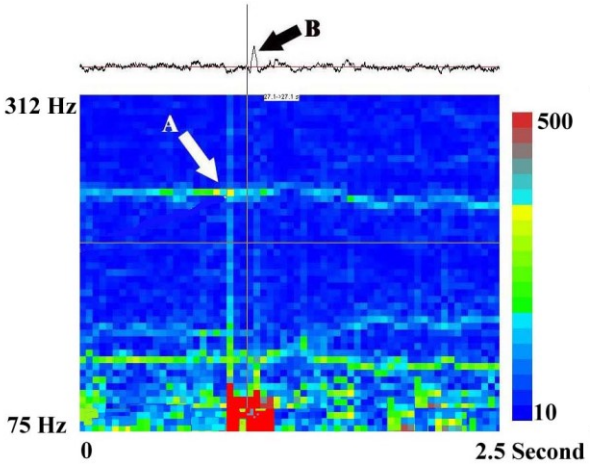
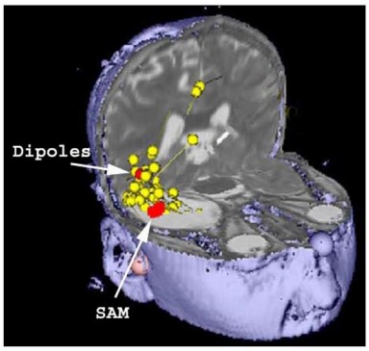
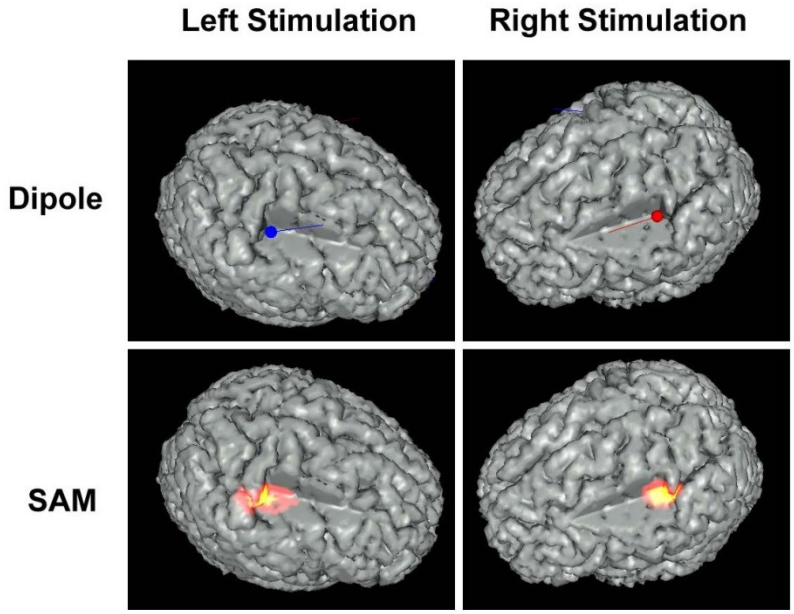
File Operation Guide







DISCLAIMER

We have used reasonable effort to include accurate and up-to-date information in this manual; it does not, however, make any warranties, conditions or representations as to its accuracy or completeness. We assume no liability or responsibility for any errors or omissions in the content of this manual. Your use of this manual is at your own risk. Under no circumstances and under no legal theory shall the authors be liable for any indirect, direct, special, incidental, punitive, exemplary, aggravated or consequential damages arising from your use of this manual.

Features and specifications of this software program are subject to change without notice. This manual contains information and images about Magnetic Source Imaging (MSI) Studio, its user interface, GUI and its other signal processing algorithms, publications that are protected by copyright.

Sending Your Comments and Critiques: We'd like to hear from you. Your comments and suggestions for improving this document are welcome and appreciated. Please e-mail your feedback to support@mecurer.com.

Thank you.

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Warnings and Cautions

This software supports both functional and structural images. Functional image data include electroencephalography (EEG), electrocorticography (ECoG), intracranial EEG (iEEG), and magnetoencephalography (MEG) and data. Structural image data include magnetic resonance imaging (MRI) and computed tomography (CT). Though EEG and MEG waveforms appear similar, they have different unit in amplitude. If the EEG and MEG data recorded simultaneously, their time unit or temporal resolution is typically the same.

If you use MSI Studio to convert a DICOM (Digital Imaging and Communications in Medicine) series containing oblique slices with a slice plane that is not orthogonal to the scan direction, the result will be a distorted image. The severity of distortion will depend on the angle of the oblique scan. Such a distorted image should not be used for analysis.

There are a set of source localization algorithms in the program. Each source localization algorithm has been designed and tested for specific reasons. To ensure the quality and visibility, all source localization algorithms will generate a volumetric source image, which can be considered as a image with millions of "dipoles" or multi-value-voxel, which is significantly different from the conventional magnetic source imaging (MSI) or equivalent current dipoles.

The accuracy of the structural images (MRI/CT) may also affect the MEG results if the conventional magnetic source imaging (MSI) is used. If MRI/CT is distorted, the combination of MEG/MRI/CT will be low-quality. In addition, multiple local sphere, head model or other structural constrained source localization my internally use the MRI/CT images. Any analysis based on those distorted images may yield unexpected or poor results.

The co-registration is only as good as how closely the lipid markers correspond to the placement of the head localization coils during an MEG collection, and how accurate the head coil locations are relative to the sensors. Please See the Head Localization Guide for more details on head coil localization methods and accuracies. In addition, if the MRI contains any distortions which may distort the locations of the lipid markers, the co-registration of the MEG data results and the MR image may also be compromised.

For source localizations on the surface of the brain, there is little or no difference in results between the MSI Studio shape data extraction methods ("cortical hull", "head" and others). However, for deep sources (e.g., those located in the hippocampus or inferior temporal lobes), the cortical hull extraction method results in source localizations that more closely approximate the true model. This method is the default selection in the MSI Studio software.

The accuracy of the multiple local spheres head model used for the mathematical analysis of MEG data is dependent on the accuracy of the MRI itself. If MR images are poor (i.e., distorted), the shape data created in MSI Studio and the resulting multiple local spheres model created by the local spheres application will likewise be inaccurate. Any analysis based on this multiple local spheres model may yield poor results.

It is a good idea to use input data generated by EEG Studio software when processing and analyzing data. For example, the multiple local spheres model created by the local spheres model in MSI Studio has only been tested and validated using shape data files generated by MEG Processor. Use of other software to generate input files for MSI Studio is at the discretion of the user.

When the source volume is not overlay correctly on an MRI, it is possible due to the source localization methods, MR images and/or co-registration errors. The following warnings and cautions appear in this guide. Please ensure you are aware of all the operations and interpretations.

Preface

This guide describes the operation of the MSI Studio. The MSI Studio is one of the core windows for integration of EEG/MEG and MRI/CT. It is used as the primary tool to view structural and functional activity/activation or abnormality for academic or clinical purposes. Importantly, the MSI Studio provides graphic user interface (GUI) for access other function. In other words, it is also often used to launch other windows such as source localization.

Intended Audience

This guide is intended for persons responsible for co-registering source images with volumetric MRI/CT data and/or generating "best-fit" sphere models. The guide assumes the reader is familiar with standard EEG/MEG procedures and is familiar with the Windows operating systems.

References

This document assumes familiarity with many terms related to computer operations and physiology. There is also wide use of acronyms.

Document Structure

Documents are generally provided in both Microsoft Word® format and Adobe® Acrobat® PDF (Portable Document Format). All editions are distributed on Flash Driver, CD or websites with the related software, and include bookmarks and hyperlinks to assist navigating the document. Please feel free to send your critiques, corrections, suggestions and comments to support@mecurer.com.

Conventions

Numeric: Numeric values are generally presented in decimal but in special circumstances may also be expressed in hexadecimal or binary. Hexadecimal values are shown with a prefix of 0x, in the form 0x3D. Binary values are shown with a prefix of 0b, in the form 0b00111101. Otherwise, values are presumed decimal.

Units: Units of measure are given in metric. Where measure is provided in imperial units, they are typically shown in parenthesis after the metric units.

A millivolt (mV) is one one-thousandth of a volt (0.001 V or 1 10^{-3}. These units commonly are used in EKG, EMG, and sometimes in EEG. A microvolt (uV) is one one-millionth of a volt (0.000000 V or 1 x 10^{-6}). This is the co

mmonest voltage measure in EEG. A nanovolt (nV) is one-thousandth of one-millionth of a v (0.000000001 V or 1 x 10^{-9}). This measure is used in the specific area of EEG dealing with evoked potentials.

The unit of current is the ampere (A). In EEG, typical smaller amounts are encountered. A milliampere (mA) is one one-thousandth of an ampere (0.001 A or 1 x 10^{-3}). A microamplere (uA) is one one-millionth of an ampere (0.000000 A, or 1 x 10^{-6}).

Magnetic signal strength is given in Teslas (T), the SI unit of flux density (or field intensity) for magnetic fields, also known as the magnetic induction. Typical signal strengths in MEG measurements are in the order of pT (picoteslas = 10^{-12}) or fT (femtoteslas = 10^{-15}).

Overview

This chapter describes functions in File Menu. The functions include File saving, opening, data importing, exporting and remotely downloading and uploading data.

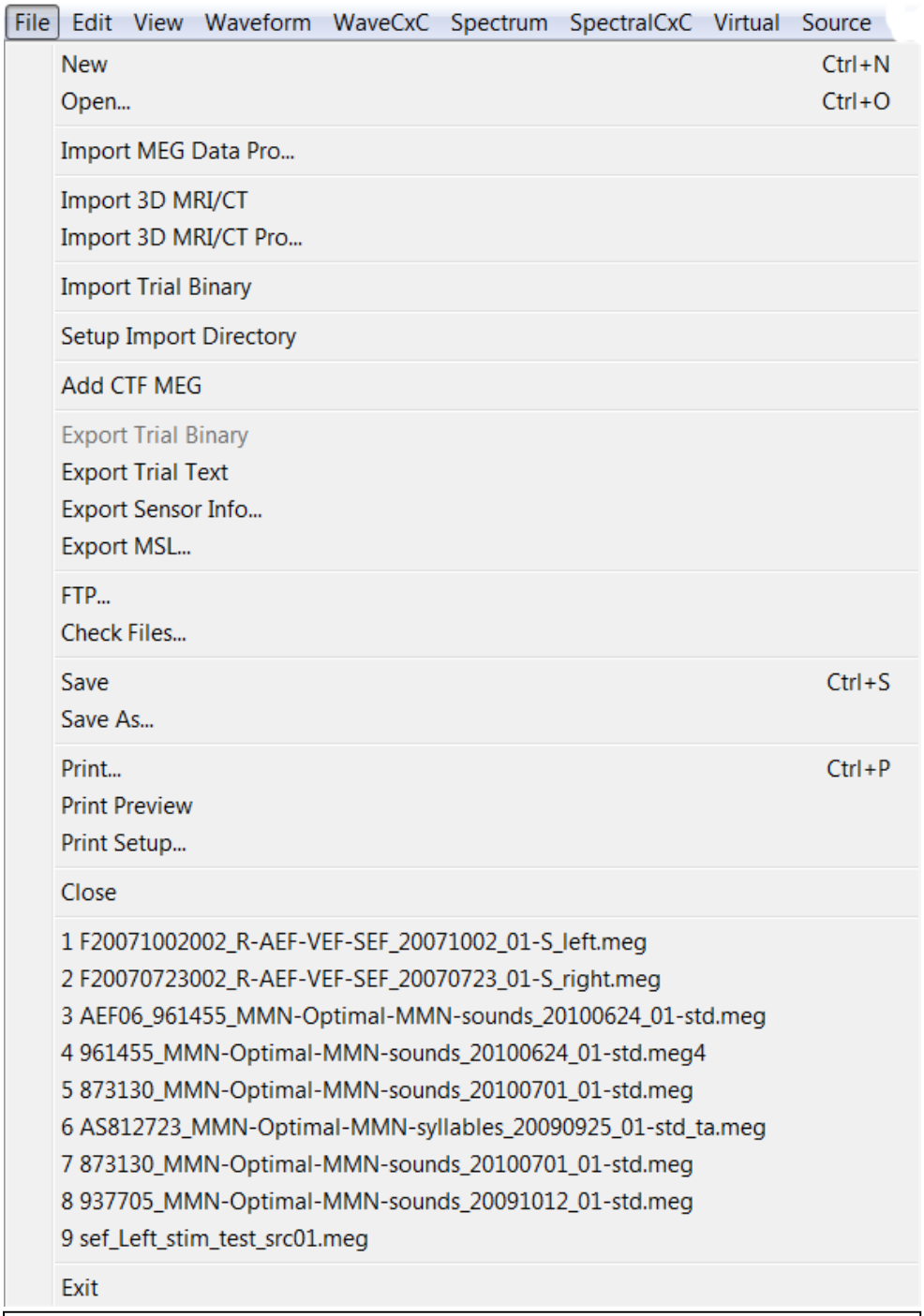

Figure 1. File Menu in MEG Processor Main Frame.

New Document

The “New” Menu, which is similar to the new button in the main frame, enable you to create a new document so that you can add or open MEG/EEG, MRI/CT and other data to the document.

It is important to remember to save the data before exit the new document.

Open Document

The “Open” Menu, which is similar to the open button in the main frame, enable you to open a previously saved document and files. If the files are generated by other documents such data acquisition software such as EEG/MEG recording software or MRI/CT scanning software, the program will automatically check and call the import function.

Import EEG/MEG data Professional

The “Import EEG/MEG data Pro” Menu provides GUI to import selected trials and segments of EEG/MEG data.

As the development of computer technology and the increasing of 64-bit computer operating systems (e.g. Windows 7 and window 8), this function is becoming obsolete. Noteworthy, this function stays here for back compatible purposes.

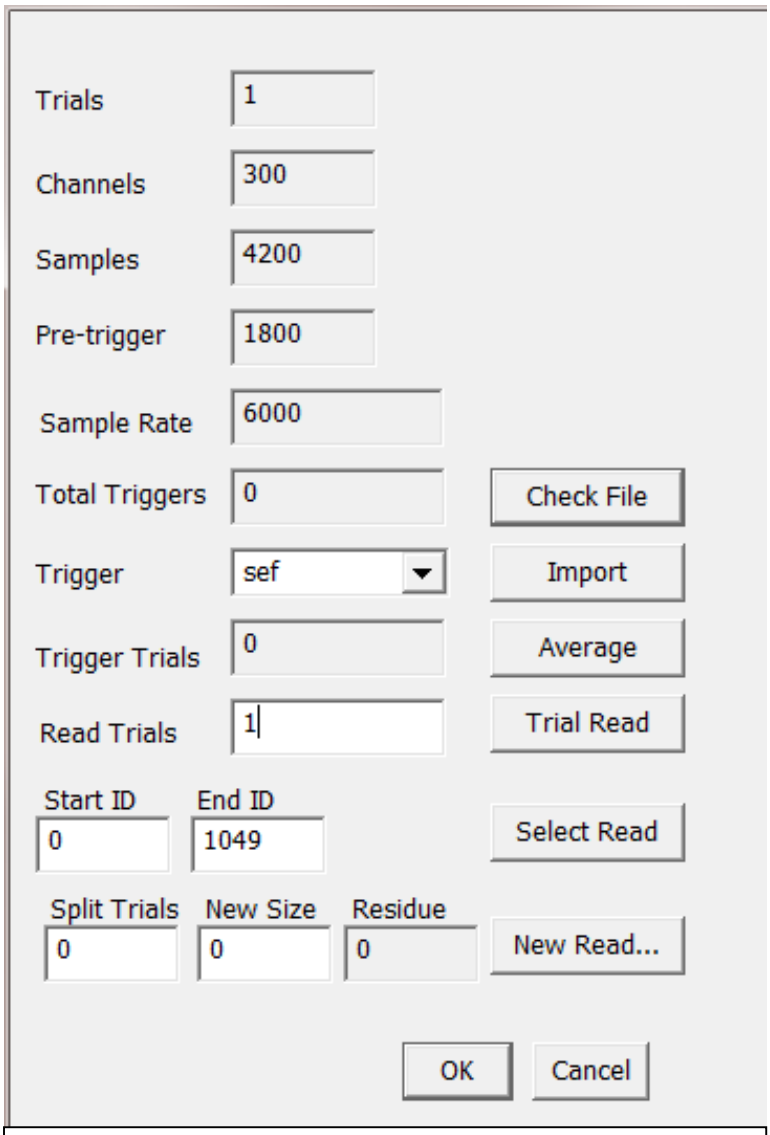

Figure 2. Professional Window for importing and checking MEG/EEG data.

Importing 3D MRI/CT Data

The "Importing 3D MRI/CT Data Menu" allows drag-drop file importing. Before an MRI file can be displayed in MSI Studio or MRI/CT Viewers, it must be converted to the program data file format (see "MRI/CF File Formats"). This program can directly read and convert MRI/CT files from DICOM format, which stores the MRI in individual files for each image slice.

To open and convert a set of DICOM MRI files, use one of the following methods:

- Select File > Import DICOM Series from the program main menu

- Drag-and-drop one DICOM file. The program will ask if the entire files in the fold will be selected; click “Yes”.
- Drag-and-Drop the entire fold to the main window. For details, see “Import DICOM Series”.

Importing 3D MRI/CT Data Professional

The “Importing 3D MRI/CT Data Menu” provides GUI to check, verify and align MRI/CT data. MRI/CT data are typically in DICOM format, please read the section of structural file format for details. Before an MRI file can be displayed in MSI Studio or MRI/CT Viewers, it must be converted to the program data file format (see “MRI/CF File Formats”). This program can directly read and convert MRI/CT files from DICOM format, which stores the MRI in individual files for each image slice.

The “Import EEG/MEG data Pro” Menu provides GUI to import selected trials and segments of EEG/MEG data.

As more and more companies implement standard DICOM format, this function is becoming obsolete. This function stays here mainly for back compatible purposes.

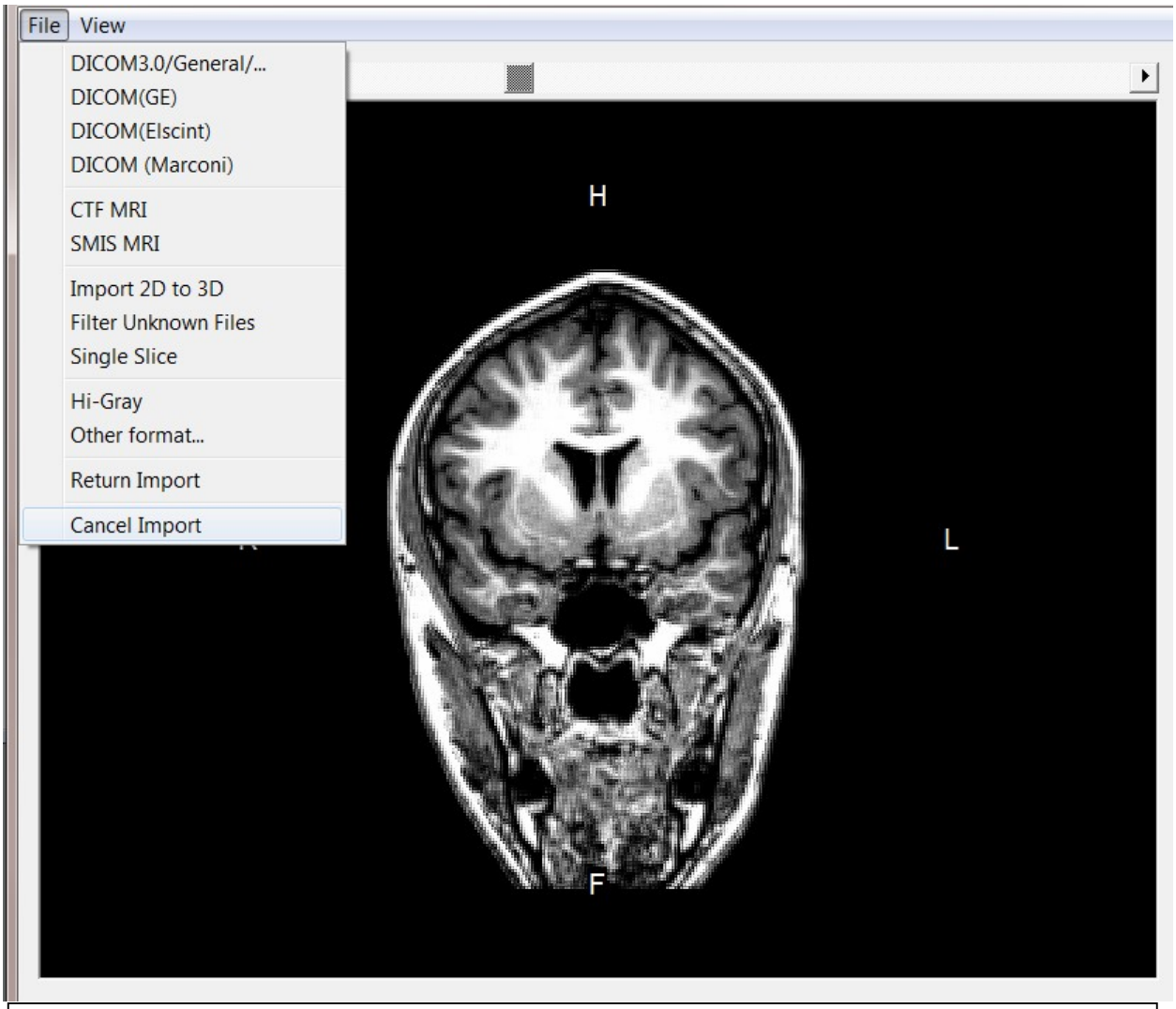

Figure 2. Professional Window for importing and checking MEG/EEG data.

DICOM Parameters

When importing a DICOM series, the following DICOM parameters in the source series are included in the program file:

1. Slice spacing
2. Slice thickness
3. Number of slices in the source series
4. Number of rows and columns in the source slice
5. Row and column resolution (in mm) in the source slice
6. Location of each source slice

Discarded Slices

If the spacing between slices in the source series is less than the final structural pixel resolution, some source slices will be discarded during the conversion. A message may display to inform you which slices have been discarded or distortion may occurs. Discarded slices are replaced by “reformatted slices” if the Use source DICOM series parameters option is enabled in the program attributes dialog when the image is exported back to a new DICOM series.

If you use this program to convert a DICOM series containing oblique slices with a slice plane that is not orthogonal to the scan direction, the result will be a distorted image. The severity of distortion will depend on the angle of the oblique scan. Such a distorted image should not be used for analysis.

Oblique Slices

The program can correctly convert to structural format a source DICOM series containing oblique slices providing the scan direction is orthogonal to the slice plane. However, if the source DICOM series contains the following types of oblique slices, the program cannot correctly convert the series.

1. Non-orthogonal row and column directions: Slice rows and columns are not perpendicular.
2. Multi-angle oblique slices: Slice angles are different.
3. Skewed slices: Edges of slices are skewed relative to each other.
4. Mix of multi-scan data or data corruption

Export a DICOM Series

For information related to exporting a DICOM series, see the exporting a DICOM series for details.

Import Trial Binary

The “Importing Trial Binary Menu” enables you to import a EEG/MEG trial data into the current document or EEG/MEG dataset.

It is important to note that, the trial data to be imported should be saved by the same or older version of software.

Import 3D Image Binary

The “Importing 3D Image Binary Menu” enables you to import a 3D MRI/CT data (volumetric data exported from either EEG Studio or MEG Processor) into the current document or EEG/MEG dataset.

It is important to note that, the trial data to be imported should be saved by the same or older version of software.

Setup Import Directory

The “Setup Import Directory” enables you to setup a default directory for importing EEG/MEG trial data in other format. EEG/MEG data saved with the current version of the software do not affected by this function.

Add EEG/MEG Dataset

The “Add EEG/MEG Dataset” function enables to import and add an EEG/MEG dataset to the current document. Consequently, this function provides the possibility to compare more than two MEG datasets.

Export Trial Binary

The “Export Trial Binary” function enables to export a selected trial in the current document in binary format. The exported trial file can only be read by this software or other software which supports the binary format.

Of note, this function provides the possibility to compare more than two MEG datasets.

Export 3D Image Binary

The “Export 3D Image Binary” function enables to export a selected 3D Image dataset in the current document in binary format. The exported trial file can only be read by this software or other software, which supports the binary format.

Of note, this function provides the possibility to compare more than two EEG/MEG datasets.

Export Trial Text

The “Export Trial Text” function enables to export a selected trial in the current document in text format. Consequently, the exported file can be read by many programs because text files are typically readable in many platforms.

Export Sensor Info

The “Export Trial Text” function enables to export the sensor information including the sensor names and positions.

Export MSL

The “Export MSL” function enables to export magnetic source locator (MSL) data which include the source information as well as MRI/CT data.

FTP

File Transfer Protocol (FTP) is a standard network protocol used to transfer files from one host to another host over a TCP-based network, such as the Internet. FTP is built on a client-server architecture and uses separate control and data connections between the client and the server.

This function enables remotely download and upload EEG/MEG and MRI/CT data. Consequently, file data can be saved and/or opened remotely and opened.

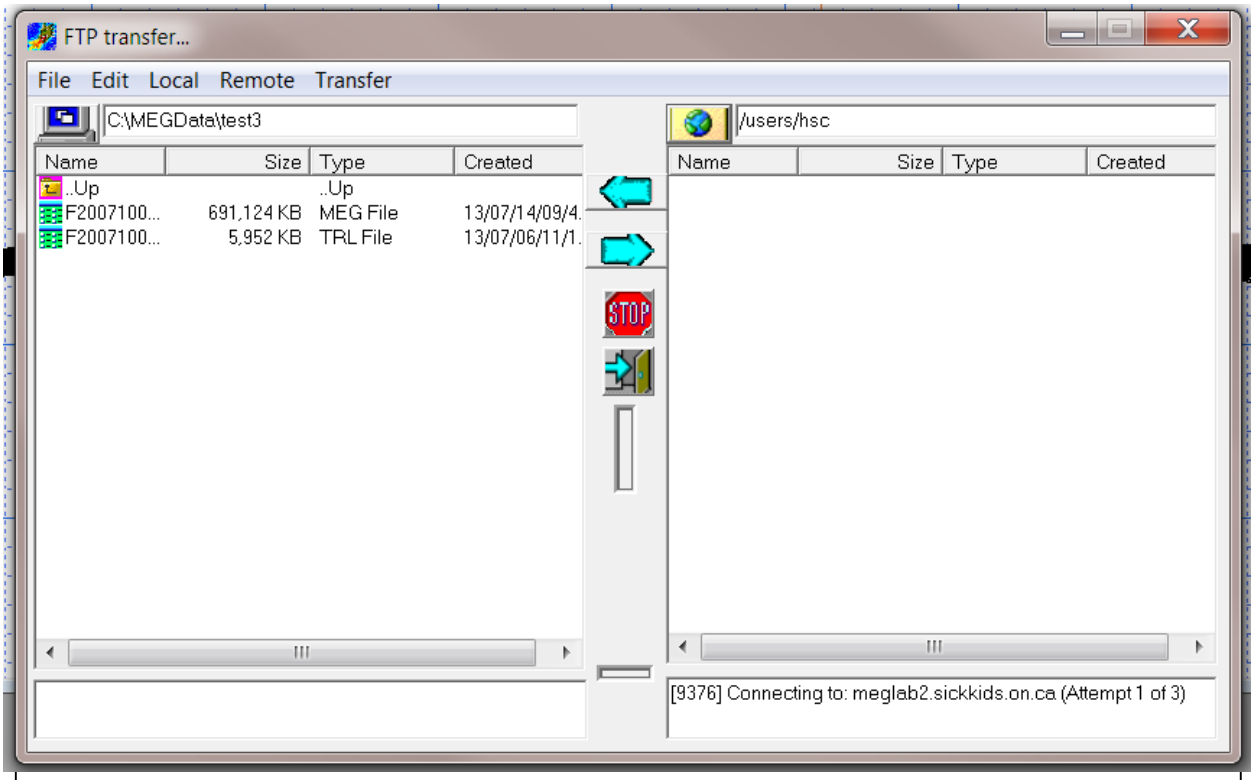

Figure 2. Professional Window for importing and checking MEG/EEG data.

Check Files

The “Check Files” function checks the file format and provide clues for importing or reading.

Save

Save the current document.

Save As

Save the current document as a new file.

Print

Print the current waveforms.

Print Preview

Previewing of the current waveforms.

Print Setup

Setup the printer for printing.

Close

Close the current document.

Exit

Exit the entire program which is running.

Recent Files

Recent used files are listed in the File Menu for easy to access.

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