# Blood Pressure Analysis with LabScribe

Introduction

Arterial and ventricular blood pressure parameters are detected, and functions derived from those parameters are computed in *LabScribe's* **Blood Pressure Advanced Analysis Module**.

The **Blood Pressure Advanced Analysis Module** requires a separate license. The first time you select **Blood Pressure**, you will be asked for a username and a serial number. Contact iWorx Systems for more information.

This document includes a step by step tutorial for using most of the features of the **Blood Pressure Advanced Analysis Module**,as well as a more detailed **Reference** section that covers the material in the tutorial, and adds additional context and detail. To use the step by step guide, you will need a recording with at least one arterial or ventricular blood pressure channel. This can be from any mammalian species. In order to use the online analysis part of the module, you will need to be recording these parameters as you proceed through the tutorial. This file can then be saved and used in the offline analysis tutorial.

Blood Pressure Analysis: Step by Step

When **Blood Pressure** is chosen from the **Advanced** menu, a submenu opens, displaying two options: **Online Calculations** (accessed by choosing from as many as eight **Online Toolbars**) and **Offline Calculations**.
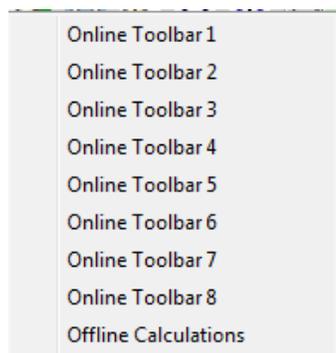
Blood Pressure submenu.

Online Blood Pressure Calculations

To use the Online Calculations:

You will need a recording of either arterial or ventricular blood pressure. Using the **Online Blood Pressure Calculations**, it is possible to generate Blood Pressure calculations and graphs in real time.

1) Prepare the animal and configure the hardware and software to record blood pressure on *LabScribe*.
2) Record a sample and ascertain that the pressure channel is recording data at the scale you desire. Stop recording as you configure the online analysis.

3) Choose one of the **Online Toolbar** choices from the **Blood Pressure** submenu to display that **Blood Pressure Toolbar** above **Channel 1**.

4) Multiple **Blood Pressure Toolbars** can be chosen sequentially, corresponding to as many as eight different blood pressure transducers.

| ▽ BP. Calc:	#	Time	HR	DURs	DURd	DURc	FillT	T:ES-ED	P1:Pmax	P1:Pmin	P1:dPmax	P1:dPmin	P1:Pmean	P1:MAP	P1:CI	P1:RI	P1:PH

Online Blood Pressure Toolbar.

5) Click on the down arrow on the left side of each **Blood Pressure Toolbar** to display a submenu with three choices: **Setup**, **AutoSize**, and **Set Font Size**.

Setup
AutoSize
Set Font Size
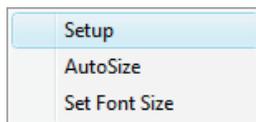
Blood Pressure Online Setup menu.

6) Choose **Setup** to open the **Online Calculation Setup** dialog.
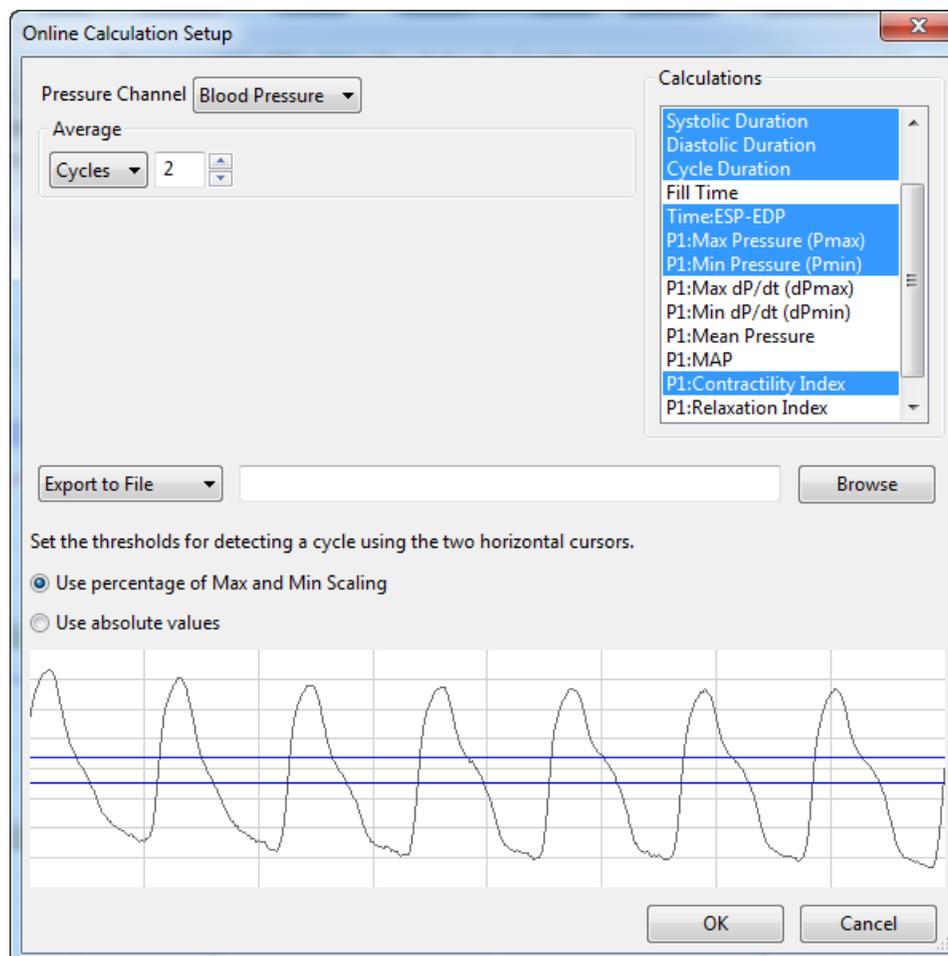
Online Calculation Setup dialog.

7) From the **Pressure Channel** menu, choose the pressure channel from your recording.

8) Once you select the **Pressure Channel**, a sample of the recording will be displayed at the bottom of the dialog. Set the thresholds for cycle detection by adjusting the Max and Min blue horizontal lines so that all cycles pass through both lines.

9) As you record data, cycles will be detected as either a percentage of the amplitude of the cycles based on where you placed the Max and Min lines, or as the absolute values of their set location. Choose which you prefer from the two choices above the sample recording.

10) From the **Calculations** list, control-click on those variables you would like to record in the data boxes of the **Blood Pressure Toolbar**. To remove a variable after you have selected it, control-click on that variable. Definitions of all variables can be found in the **Blood Pressure Analysis: Reference** section.

11) In order to compensate for variation from cycle to cycle, it is possible for *LabScribe* to average a user selected number of sequential cycles. Enter this number in the **Cycles to Average** text box. Start with a low number and adjust upward as necessary. Alternatively, it is possible to average over a desired duration (**Time**).

12) Click the **Export to File** menu item to send the data recorded in the **Blood Pressure Toolbar** as a .csv file to a location chosen in the dialog that opens. The other alternatives send the data to the *LabScribe* **Journal** (**Export to Journa**l) or do not export the data at all (**No Export**).

13) Click **OK** to close the dialog.

14) Return to the **Blood Pressure Toolbar** menu (accessed by clicking the arrow) and choose **AutoSize**. The size of the data boxes and the titles will be adjusted to the number of variables you have chosen.

15) From the **Blood Pressure Toolbar** menu, choose **Set Font Size**. The font size of the data box values can be chosen from the dialog that opens.

16) Resume recording. The changing variables will be displayed in the data boxes of the toolbar.
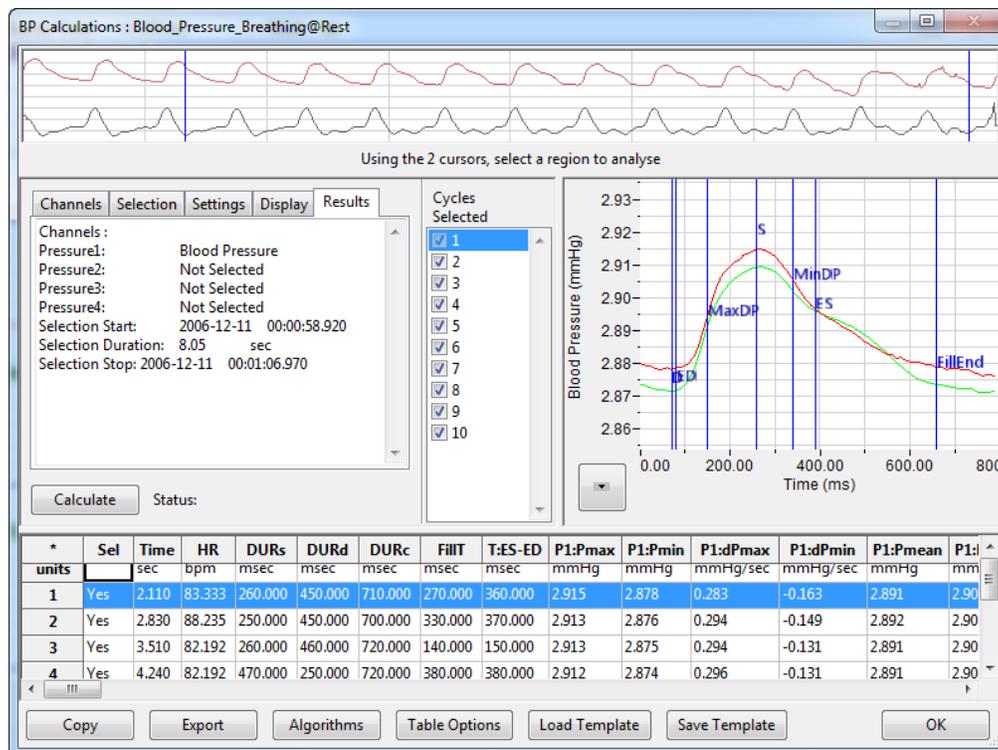

Online Blood Pressure display.

17) Save the recording for offline analysis.

Offline Blood Pressure Calculations

The offline **Blood Pressure Calculations** dialog allows sophisticated offline analysis of previously recorded blood pressure data.

To perform offline **Blood Pressure** analysis**:**

1) Open the recording from the online analysis or another file with previously recorded arterial or ventricular blood pressure data.

2) Choose **Offline Calculations** from the **Blood Pressure** submenu to open the offline **Blood Pressure Calculations** dialog. The panels of this dialog can be resized by moving the mouse cursor over the boundaries until a double-headed arrow appears, and dragging the boundaries to resize the panels.
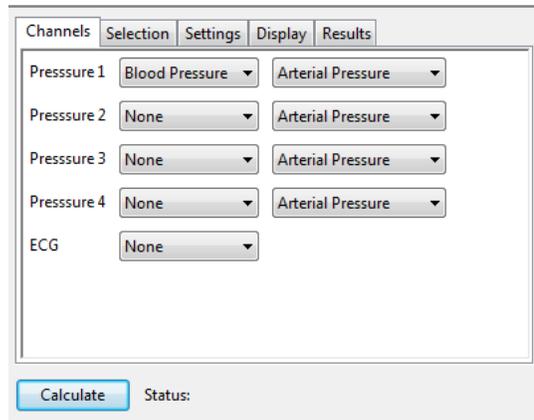

Blood Pressure Calculations dialog.

3) Familiarize yourself with the offline **Blood Pressure Calculations** dialog, pictured above.
   - Across the top of the dialog, in the channel display area, is the blood pressure channel from the recording and a computed derivative used to identify cycles and derivative functions.
   - The tabbed configuration dialogs are on the left below the recordings.
   - An XY graph window on the right displays the **Blood Pressure Graph**, showing the selected cycle and the average of all checked cycles from the **Cycles Selected** list.
   - Between the configuration dialogs and the XY graph window is the **Cycles Selected** list, an editable list of the cycles that can be displayed and analyzed.
   - The **Data Table** is located on the lower part of the dialog.

To configure the **Channels:**

1) Click on the **Channels** tab, opening the **Channels** configuration dialog.

Blood Pressure Channels configuration dialog.

2) From the **Pressure 1** menu, choose a channel with the blood pressure recording. Choose whether the recording represents an **Arterial Pressure** or a **Ventricular Pressure** measurement from the menu to the right. If you would like to analyze additional blood pressure channels, choose them from the **Pressure 2**, **Pressure 3**, and **Pressure 4** menus.

3) Optionally, choose an **ECG** channel if there is one on the recording.

Once the pressure channel is selected, the recording of that channel will be displayed in the channel display area at the top of the dialog and the **Blood Pressure Graph** will be displayed in the XY graph window.
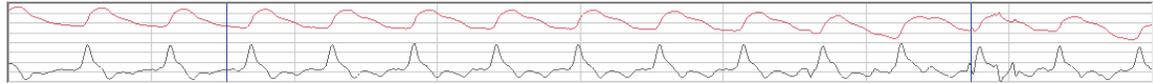
To configure the **Selection:**

1) Click on the **Selection** tab, opening the **Selection** configuration dialog.
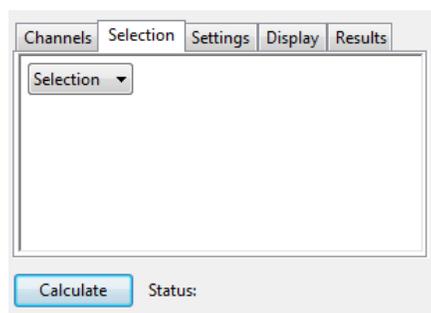
Blood Pressure Selection configuration menu.

2) From the **Selection** menu, choose to analyze either a selection or the entire recording.

3) If you choose to analyze just a selection from your recording, select the area of the recording to be analyzed by moving the two vertical cursors in the channel display area at the top of the dialog to designate the section to be analyzed. Only those cycles will now be averaged in the **Blood Pressure Graph**, and the cycles will be listed by sequential number in the **Cycles Selected** list to the left of the graph.

Selection from the channel display area.

To configure the **Settings:**

1) Click on the **Settings** tab, opening the **Blood Pressure Settings** configuration dialog.


Blood Pressure Settings configuration dialog.

Starting at the top of the **Blood Pressure Settings** configuration dialog:

2) Check whether you wish to use an **ECG** recording for the detection of end-diastole (**ED**).
3) Check whether you would like to use the derivative of the data instead of the raw blood pressure data to detect cycles.
4) Enter a lower and upper permissible heart rate
5) Enter 5 as the number of cycles that should be used to determine the **Cycle Detection Threshold Sensitivity**. By default, a threshold sensitivity of 5 is used to detect cycles. If each cycle is not being detected properly, the sensitivity can be adjusted.
6) Enter a value to indicate the range over which data should be smoothed.
7) For each pressure being analyzed, enter the number of mmHg above end-diastolic pressure (**EDP**) that should be designated as the uppermost point that should be used to create the best fit line from which **Tau** (the time constant of blood pressure decrease during diastole) is computed.
8) For each pressure being analyzed, specify the percentage of the time it takes for the pressure to recover that should be displayed in the **Data Table**.
9) For each pressure being analyzed, specify the percentage of the **Relaxation Time** to be displayed in the **Data Table**. **Relaxation Time** is the time between the minimum dP/dt (**dPmin**) and the end of the cycle.
10) For each pressure being analyzed, specify up to two different specified blood pressures (**A** and **B**) at which the derivatives (**dPdT A** and **dPdT B**) should be determined and displayed in the **Data Table**.

11) Click the **Calculate** button above the **Data Table** to update all settings. Click **Calculate** whenever settings are updated.

To display and analyze the **Blood Pressure Graph:**

1) Familiarize yourself with the **Blood Pressure Graph**, which will be displayed in the XY graph area for all the cycles in the selection and is illustrated below.
   - The highlighted cycle in the **Cycles Selected** window is shown in red, while the average of all the checked cycles is displayed in green.
   - Cycles can be deselected (or selected) by clicking on the check box to the left of the cycle number in the **Cycles Selected** list to the left of the graph. The UP and DOWN arrows on the computer keyboard can be used to move quickly through the individual cycles.
   - The specific parameters shown in the graph are chosen from the **Display** configuration dialog.
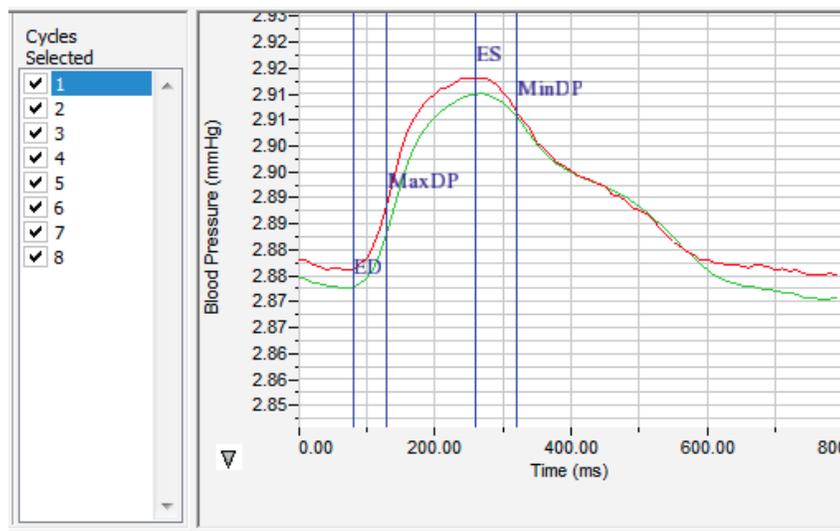
The Blood Pressure Graph.

2) Click the arrow to the lower left of the XY graph window to open a menu with options for the displayed XY graph.
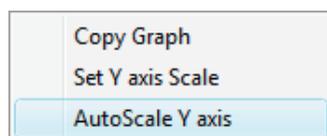
XY graph window menu.

3) Click **Copy Graph** to copy the **Blood Pressure Graph** to the clipboard. It can then be pasted into the **Journal** or an external application.
4) Click **Set Y-axis Scale** to set the Y-axis scale manually.
5) Click **AutoScale Y-axis** to optimize the display scale of the Y-axis.

To configure the **Display:**

1) Click on the **Display** tab to open the **Blood Pressure Display** configuration dialog.
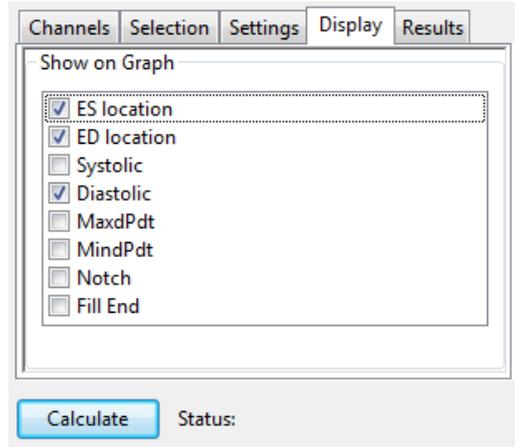
Blood Pressure Display configuration dialog.

2) Choose the parameters you would like displayed on the **Blood Pressure Graph**. Observe the **Blood Pressure Graph** to see the addition or subtraction of the parameters as they are clicked and un-clicked.

To configure the **Results:**

1) Click on the **Results** tab to open the **Blood Pressure Results** configuration dialog. Here information about the channel and the specific selection are displayed, based on the data from the currently displayed **Blood Pressure Graph**. Additional text can be entered into this dialog.
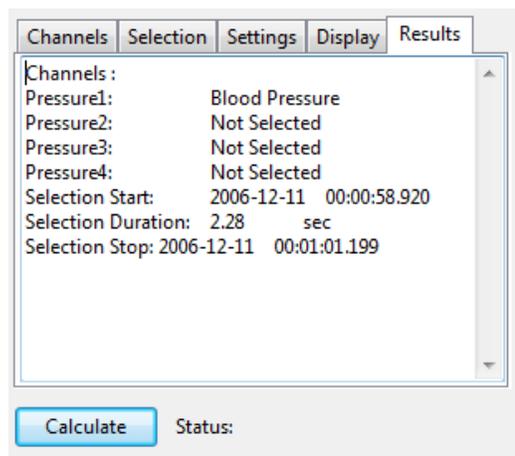
Blood Pressure Results configuration dialog.

To use the **Data Table:**

Blood Pressure Data Table.

| *	Sel	Time	HR	DURs	DURd	DURc	FillT	T:ES-ED	P1:Pmax	P1:Pmin	P1:dPmax	P1:dPmin	P1:Pmean	P1:MAP	P1:CI	P1:RI	P1:PH	P1:ESP	P1:EDP	P1:ESP-EDP	P1:
units		sec	bpm	msec	msec	msec	msec	msec	mmHg	mmHg	mmHg/sec	mmHg/sec	mmHg	mmHg	#	#	mmHg	mmHg	mmHg	mmHg	mmH
1	Yes	2.740	82.192	230.000	490.000	720.000	490.000	510.000	2.913	2.875	0.457	-0.180	2.891	2.900	0.158	-0.062	0.038	2.913	2.875	0.038	2.87
2	Yes	3.470	82.192	230.000	490.000	720.000	490.000	510.000	2.912	2.874	0.474	-0.170	2.891	2.900	0.164	-0.059	0.038	2.912	2.875	0.038	2.87
3	Yes	4.200	84.507	230.000	490.000	720.000	480.000	510.000	2.912	2.874	0.459	-0.171	2.891	2.900	0.159	-0.059	0.038	2.912	2.874	0.038	2.87
4	Yes	4.910	82.192	230.000	470.000	700.000	420.000	510.000	2.912	2.874	0.470	-0.181	2.890	2.900	0.163	-0.062	0.039	2.912	2.874	0.038	2.87
5	No	5.640	84.507	240.000	500.000	740.000	380.000	530.000	2.910	2.872	0.457	-0.177	2.889	2.898	0.159	-0.061	0.038	2.910	2.873	0.037	2.87
6	Yes	6.350	83.333	220.000	470.000	690.000	470.000	500.000	2.908	2.870	0.462	-0.181	2.886	2.895	0.160	-0.062	0.039	2.908	2.870	0.038	2.87
7	Yes	7.070	88.235	230.000	460.000	690.000	300.000	490.000	2.902	2.865	0.436	-0.188	2.877	2.889	0.152	-0.065	0.037	2.902	2.865	0.036	2.86
8	Yes	7.750	92.308	470.000	210.000	680.000	-7980.0▶	450.000	2.899	2.855	0.494	-0.169	2.886	2.885	0.172	-0.059	0.044	2.899	2.856	0.044	2.85
10																					
11	#		7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
12	Mean		84.994	262.857	440.000	702.857	-761.429	497.143	2.908	2.870	0.465	-0.177	2.888	2.895	0.161	-0.061	0.039	2.908	2.870	0.039	2.87
13	SD		3.597	84.636	94.567	15.779	2947.636	20.504	0.005	0.007	0.017	0.006	0.005	0.006	0.006	0.002	0.002	0.005	0.007	0.002	0.00
14	Max		92.308	470.000	490.000	720.000	490.000	510.000	2.913	2.875	0.494	-0.169	2.891	2.900	0.172	-0.059	0.044	2.913	2.875	0.044	2.87
15	Min		82.192	220.000	210.000	680.000	-7980.0▶	450.000	2.899	2.855	0.436	-0.188	2.877	2.885	0.152	-0.065	0.037	2.899	2.856	0.036	2.85

1) Familiarize yourself with the **Data Table**.
   - The **Data Table** spans the lower part of the **Blood Pressure Calculations** dialog and displays the calculated values for each of the cycles checked in the **Cycles Selected** list.
   - The top line indicates the **units** for each of the chosen parameters.
   - The bottom few rows show the sample size, the mean, the standard deviation, minimum and maximum values, and the range of each of the chosen parameters averaged over all the selected cycles.

There are six buttons beneath the **Data Table: Copy, Export, Algorithms, Table Options, Load Template, and Save Template.**

2) Click the asterisk at the upper left of the **Data Table** to display two options: **Autosize** and **Copy Selection**. **Autosize** will optimize the size of the **Data Table** boxes, and **Copy Selection** copies any selected **Data Table** cells to the clipboard.

3) Click **Copy** to copy all the calculated data in the **Data Table** to the clipboard.

4) Click the **Export** button to export the data as a tab (*.txt) or comma (*.csv) separated text file. The currently displayed XY graph can be exported as a Portable Network Graphics (*.png) or JPEG (*.jpg) image.

5) Click **Algorithms** to display the mathematical definitions of the parameters included in the **Data Table**.

6) Click **Table Options** to open the **Offline Calculations Options Dialog**, which lists the functions from which the **Data Table** parameters can be chosen. All functions are described in the **Blood Pressure Analysis: Reference** section. Marks indicating temperature and activity can also be added to the file, and those values can be chosen from the **Table Options** list and included in the **Data Table**.
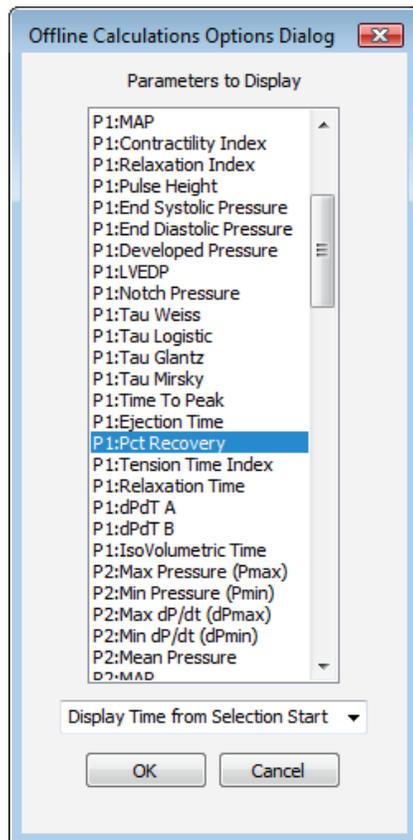
Complete list of Data Table parameters.

7) Click **Load Template** or **Save Template** to display a dialog allowing you to name and save a specific configuration for future use or to load a previously saved template.

8) Click **OK** to close the analysis.

Blood Pressure Analysis: Reference

When **Blood Pressure** is chosen from the **Advanced** menu, a submenu opens, displaying two choices: **Online Calculations** (accessed by choosing from as many as eight **Online Toolbars**) and **Offline Calculations**.
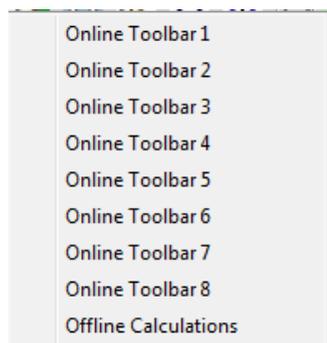
Blood Pressure submenu.

Online Blood Pressure Calculations

While recording data, some beat-by-beat parameters can be calculated and displayed online using **Online Calculations**. Choosing one of the **Online Toolbars** from the **Blood Pressure** submenu opens a **Blood Pressure Toolbar** above the uppermost channel. The function titles and the corresponding data values are displayed in the toolbar's data boxes. Channel-specific parameters can be calculated for up to four different blood pressure channels (**P1**,**P2**,**P3**,**P4**), or separate toolbars can be displayed for individual blood pressure data channels.

| ▽ BP. Calc:	#	Time	HR	DURs	DURd	DURc	FillT	T:ES-ED	P1:Pmax	P1:Pmin	P1:dPmax	P1:dPmin	P1:Pmean	P1:MAP	P1:CI	P1:RI	P1:PH

The Online Blood Pressure Toolbar.

The online parameters are:

- **Time**: Time (in seconds) from the start of the selection, or the time of day of the recording, depending upon which option is chosen.
- Heart Rate **(HR)**: 60/period of each cycle.
- Systolic Duration (**DURs**): Time between the start of the cycle and minimum dP/dt (**dPmin**)**.**
- Diastolic Duration (**DURd**): Time between minimum dP/dt (**dPmin**) and the end of the cycle.
- Cycle Duration (**DURc**): Time between any two analogous points in two cycles (often **ED**).
- Fill Time (**FillT**): Time from end-systole (**ES**) to where the pressure starts to fall to end-diastole (**ED**)
- pressure.
- Time from end-systole to end-diastole (**T:ES - ED**): Time from **ES** to next **ED**.
- Maximum Pressure (**Pmax**): Maximum value of the pressure channel for that cycle.
- Minimum Pressure (**Pmin**): Minimum value of the pressure channel for that cycle.
- Maximum dP/dt (**dPmax**): The smoothed derivative of the pressure channel is calculated, using 2 points on either side of any given point. **dPmax** is the steepest slope as pressure increases.
- Minimum dP/dt (**dPmin**): The smoothed derivative of the pressure channel is calculated, using 2 points on either side of any given point. **dPmin** is the steepest slope as pressure decreases.
- Mean Pressure (**Pmean**): Mean of all values in the cycle.
- Mean arterial pressure (**MAP**): 2/3 end systolic pressure (**ESP**) + 1/3 end diastolic pressure (**EDP**).
- Contractility Index (**CI**): (**dPmax**) / (**Pressure** at **dPmax**).
- Relaxation Index (**RI**): (**dPmin**) / (**Pressure** at **dPmin**).
- Pulse Height (**PH**): **Pmax** - **Pmin**.
- End Systolic Pressure (**ESP**): Value of the **Pressure** channel at end-systole (**ES**).
- End Diastolic Pressure (**EDP**): Value of the **Pressure** channel at end-diastole (**ED**).
- Developed Pressure (**ESP** - **EDP**)**: ESP** - **EDP**.
- Left Ventricular End Diastolic Pressure (**LVEDP**): Pressure at end-diastole (**ED**) in a left ventricular pressure channel.
- Tau Weiss (**Tau W**): P(t) = A(-t/**Tau**).
- Tau Logistic (**Tau L**): P(t)= A(-t/**Tau**) + B.
- Tau Glantz (**Tau G**): Regression of **dP/dt** vs. **Pressure**.
- Tau Mirsky (**Tau M**): Time required for **LV pressure** to fall to one-half of its value at **ESP**.
- Time to Peak (**TT Peak**): Time from the start of the cycle to **Pmax**.

- Ejection TIme (**ET**): Time between the start of the cycle and the dichrotic notch.
- Percent Recovery (**% rec**): Designated (by user) percentage of the time it takes for the pressure to recover.
- Tension Time Index (**TTI**): The average pressure during systole multiplied by systolic duration.
- Relaxation Time (**RT**): The time between **dPmin** and the time specified by the relaxation time value set by user.
- **dPdT A**: Rate of pressure change as a function of time at user designated point A.
- **dPdT B**: Rate of pressure change as a function of time at user designated point B.
- IsoVolumetric Time (**IVT**): Duration of the isovolumetric contraction period.

Clicking on the down arrow on the left side of the **Blood Pressure Toolbar** will display a submenu with three choices.
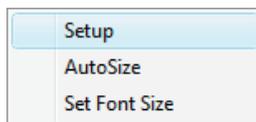
Blood Pressure Online Setup menu.

- **Setup**: Opens the **Online Blood Pressure Setup** dialog.
- **AutoSize**: Adjusts the size of the **Blood Pressure Toolbar** title and data boxes.
- **Set Font Size**: The user can change the size of the font in the **Blood Pressure** toolbar data boxes.

The criteria for setting up the **Blood Pressure** online calculations are entered into the **Online Calculation Setup** dialog.
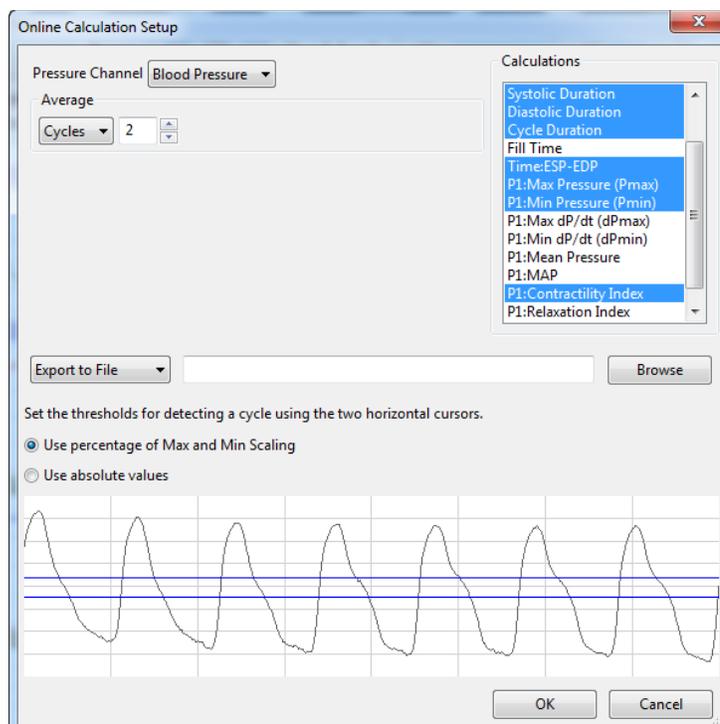
The Online Blood Pressure Calculation Setup dialog.

The **Online Blood Pressure Setup** dialog is configured by choosing the pressure channel to be used, the calculations to be performed in real time, and whether these calculations should be exported to the **Journal**.

When the **Pressure** channel is selected, its graph will appear in the dialog. The threshold lines should be set so that they are between the cyclic minimum and maximum data values. *LabScribe* uses the positive threshold crossing from below the bottom cursor to above the top cursor to determine the cycle.

In order to compensate for variation from cycle to cycle, it is possible for *LabScribe* to average a user-selected number of sequential cycles. This number should be entered in the **Cycles to Average** text box. Alternatively, data can be averaged over a designated T**ime** duration.

Clicking **OK** will close the dialog and the selected calculations will be displayed in the data boxes of the **Blood Pressure Toolbar** as data are recorded.

Offline Blood Pressure Calculations

In addition to the online **Blood Pressure** calculations, *LabScribe* can perform additional offline **Blood Pressure** calculations on previously recorded blood pressure traces, and display an XY graph of averaged **Blood Pressure** over time derived from user-selected cycles.

Choosing **Offline Calculations** from the **Blood Pressure** submenu opens the **Blood Pressure Calculations Dialog**. The panels of this dialog can all be resized by moving the mouse cursor over the boundaries until a double-headed arrow appears, and dragging the boundaries to resize the panels.
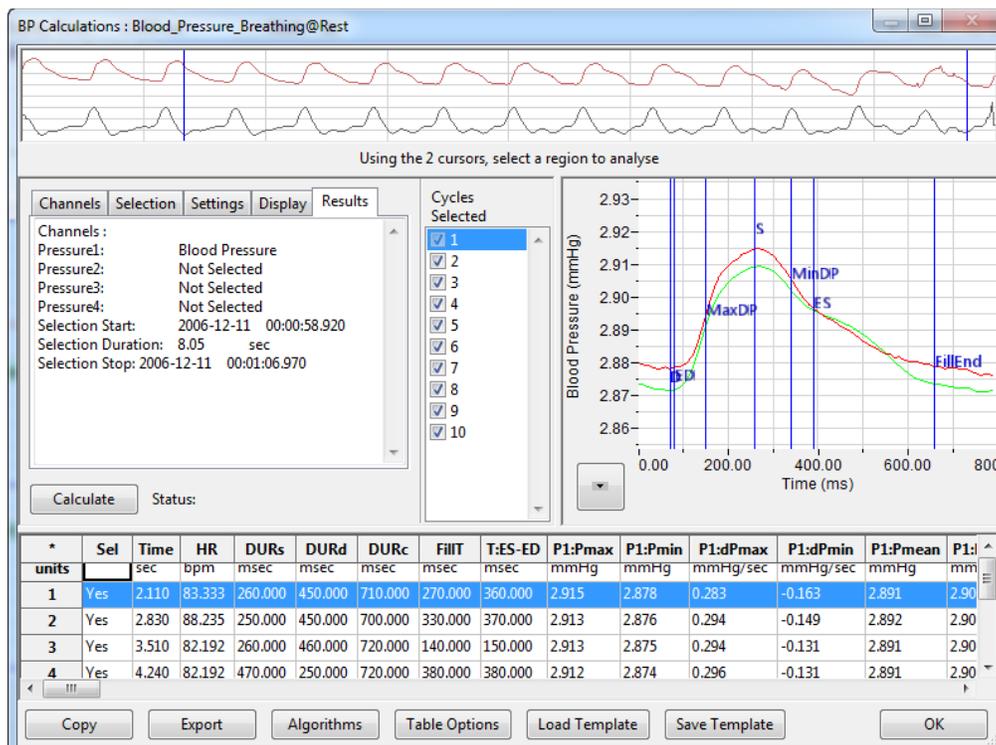
The Blood Pressure Calculations dialog.

The sections of the offline **Blood Pressure Calculations** dialog, each of which is described in more detail below**:**

- Across the top of the dialog in the channel display area is the blood pressure channel from the recording and a computed derivative used to identify cycles and calculate derivative functions.
- The tabbed configuration dialogs are on the left below the recordings.
- An XY graph window on the right displays the **Blood Pressure Graph**, showing the selected cycle and the average of all checked cycles from the **Cycles Selected** list.
- Between the configuration dialogs and the XY graph window is the **Cycles Selected** list, an editable list of the cycles that can be displayed and analyzed.
- The **Data Table** is located on the lower part of the dialog.

The Channel Display Area: In the channel display area, the two vertical blue lines can be adjusted to designate a section of the recording for analysis.

The Configuration Dialogs: There are five tabbed configuration dialogs: Channels, Selection, Settings, Display, and Results.

The Channels Configuration Dialog

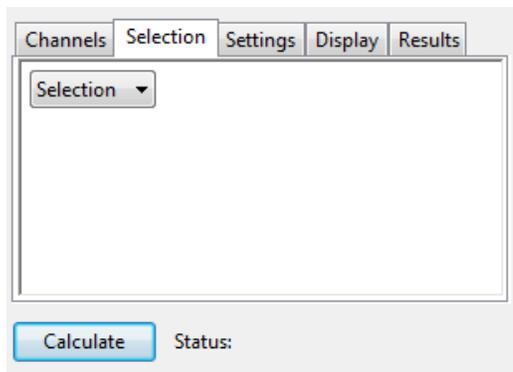*Blood Pressure Channels configuration dialog.*

- At least one blood pressure channel must be selected from the **Pressure 1** menu, and it is designated as an **Arterial Pressure** or a **Ventricular Pressure** measurement. If additional blood pressure channels are to be analyzed, they are chosen from the **Pressure 2**, **Pressure 3**, and **Pressure 4** menus.
- Optionally, an **ECG** channel may be chosen if there is one on the recording.
- Once the pressure channel is selected, the recording of that channel will be displayed in the channel display area at the top of the dialog and the **Blood Pressure Graph** will be displayed in the XY graph window.
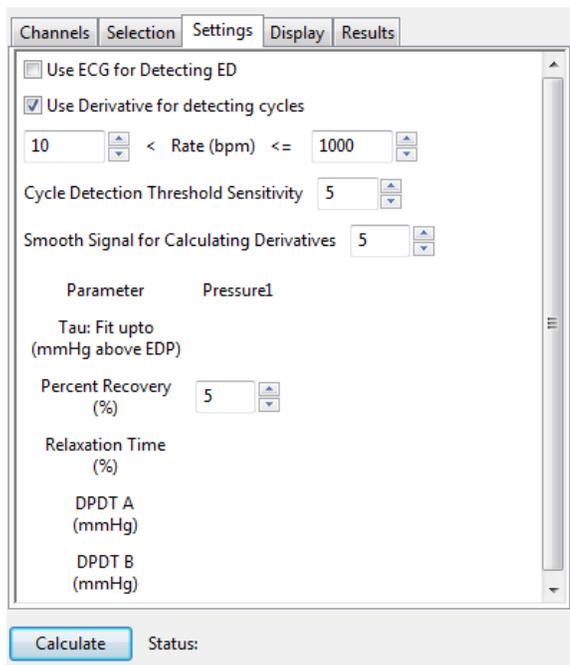
The Selection Configuration Dialog

Blood Pressure Selection configuration dialog.

- Whether to analyze a selection or the entire recording is chosen from the S**election** menu.
- If only a selection is chosen, the area of the recording to be analyzed is designated by adjusting the two vertical cursors in the channel display area at the top of the dialog.

The Settings Configuration Dialog
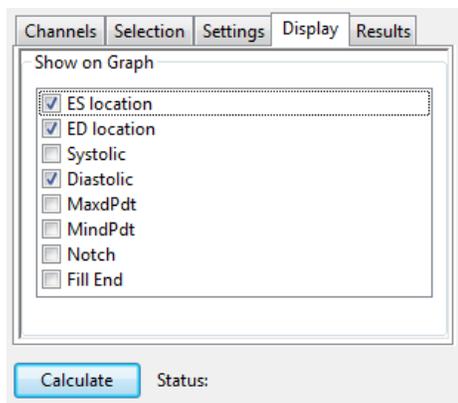

Blood Pressure Settings configuration dialog.

Starting at the top of the **Blood Pressure Settings** configuration dialog**:**

- An **ECG** recording can be used for the detection of end-diastole (**ED**).
- The derivative of the data instead of the raw blood pressure data can be used to detect cycles.
- The lower and upper rates of the permissible heart rate range should be entered.

- If each cycle is not being detected properly, the sensitivity can be adjusted changing the number of cycles that should be used to determine the **Cycle Detection Threshold Sensitivity**. By default, a threshold sensitivity of 5 is used to detect cycles.
- A range over which the data should be smoothed can be entered.
- **Tau Fit**: Allows the user to adjust the uppermost point that should be used to create the best fit line from which **Tau** (the time constant of blood pressure decrease during diastole) is computed (for each pressure being analyzed).
- **Percent Recovery:** Allows the user to specify a percentage of the time it takes for the pressure to recover. This value is displayed in the **Data Table** (for each pressure being analyzed).
- **Relaxation Time**: Allows the user to specify a percentage of the **Relaxation Time** to be displayed in the **Data Table**. **Relaxation Time** is the time between **dPmin** and the end of the cycle (for each pressure being analyzed).
- **dPdt A, dPdt B**: Allows the user to determine (for each pressure being analyzed) the derivative at up to two different specified blood pressures (**A** and **B**).
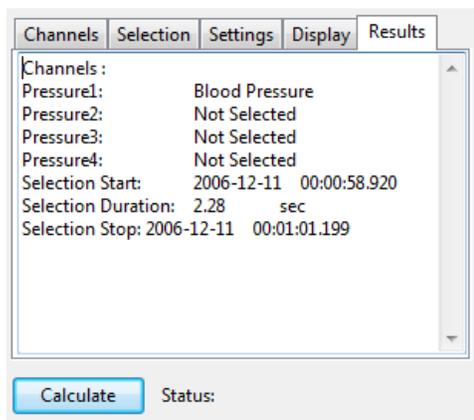
The Display Configuration Dialog

Blood Pressure Display configuration dialog.

- The parameters to be displayed on the **Blood Pressure Graph** are chosen in this dialog.

The Results Configuration Dialog

*Blood Pressure Results configuration dialog.*

- Information about the channel and the specific selection are displayed in this dialog based on the data from the currently displayed **Blood Pressure Graph**. Additional text can be entered into this dialog.

The Blood Pressure Graph: The XY graph plots blood pressure as a function of time. The currently selected cycle is displayed in red, and the average of all the cycles is displayed in green. Cycles can be deselected (or selected) by clicking on the check box to the left of the cycle number in the **Cycles Selected** box. The UP and DOWN arrows on the computer keyboard can be used to move quickly through the individual cycles.
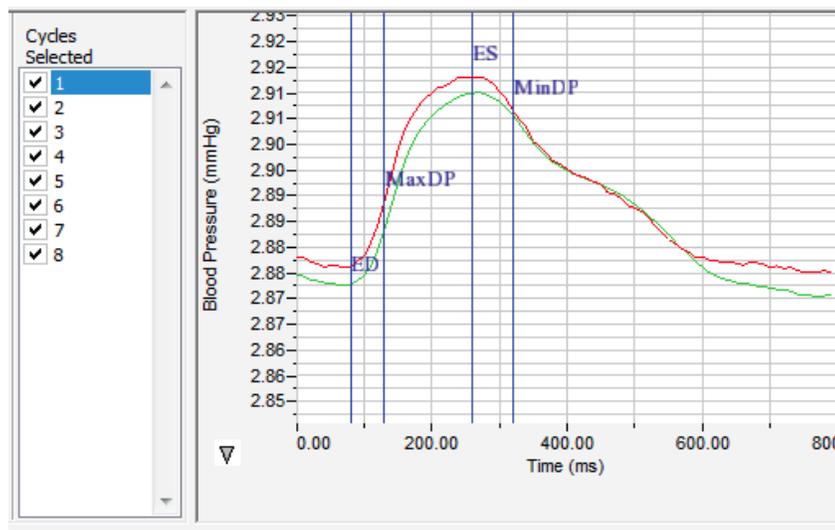
The Blood Pressure Graph.

The XY Graph Menu: Clicking on the arrow in the lower left corner of the XY graph pane opens a menu that offers options for scaling both the X-axis and Y-axis, as well as an option to copy the graph to the clipboard.
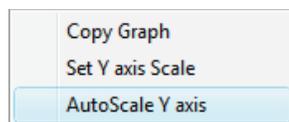
The XY Graph menu.

The menu items are:
- **Copy graph**: Copies the current XY graph to the clipboard. It can then be pasted into the journal or an external application.
- **Set Y-axis Scale**: Allows the user to set the Y-axis scale.
- **AutoScale Y-axis**: Optimizes the display scale of the Y-axis of the XY graph.
- The axes can also be re-scaled by left-clicking and dragging either of the axes.

The Data Table

The **Data Table** displays the chosen calculated values for each cycle.

*	Sel	Time	HR	DURs	DURd	DURc	FillT	T:ES-ED	P1:Pmax	P1:Pmin	P1:dPmax	P1:dPmin	P1:Pmean	P1:MAP	P1:CI	P1:RI	P1:PH	P1:ES
units		sec	bpm	msec	msec	msec	msec	msec	mmHg	mmHg	mmHg/sec	mmHg/sec	mmHg	mmHg	#	#	mmHg	mmHg
1	Yes	2.740	82.192	230.000	490.000	720.000	490.000	510.000	2.913	2.875	0.457	-0.180	2.891	2.900	0.158	-0.062	0.038	2.913
2	Yes	3.470	82.192	230.000	490.000	720.000	490.000	510.000	2.912	2.874	0.474	-0.170	2.891	2.900	0.164	-0.059	0.038	2.912
3	Yes	4.200	84.507	230.000	490.000	720.000	480.000	510.000	2.912	2.874	0.459	-0.171	2.891	2.900	0.159	-0.059	0.038	2.912
4	Yes	4.910	82.192	230.000	470.000	700.000	420.000	510.000	2.912	2.874	0.470	-0.181	2.890	2.900	0.163	-0.062	0.039	2.912
5	No	5.640	84.507	240.000	500.000	740.000	380.000	530.000	2.910	2.872	0.457	-0.177	2.889	2.898	0.159	-0.061	0.038	2.910
6	Yes	6.350	83.333	220.000	470.000	690.000	470.000	500.000	2.908	2.870	0.462	-0.181	2.886	2.895	0.160	-0.062	0.039	2.908
7	Yes	7.070	88.235	230.000	460.000	690.000	300.000	490.000	2.902	2.865	0.436	-0.188	2.877	2.889	0.152	-0.065	0.037	2.902
8	Yes	7.750	92.308	470.000	210.000	680.000	-7980.0▸	450.000	2.899	2.855	0.494	-0.169	2.886	2.885	0.172	-0.059	0.044	2.899
10																		
11	#		7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
12	Mean		84.994	262.857	440.000	702.857	-761.429	497.143	2.908	2.870	0.465	-0.177	2.888	2.895	0.161	-0.061	0.039	2.908
13	SD		3.597	84.636	94.567	15.779	2947.636	20.504	0.005	0.007	0.017	0.006	0.005	0.006	0.006	0.002	0.002	0.005
14	Max		92.308	470.000	490.000	720.000	490.000	510.000	2.913	2.875	0.494	-0.169	2.891	2.900	0.172	-0.059	0.044	2.913
15	Min		82.192	220.000	210.000	680.000	-7980.0▸	450.000	2.899	2.855	0.436	-0.188	2.877	2.885	0.152	-0.065	0.037	2.899

*The Blood Pressure Data Table.*

Clicking the asterisk at the upper left of the **Data Table** displays two options: **Autosize** and **Copy Selection**. A**utosize** will optimize the size of the **Data Table** boxes, and **Copy Selection** copies any selected **Data Table** cells to the clipboard.

The **Data Table** displays the chosen calculated values for each of the cycles checked in the **Cycles Selected** window, as well as the mean, standard deviation, and range of each of the chosen parameters averaged over all the selected cycles.

Clicking **OK** in the **Offline Calculations Options Dialog** saves the settings for future **Blood Pressure** analyses.

There are four buttons across the bottom of the Blood Pressure Calculations Dialog**: Copy, Export, Algorithms, Table Options, Load Template, and Save Template.**

- All the calculated data in the **Data Table** can be copied to the clipboard by clicking the **Copy** button, or exported by clicking the **Export** button. The data are exported in a tab (*.txt) or comma (*.csv) separated text file, and the XY graph can be exported as a Portable Network Graphics (*.png) or JPEG (*.jpg) image.
- Clicking **Algorithms** opens an information window describing the mathematical equations used to compute a number of the offline parameters.
- *LabScribe* is able to calculate a large number of blood pressure calculations for each cycle. By clicking **Table Options** at the bottom of the **Blood Pressure Calculations Dialog**, the **Offline Calculations Options Dialog** opens, and calculations to be displayed in the dialog data table can be chosen from the list of all possible calculations. Marks indicating temperature and activity can also be added to the file, and those values can be chosen from the **Table Options** list and included in the **Data Table**.
- Clicking **Load Template** or **Save Template** displays a dialog allowing you to name and save a specific configuration for future use or to load a previously saved template.
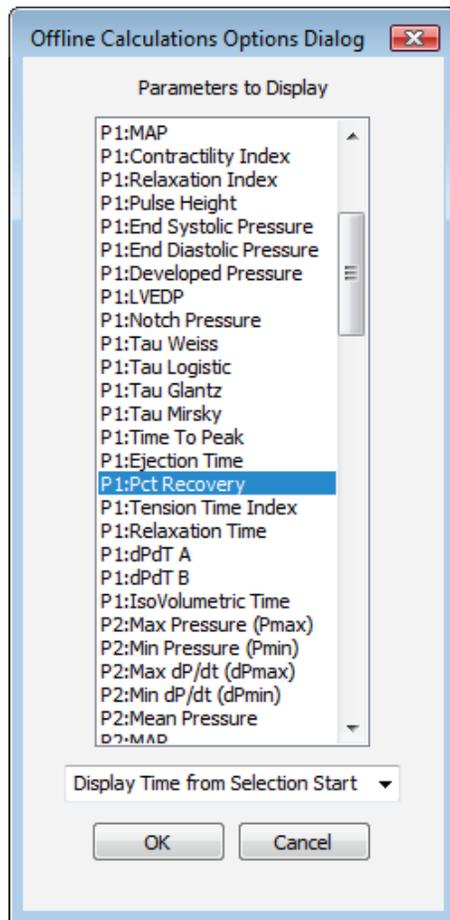
Offline Calculations Options dialog.

Offline Calculations:

- **Time**: Time (in seconds) from the start of the selection, or the time of day of the recording, depending upon which option is chosen.
- Heart Rate **(HR)**: 60/period of each cycle.
- Systolic Duration (**DURs**): Time between the start of the cycle and the minimum dP/dt (**dPmin**)**.**
- Diastolic Duration (**DURd**): Time between the minimum dP/dt (**dPmin**) and the end of the cycle.
- Cycle Duration (**DURc**): Time between any two analogous points in two cycles (often **ED**).
- Fill Time (**FillT**): Time from end-systole (**ES**) to where the pressure starts to fall to end-diastole (**ED**).
- Time from end-systole to end-diastole (**T:ES - ED**): Time from **ES** to next **ED**..
- Maximum Pressure (**Pmax**): Maximum value of the pressure channel for that cycle.
- Minimum Pressure (**Pmin**): Minimum value of the pressure channel for that cycle.
- Maximum dP/dt (**dPmax**): The smoothed derivative of the pressure channel is calculated, using 2 points on either side of any given point. **dPmax** is the steepest slope as pressure increases.
- Minimum dP/dt (**dPmin**): The smoothed derivative of the pressure channel is calculated, using 2 points on either side of any given point. **dPmin** is the steepest slope as pressure decreases.
- Mean Pressure (**Pmean**): Mean of all values in the cycle.
- Mean arterial pressure (**MAP**): 2/3 end systolic pressure (**ESP**) + 1/3 end diastolic pressure (**EDP**).

- Contractility Index (**CI**): (**dPmax**) / (**Pressure** at **dPmax**).
- Relaxation Index (**RI**): (**dPmin**) / (**Pressure** at **dPmin**).
- Pulse Height (**PH**): **Pmax – Pmin**.
- End Systolic Pressure (**ESP**): Value of the **Pressure** channel at **ES**.
- End Diastolic Pressure (**EDP**): Value of the **Pressure** channel at **ED**.
- Developed Pressure (**ESP** - **EDP**)**: ESP** - **EDP**.
- Left Ventricular End Diastolic Pressure (**LVEDP**): Pressure at **ED** in a left ventricular pressure channel.
- Notch Pressure (**Notch**): Pressure at the dicrotic notch.
- Tau Weiss (**Tau W**): P(t) = a(-t/**Tau**).
- Tau Logistic (**Tau L**): P(t)= a(-t/**Tau**) + b.
- Tau Glantz (**Tau G**): Regression of **dP/dt** vs. **Pressure**.
- Tau Mirsky (**Tau M**): Time required for **LV pressure** to fall to one-half of its value at **ESP**.
- Time to Peak (**TT Peak**): Time from the start of the cycle to **Pmax**.
- Ejection TIme (**ET**): Time between the start of the cycle and the dichrotic notch.
- Percent Recovery (**% rec**): Designated (by user) percentage of the time it takes for the pressure to recover.
- Tension Time Index (**TTI**): The average pressure during systole multiplied by systolic duration.
- Relaxation Time (**RT**): The time between **dPmin** and the time specified by the relaxation time value set by user.
- **dPdT A**: Rate of pressure change as a function of time at user designated point A.
- **dPdT B**: Rate of pressure change as a function of time at user designated point B.
- IsoVolumetric Time (**IVT**): Duration of the isovolumetric contraction period.