8.12: Respiration Analysis

Introduction

The **Respiration Analysis Module** calculates physiologically relevant parameters from previously recorded respiration pressure and volume data.

This document includes a step by step tutorial for using the features of the *LabScribe* **Respiration Analysis Module**. To use the step by step guide, you will need a recording of recorded Respiration from any species.

Respiration Analysis: Step by Step

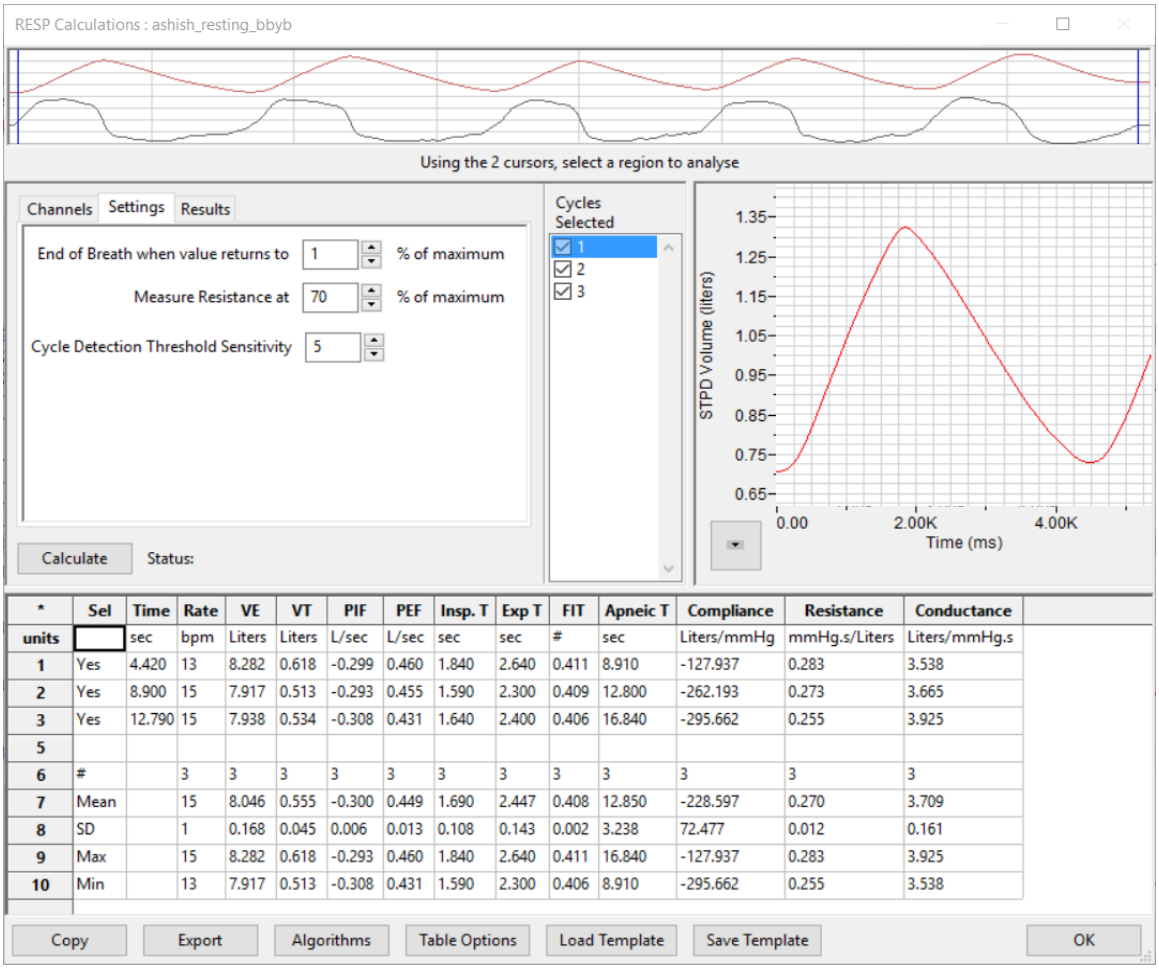
Offline Calculations

Sophisticated analysis can be done on a previously recorded Respiration data file using the **Offline Calculations** function of the **Respiration Advanced Analysis Module**. This analysis is performed using the offline **Respiration Calculations** dialog, so you should first become familiar with this dialog.

The Offline Respiration Calculations Dialog

To display the **Respiration Calculations** dialog and familiarize yourself with its features:

1) If it is not already open, open a respiration recording.
2) Select **Respiration Analysis** from the **Advanced** menu. This will open the offline **Respiration Calculations** dialog.
3) Familiarize yourself with the offline **Respiration Calculations** dialog, pictured below.
   - Across the top of the dialog, in the channel display area, you will see a sample of the raw data channel to be analyzed, including the selection between the two cursors. By default **Channel 1** is displayed.
   - On the left of the middle row are the tabbed dialogs used to configure the analysis.
   - At the right is the XY graph window in which the **Respiration Graph** is displayed.
   - Between the configuration dialogs and the graph are the editable lists of the **Cycles** to be analyzed and displayed.
   - Across the lower part of the dialog is the **Data Table** with the calculated average values for each of the analyzed groups of beats.



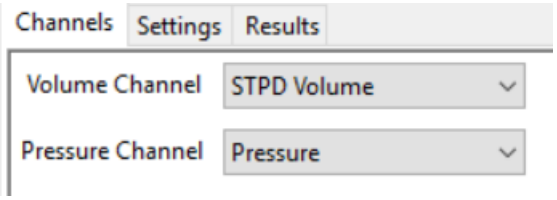
*	Sel	Time	Rate	VE	VT	PIF	PEF	Insp. T	Exp T	FIT	Apneic T	Compliance	Resistance	Conductance
units		sec	bpm	Liters	Liters	L/sec	L/sec	sec	sec	#	sec	Liters/mmHg	mmHg.s/Liters	Liters/mmHg.s
1	Yes	4.420	13	8.282	0.618	-0.299	0.460	1.840	2.640	0.411	8.910	-127.937	0.283	3.538
2	Yes	8.900	15	7.917	0.513	-0.293	0.455	1.590	2.300	0.409	12.800	-262.193	0.273	3.665
3	Yes	12.790	15	7.938	0.534	-0.308	0.431	1.640	2.400	0.406	16.840	-295.662	0.255	3.925
5														
6	#		3	3	3	3	3	3	3	3	3	3	3	3
7	Mean		15	8.046	0.555	-0.300	0.449	1.690	2.447	0.408	12.850	-228.597	0.270	3.709
8	SD		1	0.168	0.045	0.006	0.013	0.108	0.143	0.002	3.238	72.477	0.012	0.161
9	Max		15	8.282	0.618	-0.293	0.460	1.840	2.640	0.411	16.840	-127.937	0.283	3.925
10	Min		13	7.917	0.513	-0.308	0.431	1.590	2.300	0.406	8.910	-295.662	0.255	3.538

Respiration Calculations dialog.

To configure the analysis, the tabbed configuration panels at the left side of the middle row of the dialog are used.

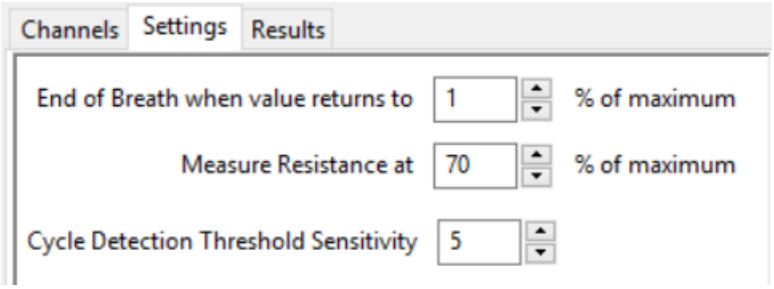
To configure **Channels:**

1) Click the leftmost tab of the configuration dialogs, the one labeled **Channels**.
2) Choose the Volume and the Pressure Channel.



To configure the **Settings:**

1) Click the **Settings** tab, which is the second tab from the left in the configuration dialogs. The **Respiration Settings** configuration dialog will open.



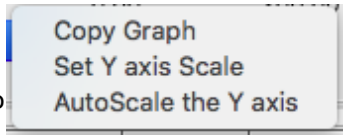
2) Choose when the end of the breath should be determined.
3) Choose the point at which the Resistance should be calculated.
4) From the **Cycle Detection Threshold Sensitivity** menu, choose **2**. It is important that the cycle detection is set to the correct sensitivity. Adjusting the **Cycle Detection Threshold Sensitivity** number to higher numbers will lower the threshold at which a cycle is detected. Start at a low value; you will be able to adjust this later if you discover that cycles are being missed in the analysis.
5) Click the **Calculate** button just above the **Data Table** to start the analysis. The **Respiration Graph** will appear in the graph window at the right, and the **Data Table** will be populated with values.

Important: *After any configuration settings are changed, click* ***Calculate*** *again, to trigger the revised analysis.*

Once the **Channels** and **Settings** configuration dialogs are completed, it is possible to view the **Respiration Graph** and start the analysis.

To display the **Respiration Graph:**

1) The Respiration Graph should be automatically displayed in the XY Graph window, showing the selected cycle from the group of cycles specified in the **Cycles in Group** list to its left.



2) Use the menu indicated by the arrow at the lower left of the graph to **Copy Graph** to the clipboard, **Set the Y axis scale**, or **AutoScale the Y axis**. .
3) Look at the **Respiration Graph** and familiarize yourself with its features.
   - Respiration parameters are indicated by the vertical blue Marks on the graph. The parameters that are shown are determined by the **Display** configuration dialog.
   - The specific cycle shown in the graph corresponds to the checked cycle in the **Cycles Selected** list to the left of the graph. The parameters and calculations from this cycle appear in the **Data Table**.
4) Change the cycle displayed by selecting a different cycle in the **Cycles Slected** list. The cycles are listed in order of their appearance in the data file.

The **Results** dialog includes basic information about the selection being analyzed,

1) Click on the **Results** tab to open the **Results** configuration dialog.
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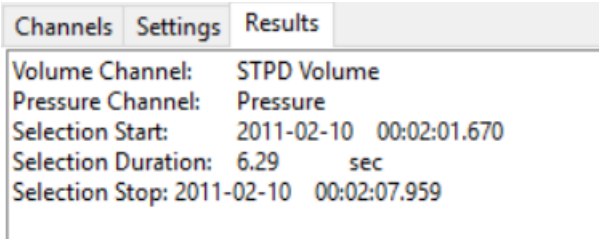

Data Table

All the data for each cycle, as well as the averaged values for all the cycles, is included in the **Data Table.**

*	Sel	Time	Rate	VE	VT	PIF	PEF	Insp. T	Exp T	FIT	Apneic T	Compliance	Resistance	Conductance
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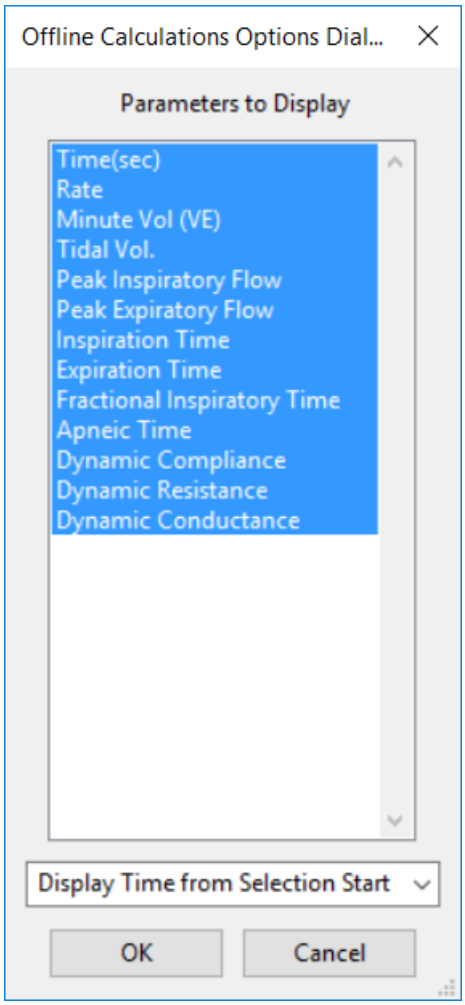
The Respiration Data Table.

To use the **Data Table** and export values to the **Journal:**

1) Click **Table Options** at the bottom of the dialog to see a list of all the cardiac action potential parameters that can be displayed in the **Data Table**. These parameters and calculations are all defined in the **Algorithms** dialog, and are summarized below.
2) Choose the options you wish to include in the analysis and display in the **Data Table**. Choose whether you wish to display the **Time from the Start of the Selection** or the **Time of Day** of the recording. Click **OK**.
3) Click the asterisk in the upper left corner of the **Data Table**. The **Autosize** option adjusts the size of the cells for optimal display. The **Copy Selection** option will copy any selected cells to the clipboard.
4) Click **Algorithms** to see the definitions of the parameters and calculations. The definitions are also included below.
5) To copy all the calculated data in the **Data Table** to the clipboard, click the **Copy** button, or click the **Export** button to export the data. The data are exported in a tab (*.txt) or comma (*.csv) separated text file, and the graph can be exported as a Portable Network Graphics (*.png) or JPEG (*.jpg) image.
6) To load the analysis configuration for the current analysis, click **Save Template** to name and save the settings. Clicking **Load Template** when the module is reopened will display the list of previously saved templates.
7) Click **OK to** save the current configuration. The next time the offline **Respiration Calculations** dialog is opened, it opens with these settings.



Offline Calculation Algorithms: The offline calculations include:

- **Rate** : Respiration Rate (bpm)
- **VE**: Minute Vol. (VE) is calculated as VT*Rate
- **VT:** Tidal Vol. Volume of air displaced between normal inspiration and expiration
- **PIF**: Peak Inspiratory Flow.
- **PEF**: Peak Expiratory Flow
- **Insp. T:** Inspiration Time
- **Exp. T**: Expiration Time
- **FIT**: Fractional Inspiratory Time, it is calculated as
  Inspiration Time/(Inspiration Time + Expiration Time)
- **Apneic T**: Apneic Time. Time from end of breath to start of next breath
- **Compliance**: Dynamic Compliance
  deltaV/deltaP) at zero flow pt
- **Resistance**: Dynamic Resistance
  (deltaP/deltaF) at isovolume pts
- **Conductance**: Dynamic Conductance
  (deltaF/deltaP) at isovolume pts