi

Meysam Hashemi

Lionel Kusch

Kashyap Ananth

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Jan Fousek