



NemaMetrix

# NemAnalysis Software User Guide

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NemAnalysis detects and quantifies pharyngeal pumps in ScreenChip recordings. In NemAnalysis, a pharyngeal pump is defined as an event with a distinct positive excitation event (E spike) followed shortly by a distinct negative relaxation event (R spike). The number of pumps, pump durations, pump amplitudes and inter-pump intervals can then be exported and compared for easy statistical analysis.

## Minimum Computer Requirements

1. Windows 10 64-bit OS or Mac OS X 10.11
2. 4 GB memory
3. 2.6Hz Intel Celeron Processor
4. Minimum 1440 x 900 display resolution

## Installation

1. Open the NemAnalysis installation file on your computer. For Windows this will be an .msi file. For Mac OS X this will be a .dmg file.
2. For Windows Users:  
Follow the on-screen directions to complete installation. A NemAnalysis icon will be placed on your desktop. Double-click this icon to run the program.
3. For Mac Users:  
Double-click on the NemAnalysis .dmg file. This will open a small window, where you can drag the icon to your Applications folder. This will install the program. To run the program, double-click on the new NemAnalysis icon in the Applications folder.
  - If your Mac gives you a 'Unidentified Developer' error, you may need to change your Mac security settings. Go to the Apple menu at the top left of the screen and select System Preferences. Select Security & Privacy from the main menu. Then, select the General tab. In the 'Allow Apps downloaded from:' section, there will be a notice about NemAnalysis. Click 'Open Anyway' to run the program.

## Quick Start

1. Double-click on the NemAnalysis icon to start the program. The first time the program runs, a welcome message is shown. Select **OK** in this dialog to select a folder where your ScreenChip recordings are saved. Click **Select Folder** to load the files into NemAnalysis.



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- To change folders, click the blue **Select Folder** button or choose **Select Folder** from the **File Menu**. The five most recently selected folders are listed in the Selected Folder Dropdown and can be selected again through the Dropdown for convenience.
  - If you do not have any ScreenChip recordings, a demo file is included. Select this by choosing **Open Demo File** from the **File Menu**.
2. The ScreenChip recordings are listed in the File Navigation Panel, to the left. Select the first file in the list to automatically analyze it. Information about the analysis status is shown on the bottom of the window, in the blue Status Bar.
  3. For accurate analysis and display, it is essential that the orientation of the worm is correct. The waveform plot displays normal polarity by default, which means that E spikes are positive and R spikes are negative. Select the **View Recording Notes** button at the top of the screen and verify that the Orientation field accurately reflects the recording. If the field is blank, the program will default to assume the worm is head-first, with positive E spikes and negative R spikes.
    - If the orientation is not correct, select **Unlock** to make the fields editable. Change the text in the orientation field to either 'H' (head-first) or 'T' (tail-first) and then select **Save**. Close the window by clicking the **Close** button. The display will refresh using the new setting. All subsequent analysis will now use this new setting. To reanalyze a file, select the **Customize Analysis** button. Click **Re-analyze** and then **Close**.
  5. Once analysis is complete, information about the analyzed recording is displayed both within the Waveform Plot and in the surrounding plots and Important Metrics Panel.
    - Within the Waveform Plot:
      - Yellow pump indicators show the beginning, end and duration of each pump.
      - Blue circles indicate E spikes identified by the current analysis settings.
      - Green circles indicate R spikes identified by the current analysis settings.
      - Mean pump duration and frequency are on the upper-right side of the plot.
    - The Important Metrics Panel displays information about the whole recording based on the current analysis settings.
    - Four Analysis Subplots below the Waveform Plot will display information about the recording using the current analysis settings. See the Reference Guide below for more information about these plots.
  6. There are several ways to navigate through the recording:
    - The mouse can be used to navigate: the left button will pan across the recording, while the right mouse button will scale the recording.
    - The Scrolling Plot below the Waveform Plot always shows the whole length of the recording. It can be used to scroll across the plot. It also gives context about the portion of the recording shown in the Waveform Plot in relation to the full recording.
    - Use the buttons in the bottom left of the Waveform Plot to scale the recording. The fit button will fit the amplitude of the current selection within the Waveform Plot.





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- Once the file is analyzed, select **Export Results** to export the data to a spreadsheet.
  - The **Browse** button will allow you to select a location for the spreadsheet. You can choose to export results for only one file or all analyzed files in the folder. Click **Save** to export the results.
- Congratulations! You have now analyzed and exported your first ScreenChip file!

## Reference Guide



### Main Features

- A:** Main Menu
- B:** Main Button Panel
- C:** Display Panel
- D:** File Navigation Panel
- E:** Waveform Plot
- F:** Scaling Buttons
- G:** Important Metrics Panel
- H:** Scrolling Plot
- I:** Analysis Subplots
- J:** Status Bar

### A. Main Menu

#### File Menu

- Select Folder: Use this menu item to select a new folder containing ScreenChip recordings.





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2. Show Selected Folder: Selecting this menu item will open the most recently selected folder in a new file system window.
3. Delete Results in Selected Folder: This menu item will delete all results files associated with the ScreenChip files in the current folder, reverting the files to an “unanalyzed” state. A warning is shown and must be verified before the files are deleted.
4. Open Demo File: This menu item will load the included demo file.

### **View Menu**

#### *Mean Recording Values*

1. Show Mean EPG: Checking this menu option will show the blue mean EPG value in the upper-right corner of the Waveform plot and unchecking it will hide the value.
2. Show Mean Pump Duration: Checking this option will show the blue mean pump duration value in the upper-right corner of the Waveform plot and unchecking it will hide the value.
3. Show Amplitude: Checking this menu option will show the white mean amplitude value in the upper-left corner of the Waveform plot and unchecking it will hide the value.
4. Show Offset: Checking this menu option will show the white mean offset value in the upper-left corner of the Waveform plot and unchecking it will hide the value.

#### *Analysis Symbols*

5. Show Pump Indicators (P): If checked, yellow pump indicators are shown. Hide the indicators by unchecking this menu option. This option can also be changed using the P key.
6. Show E Spike Indicators (E): If checked, blue E spike indicators are shown. Hide the indicators by unchecking this menu option. This option can also be changed using the E key.
7. Show R Spike Indicators (R): If checked, green R spike indicators are shown. Hide the indicators by unchecking this menu option. This option can also be changed using the R key.
8. Show Candidate Spike Indicators (U): During analysis, some identified E and R spikes may not qualify for the final result. To see the unused E and R spikes, check this menu option. Hide the unused indicators by unchecking the menu option. This option can also be changed using the U key.
9. Show Cursor (C): Check this option to show a blue cursor line over the Waveform Plot where the mouse is. This option can also be changed using the C key. The Cursor Stats Panel will be shown beneath the Important Metrics Panel. The cursor panel lists information about the sample at the position of the cursor line, including:
  - a. Time at cursor position
  - b. Sample number of cursor position
  - c. Voltage of the data at the cursor position
  - d. The signal-to-noise ratio (SNR) at the cursor position
  - e. If the cursor is over a pump, the pump’s duration





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10. Show Noise Envelope (N): Check this option to show a red line across the data that represents the amplitude of the noise. This is used to calculate signal-to-noise ratios (SNR) throughout NemAnalysis. Uncheck the menu option to hide the noise envelope. This option can also be changed using the N key.

### *Recording Distribution Plots*

11. Show Spectral Analysis: Selecting this menu item will open a new Spectral Analysis window. This window displays the power spectrum of the entire recording, with Frequency in Hz along the x-axis and power on the y-axis.
12. Show Amplitude Distribution: Selecting this menu item will open a new Amplitude Distribution window. This window displays the amplitude of every sample in the recording, with amplitude in  $\mu\text{V}$  along the x-axis and percentage of points at that amplitude on the y-axis.

### **Help Menu**

1. About NemAnalysis: This menu item opens a window that displays information about the software version, build date and copyright.
  - On the **Mac**, this menu option will be under the NemAnalysis menu
2. NemAnalysis User Guide: Selecting this menu item will open this document, the NemAnalysis User Guide.

