Tools

Software Guide

DISCLAIMER

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Features and specifications of this software program are subject to change without notice. This manual contains information and images about MEG Processor, 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 MEG_Processor@live.com

Thank you.

Contents

Warnings and Cautions

This software supports both magnetoencephalography (MEG) and electroencephalography (EEG) data. Though MEG and EEG waveforms appear similar, they have different unit in amplitude. If the MEG and EEG data recorded simultaneously, their time unit or temporal resolution is typically the same.

Modern MEG/EEG systems typically have MEG/EEG sensor/electrode channels as well as other channels. For example, trigger channel, head-localization channels and additional ADC (analog-to-digital) channels. To avoid problems, please pay attention to the channel names and the amplitude value/unit. Their values may be of different orders of magnitude. Unexpected results may occur if their values are mixed in measurements.

When performing waveform analysis, regardless of whether MEG or EEG or both are displayed, ensure that the data are appropriately filtered with DC-offset/linear-trend removal. If the waveforms had very large amplitude (e.g > 3 pt), it is recommended that you identify possible noise.

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.

Head movement during MEG recordings may affect the accuracy of source imaging. If subjects move too much during MEG recordings, the MEG results are more than likely poor.

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 following warnings and cautions appear in this guide. Please ensure you are aware of all the operations and interpretations.

Preface

There are several miscellaneous tools that are important in MRI/CT and MEG/EEG data analyses. Importantly, each tool 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.

This guide describes the operation of the MEG Processor application for MEG/EEG. Though there are many functions related to MRI/CT, analyses of MRI/CT are not the focuses of this guide.

Determining the Software Version

In the Main Frame: select Help -> About.

The About Dialog will show the version of the software.

Intended Audience

This guide is intended for anyone needing to view or edit data collected using a MEG/EEG system. It assumes the reader is familiar with standard MEG/EEG procedures and with the Windows operating systems.

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 MEG_Processor@live.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 commonest 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}).

Trial Operator

The trial operator provides various ways to operate on trials — including subtracting two trials to generate new virtual trial. The trial operator also allows you to analyze the data to identify the community and differences of two trials. This chapter explains how to get started with trial operator.

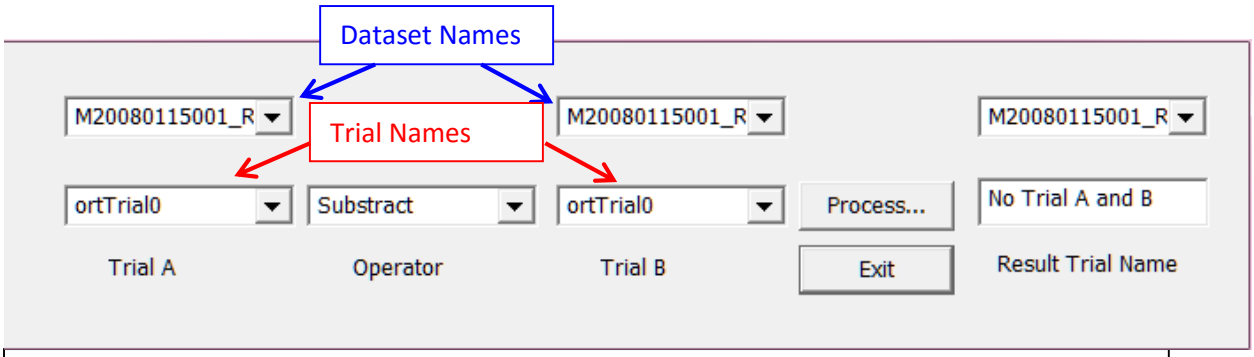

Figure 1. Trial Operator.

Launching Trial Operator

The trial operator window can be launched from MEG Processor by selecting Tool->Trial Operator menu.

Selection of Dataset and Trial

The trial operator provides GUI for the selection of dataset and trials. Trials in different datasets can be operated to generate a new virtual trial. You may decide where to store the new virtual trial.

Trial Operation

The operator combo box provides the selection of operations.

- "Subtract" will subtract trial B from trial A for each channel.
- "Add" will add trial A and Trial B together as a summation for each channel.
- "Time" will generate a virtual trial by timing Trial A with Trial B for each channel.

Select Wave Viewer

The select wave viewer provides a unique window to view, analyze and measure one or more picked waveforms. The select wave viewer also allows you to select a few channels and comparing them in details. Each waveform in the select wave viewer can have unique color, line style and size. This feature is very important in some publications.

Launch Select Wave Viewer.

Click menu Tool-> Select Wave Viewer to launch the Multi-wave Viewer. The window can show waveforms in multiple dataset and/or trials. Consequently, the comparison can be between subjects or a same subject in different sessions or time.

Noteworthy, many channels may be simultaneously displayed. Since each channel can have different color, line style and size, the waveforms are differentiable from each other easily.

By click the "Select Pen", a pen setting window will be launched. From this window you can specify the color, size of pen as well as different kinds of notes.

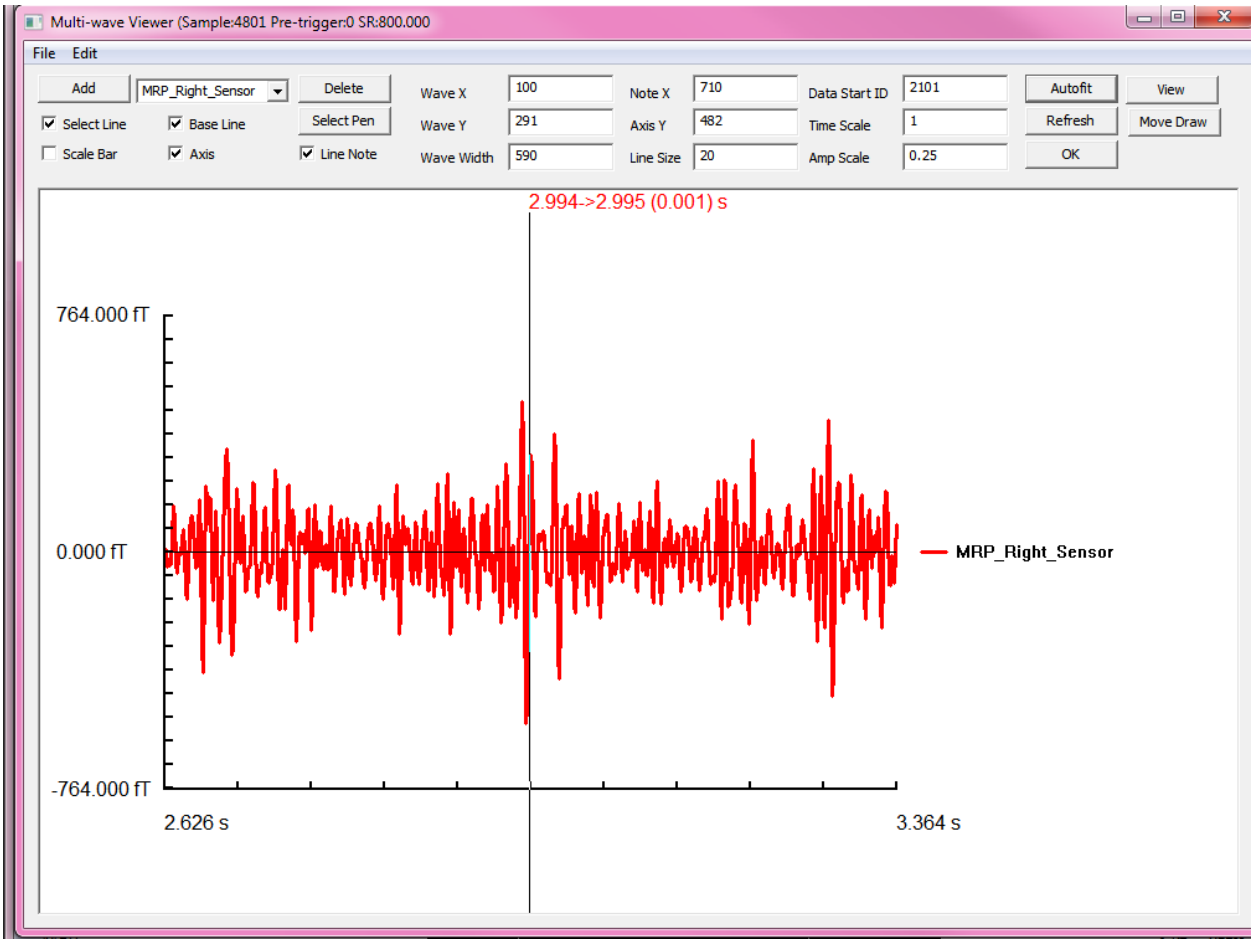

Figure 2. Select Wave Viewer.

Selection of Channels for Select Wave Viewer

The “Add” button is designed to select a channel to be displayed on viewer. Click the “Add” button will launch the window of wave maker. You may select the dataset, trial and channel from the available database and transfer the channel data to wave viewer.

To make the select the channel easier, you may click on a channel in the Main Frame Viewer at column mode. Once you select the channel and then click “Add” button, the default channel on the wave maker will be the selected channel.

Wave Maker

Click the “Add” button in the aforementioned Select Wave Viewer will launch the window of wave maker. You may select the dataset, trial and channel from the available database and transfer the channel data to wave viewer.

You may give a new meaningful name in the Name edit field.

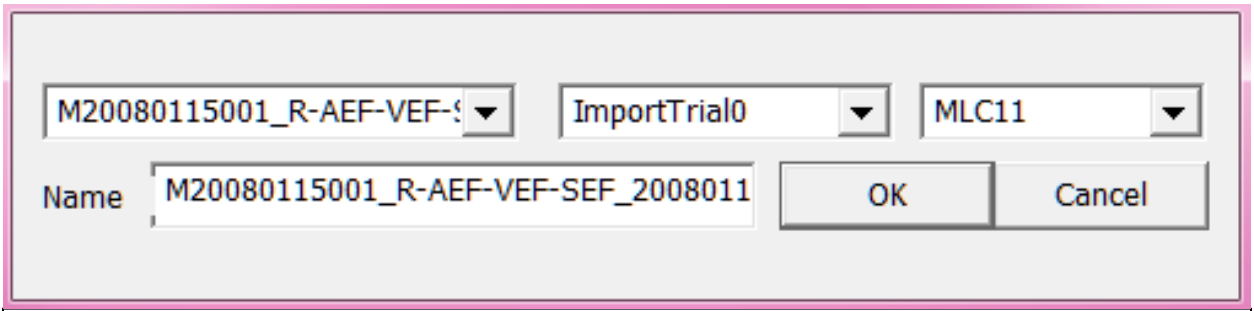

Figure 3. Select Wave Viewer.

Wave Pen

Click the “Select Pen” button in the aforementioned Select Wave Viewer will launch the window of pen settings. You may select pen style, width and color for wave viewer.

DICOM Inspector

DICOM Inspector provides GUI to inspect and check the DICOM file. DICOM means digital imaging and communications in medicine. This program provides two DICOM Inspectors. Two DICOM Inspectors enable users to compare two DICOM files and identify the differences.

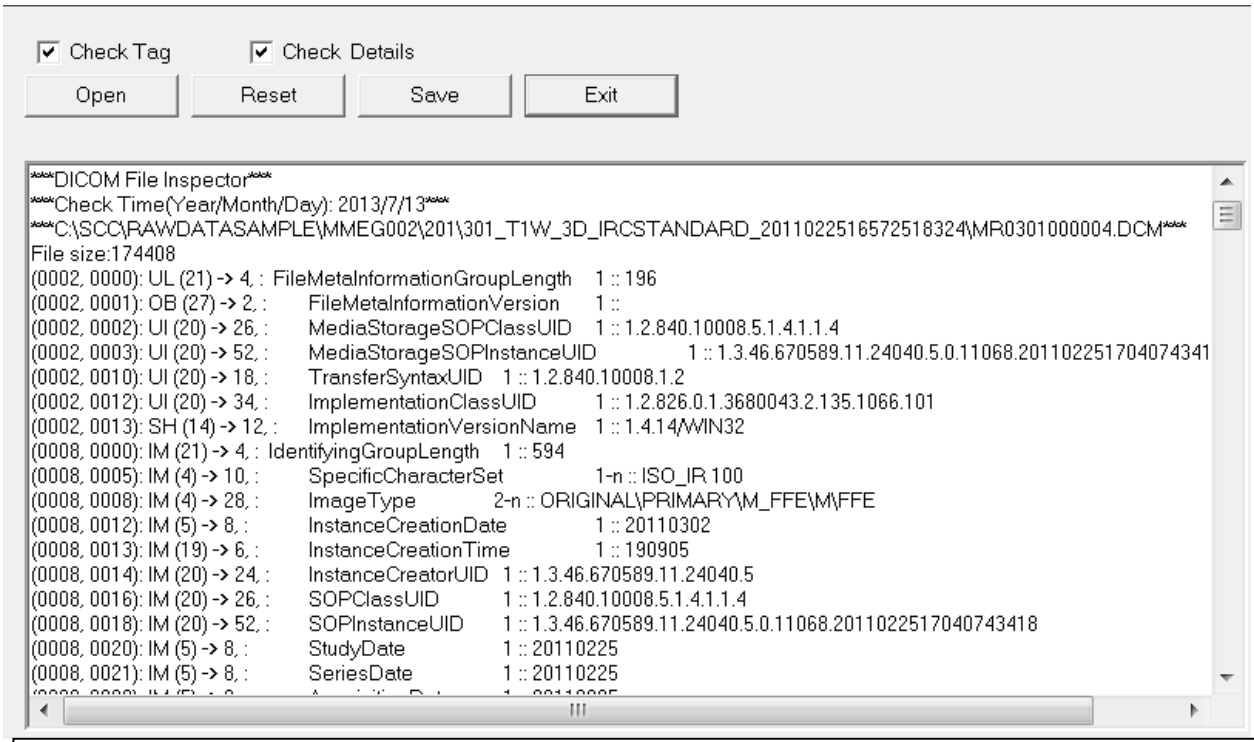

Figure 4. DICOM Inspector.

Measurement Results

To facilitate the measurements of waveform latency and amplitude, a Measurement Window was designed to provide GUI to view, edit and store the measurement results.

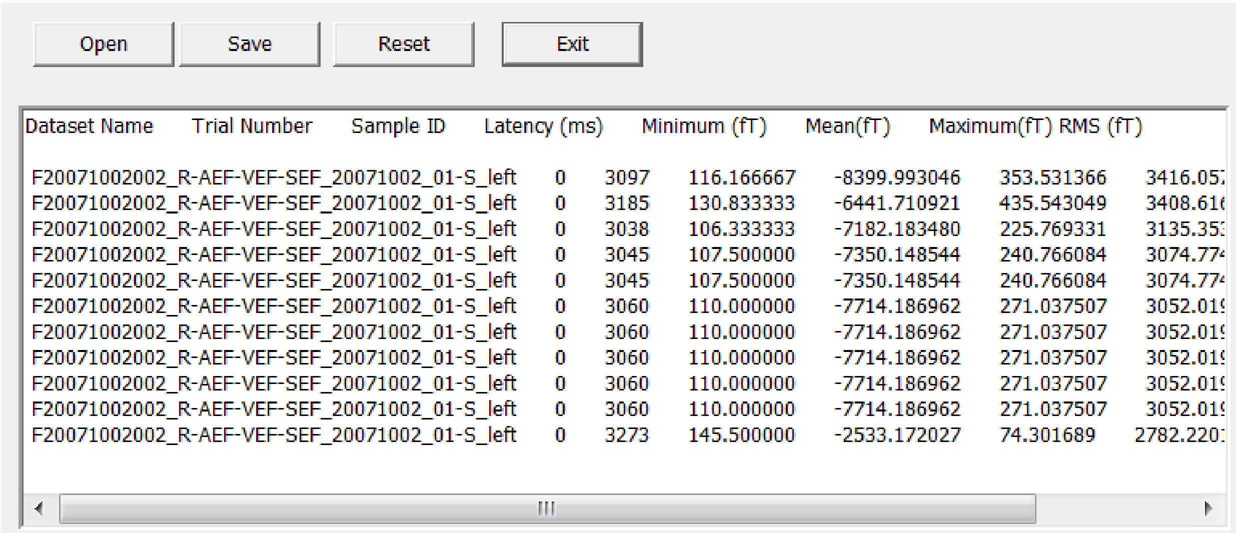

Figure 4. The window for view, store and edit the results of measurements.

Index