BRAIN QUICK Software User Manual

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GENERAL INTRODUCTION

INTRODUCTION

BRAIN QUICK SOFTWARE is the software that handles all of Micromed acquisition and Review systems for EEG, EMG and EP, which means that according to the enabled key options, BRAIN QUICK SOFTWARE integrates all types of exams in a single application, such as:

- EEG
- Video EEG
- Long term monitoring of Epilepsy - Stereo EEG
- Ambulatory EEG/PSG
- EEG Recording during functional MRI
- Electromyography
- Evoked Potentials
- Intra-Operative Monitoring

The configurations are opened towards external systems and are organized according to the criteria of maximum working flexibility. The single archive and project design guarantee that all the standard activities of Acquisition, Review, Analysis, Report and Archive of all exams can be managed in a single unit or on several systems distributed over a network. The program has been designed to be offered in various performance/feature levels. Hence, some of the features described in the present manual could be not available on the software installed on your system.

This document includes updated features available from BRAIN QUICK SOFTWARE version 3.05.

It is intended to manage the following hardware devices:

- **SD PLUS FLEXI** amplifier
- **SD PLUS FLEXI HIGHRATE** amplifier
- **SD PLUS FLEXI CLINIC** amplifier
- **SD PLUS RESEARCH** amplifier
- **MORPHEUS** amplifier
- **BRAIN SPY PLUS** amplifier
- **SD LTM 32 PLUS, SD LTM 64 PLUS** amplifiers
- **SD LTM 32 EXPRESS, SD LTM 64 EXPRESS** amplifiers
- **SD LTM STIM** cortical stimulator
- **BQ NET POE M** interface
- **BQ NET POE 2** interface
- **BQ NET POE PLUS** interface
- **BQ USB** interface
- **BQ USB EXPRESS** interface
- **BQ USB PLUS** interface
- **BQ USB MULTI** interface
- **BOX TERMINAL EXPRESS** interface
- **BOX TERMINAL MULTI** interface

This manual describes the functionality of the software and how to carry out the examination programs for neurophysiologic studies.

SYSTEM REQUIREMENTS

PROCESSOR: Intel® i7 minimum, 2.1 GHz or faster
MEMORY: 16 GB RAM minimum
HARD DISK: 512 Gb minimum
OPERATING SYSTEM: Windows 10 – 64bit
DISPLAY: 22'' minimum
SCREEN RESOLUTION: 1920x1080 minimum (FullHD aspect ratio 16:9)
NETWORK CARD: 1Gb
OUTPUT PERIPHERALS: Any display meeting IEC 60950 requirements and printer supported by the installed operating system.
NETWORK: Systems meant to be connected to the local network will need an Ethernet cord with RJ45 connector.
INPUT PORT FOR USB CONNECTION

If Brain Quick software shall be installed in a Citrix environment, the server shall satisfy the following minimum specifications:

PROCESSOR: 4 vCPUs
OPERATING SYSTEM: Windows Server 2016 (10.0.14393) minimum
MINIMUM CITRIX XENAPP/VAD VERSION: 7 (1903.1) minimum
MEMORY: 16 GB RAM minimum
HARD DRIVE STORAGE (USABLE): 80 GB OS minimum and 40 GB App (Optional)
OPERATING SYSTEM FEATURES:
- PDF reader and default application set for .pdf file type
- .Net 4.0 or later

Separation devices: Parts of the system that are in the "Patient Area" or are electrically linked (i.e. data cable, network or triggers) to devices in the patient area needs proper isolation from the mains voltage and measure to lower the leakage currents on the enclosures of IT-devices included in the system. Hence, the use of a separation transformer on their mains connection, or proper separation devices between devices in patient area and devices outside it (e.g. BQ USB interfaces) is mandatory. The user must not the system configuration made by authorized technicians at the installation.

Failure to use Separation Transformer Units or complete systems from our company will void any declaration of compliance with the standards from our company.

INTENDED USE

BRAIN QUICK SOFTWARE is explicitly designed to help physicians in recording, archiving, and reviewing data coming from Micromed digital acquisition systems.

BRAIN QUICK SOFTWARE can be used for EEG, EMG, and EP exams and other neurophysiologic studies based on the data recorded from the patient through Micromed acquisition devices. The software could also be used for cortical stimulation during electroencephalography examinations (i.e. stereoEEG) in combination with specific stimulators.

Some analysis functional tools are provided as default or software options. Results coming from these tools must never substitute the critical interpretation and the clinical conclusions by a physician.

BRAIN QUICK SOFTWARE is not intended to continuously monitor central nervous system functionality, in conditions where a warning on the change of patient condition is essential (e.g. OR and ICU automatic monitoring without the presence of the physician), since the system is not equipped with proper alarms that substitute continuous medical surveillance. The use of BRAIN QUICK SOFTWARE must always be overseen by a physician or a qualified technician.

INTENDED USERS

The use of the software is reserved to physicians, technicians, or other medical professionals that are trained in bio-potential recording. Also when it is used at home, the intended users are the medical professionals that are the only people that have the skills to start and stop the signals' recording and review the traces.

ADDITIONAL INFORMATION

BRAIN QUICK Software is not intended to continuously monitor Central Nervous System functionality in conditions where a warning on the change of patient condition is essential (e.g. OR and ICU automatic monitoring without the presence of the physician), since it is not equipped with the proper alarms that substitute continuous medical surveillance. The use of BRAIN QUICK Software must always be carried out under the supervision of a physician or a qualified technician.

GENERAL PRECAUTIONS AND WARNINGS

Read this section carefully.

RESPONSIBILITY

Micromed can only be held responsible for the accuracy of signals recorded under the circumstances described in this user manual. The collected data is not a substitute for the interpretation and clinical conclusions by a physician.

Micromed cannot be held responsible for data generated by misuse of the equipment from its operators.

BRAIN QUICK SOFTWARE CONFIGURATION

- BRAIN QUICK Software installation must always be carried out by authorized technicians. Deep knowledge of the inside software structure and of the hardware system is needed.
- To solve any problems that can arise during the use of software, contact your Micromed representative and the Micromed Service department.
- DO NOT ATTEMPT TO MODIFY THE SYSTEM CONFIGURATION BY YOURSELF (including the parts of software that manages hardware setup and that are highlighted and described in the user manual as reserved to the technicians). For any needs, contact Micromed Service Department or a Micromed authorized technician.
- The configuration of the resource list must only be performed by authorized personnel, since a wrong or incomplete configuration of resources can lead to data loss. Ask for Technical Assistance if you need to modify your system: the best software and hardware configuration according to your new exigencies will be suggested.
- Moreover, it is strongly suggested not to install other software on the PC. Any additional software you install is at your own risk and Micromed cannot be held responsible for any problems from that installation. Intervention for resuming a situation where an additional installation has led to a problem will incur a charge by Micromed according to the standard Service Price List.

DATA SAFETY

- Micromed BRAIN QUICK SOFTWARE advanced storage and data management features work properly ONLY if the user does not copy or move data without using the proper archive function, which are better explained in the Archive section of the user manual. This allows the software archive references to always be synchronized with the current situation. OPERATIONS PERFORMED ON DATA FILE NOT USING THE BRAIN QUICK SOFTWARE ARCHIVE COMMANDS CAN LEAD TO TEMPORARY OR DEFINITIVE PATIENT DATA, EXAM OR FILE LOSS.
- It is highly recommended to never access to BRAIN QUICK SOFTWARE work directories (defined in the path selection box of the installation setup, the database and resources setup screens) using the operating system functions (Windows Explorer or the desktop My Computer or Network Neighbourhood icons) to avoid any possible damage to the files.
- Using BRAIN QUICK SOFTWARE, trace data and database backup can be stored on external supports.
- Periodic backup of the database on external supports is available setting the “Database Backup Scheduler” properties. If these are already set, you should modify only the time interval between two

backups while the other configurations (e.g. the path) should be changed only under Micromed technician instructions. Refer to the related chapter of the user manual for detailed instructions.

- IT IS RECOMMENDED TO PERFORM BOTH DATA AND DATABASE BACKUPS REGULARLY to prevent data loss due to physical support damage (e.g. scratches on CD-ROM surfaces) or to a problem with wrong linkage in the database management or to interference with some other running software.
- Trace data and database backup can be performed on a similar or different type of support than the original one. Considering the particularly critical operation, BACKUP MUST BE PERFORMED ON DEVICES NOT CONNECTED TO THE NETWORK (or temporarily disconnected) in order to avoid accidental access to the data during the copy operation.

DATA ACQUISITION AND ANALYSIS

- Since BRAIN QUICK software uses a large amount of PC resources (memory and CPU), it is recommended to close other running applications, especially when performing operations that require the management of a great amount of data (e.g. video acquisition, 32 channel acquisition at high sampling rate and so on) otherwise, a message “SPEED ERROR” could appear and the acquisition could be stopped.
- During data acquisition, it is recommended that the user checks the quality of the resulting traces, keeping them displayed on the monitor. No other operation should be performed during acquisition, in order to minimize the error probability. During the review of the traces for interpretation, it is recommended to check the correspondence of the traces displayed to those desired (patient data, trace parameters, montage).
- The measures automatically performed (e.g. nervous conduction velocity calculation) by EMG and EP software, according to the settings chosen by the user, display the numerical results on the side of the related trace. The flags on the trace indicate the calculation points. The physician that performs the exam should always check if the points selected by the software are the most significant ones from a clinical point of view, and should eventually correct them manually. In all the software features, any automatic analysis tool always has to be considered help in interpreting traces, and not the interpretation itself.

CYBERSECURITY

Micromed systems should comply with the following recommended cybersecurity controls:

- The PC should have an antivirus installed, Micromed usually uses Paloalto Cortex XDR antivirus
- User passwords have to be private and follow the recommended password policy listed below:
    - They have to be renewed every six months
    - They have to be at least 8 characters long
    - They have to contain both upper-case and lower-case letters (case sensitivity)
    - They have to include special characters, such as @, #, $
    - Passwords that match the format of calendar dates, license plate numbers, telephone numbers, or other common numbers are not allowed should be avoided
- If the system is connected to a computer network (intranet and/or internet), the firewall must be active and properly configured by technical personnel to allow Micromed software network services
- Usage of USB media devices should be limited
- Only a limited set of users should access shared folders and disk resources – sharing of

resources by several people should be avoided

- It is also recommended to install the most important Windows updates and patches as soon as they are available on Microsoft update centre.

HIPAA AND GDPR COMPLIANCE

In the implementation of software, Micromed implemented all the necessary measures to ensure the compliance with HIPAA and GDPR regulations, including controls to guarantee the protection of e-PHI (Patient Health Information).

The design solutions adopted by Micromed consider the following aspects:

1. Ensure the confidentiality, integrity and targeted availability of all patient information
2. Identify and protect the software against external threats, which could compromise the security or integrity of the information
3. Protect the software from improper use

Furthermore, the software must always be installed in environments that are compliant with the current network regulations.

ARCHIVE – FILE MANAGER SOFTWARE

ABOUT FILE MANAGER

FILE MANAGER is the gateway to review patient data, execute analysis, create reports, or start and stop a study.

The software is comprised of an application conforming to Windows standard and of an archive adhering to ODBC standards; any query can be performed following SQL standards.
Micromed has optimized the FILE MANAGER layout for efficiency: users can manage any part of archived information and the transfer processes from one screen.

All FILE MANAGER features are enabled by a dedicated software license.

ACCESS TO THE SOFTWARE

User can access to **FILE MANAGER with** or **without authentication**.

User authentication can be activated from Micromed Suite after installation, in server machine in case of distributed environment. Logon preferences are then centralized and modifiable only from Micromed Suite.

When user authentication is enabled the Logon system is active and the user must enter valid credentials to access FILE MANAGER; otherwise, if user authentication is disabled, it is possible to directly access FILE MANAGER as “Windows User” logged in the machine.

For further details about access mode configuration, see the **Logon System Configuration** section of this manual.

WINDOWS USER ACCESS

When authentication is disabled, login is not required and access to software is direct. When accessing without authentication, whole set of functions is available, depending on user permission, and Windows user is set as logged-in user.

For a detailed description of each functionality, see the dedicated sections of this manual.

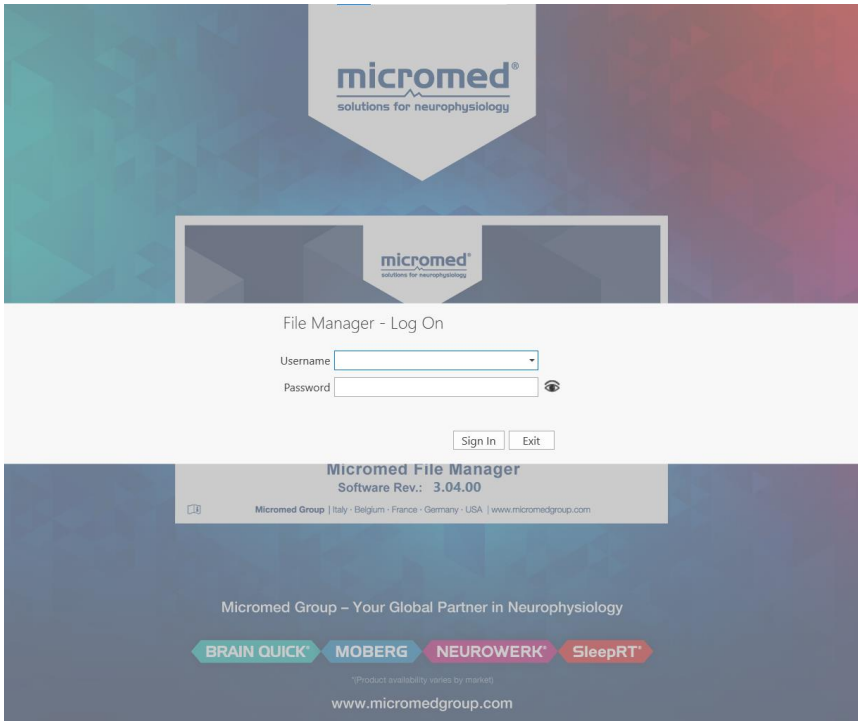
AUTHENTICATED ACCESS

If the Logon system is active, user authentication is required before accessing the application.

A valid username and password must be entered to access FILE MANAGER (see figure below). Once entered, click the “Sign In” button to proceed.

Only two failed authentication attempts are allowed; the application will close on the third failed attempt.

Note. Only users registered in the centralized Users database can access FILE MANAGER. The application allows to authenticate using both Windows user (Active Directory domain user) and non-AD user credentials; see the dedicated section of this manual for a complete description of the **Users database Configuration and Users management.**



When accessing through authentication, the functions to Switch User and Lockdown are enabled and become visible to the user.

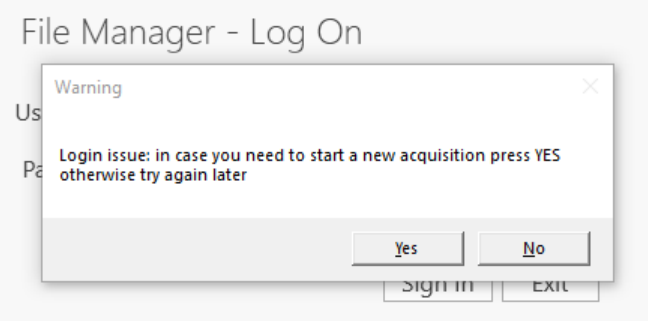
The "Reassign Patient" and "Merge Patients" features are NOT available if the HL7 Interface is enabled, the latter allows to manage order entries received from the Hospital Information System (HIS); these operations are performed automatically only when a specific request is received from HIS in order to guarantee a constant alignment between patients database and the anagraphic data managed centrally by the HIS. HL7 is a widely adopted set of standards and protocols designed to facilitate the exchange, integration, sharing, and retrieval of electronic health information among healthcare systems. It ensures interoperability and communication between diverse healthcare applications, devices, and information systems. By providing a common framework for the exchange of clinical and administrative data, HL7 contributes to the improvement of healthcare delivery, patient care coordination, and overall efficiency within the healthcare ecosystem. For more information about HL7 interface, see HL7 section of this manual.

FILE MANAGER functionalities depend on the user permissions when authenticated access is enabled.

Each user accessing the FILE MANAGER has a specific **role**, i.e. a collection of permissions which define which operations are or are not allowed for that user. See **section** below for a complete list of available user permissions.

EMERGENCY LOGON

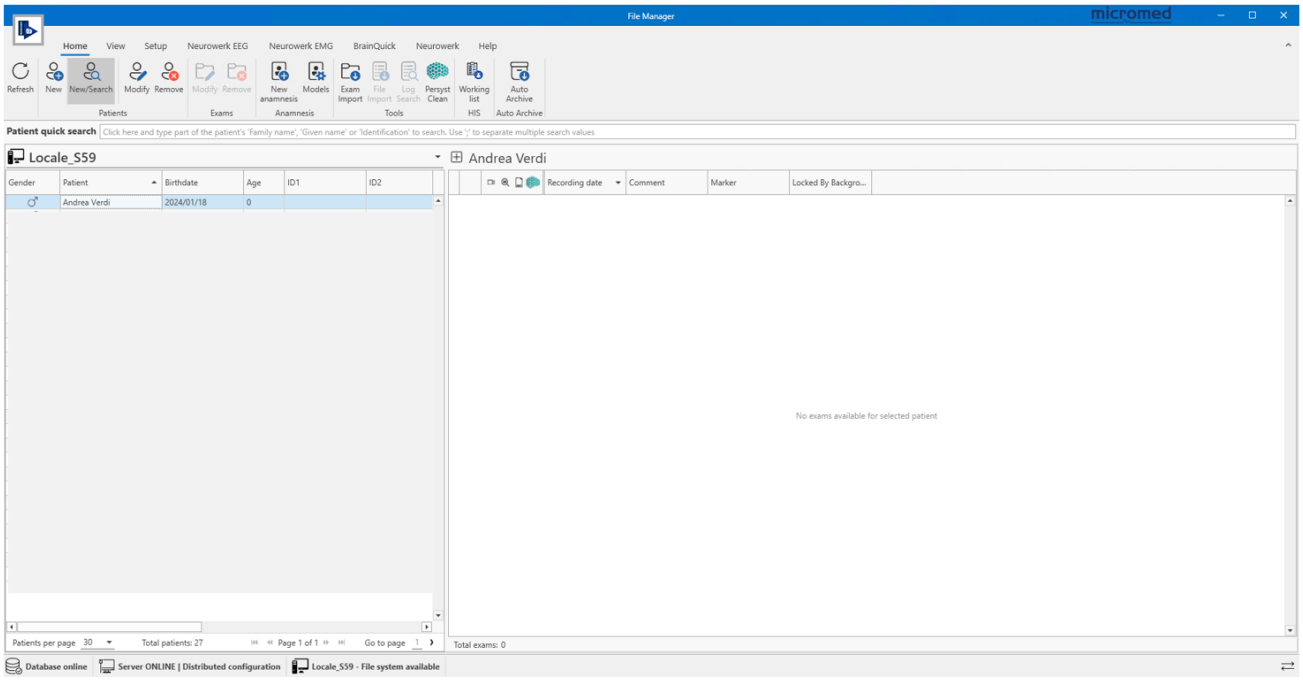
Emergency logon is an important feature that allows to authenticate in File Manager application in case of users database not reachable or server LDAP offline.
In those cases, user is not able to authenticate, and after the third login attempt failed, File Manager detects the anomaly and prompts the user whether he wants to log using emergency logon to record an exam (EEG/EMG/EP).



If the user clicks on No, it is possible to quit the application, instead if the user clicks on Yes, File Manager starts in Emergency Logon mode. By default no patient is selected, patients list looks blurred and user cannot interact with it. Other features not available in case of emergency logon are:

- New/Search, Switch User, Lockdown
- Patients' information
- Filters
- Exam contextual menu
- Quick search

From emergency logon, it is possible to create a new patient and, in case it is already recorded in the database, File Manager will directly point to it to start a new recording.



The user can acquire and record new exams for the newly created patient, using EEG and EMG/EP acquisition software.

USER PERMISSIONS

One of the greatest advantages offered by authenticated access is represented by role-based restrictions.
Each FILE MANAGER user is assigned a specific **Role** which determines user capabilities and restrictions.
Each Role consists of a collection of permissions covering key features and operations available within Micromed system.

FILE MANAGER offers up to six levels of granularity, i.e. six pre-defined roles: the **Administrator** one and other **five customizable roles** allowing to handle up to five different combinations of permissions (Senior Doctor, Junior Doctor, Senior Technician, Junior Technician, Guest).

All user permissions available are the following:

1. Report creation/modification
2. Report deletion
3. Ability to mark patients and exams as “read”
4. File deletion
5. EEG and Video EEG reduction
6. Patient creation and deletion
7. Patient demographic data modification
8. Ability to acquire
9. Modification of doctor and technician information related to exam
10. Resources creation/modification/deletion
11. Manual reassignment of exam to another patient (*)
12. Manual merge of two patients (*)
13. Machine Settings change
14. Central Settings change
15. Manual archiving
16. Management of HIS requests (HL7 interface)
17. Report export to HIS
18. Add/Modify/Delete database values of lookup lists

(*) Features disabled if the HL7 Interface is enabled.

Note. Not all permissions are available for all roles. Permissions are however customizable

WORKING CONFIGURATION AND OPERATING MODE

FILE MANAGER supports two possible working configurations:

- **Distributed System**: system of workstations connected in a network domain with a centralized users administration and a centralized settings management. In such configuration there is typically a server machine hosting: the central SQL database (ensuring that any file or exam can be retrieved by any user at any time), the centralized Users Database and the Audit Log database. In such networked environment there can also be local SQL databases separate from the central one, generally on LTM acquisition stations.
- **Stand-Alone:** single workstation, never connected to other stations, with its own local configuration and no need to share settings or have a centralized audit trailing; typically user authentication is disabled.

Note. Configuration type must be defined at installation time.

Both configurations require **File Manager Core** service to be installed together with FILE MANAGER software in the workstation. Distributed System configuration requires a File Manager Core Client instance installed locally in communication with central File Manager Core Server instance installed on server; instead, Stand-alone configuration requires only a File Manager Core instance installed locally.

File Manager Core service is responsible of centralized user administration, centralized settings management and centralized audit trailing.

OPERATING MODE

In a Distributed System configuration, the operating mode is very important. It determines if and how your computer communicates with the central database and other computers in the network.

Working machine can be either **Online** or **Offline**.

Working Online

In a distributed environment, communication with central server and between stations is based on network connection.
If the system is online, central settings are kept synchronized with central configuration and audit trailing, if enabled, is centralized.
In addition, all running EEG recordings in other online stations can be monitored through the Acquisition List and the other review stations of the system can monitor the EEG recording running on your workstation, if any.

Working Offline

When the network connection is not available, your workstation is in offline mode.
If the system is online, user authentication is guaranteed and audit trailing, if enabled, is stored locally.
Changes made to central settings are not uploaded to server until online mode is recovered and no centralization or sharing is possible.
During the offline period, you cannot monitor EEG studies running on other stations, and any recording made on your workstation is not available for monitoring either.

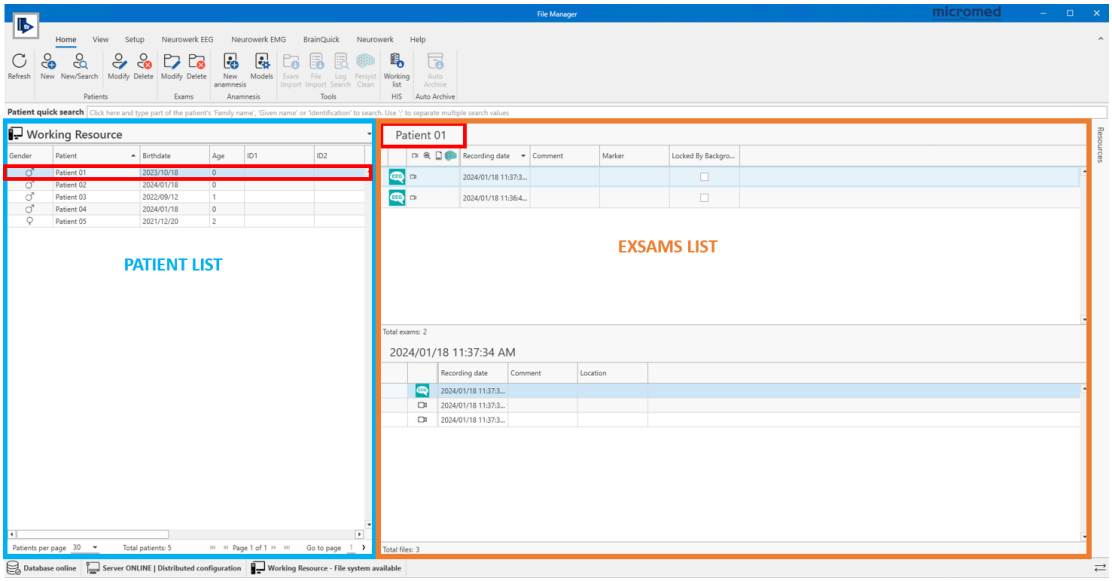
MAIN WINDOW

BASIC OVERVIEW

FILE MANAGER is the working environment for other Micromed acquisition and review software. It is the user gateway to review patient data, record new information or run new studies.
FILE MANAGER application manages files, exams, and patients, that are stored in a resource, linked to a database.

FILE MANAGER main window consists of three main components:

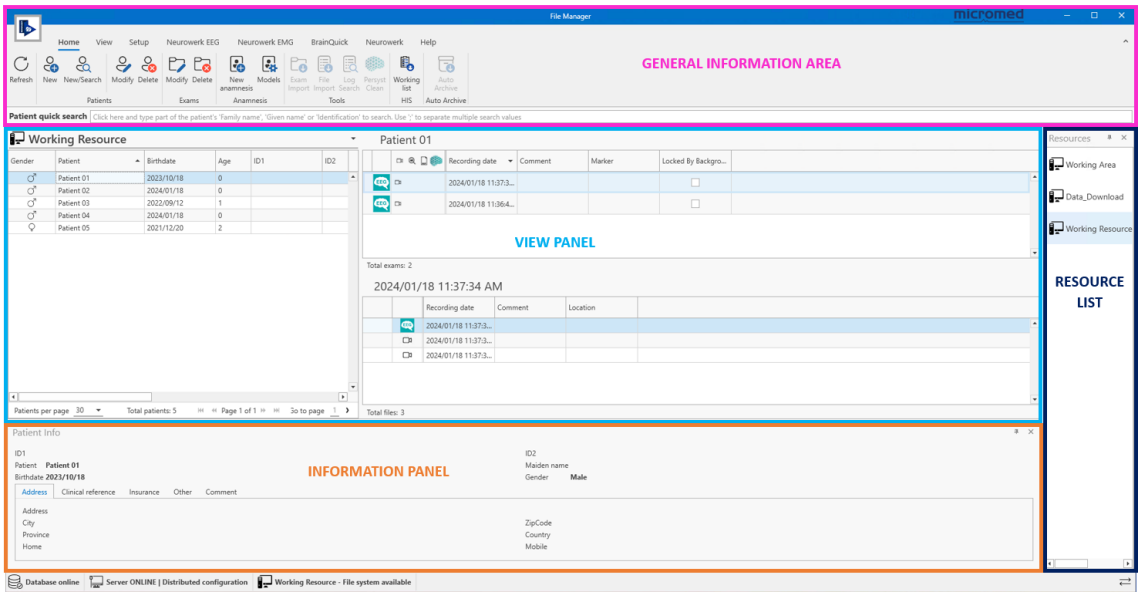
1. **View pane**, which displays patient and exam information accessible by the current resource. Displayed data are grouped in a patient-based view, with the Patients List on the left and the Exams List on the right, showing the exams associated to the currently selected patient. From View pane, user can change resource selecting one available from dropdown menu.



Standard Layout Split View

2. **Resource List**, which contains all defined resources or folders where patient and exam information is located
3. **Information panels,** which displays patient relative information

In the upper part of the main window there is a **General Information Area** composed by the Title Bar, the Ribbon Bar, the Application Button and the Quick Access Toolbar; at the bottom of the screen there is the **Status Bar**.



Main Window Overview

In the following paragraphs the function and content of each component is explained.

View Pane and Layouts

The View Pane is a picture of patient and studies information stored inside Micromed database; depending on the type of layout selected it shows information in different ways.

Available layouts are **patient-based**; the View pane is always split into two components: the **Patients List** on the left, above which the name of the selected resource is shown, and the **Exams List** on the right, which groups all the exams for the patient selected in the Patients List; see paragraphs below for more details about Patients List and Exams List.
The total number of items (patients or exams) and the number of selected items is shown below each list.

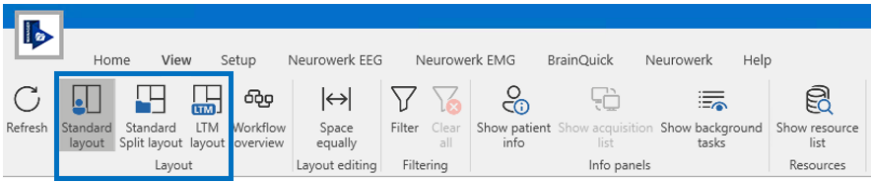
There are three possible patient-based layouts:

- **Standard** layout
- **Standard Split** layout
- **LTM** layout

They represent three different ways to display patient and studies information.

In addition to the three patient-based layouts there is a further layout, the **Workflow overview**, which is an exam-based multiple steps layout. It splits the View pane in four columns, one for each workflow step: each step corresponds to a specific status of the workflow and groups all studies in such status for all patients in one single list where each line represents a single visit; see section below for details.

Default layout is the **Standard layout** and it is possible to change current layout clicking the related button available in the View Tab of the Ribbon Bar, as shown in the figure below.

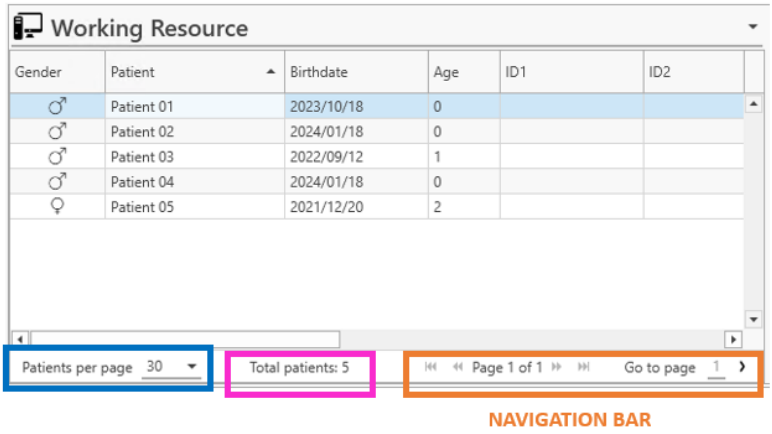


Available Layouts

Pagination in patient-based layout

In patient-based layouts patients data visualization is organized in different pages to guarantee better performance and easier information display; this is very useful tool managing databases with a significant number of patients.

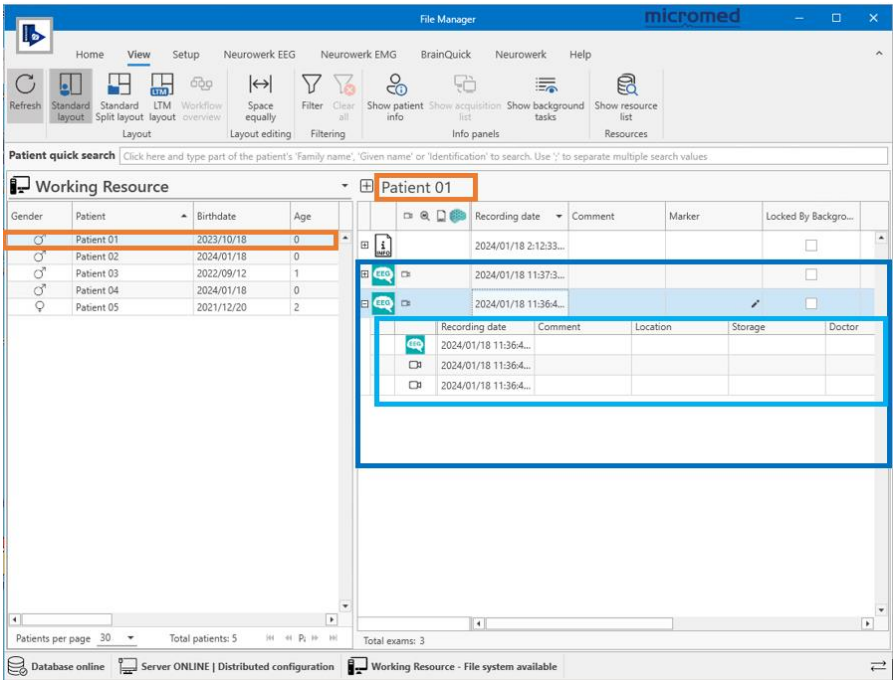
It is possible to choose the number of patients to be displayed in each page; according to the set-up number, patients are split in a suitable number of pages and it possible to easily navigate through different pages by the navigation bar available at the bottom of the Patients List. The navigation bar displays the current page number, the total number of patients and it offers navigation arrows to go through patient pages and a “Go to page” button to directly jump to a specific page.



Patients List - Pagination

Standard Layout

The **Standard layout** is suitable for displaying EEG routine studies in a collapsed way.
It consists of Patients List on the left and Exams List on the right, as shown in the figure below.



Standard Layout – Routine EEG

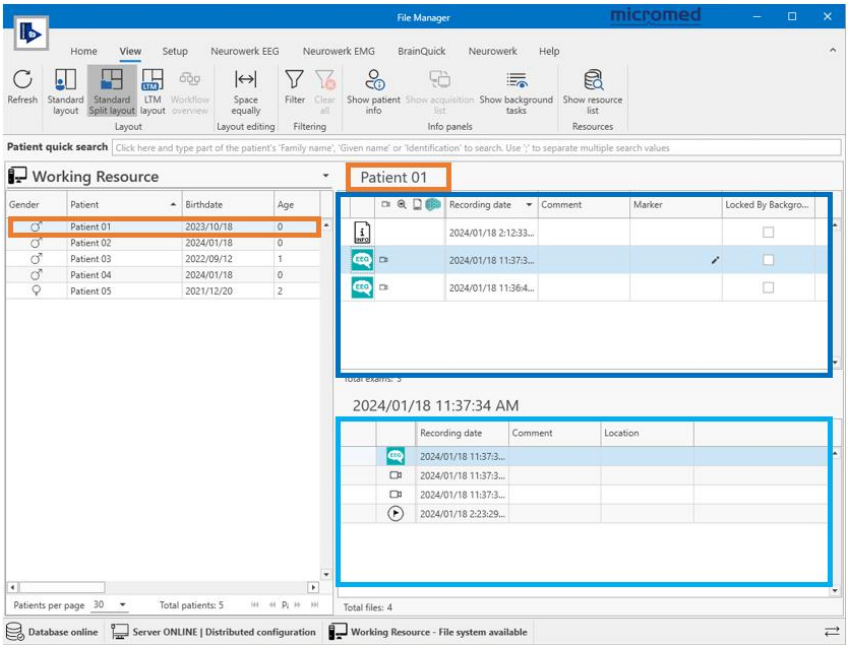
Exams List consists of a tree with two levels:

- **Exam**, representing the recorded study
- **File**, the inner level collecting all secondary files related to the study, such as videos, report and analysis

Each column at each level of the Exams list shows specific information (according to the level) and it is possible to easily customize visible data by Column Chooser tool available in the contextual menu.
To quickly expand/collapse the inner level for each study it is possible to click the “Plus”/ “Minus” icon next to patient name at the top left corner above the Exams List.

Standard Split Layout

Standard Split layout is the most suitable for displaying EMG-EP studies; it is also useful to display EEG routine studies and related details in an alternative way.
It consists of Patient List on the left and Exam List on the right.
It simply splits information displayed in the Exam List in two separate panes: the **Exam** pane above and the **File** pane below.



Standard Split Layout – Routine EEG

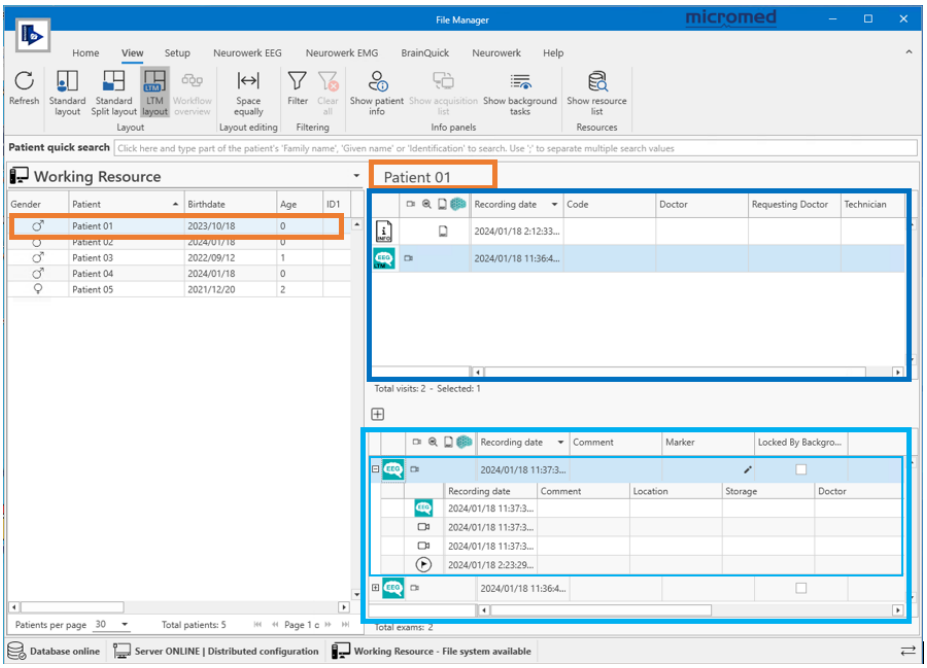
In the case of an EMG-EP study, the EMG-EP recording session is represented by a single line, in the upper pane, and there is a line for each single examination performed within the same session, in the lower pane; any report related to the EMG-EP study can be found in the lower pane.

In the case of an EEG routine study, the EEG recording session is represented by a line, in the upper pane, and there is line for each related secondary file, such as videos, report and analysis, in the lower pane.

LTM Layout

LTM layout is dedicated to LTM studies, and it is automatically activated when the option “Group LTM Exams into Visits” (display settings) is enabled.

It is patient-based so it consists of Patients List on the left and Exams List on the right; it split each study information in two panes: the **Visit** pane above and the **Exams List** below.

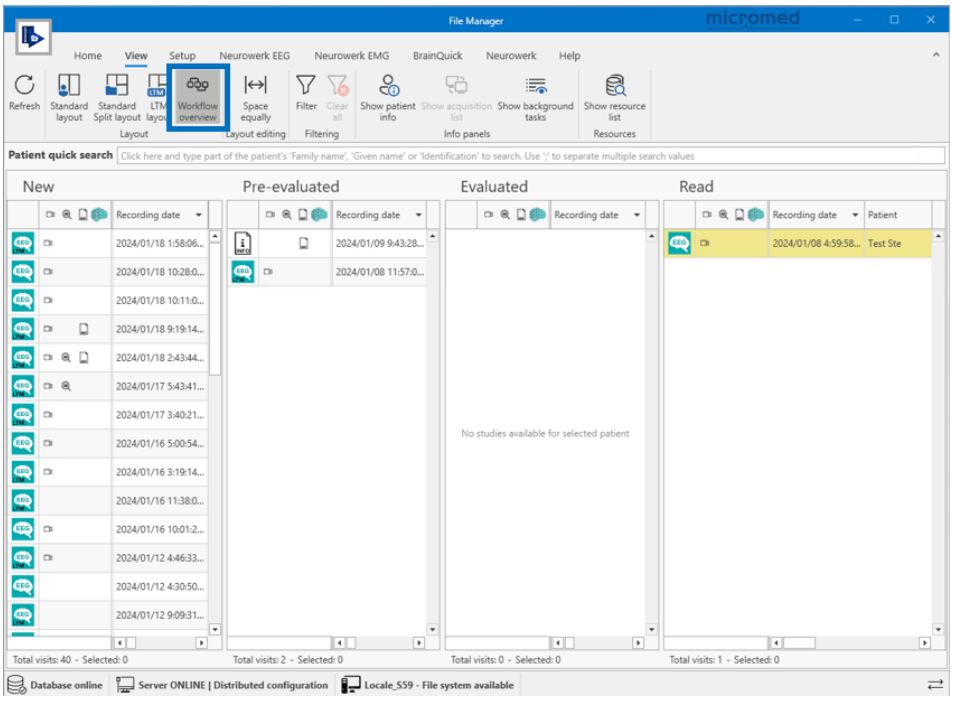


LTM Layout

The single LTM study grouping one or more EEG recording is represented by a line in the upper pane; the Exams List in the lower pane represents by a tree with two levels of detail all the recording related to the LTM study; the number of EEG recordings belonging to the LTM study are reported at the bottom of the exams list. **Note. EEG recordings are grouped in LTM visit according to the grouping criteria set in the display settings.**

Workflow Overview

Workflow overview layout is an exam-based layout, i.e., it collects in a single list all studies for all patients, but according to the respective workflow status; as shown in figure below.



Workflow overview Layout

It consists of four steps, one for each workflow status, and for each step the view displays in a single list all studies which are marked as belonging to that specific workflow status.

Default workflow steps are:

- **New**
- **Pre-evaluated**
- **Evaluated**
- **Read**

The first columns of the studies list show essential information, such as the recording date, patient name and patient's ID1; for each step it is possible to customize visible information by selecting the "Show Column Chooser" option available when right-clicking on each column header.

Available columns are:

a. Code
b. Doctor
c. Requesting Doctor
d. Technician
e. Hospital department

Workflow overview allows to quickly move studies forward and backward through available step by selecting a study and simply dragging and dropping it to the desired workflow step.
Workflow status associated to each study is stored in the "Marker" field and it can be used as filtering criterium.

PATIENTS LIST

Patients List displays all patients stored in the selected resource. Each patient is associated with a record, i.e. a line in the list of patients.

Each column in the Patients List shows a customizable selection of patient information.

It is possible to move a column to the desired position by dragging the column and dropping it before or after other columns.

Left clicking on the header of one of the available columns allows to sort patients in ascending or descending order based on the selected field. In addition, right clicking on one of the available column headers opens a contextual menu with the following options:

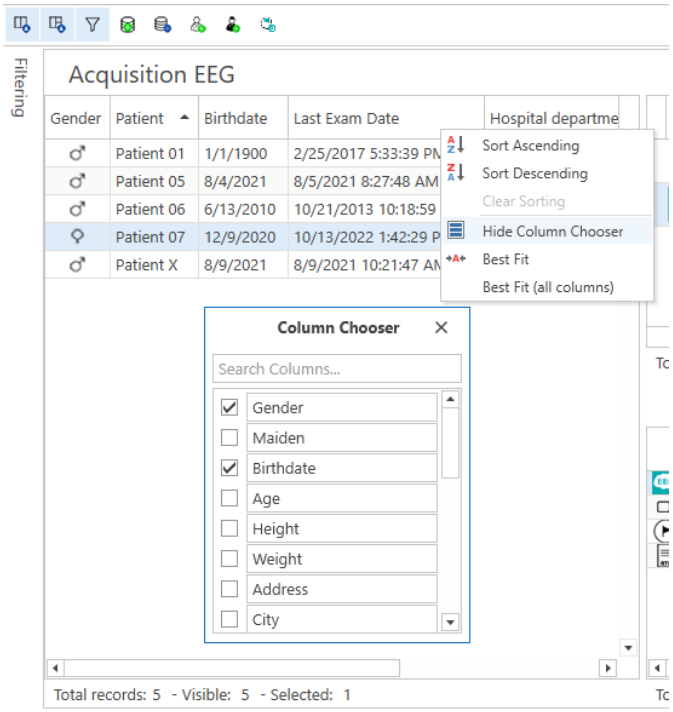
- **Sort Ascending**, to sort the Patients List in ascending order (according to the selected column)
- **Sort Descending**, to sort the Patients List in descending order (according to the selected column)
- **Show Column Chooser**, to choose the columns to display
  Available columns are:

  a. Gender
  b. Maiden
  c. Birth Date
  d. Age
  e. Height
  f. Weight
  g. Address
  h. City
  i. State
  j. Zip Code
  k. Country
  l. Home (home number)
  m. Mobile (mobile number)
  n. Insurance Number
  o. Insurance Company
  p. ID 1
  q. ID 2
  r. Hospital Department
  s. Comment
  t. Marker

u. Doctor
v. Gestation Days
w. Last Exam date

Note. By default, the following columns are visible: Gender, Patient, Birthdate, Age, ID 1, and Doctor.

- **Best Fit**, to adjust the width of the selected column to the best fit
- **Best Fit (all columns)**, to adjust the width of all visible columns to the best fit



Column Chooser – Patients List

EXAMS LIST

The Exams List contains all examinations related to the patient selected in the Patients List.

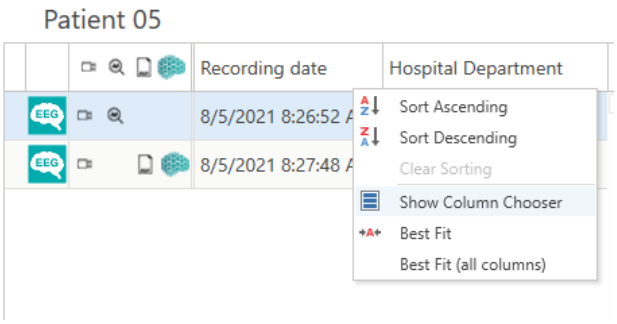
Information related to studies are organized and displayed in different way according to the selected layout, but there are always two levels of detail available, **exam** and **file**; a further level, the **visit**, is available in LTM layout in order to group more recordings related to a specific patient under the same study.

Each column at each level of the Exams List shows a customizable selection information related to a specific study or file, according to the level.

As for Patient Lists, left clicking on the header of one of the available columns allows to sort exam (file) in ascending or descending order based on the selected field.

In addition, right clicking on one of the available column headers opens a contextual menu with the following options:

- **Sort Ascending**, to sort exams (files) in ascending order (according to the selected column)
- **Sort Descending**, to sort exams (files) in descending order (according to the selected column)
- **Best Fit**, to adjust the width of the selected column to the best fit
- **Best Fit (all columns)**, to adjust the width of all visible columns to the best fit



Exam

Exam level represents a specific recording session and corresponds to a line of the Exam List (upper level) or the Exam pane.

Essential information related to a study are shown in the first columns.

- The first column refers to the **type** of exam, which could be an EEG, an EMG-EP, or an anamnesis; a symbolic icon allows to easily recognize the examination type (see the figure below)
- The **second column** summarizes which type of files are included in the study by showing a collection of representative symbols.

Icon	Description
	Study contains one or more video files
	Study contains analysis file
	Study contains one or more report file
	Study contains Persyst file

"Study contains" Column - Icons

By clicking on the report icon it is possible to open the anamnesis and report files directly from this first level. If more than one file is present, when clicking on the report icon a tooltip list appears allowing to choose which file to open.

- The third column is the **Recording Date** which shows the date and time in which the exam was created.

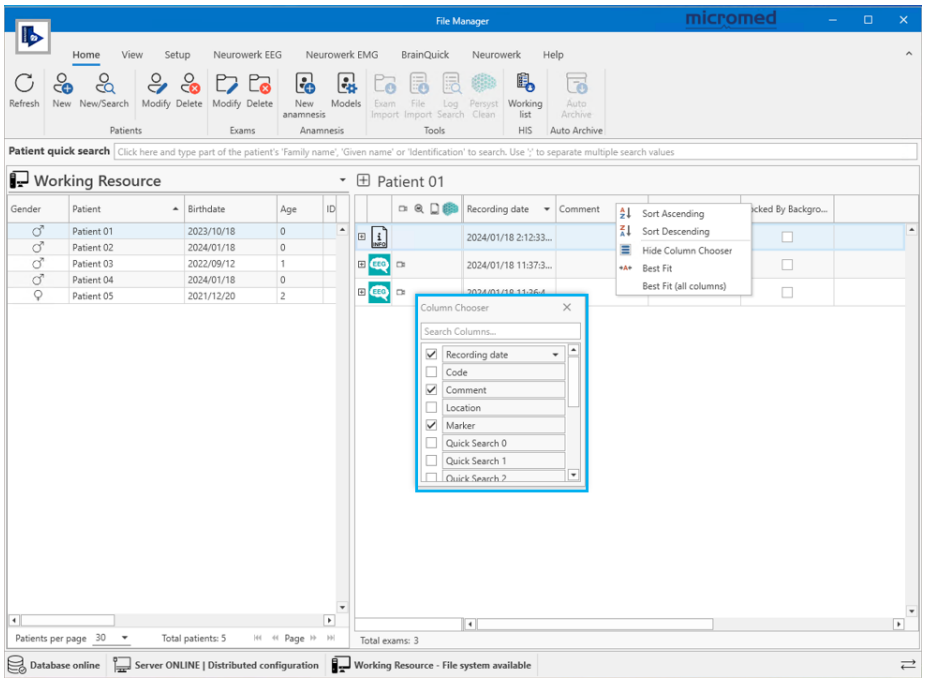
Exams list – Exam Level Detail

Columns visible after the second can be chosen by users by clicking on the “Show Column Chooser” option in the right-click contextual menu available on each column header.

Available columns are:

a. Recording Date
b. Code
c. Comment
d. Doctor
e. Requesting Doctor
f. Technician
g. Hospital department
h. Marker
i. Quick Search Flag 0 through 5
j. Corrupted Video
k. Location
l. Locked by Background Copy

Default visible columns are Recording Date, Comment, Marker, and Locked by Background Copy.



Column Chooser (Exam) – Exams List

File

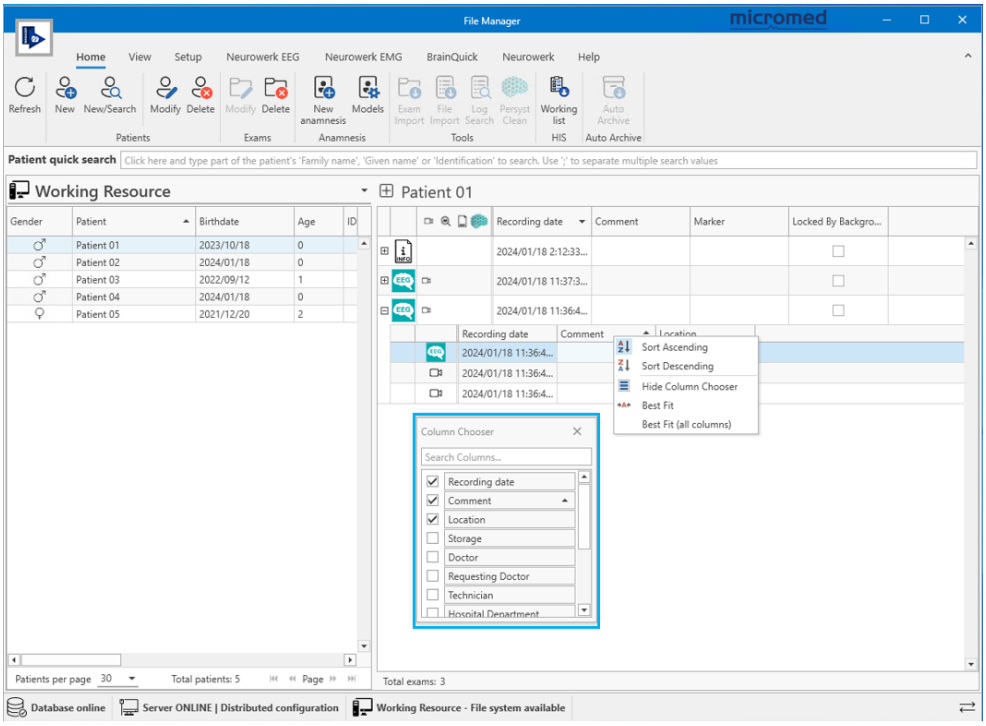
File level is comprised of all the files associated to a selected exam, i.e. all the traces, reports, videos and files created during the analysis.
As for the exam, the first column represents the file type through a symbolic icon.

Visible columns after the first can be customized by clicking on the “Show Column Chooser” option in the right-click contextual menu available on each column header.

Available columns are:

a. Recording Date
b. Comment (file comment)
c. Location (resource name)
d. Storage (archive resource name)
e. Doctor
f. Requesting Doctor
g. Technician
h. Hospital Department

Default visible columns are Recording Date, Comment, and Location.



Column Chooser (File) – Exams List

Visit

A Visit represents a collection of exams performed under the same recording session; it is typically used to represent LTM studies.

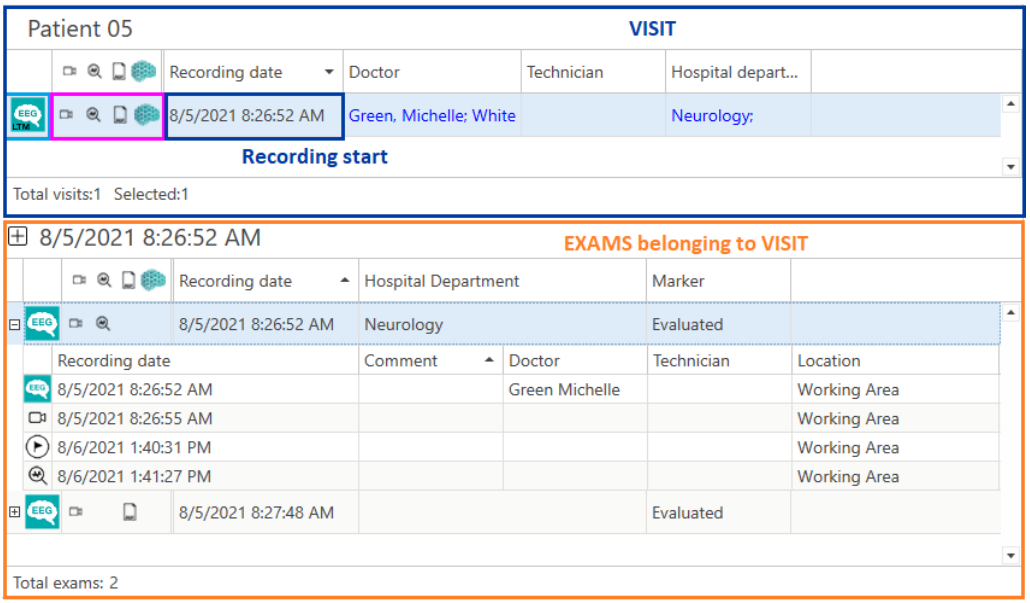
Information available at visit level are only the essential ones.

- The first column refers to the **type** of visit.

  Note. When the display option "Group LTM exams into Visits" is enabled, it is possible to choose the criteria according to which multiple exams are grouped under the same LTM session; options available are from 1 up to 7 days. For example, if the 1 day option is selected, all EEG recordings performed in the same day, i.e. within 24h, are grouped together.

- The **second column** summarizes which type of files are included in the visit by showing a collection of representative symbols (see the "Study contains Icons" table above for details).

- The third column represents the **Recording start**, i.e. the date and time in which the LTM session was started.

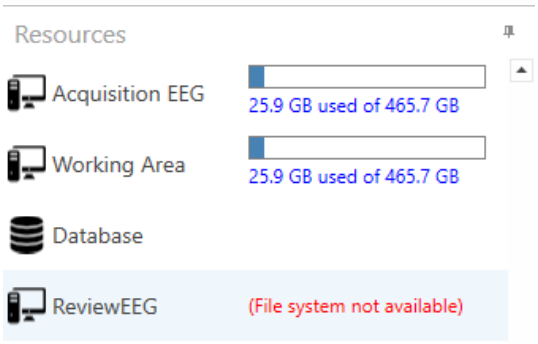


Exams List - Visit

RESOURCES LIST

The Resources List is a dockable panel which lists all resources available to the user; the name of the resource is on the left and the available space is on the right.

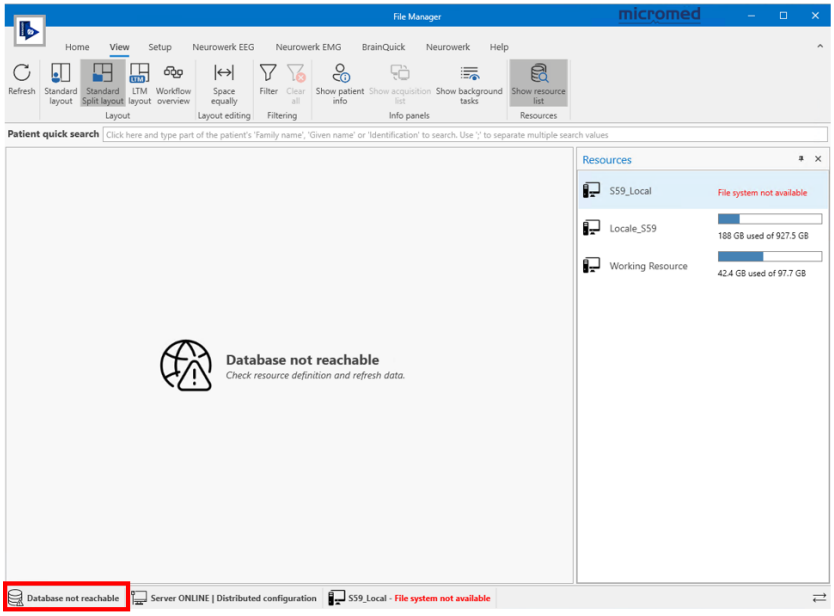
If path associated to a resource is not accessible or reachable the red message “File system not available” is shown next to the resource name (instead of the space available) to notify the user no operation can be successfully performed on such resource. Check the network connection, for resources associated to a network shared folder, and the correctness of the path entered in the resource definition.



Resource - File System Not Available

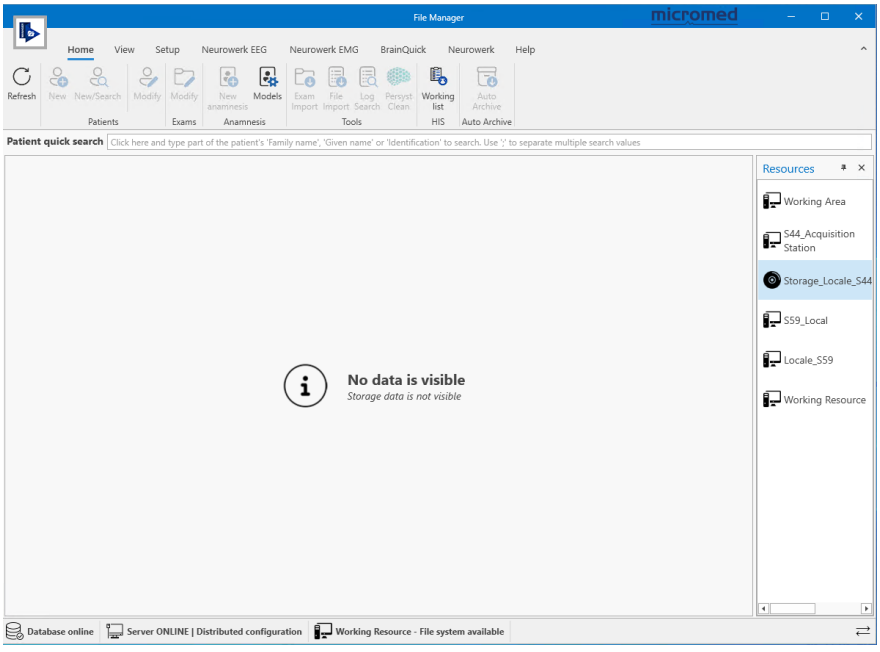
Clicking on a specific resource on the Resource list, patients and exams list display all patients stored in the database and for each one all studies stored on the selected resource path.
View pane displays error messages if the patient and exam data loading fail for some reason.

If patient database is not reachable the message shown in figure below will appear:



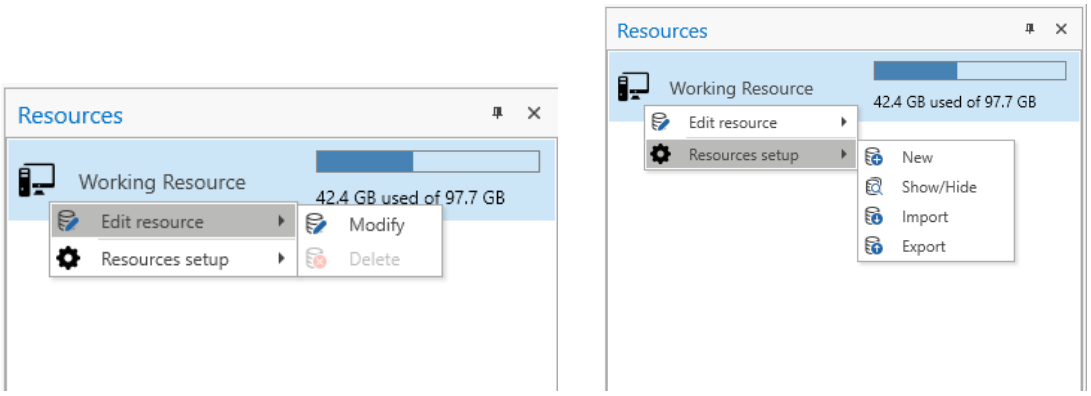
Main reasons behind such error are network disconnection or wrong resource definition, caused by incorrect database details filled.

If resource name is not correctly defined0 the message below will appear:



It is possible to create, modify, and delete a resource directly from the Resources List panel.
Right-clicking on a resource a contextual menu will appear, allowing the user to modify or delete the selected resource.
Right-clicking on the Resources List Panel, another contextual menu appears allowing the user to create a new resource**;** for further information, see the paragraph **Data Access: Resources Configuration** below.

From the context menu it is also possible to hide resources by selecting the **Show/Hide** option, or to import or export one or more resources by selecting the **Import** and **Export** item, respectively.



Resource List – Context Menu

RIBBON BAR

On top of the FILE MANAGER main window, above the View Pane, there is the main toolbar, called Ribbon Bar, which helps the user to navigate through the software and shows all the functions that the application offers to the user. Buttons are grouped in different menus (or Tabs) according to their functionality.

Ribbon Bar can be minimized keeping only tabs titles displayed.

The user has the possibility to use this bar in normal mode, in minimized mode and on auto-hide mode, that is a function that automatically hides entire Ribbon Bar to work on the window in full screen.

The Ribbon Bar of the FILE MANAGER is comprised of the following Tabs:

- **Home**
- **View**
- **Setup**
- **Brain Quick (if installed)**
- **Neurowerk (if installed)**
- **SleepRT (if installed and configured)**
- **Neurowerk EEG (if installed)**
- **Neurowerk EMG (if installed)**
- **Help**

A **Refresh** button is present in every tab and it allows to update patients list and the associated exams.

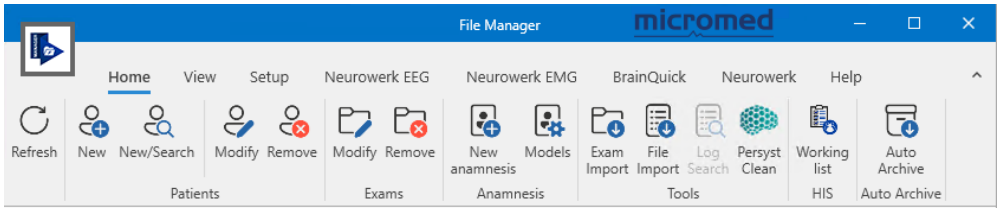
Home Tab

The Home Tab groups the FILE MANAGER main functions related to the management of patients and exams; buttons are organized in functional Groups.

It contains the following Groups:

- **Patients**
- **Exams**
- **Anamnesis**
- **Tools**
- **HIS**

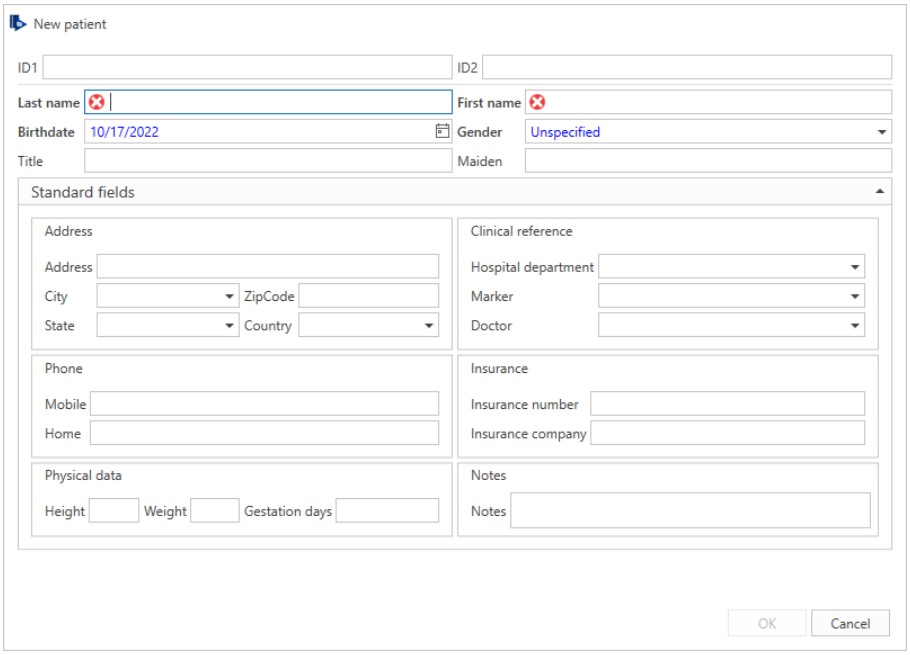
- **Auto Archive**
- **Users**



Patients Group

The Patients group offers four buttons for the creation, search, modification, or removal of a single patient. While the “New” and “New/Search” buttons are always available, the “Modify” and “Remove” buttons are enabled only when a patient has been selected.

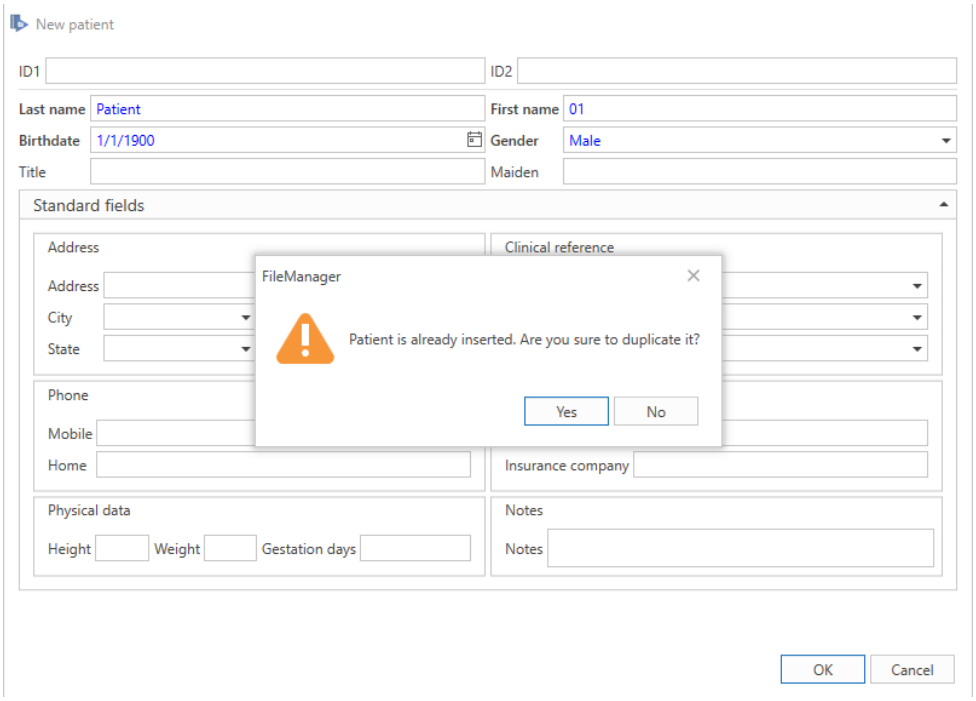
Clicking the **New** button opens the dialog for the creation of a new patient. As shown in the figure below, the dialog offers several fields that can be populated with the patient personal data. The only DEFAULT required fields are “Last name”, “First name” and “Birth Date”; mandatory fields are marked with a red X when empty. The “ID1” and/or “ID2” fields may also be set as mandatory. For more information, see the section related to **Labels Customization**.



Once all the mandatory fields are filled, the “OK” button will become enabled.

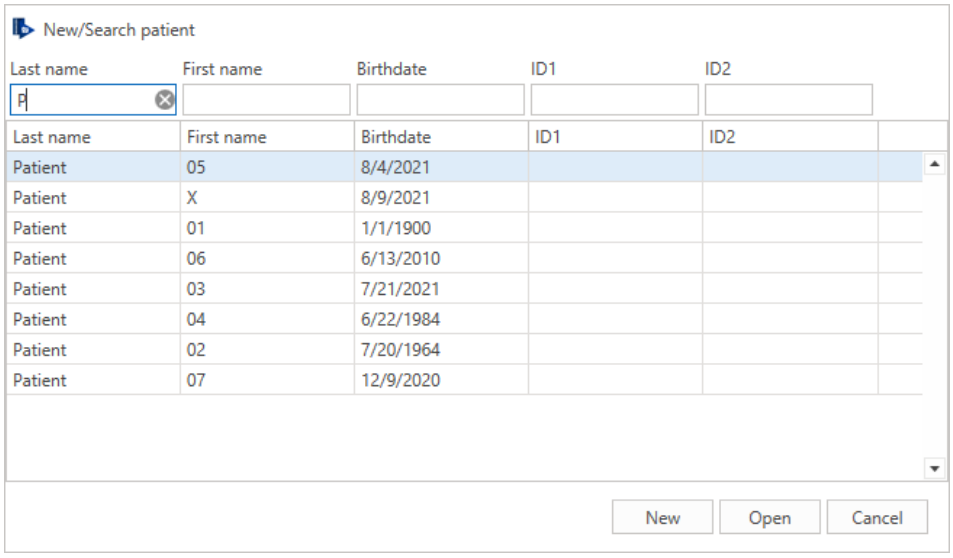
Note. “First name”, “Last name”, “Birth Date” and “ID1” fields are used by the FILE MANAGER application for the unique patient identification check performed every time a new patient is created or an existing patient demographic data is edited.

When creating a new patient record, FILE MANAGER checks if another patient with the same demographic data already exists, to avoid any unwanted duplicates. If a matching patient record exists, the user is asked for confirmation before proceeding.



Once created, the patient will appear in the Patient List.

The **New/Search** button can be used to search for a patient. The search can be filtered based on patient “Last name”, “First Name”, “Birth Date”, “ID1”, and “ID2” fields, as shown in the picture. Once the correct patient record is selected, the “Open” button is enabled to open that patient on patients list. Selected patient can be opened even double-clicking on the selected row.



If no patient matching the search criteria is found, pressing the “New” button it is possible to open the patient creation dialog where fields are pre-populated with the information used in the search.

The **Modify** button opens a dialog that allows users to modify the content of the fields for a selected patient. Press "OK" to save the changes or press "Cancel" to discard them.

Note. Patient demographic data, such as "Last name", "First Name", "Birth Date", "ID1", and "ID2, can be changed by authorized user only, i.e. user with the "Can Modify Patient Demographics" permission. Moreover, demographic information are locked and not modifiable in case of HL7 environment enabled. If request extra fields management is also enabled from Micromed Suite at central level, other fields are locked and non-modifiable (Address, City, Doctor, etc.)

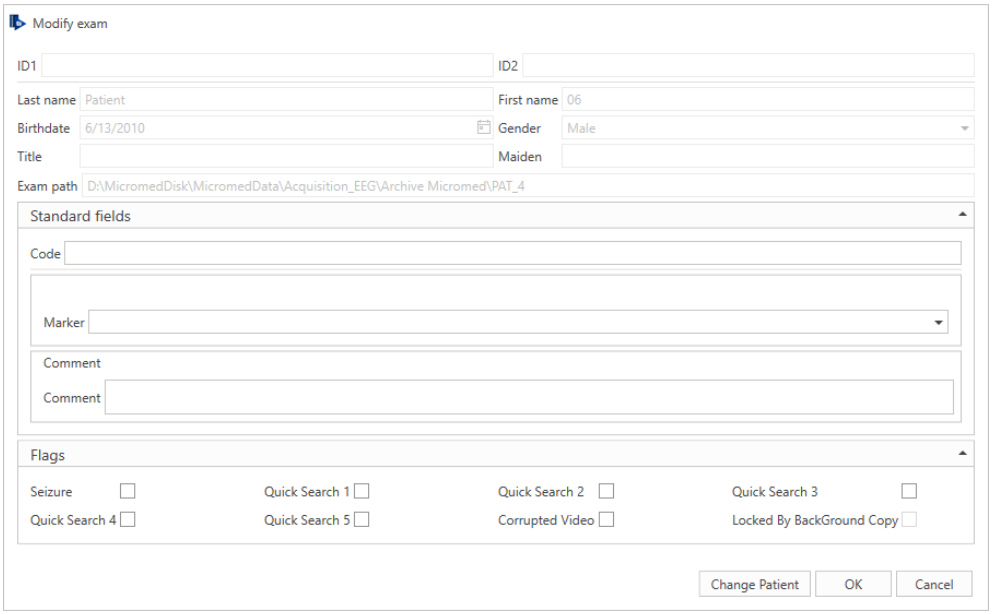
The **Remove** button allows users to remove the selected patient record and all the associated exams. When clicking this button, a popup will appear asking the user for confirmation before proceeding with the deletion. If the user confirms, a final fail-safe popup appears and asks if the user would like to cancel the removal. By clicking "No", the patient record and all its exams will be deleted permanently. It is possible to remove multiple patients from Remove button, in case of multiple patients' selection (Ctrl + click or Shift + click).

Note. Only authorized user with the "Can Create/Delete Patient" permission can add a new patient to or remove an existing patient from Micromed database.

Exams Group

The Exams group offers two buttons to modify and remove an exam belonging to a selected patient, respectively; such buttons are enabled only when an exam has been selected.

To modify an exam, first, select the desired patient from the Patient List. Once the patient is selected, the associated exams will be automatically displayed in expanded mode in the Exam List. When clicking on exam or on any of exam-related files, the "Modify" and "Remove" buttons will be enabled.



Clicking the **Modify** button opens a dialog (shown above) that allows users to modify any editable field of the selected exam. The dialog also shows the patient-related data in read-only mode. Click "OK" to save the changes or click "Cancel" to discard them.
By default, no exam related field is mandatory. For information about setting exam fields as mandatory, see the **Labels Customization section of this manual**.

At the bottom of the “Modify exam” dialog there is the **Change Patient** button which allows users to re-assign the exam to a different patient, for example if the acquisition was performed under the wrong patient; see the **Reassign Patient** section below for further details.

To remove a WHOLE exam, select the exam to be removed from the list of exams and then click the **Remove** button. It is even possible to remove multiple exams, in case of multiple exams selection (Ctrl + click or Shift + click).
Note. Exam removal will remove the WHOLE selected exam, including all files within it. To remove a single file, instead, see the section related to the basic operations available on Exam Files.

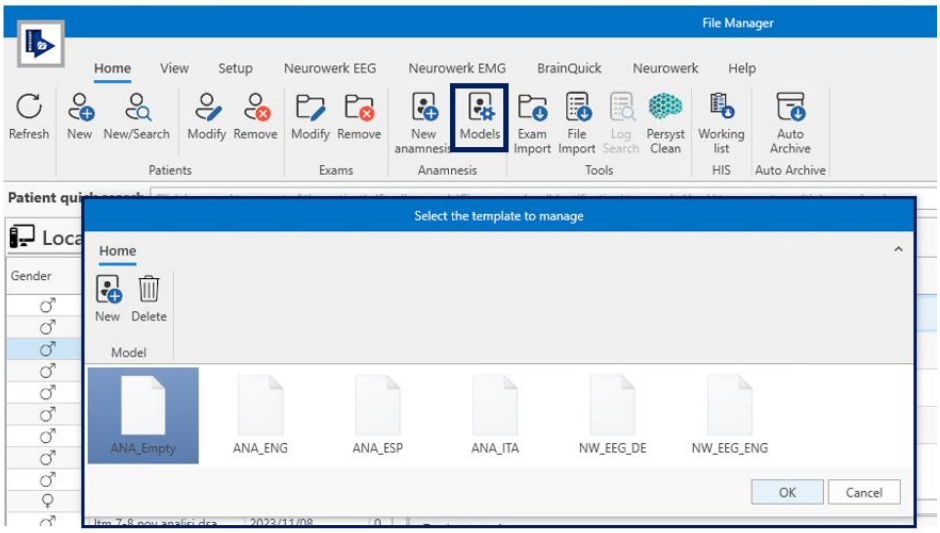
Depending on whether exam or file is selected, the Exams List allows users to perform a series of operations by selecting the dedicated option in the right-click context menu; see the **Basic Operations** section below for a detailed description of all available functionalities.

Anamnesis Group

The Anamnesis group allows users to create a new anamnesis and manage models for anamneses.

To create a new anamnesis, select a patient and click on the **New Anamnesis** button.
A dialog will open allowing to choose a predefined model. Once the model is saved, the new anamnesis will appear in the list of exams for the selected patient.

The **Models** button allows the creation of new models for anamneses; see the **Anamnesis Models** section for further details.



Anamnesis models

Tools Group

The Tools group offers buttons to perform importing operation and to search on the Audit Log trail.

Clicking the **Exam Import** button allows the user to import EEG exam with related videos or EMG-EP exam.
It is also possible to import a video file for anamnesis purpose and associated it to a new anamnesis.

Clicking the **File Import** button allow the user to import single secondary file related to the selected exam, such as event file or analysis file.
Note. The import of Persyst analysis files is not supported.

See the **Importing Studies and Files** section below for further details about importing functionality.

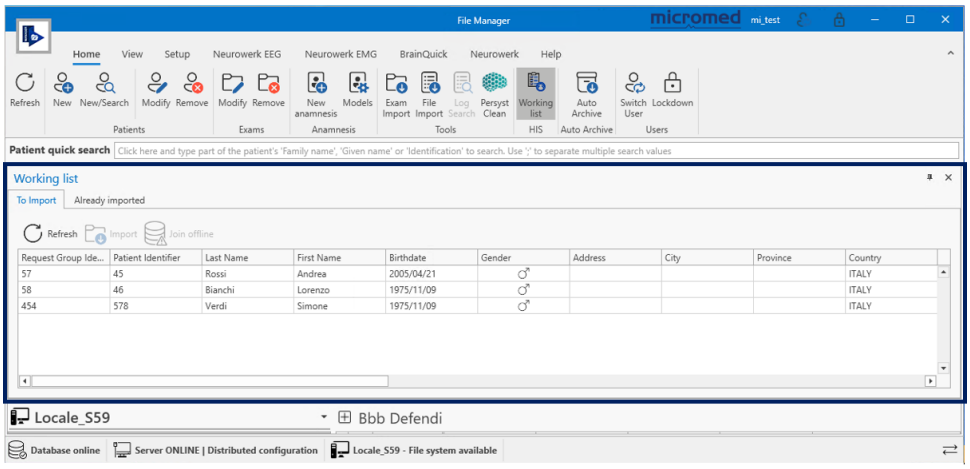
If the Audit trailing is enabled and network connection is available, it is possible to search on the Audit Log database by clicking the **Log Search** button. The Audit Log Search window will appear allowing to define searching criteria and to visualize search results; see the **Audit Trailing and Log Search** section below for further details about this functionality.

Clicking the **Persyst Clean** button it is possible to manually clean up database associated to current local resource by grouping all Persyst files related to each EEG exam, if any, into one only main zip (PST) file; such operation improves the archive module performance in accessing and managing Persyst files.

Important Note. After the clean up it will be NO more possible to review any Persyst analysis file with previous versions of Brain Quick software (1.xx.yy).

HIS Group

If HL7 Interface is active, the His group is available: it consists of one only button to access the **Working List** panel where all requests received from the Hospital Information System are collected; requests are split in new requests to import, and requests already imported to be executed.



Working List

Working List, as most of the Archive panels, is dockable; information displayed are customizable and it is possible to filter on the requests list.

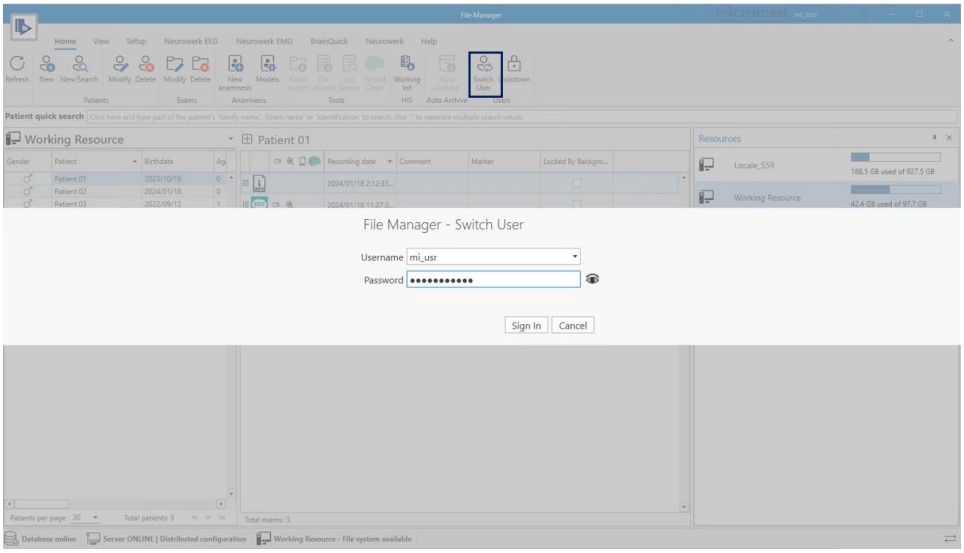
The Working List can be manually refresh and clicking the **Import** button on the toolbar it is possible to import a specific HIS request with related patient information within Patients database; for further details on HL7 requests management see the **HL7 Integration** section of this manual.

Users Group

If the Logon system is active, the Users group is available on the Home Tab; it contains the Switch User and the Lockdown buttons.

User Switching

Clicking **Switch User** button it is possible to switch to a different user by entering the appropriate user credentials.



Switch User

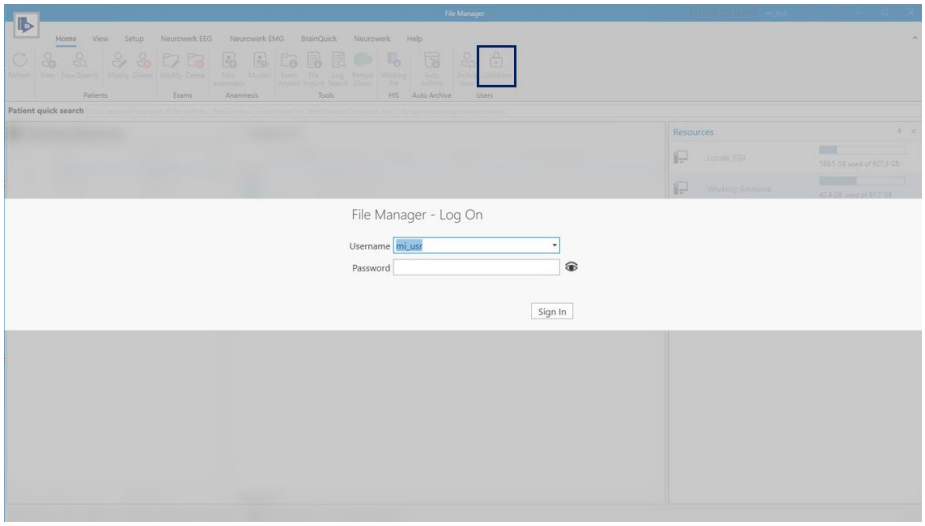
It is also possible to switch user clicking the “switch user” icon on the top right corner of FILE MANAGER title bar next to current logged in user username.
When switching users, user capabilities are automatically upgraded according to user role, i.e., according to the collection of permissions assigned to the user. It is possible to switch user only towards one with higher privileges. For instance, it is not possible to switch user from an administrator role to a technician role.

Note. Any on-going process will be completed in the background and the new user will be able to see all the on-going tasks launched by the previous user in the Background tasks panel. The Background tasks panel can be enabled by clicking the Show background tasks button on the Ribbon Bar (View Tab).

Manual Lockdown

Clicking the **Lockdown** button, it is possible to enter in lockdown mode, that is to manually force the FILE MANAGER application lockdown.

When FILE MANAGER is locked down the main window is blurred, no PHI data is visible, and any button is disabled. Even all additional windows (Brain Quick, Neurowerk, etc.) will appear blurred and all functionalities will be locked. Logon dialog window automatically appears over the application window to allow user to unlock the system by entering valid credentials when a user interaction with the application main window is detected.



Lockdown mode

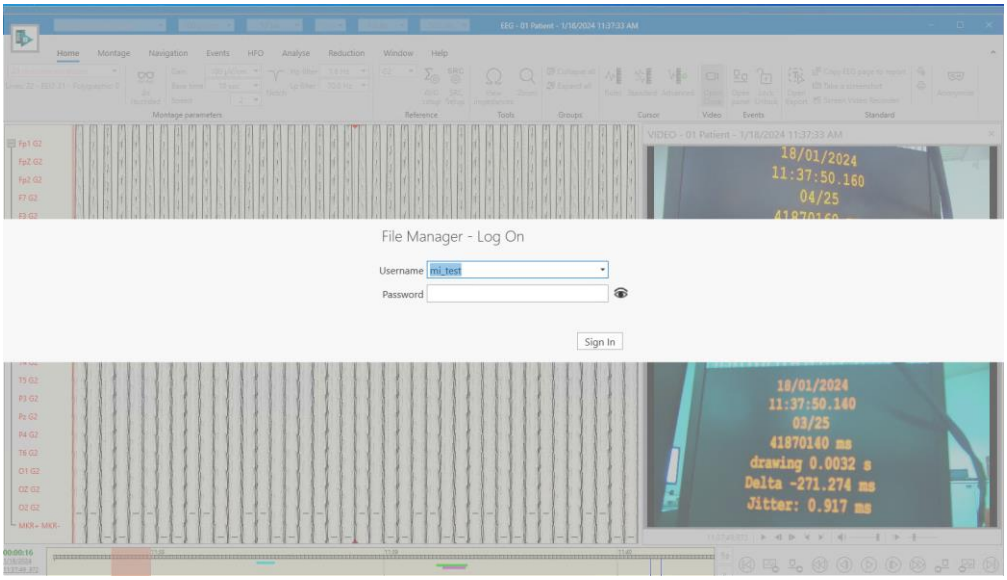
Automatic Lockdown

Lockdown mode can also be enabled in an automatic way; FILE MANAGER offers a dedicated option stored at machine level allowing to activate the automatic lockdown of the application after a certain period of inactivity of the Archive module; for details about the automatic lockdown activation see the **Lockdown Preferences** section of this manual.

EEG Sessions in Lockdown Mode

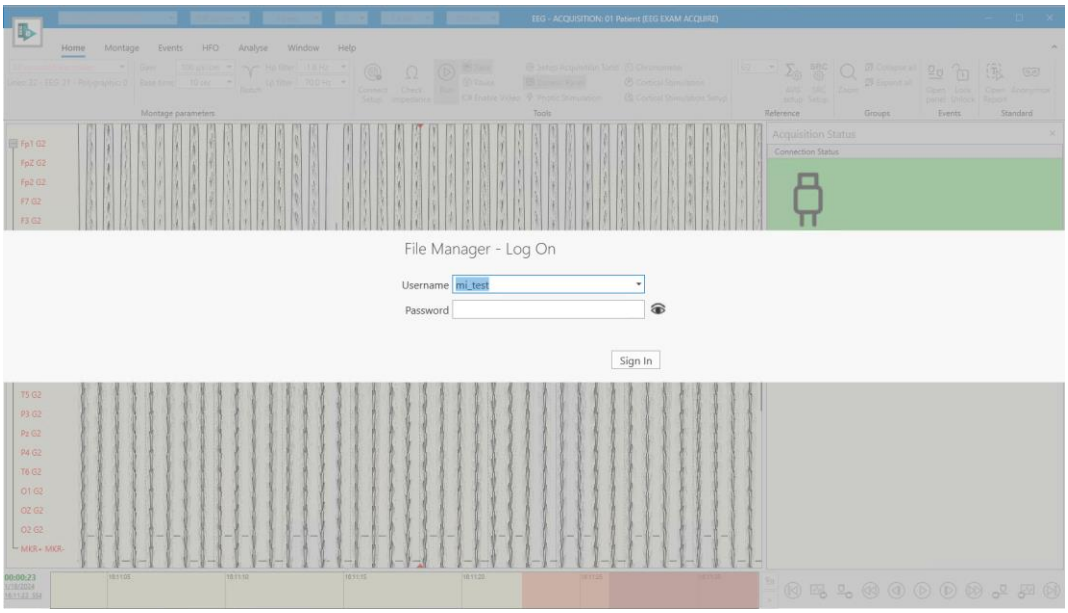
The lockdown mode automatically propagates to any on-going EEG recording and/or review session.

When an EEG review session is locked down, in the Brain Quick review window any PHI data is anonymized, all panels showing PHI data are blurred and no action is possible: ribbon bar buttons are disabled, and no event insertion is possible.



EEG Review session – Lockdown mode

Instead, when an EEG recording session is on-going and the system enters in lockdown mode, the EEG trace and video, if any, continue to be visible on the screen allowing the live monitoring, also patient name remains visible but no operation can be performed by the user without logging in again.



EEG Recording session – Lockdown mode

Again, the LogOn dialog window automatically appears over the Brain Quick window to allow user to unlock the system when any interaction with the application main window is detected.

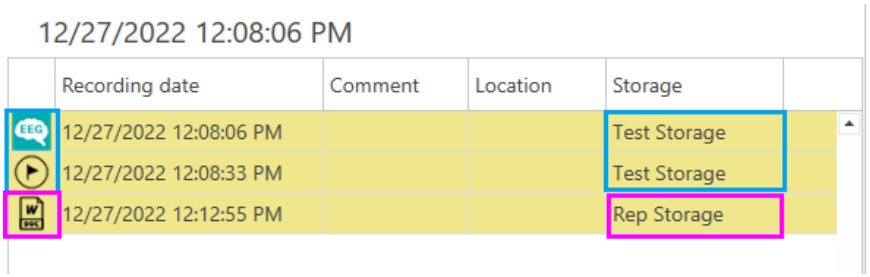
Auto Archive Group

The Auto Archive group offers a button to manually run the automatic archiving procedure.

Note. The auto-archive feature is available only if the FMS AUTOARCH license is active.

Clicking the **Auto Archive** button it is possible to manually run the auto archive for exams marked as “read” of current local resource; such procedure scans patients marked as “read” and archive related exams in the defined storage resource. It is possible to archive reports in a dedicated storage resource, i.e. in a different path respect to the exam data.
Note. Persyst and analysis files (.fft), if any, are considered by the auto archive procedure ONLY if the related option is enabled, otherwise they are discarded and permanently deleted.

The auto archive procedure allows to automatically delete exams marked as “to delete”, if any; such exams are discarded from the archiving and are permanently deleted.
If the auto archive is successful, the archived files are moved to the designated storage resource; the destination storage resource name is shown the “Storage” column of the Exams list at file level.



Archived files – Storage

Finally, the auto archive can be combined with the EEG/VEEG exams cut: if such option is enabled, EEG and Video EEG exam marked as "read" are automatically cut according to the chosen reduction protocol and then archived, i.e. moved to the designated storage resource. It is even possible to automatically delete the original trace file, keeping only the reduced exam. The automatic cut is highly recommended in order to avoid saving unnecessary files.

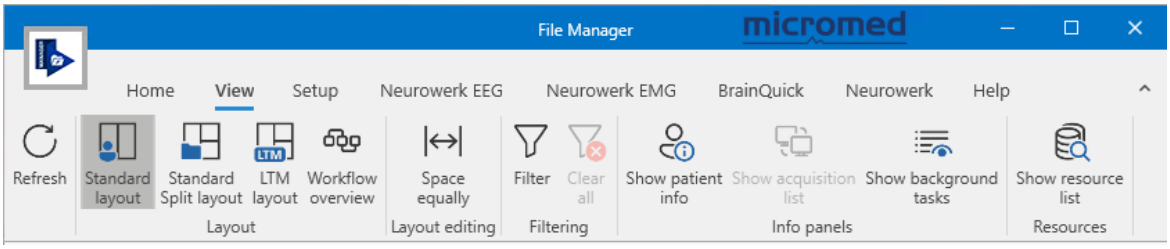
An additional auto archive setting is Patients list cleaning from archived patients, allowing the archived patients to be no longer visible on source resource after the procedure.

View Tab

The View Tab groups the main functionalities related to the window layout management; buttons are organized in functional Groups.

It contains the following Groups:

- **Layout**
- **Layout editing**
- **Filtering**
- **Info panels**
- **Resources**



Layout Group

The Layout group collects all layout options. Available patient-based layouts are: Standard, Standard Split and LTM; they show the exams grouped by patients.
Note. The Standard layout is the default one.

To turn on one of these layouts on, click on the **Standard**, **Standard Split** or **LTM** button. The View pane will be divided in two components: Patient List, on the left, and Exam List with all studies related to the selected patient, on the right.

A further layout available is the Workflow overview layout which is exam-based and groups all studies according to the associated workflow status; user can activate it by clicking on the **Workflow overview** button: it splits the View pane in four columns, one for each workflow step and it is useful to move studies forward and backward supporting the user in the workflow management.

See the **View Pane and Layouts** section above for further details about available layouts.

Layout Editing Group

This group contains only one button, which can be used only when a patient-based layout is selected. The **Space Equally** button automatically adjusts the Patient List and Exam List so that they have the same width.

Filtering Group

The Filtering group contains the **Filter** button which allows to enable or disable the Filtering pane which is dockable.

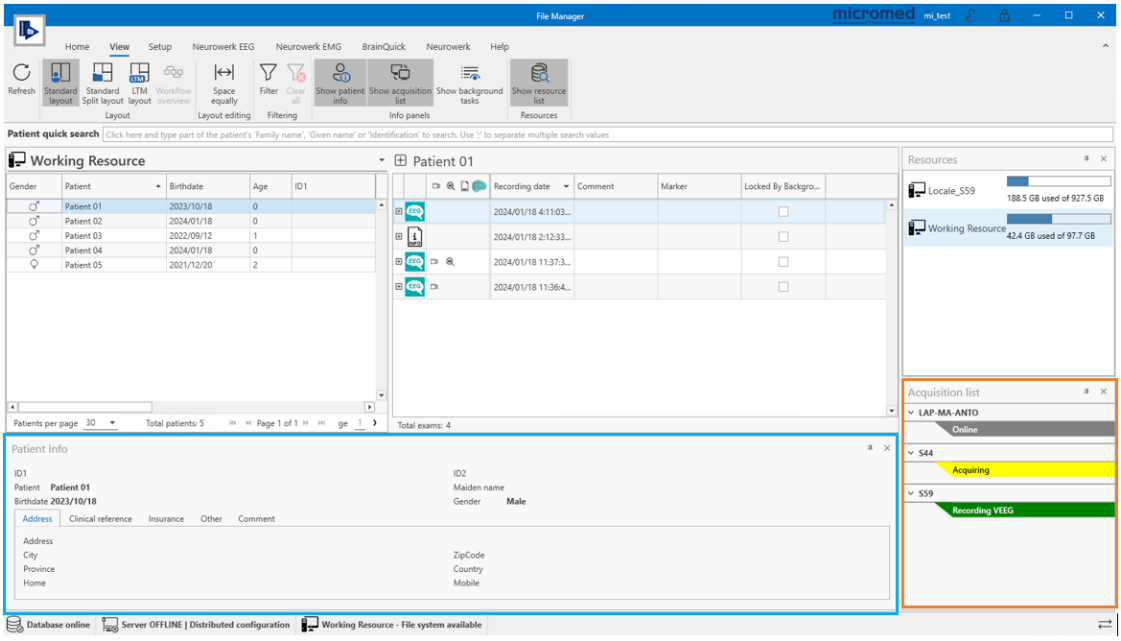
The Filtering pane allows the user to set multiple searching criteria to filter current view; it also allows to apply a custom filter or to define a new one and save it; see the **Filtering View** paragraph for further details about how filtering patients and studies.

This group contains also the **Clear all** button which allows the user to quickly reset current view clearing all applied filtering criteria at a time.

Info Panels Group

This group contains the buttons enabling or disabling information panels; such panels are dockable.

Clicking the **Show patient info** button will open a pane that shows any information related to the selected patient, as seen in the figure below. The patient information is in read-only mode and therefore no changes can be made directly from the Patient Info pane.



Info Panels

The **Show acquisition list** button opens a pane that shows the status of all the acquisition systems connected. Each acquisition system is represented by a "card" with a status bar reporting system name and related status and a reduced details panel.

To be visible in the Acquisition List, an acquisition system has to first be configured in the dedicated pane of the "Options" window, as described later in this manual. The acquisition machines to be managed from acquisition list must be defined as resources in File Manager, to allow remote reviewing tools.

For details about Acquisition List configuration see the **Acquisition List Tab** paragraph below.

Clicking on the caret icon close to the acquisition system name will reveal the name and ID of the patient under acquisition, as well as the location (resource name) of the exam, as seen in the side figure.

Note. Fields shown as part of the information displayed for the acquisition systems are user configurable and can set in the "Options" window (Acquisition List tab).

The Acquisition List panel also shows the (color coded) state of each acquisition system:

- **Online (grey)**, if FILE MANAGER is connected with the acquisition system
- **Idle (grey)**, if Brain Quick Software (or SystemPlus EVOLUTION) is open on the acquisition system but it is not acquiring data
- **Acquiring (yellow)**, if the acquisition system is actively receiving data from the amplifier
- **Recording EEG (green)**, if the acquisition system is recording EEG, i.e. saving data
- **VEEG Recording (green)**, if the acquisition system is recording VEEG (EEG + video)
- **Paused (red)**, if the acquisition system is paused
- **Impedance Check (purple)**, if the acquisition system is checking the impedance values

Right-clicking on the Acquisition List panel a contextual menu with the following options will appear:

- **Ascending**, to sort the systems in alphabetical order
- **Decreasing**, to sort the systems in reverse alphabetical order
- **View as**, to see the acquisition systems by system or by patient
- **Filter by**, to see only the systems that meet the selected criteria (state)
- **Refresh**, to refresh the panel

Right-clicking on each system status bar a contextual menu with the following options will appear:

- **Remote Control**, which allows the user to remotely control the acquisition system (via UltraVNC or Brain Quick software) and live monitor eventual on-going EEG recording
  Note. Remote control is based on UltraVNC for acquisition systems running SystemPLUS Evolution, otherwise it calls Brain Quick software for acquisition stations where Brain Quick software is installed
- **Remote Review**, which opens Brain Quick software for the remote review of the on-going EEG recording on the selected acquisition machine
- **See in Database,** which allows to point directly to the patient and the exam under recording

The **Show background tasks** button opens the Background Tasks pane, which displays all the on-going background processes as "cards".
The information shown by each card depends on the process type, but all cards report at least the task name and the progress status. It is possible to display further details by "expanding" the card clicking the caret icon on the top right corner of the card. Finally, it is possible to cancel the process at any time clicking the Trash icon.
The processes that are displayed in the Background Tasks Pane are the following:

- **Data transfer** performed with the 'copy to' and 'move to' operations. The information displayed in these types of cards is:

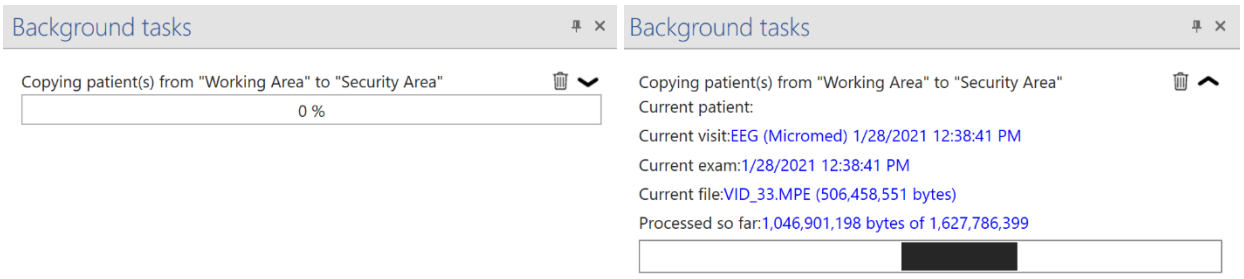
- The source and the target resources
- The name of the patient currently being transferred
- The visit, exam and file currently being transferred
- How much data has been processed so far

- **Video EEG reduction** tasks. In addition to the task name and the progress status, this type of card displays also:
  - The patient name
  - The file under reduction and the date and time of the related exam
  - The user who has launched the reduction task
  - The machine where the reduction task has been launched
- **Auto archiving** tasks. The card shows the progress status, the patient and the exam ID in which the procedure is running.
- **Persyst cleaning** tasks. Even in this case, the card shows the progress status, the patient and the exam ID in which the procedure is running.

The progress bar is labelled differently according to the reduction task status:

- **Queued:** the reduction task is in queue and waiting for to be processed
- **Running**: the reduction task has already started but has not been completed yet
- **Cancelling**: the reduction task is being cancelled
- **Cancelled**: the reduction task was aborted and has been completely removed from the queue
- **Completed**: the reduction task has been completed. The card will disappear from the Background Tasks panel.
- **Failed**: the reduction task failed or was rejected by Reduction service due to some error; a tooltip report a brief description of the occurred error. Failed tasks have to be cancelled manually.

Reduction tasks only can be promoted by clicking the Promote icon available for each card next to the Trash one; promoting a task means assign to it high priority in the processing, tasks with the same priorities are executed according to the insertion order.



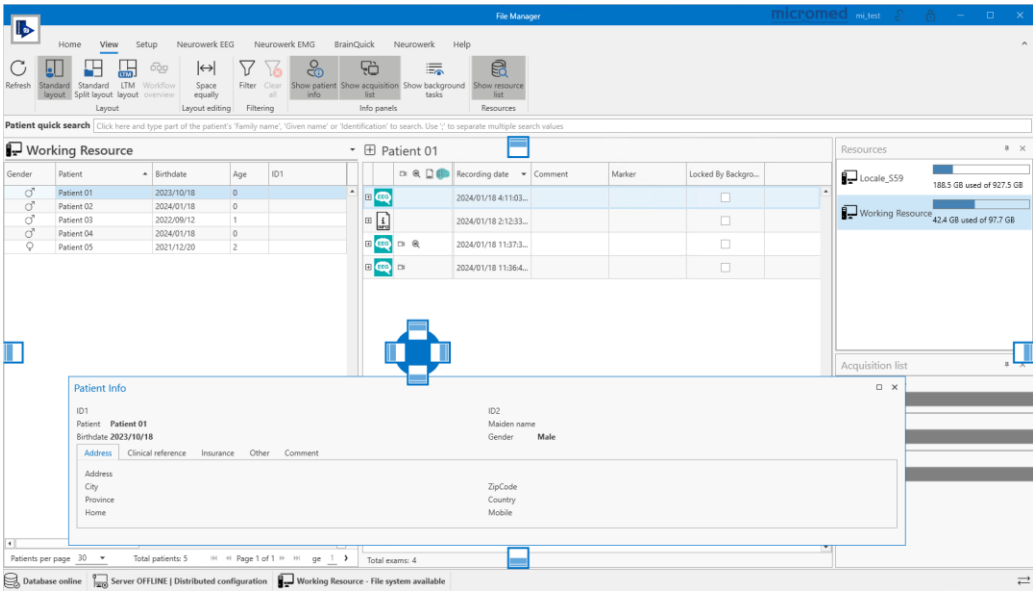
View Customization

FILE MANAGER allows the user to define size and position of all its information panels; each panel can be moved by clicking on its title bar and then dragging it to the desired position.

In order to modify height and width of a panel, point the mouse cursor on the panel's edge and, when the cursor turns into a two-sided arrow, click and drag the panel's edge until the desired dimension is reached.

All File Manager panels, except for the Patients List and the Exams List, are dockable. A dockable panel is a layout panel that provides an easy docking in preset positions.

When dragging one of the panels File Manager displays all the preset positions in which the panel can be docked. Just release the panel over a docking position and the panel will be docked in that location. Panels can be docked on the left, right, top, bottom, or center of the window. If docked, they can be moved and pinned to the top, bottom, left, or right of the application window.

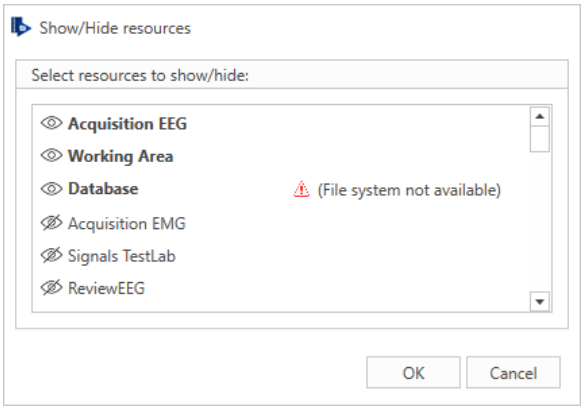


View Customization

Resources Group

This group contains the **Show/Hide** button which allows the user to decide which resources to hide or show among the defined ones; enabled resources are visible in the Resource List.

The Show/Hide resource window that opens when clicking this button is shown in the picture below.



Show/Hide Resources

Users can show (hide) a resource by toggling the “eye” icon next to each resource in the list of the available ones.

Hiding a resource makes it invisible in the Resource List and it will not be possible to transfer any type of data from and to the hidden resource. Conversely, showing a hidden resource makes it visible and enables data transfer from and to it again.

From Show/Hide Resources, it is possible to reorganize resources list, by dragging-and-dropping a resource to the selected position.

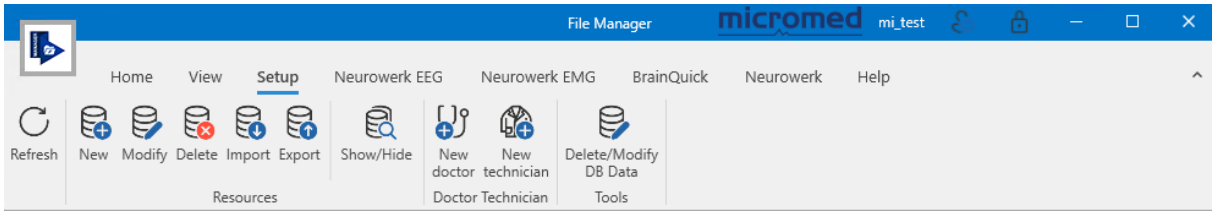
The Resource group contains also the **Show resource list** button which allows to show/hide the Resource list panel as it is possible for all other information panels.

Setup Tab

The Setup Tab contains all the functionalities that are related to resources, doctors, and technicians.

It is divided in two Groups:

- **Resources**
- **Doctor Technician**
- **Tools**



Resources Group

The Resources group allows users to create, modify, or delete a resource from the FILE MANAGER.

Micromed resource allows users to access patient information and exam data, and to perform operation on recorded studies.
Note. Resource setup is an advanced feature which can be performed by authorized personnel only, i.e. user with the "Can Create/Modify/Delete Resource" permission. Depending on the environment where workstations have to be installed, many variants are possible; it is highly recommended resource setup is performed with the support of Micromed technicians at installation time according to system configuration.

Clicking on the **New** button will open a dialog for the creation of a new resource; see the **Data Access: Resources Configuration** paragraph below for more details.
Note. A password is needed to define a new resource.

Clicking the **Modify** button allows users to modify the current resource. This will open a dialog, similar to the dialog for the creation of a new resource, where it is possible to modify any field of the current resource.

Clicking on the **Delete** button will trigger an alert message asking to confirm the resource deletion; clicking "OK" will delete the selected resource. Deleting a resource DOES NOT delete the patients and their exams and DOES NOT delete the database associated with the resource, but it simply removes the resource from the list of resources.
Note. A password is needed to delete a resource.

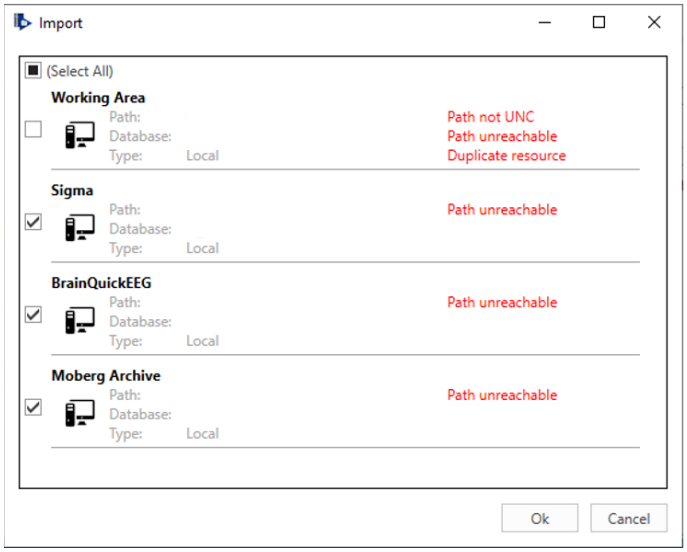
The Resources group allows also to import and export resources.

It is possible to import one or more resources by clicking the **Import** button and selecting the configuration file (systemResources.xml) storing the definition of the resources to import. This will open the "Import" dialog window where all detected resources are listed.

For each resource the following information are displayed:

- resource name (same displayed in the Resource List)
- resource path
- name of the patient database associated to the resource
- resource type (Local, Database, Storage etc.)

In addition, on the right side it is shown whether the resource is duplicated, i.e. if it already exists a resource with the same name, whether its path is not UNC [*], and whether it is reachable.



Import Resources

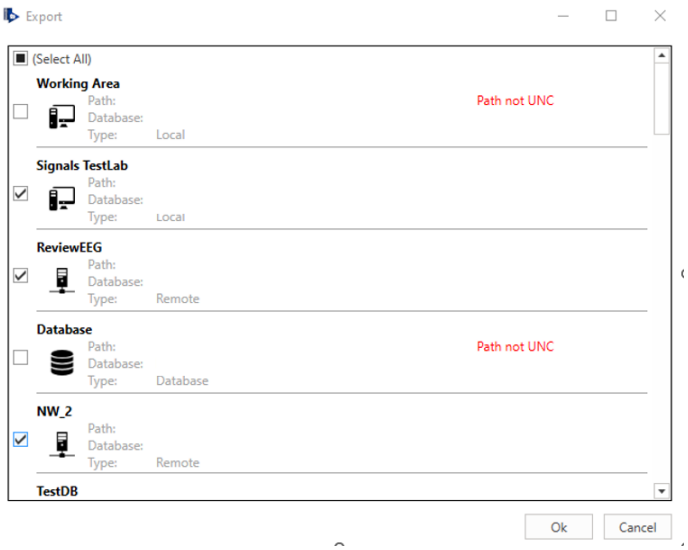
[*] UNC paths are used to access network resources; they have a conventional format starting with the host name (machine name) or the server name preceded by "\\" and followed by a shared directory name.

As default all new resources with a UNC path are selected for the import and it is possible to change the selection; clicking the "Ok" button selected resources are added to the list of system resources but they are not enabled, in order to make them visible the user have to click the **Show/Hide** button (View tab) and enable the ones of interest. Importing a duplicated resource, changes will be ignored.

Finally, it is also possible export one or more resources by clicking the **Export** button; this will open the "Export" dialog window where all system resources are listed, and the user can select the ones to export.

For each resource the following information are displayed:

- resource name (same displayed in the Resource List)
- resource path
- name of the patient database associated to the resource
- resource type (Local, Database, Storage etc.)



Export Resources

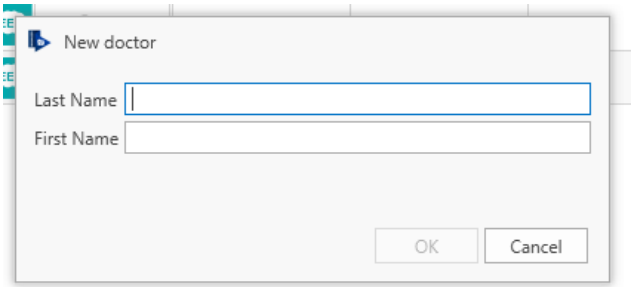
In addition, on the right side it is shown whether the resource path is not UNC (see note above).
As default all resources with a UNC path are selected for the export and it is possible to change the selection; clicking the "Ok" button resources are saved in a configuration file (.xml) which can be shared with other stations of the system and imported.

The Import/Export options are also available in right-click contextual menu of the Resource List.

Doctor Technician Group

From the Doctor Technician group it is possible to add new doctors/technicians to the database.

Clicking on the **New doctor** (**New technician**) button will open a dialog where doctor (technician) information can be entered.

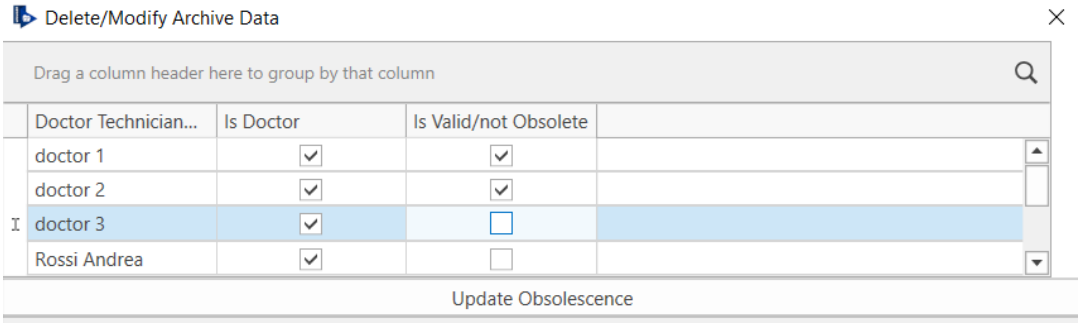


Once the required fields are filled in, the doctor (or technician) will be saved to the database and it will be available in the list of doctors (or technicians).

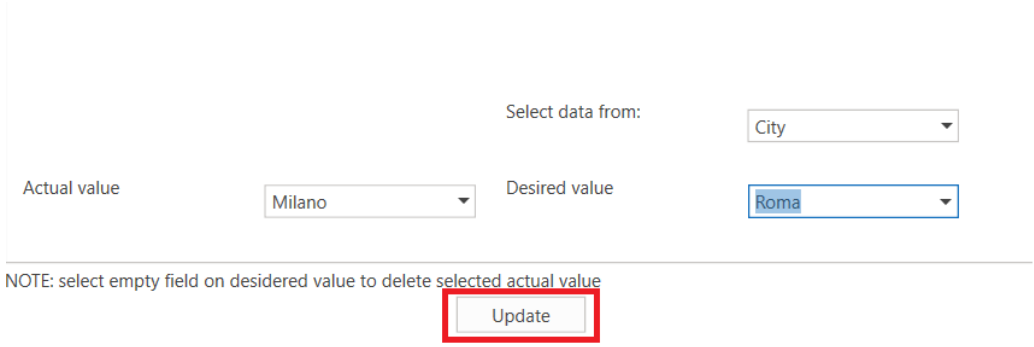
Tools Group

From Tools Group it is possible to Modify or Delete database data for already existing fields, related for instance to City, Doctor, Department, etc.
Note: only if the permission Can Add/Modify/Delete DB Values of Lookup Lists is enabled for the logged-in account the button will be active

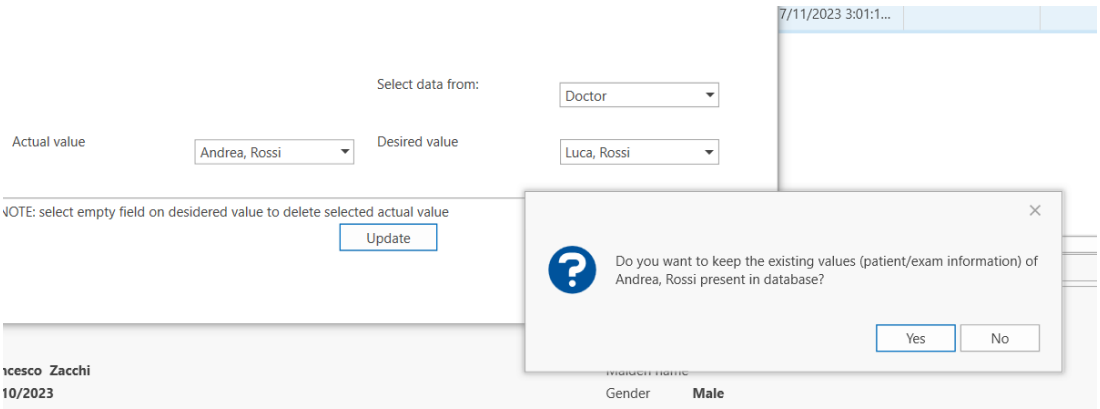
Clicking on the **Delete/Modify DB Data** button will open a dialog where the user can catalogue doctor and technicians as valid or obsolete and to select database fields to be updated or deleted. When a new doctor or technician is created, by default it is marked as Valid, and hence available from dropdown menu to be assigned to a record. From the interface, for each doctor/technician available, the user can uncheck Valid/Not obsolete field. If a doctor or a technician is obsolete, the choice will not appear when the user selects from the available doctors or technicians list. When a technician or a doctor becomes obsolete, all patients, exams, or files associated with that entity on database will remain unchanged and will not alter after rendering a doctor or technician obsolete.
Clicking on **Update obsolescence** button, all changes will be saved.



As shown in the following image, it is possible to **select data from** the available Database fields (City in the example), select an **Actual value**, type the **Desired value**, and click on update to change it with the desired one.



The user can then decide whether to overwrite the Actual value or to keep it in the database.



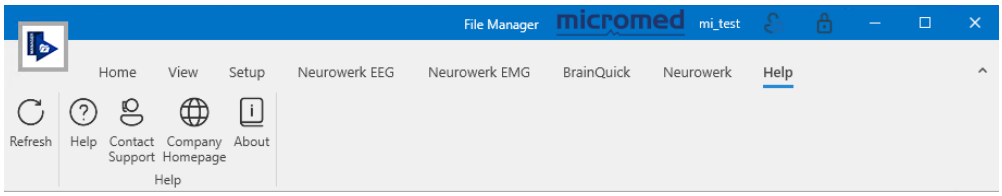
- Clicking on **Yes,** the Desired value will be added to the database keeping even the actual value (N.B. if the field is doctor or technician, actual value will be marked as Not valid)

- If the user selects **No**, another confirmation popup will appear and, if confirmed, desired value will replace the actual value in the list
- If the desired value is empty, the actual value will be deleted from the database.

All records in the selected database will be updated consequently. If the user decides to overwrite values, all entities on database associated to the actual value will be updated with the desired value. The field will be deleted for existing entities in case the desired value is empty.

Help Tab

The Help Tab contains all the functionalities that offer help to the user, as shown in the figure.

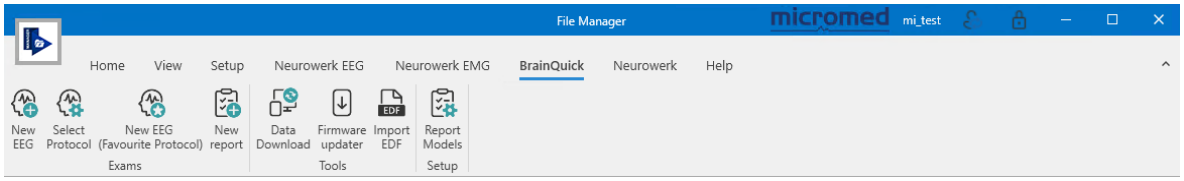


The **Help** button allows users to open the user manual for the FILE MANAGER.
The **Contact Support** button will open a window with the customer support number and email address.
The **Company Homepage** button opens the www.micromedgroup.com webpage in a browser and the **About** button opens a window with information about the manufacturer, the name of the product, the software version, and the copyright (shown below).

Brain Quick Tab

Brain Quick Tab will be available if the Brain Quick and Brain Quick Acquisition applications are installed and the system has licenses for acquisition and review.

The Brain Quick Tab groups all functionalities that allow the user to start a new EEG or Video EEG recording, create a new acquisition protocol or define an EEG report model.



Clicking the **New EEG** button will open the Brain Quick Software acquisition window which allows to start a new EEG or Video EEG recording with the last used acquisition protocol. The name of the last used acquisition protocol will be available under **New EEG** button during the File Manager session.

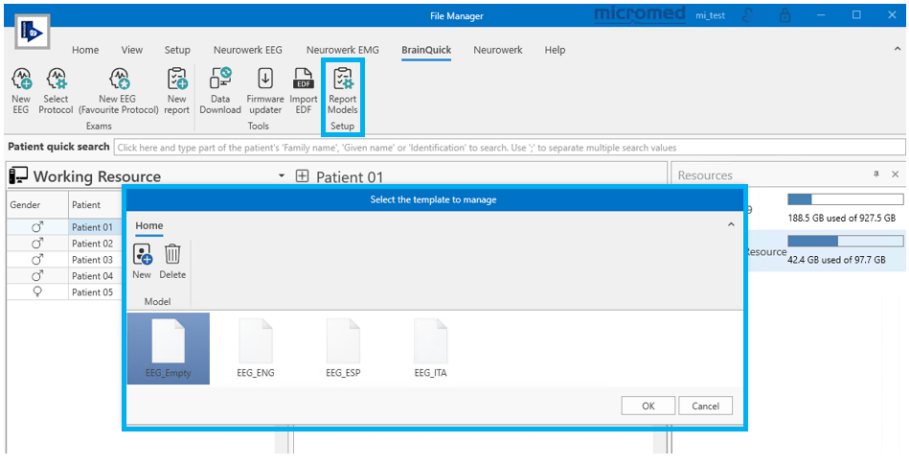
It is also possible to start a new recording by selecting the desired protocol; clicking the **Select Protocol** button will open a dedicated window of the Brain Quick Software where all defined acquisition protocols are listed, and it is possible to start a new recording with the selected protocol or create a new protocol.

Finally, it is possible to start a new recording with the default acquisition protocol by clicking the **New EEG (Default Protocol)** button; the Brain Quick Software acquisition window will appear allowing to start a new recording.

New EEG Acquisition

Selecting an exam and clicking on **New Report** button, will allow the user to choose from the existing available templates and to create and save a new report under the selected exam.

It is also possible to define a new EEG report model; clicking the **Report Models** button the "Models management" window will open allowing to define a new report template and save it.



EEG Report Models

Note. EEG Report creation and related models management are handled by Brain Quick Software; if Brain Quick Software is not installed, it will not be possible to create any EEG reports or EEG report models.

The Brain Quick tab collects also other useful tools allowing ambulatory data download, EDF file import and firmware update.

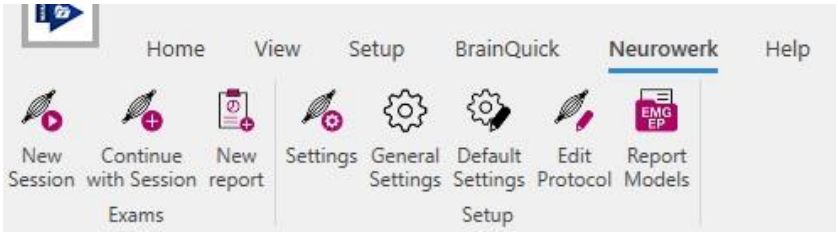
Clicking the **Data Download** button, it is possible to download ambulatory EEG data directly from amplifier (connected via cable) or from memory card by a card reader; see the **Ambulatory Data Download** section of this manual for details.

Clicking the **Firmware updater** button, it is possible to check the actual firmware version of a specific amplifier and upgrade/downgrade the firmware.

Finally, the **Import EDF** button allows to import an EEG exam in EDF or EDF+ format by calling Brain Quick software conversion tool from EDF/EDF+ file into Micromed EEG file format; the imported trace will appear as a new EEG exam in the Exams list associated to currently selected patient in the Patients list.

Neurowerk Tab

The Neurowerk Tab groups all the main commands that allow the user to start a new EMG recording, define a new acquisition protocol, manage settings for electromyography, or define an EMG report template.

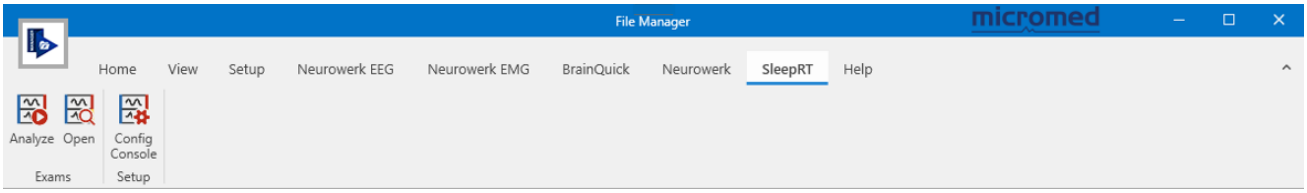


Neurowerk Tab in File Manager

- **New Session** button starts a new sequence of EMG examinations allowing the user to select or create a new acquisition protocol and start the recording of a new session.
- **Continue with Session** button allows to select an existing EMG session and to record new exams, appending them directly in the selected session.
- **New Report** button allows the user to choose from an existing report template, to create and save a report for the selected session.
- **Report Models** button, allows the user to select and edit an existing template, or to create a new one from an empty form.
- Finally, there are three buttons for session appearance and general settings (**Settings, General Settings, Default Settings**), and one for editing the protocols already defined from the user (**Edit Protocol**).

SleepRT Tab

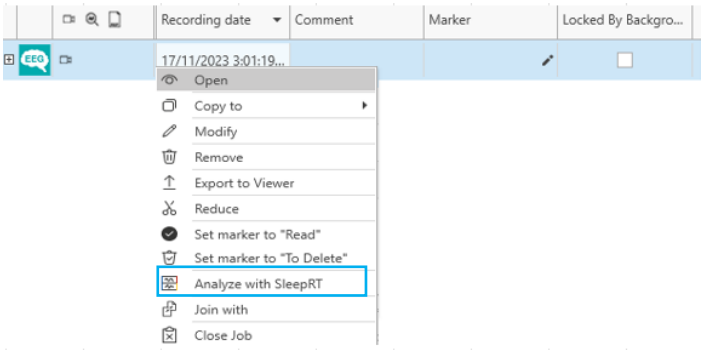
SleepRT Tab groups the functionalities available from the integration with SleepRT software.



SleepRT Tab in File Manager

If SleepRT is installed in the machine and the .exe path has been correctly configured from settings, SleepRT tab is available to process and open analysis executed with the external software.

Analyze button allows to start a new analysis for the selected EEG exam. The exam is directly opened from SleepRT software, and the user can define a new protocol to be used for the analysis of the desired exam. Analysis can be either launched from contextual menu at exam level.



Analyze with SleepRT from contextual menu

Once an analysis is launched and saved, a new file of type OSG and dedicated icon is added under the analysed exam.

Open button allows to open an existing analysis belonging to the selected EEG exam, that will be the first one in case of multiple analysis.

Config Console button opens SleepRT specific configuration console, useful for changing and defining new settings on the external application.

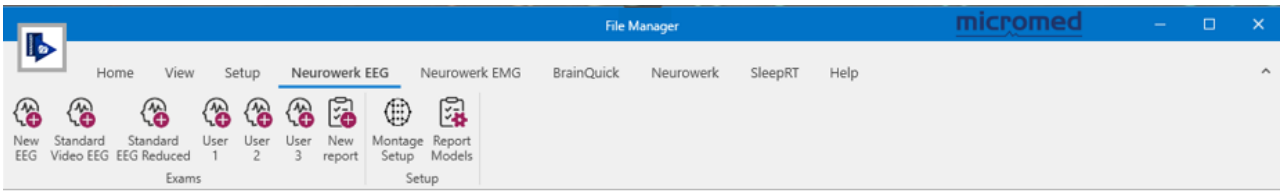
File Manager can manage and save reports created during analysis with SleepRT software to be opened and modified from its editor.

Note: only the first version of the report will be saved and visible in File Manager, additional modification after the analysis or newly created reports will not be updated and saved in File Manager

From File Manager settings, specifying the analysis destination folder, it is possible to open and review an analysis executed with SystemPLUS Evolution.

Neurowerk EEG Tab

Neurowerk EEG Tab groups the functionalities available from the integration with Sigma Neurowerk EEG software.



Neurowerk EEG Tab

If Neurowerk is installed and configured in the machine, Neurowerk EEG tab is available to start new acquisitions using the external software and to create new reports.

New EEG button allows to start Neurowerk EEG software to start a new EEG acquisition.

Standard Video EEG button starts Neurowerk EEG to run a standard video EEG acquisition.

Standard EEG reduced button allows to run a standard EEG reduced.

User 1, User 2, User 3 buttons refer to acquisition protocols configured by the logged user to start a default protocol.

When a new acquisition is started, a new exam will be created in the archive with a dedicated Neurowerk EEG icon.

New Report button allows the user to select from the available report templates and to create a new one for the selected exam.

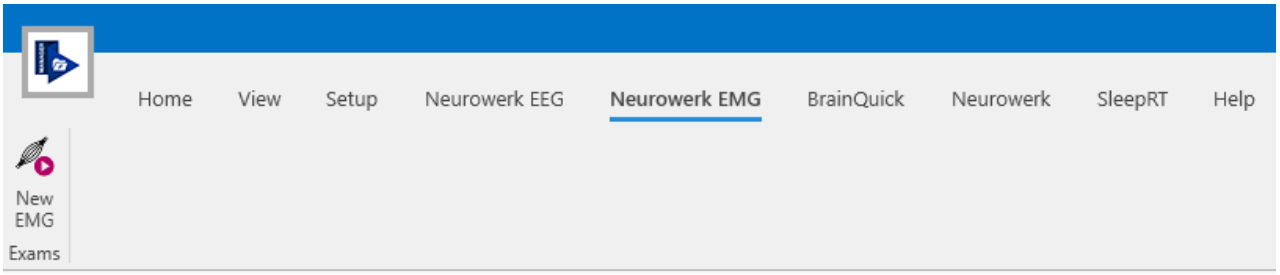
Montage Setup button starts Neurowerk EEG and directly opens Montage Setup window to allow the user changing the acquisition montage

Report Models button opens the existing report templates, with the possibility for the user to create a new one or to modify the defaults

EEG exams recorded with Neurowerk EEG can be opened directly from double clicking on them.

Neurowerk EMG Tab

Neurowerk EEG Tab groups the functionalities available from the integration with Sigma Neurowerk EEG software.



If Neurowerk is installed and configured in the machine, Neurowerk EMG tab is available to start new acquisitions using the external software.

New EMG button allows to start Neurowerk EMG software to start a new EMG acquisition.

When a new acquisition is started, a new exam will be created in the archive with a dedicated Neurowerk EMG icon.

EMG exams recorded with Neurowerk EMG can be opened directly from double clicking on them.

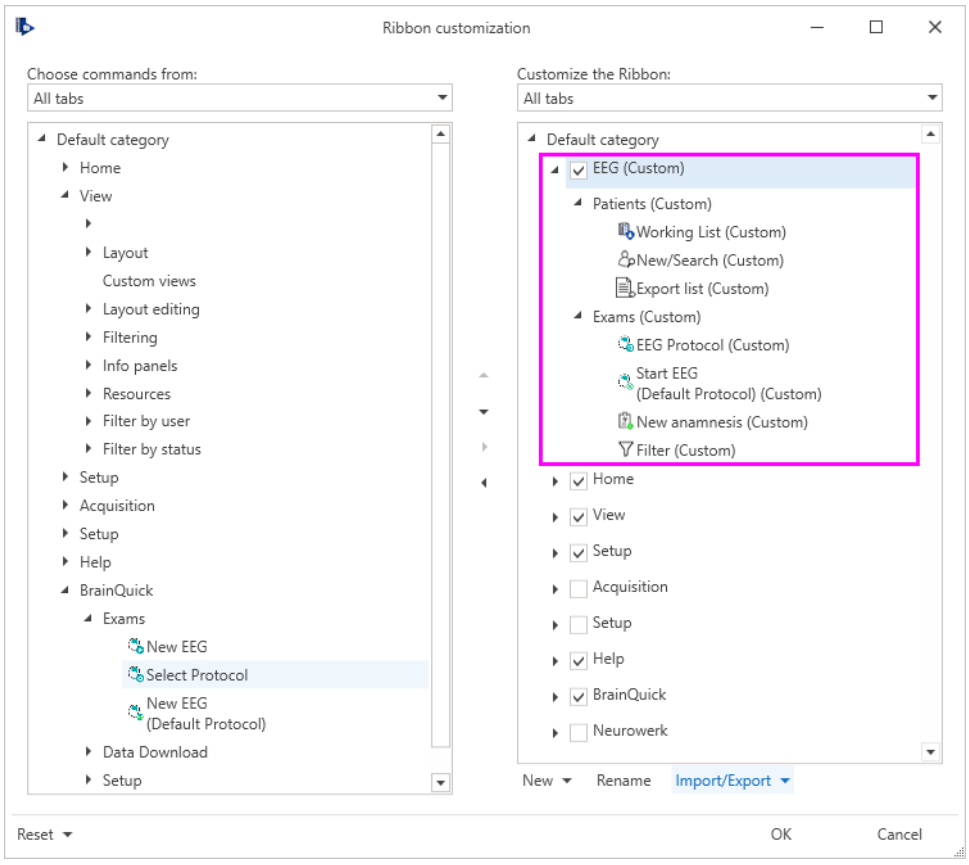
Ribbon Bar Customization

FILE MANAGER allows the user to customize all Ribbon Bar tabs and groups and define which functions shall be present in the different tabs and groups.

To access ribbon bar customization tool right-click anywhere on it and select the “Customize Ribbon” option in the contextual menu.
The “Ribbon Customization” dialog window is split into two panels: on the left, all the available commands, i.e. features (buttons) available, grouped according to the default configuration; on the right, currently applied ribbon bar configuration.

It is possible to create a new custom tab by selecting **New Page** from the “New” menu at the bottom of the right panel; to populate the tab with a new functional group the user has to select **New Group** from the “New” menu and enter the new group name.
After that, it is possible to add to each group all buttons corresponding to the desired functionalities: the user has to simply search for a specific function in the commands list available in the left panel, then click on the **right-arrow** button placed between the two panels to move the selected command under the selected group on the right panel, and so on.
Click the “Ok” button to save and apply the customized configuration.

In the right panel, customized tabs and groups are recognizable since marked by the “(Custom)” label next to the tab or group name (as shown in figure below).



Ribbon Bar Customization

Each tab and group name can be changed by clicking the **Rename** button (at the bottom of the right panel) and the order of tabs, groups within the same tab or commands within the same group, can be changed by simply selecting the item to move and using the **up-arrow** and **down-arrow** buttons available in the middle of the customization window.

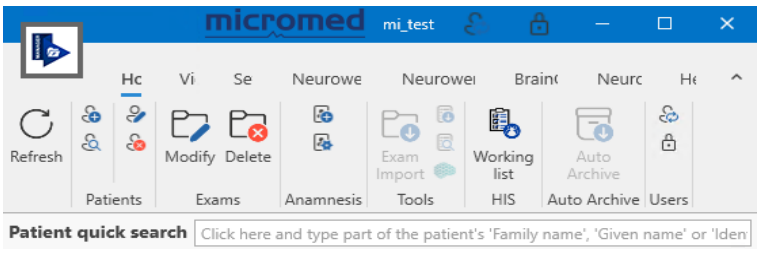
It also possible to **hide** useless tabs, groups or buttons by **unchecking** related item in the right panel or moving a specific command back to the left panel by clicking the **left-arrow** button.

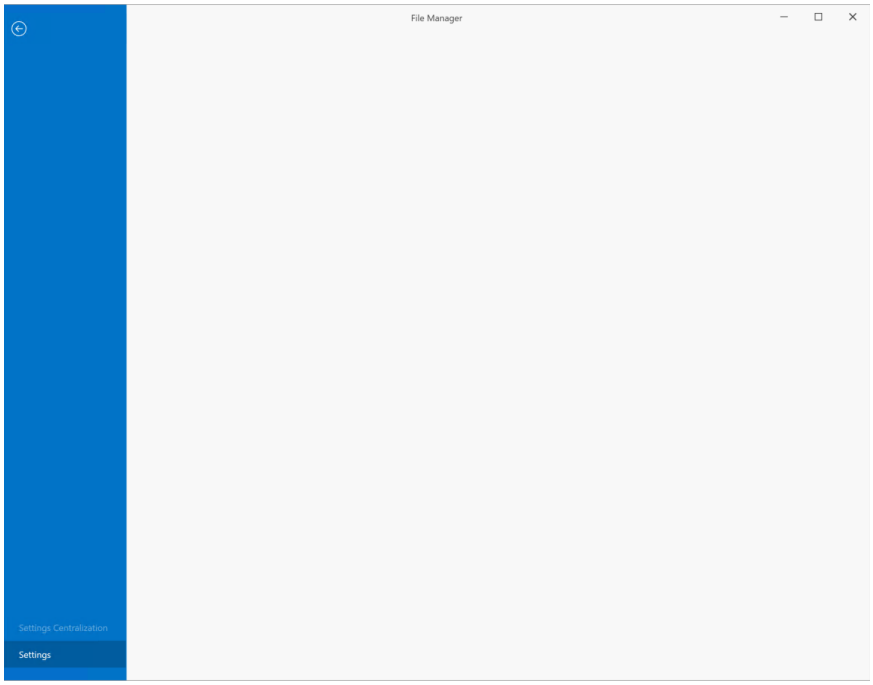
Ribbon customizations can be exported or imported from file clicking the **Import/Export** menu and choosing the desired option.

It is also possible to reset the entire ribbon bar to the default configuration or restoring only a specific tab (page) by selecting one of the available options from the **Reset** menu in the bottom left corner.

APPLICATION BUTTON

FILE MANAGER main window contains an Application button at the top left corner.



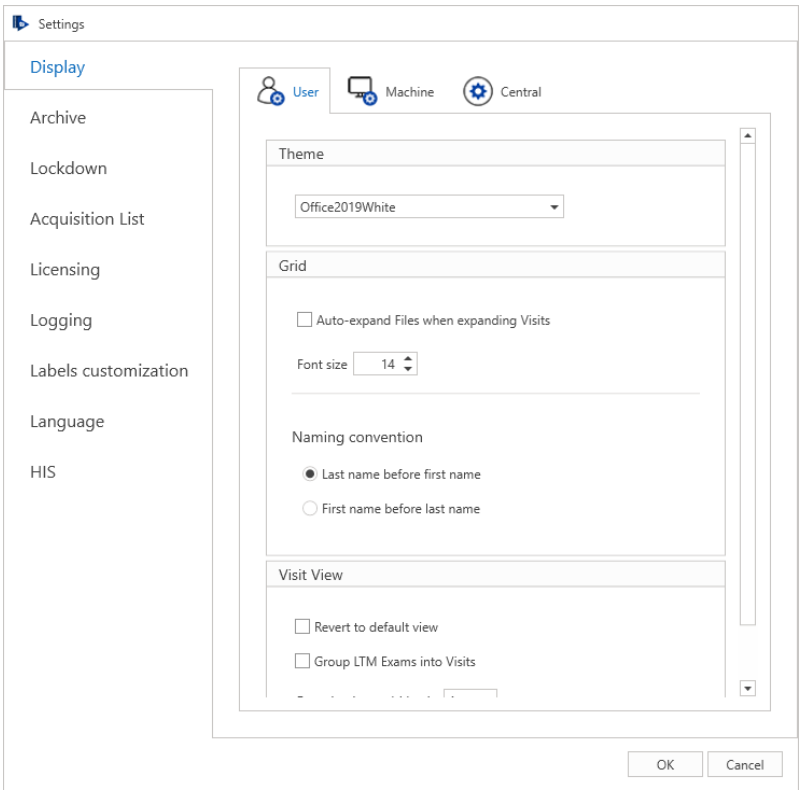


Clicking on the application button opens a menu allowing to access:

- **Settings area**
- **Settings Centralization area** (*)

(*) **Administrator user only can access this area, only if the working configuration is Distributed**

Clicking **Settings** in the left side menu it is possible to access the "Settings" window where the user can configure FILE MANAGER options; see the **Settings** chapter of this manual for all details about setting types and how to change settings.



Settings window

Selecting the other options available in the left side menu it is possible to perform advanced operations.

Clicking on **Settings Centralization,** the user can access a dedicated area where he can centralize local settings defined at machine level, to be available on all the machines of the distributed system; see the **Settings Centralization** section of this manual for further details.
Note. Only authorized user, i.e. user with the "Can Modify Central Settings" permission, can access Settings Centralization area.

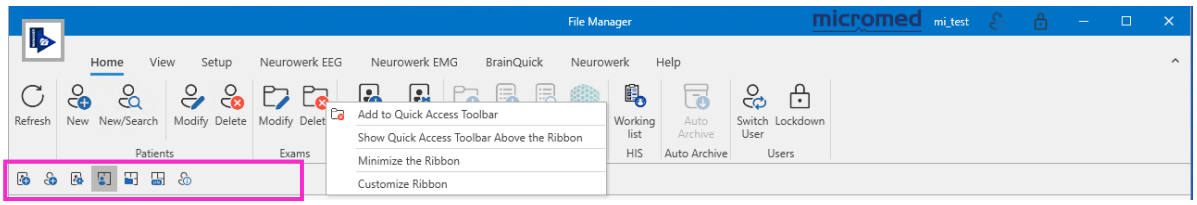
TITLE BAR

When user authentication is enabled, Title bar at the top of the main window shows the username of the user currently logged in.
On the top right corner, it also contains two controls (icon), the Switch User and the Lockdown, as seen in figure below.

Clicking on these buttons it is possible to quickly switch to another user and lockdown FILE MANAGER application, respectively.
See dedicated sections of this manual for further details about both functionalities.

QUICK ACCESS TOOLBAR

The Quick Access Toolbar is a small customizable toolbar which collects commands most frequently used. It is possible to add any control placed in the ribbon bar by selecting the “Add to Quick Access Toolbar” option in the right-click contextual menu available for each button.



Quick Access Toolbar

The Quick Access Toolbar default position is above the ribbon bar next to the application button placed in the top left corner of the main window. By right clicking any ribbon button it is also possible to move the Quick Access Toolbar below the ribbon bar (“Show Quick Access Toolbar Below the Ribbon” option) and to minimize the Ribbon.

STATUS BAR

At the bottom of the main window there is a Status bar which provides useful information.

On the left, it shows whether the **database** is online or not and the **operating mode** (distributed or stand-alone); only in case of distributed system configuration, the **server connection** status is displayed.
In addition, the **name** of current **resource** is shown with indication about the file system availability.

Status Bar

DATA ACCESS: RESOURCES CONFIGURATION

A typical networked installation is composed by:

- some **Acquisition** stations,
- several **Review** stations to be used by the consultants to read and analyse the recorded data,
- a Server containing the SQL Central Database
- a Storage containing the **Working Area,** the **Virtual Disks** and the **Multistorage**

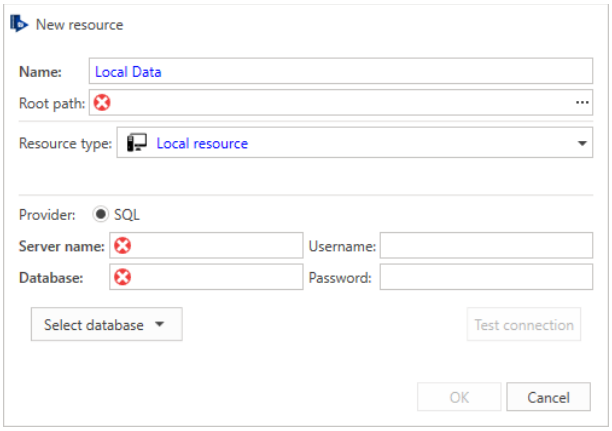
Depending on the installation environment many variants are possible; sometimes acquisition, review and/or server operations can be performed on the same unit.

Micromed resource is the key component to access patient and exam data; it consists of two parts:

- a link to the **SQL database** where patient information are stored
- a **path**, i.e. a local or shared network folder, where studies are stored

Into every workstation, a series of resources is defined, every folder having different purposes and having the need to be accessed from the other units.

A resource can be define from the Setup Tab of the ribbon bar by clicking the **New** resource button; the "New resource" dialog will open allowing to enter resource details.



"New resource" dialog window

The fields required to define a new resource are:

- the "Root path", which defines where the study files are physically stored
- SQL database details, i.e. "Server name" and "Database" the resource points to

Note. No resource creation is possible without the above information; mandatory fields are highlighted by a red cross if not filled in and the OK button is disabled.

Every resource has a specific name configured by the technician during the installation; this information can change across users.

A "Resource type" needs to be specified for every resource. The following types are available:

- **Local**: a "powerful" resource in which the user has full control, i.e. he can create, modify, remove patients and exams, and mark exams as "read" or "to delete". This resource points to a local or a network repository and it is always linked to a SQL database.
- **Local Lite**: a Local resource but portable, i.e. linked to a SQLite database; user can create, modify, delete patients and exams, but not mark exams as "read" or "to delete".
- **Auxiliary**: a portable, temporary archive resource, typically used for data exchange. This resource is always linked to a SQLite database.
- **Remote**: a resource on which the user has only a partial control, i.e. he can only remove patients and

exams, and mark exams as “read” or “to delete”. It points to a local or network repository ant it is always linked to a SQL database. It is possible to set this resource as read-only to limit operations the user can perform on data.

- **Database**: a resource typically used to read database information with limited access: “new” and “modify” functions are not allowed. Users can only delete patients and exams, and mark exams as “read” or “to delete”. This resource must be linked only to SQL databases.
- **Storage**: it represents a virtual disk partition or an optical media (DVD or BluRay disk) where data and reports are stored for archiving purpose. This resource must be linked only to SQL database and it can be set as read-only.

  Note. This resource cannot be selected by the user to obtain a patients list since this function is managed directly by the Database.
- **MultiStorage**: it represents a collection of archive resources. This resource must be linked only to SQL database and it is read-only to guarantee archived data protection.

  Note. This resource cannot be selected by the user to obtain a patient lists since this function is managed directly by the Database.
- **Moberg Live Data**: this resource is used to access Moberg CNS data during the acquisition for the live monitoring; it is generally linked to a network repository used by the Integrator to handle Moberg CNS data.

  Note. Local type resources must be used to review Moberg CNS data after the acquisition.

IMPORTANT NOTE. Operations the user can perform on data depends on user’s permission; that is the resource gives access to data with some limitation according to the resource type but features allowed and not allowed are determined by user’s rights.

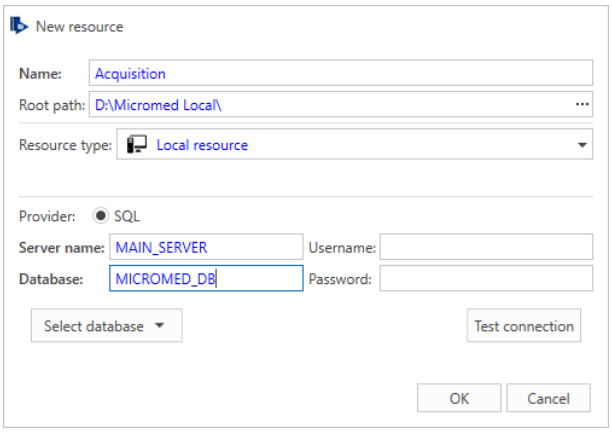
Once all required fields are populated, it is possible to test the connection to the database by clicking the “Test connection” button: this allows users to test whether the configuration fields have been filled correctly. The “Select database” button allows users to select one of the previously used databases.

Clicking the OK button resource is created and it automatically appears in the Resources List. Patients List automatically shows all patients with at least a study stored on current resource.

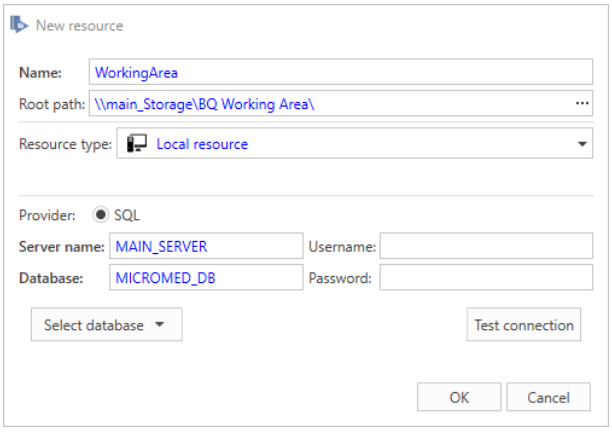
ROUTINE ACQUISITION STATION

Here is an example of the resources typically defined in a **routine acquisition station**:

- **Acquisition**: Local type, pointing to a local folder of the recording PC, linked to the Central SQL Database. Data will be recorded here.
- **Working Area**: Local type, pointing to a folder shared on the network, linked to the Central SQL Database. Data will be moved here at the end of the recording.



Acquisition Resource

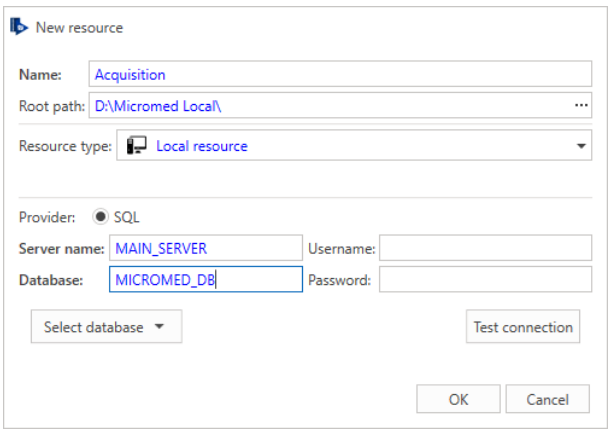


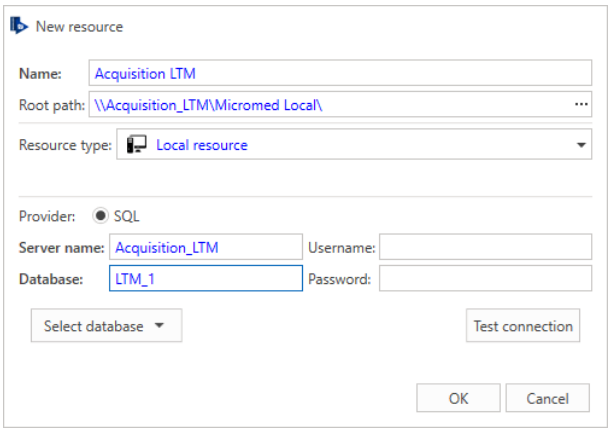
Working Area Resource

REVIEW STATION

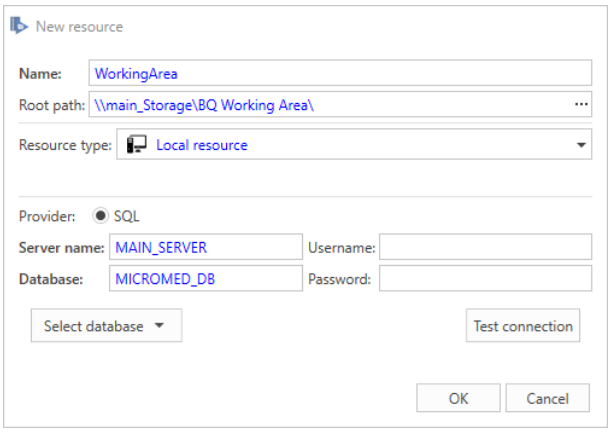
Here is an example of the resources typically defined in a **review station**, which, in general, is intended to review data and create reports:

- **Acquisition**: Local type, pointing to a folder shared on the network by the recording PC, linked to the Central SQL Database. Data will be recorded here.
- **Acquisition LTM**: Local type, pointing to a folder shared on the network by the recording PC, linked to the SQL Database of the recording unit. Data will be recorded here and no network is necessary to run.
- **Working Area**: Local type, pointing to a folder shared on the network, linked to the Central SQL Database. Data will be moved here at the end of the recording.
- **Multistorage**: Multi-storage type, pointing to a local folder of the Server or shared on the network, linked to the Central SQL Database. Data will be archived here.



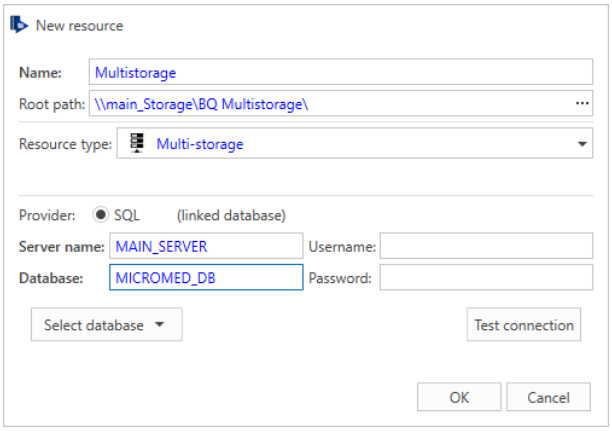


Acquisition Resource



Working Area Resource

Acquisition LTM Resource



Multistorage Resource

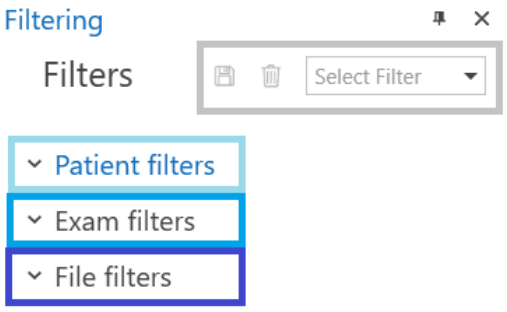
FILTERING VIEW

The number of patients stored inside Micromed database can be significant resulting in a huge amount of studies to manage. In order to easily find a specific patient or study, or to perform operation on a group of studies it is possible to filter current view.

FILE MANAGER offers a Filter tool which allows to filter patients and studies displayed according to a collection of searching criteria.

Note. It is possible to set up to six different criteria which can be applied at a time.

Clicking the **Filter** button on the ribbon bar (View Tab) the Filtering panel will open allowing the user to set filtering criteria.



Filtering Panel

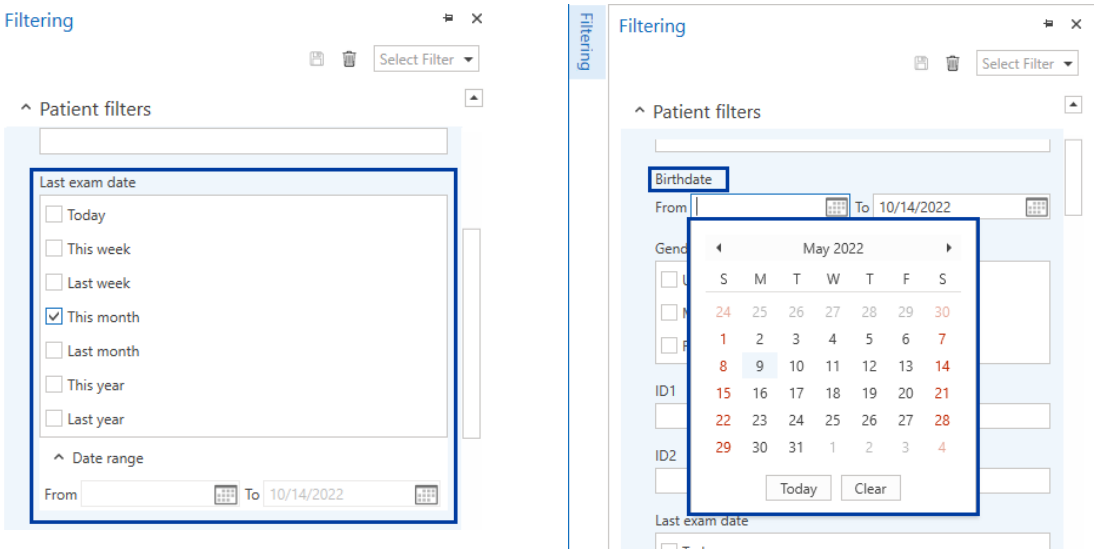
Filtering panel consists of three main parts:

- the upper section, where it is possible to select a custom filter among the saved ones or create a new filter by saving a collection of searching criteria
- the **Patient filters** pane, where it is possible to choose patient related fields as filtering criteria

- the **Exam filters** pane, where it is possible to select information related to exam as filtering criteria
- the **File filters** pane, where it is possible to select information related to statistic items at file level as filtering criteria

FILTERING ON PATIENTS

The Patient filters pane allows user to choose filtering criteria among all available patient related fields. Most of filters available are editable text fields, such as patient first name and last name, patient ID number or patient's notes.

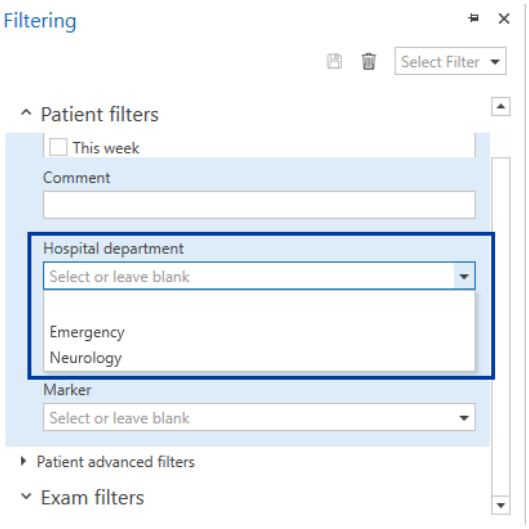


Filtering on Patients

It is possible to easily filter on patients on the base of their "Birthdate" or focusing on the most recent study filtering on the "Last Exam Date" field; for the both fields it is possible to easily set a specific time interval making use of the calendar or choosing among standard date ranges, as shown in the previous pictures.

For some fields Filter tool allows to choose among a pre-compiled list of values:

- The Gender filter contains a check box for each of the three available options (Male, Female, Unspecified).
- The Doctor filter contains a scrollable list of all doctors saved in the database of the current resource.
- The Hospital Department filter contains a scrollable list of all hospital departments saved in the database of the current resource.



Filtering on Patients – Hospital department

- The Marker filter contains a scrollable list of all markers saved in the database of the current resource.

Finally, there is a **Patient advanced filters** section where it is possible to filter for further details, such as insurance details, physical data etc.

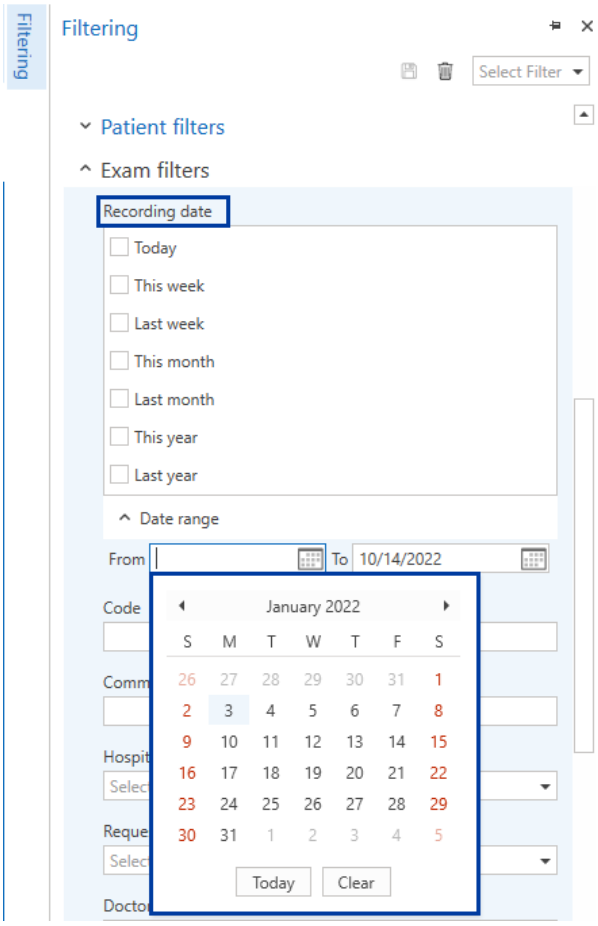
FILTERING ON STUDIES

The Exam filters pane allows user to choose filtering criteria among all available information related to studies and related files.

Filters available on exam allow for example to display:

- Only specific type of studies, such as EEG or EMG
- All EEG studies recorded last week or in a specific date range
- All EEG studies to be reviewed by a specific doctor

It is possible to easily filter on studies on the base of their type or focus on examinations performed in a specific date range filtering on the “Recording Date” field; for the latter field it is possible to easily set a specific time interval making use of the calendar or choosing a standard date range, as shown in the picture below.



Filtering on Studies – Recording Date

For field such as exam Code and Comment it is possible to search by typing free text, like keywords, in an editable textbox.

As for patients, for some exam related fields Filter tool allows to choose among a pre-compiled list of values:

- The Doctor, Technician and Requesting Doctor filters contain the list of all doctors and technicians saved in the database.
- The Hospital Department field contains a scrollable list of all hospital departments saved in the database of the current resource.
- The Marker filter contains the list of all available markers.

Finally, the Flags filter groups all the flags which can be assigned to a study in a box containing a check box for each “Quick Search” flag and one for the “Corrupted Video” flag.

Note. “Quick Search” flags description can be customized to mark a study as desired; see the Labels Customization section of this manual for further details.

Filtering criteria on studies can be combined with filtering criteria related to patient, for example to visualize all EEG studies related to patients belonging to a specific hospital department or assigned to a specific doctor.

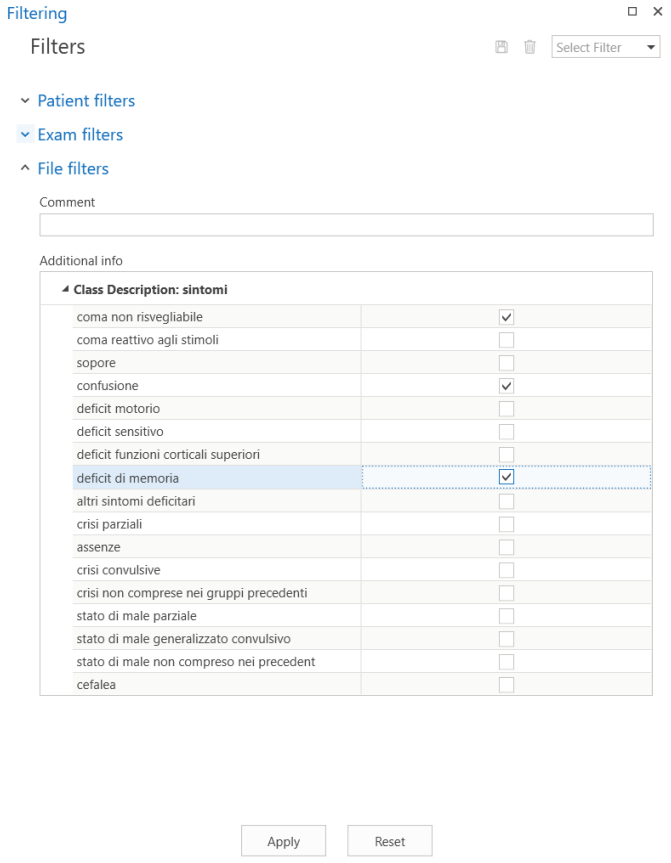
FILTERING ON FILES

The File filters pane allows user to choose filtering criteria among all available statistic fields present in database statistic tree and comment at file level.

Filters available on a file allow for example to display:

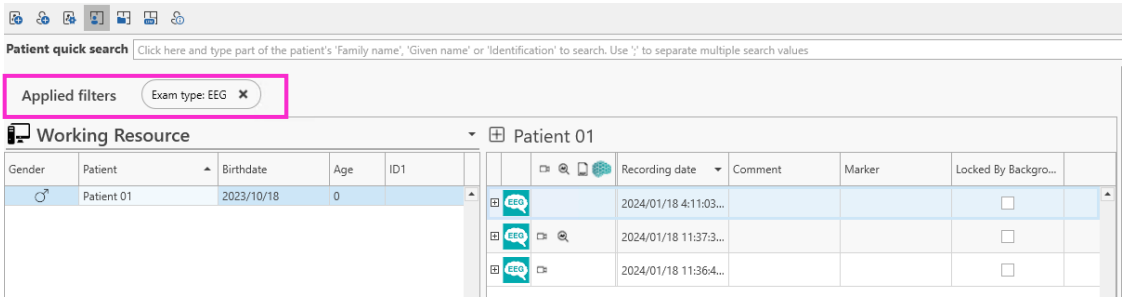
- Only a set of files with a specific comment
- All files related to a single or multiple statistic classes

This filtering tool is powerful if a statistic tree is defined in the selected database, and allows to display multiple files with the same classification.



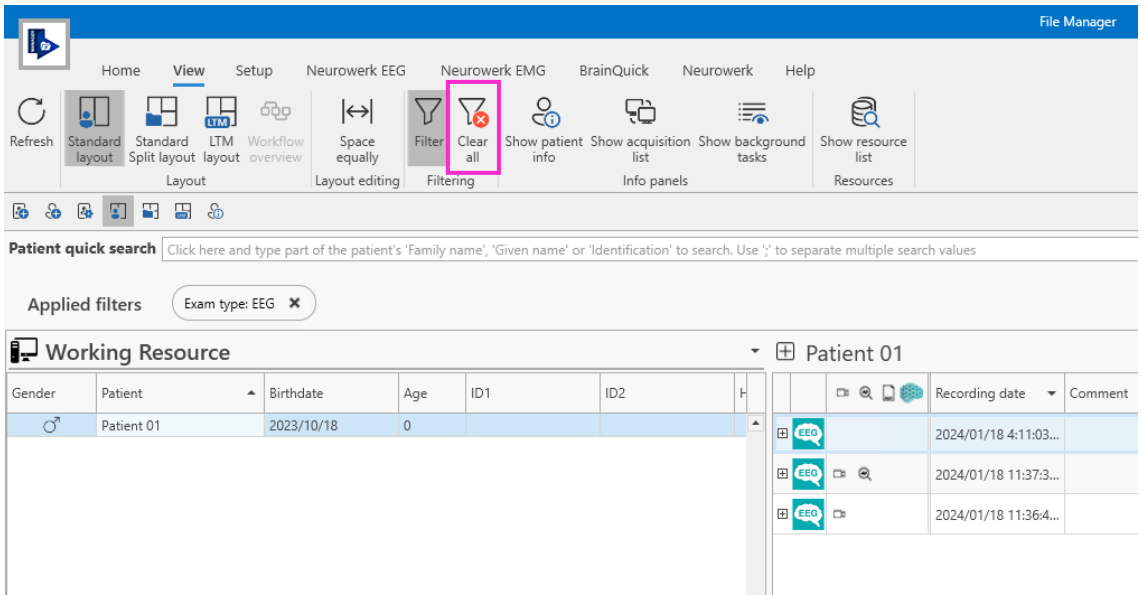
ACTIVE FILTERS

It is possible to enable more than one filter at a time, i.e. to apply a collection of filtering criteria. All applied filters are shown in a dedicated panel which appears on top of the View pane above the patients and exams list when there is some filter active (see figure below).



Applied Filter Summary

From the “Applied filters” panel it is possible to clear active filters one by one, i.e. to reset only the selected filter, by clicking the “X” button. Alternatively, the user can reset ALL the filters by clicking the **Clear all** button on the ribbon bar (or in the Quick Access toolbar, if added), as highlighted in the image below.



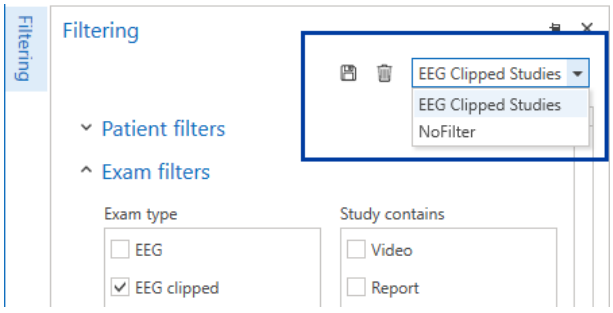
Clear All Filters

Note. Active filter applies to all views, that is if the user changes current layout, patients and studies displayed are only those satisfying the applied filtering criteria.

SAVING FILTERS

Filter tool allows to create custom filters, assign a friendly name and save them for quick access.

In the upper part of the Filtering panel there is a dropdown list with all available saved filters, as shown in the figure below. The user can select one of the pre-defined filter to quickly load and apply it searching for patients and/or studies of interest according to the customized criteria.



Saved Filters

Next to the filters list there are a “Save” and a “Delete” button which allow to save a collection of filtering criteria as custom filter and to remove a saved filter, respectively.

To save a filter:

1. Fill in one or more search criteria in the Filtering pane and apply the filter.

2. Click on the “Save” filter button.
3. Enter the name of the filter to be saved and press the “Save” button.

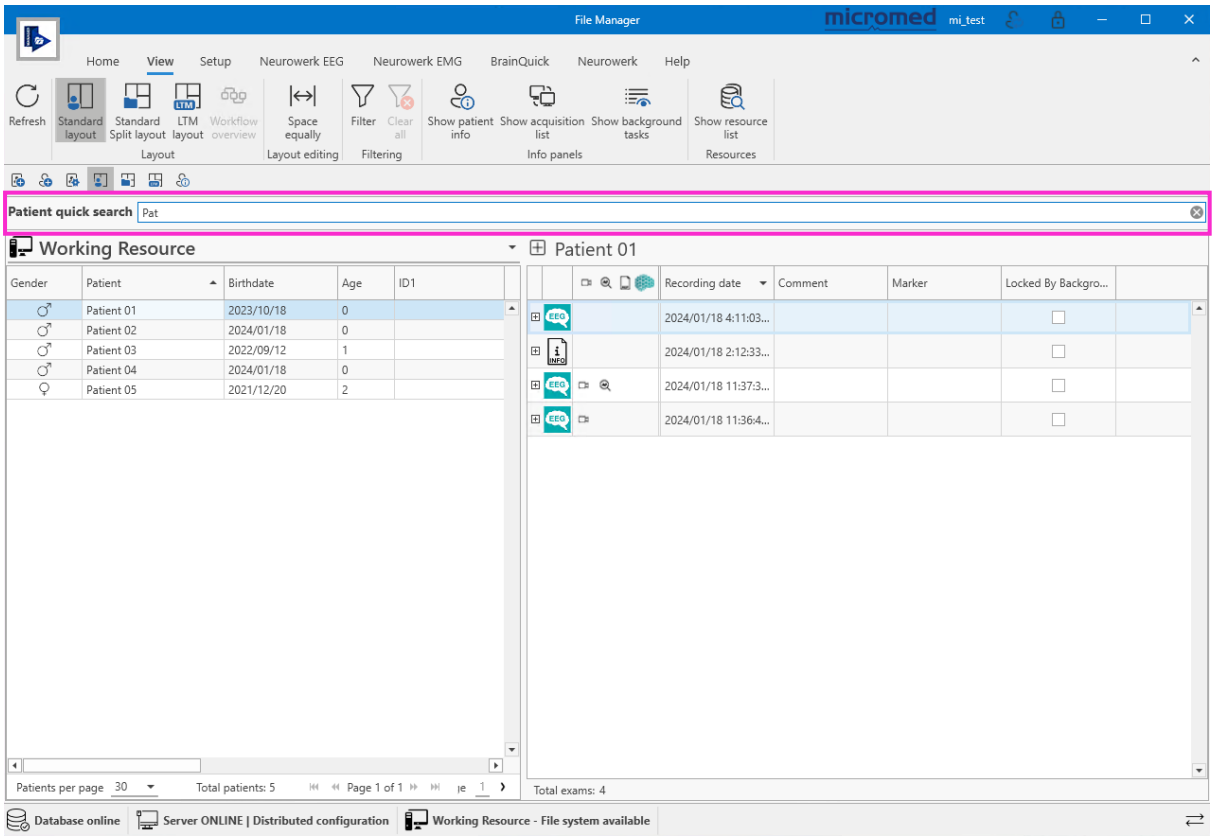
From now on, the saved filter will be available among custom filters and the user can apply it by selecting it from the dropdown list on the top right corner of the Filtering pane.

To remove a custom filter, first apply the filter to be removed, then click on the “Delete” filter button to the left side of the custom filters list.

PATIENT QUICK SEARCH

In the Archive module it is also possible to quickly search for a specific patient or group of patients thanks to the **Patient quick search** box available on top of the View panel above the Patients List itself.

Entering patient name, last name or identification the patients list will be filtered in **real time** showing only patients who match current searching criterium; more criteria can be combined using “;” as separator.
The order for patient search is First Name ; Last Name ; ID1.



Patient Quick Search

To reset patient list visualization and show all the patients click the “x” button on the right corner of the quick search box.

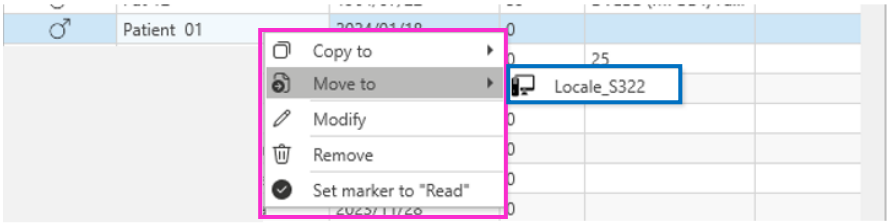
BASIC OPERATIONS

BASIC OPERATIONS ON PATIENTS

All basic operations the user can perform on patient are quickly accessible from the Patients List.

Right-clicking on a patient record will present a contextual menu showing all the actions available:

- **Move to**: this action allows moving the selected patient from one resource to another that is linked to the same database. The patient will be no longer available in the source resource, as it has been moved to the target resource.
- **Copy to**: this action allows copying the selected patient from a resource linked to a database to a resource linked to a different database. After the copy, the patient in the source resource will be still present, and any changes made on it will not affect the patient copied in the target resource.

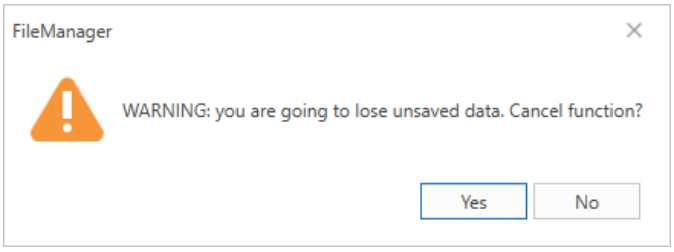


Patient – Basic Operations

- **Modify**: this action allows editing patient information by accessing the “Modify patient” window.
- **Remove**: this action allows removing the selected patient from the Patients List and delete all of its related exams.

  Note. **Patient removal requires confirmation by the user**. If the user confirms patient removal but at least one exam related to the selected patient has not been archived yet, a further popup appears warning about the possibility to lose unsaved data and suggesting to cancel the operation. The user can decide if continue or not. If patient removal is confirmed, the patient and all associated exams will be permanently deleted.

  Figure below shows the warning message displayed: answer “Yes” if any unsaved data to avoid data loss, answer “No” to confirm patient removal.

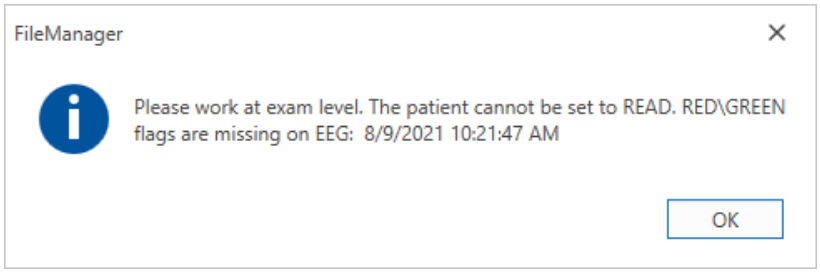


- **Set marker to “Read”**: this action allows marking the selected patient as “read” in order to trigger the automatic archiving procedure; typically used after the exams of the selected patient are reviewed by the doctor/technician.

  Note. A patient can be marked as “read” **only** if all the related exams are already marked as “read” or

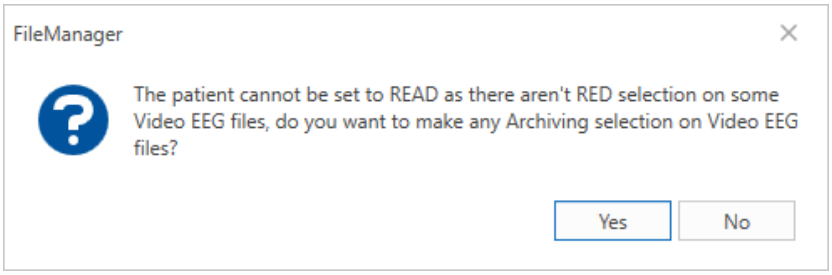
"to delete".

If a patient has no associated VEEG exams and one or more exams are not marked yet, the following popup will appear:



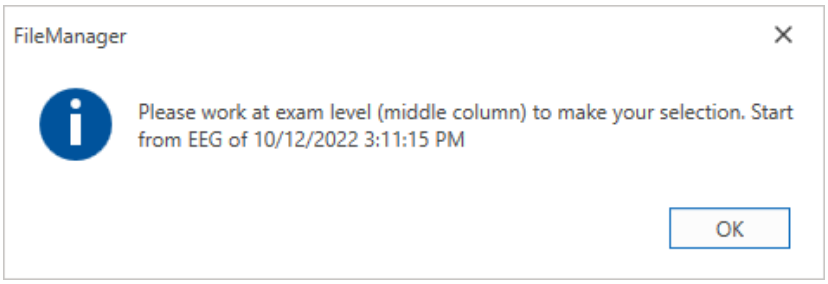
The popup will notify the user that the patient cannot be set to "read" since one or more EEG exams do not contain any GREEN flag (used to select parts of the EEG exam to keep) and the operation will be aborted.

If a patient has associated VEEG exam and one or more exams are not yet marked, the following popup will appear:

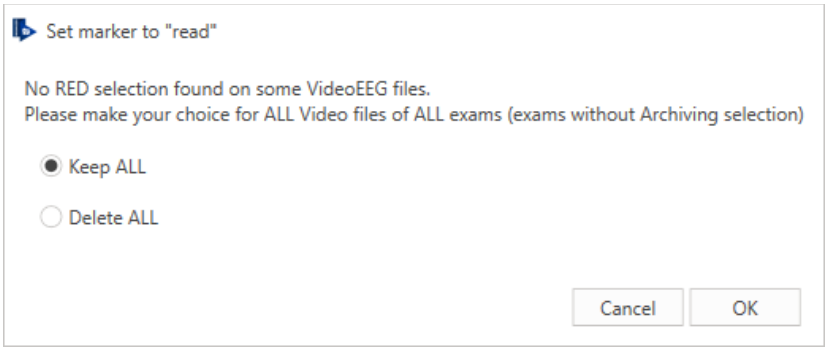


The popup will notify the user that one or more VEEG exams do not contain any RED flags (used to select parts of the VEEG exam to keep). The user will be asked if they would like to add the RED flags manually:

1. Choosing "Yes", the user will be prompted to work on each single exams (at a later time) and the patient will not be marked as "read".



2. Choosing "No", the user will be asked whether to maintain all videos ("Keep ALL") or to delete them all ("Delete ALL"). After selecting one of these options and pressing the "OK" button, the patient will be marked as "read", as well as all its associated exams. The user will still be able to abort the operation by clicking the "Cancel" button.



Operations on Multiple patients' selection

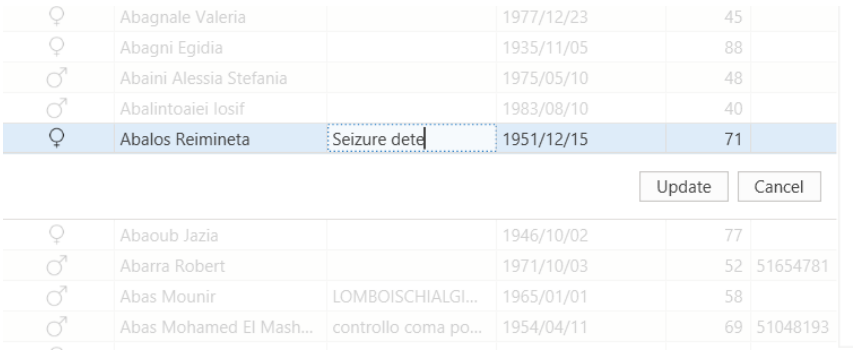
File Manager allows to select multiple patients from patients list (Ctrl + click or Shift + click). Right clicking on the multiple patient's selection, it is possible to perform the following operations, that follow the rules of single patient selection:

- **Copy To:** all patients and related exams will be copied to the destination resource
- **Move To:** all patients and related exams will be moved to the destination resource
- **Remove:** all patients and related exams will be removed from the selected resource

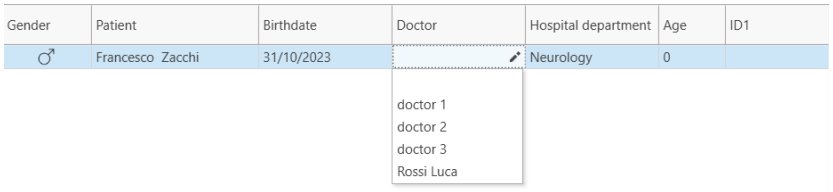
Direct Patient Info Editing

In the Archive module it is also possible to directly edit Patient information acting on Patients list columns.

For example, the user can quickly enter patient **Comment** by directly typing into the related column or he can easily assign exam **Doctor**, **Marker,** or **Hospital Department** by selecting the desired value among the available options in the drop-down menu which opens by clicking the "pencil" icon in related column.



Comment editing

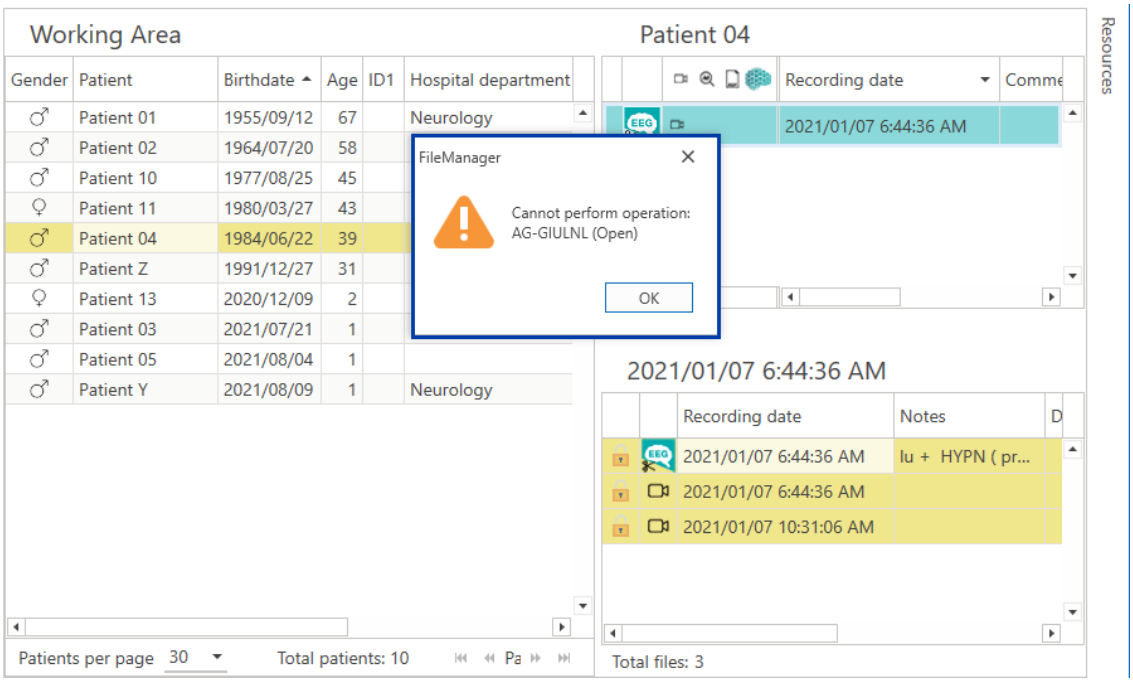


Patient Fields editing

Concurrency

FILE MANAGER does not allow some operations on patient in case of **concurrency**, i.e. if some exam related to the patient is open or under elaboration, such as editing, removal or transfer, OR if the patient itself is "locked" for modification, removal or transfer by another workstation of the system.

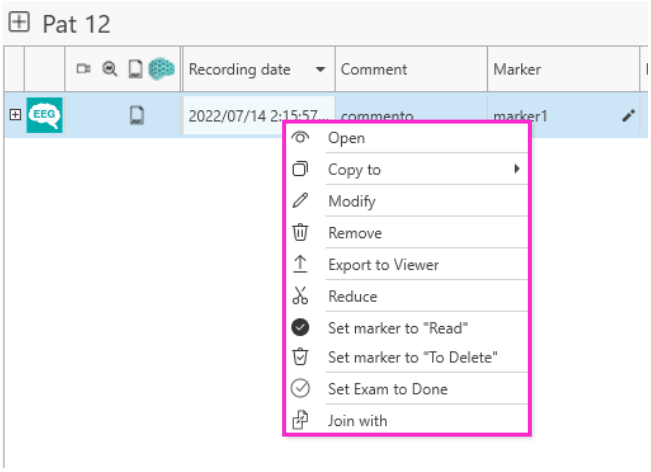
A popup message will appear warning the user the operation cannot be performed when such action is temporarily blocked for concurrency matter; the message displays the name of the machine "locking" the patient and the cause of the block in brackets.



BASIC OPERATIONS ON EXAMS

All basic operations the user can perform on a selected exam are quickly accessible from the Exam List or the Exam pane, according to current layout.

Double clicking on a single exam opens the exam primary file with its associated application, such as Brain Quick software for EEG studies; this allows the user to review the recorded study with the suitable application.



Exam – Basic Operations

Right-clicking on an exam presents a contextual menu that allows the user to perform the following operations:

1. **Open** the exam file with the associated application, if it is installed; otherwise, a warning message will appear notifying the user that the expected application is not installed.

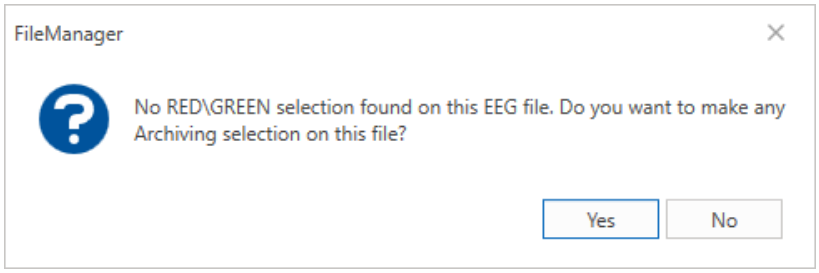
   IMPORTANT NOTE: If the selected exam is **CNS Moberg**, a further option **Open With** is available, which allows the user to choose the specific application to use for the exam review.

   Options available are: **CNS Envision**, **Brain Quick** and **Persyst**. If the selected application is not installed the CNS exam is not open.

2. **Copy** the selected exam and related patient **to** the chosen resource. This option copies ONLY the selected exam; to copy all the exams for the patient, see the "Copy to" in the Patients list.
3. **Modify** the exam through the "Modify exam" dialog (see Home Tab section for further details)
4. **Remove** the selected exam. In order to remove the selected exam, it is required for the exam to be accessible through current resource, i.e. it is required for the exam files to belong to the current resource path.
5. **Set the marker to "Read"**, i.e. mark the selected exam as "read" (ready to be archived).

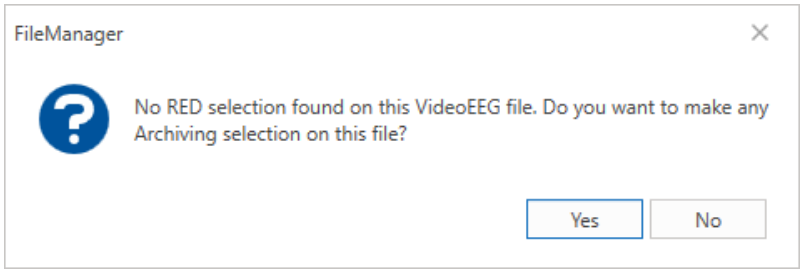
   Note. An exam can be marked as "read" only if it contains GREEN/RED flags (used to select which part of EEG/Video EEG to keep).

   If the exam has no associated Video EEG files and no flags are present, the following message will appear:



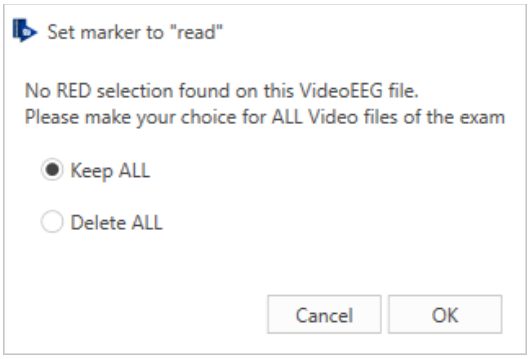
   By clicking "Yes", File Manager will alert the user to work at exam level to insert the desired flags. If instead the user chooses "No", the exam will be marked as read.

   If the exam has associated Video EEG files and no RED flags are present, the following message will appear:



   By clicking "Yes", File Manager will alert the user to work at exam level to insert the desired flags.

   By clicking "No", the user will be asked whether to maintain all the videos ("Keep ALL") or to delete them all ("Delete ALL"). After selecting one of these options and pressing the "OK" button, the selected exam will be marked as "read". The user will be able to abort the operation by clicking the "Cancel" button.

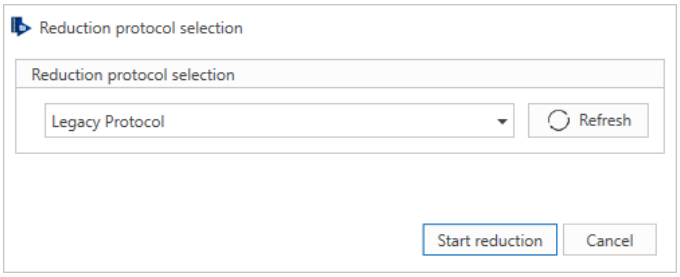


Note. If no GREEN/RED flags are inserted and the "Keep ALL" option is chosen, the entire EEG trace with related videos is kept when the exam clipping is performed; it is highly recommended to save storage space avoiding to archive not interesting data.

6. **Reduce**, which allows the user to create a reduction task for the selected exam according to the selected reduction protocol.

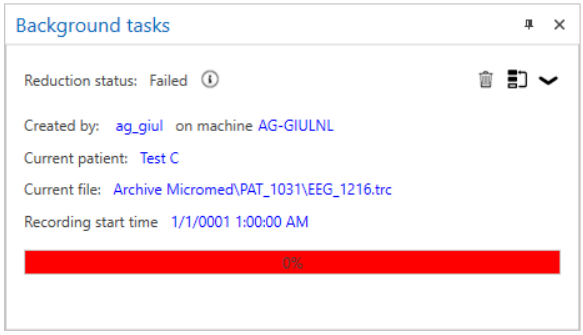
   Note. This option is available ONLY for EEG and Video EEG exam, not yet archived, recorded with Micromed Acquisition Software.

   After clicking on this item, a dialog will open to allow the user to select a suitable reduction protocol among the available ones from a refreshable drop-down list. Once the reduction protocol is chosen, the user can send a reduction request to the Brain Quick Background Reduction Service by clicking the "Start reduction" button.



Note. Background Reduction Service in embedded inside Brain Quick Software, FILE MANAGER sends a reduction request to Brain Quick Software when the "Start reduction" buttons is clicked. If Brain Quick Software is not installed, it will not be possible to perform EEG reduction

A new reduction task will automatically appear in the Background Tasks panel reporting related progress status and further details, as illustrated in the dedicated section before.
If the reduction request fails for some reason, the related task is marked as failed and a brief description of the occurred error is available clicking on the info icon which appears next to the task status.

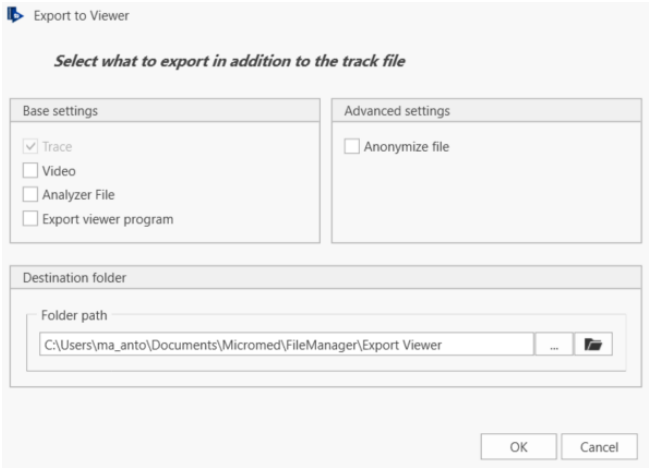


7. **Export to Viewer**, which allows to export the selected trace to a ".vwr" format that can be opened using external viewer programs.

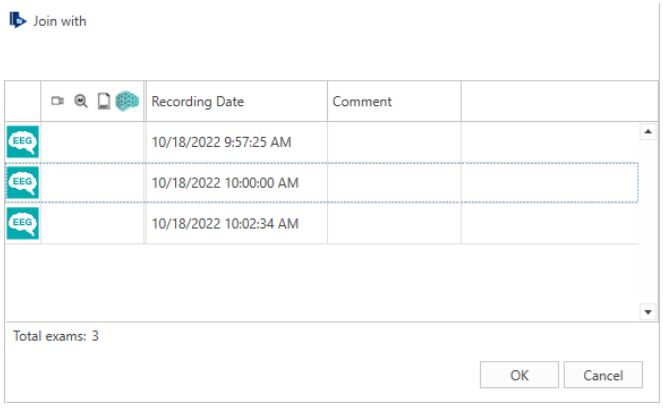
   Clicking this item will open the "Export to Viewer" dialog, where it is possible to choose whether to also include the video, events, and analyser files related to the selected trace. It is even possible to export Viewer program to easily open exported data. Program export will be successful just in case Brain Quick Viewer is installed in the machine.

   Another option is to keep the exported exam anonymous, by checking the related option.

   Note. This option is available ONLY for EEG exams recorded with Micromed Acquisition Software.



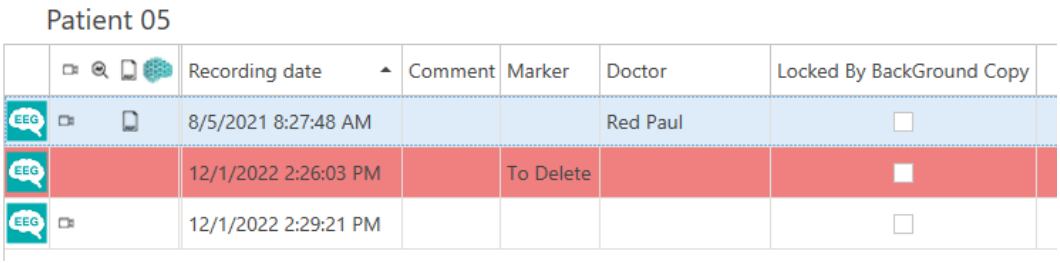
8. **Join with**, which allows to join EEG or Video EEG traces associated to the same patient into a unique one.
   Clicking this item will open the "Join with" dialog where it is possible to choose EEG recordings to be joined with the selected one in the Exams list.



   Note. This option is available ONLY for EEG exams recorded with Micromed Acquisition Software. The functionality does not handle the joining process when the traces exhibit different connections. Moreover, it only combines EEG data, even when video files are present, as the merging of video files is not supported.

9. **Set marker to "To Delete"**, i.e. mark the exam as ready to be deleted. Exam marked as "to delete" will be discarded by the auto-archive procedure and automatically deleted.

   A double confirmation is required for marking an exam as "to delete", since it will be permanently removed during the auto-archive procedure and not archived at all.



Note. Exams marked as "to delete" are considered by the auto-delete procedure ONLY if related patient is marked as "read".

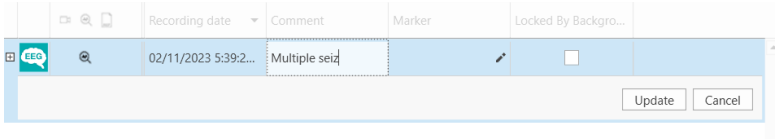
10. **Reset Marker**, allows to remove a marker that has been set for the selected exam

11. **Close Job** allows to close working cycle in case of patient imported with HL7 environment. The option will be visible among the basic operations only if it has been enabled from options. **See section related to HL7 integration for further information**.

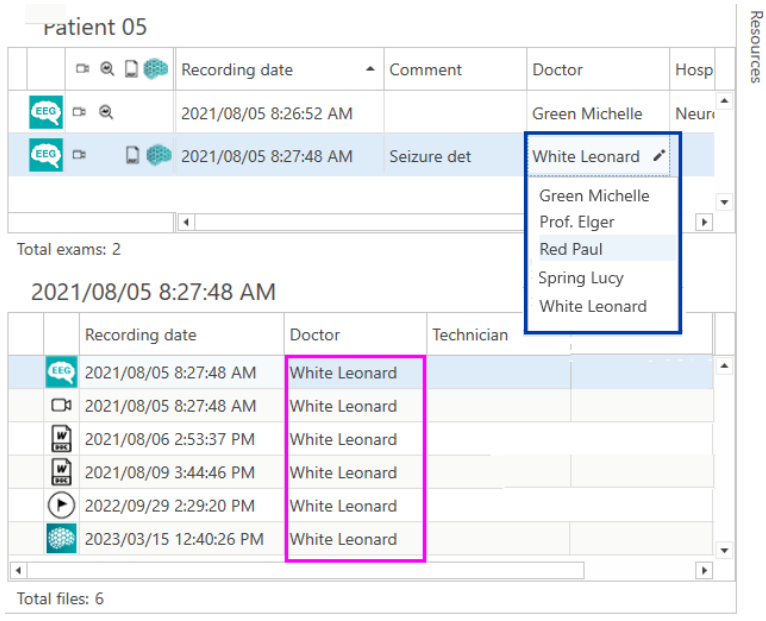
Direct Exam Info Editing – Exam level

In the Archive module it is also possible to directly edit Exam information acting on Exams list columns.

For example, the user can quickly enter exam **Comment** by directly typing into the related column or he can easily assign exam **Doctor**, **Technician** or **Hospital Department** by selecting the desired value among the available options in the drop-down menu which opens by clicking the "pencil" icon in related column.



Comment editing



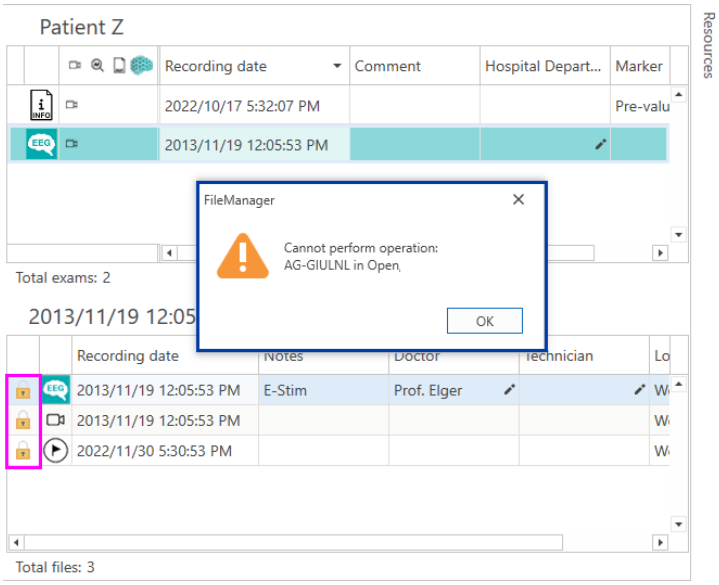
Exam Fields editing

Note. Modifications related to “Doctor”, “Technician”, “Requesting Doctor” and “Hospital Department” fields will automatically apply to all the files associated to the edited exam.

Concurrency

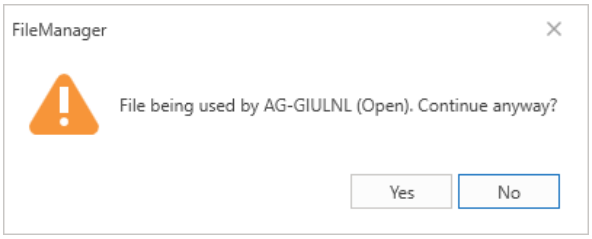
FILE MANAGER does not allow some operations on exam in case of **concurrency**, i.e. if some file related to the exam is open or under elaboration, such as editing or removal, OR if the exam itself is “locked” for modification, removal or transfer by another workstation of the system.

A popup message will appear warning the user the operation cannot be performed when such action is temporarily blocked for concurrency matter; the message displays the name of the machine “locking” the exam and the cause of the block in brackets.



In addition, if there is any on-going review session or report file is open or any “locking” operation is in progress, the Exam is highlighted in a different color in the Exams list and all the Files interested by the “locking” operation, such as trace file, video, events file, analysis file and/or report, are visually marked as “locked” by a “lock” icon which appears at file level (as shown in the image).

Note. Exam or single file **editing** and **removal** are “blocking” operations, i.e. no action is temporarily allowed on Exam and File; instead, if an exam or a file is open it is possible to open it again in another workstation (collaboration): the user will be notified about it and asked to confirm the file opening.

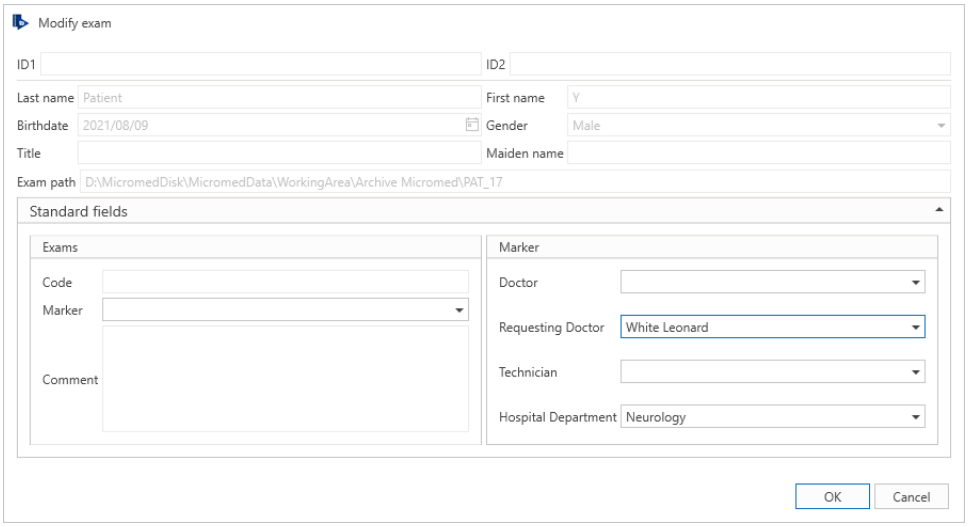


Basic Operations on Multiple Exams

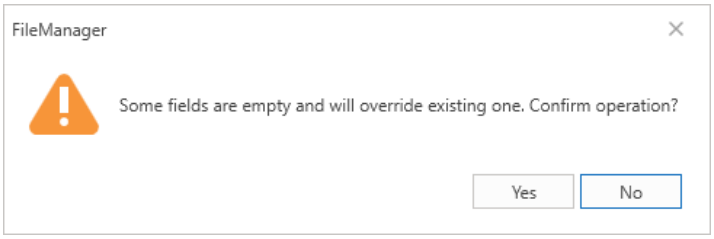
Exams list allows to select multiple exams and apply the same action at the same time.

Keep the “Ctrl” or “Shift” button pressed and select multiple exams, then right-click on the selection: a contextual menu will appear allowing the user to perform the following operations:

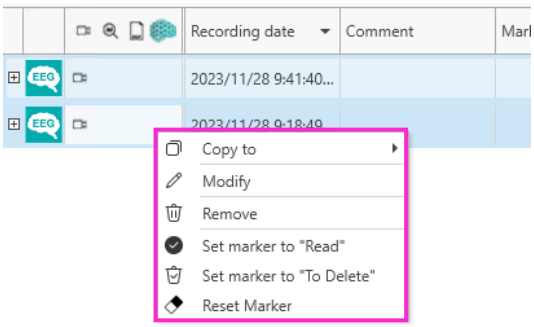
1. **Copy to**, to copy all selected examinations (and related files) to a target resource at the same time.
2. **Modify**, to modify the same information in all the selected exams at the same time.
   The "Modify all" dialog will display all common editable fields, such as Doctor, Technician, Hospital Department etc.; modification(s) will apply to all files related to each selected exam.



Note. If any exam has some value already assigned for the edited field(s) the user is warned and asked to confirm the overriding of the existing value(s) with the new one(s).



3. **Remove**, to remove all the selected exams at a time. Exams must belong to current resource path to be effectively removed.
4. **Set marker to "Read"**, i.e. mark all the selected exams as "read" (ready to be archived).
5. **Set marker to "To Delete"**, i.e. mark all the selected exams as ready to be deleted; such exams will be discarded by the automatic archive procedure and definitively removed.
6. **Reset marker**, to remove all "read" or "to delete" markers assigned to any of the selected exams.

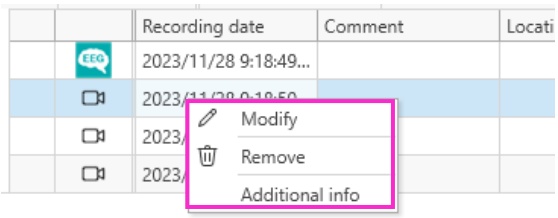


Multiple Exams – Basic operations

BASIC OPERATIONS ON EXAMS FILES

All basic operations the user can perform on a selected file are quickly accessible from the inner level of the Exam List or the File pane, according to current layout.

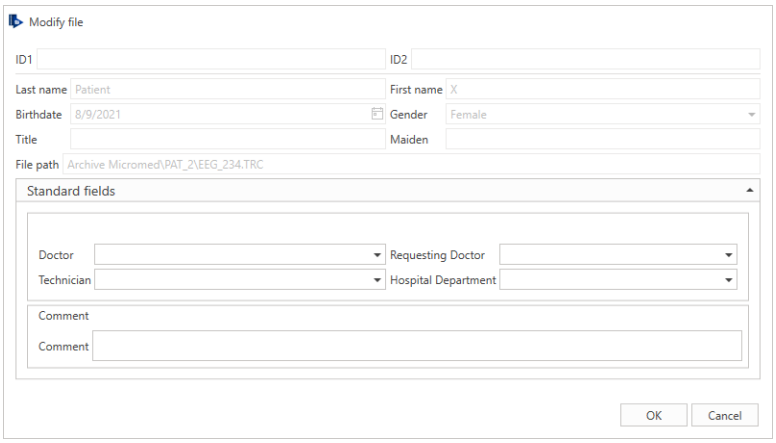
Double clicking on a single file opens it with its associated application.
Note. Only EEG (EMG-EP) trace files, report file, and anamnesis file can be opened by double click.



File – Basic Operations

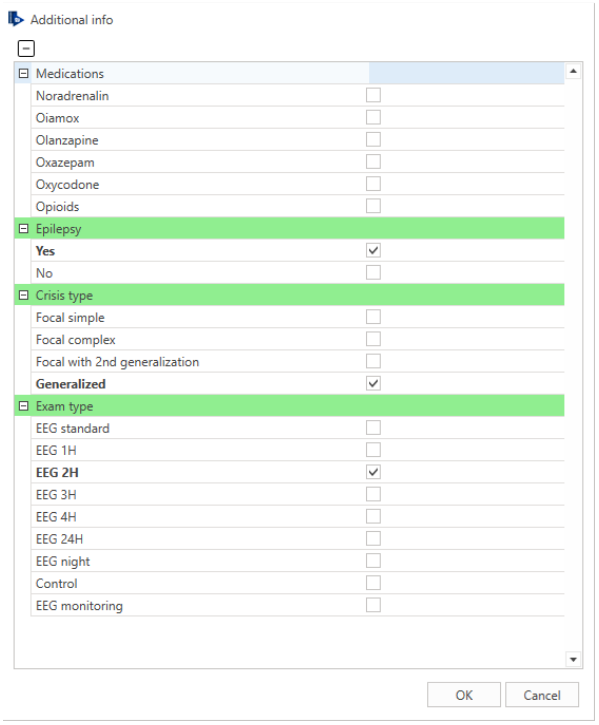
Right clicking on a file shows a contextual menu with the following options:

1. **Modify**, which opens a dedicated dialog for editing file information, as shown in the figure below. Like the "Modify exam" dialog, the "Modify file" dialog shows the patient information in read-only mode. The drop-down menus for the "Doctor" and "Technician" are filled in with the doctors and technicians added using the "New Doctor" / "New Technician" buttons in the Setup Tab.



"Modify file" dialog window

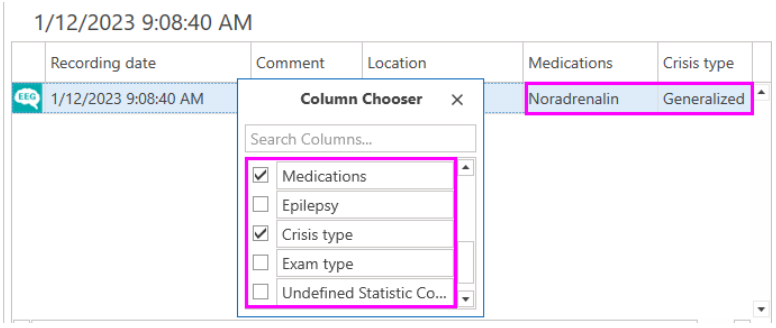
2. **Remove**, which allows the user to remove the selected file. As is required for the removal of the entire exam, a file can be removed only if it belongs to the current resource.
   Note. It is not possible to remove trace file, act at exam level for such purpose.
3. **Additional info**, which allows the user to assign additional information (custom fields) to current recording. It is possible to assign different fields to each trace file and for each additional information it is possible to select multiple values from a pre-compiled list.



Additional Info

Note. Additional information available must have been defined as statistic items in SystemPLUS Evolution. FILE MANAGER only read statistic items defined in Micromed database and allows the assignment to EEG recordings.

Additional info assigned to a specific recording can be visualized in the Exams list at file level by selecting the information to show through the Column Chooser, as shown in figure below.

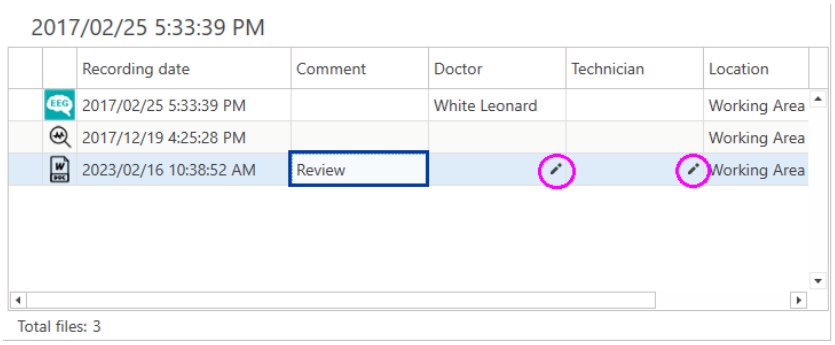


Note. Only the first six additional information classes can be selected as column to display on the Exams list; if less than six classes have been defined Undefined Statistic Column option will appear in the Column Chooser list.

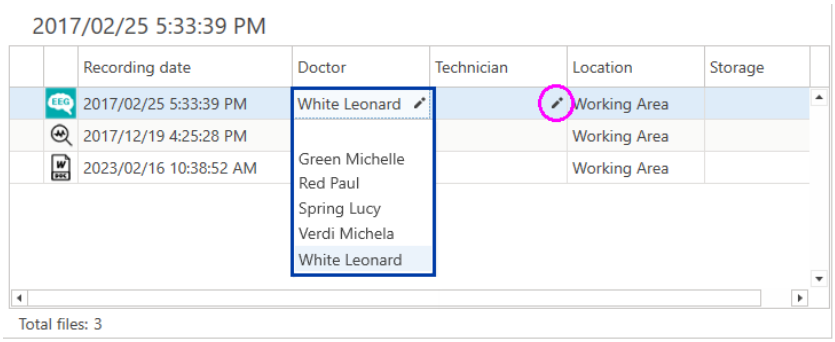
Direct File Info Editing - File level

In the Archive module it is also possible to directly edit File information acting on Exams list columns at file level.

As for Exam, the user can quickly enter file **Comment** by directly typing into the related column and he can easily assign **Doctor**, **Technician**, **Requesting Doctor** and **Hospital Department** by selecting the desired value among the available options in the drop-down menu which open by clicking the “pencil” icon in related column.



Comment editing

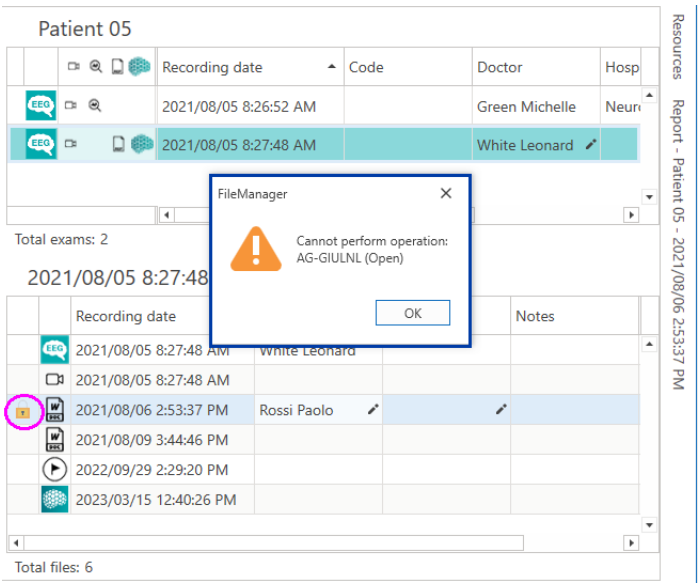


File Fields editing

Concurrency

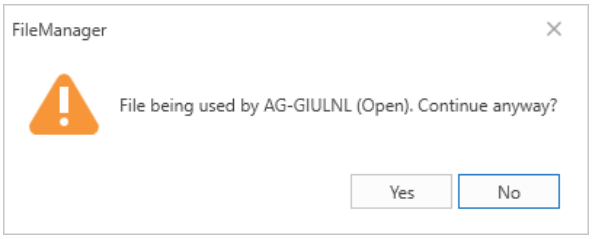
FILE MANAGER does not allow some operations on single file in case of **concurrency**, i.e. if the file is temporarily "locked" since it is open or under elaboration, such as editing, removal or transfer.

A popup message will appear warning the user the operation cannot be performed when such action is temporarily blocked for concurrency matter; the message displays the name of the machine "locking" the exam and the cause of the block in brackets.



In addition, the Exam to which the "locked" file is associated is highlighted in a different color in the Exams list and the File itself is visually marked as "locked" by a "lock" icon (as shown in the image).

Note. File **editing** and **removal** are "blocking" operations, i.e. no action is temporarily allowed on such file; instead, if the file is open it is possible to open it again in another workstation (collaboration): the user will be notified about it and asked to confirm the file opening.



BASIC OPERATIONS ON VISIT

As described before a visit is a collection of exams; in particular, LTM visit groups EEG (Video EEG) recordings performed under the same LTM recording session.

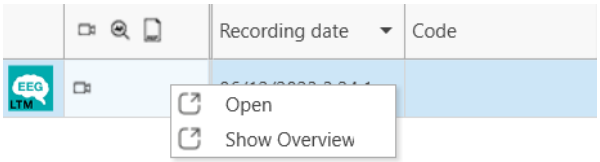
All basic operations the user can perform on a selected visit are quickly accessible from the right-click contextual menu; options available are:

- **Open**, which allows to directly open the entire visit, i.e. all trace and video files, with the application associated; if the latter is not installed, a warning message will appear notifying the user of the inability to open the selected visit.
- **Show Overview,** which allows to open the Events Overview Panel

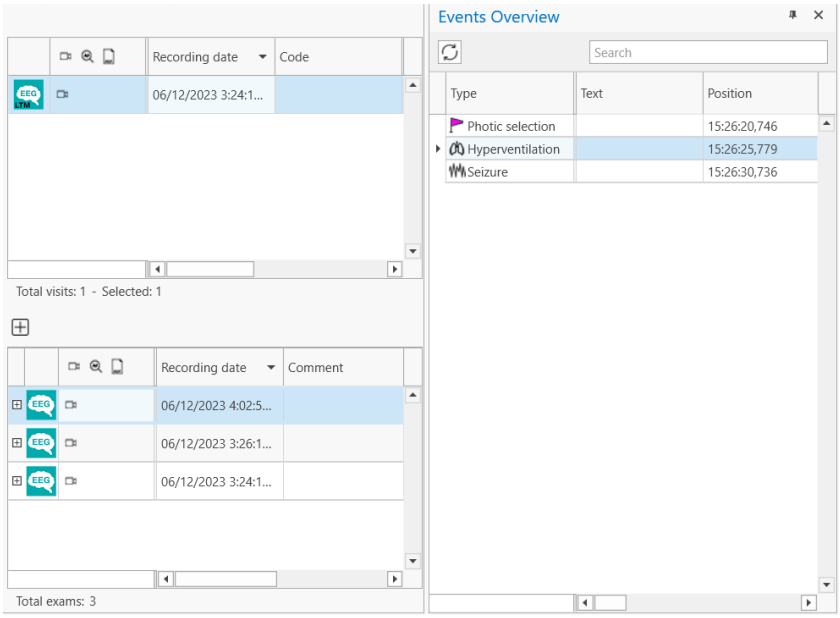
It is also possible to open a visit by a double click, like for exams and files.

Show Overview

File Manager allows to visualize all events contained in a single visit. From LTM Layout view, right clicking on a visit, click on Show Overview.



This function open the events overview panel, which allows to visualize all events contained in all grouped traces. From the panel, it is possible to refresh the view in case of new events insertion, or to filter and look for specific events in the visit. It is a dockable panel so it can be moved and pinned within FILE MANAGER main window or be kept separate in a second monitor.



Double clicking on a single event, makes Brain Quick Software open the related exam and move to the temporal position related to the selected event.

ADVANCED FUNCTIONALITIES

Feature described in following sections are advanced functionality and may not be available for standard user.

MERGE PATIENTS

FILE MANAGER allows to manually merge two patients when a patient has been erroneously duplicated with different demographic data in order to collect all patient's studies under the correct patient.

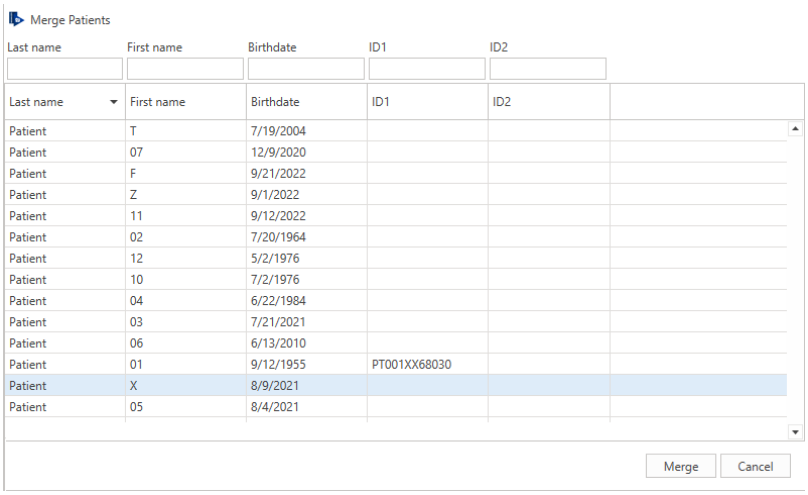
Important Note. Manually patients merge is enabled ONLY if HL7 Interface is NOT active; with HL7 integration enabled, MERGE operations are automatically handled according to ADT messages received from the Hospital Information System.

From the Patients List, it is possible to merge two patients, that is to associate all exams (and related files) of a patient to another patient. After the merge operation, the obsolete patient (erroneously defined) will be deleted from database.

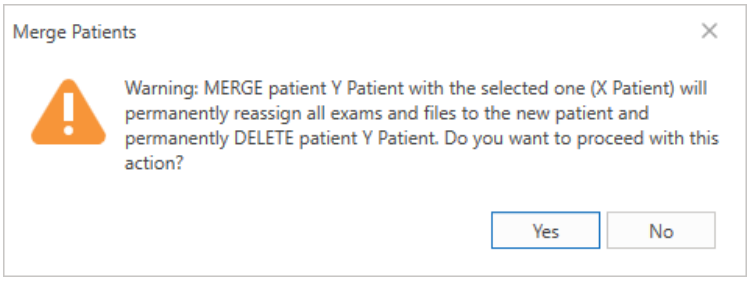
Note. The "Merge Patients" functionality is available for authorized user only, i.e. user with the "Can Manually Merge Patient" permission.

Merging two patients is a critical operation and can be performed only if the obsolete patient is not locked by background copy nor is under archiving.

To merge two patients, select the obsolete patient in the Patients List, right-click and choose the "Modify" option in the contextual menu. The **Merge with** button is at the bottom of the "Modify patient" window. By clicking on it, a password will be required and then the "Merge Patients" window will appear with a list of all available patients in the database, as shown in the figure below:



The patients list can be filtered by “Last name”, “First name”, “Birth Date”, “ID1” and “ID2” to quickly search for the patient to merge with. Once the correct patient is selected, click on the **Merge** button; the following message will appear:



The message warns the user that the MERGE operation will permanently reassign all exams and files to the selected patient and that the obsolete patient will be permanently deleted. By clicking “Yes” patients will be merged and the obsolete patient will be removed from Patients list; by clicking “No” the operation will be cancelled.

Note. The target patient selected for the merge operation cannot be locked by background copy nor be under archiving.

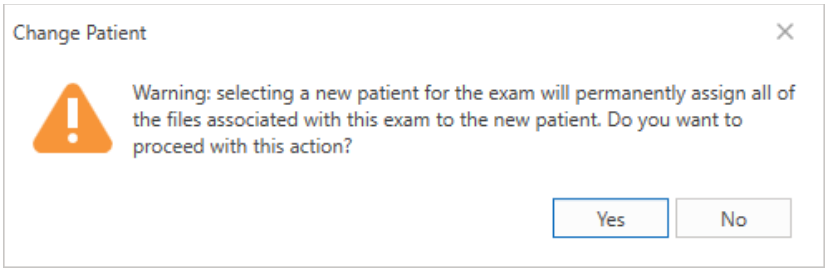
IMPORTANT NOTE. Archived exams, if any, are included in the MERGE operation, i.e. they are associated to the new patient.

REASSIGN PATIENT

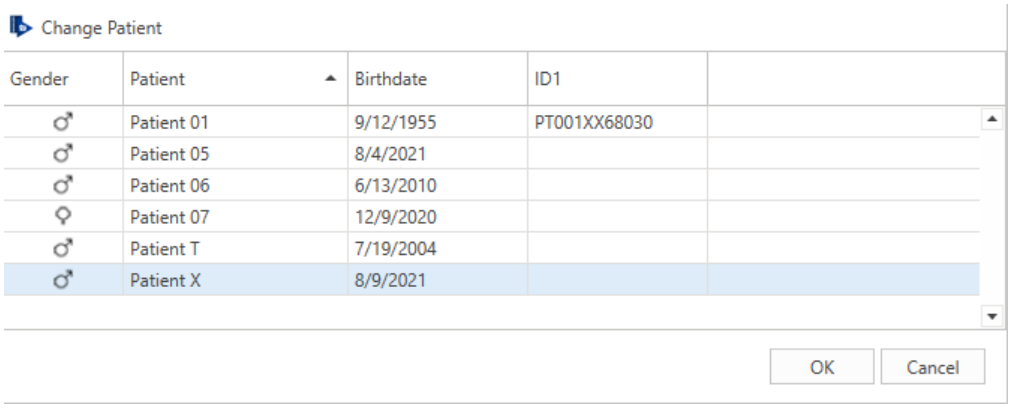
FILE MANAGER allows users to re-assign an exam to a different patient, for example if the acquisition was performed under the wrong patient.

Important Note. Manually re-assignment of patient is enabled ONLY if HL7 Interface is NOT active; with HL7 integration enabled, such operations are handled according to requests received from the Hospital Information System.

It is possible to manually re-assign a study to a different patient directly from the Exams List.
To re-assign an exam select it, right-click and choose the “Modify” option in the contextual menu, the **Change Patient** button is at the bottom of the “Modify exam” dialog.
After clicking this button, the user will be required first to enter a password and then to confirm the action.



The message shown in the figure above warns the user that the CHANGE PATIENT operation permanently reassigns the selected exam and all associated files to another patient.
After giving confirmation, the "Change Patient" window shown in the figure below will appear, allowing the user to select the new patient.



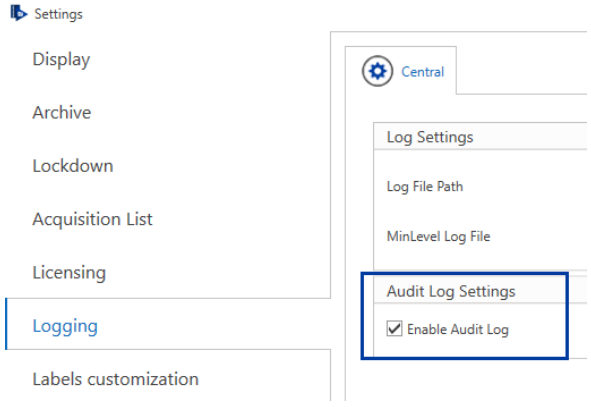
Clicking "OK" will reassign the exam to the selected patient.

Note. The Change Patient functionality is available only for authorized user, i.e. user with the "Can Manually Reassign Patient" permission.

AUDIT TRAILING AND LOG SEARCH

FILE MANAGER offers the possibility to track user interaction with each workstation and record the execution of key functions to an audit log; in a networked environment such functionality is manage centrally, that is all significant activities performed by users within Micromed system are written to the **central Audit Log database** (on server).

To enable the audit trailing click the application button, enter the Settings area (Logging) and select the "Enable Audit Log" option:



Audit Log Setup

Note. Only authorized user with the "Can Modify Central Settings" permission can enable audit trail.

In the centralized Audit Log database are trailed all FILE MANAGER and Brain Quick software significant activities performed by the logged-in user.

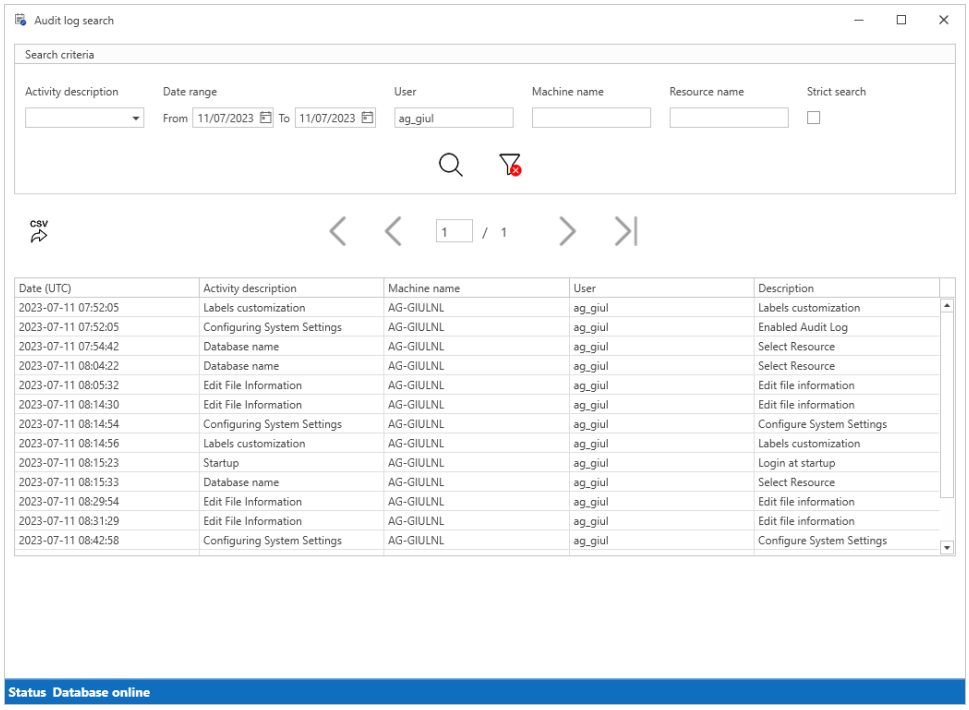
Note. If users authentication is disabled (not recommended), there is an option in the logon preferences ("Use Environment Username") which allows to consider the domain user logged into the machine in the audit trail.

Audit Log Search

FILE MANAGER offers an embedded searching tool, the **Log Search**, which allows to search on the Audit Log trail focusing on a specific activity or a specific user.

Clicking the **Log Search** button on the ribbon bar (Home Tab) the "Audit Log Search" window will open; it consists of an upper pane where the user can insert search criteria and a lower panel where research results are displayed in tabular way.
Log Search tool allows to monitor all activities performed by a certain user on a specific machine or generally on the system; it also allows to focus on a specific activity.
It is possible to filter search results in a certain date range or for a specific machine.

Set desired criteria and click the "Search" icon to visualize search results. A navigation bar, above the results table, allows to easily scroll through different pages.



Audit Log Search window

HL7 INTEGRATION

In FILE MANAGER it is possible to see, handle and process HL7 requests received from the **Hospital Information System** (HIS).

Micromed Suite offers a dedicated **HIS Settings configurator** where it is possible to set up HL7 Interface and enable HL7 requests management on authorized workstations; HL7 interface is based on both **Central** and **Machine** (local) settings which are stored in dedicated configuration files.

Central settings configuration is typically performed on **server** and it is inherited by all client stations involved in the HL7 requests management.

Machine settings configuration is performed on **single workstation** in order to set up local HL7 preferences; FILE MANAGER *Settings area* has a dedicated **HIS** settings panel for this purpose.

Note. HL7 Interface functionalities, both server and client side, are protected by specific license keys.

HIS REQUESTS WORKFLOW

Once HL7 interface is properly configured, FILE MANAGER offers a dedicated panel, the **Working List**, where all HL7 requests received from the Hospital Information System are displayed and can be imported to be executed.

It is possible to easily filter on received HIS requests and **import** patient-specific request within Micromed database as request associated to a new patient whose demographic data are automatically aligned with information received from the HIS.
Since then, patient data will be kept automatically **synchronized** (updated) with the central anagraphics handled by the Hospital Information System.

Finally, **report** document related to an imported HL7 request can be **exported in Pdf** format, i.e. sent back to the HIS, and there is also the possibility to handle subsequent versions of the same document before closing the loop.

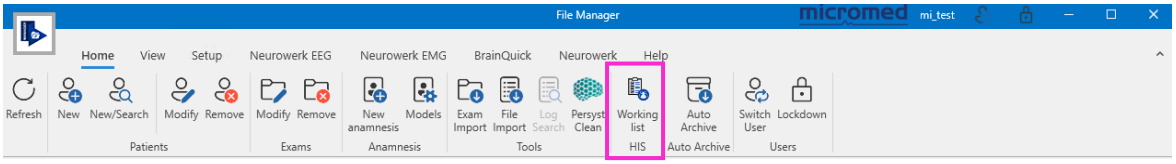
IMPORT OF HIS REQUESTS INTO THE ARCHIVE

In the Archive module (FILE MANAGER) it is possible to import HIS request, such as order entry or appointment request, received from the Hospital Information System as a new patient with a pending exam to be executed; if the patient already exists in Patients database, the Archive will directly point to this patient.

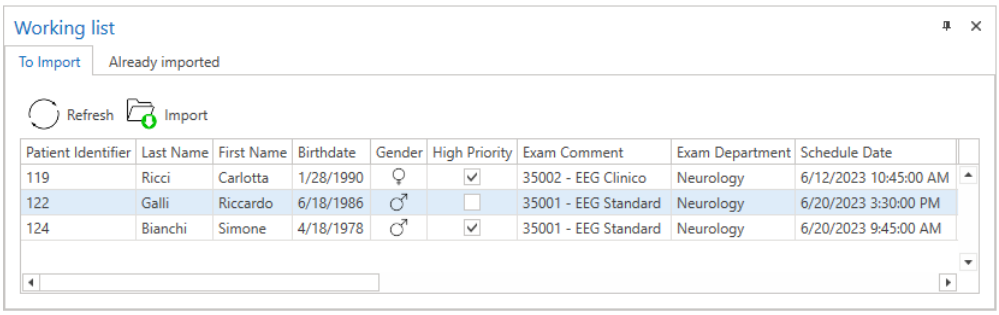
Important Note. **To activate the Working List panel and manage HIS requests on single workstation you need the *FMS HIS CLIENT* license enabled and the logged user must have the "*Can Access to External HIS Interface*" permission.**
In addition, to export report and send it back to HIS the logged user must have the "*Can Export Report to HIS*" permission.

Working List panel

When HL7 Interface is properly configured and enabled, the **Working List** button appears in the Home tab of the archive window ribbon bar under the HIS functional group.



Clicking on the **Working List** button, the Working List appears; it is a dockable panel so it can be moved and pinned within FILE MANAGER main window or be kept separate in a second monitor.



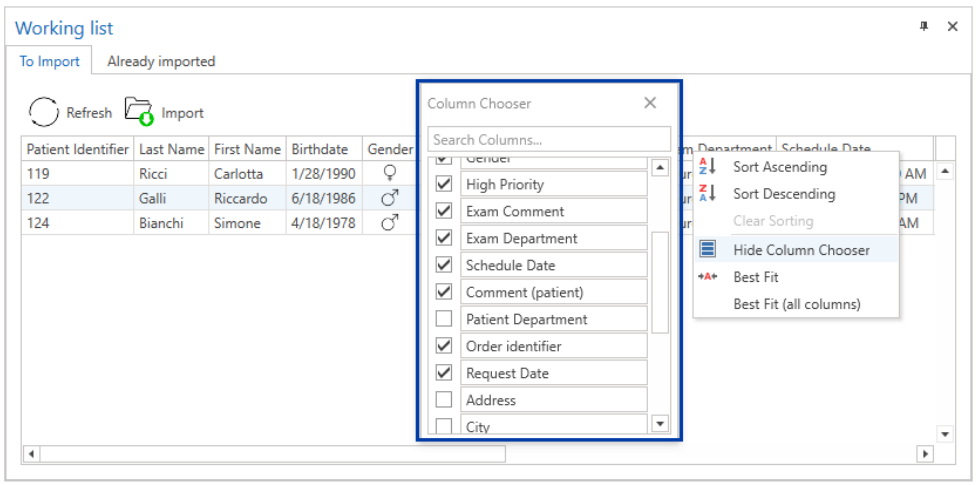
Working List

The Working List collects all HL7 requests received from the HIS listed in a table where each line represents a specific-patient request; requests are split into two main tabs: *To Import* and *Already imported*.
The former displays all received requests to be processed; the latter shows all the already imported requests.

It is possible to manually refresh the list of the received requests by clicking the **Refresh** button on the toolbar.

For each request essential information related to the patient and the request itself are displayed, such as patient name, patient ID, patient date of birth, the request scheduled date and time, eventual comments/notes and whether it is urgent.
Information displayed are customizable, i.e. by the *Column Chooser* tool available in the context menu it is possible to select what show/hide.

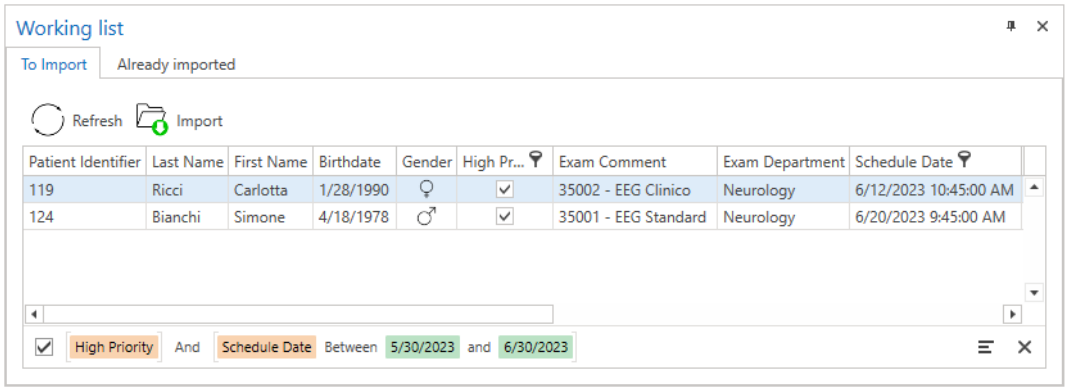
Note. The management of patient extra fields and exam extra fields is a Central settings option; if enabled, extra information available in the received HL7 requests will be automatically imported and kept updated.



Working List - Column Chooser

Requests can be sorted in ascending or descending order based on the selected field by simply clicking the column header.

It is possible to filter on displayed requests by setting on or more filtering criteria at the same time; currently applied filters are shown at the bottom of the list.

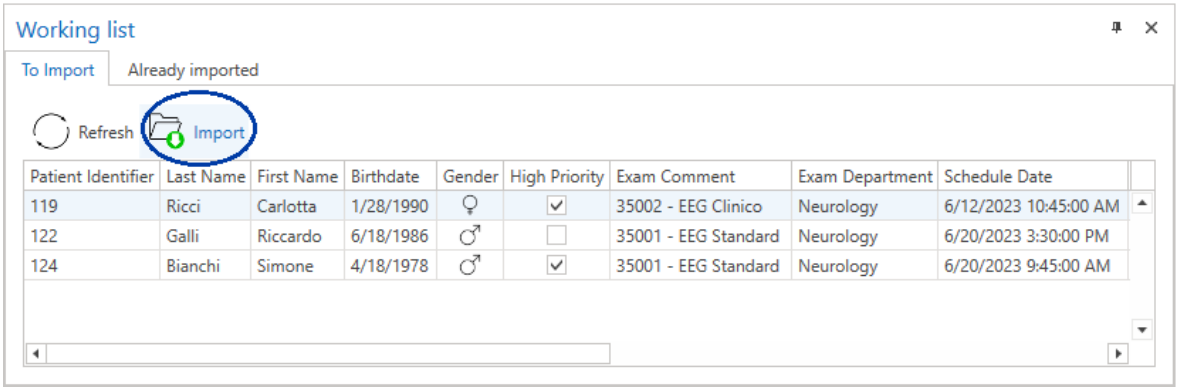


Filtering Working List

Note. Filters applied to the Working List will be maintained after closure and restart of FILE MANAGER.

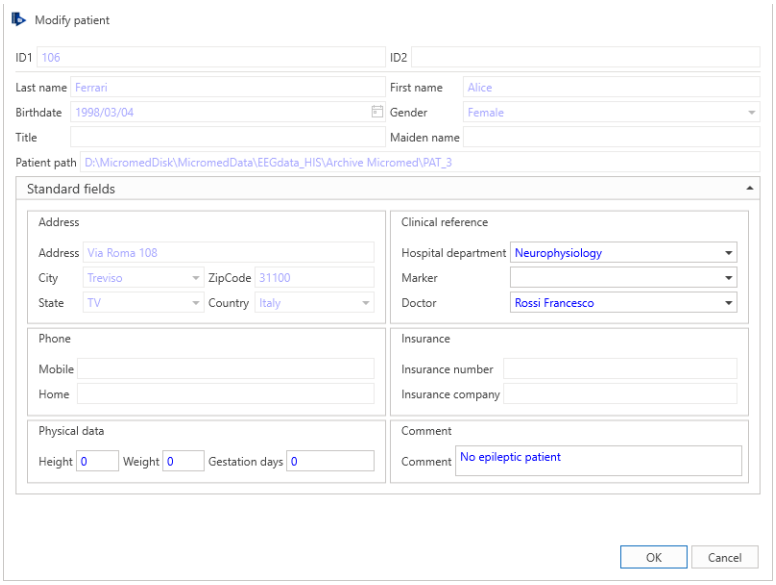
Importing HL7 Request

To import a patient-specific request inside the Archive module you have to select the request from the Working List (*To Import* tab) and click the **Import** button on the toolbar.



Working List - Import HL7 request

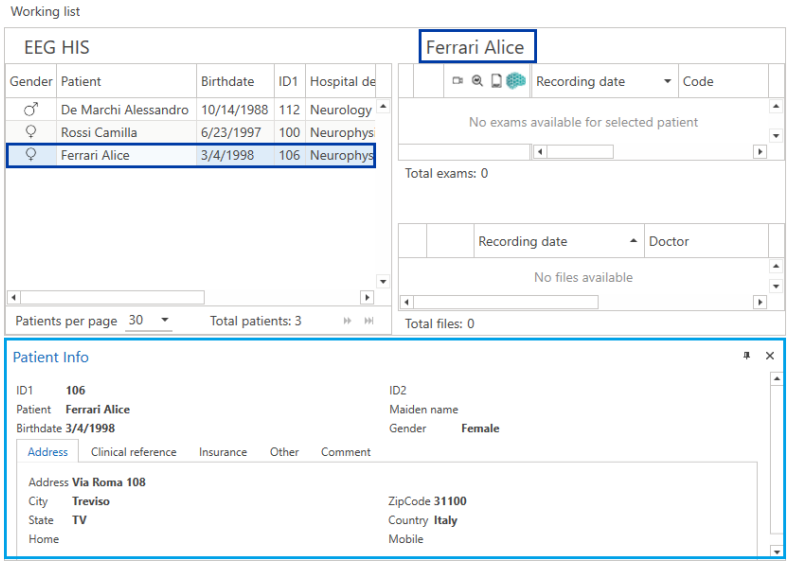
Patient related to the imported request is automatically added to Patients database, if not yet registered, and patient information received from the HIS are inherited; you can see all patient information in the “Modify patient” dialog which opens by selecting the “Modify” option in the right-click contextual menu.



Patient Info

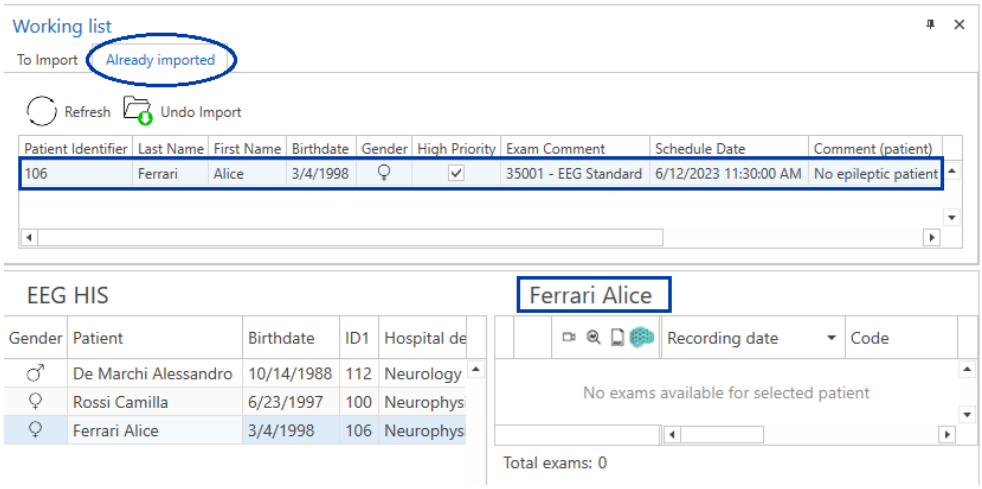
The new patient appears in the Patients List or, if already existing, is highlighted.

For the newly imported patient, no exam is available, and you can proceed with the exam execution according to the received order entry, for example performing a new EEG recording.



Imported HL7 request (patient)

In the Working List panel imported requests automatically pass from the *To Import* list to the *Already imported* one.

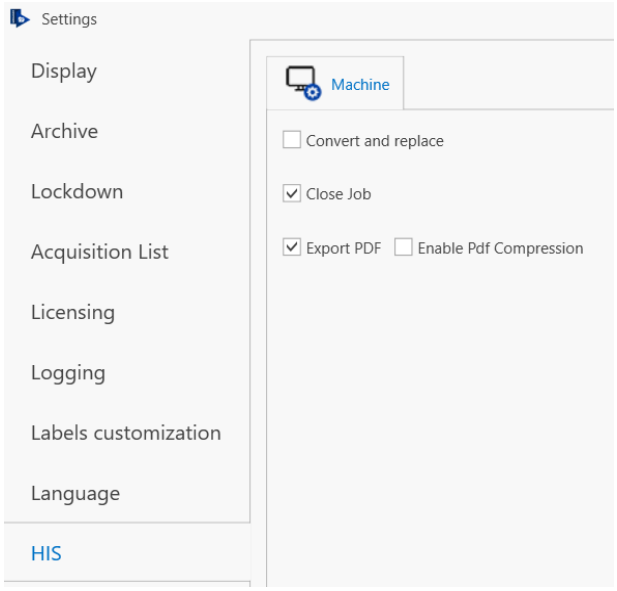


Working List – Already imported requests

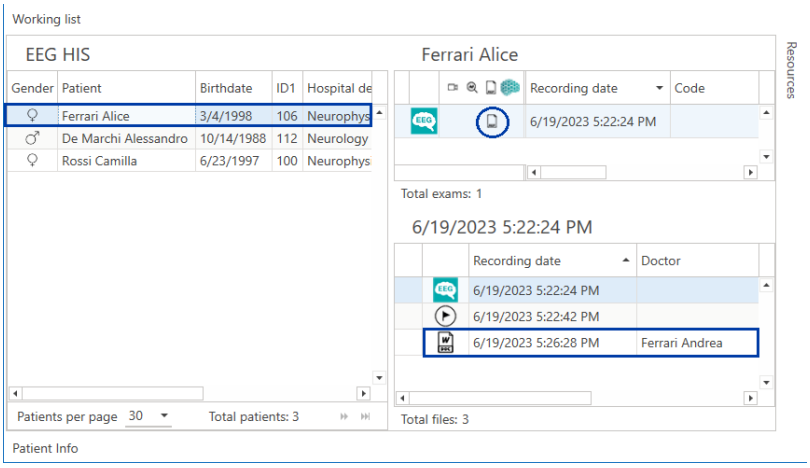
It is also possible to perform import undo, i.e. to cancel an import operation, by simply selecting the imported request in the "Already imported" list and clicking the **Undo import** button on the toolbar: the request will return to the "To Import" list and eventual examination already executed will be "invalidated", that means it will not be possible to close the loop by exporting the report associated, if any, i.e. sending it back to HIS.

REPORT EXPORT TO HIS

Once the exam is done, it can be reviewed and related report document is created; to close the imported request loop it is possible to send it to the Hospital Information System in Pdf format within an HL7 message. The PDF export option needs to be activated from File Manager settings.



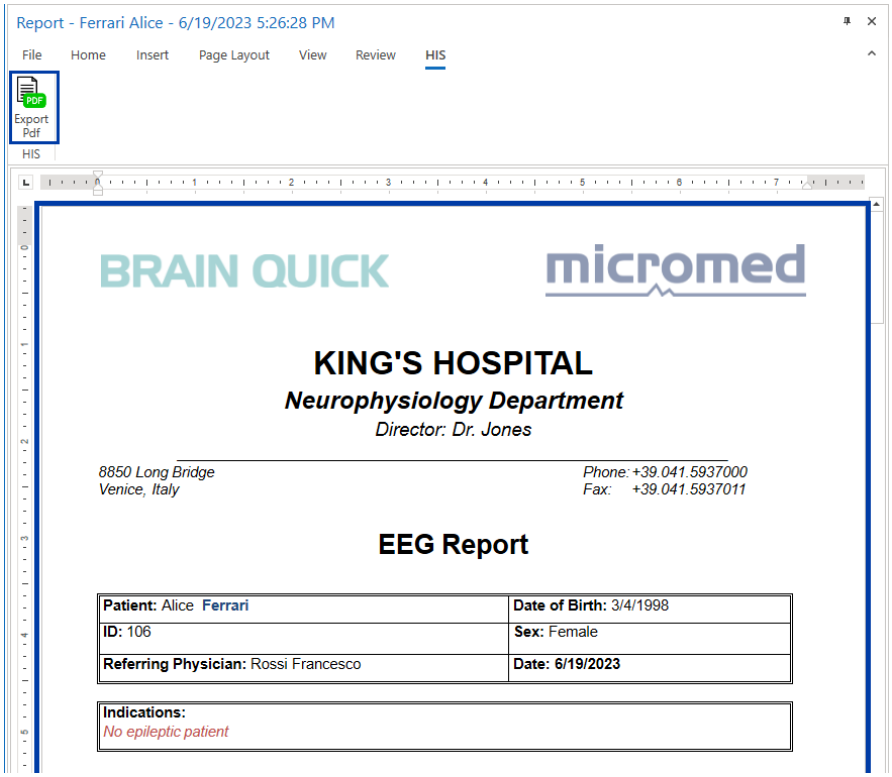
The saved report will appear in the archive window Exams List as a document associated to the Exam; in addition, a "report" icon will appear in the "Study contains" column (second column) related to the exam.



EEG Report – Exams list

By clicking on the "report" icon it is possible to open the saved report within the Report Editor, check the content of the document and send it to the HIS in Pdf format by clicking the **Export Pdf** button available in the HIS tab of Report Editor toolbar.

Note. According to the set central preference, the name of the doctor assigned to the examination or the name of the logged user can be included in the report export message.

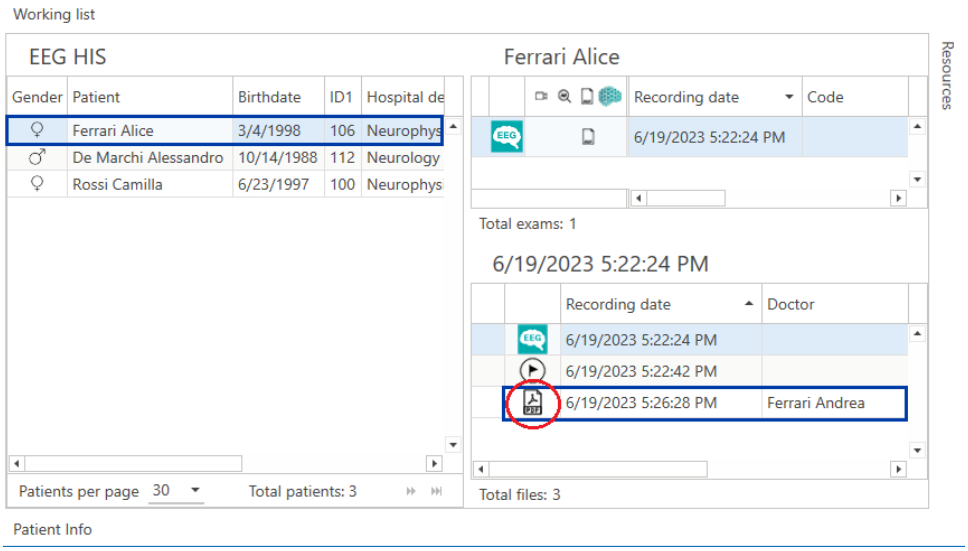


Report Editor – HIS tab

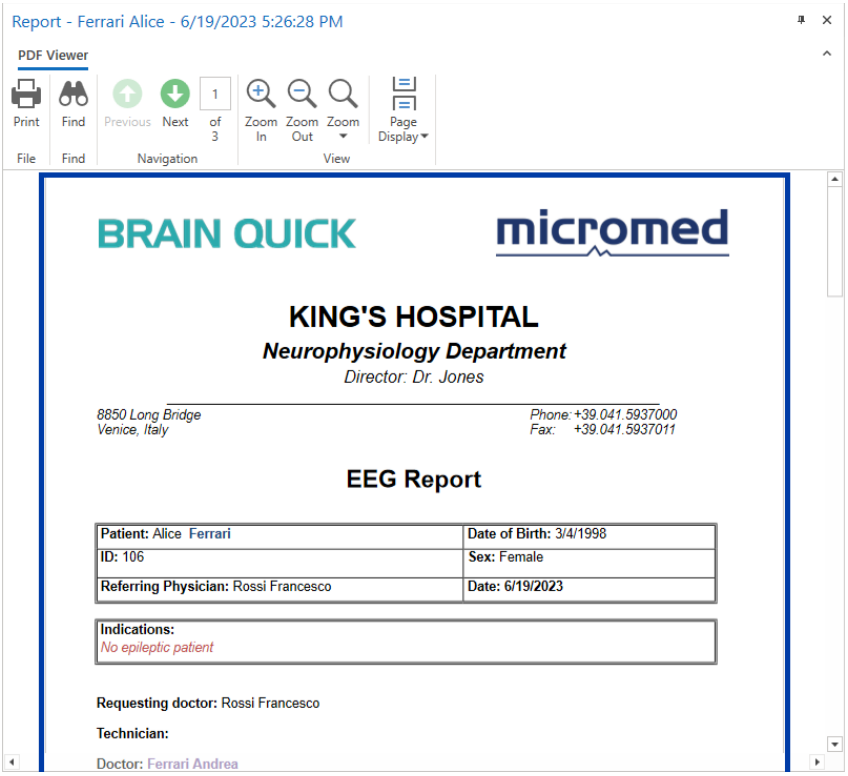
Clicking the **Export Pdf** button, the report is converted in PDF and sent to the HIS.

In case the option **Convert and Replace** is not enabled, a new PDF report will be added to the exam and can be open in **read-only** mode within the Report Editor. It can be used to handle different versions of the report. Instead, if the option is enabled, the exported report will be replaced from the new PDF report. It is even

possible to enable the PDF compression, which allows to reduce the PDF memory size in case of images, or any other media saved in the report.



Exported Pdf Report in case of Convert and Replace – Exams list



Report - Pdf Viewer

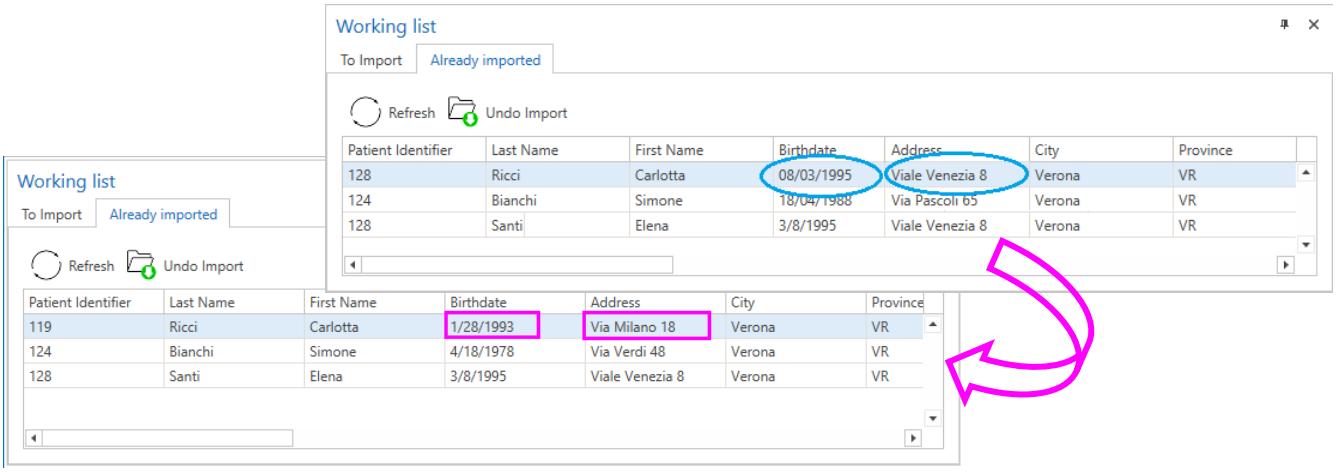
PATIENT UPDATE AND PATIENTS MERGE REQUESTS

HL7 Interface also supports the automatic handling of patient info **update** and patients **merge** requests received from the Hospital Information System (HIS).

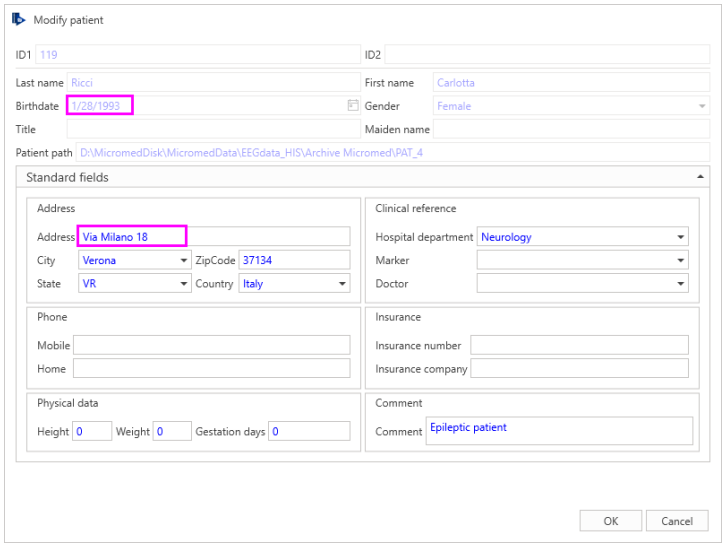
Patient Info Update

HL7 requests with the purpose of updating a specific patient information are **automatically** processed with the result of keeping the imported patient information **always synchronized** with the Hospital Information System.

For example, if demographic data related to a specific patient, such as the birthdate or the address, are wrongly entered by HIS, when the HIS itself detects and corrects the error it can send an ADT message notifying Micromed system about the patient information update.



Working List – Updated Patient Info

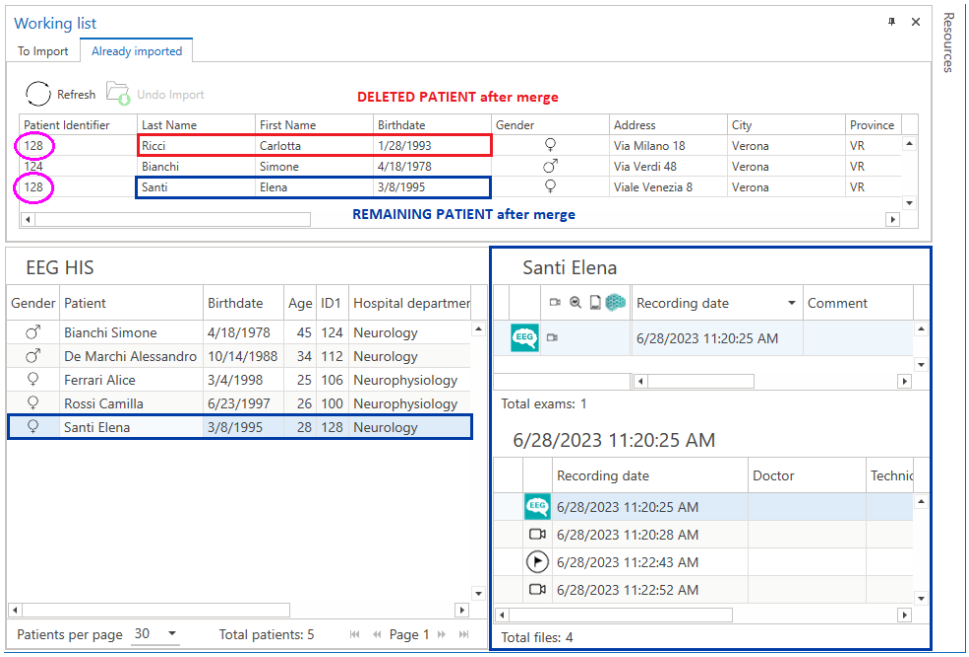


Patients List - Updated Patient Info

Patient information inside Patients database are automatically aligned with the central HIS anagraphics and in the Archive module updated data are shown both in the Working List panel than in Patients list (and so in the "Modify patient" dialog).

Patients Merge

Hospital Information System can send HL7 messages with the purpose of **merging two patients**, for example in case a patient has been wrongly doubled in the central HIS anagraphics and there is the need to unify all examinations under the correct anagraphic data (patient); such messages are **automatically** processed and patients are properly merged.



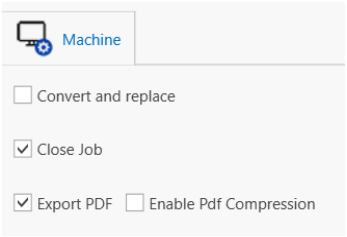
Patients Merge

The merge operation implies that one only patient is maintained in Patients database and any exam associated to the removed patient (obsolete) is moved to the correct patient folder.

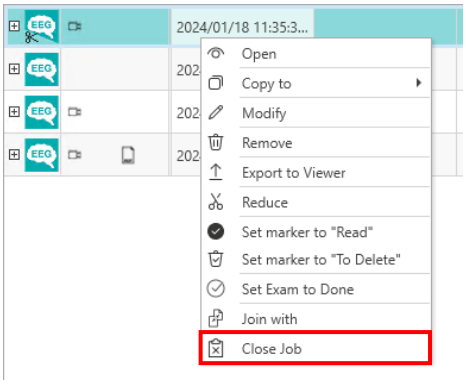
In the Working List panel, any existing request related to the obsolete patient is unified, i.e. properly assigned to the correct patient ID.

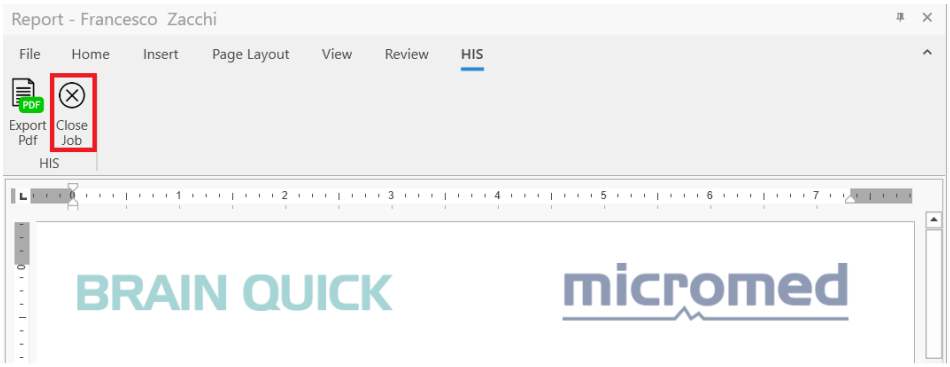
CLOSE JOB

HL7 Interface also supports the manual closure of the working cycle in case of request already imported in which the PDF export is no longer useful. The option Close Job needs to be enabled from File Manager settings.



When the option is enabled, the choice gets available from the contextual menu at exam level, and from HIS tab in the created report.



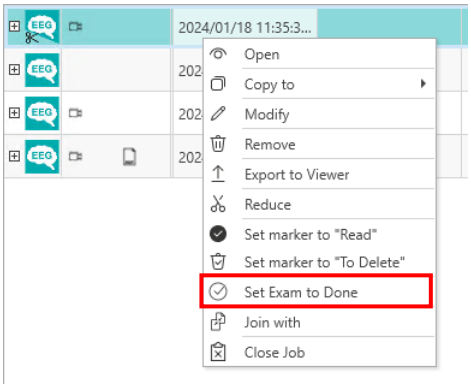


When clicking on Close Job, the working cycle will be closed and it will no more be possible to export the PDF report, nor to Undo the request import.

EXAM DONE

HL7 Interface also supports the manual setting of exams as Done. This feature can be enabled at from server and allows to mark an exam before exporting to PDF or closing the job.

When the option is enabled, the choice gets available from the contextual menu at exam level.

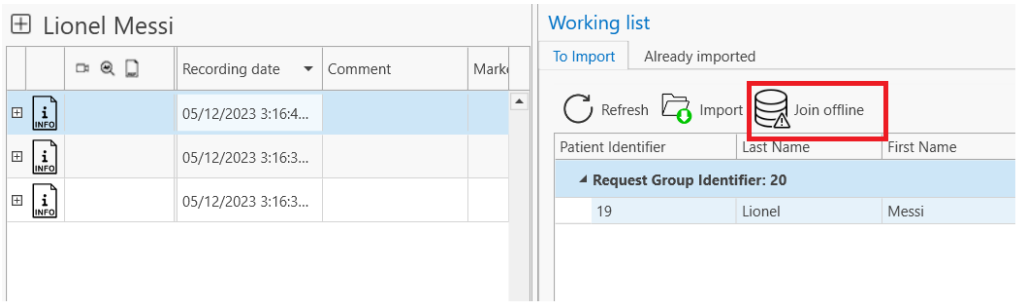


Clicking on Set Exam to Done will open a dialog window, in which it is possible to mark the exam as “Done” or “Not Done” and to confirm the operation sending the notification to HIS.

JOIN OFFLINE PROCEDURE

HL7 Interface supports the Join Offline feature, which allows to join an exam which was previously done with a newly received request. This may be useful in case of network faults, in which the request may not be available to be imported. In those cases, the patient can be created manually with just basics information, the exam can be executed and, once the request import will available again, it will be possible to select the exam, the request and to join them. Join Offline may be also useful in case the request is imported from another resource.

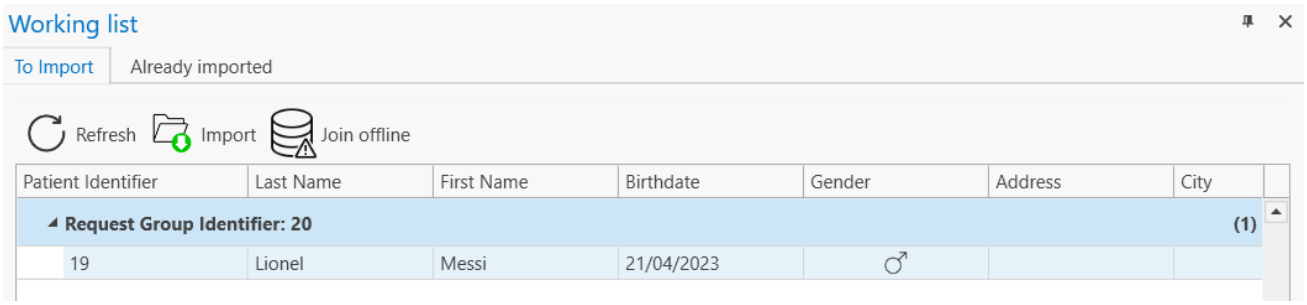
In this case, all patient and exam information will be updated with the ones received from the joined request. This closes the HL7 working cycle, and the request will no more be available in “Already Imported” tab. To execute the procedure, it is necessary to select an exam, then a request and click on **Join Offline** button.



MULTIPLE REQUESTS MANAGEMENT

HL7 Interface also supports the management of Multiple Requests. The option can be activated at Central level from Micromed Suite and is propagated to all the clients of the system. When multiple requests environment is enabled, requests for a single patient are no more managed singularly but as a group of requests for the single patient.

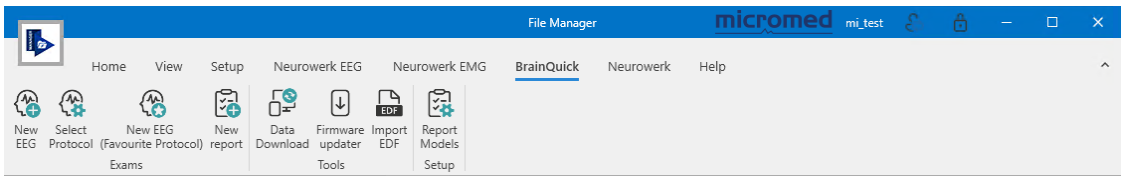
This causes that all the operations previously seen work with a group of requests. The workflow from File Manager (requests import, PDF export, Exam Done, Join Offline) is the same. During import procedure, it is no more possible to import a single request but only the requests group.



EEG RECORDING FROM ARCHIVE

FILE MANAGER is the entry point for EEG recording and all reviewing activities clinicians and physicians can perform on EEG studies.

The **Brain Quick Tab** of the ribbon bar collects all commands to start a new EEG recording.



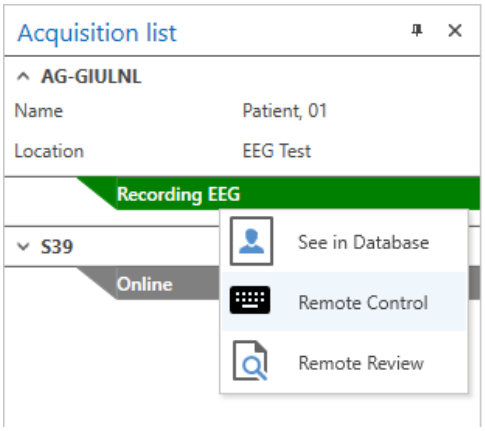
Clicking the **New EEG** button will open the **Brain Quick software** Acquisition window which allows to start either a new EEG or Video EEG recording with the last used acquisition protocol. An acquisition protocol is the collection of configuration parameters needed to perform an EEG recording, such as the headbox, one or more cameras, the connect configuration, i.e. the settings of the input channels of the acquisition device, and the photic stimulation protocol.

The Home Tab of the ribbon bar of Acquisition window collects all commands to start, save, pause and stop the acquisition, and to set up photic stimulation, chronometer, notes and cortical stimulator; **see the dedicated chapter of Brain Quick software User Manual for all the details.**

If there are on-going EEG recordings the Acquisition List panel allows to monitor the progress status of the on-going recordings; in the detail section related to the specific acquisition machine the patient name and the name of the acquisition resource are shown.

From the Acquisition List of other review stations of the system, it is possible to remotely review the on-going EEG study during the recording by selecting the acquisition system from the list and choosing the “Remote Review” option in the right click contextual menu.

In addition, it is possible to take the remote control of an acquisition station and live monitoring the on-going recording by choosing the “Remote Control” option in the right click contextual menu.



Acquisition List – Options

It is also possible to start a new recording by selecting the desired acquisition protocol; clicking the **Select Protocol** button will open a dedicated window of the Brain Quick software where all defined acquisition

protocols are listed and it is possible to start a new recording by selecting a protocol from the list, create a new protocol or edit an existing one.

Finally, clicking the **New EEG (Default Protocol)** button it is possible to start a new recording with the default acquisition protocol.

EEG REVIEW FROM ARCHIVE

From FILE MANAGER main window it is possible to access the EEG review window of **BRAIN QUICK software** which allows to read and review EEG and Video EEG data recorded with BRAIN QUICK software itself, with SystemPlus EVOLUTION and with the CNS Monitor.

To access the EEG review window, the user must select a patient from the Patients list and choose the study to review from the Exam list, then follow the procedures below:

- Click twice directly on the EEG exam icon in the first column of the exam list
- Or click twice on the trace file on the inner level (or the lower panel) of the exam list (depending on the active layout)
- Or select the **Open** function from the right click contextual menu available both for exam and file

This way, the EEG review screen will appear: it is the part of Brain Quick software that is used to review and analyze EEG exams. In the review section, it is possible to review more than one trace at the same time and this allows the user to compare different exams of the same patient or of different patients. **For further details about the EEG studies Review see the dedicated chapter of Brain Quick software User Manual.**

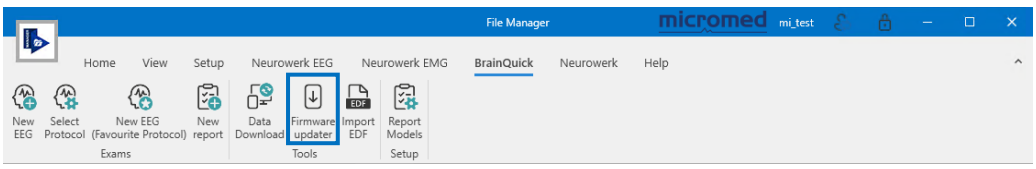
EEG REPORT CREATION FROM ARCHIVE

From FILE MANAGER main window it is possible to create a new report for the selected exam. After selecting an exam, In Brain Quick Tab there is a **New Report** button, which opens the window for the template selection. After selecting a template from the available ones, editing the report, and saving it, makes the report to be added to the desired exam.

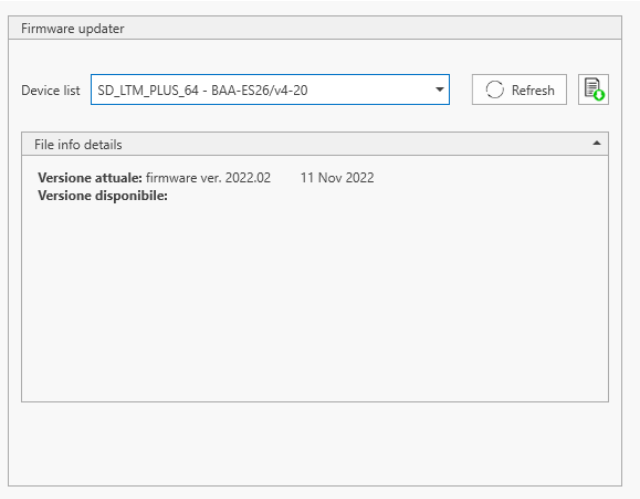
FIRMWARE UPDATE

From the Archive main window it is possible to perform the firmware update of the amplifier when it is connected to the PC.

In Brain Quick Tab there is a **Firmware Updater** button to open the window in order to perform the headbox update.



Clicking on the button opens the following window:



From the drop-down menu, it is possible to choose which of the available headboxes to perform the firmware upgrade. Once selected, information regarding the current version and the version available for upgrade is shown. Finally, the two buttons next to the drop-down menu are used to update the list of available devices and to upgrade the firmware, respectively.

AMBULATORY DATA DOWNLOAD

From the Archive main window it is possible to **download ambulatory data** directly from the amplifier, which can be connected via cable, or from a memory card reader; the data download is performed by **Brain Quick Software.**

In **Brain Quick Tab** there is a **Data Download** button to access the “Data downloader” dialog window.

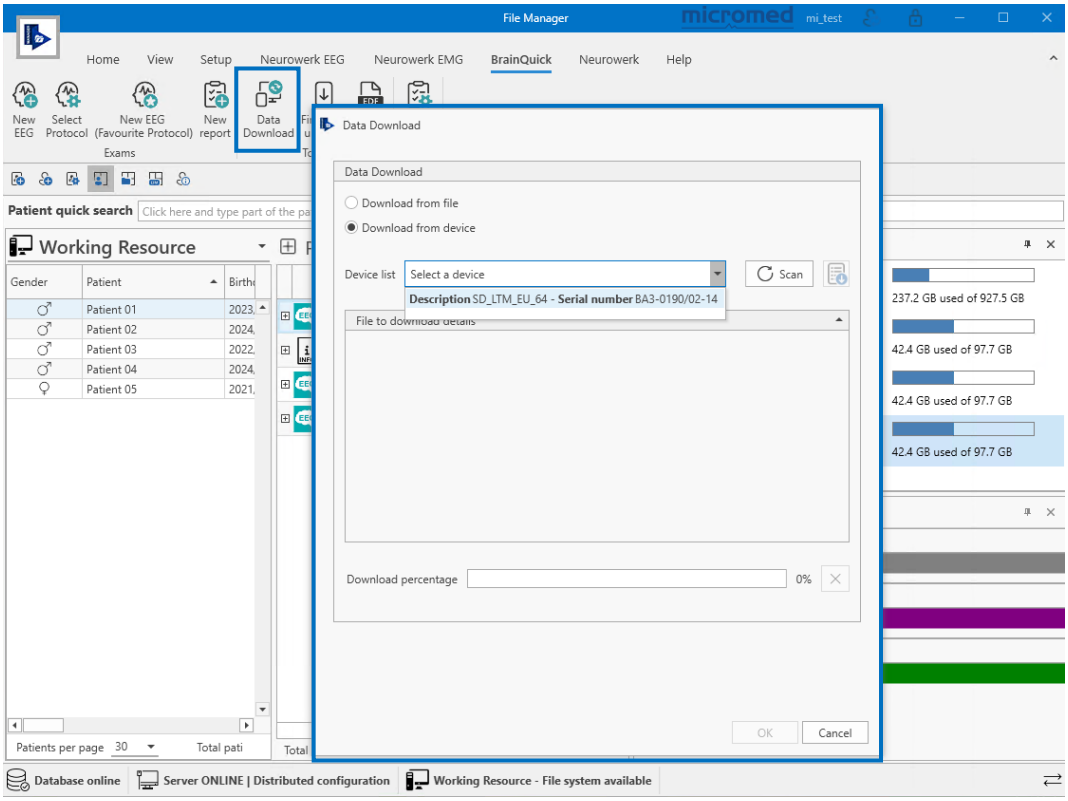
Note. Supported Micromed ambulatory recorders are:

- **SD LTM PLUS family**
- **SD LTM EXPRESS family**
- **Morpheus**

DATA DOWNLOAD FORM DEVICE

In the “Data downloader” dialog window, select the **Download from device** option in order to get ambulatory data from the desired amplifier.

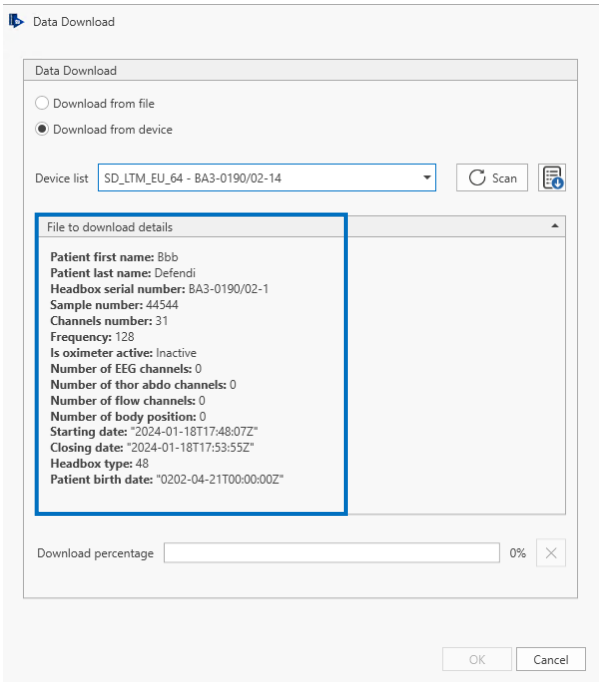
Select the amplifier from the list of the available devices and wait for the data reading.



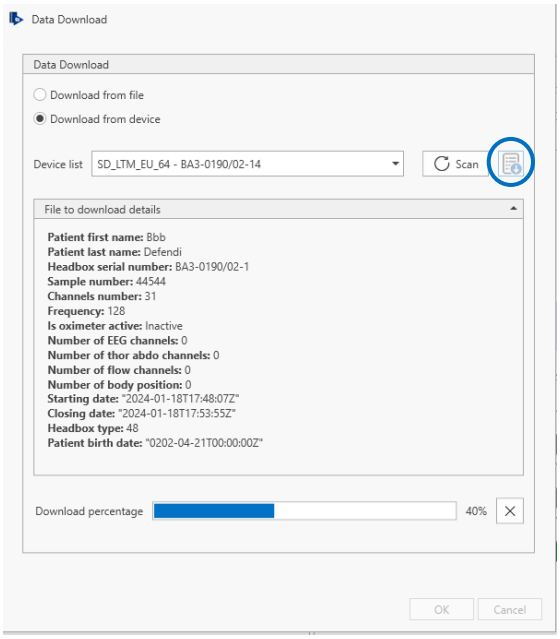
Data Download from Device

Note. If the amplifier is not in the list, it is possible to force the headbox discovery by clicking the **Refresh** button.

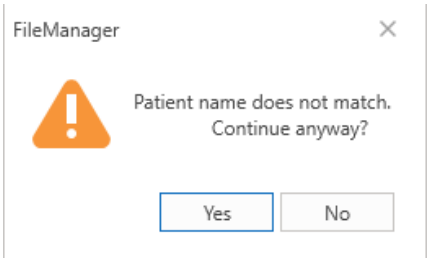
As soon as data reading completed, in the “File info details” panel below essential information related to the recorded data are displayed, such as patient name, the headbox serial number, the number of recorded channels, the sampling frequency**,** the recording start and stop etc.



Click the **Import** button in order to start the ambulatory data download; a progress bar will report the data download progress status.

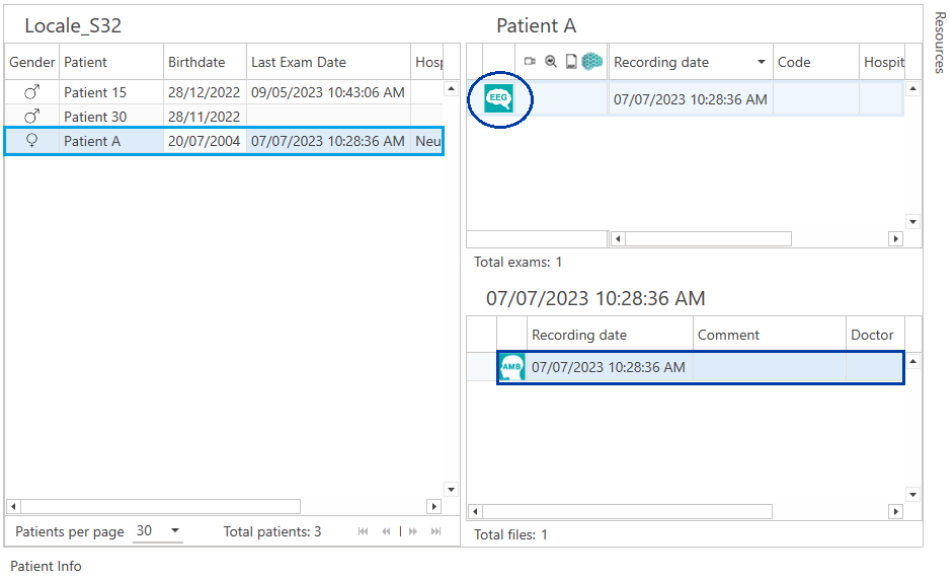


Note. If patient currently selected does **not** correspond to the patient associated with the recorded data you are going to download, a warning message will ask you for confirmation before starting the data download.



When download completed, click “Ok” to exit.

In the Exams list a new EEG exam related to the selected patient will appear with an ambulatory trace file associated at file level.

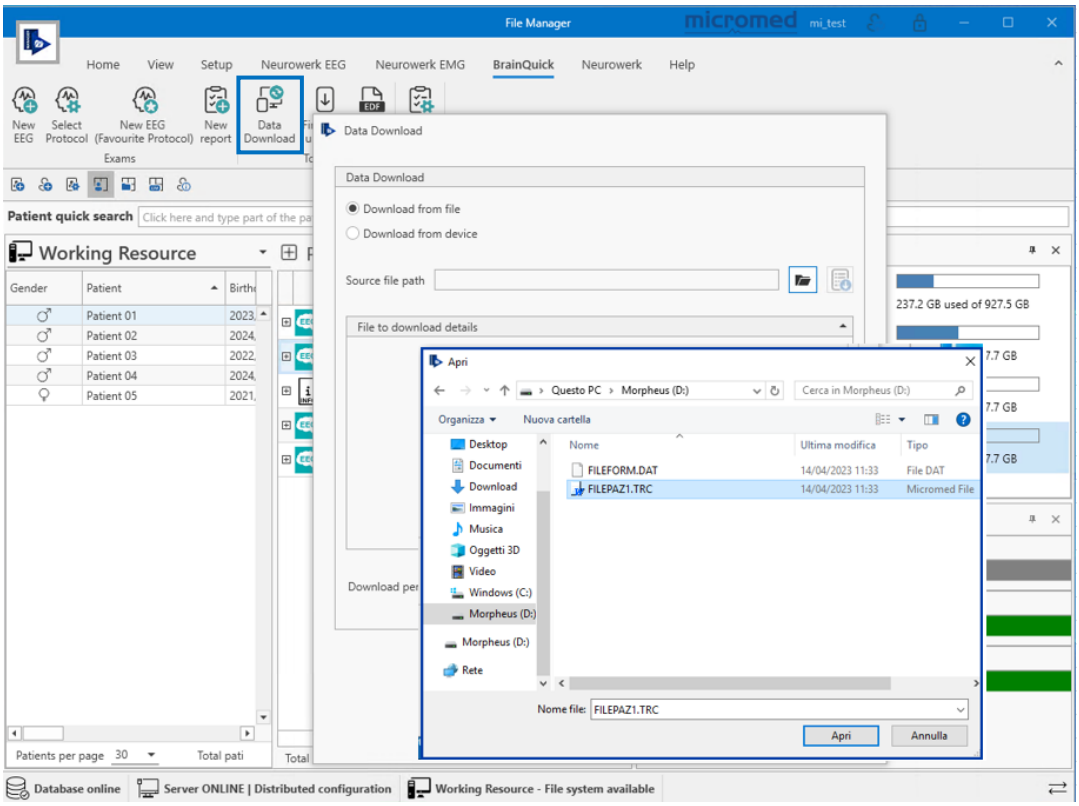


Ambulatory Data – Exams list

DATA DOWNLOAD FROM FILE

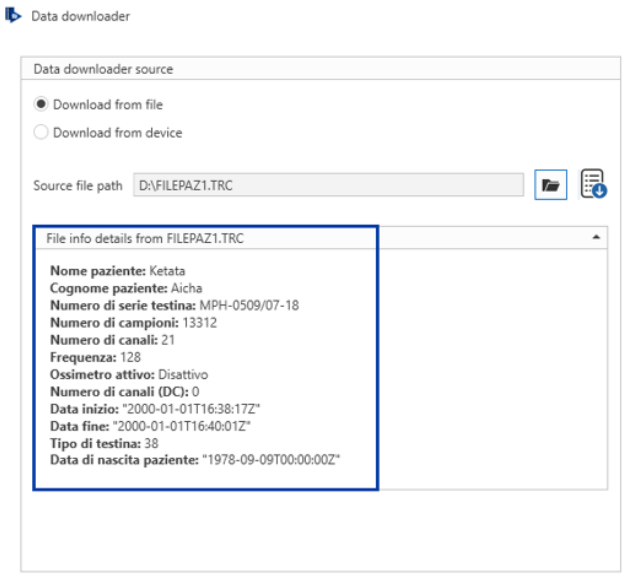
In the “Data downloader” dialog window, select the **Download from file** option in order to get ambulatory data directly from file when a memory card reader is connected to the PC.

Click the “folder” icon to browse the source trace file with data to download: Windows File Explorer dialog will open allowing you to navigate to the .trc file location (file name will be in the format *FILEPAZn.TRC*, where n is a progressive number).

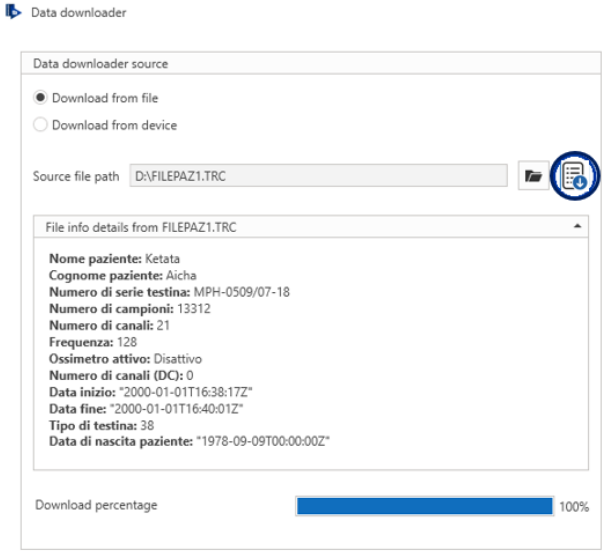


Data Download from File

Select the trace file to import, click “Open” button to confirm and wait for the data reading to complete; at the end, in the “File info details” panel below essential information related to the recorded data are displayed, such as patient name, the headbox serial number, the number of recorded channels, the sampling frequency**,** the recording start and stop etc.

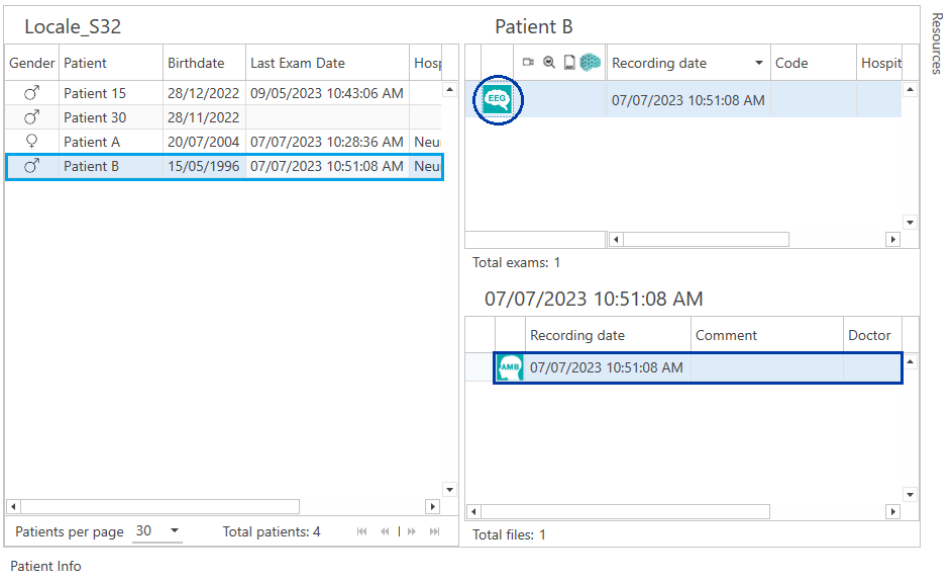


As for the download from device, click the **Import** button in order to start the ambulatory data download; a progress bar will report the data download progress status.



When download completed, click “Ok” to exit.

As before, in the Exams list a new EEG exam related to the selected patient will appear with an ambulatory trace file associated at file level.



Ambulatory Data – Exams list

IMPORTING STUDIES AND FILES

FILE MANAGER provides two import functions:

- **Exam Import**
- **File Import**

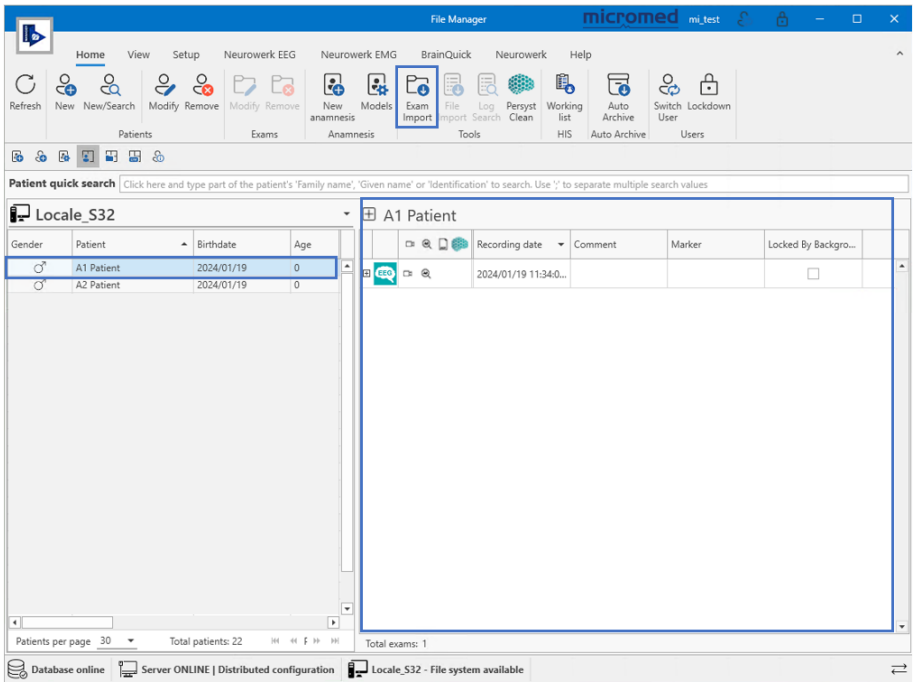
Importing functionality can be related to a specific patient or to an existing study.

HOW TO IMPORT A STUDY

From the Home tab (Tools group) of ribbon bar it is possible to import an entire examination clicking the **Exam Import** button.

Windows File Explorer will open and the user can select the EEG (EMG-EP) trace file related to the study to import. When click “Open” the “Patient Info” window will appear with patient data pre-compiled, click “OK” to confirm the import.

If imported study is related to a patient not yet registered, a new patient will appear in the patients list with the imported exam associated in the Exams list.



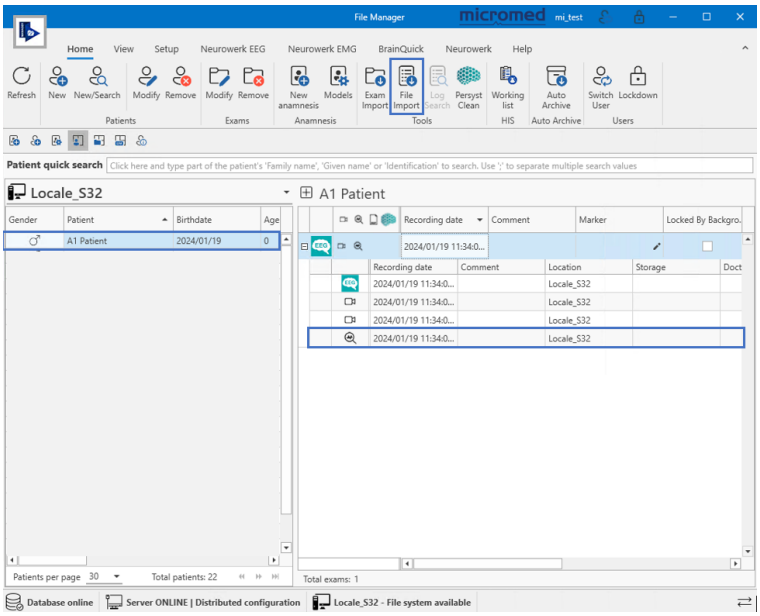
VEEG Exam Import

Note. If a Video EEG study is selected both trace file and all related video files are imported.

HOW TO IMPORT A FILE

From the Home tab (Tools group) of ribbon bar it is possible to import a single file related to existing or already imported examination clicking the **File Import** button.

Windows File Explorer will open and the user can select the file to import. It is possible to import only event or analysis files; such file will be associated to the EEG study currently selected.
When click “Open” the import is confirmed and the selected file will appear in the inner level of the Exams list under the selected study or in the File pane, according to current layout.



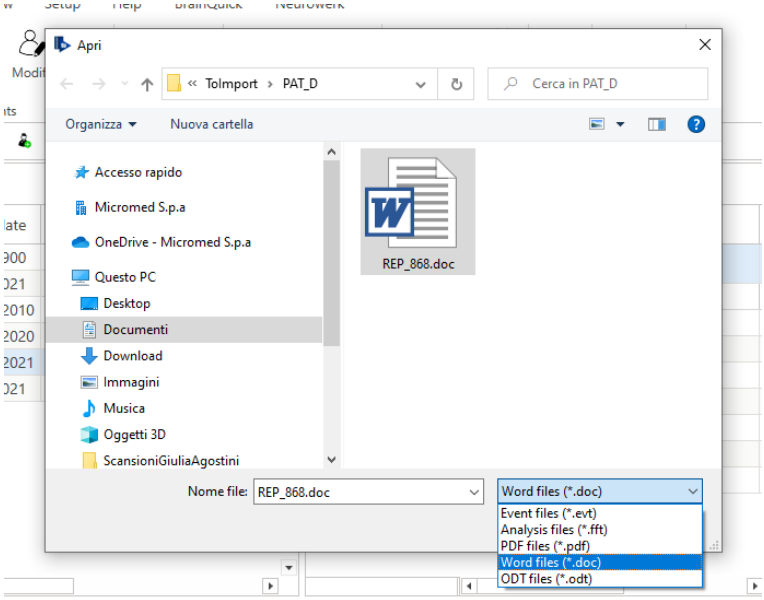
Event File Import

Note. It is supposed the user knows the EEG study to which the imported file is associated; no check is performed by FILE MANAGER importing procedure.

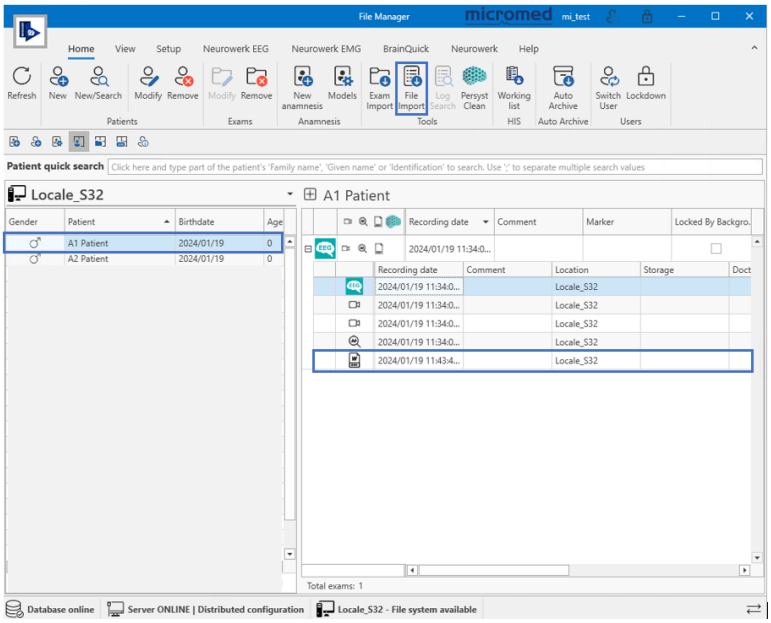
HOW TO IMPORT A REPORT

From the Home tab (Tools group) of ribbon bar it is possible to import a report related to existing or already imported examination clicking the **File Import** button.

Windows File Explorer will open and the user can select the report file to import. It is possible to import report in Word, Odt or Pdf format only; such file will be associated to the study currently selected.



When click “Open” the import is confirmed and the selected report will appear in the inner level of the Exams list under the selected study or in the File pane, according to current layout. In addition a report icon will appear in the “Study contains” column of the exam list related to the study.



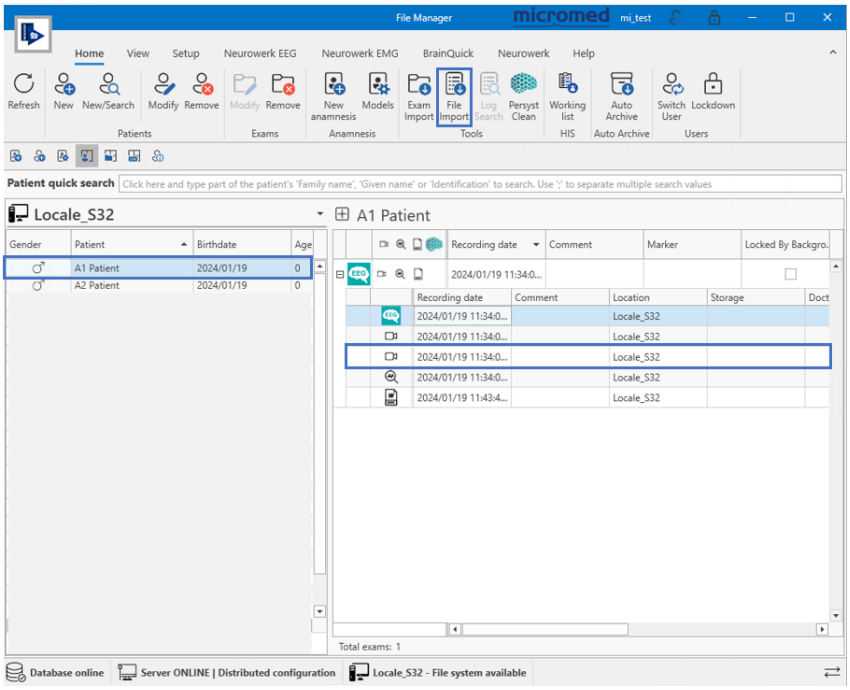
Report Import

Note. Report file does not store information which allows univocal identification of related patient and associated exam. It is supposed the user knows the EEG study to which the imported report is referred; no check is performed by FILE MANAGER importing procedure.

HOW TO IMPORT A VIDEO

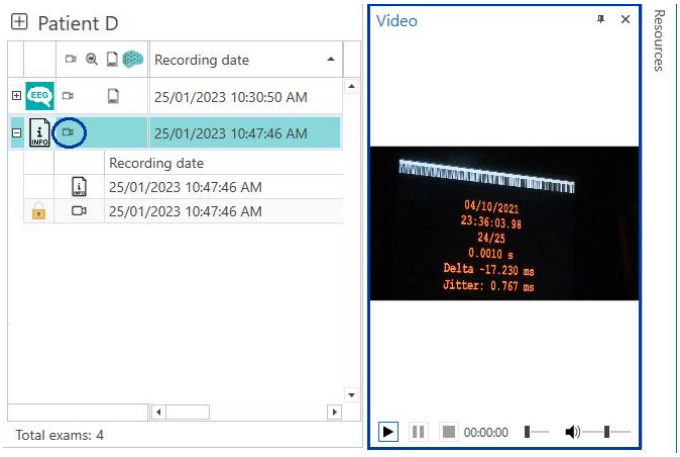
FILE MANAGER also allows to import video file for anamnesis purpose and to associate it to a specific patient. Select the patient in Patients list and click the **Exam Import** button in the Home Tab (Tool group) of the ribbon bar.

Windows File Explorer will open, change the file type choosing the “video file (*.MP4)” option and select the video to import.
When click “Open” the import is confirmed a dialog window will appear allowing the user to select the template to create a new anamnesis for the selected patient. The new anamnesis will appear in the Exams list with the imported video associated. In addition, a video icon will appear in the “Study contains” column of the exam list related to the anamnesis.



Video Import (Anamnesis)

It is possible to play the imported video directly within FILE MANAGER main window by double clicking on video icon or on the video file itself; the Video panel (dockable) will appear with buttons to play, pause and stop the video.



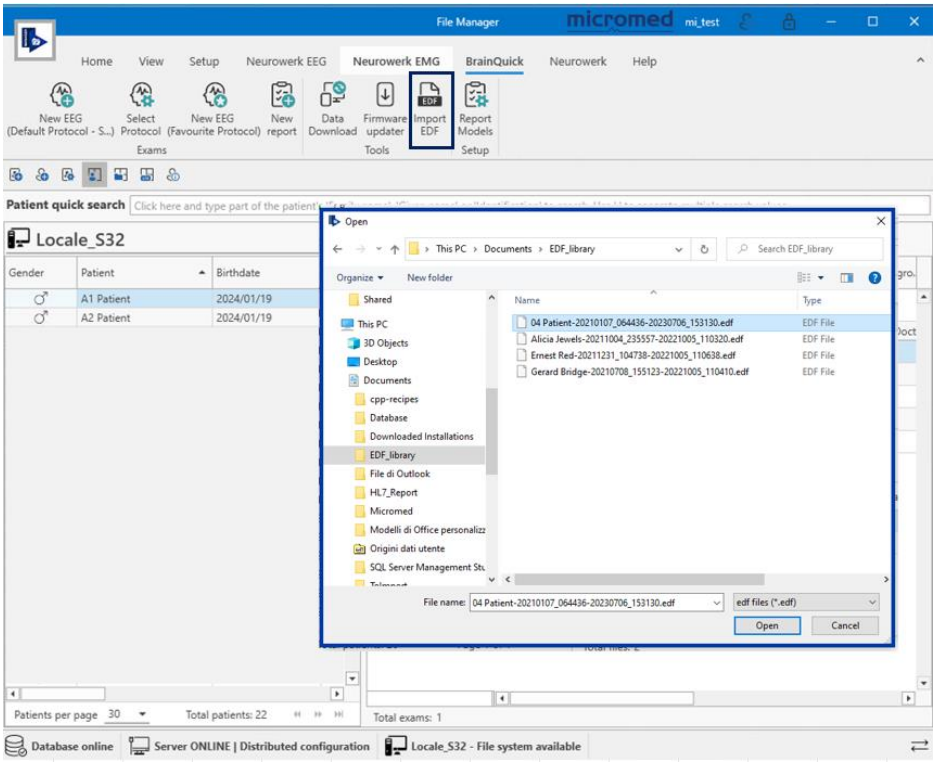
Video Panel

HOW TO IMPORT EDF FILE

FILE MANGER allows to import also file in EDF or EDF+ format and associate it to a specific patient.

Select the patient in Patients list and click the **Import EDF** button in the Brain Quick Tab (Tools group) of the ribbon bar.

Windows File Explorer will open with file type set to “edf files (*.edf)”: navigate to the folder where file to import is located and select the EDF to import; click “Open” to confirm the operation.



EDF File Import

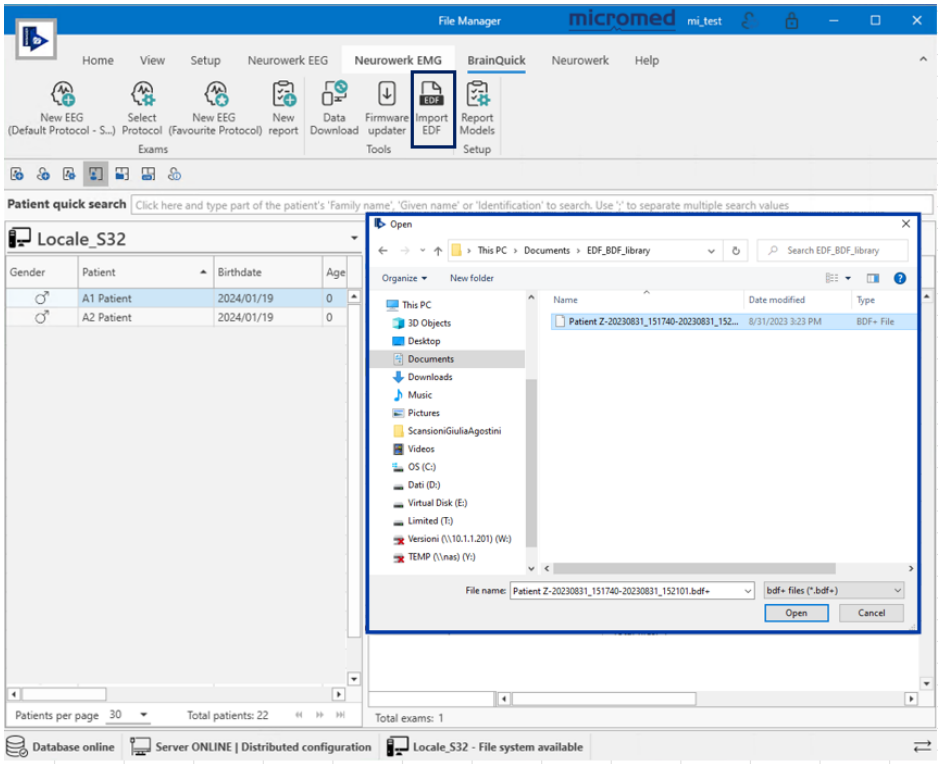
The imported file is automatically converted by Brain Quick Software into an EEG trace file and a new EEG exam appears in the Exams list associated to current patient.

HOW TO IMPORT BDF FILE

FILE MANGER allows to import also file in BDF format and associate it to a specific patient.

Select the patient in Patients list and click the **Import EDF** button in the Brain Quick Tab (Tools group) of the ribbon bar.

Windows File Explorer will open: change the file type choosing the “bdf files (*.bdf)”, then navigate to the folder where file is located and select the BDF file to import; click “Open” to confirm the operation.



BDF File Import

The imported file is automatically converted by Brain Quick Software into an EEG trace file and a new EEG exam appears in the Exams list associated to current patient.

SETTINGS

FILE MANAGER and Brain Quick software settings type are:

- **User: local** settings **different for each user** (applied to a specific user on a specific machine)

  Note. All FILE MANAGER User settings are centrally stored; there are no local User settings.

- **Machine: local** settings **equal for all users** on a specific machine

  Note. Machine settings are editable by authorized users only, i.e. user with the “Can Modify Unit Settings” permission

- **Central User: central** settings **different for each user** (applied to a specific user in all the machines)

- **Central: central** settings **equal for all users** in all the machines of the system

  Note. Central settings are editable by authorized users only, i.e. user with the "Can Modify Central Settings" permission

In a networked environment the centralized settings configuration is stored on **server**; **local** type settings are maintained on single workstation with possibility to be **manually centralized**, while **central** type settings are automatically downloaded to single workstation at installation time and kept **synchronized** with the central configuration.

It is possible to access the Settings area by clicking the FILE MANAGER application button on the top left corner of the main window and selecting **Settings** from the menu; the "Settings" window will open organized into different tabs.

This dedicated area allows the user to modify many application settings, some of which are key to the correct functioning of the FILE MANAGER application itself.

Note. It is highly recommended that Administrator users only perform Central settings setup and that Unit settings are changed only by qualified technical personnel.

The complete list of options is comprised of eight tabs, each one grouping different settings.

The Tabs are:

- **Display**
- **Language**
- **Archive**
- **Acquisition List**
- **Licensing**
- **Logging**
- **Lockdown**
- **Labels Customization**
- **HIS**

Settings type for each configuration tab will be specified in the following sections.

Note. Following paragraphs describe all options available for Administrator user which is allowed to setup and change also Unit and Central settings. The majority of settings illustrated below is not available for standard user who typically can access only User settings.

DISPLAY SETTINGS

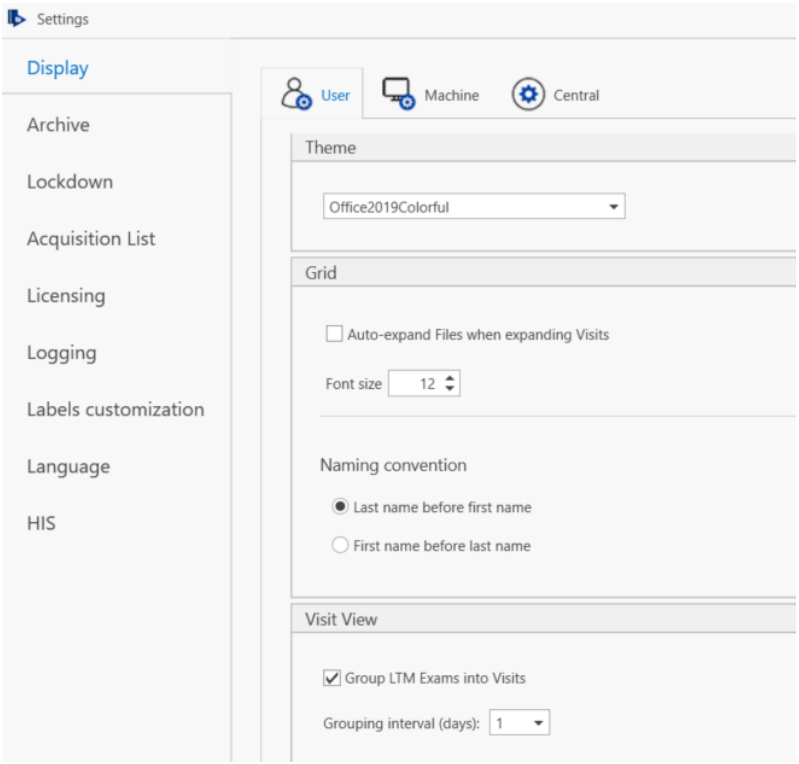
The Display Tab allows users to configure display settings of the application; the tab pane is divided into the following three sections: User, Machine and Central.

User Settings

Each user can setup the following display settings:

- **Theme** of FILE MANAGER application, the user can select the desired theme among many Microsoft Office themes. Once the theme is changed, restarting the FILE MANAGER is NOT required to apply the changes.
- **Grid**, preferences related to the Patients list and Exams list. In this section it is possible to:
    a. Enable the option to auto-expand files when selecting a visit in the exams list.
    b. Change the font size for patients and exams.
    c. Select the naming convention, patient's last name before the first name or vice versa.

    Note. Chosen naming convention will be applied to any physical person whose data is shown in FILE MANAGER, such as patients, doctors, and technicians.



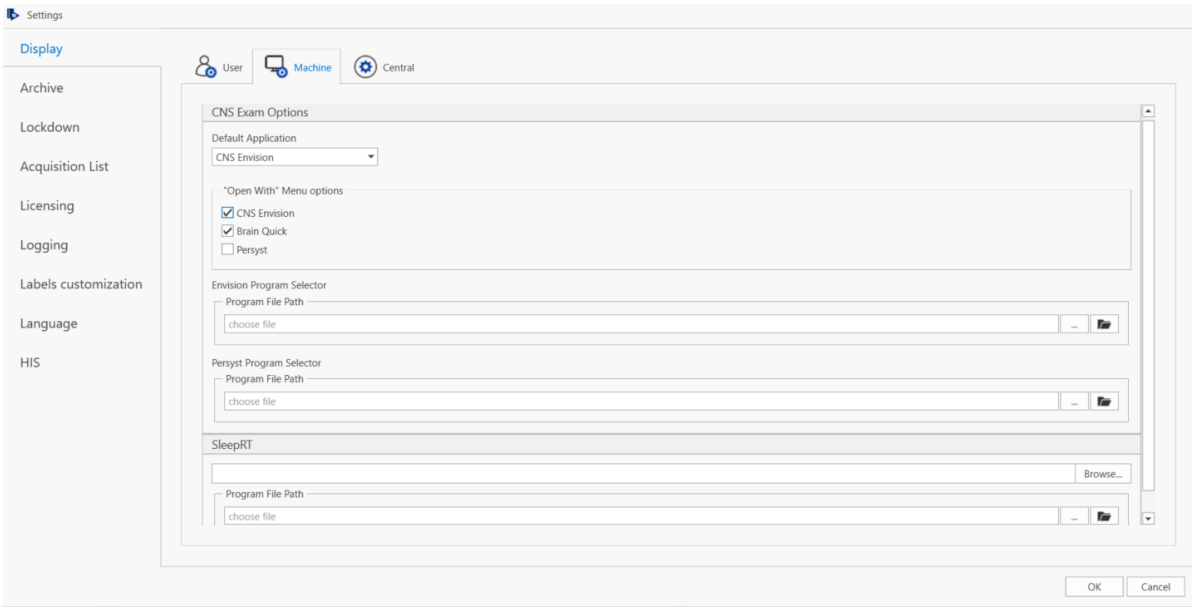
- **Visit View**, in this section it is possible to:
    a. Enable the automatic grouping of LTM EEG exams in a single visit. If this option is enabled, the user can also decide the grouping criteria (in days) from one up to seven days; for example, if "1 day" option is selected all EEG recording performed within the same day are grouped under the same LTM visit.

    Note. The LTM aggregator algorithm considers two parameters: the grouping criteria and the anchor time, a central settings, which represents the starting time of the day from which the grouping begin.

Machine Settings

Authorized user can setup the following display settings which are saved at machine level, i.e. applied to all users working on the machine:

- **CNS Exam Options**, to manage the integration between Moberg CNS Envision software and FILE MANAGER.



As seen in the figure above, in this section is possible to:

a. Choose the default application to open a CNS exam when double clicking.
   Available options are Brain Quick, CNS Envision, and Persyst.

b. Configure the right-clicking "Open With" menu options for CNS exams opening; if any of the listed options is selected, the ability to open files with applications different from the default one will be enabled.
   Note. The "Open with" option will be available in the right-click contextual menu of Exams list when a CNS exam is selected.

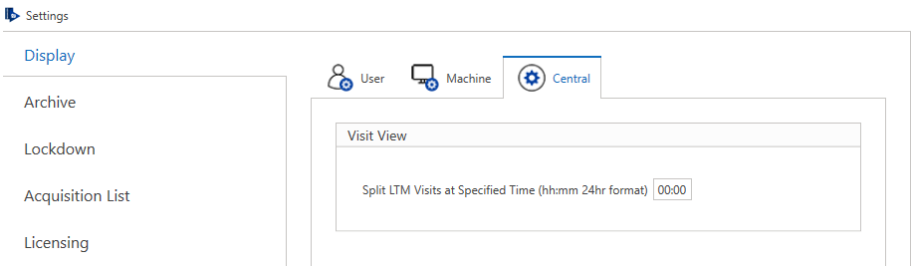
c. Set the program file path for
   a. CNS Envision executable file (.exe)
   b. Persyst executable file (.exe)
   c. Analysis destination folder, in case of hybrid system with SleepRT analysis executed from SystemPLUS Evolution
   d. SleepRT executable file (.exe)

   Note. To open CNS exam files with applications other than the default one, it is required that the CNS Envision and Persyst path fields point to their respective ".exe" files.

Central Settings

Authorized user can set up the following centralized display options which apply to all users and all machines:

- **Anchor time**, which is the starting time of the day used as reference to split EEG exams into different LTM visits according to the grouping criteria chosen by each user.

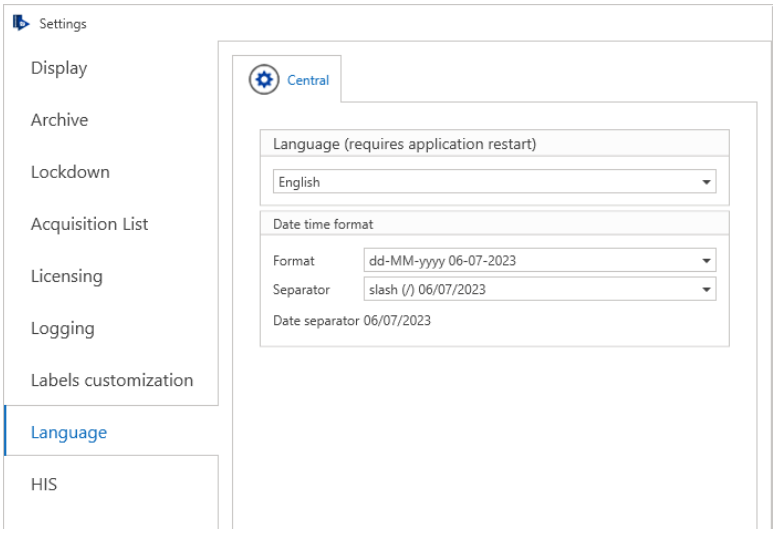


LANGUAGE AND INTERNATIONALIZATION

The Language Tab allows authorized user to choose the application language.

Note. Available languages are English (default), Italian, German, French, Spanish, Portuguese, Danish, Dutch, Finnish, Russian, Swedish and Turkish.

In the same tab it is also possible to set up internationalization preferences, i.e. to choose the date time format and related separator.



Once the selections are saved, THE APPLICATION NEEDS TO BE RESTARTED to apply the changes.

Note. Language and Internationalization preferences are Central settings, i.e. they must be set up by Administrator user and they apply to all users and all machines of the system.

ARCHIVE SETTINGS

The Archive Tab is divided into two sections: User and Central.

User Settings

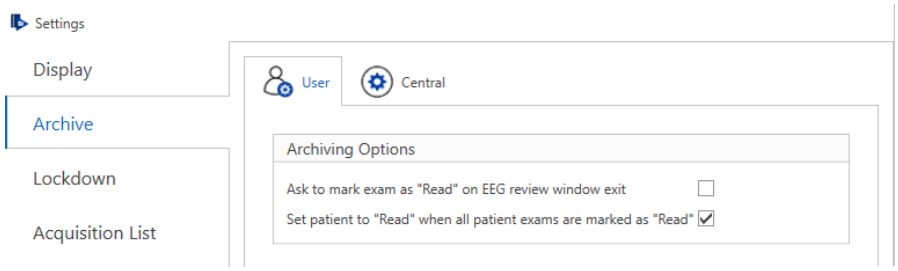
User can set up the following options:

a. Enable the "**Set patient to "Read" when all patient exams are marked as "Read"**" option, which allows to automatically set a patient to "read" if all the patient's exams have been marked as "read". The "read" option allows the user to trigger the automatic archiving procedure.

If this option is disabled, the patient is not set to “read” even when all the patient’s exams have been marked as “read”; such operation have to be performed manually.

Note. The option takes into consideration also the “to delete” marker, i.e. if enabled, patient is automatically set to “read” if all related exams are either marked as “read” OR as “to delete”.

b. Enable the “**Ask to mark exam as “Read” on EEG review window exit**” option to automatically prompt the user to set an exam to “read” when exiting from an EEG review session.



Central Settings

Authorized user can set up the following centralized options which apply to all users and all machines:

a. Enable the “**Archive analysis file to Storage (Persyst, .fft)**” option, which triggers the automatic archiving of analysis files, if any, when an EEG exam is archived.

ACQUISITION LIST SETTINGS

The Acquisition List Tab allows to configure the settings of the Acquisition System List; it is divided into two sections: Machine and Central.

Machine Settings

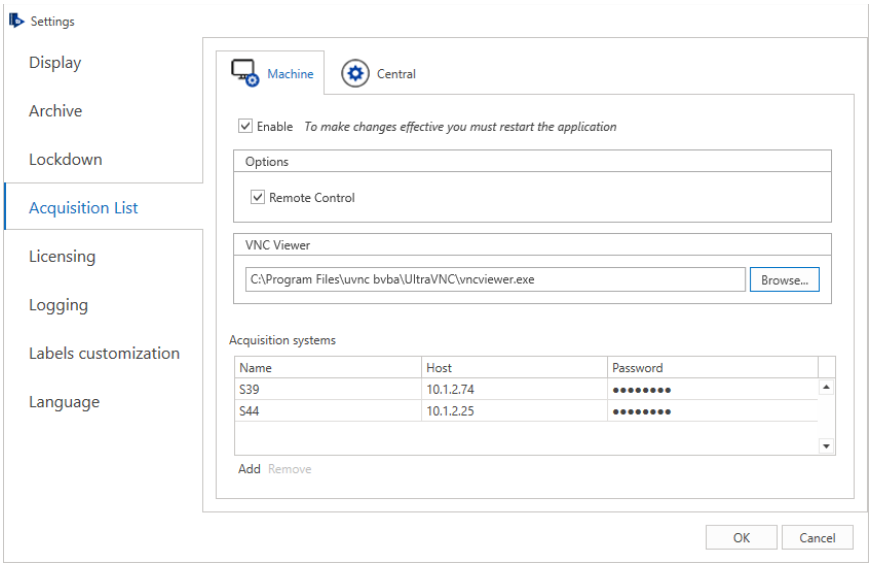
Authorized user can enable/disable the Acquisition list on each single machine.

Then it is possible to configure the following settings of the Acquisition System List:

a. Enable option for the remote control of the listed acquisition systems.
b. Browse the UltraVNC Viewer installation path for the remote control of acquisition system running System PLUS Evolution.
c. Add/Remove an acquisition system; each workstation can monitor and/or take the control only of acquisition system listed in the Acquisition systems table.

   All controllable acquisition systems are listed, together with their host (i.e. their IP address) and their (hidden) password for the remote control by UltraVNC. Buttons “Add” and “Remove” at the bottom of the list can be used to add a new system or to remove the selected one.

   Note. Machine name, IP address and password are mandatory to interact with the acquisition system.



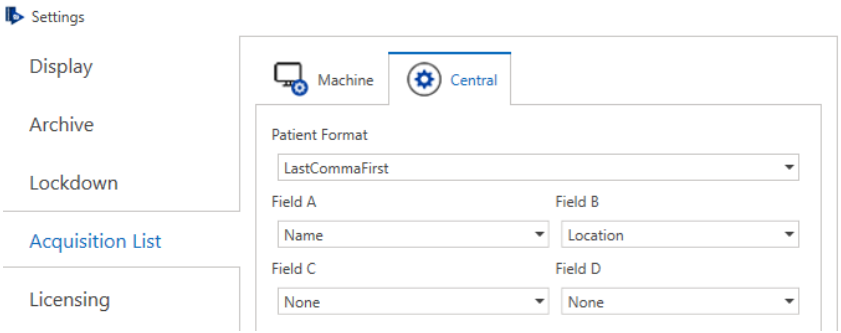
IMPORTANT NOTE. In order to use the Control functionality on acquisition stations running SystemPLUS Evolution, the software UltraVNC must be installed both on the server computer and the client computer.

Central Settings

Authorized user can set up the following centralized options for the Acquisition list configuration:

a. Choose the format for the patient name.

b. Configure the four visible fields (A through D) displayed in the details pane of each acquisition machine shown in the Acquisition List panel; default values are Name, Location, ID1 and None, respectively.

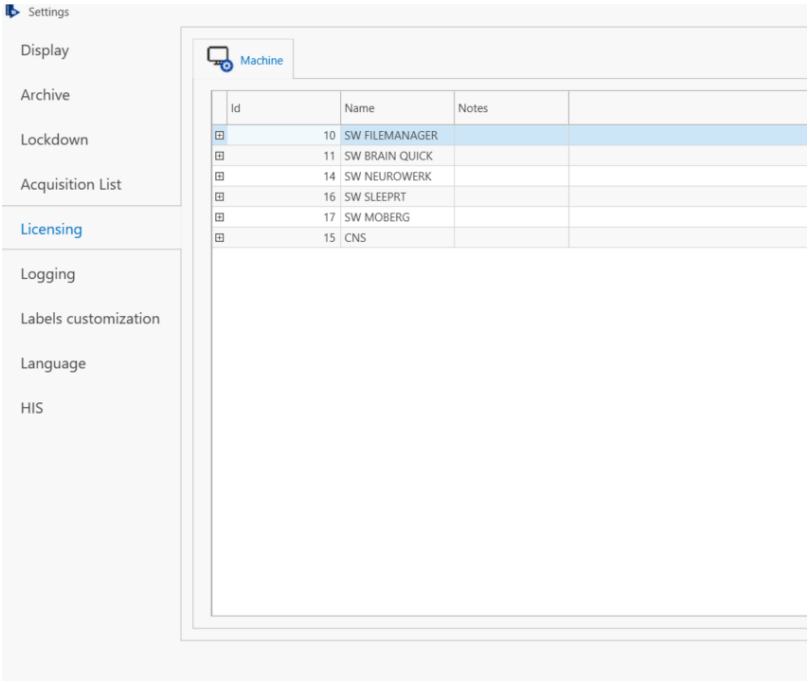


LICENSING

Note. All Licensing settings are Machine settings, i.e. they apply to all users working on a specific station.

The Licensing Tab allows authorized user to configure and view the active licenses for the application.

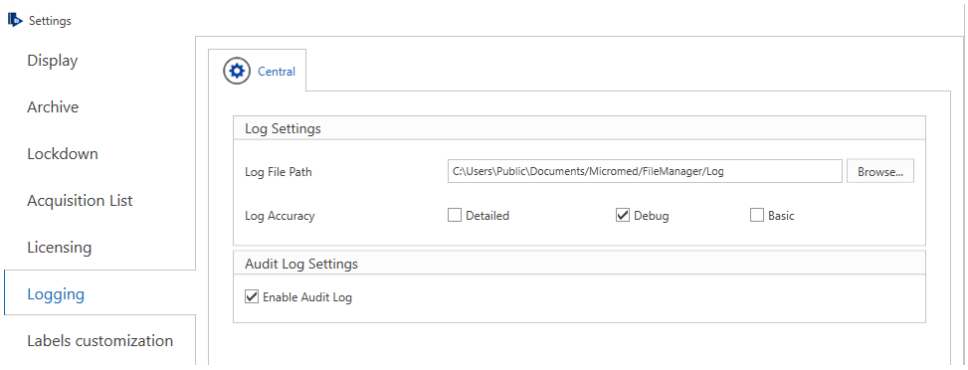
All active licenses are listed in a table and grouped by category.



LOGGING PREFERENCES

Note. All Logging preferences are Central settings, i.e. they apply to all users and all machines.

The Logging Tab allows authorized user to configure the level of detail of the log activity and to enable the auditing functions for the application.



Log settings

In the Log Settings section it is possible to define the log file path, i.e. where comments and/or errors are logged while FILE MANAGER application is running.

Authorized user can select the destination folder to save the log files and choose the level of details of the log file; such options are the same for all machine of the system.

Three levels of accuracy are available:

- **Detailed**, which keeps track of each action performed in the FILE MANAGER
- **Debug**, which tracks less actions than the “Detailed” level
- **Basic**, which keeps track only of the most important information (typically errors and exceptions) related to actions performed in FILE MANAGER

Note. The default path for the log file is "C:\Users\Public\Documents\Micromed\FileManager\Log".

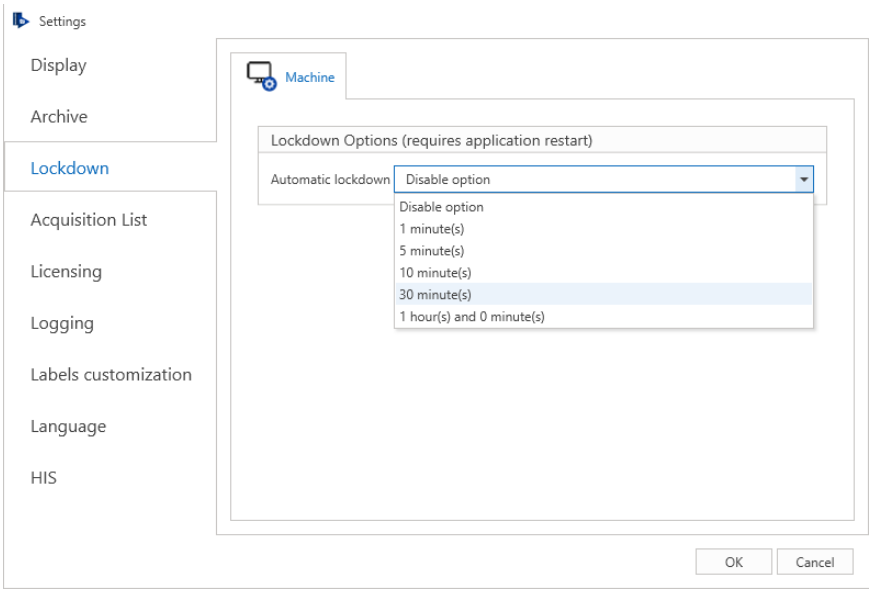
Audit Log Settings

The Audit Log trail keeps track of the actions performed and which user performed them.

In the Audit Log Settings section it is possible to activate or deactivate the audit trailing; activities are centrally stored in the Audit Log database (on server).

LOCKDOWN PREFERENCES

If Logon system is enabled, the Lockdown Tab allows authorized users to enable the application automatic lockdown and to set up the idle timeout, i.e. the period of inactivity of the Archive module after which the application automatically enters in lockdown mode.



Note. Lockdown preferences are Machine settings, i.e. they apply to all users working on a specific station.

LABELS CUSTOMIZATION

For authorized users it is possible to assign a custom description to application labels.
Note. Customized application labels are shared among all users and machines in the networked system.

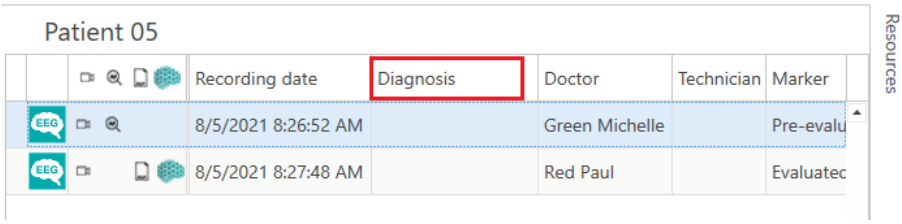
Clicking on the FILE MANAGER application button in the top left corner of the main window and selecting "Labels customization" tab in the Settings area it is possible to access a dedicated pane.
Note. Authorized user only, i.e. user with the "Can Modify Central Settings" permission, can perform labels customization.

The "Label customization" pane allows users to assign a custom description to application labels. It is comprised of four tabs:

- Patient
- Exam
- File
- Visit

Note. The configuration of custom labels is saved at Central level, i.e. it is unique to all users in all machines of the networked system where FILE MANAGER is installed.

FILE MANAGER will refresh with customized descriptions as soon as changes are confirmed.
The figure below shows an example of customization for the “Comment” column label in the Exams list.

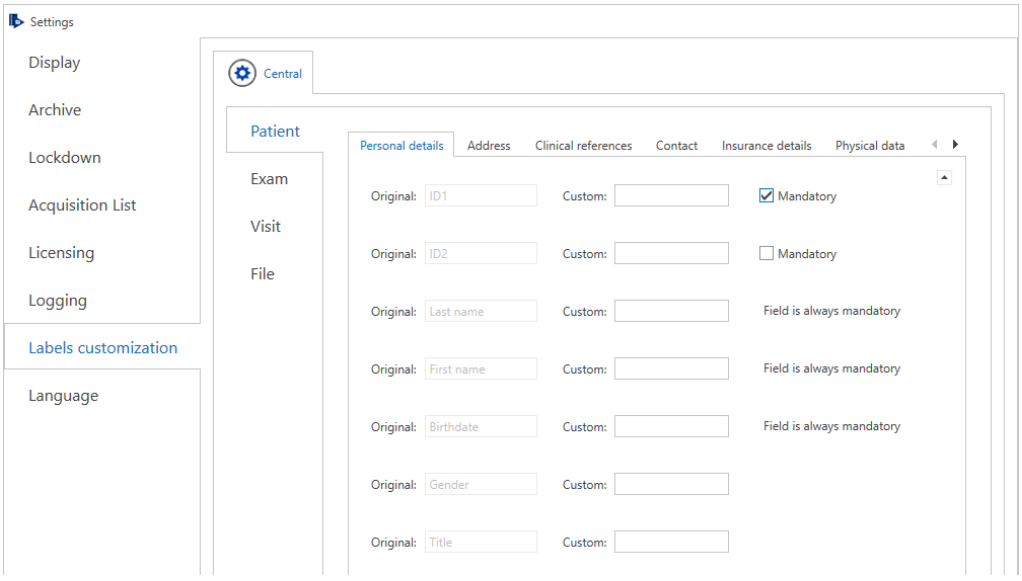


Patient

The Patient tab allows users to assign a custom description to patient related fields shown in FILE MANAGER application.
The Patient pane is comprised of the following sections:

- Personal details
- Address
- Clinical references
- Contact
- Insurance
- Physical data
- Other

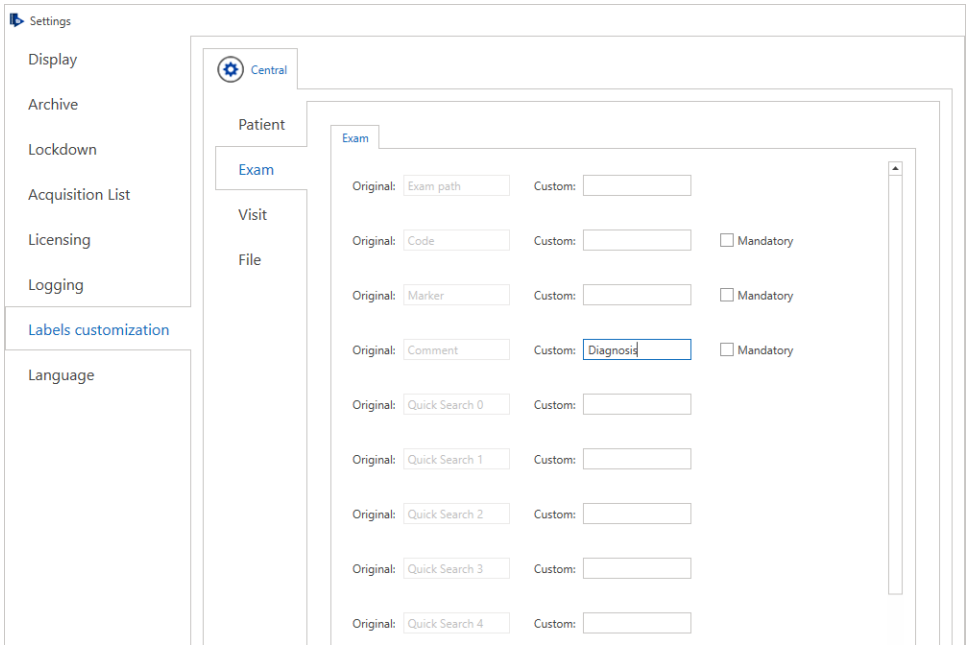
In each section it is possible to customize specific labels related to patient data, such as demographic details, insurance information, etc.



Additionally, in the “Personal details” section it is possible to set the “ID1” and “ID2” fields as mandatory.
Note. The default mandatory patient fields are “Last name”, “First name” and “Birth Date”.

Exam

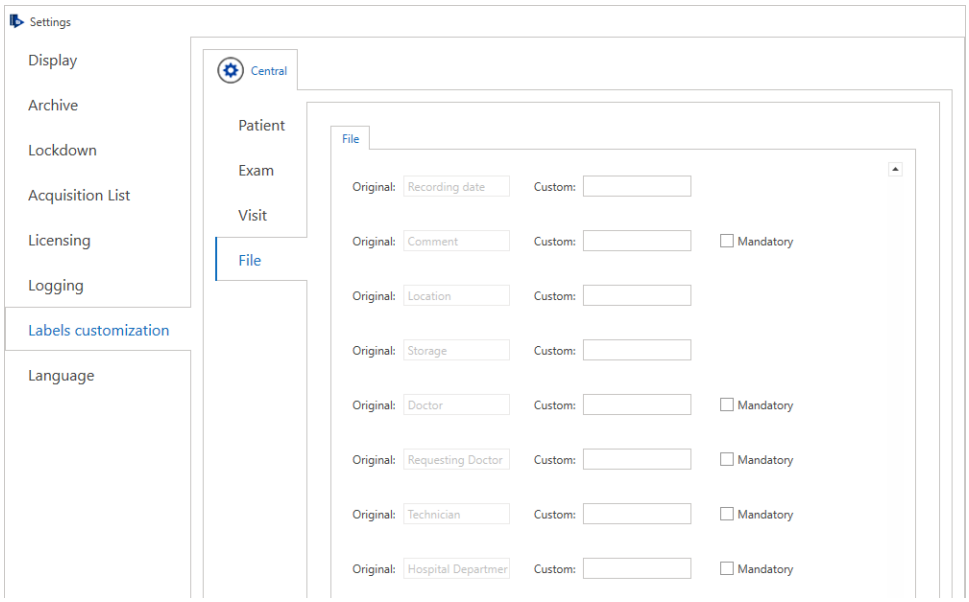
The Exam tab allows users to assign a custom description to exam related fields shown in the FILE MANAGER application, such as “Code”, “Marker”, etc.



As in the Patient tab, it is possible to set certain exam related fields editable by users as mandatory; this option is available only for “Code”, “Marker”, and “Comment”.

File

The File tab allows users to assign a custom description to file related fields shown in the FILE MANAGER application, such as “Comment”, “Doctor”, etc.



Again, it is possible to set certain fields as mandatory; this option is available only for user-editable fields, i.e. Comment”, “Doctor”, “Technician”, “Hospital Department”, and “Requesting Doctor”.

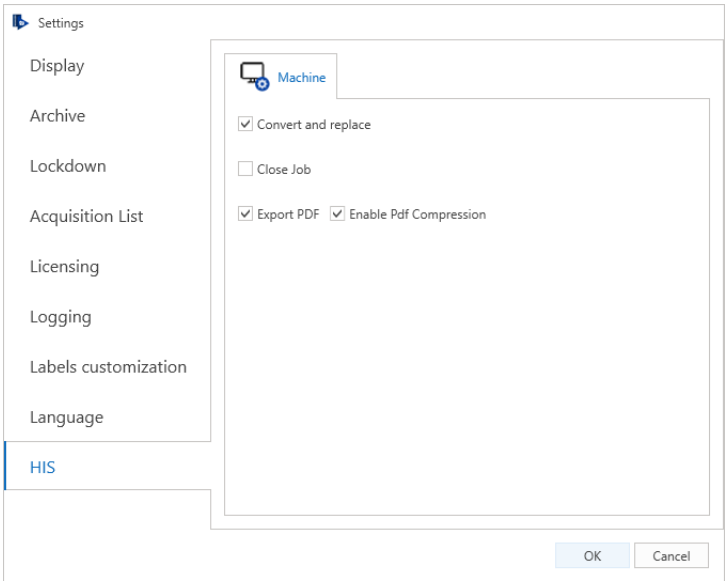
Visit

Finally, the Visit tab allows users to assign a custom description to columns associated to visit.

HIS SETTINGS (HL7 INTERFACE)

Note. All HIS preferences settable in FILE MANAGER *Settings area* are Machine settings, i.e. they apply to all users of the workstation.

The HIS Tab allows authorized user to configure the HL7 Interface local preferences linked to report management.

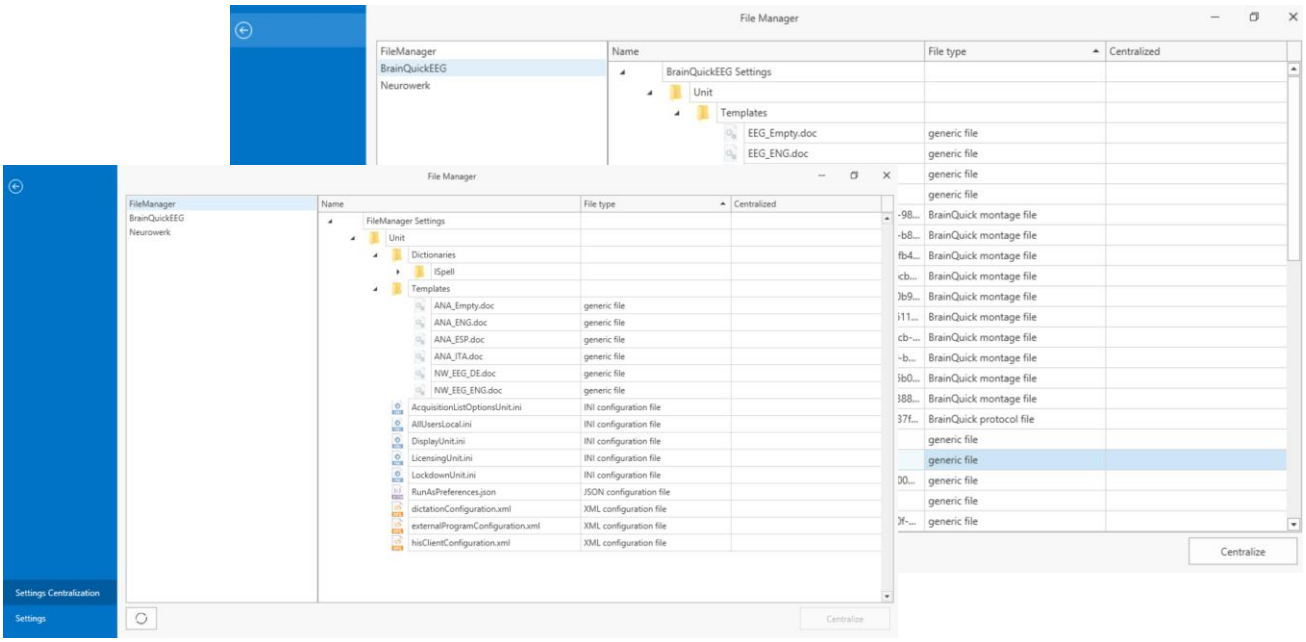


For single workstation (machine) it is possible to:

- Enable the "**Convert and replace**" option, i.e. decide to override the original report document keeping only the exported pdf document. Otherwise, it is possible to keep a copy of the exported report (useful to handle different versions of the same document) if leaving the option unchecked.
- Enable the **report export** in **Pdf** format and decide if send it in a compressed format or not.
- Enable the "**Close Job**" option, i.e. the possibility of closing a job (imported HL7 request) even if the related report is not yet been exported.

SETTINGS CENTRALIZATION

In a networked environment it is possible to share local settings, i.e. Unit settings, with other users and machines of the system.
FILE MANAGER offers a dedicated area where it is possible to select configuration files to share and centralize them.
Note. Only authorized user, i.e. user with the "Can Modify Central Settings" permission, can perform settings centralization.



To centralize settings click the FILE MANAGER application button on the top left corner of the main window and select the **Settings Centralization** option from the left menu; a dedicated pane will appear where it will be possible to select the software for which configuration parameters have to be shared (FILE MANAGER, Brain Quick software). All configuration files available to be centralized are listed and a checkbox indicates which settings have already been shared.

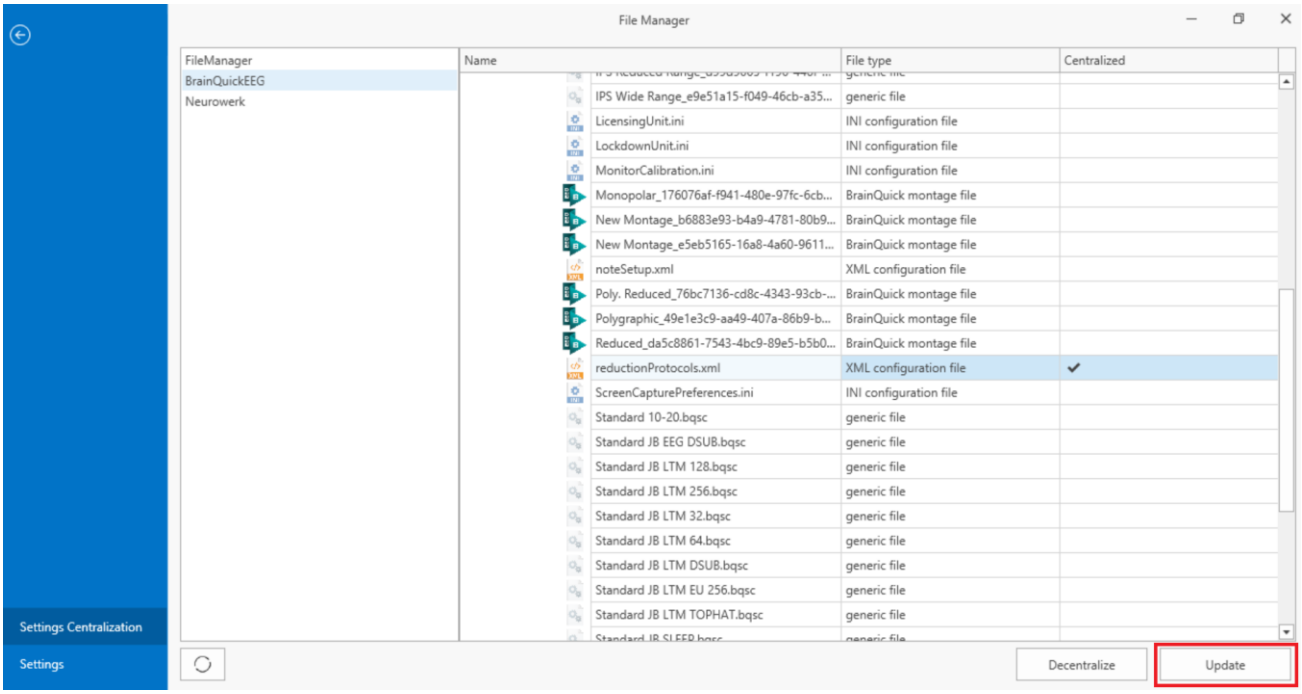
Select items corresponding to settings to centralize and click the **Centralize** button. The setting is marked as centralized and will be spread to all other machines of the distributed system.

In all other workstations, at software restart, the user will be prompted with a notification as soon as he accesses FILE MANAGER and can decide whether to accept or reject the settings just centralized, i.e. to be synchronized or not with central configuration.

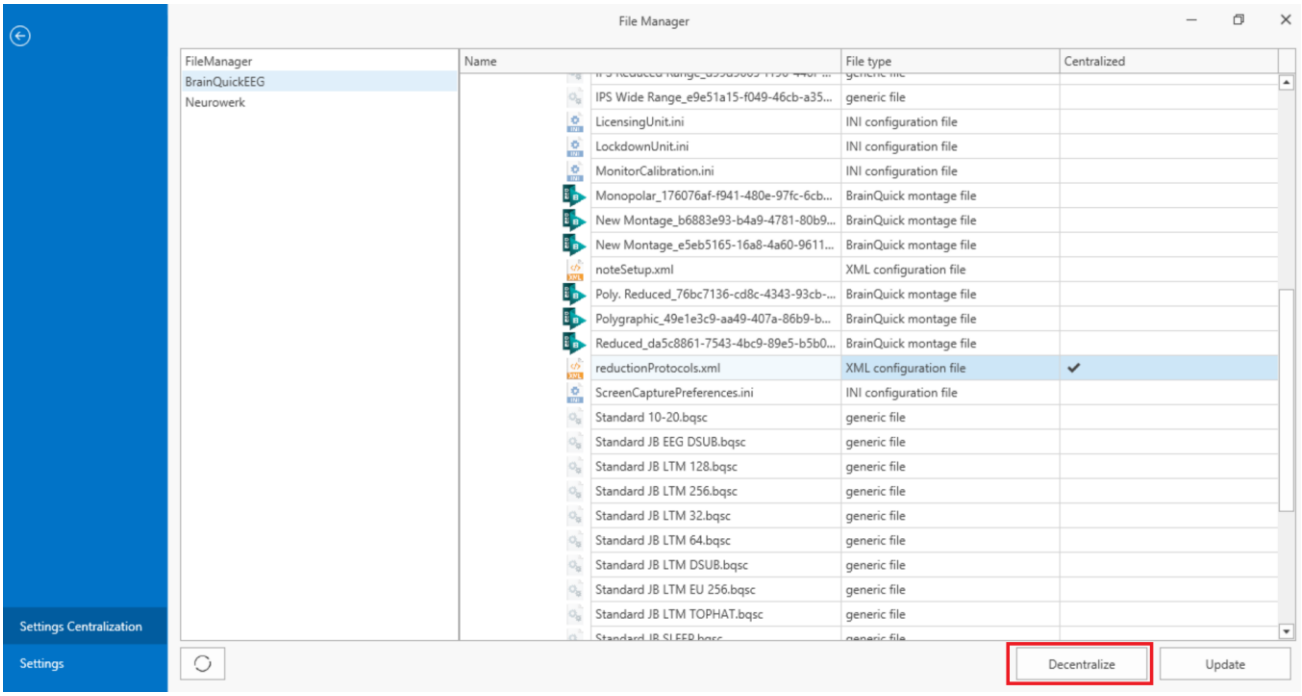
When a setting file is centralized, all machines of the network have a local copy of it and can still go on modifying it locally.

In case an already centralized setting is updated from a client machine and the changes need to be updated in all clients on the network, the user can select the desired setting and click on **Update**. The modifications will be propagated to server which will spread the modified setting to all clients through the distributed network. In all other workstations, at software restart, the user will be prompted with a notification as soon as he accesses FILE MANAGER and can decide whether to accept or reject the settings just centralized, i.e. to be synchronized or not with central configuration.

When a setting file is updated, all machines of the network have a local copy of the modified settings and can still go on modifying it locally.



After a file has been centralized, it is still possible to decentralize it, hence from server there will be no more mechanisms to distribute that file to all available client machines. To trigger that, it is necessary to select the setting to be decentralized and click on Decentralize button. The setting file will be still available locally in all machines of the distributed environment and can still be used and modified.

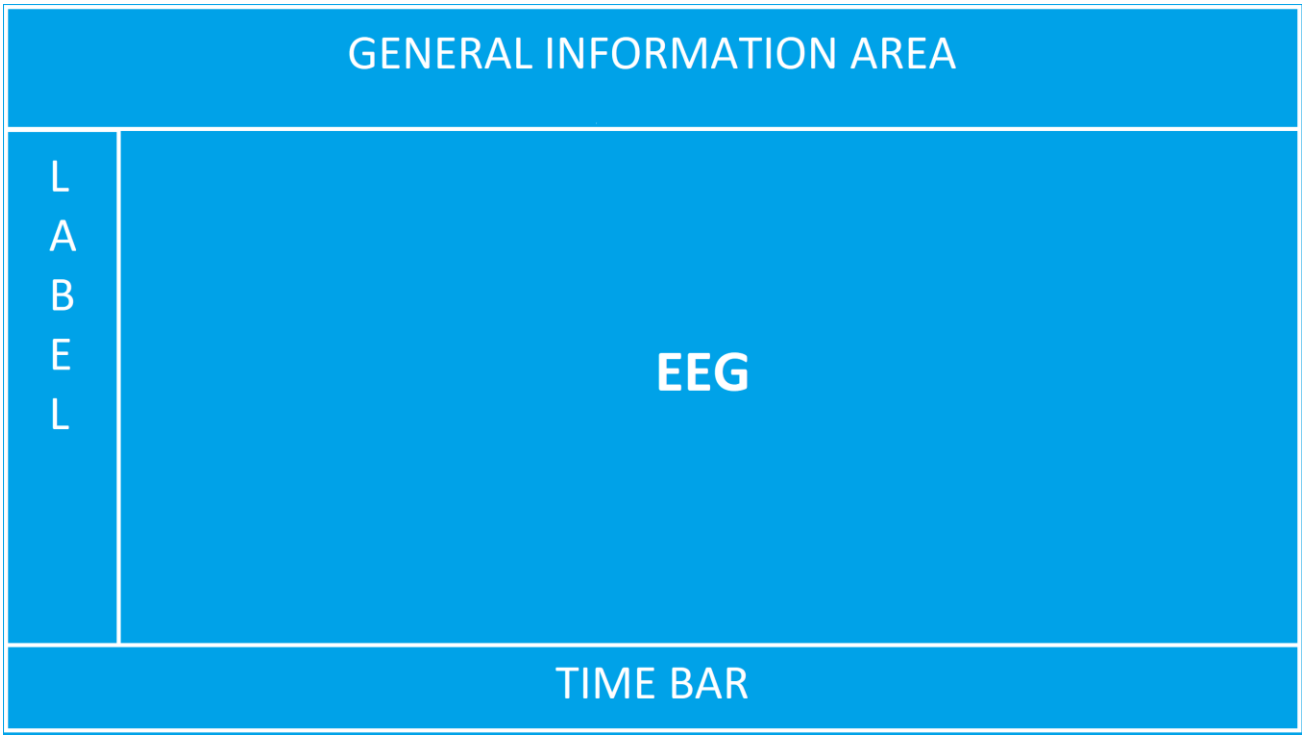


EEG MODULE – BRAIN QUICK SOFTWARE

BRAIN QUICK SOFTWARE is the software that handles all of Micromed acquisition and Review systems for EEG, EMG and EP, which means that according to the enabled key options, BRAIN QUICK SOFTWARE integrates all types of exams in a single application.

MAIN WINDOW BASIC ELEMENTS

The EEG window makes up the main part of BRAIN QUICK SOFTWARE window. The figure below shows the basic elements of this window:



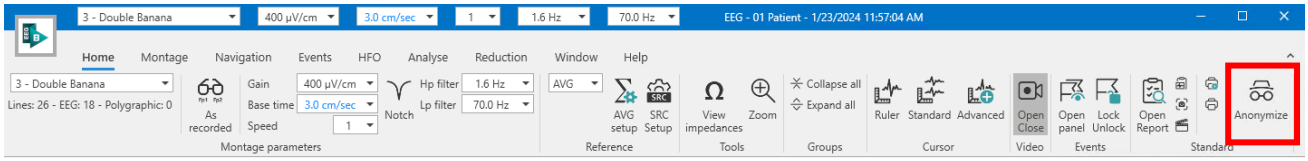
In particular, the General Information Area is divided into four parts:

- Title Bar;
- Ribbon Bar;
- Application Button;
- Quick Access Toolbar.

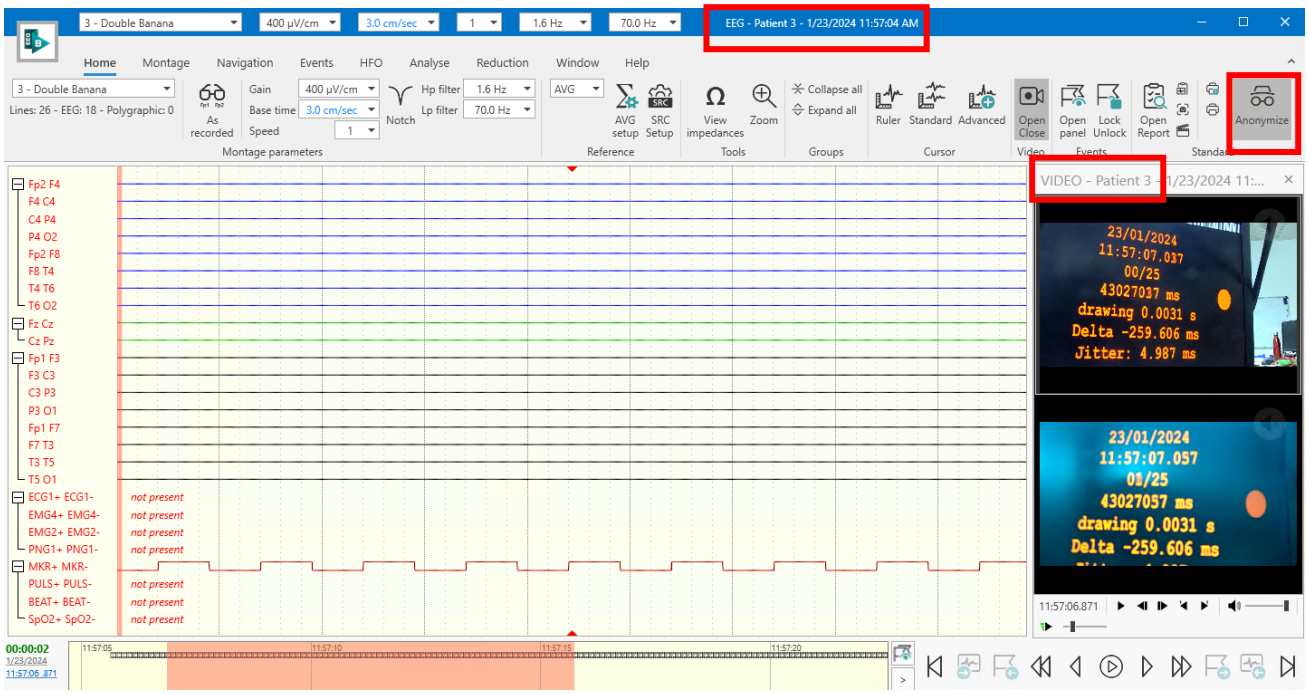
TITLE BAR

Title bar displays the type of the window open ("EEG" or "REPORT"), first and last name of the patient with recording date and time.

During the review, if the user needs to hide patient's personal information the function **Anonymize** is available in the Home tab of the Ribbon bar:



This function hides patient's name and surname from the title bar and from the Video review window:



RIBBON BAR

The upper part of BRAIN QUICK SOFTWARE window is devoted to the Ribbon menu containing the toolbars commands that allow access to all the functions. It is designed to help the user to quickly find the commands that he needs to complete a task.

The Ribbon bar contains all the toolbars placed on several tabs, grouped by functionality to expose different sets of controls when needed.

This menu uses tabs to expose different sets of controls, eliminating the need for many parallel toolbars.

Contextual tabs are tabs that appear only when the user needs them.

It could be minimized keeping only tabs titles displayed.

The user has the possibility to use this bar in normal mode, in minimized mode and on auto-hide mode, that is a function that automatically hides entire Ribbon in order to work on the window in full screen.

Commands are organized in logical groups, which are called together under the tabs.

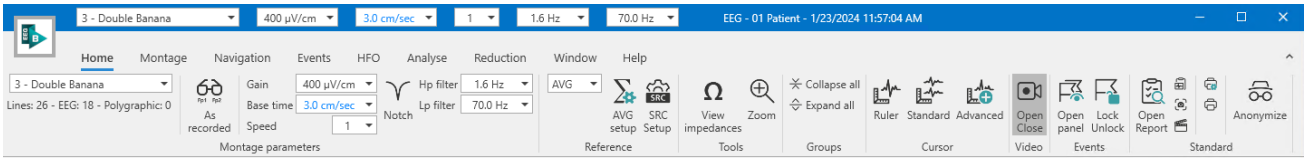
BRAIN QUICK Software allows the user to customize all tabs, groups and define which functions could be present in the different tabs and groups. This software could also allow the user to change tab and group name, to reset the selected tab or the entire Ribbon Bar to the default configuration.

It contains by default the following tabs:

- Home

- Montage
- Navigation
- Events
- HFO
- Sleep
- Analyze
- Reduction
- Window
- Help

Home Tab



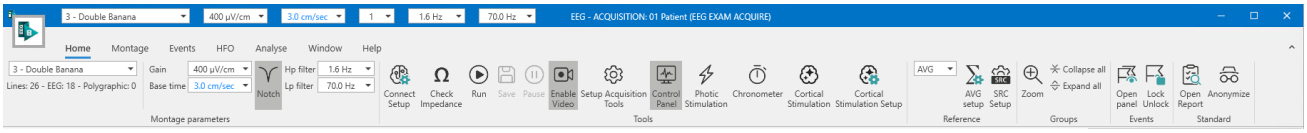
Home tab contains command buttons and provides quick access to the functions needed most often during Video EEG.

"Home" tab in Review window contains the following Groups and Functions:

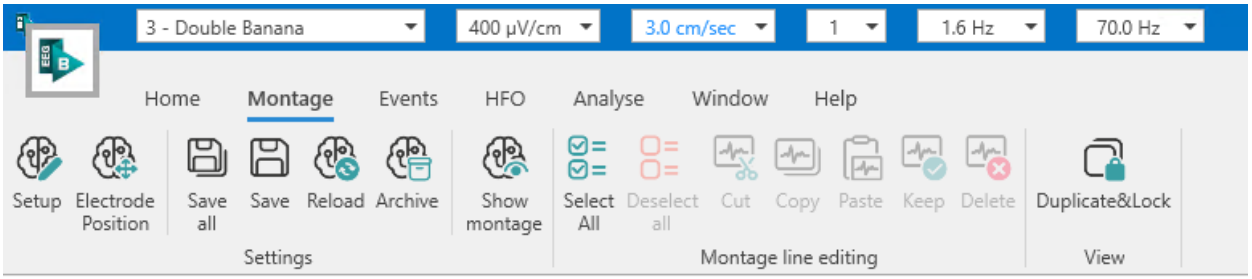
- "Montage Parameters" group: Montage selection, As recorded, Gain selection, Base time selection, Speed selection, Notch, Hp filter selection, Lp selection
- "Reference" group: reference selection (G2, AVG, A1A2, SRC), AVG Setup, SRC Setup
- "Tools" group: View Impedances, Zoom
- "Groups" group shall: Collapse all, Expand all
- "Cursor" group: Ruler, Standard, Advanced
- "Video" group: Open/Close
- "Events" group: Open panel, Lock/Unlock
- "Standard" group: Open report, Copy EEG page to report, Take a screenshot, Screen video recording, Print Setup, Print, Anonymize

"Home" tab in Acquisition window contains the following Groups and Functions:

- "Montage Parameters" group: Montage selection, Gain selection, Base time selection, Notch, Hp filter selection, Lp selection
- "Reference" group: reference selection (G2, AVG, A1A2, SRC), AVG Setup, SRC Setup
- "Tools" group: Connect Setup, Start/Stop Acquisition, Pause, Save, Check Impedances, Enable Video, Setup Acquisition Tools, Control Panel, Photic Setup, Chrono Setup, Cortical Stimulation, Cortical Stimulation Setup;
- "Groups" group: Collapse all, Expand all
- "Video" group: Open/Close
- "Events" group: Open panel, Lock/Unlock
- "Standard" group: Open report, Anonymize

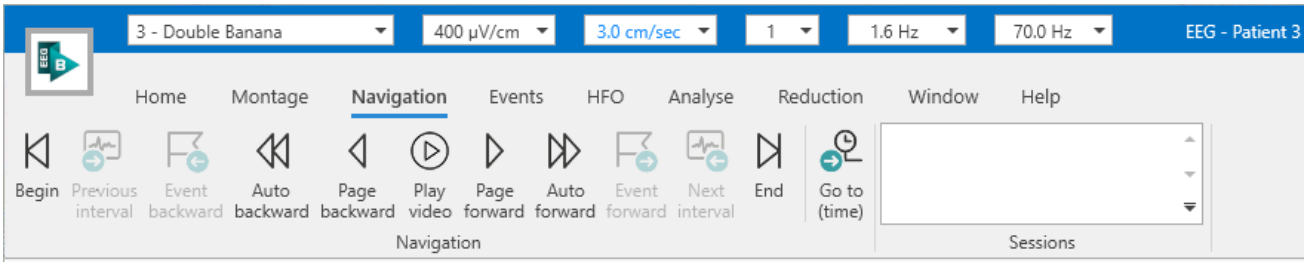


Montage Tab



The Montage tab allows the Montage visualization and the **Montage editing** directly in the EEG review window or in Setup menu.
From this tab it possible to change **Eletrode Position** and enable **Duplicate & Lock** View.

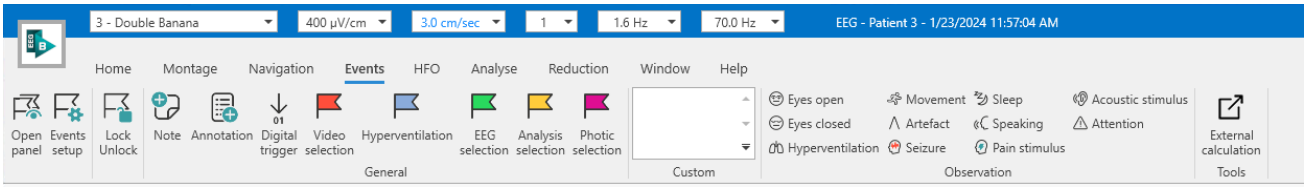
Navigation Tab



Navigation tab groups the **navigation** commands present also in timebar for the movements through the trace and in Video window for video play.

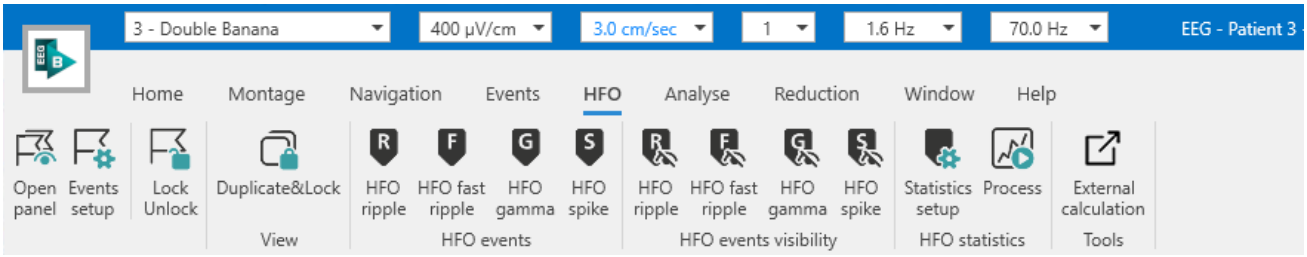
The software allows several users to review the same EEG trace at the same time and all the users are listed in the **Session** list and presented as {*machine name*}/{*user name*} including the position of the given user.

Events Tab



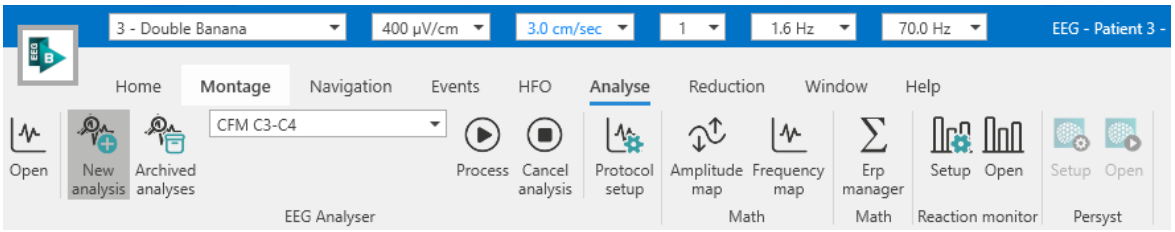
Events tab contains commands to enable insertion of **General** events, like Notes, Digital Triggers, Annotations, Flags, and Selections, to enable insertion of **Custom** events defined from users and to enable **Tools** such as the External Event Calculation.

HFO Tab



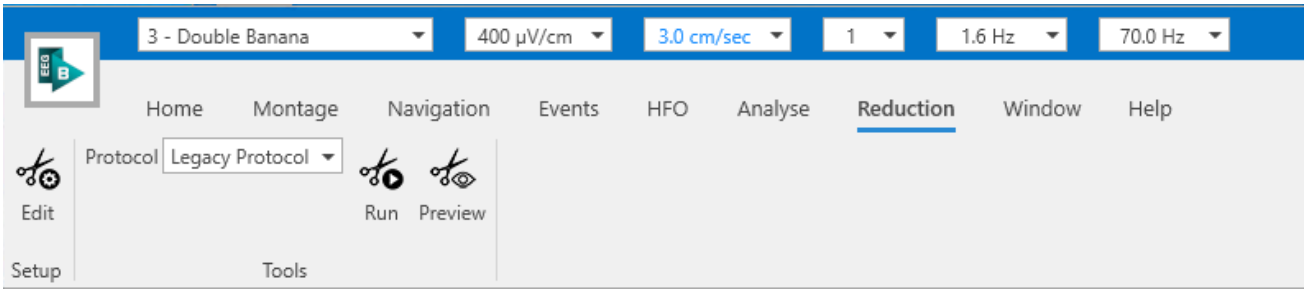
HFO tab allows insertion of **HFO events**, to change view settings enabling Duplicate&Lock function, to change **HFO Events Visibility** and gives the possibility to perform **HFO Statistics** and call **External Calculation**.

Analyze tab



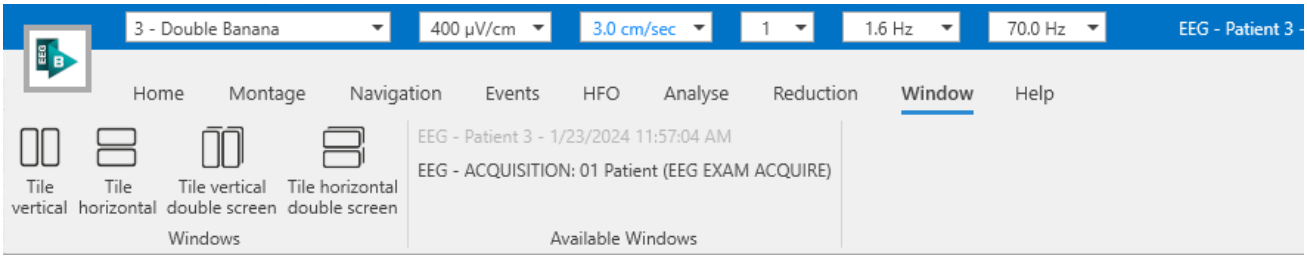
In Analyze tab there are all the features to perform online and offline analysis on the recorded EEG: **EEG Analyzer**, **Maps**, **Reaction Monitoring**, and **Persyst**. All these features will be described in the following sections.

Reduction Tab



In Reduction tab it is possible to define a new **Reduction Protocol**, select one of the saved protocols to visualize on the open trace a **Preview** of the reduction that can be performed and to **Run** it to start the reduction.

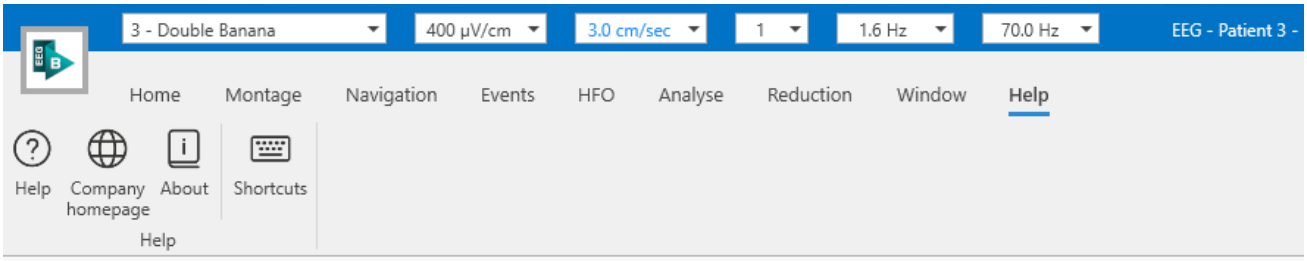
Window Tab



Window tab contains information about the **Available Windows** related to the open files (EEG exams) and clicking on the title of these windows the user can focus the selected window that will be visualized. The aim of this component is to select the window of interest to easily change visualization between different windows.

This tab also allows the user to change multiple **Windows** layout with the dedicated icon.

Help Tab



Help tab provides information about the company and supports the user providing the possibility to quickly access to this online **Help** manual that includes a search functionality that the user can use to search for help in the BRAIN QUICK SOFTWARE documentation.

APPLICATION BUTTON

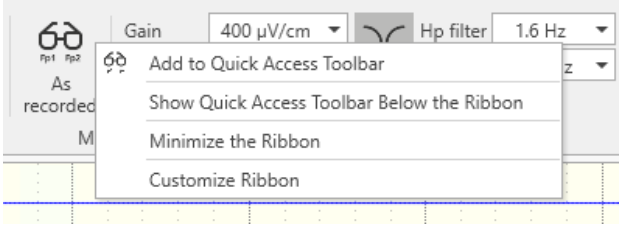
The BRAIN QUICK software window contains an application button at the top left. Clicking on that button opens a menu containing commands related to operations on the file (such as Open, Print, Export to ASCII or EDF+), information related to File Properties, and useful commands for changing the display of the exams.

From Application Button it's possible to open the properties window, where the user can personalize:

- The Monitor Calibration;
- The visualization preferences (derivation labels color and font, time and video cursor color, background color)
- Screen Capture folder (the path where it's possible to save screenshots and screen records)
- System Preferences, in order to set the Notch Filter Frequency.

QUICK ACCESS TOOLBAR

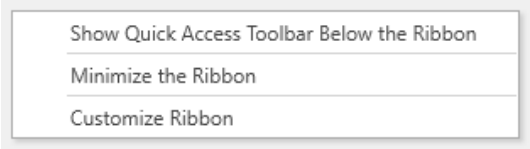
It is a small, customizable toolbar that displays frequently used commands. Commands can be added to the Quick Access Toolbar from Ribbon bar by right-clicking on the command and choosing "Add to Quick Access Toolbar"



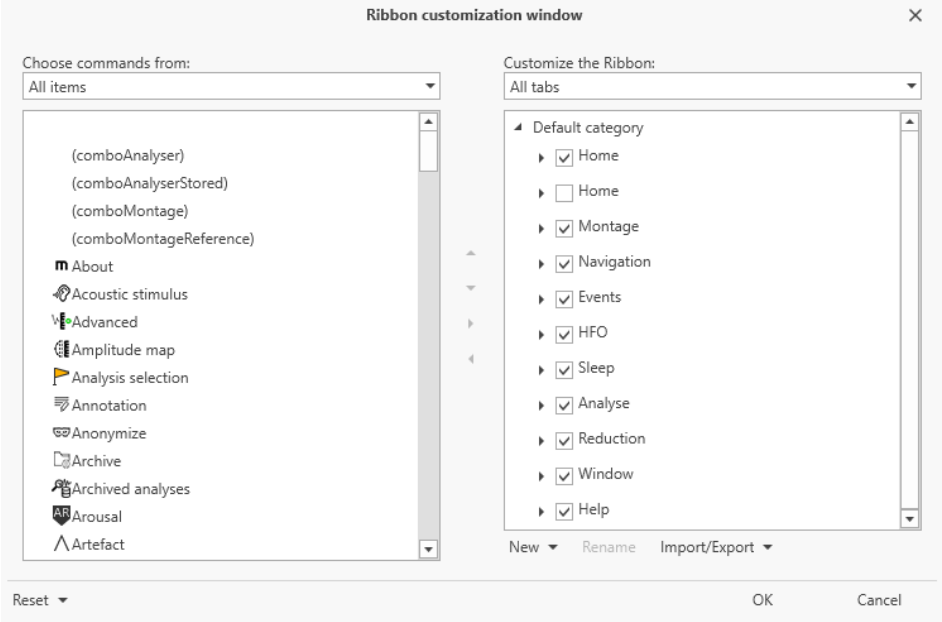
The Quick Access Toolbar default position is on top of BRAIN QUICK Software window next to the application button placed in the top left corner. By right-clicking each ribbon button the user is also able to minimize the ribbon bar and to move Quick Access Toolbar below or above the ribbon.

RIBBON CUSTOMIZATION WINDOW

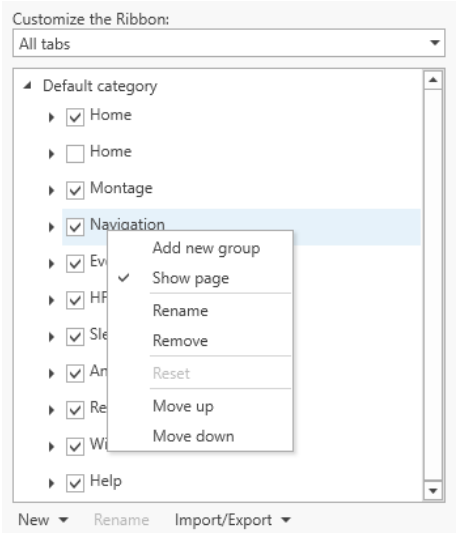
It is possible to customize the Ribbon Bar for all associated tabs and groups through the Ribbon Customization window. To access it, it is necessary to right-click on the Ribbon Bar, so that the following menu appears:



Choosing "Customize Ribbon," the following window opens:



In this window it is possible to choose which tabs to activate or deactivate during acquisition or review, as well as add functionality for individual tab groups. Finally, by right-clicking on one of the tabs, it is possible to create a new group, rename the tab, remove it, or change its order.



In the end, it's possible to export the customization performed or import an existing one, using "Import/Export" button in the window.

TIME BAR

Time Bar is an area placed under the EEG trace panel that represents information about the position of EEG page displayed in the trace and about the entire duration of the exam giving an overview on the presence of video files, notes, selections and other events. The time bar allows the user to quickly locate interesting parts of the recording. By taking advantage of this information, the user can more easily navigate the trace and can quickly locate the parts of greatest interest.

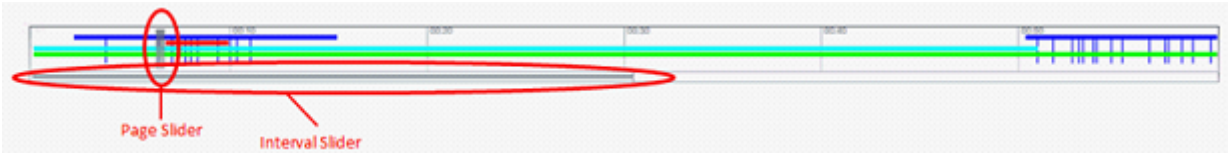
The time bar of the BRAIN QUICK acquisition software indicates the length of the associated trace with indication for events added during acquisition.

Brain Quick Review Software Time bar includes the following elements:

- Date and Time of the beginning of EEG signal page in visualization. Each time the user moves along the trace these values are refreshed at once.
- Timer from the beginning of the recording
- Completed Visualization Interval area with vertical lines of division (parameters for time reference)
- Complete EEG tracks area with vertical lines of division (parameters for time reference)
- Page Cursor
- Interval Cursor visualized as a horizontal line under the interval of visualization
- Vertical lines for the representation of NOTE Events (default colour blue)
- Vertical lines for the representation of TRIGGER Events (default colour green)
- First horizontal line as indicator for the presence of VIDEO (default cinematograph film)
- Second horizontal line for SELECTION event as indicator for VIDEO to archive (default colour red)
- Third horizontal line for SELECTION event as indicator for EEG to archive (default colour green)
- Fourth horizontal line for SELECTION event as indicator for TIMER, like hyperpnea (default light blue)
- Fifth horizontal line for SELECTION event as indicator for MAP to analyse (default colour orange)
- Sixth horizontal lines for customizable EVENTS (defined by user)
- Horizontal lines for HFO SELECTION (e.g. colour red)

During the review, the Time Bar includes two slider:

- **Page Slider:** allows the user to scroll the trace and represents the position of the EEG page displayed in the entire duration of EEG exam.
- **Interval Slider:** represents the position of the Interval displayed in Time bar in the entire duration of EEG exam and allows the user to scroll through the recording



In review, the Time Bar can manage a temporal interval including one or more traces, consecutive or not, previously selected and related to the same patient. In addition, it can work as a calendar with interval included between the start of the first EEG trace and the end of the "last" EEG trace.

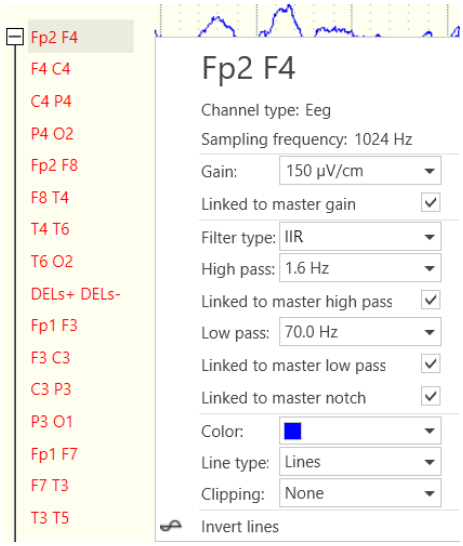
In the end, it can include time period with no EEG trace appropriately highlighted with maximum duration of 23 hours and 59 minutes (less than 1 day with no EEG) between other traces in Multiple EEG visualization.

The navigation bar, placed near the time bar, allows the user to manage all the temporal movements in the trace during the review.

EEG SIGNAL WINDOW

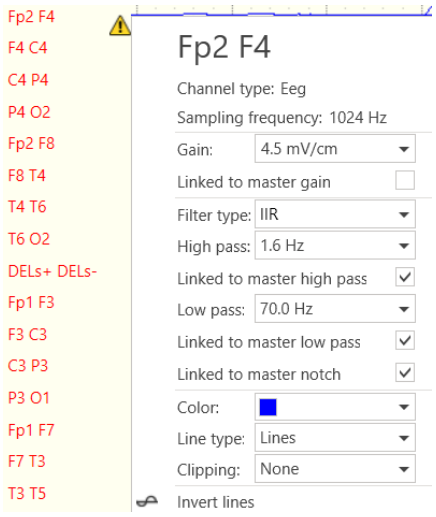
EEG trace panel contains:

- Labels view of the selected channels according with the chosen montage. From EEG window it is possible to modify the view of all the channels displayed using the specific functions proposed in Montage tab of the Ribbon bar. Selecting one or more line labels and right-clicking on them, a line editor will be open in order to allow the user to quickly change parameters only of the selected lines like the color of the displayed trace or filter parameters



It is possible to perform a multiple selection of labels with Shift+Click or Ctrl+Click.

The presence of lines with different gains or filter settings will be indicated using a warning symbol near the label, in this way:



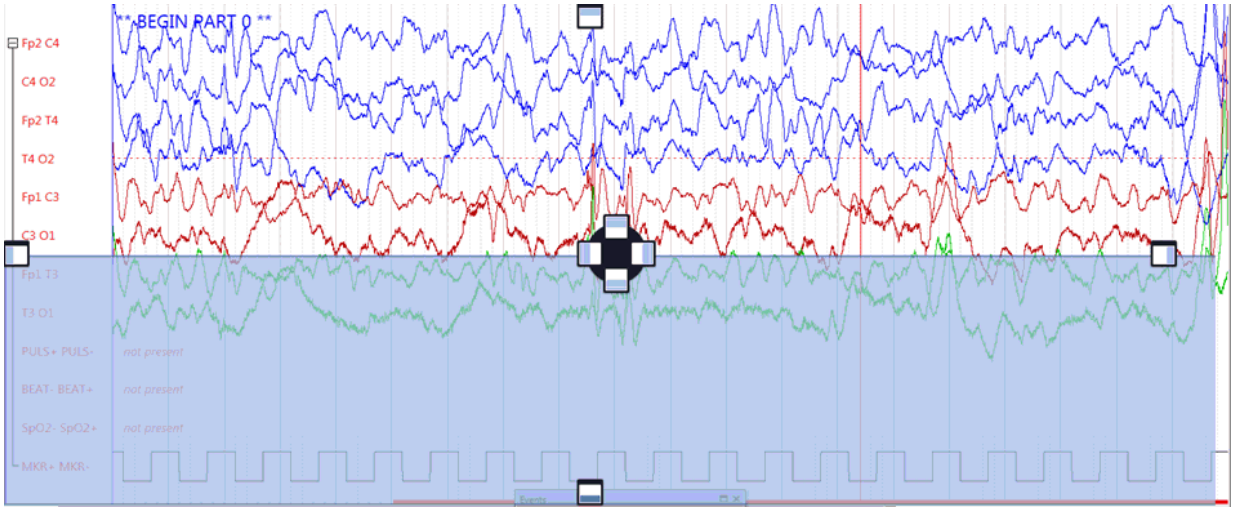
- Traces visualization of one EEG page. Traces are displayed according to their montage options and the number of EEG seconds that will be visualized can be changed from base time option in Ribbon bar. In EEG page also the events are displayed related to the position in which they were inserted with a vertical bar if the event is on all lines or using a selection on a line.

VIEW CUSTOMIZATION

BRAIN QUICK SOFTWARE allows the user to define size and position of all its windows and panels. BRAIN QUICK SOFTWARE's panels and windows can be moved by clicking on their title bar and then dragging them to the desired position.

In order to modify height and width of panels and windows, point the mouse cursor on the panel's/window's edge and, when the cursor turns into a two-sided arrow, click and drag the panel's/window's edge until the desired dimension is reached.

All BRAIN QUICK SOFTWARE's panels are dockable panels. A dockable panel is a layout panel that provides an easy docking in preset positions. When dragging one of the panels BRAIN QUICK SOFTWARE displays all the preset positions in which the panel can be docked. Just release the panel over a docking position and the panel will be docked in that location. Panels can be docked on the left, right, top, bottom, or center of the window.



BRAIN QUICK Software's panels can be also dragged to locations different from docking positions. In this case, the panel will remain floating.

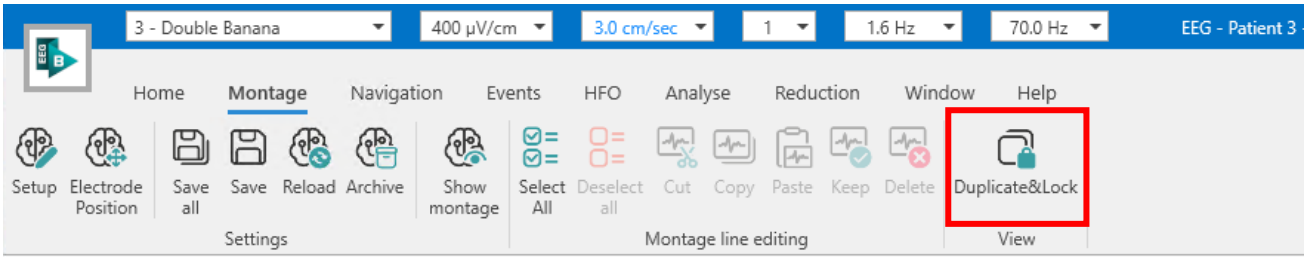
The windows placement defined by the user before the EEG window closure will be restored when the window is reopened keeping the last size and position set.

Windows placement memorization depends on the number of windows opened and on the window's type (EEG or Report), so the system saves and restores the last size and position used with 1 EEG window, with 1 Report window, with 2 EEG windows, with 1 EEG window + 1 report window, and so on.

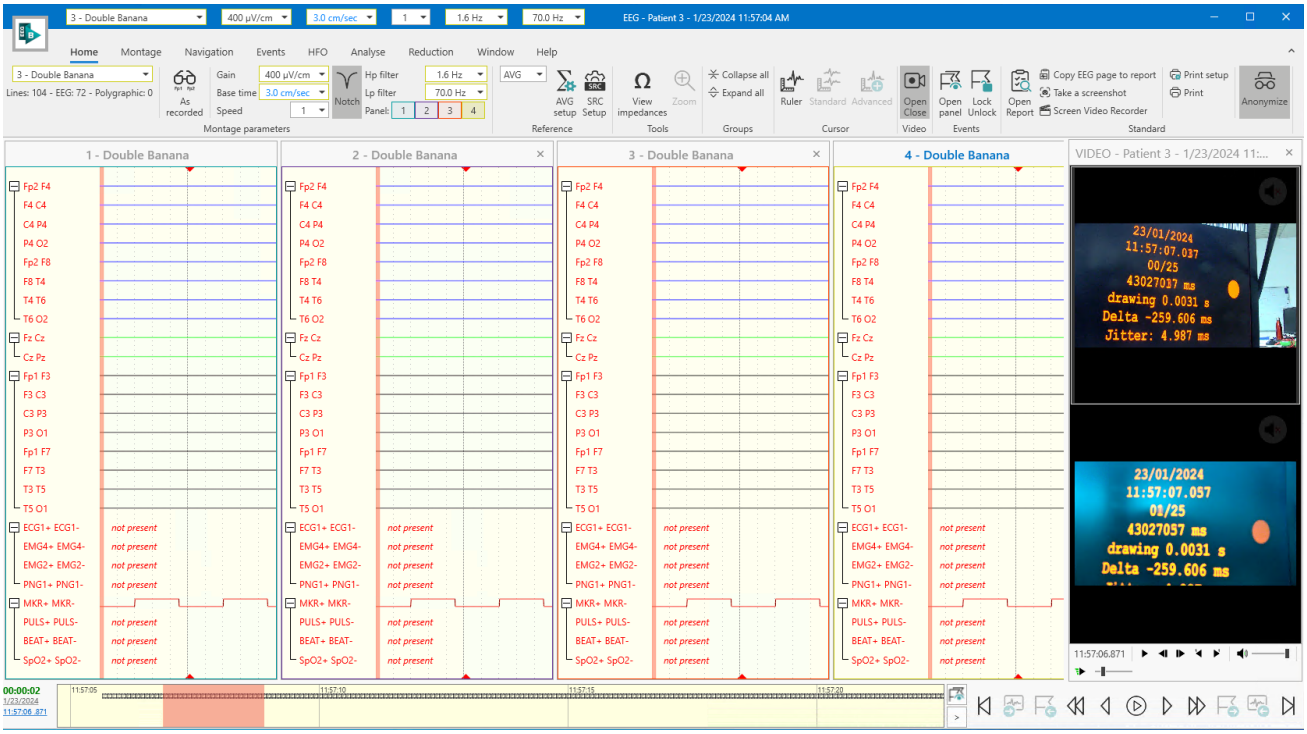
BRAIN QUICK Software makes sure the windows are placed exactly where the user wants them every time he opens them; moreover, windows and panels disposition can be associated to the user logged in the machine.

DUPLICATE AND LOCK

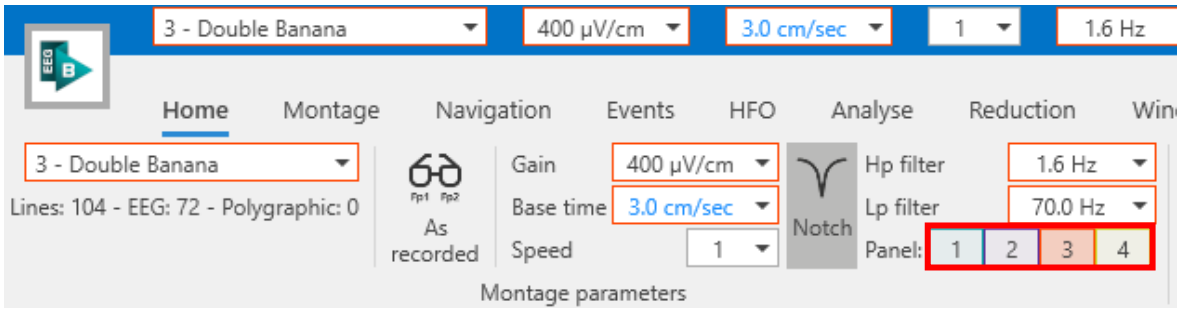
"Duplicate and Lock" function can be enabled from Montage Tab with a dedicated button.



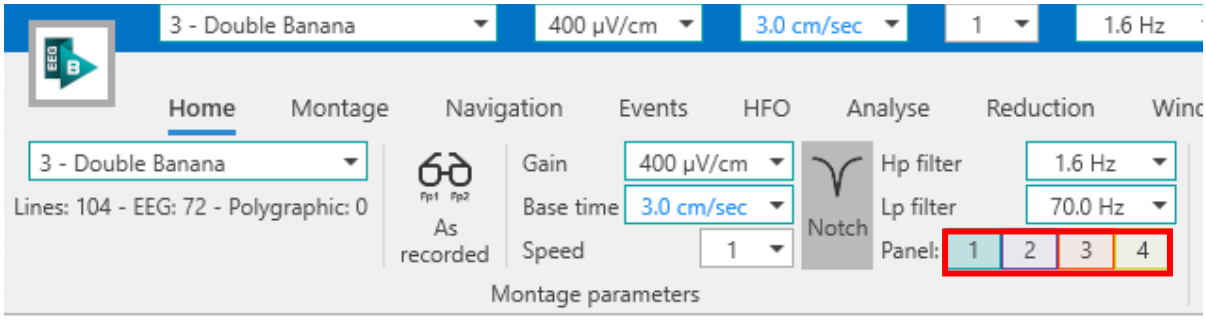
Duplicate and Lock function automatically opens additional panels for EEG visualization. The panels are synchronized and allow the user to scroll the trace, play video, modify montage and visualization parameters, analyze the EEG and insert notes and events. The user can have different EEG visualizations in different panels:



By default, montage is the same of primary window and can be modified. To change montage and modify lines parameters on a single panel, the user can either click on the panel or select it from Montage Parameters group in Home Tab. Once one panel is selected, the parameters border color changes according to the selected panel. Parameters will be highlighted in different colors depending on how many panels are open.

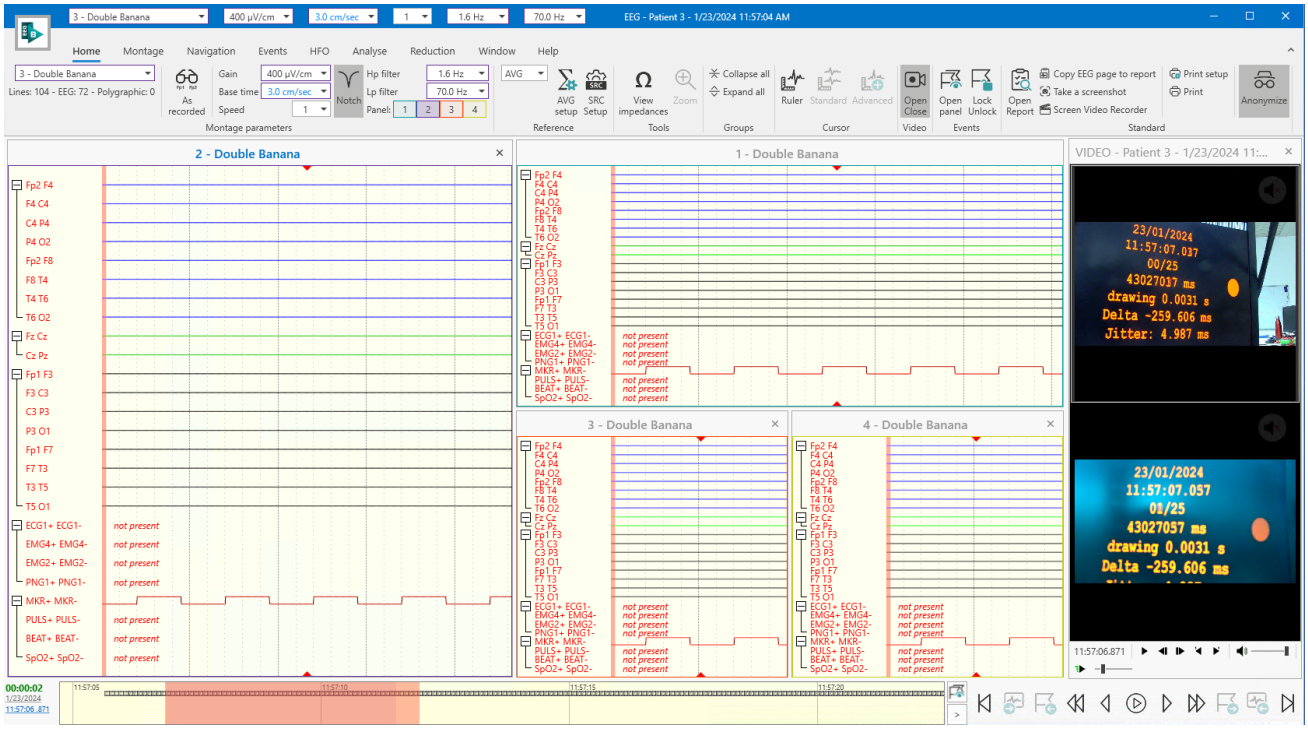


Montage parameters in case of third panel selected (red)



Montage parameters in case of first panel selected (light blue)

User can change montage parameters (Montage, Gain, Base Time, HP and LP filters) modifying them after panel selection. Show Montage function, available from Montage Tab, always displays montage related to first panel.
The function allows to open up to 4 synchronized EEG panels at the same time. Panels are dockable, so the user is able to drag and drop them to the desired position, even using multiple monitors.
To scroll through the EEG recording when Duplicate and Lock is enabled the user can use the buttons from Navigation tab of the Ribbon Bar, the buttons of the Navigation Bar or keys from the keyboard (see section Shortcuts). In case of Video EEG recording, video player buttons can also be used.



If the user starts Autoscroll feature when Duplicate and Lock is enabled, all EEG panels will scroll the trace according to the selected speed, and the user can stop Autoscroll from one of all open panels.

Duplicate and Lock function is available even during acquisition to visualize synchronized EEG acquisition in different panels, in case of high number of channels recorded, or in the case user needs to view the recording trace with different montages.
The workflow to enable and use duplicate and lock function is identical.

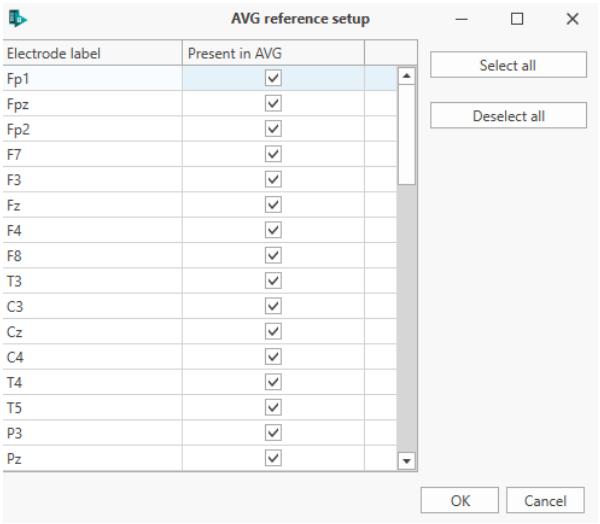
SIGNAL REFERENCE

The following referencing algorithms can be applied to the signal:

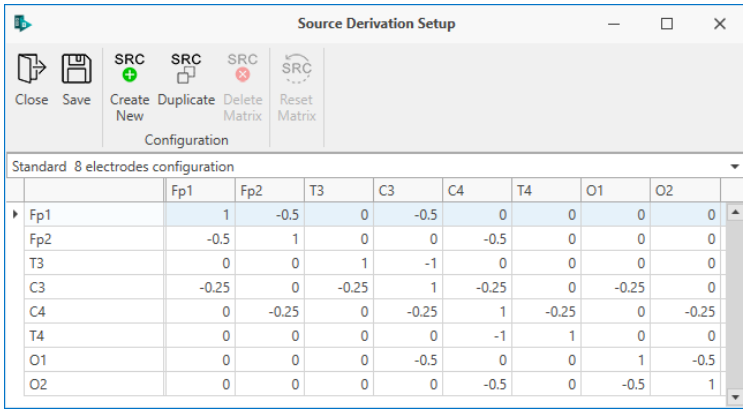
- Average Reference (AVG): visualize data with the reference referring to the average of the signals recorded with all electrodes;
- Bi-Auricular Reference (A1-A2): visualize data with the reference referring to the average of the two signals A1 and A2 recorded on the earlobes;
- Source Reference (SRC): visualize data according to the parameters of the derived reference source (called Laplacian or Hjort derivations).

In particular, the AVG and SRC references have settings, which can be selected from the Home Tab.

AVG settings allows the user to choose which electrodes to include in the AVG calculation:



SRC settings, on the other hand, sets the parameters of the derivation's reference source. Through the present matrix, the user can set the parameters of the reference, creating a new matrix, duplicate it, delete it or reset it.



	Fp1	Fp2	T3	C3	C4	T4	O1	O2
Fp1	1	-0.5	0	-0.5	0	0	0	0
Fp2	-0.5	1	0	0	-0.5	0	0	0
T3	0	0	1	-1	0	0	0	0
C3	-0.25	0	-0.25	1	-0.25	0	-0.25	0
C4	0	-0.25	0	-0.25	1	-0.25	0	-0.25
T4	0	0	0	0	-1	1	0	0
O1	0	0	0	-0.5	0	0	1	-0.5
O2	0	0	0	0	-0.5	0	-0.5	1

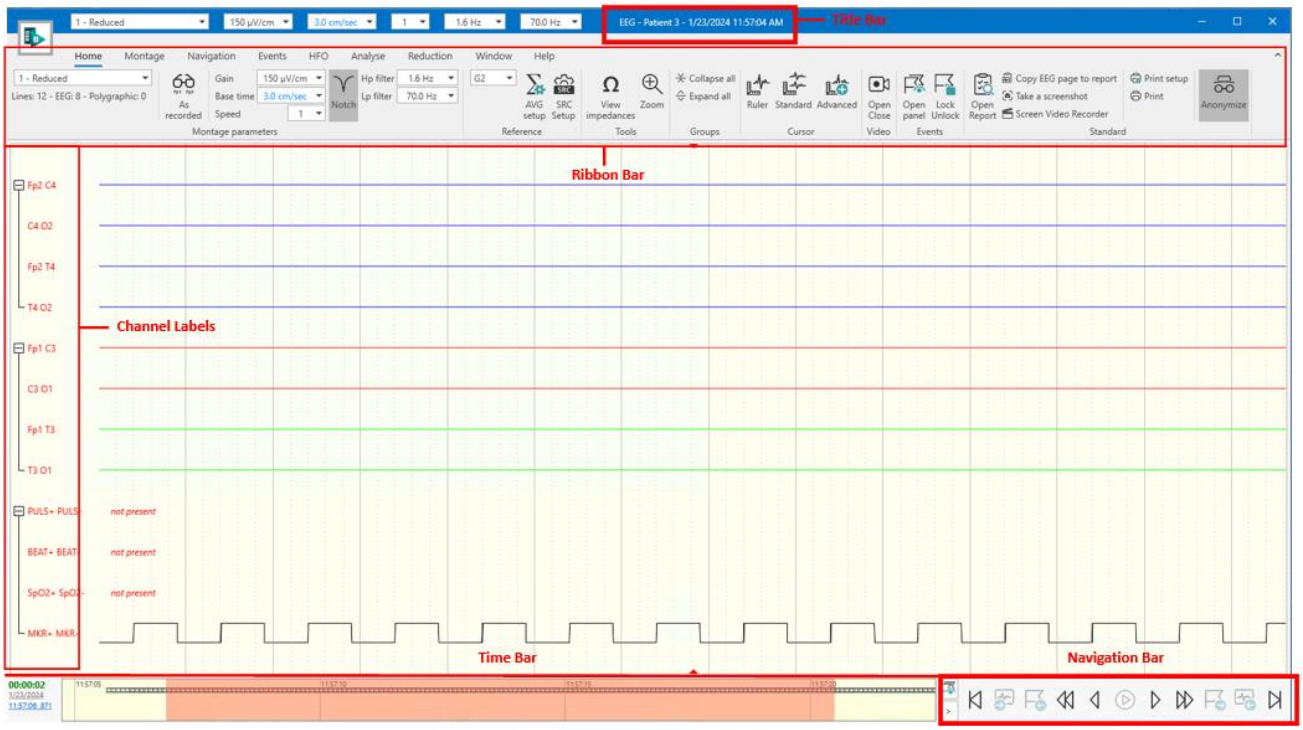
EEG REVIEW

BRAIN QUICK software can read EEG data recorded with SystemPLUS Evolution, with BRAIN QUICK software and with CNS Monitor. The software allows to review also the Video recorded during the exam. To do that, the user shall enable the Video window from the Ribbon bar and move through the recording using the Video window buttons or by dragging the video cursor.

To access the EEG review window, the user must select a patient from the patient list in the Archive section and choose the exam from the exam list and follow the procedures below:

- Click twice directly on the exam icon in the exam list column
- Or click twice on the file icon (trace) in the file list column
- Or click the right mouse button on the exam icon or file icon (respectively on the exam or file columns) and select the **View** function from the menu bar

This way, the user enters the EEG review screen, which is very similar to the acquisition screen. The EEG review screen is the part of the program that is used to review and analyze EEG exams. In the review section, it is possible to review more than one trace at the same time and this allows the user to compare different exams of the same patient or of different patients.
The EEG review screen is sub-divided into four main sections. On the top, there are the menu bar and the toolbars; in the center of the window, there is the display of traces; on the bottom, there is the status bar.

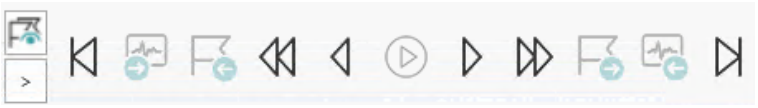


NAVIGATION

The navigation bar is placed under the EEG trace panel and allows all the temporal movements in the trace. From left to right:

- **BEGIN BUTTON:** moves to the beginning of the trace
- **INTERVAL BACKWARD BUTTON:** moves to the previous interval
- **EVENT BACKWARD BUTTON:** moves to the previous event

- **AUTO BACKWARD BUTTON:** automatic scrolls backward
- **PAGE BACKWARD BUTTON:** moves to the previous page
- **PLAY BUTTON:** starts/stops video play
- **PAGE FORWARD BUTTON:** moves to the next page
- **AUTO FORWARD BUTTON:** automatic scrolls forward
- **EVENT FORWARD BUTTON:** moves to the next event
- **INTERVAL FORWARD BUTTON:** moves to the next interval
- **END BUTTON:** moves to the end of the trace

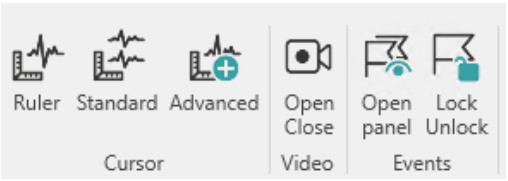


There are other movement functions that could be called from hotkeys (see Shortcuts topic) and not associated with buttons in the Navigation bar, like:

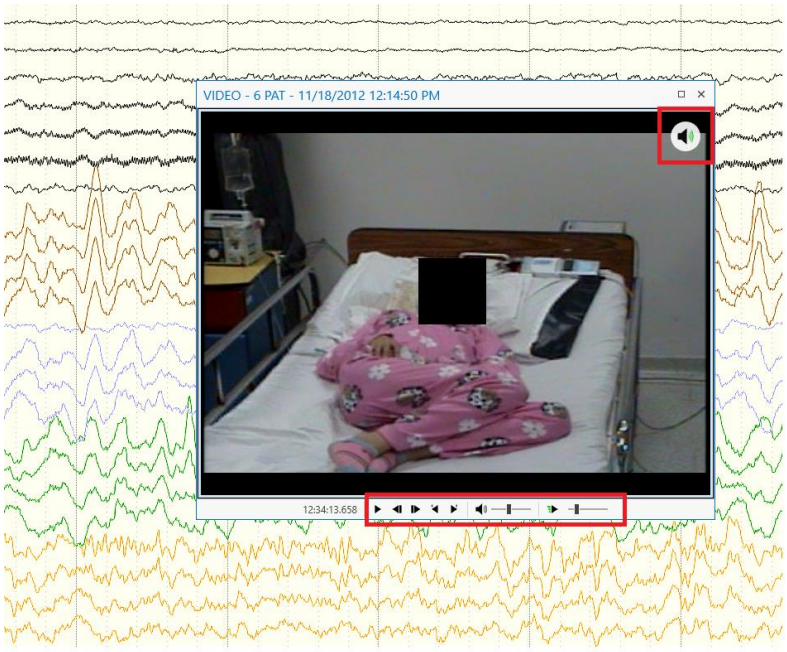
- **HALF PAGE BACKWARD**: Shift + Left Arrow
- **HALF PAGE FORWARD:** Shift + Right Arrow
- **ONE SECOND BACKWARD**: Ctrl + Left Arrow
- **ONE SECOND FORWARD**: Ctrl + Right Arrow
- **INCREASE SPEED AUTO SCROLL**: *
- **DECREASE SPEED AUTO SCROLL**: /

VIDEO REVIEW

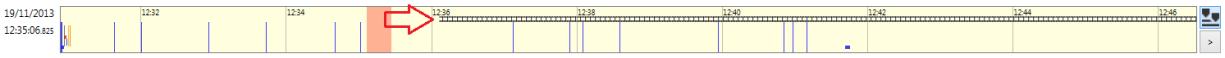
Video window allows video review and enables video cursor at the same time. Video window can be opened/closed from Ribbon bar > Home tab:



Video window provides an intuitive, easy-to-use interface to play Video files recorded during EEG acquisition:



The presence of Video files on a particular part of the EEG recording is underlined in the Time bar by a horizontal line with "cinematographic film" style:



If the video line is present in the current EEG page it means that a video file can be opened and played.
If the video line is not present the video window can be opened anyway, but no image will be displayed because in that part of the EEG the Video was not recorded. In this case a NO VIDEO warning will appear on the video window.

Video window can be floating in the position of interest in the EEG window or can be docked to one of the preset positions in the EEG window (see sections “Dock Panel Layout” and “Windows Placement”). Video window can also be placed on a second screen. To move Video window, just click on its header and drag it to the desired position.
The height and width of Video window can also be modified. To resize Video window just hover the mouse on one of its edges. When the cursor turns into a two-sided arrow, click and drag the window edge until the desired dimension is reached.

Video Play

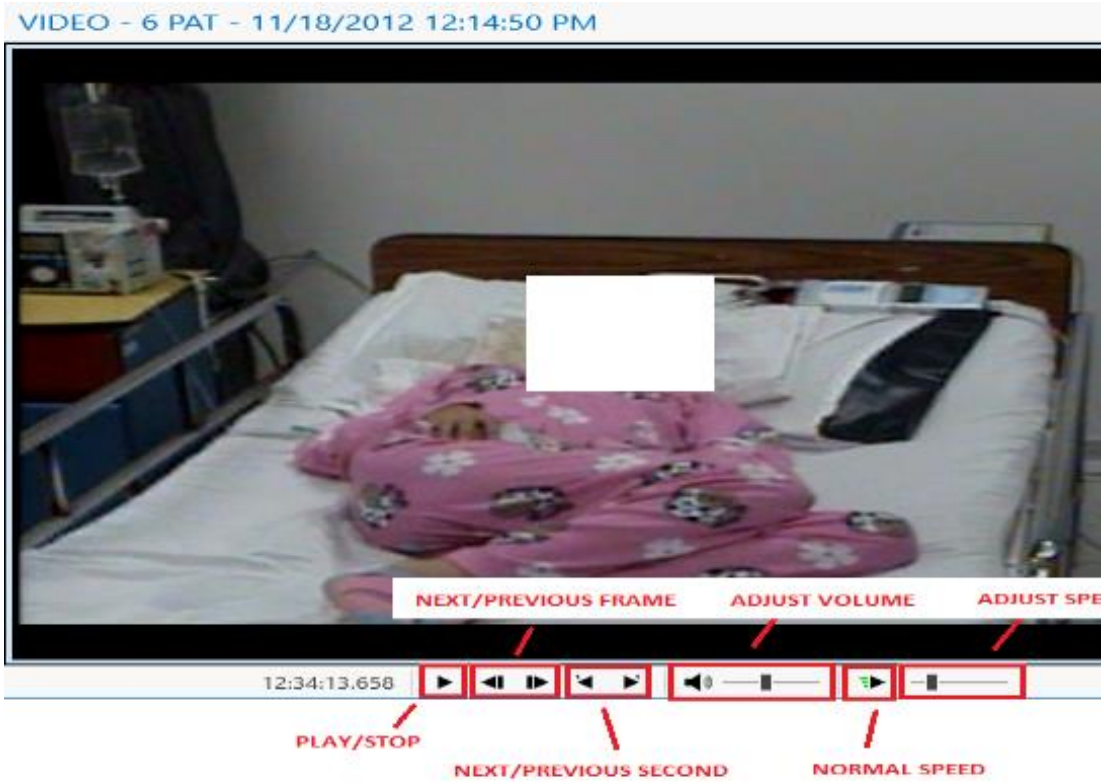
After clicking on **Open/Close Video** button, the Video window opens and a Video cursor appears on the trace. Video Cursor is a red vertical bar having width 1 frame and indicates the exact point on the EEG page, which corresponds with the image displayed by the Video window.
The user can manually move video cursor dragging it with the mouse for an accurate visualization of patient movements during particular EEG activities.
Video window displays patient and recording date information on its header and contains also information about the date/time of the video in visualization, which are displayed in yellow on the bottom right of the Video window.

Video window provide a set of buttons, placed under the video image, to:

- PLAY/STOP the video
- Move to PREVIOUS/NEXT FRAME

- Move to PREVIOUS/NEXT SECOND
- Enable/disable VOLUME
- Adjust the VOLUME
- Restore DEFAULT VIDEO SPEED
- Increase/decrease VIDEO SPEED
- Toggle FULL SCREEN VIDEO

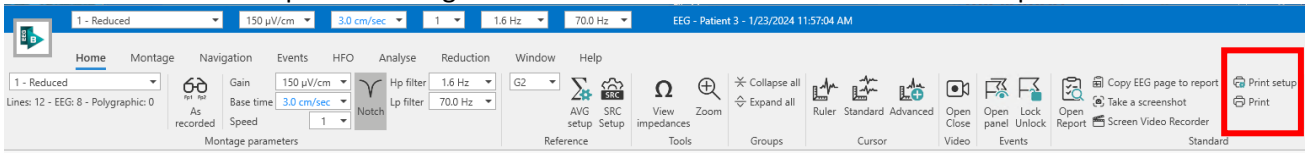
NOTE: TOGGLE FULL SCREEN button is present only if Video window is floating.



The user can also start/stop video play by using spacebar.
The video image can be **zoomed** using left mouse click selection on the image area to be zoomed. Selecting another area with left mouse click, the zoom will increase. To de-zoom the video image, just double click on it with left mouse button.

PRINT

This function is placed in Home tab from EEG review window and allows the user to print one or more pages of the EEG trace during Exam review. The user can use indifferently the thermal printer (continuous module) or a standard printer single sheet (laser or ink-jet).
The Print function uses printer settings from windows that can be set from Print Setup function.



How to Print an EEG on Paper

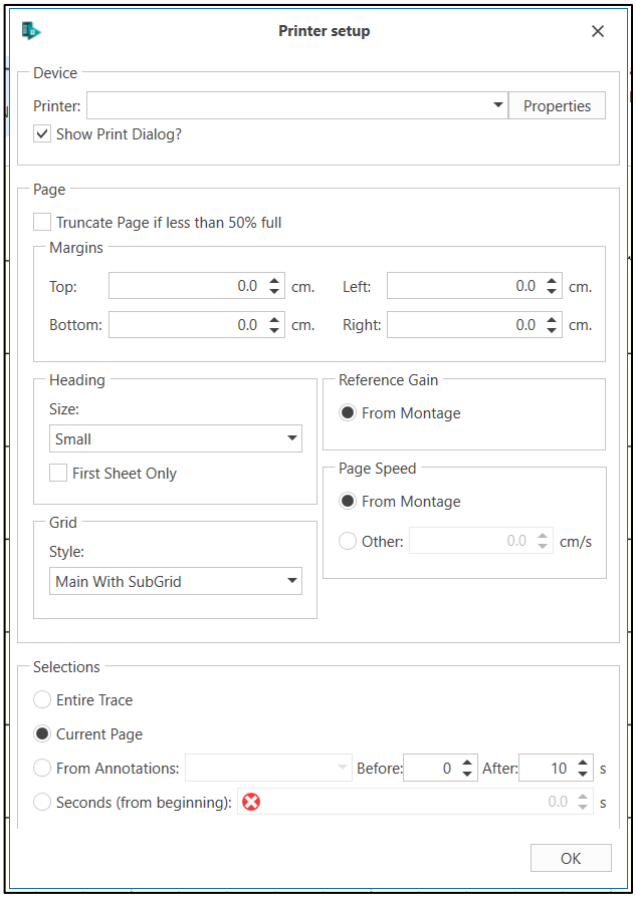
Print and Print setup functions allow the user to print the trace during the review of an EEG exam.

Print Setup: allows the user to set the parameters for the print and the printer:

- Device:
  - **Printer**: a combo menu allows the user to select the printer to use.
  - **Properties**: allows to set up some print settings, such as Portrait/Landscape orientation.
  - **Show Print Dialog?**: enabling this option a dialog window will appear after clicking Print button (before the print process starts). If this option is disabled the print starts immediately after clicking on Print button.

- Page:
  - **Truncate Page if less than 50% full**: if this option is enabled only pages more than 50% full will be printed. Pages less than 50% full will not be printed even if included in the paged to be printed.
  - **Margins**: the user can select a value for the page's Top, Bottom, Left, and Right margins. Margins values must be specified in cm.
  - **Heading**:
    - Size: None, Small, or Large
    - **First Sheet Only**: if this option is enabled an heading with the above specified size will be added only to the first page. If this option is disabled an heading with the above specified size will be added to all pages.
  - **Reference Gain**: From Montage. This means that reference gain is imported from the current montage applied.
  - **Page Speed**: it can be imported From Montage or it can be specified by the user. Page Speed value must be specified in cm/s.
  - **Grid Style**: No Grid, Main Only, Main With SubGrid

- Selections:
  - **Entire Trace**: all the EEG recording will be printed
  - **Current Page**: only the currently visualized EEG page will be printed
  - **From Annotations**: the user can select an event from the list of available Selection events. The EEG included within the Selection will be printed. The user can specify EEG seconds to be printed before/after the event selected.
  - **Seconds (from beginning)**: the user can specify EEG seconds to be printed. Seconds are calculated from the beginning of the EEG recording.



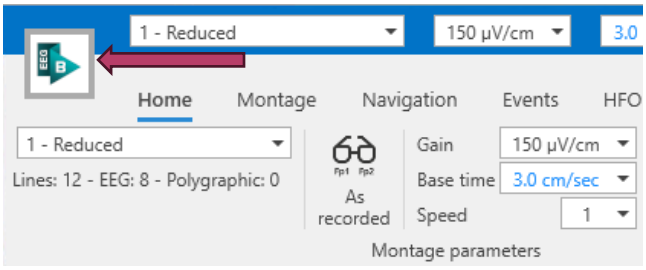
Once the printer setup is configured, the user can press the button **Print** in order to send the job to the selected printer. A prompt dialogue window will appear if this option has been set in the Printer setup, otherwise the print process will immediately start.

EXPORT

BRAIN QUICK SOFTWARE provides different kinds of export functions:

- Export to Ascii
- Export to Edf+
- Export Events
- Export Analyzer Data

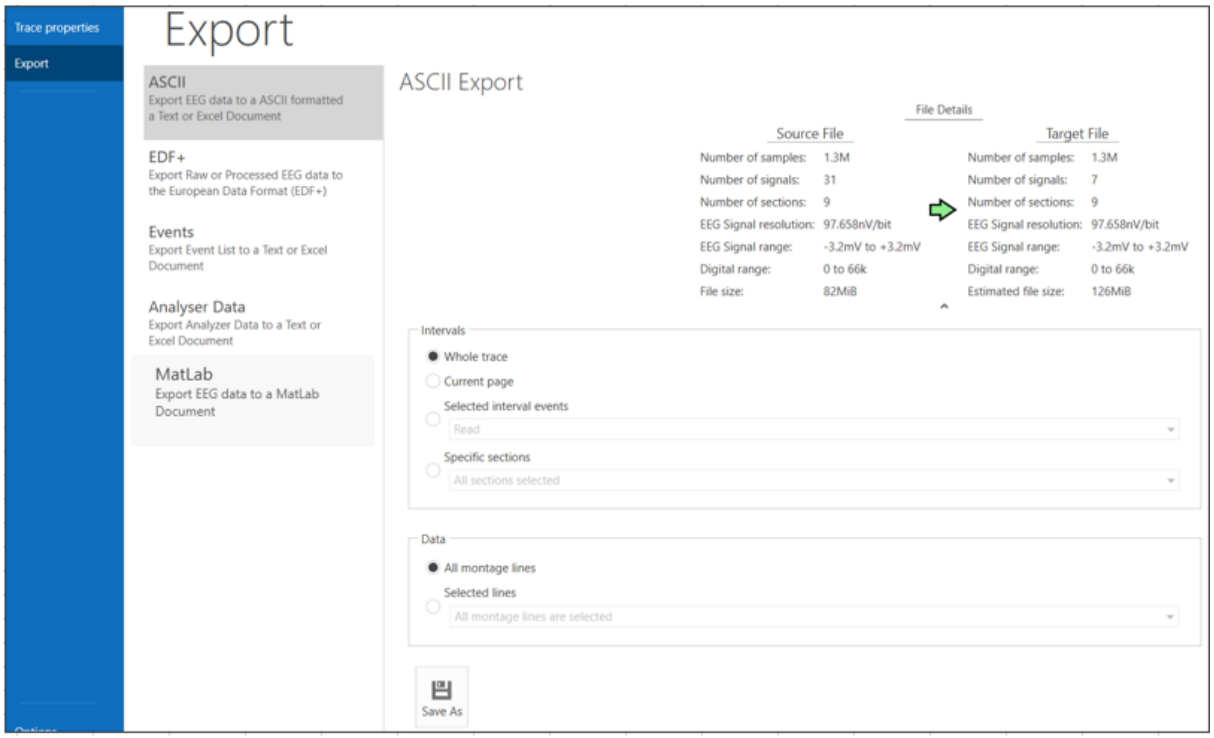
All these functions are available in the menu, which opens by clicking on BRAIN QUICK Application button:



Export to Ascii

This function exports the acquired EEG signal data in a ASCII format file. To export data, follow this procedure:

1. From BRAIN QUICK Application button, select the function **Export Ascii**
2. Select the EEG trace interval to export: Whole trace, Current page, or part of the trace defined by the user's selections
3. Select which montage lines to export: All montage lines or some Selected lines
4. **Save As**

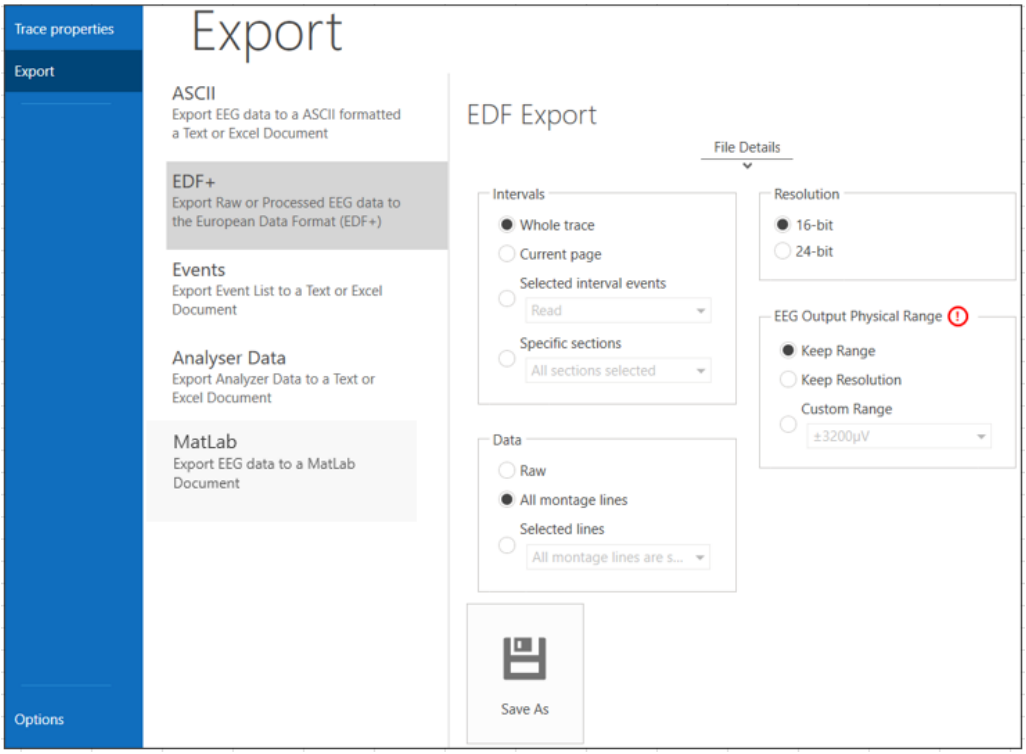


Export to Edf+

EDF formatted files make it easier to use Micromed EEG data for research purposes with external analysis applications. The EDF+ file format support can handle multiple segments using the same Amplifier inputs. The software can support events and sleep scores in multiple segmented EDF+ files. If the exam contains multiple montages (as in As Recorded), multiple EDF+ files are created.

Multiple sleep scores cannot be exported, just the current sleep score. An extra channel is added to the EDF+ file, which is used to store the scores from 0 to 9.

1. From BRAIN QUICK Application button, select the function **Export Edf+**
2. Select the EEG trace interval to export: Whole trace, Current page, or part of the trace defined by the user's selections
3. Select which montage lines to export: All montage lines or some Selected lines
4. Select resolution (16 or 24 bit)
5. Select EEG Output Physical Range
6. **Save As**



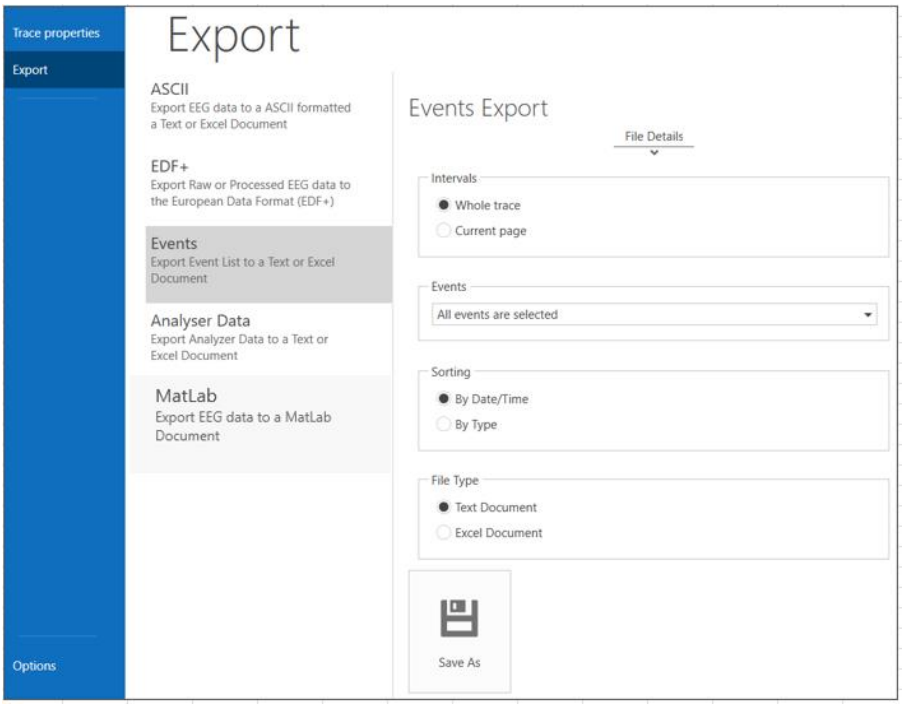
The same procedure can be applied to export the EEG trace in Edf+ starting from raw EEG data. To export raw data, the user has to select the function **Export Edf+ from raw** from the menu on the left.

Note: 24-bit export is available only for trace acquired at 24 bits

Export events

This function exports the list of the events of the exam, according to the settings specified by the user:

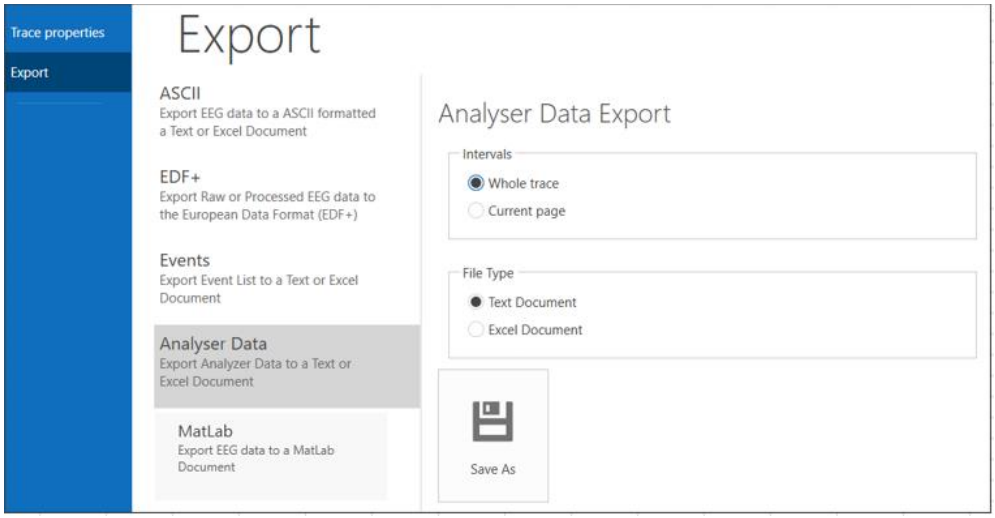
1. From BRAIN QUICK Application button select the function **Export Events**
2. Select the EEG trace interval to export: Whole trace or Current page
3. Select which types of events to export
4. Select how to sort the events to export: Sort by begin time o Sort by type
5. Select the document format: Text document or Excel document
6. **Save As**



Export Analyzer data

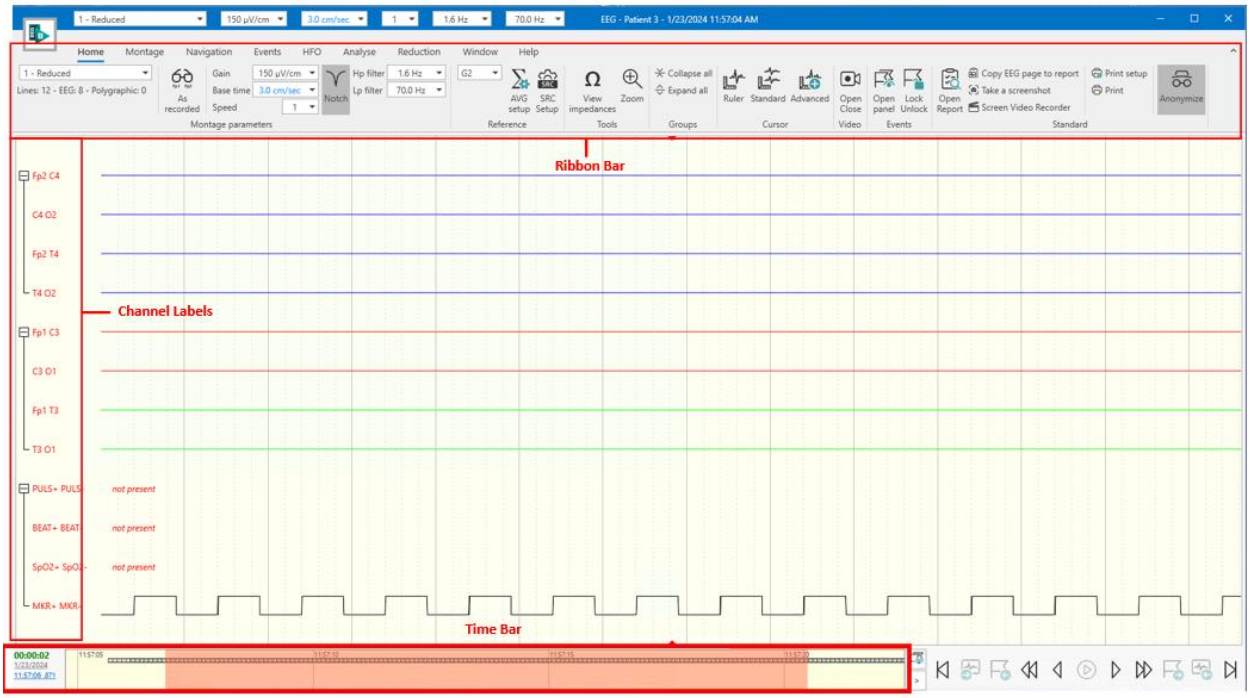
This function exports the numerical values obtained by analyzer calculations, according to the settings specified by the user:

1. From BRAIN QUICK Application button select the function **Export Analyser Data**
2. Select the EEG trace interval to export: Whole trace or Current page
3. Select the document format: Text document or Excel document
4. **Save As**

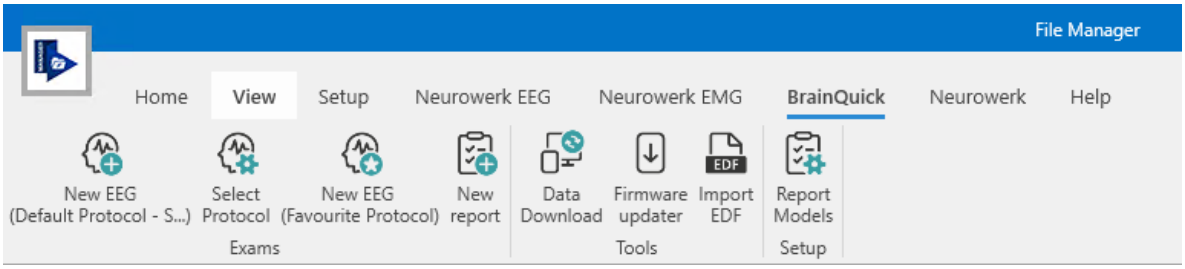


EEG ACQUISITION

The acquisition window allows the user to record either an EEG or Video EEG exams. Acquisition is performed by technicians using an acquisition headbox that requires the configuration of certain parameters. The signal is displayed according to the criteria grouped in the Montage tab.
The fundamental concept that must be kept in mind is the way in which the acquisition takes place. The headbox always works with a fixed sampling rate and has only minimal hardware filtering, this means that the signal is always saved referenced to G2 and with maximum bandwidth, being then displayed with desired leads, references and values of filters and amplification.
Connect contains all parameters related to the hardware part, such as sampling rate, Maximum signal amplitude, number and type of channels acquired, and more. All parameters related to the display (leads, filters, Notch Filter, amplification, reference) are contained in the Montage section. These parameters can be changed or modified at any time.
The EEG acquisition screen is divided into four main sections. At the top are the menu bar and toolbars; in the center of the window is the Trace Display; to the left side is the Channel Label; and finally at the bottom is the Status Bar.

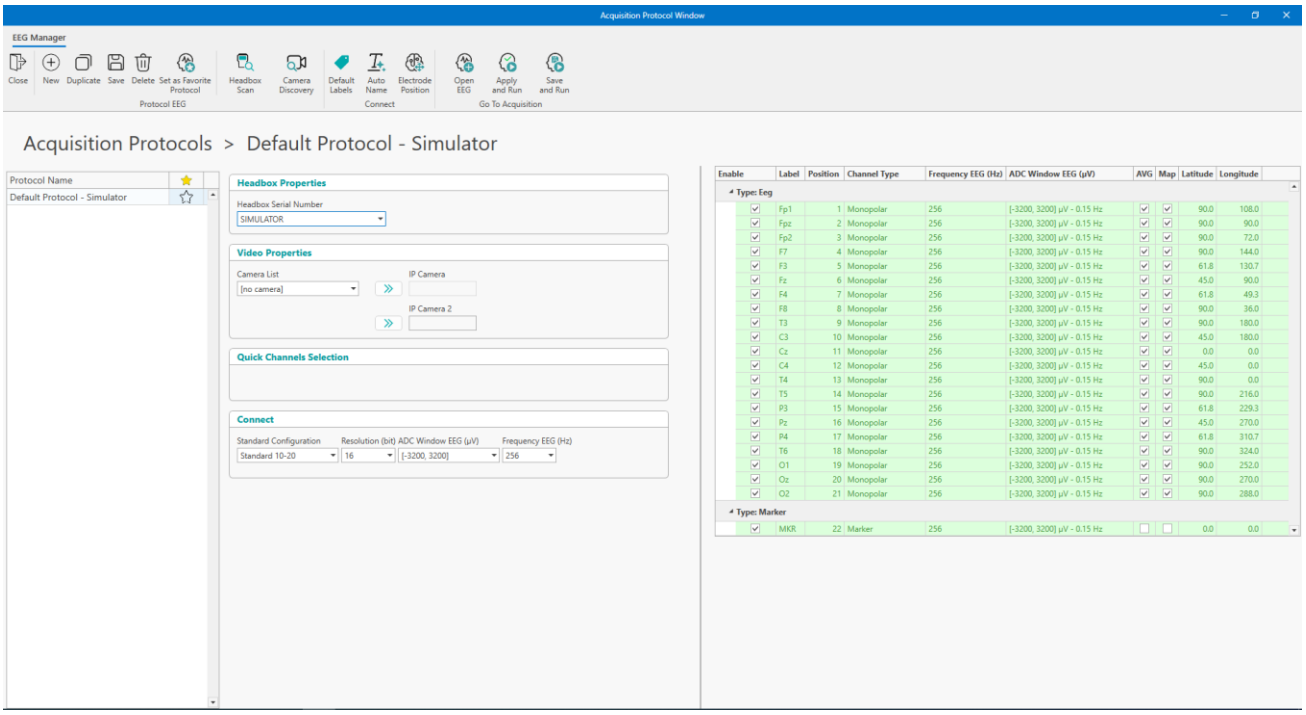


From the archive the user can open a new acquisition window, select or create a new protocol, start a New EEG using the default protocol, create a new report, data download from a device, Update the firmware of a device connected, Import an EDF or create a new report model, via the BrainQuick tab.

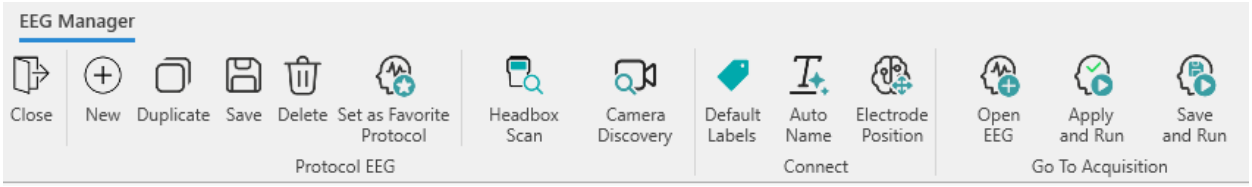


ACQUISITION PROTOCOL WINDOW

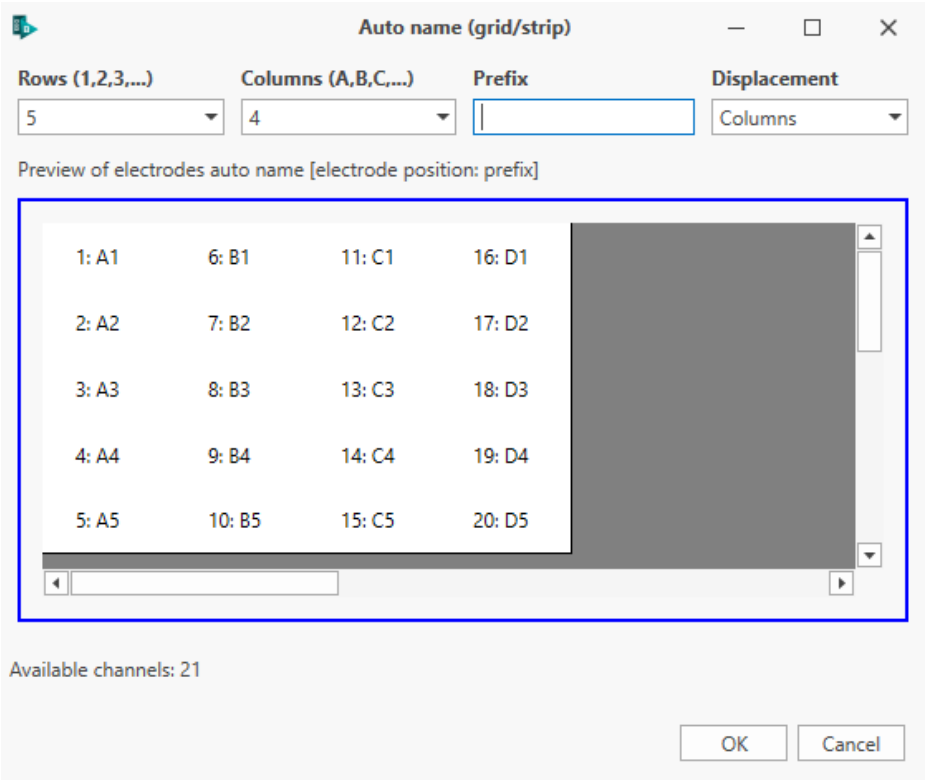
By clicking on "Select Protocol" button from the Brain Quick tab, a window appears divided into three parts: the list of protocols created on the left, general protocol properties in the middle and connection properties on the right.



The tab is divided by 14 buttons:



- "Close": if the user is editing a protocol or creating one, this button allows to return to the initial protocol selection screen;
- "New": allows the creation of a new protocol.
- "Duplicate": allows duplication of an existing protocol.
- "Save": allows saving changes to an existing or newly created protocol.
- "Delete": allows deletion of the selected protocol.
- "Set as Favorite Protocol": allows to select a protocol as default, in order to start an acquisition from the BrainQuick Tab.
- “Headbox Scan”: allows starting a new headbox discovery
- “Camera Discovery”: allows starting a new camera research on the network
- "Default labels": inserts the default labels corresponding to the associated headbox.
- “Auto name”: allows to insert the labels and prefixes to a grid or a strip electrodes, depending on the rows and columns chosen.



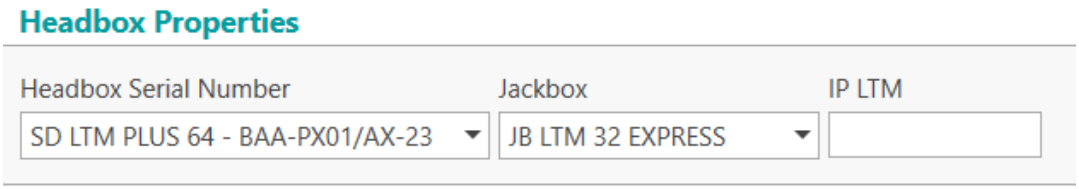
- “Electrode position”: allows to open electrode position window (more information in its section).

More details regarding the section of the acquisition protocol window are in the next paragraphs.

- "Open EEG": once a protocol is selected, it allows to open a new acquisition window with the decided parameters.
- "Apply and Run": allows to apply the changes made to the selected protocol and to run the acquisition.
- "Save and Run": allows to save the changes made to the selected protocol and to run the acquisition.

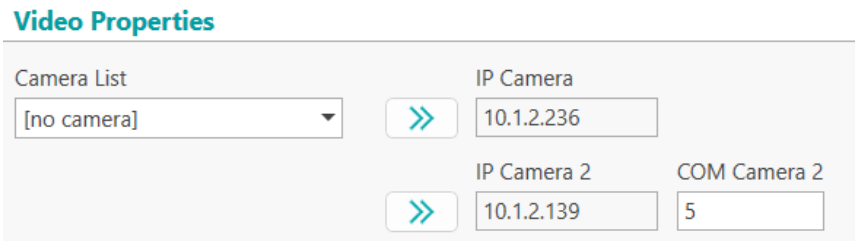
Headbox properties

In this section it’s possible to choose the headbox from the available ones found by Brain Quick Software. There is a drop-down menu with all the available devices. On the side, there is the possibility to select the desired Jackbox and to enter the headbox IP if you are using an SD LTM 32/64 PLUS.



Video properties

In the video settings, one or two cameras can be associated with the protocol, so the user has the possibility to record Video EEG during acquisition. In order to view the available cameras, click on the "Camera List" and select the one desired. It’s possible finally to associate the chosen camera with Camera 1 or 2 by pressing the small arrow next to one at the corresponding box. If a camera is not available, it will be notified to the user through a warning. The cameras listed in the camera list are identified within the subnet specified in the Micromed Suite's “Camera Settings” section. For additional details, refer to the installation manual of Brain Quick Software 3.05.

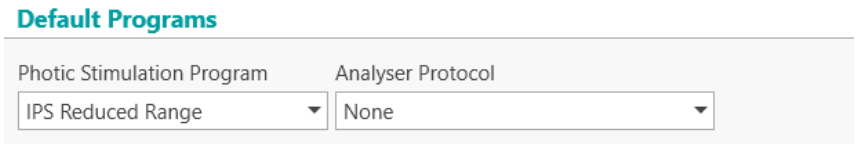


BRAIN QUICK software also recognizes if the selected camera is a VISCA type, also ensuring association with the COM port from where PTZ movement of the camera can be controlled.

User can remove cameras from protocol by choosing “No Camera” option from dropdown menu and by pressing the small arrow next to one at the corresponding box.

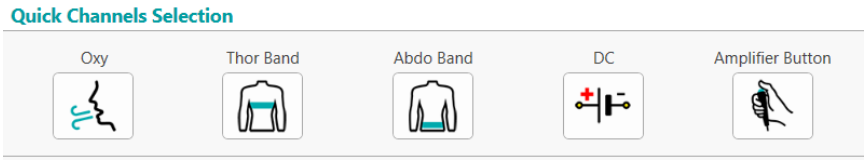
Default programs

In this section it’s possible to select default Photic Stimulation Programs and Analyzer Protocols that will be automatically loaded for acquisition. In the case displayed below the user will find “IPS Reduced Range” Photic Program enabled by default and analyzer not enabled by default. The user will be able to modify these programs in every moment during the acquisition.



Quick channels selection

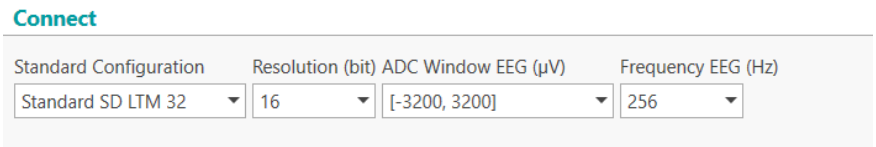
In this section it’s possible to enable and disable special channels management, such as OXY, THOR, ABDO, DC It is even possible to enable and disable the Amplifier button management.



Connect

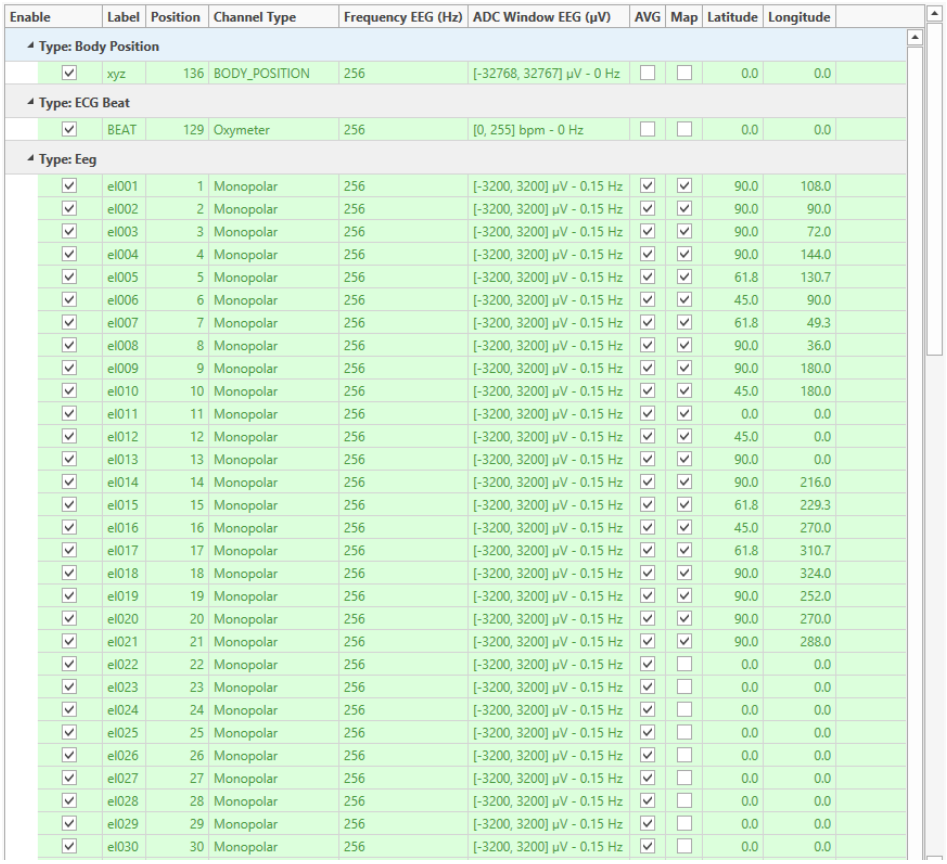
'Connect' means the setting of the input channels of the acquisition device (the 'headbox').

The 'connection' indicates which channels are active for acquisition and their settings, including: the sampling rate, the resolution (in bits) of the analog-to-digital conversion, and the quantization ADC window (in µV) for the EEG channels.



In addition, it is possible to choose the channels to be enabled and personalize their label typing the desired name on “Label” section of the desired channel.

The channels in the list are divided by type: EEG (Monopolar or Bipolar), marker, oxymeter, DC, Body_position, Thor, and Abdo.

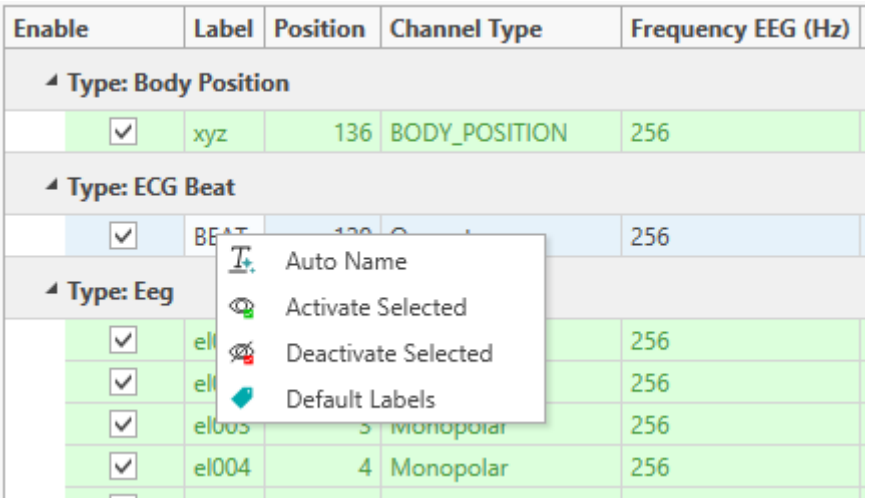


Enable	Label	Position	Channel Type	Frequency EEG (Hz)	ADC Window EEG (µV)	AVG	Map	Latitude	Longitude
Type: Body Position									
☑	xyz	136	BODY_POSITION	256	[-32768, 32767] µV - 0 Hz	☐	☐	0.0	0.0
Type: ECG Beat									
☑	BEAT	129	Oxymeter	256	[0, 255] bpm - 0 Hz	☐	☐	0.0	0.0
Type: Eeg									
☑	el001	1	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	90.0	108.0
☑	el002	2	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	90.0	90.0
☑	el003	3	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	90.0	72.0
☑	el004	4	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	90.0	144.0
☑	el005	5	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	61.8	130.7
☑	el006	6	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	45.0	90.0
☑	el007	7	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	61.8	49.3
☑	el008	8	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	90.0	36.0
☑	el009	9	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	90.0	180.0
☑	el010	10	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	45.0	180.0
☑	el011	11	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	0.0	0.0
☑	el012	12	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	45.0	0.0
☑	el013	13	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	90.0	0.0
☑	el014	14	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	90.0	216.0
☑	el015	15	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	61.8	229.3
☑	el016	16	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	45.0	270.0
☑	el017	17	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	61.8	310.7
☑	el018	18	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	90.0	324.0
☑	el019	19	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	90.0	252.0
☑	el020	20	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	90.0	270.0
☑	el021	21	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☑	90.0	288.0
☑	el022	22	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☐	0.0	0.0
☑	el023	23	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☐	0.0	0.0
☑	el024	24	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☐	0.0	0.0
☑	el025	25	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☐	0.0	0.0
☑	el026	26	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☐	0.0	0.0
☑	el027	27	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☐	0.0	0.0
☑	el028	28	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☐	0.0	0.0
☑	el029	29	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☐	0.0	0.0
☑	el030	30	Monopolar	256	[-3200, 3200] µV - 0.15 Hz	☑	☐	0.0	0.0

In this list it is possible to select the channels to be included in the AVG reference. By flagging the checkbox of channel in the AVG column, the channel will be used to calculate the AVG reference. Only monopolar channels can be used for the calculation of the AVG reference.

If an electrode in the acquisition protocol is currently mapped to a spatial position of the brain, the relative flag in the MAP column is checked. In order to remove the mapping for one or more electrodes, the user must open the Electrode Position window using the toolbar icon (more details in the Electrode Position section).

Right clicking on a single channel or on a channel selection (created with Shift + Click or Ctrl + Click), it is possible to select among four options:



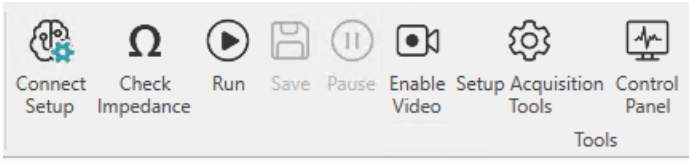
- **Auto Name** opens Auto Name window and allows to rename labels starting from the selected electrode

- **Activate Selected** activates the selected electrode or group of electrodes
- **Deactivate Selected** deactivates the selected electrode or group of electrodes
- **Default Labels** assigns the default labels from the first default standard configuration

ACQUISITION WINDOW

Once the protocol to be used has been created or chosen, the window for acquisition can be opened.

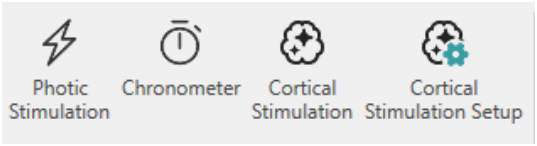
In addition to the montages to use - functions present in both acquisition and review - the main buttons for managing acquisition are grouped in the "Tools" section of the Home Tab:



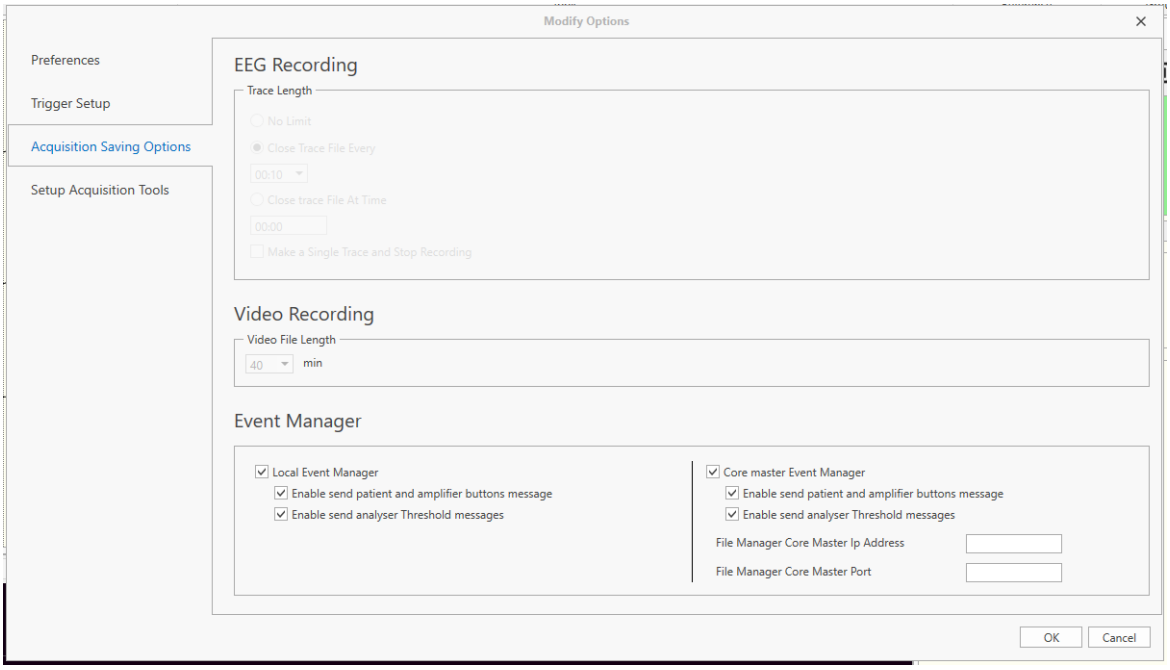
Connect Setup button allows to open the protocol in order to modify it, while the Check Impedance, Run, Save and Pause buttons handle the checking impedance, starting, saving, pausing the acquisition, respectively. Finally, the Setup button opens a settings window for photic stimulation, chronometer and quick notes and the Control Panel button opens the Acquisition Status Panel, as we will see in the following sections.

Note: The options present by opening the window with the setup button are also present by clicking on Application button > Properties.

On the "Tools" section there are also buttons to enable photic stimulation, chronometer and cortical stimulation and cortical stimulation setup. Photic Stimulation allows to open photic stimulation panel to start a stimulation, Chronometer opens chronometer interface, while Cortical Stimulation opens cortical stimulation panel which allows to start a new stimulation. Cortical Stimulation Setup instead open setup for cortical stimulation. Detailed discussion of these features can be found in the following sections.



In the end, it is possible to decide the trace length and the video recording length by clicking on Application Button > Preferences > Acquisition Saving Options:



From this window the user can enable messages exchange to Event Manager. The user can enable the use of a Local Event Manager or/and the communication to the File Manager Core Master. The user can decide whether to enable Amplifier Buttons message or analyzer threshold messages to be sent. In case of communication with the File Manager Core Master the required parameters are File Manager Core IP Address and Port. “Event Manager” section is available only in case EVENT MANAGER license is enabled in the acquisition machine. More details about Event Manager are described in Advanced Guide Installation Manual.

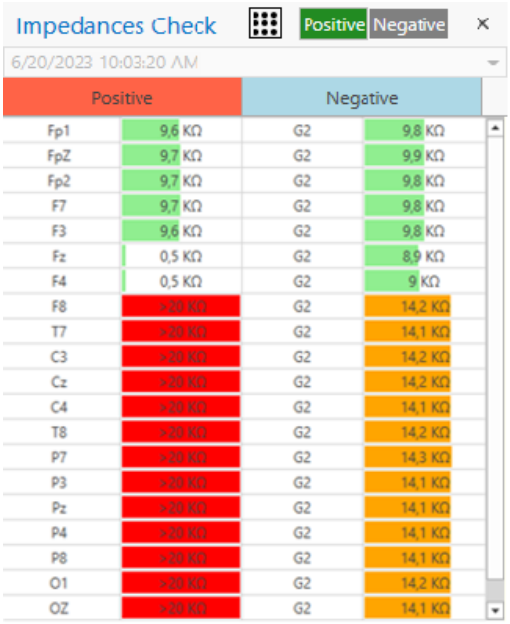
CHECK IMPEDANCE

From the "Check impedance” button, it is possible to view the value of the impedances of the headbox channels. Check Impedance can be enabled during acquisition even without pausing the recording: in this case, recording is automatically paused and impedances check is executed.

This panel can be used to view impedance values during EEG acquisition and check cable connections and adjust impedances between electrodes and the patient's skin. The measured impedance values can be saved in the recorded EEG file and read back at any time during the acquisition.

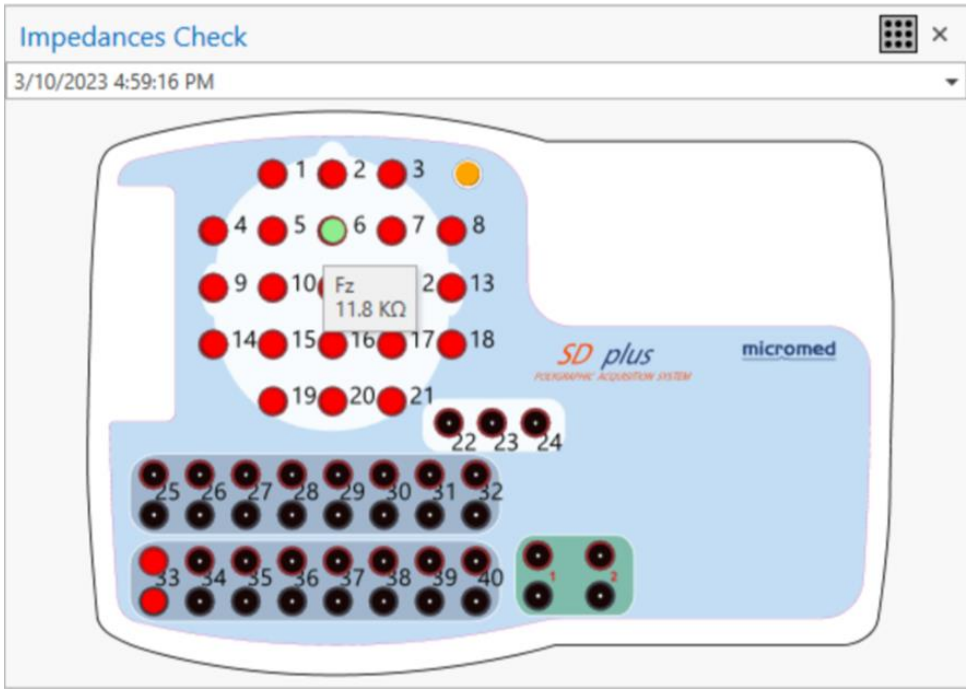
The Impedance Check panel offers two visualisation modes:

- a table with the list of impedance values for all the active channels
- a headbox image with channels colored in different way according to the impedance value



In the first visualization mode, the table shows the list of active channels with relative current impedance for both positive and negative inputs. For each input, then, a different color is associated according to the measured impedance: white if tending to 0 KΩ, green below 10 KΩ, orange between 10 and 20 KΩ, red if higher, as also shown in the figure.

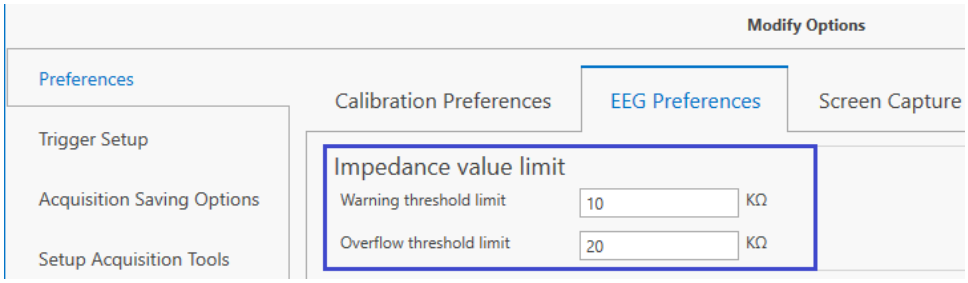
Note. Threshold limits considered in the impedance check can be customized; default values are 10 KΩ as warning threshold and 20 KΩ as overflow threshold.



In the second visualization mode, the image of the headbox connected is shown and each input channel is colored in green, orange or red according to the related current impedance value; by hovering the mouse over a specific channel it is possible to see the exact impedance value measured.

It is possible to switch among the two visualization by clicking the button in the top right corner of the impedance check panel.

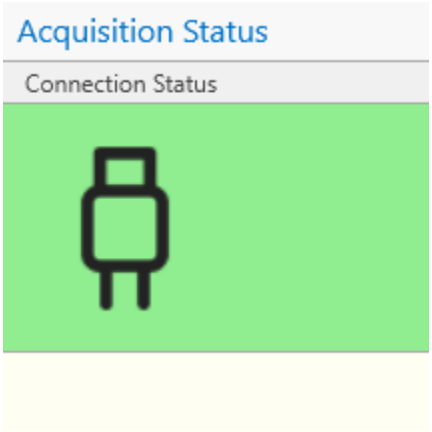
The impedance check is based on the threshold limits set in the software preferences; it is possible to set a warnig threshold limit and a overflow threshold limit by clicking the Brain Quick application button and selecting Preferences > EEG Preferences.



All active input channels with a impedance value below the warning threshold will be highlighted in green, the ones with a impedance value between the warning and the overflow threshold will be colored in orange, the ones with a impedance value greater than the overflow threshold will be highlighted in red.

STATUS CONTROL PANEL

From the "Control Panel" button it is possible to open the status control panel, a window that allows the user to view the type of connection (whether wired or wireless) and the status (connected, recovering or no connection). Below is an example of a wired connection:

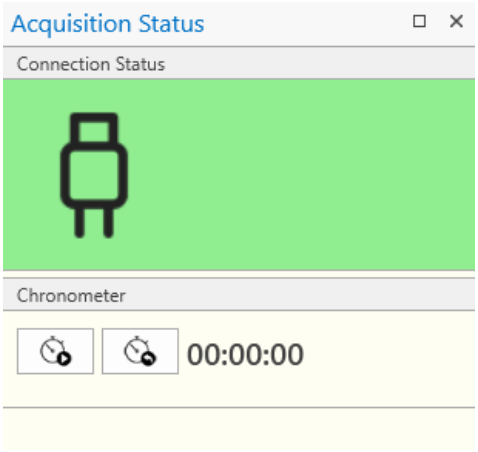


The background will be green when the connection between the headbox and Brain Quick Software is present, yellow when data recovery is in progress showing residual delay, and red when it is absent.

Finally, in the panel, there is the possibility to start the chronometer and photic stimulation procedures, described in the next paragraphs.

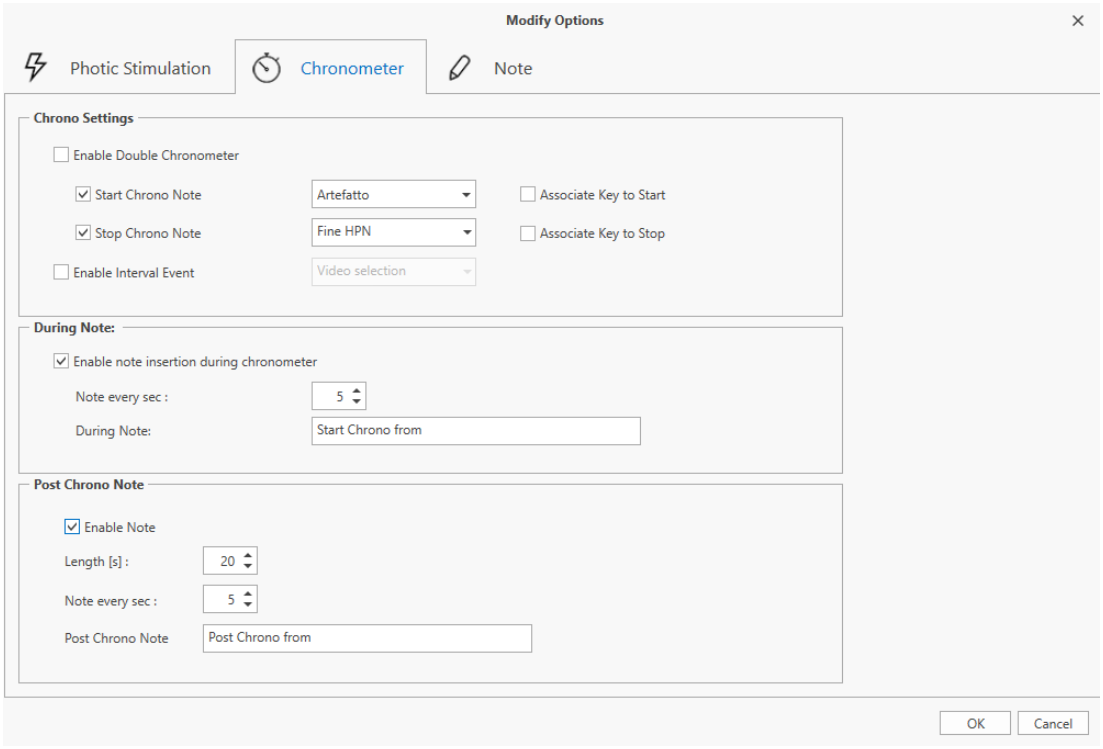
CHRONOMETER

During recording, the user has the option of measuring the duration of a specific event such as hyperventilation. Chronometer needs to be enabled from Ribbon Bar and started by clicking the proper button from the status control panel, where the chronometer controls are displayed.



The first button starts the chronometer, once started it also allows the pause function, which allows the user to stop the time count. The second button allows the user to reset the count to zero. Finally, the elapsed time is displayed in the center of the display in hh.mm.ss.

From the "Setup" button on the Home Tab, the chronometer options tab can be accessed:

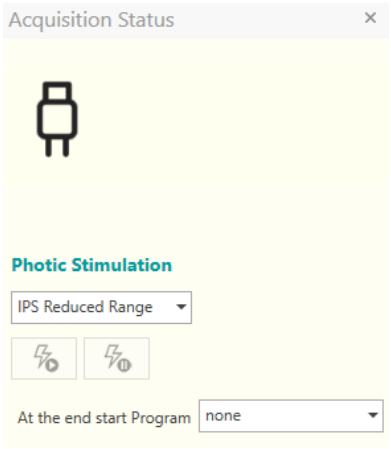


From these settings it is possible to:

- Enable a possible double chronometer;
- Set a start and end note for the duration that the chronometer is running. Chronometer can be started and stopped using Quick Notes
- Enable an event for the interval when the chronometer is running;
- Enable note insertion during and post chronometer.

PHOTIC STIMULATION

During the recording of the examination, the user can enable Photic Stimulation controls from Photic Stimulation button on Ribbon Bar and has the option of starting the photic stimulation by clicking the proper button from the status control panel, where the controls of the photic stimulator are displayed.



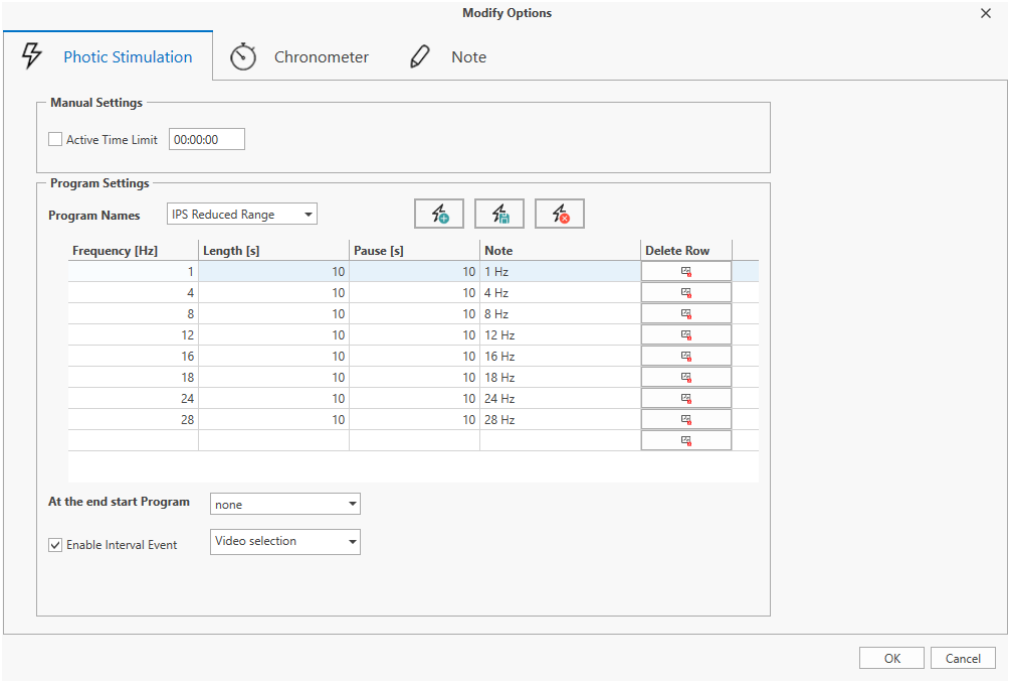
Using a user defined program, the first button allows to start stimulation according to the selected program, while the second one allows to pause the ongoing program. In case of Manual stimulation, the second button is a Single Photic Stimulation. The drop-down menu allows the user to select the program to be used. If "Manual" stimulation is chosen, stimulation is carried out with the frequency set in the box below.

The photic stimulation setup can be opened from Setup Acquisition Tool button on Home Tab or from Acquisition Tools Options tab from application button preferences and contains two sections: Manual Settings and Program Settings.

In the Manual Settings section, it's possible to set a time limit for stimulation (hh:mm:ss), which allows to automatically stop manual stimulation after the time specified from the user.

The Program Settings section allows to create, modify, and delete photic programs that contains an automatic sequence of stimulations. In each sequence of stimulation, it is possible to define the following parameters:

- Frequency (Hz): sets the stimulation frequency.
- Length (sec): sets the duration of the stimulation in seconds.
- Pause (sec): sets the duration of the pause before the next stimulation.
- Note: selects the note that will be entered at the beginning of the stimulation.

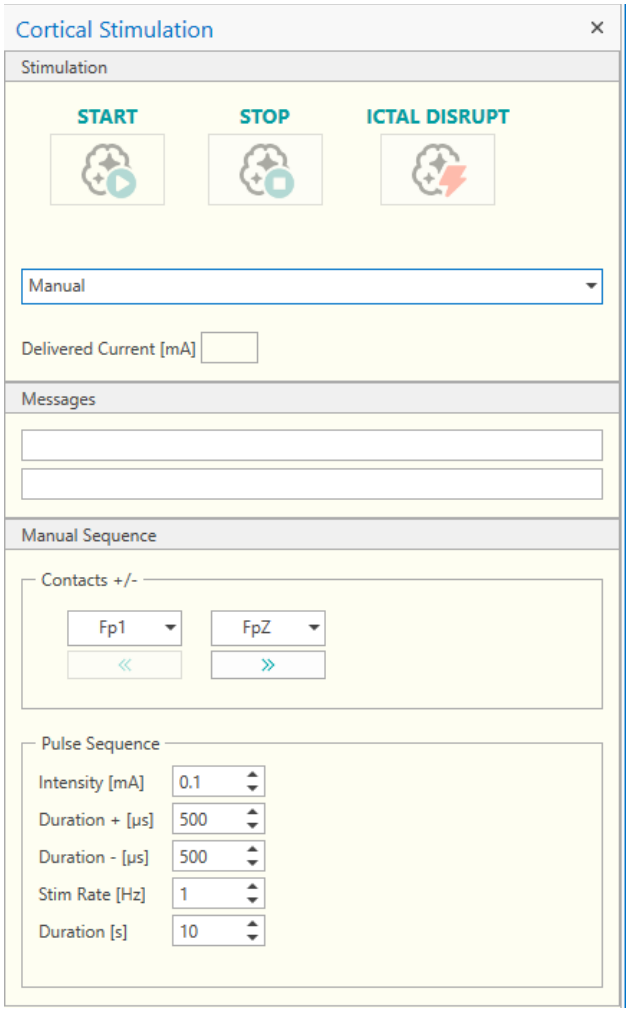


It is also possible to create, save changes and delete programs with the three icons at the side of the program drop-down menu.

It is possible to access Photic Stimulation program even during the acquisition.

CORTICAL STIMULATION

During exam recording, the user has the option of starting cortical stimulation by clicking on Cortical Stimulation button from Home Tab. When the Cortical Stimulation button is pressed, Cortical Stimulation panel is displayed. This function is possible only with SD LTM 64/128/256 PLUS and SD LTM 64/128/256 EXPRESS headboxes and only when the SD LTM STIM cortical stimulator is connected to the headbox.

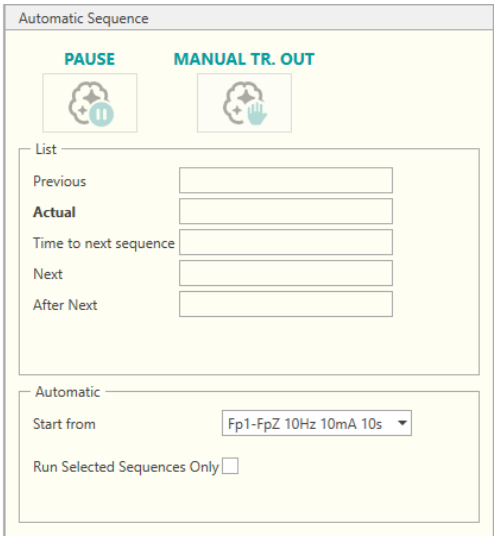


From this interface, you can initiate, terminate stimulation, and execute an ictal disrupt using the buttons located at the top. The drop-down menu provides options to select the type of program.

The **Ictal Disrupt** function repeats the last single stimulus, delivering a one-second stimulation at the chosen frequency. This means that if the stimulation was set to 1 Hz, then one stimulus is delivered, whereas if the sequence was at 50 Hz, one second of stimulation needs to be administered, equivalent to 50 pulses.

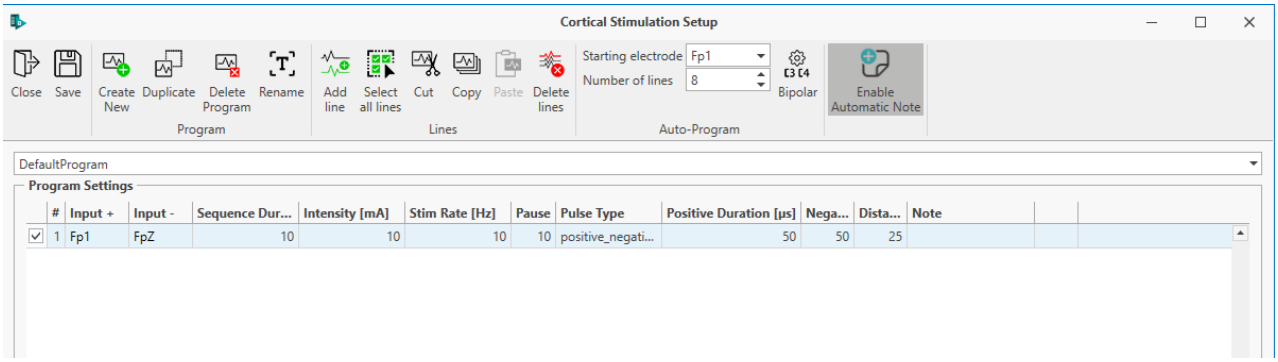
Below this, there is information about the delivered intensity and messages generated by the software to update the user on the stimulation status. Additionally, if the Manual program is chosen, the Manual Sequence section allows you to select the contacts and the pulse sequence for stimulation.

If an automatic program is set, the Automatic sequence section appears:



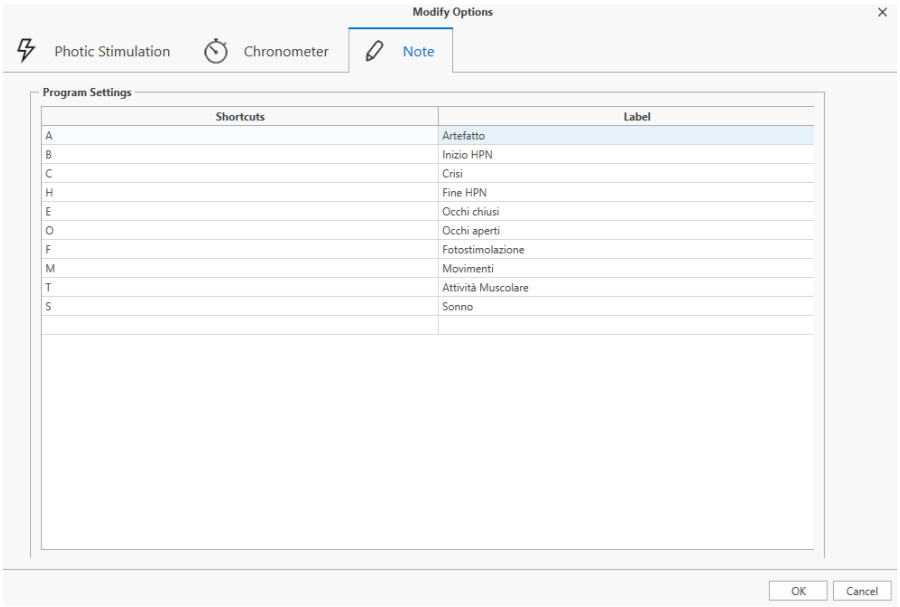
In this section the user can pause, execute manual trigger out and observe the status of the automatic stimulation, reading the previous, actual, next and after next stimulation type. Then, it's possible to start from a particular stimulation and run selected sequence only.

In the end, from the Setup Acquisition Tools the user can create, modify and save a new stimulation program from the Cortical Stimulation section, choosing to insert the automatic note.



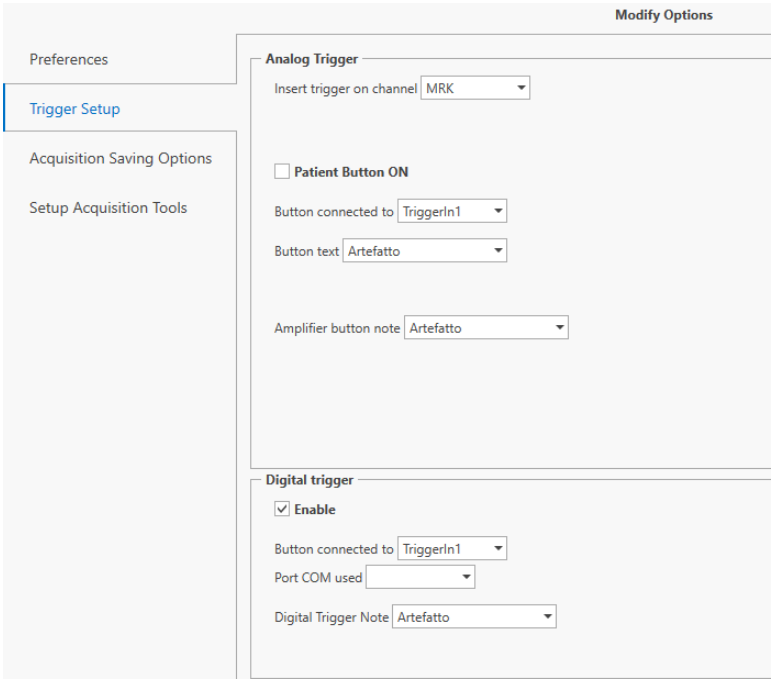
NOTE SETUP

The "Setup" button allows the user to define some keyboard keys associated with the creation of notes added in the trace during acquisition. By default the following keys are present in the software, but both text and shortcut are editable and new quick notes can be added to the list.
Quick Notes are case insensitive and cannot be added during pause.



TRIGGER SETUP

BRAIN QUICK software allows to configure how triggers acquired during the recording are inserted; specifically, the user can choose between analog and digital type triggers by selecting the channel in which to place the markers, clicking to Application Button > Preferences > Trigger Setup:

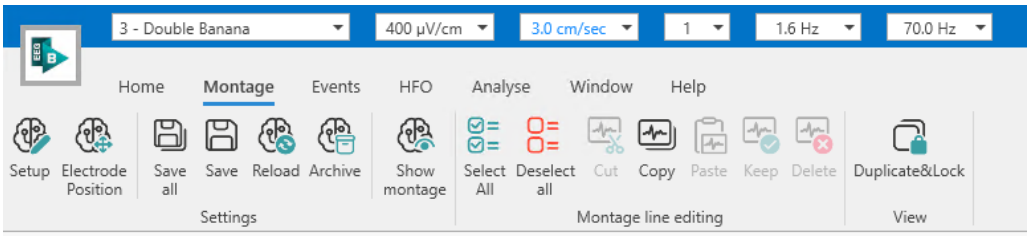


Analog Trigger: This function allows the user to choose the channel in which to place analog triggers from an external unit.
In this section it's possible to enable the Patient Button and personalize the text when the button is pressed.

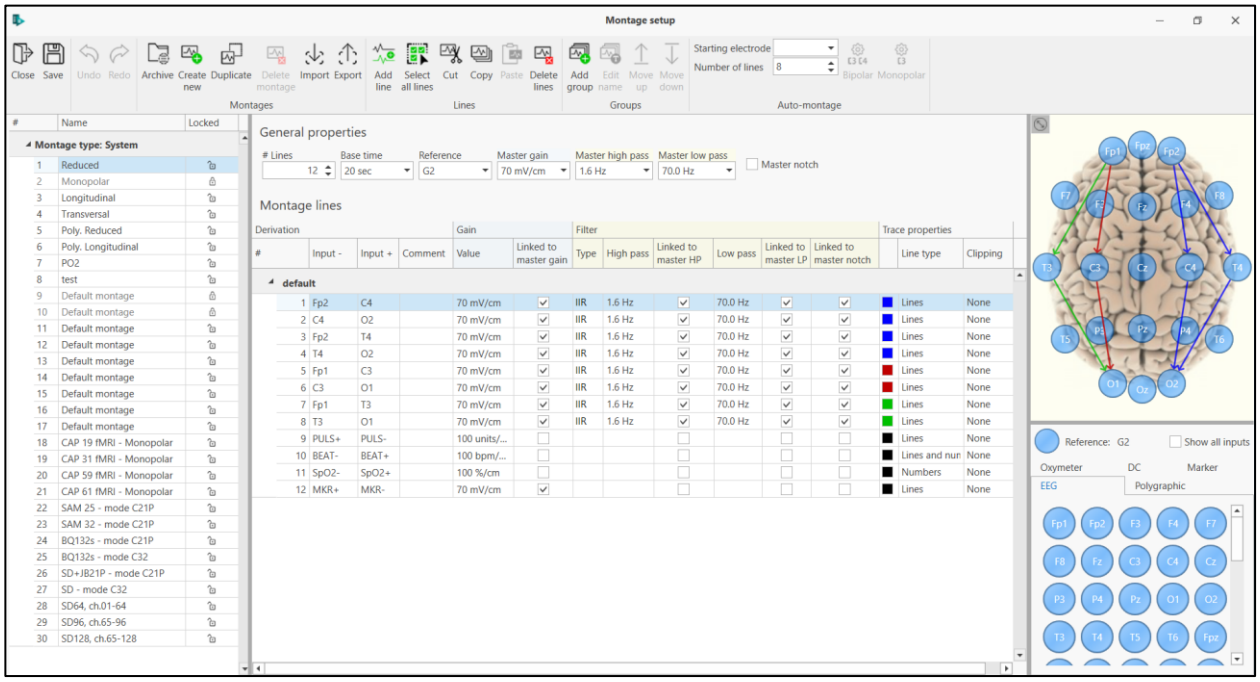
Digital Trigger: it allows the user to select the com port used to receive digital triggers from COM1, COM2, COM3, COM4.

MONTAGES AND EEG VISUALIZATION

The Montage tab allows the Montage visualization and the **Montage editing** directly in the EEG window or in Setup menu.



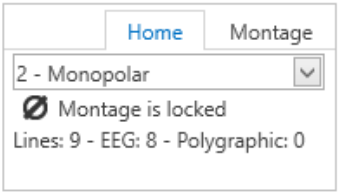
Clicking on **Montage** tab in Ribbon bar, the **Setup** icon allows the user to open the **Montage Editor** from which the user can setup all the Montages and other various parameters.



Montage Editor panel is composed by:

- Montage Editor Ribbon bar
- The list of Montages on the left
- The list of all available channels and their position on the brain on the right
- Information about the selected montage

Montages could be of different types: System (local montages), Archived (saved on EEG trace) and Shared (on server). The user can LOCK the montages in order to avoid that other users change them. If a montage is locked the padlock next to the montage name becomes red. In the EEG Review window it is also shown if the user selects a locked montage:

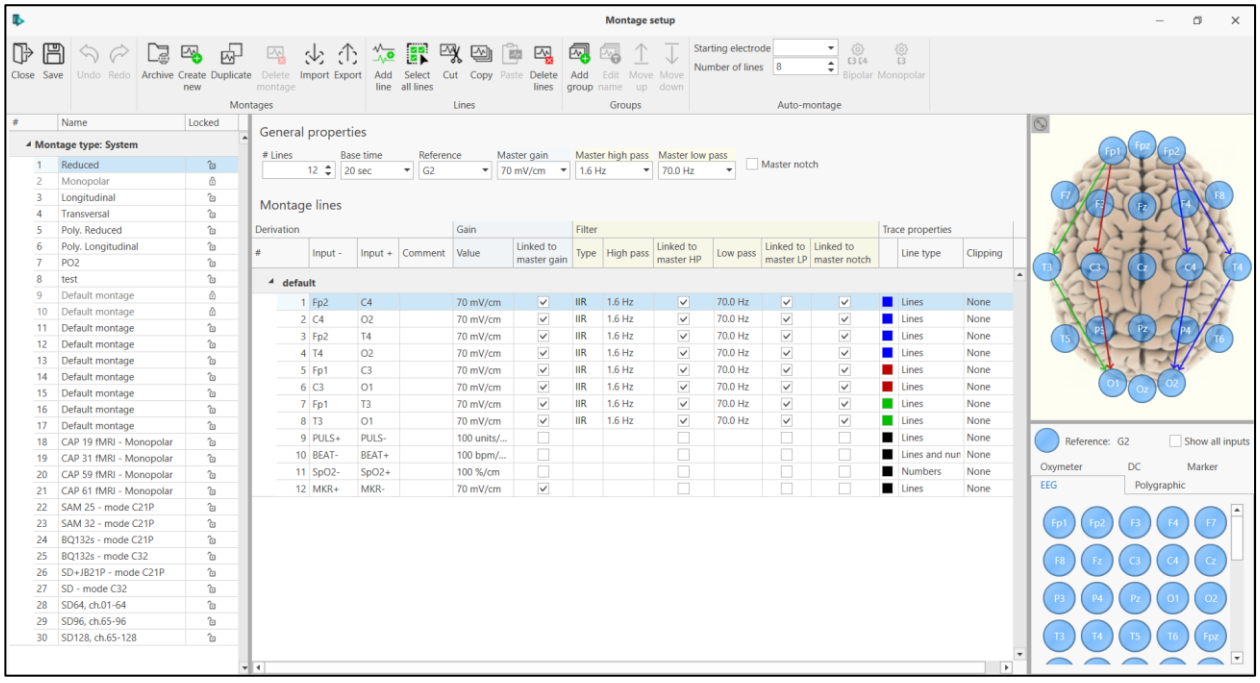


How to configure a Montage?

1. Select the montage of interest from the Montage column or create a new one using the apposite button **Create New** or duplicate an existing montage using **Duplicate** button
2. Define the number of lines, the gain, the time base, the reference and the filter properties that will be applied to all the lines "Linked to Master"
3. Fill in the information for each lines as follow:
    - Input + and Input -: the user can choose from the input list or type the input name or select the input of interest from the list of available channels.
    - Comment: the name that appears in front of the trace in EEG review window as label (the inputs name will appear in Line Editor).
    - Gain value: if a line is not linked to master, the user can choose a different gain.
    - Filter properties: if a line is not linked to master, the user can choose different filter properties.
    - Color: select a color for the trace.
    - Line Type: the user can choose to have the trace displayed numerically, as a trace, both at the same time or off.
    - Clipping
    - Line thickness
4. Save changes
5. The user can define different **Groups** of lines using **Add Group** button. Different groups will be displayed in EEG review window and there is the possibility to overlap the groups

MONTAGE SETUP WINDOW

The montage page setup is shown as below:

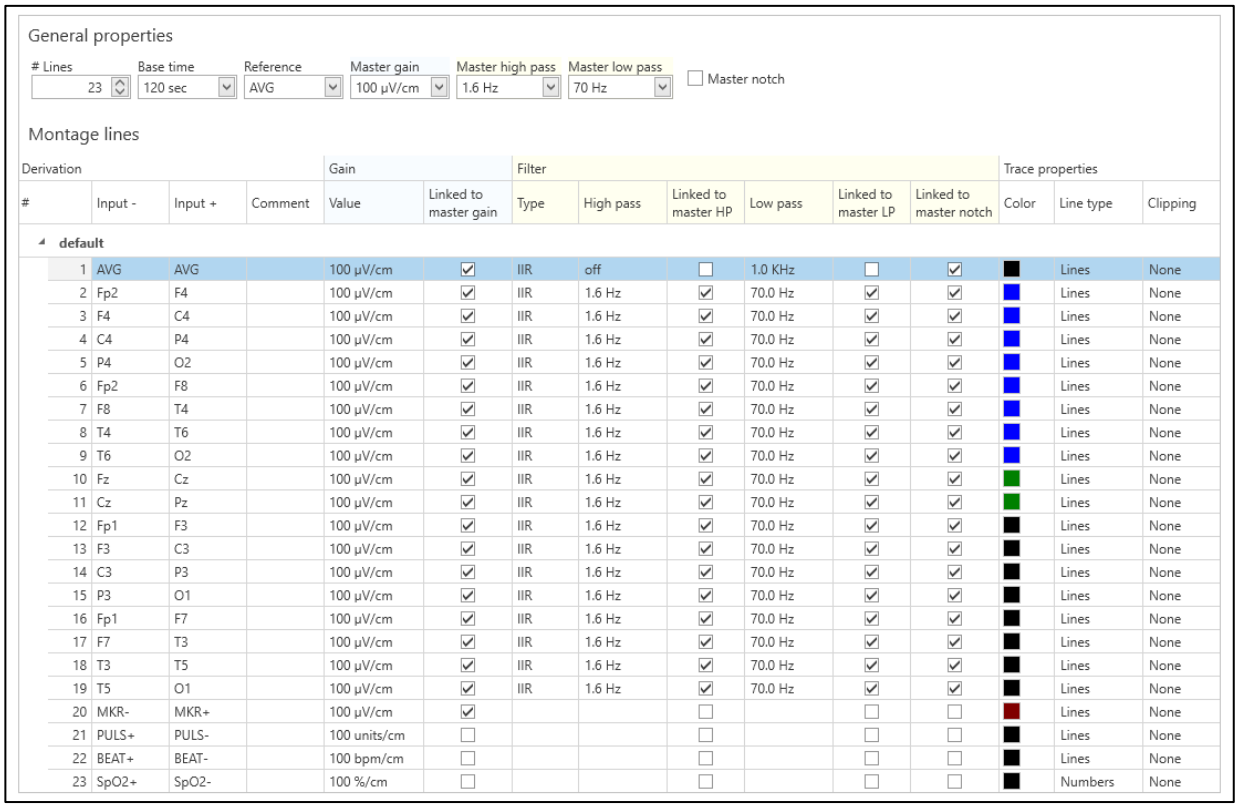


On the left part there is the list of the montages, which include two types:

- Archived montages, which are stored with the EEG file
- General montages, which are PC based (the montages can also be centralized over the network)

Note. iIn the review stations the number of the montages will be **UNLIMITED**
Note. Montages can be “locked,” this means write protected

In the central part there is the Montage setup: the line on top is the “MASTER,” in which the user can setup the default Parameters.



General properties

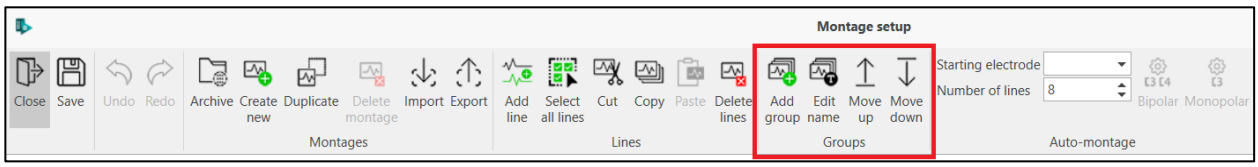
# Lines	Base time	Reference	Master gain	Master high pass	Master low pass	Master notch
23	120 sec	AVG	100 µV/cm	1.6 Hz	70 Hz	☐

Montage lines

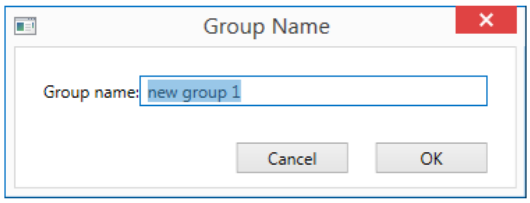
	Derivation			Gain		Filter						Trace properties		
#	Input -	Input +	Comment	Value	Linked to master gain	Type	High pass	Linked to master HP	Low pass	Linked to master LP	Linked to master notch	Color	Line type	Clipping
default														
1	AVG	AVG		100 µV/cm	☑	IIR	off	☐	1.0 KHz	☐	☑		Lines	None
2	Fp2	F4		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
3	F4	C4		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
4	C4	P4		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
5	P4	O2		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
6	Fp2	F8		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
7	F8	T4		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
8	T4	T6		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
9	T6	O2		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
10	Fz	Cz		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
11	Cz	Pz		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
12	Fp1	F3		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
13	F3	C3		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
14	C3	P3		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
15	P3	O1		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
16	Fp1	F7		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
17	F7	T3		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
18	T3	T5		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
19	T5	O1		100 µV/cm	☑	IIR	1.6 Hz	☑	70.0 Hz	☑	☑		Lines	None
20	MKR-	MKR+		100 µV/cm	☑			☐		☐	☐		Lines	None
21	PULS+	PULS-		100 units/cm	☐			☐		☐	☐		Lines	None
22	BEAT+	BEAT-		100 bpm/cm	☐			☐		☐	☐		Lines	None
23	SpO2+	SpO2-		100 %/cm	☐			☐		☐	☐		Numbers	None

The montages can be created by clicking on the brain scheme on the right, or by clicking on the blue spots on the bottom right.
NOTE: the button on the top left of the brain scheme ( ) will toggle the electrodes visualization on the brain scheme from big to small and vice versa.

Groups



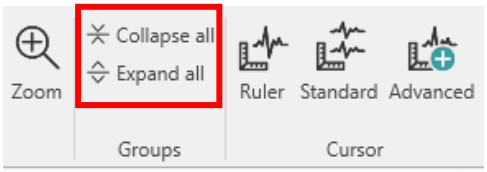
Using "Add group" button it is possible to define a group of lines within the selected montage. When clicking on "Add group" button a window appears, in which the user can type a name for the group:



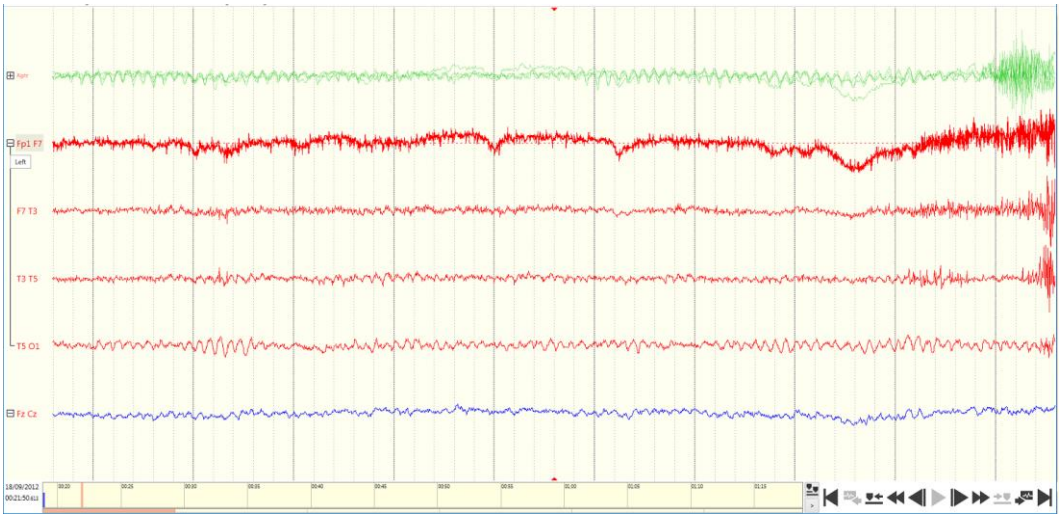
The user can also modify the group's name later on, by selecting the group and clicking on the button "Edit name."
The Move up and Move down buttons allow the user to change the group's position inside the montage. These buttons are enabled only when a group is selected.

NOTE: Groups are useful in case of montages for SEEG; a group can be defined for each deep electrode used.

If a montage with some groups is applied, in the EEG review window, it is possible to collapse or expand groups. This can be done using the + and - buttons near the EEG labels or using **Collapse all** and **Expand all** buttons from the Home tab of the Ribbon Bar:

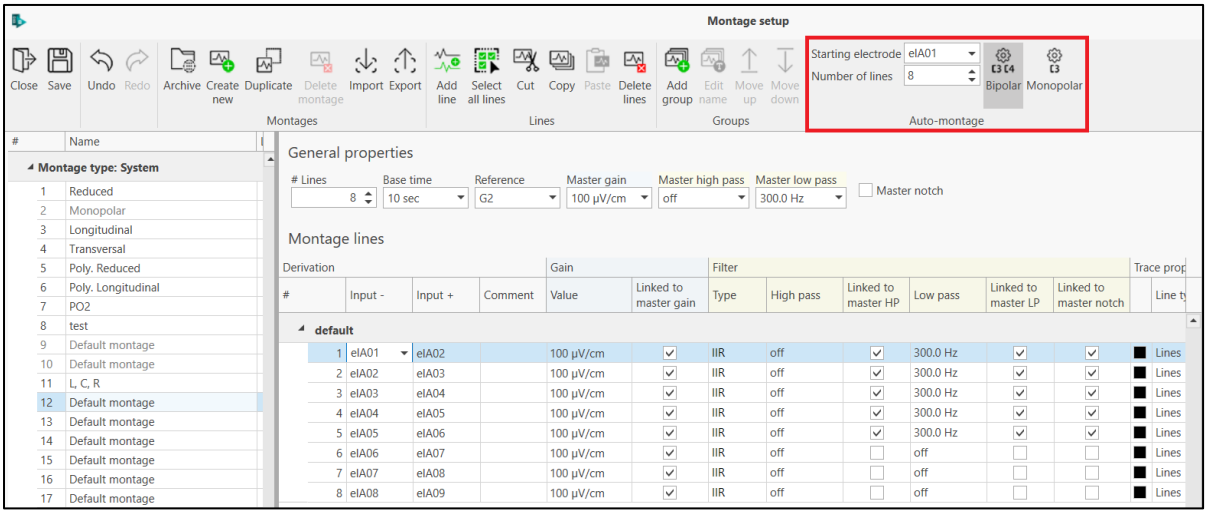


Below, there is an example with a group collapsed and a group expanded:



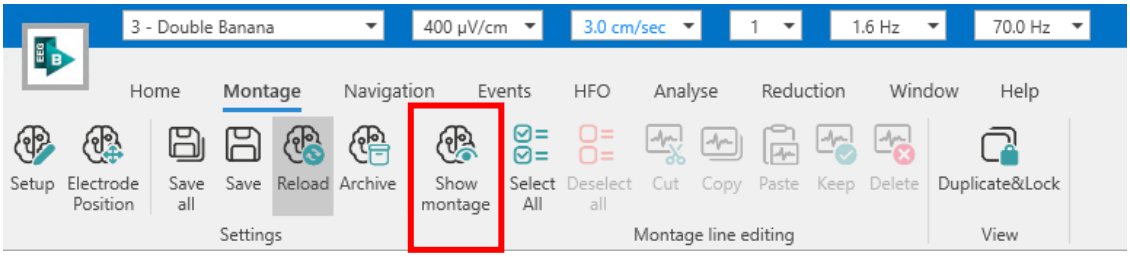
Auto-Montage

There is also the possibility to automatically create a montage, specifying the Starting electrode and the Number of lines. Clicking on the button **Bipolar or Monopolar** will respectively create a bipolar or a monopolar auto-montage, starting with the electrode specified and having the predefined number of lines.

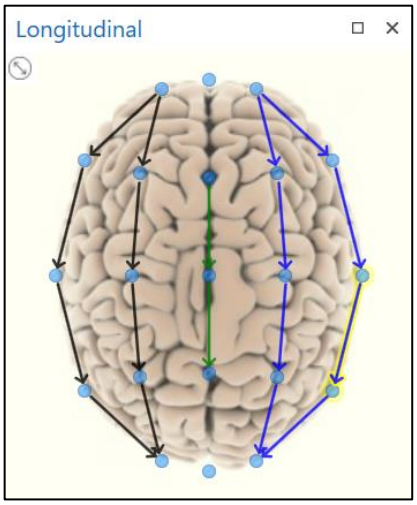


MONTAGE VIEW

The Montage View palette provides a quick view of the current montage, by clicking on **Show Montage** button in Ribbon bar > Montage tab

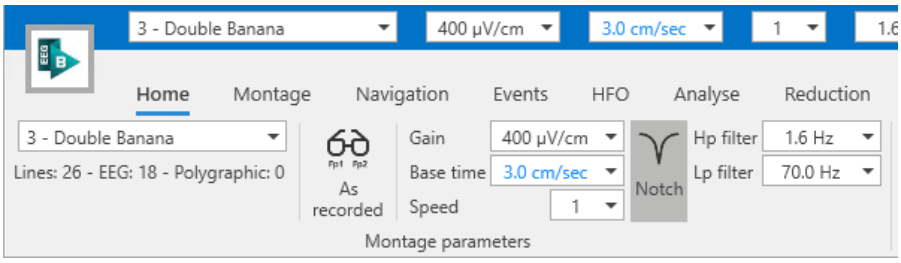


The Montage View panel will be open with the name of the montage as title and it can be visible also in floating mode. The user can drag a corner of the window to increase Montage View panel size until the can view the positions on each channel on the brain:



Hovering the mouse over an EEG line, the derivation corresponding to the trace will be highlighted in Montage View panel.

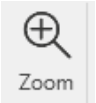
The montages can be changed during the acquisition, then, when reviewing, there will be the “as recorded” button, which will permit to review the traces with exactly the same parameters used during the acquisition.



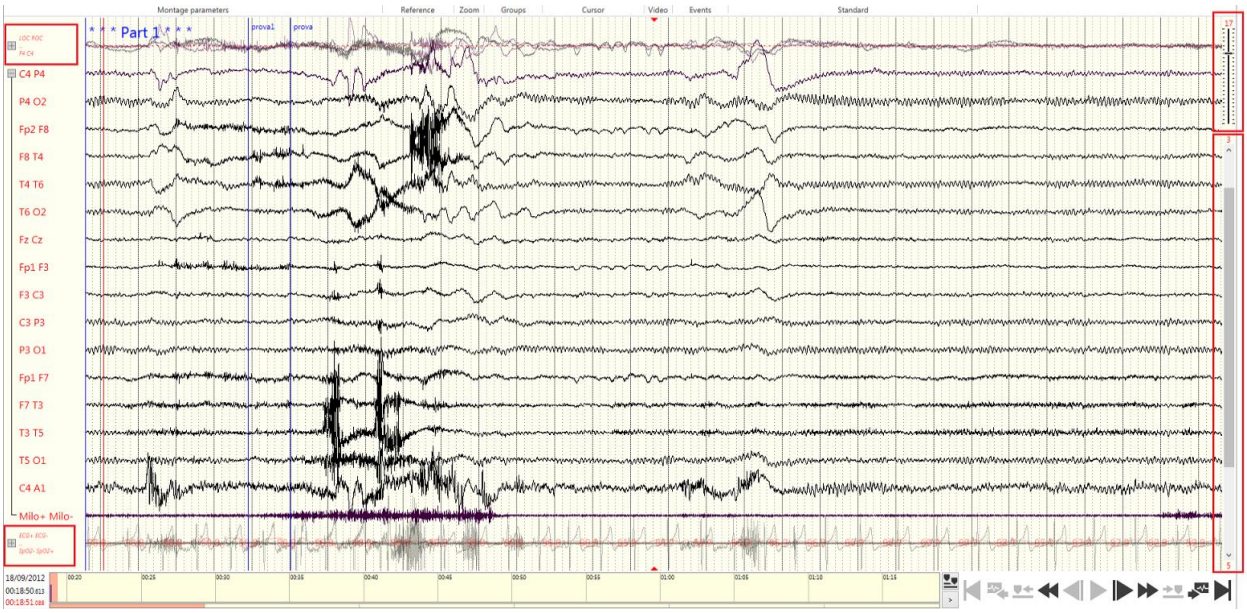
On the other hand, if there are some changes during the acquisition \ review, these changes are kept also if the user is changing the montage and then going back to the same montage. The changes are active, but there is a button, which permits going back to the original. The changes are temporary only (for the patient reviewed), if the user what to save them, has to “save montage.”

ZOOM

Another way to visualize only some of the montage channels is to activate Zoom modality:



In Zoom modality The software gives the possibility to select how many channels visualize, then with the mouse wheel focus on the vertical scroll bar on the right of the EEG page, it will be possible to scroll the EEG up and down. While scrolling, the channels not visualized will be shown on the top and on the bottom of the window, superimposed. The picture below shows an example of zoom in an EEG recording:

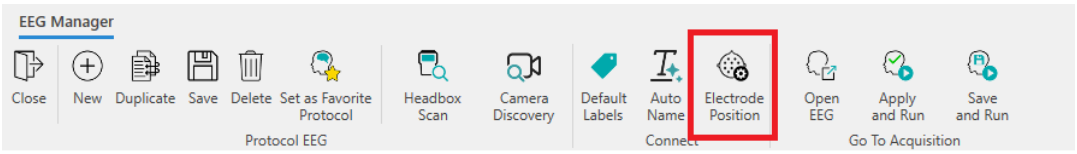


On the right part of the window, it is possible to select the number of zoomed traces to visualize (in this case 20), while the bottom vertical bar allows to scroll the traces. Zoom is disabled in case Duplicate & Lock function is enabled.

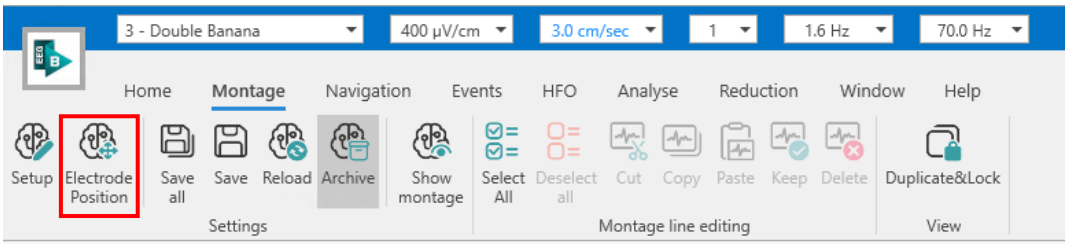
ELECTRODE POSITION

The user can move one or more electrodes from their default position on the real patient's head coordinates deliberately:

- from the acquisition protocol window, pressing **Electrode Position** button in the tab;

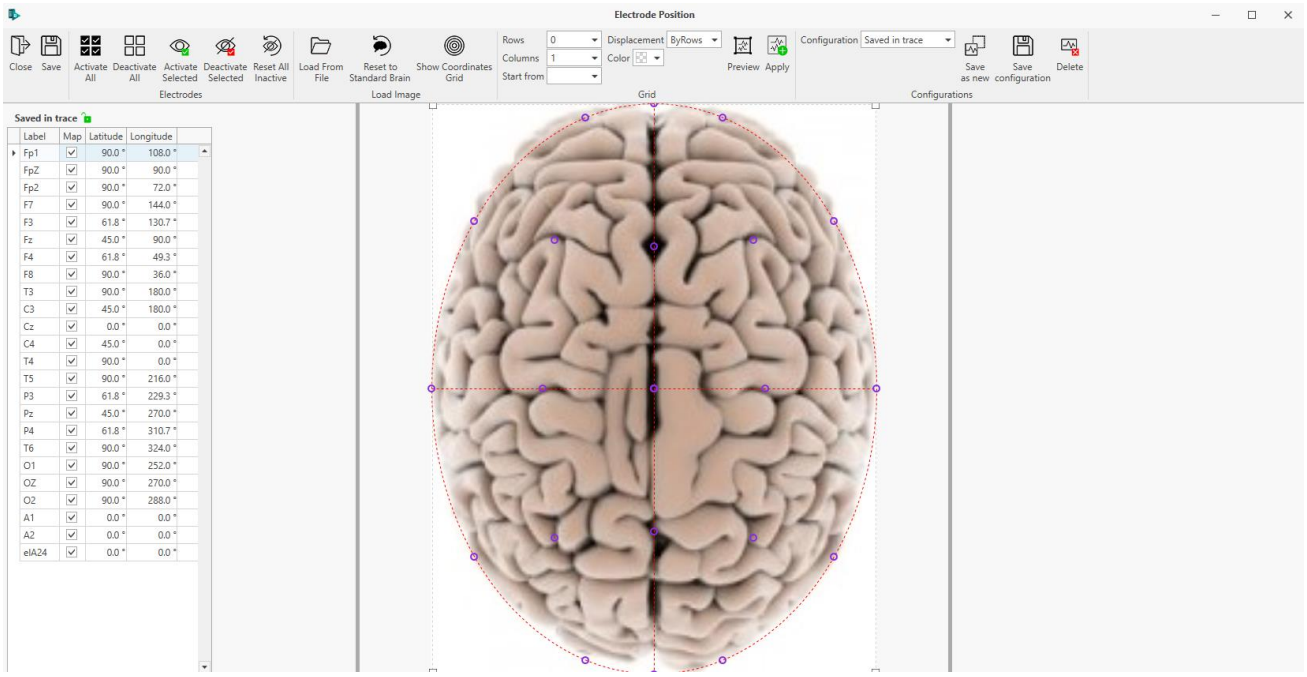


- from Montage Tab, pressing **Electrode Position** button:



Using this function, it is possible to update the electrode position manually memorized in the trace in order to reflect this change on the analysis maps and analysis tools.

Electrode Position window allows to visualize brain image together with the list of recorded electrodes and their coordinates:



The screen is divided in three sections: the **Electrode Position Ribbon Bar** on top, the **list of electrodes** on the left and the **head** on the right**.**

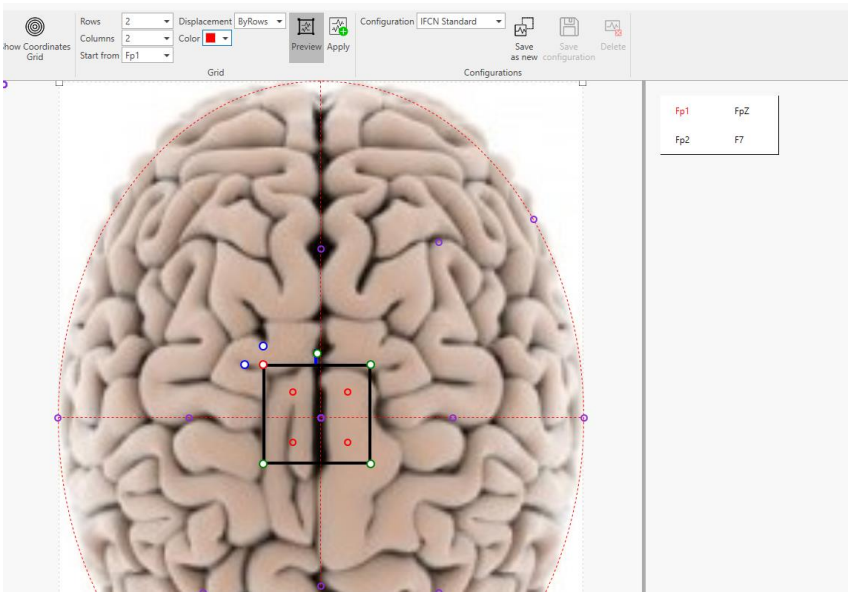
The **Electrode Position Ribbon Bar** allows to activate and deactivate all or the selected electrodes, to add grid / strip on brain image and to show coordinates grid, to load a brain image and to define or recall an electrode position configuration. Buttons available in Ribbon Bar are:

1. **Close:** this button allows to close Electrode Position window
2. **Save:** allows to save all changes in Electrode Position window

3. **Activate All:** allows to activate all electrodes available in the list
4. **Deactivate All:** allows to deactivate all electrodes available in the list
5. **Activate Selected:** allows to activate all electrodes selected by the user in the list
6. **Deactivate Selected:** allows to deactivate all electrodes selected by the user in the list
7. **Reset All Inactive:** allows to reset position of all electrodes to default central position (Latitude and Longitude equals to 0.0°)
8. **Load From File:** this button allows to load a new image to be loaded instead of the default one
9. **Show Coordinates Grid:** allows whether to display or not grid with coordinates in degrees
10. **Reset to Standard Brain:** allows to reset the image to the standard one

Grid group in Ribbon Bar allows to group electrodes into grids to be added to the existing image, depending on how many electrodes are deactivated from electrodes list:

1. **Rows:** defines the number of rows of the grid
2. **Columns:** defines the number of columns of the grid
3. **Start From:** defines the starting electrode
4. **Displacement:** can be either horizontal or vertical
5. **Colour:** defines the electrodes colour
6. **Preview:** shows a grid preview
7. **Apply:** adds the defined grid to the image

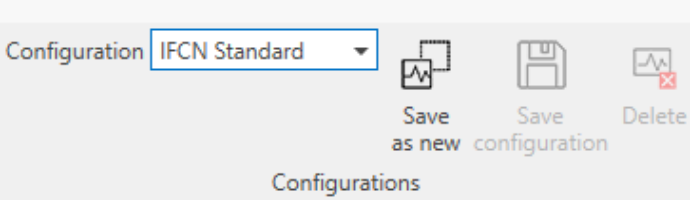


Configurations group in Ribbon Bar allows to define and save electrode position configurations as standard electrodes placement:

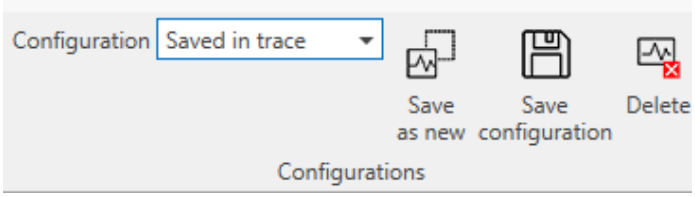
1. **Configuration**: allows to select one from the available configurations. By default, only the IFCN Standard and Saved in Trace configurations are available

2. **Save As New**: allows to save the user defined electrodes position in a new configuration
3. **Save Configuration**: allows to modify and save the selected configuration
4. **Delete**: allows to delete the selected configuration

Note: IFCN Standard is the default configuration, which cannot be modified or deleted. User can only save the changes made on IFCN standard in a new configuration. New configurations are stored in the machine, hence at Unit level.



When the user works on Saved in Trace configuration, the modifications are directly saved in the EEG file.



The **list of electrodes** is composed of four columns called: **Label**, **Active**, **Latitude** and **Longitude**.

1. **Label**: indicates the electrode name. The EEG channels here visible are selected in the "Modify Connection" window, in acquisition, recallable only in the acquisition phase of EEG traces.
2. **Active**: indicates if the electrode is enabled or not. The user can activate the electrodes by clicking the left mouse button on the corresponding checkbox, making a symbol appear. Repressing the left mouse button, the symbol disappears and the electrode is disabled.
3. **Latitude**: indicates the latitude of the electrode and can be modified by the user. Click the left mouse button on the interested electrode cell and type the new value or selecting the electrode visualized in the brain image and dragging it in the desired position.
4. **Longitude**: indicates the longitude of the electrode and can be modified by the user. Click the left mouse button on the interested electrode cell and type the new value or selecting the electrode visualized in the brain image and dragging it in the desired position.

The **head** contains the head image that can be loaded by user and it is represented with circles that represent the active electrodes. These circles can be moved inside the red circle dragging them with the mouse; in the latitude and longitude columns the values change automatically. The name of the electrode appears when the user moves the mouse over each circle.

EVENTS

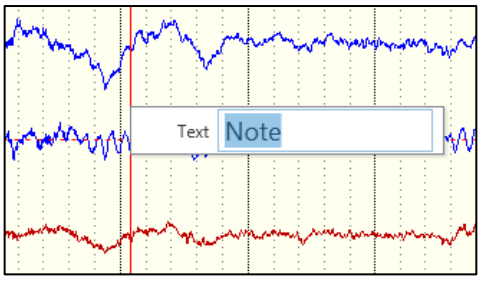
BRAIN QUICK software allows the user to insert notes to distinguish events during review and acquisition.

EVENTS DESCRIPTION

During the exam, the user has the possibility to insert events to distinguish particular situations during the recorded trace. There are three main events insertion modalities, which are described in the following:

Direct Notes Insertion

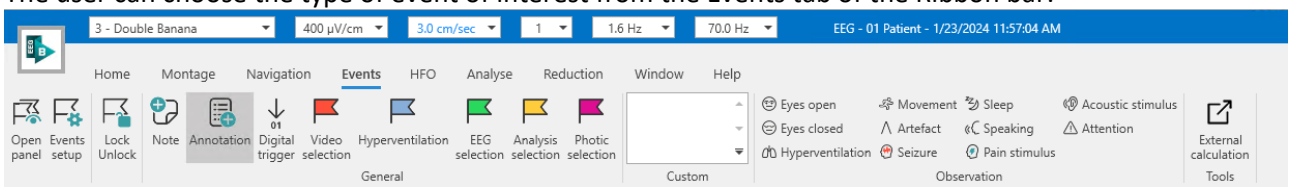
Direct notes insertion on the EEG page can be done with right mouse click on the part of the trace of interest: a text box appears if “note” is selected and the user can type the note text. Pressing Enter from the keyboard the note will be inserted in the EEG trace.



Notes can be inserted directly typing the note from the keyboard and pressing Enter, in this case the note will be inserted in the middle of the EEG page.
To avoid accidental events insertion, the events insertion can be locked using the Lock/Unlock button (which is present in the Home tab, in the Events tab and in the HFO tab of the Ribbon bar) shows a locked padlock:

Continuous Event Insertion (from the Ribbon bar)

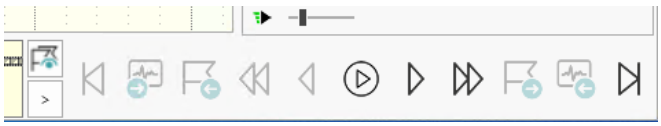
The user can choose the type of event of interest from the Events tab of the Ribbon bar:



Events can be of different types:

- General events: such as Notes, Annotations, Digital triggers and Selections
- Observation events: such as Eyes open, Eyes closed, Hyperventilation, Movement and Stimuli events
- Custom events: defined by the user

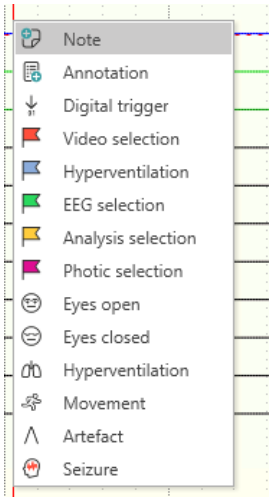
After clicking on a event the system enters continuous event insertion modality. This modality is indicated on the bottom right of the EEG window, with a flashing red warning. For example, if the user chooses "Video selection" event the warning" Inserting Video Selection" will appear:



Then the user has to click or click and drag on the EEG trace to insert the selected event. While event insertion modality is active the user can insert as many events as he wants (of the selected type).
Continuous event insertion modality remains active until the user clicks again on the event button on the Ribbon bar or clicks on the Lock/Unlock button or presses Esc key from the keyboard.

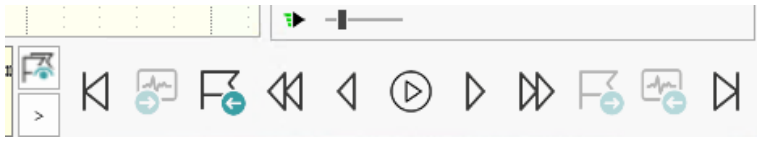
Single Event Insertion (from drop down menu)

If events insertion is unlocked there is the possibility to insert all kinds of events in the EEG trace. The user has to right-click on the EEG page in order to open the following drop down menu:



Then the user has to select the event of interest from the menu.

After clicking on a event, the system enters single event insertion modality. This modality is indicated on the bottom right of the EEG window, with a flashing red warning. For example, if the user chooses "Video selection" event the warning" Inserting Video Selection" will appear:

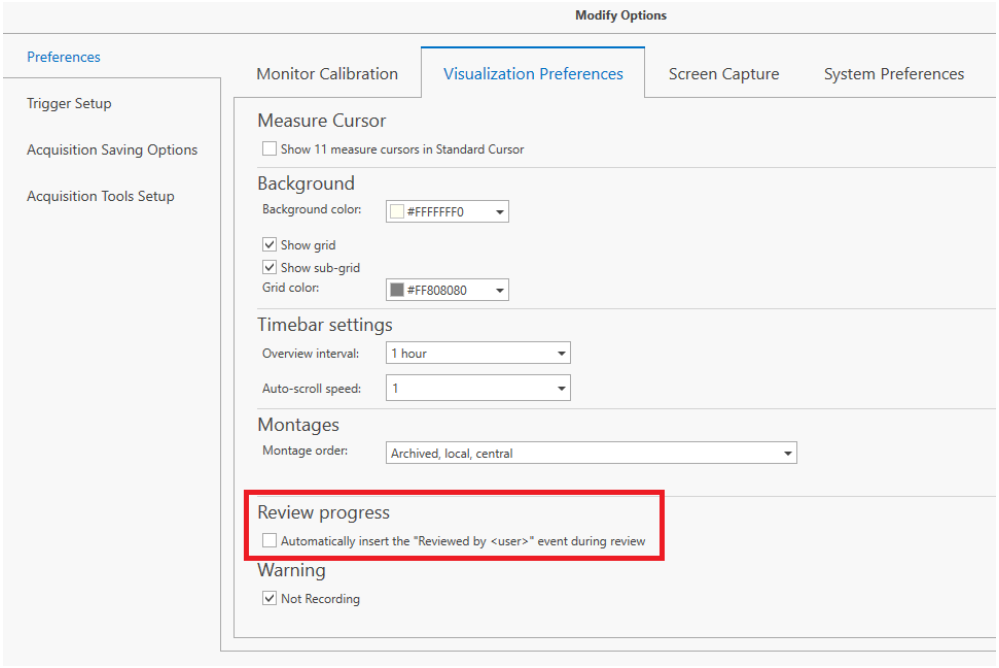


Then the user has to confirm event insertion or click and drag on the EEG trace (in case of selection events) to insert the selected event. Single event insertion modality remains active until the user inserts the selected event or clicks on the Lock/Unlock button or presses Esc key from the keyboard.

Once the event has been inserted single event insertion modality is automatically disabled. The event will be inserted in the exact point of the EEG on which the user clicked in order to open the drop down menu.

Automatic “Reviewed By” Event Insertion

It is possible to enable the automatic insertion of the event “Reviewed by <user>” (where <user> is the name of the user logged in the software) to automatically mark the part of the trace already reviewed by the user during page scroll.
This option can be enabled from Application button > Preferences > Preferences > Visualization Preferences > Review Progress > “Automatically insert the “Reviewed by <user>” event during review.



The Review Progress Bar will be visible in the EEG page and as event in Event Panel together with the duration of the event.
The user can remove this event from Event Panel or right clicking and pressing Delete from the Event but it cannot be moved or manually added.
From Event Setup each user has the possibility to change font, color and text color of Review Progress bar event.

Move an Event

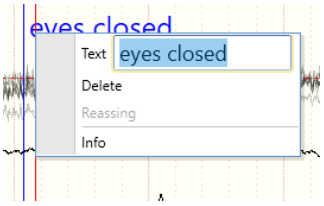
The user can move an event after its insertion. In order to move an event, follow these steps:

1. Click on the event and hold down the mouse button
2. Drag the event to the desired location and release the mouse button.

Edit an Event

The user can edit an event after its insertion. To rename an event follow these steps:

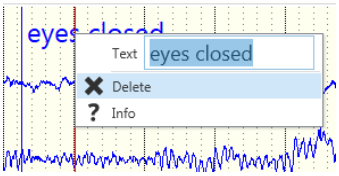
1. Right-click on the event you want to rename
2. Edit the event's name typing the new name in textbox



Delete an Event

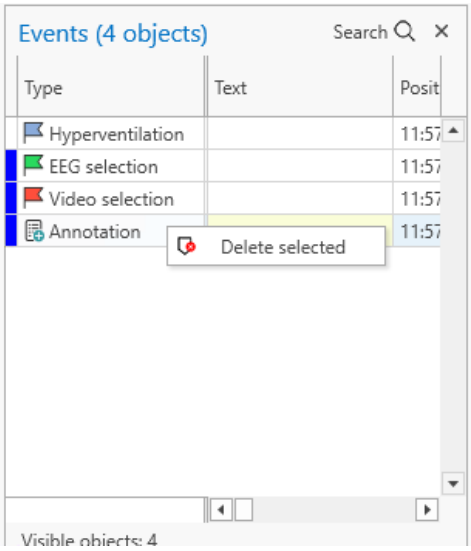
The user can delete an event in two different ways:

1. Right-click on the event
2. Click Delete
3. The event will be immediately deleted (no confirmation message will appear)



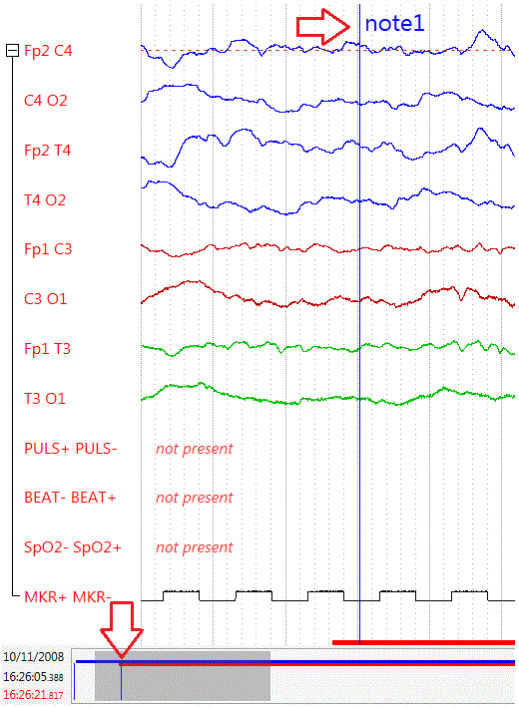
or

1. Open Events Panel using "Open Panel" button
2. Select the event to be deleted
3. Right-click on the event and click Delete (or press Canc button on the keyboard)
4. A confirmation message will appear. The user can choose to proceed or to cancel the operation



NOTES

During the exam review, the user has the possibility to insert notes to distinguish particular events. Notes are displayed as vertical blue lines in the EEG page and in the Time bar:



Insert Notes

Notes can be inserted in three different ways:

Direct Notes Insertion

Brain Quick Software allows **Direct Notes Insertion**

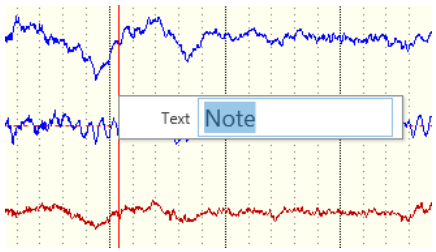
1. Right-click on the point of the EEG trace in which you want to insert the note
2. Select "Note"
3. A textbox appears
4. Type the note text
5. Press Enter from the keyboard to confirm the note insertion

or

1. Directly type from keyboard
2. A textbox appears
3. Type the note text
4. Press Enter from the keyboard to confirm the note insertion
5. The note will be inserted in the middle of the EEG trace page

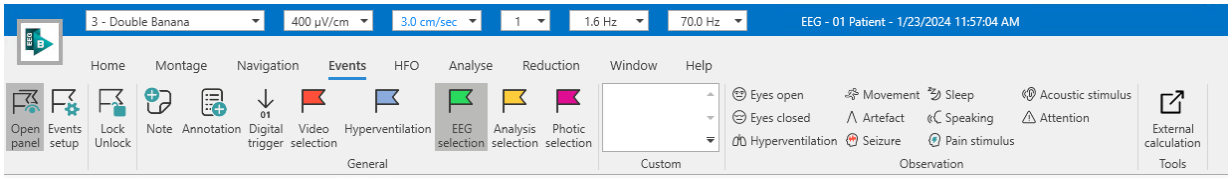
or (in acquisition)

1. Use one of the keyboard keys defined in Note Setup
2. The note associated to the keyboard key in Note Setup will be inserted in the middle of the EEG trace page



Notes Insertion from the Ribbon Bar

1. Unlock events insertion clicking on Lock/Unlock button
2. Click on "Note" button on the Events tab of the Ribbon bar

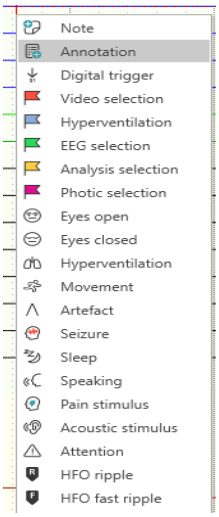


3. The warning "Inserting Note" appears on the bottom right of the EEG window
4. Click on the point of the EEG trace in which you want to insert the note
5. A textbox appears
6. Type the note text
7. Press Enter from the keyboard to confirm the note insertion
8. When finished, click again on "Note" button or click on "Lock/Unlock" button or press Esc key from the keyboard to disable notes insertion modality

Notes Insertion from Drop Down Menu

1. Unlock events insertion clicking on Lock/Unlock button
2. Right-click on the point of the EEG trace in which you want to insert the note

3. A drop down menu appears



4. Select "Note" from the drop down menu
5. A textbox appears
6. Type the note text
7. Press Enter from the keyboard to confirm the note insertion

Move a Note

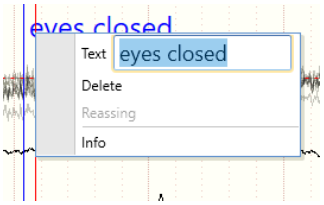
The user can move a note after its insertion. In order to move a note, follow these steps:

1. Click on the note and hold down the mouse button
2. Drag the note to the desired location and release the mouse button.

Edit a Note

The user can edit a note after its insertion. To rename a note follow these steps:

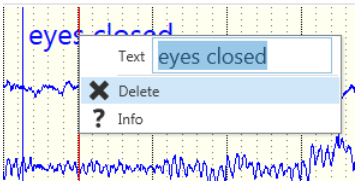
1. Right-click on the note you want to rename
2. Edit the note's name typing the new name in the text box
3. Press Enter from the keyboard to confirm the note's modification



Delete a Note

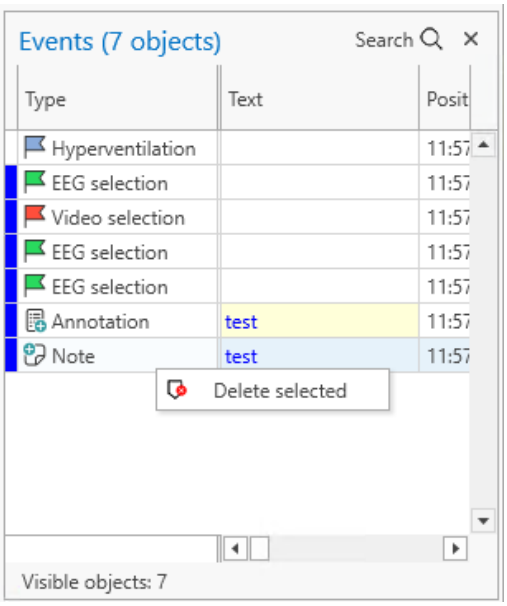
The user can delete a note in two different ways:

1. Right-click on the note
2. Click Delete
3. The note will be immediately deleted (no confirmation message will appear)



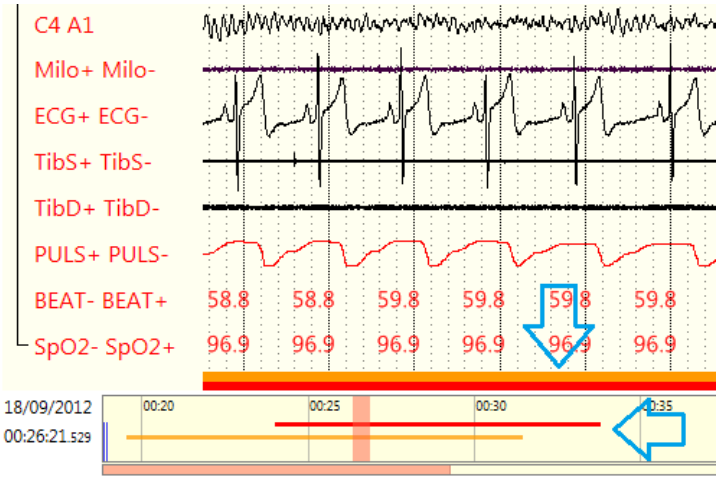
or

1. Open Events Panel using "Open Panel" button
2. Select the note to be deleted
3. Right-click on the note and click Delete (or press Canc button on the keyboard)
4. A confirmation message will appear. The user can choose to proceed or to cancel the operation



SELECTIONS

During the exam review the user has the possibility to mark a piece of trace by using a selection event. Selections are displayed as horizontal lines in the EEG page and in the time bar:



In particular:

- **Video Selections** are displayed as red horizontal lines and are used to mark interesting pieces of video
- **Hyperventilation Selections** are displayed as light blue horizontal lines and are used to mark or measure the time duration of a particular event as hyperventilation
- **EEG Selections** are displayed as green horizontal lines are used to mark interesting pieces of EEG
- **MAP Selections** are displayed as orange horizontal lines and are used to mark pieces of EEG trace that can be analyzed

- **Photic Selections** are displayed as purple horizontal lines and are used to mark or measure the time duration of a particular event as photic stimulation

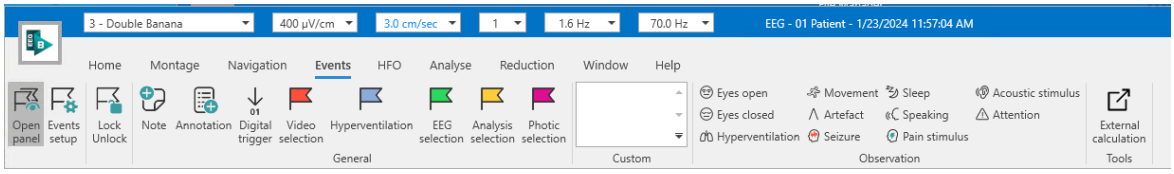
Video and EEG selections can be used also during Video EEG files reduction (see section EEG Reduction).

Insert Selections

Selections can be inserted in two different ways:

Selections Insertion from the Ribbon Bar

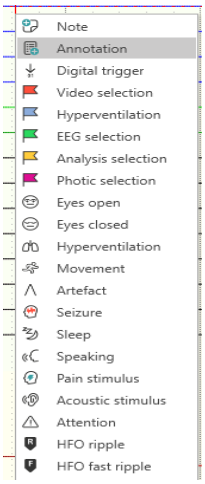
1. Unlock events insertion clicking on Lock/Unlock button
2. Click on one of the selection buttons on the Events tab of the Ribbon bar, for example "Video selection"



3. The warning "Inserting Video selection" appears on the bottom right of the EEG window
4. Click on the point of the EEG trace in which you want to insert the selection and drag the selection until the desired end point
5. Release the mouse button to confirm selection's insertion
6. When finished, click again on "Video selection" button or click on "Lock/Unlock" button or press Esc key from the keyboard to disable Video selection insertion modality

Selections Insertion from Drop Down Menu

1. Unlock events insertion clicking on Lock/Unlock button
2. Right mouse click on the EEG trace
3. A drop down menu appears



4. Click on one of the selections buttons from the drop down menu, for example "Video selection"
5. Click on the point of the EEG trace in which you want to insert the selection and drag the selection until the desired end point
6. Release the mouse button to confirm selection's insertion

Move a Selection

The user can move a selection after its insertion. In order to move a selection, follow these steps:

1. Click on the selection and hold down the mouse button
2. Drag the selection to the desired location and release the mouse button.

Resize a Selection

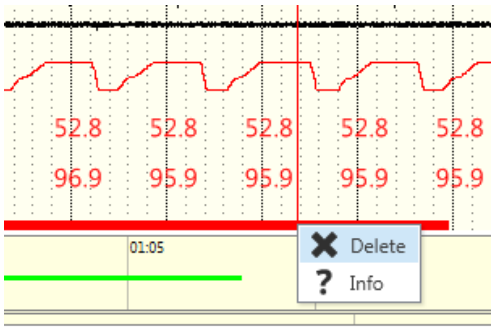
The user can modify a selection's duration after its insertion. To resize a selection follow these steps:

1. Click on the start point (or on the end point) of the selection
2. Drag the start point (or the end point) of the selection to the desired location and release the mouse button.

Delete a Selection

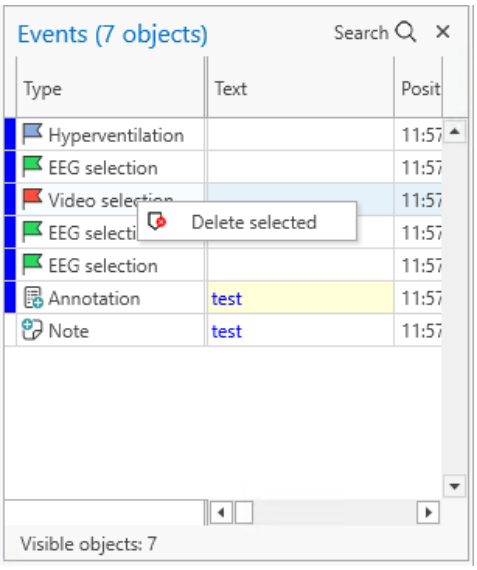
The user can delete a selection in two different ways:

1. Right-click on the selection
2. Click Delete
3. The selection will be immediately deleted (no confirmation message will appear)



or

1. Open Events Panel using "Open Panel" button
2. Select the selection to be deleted
3. Right-click on the selection and click Delete (or press Canc button on the keyboard)
4. A confirmation message will appear. The user can choose to proceed or to cancel the operatio



ANNOTATIONS

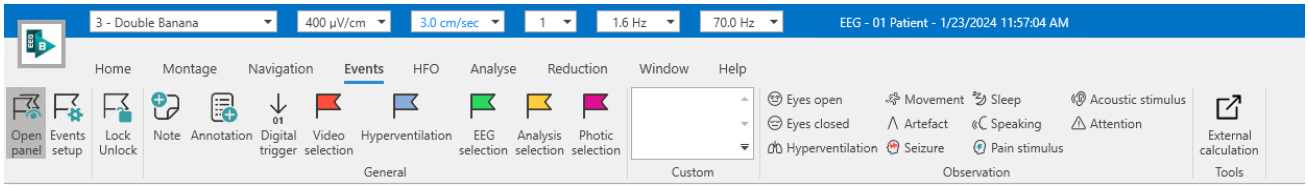
During the exam review the user has the possibility to mark a piece of trace by using an annotation event. Annotations are not-formatted text multi-line notes that can be inserted on the EEG trace.

Insert Annotations

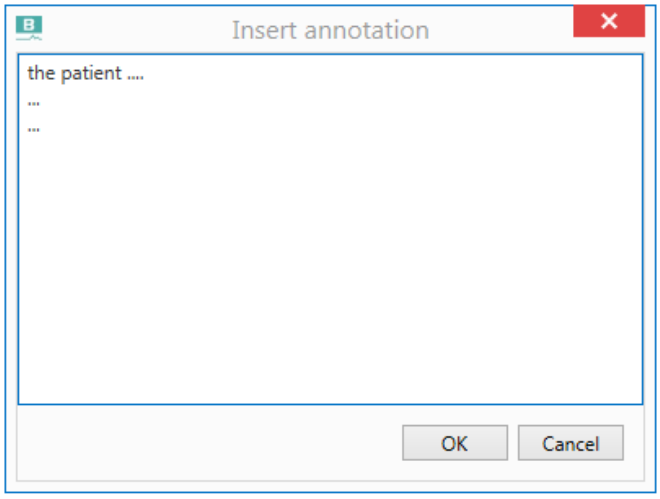
Annotations can be inserted in two different ways:

Annotations Insertion from the Ribbon Bar

1. Unlock events insertion clicking on Lock/Unlock button
2. Click on "Annotation" button on the Events tab of the Ribbon bar



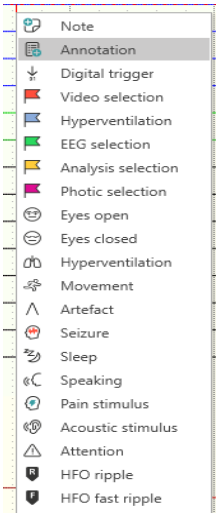
3. The warning "Inserting Annotation" appears on the bottom right of the EEG window
4. Click on the point of the EEG trace in which you want to insert the annotation
5. Write the annotation content into Insert annotation window



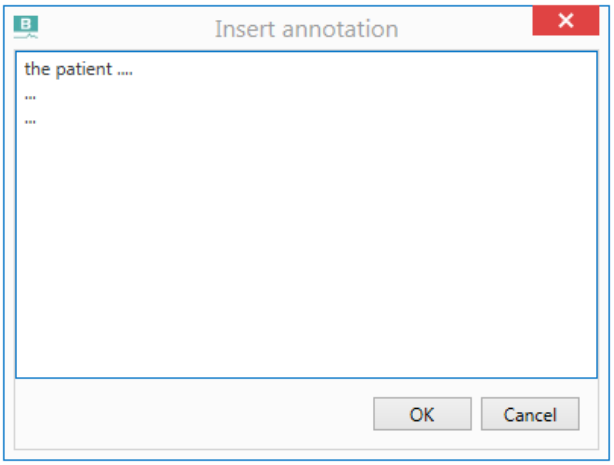
6. Click OK to confirm annotation's insertion
7. When finished, click again on "Annotation" button, or click on "Lock/Unlock" button, or press Esc key on the keyboard to disable annotation insertion modality

Annotation Insertion from Drop Down Menu

1. Unlock events insertion clicking on Lock/Unlock button
2. Right-click on the EEG trace
3. A drop down menu appears



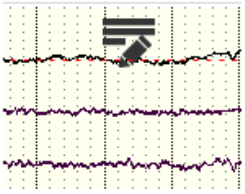
4. Select "Annotation" from the drop down menu
5. Click on the point of the EEG trace in which you want to insert the annotation
6. Write the annotation content into Insert annotation window



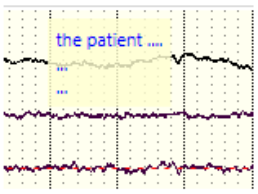
7. Click OK to confirm annotation's insertion

Collapse or Expand an Annotation

Annotations can be displayed on the EEG page in collapsed or expanded mode:

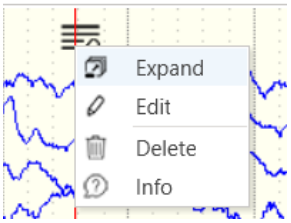


Collapsed RTF Annotation

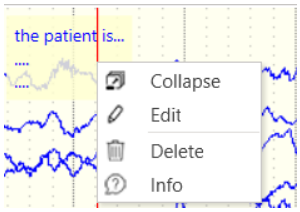


Expanded RTF Annotation

To toggle from collapsed to expanded visualization mode right-click on a collapsed annotation icon and select Expand. All annotations will be displayed in expanded mode:



To toggle from expanded to collapsed visualization mode right-click on an expanded annotation icon and select Collapse. All annotations will be displayed in collapsed mode:



Move an Annotation

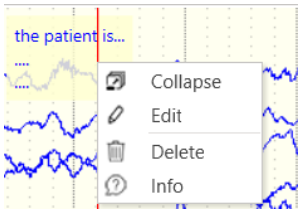
The user can move an annotation after its insertion. In order to move an annotation follow these steps:

1. Click on the annotation and hold down the mouse button
2. Drag the annotation to the desired location and release the mouse button.

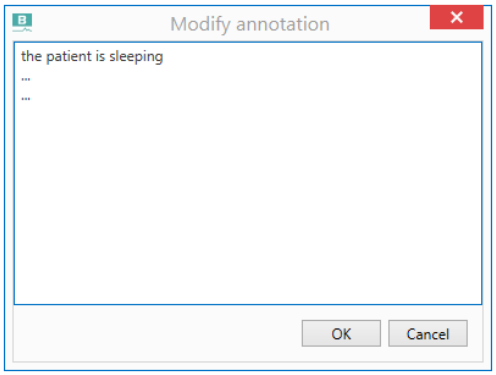
Edit an Annotation

The user can edit an annotation's text after its insertion. To edit an annotation follow these steps:

1. Right-click on the annotation you want to edit
2. Select Edit



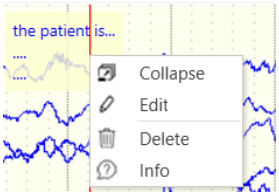
3. Edit the annotation's text from Modify annotation window
4. Click OK to confirm annotation's modification



Delete an Annotation

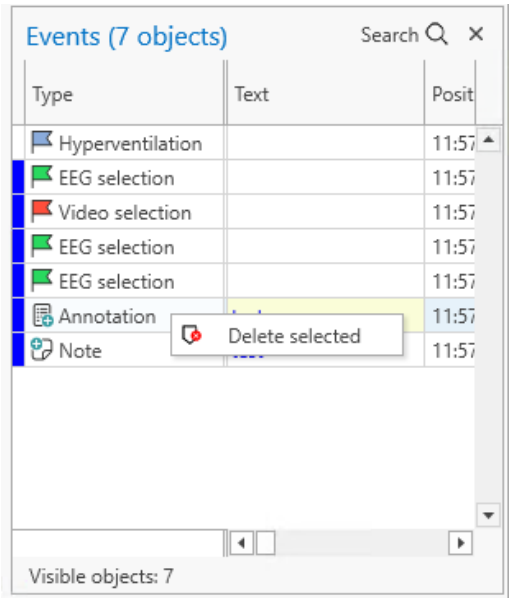
The user can delete an annotation in two different ways:

1. Right-click on the annotation
2. Click Delete
3. The annotation will be immediately deleted (no confirmation message will appear)



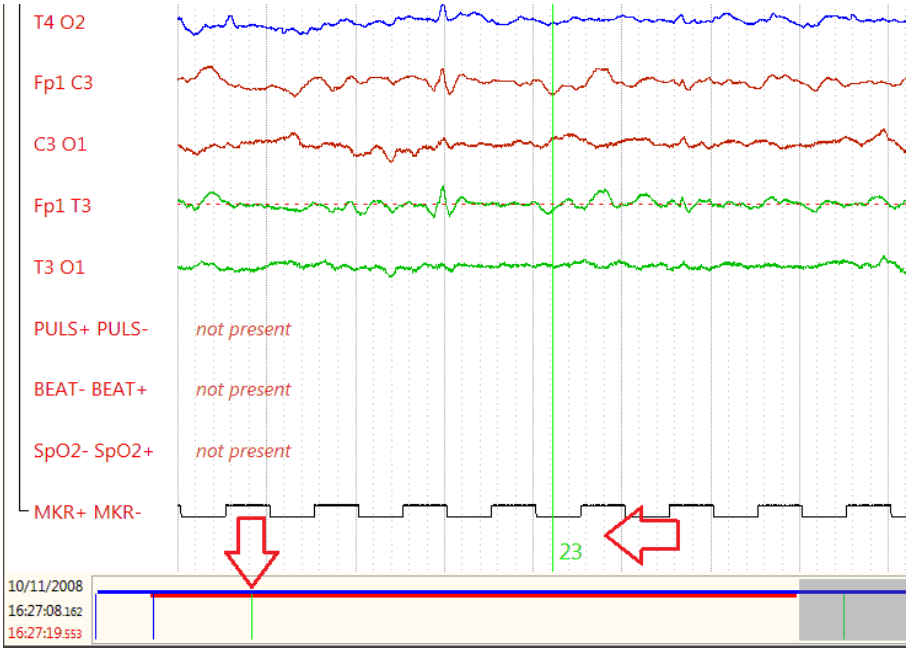
or

1. Open Events Panel using "Open Panel" button
2. Select the annotation to be deleted
3. Right-click on the annotation and click Delete (or press Canc button on the keyboard)
4. A confirmation message will appear. The user can choose to proceed or to cancel the operation



DIGITAL TRIGGERS

Triggers are synchronizing events introduced on the recorded EEG either during acquisition or during review. Digital triggers are composed of a numeric value that is stored within the trace and adds information to the trigger itself: in fact a numeric value can inform on which kind of event has generated the trigger. By default, digital triggers are displayed as vertical green lines in the EEG page and in the Time bar:



Insert Digital Triggers

Digital triggers can be inserted in two different ways:

Digital Triggers Insertion from the Ribbon Bar

1. Unlock events insertion by clicking on Lock/Unlock button
2. Click on "Digital trigger" button on the Events tab of the ribbon bar
3. The warning "Inserting Digital trigger" appears on the bottom right of the EEG window
4. Click on the point of the EEG trace in which you want to insert the digital trigger
5. A text box appears
6. Type the digital trigger value
7. Press Enter from the keyboard to confirm the digital trigger insertion
8. When finished, click again on "Digital trigger" button or click on "Lock/Unlock" button or press Esc key from the keyboard to disable digital trigger insertion modality

Digital Triggers Insertion from Drop Down Menu

1. Unlock events insertion by clicking on Lock/Unlock button
2. Right mouse click on the point of the EEG trace in which you want to insert the digital trigger
3. A drop down menu appears
4. Select Digital trigger" from the drop down menu
5. A text box appears
6. Type the digital trigger value
7. Press Enter from the keyboard to confirm the digital trigger insertion

Move a Digital Trigger

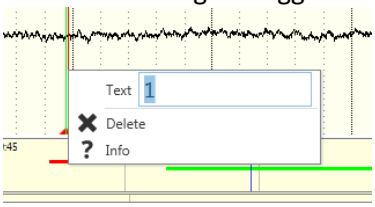
The user can move a digital trigger after its insertion. In order to move a digital trigger follow these steps:

1. Click on the digital trigger and hold down the mouse button
2. Drag the digital trigger to the desired location and release the mouse button.

Edit a Digital Trigger

The user can edit a digital trigger after its insertion. To edit a digital trigger follow these steps:

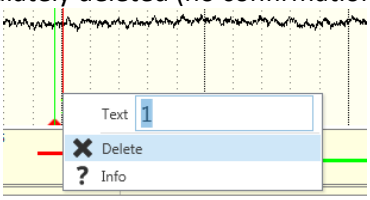
1. Right-click on the digital trigger you want to edit
2. Edit the digital trigger's value typing the new value in the text box
3. Press Enter from the keyboard to confirm the digital trigger's modification



Delete a Digital Trigger

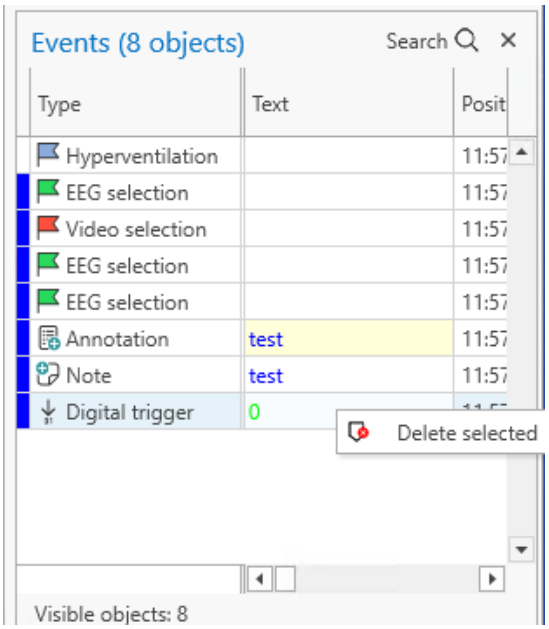
The user can delete a digital trigger in two different ways:

1. Right-click on the digital trigger
2. Click Delete
3. The digital trigger will be immediately deleted (no confirmation message will appear)



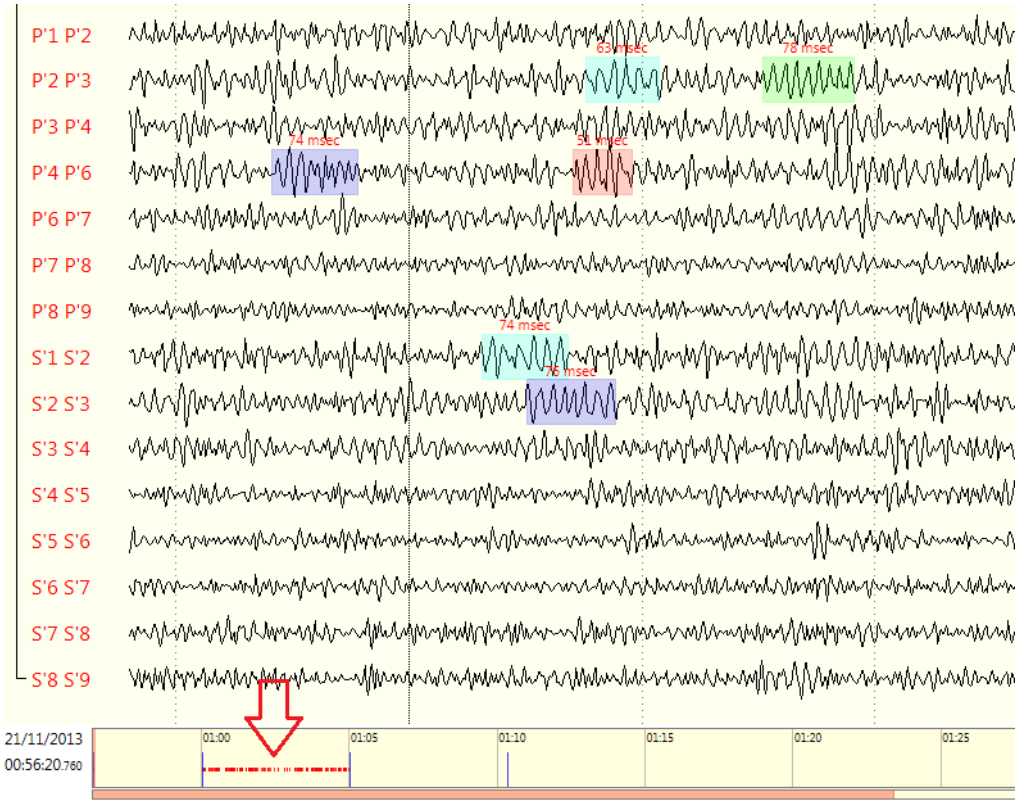
or

1. Open Events Panel using "Open Panel" button
2. Select the digital trigger to be deleted
3. Right-click on the digital trigger and click Delete (or press Canc button on the keyboard)
4. A confirmation message will appear. The user can choose to proceed or to cancel the operation



HFO EVENTS

HFO software module has been developed in order to allow the user to analyze scalp and intracranial HFOs as candidate to represent a valuable biomarker for the localization of the Seizure Onset Zone (SOZ).
During the exam review the user has the possibility to insert manually HFO events on the EEG trace or to perform an automatic HFO detection (see section External Calculation). In both cases HFO events are displayed as horizontal selections in the EEG page and in the Time bar. Over each HFO event its duration (in milliseconds) is displayed:



In particular:

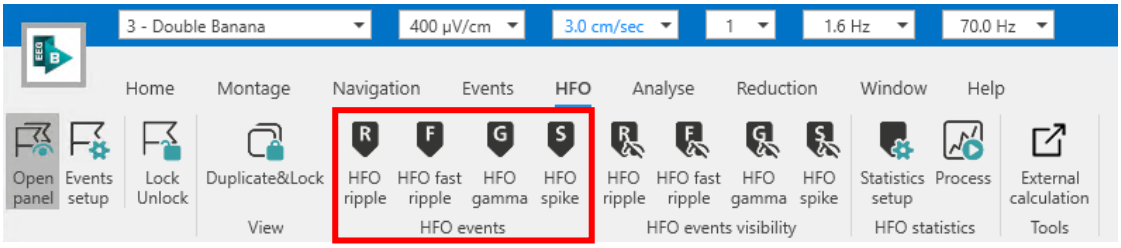
- **HFO ripple** are displayed as red selections
- **HFO fast ripple** are displayed as green selections
- **HFO gamma** are displayed as light blue selections
- **HFO spike** are displayed as violet selections

Insert HFO Events

HFO events can be inserted in two different ways:

HFO Events Insertion from the Ribbon Bar

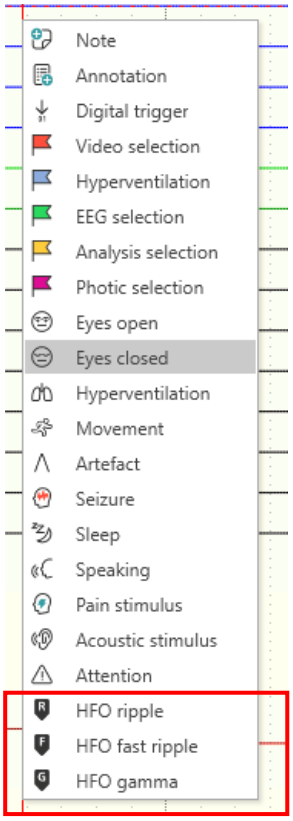
1. Unlock events insertion by clicking on Lock/Unlock button
2. Click on one of HFO events buttons on the Events tab of the Ribbon bar, for example "HFO ripple"



3. The warning "Inserting HFO ripple" appears on the bottom right of the EEG window
4. Click on the start point of the pattern of interest and drag the HFO event until the desired end point
5. Release the mouse button to confirm HFO event's insertion
6. When finished, click again on "HFO ripple" button, or click on "Lock/Unlock" button, or press Esc key from the keyboard to disable HFO ripple insertion modality

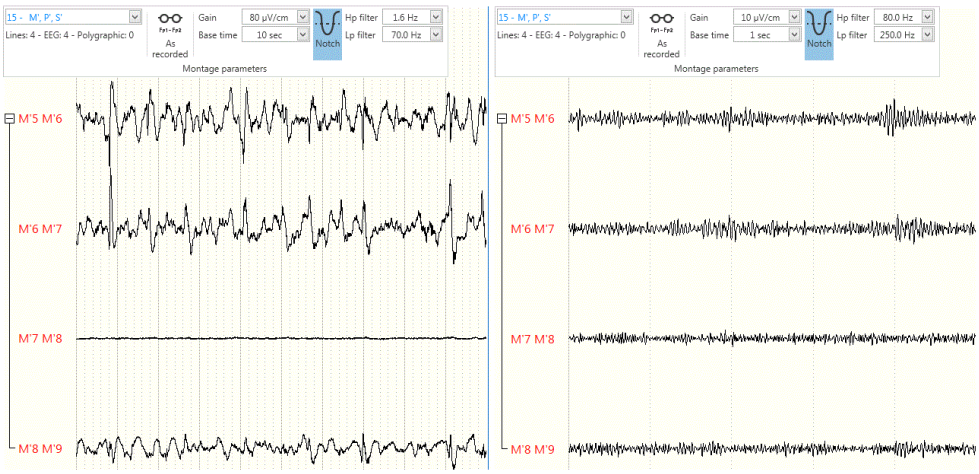
HFO Events Insertion from Drop Down Menu

1. Unlock events insertion by clicking on Lock/Unlock button
2. Right-click on the EEG trace
3. A drop down menu appears



4. Click on "HFO" and then select one of the HFO events buttons, for example "HFO ripple"
5. Click on the start point of the pattern of interest and drag the HFO event until the desired end point
6. Release the mouse button to confirm HFO event's insertion

NOTE: Duplicate and Lock feature can be really useful during HFO insertion process, in fact it allows the user to visualize the same EEG trace with different filters and different time bases (see section Duplicate and Lock):



NOTE: In order to better identify HFOs there is the possibility to set a “FIR” filters type from Montage Setup (see section Montage Editor).

Below 2 figures are reported in order to show the same part of an EEG trace filtered at [80-250 Hz] for RIPPLE visualization using a FIR filter in the first figure and an IIR filter in the second figure. As you can see the correct HFO visualization is available only selecting FIR filter type:

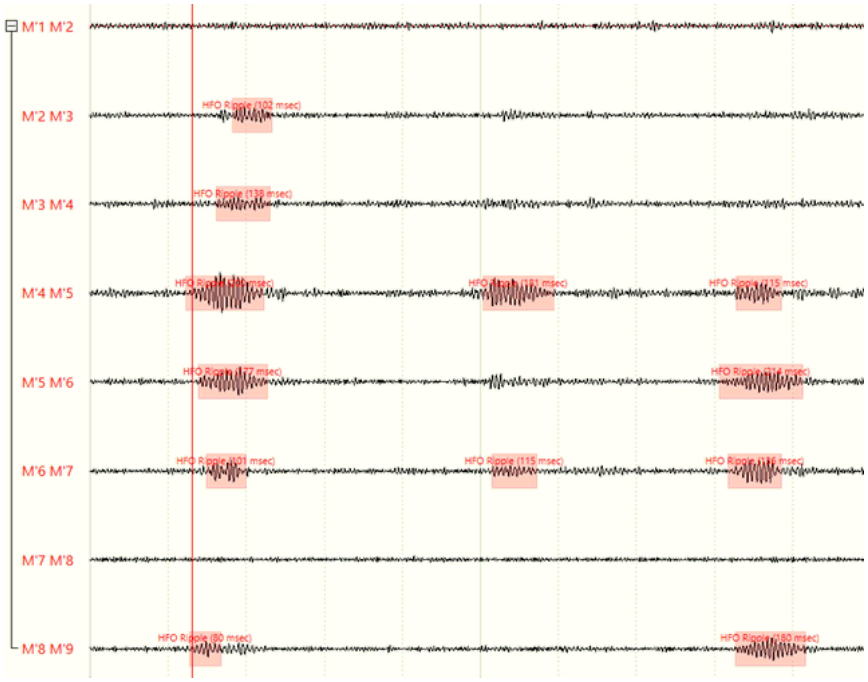


Figure: FIR Filter between [80-250Hz]

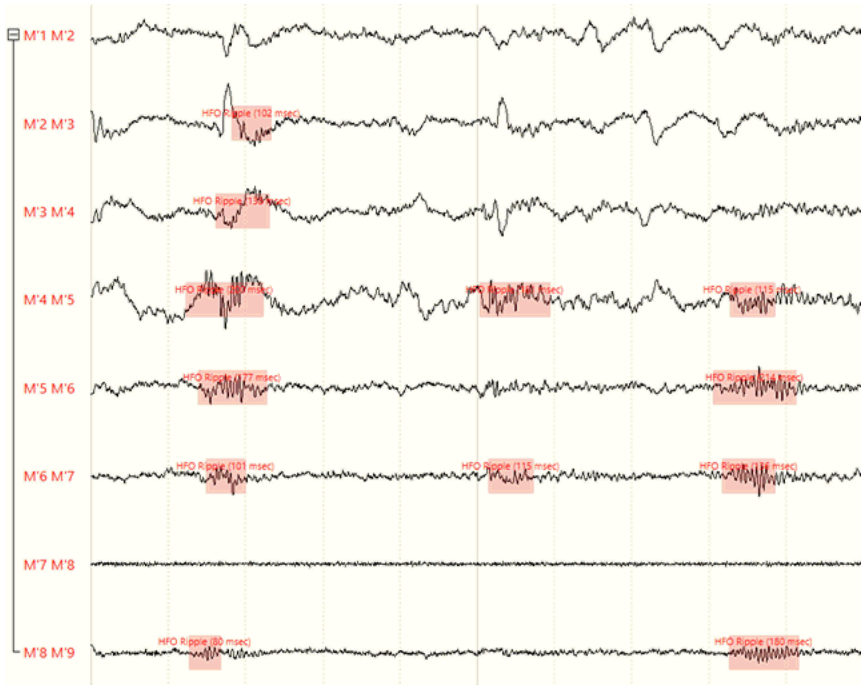


Figure: IIR Filter between [80-250Hz]

Move a HFO Event

The user can move a HFO event after its insertion. In order to move a HFO event follow these steps:

1. Click on the HFO event and hold down the mouse button
2. Drag the HFO event to the desired location and release the mouse button.

Resize a HFO Event

The user can modify a HFO event's duration after its insertion. To resize a HFO event, follow these steps:

1. Click on the start point (or on the end point) of the HFO event
2. Drag the start point (or the end point) of the HFO event to the desired location and release the mouse button.

Delete a HFO event

The user can delete a HFO event in two different ways:

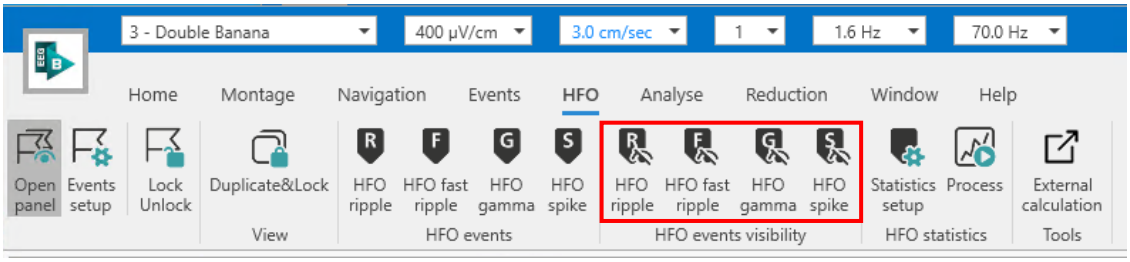
1. Right-click on the HFO event
2. Click Delete
3. The HFO event will be immediately deleted (no confirmation message will appear)

or

1. Open Events Panel using "Open Panel" button
2. Select the HFO event to be deleted
3. Right-click on the HFO event and click Delete (or press Canc button on the keyboard)
4. A confirmation message will appear. The user can choose to proceed or to cancel the operation

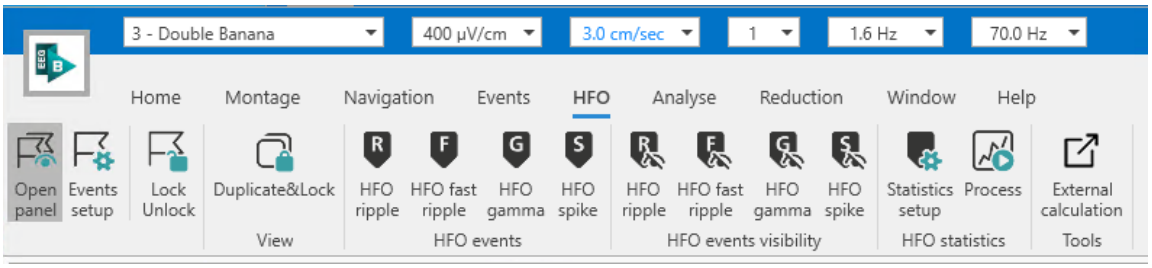
HFO Events Visibility

There is the possibility to enable / disable HFO events visibility for each EEG window to allow the user to visualize only the events of interest.

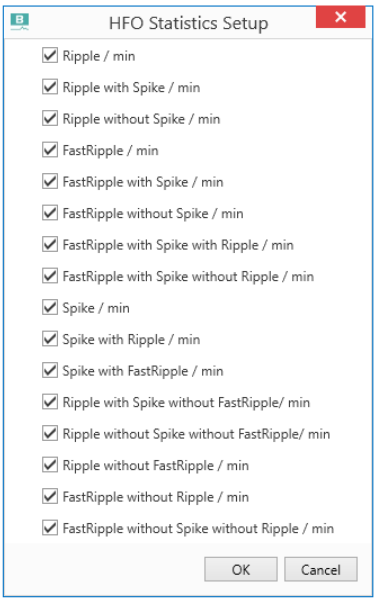


HFO Statistics

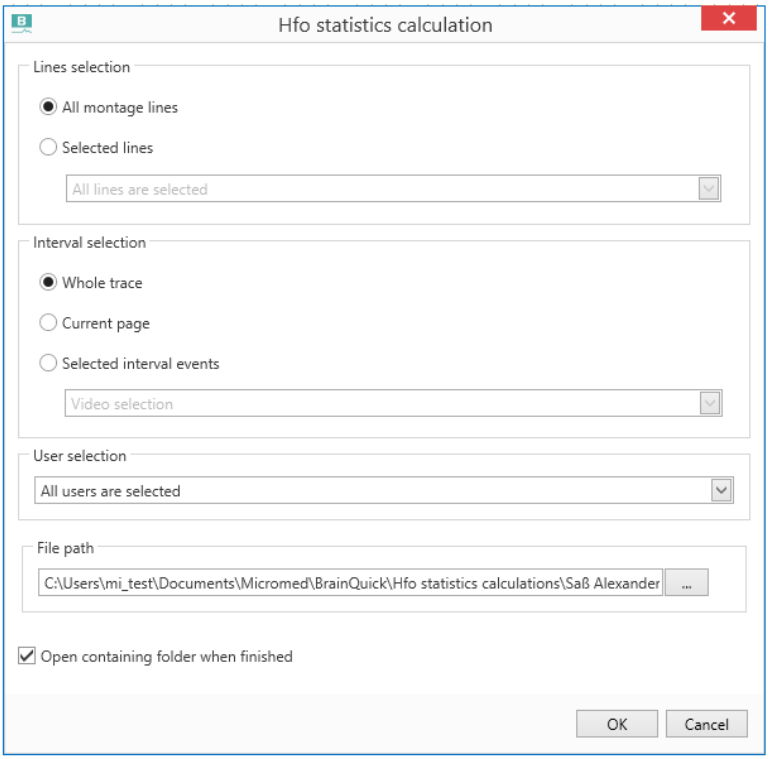
There is the possibility to perform analysis on the number of HFO with or without SPIKES in the different channels in order to underline the channels with the major number of high frequency events that are candidate to represent the Seizure Onset Zone. This can be done using the HFO statistics functions in the HFO tab of the Ribbon bar:



Statistic setup button will open the HFO Statistic Setup window, from which the user can select the statistic calculations to be performed:

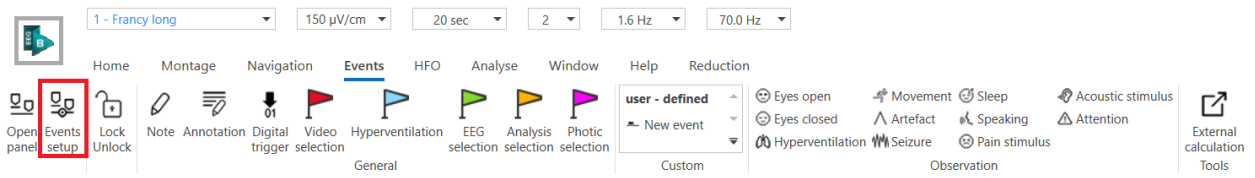


The HFO statistics calculation window will open by pressing the button **Process**. From this window, the user can define settings such as the montage lines on which the statistic calculation will be applied and the selection of EEG trace involved. There's also the possibility to analyze only the HFO events created by a defined user. Pressing the button OK the calculation will start. An excel file will be created in the destination folder, containing all the values selected in the HFO Statistics setup menu.

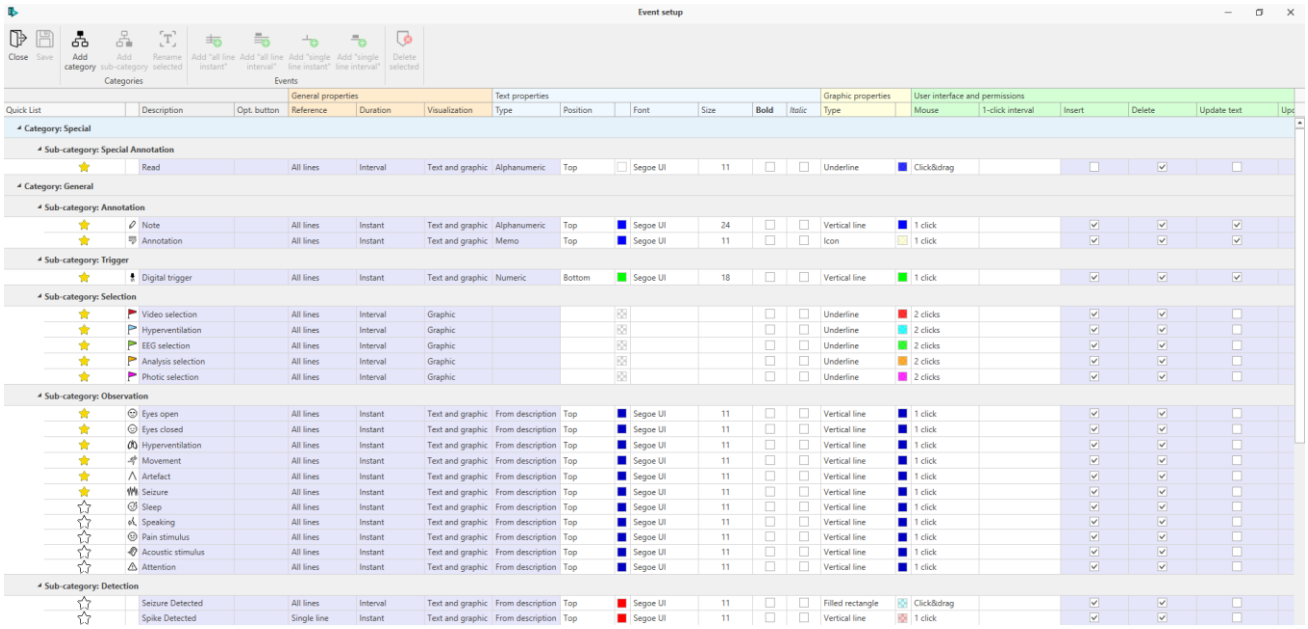


CUSTOM EVENTS

In Ribbon Bar > Events tab there is the possibility to define custom events, in order to let the user create a new event type choosing its graphical and insertion properties.



Clicking on **Events setup** button a window will be opened, from which the user can visualize the default events grouped by category:



Events properties

An event is defined by the following properties:

- **Quick List:** defines if the events are available from insertion with right click on the trace
- **Description:** name of the Event that will be visualized in the Event tab
- **General Properties**
  - **Reference:** could assume the following values:
    SingleLine: if the event will be associated to a single line (e.g. HFO event)
    AllLines: if the event will be associated to all the lines (e.g. Red Selection)
  - **Duration:** could assume the following values:
    ZeroDuration: if the event is related to a fixed moment and not with a duration in timing (e.g. Note event).
    Interval: if the event is related to an interval (e.g. Selection or HFO Events).
  - **Visualization:** could assume the following values:
    Text: if the events will be visualized with a text.
    Graphic: if the events will be marked with a graphic selection or line (if it is defined with ZeroDuration).
    Text And Graphic: both the previous.

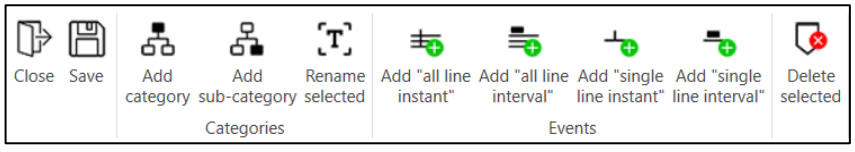
- **Text Properties**
  - **Type:** could assume the following values:
    Alphanumeric
    Numeric
    Rtf: if the text related to the event is an annotation (a document rtf attached to the event).
    From Description: if the text displayed with the event is the Description of the Event.
  - **Color:** the user can define the text color.
  - **Font:** the user can define the text font.
  - **Size:** the user can define the text size.
  - **Bold:** the user can enable Bold if the text should be displayed in bold font.
  - **Italic:** the user can enable Italic if the text should be displayed with Italic font.

- **Graphic Properties**
  - **Type:** the user can define the graphical visualization of the event and could assume the following values:
    Fill Rectangle
    Empty Rectangle
    Underline
    Vertical Line
    Image
  - **Color:** the user can define the graphic color.

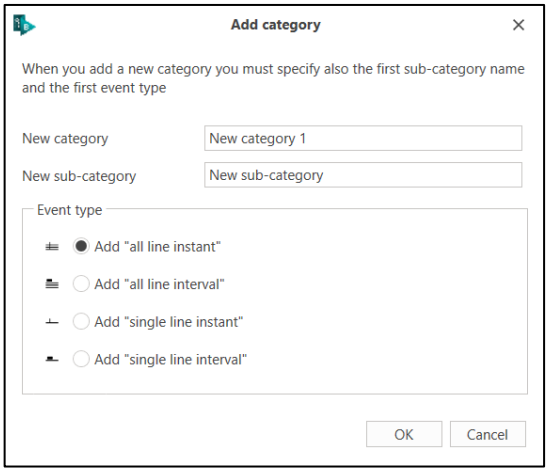
- **User Interface and Permission:**
  - **Mouse:** could assume the following values:
    One Click: if the event will be added to the trace using a single click (e.g. Note events).
    Click And Drag: if the user has to click and drag the event in order to place it in the position of interest with the duration of interest (e.g. HFO events).
    Two Clicks: if the event will be added to the trace using one click to start and one click to end the event insertion (e.g. Red Selection).
  - **1-Click Interval:** the duration of the event could be fixed adding the event with a single click and the user can define the duration of this interval in seconds.
  - **Insert:** allows to define the possibility to add an event or not.
  - **Delete:** allows to define the possibility to delete an event or not.
  - **Update Text:** allows to define the possibility to modify event's text or not.
  - **Update Position:** allows to define the possibility to modify event's position or not.

Add new events category and subcategory

From Event setup window the user can edit existing events definitions but also create new events, events categories and subcategories, using the buttons available on the Event setup toolbar:



The buttons **Add category** and **Add subcategory** open a window in which the user can define the new category and subcategory name and the event type to insert in the subcategory created:



The user can choose to insert by default an event with type All-line zero-duration, All-line interval, Single-line zero-duration, or Single-line interval.
NOTE: an event category cannot be empty. The creation of a new category always implies the creation of a new sub-category and of an event.
NOTE: an event subcategory cannot be empty. The creation of a new subcategory always implies the creation of an event.

Add new events

The four buttons on the Events group of the toolbar allow the user to define new events:

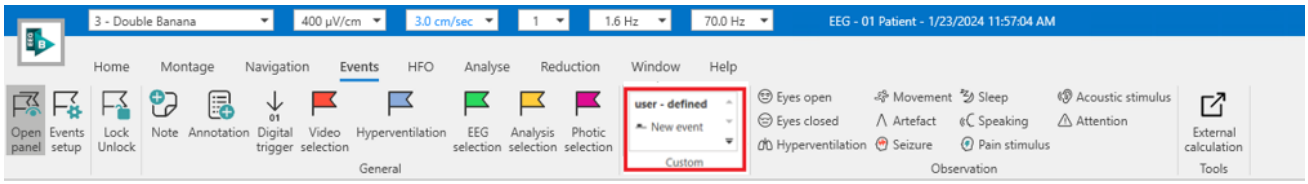
- **Add "all line instant"**: adds a zero-duration event which will be present in all the EEG lines.
- **Add "all line interval"**: adds an interval event which will be present in all the EEG lines.
- **Add "single line instant"**: adds a zero-duration event, which will be present in the selected EEG line only.
- **Add "single line interval"**: adds an interval event, which will be present in the selected EEG line only.

New events can be customized according to the table below:

Event Type	Text	Text and Graphic	Graphic	Graphic Type
All Lines Instant	- Alphanumeric - Numeric - From description	- Alphanumeric - Numeric - From description - Memo	YES	- Vertical line - Icon (available only if Text and graphic with type "Memo" is selected)
All Lines Interval	NO	From description	YES	- Filled rectangle - Empty rectangle - Underline
Single Line Instant	- Alphanumeric - Numeric - From description	- Alphanumeric - Numeric - From description	YES	- Vertical line
Single Line Interval	NO	- From description	YES	- Filled rectangle - Empty rectangle - Underline

NOTE: Reference and Duration fields of already defined events cannot be modified. To change the event's Reference and Duration properties it is necessary to change event's type. The user has to delete the undesired event and to add a new one having the desired type.

The custom events defined by the user will be visualized in the Ribbon bar > Events tab > Custom:



Rename Selected and Delete Selected

The function **Rename Selected** allows the user to rename the selected category or subcategory. This function is enabled only if a category or a subcategory is selected.

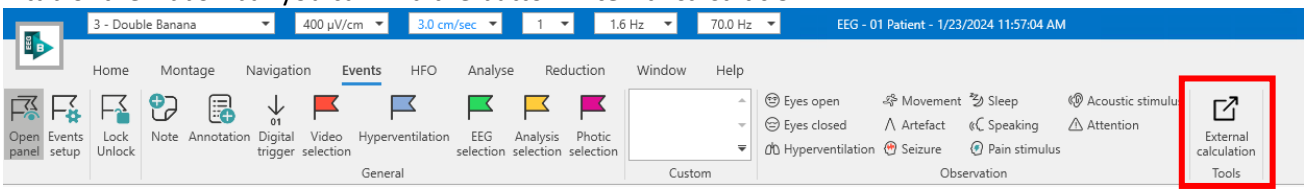
NOTE: This function is not available to rename events. To rename an event just click on its name and type the new name, then save the changes.

The function **Delete Selected** allows the user to delete the selected item, which can be an event, a category, or a subcategory. A confirmation message will appear.

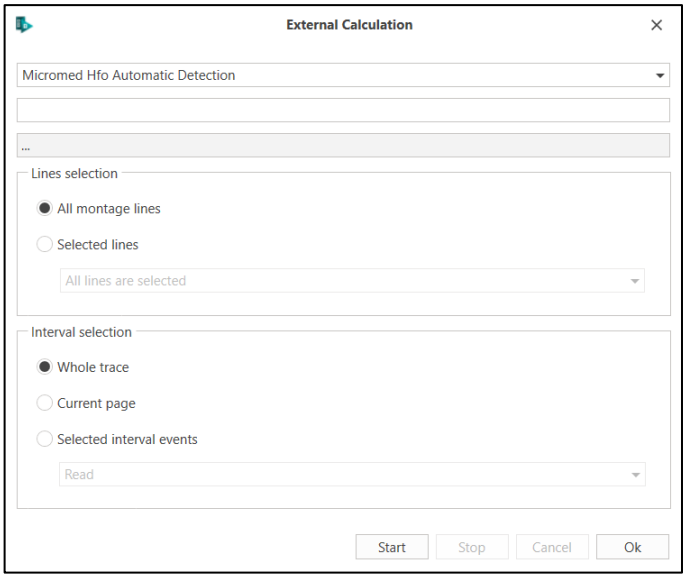
NOTE: Default events categories (General, HFO, Respiration, and Scoring) and their subcategories and events cannot be renamed nor deleted.

EXTERNAL CALCULATION

From BRAIN QUICK review window there is the possibility to run external calculation programs. In the Events tab of the ribbon bar you can find the button **External calculation**:



Pressing External calculation button the following window will open:



From the External Calculation window it is possible to select the plugin to be used for the calculations, choosing from a list of available plugins. The user can also define the montage lines and the trace interval on which the calculations will be performed.

Pressing the button Start the calculation will be launched, using the algorithm and the parameters defined by the user.

At the end of the external calculation results will be automatically imported and displayed.

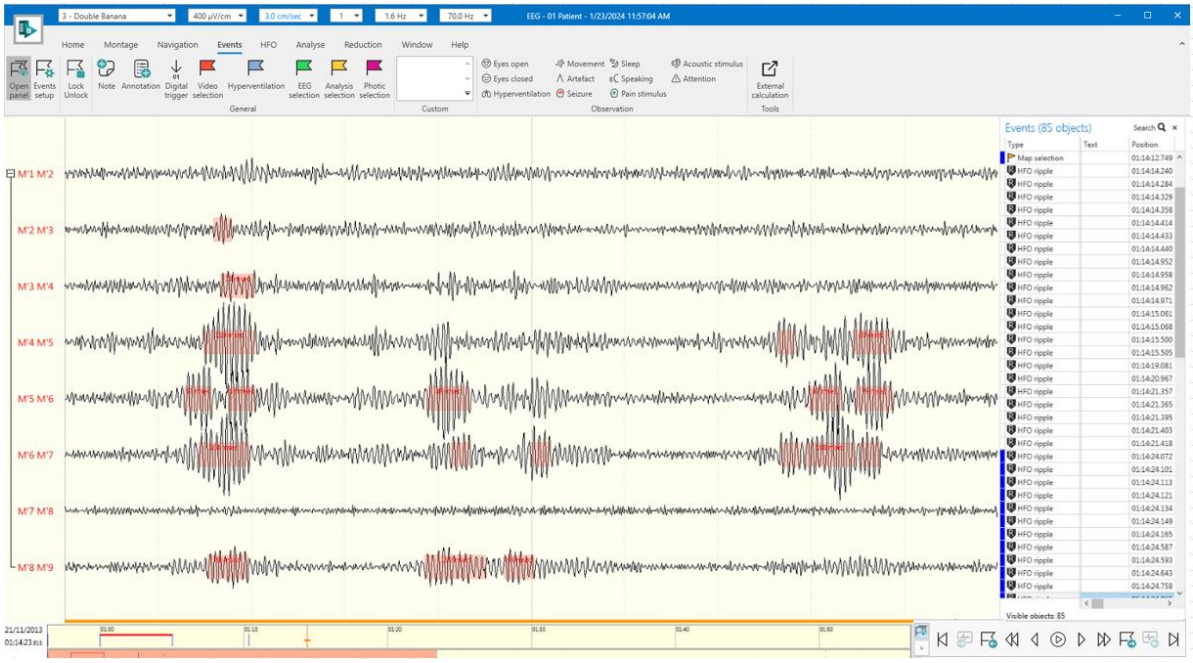
NOTE: a progress bar will show the progress f the external calculation. At the end of the analysis the External Calculation window will automatically close.

Micromed HFO Automatic Detection

Micromed HFO Automatic Detection algorithm is implemented according to Staba's method and consists of detection of spontaneous high-frequency oscillation (HFO) events from continuous wideband EEG recordings. The wideband EEG is band-pass filtered 80–250Hz to identify high-frequency EEG events (Ripple oscillations). The threshold of 2.5 SD above the mean value of the rectified band-pass signal is calculated and used to detect HFO events. Consecutive events separated by less than 10ms are combined as one only event and only those with at least 6 peaks are considered.

To start HFO Automatic Detection follow these steps:

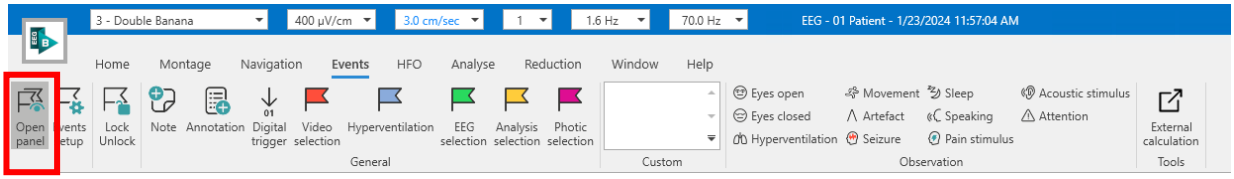
1. Click on External calculation button in order to open External Calculation window
2. Select "Micromed HFO Automatic Detection" plugin
3. Select montage lines (All montage lines or a selection of these) on which the calculation will be performed
4. Select EEG trace interval (Whole trace, Current page, or a trace user-defined selection) on which the calculation will be performed
5. Click on Start
6. All the HFO events detected will be displayed on the EEG trace and in the Events panel. Detected events will be added to the events file associated to the EEG file



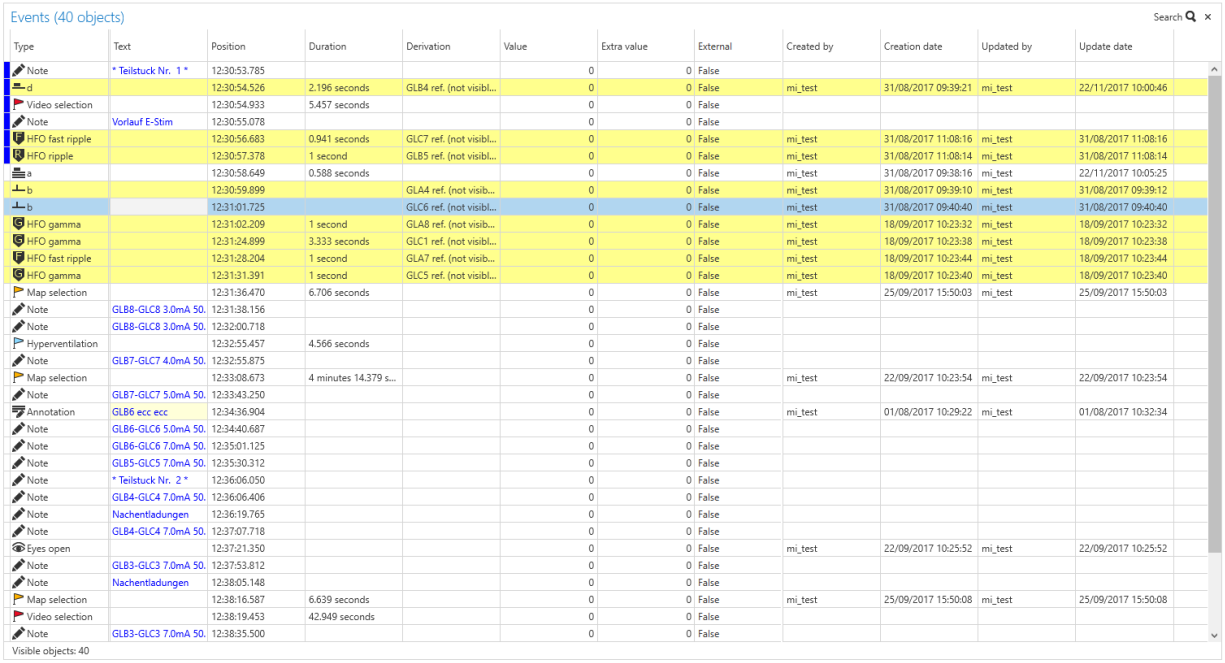
NOTE: threshold, distance between events and peaks number values used by the algorithm can be edited using SettingsHFO.ini file located in C:\System98\Programs\HFO.

EVENTS PANEL

The Events Panel is a tool used to visualize, analyze, and edit all the events of an EEG recording. The Events Panel can be opened using the Open panel button in the Events tab of the Ribbon bar:



The Events Panel displays all the events sorted by default by their position in the EEG trace:



For each event the following information is displayed:

- **Type:** Note, Annotation, Digital Trigger, Video selection, etc.
- **Text:** available for events with type Note, Annotation, and Digital Trigger.
- **Position:** time position of the event in the EEG trace.
- **Duration:** available for events with type selection or interval
- **Derivation:** name of the derivation in which the event is inserted. Available for single line events only.
- **Value, Extra Value and Extra Text:** auxiliary multi-use fields, available for all the events except from Notes, Digital triggers, Video; Hyperventilation and EEG selections. These additional fileds can be used to group events.
- **External:** True or False. This field allows the user to identify events created and imported using external calculation tools.
- **Created by:** the user who created the event.
- **Creation date:** date and time of the creation of the event.
- **Updated by:** the user who modified the event.
- **Update date:** date and time of the event modification.

On the top of the Events Panel, the total number of events present in the EEG recording is displayed.

NOTE: All the events visible in the current EEG page are marked with a blue rectangle on the left. Using up and down arrow keys the user can scroll the events list. The blue mark will scroll too, in order to underline always those events, which are currently displayed.
NOTE: All the events belonging to derivations ,which are not visible in the current montage, instead, are highlighted in yellow.

Jump to Event

Click on any event in the Events Panel and the trace display automatically jumps to that point in the recording.
If you scroll to a new page in the recording, the first event on that page is highlighted in the Events Panel.
If a duration event of any type is clicked in the Events Panel, the event is centered on the screen display. If the duration event is too long to fit fully on the screen, the left edge of the event will be displayed.

Sort

All events in the Events Panel can be sorted by Type, Text, Position, Duration, Derivation, Value, Extra Value, Extra Text, External, Created by, Creation date, Updated by and Update date, just by clicking on the column's header. Click the header a second time to reverse the order.

Reordering the Column Headers

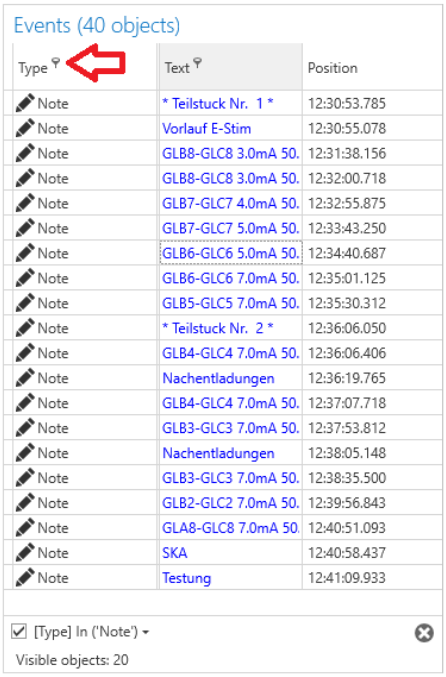
You can reorder the Events Panel's columns by clicking on the column's header and dragging it to the desired position. For example, you can rearrange the headers from Name: Time : Duration to read Time : Name : Duration or in any other sequence you want to view them.

Delete

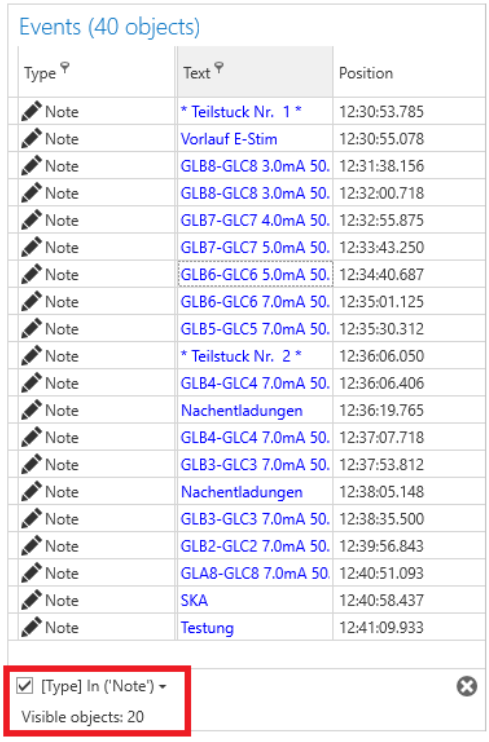
To delete events from the list of the Events Panel select the event, right-click on it with the mouse and choose Delete from the popup menu. A confirmation message will appear.
Otherwise you can select the event and press the Canc key on the keyboard. In this case no confirmation message appears before deletion.
NOTE: if you delete an event from the Events Panel, it will also be deleted from the EEG trace.

Filter

There is the possibility to filter events visualization in the Events Panel by Type, Text, Derivation, Value, Extra Value, Extra Text, External, Created by, Creation date, Updated by and Update date.
To filter events click on the funnel icon on the column header and select the items you want to visualize in the list:



On the bottom part of the Events Panel a summary of the applied filters will appear:



Clicking on the checkmark next to the filter properties you can disable on enable again the filter. Clicking on the X button on the bottom right, instead, you can clear all filter settings.
Under the filter settings the number of currently visible events is displayed: this number takes into account events, which are visible after the filters application.

VISUALIZATION SETTINGS

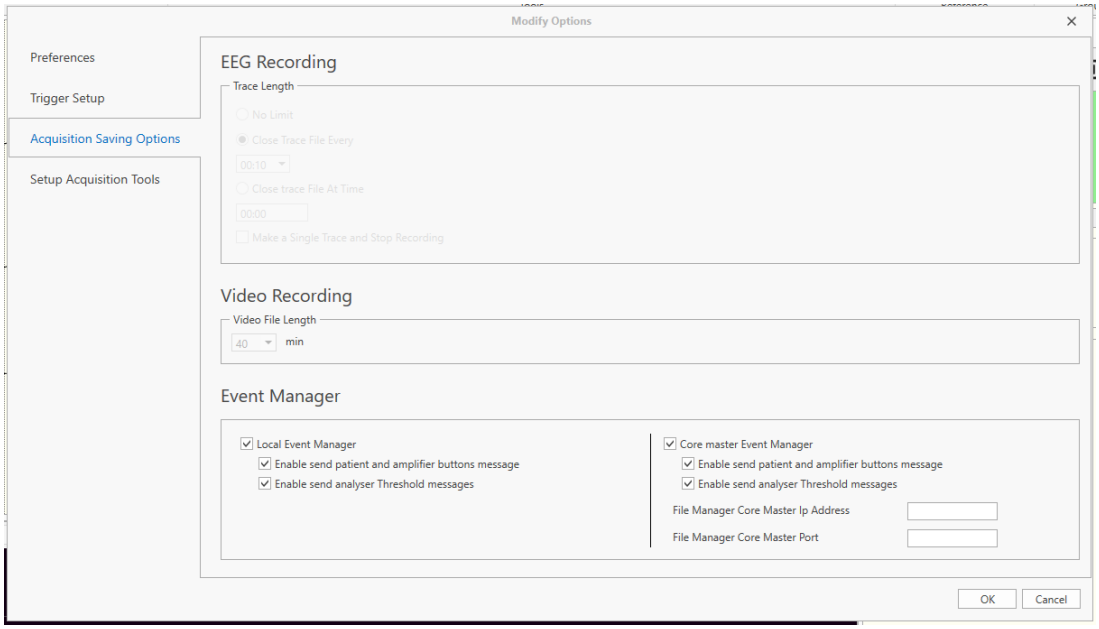
The user can enable Events Panel visualization pressing "Open Panel" button that is available from different points of the EEG window:
- From Ribbon bar > Home tab (Events group)
- From Ribbon bar > Events tab
- From Ribbon bar > HFO tab
- From Time bar:

Events Panel can be floating in the position of interest in the EEG window or can be docked to one of the preset positions in the EEG window (see sections “Dock Panel Layout” and “Windows Placement”). Events Panel can also be placed on a second screen. To move Events Panel, just click on its header and drag it to the desired position.
The height and width of Events Panel can also be modified. To resize Events Panel just hover the mouse on one of its edges. When the cursor turns into a two-sided arrow, click and drag the window edge until the desired dimension is reached.

LOCAL EVENT MANAGER

Brain Quick software implements a local event manager for the display of alarms. To enable the event manager, the user has to enable the alarms of interest in the software preferences.

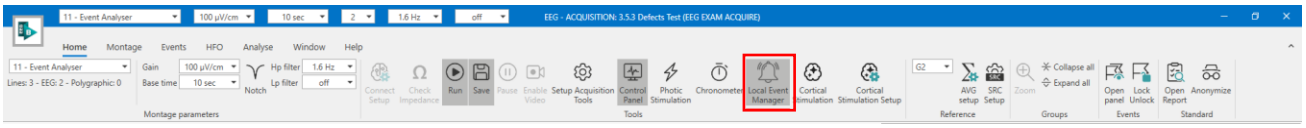
By clicking on Application Button > Preferences > Acquisition Saving Options the user can access the local event manager options:



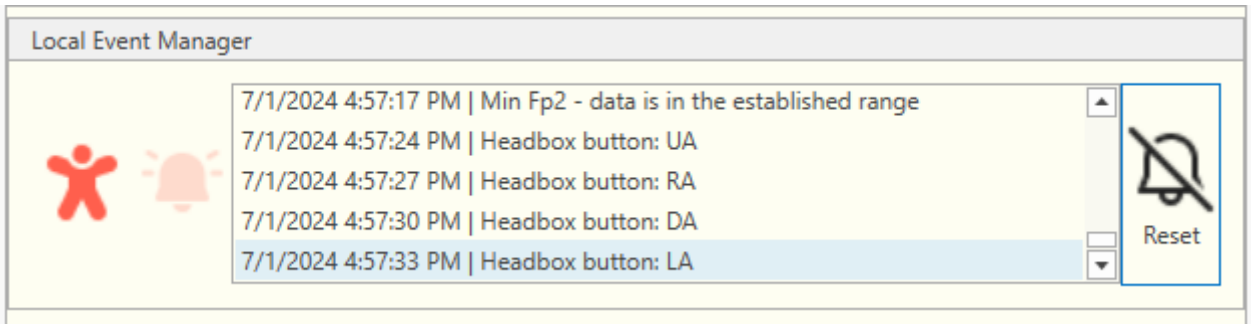
In this page it is possible to enable the Local Event Manager and to select whether to be alerted by the either or both the following possible events:

- Patient button/Amplifier button
- Analysis alarm threshold

Once the Local Event Manager is enabled, it is possible to open its window in the status panel by clicking on the relative icon in the home tab of Brain Quick Software:



Once enabled, the Local Event Manager will be visible in the status panel:



With the Local Event Manager window open, the software will prompt information regarding alarms during the recording of an EEG exam. Once an alarm is triggered, a sound will start playing to alert the user and a red flashing icon will appear to the left of the information box. No alarm will be issued if the current EEG exam is not currently been saved.

Amplifier button and patient button

Alarms triggered by pressing the amplifier button or the patient button a sound alarm will start ringing and a red man-shaped icon will start flashing to the left of the information box:

By pressing the Reset button to the right of the information box, both the red icon and the sound alarm will stop and the text in the information box will be preserved.

Analyzer threshold alarm

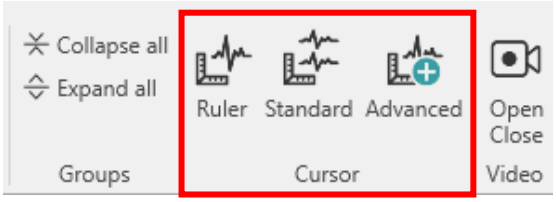
If an analysis protocol is set for the current analysis and the analysis panel is open, the software will automatically notify the user of alarm threshold been triggered. To setup an analysis threshold alarm, refer to the **Analyzer** section of the manual.

When an analyzer threshold alarm is triggered, a sound will start playing and a red bell-shaped icon will start flashing to the left of the information box:

By pressing the Reset button to the right of the information box the alarm sound will stop. The red icon will continue to flash up until the analyzer signal is no longer in the alarm region. Furthermore, no more sound will be played until the graph that triggered the alarm goes back into the safe region or a different graph triggers a new alarm.

MEASURE CURSORS

Measure cursors are tools which allows to measure oscillations amplitude, duration and frequency in a quick way. They can be enabled by clicking on the **Cursor** section from the Home tab of the Ribbon bar:



Finally there is the Distance cursor, another tool that allows the user to measure time differences between two defined points on the trace.

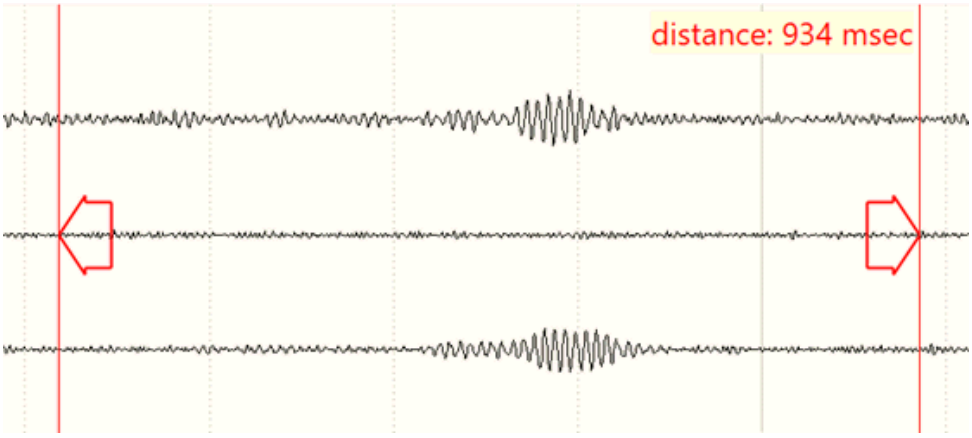
These features and how to use them are explained below.

DISTANCE CURSOR

Distance cursor is a tool that allows the user to measure time differences between two defined points on the EEG trace. It is composed of two vertical red lines with red arrows, which identify the start and end point selected for the distance measurement. A textbox displays the distance measured between the selected start point and end point.

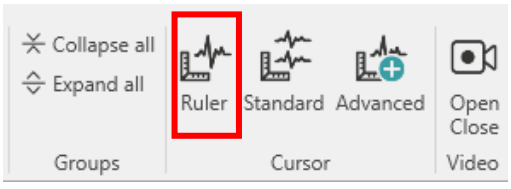
The user can enable and disable distance cursor by directly clicking with the mouse on the EEG trace:

1. Double-click on the EEG trace to set the start point for distance measurement
2. Double-click on the EEG trace to set the end point for distance measurement
3. Distance information is displayed
4. Double-click on the EEG trace to close distance cursor

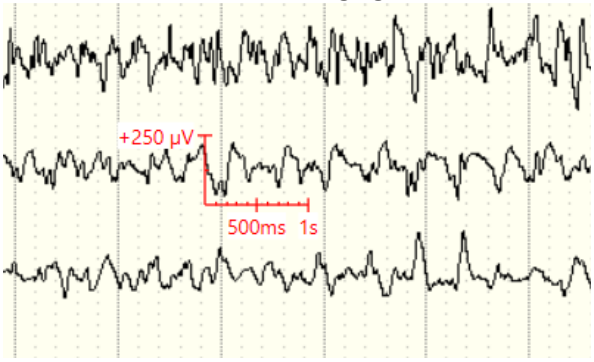


RULER MEASURE CURSOR

Ruler cursor is a tool that allows the user to measure oscillations amplitude in a quick and qualitative way. It can be enabled by clicking on **Ruler** button from the Home tab of the Ribbon bar:



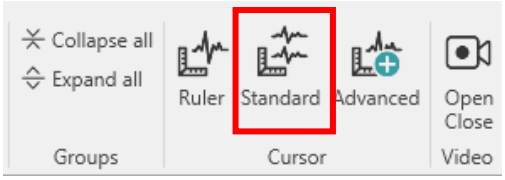
A floating ruler with graduated axis appears when hovering the mouse on the EEG trace. The ruler can be positioned in correspondence with the oscillations of interest to measure their amplitude and it can be fixed on the EEG page using shortcut CTRL+F and unfixed using again CTRL+F.



The ruler cursor y-axis is equal to the gain and the x-axis is equal to 1 second.

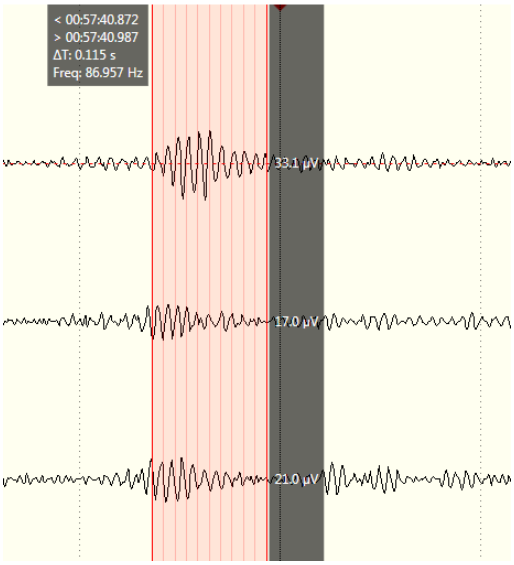
STANDARD MEASURE CURSOR

Standard Measure Cursor is a tool which allows to measure oscillations amplitude, duration and frequency in a quick way. It can be enabled by clicking on **Standard** button from the Home tab of the Ribbon bar:



When clicking on Standard button the Standard Measure Cursor directly opens in the middle of the EEG page. It is composed of a red area, which delimits the part of the EEG trace to be measured. The selection applies to all the montage lines.
Standard Measure Cursor displays information updated in real time about the:

- Initial and final timing position of the vertical selection
- Temporal duration of the interval
- Peak-to-peak amplitude of the interval

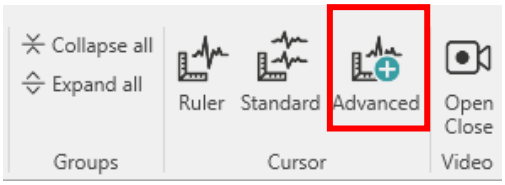


The area selected by the Standard Measure Cursor can be resized by clicking with the mouse on the start point (or on the end point) of the selection and dragging it to the desired position. The selection can also be moved by clicking with the mouse on the red area and dragging it to the desired position.

Standard Measure Cursor allows also to fit frequency of the selected waves: the cursor provides 9 vertical bars within the selected area that split the selection in 10 parts, which allow the user to fit the interesting wave's peaks. Just selecting with the cursor the wave of interest and reshaping the selection in order to fit the peaks you can obtain a direct measure of the frequency of the selected wave. Frequency value calculated is displayed in the results box which appears on the top left of the measure cursor.

ADVANCED MEASURE CURSOR

Advanced Measure Cursor is a tool which allows to measure oscillations amplitude, duration and frequency in a quick way. It can be enabled by clicking on the **Advanced** button from the Home tab of the Ribbon bar:



When clicking on the **Advanced** button the Advanced Measure Cursor directly opens in the middle of the EEG page. It is composed, as the Standards Measure Cursor, of a red area that delimits the part of the EEG trace to be measured. The selection applies to all the montage lines and by default the first montage line is selected.

The user can select the area of interest by clicking and drag the selection directly from the EEG page.

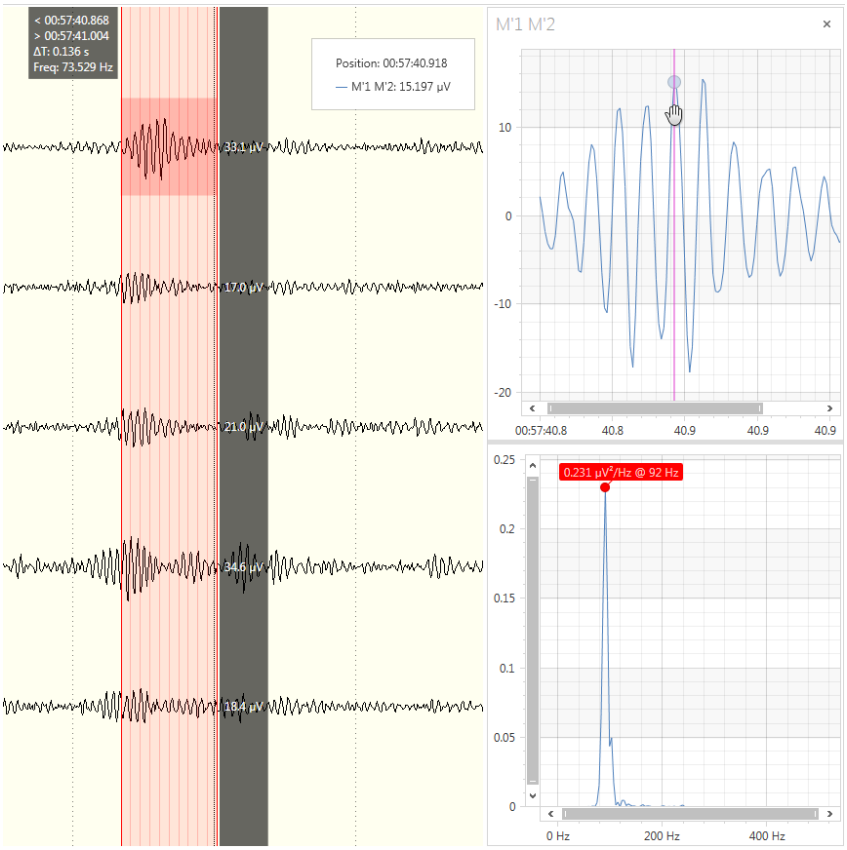
Advanced Measure Cursor displays information updated in real time about the:

- Initial and final timing position of the vertical selection
- Temporal duration of the interval
- Peak-to-peak amplitude of the interval

The area selected by the Advanced Measure Cursor can be resized by clicking with the mouse on the start point (or on the end point) of the selection and dragging it to the desired position. The selection can also be moved by clicking with the mouse on the red area and dragging it to the desired position.

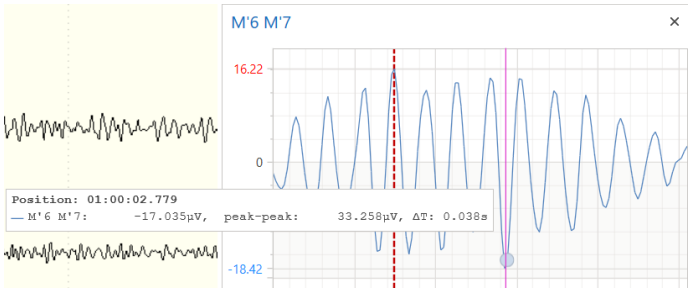
Advanced Measure Cursor allows also to fit frequency of the selected waves: the cursor provides 9 vertical bars within the selected area that split the selection in 10 parts, which allow the user to fit the interesting wave's peaks. Just selecting with the cursor the wave of interest and reshaping the selection in order to fit the peaks you can obtain a direct measure of the frequency of the selected wave. Frequency value calculated is displayed in the results box, which appears on the top left of the measure cursor.

In addition to Standard Measure Cursor's features, Advanced Measure Cursor provides a panel showing two graphs. The upper graph displays a zoom of the selected part of the EEG trace. The lower graph displays the spectrum of the selected part of the EEG trace, with indication of the peak frequency:

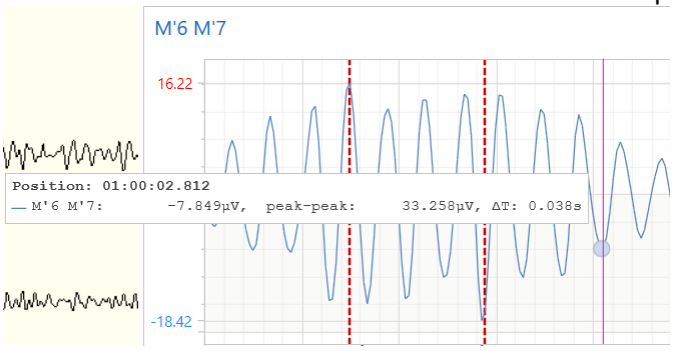


Hovering the mouse over the Advanced Measure Cursor's graphs the user can obtain additional information about the amplitude or the power of the trace: each graph provides a vertical cursor which is displayed when the mouse hovers on the plot. When the vertical cursor is active a box displays information about the position and amplitude of the selected point for the zoom graph and about frequency and power of the selected point for the spectrum graph.

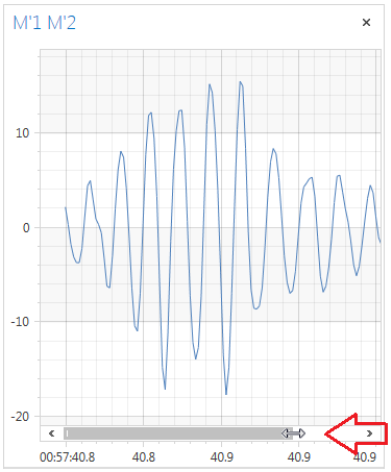
Double clicking on the amplitude graph it is possible to add a fixed reference to visualize information about the position and amplitude difference between the fixed value and the actual position of the mouse over the amplitude graph:



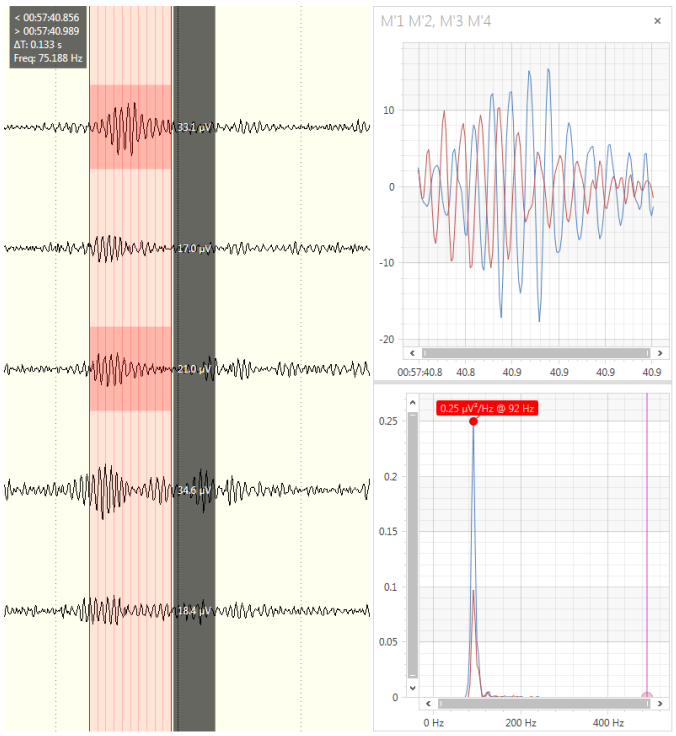
It is possible to double click to fix and compare two different values on the amplitude graph and in this case the active box will show information about the difference between the selected peaks:



The user can also modify both graphs' axis scale by clicking on the axis cursor's extremity and dragging it:



Advanced Measure Cursor allows to analyze more than one EEG segment at the same time. The user can select more than one EEG segment using Ctrl + mouse click on the lines of interest. If more lines are selected, their graphs are superimposed with different colors in Advanced Measure Cursor panel:



ANALYZER

ANALYZER DATA PROCESSING

Introduction

The EEG Analyzer software is a dedicated instrument for analysis of EEG and Polygraphic signals (in the following they will be both referred as EEG signals). It provides quantitative analysis of data both in frequency and time domain, with display of evolution of any of the calculated parameters over the time.

The EEG Analyzer is designed to fulfill the analysis needs in the following activities:

1. Monitoring EEG Signals in **Intensive Care Units** – Adult/Pediatric/Neonatal
2. Monitoring SpO2 and HR in **Long Term Monitoring** for Epilepsy
3. Analyzing EEG and Polygraphic Signals for Reporting **LTM and/or Ambulatory Recording**

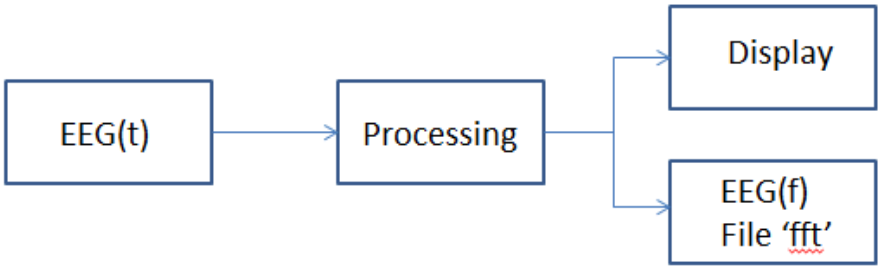
The design of the User Interface is defined for two main groups of users:

A. Basic Users: very simple User Interface, a Quick Startup, a few pieces of information that is clear and condensed.

B. Advanced Usesr: sophisticated Analysis with the possibility to configure any single detail, in a User Friendly manner, which simply need to be fast in term of calculation and efficient in term of display. They might choose to display lot of information and to export lot of data for further analysis.

Data Processing Scheme

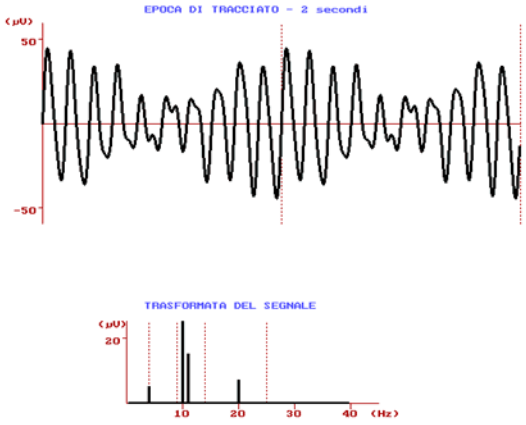
The calculation is based on a segmentation of the signal into 2 sec. epochs, the so called “minimum epoch.”

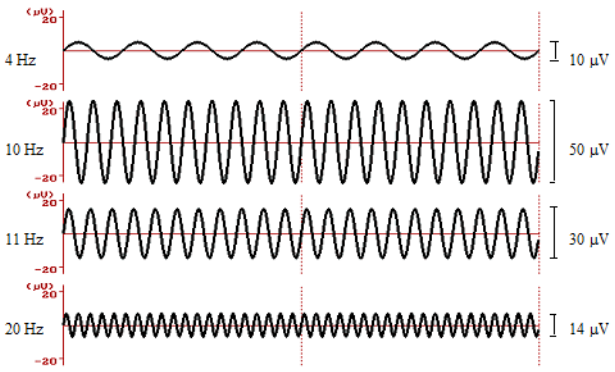


Already Calculated Parameter will be saved, storing ONLY the really used parameters. For sure an offline modification of the displayed parameters will require a recalculation of the data.

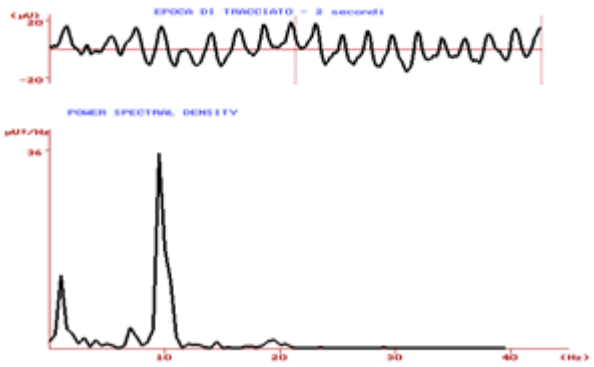
Spectral Analysis

Spectral analysis is a process that is based on the transformation of the trace from the time domain to the frequency domain. The advantage of such an operation consists in the possibility to condense information contained in trace segments of several seconds or up to several hours into a single graph. This analysis supplies information about the structure of the trace, but does not supply information regarding any eventual morphology present in the signal, which is however not the real objective of long term monitoring. Spectral analysis is based on the principle that any signal can be viewed as a sum of pure sinusoidal components that differ in frequency and phase.





The signal display in the form of a spectrum is simply a graph that shows, for each pure frequency component, its power, also called PSD - Power Spectral Density. This graph should be shown in columns, but typically is always drawn as a continuous graph where the X-axis shows the measured frequency in Hertz or cycles/sec and the Y-axis shows the power, where the unit measurement is uV^2/Hz. The computation of this decomposition is obtained by the DFT - Discrete Fourier Transform, of which a rapid calculation version was introduced in 1970 and took the name of FFT - Fast Fourier Transform.



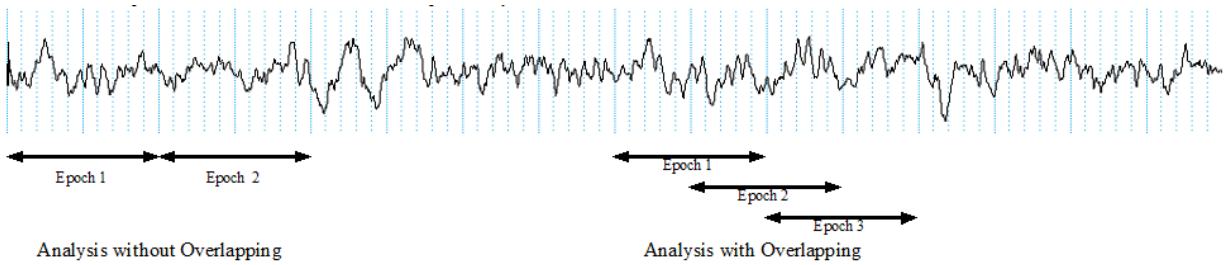
Frequency analysis consists in the segmentation of the EEG trace in multiple epochs of 2 seconds or more, transformation of each of these according to Fourier, then averaging the various spectrums and displaying the results obtained as a graph.

As already stated, spectral analysis is not a punctual methodology, but median, in such that it highlights the harmonic content of the signal contained in fixed epochs; if we add the fact that we average the results obtained from multiple epochs, we can clearly understand why such an analysis is not capable of highlighting sporadic low power events present in the trace.

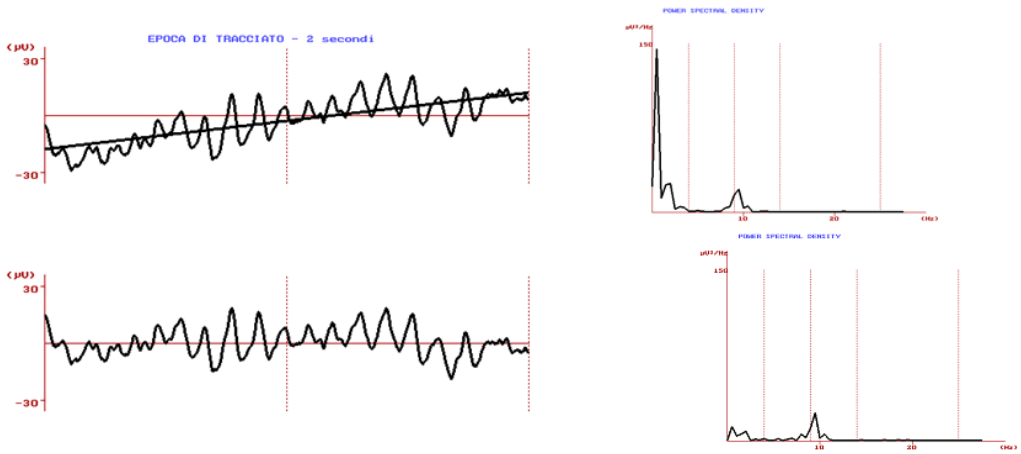
Signal Conditioning (Pre-Processing)

To improve the performance of both Time Domain Analysis and Spectral Analysis a conditioning of the original signal can be performed as follows:

- **Overlapping**: this is a technique consisting in analysis of superimposed epochs. This consists in the analysis of, for example, preset epochs of 2 seconds selecting consecutive epochs every second (1 sec, following figure). This permits the analysis of each trace element in a manner that they are centrally located within the analysis epoch.



- **Detrending**: this is a technique consisting in the removal from each epoch of any eventual DC or their derived components. This consists in removing the straight -ine components from the signal that best approximate the trace tendency within the epoch. The result obtained is notable, because the very slow components that are suppressed are usually of no interest, while any rapid components are highlighted, as they are the most important ones within analysis.



- **Tapering**: this technique has the aim to reduce the phenomena of spectral leakage which, distributing the signal power in a wide band of the spectrum, risk masking other important low power components of the trace. The resulting improvement is considerable, especially with signals characterized by a dominating rhythm, whose dispersed components could effectively mask other real components of the trace. This operation consists in multiplying the epoch of the signal by a known constant function, which is usually 0 at the extremes of the epoch.

Signal Referencing

The following Referencing algorithm can be applied to the signal, prior to any signal re-combination:

Average Reference (AVG)

Bi-Auricular Reference (A1-A2)

Source Reference (SRC)

Signal Recombination

The EEG Analyzer allows the selection of the following channels for the analysis:

MONOPOLAR EEG CHANNEL

This is a monopolar EEG Channel “As Recorded”, that is with the physical Common Reference used during acquisition (i.e. Fp2-G2).
Processing allowed on this kind of data are the following:
Average Reference
Biauricular Reference
Source Reference
No need to predefine these channels for the analysis as they are derived from the list of recorded channels.

BIPOLAR POLYGRAPHIC CHANNEL

This is a Polygraphic Channel “As Recorded”, that is then a Physical Bipolar signal.
No processing is allowed on this kind of data.
No need to predefine these channels for the analysis as they are derived from the list of recorded channels.

BIPOLAR EEG CHANNEL

This is a Bipolar EEG Channel derived from 2 Monopolar EEG Channel by simple subtraction (i.e. Fp2-C4 derived from Fp2-G2 and C4-G2).
Processing allowed on this kind of data (prior to bipolar calculation) are the following:
Average Reference
Biauricular Reference
Source Reference
The list of possible "Bipolar EEG Channels" need to be defined in the protocol Setup

MONOPOLAR EEG CHANNELS GROUP

This is a Group of Monopolar EEG Channels, which specify to calculate the average activity of any of the parameters over the selected Monopolar EEG channels.
Processing allowed on this kind of data (prior to average group activity calculation) are the following:
Average Reference
Biauricular Reference
Source Reference
The list of possible "Monopolar EEG Channels Group" needs to be defined, with the detailed composition of each group, in the Protocol Setup

BIPOLAR EEG DATA GROUP

This is a Group of Bipolar EEG Channels, which specify to calculate the average activity of any of the parameters over the selected Biopolar EEG channels.
Processing allowed on this kind of data (prior to average group activity calculation) are the following:
Average Reference
Biauricular Reference
Source Reference
The list of possible "Bipolar EEG Channels Group" needs to be defined, with the detailed composition of each group, in the Protocol Setup

Signal Filtering

The following Filtering can be applied to the signal:

High Pass Filter
Low Pass Filter
Notch Filter
"Rectangular Like" Filter

Period of Calculation

This parameter defines the duration of the super epoch for the calculation of the values to be displayed, i.e. the number of epoch to consider in order to produce an output (which is not always the "Average" of the values of single epochs). It must be defined in seconds.

Interval Type

This parameter defines the duration of the super epoch for the calculation of the values to be displayed, i.e. the number of epoch to consider in order to produce an output (which is not always the "Average" of the values of single epochs). It must be defined in seconds.

Parameter List

All the parameters used in the EEG Analyzer are calculated any time the user runs the EEG Analyzer program.
The list of these parameters is the following:

1. PSD (Power Spectral Density): this parameter is calculated using the Fourier Transform: further information is described in the following section (Spectral Analysis)

2. Absolute Power
3. Relative Power
4. Spectral Edge Frequency (SEF)
5. Peak Frequency
6. Main Dominant Frequency (MDF)
7. Median Frequency (MF)
8. User Index
9. Burst Suppression Ratio (BSR)
10. Average Coherence
11. Signal Value
12. Integrated Amplitude (IAEEG)
13. Tachogram in bpm
14. Tachogram in sec

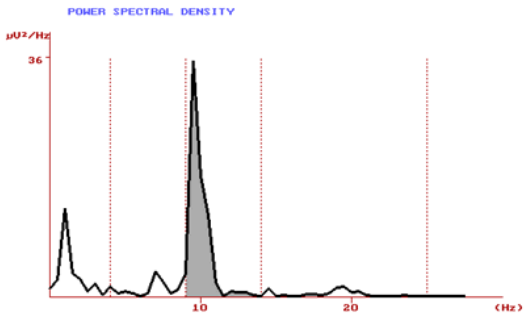
ANALYZER PROTOCOLS

PSD-Power Spectral Density

This parameter is calculated using the Fourier Transform: further information are described in the "Spectral Analysis" part.

Absolute Power

The absolute power on a band is calculated as the area of the spectrum delimited by the frequency band limits (mathematically it is the integration, in the frequency domain, of the PSD). The unit of measure is μV^2. In the figure below the absolute power of the alpha band is shown as the area under the graphic of the PSD (Power spectral Density) within the Alfa Band limits.



Absolute power of the Alfa band shown as a shaded area of the spectrum.

Relative Power

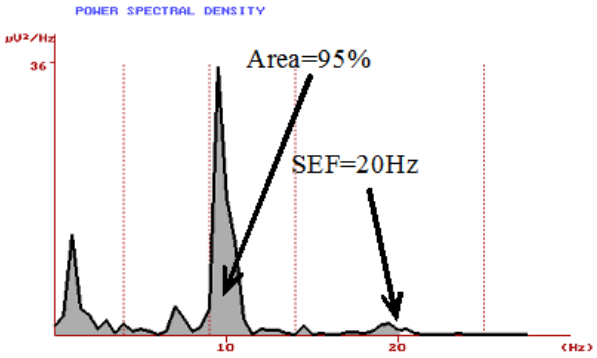
Calculated as the ratio between the absolute power in a specific band and the total spectral power (equal to the total sum of the power in all bands). Taking as an example the 4 standard spectral bands, we can obtain the following:

$$Delta_{REL} = \frac{Delta_{ABS}}{Delta_{ABS} + Theta_{ABS} + Alfa_{ABS} + Beta_{ABS}}$$

Being a ratio between two similar quantities, the result has no dimension and is usually expressed as a percentage.

Spectral Edge Frequency (SEF)

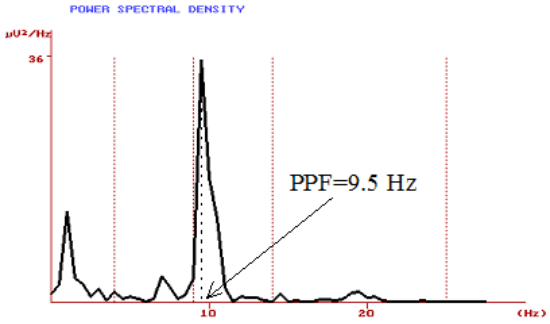
This is defined as the width of the spectrum. Its calculation can be derived in different ways but it is most often calculated as the frequency, which delimits 95% of the total spectral power (figure 6). Its dimension is in Hz or cycles/sec.



Example of the SEF value derived from an EEG spectrum

Peak Frequency (PF)

This is the frequency where the power of the spectrum, reaches its maximum value or peak. This value can also be defined as the maximum value reached in each of the specific bands. Its dimension is in Hz or cycles/sec.



Main Dominant Frequency (MDF)

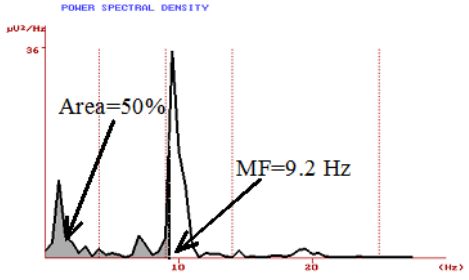
This is the dominant frequency of the spectrum, defined as the weighted average of the power at various frequencies and is calculated by the following formula:

$$MDF = \frac{\sum_{f=0}^{f_{MAX}} f \cdot PSD[f]}{\sum_{f=0}^{f_{MAX}} PSD[f]}$$

Its dimension is in Hz or cycles/sec.

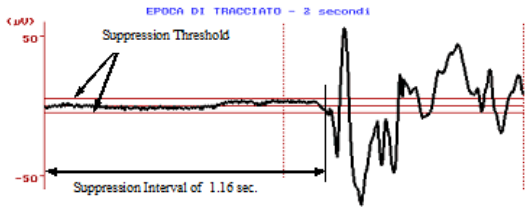
Median Frequency

Median frequency is the specific frequency value that divides the spectrum into two regions, each containing 50% of the total power (figure 8). Its dimension is in Hz or cycles/sec.



Burst Suppression Ratio (BSR)

This is a parameter that quantifies the degree of suppression of the trace. It is calculated on preset epoch lengths as a ratio of the period where the signal remains stable and below a specific threshold, for example ±5 μV, and the duration of the epoch (figure 9). To qualify the trace considered in suppression, the threshold must be surpassed for at least 400 - 500 msec. If there are multiple intervals of suppression during a single epoch they are summed. This parameter shows the percentage of suppression present in each data interval. Normally the program visualizes a value of BSR every 8 seconds but the calculation is of a sample every 2 seconds, so there will be 4 values of BSR calculated every 8 seconds. In the EEG Analyzer setup the user can setup if visualizing the higher, lower or the mean of these 4 values. (In general the option “Mean” is choosen).



Inter Burst Interval - IBI

This is a parameter that quantifies the degree of suppression of the trace. It is calculated as the Interval between two burst of activity if the signal in that interval keep on staying within a predefined threshold (the same amplitude threshold of the BSR).

As the calculation can be based on several consecutive epochs, particular precautions need to be taken into its calculation and or recombination over epochs.

Average Coherence

This is the parameter that quantifies the average coherence between 2 channels. It can be defined as Coherence between 2 “Monopolar EEG Channels” or between 2 “Bipolar EEG Channels”

Signal Value

This is the parameter that visualizes the numerical value of the signal selected. As it refers to a signal epoch, it should be displayed as the “Maximum”, “Minimum” or “Mean” value within the epoch.

If “Maximum” or “Minimum” are selected, when “averaging” values over epochs the “Maximum” of all the “Maximum” of each epoch must be calculated as well as the “Minimum” of all the “Minimum” of each epoch must be calculated.

IAEEG (Integrated Amplitude EEG)

This parameter is calculated on a channel as the “Lower Edge” and “Upper Edge” of an “Amplitude Integrated” processed channel. Amplitude Integrated of an EEG channel means pre-filter the signal (with a pass-band filter 2-20 Hz), rectify smooth and compress the values in time in order to obtain the desired values.

User Index

All the parameters already described can be used singularly as a variable to be monitored, or in combination to define new variables also known as **Indexes**. A typical example often found in literature is the Theta/Alfa quotient, which is calculated as the ratio of the absolute power in Theta and the absolute power in Alfa of any given signal. It is obvious that many other indices can be defined, including the definition of different signal ratios. An index can be defined as follows:

$$Index = \mathrm{K} \cdot \frac{\mathrm{ParA} \pm \cdot \mathrm{ParB}}{\mathrm{ParC} \pm \cdot \mathrm{ParD}}$$

Tachogram in bpm

ECG channel is pre-filtered (with a pass-band filter 4-40 Hz) and a detection algorithm is applied for peak R recognition. This parameter is a measure of the heart rate variability and represents the number of beats per minute (BPM).

Tachogram in sec

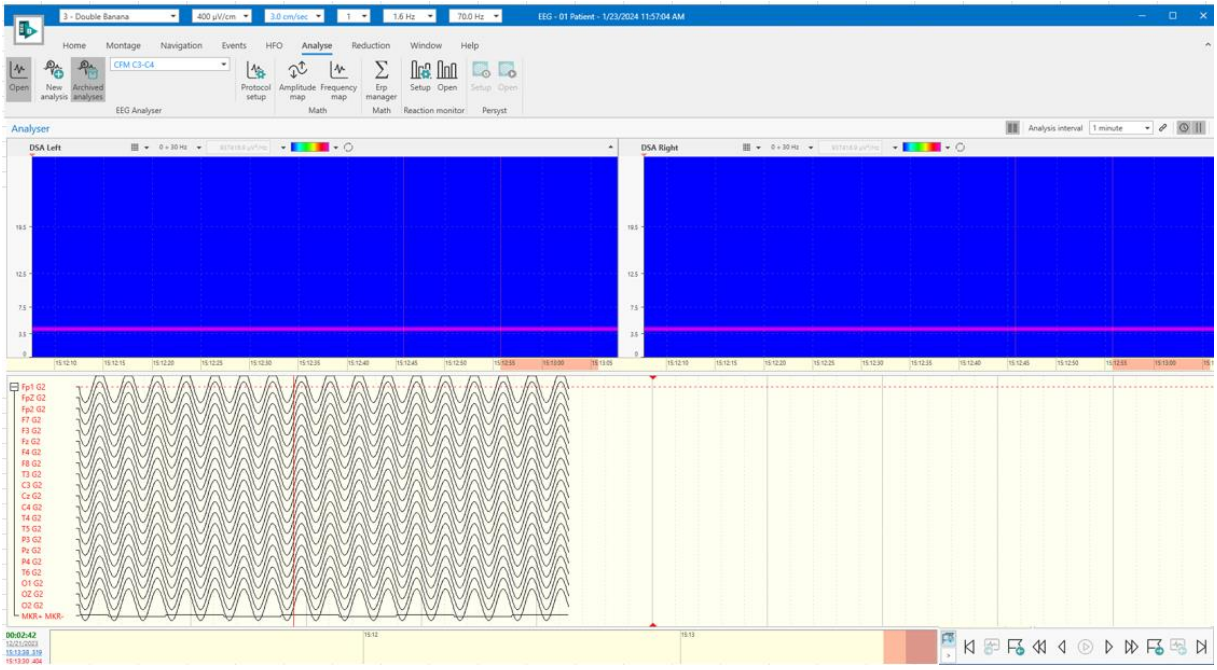
ECG channel is pre-filtered (with a pass-band filter 4-40 Hz) and a detection algorithm is applied for peak R recognition.
"Tachogram in sec" is an analysis of variation in the instantaneous heart rate time series using the beat-to-beat RR intervals and it describes the duration of interval RR in seconds. The RR interval is the time measured between the R wave of one heartbeat and the R wave of the preceding heartbeat.

HOW TO PERFORM EEG ANALYSIS

EEG analysis can be executed either online during acquisition or offline during review of EEG traces.
EEG Analyzer panel can be opened from Ribbon bar > Analyzer tab pressing **Open** button. In case of online analysis, panel is automatically opened if the user set an analysis program from acquisition protocol.

The following steps explain how to perform an online analysis:

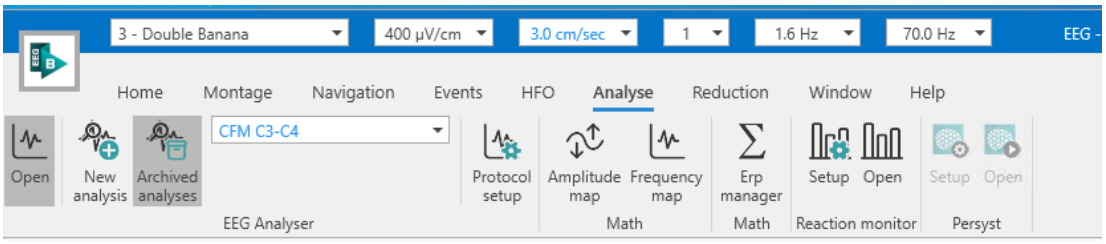
1. Click on Open button to open EEG Analyzer panel
2. Select an analysis protocol from the available protocols in the combo box (only trends type)
3. Start the EEG acquisition
4. Calculation starts and the analysis results are progressively displayed in the Analyzer panel



Instead, to run a new offline analysis, follow these steps:

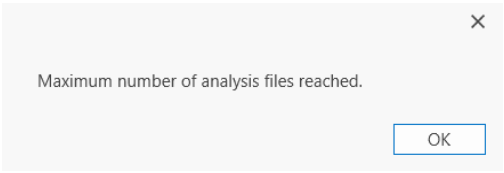
1. Click on Open button to open EEG Analyzer panel

2. Select an analysis protocol from the available protocols in the combo box
3. Click on **Process** button to start calculation
4. Calculation starts and the analysis results are progressively displayed in the Analyzer panel. Below the protocols combo box a progress bar is displayed to show the calculation's progress
5. Wait until the calculation is complete, otherwise click again on the **Process** button to stop the calculation



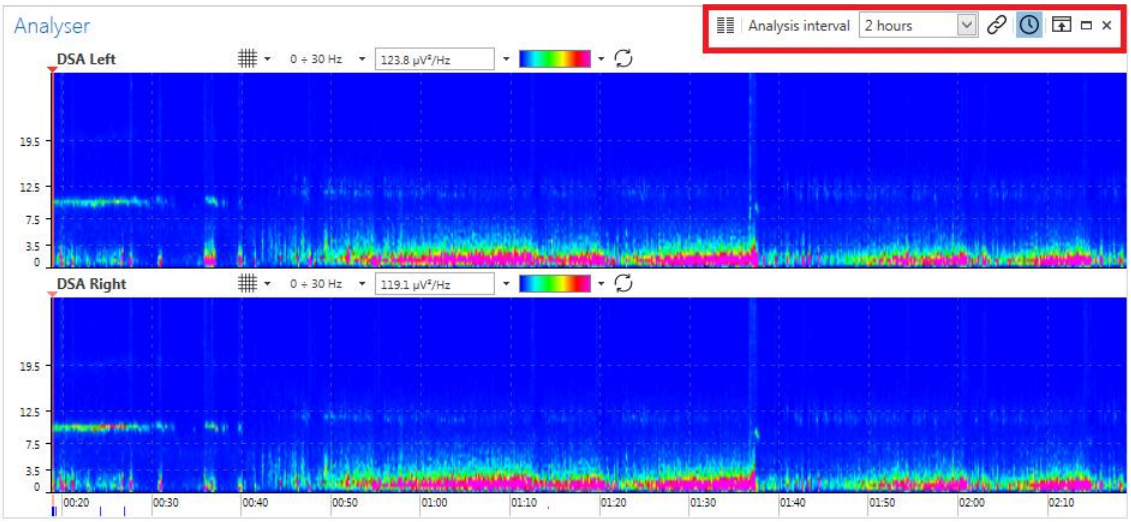
NOTE: the analysis process can run also in background, so the user can keep EEG Analyzer panel closed during calculation and open it later (either during calculation progress or when calculation is complete).

When the process is completed, from the Archived Analysis combo box is possible to review it. The maximum limit for conducting analyses on a single EEG examination is 2. When this limit is reached, the user must delete one or both analyses from the archive window to initiate additional analyses, as indicated by the displayed alert.



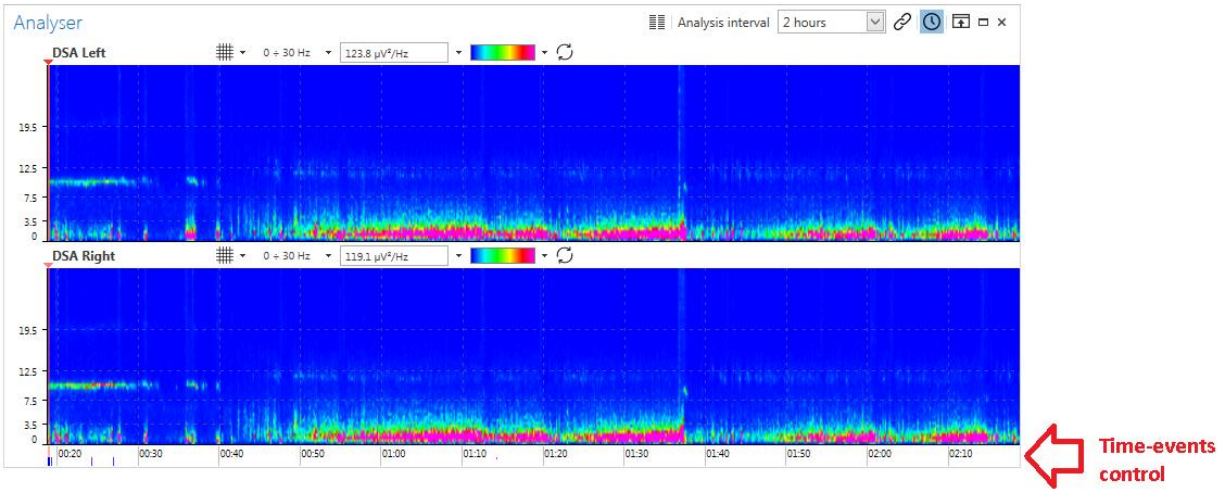
EEG Analyzer panel

EEG Analyzer panel provides a toolbar that allows the user to configure Analyzer graphs visualization settings.



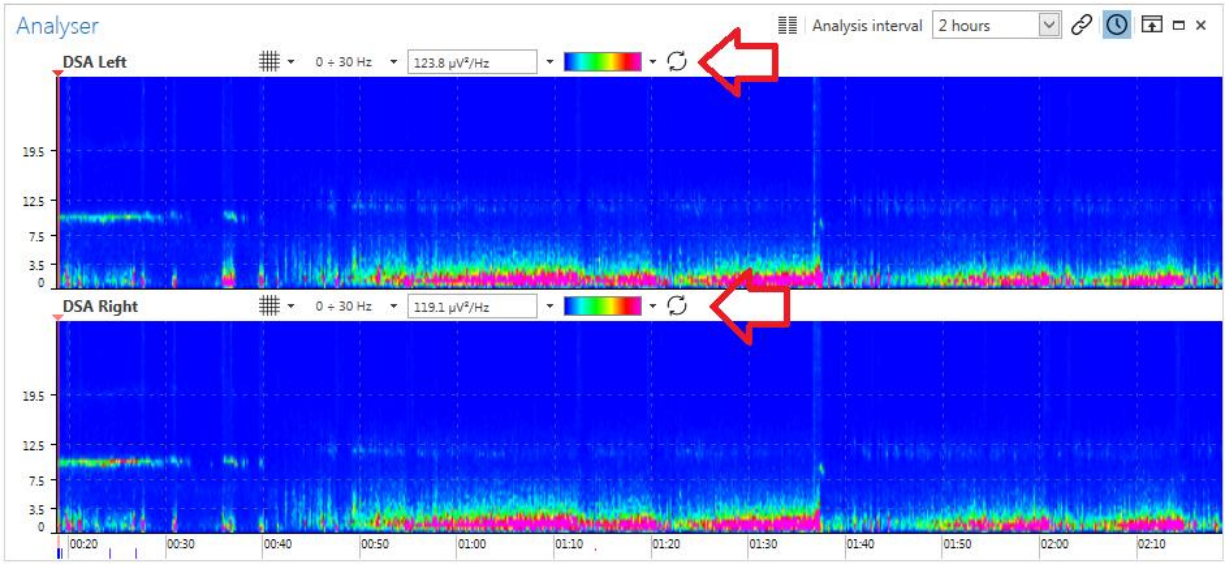
From left to right:

- **Toggle One/Two Columns:** this feature allows the user to switch EEG Analyzer graphs visualization from one column to two columns and vice versa. This feature is enabled only when two of more graphs are displayed in the EEG Analyzer panel.
- **Analysis Interval**: this feature allows the user to modify EEG Analyzer graphs time base. Available values for Analysis interval go from 10 seconds to 7 days.
- **Link Analysis Interval to Time Bar Overview Interval**: this feature allows the user to apply to EEG Analyzer graphs a time base equal to Time bar's overview interval. Time bar's overview interval can be set from BRAIN QUICK Application menu > Preferences > Time bar settings. When Link analysis interval to time bar overview interval is enabled Analysis interval combo box is disabled.
- **Show Time-Events Control**: Time-events control is a bar displayed at the bottom of EEG Analyzer panel. Time-events control replicates Time bar's information, is aligned with EEG Analyzer graphs and provides #day and time information. If Time-events control is already present clicking on "Show time-events control" button will hide the bar.



- **Hide Panel Caption**: this feature allows to hide/show EEG Analyzer panel's title bar.

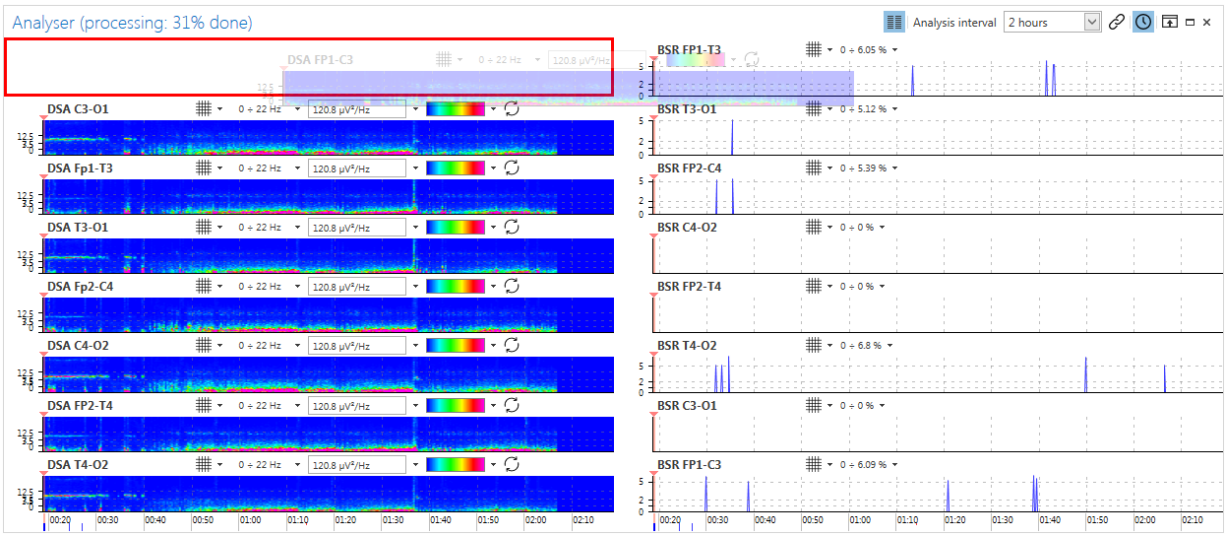
Moreover, each EEG Analyzer graph has its own toolbar:



This toolbar allows the user to modify visualization properties for each Analyzer graph independently one from the others. From left to right:

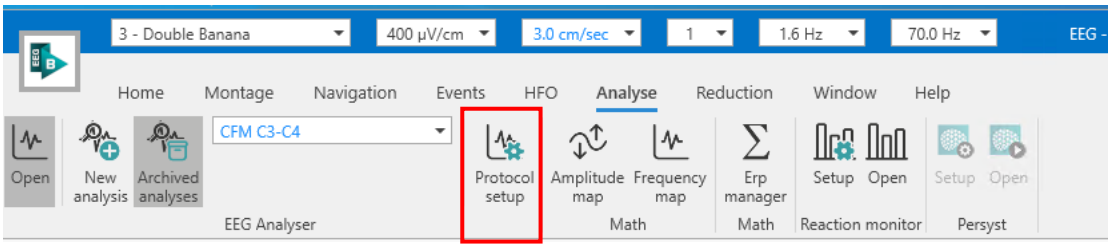
- **Protocol Name**: current analysis protocol name is displayed just above the corresponding Analyzer graph.
- **Grid Options**: this menu allows to show/hide EEG Analyzer graphs X-grid and Y-grid.
- **Scale Options**: these menus allow to modify Y scale or to set **Auto-fit Y-scale**. Analyzer graphs are updated according to the scale set. Auto-fit Y scale feature allows the display of the graph using the best scale.
- **Color Scale** (available for DSA protocols only): this menu allows the user to select one of the available color scales for DSA analysis. 4 different color scales are available.
- **Synchronize All DSA Plotters To This** (available for DSA protocols only): this feature allows to apply current DSA graph visualization options to all the other available DSA graphs.

In case of EEG Analyzer protocols containing more different analysis cells it is possible to re-arrange cells position within the EEG Analyzer panel with CRTL+ mouse clicking on the cell and dragging it to the desired position:

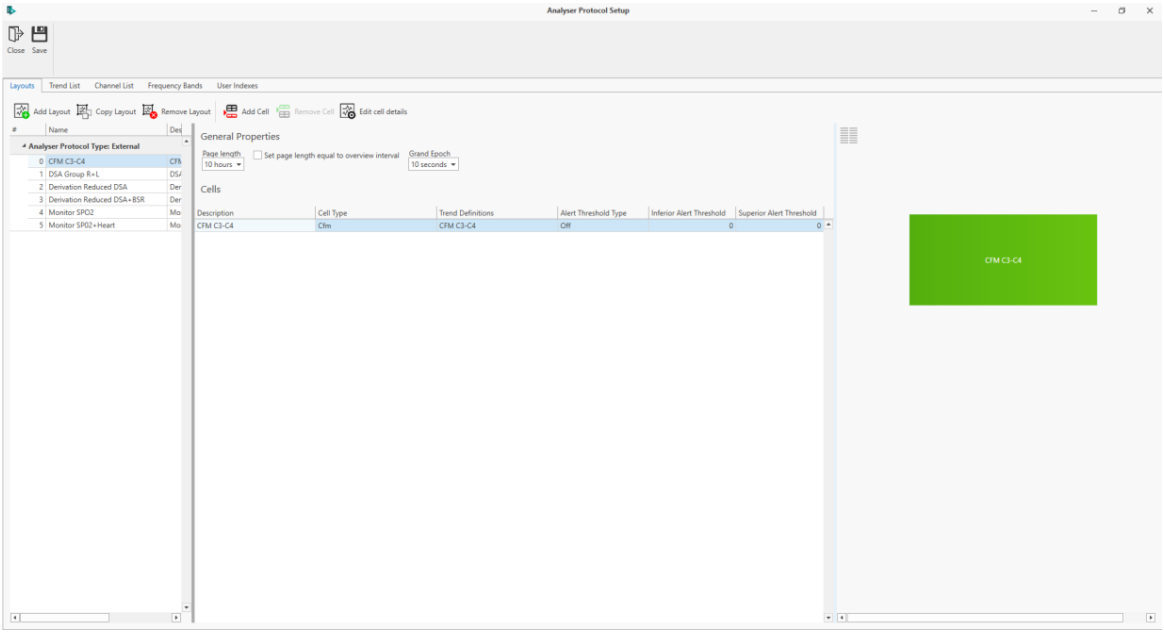


EEG ANALYZER PROTOCOL SETUP

There is the possibility to define custom EEG Analyzer protocols. To do that click on **Protocol setup** button from the Analyze tab of the Ribbon bar:



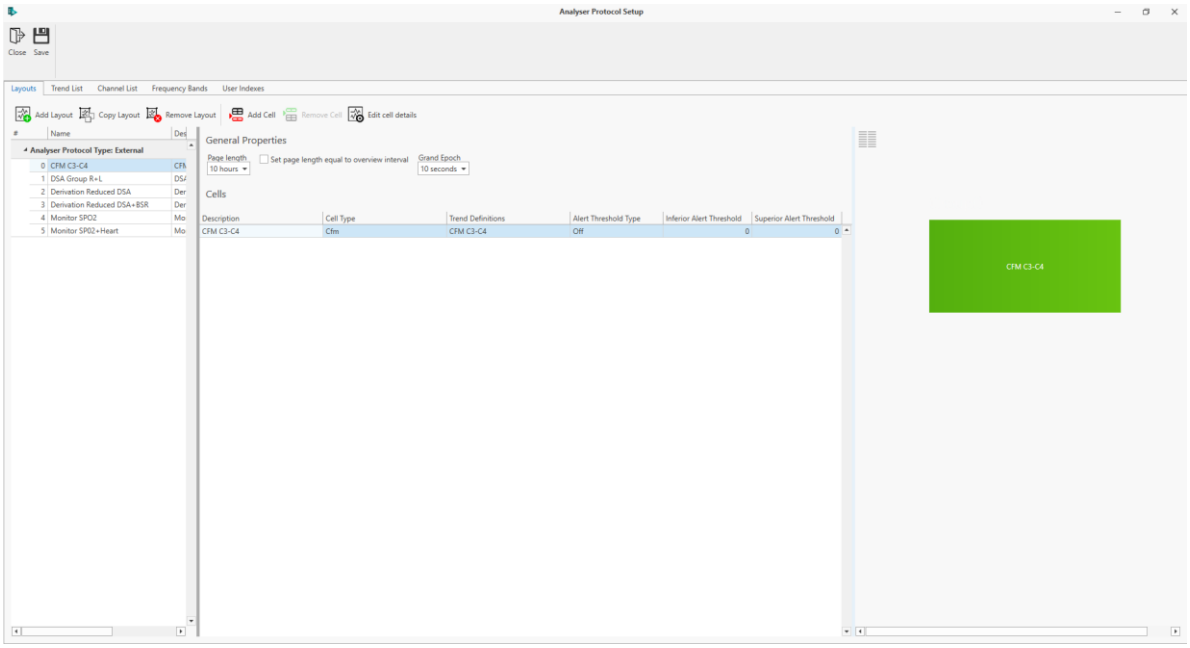
Analyzer Protocol Setup window opens:



Analyzer Protocol Setup window is composed by 5 different tabs: Layouts, Trend List, Channel List, Frequency Bands and User Indexes.

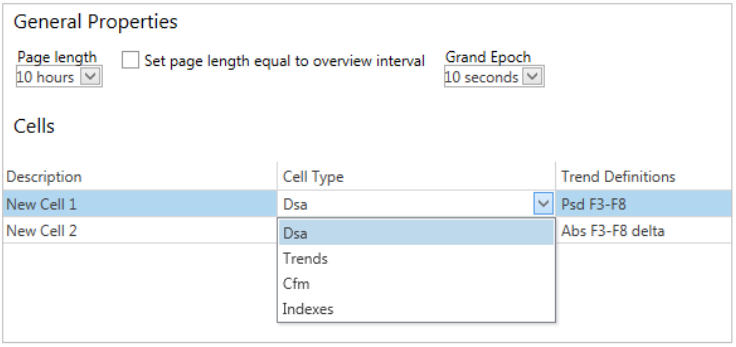
Layouts

A Layout includes all the calculation and graphical properties of an analysis protocol. Each Layout is composed of one or more cells, which correspond to the EEG Analyzer graphs that will be displayed.
The list of all available layouts is displayed in the left column of Layouts tab. In the middle column general properties and cells of the selected layout are shown. In the right column there is a preview of the cells' position within EEG Analyzer panel.



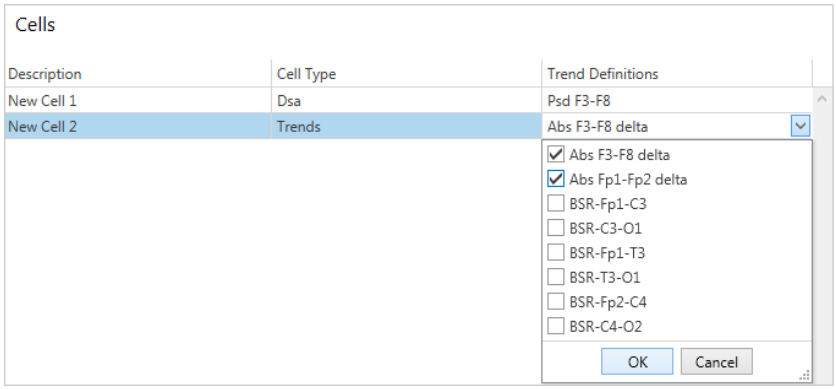
To setup a new analysis protocol, follow these steps:

1. Click on **Add Layout** button. A new layout named "New Layout" is created on the left column of the window. "New Layout" contains a cell by default.
2. To edit the new layout's name, click on it and type the new name
3. To edit the cell's description, click on it and type the new name
4. Select cell type by clicking on **Cell Type** combo box. Available cell types are: Dsa, Trends, Cfm and Indexes

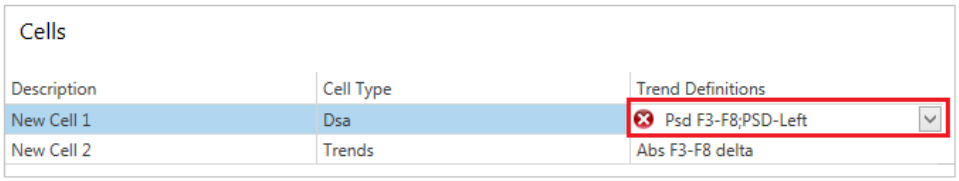


5. Select Trend definitions by clicking on **Trend Definitions** combo box. Available trends are displayed according to the selected cell type.

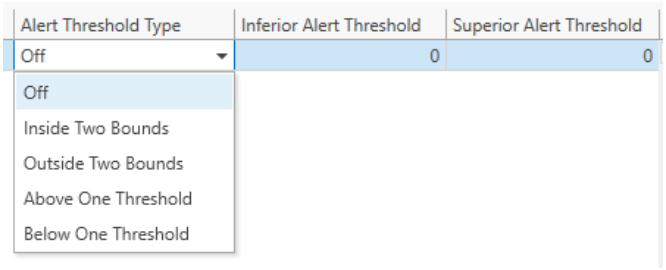
The user can select one or more trend definitions for the same cell. If more than one trend definition is selected their graphs will be superimposed with different colors in the EEG Analyzer panel.
Click on **OK** button to confirm trend definitions choice.



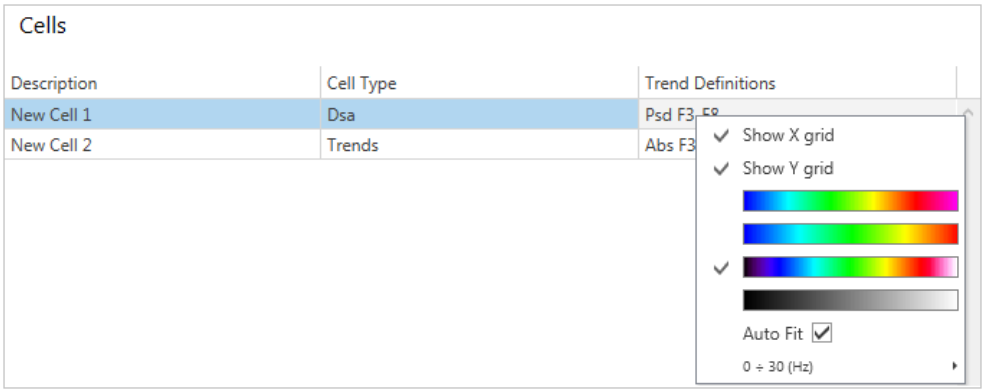
NOTE: for cells with type Dsa it is not possible to select more trend definitions per cell. If the user tries to add more than one trend definition to a Dsa cell the following error will appear and it will not be possible to save nor to exit from Analyzer Protocol Setup window:



6. Select on Alert Threshold Type by clicking on **Alert Threshold Type** button. From this options it's possible to enable an alert if the analysis is inside or outside two bounds, above or below one threshold. Each Threshold are settable using Inferior and Superior Alert Threshold options.



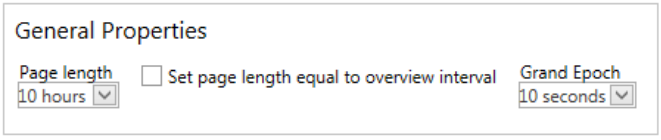
7. Click on **Edit cell details** button to set cell's grid and scale properties and to enable/disable Auto Fit feature. Edit cell details menu can be opened also with mouse right-click directly on the cell



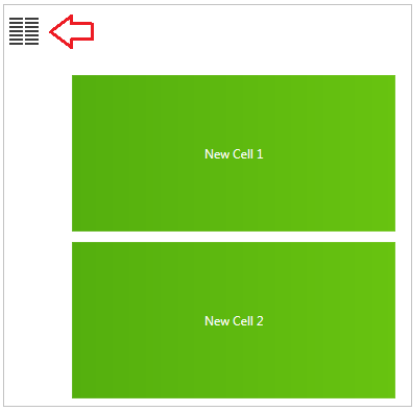
NOTE: color scale and frequency scale properties are available only for cells with type Dsa.

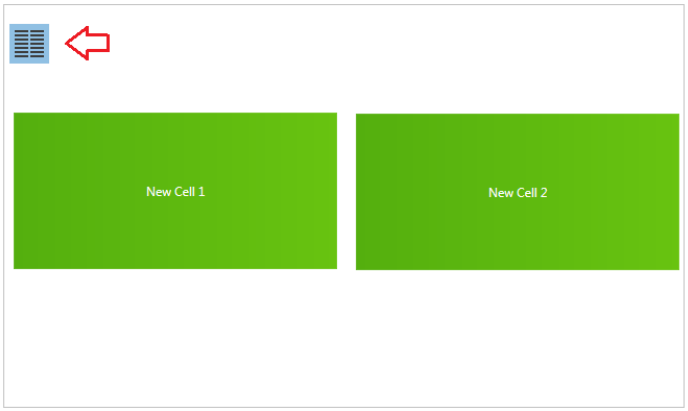
7. Click on **Add Cell** button to add another cell to the selected layout

8. Click on **Remove Cell** button to remove the selected cell
9. Set layout's General Properties:
    - Page Length: is the EEG Analyzer graphs page length. Available values go from 10 seconds to 7 days.
    - Set page length equal to overview interval: allows the user to set EEG Analyzer graphs page length equal to EEG trace page length.
    - Grand Epoch: super-epoch value used for the calculations. Available values go from 2 seconds to 10 seconds.



10. Set cell's orientation (vertical/horizontal) using the toggle button:

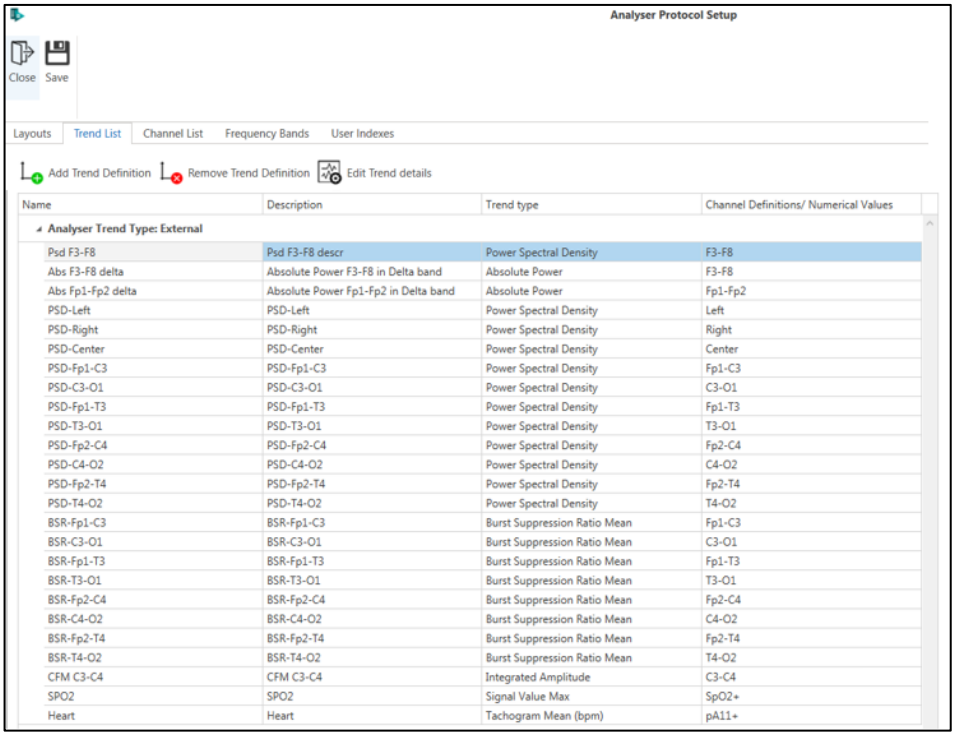




Layouts tab provides also the possibility to duplicate an existing layout, by selecting it and click on **Copy Layout** button and to remove an existing layout by selecting it and clicking on **Delete Layout** button.

Trend List

A Trend defines which kind of calculation will be performed and which channel or group of channels is involved in the analysis.
Trend List tab displays a list of all the available Trends:



Name	Description	Trend type	Channel Definitions/ Numerical Values
Analyser Trend Type: External			
Psd F3-F8	Psd F3-F8 descr	Power Spectral Density	F3-F8
Abs F3-F8 delta	Absolute Power F3-F8 in Delta band	Absolute Power	F3-F8
Abs Fp1-Fp2 delta	Absolute Power Fp1-Fp2 in Delta band	Absolute Power	Fp1-Fp2
PSD-Left	PSD-Left	Power Spectral Density	Left
PSD-Right	PSD-Right	Power Spectral Density	Right
PSD-Center	PSD-Center	Power Spectral Density	Center
PSD-Fp1-C3	PSD-Fp1-C3	Power Spectral Density	Fp1-C3
PSD-C3-O1	PSD-C3-O1	Power Spectral Density	C3-O1
PSD-Fp1-T3	PSD-Fp1-T3	Power Spectral Density	Fp1-T3
PSD-T3-O1	PSD-T3-O1	Power Spectral Density	T3-O1
PSD-Fp2-C4	PSD-Fp2-C4	Power Spectral Density	Fp2-C4
PSD-C4-O2	PSD-C4-O2	Power Spectral Density	C4-O2
PSD-Fp2-T4	PSD-Fp2-T4	Power Spectral Density	Fp2-T4
PSD-T4-O2	PSD-T4-O2	Power Spectral Density	T4-O2
BSR-Fp1-C3	BSR-Fp1-C3	Burst Suppression Ratio Mean	Fp1-C3
BSR-C3-O1	BSR-C3-O1	Burst Suppression Ratio Mean	C3-O1
BSR-Fp1-T3	BSR-Fp1-T3	Burst Suppression Ratio Mean	Fp1-T3
BSR-T3-O1	BSR-T3-O1	Burst Suppression Ratio Mean	T3-O1
BSR-Fp2-C4	BSR-Fp2-C4	Burst Suppression Ratio Mean	Fp2-C4
BSR-C4-O2	BSR-C4-O2	Burst Suppression Ratio Mean	C4-O2
BSR-Fp2-T4	BSR-Fp2-T4	Burst Suppression Ratio Mean	Fp2-T4
BSR-T4-O2	BSR-T4-O2	Burst Suppression Ratio Mean	T4-O2
CFM C3-C4	CFM C3-C4	Integrated Amplitude	C3-C4
SPO2	SPO2	Signal Value Max	SpO2+
Heart	Heart	Tachogram Mean (bpm)	pA11+

For each of the defined Trends a Name, a Description, Trend type and Channel Definitions/Numerical values are displayed.

All Trends defined in Trend List tab will be automatically displayed in the **Trend Definitions** combo box of Layouts tab.

To set up a new Trend Definition follow these steps:

1. Click on **Add Trend Definition** button. A new trend will be added at the end of the Trend List
2. Type a **Name** and a **Description** for the new trend

3. Select the **Trend Type**. Available Trend Types include the following:

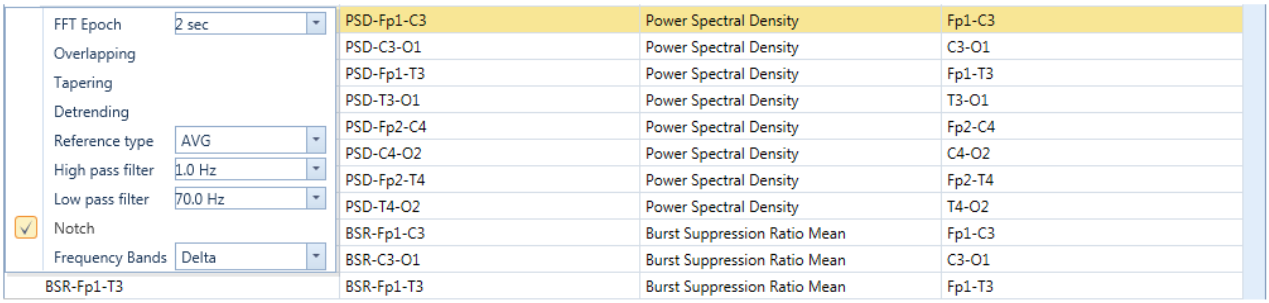
    - Power Spectral Density
    - Absolute Power
    - Relative Power
    - Spectral Edge Frequency
    - Main Dominant Frequency
    - Median Frequency
    - Burst Suppression Ratio Max
    - Burst Suppression Ration Min
    - Burst Suppression Ratio Mean
    - Signal Value Max
    - Signal Value Min
    - Signal Value Mean
    - Tachogram Max (bpm)
    - Tachogram Min (bpm)
    - Tachogram Max (sec)
    - Tachogram Min (sec)
    - Tachogram Mean (sec)

- Integrated Amplitude

4. Select a monopolar channel, a bipolar channel, a group of channels, or a constant from the list of available items in **Channel Definitions/ Numerical Values** column.
5. Click on the newly created Trend and then click on **Edit Trend details**. A menu opens showing all the customizable Trend properties. According to the selected Trend type different modifiable settings will be displayed.

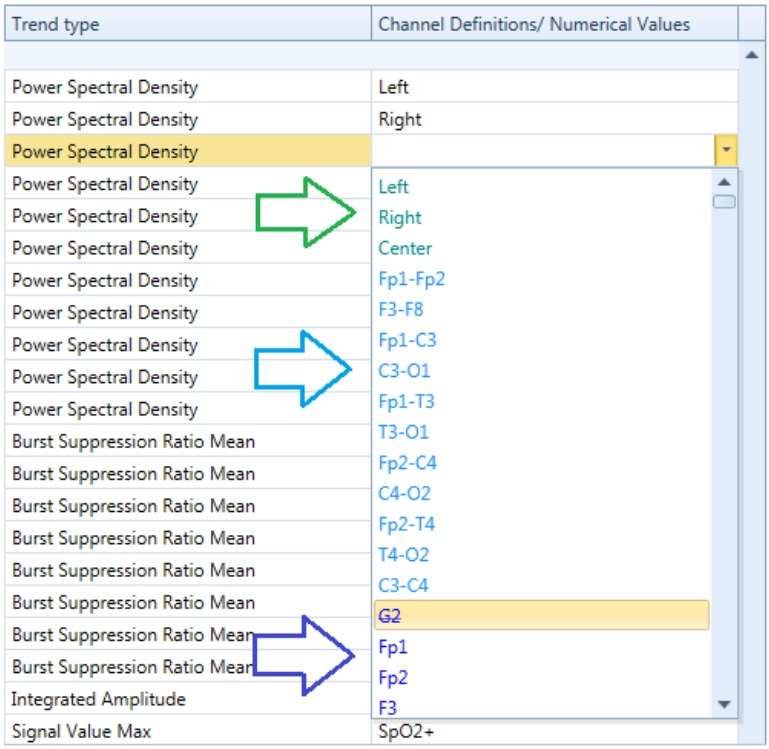
Below there is a list of all modifiable Trend settings:

- FFT Epoch: 2 seconds or 10 seconds
- Overlapping: enabled or disabled
- Tapering: enabled or disabled
- Detrending: enabled or disabled
- Reference type: G2, AVG,A1A2
- High pass filter cut off frequency: from OFF to 800 Hz
- Low pass filter cut off frequency: from OFF to 1 kHz
- Notch filter: enabled or disabled
- Frequency Bands: the user can select a frequency band from the list of available frequency bands
- Bsr duration: from 200 msec to 750 msec (available for Burst trend type only)
- Bsr threshold: from 5 uV to 50 uV (available for Burst trend type only)
- Cfm threshold: from 10 uV to 300 uV (available for Integrated amplitude trend type only)

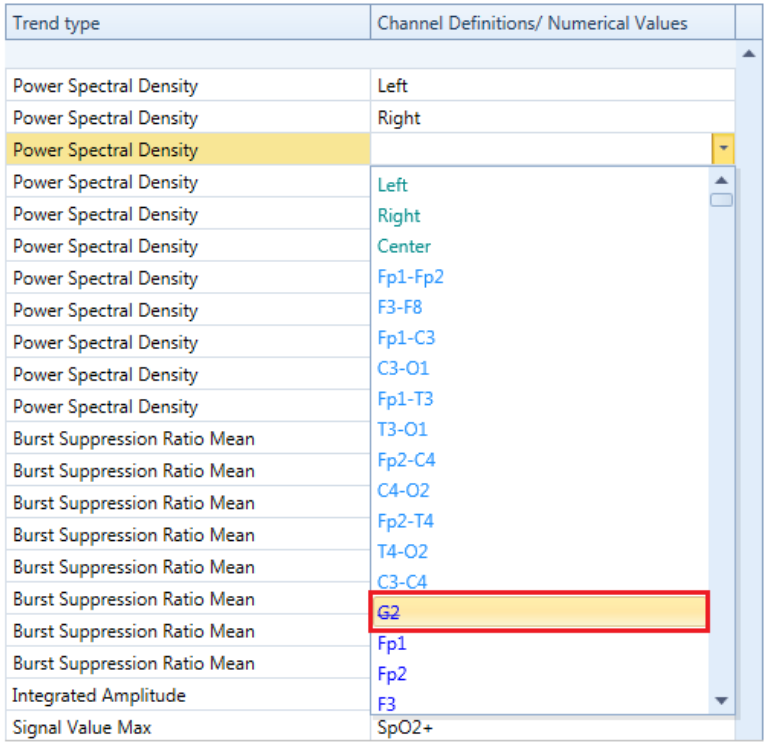


NOTE: In Channel Definitions/Numerical Values combo box, different items are displayed with a different color. In particular:

- Group of channels are displayed in green
- Bipolar channels are displayed in light blue
- Monopolar channels are displayed in deep blue



NOTE: Not available channels or groups of channels are displayed as strikethrough text, as shown in the figure below:



Channel List

Channel List tab displays a list of all the available bipolar channels and groups of channels. Bipolar channels list is displayed in the left column, while groups of channels are displayed on the right column.

In this tab the user can define new bipolar channels or channels groups or delete them.

To create a new bipolar channel, follow these steps:

1. Click on **Add bipolar channel** button. A New Bipolar Channel will be added at the end of the channel list on the left
2. Edit the bipolar channel's name
3. Set Input+ and Input- from the list of available derivations
4. Click on **Save** button

To remove a bipolar channel, follow these steps:

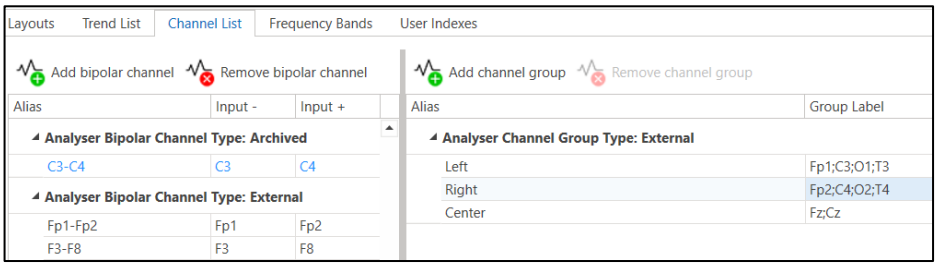
1. Select the bipolar channel you want to delete
2. Click on Remove bipolar channel button
3. A confirmation message will appear: "Are you sure to remove the selected bipolar channel?" Click on Yes to permanently remove the bipolar channel, click on No to cancel the operation

To create a new group of channels follow these steps:

1. Click on **Add channel group** button. A New Channel Group will be added at the end of the groups list on the right
2. Edit the channel group's name
3. Select the channels belonging to the group from the list of available channels
4. Click on **Save** button

To remove a group of channels follow these steps:

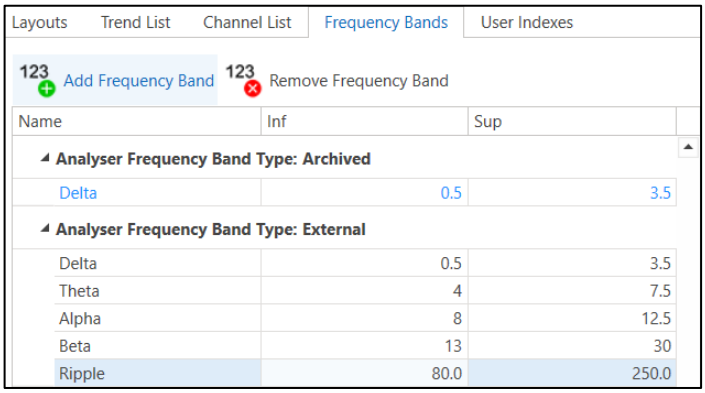
1. Select the group of channels you want to delete
2. Click on Remove channel group button
3. A confirmation message will appear: "Are you sure to remove the selected channel group?" Click on Yes to permanently remove the channel group, click on No to cancel the operation



Frequency Bands

Frequency Bands tab displays a list of all the available frequency bands. There are four default frequency bands: **Delta**, **Theta**, **Alpha** and **Beta**.

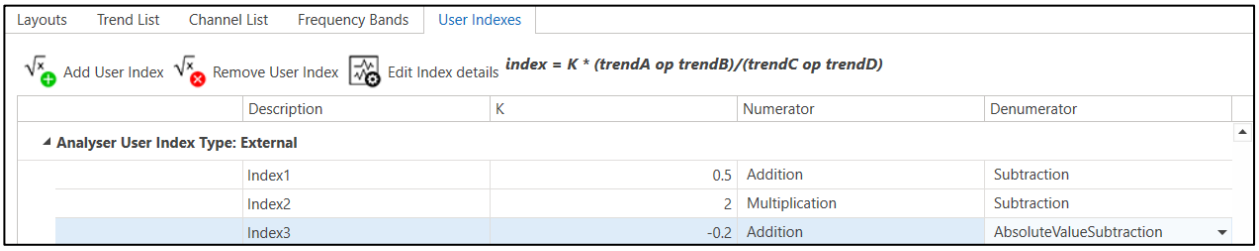
The **Add Frequency Band** button allows the user to add new frequency bands with the desired name and limits. **Remove Frequency Band** button, instead, allows the user to delete selected frequency bands (a confirmation message will appear before deletion is started).
Each frequency band can be renamed and its frequency limits can be changed choosing them from the popup menu or directly typing them in the correct cell. Frequency bands limits can be set from 0Hz to 512Hz.



NOTE: default frequency bands (Delta, Theta, Alpha and Beta) cannot be removed.

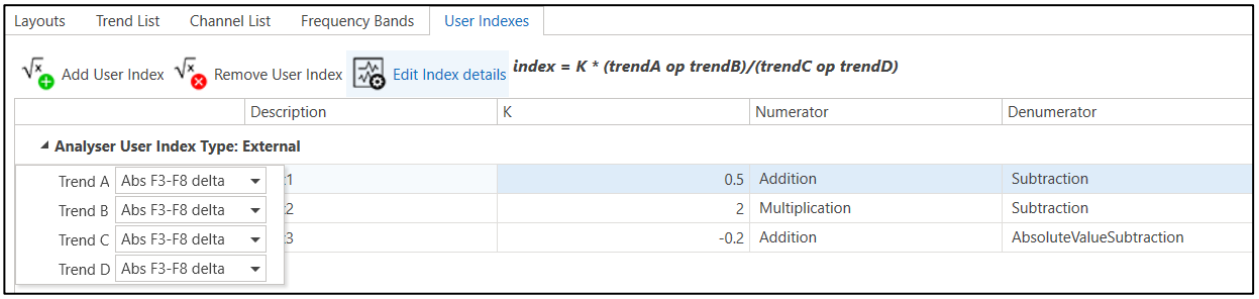
User Indexes

User Indexes tab displays a list of all the available indexes. The user can add new indexes or delete existing ones.



To add a new User Index, follow these steps:

1. Click on **Add User Index** button. New Index will be inserted at the end of the indexes list
2. Type a name and a description for the new index
3. Set K, Numerator and Denumerator for the index, according to the following formula: index = K*(trendA op trendB)/(trendC op trendD)
4. Click on **Edit Index Details** button. A drop down menu opens:



5. Set trendA, trendB, trendC and trendD to be used in the index formula
6. Click on **Save** button

To remove a User Index, follow these steps:

1. Select the User Index you want to delete
2. Click on Remove User Index button

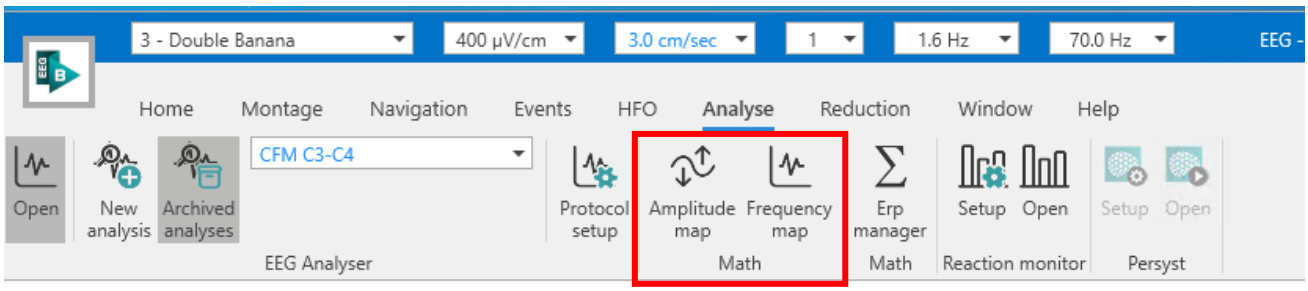
3. A confirmation message will appear: "Are you sure to remove the selected index?" Click on Yes to permanently remove the User Index, click on No to cancel the operation

MAPS

MAP DESCRIPTION

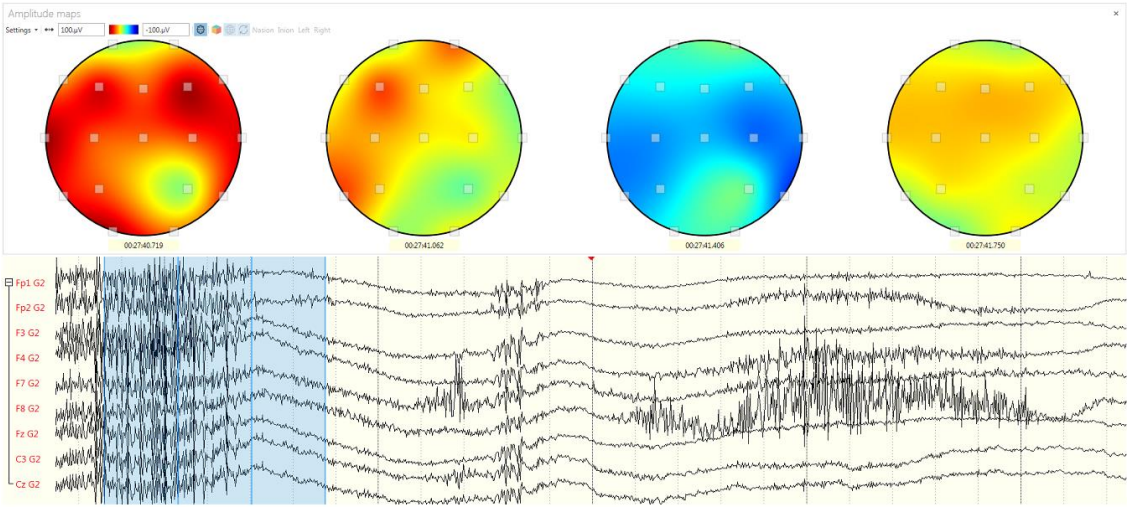
BRAIN QUICK SOFTWARE provides the possibility to display EEG data as brain maps. In a brain map the patient's head is represented as a circle and each electrode is depicted as a point on the circle.
The value of the map in the points corresponding to the electrodes is determined by the EEG data and by the mapping method chosen. Interpolation is used to obtain a value for every point of the map, which is then represented on the screen using color-coded scaling.
The software allows MAPS offline analysis during EEG review.

It is possible to enable Amplitude and Frequency Maps from Analyze tab:

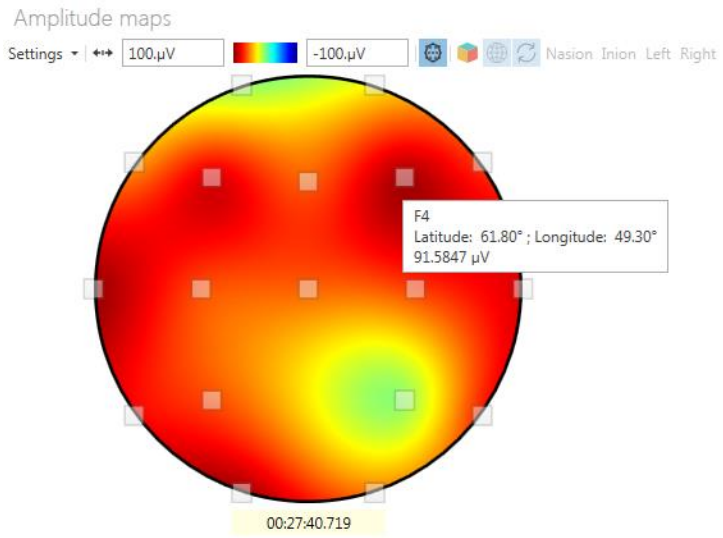


AMPLITUDE MAPS

Amplitude maps represent the distribution of the EEG amplitude in the brain in a determined timing of the EEG recording.
Clicking on Amplitude map button on Analyzer tab of the Ribbon bar Amplitude maps panel opens. Together with the panel a vertical cursor appears on the EEG trace. The cursor is made of 1/4/8/32 (according to the number of Amplitude maps displayed) equally spaced vertical bars which can be dragged or stretched using the mouse in order to select exactly the points in the EEG trace to be analyzed. Amplitude maps are automatically calculated when the vertical cursor is placed on the EEG trace.
Below each Amplitude map the timing of the EEG recording in which the analysis is performed is displayed.



Hovering the mouse on the map's electrodes information about the electrode and the EEG Amplitude value (in μ V) corresponding to that electrode is displayed:



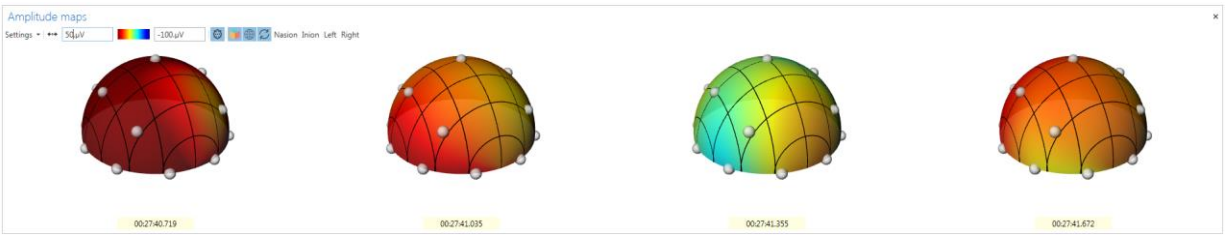
Amplitude Maps Settings

Amplitude maps panel provides a toolbar that allows the user to configure analysis parameters and visualization settings:

- **Settings**: this menu allows the user to set up
  - The number of maps to be displayed: 1, 4 ,8, or 32
  - The algorithm to be used for the interpolation: Knn, Planar spline or Spherical spline
  - Filter settings: HP filter cutoff frequency, LP filter cutoff frequency, Notch filter
- **Auto-fit**: this button allows the user to automatically adjust the scale in order to visualize Amplitude maps using the best scale.
- **Color Scale**: min and max values can be directly typed into the scale text boxes.
- **Show Electrodes**: this button allows the user to show/hide electrodes positions on the maps.

3D Amplitude Maps

BRAIN QUICK SOFTWARE provides the possibility to display three-dimensional Amplitude maps. 3D Amplitude maps can be displayed by clicking on **3D View** button on Amplitude maps panel's toolbar. This feature allows the user to display the already calculated Amplitude maps in three dimensions.

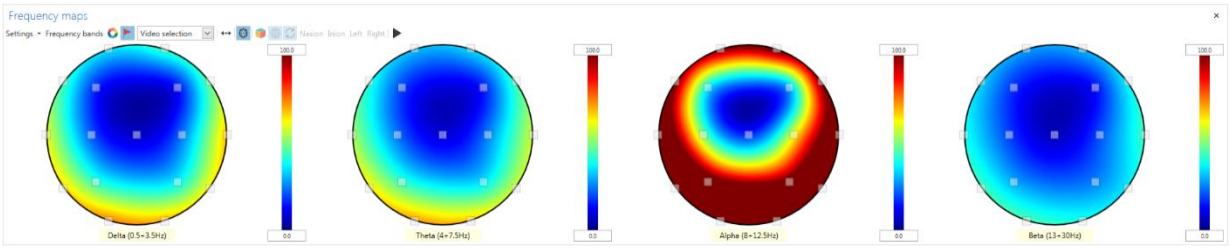


Enabling 3D Amplitude maps view the following features are available from Amplitude maps panel's toolbar:

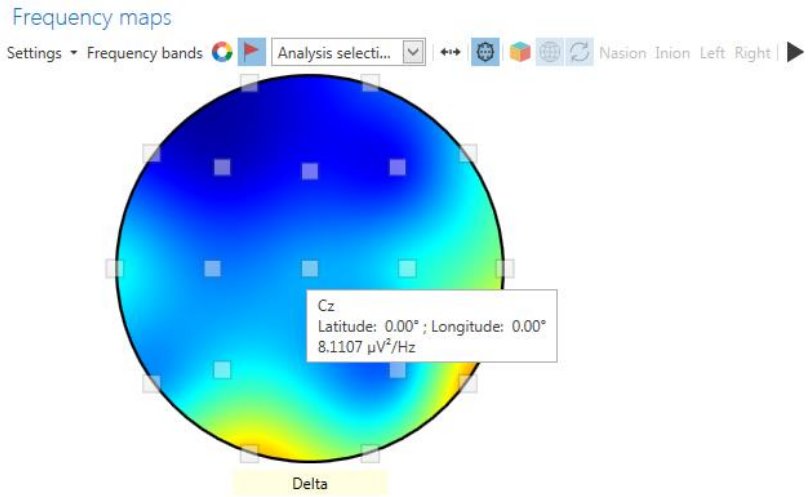
- **Show Grid**: this feature allows to display/hide the grid on 3D maps. When 3D View of the maps is disabled Show grid button is disabled too.
- **Synchronize Positions**: if enabled this feature allows the user to rotate all the 3D maps together, otherwise only the selected Amplitude map is rotated. When 3D View of the maps is disabled Synchronize positions button is disabled too.
- **Nasion**: this feature allows the user to put Nasion in front of view.
- **Inion**: this feature allows the user to put Inion in front of view.
- **Left**: this feature allows the user to put the left ear in front of view.
- **Right**: this feature allows the user to put the right ear in front of view.

FREQUENCY MAPS

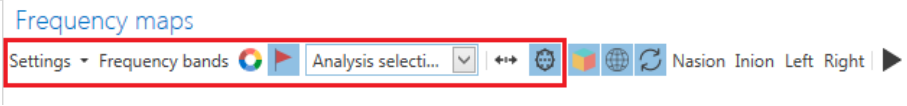
Frequency maps represent the topographic distribution on the patient's brain of the original signal transformed in the frequency domain and divided in spectral bands, each one covering a determined frequency range.
The analysis is based on average and therefore the user has to define the interval where it is performed.



Hovering the mouse on the map's electrodes information about the electrode and the EEG power spectral density value (in µ V^2/Hz) corresponding to that electrode is displayed:

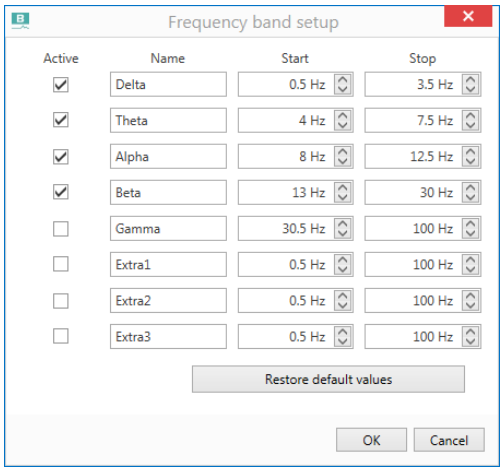


Frequency Maps Settings



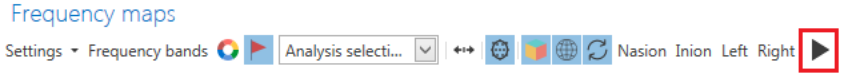
Frequency maps panel provides a toolbar that allows the user to configure analysis parameters and visualization settings:

- **Settings**: a menu allows the user to set up
  - The algorithm to be used for the interpolation: Knn, Planar spline or Spherical spline
  - Filter settings: HP filter cutoff frequency, LP filter cut off frequency, Notch filter
- **Frequency Bands**: from the menu below the user can set up the frequency ranges in which the analysis is performed. A Frequency map is created for each frequency band defined. Indication of the frequency band on which the calculation is performed is displayed below each Frequency map.



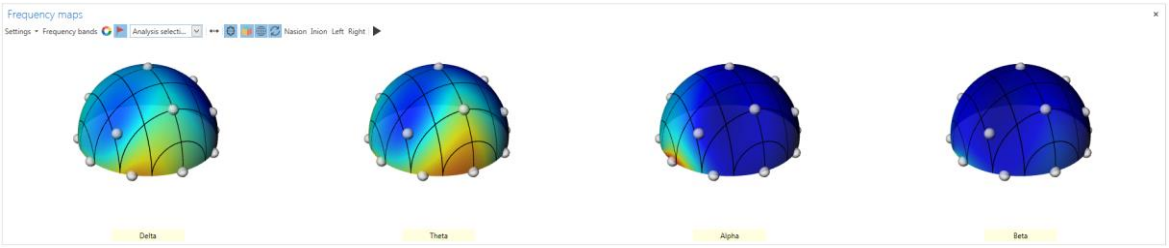
- **Process on Whole Trace**: this button allows the user to calculate Frequency maps on the whole EEG recording.
- **Process on Selected Interval**: this button allows the user to calculate Frequency maps on a specific part of EEG recording. The part of EEG recording to be analyzed is identified by a selection event. The user can choose one of the available selection events from the combo box on Frequency maps panel's toolbar.
- **Auto-fit**: this button allows the user to automatically adjust the scale in order to visualize Amplitude maps using the best scale.
- **Show electrodes**: this button allows the user to show/hide electrodes positions on the maps.

To start Frequency maps calculation the user has to press the button "Process" on Frequency maps panel's toolbar:



3D Frequency Maps

BRAIN QUICK SOFTWARE provides the possibility to display three-dimensional Frequency maps. 3D Frequency maps can be displayed clicking on **3D View** button on Frequency maps panel's toolbar. This feature allows the display of the already calculated Frequency maps in three dimensions.

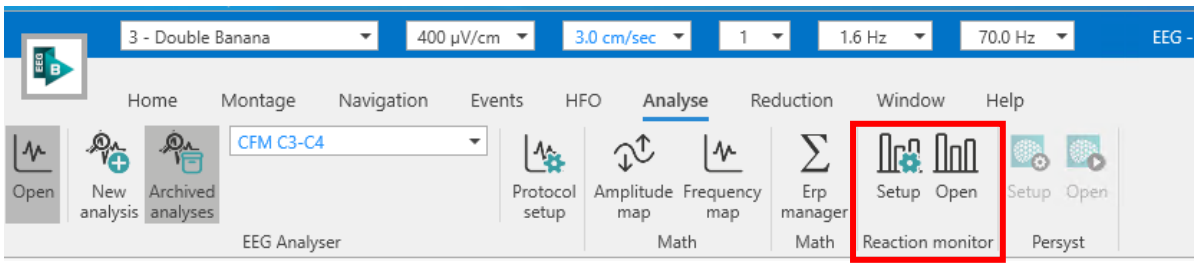


REACTION MONITOR

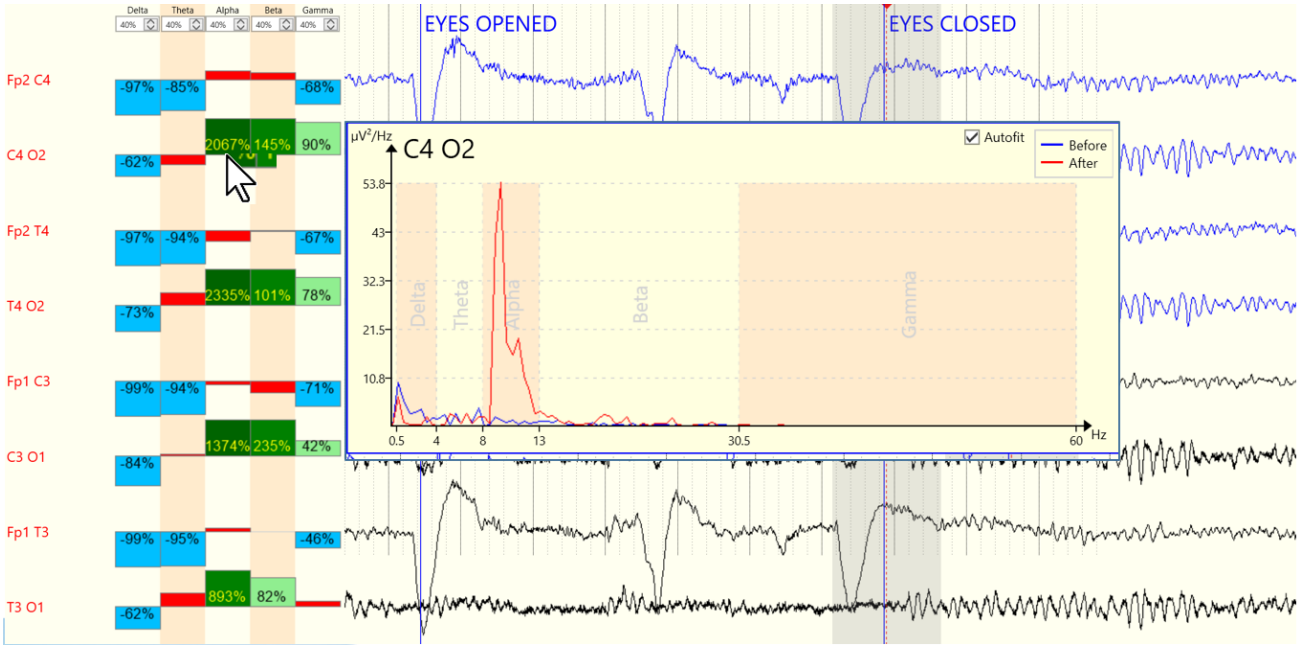
The "Reaction monitor" function is an analysis tool that highlights EEG modification after an event or a patient stimulation. In particular, this tool allows to have quantified data (Spectral bands power) to see signal components difference BEFORE / AFTER an event, with the adjustment of the % threshold between BEFORE and AFTER to highlight only the important changes.

HOW TO PERFORM REACTION MONITOR ANALYSIS

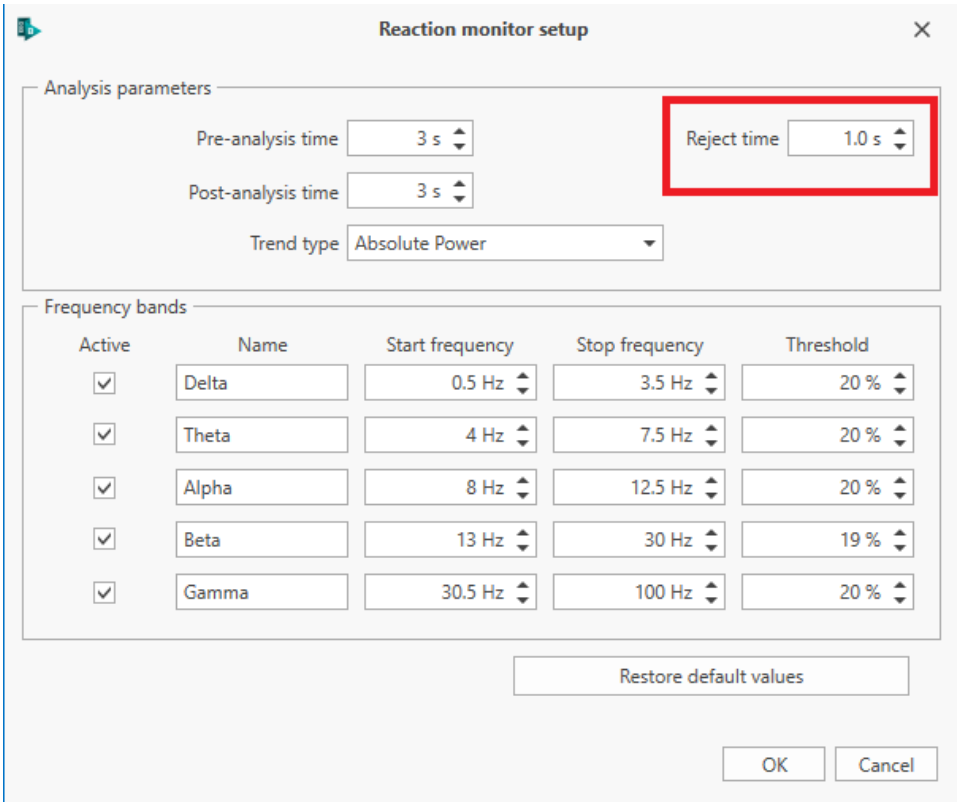
Reaction Monitor panel can be opened from Ribbon bar > Analyse tab pressing **Open** button in the “Reaction Monitor” group.



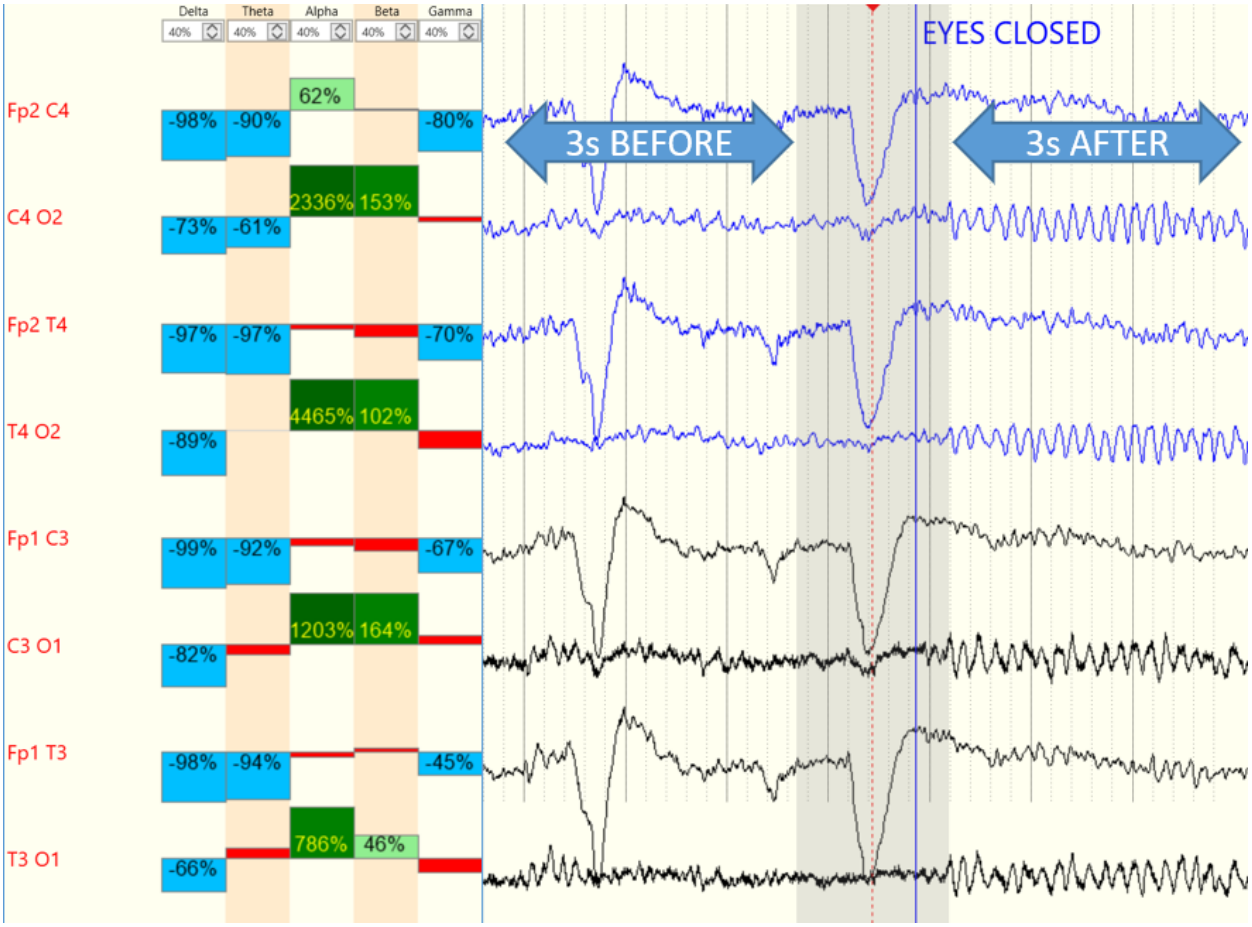
When clicking on the **Open** button, the Reaction Monitor directly opens in the middle of the EEG page. It is composed of a highlighted area that delimits the part of the EEG trace which corresponds to the "Reject Time”. On the left side of the eeg trace appears a table with some comparison values before/after the reject time, as detailed in this section. Finally, moving the cursor on one of the values of the table, it is possible to visualize in detail the graph of the trend type chosen, with a comparison between BEFORE / AFTER the Reject time.



The width of the Reject Time area can be set by opening the Reaction Monitor setup:

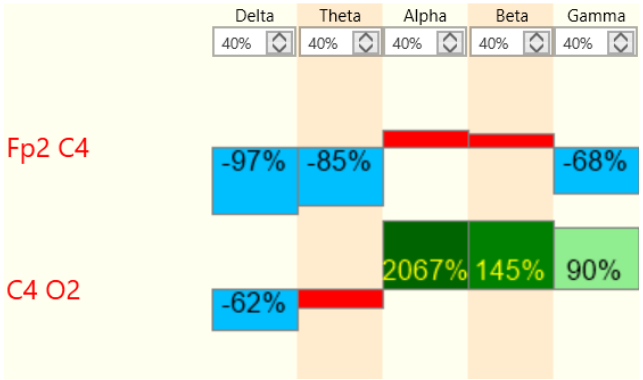


As can be seen from the previous picture, it is also possible to set the analysis interval before/after the event in the Reject Time area.



From Reaction Monitor Setup, it's also possible:

- choose trend type selection: the default value is Absolute power, but other choices are available (Relative power, Peak Frequency, SEF, Median Frequency, Main dominant Frequency);
- define the frequency bands and activate the display of the band;
- define for each band a threshold in % (Difference in % Power AFTER - BEFORE). For example, if difference between Power AFTER / Power BEFORE is less than 40% threshold, bargraph is displayed in RED:



In the case of Power After lower than Power Before, the bargraph is blue. On the other hand, in the case of Power After higher than Power Before, the bargraph is green. Deep of blue/green colour depend of % of difference.

DATA AVERAGE

The synchronized average, called "data average," is a particular procedure that uses the trigger events positioned in an automatic way or manually on the trace during acquisition or review; the program in a second moment can perform trace scan in search of such events to perform the average of channel per channel of periods of trace delimitation from such events and which the user is set by the user (from 10 msec to 10 sec). On the trace both analog and digital trigger can be placed; the two types of triggers are generated in an automatic way from different units (stimulators) to synchronized with particular events; the following grid indicates the main differences between the two types of trigger:

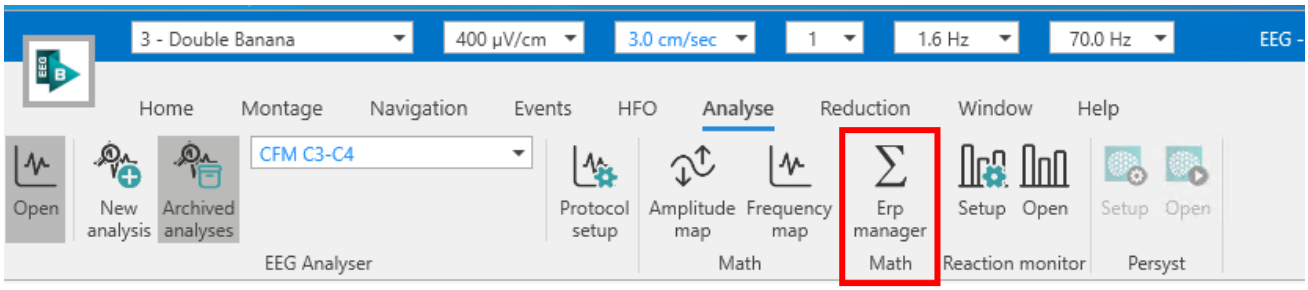
Analog trigger	**Digital Trigger**
Positioned on one channel only (it is possible in the same trace to position the analog trigger on different channels)	Appears as an event and does not interest a single channel
Appears as a variation of level of the signal (vertical peak)	The instant and numerical code is memorized
The triggers can not distinguish one from the other (apart from the channel where they are positioned)	The trigger are distinct from a numerical value; it is possible to perform synchronized average on groups of trigger having the same code.
The number of triggers that can be inserted is limited only by the length of the file (two triggers must be distant at least a minimum of three samples one from the other)	Maximum of 8192 triggers can be inserted

NOTE: it is not possible to perform the data average by using digital triggers and analog triggers at the same time.

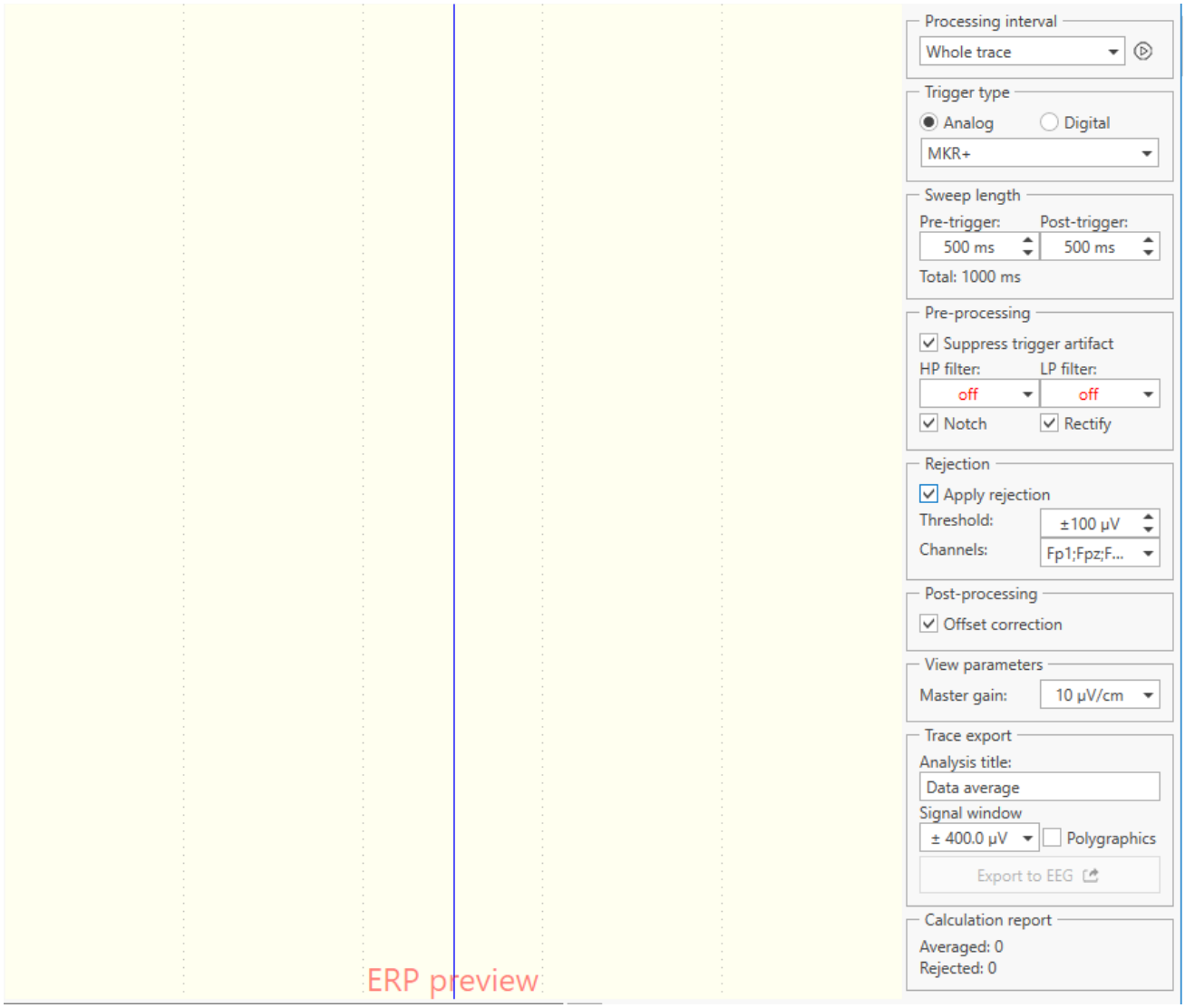
The window of synchronized average is accessible by selecting the item **Data Average** from the menu **Analyze – Erp Manager**.

HOW TO PERFORM DATA AVERAGE ANALYSIS

Data Average panel can be opened from Ribbon bar > Analyse tab pressing **Erp Manager** button in the "Math" section.



When clicking on the button, the Data Average directly opens on the right of the EEG page. It is composed of a new eeg window, which corresponds to the ERP Preview, and a panel with ERP Processing settings.

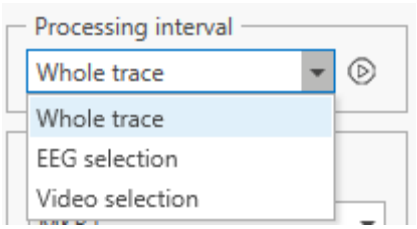


DATA AVERAGE PARAMETERS

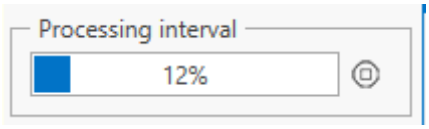
This tab is subdivided into various sections that are listed from top to bottom.

Processing Interval

The Processing interval section allows to select the whole trace or one of the selection interval already present in the trace. Next the combo box there is the Process button to realize the ERP preview.



Next the combo box there is the Process button to realize the ERP preview. When it is pressed, the process starts and a loading bar appears.

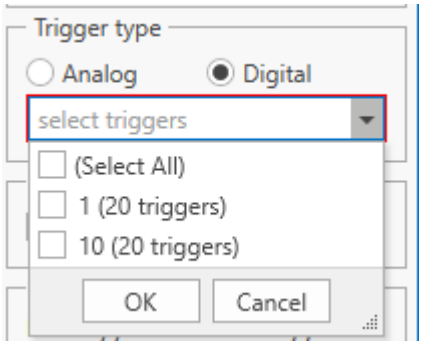


Trigger Type

Two options are visible, *Digital triggers*, and *Analog triggers*.

Digital Triggers: enables the use of digital trigger for the synchronized average and excludes analog trigger. The following controls become visible:

Trigger Type: It's a dialog window that allows the user to select which triggers to consider for the trace scan to perform the data average. When "Digital" option is selected, if there are digital triggers in the EEG trace it's possible to select all the triggers or only a particular trigger.

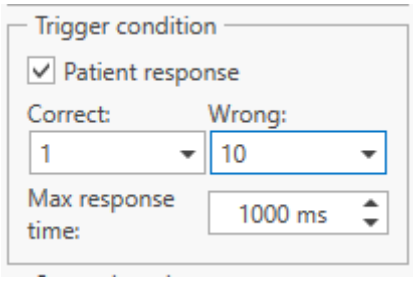


Trigger condition: if "Patient Response" option is checked then the user can set a "condition," that is how to consider the different triggers as they are disposed on the recorded trace; for example a particular trigger can be considered as a *response trigger* and has to follow another trigger (the *stimulus trigger*) before a specified interval of time; if the stimulus trigger is followed by a different response trigger then it can be considered as a "wrong response" and rejected from the calculation of data average. When this option is checked, it opens a dialog window where to set the following values

Correct Answer Trigger Value: from the popup menu you can select the value of trigger that has to be considered as the "correct response" of the patient which receives the stimulus.

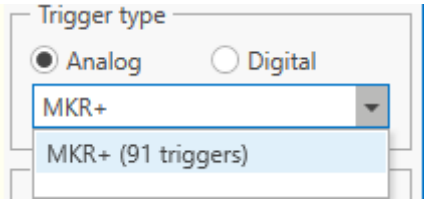
Correct Answer Interval: max time interval (in milliseconds) from the "correct answer" trigger and the previous trigger (the stimulus trigger).

Wrong Answer Trigger Value: value of triggers that have to be rejected and not considered in the calculation of data average.



Analog Triggers: enables the use of the analog trigger for the synchronized average and excludes the use of digital triggers.

Channels trigger: a popup menu in which the user selects the channels of trace in which the scanning of the analog triggers is performed.



NOTE: if this field appears blank, the user cannot proceed with the calculation of the synchronized average.

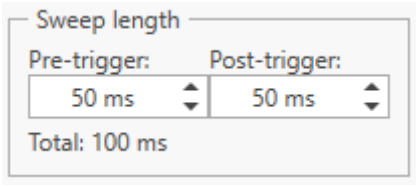
Sweep Length

ERP Processing settings panel allows to set and visualize the sweep length, defining the Pre-trigger and Post-trigger intervals.

Pre-trigger Interval (msec): interval (in milliseconds) of considered trace in the construction of the average BEFORE of the trigger event.

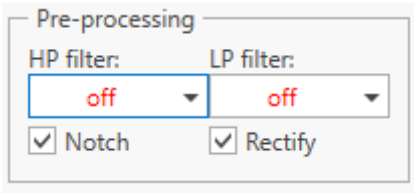
Post-trigger Interval (msec): interval (in milliseconds) of trace considered in the construction of the AFTER trigger event.

Total (msec): sum of the time of pre-trigger and post-trigger, in milliseconds.



Pre-processing

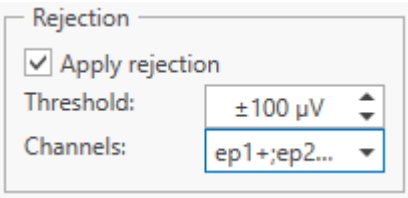
During the trace scanning a pre-processing on the channels can be performed: before this can be used for the average, the signal can be conditioned with the filters (high-pass, low-pass and notch) and rectification (the negative part of the signal is inverted).



Rejection

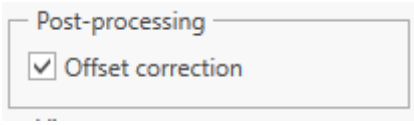
Enable Rejection: enables/disables rejection.

Set Rejection Parameters: opens a dialog window that allows the user to set the parameters for the rejection. In a grid all the channels of the trace appear: channel by channel, it is possible to enable/disable the rejection to set the threshold intervention (in µV).



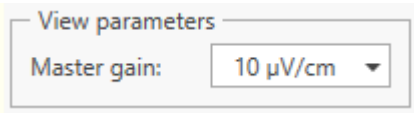
Post-processing

ERP Processing settings panel allows to enable or disable an Offset correction on Post-processing.



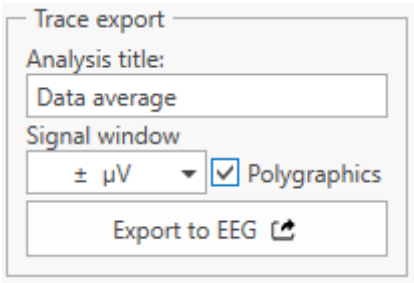
View parameters

From the view parameters section, it's possible to change Master Gain on ERP Preview.

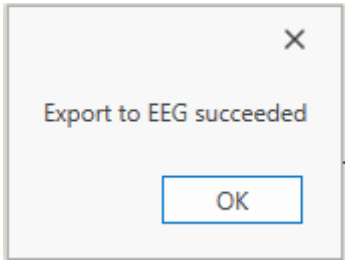


Trace Export

After the process to realize the ERP Preview, it's possible to export to EEG the processed average trace according to the defined parameters. In this section the user can define the Analsys title, the Signal window and select if the signal window shall be applied to the Polygrafic channels too.



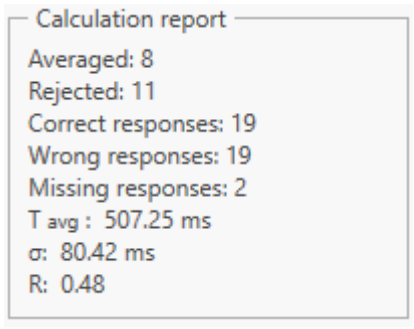
After clicking "Export to EEG" button, a message appears:



Calculation Report

The last section allows to give a Calculation report containing:

- the number of triggers averaged;
- the number of triggers rejected;
- the number of correct responses (if Patient Response option is enabled);
- the number of wrong responses (if Patient Response option is enabled);
- the number of missing responses (if Patient Response option is enabled);
- T_{avg}: Correct response average time (if Patient Response option is enabled);
- σ: Standard Deviation of the Correct response time (if Patient Response option is enabled);
- R: Correct responses / number of triggers (if Patient Response option is enabled).

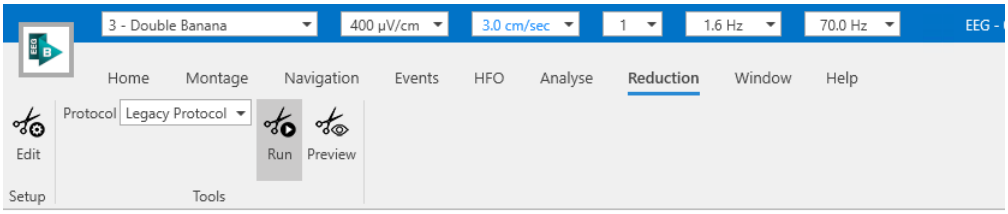

Calculation report
Averaged: 8
Rejected: 11
Correct responses: 19
Wrong responses: 19
Missing responses: 2
T avg : 507.25 ms
σ: 80.42 ms
R: 0.48

BACKGROUND REDUCTION

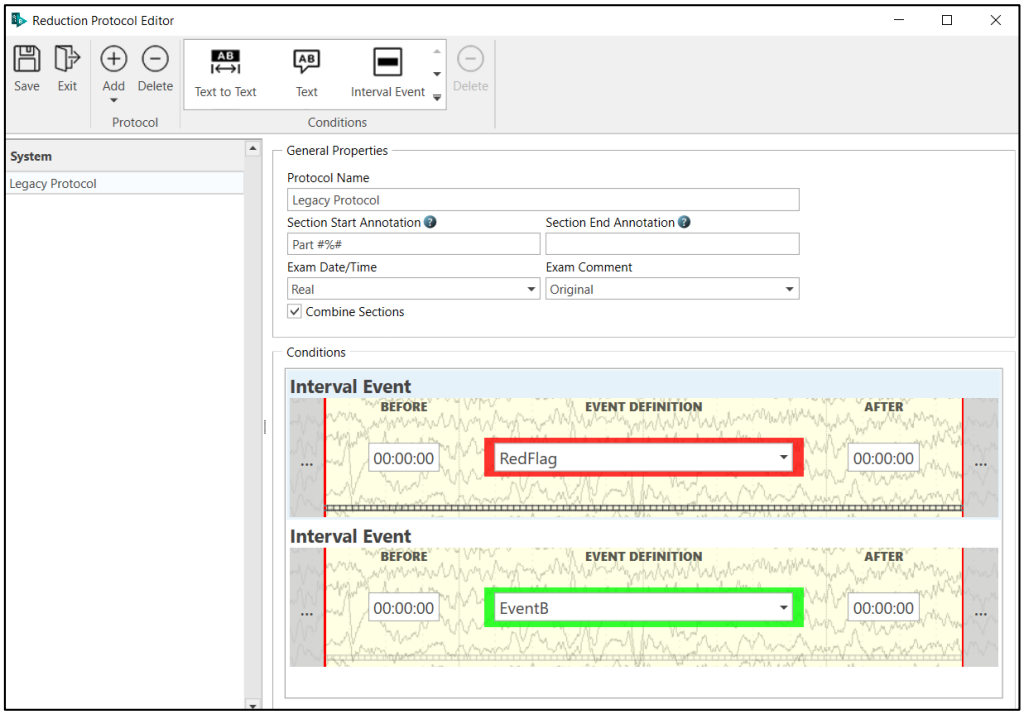
EEG REDUCTION IN BACKGROUND

Brain Quick software allows files reduction in background to consent the user to keep in memory only the important segments selected of an acquired EEG trace and to allow the user to do different activities during the reduction process.

To perform a file reduction, the user can select the segments of the trace of interest, during acquisition and reading phase of an EEG exam and define the **Reduction Protocol** opening **Reduction Setup** from Reduction tab.



From **Reduction Protocol Setup** it is possible to add, delete and modify reduction protocols.



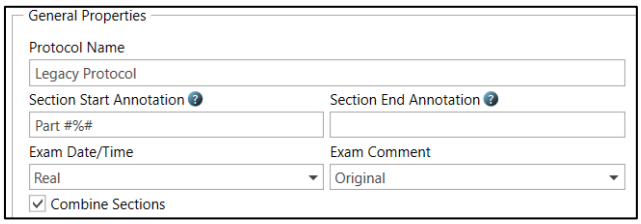
Each protocol is described with a “Protocol Name” and it is possible to define:

- How reduced exam comments are handled (protocol name, original exam comment, trigger or none comments)
- If reduced sections are combined or separated (possibility to define if trace selections will be reduced into SAME FILE composed by different segments), a “Section Start Annotation” and a “Section End Annotation”. It is also possible to use the following tokens to create a unique annotations in sections:
    - %# = Section Count
    - %sd = Section Start Date
    - %st = Section Start Time

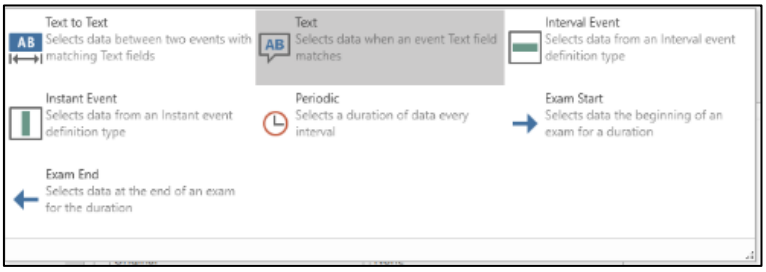
- %ed = Section End Date
- %et = Section End Time

Example: “Part #%# %sd %st” = “Part #1 08/04/2021 07:39”

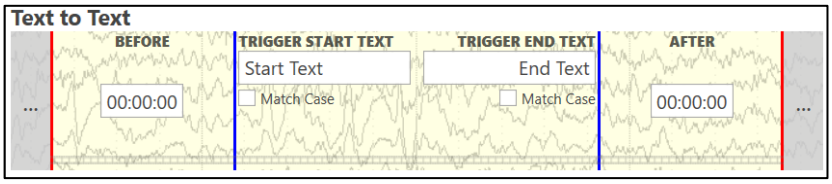
- How exam date/time is handled (original, real, now)



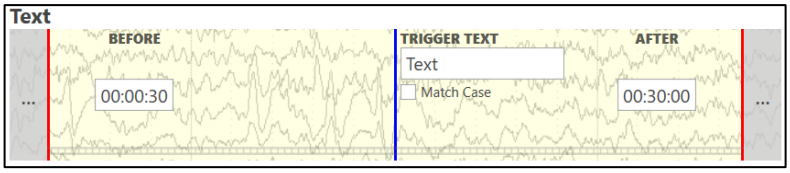
Each reduction protocol can be composed by one or more reduction “Conditions”, that is used to detect what part of the EEG/Video should be kept:



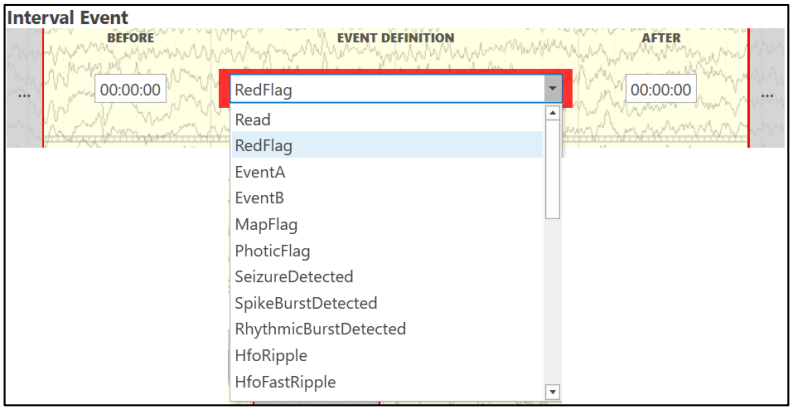
a. **Text to Text**, to keep V/EEG from X seconds/minutes before a user defined “Trigger Start Text” to Y seconds/minutes after a user defined “Trigger End Text”, where X and Y are defined by user and with the possibility to choose to enable or not “match case” for Trigger Texts



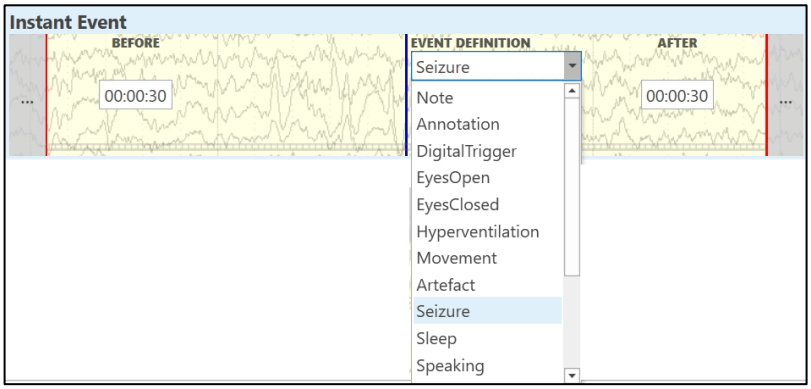
b. **Text**, to keep V/EEG from X seconds/minutes before a user defined “Trigger Text” to Y seconds/minutes after that “Trigger Text”, where X and Y are defined by user and with the possibility to choose to enable or not “match case” for Trigger Texts



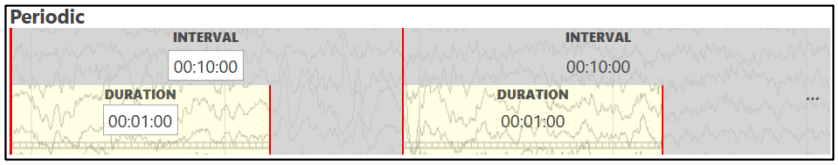
c. **Interval Event**, to keep V/EEG from X seconds/minutes before a user selected “Event” from the list of available interval events to Y seconds/minutes after that event, where X and Y are defined by user.



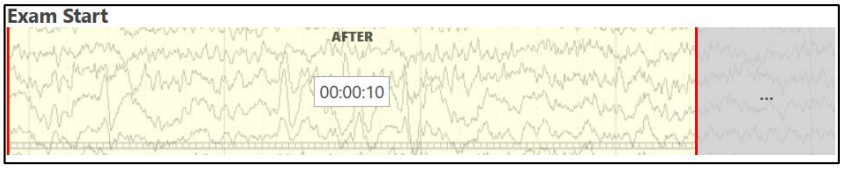
d. **Instant Event,** to keep V/EEG from X seconds/minutes before a user selected "Event" from the list of available instant events to Y seconds/minutes after that event, where X and Y are defined by user.



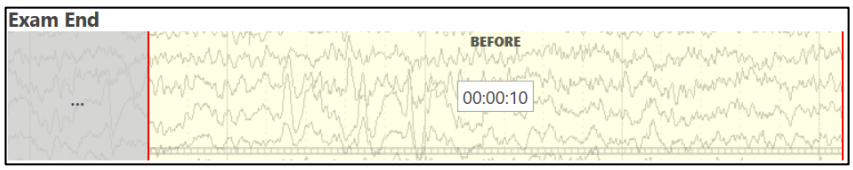
e. **Periodic**, to keep n amount of V/EEG every n time, it is possible to define the duration of the V/EEG to keep and the interval between the segments.



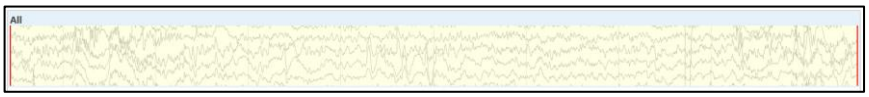
f. **Exam start**, to keep V/EEG X minutes after beginning (where X is defined by user).



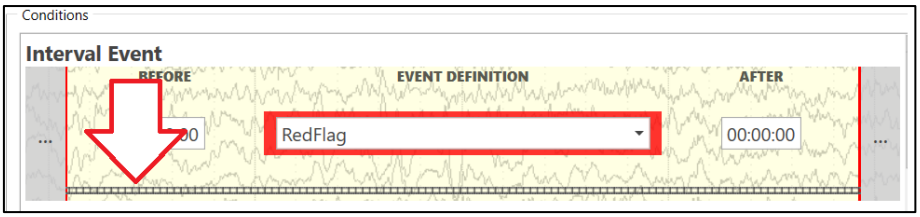
g. **Exam end**, to keep V/EEG X minutes before end (where X is defined by user).



h. **All**, to keep the entire V/EEG exam.



Select/Unselect the cinema bar in each condition to keep or not the Video together with EEG:



From Reduction tab it is possible to select one of the saved protocols to visualize on the open trace a **Preview** of the reduction that can be performed and to **Run** it to start the reduction. Reduction can be even launched from File Manager interface, right clicking on an EEG exam, and selecting “Reduce”. Available protocols are the ones defined in Brain Quick.

REPORT

Brain Quick software and Neurowerk software manages the creation of reports, which can be realized both during the acquisition and the review of EEG and EMG traces.

Instead, FILE MANAGER software can open, edit and delete these documents, as well as create new anamnesis.

It has a default editor, but the user can use Microsoft Word as default editor for report management. Anyway, the software has an editor that is independent from Word, in order to be used without installing Microsoft Office license.

REPORT MODELS

The model is a prebuilt document that can contain information, headers and so on. The user can modify this information such that the report model adapts to the user (doctor, lab, or hospital) needs.

The model can contain automatic fields, that is, referrals to record fields of the patient.
When the report of an exam of a determined patient is created, instead of the referrals, the patient data automatically appears.

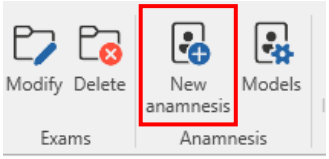
Different doctors or different type of exams can have different models for the creation of a report.

The model is a prebuilt document that can contain information, headers, etc. The user can modify this information such that the report model adapts to the user (doctor, lab, or hospital) needs.

The model can contain automatic fields, that is, referrals to record fields of the patient.
When the report of an exam of a determined patient is created, instead of the referrals, the patient data automatically appears.

ANAMNESIS

In FILE MANAGER it is possible to create an anamnesis for a selected patient by clicking the **New Anamnesis** button on the ribbon bar (Home Tab).

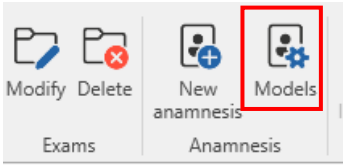


A dialog will open allowing to choose a predefined model; if no default template has been created, an empty anamnesis document will open. Once the model is selected, the Report editor panel will appear allowing the user to enter observations and patient information. If the anamnesis template contains referrals to patient record fields, patient information is automatically filled in with the selected patient data.
When anamnesis is saved, it will appear in the list of exams for the selected patient as a separate “study”.

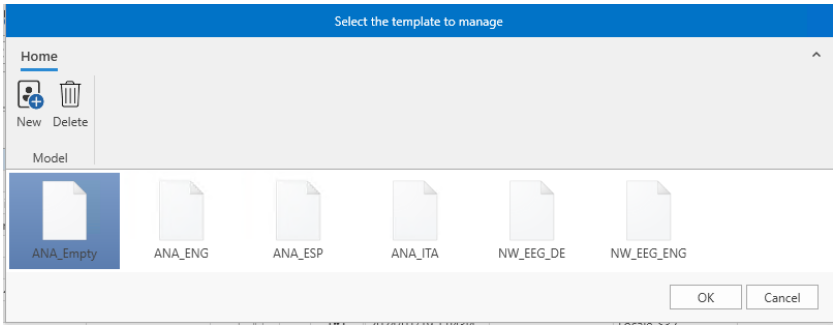
Double clicking on anamnesis exam or file, it is possible to open and edit it directly from in the Report editor panel. Report Editor is dockable, so it can be moved and pinned to the top, bottom, left, or right of the application window, and it can be resized as desired.

Anamnesis Models

The **Models** button of the ribbon bar (Home Tab) allows the creation of new models for anamneses or the modification of an existing one; the "Models Management" dialog will open with the collection of all available templates. It is possible to edit an existing model or define a new one.



Clicking the "New" button on the toolbar the Windows "Save As" dialog will appear allowing to enter template name and save it in the Templates folder. Once saved, it is possible to select the model and open it with the Report Editor for the template definition.
Report Editor offers different tools to setup layout, style, define header and footer etc.; in addition, the Insert tab allows to add to the model referrals to some patient record fields.

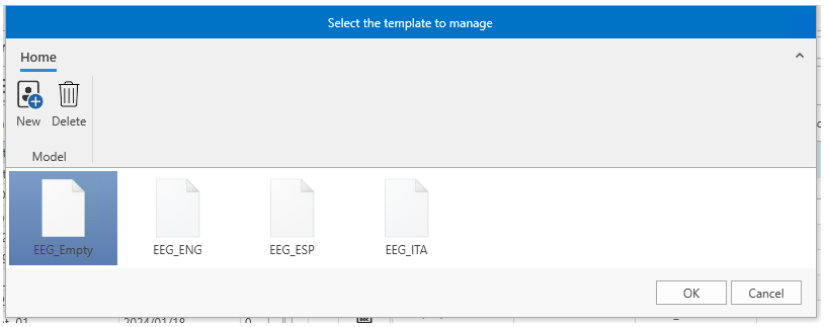


Anamnesis Models Management

Note. Anamnesis models are saved locally and are shared among all users.

HOW TO CREATE A NEW REPORT MODEL?

To create a new model or to modify an existing one, the user must select the **Report Models** button in the BrainQuick bar of the Archive window.
The **Model** window is shown, in order to let the user choose the Model file to modify or to allow the creation of the new model.



To create a new model, the user must click on New Button and save the document in the folder chosen.

When a new model is created, the user can insert a lot of information, for example the patient's name, the hospital, the street, the telephone number, etc. This can be done by simply typing the text and modifying its dimension, font, and position. See **Report Editor**.

REPORT EDITOR

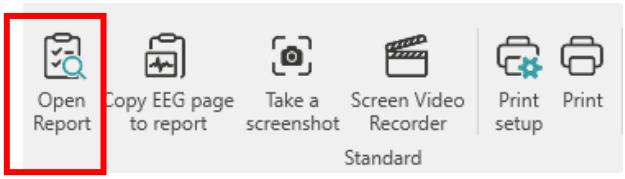
In the report editor the creation of a report or anamnesis consists on the creation of a new document containing all the information about the patient and the exam diagnosis.
For each exam, the user can assign a report.

There are various ways to assign a report:

- From Review window (during exam review phase), choosing **Open Report** from **Ribbon bar > Home tab**.

If a report associated to the exam in review already exists, it will be opened to allow the user to add diagnosis information to the report.

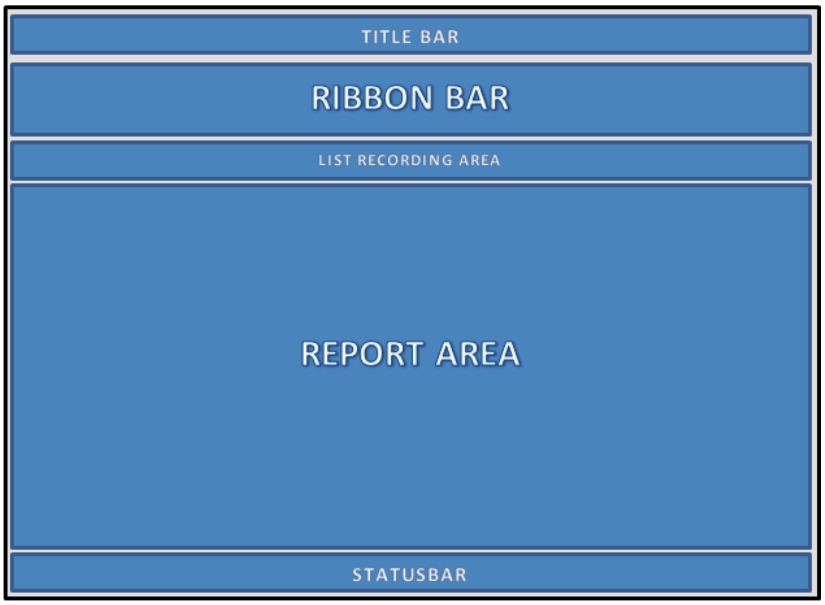
If there are no reports related to the opened exam, a new report file will be created and opened to allow the user to type patient or diagnosis information and observations to the report.



- From the FILE MANAGER archive ribbon bar under Brain Quick tab, pressing **New Report** button when it is positioned on the visit or exam of interest.

A dialogue window appears, that asks the user to specify the type of model to be used for the report.

Report Window



The report window appears like a text document and it is composed of:

1. The Report TITLE BAR, that contains an indication about the "type" of document ("REPORT") with First and Last Name of the patient and Date and Time of creation of the report. There will be also the possibility to enable "anonymous" function in order to hide patient name from the title bar

2. Report RIBBON BAR, containing all the toolbars placed on several tabs, grouped by functionality. The Ribbon bar uses tabs to expose different sets of controls, eliminating the need for many parallel toolbars

The ribbon bar could be minimized, keeping only tabs titles displayed:

The user has the possibility to visualize Ribbon bar in Normal Mode or in Minimized mode.

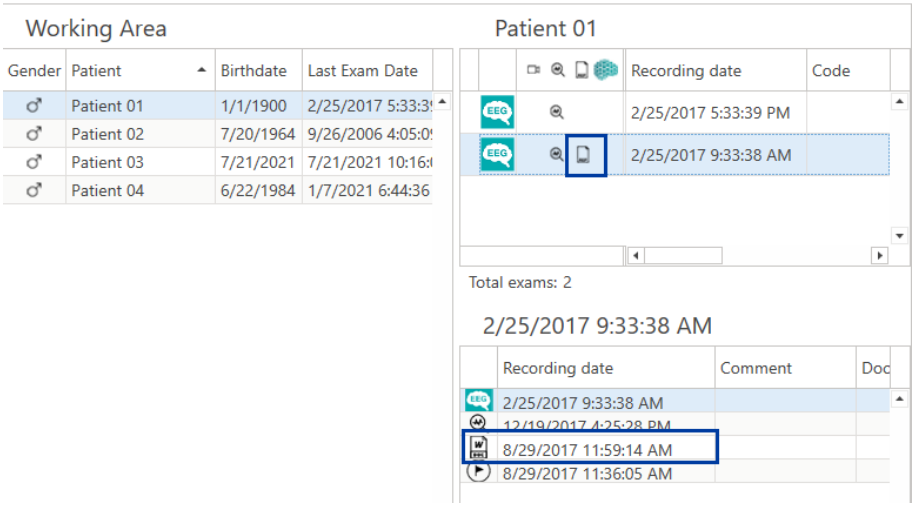
The ribbon bar is designed to help the user to quickly find the commands that he needs to complete a task. Commands are organized in logical groups, which are called together under the tabs. Each tabs relates to a type of activity, such as writing or laying out a page.

- **FILE** tab contains principal commands for writing, save and print the report
- **HOME** tab contains Clipboard, Font, Styles, and Editing menus
- **INSERT** tab allows the user to add pages, tables, pictures and hyperlink to the document. From this tab there is also the possibility to add FIELDS and BLOCKS: the report can contain automatic fields that refer to record information of the patient.
  When the report of an exam related to a patient is created, instead of the FIELD, the patient data automatically appears: this information are typically patient's name, birthdate or other items.
  BLOCKS let the user insert preset blocks of text. It opens a window that asks to the user to specify the name of the block to insert. From the same menu the user can create a new block with the selected text (or add the selected text to an existing block) and eventually define a shortcut in order to automatically add a specific block to the report pressing the shortcut key
- **PAGE LAYOUT** contains Page Setup and Page Background menus and describes how each page of the document will appear when it is printed
- **VIEW** tab allows the user to change the view
- **HIS** tab allows to export PDF (only if HL7 settings is activated)
- **VOICE** tab allows to dictate in order to write in the report (present only if it's activated in settings, for more details see "Report Dictation" section).

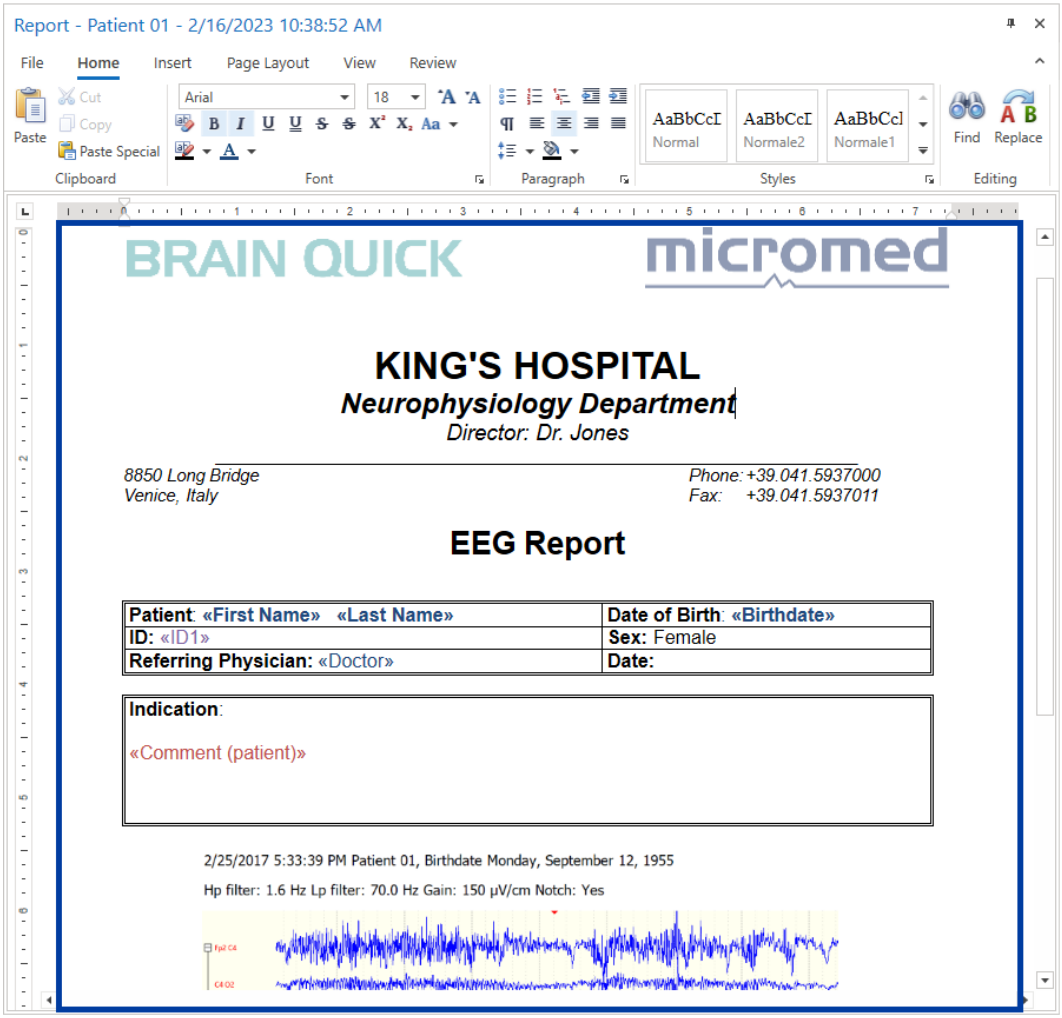
3. REPORT AREA, that is the real body of the text document, where the user can type his own comment about the exam

The report will be saved in.docx format and can be open from all the computer using all the commercial .docx reader (like Microsoft Office Word or WordPad) without any compatibility problems.

When the new report is saved, it appears in the exams list associated to the EEG study; by double clicking on report file it is possible to edit report information or add notes and observations through the Report Editor.



When double clicked, the editor will open the report to edit.



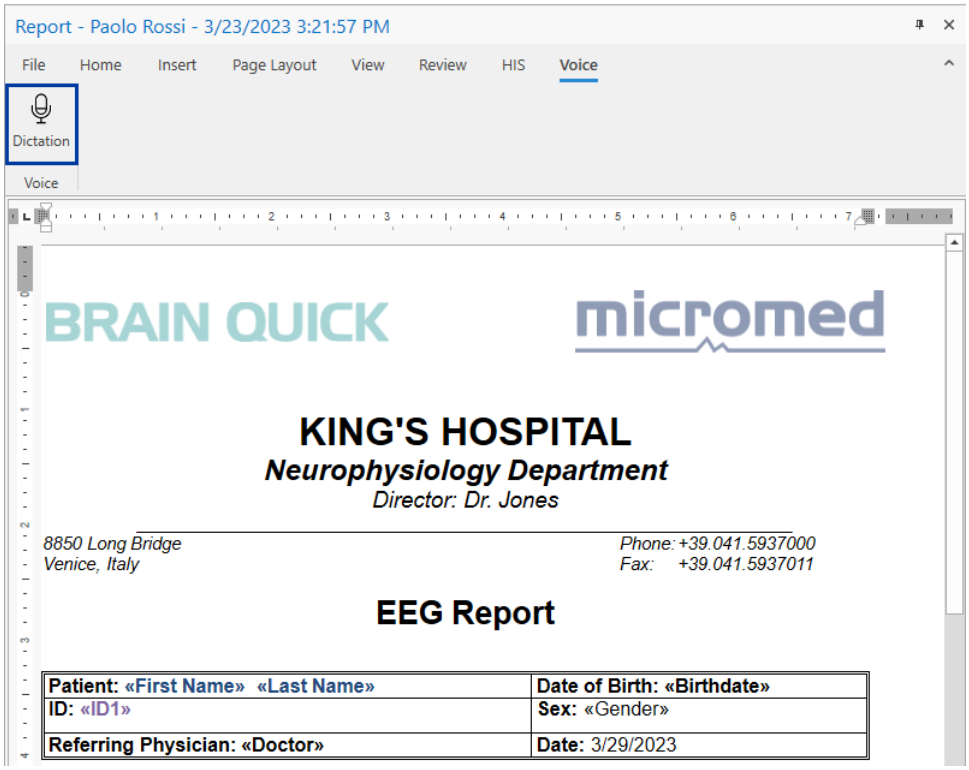
Report Dictation

Report Editor is integrated with **Voisis dictaphone**, a voice recognition system able to convert the speaker voice into written text which helps making reporting activity easier and immediate.

Thanks to such integration it is possible to dictate report and anamnesis content directly from the Report Editor.

Note. Dictation functionality is protected by a specific license (FMS SPEECH).

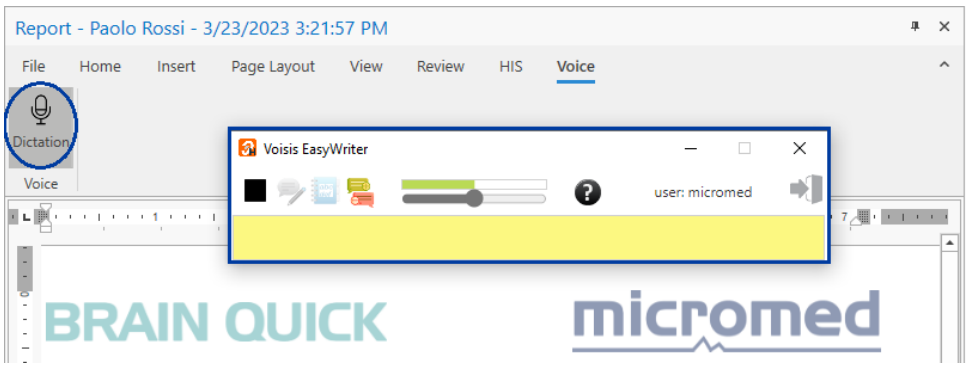
Report Editor toolbar has a dedicated **Voice** tab with a **Dictation** button; to enable dictation click with the mouse on the document position where you want to enter some text then click the **Dictation** button.



Dictation – Report Editor

Voisis EasyWriter console will automatically appear; the user currently logged in [(*)] will be used for the connection to Voisis dictaphone and the transcription will be automatically enabled.

[(*)] **Important Note.** In order to guarantee the access to the dictation console the username of the logged user **must** match with one of the Voisis users registered in Voisis server; for example, if currently logged in user is **micromed**, in Voisis server there must be a "micromed" user defined.

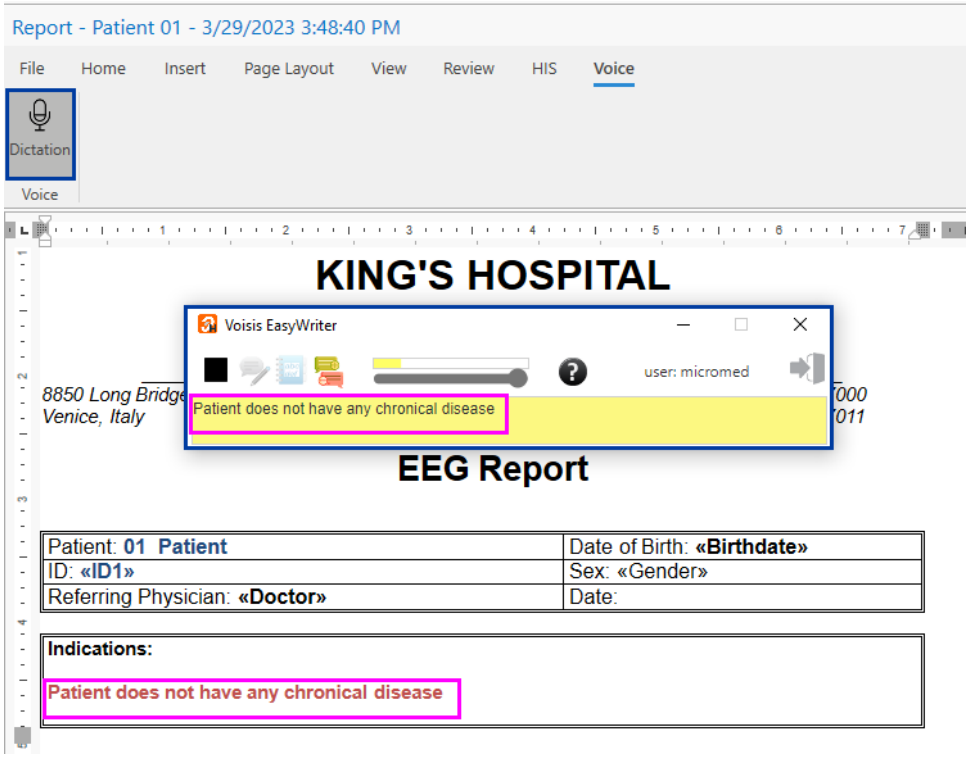


Voisis EasyWriter console

In case of **anonymous** access, Voisis login dialog will appear: enter **valid** credentials, i.e username and password of a Voisis user registered in Voisis server, in order to access dictaphone console; then enable the transcription by clicking the "microphone" button on the toolbar.
Note. Voisis users shall have username and password equal.

You can start dictate: your voice will be recognized from the Voisis dictaphone and text will automatically appear inside the report document starting from the cursor position.

Voisis EasyWriter dialog window can be kept opened: in the panel with yellow background all words and phrases recognized (automatically entered in the report document) will be displayed.



Report Dictation

When you finished click again on the **Dictation** button to disable the transcription and disconnect from the dictaphone.

ADVANCED FEATURES and CONFIGURATION

USER MANAGEMENT

As illustrated in the **Access to the Software** paragraph, it is possible to protect access to **FILE MANAGER**, and other Micromed softwares, by **username** and **password** and to assign different rights to the different users.

In a typical networked environment, Micromed security framework is based on a **centralized Users database** which collects the list of users who can access FILE MANAGER (and Brain Quick software) and all roles assigned.

Micromed security framework offers the following features:

- **Authentication services**: users are allowed or denied accessing parts of system functionality according to the role assigned, i.e. to their permissions.
- **Login management:** if logon system is enabled, users can log in and out of FILE MANAGER and current logged-in user is tracked.
- **Audit services:** user interaction with single machine is tracked and key functions/operations are recorded in an audit log.

MICROMED SUITE

Micromed Suite is an external utility intended to support in system configuration at installation time; in particular, it allows to setup:

- **Active Directory integration** with the possibility to enable Active Directory user authentication and bind entire Active Directory groups to File Manager user Roles in order to keep the central Users database automatically synchronized with the linked domain users credentials (central configuration).
- **Logon preferences**, i.e. enabling user authentication on single workstation.
- **Network Configuration**, i.e. setting up the communication between the local File Manager Core service running on single workstation and the central File Manager Core service running on server (distributed system configuration only).
- **Network Key Reading**, i.e. enabling the read of network license key(s) (optional).
- **License Key Activation** via **Key Updater** tool.
- **Configuration of other archiving features:**
  - Automatic archiving procedure
  - Persyst cleaning procedure
  - Background Transfer
  - Dictation
  - Databases conversion

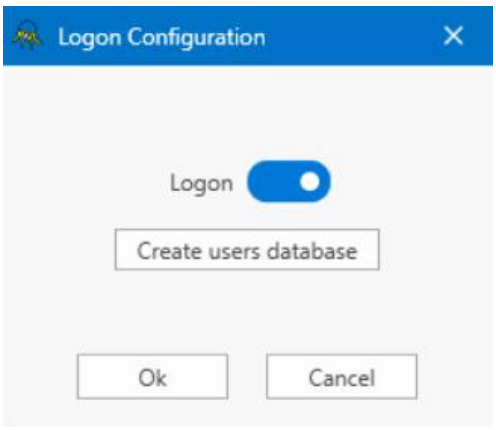
Note. The above configurations are advanced features that must be performed by authorized personnel only.

LOGON SYSTEM CONFIGURATION

In a networked environment, logon preferences are centralized, that is user authentication can be enabled or not, even if it is always highly recommended.

Logon preference can be setup through the Micromed Suite external application; this operation is typically performed at installation time by authorized personnel.
Note. Authorized users only can access Micromed Suite: a password is required.

From Micromed Suite users tab, click on Logon and then "Enable Logon" toggle switch to enable user authentication and click "OK" button to save preferences. If the users' database is not present, it is necessary to create it to start adding users and roles to it.



The FILE MANAGER logon system supports both **online** and **offline** user authentication; offline user authentication is based on a local copy of the centralized Users database which is kept synchronized; only users registered in local User Database can access FILE MANAGER in off-line mode.

ACTIVE DIRECTORY INTEGRATION

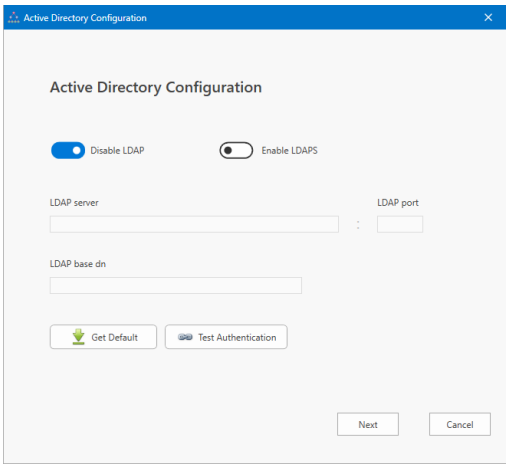
In a networked environment where Active Directory groups are established, FILE MANAGER logon system can be configured to **link Active Directory groups** to FILE MANAGER Roles. This represents a great advantage since it allows to bind group membership on network domain to medical device system restrictions.

Note. Each Role can be linked to specific Active Directory group only: all domain users belonging to the group will share the same permissions.

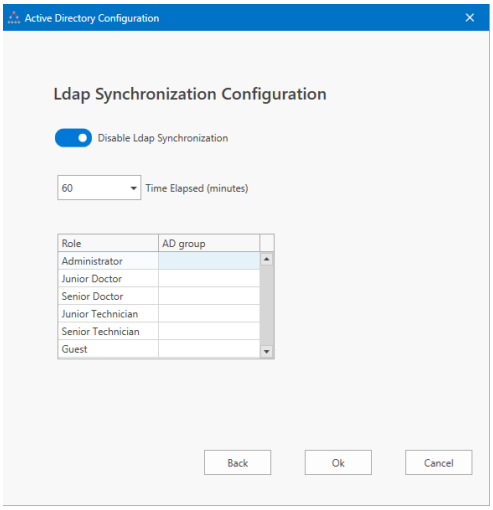
Active Directory Configuration

The Active Directory authentication enabling and related configuration must be performed centrally on server by authorized personnel at installation time through **Micromed Suite**.

In Micromed Suite menu select the Users tab and click the **Active Directory configuration** button; the Active Directory Configuration wizard will open.
In the first configuration step, it is possible to enable Active Directory authentication ("Enable LDAP" toggle switch) and setup the LDAP (Lightweight Directory Access Protocol) server details; in particular, it is necessary to specify the LDAP Server name and the port on which to contact it. Moreover the LDAP Base DN indicating the starting point of the search should be entered.



LDAP Server details



AD Groups Linking and Synchronization

The **Get Default** button allows to retrieve the standard values of these parameters (or it is possible to specify them manually).

Alternatively, AD Authentication over SSL ("Enable LDAPS" toggle switch) allows to communicate with Domain Controller through sign a secure communication protocol.

Clicking the **Test Authentication** button it is possible to test the correctness of entered parameters by testing authentication from a username and a password known.

Once AD authentication has been enabled, clicking on the "Next" button it is possible to proceed and enable the **automatic synchronization** with one or more Active Directory groups linked to FILE MANAGER pre-defined user role.
The synchronization timeout can be set and Active Directory groups can be manually linked to available roles by entering the Active Directory group name (among the existing ones in the reference domain) in correspondence of the chosen role.
Note. FILE MANAGER roles have a default set of permissions assigned; each role, except for the Administrator one, can be customized according to specific needs.

Click "Ok" to save Active Directory configuration; it will apply to all stations belonging to the networked environment ensuring the possibility to login to FILE MANAGER using domain credentials (username and password) for all users belonging to any linked Active Directory group.

If automatic synchronization is enabled, all Windows users belonging to the linked Active Directory group are added to Users database and can access FILE MANAGER (and Brain Quick software).
Main advantage is that linked groups are kept synchronized, so if a new user is added to the group by the IT he is automatically allowed to login to FILE MANAGER; similarly, "obsolete" user removed from the group by the IT will be no more allowed to login.

USERS DATABASE CONFIGURATION

IMPORTANT NOTE. It is highly recommended that Users database configuration is performed by expert technicians only, i.e. by authorized users with a complete understanding of FILE MANAGER software architecture and the networked environment where Micromed softwares are installed.

As mentioned above, in a networked environment users are centrally administered, and all users are stored in the central Users database.
The Users database can contain both Windows users (Active Directory users) and workgroup users (non-AD), i.e. it is possible to choose whether to authenticate only with Micromed defined users (non-AD) or to authenticate using Active Directory.

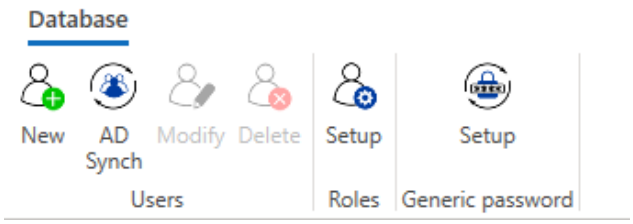
Administrator user only can (directly within FILE MANAGER in a dedicated and protected area) manage the central Users database with possibility to:

- Add/modify/delete users (non-AD) to database
- Customize user Roles
- Setup the "generic" protection password used to specific operation
- Manually synchronize linked Active Directory groups

From Micromed Suite, it is possible to access the Users Database Manager area. Go to Micromed Suite users tab, click on Logon and then on "Users Database" button.

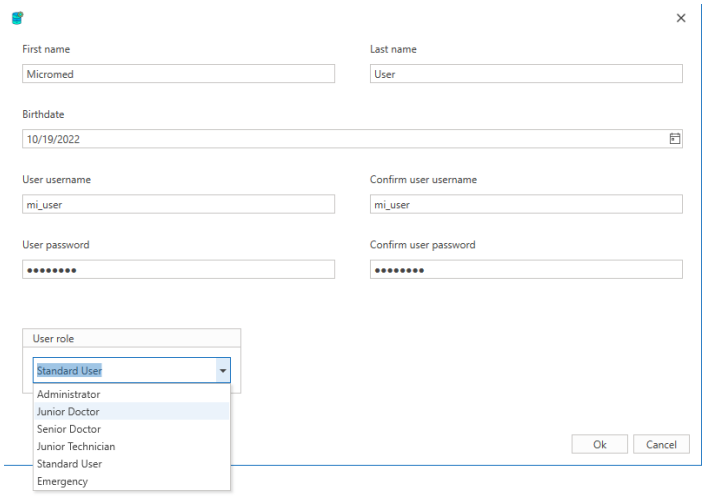
"Users Database Manager" window is composed by a toolbar and the Users Area which displays all users stored inside the Users Database, both Windows and not, grouped by role. If the role is linked to a specific Active Directory group also group name is shown between brackets.
For each user the following information is shown: full name, username (used for the authentication), and whether it is a Windows user imported from Active Directory.

The toolbar contains all buttons organized in functional groups: Users, Roles and Generic Password.



Adding a new user

Clicking the **New** button it is possible to create a non-AD user and assign it some "special permissions" (role).



User Database Manager - New User

In the “New user” dialog window, the following information is mandatory: first name and last name, birthdate, username and password, and user role (to be selected among the available ones).

Note. A double confirmation is required for both username and password.

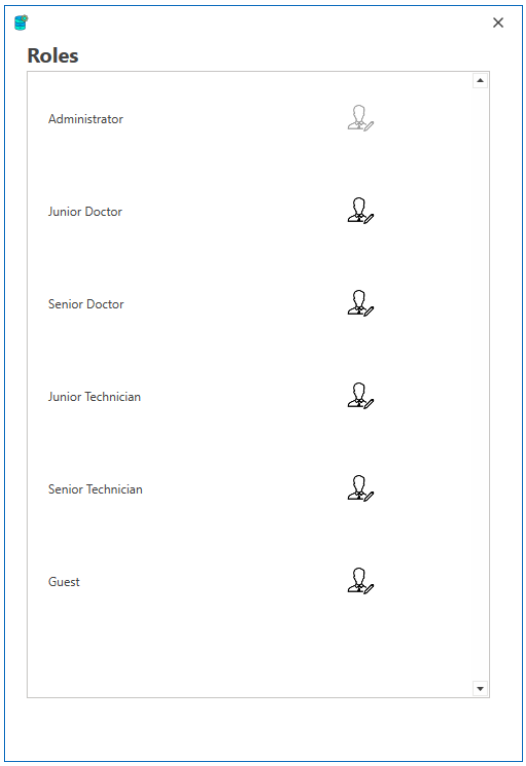
To change an existing non-AD user information or the assigned role, select it and click the **Modify** button. It is also possible to delete a non-AD user, i.e. to remove it from database, by clicking the **Delete** button; once deleted the user cannot access FILE MANAGER anymore.
Note. Active Directory user management is demanded to IT department, that is domain users can only be imported with their own credentials and associated to a set of pre-defined permissions by linking the domain group to which they belong to a specific FILE MANAGER role.

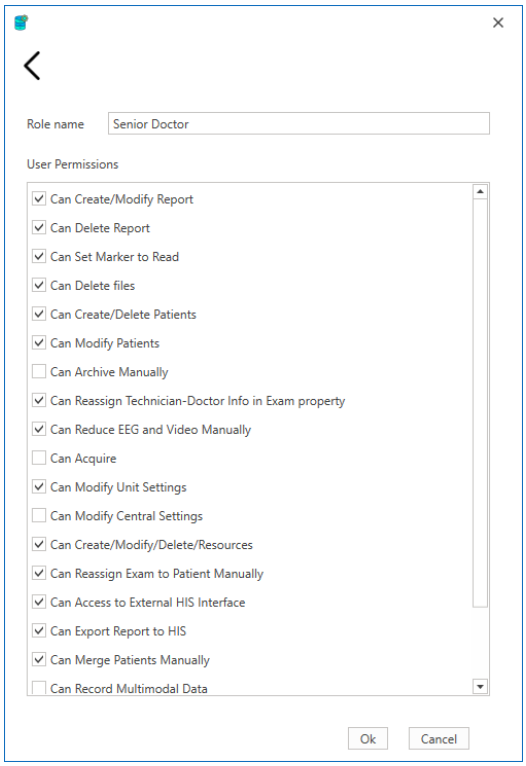
Customizing Roles

To give specific permission to user or group of users, it is possible to customize one of the available Roles.

From the Roles tab, click the **Setup** button to open “Role management” dialog.

All available Roles are listed with the possibility to customize each one, except for the Administrator, i.e. to change the collection of default permissions assigned.





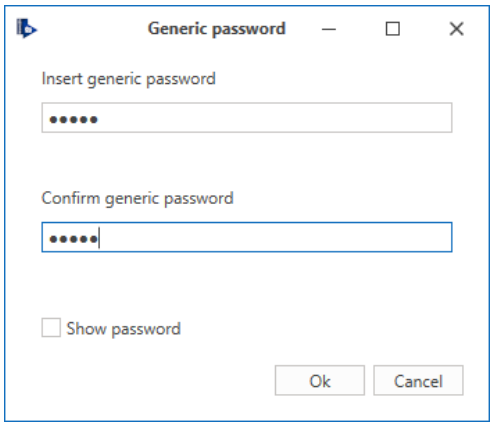
Roles ***Role Permissions***

Clicking the “Edit role” icon a dialog will open with the list of all user permissions available for the selected role; simply check or uncheck single to change pre-defined permissions associated to the role and click “Ok” to confirm. It is also possible to change the default name assigned to each role, except for the Administrator.

Generic Password Setup

Critical operations are furtherly protected by password, i.e. user needs to enter a “generic” protection password, to access specific FILE MANAGER functionalities or confirm specific operation.
In a networked environment, the “generic” password is shared by all stations and can be changed by authorized user only.

Clicking the **Setup** button in the Generic password group it is possible to change the default password; a double confirm is required.



Generic password Setup

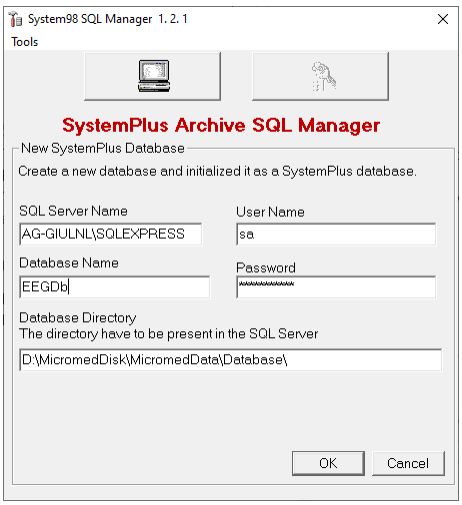
SYSTEM98 SQL MANAGER

The **System98 SQL Manager** tool is a Micromed application which allows to create Micromed Patient Database that is managed and used by the FILE MANAGER.

The application is comprised of two selectable macro areas; clicking the button with the “computer” icon will allow the user to set up the Patient Database.

CREATING A PATIENT DATABASE

In System98 SQL Manager main window select the “computer” icon and choose the “**New SystemPlus Database**” option to create a new Patient Database



System98 SQL Manager - New Database Creation

In the “New SystemPlus Database” dialog, enter the name of the SQL Server where you are going to create the database and the Database name.

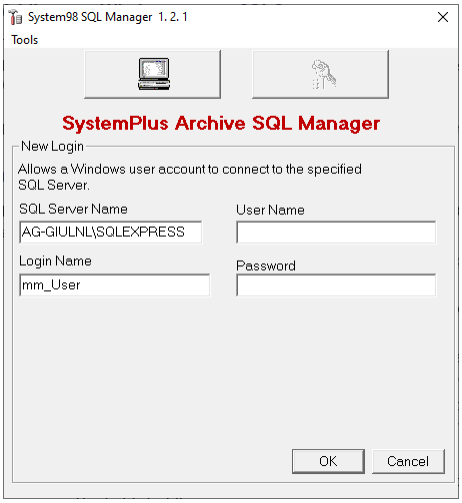
Important Note. Do not use special characters like “?”, “/”, “.”, “,” and blank spaces into the Database Name; only use letters and the underscore character as separator.

It is also possible to specify valid credentials (username and password) if needed to access the SQL server. Finally, select the Database directory, i.e. the path where to save the database; if changing the default folder, ENSURE THAT THE FOLDER EXISTS WITHIN THE COMPUTER WHERE THE SERVER IS DEFINED. Click “OK” to confirm database creation.

IMPORTANT NOTE. THE PATIENT DATABASE NEEDS TO BE UPDATED IN ORDER TO BE USED BY THE FILE MANAGER. WHEN A RESOURCE LINKED TO THE PATIENT DATABASE IS DEFINED FILE MANAGER WILL ASK THE USER TO PROCEED WITH THE UPDATE, REMIND TO ANSWER “YES”.

ADDING NEW WINDOWS USER TO SQL SERVER

To guarantee the access to Patient Database to a specific Windows user choose the “**New login”** option.
In the “New Login” dialog, enter the SQL server name to which add the Windows user and the name of the Windows user to add.



System98 SQL Manager - New Login

Enter valid credentials (username and password) if needed to access the SQL server. Click “OK” to confirm the new login.

OTHER FUNCTIONALITIES AVAILABLE

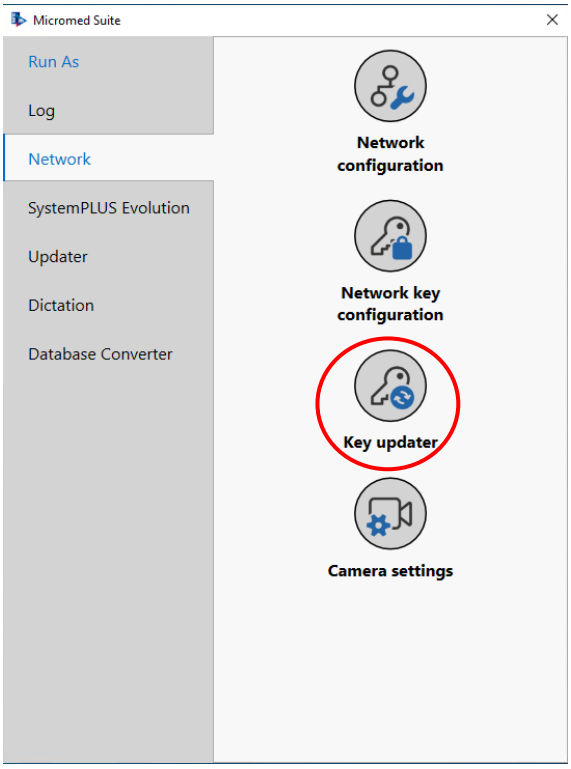
From System98 SQL Manager, in the area dedicated to Patient Database there also the following options available:

- **Backup of SystemPlus Database**, to perform a backup of the selected database. The target folder for backup must exist within the computer where the server is defined.
- **Restore of SystemPlus Database**, to restore a database from the backup folder and to save it to the target folder.
- **General Information**, to obtain information about the selected server. This shows which database are defined within the server and which users have access to the server.

- **Test of SystemPlus Database**, to test the selected database. Both in case of success or failure, it is possible to view the test result in the Windows registry.
- **Delete a Database**, to delete the selected database
- **Import SystemPlus database – Access to SQL Server**, to import data from one database to another. The fields to fill in are:
    - Name of the server to copy the database to
    - Username and password to access the database
    - Target database name
    - Folder of the target database
    - Source folder to copy the data from
- **Move Database fields**, to switch the database fields.

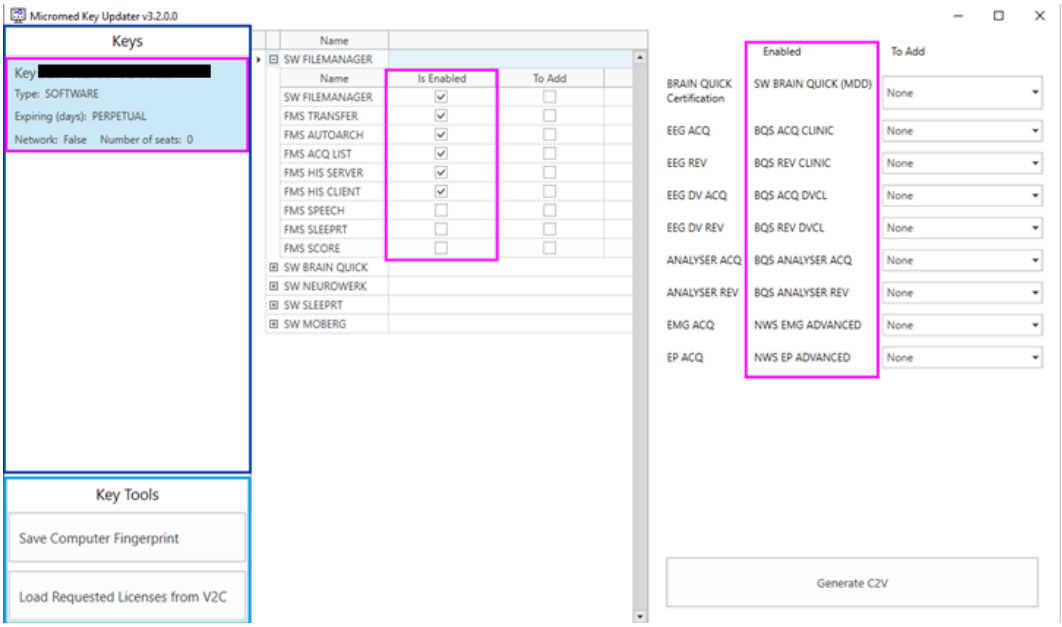
KEY UPDATER

The **Key Updater** tool is an external application used to activate and update the license keys of the FILE MANAGER and other Micromed software.
It is installed as part of the **Micromed Suite** installation and can be launched from the *Network* menu of the suite itself.



As shown in the figure below, the Key Updater main window is divided in three columns:

- the first column (on the left) shows all the keys that can be viewed in the Key Updater, their ID, their type, days left to expiration, if network keys and the related number of seats. At the bottom, there is a Key Tools panel with two buttons:
    - **Save Computer Fingerprint**, which allows to generate the fingerprint of the machine for which requiring a new license key.
    - **Load Requested Licenses from V2C**, which allows to activate a new license key or to update an existing key with the additional licenses required starting from the V2C file received from Micromed.
- The second column (in the middle) lists all the available licenses for the selected key, those that have already been activated ("Is Enabled" column) and those to add, in case of existing key update.
- The third column (on the right) shows the options enabled related to the sets of mutual exclusive licenses with the possibility to select those to add. At the bottom there is the **Generate C2V** button which allows to generate a key update request with the selected licenses to add.



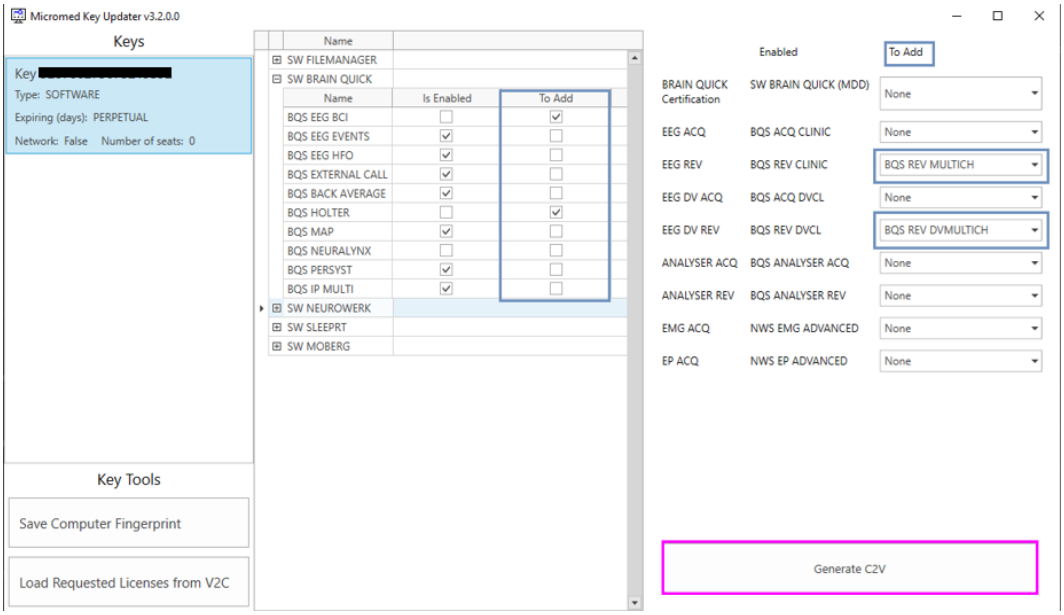
The Key Updater allows users to view and update all keys managed by Micromed; keys can be grouped as follows:

- **Hardware keys**, which are simple USB dongles.
- **Local software keys**, which are codes saved on the computer. These keys can only be used on the computer for which they were generated and cannot be recognized by any other computer.
- **Network software keys**, which are a special type of software keys that can be used by a predefined number of computers (workstations) simultaneously.

UPDATING KEYS

The process of updating licenses for hardware and software keys follows these steps:

1. If updating a hardware key, connect it to the computer. Launch the Key Updater: the key will appear on the left column in the list of available keys. If updating a software key, ensure that the computer with the software key of interest is being used.
2. Select the key to update in the left-hand column.
3. Select the licenses to add by enabling them in the “To Add” column of the license list in the middle pane and/or selecting option to add/change in the dropdown menus related to mutual exclusive licenses on the right pane.



4. Click the **Generate C2V** button to generate the ".c2v" file in the defined path.

The ".c2v" file needs to be sent to Micromed, which will use it to generate the codes needed to unlock the requested licenses. These codes will be stored in a ".v2c" file that Micromed will send back to you.

In order to update the key after receiving the ".v2c" file with the code, the user needs to:

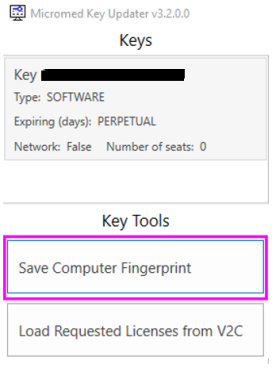
1. Ensure that the hardware key is connected to the computer or use the computer with the software key.
2. Launch the Key Updater and select the key to update in the left column.
3. Click the **Load Requested Licenses from V2C** button to load the received ".v2c" file.

When the .v2c file is successfully loaded, the updated key and the new licenses will be immediately available to the FILE MANAGER.

CREATING SOFTWARE KEYS

To create software keys, the user will need to generate the *fingerprint* for the machine where the licenses will be installed. The fingerprint is a file containing the digital print of the machine and is therefore specific to each computer.

To generate the *fingerprint*, launch the Key Updater and click the **Save Computer Fingerprint** button (in the Key Tools pane on the left) which allows to save the fingerprint in the desired folder.
A message will confirm if operation is successful.



The *fingerprint* file needs to be sent to Micromed, which will use it to generate a ".v2c" file containing the requested software key.

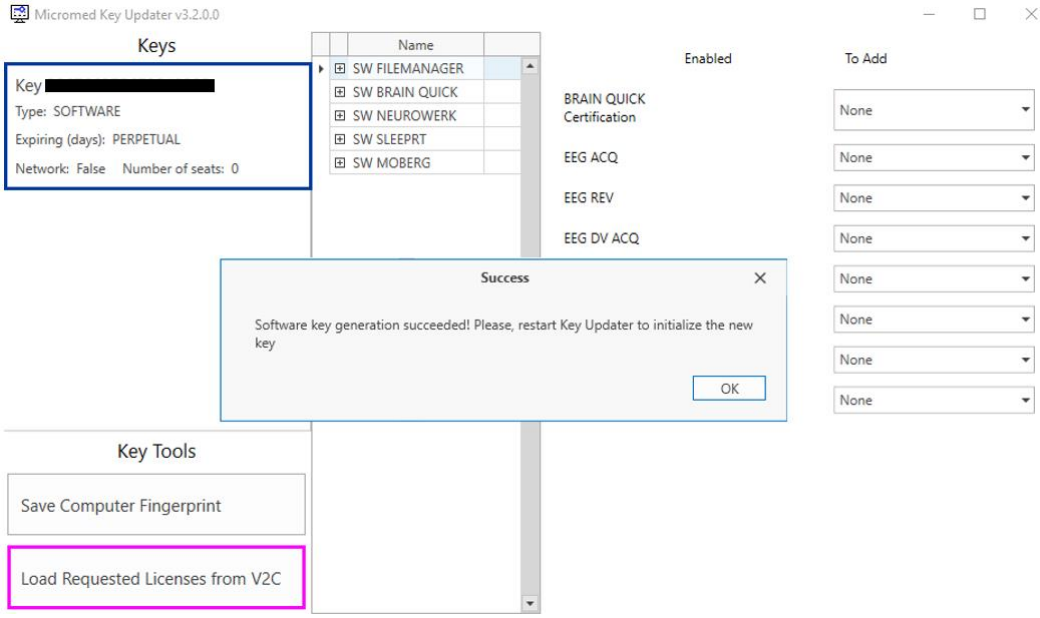
Note. Since the ".v2c" file is generated using the fingerprint of the computer for which the software key was requested, it is not possible to use the same ".v2c" file for a different computer.

In order to load the received ".v2c" file, the user needs to:

1. Launch the Key Updater.

2. Click the **Load Requested Licenses from V2C** button in the Key Tools panel on the left to load the received ".v2c" file with the requested key.

3. After clicking "Open", the software key will be created and it will appear in the list of keys in the left column. A message will notify if operation is successful.



The software key and related licenses will be immediately available to the FILE MANAGER.

APPENDIX

SHORTCUTS

Events Shortcuts

Previous event	CTRL + P
Next event	CTRL + N

Paging Shortcuts

BEGIN	Home
END	End
Interval Back	Page Down
Interval Forward	Page Up
Auto Back	Down Arrow
Auto Forward	Up Arrow
Page Left	Left Arrow
Page Right	Right Arrow
½ Page Left	SHIFT + Left Arrow
½ Page Right	SHIFT + Right Arrow
1 Sec Left	CTRL + Left Arrow
1 Sec Right	CTRL + Right Arrow
Increase Speed	*
Decrease Speed	/
Place/Move ruler cursor	CTRL + F
Go to time	CTRL + T

Video Shortcuts

Play/Stop Video	Space

TERMINOLOGY

Review Window

The EEG review screen is the part of the program that is used to review and analyze EEG exams. In the review section it is possible to review more than one trace at the same time and this allows the user to compare the different exams of the same patient or of different patients.

Ribbon Menu

The upper part of BRAIN QUICK SOFTWARE review and acquisition window containing the toolbars commands that allow access to all the review and acquisition functions.

Events Panel

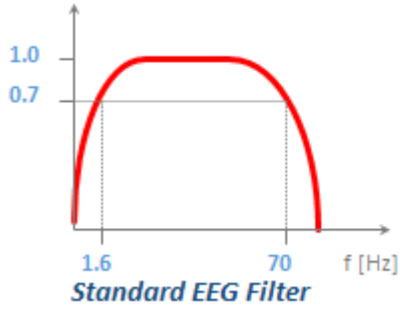
The list of events placed in the trace opened in review and acquisition.

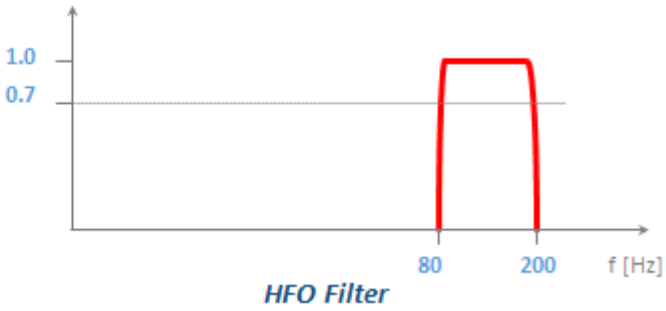
HFO

Filters

BRAIN QUICK SOFTWARE allows the possibility to set Low/High pass frequency from Montage Setup and directly from acquisition/review window and to apply the same filter at the same time to all the lines or it can be applied separately on the selected line.
A popup menu appears in order to let the user choose the value of the cut off frequency of the filter.

The review software is HFO compatible and contains possibility to set band filters for High Frequency Oscillation visualization allowing the possibility to filter at high frequency bands and to set “FIR” filter type, instead of the “IIR” filter type for the spike visualization





Below 2 figures are reported in order to show the same part of an EEG trace filtered at [80-250 Hz] for RIPPLE visualization using a FIR filter in the first figure and an IIR filter in the second figure. As you can see, the correct HFO visualization is available only by selecting FIR filter type:

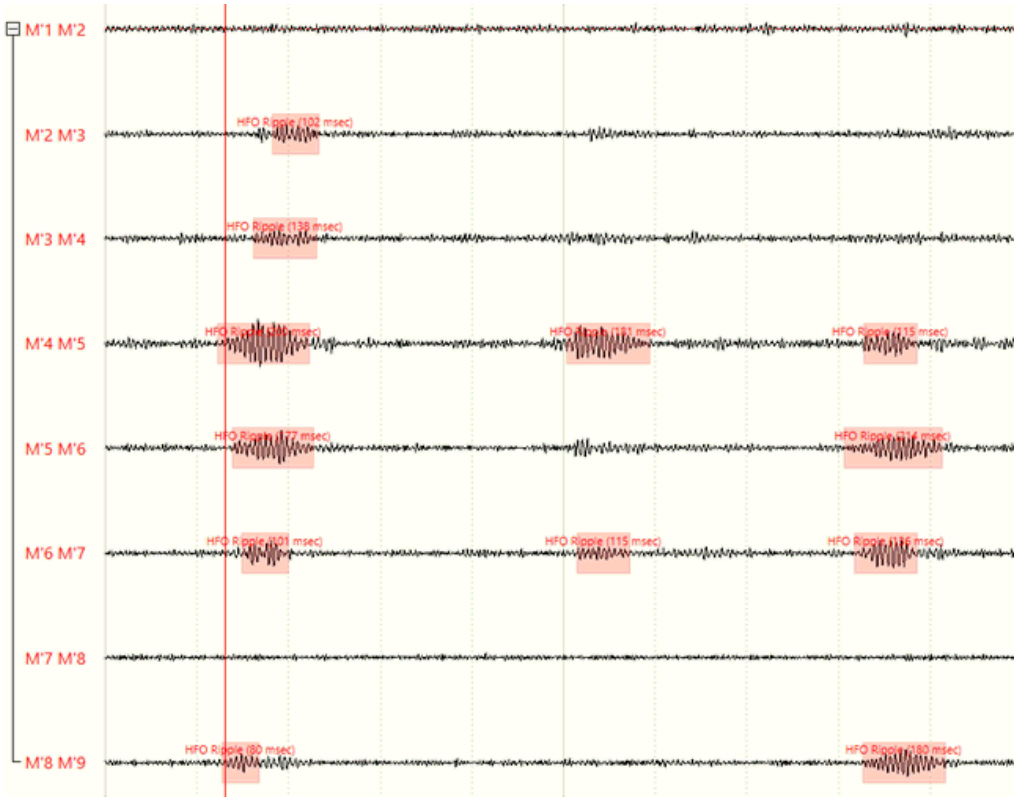


Figure: FIR Filter between [80-250Hz]

Figure: IIR Filter between [80-250Hz]

As you can see, the typical filter commercially available (IIR Filter) does not permit the correct HFO visualization. Micromed software permits to have both filters available in Montage Setup.