

Net Station 5

Geodesic EEG Software
version 5.3

User Manual



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Key changes in this revision:

- Preface: Added the Reciprocity Visualization Environment (RVE).
- Section 1.2: Updated the listed features.
- Section 2.1: Updated the system requirements.
- Chapter 3: Updated the EGI folder and the Acquisition and Review module interfaces.
- Section 4.1: Updated the Anti-Alias Filter Alignment feature.
- Section 4.6: Added the Net Station Uninstaller utility.
- Section 6.1: Removed system timing from Acquisition Preferences.
- Section 6.2.1: Updated the Acquisition commands with Stop GTEN.
- Section 6.2.2: Updated the Acquisition views with the GTEN view.
- Section 6.3.2: Removed system timing from Acquisition Preferences.
- Section 6.3.4: Updated the Destination features with the Backup feature.
- Section 6.3.6.1: Added the Shutdown Amplifier feature.
- Section 6.3.6.4: Changed 1000 s/s TMS to 1000 s/s Fast Recovery.
- Section 6.3.11: Deleted Amplifier Diagnostics.
- Section 7.1: Added Event Display and GeoSource Head Models to Review Preferences.
- Section 7.2.2: Added the Workflows button bar.
- Section 7.2.2.1: Clarified that GeoSource Waveform and GeoSource MRI are GeoSource 2.0 functions.
- Section 7.2.2.1: Added GeoSource 3.0 Research RVE.
- Section 7.2.2.1.1: Clarified that a source montage in GeoSource 2.0 is the same as a source collection in GeoSource 3.0 Research.
- Section 7.2.2.3: Added the Combine Categories workflow.
- Section 7.3.5.4: Clarified that settings are for GeoSource 2.0 functionality.
- Section 8.1.5: Added the Combine Files and Temporal Downsample tools.
- Section 8.2: Clarified that the GeoSource specification tool is a GeoSource 2.0 tool.
- Chapter 9: Added the Reciprocity Visualization Environment (RVE).
- Appendix C: Added the Combine Files and Temporal Downsample tools.

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Preface

Welcome to the Net Station™ 5 EEG software from Electrical Geodesics, Inc. (EGI), which includes the Reciprocity Visualization Environment (RVE).

The Net Station software operates within EGI's Geodesic EEG Systems™ 400 Series systems (GES 400 series systems) with the Net Amps™ amplifiers (300 or 400 series) and the HydroCel or MicroCel Geodesic Sensor Nets™ (HC GSNs, MC GSNs, GSNs, or Nets) to acquire electroencephalographic (EEG) data. For details, refer to the GES 400 series systems manual (8100400) or the GES 400 MR series systems manual (8100401).

Net Station also operates within EGI's Geodesic Transcranial Electrical Neuromodulation™ 100 Research systems (GTEN 100 Research systems) with the HydroCel Geodesic Sensor Nets™ and the Net Amps™ GTEN 100 amplifiers to modulate cortical activity. For details, refer to the GTEN 100 Research manual (8102120).

The RVE visualizes scalp voltage data on realistic 3D head models. The 3D views are fully synchronized with Net Station's chart view to better understand EEG changes.

The RVE is also the user interface for the GeoSource™ 3.0 Research electrical source estimation software, which is sold separately.

Net Station 5 is a complete software package for acquiring, reviewing, visualizing, and manipulating EEG data.

You will use separate Net Station modules while working with scalp EEG data:

- **Net Station Acquisition.** Acquires scalp EEG data.

-
- **Net Station Review.** Allows you to view scalp EEG data with a variety of views:
 - Standard chart, butterfly, topo plot, topo map, events, spectral chart, spectral plot, spectral map views
 - Standard 3D atlas head models via the Reciprocity Visualization Environment (RVE)
 - (optional) GeoSource 2.0 or 3.0 Research source estimation results as waveforms
 - (optional) GeoSource 2.0 source estimation results on 2D MRI slices
 - (optional) GeoSource™ 3.0 Research source estimation results via a full-featured Reciprocity Visualization Environment (RVE) showing 3D head models for Basic, Intermediate, and Advanced, and showing MRI slices for Basic and Intermediate
 - **Net Station Tools.** Further explores EEG data with over two dozen tools.
 - **Utilities.** Utilities are also available for converting older files, updating your software HASP, and working with anti-alias filter and event timing.

Net Station records low- to high-density (32 to 256 channels) routine (short term) and LTM (long-term monitoring) EEG data, along with simultaneous video, peripheral nervous system (PNS), or external signal data.

NOT ALL SYSTEM OR SOFTWARE FEATURES ARE AVAILABLE FOR PURCHASE OR USE IN ALL COUNTRIES OR MARKETS.

For all safety and use conditions for using your EGI system, refer to the manuals and instructions that shipped with your GES system configuration.

About This Manual

This manual provides general information for safely and effectively using the Net Station software to acquire, review, visualize, and manipulate EEG data. *It assumes a working proficiency with EEG and computer systems.*

Note: The term *patient* is used to refer to subjects, participants, or patients.

An EGI support or authorized engineer will install and configure your EGI system, including all connections required for its operation. At the time of initial installation, the EGI support or authorized engineer will also train relevant staff in its operation. At any time you have additional questions or wish retraining, contact EGI Technical Support (Table P-1).

Typographic conventions:

- *Italics* are used for definitions or newly introduced terms.
- **Boldface italics** are used for important concepts or for special emphasis.
- **Boldface** is used for command paths (for example, **File > Open**).

Warnings, Cautions, and Notes

The following are used to convey important information:



WARNING: Warnings provide important information that, if unheeded, could result in serious physical injury, death, or equipment damage.



CAUTION: Cautions provide important information that, if unheeded, could hinder the use of a product, feature, or procedure, or result in physical injury or equipment failure.

Note: Notes provide clarifying information about a product, feature, or procedure.

Support, Repairs, and Documentation

Electronic system manuals and user instructions are provided to customers from www.cgi.com using your customer login or your amplifier's serial number.

If you have a question, please:

- For *urgent issues during acquisition*, contact EGI immediately.
- For *nonurgent issues*, do the following before contacting EGI:
 - **Isolate the problem.**
Try to repeat and define the problem.
 - **Document the problem.**
Carefully record the sequential details of the problem.
 - **Report the defined problem.**
Contact EGI.

Table P-1. EGI contact information

EGI Technical Support web page	www.cgi.com/support
Email Technical Support	supportteam@cgi.com
Email Sales	orderdesk@cgi.com
Telephone	+1.541.687.7962
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Address	Electrical Geodesics, Inc. (EGI) 500 E 4th Avenue, Suite 200 Eugene, OR 97401



Typical GES System

The Net Station software operates within EGI's GES systems to acquire EEG data from a single Net Amps amplifier, to acquire EEG data from more than one amplifier, or to acquire simultaneous data from two different signal sources.

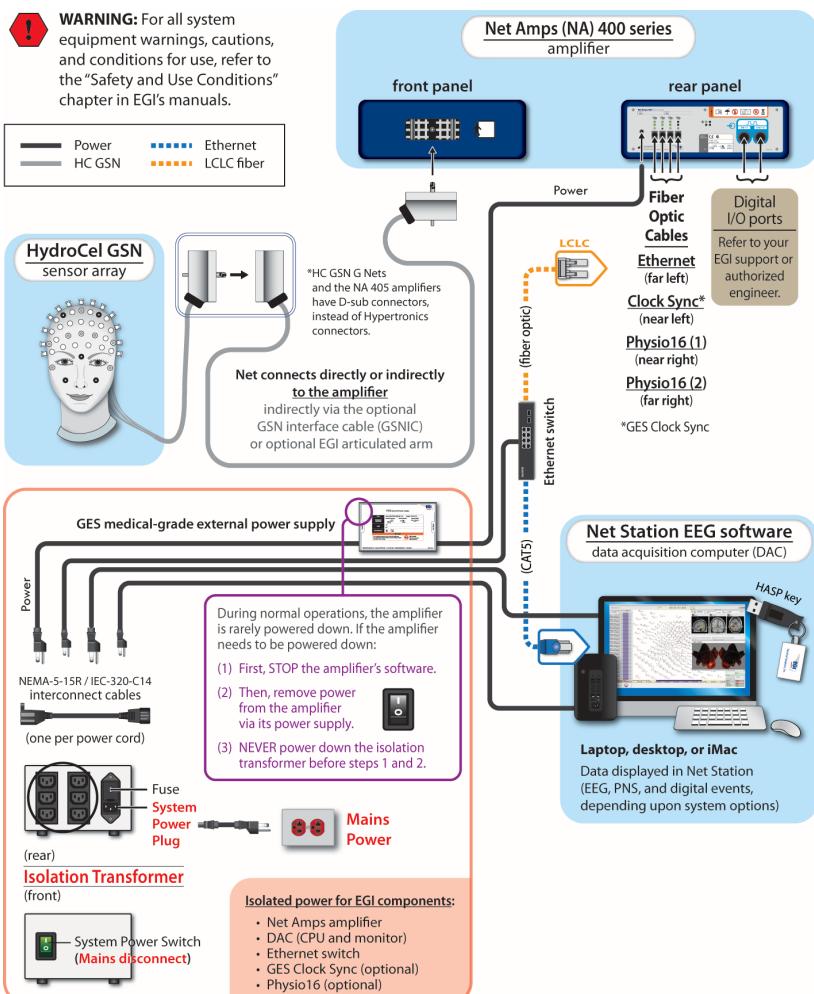


Figure P-1. Core components of a typical EEG-only GES system

1. Safety and Use Conditions

For all safety and use conditions for using your EGI system, refer to the manuals and instructions that shipped with your GES system configuration.

Do not operate your GES system, including the Net Station software, ***until you are fully trained and understand*** all warnings, cautions, and conditions for use provided in EGI's manuals for the components of your GES system. If you have any questions, contact EGI Technical Support (Table P-1).



WARNING: All EGI system components must be installed and configured by an EGI support or authorized engineer. Deviating from the supported configuration or running the system with non-EGI-approved components attached can cause hazards or unexpected performance.

Note that the information in this manual is subject to change, without notice. The manufacturer declines responsibility for the safety, reliability, and performance of EGI system components if not used in compliance with EGI documentation.

1.1 Intended Use

The Net Station software is intended to measure and record the electrical activity of the brain. It can be used with adults, children, and infants.

Rx only.

1.2 Features

Each Net Station 5.3 license provides the following.

Components:

- Licensed software download
- MFF File Converter application
- HASP key
- Electronic product manual
- Free updates and upgrades, as advertised

Latest features:

- Reciprocity Visualization Environment (RVE) for the visualization of scalp voltage fields on realistic head models
 - With no licensed GeoSource 3.0 Research software, RVE displays a standard 3D topo map view
 - With licensed GeoSource 3.0 Research software:
 - **Basic:** RVE additionally displays custom source collections on a 3D head model using six built-in atlas head models (three adult and three pediatric)
 - **Intermediate:** RVE additionally displays source collections on a 3D head model using conformal atlas head models (CAHMs) warped to GPS or GeoScan sensor positions
 - **Advanced:** RVE additionally displays source collections on a 3D head model using individual head models (IHMs) based on MRI data
- Combine Files tool
- Temporal Downsample tool
- Enhanced Net Noise algorithm
- Combine Categories workflow

Standard features:

- Complete software package for the acquisition, review, and manipulation of EEG data
- Intuitive dashboard interface with standardized controls
- For routine and LTM EEG recording
- For multimodal imaging with external signals
- Optimized for standard workflows
- Support for all HydroCel GSN and MicroCel GSN Nets
- Option for faster recovery rate (as low as 4 ms)
- Pulse detection tool for EEG-based BCG cleaning

Based on: Iannotti, G. R., Pittau, F., Michel, C., Vulliemoz, S., & Grouiller, F. (2014). Pulse artifact detection in simultaneous EEG-fMRI recording based on EEG map topography. *Brain Topogr*, 28, 21-32.

- Support for Ethernet-connected digital PTZ cameras
- Support for streaming acquisition to a network-attached storage (NAS) device
- Support for full offline review of data stored on a NAS device
- Over 20 waveform tools available, including a Wavelet (Joint Time Frequency) tool and spectral displays (chart, topo map, and topo plot)
- Automatically detects attached hardware and configures the software with default settings
- Easily customized
- Synchronizes EEG, video, PNS, and external signals
- Reviews data easily in linked or unlinked views
- Seamless operation with the optional GeoSource electrical source estimation software (2.0 or 3.0 Research)—see GeoSource 2.0 waveforms and GeoSource 2.0 MRI slices

-
- within Net Station Review, or link out to the full GeoSource application for additional resources
 - EGI's Metafile Format (MFF) for faster processing, efficient data compression, no file size limit, and expanded interoperability with APIs
 - Export to many file formats, including EDF+, MATLAB, and Persyst
 - For low to high density EEG (32 to 256 channels)
 - Support for 32 auxiliary channels and 2 SpO₂ channels using the Physio16 input box
 - Support for the Photic Stimulator
 - Filter aliasing options

1.3 Safety Warnings

1.3.1 Data Acquisition Computer (DAC)



CAUTION: Before upgrading your EGI system (computer, operating system, or EGI software), confirm compatibility with EGI Technical Support (Table P-1).

1.3.2 Reviewing and Manipulating EEG Data



CAUTION: Vary file names within the first 22 characters. When exporting data to text files, Net Station truncates file names longer than 22 characters. If truncated file names are identical, they may overwrite each other

2. Software

EGI protects its software from unauthorized use by encoding the licensing data in a HASP key (similar to a USB flash drive). All authorized EGI software users have a HASP key that plugs into one of the USB ports of any EGI Mac OS system computer to allow access to the purchased applications licensed to that HASP key.

2.1 System Requirements for Net Station 5.3

Table 2-1. Software/firmware compatibilities

Net Station	Mac OS	Compatible Amplifier Firmware	
		NA 400s	NA 300s
5.3*	10.11.5	v1.6.17**	v11
5.2	10.10.5	v1.6.17**	v11
4.5.7	10.6.8	v1.4.5	v11

*Net Station 5.3 requires an Intel Core 2 Duo processor (2 GHz minimum) with a recommended 16 GB RAM.

**If using Amp Server Pro SDK, you must use amplifier firmware version 1.6.17.

To confirm the system requirements for earlier versions of Net Station, contact EGI Technical Support (Table P-1).

2.2 Installation

The Net Station software comes installed on the GES system computer. If you need to reinstall or upgrade the software, contact EGI Technical Support (Table P-1).

3. Net Station Interfaces

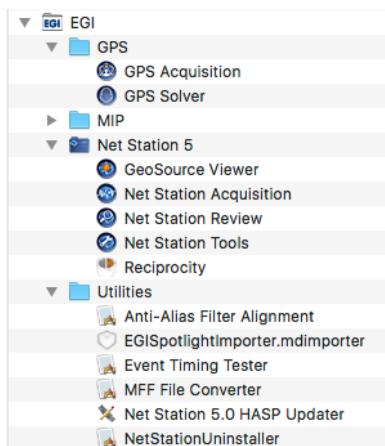
The Net Station Acquisition, Review, and Tools modules have interfaces that feature mostly standard controls. ***Standard controls operate as expected.*** Nonstandard controls are explained in chapters 6, 7, and 8.

If you desire additional training or support with Net Station, contact EGI Technical Support (Table P-1).

- If their icons are not in the Dock , access Net Station's modules from **Finder > Applications:**

EGI > Net Station 5 >

- Net Station Acquisition
(see 3.1)
- Net Station Review
(see 3.2)
- Net Station Tools
(see 3.3)



Note: For information regarding the GPS Acquisition and GPS Solver applications, refer to the GPS manual (8103002).

Note: What GeoSource 2.0 or 3.0 Research functionalities are available through the Net Station software are described in this manual. For details about the full-featured versions of the GeoSource software (2.0 or 3.0 Research) or the MIP software, refer to the GeoSource manual (8103101).

3.1 Acquisition Interface

The Net Station Acquisition interface is used for acquiring EEG and related data.

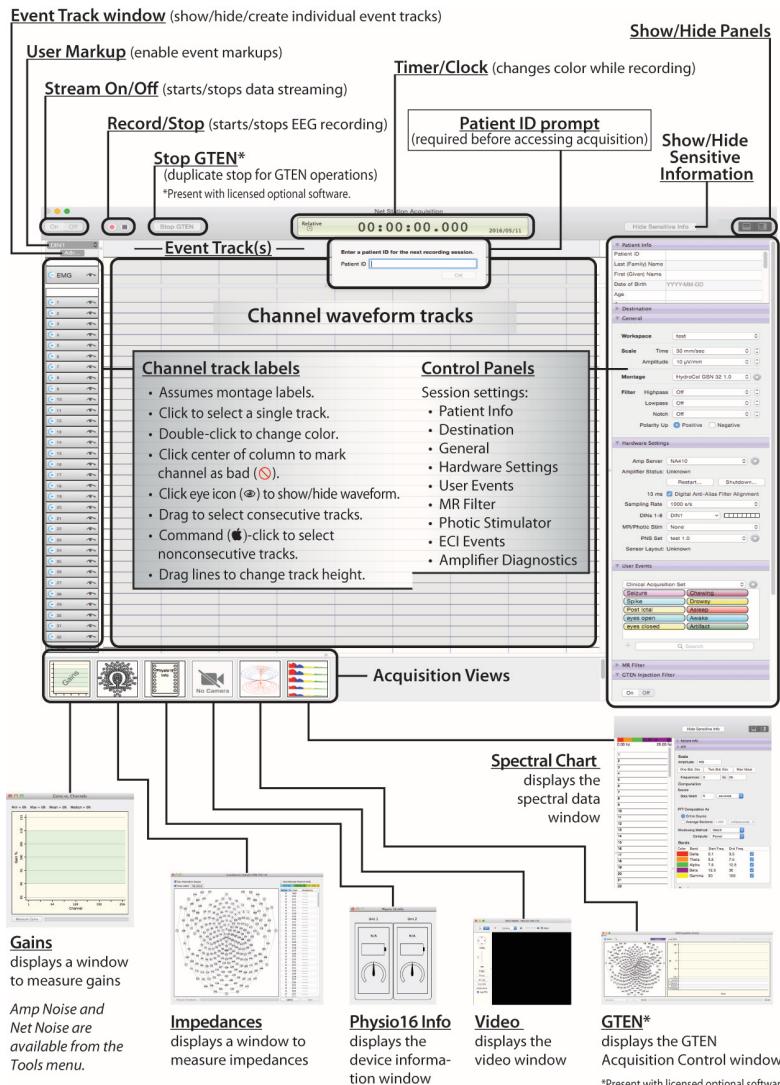


Figure 3-1. Net Station Acquisition interface

3.2 Review Interface

The Net Station Review interface is used for reviewing EEG data.

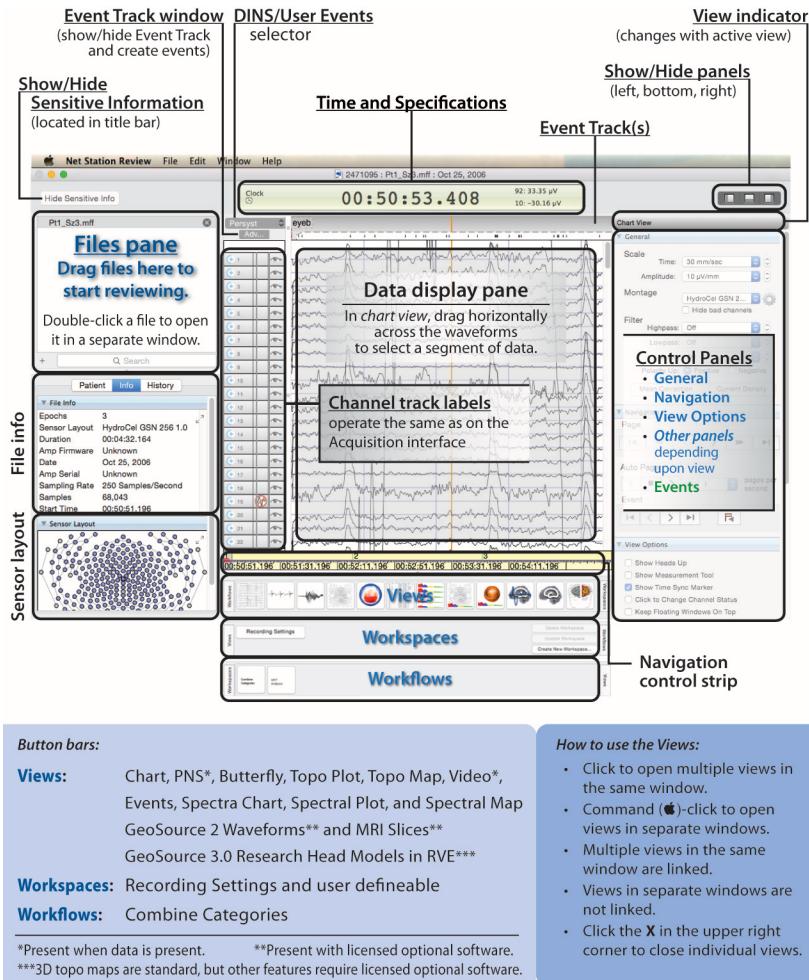


Figure 3-2. Net Station Review interface

3.3 Tools Interface

The Net Station Tools interface is used for manipulating EEG data.

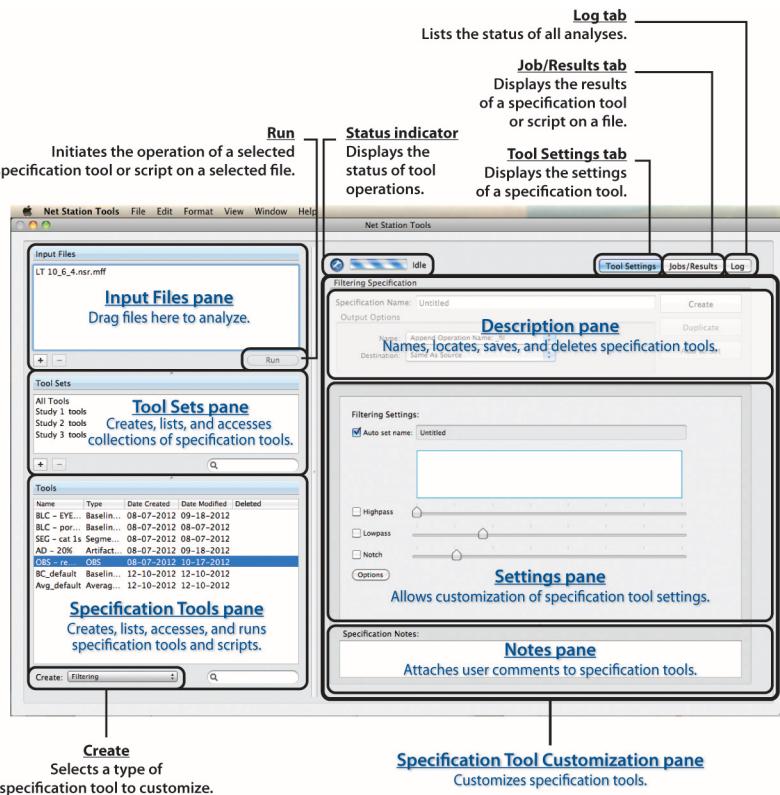


Figure 3-3. Net Station Tools interface

3.4 Workspaces

Workspaces are handy collections of windows and view settings to make doing repetitive work quicker and consistent. How you create them, however, is different in Acquisition (see section 6.3.5.1) from Review (see section 7.2.2.2).

Workspace features:

- Recording settings are saved to a file during recording and become one of the available workspaces that users can choose in Net Station Review.
- Users can create, save, edit, and delete custom workspaces.
- The settings available for workspaces include the locations, sizes, and scroll positions of views; time and amplitude scales; filter, montage, mean correction, current density, and GeoSource settings; active event sets; and event editing mode.
- If selected, workspaces open with files.
- In Net Station Acquisition, the last workspace used will be the one that opens the next time you launch Acquisition.
- In Net Station Review, current file settings (such as time sync marker, category, and segment) will reopen as they appeared when the file was last closed.
- When selected, the view attributes of a workspace appear, replacing the view attributes of the previous workspace.
- The active workspace can be updated, while in use, by changing and saving its settings.
- If a workspace contains settings or values that are not found or are in conflict with the file being opened, they will be ignored.

-
- You can set all files to open with no, a default, or individual workspaces with the Review Preferences dialog. If a default workspace is selected, then all files will open with the same settings, instead of individual files opening with different settings.

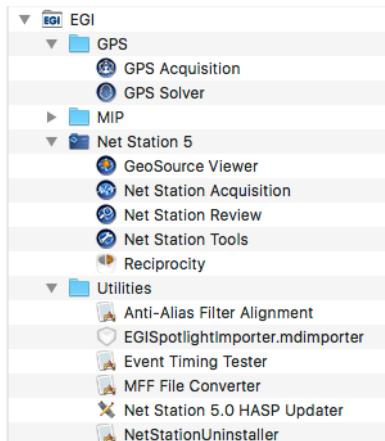
4. Net Station Utilities

Net Station includes a series of utilities to facilitate auxiliary tasks.

Launch them from:

**Finder > Applications >
EGI > Utilities.**

Note that not all features are available in all versions of Net Station. If you have any questions, contact EGI Technical Support (Table P-1).

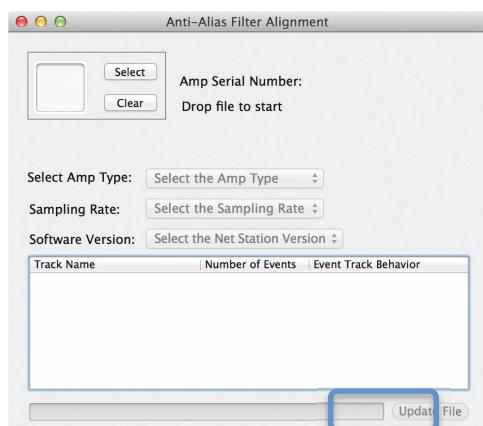


4.1 Anti-Alias Filter Alignment

If not adjusted for during acquisition (section 6.3.6.1), use this utility to adjust files for the delay of the recorded EEG relative to the real-time events recorded during EEG acquisition.

MFF files must be version 3.0 or later.

For details, see sections 6.3.6.1 and 9.1.





CAUTION: This utility will change the original file—it does not generate a new file. Always make a copy of a file and run this utility on the copy.

Be aware that event tracks differ when considering whether or not to run this utility on a file.

- Manually marked events are already correctly aligned, so you don't need to run the utility for those events.
- DIN and TCP/IP events (for example, ECI events) are delayed, so you might want to apply the utility.

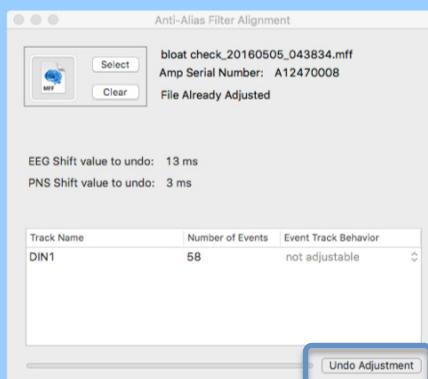
If you are unsure, contact EGI Technical Support (Table P-1).

If you have applied the wrong values to a file, you can use this same utility to undo the adjustment, and then update the file again with the correct values.

To use this utility:

- ① Drop or select the file to be adjusted.
- ② Select the type of amplifier that was used for the recording.
- ③ Select the version of Net Station that recorded the file.
- ④ Click **Update File**.

Note: The utility will not adjust a file more than once. It also will not adjust a file that was automatically adjusted during recording with the Digital Anti-Alias Filter Alignment setting from the Hardware Settings panel.



4.2 Spotlight

The Spotlight utility (showing in the Utilities folder as EGISpotlightImporter) requires you to do nothing to take advantage of it. It is installed when Net Station is installed.

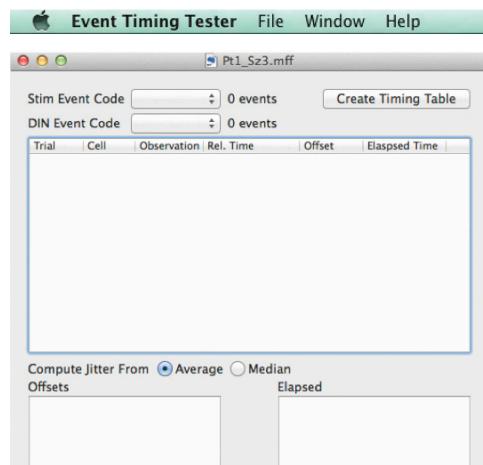
This utility is a plug-in that works locally to let our Mac's OS X understand and index your MFF-based EEG and GPS data files so that you can use Apple's Spotlight feature to search those files using such criteria as Net type or a specific event code.

4.3 Event Timing Tester

Use this utility to chart and compare the Stim and DIN event codes found in a recording.

Open the utility with a file by selecting **File > Open** or dragging the file onto the utility's icon in Finder.

Note that the file must be an MFF file, but it can be any version of MFF (v1, v3, etc.).



For assistance, contact EGI Technical Support (Table P-1).

4.4 MFF File Converter

Two MFF File Converter utilities are available to convert older file formats to EGI's latest MFF version 3.



CAUTION: Depending upon which converter is used, this utility will change the original file—it does not generate a new file. Always make a copy of a file and run this utility on the copy.

MFF File Converters			
Mac OS X	10.9.5	10.6.8	
Formats converted	MFF v1 – to – MFF v3	NSR – to – MFF v3	
How converted	original file changed	new file generated	
Will not work on these Net Station export formats	NS Simple Binary, EGIS, Text, Persyst, and MATLAB		

Use the appropriate version of the utility when converting older files to EGL's latest Metafile Format (MFF).



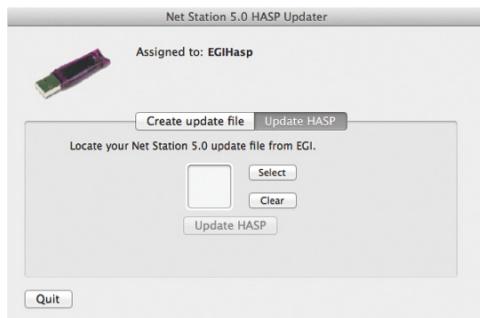
To use this utility:

- ① If desired, save your output files to a location other than where they originated by clicking **Alt Legacy Files Folder**.
- ② Drop or select the file(s) to be converted. Conversion is automatic. Progress messages will appear in the text pane.
Note: This utility converts single files, a selection of files, or one folder of files—but not files that are in a folder within a folder.
- ③ Unless canceled, the conversion is complete.

4.5 Net Station 5 HASP Updater

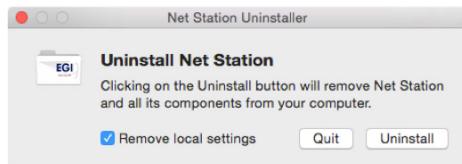
Use this utility when updating your HASP.

For details, refer to the HASP updating guide (8408078).



4.6 Net Station 5 Uninstaller

Use this utility only at EGI Technical Support's direction.



5. Sample Workflow

Workflows are provided for reference only. It is the responsibility of users to follow the laws and regulations of the country in which they are located. EGI does not endorse any “off-label” (that is, unintended or unapproved) use of its products.

The sample workflow in Table 5-1 highlights the typical steps needed to acquire and review EEG data. Your steps may differ.

Contact EGI Technical Support (Table P-1) for:

- specific workflows for routine, LTM, or other recordings, and
- details for using the **tools** of Net Station Tools.

All connections that are required for the operation of your EGI system are made by an EGI support or authorized engineer during installation. After the EGI support or authorized engineer has installed and trained you on the use of your EGI system, including the Net Station software, it is ready to use with minimum preparation.

Table 5-1. Sample workflow for typical routine EEG

I – Acquire EEG

with *Net Station Acquisition*
(see Figure 3-1)

Set up EEG system ▶ Verify data quality ▶ Record



1

EEG system setup:

- Ensure that all GES equipment is set up and operating properly.
- According to your GSN’s instructions, prepare the patient, apply the GSN, and plug the GSN into the Net Amps amplifier.

- 2** Launch **Net Station Acquisition**.
 - 3** Enter the **Patient ID**.
 - 4** Change any channel, session, or workspace settings desired.
 - 5** If recording video and/or PNS, select the device(s) and settings. For video, also set the video source in the Acquisition Preferences dialog.
 - 6** Click **Stream On** to start streaming data.
 - 7** Check data quality and measure impedances.
 - 8** Click **Record** to start recording.
 - 9** Monitor data and enter events (if marking).
 - 10** Click **Stop** to stop recording.
 - 11** Click **Stream Off** to stop streaming data.

(optional)

**Locate sensors with
Geodesic Photogrammetry System (GPS)**

Acquire images • Model sensors • Solve 3D positions

If you are a licensed GPS user, refer to the GPS manual (8103002) and/or contact EGI Technical Support for details (Table P-1).

II – Review EEG

with *Net Station Review*
(see Figure 3-2)

Open file ▶ Set display parameters ▶ Enter events



- 1 Launch **Net Station Review**.
- 2 Open a file.
- 3 Set the display parameters (e.g., time, amplitude, montage, filters, polarity, selection size, categories, etc.).
- 4 Display video, if exists for file.
- 5 Navigate through the data.
- 6 Enter events.

(optional)

Manipulate data with Net Station Tools

Segment • Remontage • Detect artifacts • Correct bad channels • Average • Rereference

Contact EGI Technical Support for details (Table P-1).

(optional)

Estimate sources with GeoSource 2.0 or 3.0 Research

If you are a licensed GeoSource user, refer to the GeoSource manual (8103101) and/or contact EGI Technical Support for details (Table P12).

6. Using Acquisition

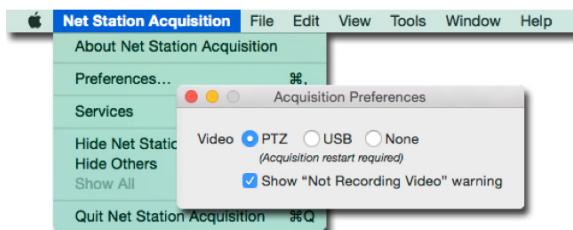
Net Station's Acquisition interface allows you to display and record EEG data using default or customized settings. After acquisition, the recording file is immediately available to review.

Note: Not all features are available in all versions of Net Station. If you have any questions, contact EGI Technical Support (Table P-1).

For the step-by-step instructions for using your EGI system, refer to the manuals and instructions that shipped with your GES system configuration.

6.1 Acquisition Preferences – Video

The Acquisition Preferences dialog is where you ensure that the correct video source is added to an acquisition setup before a session recording.



Video sources include:

- PTZ for any of several Ethernet cameras

Note that if PTZ is selected, you must also select the specific PTZ camera being used in the Video View and the appropriate sampling rate in the Hardware Settings control panel.
See sections 6.2.2, 6.2.2.1, and 6.3.2.

- USB for a low-end USB camera

- None for no source

6.2 Acquisition Commands and Views

Commonly used Acquisition commands and views are easily accessible on the Acquisition interface. The right-hand control panels are described in section 6.3.

6.2.1 Acquisition Commands

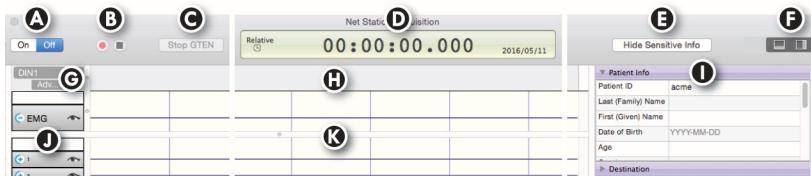


Figure 6-1. Commands of the Acquisition interface

Table 6-1. Acquisition commands

Callout	Command	Description
A	Stream On/Off	Starts/stops data streaming.
B	Record (●) and Stop (■)	Starts/stops the recording of EEG.
C	Stop GTEN	<i>Available only for GTEN 100 Research licensed users.</i> Available as a duplicate stop function to the stop function on the GTEN Acquisition Control window.
D	Time/Clock Toggle through the time modes by clicking the mode words.	For acquisition and review, displays time as: <ul style="list-style-type: none"> Relative: hh:mm:ss.sss (as time elapsed during an acquisition) Epoch: 000[epoch number] hh:mm:ss.sss Clock: hh:mm:ss 'TIME ZONE'
E	Sensitive Info	Shows/hides patient information.

Callout	Command	Description
F	Panels	Shows/hides the panels along the bottom and right sides of the interface.
G	Events Controls	Enables event entry and shows/hides/creates individual event tracks.
H	Event Track(s)	Displays enabled event tracks, which allow: <ul style="list-style-type: none"> Editing of events in their tracks, as well as in the events list. Placement of coincident events into separate event tracks. Mouseover display of event information. Moving of events with a click, drag, and confirmation. Dragging of events to the trash can.
I	Control Panels	Provide default or customizable settings for displaying, identifying, and recording EEG data.
J	Channel Track Labels	Allows control of corresponding tracks, such as: <ul style="list-style-type: none"> Show/hide waveform with eye icon. Mark individual channels as bad. Drag lines to change track height. Click to select a single track. Drag to select consecutive tracks. Command+click to select nonconsecutive tracks. Double-click to change color. Assumes montage labels. Double-clicking PNS channels allows control of display, filter, and other PNS settings.
K	Channel Tracks	Displays waveforms.

6.2.2 Acquisition Views and Tools Menu

You have two ways to access frequently used acquisition tools—via the view buttons at the bottom of the window or the options under the Tools menu.

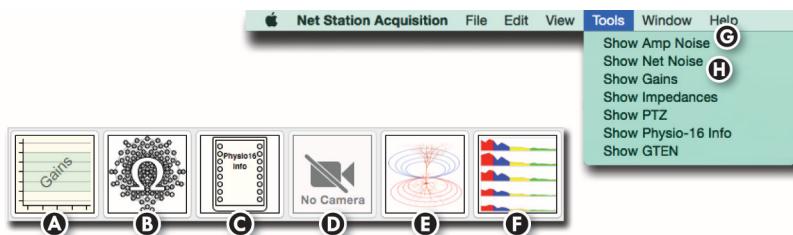
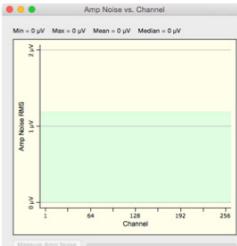
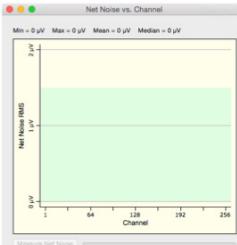


Figure 6-2. View buttons and Tools menu of the Acquisition interface

Table 6-2. Acquisition views

Callout	View / Menu	Description	Display
A	Gains	Displays a window to measure gains, which is a diagnostic for amplifier performance.	A scatter plot titled 'Gains vs. Channels' showing Gain % on the y-axis (from 80 to 115) versus Channel on the x-axis (from 1 to 256). The plot area is mostly green, indicating most channels are within a 10% range of the mean. Text at the top of the window reads: Min = 0% Max = 0% Mean = 0% Median = 0%. A 'Measure Gains...' button is at the bottom.
B	Impedances	Displays a window to measure impedances, which is a diagnostic for the quality of electrode-to-scalp contacts.	A window titled 'Impedance Matrix 256 x 256' showing a 256x256 grid of impedance values. The grid has a color scale from dark purple (low impedance) to light yellow (high impedance). On the right side, there is a vertical list of electrode names and a legend for the color scale.

Callout	View / Menu	Description	Display
C	Physio16 Info	Displays a window to show device connectivity, firmware version, battery level, and internal temperature.	
D	Video	Displays a window to view video, along with controls for selecting between different cameras and adjusting video attributes.	
E	GTEN	<p><i>Available only for GTEN 100 Research licensed users.</i></p> <p>Opens the GTEN Acquisition Control window.</p>	
F	Spectral Chart	<p>Displays a window to view data as spectrograms. FFT controls appear to adjust attributes.</p> <p>You can edit the bands with the + (plus) and - (minus) buttons, and by clicking and changing the numbers, names, and colors.</p>	

Callout	View / Menu	Description	Display
G	Amp Noise	Displays a window to measure amplifier noise, which is a diagnostic for amplifier performance.	 <p>The window title is "Amp Noise vs. Channel". It displays a histogram with the Y-axis labeled "Amp Noise (dB)" ranging from -20 to 20, and the X-axis labeled "Channel" ranging from 1 to 256. The histogram bars are light green. At the top, it shows statistics: Min = 0 µV, Max = 0 µV, Mean = 0 µV, and Median = 0 µV. A button at the bottom left says "Measure Amp Noise".</p>
H	Net Noise	Displays a window to measure Net noise, which is a diagnostic for Net performance.	 <p>The window title is "Net Noise vs. Channel". It displays a histogram with the Y-axis labeled "Net Noise (dB)" ranging from -20 to 20, and the X-axis labeled "Channel" ranging from 1 to 256. The histogram bars are light green. At the top, it shows statistics: Min = 0 µV, Max = 0 µV, Mean = 0 µV, and Median = 0 µV. A button at the bottom left says "Measure Net Noise".</p>

6.2.2.1 Video View

If a camera is being used to record video, the system does not automatically detect the specific camera that is attached, only that a camera is attached.

Note that EGI offers a range of pan/tilt/zoom (PTZ) cameras that offer different programmable features within Net Station Acquisition.

To record video, you must:

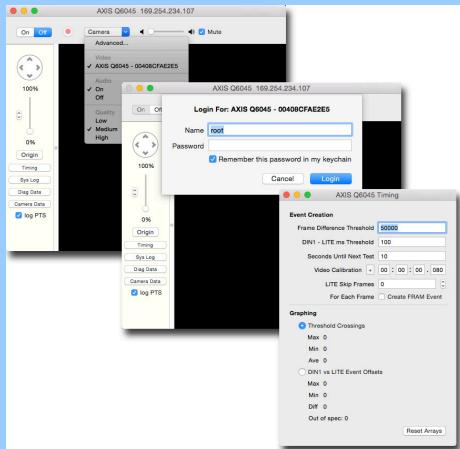
- ① Select a **video source** in the Acquisition Preferences dialog.

See section 6.1.2.

Note that PTZ is the video source for three Ethernet cameras, USB is the source for a low-end USB camera, and None is no source.

- ② Select and set up a specific **camera** in the Video View window:

- The Axis Q6045 PTZ camera offers the most programmable features for greater control and automation.
- The Axis P3364 (a fixed dome camera that supports digital PTZ) and the Axis M1034 camera must be zoomed in on the target location so that the patient stays in the field of view during panning and tilting.



- ③ Select **1000 s/s** as the sampling rate in the Hardware Settings control panel, as is necessary for any DIN device. See section 6.3.6.2.

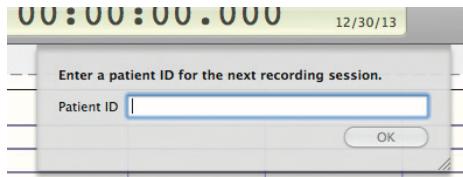
6.3 Acquisition Control Panels

If desired, you can change the default settings of the control panels' features to customize how EEG data is displayed, named, and where it is recorded.

You can also create workspaces of these custom setups, with some exceptions. See section 6.3.5.1.

6.3.1 Patient ID

The *Patient ID* prompt is presented before accessing Acquisition. This prompt ensures that a patient ID, which cannot be changed later, is appended to all recordings.

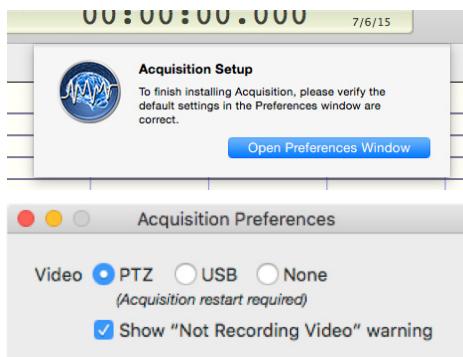


To use GPS, GeoSource, and GTEN data files together, the patient ID must be the same in all files.

6.3.2 Acquisition Preferences – Video

The *Acquisition Preferences* prompt is presented after the Patient ID prompt upon a fresh installation or upgrade.

This prompt ensures that any video source being used is added to the setup before a session recording. See section 6.1.



6.3.3 Patient Info

All patient information listed is stored within recordings.

The *Patient ID* is required and entered prior to beginning a recording and cannot be changed later.

All other fields are optional and changeable until the Record button is clicked.

Patient Info	
Patient ID	
Last (Family) Name	
First (Given) Name	
Date of Birth	
Age	
Gender	?
Handedness	?
Family Handedness	?
Session Number	1
Counterbalance Info	
Patient History	
Patient State	
Technician	
Physician	
Comments	

6.3.4 Destination

The default file name for an EEG recording is based upon the time of the recording.

You can change both the name and destination of an EEG recording file in the text box prior to acquisition.

Destination	
Session	
Name	Patient ID_Date_Time
Path	Net Station Sessions Folder
/Users/egi/Documents/Net Station User Data/Sessions/acme_20160511_020138.mff	
<input type="checkbox"/> Backup	
Path	Net Station Backups Folder
/Users/egi/Documents/Net Station User Data/Backups/acme_20160511_020138.mff	
Delete	Never

6.3.4.1 Backups

You can also set Net Station to create a backup copy of the session file with a different destination.

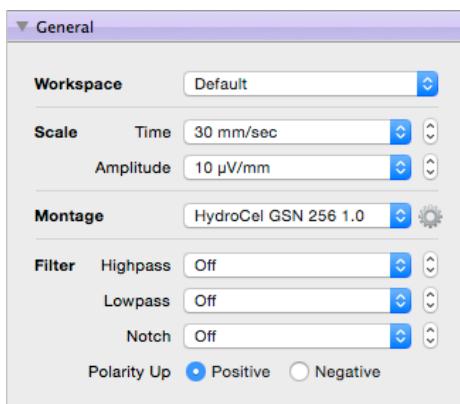
Path. You might find it useful to make the backup destination opposite that of your typical destination (network or local computer) to ensure uninterrupted access to the file.

Delete. You have a variety of settings, including Never, to retain the copy of the recording before it is deleted.

6.3.5 General

Besides selecting the time, amplitude, workspace, and montage, use these controls to filter out undesired frequencies from the onscreen display. Note that these settings do not affect how data are recorded or saved.

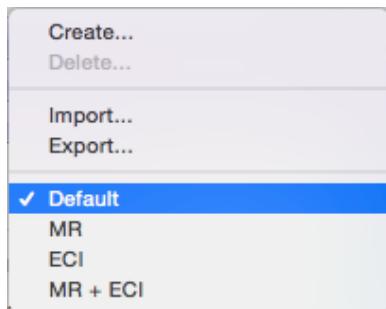
Note that only those frequencies within the band between the highpass and lowpass filter settings are attenuated, not the frequencies at those settings.



6.3.5.1 Workspaces

Use these controls from the Workspace pull-down menu to select, create, import, export, or delete workspaces in Acquisition.

- Make a selection of an existing workspace to apply to your recording by clicking one from the list.
- Share workspaces between files by exporting/importing them to/from a computer location.
- Create new workspaces.
- Net Station Acquisition opens with the last workspace used.



To create new workspaces in Net Station Acquisition:

- ① Set the following available settings as desired: size of windows; location of windows; and display, hardware, montage, PNS, event, photic stimulator, and video settings.
- ② Click **Create** in the Workspace pull-down menu, name the new workspace, and then click **Create** in the dialog.

You can also:

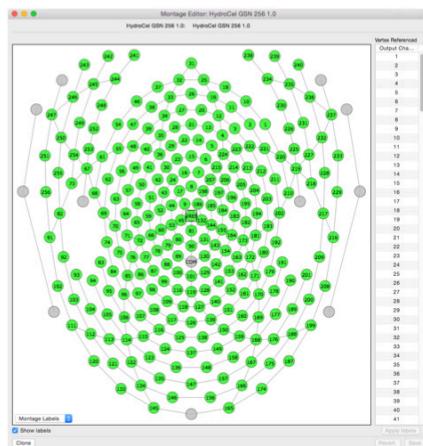
- Change the settings of a workspace before or during recording, as needed.
- Save or Don't Save any changes to workspace settings when prompted upon closing a file, quitting Net Station Acquisition, or changing workspaces.

6.3.5.2 Montage Editor

Clicking the cog (⚙️) icon next to Montage in the General control panel opens the Montage Editor. With this editor you can select a different montage to view the data with or create a custom montage.

A montage created in either Acquisition or Review is available in both modules, as well as Tools.

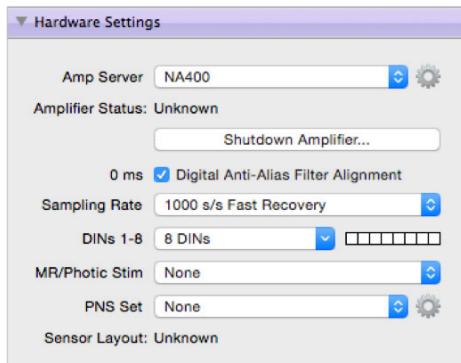
With the Montage Editor you can show/hide/select labels, reorder the list of channels, and clone, revert, and save new montages.



6.3.6 Hardware Settings

Although attached hardware (such as the amplifier and GSN) is automatically detected, accessories such as the Photic Stimulator and video cameras are not.

Be aware that the hardware settings do affect how data are recorded and saved, and that you cannot make changes to the hardware settings after clicking Record.





CAUTION: Do not change the sampling rate after streaming is on; otherwise, drift errors will occur.

Note: See sections 6.1.2 and 6.2.2.1 for video camera setup.

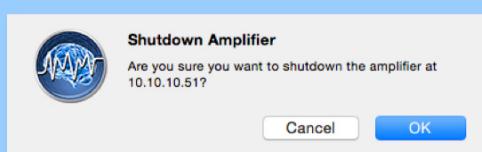
6.3.6.1 Shutdown Amplifier

If the amplifier needs to be powered down, you must first safely shutdown the amplifier's software with the Shutdown button.

To shutdown the amplifier:

- ① From the Hardware Settings control panel, click **Shutdown Amplifier**.
- ② Click **OK** to continue with the shutdown.

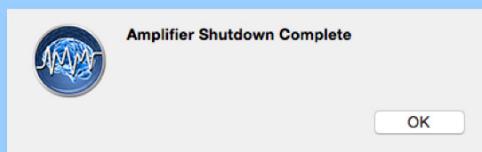
[Shutdown Amplifier...](#)



- ③ The Time/Clock bar will give status during shutdown.



- ④ Click **OK**.



⑤ Quit Net Station Acquisition.

⑥ Reset or unplug the amplifier:

Reset Amplifier

When not unplugging the amplifier, you will need to reset it before the next acquisition session.

Do either of the following:

- Turn the amplifier's power supply off and back on.
- At the amplifier, unplug the power cord and replug it.



Unplug Amplifier

When moving the amplifier:

- a) Turn off the amplifier's power supply.
- b) Unplug the power cable from either the amplifier or the isolation transformer.

If the shutdown fails, contact EGI Technical Support (Table P-1).

6.3.6.2 Digital Anti-Alias Filter Alignment

When checked, the temporal delay of each amplifier's *anti-aliasing filter* is automatically adjusted for during acquisition, which aligns the EEG with the real-time events (i.e., those from digital inputs or TCP/IP connection). This setting is checked by default. For details, see sections 4.1 and 9.1.

6.3.6.3 Sampling Rate for DIN Devices

To ensure millisecond delivery of DIN inputs to the amplifier when using any DIN device, such as a photic stimulator or external signal device, you must set the sampling rate to **1000 s/s**.

6.3.6.4 1000 s/s Fast Recovery Sampling Rate

Only select this option if you understand the relationship between timing and bandwidth.

If you select the 1000 s/s Fast Recovery sampling rate, the hardware anti-aliasing filter of your NA 400 series amplifier will be used rather than the software anti-aliasing filter.

For example, knowing that:

1. the amplifier's analog-to-digital converter (ADC) built-in anti-alias filter settles within three samples (3 ms at 1,000 samples/sec) after the TMS pulse, and
2. the bandwidth of the amplifier's ADC is roughly 1/4 the sampling rate, then

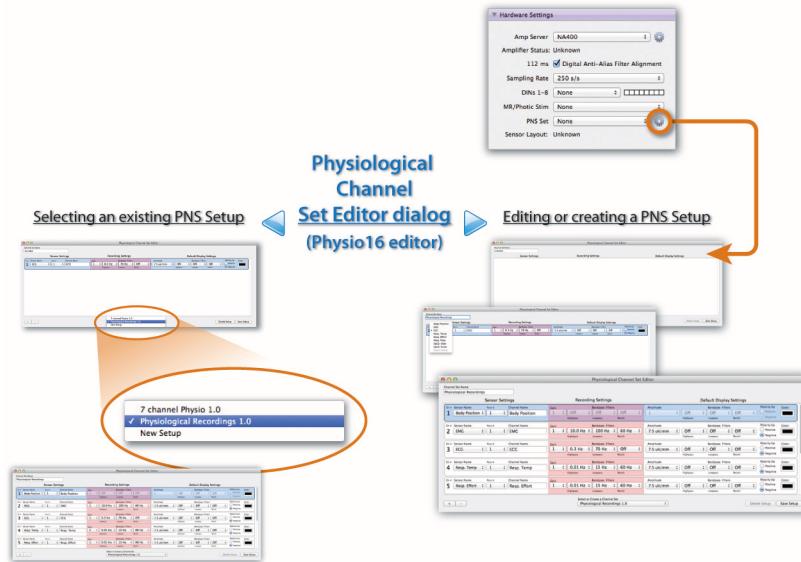
the **1000 s/s Fast Recovery** setting sets the analyzable frequency bandwidth to 250 Hz.

This is compared to the non-Fast Recovery options, which set the native sampling rate of the amplifier's ADC to 8,000 Hz, along with the amplifier's field-programmable gate array (FPGA) anti-alias filter pushing the chosen sampling rate, you would get the analyzable frequency bandwidth of 400 Hz with the 1000 s/s option.

For details, contact EGI's Technical Support (Table P-1).

6.3.6.5 PNS Set

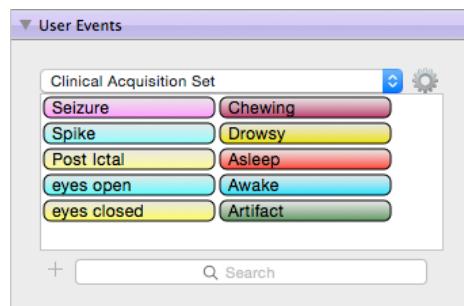
If you are recording PNS data, click the **cog** (⚙) beside PNS Set, then use the PNS Set Editor to select, edit, or create a PNS setup. For details, refer to the Physio16 user instructions (8404163).



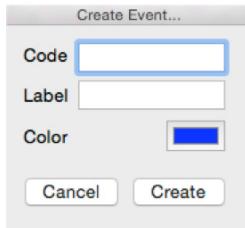
6.3.7 User Events

Use these controls *during acquisition* to:

- Enter event markers into a recording by clicking the event buttons.



- Add event markers to an event set by clicking the **+** button.



- Add event sets to the list of event sets by clicking the **cog** (*****) or by clicking **Create New** in the pull-down list for set selection.

Click **+** (plus) and **-** (minus) to add or remove single events, and click **Clear** to remove all events at once.



You can edit and delete only created sets, not default sets.

To enter events during acquisition:

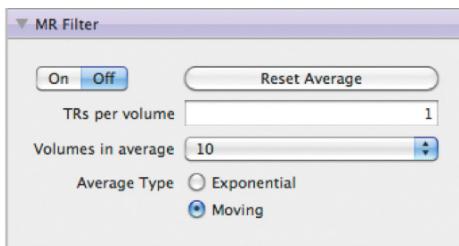
- ① Select an **event set**.
- ② Click an **event button**.

An event will be inserted at the moment the event button was clicked.

6.3.8 MR Filter

For MR conditional
GES MR systems only

When using a GES MR system, click **On** so that Net Station attenuates MR scanner artifacts by using the scanner's test scan TR pulses to build a template.



TRs per volume. Sets the number of TR pulses expected per scan. A *volume* is one scan. Be aware that some MRI scanners send one TR pulse at the beginning of each scan whereas others send one TR pulse at the beginning of each slice.

Volumes in average. Sets the number of volumes to be used when averaging.

Average type:

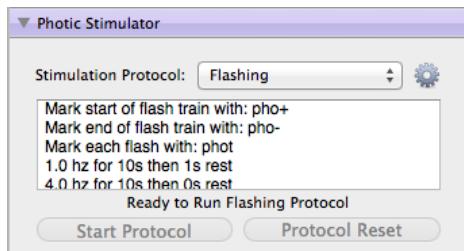
Exponential average. Uses a TR pulse event series (starting with an average of the first 10 TR pulse events) and adds all subsequent TR pulse events at a ratio of 90% of the added TR pulse event series to 10% of the individual subsequent TR pulse events to generate an exponential average for removing MR artifacts.

Moving average. Uses a selected number of TR pulse events to generate a moving average for removing MR artifacts.

6.3.9 Photic Simulator

When using a photic simulator, use these controls to operate it.

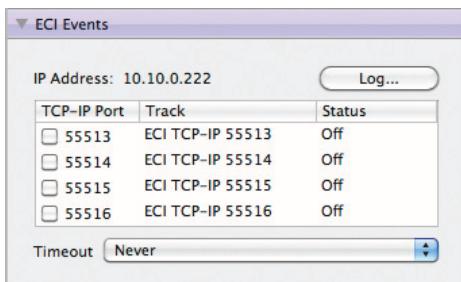
Note that to use the photic simulator, you must first go to the Hardware Settings pane and set the sampling rate to **1000 s/s** and select the photic simulator as the MR/Photic Stim device. For details, refer to the Photic Stimulator user instructions (8405001).



6.3.10 ECI Events

Use these controls to allow TCP/IP communication between external signal devices and the DAC.

Note that ECI events are events that are generated by external applications that use the Net Station's Experiment Control Interface (ECI).



Also note that when using E-Prime, 55513 is automatically selected.

7. Using Review

Net Station's Review interface allows you to review EEG data with flexible view, navigation, and modification controls.

Note that not all features are available in all versions of Net Station. If you have any questions, contact EGI Technical Support (Table P-1).

Also note that multiple views in the same window are linked. To unlink a view, open it in a separate window (command []-click).

7.1 Review Preferences

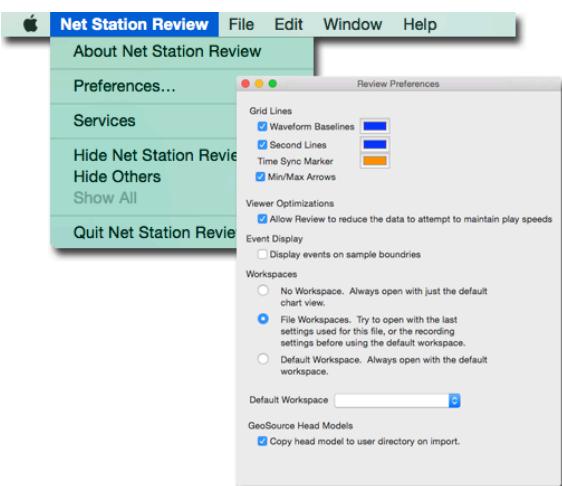
You access the *Review Preferences* from the Net Station Review menu.

The Review Preferences dialog is where you:

Grid Lines. Shows/hides and change the color of grid lines.

Time Sync Marker. Shows/hides the Min/Max arrows of the Time Sync Marker.

Viewer Optimizations. Simplifies the drawing of data playback to reduce the resource load on your computer in order to maintain paging speed.



Data playback is simplified by drawing thinner lines of every other sample. Your choice is then between:

- [unchecked] drawing every sample thicker, but slower, or
- [checked] drawing every other sample thinner, but quicker.

Event Display. Forces events to be aligned with EEG samples, when recording data at less than 1000 s/s;

Note that since events are recorded with millisecond precision, when recording EEG data at less than 1000 s/s, some events will not be aligned with the EEG.

Workspaces. Selects whether to use a default, custom, or no workspaces.

GeoSource Head Models. When selected, copies head models to the Net Station folder. When unselected, stores shortcuts for head models in the Net Station folder. Regardless, head models are available whenever an EEG file with the same patient ID is present in Net Station Review.

7.2 Review Commands and Views

Commonly used Review commands and views are easily accessible on the Review interface.

The right-hand control panels are described in section 7.3.

7.2.1 Review Commands and File Information

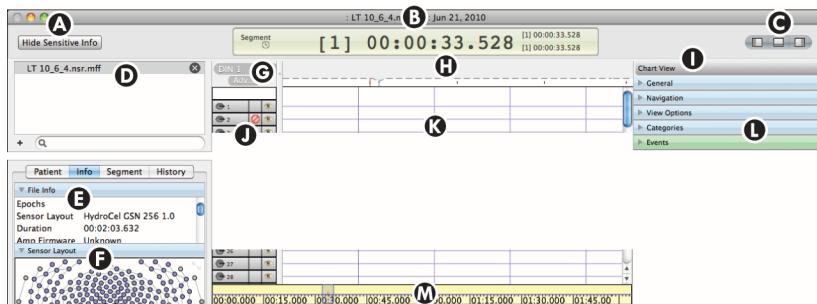


Figure 7-1. Commands of the Review interface

Table 7-1. Review commands

Callout	Command	Description
A	Sensitive Info	Shows/hides patient information.
B	Time/Clock	<p>Displays the elapsed time and amplitude at points within a recording.</p> <p>For review and acquisition, time displays as:</p> <ul style="list-style-type: none"> Clock: hh:mm:ss.sss Relative: hh:mm:ss.sss (as time elapsed during an acquisition) Epoch: [1] hh:mm:ss.sss (epoch number in brackets) Segment: [1] hh:mm:ss.sss (segment number in brackets)
C	Panels	Shows/hides the panels along the left, bottom, and right sides of the interface.
D	File Pane	<p>Accepts opened or dragged files for review.</p> <p>Note that a filename that appears red is unavailable. Check settings and compatibilities.</p>
E	File Info	Provides patient and history information for the currently selected file.
F	Sensor Layout	Displays the sensor layout for the file being reviewed.
G	Event Controls	Shows/hides/creates individual event tracks and enables event entries.

Callout	Command	Description
H	Event Track(s)	Displays enabled event tracks, which allow: <ul style="list-style-type: none"> • Editing of events in their tracks, as well as in the events list. • Placement of coincident events into separate event tracks. • Mouseover display of event information. • Moving of events with a click, drag, and confirmation. • Dragging of events to the trash can.
I	View indicator	Shows the view (chart, PNS, butterfly, topo plot, topo map, or event) of the active window.
J	Channel Track Labels	Allows control of corresponding tracks, such as: <ul style="list-style-type: none"> • Show/hide waveform with eye icon. • Mark individual channels as bad. • Drag lines to change track height. • Click to select a single track. • Drag to select consecutive tracks. • Command+click to select nonconsecutive tracks. • Double-click to change color. • Assumes montage labels. • Double-clicking PNS channels allows control of display, filter, and other PNS settings.
K	Channel Tracks and Data Display	Displays data with the chosen view.
L	Control Panels	Provides data display controls. See section 7.3.
M	Navigation Control Strip	Allows temporal navigation through data with a slider along the time ruler.

7.2.2 Button Bars—Views, Workspaces, and Workflows

7.2.2.1 Review's Views

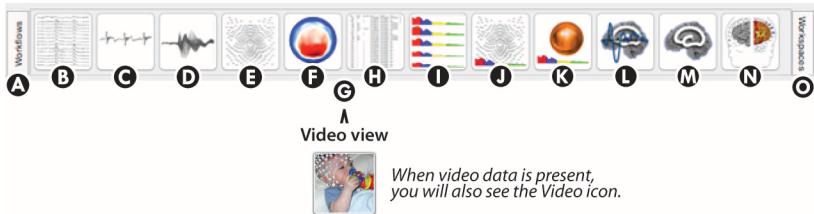
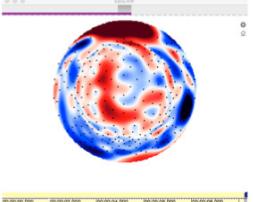
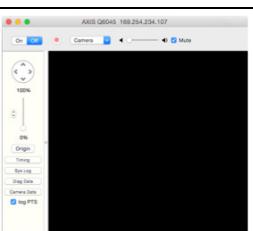
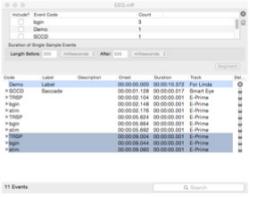
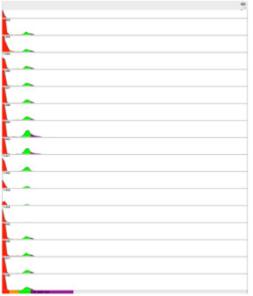
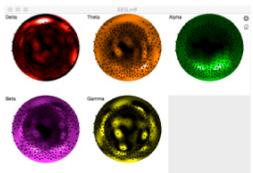
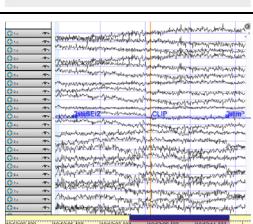
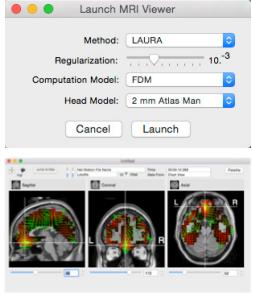
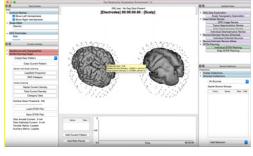


Figure 7-2. View buttons of the Review interface

Table 7-2. Review views

Callout	View / Button	Description	Display
A	Workflows	Toggles between the Views, Workspaces, and Workflows bars.	
B	Chart	Shows EEG data as traditional waveforms.	
C	PNS	Shows PNS data, if present, as traditional waveforms below the channels of EEG.	
D	Butterfly	Shows all channels of EEG as overlaid waveforms for highlighting bad channels and peaks of activity and for checking baseline correction.	

Callout	View / Button	Description	Display
E	Topo Plot	Shows all channels of EEG as spatial and temporal patterns of shorter selections of data organized by location on the head.	
F	Topo Map	Shows all channels of EEG as a spatial voltage map with amplitudes represented by color and the amplitudes between sensors being interpolated to depict the entire surface of the head.	
G	Video	Shows the video that was recording simultaneously with the EEG.	
H	Events	Lists all events marked in the EEG.	
I	Spectral Chart	Shows all channels of EEG as spectrograms.	

Callout	View / Button	Description	Display
J	Spectral Topo Plot	Shows all channels of EEG as spectrograms organized by location on the head. See section 7.3.5.3.	
K	Spectral Topo Map	Shows all channels of EEG as maps of spectral data by frequency band. See section 7.3.5.3.	
L	GeoSource Waveform GeoSource 2.0 and GeoSource 3.0 Research	Shows all channels of EEG as GeoSource waveforms with associated GeoSource computation, montage, and view controls.	
M	GeoSource MRI GeoSource 2.0	Shows all channels of EEG as MRI slices. The Palette button is a toggle button that shows/hides a palette of additional display options for the MRI viewer.	
N	RVE with two states*: <i>Net Station 5.3, showing only 3D topo maps.</i> <i>GeoSource 3.0 Research, showing all research features,</i>	Opens the Reciprocity Visualization Environment (RVE). <i>Without a license for the optional GeoSource 3.0 Research or GTEN 100 Research software, this window only displays 3D topo maps.</i> <i>With additional license(s), this window provides additional features.</i> For details, refer to the GeoSource 3.0 Research (8103101) or GTEN 100 Research (8102120) manuals.	

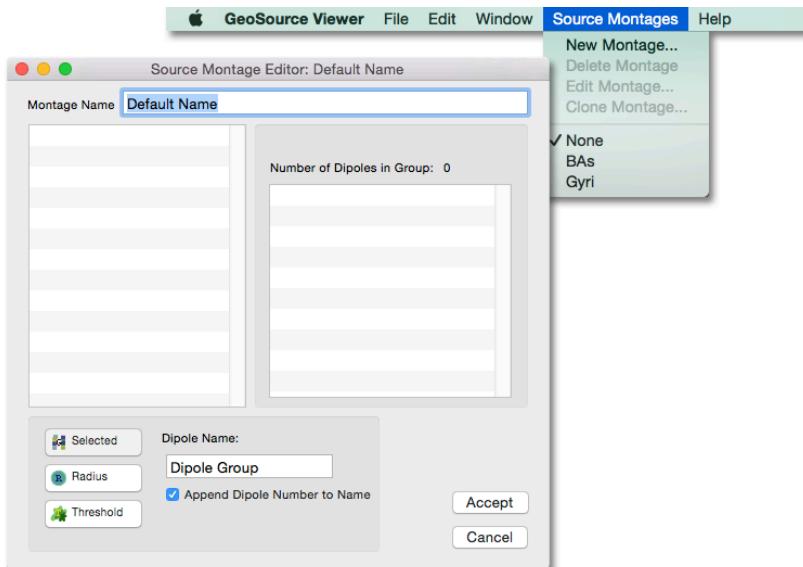
Callout	View / Button	Description	Display
①	Workspaces	Toggles between the Views, Workspaces, and Workflows bars.	

7.2.2.1.1 GeoSource 2.0 Source Montages

After launching GeoSource 2.0 MRI view, the GeoSource 2.0 menu bar is available and is where you can create source montages, when using the GeoSource 2.0 software.

Note that a *source montage* in GeoSource 2.0 is the same as a *source collection* in GeoSource 3.0 Research.

A source montage allows you to highlight only the source data that is of interest. You can then export this subset of data to another file.



If you save out individual participant average files as source waveform files using a source montage, you can then use these files in the Statistics Extraction tool to extract values for statistical analyses in time windows and brain regions of interest across conditions or participant groups.

OBSERVATIONS: Notice that each dipole group of a source montage is displayed as a composite dipole with three vectors. Also notice that the length of each vector indicates the intensity of the corresponding dipole's orientation in the X, Y, and Z planes. The vectors point in the positive direction of the dipolar activity. In orthogonal slice views, only two of the three vectors are visible. For example, the coronal slice view shows vector orientation strengths in the X and Z directions.

To view the vectors more clearly, you may need to toggle off the crosshairs.

Source montages can be created only in the GeoSource Viewer. The dipoles in the GeoSource Viewer are approximately represented by *voxels*, which are colored 3D volume pixels. A dipole group represents one compound dipole in a source montage (computed as the mean intensity of the dipoles included in the group). Once created, source montages are available in either the GeoSource Viewer or the Net Station Review for any source data file.

To create a source montage:

- ① View the source data at the time point of interest.
- ② To make the spatially discrete areas of the MRI slices more obvious, you can reduce the number of low-intensity voxels that are showing. A good starting point is to reduce the palette maximum by approximately 20% to highlight the higher intensity voxels. To reduce the number of low-intensity voxels, raise the palette-minimum slider.
- ③ Click **Source Montages > New Montage**.
- ④ After the Source Montage Editor window opens, notice

that the voxels in the MRI panes of the GeoSource Viewer are now empty so that they may be easily selected for a new source montage.

- ⑤ In the Source Montage Editor window, type in a name for this source montage and type in a name for the first (or only) dipole group to be included in the montage.

When naming dipole groups, consider names that are meaningful, such as amygdala, OFC, or P300.

- ⑥ Create the first dipole group for the source montage with the selected, radius, or threshold dipole-group method.

- If using the *Selected* method:
 - a) Click **Selected**.
 - b) Manually select voxels to populate the dipole group. Do so by clicking or shift-clicking voxels in the MRI panes.
Clicking starts a new group and shift-clicking adds voxels to the current group.
 - c) Watch the dipole-group table for updates of the chosen method, name, dipole ID numbers, and the number of dipoles that are included.
- If using the *Radius* method:
 - a) Click **Radius**.
 - b) In the Radius text box, specify a distance from the selected voxel to be included in the group.
 - c) Click a **voxel** in the MRI panes. All voxels that fall within the specified radius of the voxel clicked will be added to the group.
- If using the *Threshold* method:
 - a) Click **Threshold**.
 - b) In the Percent of Peak text box, specify a percentage of intensity voxels adjacent to the

- selected voxel to be included in the group.
- c) Click a **voxel** in the MRI panes. All adjacent voxels with intensities that fall within the specified percentage of the voxel clicked will be added to the group.
- ⑦ If adding additional dipole groups, repeat step ⑥.
- ⑧ Click **Accept**.
- ⑨ Upon creation, the new source montage will be displayed. To change between montages or no montage, choose **Source Montages > {montage name}**.

For detailed instructions for using the full-featured version of the GeoSource source estimation software, refer to the GeoSource manual (8103101).

7.2.2.2 Review's Workspaces

Use the controls from the Workspaces bar to select, create, update, or delete workspaces in Review.

Note that files recorded with Net Station 5.2 or later contain an initial default workspace named "Recording Settings."



- Make a selection of an existing workspace to apply to your file by clicking **one from the list**. (A checkmark appears beside the active workspace.)
- A workspace must be active to be updated or deleted.

To create new workspaces in Net Station Review:

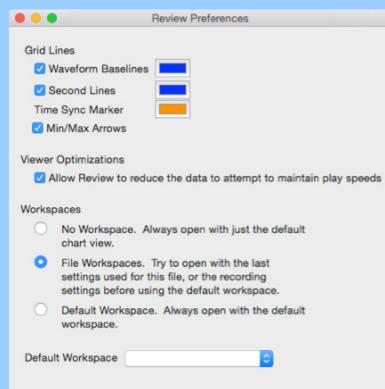
- ① Open a file in Net Station Review.
- ② Set the available workspace settings as desired: window sizes, window locations, views (topo map, spectral topo plot, etc.), montages (for each data window), filters (for each data window), and event set (also event track, if needed).
- ③ Click **Create New Workspace**, name the new workspace, and then click **OK**.

To set how Net Station Review displays workspaces:

- ① Open **Review Preferences**.

- ② Select:

- **No Workspace** to always open files using the default chart view.
- **File Workspaces** to open files in the order of:
 - (a) last settings used for this file;
 - (b) Recording Settings; or
 - (c) Default Workspace.
- **Default Workspace** to always open files using the Default Workspace, which is set by the pull-down list below these Workspace settings.

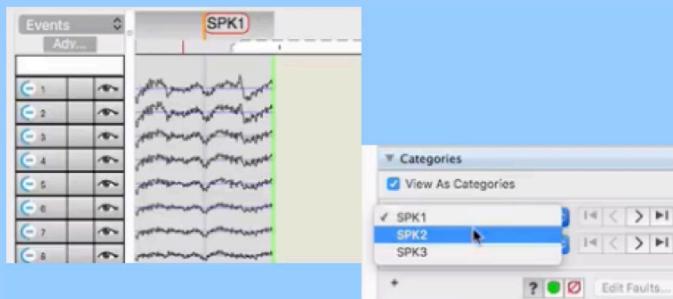


7.2.2.3 Review's Workflows—Combine Categories

The *Combine Categories* workflow is useful for reassigning the segments and categories of segmented files.

One example of using the *Combine Categories* workflow:

- ① Open any *segmented* file in Net Station Review.
- ② Review the file's segments and categories.

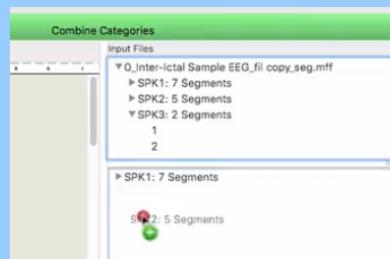


- ③ Click **Workflows** on the button bar.
- ④ Click **Combine Categories** on the Workflows button bar.



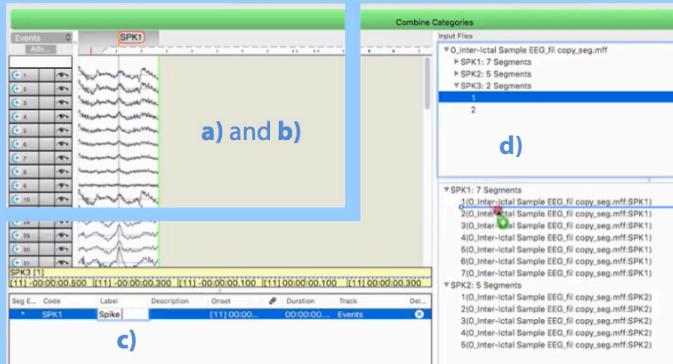
Notice that the same file is listed in both the upper-left pane and the Input Files pane.

- ⑤ Expand the file's folder in the Input Files pane to see the file's categories and segments.
- ⑥ Drag and drop the categories you want to keep to the Segment's pane.

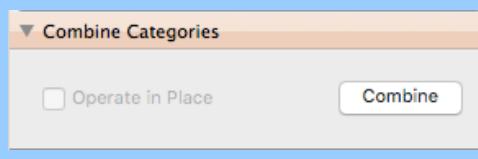


- 7** Select a segment in the remaining category, then:
- If necessary, review it in Net Station Review.
 - Decide which category to move the segment to.
 - If desired, edit the segment's code and/or label.
- Note that changing the category of a segment does not change the codes of the events contained within the segment.
- Drag and drop the segment to the desired category.

If you need a new category, drop the segment to the empty area in the Segment's pane below all segments.



- 8** Apply the changes with one of two choices:
- Save changes to the original file.**
Check **Operate in Place**, then click **Combine**.



- **Save changes to a copy of the original file.**

Leave the Operate in Place option *unchecked*, and click **Combine**.

The copy with the changed segments/categories will be saved to the same location as the original file, with *_cmb* appended to the filename.

If you explore the Categories control panel and the Events list for the new file, you will now see only the categories and segments you reassigned to it.

7.3 Review Control Panels

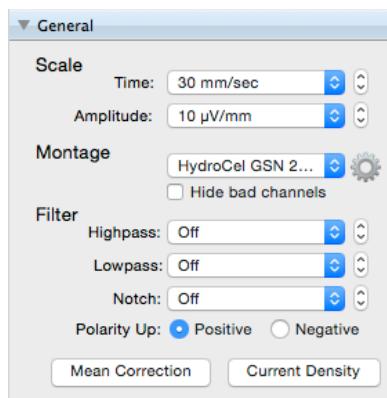
Following are the standard Review control panels.

Note that some controls change according to the selected view (topo plot, etc.).

7.3.1 General

Use these controls to filter out undesired frequencies. They affect only how data are displayed onscreen, not how they were recorded or saved.

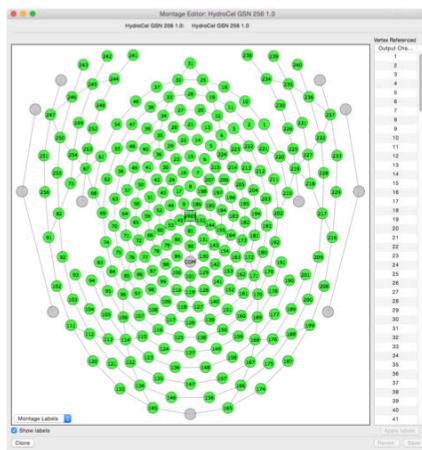
Note that only those frequencies within the band between the highpass and lowpass filter settings are attenuated, not the frequencies at those settings.



7.3.1.1 Montage Editor

Clicking the cog (⚙️) icon next to Montage in the General control panel opens the Montage Editor. With this editor you can select a different montage to view the data with or create a custom montage.

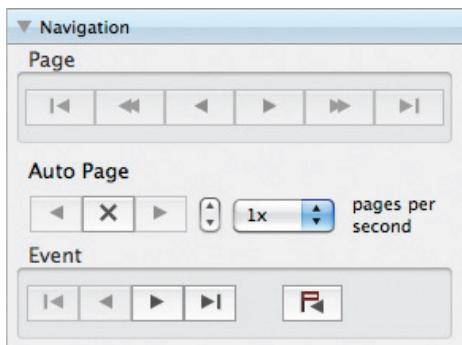
A montage created in either Acquisition or Review is available in both modules.



With the Montage Editor you can show/hide/select labels, reorder the list of channels, and clone, revert, and save new montages.

7.3.2 Navigation

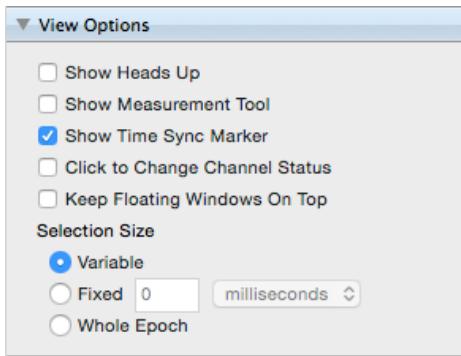
Use these controls to move through the data by page, automatic scrolling, or event (sequential or flagged).



7.3.3 View Options

Use these controls to change the appearance of the data display pane.

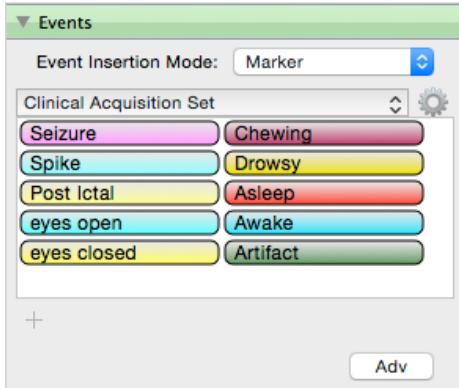
- **Heads Up:** Shows/hides mouseover information for data points.
- **Measurement Tool:** Shows/hides the amplitude and time scale ruler that is used for measuring waveforms.
- **Time Sync Marker:** Shows/hides the time sync marker.
- **Channel Status:** Enables/disables the ability to change the status of individual channels.
- **Floating Windows:** Keeps unlinked windows in front of all other windows.
- **Selection Size:** Changes the preset selection size between variable (how wide you drag), a fixed quantity of time, or one epoch.



7.3.4 Events

Use these controls to create events, create event sets, and to place markers into recordings.

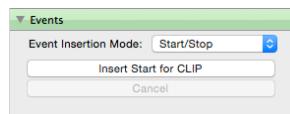
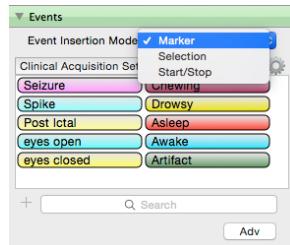
Use the Event View (see section 7.2.2) to edit the attributes (code, label, description, onset, duration, or track) of events in recordings or to delete events from recordings.



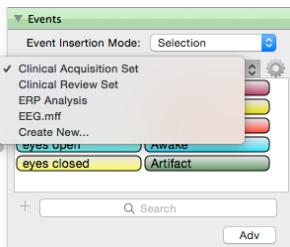
- **Event Insertion Mode:**

To select how events will be inserted into the data, choose between:

- **Marker:** a point in time
- **Selection:** a dragged span of time
- **Start/Stop:** a *CLIP* of time (longer than can be dragged) with start and stop points



- **Event set selection:** To select an event set, choose one from the pull-down list.

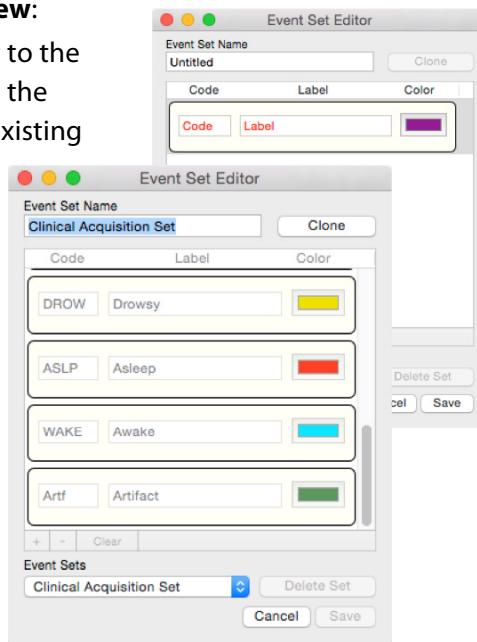


- **Cog (⌘)** and **Create New**:

To add a new event set to the list of sets or to change the events included in an existing set,

click either the **cog (⌘)** or **Create New** in the pull-down list for set selection.

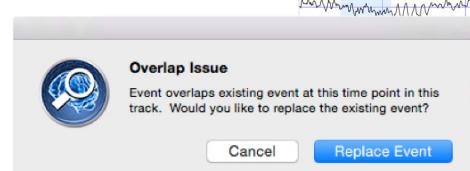
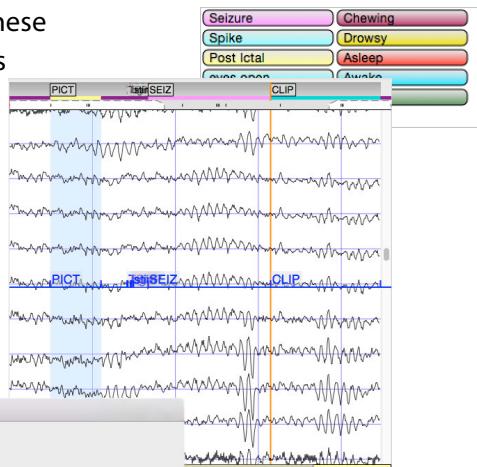
Click + (plus) and **- (minus)** to add or remove single events, and click **Clear** to remove all events at once.



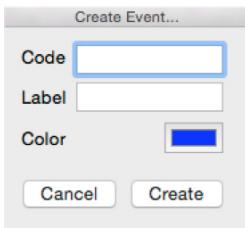
You can edit and delete only created sets, not default sets.

- **Event buttons:** Click these buttons to enter events into recordings.

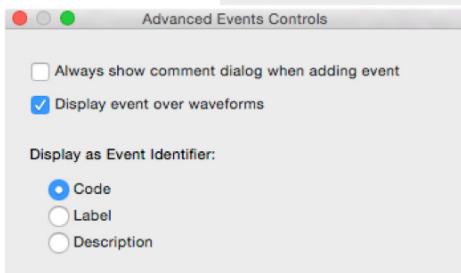
If an event entry overlaps an existing event marker, you will get a message to choose which to retain.



- **+** (plus): To add event markers to an event set, click **+** and make choices in the Create Event dialog.



- **Adv button:**
To change how events will be displayed, click **Adv** and make choices in the Advanced Events Controls dialog.



To enter events during review:

- ① Select an **insertion mode**.
- ② Select an **event set**.
- ③ Click a **point** or drag a **selection of time** in the time ruler or data display pane.
- ④ Click an **event button**.
- ⑤ If the Overlap Issue message appears, choose which event to retain (the previous or the new).

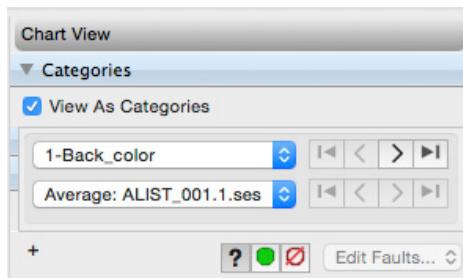
7.3.5 Additional Control Panels

Additional control panels will appear to support selected views.

7.3.5.1 Categories

for the Chart View

Category controls will appear when viewing segmented EEG data in Chart or GeoSource Waveform views. When enabled, use these controls to view and navigate data one segment at a time (within the selected category) or to change the status of segments.

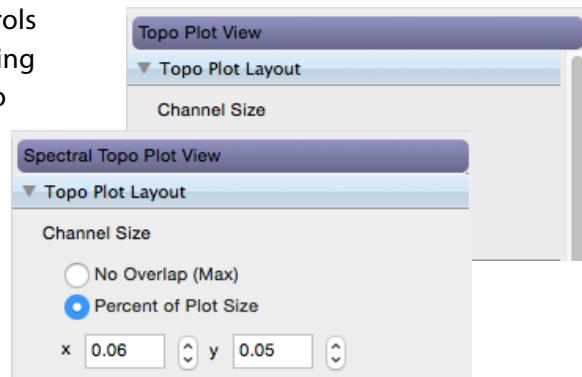


Use the **+** (plus) to add (overlay) waveforms from different categories within an averaged file containing external events.

7.3.5.2 Topo Plot Layout

for the Topo Plot and Spectral Topo Plot Views

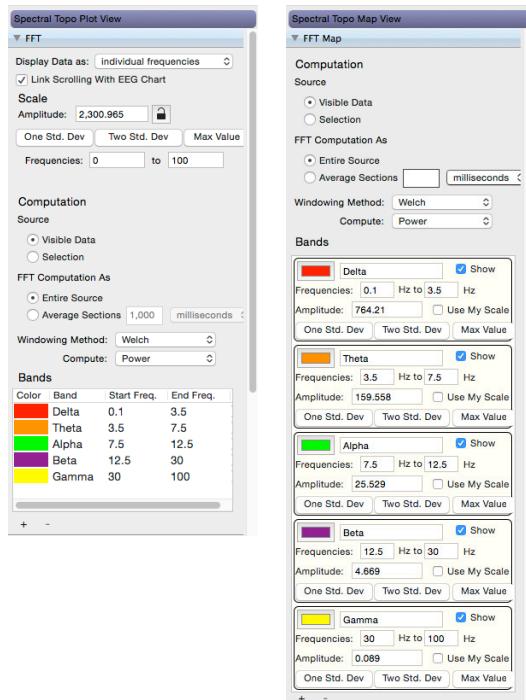
Topo Plot Layout controls will appear when viewing EEG data as either topo plots or spectral topo plots.



7.3.5.3 FFT

for the Spectral Topo Plot or Spectral Topo Map Views

FFT controls will appear when viewing EEG data as spectral topo plots or spectral topo maps.

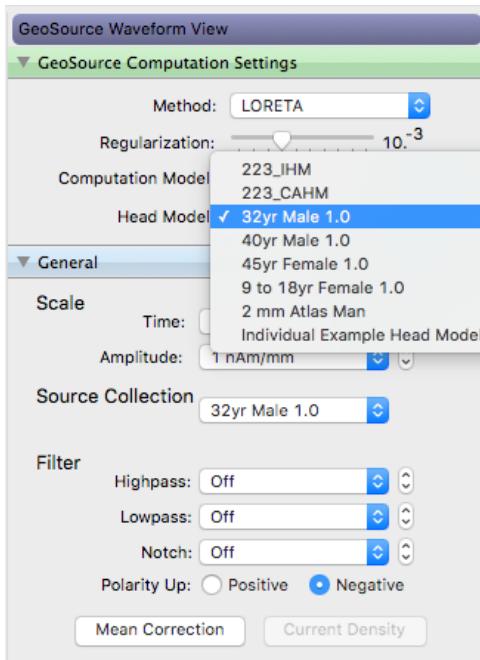


7.3.5.4 GeoSource Computation Settings

for the GeoSource 2.0 or 3.0 Research Waveform View

Use these controls to select the *method* (the source-imaging specification for solving the inverse problem), *regularization* (the method that adds information to stabilize an ill-posed problem), *computation model* (the finite difference method that defines the geometry of the head tissues), and *head model* (a defined dipole set) for the GeoSource waveforms.

Several things to note:



- The General control panel changes by adding a Source Collection field.
- Specifications created in the GeoSource Waveform view do not propagate to the GeoSource MRI view or the RVE.
- You must carefully create specifications in each view (GeoSource waveform, GeoSource MRI, and RVE) in order to compare results between the three views.
- The source collections that appear in the General control panel are based on those created in the RVE; therefore, those results in Net Station Review would propagate to the RVE.

7.3.5.4.1 GeoSource Data as Numbers versus Visualizations

The following will help you understand the difference between the GeoSource specification tool that is available in Net Station Tools and the GeoSource views that are available in Net Station Review.

Primarily, the GeoSource views allow you to **see** your source estimations, while the GeoSource tool allows you access the numbers behind what you are seeing.

Secondly, understand that source estimation with GeoSource is different from visualizing the energy of voxels with fMRI. With GeoSource, *unlike fMRI*, when you see a voxel due to its energy, that doesn't mean that that voxel has statistically more energy than surrounding voxels. With fMRI, the statistical computations are part of the fMRI data, but, with GeoSource source estimation, you still need to explore the data, based on your goals.

For example, if you were interested in source estimation, you might:

- Review your data in Net Station Review to understand how to best explore it.
- To visualize certain aspects more closely or in isolation, select the RVE icon in Net Station Review.
- The results of the specification can be examined in either or both Net Station Review (when in Chart view) and the RVE, because they are linked in time. The visualizations in the RVE would show you such aspects of your data as the orientation of dipoles and the composition of the cortex.

If you wanted to go further, to find the numbers behind the visualizations, you might:

- If doing a classic ERP workflow with visual target detection, again, first, review your data in Net Station Review to understand how to best explore it.

-
- Look for something significant that represents a common occurrence, such as a specific activation at say 300-400 m/s, that might indicate an active/inactive condition to examine further across the subject group.
 - To visualize certain aspects more closely or in isolation, select the RVE icon in Net Station Review.
 - After exploring the data thoroughly, pick the best source specification that matches the source montages (also known as *source collections* in RVE).
 - Take that specification into the GeoSource specification tool of Net Station Tools to run the GeoSource Tool on your data to extract the numbers behind it.
 - You can then run a Statistics Extraction tool from Net Station Tools to go further with statistical analysis.

7.4 Keyboard Shortcut Mapping

Net Station comes with default keyboard shortcuts. You can, however, set up different mappings for different purposes.

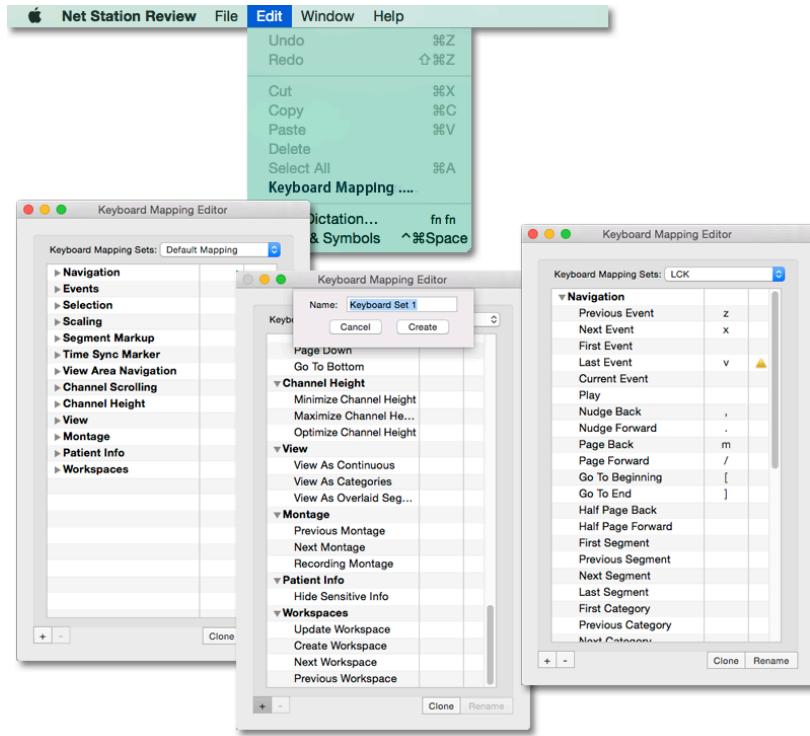
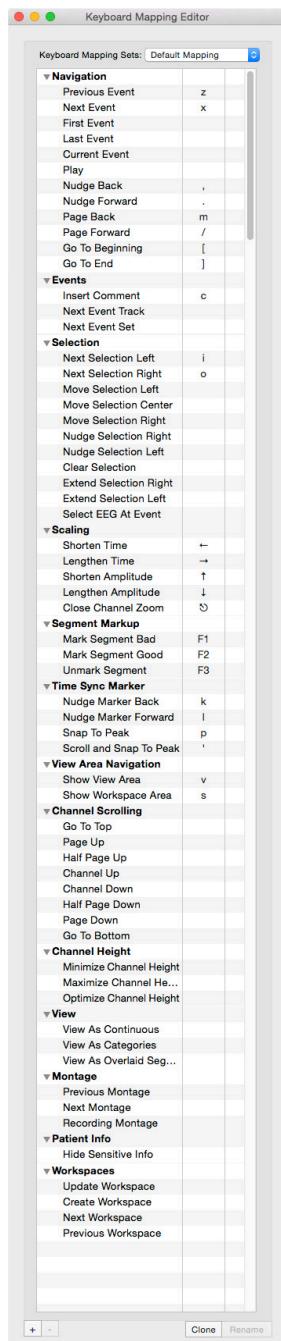


Figure 7-3. Keyboard shortcut mapping

Starting from **Net Station Review > Edit > Keyboard Mapping**:

- Keystroke mappings are organized by task, such as navigation, events, segment markup, etc.

- You can create new sets with unique mappings by **cloning** the selected set (and changing the set name) or clicking **+** (plus).
- You can enter or change a keystroke mapping in a set by double-clicking a stroke cell (the middle column) associated with a shortcut (like Page Back) and pressing a keyboard key. The stroke is saved upon closing the dialog.
- If you attempt to use a key that has already been mapped to another shortcut, a caution symbol will appear next to both shortcuts it is assigned to so that you can set the appropriate keys for each shortcut.
- You cannot change the shortcut mappings of the default set.



8. Using Tools

Net Station's Tools interface allows you to create and run specified waveform tools and scripts on your files to manipulate EEG data.

After you have run a tool or tools on a file, you will open it in Review for evaluation.

Note that not all features are available in all versions of Net Station. If you have any questions, contact EGI Technical Support (Table P-1).

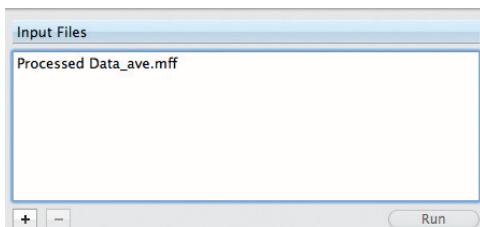
8.1 Tools Control Panels

Following are the standard Tools control panels.

8.1.1 Input Files

Use these controls to add (+) and remove (-) files to be run with selected tools or scripts.

Note that a filename that appears **red** is incompatible with the selected tool. One that appears **blue** is open in Review.



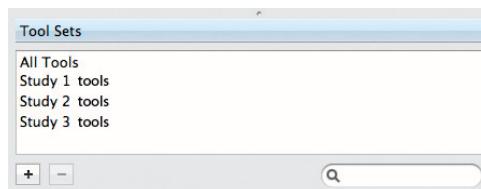
8.1.2 Run Button

Use the Run button to initiate the operation of a selected tool or script on a selected file.



8.1.3 Tool Sets

If desired, use these controls to create unique collections of tools.



8.1.4 Tools

Use these controls to create, view the settings of, or select tools and scripts.

Name	Type	Date Created	Date Modified	Delete
BLC - EYE...	Baselin...	08-07-2012	09-18-2012	
BLC - por...	Baselin...	08-07-2012	08-07-2012	
SEG - cat 1s	Segme...	08-07-2012	08-07-2012	
AD - 20%	Artifact...	08-07-2012	09-18-2012	
OBS - re...	OBS	08-07-2012	10-17-2012	
BC_default	Baselin...	12-10-2012	12-10-2012	
Avg_default	Averag...	12-10-2012	12-10-2012	

Create: Difference Wave

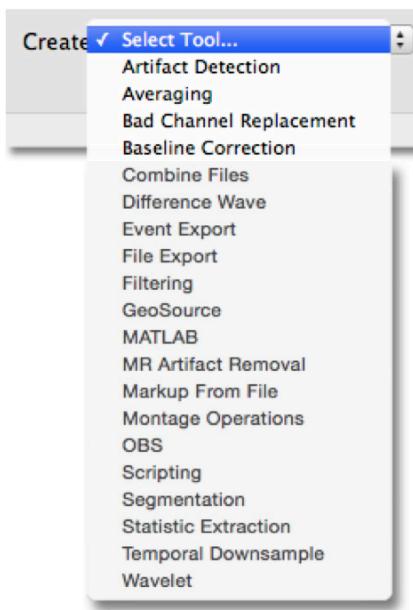
Search bar

8.1.5 Create Tools

Use this control to select individual tools to create.

A *Scripting* tool runs a *specified series* of tools in a defined order. All other tools run individually.

See Appendix C, “Net Station’s Tools,” for details about individual tools.



8.1.6 Operation Status Indicator

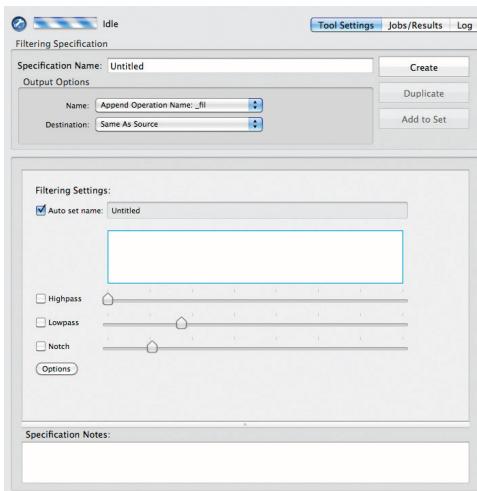
Displays the status of tool or script operations.



8.1.7 Settings, Results, and Log Tabs

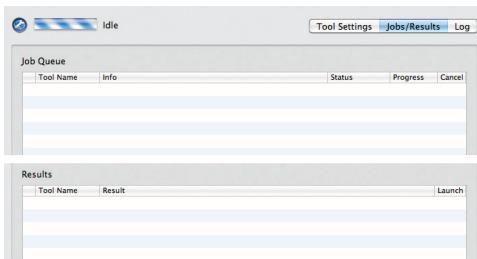
Tool Settings

Displays the settings for a tool.



Jobs/Results

Displays the files waiting to be run and/or the results of running a tool or script on a file.



Log

Lists the pending, completed, or failed status of all jobs.



8.2 Creating Tools

This section gives you an example of how to use the controls of Net Stations Tools to specify a particular tool.

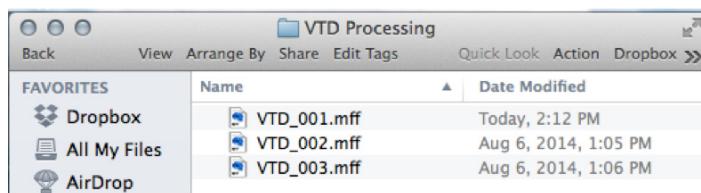
The same tool may be specified differently for different evaluations, such as clinical interictal or classic ERP. Even for the same evaluation, the same tool may be specified with different parameters to better explore the data.

Common workflows (clinical interictal, classic ERP, etc.) containing different tools and settings are available from EGI Technical Support (Table P-1).

To specify a tool, in this case a GeoSource specification tool, do the following:

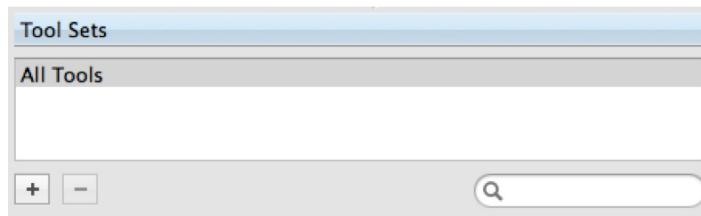
1. Know where your session data files are.

In this example, the three session data files are titled VTD_00X and the folder they are in is titled VTD Processing.



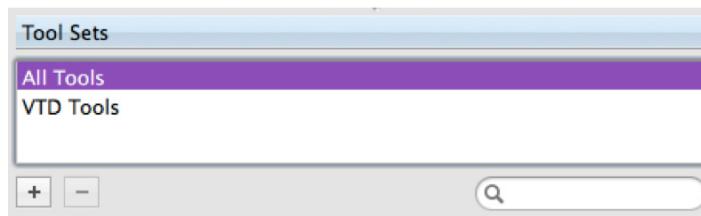
2. Open the **Net Station Tools** module of Net Station 5.

-
3. Click **+** (plus) to make a new tool set.

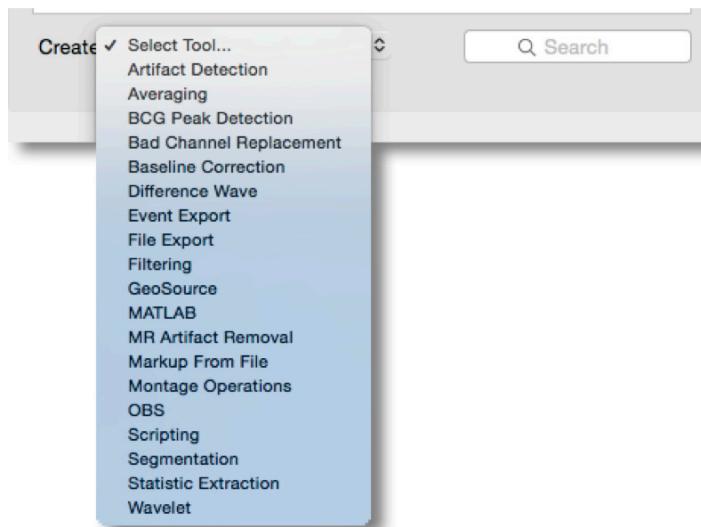


4. Name your tool set.

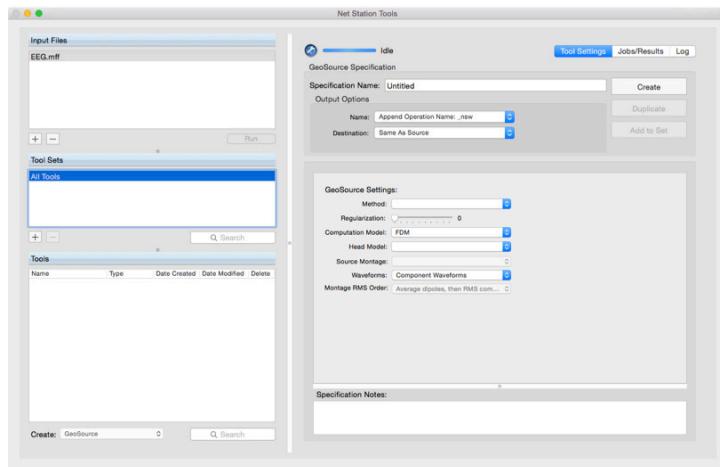
In this example, change the untitled tool set to VTD Tools.



5. Beside Create, select **GeoSource** as the tool to be specified.

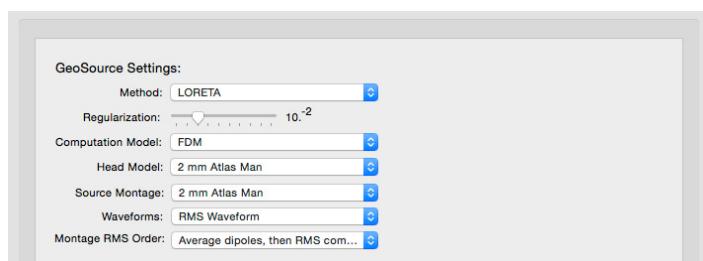


-
6. A new GeoSource Specification with default settings appears on the right. Type a **name** for this new specification (that is, this new tool) into the Specification Name field.



7. Under GeoSource Settings, set the fields as follows:

- **Method:** LORETA
- **Regularization:** 10^{-2}
- **Computation Model:** FDM
- **Head Model:** 2 mm Atlas Man
- **Source Montage:** 2 mm Atlas Man
- **Waveforms:** RMS Waveform
- **Montage RMS Order:** Average dipoles, then RMS components

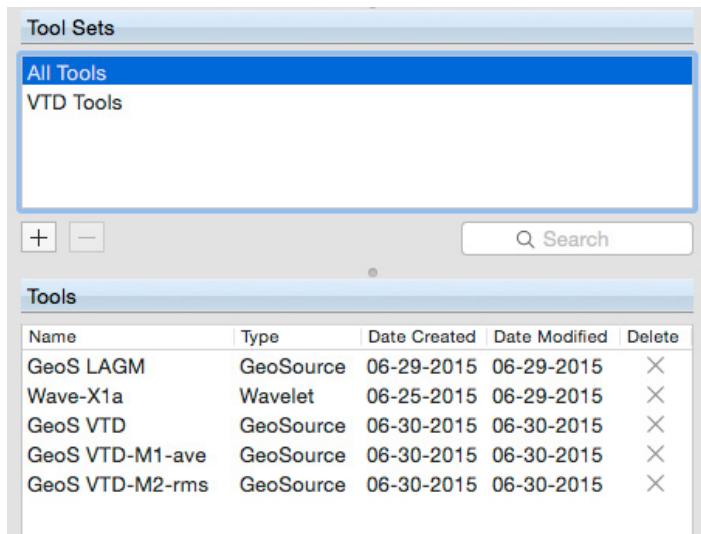


-
8. For this example, leave the Destination output **Same As Source** and click **Create**. This creates a tool that outputs files with automatically appended names (for GeoSource specification tools, “_nsw”), saved to the source file’s location.



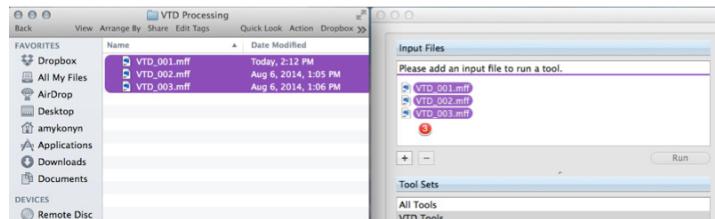
9. Notice that your new GeoSource tool appears in the Tools pane below the Tool Sets pane.

As shown in the image below, when estimating sources, you would normally explore your data with various versions of the GeoSource Tool to verify results.



10. Drag your **session files** to the Input Files pane.

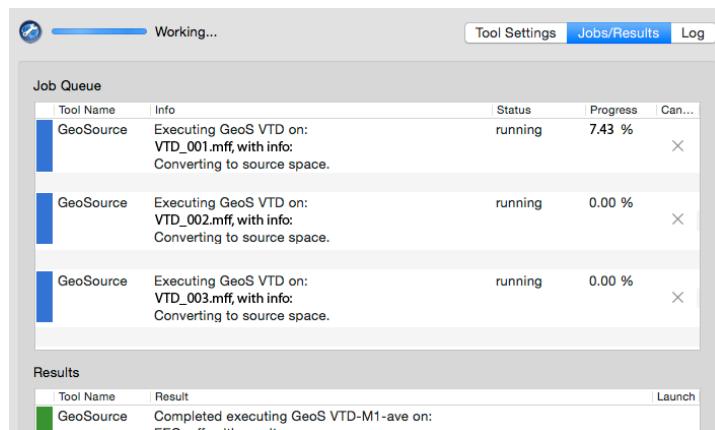
Note: Tools have been run successfully on up to 30 input files.



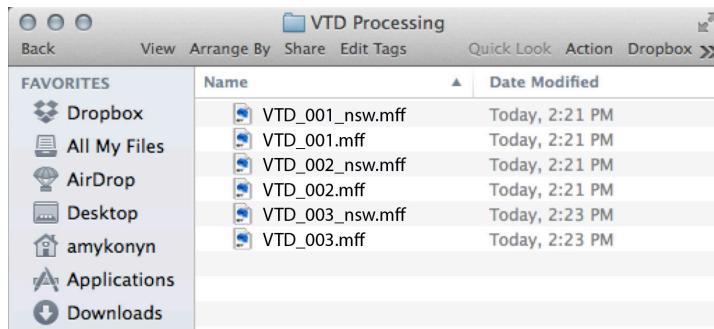
11. If not done already, select (highlight) your **new GeoSource tool** in the Tools pane.

Confirm you have selected the correct tool and that the specification settings are correct.

12. Click **Run** to process the files. Net Station will display the Job Queue and begin executing the selected tool.



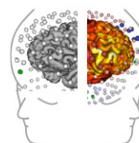
-
13. New files will appear in the processing folder, which, in this case, is also the location of the source files.



9. 3D Visualization

Along with head models generated by EGI's Modal Image Pipeline (MIP), Net Station 5.3 works seamlessly with the Reciprocity Visualization Environment (RVE) and GeoSource 3.0 Research software to provide you with vivid visualizations and 3D source localizations of your EEG scalp data.

- **Net Station 5.3** acquires, reviews, and exports EEG data; can save EEG data as source waveforms (source space); and also provides the link between EEG data and 3D head models in the RVE.
- **RVE** is the portal to 3D topo maps (without or with any level of GeoSource 3.0) and 3D advanced visualization of your EEG data (with any level of GeoSource 3.0).



The 3D viewer displays source intensities with 3D topo maps and 3D head models of your EEG data generated from a variety of views, including scalp topography, atlas triples dipoles, and individual oriented dipoles. The 2D viewer displays MRI slices of the corresponding cortical source estimations.

- **GeoSource 3.0 Research** (Basic, Intermediate, and Advanced) is the hub of the source estimation and imaging process. It provides estimations of EEG sources, which are then displayed in Reciprocity.
- **Modal Image Pipeline (MIP)** is a separate application that lives outside of Net Station. It creates conformal atlas head models (CAHM) and individual head models (IHMs).

For details, refer to the GeoSource 3.0 Research manual (8103101).

Following are the key features of EGI's source estimation and imaging programs and how they display in the RVE.

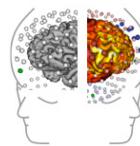
Table 9-1. What the RVE displays, depending upon what software is licensed

Net Station 5.3 Review, GeoSource (2.0 and 3.0), and MIP	Reciprocity Visualization Environment (RVE)
<p>Net Station 5.3 Review</p> <p><i>with GeoSource 2.0</i></p>  <p>The RVE is not available with GeoSource 2.0. GeoSource 2.0 files open only with the MRI Viewer in Net Station Review, which provides access to:</p> <ul style="list-style-type: none">• 2 mm Atlas Man head model• 2D MR slice view with highlighted sources• all GeoSource 2.0 features	
<p>Net Station 5.3 Review</p> <p><i>with no version of GeoSource</i></p> <p>Review provides access to the RVE, even when no version of GeoSource is licensed.</p>	With no licensed version of GeoSource, the RVE provides only 3D topo maps for review.
<p>Net Station 5.3 Review</p> <p><i>with GeoSource 3.0 Research Basic</i></p>  <p>Review provides access to the RVE, while GeoSource 3.0 Research Basic provides access to the following in the RVE:</p> <ul style="list-style-type: none">• Three views:<ul style="list-style-type: none">– EEG Data Exploration– Head Model Review– Source Estimate Review (Triples)• <i>Cannot use MIP outputs.</i>• Six atlas head models:<ul style="list-style-type: none">– Three adult atlases– Three pediatric atlases	With GeoSource 3.0 Research Basic , the RVE provides: <ul style="list-style-type: none">• 3D topo maps• Custom source collections and dipole source groups

Net Station 5.3 Review, GeoSource (2.0 and 3.0), and MIP	Reciprocity Visualization Environment (RVE)
Modal Image Pipeline (MIP)	
	For GeoSource 3.0 <i>Intermediate</i> , the MIP creates Conformal Atlas Head Models (CAHMs).
<p>Net Station 5.3 Review</p> <p><i>with GeoSource 3.0 Intermediate</i></p> <ul style="list-style-type: none"> Includes all of Basic's features, plus: Uses the MIP's Conformal Atlas Head Model (CAHM) outputs 	 <p>With <i>GeoSource 3.0 Research Intermediate</i>, the RVE provides:</p> <ul style="list-style-type: none"> 3D topo maps Custom source collections and dipole source groups
Modal Image Pipeline (MIP)	
	For GeoSource 3.0 <i>Advanced</i> , the MIP creates Conformal Atlas Head Models (CAHMs) and Individual Head Models (IHMs).
<p>Net Station 5.3 Review</p> <p><i>with GeoSource 3.0 Advanced</i></p> <ul style="list-style-type: none"> Includes all of <i>Intermediate</i>'s features, plus: Provides one additional view <ul style="list-style-type: none"> Source Estimate Review (Oriented) Uses both of the MIP's outputs: <ul style="list-style-type: none"> Conformal Atlas Head Models (CAHMs) Individual Head Models (IHM) 	 <p>With <i>GeoSource 3.0 Research Advanced</i>, the RVE provides:</p> <ul style="list-style-type: none"> 3D topo maps Custom source collections and dipole source groups

9.1 RVE Viewer

Depending upon what you want to do with your data, you will launch the RVE Viewer either from inside **Net Station Review** or from **Finder > Applications > EGI > Net Station 5**. Select the RVE icon either place.

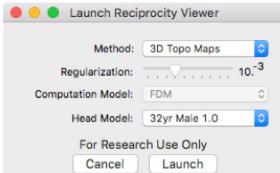
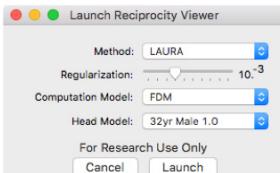


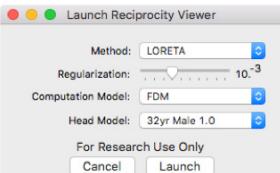
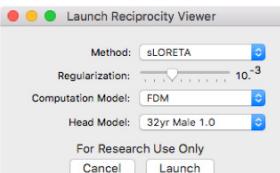
Opening the RVE from Finder > Applications allows you to open any head model directly into the Reciprocity Viewer.

Refer to Table 9-1 and the following table.

9.1.1 Launched from Net Station Review

Table 9-2. Reciprocity's available launching options from Net Station Review

Methods	Regularization Values	Computational Models	Head Models
3D Topo Maps  A screenshot of a Mac OS X-style dialog box titled "Launch Reciprocity Viewer". It contains four dropdown menus: "Method" set to "3D Topo Maps", "Regularization" set to 10^{-3} , "Computation Model" set to "FDM", and "Head Model" set to "32yr Male 1.0". Below these is a checkbox "For Research Use Only" and two buttons "Cancel" and "Launch".	<i>Not applicable</i>	<i>Not applicable</i>	Built-in atlases <ul style="list-style-type: none">• three adult• three pediatric
LAURA*  A screenshot of a Mac OS X-style dialog box titled "Launch Reciprocity Viewer". It contains four dropdown menus: "Method" set to "LAURA", "Regularization" set to 10^{-3} , "Computation Model" set to "FDM", and "Head Model" set to "32yr Male 1.0". Below these is a checkbox "For Research Use Only" and two buttons "Cancel" and "Launch".	$10 - 10^{-9}$ (10^{-3} is the default.)	Spherical / FDM (FDM is the default.)	Built-in atlases <ul style="list-style-type: none">• three adult• three pediatric

Methods	Regularization Values	Computational Models	Head Models
LORETA* 	10 – 10^{-9} (10^{-3} is the default.)	Spherical / FDM (FDM is the default.)	Built-in atlases <ul style="list-style-type: none">• three adult• three pediatric
sLORETA** 	10 – 10^{-9} (10^{-2} is the default.)	Spherical / FDM (FDM is the default.)	Built-in atlases <ul style="list-style-type: none">• three adult• three pediatric

*Also appropriate for atlases and conformal atlas head models (CAHMs).

**Also appropriate for individual head models (IHMs).

9.1.2 Launched From Finder > Applications

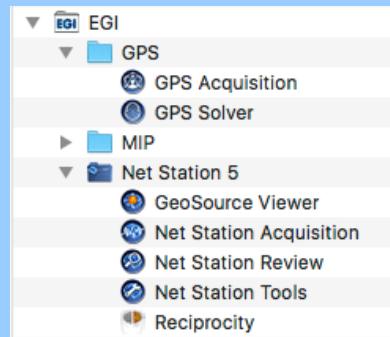
Accessing the RVE as a standalone application provides the features for visualizing head models and/or creating neuromodulation protocols with GTEN Planning. For details about GTEN 100 Research, refer to the GTEN 100 Research manual (8102120).

When launched as a standalone application, the Reciprocity Viewer provides most features as when launched from Net Station Review, except source localization—there are no GeoSource settings for method, regularization, computation model, or head model.

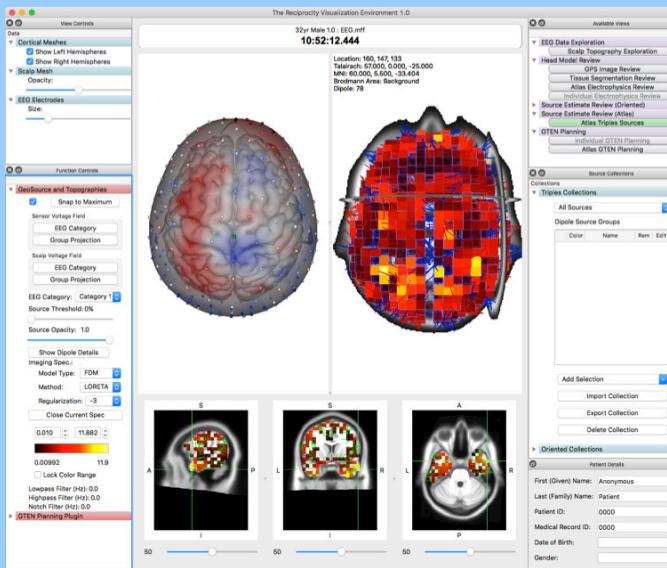
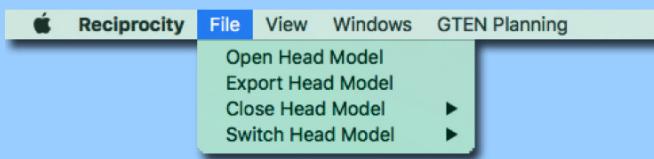
Note that source localization with all of Reciprocity's 3D source estimation and visualization features requires that you access your EEG data from Net Station Review.

To launch the RVE and visualize a head model:

- ① Launch the RVE from **Applications > EGI > Net Station 5 > Reciprocity.**



- ② Open a head model by clicking **File > Open Head Model.**



9.2 RVE Window, Features, and Controls

Not all features are available in all versions of software. If you have any questions, contact EGI Technical Support (Table P-1).

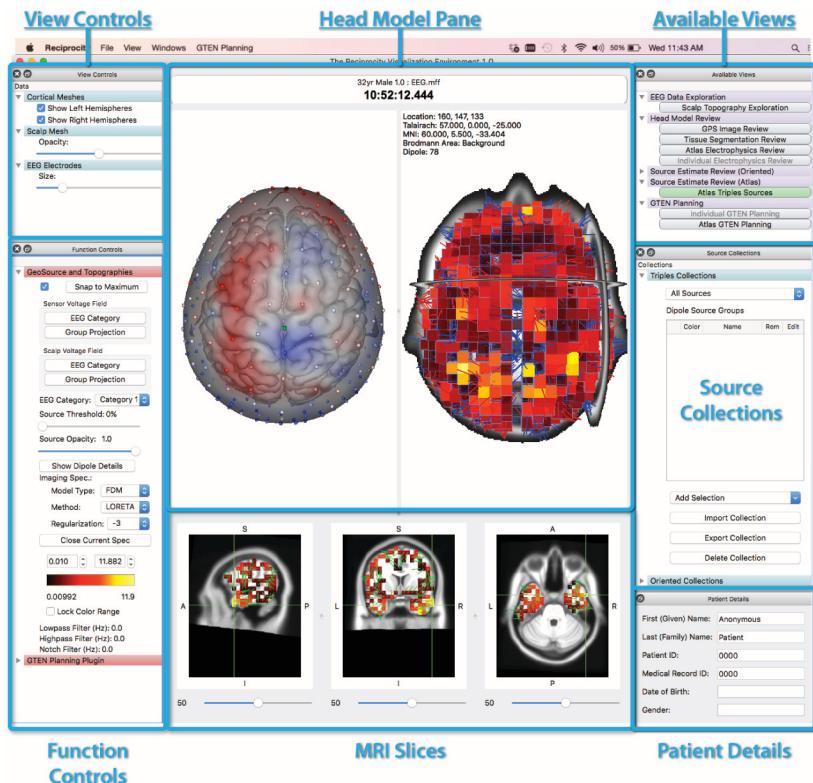


Figure 9-1. Features and controls of the RVE window

9.2.1 Available Views

Depending upon which version of GeoSource you have a license for (GeoSource 2.0 or the Basic, Intermediate, or Advanced level of GeoSource 3.0 Research), different views will be available to you in the RVE.

After the RVE opens, either from Net Station Review or Finder > Applications, the RVE provides a selection of views to facilitate your further research or clinical work.

Note that EEG data displayed in the RVE is controlled by the settings made in Chart view in Net Station Review.

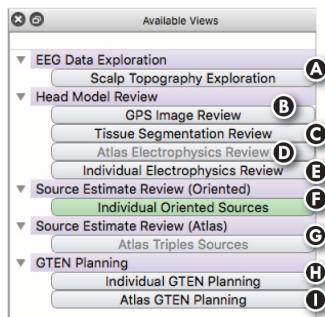


Table 9-3. Available views

Callout	View	Description
A	EEG Data Exploration	<i>Scalp Topography Exploration.</i> This is the 3D topo map view that is selected as a Method from Net Station Review.
B	Head Model Review	<i>GPS Image Review.</i> This view shows how well EEG sensor positions are registered to CAHMs and IHMs.
C		<i>Tissue Segmentation Review.</i> This view shows how well tissue classifications are characterized.
D		<i>Atlas Electrophysics Review.</i> This view verifies the leadfield matrix for built-in atlases and CAHMs.
E		<i>Individual Electrophysics Review.</i> This view verifies the leadfield matrix for IHMs.
F	Source Estimate Review (Oriented)	<i>Individual Oriented Dipoles.</i> This is a GeoSource 3.0 Research view for IHMs.
G	Source Estimate Review (Triples)	<i>Atlas Triples Dipoles.</i> This is a GeoSource 3.0 Research view for any atlas-based head model.

Callout	View	Description
H	GTEN Planning	<i>Individual GTEN Planning. Present with licensed optional software. Used to create modulation protocols with individual head models (IHMs).</i>
I	Atlas GTEN Planning	<i>Atlas GTEN Planning. Present with licensed optional software. Used to create modulation protocols with atlas and conformal atlas head models (CAHMs).</i>

9.2.2 Source Collections

You can create customized triples or oriented source collections within the RVE to display specific dipoles or dipole groups.

Remember that:

GeoSource 2.0 = GeoSource 3.0 Research	
source montage	= source collections
ROIs	= dipole source groups

In addition to creating dipole source groups from the Source Collections pane, you can select dipoles (voxels) manually.

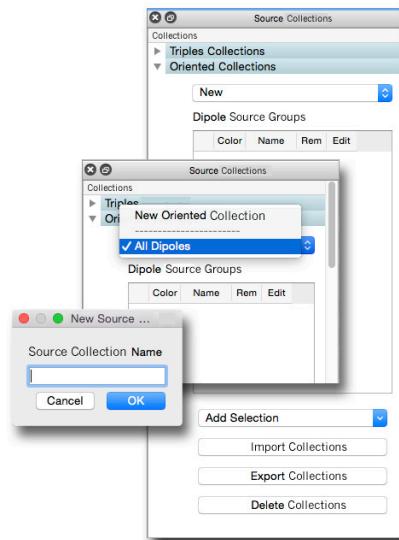


Table 9-4. Selecting dipoles (voxels)

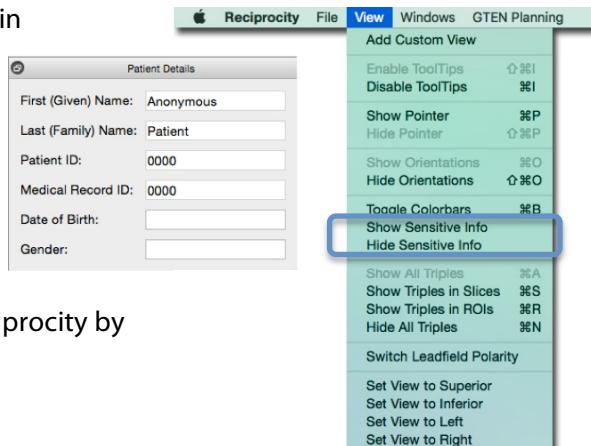
Method	Keystrokes	Descriptions
2D MRI Slices — Basic and Intermediate		
Individual	Shift + click	Selects individual dipoles to populate a dipole source group.
Radius	Shift + click + drag	Selects a group of dipoles within a drawn radius.

Method	Keystrokes	Descriptions
Threshold	Cmd (⌘) + click	Selects the first dipole and then displays a dialog box to enter a threshold value for the automatic selection of additional dipoles that are connected to the first dipole. For example, a threshold of 50 entered for a dipole of 10 µA fills the dipole source group with dipoles that are within ± 50% (5-15 µA).
Dynamic Threshold	Cmd (⌘) + click + drag	Selects the first dipole and then displays mouseover text of the threshold percentage value based upon the additional dipoles you select by dragging.
3D Head Models — Advanced		
Patch	Cmd (⌘) + click	Selects patches of dipoles to populate a dipole source group.

9.2.3 Patient Details

The Patient Details pane in Reciprocity is linked to the Show/Hide Sensitive Info button in Net Station Review.

You can change the display (show or hide) from Review or from Reciprocity by clicking **View > Show [or Hide] Sensitive Info**.



9.2.4 Function Controls—GeoSource and Topographies

Following are the function controls that appear when viewing GeoSource and topographic data.

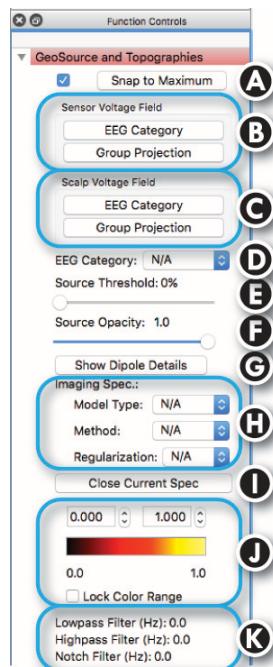


Table 9-5. Function controls for GeoSource and Topography views

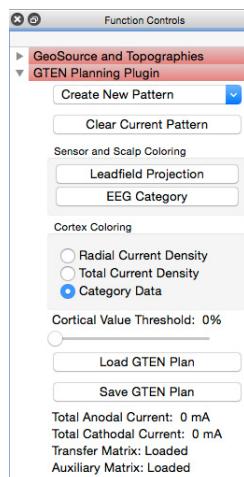
Callout	Control	Description
A	Snap to Maximum	<p>Centers the crosshairs to the location of the maximum (or highest) dipole intensity.</p> <p>Checkbox. When checked, the crosshairs will automatically snap to the location with the highest dipole intensity as you continue to move through the data.</p> <p>Button. When the checkbox is unchecked, the button is still available to selectively snap the crosshairs to the highest dipole intensity.</p>
B	Sensor Voltage Field	Provides buttons to view sensor voltage data as scalp EEG categories or dipole source group projections.
C	Scalp Voltage Field	Provides buttons to view scalp voltage data as scalp EEG categories or dipole source group projections.

Callout	Control	Description																								
D	EEG Category	Shows the category currently being displayed, which is the category selected in Net Station Review and linked to RVE.																								
E	Source Threshold	Shows/hides (by a percentage of opacity) the surface view versus the volume view.																								
F	Source Opacity	Adjusts the transparency of the displayed source data.																								
G	Show Dipole Details	<p>For a category range, lists all dipoles and their values and colors.</p> <p>This dialog can be sorted and used to navigate (jump) to specific locations.</p> <table border="1"> <caption>Category Range: 0.00711095, 12.9239</caption> <thead> <tr> <th>Dipole</th> <th>Value</th> <th>Color</th> </tr> </thead> <tbody> <tr><td>1</td><td>4.58092</td><td>Red</td></tr> <tr><td>2</td><td>5.58328</td><td>Orange</td></tr> <tr><td>3</td><td>4.79511</td><td>Yellow</td></tr> <tr><td>4</td><td>4.28048</td><td>Yellow</td></tr> <tr><td>5</td><td>8.7303</td><td>Orange</td></tr> <tr><td>6</td><td>12.2799</td><td>Red</td></tr> <tr><td>7</td><td>9.36704</td><td>Orange</td></tr> </tbody> </table> <p>Any view, except 3D topo maps, will show dipole details.</p>	Dipole	Value	Color	1	4.58092	Red	2	5.58328	Orange	3	4.79511	Yellow	4	4.28048	Yellow	5	8.7303	Orange	6	12.2799	Red	7	9.36704	Orange
Dipole	Value	Color																								
1	4.58092	Red																								
2	5.58328	Orange																								
3	4.79511	Yellow																								
4	4.28048	Yellow																								
5	8.7303	Orange																								
6	12.2799	Red																								
7	9.36704	Orange																								
H	Imaging Spec	<p>Shows the <i>Model Type</i>, <i>Method</i>, and <i>Regularization</i> a file was launched with.</p> <p>To see a head model with other parameters, you go back into Net Station Review, click the RVE button again, and launch another RVE window for the same head model with different parameters that are linked to the same EEG data in Review.</p> <p>With multiple RVE windows open for the same head model (with different parameters), the Imaging Spec fields become active so that you can change the parameters for the <i>active head model</i> (that is, the <i>Active Scene</i>).</p> <p>Note that only two head models can be open at the same time and only four windows associated with each head model can be open.</p>																								
I	Close Current Spec	<p>When multiple RVE windows are open, this button closes the active window. When only one window is open, it closes the RVE completely.</p> <p>Note that up to four windows can be open for the same head model and up to two head models can be open at a time.</p>																								

Callout	Control	Description
J	Intensity color controls	<p>Minimum and Maximum pickers. Upon first displaying a file, these pickers display the default minimum (right picker) and default maximum (left picker) intensities. You can adjust these as desired.</p> <p>Intensities color bar. Graphically shows the intensities shown by the pickers.</p> <p>Lock Color Range. When checked, the minimum and maximum, as well as the spectrum palette, are locked, regardless of the time point changing. When unchecked, the minimum and maximum values will update as the current time point changes in the data.</p>
		<p>You can use these controls to make spatially discrete areas more obvious:</p> <ul style="list-style-type: none"> • Reduce the maximum picker value by 20% to highlight the higher intensity voxels. • Reduce the number of low-intensity voxels that are showing by raising the minimum picker value.
K	Filters	Shows the values of the lowpass, highpass, and notch filters as set in the file.

9.2.5 Function Controls—GTEN Planning Plugin

The Function Controls of the GTEN Planning Plugin are described in the GTEN 100 Research manual (8102120).



9.2.6 View Controls

The View controls increase the visibility of areas of interest in head models.

Not all view controls appear for all types of head models.

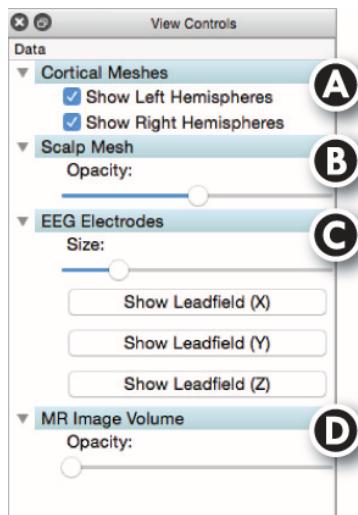


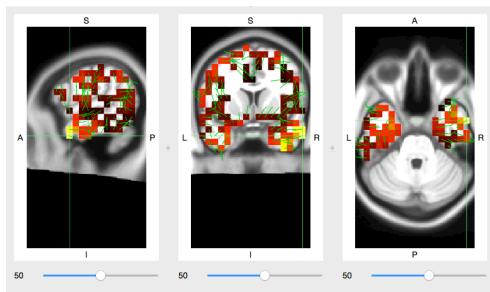
Table 9-6. View controls (*some are not available for all views*)

Callout	Control	Description
A	Cortical Meshes	Shows/hides the left and/or right hemispheres.
B	Scalp Mesh	Indicates the head surface. Opacity slider. Adjusts the transparency of the scalp mesh.
C	EEG Electrodes	Indicates the location of the EEG sensors across the head surface. Size slider. Adjusts the size of the displayed EEG sensors. Show Leadfields (X, Y, and Z). Of the three vectors (X, Y, and Z) of a triples dipole, these buttons change the leadfield projection to the stated direction (X, Y, or Z) and displays only this projection.
D	MR Image Volume	Indicates dipole intensities. Opacity slider. Adjusts the transparency of the MR slices.

9.2.7 MR Slices

For atlas head models, the MR slice controls display dipole intensities overlaid onto sagittal, coronal, and axial MRI slices.

Dipoles are approximately represented by voxels, which are colored 3D volume pixels.



The **slice sliders** navigate to a specific slice in the corresponding pane (sagittal, coronal, or axial). As they do, the other two slice panes will update accordingly.

The grid numbers used in GeoSource do not correspond to Talairach Daemon or MNI coordinates.

9.3 3D Image and 2D Slice Shortcuts

The keyboard shortcut mappings available for GeoSource 3.0 Research in the RVE allow you to easily rotate, zoom, move, and navigate 3D images and 2D MRI slices.

Table 9-7. 3D image and 2D slice keyboard shortcuts for GeoSource 3.0 Research in the RVE

Mode	Function	Keys
2D slice	Zoom	Right-click + drag
	Move	Shift + right-click + drag
	MRI slice navigation	Left-click + drag
	Brightness	Cmd (⌘) + right-click + drag ⇝
	Contrast	Cmd (⌘) + right-click + drag ⇕
3D image	Zoom	Right-click + drag
	Move	Shift + right-click + drag
	Rotate	Left-click + drag

Appendix A: Filter Basics

Anti-aliasing Filter

Effects on EEG Timing

The anti-aliasing filters of the Net Amps amplifiers introduce a temporal delay in the EEG. Whether EEG is steaming, displaying, or recording, there is a temporal delay from *real time* and any event aligned with real time.

Without adjustment, this delay affects the alignment of EEG with the real-time events (as from digital inputs or TCP/IP connection) recorded during EEG acquisition.

This delay does not affect the alignment of events manually entered during EEG acquisition. It also does not affect the alignment of events entered during review or from the operation of tools after data acquisition.

For the automatic adjustment of this delay during acquisition, see sections 4.1 and 6.3.6.2.

If you are segmenting data, you can adjust the delay between EEG and real-time events by adding a positive value (a stimulus presentation offset) in the Offset Segment field of the *Segmentation* tool, in addition to adjusting for external event or digital input (DIN) offsets. For details, refer to the GES 400 Series manual (8100400) or contact EGI Technical Support (Table P-1).



CAUTION: The anti-aliasing filters of the Net Amps amplifiers introduce a temporal delay in the EEG. To adjust for the delay between recorded EEG and the real-time events recorded during EEG acquisition, use the following known delays for each sampling rate and amplifier model:

Sampling Rate	NA 300	NA 400	NA 405	NA 410
1,000 s/s	8 ms	36 ms	36 ms	13 ms
500 s/s	18 ms	66 ms	66 ms	34 ms
250 s/s	36 ms	112 ms	112 ms	76 ms
125 s/s	72 ms			

Effects on EEG Averaging

You will want to be careful when averaging files.

- Only average adjusted files with adjusted files and unadjusted files with unadjusted files.
- Only average unadjusted files that have the same temporal delay. For example, the NA 300 at 250 s/s with the NA 400 at 1,000 s/s, because both have a 36 ms delay adjustment.

Appendix B: Net Station Reminders

Following is a collection of reminders for effectively using your Net Station software.

Anti-alias Filter Alignment. You can adjust for the amplifier's anti-alias filter delay *during* or *after* the acquisition of your EEG data.

- Section 4.1 describes the Anti-Alias Filter Alignment utility that can be used after the acquisition of EEG data.
- Section 6.3.6.2 describes the Digital Anti-Alias Filter Alignment option that can be used during the acquisition of EEG data. It is checked by default.
- Appendix A explains this filter's effects on EEG timing and EEG averaging.

MFF Conversion. When converting older files to EGI's latest .mff file format (version 3), save a backup of the original file and convert the copy. See section 4.4.

Sampling Rate. To ensure millisecond delivery of DIN inputs to the amplifier when using any DIN device, such as a photic stimulator or external signal device, you must set the sampling rate to **1000 s/s**. See section 6.3.6.3.



CAUTION: Do not change the sampling rate after streaming is on; otherwise, drift errors will occur.

Video Cameras. When recording video, the system does not automatically detect the specific camera that is attached, only that a camera is attached. Before a recording session, you

must select the camera and video source. You select the video source (Ethernet, USB, or none) with the Acquisition Preferences dialog and the specific camera with the Video viewer. See sections 6.1 and 6.2.2.1.

Appendix C: Net Station's Tools

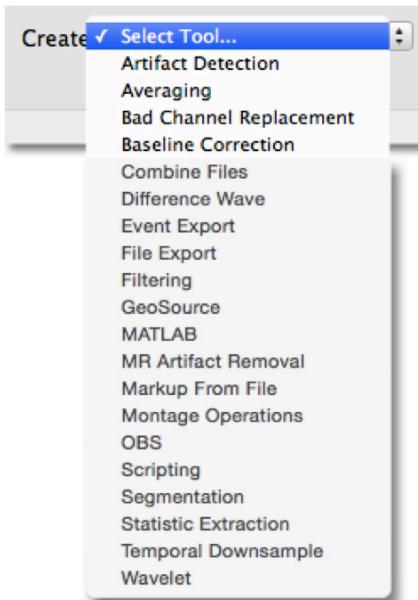
Net Station's tools allow you to run various signal-processing operations on your EEG data.

Note: EEG data must be in EGI's latest .mff file format.

Tools can be run singly or in series. When run in series, many tools output a form of the data that is used as the input of a next tool.

Most of the tools provide default parameters that you will want to change for your specific purposes.

All tools work only on data from good channels.



To specify new tools, in general:

1. Open **Net Station Tools**.
2. Select a **tool**.
3. Name the new tool and set the output options.
4. Accept the tool's defaults or customize the tool's settings.
5. Click **Create**.

Common Tools

The following tools are useful for various signal-processing operations on your EEG data. For research-only tools, see section “RESEARCH ONLY fMRI Tools” later in this appendix.

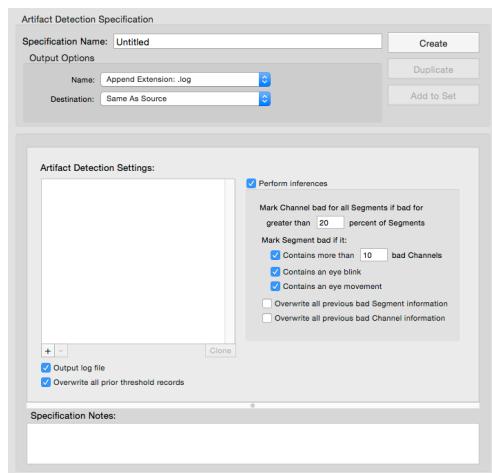
For additional details or white papers related to any of the tools, contact EGI Technical Support (Table P-1).

Artifact Detection

The Artifact Detection tool automatically detects and marks *bad channels* and *bad segments* in a file.

Additionally:

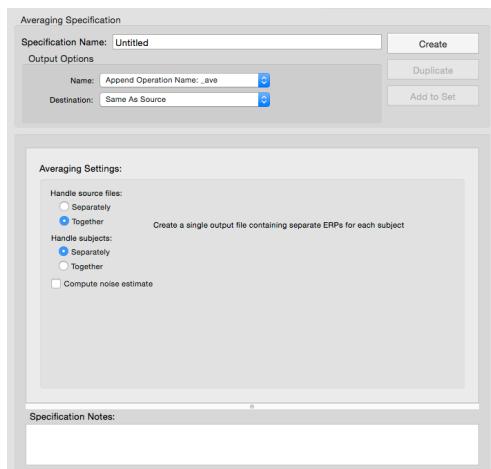
- This tool can be run on any Net Station .mff segmented or averaged file.
- This tool does not produce an output file.
- Bad channels in good segments are replaced when you run the Bad Channel Replacement tool.
- Bad channels in bad segments are not replaced but rather are automatically excluded when you run other tools.



Averaging

The Averaging tool performs both *averaging* and *grand averaging*.

- **Averaging.** When averaging, the tool calculates a single, average segment from all of the segments that were *not marked as bad*, for each category created during segmentation. Depending upon your selections, you will output a single or multiple files.
- **Grand Averaging.** When grand averaging (selecting *Together* for handling both source files and subjects), the tool averages all of the individual participant ERPs to create a cross-participant ERP. All of the files in this case must then have the same sampling rate.
- **How Different.** Grand averaging emphasizes the ERP patterns shared by all of the participants and deemphasizes individual differences. You should use non-baseline-corrected data for grand averaging so that you can understand the effects of baseline correction on your grand-average ERPs.
- **Different Settings.** In the settings, the *Separately* setting creates an averaged file that allows you to view individual participant data. The *Together* setting creates a grand average file. The pane to the right of the settings tells you what type of



files you are creating based on your mix of *Separately* and *Together* settings.

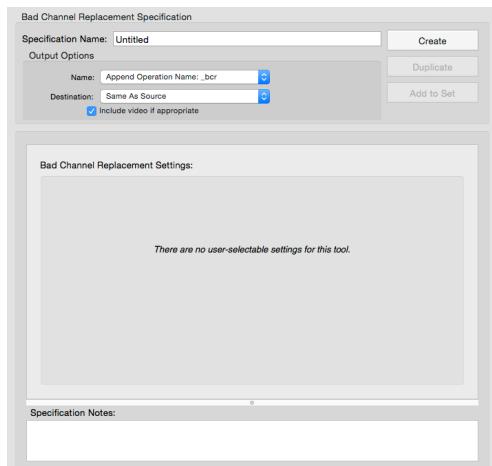
Additionally:

- This tool can be run on any Net Station .mff segmented or averaged file.
- This tool outputs to a Net Station .mff averaged file.
- This tool copies events from the first segment in the first file in the source list. Be aware that the list is reordered alphabetically each time a new file is added.

Bad Channel Replacement

The Bad Channel Replacement tool replaces the bad channels (in good segments only) detected manually or by the Artifact Detection tool with data interpolated from the remaining channels and deactivates the bad channel status.

Note: Bad channels in bad segments are not fixed by this tool.



The Bad Channel Replacement tool never perfectly re-creates a channel. The resulting waveform is only an **approximation** of the signal that was present at that location on the scalp during recording. Because reconstructing a bad channel is an approximation of the actual missing data, it is limited by the spatial frequency of the electrode system and the spatial frequency of the underlying signal. A channel reconstructed

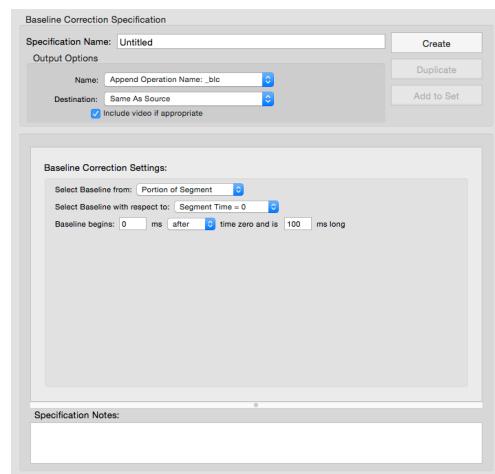
from 64-channel data will be less accurate than one reconstructed from 128-channel data, if sufficiently high spatial frequencies are present.

Additionally:

- There are no customizable parameters for this tool, other than its name, appended filename, and file destination.
- This tool can be run on any Net Station .mff file containing marked bad channels (marked either by the Artifact Detection tool or manually in Review).
- This tool outputs to the same format as the input file.
- The bad channel replacement algorithm operates on good segments only. For each good segment, it replaces every sample of every channel that is bad for that segment with data interpolated from the remaining channels. It uses spherical splines as the interpolation method.

Baseline Correction

The Baseline Correction tool establishes a new zero-voltage value based on a *baseline interval* that you select within the segment. The baseline interval could be a portion of the segment or the entire segment.



-
- For stimulus events, the baseline interval normally precedes the stimulus.
 - For each channel, the average of all the samples within the baseline interval is subtracted from every sample in the segment.

Additionally:

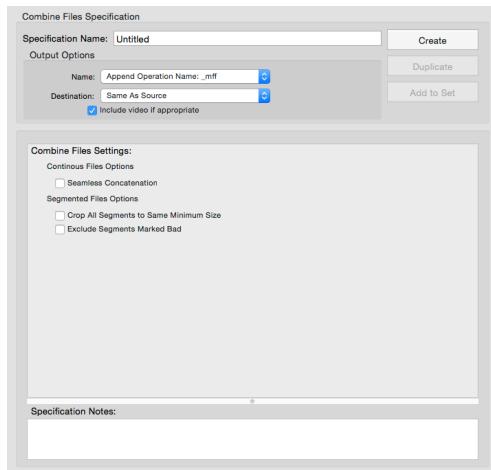
- This tool can be run on any Net Station .mff segmented file.
- This tool outputs to a Net Station .mff segmented or average file.

Combine Files

The Combine Files tool organizes the segments in a data file.

Options:

- Preserves/removes segment breaks
- Crops all segments to the same size
- Excludes bad segments



Seamless Concatenation.

When selected, this feature removes segment breaks from the output file. When unselected, this feature preserves segment breaks in the output file.

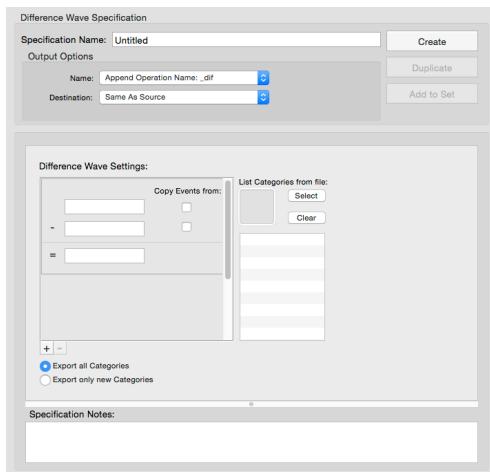
Crop All Segments to Same Minimum Size. When selected, all segments and epochs are cropped from the end until they are the same length as the shortest segment or epoch.

Exclude Segments Marked Bad. When selected, all segments and epochs that are marked as bad will be excluded.

Difference Wave

The Difference Wave tool, based on the *subtractive method*, creates new output categories that are the difference between the input categories you specify.

- If there is more than one segment in each category, then each segment is subtracted.
- If categories are of different lengths (for example, segment number and size), then the tool skips that category and issues a warning that a problem has occurred.



Additionally:

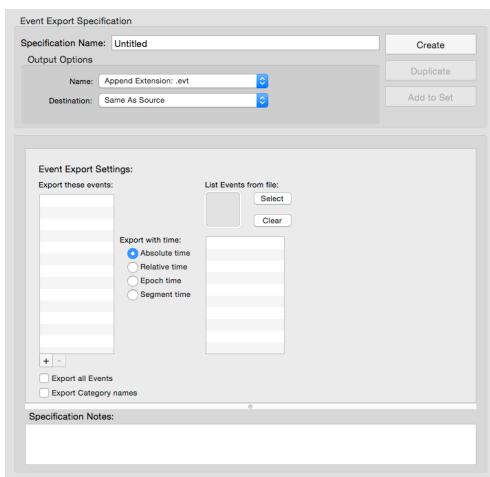
- This tool can be run on any Net Station .mff segmented or averaged file.
- This tool outputs to the same format as the input file.
- The subtractive method is a common psychological research technique based on the assumption that:
If two experimental conditions differ in only one psychological process, and the difference between these two conditions is taken, then common processes will be eliminated and the unique process will be preserved.

- Neuroimaging researchers use the subtractive method to reveal the brain area(s) involved in an isolated psychological process. However, designing experimental conditions that differ in only one process is not entirely easy. You should always inspect the original waveforms to understand the difference waveform. The experimental conditions can differ in just one psychological process, and this difference may be associated with one or more unique ERP components. However, this psychological difference may also lead to latency differences in shared ERP components. The latency differences will distort the difference waves and may lead to spurious ERP components.

Event Export

The Event Export tool creates an ASCII file of all the events from the source data. Event information is displayed in a spreadsheet that is similar to the Net Station Event List.

Remember that there can be any number of event tracks in an EEG file:



- First, those entered via TCP/IP.
- Second, those entered via the Markup From File tool.
- Third, those entered manually via Net Station Review.
- And so on ... like those entered by the Segmentation Markup tool (under the Segmentation tool), when another form of the event code names is needed by another program.

Additionally:

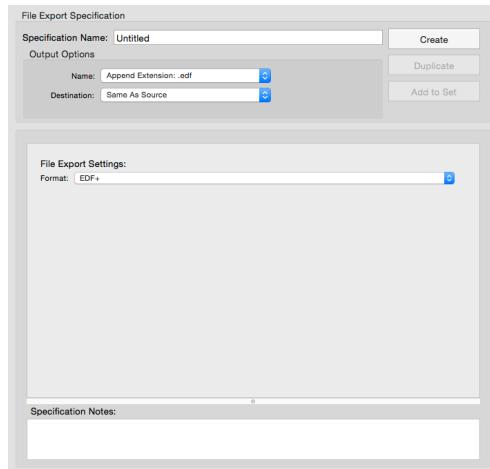
- This tool can be run on any Net Station .mff file.
- You can use this event file with custom programs or other applications.
- You export your EEG data file to a Microsoft Excel spreadsheet that itemizes your events; you manipulate the events as needed; and, then you add those changes back into your EEG data file using the Markup From File tool.

File Export

The File Export tool creates tools to export data to a variety of formats. There are different parameters to set for the different export formats.

Additionally:

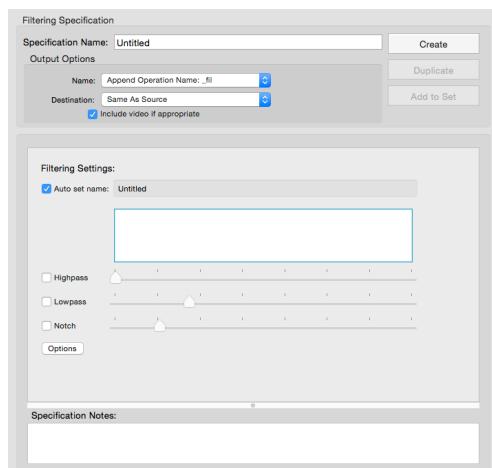
- This tool can be run on any Net Station .mff file.
- You can export to a variety of formats, including: EDF+ (.edf), MATLAB (.mat), metadata (.txt), Net Station Simple Binary (.raw), Persyst (.lay), and tab-delimited text (.txt).



Filtering

The Filtering tool lets you filter out activity in frequencies that are not of interest.

- **Highpass.** Attenuates frequencies below the specified frequency, while passing frequencies above the specified frequency.



Note: Frequencies at or below 1 Hz are IIR filters, while frequencies above 1 Hz are FIR filters.

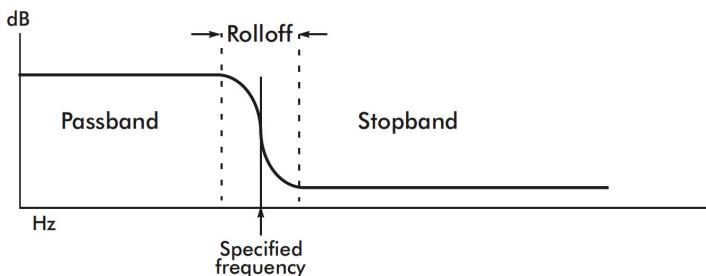
- **Lowpass.** Attenuates frequencies above the specified frequency, while passing frequencies below the specified frequency.
- **Notch.** Attenuates frequencies in a narrow band around the specified frequency, while passing frequencies outside the band. The notch filter is primarily used to filter out 50 Hz (most countries) or 60 Hz (United States and some regions) line noise.

To further refine the settings of the highpass, lowpass, and notch filters, there are optional passband gain, stopband gain, and rolloff settings. Click **Options** to access them.

- **Passband gain.** Controls the amount of the signal that the filter retains in the passband (that is, the frequency range in which the signal is to be retained). For example, a passband gain of 0.1 dB results in approximately 98.86% of the signal being

retained, whereas a passband gain of 1.0 dB results in approximately 89.13% of the signal being retained.

- **Stopband gain.** Controls the amount of the signal that the filter attenuates in the stopband (that is, the frequency range in which the signal is to be attenuated). For example, a stopband gain of 40 dB results in 99% of the signal being attenuated, whereas a stopband gain of 20 dB results in 90% of the signal being attenuated.
- **Rolloff.** Controls the frequency range of the transition band (that is, the frequency range in which the filter transitions from retaining the signal to attenuating it). Rolloff is typically measured in Hertz (for example, from 10 to 11 Hz).



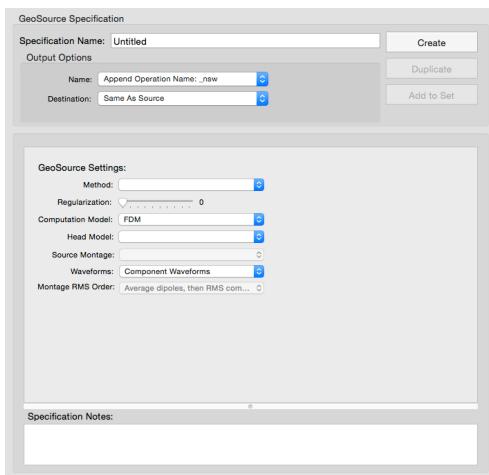
Additionally:

- This tool can be run on any Net Station .mff continuous file.
- This tool outputs to the same format as the input file.

GeoSource

The GeoSource tool allows you to easily visualize and explore source activations represented in MRI and waveform views. These comparative source estimations allow you to draw educated conclusions.

For details, refer to the GeoSource manual (8103101).



Additionally:

- This tool can be run on any Net Station .mff file.
- This tool outputs to a Net Station _nsw.mff file, which is a different form of the data.

Note: The .mff file is the scalp potential EEG form of the data, while the _nsw.mff file is the current source results form of the data.

The solutions provided by GeoSource are *approximations* of the locations of sources that are responsible for generating the EEG that is recorded at the scalp. It is a good idea to use GeoSource solutions from different source-imaging specifications in conjunction with other EEG tools and the results from other imaging modalities to determine if the solutions are consistent with the recorded data.



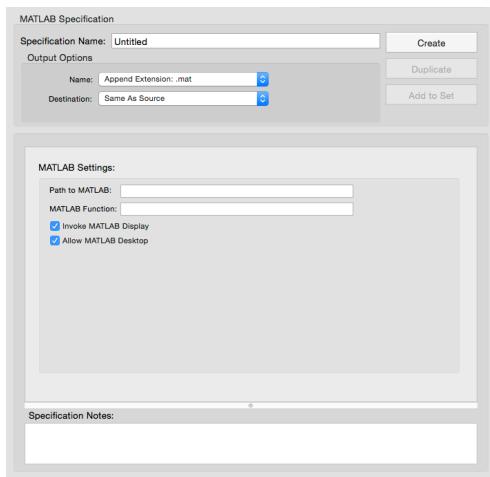
WARNING: Source estimation refers to methods that are employed for estimating the current sources of scalp recorded EEG. There are two classes of methods: linear and nonlinear. Each class employs different approaches to source estimation, which is an ill-posed problem. In the nonlinear class are methods that employ equivalent dipoles, and in the linear class are methods that employ different constraints applied to a minimum norm solution. Because source estimation is an ill-posed problem, there are no unique

answers. Therefore, estimates of current sources from scalp recorded EEG data, whether they are derived from linear or nonlinear techniques, are approximate, and should always be viewed in the context of the scalp data by a trained reviewer.

MATLAB

The MATLAB tool allows you to run MATLAB functions on your EEG data from out of Net Station one of two ways. Either way, the results will come out of MATLAB.

The Path to MATLAB field is where you type the actual path to MATLAB on your computer.



The MATLAB function entered must be one of MATLAB's recognized functions.

- **With the EGI MATLAB MFF API:**

For example, after filtering and segmenting the data, you input the .mff file into the MATLAB tool, and then Net Station calls up MATLAB and MATLAB runs the set function on the file via the API.

- **Without the EGI MATLAB MFF API:**

For example, after filtering and segmenting the data, you export your file (using the File Export tool) as a .mat file, input that .mat file into the MATLAB tool, and then Net Station calls up MATLAB and MATLAB runs the set function on the file.

Additionally:

-
- This tool can be run on any Net Station .mff or .mat file, depending upon whether or not you are using EGI's MATLAB MFF API.
 - This tool outputs to a MATLAB readable format.

Markup From File

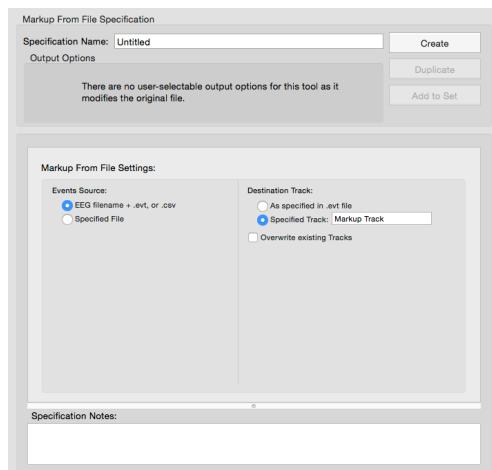


CAUTION: This tool will change the original file—it does not generate a new file. Always make a copy of a file and run this utility on the copy.

The Markup From File tool uses an ASCII text file (created by the Events Export tool) to add events to a Net Station file.

Additionally:

- This tool can be run on any Net Station .mff file.
- This tool does not produce an output file—it modifies the current input file.



Required Mark-up Event Formats

To add mark-up events to a Net Station EEG file using the Markup From File tool, the mark-up events must be in one of three formats:

Note: The time formats of data and mark-up events must be the same in order to apply the Markup From File tool. If they are not, you may get an error message in the Results pane.

-
- **Event Export file.** This is an ASCII text file of all events from your data—it is created by using the Event Export tool.

Note: All events includes those manually marked during acquisition and review as well as those marked via TCP/IP, DINs, Segmentation Markup, and Markup From File.

For Markup From File, the events must be exported in either Relative or Epoch Time timing.

- **Persyst CSV file.** This is a comma-separated value format. The general CSV file format is used to exchange data between disparate applications. Each record is a line and each field is separated by a comma. For details, refer to Persyst's documentation.

For Markup From File, the time format for the mark-up events must be in milliseconds from the beginning of the recording.

- **Markup From File format.** This is a tab-delimited format, which requires that you create an ASCII text file and write your own code to add mark-up events to a Net Station file based on the results of a separate event-generating program, such as an eye tracker.

For Markup From File, the time format for the mark-up events must be in milliseconds from the beginning of the recording.

Required Coding Conventions

When adding events, marking channels good or bad, or marking segments good or bad, adhere to these conventions:

- Angle brackets <xxxx> are used to indicate user-entered information.
- The angle brackets are not part of the code. So, do not include them.
- Any item not enclosed by angle brackets is mandatory.

Adding Events

To add a mark-up event, your code should contain a line that includes:

- the time of the event (in milliseconds from the beginning of the recording)
- a tab space
- the four-character code of the event

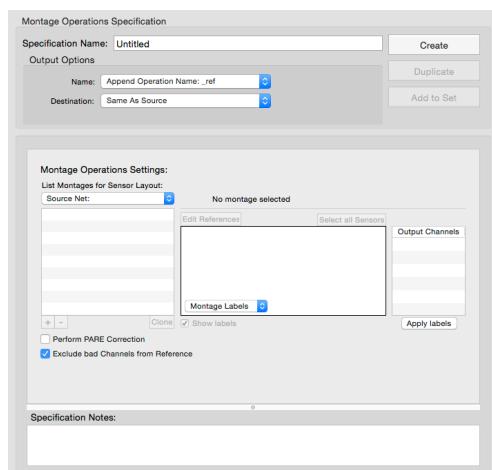
Task	Code	Example
Add a mark-up event at a specific time point in milliseconds from the start of the recording.	<time><tab><4-char. code>	60000 eyeb Marks an eye blink 1 minute from the start of the recording.

Montage Operations

The Montage Operations tool creates a montage containing a specified reference and a subset of channels. Montages modify files as follows:

- Data can be rereferenced, if set to.

- Spatial downsampling of the data can result.



If the tool's number of channels is fewer than the number of channels in the input file, the output file will contain only those channels specified by the tool.

Additionally:

- This tool can be run on any Net Station .mff continuous, segmented, or averaged file.
- This tool outputs the same format as the input file.
- This tool rereferences your data. You can rereference your data to any channel or to the average of any set of channels. Average referencing means rereferencing your data to the average of all the channels. When you average reference your data using the Montage Operations tool, you have the option of using a PARE-corrected average reference.
- In general, EGI recommends doing an average reference or a PARE-corrected average reference.
- When comparing your data with another's data, you should use the same reference for the purpose of comparison.

Rereferencing

EEG is a measure of voltage, and voltage measurements are inherently differential. In other words, any voltage measurement is really a measurement of the difference in potential between the site being measured and a reference site that is assumed to have a value of zero. In actuality, any choice of reference is arbitrary. There is no site that can be assumed to have a value of zero, and, to make matters worse, there is no site that can even be assumed to have a constant value from one timepoint to the next.

The objective of rereferencing EEG data is to estimate a true, *nonarbitrary zero value* to which to reference the voltage measurements.

Polar Average Reference Effect (PARE)

There are several reasons to believe that, at any given time, the average over every point on the surface of the body (the surface integral) would represent such an ideal reference value:

-
- If you assume, as many researchers do, that neural sources are dipolar (at practical distances from the sources), then positive and negative fields will sum to zero. Regardless of how many sources are active, if the entire surface of the volume is measured, assuming homogeneous conductivity, the surface integral will therefore be zero.
 - Even if you don't make the preceding assumption, the surface integral will be zero because of the conservation of charge inside an electrically neutral body.

As channel counts increase, the average of all the channels better approximates the surface integral and, therefore, the ideal zero reference value. To eliminate the influence of the arbitrary recording reference channel and use instead a reference that approximates the ideal zero reference, many researchers prefer to rerefence their data to the average reference.

However, if the head surface is unevenly sampled, then the average reference is biased toward the region that is sampled. This is known as the polar average reference effect (PARE). For example, if the electrodes are concentrated on the top of the head, and inadequately sampled on the undersurface, then the average reference is biased toward the top of the head. Even with EGI's dense array Geodesic Sensor Nets, the entire head surface cannot be adequately sampled (the underside is still not sampled). Therefore, there will always be a PARE when using the average reference.

One solution to this problem is to use a PARE-corrected average reference. The PARE-corrected average reference is computed from the entire surface of the head, including the surface not covered by electrodes. Spherical spline interpolation is used to estimate the voltages of the surface that is not covered. For more information on PARE, see the following:

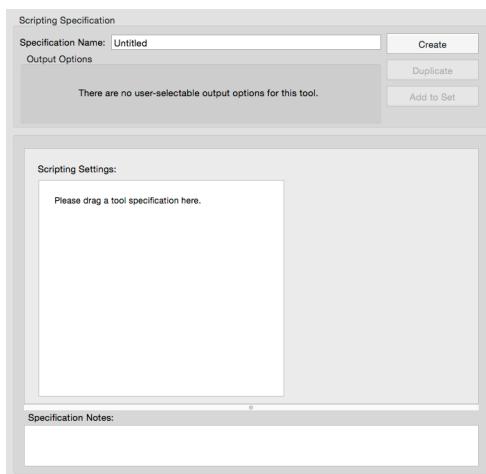
Junghoefer, M., Elbert, T., Tucker, D.M., & Braun, C. (1999). The polar average referenced effect: A bias in estimating the head surface integral in EEG recording. *Electroencephalography and Clinical Neurophysiology*, 110, 1149–1155.

Scripting

The Scripting tool chains the operations of other tools together in order to automate data analysis.

Note: The Scripting tool has been run successfully on up to 30 input files.

After specifying individual tools and ordering them according to your data analysis path, the Scripting tool can run them in order.



The output of most tools becomes the input for the next tool specified in the script.

Note: The Averaging tool can process multiple input files to generate a single output file. In a script, the Averaging tool will accumulate all of the input files first, before generating the output file.

Additionally:

- This tool does not operate directly on a Net Station .mff file.
- This tool does not produce an output file.

Incorrect Scripting Specifications

It is possible to incorrectly specify Scripting tools. The Scripting Specification editor will notify you of some errors during setup, but

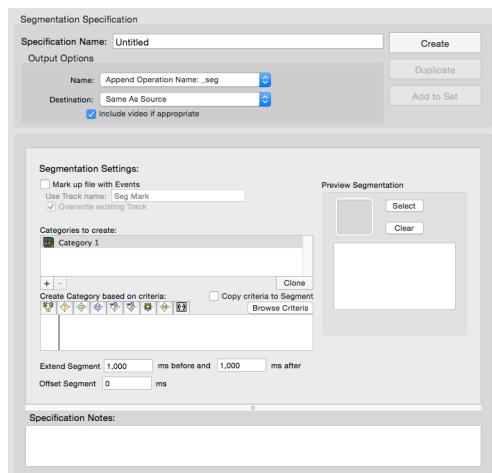
some specification errors are only revealed when you attempt to run a tool.

- If you set up a script to export a file to a format that is not supported for import by another tool and then try to perform another operation on the file, the Scripting Specification editor generates an error message during the scripting session.
- If a Scripting tool is set up to run a Segmentation tool followed by an Averaging tool, and the Segmentation tool's output happens to contain no segments, averaging cannot be done. In this case, Net Station generates an error when you run the script.
- If a Scripting tool is set up to run a Filtering tool followed by an Averaging tool, and continuous data are supplied to the Filtering tool, the Averaging tool will fail because it requires segmented data. This error can be detected only at run time because the Scripting Specification editor cannot know ahead of time what type of data will be supplied.

Segmentation

The Segmentation tool specifies parameters for segmentation and segmentation markup.

- **Segmentation.**
Breaks a continuous recording into event-locked epochs (called *segments*) based on a set of



selection rules and user-defined criteria. The purpose of segmentation is to organize your data into categories so that you can average them or perform other operations on them.

- **Segmentation Markup.** Places event markers into EEG data to locate segments, but unlike segmentation, you do not segment the data or generate an output file. Segmentation markup allows you to extract data from the Net Station key lists to a form suitable for export into other applications that do not support key lists. In most applications, events have only names—they contain no key lists. After segmentation markup, you can perform segmentation in these other applications. Also see the Event Export and Markup From File tools.

Additionally:

- This tool can be run on any Net Station .mff continuous, segmented, or averaged files.
- For segmentation, this tool outputs to a segmented Net Station file.
- For segmentation markup, this tool outputs an edited input file.

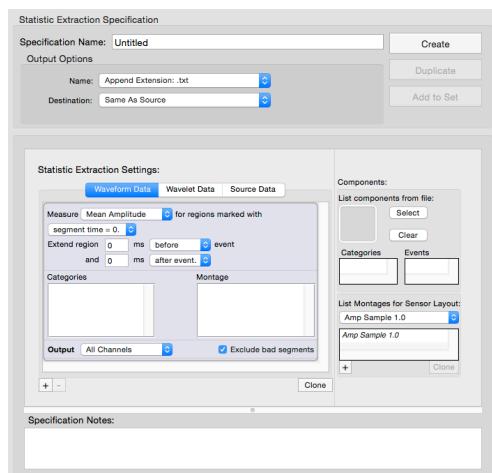
Markup Example

In Net Station, all the stimulus events might be named ***stim***. The distinction between *standard* and *target* stimuli cannot be determined from the event name—it can be determined only from the key lists. Segmentation markup allows you to create new events, at the appropriate locations, called *targ* and *stnd*. You can segment on these events in other applications.

Statistic Extraction

The Statistic Extraction tool extracts data to a text file to be used in external statistical applications.

To do this, you run the Statistic Extraction tool on a multiparticipant averaged file, and then import the output into a statistical software package (such as SPSS or JMP) for analysis.



Additionally:

- This tool can be run on any Net Station .mff averaged or segmented file.
- Before extracting data from a file, make sure that a participant has been assigned.

Data Types

The Statistic Extraction tool operates on the following data types:

- **Waveform data.** This is the scalp data (in microvolts) that was acquired with EGI's Geodesic EEG System.
- **Source data.** This is the cortex data (in nano-amp meters) derived by using EGI's GeoSource software.
- **Wavelet data.** This is the joint time-frequency information produced when you run a Wavelet tool on your data.

Parameters Needed

The Statistic Extraction tool needs you to specify the following parameters:

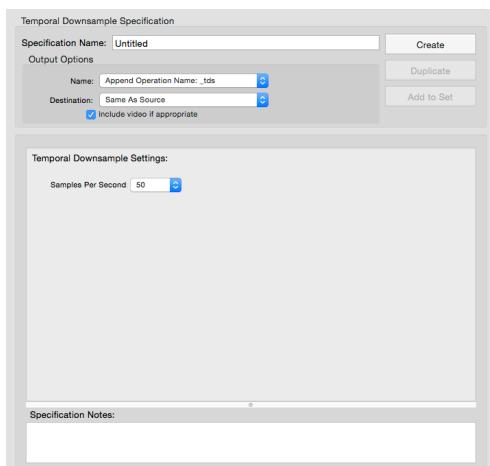
- a time window
- a measure (mean amplitude, adaptive mean, minimum amplitude, maximum amplitude, or latency)
- how the measure is to be reported for each channel group
- one or more categories
- one or more channel groups

Note: Specify a channel group using montages, which have to be using the same sensor layouts as the input file.

Temporal Downsample

The Temporal Downsample tool lowers the sampling rate of data in a file.

This tool allows you to oversample EEG data during a recording, and then later lower the sampling rate to reduce file size. It also allows you to process files with different sampling rates by resampling them to the same rate prior to analysis.



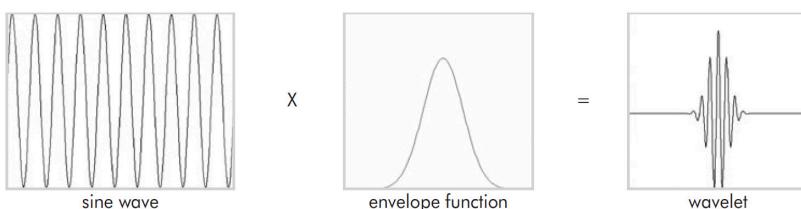
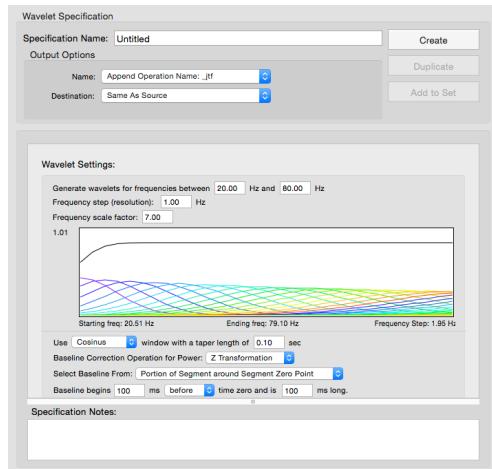
The process of downsampling involves filtering the data to remove frequencies above the nyquist to avoid aliasing the data. Due to this

filtering, this tool cannot be used on files containing segmented or averaged data.

Wavelet

The Wavelet tool decomposes the EEG signal into its temporal and frequency components, using a scale-varying basis function—the wavelet.

Net Station uses the Morlet wavelet, which is created by multiplying a sinusoidal wave by a Gaussian envelope, resulting in a small wave that oscillates with varying amplitude within a finite period, concentrating its energy around a point in time.



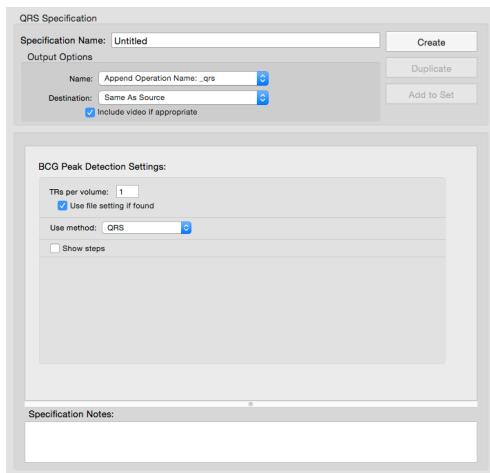
Additionally:

- This tool can be run on any Net Station .mff segmented or averaged file.
- This tool outputs to a Net Station _jtf.mff file.

RESEARCH ONLY fMRI Tools

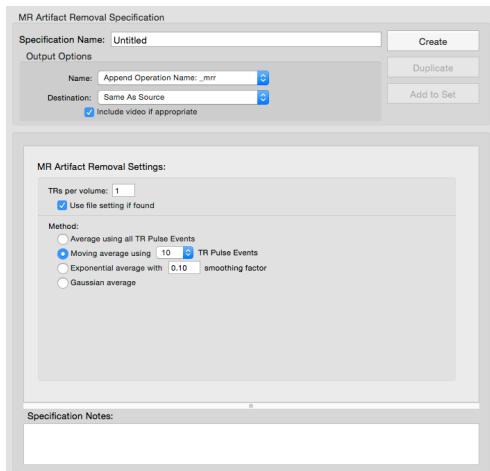
BCG Peak Detection

The BCG Peak Detection tool detects and marks the R peaks of the QRS compounds in an ECG signal (from QRS, Niazy et al. 2005) or the onset of the BCG artifacts (from EEG, Iannotti et al. 2014). These makers are time locked to the BCG artifacts and will be used for removing the BCG artifacts in the OBS tool.



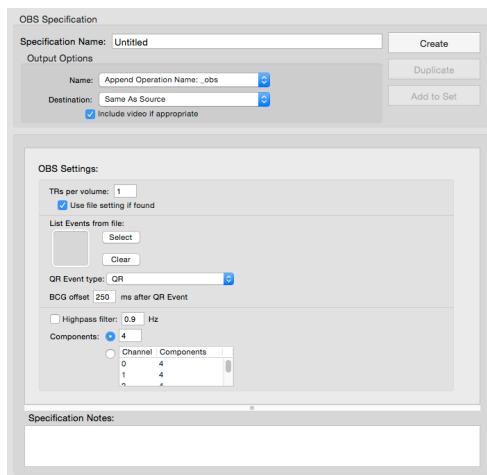
MR Artifact Removal

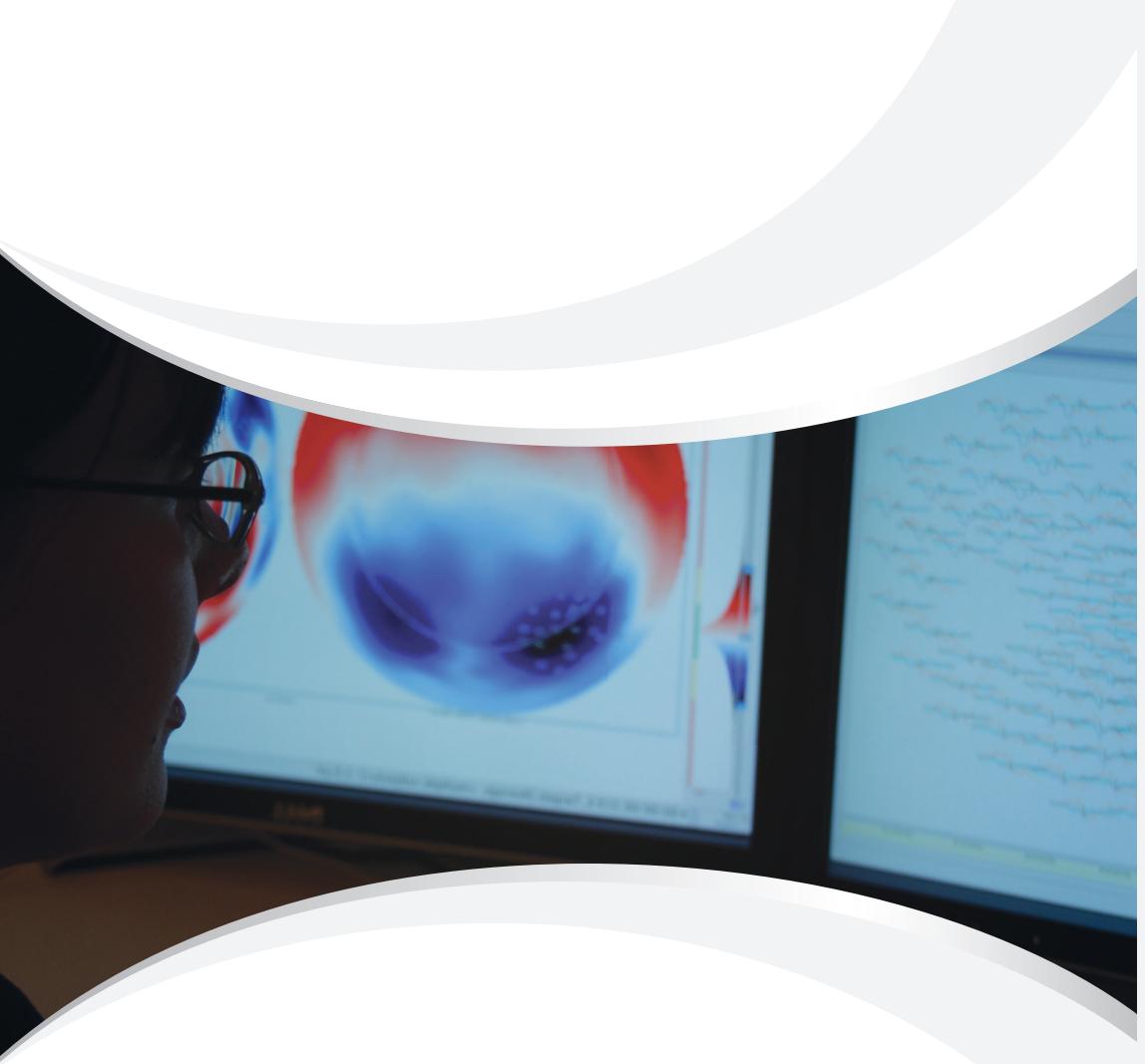
The MR Artifact Removal tool removes the gradient artifacts in the EEG data that are collected from the MRI scanner. It is based on the template subtraction method.



OBS

The OBS tool is based on the optimal basis sets (OBS) algorithm developed by Niazy et al. (2005) for removing BCG artifacts. It is mainly a principal component analysis (PCA) followed by the creation of a set of basis functions that describe the temporal variation of the artifacts, and then removes these artifacts.





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