

Animal electrophysiology system

- **neuro electrophysiology for research**
- **electrophysiology system for education**
- **brain stimulation and DBS systems**

(Animal extracellular electrophysiology workstation)

In-vivo and in-vitro

Spinal cord and brain

Recording Local Field Potential (LFP),
single-unit, Long Term Potential (LTP),
ECoG, EEG/ECG/EMG/VEP/NCV

Neuro conductive velocity

Visual evoked potential

Electroencephalography (EEG)

Electrocorticography (ECoG)

Sciencebeam solution

1. eLab 2/4ch
2. eWave+: 8/16/24/32ch
3. ePulse
4. eLab mini
5. Bio sensors
6. Accessory



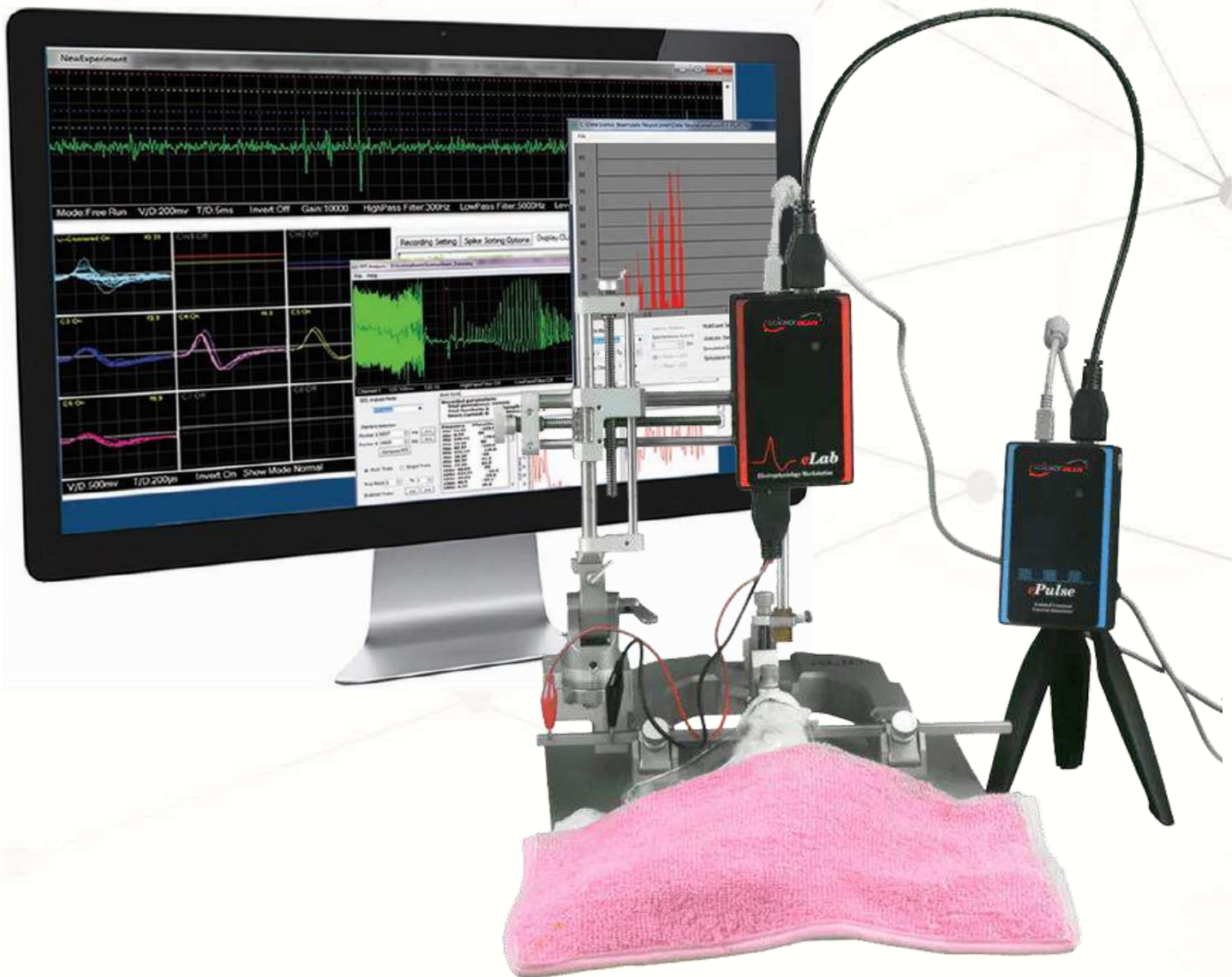
eLab device -20 in ONE!

The Integrated and Powerful Electrophysiology Lab

20 in ONE!

More than 20 electrophysiological devices have been integrated into eLab.

All adjustments are done in the software; therefore, it is savable and sharable.



eLab device -20 in ONE!

The Integrated and Powerful Electrophysiology Lab



A complete electrophysiology lab **eLab** is a singular data acquisition system for simultaneous recording of a full range of extracellular techniques from **single-unit action potentials (Spikes)** to **multi-unit ones including local field potential (LFP), LTP, NCV, EEG/ECG**, as well as signal modulation by external digital events. So, by using one device, one can carry out too many neuroscience/electrophysiology research projects.

This singular system enjoys integrity, leading to amazing simplicity so that all users may use it easily even if they are not signal experts, the **signal-to-noise ratio** being much higher than major extracellular electrophysiological devices, portability, and quick setup (in a couple of hours) opposite to those requiring as much as several months to overcome too much noise prior to setting up.

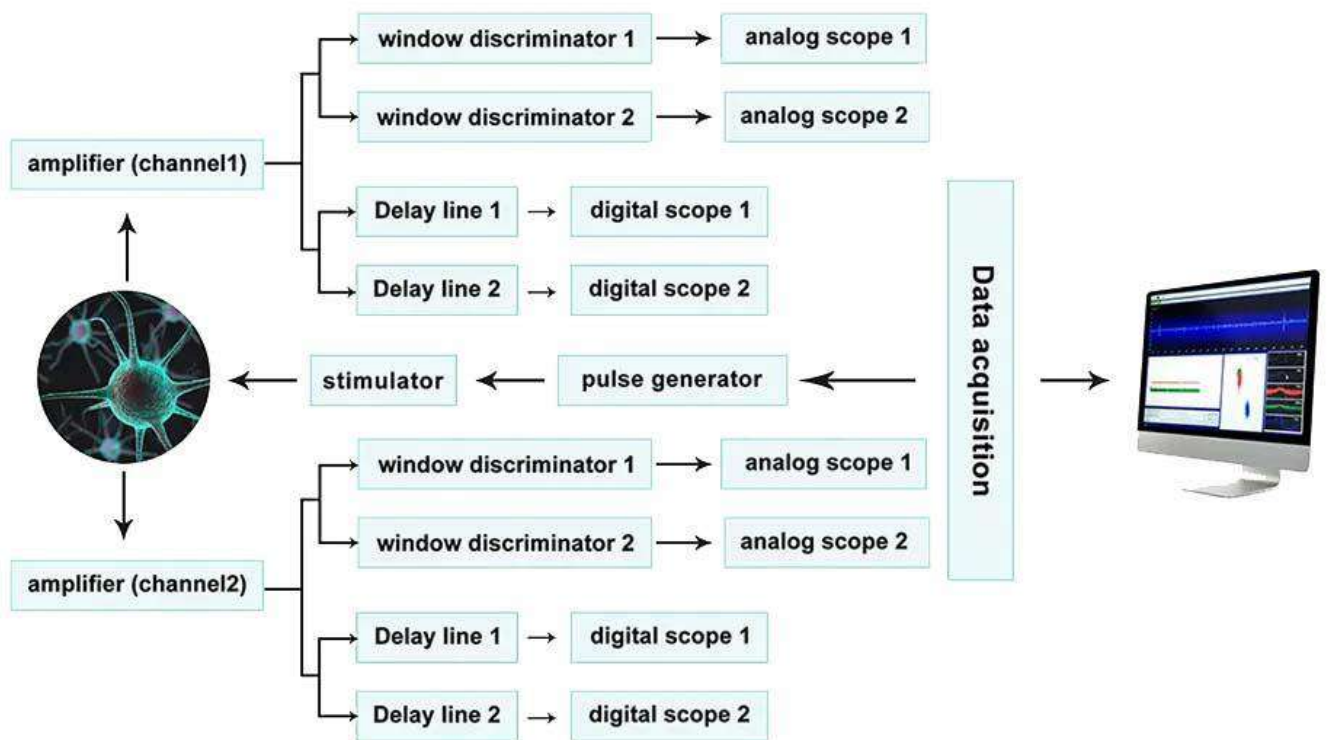
All adjustments have been made to the comprehensive software, so they are simple and more accurate. You can save the adjustment as a protocol and share it online with other researchers through the online protocol section. You will also have access to our available online protocols.

eLab is suitable for **invasive/non-invasive**, also **in-vivo/in-vitro** recordings, over both the central nervous system and peripheral nervous system. The device uses **24-bit** analog-to-digital converter that provides very high-resolution signals by letting low gain amplification coefficient and consequently much lower noise. The compact system, which has a compatible pulse generator, can be used to define any desired electrical stimulation protocol for conducting many different research ideas.

Animal research- design protocol

eSpike- for extracellular electrophysiology studies (signal recording and analysis)

Record “single-unit” activity and determine a local field potential (LFP) by using only one electrode in an experiment!!!



20 in ONE!
More than 20
electrophysiological devices
have been integrated into eLab.



Complete Electrophysiology Lab

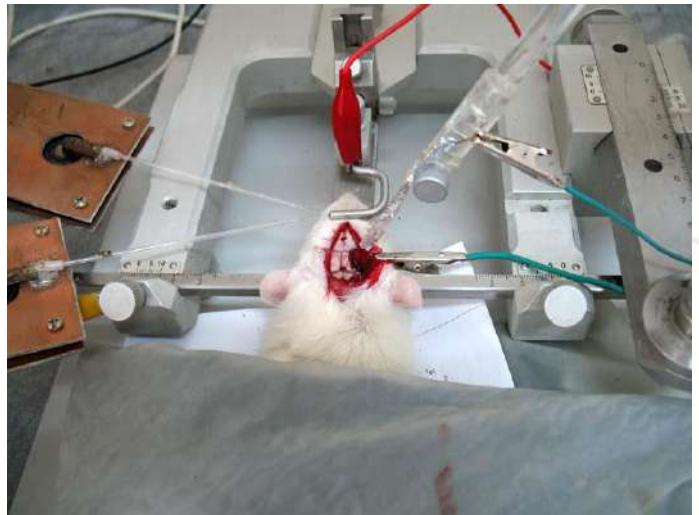
eLab is a singular data acquisition system for recording the single-unit action potentials (Spikes), Local Field Potential (LFP), LTP, **NCV, EEG/ECG**



- Suitable for **invasive/non -invasive** also **in-vivo/in-vitro** recordings
- eLab electrophysiology system is able to cover all extracellular techniques, while other general equipment performs one or some. So, by using one device, one can study too many neuroscience/electrophysiology research projects.
- The signal-to-noise ratio of this device is much higher than major extracellular electrophysiological devices.
- The device uses **24-bit analog-to-digital converter** that provides very high-resolution signals.
- The compact system, which has a compatible pulse generator, can be used to define any desired electrical stimulation protocol for conducting many different research ideas.
- All adjustments have been made in the software. Which is much more accurate.
- It is possible to save all your adjustments as a protocol. Also, it is possible to share with other researchers through the online protocol section in the software.

The Integrated and Powerful Electrophysiology Lab

- Recording EEG/LFP/single unit/EOG/ECG/ECG/EMG
- 2/4/8 input analog channels (24 bits, 50 KS/S) – high precision
- 8 Digital Input and outputs channels
- Compatible with **ePulse** (Isolated Stimulator) for electrical and mechanical stimulation
- Compact and portable (56 x 125 x 20 mm) & Lightweight (80 gr)
- Microelectrode amplifier
- Pulse generator & Stimulator isolator
- Raw and sorted scopes
- Amplitude window discriminator
- Data acquisition
- Offline spike sorting for spike clustering
- 4 Channel pulse generator, 10 μ s pulse duration resolution
- Isolated constant current simulator (4 mA/20 mA)
- Optional mechanical stimulus controller
- Plug and Play (USB2 connector)
- Operating voltage: 5 VDC
- Easy to setup



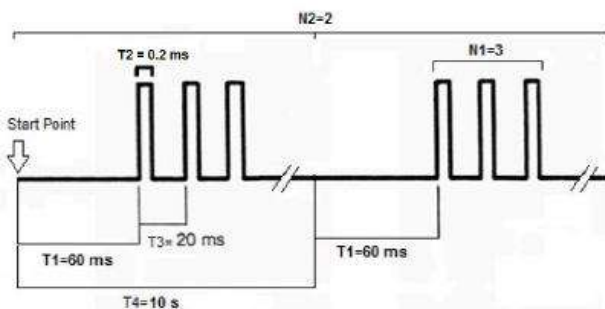
ScienceBeam Mechanical stimulator

- A mechanical stimulus generator for studying of somatosensory system
- Up to 1000 μ s mechanical displacement of rat and cat vibrissae
- Timing and speed controlling of mechanical displacement

Constant current Electrical stimulator-ePulse

Electrical stimulator

- Mode: Constant current, Isolated
- Number of Channels: 1 Channels
- Current Range: 0 to 4 mA or 0 to 20 mA (optional)
- Current Resolution: 1 μ A or 5 μ A (optional)
- Output Waveform: DC or current pulse
- Current Control: Controlling by 12 bit DAC
- Polarity Inversion: the software controlling by Relay
- Output Switch: software controlling by Relay
- Output Voltage Compliance: 150 V
- Current Rise Time and Delay: 5 μ s, typical (1 K Ω load)
- Current Fall Time and Delay: 5 μ s, typical (1 K Ω load)
- Isolation Type: Optical
- Isolation Voltage: 2500 V
- Isolation Resistance: 10¹² Ω



Micro electrode array

Features:

16 channel signal recording

Selectable channel for stimulus

Small size array (less than 10 mm)

Suitable for ECG, ECoG and EEG signals recording
Compatible with eWave and elab systems

Research Applications

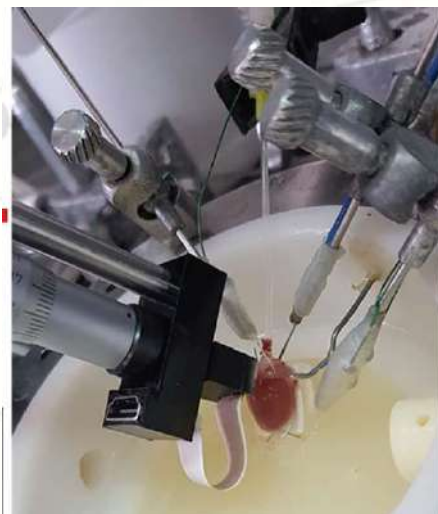
Neuronal studies

Cardiac tissue studies

Muscular tissue studies

Tissue engineering studies

Brain slice field potential recording
Bio-chamber recordings





The Fantastic Electrophysiology Workstation Single-unit, LFP, LTP, NCV, VEP and EXG (EEG/ECG/ECoG)

Key Features:

- Highly precise data recording
- 24 bits data resolution
- Up to 8 inputs ch's with 50K SPS and up to 32 ch's with 10K SPS
- Fast real time data processing
- Fully-integrated in eProbe software for data recording and analyzing
- Empowered with many tools for different classes of extracellular research
- Suitable for invasive, non-invasive, in vivo and in vitro situations
- Well-matched with ePulse as an isolated electrical and mechanical stimulator
- Light weight, portable and easy to use



Data Acquisition

FIFO memory	64 KB
Processor	32 bit ,168 MHz
Data transfer	USB

Amplifier

Amplifier type	Differential, Isolated
Number of channels	2/4/8/16/32
Gain	50
Input voltage range	±2.5 V
Maximum analog input	±2.5 V
Input impedance	$10^{12} \Omega$, common
Input leakage current	60 pA (typical)
Input capacitance	8 pF
Common mode rejection	75 dB @ 50/60 Hz
Isolation type	Optical
Isolation voltage	2500 V
Isolation resistance	$10^{12} \Omega$
Low cut filter	1 Hz
High cut filter	10 KHz

Pulse Generator

Experiment protocols	Single/multi trial and protocols
Stimulation timing Patterns	4
Pulse pattern parameters	Delay, duration, cycle, numbers
Timing pattern resolution	20 μ s
Mixers	Internal stimulators, Digital outs
Mechanical stimulator	2 ch's digital outputs
Mixer inputs	4 patterns pluse 2 digital inputs

Analog to Digital Converter

Number of channels	2/4/8/6/32
ADC resolution	24 bit
Linearity error	±7.6 ppm
Sample rate (eLab / eLab+)	10 K/ 50 K per second
Analog input range	±2.5 v
Interface	Serial
Isolation type	Optical
Isolation voltage:	2500 V
Isolation resistance:	$10^{12} \Omega$

Electrical Stimulator

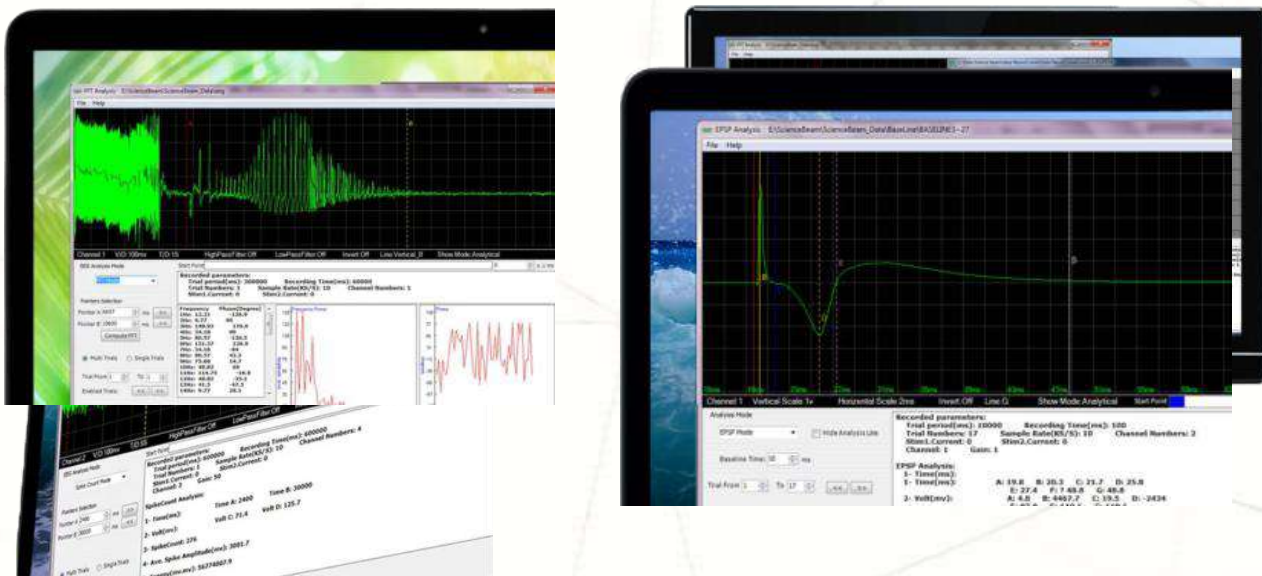
Mode	Constant current
Uni-polar, isolated	Yes
Number of channels	2
Current range (optional)	0 to 4mA, 0 to 20mA
Current resolution	1 μ A or 5 μ A (optional)
Output waveform	DC or current pulse
Current control	Using a 12 bit DAC
Current amplitude error	3 LSB (maximum)
Polarity inversion	Yes, by software
Output switch	Yes, by software
Output voltage compliance	150 V
Current rise/fall time	5 μ s, typical
Isolation type	Optical
Isolation voltage	2500 V
Isolation resistance	$10^{12} \Omega$

Animal electrophysiology software

eProbe for animal Research

eProbe software lets you watch and probe almost all ranges of neuro/electrophysiological signals in superlative quality. You can see streams online and offline. Also, great data analyzing tools associate you with your research.

eProbe has a different toolbox for recording signals, stimulation, data acquisition, and off-line analysis of a wide range of extracellular electrophysiology studies such as long-term potentiation (LTP), long-term depression (LTD), EEG, EMG and epileptiform, bursts activity, extracellular single-unit, multi-unit action potential, NCV, VEP, and ECG (RRI).

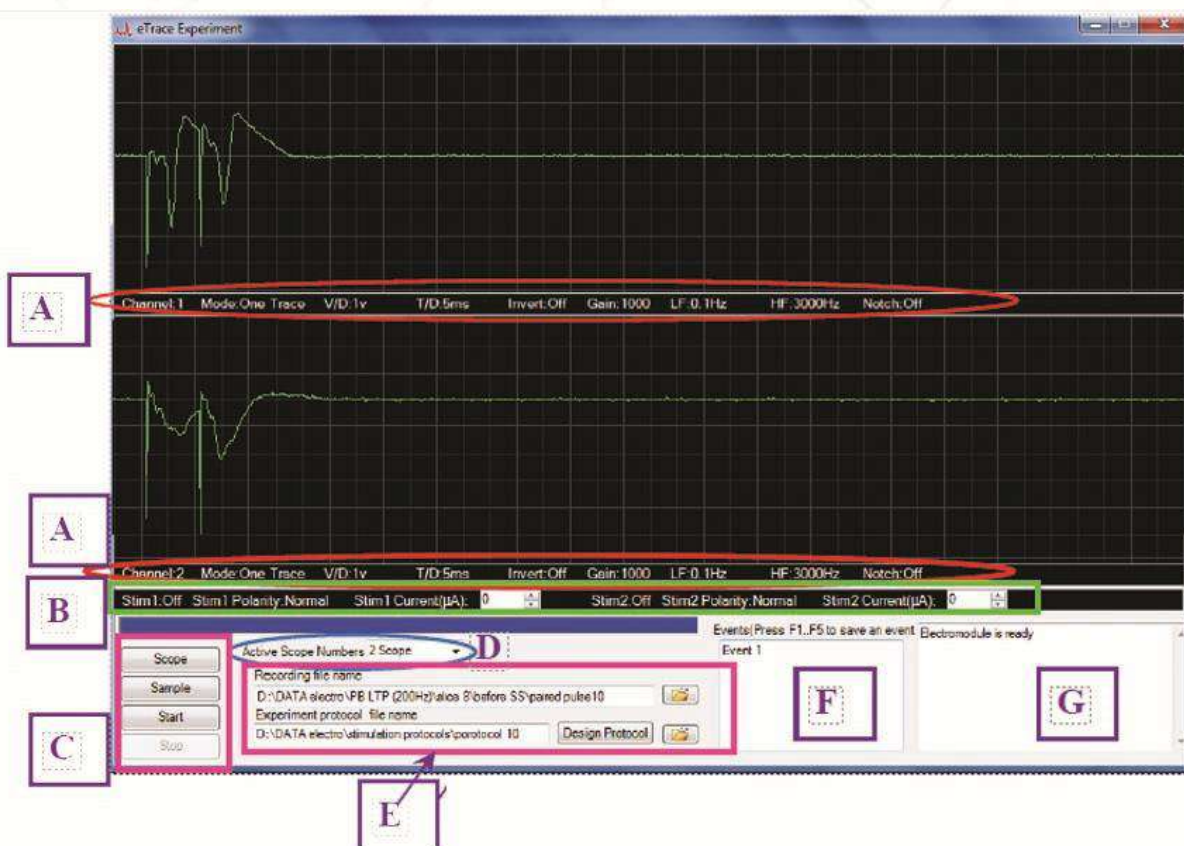


eTrace

eProbe has two eTrace toolbox for stimulation, data acquisition and off-line analysis of a wide range of extracellular electrophysiology studies, such as Long-Term Potentiation (LTP), Long-Term Depression (LTD), EEG, EMG and epileptiform bursts activity.

eTrace records extracellular signals at 10KHz/channel. Users are able to run up eTrace through two different toolboxes simultaneously and independently (as appeared at the above figure):

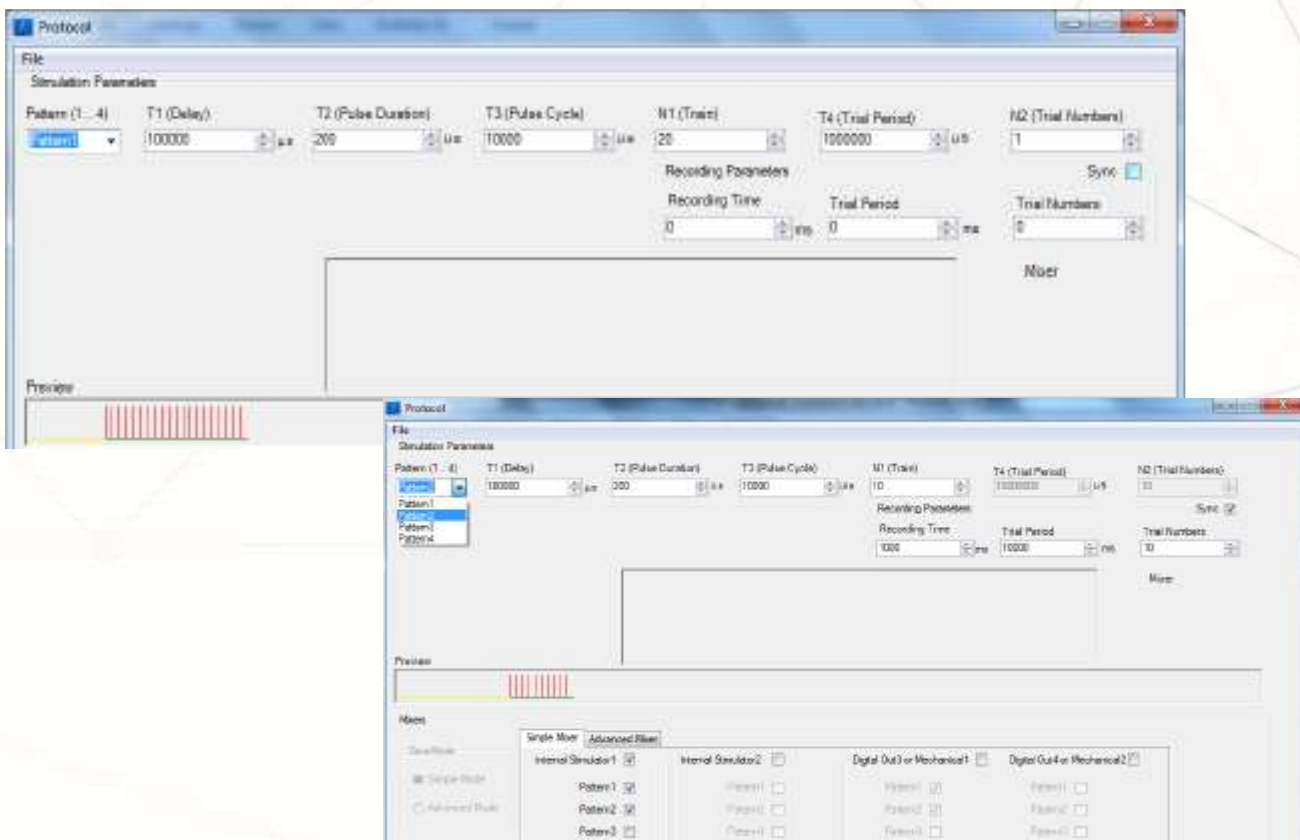
in eTrace, you are able to run up three or four scopes in your eTrace experiments and then set each scope separately



A demonstration of eTrace experiments panel. Two scopes each one has a menu bar at the beneath (red lines, A). Using this menu bar user is able to set both the scope and amplifier, in accord with the recording situation. Another menu bar (green line, B) is provided to set the stimulation. Using these buttons (pink line, C) you could run the program in scope, sample or saving modes or stop each running mode. Through this item (blue line, D) you can change available scope numbers from one to four scopes. From here (pink line, E) you could select a pathway and a filename to save each recording, also you can choose to apply a previously made-up stimulation pattern. Using this box (F), user is able to save occurrence of one to five different events. Finally, through this box (G) you could see the running status.

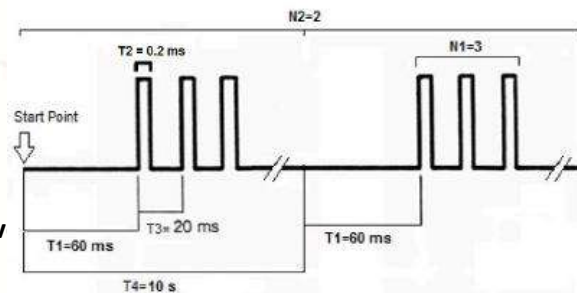
eTrace experiments

In the eTrace experiments panel there is a toolbox named “**design protocol**”. Click on this item then you will see another window. Through this panel you are able to design and save a simple or complex stimulation pattern to use during an experiment.



Example

When I want a stimulation pattern in 100 Hz (100 pulses/second), so the pulse cycle must be 10ms (1000ms/100pulse). As you see, through the pulse cycle you could establish frequency of a train. Also, 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.



eTrace Analyze modes:

To analyze field neuronal response, eTrace has a panel of different “analyze modes” and a box of various indicators, as illustrated in the following figure, to have a correct analyze you have to select an appropriate indicator. eTrace analysis is designed to analyze various types of field responses, including full analysis of potential synaptic (Slope, Peak Amplitude, Latency, Area, Pop Spike Amplitude, etc.) as well as EEG, EMG, phase, and frequency of signals.



An illustration of eTrace analysis window presented. As you see, the main part of this window includes a scope panel, which provides you to see a recorded file offline. Each letter in this figure shows different parts and options of analysis window.

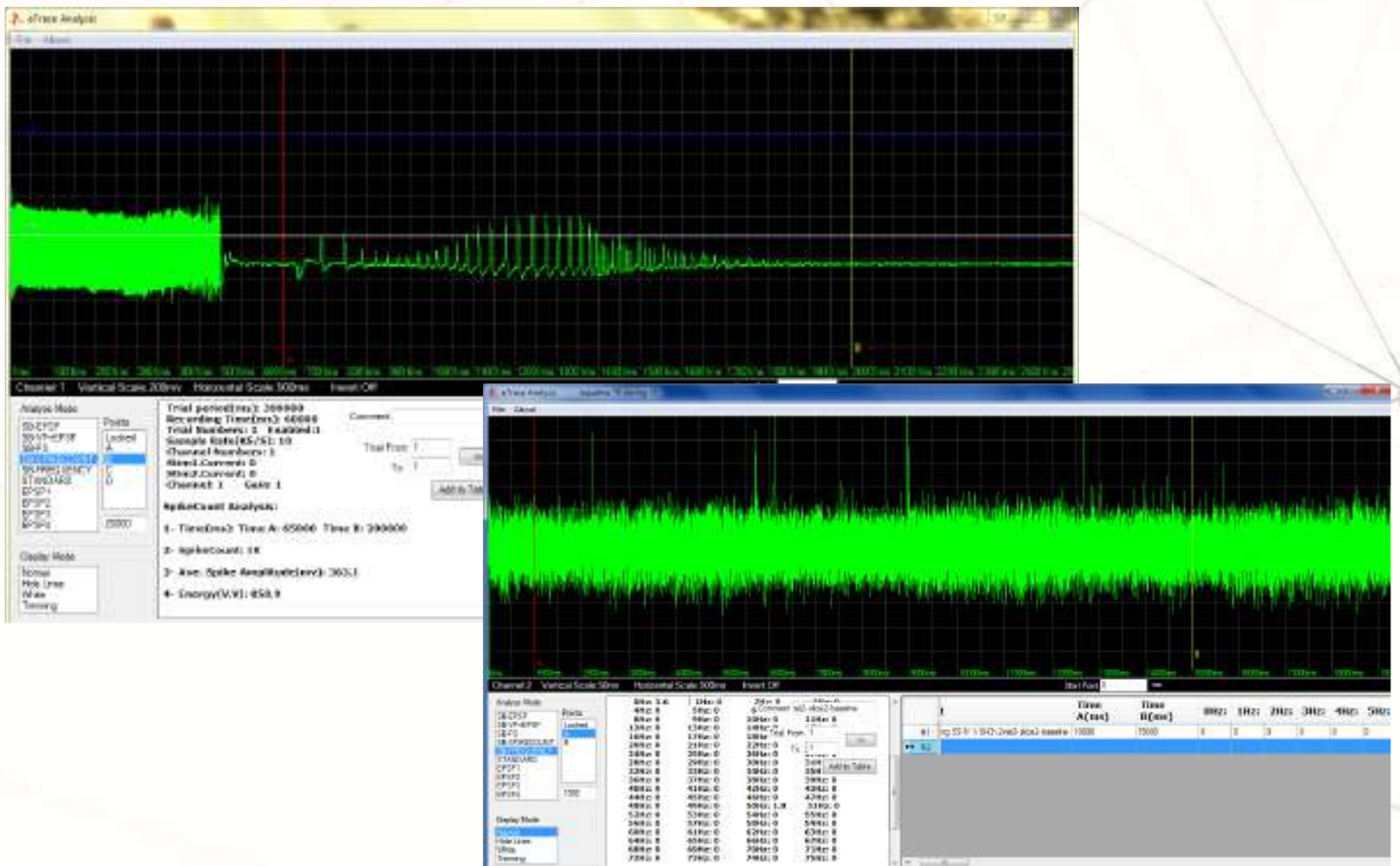


Technology Provider of Innovative Solutions for Neuroscience Applications

eTrace- for extracellular electrophysiology studies (LFP/ECOG/EEG/NCV/VEP)

Spike Count: Using this item you can calculate the number of spontaneous spikes in each recording epoch. For example, this mode make possible to count interictal spikes in epileptic models, counting QRS peaks in and EKG or other spiking activity (regardless to their shape) are countable through this mode

Frequency: to extract and analyze the frequency of oscillatory activity of a neuronal population you can use this item



User Defined templates: eTrace also offer the users this ability to create a new mode (in accord with their needs) and then save it for future applications. When you download eTrace to your computer,



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eSpike- for extracellular electrophysiology studies (signal recording and analysis)

eSpike experiment mode

eSpike toolboxes are designed for single or multi-unit EXTRACELLULAR recording of neuronal activity and analyzing them.

Extracellular recordings are recorded by inserting microelectrodes into the CNS. After amplification and bandpass filtering, the firing of the near neurons will appear as spikes.

According to articles, the neurons, which are close to the electrode tip (about 100 microns), have enough “signal-to-noise” ratio to distinguish the activity of every single unit. For distant neurons (up to about 150 microns), spikes can be detected, but the difference in their shapes is masked by noise (multi-unit activity). For more than 150 microns, Spikes cannot be detected and they have been shown as background noise.



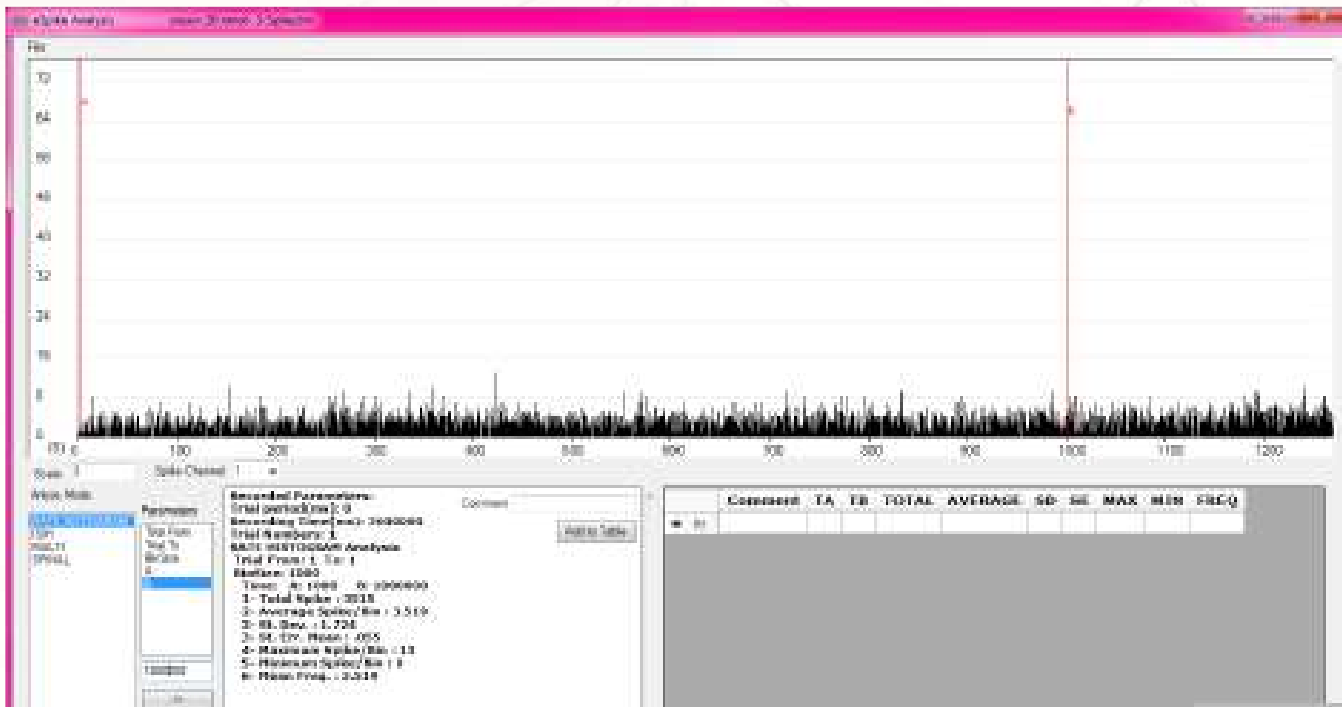
online PSTH are demonstrated, each one shows frequency distribution of neuronal unit activity. The software provides discriminative Bin sizes for detection and Applications scales are controllable from a setting box named as “PSTH setting”.

eSpike- for extracellular electrophysiology studies (signal recording and analysis)

eSpike analysis:

Four different modes are designed for data analysis in eSpike analysis. However, it is possible for users to create one or more new modes in accordance with their needs.

eProbe software Rate histogram:



Analyzing modes

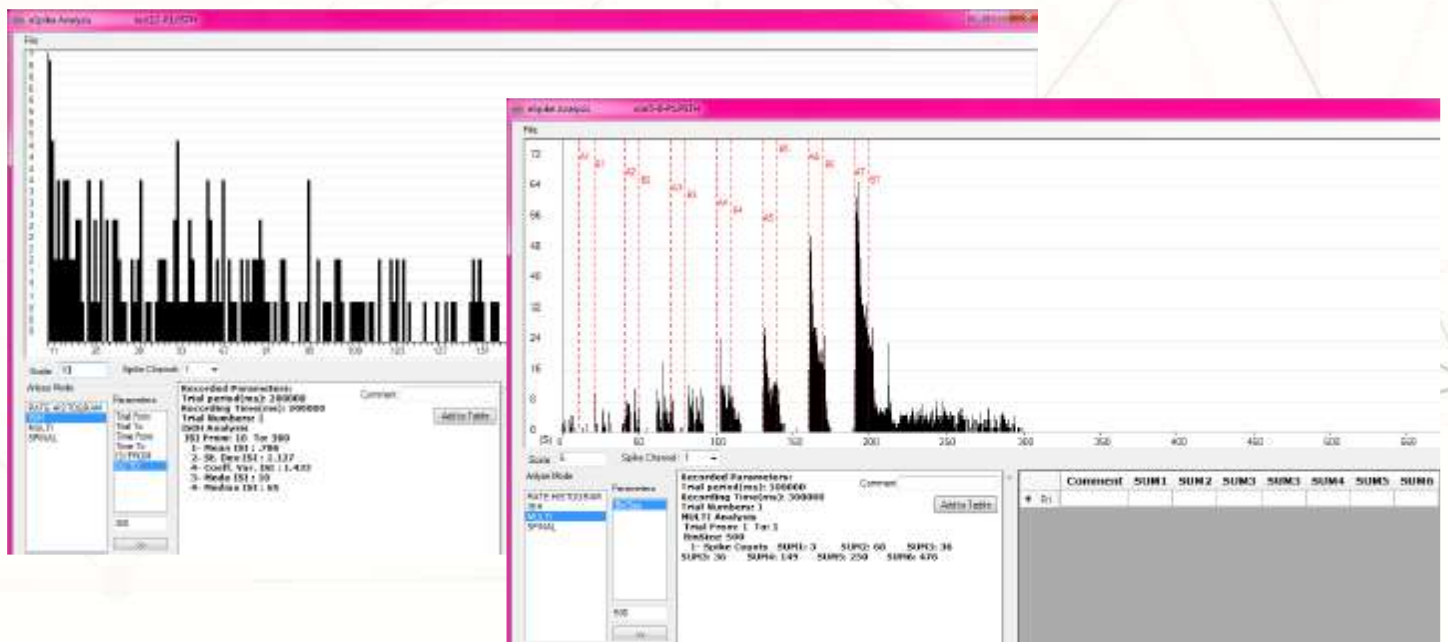
In the eSpike analysis four different modes - are described for data analyzing. However, it is possible for users to define one or more new modes in accord with their needs. To make a new analyzing mode you should use “eSpikeTemplate.text” file and describe a new mode in that. The “eSpikeTemplate.text” file located in eSpike folder. Later, I will explain who you could define a new mode in this file. When you save a new described mode in this file, it

SCIENCE BEAM the analyzing box provider of Innovative Solutions for Neuroscience Applications

eSpike- for extracellular electrophysiology studies (signal recording and analysis)

ISIH (inter-spikes intervals histogram)

An inter-spike interval (ISI) is time duration between occurrences of two subsequent spikes. ISIH will represent a histogram of distribution of these intervals (as represented in the next figure). In this analysis mode, each column shows an inter-spike interval time (on



Multi-Event

This is an analysis mode designed for a particular type of recording with a pattern of stimulation. This PSTH shows a pattern according to the stimulation pattern applied during the recording. To do analysis on the PSTH “multi” includes different constant indicators. These pointers are drawn according to the stimulation pattern. When you choose “multi” and set the bin size, the software automatically calculates the spiking activity between every two pointers and will show it as a “SUM” in the analysis box.



mode provided for analyzing single of the neuronal unit activity in the spinal cord through a peripheral stimulation

scienceBeam Spike sorter(online and offline)

ScienceBeam spike sorter is a high performance and user friendly software, designed for visualizing and classifying action potential signals _spikes_ and PSTH collected from single and micro-arrey electrodes. It gives the ability to separate action potential signals through two modes, amplitude window discriminator and 2D feature space clustering.



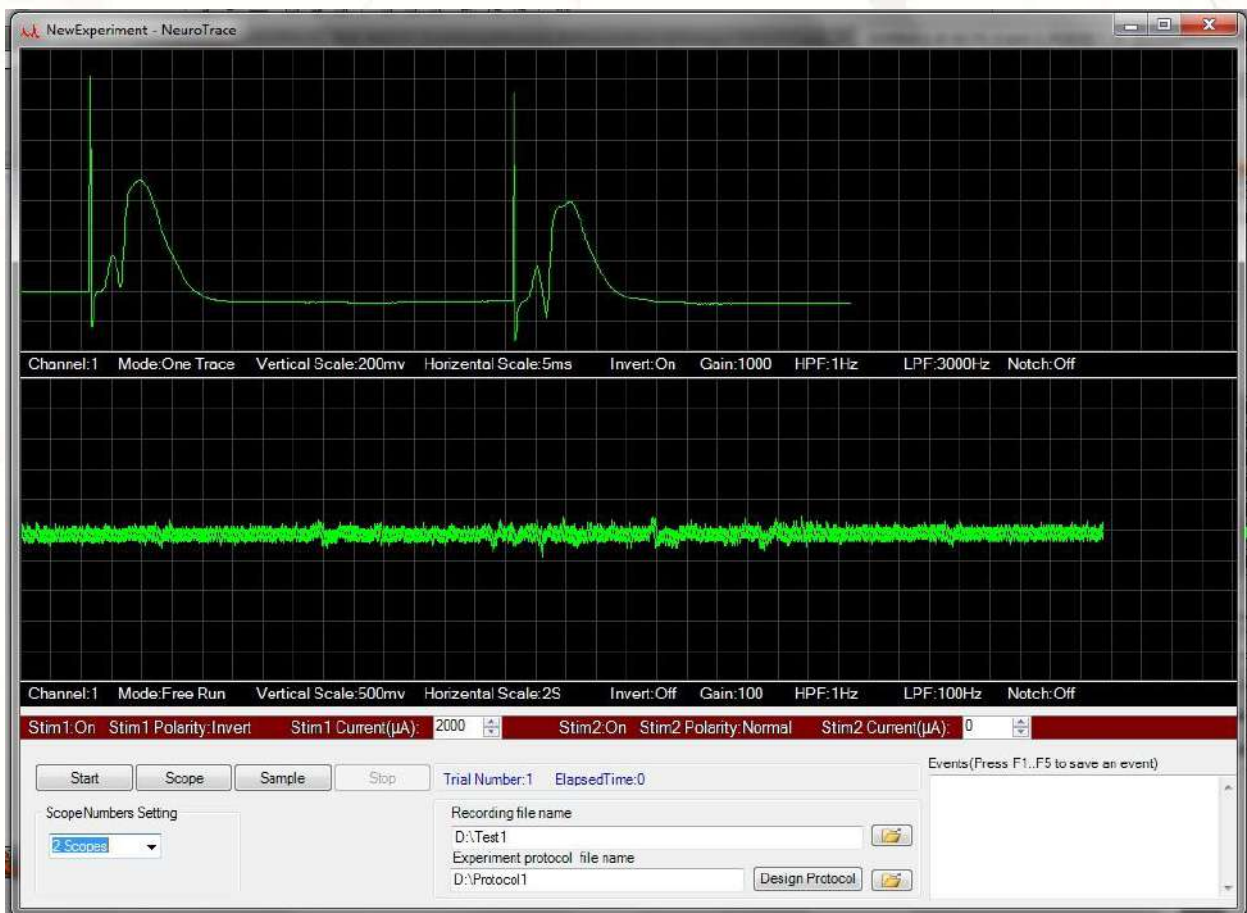
Technology Provider of Innovative Solutions for Neuroscience Applications

www.sciencebeam.com

info@sciencebeam.com

Simultaneously Recording

Electromodule is a General purpose data acquisition system for recording Action potential (Spikes), Field Potential, EEG signals, and signal modulation by external digital events.



eLab mini

eLab-mini is a high-power, low-power, wireless neuro electrophysiology system designed to be **implanted** on the brain or spinal cord of laboratory animals.

This system consists of a stimulator for deep brain stimulation (DBS) and two channels of an amplifier to record the signal at a sampling rate of ten kilos.

(field potential and ECoG)

Primate applications typically involve recording from awake, behaving monkeys engaged in behavioral or perceptual tasks

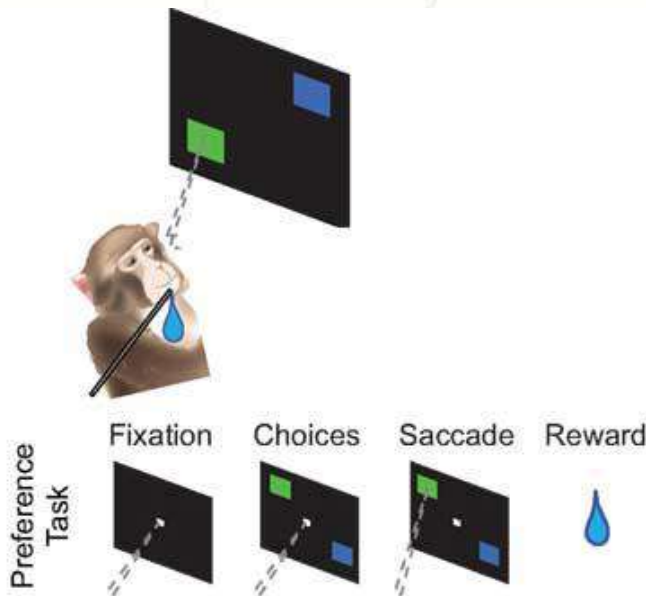
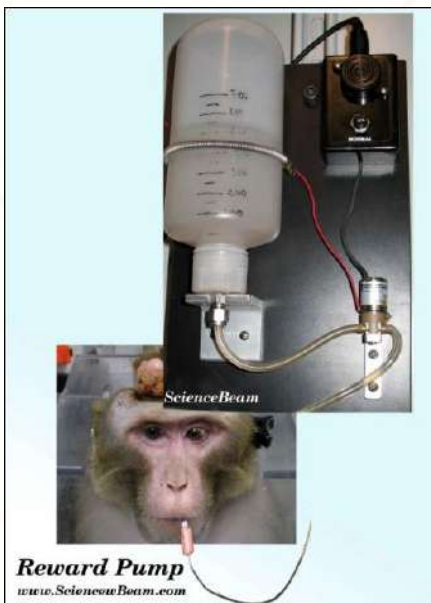
for Vision Science and Psychophysics

ScienceBeam is manufacturer of modern Products in field of Electrophysiology and Vision Science

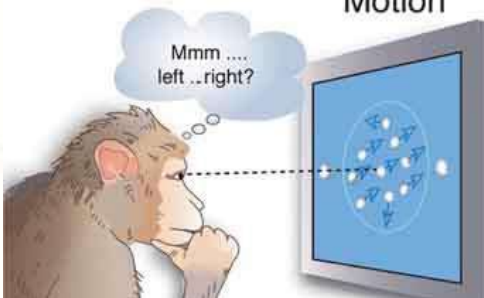


eLab FOR Primate

Primate applications typically involve recording from awake, behaving monkeys engaged in behavioral or perceptual tasks for Vision Science and Psychophysics
 ScienceBeam is manufacturer of modern Products in field of Electrophysiology and Vision Science



Motion



Primate applications typically involve recording from awake, behaving monkeys engaged in behavioral or perceptual tasks for VisionScience and Psychophysics

ScienceBeam is manufacturer of modern Products in field of Electrophysiology and Vision Science

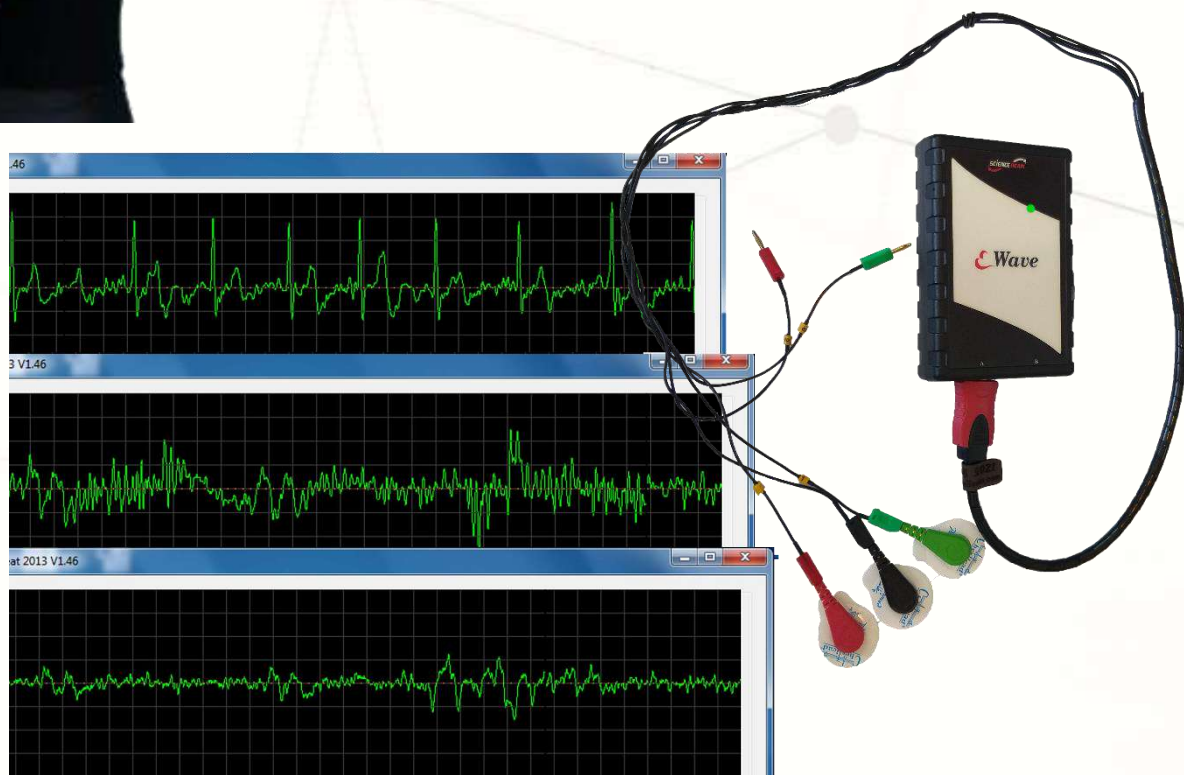


eWave+ for animal electrophysiology



Description

eWave+ is a multi-channel bio-signal amplifier, which has 8,16,24,32, 40, 64, or 128 recording channels. eWave+ provides a wide input sensitivity to record various bio-signals such as **EEG, EMG, ECG**, and EOG. Besides, eWave+ is a special **ERP** acquisition system with high precision. Sciencebeam has also offered eCap series of EEG caps to provide consistent signal recording of up to 128 electrodes. Furthermore, external body sensors can be connected in order to record various biological signals. eProbe software, which is a user-friendly software that is compatible with eWave+ device, is also offered by Sciencebeam company for visualization and analysis of recorded signals. Also, all 128 channels can be analyzed in real-time with eBridge Simulink software.

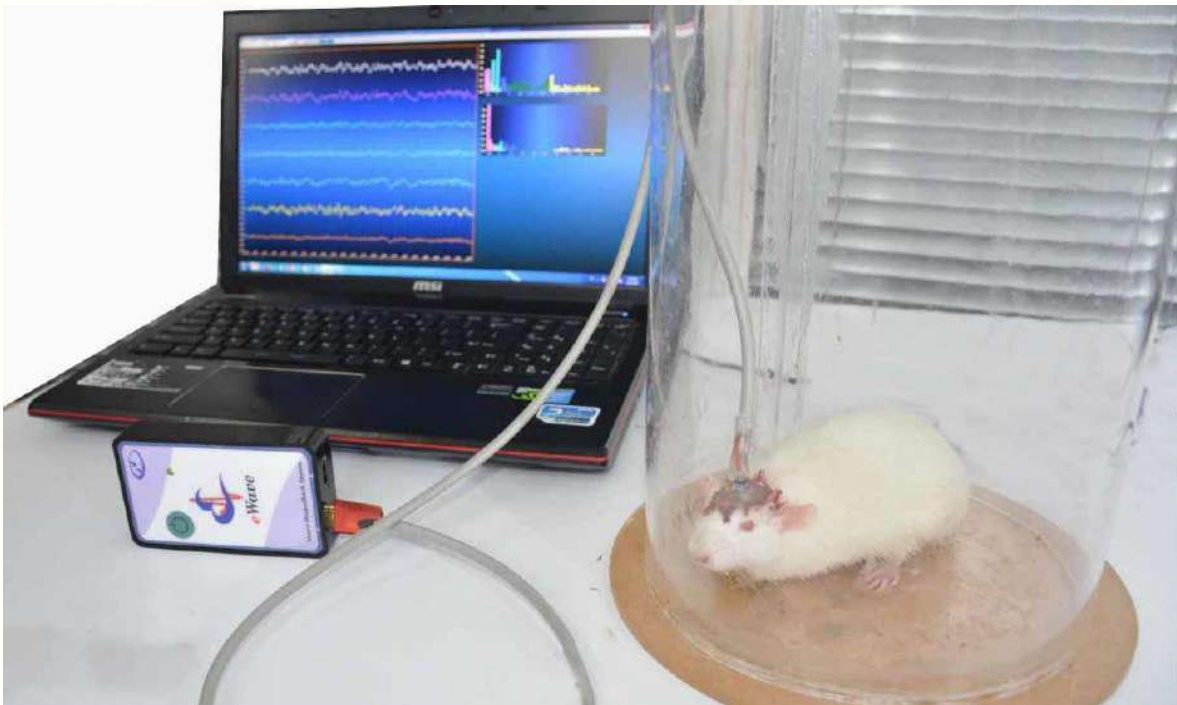


eWave+ for animal electrophysiology

EEG/ECoG Recordings in Animals

The EEG (ECoG) provides a measure of cortical electrical activity and differs according to sleep-state, level of arousal and mental activity. Given that EEG (ECoG) voltage signals are relatively small (typically 50 μ V peak-to-peak)

Electromyography (EMG) is a technique for evaluating and recording the electrical activity produced by skeletal muscles.^[1] EMG is performed using an instrument called an **electromyograph**, to produce a record called an **electromyogram**. An electromyograph detects the electrical potential generated by muscle cells when these cells are electrically or neurologically activated. The signals can be analyzed to detect medical abnormalities or activation level.



eWave+ for animal electrophysiology

DATA ACQUISITION

Technology: ARM Cortex 32

Processor: 160 MHz

Data Connection: Bluetooth wireless, 1 Mb/s, up to 10 meters

ANALOG TO DIGITAL CONVERTER

Number of channels: 8/16/24/32

ADC resolution: 24 bit

Linearity error: 7.6 ppm (maximum)

Sample rate: 10000 samples per second per channel (up to 16000 per channel)

BIO AMPLIFIER

Number of channels: 8/16/24/32/64/128

Amplifier type: Differential; DC

Gain: 4

Common mode rejection ratio: 75 dB @ 500 Hz

Low cut filter: DC

High cut filter: 500 Hz

Input voltage range: 2.5 V

Maximum analog input voltage: 2.5 V

Input impedance: 1000 Giga ohm

Input leakage current : 60 pA (typical)

Input capacitance: 8 pf

OTHER SPECIFICATIONS

8/16/24/32 AUX channels: Skin conductance, Temperature, BVP/HR/NIBP/IBP

8/16/24/32 EXG Channels: EMG, EEG, EOG, ECG

Power: Battery (Lithium, 3.7 V) , Battery Charger 5 V



Bio sensor from human and animal

Respiratory sensor

Respiratory control is an important parameter for biofeedback therapy. Changes in breathing depth as well as the number of breaths per minute can be assessed using this sensor, which is placed in the chest or abdomen. This sensor is used to control anxiety spectrum disorders.



Blood volume pressure sensor

Display the number of blood flow changes in the arteries as well as the heart rate used to control and treat blood pressure, headaches and migraines. This device comes in two types of finger and forehead.



Skin temperature sensor

Skin temperature changes measured by a temperature sensor attached to the skin, indicates blood flow and blood pressure and is used to control stress and anxiety.

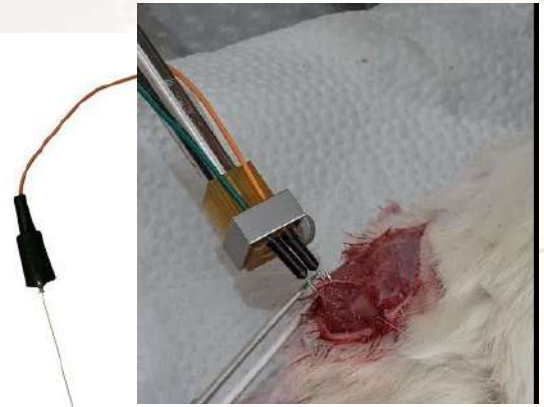


Galvanic Skin Response (GSR)

Increased secretion of sweat glands by stimulating the sympathetic nervous system in various conditions causes a change in skin resistance. This sensor is used to measure dry skin resistance and control disorders such as anxiety, fear or phobia, PTSD, etc.

invasive signal recording (NCV/VEP/ECoG/EMG)

EMG recording electrode for NCV (Neuro conduction velocity) technique



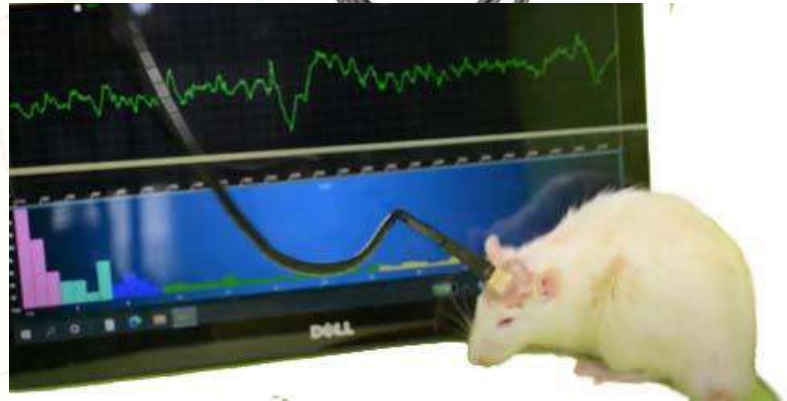
VEP Sensor (visual evoked potential) sensor (white LED)

With setting frequency and time duration



Freely Moving ECoG cable

Freely moving signal (ECoG, LFP) recording from rat models using eLab/eWave device.



Glass micro pipette electrode holder and cable

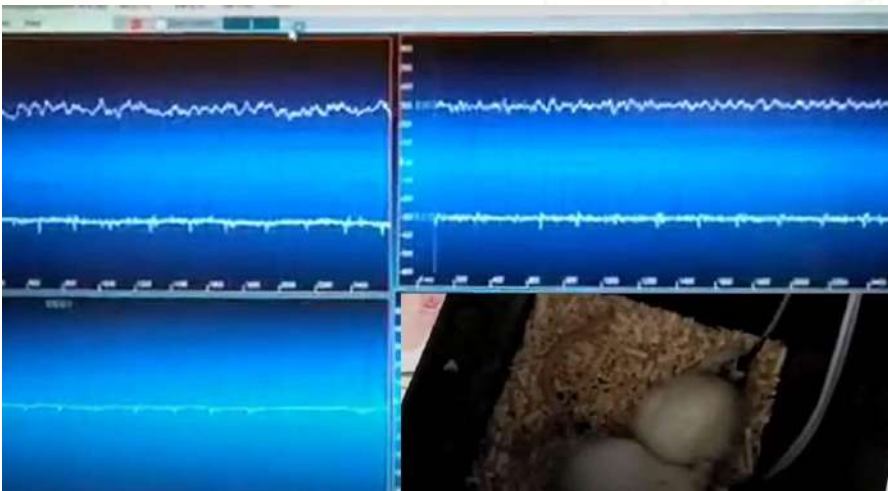
Non- invasive signal recording -EXG(EEG/EMG/ECG/EOG)

EXG Cable for human/big animal
ECG/EMG/EEG



Human EEG cap for Recording EEG
10-20 system/ 19channel

EXG toolbox for recording and analyzing
of human and animal (EEG/ECG/EMG)
signal



EEG/EMG recording from
2 rat with one device

Long term monitoring for
sleep research

Non-invasive Rat Blood Pressure

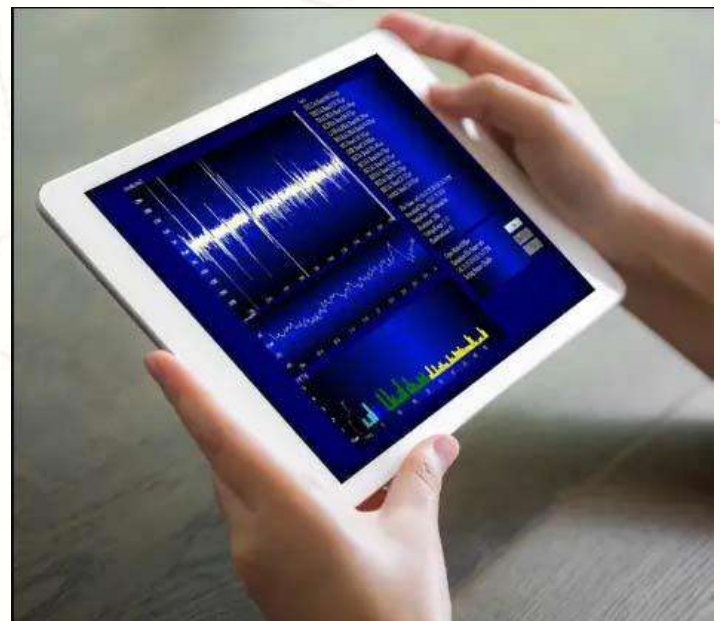
Non-invasive Rat Blood Pressure (BVP sensors + eWave device + tail cuff + eProbe software)

The ability to accurately and noninvasively measure the systolic and diastolic blood pressure, in addition to the heart rate and other blood flow parameters in rodents, is of great clinical value to research.

The noninvasive rat and mouse blood pressure measurement methodology consists of utilizing a tail-cuff placed on the tail to occlude the blood flow. Upon deflation, one of several types of noninvasive blood pressure sensors, placed distal to the occlusion cuff, can be used to monitor the blood pressure.

The main advantages of noninvasive blood pressure are:

- Requires no surgery
- Significantly less expensive than other mouse blood pressure equipment
- Ability to screen for systolic and diastolic BP changes over time in large numbers of animals
- Allows the researcher to obtain accurate and consistent rate and mouse blood pressure measurements over time in long-term studies



Comparison between eLab and

COMPARISON BETWEEN ELAB AND EWAVE DEVICE

ELAB2/4



EWAVE8/16/24/32



SAMPLING RATE	50KS/PS-per channel	10KS/PS-per channel
ADC RESOLUTION	24 bit	24 bit
AMPLIFIER TYPE	Differential, Isolated, Extracellular	Differential, Isolated, Extracellular
NUMBER OF CHANNELS	2/4	4/8/16/24/32/64
CHANNELS GAIN	50	4
WIRELESS	No	Yes
EEG /ECOG/EOG	Yes	Yes
ECG	Yes	yes
EMG	Yes	yes
EXTRACELLULAR SINGLE UNIT	Yes	no
LOCAL FIELD POTENTIAL	Yes	yes
IBP	yes	yes
NIBP	Yes	Yes
NCV(NEURO CONDUCTIVE VELOCITY)	Yes + ePulse	Yes + ePulse
VEP(VISUAL EVOKED POTENTIAL)	Yes	Yes



LOCATION

147:KORDONBOYU MAH.ANKARA CAD.NO
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ScienceBeam is a worldwide leader in research and clinical Neuro-electrophysiology technologies, including Neurofeedback, QEEG, EEG/ERP, etc.

ScienceBeam was founded in 2000 with the aim of designing and developing a wide range of research equipment for human and animal studies, by recording and analysis of various extracellular bio-signals.

After a few years, ScienceBeam started designing and development of the most up-to-date, compact, and portable electronic systems for Neurofeedback, QEEG, and EEG/ERP applications.

ScienceBeam team includes dozens of psychologists and psychiatrists, medical engineers, electronics and computer scientists, physiologists, and neuroscientists.

We do believe in providing science and knowledge, as much as we are able to, to the interested researchers and clinicians all over the world. So, ScienceBeam has held more than 300 Neuroscience and Electrophysiology workshops and courses and participated in hundreds of seminars and congresses during these years.

