

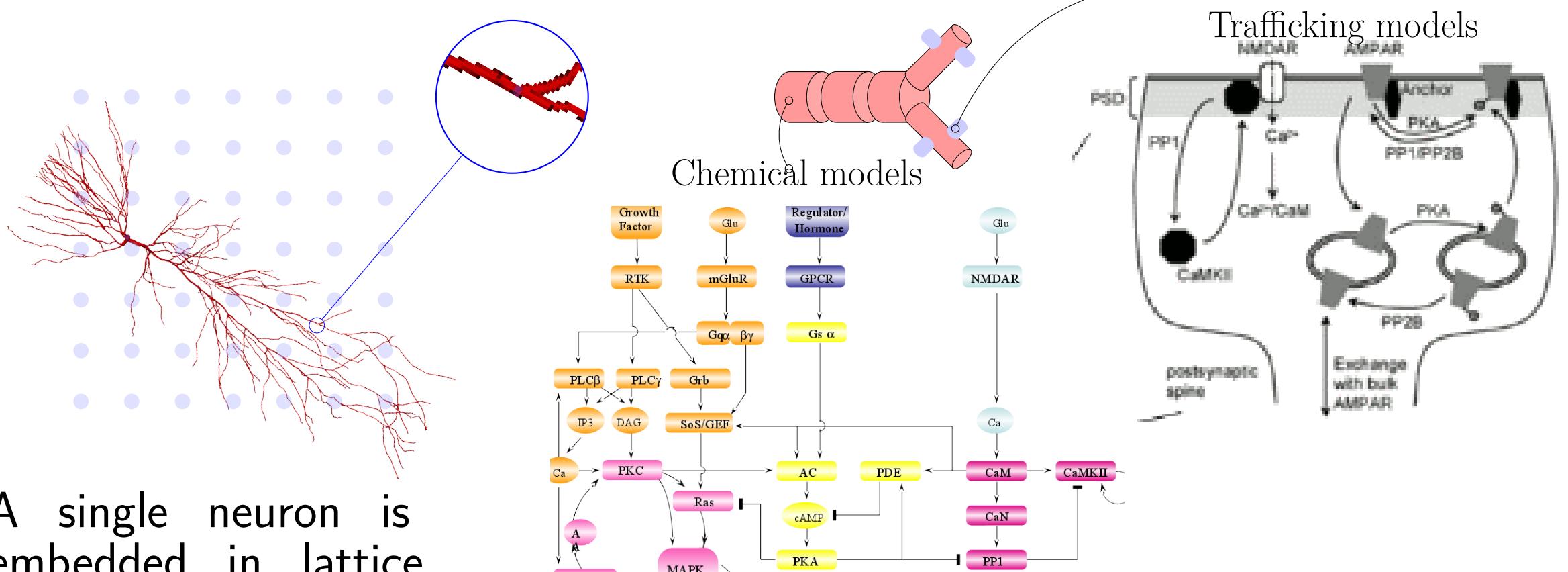
Modelling Memory Across Scale

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Introduction

- Memory and plasticity involve brain mechanisms from molecular scale to enormous networks.
 - We have developed **MOOSE** the Multiscale Object Oriented Simulation Environment, to model plasticity across scales.



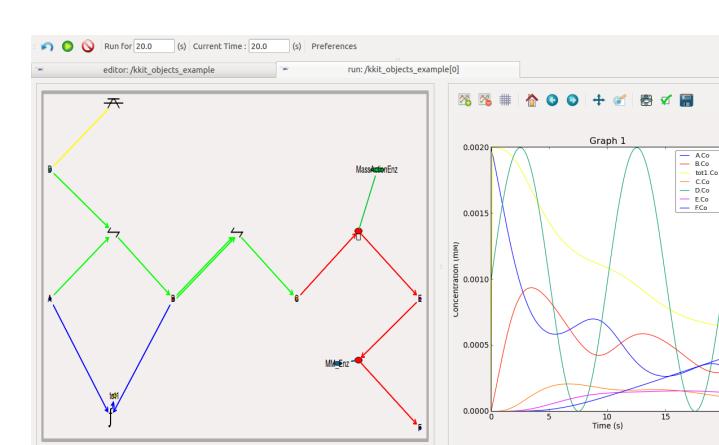
A single neuron is embedded in lattice of neural network



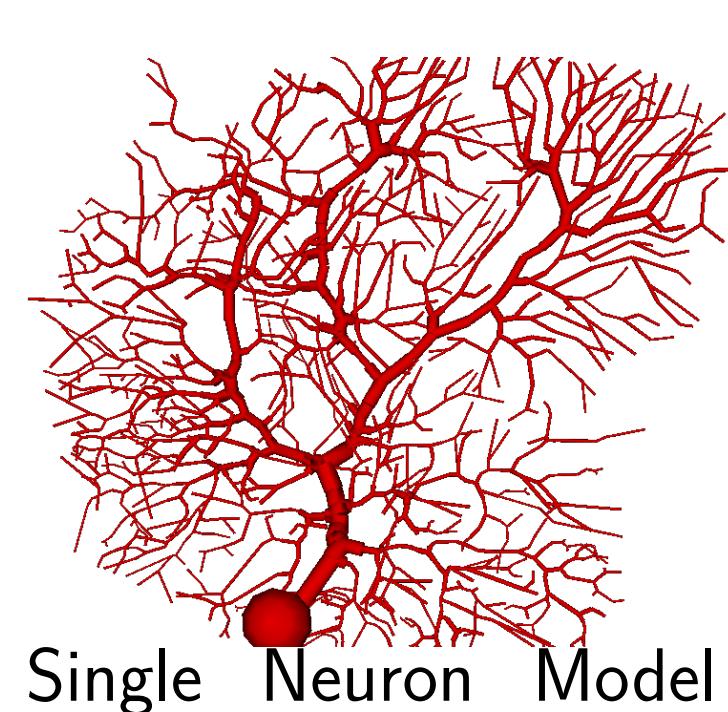
Multiscale Modeling in MOOSE

Why multiscale?

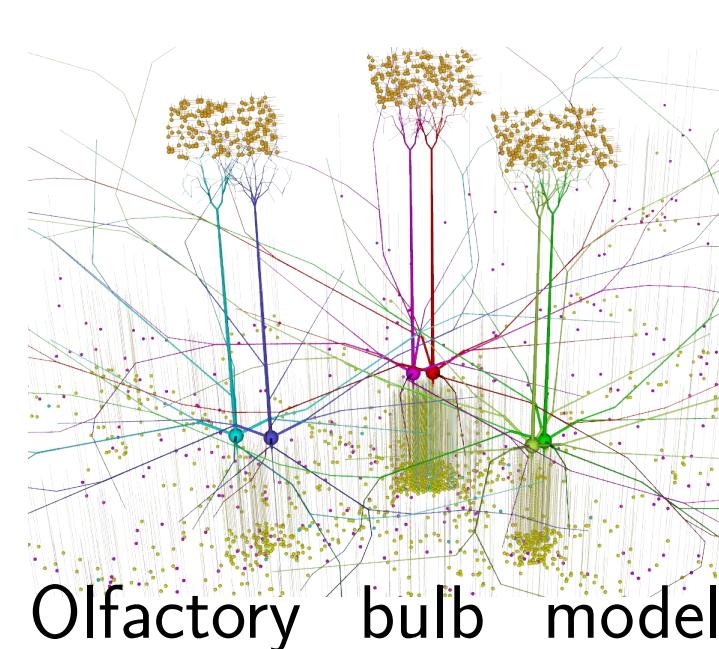
- 10^{11} cells
 - 10^{15} synapses



Signalling Model

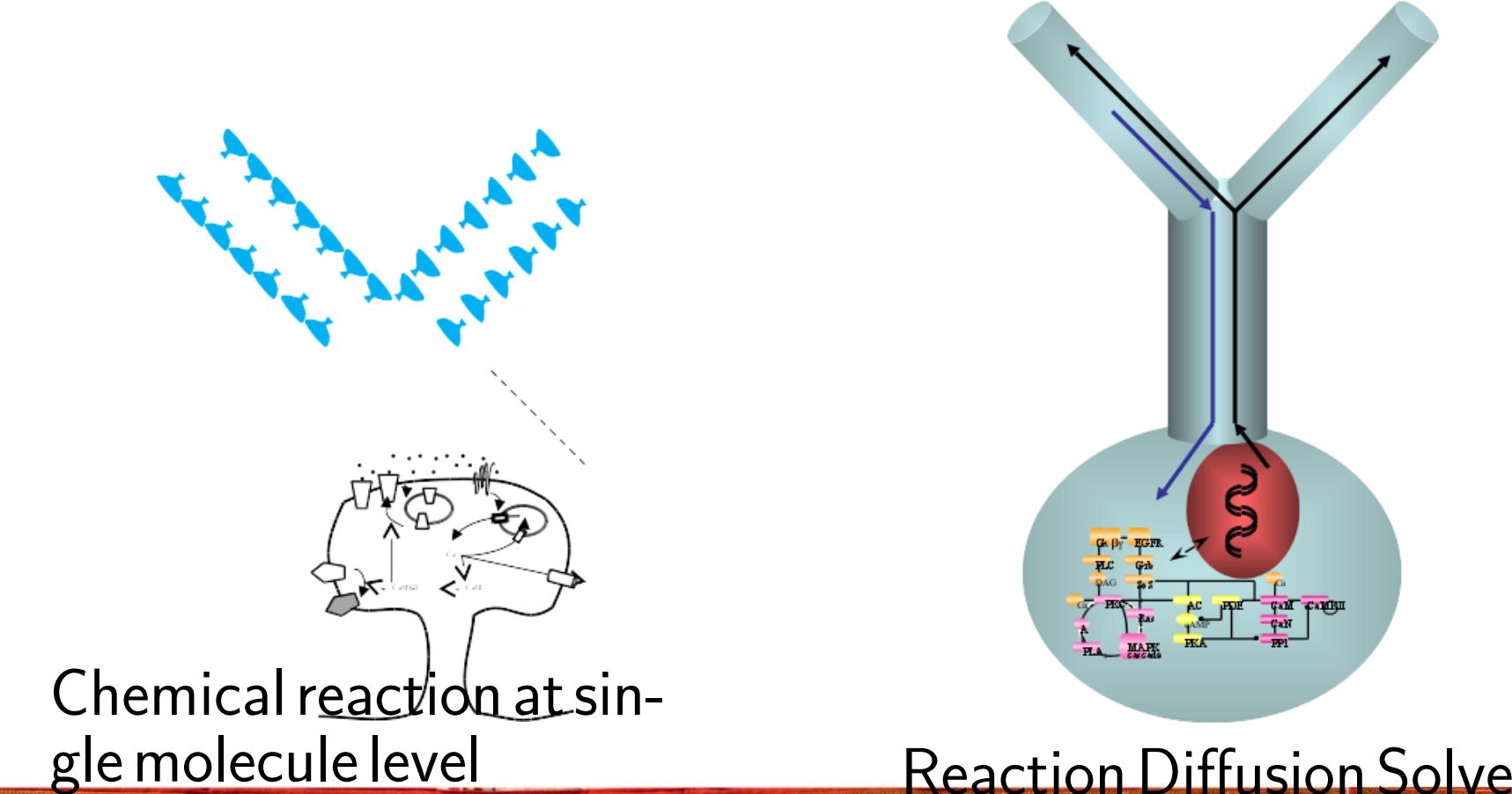


Single Neuron Model

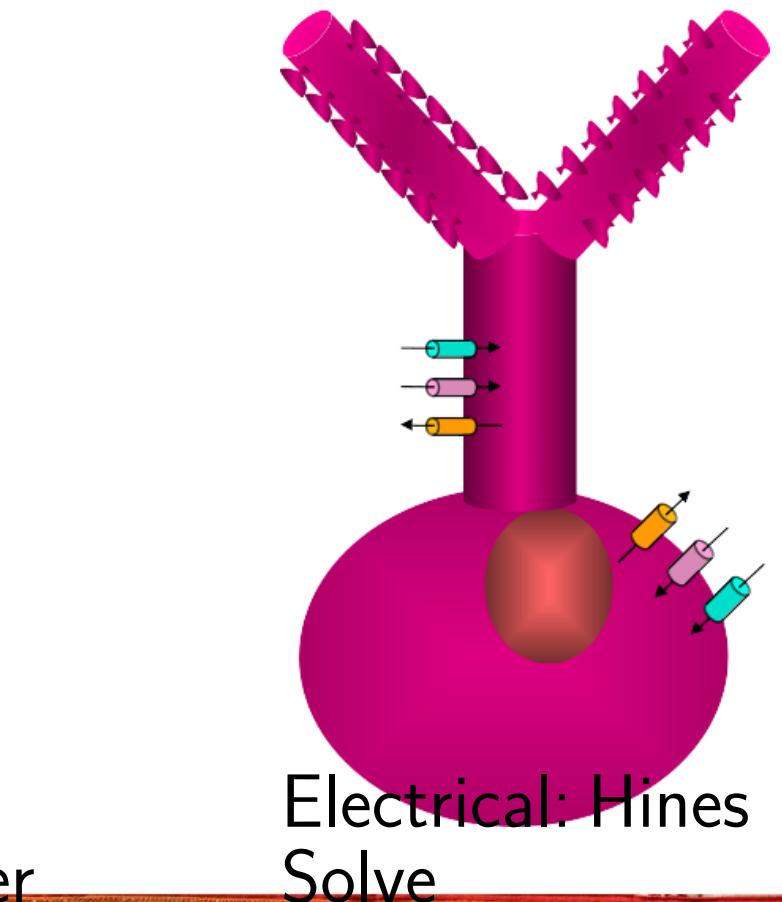


Olfactory bulb model

MODULAR SOLVERS IN

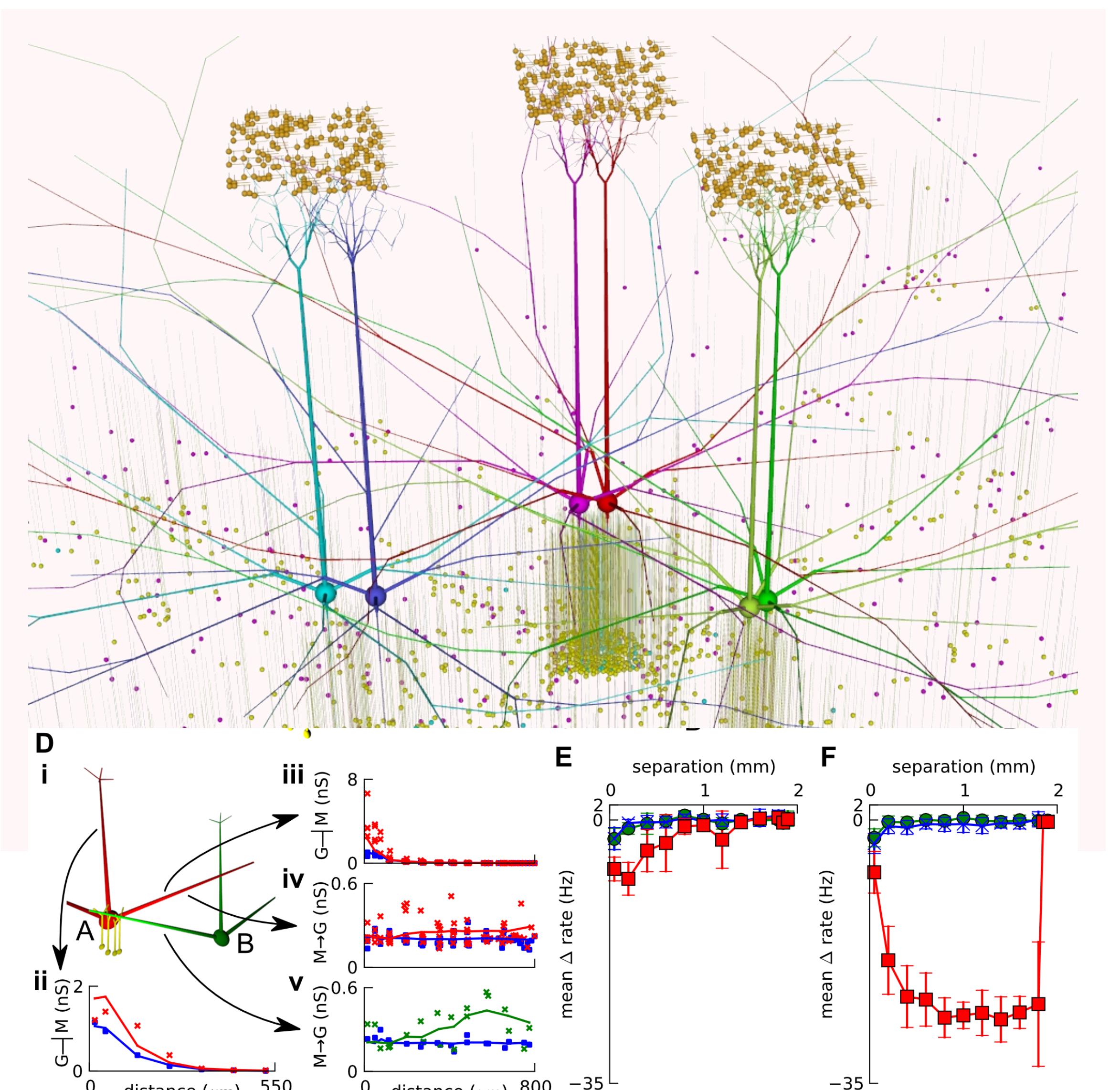


MOOSE

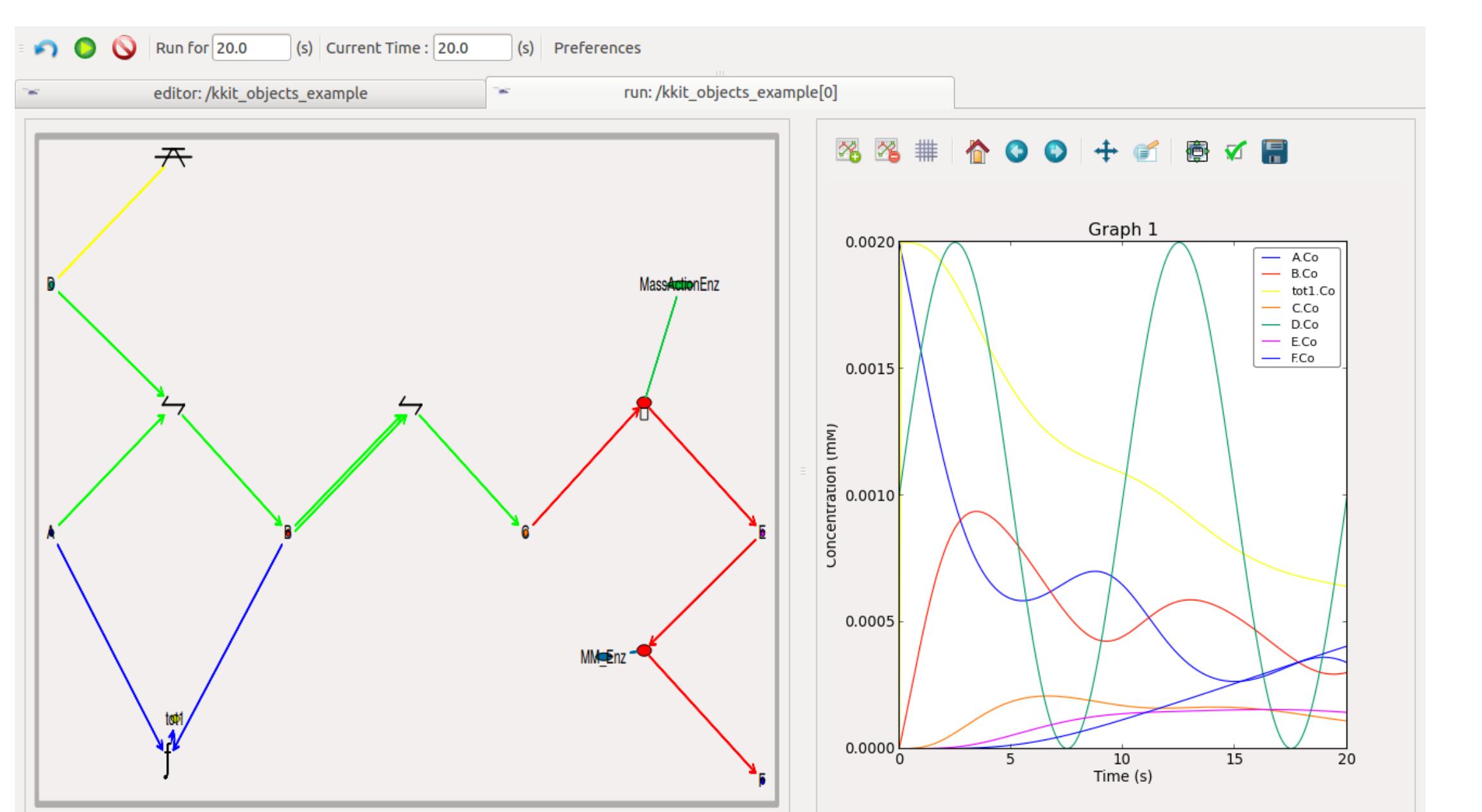




Some projects using MOOSE

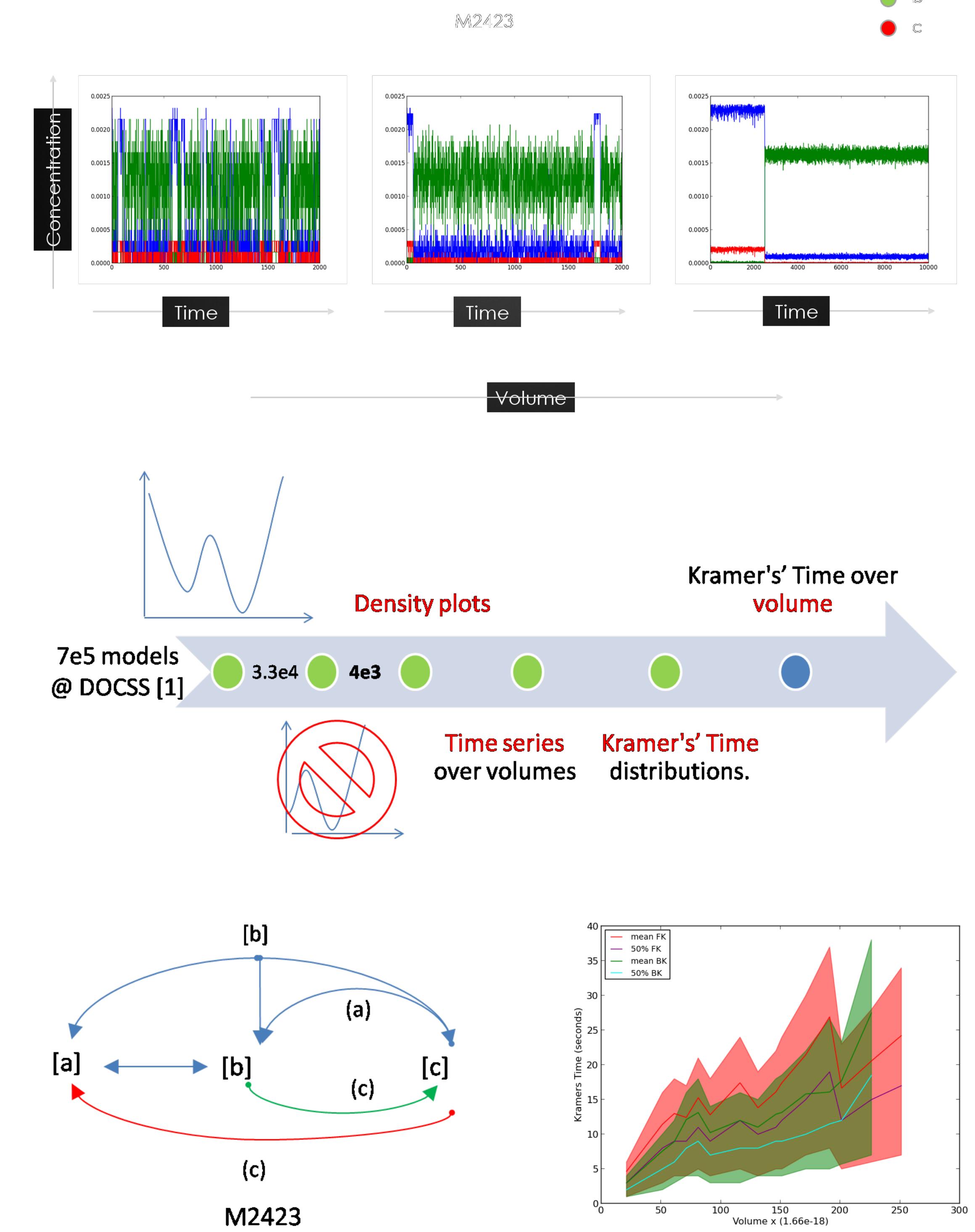


Network coding and computation in olfaction and sematosensory cortex. It explains linear coding and phase-decorrelation and predicts connectivity, lateral dendrite output structure.



Robustness of chemical switches with respect to stochasticity and parameters.

A blue cartoon character with a white shirt and black pants stands next to a large red name.



Summary

Summary We use models to

- Integrate many scales of neuronal data with basic physical/chemical principles.
 - Explain phenomenon of plasticity, activity and neuronal coding.
 - Predict circuit mechanisms, plasticity rules, and emergent phenomena such as *decorrelation*, *robustness*, and *memory decay*.

We have developed MOOSE to carry out these simulations.