Description of the code for simulating nested gamma and theta oscillations

All the simulations were generated using the NEURON software, which is available for free download at *http://www.neuron.yale.edu/neuron*. As in other NEURON scripts, the user must first compile all the mod files using `mknrndll`.

About the files in the directory:

There are three mod files: `ECellOlufsen.mod`, `IcellWangBuzsaki.mod` and `OCellTort.mod`, and each of them contains all the current equations for a given cell type, as indicated by their name. The template file `cell.tem` is used to construct the cells. The file `raster.hoc` is required for plotting the simulation results. The file `synapses.hoc` contains information about the synaptic connections, including the parameter sets used to generate the figures. Finally, the file `OIENetwork.hoc` is the main routine which calls the other files.

How to use these files:

After compiling the mod files, the user only needs to run the `OIENetwork.hoc` file. A general control panel will pop-up (shown at the left side of the Figure below). Using this control panel the user can set the main network parameters. The parameter sets employed in each subfigure of Figures 3 and 4 can be also selected by clicking on the corresponding button. Hitting *Run* starts the simulation. When the simulation finishes, the results are plotted as a spike rastergram together with the model LFP, which are shown in two different views: all the simulation time and a zoomed in view (see Figure).

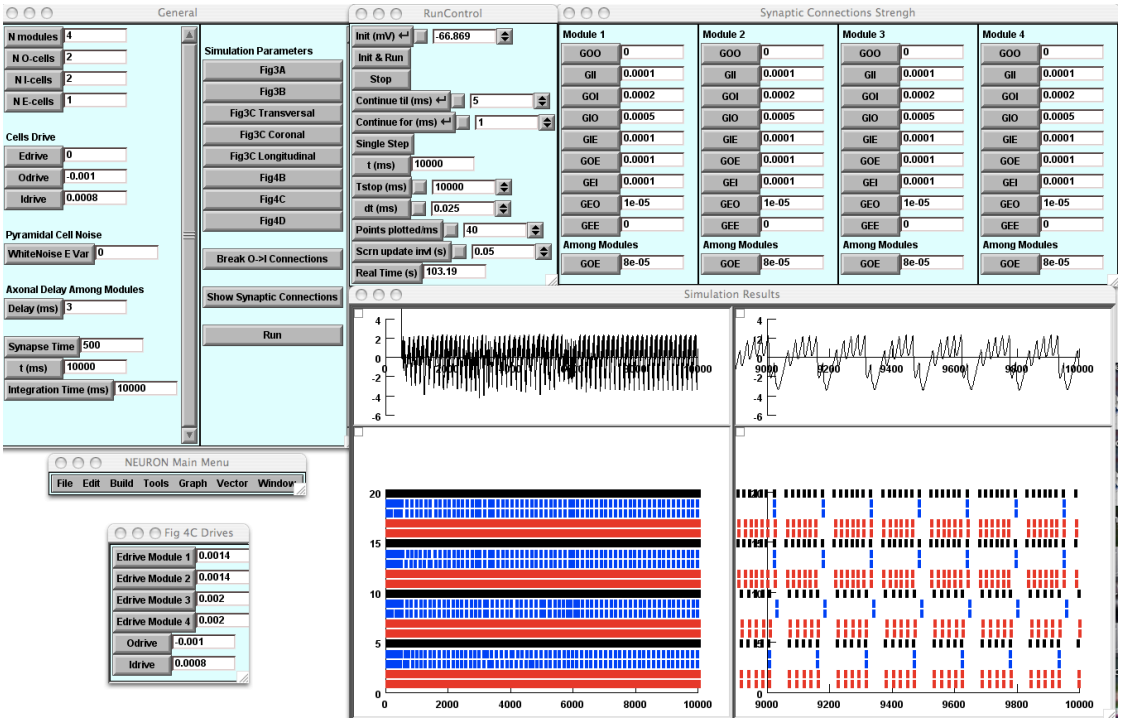

Figure 1: The NEURON user-interface for reproducing Figures 3 and 4.

Remark 1: The initial conditions are set to be random in each simulation; therefore, the results will not be identical among different network simulations under the same parameter setting, although they should be qualitatively similar to each other for most of the initial conditions.

Remark 2: The E-cell drive is set at the general control panel for most of the simulations. The exception is Figure 4C, which studied modules with distinct E-cell drives. When replicating this figure, a new panel will pop-up showing the E-drive values for each of the four modules.

Remark 3: For each parameter set, the loss of O-I connections can be obtained by clicking on the "Break O → I Connections" button.

Remark 4: Although the impairment of the theta rhythm shown in Figure 3 should be readily visible by visual inspection of the spike rastergram, during the LFP inspection this impairment becomes more noticeable when employing a higher number of O-cells than five.