



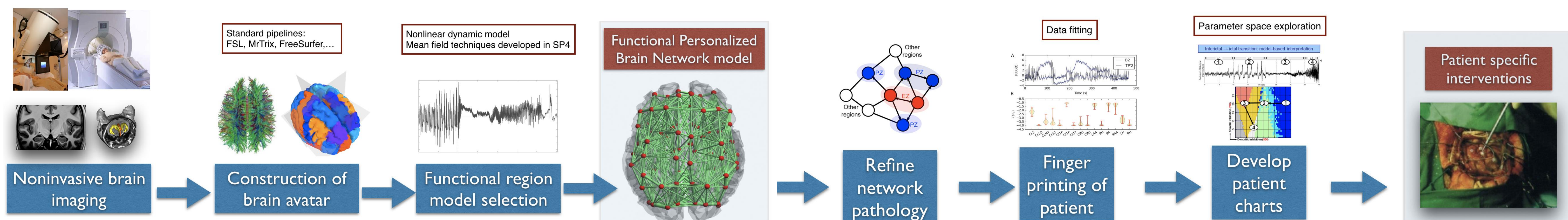
THE VIRTUAL EPILEPTIC PATIENT WORKFLOW

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OVERVIEW

We developed a workflow of Virtual Epileptic Patient (VEP) brain model to brain interventions based on personalized brain network models derived from non-invasive structural data of individual patients with drug-resistant epilepsy (Jirsa et al., 2017)

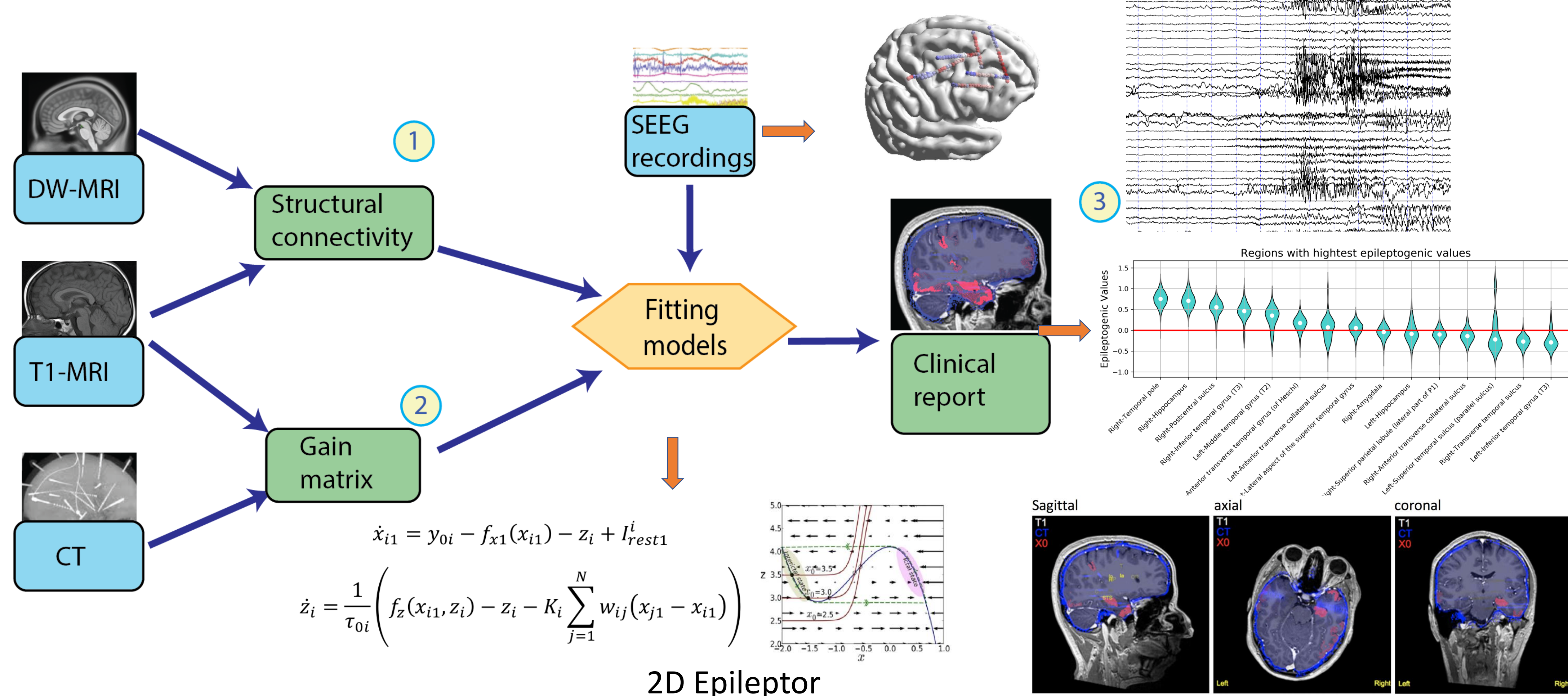


THE VIRTUAL PATIENT FOR CLINICAL TRIALS (EPINOV PROJECT)

For a given patient VEP combines structural information with large-scale brain modelling based on The Virtual Brain (TVB) technology and produces a clinical report depicting specific heat maps estimating the degree of epileptogenicity projected on the patient's brain anatomy. Evaluation on the retrospective patients shows the potential: →

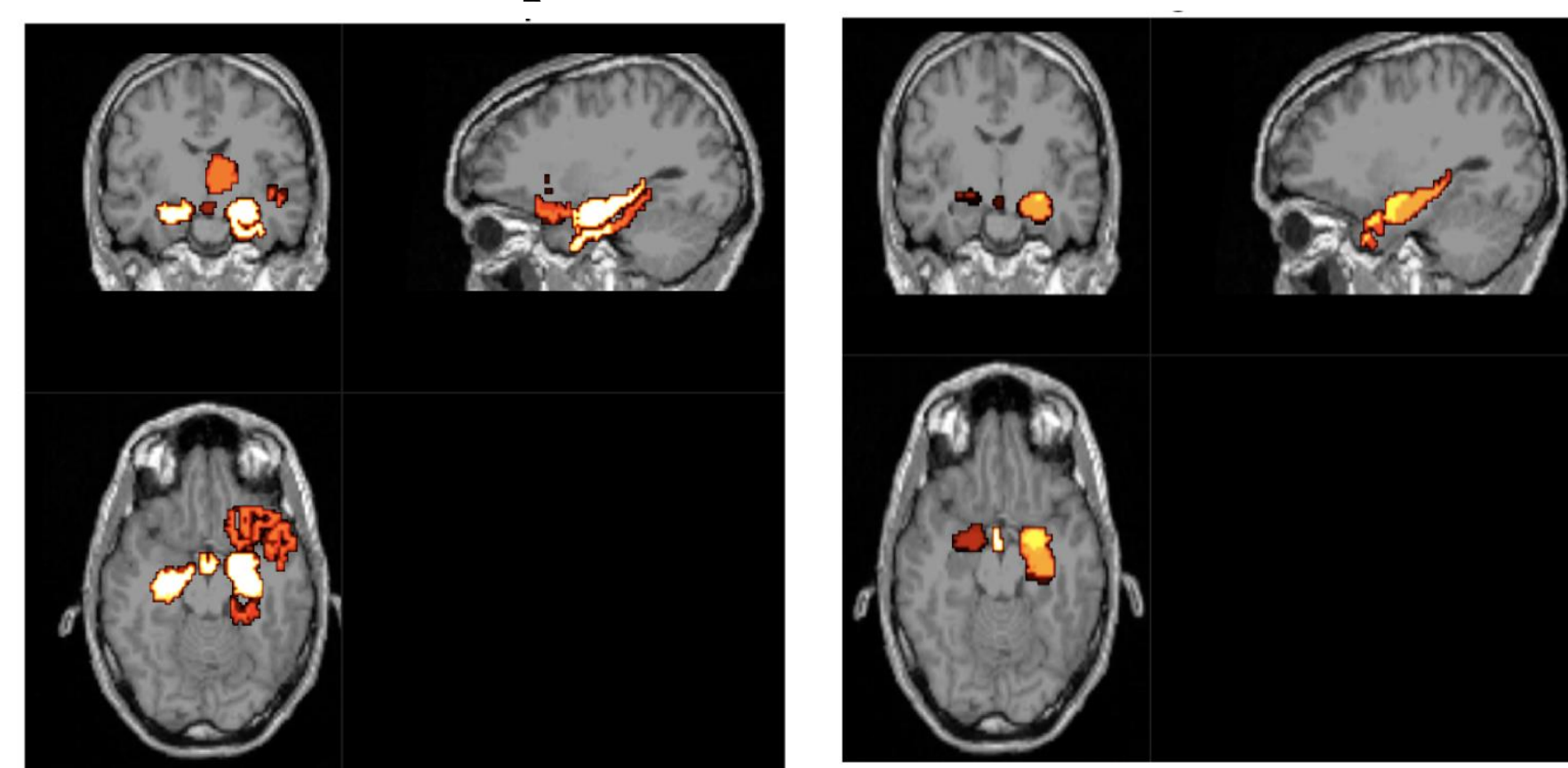
- Improving success rate in epilepsy surgery
- Minimizing invasiveness
- Improving diagnosis

Workflow

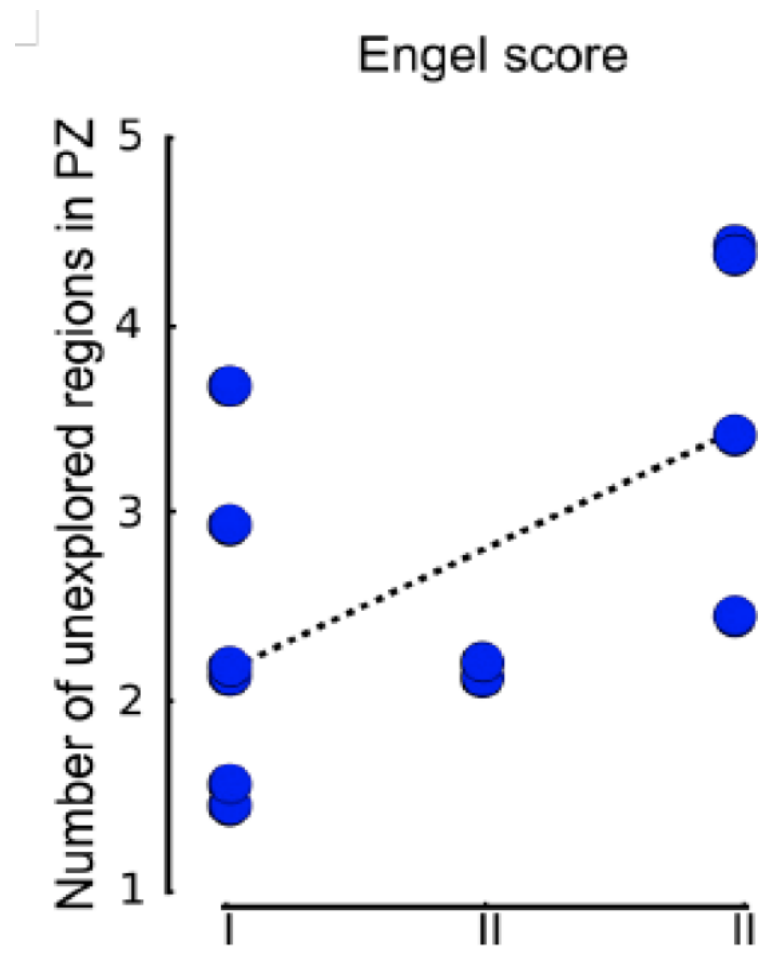
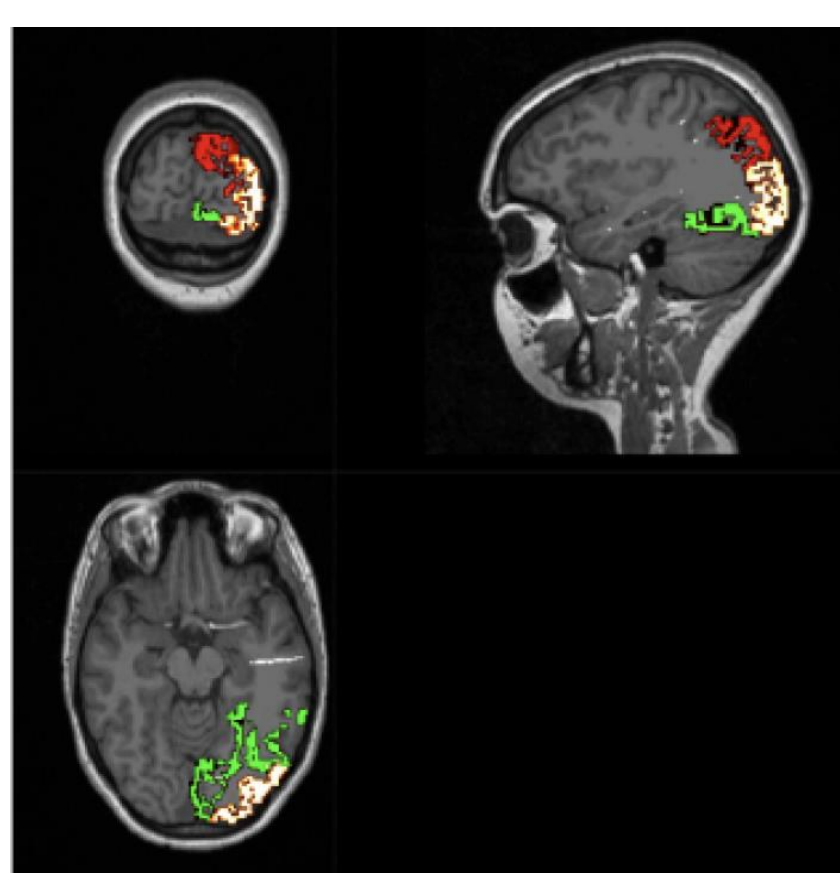


EVALUATION

A. Clinician EZ prediction B. Data fitting excitabilities



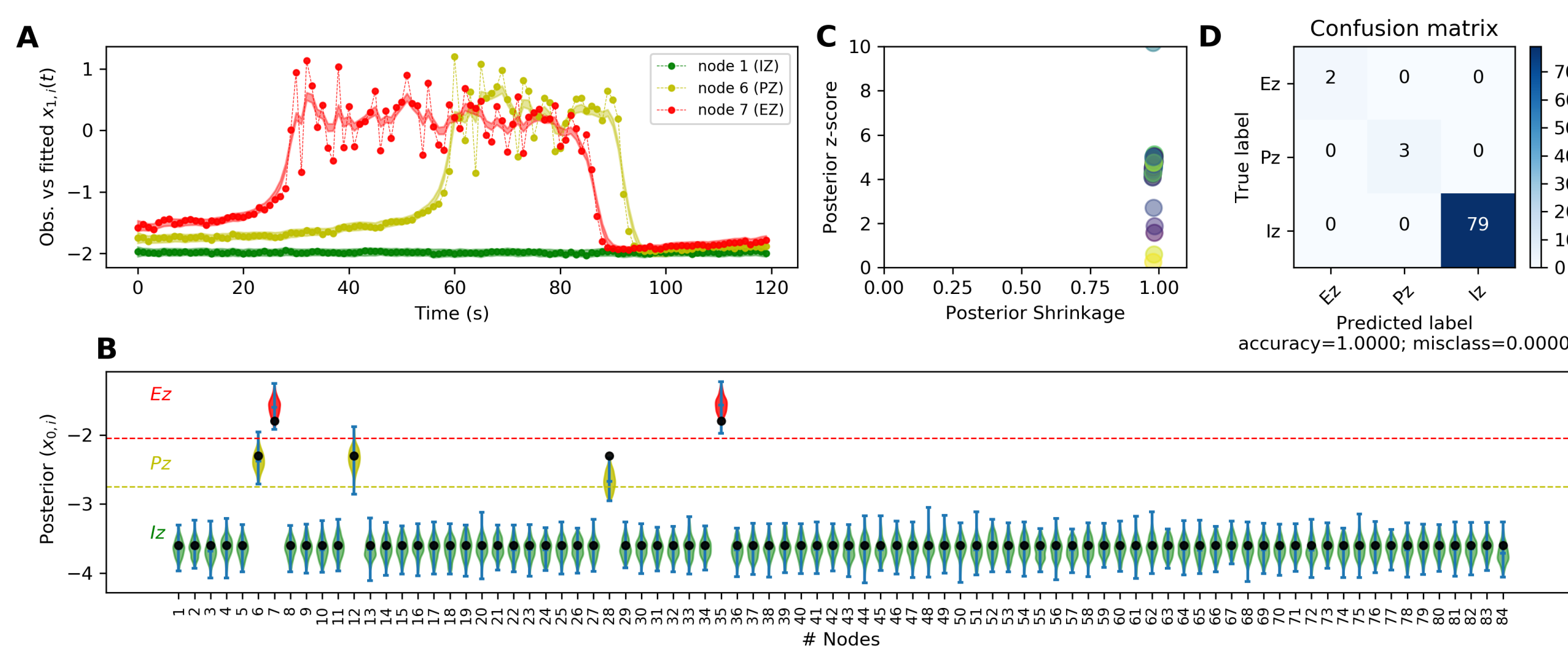
Comparison A & B



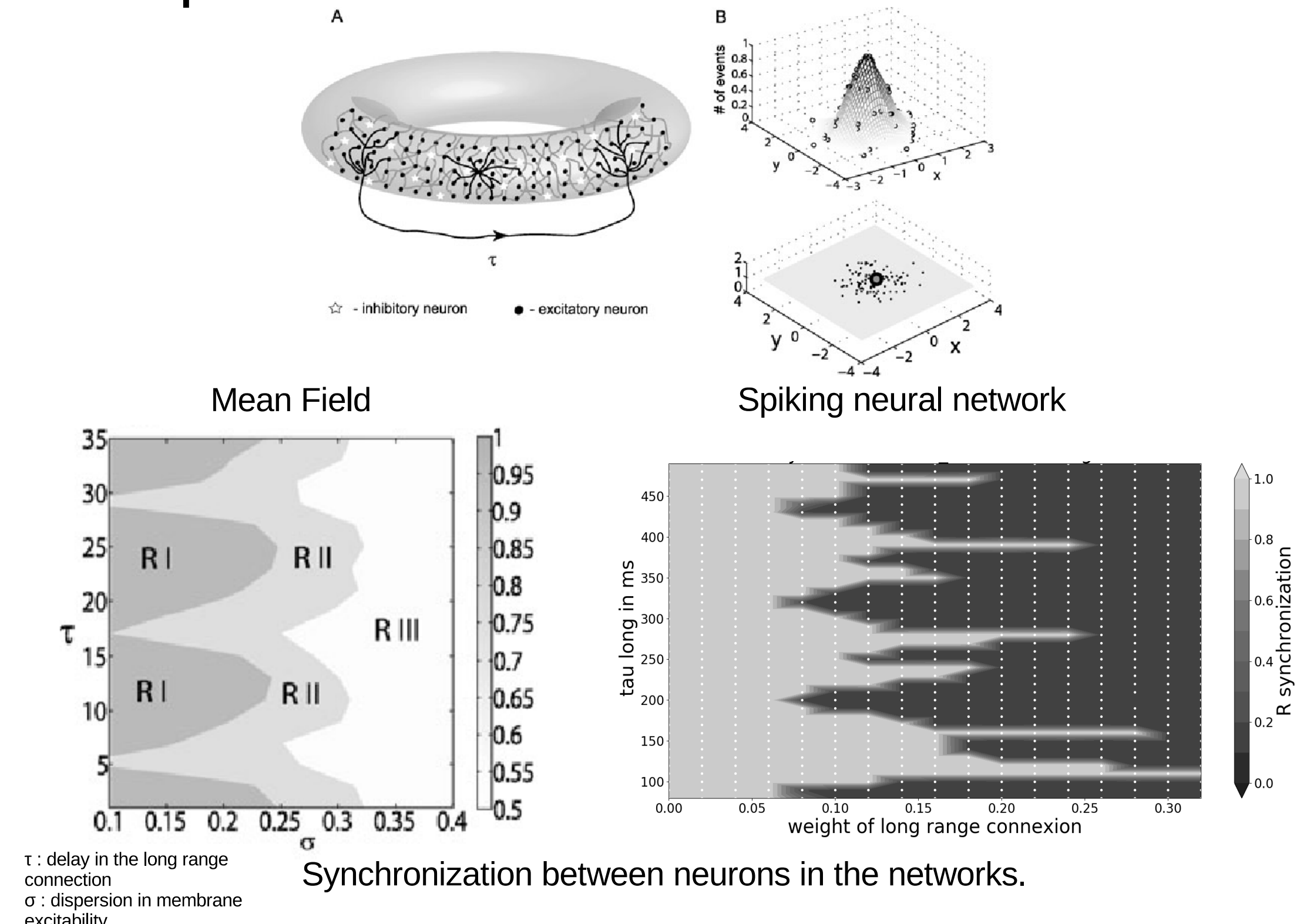
ALGORITHM INVESTIGATION

Inversion of Bayesian VEP model using NUTS algorithm

A. The simulation as the observation data versus the prediction for three selected nodes B. Violin plots of the estimated densities of the epileptogenicity (C) (C) the distribution of posterior z-scores vs posterior shrinkages for all the estimated excitability parameters. (D) The calculated confusion matrix for the estimated spatial excitabilities.



Importance of tracts in neural network



Main Reference:

1. Jirsa, V. K., Stacey, W. C., Quilichini, P. P., Ivanov, A. I. & Bernard, C. On the nature of seizure dynamics. *Brain* **137**, 2210–2230 (2014).
2. Proix, T., Bartolomei, F., Guye, M. & Jirsa, V. K. Individual brain structure and modelling predict seizure propagation. *Brain* (2017).
3. Jirsa, V. K. *et al.* The Virtual Epileptic Patient: Individualized whole-brain models of epilepsy spread. *Neuroimage* **145**, 377–388 (2017).
4. Jirsa, V. K. & Stefanescu, R. A. Neural Population Modes Capture Biologically Realistic Large Scale Network Dynamics. *Bull. Math. Biol.* **73**, 325–343 (2011).

