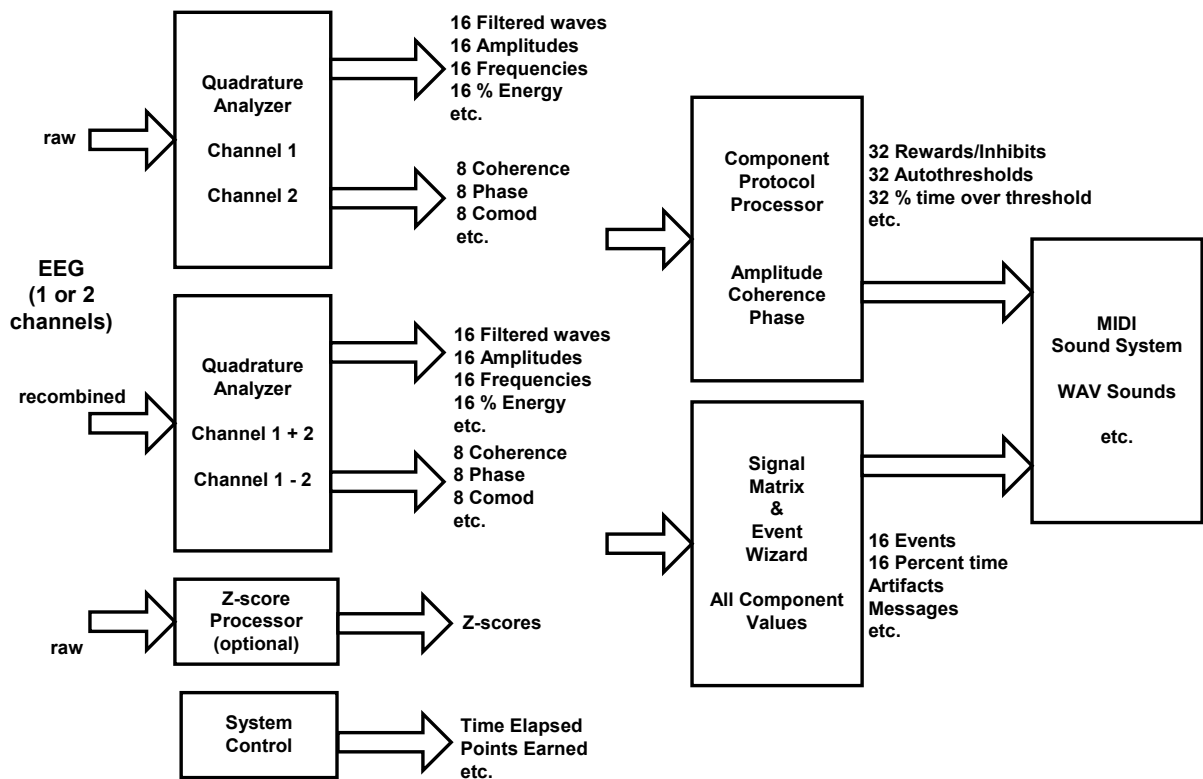


## Uses of the Event Wizard

### Event Designer

This tool allows the user to design up to 16 independently targetable threshold/voice modules, which supplement the 32 built-in threshold/voice modules in the BrainMaster 2.5 software. It is based on the real-time EEG processing provided by the BrainMaster 2.5SE software. Using the built-in processing modules and controls, the Event Wizard allows the user to tap into the data at any of a wide range of places, and to design control variables and feedback with a wide variety of options.

The conceptual plan of the internal signal processing in the BrainMaster 2.5SE software is as follows:



### BrainMaster 2.5SE with Event Wizard

The BrainMaster 2.5SE software provides all of these processing modules at all times, as part of the built-in monitoring and control functions. These elements provide the equivalent of hundreds of individual signal processing objects, in a single, integrated system. With the Event Wizard, users are able to define complex protocols and sequences of operations, using an intuitive and extensible interface. All of the built-in functions (8 adjustable frequency bands per channel, autothresholding, real-time coherence and phase metrics, etc) are available under the Event Wizard, where they can

be used as training variables, thresholds, or in equations and expressions defining new quantities or functions.

Using the Event Designer, protocols can be created to respond to any of the following components. Note: All components will be available for Channel 1, Channel 2, Sum (Channel 1 + 2) (forthcoming), and Difference (Channels 1 – 2) (forthcoming). We may also include channel multiplication / division at the EEG signal level if desired

Components (8 adjustable bands):

Delta, Theta, Alpha, Lobeta, Beta, Hibeta, Gamma, User

Values:

Amplitude (uV computed via quadrature filtering)

Modal Frequency (Hz, computed via FFT)

% Energy (% , computed via FFT)

Threshold (from built-in threshold system)

% Time over threshold (from built-in autothresholding system)

Variability (forthcoming)

Etc.

When 2 channels are used:

For Channels 1, Channel 2, and for the Sum and difference “virtual” channels:

Coherence

Similarity

Phase

Comodulation (forthcoming)

Etc.

The user interface provides the ability to apply scale factors, offset factors, and damping factors independently to the components, for use in tailoring training protocols.

Z scores are also available via. the NeuroGuide real-time interface (forthcoming)

Other criteria that can be used for events include:

Time elapsed in session

Points earned in session

The Event Condition is defined using the control panel that provides selections of channel, component, value, and user-defined values to control the signal processing. The Condition consists generally of the comparison of two values. Either value may be any available component, with adjustable scale and offset factors, and each value has its own damping factor. The Condition is stated in terms of “IF (value1) (Rule) (value2) THEN”. Where value1 and value2 may be defined as a wide range of values and computations, under user control.

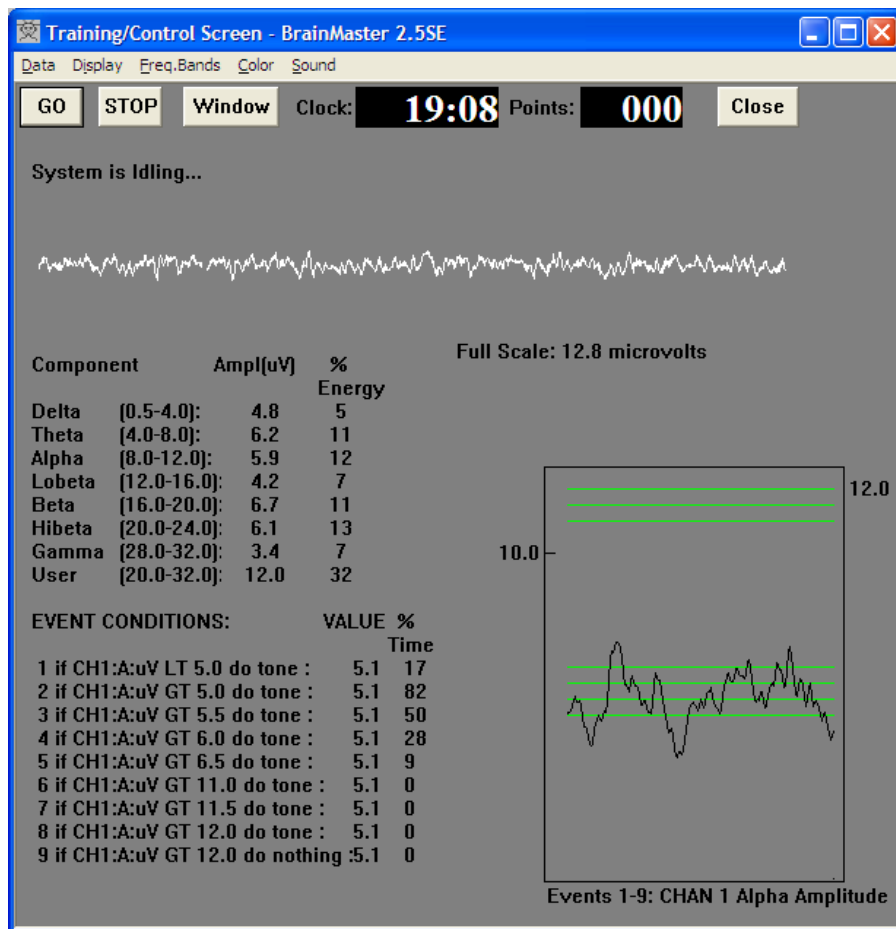
Once the Condition is defined, the Event Wizard makes it possible to define “Result” events that follow when the Condition is met. The results include producing MIDI sounds with up to 128 voices and 88 notes, playing sound files, displaying messages (forthcoming), changing protocols (forthcoming), etc.

### Event Text Panel

This panel displays the status of the built-in components (delta, theta, etc), as well as any events that have been enabled. It is useful as a real-time indicator of current levels, percent energy, and percent time that events meet their conditions, etc.

### Event Trend Viewer

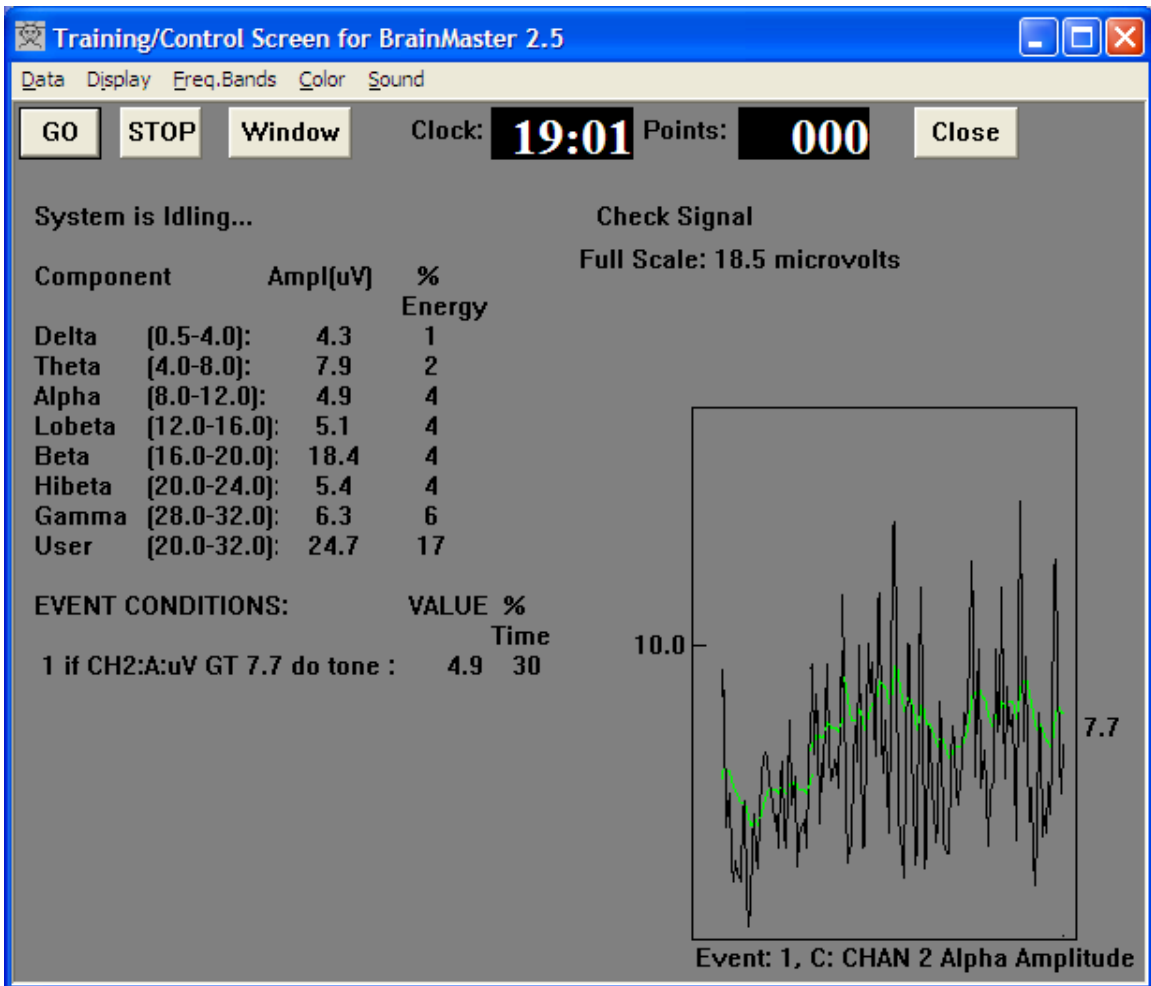
The Event Trend Viewer automatically displays the enabled events as an optional panel on the BrainMaster Training Screen. It can be viewed alongside any other panels as desired.



## Uses of the Event Wizard

### Dynamic Thresholding:

The following screen uptrains alpha by using a damped version of the alpha amplitude as the threshold:



As shown in the Event Designer screen, the alpha is damped with a factor of 20, then added to an offset of 2.0 microvolts, to cause it to be more challenging. As a result, the % time over threshold is around 30%. A single continuous tone signals when the instantaneous value of the envelope exceeds the dynamic threshold.

Event Wizard for BrainMaster - Preliminary 11/17/05

**Event Designer for BrainMaster**

Event Number:  1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16

This Event Is:  Enabled  Disabled

**Event Condition:**

IF: Channel 1 Alpha Amplitude Damping Factor:  
Constant: 0 Scale Factor: 100 Offset: 0.0 0

Equation:

RULE: IS GREATER THAN

Channel 1 Alpha Amplitude Damping Factor:  
Threshold: 0 Scale Factor: 100 Offset: 2.0 20

Equation:

**MIDI Sound Properties:**

Starting Note: 45 F (698.5) 1 to 88  
Instrument: 16 Organ 1 128 choices  
Playing Style: Sustained Percus. or Sust.  
Modulation: Amplitude Ampl. or Pitch  
Starting Loudness: Level 1 1 to 128  
Loudness Change Rate: +10 -10 to +10  
Note Change Rate: +10 -10 to +10  
Musical Scale (Mode): Major (Ionian) 15 choices  
Musical Key: C C to B Flat  
Play Note or Chord: 1 Note 1 to 8 Notes

**Event Result:**

THEN: Play MIDI Sound

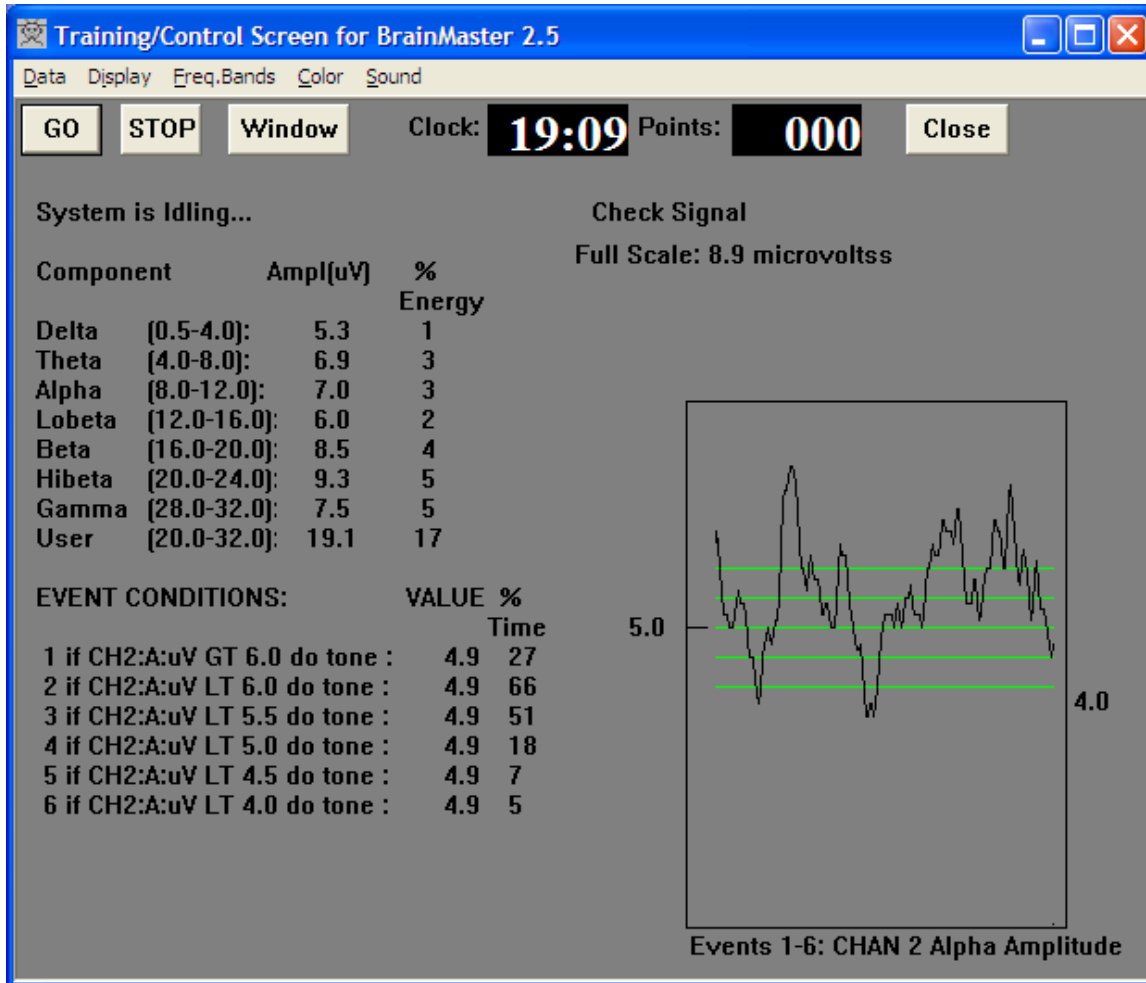
Obey Inhibits ("stops")  Control MMP Player

**Event Summary:**

Summary for Event 1: EVENT 1 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS GREATER THAN Channel 1 Alpha Amplitude  
THEN: Play MIDI Sound MODE: 2 NOTE: 45 INSTR: 16 Organ 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Multiple Thresholding:

By defining events that respond to a given component, but use different thresholds, it is possible to put up to 16 independent thresholds (with MIDI voices, etc.), on one component. This facilitates sensitive level training, for any component such as amplitude, frequency, and so on.



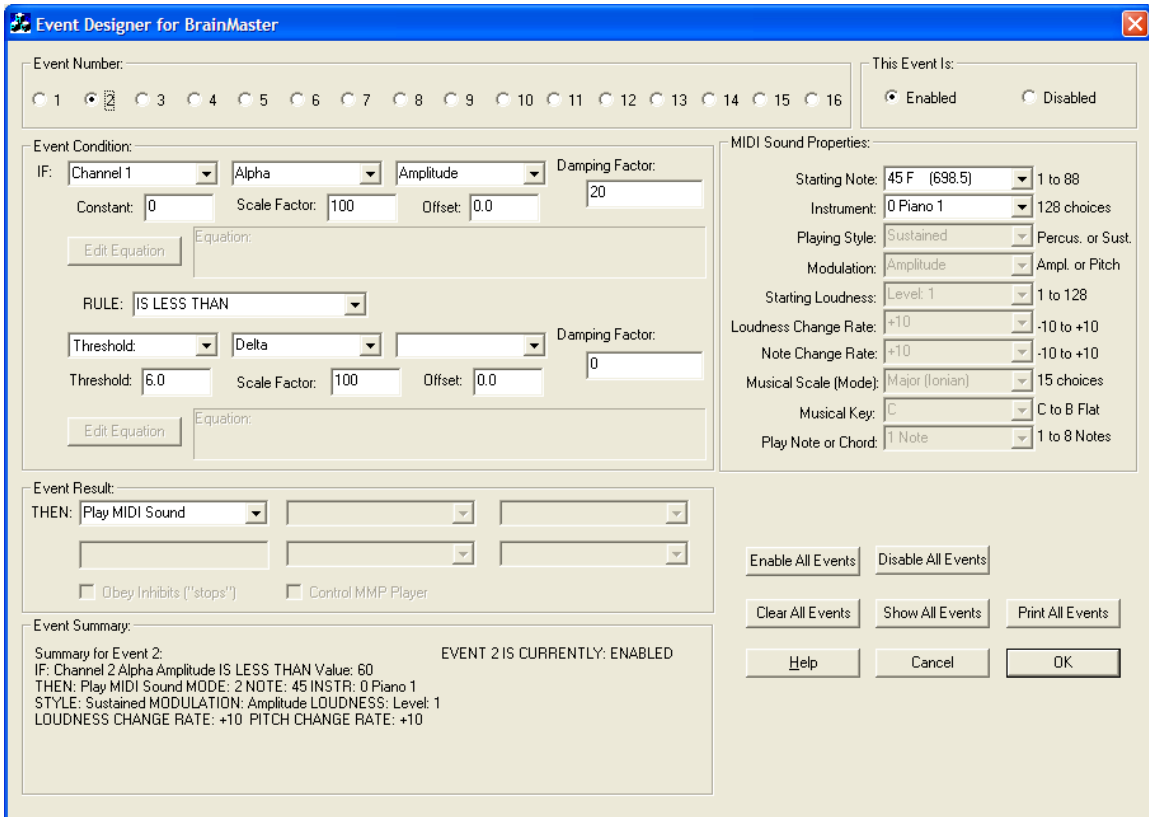
The trainee hears one of two things:

A soft organ tone when alpha is above 6.0, or  
 Piano notes walking down the keyboard as the alpha amplitude decreases.

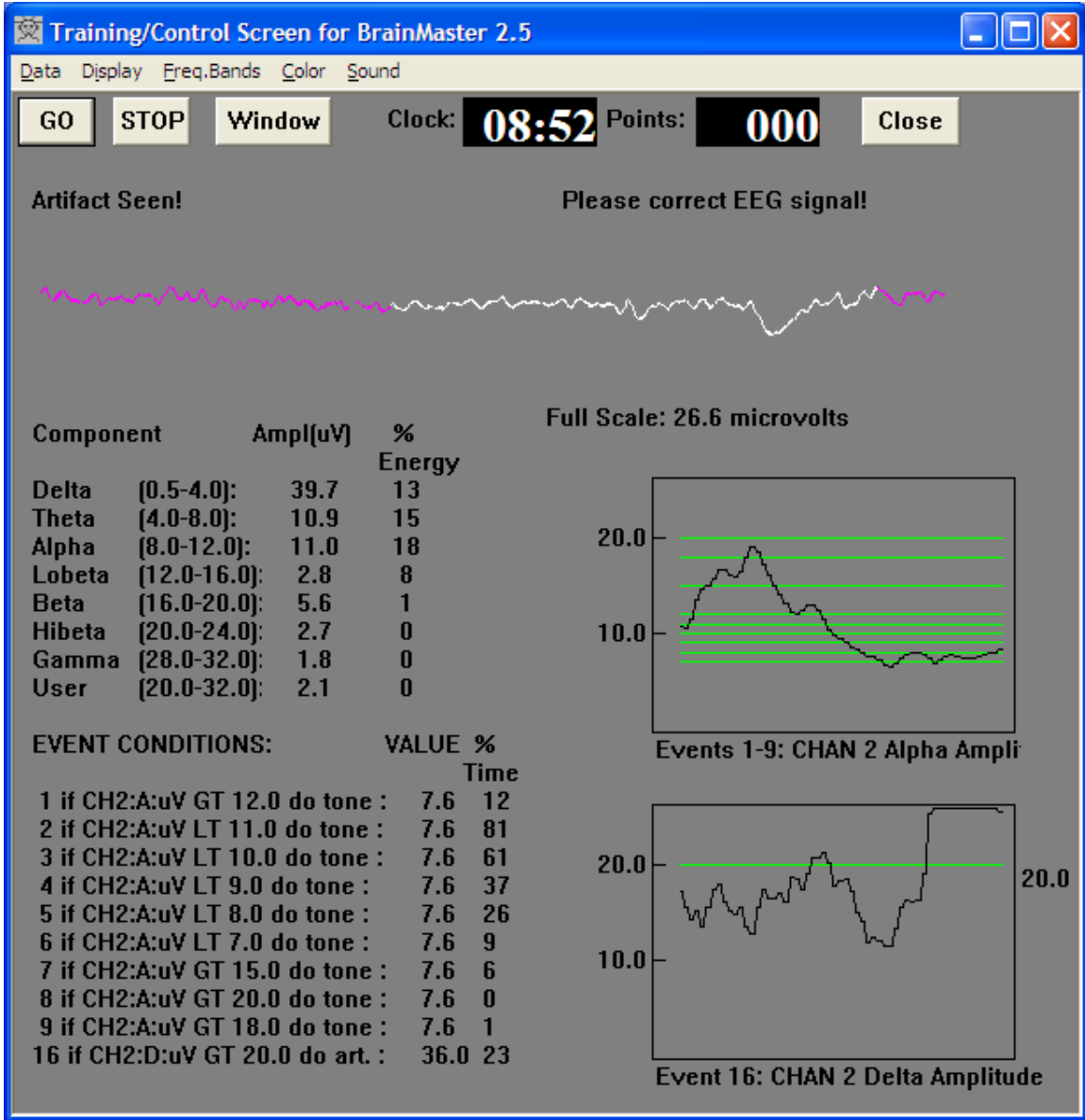
The first 6 events are defined to “look at” the same component, i.e. Channel 1 Alpha Amplitude. As a result, the Event Trend Display combines the events into one plot.

The Trend Text display shows the percent time in criterion for each event. Note that this is the time that the component meets the rule (“less than”, “greater than”), etc., not simply the time that the value is above threshold.

This type of training can be used with any available values including amplitude, frequency, relative energy (ratio training), and percent time over threshold. Regarding the use of percent time over threshold, it is possible to set fixed thresholds, and then use as the training signal the percentage of time the trainee exceeds that threshold. Thus, in certain types of training, it is possible to train up to a limit, at which, if the trainee is producing any particular component more or less than a given percentage of the time, a sound can be generated, etc.



Further example of multiple thresholding:



This example plays descending notes if the trainee's alpha is falling below a set threshold level, and plays different notes when the alpha is above. When above threshold, the trainee hears first an organ tone, then a higher pipe organ tone, and finally a tubular bell, as the top threshold is reached. As the trainee attempts to achieve more bells during the session, the top bar provides an effective indicator of precise progress. Delta is used as an artifact detector, and shows in its own graph.



**BMrEventGUI** 

 Summary for Event 1: EVENT 1 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS GREATER THAN Value: 120  
THEN: Play MIDI Sound MODE: 2 NOTE: 45 INSTR: 16 Organ 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 2: EVENT 2 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS LESS THAN Value: 110  
THEN: Play MIDI Sound MODE: 2 NOTE: 45 INSTR: 16 Organ 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 3: EVENT 3 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS LESS THAN Value: 100  
THEN: Play MIDI Sound MODE: 2 NOTE: 44 INSTR: 16 Organ 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10


Summary for Event 4: EVENT 4 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS LESS THAN Value: 90  
THEN: Play MIDI Sound MODE: 2 NOTE: 43 INSTR: 16 Organ 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10


Summary for Event 5: EVENT 5 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS LESS THAN Value: 80  
THEN: Play MIDI Sound MODE: 2 NOTE: 42 INSTR: 16 Organ 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 6: EVENT 6 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS LESS THAN Value: 70  
THEN: Play MIDI Sound MODE: 2 NOTE: 41 INSTR: 16 Organ 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 7: EVENT 7 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS GREATER THAN Value: 150  
THEN: Play MIDI Sound MODE: 2 NOTE: 57 INSTR: 19 Church org. 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 8: EVENT 8 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS GREATER THAN Value: 200  
THEN: Play MIDI Sound MODE: 2 NOTE: 52 INSTR: 0 Piano 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

**BMrEventGUI** 

 Summary for Event 9:  
IF: Channel 2 Alpha Amplitude IS GREATER THAN Value: 180  
THEN: Play MIDI Sound MODE: 2 NOTE: 64 INSTR: 14 Tubular bell  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10  
EVENT 9 IS CURRENTLY: ENABLED

Summary for Event 10:  
IF: Channel 1 Delta Amplitude IS GREATER THAN Value: 0  
THEN: Do Nothing  
EVENT 10 IS CURRENTLY: DISABLED

Summary for Event 11:  
IF: Channel 1 Delta Amplitude IS GREATER THAN Value: 0  
THEN: Do Nothing  
EVENT 11 IS CURRENTLY: DISABLED

Summary for Event 12:  
IF: Channel 1 Delta Amplitude IS GREATER THAN Value: 0  
THEN: Do Nothing  
EVENT 12 IS CURRENTLY: DISABLED

Summary for Event 13:  
IF: Channel 1 Delta Amplitude IS GREATER THAN Value: 0  
THEN: Do Nothing  
EVENT 13 IS CURRENTLY: DISABLED

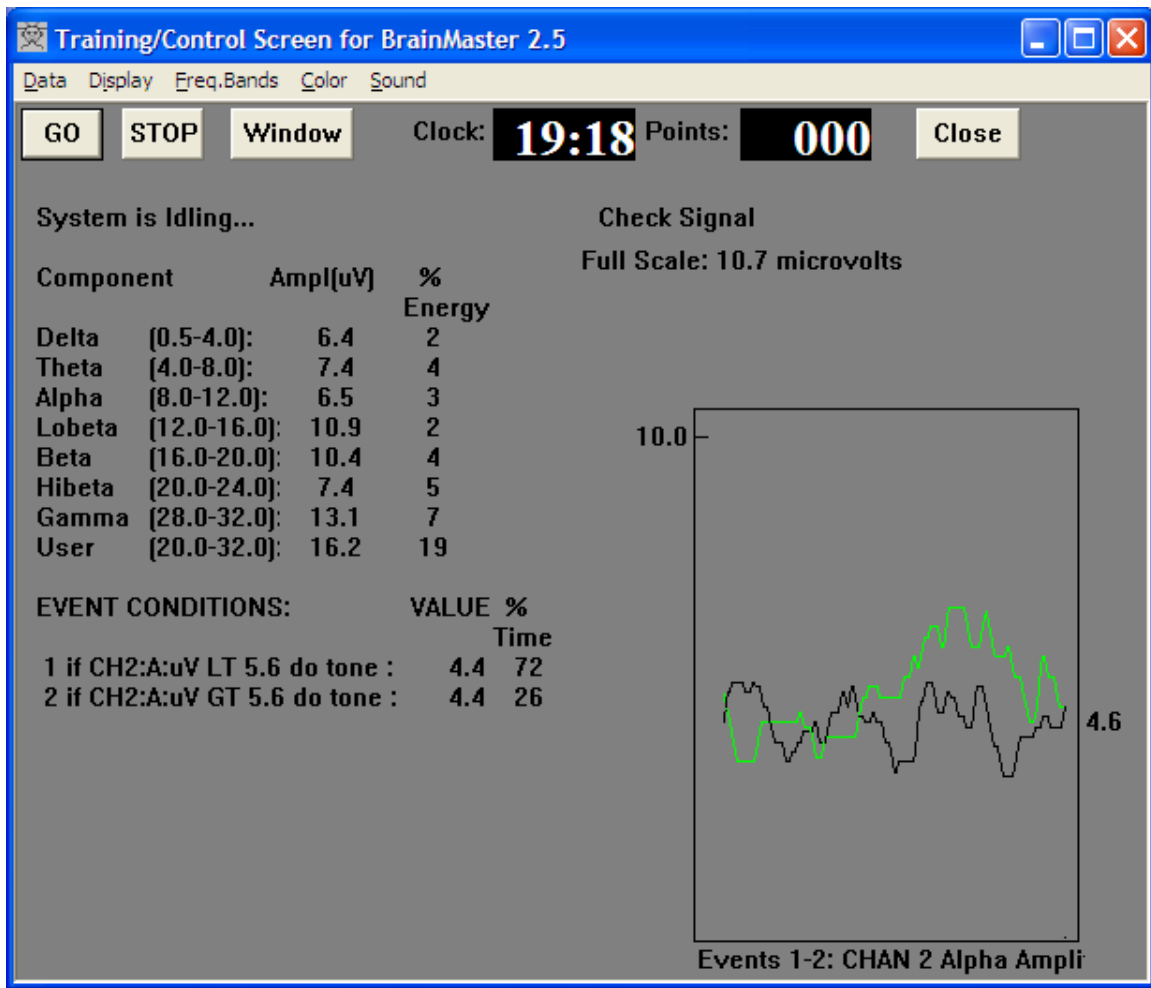
Summary for Event 14:  
IF: Channel 1 Delta Amplitude IS GREATER THAN Value: 0  
THEN: Do Nothing  
EVENT 14 IS CURRENTLY: DISABLED

Summary for Event 15:  
IF: Channel 1 Delta Amplitude IS GREATER THAN Value: 0  
THEN: Do Nothing  
EVENT 15 IS CURRENTLY: DISABLED

Summary for Event 16:  
IF: Channel 2 Delta Amplitude IS GREATER THAN Value: 200  
THEN: Signal Artifact  
EVENT 16 IS CURRENTLY: ENABLED

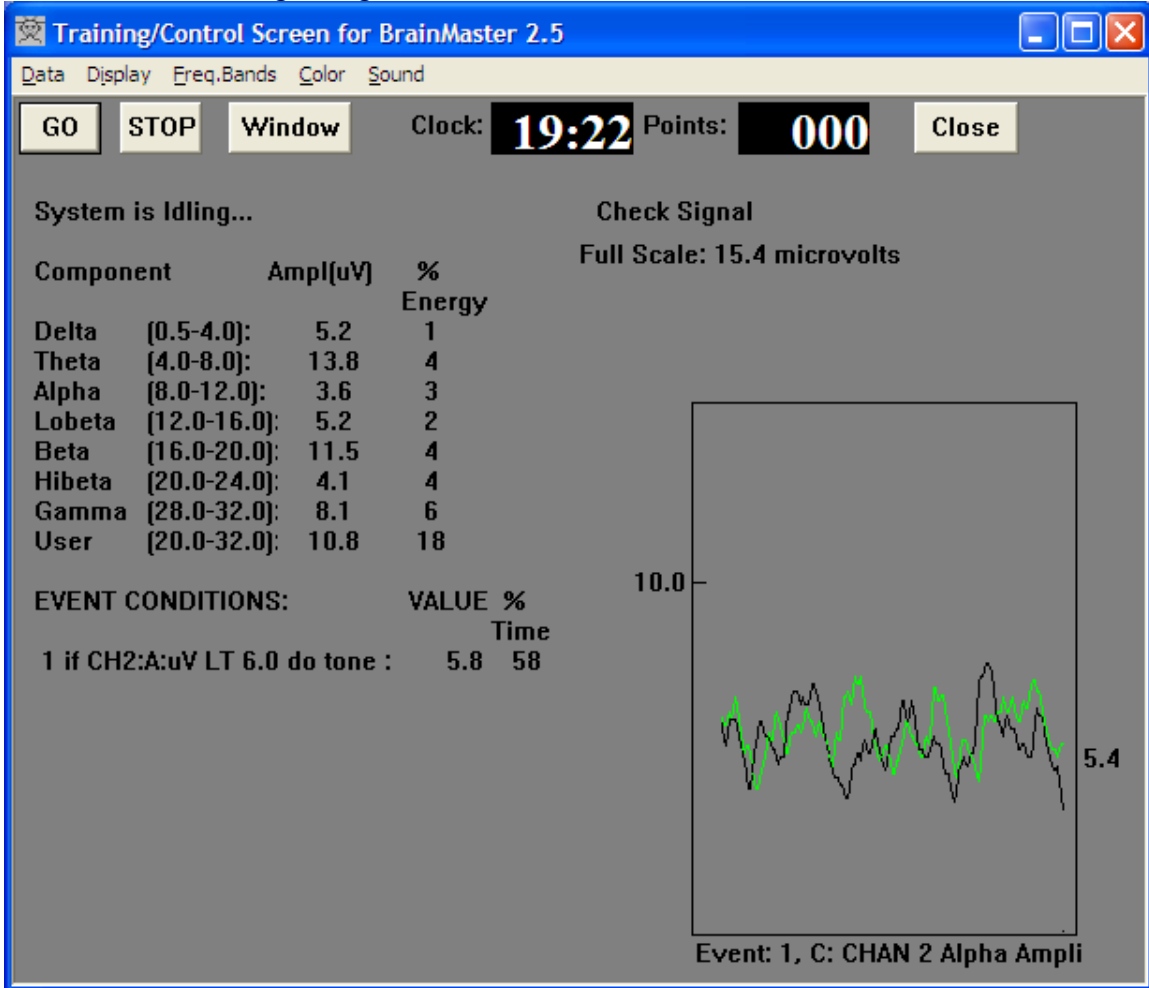
Training two components against each other:

The following example trains alpha vs. theta, in a relaxation protocol.





Asymmetry training:

This is achieved using a single event to control the reward feedback tone.



X

**BMrEventGUI** 

 Summary for Event 1: EVENT 1 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS LESS THAN Channel 1 Theta Amplitude  
THEN: Play MIDI Sound MODE: 2 NOTE: 45 INSTR: 16 Organ 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 2: EVENT 2 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS GREATER THAN Channel 1 Theta Amplitude  
THEN: Play MIDI Sound MODE: 2 NOTE: 45 INSTR: 102 Echo Drops  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 3: EVENT 3 IS CURRENTLY: DISABLED  
IF: Channel 2 Alpha Amplitude IS LESS THAN Value: 55  
THEN: Play MIDI Sound MODE: 2 NOTE: 44 INSTR: 0 Piano 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 4: EVENT 4 IS CURRENTLY: DISABLED  
IF: Channel 2 Alpha Amplitude IS LESS THAN Value: 50  
THEN: Play MIDI Sound MODE: 2 NOTE: 43 INSTR: 0 Piano 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 5: EVENT 5 IS CURRENTLY: DISABLED  
IF: Channel 2 Alpha Amplitude IS LESS THAN Value: 45  
THEN: Play MIDI Sound MODE: 2 NOTE: 42 INSTR: 0 Piano 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 6: EVENT 6 IS CURRENTLY: DISABLED  
IF: Channel 2 Alpha Amplitude IS LESS THAN Value: 40  
THEN: Play MIDI Sound MODE: 2 NOTE: 41 INSTR: 0 Piano 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 7: EVENT 7 IS CURRENTLY: DISABLED  
IF: Channel 1 Delta Amplitude IS GREATER THAN Value: 0  
THEN: Do Nothing

Summary for Event 8: EVENT 8 IS CURRENTLY: DISABLED  
IF: Channel 1 Delta Amplitude IS GREATER THAN Value: 0  
THEN: Do Nothing

Event Wizard for BrainMaster - Preliminary 11/17/05

**Event Designer for BrainMaster**

Event Number:  1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16

This Event Is:  Enabled  Disabled

**Event Condition:**

IF: Channel 1 Alpha Amplitude Damping Factor: 20  
 Constant: 0 Scale Factor: 100 Offset: 0.0  
 Edit Equation Equation:

RULE: IS LESS THAN

Channel 2 Alpha Amplitude Damping Factor: 20  
 Threshold: 0 Scale Factor: 100 Offset: 0.0  
 Edit Equation Equation:

**MIDI Sound Properties:**

Starting Note: 45 F (698.5) 1 to 88  
 Instrument: 16 Organ 1 128 choices  
 Playing Style: Sustained Percus. or Sust.  
 Modulation: Amplitude Ampl. or Pitch  
 Starting Loudness: Level 1 1 to 128  
 Loudness Change Rate: +10 -10 to +10  
 Note Change Rate: +10 -10 to +10  
 Musical Scale (Mode): Major (Ionian) 15 choices  
 Musical Key: C C to B Flat  
 Play Note or Chord: 1 Note 1 to 8 Notes

**Event Result:**


THEN: Play MIDI Sound  
 Obey Inhibits ("stops")  Control MMP Player

**Event Summary:**

Summary for Event 1: EVENT 1 IS CURRENTLY: ENABLED  
 IF: Channel 2 Alpha Amplitude IS LESS THAN Channel 2 Alpha Amplitude  
 THEN: Play MIDI Sound MODE: 2 NOTE: 45 INSTR: 16 Organ 1  
 STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level 1  
 LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Enable All Events Disable All Events  
 Clear All Events Show All Events Print All Events  
 Help Cancel OK

X

**BMrEventGUI** 

 Summary for Event 1: EVENT 1 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS GREATER THAN Value: 60  
THEN: Play MIDI Sound MODE: 2 NOTE: 45 INSTR: 16 Organ 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 2: EVENT 2 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS LESS THAN Value: 60  
THEN: Play MIDI Sound MODE: 2 NOTE: 45 INSTR: 0 Piano 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 3: EVENT 3 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS LESS THAN Value: 55  
THEN: Play MIDI Sound MODE: 2 NOTE: 44 INSTR: 0 Piano 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 4: EVENT 4 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS LESS THAN Value: 50  
THEN: Play MIDI Sound MODE: 2 NOTE: 43 INSTR: 0 Piano 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

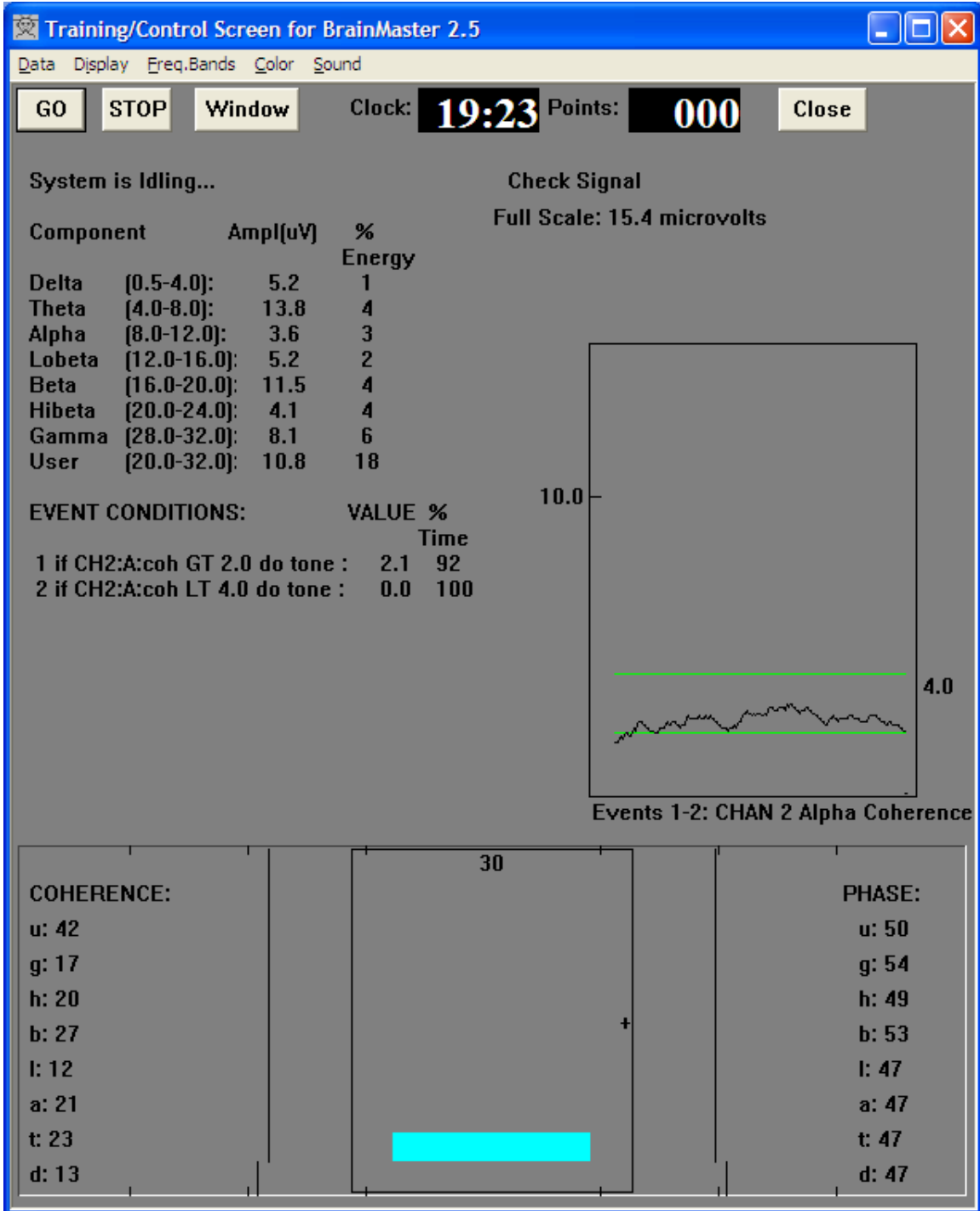
Summary for Event 5: EVENT 5 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS LESS THAN Value: 45  
THEN: Play MIDI Sound MODE: 2 NOTE: 42 INSTR: 0 Piano 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 6: EVENT 6 IS CURRENTLY: ENABLED  
IF: Channel 2 Alpha Amplitude IS LESS THAN Value: 40  
THEN: Play MIDI Sound MODE: 2 NOTE: 41 INSTR: 0 Piano 1  
STYLE: Sustained MODULATION: Amplitude LOUDNESS: Level: 1  
LOUDNESS CHANGE RATE: +10 PITCH CHANGE RATE: +10

Summary for Event 7: EVENT 7 IS CURRENTLY: DISABLED  
IF: Channel 1 Delta Amplitude IS GREATER THAN Value: 0  
THEN: Do Nothing

Summary for Event 8: EVENT 8 IS CURRENTLY: DISABLED  
IF: Channel 1 Delta Amplitude IS GREATER THAN Value: 0  
THEN: Do Nothing

Coherence Range Training:



Note: coherence is currently being shown with a scale factor of 1/10, so 100% looks like a value of 10. This will be amended in a further revision.



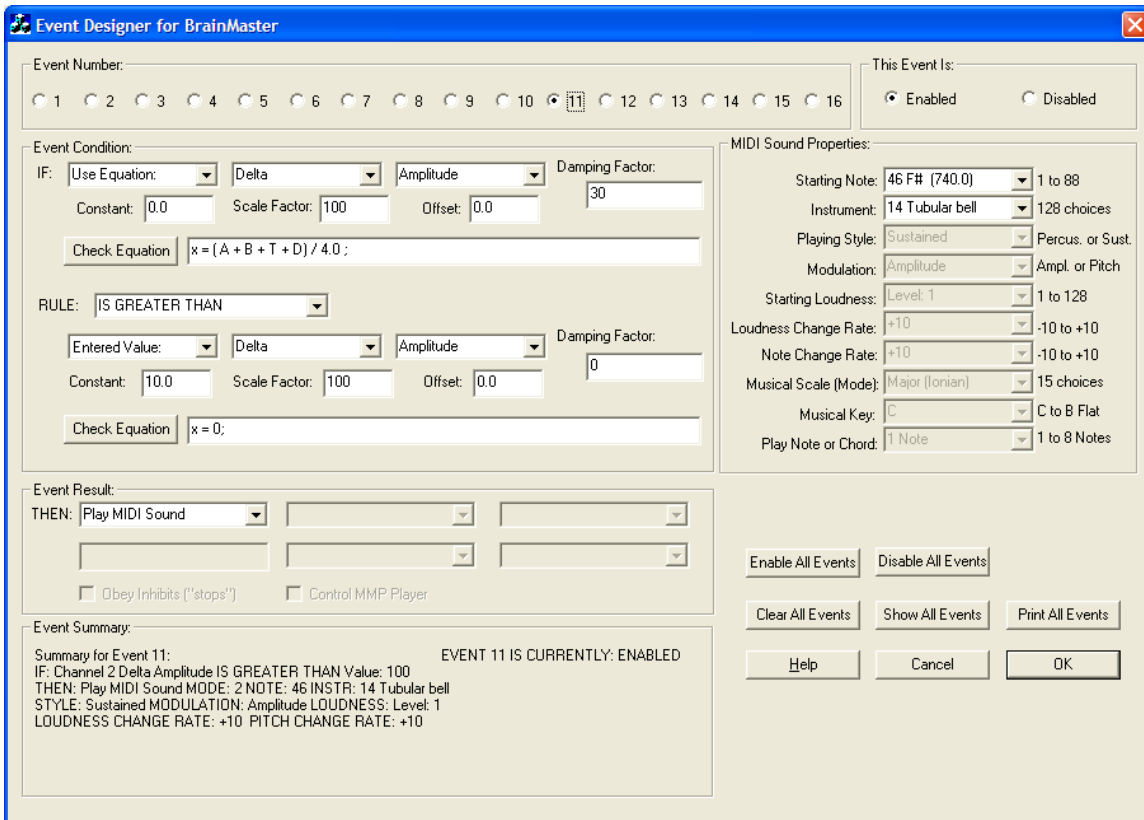
Use of equation processor:

It is possible to define up to two expressions per event, and to use them in place of simple variables such as amplitude, phase, etc. An expression consists of one or more equations, that define a value “x” that is used as the training variable. The component values that are available in the Event Wizard selectors are also available for use in equations. In addition, many additional values are available in equations, as defined in the Data Dictionary. Each expression must define the value of “x” in some way, as in the following examples:

x = ALPHA ; // x is the current value of alpha  
 x = 100 \* ALPHA1 / ALPHA2 ; // ratio of alpha, made into a percent  
 ratio = THETA/BETA; x = 10 \* ratio ; // t/b ratio scaled for training  
 total = d + t + a + l + b + h + u ; x = total / 5.0 ; // average amplitude

The appendix shows the possible use of parameters in equations.

In this example, we are computing the average of 4 bands, as shown:



This example shows the initial set of events providing multiple-threshold training, the remaining events used to process derived values.

Training/Control Screen for BrainMaster 2.5

Data Display Freq.Bands Color Sound

GO STOP Window Clock: **19:07** Points: **000** Close

System is Idling... Check Signal

Full Scale: 26.6 microvolts

Component	Ampl[uV]	% Energy
Delta [0.5-4.0]:	5.3	1
Theta [4.0-8.0]:	6.9	3
Alpha [8.0-12.0]:	7.0	3
Lobeta [12.0-16.0]:	6.0	2
Beta [16.0-20.0]:	8.5	4
Hibeta [20.0-24.0]:	9.3	5
Gamma [28.0-32.0]:	7.5	5
User [20.0-32.0]:	19.1	17

EVENT CONDITIONS:

	VALUE	% Time
1 if CH1:A:uV LT 9.0 do tone :	4.5	100
2 if CH1:A:uV GT 9.0 do tone :	4.5	0
3 if CH1:A:uV GT 9.5 do tone :	4.5	0
4 if CH1:A:uV GT 10.0 do tone :	4.5	0
5 if CH1:A:uV GT 10.5 do tone :	4.5	0
6 if CH1:A:uV GT 11.0 do tone :	4.5	0
7 if CH1:A:uV GT 11.5 do tone :	4.5	0
8 if CH1:A:uV GT 12.0 do tone :	4.5	0
9 if CH1:A:uV GT 12.0 do nothing :	4.5	0
10 if EQN: GT 0.0 do nothing :	7.7	100
11 if EQN: GT 10.0 do tone :	5.1	0

Events 1-9: CHAN 1 Alpha Amplitude

Event 10:  $x = 1.5 * \text{ALPHA}$  ;

Event 11:  $x = (A + B + T + D) / 4.0$  ;

X

### Use of Variables in the BrainMaster Event Wizard Expression Evaluator:

The Expression Evaluator allows you to use a wide range of mathematical expressions to create training variables. All common mathematical operations are used including trigonometric and scientific functions, plus parenthesis, and multiple equations separated by semicolons. Comments can be included using “//” or by delineating with “/\*” and “\*/” symbols. A simple expression might be:

```
x = 1.5 * ALPHA ; // define x as 150% of channel 1 alpha
```

Which provides a training variable that is equal to 1.5 times the current value of alpha.

Expressions can include more than one statement, separated by semicolons. Even complex sequences of operations such as:

```
Ratio1 = DELTA / ALPHA; Ratio2 = C1DE / C1AE; x = 10 * Ratio1 / Ratio2;
```

can be used. As long as the sequence finishes by defining the value of “x”, the expression should work in the Event Wizard.

Filter amplitudes can be accessed with simple keywords. Other variables can be accessed by constructing keywords as described below.

Names of components provide their current amplitudes:

DELTA, THETA, ALPHA, LOBETA, BETA, HIBETA, GAMMA, USER

Initials of components also provide current amplitude values:

D, T, A, L, B, H, G, U

Channel 2 values are similarly easily accessed with names such as DELTA2, THETA2, ALPHA2 or D2, T2, A2, and so on.

For completeness, we go ahead and also allow, e.g. DELTA1, ALPHA1, T1, L1, etc. for channel 1 amplitudes, so that equations that use both channels 1 and 2 can be more readable. For example, “ $x = (T1 + A1 + T2 + A2) / (L1 + B1 + L2 + B2)$ ,” defines the ratio of the sum of the values of theta and alpha on both channels, to the sum of the values of lobeta and beta also on both channels.

More complex expressions are also possible:

Variables beginning with a C denote channel data. The following channel designators are possible as the first 2 letters:

C1 : channel 1

C2 : channel 2

CS : sum of channels (1 + 2)

CD : difference of channels (1 – 2)

The third letter denotes the component, as follows:

D : delta  
T : theta  
A : alpha  
L : lobeta  
B : beta  
H : hibeta  
G : gamma  
U : user  
    Total  
    Aux channel 1  
    Aux channel 2  
    HEG  
    Impedance (Act) (future)  
    Impedance (Ref) (future)  
    DC potential (future)  
    SCP Slow Cortical Potential (future)

The fourth letter denotes the value to be accessed, as follows:

A : amplitude  
F : frequency  
E : percent energy  
T : percent time over threshold  
V : variability  
C : coherence  
S : similarity  
P : phase  
M : comodulation  
    : current threshold (from built-in amplitude-based processor)

Note: when a measure involving two channels is used, use the first channel to designate it, e.g. C1DC is the coherence in delta, for channel 1 measured in comparison with channel 2.

In addition Z scores will be available when used with the NeuroGuide run-time processor:

ZAP Absolute Power 2 channels / 8 bands  
ZRP Relative Power 2 channels / 8 bands  
ZPR Power Ratios 2 channels /10 ratios  
ZAA Amplitude Asymmetry 8 bands  
ZCO Coherence 8 bands

ZPH Phase Difference 8 bands

NG 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 usable variables are as follows:

C1DA = channel 1 delta amplitude

C2AF = channel 2 alpha frequency

CSAT = sum-channels alpha percent time over threshold

C2DZAP = channel 2 delta z-scored absolute power

C1AZCO = channel 1 alpha z-scored coherence (measured between channels 1 and 2)

C13ZRP = channel 1 Beta 3 z-scored relative power

Etc.

Z scores take values of + or – the number of standard deviations, e.g. –1.5, +3.1, etc.