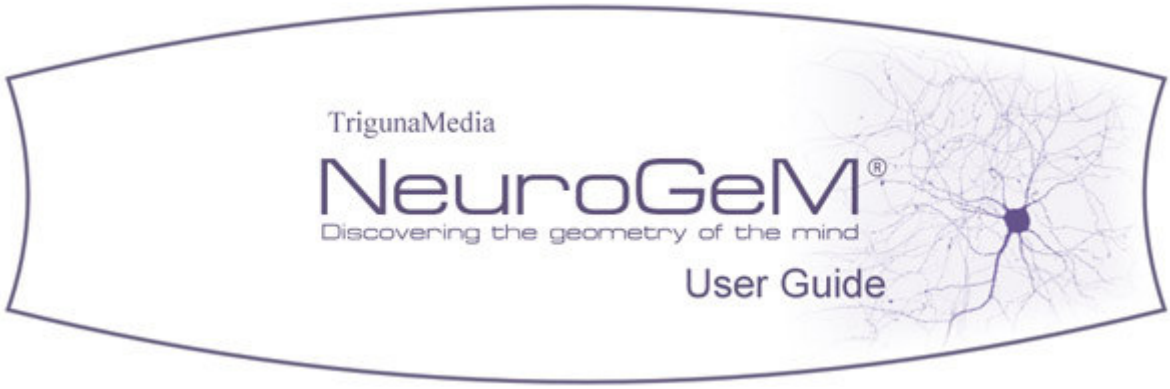


version 1.50 ES, March 2011

Content

Preface

Dear customer

Thank you for choosing NeuroGem, bringing you cutting edge insights in the bio-physics of conscious experience and state of the art diagnostics into you therapeutic practice or lab.

We trust this manual will prove useful in becoming familiar with the technical and practical characteristics of the hard- and software. This manual is not designed as a guide for therapy or training so the interpretation of the various diagnostic channels and evaluations is only consisely indicated.

For a quick first impression of the NeuroGem full version or the demo version, it is sufficient to go through the preliminary section (2). However we kindly advise you to carefully check out the preliminary notes, as it provides useful tips for trouble-free use of the software, sensors and hardware.

Please feel free to contact us if you have any questions, suggestions or comments regarding this manual.

You may contact us via email: info@trigunamedia.com

1. Introducing the NeuroGem

The NeuroGem performs a revolutionary form of EEG analysis called geometric spectrum analysis. It is based on the new and proprietary “GFFT” (Geometric Fast Fourier Transform) algorithm. Geometric spectrum analysis detects patterns in the EEG spectrum associated with deepened focus and clear inner awareness, more advanced and resourceful mental states and general mental and emotional (re-) activation. The NeuroGem, along with its underlying concepts can be used as a powerfull diagnostic aid, for various training purposes and for research.

Characteristics of diagnosis / training with the NeuroGem include:

- Detection of highly significant ("musical") brain wave patterns comprising the entire spectrum
- Based on state of the art insights in why biophysics favors such frequency patterns and for what purpose
- Can output a simple "0 - 100%" scale of various aspects of biophysical coherence while providing consise statistics and other evaluation tools

Practical benefits are for example:

- Fully and naturally integrates brain function / experience associated with the various traditional spectrum ranges (delta, theta, alpha, beta)
- No norm group needed
- No specialist skills or extensive training rquired for basic operation

The following sections include the introduction and detailed use of the software, some important notes on the hardware and how to set up an EEG session.

This is a technical guide. For backgrounds on using the NeuroGem in therapeutic practice, training or biofeedback please refer to the available resources.

Before moving into biofeedback practice with the NeuroGem, please carefully read the special advice in the section on this subject.

2. Getting started

2.1 Preliminary notes and hardware setup

We advise before you start using the NeuroGem, to read below notes carefully. It may prevent unnecessary issues during setup, registration or use of the hardware.

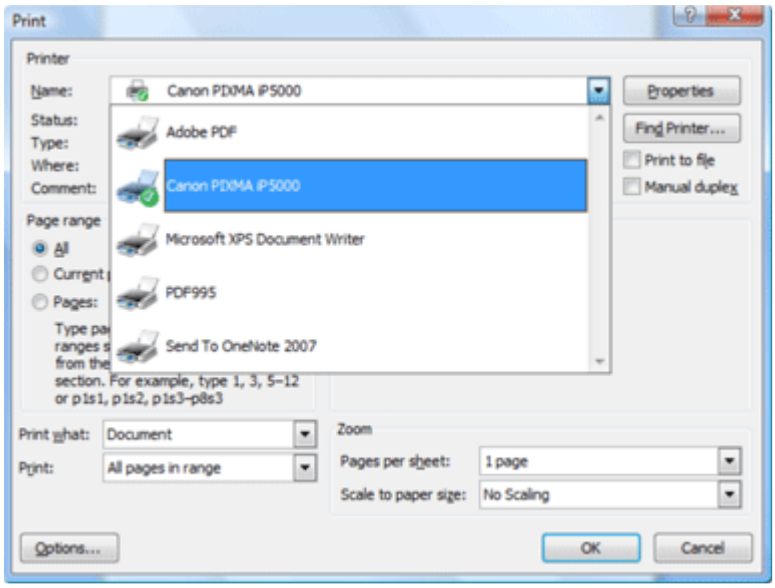
Demo Version
If you use this manual with the demo version please check out section 2.3 on playing sample files.

System requirements
The NeuroGem is designed for Microsoft Windows XP / Vista, but also performs well on your Apple Mac. It does not put an extraordinary demand either on your processor,

internal memory, harddisk size or video card and it will run on virtually all machines of recent years. Processor speed:1.5 GHz is recommended; monitor 1024 x 768 is strongly recommended, higher speed and resolution are advised however. In case of doubt, try the (free) demo; if your computer replays sample data properly it will also work with real data. For biofeedback, your computer should have a standard onboard or dedicated MIDI player. See the section on biofeedback for the proper device settings under Windows.

Using the NeuroGem on your Mac
It is possible to run most Windows applications on Apple, using a Windows environment or emulator (software). The NeuroGem performs well under the “Parallels” or "Fusion" emulator. You will need a modern Mac however. Please inquire with your Apple dealer, while mentioning the conventional system requirements as above. Also, you can try the free demo version before deciding to buy the NeuroGem for your Mac. If the demo works smoothly, you may assume that the full version also works.

How to make .pdf files
The NeuroGem has various evaluation tools with direct printout option (Spectrogram, Quick Scan, Progress Scan) which can either be printed normally, or can be turned into a .pdf file (Adobe reader document format). The .pdf creator is installed directly under Windows, in the form of a so-called virtual printer. This means, that you select a "pdf printer" from your printer menu. A PDF printer may be installed already by your computer manufacturer. In the other case, you could use for example PDF995 (free). Below example shows a typical printer menu with normal printer, original Adobe PDF and PDF995.



Setting up and using the ECG / EEG sampling amplifier
The ECG / EEG sampling amplifier uses 4 A4 batteries in a bay at the back side. Verify that the batteries are fresh and in the proper positions, and do not leave batteries inside when unused for a longer period.

The EEG device has a standard USB interface which requires no external drivers. After plugging in first time, Windows will recognize the new device and automatically installs the proper drivers from its own resource (HID compliant device + USB-HID). Note that this is different from the software drivers (see next topic). *After plugging in the EEG device, the green LED indicator is NOT supposed to light up*. When the NeuroGem starts taking data prompted by the software, the green LED will be activated. Upon ending sampling or program shutdown, the LED will flash for a few seconds and then switch off. *In case of irregular program- or computer shutdown, the EEG device will not properly be switched of, and the LED stays on. This indicates that you need to manually reset the hardware by re-*

plugging the usb connector..

Registration
The NeuroGem Demo version is freely available, however you are required to register in order to acquire a free demo license. This will help us to keep track of the use of the NeuroGem demo, and facilitate easier service. If you have just installed a demo version, the program will give you a unique serial number attached to your PC. To obtain your activation key, the only thing you need to do is send your serial number to your vendor or to TrigunaMedia directly. You can email to info@trigunamedia.com or call us. The demo version replays pre-processed life sample files, and cannot be used with the EEG device.

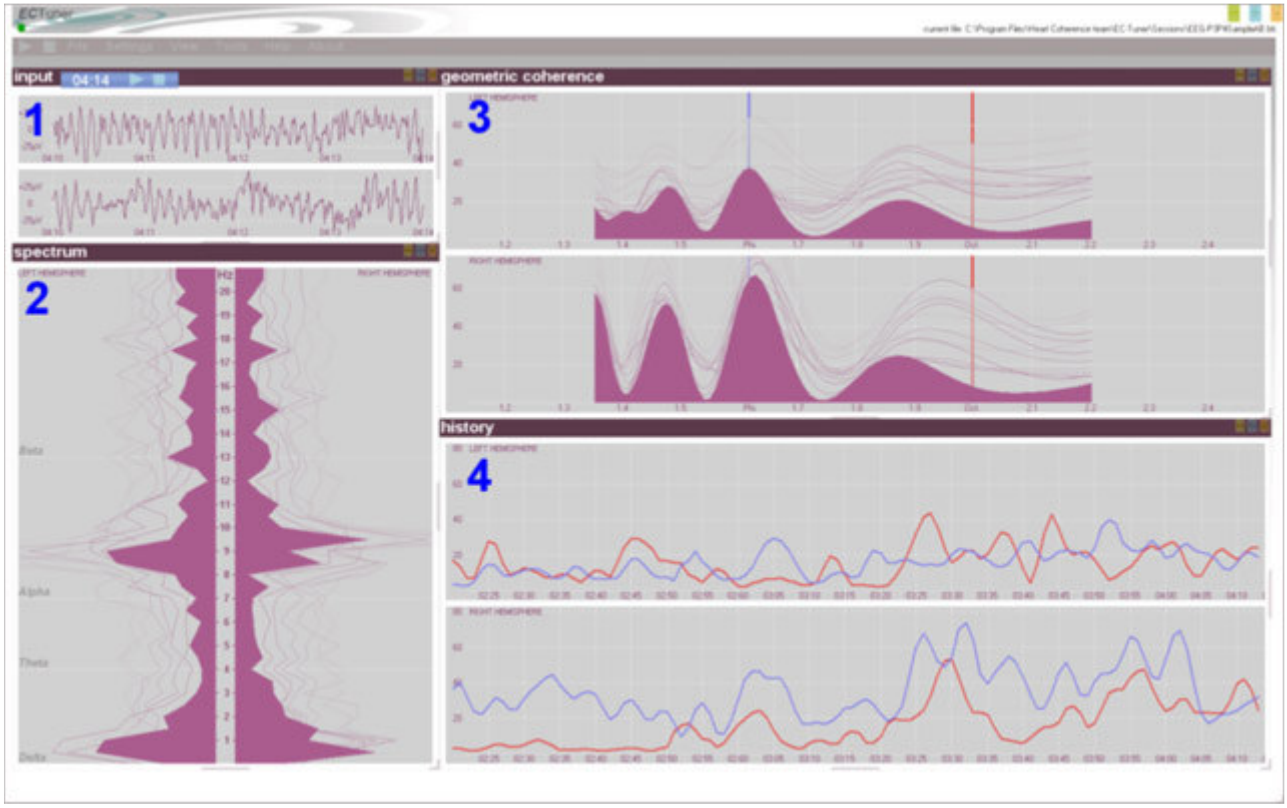
The NeuroGem full version comes with the EEG amplifier, or may have been purchased as software only. The full version is protected with a so called dongle. This is a memory-stick like device (usb-stick) which contains information like your user key, encrypted data, encryption keys and proprietary algorithms. The licensed software checks for the presence of the dongle at program startup, during sampling and at other times. The dongle protection facilitates easy portability of your NeuroGem license to any computer you like, but you need to keep the dongle in your computer while the software is running.

Important note: the dongle is a usb device which should normally not interfere with other usb devices. If nevertheless the software generates a dongle error, just replugging may be sufficient. If a dongle error keeps recurring, try another usb port, or try to (temporarily) unplug other usb devices.

Updates
Please check back on our website for updates at www.trigunamedia.com/NeuroGem or at the users download and resource page.

Help-desk
We are gladly available for phone service for all issues related to the setup and operation of the NeuroGem. In order to help you, we assume that you have basic experience with Microsoft Windows, or have somebody with you who has. For questions on the setup and use of the hard- and software, call TrigunaMedia (++31-53-4361096, Netherlands, UTC+1 or send an email to info@trigunamedia.com) or contact your local dealer.

2.2 NeuroGem main screen overview



(scaled sample)

Overview of the NeuroGem modules:

1. **Input Module**
   Shows the raw EEG data coming directly from the amplifyer. Each channel (hemisphere) is directed to one screen. During data reading, the screen is updated every second. The interval shown is a 4 seconds fixed, running from right to left, with a fixed scale of plus - minus 50 micro-Volts.

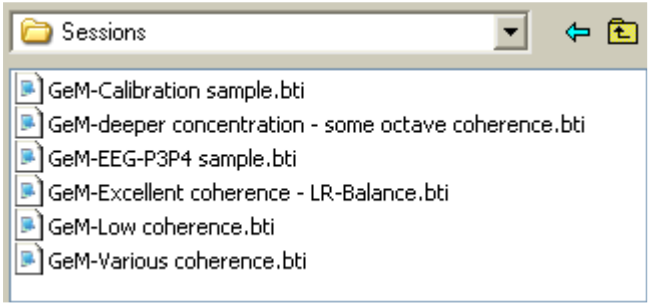
2. **EEG Spectrum Module**
   This is the traditional spectrum, in this example and by default shown vertically. The spectrum intervals as used in classical neurofeedback are indicated.

3. **Geometric Coherence Module**
   This module shows the Geometric Coherence of each hemisphere.

4. **History Module**
   History plots (time series) of various Geometric Coherence indicators (resp. biofeedback channels) in different formats and combinations.

2.3 Opening and playing sample files

The NeuroGem software comes with a few pre-recorded EEG sample files. These can be accessed through Main menu -- File -- Open session and are found in the folder “Sessions” in your application folder. The following sample recordings are included:



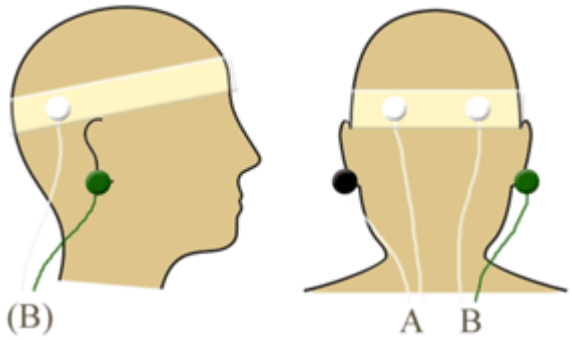
3. Setting up a NeuroGem session

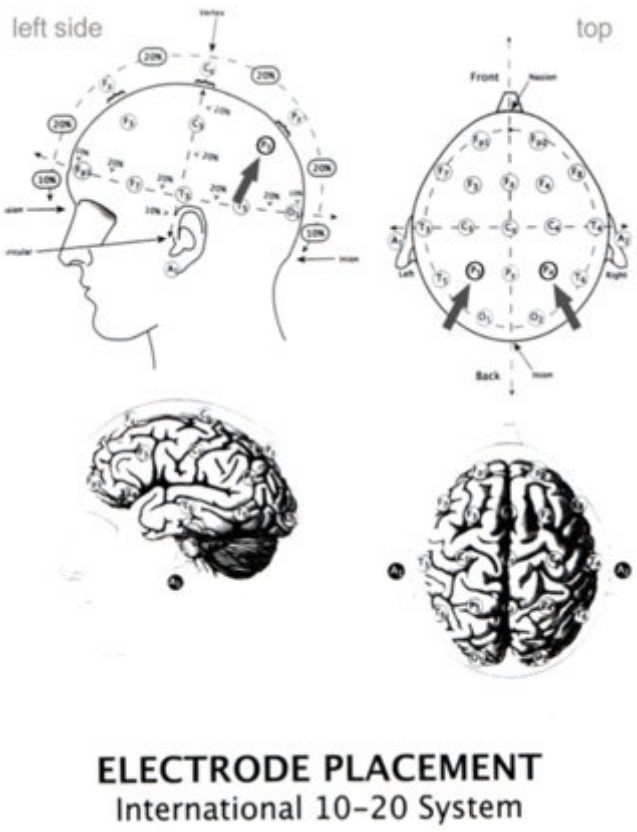
3.1 Verifying the hard- and software

Before applying the sensors, it is good to do a hardware check first. As long as the sensors are unattached, it is better not to have them plugged in either, as the wires may pick up undesirable noise levels. If the batteries and usb connection are ok, you can start taking samples by clicking the “play” button at the top left on your screen (not the one in the input module, which is the replay button). The input module will typically show a bit noisy data stream, updated every second. Just moving your hand near the wire plugs is usually enough to be picked up by the sensitive amplifyer and is clearly visible on the screen.The subsequent modules will of course give no meaningful output, however you could check for the 50Hz peak (60Hz in the US) in the spectrum module. If you see this, you can proceed to apply the head sensors, while leaving the wires unplugged.

3.2 Applying the EEG sensor head set

The hardware NeuroGem is customized for easy hook-up with 2 + 2 sensors only. The left hemisphere is channel A, corresponding to the front left of the EEG device, and indicated accordingly in the software. The main electrodes are preferably placed at the back of the head, at the P3 and P4 points as per the neurofeedback map. The grounding resp. shielding electrodes are applied using the ear-clips. *For either sensor cable itself there is no A or B channel prevalence, but you must ascertain that per channel the ear-clip corresponds to the same side of the head as the head sensor..*






head-clip

The sensors are gel-free types, however especially when the hair forms an obstacle, it is advised to use small moist pads to guarantee sufficient electrical conductivity. The images show the physiological location of the official P3 and P4 points for the positioning of the wires and sensors. The NeuroGem further comes with plastic sensor clips with easy to hook-up moist pads for conveniently mounting and positioning the sensors. Detailed instruction on the one time assembly and for hookup come with the package and can also can be found below in the attachment.

3.3 Noise issues

The highly sensitive EEG measurement can easily pick up noise artifacts, despite maximum protective measures. This may not necessarily completely disrupt your session but can at least be quite annoying. Some patience is recommended to create a comfortable work place. Main noise sources are of course all electric mains cables in the vicinity, but also transformers (like your laptop adaptor) and sometimes the computer itself. In many cases, simply re-arranging some cables or appliances helps greatly. *It is always recommended to run the computer on battery* and disconnect it from the power cable. In the worse case, the room is simply too electrically polluted to work well. In order to get successful EEG readings, you may need to relocate to another place, which you might anyway for your own health.

3.4 Starting a Geometric Coherence session with the NeuroGem

If the previous steps were carried out successfully, you can start taking EEG data using the NeuroGem software.

On the screen, by default all modules are active and well arranged on the screen, resp.: Input Module, Spectrum Module, Geometric Coherence Module and History Module. If something is missing or the screen looks messed-up, go to the Settings tab at the top,

move to “general settings” and click “default config”. This will arrange the screen for a default 1024 x 768 monitor.

In order to prepare for meaningful data, let your test person relax in a chair (best is a chair with head rest in slightly back tilted position), ask him or her to avoid neck and jaw movements and step by step try concentrate for example on a joyful scene or memory. In normal cases and with a bit deepening concentration, you may typically discern the following phases:

Subject	**NeuroGem**
Wakeful, eyes open	Generally beta activity; otherwise no distinct spectrum and no distinct Geometric Coherence (GC) spectrum
Wakeful, relaxed, eyes closed	After a few minutes a distinct alpha peak; often little significant GC result
Deeper relaxation, concentration	Alpha peak, but also increasing other spectrum activity; regular moments of GC peaks, typically centered around Golden Mean ratio
Deep focus and clear inner awareness	Increasingly distinct, but changing spectrum shape; consistently appearing and longer lasting (>8 sec.) GC peaks
Light trance, meditation	Yet more stable spectrum, consistent GC reward

You can start, pause and stop your session with the recorder buttons at the top left.

3.5. Replay and store last session

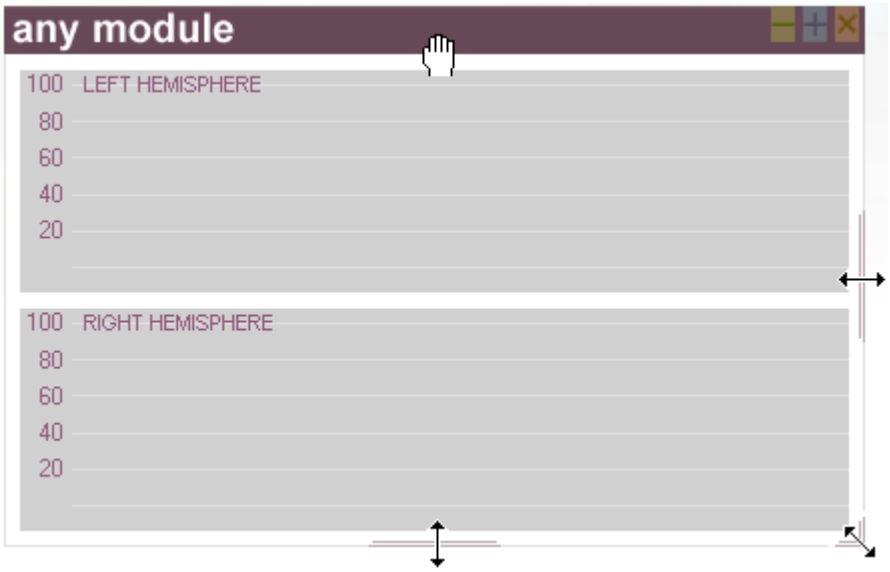
Every NeuroGem session is automatically stored in the temporary memory. After ending a session, you can replay the session from memory using the “multi-media” buttons on top of the Input Module (not to confuse with the sample buttons). You can also manually scroll through the recorded session. If you point on either input screen without pressing, the mouse cursor will change into a horizontal pointer. It changes as you move up or down, which sets the scrolling speed until you press the mouse button. Press and move horizontally to scroll through he recording. You may permanently store your last session on hard disk using the “File” menu on the top, and select “store session”. Likewise, you can open a previously stored session for replay.

4. Description of the NeuroGem software

The following sections are arranged on the basis of the functional sequence of the NeuroGem software. Note: menu items are always indicated with an underscore, like Menu - - Item.

4.1 General

4.1.1 Arranging your workspace



Grab top bar to move modules, sides and corner to resize. Use control buttons to minimize, restore or close the module. The same applies to the main screen as a whole, the evaluation modules and the user guide. Note: a closed module will remain active, although not visible.

Other functions related to arranging your workspace can be accessed from the main menu bar at the top, and are summarized in the table below:

Main menu item:	**Function:**
File - Save config	Save current screen configuration
File - Open config	Open existing screen configuration
Settings - General - Auto load previous..	Automatically load previous configuration at start
Settings - General – Auto scale all	Automatically resize modules while resizing workspace
Settings - General - Set default config	Restores default screen configuration (1024 x 768)
View - [module]	Show or hide modules
View - Align to grid	Helps to easily line up your personal screen arrangement
View - Lock config	Locks the current screen configuration
View - Set config	Same as “open config” in the File menu, but with a nice thumbnail selection gadget

4.1.2 Adjusting the graphs by means of on-screen scaling options

All graphical content except in the input module can be scaled simply by dragging the mouse cursor over the screen in the direction of the desired effect:

- Spectrum module: scaling the gain by dragging the mouse cursor over the graph, scaling the frequency range over the frequency bar

- Geometric Coherence module: scaling the gain over the graph
- History Module: scaling the gain as well as the time base over the graph

4.1.3 Adjusting the graphs through the settings menu

All graphical modules except the input module can further be controlled from Main menu - Settings - [Module], resp.:

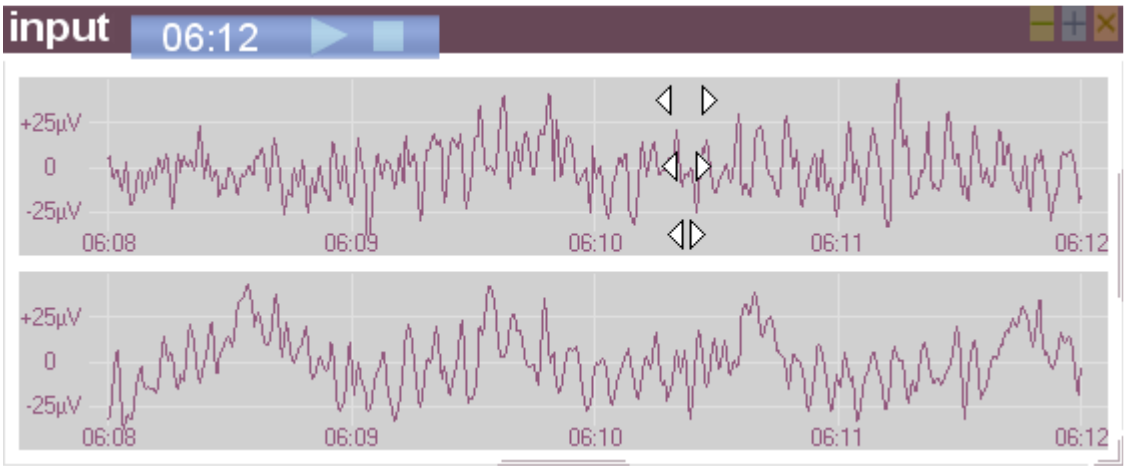
- Spectrum module: move sliders to adjust waterfall depth and spacing
- Geometric Coherence module: move sliders to adjust waterfall depth and spacing
- History module: drag cursor over history thumbnail to select different combinations and formats of Phi and octave graphs

4.2 Modules and process flow

The raw EEG data coming in from the left and right channel is processed step by step to produce the geometric coherence result, and from there the history graphs. A modules and process flowchart is given in the attachment [**>**].

4.2.1 Input module

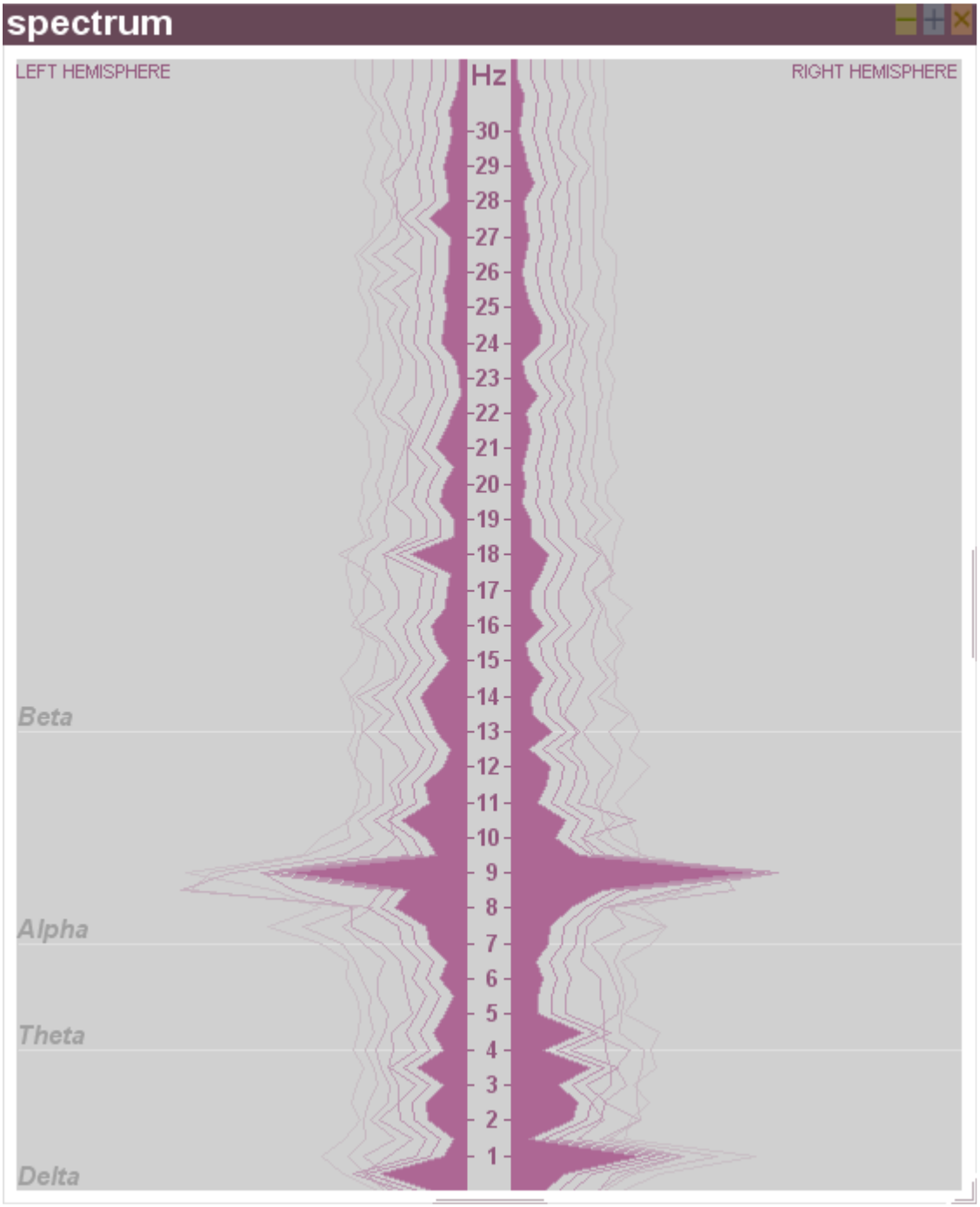
The channel input data is displayed in a fixed, right to left scrolling 4 second window, updated every second. Also the gain is fixed, with a rough 25 µV reference. The timer indicates the lapsed time during sampling, resp. replay.
After a life recording session, or after opening a previously recorded session from harddisk, the session can be replayed using the multimedia buttons or by manual scrolling. The scrolling speed can be adjusted by moving the cursor up and down over either input screen, before pressing. The manual scrolling speeds are resp. 1, 5 and 30 seconds per step.



4.2.2 Spectrum module

The channel input data is spectrum analyzed over a 2 sec. window resulting in a 0-64 Hz. magnitude spectrum. The spectrum can be displayed in waterfall mode, with a fixed one

step averaging. This means that every waterfall graph is the averaged result of the corresponding last two magnitude spectra. This creates a slight smoothed effect without loosing definition. Below example is a typical spectrum during relaxation, with a characteristic alpha peak in both hemispheres.



4.2.3 Geometric Coherence module

This is the final EEG data processing step using the GFFT (Geometric Fourier analysis) method to produce the geometric coherence result. The total power of geometric frequency series hidden in the spectrum is calculated for each geometric ratio, within a practical range of roughly 1.5 to 2.1. If the brain is coherent (either one or both channels), a central peak emerges like in below screen plot. For example, if there is a main peak in the geometric module around ratio1.5. this can mean that significant spectrum power is detected for example at 1, 1.5, 2.25 etc. Hz. But also, or simultaneously, it can indicate a series of, for example, 1.2, 1.8, 2.7 Hz. So the result shows the sum total power density

for each ratio.

The geometric coherence graph usually shows more peaks. This can mean, in order of likeliness:

A) there are higher harmonics, which is very common

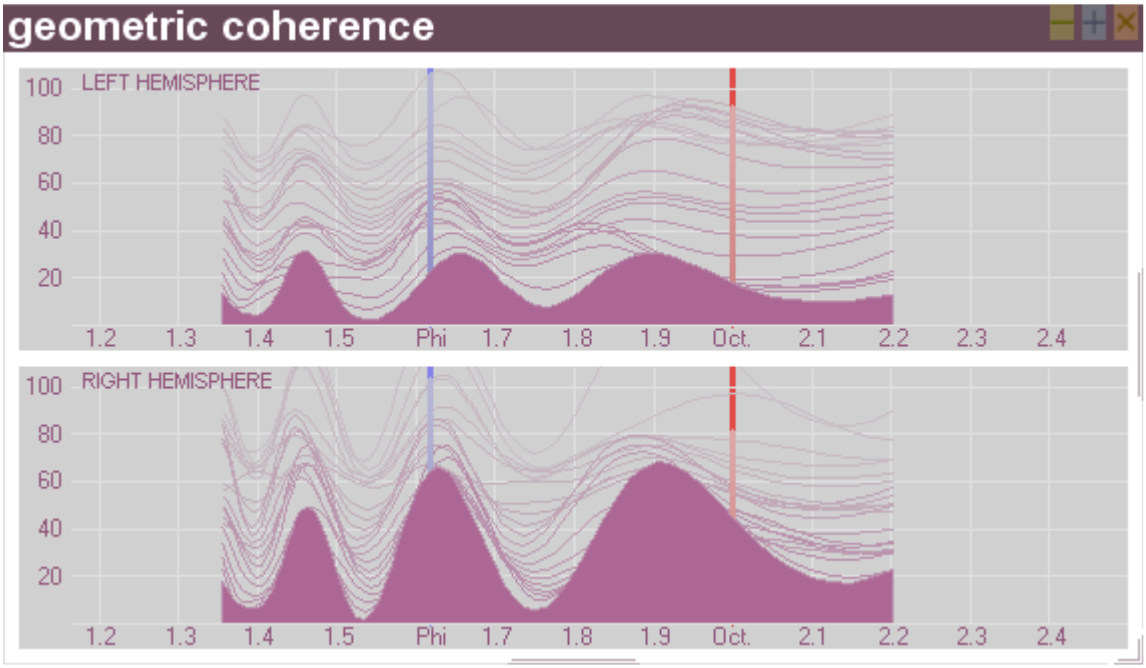
B) there are different significantly powerful ratios at the same time

C) a combination

Also electric noise can be a source of what looks like coherence peaks, ususally a train of much narrower peaks, but this is clearly not representative and should be solved before taking data. See the preliminary notes on noise reduction.

Below screenshot is a typical example of geometric coherence, in this case especially in the right hemisphere. The main ratios here are around 1.63 and 1.9.

The peak at around 1.45 is a higher harmonic of the 1.9 peak. The clipped peak all at the left is a higher harmonic of the 1.63 peak. The harmonics are in most cases smaller than the main peaks.



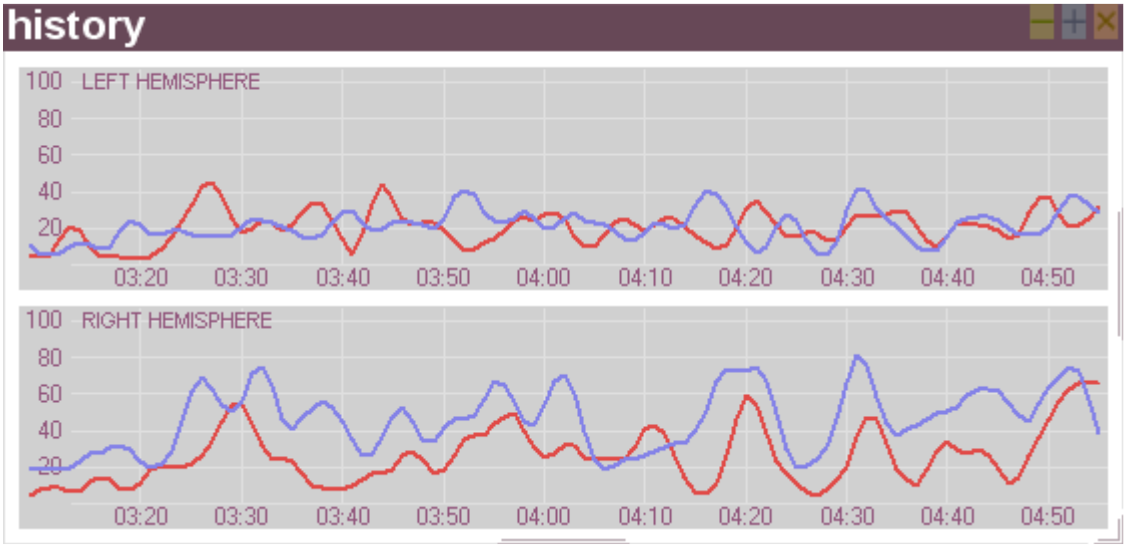
Note: the geometric coherence vertical scale is normalized so that it is *not affected by spectrum power and only rewards actual coherence*. The 100% level is purely based on an empirical reference, and has otherwise no mathematical basis. Significant geometric coherence typically lies in a range from 40 - 80%.

4.2.4. History module

Empirical evidence show that two specific ratios are preferred by, and are predominantly present in the EEG spectrum of the coherent brain. These ratios are Golden Mean (or; “Phi”, 0.618) and Octave (2) as was predicted by wave matrix theory. These ratios are indicated by the blue resp. red markers in the Geometric Coherence module. The geometric coherence spectrum at these precise ratios is evaluated on the following properties:

- Quality (shape) of the peak
- Power level of the peak or in general
- Efficiency, which combines Quality and Power

Further, an approxiamate allover coherence is calculated. These resp. values, for each hemispgere, are all recorded every second. They are used for the resp. biofeedback reward schemes, are printed in the history display and are used in the statistical evaluations. Note the different viewing modes which can be selected under Settings-History menu. Golden Mean is printed blue, octave red:



5. Other main menu items

5.1 Settings - General

Select whether the about screen will be shown or remains hidden at each application startup.

The screen configuration at program shutdown can automatically be reloaded at next startup.

If the NeuroGem main screen is resized, all modules can optionally be proportionally scaled. At any time, the default screen configuration for your computer screen size can be applied.

The language selection immediately applies to all menu- and screen items. For advanced use, an embedded language editor is optionally accessible.

A favorite NeuroGem theme can be chosen with the thumbnail selector, with optional background image. The default NeuroGem theme is presently available, more themes are expected in near future.

5.1.1 Settings - Input

Enabling “multi sessions” allows the pausing and resuming of sampling sessions in a row, so that subsequent sessions can be saved as one whole. The time counter stops at each pause. Optionally, a 5 second pause signal is automatically inserted.

Locking the screen during sampling prevents disturbance of measurements as a result of processor overload. You are advised to keep this function activated, however in order to optimize your module and graph settings, you can run a short trial first without screen lock.

5.1.2 Settings - Spectrum

Use the slider to adjust spectrum waterfall depth and - spacing. The changes are immediately applied.

5.1.3 Settings - Geometric Coherence

Use the slider to adjust Geometric Coherence waterfall depth and - spacing. The changes are immediately applied.

5.1.4 Settings - History

Drag your mouse cursor over the History thumbnail to select a Golden Mean and / or Octave combination and style. The changes are immediately applied.

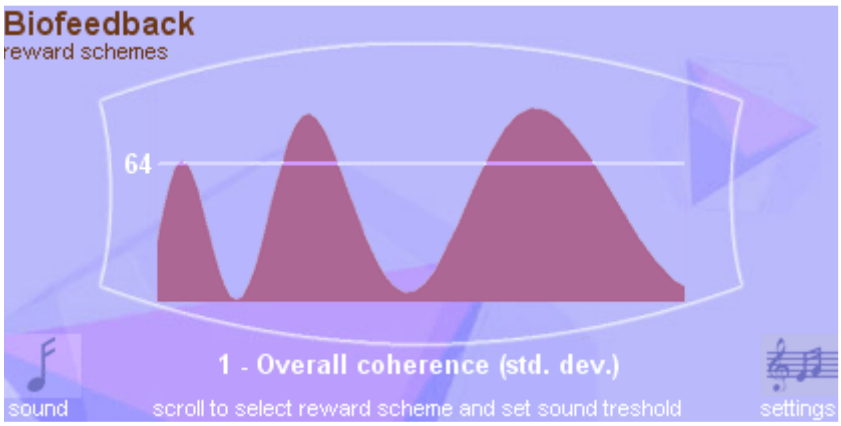
Use the slider to adjust the averaging of all channels in the History graph. The changes are immediately applied.

5.1.5 Settings - Biofeedback and sound settings

The NeuroGem offers powerful biofeedback capabilities with different reward schemes. A reward scheme prescribes how the geometric coherence graph is interpreted and translated into a sound level, typically from 0 to 100%. Through onboard or external speakers, or preferrably by means of a headset, the sound can be used for biofeedback training. The reward schemes are:

Reward scheme:		Explanation:
1	Overall coherence	Standard Deviation among the levels of all ratios in the geometric spectrum result. This is an approximate indication of the amount of peaks, however without specifying their position.
2	Quality, Phi	Evaluation of the peak shape at Golden Mean ratio, indicating the degree of geometry associated with empathy, engagement, vitality and bliss, i.e. as a result of "being one with others"
3	Power, Phi	Level at Golden Mean ratio, indicating the amount of power around Golden Mean ratio.
4	Effective, Phi	Combination of 2 and 3 as the mathematical product.
5	Quality, octave	Evaluation of the peak shape at octave ratio, indicating the degree of personal focus, cognition, autonomy, i.e. "being

		one with oneself".
6	Power, octave	Level at octave ratio, indicating the amount of power around octave ratio.
7	Power, effective	Combination of 5 and 6 as the mathematical product.

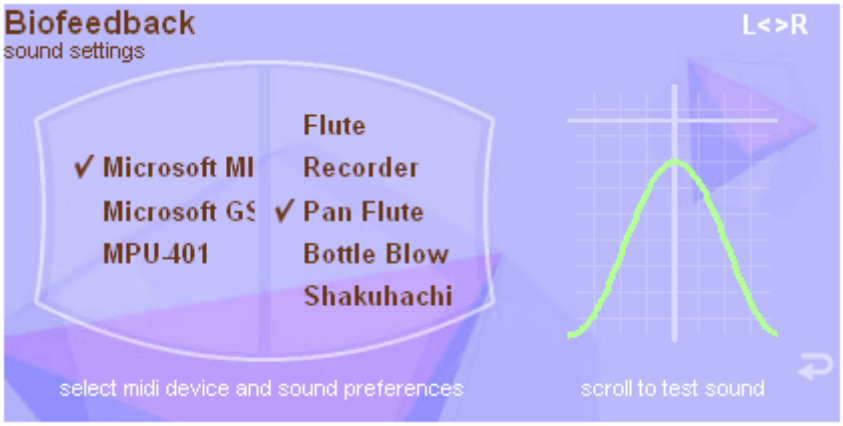


A biofeedback reward scheme can be selected by horizontally scrolling over the image.

The treshold bar (in this example at level 64) indicates the point where the biofeedback sound level reaches its maximum. Move the mouse cursor over the level bar to see the cursor change and then drag it up or down. A lower treshold resuls in an easier reward, and can be used e.g. during initial sessions to become acquinted with NueroGem biofeedback. Later, the treshold can be raised, so that a sound reward requires more training.

Use the sound swich on the left to toggle sound cue on or off. Your midi sound under Windows should be activated (Windows "Start" - Control Panel - Sounds & Audio Devices - Volume - Advanced. Set Master Volume and Midi Volume to max). In case your computer has an external sound adjustment, be sure to set it high enough.

Clicking the musical icon on the right opens the sound settings and "dry test" panel:



The list on the left shows installed standard and custom MIDI players on your computer. Select a device by clicking it before proceeding. Scroll through the list at the right to select

your favourite biofeedback sound. While scrolling, each sound will be played briefly.

The small test window shows a playable virtual coherence peak, plus the Golden Mean or Octave target and level bar of the reward scheme. Move and resize the peak to test the sound, and how it responds to different levels and treshold. It is very helpful to let a biofeedback client experience this before starting a biofeedback session.

If you can't hear any sound, please check your computer's midi- and sound settings as described above.

IMPORTANT: BIOFEEDBACK DOES NOT FALL UNDER THE CATEGORY OF "DIAGNOSTIC USE" AS IT ACTUALLY ADMINISTERS SOMETHING - A SOUND CUE - TO THE BODY WITH THE PURPOSE OF HELPING TO IMPROVE, FOR EXAMPLE, RELAXATION OR TO CREATE A PLEASING AND UPLIFTING EFFECT. NO CLAIMS ARE BEING MADE SOFAR AS TO THE EFFECT OR EFFECTIVENESS OR THE REQUIRED DOSAGE I.E. DURATION OF NEUROGEM BIOFEEDBACK PRACTICE. AS THE EFFECT OF BIOFEEDBACK IN GENERAL CAN BE SUBSTANTIAL, AS IT IS WITH THE NEUROGEM, WE ADVISE TO USE GEOMETRIC COHERENCE BIOFEEDBACK JUDICIOUSLY AND IN SMALL DOSES ONLY, E.G. STARTING WITH MAXIMUM OF TWO TIMES 15 MINUTES A DAY.

5.1.6 Settings - Evaluation

Currently there is one option under Evalution: show signed values in QuickScan and Progess Chart. See see explanation under 5.3.2. Quick Scan [**>**].

5.2 The View menu

The View menu has the following functions, resp.:

Module settings: show or hide, and set horizontal or vertical alignment of the modules (future option) in the NeuroGem main window.

Align to grid helps to easily setup a straight screen arrangement on an (invisible) grid.

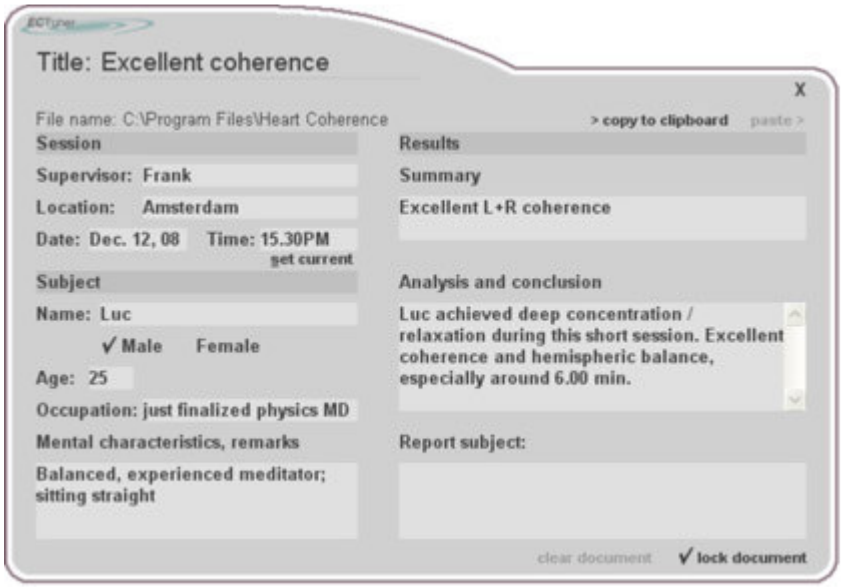
Lock config locks the size and position of all modules.

Set config does the same as in the file menu, however by means of a thumbnail scroll selector. Scroll horizontally to find your preferred screen configuration, then double-click or click the arrow to apply it.

5.3 The Evaluate menu

5.3.1 Session report

The Session Report is a user editable document containing relevant parameters such as the subject's details and personal observations. Every recording automatically includes a report which by default is empty. The entry fields are normal textboxes. The "copy to clipboard" and "lock document" functions apply to the whole report. Data can be added and edited for a newly recorded session as well as existing recordings. Click the "lock document" button to lock or unlock a document for editing. Note a session report can only be edited when attached to a newly recorded session, or when is was originally loaded with a previously stored session. It cannot be edited if opened by the long scan module.



Session Report, scaled

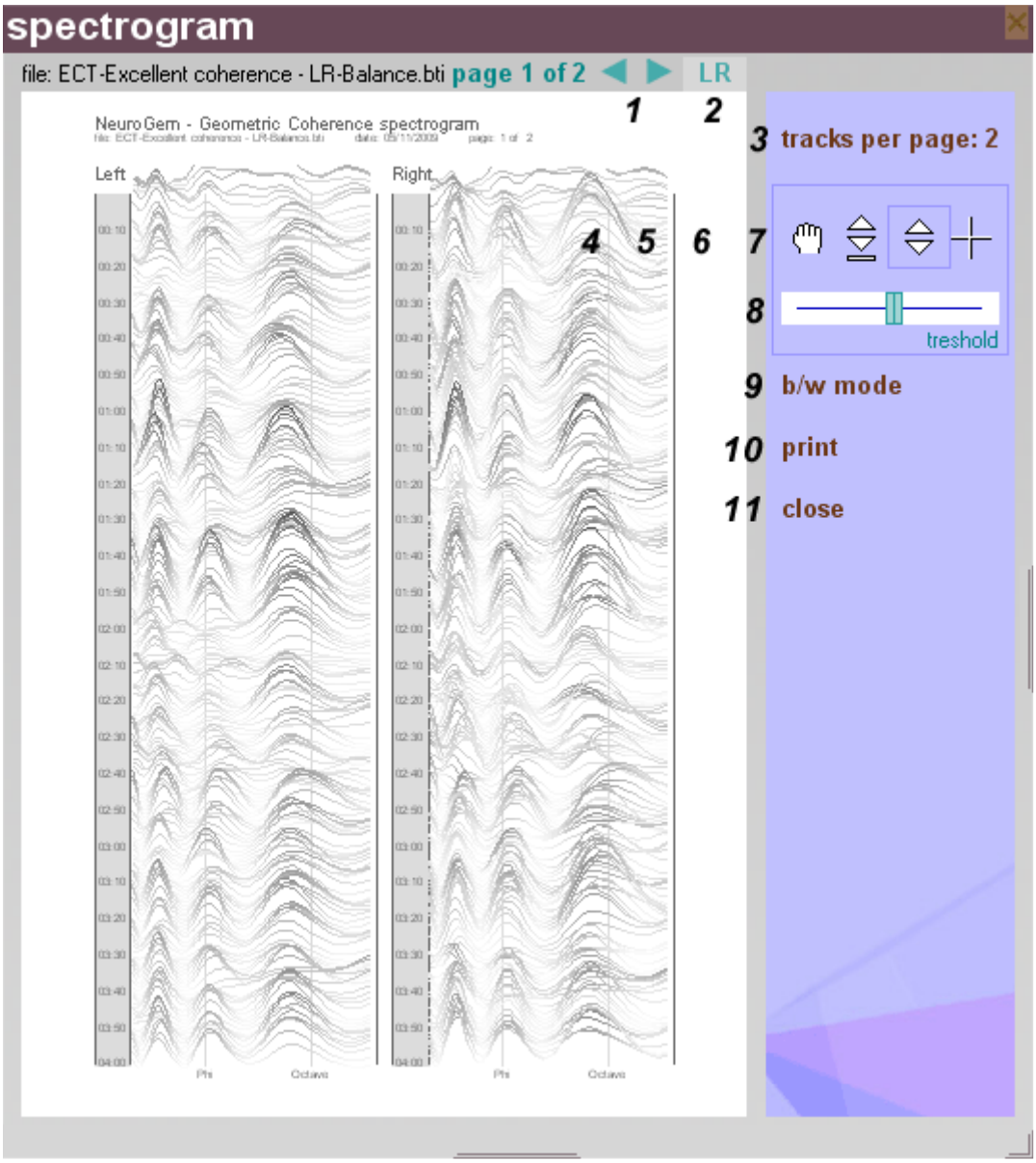
5.3.2 Spectrogram viewer

The NeuroGem spectrogram combines the advantages of state of the art EEG assessment with a highly relevant extended session time, in a directly printable format. The spectrogram (actually, "geometric coherence spectrogram") shows essentially the same result as the geometric coherence waterfall plot, only for a full session duration.

The spectrogram provides a visually compelling overview of general coherence trends as well as the predominant spectral and cross-hemispheric balance, however without actually quantifying them.

The page settings at the top and control panel at the right can be used to arrange your spectrogram printout. The selectable cursors are used for various direct adjustments by dragging them vertically over the print preview.

The spectrogram viewer is always placed on top of the graph modules and is fully sizeable and scaleable.



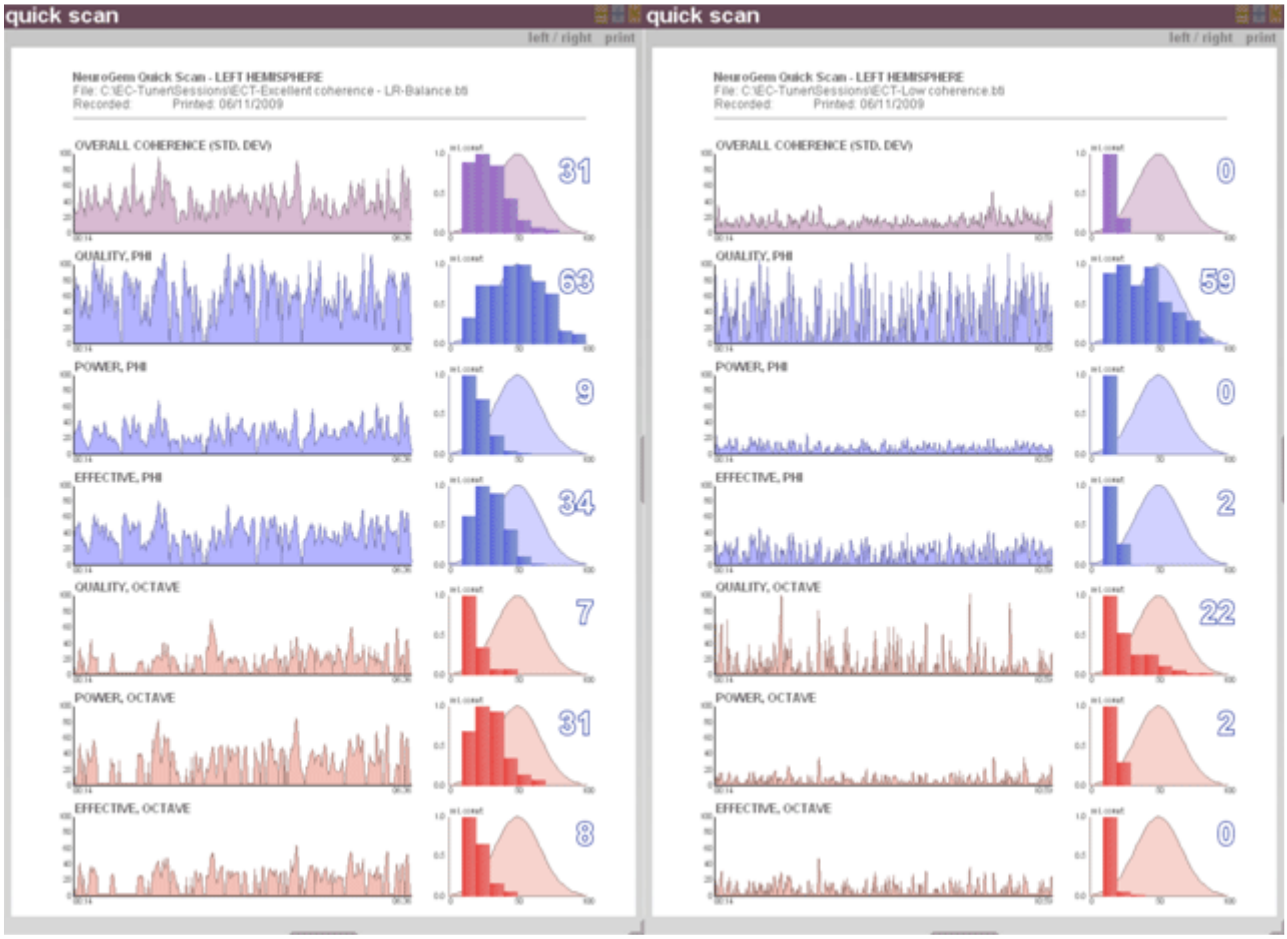
Spectrogram

Spectrogram setting:	Function:
1	If there are more than one pages, switch to next or previous page
2	Toggle between showing Left or Right hemisphere, except if the number of tracks on the page is set to 2
3	The number of tracks (columns) per page can be set to 1, 2 or 3. If 2 tracks is selected, both hemisheres (L+R) are shown. In the other case, the left or right can be choosen
4	If the page is taller than the window, scroll up / down
5	Adjust the spacing between the single graphs. This will often affect the number of pages
6	Adjust the visual gain of the graphs
7	[future editing options]
8	Select the incoloring treshold - higher amplitudes in the

	geometric coherence graph are emphasized by denser color.
9	Toggle between black / white or color graph
10	Print this page, or create a .pfd file
11	Close the spectrogram viewer

5.3.3 Quick Scan

The Quick Scan provides a one-click printable statistics summary an entire session. The time history and resp. histogram are summarized for the 7 distinct properties of the coherence spectrum (resp. for the total-, Golden Mean and octave ratio coherence) correponding to the seven biofeedback reward schemes, as summarized under "Settings - Biofeedback". [**>**]



Quick Scans, scaled

These are two examples of the Quick Scan statistic summary, resp. of persons with higher coherence and lower coherence.

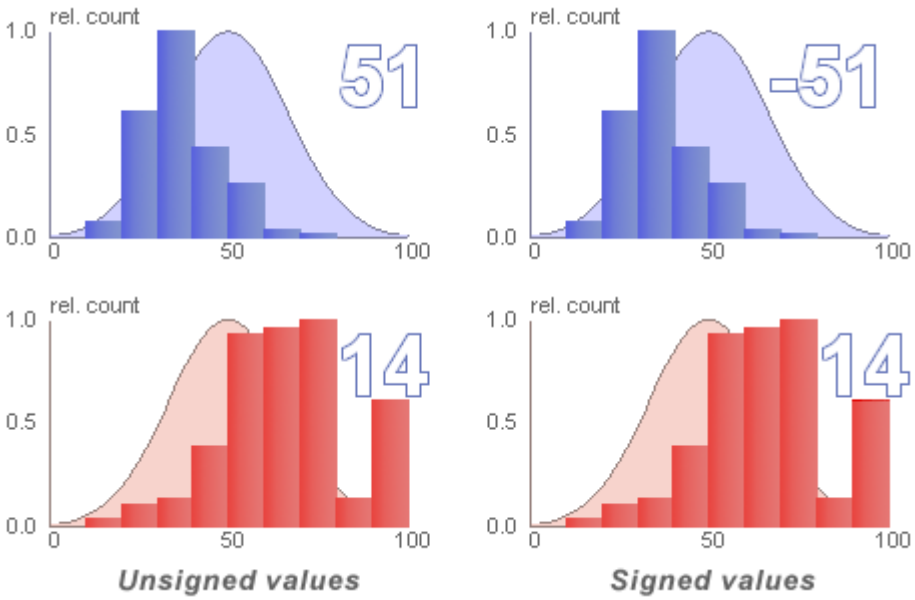
In the menu above the graphics, Click "Quick Scan" to do the scan of the complete session, and left / right to toggle between the both hemispheres. Click "print" to make a printout or PDF document.

Interpretation: The history graphs show the value of each resp. property of the coherence spectrum (i.e. for the total, for Golden Mean and for octave ratio's), normalized to a scale from 0 - 100%. The histogram shows the distribution of that same value within 10% bins

(note that the horizontal index in the histogram corresponds to the vertical value of the history graph). The vertical value of the histogram indicates the relative occurence of the value in each bin. The "ideal" distribution (Gauss- or bell curve) in the back serves as a reference.

The index printed next to the histograms indicate how well the session histogram matches the "ideal" natural Gaussian distribution, on a scale from 0 to 100. A perfect match, i.e. nicely in the middle, results in a histogram index of "100". The more the histogram is shifted left or right out of centre, the lower the index. That means that the average value is above or below ideal, but in many cases also points at a not optimal (natural) distribution (see also red histogram in example below. The histogram index is meant for effective relative comparison only, and does not mean to represent a solid dimensional value.

Signed versus unsigned values: In the Settings - Evaluation menu you can choose between showing signed or unsigned index representation. This is related to how the histogram results are processed internally:

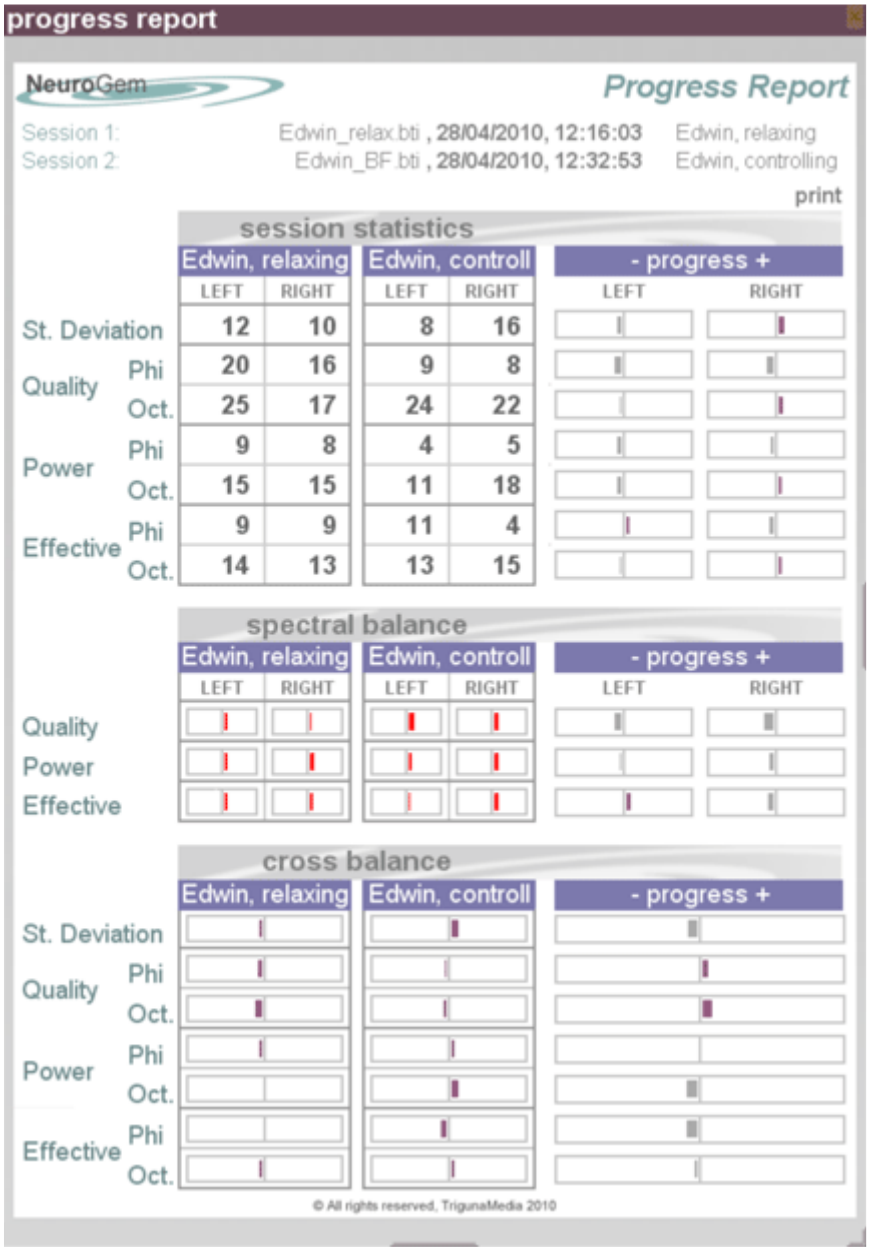


Above samples from the Quick Scan are both identical, but the second one shows signed (i.e. plus / minus) values. In the case of signed values (right example), a positive sign means that the histogram is (per saldo) shifted right from the centre. I.e. a person has an above-ideal distribution of that geometric coherence aspect. In most cases, like in this example, also the smooth clock shape of the histogram is distorted, which is another indication that the center position is ideal. The difference between left- or right balance is critical for the NeuroGem's Progress Scan and Long Scan to make spectral and cross-balance comparisons between two sessions. The reason to show unsigned values is only visual: the signed values are a bit cumbersome to read quickly, whereas in almost all cases the coherence values are distributed to the left, i.e. below "ideal", so that a normal (unsigned) value suffices. This below-average distribution is quite normal, as the total coherence is effectively shared between Phi and Octave. This gives a rough indication of what can be labeled as "good coherence", that is an histogram index from about 25 to 50.

5.3.4 Progress Scan

With the NeuroGem's Progress Scan yet more consise data presentation is available. The Progress Scan creates a bar graph presentation of the Quick Scan's statistics summary, resp. of the spectral balance (Phi vs. Octave coherence) and cross-hemispheric balance. Its most obvious use is the comparison sessions before and after therapeutic intervention

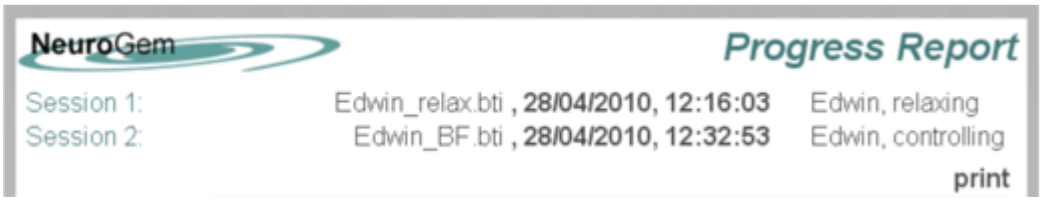
or biofeedback, in a glance. The differences in resp. coherence values, spectral- and cross balance are printed as bar indicators in the respective "progress" tables:



Progress Scan, scaled

In above example, the earlier recorded sessions were labeled "Before" and "After" and are compared. Most of the channels except Quality Phi show progress in coherence after intervention. The spectral balance increased especially for the Quality channel, i.e. the Phi / Octave balance has improved. Note that "ideally" the balance bars show no reading at all, indicating perfect balance. The cross balance (i.e. between the hemispheres) was already very good and improved somewhat for Octave power, whereas other channels are slightly less.

The Progress Scan is based on recorded sessions, and in that sense stands a bit apart from the rest of the application. The header by default looks as follows:



Progress Scan header, scaled

For each of the two sessions, the data is loaded by clicking the "browse" tab, which after loading will show the file name. The date is automatically copied from the session report, if submitted. The labels can be edited inside the textbox, by default containing the text "[enter]" and are automatically copied to the respective fields. After loading and labeling one or both sessions, the progress scan can be printed on A4 or as .pdf document with one click. To clear session data, double-click on the corresponding label.

The Progress Scan is always placed on top of the graph modules, is resizable to the maximum print preview size, however is not scaleable.

5.3.5 Long Scan

The Long Scan evaluation creates graphics and a printout of a complete test series or biofeedback course.

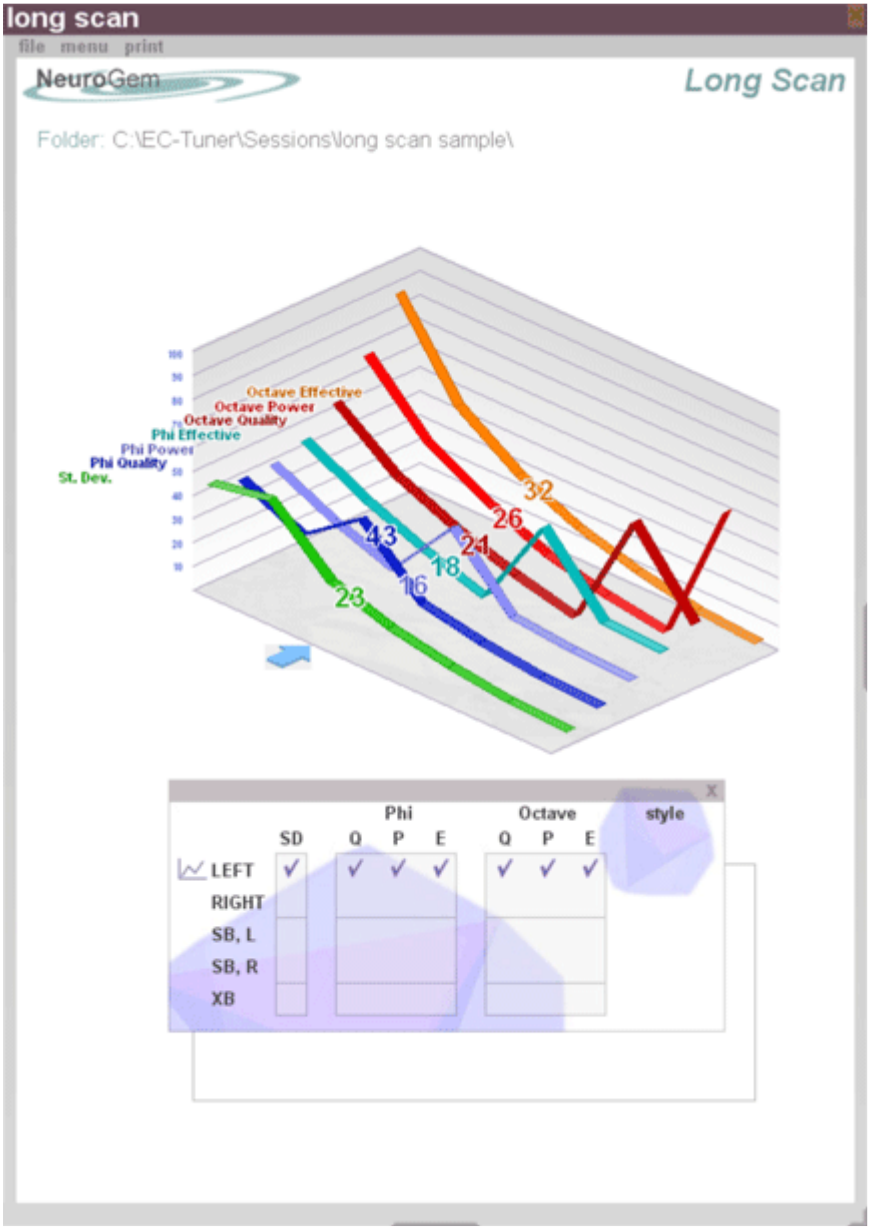
To prepare a test series for later evaluation with the "long scan", all related, consecutive sessions need to be stored in one folder, e.g. "../sessions/john/".

To create the long scan, click the "file" menu item inside the long scan module and open the so called anchor file ("NG-LongScan-anchor.nls") which will then prompt the loading of the statistics data of all sessions earlier stored in that folder. The anchor file itself contains no session data and is automatically created once a session is saved in that folder.

There are three types of graphs, resp. styles: the raw statistics as created by the Quick Scan, the spectral balance and the cross-hemispheric balance. These are selected (per left / right channel, naturally except the cross-balance) by clicking the items on the left of the menu (don't click the check marks). Within each set, individual tracks or groups can be selected with the items on top of the menu.

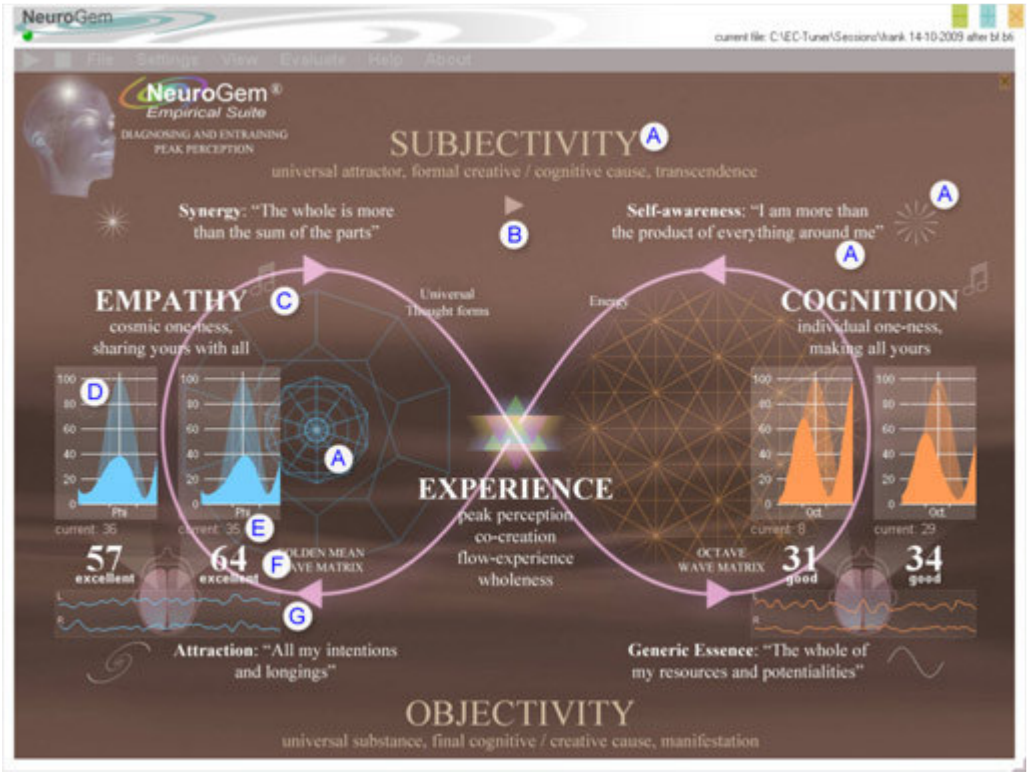
When the sessions data is loaded, open the selection menu to compose any desired combination of session data as they evolved e.g. during a test, therapeutic or biofeedback course. For example, if you wish to compare the Phi and octave power results of all the sessions over time, in the menu select the righ or left channel and (un)select the desired tracks.

Click "print" to make a single A4 printout, or a .pdf.



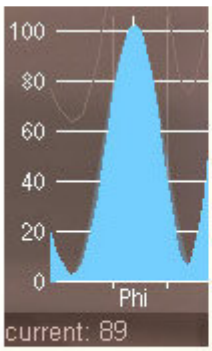
5.3.5 Empirical Suite

The Empirical Suite shows the geometric coherence graphs placed in the diagram of experience based on the creative factors (cycle of principal subjective and objective states). Open the Empirical Suite through Main menu - Evaluation - Empirical Suite.

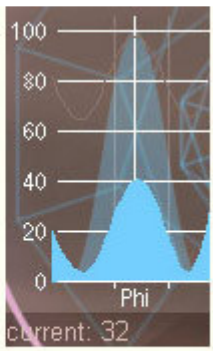


EMPIRICAL SUITE FUNCTIONS AND ACTIONS	
A	Click any text, graphic or graph item to see relevant topic in Session Reference.
B	Click to bring to front / hide input module to scroll through a recorded session.
C	Click note to select Golden Mean (Phi) or octave biofeedback, based on reference peak calibration. Click 2nd. time to disable. Biofeedback settings are synchronized with settings menu.
D	Empirical Suite mode coherence graphs **with reference peak**. Graph always shows Phi resp. octave in centre. The thin index lines indicate 1.6 resp. 1.7 ratio around Phi, and 1.9 resp. 2.1 ratio around octave. See examples below.
E	Actual geometric coherence per L/R, Phi/octave channel as per peak ref. calibration.
F	Average geometric coherence. During sampling, and during scrolling the last 10 seconds of the recording, also the final evaluation is printed ("low, average, etc.."). See table below.
G	Simple 90 sec. fixed coherence history, by way of progress indicator. The Empirical Suite coherence can also be viewed in the normal History module, by selecting the biofeedback channel.

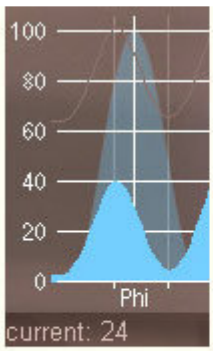
Calibration and evaluation:
In the empirical suite, the geometric coherence is evaluated by peak reference. A perfect match with an "ideal" peak (known maximum) is normalized to 100. This value is reduced in the case lesser power under the reference curve, as well as more power outside. For the latter, obviously only data within the span of the reference peak is considered. Some examples (the colors are not important here):



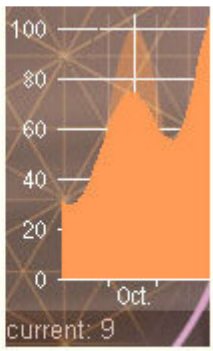
Close to ideal peak (coherence)



Lower, but good peak



Same, out of center



High and well centered, but much dissipated

EMPIRICAL SUITE FINAL EVALUATION	
Measured average geometric coherence, per channel	**Printed final evaluation**
75 - 100	"Exceptional"
51 - 75	"Excellent"
41 - 50	"Very good"
31 - 40	"Good"
21 - 30	"Average"
11 - 20	"Low"
0 - 10	"Very low"

Technical note on horizontal index :
In the normal geometric coherence graph, the result is plotted on a hyperbolic horizontal scale, so that the *ratio's* are equidistantly indexed. As a result, an octave (higher ratio) peak looks much wider than a Phi (lower ratio) peak. In the Empirical Suite, the focus is on the individual peaks. So here the *peaks* are printed linearly, having the same width, but as a result the indexing is not equidistant which explains the somewhat asymmetric adjacent index lines in the resp. graphs (see functions and actions table).

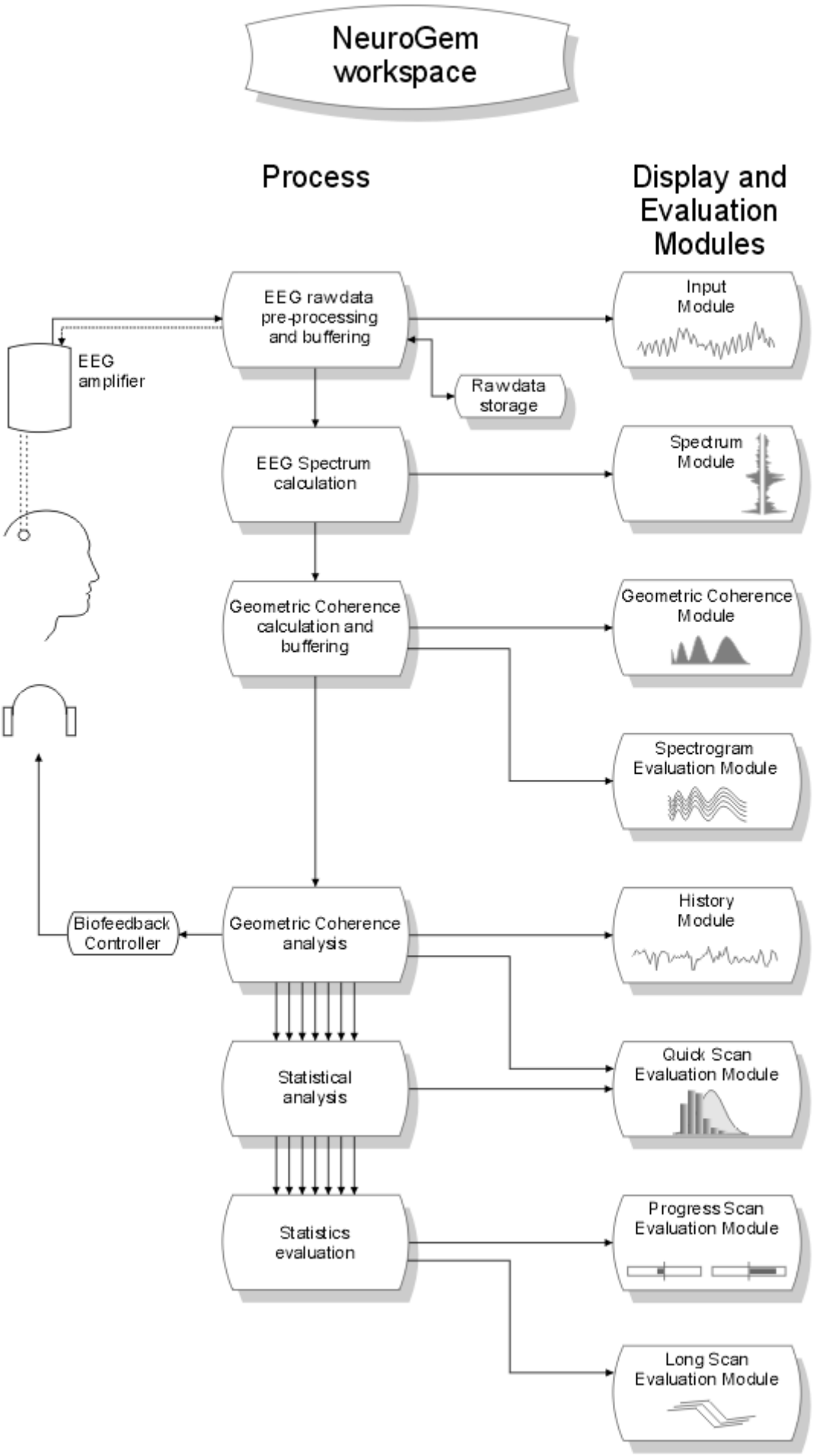
5.4 Help

Opens or closes the embedded user manual.

5.5 About

Shows or hides the introduction screen with logo and version number. Clicking the intro screen will also hide it. See Settings - General how to show or hide the intro screen during startup.

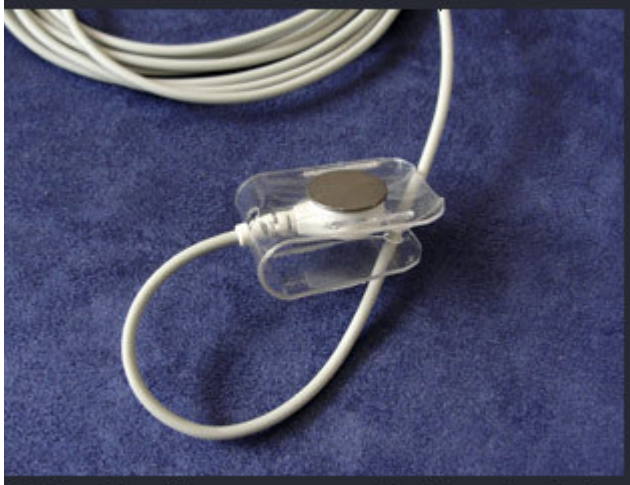
Attachments


NeuroGem workspace
Process
Display and Evaluation Modules
EEG rawdata pre-processing and buffering
Input Module
EEG amplifier
Rawdata storage
EEG Spectrum calculation
Spectrum Module
Geometric Coherence calculation and buffering
Geometric Coherence Module
Spectrogram Evaluation Module
Biofeedback Controller
Geometric Coherence analysis
History Module
Statistical analysis
Quick Scan Evaluation Module
Statistics evaluation
Progress Scan Evaluation Module
Long Scan Evaluation Module

How to apply the NeuroGem EEG sensors to the head clips yourself

1. For one channel (shown) the black resp. groundref. will be snapped into the earclip, the other into the head clip

2. Remove the sensor pellet and slide the wire (not the sensor itself) in the slit as indicated.



3. Position the sensor, guide the wire to the main opening and snap the pellet back on the sensor thereby fixing it to the head clip.

4. Apply the moisture pad (use a knife point or etc..). Ready. Repeat the process for the other channel.