



eProbe - eLab

ScienceBeam Co





Version 5.3.4

Acquisition and analysis software

June 2016



www.ScienceBeam.com



devices

⦿ Devices manufactured by ScienceBeam company are:

- eWave
- eLab
- ePulse
- eMech
- eClamp
- electromodule

⦿ eProbe software designed to work with above workstation devices.

- you can have access the eProbe manual for each device in separated part specified for each device.

1

Installation

Let's start



There is two folders in software
package:
eProbe and Protocols

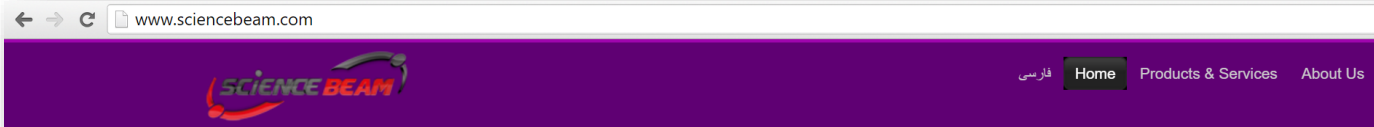
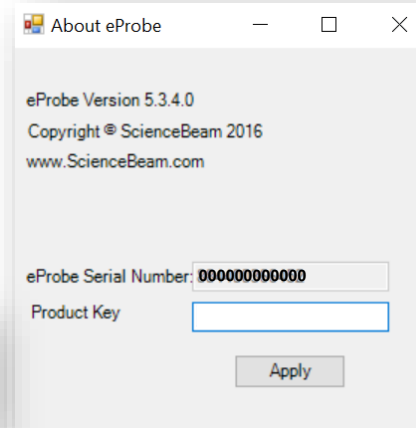
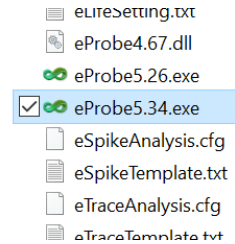


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eProbe folder

- It consists of eProbe.exe and other files that is internally used by software.
- Run the eProbe.exe -> “eProbe is not activated” error -> **you need to register:**
- Help menu -> About eProbe -> copy eProbe Serial Number (12 digits)
- Open www.ScienceBeam.com -> find the Product Key box and paste serial number in it and click OK -> copy generated Serial -> paste Serial in the Product Key box in eProbe and click Apply.
- **unplug any extra USB drive or Hard drive or you might receive error even after registration!**





Protocols folder

- The Protocols Folder consists of some folders and text files and you should add every new protocol, file or folder exactly in its proper folder:

- Animation files for the Game panel of software.
- Game files for the Game panel.
- Image files for the Image panel.
- Movie files for the Game panel.
- Movie files for the Game panel.
- Image files for the Game panel.

- Anim
- Games
- Image
- Movie
- Scene
- Video

2

Start the program

Let's run



Run eProbe

☉ eProbe environment has four menu:

➤ File

- Open Protocol
- New Protocol
- ToolBox
- Close

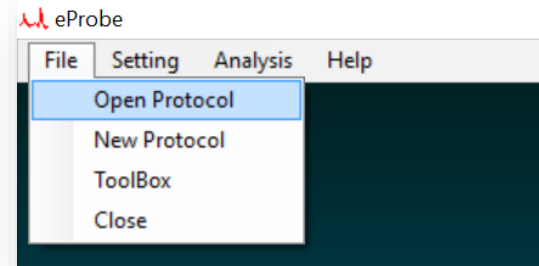
➤ Setting

➤ Analysis

- eTrace
- eSpike

➤ Help

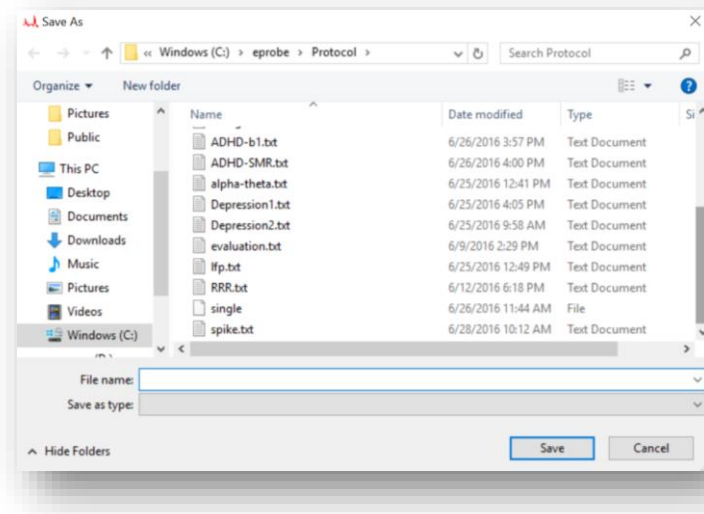
- About eProbe





Protocol

- Open protocol
 - To open previously saved or sample protocol from Protocol folder
- New protocol
 - To create new protocol you choose a name for your protocol and save it in Protocol folder
- Protocol type defined as txt file





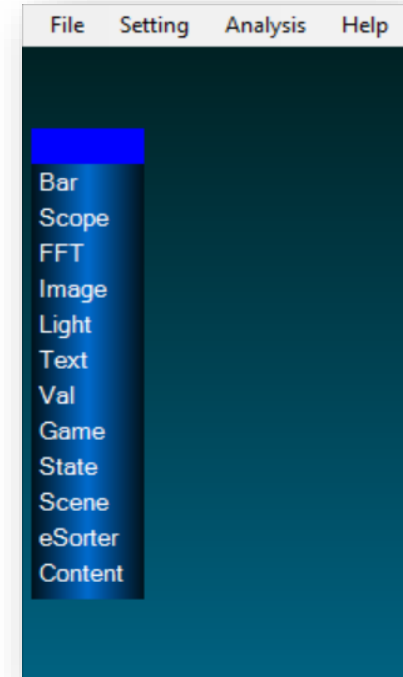
ToolBox parts

Here you can configure what you need in eProbe environment based on your experiment design.

ToolBox includes:

- Bar
- Scope
- FFT
- Image
- Light
- Text
- Val
- Game
- State
- Scene
- eSorter
- Content

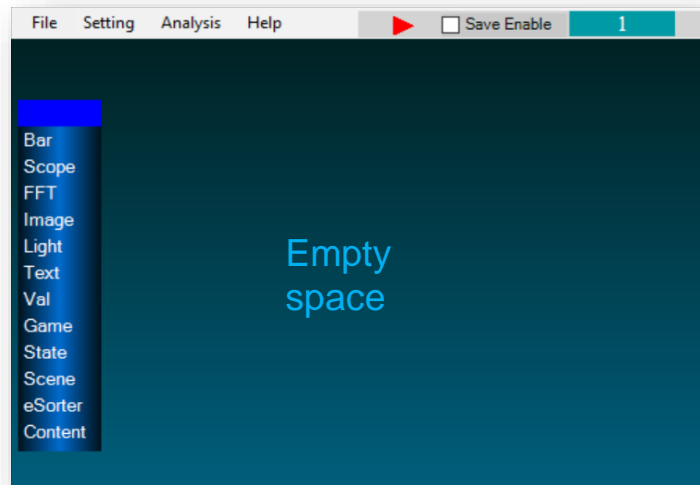
You only need some part of ToolBox based on the device you use. You can have access to the specified manual list at page 22.





ToolBox

- To add any of ToolBox parts, just simply click on it (for example: Bar) and then click on the available empty space of program environment. You can also resize it by dragging its corners.
- To optimize or configure any ToolBox parts, just simply right click on that added part in screen and you have access to that specific ToolBox Part setting.

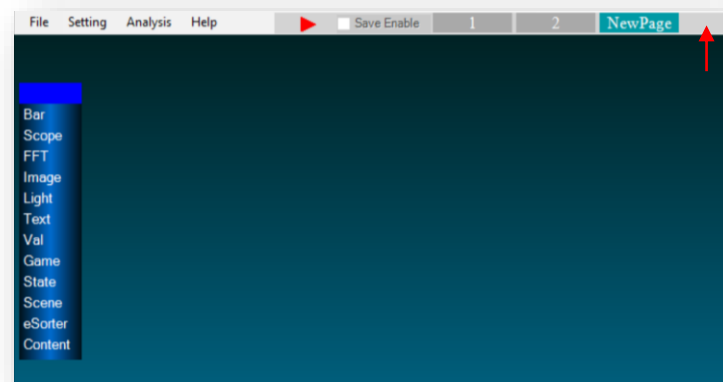




Create new page

☉ To create new page for better management of your project (For example: you can create recording and analysis pages), when you choose ToolBox, click on empty bar at the right side of page shown in green and change its name. You can also remove page by deleting page name.

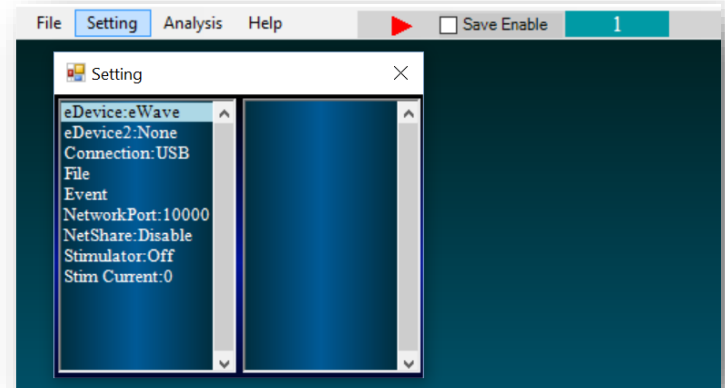
☉ You can add, remove, resize or reposition ToolBox parts only when you choosed ToolBox from File menu and ToolBox is active!





Setting menu

- It consisted of:
 - eDevice: eWave/eLab/ePulse/eMech/eClamp/Electromodule/WSI3108
 - Connection: Offline/USB/WIFI/Bluetooth
 - File: Record/Simulation/Stim Protocol/Make Stim Protocol
 - Event
 - NetworkPort
 - NetShare
 - Stimulator: Off/Normal/Inverted
 - Stim Current



2

Connect to computer

Let's do



Connect to computer

- Via Bluetooth
 - Choose Bluetooth from Setting menu/Connection in eProbe software
 - Via USB cable
 - Choose USB from Setting menu/Connection in eProbe software
 - Via WIFI
 - Choose WIFI from Setting menu/Connection in eProbe software
- You also need to choose your device name from Setting menu/eDevice in eProbe software!





Run and Save experiment

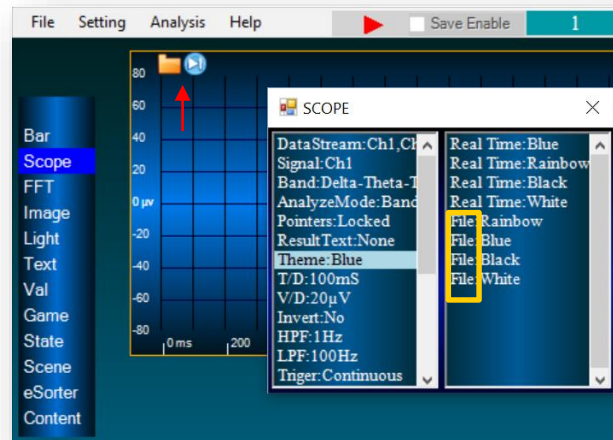
- After you created your required screen parts by using ToolBox to start experiment, you need to change the settings of each part as described before in setting parts based on your need.
- Now, you can run your protocol simply by clicking on **red start button** above beside Help menu to start your designed experiment.
- You can open your stimulation protocols by Setting -> File -> Stim Protocol
- By checking Save Enable, your data will be recorded in destination you will set.
- You can access your saved data by Setting -> File -> Simulation File





Access to saved data

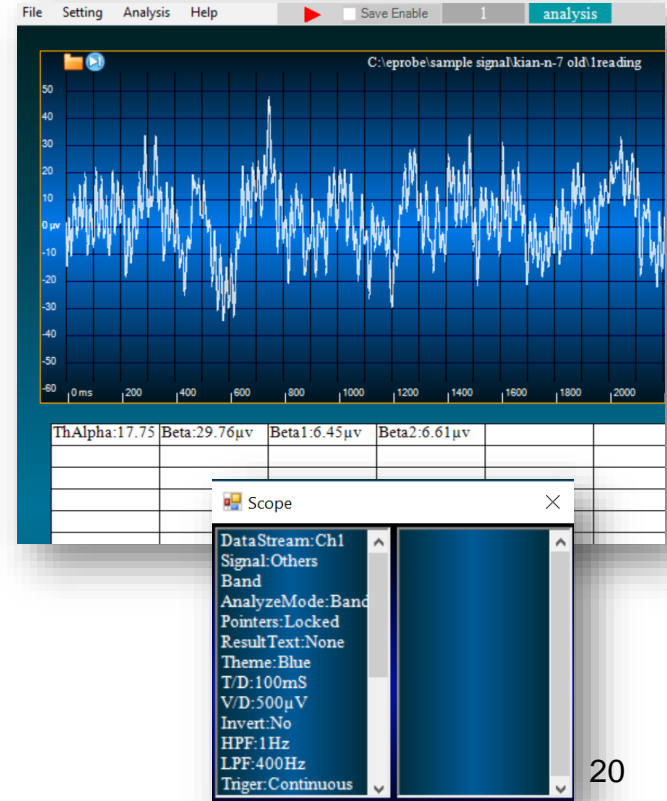
- Right click on scope to access setting -> Theme -> File
- Folder icon appear above scope -> click and open your saved data
- Forward icon jump to the next part of data if it be available





Analysis of saved data

- You can analysis your data in offline mode via Setting menu -> Connection -> Offline
- Change settings based on your input (Data Stream) and desired output (for example: Alpha, Theta, Gama) from Band.
- You can watch the results in the Result Text section by choosing This Panel or another Text part if it be created previously by ToolBox



Follow the specified manual based on your device

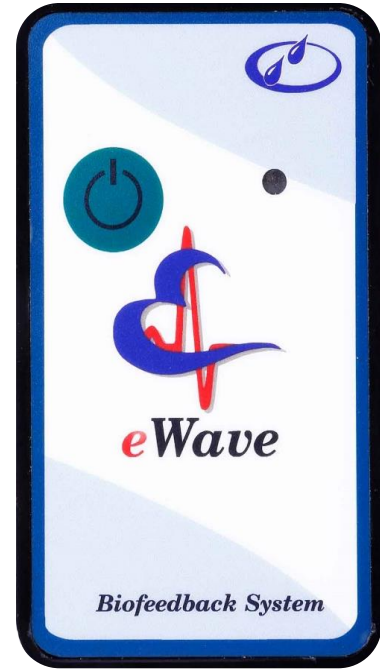


eWave --- page 21-40
eLab --- page 40-68
Analysis --- page 69-95
ePulse --- page 96-108



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eWave





eWave

● eWave can be used to acquire and analyze neurofeedback and biofeedback data.

● Specification:

- Internal memory
- 1 KS/S sampling rate
- 8 channel EXG (ElectroXGraphy)
- Digital i/o
- WIFI/ USB
- Full sensor
- Chargeable battery 2000
- 116 gr





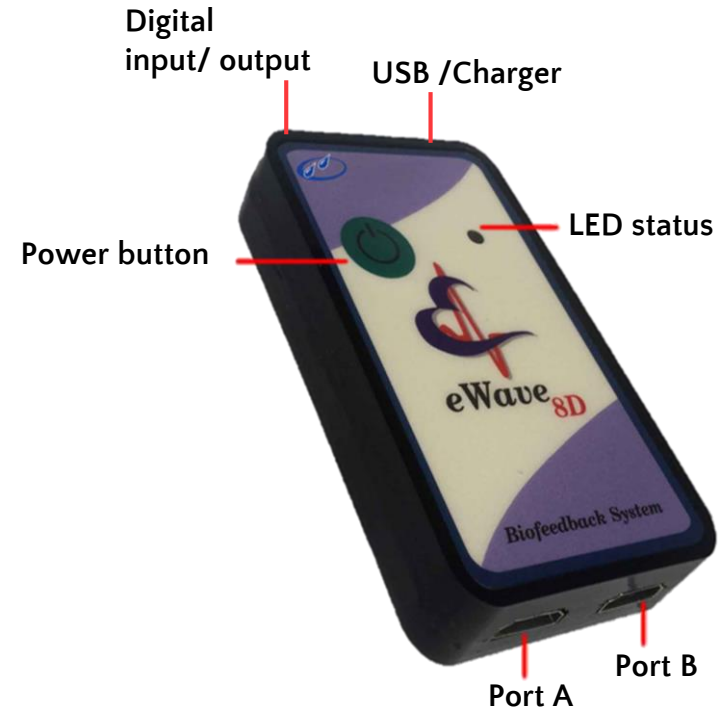
eWave device

● Power button:

- Press once to turn on
- Press and hold for 3 second to turn off

● LED status:

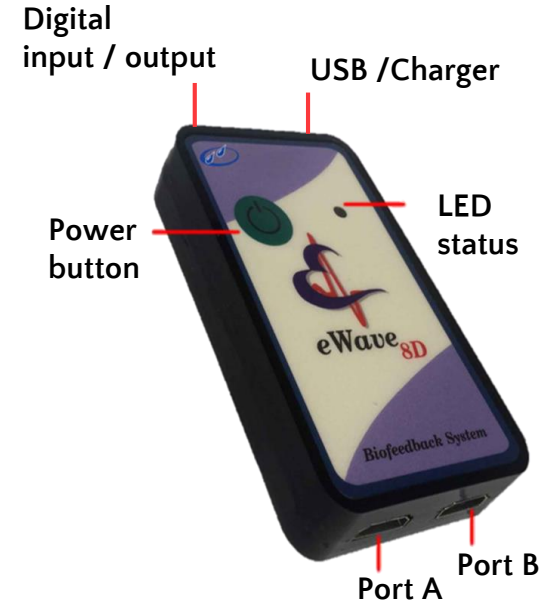
- **Constant red light** means ready for programming by manufacturer
- **Flashing red light** means out of charge
- **Fast flashing Green light** means device connected to computer and record signal properly
- **Slow flashing green light** (every 2 Sec) means device turned on but not connected to computer properly





eWave device

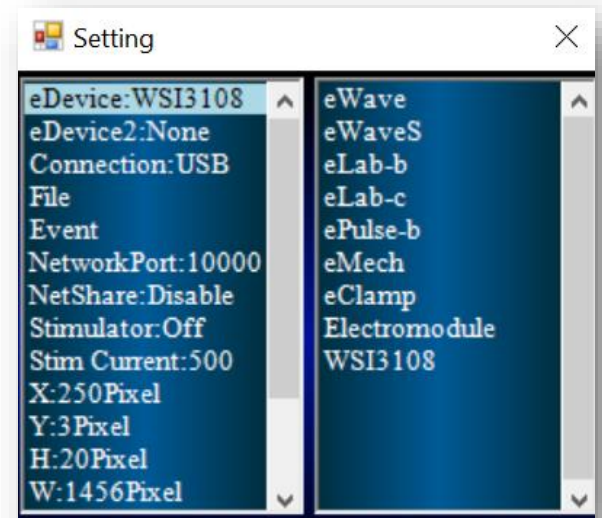
- Port A / B
 - EXG recording signal cables can be attached to port A or B
 - Port A is the only active port for two / four channels device
 - Port B is active for eight channel device (channel 5-8 of recording signal is throughout of port B)
- USB / Charger
 - To charge device, use 5 Volt adaptor via USB-B
 - To connect device to computer, use this USB port
- Digital input/ output
 - It belongs to digital input/ output and manufacturer settings
 - **Don't use it for EXG recording signal**





Run eWave

- To use eWave device, open eProbe software -> setting menu -> eDevice -> read the model from back of your eWave device and then choose it from the available eDevices of list (for example: eWave)
- Choose your device connection type from setting menu (USB or WIFI or bluetooth ports)
- To record your experiment, choose File from setting menu -> Record File -> set name and destination for your experiments
- **No need to change other settings!**

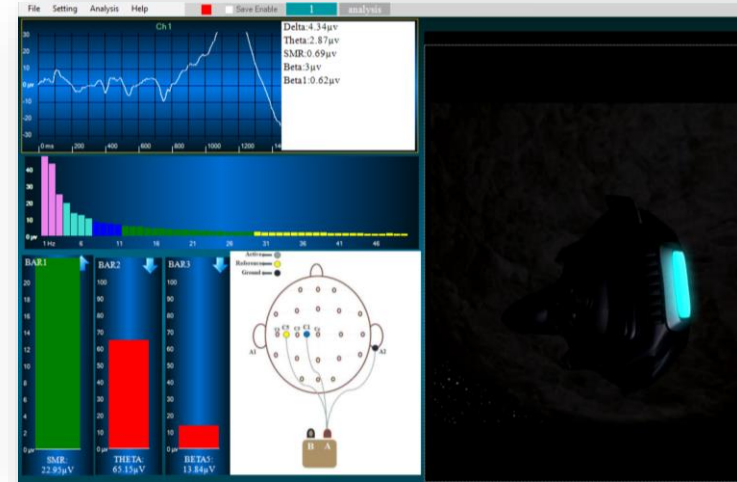




eWave requirements

☉ All you need to record and analyze using eWave in ToolBox are:

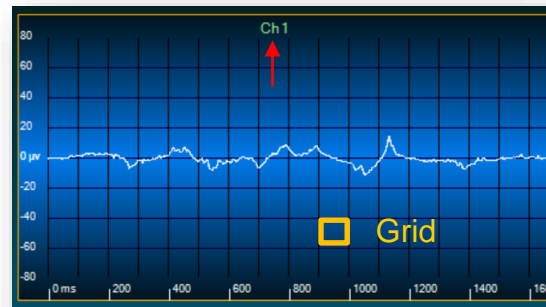
- Scope, Bar, FFT, Image, Text, Game
- ☉ So you can create the demanded parts of ToolBox simply from File menu -> ToolBox -> click on desired part (for example: Bar) -> click on desired spot in empty space of software to add that part
- ☉ If ToolBox be chosen and active, by right clicking on each part, you can have access to its settings





Scope

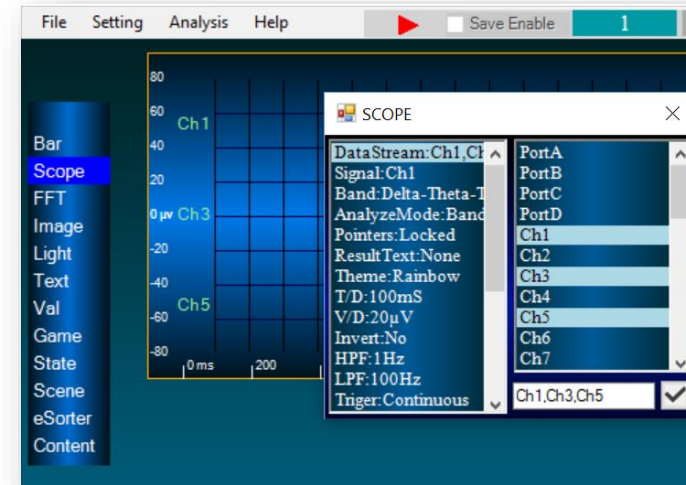
- It displays the signal both in time and frequency domain.
- The name of channel or channels which stream data is shown above of scope (here shown as Ch 1)
- If the name of channel has **green color** it means that signal is unsaturated and natural
- If the name of channel has **red color** it means that signal is saturated and must be fixed





Scope setting

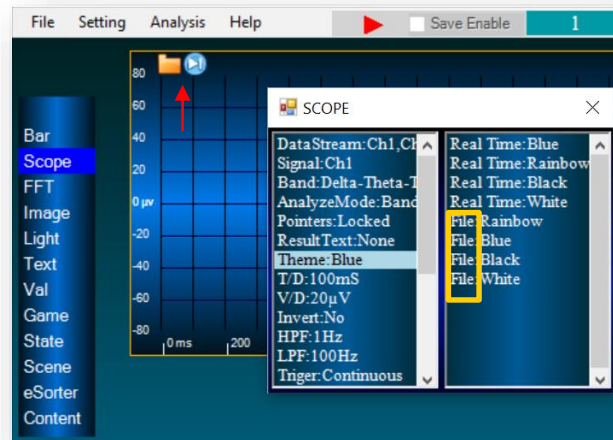
- Data Stream: Channels or ports which stream data
- You can choose more than one channel based on the numbers of channel your device supports:
 - If you choose port A, it means you choosed channel 1-4
 - If you choose port B, it means you choosed channel 5-8
 - you can choose many channel just by licking on its name (for example: Ch1, Ch6, Ch3)
- Signal: type of signal(ECG/EEG/EMG/RRI/RatRRI/BVP/IBP)
- Band: Brainwaves spectrum, Low/High Artifact
 - You can choose more than one specific band by clicking on its name (for example: Delta, Theta, Beta)
- analyzeMode: Bands





Scope setting

- ResultsText: showing a result text beside scope or on Text part created by ToolBox
- Theme: Change the color of waves inside scope
 - If you choose Real Time, you have access to streaming data
 - If you choose File, you have access to previously saved data (Notice to folder and forward icon which appear above of scope)
- T/D: Time scaling to optimize view
- V/D: Amplitude scaling to optimize view
- Invert: invert waves in scope
- HPF: eliminate the low frequency signals or noises (high pass filter)
- LPF: eliminate the high frequency signals or noises (low pass filter)
- Trigger: to trigger continuously or not





Bar

It shows whether the square of the instantaneous FFT (Fast Fourier Transform) power of a specific band ($\delta, \theta, \alpha, \beta, \gamma$) is beyond or less (direction) than the threshold and considers it as a logic for the Game panel.

Non inverted

Exceed threshold

Green color



Inverted

Exceed threshold

Red color



Bar setting

Delta: 1 – 4Hz

Theta: 4 – 8Hz

Thalpa: 6 – 10Hz

Alpha: 8 – 12Hz

LowAlpha: 8 – 10Hz

HighAlpha: 10 – 12Hz

Mu: 8 – 13Hz

SMR: 12 – 15Hz

Beta: 12 – 35Hz

Beta1: 15 – 18Hz

Beta2: 18 – 22Hz

Beta3: 22 – 26Hz

Beta4: 26 – 30Hz

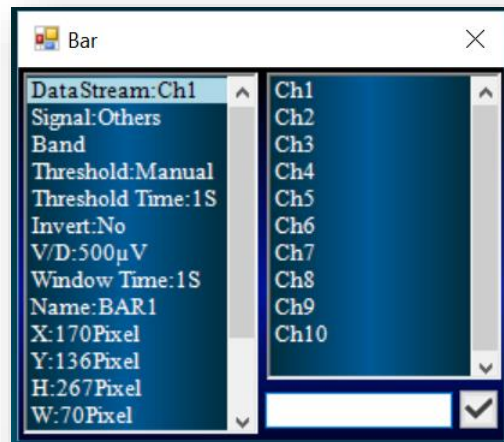
Beta5: 30 – 35Hz

Gama: 35 – 100Hz

LowArtifact: 43 – 59Hz

HighArtifact: 1 – 2Hz

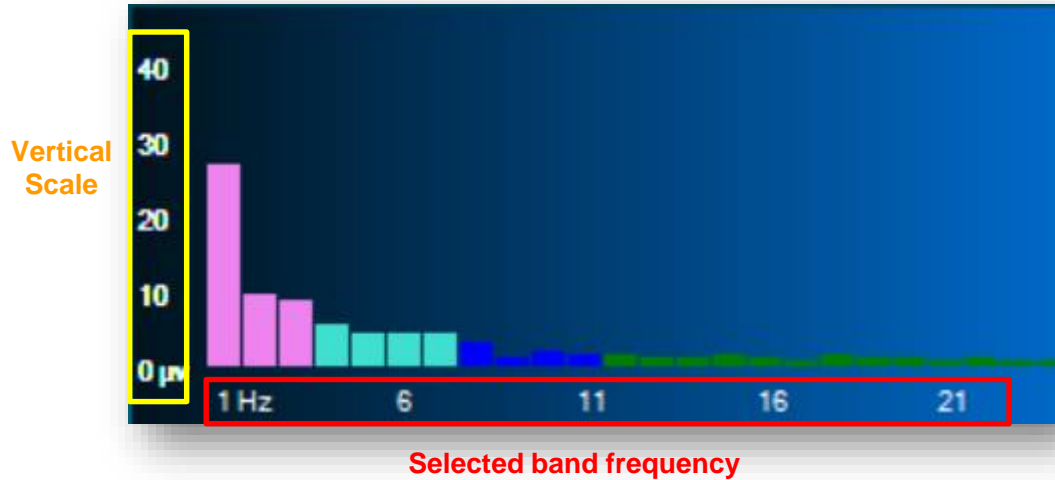
- Data Stream: channels or ports which stream data
- Signal: type of signal (ECG/EEG/EMG/RRI/BVP/IBP/Spike/Field)
- Band: brainwaves spectrum, Low/High Artifact
- Threshold: manual or percent
 - Manual amount can be set and is constant during experiment but percent amount is variable based on variation of amplitude
- Threshold Time: Set the time period for staying above the threshold to be considered as significant threshold passing
- Invert: Objective direction of frequency band in Bar
- V/D: Amplitude scaling to optimize view
- Window Time: change the time period which FFT apply on it.
- Name: Change the name of Bar





FFT

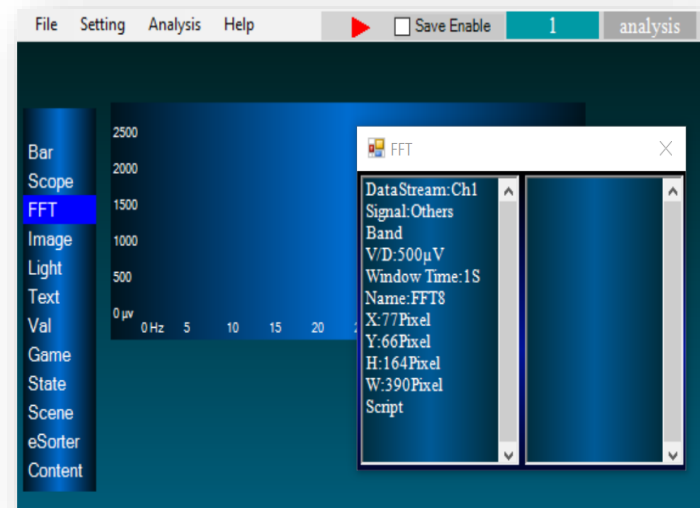
- In FFT panel, you can see the square of the instantaneous FFT power of your desired band
- You can watch column bar of amplitude on each specified frequency.





FFT setting

- Data Stream: Channels or ports which stream data
- Signal: Type of signal(ECG/EEG/EMG/RRI/BVP/IBP/Spike/Field)
- Band: Brainwaves spectrum, Low/High Artifact
- V/D: Amplitude scaling to optimize view
- Window Time: change the window size of FFT calculation
- For example, if you choose 10 S, it calculate from 10 Sec before

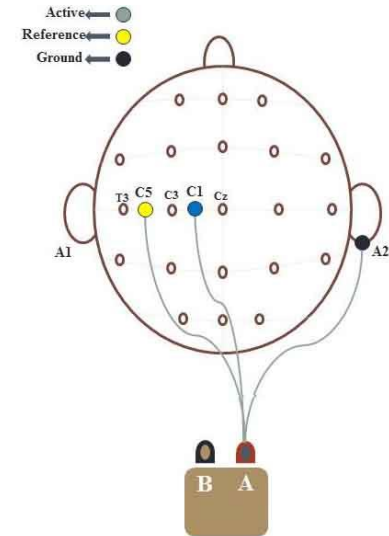




Image, Text

- Image panel shows image. You can select the image file you want to display. For example you can show an image of your protocol here.
- Text panel add some information as text to your protocol or show the result of the analyze panel.

ThAlpha:17.75	Beta:29.76 μ v	Beta1:6.45 μ v	Beta2:6.61 μ v





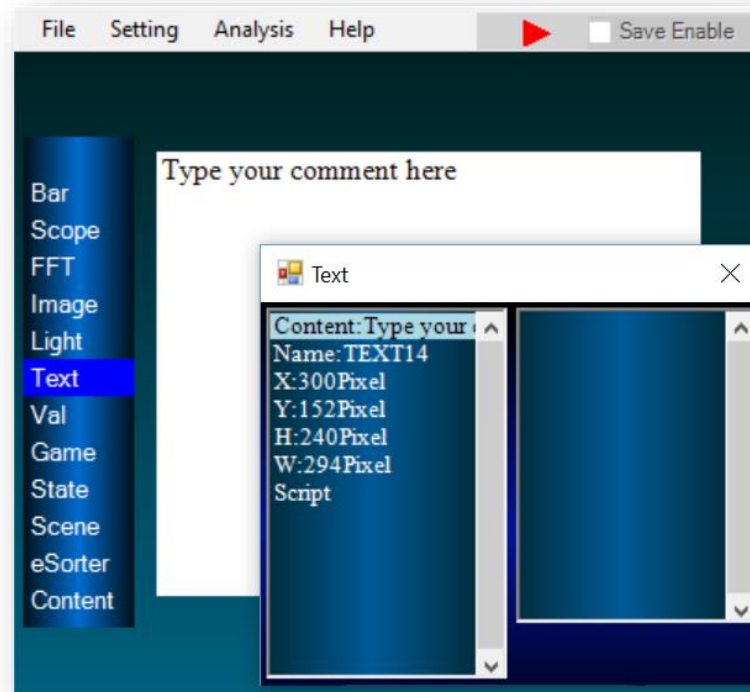
Image, Text setting

Image

- File: Choose the image from here (first you must add the image in image folder)

Text

- Content: Type the text here





Game

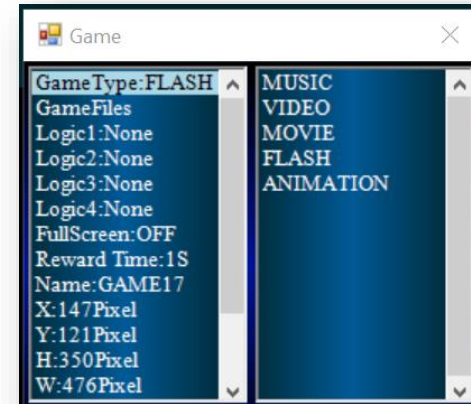
- Game panel enables clients to play video, movie or game. The Game or video works based on the client's brain waves reflected on Bar panels and according to the features you have specified.
- Using this panel, you can select the type of the game or the file that you want to display. You can also change the logic or rule of the play.





Game setting

- GameType: Music/Video/Movie/Flash/Animation
- GameFile: choose Game file available in Game folder
- Logic: control application of each Game using the output of one or multiple Bars.
 - To do this, you should specify the name of the bar or bars that you want as Logic1 (you can choose more than one bar for each Logic)
 - Only Flash types of game may need more than one logic since it can have more than one game component (Music, Video, Movie and Animation only has one game component – play/stop – so they need only one logic)
 - **You set logic for each bar by changing its Signal, Band, Threshold, Threshold Time and Invert situation!**
- FullScreen
- Reward Time: The time period which set to allow client reach that amount to obtain one score as a reward



eLab





eLab

● eLab is all in one system that can record extracellular signals including:

- single unit Recording
- local field potential
- in vivo Brain Slice (LFP & single unit)
- ECOG-Electrocorticography





eLab Specification

● Specification:

- Two Channel 12 bit digital to analog converter
- 8 analog input channels (24bits, sample rate: 50KS/S)
- 8 Digital i/o
- 4 channels bioamplifier for recording of EEG/LFP/ single unit/EOG/ECG/ECG/EMG
- 4 channel Pulse generator, 10 μ s pulse duration resolution
- Isolated constant current simulator (4mA/20mA)
- Optional mechanical stimulus controller
- Plug and Play (USB2 connector)
- Operating voltage: 12V DC
- 500 gr



eLab device

- Power button:
- There is no power button. Device turn on by connecting to computer through USB
- LED status:
 - **Constant red light** means ready for programming by manufacturer
 - **Flashing red light** means out of charge
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eLab device

● Port A

- EXG recording signal cables can be attached to port A or B
- Port A is the only active port for two / four channels device
- Port B is active for eight channel device (channel 5-8 of recording signal is throughout of port B)

● USB / Charger

- To charge device, use 12 Volt adaptor via USB-B
- To connect device to computer, use this USB port

● Digital input/ output

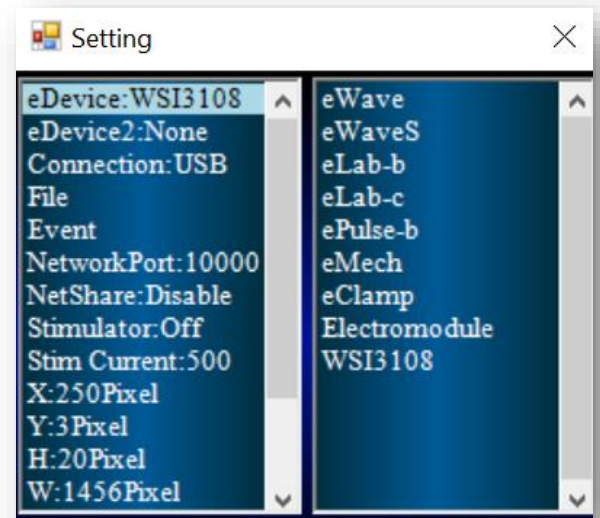
- It belongs to digital input/ output and manufacturer settings
- **Don't use it for EXG recording signal**





Run eLab

- To use eLab device, open eProbe software -> setting menu -> eDevice -> read the model from back of your eLab device and then choose it from the available eDevices of list (for example: eLab-c)
- Choose your device connection type from setting menu (USB or WIFI or bluetooth ports)
- To record your experiment, choose File from setting menu -> Record File -> set name and destination for your experiments
- **No need to change other settings!**

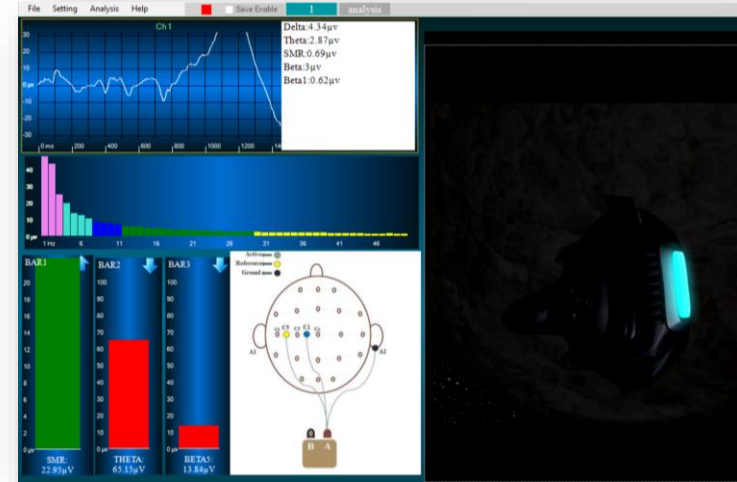




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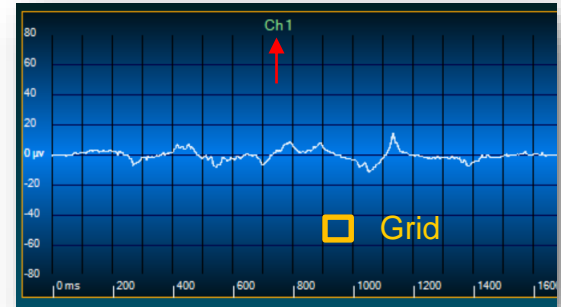
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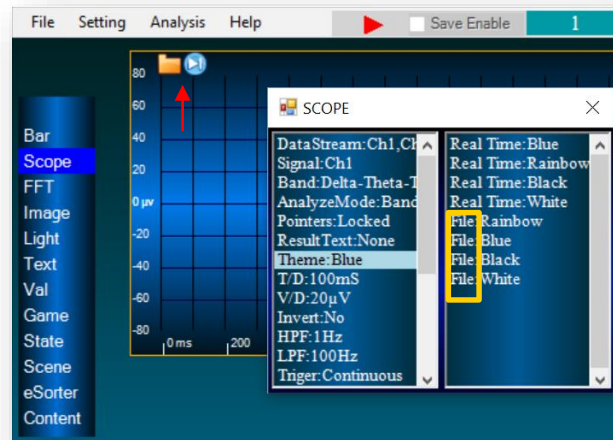
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Scope setting

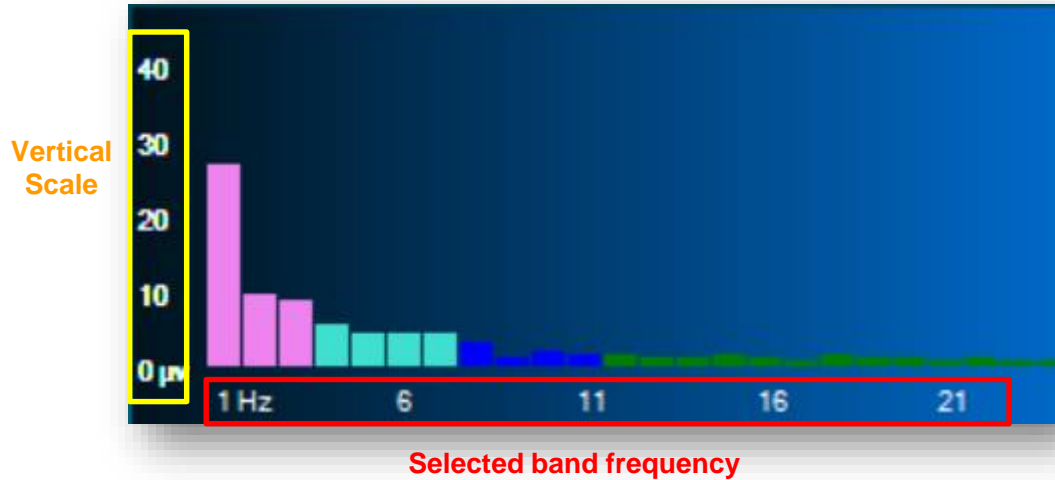
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FFT

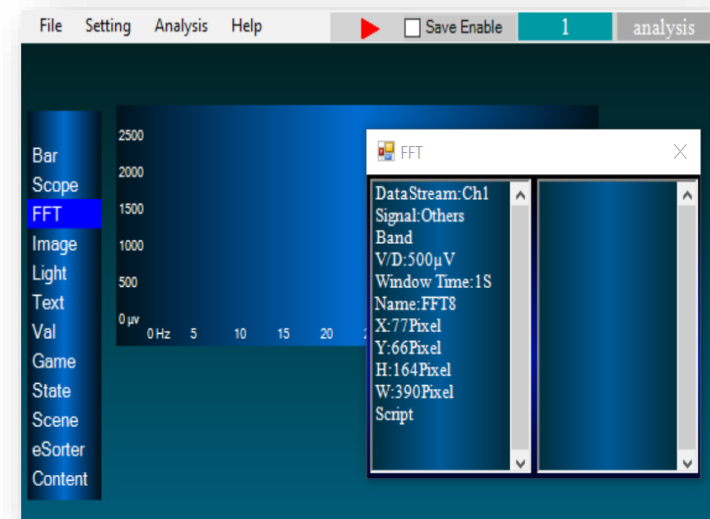
- In FFT panel, you can see the square of the instantaneous FFT power of your desired band
- You can watch column bar of amplitude on each specified frequency.





FFT setting

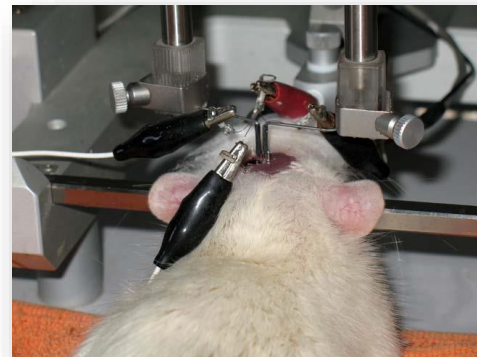
- Data Stream: Channels or ports which stream data
- Signal: Type of signal(ECG/EEG/EMG/RRR/BVP/IBP/Spike/Field)
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- V/D: Amplitude scaling to optimize view
- Window Time: change the window size of FFT calculation
- For example, if you choose 10 S, it calculate from 10 Sec before





Image, Text

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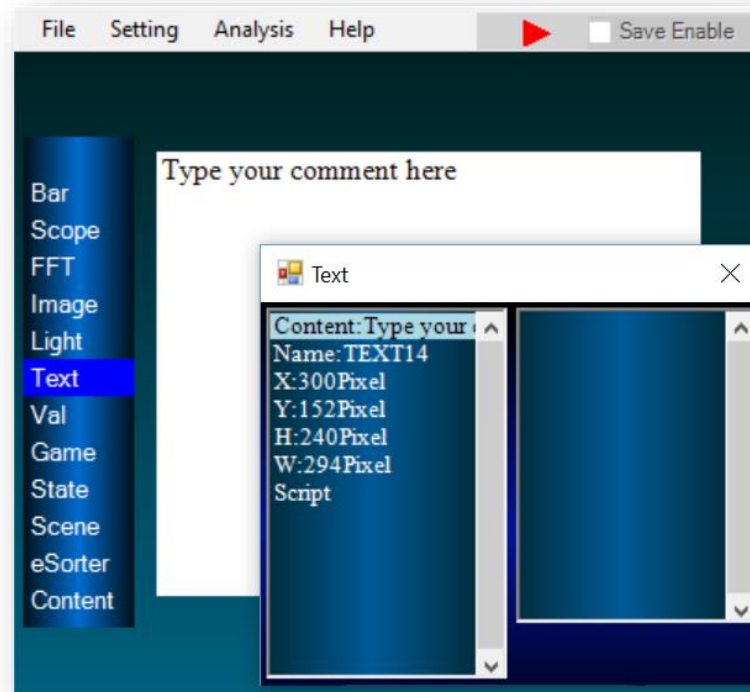
Image, Text setting

Image

- File: Choose the image from here (first you must add the image in image folder)

Text

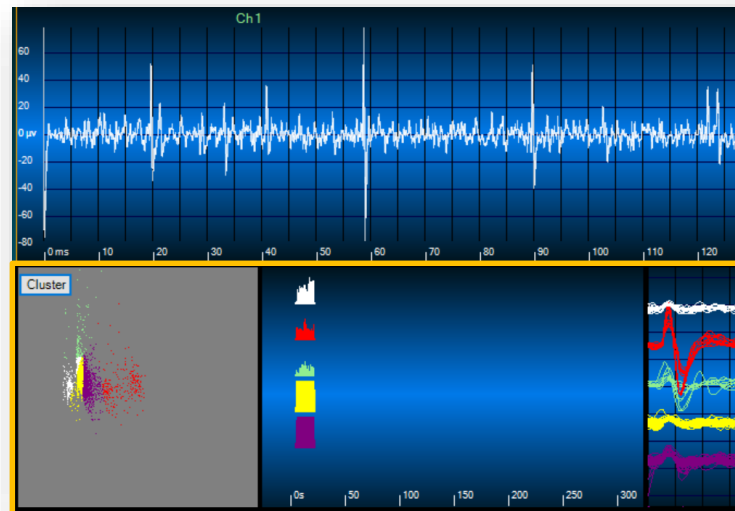
- Content: Type the text here





eSorter

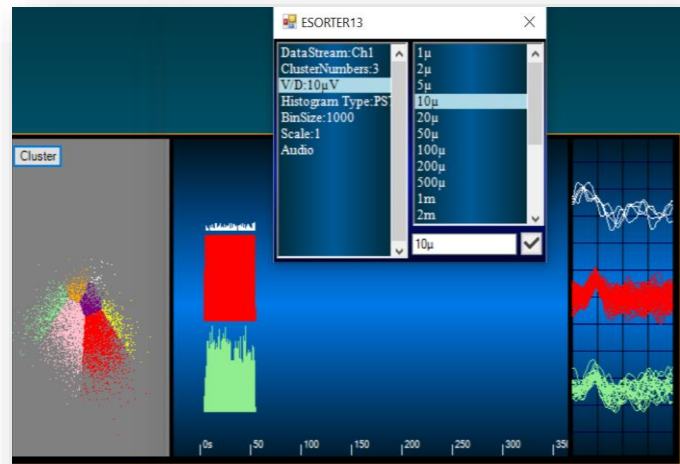
- It is designed for offline sorting and clustering of extracellular recorded action potentials.
- It has three windows which separate action potential signals through 2D feature space clustering, histogram in the middle and amplitude window discriminator in the third window.





eSorter setting

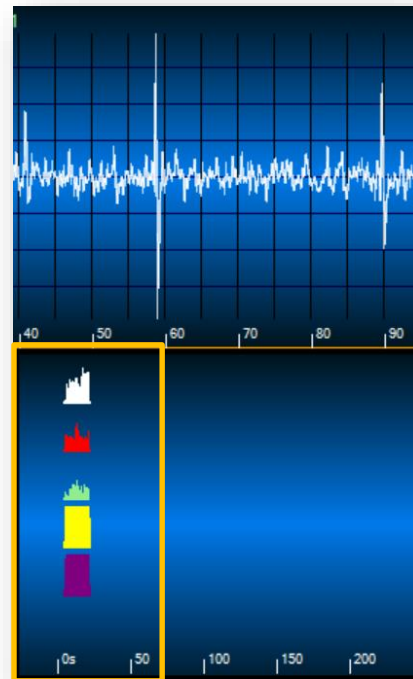
- **DataStream:** Channels or ports which stream data
- **ClusterNumber:** number of shown cluster
- **V/D:** Amplitude scaling to optimize view
- **Histogram Type:** PSTH/ISIH
- **BinSize:** Use this item to set a bin size for PSTH. Bin size will plot in the X-axis. Through choosing bin size, users could define the time resolution of PSTH demonstration. Bin size could have a value from 1ms to several minutes.
- **Scale:** Change the scaling value to optimize the view of histogram.
- **Audio:** Set this item to raw or values to hear the sound of activity.





PSTH

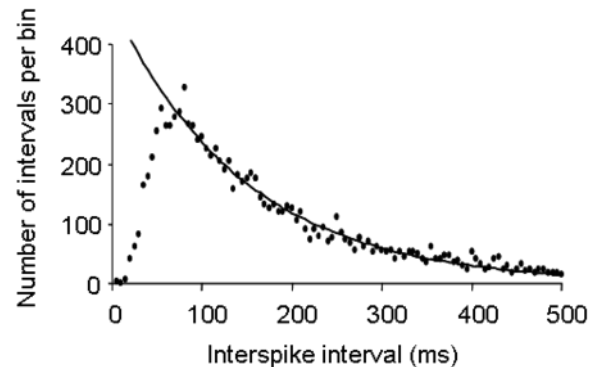
- PSTH: Peri/Post Stimulus Time Histogram – It used to visualize the rate and timing of neuronal spike discharges in relation to an external stimulus or event.
- The prefix *peri*, for *through*, is typically used in the case of periodic stimuli, in which case the PSTH show neuron firing times wrapped to one cycle of the stimulus.
- The prefix *post* is used when the PSTH shows the timing of neuron firings in response to a stimulus event or onset.





ISIH

- ISIH: InterSpike-Interval Histogram - It used to analyse the electrical behaviour of neurons. One of the simplest ways to study the patterning of spike activity in a neuron is to record the spikes from a single neuron, and then to construct an interspike interval histogram.
- It plot the distribution of the observed times between spikes (t_1, t_2, t_3 , etc) collected in 'bins' of fixed width.

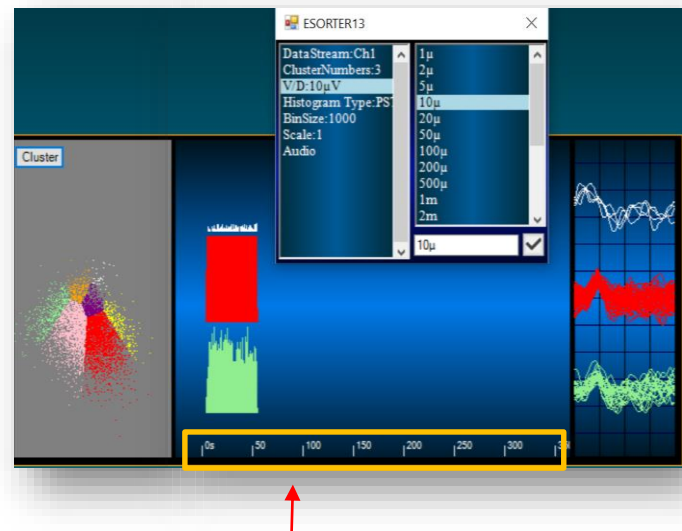




Bin Size

- Each bin is a division of time and appears as a column in the PSTH. The altitude of each column shows frequency of spikes in that bin size.
- The optimal bin size (assuming an underlying Poisson point process) Δ is a minimizer of the formula, $(2k-v)/\Delta^2$, where k and v are mean and variance of k_i (number of spikes).
- If you chose small bin size, you will have high-resolution of spike frequency in time. However, if you chose a big bin size, time resolution will decrease although frequency values will increase.

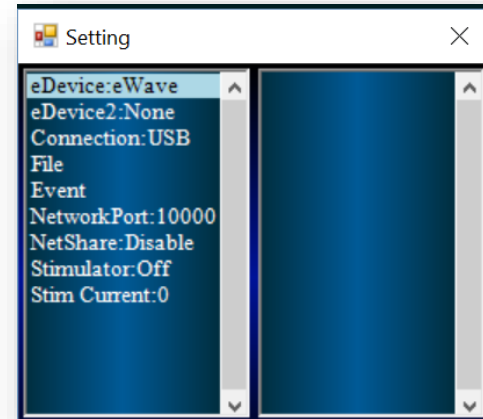
use a wide bin size when the spontaneous activity of the unit is low or when the spiking activity in response to the stimulus is low!





Setting menu

- You need to change some setting menu parameters for using eLab:
 - eDevice: Set it on eLab
 - Connection: Choose the appropriate type of connection- Offline/USB/WIFI/Bluetooth-
 - File:
 - Record: define the path for recording data
 - Simulation: Open simulation file
 - Stim Protocol: Open stimulation protocol
 - Make Stim Protocol: Define protocol for stimulation
 - Stimulator: Off/Normal/Inverted
 - Stim Current





Make Stimulation Protocol

- Stimulation Parameters
- Recording Parameters
- Preview
- Mixers

File

Stimulation Parameters

Pattern (1 .. 4) T1 (Delay) T2 (Pulse Duration) T3 (Pulse Cycle) N1 (Train) T4 (Trial Period) N2 (Trial Numbers)

Pattern1 0 µs 0 µs 0 µs 0 0 µs 0

Recording Parameters Sync

Recording Time Trial Period Trial Numbers

0 ms 0 ms 0

Mixer

Preview

Mixers

SaveMode

Simple Mode

Advanced Mode

Simple Mixer Advanced Mixer

Electrical Stimulator1 Electrical Stimulator2 Mechanical1 Mechanical2

Pattern1 Pattern1 Pattern1 Pattern1

Pattern2 Pattern2 Pattern2 Pattern2

Pattern3 Pattern3 Pattern3 Pattern3

Pattern4 Pattern4 Pattern4 Pattern4

Digital Input 1 Digital Input 1 Digital Input 1 Digital Input 1

Digital Input 2 Digital Input 2 Digital Input 2 Digital Input 2

Fixed Current(uA) Fixed Current(uA) Voltage1 0 mV Voltage2 0 mV

0 µs 0 µs Rise Time1 0 µs Rise Time2 0 µs



Stimulation Parameters

Pattern (1 .. 4)

Pattern1

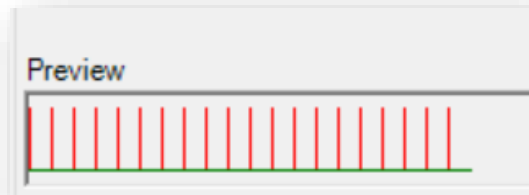
- Pattern (1 .. 4): make four different patterns of stimulation. you can mix these patterns to produce a complex protocol by using Mixers.
- T1 (Delay): Latency between starting the recording time and applying the first stimulation pulse of each train
- T2 (Pulse Duration): Duration of a single stimulation pulse.
- T3 (Pulse Cycle): Duration from starting a single pulse to starting the next single pulse.
- N1 (Train): Number of pulses in a *trial period*.
- T4 (Trial Period): Duration from starting a trial period to starting the next one.
- N2 (Trial Numbers): Number of repeating a desired trial.

T1 (Delay)	T2 (Pulse Duration)	T3 (Pulse Cycle)	N1 (Train)	T4 (Trial Period)	N2 (Trial Numbers)
0 <input type="text"/> <input type="button" value="▲"/> <input type="button" value="▼"/> μs	0 <input type="text"/> <input type="button" value="▲"/> <input type="button" value="▼"/> μs	0 <input type="text"/> <input type="button" value="▲"/> <input type="button" value="▼"/> μs	0 <input type="text"/> <input type="button" value="▲"/> <input type="button" value="▼"/>	0 <input type="text"/> <input type="button" value="▲"/> <input type="button" value="▼"/> μs	0 <input type="text"/> <input type="button" value="▲"/> <input type="button" value="▼"/>



Example

- A train of 20 single pulses at 100 Hz, each single pulse has 200 μ s duration.
- stimulation pattern in 100 Hz (100 pulses/second): pulse cycle must be 10ms (1000ms/100pulse).
- Through the pulse cycle you could establish frequency of a train and vice versa.
- N1 will explain how many pulses you want to have in a train.
- According to T1, T3 and N1 you must write a value for T4.

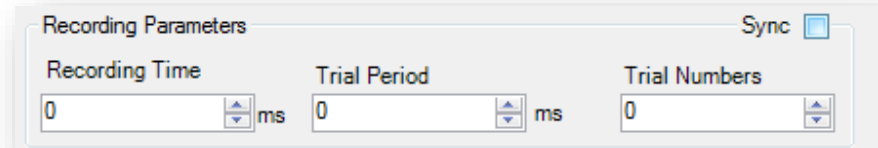


Stimulation Parameters						
Pattern (1 .. 4)	T1 (Delay)	T2 (Pulse Duration)	T3 (Pulse Cycle)	N1 (Train)	T4 (Trial Period)	N2 (Trial Numbers)
Pattern1	0 μ s	200 μ s	10000 μ s	20	200000 μ s	1



Recording Parameters

Usually, following the stimulation, you have an electrophysiological response and you want to save it. Record your data using the below menu:

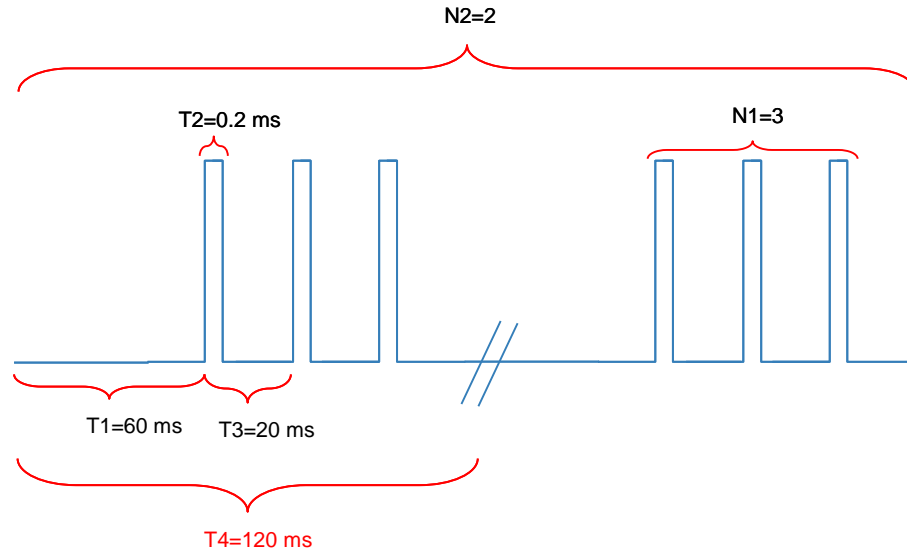


- Recording time: It is part of trial period, which you wish to save it on the computer.
- Trial period and Trial Numbers are the same as described in stimulation parameters.
- Recording time must not be longer than the trial period (could be lesser or equal).**
- check the sync box to equalize the values of Trial period and Trial Numbers in both stimulation and recording parameters.

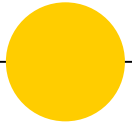


Preview of Stimulation Protocol

● According to T1, T3 and N1 you must write a value for T4!



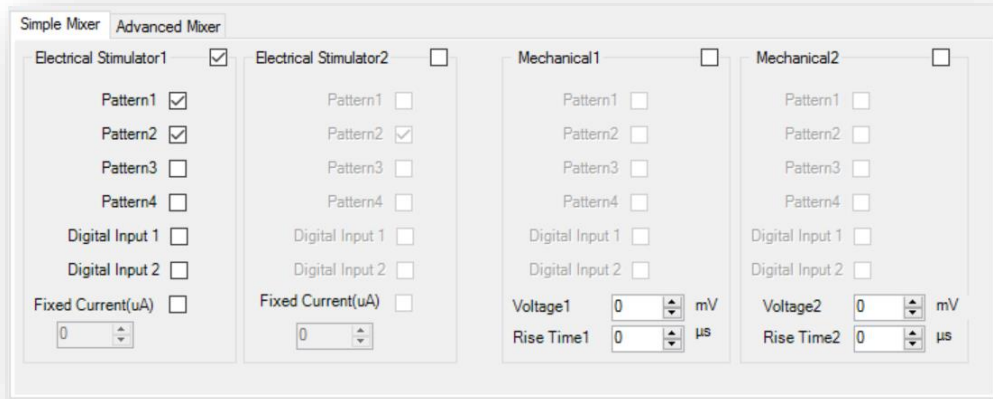
Mixers





Simple mixer

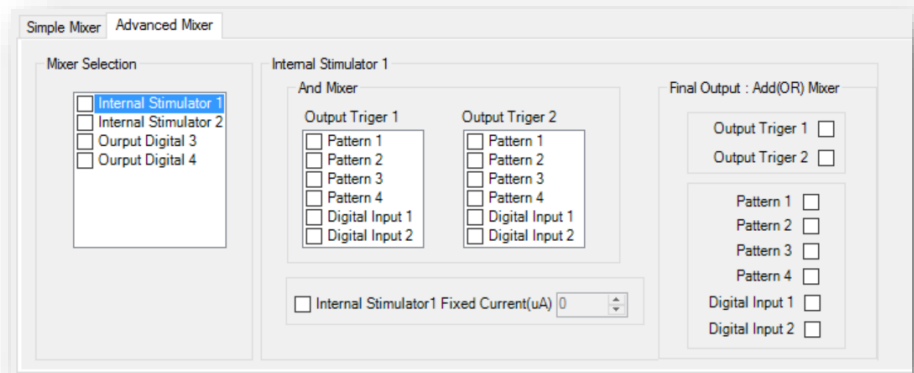
- You can mix your stimulation protocol here.
- **Electrical Stimulator:** mix your defined electrical pattern here by choosing patterns and inputs and also fixed current.
- **Mechanical:** it is mechanical mixer that you can choose patterns and inputs and also Voltage and Rise time



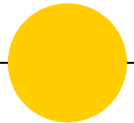


Advanced mixer

☉ You have access to more advanced settings for mixer here



Analysis

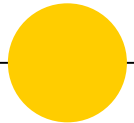




Analysis

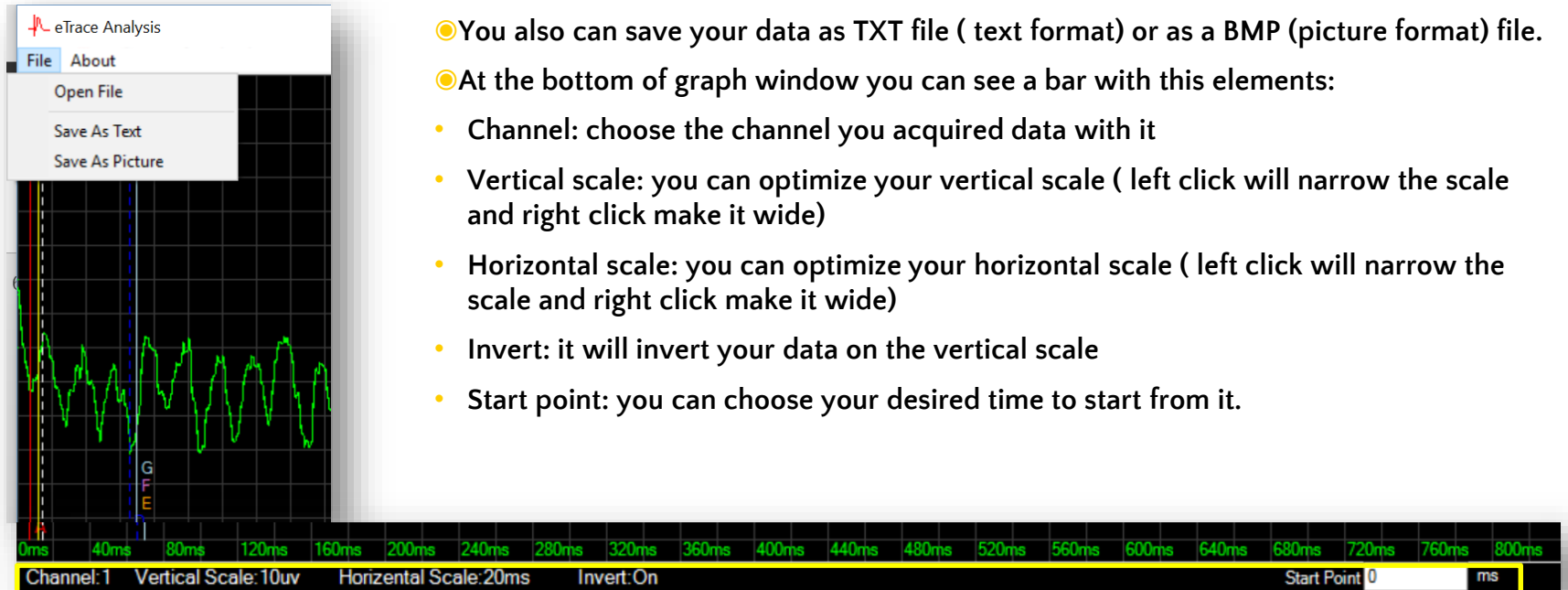
- eTrace : It designed for offline analysis of data collected through eTrace Experiments (local field potentials) such as evoked fEPSP and PS, EEG, EMG,
- It analyzing all basic properties of synaptic potentials (Slope, Peak Amplitude, Latency, Area, PopSpike Amplitude, ...) and also EEG, EMG, phase and frequency of signals.
- eSpike: It developed as an offline analyzing program for collected data through eSpike Experiments (neuronal unit activity) such as single or multi unit activity .

eTrace





eTrace – graph window



- You can open the data you need to analyze by Analysis -> eTrace -> File -> Open File
- You also can save your data as TXT file (text format) or as a BMP (picture format) file.
- At the bottom of graph window you can see a bar with this elements:
 - Channel: choose the channel you acquired data with it
 - Vertical scale: you can optimize your vertical scale (left click will narrow the scale and right click make it wide)
 - Horizontal scale: you can optimize your horizontal scale (left click will narrow the scale and right click make it wide)
 - Invert: it will invert your data on the vertical scale
 - Start point: you can choose your desired time to start from it.



eTrace- data windows

☉ At the data window below the graph window, you can see these boxes:

- Analyze Mode
- Display Mode
- Points
- Results
- Table

The screenshot displays the eTrace software interface with several data windows highlighted by colored boxes:

- Analyze Mode (Green box):** Lists various analysis modes: SB-EPSP (selected), SB-VP+EPSP, SB-PS, SB-SPIKECOUNT, SB-FREQUENCY, STANDARD, and EEG.
- Points (Red box):** Shows a list of points: A, B, G, and Locked.
- Display Mode (Purple box):** Shows options: Normal, Hide Lines, White, and Trimming.
- Results (Yellow box):** Displays trial and EPSP analysis data:
 - Trial period(ms): 35978
 - Recording Time(ms): 35978
 - Trial Numbers: 1 Enabled:1
 - Sample Rate(KS/S): 10
 - Channel Numbers: 1
 - Stim1.Current: 0
 - Stim2.Current: 0
 - Channel: 1 Gain: 1
 - EPSP Analysis:
 - 1- Time(ms): A: 7.8 B: 12.2 C: 15 D: 66.2
 - E: ? 69.6 F: ? 69.6 G: 69.6
 - 2- Volt(μ V): A: -3.4 C: 1.9 D: -31.3
 - E: 25.6 F: 25.6 G: -25.6
 - 3- Latency(ms): Latency (TC-TA): 7.2
 - 4- Amplitude (μ V): Field EPSP (VD-VC): -33.2
 - 5- Slope(μ V/S): CD: -647.9 DE: 1683
 - 6- Slope10_90(μ V/S): CD: -564.6 DE: 1634.9
 - 7- AreaUnderCurve(μ V.ms): CE: 7255 EF: 25
- Table (Blue box):** A table with columns for Comment and Time A(m). It contains one row with the value 'R1' in the Comment column.

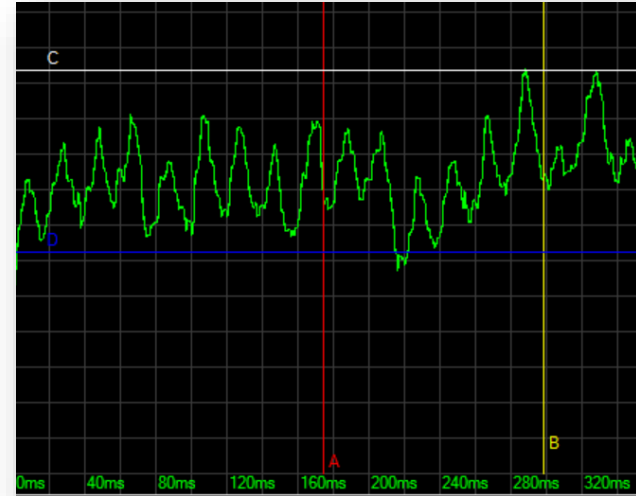
eTrace – points

Points

Locked
A
B
G

224.8

- You can place the point bars by choosing them from points box and moving your mouse cursor on the graph to put the point bar on appropriate place or by entering a value in value box under the points box.
- If you choose Locked in points box, you are not able to move points bar in the graph window.
- There is a file named eTraceTemplate.txt in the eProbe folder that you can change it's content to add or remove points and other templates available in eTrace analysis.
- You can find the instruction for changing the template in the ScienceBeam company [website!](#)



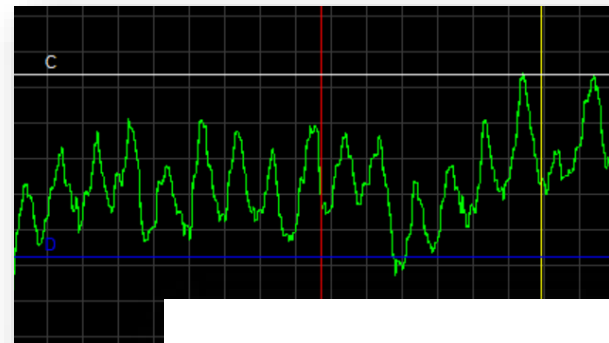


eTrace – Display Mode

- it has four options:
- Normal: you will see the whole graph in a dark background with shown points
- Hide Lines: points will be hidden
- White: the whole graph will be shown in a white background
- Trimming: you can trim your data here by moving trials between enabled or disabled trials.

Display Mode

Normal
Hide Lines
White
Trimming



Enabled Trials

1

Disabled Trials

>>

<<



eTrace – Results

- In advance to the specific analysis information, you can see these informations in results box too:
- Trial period
- Recording time
- Trial number
- Sample rate
- Channel number
- Stimulation current
- Gain
- You can write comment in comment box and also move between trials in Trial From – To boxes
- You can move results to the Table by clicking on Add to Table

Trial period(ms): 35978
Recording Time(ms): 35978
Trial Numbers: 1 Enabled:1
Sample Rate(KS/S): 10
Channel Numbers: 1
Stim1.Current: 0
Stim2.Current: 0
Channel: 1 Gain: 1

Comment

Trial From

To

EPSP Analysis:

1- Time(ms): A: 7.8 B: 12.2 C: 15 D: 15.2
E: 18.1 F: ? 69.6 G: 69.6

2- Volt(μ V): A: 3.4 C: 1.9 D: -4.6
E: .6 F: 25.6 G: 25.6

3- Latency(ms): Latency (TC-TA): 7.2

4- Amplitude (μ V): Field EPSP (VD-VC): -6.4

5- Slope(μ V/S): CD: -13411 DE: 1356.5

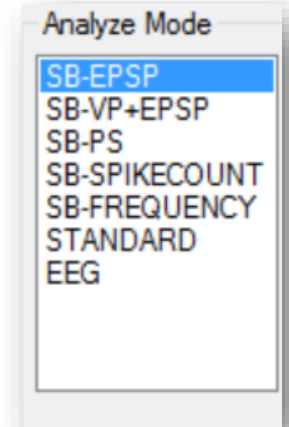
6- Slope10_90(μ V/S): CD: -21474836.5 DE: 1124

7- AreaUnderCurve(μ V.ms): CE: 107 EF: 7148



eTrace – Analyze Mode

- It has many mode to analyze your data:
 - SB-EPSP: Science Beam defined EPSP (Excitatory Post Synaptic Potential)
 - SB-VP+EPSP: Science Beam defined VP+EPSP (Volley Potential+ EPSP)
 - (Volley is an indication of the presynaptic action potential arriving at the recording site and the EPSP itself)
 - SB-PS: Science Beam defined Population Spike
 - SB-SPIKECOUNT: Science Beam defined spikes counting
 - SB-FREQUENCY: Science Beam defined frequency measurement
 - STANDARD
 - EEG





SB-EPSP

● It can analyze these measures between you defined points:

- Time
- Volt
- Latency
- Amplitude (Field EPSP)
- Slope
- Slope10-90
- Area under curve

Trial period(ms): 35978	Comment <input type="text"/>
Recording Time(ms): 35978	
Trial Numbers: 1 Enabled:1	
Sample Rate(KS/S): 10	Trial From <input type="text" value="1"/>
Channel Numbers: 1	To <input type="text" value="1"/>
Stim1.Current: 0	<input type="button" value=">>"/>
Stim2.Current: 0	
Channel: 1 Gain: 1	<input type="button" value="Add to Table"/>

EPSP Analysis:

1- Time(ms): A: 7.8 B: 12.2 C: 15 D: 15.2
E: 18.1 F: ? 69.6 G: 69.6

2- Volt(μ V): A: 3.4 C: 1.9 D: -4.6
E: .6 F: 25.6 G: 25.6

3- Latency(ms): Latency (TC-TA): 7.2

4- Amplitude (μ V): Field EPSP (VD-VC): -6.4

5- Slope(μ V/S): CD: -13411 DE: 1356.5

6- Slope10_90(μ V/S): CD: -21474836.5 DE: 1124

7- AreaUnderCurve(μ V.ms): CE: 107 EF: 7148



SB-VP+EPSP

● It can analyze these measures between you defined points:

- Time
- Volt
- Latency (Field EPSP, Volley potential, Peak Field EPSP)
- Amplitude (Field EPSP, Volley potential)
- Slope
- Slope10-90
- Area under curve

Stim2.Current: 0
Channel: 1 Gain: 1 Comment

VP+EPSP Analysis:
1- Time(ms): A: 226.4 B: 342.4 C: Trial From E >>
F: 421.6 G: ? H: ? I: τ_0
2- Volt(μ V): A: 9.5 B: 18.9 C: 9.8
D: -9.4 E: -5.2 F: -5.2
G: -10.9 H: 0 I: 0

3- Latency(ms): Field EPSP (TC-TA): 125.7
Volley Potential (TD-TA) 188.8
Peak Field EPSP (TF-TA) 195.2

4- Amplitude (μ V): Volley Potential (VD-VC): -19.2
Field EPSP (VF-VG): 5.7

5- Slope(μ V/S): CD: -304.6 CF: -216.1 EF: 0 FG: 0

6- Slope10_90(μ V/S): CD: -247.6 CF: -5722 EF: 0 FG: 0

7- Area(μ V.ms): CE: 6390 CG: 0 EG: 0
GH: 0



SB-PS

● It can analyze these measures between you defined points:

- Time
- Volt
- Latency (PS, Field EPSP)
- Amplitude (PS)
- Slope
- Slope10-90
- Area under curve

Trial Numbers: 1 Enabled: 1
Sample Rate(KS/S): 10
Channel Numbers: 1
Stim1.Current: 0
Stim2.Current: 0
Channel: 1 Gain: 1

Comment

Trial From To

PS Analysis:

1- Time(ms): A: 210.4 B: 306.4 C: 352.1 D: 32 E: 368.8 F: 368.8 G: 368.8 H: 144.8 I: 144.8 J: 144.8 K: ? L: ? M: 0

2- Volt(μ V): A: 15.7 B: 22 C: 9.8 D: 43.5 E: 27 F: 27 G: 49.8 H: 14.8 I: 14.8 J: 14.8 K: 0 L: 0 M: 0

3- Latency(ms): PS (TF-TA): 158.4 Field EPSP (TJ-TA): -65.6

4- Ampiltude(μ V): PS (VG-VF): 22.8

5- Slope(μ V/S): CD: 0 DF: -405.2 FI: 0 FJ: 0

6- Slope10_90(μ V/S): CD: 0 DF: -4245.4 FI: 0 FJ: 0

7- Area(μ V.ms): DI: 0 CK: 0 KL: 0



SB-SPIKECOUNT

● It can analyze these measures between you defined points:

- Time
- SpikeCount
- Ave.Spike Amplitude
- Energy

Trial period(ms): 35978
Recording Time(ms): 35978
Trial Numbers: 1 Enabled:1
Sample Rate(KS/S): 10
Channel Numbers: 1
Stim1.Current: 0
Stim2.Current: 0
Channel: 1 Gain: 1

Comment

Trial From

To

SpikeCount Analysis:

1- Time(ms): Time A: 1744 Time B: 2984

2- SpikeCount: 0

3- Ave. Spike Amplitude(μ V): 0

4- Energy(V.V): .4



SB-FREQUENCY

● It can analyze these measures between you defined points:

- Time
- Power

Trial period(ms): 35978
Recording Time(ms): 35978
Trial Numbers: 1 Enabled:1
Sample Rate(KS/S): 10
Channel Numbers: 1
Stim1.Current: 0
Stim2.Current: 0
Channel: 1 Gain: 1

Comment

Trial From

To

Frequency Analysis:
1- Time(ms): A: 116.8 B: 160.8
2- Power(μ V):

0Hz: 19.7	1Hz: 19.6	2Hz: 19.5	3Hz: 19.3
4Hz: 19.1	5Hz: 18.9	6Hz: 18.5	7Hz: 18.1
8Hz: 17.6	9Hz: 17.2	10Hz: 16.5	11Hz: 15.9
12Hz: 15.3	13Hz: 14.6	14Hz: 13.9	15Hz: 13.1
16Hz: 12.2	17Hz: 11.4	18Hz: 10.5	19Hz: 9.7
20Hz: 8.7	21Hz: 7.8	22Hz: 6.9	23Hz: 6.1
24Hz: 5.2	25Hz: 4.5	26Hz: 3.8	27Hz: 3.3



STANDARD

- It can analyze these measures between you defined points:
- Time
- Amplitude

Trial period(ms): 35978
Recording Time(ms): 35978
Trial Numbers: 1 Enabled:1
Sample Rate(KS/S): 10
Channel Numbers: 1
Stim1.Current: 0
Stim2.Current: 0
Channel: 1 Gain: 1

Comment

Trial From

To

STANDARD Analysis
1- Time A: 340.8 B: 490.4 C: 433.2 D: 487.2
2- Amplitude A: 12.3 B: 18.3 C: -20.3 D: 30.4



EEG

● It can analyze these measures:

- Time
 - Alpha band
 - Beta band
 - Theta band
 - Delta band
- Points are locked in EEG mode

Trial period(ms): 35978
Recording Time(ms): 35978
Trial Numbers: 1 Enabled:1
Sample Rate(KS/S): 10
Channel Numbers: 1
Stim1.Current: 0
Stim2.Current: 0
Channel: 1 Gain: 1

Comment

Trial From

To

EEG Analysis
1- time(ms) A: 0 B: 35978
2- Alpha(μ v) : 23800.8
3- Beta(μ v) : 35631
4- Theta(μ v) : 33047.5
5- Delta(μ v)

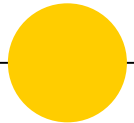


eTrace – Table

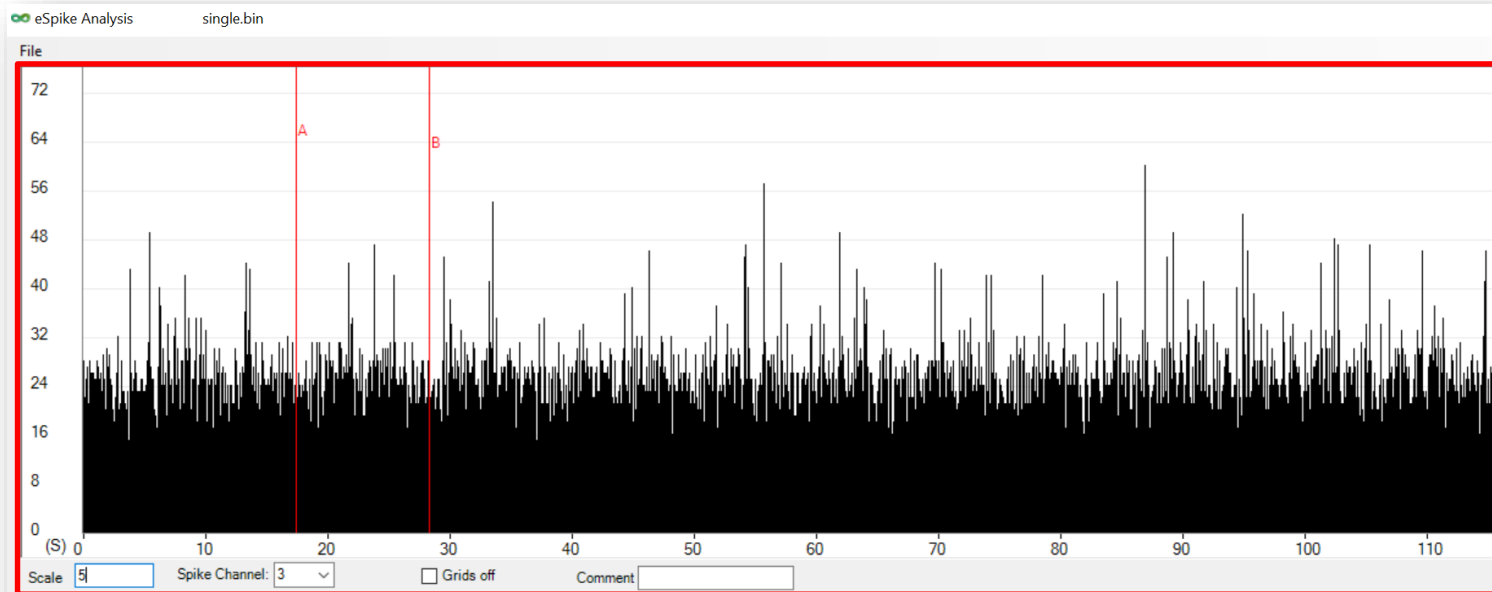
- By clicking on Add to Table in result box, data will be added to the table next beside the result box.
- You can copy Data or Data/Header of this table by right clicking on the table and then paste it in Excel for more analysis.
- You also can remove the table by right click on the table -> Remove

	Comment	Time A(ms)	Time B(ms)	Time C(ms)	Time D(ms)	Time E(ms)
R1	-Tr.1-Ch.1-	7.8	12.2	15	15.2	18.1
R2	-Tr.1-Ch.1-	1472	4696	0	0	.9
R3	-Tr.1-Ch.1-	226.4	342.4	352.1	415.2	421.6
R4	-Tr.1-Ch.1-	226.4	342.4	352.1	415.2	421.6
R5	-Tr.1-Ch.1-	226.4	342.4	352.1	415.2	421.6
R6						

eSpike



Graph window



Data window

ANALYZE MODE

- RATE HISTOGRAM
- RATE HISTOGRAM2
- ISH
- MULTI
- SPINAL

Parameters

Time From
Trial From
Trial To
BinSize
A
B

28300

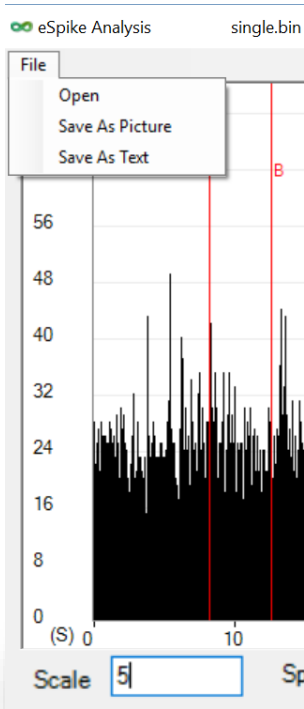
>>

Recorded Parameters:
Trial period(ms): 0 Recording Time(ms): 36000000 Trial Numbers: 1
RATE HISTOGRAM Analysis:
Trial From: 1 To:1 BinSize: 100 TimeFrom: 0 To: 36000000

TOTAL: 2854
AVERAGE: 26.183
SD: 4.74
SE: .454
MAX: 47
MIN: 17
FREQ: 261.835



eSpike - graph window



- You can open the data you need to analyze by Analysis -> eSpike -> File -> Open File
- You also can save your data as TXT file (text format) or as a BMP (picture format) file.
- At the bottom of graph window you can see a bar with this elements:
 - Scale: you can change the scale number to optimize the graph view
 - Spike Channel: choose which channel you want to analyze
 - Grid off: If you check the box, grids will be hidden
 - Comment: You can write any comment here



eSpike- data windows

At the data window below the graph window, you can see these boxes:

- Analyze Mode
- Parameters
- Results

Time From	Trial From	Trial To	BinSize
A			
B			

8200

Recorded Parameters:
Trial period(ms): 0 Recording Time(ms): 36000000 Trial Numbers: 1
RATE HISTOGRAM Analysis:
Trial From: 1 To:1 BinSize: 100 TimeFrom: 0 To: 36000000

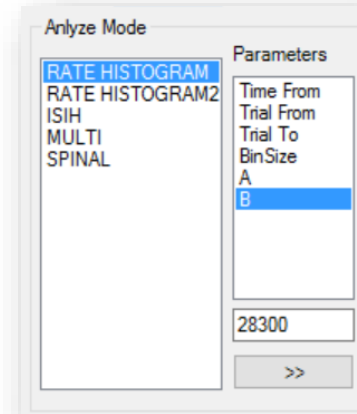
TOTAL: 1139
AVERAGE: 25.886
SD: 5.231
SE: .789
MAX: 42
MIN: 17
FREQ: 258.864

You can see the trial period, recording time, trial numbers in result window despite which analyze mode you choose.



Analyze Mode

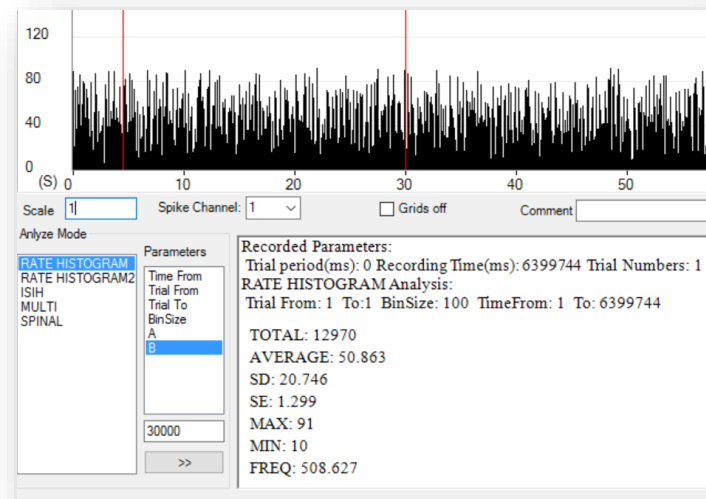
- Rate Histogram: Use this mode for continuous recording without electrical stimulation (for example to investigate the effect of drug X)
- ISIH: It gives you an InterSpike nterval Histogram
- Multi: Use this mode to check the response number of neurons
- Spinal: you can evaluate the impact of every neuronal fiber specially in the pain research





Rate histogram

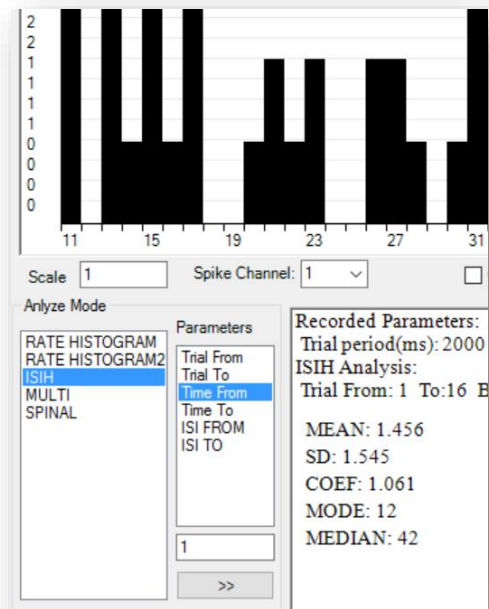
- In the parameters box, set appropriate value for Bin size
- Choose from which trial, it begun to analyze and to which trial, it ends by locating desired trial number
- Set the appropriate value for point A and B to limit the analyze between A and B
- Recorded parameters for this analyze mode are:
 - TOTAL: total number of spikes
 - AVERAGE
 - SD (Standard Deviation)
 - SE (Standard Error)
 - MAX (Maximum)
 - MIN (Minimum)
 - FREQ (Frequency)





ISIH

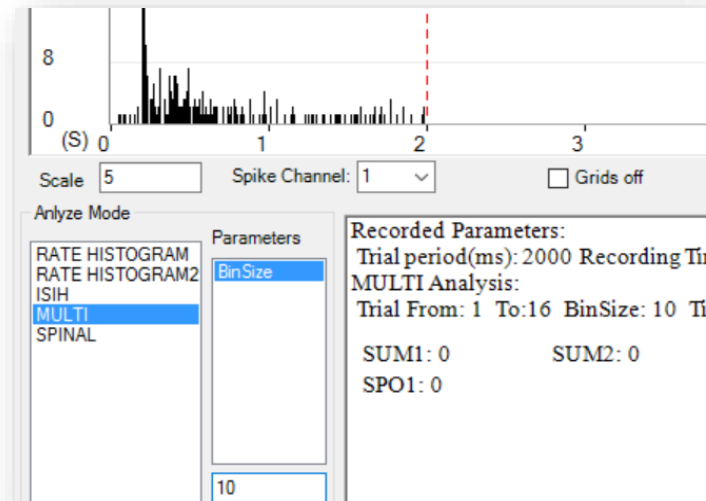
- Choose from which trial (Trial from), it begun to analyze and to which trial (Trial to), it ends by locating desired trial number
- Set the appropriate value for ISI FROM-TO to limit the ISI Histogram between those values.
- Recorded parameters for this analyze mode are:
 - MEAN
 - SD (Standard Deviation)
 - COEF (Coefficient)
 - MODE
 - MEDIA





MULTI

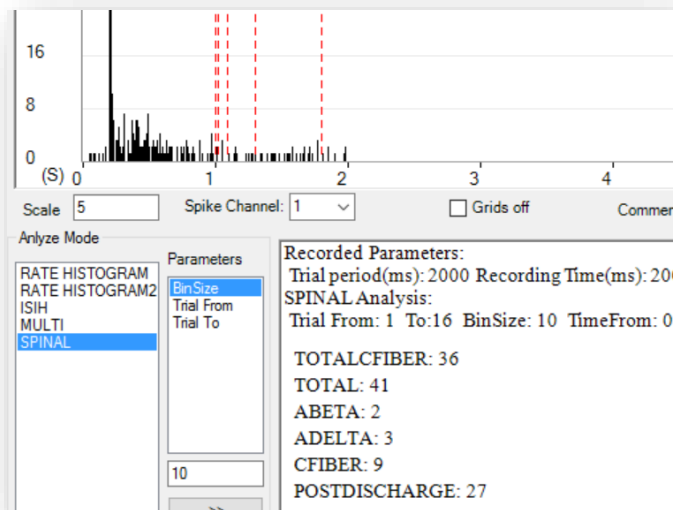
- In the parameters box, set appropriate value for Bin size
- You get the result which is SUM of neuronal responses in result box





SPINAL

- In the parameters box, set appropriate value for Bin size
- Choose from which trial, it begun to analyze and to which trial, it ends by locating desired trial number
- You get the result which is Total neuronal fibers and also the number of every fiber type (C Fiber) and also PostDischarge in the result box.



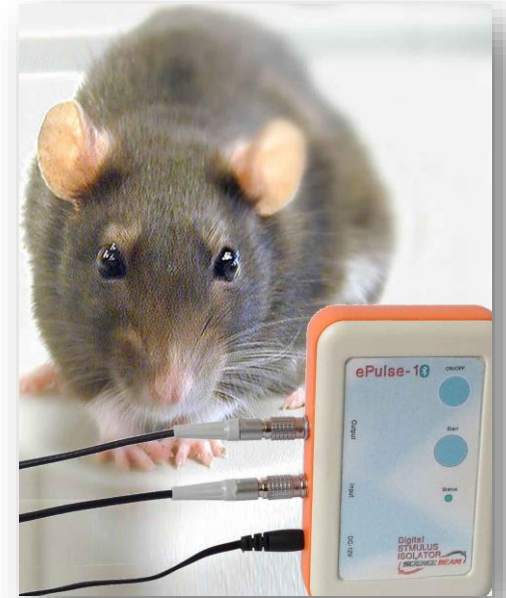
ePulse





ePulse

- ePulse is a Wireless Stimulus Isolator which is used for deep brain stimulation
- 4 channel Pulse generator
- Professional mixer in designing stimulus pattern





Specification

Electrical stimulator

Mode	Constant current, unipolar, isolated
Number of channel	Optional, 1 or 2
Current range	0–4 mA or 0–20 mA (optional)
Current resolution	1 μ A or 5 μ A (optional)
Output waveform	DC or current pulse
Current control	Yes, software control by 12 bit DAC
Current amplitude error	3 LSB (maximum)
Polarity inversion	Yes, software control by relay
Output switch	Yes, software control by relay
Output voltage compliance	150 V
Current rise time and delay	5 μ s, typical (1K Ω load)
Current fall time and delay	5 μ s, typical (1K Ω load)
Isolation type	Optical
Isolation voltage	2500 V
Isolation resistance	10 ¹² Ω



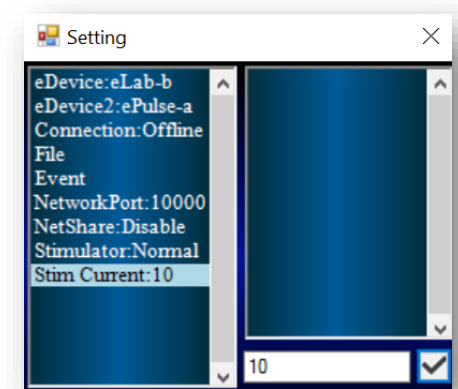
Specification

Pulse generator	Experiment protocols	Single trial, multi trial, single protocol, multi protocol
	Stimulation timing pattern	4
	Pattern parameters	Delay, pulse duration, pulse cycle, pulse numbers, trial period, trial number
	Timing pattern resolution	10 μ s
	Mixers	2Ch internal stimulator, 2Ch mechanical stimulator, 2Ch digital outs
	Mixer inputs	Pattern1, pattern2, pattern3, pattern4, digital input1, digital input2



Connection

- To use this device, it needs to be connected to eLab via a cable and eLab connect to the computer. In eProbe software -> Setting menu -> set these parameters -> eDevice: eLab and eDevice2: ePulse.
- Then, you only need to create your stimulation protocol. Go to the Setting -> File -> Make Stim Protocol.
- You can change stimulator situation to off, normal or inverted from Setting menu -> Stimulator
- You can define current in Setting menu -> Stim Current -> set the value in the box





Make Stimulation Protocol

- Stimulation Parameters
- Recording Parameters
- Preview
- Mixers

The screenshot displays the ePulse 1+ software interface. At the top, the 'Stimulation Parameters' section includes fields for Pattern (1..4), T1 (Delay) in μs , T2 (Pulse Duration) in μs , T3 (Pulse Cycle) in μs , N1 (Train), and T4 (Trial F). Below this, the 'Recording Parameters' section shows Recording Time and Trial Pe. The central part of the interface features a waveform preview with labels for T1, Rise Time, T2 - Rise Time, Fall Time, T3 - Fall Time, and T4. The bottom section, titled 'Mixers', contains 'Simple Mixer' and 'Advanced Mixer' tabs. The 'Simple Mixer' tab is active, showing checkboxes for Internal Stimulator1, Internal Stimulator2, Digital Out3 or Mechanical1, and Digital. It also includes fields for Fixed Current (μA) and Mechanical Rise Time1.



Stimulation Parameters

Pattern (1 .. 4)

Pattern1

- Pattern (1 .. 4): make four different patterns of stimulation. you can mix these patterns to produce a complex protocol by using Mixers.
- T1 (Delay): Latency between starting the recording time and applying the first stimulation pulse of each train
- T2 (Pulse Duration): Duration of a single stimulation pulse.
- T3 (Pulse Cycle): Duration from starting a single pulse to starting the next single pulse.
- N1 (Train): Number of pulses in a *trial period*.
- T4 (Trial Period): Duration from starting a trial period to starting the next one.
- N2 (Trial Numbers): Number of repeating a desired trial.

T1 (Delay)

0 μs

T2 (Pulse Duration)

0 μs

T3 (Pulse Cycle)

0 μs

N1 (Train)

0

T4 (Trial Period)

0 μs

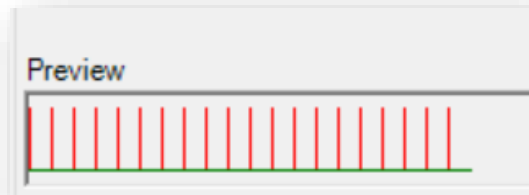
N2 (Trial Numbers)

0



Example

- A train of 20 single pulses at 100 Hz, each single pulse has 200 μ s duration.
- stimulation pattern in 100 Hz (100 pulses/second): pulse cycle must be 10ms (1000ms/100pulse).
- Through the pulse cycle you could establish frequency of a train and vice versa.
- N1 will explain how many pulses you want to have in a train.
- According to T1, T3 and N1 you must write a value for T4.



Stimulation Parameters

Pattern (1 .. 4)	T1 (Delay)	T2 (Pulse Duration)	T3 (Pulse Cycle)	N1 (Train)	T4 (Trial Period)	N2 (Trial Numbers)
Pattern1	0 μ s	200 μ s	10000 μ s	20	200000 μ s	1



Recording Parameters

Usually, following the stimulation, you have an electrophysiological response and you want to save it. Record your data using the below menu:

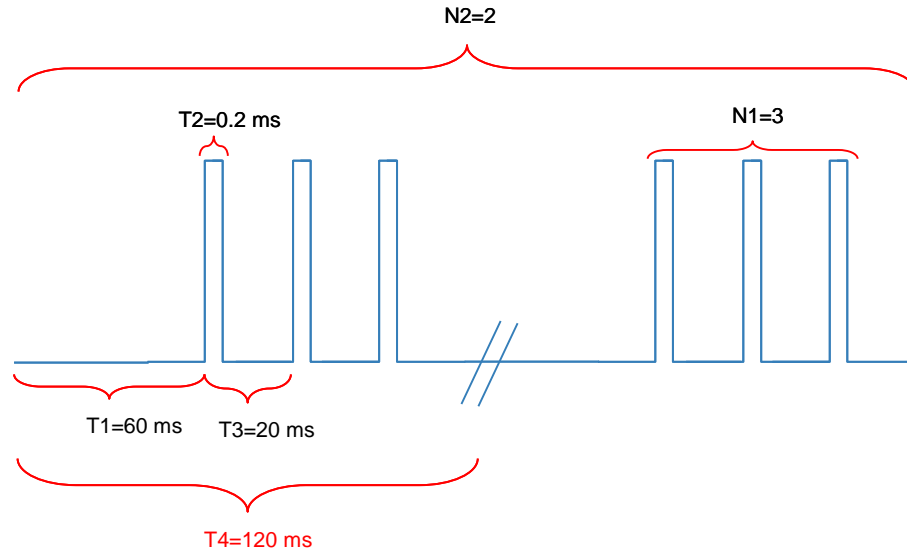
The screenshot shows a dialog box titled "Recording Parameters" with a "Sync" checkbox in the top right corner. The dialog contains three input fields: "Recording Time" with a value of 0 and a unit of "ms", "Trial Period" with a value of 0 and a unit of "ms", and "Trial Numbers" with a value of 0. Each input field has a small up/down arrow icon next to it.

- Recording time: It is part of trial period, which you wish to save it on the computer.
- Trial period and Trial Numbers are the same as described in stimulation parameters.
- Recording time must not be longer than the trial period (could be lesser or equal).**
- check the sync box to equalize the values of Trial period and Trial Numbers in both stimulation and recording parameters.

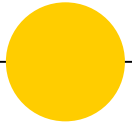


Preview of Stimulation Protocol

● According to T1, T3 and N1 you must write a value for T4!



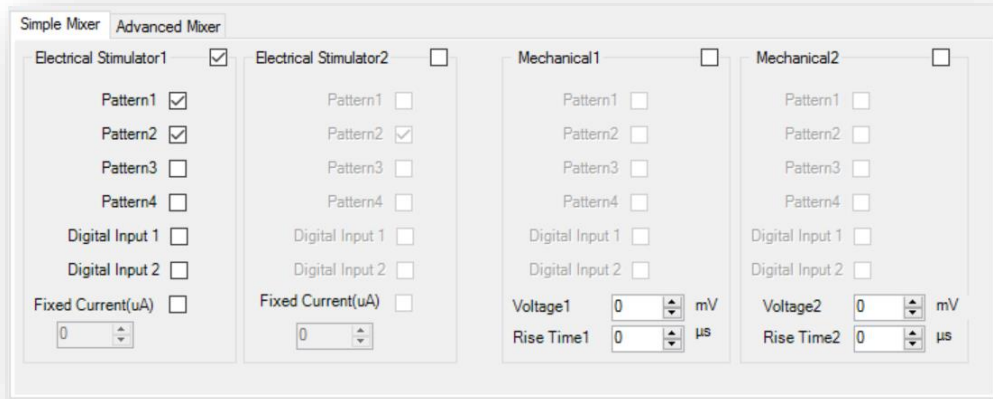
Mixers





Simple mixer

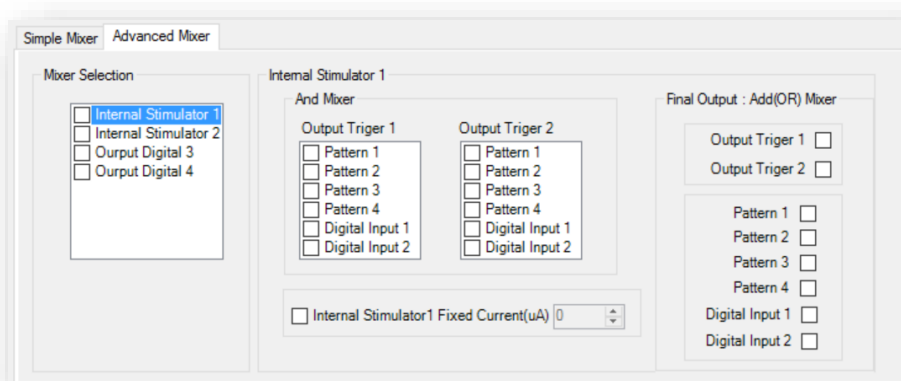
- You can mix your stimulation protocol here.
- **Electrical Stimulator:** mix your defined electrical pattern here by choosing patterns and inputs and also fixed current.
- **Mechanical:** it is mechanical mixer that you can choose patterns and inputs and also Voltage and Rise time





Advanced mixer

- You have access to more advanced settings for mixer here
- You have access to AND/ OR feature to apply it on your stimulus design.





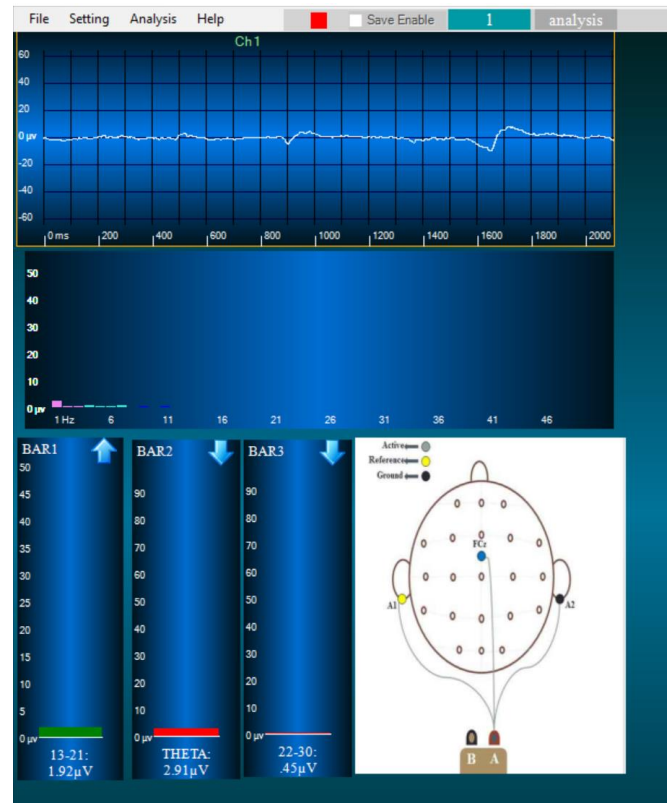
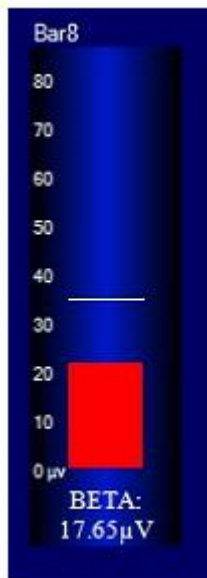
⦿ **deep brain stimulation**

⦿ **Brain stimulator**



Bar

It shows whether the square of the instantaneous FFT (Fast Fourier Transform) power of a specific band ($\delta, \theta, \alpha, \beta, \gamma$) is beyond or less (direction) than the threshold and considers it as a logic for the Game panel.

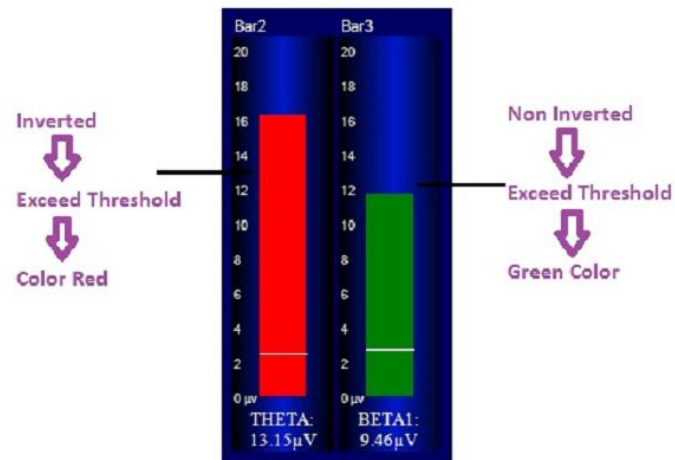
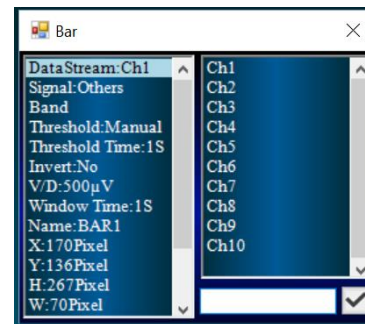




Bar setting

- Data Stream: channels or ports which stream data
- Signal: type of signal (ECG/EEG/EMG/RRI/BVP/IBP/Spike/Field)
- Band: brainwaves spectrum, Low/High Artifact
- Threshold: manual or percent
- Threshold Time
- Invert: Objective direction of frequency band in Bar
- V/D: Amplitude scaling to optimize view
- Window Time: change the window size
- Name: Change the name of Bar
- X/Y/H/W: Change the size and coordination of Bar
- Script

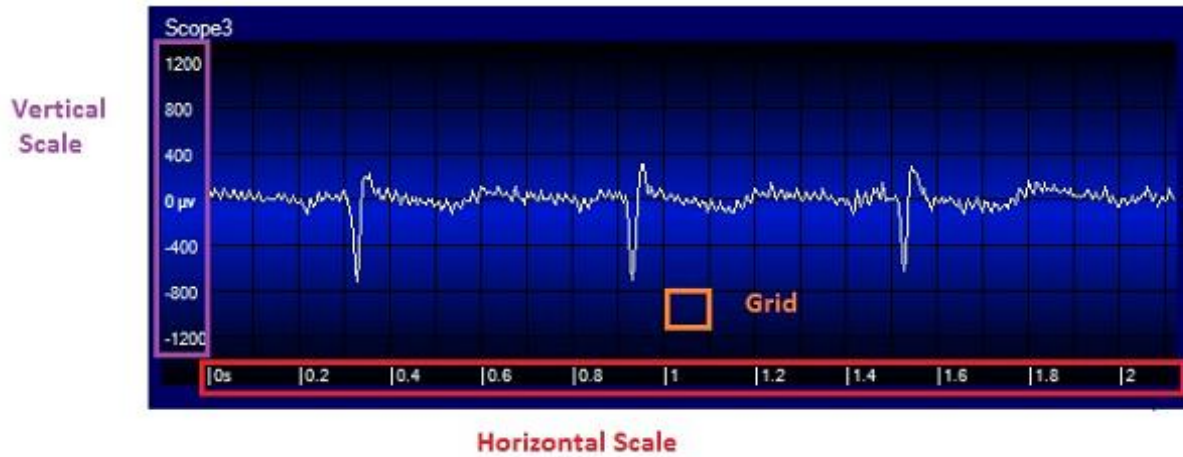
Delta: 1 – 4 Hz
Theta: 4 – 8 Hz
Thalpa: 6 – 10 Hz
Alpha: 8 – 12 Hz
LowAlpha: 8 – 10 Hz
HighAlpha: 10 – 12 Hz
Mu: 8 – 13 Hz
SMR: 12 – 15 Hz
Beta: 12 – 35 Hz
Beta1: 15 – 18 Hz
Beta2: 18 – 22 Hz
Beta3: 22 – 26 Hz
Beta4: 26 – 30 Hz
Beta5: 30 – 35 Hz
Gama: 35 – 100 Hz
LowArtifact: 43 – 59 Hz
HighArtifact: 1 – 2 Hz





Scope

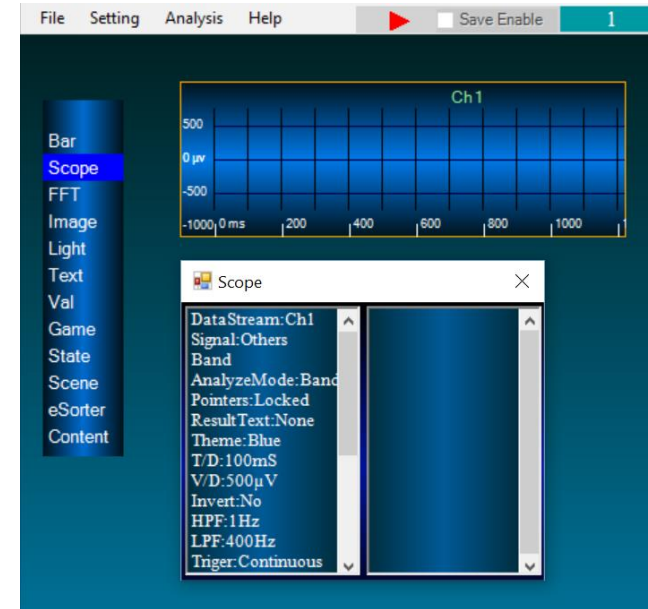
- It displays the signal both in time and frequency domain





Scope setting

- Data Stream: Channels or ports which stream data
- Signal: type of signal(ECG/EEG/EMG/RRI/RatRRI/BVP/IBP)
- Band: Brainwaves spectrum, Low/High Artifact
- analyzeMode: Bands
- Pointers: Lock pointer lines
- ResultsText: showing a result text beside scope
- Theme: Change the color of waves inside scope
- T/D: Time scaling to optimize view
- V/D: Amplitude scaling to optimize view
- Invert: invert waves in scope
- HPF: eliminate the high frequency signals or noises
- LPF: eliminate the low frequency signals or noises
- Trigger: to trigger continuously or not





eWaves devices

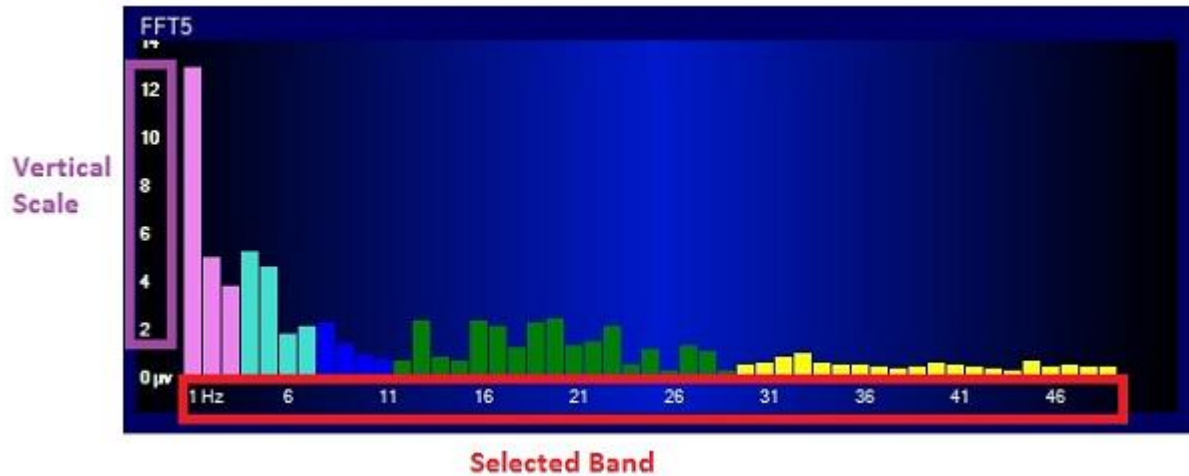
Product name	eWave8D	eWave16D	eWave32-64-128D	eWave4s
Amplifier Channel numbers	8	16	32/64/128	3
Amplifier Type	Differential, DC	Differential, DC	Differential, DC	Differential, DC
ADC resolution	24bit	24bit	24bit	24bit
Sample rate/ per channel	1Ks/s	1Ks/s	500s/s	5Ks/s
Processor	32bit, 128MHz	32bit, 128MHz	32bit, 153MHz	32bit, 72MHz
Data Interface	WI-FI/USB2 Bluetooth wireless	WI-FI/USB2	WI-FI/USB2	USB2 Bluetoothwireless
Current Stimulator	No	No	No	Yes (100mA, 350V)
Gain	6	6	6	6

Product name	eWave8b	eWave16b	eWave32b	ePulse
Digital inputs	2	2	2	2
Digital output	2	2	2	2
Analog input	1	0	0	0
Analog output	1	0	0	0
Dimensions (L/H/W) mm	120x28x60	120x28x60	155x33x95	155x33x95
inputs resistance	$10^{12} \Omega$	$10^{12} \Omega$	$10^{12} \Omega$	$10^{12} \Omega$
Battery life Re-chargeable	24 Hours	12 Hours	12Hours	24 Hours
Filter band	DC -500Hz	DC -500Hz	DC -250Hz	DC -2KHz
Application EEG/ ECoG /ECG/EMG/ EOG	Yes	Yes	Yes	Yes
ERP	Yes-8ch	Yes -16ch	Yes -32/64/128ch	No
Sensors EEG,EMG,ECG,BVP, Temp, Skin Resistance	Yes	No	yes	No
LFP	No	No	No	No
Single unit	No	No	No	No
Intracellular recording Patch ,Voltage ,Current Clamp Spike Sorter	No	No	No	No



FFT

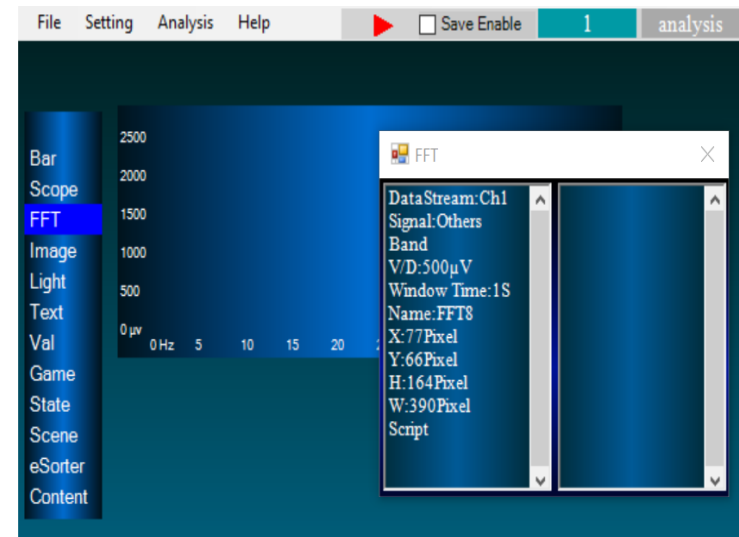
- In FFT panel, you can see the square of the instantaneous FFT power of your desired band





FFT setting

- Data Stream: Channels or ports which stream data
- Signal: Type of signal(EGC/EEG/EMG/RRI/BVP/IBP/Spike/Field)
- Band: Brainwaves spectrum, Low/High Artifact
- V/D: Amplitude scaling to optimize view
- Window Time: change the window size of FFT calculation





Image, Text, Light



- Image panel shows image. You can select the image file you want to display.
- Text panel add some information as text to your protocol or show the result of the analyze panel.
- Light panel calculates the square of the FFT power of the selected band and compares it with two thresholds. If the value is more than both thresholds the light shows green color. If it is less than both thresholds the color is red and if it is in the middle, the color is orange.





Image, Text, Light setting

Image

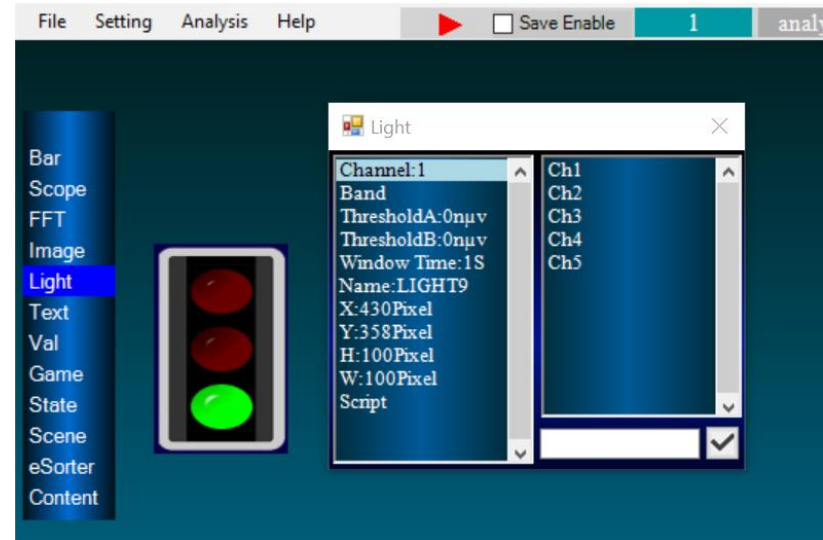
- File: Choose the image from here (first you must add the image in image folder)

Text

- Content: Type the text here

Light

- Channel
- Band
- ThresholdA
- ThresholdB
- WindowTime





Val

- Val panel displays the square of the FFT power of the band that you have selected.
- You can see the output of only one channel at a time in each Val panel.



◎ Please, write your comments on
for us



“