1- Open the file CELLUM.lvproj. This is the LabVIEW project containing the biCNN model. LabVIEW will launch the Project Explorer window (Fig. 1) showing the project tree with all the classes and folders of the biCNN model.

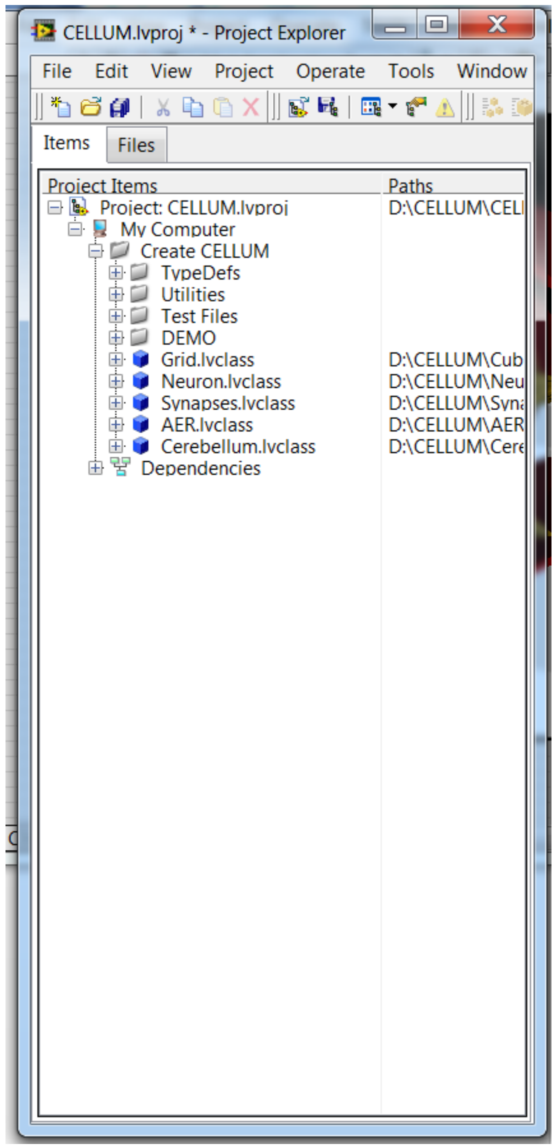

Fig. 1. CELLUM Project Tree.

2- To run one of the demos, open the folder DEMO and click on the file DC MOTOR.vi (Fig. 2)

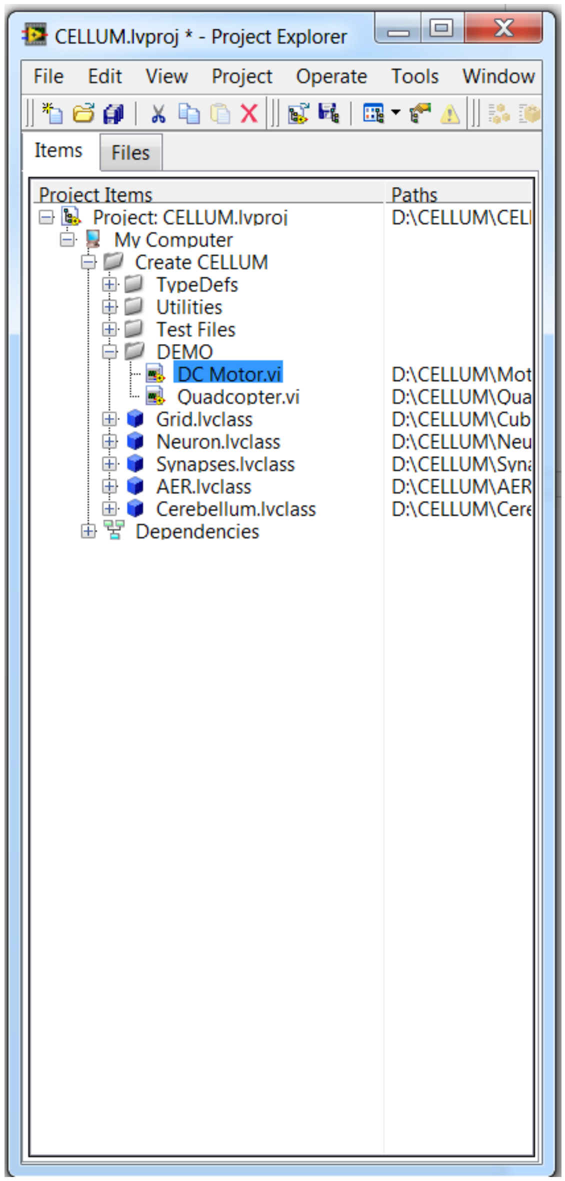

Fig. 2. Demonstration folder and DC Motor.vi.

3- The main window diplaying: (1) a Virtual reality model of a DC motor; (2) a waveform indicator showing the firing rate of the PD[n], Vn[n], left and right hemispheres PCl[n], PCr[n], and their sum cere[n]; (3) the desired shaft position Pref[n], the yielded shaft position P[n], and the RSE of P[n]; (4) the Stop simulation button; (5) and the enable/disable button for the biCNN model.

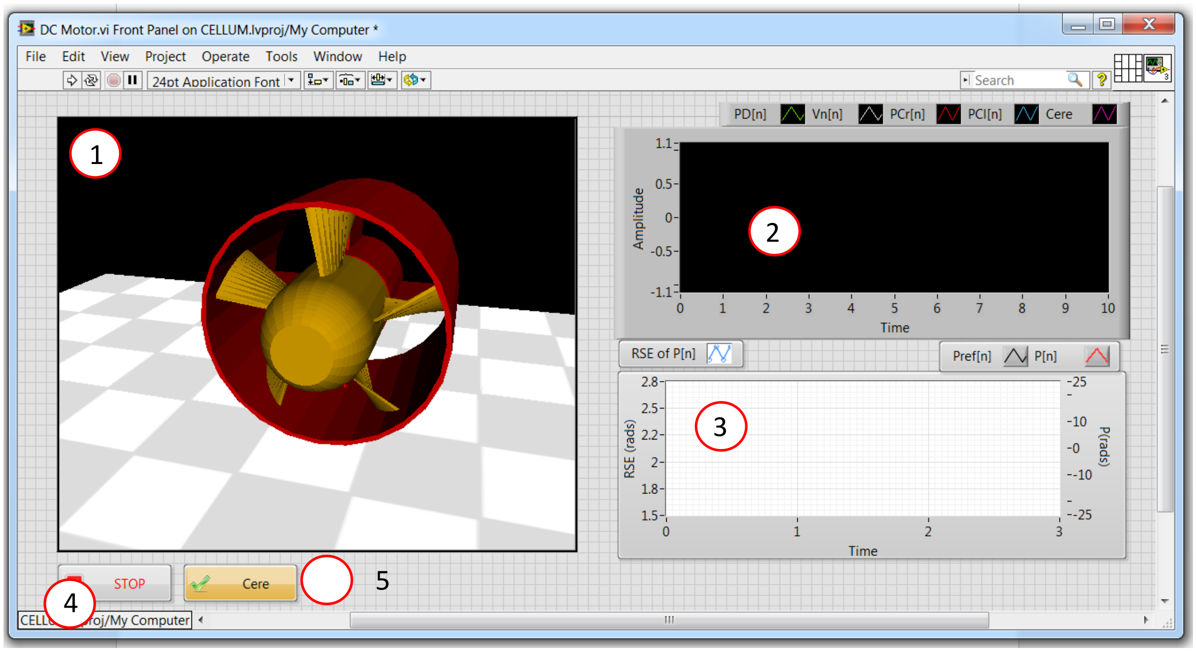

Fig. 3. Main Window of the DC Motor.vi demonstration.

4- To Run the simulation use: menu Operate->Run or Ctr+R. The Start Simulation Windows pops up. This window shows (1) previously saved configurations files (i.e., trained biCNNs models). If there are any saved files they can be (2) loaded for the new simulation or a set of (3) new configuration files can be created.

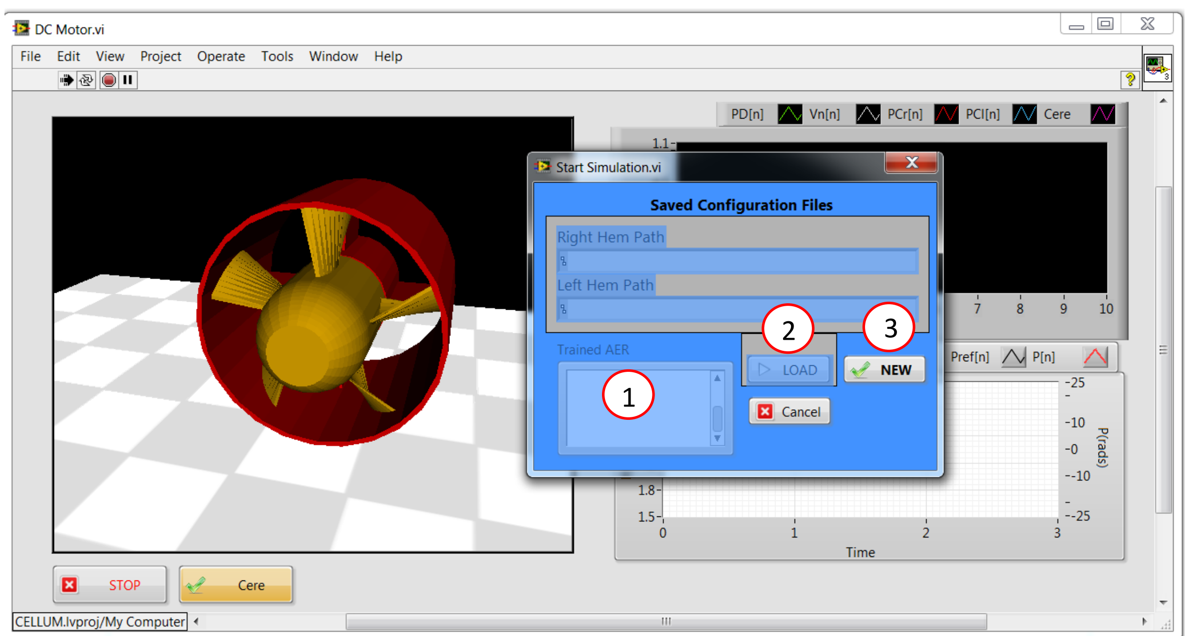

Fig. 4. Start Simulation.vi.

5- To create a new configuration file press the button NEW in the Start Simulation window. It will open the initialization window: Cerebellum.lvcalss.Initialize.vi. The initialization of a the biCNN model comprises 3 main steps: (1) create a grid of the cerebellar cortex; (2) connect the neurons inside the grid; (3) create the AER table. Later the created table can be assigned to the (4) Left or Right hemisphere of the biCNN.

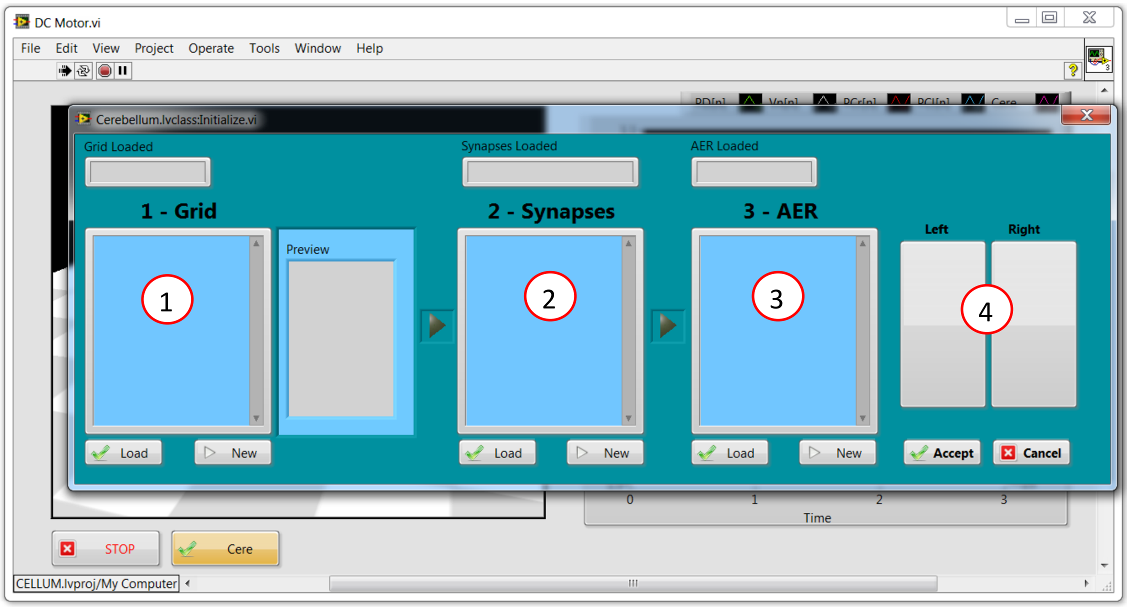

Fig. 5. Initialization of the biCNN model.

6- Creating the grid. In the Initialization window press the button New under the title 1-Grid. It will open the window Number of GCs.vi. This windows set the (1) number of GCs in the model, and the (2) size of the cube of the cerebellar cortex that will contain all the neurons. By default the size of the cube is 50x50x50 um. Using the default size allows to allocate up to 500 GCs. If the size is not adequately set the allocation algorithm could take too much time trying to allocate all the neurons. The (3) numbers of other types of cerebellar neurons are calculated from the entered number of GCs and the ratios reported in the literature.

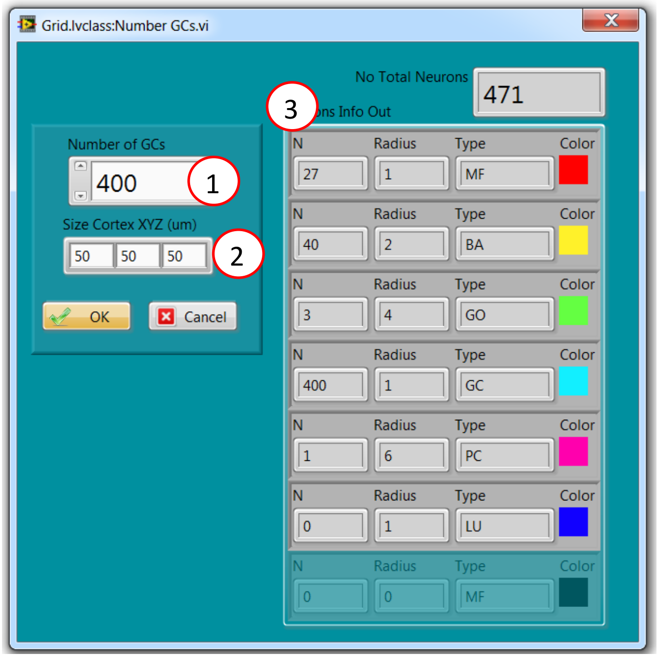

Fig. 6. Setting the number of GCs and the size of the cerebellar cortex.

7- Once the number of GCs is set and the OK button is press in the Number of GCs.vi the program initialize and save the grid. Now the grid file can be (1) selected and loaded in the Initialization window. The general features of the file can be (2) previewed by double clicking the file in the listbox. To use a saved file for the next steps in the initialization of the biCNN, select the file from the listbox and then press the button (1) Load.

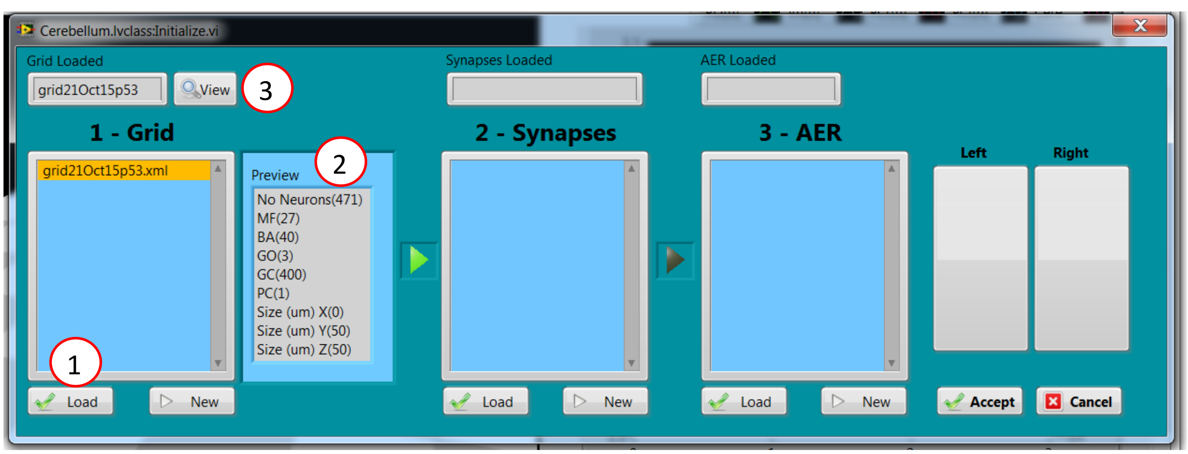

Fig. 7. Loading a Grid File.

8- The grid loaded can be visualized in a Virtual Model by clicking the button (Fig. 7 (3)) View that is enabled once the grid file has been loaded. Pressing the View button will display the following window. The information of each type of neuron in the loaded file can be changed by operating the (1) Neurons Info control.

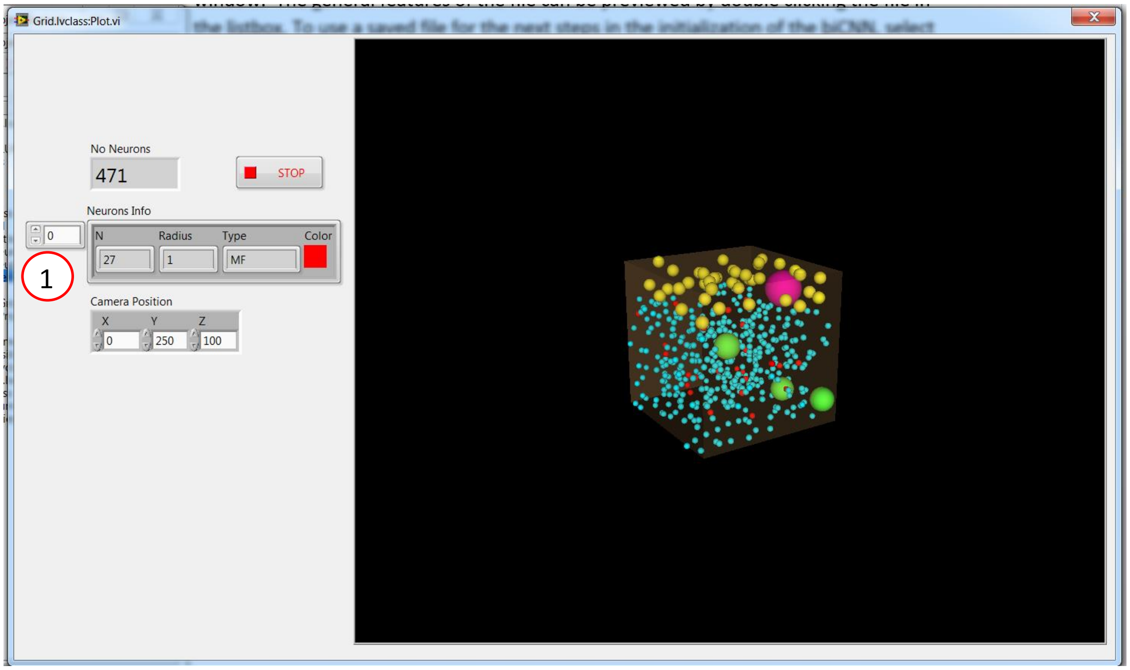

Fig. 8. Visualizing a Grid File.

9- The second step in the initialization of the biCNN model as mentioned before is connecting the neurons inside the grid. Once the grid file is (1) loaded, then pressing the (2) New button under the title "2-Synapses" creates and saves a connectivity table (3). Each time a New synapses is created, different connections are likely to happen because of the semi-random nature of the algorithm connecting the neurons.

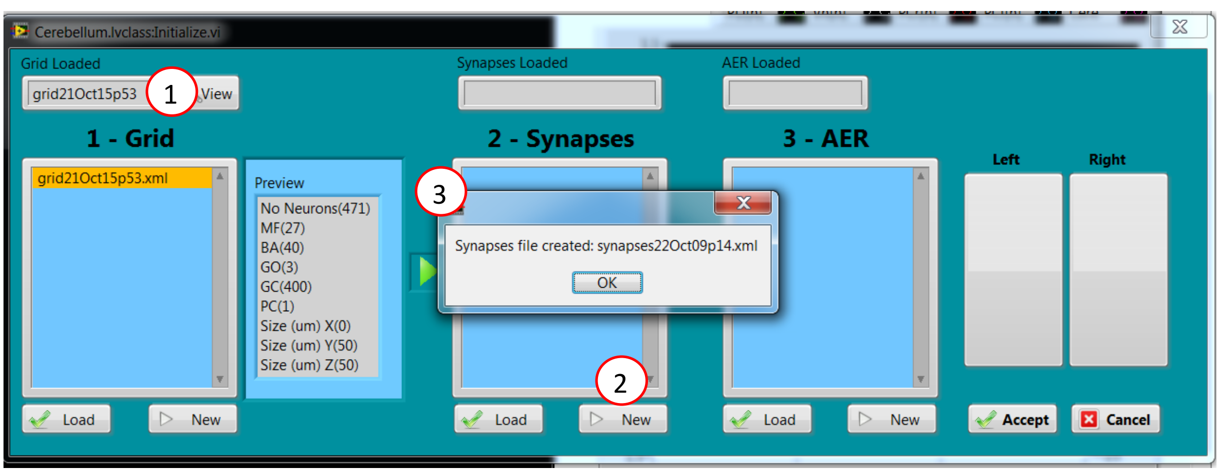

Fig. 9. Creating the synapses file.

10- Third step in the initialization of the biCNN is creating the AER representation of the grid and synapses files. Once the synapses have been loaded (1), a new AER file can be created by pressing the (2) New button under the title “3- AER”. Once the file is created it has to be selected from the (3) listbox, and loaded (4). Once loaded correctly, the connectivity in the network can be visualized by pressing the (5) View button enabled. The algorithm generating the AER file is one-to-one with the synapses files, this implies that to generate two different synaptic connections from the same grid, creating two new AER files is not the way. To this purpose create two different synaptses files, and then an AER file for each synapses file.

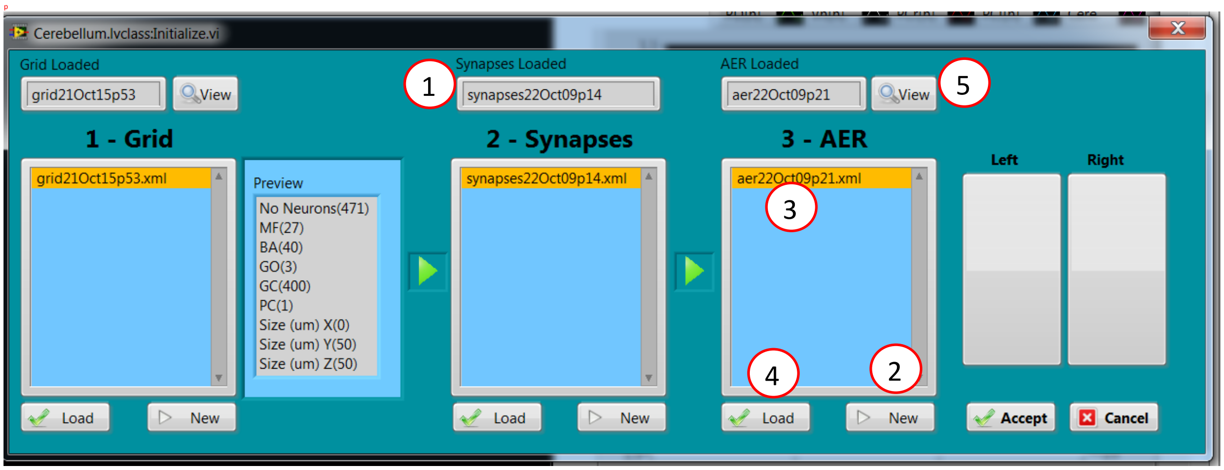

Fig. 10. Creating the AER file.

11- Visualizing the connectivity in a specific AER file is possible by pressing the (Fig. 10 (5)) View button next to the name of the AER file loaded. The window opened presents a network graph following the color convention for each neuron. The connection of a particular neuron can be change by operating the Numeric Control

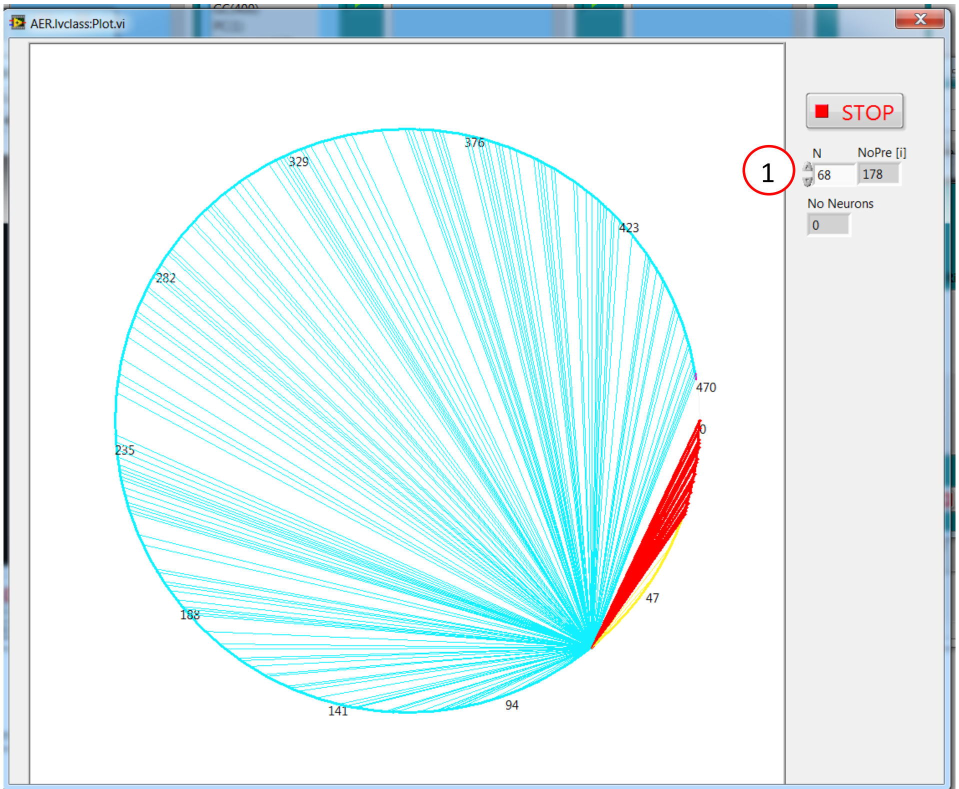

Fig. 11. Visualizing the connections of each neuron.

12- The last step is to assing to the (1) Left or (2)Right hemisphere of the biCNN model the AER file loaded. This is done by pressing either the button Left or Right. Once finilized the same operation can be repeated for the second hemisphere until both Left anf Right hemipheres are loaded and the message “OK” is displayed on each button. The simulation will start once the (3) Accept button is pressed.

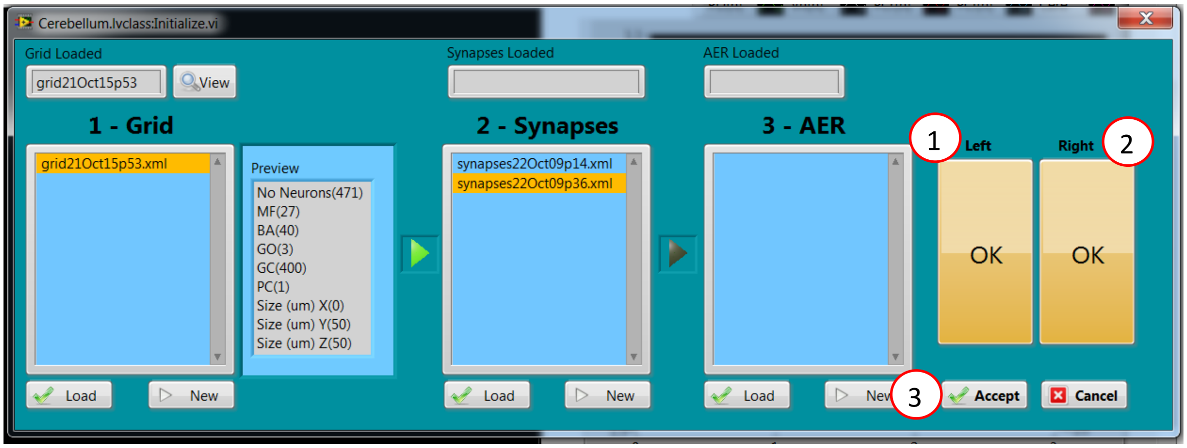

Fig. 12. Saving the AER file into the hemispheres of the biCNN model.

13- The example simulation starts by a Step response stimuli to the DC motor followed by a sinusoidal desired motion. The simulation can be stoped at any momement. The program will ask if the trained biCNN model has to be saved. If the model is saved, it will be available for the next simulation at **step 4**.

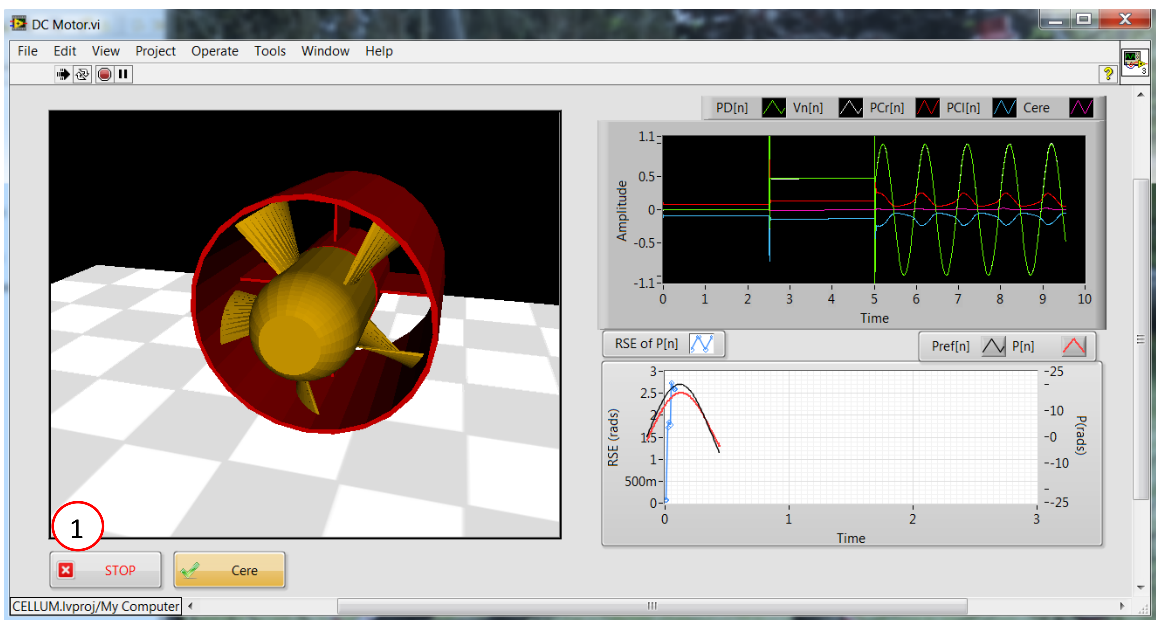

Fig. 13. Simulation running

14- Visualizing the firing rate of the different neurons inside the model can be done by the preconfigured probes. To this purpose first open the diagram panel by pressing CTR+E.

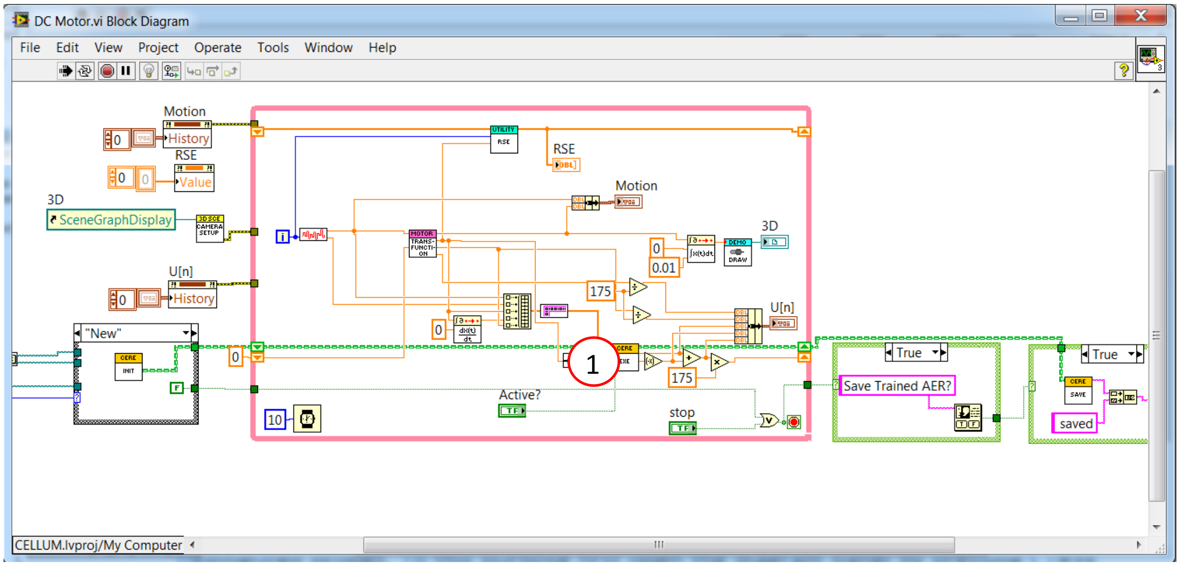

Fig. 14. Diagram panel of the DC motor demo.

15- Then locate and click in the biCNN model execution block (1) to open its front panel. Repeat the operation CTR+E to open the diagram panel of the biCNN model.

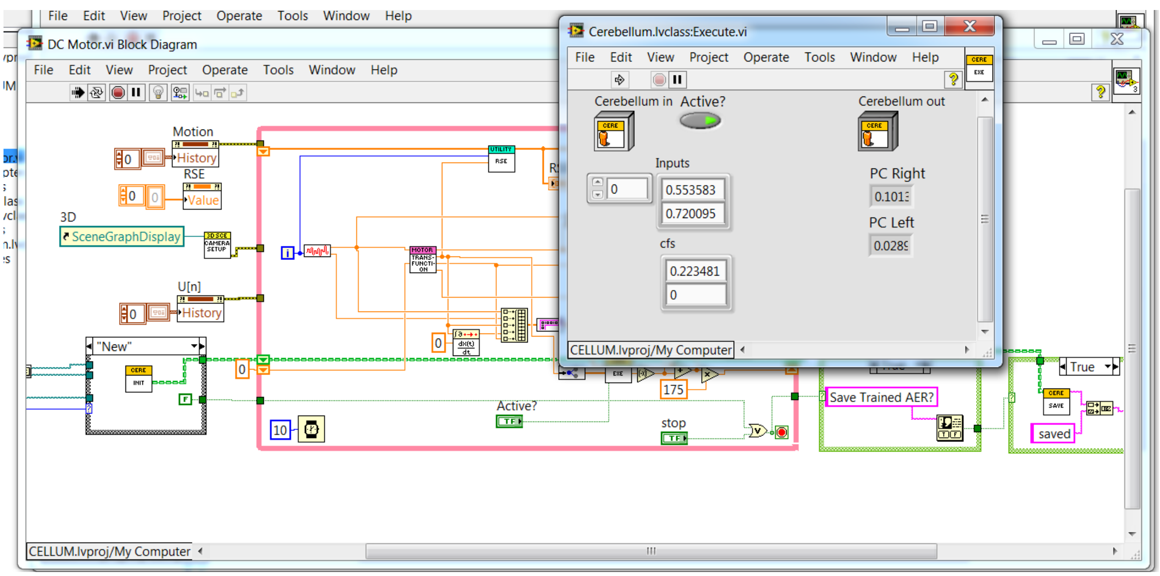

Fig. 15. Control panel of the biCNN model.

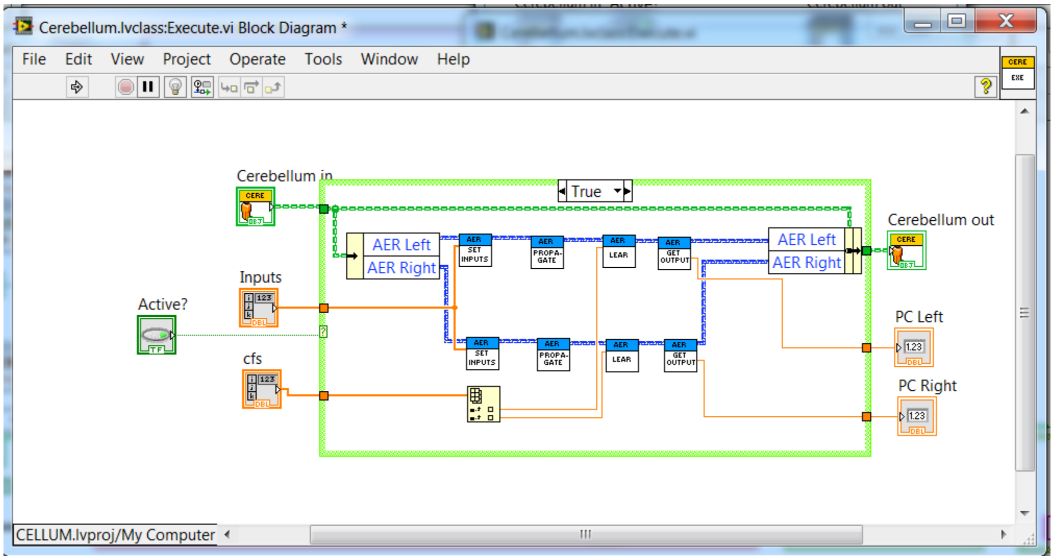

Fig. 16. Diagram panel of the biCNN model.

16- Clicking in any of the blue thick lines will open a probe showig the firing rates of the Left or Riht hemisphere.

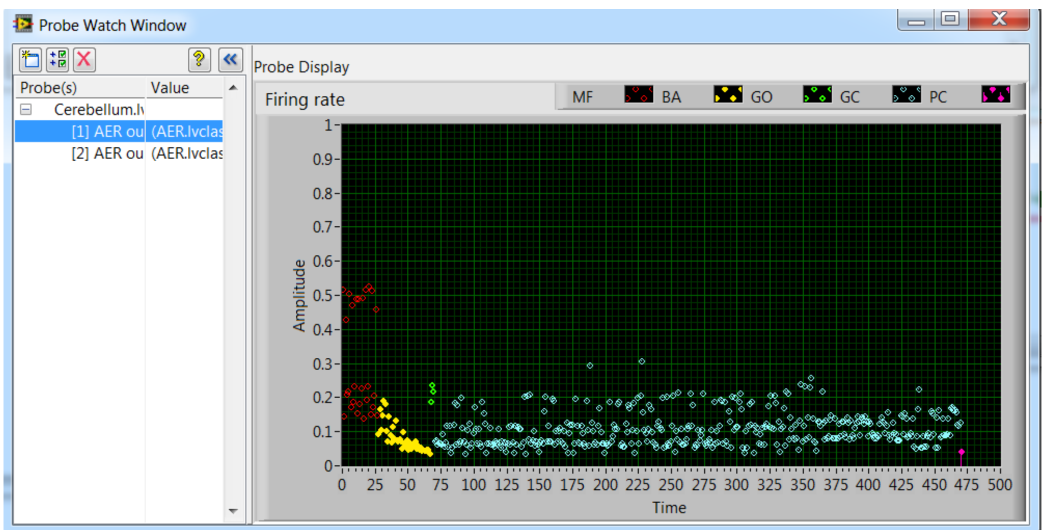

Fig. 17. Fring rate of the neurons in one hemisphere of the biCNN.

17- Finally the simulation can be stoped and saved.

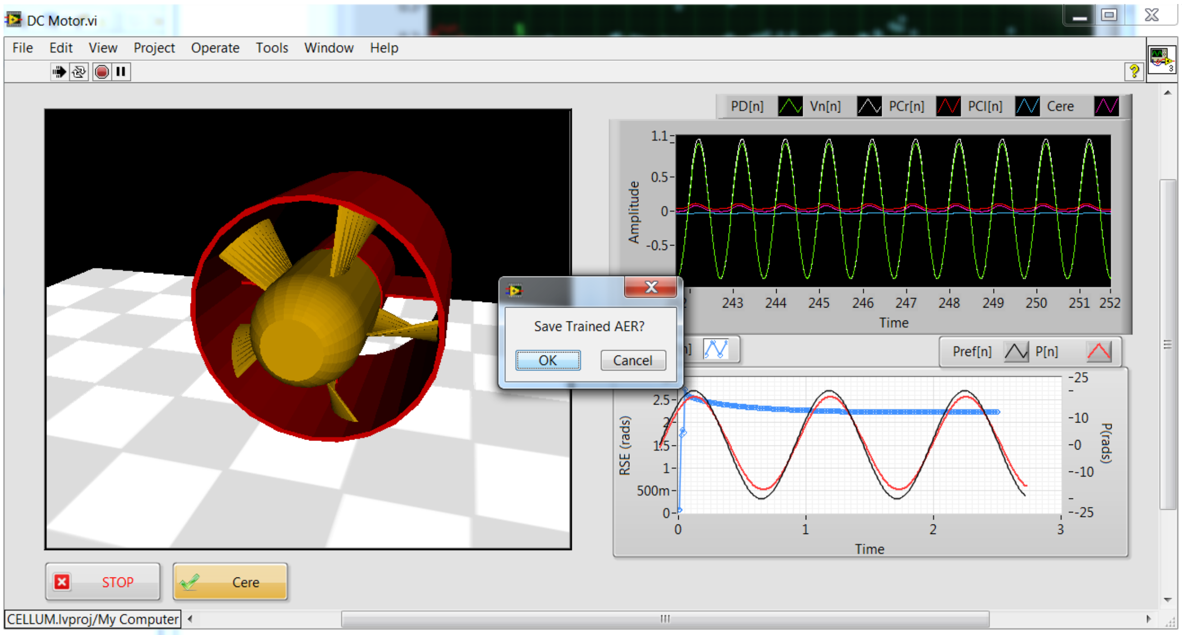

Fig. 18. Simualtion Stoped and Saved (optional).