Cliniscan EEG Clinical Decision Support System

User Manual

Cliniscan, a Picofemto product, is a clinical decision support system for medical metadata, including, but not restricted to, EEG, ECG and medical imaging. This user manual addresses the Cliniscan EEG Clinical Decision Support System accessible via http://cliniscan.picofemto.com. CliniScan

Overview and Key Terms

Understanding the terms CliniScan uses to refer to various features of the product will assist you in using it successfully. The following are the most important such terms:

- **Data Store**: A data store is a collection of uploaded files. A data store can contain multiple file types, although the primary supported file type at the moment is EDF+. In order to analyze files, they are first uploaded into a data store.
- **User Group**: This is a grouping of users. Objects in CliniScan are associated with a user group and this association determines whether or not a file or analysis can be seen by other users. A user can be in more than one user group
- **Data Analysis**: A data analysis is a process that analyzes one or more data files and produces a an output result.
- **Visualization**: One a series of files has been analyzed, it appears in the data analysis listing. From here it can be visualized. A visualizer is a custom interface that allows the user to explore the results of a data analysis

Icons Used Throughout The Site

- ▤ -This icon indicate that clicking on it will provide a drop down menu of actions to perform
- ☑ - This icon indicated that clicking on it will allow you to view or edit the target object
- ⬇ - This icon indicated that clicking on it will allow you to download the target item
- ⚡ - This icon indicated that clicking on it will allow you to launch a visualizer to examine the output of a data analysis
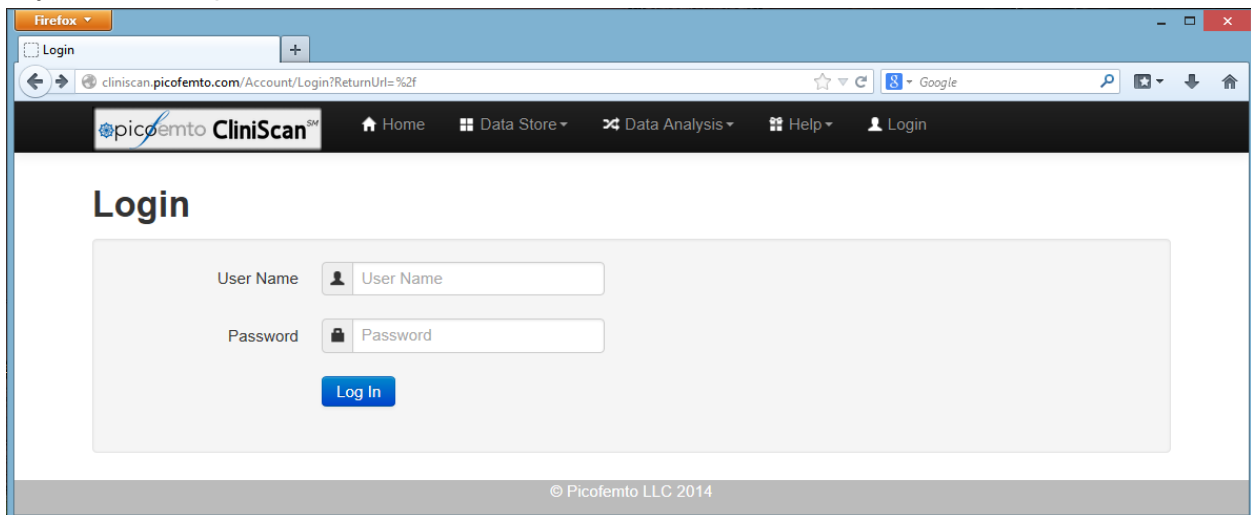
Process Overview

The standard process for analysing data in the CliniScan system is as follows:
1. Upload the source data to a data store
2. Create a new data analysis and select the source data, following the instructions provided for the analysis type
3. Wait until processing is finished
4. Find the analysis in the analysis listing, and select the appropriate visualizer to view the results.
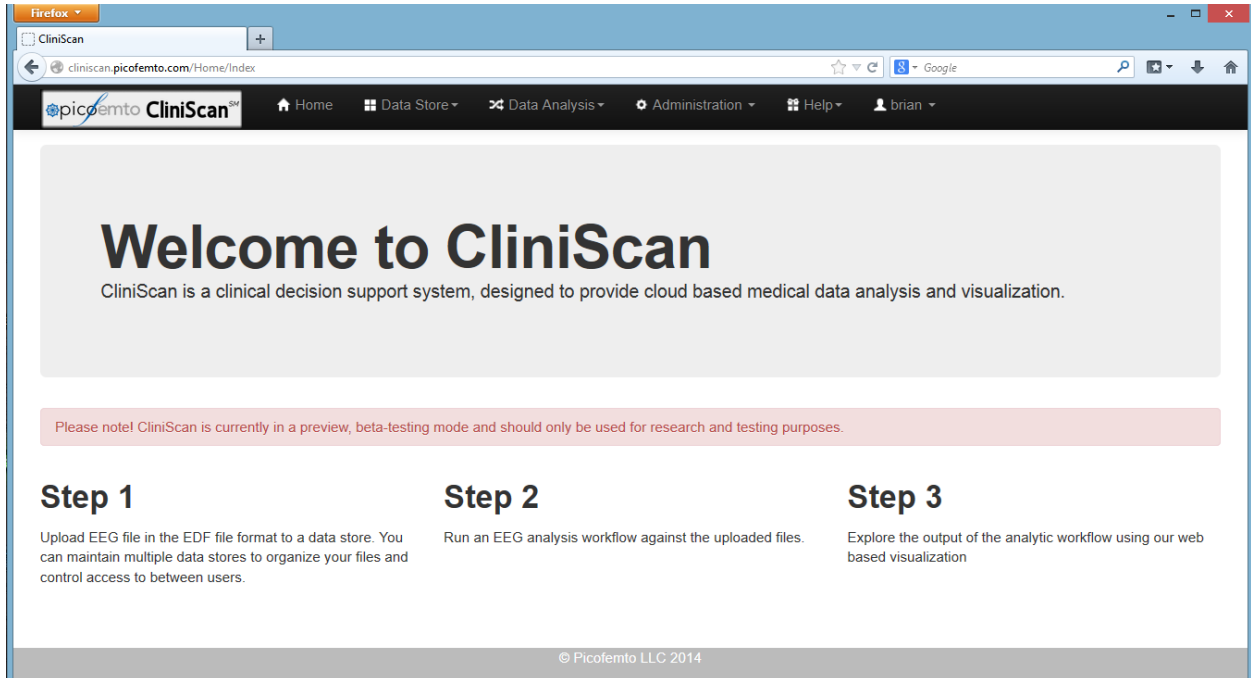
Log in

You will be provided with a username and password for this beta version. You must log-in before any actions are performed on the site.
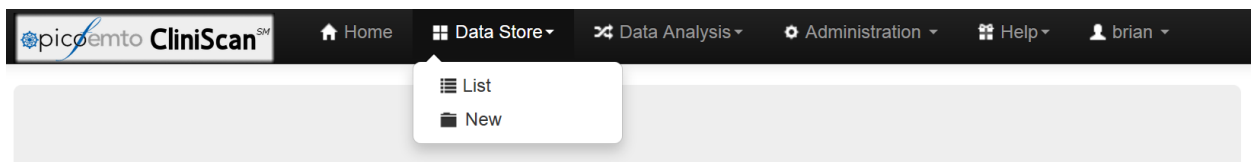

Home Screen
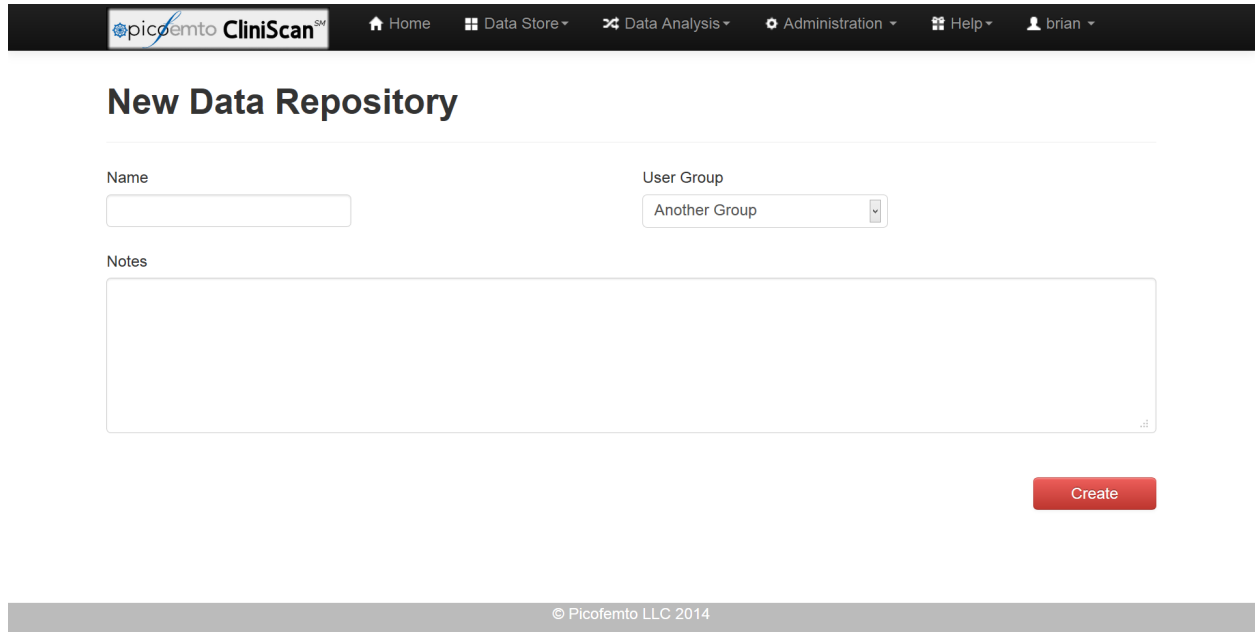
Navigation Bar
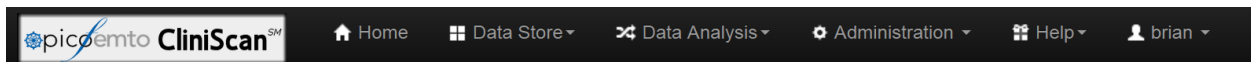
The navigation bar outlines all the actions that can be performed in the CliniScan system that your user has the permission to perform.

Data Store

The data store menu provides the option to view a list of existing data stores, or to create a new data store. Typically new data stores are created to logically separate groups of files or to provide different security levels for certain files, as a data store can hold a large number of files.

When selecting to create a new Data store, the following menu appears, with options on to name the type of store. The user group indicate which users of the site can see this data store and the files contained in it.

When viewing a list of existing data stores, click on the data store name or the edit icon on the right to view the details of the data store.

Data Repositories

<div style="text-align:right">Create New Data Repository</div>

| Key	File Count	Group	Created At ⌄	Created By	
Bill's Repository	4	Billy Bob Branch Plant	02/28/2014 10:44 PM	Bill	☑
Repsoitory B	0	Billy Bob Branch Plant	02/28/2014 10:41 PM	Billy.Bob	☑
Repository A	0	Billy Bob Research	02/28/2014 10:41 PM	Billy.Bob	☑
Sample Store For Sri	5	Sri's Data	02/27/2014 06:06 PM	Brian	☑
EDF+ Type	2	Picofemto Admin Users	02/25/2014 07:14 PM	Brian	☑
NewFeb14Store	1	Picofemto Admin Users	02/25/2014 04:44 PM	Brian	☑
test	26	Picofemto Admin Users	12/16/2013 03:39 PM	Brian	☑
Neuro_Demo_1	14	Picofemto Admin Users	11/04/2013 05:30 PM	Cxi	☑
dk_test	5	Picofemto Admin Users	11/04/2013 04:59 PM	Brian	☑
Store Alpha	495	Picofemto Admin Users	09/30/2013 05:25 PM	Brian	☑
Sample Store	60	Picofemto Admin Users	09/30/2013 04:59 PM	Brian	☑
Demo Data Store	693	Picofemto Admin Users	09/18/2013 12:54 PM	Brian	☑
Sample Data Store	901	Picofemto Admin Users	09/09/2013 01:01 AM	Brian	☑
20130904-620e56b	1	Picofemto Admin Users	09/04/2013 07:53 PM	Brian	☑
20130904-2111b16	1	Picofemto Admin Users	09/04/2013 07:41 PM	Brian	☑
20130904-9c02744	1	Picofemto Admin Users	09/04/2013 07:39 PM	Brian	☑
20130904-043fb26	1	Test Client 001 Admins	09/04/2013 07:16 PM	Brad	☑
20130904-ffbdf4a	1	Picofemto Admin Users	09/04/2013 07:06 PM	Brian	☑
20130904-bc6c683	0	Picofemto Admin Users	09/04/2013 07:04 PM	Brian	☑
20130904-5dfcdc5	0	Test Client 001 Admins	09/04/2013 06:59 PM	Brad	☑
20130904-bc087e3	0	Picofemto Admin Users	09/04/2013 06:59 PM	Brian	☑
20130904-fb944e8	0	Picofemto Admin Users	09/04/2013 06:58 PM	Brian	☑

Data Analysis

The data analysis menu provides the option to view a listing of complete or in progress data analyses or to initiate a new analysis.
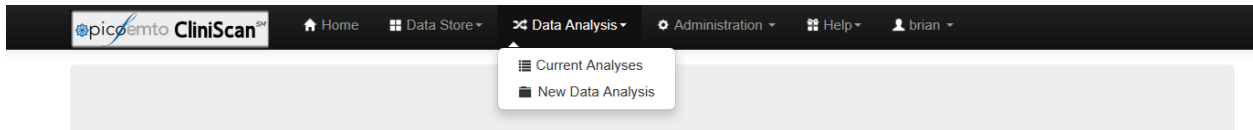
Create New Data Analysis Workflow

When creating a new analysis, you a required to give the analysis a name, in order to be able to identify it later. In addition, you should select the type of analysis you wish to perform and the user group that will be able to view the analysis results. Based on the analysis type, you will be prompted to select one or more files to be processed.

View a list of Data Analysis

When viewing a list of data analysis, you can search through all processing or completed data analysis. Clicking on the name of the analysis will take you to the detailed status page for the analysis while click on the actions link for an individual analysis will provide you an option of actions to perform.

Analysis Details

The analysis details page shows the basic information about the data analysis, including the name, the type of analysis, and any notes entered when creating the analysis.

Analysis Status

The data analysis status page provides details of the progress of analysis that are currently

processing and a log of actions performed during analysis for completed analysis.

Visualizer Selection

The visualizer selection screen allows the user to select a visualizer to view the results of an analysis. Several visualizers may apply to a given analysis result, so a listing is shown with a description of each visualization. Clicking on the appropriate visualization button will take you to the visualizer page.
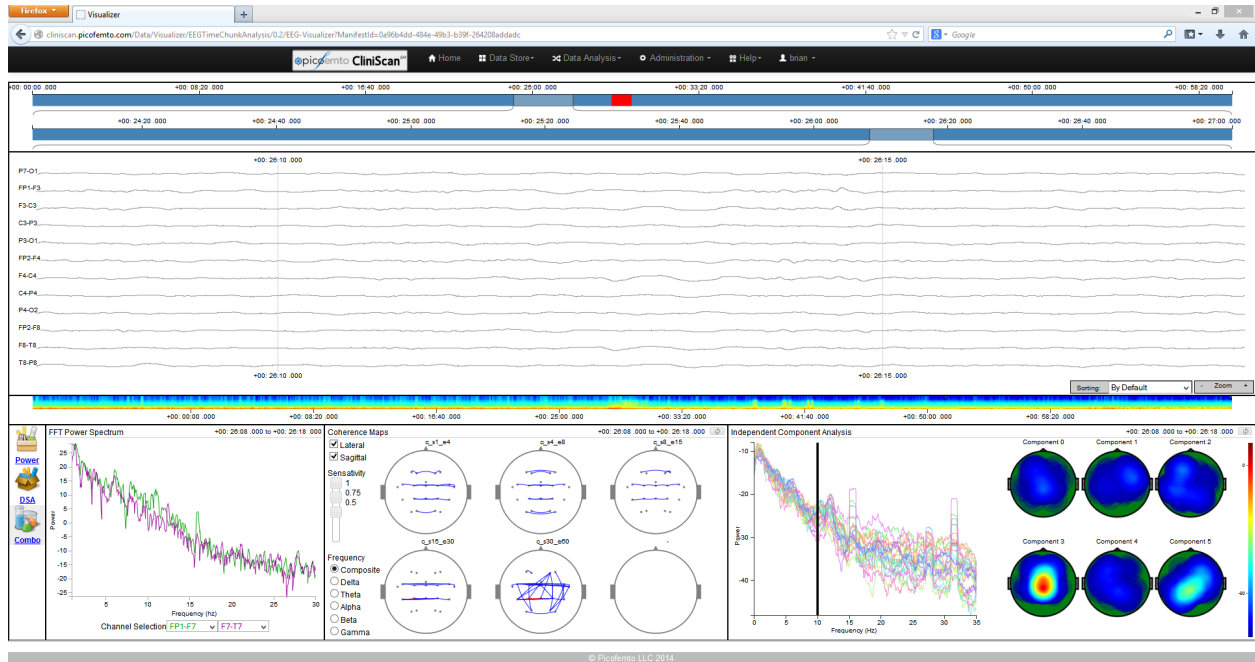
Visualizer

The Cliniscan EEG visualizer in full screen mode allows for eeg analytic data to be displayed with a dashboard feel. The screen is arranged in three sections: the Time bar, the wave display and the analytic toolbox. The tools from the analytic toolbox are arranged in preconfigured bundles accessible at the bottom left pane of the screen. The first analytic tab is Power, showing Fast Fourier Transforms of any two channels simultaneously and decomposition of any channel into frequency subbands. The second tab accesses the Density Spectral Map and the third is a combination of FFT Power Spectrum, Coherence and Independent Component Analysis.

Time bar
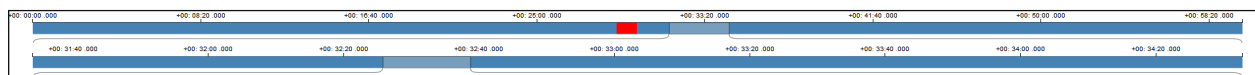
The Time bar allows the user to navigate through the EEG data using two linked navigation bars. The top bar represents the entirety of the file, while the bar below displays the highlighted region from the top bar in more detail. Regions can be selected in the each bar by dragging the light blue brush.

Any detected incidents that may be indicative of seizures are marked in red.
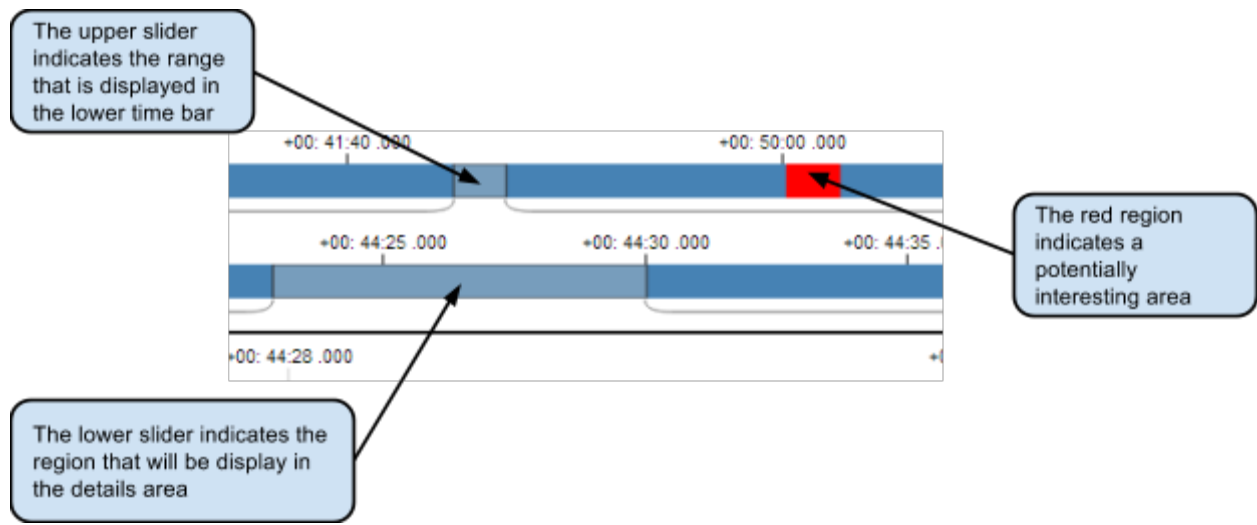
EEG Signal Display
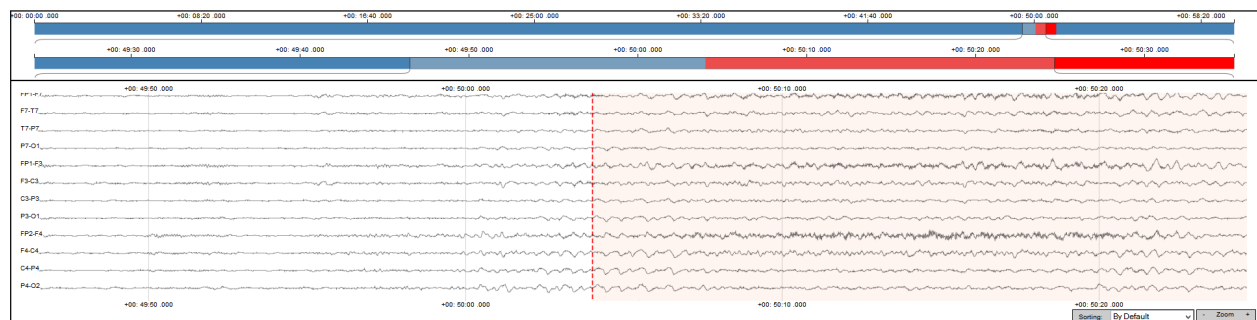
The EEG display is tied to the selection on Time bar. It is comprised of channel name, EEG waveform display, electrode montage sorting and a zoom function. Detected incidences characterized by the analytical workflow are highlighted in a red background. The first 12 channels are shown and using mouse scroll, the user can view the rest channels. By dragging the display section left to right, the user can view channel data immediately to the left and right of the initial selection. The analytical tools tied to the data selection will update automatically.

Power Tab

The Power Tab is found at the bottom left of the visualizer-analyzer interface. The user can obtain frequency distribution of EEG channel data, using Fast Fourier Transform (FFT). Additionally, user can examine known frequency bands using wavelet subbands decomposition. Both demonstrate how prevalent certain frequencies are over others. They are calculated based

on the selection of the EEG signal from the Time bar.

FFT Power Spectrum
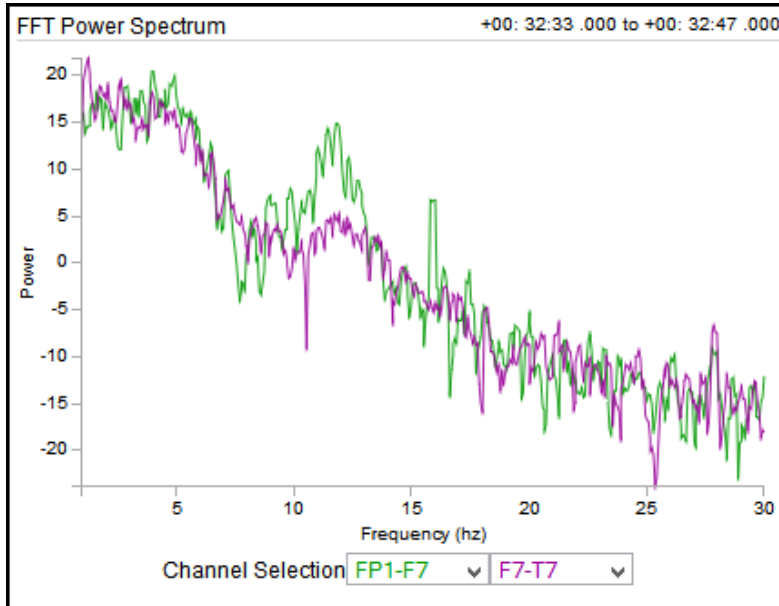
The FFT Power Spectrum is a graph of Power vs. frequency. It provides relative and absolute measures of the expression of frequencies inside the EEG signal. The user can choose to compare the frequency distribution of any two channels. Each is displayed with a different line color and the frequency range is up to 30 Hz.

Wavelet Subband Decomposition
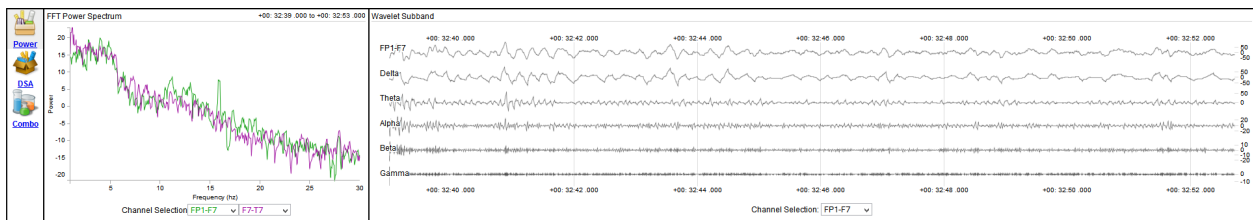
The wavelet subband decomposition provides the investigator with the tool needed to examine the frequency subbands, delta (0.01 Hz - 4Hz), theta (4 Hz - 8 Hz), alpha (8 Hz - 15 Hz), beta (15 Hz - 30 Hz) and gamma (above 30Hz) from any selected EEG channel, by choosing the particular channel from the channel selector at the bottom of the subband wave display.

Density Spectral Map Tab
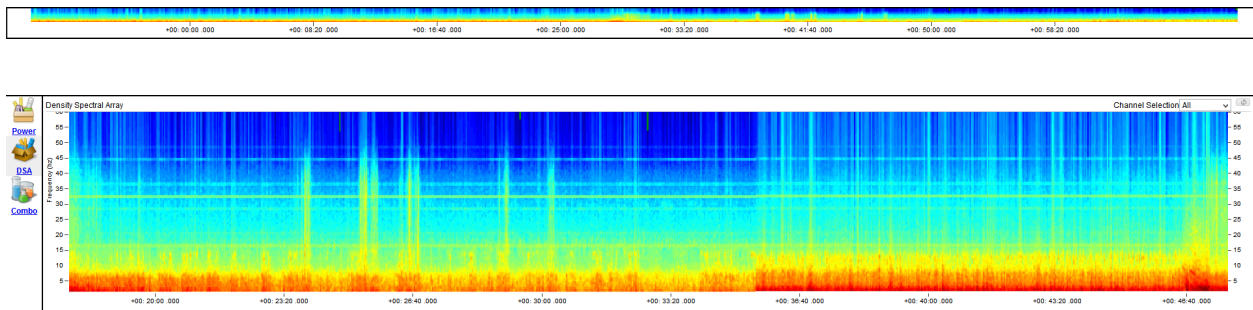
The density spectral map is provided in two forms. The first one is generated for the entirety of the wave signal and found in miniature form between the EEG signal display and the analytical tools. The second is accessible via the analytical toolbox on the bottom left side of the full screen display of the EEG visualizer-analyzer, under "DSA". With frequency on the y-axis and x-axis representing time, occurrence of frequencies are then mapped to a colormap. The result is a graphical representation of the dominance of particular frequencies over others. For instance, our color spectrum uses red to illustrate high prevalence and blue to illustrate low prevalence. At a glance, the user has an idea of which frequencies are relatively more present.

Combo Tab

Represents three of the main tools - FFT Power Spectrum, Coherence and Independent Component Analysis, arranged next to each other to facilitate user investigation.

Coherence Calculations
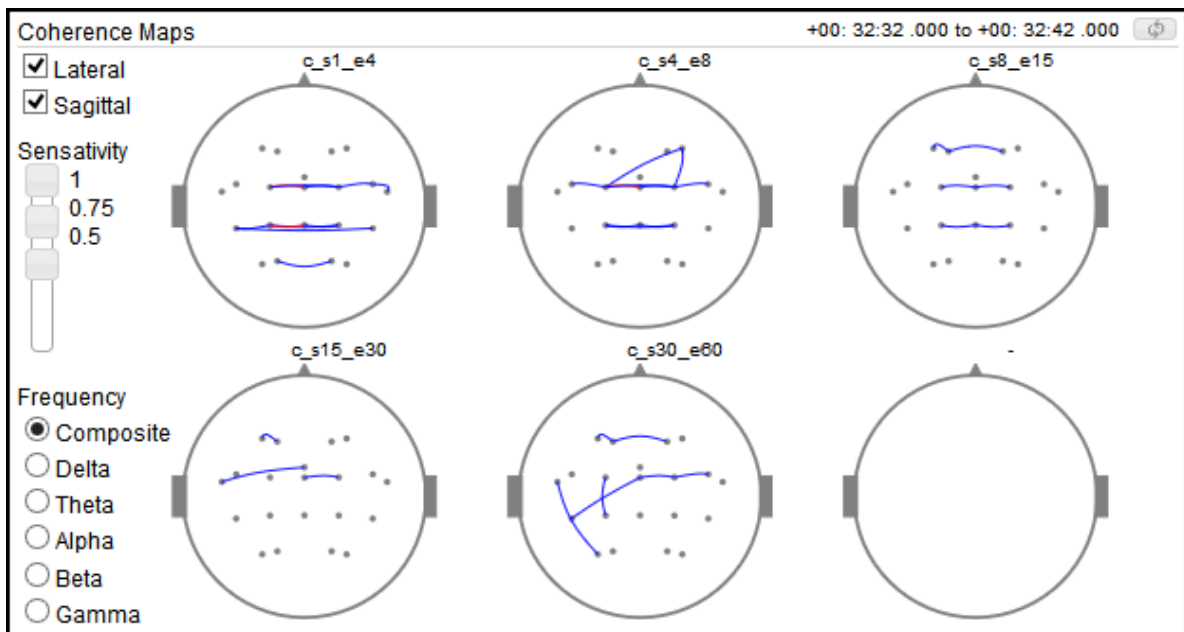
The user can obtain coherence calculation results between electrodes or between electrode pairs, based on the section of the EEG signal selected via the Time bar. Lateral (interhemispheric) coherence and sagittal (intrahemispheric, front to back) coherence can be selected separately or together. The sensitivity of the coherence display can be adjusted so as to display coherence values under and above a particular threshold. Within a particular user set range of coherence to be displayed, a cutoff marker is available to display higher coherence in red and lower coherence in blue. During slow left and right scrolling on the time domain, the coherence values are not updated until the user clicks on the refresh button on the top right of the coherence calculations box. Coherence values are recalculated after any click on Time bar. Coherence values can be displayed for a particular subband, as well as for all subbands.

Independent Component Analysis (ICA)
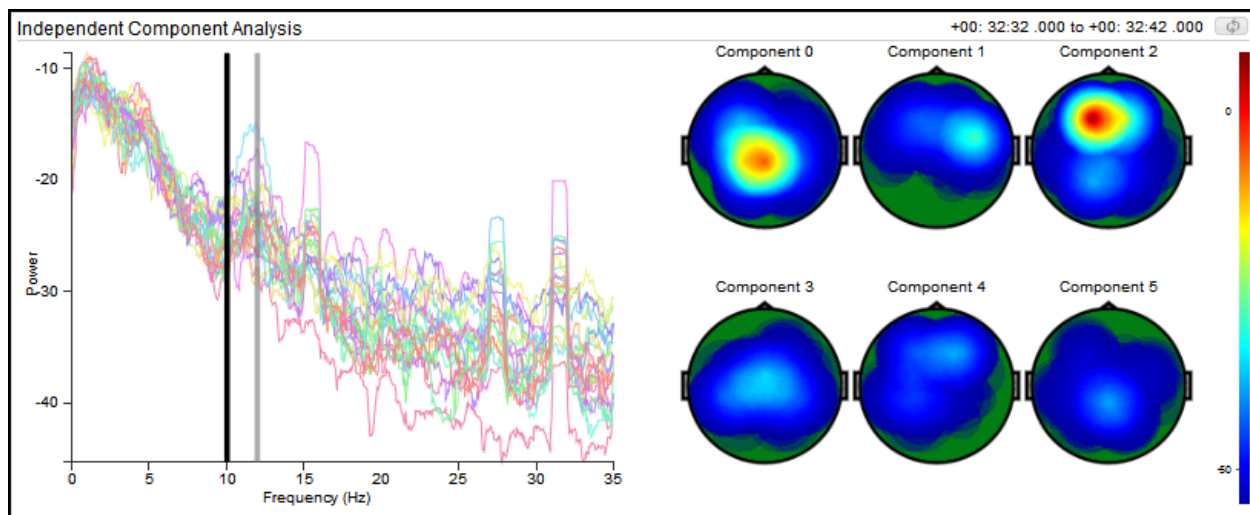
EEG signal analysis in Cliniscan allows the user to identify components representative of the source behind the detected signals. The system automatically identifies the top 5 most powerful components at a particular frequency and displays the effect of each component on each electrode via a heat map. The scale bar on the right indicates the absolute power of the component on each electrode. Therefore, the heat map acts as a localization tool for the signal source. The user can select the frequency of interest by clicking on the frequency power spectrum of all components. ICA analysis is refreshed automatically by clicking on the Time bar but not when slow left and right scrolling through the wavedata is initiated.