SOFTWARE FOR ELECTROENCEPHALOGRAM ACQUISITION AND PROCESSING

“WinEEG”

Version 2.8
(User Manual)

St-Petersburg, Russia
2009

Main Features

The WinEEG software runs on a PC (personal computer) and is intended for clinical observation of EEG, video EEG and ERP/ERD recording for diagnostic of brain diseases. WinEEG software for MS Windows XP/Vista allows perform an advanced computerized analysis of the EEG on standard personal computer or Notebook including digital filtering, montage reformatting, spectra and coherence analysis, ERP and event related de-synchronization analysis, topographic maps and etc.

WinEEG software is designed to work with Mitsar-EEG-201 and Mitsar-EEG-202 amplifiers.

WinEEG is designed for the IBM PC and MS Windows XP/Vista which together define minimal system requirements. But the program performance significantly depends on capabilities of the computer. Here are recommended computer specifications:

Minimal - to work with EEG or ERP recording and analysis:

CPU	Celeron 850
RAM	128 Mb
HDD	20 Gb, IDE
Video Adapter	SVGA 16 Mb, AGP, accelerator
Monitor	17"
Floppy drive	3.5", 1.44 Mb
CD-Writer	4 x 4 x 32
Printer	HP Laser Jet 1020
OS	MS Windows XP

Optimal - to perform different EEG/ERP/ERD processing efficiently:

CPU	Pentium III 800 and higher
RAM	256 Mb
HDD	40 Gb
Video Adapter	SVGA 32 Mb, AGP, accelerator
Monitor	17”
Floppy drive	3.5", 1.44 Mb
CD-ROM	40 x
CD-Writer	8 x 4 x 32
Printer	HP Laser Jet 1020
OS	MS Windows XP

Professional - to perform additional processing like independent component analysis (ICA) or wavelet band power and wavelet coherence analysis:

CPU	Pentium IV 2000 and higher
RAM	2 Gb
HDD	500 Gb
Video Adapter	SVGA 64 Mb, AGP, accelerator
Monitor	19"
Floppy drive	3.5", 1.44 Mb
CD-ROM	40 x
CD-Writer	8 x 4 x 32
Printer	HP Laser Jet 1020
OS	MS Windows XP/Vista

For Video EEG – this computer provide synchronously recording of EEG, video from one or two cameras with on-line MPEG4 compression and audio with on-line MPEG3 compression during at least 48 hours.

CPU	Pentium IV 3000 and higher
RAM	2 Gb
HDD	500 Gb
Video Adapter	SVGA 64 Mb, AGP, accelerator.
Sound card	Any
Monitor	19 “
FDD	3.5 “, 1.44 Mb
DVD-Writer	8 x 4 x 32
Printer	HP Laser Jet 1020
OS	MS Windows XP/Vista and Direct X 9.0

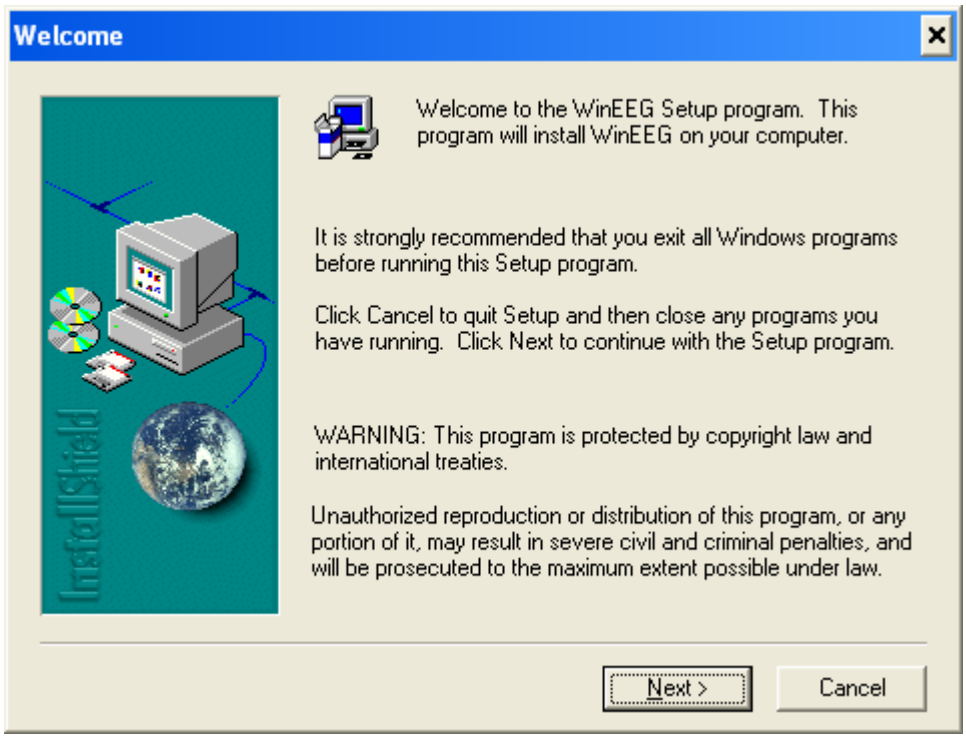
Attention!!! DirectX 9.0 should be installed.

WinEEG software Installation

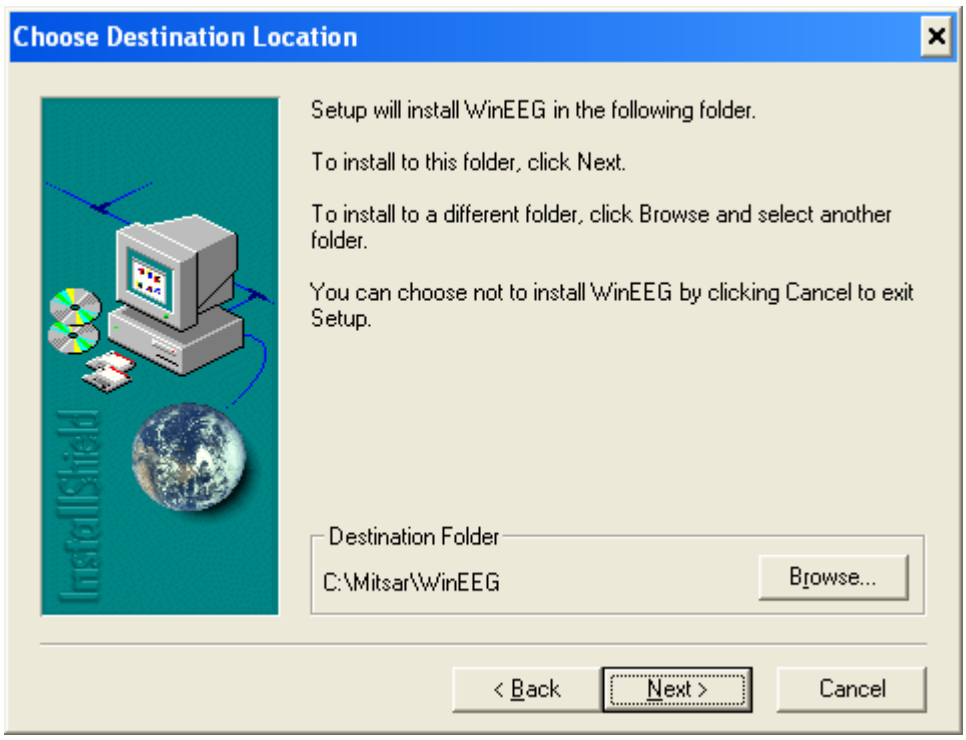
To install WinEEG software:

1. Insert the CD to the corresponding drive
2. Open folder with name “WinEEG” (or “WinEEGCompact” or “WinEEGMedium” or “WinEEGSP”
3. Run SETUP.EXE program.
4. Follow the instruction on the screen

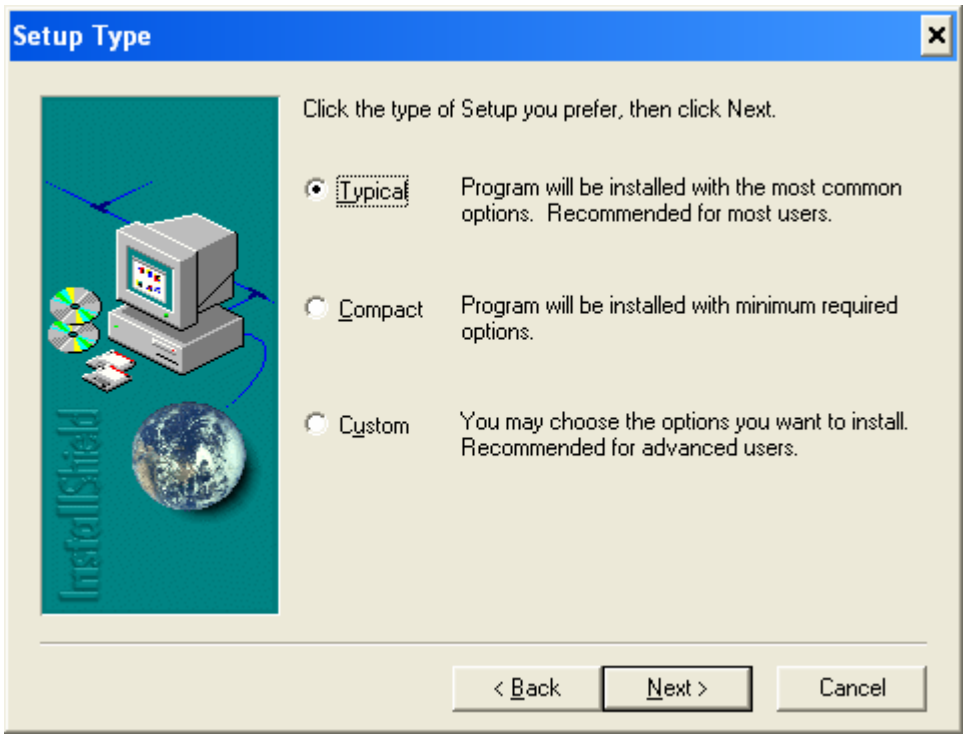
5. Setup program will begin WinEEG software installation



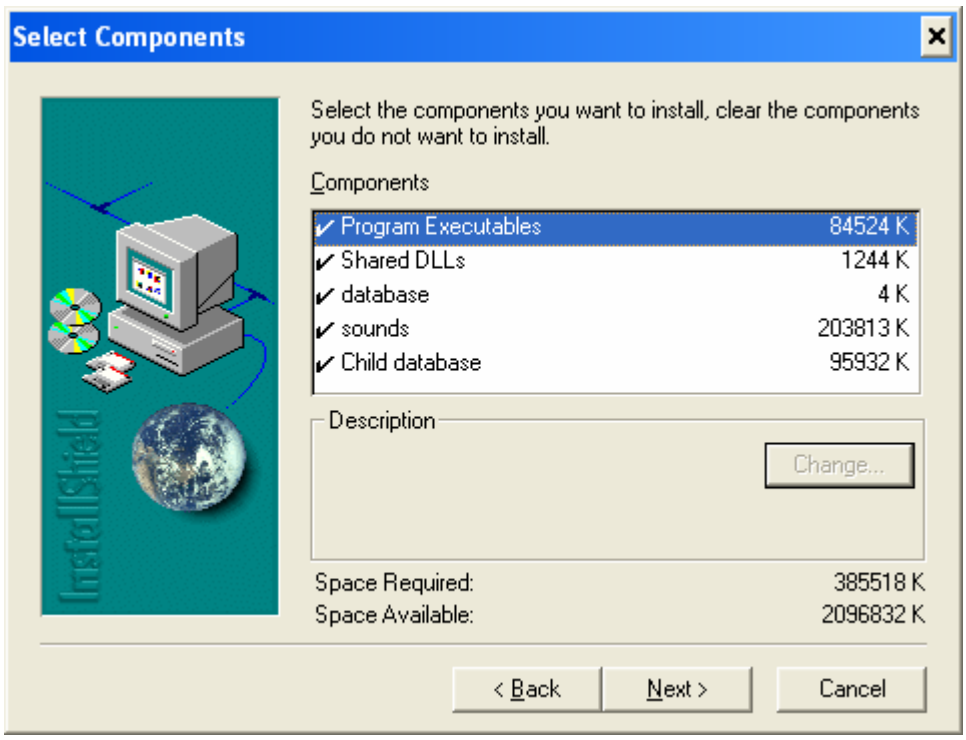
6. Press “Next” button to continue installation.



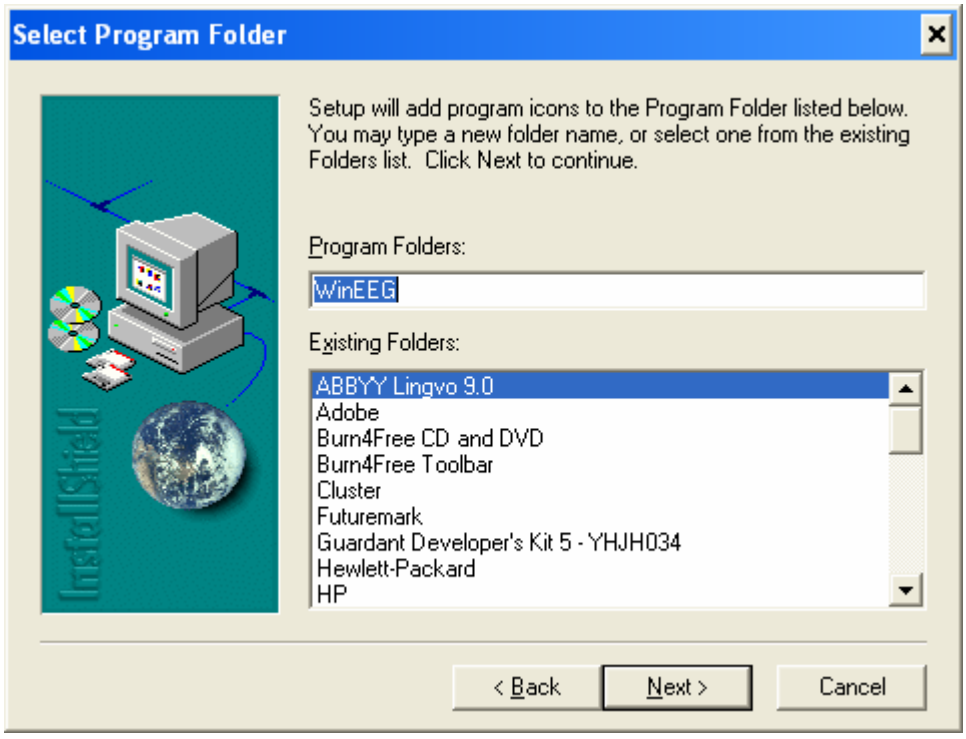
7. Press “Browse…” button if you would like to change location WinEEG program. Press “Next” button to continue installation.



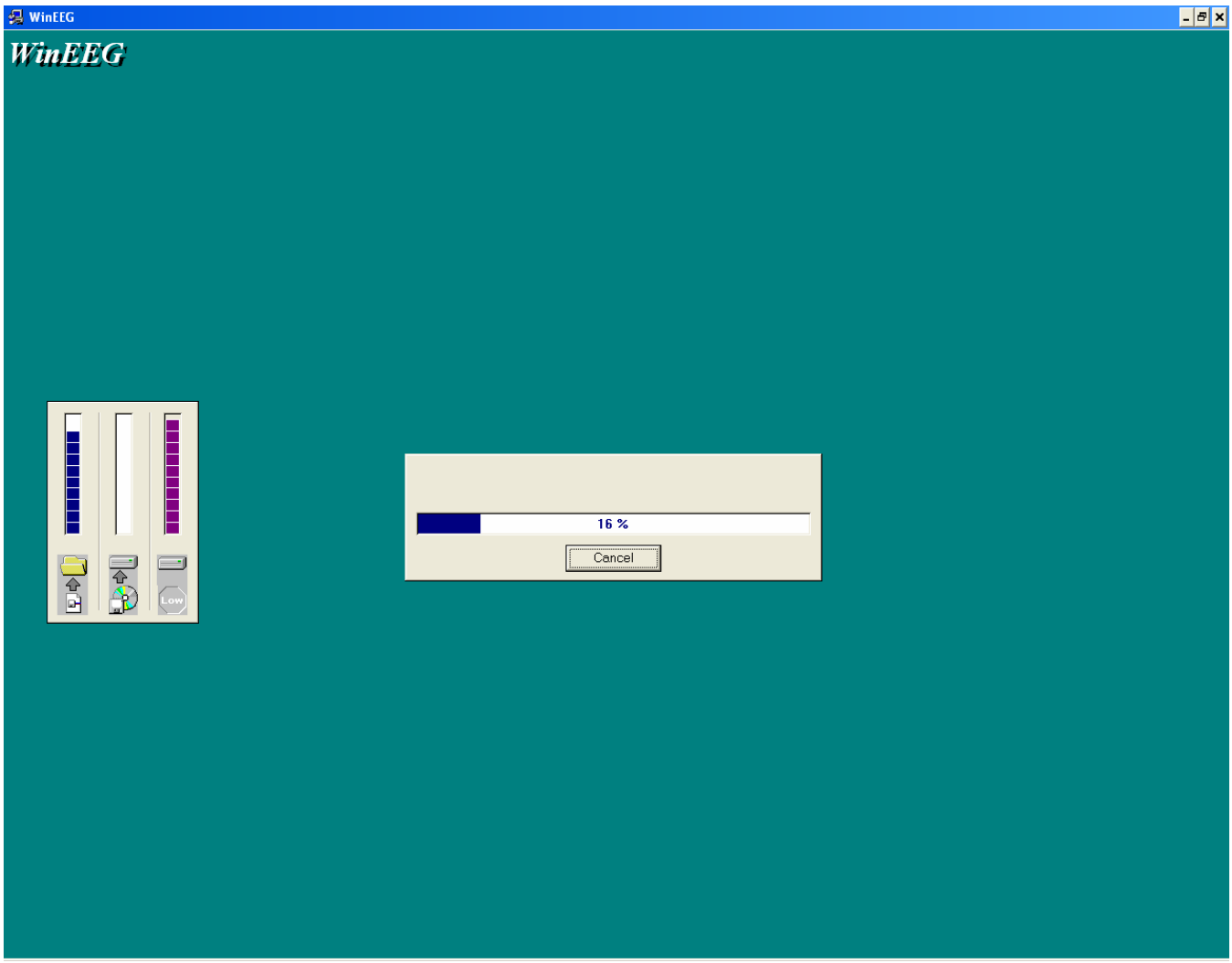
8. Select type of Setup you prefer. Press “Next” button to continue installation. If Custom installation is selected following window will appear on the screen:



9. Select components you want to install. Don't install "Sounds" component if you don't plan to use auditory biofeedback. Don't install "Child Database" component if you will not use Normative Database including spectra and ERP for children with the age from 7 to 16 years. Press "Next" button to continue installation.

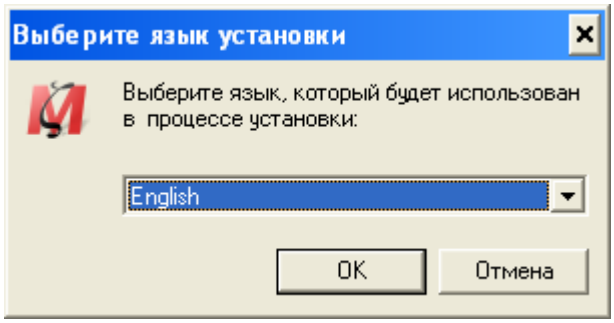


10. Type a new folder name if you want. Press "Next" button to continue installation.



11. Wait for finish of WinEEG software installation.

Setup program will begin installation of Mitsar hardware drivers

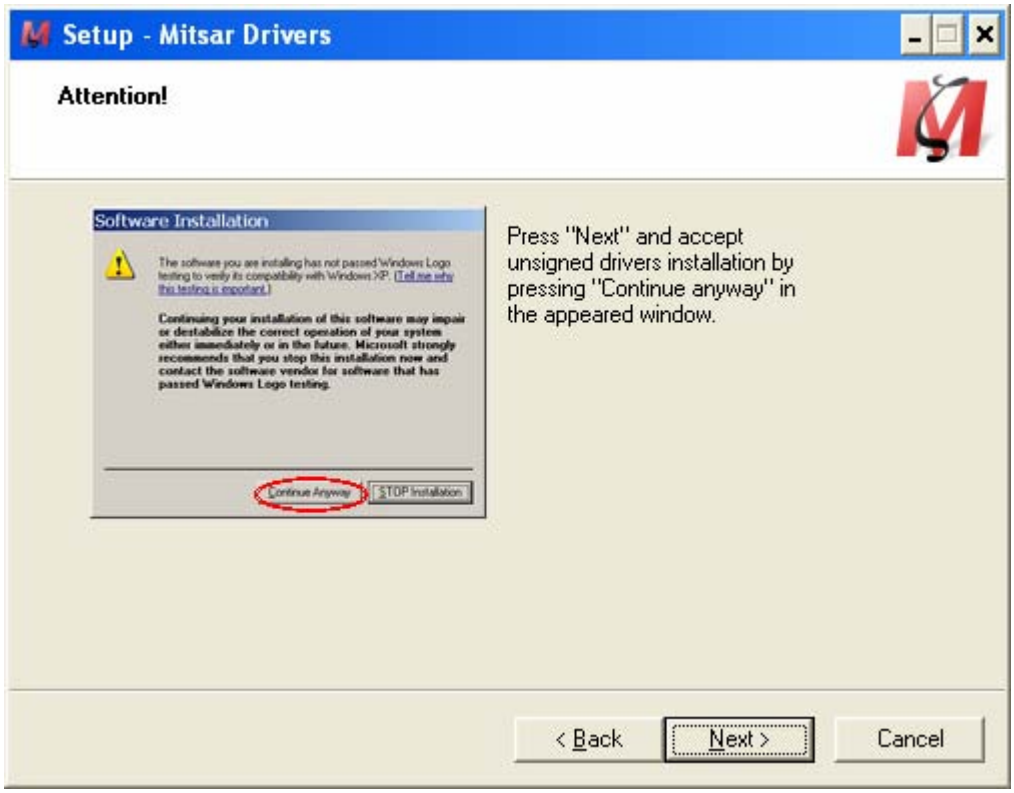


12. Select English language from the list as following:

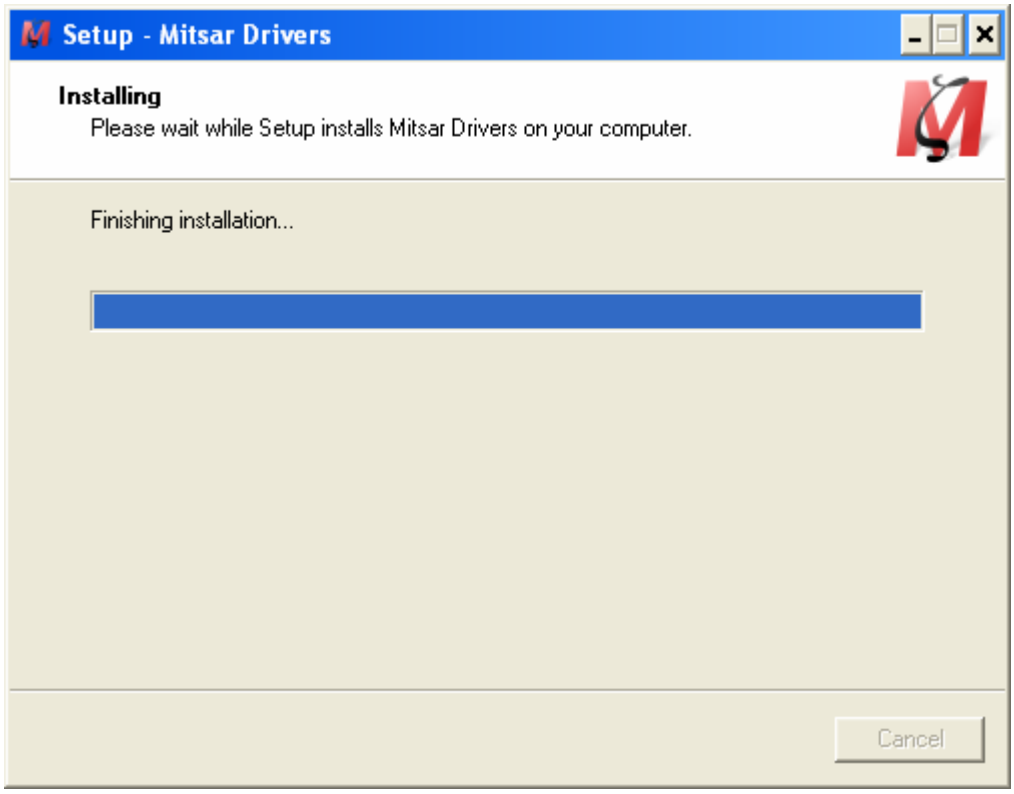
13. Press “Next” button to continue installation.

14. Select required hardware drivers that you are going to install in dependence on your hardware configuration and press “Next” button.

15. Connect USB cable(s) to the selected device(s) and cancel “New Device Found Wizard” the will appear after connection(s). Press “Next” button.



16. Press “Next” and accept unsigned drivers installation by pressing “Continue anyway” in appeared window(s).

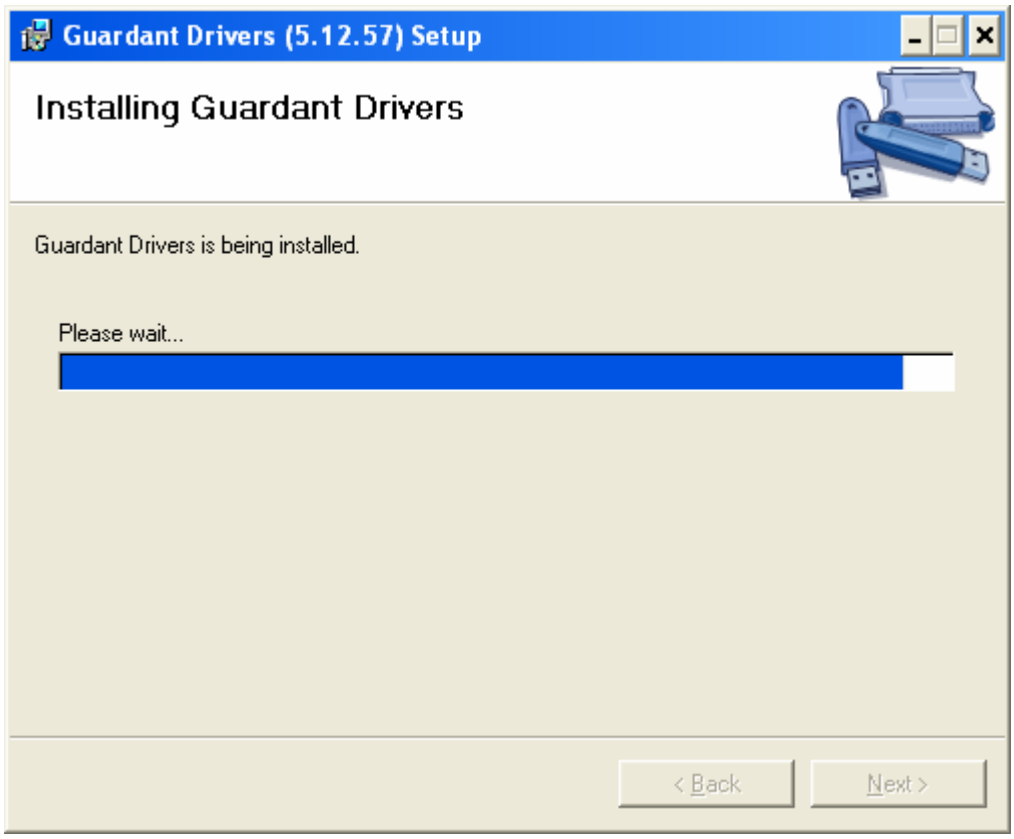


17. Wait for end of driver(s) installation.

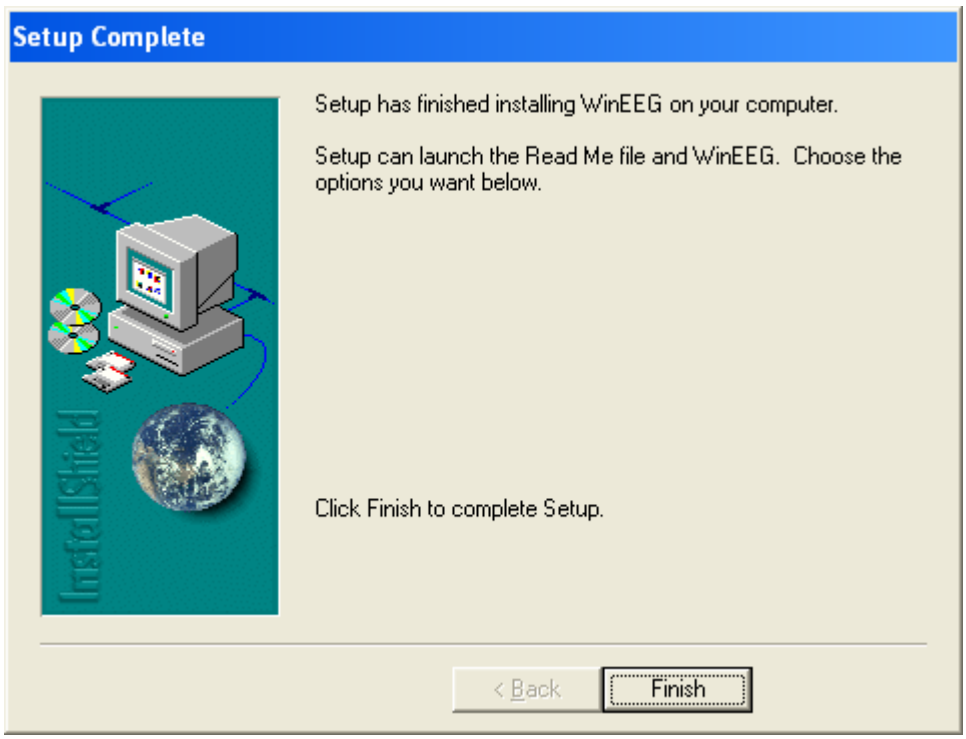
18. Press “Finish” to complete Mitsar hardware drivers installation.

Setup program will begin “Guardant” dongle driver installation.

19. Press “Finish” to continue installation



20. Wait for finish of driver installation.



21. Press “Finish” to complete Mitsar software installation.

22. Insert the “Guardant” dongle in free USB connector.

23. Windows will detect a new hardware

24. Select Automatic search for the corresponding driver and allow Windows to install it (press button “NEXT”).

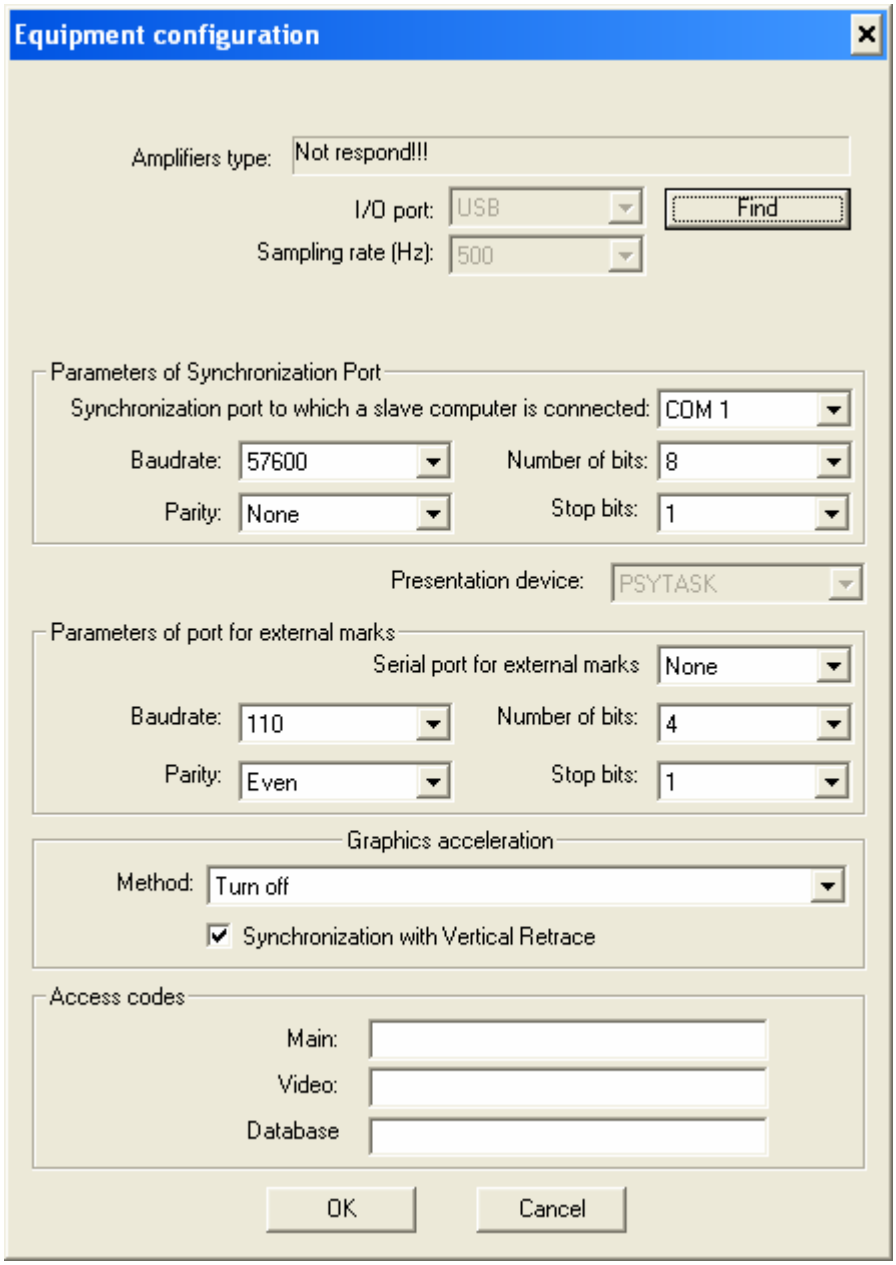
25. Sometimes you will need to reboot computer

After finishing of Setup you need to run WinEEG program. It will ask for automatically search connected Mitsar amplifiers. If Mitsar amplifiers are not connected now or some problem occurs the manual search of connected amplifiers can be performed using **Setup: Equipment parameters** command.

Is you haven’t Security Key you can open protected functions by **Access Codes**. The Access Codes are distributed by Mitsar Ltd. Mitsar will give you these codes by requirement if you have purchased the corresponding hardware/software configuration.

The Access Codes are unique for each amplifier box and are active if this amplifier box is connected to computer only. To generate Access Codes it is necessary to know the information about amplifier box such as its version and its serial number. This information can be found using **Setup: Equipment parameters** command. The next or similar string will be displayed in “**Amplifiers type**” field if the amplifier box is connected to the computer:

Mitsar 201 version 8 serial number 46



The access codes should be entered to corresponding fields:

Main field is used to open EEG recording function.

Video field is used to open video signal capture function.

Database field is used to open functions of comparison the data with normative database.

Attention!!! The access code is 8-characters string with digits or capital English letters and without additional symbols such as space, point, comma and others.

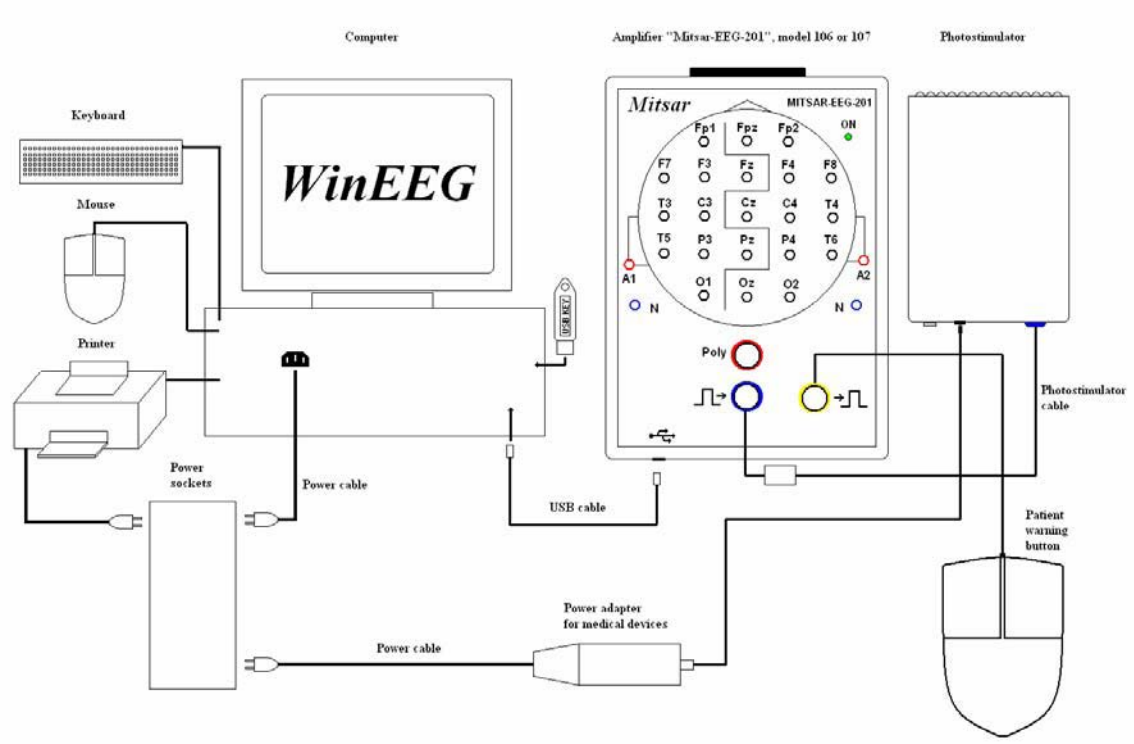
Mitsar EEG System Overview

There are at least three system configurations that can be used for practical goals:

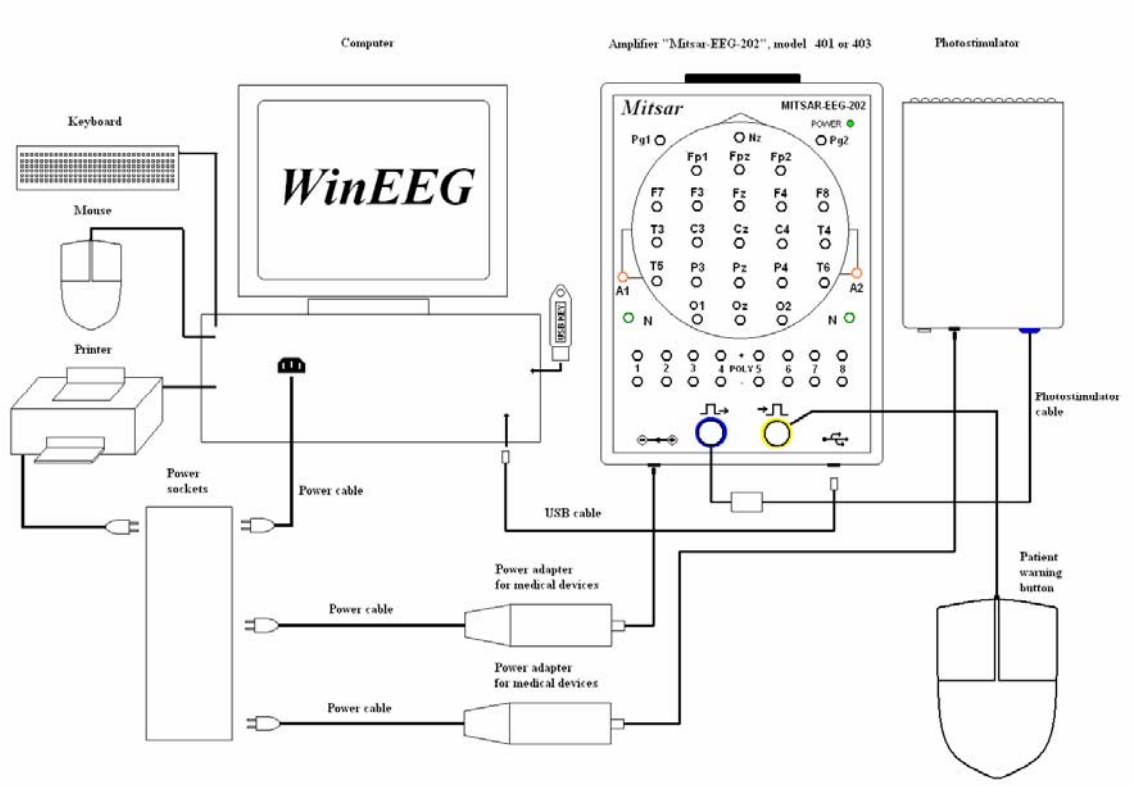
1. The EEG recording system configuration.
2. The ERP recording system configuration.
3. The video EEG recording system configuration.

Any combination of mentioned above system configuration can be used also.

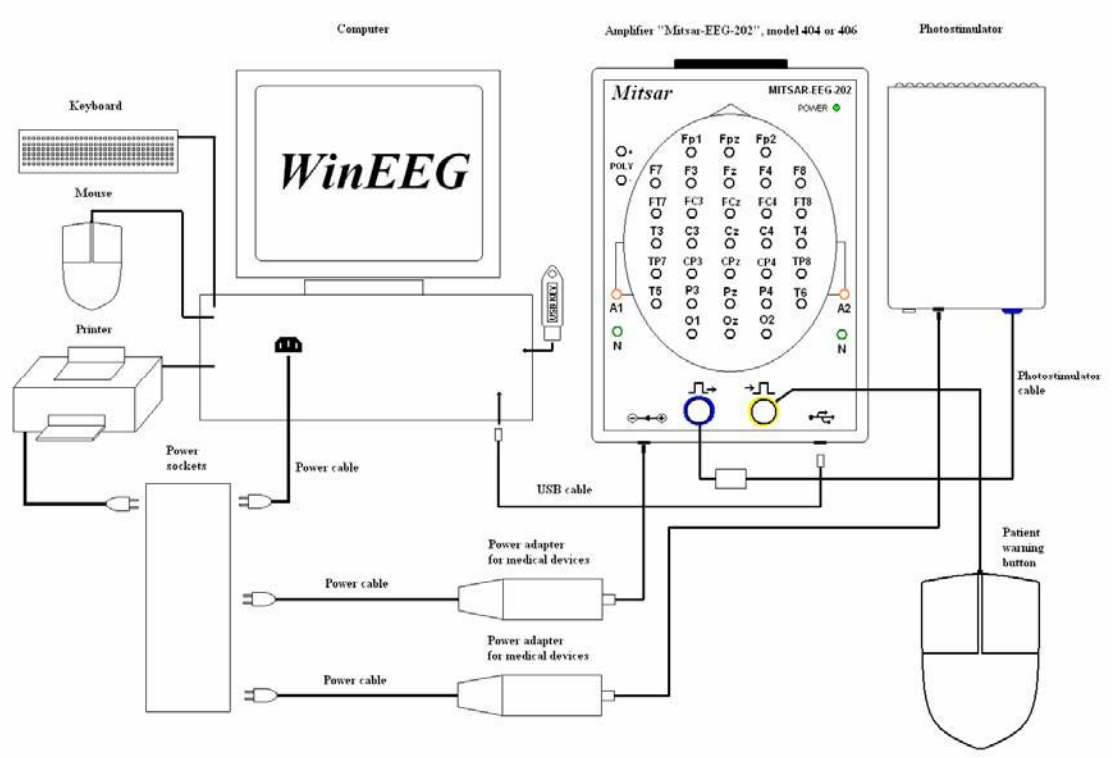
1. The EEG recording system configuration.



The EEG recording system based on Mitsar-EEG amplifiers.



The EEG recording system based on Mitsar-EEG-202 amplifiers (model 401 and 403).

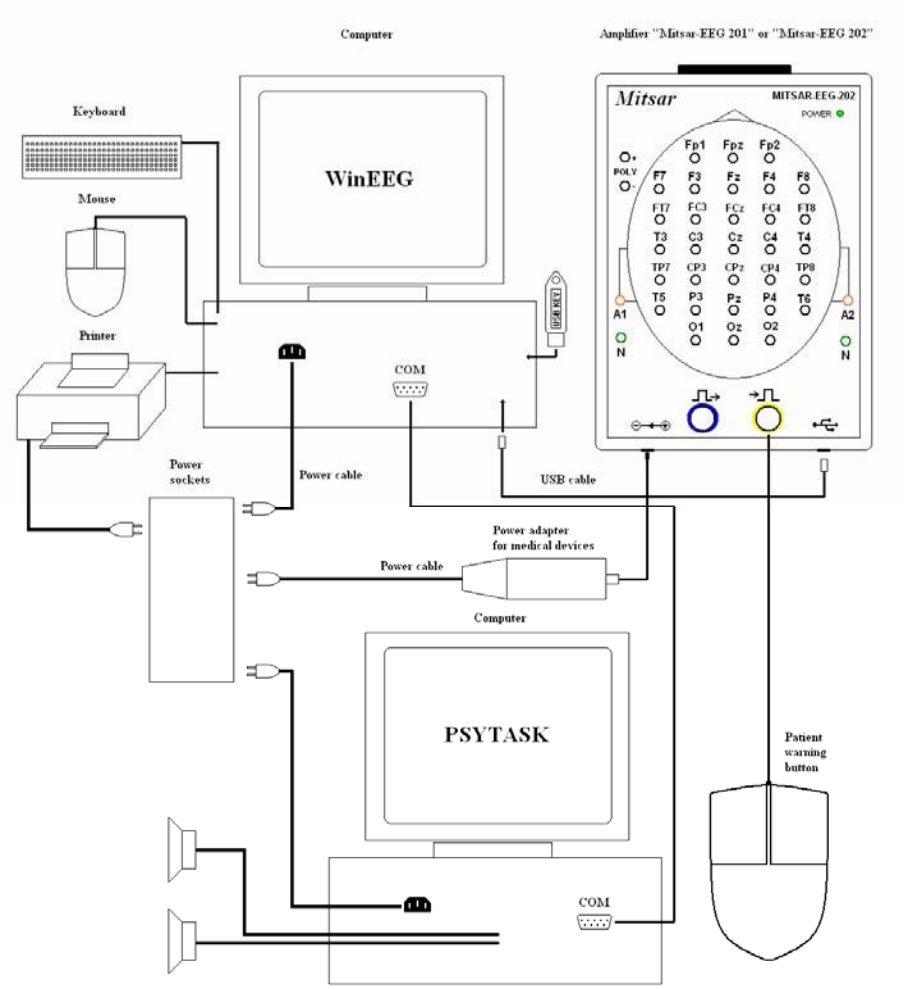


The EEG recording system based on Mitsar-EEG-202 amplifiers (model 404 and 406).

All modifications of system differ in the connected Mitsar-EEG amplifiers only and include the doctor-physiologist's PC (with keyboard, mouse, printer and USB dongle), the EEG amplifiers, the photo stimulator, the patient's warning button and the power supply.

WinEEG software receives the amplified, pre-filtered and digitized EEG signals, stores them to hard disk of PC for the future processing, process the signals in real-time and displays them on the PC monitor. All functions of recording and analysis are controlled using the keyboard and the mouse of PC.

2. The ERP recording system configuration.

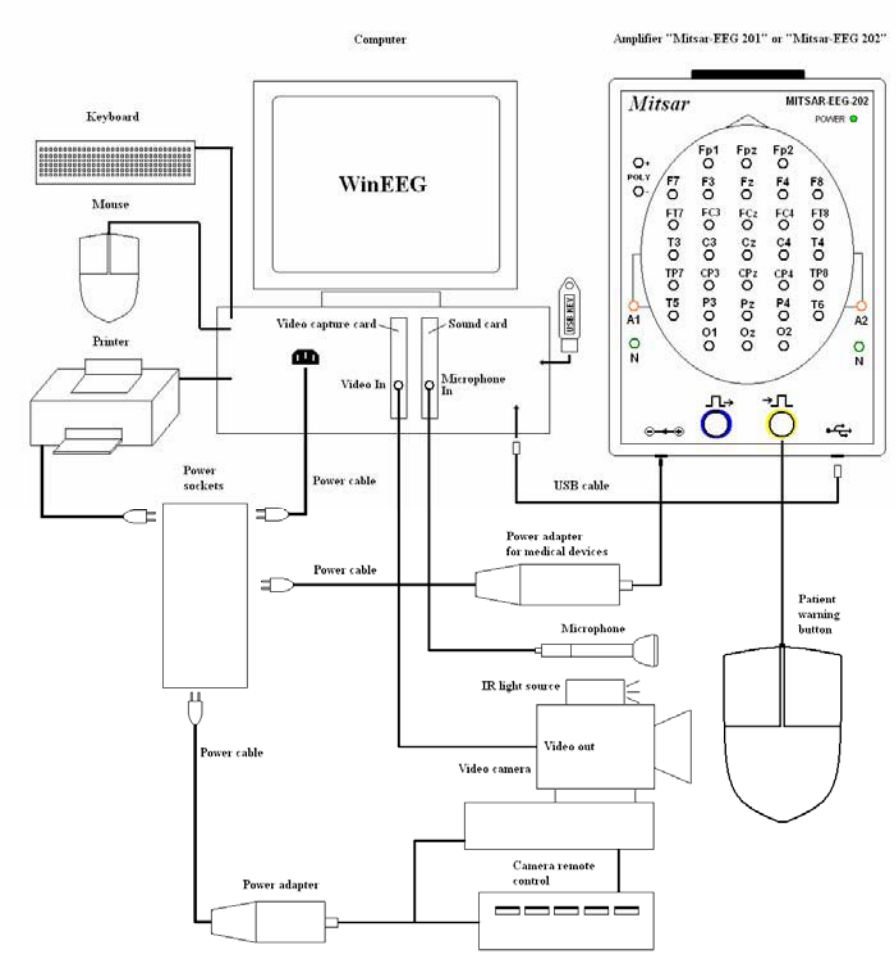


The EEG recording system.

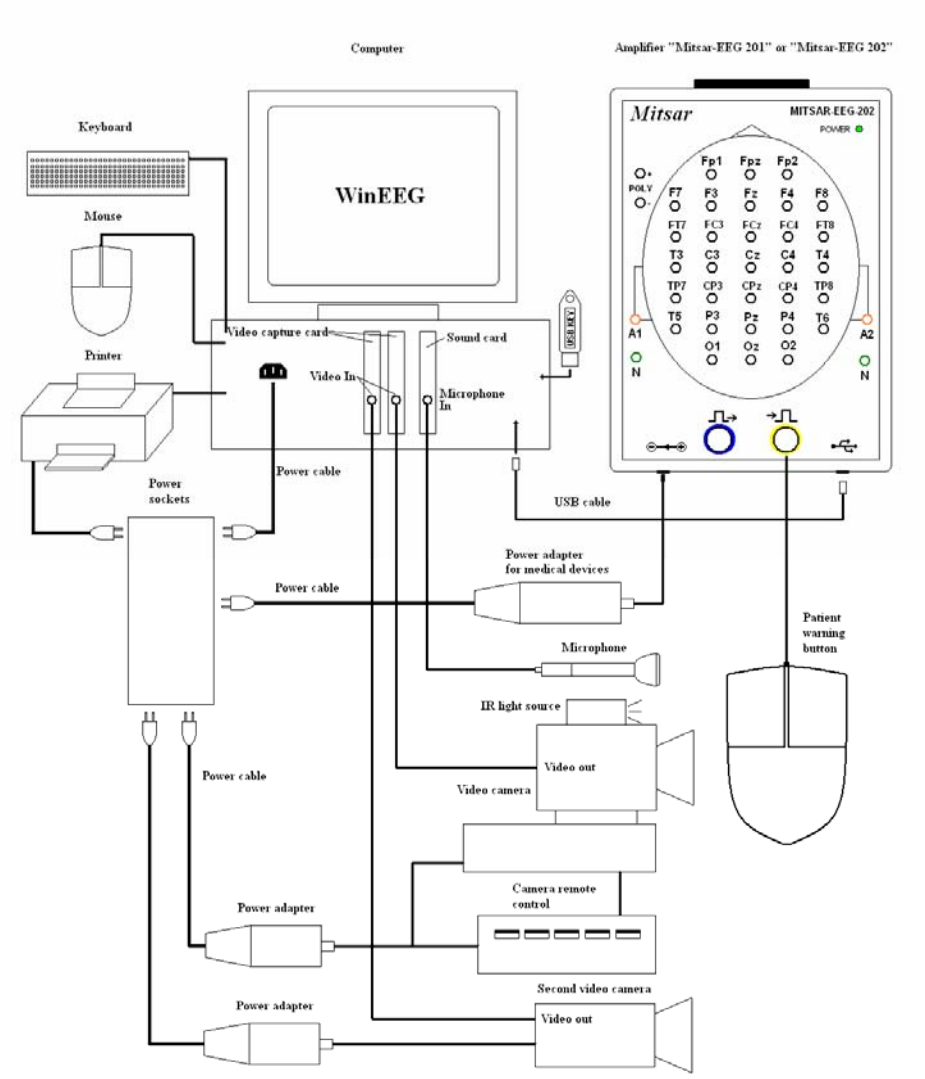
This system configuration includes an additional PC (so called stimuli presentation computer). Stimuli presentation computer is connected with EEG recording computed vie COM ports using null-modem cable to provide synchronization of signals recording and stimuli presentation. The additional PSYTASK software developed for Windows XP/Vista presents different stimuli of additional PC such as images, sounds and text.

PSYTASK software allows prepare pre-defined stimuli presentation protocols and presents these protocols during ERP recording. During ERP recording PSYTASK software is working in so called “slave” modes and WinEEG software controls the PSYTASK’s functions by sending the control codes via COM ports. WinEEG software receives the amplified, pre-filtered, digitized EEG signals, stores them to hard disk of PC for the future processing and control synchronously stimuli presentation process.

3. The video EEG recording system configuration.



The video EEG recording system with one camera.



The video EEG recording system with two cameras.

One or two video cameras and microphone can be connected to doctor's PC for synchronous recording of EEG and video movies.

WinEEG software receives the amplified, pre-filtered, digitized EEG signals, stores them to hard disk of PC for the future processing. WinEEG receives synchronously the signals from cameras and microphone, compress these signals on-line and stores them to hard disk for future playback and analysis.

During the work WinEEG and PSYTASK interact with OS and different external modules and drivers (see figure below).

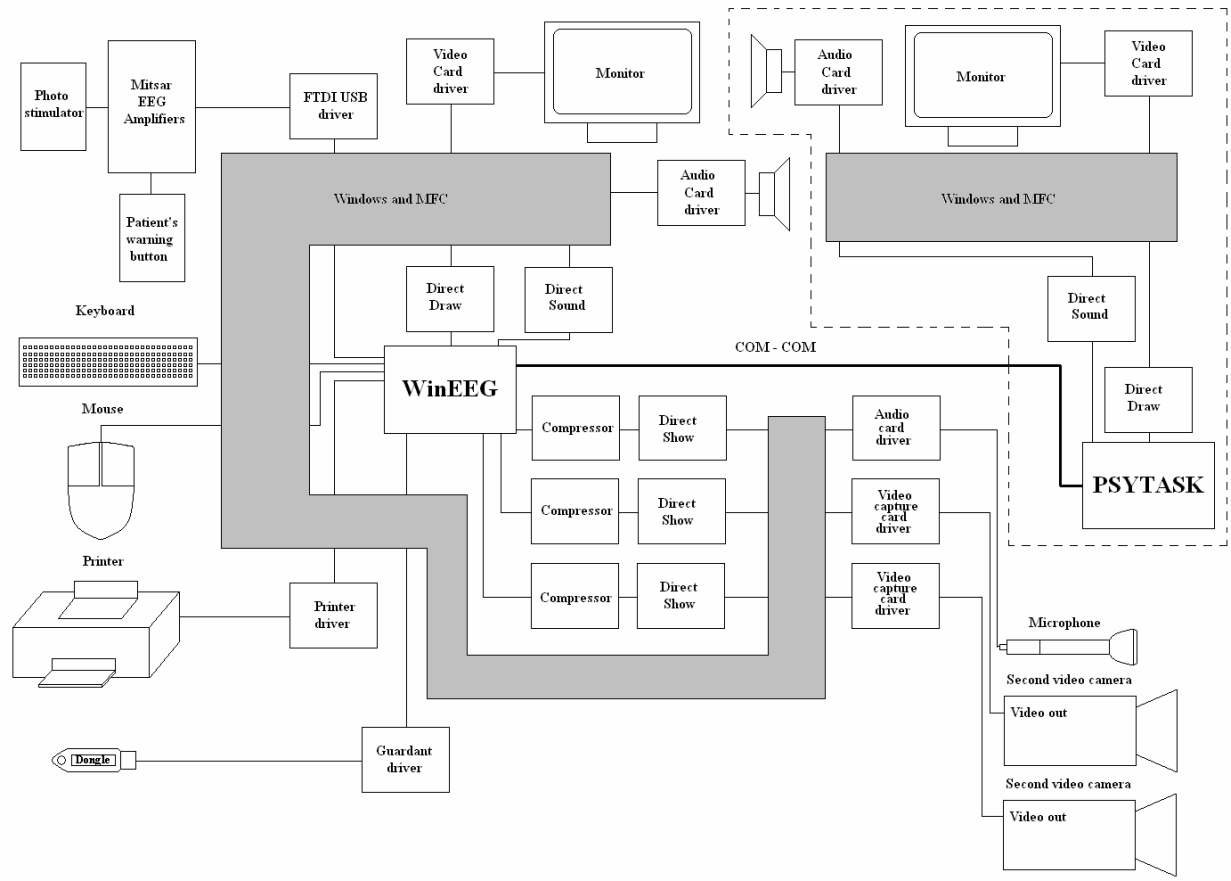


Diagram of interaction of WinEEG and PSYTASK software with different external modules and drivers

Main Functions

1. EEG Recording.

During recording, EEG and other signals are acquired in digital form by the computer through amplifier block and displayed on the monitor screen as curves (graphs) simulating those made by a plotter on moving paper. WinEEG software includes graphic tools allowing the display of paper speed (mm/sec) and sensitivity (mV/cm) with 10% accuracy. A user can initiate, stop and resume writing EEG signals on the hard disk to save them for future analysis. Total record duration is limited only by available disk space.

A video signal from a camera connected to the computer can be recorded synchronously with EEG. The best results will be if analog or digital camera connected to corresponding video capture card is used. In this case video signal is compressed on-line that decrease required disk space and increase possible total recording time. The night video EEG monitoring can be performed if video camera with infrared illuminant is used. Video capture can be continuous or can be turned on and turned off manually many times. The video EEG can be played back in moving paper emulation mode. User interface provides a fast access to any part of EEG and video record. Video signal can be recompressed off line. Any selected part of video signal can be deleted to decrease total space. Any selected part of EEG and corresponding video signal can be copied to another smaller file to prepare the data for writing to CD. A free distributed video EEG viewer is available. It is similar to WinEEG programs and includes all functions for visual analysis of video EEG data you need.

2. Visual EEG Analysis.

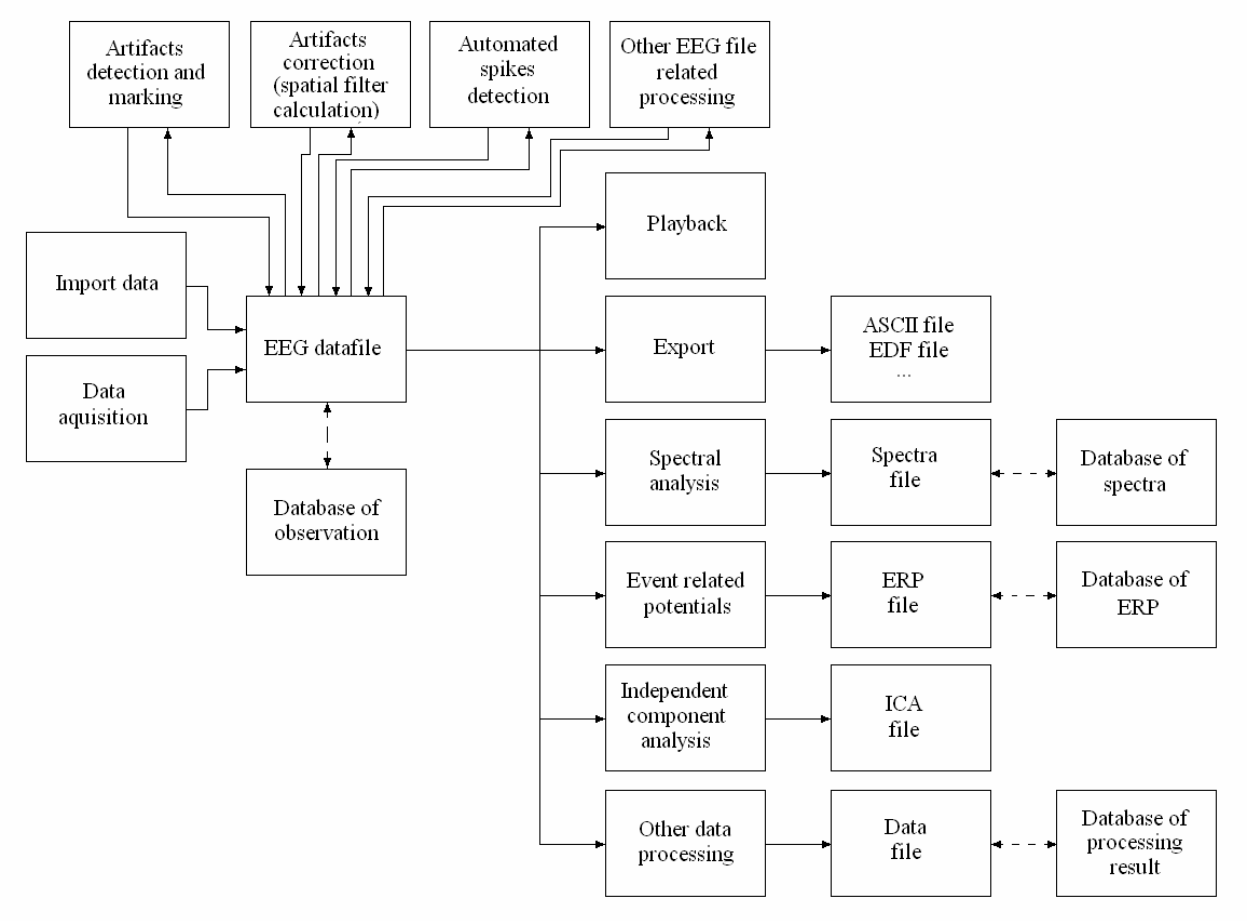
After finishing EEG acquisition, it is possible to analyze stored data visually. During both data acquisition and visual analysis, EEG signals are displayed in plotter-like mode. Also, the visual analysis mode enables manual measurement of signal parameters (intervals and amplitudes), horizontal and vertical (speed and sensitivity) scaling, marking sites of interest, removing artifacts, etc.

3. EEG Processing.

WinEEG includes the following methods of EEG analysis:

1) Digital EEG filtering.
2) Artifacts correction based on PCA or ICA decomposition and spatial filtering.
3) Automatic artifacts detection and elimination.
4) Automated dipole based spike detection.
5) Spectral and coherence analysis (including topographic power and asymmetry mapping)
6) Analysis of EEG indices.
7) Topographic mapping of instantaneous scalp potential values, spectral parameters and etc, using 2-D (spherical spline) or 3-D (LORETA) methods.
8) Source dipole localization
9) Event-related potentials.
10) Event-related EEG de-synchronization.
11) Event-related EEG coherence.
12) Event-related wavelet band power.
13) Event-related wavelet coherence.
14) The spectra of EEG independent components.
15) Single trial independent components analysis of ERPs

16) The grand average spectra of EEG independent components.
17) The grand average ERPs of independent components.
18) Exporting the data to ASCII file for analysis by another statistical package.
19) Computing of grand average EEG spectra, grand average EEG coherence, grand average ERP, grand average ERD for selected set of observation.
20) Comparison of EEG spectra, EEG coherence, ERP and ERD for different subjects (groups of subjects) or condition with the simplest estimation of statistical significance of differences.
21) Batch data processing. It helps to compute a lot of different spectra, ERP, ERD automatically and etc.



Data flow functional diagram

4. Composing a Final Report.

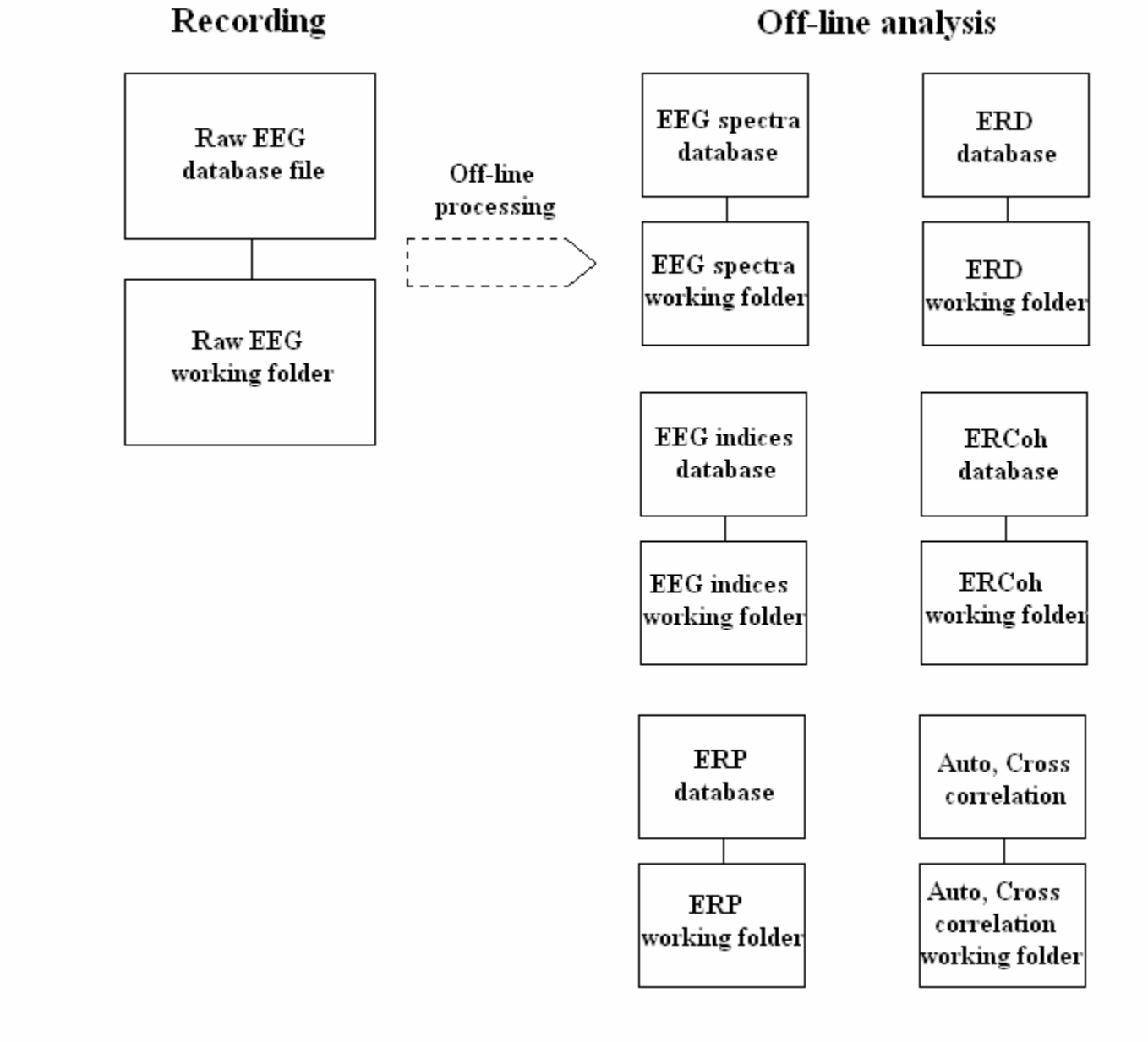
To create a final report, WinEEG has a built-in window text editor with standard text functions, including block operations. The patient card is automatically added to the report. There is also a help menu enabling automatic inclusion of standard formulations in the text. The final report can be prepared using MS Word. Both the patient card and pictures and tables of processing results can be inserted into final report text.

5. Printing EEG Fragments, Processing Results and Report Text.

WinEEG enables high-quality graphic printing of EEG signals and processing results on many of the most popular color or black-and-white printers. When printing EEG signals, absolute horizontal and vertical scales (paper speed, mm/sec, and sensitivity, Ohm/cm) are maintained with 10% accuracy. Color printing maintains hues when printing spectra, graphs and maps. Monochrome printers replace hues with gray levels.

6. Maintaining EEG Database and Processing Results.

WinEEG has a built-in database for simplifying data save and search. Using this database is not mandatory, but it provides features that are often useful. These include automatic conditional data search, long file archiving and record restoration tools, and dividing the whole set of EEG records into several independent databases (which may be placed on different changeable magneto optical disks or CD of large capacity).



WinEEG software database structure

Whole database is divided on two parts: EEG recording database and EEG processing results database. EEG recording database includes “raw EEG database file” – the list of EEG observations and “raw EEG working folder” that is the storage of EEG data files and corresponding video movies files and final report files. Off-line EEG processing results database includes six independent storages (see figure 6). Each of storages consist of “processing results database file” – the list of records and corresponding working folder using for writing “processing result files”.

Quick Start

The following steps describe briefly how to acquire an EEG and to create a final report:

1). Place the electrodes on the patient's head. For a normal investigation 19 electrodes are placed using the International 10-20 system. Also a "common point" electrode, "N" electrode and reference electrodes must be placed.

Attention!!! Common point and reference electrodes are to be placed in any case, whether bipolar or monopolar montage is used. If EEG is assumed to be recorded in reference to ears two reference electrodes are placed on the ears. A reference electrode can be placed on the forehead and connected to A1 or A2 input (the appropriate electrode is provided in the set) and a corresponding montage is set in the program. EEG signal quality depends on paying special attention to the placement of common point and reference electrodes.

2) Connect the electrodes to their respective inputs on the front panel of the amplifier block.

3) Set the electrode impedance checking mode using **Recording: Impedance** command. If the impedance value is satisfactory (less than 5 kOhm), close the **Control of Electrode Impedance dialog**. Otherwise re-install electrodes showing excessive impedance.

4) Run the **File: New command**. - Fill in the patient card, choose a montage and check it. When these actions are completed successfully, a new EEG window will be displayed on the screen.

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5) Run the **Recording: EEG Monitoring command**. Visually check the quality of the live EEG displayed in the new window. If any channel is acquiring EEG poorly, re-install the corresponding electrode(s). Check EEG acquisition quality using a monopolar montage, without averaging.

6) Run the **Recording: EEG Recording command** to start recording signals to a file. To stop recording, run the **Recording: EEG Recording command** once more. One fragment of the EEG will be recorded. Record another fragment if necessary. Before recording a fragment its name should be set using the **Fragment** list on the **Recording bar Input Control Toolbar**. If photo stimulation is necessary, set its frequency using arrows in the **PS Frequency** field of the **Recording bar**, start the EEG fragment recording, turn the photo stimulator on using the **Recording: Photostimulation (on/off)** command, wait for the time needed, change the photo stimulation frequency or turn the photo stimulator off, and so on. After finishing the photo stimulation procedure, stop EEG recording.

7) Stop EEG acquisition using the **Recording: Stop command**.

8) Save the newly created EEG file into the database using the **File: Save command**.

9) Remove the electrodes and let the patient go.

(**Attention!!!** To avoid data loss, do not carry out Step 9 before Step 8).

10) Analyze the newly recorded EEG. (See **EEG window**).

11) Open the **Final Report window** using the **Analysis: Final Report command**.

12) Compose the final report and save it to the database using the **File: Save command**.

13) Print the final report and illustrative fragments of the EEG using the **File: Print command**.

14) Close the WinEEG window using the **File: Exit command**.

Note. The EEG recorded to the database is the raw one, acquired using monopolar montage in relation to reference electrodes, with the bandwidth 0.5 - 30 Hz for "Mitsar EEG-2" or 0.15 - 70 Hz for "Mitsar EEG-3". But the EEG displayed on the screen is reformatted and filtered according to the montage parameters that have been set (see **Setup: Montage List command).** The raw EEG data may be reformatted into any montage, without limitation.

Data Archiving

Don't forget the main difference between "paper" and "paperless" technologies. By recording an EEG on a paper sheet and putting it in a bookcase, you can be absolutely sure it will be stored safely unless a catastrophe happens or an untidy colleague accidentally throws the EEG record in a dustbin. We of course assume that you have effectively arranged your EEG records so you can find any particular one among all the others, quickly and easily. Paperless technologies help avoid storing kilometers and kilograms of paper on bookshelves and also simplify searching for necessary records. But it is too soon for you to relax.

Unfortunately, practically no operating system enables 100% safe data storage. Moreover, magnetic media are sensitive to damage by different external factors, either mechanical or electromagnetic. Operating systems and environments on a computer hard disk are even more sensitive given additional damaging factors such as computer viruses, abuses, hardware (especially hard disk) and software failures. If you think your computer performance is stable enough, don't rush to calm yourself.

Remember your friends and colleagues who have been working on a PC for a year or longer? Do they ever complain that documents, graphs, tables or other data, having taken plenty of time to obtain, were "lost" or "cannot be read"? You should listen to them, because your unique experimental data, from one-time procedures - or your own creative results - is the most valuable information of all.

Modern computer technologies allow development of highly robust storage systems which are, however, very expensive to apply in medicine. So, **data archiving (duplication)** is the only way to save results of your work. Remember also that the capacity of your hard disk is limited, so sooner or later there will be no free space in which to continue working.

So, in case we succeeded in persuading you that accurate archiving and duplication of EEG data is necessary and inevitable, here are some words about magnetic media.

Of course, copying EEG files to floppy disks is the easiest way, but also the most expensive. CD or DVD Writers are the most convenient and relatively cheap. A CD or Writer costs $30-50, and a 700 Mb optical disk and 4.7 Gb DVD disk costs less than $1. So we recommend this device for EEG archiving.

Finally, what to archive?
EEG files, of course, are most valuable - and, in a number of cases, unrecoverable. After system setup, these files will be stored in the “\DATA” folder and named as D0000001.EEG, D0000002.EEG, D0000003.EEG, etc. These names are assigned automatically by the built-in database. Final report texts are also stored as D0000001.RTF, D0000002.RTF, D0000003.RTF or D0000001.DOC,

D0000002.DOC, D0000003.DOC, etc. Processing results, such as power spectra or EEG indices (.SPC and .IDX files respectively) can also be of a certain value.

In addition, there are database files eegbase.dbf, spcbase.dbf, idxbase.dbf, erpbase.dbf, bfbbase.dbf, etc., in the WinEEG working directory. These contain information necessary for automatic data searching and also links to data files. If you have EEG files or processing results stored, it is always possible to restore database files, but it can take plenty of effort. So we recommend archiving database files regularly.

Note that the placement of database and EEG files is not fixed and can be modified by user. So, additional attention may be needed to archive and duplicate data properly.

Digital EEG Filtering

WinEEG software offers at least two methods of digital EEG filtering.

The first method is used to define the bandwidth and to suppress AC line interference at 50 (60) Hz. It uses filters with infinite impulse response (IIR) characteristics that most accurately simulate the RC circuits used in "paper" chart recorders. In other words, IIR filters allow EEG recordings that most closely mimic results achieved by means of "paper" chart recorders. IIR filters with different order are used for various goals. Low cut filters are first-order so signal suppression outside the pass-band is small - 6 dB per octave. High cut filters are second-order. They signal suppression at stop-band is equal to 12 dB per octave. All notch filters are twelfth-order. This filters have the high suppression of at 50 (60) Hz – more then 40 dB. The notch filters with different stop-band can be used in dependence on settings: 45-55, 40-50, 35-65, 55-65, 50-60 or 45-75 Hz. The additional combinations of filters are also available 45-55 & 95-105, 40-50 & 90-110, 35-65 & 85-115, 55-65 & 115-125, 50-60 & 110-130 or 45-75 & 105-135 Hz. The last combinations of notch filters can be used for suppression both first and second harmonics of AC line interference.

Parameters of filters mentioned above can be set in the montage parameter list or by means of the **Filters bar**. The disadvantage of these filters is that they shift signal phase.

The second method can be used to detect signals in a certain frequency range, for example, when calculating event-related EEG de-synchronization. It uses filters with finite impulse response (FIR). They provide significant signal suppression outside the bandwidth of interest and do not shift signal phase. Filter parameters can be set by means of the **Setup: EEG Bandranges...** command. The disadvantage of these filters is that they take a long time for calculations so they can not be used for real time EEG acquisition.

Electrooculographic artifacts correction

The method of electrooculographic artifacts correction based on linear regression method in the time domain. It is very helpful if there are many artifacts related eyes blinks. To use this method an additional signal (electrooculogram) should be recorded. The electrooculogram (EOG) is recorded using two additional electrodes placed higher and below eye and connected to additional EEG channels (for example Fpz and Oz sockets). In this case a montage should include one additional bipolar channel Fpz-Oz.

During the processing WinEEG program using threshold criteria will automatically detect time intervals in which eye blinks were observed. Using this data WinEEG program calculates coefficient of influence

of EOG for each EEG channel separately. Finally WinEEG program subtracts EOG signal multiplied in corresponding coefficient from EEG signal. This correction procedure can be performed using Analysis: Remove EOG command.

Attention!!! The quality of work of this correction procedure depends on quality if EOG recording. The EOG and EEG signals should be recorded using the same frequency bands. Because additional artifacts can influence on quality of correction of eye blink artifacts the visual inspection of its result should be done.

Correction of EEG artifacts

Eye blink artifacts and some other artifacts can be corrected using this procedure even if the EOG signal was not recorded. This method based on blind source separation procedure from multi-channel EEG data and spatial filtering of some components of EEG signal. The input data is manually selected time interval including artifacts. Blind source separation can be performed using both principal component analysis (PCA) and independent component analysis (ICA) methods. After the decomposition of milti-channel signal the components of signal related to artifacts are selected manually based during the analysis of their topographies and waveforms of components. The components corresponding to artifacts are cleared (set to zero) and corrected EEG waveforms are computed by multiplying artifacts topographies matrix and new components set. In fact a spatial filter performing equivalent transformation is calculated and applied to raw EEG. This correction procedure can be performed using **Analysis: Artifacts correction and Analysis: Artifacts correction using templates** commands. At last case the artifacts related components are selected automatically using criteria of similarity to predefined artifact topography templates.

More information concerning this method can be found at: Jung T., Makeig S., Humphries C., Lee T., McKeown M., Iragui V and Sejnowski T. Removing electroencephalographic artifacts by blind source separation. // Psychophysiol. 2000, V.37, P.163-178.

It should be emphasized that the quality of artifact signal correction depends on a possibility to separate the blind source signals related to the artifacts. Theoretically the artifact related signals usually correlate with brain signals. As results there is no way to separate pure artifact related components. That is why some EEG signals will be suppressed also by this method. Our studies are shown that this method will suppress EEG and ERP signals for the frontal recording sites (Fp1 and Fp2 channels) to a marked degree. These studies are shown that ICA method will give smaller signal distortions in comparison with PCA method.

Attention!!! The quality of work of this correction procedure depends on selection of time interval used for estimation of spatial filter matrix. That is why the visual inspection should be done after performing this procedure. If the results of artifact correction are not satisfactory another time interval should be selected for analysis.

Automatic and manual artifacts elimination

WinEEG program includes different artifacts detection procedures. The simplest way is a visual inspection of EEG record and marking or removing the time intervals including artifact related signals.

Long term artifacts can be constantly removed from EEG recording. Following steps should be done to remove artifacts.

1. Find the time interval including artifact related signals by visual inspection.
2. Select the time interval using vertical markers (see Chapter 15.7.7).
3. Run command “Clear” from menu “Edit”.

WinEEG software will remove selected time interval from EEG recording and length of EEG file will decreases.

This method of removing artifacts related time interval has some disadvantage. The additional artifacts related to transient response of band pass and notch filters in EEG recording parts joint time moments.

Another manual procedure does not remove artifacts related time intervals from EEG recording but marks it only. These time intervals will exists in EEG recording but will be eliminated from processing

during EEG spectra, ERP, ERD, wavelet band power, wavelet coherence and independent components computation. Following steps should be done to mark artifacts.

1. Find the time interval including artifact related signals by visual inspection.
2. Select the time interval using vertical markers.
3. Run command “Cut” from menu “Edit”.

The time interval will be marked by horizontal blue bar placed on the bottom of EEG window. Marked time interval can be recovered.

The automatic artifact detection procedures base on comparison of any parameter of EEG signal with defined threshold. If this parameters of EEG for given time interval is higher then threshold then this time interval is marked as artifact and eliminated from further processing.

Most power artifact detection and marking procedure is implemented in Analysis: Mark Artifacts command. This procedure makes three independent EEG signal parameters comparison with defined thresholds:

1. The comparison of absolute voltage of signal with the threshold.
2. The comparison of amplitude of slow wave in defined frequency band with the threshold.
3. The comparison of amplitude of fast wave in defined frequency band with the threshold.

This procedure can be performed many times independently.

Command “Mark Artifacts…” from submenu “Analysis” runs this procedure. Search and rejection artifacts” dialog will appear on the screen and allows enter or change parameters of automatic artifact detection.

EEG Indices

The section describes the algorithm for analyzing EEG indices and its features.

We should note that the method of EEG index analyses implemented in this software is more a research method than a standard routine. That is why we recommend using this method only if you realize quite clearly what parameters and algorithms are used and what they mean.

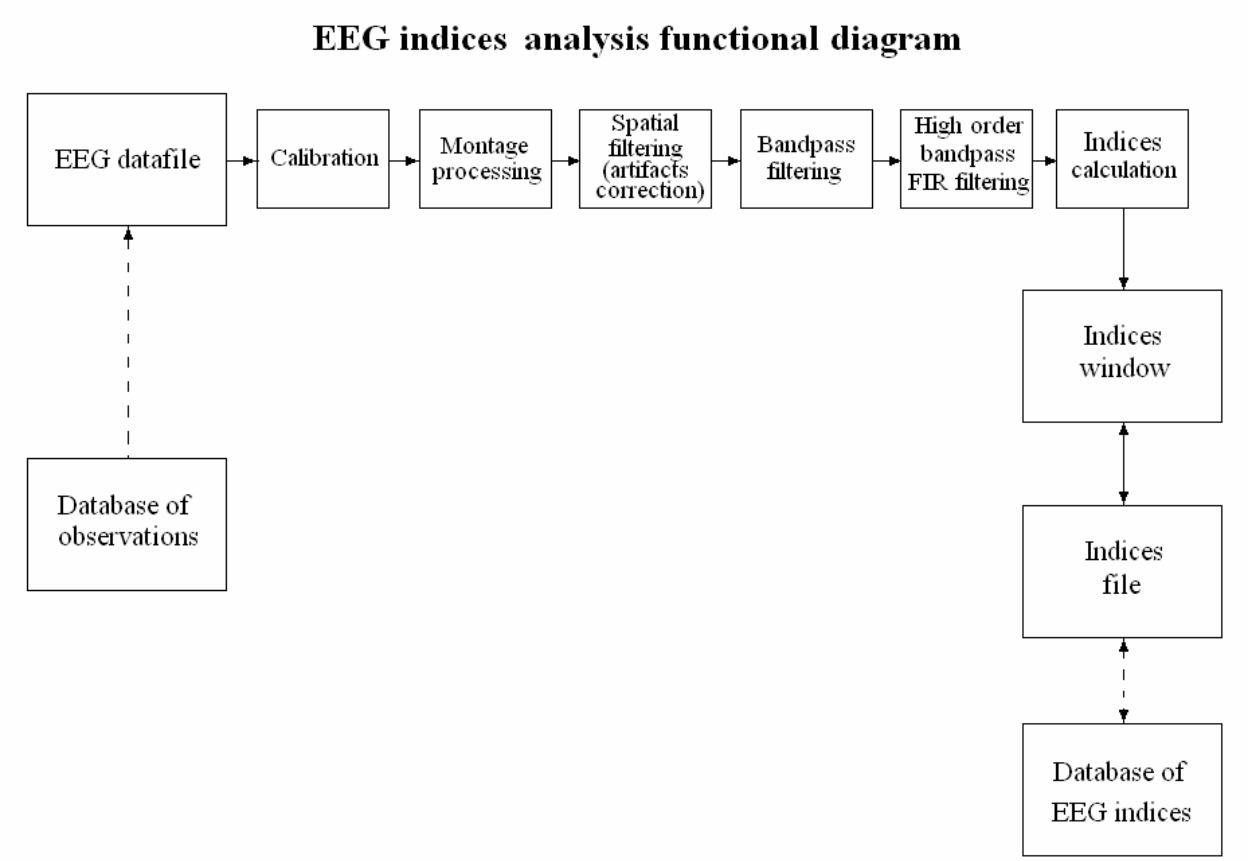
We define an EEG index as the percentage of time that EEG potential fluctuations occurred within a given frequency range. In other words, if we have defined four standard EEG frequency bands (alpha, beta, theta, and delta) then, after analysis of recording interval, four indices will be calculated for each EEG channel, representing percentages of time when the potential fluctuations had frequencies lying within the given ranges.

There is no standard algorithm for calculating EEG indices, so two methods are implemented in the WinEEG software: the first method is based on detection of zero crossings for half-wave period calculation; the second one - on detection of local peaks. In either case one additional parameter is used: this is the minimum (threshold) signal voltage for rejecting low-amplitude potential changes. So a zero crossing will be considered valid if there are two time readouts such that the signal voltage should exceed the threshold for the first readout, and fall below the threshold for the second one (for opposite polarity signal intervals, simply invert the threshold and signal relationships). Besides that, the potential values for time readouts placed between the above-threshold readouts found, should not exceed the threshold value. In other words, low-amplitude potential fluctuations are ignored in order to eliminate amplifier noises and external ones from the analysis. When detecting local peak values, also only those exceeding the given threshold are taken into account.

The threshold potential may be set as an absolute value (in microVolts) or as a relative one. In the relative case the standard deviation of the signal potential about zero is calculated and half of this value is accepted as the threshold.

Finally, raw EEG recordings are not used for processing, only those reformatted and filtered according to the user-selected parameters established in the active montage.

Following diagram illustrates consequence of processing and analysis steps.



EEG indices processing.

Therefore, **EEG indices calculation results depend on the processing parameters (set using the EEG Bandranges... command or in the Parameters of EEG indices computation dialog) and also on the montage parameters.**

While defining limits of the EEG frequency bands should not cause any difficulties, selecting parameters for the indices can be quite highly counter-intuitive.

If the threshold is too low (could be as low as zero), half-waves will be selected if there are any fluctuations of the signal. Taking into account that real amplifiers have some level of self noise and that there is also other noise detected in a number of cases, such a low selection of the threshold may well lead to detection of high-frequency oscillations, including some with a frequency exceeding 30 Hz. On the other hand, if a high threshold value is set, low-amplitude oscillations (beta-rhythm most likely) will be lost. In addition, these algorithms are unstable in the presence of circuit noise if its level is significant. So it is impossible to offer unified recommendations for choosing the optimal amplitude threshold setup, especially in view of the dependence of noise level on montage parameters and the notch filter use. Here we list a set of parameters that is optimal from our point of view: low-frequency filter 30 Hz, notch filter

50 Hz is on, absolute peak-to-peak threshold 3 uV. The peak-to-peak threshold should be chosen to exceed the amplifier noise level for the chosen bandwidth.

Selection of half-wave detection algorithm is also not trivial.

If you use the algorithm based on zero crossing detection, processing will detect low-frequency high-amplitude oscillations caused by signal baseline fluctuations generated by motor or vascular artifacts. The influence of artifacts can be reduced by choosing a lower frequency limit. We recommend the value of 0.1 sec (or 1.5 Hz). Unfortunately, even in this case estimated EEG indices would be offset towards the low frequency range. For example, high-frequency low-amplitude signal oscillations in the beta range are often observed against high-amplitude low-frequency potential fluctuations. In this case, the zero-cross half-wave detection algorithm will not detect the high-frequency signal components. However, at the same time, the results obtained by means of this algorithm will correspond better to those of spectral analysis, although not precisely.

On the other hand, the algorithm of half-wave detection from local extremes is less sensitive to motor and vascular artifacts and is also more sensitive when detecting high-frequency low-amplitude signal oscillations. The results of EEG indices analysis by means of these methods are the closest to visual EEG estimations. Though this method leads to some offset of the indices toward the high-frequency range, we consider it to be the most stable. But, unfortunately, this approach is used practically nowhere and seems to be original. That, certainly, is a significant disadvantage for its implementation in routine encephalographic investigations.

So, if you still have not given up EEG indices analysis, here are some recommendations that of course must not be considered as dogma:

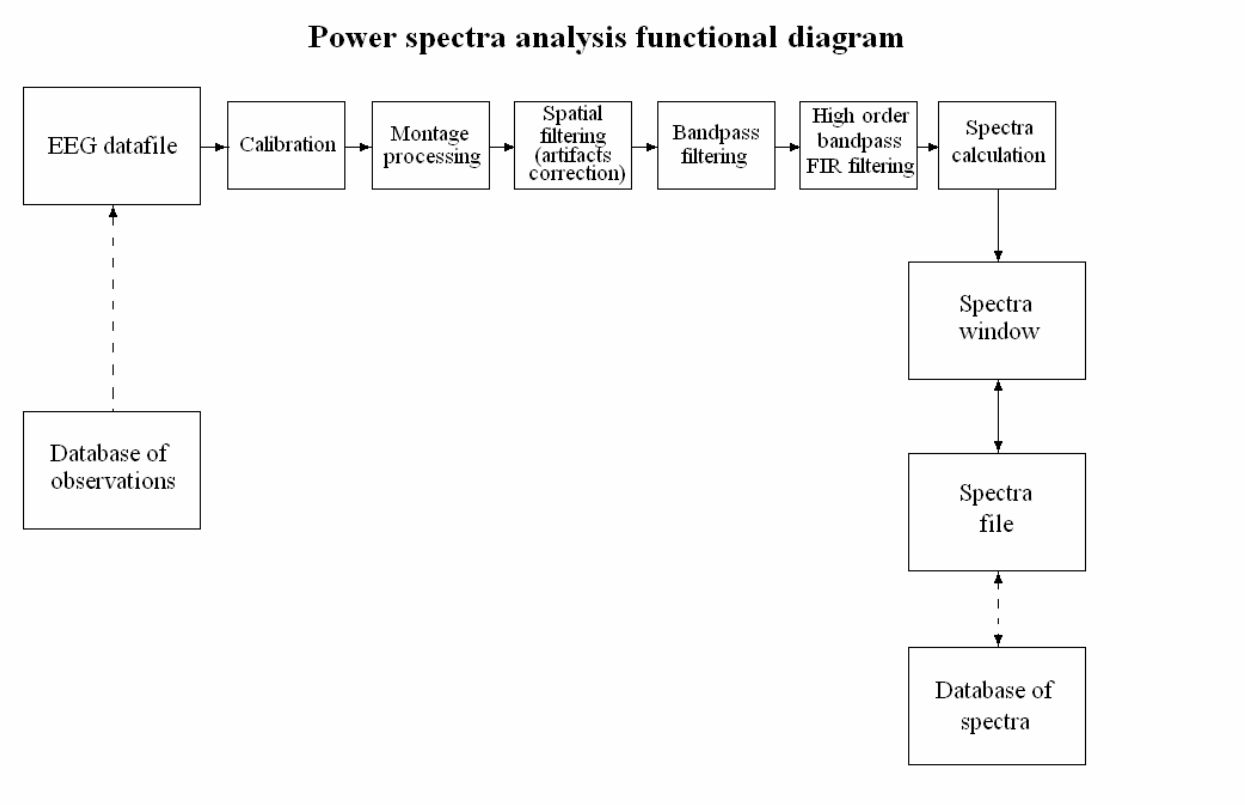
1) Choose the bandwidth (we recommend 0.1 sec for low cut and 30 Hz for high cut).
2) Turn on the notch filter.
3) Set the absolute threshold near 3 uV.
4) Choose an appropriate algorithm of half-wave detection (the local extreme-based algorithm has a number of advantages but if you use it, further comparison of results with the limited, existing data will be complicated). The algorithm choice, therefore, is defined by your goal.
5) Either fix the chosen parameters once and for all, or systematically investigate the dependence of results on control parameters. Don't try to manipulate parameters in order to reach a certain local goal: for example to prepare a remarkable illustration for your EEG description.
6) A final reminder: there are no standards or norms for the methods of EEG indices analysis.

EEG Power Spectra

This section describes the algorithm of power spectral computation.

We assume you are already acquainted with theoretical basis of spectral analysis. If not, you can find complete information in the book by J.Bendat, A.Pirsol «Random data. Analysis and measurement procedure», John Wiley and Sons, NY 1986, 540 pp**.** As for the practical use of EEG spectral analysis in the diagnosis of diseases, you can read specialized journals such as «Electroencephalography and Clinical Neurophysiology».

Following diagram illustrates consequence of processing and analysis steps.



EEG spectra analysis.

We will briefly describe the features of power spectral calculation algorithms implemented in WinEEG. Suppose that we process a single interval of an EEG record:

1) First of all, the source EEG record interval is reformatted and filtered according to the active montage parameters (i.e. the montage currently selected by the user).
2) Channels not included in the list of channels to process are excluded from the reformatted and filtered multi-channel record.
3) The entire record interval is divided into equal parts (epochs). The length of an epoch is defined by adjusting the Epoch Length parameter in the menu displayed by **Analysis: Spectra**. Epoch Length may be set equal to 1, 2 or 4 sec. Overlapping of the epochs is also set as a parameter when dividing the record interval into epochs. If Overlapping is set equal to 50%, beginning with the second epoch each, the first 50% of each epoch overlaps the final 50% of the previous epoch. After the interval is divided into epochs, separate calculations are performed for each channel.
4) For each EEG epoch, polynomial trend parameters are computed and the trend is compensated. The order of the polynomial trend is set by means of the corresponding parameter and can be chosen from 0 to 5. If zero trend order is chosen, only the constant (DC) component is eliminated.
5) To suppress energy infiltration through filter side lobes, each epoch is smoothed by a time window. Bartlett, Hanning and Welch time window types can be selected. If a rectangular time window is used then energy infiltration through side lobes would not be suppressed (and in this case there would be no sense in using half-overlapping analysis epochs).
6) The power spectrum is computed by means of "quick Fourier transformation".
7) For the frequency interval set by the Low-Frequency Band parameter, signal power is calculated and compared with the Maximal Low-Frequency Signal Power parameter value. If the power calculated exceeds that set by the last parameter then the EEG epoch is treated as an artifact. To cancel artifact elimination, select zero (0.25 Hz) limits of Low-Frequency Signal Range parameter. Note that an EEG epoch is treated as artifact if low-frequency signal power exceeds the limit value for any of the channels.

8) Finally the average spectrum is calculated for each separate channel over all non-artifact EEG record epochs in the single interval.

You may think choosing EEG spectral analysis parameters is too cumbersome. If so, we recommend you use a standard parameter set: epoch length - 4 sec, 50% overlapping, zero order of polynomial trend, Hanning time window, 0.2-1.25 Hz range of low-frequency signal, 200 mkV^2 maximal low-frequency signal power. The duration of the analyzed interval should not be less than 10 sec (for at least 4 epochs to be averaged). Use other settings and parameter values only when needed to obtain data compatible with that described in the literature.

EEG power spectra dynamics, EEG coherence, EEG phase spectra, bi-spectra and bi-coherence can be computed and saved together with EEG power spectra but auto and cross correlations are computed separately and saved in another file.

Event-Related Potentials

This section describes the main features of the event-related potential (ERP) acquisition tool. (We assume you are familiar with the ERP method.)

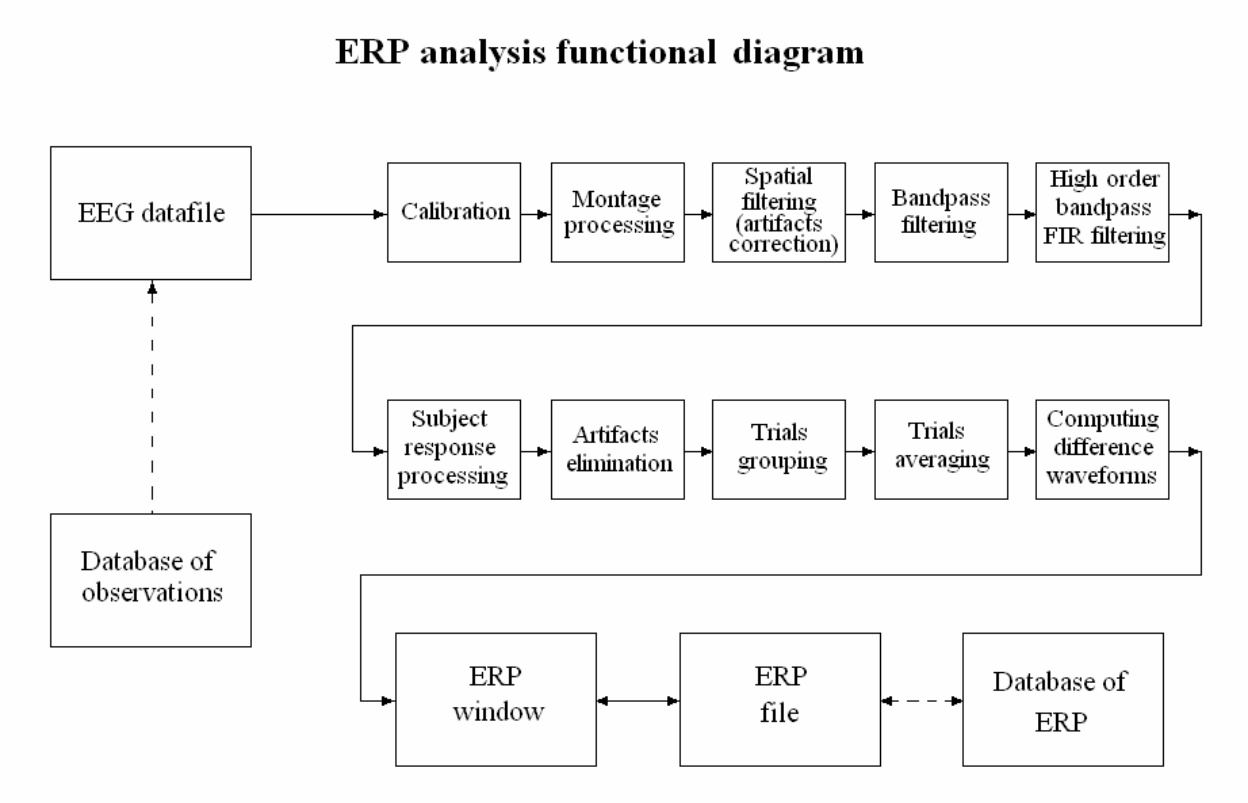
WinEEG permits recording the simplest long-latency visual evoked potentials (evoked by a photo stimulator flash) as well as event-related potentials (ERP_, such as P300 wave, mismatch negativity (MMN), conditionally negative variance (CNV) and many others. In evoked response measurements, an additional computer is used as a universal device for presenting visual and auditory stimuli. It is connected to the WinEEG computer by a null-modem (link) cable through the COM1 or COM2 serial port in order to synchronize stimulation and EEG recording. The stimulus-presenting computer should use PSYTASK 2.x software working in concert with WinEEG. In addition, a pushbutton connected to the ECG channel input or to “digital input” (in dependence on amplifiers type) can be used for monitoring user response.

Although EEG is being recorded non-stop during the whole investigation, non-overlapping EEG intervals (trials) will be selected for ERP calculation, for synchronizing signal, and used for ERP summation. If photo flash ERPs are recorded then trial length and pre-stimulus interval duration are set as processing parameters. In this case you may calculate ERPs for a selected EEG record interval, for the whole record, or for each fragment separately.

If an additional stimulus-presenting computer is used, trial length is defined by a protocol set in the PSYTASK program. In this case one trial can present more than one stimulus. Several different ERPs are calculated for different trial subsets. To sort trials into subsets, special trial labels (arbitrary integer numbers) are also set in the stimuli presentation protocol.

Artifact records are eliminated during ERP calculation. For cognitive ERPs, the patient response is also analyzed: reaction time and percent of error are calculated separately for each trial subset.

Following diagram illustrates consequence of processing and analysis steps.



ERP analysis.

Finally, you can average ERP over a group of patients selected from the database.

Event-Related EEG De-synchronization and Coherence

Event-related EEG de-synchronization (ERD) and event-related EEG coherence (ERCoh) are computed similarly to ERPs (see above). ERD and ERCoh can be calculated only for EEG files recorded together with stimulus presentation by PSYTASK program on an additional stimulus-presenting computer.

Below we describe the algorithm of ERD computation (see *Kalcher J. Pfurtsheller G.* Discrimination between phase-locked and non-phase-locked event-related EEG activity // EEG and Clin. Neurophysiol. 1995, V. 94, P.381. and G. Pfurtscheller, F.H. Lopes da Silva. Event-related EEG/MEG synchronization and desynchronization: basic principles // Clinical Neurophysiology. 1999, V. 110, P. 1842-1857.). The method of ERCoh is not common at present but it is described, for example, in: Shibata T., Shimoyama I., Ito T., Abla D., Iwasa H., Koseki K., Yamanouchi N., Sato T., Nakajima Y. The synchronization between brain areas under motor inhibition process in humans estimated by event-related EEG coherence // Neurosci. Res. 1998, v.31., p. 265-271.

Event-related EEG de-synchronization and synchronization (ERDS) is calculated by several steps:

1) To reduce the affect of the common referent, source EEG is reformatted to average weighted referent (do not forget to use a montage containing an average weighted referent AvW).

2) The signal for a given frequency range is detected for each EEG fragment (trial) by means of digital band pass filters (do not forget to turn band pass filter on).

3) To reduce the influence of ERP components on ERDS, averaged ERPs are computed over the trial to be then subtracted from each trial.

4) To assess EEG signal power dynamics for a given frequency range, for each time readout (bin) the values are squared and averaged over all trials.

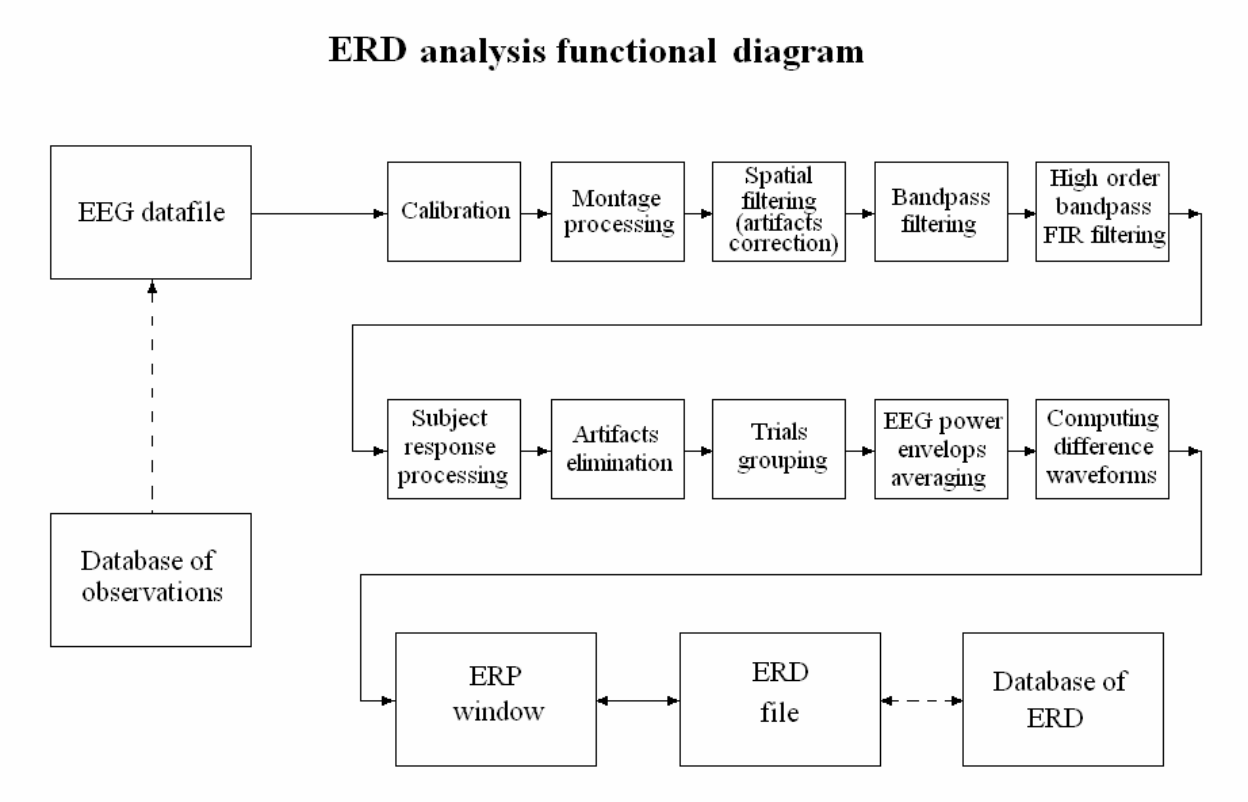
5) To reduce data dispersion, the EEG power dynamics is smoothed by moving average with averaging epoch width (optimally 100 ms or 25 bins).

6) ERDS is calculated as percent of signal power change for each bin in relation to average power during the prestimulus interval (R):

((P(i) - R) / R) x 100%

The signals obtained are then averaged similarly to ERPs.

Following diagram illustrates consequence of processing and analysis steps.



ERD analysis.

Wavelet ERP and Wavelet Coherence Analysis

The wavelet ERP and wavelet coherence analysis is performed similarly to cognitive ERP computation, wavelet ERP and wavelet coherence analysis can be performed only for EEG files recorded together with stimuli presentation by PSYTASK program on an additional stimulus-presenting computer.

These methods is based on signal power and coherence dynamics assessment for the given frequency range by means of source EEG wavelet decomposition. Usually Morlet's wavelet transform is used for signal decomposition. Detailed description event-related band power computing can be found in Tallon-Braudry C., Bertrand O. Oscillatory gamma activity in humans and its role in object representation // Trends in Cognitive Science 1999. V.3., No 4, P.151-162, and detailed description the algorithm of wavelet coherence computation is present in R. Saab, M.J. McKeown, L.J. Myers, R. Abu-Gharbieh. A Wavelet Based Approach for the Detection of Coupling in EEG Signals // Proceedings of the 2 International IEEE EMBS Conference on Neural Engineering Arlington, Virginia · March 16 - 19, 2005. P.616-620

Recording and analysis of ERP, ERD, ERCoh Wavelet Power and Wavelet coherence.

This chapter includes a brief description of method of recording and analysis of ERP, ERD and ERCoh. More information can be found in **PSYTASK user manual** and in the next chapters of this manual: **EEG window, ERP window, Analysis: Compute ERP… command, Analysis: Compute ERD… command, Analysis: Compute ERCoh… command, Analysis: Compute Wavelet… command, Analysis: Compute Wavelet coherence… command, Stimuli Presentation Program List dialog, Parameters For Event-Related Potential Computation dialog, Parameters For Event-Related De-synchronization Computation dialog, Parameters For Event-Related Coherence Computation dialog, Wavelet Decomposition dialog, Wavelet Coherence dialog, Choose Group Differences dialog, Artifact Rejection Thresholds dialog, Subject Response Processing Parameters dialog, Export and Import the data, Batch data processing, Select List of Channels dialog, Results of Averaging And Subject Response Processing dialog, Graphics Page Format Dialog, EEG Bandranges dialog, Parameters of Bandpass Filter dialog and Equipment Configuration dialog**.

The ERP and other mentioned above studies can be performed if EEG is recorded synchronously with stimuli presentation. The additional signal from special micro switch can be recorded for estimation of reaction time and task performance. The auditory and visual stimuli can be presented by PSYTASK program developed by Mitsar Ltd or by conventional stimuli presentation software (for example Presentation or E-Prime program). An additional computer is used for stimuli presentation. Both computers should be connected by null-modem cable.

Equipment preparation for performing ERP studies.

The preparation of computers for ERP studies will be describe below only for using the PSYTASK program for the stimuli presentation. The information concerning preparation of computers for using other presentation software can be found in corresponding user manuals.

1. Installation and preparation PSYTASK program.

1. Install PSYTASK program. To do this installation insert CD with PSYTASK setup program and run SETUP. Follow the instruction on the screen.
2. Run PSYTASK program.
3. Perform Modify Synchronization Parameters (Windows XP) command and check parameters of Serial Port for External Synchronization. The default parameters are the next:
   Baud Rate – 57600,
   Word length – 8,
   Stop bits –1
   Parity – NONE
   You can change these parameters. But in this case you should change them in WinEEG program also (see Setup: Equipment configuration command).

2. Testing the synchronization of computers.

4. Perform Switch to Slave Mode command of PSYTASK program.
5. Perform Analysis: Stimuli Presentation Programs command of WinEEG program
6. Click “Update” button. If synchronization COM ports are defined correctly the progress bar will display a process of transferring of task protocols from PSYTASK program to WinEEG program. Otherwise WinEEG program will report that the slave computer doesn’t respond.
7. Change the COM ports and their parameters if it is necessary using Modify Synchronization Parameters command of PSYTASK program and Setup: Equipment configuration command of

WinEEG program and perform 4-7 steps. It is necessary to find correct combination of COM ports.

Attention!!! It is necessary to perform steps 4-6 every time when the list of tasks or their parameters is changed in PSYTASK program.

Attention!!! PSYTASK program is able to send correct task protocols. Please be attentive and check newly added task protocols before updating list of protocols for WinEEG program.

Carrying out of ERP studies.

1). Place the electrodes on the patient's head. For a normal investigation 19 electrodes are placed using the International 10-20 system. Also a "common point" electrode, "N" electrode and reference electrodes must be placed.

Attention!!! Common point and reference electrodes are to be placed in any case, whether bipolar or monopolar montage is used. If EEG is assumed to be recorded in reference to ears two reference electrodes are placed on the ears. A reference electrode can be placed on the forehead and connected to A1 or A2 input (the appropriate electrode is provided in the set) and a corresponding montage is set in the program. EEG signal quality depends on paying special attention to the placement of common point and reference electrodes.

2) Connect the electrodes to their respective inputs on the front panel of the amplifier block.

3) Set the electrode impedance checking mode using **Recording: Impedance** command. If the impedance value is satisfactory (less than 5 kOhm), close the **Control of Electrode Impedance dialog**. Otherwise re-install those electrode(s) showing excessive impedance.

4) Run the **File: New command**. - Fill in the patient card, choose a montage and check it. When these actions are completed successfully, a new EEG window will be displayed on the screen.

.

5) Run the **Recording: EEG Monitoring command**. Visually check the quality of the live EEG displayed in the new window. If any channel is acquiring EEG poorly, re-install the corresponding electrode(s). Check EEG acquisition quality using a monopolar montage, without averaging.

6) Run the **Recording: EEG Recording command** to start recording signals to a file.

7) Run the stimuli presentation program using the **Recording: Stimuli Presentation Program command.**

8) Use the **Recording: Pause command** to temporary stop EEG recording and stimuli presentation if it is necessary. Use **Recording: EEG Monitoring command** to continue EEG recording and stimuli presentation.

9) Stop EEG acquisition using the **Recording: Stop command.**

10) Save the newly created EEG file into the database using the **File: Save command.**

11) Remove the electrodes and let the patient go.

(**Attention!!!** To avoid data loss, do not carry out Step 11 before Step 10).

12) Analyze the newly recorded EEG using commands: **Analysis: Compute ERP… command, Analysis: Compute ERD… command, Analysis: Compute ERCoh… command, Analysis: Compute Wavelet… command**.

Attention!!! If it is necessary to study subject reaction time and task performance parameters (omission and commission errors) the signal from special micro-switch should be recorded. To do this:

1) Connect micro-switch to ECG socket or to digital inputs socket (in dependence on type of EEG amplifiers).
2) Add ECG channel to montage planed to use (if ECG socket is used).
3) Don't forget to define the parameters of processing of button signal.

Computing and analysis of ERP, ERD or ERCoh.

To compute and analyze ERP (ERD, ERCoh or Wavelet) three steps should be performed:

1) Manual or automatic artifact rejection.
2) Computing the ERP (ERD, ERCoh or Wavelet) using **Parameters for Event-Related Potential Computation, Parameters for Event-Related De-synchronization Computation, and Parameters for Event-Related Coherence Computation and Wavelet Decomposition dialogs.**
3) Analysis of ERP (ERD, ERCoh or Wavelet) using **ERP window.**

We don't describe details in this chapter. For more information see below in corresponding chapters. But we should to make a number of definitions to simplify understanding of used processing parameters.

Each task consists of a number of trials. The trial is some minimal time interval during which one or more stimuli are presented and subject responds according to the instruction. A digital label is defined to each trial according to mean of stimulus (stimuli) and task instruction. This digital labels help to sort EEG sweeps corresponding to task trials for averaging.

As an example we will consider so called "Odd ball" task using for P300 studies. During this task two different stimuli are presented: a standard (frequent) stimulus and deviant (rare) stimulus. The subject should press a button in response to the presentation of deviant stimulus. The whole task will be divided on two parts. Let trial corresponding to presentation of standard stimulus in the first part of task have digital label 1, deviant stimulus in the first part – 2, standard stimulus in the second part – 3 and deviant stimulus in the second part – 4. We want to compute ERP corresponding to standard and deviant stimuli in the first and second parts separately. Also we want to compute the ERP corresponding to standard and deviant stimuli in whole task. In this case we need to define at least six averaging groups (see **Parameters for Event-Related Potential Computation)** for which the ERP will be computed separately. This definition can be done as shown below:

Standard1	1
Deviant1	2
Standard2	3
Deviant2	4
Standard	1,3
Deviant	2,4

The computation of differences of waveforms is very useful for ERP analysis. To do this the averaging Group of differences should be defined. The three useful groups of differences can be defined for

mentioned above example: Deviant1 – Standard1, Deviant2 – Standard2 and Deviant – Standard. In this case the processing parameters will be the next:

2-1,4-3,6-5

The artifacts elimination procedure bases on comparison absolute voltage of EEG with defined threshold. The recommended value of voltage threshold is in voltage interval from 70 to 100 uV.

Attention!!! Select “Only EEG” mode for artifact detection if the micro-switch signal was recorded. Otherwise all sweeps including subject response will be eliminated.

Usually the synchronization by first stimulus is recommended. Another setting of synchronization parameters can be used if two or more stimuli in the trials are presented with different intra stimuli interval.

The parameters of subject response processing should be defined if signal of micro-switch was recorded only.

Finally WinEEG have a number of predefined sets of ERP processing parameters saved in the files into WinEEG\ERPPARAM folder and corresponding to each example of task included in PSYTASK program:

P300.PAR	- for Odd ball task,
Go_NoGo.RAP	- for Go-NoGo task,
TOVA.PAR	- for TOVA task,
PAT_H.PAR, PAT_HLR.PAR, PAT_LR.PAR	- for Reversionary pattern tasks.

The parameters of computation of ERD, ERCoh and Wavelet are the similar.

Analysis of EEG independent components and ERP independent components

A common view of EEG and ERP components recorded from the scalp is that they are a superposition of several signals from sites placed inside the brain. Many attempts of localization of these sources were made at different scientific laboratories in the world. The results of this studies is the development very effective methods of localization of equivalent brain sources thus as dipole source localization, low resolution electro-magnetic tomography and etc.

This studies display some problems that should be solved to increase the accuracy of localization of brain sources. So in the case of equivalent dipole sources localization the number of dipoles is a priori unknown.

One of solution of this problem is to decompose raw multi channel EEG to a number of components using information about interaction of signals recorded from different sites and localize equivalent sources for resulting components separately. The additional suggestion is usually any independence of these components.

Assumptions that underline the application of ICA for analysis of array of individual EEG and ERPs are as follow: 1) summation of the electric currents induced by separate generators is linear at the scalp

electrodes; 2) spatial distribution of components' generators remains fixed across time, 3) generators of spatially separated components are temporally independent from each other (for review see Onton, J., Westerfield M., Townsend J., Makeig, S., Imaging human EEG dynamics using independent component analysis // Neuroscience and Biobehavioral Reviews 2006, V.30, P.808–822.).

This problem can be formulated mathematically as follow. Let $X_i(t)$ is raw EEG signal recorded from i-th electrode ($i = 1, N$), t – time, $s_j(t)$ is the signal from j-th blind source ($j = 1, M$) placed inside the brain. Let $X_i(t)$ is the sum of $s_j(t)$ with different waves:

$$X_i(t) = \sum_j A_{i,j} s_j(t)$$

Here $A_{i,j}$ is a matrix of weights. The task is to recover a version,

$$u_j(t) = \sum_i W_{j,i} X_i(t) ,$$

of original sources $s_j(t)$ by finding a matrix $W_{j,i}$.

A number of methods as principal component analysis (PCA) suggest that the sources $s_j(t)$ are uncorrelated ($\langle u_i u_j \rangle = 0, \ \forall \ ij$). In contract with decorrelation techniques independent component analysis (ICA) is imposes a much stronger criterion, statistical independence required that all second-order and higher-order correlations of $u_j(t)$ are zero. Statistical independence means the joint probability density function (pdf) of the output *factorizes*

$$p(u) = \prod_{i=1}^{N} p_i(u_i)$$

The data submitted to ICA are simply the recorded EEG channel data arranged in a matrix of n channels (rows) by t time points (columns). No channel location information at all is used in the analysis. ICA performs a blind separation of the data matrix (X) based only on the criterion that resulting source time courses (U) are maximally independent. Specifically, ICA finds a component 'unmixing' matrix (W) that, when multiplied by the original data (X), yields the matrix (U) of independent component (IC) time courses.

Each column of the (W^{-1}) mixing matrix represents the relative projection weight at each electrode of a single component source (IC topography). Mapping these weights to corresponding electrodes on a cartoon head model allows visualization of the scalp projection or scalp map of each source. The source locations of the components are presumed to be stationary for the duration of the training data. That is, the brain source locations and projection maps (W^{-1}) are assumed to be spatially fixed, while their 'activations' (U) reveal their activity time courses throughout the input data. Thus, the IC activations (U), can be regarded as the EEG waveforms of single sources, although obtaining their actual amplitudes at the scalp channels requires multiplication by the inverse of the unmixing matrix (W^{-1}).

The back-projected ICs (X_i) are in the same mV units as the recorded scalp data. However, neither the IC scalp maps nor the IC activations are themselves calibrated. Rather, the original activity units (mV) and polarities (+/-) are distributed between the two IC factors - the IC scalp map and activation time series. For example, reversing the polarities of the activation and inverse weight matrices, then back-projecting the activations through the respective columns of W^{-1} recovers the original component

activities in their native mV units. Thus, neither the sign of the scalp maps nor the sign of the activations are meaningful in themselves, but only their product, which determines the sign of the potential accounted for at each scalp channel. However, IC activation magnitudes may be normalized by multiplying each by the root-mean square (RMS) amplitude of the corresponding IC scalp map. The activation units are then RMS mV across the scalp array.

The matrix W can be s found using the infomax approach (see Bell A.J., Sejnowski T.J. An information-maximization approach to blind separation and blind deconvolution // Neural. Comput. – 1995. – Vol. 7. – P. 1129-1159., Lee, T.W., Girolami, M., Sejnowski, T.J., 1999. Independent component analysis using an extended infomax algorithm for mixed subgaussian and supergaussian sources. Neural Computation 11, 417–441.) to carry out blind source separation. Infomax ICA is one of a family of algorithms (Cardoso, J.-F., Laheld, B., 1996. Equivariant adaptive source separation. IEEE Transactions on Signal Processing 44, 3017–3030.; Comon, P., 1994. Independent component analysis, a new concept. Signal Processing 36, 287–314. Jutten C and Herault J (1991): Blind separation of sources I. An adaptive algorithm based on neuromimetic architecture. Signal Processing 24:1–10.) that exploit independence to perform blind source separation. ICA algorithms can separate complex multi channel data into spatially fixed and temporally independent components whose linear mixtures form the input data records, without detailed models of either the dynamics or the spatial structure of the separated components.

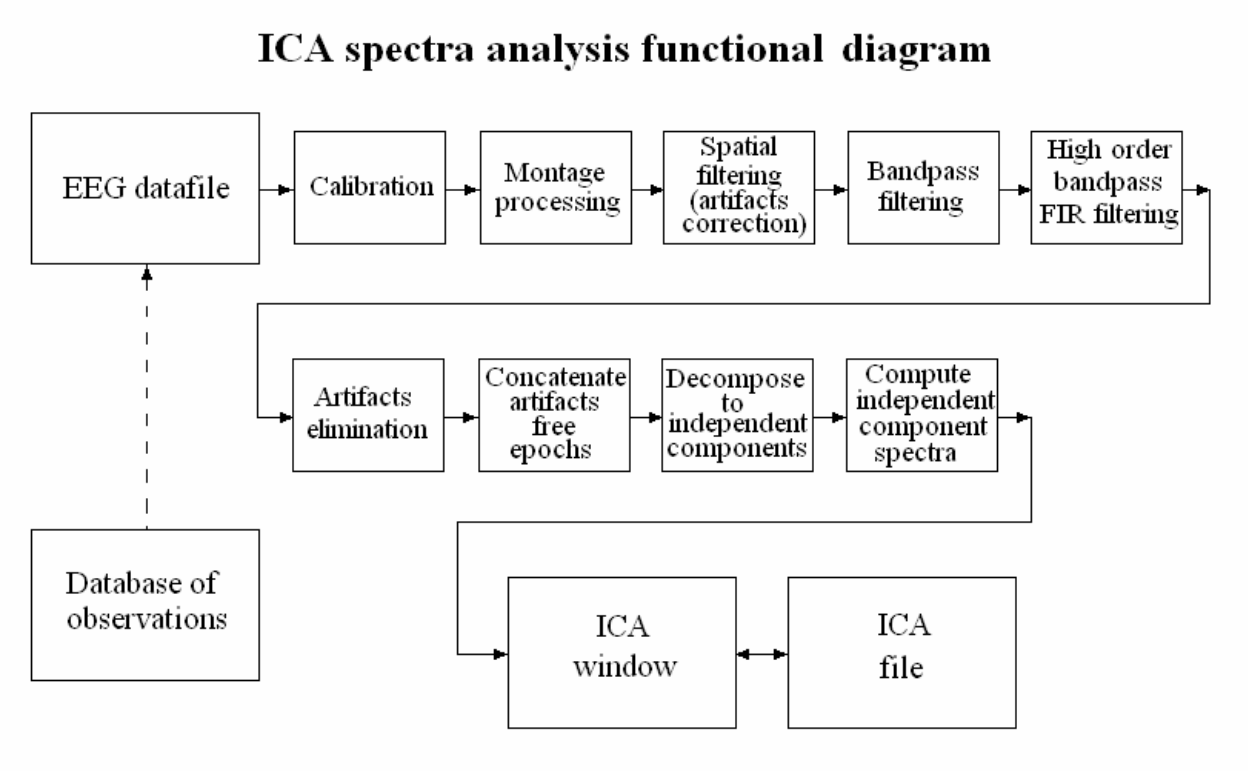
The “Infomax” algorithm was implemented in EEGLAB software (Delorme A., Makeig S. EEGLAB: an open source toolbox for analysis of single-trial EEG dynamics including independent component analysis // Journal of Neuroscience Methods 2004, Vol.134, pp. 9–21.) and successfully applied for both analysis of independent components of EEG, ERP (for review see Onton, J., Westerfield M., Townsend J., Makeig, S., Imaging human EEG dynamics using independent component analysis // Neuroscience and Biobehavioral Reviews 2006, V.30, P.808–822.) and for artifacts correction procedures (Delorme A., Sejnowski T, Makeig S. Enhanced detection of artifacts in EEG data using higher-order statistics and independent component analysis. NeuroImage, 2007, V. 34, P. 1443–1449.).

This “Infomax” algorithm was implemented in WinEEG software for analysis on raw EEG and ERPs. WinEEG program provides following possibilities:

1 The spectra of EEG independent components.

The spectra of EEG independent components are computed for selected time interval. Multi-channel raw EEG is decomposed to independent components. Than power spectra are computed separately for each independent component similarly described above. The single spectra, average spectra and component topographies are displayed in ICA window and are available for analysis.

Following diagram illustrates consequence of processing and analysis steps.



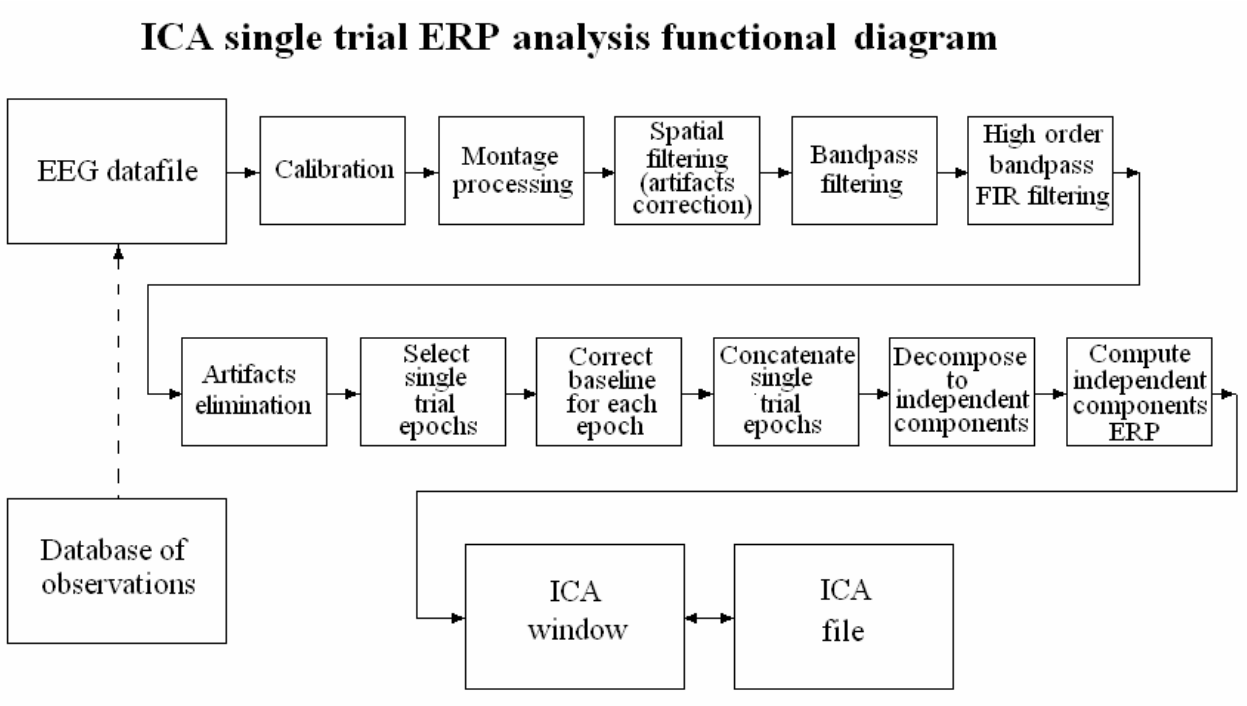
Computing and analysis independent components spectra.

The command “Independent component spectra” from menu “Analysis” runs this procedure.

2 Single trial independent components analysis of ERPs.

The independent components of ERPs are computed not for whole EEG file but for specified time intervals beginning after selected time events (stimulus in the trials). This time intervals are merged to continuous time series and corresponding multi-channel raw EEG is decomposed to independent components. ERPs are computed separately for each independent component similarly described above ERPs calculation (Chapter 15.15). Single trials component waveforms, average component ERPs and component topographies are displayed in ICA window and are available for analysis.

Following diagram illustrates consequence of processing and analysis steps



Computing and analysis independent components ERP.

The command “Independent component ERP” from menu “Analysis” runs this procedure.

3 The grand average spectra of EEG independent components.

The spectra of EEG independent components are computed for selected in EEG database collection of EEG recordings. Additional assumption is also suggested that cortical localization of components is similar between subjects, so that it is viable to implement the ICA on array of EEGs. The ICA decomposition of the array of individual EEGs was performed as follows. Several seconds epochs (defined as parameter of processing) of artifact-free multi channel EEG recording of each subject were merged into conjunct time series. This time series was used for assessment of *W* matrix.

Let X_c - conjunct time series.

$$X_C = \bigcup_j X_j$$

where X_j – individual EEG of j-th subject, and $\bigcup_j$ denote conjunction operator.

The unmixing matrix was estimated in accordance to the next equation

$$X_C = W_C^{-1} S_C$$

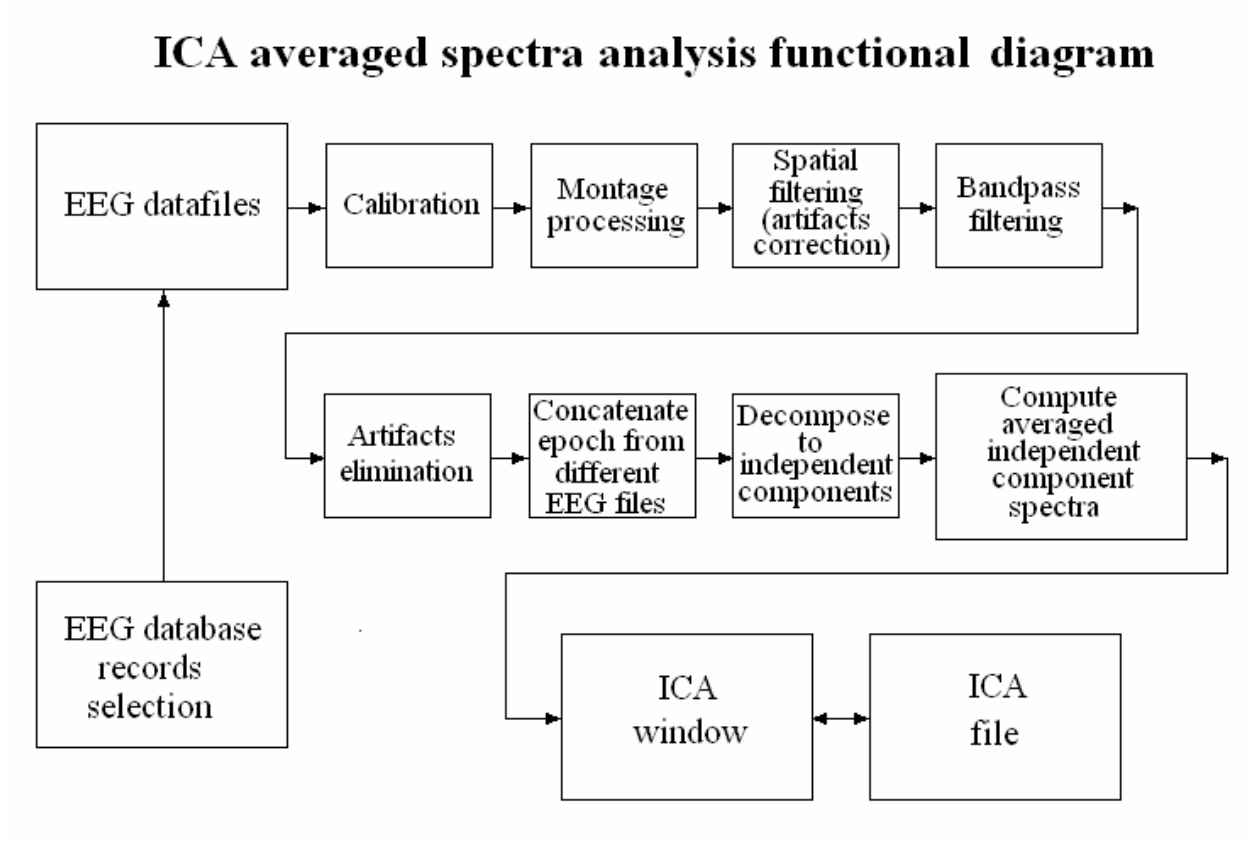
using Infomax algorithm.

Then individual activation curves for each subject were calculated as following

$$S_j = W_C X_j$$

For each individual and for each independent component the power spectra were computed. Individual spectra of components, grand average spectra of components and component topographies are displayed in ICA window and are available for analysis.

Following diagram illustrates consequence of processing and analysis steps.



Computing and analysis grand average independent components spectra.

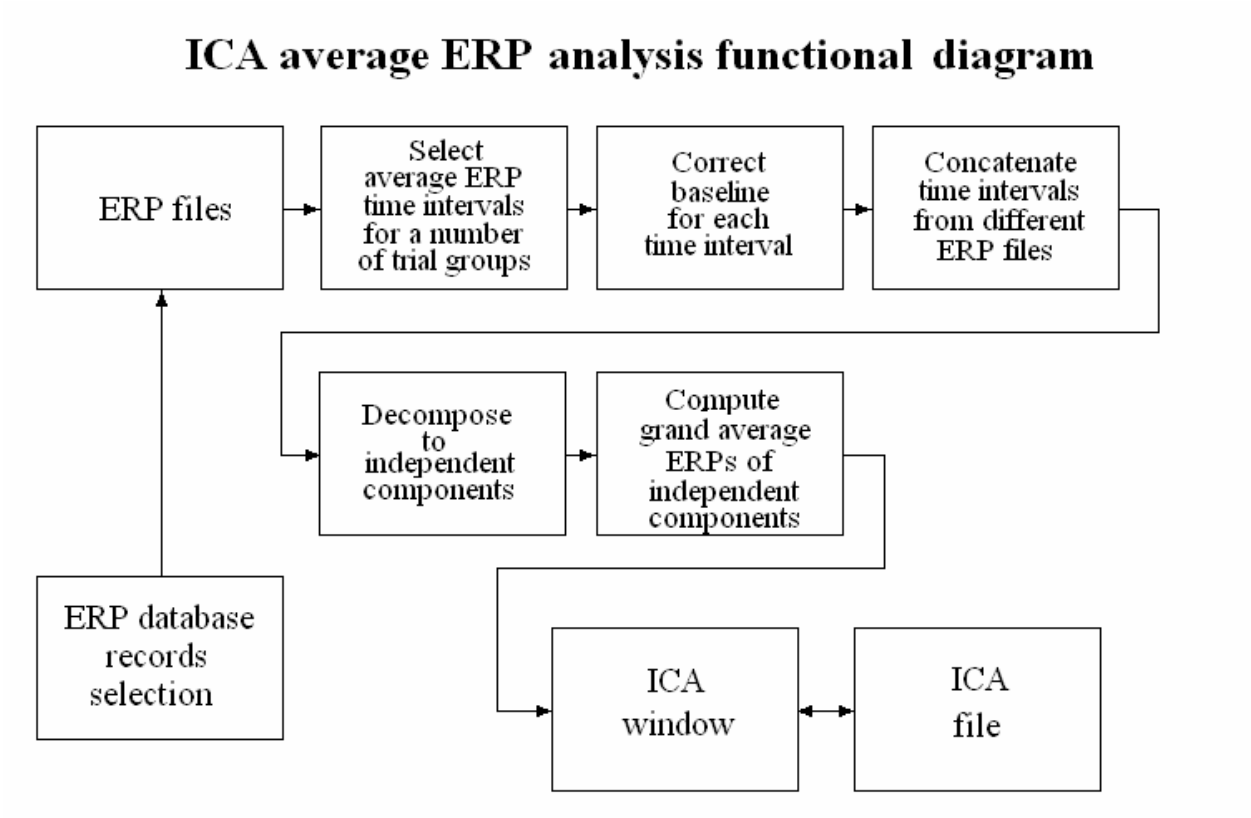
This procedure is run by pressing button “ICA” in Database dialog window for EEG database (see below)

4 The grand average ERPs of independent components.

The independent components of average ERPs are computed using selected in ERP database array of individual (subject or observation) ERPs as a source data. The parts of ERP waveforms corresponding to specified time intervals are merged to continuous time series and than this data are decomposed to independent components. Grand average ERPs are computed separately for each independent component. Individual ERP component waveforms, grand average ERP components and component topographies are displayed in ICA window and are available for analysis.

Additional assumption is also suggested that cortical localization of components is similar between subjects, so that it is viable to implement the ICA on array of ERPs.

Following diagram illustrates consequence of processing and analysis steps.



Computing and analysis grand average independent components ERP.

This procedure is run by pressing button “ICA” in Database dialog window for ERP database (see below)

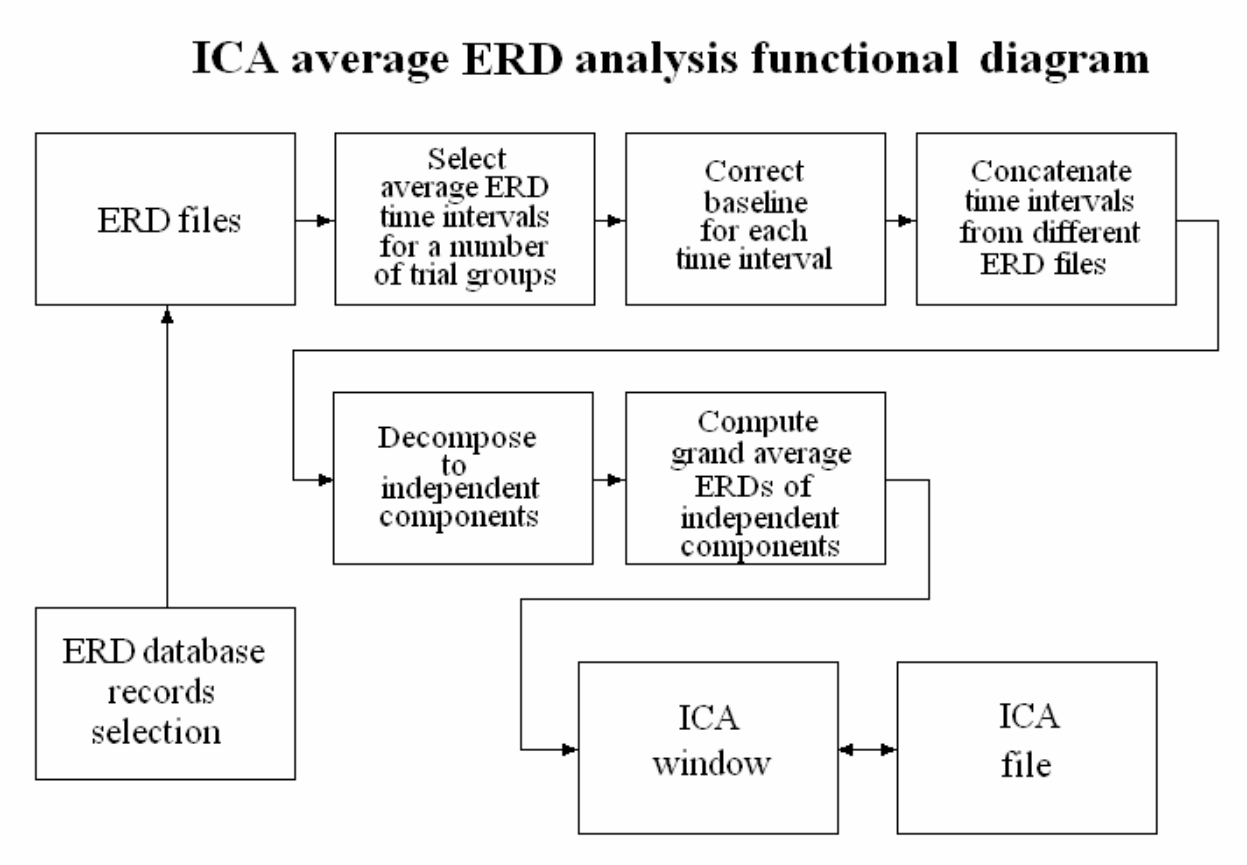
5 The grand average ERD and wavelet band power of independent components.

Formally similar procedure (see previous chapter) can be applied for ERD waveforms. But it should be stressed here that assumption “Summation of the electric currents induced by separate generators is linear at the scalp electrodes” is not satisfied computing of ERD is nonlinear procedure. So, application of ICA for ERD waveforms does not allow analyzes the signals from independent sources.

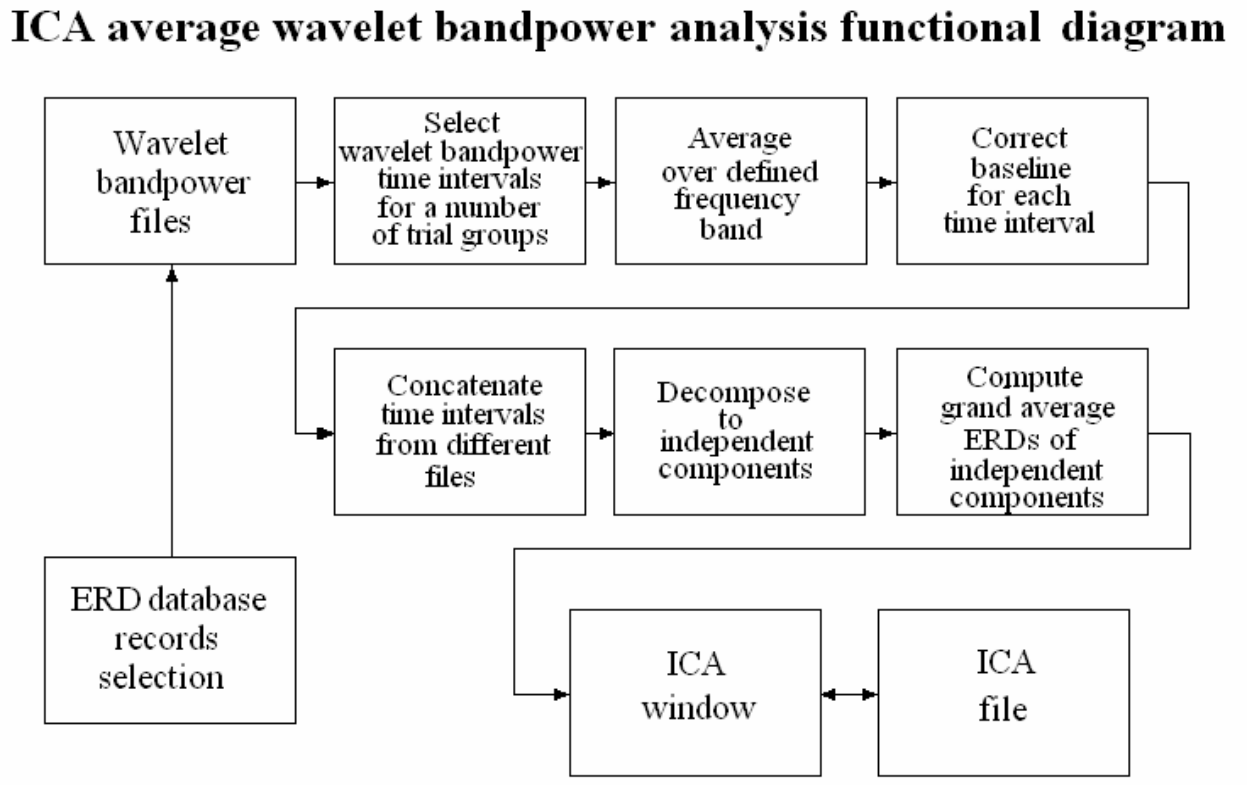
The independent components of average ERDs are computed using selected in ERD database array of individual (subject or observation) ERDs as a source data. The parts of ERD waveforms corresponding to specified time intervals are merged to continuous time series and than this data are decomposed to independent components. Grand average ERDs are computed separately for each independent component. Individual ERD component waveforms, grand average ERD components and component topographies are displayed in ICA window and are available for analysis.

Additional assumption is also suggested that cortical localization of components is similar between subjects, so that it is viable to implement the ICA on array of ERDs.

Following diagram illustrates consequence of processing and analysis steps.



Computing and analysis grand average independent components ERD.



Computing and analysis grand average independent components ERD for wavelet band power.

Video EEG recording

WinEEG program provides the next features for Video EEG recording:

1. Synchronous on-line recording of EEG, video signals from one or two cameras and audio signal from microphone.
2. On-line and off-line compression/recompression of video and audio signal. MPEG4 compression of video signal and MPEG3 compression of audio signal are provided.
3. Night video monitoring using video camera with infrared illuminant.
4. Manual marking of events during EEG and video recording.
5. Off-line synchronous playback of EEG, video and audio signals.
6. Automatic positioning to video pictures corresponding to manually selected EEG sample or marker.
7. Editing of EEG, video and audio signals to save meaningful fragments only.
8. Advanced service for preparation of CD copy of video EEG record.
9. Compact but powerful free video EEG viewer for displaying of CD or DVD copy of video EEG record provides next passivity: off-line.

The next command of WinEEG program help to control corresponding features of Video EEG recording: **Setup: Video Recording, View: Main Video Window, View: Additional Video Window, View: Video Window Size, Recording: Video Recording, Edit: Clear All…, Edit: Clear All Video Data, File: Compress Video Files, File: Export EEG and Video EEG, Recording: Play Forward, Recording: Rewind Forward.** Positioning to video pictures corresponding to manually selected EEG sample can be performed using **horizontal scroll bar** of EEG window. The selection of sample in EEG window to which corresponding video frame will be displayed can be done using **Sample slider** placed at the top of EEG window.

Export and Import the data

There is a possibility to save raw EEG data for selected time interval or whole EEG record to anther data format. The WinEEG program supports the next data formats for export raw EEG data:

1) ASCII data format. The columns of resulting data file correspond to montage channels and rows – to time samples. The data is processed before exporting according to the montage parameters, band pass filtering and artifacts correction procedures and is stored to the file in micro Volts.
2) Binary data format. The data is stored as 4-bytes float number in multiplexed format; i.e., letting J = number of montage channels and I = number of time points (samples) in selected time interval, the data points are as follows: data point #1 for channel #1, data point #1 for channel #2, … , data point #1 for channel #J; … ; data point #I for channel #1, data point #I for channel #2, … , data point #I for channel #J. The data is processed before exporting according to the montage parameters, band pass filtering and artifacts correction procedures and is stored to the file in micro Volts.
3) European Data Format (EDF) that supported by software developed by another companies. The data is processed before exporting according to the montage parameters, band pass filtering and artifacts correction procedures.
4) Universal Data Format (UDF) – an extension of EDF data format.
5) LEXICOR data format.

The WinEEG program is able to export EEG spectra, EEG coherence, ERP and ERD to ASCII data format for the further processing of these data by STATISTICA or similar programs for more advanced statistical analysis.

The WinEEG program supports the next data formats for import raw EEG data recorded by other equipment:

1) ASCII data format. The columns of resulting data file correspond to montage channels and rows – to time samples.
2) European Data Format (EDF) that supported by software developed by another companies.
3) Universal Data Format (UDF) – an extension of EDF data format.
4) NeuroScan CNT data format.
5) NeuroScan EEG data format.

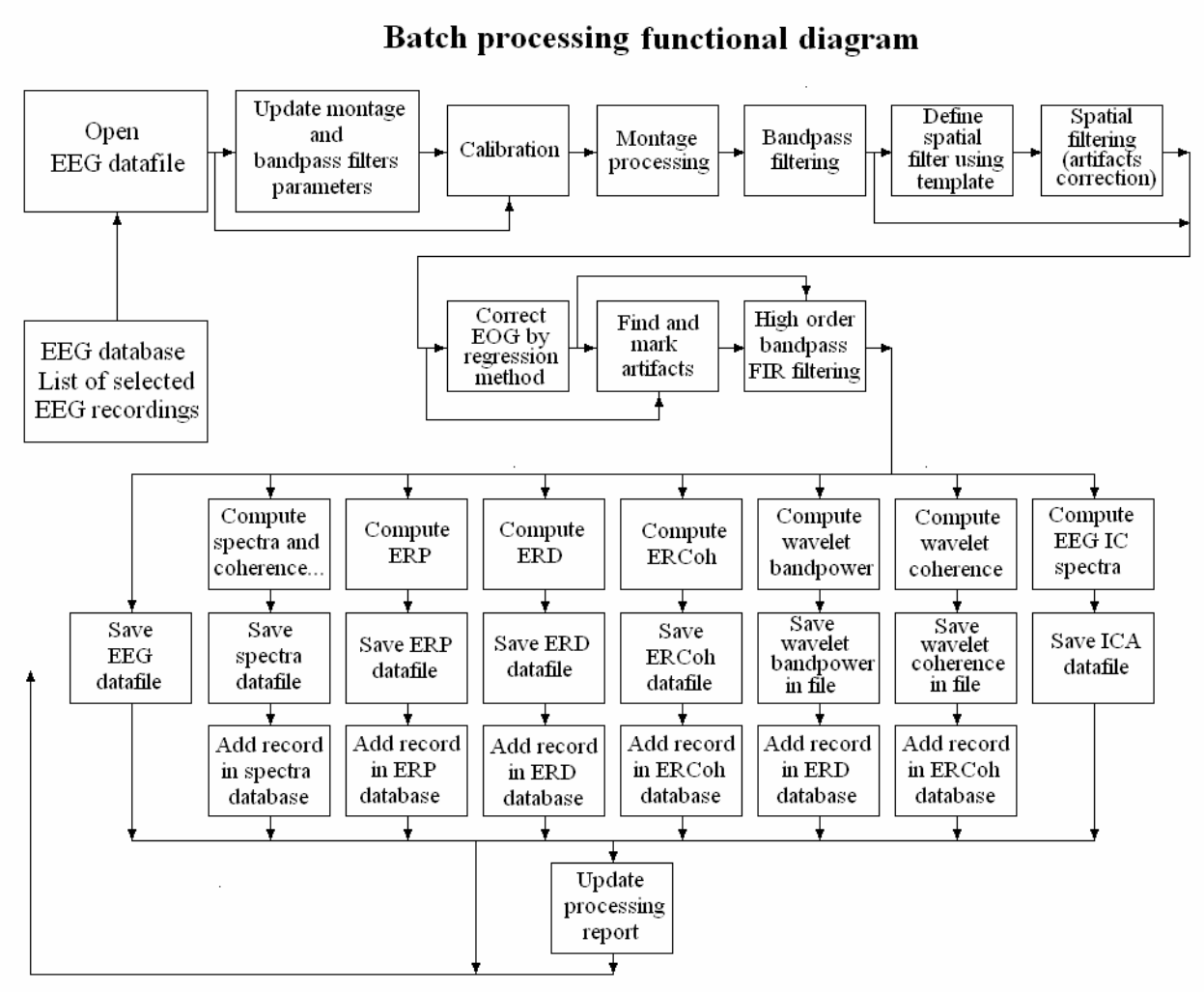
Grand averaging and Batch data processing

The WinEEG program can compute grand average EEG spectra, grand average EEG coherence, grand average ERP and grand average ERD for selected set of observation. To perform grand averaging open corresponding database, select subset of records and press button “Average”.

Attention!!! The compatible data only can be used for grand average computation. This means the montage and processing parameters should be the same for all averaging spectra, ERPs or ERDs.

The WinEEG program can perform batch data processing. It helps to process large amount of data automatically. This could be artifacts correction, artifacts detection, EEG filtering, computation EEG power spectra and coherence, ERP, ERD, wavelet analysis and wavelet coherence. The results of processing can be saved to source EEG data files and to new processing results data files in dependence on settings. The power spectra and coherence, ERP, ERD, wavelet decomposition and wavelet coherence are saved in corresponding databases of processing results. The processing report could be generate automatically and could be used for detection of processing mistakes. To start batch data processing open EEG database, select subset of records and press button “Average”.

Following diagram illustrates automatic EEG batch processing steps.

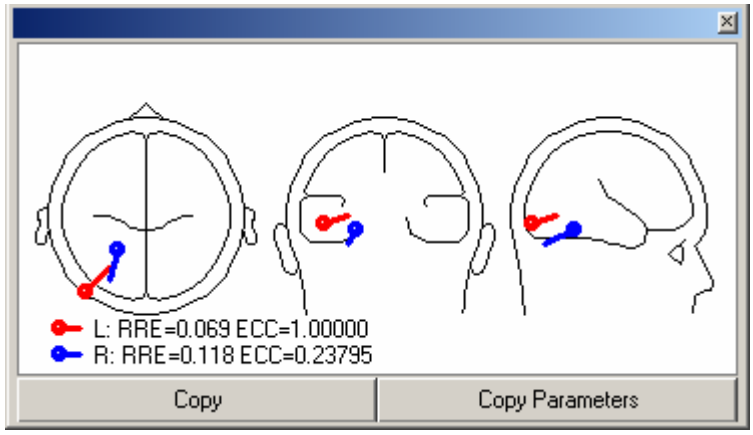


EEG batch processing functional diagram.

Dipole source localization

Dipole source localization function uses scalp potentials and electrode 3-D coordinates as input parameters. The 3-D coordinates can be set or modified using commands **View: Select montage…** or **Setup: Montage list** (See chapter **Montage Parameters: Electrodes dialog**)

Equivalent dipole source coordinates and momentums are computed automatically using this method and are displayed in a special window.



This window can be displayed using **View: Toolbar->Dipole window command**

The four-shell spherical volume conductor model of head used by dipole source localization method is presented by C.J.Stol, J.W.H. Meijs, M.J.Peter Inverse solution based on MEG and EEG applied to volume conductor analysis // Phys. Med. Biol., 1987, V.32, No.1, P.99-104. Least-square solution if inverse problem is performed by Nelder-Meade simplex method (W.H.Press, S.A.Teukolsky, W.T.Vetterling, B.P.Flannery. Numerical Recipes in C. The Art of Scientific Computing. Second Edition. Cambrige University Press 1992, 994 p. Used in WinEEG program optimization of forward model parameters computation was presented by Sun M. An efficient algorithm for computing multishell spherical volume conductor models in EEG dipole source localization. IEEE Trans. Biomed. Eng., 1997, V. 44, P.1243–1252.

Attention!!! Many authors prefer to use average referent montage for dipole source localization to eliminate influence of reference electrode signal.

Attention!!! Please do not forget that an accuracy of dipole source localization method can be bad due to a number of different factors: incorrect head model, large errors in electrode coordinates, existing more than one brain electromagnetic source and etc.

WinEEG and LORETA

WinEEG have simple user interface that helps to transfer data from WinEEG to LORETA program. LORETA program is rather popular software for 3D mapping of EEG or ERP voltage distribution or EEG frequency band power into 3D Talairach atlas. For more information see chapters Analysis: Source distribution (LORETA) command and Analysis: Spectra power distribution (LORETA) command. The detail description of LORETA (Low resolution electromagnetic tomography) method can be found in R.D.Pasqual-Marqui, C.M.Michel, D.Lehmann Low resolution electromagnetic tomography: A New Method for Localizing Electrical Activity in the Brain. // International Journal of Psychophysiology 1994, v.18, pp. 49-65.

Automated spikes detection and analysis

The automated spike detection method uses both amplitude-temporal parameters of waveforms and their spatial characteristics.

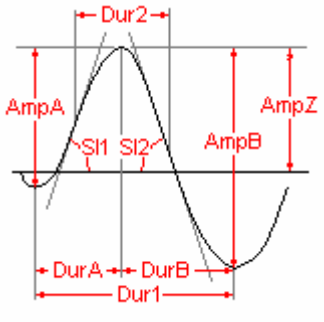
Many authors emphasized the amplitude-temporal parameters of waveforms are necessary for development of effective spike detection methods.

1. Gotman J, Gloor P. Automatic recognition and quantification of interictal epileptic activity in the human scalp EEG. Electroenceph clin Neurophysiol, 1976, Vol. 41, P. 513–529.
2. Gotman J, Wang LY. State-dependent spike detection: concepts and preliminary results. Electroenceph clin Neurophysiol, 1991, Vol. 79, P. 11–19.
3. P.Y.Ktonas Automated spike and sharp wave (SSW) detection. In Methods of analysis of brain electrical and Magnetis signals. EEG handbook (revised series, Vol 1)
4. A.S.Gevins and A.Remond (Eds). 1987, Elsevier Science Publishers B.V. 211-241 pp.,
5. P.Van Hesse, H.Hallez, B. Vanrumste, Y.D`Asseler, P. Boon Evaluation of temporal and spatial EEG spike detection algorithms.

From the other hand the usage of additional parameters characterizing the spatial distribution of potentials (for example, equivalent dipole parameters) can increase a specificity of detection method.

1. D. Flanagana, R. Agarwala, Y.H. Wanga, J. Gotman Improvement in the performance of automated spike detection using dipole source features for artifact rejection. Clinical Neurophysiology, 2003, Vol. 114. P. 38–49.
2. A. Ossadtchi, S. Baillet, J.C. Mosher D. Thyerlei,W. Sutherling, R.M.Leahy Automated Interictal Spike Detection and Source Localization in MEG using ICA and Spatio-Temporal Clustering. Clinical Neurophysiology, 2003, submitted.

The amplitude-temporal parameters using by WinEEG program are the following:



1. Duration 1, defined as the time interval between two successive maxima or minima of an EEG wave (Dur1).
2. Duration 2, defined as the time interval between two successive inflection points (i.e. points where the absolute value of the first time derivative of the wave form has a maximum value) of an EEG wave (Dur2).
3. Duration A, defined as the time interval between the beginning and the pick of an EEG wave (DurA).
4. Duration B, defined as the time interval between the pick and the end of an EEG wave (DurB).
5. Amplitude A, measured from the beginning to the pick of EEG wave (AmpA).
6. Amplitude B, measured from the pick to the end of EEG wave (AmpB).
7. Amplitude, measured from the baseline (zero-voltage) to the pick of EEG wave (AmpZ).
8. Slope 1, defined as the maximum magnitude of the first time-derivative during the leading edge of an EEG wave (Sl1).
9. Slope 2, defined as the maximum magnitude of the first time-derivative during the trailing edge of an EEG wave (Sl2).
10. Sharpness, defined as the second time derivative of an EEG wave at its pick: (d^2P/d^2t).

For more information see following papers:

1. P.Y.Ktonas Automated spike and sharp wave (SSW) detection. In Methods of analysis of brain electrical and Magnetic signals. EEG handbook (revised series, Vol 1).
2. A.S.Gevins and A.Remond (Eds). 1987, Elsevier Science Publishers B.V. 211-241 pp.

The dipole parameters using by WinEEG program are the following:

1. Relative residual energy (RRE)
2. Dipole source eccentricity (ECC = $X^2+Y^2+Z^2$).

The parameters of dipole source are used both for more exact spike detection and for eye blink artifact rejection. Both monopolar and bipolar montages could be used for EEG to which automated spike detection is applied. But dipole source parameters will be not estimated for EEG at bipolar montage.

The estimation of dipole model could be done using raw EEG voltage and EEG component (PCA or ICA) topographies.

1. D. Flanagana, R. Agarwala, Y.H. Wanga, J. Gotman Improvement in the performance of automated spike detection using dipole source features for artefact rejection. Clinical Neurophysiology, 2003, Vol. 114. P. 38–49.
2. P. Van Hese, P. Boon, K. Vonck, I. Lemahieu1, R. Van de Walle A New Method for Detection and Source Analysis of EEG Spikes.
3. Bart Vanrumste, Richard D. Jones and Philip J. Bones DETECTION OF FOCAL EPILEPTIFORM ACTIVITY IN THE EEG: AN SVD AND DIPOLE MODEL APPROACH.

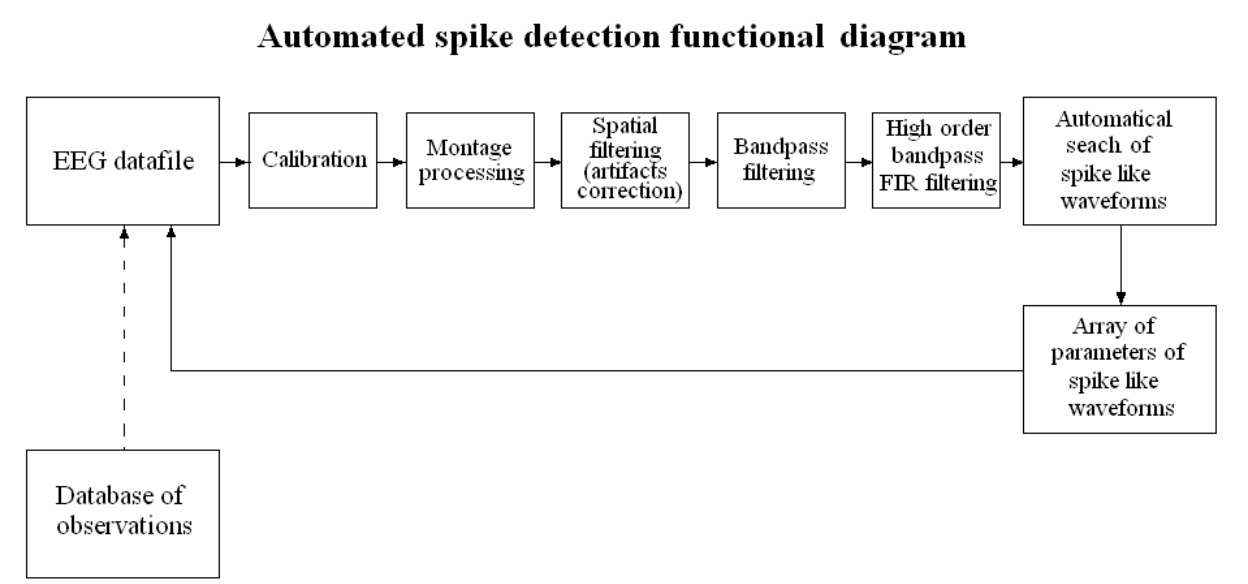
Proceedings of the Second Joint EMBS/BMES Conference Houston, TX, USA, October 23-26, 2002.
4. A. Ossadtchi, S. Baillet, J.C. Mosher D. Thyerlei,W. Sutherling, R.M.Leahy Automated Interictal Spike Detection and Source Localization in MEG using ICA and Spatio-Temporal Clustering. Clinical Neurophysiology, 2003, submitted.
5. S. Faul, L. Marnane, G. Lightbody, G. Boylan, S. Connolly A METHOD FOR THE BLIND SEPARATION OF SOURCES FOR USE AS THE FIRST STAGE OF A NEONATAL SEIZURE DETECTION SYSTEM.

The parameters of dipole source are used both for more exact spike detection and for eye blink artifact rejection.

For more information see description of command **Analysis: Spike Detection, Analysis: Spike Averaging, Analysis: Add Spike, Analysis: Delete Spike, Analysis: Change Channel, Analysis: Copy EEG, Analysis: Copy Spike, Analysis: Copy EEG to report, Analysis: Copy Spike to report** and dialogue windows: **Spike detection** and **Average spike calculation**

Both monopolar and bipolar montages could be used for EEG to which automated spike detection is applied. But dipole source parameters will be not estimated for EEG at bipolar montage.

Following diagram illustrates consequence of processing and analysis steps.



Automatic spike detection.

Warranties

Of course WinEEG may have its own bugs as any other software. We apologize in advance for possible troubles and promise to do our best to find and correct software errors hoping that you would meet them not very often. If you detect any discrepancy between the manual and the real performance of the software, please do not hesitate to contact the developers directly. You can always learn the contact information using the **Help: About WinEEG…** command. Quick and effective troubleshooting is our duty, and we shall be grateful for your help in detecting any bugs. You will receive a free revised software version on your request.

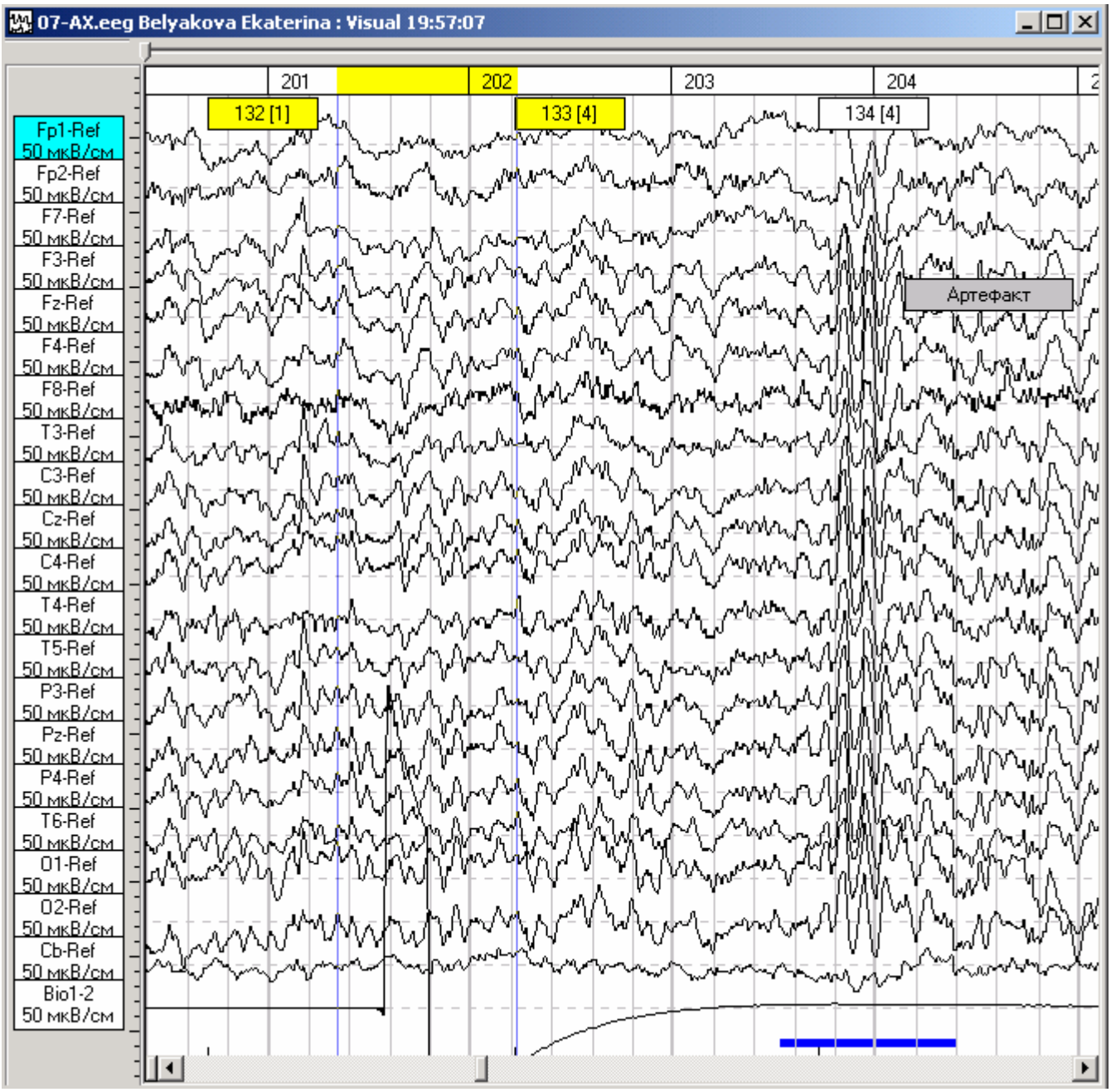
Extending the WinEEG vocabulary of software features is another question. WinEEG is a commercial product, so the developers follow industry practices and deliver the product "as is". Your comments on the product features will be gratefully accepted and probably be taken into account when developing further software versions. But we cannot guarantee immediate addition of new features requested by our users.

Naturally, we will meet the wishes of any customer who wishes to support the development of new methods for EEG analysis.

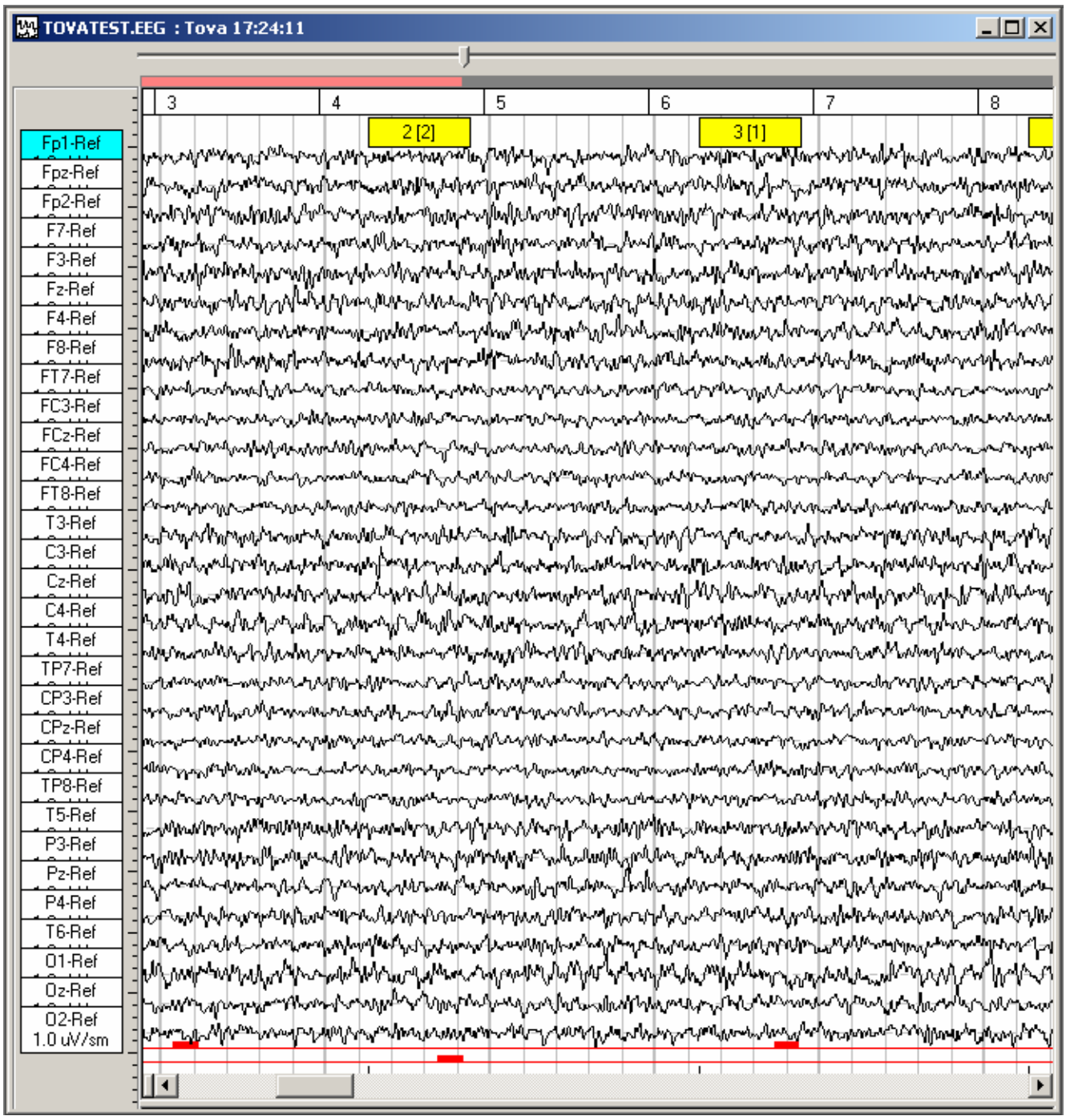
WinEEG COMMANDS AND INTERFACE REFERENCE

WinEEG Windows

1. EEG Window



An EEG window is used for electroencephalogram monitoring. The **Channel Names bar** placed on the left side of EEG window is used for channel selection. The Slider placed in the top of EEG window is used to select time sample for which a synchronous video frame is displayed. The **Status bar** placed in the bottom of WinEEG window displays parameters for a selected channel. In the top of the EEG window there is a time scale displaying fragment names and time marks. Any EEG interval in the EEG window can be selected for further processing by means of two vertical markers.



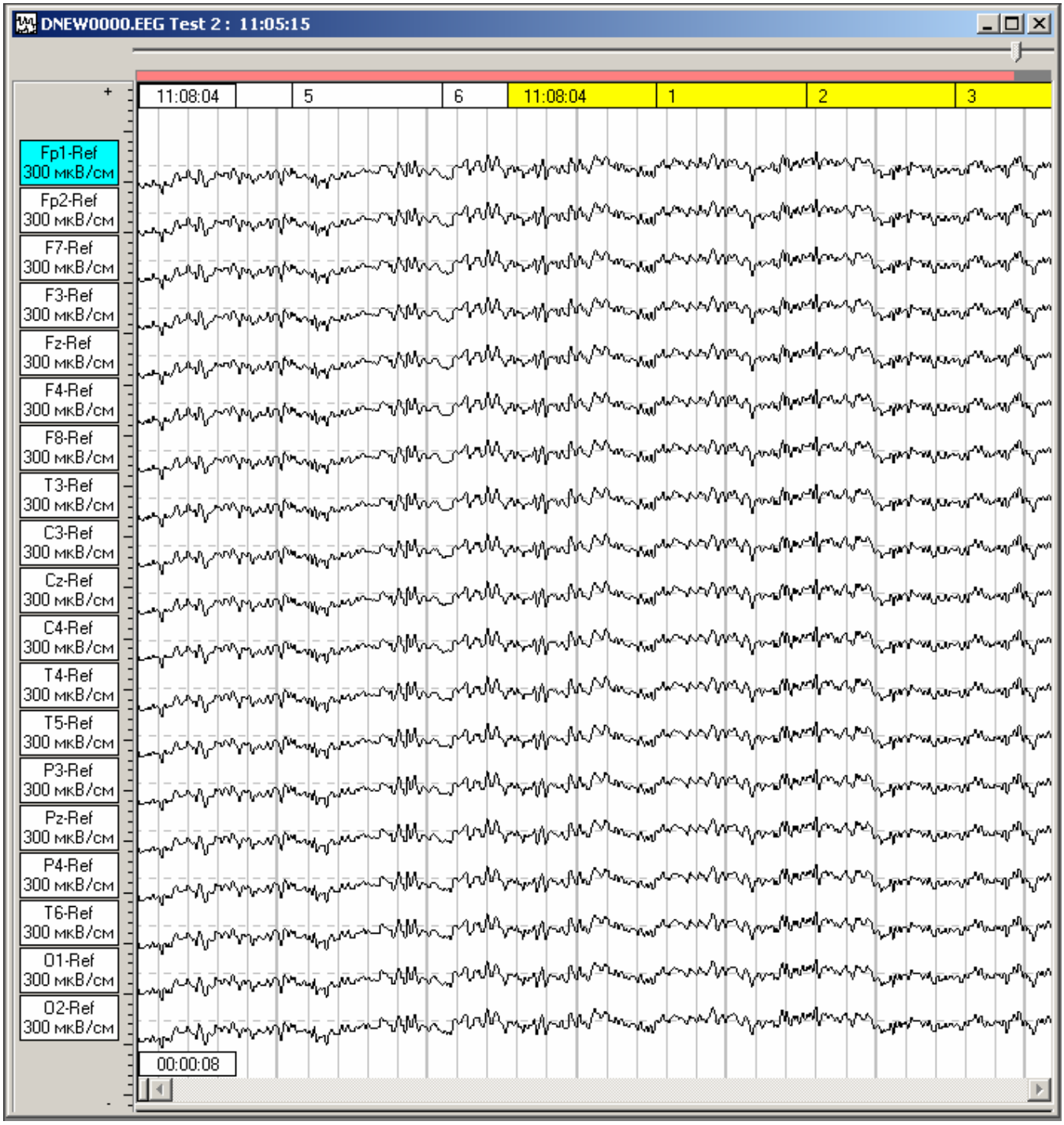
Some Mitsar amplifiers have additional digital (TTL) inputs. In this case the signals from these inputs are displayed by red horizontal bars placed at the bottom of EEG window. Thin horizontal bar correspond to logical zero (high TTL level) and thick bar – to logical one (low TTL level). Usually the special “digital” button is connected to these digital inputs to measure subject reaction. Upper horizontal bar correspond to “Digital 1” input and to left button, lower bar correspond to “Digital 2” input and to right button. If Mitsar amplifiers have not additional digital (TTL) inputs another “analog” button is connected to ECG input to measure subject reaction. Last modification of button has two output levels: left button – low level, right button – high level and provide all possibilities as “digital button.

Attention!!! Different parameters of processing of subject reaction should be set up for different modification of buttons. Incorrect settings of button signal processing can be potential source of errors.

Main features of EEG window are listed below:

1. EEG Acquisition.

During EEG recording additional information is displayed in the window.



Current time is displayed on the left top corner of the window. Total duration of EEG recorded to the hard disk is shown on the left bottom corner of the window. The time scale colored by yellow indicates the signals which are really recorded to the disk.

Attention!!! If window background is colored by red this means that batteries are low and you should change them as soon as it is possible.

Use Record menu commands to manage EEG acquisition including start EEG monitoring and recording, start/stop video capturing, pause and stop recording. Note that these commands are available only for a new EEG file. In other words, you cannot record EEG into a pre-existing file in the database. To create a new EEG file, use File: New command.

2. Searching for an EEG interval.

To find a certain EEG interval, use the scrollbar or keys (Left arrow, Right arrow, Page Up, Page Down). To go to the beginning of a certain fragment, use the **View: Find Fragment** command. To playback EEG or video EEG use the **Record: Rewind Back**, **Record: Play Back**, **Record: Play Forward** and **Record: Rewind Forward** commands.

The video frames are displayed synchronously with EEG scrolling in pop-up Video Windows. This window is shown or hided by **View: Main Video Window** and **View: Additional Video Window** commands. Its size is changed by **View: Video Window Size** command.

3. Comparing two EEG intervals.

To perform this task, first of all split the EEG window in two panes using **Window: Split** command. Then use scrollbars in each pane to find the intervals of interest.

4. Copying window contents to clipboard.

To perform this task, use **Edit: Copy** command. The waveform areas visible in the EEG window will be copied to clipboard and can be then pasted into final report text or into any application (WinWord, Paint. etc.) window by means of **Edit: Paste** command.

5. Selecting an interval for processing.

To select an interval, use vertical markers. Place the cursor on the time scale of the active window - the cursor should change its form to:

Clicking the left or right mouse button sets the corresponding left or right marker. The time scale for selected interval will be highlighted in color.

Marker position can be changed by means of the mouse. Place the cursor on one of the markers - the cursor should change its form to:

Then drag the cursor (with left mouse button pressed).

Marker position can also be changed using keyboard. Press **Shift** + **Left /Right arrow** keys to move left marker. Press **Ctrl** + **Left /Right arrow** keys to move right marker. Press **Ctrl** + **Shift** + **Left /Right arrow** keys to move both markers simultaneously.

6. Printing an EEG interval

To print an EEG interval, use **File: Print** and **File: Print Preview** commands.

7. Deleting an EEG interval

You may need to delete an EEG artifact interval. To delete an interval, select it and use **Edit: Clear** command. This command can be used to delete a part of video data only but EEG data will be kept.

Attention!!! Using this command you have a risk to loss the data. That is why the usage of **Edit: Clear** command to mark artifacts time interval is the better ideas.

8. Choosing a channel to be processed.

To choose a channel, press the corresponding button on the **Channel Names bar**. You can also choose channels using Arrow Up and Arrow Down keys. For more detailed view of a single channel use one-channel display mode. To toggle between one-channel and multi channel modes, place cursor on a button on the **Channel Names bar** or on the corresponding EEG curve and double click left mouse button.

9. Comparing EEG for different channels.

To compare EEG recorded from different sites you can place one curve over another while viewing. Place cursor on a button on the **Channel Names bar** and drag vertically with left mouse button pressed. The curve depicting the selected channel also will move in the vertical direction. When left mouse button is released the selected curve automatically returns to its original position.

10. Measuring channel parameters.

Channel parameters are measured automatically and displayed in the **status bar** fields. Note that all parameters are not always measured. The selected interval (see 8. above) should be 100msec - 10sec long and visible in the EEG window.

The following parameters are computed automatically:

1. EEG value at the left marker: L = 0.1 uV.
2. EEG value at the right marker: R = 0.1 uV.
3. Time interval between two markers: T[R-L] = 0.1 sec.
4. Difference between EEG values at the two markers: R-L = 0.1 uV.
5. EEG amplitude, i.e. difference between maximal and minimal values in the selected interval A=0.1 uV.
6. «Average» signal frequency: F = 1.0 Hz.
7. Photo stimulation frequency: FS = 5 Hz.

11. Montage modification.

To edit montage parameters, run the **View: Select Montage…** command.

12. Changing speed (horizontal scaling).

On the **Filters bar** choose an appropriate value from the **Speed** list. You can also use **"*"** and "/" keys. Press "/" key to decrease speed by half or **"*"** key to double the speed.

13. Changing gain (vertical scaling).

On the **Filters bar** choose an appropriate value from the **Gain** list. You can also use **"+"** and **"-"** keys. Press **"-"** key to half reduce gain by half or **"+"** key to double the gain.

To change gain only for a selected channel, hold **Ctrl** pressed. Otherwise gain will be changed for all channels that are visible in the montage.

14. Changing upper cutoff frequency.

On the **Filters bar** choose an appropriate value from the **High Cut (Hz)** list.

To change high cut only for a selected channel, hold **Ctrl** pressed. Otherwise high cut will be changed for all channels that are visible in the montage.

15. Changing lower cutoff frequency

On the **Filters bar** choose an appropriate value from the **Low Cut (Hz)** list.

To change low cut only for a selected channel, hold **Ctrl** pressed. Otherwise low cut will be changed for all channels that are visible in the montage.

16. Setting AC Mains (50/60) Hz notch filter.

On the **Filters bar** choose an appropriate value from the **Notch (Hz)** list.

To change notch only for a selected channel, hold **Ctrl** pressed. Otherwise notch will be changed for all channels that are visible in the montage.

17. Baseline offset.

On the **Filters bar** click up and down arrows of the **Baseline** field to change baseline.

To change baseline only for a selected channel, hold **Ctrl** pressed. Otherwise baseline will be changed for all channels that are visible in the montage.

18. Adding or clearing user labels.

To **add** a user label, run the **Edit: Add Label** command or press **Add Label** button on the **main toolbar** and choose label type from the popup menu. The cursor will change its shape to:

Place cursor at the desired position in the EEG window and click. When adding a **Channel** or a **Contour** label, its length can be adjusted by dragging and releasing the left mouse button.

To **find** a certain label, use **Find next left label** and **Find next right label** buttons on the **main toolbar**.

To **delete** a label, run **Edit: Delete Label** command or press **Delete Label** button on the **main toolbar**. The cursor will change its shape to:

Place it on the label to be deleted and click the left mouse button.

Attention!!! After you have finished dealing with labels, press the **Add Label** or **Delete Label** button on the **main toolbar** to return to default mode. The cursor will return to its standard shape.

19. Adding and excluding trials for ERP calculations.

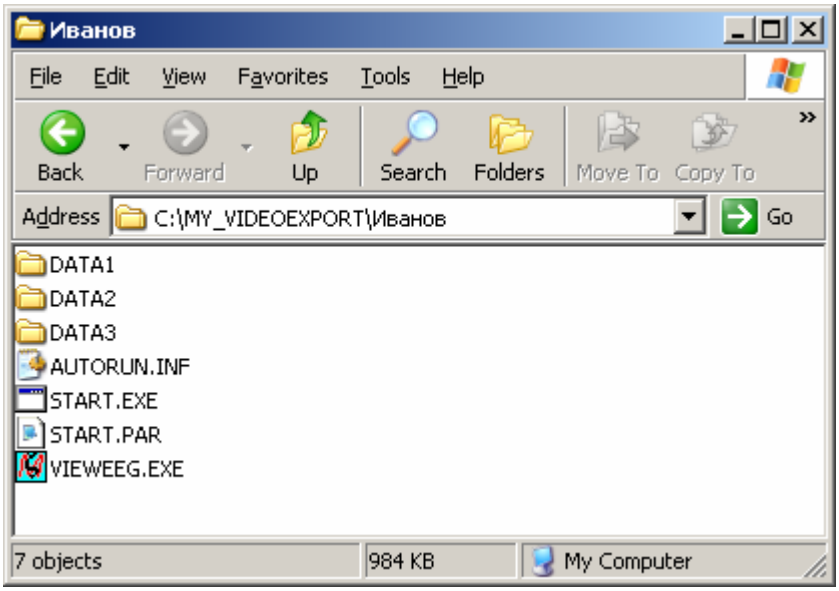
Some EEG trials (intervals) can contain artifacts. They can be manually excluded from the process of ERP calculation. Place cursor on the trial label (rectangle containing the trial number) and click. The rectangle will change its color. All the trials labeled by this color will be excluded from further processing. Click again to include the trial in the processing.

20. Marking artifacts time intervals.

To mark artifacts time intervals, select corresponding time interval by vertical markers and use **Edit: Cut** command. A horizontal blue bar displayed the artifacts marking time interval.

21. Copying selected time intervals of EEG record and video EEG record to another file.

To copy a selected time intervals of EEG record and video EEG record to another file, use **File: Export EEG and Video EEG"** command. This function is useful if it is necessary to prepare a number of video EEG examples to write them to CD. The WinEEG program will copy automatically video EEG data, video EEG viewer (ViewEEG program) and some additional service data in selected folder. It is possible to run this function many times. As the results a number of subfolders will be created and the data will be copied in these subfolders.



START.EXE utility helps to open all copied data automatically by ViewEEG program.

ViewEEG program is restricted version of WinEEG program providing reviewing of video EEG data.

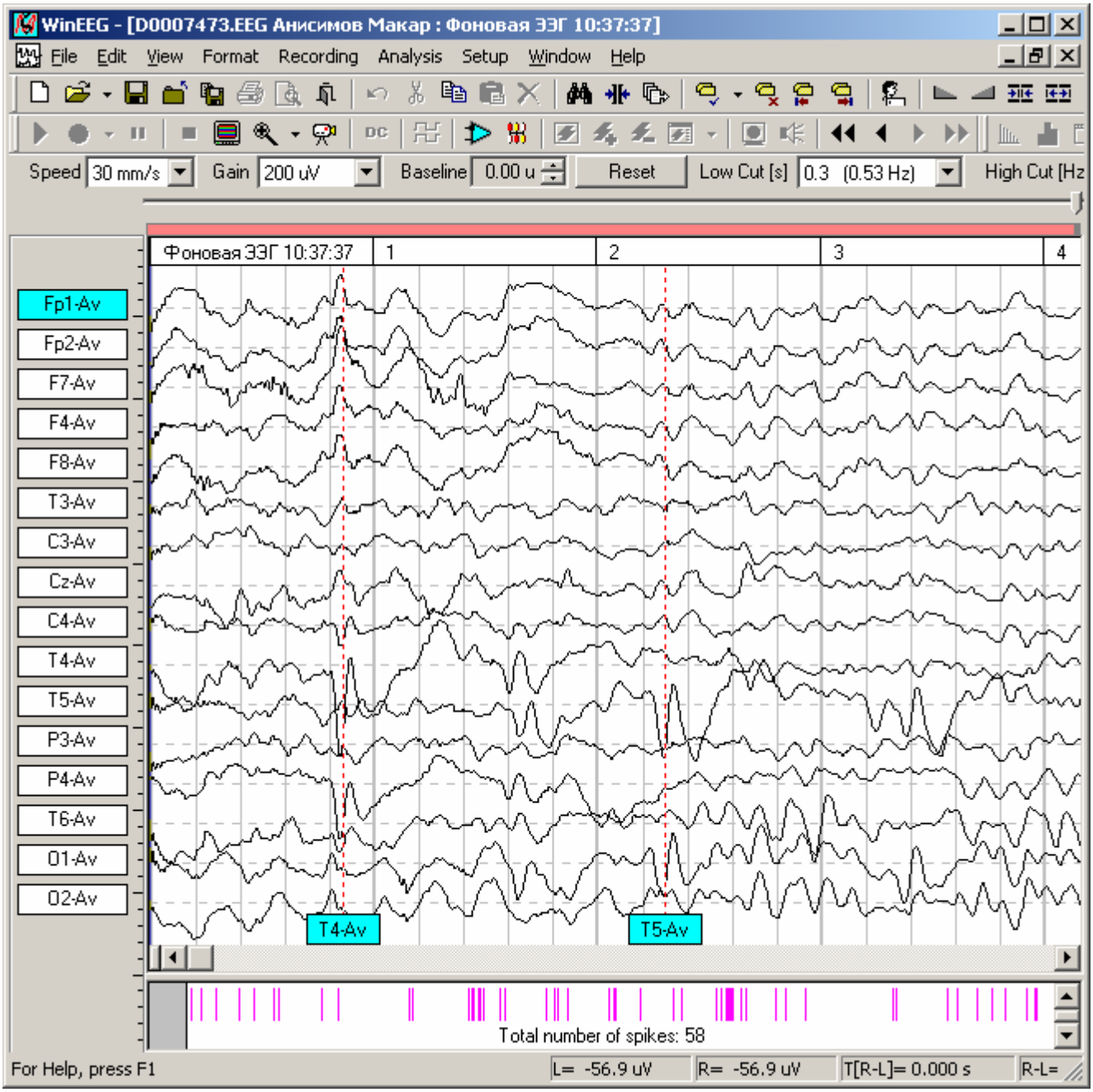
Attention!!! ViewEEG program requires DirectX 9.0 installation.

22. Search for EEG events.

Sometime it is necessary to find quickly such called EEG events. WinEEG program is able to finds simplest events: time intervals during which the absolute voltage of selected EEG channel is higher the defined threshold. To start this procedure, use **Edit: Find** command.

23. Automated spike detection.

To automatically find and mark spikes use a command **Analysis: Spike Detection**. All founded spikes will be marks by vertical dot-lines and spike's labels in the bottom of EEG window. A name of channel in which the pick voltage was maximal is printed in spike's label.



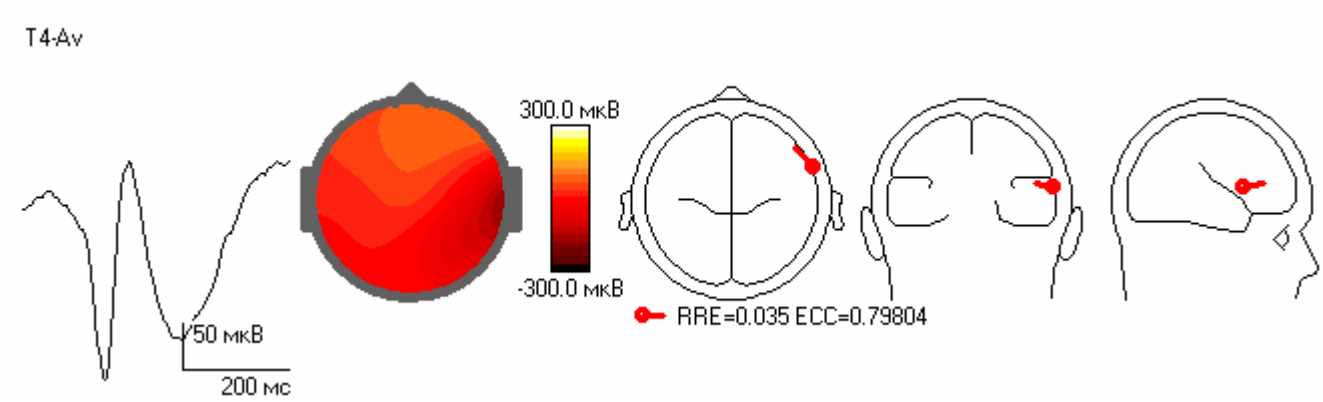
The EEG window could be divided into two parts by horizontal splitter. In this case the EEG will be displayed in upper parts and position of all founded spike will be output in lower part by vertical bars. The horizontal scale is selected thus as the whole array of spikes can be displayed in lower part. The left and right border of track-button of scroll bar will correspond to first and last displayed EEG sample. They will correspond to first and last displayed spike's mark also. This relationship between track-button, displayed spikes array and displayed time interval at upper part will help to find a part of EEG required for analysis.

24. Manual changing spike parameters.

The automated spike detection method can miss real spikes and mark some artifacts. To correct results of automated spike detection method commands **Add Spike** and **Delete Spike** could be used. To add spike move mouse pointer to appropriate channels and time sample, press and release right mouse button and choose command **Add Spike** from pop-up menu. To delete marked as spike artifact move mouse pointer to appropriate spike label, press and release right mouse button and choose command **Delete Spike** from pop-up menu. To change "main" channel of spike (defining a localization of spike source) move mouse pointer to appropriate spike label, press and release right mouse button, select command **Change Channel** in pop-up menu and choose appropriate channel from additional menu.

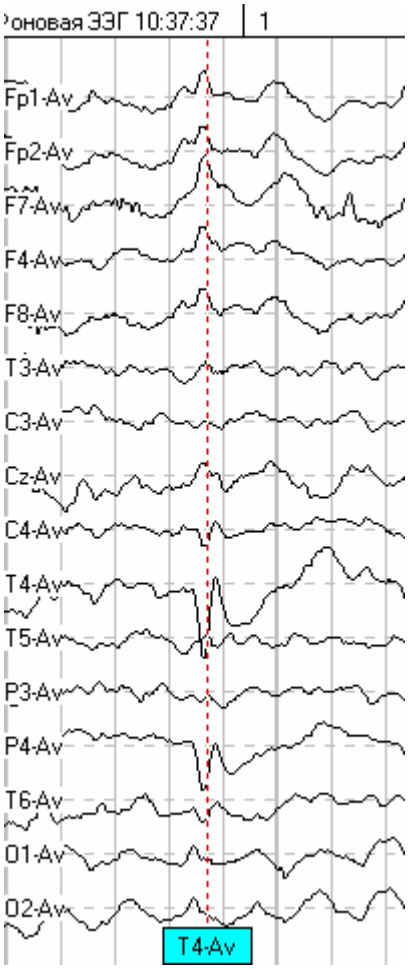
25. Insert spike waveform into report.

To insert waveform of selected spike into clipboard or final report commands **Copy Spike** of **Copy Spike to report** of pop-up menu could be used. To do this artifact move mouse pointer to spike label press and release right mouse button and select appropriate command The next picture will be placed into clipboard or final report commands.



Attention! The voltage map and dipole localization picture will be not added for bipolar montage.

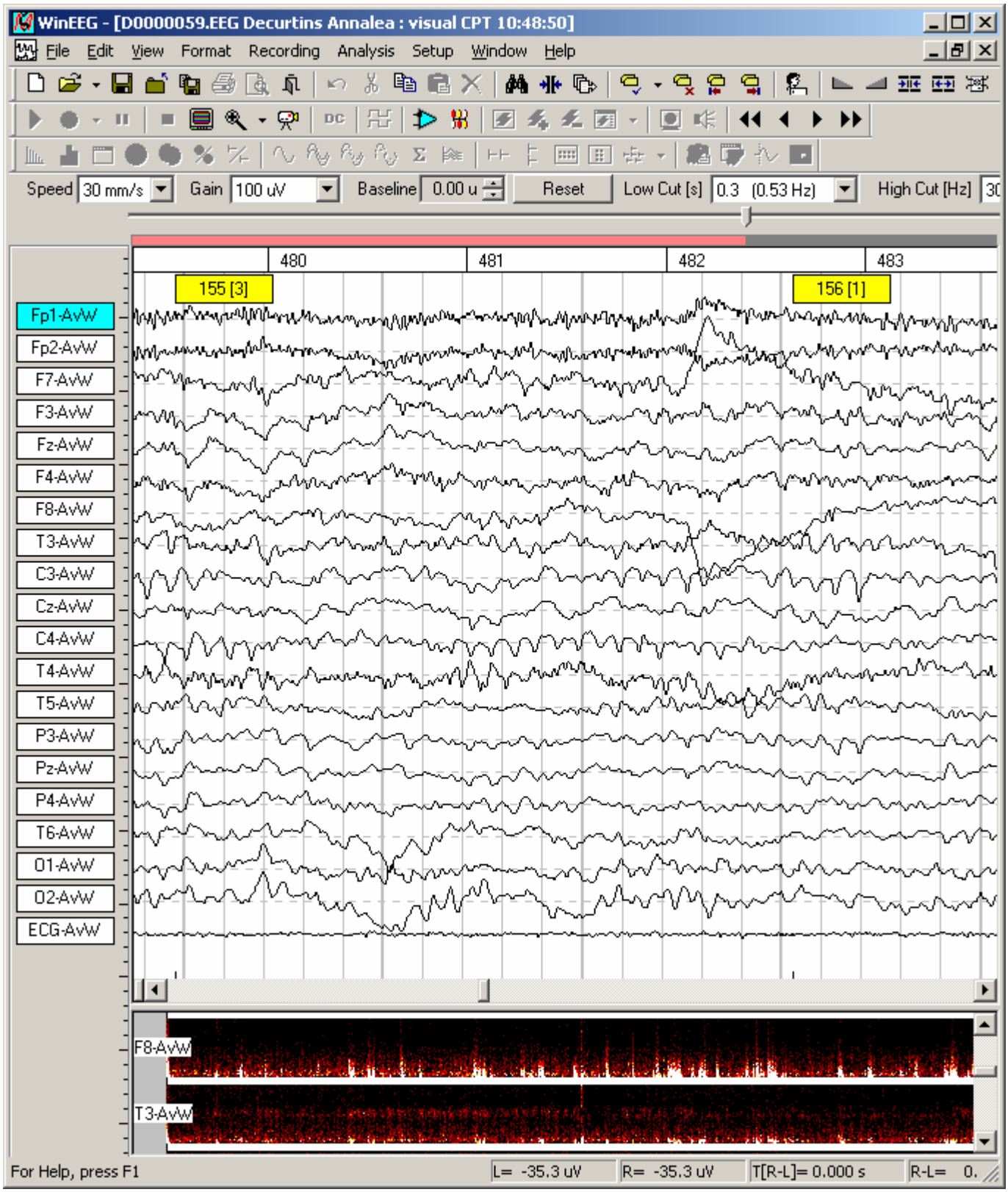
To insert corresponding to spike waveforms of EEG into clipboard or final report commands **Copy EEG** of **Copy EEG to report** of pop-up menu could be used. The next picture will be placed into clipboard or final report commands.



Attention! Use MS Word only if you want to insert picture into final report.

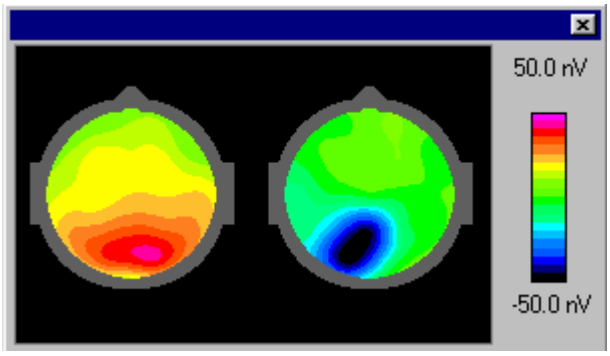
26. Display spectra density arrays.

To display “Spectra density arrays” use command **Analysis: Spectra Density Array**. The color bitmaps (time-frequency plots) will be displayed at lower part of EEG window.



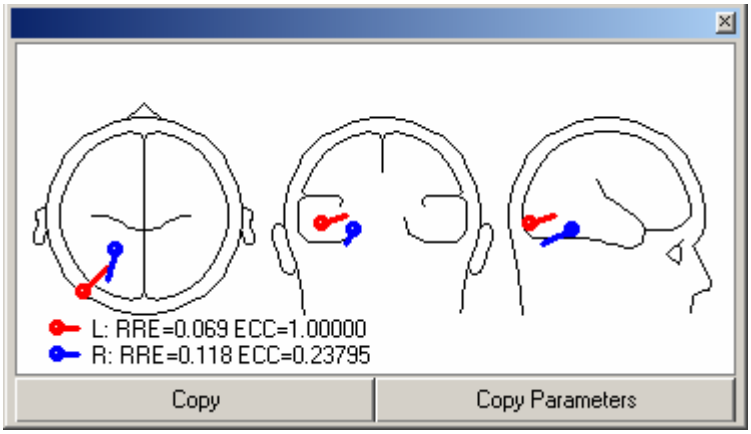
27. Scalp potentials maps.

Scalp potentials maps are displaying automatically in **Maps window** for selected by vertical markers time samples.



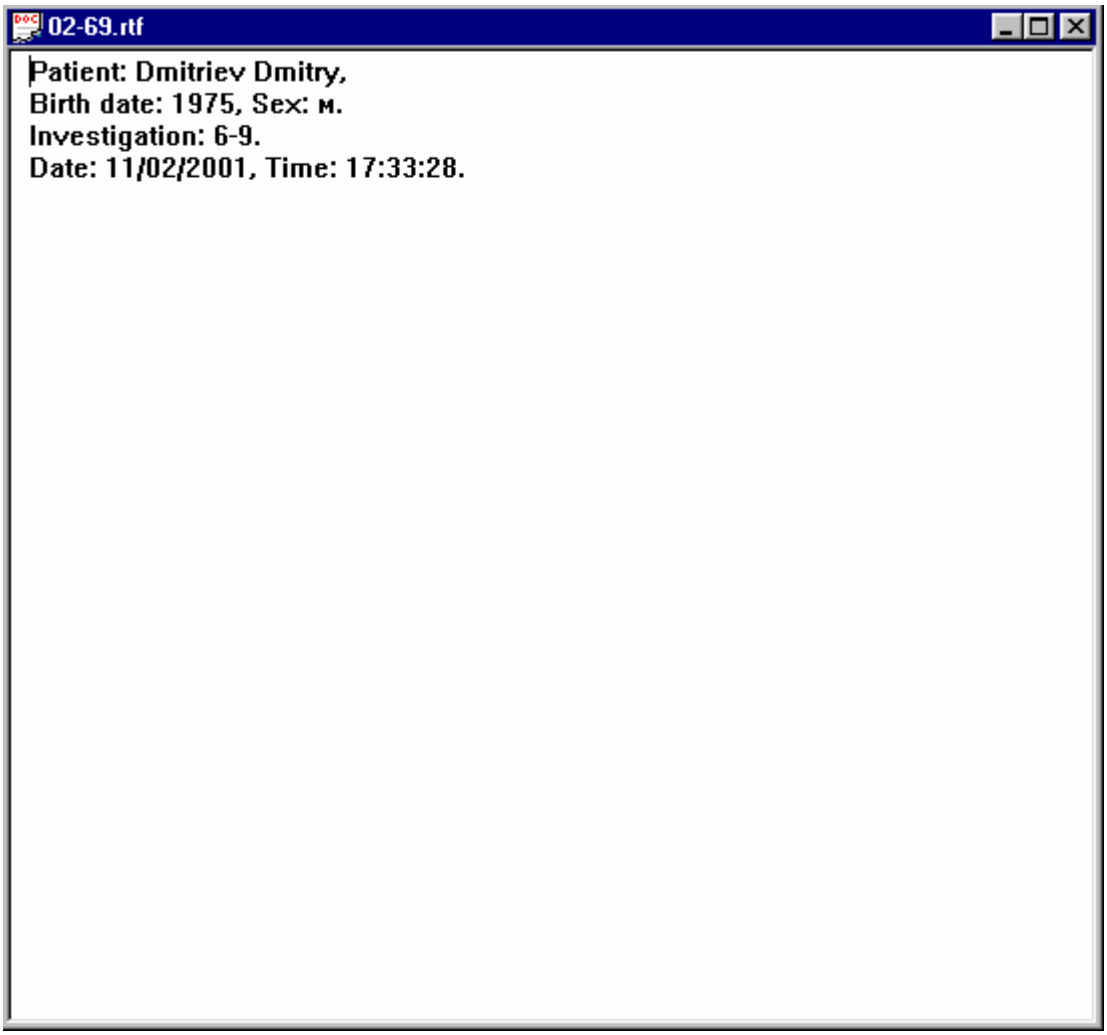
28. Dipole source localization.

The dipole source localization is performed automatically for selected by vertical markers time samples. The results of dipole source localization are displayed in **Dipole window**.



2. Final Report Window

The WinEEG Final Report window is similar to WordPad, but with some WordPad features disabled. See WordPad Help to learn more about text editing by means of **Edit menu commands** and **Format menu commands**. The major differences are as follows:



First, WinEEG allows the final report file to be created automatically in the EEG database working folder and to be opened together with the active EEG file. In addition, the patient card is automatically inserted in the text when generating a new final report.

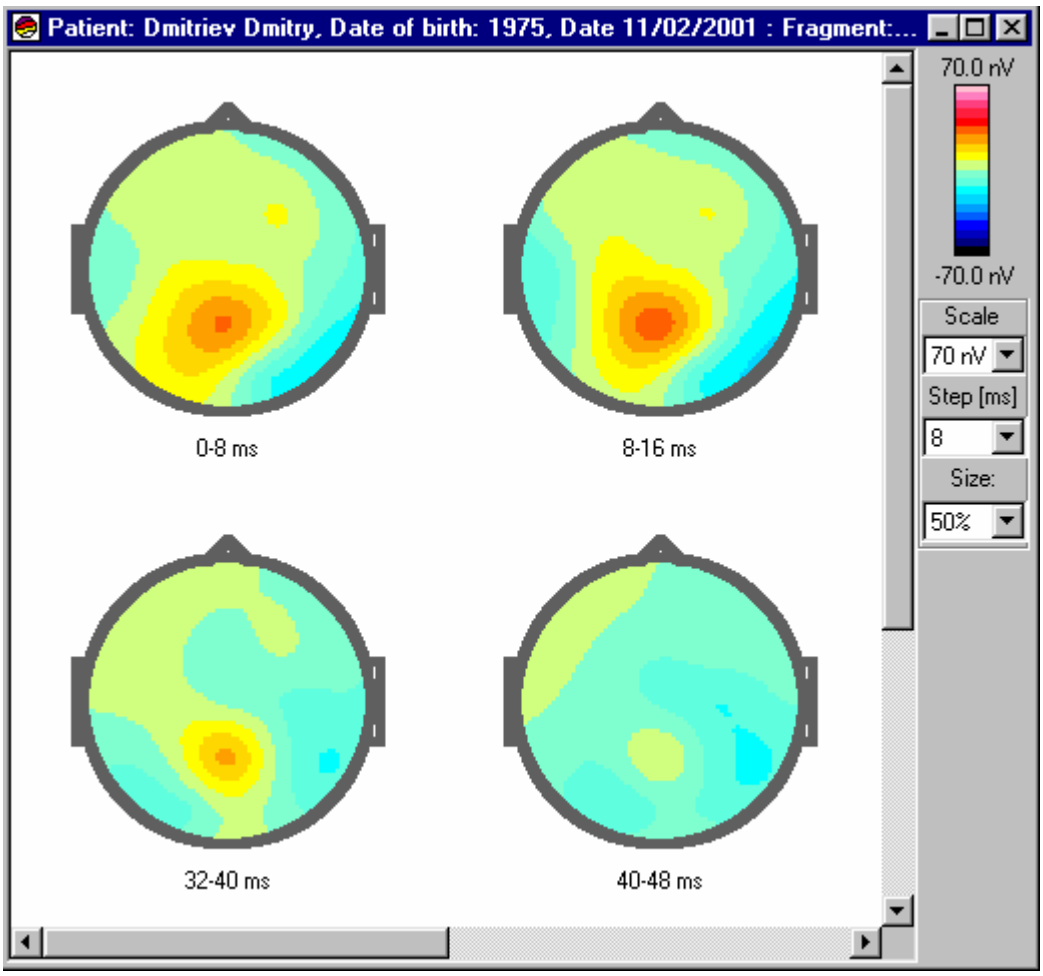
Second, the EEG database enables the final report file to be backed-up automatically along with EEG files.

Third, WinEEG enables the insertion of templates in the final report text.

You are not obliged to use the built-in WinEEG final report editor. To use Microsoft Word and to keep all the advantages of the built-in editor, you should install MS Office 2000 and customize WinEEG for using Microsoft Word (see **Setup: Final Report...** command).

3. EEG Maps Window

This window displays maps of instantaneous ERP values for a selected EEG interval. The EEG interval is divided into non-overlapping epochs with length defined by the **Step** parameter value. Thus, the number of maps displayed depends on the selected interval duration and on the "Step" parameter value. For each channel and each epoch, time-averaged ERP values are used as input data for an interpolation algorithm. Under each map there are figures displaying the beginning and the end of the averaging epoch relative to the first time readout of the selected EEG interval.



On the right side of the window there is **Maps bar**. In the top of the bar there is a color scale and below it controls allows to modify mapping parameters are placed.

Use the **Scale** list or "+" and "-" keys to change color scale sensitivity.

Use the **Step** list to change averaging epoch length.

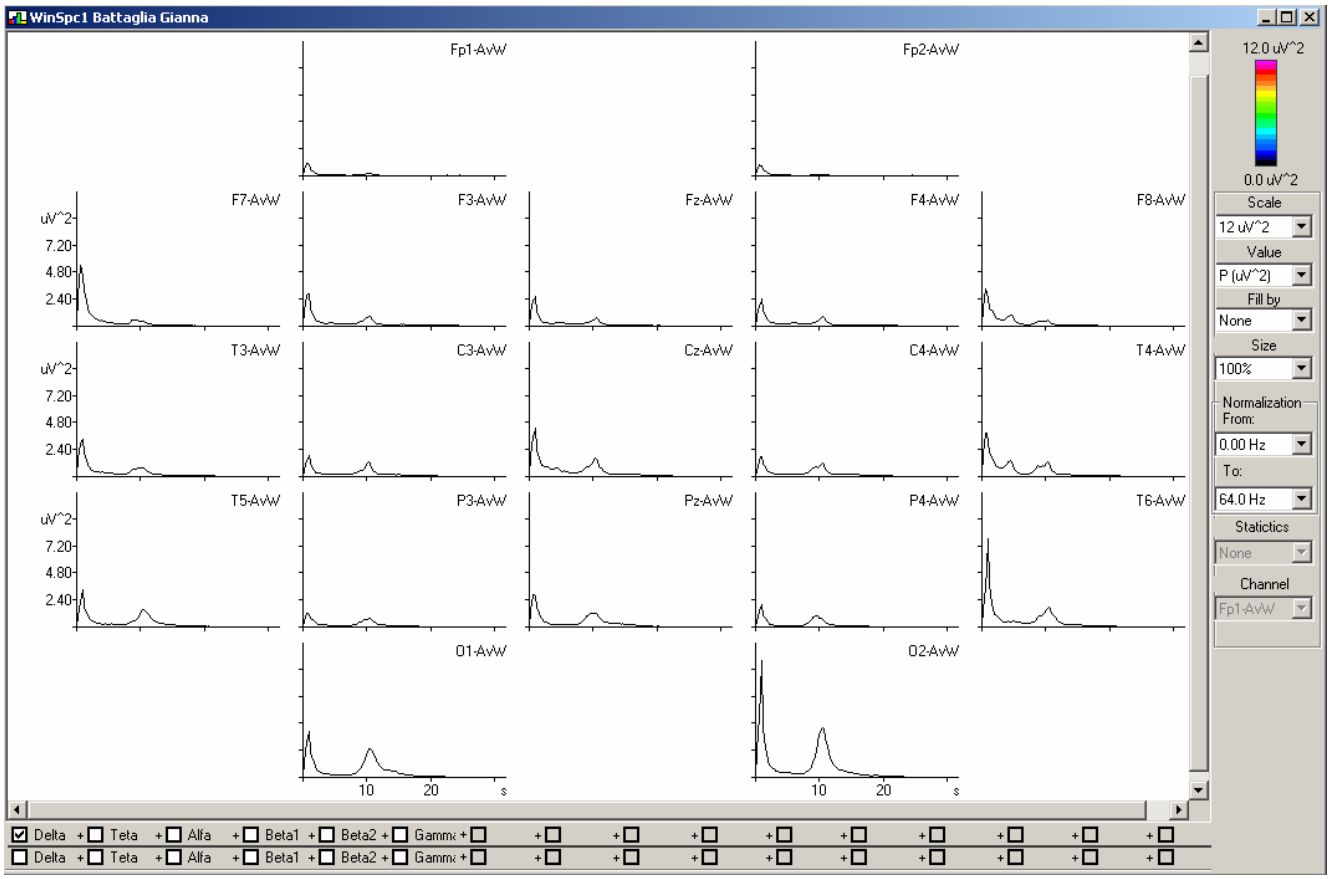
Use the **Size** list to zoom maps.

Use the **Setup: Mapping Style** command to change color scale palette and appearance of maps.

Use **Edit: Copy** command to copy maps visible in the window to the clipboard. They can then be pasted into final report text or into any application (WinWord, Paint. etc.) window by means of **Edit: Paste** command.

4. EEG Power Spectra (Auto and Cross-correlations) Window

This window is designed for EEG power spectra and correlation analysis. On the right side of the window there is **Spectra bar** and at the window bottom there is the **Calculator bar**.



The results of EEG power spectral analysis can be presented in seven window modes that are selected by commands available on the **Analysis menu**:

Graphs	Power spectra (auto and cross correlation) are shown as graphs for each separate channel. For the Spectral Dynamics display mode, spectra for each epoch are superposed with a small vertical shift.
Histograms	Total signal power for given EEG frequency bands is depicted as a histogram for each separate channel. **Disabled for auto and cross correlation**
Table	For EEG power spectra: absolute or related (percent) of spectral power and the frequency of signal maximum for given EEG frequency bands are listed in the table For EEG coherence: average coherence and the frequency of signal maximum for given EEG frequency bands are listed in the table For EEG autocorrelations: minimal lag value in which autocorrelation function cross zero and corresponding to lag frequency are listed in the table For EEG cross-correlations: value of first maximum (minimum) of cross correlation function and corresponding lag are listed in the table
Maps	Total signal power for given EEG frequency bands is shown on maps. For the Spectral Dynamics mode, power is mapped separately for each epoch. **Disabled for auto and cross correlation**
Asymmetry	Total signal power asymmetry for given EEG frequency bands is shown on

maps. For the Spectral Dynamics mode, asymmetry is mapped separately for each epoch. **Disabled for auto and cross correlation**

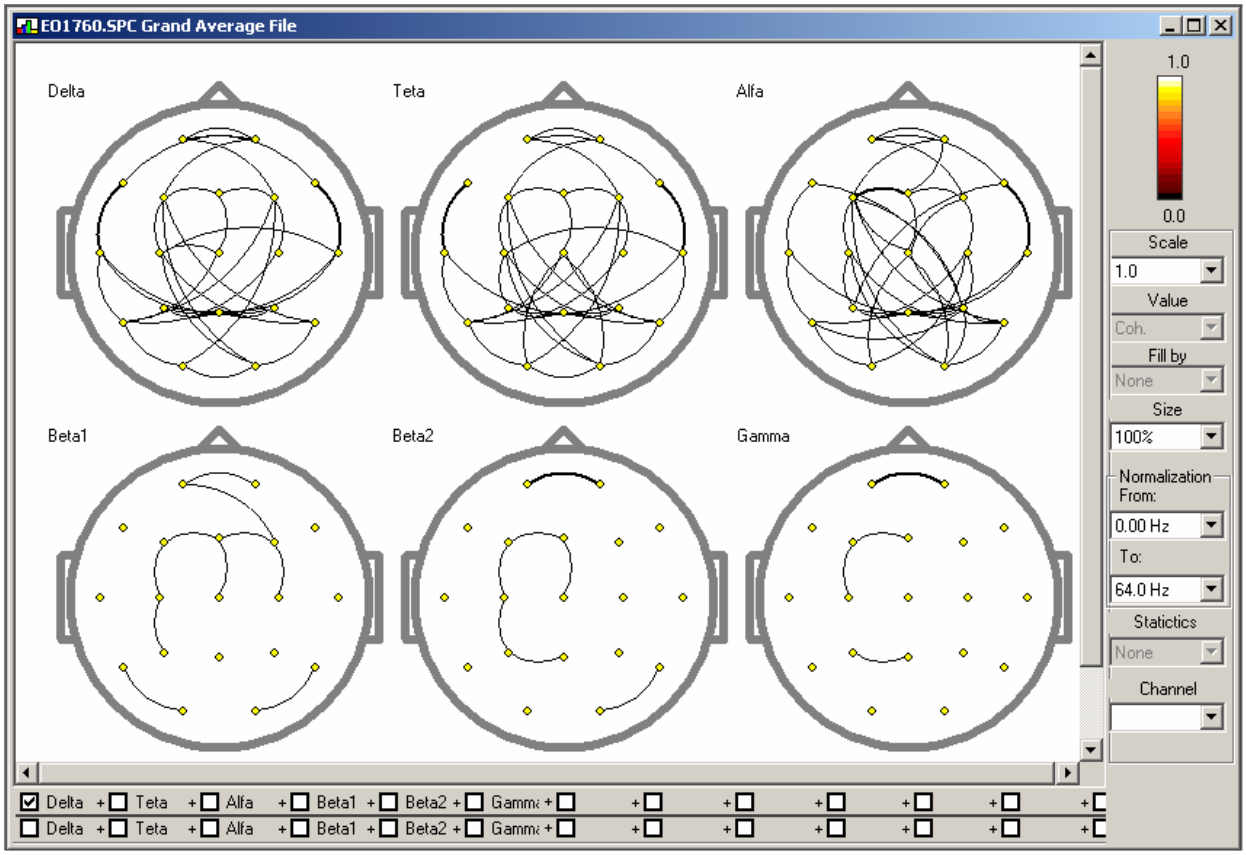
Formula (Mapping) A map depicting the ratio of signal powers for two given EEG frequency bands. The ratio formula is defined by means of the **Calculator bar**. For the Spectral Dynamics mode, multiple maps are displayed. **Disabled for auto and cross correlation**

Formula (Graphs) Signal power ratio dynamics for two given EEG frequency bands. **Disabled for auto and cross correlation**

Interaction diagram The EEG coherence and cross correlation can be presented by so called interaction diagrams.

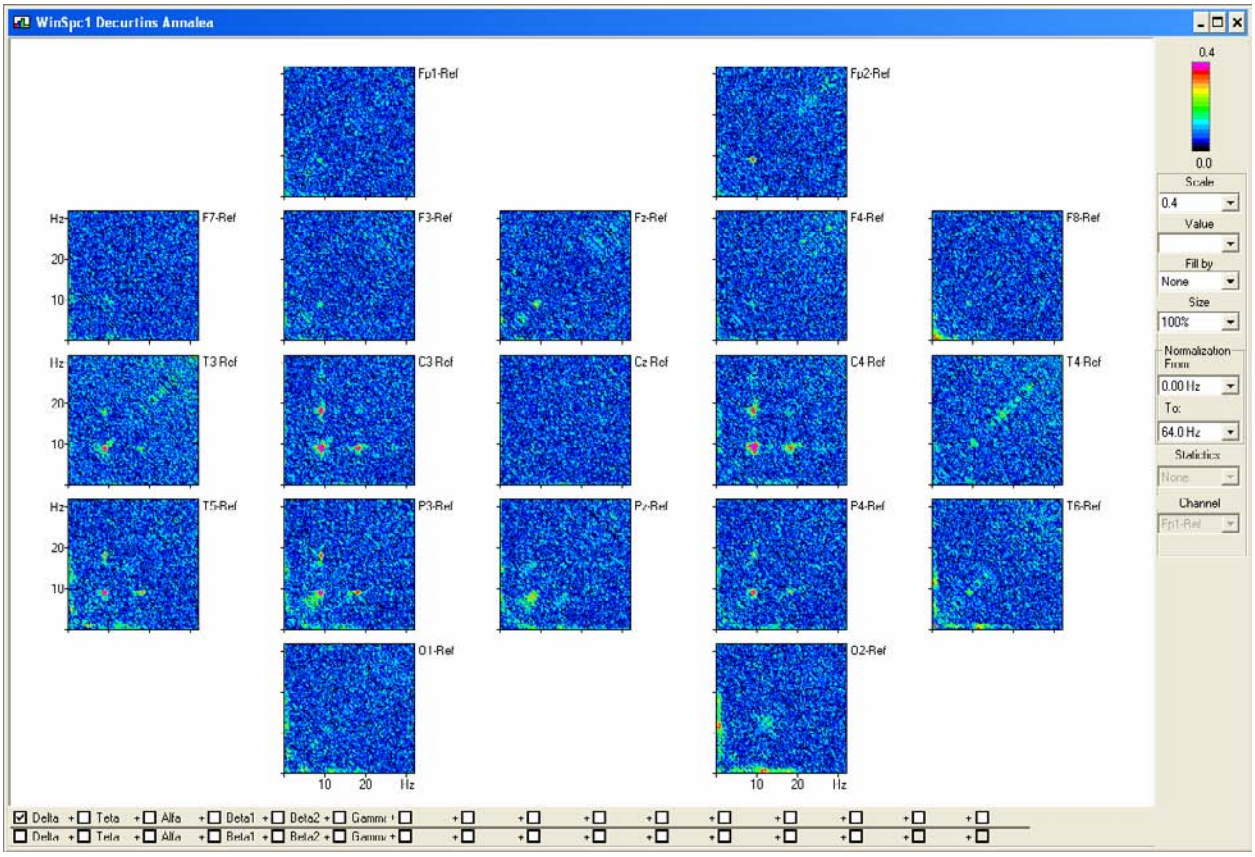
For EEG coherence: electrodes will be connected by curves with different thickness and colors in dependence of value of average coherence

For EEG cross correlation: electrodes will be connected by curves with different thickness and colors in dependence of value first maximum (extreme) of cross correlation function.



The window can display background EEG coherence and phase spectra as well as power spectra.

Bi-spectra and bi-coherence are displayed by frequency-frequency color plots.



To switch between window modes, use the following **Analysis menu commands**:

EEG Spectra	Displays EEG power spectra (autocorrelation)
Coherence for Channels	Displays EEG coherence (cross correlation) for a selected channel
Average Coherence	Displays average EEG coherence for all channels **Disabled for auto and cross correlation**
Phase Spectra	Displays EEG phase spectra for a selected channel. **Disabled for auto and cross correlation**
Bispectra	Displays EEG bi-spectra frequency-frequency plots **Disabled for auto and cross correlation**
Bicoherence	Displays EEG bi-coherence frequency-frequency plots **Disabled for auto and cross correlation**

If spectral dynamics have been calculated during EEG processing, you can toggle between Average Spectra and Spectral Dynamics window modes (see **Analysis menu commands**) **Disabled for auto and cross correlation.**

Use the **Scale** list or "+" and "-" keys to change color scale sensitivity (or Y axis scale for graphs).

Use the **Value** list (**disabled for auto and cross correlation**) to choose what value to depict in graphs and maps:

P (uV^2)	Graphs: Y axis shows signal power. Color scale encodes power (in regular intervals). Measurement units – squared microvolt.

A (uV)	Graphs: Y axis shows signal “amplitude”, i.e. square root of power. (The “amplitude” term has physical sense only for spectral graphs, in all other cases it means square root of the total signal power in a given frequency band). Color scale encodes “amplitude” (in regular intervals). Measurement units – microvolt.
%	Graphs: Y axis shows percentage of total broadband signal power is in a particular frequency band. Color scale encodes power percentage (in regular intervals). Measurement units – percent.
Log(P)	Graphs: Y axis shows logarithm of signal power
Units	For coherence and auto and cross-correlations
Grad	For phase

Use the **Fill By** list (**disabled for auto and cross correlation**) to choose how to fill areas under a graph or a histogram.

None	Blank (white) areas
Bandranges	Fills areas by colors defined in the standard frequency band parameters (see **Setup: EEG Bandranges…** command)
Color Scale	Fills areas by color scale showing power level

Choose graph or map size from the **Size** list.

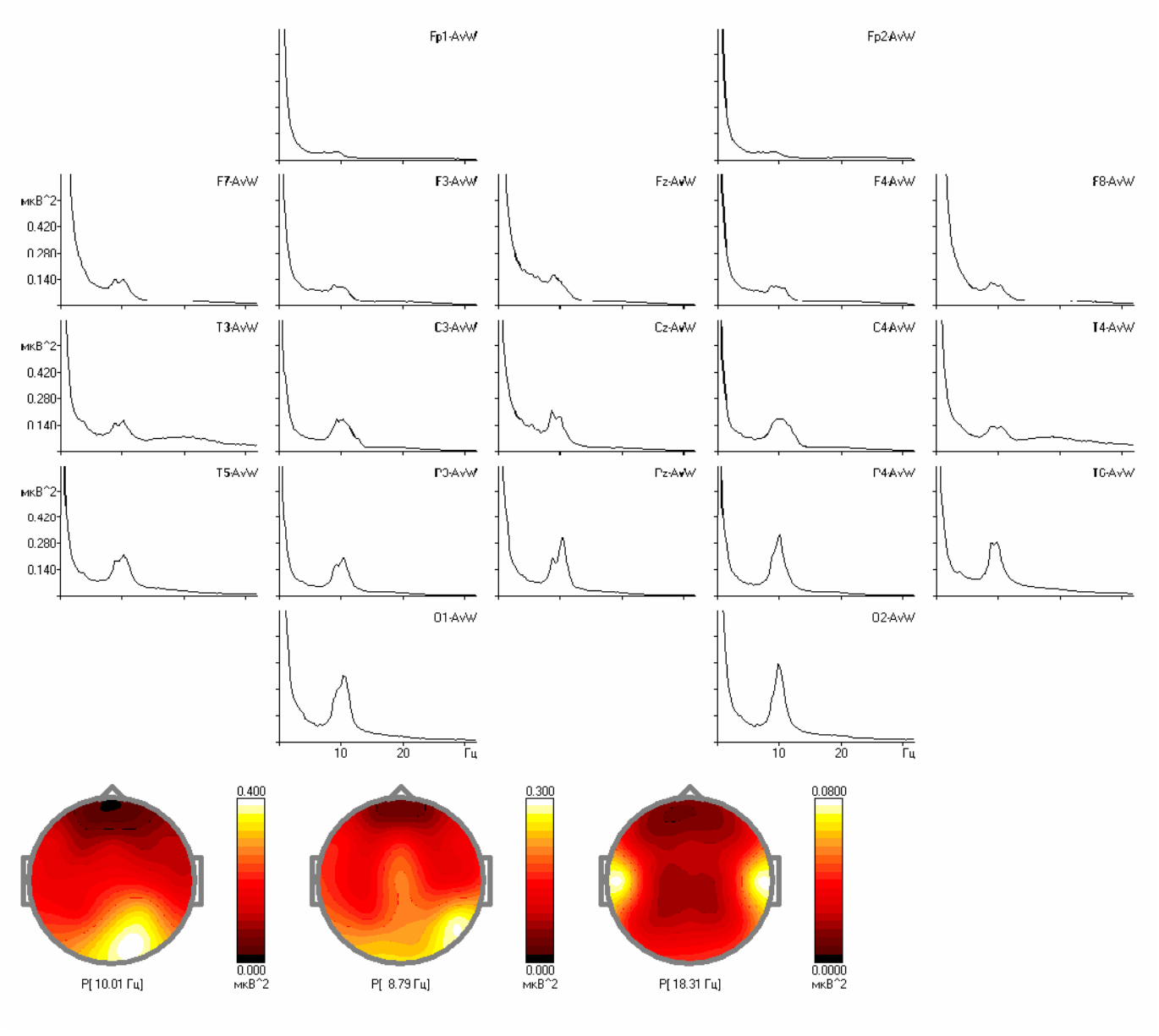
Use **Normalization fields** (**disabled for auto and cross correlation**) to define frequency band used for computation and displaying normalized spectra (see above **Value: %**). These parameters will influence on results of statistical comparison of two spectra (see Analysis: Comparison of results command).

Use **Statistics field** (**disabled for auto and cross correlation**) to show or hide results of statistical comparison of two spectra. The statistical significance of differences is displayed be vertical bar with different height: shorter bar means that significant of differences is lower then 0.05 ($p<0.05$), middle bar – $p<0.01$ and longer bar – $p<0.001$.

Use the **Channel** list to choose a channel to display EEG coherence or phase spectrum for.

For **Graphs** and **Histograms** modes, **Value**, **Freq. (tag) and** p<0.0* fields of the **status bar** are used to show power level, frequency and significance of differences. A frequency component may be pointed to on a graph or selected in a histogram by cursor position, when holding the left mouse button pressed.

There is a possibility to add one or more maps corresponding to selected frequency of frequency band. A frequency component may be pointed to on a graph or selected in a histogram by cursor position, when holding the right mouse button pressed. When right button will be released a pop-up menu will appears on the screen. Use Add Map command to add map for selected frequency.



Use the **Setup: EEG Bandranges…** command (**disabled for auto and cross correlation**) to modify parameters for standard EEG frequency bands.

Use the **Setup: Mapping Style command** to change color scale palette and map appearance.

Use **Edit: Copy** command to copy graphs or maps visible in the window to the clipboard. They can then be pasted into final report text or into any application window (WinWord, Paint and etc.) by means of **Edit: Paste** command. The table of spectral parameters can be also copied to clipboard as text.

Use the **File: Save** command to save newly calculated EEG power spectra in the database.

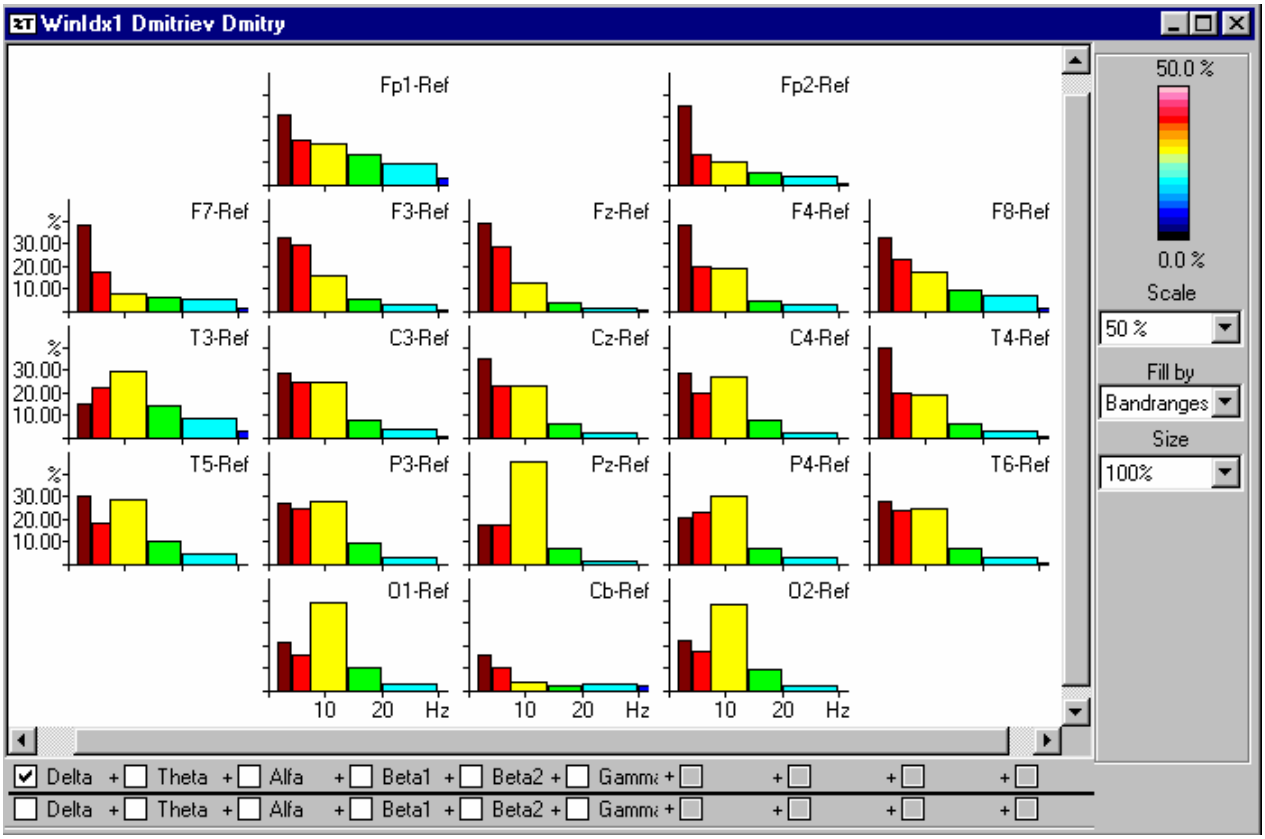
Use the **Analysis: Insert tables** into report command (**disabled for auto and cross correlation**) to insert detailed report into the text of MS Word window. This option is available only if raw spectra are kept during computation of power spectra (see Parameters of EEG spectra computation dialog).

Use the **File: Print** command to printout of content of window. Graphs and maps are rescaled to fit single page.

The preliminary review of printing form can be done using the command **File: Print Preview**.

5. EEG Indices Window

This window is designed for EEG indices analysis.



On the right side of the window there is the **Maps/Spectra/Indices bar** and at the window bottom there is a **Calculator bar**. The results of EEG indices analysis can be presented in six window modes that are switched from one to another by corresponding commands found on the **Analysis menu**:

Graphs	Indices are depicted as graphs for each separate channel. X axis - frequency (0.25 Hz increments), Y axis – percentage of time, that signal of a given frequency was detected.
Histograms	Indices are depicted as graphs for each separate channel. X axis - frequency (0.25 Hz increments), Y axis – percentage of time, that signal of a given frequency lay within a certain standard EEG frequency band.
Table	EEG indices are listed in a table.
Maps	Percentage of time a signal existed within a certain standard EEG frequency band.
Asymmetry	Map of Asymmetry of EEG indices.
Formula	Ratio of percentages of signal existence time for two standard EEG frequency bands is mapped. Ratio formula to be mapped is defined by means of **Calculator bar**

Use the **Scale** list or “+” and “-” keys to change color scale sensitivity (or Y axis scale for graphs).

Use the **Fill By** list to choose how to fill areas under a graph or a histogram.

None	Blank (white) areas
Bandranges	Fills areas by colors defined in the standard frequency band

	parameters (see **Setup: EEG Bandranges…** command)
Color Scale	Fills areas by color scale showing index level

Choose graph or map size from the **Size** list.

For **Graph** and **Histogram** modes, **Value** and **Freq.** Fields of the **status bar** are used, showing level and frequency for an index indicated by cursor on a graph or a histogram when holding the left mouse button pressed.

Use the **Setup: EEG Bandranges…** command to modify parameters for standard EEG frequency bands.

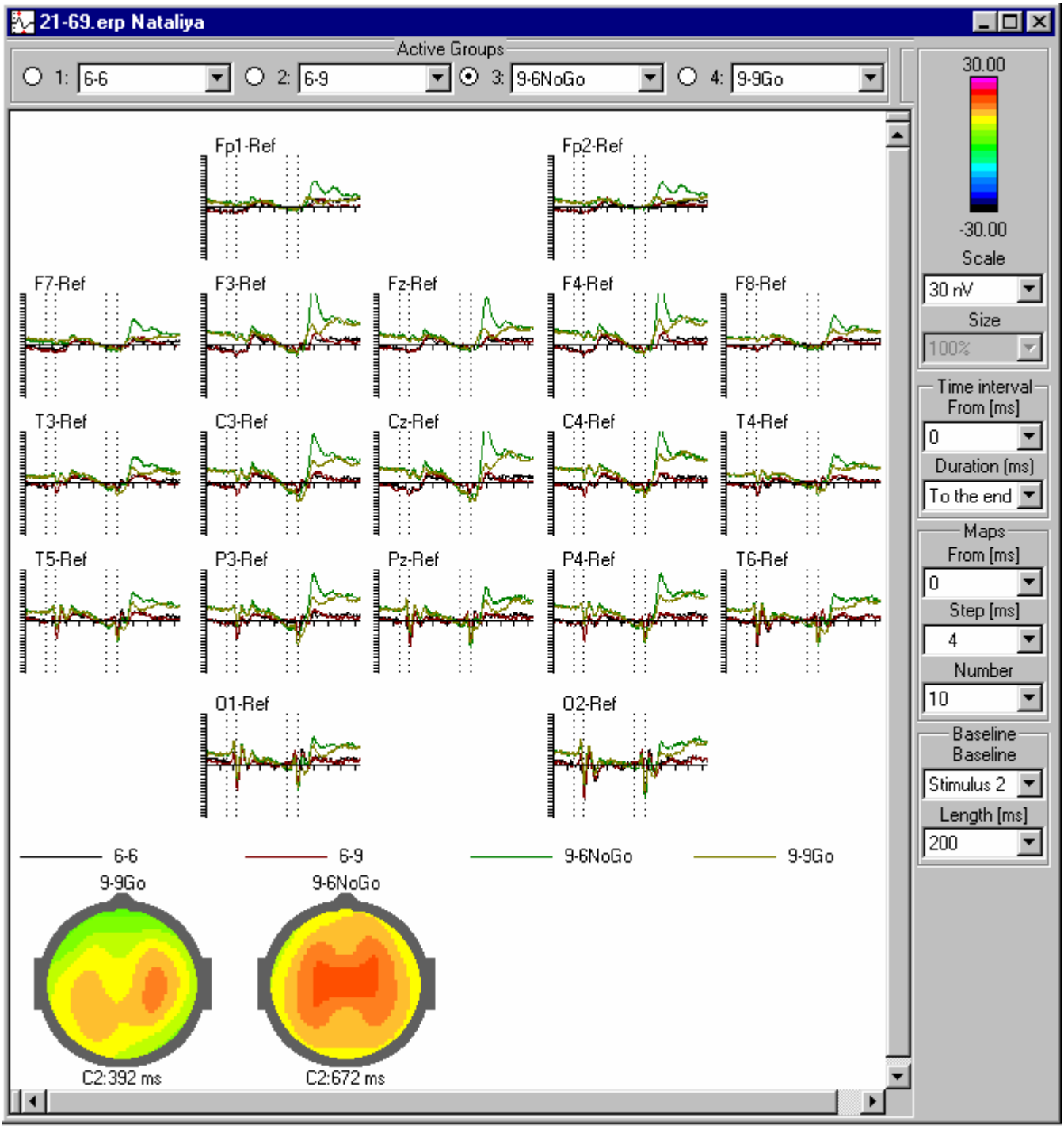
Use the **Setup: Mapping Style** command to change color scale palette and map appearance.

Use **Edit: Copy** command to copy graphs or maps visible in the window to the clipboard. They can then be pasted into final report text or into any application (WinWord, Paint and etc.) window by means of **Edit: Paste** command. The table of spectral parameters can be also copied to clipboard as text.

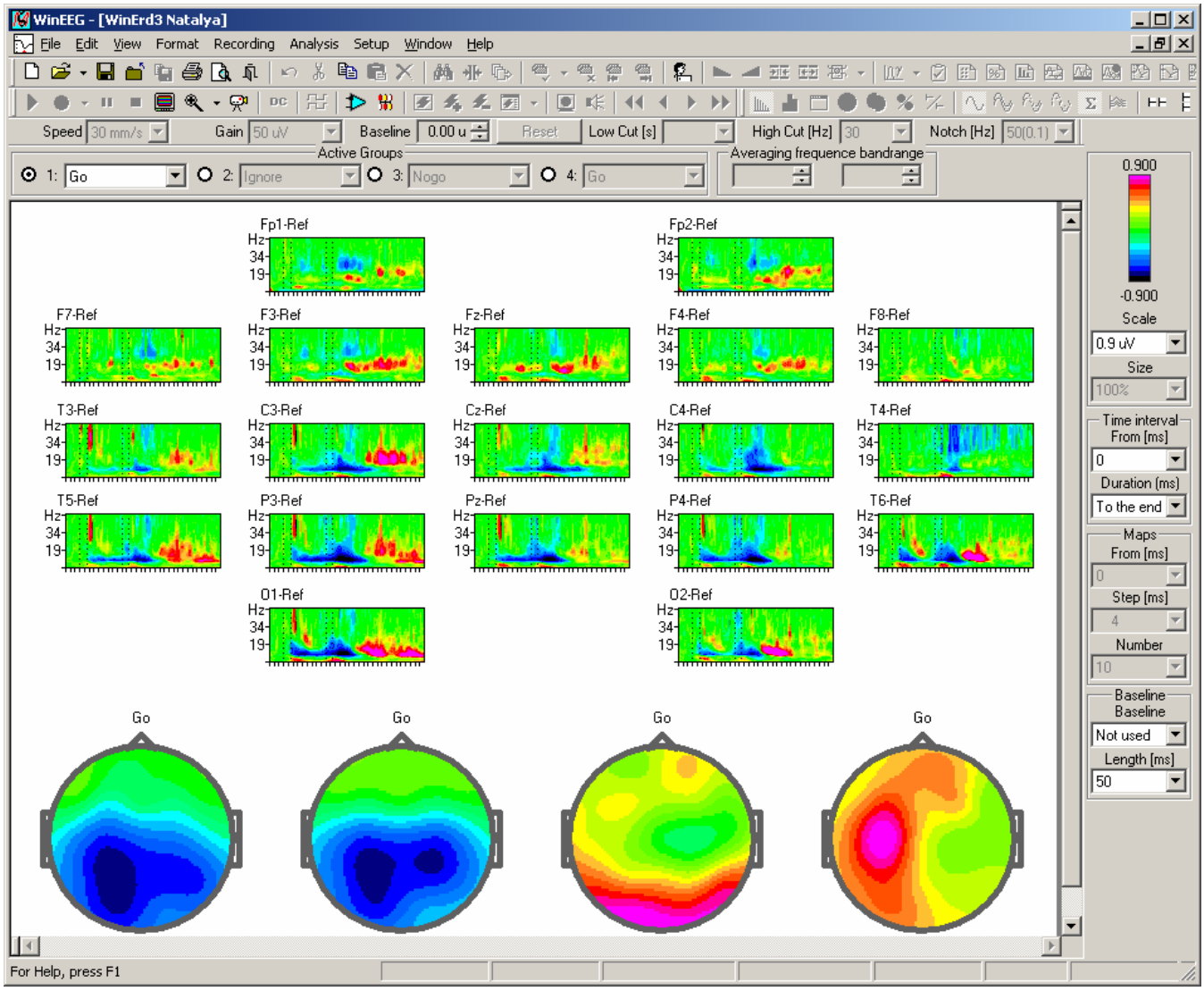
Use the **File: Save** command to save newly calculated EEG indices in the database.

6. ERP Window

This window is designed to analyze event-related potentials (ERP), event-related EEG de-synchronization (ERD), event-related EEG coherence (ERCoh) or to perform wavelet ERP analysis.



ERP bar is placed on the right side of the window and at the top there is the **Averaging group bar**. ERPs can be presented in five window modes that are selected by corresponding commands on the **Analysis menu** as listed in the table below. In addition, for wavelet ERP analysis there is a feature that allows display of EEG oscillation dynamics for the given frequency band as graphs or as bitmaps (X axis – time, Y axis – frequency)



Channels / Groups	ERPs are depicted as graphs arranged in columns by channels and in rows by trial groups.
Groups/ Channels	ERPs are depicted as graphs arranged in columns by trial groups and in rows by channels
Time / Groups Mapping	ERPs are depicted as maps arranged in columns by time readouts and in rows by trial groups.
Groups / Time Mapping	ERPs are depicted as maps arranged in columns by trial groups and in rows by time readouts.
Formatted Page	ERPs are depicted as graphs and maps. ERPs are depicted as graphs and maps. Graphs are placed according to selected format parameters (see "**Setup->Graph Formats…**" command). Maps are placed below graphs.
Average bandpower	Displays average band power graphs for wavelet ERP analysis.
Rasters Time/Frequency	Displays time/ frequency rasters for wavelet ERP analysis.

Use the **Scale** list in the **ERP bar** or "+" and "-" keys of keyboard to change color scale sensitivity (or Y axis scale for graphs).

Choose graph or map size from the **Size** list in the **ERP bar**.

Use **Active group** fields in the **ERP bar** to set start and end time of the interval to be depicted by ERP graphs.

Use **Maps** group fields in the **ERP bar** to set start and end time of the interval to be mapped and also to define degree of ERP compression. If the **Step** parameter value exceeds quantizing interval then time-averaged ERPs will be mapped.

Use **Baseline** group fields in the **ERP bar** to modify interval for baseline calculation

Use **Active Groups** group fields in the **Averaging group bar** to choose groups to be displayed and to select an “active” group.

Use **Averaging bandrange** group fields in the **Averaging group bar** to set frequency band for displaying average band power graphs for wavelet ERP analysis.

Use **Setup: Mapping Style** command to change color scale palette and map appearance.

Use **Edit: Copy** command to copy graphs or maps visible in the window to the clipboard. They can then be pasted into final report text or into any application (WinWord, Paint and etc.) window by means of **Edit: Paste** command.

Use the **File: Save** command to save newly calculated ERPs in the database.

Click right mouse button to show the popup menu. If the cursor is placed on a graph then **Add Map, Add Label, Copy Parameter Distribution, Copy Channel** and **Copy Channel to Report** commands will be available in the popup menu.

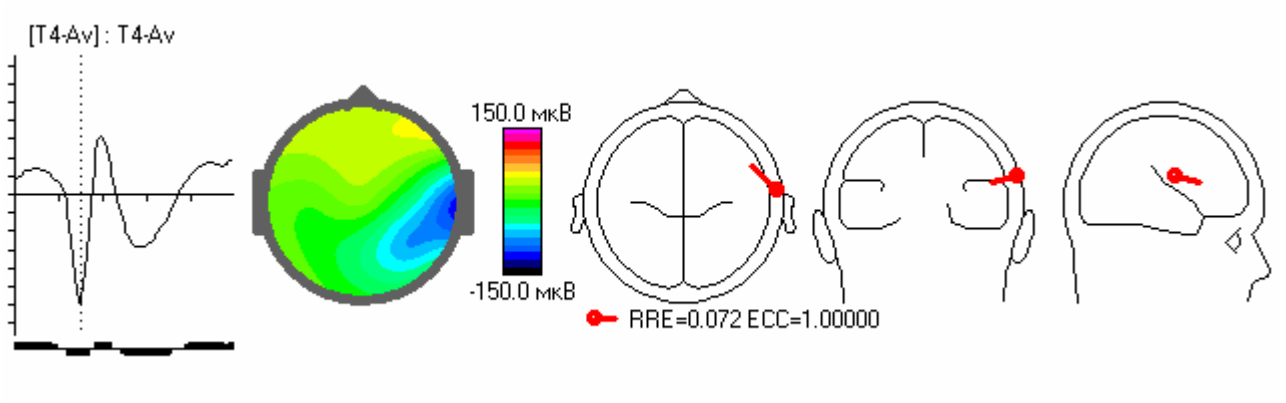
Use the **Add Map** command to add a map in the **Formatted Page** window mode.

Use **Add Label** command to add peak labels on the “active” group ERP curve.

Use **Copy Parameter Distribution** to place a string of voltages into clipboard for selected “active” group ERP curve and time sample:

```
    Subject  Name,  [T4-Av],        148,     37.30,     39.38,     34.88,
30.82,    34.50,    11.81,     2.91,    20.26,   -36.97, -120.12,    11.20,
-8.24,   -74.47,   -36.31,    -0.21,   -15.95
```

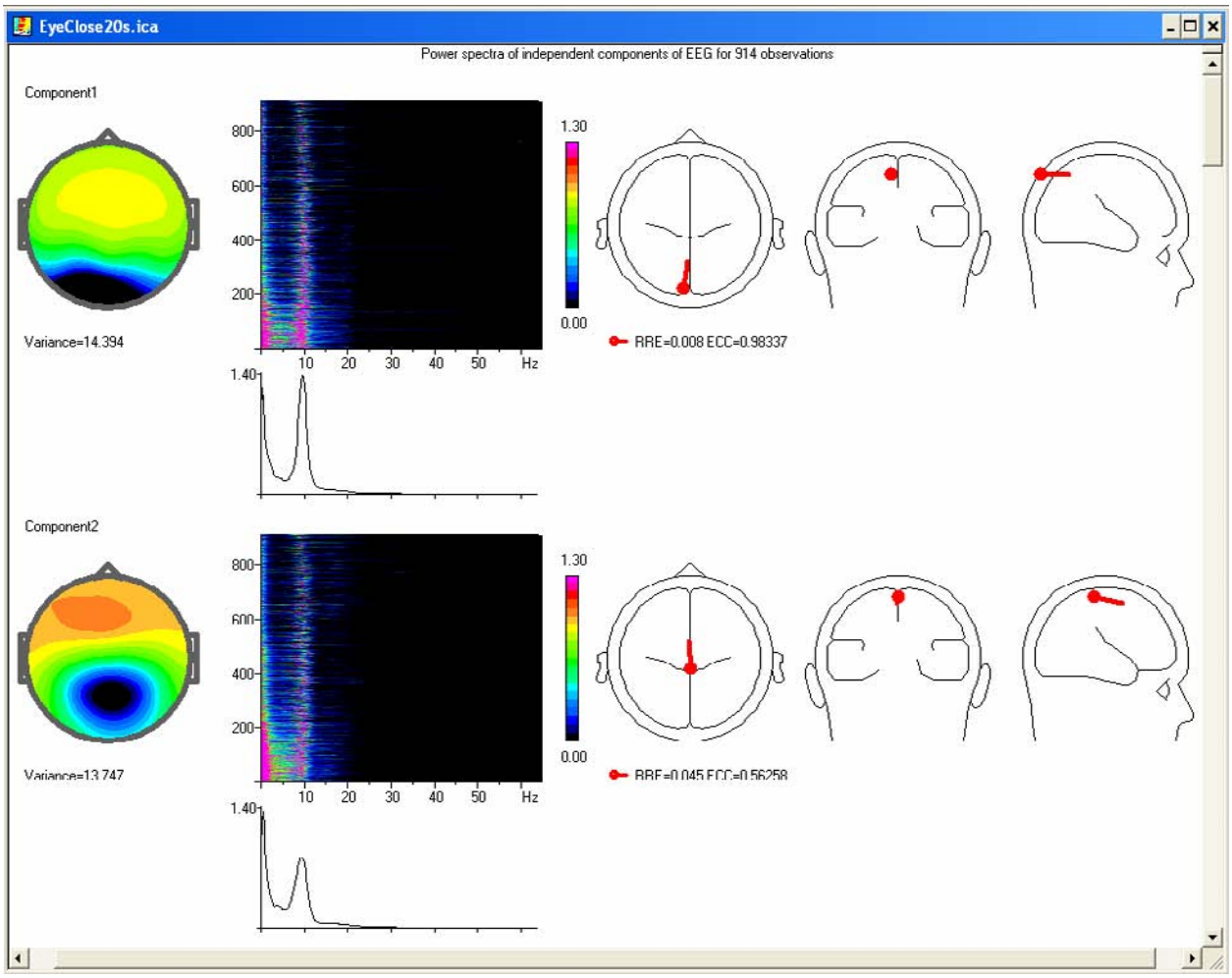
Use **Copy Channel** and **Copy Channel to Report** commands to place selected channel and the “active” group waveform into clipboard or final report.



The map and dipole localization picture will added for selected time sample if monopolar montage was used.

7. ICA Window

The design of ICA window for spectra of EEG independent components is presented on following figure.



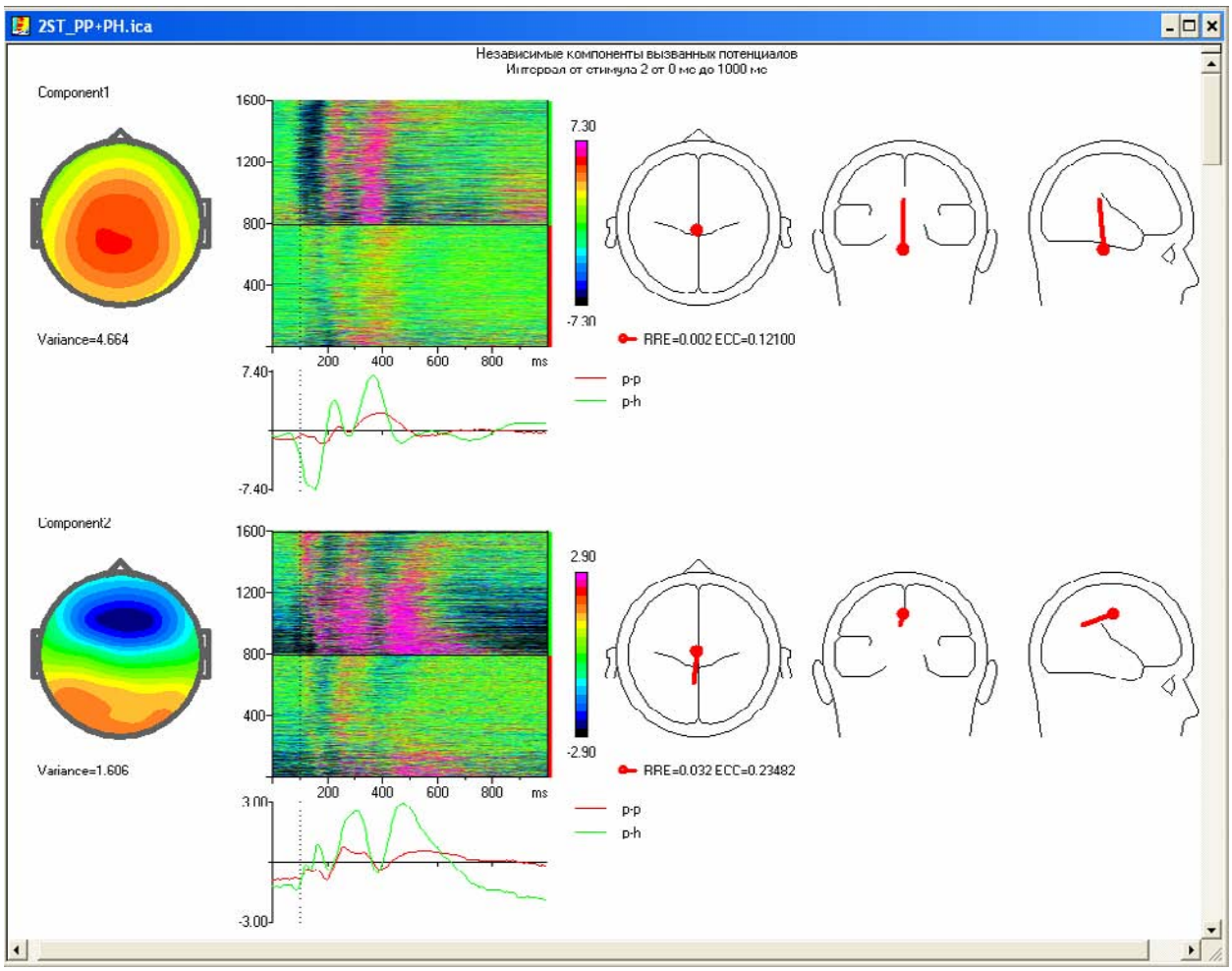
ICA window for independent component spectra.

The topographies of components are placed on the left side of ICA window. The “power” (variance) of components is placed below topographies. The bitmaps displaying individual (not averaged) components spectra are place on the right from topographies. The average components spectra are displayed by curves places below bitmaps.

Each row of bitmap corresponds to single epoch spectra or individual spectra. The first spectrum is displayed on the bottom of bitmap. The x-axis corresponds to the frequency. The power of spectrum is coded by color. The curve displays average power spectra of EEG component. The parameters of equivalent dipole source for component topographies are displayed on right side of window. Here RRE is “Residual Relative Energy” allowing estimate the accuracy of fitting of real data by dipole model and ECC is eccentricity of dipole.

The frequency of selected by mouse spectrum harmonic is displayed on status bar.

The design of ICA window for independent components of ERPs is presented on following figure.



ICA window for independent component ERPs.

The topographies of components are placed on the left side of ICA window. The “power” (variance) of components is placed below topographies. The bitmaps displaying individual (not averaged) components are place on the right from topographies. The average components are displayed by curves places below bitmaps.

Each row of bitmap corresponds to single trial or individual ERP. The first or individual ERP trial is displayed on the bottom of bitmap. The x-axis corresponds to the time. The value of components is coded by color. The curves display average ERPs for different conditions. The legend of curves (the correspondence of colors to conditions) is displayed right.

The parameters of equivalent dipole source for component topographies are displayed on right side of window. Here RRE is “Residual Relative Energy” allowing estimate the accuracy of fitting of real data by dipole model and ECC is eccentricity of dipole.

The time offset of selected ERP samples is displayed on status bar.

The command “**Copy component**” from pop-up menu of window is used to place corresponding bitmaps and graphs to clipboard.

The command “**Component name**” from pop-up menu of window is used to modify corresponding name.

The command "**LORETA for component**" from pop-up menu of window is used to runs LORETA application and automatically store to it the topographies of selected component.

The command "**Select groups**" from menu "**Analysis**" is used to select the list of conditions to which corresponding average curves will be displayed.

The command "**Select group pairs**" from menu "**Analysis**" is used to select the list of condition pairs to which corresponding difference waves will be displayed.

The command "**Change graph scale**" from menu "**Analysis**" is used to change vertical scale of the graph.

The command "**Correct baseline**" from menu "**Analysis**" is used to define the length of baseline time interval for baseline correction.

The command "**Save components filter**" from menu "**Analysis**" is used to save to ASCII file matrix $A_{i,j}$ using as a spatial filter for transformation raw EEG (ERP) to components.

The command "**Save signals filter**" from menu "**Analysis**" is used to save to ASCII file matrix using as a spatial filter for reviling (or suppression) of signals from raw EEG (ERP) for selected list of components.

The command "**Export of component parameters"** from pop-up menu of window is used to save to ASCII file the parameters of selected component for the future statistical analysis.

The "**Save**" command from submenu "**File**" is used to save newly calculated independent components ICA file.

The "**Save As…**" command from submenu "**File**" is used to save independent components in ICA file with another name.

WinEEG Bars

1. Main Toolbar

The main toolbar is placed in the top of the WinEEG window under the menu bar. It enables quick initiation of many WinEEG commands by simple mouse clicks.

To show or to hide the main toolbar, use **View: Toolbar -> Main Toolbar command**.

To change the arrangement of buttons in the main toolbar, use **View: Toolbar – Customize Main Toolbar command**. You can also move or delete buttons by dragging them while holding the **Shift** key down.

Click To	
	Create a new EEG file.
	Open a data file (EEG, spectra file, etc.) Click the arrow to open database list
	Save the active file to the database.
	Close the active document.
	Open the Export file format menu.
	Print the active document.
	Preview the active document before printing.
	Exit WinEEG.
	Undo last action (when editing final report text).
	Mark selected time interval of EEG record as artifact. Cut selected block from final report text to clipboard.
	Copy active window contents or selected block of text from final report to clipboard.
	Paste the clipboard content to final report text
	Delete selected block from final report text or selected interval from data plot.
	Find given text in the final report.
	Find the beginning of selected plot interval.
	Find the beginning of a plot fragment (trial).
	Add a user label or turn Add Label mode off. Click the arrow to open label list.
	Delete a user label or turn Delete Label mode off.

 Find nearest user label beyond the left border of the plot window.

 Find nearest user label beyond the right border of the plot window.

 View or edit patient card.

 Decrease sensitivity (vertical scale).

 Increase sensitivity (vertical scale).

 Decrease speed (horizontal scale).

 Increase speed (horizontal scale).

 Modify montage. Click arrow to open montage list.

 Turn band pass filter on or off. Click arrow to open filter list.

 Open or activate final report window for the active program file.

 Open map window.

 Calculate EEG indices.

 Calculate EEG spectra.

 Correct electro oculogram (EOG)

 Correct EEG artifacts or restore last correction.

 Mark EEG artifacts automatically.

 Computes event-related potentials.

 Computes event-related EEG desynchronization.

 Computes event-related EEG coherence.

 Computes event-related wavelet EEG bandpower.

 Computes event-related wavelet EEG coherence.

 Insert patient card into final report text.

 Insert a final report template.

 Cascade windows.

 Tile windows horizontally.

 Tile windows vertically.

 Get context sensitive help on a WinEEG control.

2. Input Control Toolbar

This toolbar is usually placed in the top of the WinEEG window under the main toolbar (but can positioned differently) and is used to control EEG acquisition and to scroll EEG window.

To show or to hide the Input Control toolbar, use **View: Toolbar – Input Control Toolbar command**.

To arrange buttons in the Input Control toolbar, use **View: Toolbar – Customize Input Control Toolbar command**. You can also move or delete buttons by dragging them when holding the **Shift** key pressed.

Click To	
	Start EEG acquisition and monitoring without recording to hard disk.
	Start EEG fragment recording to hard disk. Click arrow to open list of fragment names.
	Pause EEG acquisition, monitoring and recording.
	Stop EEG acquisition, monitoring and recording and switch to EEG view mode.
	Show (hide) Main Video Window.
	Show (hide) Additional Video Window
	Change the size of Video Window.
	Start (stop) recording of Video signal synchronously with EEG recording.
	Start calibration signal (0.5 Hz, 0.1 Ohm) acquisition and monitoring in a new EEG window without recording to hard disk.
	Reset DC component
	View calibration efficiencies of the amplifiers.
	Measure electrode impedance.
	Turn rhythmic photo stimulation on or off. Click arrow to open menu of photo stimulator colors (White, Red and Red-With).
	Increase photo stimulation frequency.
	Decrease photo stimulation frequency.
	Turn on (off) a photo stimulation program. Click arrow to open photo stimulation program list.
	Start or stop a stimuli presentation program.
	Rewind the EEG window left (with high speed).
	Playback the EEG window left (with normal speed).
	To playback the EEG window right (with normal speed).
	To rewind the EEG window right (with high speed).

3. Analysis Toolbar

This toolbar is usually placed in the top of the WinEEG window under the main toolbar (but can be moved) and is used to manage ERP, Spectra and Indices windows.

To show or to hide the toolbar, use **View: Toolbar Analysis Toolbar command**.

To modify button set or to change order of buttons in the Input Control toolbar, use **View: Toolbar Customize Analysis Toolbar command.** You can also move or delete buttons by dragging them when holding the **Shift** key pressed.

Click To	
	Display spectra or indices as graphs (Graphs mode).
	Display spectra or indices as histograms (Histograms mode).
	List spectra or indices parameters in a table (Table mode).
	Display spectra or indices as maps (Maps mode).
	Map asymmetry for spectra or indices (Asymmetry mode).
	Map ratio for spectra or indices (Formula Mapping mode).
	Display interaction diagrams (Interaction diagrams mode).
	Display ratio dynamics for spectra as graphs (Formula Graphs mode).
	Display power spectra or their parameters in spectra window.
	Display EEG coherence or its parameters for each channel in spectra window.
	Display average EEG coherence or its parameters in spectra window.
	Display phase spectra or their parameters in spectra window.
	Displays EEG bi-spectra frequency-frequency plots.
	Displays EEG bi-coherence frequency-frequency plots
	Display average spectra in spectra window.
	Display spectra dynamics in spectra window.
	Switch ERP window to Channels/Groups mode.
	Switch ERP window to Groups/Channels mode.
	Switch ERP window to Time/Groups Mapping mode.
	Switch ERP window to Groups/Time Mapping mode.
	Switch ERP window to **Formatted Page** mode.
	Display average band power for wavelet ERP analysis.

 Display time-frequency plots for wavelet ERP analysis.

 Copy window contents and paste it into MS Word (to current cursor position on instead selection).

 Insert tables of EEG spectra parameters into MS Word.

4. Status Bar

The status bar is located at the bottom of the WinEEG window. To show or to hide it, run **View: Status Bar command**.

The left part of the status bar displays a brief description of a menu command, a toolbar button, a Filters bar control, an Input Control bar control or a Channel Names bar control pointed to by the mouse cursor (used, e.g., to preview a software action by hesitating with the mouse cursor on a command item to ensure the intended action will take place when the mouse button is clicked).

On the right side of the status bar there are fields displaying values for a selected EEG channel (or spectrum or ERP parameters evaluated at the marker) and indicating states of the locking keys.

Field	**Description**
	For EEG window:
L =	Instantaneous EEG value at left marker
R =	Instantaneous EEG value at right marker
T[R-L] =	time interval between markers
R-L =	Difference between instantaneous values at the markers
A =	Peak-to-peak EEG amplitude for selected interval (difference between maximal and minimal values)
F =	“Average” signal frequency
ΦC =	Photo stimulation frequency
	For EEG spectra window:
6.	Measured parameter value
2.	Frequency at the marker position
3.	
	For ERP window:
V	Measured potential value (uV)
T	Time from the last preceding stimulus (ms); stimulus number is indicated by number before colon
F	Frequency (Hz) for time-frequency plots.
P<	Statistical significance.

Indicator	**Description**
CAP	Caps Lock key locked
NUM	Num Lock key locked
SCRL	Scroll Lock key locked

5. Print Preview Control Bar

Print – Call **Print dialog** to start printing the document.
Next – View next page.
Previous – View previous page.
Two Pages / One Page – View two pages or one page at a time.
Zoom in – Zoom page in.
Zoom out – Zoom page out.
Close – Close Print Preview.

6. Filters Bar

This bar is usually placed at the top of the WinEEG window (but can be moved) and is used to edit a number of parameters for the active EEG window or active EEG file.

Use the **Speed** list to choose horizontal scale (simulating paper speed). You can also use **"*"** and **"/"** keys. Press **"/"** key to half decrease speed or **"*"** key to increase the speed twice.

Use the **Gain** list to choose vertical scale (gain). You can also use **"+"** and **"-"** keys. Press **"-"** key to half decrease gain or **"+"** key to increase gain twice.

To change gain only for a selected channel, hold **Ctrl** pressed (see **Channel Names bar**), otherwise gain will be changed for all channels that are visible in the montage.

Use **High Cut (Hz)** list to choose EEG band pass high frequency cutoff.

To change high cutoff only for a selected channel, press and hold **Ctrl** to avoid changing cutoff frequency for all channels that are visible in the montage.

Use **Low Cut (Hz)** list to choose EEG band pass low frequency cutoff.

To change low frequency cutoff only for a selected channel, press and hold **Ctrl** to avoid changing cutoff frequency for all channels that are visible in the montage.

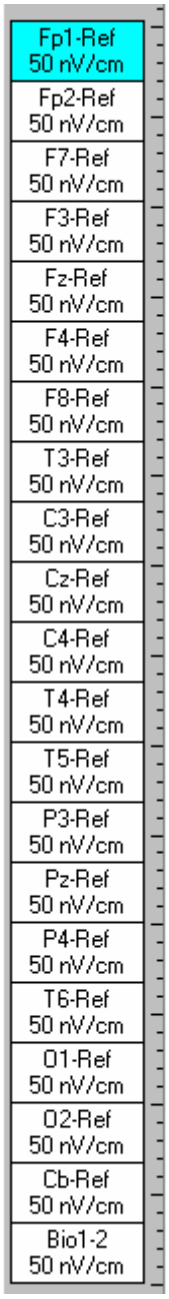
Use **Notch (Hz)** list to turn notch 50 or 60 Hz filter on or off.

To change notch only for a selected channel, hold **Ctrl** pressed, otherwise notch will be changed for all channels that are visible in the montage.

Use **Baseline** field to change baseline.

To change baseline only for a selected channel, hold **Ctrl** pressed, otherwise baseline will be changed for all channels that are visible in the montage.

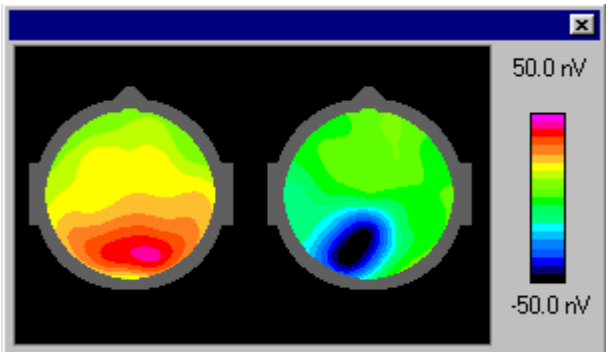
7. Channel Names Bar



This bar is placed at the left side of the EEG window and is used to select a channel for processing. The channel also can be selected by the **Up** and **Down** arrow keys.

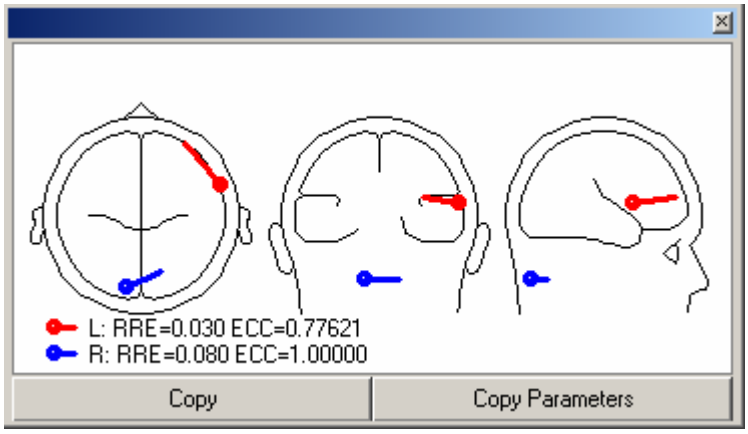
Suggestion: to compare EEGs recorded from different sites you can move a channel in the vertical direction while viewing. Place cursor on a button on the Channel Names bar and drag vertically with left mouse button pressed. The curve depicting the selected channel will also move in the vertical direction. When the left mouse button is released, the curve will automatically return to its original position.

8. Maps Bar (Map Window)



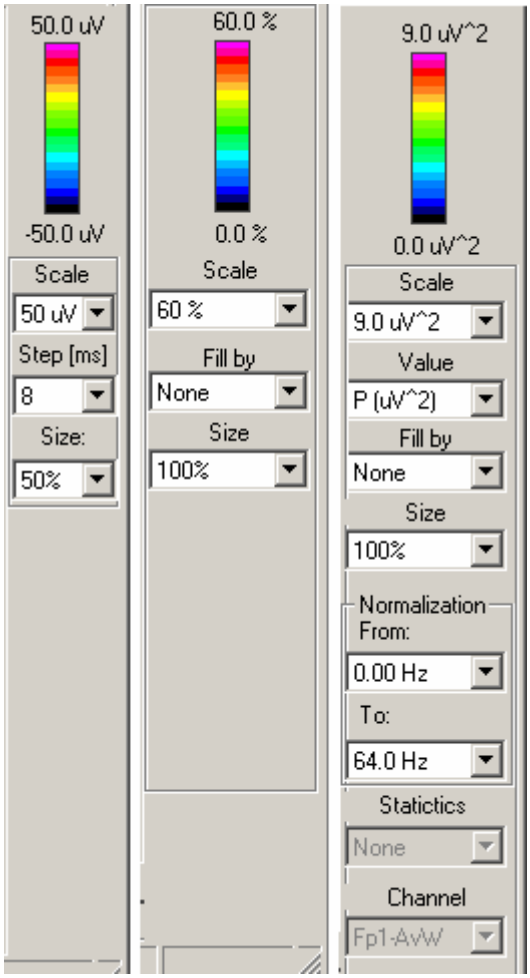
Select an EEG interval and run **View: Toolbar Maps** command to view two potential or spectral power maps corresponding to each of the vertical mouse cursors (Left and Right).

9. Dipole Window



The dipole source localization and dipole parameters id displayed in this window. RRE is relative residual energy and ECC is eccentricity. Use buttons “Copy” or “Copy parameters” to copy this picture or table of dipole parameters into clipboard

10. Maps, Spectra and Indices Bars

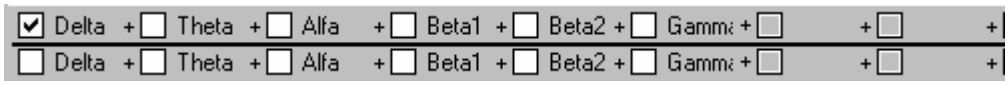


This bar is located at the right side of the EEG mapping, spectra or indices windows. Its controls depend on window type.

At the top of this bar is a **color scale**. Numbers above and below the scale indicate parameter values corresponding to highest and lowest color degree.

Below the color scale are controls for setting color scale sensitivity, size of maps or graphs, etc. To learn for additional details about these controls, see the sections describing particular windows.

11. Calculator Bar



This bar is located at the bottom edge of the **EEG Spectra window** or **EEG Indices window** and is used to define a formula for calculating a value to be mapped in the **Formula** mode.

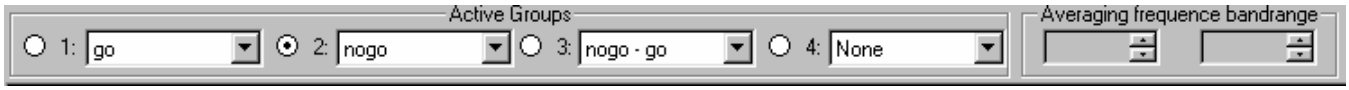
The bar has two rows of buttons corresponding to standard EEG frequency bands. The top row defines the sum for ratio numerator and the bottom one – for ratio denominator. The standard EEG frequency band parameters (signal powers or EEG indices) marked by “checked” buttons will be summed when calculating the ratio of numerator and denominator.

For example, if “Alpha” and “Beta” buttons are checked in the top row, and “Delta” and “Theta” – in the bottom row, then the following power ratio would be calculated for each channel:

(P[alpha] + P[beta]) / (P[delta] + P[theta]),

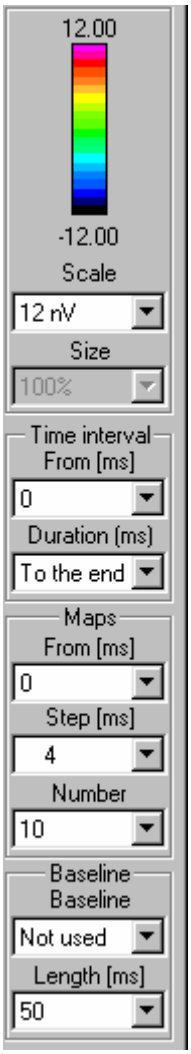
and displayed whenever Formula mapping were selected.

12. Averaging Groups Bar



This bar is located at the top of the **ERP Window** and is used to choose which groups may be displayed, and to select an "active" group.

13. ERP Bar



This bar is placed on the right edge of the **ERP Window** and is used to set graph or map size, vertical and horizontal scaling (for graphs), color scale sensitivity and time readouts for ERP mapping.

14. Video Window.

The video data corresponding to position of slider (see EEG window) is displayed in this window. Use command **View: Video Window** to show (hide) this window.

Menu Commands

File Menu Commands

The File menu offers the following commands:

New	Creates a new EEG file.
Open EEG Database	Opens a source data record from the database
Open Another Database	Opens a file from the database of processing results:
- EEG Spectra	an EEG spectra file
- EEG Cross-correlations	…an EEG auto and cross-correlation file
- EEG Indices	an EEG indices file
- ERP (EP) File	an ERP file
- ERD File	an event-related EEG de-synchronization file
- ERCoh File	an event-related EEG coherence file
Open File…	Opens a file from hard disk (containing source EEG or processing results).
Import EDF+ Data	Import of EDF+ data file.
Import Data	Converts data from another format to WinEEG format
Close	Closes the active file.
Save	Saves the active file under its current name.
Save As…	Saves the active file under another name.
Compress video files…	Compress or recompress video files by selected method
Export Data…	Writes the data file in ASCII, binary or another format.
Export EEG and Video EEG	Copy selected part of EEG record to another file.
Print…	Prints the active document.
Page Setup…	Sets parameters for a page to be printed.
Print Preview…	Displays the document, as it will be printed.
Print Setup…	Chooses a printer and sets parameters for it.
Exit	Quits WinEEG.

Edit Menu Commands

The Edit menu offers the following commands:

Undo	Undoes the previous edit action.
Cut	Mark selected time interval of EEG record as artifact. Removes the selection and places it on the clipboard.
Copy	Copies the selection (or the window content) to clipboard.
Paste	Inserts the clipboard content at the current cursor position in the active document.
Clear	Deletes the selected block.
Select All	Selects the whole document.
Clear All	Clears the whole document.
Clear All Video Data	Clears all video data for active document.
Find…	Finds events in EEG record. Finds a string in the text.
Replace…	Finds one string in the text and replaces it with a different string.
Find Selection	Finds the EEG interval selected by left and right vertical markers.
Find Fragment…	Finds the beginning of an EEG fragment.
Add Label	Adds a user label.
Delete Label	Deletes an existing user label.
Patient Card	Edits a patient card.

Trial Labels	Edits trial labels used for ERP calculation.
Adjust trial synchronization	Adjust trial synchronization using synchronization signal recorded from special detector (for example photodiode)
Change polarity	Change polarity of signals for selected list of channels.
Load Trial List	Load trial list from ASCII file.

View Menu Commands

The View menu offers the following commands:

Toolbar	Toggles display of:
- Main Toolbar	- Main toolbar
- Input Control Toolbar	- Input Control toolbar
- Analysis Toolbar	- Analysis toolbar
- Maps	- maps of two EEG instants selected by Left and Right cursors
- Dipole Window	- dipole source localization of two EEG instants selected by Left and Right cursors
- Filters Bar	- Filters bar.
- Maps Bar	- Maps bar in an EEG mapping window.
- Spectra Bar	- Spectra bar in a spectra window.
- Indices Bar	- Indices bar in an indices window.
- ERP Bar	- ERP bar in an ERP window.
- Biofeedback Bar	- Biofeedback bar in a biofeedback window.
- Calculator Bar	- Calculator (ratio formula) bar in a spectra window, an indices window or a biofeedback window.
- Averaging Group Bar	- Averaging Group Bar in an ERP window.
- Customize MainToolbar	Modifies Customize MainToolbar button set.
- Customize Input Control Toolbar.	Modifies Input Control toolbar button set.
- Customize Analysis Toolbar…	Modifies Analysis toolbar button set.
Status Bar	Shows or hides the status bar.
Channel Names Bar	Shows or hides the Channel Names bar.
Main Video Window	Show (hide) Video Window for main video camera
Additional Video Window	Show (hide) Video Window for additional video camera
Video Window size	Change a size of Video window
Decrease Gain	Decrease vertical scale in an EEG window.
Increase Gain	Increase vertical scale in an EEG window.
Decrease Speed	Decrease horizontal scale in an EEG window.
Increase Speed	Increase horizontal scale in an EEG window.
Select Montage…	Chooses or modifies a montage: channel list, filters, gain, color, electrodes, etc.

Format Menu Commands

The Format menu offers the following commands:

Font	Chooses a font.
Paragraph	Formats a paragraph.

Recording Menu Commands

The Recording menu offers the following commands:

EEG Monitoring	Starts (resumes) EEG monitoring without recording data to the hard

	disk.
Turn On(Off) Calibration	Turns on (off) calibrating signal.
EEG Recording(on/off)	Starts recording a new EEG fragment to the hard disk.
Pause	Pauses EEG acquisition.
Stop	Stops EEG acquisition and switches to signal view mode.
Video Recording	Start (stop) recording of video data.
Reset DC Filter	Use this command to reset constant component of the signal.
Photostimulation (on/off)	Turns photo stimulator on (off).
Photostimulation Program	Starts a photo stimulation program.
Stimuli Presentation Program	Starts presenting stimuli for ERP acquisition.
Turn on (off) Music	Turns on (off) music (for auditory biofeedback).
Calibration	Checks calibration of the amplifiers.
Impedance	Enables automatic measurement of electrode impedance.
Rewind Back	Rewinds the EEG window left.
Play Back	Plays back the EEG window left.
Play Forward	Plays back the EEG window right.
Rewind Forward	Rewinds the EEG window right.

Analysis Menu Commands

The Analysis menu offers the following commands:

	For EEG Window
Final Report	Opens a final report.
Insert Patient Card	Inserts patient card into final report text.
Insert Final Report Template	Inserts a final report template into final report text.
Signal Parameters	Display signal parameters table
EEG Mapping	Opens an EEG Mapping window.
EEG Indices…	Calculates EEG indices for a selected interval.
EEG Spectra…	Calculates EEG power spectra and the coherence function for a selected interval.
EEG Cross-correlations…	Calculates EEG power auto and cross correlation for a selected interval.
Spectra Density Array	Calculate and display (hide) spectra density arrays in EEG window
Source distribution (LORETA)	Runs LORETA application and store to it the voltage data corresponding to position of vertical markers.
Spectra power distribution (LORETA)	Runs LORETA application and store to it the EEG power (covariance matrix) computing for selected time interval.
Dipole Source (BrainLock)	Run BrainLock program (optional)
Nonlinear Analysis	Run utilities for nonlinear analysis of EEG (optional)
Spike Detection…	Start automated spike detection procedure
Spike Averaging	Calculate averaged spike waveforms and open ERP window
Remove EOG	Correct electro oculogram artifacts (caused by eye movements) from the record.
Mark artifacts	Mark EEG artifacts.
Artifacts correction	Correct EEG artifacts by spatial filtering of raw EEG or recover previous correction. The artifact components are selected manually.
Artifacts correction using templates	Correct EEG artifacts by spatial filtering of raw EEG. The artifact components are selected automatically by similarity component topographies to predefined templates.
Bandrange filter	Turn on (off) band pass filter defined by **Setup: EEG bandranges**… command.

Compute ERP	Computes event-related potentials.
Compute ERD	Computes event-related EEG de-synchronization.
Compute ERCoh	Computes event-related EEG coherence.
Compute Wavelet	Performs wavelet ERP analysis.
Compute Wavelet coherence	Compute Wavelet coherence
Independent component spectra	Compute spectra for independent component of EEG and open ICA window
Independent component ERP	Compute ERP for independent component of EEG and open ICA window
Comparison of results	Compare spectra, ERP or ERD.

For pop-up menu of EEG window

Add Spike	Add spike label for selected channel and time sample
Delete Spike	Delete selected spike label
Change Channel	Change “main” channel for selected spike label
Copy EEG	Copy EEG time interval into clipboard for selected spike
Copy Spike	Copy spike waveform into clipboard for selected spike
Copy EEG to Report	Copy EEG time interval into clipboard for selected spike
Copy Spike to Report	Copy spike waveform into text of final report for selected spike

For EEG Spectra and EEG Indices Window

Average Spectra	Displays average EEG spectra.
Spectra Dynamics	Displays EEG spectra dynamics.
Graphs	Shows processing results as graphs.
Histograms	Shows processing results as histograms (by EEG frequency bands).
Table	Shows processing results as a table of parameters for EEG frequency bands.
Maps	Shows processing results as distribution maps by EEG frequency bands.
Asymmetry	Shows processing results as asymmetry distribution maps by EEG frequency bands.
Formula (Mapping)	Maps spectra (indices) ratio.
Formula (Graphs)	Displays spectral ratio dynamics in a Spectra window as graphs.
Interaction diagram	Displays interaction diagram in a Spectra window.

For EEG Spectra

Power Spectra (Autocorrelations)	Displays EEG power spectra or EEG autocorrelations.
Coherence (Cross-correlations) for Channels	Displays EEG coherence for one of selected channels or EEG cross-correlations.
Average Coherence	Displays EEG coherence averaged over all channels.
Phase Spectra	Displays phase spectra for one of selected channels.
Parameters of interaction diagrams	Modify parameters of interaction diagrams: channel pairs and thresholds.
Insert tables into Report	Insert tables of EEG spectra parameters into MS Word
Bispectra	Display bispectra frequency-frequency plot
Bicoherence	Display bicoherence frequency-frequency plot

For pop-up menu of EEG Spectra window

Add map	Add map for selected frequency

	For ERP Window
Channels/Groups	Displays ERP graphs arranging channels in columns and averaging groups in rows.
Groups/ Channels	Displays ERP graphs arranging channels in rows and averaging groups in columns.
Time/Groups Mapping	Displays ERP maps arranging time intervals in columns and averaging groups in rows.
Groups/Time Mapping	Displays ERP maps arranging time intervals in rows and averaging groups in columns.
Formatted Page	Displays ERP graphs according to ERP Display Format you have chosen.
Average Bandpower	Displays average EEG bandpower graphs for wavelet ERP analysis.
Rasters Time/Frequency	Displays Time/Frequency rasters for wavelet ERP analysis.
Channel List	Selects channels to be displayed on graphs or maps.
Group Info	Views the statistics for averaging of ERP and response reaction processing results.
Export trial parameters	Export parameters of task performance for single trials
	For pop-up menu of ERP Window
Add Map	Adds an ERP map for selected (active) trial group.
Add Label	Adds a peak label on the graph for selected (active) trial group.
Copy Parameter Distribution	Copy string of voltages of “active” ERP group for selected time sample into clipboard
Copy Channel	Copy channel waveform, map and dipole picture for “active” ERP group into clipboard
Copy Channel to Report	Copy channel waveform, map and dipole picture for “active” ERP group into final report
Sources distribution LORETA	Runs LORETA application and store to it the voltage data corresponding to selected time point.
Dipole source (BrainLock)	Runs BrainLock application and store to it the voltage data corresponding to selected time point.
Delete All Labels	Clear all pick labels
Delete Labels and Maps	Clear all pick labels and maps
	For Final Report window
Generate Final Report	Activates final report generation procedure. (Only Russian version available).
Insert Patient Card	Inserts patient card into final report text.
Insert Final Report Template	Inserts a final report template into final report text.
	For ICA window
Select groups	Select averaging groups from list of groups for displaying of the graphs.
Select group pairs	Select averaging group pairs from list of groups for displaying of the difference curve graphs.
Change graph scale	Change vertical scale for ICA average curves.
Correct baseline	Define time interval for baseline correction
Save components filter	Save to the ASCII file a matrix transforming raw EEG (ERP) to the components of EEG (ERP).
Save signal filter	Save to the ASCII file a matrix – spatial filter, revealing or suppressing signals from raw EEG (ERP) for selected list of

	components.
Export activation curves (spectra)	Export activation curves or spectra into ASCII text file.
	For pop-up menu of ICA Window
Copy component	Place bitmaps and graphs to clipboard corresponding to selected component by mouse.
Component name	Modify component name
LORETA for component	Runs LORETA application and store to it the topography of selected component.
Export of component parameters	Save to the ASCII file the parameters of selected component for the future statistical analysis

Setup Menu Commands

The Setup menu offers the following commands:

Database Pathnames...	Sets (modifies) Database pathnames.
Preferences...	Sets EEG display parameters.
Mapping Style...	Sets map display parameters.
Montage List...	Edits list of montages.
Fragment Names...	Edits list of fragment names.
Label List...	Edits list of user labels.
Photo stimulation Programs...	Edits list of photo stimulation programs.
EEG Bandranges...	Modifies standard EEG frequency bands.
Stimuli Presentation Programs...	Views and modifies the list of stimuli presentation programs for ERP acquisition.
Graph Formats...	Modifies formats for displaying ERP graphs.
Title...	Edits organization title.
Final Report...	Customizes final report generator.
Final Report Templates...	Edits list of final report templates.
Video recording	Select video capturing device. Set and modifies parameters of capturing: resolution, frame rate, signal format and on-line compression.
Equipment Parameters...	Customizes hardware configuration.

Window menu commands

The Window menu offers the following commands:

Cascade	Arranges windows in cascade.
Tile Horizontally	Tiles windows horizontally.
Tile Vertically	Tiles windows vertically.
Arrange Icons	Arranges icons of minimized windows.
Split	Splits active window in two panes.
1, 2...	Activates window you choose.

Help menu commands

The Help menu offers the following commands:

About WinEEG...	Displays program information and copyright.

Description of Menu Commands

1. File: New command

Run this command to create a new EEG file. It should be created before starting EEG monitoring. Before creating a new EEG file a number of EEG parameters should be defined in the Montage Parameters dialog box consisting of 7 tabs. Switch from tab to tab to define parameters for a new EEG file:

1. Fill in the patient card (see **Montage parameters: Patient card dialog**).

2. Choose a montage from the existing list and/or enter its parameters.

A montage includes a number of options such as list of monitored channels, list of displayed channels and their parameters (gains, bandwidths, baseline, colors, etc.)

Don't forget that signals are acquired and recorded always monopolarly (in relation to the electrodes connected with «A1», «A2» inputs). The bandwidth for acquisition and recording is maximally wide: 0.15 - 70 Hz or 0.5 -30 Hz. Remember that 0.15 Hz frequency corresponds to 1.0 sec time constant and 0.5 Hz - to 0.3 sec time constant. This acquisition method allows convert raw data to any mono- or bipolar montage with any bandwidth during subsequent viewing and processing.

Attention!!! Montage parameters set by **New** command are active only for the currently created file and are not saved in the montage list. If a parameter set is expected to be used many times, it would be better to define it in the montage list (see **Setup: Montage List... command)**. Next time you would simply select it from the list instead of repeatedly entering parameters (which may take a considerable time).

When customizing a montage you must define a number of its parameters:

a. Define a list of channels for EEG acquisition corresponding to electrodes really placed and connected (see **Montage parameters: Electrodes dialog**). Define also coordinates of the electrodes.

b. Define a list of channels in the montage and their parameters such as gain, bandwidth and baseline (see **Montage parameters: Channels dialog**).

c. Define colors for signal displaying (**see Montage parameters: Colors dialog**).

d. Define referents to be calculated if there are any (Av, AvL and AvR) (**see Montage parameters: Referents dialog**).

e. Test whether channels are correctly defined or view another montage in the list (see **Montage parameters: View dialog**).

When the parameters are set, press OK button to create a new EEG file. A new (blank) EEG window appears on the screen. Use **Recording menu** commands to start monitoring EEG and to manage photo stimulators.

Don't forget to save the new file in the database (see **File: Save command**) when EEG monitoring is finished.

Shortcuts:

Main Toolbar: 
Keys: CTRL+N

2. File: Open EEG Database command

This command opens an EEG file from the database in a new window. You can open several EEG files simultaneously. Use the Window menu commands to switch between opened files. (See **Window: 1, 2...command**).

As you run this command **a Record List dialog** is displayed for searching EEG files in the database or in the archive.

Shortcuts:

Main Toolbar: 
Keys: CTRL+O

3. File: Open Another Database->EEG Spectra command

This command opens an EEG spectra file from the database in a new window. You can open several EEG spectra files simultaneously. Use the Window menu commands to switch between opened files. (See **Window: 1, 2...command**).

As you run this command a **Record List dialog** is displayed for searching EEG spectra files in the database or in the archive.

4. File: Open Another Database->EEG Cross-correlations command

This command opens an EEG auto and cross correlation file from the database in a new window. You can open several EEG auto and cross correlation files simultaneously. Use the Window menu commands to switch between opened files. (See **Window: 1, 2...command**).

As you run this command a **Record List Dialog** is displayed for searching EEG auto and cross correlation files in the database or in the archive.

5. File: Open Another Database->EEG Indices command

This command opens an EEG indices file from the database in a new window. You can open several EEG indices files simultaneously. Use the Window menu commands to switch between opened files. (See **Window: 1, 2...command**).

As you run this command a **Record List Dialog** is displayed for searching EEG indices files in the database or in the archive.

6. File: Open Another Database ->ERP (EP) File command

This command opens an event-related potential (evoked potential) file from the database in a new window. You can open several ERP files simultaneously. Use the Window menu commands to switch between opened files. (See **Window: 1, 2...command**).

As you run this command a **Record List dialog** is displayed for searching ERP files in the database or in the archive.

7. File: Open Another Database ->ERD File command

This command opens an event-related EEG de-synchronization (ERD) file from the database in a new window. You can open several ERD files simultaneously. Use the Window menu commands to switch between opened files. (See **Window: 1, 2...command**).

As you run this command a **Record List Dialog** is displayed for searching ERD files in the database or in the archive.

8. File: Open Another Database ->ERCoh File command

This command opens an event-related EEG coherence (ERCoh) file from the database in a new window. You can open several ERCoh files simultaneously. Use the Window menu commands to switch between opened files. (See **Window: 1, 2...command**).

As you run this command a **Record List Dialog** is displayed for searching ERCoh files in the database or in the archive.

9. File: Open Another Database -> Biofeedback File command

This command opens a biofeedback file from the database in a new window. You can open several biofeedback files simultaneously. Use the Window menu commands to switch between opened files. (See **Window: 1, 2...command**).

As you run this command a **Record List dialog** is displayed for searching biofeedback files in the database or in the archive.

10. File: Open File… command

This command uses the Windows standard file open interface to open a previously recorded data file (EEG, EEG spectra, etc.) in a new window. You can open more than one file. Use the Window menu commands to switch between opened files. (See **Windows: 1, 2...command**).

When you run this command **a File Open dialog** appears

11. File: Import EDF+ Data command

This command opens EDF+ files and converts them to EEG format. When you run this command **a File Open dialog** appears. After selection of appropriate EDF+ file a **Import of EDF+ data dialog** will appear on the screen.

12. File: Import Data command

This command opens files of other formats and converts them to EEG format.

When you run this command a **File Open dialog** appears.

13. File: Close command

Close all windows for the active data file (EEG or others). WinEEG will ask about saving changes before closing the file.

Shortcuts:

Main Toolbar: 

Mouse: Click  icon in the right top corner of the file (document) window.
Or double-click the window (document) icon in the left top corner of the window. For different file types different icons are used as follows:

 - for EEG files,

 - for final reports,

 - for potential maps,

 - for EEG power spectra (auto and cross-correlations),

 - for EEG indices,

 - for biofeedback files,

 - for ERP, ERD and ERCoh.

14. File: Save command

This command saves the active file.

If the file was opened **from the database** the corresponding record is modified when saving the file.

If the file is **new** a name is assigned to it automatically and a record is added to the database.

To save the latest changes in another file, use the **File: Save As…** command.

Shortcuts:

Main Toolbar: 

Keys: CTRL+S

15. File: Save As… command

Save the active document in a new data file. A Save As dialog appears to define the new file name.

16. File: Compress video files… command

Compress or recompress video files by selected method. When you run this command a **Video files compression dialog** appears**.**

17. File: Export Data… command

Save the data in a format compatible with other applications.

If an EEG file is active an **Export EEG Data** dialog appears. An EEG file can be converted into text (ASCII) format, binary format, European Data Format (EDF) or Universal Data Format (UDF) – Russian extension of EDF format.

If an EEG spectra file is active an **Export EEG Spectra** dialog appears on the screen. An EEG spectra file can be converted into text (ASCII) format.

If an EEG indices file is active **an Export EEG Indices** dialog appears. An EEG indices file can be converted into text (ASCII) format.

If an ERP (ERD) file is active an **Export ERP (ERD)** dialog appears. An ERP (ERD) file can be converted into text (ASCII) format.

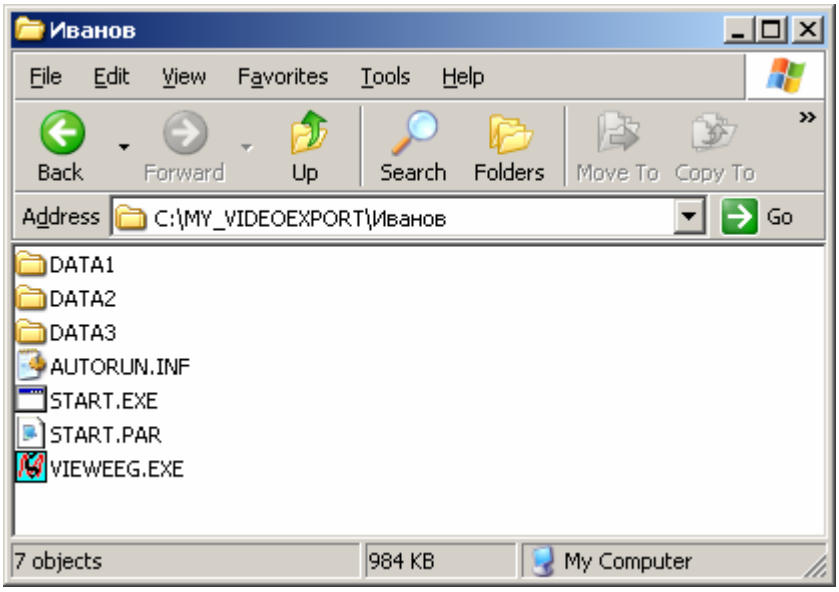
Shortcut:

Main Toolbar: 

18. File: Export EEG and Video EEG… command

Copy selected part of EEG record to another file. When you run this command **Export video EEG dialog** appears**.**

This function is useful if it is necessary to prepare a number of video EEG examples to write them to CD. The WinEEG program will copy automatically video EEG data, video EEG viewer (ViewEEG program) and some additional service data in selected folder. It is possible to run this function many times. As the results a number of subfolders will be created and the data will be copied in these subfolders.



START.EXE utility helps to open all copied data automatically by ViewEEG program.

ViewEEG program is the restricted version of WinEEG program providing reviewing of video EEG data.

Attention!!! ViewEEG program requires DirectX 9.0 installation.

19. File: Print... command

Print the active window content (active file).

By default, the full contents (graphs, maps or text) will be printed unless specific pages have been specified in the **Print dialog** that is displayed on calling this command. The exception is the **EEG window** where you position the two vertical cursors to select the EEG interval you wish to print.

Use **File: Print Preview** command to preview the document you are going to print.

Shortcuts:

Main Toolbar: 

Keys: CTRL+P

20. File: Page Setup... command

Set the print page parameters.

The **Page Setup dialog** is displayed on calling this command.

21. File: Print Preview command

Use this command to display the active document, as it would appear when printed. When you choose this command, the main window will be replaced with a print preview window in which one or two pages will be displayed in their printed format.

Use **print preview control bar** for detailed preview.

Shortcut:

Main Toolbar: 

22. File: Print Setup... command

Use this command to select a printer and to set printer options. **The Print Setup dialog box** is displayed on calling this command.

23. File: 1, 2, 3, 4 commands

Use the numbers and filenames listed at the bottom of the File menu to open any of the last four documents you have been working with.

24. File: Exit command

Use this command to end your WinEEG session.

Shortcuts:

Main Toolbar: 

Mouse: Click  icon in the right upper corner of the WinEEG window.

Double click application icon:  , in the left upper corner of the WinEEG window.

Keys: ALT+F4

25. Edit: Undo command

Undo last change in the final report.

Shortcuts:

Main Toolbar: 
Keys: CTRL+Z
ALT+BACKSPACE

26. Edit: Cut command

Mark selected time interval of EEG record as artifact ff EEG window is active.

Cut selected text to the clipboard if Final report window is active, . The command is not available unless text is selected.

Shortcuts:

Main Toolbar: 
Keys: CTRL+X

27. Edit: Copy command

Copy selected text (in the final report) or the active window (EEG waveforms, spectra graphs, ERP maps, etc.) to the clipboard.

Previous clipboard content is replaced.

Shortcuts:

Main Toolbar: 
Keys: CTRL+C

28. Edit: Paste command

Paste the clipboard content to the final report. The clipboard may contain text or graphic objects - EEG waveforms, spectra graphs, ERP maps etc.

Shortcuts:

Main Toolbar: 
Keys: CTRL+V

29. Edit: Clear command

Deletes selected text from the final report or a selected fragment from the EEG record.

Shortcut:

Main Toolbar: 

30. Edit: Select All command

Select the whole final report text.

31. Edit: Clear All command

Clear the whole final report text.

32. Edit: Clear All Video Data command

Clear the whole video data. **Video Data Deleting dialog** is displayed after calling this command.

33. Edit: Find… command

Finds evens in EEG record based on threshold criteria. **Find events dialog** is displayed after calling this command.

Find a text string in the final report. The **Find dialog** is displayed after calling this command.

Shortcut:

Main Toolbar: 

34.Edit: Replace… command

Finds a text string in the final report and replaces that string with another one.

The **Replace dialog** is displayed after calling this command.

35.Edit: Find Selection command

Use this command to find the beginning of the selected EEG time interval.

Shortcut:

Main Toolbar: 

36.Edit: Find Fragment... command

Find the beginning of an EEG fragment (a trial).

Shortcut:

Main Toolbar: 

37.Edit: Add Label command

Add a user label (run the command once more to turn Add Label mode off). After calling this command, choose label type from the popup menu. The cursor will change its shape to:

Place cursor at the desired position in the EEG window and click. If you are adding a **Channel** or a **Contour** label, also set its length by dragging to the desired length before releasing the left mouse button.

Shortcut:

Main Toolbar: 

38.Edit: Delete Label command

Delete a user label (run the command once more to turn Delete Label mode off). The cursor will change its shape to:

Position it over the label to be deleted and left-click.

Shortcut:

Main Toolbar: 

39.Edit: Patient Card... command

Edit patient card for the active file (document).

The **Patient Card dialog** is displayed after calling this command.

Shortcut:

Main Toolbar: 

40. Edit: Trial Labels… command

Edit trial labels used for grouping trials in ERP calculations for the active EEG file.

The **Modify Trial Labels dialog** is displayed after calling this command.

41. Edit: Adjust trial synchronization … command

Adjust trial synchronization using synchronization signal recorded from special detector (for example photodiode) for the active EEG file.

The **Adjust trial synchronization using synchro-impulse dialog** is displayed after calling this command.

42. Edit: Change polarity… command

Change polarity of signals for selected list of channels for the active EEG file.

The **Change signal polarity dialog** is displayed after calling this command.

43. Edit: Load Trial List… command

Load trial list from ASCII file. This feature is implemented for compatibility with Neurobotics EEG system. The format of trial list file is follow:

```
EventTable V2.0
00024118,1, 11
00024518,1, 11
00024924,1, 11
00025331,1, 11
```

```
00025737,1, 13
00026144,1,  4
00026551,1, 11
```

Where fist column – is the sample of trial beginning, second column – type of event (1 – trial), third column – trial label used for trials sorting during ERP computation.

44. View: Toolbar -> Main Toolbar command

Run this command to show or to hide the main toolbar containing shortcut buttons for most frequently used WinEEG menu commands such as "Print".

See **Main Toolbar** to learn how to use it.

45. View: Toolbar -> Input Control Toolbar command

Run this command to show or to hide the Input Control toolbar containing buttons used to manage EEG acquisition and scrolling.

See **Input Control Toolbar** to learn how to use it.

46. View: Toolbar -> Analysis Toolbar command

Run this command to show or to hide the Analysis toolbar containing buttons used to manage spectra, indices and ERP windows.

See **Analysis Toolbar** to learn how to use it.

47. View: Toolbar -> Maps Window command

Run this command to show or to hide the side window that presents mapping potentials and other processing parameters depending on the positions of two vertical cursors.

48. View: Toolbar -> Dipole Window command

Run this command to show or to hide the side window that presents dipole sources.

49. View: Toolbar -> Filters Bar command

Run this command to show or to hide Filters bar which presents a number of processing options or window parameters for the active EEG window.

To learn more see **Filters Bar**.

50. View: Toolbar -> Maps Bar command

Run this command to show or to hide Maps bar which presents data display options for the active EEG mapping window.

See **Maps/Spectra/Indices Bar** to learn how to use it.

51. View: Toolbar -> Spectra Bar command

Run this command to show or to hide Spectra bar which presents data display options for the active EEG spectra window.

See **Maps/Spectra/Indices Bar** to learn how to use it.

52. View: Toolbar -> Indices Bar command

Run this command to show or to hide Indices bar which presents data display options for the active EEG indices window.

See **Maps/Spectra/Indices Bar** to learn how to use it.

53. View: Toolbar -> ERP Bar command

Run this command to show or to hide ERP bar which presents data display options for the active ERP window.

To learn more see **ERP Bar**.

54. View: Toolbar -> Biofeedback Bar command

Run this command to show or to hide Biofeedback bar containing controls for a number of additional parameters affecting EEG acquisition and processing during biofeedback sessions.

To learn more see **Biofeedback Bar**.

55. View: Toolbar -> Calculator Bar command

Run this command to show or to hide Calculator bar in a spectra window or an indices window used to define processing for the Formula mode.

To learn more see **Calculator Bar**.

56. View: Toolbar -> Averaging Groups Bar command

Run this command to show or to hide Averaging Groups bar in an ERP window offering a choice of four trial groups to be depicted on ERP graphs.

To learn more see **Averaging Groups Bar**.

57. View: Toolbar -> Customize Main Toolbar... command

Run this command to customize main toolbar by adding, deleting or moving buttons.

Customize Toolbar dialog appears on calling this command.

58. View: Toolbar -> Customize Input Control Toolbar... command

Run this command to customize Input Control toolbar by adding, deleting or moving buttons.

Customize Toolbar dialog appears on calling this command.

59. View: Toolbar -> Customize Analysis Toolbar... command

Run this command to customize Analysis toolbar by adding, deleting or moving buttons.

Customize Toolbar dialog appears on calling this command.

60. View: Status Bar command

Show or hide status bar that displays hints for menu items or bar buttons along with indicators for Caps Lock, Num Lock and Scroll Lock keys.

To learn more see **Status Bar**.

61. View: Channel Names Bar command

Run this command to show or hide Channel Names bar where a channel in the active EEG window may be selected for additional actions.

To learn more see **Channel Names Bar**.

62. View: Main Video Window command

Run this command to show or hide Main Video window which presents main video camera data for active EEG file.

Shortcuts:

Main Toolbar: 

63. View: Additional Video Window command

Run this command to show or hide Additional Video window which presents additional video camera data for active EEG file.

Shortcuts:

Main Toolbar: 

64. View: Video Window size command

Run this command to change a size of Video window which presents video data for active EEG file.

Shortcuts:

Main Toolbar: 

65. View: Decrease Gain command

Run this command to decrease gain (vertical EEG scale).

Shortcuts:

Main Toolbar: 

Keys: - (Numpad Minus)

66. View: Increase Gain command

Run this command to increase gain (vertical EEG scale).

Shortcuts:

Main Toolbar: 
Keys: **+** (Numpad Plus)

67. View: Decrease Speed command

Run this command to decrease speed (horizontal EEG scale).

Shortcuts:

Main Toolbar: 
Keys: / (Numpad Divide)

68. View: Increase Speed command

Run this command to increase speed (horizontal EEG scale).

Shortcuts:

Main Toolbar: 
Keys: ***** (Numpad Multiply)

69. View: Select Montage... command

Use this command to choose or to modify montage for an EEG file.

Signals are always acquired and recorded in monopolar form (relative to the electrodes connected to A1 and A2 connectors). The bandwidth for acquisition and recording is maximally wide: 0.15 - 70 Hz for «Mitsar-EEG-3». Remember that 0.15 Hz frequency corresponds to 1.0 sec time constant. This recording method allows conversion of raw data to any mono- or bipolar montage with any bandwidth during subsequent viewing and processing.

The Montage parameters dialog consisting of five tabs is displayed after calling this command. Go from tab to tab to define the following montage parameters:

a. Define a list of channels and their parameters such as gain, bandwidth and baseline (see **Montage parameters: Channels dialog**).

b. Define colors for displaying signals (**see Montage parameters: Colors dialog**).

c. Define the referents calculated, if any (Av, AvL and AvR; see **Montage parameters: Referents dialog).**

d. Test whether channels are correctly defined or view another montage in the list (see **Montage parameters: View dialog).**

You can also select a montage from the list.

Attention Montage parameters set by this command are applied only to the active file and not saved in the montage list. If a parameter set is expected to be used many times, it would be better to define it in the montage list (see **Setup: Montage List...** command). Next time you

need only select it from the list instead of entering parameters all over again.

Shortcut:

Main toolbar: 

70. Format: Font... command

Modify font for selected text in final report. **Font dialog** is displayed after calling this command.

71. Format: Paragraph command

Formats selected paragraph(s) in the final report. . The **Paragraph dialog** is displayed after calling this command.

72. Recording: EEG Monitoring command

Use this command to start EEG monitoring - that means acquiring EEG to the computer memory and monitoring it in the new EEG window without recording EEG to hard disk. The command is available only if a new EEG window is opened (see **File: New command**).

To start recording EEG to hard disk use the **Recording: EEG Recording command.**

Use **Filters bar** to modify "paper" speed, montage, sensitivity and bandwidth.

To stop EEG acquisition, run **Recording: Stop command.**

Shortcut:

Input Control toolbar: - 

73. Recording: EEG Recording (on/off) command

Use this command to start recording EEG fragment to hard disk. The command is available only if a new EEG window is opened (see **File: New command**).

To stop recording the fragment and to resume EEG monitoring mode, run this command once more.

Use **Filters bar** to modify "paper" speed, montage, gain and bandwidth.

To stop EEG recording, run **Recording: Stop command**.

Shortcuts:

Input Control toolbar: - 

Keys: - Enter, F2, F3, F4, F5, F6, F7, F8 or F9.

74. Recording: Pause command

Pause EEG acquisition, monitoring and recording. The ensuing EEG fragment will be absent in the record. The command is available only if a new EEG window is opened (see **File: New command**).

To resume EEG acquisition and monitoring or recording, use the **Recording: EEG Monitoring command.**

Shortcut:

Input Control toolbar: - 

75. Recording: Stop command

Stops EEG acquisition, monitoring and recording or EEG window scrolling and switches to EEG view mode (see **EEG Window**). The command is available only if a new EEG window is opened (see **File: New command**).

Before new file is saved in the database, EEG monitoring and recording can be resumed by running **Recording: EEG Monitoring** and **Recording: EEG Recording** commands.

Shortcut:

Input Control toolbar: - 

76. Recording: Turn On (Off) Calibration command

Use this command to start acquiring calibration signal (0.5 Hz, 0.1 Ohm) to the computer memory and monitoring it in the new EEG window without recording the signal to hard disk. The command is available only if a new EEG window is opened (see **File: New command**).

To stop calibration signal acquisition and to start EEG monitoring, run this command once more.

Shortcut:

Input Control toolbar: 

77. Video recording command

Use this command to start recording the video data to hard disk. The command is available only if a new EEG window is opened (see **File: New command**).

To stop recording the video data and to resume video monitoring mode, run this command once more.

Shortcut:

Input Control toolbar: 

78. Reset DC Filter command (not in a menu)

Use this command to reset constant component of the signal. It can be necessary if extended-band amplifiers are used. Output potential of these amplifiers can contain a significant DC component (as a result of motor artifacts or after electrodes are changed) slowly returning to initial state. The command is used to speed up the process of resetting amplifiers to initial state.

How to Run:

Input Control toolbar: - 

79. Recording: Photostimulation On/Off command

Use this command to turn rhythmic photo stimulation mode on or off. The command is available only if a new EEG window is opened (see **File: New command**).

Use **Input Control toolbar** to change photo stimulation frequency.

Photo stimulation frequency can also be modified by means of keys:

Ctrl+Arrow Up	Increases frequency by 1 Hz
Ctrl+Arrow Down	Decreases frequency by 1 Hz

Shortcuts:

Input Control toolbar: - 
Keys: - Blank.

80. Recording: Photostimulation Program command

Use this command to turn a photo stimulation program on or off. The command is available only if a new EEG window is opened (see **File: New command**).

Use **Setup: Photostimulation Programs** command to set photostimulation program parameters.

Shortcut:

Input Control toolbar: - 

81. Recording: Stimuli Presentation Program command

Use this command to start/stop visual or auditory stimuli presentation. The command is available only if a new EEG window is opened (see **File: New command**).

The **Stimuli Presentation Program List** dialog is displayed after calling this command.

Shortcut:

Input Control toolbar: - 

82. Recording: Turn On (Off) Music command

Run this command to turn on (off) music for auditory biofeedback.

Shortcut:

Input Control toolbar: - 

83. Recording: Calibration command

Run this command to review calibration of the amplifiers The **Calibration of Amplifiers dialog** will be displayed on calling this command.

Attention!!! Amplifiers are calibrated by the manufacturer before metrological certification. WinEEG users are able only to view calibration results, not to modify them.

Shortcut:

Input Control toolbar: 

84. Recording: Impedance command

Call the function of electrode impedance control. **Electrode Impedance dialog** is displayed after calling this command.

Shortcut:

Input Control toolbar: - 

85. Recording: Rewind Back command

Run this command to rewind EEG window.

Shortcut:

Input Control toolbar: 

86. Recording: Playback command

Run this command to play EEG window backwards.

Shortcuts:

Input Control toolbar: 
Keys: ALT + Left Arrow

87. Recording: Play Forward command

Run this command to play EEG window forward.

Shortcuts:

Input Control toolbar: 
Keys: ALT + Right Arrow

88. Recording: Fast Forward command

Run this command to Fast Forward the EEG window.

Shortcut:

Input Control toolbar: 

89. Analysis: Final Report command

Open a **Final Report window** for the active EEG file. When opening the Final Report window, WinEEG is looking for a corresponding file in the EEG database working directory (.RTF file with the same name as the active EEG file). If the final report file is found, it is opened in the Final Report window and can be read and edited. If not found, a new file is created and Patient Card contents are inserted in it automatically.

Shortcut:

Main toolbar: 

90. Analysis: Signal Parameters command

Open Parameters of Signal dialog window. The parameters of signals (Amplitude from pick to pick, approximated frequency and voltage difference will be measured for selected by vertical markers time interval.

91. Analysis: EEG Mapping command

Open an **EEG Mapping window** for active EEG file. You can open several Mapping windows for one active EEG file, but for different intervals. Use vertical markers in the EEG window to mark an interval of interest. An interval for mapping must not exceed 1 sec. Raw data is processed according to montage parameters before mapping. ECG channels are excluded automatically.

Electrode coordinates are additional parameters for maps (see **Montage parameters: Electrodes dialog**). Incorrect coordinate settings can disable mapping.

Attention!!! EEG data reformatted to a bipolar montage cannot be mapped. Choose a monopolar montage for the active EEG window before calling this command.

Shortcut:

Main toolbar: 

92. Analysis: EEG Indices… command

Calculate EEG indices for a selected EEG interval and opens an **EEG Indices window** for the active EEG file. You can open several indices windows for one active EEG file, but there can be only one window for any specific record interval. Use vertical markers in the EEG window to mark an interval of interest. An interval for processing must not be shorter than 1 sec.

After calling this command, the **Parameters of EEG Indices Computation dialog** is opened to set additional processing parameters.

Raw data is processed according to montage parameters.

Attention EEG reformatted to a bipolar montage cannot be mapped. If you wish to view maps of indices, choose a monopolar montage for the active EEG window before calling this command.

Electrode coordinates are additional parameters for maps (see **Montage parameters: Electrodes dialog**). Incorrect coordinate settings can disable mapping.

Shortcut:

Main Toolbar: 

93. Analysis: EEG Spectra… command

Calculate EEG power spectra for a selected EEG interval and opens an **EEG Spectra window** for the active EEG file. You can open several spectra windows for one active EEG file, but for different intervals. Use vertical markers in the EEG window to mark an interval of interest. An interval for processing must not be shorter than 1 sec.

After calling this command, the **Parameters of EEG Spectra Computation dialog** is opened to set additional processing parameters.

Raw data is processed according to montage parameter.

Attention! EEG reformatted to a bipolar montage cannot be mapped. If you wish to view spectral maps, choose a monopolar montage for the active EEG window before calling this command.

Electrode coordinates are additional parameters for maps (see **Montage parameters: Electrodes dialog**). Incorrect coordinate settings can disable mapping.

Shortcut:

Main Toolbar: 

94. Analysis: EEG Cross-correlation… command

Calculate EEG auto and cross-correlation for a selected EEG interval and opens an **EEG Spectra window (Auto and Cross-correlation)** for the active EEG file. You can open several spectra windows for one active EEG file, but for different intervals. Use vertical markers in the EEG window to mark an interval of interest. An interval for processing must not be shorter than 1 sec.

After calling this command, the **Parameters of EEG Auto and Cross-correlation Computation dialog** is opened to set additional processing parameters.

Raw data is processed according to montage parameters.

95. Analysis: Spectra Density Array command

Calculate and display (hide) spectra density arrays in EEG window for the whole EEG file

96. Analysis: Source distribution (LORETA)... command

Run this command to call LORETA application and store to it the voltage data corresponding to position of vertical markers.

Before the first call of the LORETA application the WinEEG program ask for a location of LORETA.EXE file. Its usual location is folder with name \LORETA\020-MAIN

97. Analysis: Spectrum power distribution (LORETA)... command

Run this command to call LORETA application and store to it the EEG power (covariance matrix) computing for selected time interval. This command can be used together with Analysis: Turn on (off) band pass filter to estimate the distribution of sources for EEG signal in the selected frequency band.

Before the first call of the LORETA application the WinEEG program ask for a location of LORETA.EXE file. Its usual location is folder with name \LORETA\020-MAIN

98. Analysis: Dipole Source (BrainLock)... command

Run BrainLock program (optional)

99. Analysis: Nonlinear Analysis... command

Run special utilities for nonlinear analysis of EEG (optional). The **Nonlinear analysis parameters dialog** will be displayed on calling this command.

100. Analysis: Spike Detection... command

Run this command to automatically find spike waveforms in the whole EEG file. The **Spike detection dialog** will be displayed on calling this command.

101. Analysis: Spike Averaging... command

Run this command to calculate average waveform of spikes and opens an **ERP window**. The spikes will be sorted by “main” channel assigned with spike labels. **The Averaged spikes calculation dialog** will be displayed on calling this command.

102. Analysis: Remove EOG... command

Run this command to calculate coefficients for electro oculogram influence on EEG and to subtract weighted EOG signal from signals of other channels. One of the **EOG Rejection dialog** will be displayed on calling this command.

Attention! The algorithm of EOG artifact elimination is not ideal and supposes that a "pure" EOG was recorded at least by one channel. It also assumes that no other high-amplitude artifact occurred during EEG acquisition. Otherwise EEG can be significantly distorted and eye movement artifact elimination may be quite poor.

Shortcut:

Main toolbar: 

103. Analysis: Mark artifacts... command

Run this command to automatically detect artifacts parts of EEG record based on threshold criteria and to mark corresponding time intervals. One of the **Search and rejection artifacts dialog** will be displayed on calling this command.

Shortcut:

Main toolbar: 

104. Analysis: Artifacts correction... command

Run this command to calculate spatial filter matrix that is used to correct EEG artifacts. The selected part of EEG record is used to estimate EEG and artifact components of record by PCA or ICA methods. The artifacts components are selected manually by visual inspection of their topography. Using these data the corresponding spatial filter is computed. The **Artifacts space filtering parameters estimation dialog** will be displayed on calling this command.

Run this command again to disable previously activated artifacts correction spatial filter.

Attention! The processed part of EEG record should include both the artifacts signals and the artifacts free EEG signal to have a possibility to estimate their components.

Attention! The algorithm of artifacts correction is not ideal. That is why the visual inspection of results of correction is necessary. If the results are not satisfied another time interval should be selected and analyzed.

Attention! The correct usage of this method is possible for fixed parameters of EEG montage and band pass filters. That is why any changes of mentioned above parameters will automatically disable artifact correction spatial filter.

Shortcut:

Main toolbar: 

105. Analysis: Artifacts correction using templates... command

Run this command to correct EEG artifacts by spatial filtering of raw EEG. The artifact components are selected automatically by similarity component topographies to predefined templates. The **Artifacts correction using standard component topographies as templates** will be displayed on calling this command.

106. Analysis: Turn on (off) band pass filter (not in a menu)

Run this command to turn on (off) band pass filter defined by Setup: EEG bandranges… command. Press right placed arrow button to displayed pop-up menu helps to select filter.

Shortcut:

Main toolbar: 

107. Analysis: Compute ERP... command

Calculates event-related potentials (ERP) for a selected EEG interval in the active EEG file and opens an **ERP window**. You can open several ERP windows for one active EEG file, but for different intervals.

ERPs can be calculated only if presentation of visual (auditory) stimuli was carried out synchronously with EEG acquisition.

After calling this command, a **Parameters for Event-Related Potential Computation (photostimulation) dialog** or a **Parameters for Event-Related Potential Computation (stimuli presentation) dialog** is displayed to define additional processing parameters depending on whether source data type is photostimulation EEG or stimuli presentation EEG.

Raw data is reformatted according to montage parameters before processing.

Attention! EEG reformatted to a bipolar montage cannot be mapped. If you wish to view ERP maps, choose a monopolar montage for the active EEG window before calling this command.

Electrode coordinates are additional parameters for maps (see **Montage parameters: Electrodes dialog**). Incorrect coordinate settings can disable mapping.

Shortcut:

Main toolbar: 

108. Analysis: Compute ERD... command

Calculate event-related de-synchronization (ERD) for the active EEG file and opens an **ERP window**.

ERD can be calculated only if presentation of visual (auditory) was carried out synchronously with EEG acquisition.

After calling this command **Parameters for Event-Related De-synchronization Computation dialog** is displayed to define additional processing parameters.

Raw data is reformatted according to montage parameters before processing.

Attention! EEG reformatted to a bipolar montage cannot be mapped. If you wish to view ERD maps, choose a monopolar montage for the active EEG window before calling this command.

Electrode coordinates are additional parameters for maps (see **Montage parameters: Electrodes dialog**). Incorrect coordinate settings can disable mapping.

Shortcut:

Main toolbar: 

109. Analysis: Compute ERCoh... command

Calculate event-related coherence (ERCoh) for the active EEG file and opens an **ERP window**.

ERCoh can be calculated only if presentation of visual (auditory) was carried out synchronously with EEG acquisition.

After calling this command **Parameters for Event-Related De-synchronization Computation dialog** is displayed to define additional processing parameters.

Raw data is reformatted according to montage parameters before processing.

Attention! EEG reformatted to a bipolar montage cannot be mapped. If you wish to view ERCoh maps, choose a monopolar montage for the active EEG window before calling this command.

Electrode coordinates are additional parameters for maps (see **Montage parameters: Electrodes dialog**). Incorrect coordinate settings can disable mapping.

Shortcut:

Main toolbar: 

110. Analysis: Compute Wavelet... command

Perform wavelet ERP analysis for the active EEG file and opens an **ERP window**. Wavelet power can be calculated only if presentation of visual (auditory) stimuli was carried out synchronously with EEG acquisition.

After calling this command, one of the **Wavelet Decomposition dialogs** is displayed to define additional processing parameters.

Raw data is reformatted according to montage parameters before processing.

Attention! EEG reformatted to a bipolar montage cannot be mapped. If you wish to view maps, choose a monopolar montage for the active EEG window before calling this command.

Electrode coordinates are additional parameters for maps (see **Montage parameters: Electrodes dialog**). Incorrect coordinate settings can disable mapping.

Shortcut:

Main toolbar: 

111. Analysis: Compute Wavelet... command

Compute wavelet coherence for the active EEG file and opens an **ERP window**. Wavelet coherence can be calculated only if presentation of visual (auditory) stimuli was carried out synchronously with EEG acquisition.

After calling this command one of the **Wavelet Coherence dialog** is displayed to define additional processing parameters.

Raw data is reformatted according to montage parameters before processing.

Attention! EEG reformatted to a bipolar montage cannot be mapped. If you wish to view maps, choose a monopolar montage for the active EEG window before calling this command.

Electrode coordinates are additional parameters for maps (see **Montage parameters: Electrodes dialog**). Incorrect coordinate settings can disable mapping.

Shortcut:

Main toolbar: 

112. Analysis: Independent component spectra... command

Compute ERP for independent component of EEG and open **ICA window.**

The **Parameters of ICA spectra calculation dialog** will be displayed on calling this command.

113. Analysis: Independent component spectra... command

Compute ERP for independent component of EEG and open **ICA window.**

The **Parameters of ERP ICA calculation dialog** will be displayed on calling this command.

114. Analysis: Comparison of results command

Run this command to compare spectra, ERP or ERD. The results can be compared between different conditions and different subjects, or with normative database. The **Processing results comparison dialog** will be displayed on calling this command.

115. Pop-up menu of EEG window: Add Spike command

Run this command to add spike label for selected channel and time sample.

116. Pop-up menu of EEG window: Delete Spike command

Run this command delete selected spike label.

117. Pop-up menu of EEG window: Change Channel command

Run this command to change “main” channel for selected spike label

118. Pop-up menu of EEG window: Copy EEG command

Run this command to copy EEG time interval into clipboard for selected spike

119. Pop-up menu of EEG window: Copy Spike command

Run this command to copy spike waveform into clipboard for selected spike.

120. Pop-up menu of EEG window: Copy EEG to Report command

Run this command to copy EEG time interval into text of final report for selected spike

121. Pop-up menu of EEG window: Copy Spike to Report command

Run this command to copy spike waveform into text of final report for selected spike.

122. Analysis: Graphs command

Display processing results (spectra or indices) as graphs for each channel in an **EEG indices window** or in an **EEG spectra window.**

Shortcut:

Analysis toolbar: 

123. Analysis: Histograms command

Display histograms (for standard EEG frequency bands) for each channel in an **EEG indices window** or in an **EEG spectra window**.

Shortcut:

Analysis toolbar: 

124. Analysis: Table command

Display table of spectral parameters (for standard EEG frequency bands) for each channel in an **EEG indices window** or in an **EEG spectra window**.

Shortcut:

Analysis toolbar: 

125. Analysis: Maps command

Map spectral parameters distribution (for standard EEG frequency bands) for each channel in an **EEG indices window** or in an **EEG spectra window**.

Attention! Maps cannot be viewed if the source EEG was reformatted to a bipolar montage before processing.

Shortcut:

Analysis toolbar: 

126. Analysis: Asymmetry command

Map asymmetries in the distribution of spectral parameters (for standard EEG frequency bands) for each channel in an **EEG indices window** or in an **EEG spectra window**.

Attention! Maps cannot be viewed if the source EEG was reformatted to a bipolar montage before processing.

Shortcut:

Analysis toolbar: 

127. Analysis: Formula (Mapping) command

Map ratio of two spectral parameters for standard EEG frequency bands in an **EEG indices window** or in an **EEG spectra window**. Ratio formula is defined by means of **Calculator bar**.

Attention! Maps cannot be viewed if the source EEG was reformatted to a bipolar montage before processing.

Shortcut:

Analysis toolbar: 

128. Analysis: Formula (Graphs) command

Display dynamics of the ratio of two spectral parameters for standard EEG frequency bands as graphs in **EEG spectra window**. Ratio formula is defined by means of **Calculator bar.**

Shortcut:

Analysis toolbar: 

129. Analysis: Interaction diagram command

Display interaction diagrams in an **EEG spectra window**.

Shortcut:

Analysis toolbar: 

130. Analysis: Power Spectra (Autocorrelations) command

Display EEG power spectra or EEG autocorrelations in an **EEG spectra window.**

Shortcut:

Analysis toolbar: 

131. Analysis: Coherence (Cross-correlations) for Channels command

Display EEG coherence channels or EEG cross-correlations for a selected channel in an **EEG spectra window**.

Shortcut:

Analysis toolbar: 

132. Analysis: Average Coherence command

Display EEG coherence averaged over all channels in an **EEG spectra window**.

Shortcut:
Analysis toolbar: 

133. Analysis: Phase Spectra command

Display EEG phase spectra for a selected channel in an **EEG spectra window**.

Shortcut:
Analysis toolbar: 

134. Analysis: Bispectra command

Display bispectra frequency-frequency plot in an **EEG spectra window**.

Shortcut:
Analysis toolbar: 

135. Analysis: Bicoherence command

Display bicoherence frequency-frequency plot in an **EEG spectra window**.

Shortcut:
Analysis toolbar: 

136. Analysis: Average Spectra command

Display average spectra in an **EEG spectra window.**

Shortcut:
Analysis toolbar: 

137. Analysis: Spectra Dynamics command

Display spectra dynamics in an **EEG spectra window**.

Shortcut:
Analysis toolbar: 

138. Analysis: Parameters of interaction diagrams

Run this command to modify parameters of interaction diagrams: used channel pairs and thresholds. After calling this command, a **List of channel pairs and parameters for EEG coherence and EEG cross-correlations dialog** is displayed to modify these parameters.

139. Analysis: Insert tables into report

Run this command to insert detailed report into the text of MS Word window. This option is available only if raw spectra are kept during computation of power spectra (see Parameters of EEG spectra

computation dialog). After calling this command, an **Insert table of spectra parameters dialog** is displayed to define a set of inserted tables and maps.

140. Pop-up Menu of Spectra Window: Add Map command

Add a map in **Spectra window**. The map is added for selected frequency component or frequency band in dependence on displaying mode of Spectra window. A frequency component may be pointed to on a graph or selected in a histogram by cursor position, when holding the right mouse button pressed.

141. Analysis: Channels/Groups command

Display ERP graphs in an **ERP window** arranging them in columns by channels and in rows by trial groups.

Shortcut:

Analysis toolbar: 

142. Analysis: Groups/Channels command

Display ERP graphs in an **ERP window** arranging them in columns by trial groups and in rows by channels.

Shortcut:

Analysis toolbar: 

143. Analysis: Time/Groups Mapping command

Display ERP maps in an **ERP window** arranging them in columns by time readouts and in rows by trial groups.

Attention! Maps cannot be viewed if source EEG was reformatted to a bipolar montage before processing.

Shortcut:

Analysis toolbar: 

144. Analysis: Groups/Time Mapping command

Display ERP maps in an **ERP window** arranging them in columns by trial groups and in rows by time readouts.

Attention! Maps cannot be viewed if source EEG was reformatted to a bipolar montage before processing.

Shortcut:

Analysis toolbar: 

145. Analysis: Formatted Page command

Display ERP graphs and maps in an **ERP window**. Graphs are placed in the window according to defined **ERP display format** (see **Setup: Graph Formats... command**).

Attention! Maps cannot be viewed if source EEG was reformatted to a bipolar montage before processing.

Shortcut:

Analysis toolbar: 

146. Analysis: Average Bandpower command

Display average EEG band power graphs for wavelet ERP analysis in an **ERP window**.

Shortcut:

Analysis toolbar: 

147. Analysis: Rasters Time/Frequency command

Display time/frequency time-frequency plots for wavelet ERP analysis in an **ERP window**.

Shortcut:

Analysis toolbar: 

148. Analysis: Channel List… command

Selects channel list for displaying graphs and maps in the **ERP window**.

Select List of Channels dialog is displayed after calling this command

149. Analysis: Group Info… command

Display statistical results of ERP averaging and response reaction analysis. Use this command also to edit trial group names.

Results of Averaging and Subject Response Processing dialog is displayed after calling this command.

150. Analysis: Export trial parameters command

Export parameters of task performance for single trials to ASCII text file. The next table is written to text file:

1. First column – Time offset (in milliseconds) of the beginning of trial.
2. Second column – Label of trial. If the trial includes artifacts its label is equal zero.
3. Columns include reaction time measured by "**first**" button (in according with parameters of subject response processing) for each averaging group or zero if this trial does not belong to averaging group.
4. Columns include reaction time measured by "**second**" button (in according with parameters of subject response processing) for each averaging group or zero if this trial does not belong to averaging group.
5. Columns include number of "**first**" button presses during the trial (in according with parameters of subject response processing) or zero if this trial does not belong to averaging group.

6. Columns include number of "**second**" button presses during the trial (in according with parameters of subject response processing) or zero if this trial does not belong to averaging group.

151. Pop-up menu of ERP window: Add Map command

Add a map in **ERP window**. The map is added for active trial group (see **Averaging Groups Bar**) and for the time readout (bin) marked on the ERP graph by the by cursor position, when holding the right mouse button pressed.

152. Pop-up menu of ERP window: Add Label command

Add a **peak label** on a graph in an **ERP window**. Peak label is added for active trial group (see **Averaging Groups Bar**) and for time readout (bin) marked on the ERP graph by the by cursor position, when holding the right mouse button pressed.

Before the first call of the LORETA application the WinEEG program ask for a location of LORETA.EXE file. Its usual location is folder with name \LORETA\020-MAIN

153. Pop-up menu of ERP window: Copy Parameter Distribution command

Copy string of voltages of "active" ERP group for selected time sample into clipboard

154. Pop-up menu of ERP window: Copy Channel command

Copy channel's waveform, map and dipole picture for "active" ERP group into clipboard. The map and dipole picture will correspond to time sample selected by mouse pointer.

155. Pop-up menu of ERP window: Copy Channel to Report command

Copy channel's waveform, map and dipole picture for "active" ERP group into text of final report. The map and dipole picture will correspond to time sample selected by mouse pointer.

156. Pop-up menu of ERP window: Source distribution (LORETA)... command

Run this command to call LORETA application and store to it the voltage data corresponding to selected time point of ERP data. Time readout (bit) may be pointed to on an ERP graph by cursor position, when holding the right mouse button pressed.

157. Pop-up menu of ERP window: Dipole source (BrainLock))... command

Run this command to call BrainLock application and store to it the voltage data corresponding to selected time point of ERP data. Time readout (bit) may be pointed to on an ERP graph by cursor position, when holding the right mouse button pressed.

158. Pop-up menu of ERP window: Delete All Labels command

Run this command to clear all pick labels.

159. Pop-up menu of ERP window: Delete Labels and Maps command

Run this command to clear all pick labels and maps.

160. Analysis: Insert Patient Card command

Insert patient card into final report text.

Shortcut:

Main toolbar: 

161. Analysis: Generate Final Report command

Activate final report generation procedure (Only Russian version available).

162. Analysis: Insert Final Report Template... command

Insert a final report template into final report text.

Shortcut:

Main toolbar: 

163. Analysis: Select groups command

Select averaging groups from list of groups for displaying of the graphs.

Parameters of averaging groups dialog is displayed after calling this command.

164. Analysis: Select group pairs command

Select averaging group pair from list of groups for displaying of the difference curve graphs.

Select group pairs dialog is displayed after calling this command.

165. Analysis: Change graph scale command

Change vertical scale for ICA average curves.

Define graph scale dialog is displayed after calling this command.

166. Analysis: Correct baseline command

Define time interval for baseline correction.

Correct graphs baseline dialog is displayed after calling this command.

167. Analysis: Save components filter command

Save to the ASCII file a matrix transforming raw EEG (ERP) to the components of EEG (ERP).

168. Analysis: Save signal filter command

Save to the ASCII file a matrix – spatial filter, revealing or suppressing signals from raw EEG (ERP) for selected list of components.

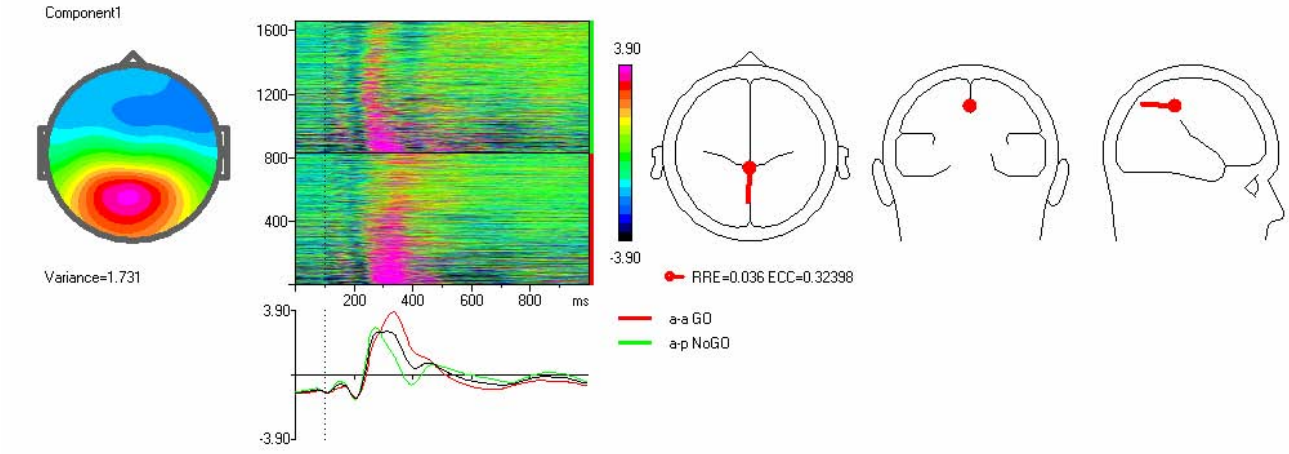
Select components for filter dialog is displayed after calling this command.

169. Analysis: Export activation curves (spectra) command

Export activation curves for independent components of ERP or spectra of independent components into ASCII text file.

170. Pop-up menu of ICA window: Copy component command

Place bitmaps and graphs to clipboard corresponding to selected component by mouse. The result of work of this command will be similar to



171. Pop-up menu of ICA window: Component name command

Modify component name.

Component name dialog is displayed after calling this command.

172. Pop-up menu of ICA window: LORETA for component command

Runs LORETA application and store to it the topography of selected component.

173. Analysis Export of component parameters command

Save to the ASCII file the parameters of selected component for the future statistical analysis.

Export of parameters of independent component dialog is displayed after calling this command.

174. Setup: Database Pathnames… command

Create or opens EEG, spectra and indices databases and customizes their parameters.

The **Database Parameters dialog** consisting of four tabs is displayed after calling this command. Go from tab to tab to define parameters for **Databases of Raw Data, Databases of Processing Results**, and also **Browser Settings** and **Base Record Search Parameters**.

175. Setup: Preferences... command

Set graphic output parameters for **EEG window**. **Preferences dialog** is displayed after calling this command.

176. Setup: Mapping Style... command

Modify map display style. **Mapping Style dialog** is displayed after calling this command.

177. Setup: Montage List… command

Modify montages in the montage list.

A montage includes a number of options such as list of registered channels, list of displayed channels and their parameters (gains, bandwidths, baselines, colors, etc.).

Remember that signals are acquired and recorded always in monopolar form (referenced to the electrode connected with A1 and A2 nets). The bandwidth for acquisition and recording is maximally wide: 0.15 - 70 Hz for «Mizar-EEG-3». Remember that 0.15 Hz frequency corresponds to 1.0 sec time constant. This recording method allows conversion of raw data to any mono- or bipolar montage with any bandwidth* during subsequent viewing and processing.

*Note: After recording EEG data, the phrase “any bandwidth” must be understood to mean “any bandwidth that is less than or equal to the instrument’s maximum bandwidth,” i.e. 70Hz in the case of the Mitsar-EEG-3.

A Montage parameters dialog consisting of six tabs is displayed after calling this command. Go from tab to tab to define the following montage parameters:

a. Define a list of channels for EEG acquisition corresponding to electrodes actually placed and connected (see **Montage parameters: Electrodes dialog**). Also define coordinates of the electrodes.

b. Define a list of channels in the montage and their parameters such as gain, bandwidth and base line (see **Montage parameters: Channels dialog**).

c. Define colors for displaying each channel (see **Montage parameters: Colors dialog**).

d. Define the calculated referents if there are any (e.g. Av, AvL and AvR) (see **Montage parameters: Referents**).

e. Test whether channels are correctly defined or view another montage in the list (**see Montage parameters: View dialog**).

178. Setup: Fragment Names... command

Define list of EEG fragment names for **Input Control toolbar**.

Names of Fragments (Trials) dialog is displayed after calling this command.

179. Setup: Label List… command

Define up to 10 user labels for **Labels popup menu**.

User Label Description dialog is displayed after calling this command.

180. Setup: Photostimulation Programs… command

Define list of photostimulation programs.

Photostimulation Program List dialog is displayed after calling this command.

181. Setup: EEG Bandranges… command

Define a list of standard EEG frequency bands to be used for data processing in an **EEG Indices window** or in an **EEG Spectra window**.

EEG Bandranges dialog is displayed after calling this command.

182. Setup: Stimuli Presentation Programs… command

Display and modifies stimuli presentation programs (protocols) for ERP acquisition.

Stimuli Presentation Program List dialog is displayed after calling this command.

183. Setup: Graph Formats… command

Change graph output options in an **ERP window.**

Graphics Page Format dialog is displayed after calling this command.

184. Setup: Title… command

Define a running header to be printed at the top of each page (for example, your organization title).

Running Head dialog is displayed after calling this command.

185. Setup: Final Report… command

Customize final report generator.

Final Report Generator Setup dialog is displayed after calling this command.

186. Setup: Final Report Templates… command

Define and modifies list of final report templates.

Final Report Template List dialog is displayed after calling this command.

187. Setup: Video recording… command

Select video capturing device. Set and modifies parameters of capturing: resolution, frame rate, signal format and on-line compression.

Video recorder parameters dialog is displayed after calling this command.

188. Setup: Equipment Parameters… command

Set and modify hardware configuration.

Equipment Configuration dialog is displayed after calling this command.

189. Window: Cascade command

Cascades all open windows.

Shortcut:

Main toolbar: 

190. Window: Tile Horizontally command

Tiles all open windows horizontally.

Shortcut:

Main toolbar: 

191. Window: Tile Vertically command

Tiles all open windows vertically.

Shortcut:

Main toolbar: 

192. Window: Arrange Icons command

Arrange the icons for minimized windows at the bottom of the main window.

193. Window: Split command

Split the active window into two panes.

194. Window: 1, 2, ... command

WinEEG displays a list of currently open document windows at the bottom of the Window menu. Check a document from this list to make its window active.

195. Help: About WinEEG... command

Displays copyright and version number for your copy of WinEEG.

196. Title Bar

The title bar is located along the top edge of a WinEEG window, a document window or a dialog. It displays application name, document name or dialog name.

To move a window or a dialog, drag its title bar.

A title bar may contain the following elements:

Application icon (in the left top corner of the application window) for calling application system menu.

Document icon (in the left top corner of a document window) for calling document system menu.

Maximize button (in the right top corner of a window).

Minimize button (in the right top corner of a window).

Restore window size button (in the right top corner of a maximized or a minimized window).

Close button (in the right top corner of a window): closes document or application.

Application name.

Document name.

Dialog name.

197. Scroll bars

Scroll bar is placed at the right and bottom edges of a document window. The scroll boxes inside the scroll bars indicate your vertical and horizontal position in the document. You can use the mouse to scroll the document.

198. Size command (System menu)

Run this command to size the active window by means of arrow keys. After the cursor shape has changed:

1. Choose what window edge to move (left, right, top or bottom) by pressing a corresponding arrow key.
2. Press arrow keys to move the edge.
3. Press ENTER when the window reaches necessary size.

199. Move command (System menu)

Run this command to size the active window by means of arrow keys. The cursor will change its shape to:

Use arrow keys to move the window. Press ENTER when the window reaches the necessary position.

Shortcuts:

Keys: CTRL+F7

200. Minimize command (System menu)

Minimize the window to an icon.

Shortcuts:

Title bar: 

Keys: ALT+F9

201. Maximize command (System menu)

Maximize an application window to screen size or a document window to application window size.

Shortcuts:

Title bar: 

Double-click title bar

Keys: CTRL+F10.

202. "Next" command (document window System menu)

Activates next document window (in order of opening time).

Shortcut:
Keys: CTRL+F6

203. "Previous" command (document window System menu)

Activate previous document window (in turn by time of opening).

Shortcut:
Keys: SHIFT+CTRL+F6

204. "Close" command (System menu)

Close a document window or application.

Shortcuts
Title bar: 
Keys: CTRL+F4 to close a document
ALT+F4 to close WinEEG

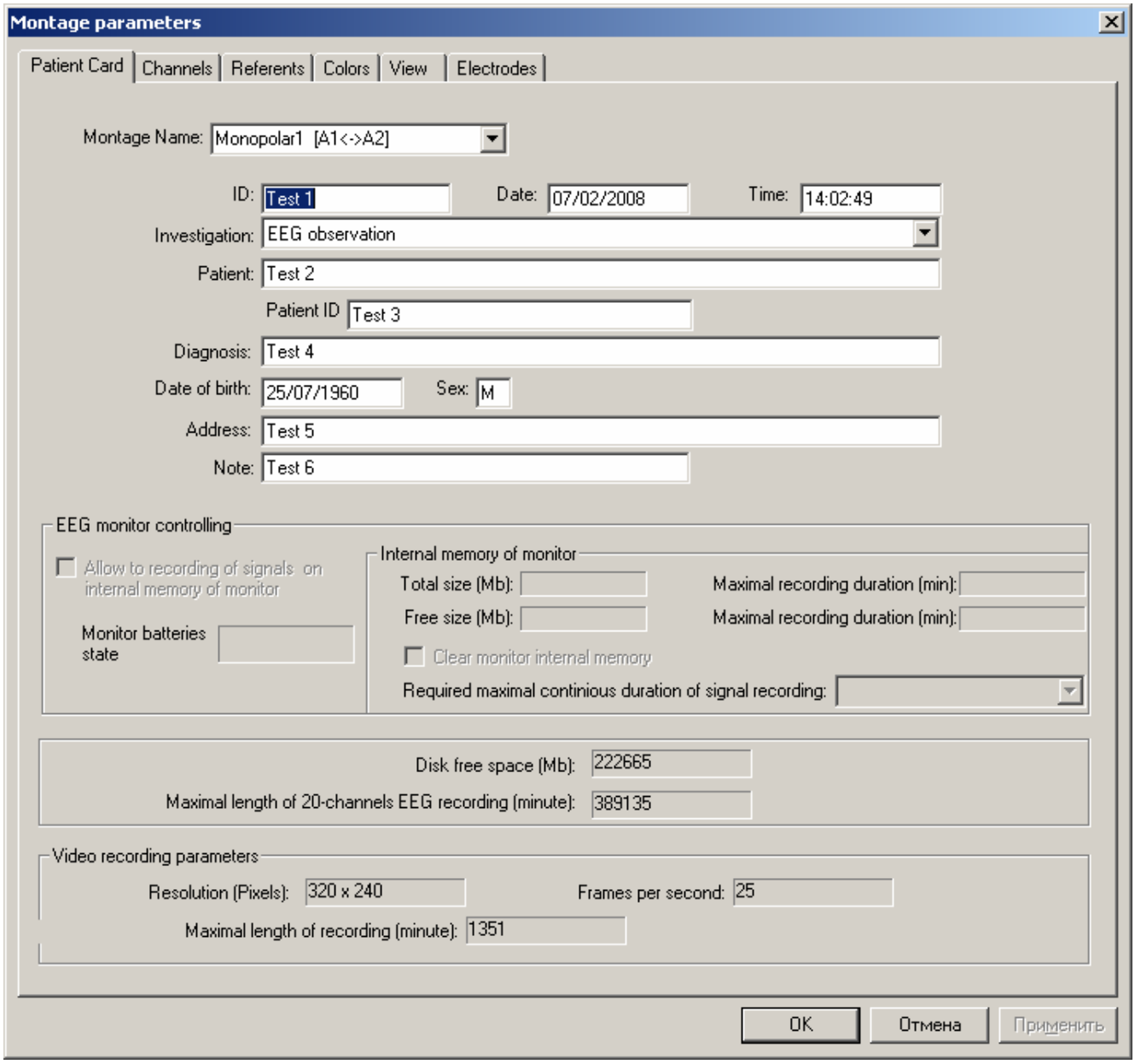
205. "Restore" command (System menu)

Restore a minimized or a maximized window.

Dialogs

1. Montage Parameters: Patient Card dialog

Use the Patient Card tab of the Montage Parameters dialog to enter data in the patient card. You can also choose a montage from the montage list (see **Setup: Montage List... command**).



Montage Name: This field initially contains the name of the default montage from the montage list. Use down-arrow button to select a different montage from the list for use as a new default. You can also rename the selected montage.

ID: EEG record ID is an arbitrary alphanumeric sequence of up to 10 characters to simplify searching the database.

Date: The date of EEG acquisition start is entered automatically. Use DD/MM/YYYY date format for successful database search by date.

Time: The time of EEG acquisition start is entered automatically. Use HH:MM:SS time format for successful database search by time.

Investigation: Select investigation type from list:

1. EEG observation

Patient: Enter patient's name.

Patient ID: Enter patient's card number.

Diagnosis: Enter a brief disease diagnosis. The final report may contain more detailed description.

Date of birth: Enter the date of patient's birth. Use DD/MM/YYYY date format for successful database search.

Sex: Enter patient's sex (M/F)

Address: Enter patient's address.

Note: Enter other useful info (patient's insurance policy number for example).

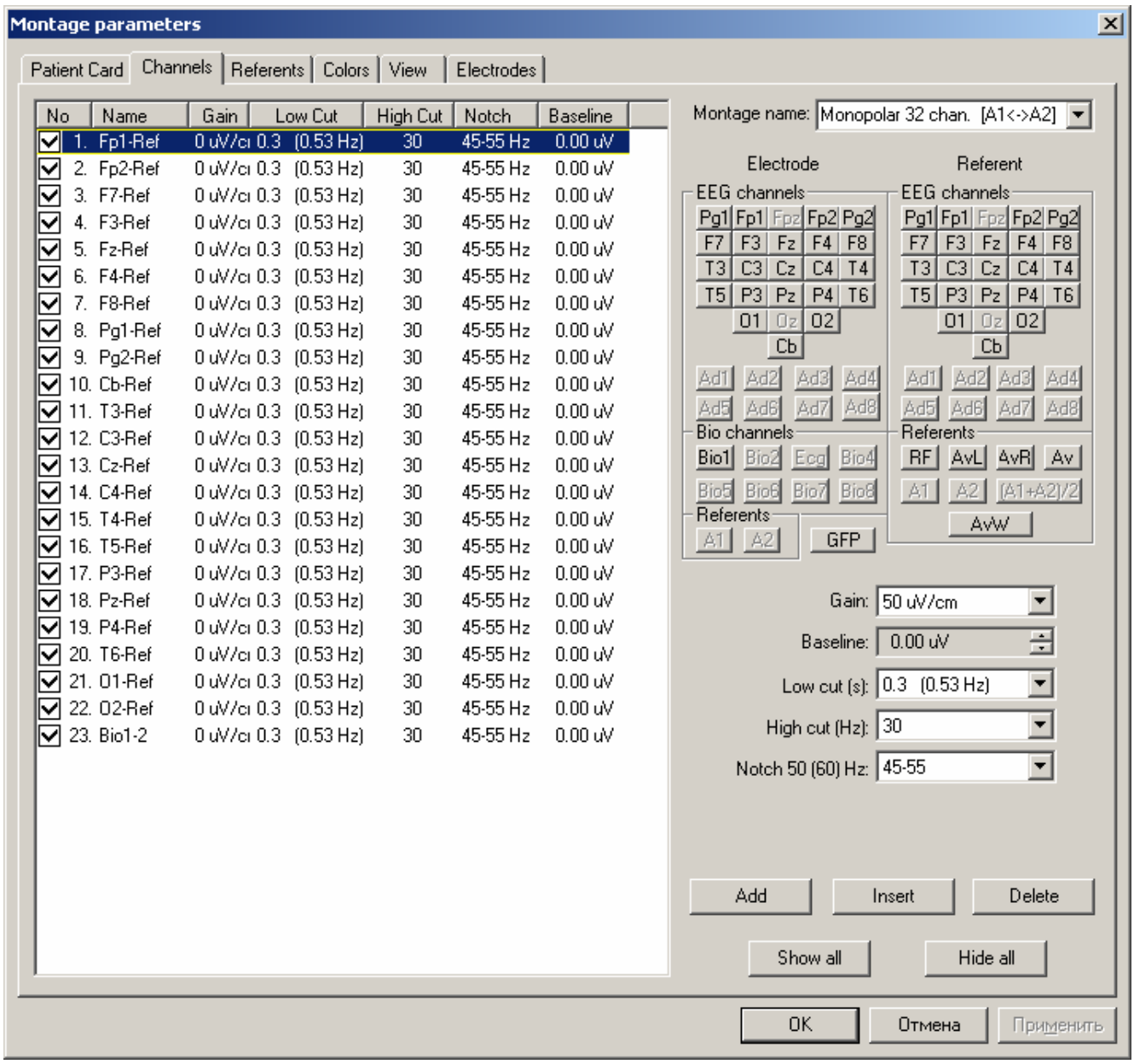
All the fields of patient card are not mandatory but can be useful when searching database. Remember that all patient info would be automatically added to the final report.

The fields are placed below used for EEG monitor control.

The fields with information about available disk free space place near patient card.

2. Montage Parameters: Channels dialog

Use the Channels tab of the Montage Parameters dialog to define the list of channels included in the montage and for setting their parameters. You can also choose a montage from the montage list (see **Setup: Montage List command**).



Montage Name: This field initially contains the name of default montage from the montage list. Use down-arrow button to select a different montage from the list for use as a new default. You can also rename the selected montage.

Channel List: The table of channels in the montage is placed on the left side. Each row corresponds to a channel in the montage (don't confuse them with the channels in the acquisition list. The montage channel list includes channels that will be displayed during the monitoring and processed). Columns correspond to channel parameters:

a. The **«No»** column contains the ordinal number of the channel. To the left of it there is a pictogram: its color is the same that the waveform color in the EEG window. It depicts also the channel status ("visible" or "hidden"): if the pictogram is marked by a "V" character the channel is shown in the EEG window ("visible"); otherwise the channel is not displayed ("hidden"). All channels included in the list of montage channels will be used for processing (except universal channels «Bio1», «Bio2»...)

a. The **«Channel»** column shows the electrode scheme (for example Fp1-Fp2; the electrode named first is the active one and the second is the passive one). A channel can be used if it is included in the list of monitored channels.

b. The **«Gain»** column shows the channel gains. For any channel in the montage you can select a gain value from list:

1.0, 1.5, 2.0, 3.0, 5.0, 7.0, 10.0, 15.0, 20.0, 30.0, 50.0, 70.0, 100.0, 150.0, 200.0, 300.0, 500.0, 700.0 uV/cm, 1.0, 1.5, 2.0, 3.0, 5.0, 7.0, 10.0, 15.0, 20.0, 30.0, 50.0, 70.0, 100.0, 150.0, 200.0, 300.0, 500.0, 700.0 mV/cm.

c. The **«Low cut»** column shows the selected low frequency cutoff value. For any channel in the montage you can set one of the following values for low cutoff frequency:

0.16 Hz (1.0 sec), 0.53 Hz (0.3 sec), 1.6 Hz (0.1 sec) и 5.3 Hz (0.03 sec), and 0.0 Hz (DC), 0.016 Hz (10.0 sec), 0.032 Hz (5.0 sec), 0.053 Hz (3.0 sec), 0.045 Hz (3.5 sec) for DC amplifiers

d. The **«High cut»** column shows the selected high frequency cutoff value. For any channel in the montage you can set one of the following values for high cutoff frequency:

15 Hz, 30 Hz, 50 Hz, 70 Hz, and possible 150 Hz, 0.5 Hz и 1.5 Hz for different modification of amplifiers.

All filters are 2-d order Butterworth filters.

e. The **«Notch»** column shows the notch values. For any channel one of the following notch values can be set:

Turn Off, 45-55 (Hz), 40-60 (Hz), 35-65 (Hz), 55-65 (Hz), 50-70 (Hz), 45-75 (Hz).

All filters are 12-th order Butterworth notch filters.

Attention! Do not use the wide width filters unless absolutely necessary since it can distort bandwidth.

f. The **«Baseline»** shows the selected value of the channel baseline offset. The offset is set in mV (micro Volts); its range and step depend on the selected gain for the given channel. So, minimal baseline offset corresponds to 1 mm on the screen, and offset range is from 100 mm below to 100 mm above.

Changing Channel Parameters

To modify a parameter for a channel in the montage, first of all select a row in the table by clicking the left mouse button on that row. The row is then highlighted by color. You can select several or all of the rows. To select multiple lines, use the mouse holding Ctrl or Shift key pressed. To select all lines, click any column heading in the table.

To change **channel status** ("visible"/"hidden") click the pictogram to the left of the channel, or press the Space key. The **Show All** and **Hide All** buttons set the same status for all channels simultaneously.

The **active electrode** is defined for all selected channels in the montage by pressing the desired button in the Electrode>EEG **Channels** group. This group includes buttons for EEG and universal (Bio) channels.

The **passive electrode** is defined for all selected channels in the montage by pressing the desired button in the Referent>EEG **Channels** group. This group includes buttons for EEG channels and other referent types.

The **gain** for all selected channels can be set by selecting a value from the **"Gain"** list.

The **low cut** for all selected channels can be set by selecting a value from the **"Low Cut (s)"** list.

The **high cut** for all selected channels can be set by selecting a value from the **"High Cut (Hz)"** list.

The **notch** parameters for all selected channels can be set by selecting a value from the **"Notch (Hz)"** list.

The **baseline** for all selected channels is changed by pressing arrow buttons to the right of the **"Baseline"** list**.**

Attention! If **active electrode** is defined as “GFP” the global field power will be displayed in EEG Window. The global field power is calculated according a formula:

$$GFP = \{(1/2n)\sum_{i=1}^{n}\sum_{j=1}^{n}[u(i)-u(j)]^2\}^{0.5}$$

Modifying Channel List

Press **Add** button to add a new line to the end of the montage channel list.

Press **Insert** button to add a new line above the currently selected one.

Press **Delete** button to delete all selected lines from the montage channel list.

3. Montage Parameters: Referents dialog

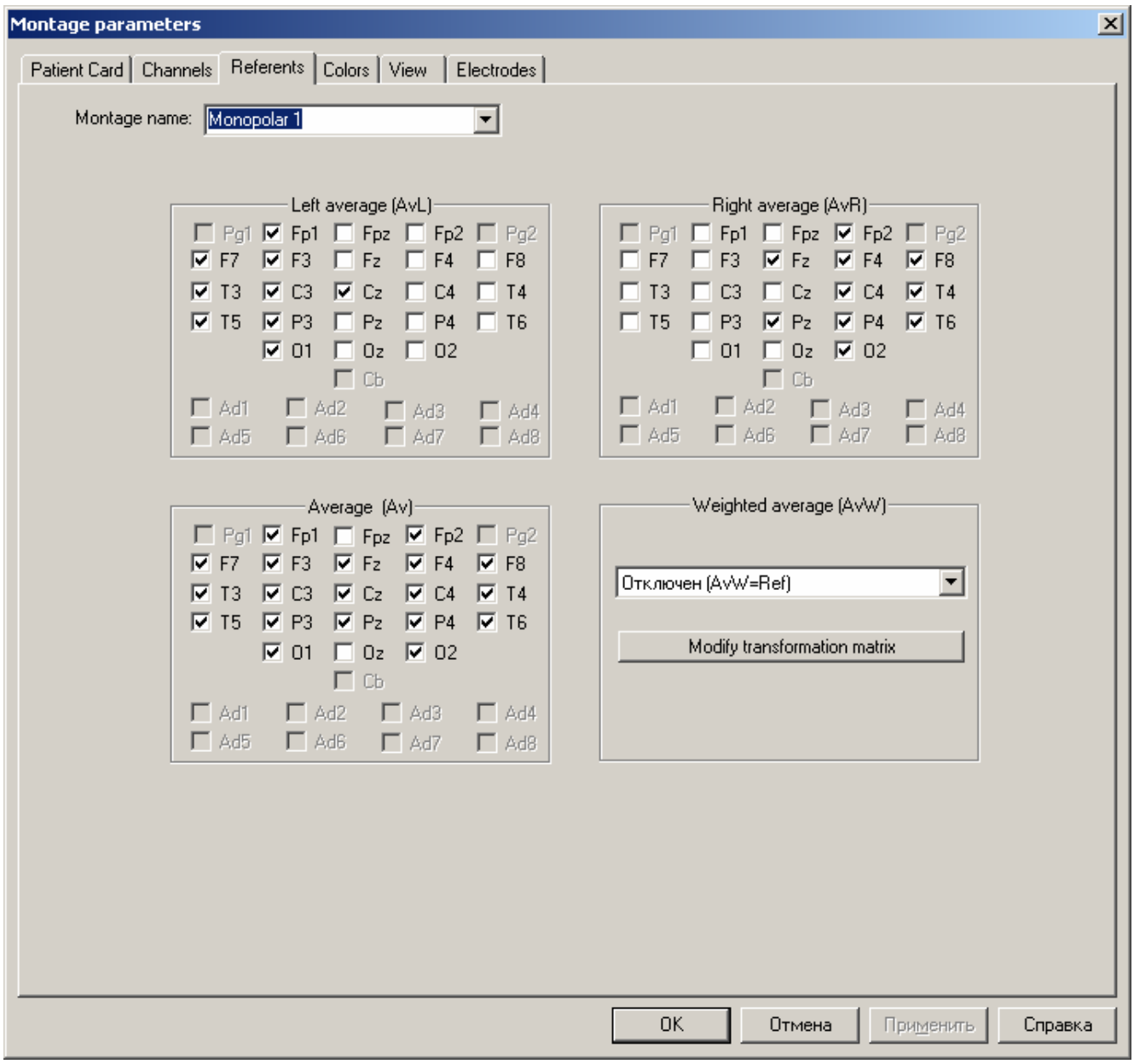
Use the Channels tab of the Montage Parameters dialog to define lists of channels to be included when calculating **Av**, **AvL**, **AvR** and **AvW** referents. You can also choose a montage from the montage list (see **Setup: Montage List command**).

Montage Name: This field initially contains the name of the default montage from the montage list. Use down-arrow button to select a different montage from the list for use as a new default. You can also rename the selected montage.

The **Left Average (AvL)** group defines the list of channels for the **AvL** referent. To calculate the **AvL** referent signal, the encephalograms of the marked (checked) channels are averaged.

The **Right Average (AvR)** group defines the list of channels for the **AvR** referent. To calculate the **AvR** referent signal, the encephalograms of the marked channels are averaged.

The **Average (Av)** group defines the list of channels for the **Av** referent. To calculate the **Av** referent signal, the encephalograms of the marked channels are averaged.



The **Weighted Average (AvW)** group defines the list of channels and weights for the **AvW** referent. You can choose a transformation (weight) matrix from the list or define your own. To define a transformation matrix, press **Modify transformation matrix button**. The **Transformation Matrix for Weighted Average Referent dialog** will appear.

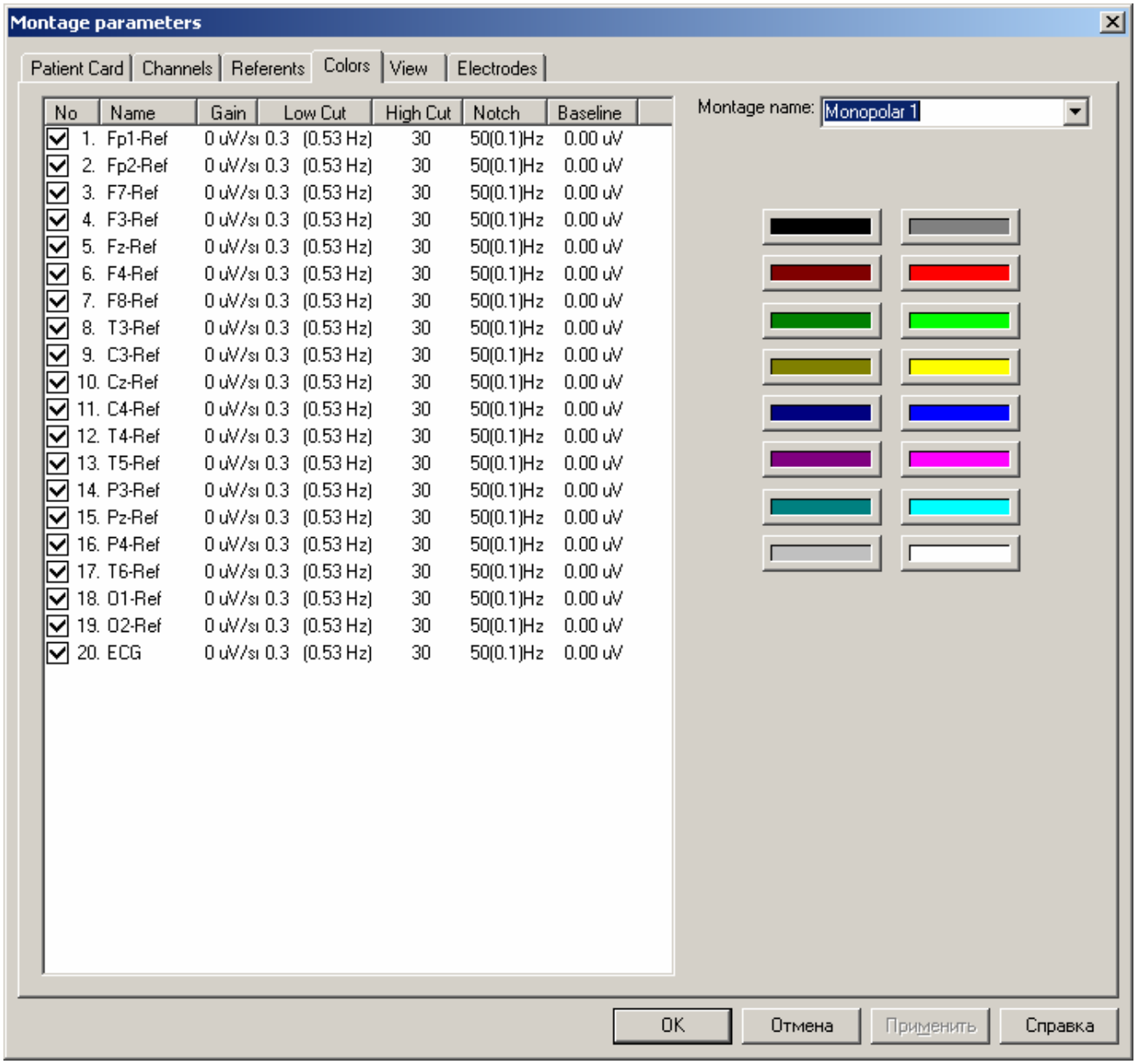
4. Montage Parameters: Colors dialog

Use the Colors tab of the Montage Parameters dialog to define colors for depicting channels. You can also choose a montage from the montage list (see **Setup: Montage List command**).

Montage Name: This field initially contains the name of default montage from the montage list. Use down-arrow button to select a different montage from the list for use as a new default. You can also rename the selected montage.

Channel List: The table of channels in the montage is placed on the left side. Each row corresponds to a channel in the montage (don't confuse them with the channels in the acquisition list. The montage channel list includes channels that will be displayed during the monitoring and processed). Columns correspond to channel parameters (for more info see Montage List: Channels dialog).

To change colors for the selected channels (how to select channels - see **Montage Settings: Channels dialog**), click one of the color buttons located to the right of the channels table.



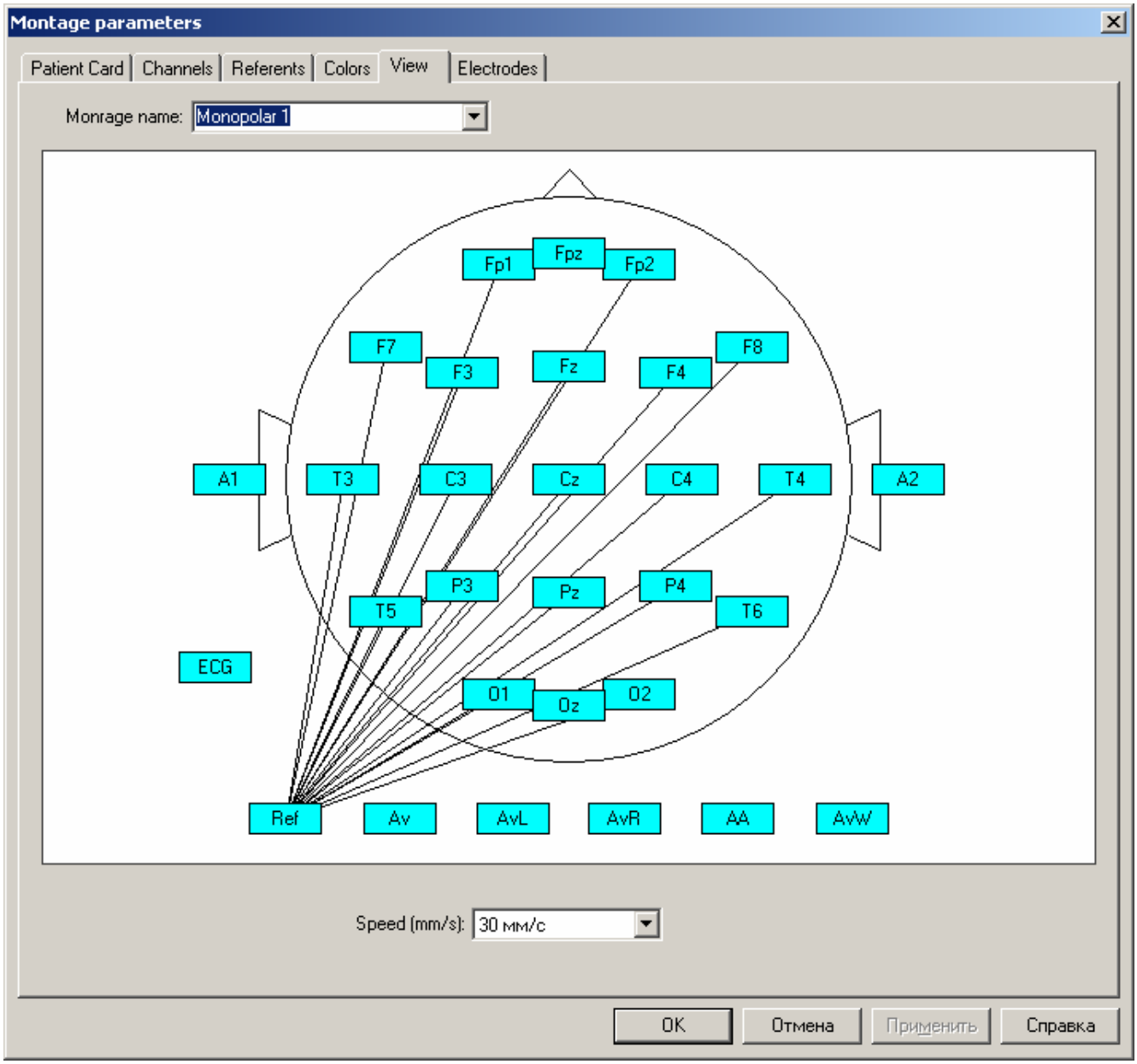
5. Montage Parameters: View dialog

Use the Colors tab of the Montage Parameters dialog to monitor the parameters set. You can also choose a montage from the montage list (see **Setup: Montage List command**).

Montage Name: This field initially contains the name of default montage from the montage list. Use down-arrow button to select a different montage from the list to use as a new default. You can also rename the selected montage.

The **paper speed** (horizontal scale) can be selected from the **Speed** list: 60, 30, 15, 7.5, 3.75 or 1.875 mm/sec.

The left window graphically depicts the electrodes used, their position (coordinates) and the site scheme (montage). The referent electrodes are also shown.



6. Montage Parameters: Electrodes dialog

Use the **Electrodes** tab of the Montage Parameters dialog to list electrodes to be used and their coordinates. You can also choose a montage from the montage list (see **Setup: Montage List command**).

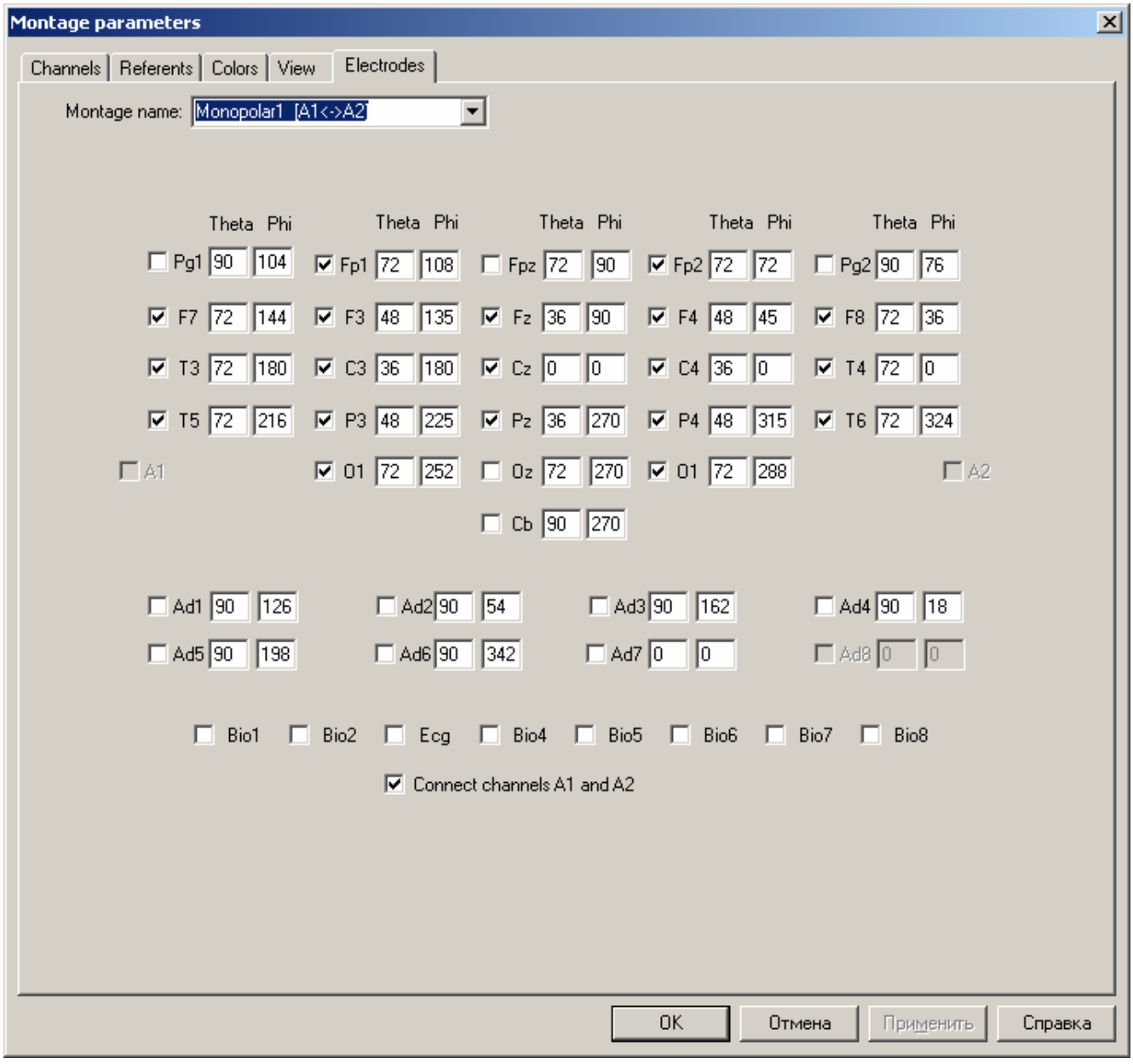
Montage Name: This field initially contains the name of default montage from the montage list. Use down-arrow button to select a different montage from the list for use as a new default. You can also rename the selected montage.

Check a channel to include it in the list for acquisition.

Spherical coordinates of the electrode upon the head (top hemisphere) are listed to the right of the channel name.

The coordinate system is set as follows: X axis goes from the left ear to the right one, Y axis - from the nape to the forehead, Z axis - upwards.

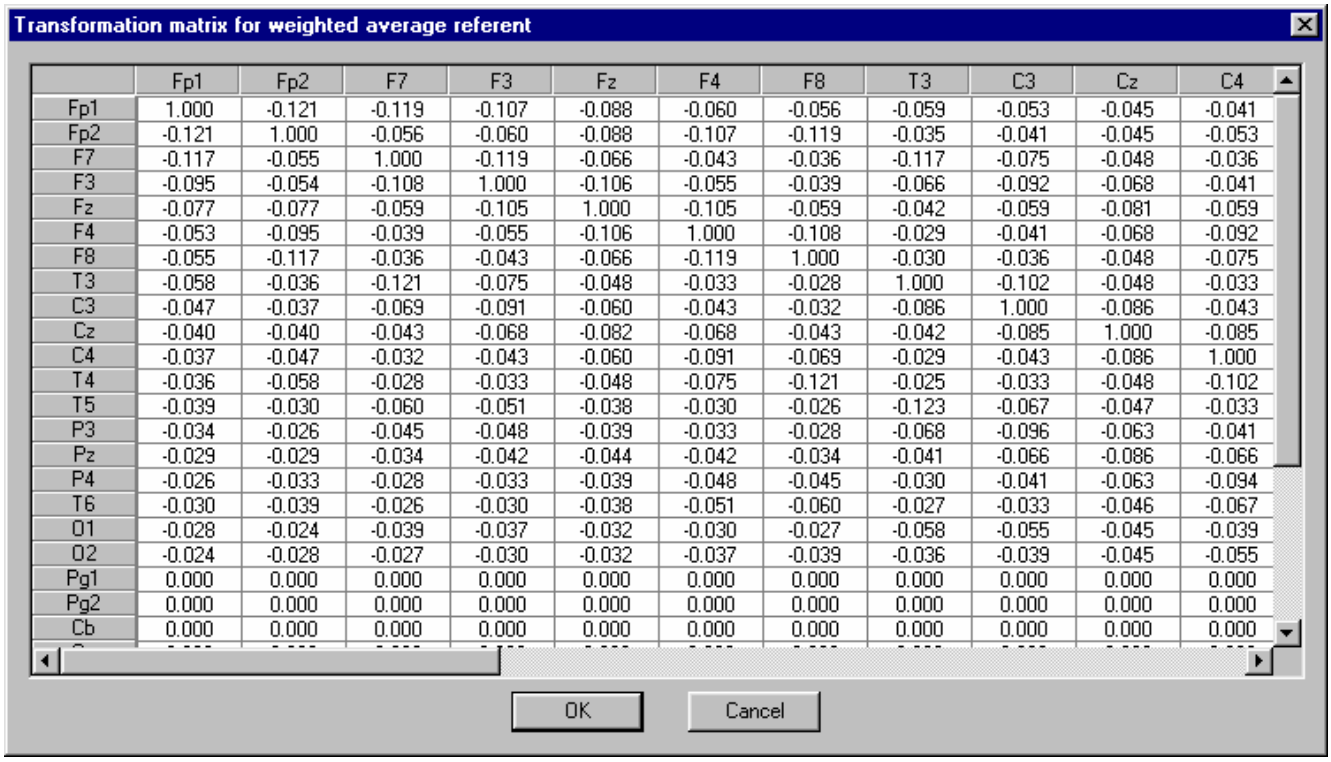
The Theta spherical coordinate must lie in the range from 0 to 90 degrees, the Phi coordinate - from 0 to 360 degrees.



Connect Channels A1 and A2: Check this option if you are not going to acquire EEG from different channels in relation to different ears or to the "average" ear. If the option is checked, **A1** and **A2** nets are connected directly in the amplifier block so that there is no necessity to connect two electrodes to these nets or to use a jumper.

7. Transformation Matrix for Weighted Average Referent dialog

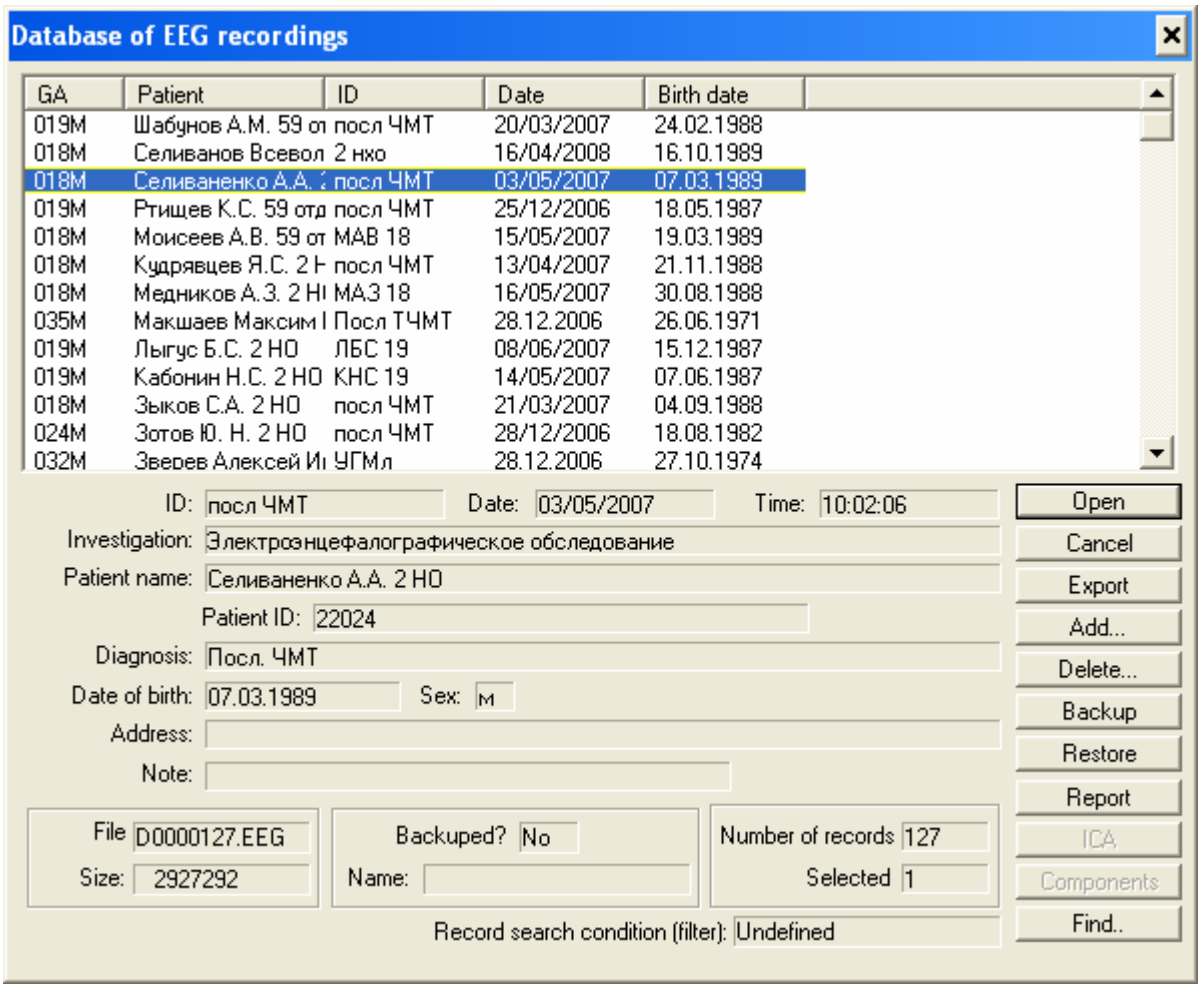
Change transformation coefficients if needed.



	Fp1	Fp2	F7	F3	Fz	F4	F8	T3	C3	Cz	C4
Fp1	1.000	-0.121	-0.119	-0.107	-0.088	-0.060	-0.056	-0.059	-0.053	-0.045	-0.041
Fp2	-0.121	1.000	-0.056	-0.060	-0.088	-0.107	-0.119	-0.035	-0.041	-0.045	-0.053
F7	-0.117	-0.055	1.000	-0.119	-0.066	-0.043	-0.036	-0.117	-0.075	-0.048	-0.036
F3	-0.095	-0.054	-0.108	1.000	-0.106	-0.055	-0.039	-0.066	-0.092	-0.068	-0.041
Fz	-0.077	-0.077	-0.059	-0.105	1.000	-0.105	-0.059	-0.042	-0.059	-0.081	-0.059
F4	-0.053	-0.095	-0.039	-0.055	-0.106	1.000	-0.108	-0.029	-0.041	-0.068	-0.092
F8	-0.055	-0.117	-0.036	-0.043	-0.066	-0.119	1.000	-0.030	-0.036	-0.048	-0.075
T3	-0.058	-0.036	-0.121	-0.075	-0.048	-0.033	-0.028	1.000	-0.102	-0.048	-0.033
C3	-0.047	-0.037	-0.069	-0.091	-0.060	-0.043	-0.032	-0.086	1.000	-0.086	-0.043
Cz	-0.040	-0.040	-0.043	-0.068	-0.082	-0.068	-0.043	-0.042	-0.085	1.000	-0.085
C4	-0.037	-0.047	-0.032	-0.043	-0.060	-0.091	-0.069	-0.029	-0.043	-0.086	1.000
T4	-0.036	-0.058	-0.028	-0.033	-0.048	-0.075	-0.121	-0.025	-0.033	-0.048	-0.102
T5	-0.039	-0.030	-0.060	-0.051	-0.038	-0.030	-0.026	-0.123	-0.067	-0.047	-0.033
P3	-0.034	-0.026	-0.045	-0.048	-0.039	-0.033	-0.028	-0.068	-0.096	-0.063	-0.041
Pz	-0.029	-0.029	-0.034	-0.042	-0.044	-0.042	-0.034	-0.041	-0.066	-0.086	-0.066
P4	-0.026	-0.033	-0.028	-0.033	-0.039	-0.048	-0.045	-0.030	-0.041	-0.063	-0.094
T6	-0.030	-0.039	-0.026	-0.030	-0.038	-0.051	-0.060	-0.027	-0.033	-0.046	-0.067
O1	-0.028	-0.024	-0.039	-0.037	-0.032	-0.030	-0.027	-0.058	-0.055	-0.045	-0.039
O2	-0.024	-0.028	-0.027	-0.030	-0.032	-0.037	-0.039	-0.036	-0.039	-0.045	-0.055
Pg1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pg2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cb	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

8. Record List dialog

WinEEG has its own database to simplify archiving and searching of files containing EEGs and processing results (EEG spectra, EEG indices, etc.). There is a separate database for each type of file: EEG files, EEG spectra files, EEG indices files and so on. It is also possible to create several databases for one file type in order to group data by some criteria - by investigation date for example. Use the **Setup: Database Pathnames command** to create a new database or to select an existing one.



Each database consists of an investigation list file and data files. Records in the investigation list file include patient card, data file name and service information. A record in the database corresponds to a single data file. Data files can be placed either in a working directory (folder) on the hard disk or in archives on removable drives. The working directory for data files also can be placed on removable drives of high capacity, such as magneto-optical diskettes. Data is searched over the investigation list file which significantly simplifies and accelerates selecting records of interest.

WinEEG Database functions allow:

1. Adding a new file (for example, an EEG file after an investigation or a spectra file after processing) to the database.
(See **File: Save command**).
2. To add a previously created data file.
3. To sort records (patient cards) by any criterion (field).
4. To select a subset of records by a set of criteria.
5. To copy (or to move) a file to an archive.
6. To copy a file from an archive to the working directory.

7. To delete a data file and/or a database record.

In the top of the Record List dialog window there is a record list. Each row in it corresponds to one record in the investigation list file. Each column in the list corresponds to one field of the patient card form. Use **Setup: Database Pathnames command** to define what fields are to be displayed and in what order.

When Record List dialog is opened record list is unsorted: the first row displays the latest investigation added to the database, etc.

To **sort** the record list by any field, click the corresponding column header.

To **select** a record for further processing, click the corresponding row so it becomes highlighted. In the bottom of the Record List window the patient card from the selected record is displayed (see **Edit Patient Card dialog**). Additional data file information is also shown there.

File field displays the name of data file corresponding to selected record.

Size field contains size (in bytes) of the data file if it is placed in the working directory. Otherwise this field contains "Not found".

Backed up? Field contains "Yes" if the data file was backed up in the archive and "No" otherwise.

Record search condition (filter) field contains the information about records filter. If this field contains word "**Defined**" this means the search condition is not clear. If this field contains word "**Undefined**" this means the search condition is clear.

To the right of the patient card there are control buttons:

Open button opens the data (EEG, ERP EEG spectra and etc.) file corresponding to the record selected in a new window. The file can also be opened by double-clicking the row in the record list. The Record List dialog is then closed.

Note: If you open an ERP, EEG spectra and etc. database and select multiple records then the **Average** button appears instead of the **Open** button. If you press the **Average** button, ERPs, EEG spectra and etc. that have been averaged over all selected records will be calculated and then a new **ERP window** or a new **EEG Spectra window** will be opened. If a raw EEG database is opened then on pressing **Average** button, a **Batch EEG processing dialog** appears, allowing the calculation of ERP, ERD, ERCoh, wavelet bandpower and etc. for several investigations simultaneously.

Cancel button closes the Record List dialog without opening any data file.

Export button calls the function of ERP (ERD, EEG spectra and EEG independent components spectra) export. It can be useful for exporting processing results of several investigations to one ASCII file for further statistical analysis.

Find... calls **automatic record search** function. A **Base Record Search Parameters** dialog will then be opened.

Add... button calls the function that adds a **data file to the database**. A file is added to the database in two cases. First, if it is necessary to add a file to the database that has not yet been recorded. This may happen after an investigation if data was saved by **Save As...** command, or if the file was copied from

other encephalographic hardware. Second, files are added if there is a need to create a new database, for example if the old one is lost.

If **Add...** command is called a **File Open dialog** appears. Using the standard Windows browsing interface, find the file of interest and open it. If the selected data file has a compatible format (EEG 1.5, EEG 3.0 or WinEEG) an **Open dialog** will appear. There are two exceptions: EEG 1.5 EEG files with bipolar acquisition and EEG 3.0 spectra files cannot be added to respective databases.

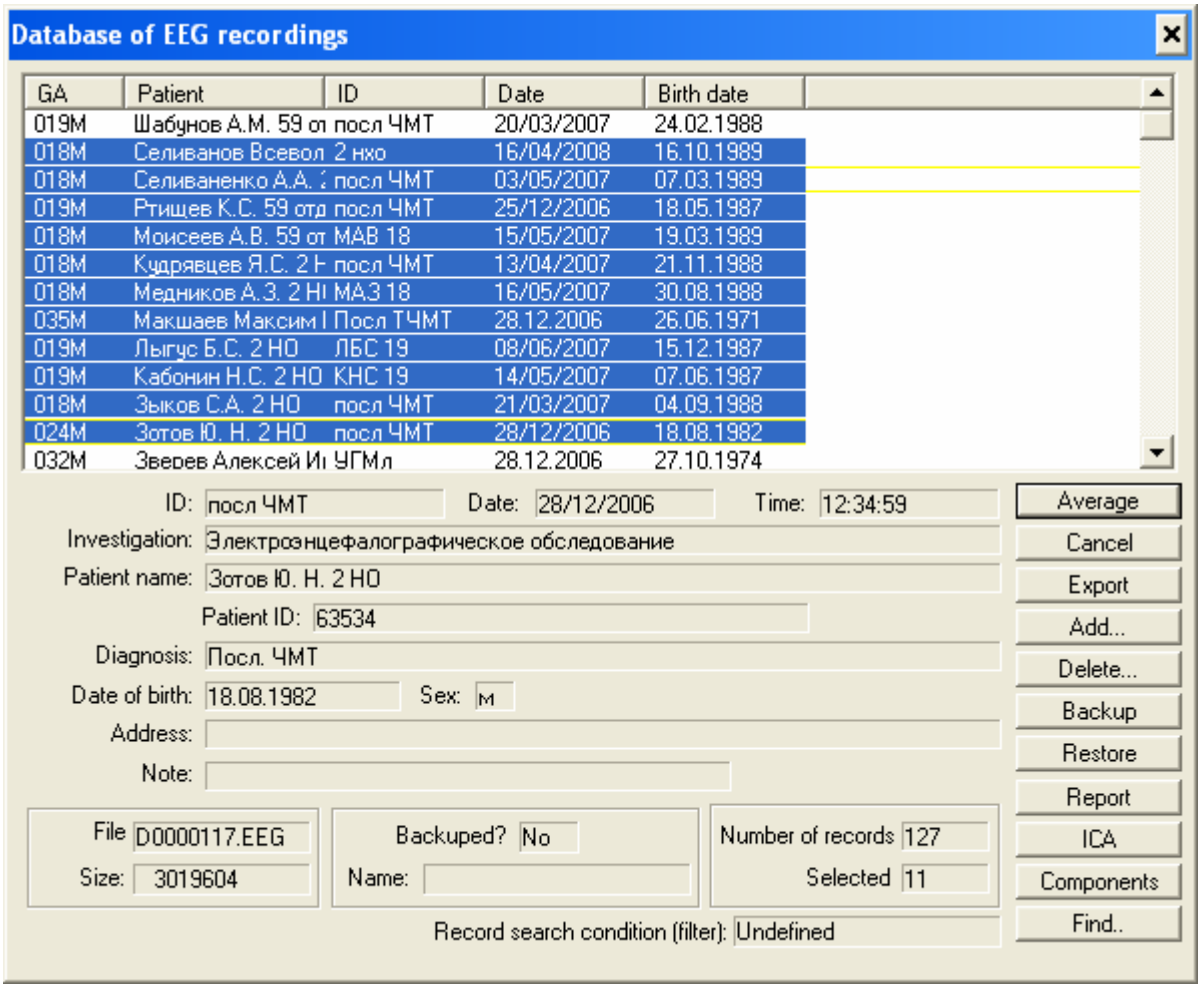
Delete button calls the **record and data file deletion** function. **Delete Data From Database dialog** is then displayed.

Backup button calls the function that backs up **data files from the working directory to an archive**. **Backup Data To Archive dialog** appears then.

Restore button calls the function of **data file copying from archive to the working directory**. **Restore Archive Data dialog** appears then.

Report button calls the function that creates a statistical report including quantity EEG observations carried out during selected time interval and/or with different groups of subjects and insert resulting table into MS Word. The **Statistical results dialog** appears then.

The databases of results of processing can have additional buttons. So, Database of evoked potentials has two additional buttons.



ICA button calls the function computing independent components of average ERPs if ERP database is opened, independent components of average ERD if ERD database is opened and EEG independent components average spectra if EEG database is opened. The **Parameters of independent component analysis (ICA) dialog** or **Parameters of ICA spectra calculation for selected group of observations** appears after calling this function.

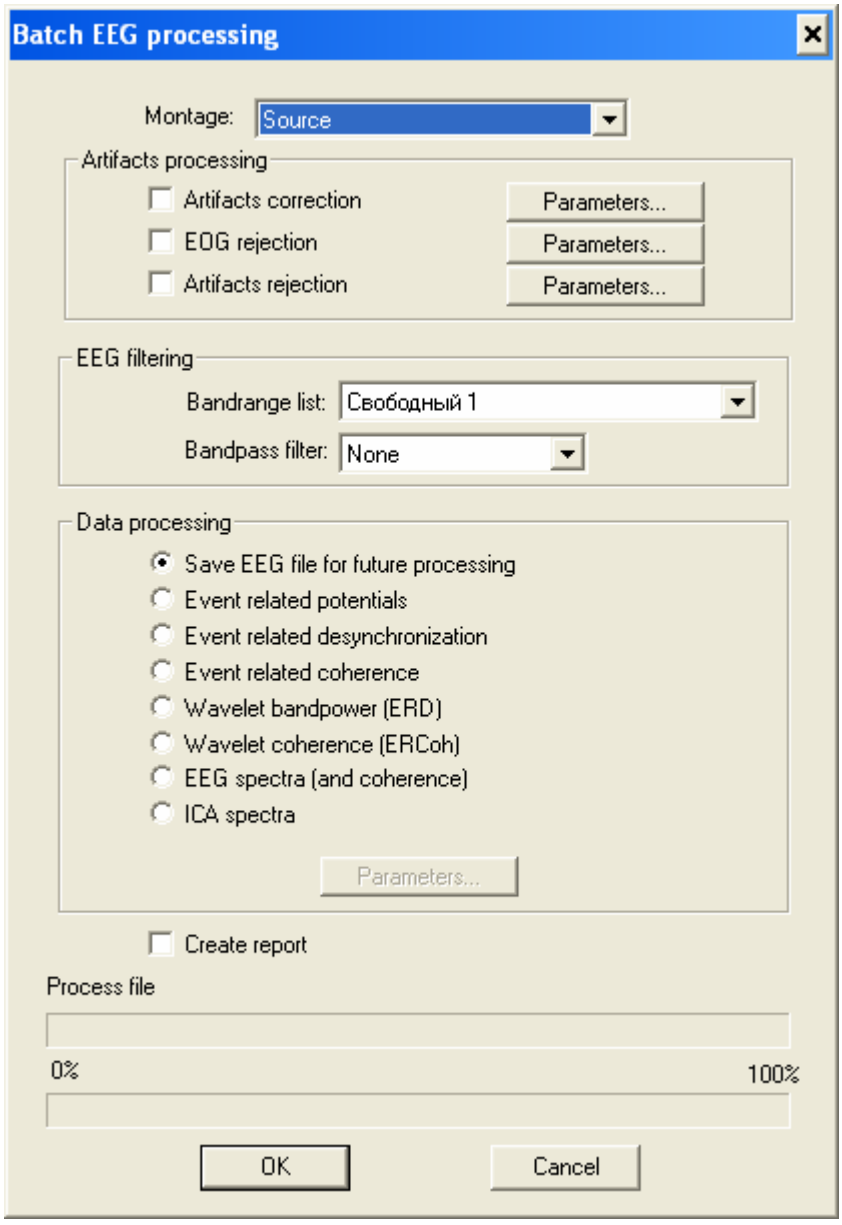
Components button calls the function performing transformation of ERPs to ERP components. The results of processing will store to the same database as additional ERP files. WinEEG ask for text file contains the description of list of spatial filters. The example of such file is presented below.

```
"P1N1 vO"       "p-p"                  "VCPT1ref.cmx"
"P1N1 vTL"      "p-p"                  "VCPT2ref.cmx"
"P1N1 vTR"      "p-p"                  "VCPT3ref.cmx"
"N1P2 aC"       "p-h"                  "VCPT4ref.cmx"
"v comTL"       "a-p NoGO - a-a GO"    "VCPT5ref.cmx"
"v comTR"       "a-p NoGO - a-a GO"    "VCPT6ref.cmx"
"P4 wmF"        "+"                    "VCPT7ref.cmx"
"P3b P"         "a-a GO"               "VCPT8ref.cmx"
"SW H"          "a-a GO"               "VCPT9ref.cmx"
"P3 supF"       "a-p NoGO"             "VCPT10ref.cmx"
"P4 monCC"      "a-p NoGO"             "VCPT11ref.cmx"
```

Each row corresponds to one component. First column contains name of component that will be used as name of averaging group in resulting file. Second column contains name of averaging group of source ERP file to which the processing will be applied. Third column contains name of text file in which the transformation matrix (spatial filter) revealing the component from multi-channel ERP is written by command **Analysis: Save signal filter** command.

9. Batch EEG Processing dialog

Montage list allows automatic changing of source EEG file montage.



Check **Artifacts correction** option to suppress the components of EEG related to artifacts. Press **Parameters** button to call up the **Artifact correction using standard component topographies as templates dialog** and set parameters of processing.

Check **EOG Rejection** option to eliminate eye motion artifacts for all files. Press **Parameters** button to call up the **EOG Rejection dialog** and set parameters for EOG rejection.

Check **Artifacts Rejection** option to automatically detect parts of EEG record including artifacts and eliminated them from processing for entire file. Press **Parameters** button to call up the **Search and Rejection Artifacts dialog** and set parameters for artifacts rejection.

Use **Bandpass List** to choose a list of **standard EEG frequency bands** for automatic source EEG filtering.

Use **Bandpass Filter** to choose a **standard EEG frequency band** filter for automatic source EEG filtering.

Choosing an option from the **Calculate** group defines how to process selected files. The following processing could be performed:

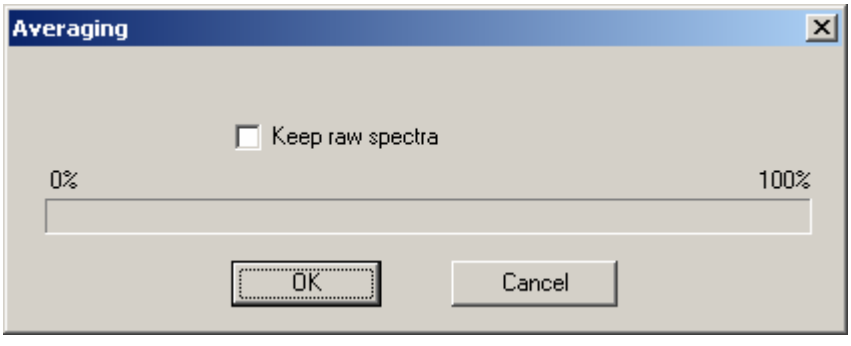
1. **Save EEG file for future processing**. The results of artifact correction, EOG rejection, artifact rejection and EEG filtering will be saved to EEG file for future processing. This option is useful if the goal of processing is to calculate different parameters: spectra, ERP, ERD and etc. for the same list of files and for the same parameters of preprocessing.
2. Event related potentials. The event related potentials will be computed and saved automatically to corresponding **Evoked potentials (ERP) database**.
3. Event related de-synchronization. The event related de-synchronization of EEG will be computed and saved automatically to corresponding **Event related de-synchronization (ERD) database**.
4. Event related coherence. The event related coherence of EEG will be computed and saved automatically to corresponding **Event related coherence (ERCoh) database**.
5. Wavelet band power (ERD). The event related de-synchronization of EEG will be computed using Morlet wavelet decomposition and saved automatically to **Event related de-synchronization (ERD) database**.
6. Wavelet coherence (ERCoh). The event related coherence of EEG will be computed using Morlet wavelet decomposition and saved automatically to **Event related coherence (ERCoh) database**.
7. EEG spectra (and coherence). Power spectra of EEG and EEG coherence will be computed and saved automatically to corresponding **EEG spectra database.**
8. EEG independent component spectra separately for each selected EEG record. The results will be saved in specified folder as separate files.

Check **Create report** button to generate automatically the **processing report.** The compressed results of processing and processing errors will inserted to this report. The processing report will be useful monitoring the processing results and allow estimate their correctness.

Processing File field displays the name of the file currently being processed.

10. Averaging Spectra dialog

The Averaging Spectra dialog if used to define a parameter of averaging. Check **Keep raw spectra** button to save individual spectra in resulting file. More accurate estimation of spectral parameters, their confidences levels and statistical significance of differences can be done using individual spectra (For more information see Analysis: Insert tables into report… command).

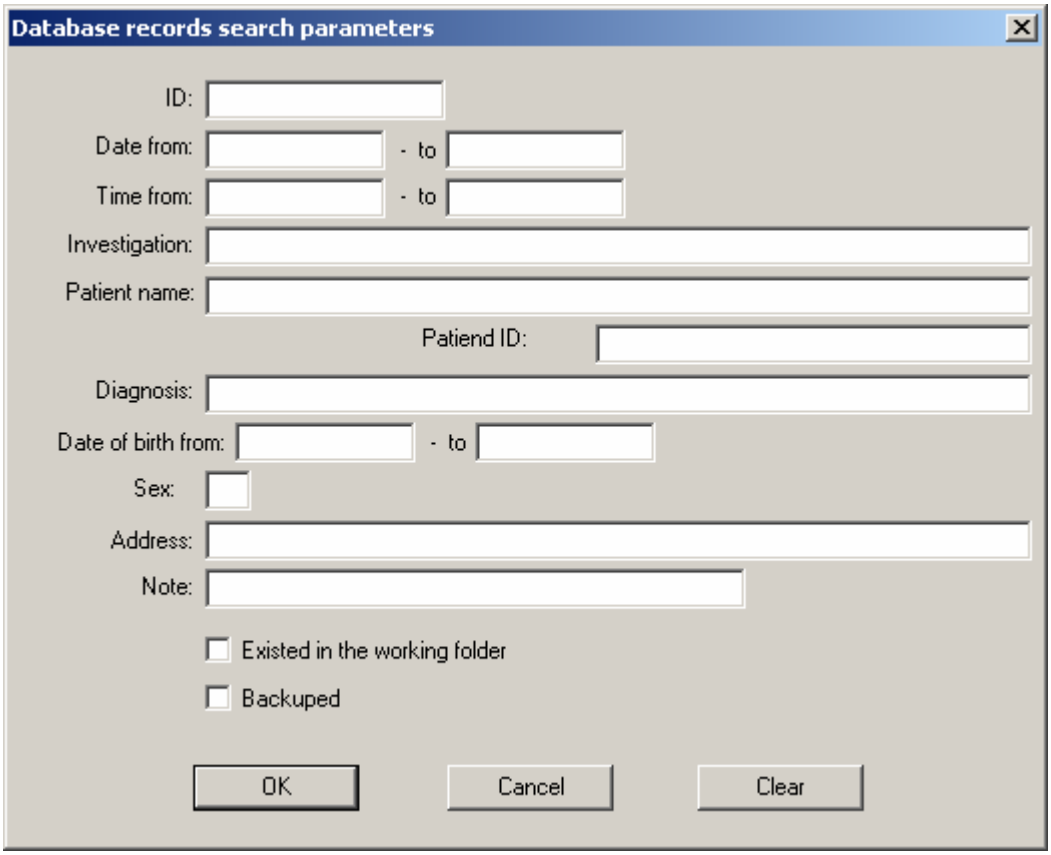


11. Base Record Search Parameters dialog

The Base Record Search Parameters dialog is used to define a set of criteria for record filtering. In other words, only records satisfying all of the specified criteria would be displayed in the list, and the others would be ignored. The search criteria are saved and re-used each time the Record List dialog is opened. This logic facilitates manipulation of a certain subset of the database records (for example, only data acquired during last month). But it may also cause mistakes and complications when searching data. If you find that some records have suddenly "disappeared" from the base, first of all check the search criteria.

Each edit box in the Base Record Search Parameters dialog defines one search criterion. A record satisfies search conditions if it contains all features that have been defined. Blank fields are ignored during search.

Here is the list of search criteria that can be defined:



ID field contains a text string that must be present in the corresponding field of the database record. If the text defined for search is shorter than in the database, a substring is searched. Symbol case is ignored. Blank spaces before and after the text are deleted. If the **ID** field in the search condition contains " ABC ", then records containing "ABC", "abc", "AbCXXxxXX", "xxxxxaBc", "xXxaBCXXx" in their **ID** fields satisfy this condition.

Date From ... - To fields define the interval of EEG acquisition dates (current year for example). To enable automatic search by date, use DD/MM/YYYY date format.

Time From ... - To fields define the interval of EEG acquisition times (before noon for example). To enable automatic search by time, use HH:MM:SS time format.

Investigation field contains a text string that must be present in the corresponding field of the database record (see also **ID** field).

Patient field contains a text string (for example, patient name) that is to present in the corresponding field of the database record (see also **ID** field).

Patient ID field contains a text string that must be present in the corresponding field of the database record (see also **ID** field).

Diagnosis field contains a text string that must be present in the corresponding field of the database record (see also **ID** field).

Date of Birth From ... - To fields define the range for dates of patients' birth, for example from 01/01/1950 to 31/12/1959. To enable automatic search by date, use DD/MM/YYYY date format.

Sex field signs patient sex (M or F). [Editing note: what about trans-gendered individuals?]

Address field contains a text string that must be present in the corresponding field of the database record (see also **ID** field).

Note field contains a text string that must be present in the corresponding field of the database record (see also **ID** field).

Check **Existed in the working folder** option to select only records corresponding to files existing in the working folder. **Attention**! Using this condition may significantly slow down the database search.

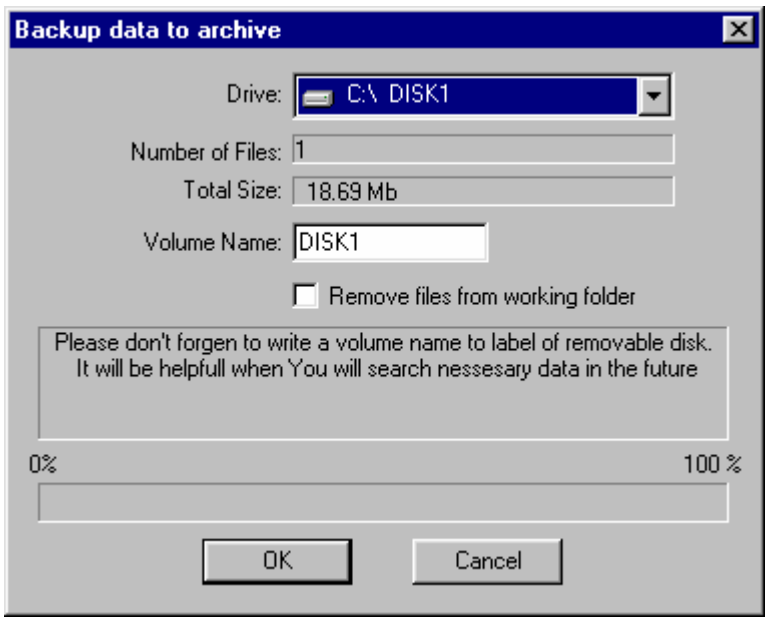
Check **Backed-up** option to select only records corresponding to EEG files that have been backed up at least once

Press **OK** button to accept search conditions.

Press **Clear** button to clear all fields.

12. Backup Data To Archive dialog

To backup a data file means to copy it to an archive on some disk. If the data file is larger than free space on the disk (for example when copying on a floppy) it will be split into several parts and the copying procedure will sequentially ask for the necessary number of removable disks.



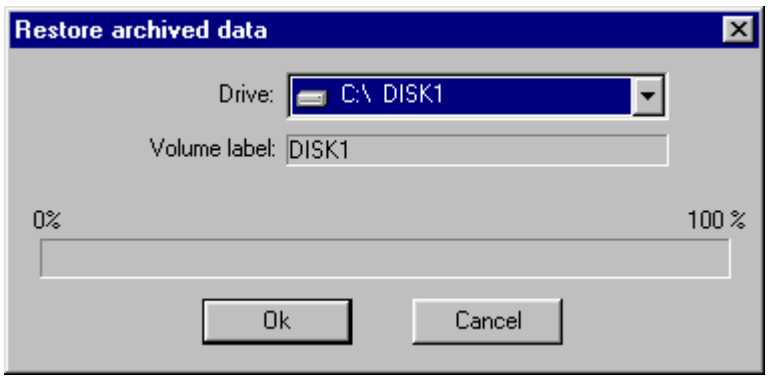
Attention! Use the **Restore command** to restore a backed-up file into the database working directory. Using a file "Copy" procedure to move data in the archive can change format of the data file.

Drive - select drive to backup the data file to.

Check **Remove Files From Working Folder** option to delete the backed-up file(s) from the working directory.

13. Archive Data dialog

To restore an archive file means to copy a backed-up (archived) file corresponding to the selected record from the specified disk to the working directory (see Data Archiving). If the data file is archived on several floppies they will be asked for sequentially.

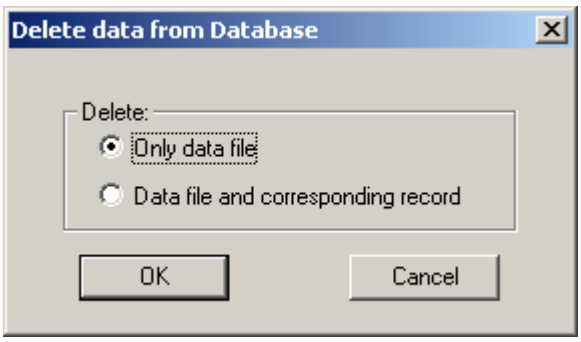


Drive - select drive to restore the data file from.

14. Delete Data From Database dialog

Be careful when running this command! A mistake can lead to **unrecoverable** loss of important data.

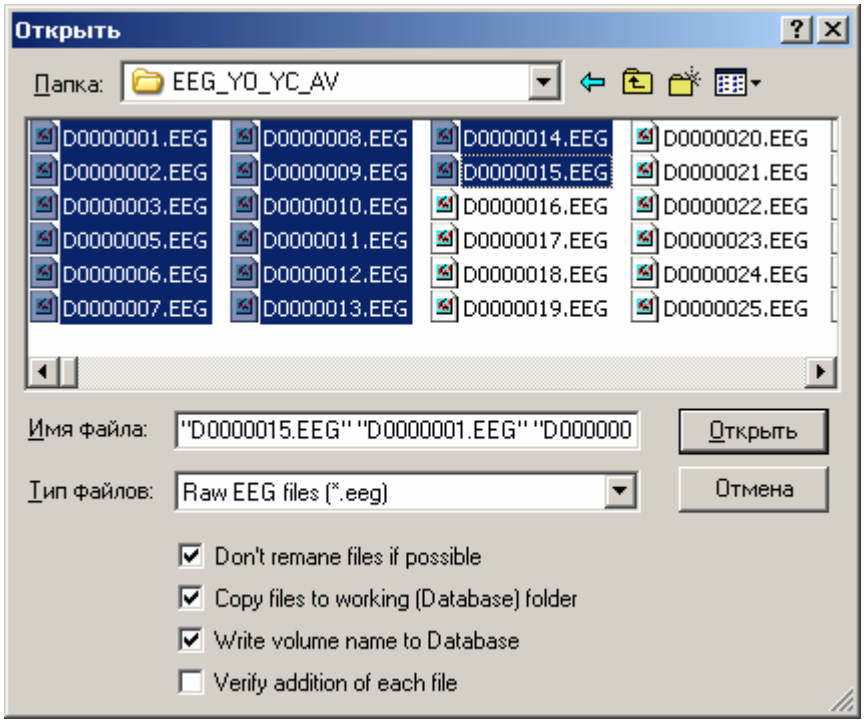
First of all define what exactly is to be deleted:



Only Data File option would be usually chosen to free hard disk space - but only if the file has been backed-up.

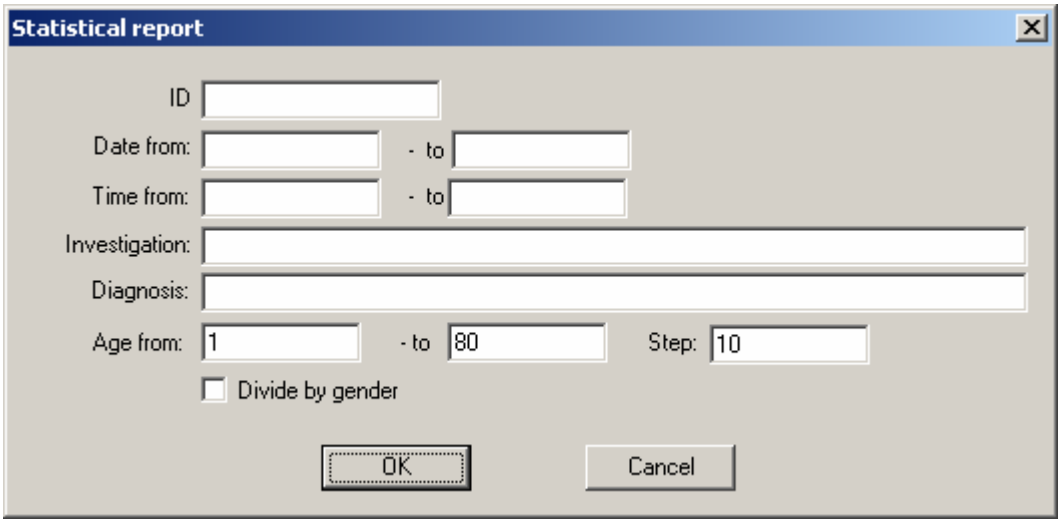
Data File and the Corresponding Record option is mostly used for deleting **test records**, not real investigation data.

15. Add File To Database dialog



You can select several files to be added. Define also if file names should be kept, if data files should be copied to working directory, if archive name should be recorded in the database and if patient card should be viewed before file adding.

16. Statistical report dialog



The Statistical report dialog is used to define a set of criteria for record filtering. In other words, only records satisfying all of the specified criteria would be calculated, and the others would be ignored.

Each edit box in the Statistical report dialog defines one search criterion. A record satisfies search conditions if it contains all features that have been defined. Blank fields are ignored during search.

Here is the list of search criteria that can be defined:

ID field contains a text string that must be present in the corresponding field of the database record. If the text defined for search is shorter than in the database, a substring is searched. Symbol case is ignored. All blanks placing before and after the text are deleted. If the **ID** field in the search condition contains " ABC ", then records containing "ABC", "abc", "AbCXXxxXX", "xxxxxaBc", "xXxaBCXXx" in their **ID** fields satisfy this condition.

Date From ... - To fields define the interval of EEG acquisition dates (current year for example). To enable automatic search by date, use DD/MM/YYYY date format.

Time From ... - To fields define the interval of EEG acquisition times (before noon for example). To enable automatic search by time, use HH:MM:SS time format.

Investigation field contains a text string that must be present in the corresponding field of the database record (see also **ID** field).

Diagnosis field contains a text string that must be present in the corresponding field of the database record (see also **ID** field).

Date of Birth From ... - To fields define the range for dates of patients' birth, for example from 01/01/1950 to 31/12/1959. To enable automatic search by date, use DD/MM/YYYY date format.

Age from … to … step fields define a number of rows in resulting table.

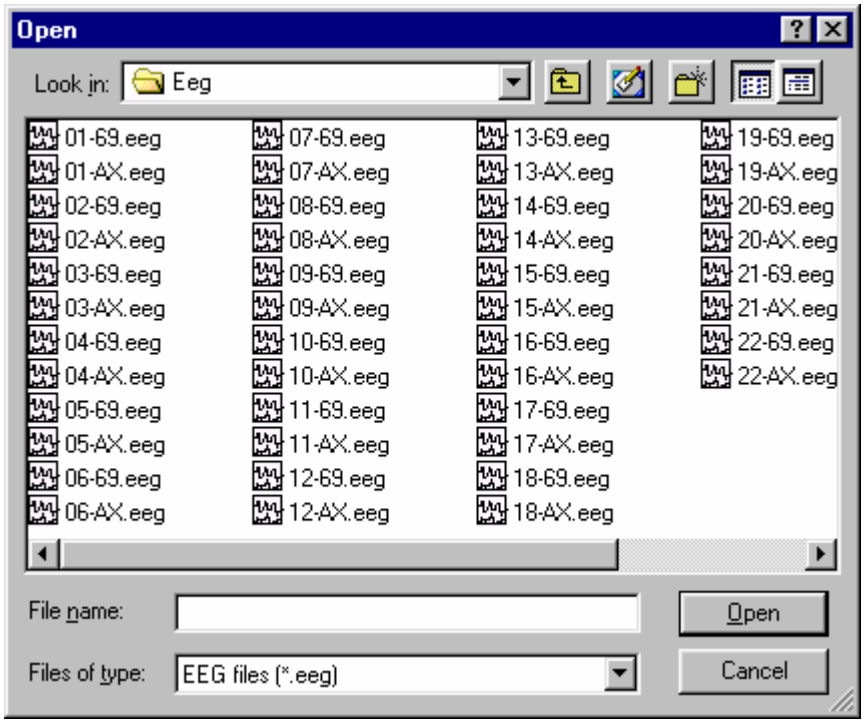
Divide by gender box defines is the observations of males and females should be calculated separately or not.

Press **OK** button for start a searching and calculation procedure. The example of resulting table is placed below:

Age	Male	Female
1-10	5	4
11-20	12	1
21-30	2	6
31-40	3	7
41-50	26	6
51-60	11	12
61-70	1	1
71-80	0	0

17. File Open dialog

Specify a file to open.



Files of Type

Select the type of file you want to open:

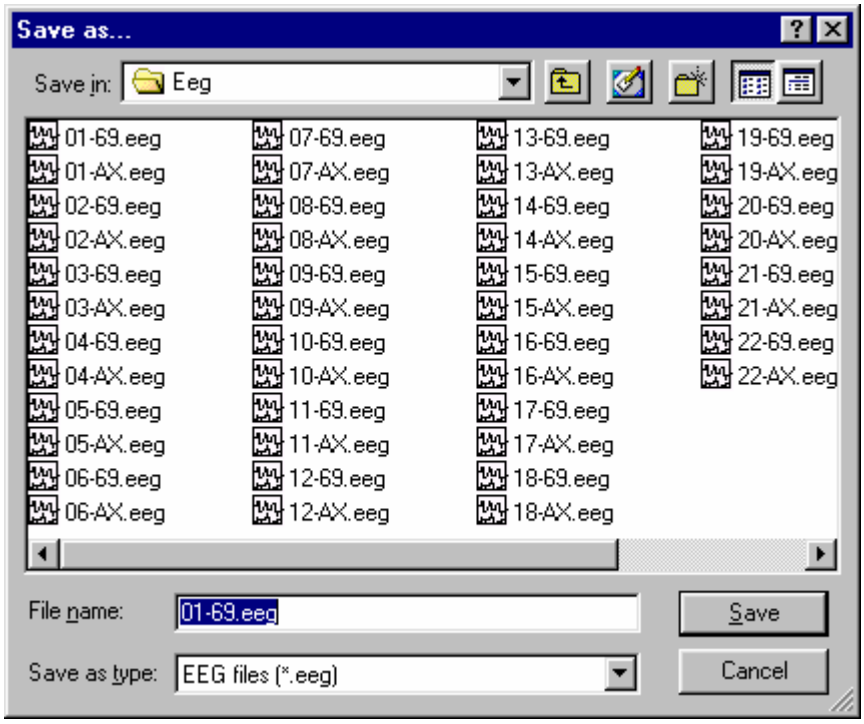
*.EEG - EEG file,
*.RTF - final report file,
*.SPC - EEG spectra file,
*.IDX - EEG indices file,
*.ERP - event-related potential file,
*.ERD - event-related de-synchronization (wavelet) file,
*.ERC - event-related coherence file,
*.BFB - biofeedback file,
And other types of file.

Look In:

Choose a folder (on a drive or in a network) where the file to open can be found.

18. File Save As dialog

Specifies the name and location of the file you want to save.



File Name

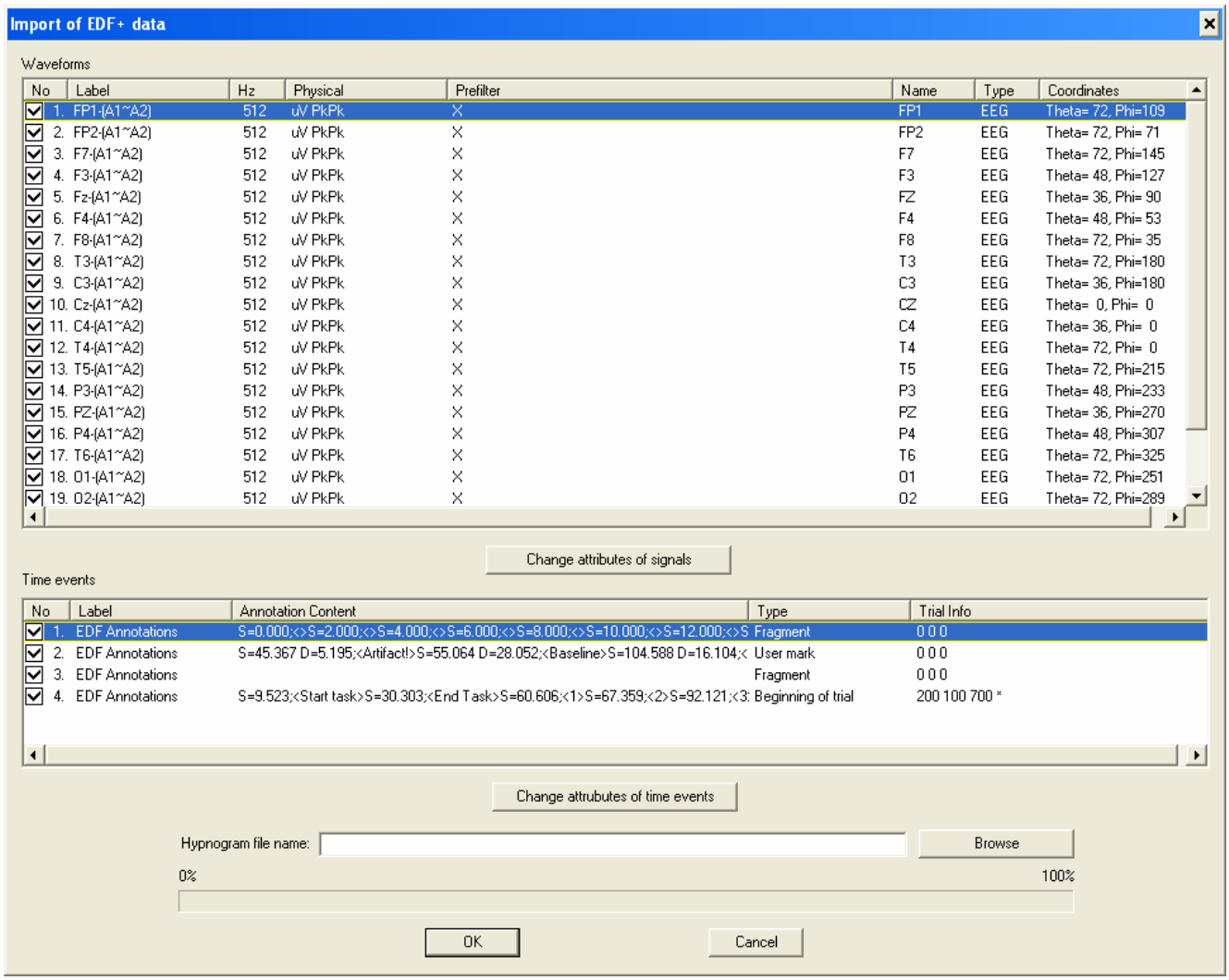
Type a new file name, the extension will be suggested by the application.
The following extensions are used:
*.EEG - for EEG files,
*.RTF - for final reports,
*.SPC - for EEG power spectra,
*.IDX - for EEG indices
*.ERP - for event-related potentials,
*.BFB - for biofeedback files,
*.ERD - for event-related EEG de-synchronization,
*.ERC - for event-related EEG coherence,
And other types of file.

Save In

Choose a folder (on a drive or a network) to place the new file in.

19. Import of EDF+ data dialog

The EDF+ data export procedure is used to convert EDF+ data to EEG format.



Both **Waveform** table and **Time events** table helps to define list of signal channels and list of EDF annotations.

The **Waveform** table includes following columns:

1. **No** – order number of channel
2. **Label** – name of channel written to EDF+ file.
3. **Hz** – sampling rate of channel in source file.
4. **Physical** – name of physical units for each channel.
5. **Prefilter** – textual data described frequency bands
6. **Name** – name of channel for destination file.
7. **Type** – type of data: EEG, Bio or Referent.
8. **Coordinates** – spherical coordinates of sensors placed on the head (for EEG channels only).

Name, **Type** and **Coordinates** channel attributes can be changed using **Change attributes of signals** button. After pressing this button **Channel attributes dialog** will appear on the screen.

The **Time events** table includes following columns:

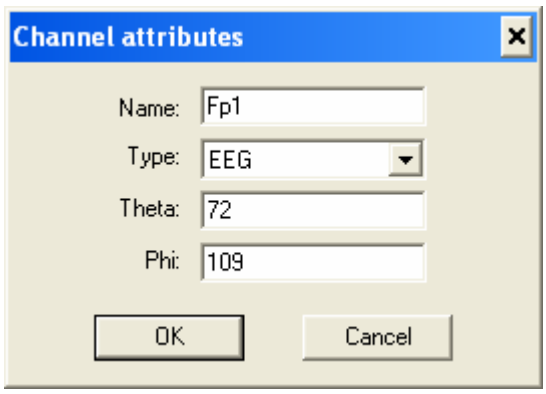
1. **No** – order number of EDP annotation.
2. **Label** – fixed name: “EDF annotation”.

3. **Annotation content** – the beginning of corresponding annotation.
4. **Type** – type of annotation that used for data interpretation.
5. **Trial info** – additional information for definition parameters of imported trials (sweeps)/

Type and **Trial info** can be changed using **Change attributes of time events** button. After pressing this button **Event attributes dialog** will appear on the screen.

Hypnogramm file name field is used to attach additional information to EEG file. Use **"Browse"** button on the right of the file name field to select a drive and a folder. (**Not implemented now!**)

20. Channel attributes dialog



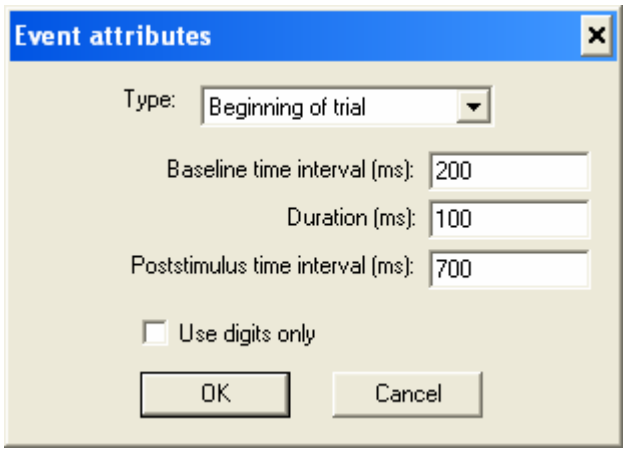
This dialog includes following fields:

Name – Name of channel for destination file: up to 7 characters.

Type – Type of channel for destination file. It can be following "**EEG**" – EEG channel, "**BIO**" additional not EEG channel or "**REF**" – referent.

Theta and **Phi** - spherical coordinates of sensors placed on the head (for EEG channels only).

21. Event attributes dialog



This dialog includes following fields:

Type – type of event for its interpretation. . It can be following:

1. **Fragment** – the beginning of fragments
2. **User mark** – the user label with text

3. **Artifact** – the beginning of artifact and its duration
4. **Beginning of trial** – the beginning of trials
5. **Stimulus onset** – the stimuli onsets.

Following additional information is necessary for **Beginning of trial** and **Stimulus onset** event types:

Baseline time interval (ms) – the duration of prestimulus time interval.

Duration (ms) – the stimulus time interval

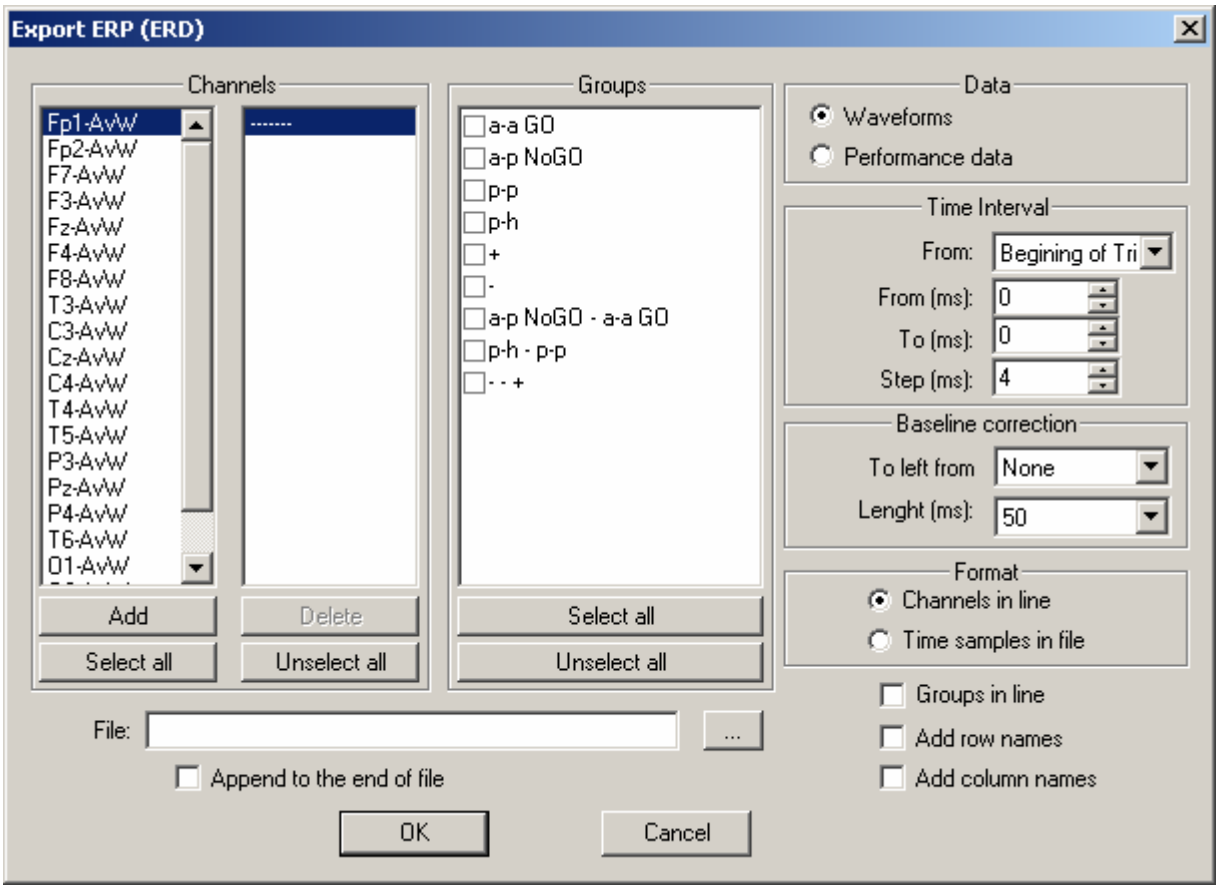
Poststimulus time interval (ms) - the duration of poststimulus time interval.

Total duration of trial will be equal to the sum of these tree parameters.

Check **Use digits only** button to exclude time events with textual information during adding trials list.

22. Export ERP (ERD) dialog

ERP (ERD) export is used for saving data in a text file readable by other applications.



Channels

Select the channels you wish to export ERP from. Use **Add**, **Delete**, **Select All** and **Deselect All** buttons.

Groups

Select the trial groups for which you wish to export ERP. To select or to unselect all groups quickly, use **Select All** and **Deselect All** buttons.

Data

Choose what data to export: **Waveforms** themselves or **Performance Data** table.

Time Interval

Set the time interval you wish to export data for. The following interval parameters need to be set:

From: - sets the starting point. You can start at the very beginning of the trial or at the moment when one of the stimuli is presented.

From (ms): - sets the beginning of the interval to export (in relation to the starting point).

To (ms): - sets the end of the interval to export (in relation to the starting point).

Step: - sets sampling interval for the exported data. If the Step value exceeds sampling interval for source data adjacent readouts are averaged.

Baseline correction

Specify parameters for baseline correction:

To left from: Define stimulus before time interval will be chosen for estimation of baseline average potential.

Length: Define length if time interval used for estimation of baseline average potential.

Format

Choose format for ERP export.

If you choose the **Channels In Line** option ERP data will be written as follows:

	Ch 1 Gr 1	**Ch 2 Gr 1**	**...**	**Ch M Gr 1**	**Ch 1 Gr 2**	**Ch 2 Gr 2**	**...**	**Ch M Gr 2**	**...**	**Ch 1 Gr K**	**...**	**Ch M Gr K**
TR 1	D,	D,		D,	D,	D,		D,		D,		D
TR 2	D,	D,		D,	D,	D,		D,		D,		D
TR N	D,	D,		D,	D,	D,		D,		D,		D

If you choose **Time Samples In Line** option ERP data will be written as follows:

	TR 1	**TR 2**	**...**	**TR N**
Ch 1 Gr 1	D,	D,		D,
Ch 2 Gr 1	D,	D,		D,
Ch M Gr 1	D,	D,		D,
Ch 1 Gr 2	D,	D,		D,
Ch 2 Gr 2	D,	D,		D,

Ch M Gr 2	D,	D,		D,
Ch 1 Gr K	D,	D,		D,
Ch 2 Gr K	D,	D,		D,
Ch M Gr K	D,	D,		D,

Here **TR X** are time readouts, **Ch X** - channels, **Gr X** - trial groups, and D - data.

If **Groups In Line** option is unchecked ERP data will be written as follows:

	Ch 1	**Ch 2**	**...**	**Ch M**
TR 1 G 1	D,	D,		D,
TR 2 G 1	D,	D,		D,
TR N G 1	D,	D,		D,
TR 1 G 2	D,	D,		D,
TR 2 G 2	D,	D,		D,
TR N G 2	D,	D,		D,
TR 1 G K	D,	D,		D,
TR 2 G K	D,	D,		D,
TR N G K	D,	D,		D,

Add Column Names

Check this option to add column names in the first row of the file. Column names can be useful, for example, for data exported to the **Statistica** program.

Add Row Names

Check this option to add row names in the first column of the file. Row names can be useful, for example, for data exported to the **Statistica** program.

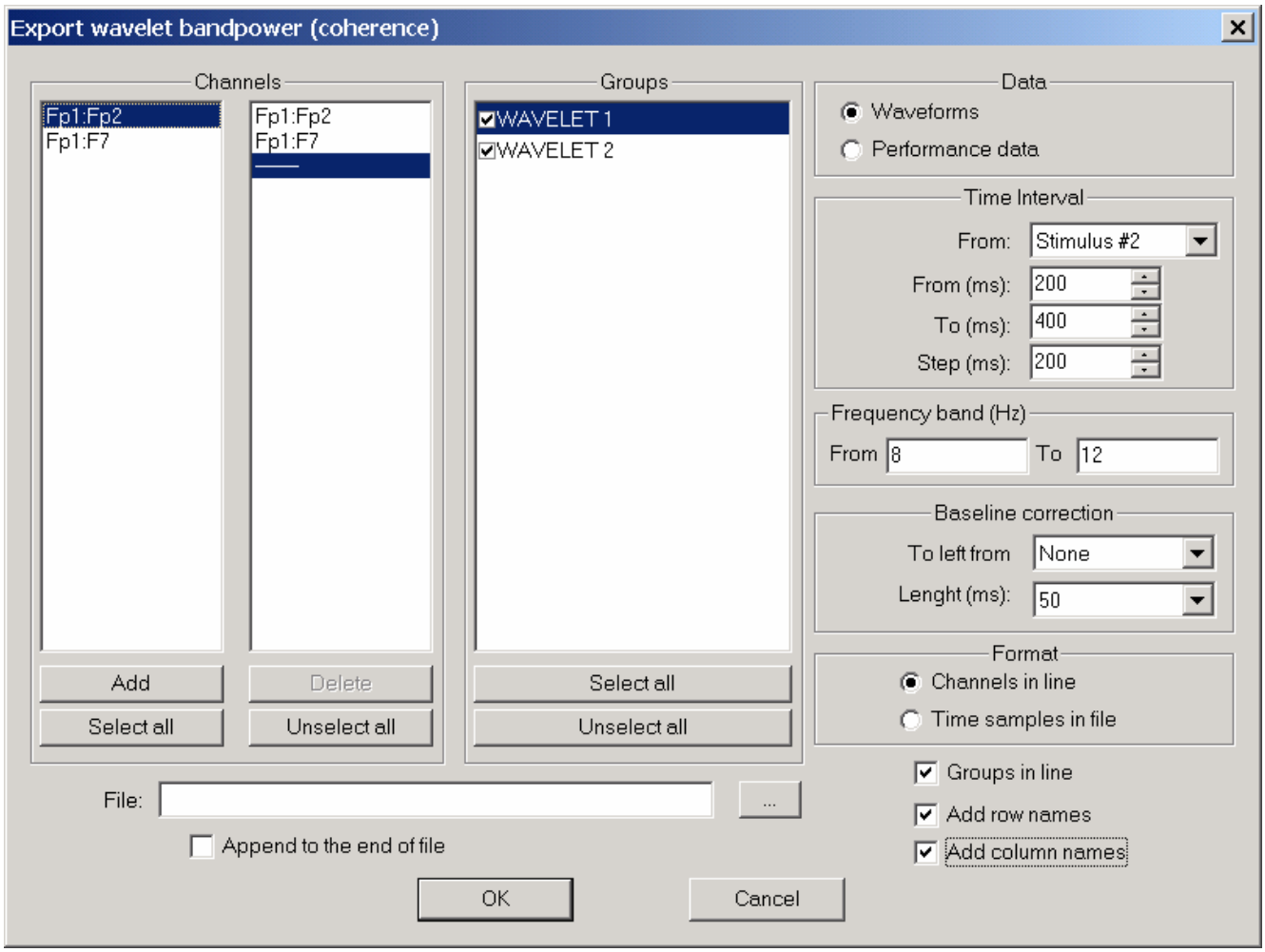
File

Enter full file path. Use **"..."** button on the right of the file name field to select a drive and a folder.

Append To the End Of File

Check this option to append data to an existing file otherwise the file will be rewritten. File appending may be useful for arranging data of several investigations in an entire table for further statistical analysis.

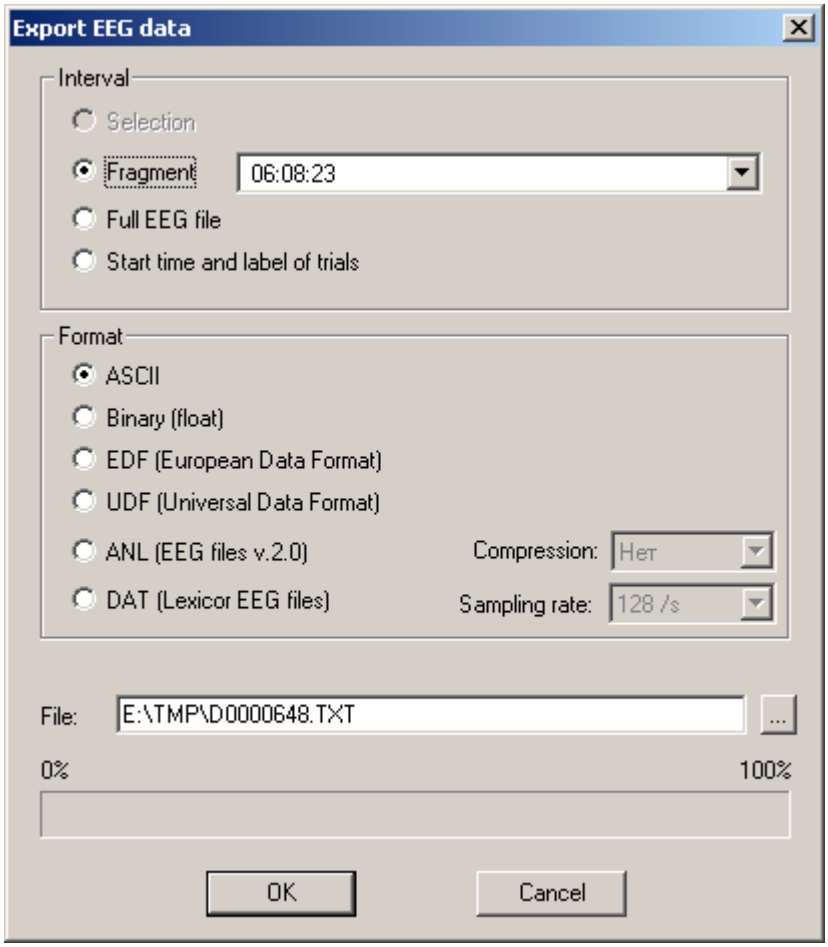
23. Export wavelet bandpower (coherence) dialog



This dialog works similar as described in previous chapter but user should also **specify Frequency band** for which average power or coherence will be calculated.

24. Export EEG Data dialog

EEG data export is used for saving data in a file readable by other applications.



Interval

Choose an EEG interval to be exported.

Selection	Exports an EEG interval selected by two vertical markers
Fragment	Exports an EEG fragment chosen from the list
Full EEG file	Exports the whole EEG

Format

Choose format for a file to export EEG interval to.

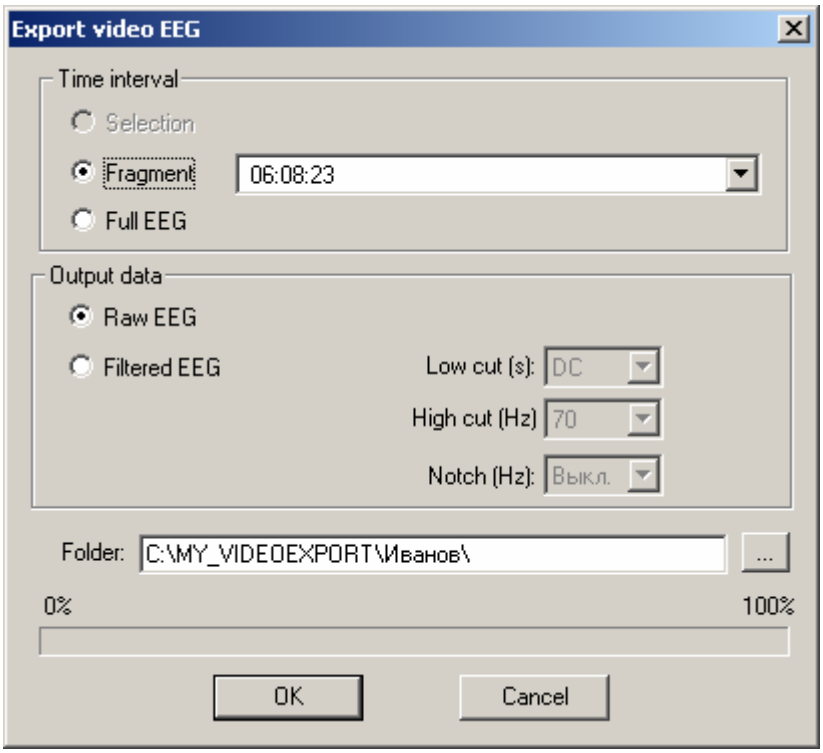
ASCII	Each column in an ASCII file means one channel and each row - one time readout. Data written to the file is reformatted and filtered according to the montage parameters: it is not raw data.
Binary (Float)	In binary format, a single value takes 4 bytes. The data is recorded as follows: $<S_1C_1>$ $<S_1C_2>$ ... $<S_1C_n>$ $<S_2C_1>$ $<S_2C_2>$ ... $<S_2C_n>$, where S_i denotes the ***i***-th time readout and C_j means ***j***th channel. Data written to the file is reformatted and filtered according to the montage parameters: it is not raw data.
EDF	European Data Format supported by a number of European and American vendors of computer encephalography. Data written to the file is reformatted and filtered according to the montage parameters: it is not raw data..
UDF	Universal Data Format supported by leading vendors of computer

	encephalography in Russia. UDF is an extension for the EDF format. Raw data is written to the file.
ANL	Old ERP data format
DAT (Lexicor data files)	Lexicor data format. In this case the sampling rate can be changed according the setting of field **Sampling Rate**

File

Define full path of the destination file for exporting data to. Use the "**...**" on the right of the name field to choose a drive and a folder.

25. Export video EEG dialog



The following options allow you to specify how the raw EEG and video EEG should be copied to another file:

Interval

Choose an EEG interval to be copied.

Selection	Copy an EEG interval selected by two vertical markers
Fragment	Copy an EEG fragment chosen from the list
Full EEG file	Copy the whole EEG

Output data

Choose a type of output EEG data.

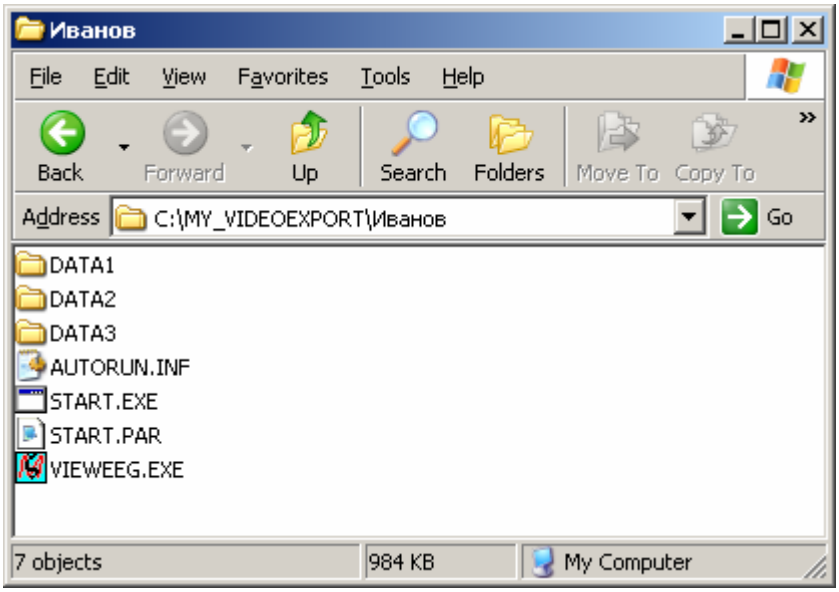
Raw EEG	Copy unfiltered (raw) EEG
Filtered EEG	Copy filtered EEG

Low cut (s), High cut (Hz) and Notch (Hz) fields allow you specify filters parameters for filtered EEG.

Folder

Define a destination folder in which the EEG data and video files will be recorded.

This function is useful if it is necessary to prepare a number of video EEG examples to write them to CD. The WinEEG program will copy automatically video EEG data, video EEG viewer (ViewEEG program) and some additional service data in selected folder. It is possible to run this function many times. As the results a number of subfolders will be created and the data will be copied in these subfolders.



START.EXE utility helps to open all copied data automatically by ViewEEG program.

ViewEEG program is the restricted version of WinEEG program providing reviewing of video EEG data.

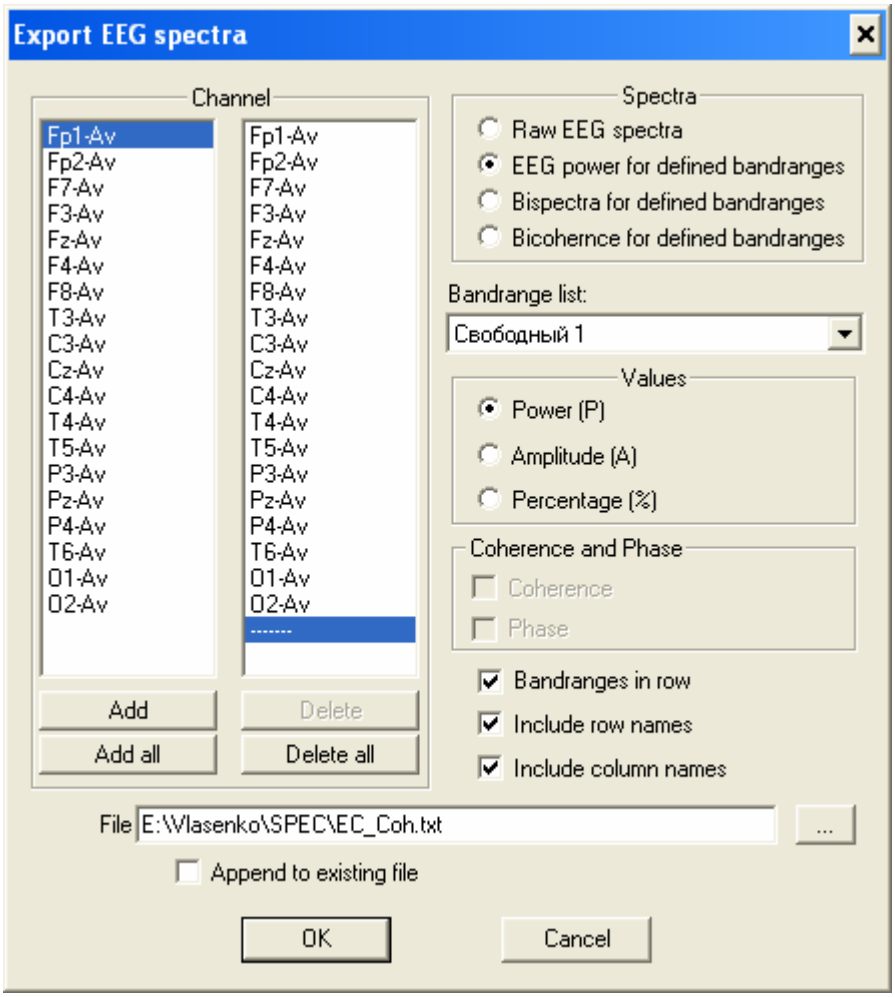
Attention!!! ViewEEG program requires DirectX 9.0 installation.

26. Export EEG Spectra dialog

EEG spectra export is used for saving data in a file readable by other applications.

Channels

Select the channels you wish to export ERP for. Use **Add**, **Delete**, **Select All** and **Deselect All** buttons.



Data

Defines what data are to be exported in an ASCII file. You can export either **Raw EEG Spectra** or table of **EEG Power for Defined Frequency bands**.

Raw EEG spectra	Writes raw EEG power spectra to an ASCII file. Columns correspond to channels and rows - to harmonics. The first row presents the first harmonic with frequency depending on analysis epoch length: 1 sec - 1 Hz, 2 sec- 0.5 Hz, 4 sec- 0.25 Hz (see **Analysis: EEG Spectra command**). The constant component is not written to the file.
EEG spectral power for the defined bandranges	Writes the table of EEG spectral power parameters to an ASCII file. Columns present channels and each pair of channels corresponds to an EEG frequency band (Delta, Theta, etc).
Bispectra for defined	Writes the table of EEG bispectral parameters to an ASCII file.

bandrange	Columns present channels corresponding to each pair of EEG frequency band (Delta, Theta, etc).
Bicoherence for defined bandrange	Writes the table of EEG bicoherence parameters to an ASCII file. Columns present channels corresponding to each pair of EEG frequency band (Delta, Theta, etc).

Bandrange list

Choose what frequency band list will be used (see Setup: EEG bandranges… command)

Values

Choose what values to export:
Power (P) – absolute power values.
Amplitude (A) – square root of absolute power values.
Percentage (%)– frequency band power as a percentage of total power

Coherence and Phase

Coherence – the coherence (or average coherence for defined frequency band) will be exported together with power spectra
Phase – the phase spectra (or average phase for defined frequency band) will be exported together with power spectra

Bandranges In Row

Check this option to arrange spectral parameters for each channel in a single line. Otherwise they will be written in several lines.

Include Column Names

Check this option to add column names in the first row of the file. Column names can be useful, for example, for data exported to **Statistica** software.

Include Row Names

Check this option to add row names in the first column of the file. Row names can be useful, for example, for data exported to **Statistica** software.

File

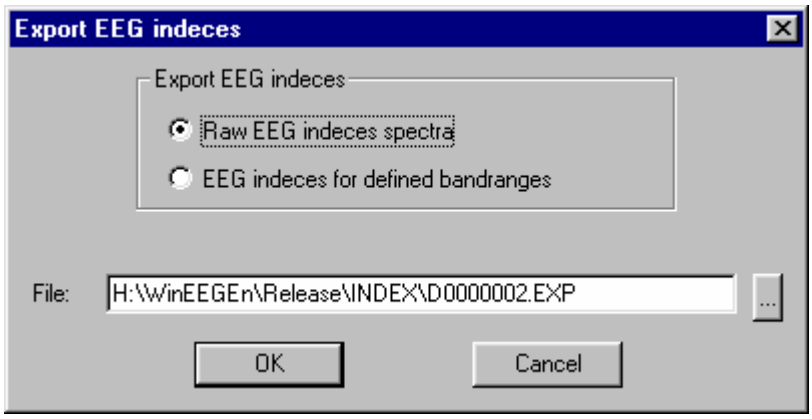
Define full path for the file to export data to. Use the **"..."** to the right of the name field to choose a drive and a folder.

Append To Existing File

Check this option to append data to an existing file otherwise the file will be rewritten. File appending may be useful for arranging data from several investigations in an entire table for further statistical analysis.

27. Export EEG Indices dialog

EEG indices export is used for saving data in a file readable by other applications.



Export EEG Indices

Defines what features of EEG indices are to be exported to an ASCII file:

Raw EEG indices spectra	Writes raw EEG power spectra to an ASCII file. Columns correspond to channels and rows - to frequencies: first line - 0.25 Hz, second - 0.5 Hz The value in a cell means the percent of time when the EEG contained half of waves of the given frequency band.
EEG indices for the defined bandranges	Writes the table of parameters of EEG indices to an ASCII file. Columns present channels and each line correspond to an EEG frequency band (Delta, Theta, etc). The value in a cell means the percent of time when the EEG contained half of waves of the given frequency band.

File

Define full path for the file to export data to. Use the **"..."** to the right of the name field to choose a drive and a folder.

28. Export EEG independent components parameters.

EEG independent components parameters export is used for saving data in a file readable by other applications.

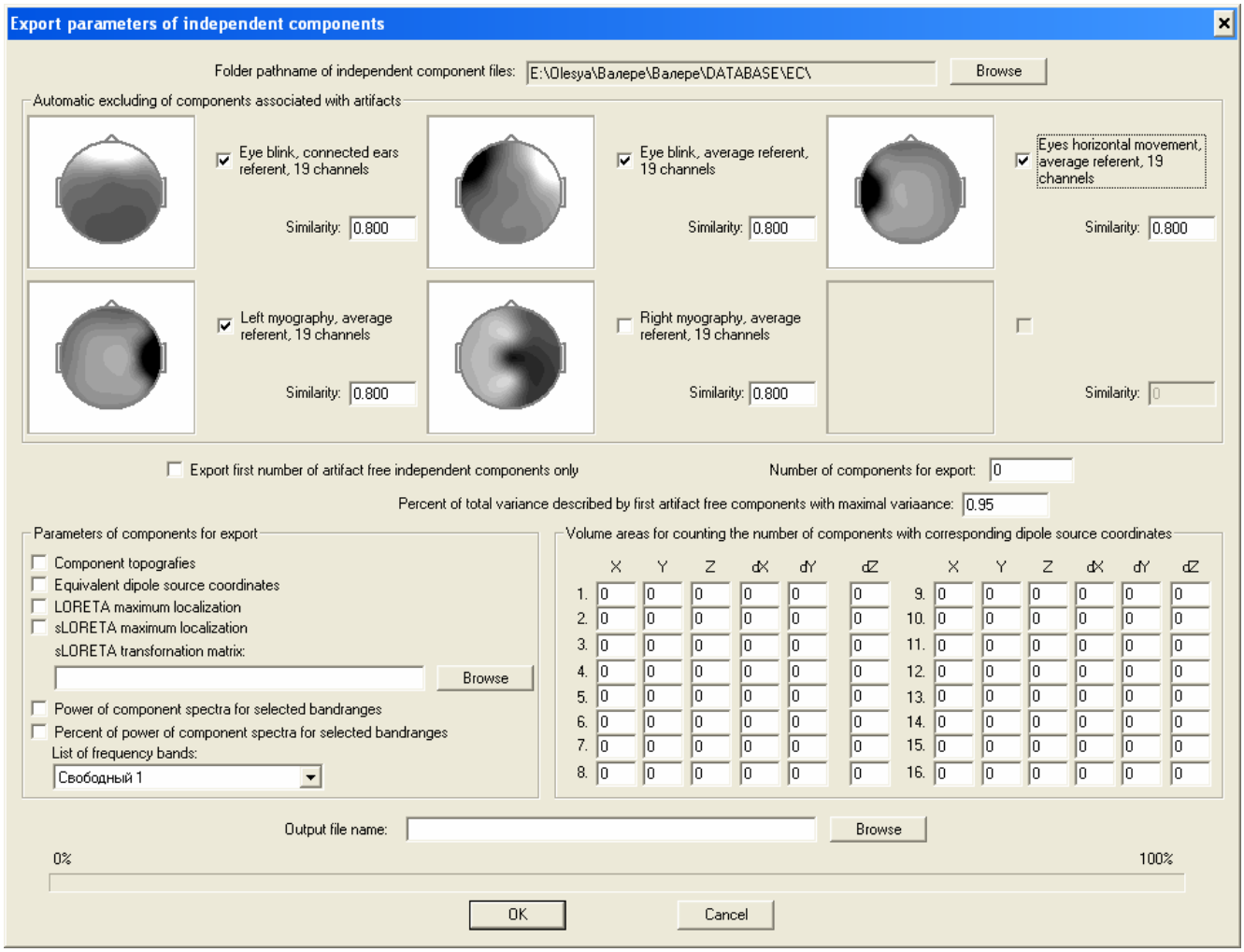
Folder pathname of independent components field displays the location of corresponding ICA files.

Use the **Browse** button to choose a drive and a folder.

Automatic excluding of components associated with artifacts fields group is used for definition of parameters of eliminations components related to artifacts. Up to 6 different independent component topography templates can be used simultaneously for detection artifacts. The additional parameters – coefficient of similarity should be defined for each template.

Check **Export first number of artifact free independent components only** button to exclude low power independent components. The number of components should be specified using **Number of components for export** field.

Another criterion of excluding of low power components is the definition of total variance described by component. This parameter can be entered in Percent of total variance described by first artifact free components with maximal variance.



Parameters of components for output fields group is used for definition list of parameters. It includes following fields:

Check **Component topography** button to export topographies table.

Check **Equivalent dipole source** button coordinates to export coordinates of dipole source equivalent to component topography.

Check **LORETA maximum localization** button to export coordinates of maximum of equivalent distribution of current density computed by LORETA method.

Check s**LORETA maximum localization** button to export coordinates of maximum of equivalent distribution of current density computed by sLORETA method.

If s**LORETA maximum localization** button is checked the **sLORETA transformation matrix** location should be specified. The **Browse** button to the right of the name field is used to choose a drive and a folder

Check **Power of component spectra for selected band range** button to export the table of spectra power for the list of frequency bands.

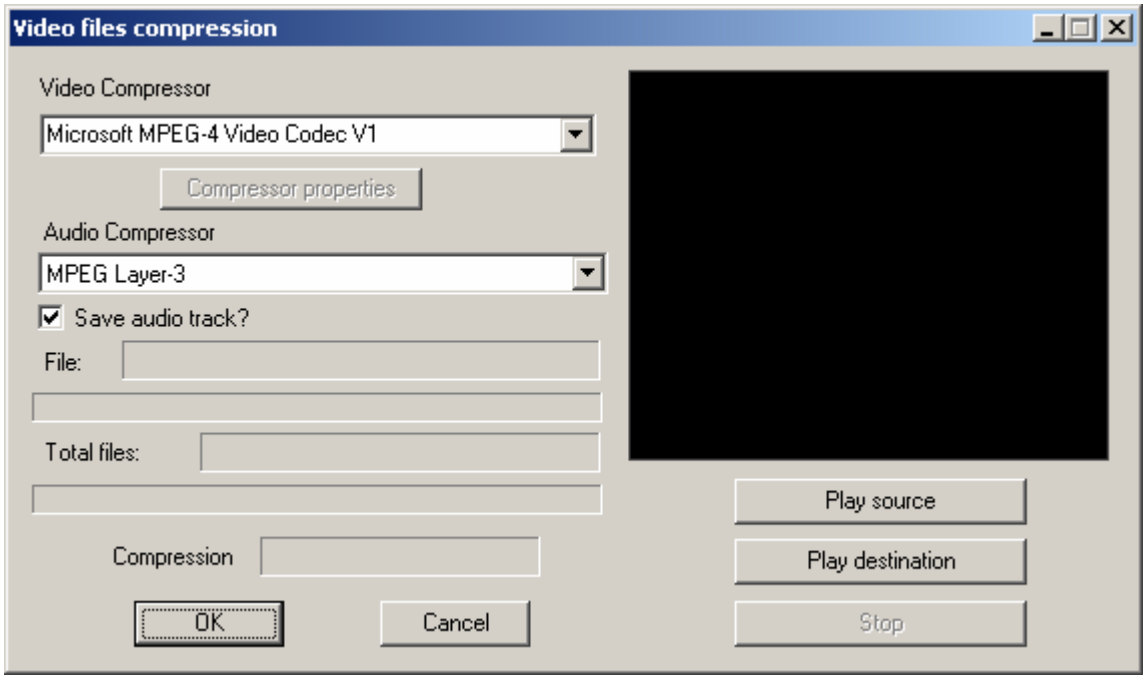
Check **Percent of power of component spectra for selected band range** button to export the table of percents of spectra power for the list of frequency bands.

Use **List of frequency bands** menu to define appropriate list. (see Setup: EEG bandranges… command)

The **Volume areas for counting the number of components with corresponding dipole source coordinates** table can be used for definition up to 16 cubic areas (not implemented now).

The **Output file name** field is used to define full path for the file to export data to. Use the **"Browse"** to the right of the name field to choose a drive and a folder.

29. Video file compression dialog



The following options allow you to specify how the video files should be compressed:

Video Compressor
: Select appropriate video compressor from a list. The best choice in mane cases is "**Microsoft MPEG-4 Video Codec V1" or** "**Microsoft MPEG-4 Video Codec V3"**

Audio Compressor
: Select appropriate video compressor from a list. The best choice in mane cases is "**MPEG Layer-3"**

Save audio output stream?
: Check this button if you would like to keep audio signal in resulting video file.

Compressor properties
: Select and modify compressor properties

Play source
: Play back source video file

Play destination

Playback compressed or re-compressed video file. The raw video file will be compressed before playing back function will be started. This option helps to choose the best compressor before beginning the video compression procedure.

Stop

Stop playing back function

OK

Start video compression procedure.

Attention!!! Not all existing compressor from a list can be compatible with source video files.

Attention!!! A number of compressors can unrecoverable decrease a quality of video signal.

Attention!!! A number of compressors will take a lot of time to process the video data.

30. Print dialog

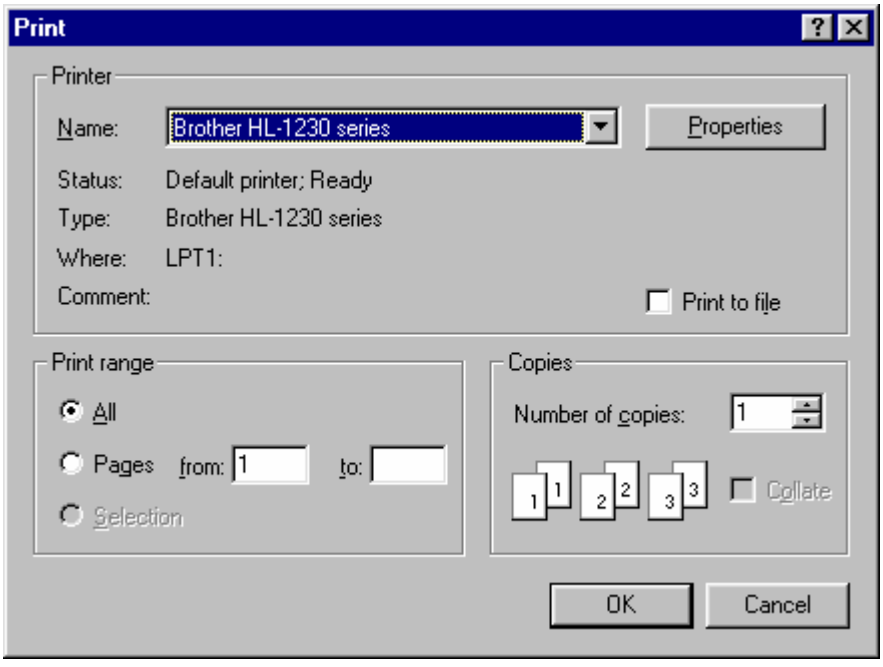
The following options allow you to specify how the document should be printed:

Printer

Select active printer and its connection. Choose **Properties** command to modify printer properties.

Properties

Call a dialog to define additional printer options.



Print Range

Specify the pages you want to print:

All	Prints the entire document.
Selection	Prints the currently selected text.
Pages	Prints the range of pages you specify in the From and To boxes.

Copies

Specify the number of copies you want to print for the above page range.

Collate

Prints copies in page number order, instead of separated multiple copies of each page.

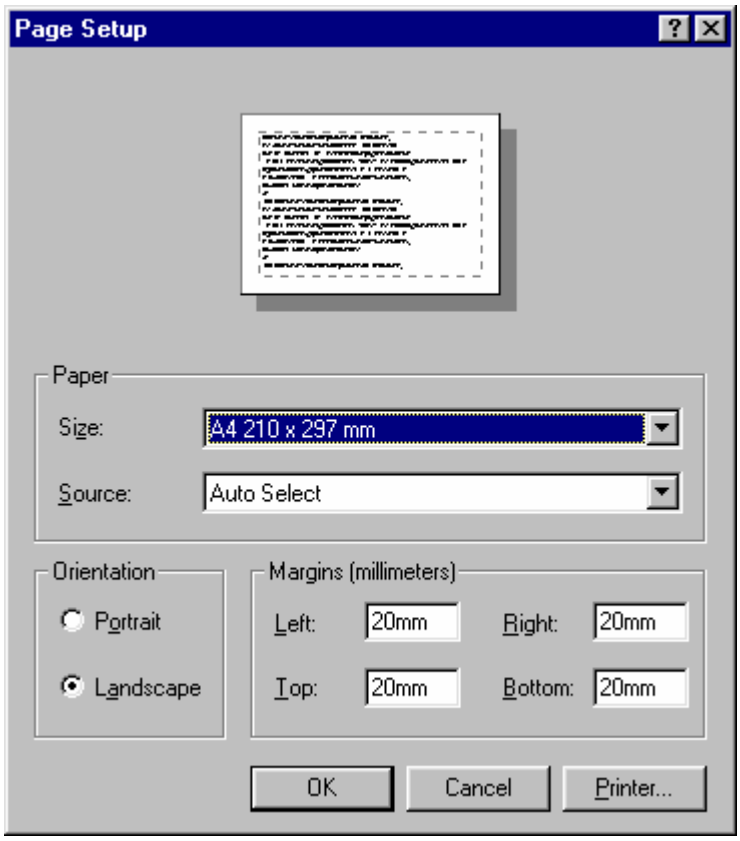
31. Printing dialog

The Printing dialog box is shown during the time WinEEG is sending output to the printer. The page number indicates progress of the printing task.

To abort printing, choose **Cancel**.

32. Page Setup dialog

You can define the following parameters for the page to be printed.



Paper:

Select appropriate paper **Size** and **Source**.

Orientation:

Select page orientation (**Portrait** or **Landscape**).

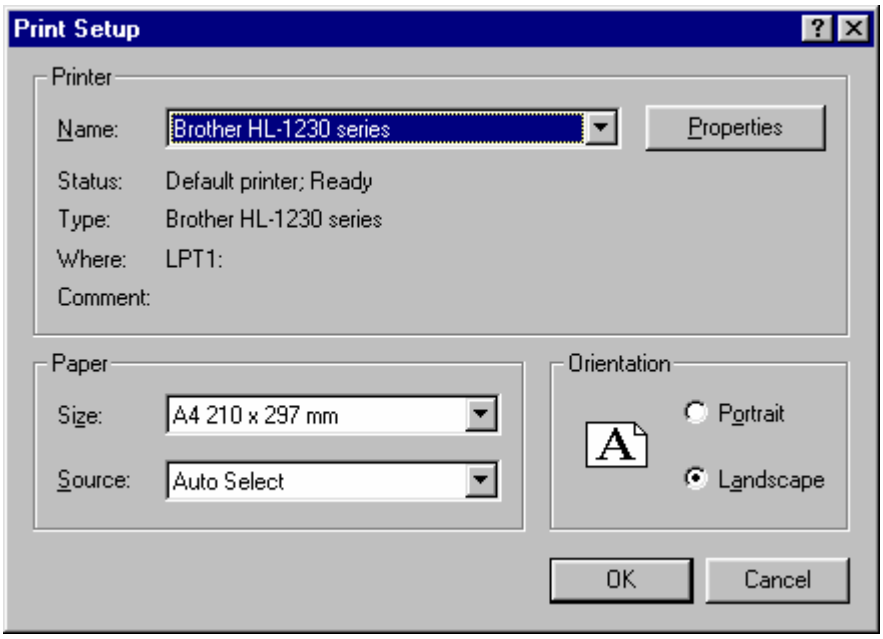
Margins:

Set margin size (in millimeters).

Printer...
Use the **Printer...** command to choose a printer and to set its options.

33. Print Setup dialog

The following options allow you to select the destination printer and its connection.



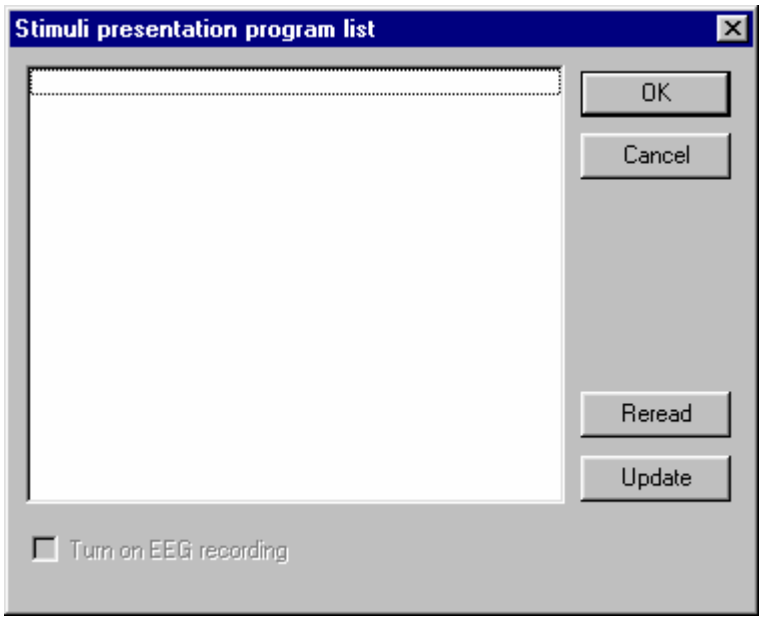
Printer
Select the printer you want to use.

Properties
Set additional printer options.

Paper:
Select appropriate paper **Size** and **Source**.
Orientation:
Select page orientation (**Portrait** or **Landscape**).

34. Stimuli Presentation Program List dialog

Use this dialog to choose a stimuli presentation protocol (program) for stimuli presentation in ERP investigations or to modify the list of stimuli presentation programs. After a program is chosen EEG acquisition starts with simultaneous stimuli presentation on an additional computer. ERPs can be calculated for this EEG file during further processing. To learn more about ERP, see **Event-Related Potentials** section.



Press the **Update** button to read a new stimuli presentation program list from a floppy if it was recorded by means of the PSYTASK program that it is to be installed on. (See PSYTASK User manual).

Press the **Reread** button to read a new file directly from the stimuli-presenting computer connected to the EEG-acquiring computer by an additional cable between their COM ports. PSYTASK must run on the stimuli-presenting computer in the slave mode. (Command line: PSYTASK /S).

Attention: If **any** parameter of stimuli presentation in the PSYTASK has been changed the stimuli presentation program list **should be updated**, otherwise ERPs will be incorrectly calculated.

Turn on EEG recording

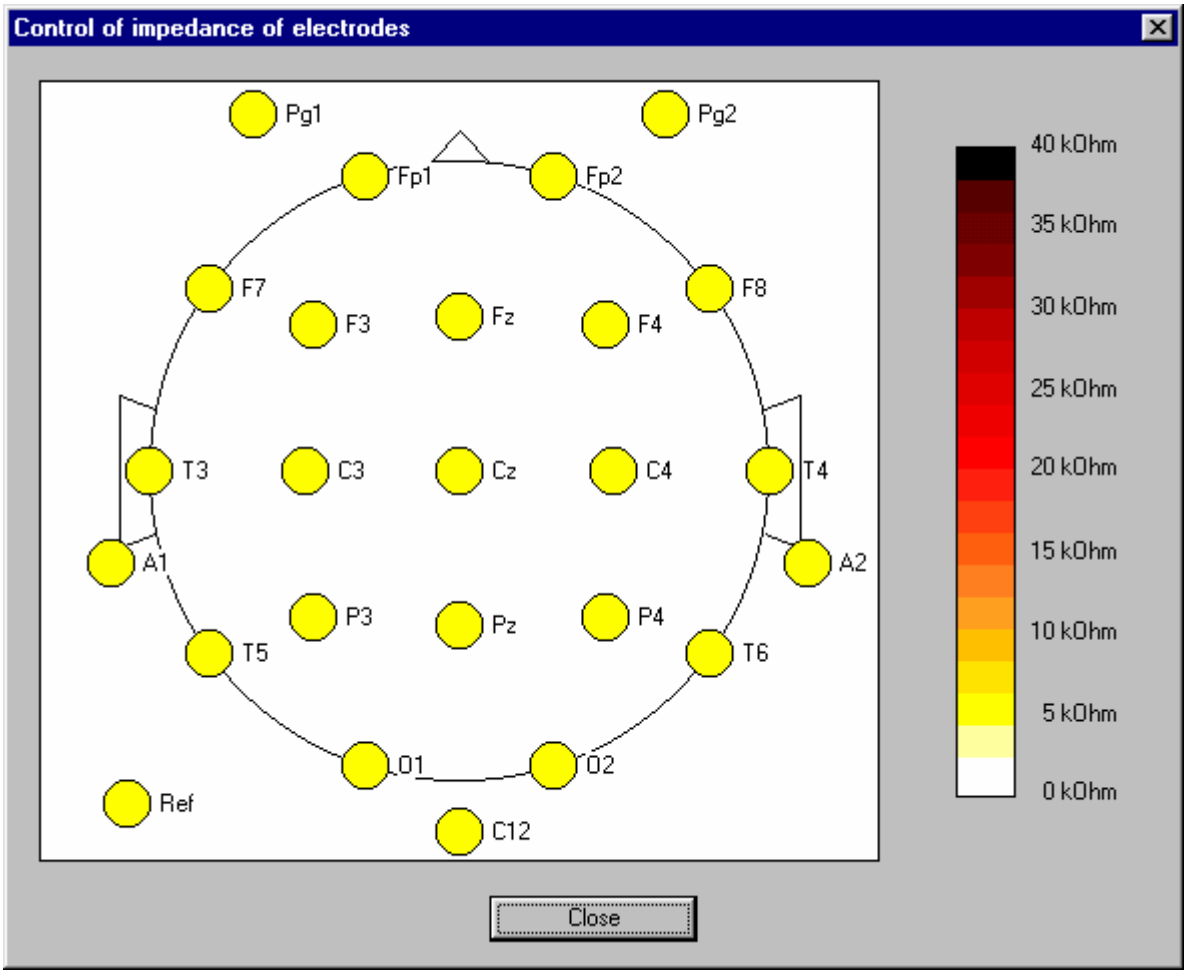
Check this option to start recording EEG to hard disk. If the option is unchecked the data will be only acquired and monitored; this mode can be useful for testing a stimuli presentation protocol or for training the patient.

35. Update task list from slave computer dialog

The dialog displays dynamics of reading task list from the presenting computer.

Press **Cancel** to stop reading the stimuli presentation program list. (The old list is not saved.)

36. Checking Impedance Of Electrodes



Depict impedance of electrodes by means of color. The color/impedance scale is shown on the right.

Attention! After every manipulation with electrodes, transients take 1-2 sec to reach a new equilibrium.

37. Calibration Of Amplifiers dialog

Attention! Amplifiers are calibrated by manufacturer before metrological certification. WinEEG user is only able to view calibration parameters, not to change them.

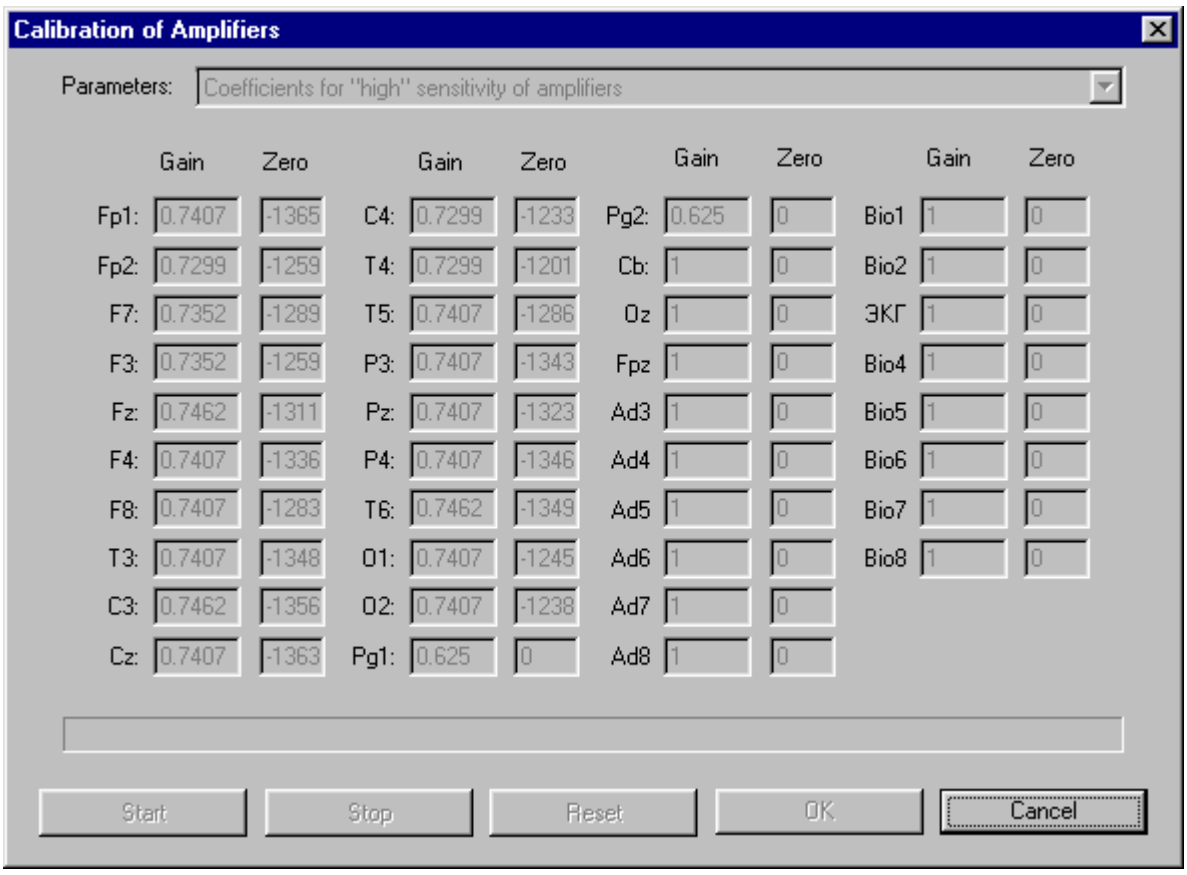
The following fields allow viewing the table of correction parameters.

Parameters:

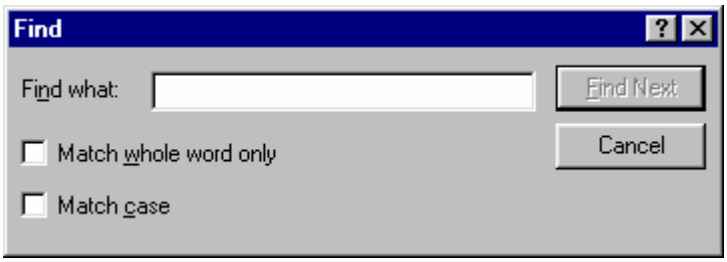
Choose what parameter set to view.

Parameters Table:

Table of gains and offsets is placed under **Parameters** list.



38. Find dialog



Find What:

Define the string to be searched for.

Match Whole Word Only:

Check to find only whole words matching the Find What string.

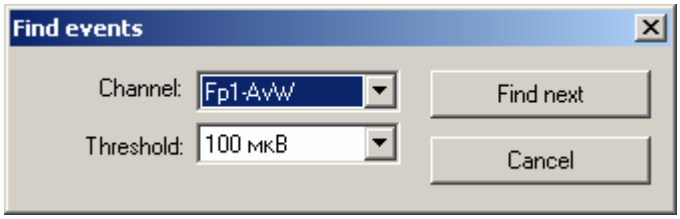
Match Case:

Extends search criteria to include uppercase and lowercase attributes while searching for the Find What string in the text.

Find Next:

Find next string matching the Find what one.

39. Find Events



The following options allow you to specify parameters of searching “Events” when the absolute voltage of EEG signal is higher then defined threshold. If selected channel is “digital” channel the voltage threshold is not used.

Channel

Select processed channel

Threshold

Select voltage threshold

Find Next:

Find next time interval of EEG record when absolute voltage of EEG signal of selected channel was higher then defined threshold and display EEG waveforms in EEG window.

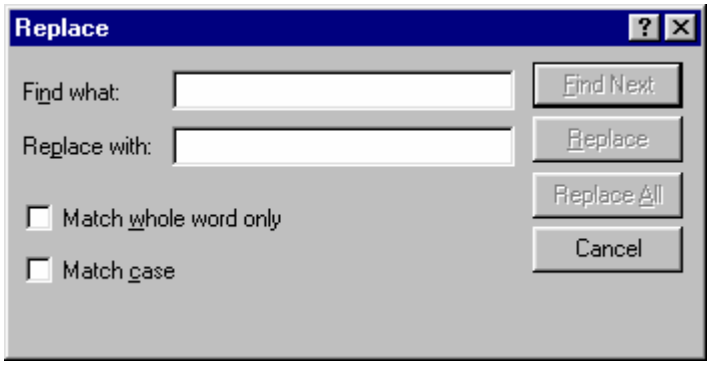
40. Replace dialog

Find What:

Define the string to be searched for.

Replace With:

Define the string to replace the one found.



Match Whole Word Only:

Check to find only whole words matching the Find What string.

Match Case:

Extend search criteria to include uppercase and lowercase attributes while searching for the Find What string in the text.

Find Next:

Find next string matching the Find what one.

Replace:

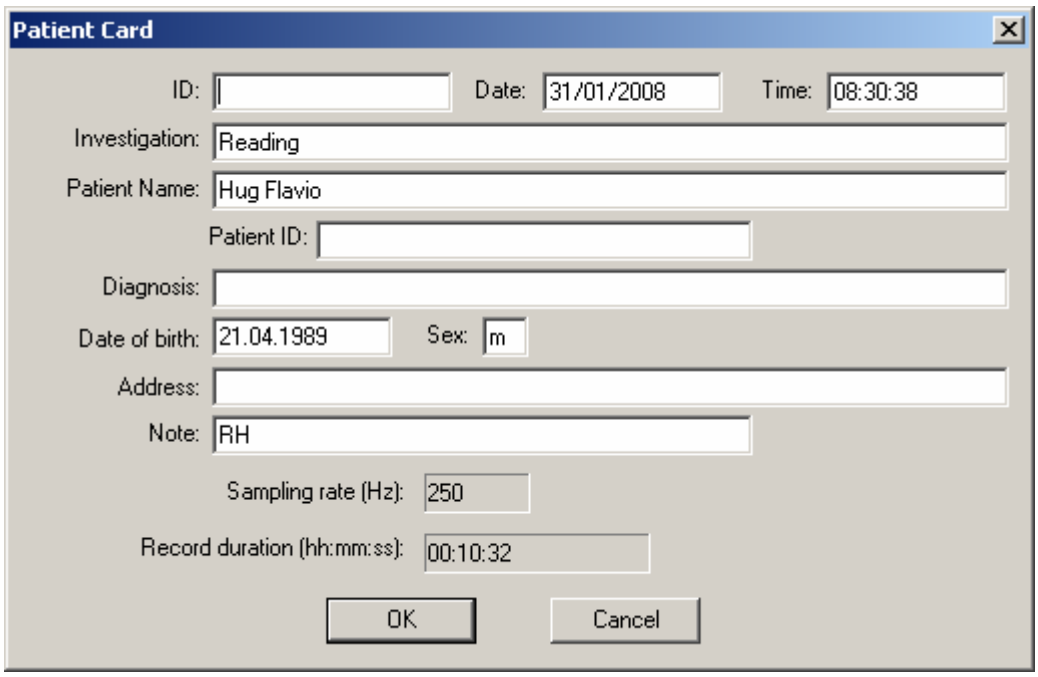
Replaces the string found and resumes searching.

Replace All:

Finds and replaces all strings that match the Find What string.

41. Patient Card dialog

Fill or edit the patient card.



ID: EEG record ID is an arbitrary sequence up to 10 characters which simplifies searching the database.

Date: The date of EEG acquisition start is entered automatically. Use DD/MM/YYYY date format for successful database search by date.

Time: The date of EEG acquisition start is entered automatically. Use HH:MM:SS time format for successful database search by time.

Investigation: Select investigation type from list:

1. EEG observation
2. Biofeedback

Patient: Enter patient's name.

Patient ID: Enter patient's card number.

Diagnosis: Enter a brief disease diagnosis. The final report may contain more detailed description.

Date of birth: Enter the date of patient's birth. Use DD/MM/YYYY date format for successful database search.

Sex: Enter patient's sex (M/F)

Address: Enter patient's address.

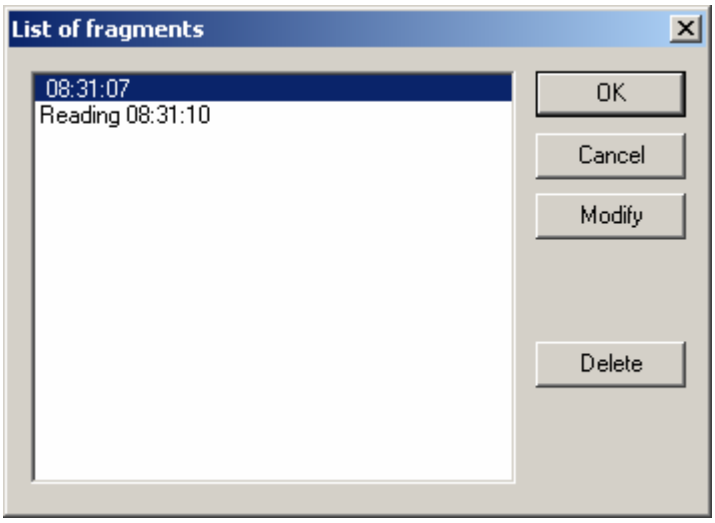
Note: Enter other useful info (patient's insurance policy number for example).

All the fields of patient card are not mandatory but can be useful when searching database. Remember that all patient info would be automatically added to the final report.

Sampling rate: The sampling rate of EEG digital recording is displayed in this field.

Record duration: The total recording time of whole file is displayed in this field.

42. Fragments List dialog

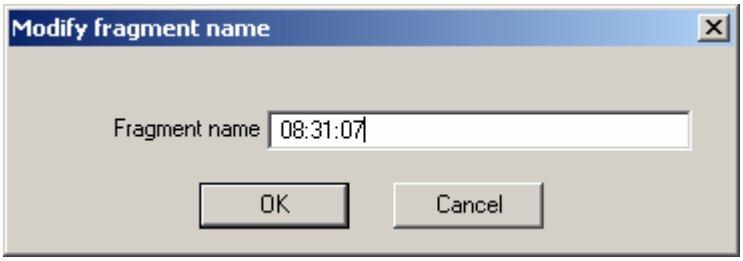


Choose a fragment and press **OK** or double-click the fragment name.

Click **Delete** to delete selected fragment from EEG file

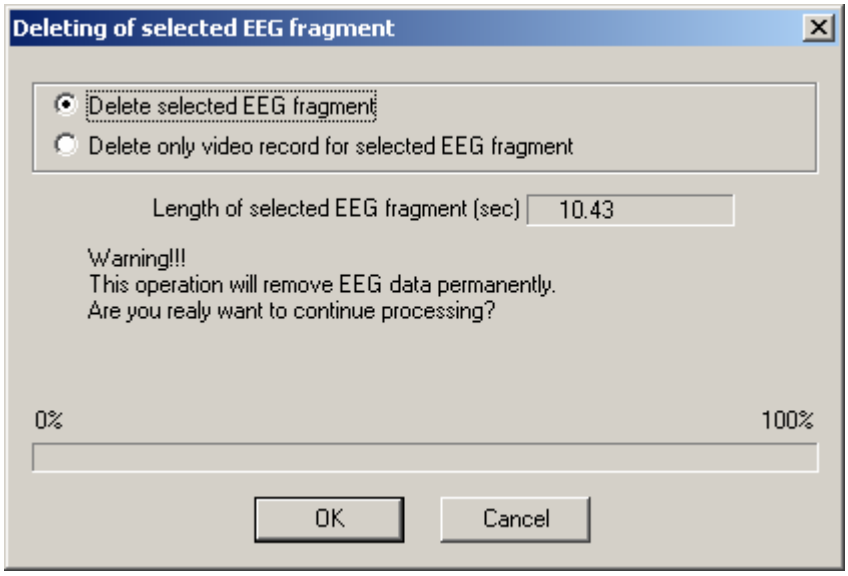
Click **Modify** to change name of selected fragment. The **Modify fragment name dialog** will appears then.

43. Modify fragment name dialog



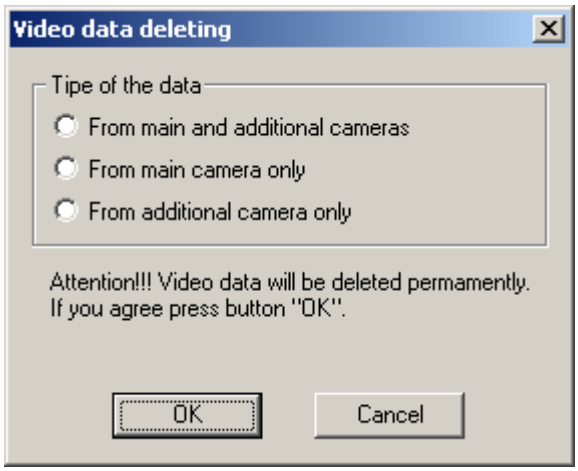
Enter new fragment name and press **OK**.

44. Deleting of selected EEG fragment



Select what kind of data are you going to delete and press **OK** button**.**

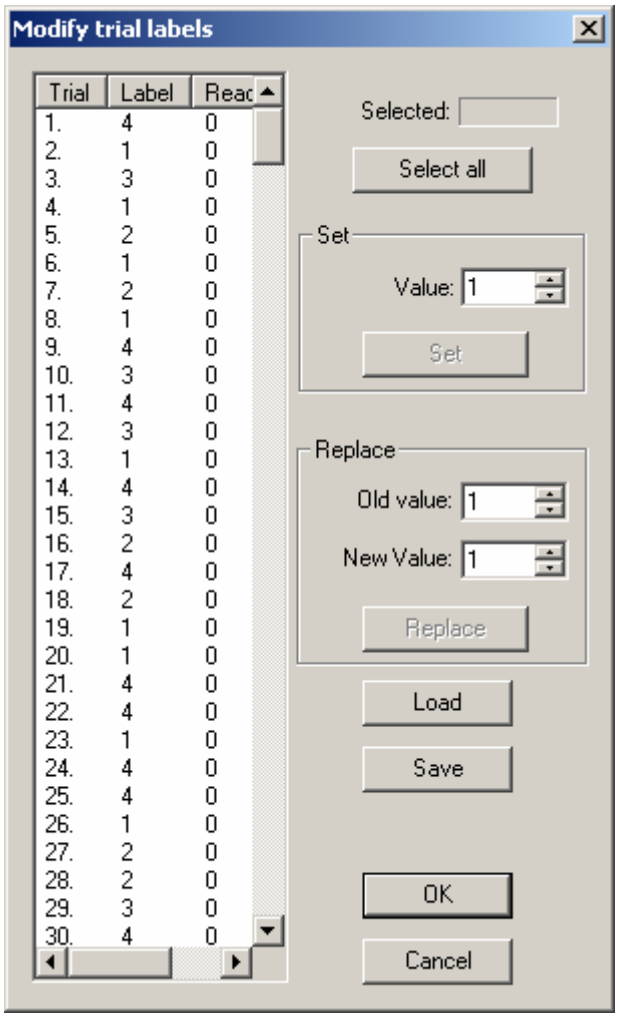
45. Deleting of video data



Select what kind of data are you going to delete and press **OK** button**.**

46. Modify Trial Labels dialog

Trial list is there on the left of the dialog. Select trials to edit labels for. Click a trial to select it. Use **Shift** and **Ctrl** keys to select multiple trials.



Press **Select All** button to select all trials in the file.

Press **Set** button to set a new label value for the trials selected. The new label value must be set beforehand in the **Value** field of the **Set** group.

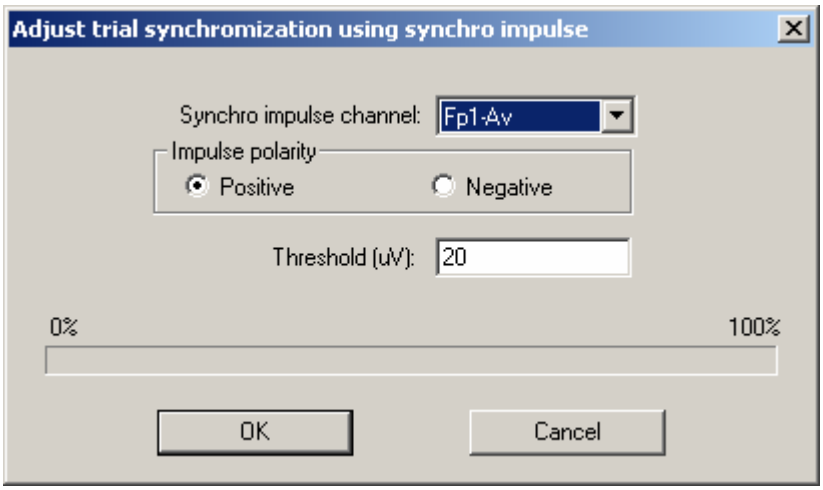
Press **Replace** button to replace all trial labels matching the value in the **Old Value** field with a new value defined in the **New Value** field.

Press **Load** button to load trial labels from selected ASCII file.

Press **Save** button to save trial labels to selected ASCII file.

The last options allow also modify manually a structure of trial (a number of presented stimuli and intra stimuli intervals).

47. Adjust trial synchronization using synchro impulse dialog



Use **Synchro impulse channel** list to select channel to which the synchronization signal is recorded using special detector (for example, photodiode).

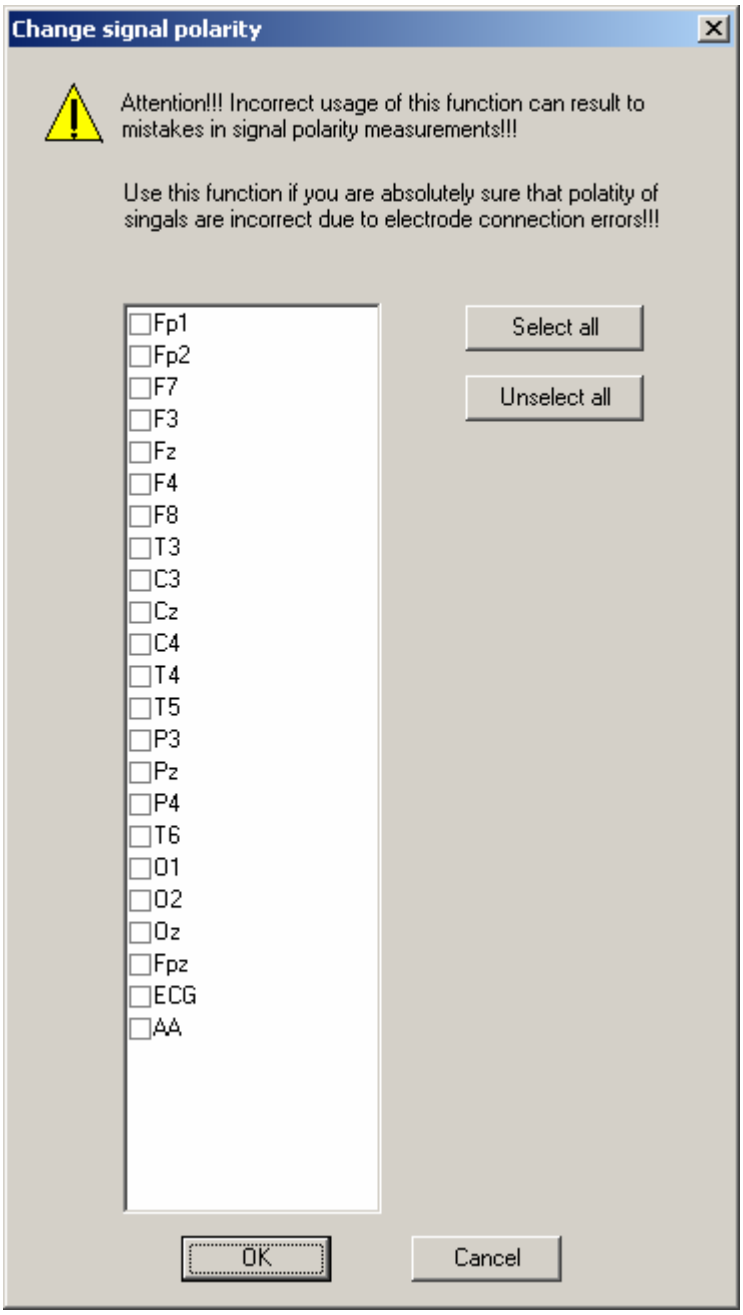
Use **Impulse polarity** group of fields to define the appropriate polarity of the synchronization signal.

Threshold: Enter appropriate voltage threshold to detect the beginning of synchronization impulses. The threshold should be defined as low as in is possible but higher the amplifier or detector noise.

Attention! The synchronization signal should be recorded from first stimulus in the trail. There is no way to adjust the beginnings of all stimuli in the trial except one.

48. Change signal polarity dialog

This function is useful if there is a priori reliable information then some signals were recorded incorrect (for example due to incorrect installation of electrodes of their connection to amplifiers).

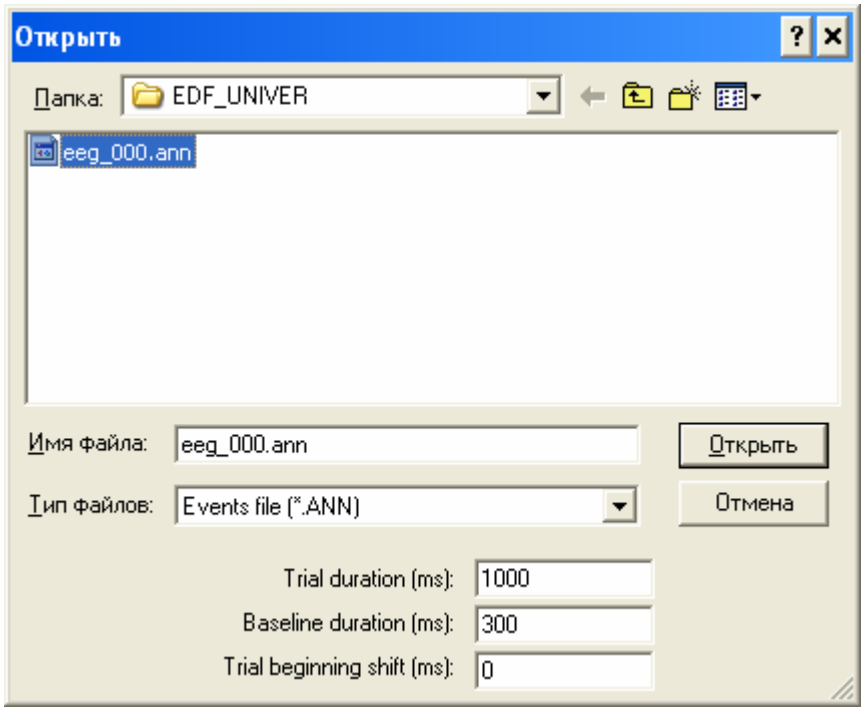


Select channel list in which the polarity should be inverted and press **OK**.

Attention! Please be very attentive using this function. Incorrect inversion of signal polarity can lead to mistakes in processing results and their interpretation.

50. Open dialog trial list.

Specifies the name and location of the file you want to open.



Following additional information is necessary:

Trial duration (ms) – total duration of trials.

Baseline duration (ms) – the duration of prestimulus time interval

Trial beginning shift (ms) - the duration shift, if any shift exists between event and real beginning of trial.

51. Font dialog

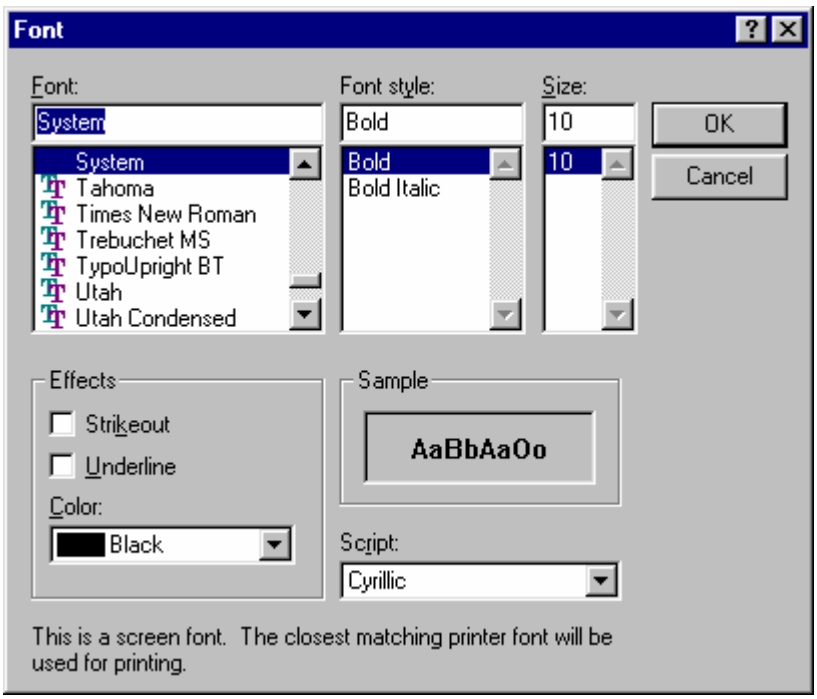
Define font parameters.

Font:
Choose font name from the list.

Font Style:
Choose font style (normal, italic, bold).

Size:
Choose font size.

Effects:
Check **Underline** and **Strikeout** options to set corresponding effects and choose font color.



Sample:

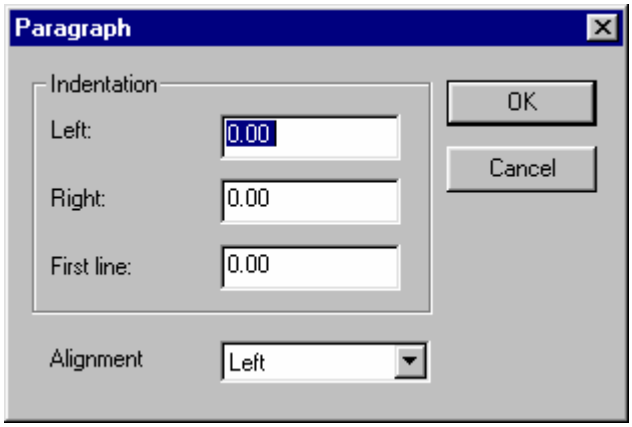
Display font sample.

Script:

Choose appropriate script (character set).

52. Paragraph dialog

Define paragraph format.



Indentation:

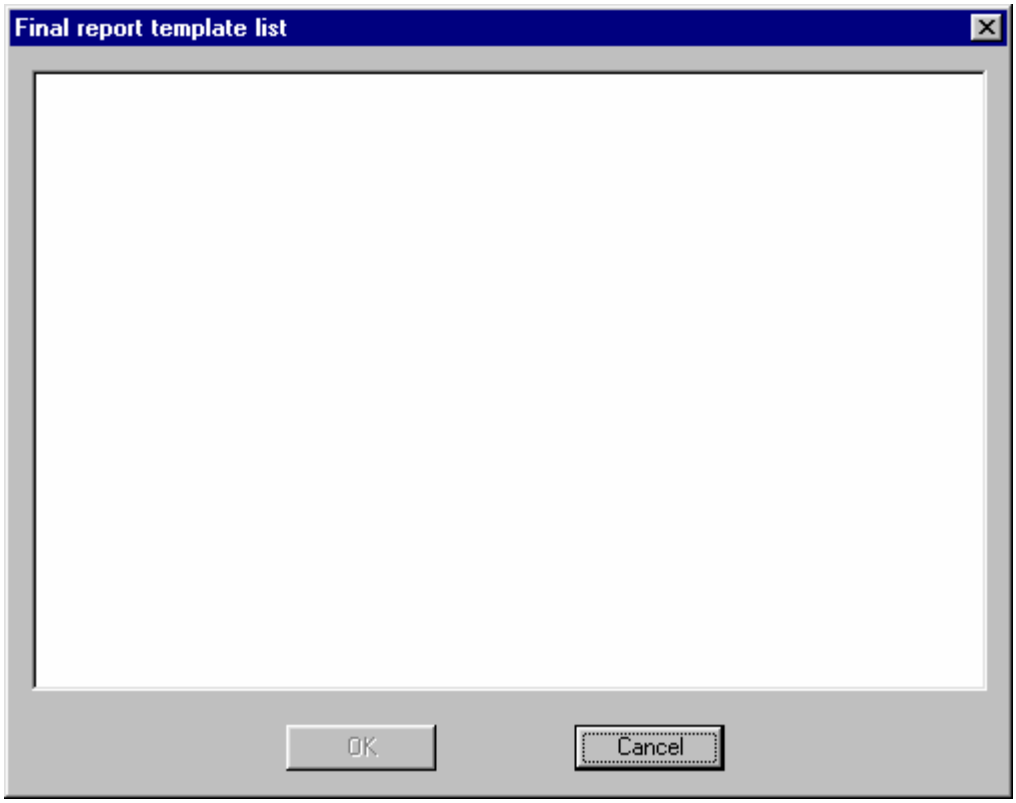
Left	Indent from left margin (cm)
Right	Indent from right margin (cm)
First line	First line indent from left edge of the paragraph(cm)

Alignment:

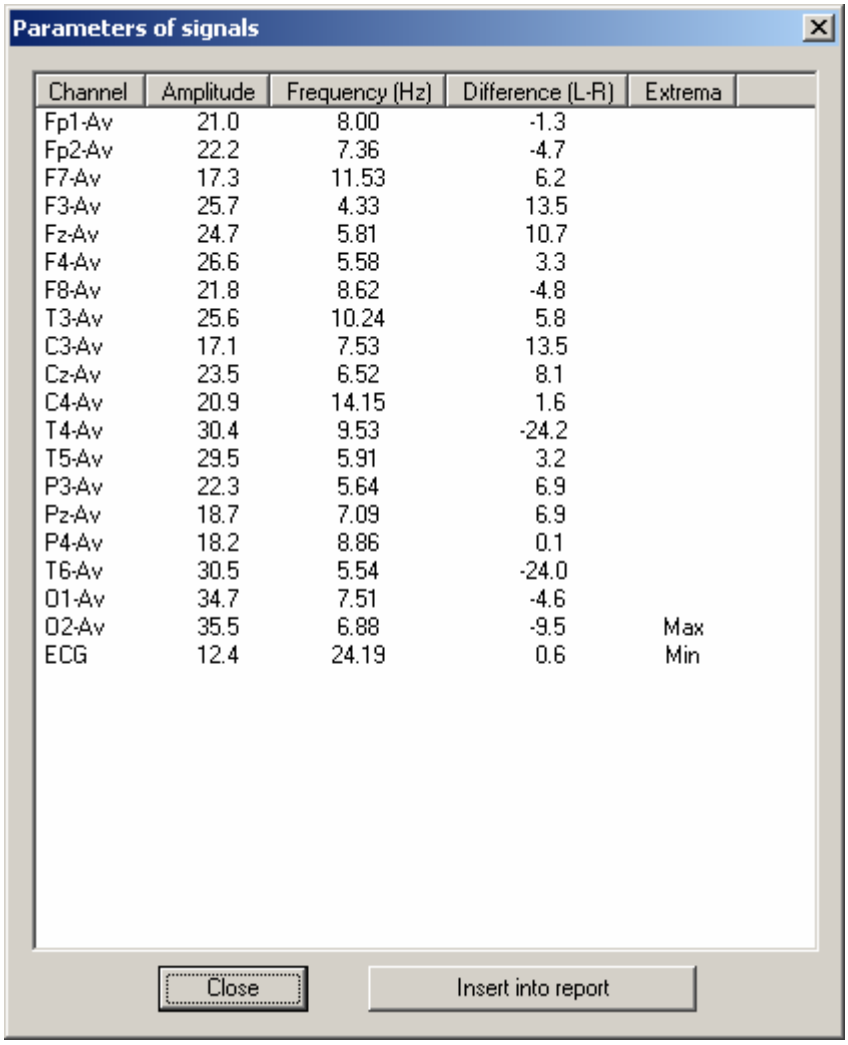
Choose paragraph alignment (left. right or centered).

47. Final Report Template List

Display list of templates for final reports. Choose the template you need and double-click its name or press **OK**.



53. Parameters Of signals dialog



The table displayed in this window includes the next columns:

Channel – channel names

Amplitude –amplitude from pick to pick for signal of each channel and for selected by vertical markers time interval

Frequency – an approximate frequency of signals.

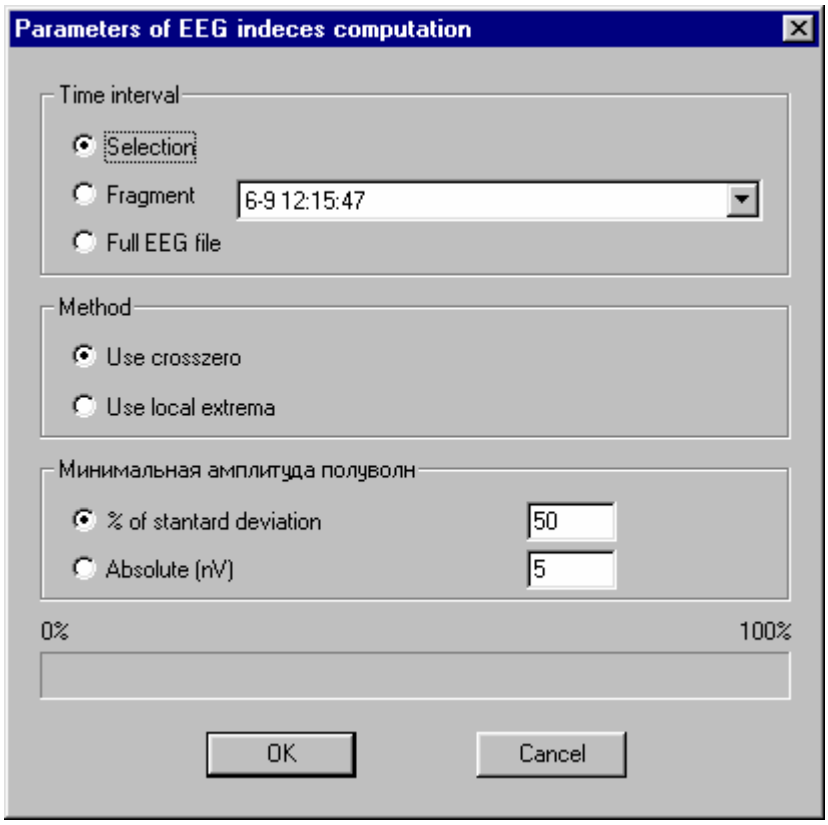
Difference – a difference of voltages for selected by vertical markers EEG samples.

Extrema – the minimal and maximal values of amplitude are marked in this column.

Press **Insert into report** button into insert this table in text of report. A usage of MS Word is recommended.

54. Parameters Of EEG Indices Computation dialog

The basic definitions and algorithms are described in **EEG Indices** section. Here only processing parameters are listed.



Interval

Define the EEG interval to be processed.

Selection	Interval between two vertical markers
Fragment	Fragment selected from the list
Full EEG file	The whole file

Method

Choose an algorithm for EEG indices calculation.

Use Zero Crossings	Select half of waves by base line cross points
Use Local Extrema	Select half of waves between a local minimum and its adjacent maximum or a maximum and its adjacent minimum

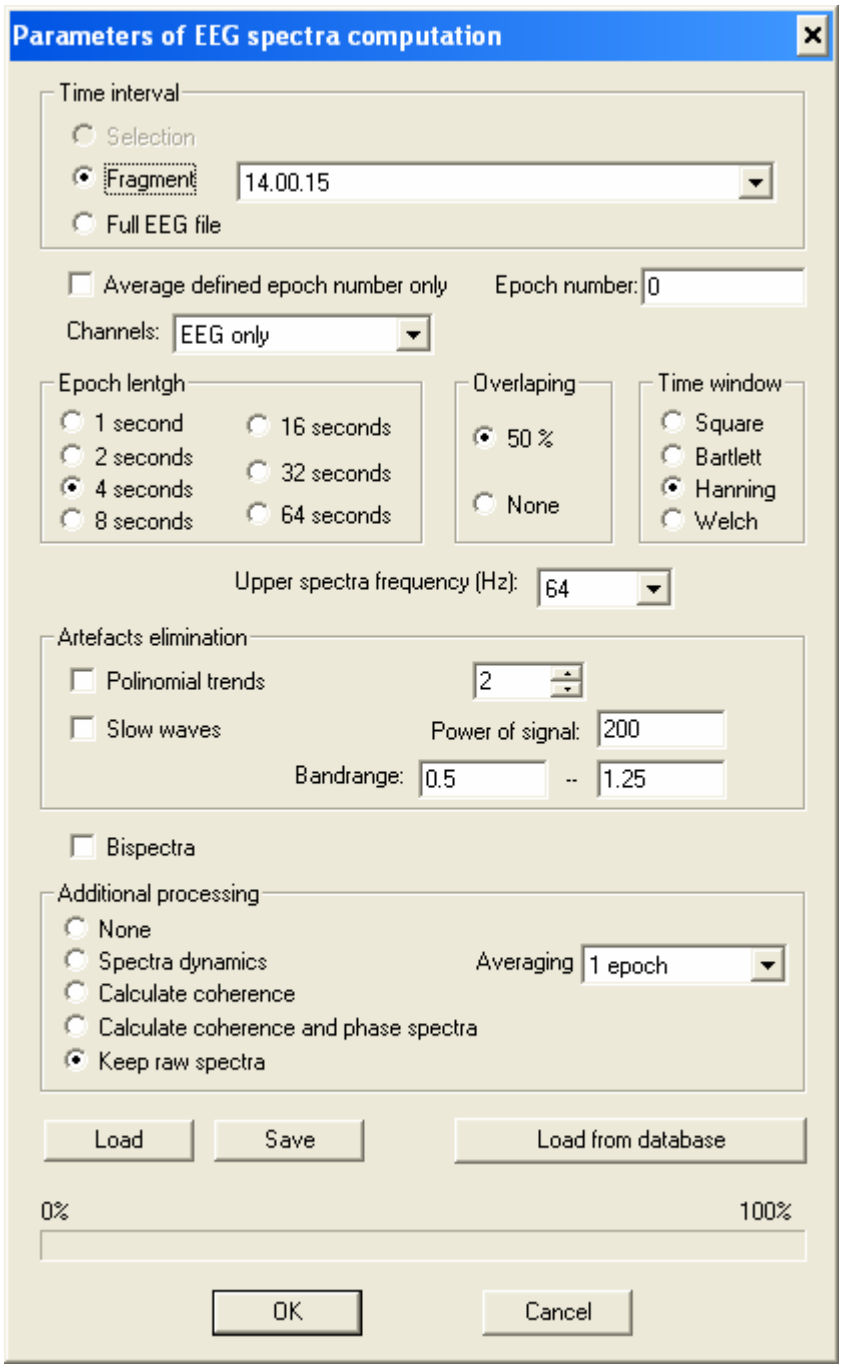
Detection threshold

Define half of wave detection threshold to filter noise.

% of Standard Deviation	Thresholds will be calculated for each separate channel from standard signal deviation.
Absolute (uV)	One common threshold is set for all channels (in uV).

55. Parameters Of EEG Spectra Computation dialog

The basic definitions and algorithms are described in **EEG Spectra** section. Here only processing parameters are listed.



Time Interval

Define EEG interval to be processed.

Selection	Process interval between two vertical markers
Fragment	Process fragment selected from the list
Full EEG file	Process the whole file

Check **Average defined epoch number only** button to compute the spectra and coherence with strong equal averaged epoch number. This option is extremely useful for analysis of EEG coherence because.

Epoch number: Specify number of epoch for averaging.

Channels

Define a sunset of channels to be processed.

Epoch Length

Select epoch length for analysis. Spectrum step is derived from epoch length:

1 second	1 Hz spectrum step.
2 seconds	0.5 Hz spectrum step.
4 seconds	0.25 Hz spectrum step.
8 seconds	0.125 Hz spectrum step.
16 seconds	0.0625 Hz spectrum step.
32 seconds	0.03125 Hz spectrum step.
64 секунды	0.015625 Hz spectrum step.

Overlapping

50 %	Choose this option if a non-square time window is used
None	Choose this option if a square time window is used

Time window

Choose time window type. Time windows are used to suppress side lobe infiltration by smoothing a source realization (epoch) to decrease sharp variations in its initial and final intervals.

Square	w[j] = 1
Bartlett	w[j] = 1 – abs((j – 0.5 N) / 0.5 N)
Hanning	w[j] = 0.5 (1 – cos (6.28 j / N))
Welch	w[j] = 1 – ((j – 0.5 N) / 0.5 N) ((j – 0.5 N) / 0.5 N)

Upper spectra frequency

Choose upper spectra frequency (their length)

Artifact elimination

Check options to define types of artifacts to be eliminated.

Polynomial trends	Polynomial trend is estimated for each epoch and each channel and eliminated from source signal **Additional parameter**: polynomial order
Slow waves	Epochs with too large slow-wave signal component (cause by eye motion or other artifact) are eliminated from averaging. **Additional parameters**: 1) maximal allowed slow-wave power, 2) frequency band to be treated as slow-wave.

Bispectra

Check this option to compute bispectra and bicoherence

Additional Processing

None	Calculate only average EEG spectra.
Spectra Dynamics	Calculate spectra dynamics together with average spectra. The **Averaging** parameter is used to define how many successive epochs to average when calculating dynamics.
Calculate Coherence	Calculate EEG coherence for each pair of channels together with average power spectra.
Calculate Phase	Calculate EEG coherence and EEG phase spectra for each pair of

Spectra	channels together with average power spectra.
Keep raw spectra	Save raw (not averaged) spectra in resulting file. This option allows do more accurate estimation of power spectra parameters, their confidence levels and statistical significance of differences during comparison.

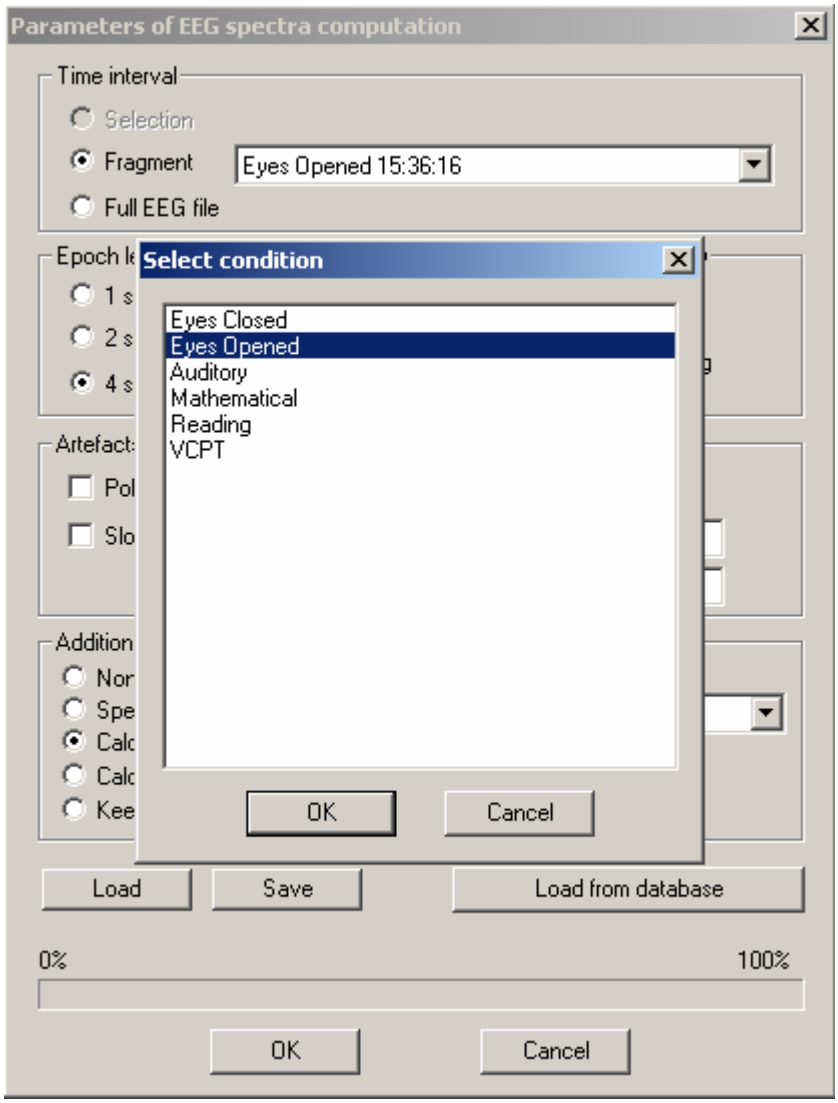
Press **Load** button to read parameter values from a file.

Press **Save** button to save current parameter values to a file.

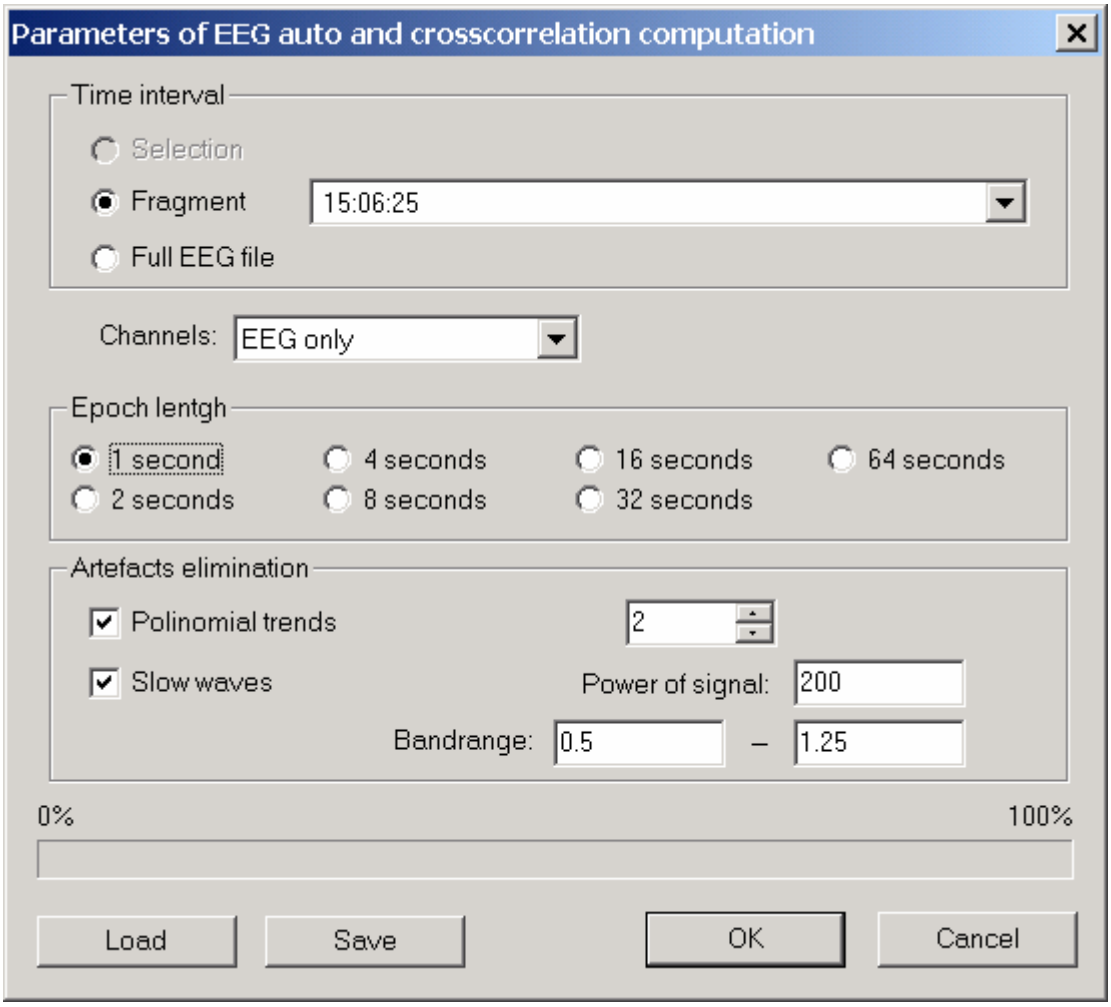
Load from database

Press this button to load standard parameters of spectra computation compatible with normative database.

To define correct parameters press button **Load from database** and select corresponding condition from the list of conditions.



56. Parameters Of EEG Auto and Cross-correlation Computation dialog



Time Interval

Define EEG interval to be processed.

Selection	Process interval between two vertical markers
Fragment	Process fragment selected from the list
Full EEG file	Process the whole file

Channels

Define a sunset of channels to be processed.

Epoch Length

Select epoch length for analysis. Maximal lag is half of epoch length:

1 second	Maximal lag - ±512 ms.
2 seconds	Maximal lag - ±1024 ms
4 seconds	Maximal lag - ±2048 ms
8 seconds	Maximal lag - ±4096 ms.
16 seconds	Maximal lag - ±8192 ms.
32 seconds	Maximal lag - ±16384 ms
64 секунды	Maximal lag - ±32768 ms

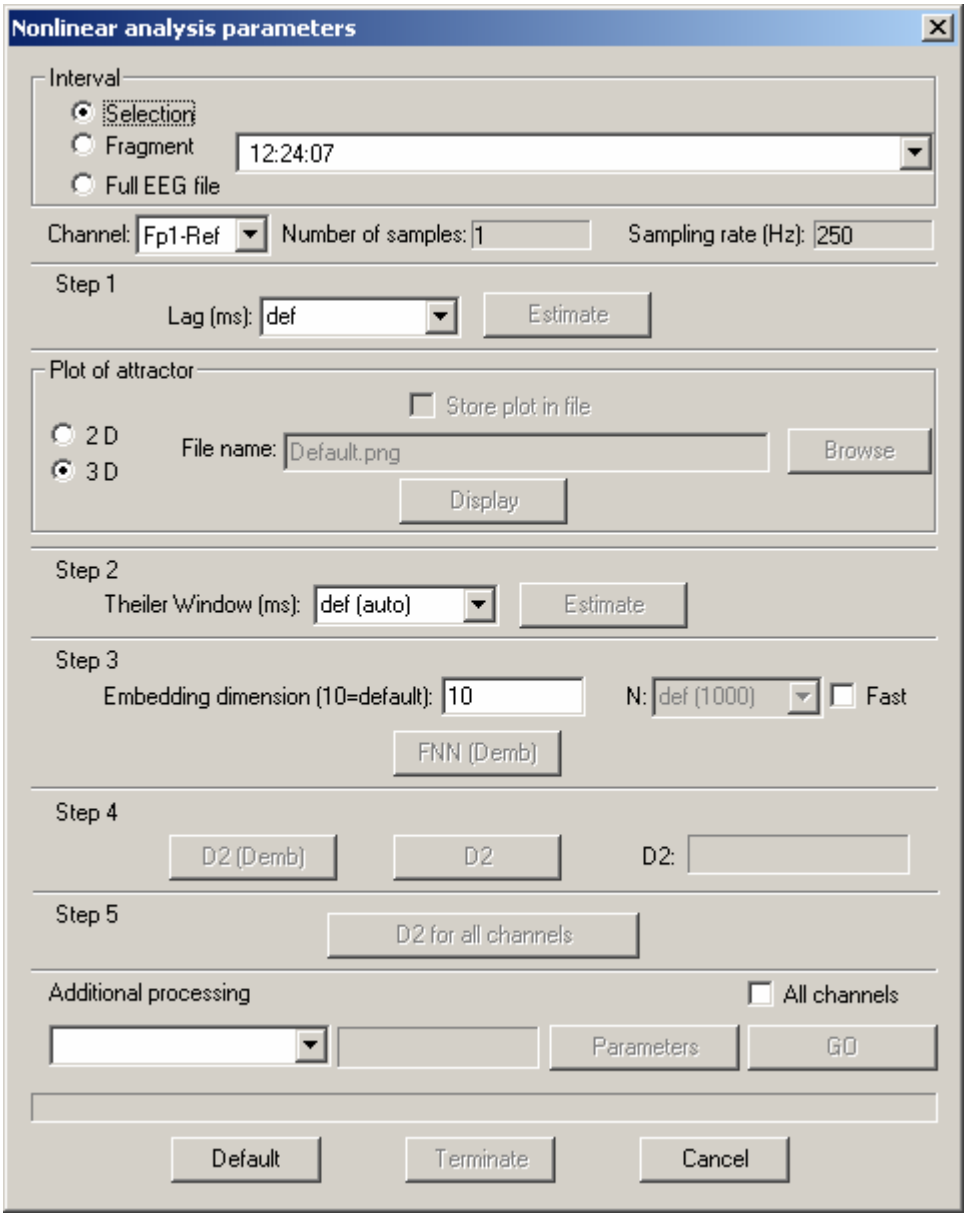
Artifact elimination

Check options to define types of artifacts to be eliminated.

Polynomial trends	Polynomial trend is estimated for each epoch and each channel and

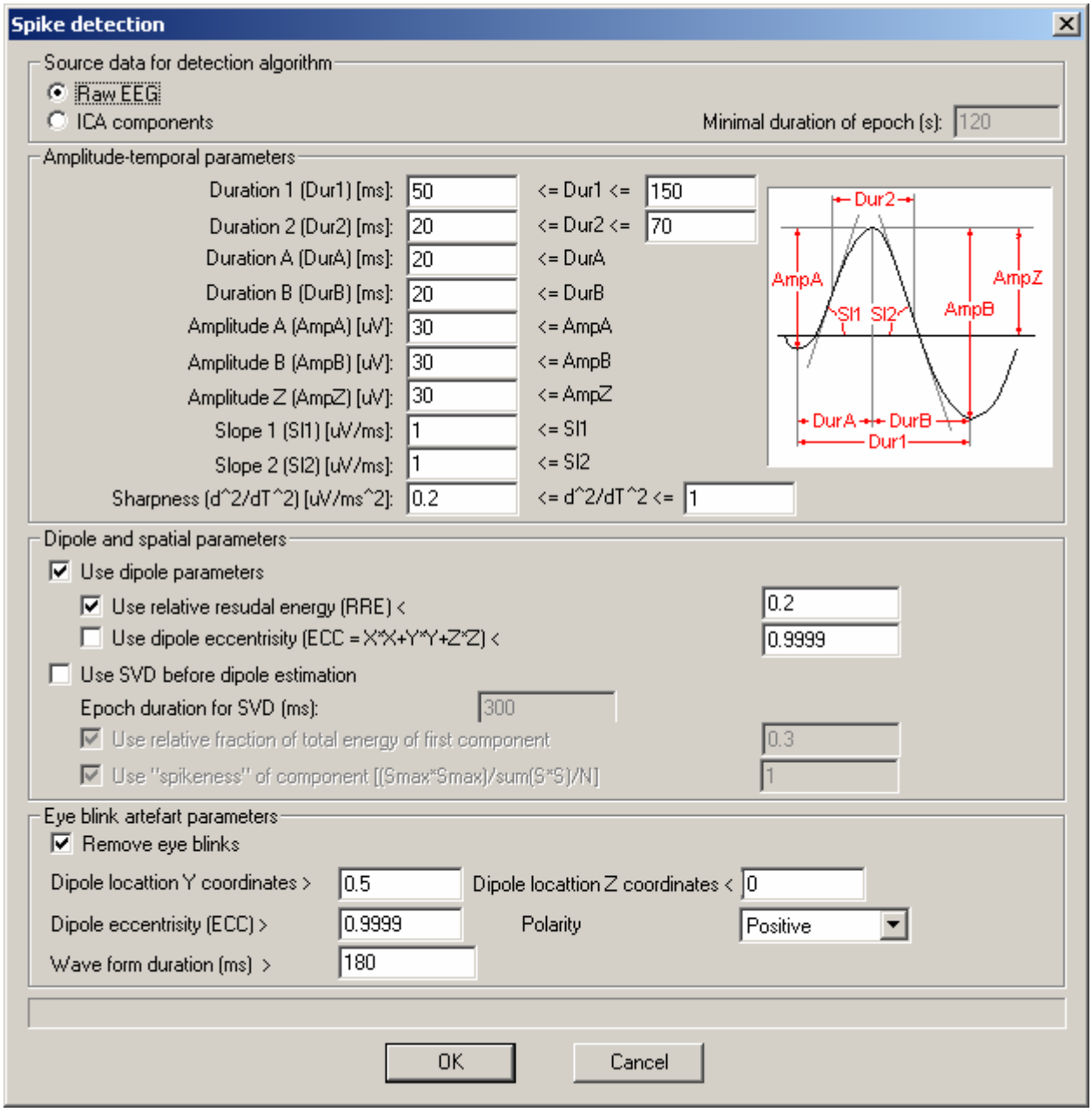
	eliminated from source signal **Additional parameter**: polynomial order
Slow waves	Epochs with too large slow-wave signal component (cause by eye motion or other artifact) are eliminated from averaging. **Additional parameters**: 1) maximal allowed slow-wave power, 2) frequency band to be treated as slow-wave.

56. Nonlinear analysis parameters dialog



Attention! This window helps to define parameters of nonlinear analysis and run processing utilities. The nonlinear analysis is optional function and can be ordered separately by special order together with description of this window.

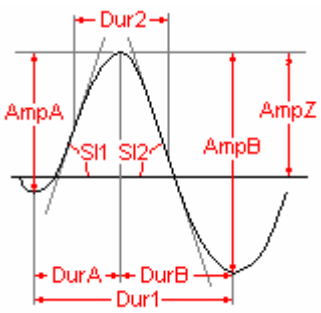
58. Spike detection dialog



Source data for detection algorithm fields define what kind of data will be used for searching of spike like waves using amplitude-temporal parameters of waves. The source data can be **Raw EEG** or independent components of multi-channel EEG signal (**ICA components**). In last case the additional parameter **Minimal duration of epoch** will be used to divide whole EEG file on separated epochs.

Amplitude-temporal parameters fields define limitation for corresponding parameters values using during searching of spike like waves. Amplitude-temporal parameters are the following:

1. Duration 1, defined as the time interval between two successive maxima or minima of an EEG wave (Dur1).
2. Duration 2, defined as the time interval between two successive inflection points (i.e. points where the absolute value of the first time derivative of the wave form has a maximum value) of an EEG wave (Dur2).



3. Duration A, defined as the time interval between the beginning and the pick of an EEG wave (DurA).
4. Duration B, defined as the time interval between the pick and the end of an EEG wave (DurB).
5. Amplitude A, measured from the beginning to the pick of EEG wave (AmpA).
6. Amplitude B, measured from the pick to the end of EEG wave (AmpB).
7. Amplitude, measured from the baseline (zero-voltage) to the pick of EEG wave (AmpZ).
8. Slope 1, defined as the maximum magnitude of the first time-derivative during the leading edge of an EEG wave (Sl1).
9. Slope 2, defined as the maximum magnitude of the first time-derivative during the trailing edge of an EEG wave (Sl2).
10. Sharpness, defined as the second time derivative of an EEG wave at its pick) (d^2P/d^2t).

Dipole and spatial parameters fields define a usage and limitation for corresponding parameters values using during searching of spike like waves. Dipole and spatial parameters are the following:

1. **Use dipole parameters** – if this button is checked the dipole source parameters will be used in spike detection algorithm
2. **Use relative residual energy** fields define a usage and limitation of this parameter.
3. **Use dipole eccentricity fields** define a usage and limitation of this parameter.
4. **Use SVD before dipole estimation** field define will singular value decomposition of multi-channel EEG data will be performed before dipole source localization procedure will be applied or not. If this button checked the topography of first component will be used as source data for dipole source localization procedure.

Attention! Is the source data are independent components the singular value decomposition is not performed.

5. **Epoch duration for SVD** field defines duration of time interval corresponding to spike wave for which the multi-channel EEG data is used as source data for singular value decomposition. The time interval is selected so that the pick of spike places at center of interval.
6. **Use relative fraction of total energy of first component** fields to define a usage and limitation of this parameter.
7. **Use "spikeness" of component [(Smax*Smax)/sum(S*S)/N]** fields define a usage and limitation of this parameter. The "spikeness" is computed according following formula:

$$(Smax*Smax) / sum(S*S) / N$$

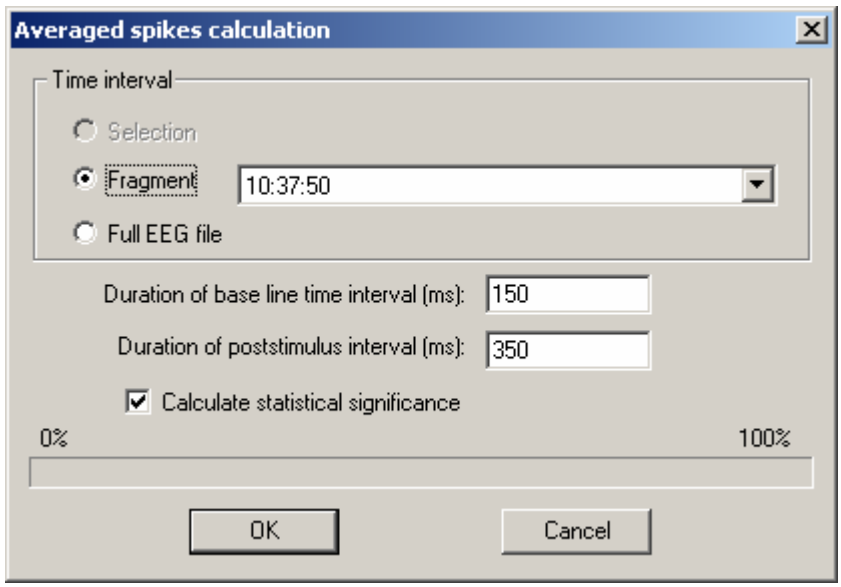
Where Smax – maximal value of signal in the first component, sum(S*S) – total energy of first component and N – number of samples in epoch.

Eye blink artifact parameters fields define a usage and limitation for corresponding parameters values using during searching and elimination of eye blink artifacts. The set of eye blink artifact parameters are the following:

1. **Remove eye blink**s define a usage of eye blink artifact detection procedure.
2. **Dipole location Y coordinates >** and **Dipole location Y coordinates >** fields define an appropriate values of Y and Z coordinates of dipole source of eye blink artifact wave.
3. **Dipole eccentricity (ECC) >** field defines an appropriate value of eccentricity of dipole source of eye blink artifact wave.
4. **Polarity** field defines a polarity of eye blink artifact wave.
5. **Waveform duration (ms) >** field defines minimal duration of eye blink artifact wave.

Attention! Both monopolar and bipolar montages could be used for EEG to which automated spike detection is applied. But dipole source parameters will be not estimated for EEG at bipolar montage.

59. Averaged spikes calculation dialog



Time Interval

Define EEG interval to be processed.

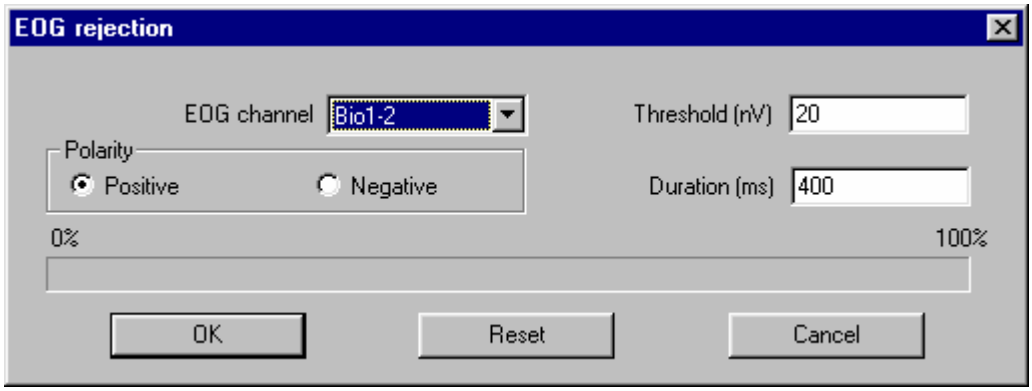
Selection	Process interval between two vertical markers
Fragment	Process fragment selected from the list
Full EEG file	Process the whole file

Duration Of Base Line Time Interval (ms) - set the duration of interval used for base line estimation (before spike pick).

Duration of poststimulus interval (ms) - set the duration of the interval after spike pick.

Calculate Statistical Significance - check this option to calculate statistical significance of difference of spike wave from baseline. The Student criterion is used to estimate statistical significance.

60. EOG Rejection dialog



EOG Channel

Choose appropriate EOG channel from list.

Polarity

Choose **Positive** or **Negative** polarity for first EOG extreme caused by blinking.

Threshold (uV)

Set threshold value for detecting EOG signal caused by blinking.

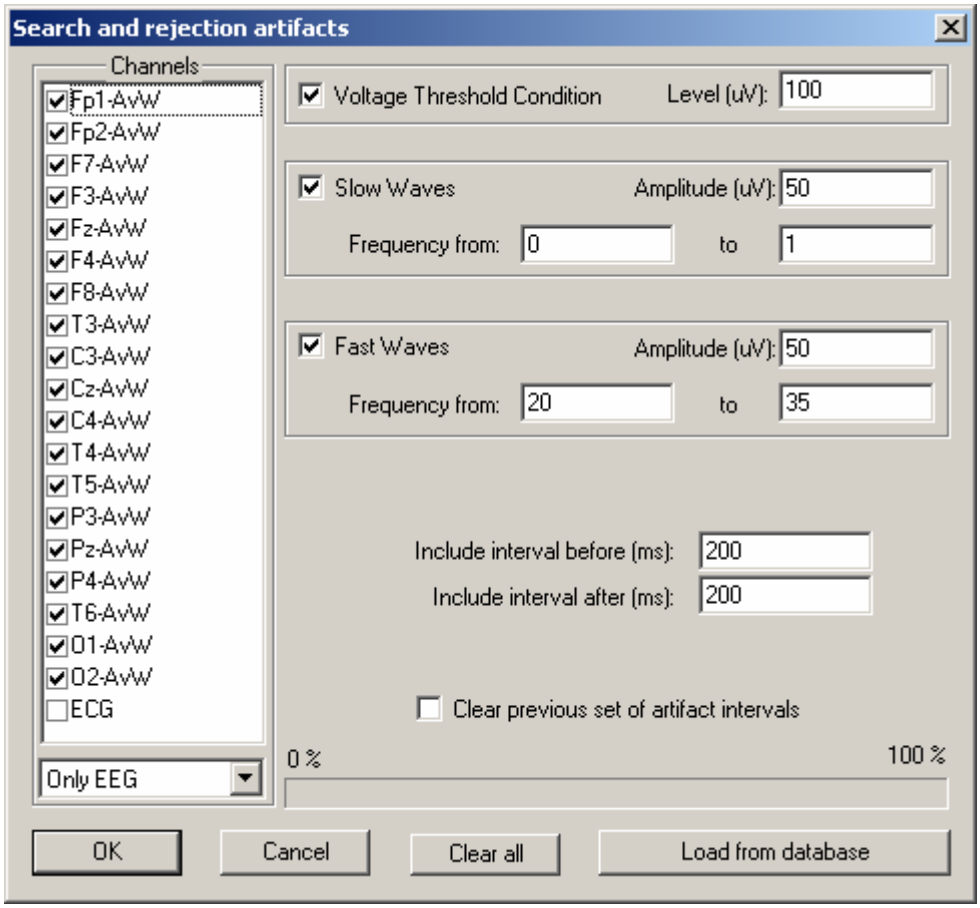
Duration (ms)

Set average duration for EOG signal caused by blinking.

Press **Reset** button to undo previous EOG rejection.

61. Search and rejection artifacts dialog

This dialog allows specify parameters of automatically detection of parts of EEG record including artifacts signals and mark corresponding time intervals. The detection bases on threshold comparison of absolute voltage of EEG signal and amplitude of show and fast waves with defined thresholds.



Channels

Select channels which signals will be used for processing

Voltage Threshold Condition

Check this button if you would like to use voltage criteria and select appropriate threshold (**Level**).

Slow Waves

Check this button if you would like to use slow wave amplitude criteria and select appropriate threshold (**Amplitude**) and frequency band (**Frequency from… to**)

Fast Waves

Check this button if you would like to use fast wave amplitude criteria and select appropriate threshold (**Amplitude**) and frequency band (**Frequency from… to**)

Clear previous set of artifacts intervals

Check this button if you would like to restore all previously marked time intervals.

Clear all

Press this button if you would like to restore all previously marked time intervals.

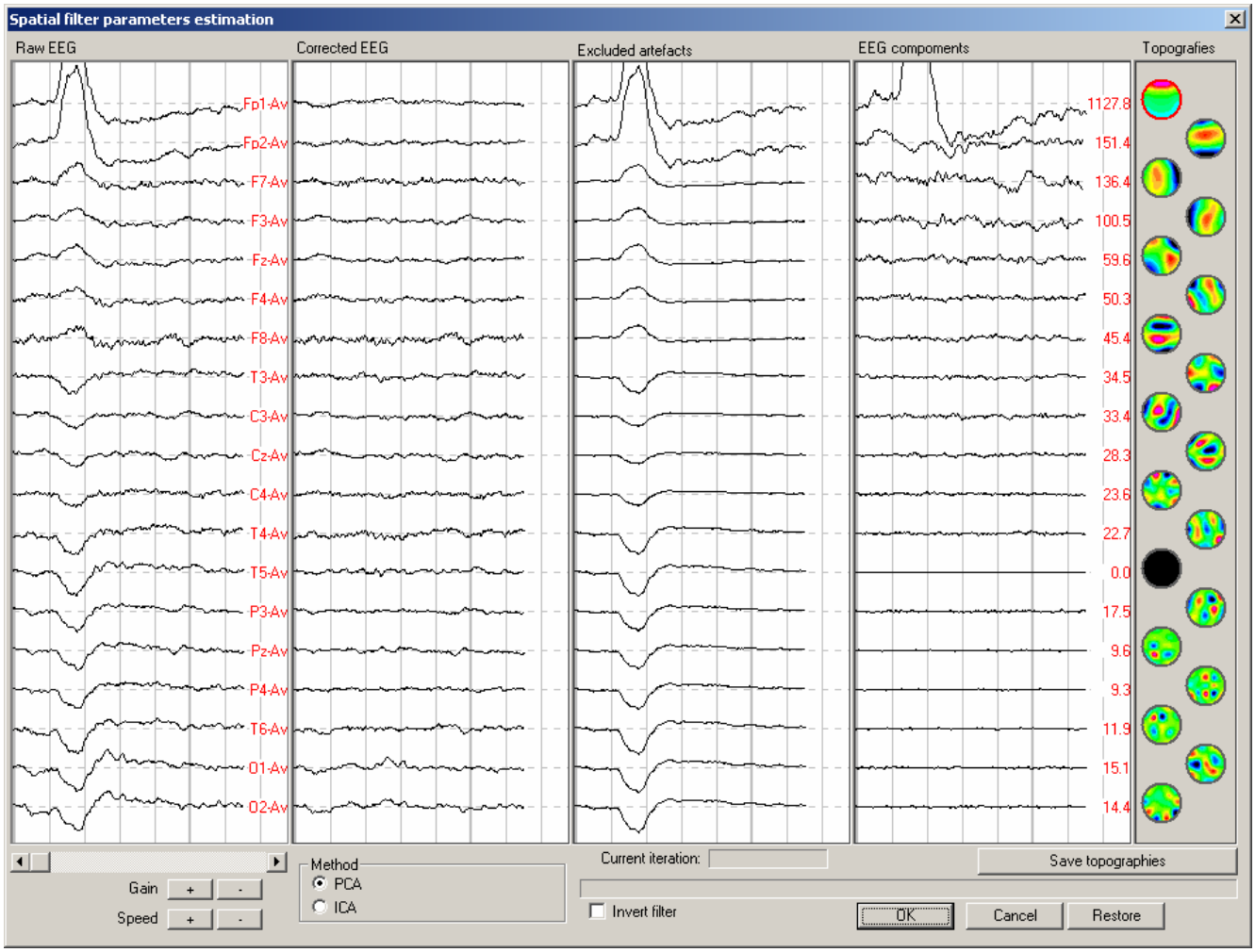
Load from database

Press this button to define default parameters used in normative database.

OK

Press this button to start processing of data using specified parameters.

62. Spatial Filter Parameters Estimation dialogue



The raw (unfiltered) EEG waveforms are displayed on **Raw EEG** plot.

The Corrected (filtered) EEG waveforms are displayed on **Corrected EEG** plot.

The pure artifacts (filtered artifacts) waveforms are displayed on **Excluded Artifacts** plot.

The waveforms of EEG signal components are displayed on **EEG components** plot. The amplitudes of these components are printed right to the waveforms.

The topographies of EEG signal components are displayed by **Topographies** maps.

The **Scroll bar** is used to change the beginning time point for all mentioned above waveforms.

The buttons **Gain "+"** and **"-"** are used to change vertical scale (sensitivity) for all waveforms.

The buttons **Speed "+"** and **"-"** are used to change horizontal scale (speed) for all waveforms.

The group of buttons **Method** is used for selection of EEG signal decomposition.

1. **PCA** method using singular value decomposition (SVD) and
2. **ICA** (independent component analysis) method can be used for this goal.

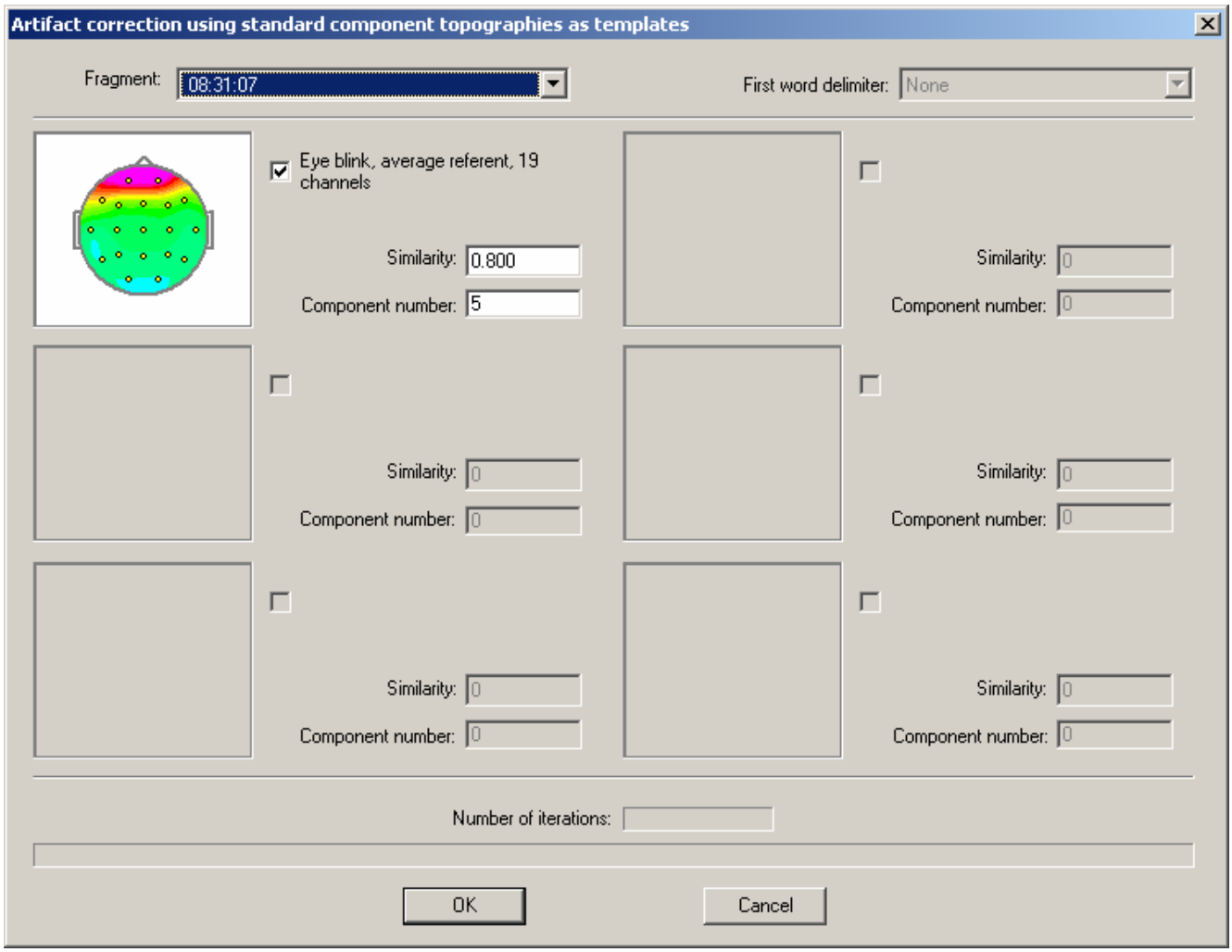
The button **Invert filter** allows estimate spatial filter so that **Corrected EEG** and **Excluded Artifacts** will be flipped. This possibility allows separate clean EEG component waveforms from mix of components in raw EEG for the future processing.

Click on **Map** of **topographies** to include (exclude) it to (from) the data set used for spatial filter estimation.

Click **Save topographies** button to store the selected topographies to ASCII test file.

Attention! The algorithm of artifacts correction is not ideal. That is why the visual inspection of results of correction is necessary. If the results are not satisfied another time interval should be selected and analyzed.

63. Artifact correction using standard component topographies as templates dialogue



Use **Fragment** list to select EEG fragment that will be used for estimation of spatial filter.

Use **First word delimiter** list to select delimiter of first word in fragment name. This option is very useful if EEG recordings have different names of fragments but there is a common part at the beginning of one.

The **topographies of components** are placed below. Check only those topographies for which corresponding components will be cleared for artifact correction.

Similarity: specify the value of similarity for used topographies. If all components have similarity of their topographies with template are lower this value WinEEG will report an error of processing.

Component number: define number of components with maximal power that will be used for search of maximally similar to template. This parameter helps to exclude the components with small power from the consideration.

There is a possibility to add manually own unique topographies into list to extend the possibility of this function. The list of topographies templates is stored in file with name **TopEng.cfg.** The example of content of similar file is presented below:

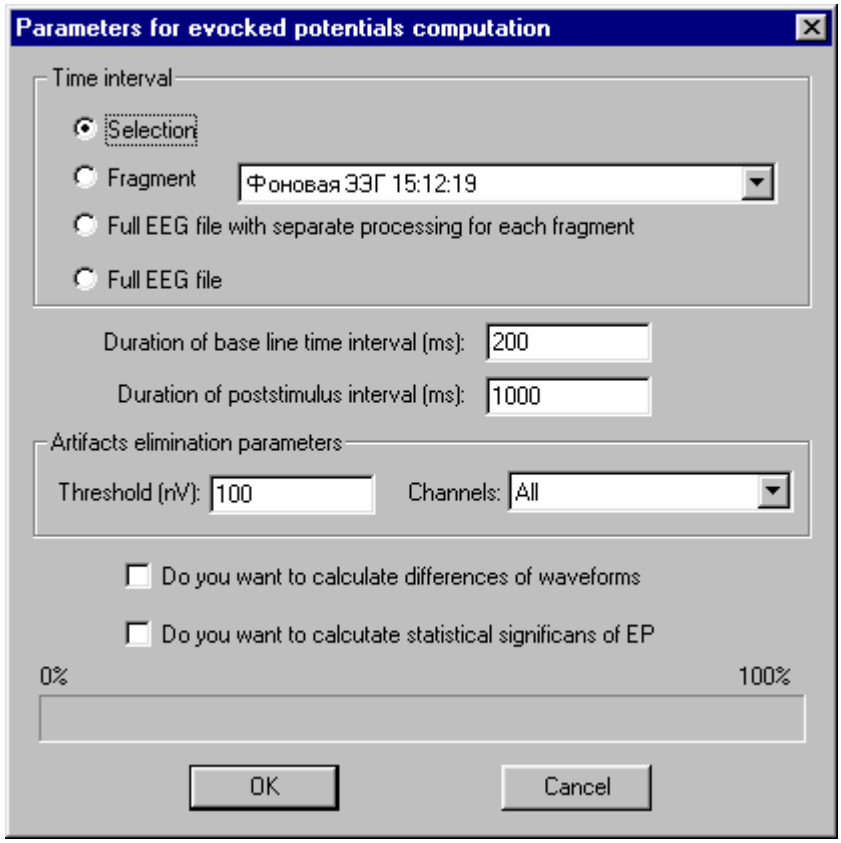
"Моргание глаз 1, референт - объединенные уши, 19 каналов"
Fp1-Ref Fp2-Ref F7-Ref F3-Ref Fz-Ref F4-Ref F8-Ref T3-Ref C3-Ref Cz-Ref C4-Ref T4-Ref T5-Ref P3-Ref Pz-Ref P4-Ref T6-Ref O1-Ref O2-Ref
0.9539 0.9312 0.0405 0.0222 0.1812 0.0383 -0.0842 -0.2245 -0.1529 -0.1550 -0.1611 -0.2318 -0.1815 -0.1404 -0.1451 -0.1497 -0.1733 -0.1536 -0.1647
0.8 5
"Моргание глаз 1, средний референт, 19 каналов"
Fp1-Av Fp2-Av F7-Av F3-Av Fz-Av F4-Av F8-Av T3-Av C3-Av Cz-Av C4-Av T4-Av T5-Av P3-Av Pz-Av P4-Av T6-Av O1-Av O2-Av
1.0530 0.9975 0.4066 0.0717 0.0979 0.0518 0.0650 -0.2405 -0.1508 -0.1461 -0.1481 -0.2091 -0.2983 -0.2314 -0.2187 -0.2228 -0.2684 -0.3023 -0.3069
0.8 5

Each component template is described by four consequent lines:

1. First line – text **name of topographies** that will displayed in dialog window.
2. Second line – **list of channel** names (in dependence on used montage). The names include the reference names also to have a possibility to use separate topographies for different referents.
3. Third line – **weights** for each electrode in topographies
4. Forth line – default values of **Similarity** and **Component number** parameters.

Attention! Be very attentive modifying content of **TopEng.cfg** file. Incorrect modification of this file can fail this function.

64. Parameters For Evoked Potential Computation dialog



Time Interval

Define EEG interval to be processed.

Selection	Process interval between two vertical markers
Fragment	Process fragment selected from the list
Full EEG file with separate processing for each fragment	Process the whole file, calculating ERPs for each fragment separately
Full EEG file	Process the whole file

Duration Of Base Line Time Interval (ms) - set the duration of interval used for base line estimation.

Duration of poststimulus interval (ms) - set the duration of the poststimulus interval.

Artifact elimination parameters - set **Threshold** in uV and choose which **Channels** to process. You can choose one of the following values for the **Channel** parameter: All, Only EEG channels, or Only Bio channels. An EEG interval (a trial) is treated as artifact if an ERP absolute value for any channel and for any bin exceeds the threshold.

Calculate Differences of Waveforms - check this option to calculate differential ERPs if **Full EEG file with separate processing for each fragment** time interval option is chosen**.**

Calculate Statistical Significance - check this option to calculate statistical significance of ERP difference from baseline (separately for each ERP or differential ERP and for each bin or for each pair of bins taken to calculate differential signal). The Student criterion is used to estimate statistical significance.

65. Parameters for Event-Related Potential Computation dialog

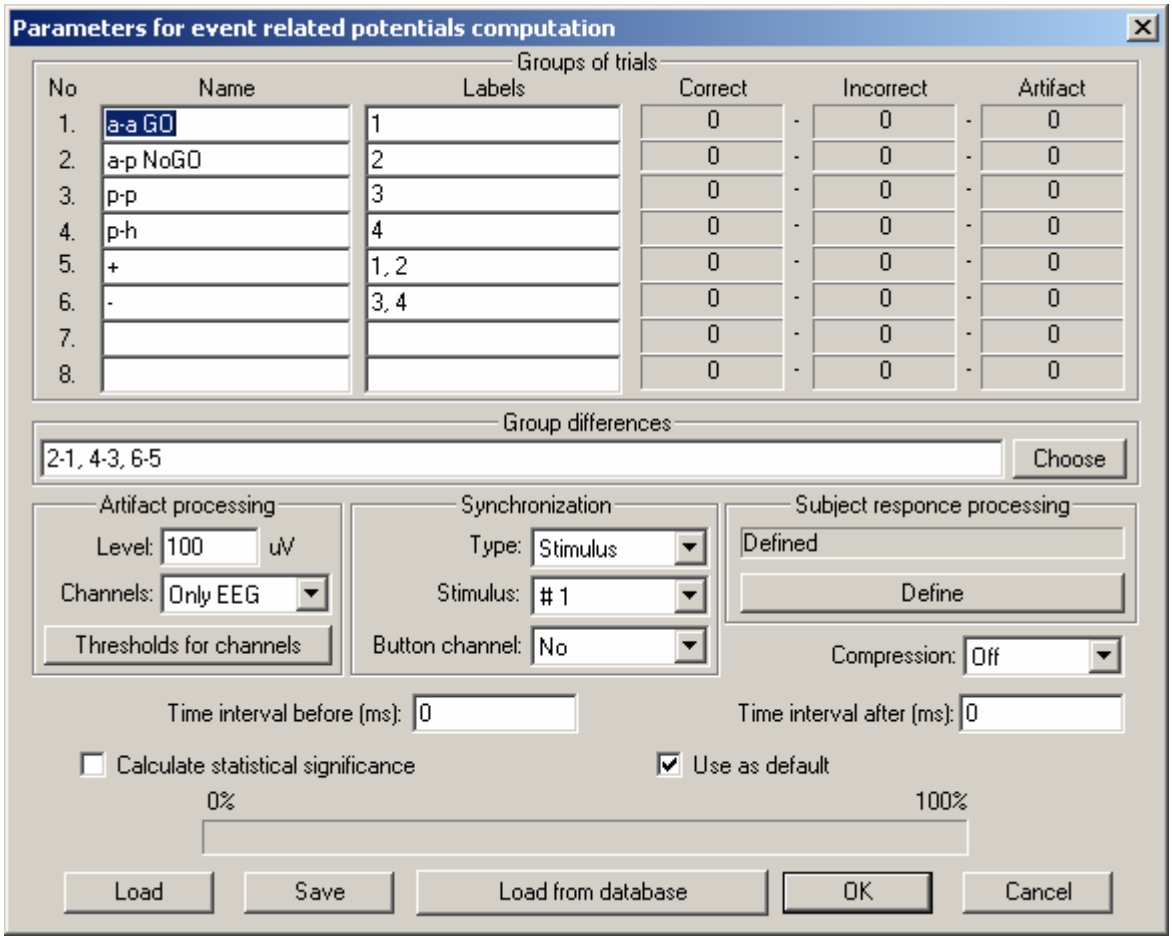
To calculate ERPs, additional information on stimuli presentation structure in each trial is used together with source data. To group trials by stimuli types or by response task, trial labels are used. These parameters are defined beforehand when creating (editing) stimuli presentation protocols by means of PSYTASK program installed on the presenting computer.

Groups Of Trials

The table defines context names for trial groups (**Name** fields) and corresponding trial label lists (**Labels** fields). Up to 8 different trial groups can be defined. For each trial group, a label list is defined (label values in the list are separated by commas: 1, 2, 5, 9…). The same trial label value may be used in several different trial groups. For groups with empty label lists ERP would not be calculated.

On the right side of the table there are fields for displaying statistical results of trial grouping, artifact analysis and response processing. The **Correct** fields show number of trials in each group when the patient performed the task correctly. The **Incorrect** fields show number of trials when the patient performed the task incorrectly.

Task performing correctness is controlled by monitoring button states according to **Subject Response Processing** parameters. Number of trials treated as artifact is displayed in the **Artifact** fields.



Group Differences

This field defines a list of trial group pairs for calculating differential ERPs. Group pairs are separated by commas. Group numbers in a pair are separated by a hyphen (a minus sign). Press **Choose** button to choose group pairs (see **Choose Group Differences dialog**.)

Artifact Processing

The following parameters are used for automatic artifact analysis and elimination:

Level - set threshold value (in uV). An EEG interval (a trial) is treated as artifact if an ERP absolute value for any channel and for any bin exceeds Level value.

Channels - define channels to be processed for artifact analysis. Possible options are:

All - process all channels
Only EEG - process only EEG channels
Only Bio - process only Bio channels
Table - the defined channel table is used and Level value is ignored
Don't Reject - artifacts are not eliminated

Use the **"Threshold for channels"** button to define a list of channels to be processed and individual threshold values for artifact analysis. This button calls **Artifact Rejection Thresholds dialog**.

Synchronization

Several stimuli are allowed to be presented during one trial. Also, pre- and poststimulus intervals may change from trial to trial even if trials belong to one averaging group. In this case it is necessary to set additional parameters to synchronize trials correctly when averaging them. Moreover, some tasks may need analyzing ERPs preceding the response reaction.

Type - select trial synchronization type:

Stimulus - standard trial synchronization for ERP calculation
Button - trials are synchronized by the start of response reaction, i.e. by the moments when the patient's finger presses the button.
Spike – trials are ignored. Averaged sweeps are selected using spike detection information. Subject response is not processed.

Stimulus - set the synchronizing stimulus number for **Stimulus** trial synchronization
Button Channel - set the number of the channel acquiring button signal for **Button** synchronization
Attention! There are different modifications of buttons: simple button – one level button, advanced button – two levels button and digital button. Setting of button channel depends on what type of button was used. "Any level" signal should be used for simple button. Both "Low level" and "High level" signal can be used for advanced button if the subject press both key during investigation. The digital inputs ("Dig1", "Dig2"…) should be used for digital button.

Subject Response Processing

Press **Define** button to define or to modify parameters for subject response processing. The **Subject Response Processing Parameters dialog** will appear.

Compression

The parameter is set in time readouts (N) and defines decrease of source EEG sampling frequency for ERP calculation. A trial is divided into equal non-overlapping time intervals (N

time readouts long) and average potential value is calculated for each interval. The result trial will have N times less time readouts than the source one.

Time Interval Before (ms)

If the parameter value exceeds zero and the interval from the trial beginning till the synchronizing stimulus (see above) exceeds this value, resulting trial will be shortened from its start.

Time Interval After (ms)

If the parameter value exceeds zero and the interval from the trial beginning till the synchronizing stimulus (see above) exceeds this value, resulting trial will be shortened from its end.

Calculate Statistical Significance

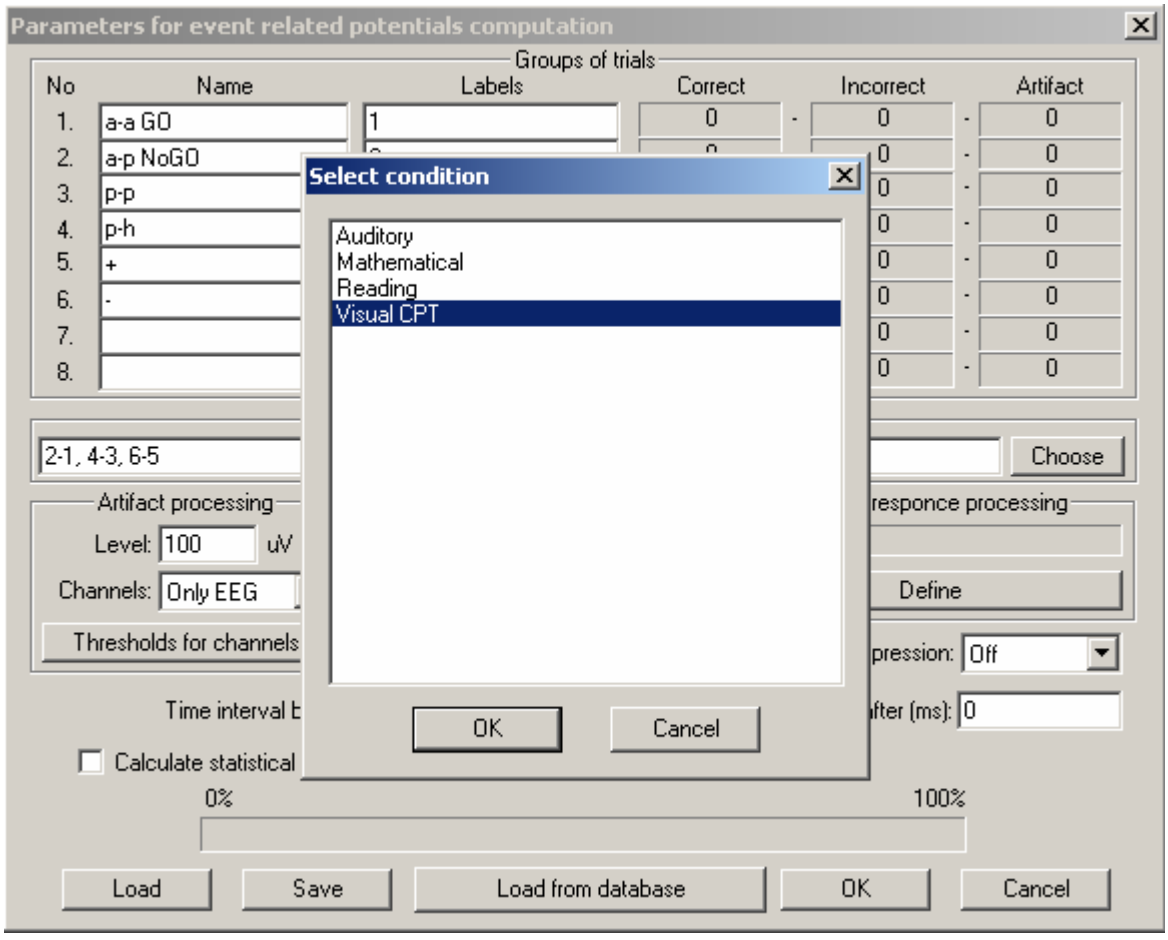
Check this option to calculate statistical significance of ERP difference from baseline (separately for each ERP or differential ERP and for each time read out or for each pair of readouts taken to calculate differential signal). The Student criterion is used to estimate statistical significance.

Use as Default

Check this option to have the current parameter values saved and then used for next EEG file processing.

Press **Load** button to read parameter values from a file.

Press **Save** button to save current parameter values to a file.



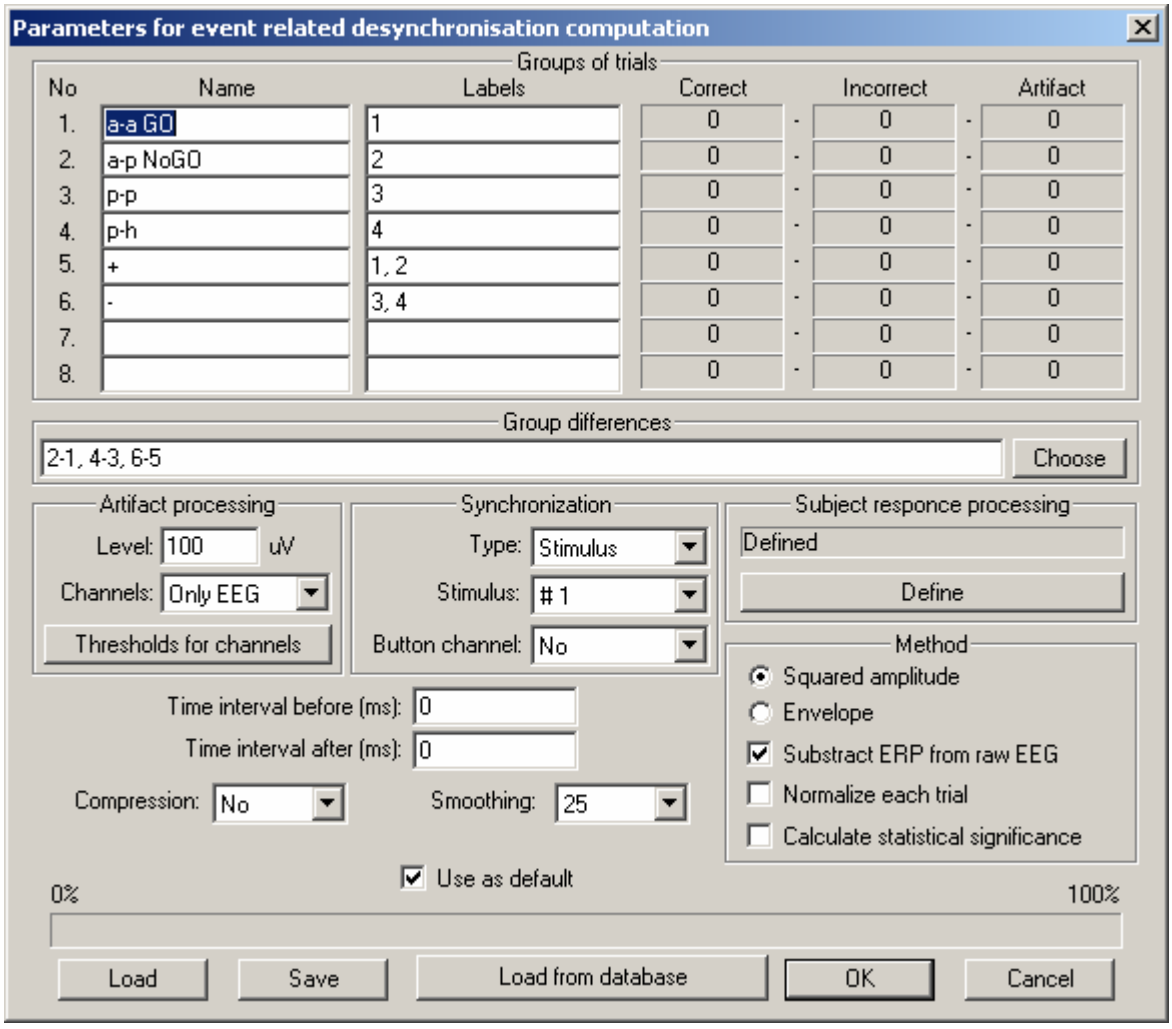
Load from database

Press this button to load standard parameters of spectra computation compatible with normative database.

To define correct parameters press button **Load from database** and select corresponding condition from the list of conditions.

66. Parameters For Event-Related De-synchronization Computation dialog

To calculate ERD, additional information on stimuli presentation structure in each trial is used together with source data. To group trials by stimuli types or by response task, trial labels are used. These parameters are defined beforehand when creating (editing) stimuli presentation protocols by means of PSYTASK program installed on the presenting computer.



Many fields of this dialog are similar to those of **Parameters for Event-Related Potential Computation dialog**. So, additional fields are described below only.

Smoothing - this parameter is set in time readouts (N) and defines filter (sliding average) width for ERD curve smoothing for each separate trial before averaging.

Method - defines method for ERD computation:

Squared Amplitude

Signal power is defined as square of EEG value.

Envelope

Signal envelope is computed by means of Gilbert transformation before power calculation.

Subtract ERP from raw EEG

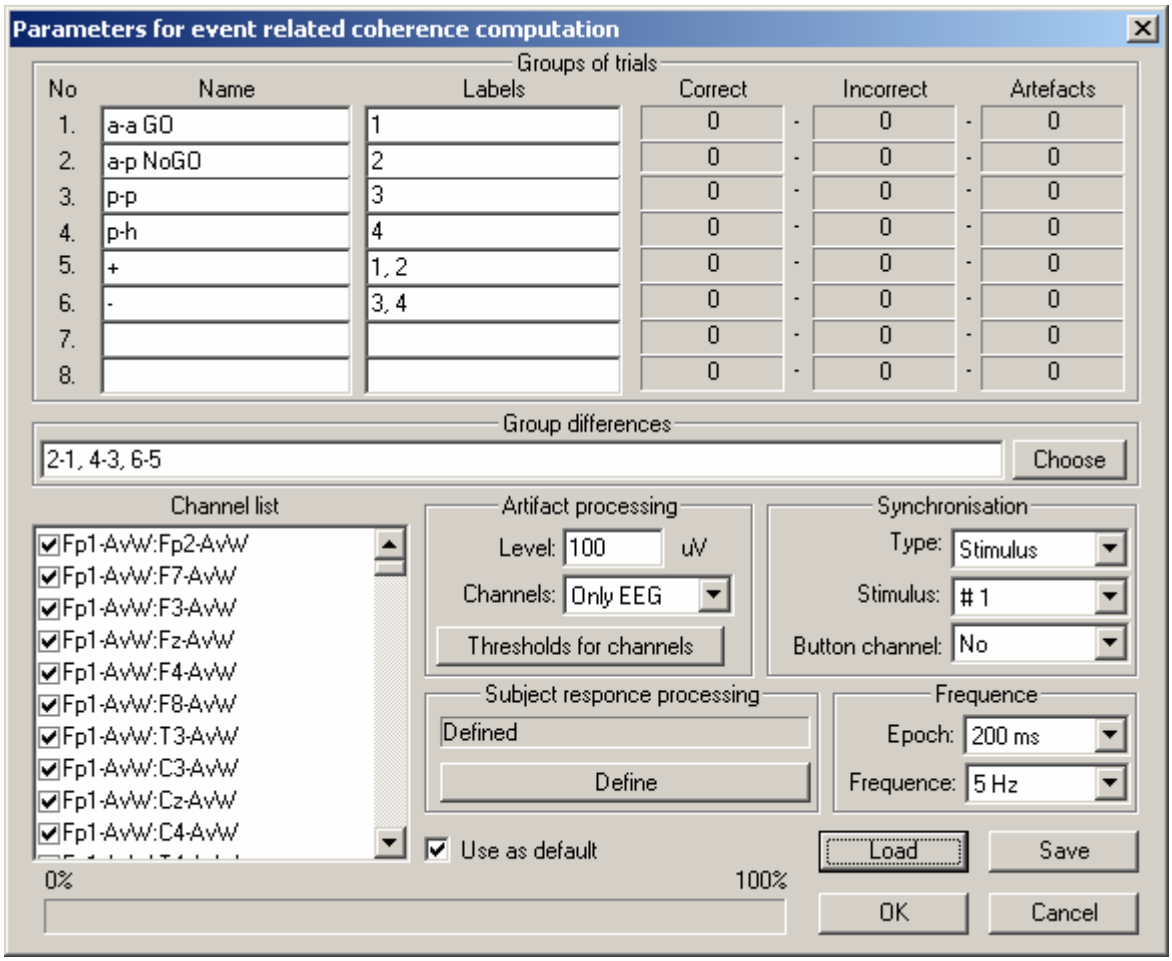
If this option is checked then before calculating EEG oscillation power ERPs will be subtracted from source data to eliminate their effect and only "induced" activity will remain.

Normalize Each Trial

If this option is unchecked average signal power dynamics is calculated over all trials and then normalized by average signal power value for prestimulus interval. Otherwise each trial is normalized separately.

Attention!!! Check this option only if prestimulus intervals and intervals between trials are long enough (not less than one second). Otherwise prestimulus signal power variance will be very big and may significantly distort ERD dynamics.

67. Parameters For Event-Related Coherence Computation dialogue



To calculate ERCoh, additional information on stimuli presentation structure in each trial is used together with source data. To group trials by stimuli types or by response task, trial labels are used. These parameters are defined beforehand when creating (editing) stimuli presentation protocols by means of PSYTASK program installed on the presenting computer.

Many fields of this dialog are similar to those of **Parameters for Event-Related Potential Computation dialog**. So, only additional fields are described below.

Channel List

Define a list of channel pairs to be processed (not more than 24 pairs).

Frequency

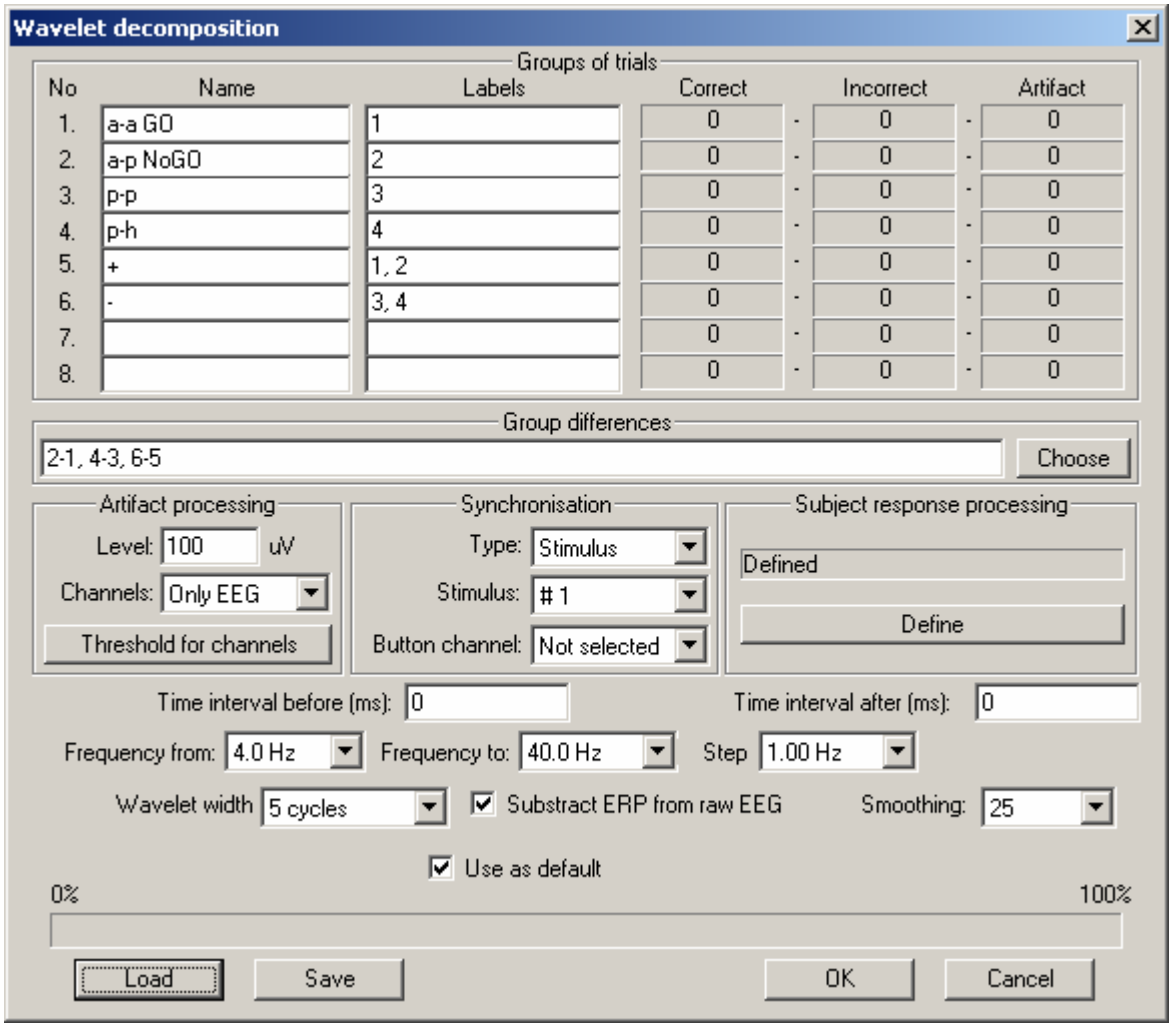
This group defines harmonic signal frequency for which the EEG event-related coherence will be calculated.

Epoch - sets width of sliding window used for ERCoh calculation

Frequency - defines the harmonic

68. Wavelet Decomposition dialog

To perform wavelet decomposition, additional information on stimuli presentation structure in each trial is used together with source data. To group trials by stimuli types, or by response task, trial labels are used. These parameters are defined beforehand when creating (editing) stimuli presentation protocols by means of PSYTASK program installed on the presenting computer.



Many fields of this dialog are similar to those of **Parameters for Event-Related Potential Computation dialog.** So only the additional fields are described below.

Frequency From, Frequency To

Choose two values defining frequency range for wavelet decomposition

Step

Choose step for calculations within a certain frequency range

Wavelet Width

Choose wavelet width in the time domain. Wavelet width can be set in absolute units (ms) or in cycles. Cycles mean different absolute wavelet width for each frequency. On the other hand, in this case resolution will change proportionally for time and frequency domains. Special papers recommend the value of 5 cycles for this parameter. But each case may require a different specific value for this parameter.

Smoothing

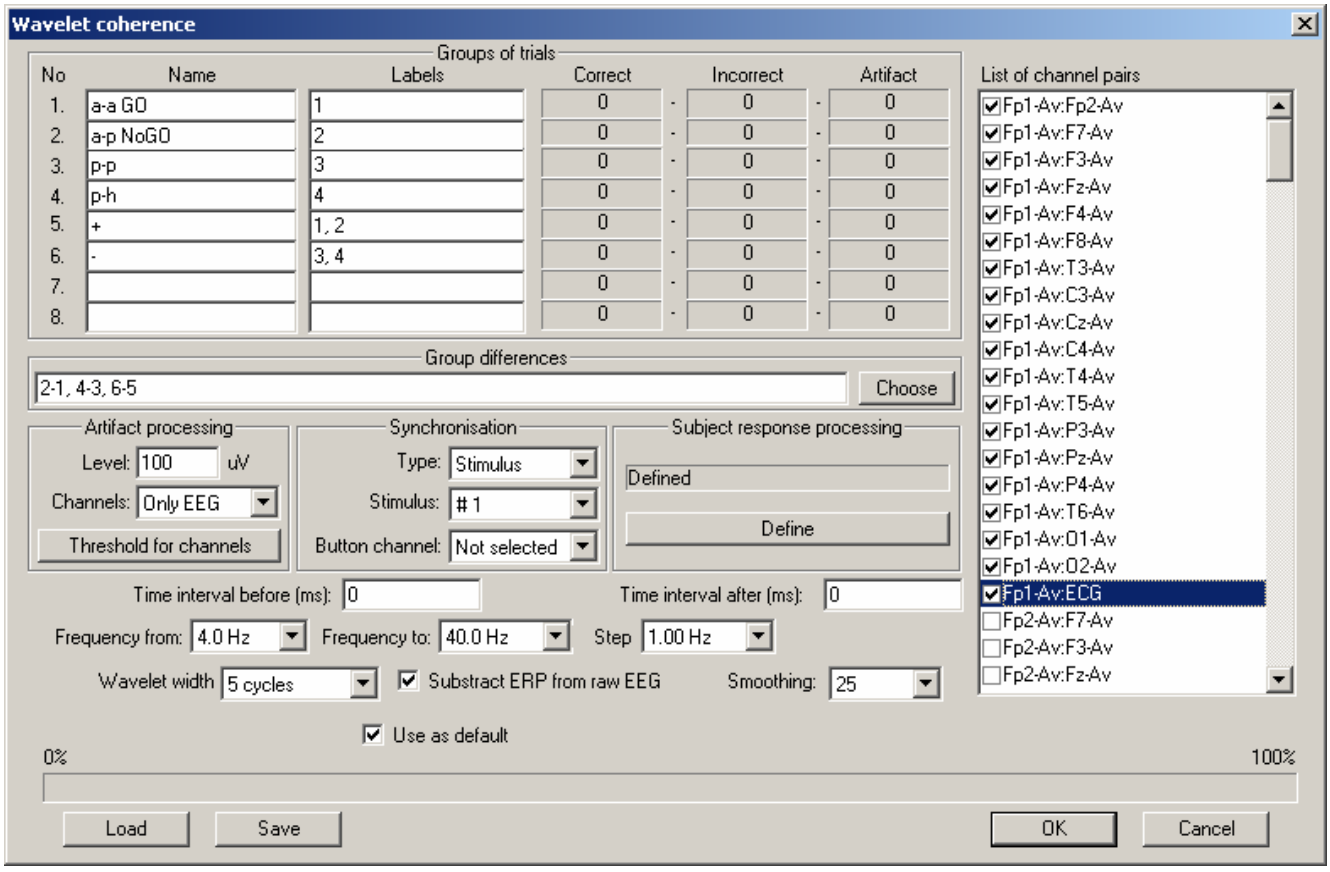
This parameter is set in time readouts (N) and defines filter (sliding average) width for ERD curve smoothing for each separate trial, prior to averaging.

Subtract ERP from raw EEG

If this option is checked then before calculating EEG oscillation power ERPs will be subtracted from source data to eliminate their effect and only "induced" activity will remain.

69. Wavelet Coherence dialog

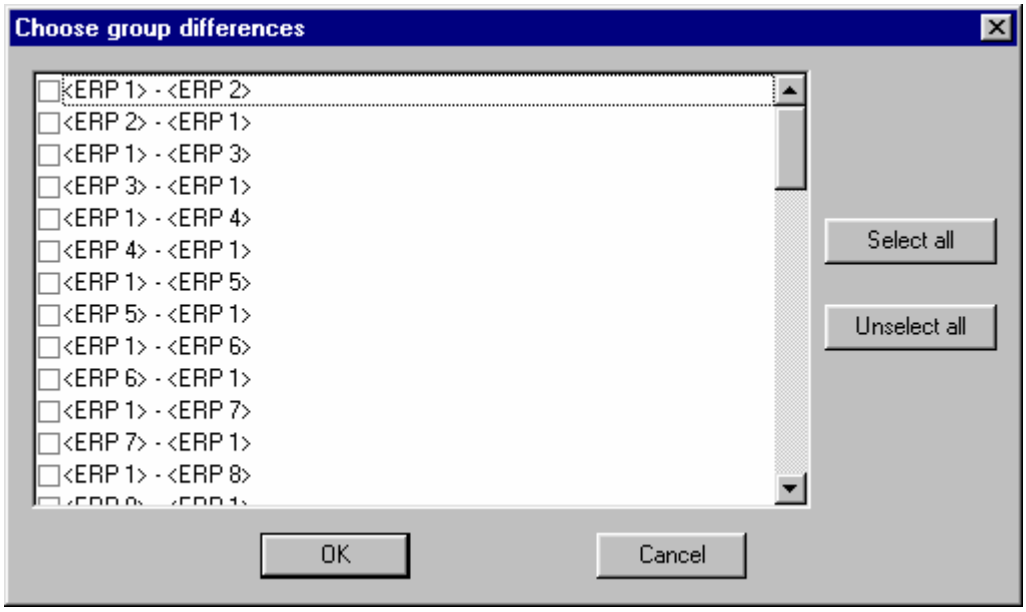
To perform wavelet coherence calculation, additional information on stimuli presentation structure in each trial is used together with source data. To group trials by stimuli types, or by response task, trial labels are used. These parameters are defined beforehand when creating (editing) stimuli presentation protocols by means of PSYTASK program installed on the presenting computer.



This dialog box works similar as described in previous chapter. But user should also specify a **list of channel pairs** to which wavelet coherence should be compute.

70. Choose Group Differences dialog

Define trial group pairs for calculating differential ERPs.

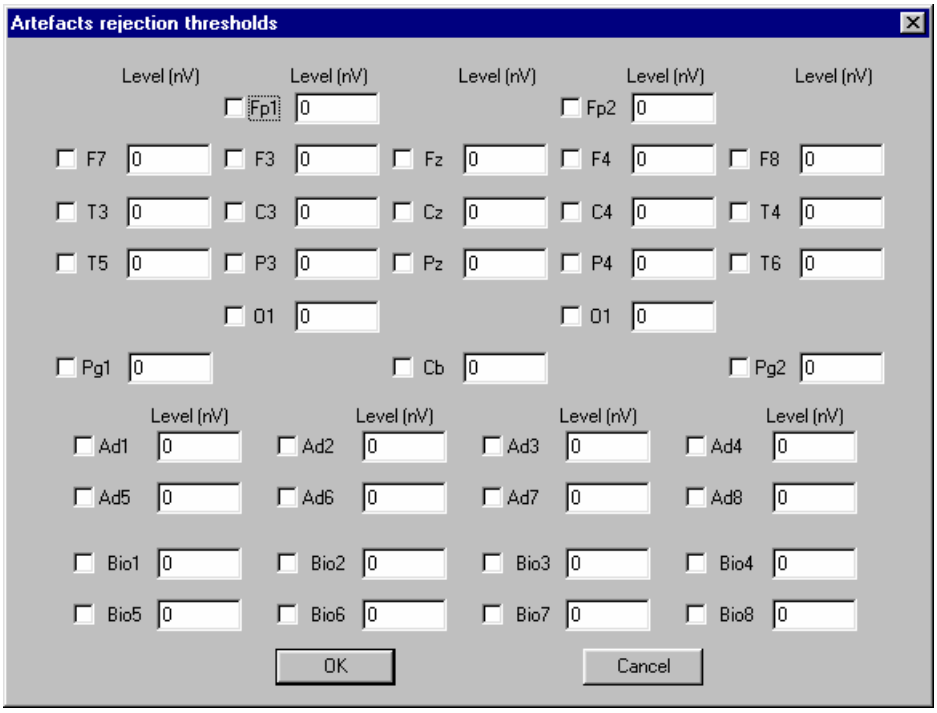


Press **Select All** button to choose all group pairs.

Press **Deselect All** button to deselect all group pairs.

Attention!!! Total number of (trial groups + trial group pairs) may not exceed 32. Therefore if there are, for example, 8 context groups, then not more than 24 trial group pairs can be selected.

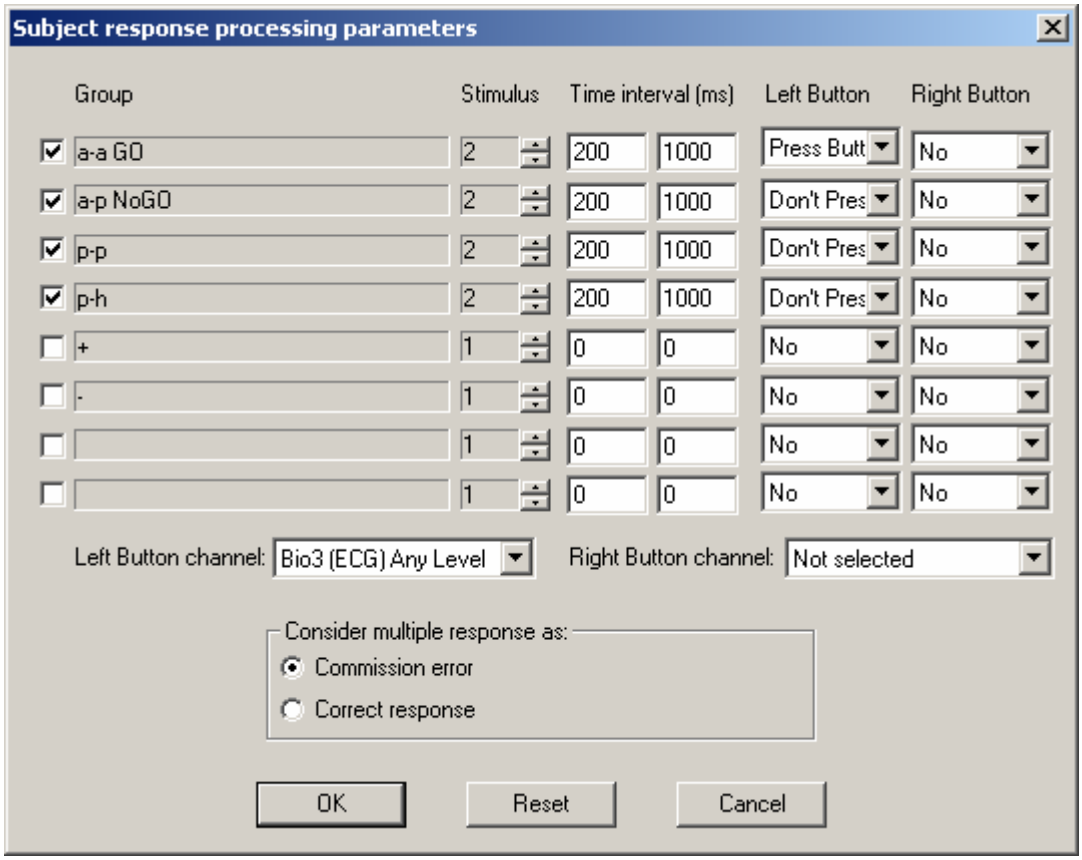
71. Artifact Rejection Thresholds dialog



Check the channels that will be tested for artifacts and define an individual threshold value for each of these channels.

72. Subject Response Processing Parameters dialog

You will need to define the following parameters for button processing:



1. Check **Groups** for which response reactions will be calculated.

2. For each of the trial groups, set the ordinal number of the **Stimulus** relative to which reaction time will be calculated.

3. Set the allowed **Time Interval** for reaction time values in milliseconds.

4. Define reaction type for **Left, Right** or both buttons.
   One of the following reaction types can be chosen:
   No - don't analyze signal from the button
   Press - patient must press the button in response to stimulus presentation. Average reaction time, number of correct trials and number of errors will be determined during processing. A trial is treated as an error if the patient did not press the button, or pressed it more than once, or pressed it not within the time interval that had been defined.
   Don't Press - patient must not press the button in response to stimulus presentation. Correct trials and errors (false alarms, or commissions) are counted during processing.

5. Choose a **Channel** for each registered.
   Attention! There are different modifications of buttons: simple button – one level button, advanced button – two levels button and digital button. Setting of button channel depends on what type of button was used. “Any level” signal should be used for simple button. Both “Low level” and “High level” signal can be used for advanced button if the subject press both key during investigation. The digital inputs (“Dig1”, “Dig2”…) should be used for digital button.

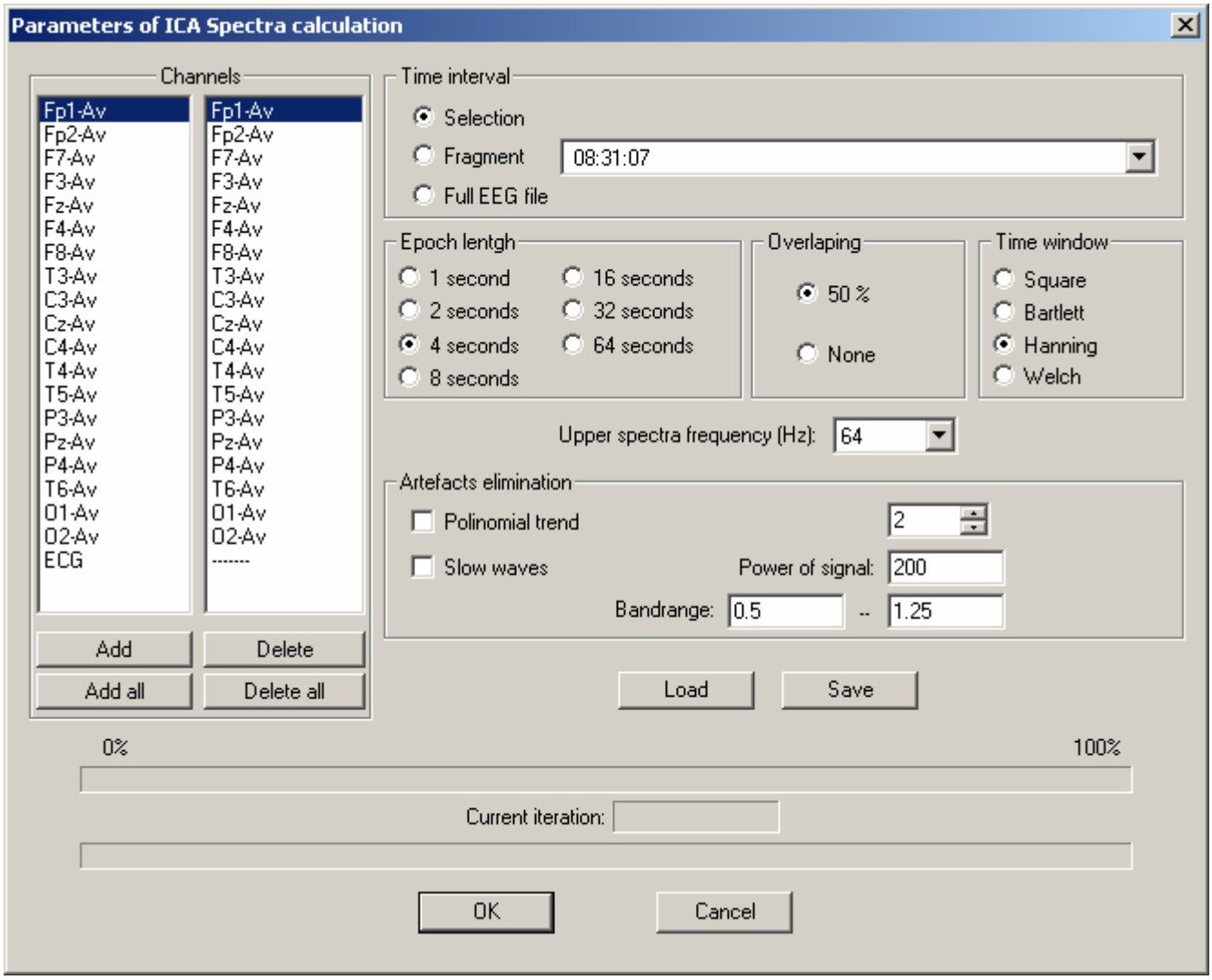
6. Choose the agreement concerning multiple subject responses during specified processing time interval. (**Consider multiple response** as group of fields)
   One of the following options can be chosen:
   Commission error – all subject responses during specified processing time interval will be considered as commission errors.
   Correct response – all subject responses during specified processing time interval will be considered as correct subject response.

Press **Reset** to reset default parameters.

Press **Cancel** to cancel response processing.

Note. Response processing results can be viewed in **Results Of Averaging And Subject Response Processing dialog** called by **Analysis: Group Info... command** (in an **ERP window**.)

73. Parameters of ICA spectra calculation dialog



Channels

Select the channels which signals you wish to process. Use **Add**, **Delete**, **Select All** and **Deselect All** buttons.

Time Interval

Define EEG interval to be processed.

Selection	Process interval between two vertical markers
Fragment	Process fragment selected from the list
Full EEG file	Process the whole file

Epoch Length

Select epoch length for analysis. Spectrum step is derived from epoch length:

1 second	1 Hz spectrum step.
2 seconds	0.5 Hz spectrum step.
4 seconds	0.25 Hz spectrum step.
8 seconds	0.125 Hz spectrum step.
16 seconds	0.0625 Hz spectrum step.
32 seconds	0.03125 Hz spectrum step.
64 секунды	0.015625 Hz spectrum step.

Overlapping

50 %	Choose this option if a non-square time window is used
None	Choose this option if a square time window is used

Time window

Choose time window type. Time windows are used to suppress side lobe infiltration by smoothing a source realization (epoch) to decrease sharp variations in its initial and final intervals.

Square	w[j] = 1
Bartlett	w[j] = 1 – abs((j – 0.5 N) / 0.5 N)
Hanning	w[j] = 0.5 (1 – cos (6.28 j / N))
Welch	w[j] = 1 – ((j – 0.5 N) / 0.5 N) ((j – 0.5 N) / 0.5 N)

Upper spectra frequency

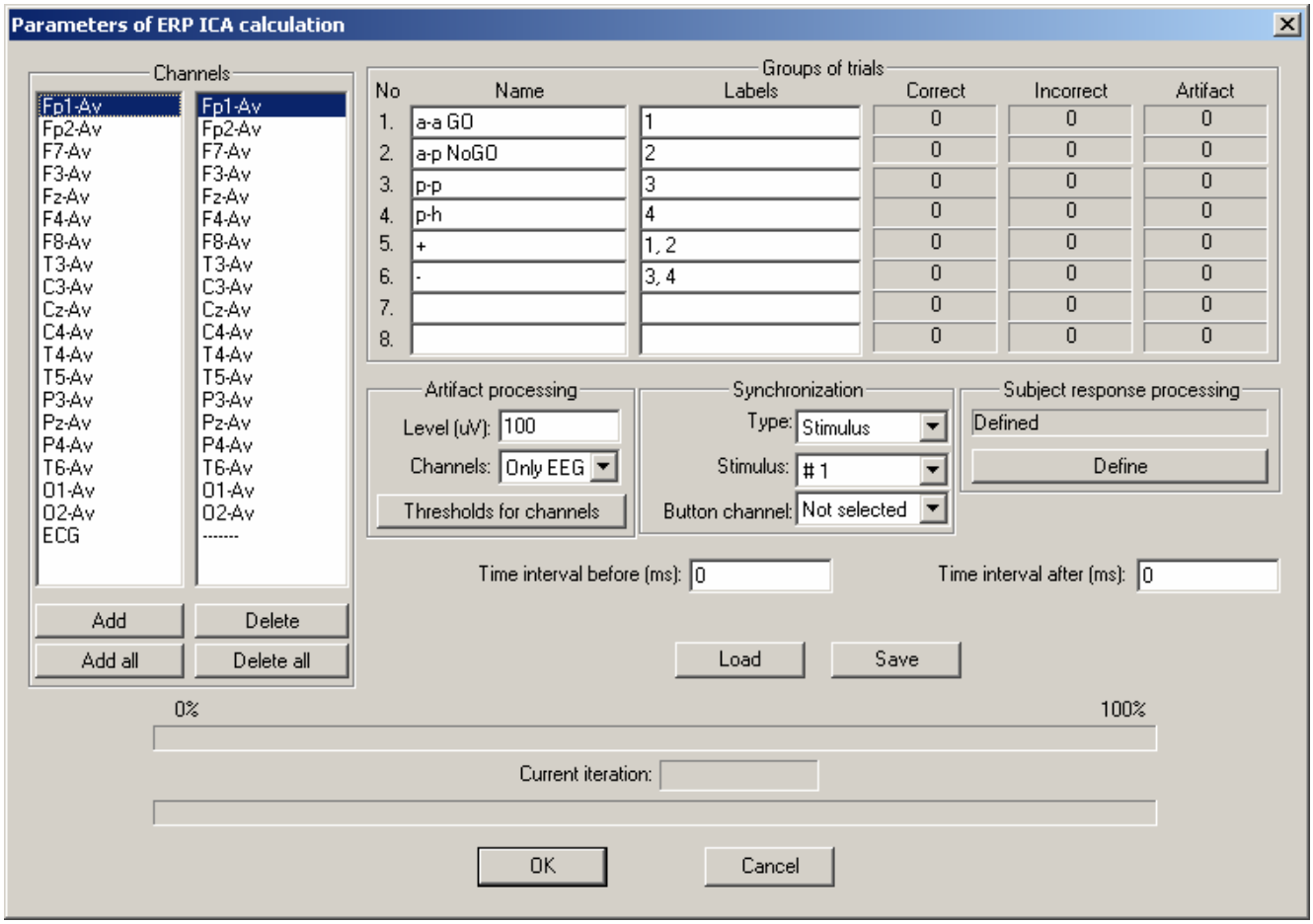
Choose upper spectra frequency (their length)

Artifact elimination

Check options to define types of artifacts to be eliminated.

Polynomial trends	Polynomial trend is estimated for each epoch and each channel and eliminated from source signal **Additional parameter**: polynomial order
Slow waves	Epochs with too large slow-wave signal component (cause by eye motion or other artifact) are eliminated from averaging. **Additional parameters**: 1) maximal allowed slow-wave power, 2) frequency band to be treated as slow-wave.

74. Parameters of ERP ICA spectra dialog



Channels

Select the channels which signals you wish to process. Use **Add**, **Delete**, **Select All** and **Deselect All** buttons.

Groups Of Trials

The table defines context names for trial groups (**Name** fields) and corresponding trial label lists (**Labels** fields). Up to 8 different trial groups can be defined. For each trial group, a label list is defined (label values in the list are separated by commas: 1, 2, 5, 9…). The same trial label value may be used in several different trial groups. For groups with empty label lists ERP would not be calculated.

On the right side of the table there are fields for displaying statistical results of trial grouping, artifact analysis and response processing. The **Correct** fields show number of trials in each group when the patient performed the task correctly. The **Incorrect** fields show number of trials when the patient performed the task incorrectly.

Task performing correctness is controlled by monitoring button states according to **Subject Response Processing** parameters. Number of trials treated as artifact is displayed in the **Artifact** fields.

Artifact Processing

The following parameters are used for automatic artifact analysis and elimination:

Level - set threshold value (in uV). An EEG interval (a trial) is treated as artifact if an ERP absolute value for any channel and for any bin exceeds Level value.

Channels - define channels to be processed for artifact analysis. Possible options are:

All - process all channels
Only EEG - process only EEG channels
Only Bio - process only Bio channels
Table - the defined channel table is used and Level value is ignored
Don't Reject - artifacts are not eliminated

Use the **"Threshold for channels"** button to define a list of channels to be processed and individual threshold values for artifact analysis. This button calls **Artifact Rejection Thresholds dialog**.

Synchronization

Several stimuli are allowed to be presented during one trial. Also, pre- and poststimulus intervals may change from trial to trial even if trials belong to one averaging group. In this case it is necessary to set additional parameters to synchronize trials correctly when averaging them. Moreover, some tasks may need analyzing ERPs preceding the response reaction.

Type - select trial synchronization type:
Stimulus - standard trial synchronization for ERP calculation
Button - trials are synchronized by the start of response reaction, i.e. by the moments when the patient's finger presses the button.
Spike – trials are ignored. Averaged sweeps are selected using spike detection information. Subject response is not processed.
Stimulus - set the synchronizing stimulus number for **Stimulus** trial synchronization
Button Channel - set the number of the channel acquiring button signal for **Button** synchronization
Attention! There are different modifications of buttons: simple button – one level button, advanced button – two levels button and digital button. Setting of button channel depends on what type of button was used. "Any level" signal should be used for simple button. Both "Low level" and "High level" signal can be used for advanced button if the subject press both key during investigation. The digital inputs ("Dig1", "Dig2"…) should be used for digital button.

Subject Response Processing

Press **Define** button to define or to modify parameters for subject response processing. The **Subject Response Processing Parameters dialog** will appear.

Time Interval Before (ms)

If the parameter value exceeds zero and the interval from the trial beginning till the synchronizing stimulus (see above) exceeds this value, resulting trial will be shortened from its start.

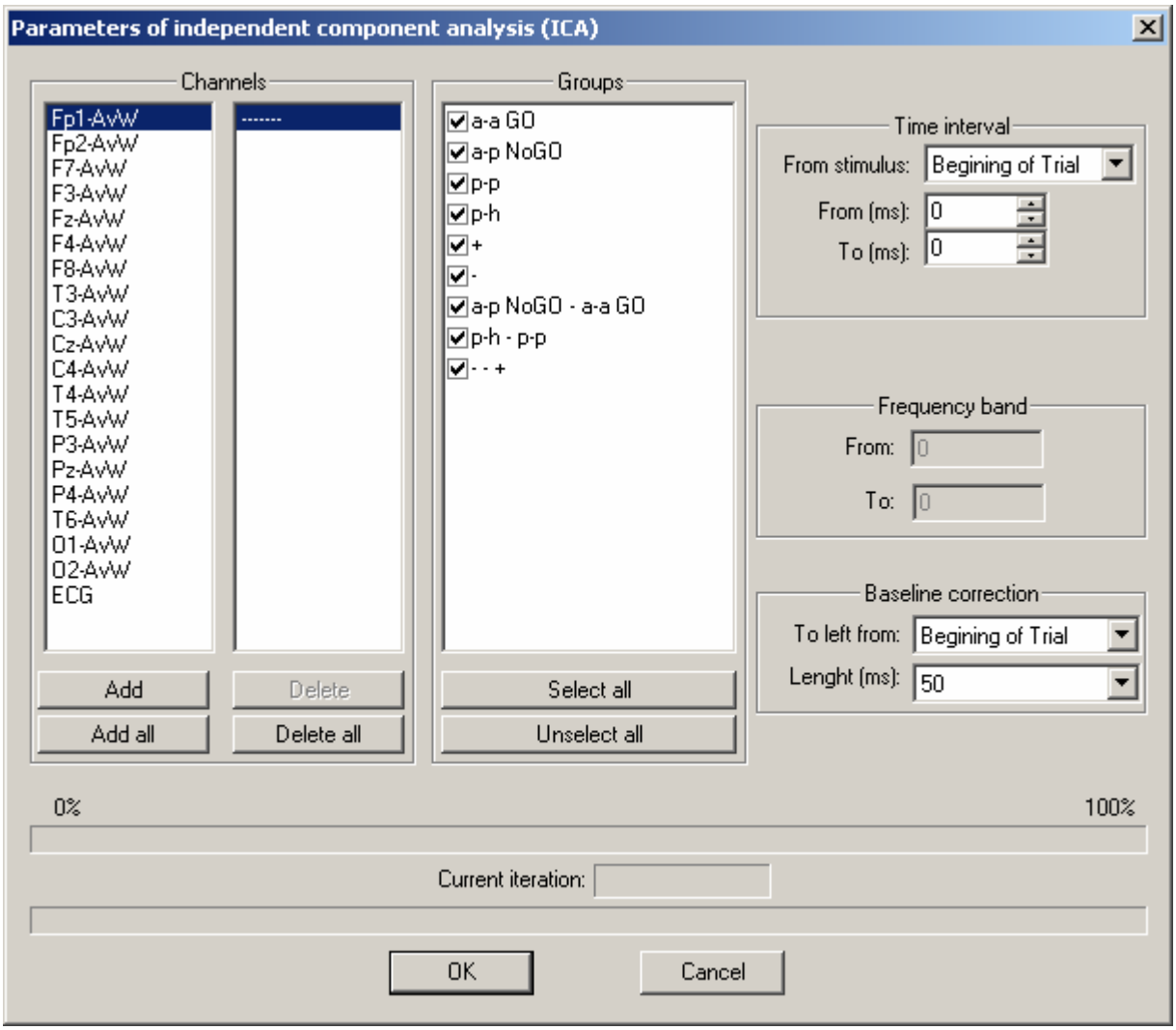
Time Interval After (ms)

If the parameter value exceeds zero and the interval from the trial beginning till the synchronizing stimulus (see above) exceeds this value, resulting trial will be shortened from its end.

Press **Load** button to read parameter values from a file.

Press **Save** button to save current parameter values to a file.

75. Parameters of independent component analysis (ICA) dialog



Channels

Select the channels you wish to export ERP from. Use **Add**, **Delete**, **Select All** and **Deselect All** buttons.

Groups

Select the trial groups for which you wish to export ERP. To select or to unselect all groups quickly, use **Select All** and **Deselect All** buttons.

Time Interval

Set the time interval you wish to export data for. The following interval parameters need to be set:

From: - sets the starting point. You can start at the very beginning of the trial or at the moment when one of the stimuli is presented.

From (ms): - sets the beginning of the interval to export (in relation to the starting point).

To (ms): - sets the end of the interval to export (in relation to the starting point).

Baseline correction

Specify parameters for baseline correction:

To left from: Define stimulus before time interval will be chosen for estimation of baseline average potential.

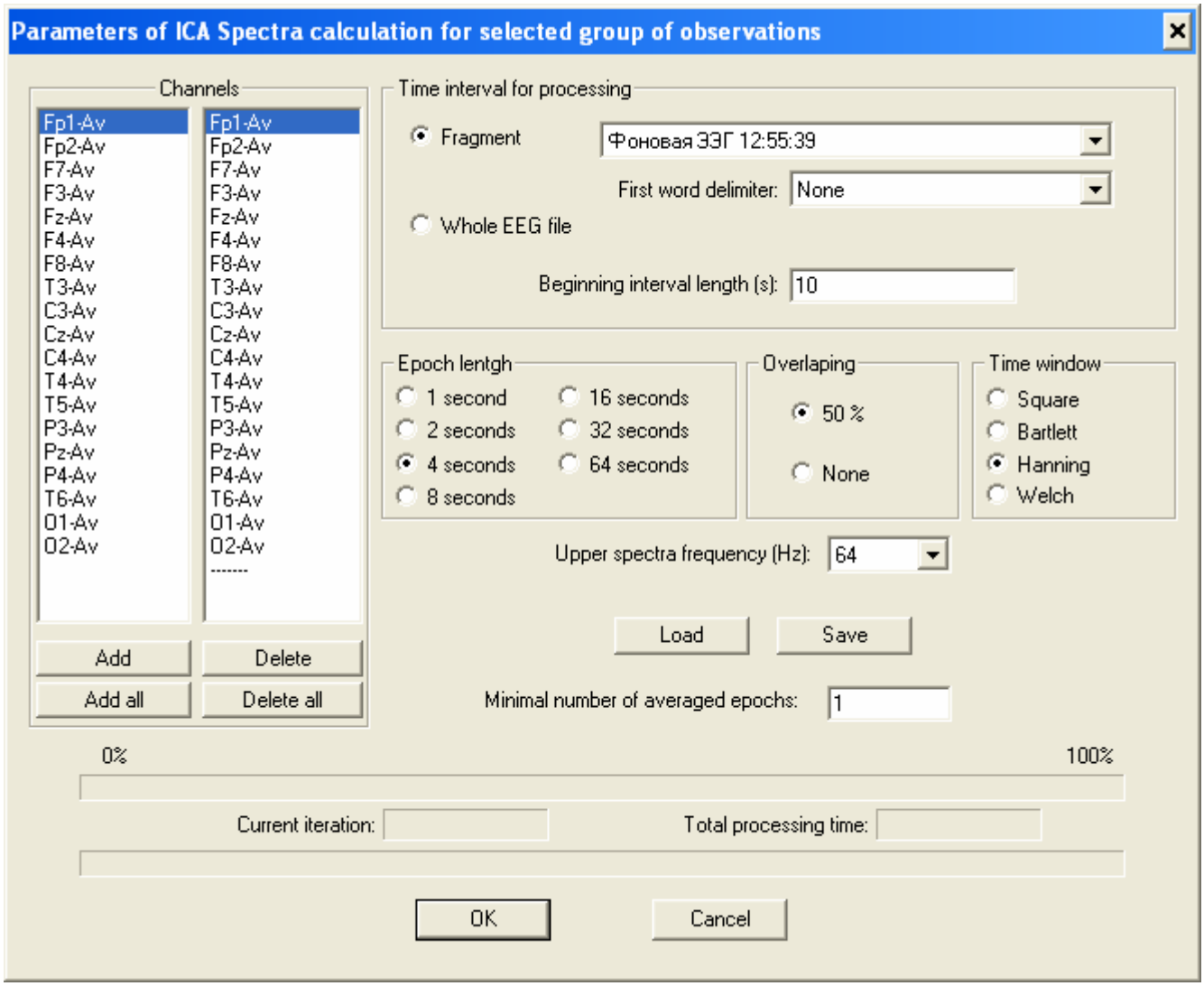
Length: Define length if time interval used for estimation of baseline average potential.

Attention!!! These parameters are not used in this version of program.

Frequency band:

Specify frequency band for which average power or coherence will be calculated.

76. Parameters of ICA Spectra calculation for selected group of observations dialog



Channels

Select the channels which signals you wish to process. Use **Add**, **Delete**, **Select All** and **Deselect All** buttons.

Time Interval

Define EEG interval to be processed.

Fragment	Process fragment selected from the list
Whole EEG file	Process the whole file

First word delimiter

Use this list to select delimiter of first word in fragment name. This option is very useful if EEG recordings have different names of fragments but there is a common part at the beginning of one.

Beginning interval length

Define maximal duration of artifact free EEG record for each selected file included in estimation of component topographies matrix (see above). This parameter should not be very large because computational time and computer memory consumption problems can occur.

Epoch Length

Select epoch length for analysis. Spectrum step is derived from epoch length:

1 second	1 Hz spectrum step.
2 seconds	0.5 Hz spectrum step.
4 seconds	0.25 Hz spectrum step.
8 seconds	0.125 Hz spectrum step.
16 seconds	0.0625 Hz spectrum step.
32 seconds	0.03125 Hz spectrum step.
64 секунды	0.015625 Hz spectrum step.

Overlapping

50 %	Choose this option if a non-square time window is used
None	Choose this option if a square time window is used

Time window

Choose time window type. Time windows are used to suppress side lobe infiltration by smoothing a source realization (epoch) to decrease sharp variations in its initial and final intervals.

Square	w[j] = 1
Bartlett	w[j] = 1 – abs((j – 0.5 N) / 0.5 N)
Hanning	w[j] = 0.5 (1 – cos (6.28 j / N))
Welch	w[j] = 1 – ((j – 0.5 N) / 0.5 N) ((j – 0.5 N) / 0.5 N)

Upper spectra frequency

Choose upper spectra frequency (their length)

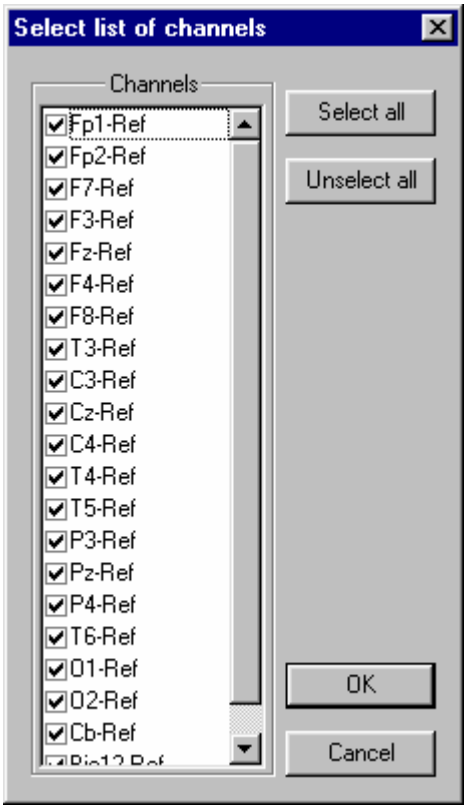
Minimal number of averaged epochs

Define this parameter to automatically exclude EEG recordings with large amount of artifacts from future analysis.

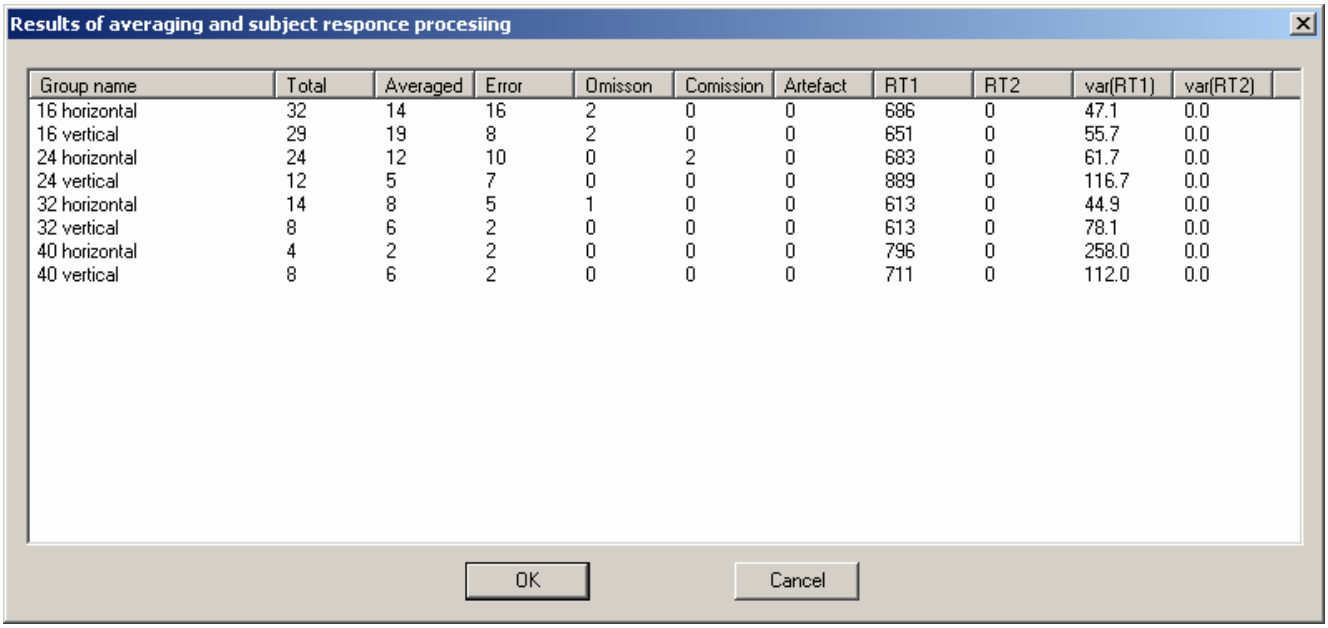
77. Select List Of Channels dialog

Select channels to be depicted by graphs or maps in an **ERP Window**.

Use **Select All** and **Deselect All** buttons to select or to deselect all channels.



78. Results Of Averaging And Subject Response Processing dialog



The table of ERP averaging results consists of the following columns:

Group Name - group names; can be edited.

Total - total number of trials of the given group in the source EEG data (as result of trial label sorting).

Averaged - number of trials used to average ERPs. This value is obtained as result of subtracting **Artifact**, **Omission** and **Commission** values from the **Total** value (for the given group).

Error - number of trials when the patient pressed incorrect button

Omission - number of trials when the patient should press the button in response to the stimulus but didn't do it.

Commission - number of trials when the patient should ignore the stimulus but pressed the button instead.

Artifacts - number of artifact trials.

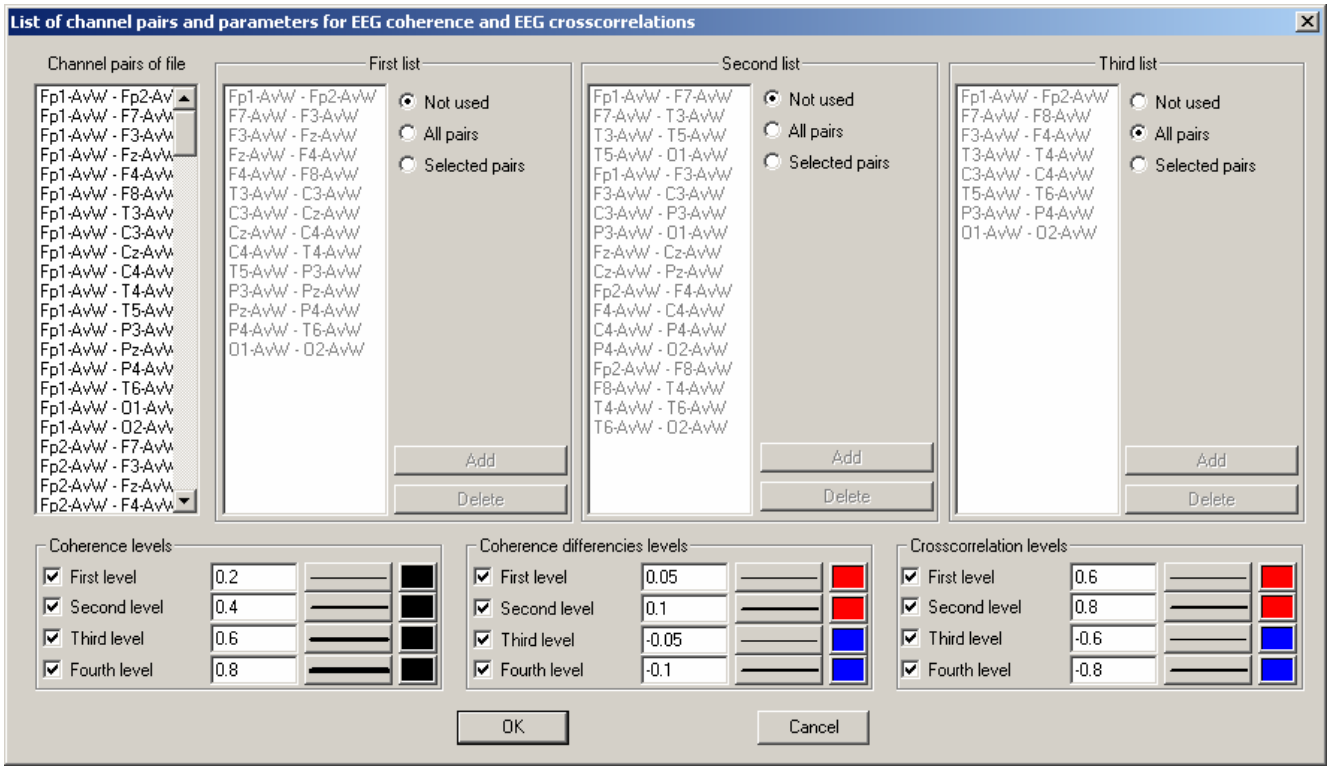
RT1 - mean reaction time for the "1st" button.

RT2 - mean reaction time for the "2nd" button.

var(RT1) - mean square variation of reaction time for the "1st" button.

var(RT2) - mean square variation of reaction time for the "2nd" button.

79. List of channel pairs and parameters for EEG coherence and EEG cross-correlations dialog



Channel pairs of file – list of existing channel pairs. Select channel pairs that will be added into one of tree channel pairs list.

First list, Second list and Third list – Three independent lists of channel pairs.

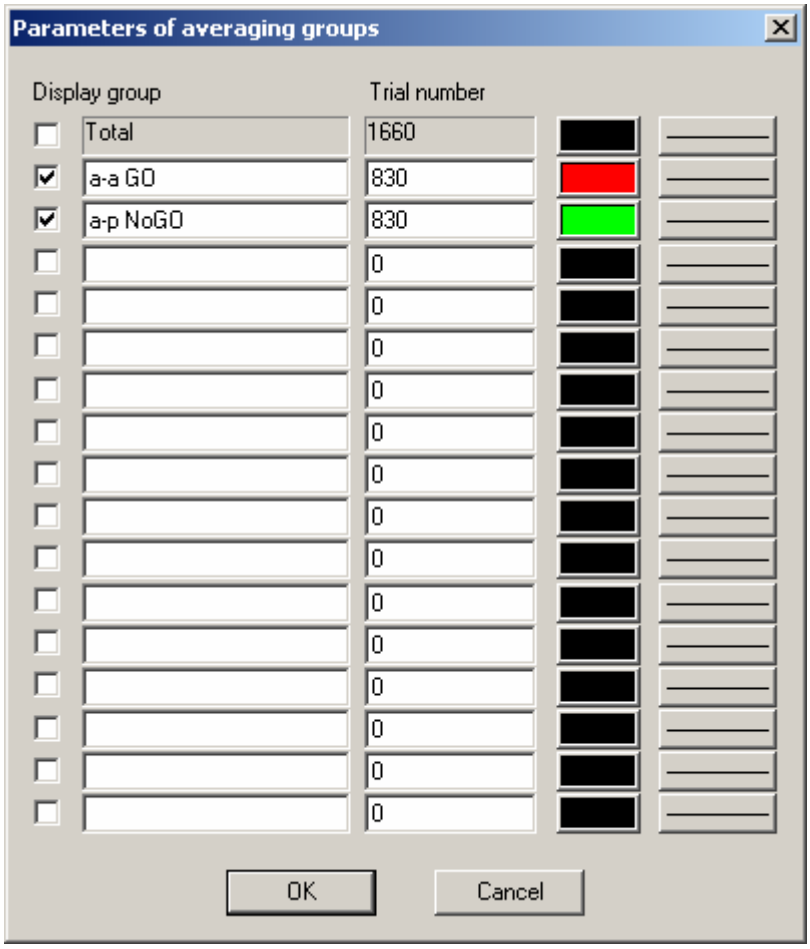
Not used, All pairs and **Selected pairs** radio buttons defines using mode if each channel pairs list.

Add buttons – Press this button to add selected in left list pairs into corresponding list of pairs.

Delete button - Press this button to delete selected pairs from corresponding list of pairs.

Three sets of buttons and fields **Coherence levels, Coherence differences levels and Cross-correlation levels** helps to define thresholds, curves style and curves colors using by interaction diagrams displaying procedure.

80. Parameters of averaging groups dialog



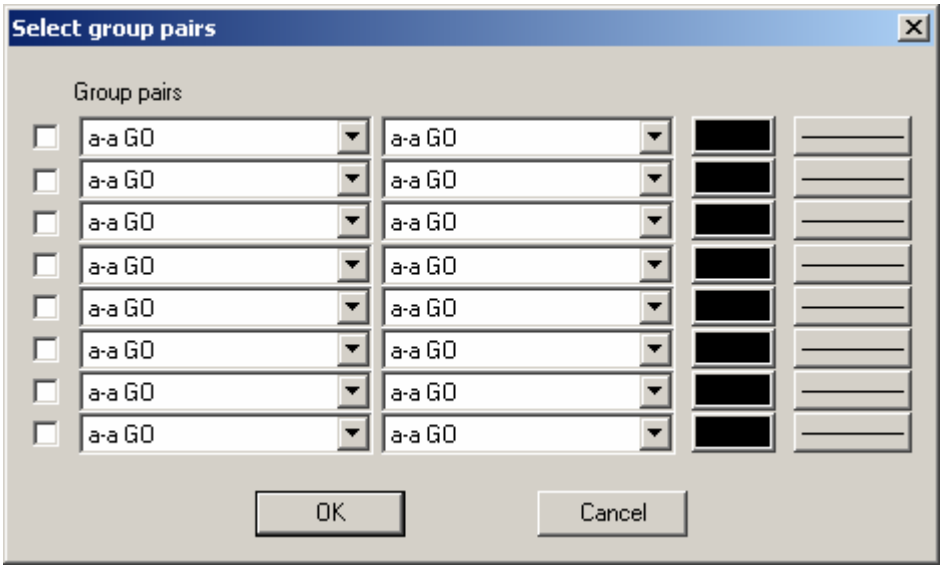
This dialog window allows select a list of groups for displaying them in ICA window.

The additional possibility is to define colors and line style for graphics.

Finally there is a possibility to rearrange the data and define new averaging groups. The new group names and trial number should be defined.

Attention!!! The sum of trials for all newly defined groups should be equals the total number of trials in the file.

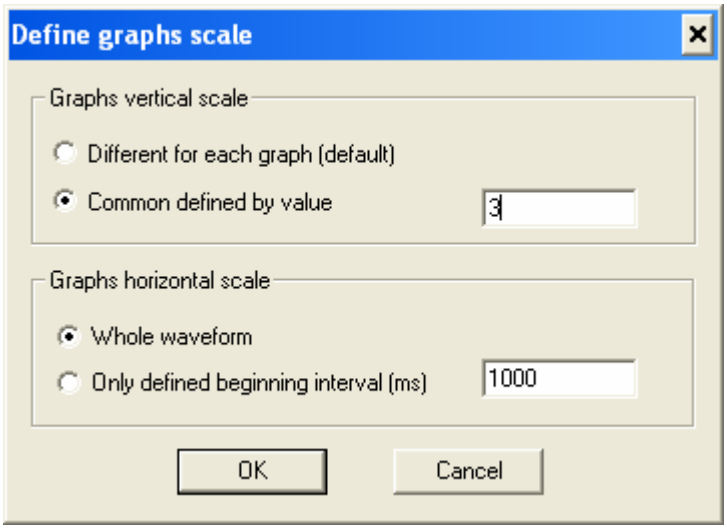
81. Select averaging groups for displaying dialog



This dialog window allows select a list of groups for displaying them in ICA window.

The additional possibility is to define colors and line style for graphics.

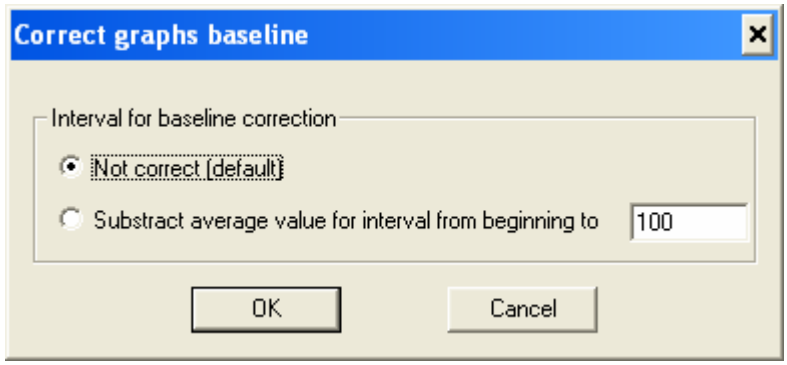
82. Define graphs scale dialog



By default independent components graphs have individual vertical scale. This dialog allows define common scale for all graphs with specific value. **Graphs vertical scale** fields group provides these changes.

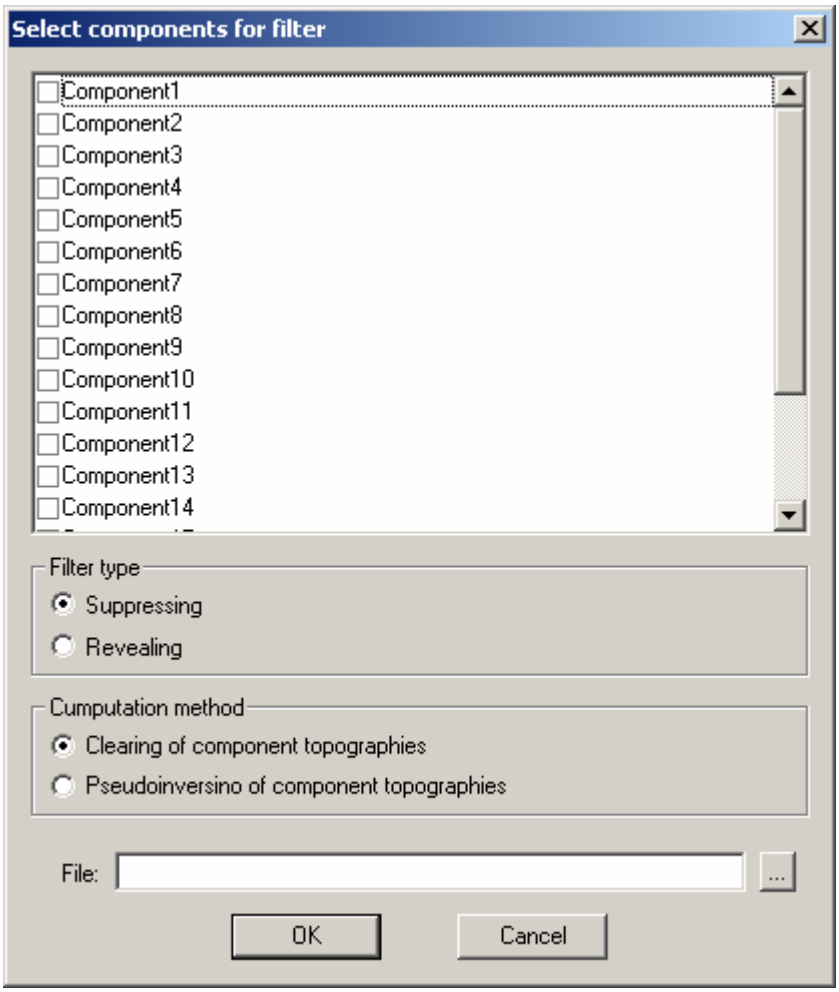
By default whole duration of independent components time interval is displayed. The **Graphs horizontal scale** fields group allows set to display only beginning time interval with specified duration

83. Correct graphs baseline dialog



By default no baseline correction is performed. For ICA ERP it is useful to make baseline correction if prestimulus time interval exists. This dialog allows specify the duration of baseline time interval.

84. Select components for filter dialog



Check the components using for spatial filter computing.

Type of filter:

Specify type of spatial filter that will be computed:

Suppressing – Compute spatial filter that will suppress selected components from raw multi-channel EEG or ERP.

Revealing - Compute spatial filter that will reveal selected components from raw multi-channel EEG or ERP.

Computation method:

Specify method for spatial filter computation

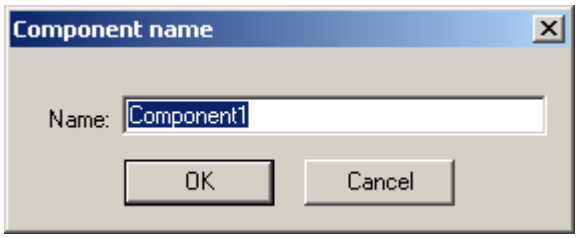
Clearing of component topographies - Compute spatial filter by clearing unchecked component topographies

Pseudo inversion of component topographies - Compute spatial filter by Moore-Penrose pseudo inversion of rectangular (not squared) matrix of checked component topographies.

File:

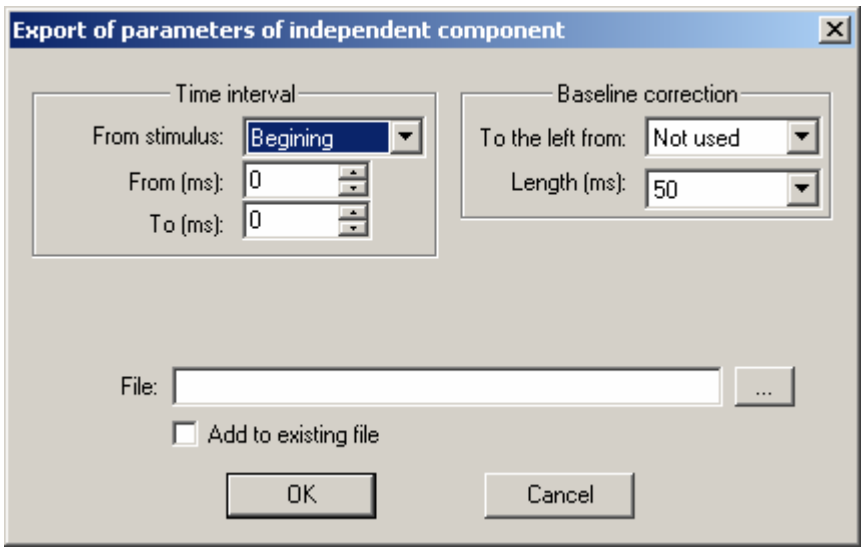
Define output file name

85. Component name dialog



Enter new name for selected component.

86. Export of parameters of independent component dialog



Specify the parameters for export

Time Interval

Set the time interval you wish to export data for. The following interval parameters need to be set:

From stimulus: - sets the starting point. You can start at the very beginning of the trial or at the moment when one of the stimuli is presented.

From (ms): - sets the beginning of the interval to export (in relation to the starting point).

Baseline correction

Specify parameters for baseline correction:

To left from: Define stimulus before time interval will be chosen for estimation of baseline average potential.

Length: Define length if time interval used for estimation of baseline average potential.

File:

Define output file name

Add to existing file

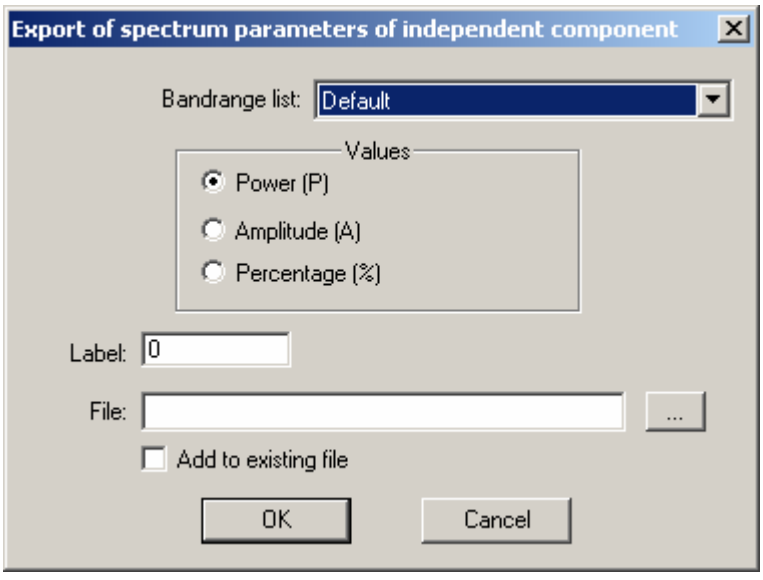
Check this option to append data to an existing file otherwise the file will be rewritten. File appending may be useful for arranging data of several investigations in an entire table for further statistical analysis.

The output file consists of four columns:

1. First column – order number of trial.
2. Second – order number of averaging group.
3. Third – average value for selected time interval
4. Fourth – Latency of pick in selected time interval

Attention!!! There is no way to determine the pick latency in selected time interval absolutely exact for each trial due to a different kind of noise. Please check output data attentively and try to determine pick latency manually for incorrect output results.

86. Export of spectrum parameters of independent component dialog



Specify the parameters for export

Bandrange list

Choose what frequency band list will be used (see Setup: EEG bandranges… command)

Values

Choose what values to export:
Power (P) – absolute power values.
Amplitude (A) – square root of absolute power values.
Percentage (%)– frequency band power as a percentage of total power

Label

Specify “label” for exporting data

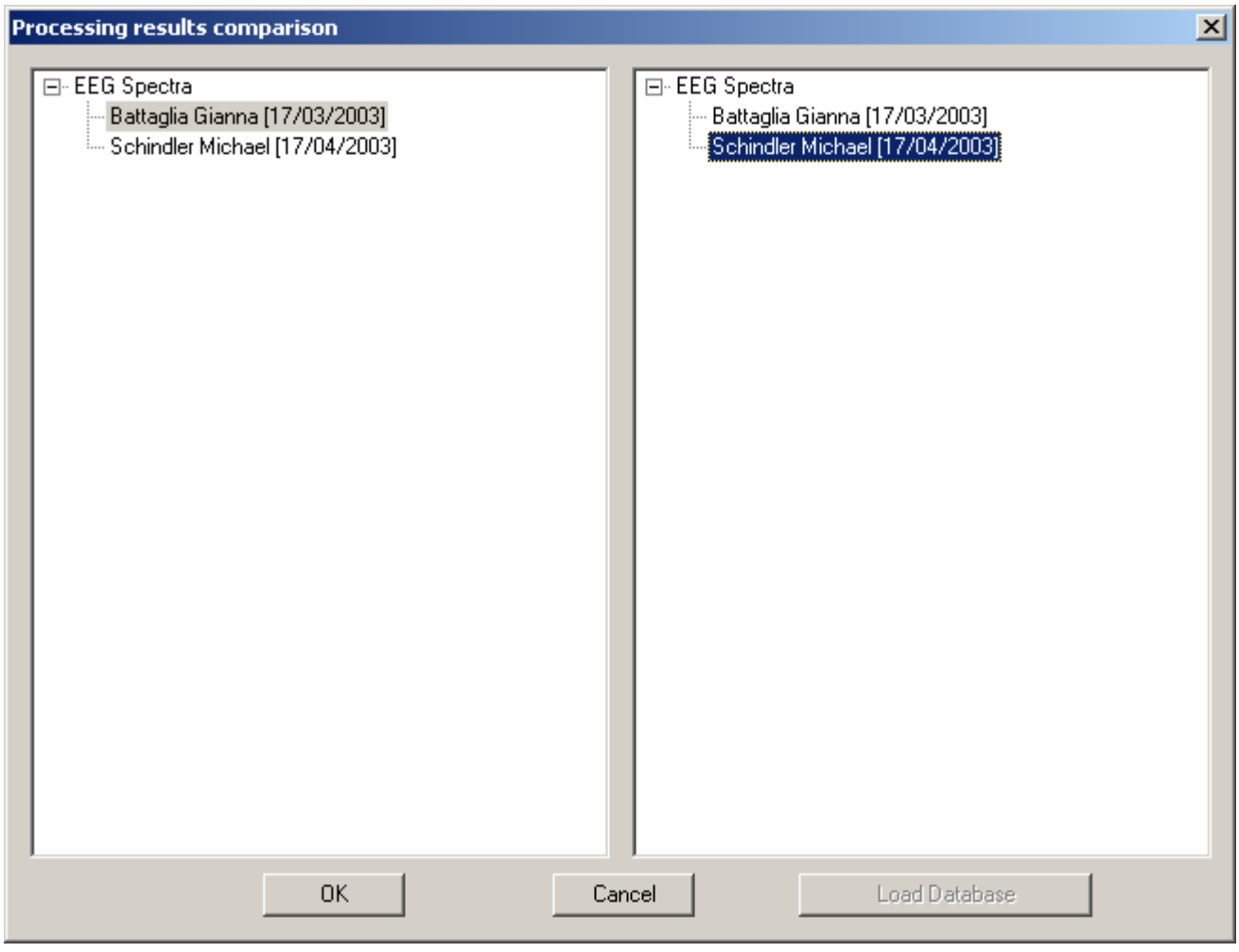
File:

Define output file name

Add to existing file

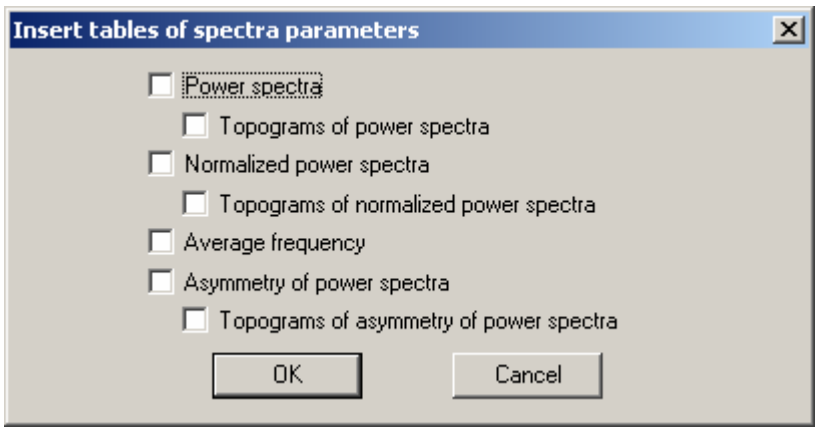
Check this option to append data to an existing file otherwise the file will be rewritten. File appending may be useful for arranging data of several investigations in an entire table for further statistical analysis.

87. Processing results comparison dialog



Select spectra, ERP or ERP from the left and right list for comparison.
Press button Load Database to load a list of processing results included in normative database.
Press button OK to compute the differences between spectra (ERP or ERD) and open corresponding Spectra (ERP or ERD) window.

88. Insert tables of spectra parameters dialog

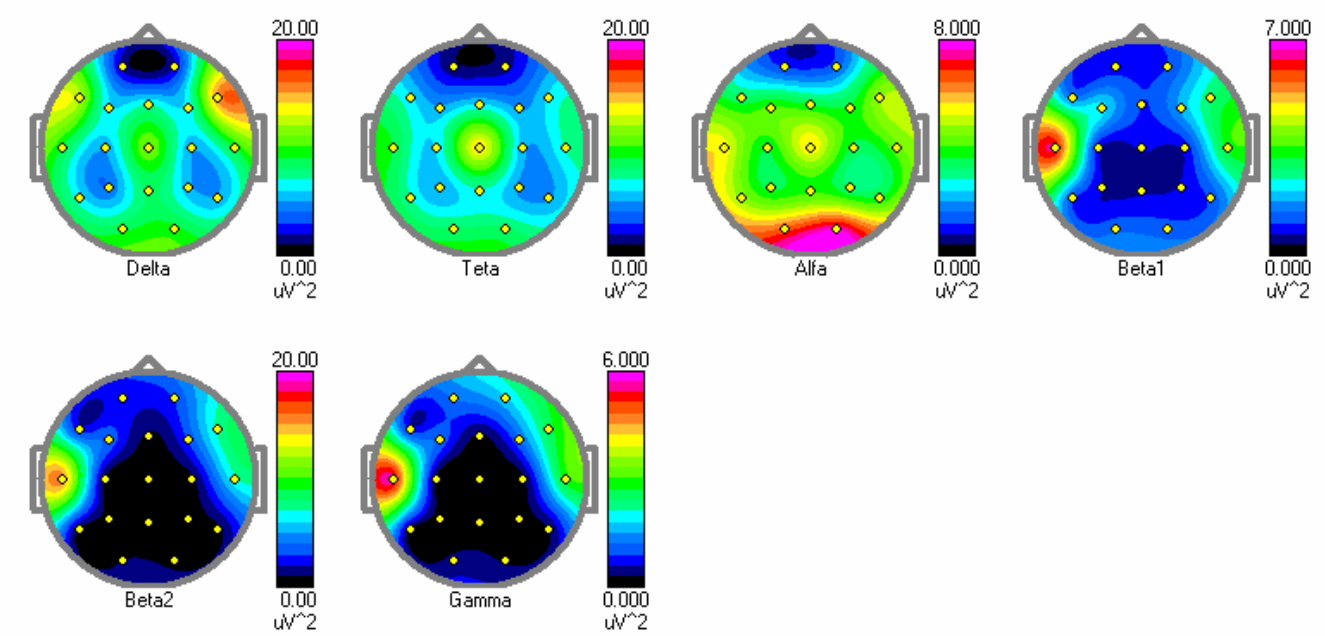


Select type of tables and maps while you would like to insert into MS Word. The result of this function is placed below:

Name: Schindler Michael
Date of observation: 17/04/2003
Total epoch number: 76
Time interval duration: 181.472 s

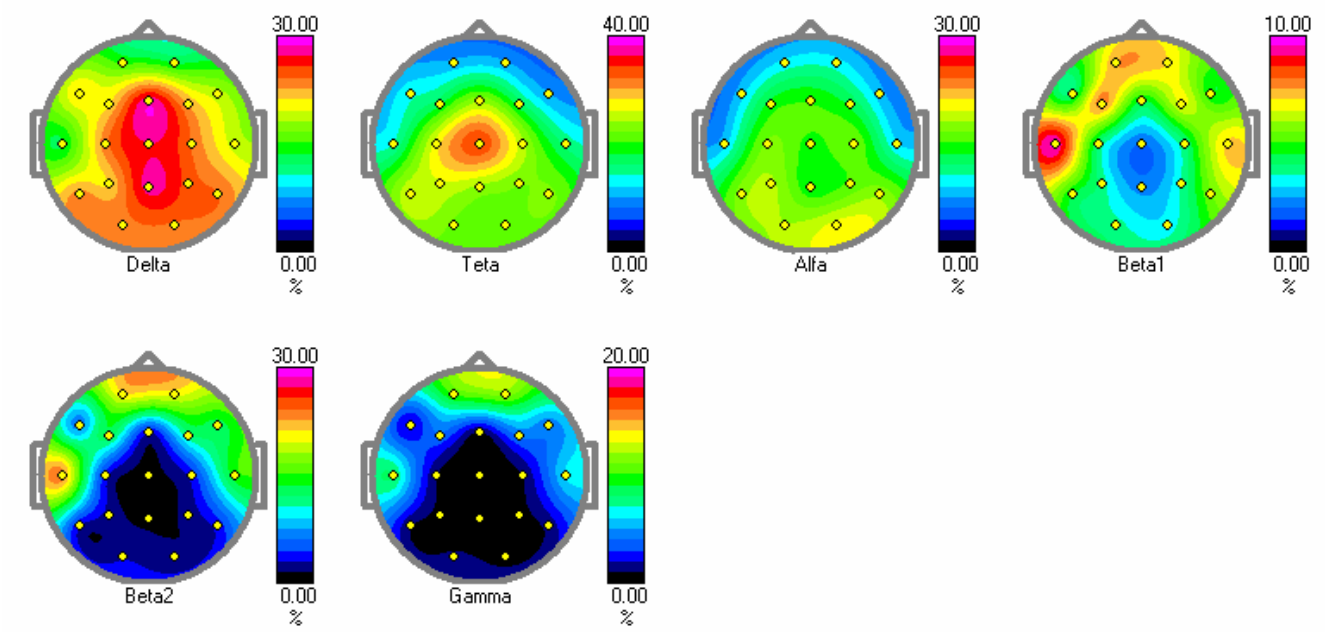
Average power of spectra (uV^2)

	Delta	Theta	Alfa	Beta1	Beta2	Gamma	Total
Fp1-AvW	1.78 : 0.20	1.25 : 0.11	1.09 : 0.08	0.87 : 0.08	2.54 : 0.22	1.24 : 0.13	12.32 : 0.56
Fp2-AvW	2.19 : 0.30	1.58 : 0.18	1.42 : 0.11	1.08 : 0.11	3.20 : 0.23	1.82 : 0.21	16.55 : 1.37
F7-AvW	12.38 : 3.15	6.23 : 0.96	3.25 : 0.28	1.45 : 0.10	2.56 : 0.16	0.77 : 0.06	64.65 : 15.04
F3-AvW	6.31 : 0.82	5.06 : 0.53	4.04 : 0.30	2.23 : 0.16	3.74 : 0.28	1.13 : 0.08	30.01 : 1.60
Fz-AvW	7.00 : 0.78	6.11 : 0.88	3.58 : 0.31	1.05 : 0.08	0.80 : 0.06	0.26 : 0.02	25.62 : 1.93
F4-AvW	6.66 : 0.82	4.79 : 0.37	3.65 : 0.29	1.91 : 0.14	3.39 : 0.21	1.24 : 0.14	29.79 : 1.64
F8-AvW	15.38 : 4.07	6.26 : 0.71	4.75 : 0.46	2.73 : 0.17	7.38 : 0.46	2.58 : 0.36	80.26 : 14.80
T3-AvW	9.00 : 1.23	9.01 : 0.93	5.40 : 0.56	6.23 : 0.69	15.31 : 1.66	5.43 : 0.89	69.83 : 11.22
C3-AvW	5.23 : 0.57	6.07 : 0.61	3.65 : 0.25	0.89 : 0.06	0.83 : 0.06	0.24 : 0.03	22.50 : 1.15
Cz-AvW	10.91 : 1.25	13.67 : 1.54	5.47 : 0.46	0.75 : 0.04	0.48 : 0.03	0.13 : 0.01	40.03 : 2.55
C4-AvW	5.20 : 0.50	5.36 : 0.52	3.43 : 0.25	0.83 : 0.06	0.77 : 0.05	0.23 : 0.02	21.78 : 1.12
T4-AvW	9.06 : 1.01	7.18 : 0.72	4.26 : 0.33	3.30 : 0.27	6.76 : 0.68	2.84 : 0.22	48.85 : 4.09
T5-AvW	6.65 : 0.65	7.24 : 0.68	4.79 : 0.35	1.23 : 0.09	0.89 : 0.08	0.32 : 0.04	28.59 : 1.75
P3-AvW	4.15 : 0.41	5.00 : 0.50	3.54 : 0.26	0.73 : 0.05	0.48 : 0.04	0.14 : 0.02	19.93 : 1.25
Pz-AvW	8.18 : 0.91	6.82 : 0.74	3.91 : 0.24	0.65 : 0.06	0.34 : 0.02	0.11 : 0.01	30.34 : 2.31
P4-AvW	5.32 : 0.57	4.71 : 0.52	3.21 : 0.20	0.76 : 0.05	0.43 : 0.03	0.13 : 0.01	21.77 : 1.29
T6-AvW	5.31 : 0.55	4.97 : 0.47	3.73 : 0.28	1.17 : 0.08	0.78 : 0.08	0.30 : 0.04	22.22 : 1.23
O1-AvW	8.81 : 0.88	8.27 : 0.77	6.63 : 0.54	1.36 : 0.10	1.03 : 0.07	0.44 : 0.04	38.35 : 2.47
O2-AvW	9.46 : 0.89	8.29 : 0.71	7.74 : 0.50	1.25 : 0.10	0.78 : 0.05	0.28 : 0.03	40.26 : 2.43



Average values of normalized spectra (%), Normalization frequency band: 0.0-64.0 Hz

	Delta	Theta	Alfa	Beta1	Beta2	Gamma
Fp1-AvW	14.50 : 1.50	10.28 : 0.80	9.19 : 0.75	7.38 : 0.76	20.85 : 1.62	10.23 : 1.06
Fp2-AvW	13.01 : 1.22	9.99 : 0.99	9.38 : 0.87	6.95 : 0.72	20.43 : 1.43	11.61 : 1.35
F7-AvW	20.83 : 2.03	13.20 : 1.65	8.23 : 1.18	3.88 : 0.60	6.79 : 0.96	1.96 : 0.27
F3-AvW	20.61 : 1.98	16.96 : 1.49	13.79 : 0.98	7.70 : 0.64	12.95 : 1.12	3.91 : 0.31
Fz-AvW	27.73 : 2.43	23.28 : 1.83	14.77 : 1.29	4.49 : 0.49	3.40 : 0.30	1.09 : 0.11
F4-AvW	22.05 : 2.12	16.35 : 1.10	12.85 : 1.18	6.59 : 0.51	11.80 : 0.81	4.38 : 0.58
F8-AvW	18.51 : 1.78	9.86 : 1.18	7.96 : 1.03	4.61 : 0.49	12.97 : 1.57	4.42 : 0.81
T3-AvW	13.39 : 1.29	13.98 : 1.29	8.35 : 0.61	9.47 : 0.79	23.12 : 1.61	7.93 : 0.64
C3-AvW	23.36 : 2.22	26.93 : 2.13	16.73 : 1.24	4.07 : 0.32	3.84 : 0.34	1.09 : 0.12
Cz-AvW	26.98 : 2.14	33.62 : 2.39	14.47 : 1.33	2.01 : 0.16	1.30 : 0.12	0.36 : 0.04
C4-AvW	23.83 : 1.82	24.48 : 1.86	16.24 : 1.24	3.98 : 0.34	3.74 : 0.31	1.08 : 0.10
T4-AvW	18.78 : 1.71	15.34 : 1.58	9.14 : 0.72	7.13 : 0.60	14.35 : 1.32	6.09 : 0.48
T5-AvW	23.18 : 1.60	25.47 : 1.77	17.22 : 1.15	4.55 : 0.39	3.32 : 0.36	1.19 : 0.17
P3-AvW	21.06 : 1.67	25.56 : 2.15	18.48 : 1.34	3.84 : 0.32	2.51 : 0.20	0.71 : 0.09
Pz-AvW	27.56 : 2.34	23.42 : 2.31	13.93 : 1.23	2.29 : 0.23	1.23 : 0.13	0.38 : 0.05
P4-AvW	24.71 : 2.24	22.05 : 2.05	15.48 : 1.16	3.65 : 0.27	2.10 : 0.17	0.62 : 0.07
T6-AvW	24.02 : 2.13	22.47 : 1.80	17.54 : 1.45	5.47 : 0.43	3.71 : 0.41	1.41 : 0.18
O1-AvW	23.44 : 1.84	21.66 : 1.54	18.07 : 1.46	3.75 : 0.32	2.90 : 0.26	1.21 : 0.13
O2-AvW	23.67 : 1.80	21.06 : 1.56	20.23 : 1.59	3.26 : 0.27	2.07 : 0.18	0.74 : 0.10



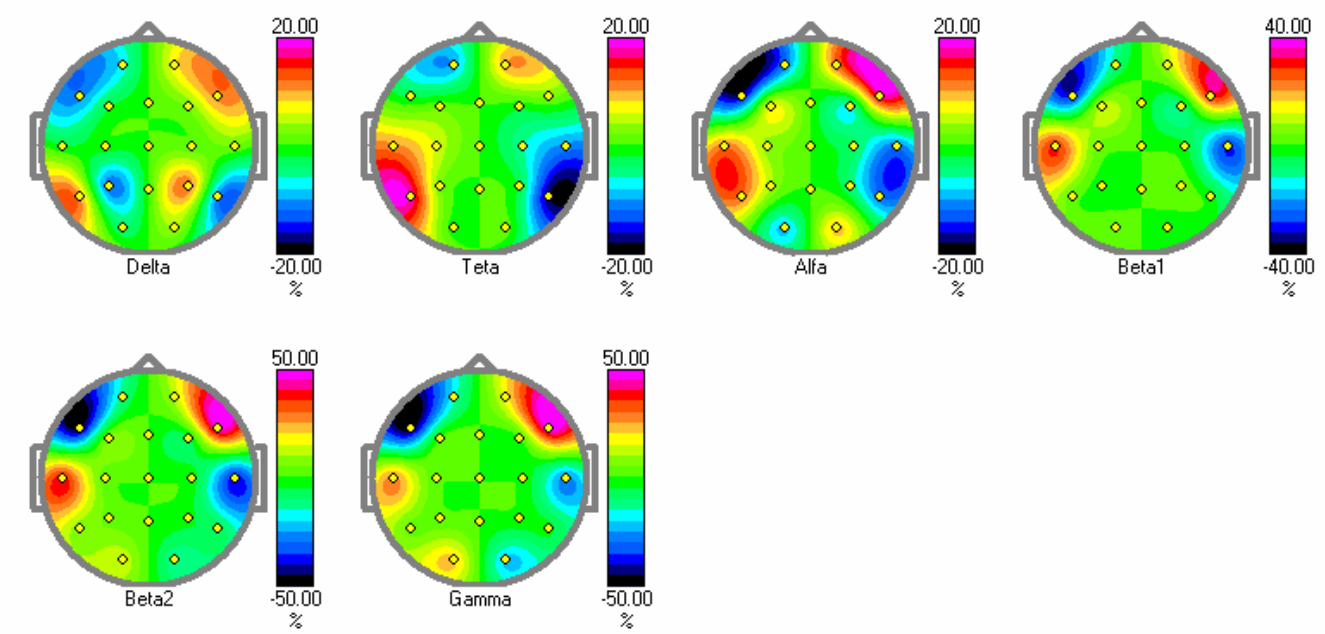
Average frequency (Hz)

	Delta	Theta	Alfa	Beta1	Beta2	Gamma	Total
Fp1-AvW	2.33 : 0.06	5.43 : 0.07	9.99 : 0.13	16.97 : 0.09	24.58 : 0.18	33.67 : 0.16	14.13 : 0.75
Fp2-AvW	2.38 : 0.06	5.38 : 0.07	10.10 : 0.11	16.84 : 0.10	24.75 : 0.17	33.77 : 0.15	14.52 : 0.77
F7-AvW	2.32 : 0.07	5.37 : 0.09	9.83 : 0.11	16.45 : 0.11	24.38 : 0.15	33.56 : 0.16	5.72 : 0.58
F3-AvW	2.41 : 0.06	5.36 : 0.07	9.83 : 0.11	16.79 : 0.11	23.98 : 0.15	34.16 : 0.16	10.11 : 0.47
Fz-AvW	2.49 : 0.06	5.43 : 0.09	9.60 : 0.11	16.35 : 0.12	23.88 : 0.15	33.64 : 0.16	5.70 : 0.23
F4-AvW	2.39 : 0.05	5.40 : 0.08	9.70 : 0.12	16.76 : 0.11	24.24 : 0.15	33.89 : 0.19	9.38 : 0.43
F8-AvW	2.33 : 0.06	5.38 : 0.09	9.91 : 0.13	16.83 : 0.11	24.68 : 0.17	33.65 : 0.20	8.61 : 0.84
T3-AvW	2.46 : 0.07	5.34 : 0.08	9.86 : 0.11	17.22 : 0.11	23.98 : 0.14	34.28 : 0.15	14.82 : 0.63
C3-AvW	2.48 : 0.06	5.45 : 0.07	9.55 : 0.09	16.45 : 0.12	23.74 : 0.13	34.02 : 0.16	6.07 : 0.23
Cz-AvW	2.52 : 0.05	5.59 : 0.08	9.10 : 0.10	16.33 : 0.10	23.71 : 0.12	33.78 : 0.14	4.86 : 0.16
C4-AvW	2.40 : 0.06	5.43 : 0.07	9.63 : 0.09	16.48 : 0.09	23.80 : 0.14	34.04 : 0.15	5.89 : 0.20
T4-AvW	2.42 : 0.06	5.36 : 0.07	9.76 : 0.12	17.09 : 0.12	23.82 : 0.18	34.66 : 0.16	12.18 : 0.61
T5-AvW	2.41 : 0.05	5.45 : 0.07	9.69 : 0.09	16.25 : 0.10	23.86 : 0.15	33.98 : 0.12	6.09 : 0.27
P3-AvW	2.38 : 0.05	5.42 : 0.09	9.51 : 0.10	16.26 : 0.11	23.53 : 0.14	33.92 : 0.12	5.49 : 0.24
Pz-AvW	2.39 : 0.06	5.40 : 0.08	9.46 : 0.09	16.27 : 0.10	23.55 : 0.13	34.04 : 0.12	4.35 : 0.20
P4-AvW	2.39 : 0.06	5.41 : 0.08	9.62 : 0.11	16.25 : 0.09	23.60 : 0.13	33.93 : 0.14	4.98 : 0.21
T6-AvW	2.36 : 0.06	5.38 : 0.06	9.79 : 0.10	16.25 : 0.11	23.80 : 0.14	34.10 : 0.16	6.38 : 0.29
O1-AvW	2.42 : 0.06	5.38 : 0.06	9.75 : 0.11	16.28 : 0.12	24.03 : 0.15	34.15 : 0.14	5.80 : 0.25
O2-AvW	2.42 : 0.06	5.36 : 0.07	9.49 : 0.08	16.21 : 0.11	23.90 : 0.13	33.96 : 0.13	5.33 : 0.25

Average asymmetry for power spectra (%)

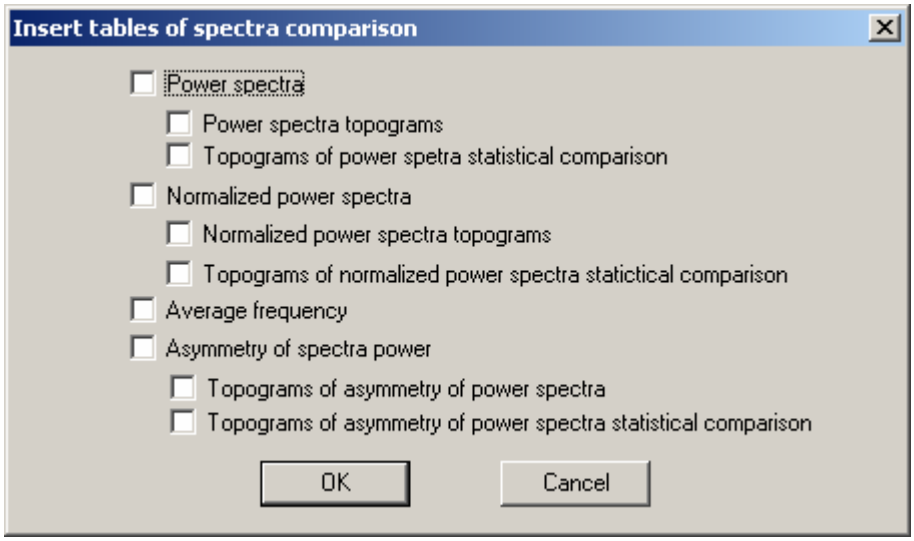
	Delta	Theta	Alfa	Beta1	Beta2	Gamma	Total
Fp2-AvW/Fp1-AvW	7.41 : 7.28	9.59 : 4.53	12.31 : 4.32	9.71 : 3.82	12.49 : 2.72	18.17 : 2.19	12.56 : 3.38
F4-AvW/F3-AvW	2.97 : 5.50	-0.81 : 5.20	-5.09 : 5.05	-7.58 : 4.72	-3.93 : 3.98	1.38 : 4.48	-0.41 : 2.87
F8-AvW/F7-AvW	11.40 : 6.95	2.79 : 5.41	17.32 : 5.23	30.14 : 3.62	47.25 : 3.41	48.72 : 3.76	16.50 : 4.13
C4-AvW/C3-AvW	0.74 : 6.43	-5.61 : 5.31	-3.35 : 4.67	-3.21 : 4.70	-2.63 : 3.55	-1.55 : 4.00	-1.57 : 3.25
T4-AvW/T3-AvW	1.70 : 6.17	-10.75 : 5.16	-11.22 : 3.84	-27.92 : 4.50	-37.48 : 4.18	-26.60 : 4.51	-14.79 : 3.63
P4-AvW/P3-AvW	10.94 : 6.39	-3.04 : 6.13	-4.36 : 4.41	2.57 : 4.35	-4.01 : 3.73	-1.61 : 3.50	4.32 : 3.23
T6-AvW/T5-AvW	-11.13 :	-17.88 :	-11.78 :	-2.56 : 4.52	-7.11 : 4.03	-3.75 : 4.76	-12.02 :

	6.39	5.38	4.75				3.19
O2-AvW/O1-AvW	3.46 : 4.71	0.81 : 4.14	8.56 : 3.41	-3.74 : 4.20	-13.75 : 2.99	-21.29 : 4.17	2.61 : 2.33



The values of corresponding spectra parameters and their confidence interval are placed in the cells of tables.

89. Insert tables of spectra comparison dialog



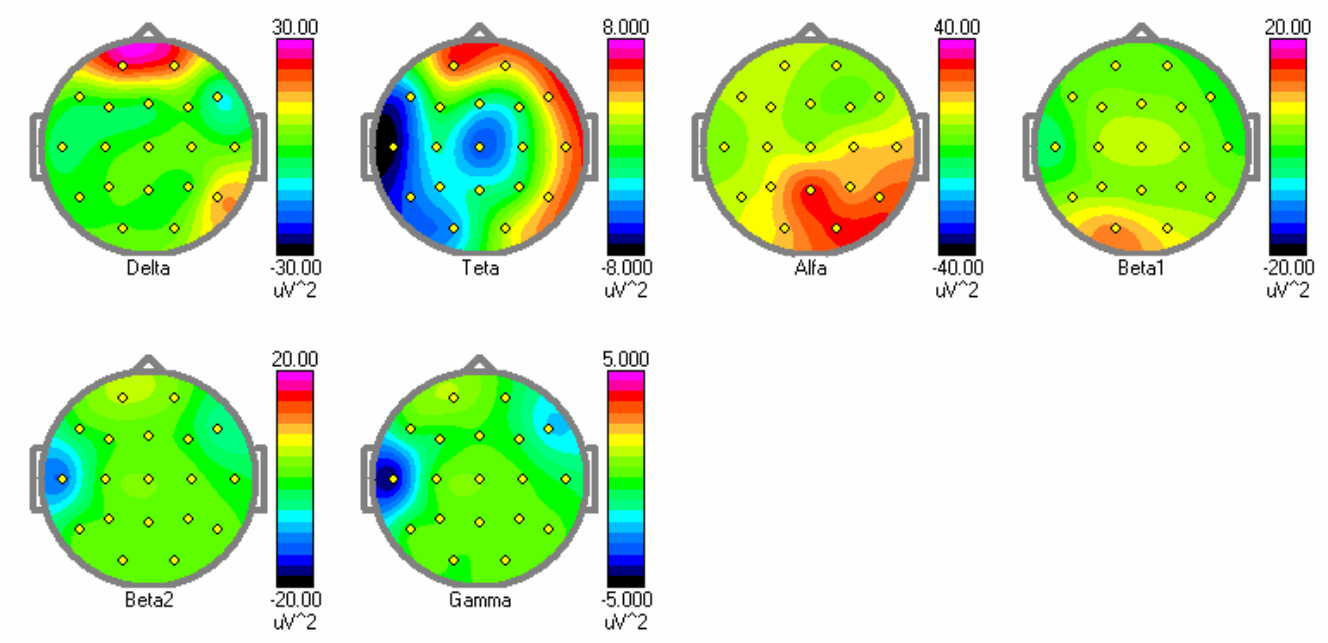
Select type of tables and maps while you would like to insert into MS Word. The result of this function is placed below:

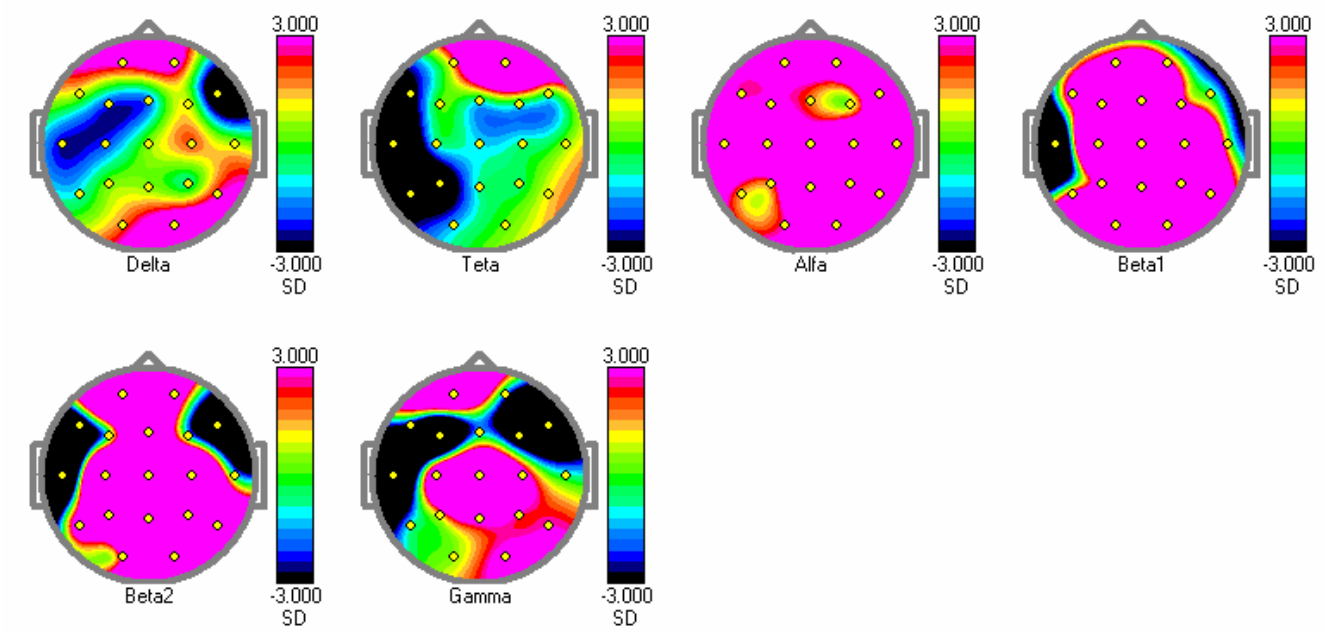
Name: Battaglia Gianna-Schindler Michael
Date of observation: 09/05/2004
Total epoch number: 2, 76

Comparison power spectra (uV^2)

	Delta	Theta	Alfa	Beta1	Beta2	Gamma	Total
Fp1-AvW	23.89 p<0.190	5.56 p<0.319	9.39 p<0.119	0.80 p<0.117	4.63 p<0.000	1.02 p<0.000	113.59

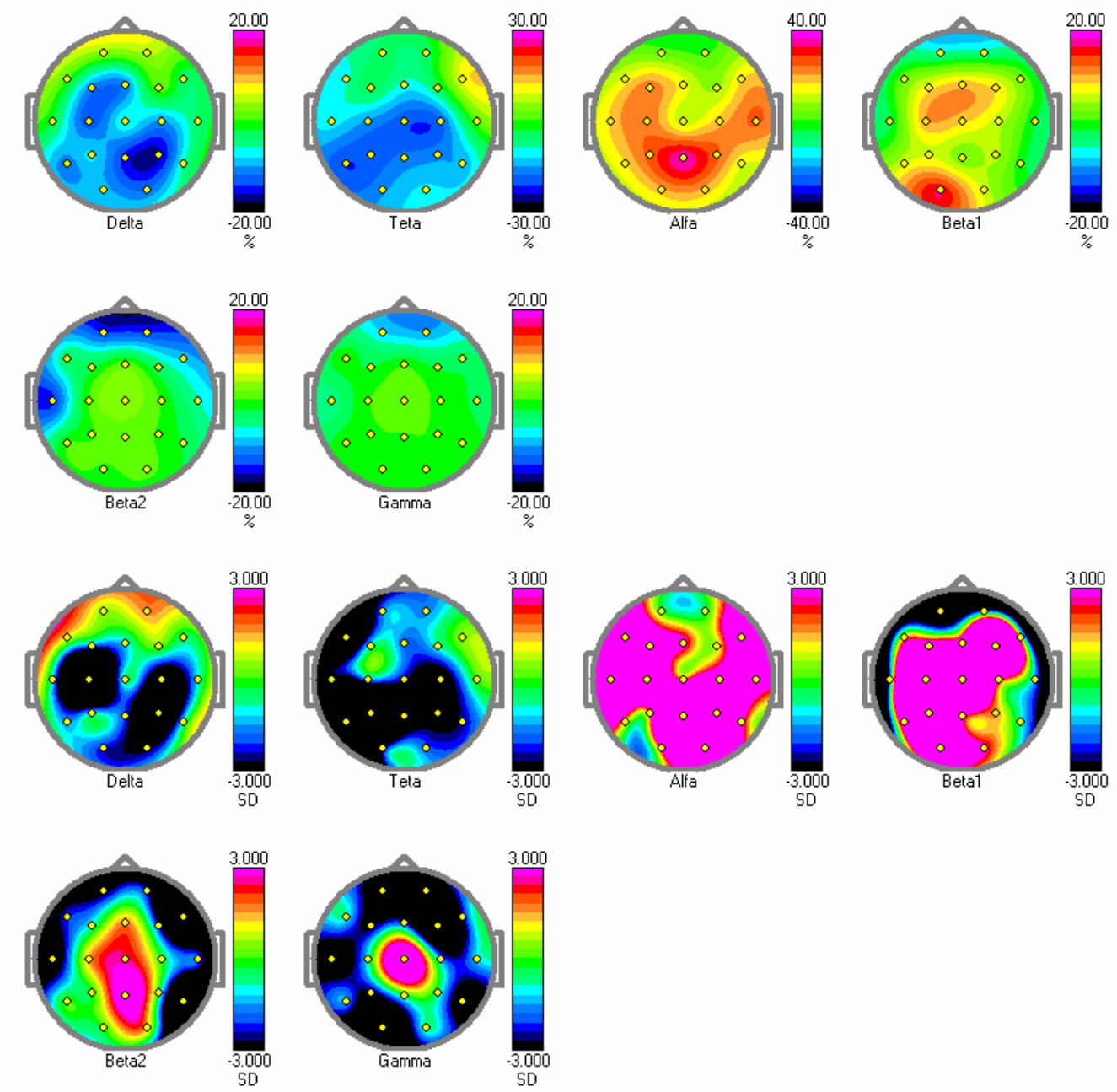
							p<0.106
Fp2-AvW	19.11 p<0.178	3.64 p<0.000	5.82 p<0.096	0.45 p<0.216	2.13 p<0.021	-0.35 p<0.119	93.94 p<0.141
F7-AvW	-0.22 p<0.553	-4.38 p<0.171	9.30 p<0.232	0.91 p<0.156	-1.22 p<0.108	-0.22 p<0.098	-6.07 p<0.788
F3-AvW	-3.01 p<0.300	-0.25 p<0.961	9.16 p<0.195	2.73 p<0.012	-0.33 p<0.474	-0.56 p<0.002	5.32 p<0.583
Fz-AvW	-2.63 p<0.333	-2.06 p<0.579	5.00 p<0.323	2.66 p<0.000	0.40 p<0.002	-0.05 p<0.379	2.98 p<0.670
F4-AvW	-0.27 p<0.585	-1.00 p<0.665	2.68 p<0.644	2.07 p<0.139	-1.19 p<0.396	-0.70 p<0.026	-0.91 p<0.933
F8-AvW	-9.08 p<0.002	4.48 p<0.986	5.50 p<0.014	-0.41 p<0.708	-5.60 p<0.089	-2.04 p<0.081	-35.45 p<0.354
T3-AvW	-4.15 p<0.249	-7.59 p<0.082	5.14 p<0.015	-3.35 p<0.002	-11.83 p<0.005	-4.33 p<0.008	-27.38 p<0.206
C3-AvW	-1.69 p<0.173	-2.27 p<0.512	10.43 p<0.088	3.91 p<0.002	0.61 p<0.000	0.07 p<0.000	12.56 p<0.134
Cz-AvW	1.19 p<0.760	-5.49 p<0.442	8.67 p<0.130	5.50 p<0.034	2.11 p<0.163	0.51 p<0.054	19.34 p<0.008
C4-AvW	2.41 p<0.309	-1.58 p<0.612	15.62 p<0.073	3.84 p<0.002	0.99 p<0.002	0.08 p<0.055	35.73 p<0.212
T4-AvW	0.72 p<0.617	4.24 p<0.730	17.15 p<0.083	-0.02 p<0.538	-1.41 p<0.533	-0.66 p<0.605	15.67 p<0.166
T5-AvW	-1.73 p<0.533	-5.14 p<0.147	11.08 p<0.353	3.52 p<0.186	0.45 p<0.146	-0.09 p<0.484	16.46 p<0.280
P3-AvW	0.09 p<0.828	-3.07 p<0.132	14.03 p<0.318	2.77 p<0.099	0.28 p<0.007	0.01 p<0.504	16.01 p<0.264
Pz-AvW	-0.14 p<0.730	-2.14 p<0.578	30.01 p<0.072	2.63 p<0.000	1.14 p<0.002	0.09 p<0.170	38.74 p<0.168
P4-AvW	-0.93 p<0.693	-0.74 p<0.736	18.77 p<0.104	2.99 p<0.048	0.43 p<0.000	0.07 p<0.250	33.84 p<0.237
T6-AvW	13.88 p<0.224	3.78 p<0.461	25.85 p<0.033	2.96 p<0.084	0.62 p<0.000	0.15 p<0.224	78.14 p<0.037
O1-AvW	0.23 p<0.072	-4.16 p<0.401	17.73 p<0.227	10.93 p<0.002	0.60 p<0.198	-0.01 p<0.704	26.50 p<0.176
O2-AvW	1.84 p<0.000	1.99 p<0.900	29.17 p<0.096	6.25 p<0.053	1.54 p<0.000	0.20 p<0.175	56.39 p<0.147





Comparison of normalized power spectra (%), Normalization frequency band: 0.0-64.0 Hz

	Delta	Theta	Alfa	Beta1	Beta2	Gamma
Fp1-AvW	3.48 p<0.645	-5.56 p<0.312	1.71 p<0.957	-5.92 p<0.105	-14.40 p<0.185	-8.18 p<0.145
Fp2-AvW	4.74 p<0.344	-4.57 p<0.344	-0.90 p<0.794	-5.22 p<0.237	-14.55 p<0.229	-10.03 p<0.136
F7-AvW	0.75 p<0.309	-9.88 p<0.013	12.60 p<0.002	1.15 p<0.620	-4.19 p<0.262	-0.81 p<0.552
F3-AvW	-10.29 p<0.383	-3.80 p<0.470	22.43 p<0.099	6.73 p<0.126	-2.91 p<0.486	-2.20 p<0.202
Fz-AvW	-10.88 p<0.456	-10.00 p<0.322	13.75 p<0.207	9.14 p<0.120	1.01 p<0.351	-0.36 p<0.142
F4-AvW	1.12 p<0.787	-3.95 p<0.571	7.51 p<0.540	7.20 p<0.000	-4.35 p<0.215	-2.48 p<0.002
F8-AvW	-3.34 p<0.698	10.44 p<0.736	15.76 p<0.018	1.57 p<0.912	-8.93 p<0.002	-3.11 p<0.249
T3-AvW	-2.07 p<0.358	-10.49 p<0.165	16.65 p<0.002	-2.61 p<0.139	-14.67 p<0.148	-5.26 p<0.153
C3-AvW	-13.30 p<0.002	-15.50 p<0.362	23.06 p<0.011	9.62 p<0.000	0.29 p<0.309	-0.20 p<0.500
Cz-AvW	-6.16 p<0.631	-20.09 p<0.235	9.67 p<0.274	8.50 p<0.002	3.17 p<0.243	0.73 p<0.102
C4-AvW	-10.18 p<0.132	-18.55 p<0.161	18.28 p<0.109	4.84 p<0.195	-0.28 p<0.862	-0.49 p<0.375
T4-AvW	-3.80 p<0.513	1.62 p<0.991	24.77 p<0.137	-1.99 p<0.337	-5.91 p<0.313	-2.59 p<0.435
T5-AvW	-11.10 p<0.383	-20.87 p<0.002	15.20 p<0.407	5.60 p<0.136	-0.27 p<0.989	-0.63 p<0.364
P3-AvW	-7.66 p<0.508	-20.06 p<0.002	25.33 p<0.356	5.91 p<0.000	-0.28 p<0.783	-0.31 p<0.202
Pz-AvW	-14.94 p<0.285	-17.01 p<0.140	35.01 p<0.000	2.66 p<0.154	0.98 p<0.161	-0.07 p<0.743
P4-AvW	-16.41 p<0.095	-15.66 p<0.184	24.61 p<0.000	4.26 p<0.368	-0.38 p<0.653	-0.20 p<0.576
T6-AvW	-5.45 p<0.639	-14.00 p<0.244	12.36 p<0.196	-1.28 p<0.523	-2.31 p<0.001	-0.95 p<0.157
O1-AvW	-9.10 p<0.264	-15.66 p<0.189	17.86 p<0.269	15.83 p<0.083	-0.27 p<0.863	-0.55 p<0.002
O2-AvW	-11.45 p<0.219	-11.21 p<0.315	17.73 p<0.000	5.08 p<0.229	0.43 p<0.452	-0.22 p<0.570



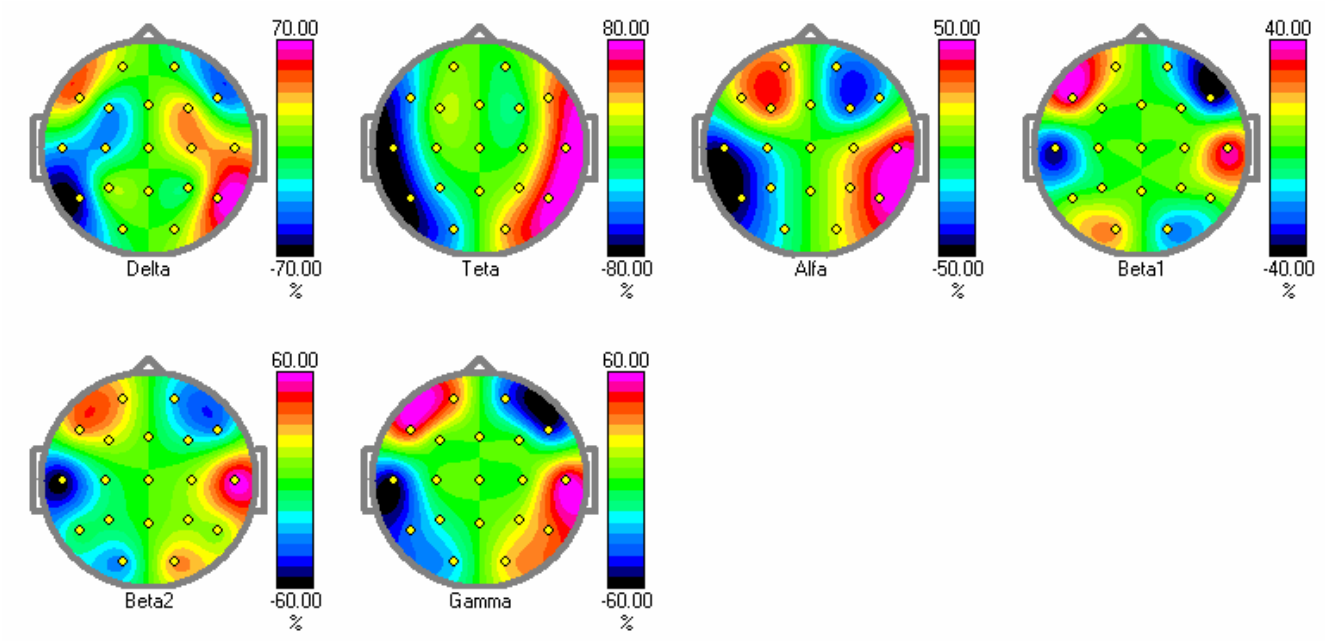
Comparison of average frequency (Hz)

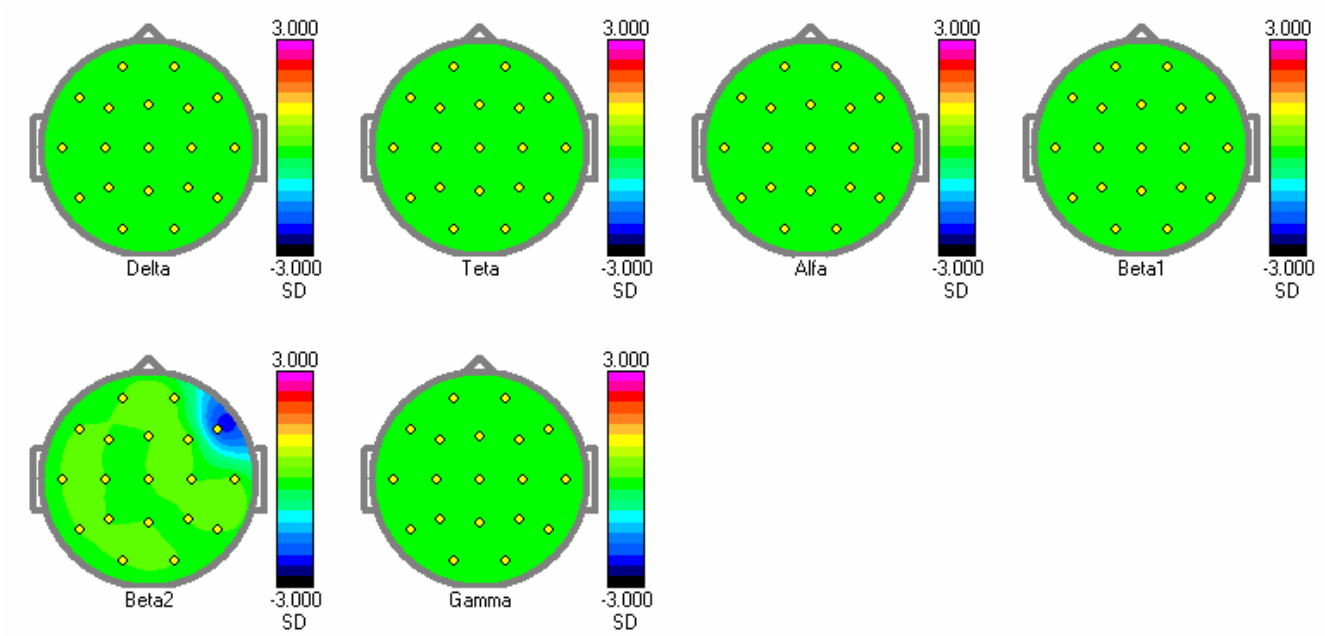
	Delta	Theta	Alfa	Beta1	Beta2	Gamma	Total
Fp1-AvW	-0.16 p<0.000	-0.17 p<0.767	-0.06 p<0.320	0.22 p<0.010	-0.40 p<0.448	0.34 p<0.186	-8.71 p<0.120
Fp2-AvW	-0.33 p<0.164	-0.66 p<0.002	-0.19 p<0.058	-0.28 p<0.532	-0.67 p<0.031	0.17 p<0.742	-9.70 p<0.118
F7-AvW	-0.02 p<0.914	0.49 p<0.316	0.34 p<0.334	0.05 p<0.359	-0.84 p<0.035	1.23 p<0.165	-0.06 p<0.966
F3-AvW	-0.20 p<0.002	0.16 p<0.017	0.06 p<0.848	-0.30 p<0.000	-0.89 p<0.293	-0.61 p<0.002	0.74 p<0.488
Fz-AvW	-0.23 p<0.007	-0.15 p<0.488	0.21 p<0.083	-0.27 p<0.024	-0.18 p<0.855	-0.07 p<0.859	2.72 p<0.008
F4-AvW	-0.13 p<0.490	0.06 p<0.490	0.19 p<0.114	-0.68 p<0.208	-0.40 p<0.686	0.27 p<0.662	-0.53 p<0.706
F8-AvW	0.20 p<0.702	-0.45 p<0.365	0.13 p<0.790	-0.05 p<0.767	-0.89 p<0.255	1.17 p<0.002	-1.68 p<0.219
T3-AvW	0.03 p<0.782	0.39 p<0.276	0.12 p<0.684	-0.32 p<0.773	-1.58 p<0.002	0.34 p<0.363	-6.56 p<0.115
C3-AvW	-0.20 p<0.116	0.48 p<0.002	0.62 p<0.172	-0.28 p<0.573	-0.39 p<0.390	-0.01 p<0.984	2.70 p<0.000
Cz-AvW	-0.21 p<0.454	-0.41 p<0.002	0.90 p<0.019	-0.12 p<0.744	-0.90 p<0.301	-0.11 p<0.769	2.14 p<0.270
C4-AvW	-0.34 p<0.358	-0.17 p<0.621	0.57 p<0.002	-0.20 p<0.721	-0.72 p<0.362	-0.54 p<0.248	0.97 p<0.546
T4-AvW	-0.12 p<0.803	-0.39 p<0.245	0.46 p<0.095	0.32 p<0.463	1.17 p<0.149	0.36 p<0.006	-1.64 p<0.574
T5-AvW	-0.44 p<0.120	0.34 p<0.284	0.64 p<0.002	-0.44 p<0.026	-1.65 p<0.000	-0.98 p<0.174	0.75 p<0.671

P3-AvW	-0.26 p<0.229	0.44 p<0.000	0.53 p<0.202	-0.38 p<0.089	-1.34 p<0.240	-0.76 p<0.282	2.25 p<0.370
Pz-AvW	0.20 p<0.660	-0.25 p<0.421	0.17 p<0.558	-0.49 p<0.408	-0.91 p<0.145	-0.42 p<0.244	2.74 p<0.082
P4-AvW	-0.21 p<0.267	0.23 p<0.692	-0.01 p<0.955	-0.48 p<0.014	0.16 p<0.840	-0.53 p<0.450	2.09 p<0.313
T6-AvW	-0.17 p<0.000	0.20 p<0.553	0.66 p<0.167	-0.63 p<0.251	-0.92 p<0.144	-0.22 p<0.021	-0.46 p<0.598
O1-AvW	-0.21 p<0.526	-0.15 p<0.000	0.96 p<0.000	-0.66 p<0.322	-0.74 p<0.050	-0.07 p<0.312	3.61 p<0.064
O2-AvW	-0.07 p<0.822	0.39 p<0.479	1.28 p<0.071	-0.04 p<0.622	-1.30 p<0.209	-0.64 p<0.237	2.58 p<0.140

Comparison of asymmetry of power spectra (%)

	Delta	Theta	Alfa	Beta1	Beta2	Gamma	Total
Fp2-AvW/Fp1-AvW	-12.80 p<0.000	-8.61 p<0.000	-27.87 p<0.000	-14.04 p<0.000	-27.24 p<0.000	-39.15 p<0.000	-19.85 p<0.000
F4-AvW/F3-AvW	30.03 p<0.000	-14.23 p<0.000	-35.15 p<0.000	-3.85 p<0.000	-19.34 p<0.000	-4.01 p<0.000	-9.21 p<0.000
F8-AvW/F7-AvW	-39.88 p<0.000	42.69 p<0.000	-21.69 p<0.000	-38.51 p<0.000	-33.30 p<0.288	-50.31 p<0.000	-26.96 p<0.000
C4-AvW/C3-AvW	34.08 p<0.000	1.03 p<0.000	17.80 p<0.000	1.99 p<0.000	12.99 p<0.000	0.44 p<0.000	22.70 p<0.000
T4-AvW/T3-AvW	31.77 p<0.000	77.12 p<0.000	43.82 p<0.000	34.37 p<0.000	58.13 p<0.000	55.56 p<0.000	35.70 p<0.000
P4-AvW/P3-AvW	-8.59 p<0.000	25.96 p<0.000	24.91 p<0.000	2.00 p<0.000	10.05 p<0.000	17.46 p<0.000	15.78 p<0.000
T6-AvW/T5-AvW	63.09 p<0.000	76.53 p<0.000	46.14 p<0.000	-1.05 p<0.000	9.57 p<0.000	36.74 p<0.000	50.75 p<0.000
O2-AvW/O1-AvW	7.65 p<0.000	40.27 p<0.000	15.26 p<0.000	-20.78 p<0.000	31.62 p<0.000	25.74 p<0.000	16.61 p<0.000





The values of differences of corresponding spectra parameters and their significance level are placed in the cells of tables.

90. Database Parameters: Databases Of Raw Data dialog

Database Of EEG: Base Pathname

Enter full path for EEG database, or press **"..."** button on the right of the name field to browse folders.

Database Of EEG: Working Folder

Enter full path for EEG working folder, or press **"..."** button on the right of the name field to browse drives and to select a folder.

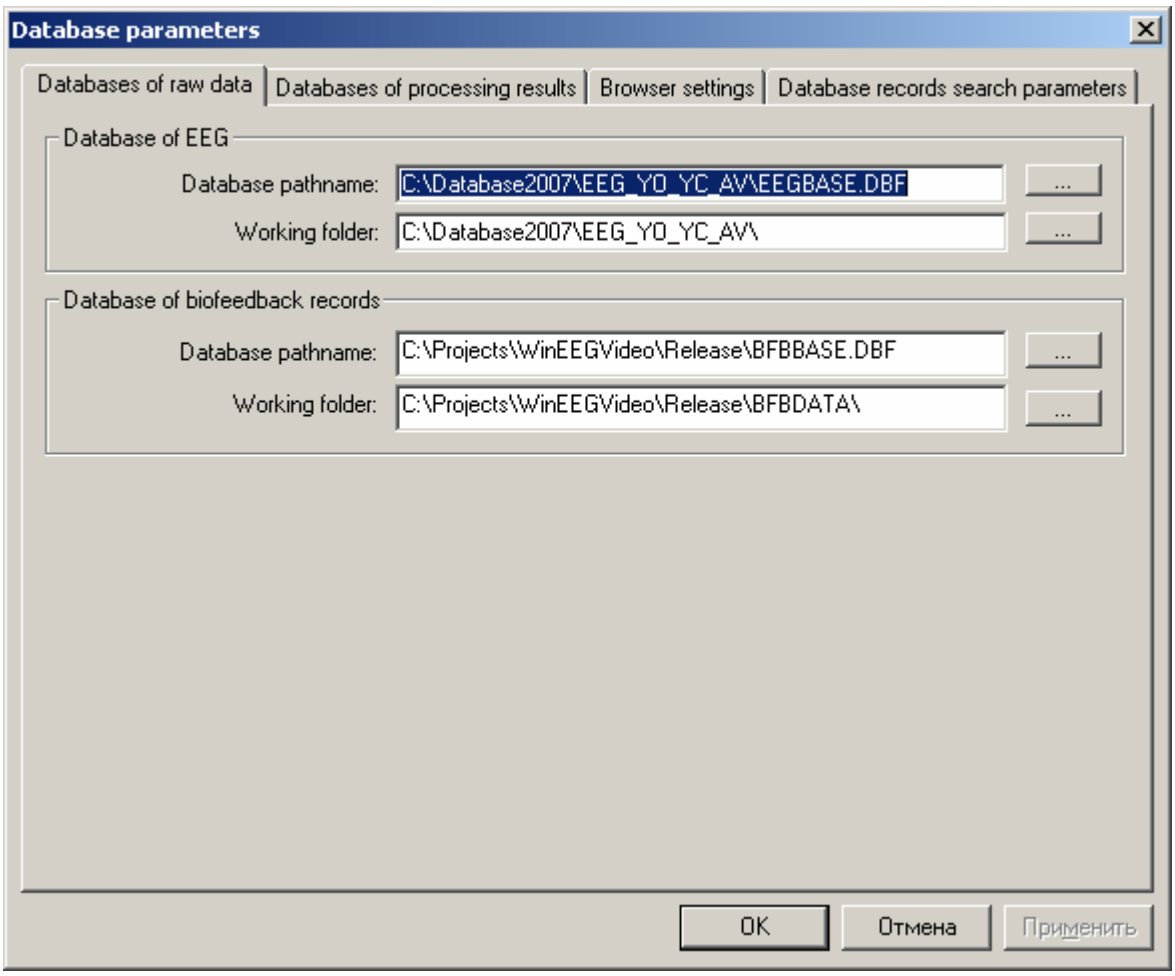
Database Of Biofeedback Records: Base Pathname

Enter full path for biofeedback database, or press **"..."** button on the right of the name field to browse folders.

Database Of Biofeedback Records: Working Folder

Enter full path for biofeedback working folder, or press **"..."** button on the right of the name field to browse drives and to select a folder.

If there is no file or folder with the name you entered, a new one will be created (if possible) when you press **OK** or **Apply** button.



91. Database Parameters: Databases of Processing Results dialog

Database Of EEG Spectra: Database Pathname

Enter full path for EEG spectra database, or press "**...**" button to the right of the name field to browse folders.

Database Of EEG Spectra: Working Folder

Enter full path for EEG spectra working folder, or press "**...**" button to the right of the name field to browse drives and to select a folder.

Database Of EEG Indices: Database Pathname

Enter full path for EEG indices database, or press "**...**" button to the right of the name field to browse folders.

Database Of EEG Indices: Working Folder

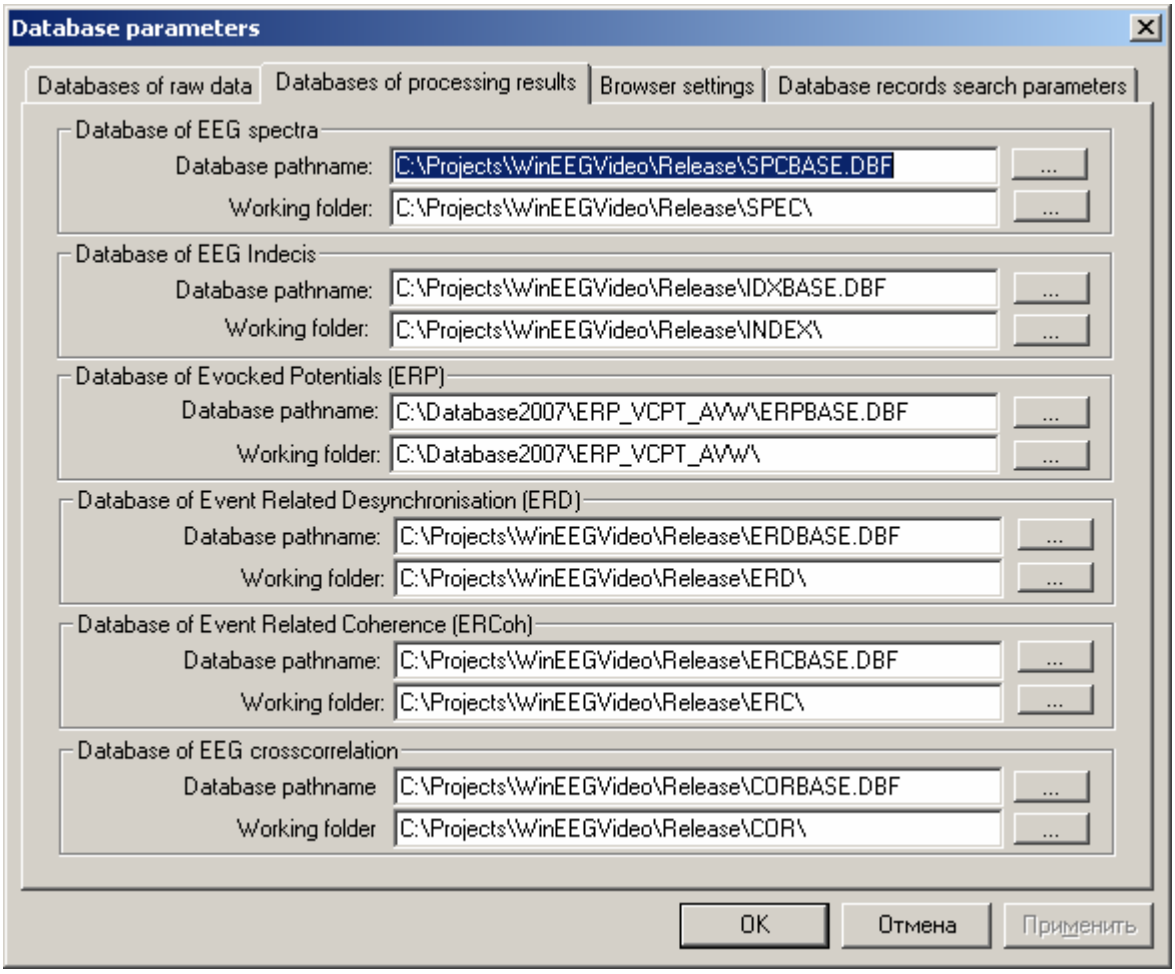
Enter full path for EEG indices working folder, or press "**...**" button to the right of the name field to browse drives and to select a folder.

Database Of Evoked Potentials (ERP): Database Pathname

Enter full path for ERP database, or press "**...**" button to the right of the name field to browse folders.

Database Of Evoked Potentials (ERP): Working Folder

Enter full path for ERP working folder, or press "**...**" button to the right of the name field to browse drives and to select a folder.



Database Of Event-Related De-synchronization (ERD): Database Pathname

Enter full path for ERD database, or press "**...**" button to the right of the name field to browse folders.

Database Of Event-Related De-synchronization (ERD): Working Folder

Enter full path for ERD working folder, or press "**...**" button to the right of the name field to browse drives and to select a folder.

Database Of Event-Related Coherence (ERCoh): Base Pathname

Enter full path for ERCoh database, or press "**...**" button to the right of the name field to browse folders.

Database Of Event-Related Coherence (ERCoh):Working Folder

Enter full path for ERCoh working folder, or press "**...**" button on the right of the name field to browse drives and select a folder.

Database Of EEG Cross-correlation: Database Pathname

Enter full path for EEG cross-correlation database, or press "**...**" button to the right of the name field to browse folders.

Database Of EEG Cross-correlation: Working Folder

Enter full path for EEG cross-correlation working folder, or press **"..."** button to the right of the name field to browse drives and to select a folder.

If there is no file or folder with the name you entered, a new one will be created (if possible) when you press the **OK** or **Apply** button.

92. Database Parameters: Browser Settings dialog

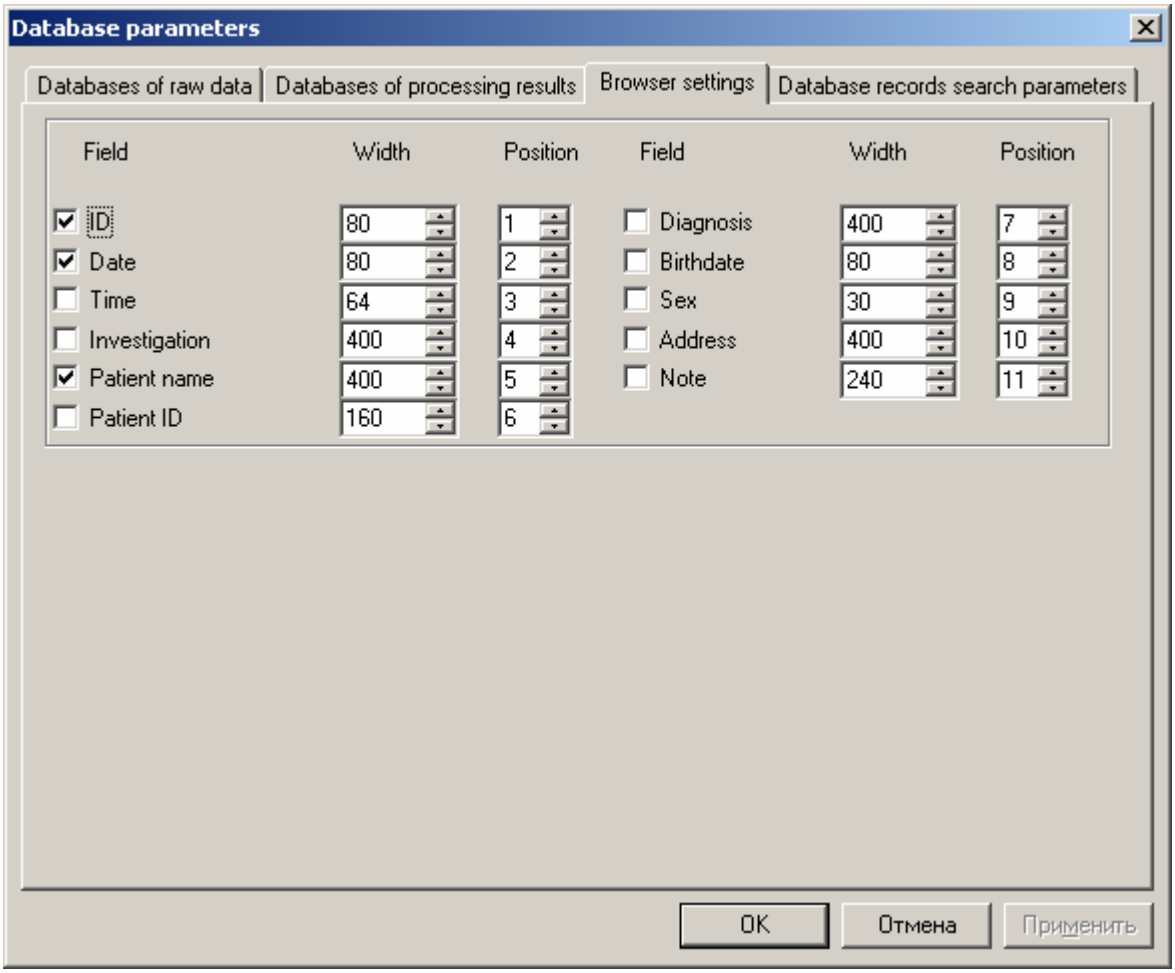
This dialog defines fields for **Record List dialog**.

Field

Check those fields you wish to use in the record list.

Width

Set width (in pixels) for each field used in the record list.



Position

Set position (ordinal number) for each field used in the record list.

93. Database Parameters: Base Record Search Parameters dialog

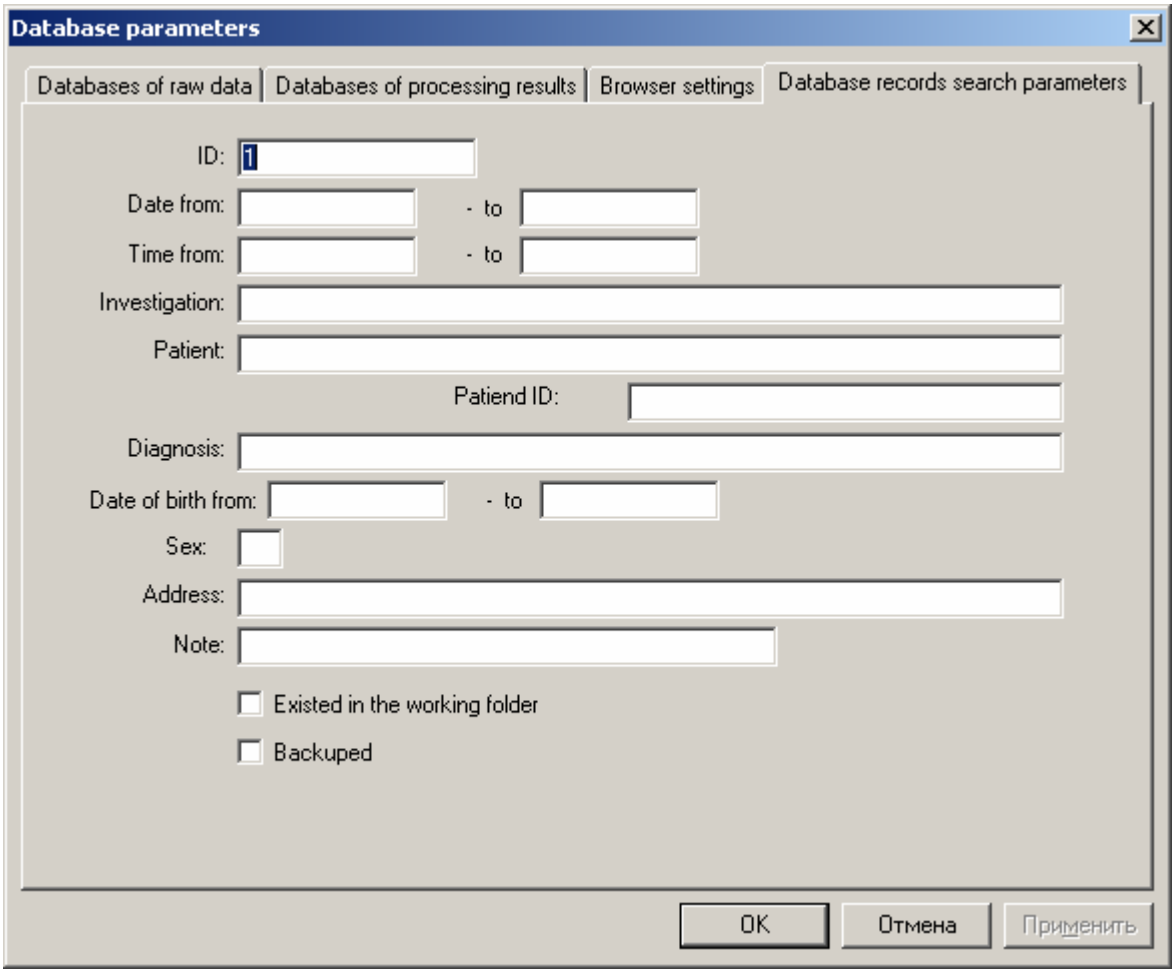
This dialog allows selection of criteria for record filtering. In other words, only records satisfying the defined search conditions would be displayed in the results list, and the others would be ignored. The criteria set is saved and then used any time when the Record List dialog is opened. This logic facilitates repetitive searches over a certain subset of the database records (for example, only with data

acquired during last month). But it may also cause mistakes and complications when looking for data. If you find that some records have suddenly "disappeared" from the database, first of all check the search criteria.

Each edit box in the Base Record Search Parameters dialog defines one search criterion. A record satisfies search conditions if it contains all features that have been defined. Blank fields are ignored during search.

Here is the list of search criteria that can be defined:

ID field contains a text string that must be present in the corresponding field of the database record. If the text defined for search is shorter than in the database, a substring is searched. Symbol case is ignored. Blanks placing before and after the text are deleted. If the **ID** field in the search condition contains " ABC ", then records containing "ABC", "abc", "AbCXXxxXX", "xxxxxaBc", "xXxaBCXXx" in their **ID** fields satisfy this condition.



Date From ... - To fields define the interval of EEG acquisition dates (current year for example). To enable automatic search by date, use DD/MM/YYYY date format.

Time From ... - To fields define the interval of EEG acquisition times (before noon for example). To enable automatic search by time, use HH:MM:SS time format.

Investigation field contains a text string to be presented in the corresponding field of the database record (see also **ID** field).

Patient field contains a text string (for example, patient name) to be presented in the corresponding field of the database record (see also **ID** field).

Patient ID field contains a text string to be presented in the corresponding field of the database record (see also **ID** field).

Diagnosis field contains a text string to be presented in the corresponding field of the database record (see also **ID** field).

Date of Birth From ... - To fields define the interval for dates of patients' birth, for example from 01/01/1950 to 31/12/1959. To enable automatic search by date, use DD/MM/YYYY date format.

Sex field displays patient sex (M or F).

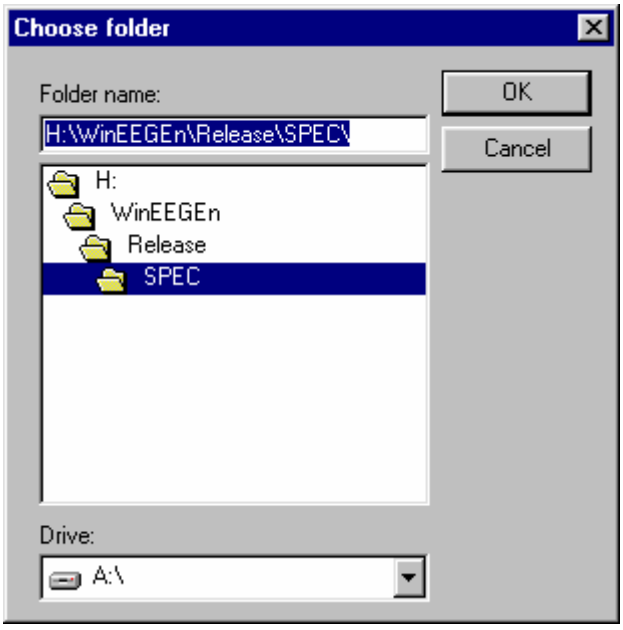
Address field contains a text string to be presented in the corresponding field of the database record (see also **ID** field).

Note field contains a text string to be presented in the corresponding field of the database record (see also **ID** field).

Check **Existed in the working folder** option to select only records corresponding to files located in the working folder. **Attention**! Using this condition may significantly slow down the database search.

Check **Backed-up** option to select only records corresponding to EEG files that have been backed-up at least once.

94. Choose Folder dialog



Folder

Enter folder name or browse the list to find the appropriate folder.

Drive

Choose a drive to look for the necessary folder on.

95. Preferences: EEG Input dialog

Set options for new data acquisition in **EEG window**.

Amplifiers

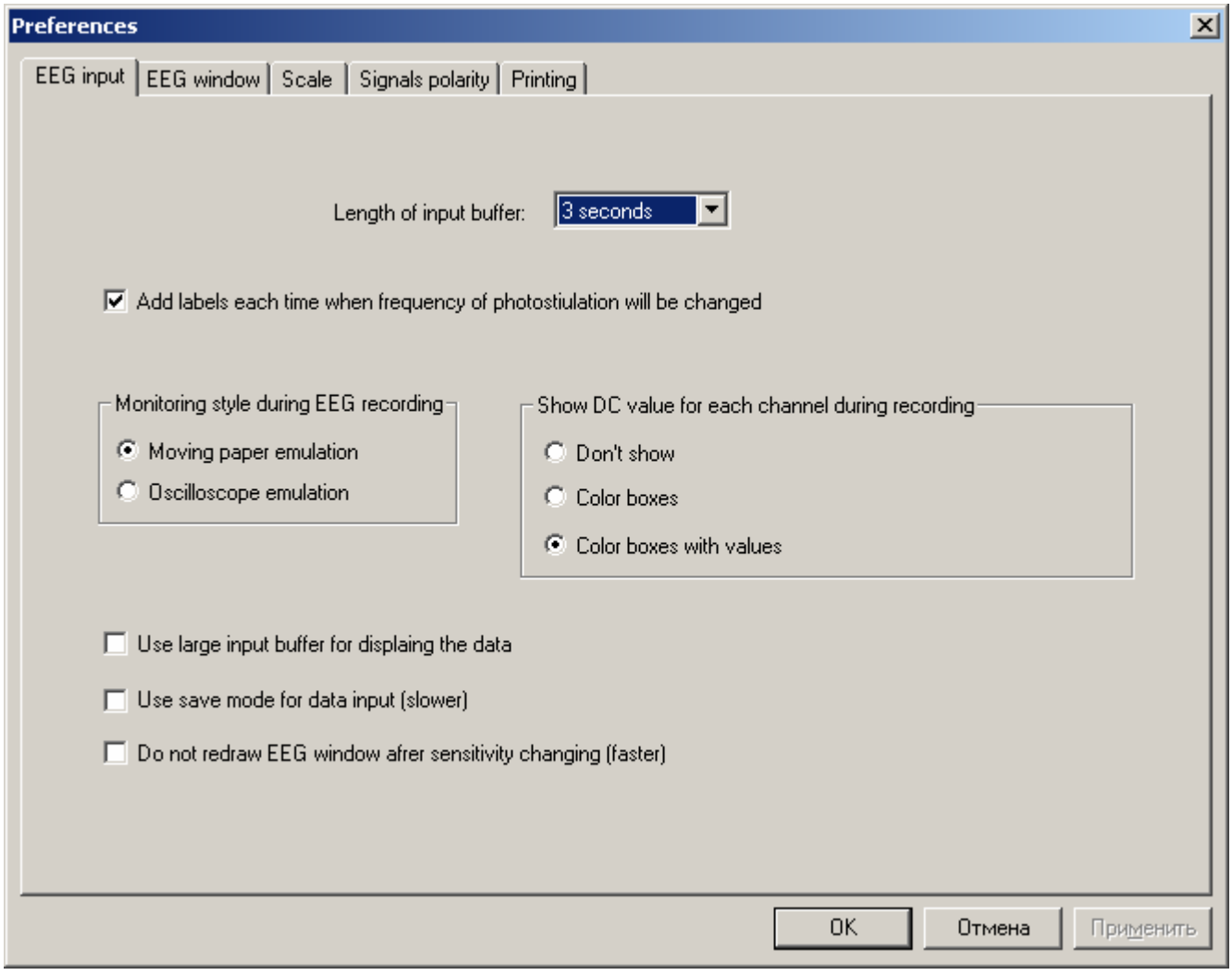
Displays name of amplifier block the software is designed for.

I/O Port

Choose input/output port to connect amplifier block to.

Length of Input Buffer

Choose how many seconds will be stored before starting EEG acquisition.



Monitoring Style During EEG Recording:

Choose EEG monitoring style.

Moving paper emulation	Scrolling EEG window from right to left.
Oscilloscope emulation	Redrawing EEG window from left to right. Can be used if the computer is not fast enough to enable smooth EEG window scrolling.

Show DC Value For Each Channel During Recording: #$[unknown item in Russian]

Choose DC component monitoring style.

Don't Show	Do not depict DC value.
Color Boxes	Depict as small colored boxes. Рисовать прямоугольники, внутри которых выводятся значения постоянной составляющей.

Use large input buffer for displaying the data

Check this button if you would like to have a possibility to redraw whole EEG window during EEG recording when horizontal scale is changed. Otherwise only newly recorded samples will be displayed using new horizontal scale. The disadvantage of this method is that it takes a lot of time and can cause the acquisition errors on slow computers.

Use save mode for data input (slower)

Check this button if you would like to use **save mode** for EEG recording. The file header will be saved together with new portion of data in this case. The data can be recovered in this case if a crash of WinEEG program or Microsoft Windows have occurred.

Do not redraw EEG window after sensitivity changing (faster)

Check this button if you would like to do not redraw whole EEG window when vertical scale is changed. Only newly recorded samples will be displayed using new vertical scale in this case. This is fastest mode of work. Use it if some problems with the acquisition errors on slow computers occur.

96. Preferences: EEG Window dialog

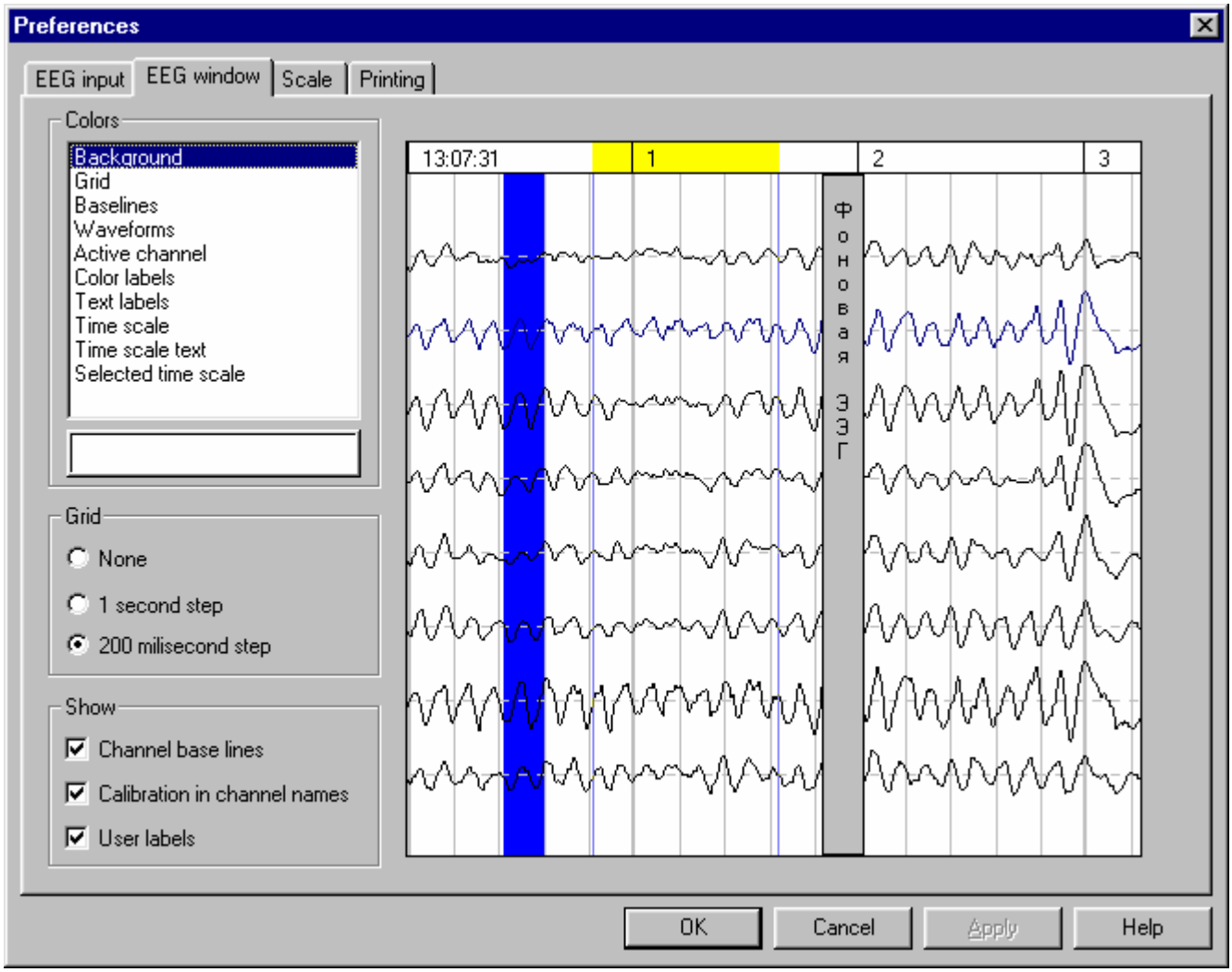
Colors

List of window elements displayed in color. Under the list there is a button showing current color for the selected element. Click it to call **Colors dialog** and to modify element color.

Grid

Choose vertical grid style for EEG window (and also for printing).

None	No grid is shown or printed.
1 second step	Coarse grid (1 second step).
200 millisecond step	Fine grid (200 millisecond step).



Show

Check additional graphical elements to be shown in EEG window.

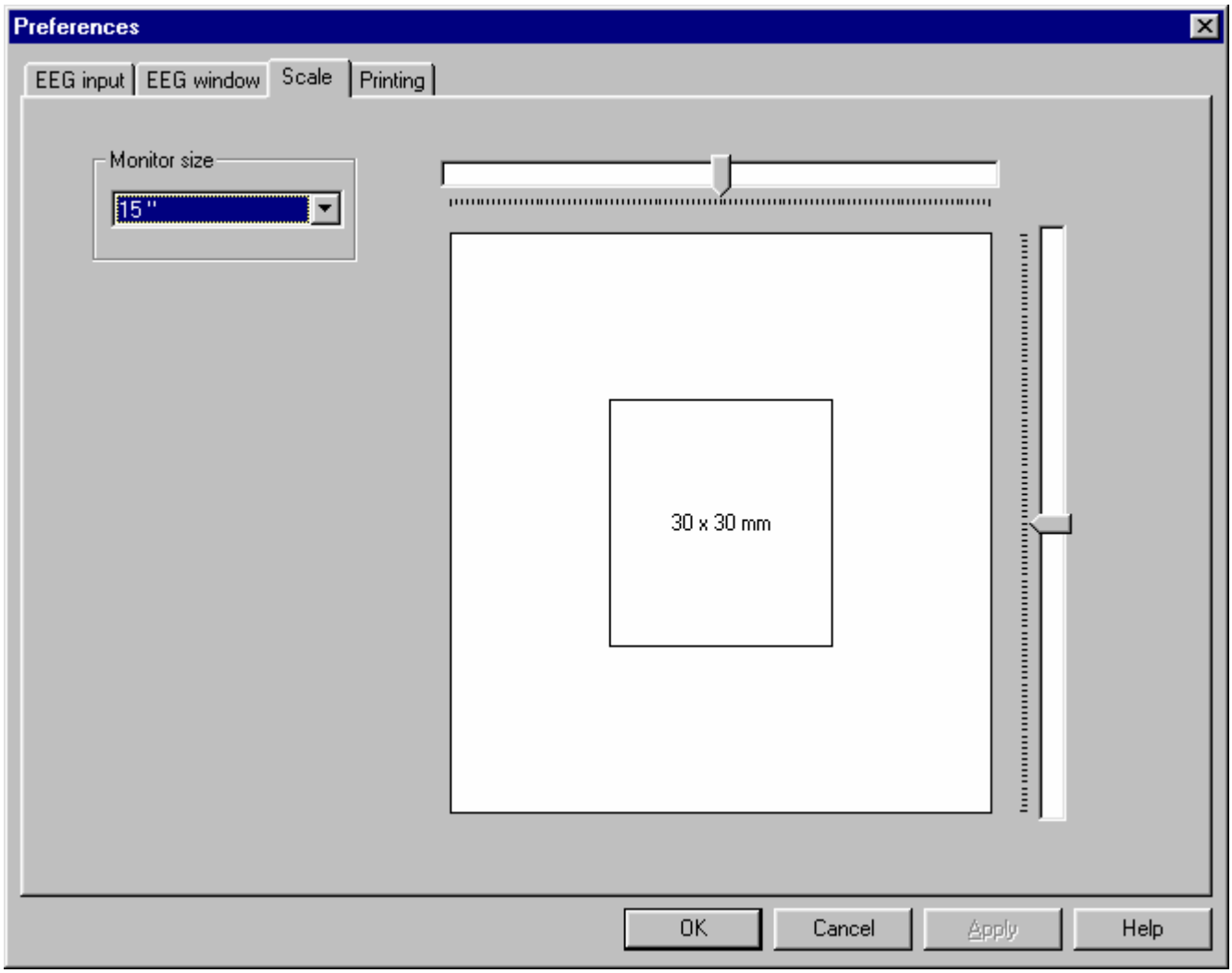
Channel Baselines	Horizontal dashed lines showing "zero" level for each channel in EEG window.
Calibration In Channel Names	Numbers showing gains (uV/cm) to the right of the channel names in the Channel names bar.
User Labels	Graphic object marking EEG interval of specific interest to user.

97. Preferences: Scale dialog

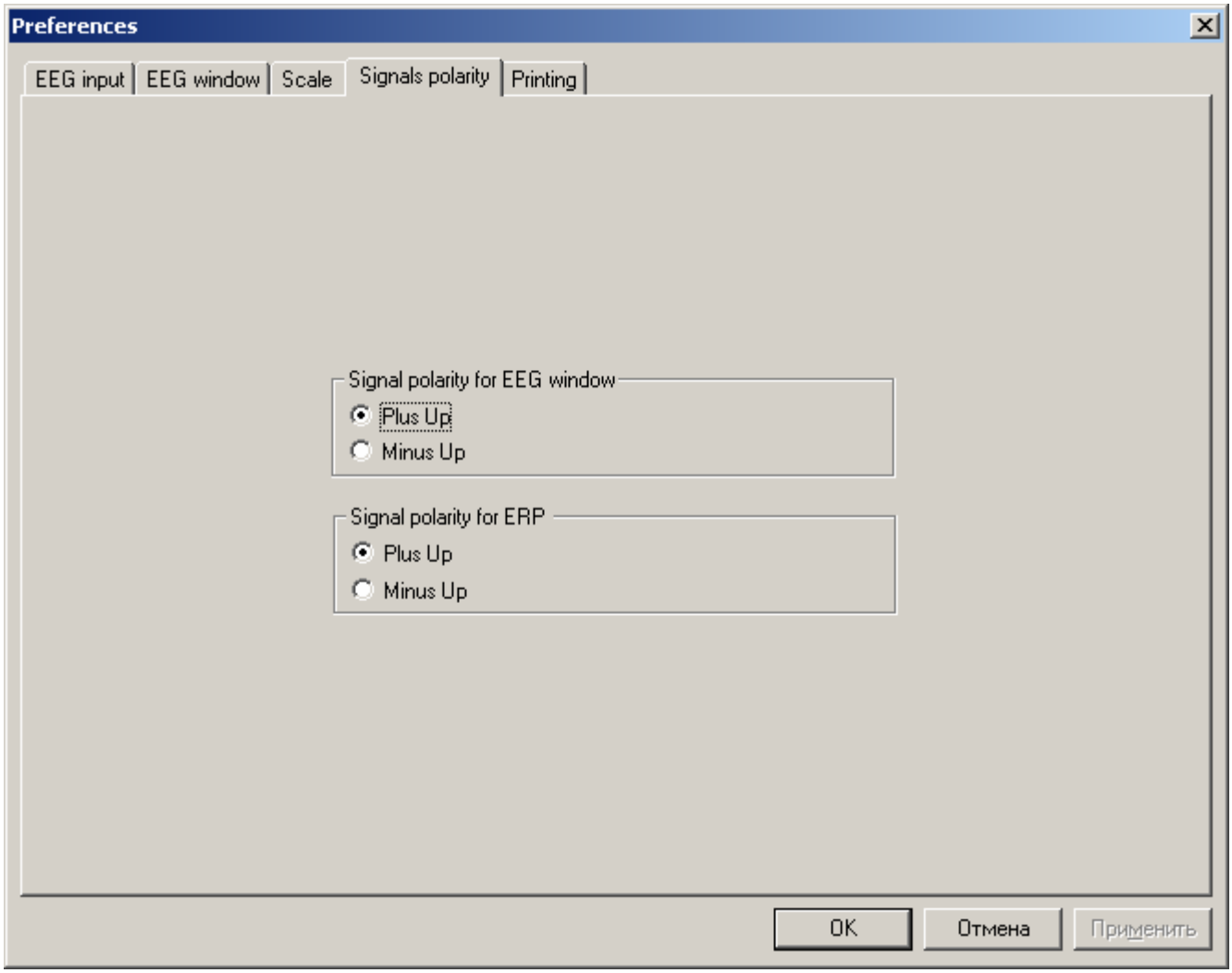
Monitor Size

Choose the display size corresponding to your monitor. Then, using the two sliders, adjust the square size so that its width and height are exactly 30 mm. This will provide proper horizontal and vertical screen scaling.

Use sliders to fine-tune EEG scaling on the screen.



98. Preferences: Signal polarity dialog



Signal polarity for EEG window

Select appropriate signal polarity for EEG window

Signal polarity for ERP

Select appropriate signal polarity for ERP window

99. Preferences: Printing dialog

Paper orientation for EEG window
Choose paper orientation for printing EEG.

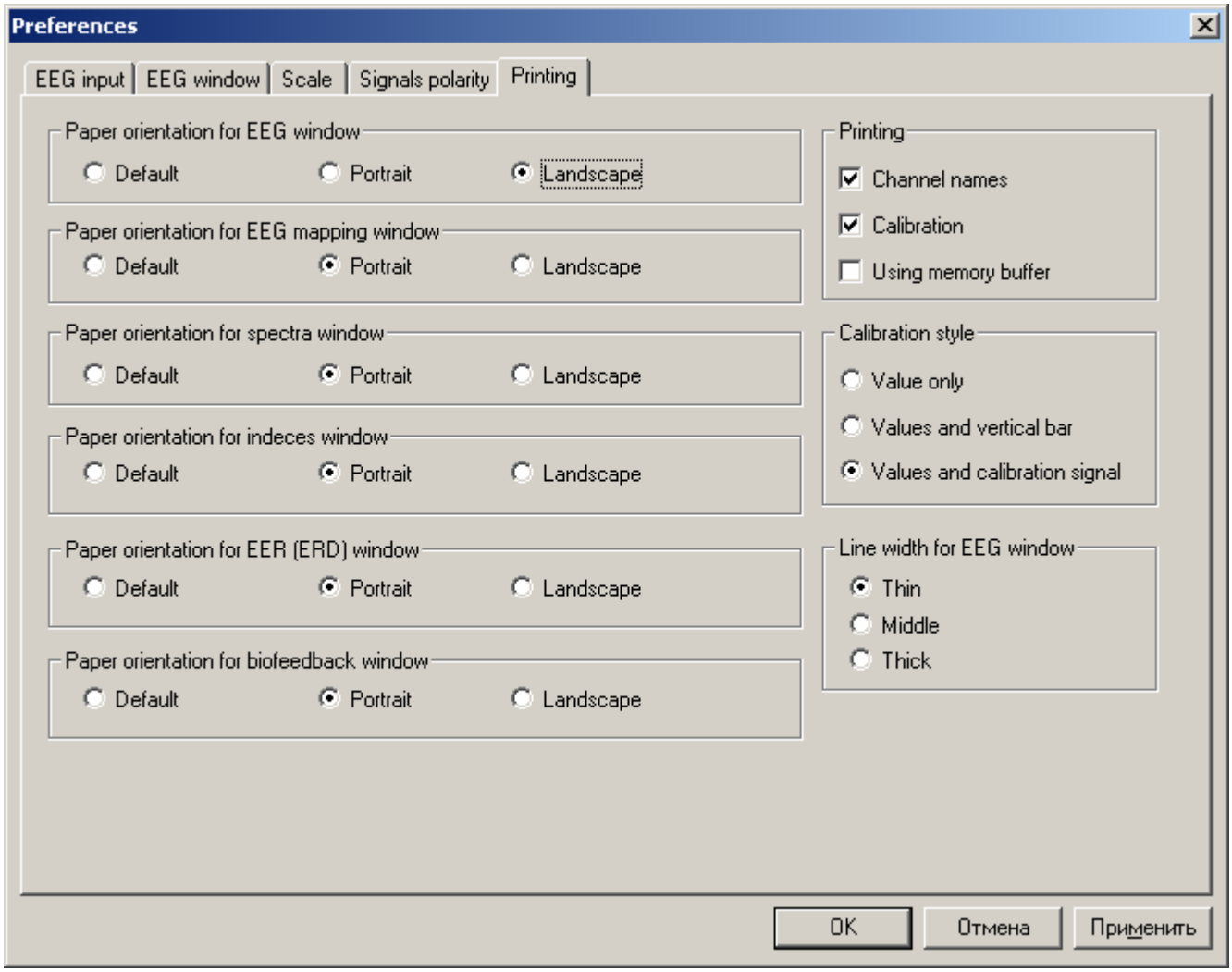
Paper orientation for EEG mapping window
Choose paper orientation for printing EEG maps.

Paper orientation for spectra window
Choose paper orientation for printing EEG spectra.

Paper orientation for indices window
Choose paper orientation for printing EEG indices.

Paper orientation for ERP (ERD) window
Choose paper orientation for printing ERP, ERD and ERCoh.

Paper orientation for biofeedback window
Choose paper orientation for printing biofeedback window contents.



Printing
Check options for graphic elements to be printed together with EEG.
Channel names Check this to print channel names on the left of each page.

Calibration Check this to print conventional calibration signals showing gains and bandwidths for EEG channels. If this option is checked calibration will be printed on the last page increasing selected interval by 60 mm.

Calibration style:
Choose an option defining how to print calibration.

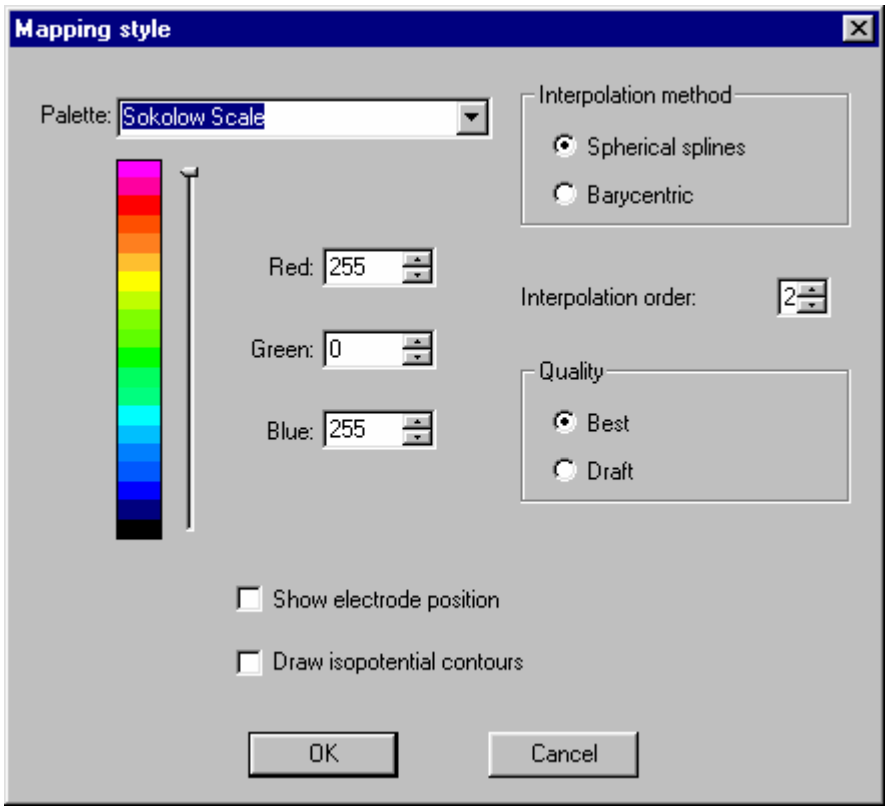
Line width for EEG window
Choose an option defining line width for printing EEG waveforms.

100. Colors dialog

To choose a color, click the corresponding button.

101. Mapping parameters dialog

Palette:
Choose a color palette from the list. The palette encodes values displayed on the maps by color.



Slider:
Use the slider placed to the right of the color scale to choose a color for modification.

Red:
Set a value for the red component of the selected palette color.

Green:
Set a value for the green component of the selected palette color.

Blue:
Set a value for the blue component of the selected palette color.

Interpolation Method
Choose an interpolation method. **Spherical splines** are recommended, but **barycentric** interpolation is better if few electrodes are used.

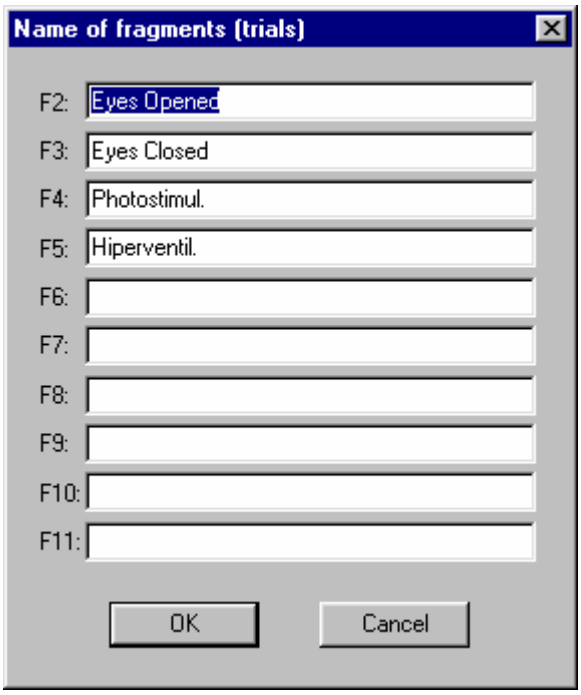
Interpolation Order:
Set interpolation order (recommended value is 2).

Quality:
This parameter defines pixel size for the maps (**Best** option is recommended, meaning the smallest pixel size). If you choose **Draft** maps will be painted about three times faster.

Show electrode position:
Check if electrode position should be shown on the maps.

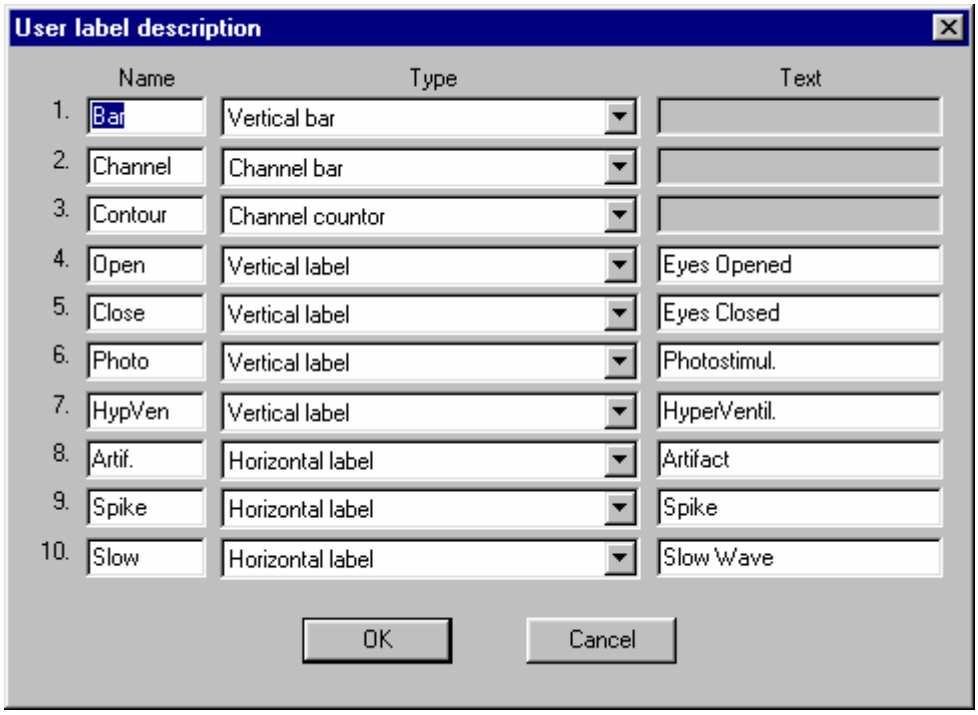
Draw isopotential contours:
Check if isopotential contours should be shown on the maps.

102. Names Of Fragments (Trials) dialog



Enter fragment names in the **F2-F11** fields.

103. User Label Description dialog



Use this dialog to define up to 10 user labels

Name

Enter label name to be included in the Label popup menu.

Type

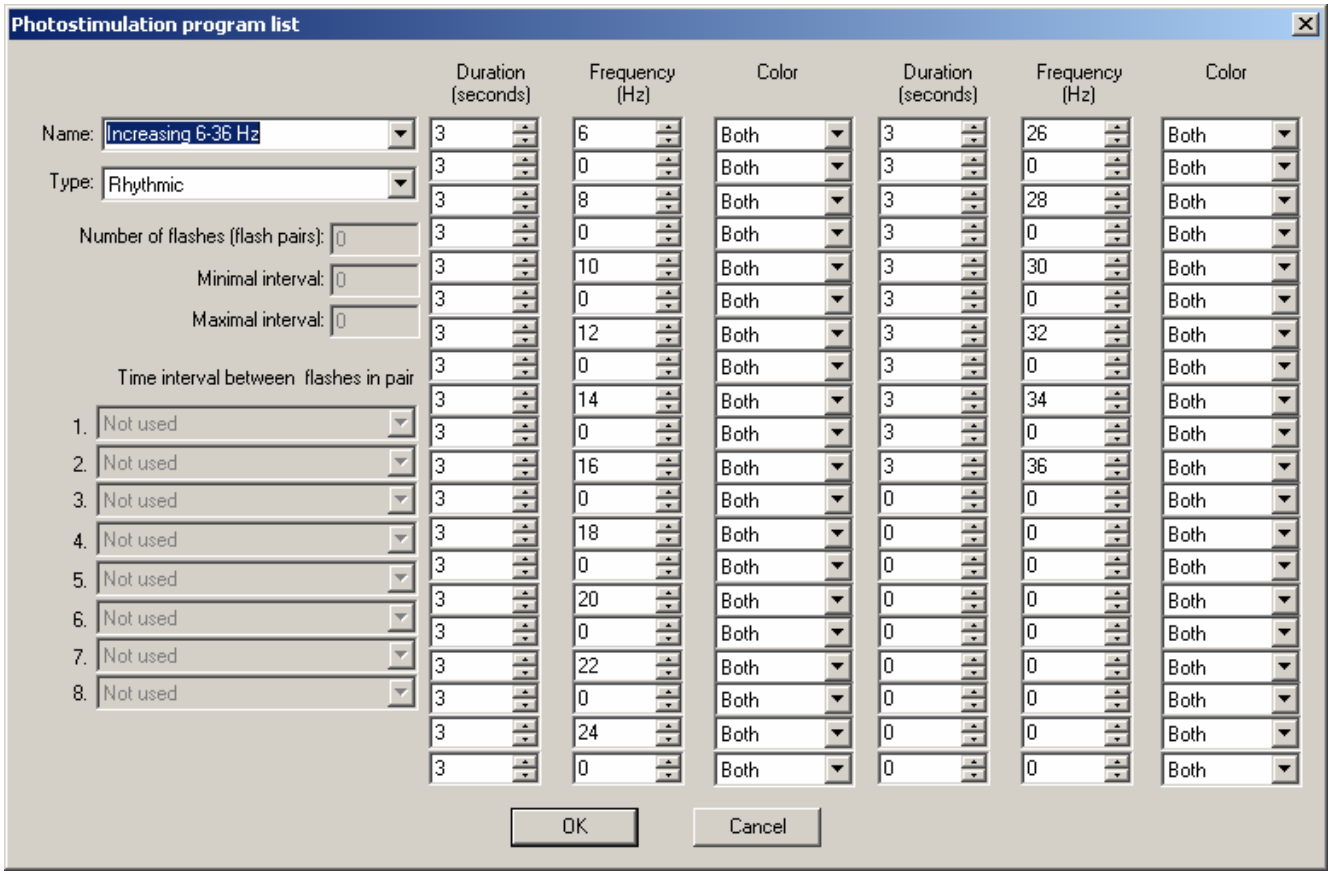
Select label type. WinEEG uses 5 label types:

Vertical bar	A vertical blue "transparent" bar without text.
Channel bar	A horizontal blue "transparent" bar without text. It highlights an interval within one certain channel (Fp1-Ref) independent of its position in the window. Label length is defined by the user when creating the label.
Channel contour	A blue rectangular contour highlighting an interval within one certain channel (Fp1-Ref) independent of its position in the window. Label length is defined by the user when creating the label.
Vertical label	A vertical gray "opaque" bar with text.
Horizontal label	A horizontal gray "opaque" rectangle with text. Its vertical position is defined by user when creating the label.

Text

Enter label text (for a **Vertical label** or a **Horizontal label**.)

104. Photostimulation Program List dialog



Photostimulation programs are used during EEG acquisition (see Input Control toolbar). There are two types of photostimulation programs: **rhythmic** and **flashes**.

A **rhythmic** photostimulation program may consist of several (from one to twenty) steps. For each step the photostimulator flashes with constant frequency and power for a certain time.

For photostimulation by **single flashes**, three parameters are set: **number of flashes**, **minimum interval** and **maximum interval,** in milliseconds. WinEEG automatically creates and uses a sequence of intervals with random durations within the range from minimal to maximal value defined.

Name

Select a photostimulation program to modify or enter a new name.

Type

Choose photostimulation program type: **Rhythmic**, **Single flashes**, or **Pairs of flashes**.

Duration

Define duration (in seconds) for each step of **rhythmic** photostimulation program.

Frequency

Set stimulation frequency for each step of the **rhythmic** photostimulation program. If zero frequency value is set, the photostimulator will be off during that step.

Power

Set flash power for each step of **rhythmic** photostimulation (if power control is enabled).

Number Of Flashes

Set the number of **single flashes** or number of flash pairs for stimulation by **flash pairs.**

Minimal interval

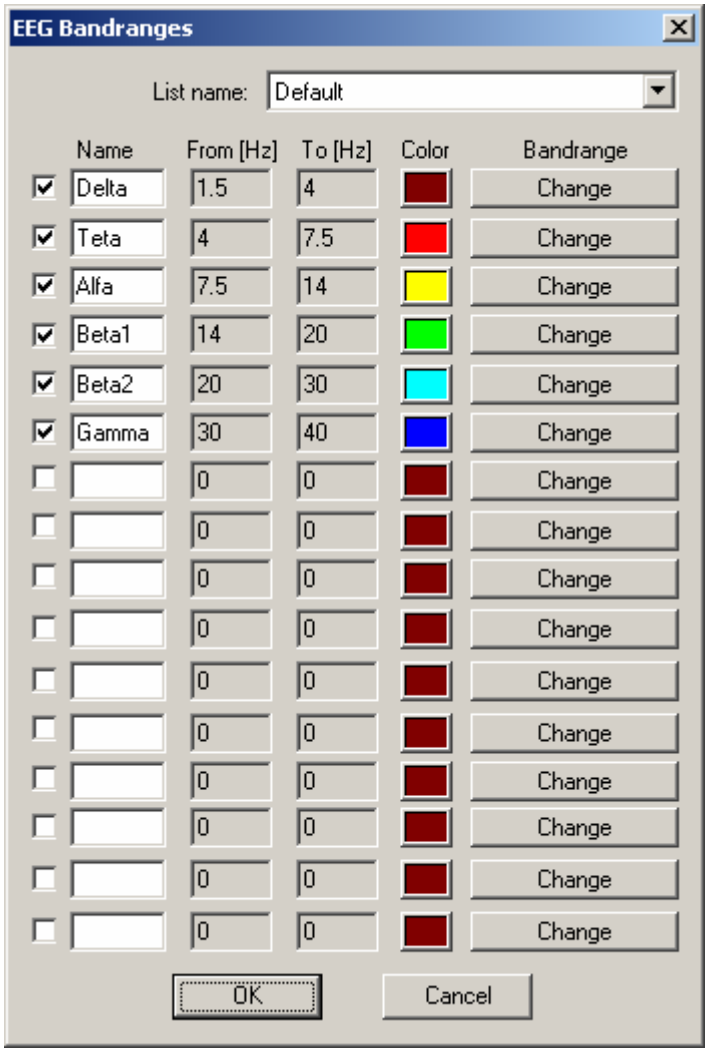
Set minimum interstimulus interval for stimulation by **single flashes** or **flash pairs**.

Maximal interval

Set maximum value for the interstimulus interval for stimulation by **single flashes** or **flash pairs**.

105. EEG Bandranges dialog

Select a list of frequency bands which parameters you would like to modify.



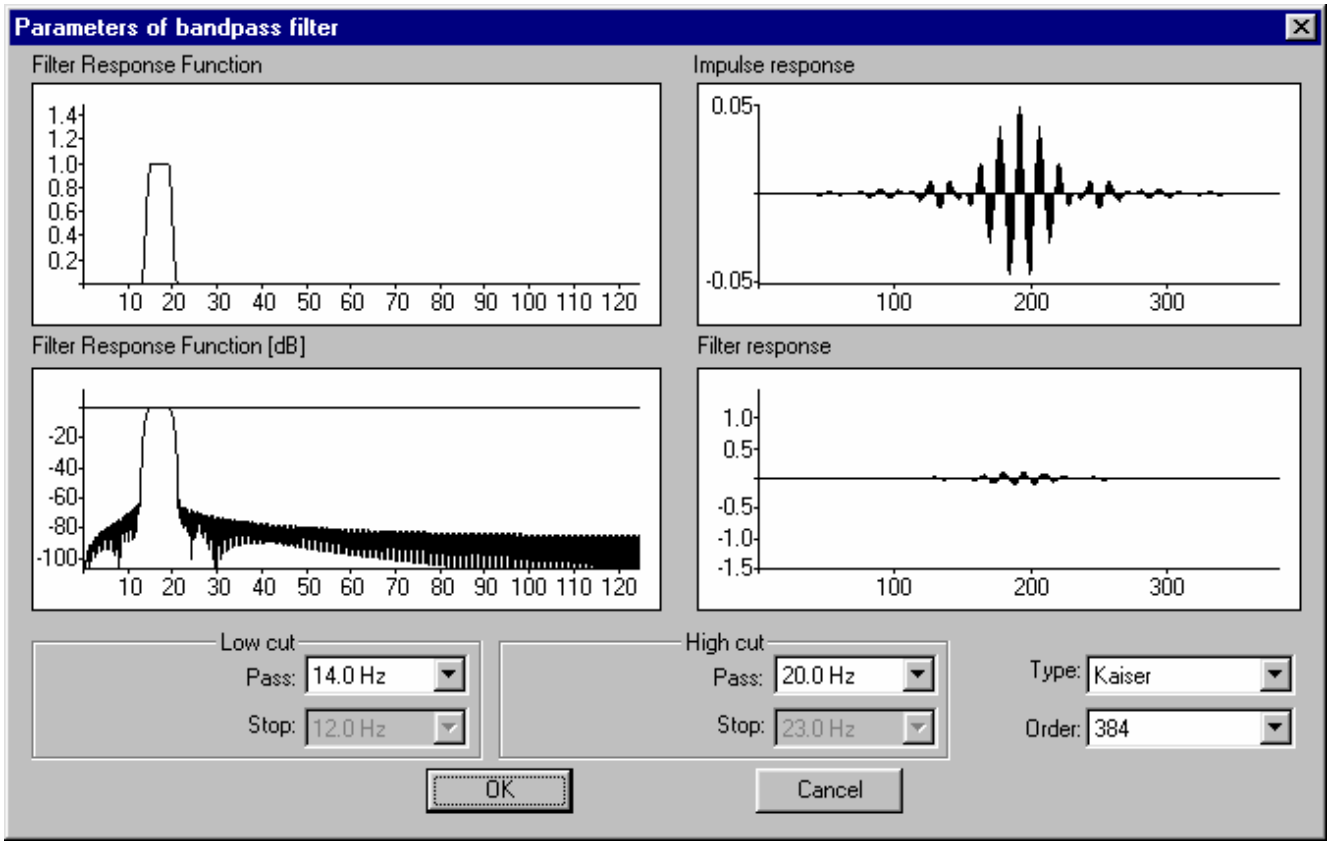
Defines names, limits and graph colors for standard EEG frequency bands. You can define up to sixteen frequency bands. A desired frequency band will be used in processing only if the checkbox to the left of the frequency band name is checked.

Use **List name** list to select list of frequency bands.

Press a **Color** button to display **Colors dialog**.

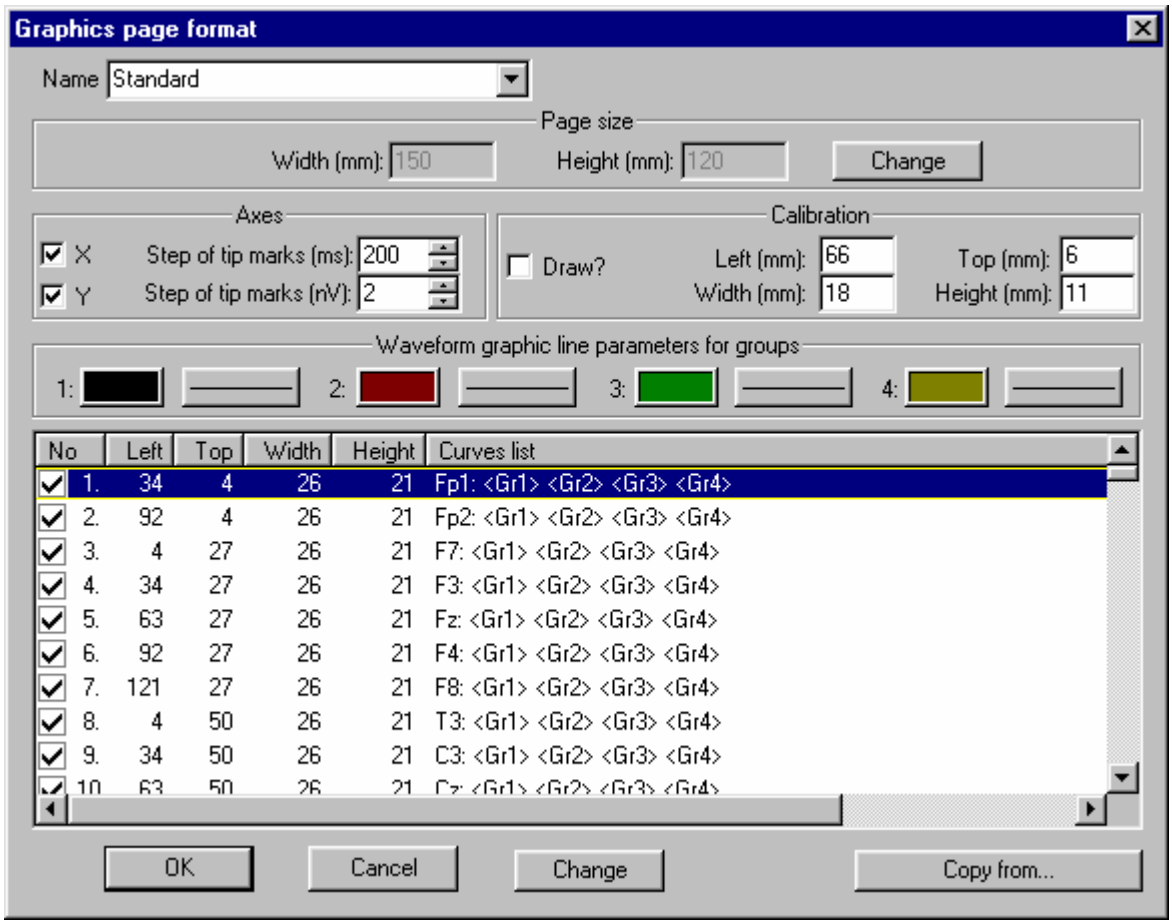
Press a **Change** button to display **Parameters Of Bandpass Filter dialog** changing frequency band limits and filter parameters.

106. Parameters Of Bandpass Filter dialog



Define frequency limits, filter type and order. For Chebyshev filter type, also select low and high frequency cutoffs. Filter Response Function, Impulse Response and Filter Response graphs help to check if filter parameters you enter are adequate.

107. Graphics Page Format dialog



Name

Choose a format from list or enter a new name for current format.

Page Size

Press **Change** button to set new graphic page size. The **Page Size dialog** is displayed after calling this command. After setting new size horizontal and vertical sizes and positions of graphs would be proportionally modified.

Axes

Customize axes output. Check axes to be displayed (**X** and/or **Y**) and set values for tic mark step (milliseconds for **X**, micro Volts for **Y**).

Calibration

Customize calibration scale output: position on the page (in relation to left upper corner) and size.

Waveform graphic line parameters for groups

Choose color and style for ERP graph lines for each trial group (up to four groups can be depicted on a page simultaneously; see **ERP window**). Press a color-filled button to call **Colors dialog**. Press a button with a horizontal line to call **Line Style dialog**.

Table of Graph Parameters

Each row of the table displays parameters for one graph: position (in relation to upper left page corner), horizontal and vertical size and list of depicted curves. One graph can depict up to four

curves corresponding to different trial groups - for only one channel. Besides, under the graph there can be histograms (for each of four trial groups) encoding results of ERP statistical analysis (see **ERP window**). For example, if "**Curves List**" field contains the following:

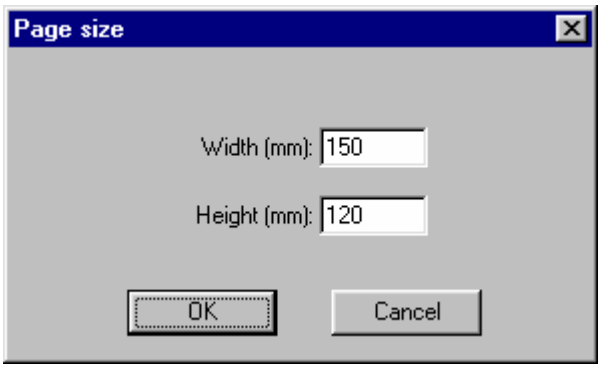
F3: <Gr1+St> < Gr2> < Gr3> < Gr4>

The graph will depict ERPs for F3 channel and for four trial groups named by means of **Averaging Groups bar**. Also, a histogram of statistical significance for the first trial group will be shown under the graph. Graphs will not be displayed for channels or trial groups absent in the opened ERP file.
Check table rows for graphs to be depicted in the **ERP window** or highlight a row (rows) to modify parameters for.

Press **Change** button to set new parameters for displaying graphs checked in the table. **The Parameters Of Graphics dialog** is displayed after calling this command.

Press **Copy From…** button to copy parameters from another format selected from list. The **Page Size dialog** is displayed after pressing this button.

108. Page Size dialog



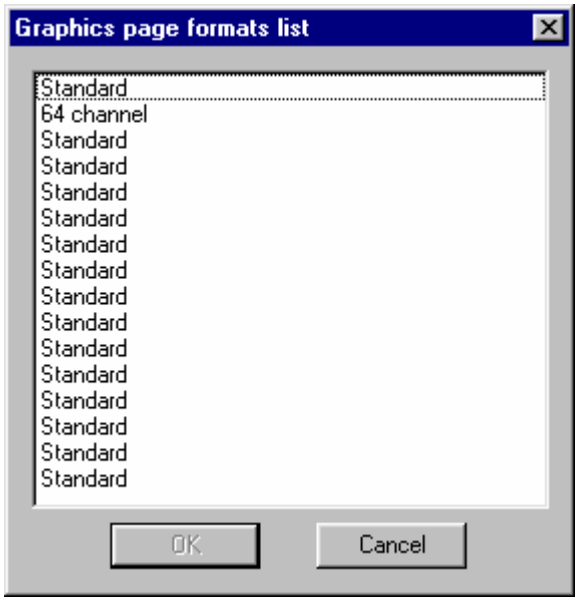
Enter page **width** and **height**.

109. Line Style dialog

Press a button to select an appropriate line style.

110. Graphics Page Format List dialog

Choose a format from list.



111. Parameters Of Graphics dialog

Rectangle

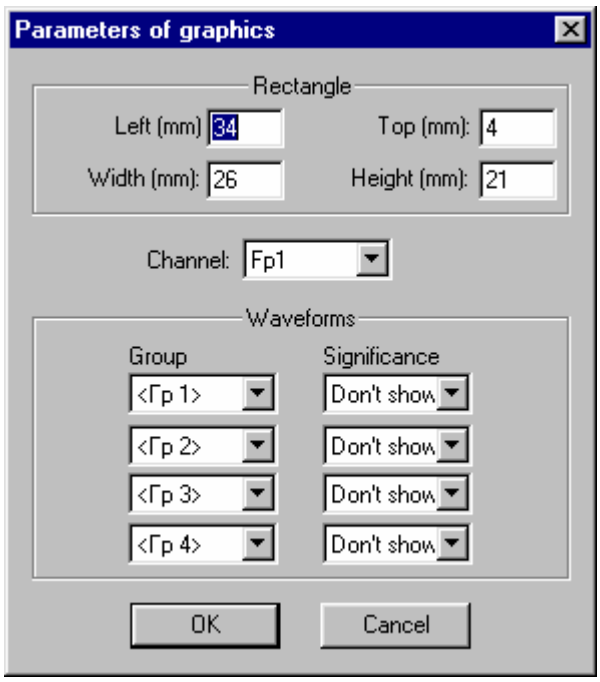
Enter graph size and coordinates of its upper left corner relatively to the upper left corner of the page. If the graph size exceeds page dimensions, they page dimensions will be increased.

Channel

Select a channel to be depicted.

Waveforms

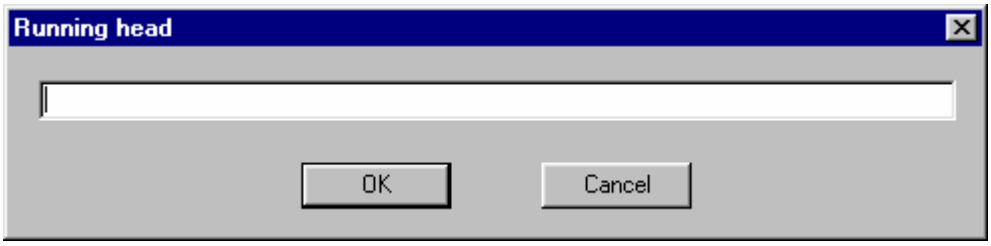
Choose a trial group to be depicted by each of curves on the graph (up to four groups can be depicted) and define whether a statistical significance histogram is to be shown for the group.



Attention!!! If you are modifying parameters for several graphs simultaneously only newly entered parameter values will be changed. For example, you can select all graphs in the table and modify their sizes; the remaining parameters will be unchanged.

112. Running Header dialog

Enter, for example, your organization title to be printed as running header at the top of each page.



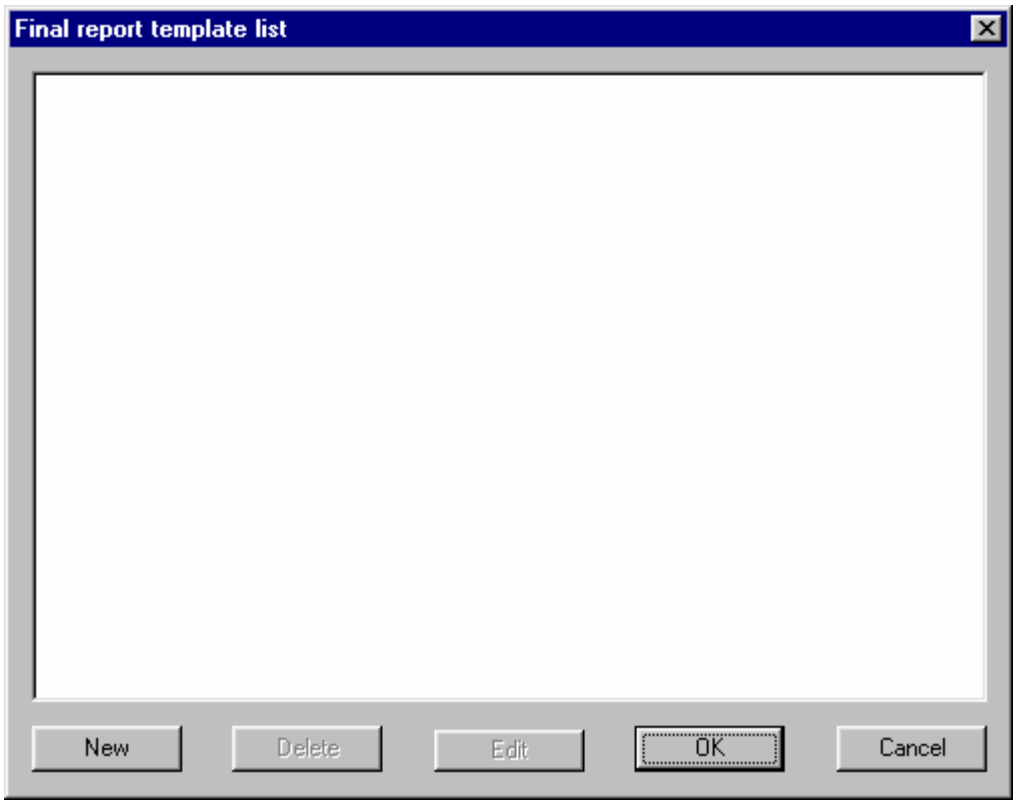
113. Final Report Template List dialog

Creates and modifies final report template list.

Use the **New** button to add a new final report template to the list. **Final Report Template dialog** will appear.

Use **Delete** button to delete the selected final report from the list.

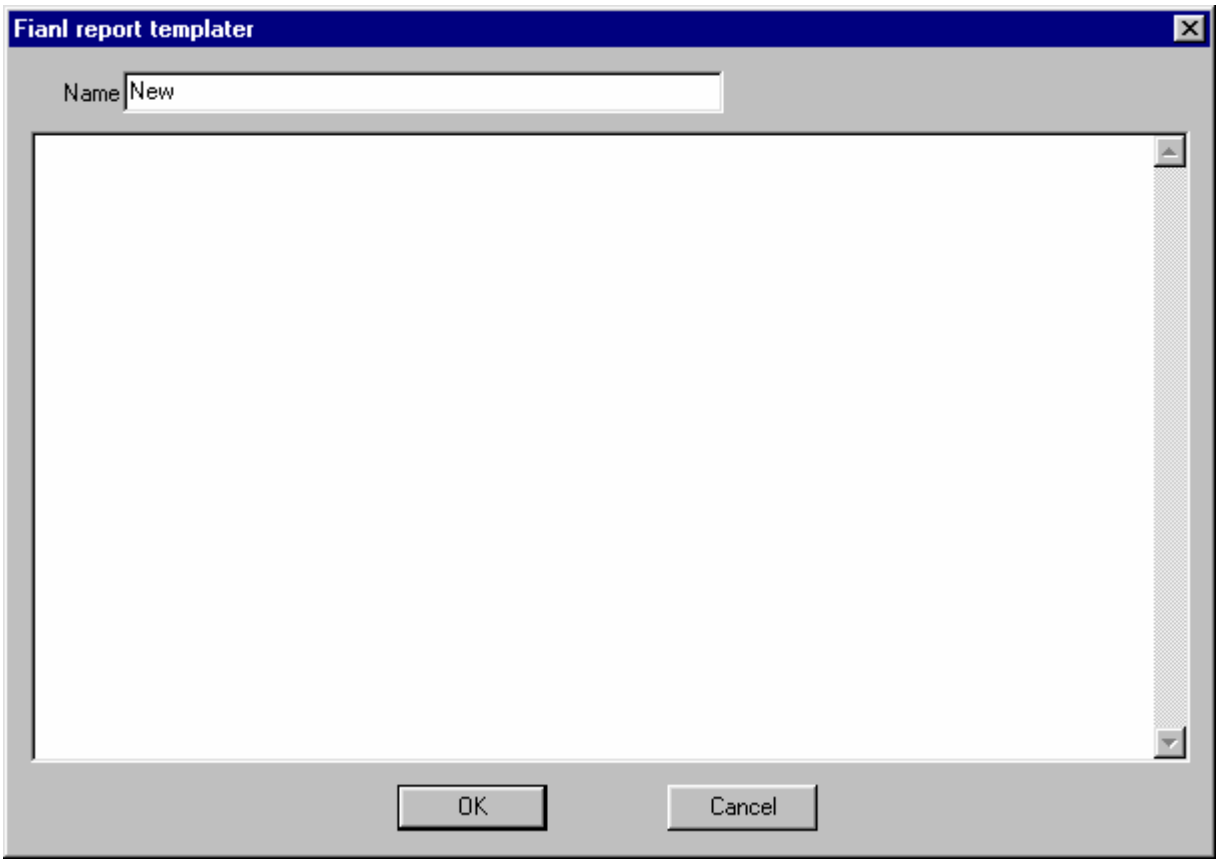
Use **Edit** button to edit selected final report. **Final Report Template dialog** will appear.



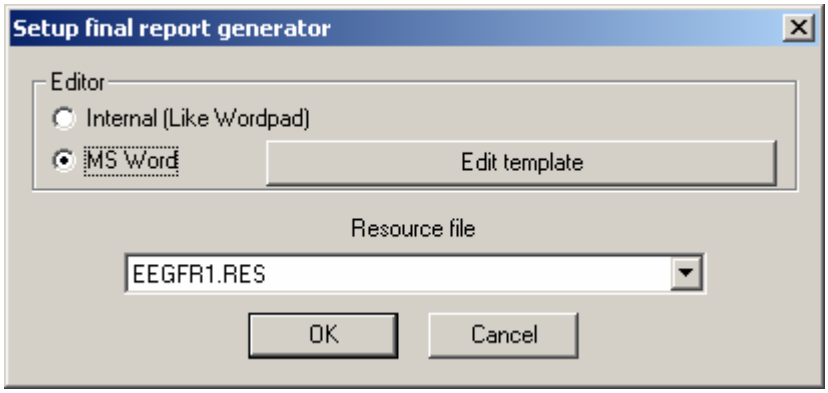
114. Final Report Template dialog

Enter template name in the **Name** field.

Enter final report text in the edit box below **Name** field.



115. Setup Final Report Generator dialog



Editor

Define what editor to use.

Attention!!! MS Word can be chosen only if it is installed on your computer. WinEEG works **only** with MS Word 97 and MS Word 2000. MS Word 95 is **not** supported.

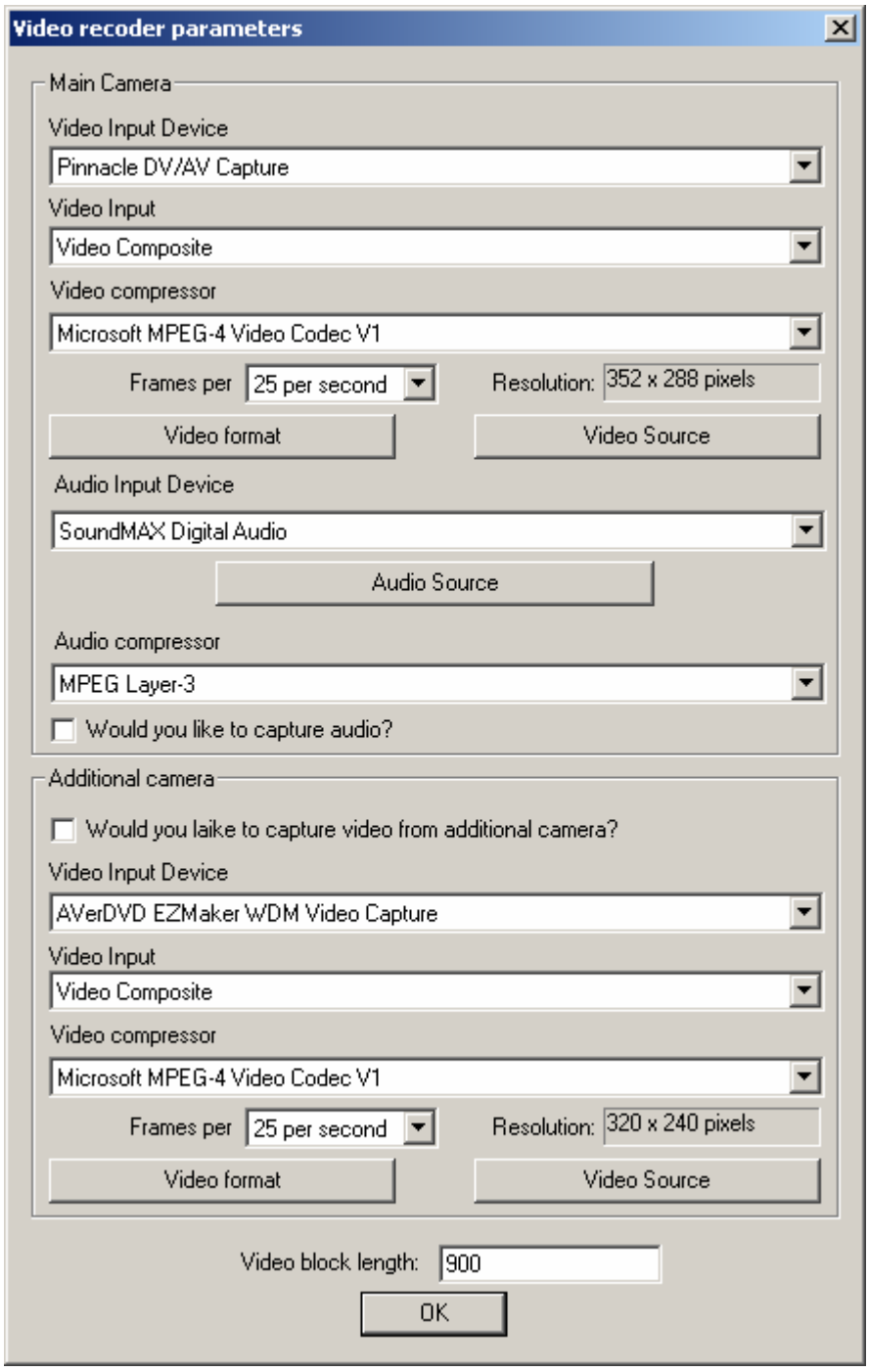
Resource File

Choose resource (.RES) file for final report generation.

Edit template

Run MS Word application to modify empty final report.

116. Video recorder parameters



The parameters of main and additional cameras can be specified using this dialog/

Video input device

Select video capturing device

Video input

Select video input to which camera is connected.

Video compressor

Select on line video compressor. The compressors **“Microsoft MPEG-4 Video Codec V1”** or **“Microsoft MPEG-4 Video Codec V3”** will be the best for many system configurations. We don’t

recommend you to use this option with rather slow computers. Use Source button to specify compression parameters if corresponding video capture card support on line compression.

Frames per second

Select frame rate if it is possible.

Video format

Press this button to specify parameters of video format.

Video Source

Press this button to specify parameters of video capturing.

Audio input device

Select audio input device.

Audio source

Press this button to specify parameters of audio input.

Audio Compressor

Select on line video compressor. The compressors **“MPEG Layer-3”** will be the best for many system configurations.

Would you like to capture audio?

Check this button if you would like to capture audio signal.

Video block length

Specify minimal length of block of video data placed into one file. By another words each specified seconds the old video file will be closed and new file will be created.

Attention! Please specify all parameters of Video format, Video source and Audio source carefully. The quality of recorded signal will depend on these parameters. Unfortunately corresponding dialog boxes are unique for each video capture and audio capture devices. Please look for information about them in corresponding operation manuals.

117. Equipment Configuration dialog

Amplifiers type

In this case the version and serial number of amplifiers box will be displayed.

I/O Port

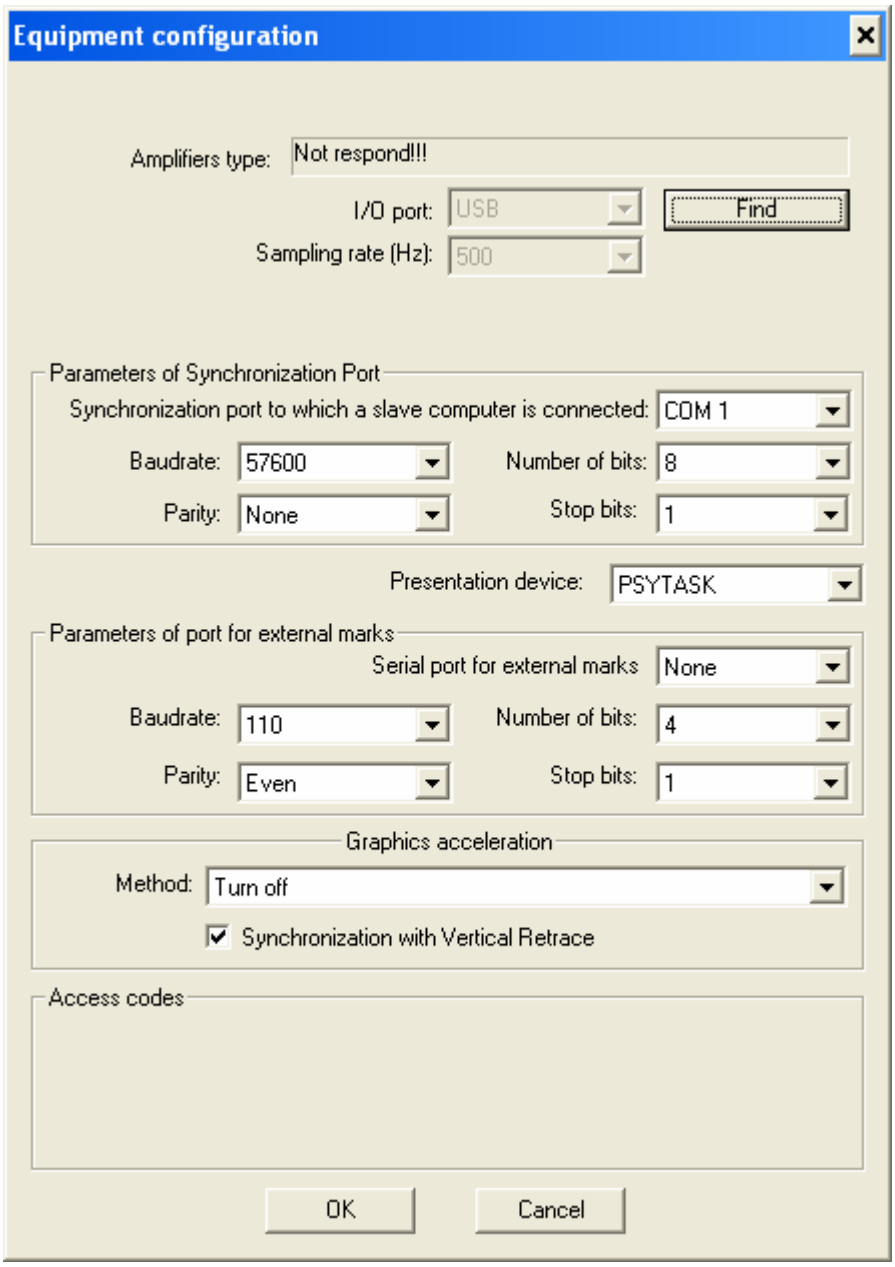
Choose COM1 or COM2 port to connect encephalograph.

Attention!!! If **I/O Port** is chosen incorrectly EEG cannot be acquired and any attempt to start EEG input will cause error.

Attention!!! This field can be disabled in a number of WinEEG versions. Use button **"Find"** in this case to perform automatic search of connected to computer Mitsar amplifiers.

Synchronization Port To Which a Slave Computer Is Connected:

Choose a COM port to connect a slave computer (presenting stimuli for ERP investigation) to and specify its parameters.



Parameters of port for external marks

Choose a COM port to connect another computer (sending external marks) to and specify its parameters.

Presentation device

Select presentation device. The presentation device can be **PSYTASK** program or **EXTERNAL**. Select **EXTERNAL** option if you would like to use **Presentation** program or **E-prime** program

Graphics acceleration

Select the method of graphics acceleration that you prefer. Default – Turn off.

Access codes

Enter 8-characrters access codes into these fields (see above).

Appendix 1. Final Report Generation Setup

Programming Language for Automatic Final Report Generation System

Automatic Final Report Generation dialog uses a programming language developed for the purpose of simplifying the creation of hierarchical menus that are used for selecting specific wordings. By means of this programming language you can develop practically any structure for calling wording-interactive menus. The developers, however, made their aim to design as simple and convenient a language as possible, and not to create the most perfectly general hierarchical menu system.

A source for a hierarchical menu system is an ASCII file created by any text editor and containing information on future structure of interactive menus. When menus are created, the text is compiled by a special compiler (FRC.EXE) that generates a resource file used by the automatic final report generation system. The resource file name is mandatory: EEGFR.RES.

The compiler interprets menu description. If an error occurs, compiling process breaks and an error messages is generated, containing the source line number and a brief error description. If no errors are detected, a message about successful compilation is displayed and a corresponding resource file is created.

Command line syntax to call the compiler:

FRC.EXE <ACSII file name> <resource file name>

1. Basic Terms.

Basic terms used in the programming language:

A **Menu** is a basic automatic final report resource unit. A *menu* is a list of wordings united into an entire group and showed in a window simultaneously. A menu can have an additional attribute - so-called menu *header*. This is an arbitrary text shown in the top of automatic final report generation window when the corresponding menu is displayed.

Menu description contains a list of **options**. An option contains: a wording to be shown and selected in the window; text to be inserted into final report on selecting the option, and a set of commands organizing menu display sequence.

All menus described in the system must be organized in **menu blocks**. A *menu block* is a set of separate menu descriptions enclosed in ***block ... endblock*** brackets. In simplest cases menu description file has only one menu block. The "block" term is introduced into the syntax in order to lessen description text size. It is very favorable to organize menus with wordings used more than once into blocks. It seems also reasonable to unit logically closed pieces of a hierarchical menu system into blocks.

2. Hierarchical Menu System Cycle.

To understand hierarchical menu system programming principles better, let us study a hierarchical menu system cycle. First of all, just after a hierarchical menu system is called, the first block (in order) is loaded to memory. Then, the first menu in the block is processed. All necessary information

on this menu is read into RAM from the resource file. A wording selection window is formed automatically, menu header (if defined) is highlighted and the control goes to the procedure processing operator commands - by means of these commands an user can choose one of existing wordings. After a wording has been chosen, corresponding text is inserted into final report and processing procedure starts. In the simplest case, when there is no menu block call commands among control transfer commands corresponding to selected wording, next menu is processed. Control transfer commands can enable transfer to next menu in order or to miss a number of menus described within executed block.

In a more complicated case, one more menu block is called to be executed. In this case required block information is loaded to memory and the first menu of new block is processed. When processing of newly loaded block menus is finished, the control transfer command corresponding to the wording that had been selected and had caused the new menu block loading to memory. In other words, in this case one more menu block is processed after inserting the selected wording into text and before control transfer to next menu according to the described control transfer command described. The system enables nested calls of menu blocks to be processed, i.e. a block can be called to be processed from another block called beforehand to be processed. But total length of all blocks that can be loaded into RAM is limited.

Note that processing of a menu block is finished in two cases: either after the last menu in order is processed, or after a *break* control transfer command is executed. The system of hierarchical menu processing completes its functioning when processing of the first (in order) block described in the hierarchical menu program is finished. So if processing of any block in the program (except the first block) is not described explicitly in control transfer commands, such a block will not be used.

Finally, menu header processing logic shall be fixed. If no header is described for next menu in order, it does not change the header set previously. Otherwise two situations may take place. If menus of one block are processed, their headers will be consequently replacing one another. If a block was loaded and a menu with a header is processed, the header will be changed. But after the block is processed completely the header defined in the block that has been previously called and is currently being processed will be restored.

3. Language Syntax.

Notation Convention.

Common notation conventions will be used in syntax descriptions as it takes place in MS DOS and in a number of programming languages like Assembler or C. A key word or a syntax expression not in brackets is directly present in the program. Text in square brackets [ ] is not mandatory to be present. Text in angle brackets < > must be present but its contents is just an example and can be replaced with another text.

Structure of Menu Block Description.

block <Block Identifier>

<Menu Description 1>
[<Menu Description 2]
[<Menu Description 3]
...
[<Menu Description n]

endblock

<*Block Identifier*> is a character string not exceeding 16 characters, not containing punctuation signs (dots, commas, colons, etc). Any block must have an identifier that will be used to program calls of this block.

Structure of Menu Description.

menu <Menu Identifier > [title "<Menu Header Text>"]
<Option Description 1>
[<Option Description 2>]
[<Option Description 3>]
...
[<Option Description m>]

end

<*Menu Identifier*> is a character string not exceeding 16 characters, not containing punctuation signs (dots, commas, colons, etc). Any menu must have an identifier that will be used to program calls of this menu.
<*Menu Header Text*> is an arbitrary text not exceeding 60 characters, enclosed into double quotation marks.
Menu header is not mandatory according to the notation convention.

Structure of Option Description.

"<Name>" "<Text>" [goblock <Block Identifier>] [<Transfer>],

where <*Name*> is a wording name indicated in the wording list window. It is an arbitrary text in double quotation marks, not exceeding 50 characters.
<*Text*> is the wording text to be inserted into final report. It is an arbitrary text in double quotation marks. Special characters can also be used:

new line - *n* (line feed)
double quotation marks - \"
apostrophe - \'
backslash - \\.

goblock <*Block Identifier*> - call of a block to be processed,
<*Transfer*> - control transfer command.
There are four control transfer commands:

next - goes to next menu (default);
break - finishes block processing;
quit - stops the whole hierarchical menu processing system functioning;
go <*Menu Identifier*> - starts processing the menu with the corresponding identifier.

There are several limitations for programming block calls and menu transfers:
Only a block can be called that is described in the text below the block currently processed.
A menu can call another menu only within a block, and the menu to be called shall be described in the text below the menu calling it.
These limitations can complicate development of a user's own hierarchical menu system but they leave out the possibility of occurrence of closed loops and therefore simplify debug of the system.

Comments

Any text from a semicolon (;) to the end of line is treated as a comment and is not included in the syntax analysis.

4. Example of a Hierarchical Menu Program

Here is a short example of a program showing all key words and features of the language. You can analyze this text by yourself, and having done it, you surely will be able to create a hierarchical menu system as complicated as you need.

```
block Block1
 menu Menu1 title "text of title1"
 "Option1 menu1" "\nOption insert text1 menu1" next
 "Option2 menu1" "\'Option insert text2 menu1" break
 "Option3 menu1" "\"Option insert text3 menu1" go Menu5
 "Option4 menu1" "\\Option insert text4 menu1" quit
 end

 menu Menu2
 "Option1 menu2" "Option insert text1 menu2" next
 "Option2 menu2" "Option insert text2 menu2" break
 "Option3 menu2" "Option insert text3 menu2" go Menu4
 "Option4 menu2" "Option insert text4 menu2" quit
 end

 menu Menu3 title "text of title3"
 "Option1 menu3" "Option insert text1 menu3" goblock Block2 next
 "Option2 menu3" "Option insert text2 menu3" goblock Block3 break
 "Option3 menu3" "Option insert text3 menu3" goblock Block2 go Menu5
 "Option4 menu3" "Option insert text4 menu3" goblock Block3 quit
 end

 menu Menu4 title ""
 "Option1 menu4" "Option insert text1 menu4" next
 "Option2 menu4" "Option insert text2 menu4" break
 "Option3 menu4" "Option insert text3 menu4" go Menu5
 "Option4 menu4" "Option insert text4 menu4" quit
 end

 menu Menu5 title ""
 "Option1 menu5 " "Option insert text1 menu5" next
; "Option2 menu5 " "Option insert text2 menu5" break
; "Option3 menu5 " "Option insert text3 menu5" go Menu6
 "Option4 menu5 " "Option insert text4 menu5" quit
 end

endblock

block Block2
 menu Menu6 title "text of title6"
 "Option1 menu6" "Option insert text1 menu6" next
 "Option2 menu6" "Option insert text2 menu6" break
 "Option3 menu6" "Option insert text3 menu6" go Menu8
 "Option4 menu6" "Option insert text4 menu6" quit
 end

 menu Menu7
 "Option1 menu7" "Option insert text1 menu7" next
 "Option2 menu7" "Option insert text2 menu7" break
 "Option3 menu7" "Option insert text3 menu7" go Menu8
 "Option4 menu7" "Option insert text4 menu7" quit
 end
```

```
 menu Menu8 title "text of title8"
 "Option1 menu8" "Option insert text1 menu8" goblock Block3 next
 "Option2 menu8" "Option insert text2 menu8" goblock Block3 break
 "Option3 menu8" "Option insert text3 menu8" goblock Block3 go Menu9
 "Option4 menu8" "Option insert text4 menu8" goblock Block3 quit
 end

 menu Menu9 title ""
 "Option1 menu9" "Option insert text1 menu9" next
; "Option2 menu9" "Option insert text2 menu9" break
; "Option3 menu9" "Option insert text3 menu9" go Men10
 "Option4 menu9" "Option insert text4 menu9" quit
 end
endblock

block Block3
 menu Menu10 title "text of title10"
 "Option1 menu10" "Option insert text1 menu10" next
 "Option2 menu10" "Option insert text2 menu10" break
 "Option3 menu10" "Option insert text3 menu10" go Menu11
 "Option4 menu10" "Option insert text4 menu10" quit
 end

 menu Menu11
 "Option1 menu11" "Option insert text1 menu11" next
 "Option2 menu11" "Option insert text2 menu11" break
; "Option3 menu11" "Option insert text3 menu11" go Menu8
 "Option4 menu11" "Option insert text4 menu11" quit
 end
endblock
```

5. Limitations.

String length should not exceed 256 characters
Not more than 256 menus can be described
Total length of blocks simultaneously loaded to memory should not exceed 64 menus
Not more than 128 blocks can be described
A menu should not exceed 32 options
A menu description (including header, wording names, and texts to be inserted) should not exceed 4000 characters