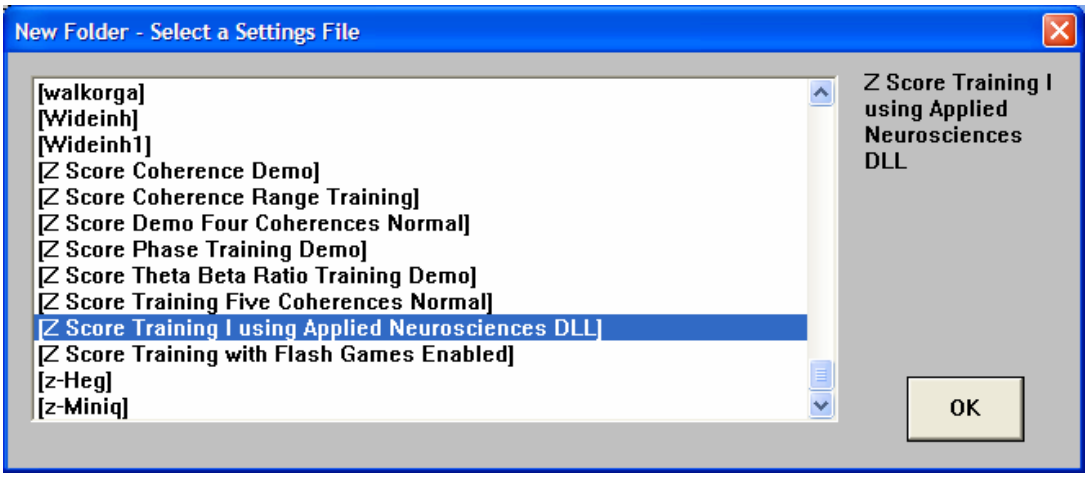
Guidelines for doing real-time Z-Score training using the Applied Neuroscience Z DLL

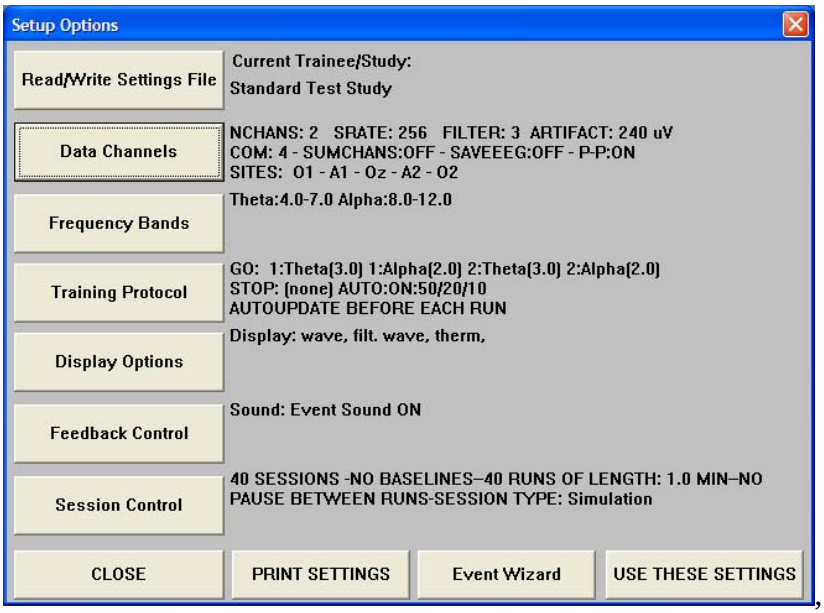
First install the latest BrainMaster BMT (Basic Modules for Training) software, version 2.5SE April 1, 2006 or later.

You may set up a new folder for a trainee, or you may use an existing trainee folder. There is a built-in settings file “Z Score Training I using Applied Neurosciences DLL” that you can use to start with.

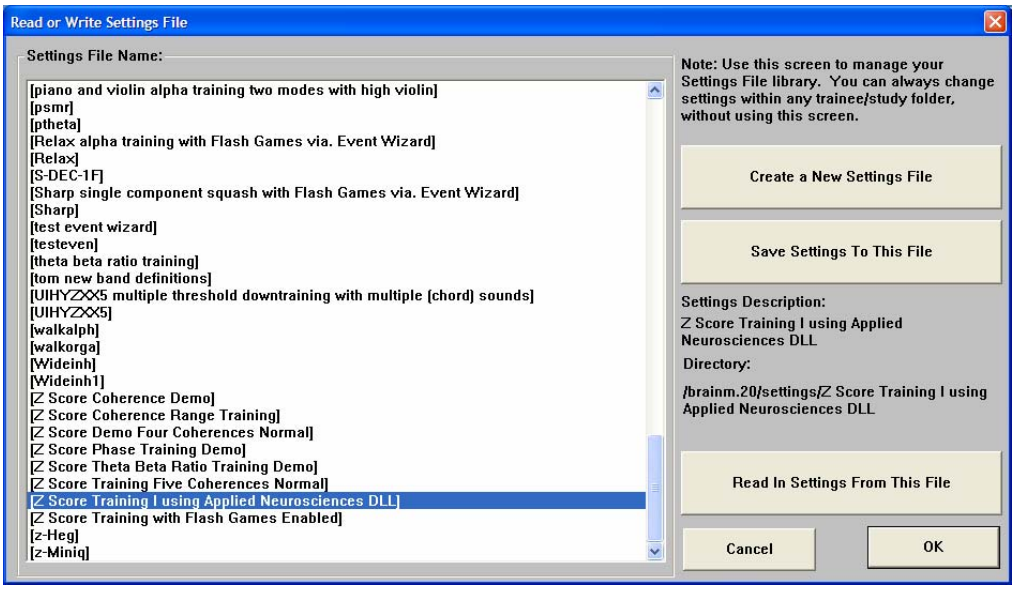
When creating a new folder, choose the settings shown below:



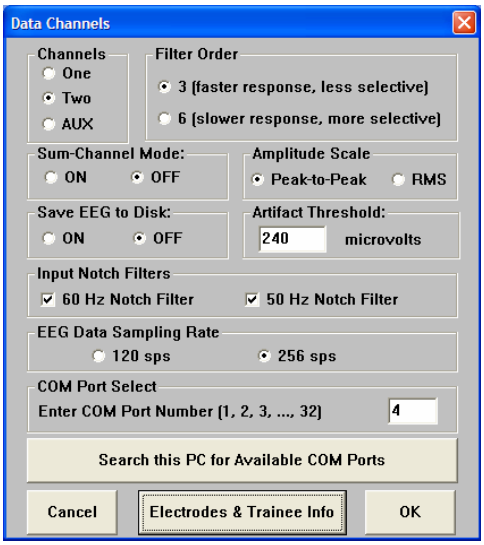
Using your new folder, or an existing folder, you can then select “View or Change Settings” to see the following control:



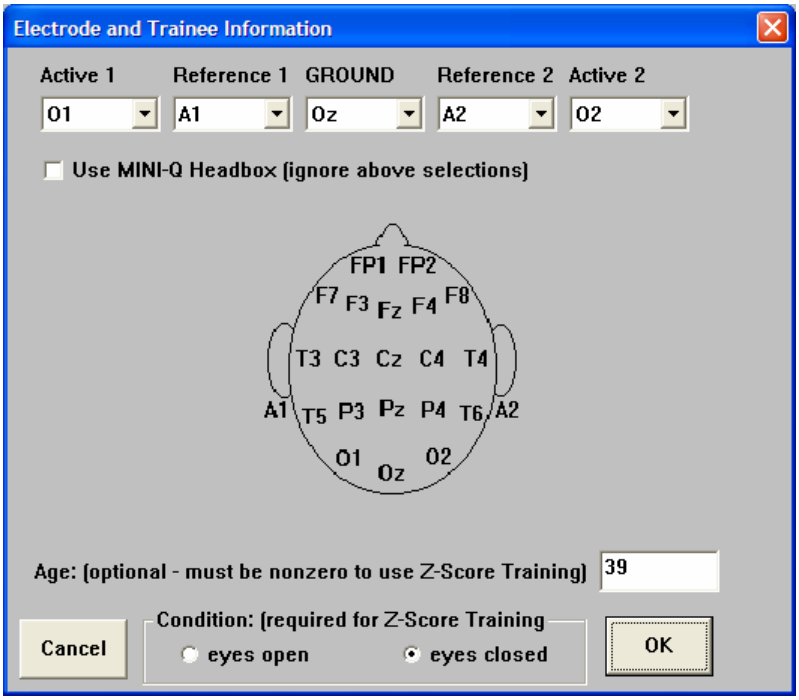
If you used an existing folder, to load in the starting settings, press “Read/Write a Settings File and select the Z Score training:



Once your folder is started, you can press Data Channels to get the following control panel:



Then press “Electrodes & Trainee Info to see the following control panel:



Inspect the Electrode and Trainee Information control panel, and ensure that all information is correct. Make changes as necessary for your trainee. Note: if you set the trainee age to 0, you will "turn off" the Z Score training. This is the recommended way of making the Z Score training software inactive when you do not wish to use it.

Theses changes will be saved and used when you press "OK" and "Use These Settings" on the appropriate screens. Then when the software is started, the entered values will be used.

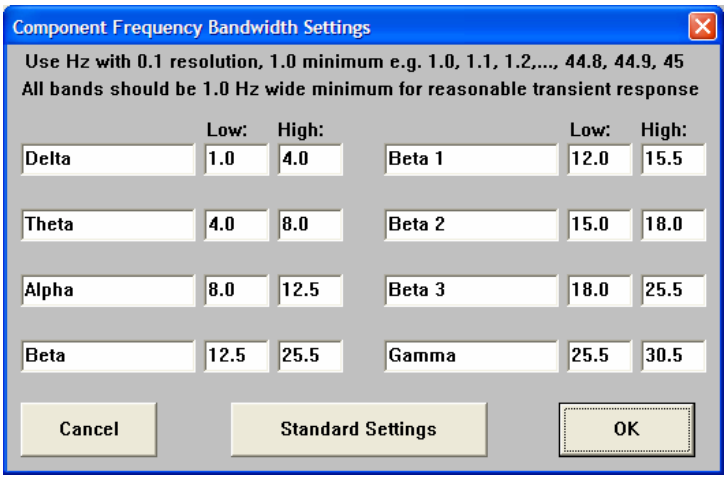
Note that it is not necessary to exit the training screen to make changes to this (or any) controls. You can simply stop the training screen, return to this control panel, make changes, and then restart the training screen (by pressing "GO"). This will allow you to change from eyes open to eyes closed, for example, without having to exit the training screen and start a new session.

You may return to this control panel at any time during the training by clicking on the title bar of the "Setup/Home Screen", and you may make changes to this screen. Then, use "OK" and "Use These Settings" to save the settings. The next time you press "GO" on the training screen, the new settings will be used.

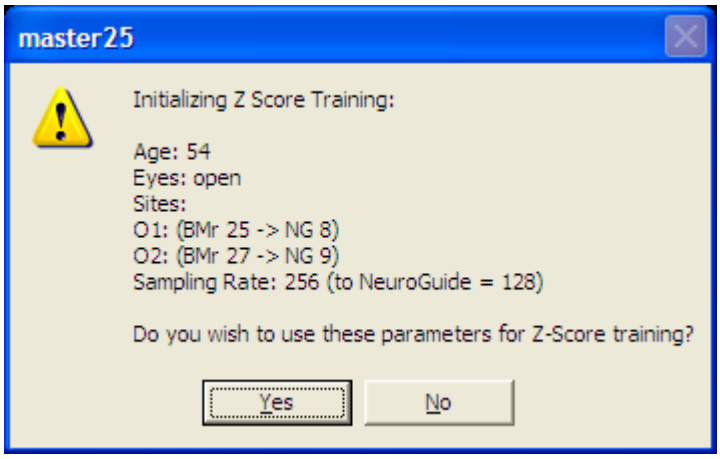
Z Scores will automatically be computed for all possible values, and results can be displayed and trained using the BrainMaster Event Wizard. The Z Score variable names and usage are described in the "Data Dictionary for the Event Wizard" in the BrainMaster 2.5SE documentation. The following event shows a simple way to use the Z Scores:

If you wish, you can reprogram the BrainMaster built-in digital filters (and FFT bins) to match those in the Z Dll. This will make interpretation and use of the Z information

simpler and more consistent. The bands are set this way in the Demo settings files provided:

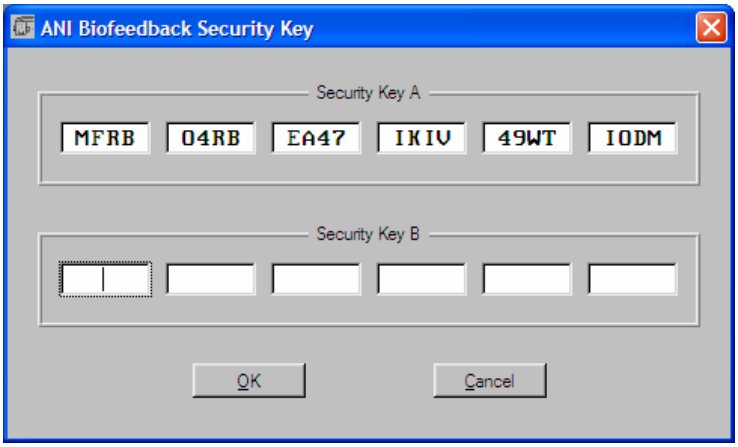


When you press GO, if Z Scores are enabled and the age is not set to "0", you should see a dialog like the following:

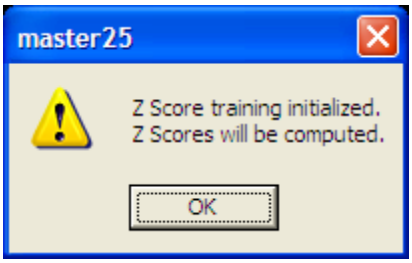


If you wish to continue with EEG training without Z Scores, or if you need to change some of the parameters, simply press "No" now. If you press "Yes", one of two things will happen:

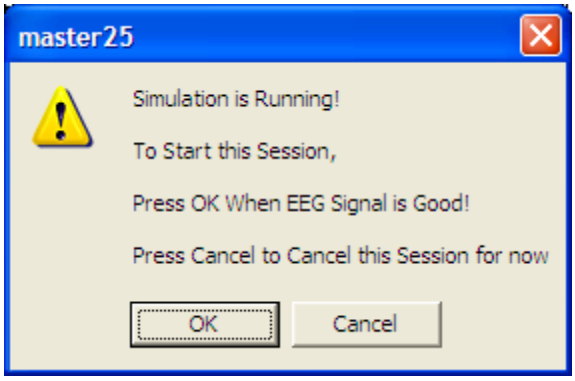
You may see a licensing control panel for the Applied Neurosciences software. If so, you will need to get your "A" key and then contact the manufacturer for a "B" key:



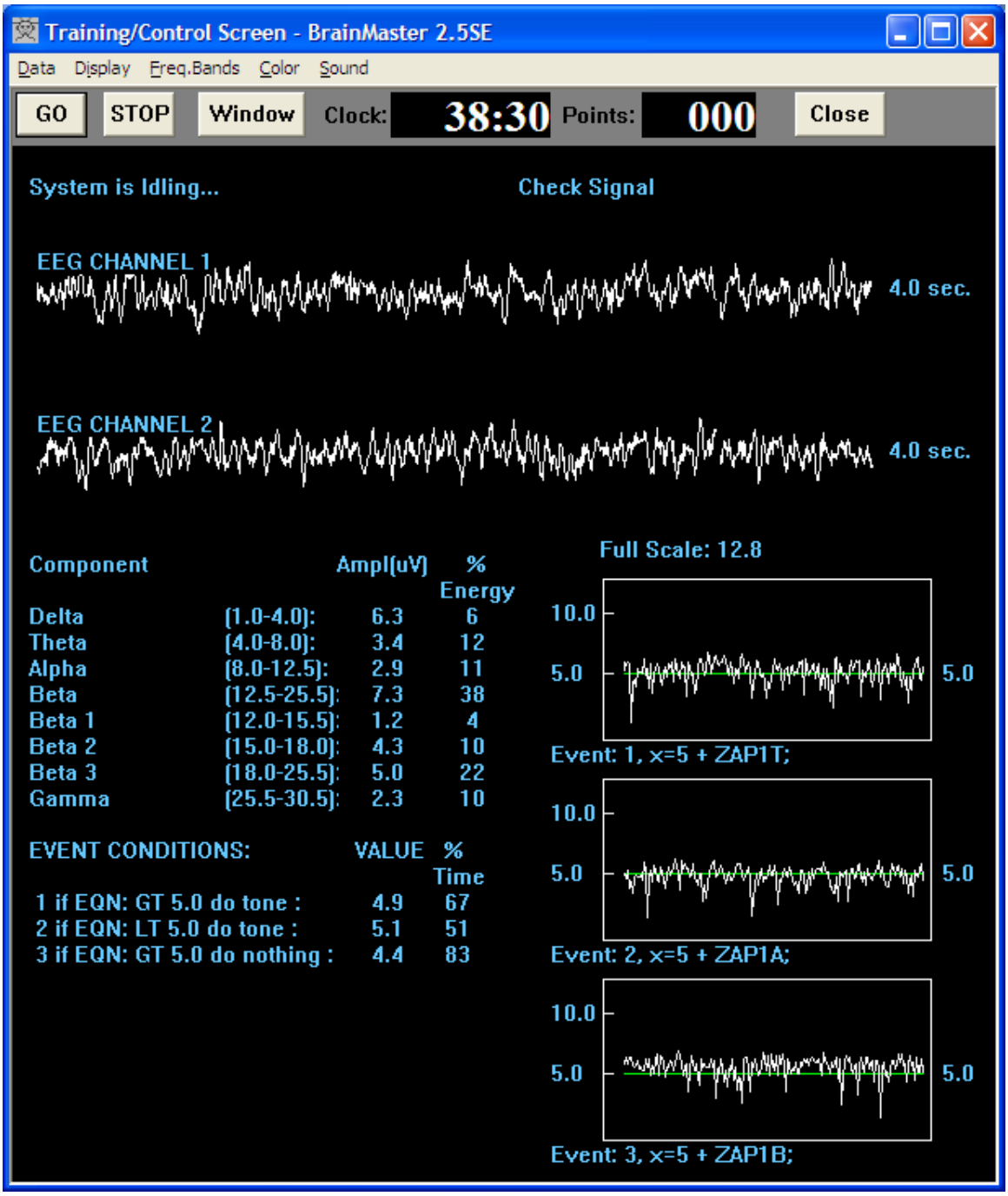
Communicate this number to Applied Neurosciences, Inc. or to BrainMaster Technologies, Inc., and you will be able to purchase a B key to use the software. Once you have licensed the ANI Biofeedback software, you will not see this screen again. You will see the following dialog after licensing the software, and in the future, you will see the following dialog immediately after pressing "GO":



Press "OK", and the system will go through its normal starting process, and then prompt you to press "OK" when the signal is OK:



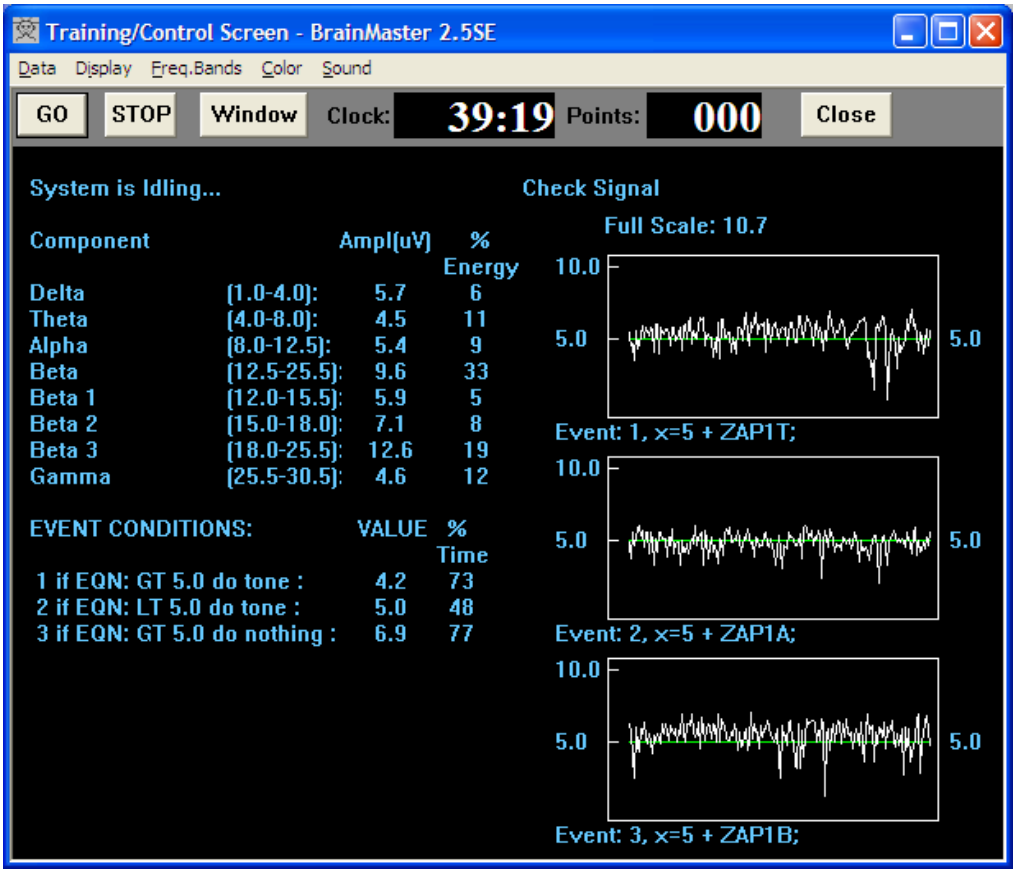
After your press "OK" and the training screen starts, you should see a screen like the following:



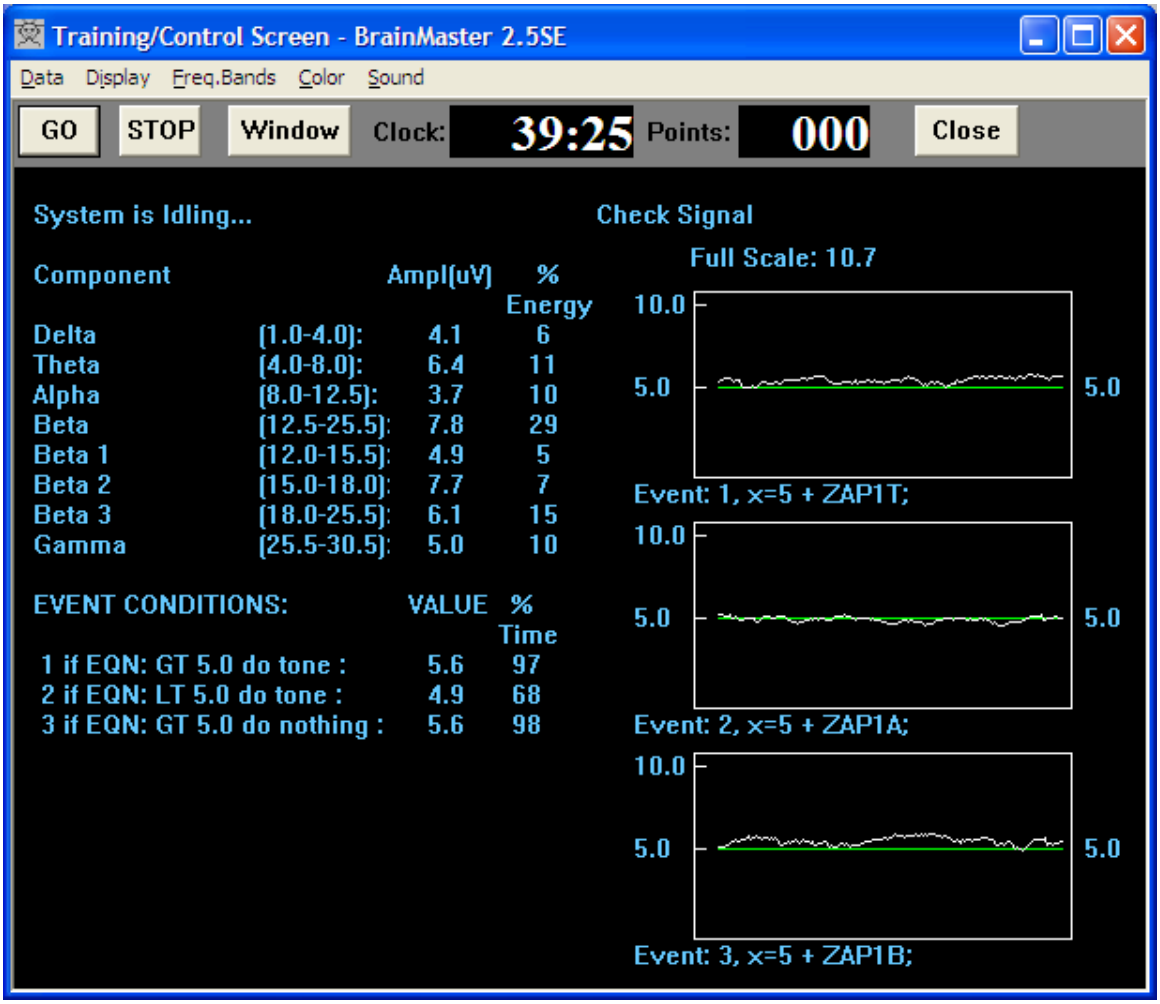
The Z Scores are shown in the graphs at lower right, and can be used for training. For convenience, we add the value 5.0 to each Z score, to make a positive number. Thus, when a Z score is 0, the graph is at 5.0.

Note: When the Z Score training is running, your PC will use more of the processor. You should expect a small (3-5%) increase when this is being used. On a typical 1GHZ processor, the BrainMaster software with Z Scores uses between 3% and 10% of the CPU, compared to 0% - 2% typically with the BrainMaster 2.5SE software alone.

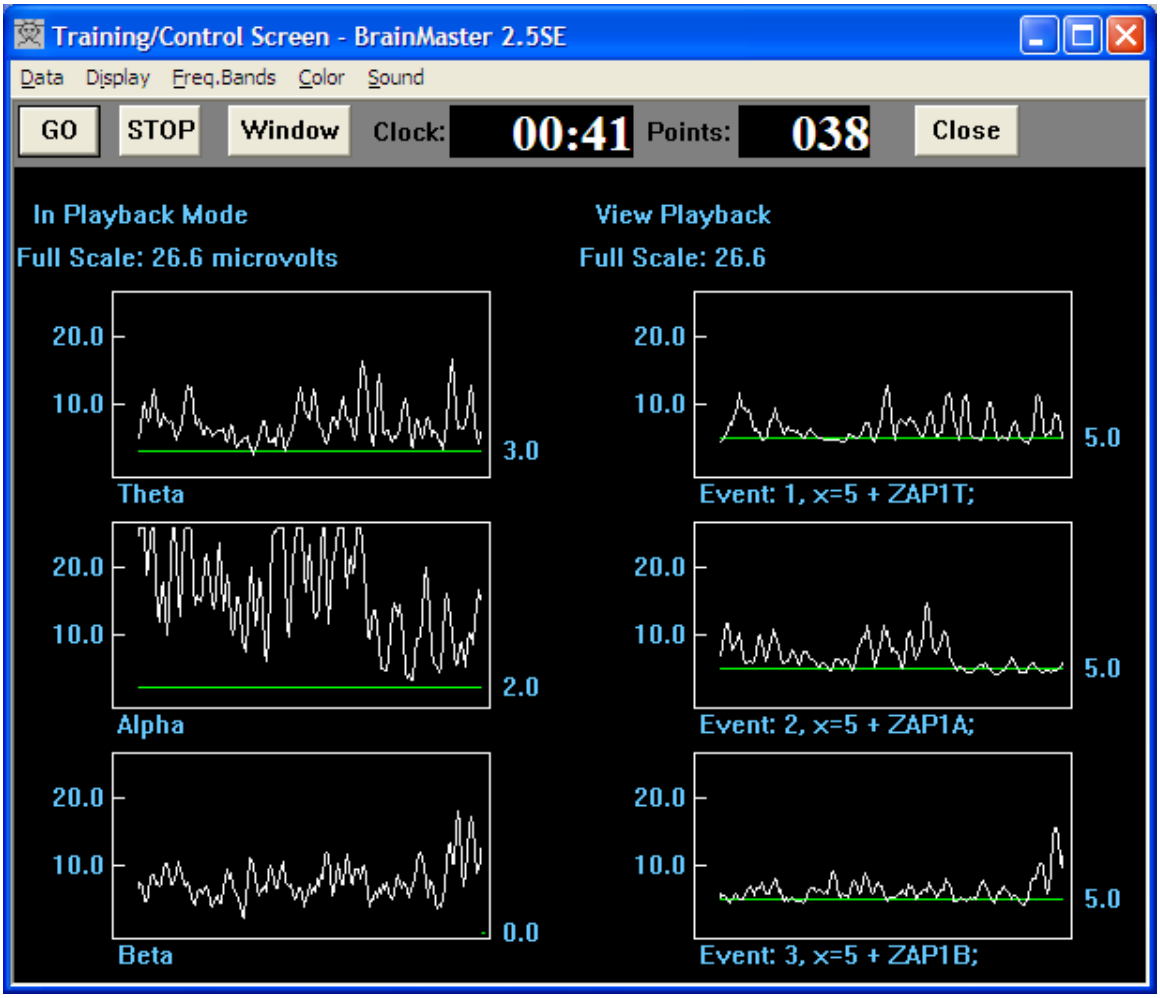
You can use any training methods with Z Scores through the Event Wizard. You can also use any screen configuration(s) you like. The Z Scores used in the Event Wizard will show up on the Text Stats panel, and on the Event Trends panel. Note that the Event Wizard automatically computes the percent time meeting criterion for any events. Thus, in the example below, the Text Stats displays the current value, as well as the percent time that each Z Score is above (or below) the "normal" value, based upon how each event is defined:



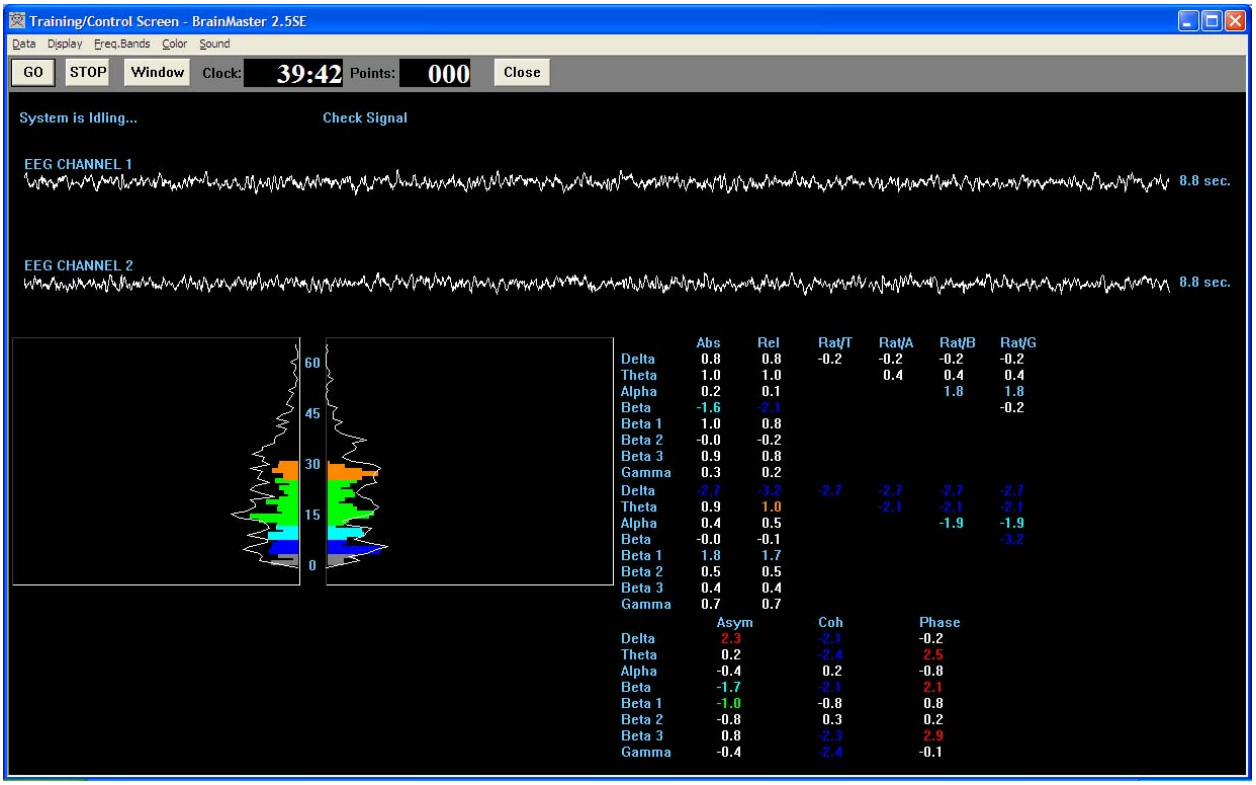
Note that you can use the “damping factors” in the Event Wizard to create time-averages of any variable, including the z scores. The following example shows the effect of a damping factor of 10:



In the following example, the BrainMaster component amplitudes are plotted along with the Z Scores as trend plots. The concordance between the raw amplitude scores and the Z sores can be seen in the signals.

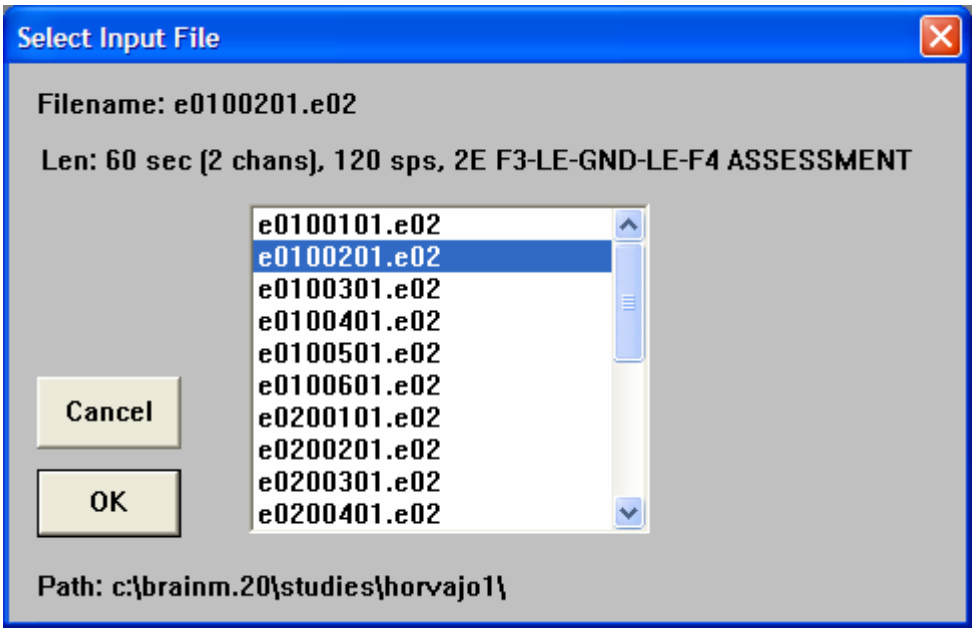


The following screen shows the live “Z Score Panel” that is available on the training screen whenever Z Scores are used. This panel shows all 76 avaialable Z Scores. The Z Scores are damped, to provide a slower time course than the standard, faster moving training variables. The Z Scores are color coded, to show when they exceed the normal limits. High Z Scores are colored yellow (+1 SD to +1.5 SE), orange (+1.5 SD to +2.0 SR) and red (+2 SD and above), and low Z Scores are colored Green (-1.0 SD to -1.5 SD), blue-green (cyan) (-1.5 SD to 2.0 SD) and blue (-2 SD and below). This provides a real-time “report” of the Z Scores, as the training or monitoring session progresses.

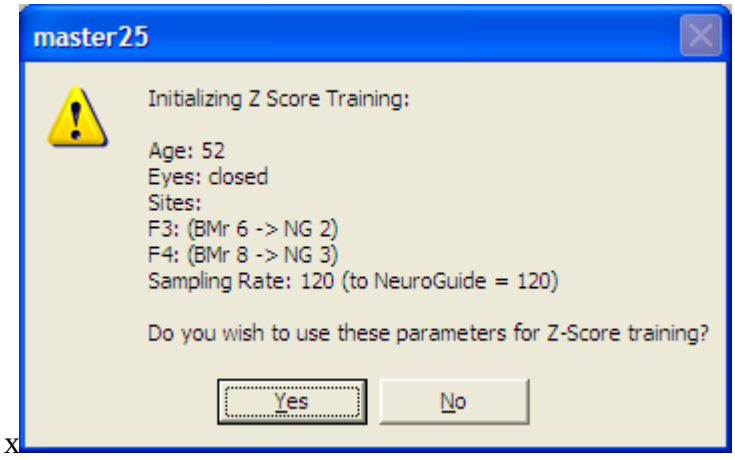


Playing back files:

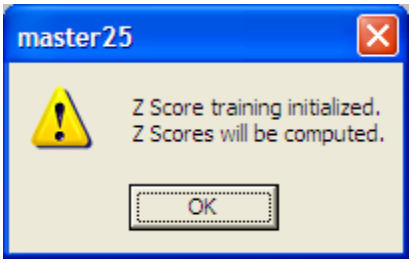
If you have the Z Score Training enabled, and you select files for playback, the system will automatically detect the sensor locations and eyes (open or closed), if these were set when the data were acquired.



When you select a playback file and hit "OK", then if the age of tehr trainee is other than "0", the system will attempt to set up the Z Score mechanism for playback. You should see a dialog like the following:

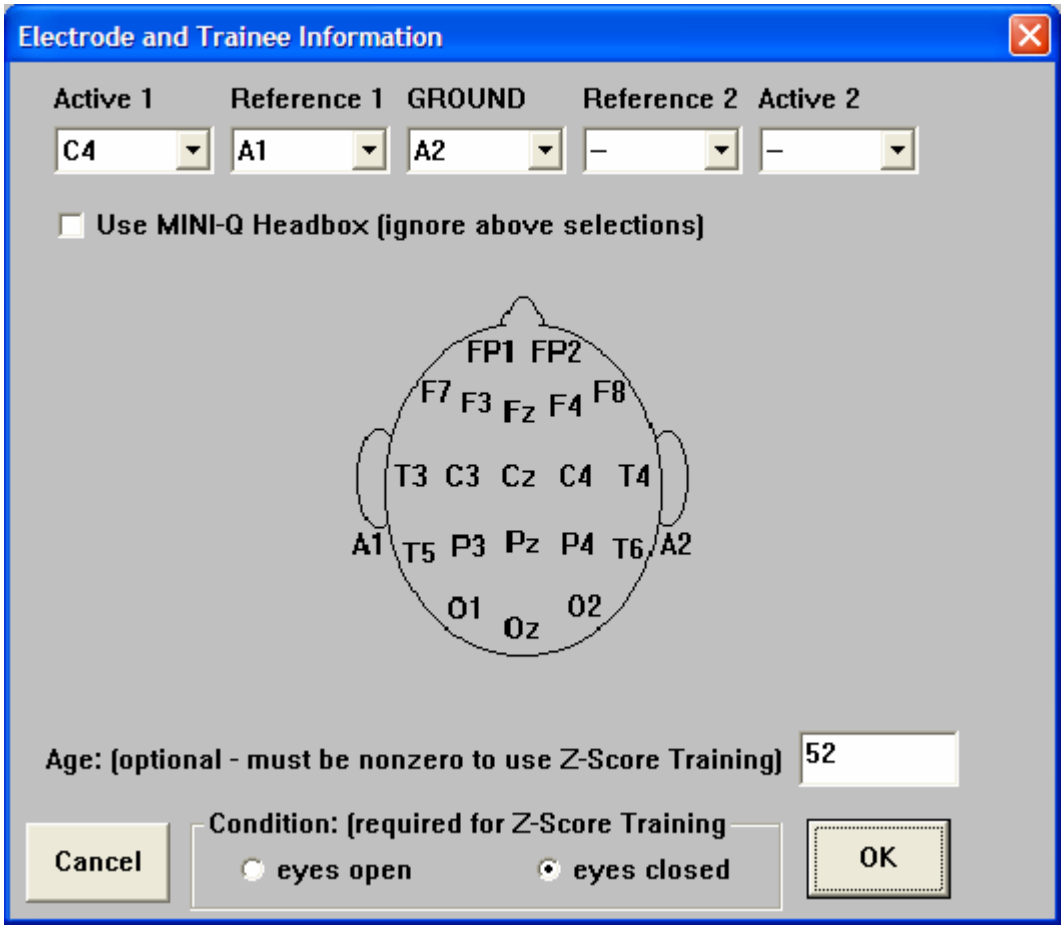


When you hit "OK" the system will initialize the Z Score system. If it is successful, you will see a dialog like the following:



Hit “OK” to proceed, and the playback will begin.

Note: For records made with software before the March 2006 software, the data keys will not contain the age or the eyes condition. When playing back such records, you should go to the following screen (the button for this control is is found on the “View or Change Settings/Data Channels” control panel)



and make changes as necessary, so that your playback contains the correct information.

Built-in Settings Files.

The following Settings files are provided in the 2.5SE April 1, 2006 release, for initial use:

Z Score Training I Using Applied Neuroscience DLL
Z Score Coherence Demo
Z Score Coherence Range Training:
Z Score Phase Training Demo
Z Score Theta Beta Ratio Training Demo

To use these settings files, either create a new folder, or select the "test" folder, or select another folder to work in. Then press "View or Change Settings / Read/Write a Settings File". Then select the name from the choices, press "Read Settings from this File" and "OK". Then you will have the settings loaded, into the current folder, to work with.

These settings files provide starting points to design further protocols. For example, sounds can be added to the Event Wizard settings, to provide training based upon the Z Scores. Some of the files already demonstrate this.

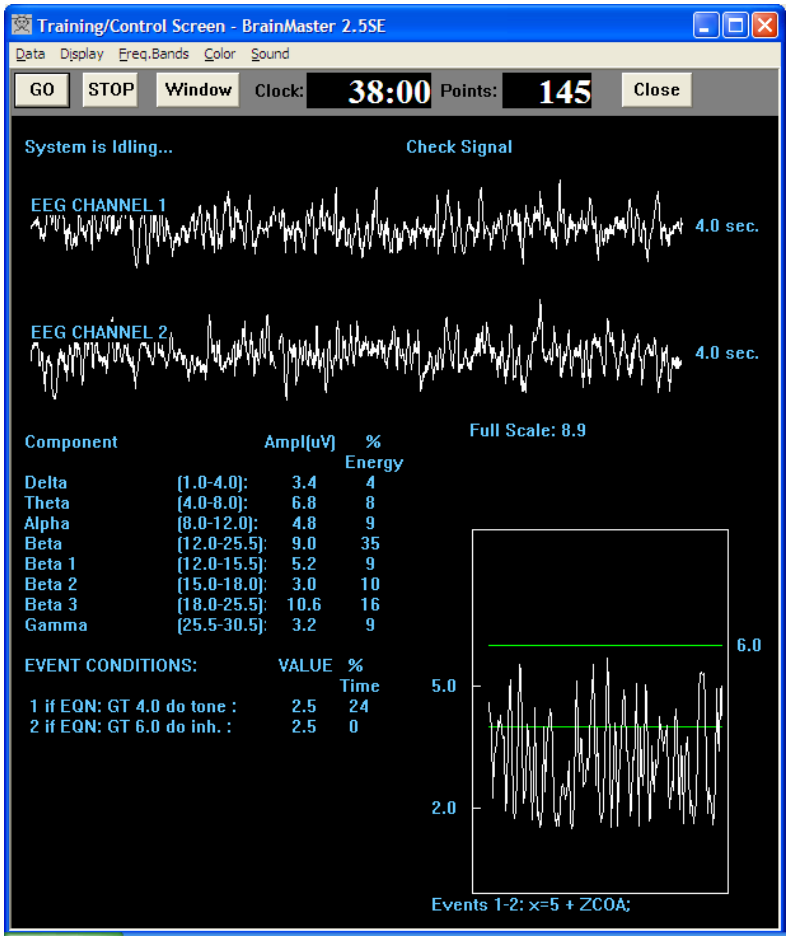
Any panels can also be added. The raw and filtered waveforms, BrainMirror displays, or other panels can be used, as required in any of these designs.

The files marked "Demo" are set up as simulations. To use them for training, use the "Session Control" panel, and change them from "simulation" to "training".

These files are described in the following descriptions.

Z Score Coherence Range Training:

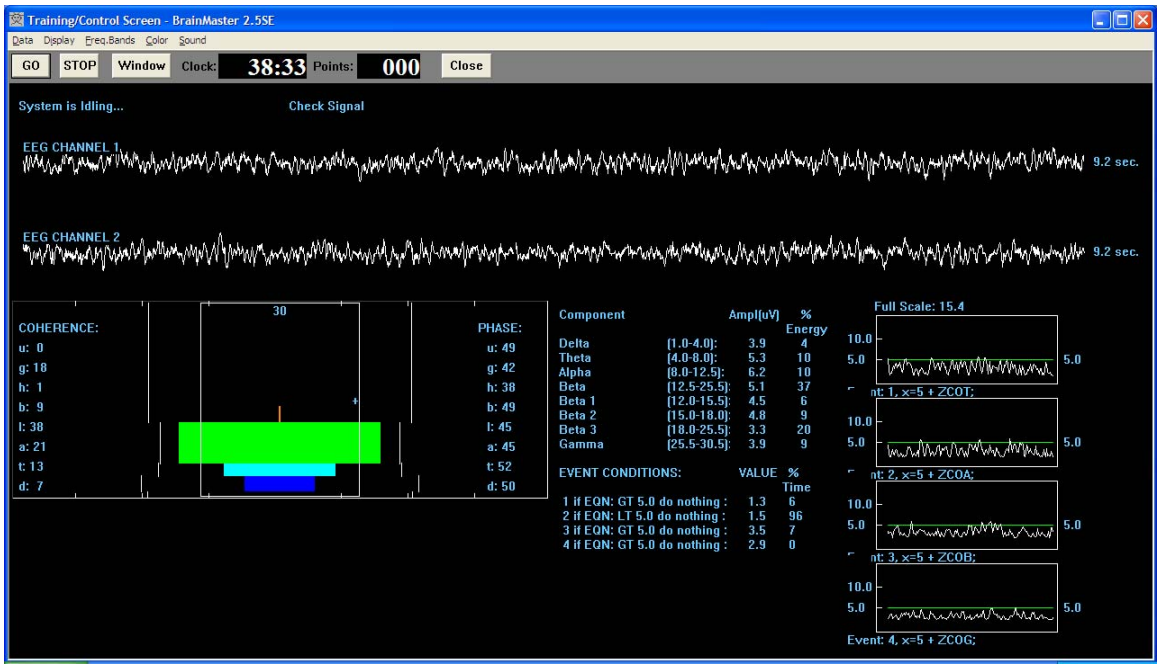
This is an example of a protocol in which the Z score of the alpha coherence is trained within a range, being rewarded when it is within 1 standard deviation of normal:



Z Score Coherence Demo

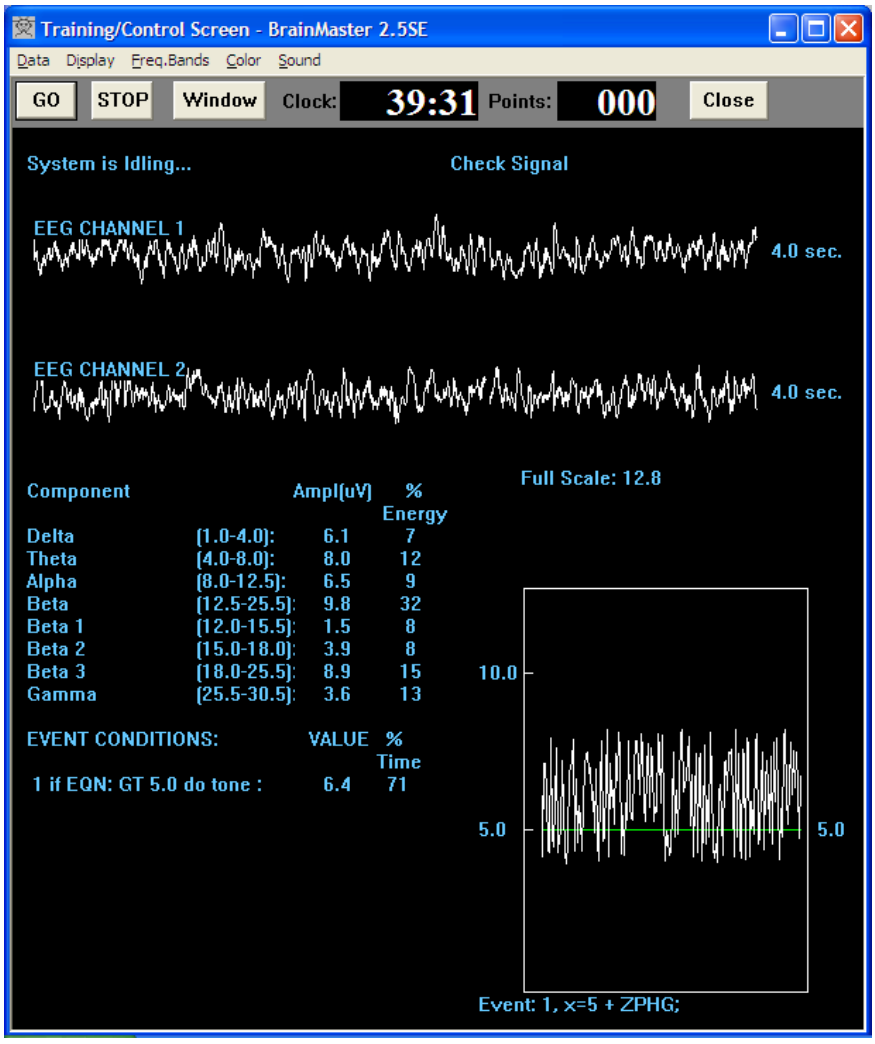
This file runs the BrainMaster coherence alongside the Z Score coherence:

Sounds can be produced by either the built in “coherence” sounds, by the event sounds, or by a combination of both.



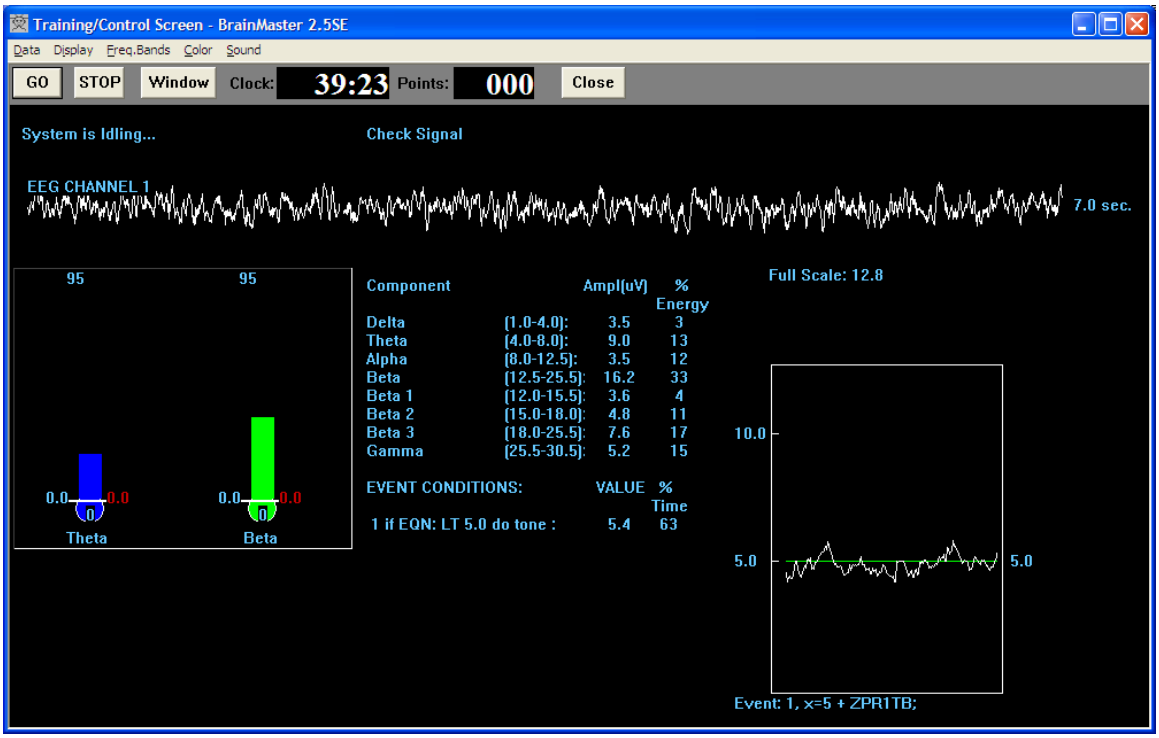
Z Score Phase Training Demo

This file demonstrates training the phase difference between two signals, using the Z phase metric.



Z Score Theta Beta Ratio Training Demo:

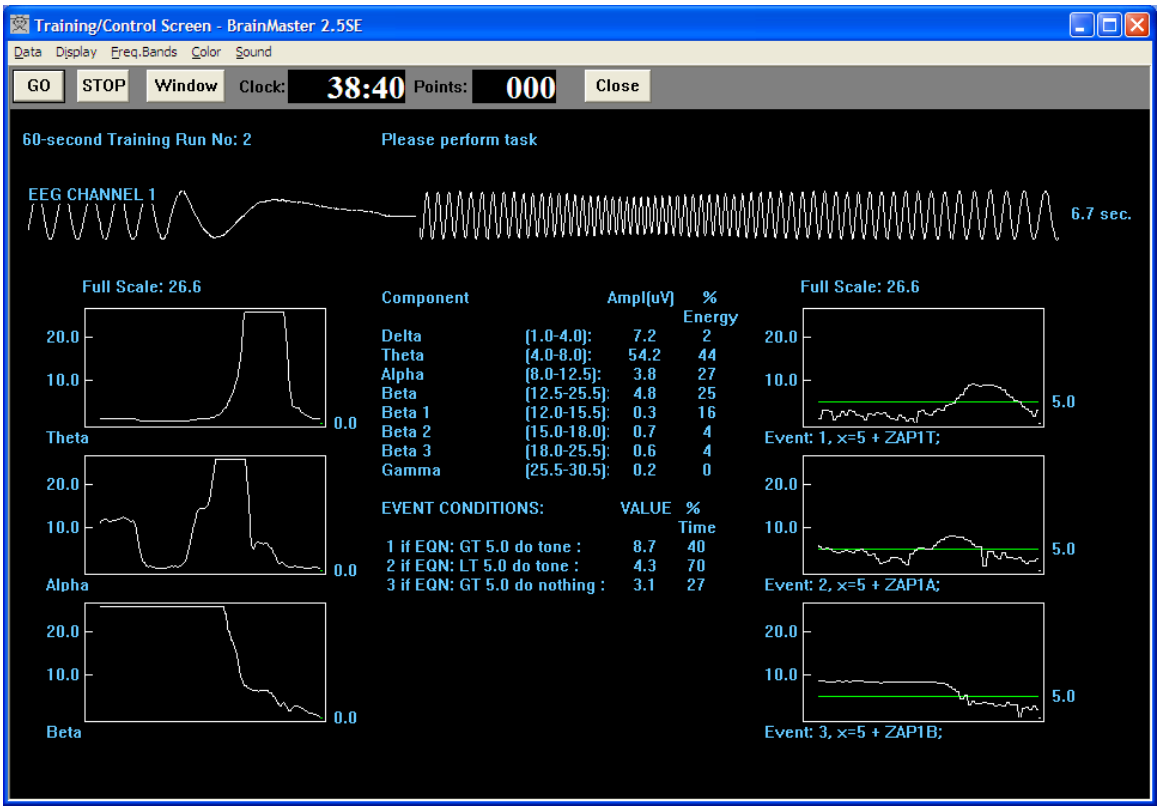
This demonstrates using the Z Score for the Theta/Beta ratio as a training variable. At the same time, the theta and beta amplitudes are monitored using the thermometers, and the Trend Text panel.



The following example shows a sinewave sweep into the system, with the BrainMaster digital filter amplitudes trended for three components on the lower left, and the Z scores for the same components trended on the lower right.

This uses the built-in settings file:

Z Score Training I Using Applied Neurosciences DLL



It shows the expected behavior. The concordance between the raw amplitudes and the Z scores is seen, as they rise and fall in a similar fashion. It is visibly evident how the Z score variable provides a metric that will occupy a range around the green line ("normal"). Z score training automatically provides this ability to train to any particular Z score, and have the details of the signals managed by the ANI Z DLL, to always provide a normalized metric.

Data Descriptions for Event Wizard Z Score Training:

The following is excerpted from the Data Dictionary for the Event Wizard. It shows the variable names and interpretations for the values accessible using the ANI Z DLL with the BrainMaster Event Wizard:

ZAP1D, ZAP1T, ZAP1A, ZAP1B, ZAP11, ZAP12, ZAP13, ZAP1G, ZAP2D, ZAP2T, ZAP2A, ZAP2B, ZAP21, ZAP22, ZAP23, ZAP2G	delta, theta, alpha, beta, beta1, beta2, beta3, gamma Absolute Power 2 channels / 8 bands
ZRP1D, ZRP1T, ZRP1A, ZRP1B, ZRP11, ZRP12, ZRP13, ZRP1G, ZRP2D, ZRP2T, ZRP2A, ZRP2B, ZRP21, ZRP22, ZRP23, ZRP2G	delta, theta, alpha, beta, beta1, beta2, beta3, gamma Relative Power 2 channels / 8 bands
ZPR1DT, ZPR1DA, ZPR1DB, ZPR1DG, ZPR1TA, ZPR1TB, ZPR1AB, ZPR1AG, ZPR1BG, ZPR2DT, ZPR2DA	d/t, d/a, d/b, d/g, t/a, t/b, t/g, a/b, a/g, b/g Power Ratios 2 channels / 10 ratios
ZAAD, ZAAT, ZAAA, ZAAB, ZAA1, ZAA2, ZAA3, ZAAG	delta, theta, alpha, beta, beta1, beta2, beta3, gamma Amplitude Asymmetry 8 bands
ZCOT, ZCOA, ZCOB, ZCOG	theta, alpha, beta, gamma Coherence 4 bands
ZPHD, ZPHT, ZPHA, ZPHB, ZPH1, ZPH2, ZPH3, ZPHG	delta, theta, alpha, beta, beta1, beta2, beta3, gamma Phase Difference 8 bands

NeuroGuide bands are:
D: Delta (1-4), T: Theta (4-8), A: Alpha (8-12.5), B: Beta (12.5-25.5)
G: Gamma (25.5-30.5), 1: Beta 1 (12 – 15.5), 2: Beta 2 (15-18), 3: Beta 3 (18 – 25.5)

Examples of Z Score Training:

x=ZAP1A;	get the alpha amplitude z score
x=ZPHT;	get the phase difference z score for theta
x=ZCO1;	get the coherence z score for beta1
x=ZPR1BG	get power ratio z score number 10 (beta/gamma) for Channel 1
x=ZAAA;	get the alpha amplitude asymmetry
x=(ZAP1T + ZAP2T)/2;	get average of z scores for theta from channels 1 and 2

NOTE: NeuroGuide and the ANI Z DLL are products and trademarks of Applied Neuroscience, Inc.

BrainMaster and the Event Wizard are products and trademarks of BrainMaster Technologies, Inc.