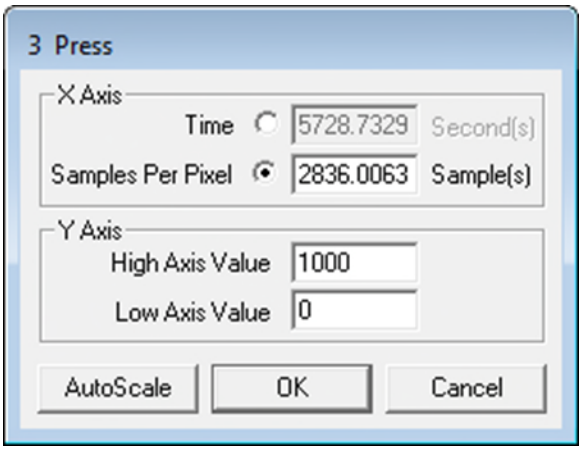


- **X axis**
  - The X axis scaling is defined for the entire graph page and permits the user to switch between **Time** and **Samples per Pixel** modes.
  - When in **Time** mode, the time that corresponds to the graph page width is specified.
  - When in **Samples per Pixel** mode, the user specifies the number of samples that should be displayed per pixel, and this relationship is maintained if the size of the graph page is modified.
- **Y axis**
  - The Y axis scaling is defined only for the signal within the graph pane the **Scaling** dialog was launched from.
  - The user can scale the Y axis manually or choose the **AutoScale** option. Clicking on the **AutoScale** button will set the **High Axis Value** and **Low Axis Value** of the Y axis edit fields to the upper and lower limits of the signal currently displayed in the display pane.

Note:

- Use the **View Entire Dataset** toolbar icon to obtain an overview of the entire acquisition period. This ultimately scales the X Axis to display the entire dataset. It is recommended to toggle **OFF** the **Validation Mark** using the graph toolbar to more clearly view the data at this scale. The **Bad Data Mark** and **Data Break Marks** may also need to be toggled off using their respective toolbar icon toggles.
- Left-click and drag the across the **Display Pane** to zoom in. If the start point of the left-click has marks clustered together, use the **Snap Zoom** icon, as this allows the left-click and drag zoom in feature to ignore the marks.
- Various icons can be used to scale the graphical data. Please see the **Graph Menus** and **Toolbar** section for compress, expand, zoom in, and zoom out icons.

DATA BREAKS

Data Breaks are only seen during a Review session and are green, vertical, dotted lines that represent time intervals where the saving of raw data has been turned off during Acquisition. Users may see **Data Breaks** for the following reasons:

- **Scheduled** sampling is being used – See the **Scheduled Sampling** section for more information.
- Multiple acquisition sessions have been loaded into Review. For example, the user acquires for eight hours during the day, stops Acquisition overnight, and then restarts acquisition for 8 hours the next day.

This will result in a time gap between the two collection periods. If data is loaded into Review that overlaps this idle period, a **Data Beak** will be present.

- The user has added **Parser Segments** during a previous **Review** session and has now loaded data into Review by **Parser Segment**. See the **Data Parser** and **Loading Data into Review** sections for more information.

Note: The display of **Data Breaks** may be toggled off using its toolbar icon to more easily see the waveform morphology.

Graph Menus and Toolbar

The following displays and defines the graph page Toolbar for Primary, Trend, and Page View graphs. The example screenshot is from a Primary Graph within Review (not all icons described in the table are displayed).

Toolbar Icon	Menu Selection	Mode Available	Description
	**File | Print**	Acquisition, Review	Prints the current graph page based on the current Review Print Setup. See the **Printing** section.
 **Not pictured in example above.**		Acquisition	The **Freeze Toggle** icon allows the window contents to be frozen or unfrozen. Freezing the graph does not impact the collection of data, only how it is displayed in the graph. Upon unfreezing the graph, the signals will speed ahead to real-time data.
	**File | ASCII Output**	Review	This option brings up a dialog for the user to create ASCII Output based on the options selected.
	**Edit | Expand**	Acquisition, Review	Expands the time span (X axis).
	**Edit | Compress**	Acquisition, Review	Compresses the time span (X axis).
 **Not pictured in example above.**		Acquisition	Scales the Y axis to display the minimum and maximum Y values of all signals displayed in the graph. Each Channel area is scaled separately to accommodate the signal is it displaying.
	**Edit | View Entire Data Set**	Review	Scales the X axis to display all available data from the Channels within the graph page that have been loaded into the Review session. This selection is useful to obtain an overview of the entire acquisition period by observing the signal envelope and to zero in on regions of interest by using the Zoom feature. It is recommended that validation marks be turned off when using this feature to permit viewing of the signal envelope

Toolbar Icon	Menu Selection	Mode Available	Description
	**Edit | Snap Zoom In**	Review	Use to expand the X axis to display the selected region. Selecting this icon will change the mouse cursor to crosshairs and permit the user to drag the mouse over an area of interest to zoom in to the selection. When this is used on an **XY-Loop** or **Scatter** graph, it changes both the X and Y scaling.
	**Edit | Snap Zoom Out**	Review	Use to compress the X axis to display the current X axis range in the area selected. Selecting this icon will change the mouse cursor to crosshairs and permit the user to zoom out by dragging the mouse over an area of interest which will result in the data currently displayed in the graph page to be compressed to fit in the selected region. When this is used on an **XY-Loop** or **Scatter graph**, it changes both the X and Y scaling.
	**Edit | Undo Graph Time Change**	Review	Removes the last graph time change, reverting to the previous state. This feature will not be available if **Enable Difference Calculations** is disabled in the **Setup | Application Configuration | Review** dialog.
	**Edit | Sync with Derived Data**	Review	Syncs derived and data reduction list views with the current cursor position.
	**Edit | Change - Search Right**	Review	Searches for the next change marker in the selected channel. This feature will not be available if **Enable Difference Calculations** is disabled in the Review dialog. This is accessed through the Application Configuration dialog from the Tools pull down menu.
	**Edit | Change - Search Left**	Review	Searches for the previous change marker in the selected channel. This feature will not be available if **Enable Difference Calculations** is disabled in the **Setup | Application Configuration | Review** dialog.
	**Edit | Note - Search Right**	Review	Searches for next **Note** in the selected channel.
	**Edit | Note - Search Left**	Review	Searches for previous **Note** in the selected channel.
	**Edit | Event - Search Right**	Review	Searches for next **Event** in the selected channel.
	**Edit | Event - Search Left**	Review	Searches for previous **Event** in the selected channel.
	**Edit | Parser Segment - Search Right**	Review	Searches for the next **Parser Segment**.
	**Edit | Parser Segment - Search Left**	Review	Searches for the previous **Parser Segment**.
	**Edit | Time - Search**	Review	Searches for a specific time in the selected channel.
	**Edit | Unmatched - Search Right**	Review	Searches for the next unmatched cycle (**Template Analysis** feature).
	**Edit | Unmatched - Search Left**	Review	Searches for the previous unmatched cycle (**Template Analysis** feature).

Toolbar Icon	Menu Selection	Mode Available	Description
	**Edit | Bad Data Mark - Search Right**	Review	Searches for the next **Bad Data Mark**.
	**Edit | Bad Data Mark - Search Left**	Review	Searches for the previous **Bad Data Mark**.
	**Options | Toggle Validation Marks**	Acquisition, Review	Toggles the **Validation Marks** for all channels in the graph page. Note: during Acquisition, this is only accessible from the main Ponemah dialog and is not located within the graph page dialogs.
	**Options | Draw Mark Differences**	Review	Toggles the **Mark Differences** on the graph page. This feature will not be available if **Enable Difference Calculations** is disabled in the **Setup | Application Configuration | Review** dialog.
	**Options | Draw Parser Segment Watermarks**	Review	Toggles the display of **Parser Segment Watermarks** on the graph page **ON/OFF**.
	**Options | Toggle Data Break Marks**	Review	Toggles the display of **Data Break Marks ON/OFF.** See the **Graph Concepts** section of this manual for more information on **Data Breaks**.
 **Not pictured in example above.**	**Options | Calibration Dialog**	Acquisition, Review	Launches **Glucose Calibration** dialog for the entry and augmentation of Glucose Calibration values. *Note*: Only visible in Toolbar when glucose input signals are being displayed by the graph page.
 **Not pictured in example above.**	**Options | Draw Calibration Marks**	Acquisition, Review	Toggles the display of **Glucose calibration Reference Values ON/OFF.** *Note*: Only visible in Toolbar when glucose input signals are being displayed by the graph page.

Data Acquisition

Sampling Control — Starting Data Acquisition

The **Sampling Control** dialog permits the user to manage the Ponemah Data Acquisition.

If this is a new Experiment or hardware has not previously been configured, the **Sampling Control** dialog will display the following message "*Please configure Sources from the Hardware menu.*"

The **Sampling Control** dialog contains all subjects that have been configured for the Experiment. This is the interface that controls which Subjects get sampled, in which order, and how often. Sampling tabs are used to manage each sampling method and provide visual feedback on the state of the data acquisition.

When Ponemah is opened, it will load the last Experiment used and automatically populate the **Sampling Control** dialog with the previously configured Subject list.

There are four tabs across the top of the window:

- **All**

  Displays implants set to Continuous and Scheduled sampling in one list. Allows start/stop of data acquisitionfor any combination of the Subjects in the **Continuous** list, and start/stop for all the implants on a schedule.

- **Schedule 1**

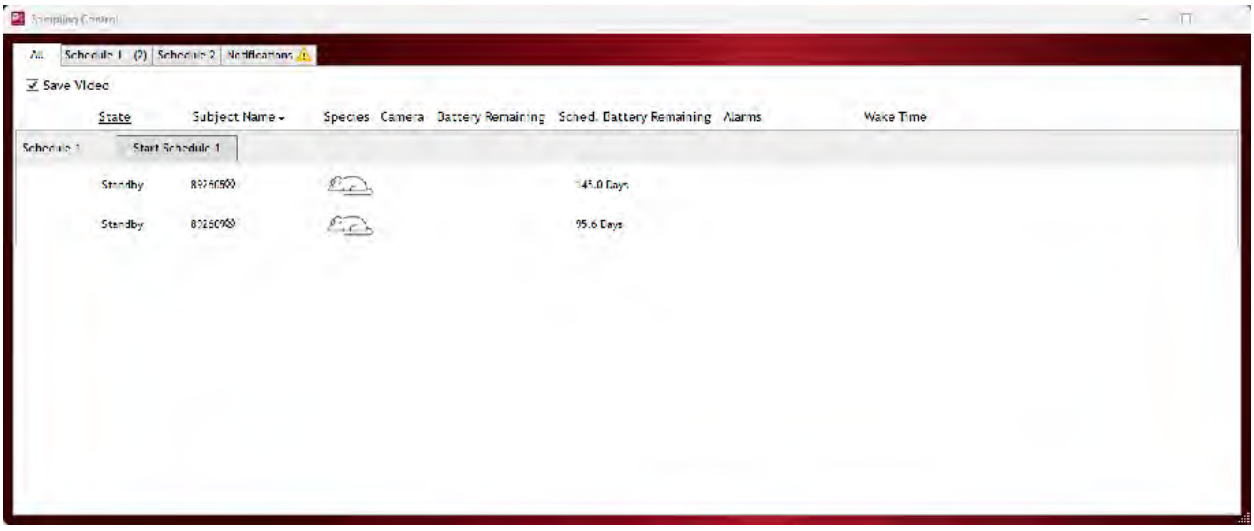
  Allows subjects to be grouped for intermittent, sequential sampling.

- **Schedule 2**

  Allows the user to run a second, separate schedule. This schedule may be run simultaneously with **Schedule 1** or with Subjects sampling continuously.

- **Notifications**

  List all hardware events associated with the Experiment. For fatal hardware events, such as hardware disconnects or reboots, the tab will include a **Warning** icon.



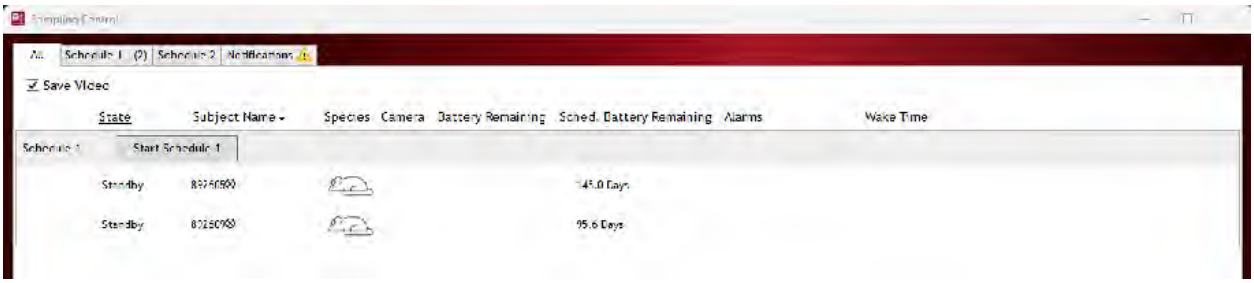
Notes:

- By default, new Subjects are automatically added to the **All** sampling tab and set up for continuous sampling.
- The Sampling Control allows you to acquire using the Continuous Sampling method in conjunction with two (2) disparate Scheduled Sampling sequences.
- The number of Subjects you may acquire from simultaneously is determined by the Subject number defined by your software license; this number is shared across all Continuous and Scheduled tabs.

  Note: The maximum number of subjects that can be sampled from simultaneously is 32, assuming the software license is at its maximum.

Continuous Sampling

Continuous sampling allows you to sample one or more implants for an extended period of time and without breaks in the data. Continuous sampling is manually started, and continues uninterrupted for minutes, hours, or days, until you stop the process.



The **All** tab is laid out in columns:

- **State:**

  Displays the sampling state (line items in the list may be sorted by clicking on this column heading). State changes are accompanied by a change in the rectangular icon to the left.

- **Subject Name:**

  Lists the Subject Name.

- **Species**

  Displays the Icon for the species that has been selected in the Subject Setup menu.

- **Camera**

  Displays associated camera if configured and assigned to subject.

- **Battery Remaining:** Displays the Battery Days Remaining of PhysioTel HD, PhysioTel Digital and SoHo implants while actively acquiring data.

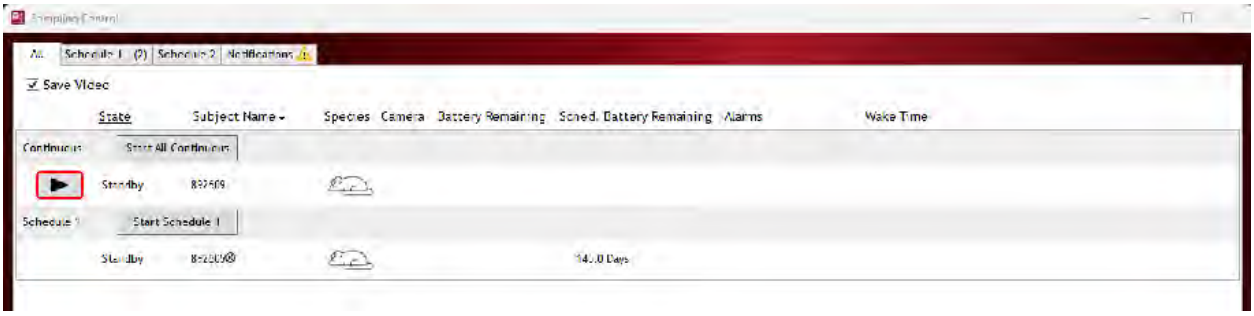
  Note: PhysioTel HD Battery ON Time counts the number of days the implant is in ON mode. The value in this field represents the warranted battery life with the Battery Days ON time subtracted. PhysioTel Digital and SoHo implants report days remaining by default.

- **Scheduled Battery Remaining:** SoHo ONLY: Displays the time that SoHo devices will run for based on remaining battery life and the current schedule that is set.

- **Alarms:** The user may set low and high alarm thresholds on parameters such as HR and when that parameter goes over that threshold, the value will be displayed in the alarm column in line with the subject that has the alarm.

- **Wake Time** Used for SoHo series implants when set to Scheduled Sampling. Displays the next time implants will wake to prepare for the scheduled sample interval.

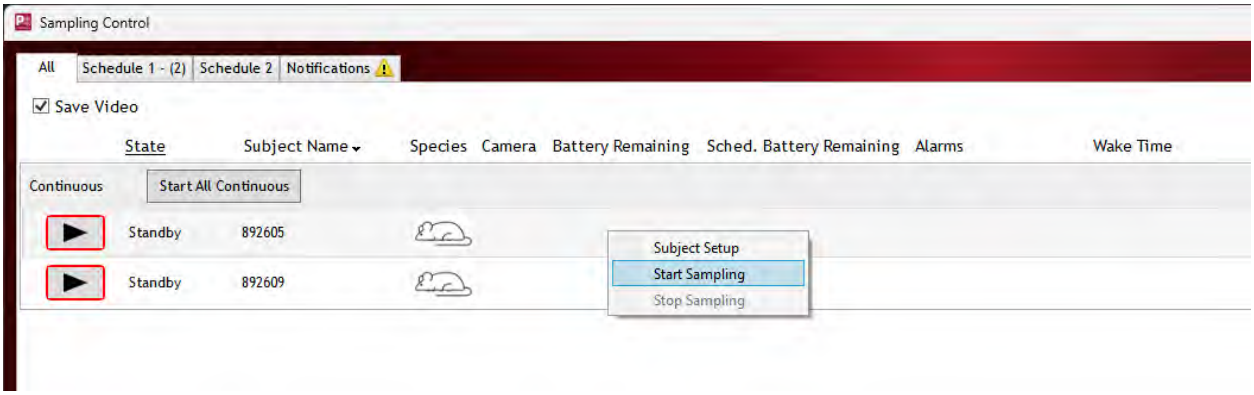
Note: The **Sampling Method** is indicated on the far-left side of the *Sampling Control* dialog and is used to indicate which **Sampling Method** – *Continuous, Schedule 1,* or *Schedule 2* – the Subject is assigned. If a Subject is assigned to a Schedule, a **Remove from Schedule** button is available to quickly reassign the Subject to *Continuous Sampling* without first having to navigate to its *Schedule* tab.



STARTING/STOPPING CONTINUOUS SAMPLING

1. To Start Continuous Sampling for All Subjects:
   a. Select the **Start All Continuous** button from the *Sampling Control* dialog.
   b. Alternatively, select the **Actions menu | Start Sampling | Continuous – All Subjects**.
2. To startContinuous Sampling for specific subjects:

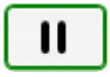
a. Multi-select the subjects you wish to start sampling from using **<Shift> + left-mouse-click** or **<CTRL> + left-mouse-click** (used if Subjects are non-sequential).
b. Right-click and choose **Start Sampling**.



3. Stop sampling using any of the menu options below:
   a. **Actions | Stop Sampling | All**
   b. **Actions | Stop Sampling | Continuous – Selected Subjects**
   c. **Actions | Stop | Stop Acquisition**
   d. **Right-mouse-click** Subject and Choose **Stop Sampling**.

STARTING/STOPPING CONTINUOUS SAMPLING USING STATE BUTTONS

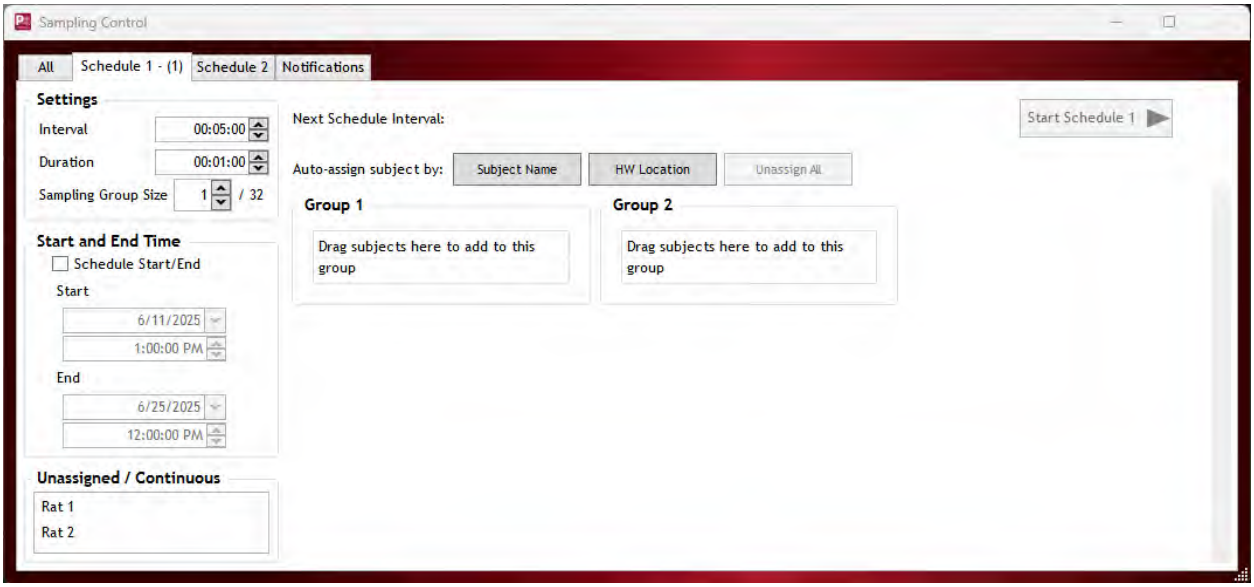
Continuous sampling can be controlled individually by using the interactive buttons to the left of the **State** column of the **Sampling Control** dialog. The sampling control buttons change in appearance according to the **State** of the acquisition process.

Button	State	Action
	Standby	Click to Start Sampling
	Waiting	None
	Searching	None, shows during data sampling when implant out of range/ not responding, wait for implant reconnect
	Searching	None, shows when not sampling and out of range/not responding, wait for implant reconnect
	Sampling	Click to Stop Sampling

	Off	None, implant is Off
	Requires Wake	None, implant in sleep or hibernate. Go to Hardware configuration to wake implant
	Error	None, displayed when hardware is unable to be accessed.

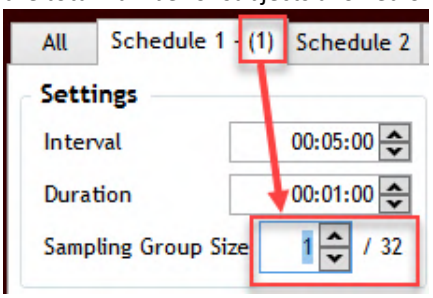
Note: Starting and stopping Continuous Sampling for a single subject will not impact the sampling of other subjects within the experiment.

Scheduled Sampling

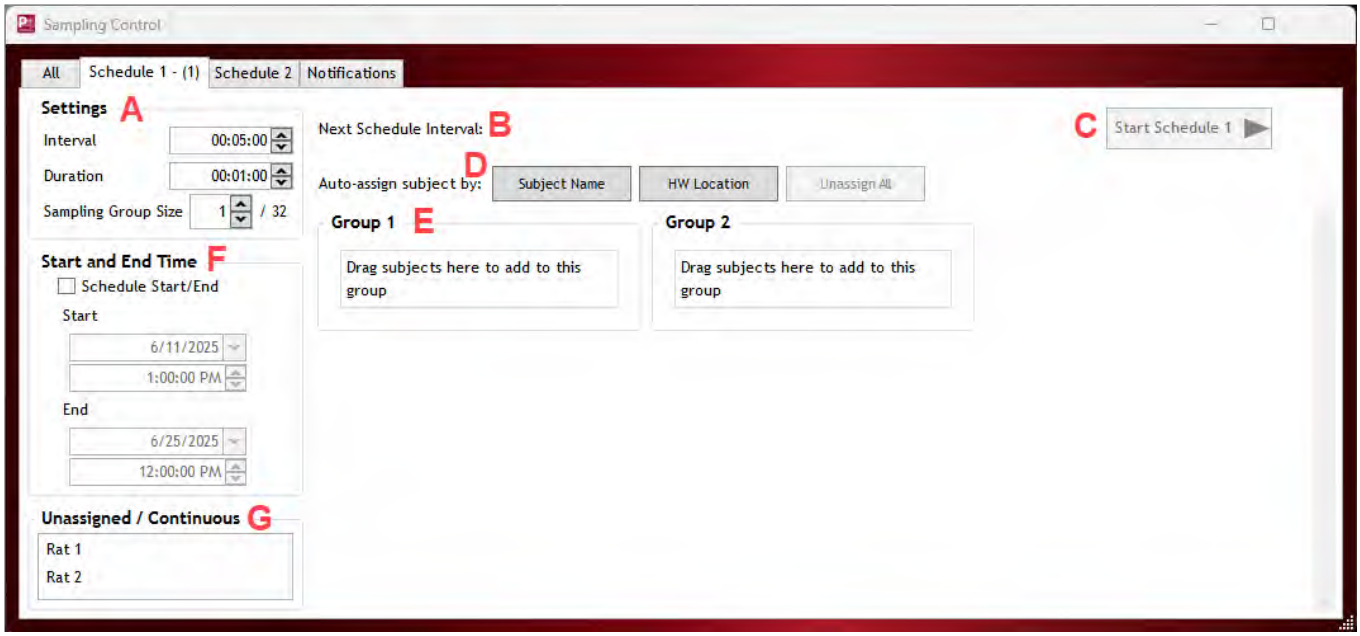


Scheduled sampling allows sampling of many implants sequentially and at intervals defined in the two **Scheduled** tabs. This allows the cycling of Subjects through the number of available resources defined by your software license to maximize the number of Subjects that can be sampled. The *Sampling Control* dialog organizes Subject sampling according to **Groups**. The user can select how the subjects are grouped and in which order they are sampled.

Scheduled sampling is controlled via the two **Schedule** tabs found in the **Sampling Control** dialog. The **Schedule1 and Schedule 2** tabs allow the flexibility to run two separate schedules simultaneously. The number in parentheses in the Schedule tab indicates the number of subjects assigned to scheduled sampling. This number counts toward the total number of subjects allowed on the license, indicated by the Sampling Group Size.



The following displays the Schedule tab and defines its functional areas.



A. Settings

The Settings section of the Schedule tab contains user defined adjustments that automatically start and stop sampling groups depending upon the length of the sampling period (**Duration**) and the frequency of sampling episodes (**Interval**).

- **Interval**

  The time repetition (hh:mm:ss) over which all **Sampling Groups** are sampled.

- **Duration**

  The time (hh:mm:ss) for which waveform data is acquired from the **Sampling Group**.

- **Sampling Group Size**

  Defines the number of Subjects that will be sampled together during the Schedule. This setting is configured as a fraction. The numerator is the user-selected number of Subjects per sampling Group. The denominator is the number of "sources" available as specified in the software license. As the **Sampling Groups** size is changed, the blank lines in the group lists increase or decrease.

B. Next Schedule Interval:

Displays the start time of the next **Scheduled** acquisition interval.

C. Start/Stop Schedule

Initiates/terminates **Scheduled** sampling for that tab.

D. Auto-assign Subject by:

Automated grouping features.

- **Subject Name**

  Assigns Subjects to groups based on **Subject Name**. Automatically populates the sampling **Group** with individual Subjects according to the **Subject Name**. Fill all slots in Group1, fill all slots in Group 2, etc.

- **HW Location**

  Automatically populates the sampling **Group** with individual Subjects according to the MX2 configuration and the receiver association. Fill all slots in Group1, fill all slots in Group 2, etc.

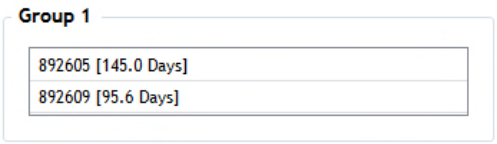
- **Unassign All**

  Empties the **Groups** and returns the all Subjects to the Unassigned / Continuous list box. A confirmation dialog will be presented. This only operates on with the selected **Schedule** tab.

E. Groups

A group of Subjects that will be sampled together during the **Schedule**. New **Groups** will be added and removed according to the **Settings** selected by the user.

Note: SoHo implants will display a number after the subject indicating the runtime based on the remaining battery life and current schedule that is set. See the SoHo Modes section for details.



F. Start and End Time

If enabled, allows scheduling a Start Date and Time and End Date and Time for the sampling to run.

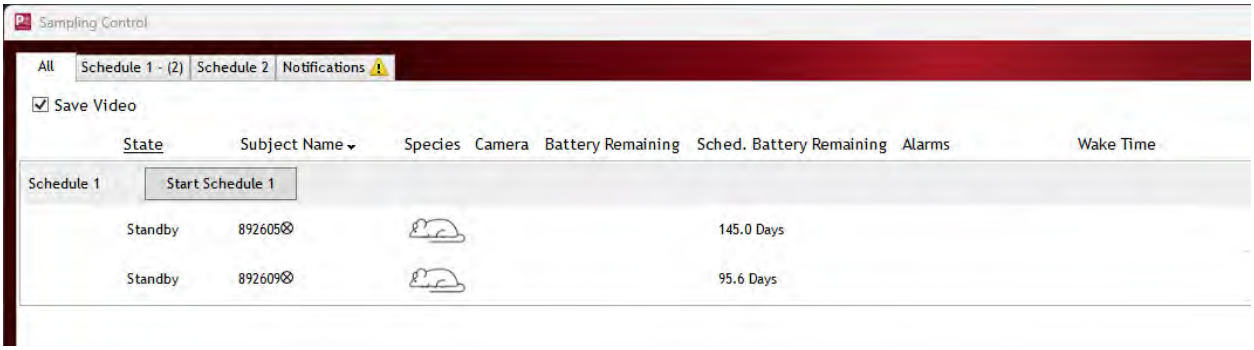
G. Unassigned / Continuous

List of configured subjects that are available for assignment to a **Sampling Group**.

ADDING SUBJECTS TO SCHEDULED SAMPLING GROUPS

- **Auto-assign** – This automates the grouping of subjects as described in Section C. of the table immediately above.
- **Drag-and-Drop** – Manually click on individual Subjects, “drag” them to a group, and release the mouse button to “drop” into its group.

Once the Subjects are configured for **Scheduled** sampling they are designated as such in the All tab in the *Sampling Control* dialog. The **State** is listed as **Standby** and the **Sampling Method** is listed by the **Schedule** tab it is assigned to. It also is listed with a **Remove from Schedule** button as shown below.



STARTING/STOPPING A SCHEDULED SAMPLING GROUP

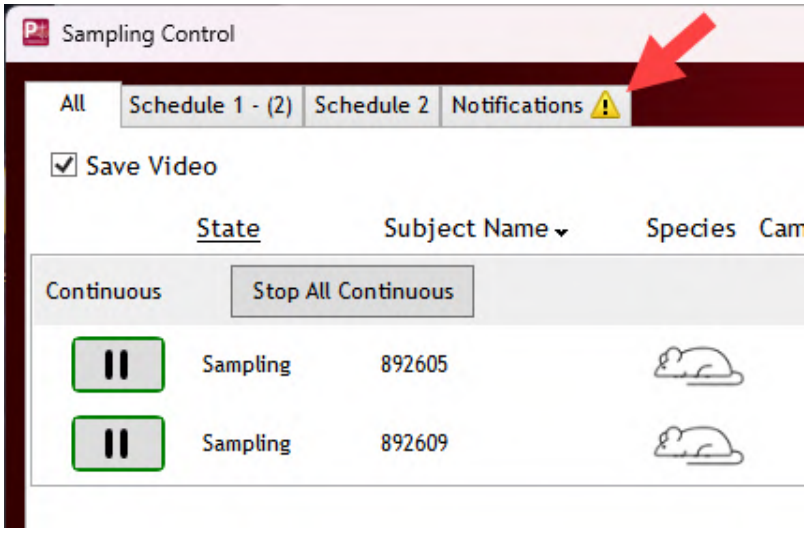
To start a sampling Schedule:

- Select the **Start Schedule** button on the particular **Schedule** tab desired.
- Select the **Actions menu | Start Sampling | Schedule 1** (or **Schedule 2**).
- Select the **Start Schedule** button on the **All** tab for the desired **Schedule**.

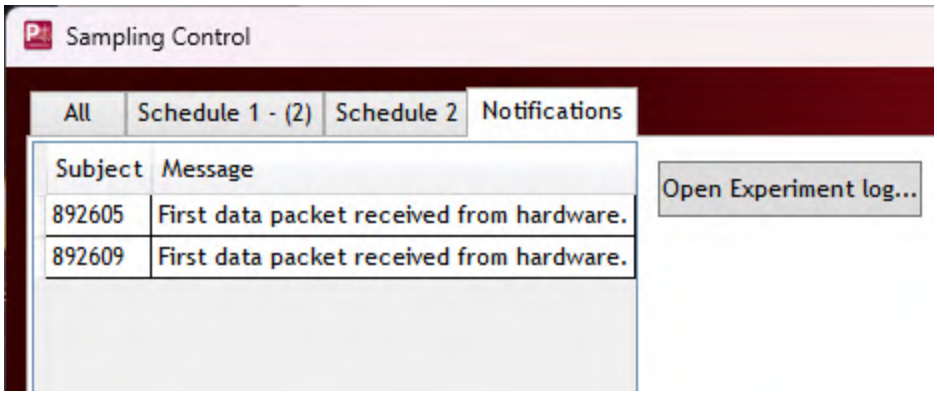
Upon starting the *Schedule Sampling*, the **Start Sampling** buttons will update to **Stop Sampling** buttons. To stop the *Schedule Sampling*, simply select one of the **Stop Sampling** buttons or select the **Actions menu | Stop Sampling | Schedule 1** (or **Schedule 2**).

Notification Tab

The **Notifications tab** will list all hardware events associated with the Experiment. For fatal hardware events, such as hardware disconnects or reboots, the tab will include a **Warning** icon as displayed below:



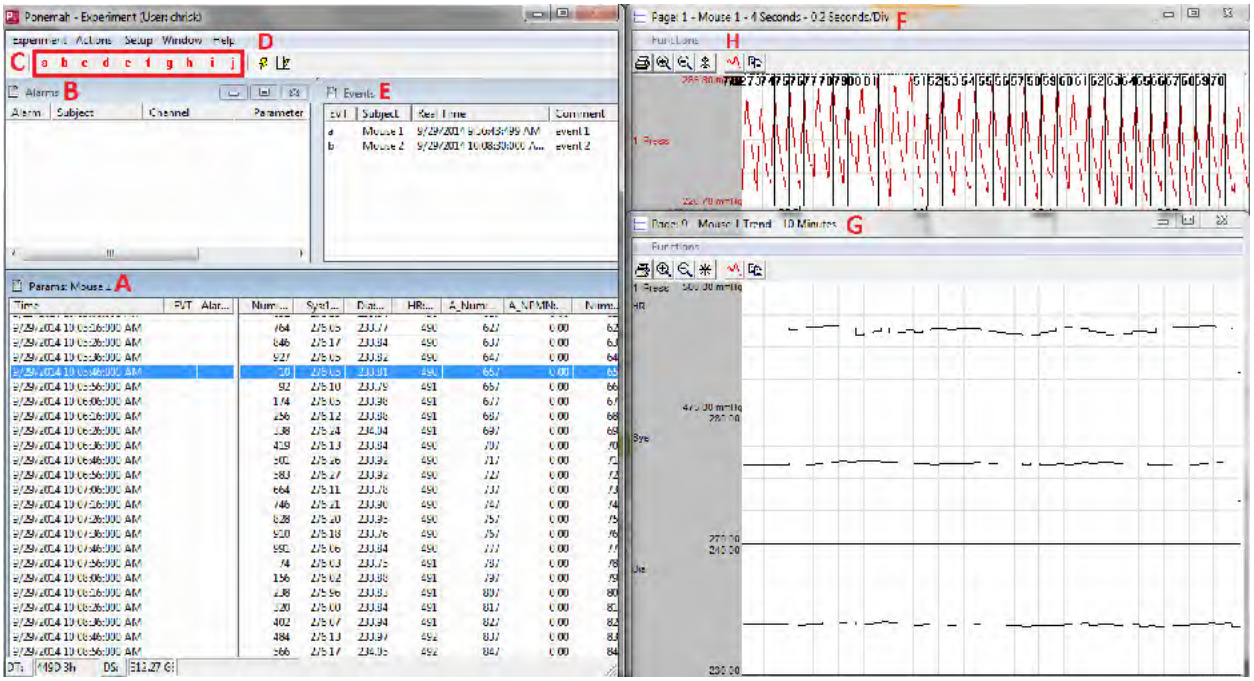
To see the notifications and clear the **Warning** icon, click the **Notification** tab. Users can see the historical notifications by selecting the **Open Experiment log…** button.



Data Acquistion Dialog

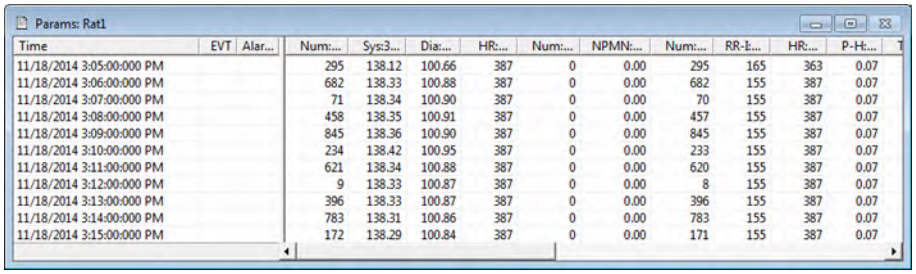
Once the Experiment is configured through the **MX2 Configuration** and **Subjects** are configured through the **Sampling Control**, the data acquisition functions are activated upon clicking **Start Sampling**. Once an acquisition session is initiated Ponemah automatically opens and displays all graph pages that are configured in the **Graph Setup** dialog.

The functions and views of Data Acquisition dialog are called out and are described in detail below:



A. Derived Parameter List View: Organizes and displays **Derived** (calculated) **Parameter** data (such as heart rate, mean blood pressure, etc.) from the real-time data analysis. **Derived Parameters** are logged to the **List View** based on user-defined settings defined within the **Logging Rate** dialog. The data on each line is from the data contained within the **Logging Period** – the rate specified in the **Logging Rate** dialog.

By default, one **Derived Parameter List View** will be available for each **Subject** being sampled. This is ideal when each Subject has a large number of **Channels** and associated **Derived Parameters** available and/or enable. For example, if an HD-S21 is being used, each Subject will have an LVP, BP, ECG, Temperature and Activity **Channels** available, each with their own set of **Derived Parameters** that can be calculate.



Time	EVT	Alar...	Num:...	Sys:3...	Dia:...	HR:...	Num:...	NPMN:...	Num:...	RR-I:...	HR:...	P-Ht:...
11/18/2014 3:05:00:000 PM			295	138.12	100.66	387	0	0.00	295	165	363	0.07
11/18/2014 3:06:00:000 PM			682	138.33	100.88	387	0	0.00	682	155	387	0.07
11/18/2014 3:07:00:000 PM			71	138.34	100.90	387	0	0.00	70	155	387	0.07
11/18/2014 3:08:00:000 PM			458	138.35	100.91	387	0	0.00	457	155	387	0.07
11/18/2014 3:09:00:000 PM			845	138.36	100.90	387	0	0.00	845	155	387	0.07
11/18/2014 3:10:00:000 PM			234	138.42	100.95	387	0	0.00	233	155	387	0.07
11/18/2014 3:11:00:000 PM			621	138.34	100.88	387	0	0.00	620	155	387	0.07
11/18/2014 3:12:00:000 PM			9	138.33	100.87	387	0	0.00	8	155	387	0.07
11/18/2014 3:13:00:000 PM			396	138.33	100.87	387	0	0.00	396	155	387	0.07
11/18/2014 3:14:00:000 PM			783	138.31	100.86	387	0	0.00	783	155	387	0.07
11/18/2014 3:15:00:000 PM			172	138.29	100.84	387	0	0.00	171	155	387	0.07

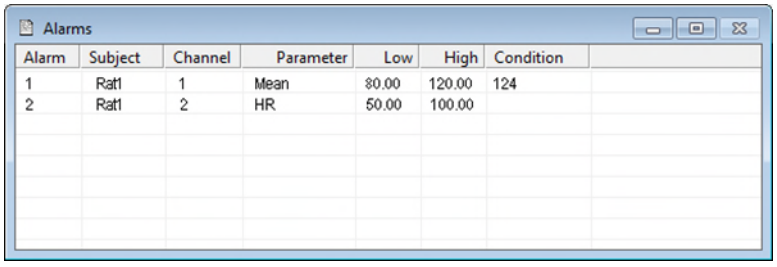
Alternatively, the **Derived Parameter List View** may be organized in an **Aggregate** mode. In **Aggregate** mode, one **Derived Parameter List View** will be available during Acquisition that displays the **Derived Parameters** from all Subjects' **Input Channels** that are being sampled. This is ideal when each Subject has a small number of **Channels** and associated **Derived Parameters**. For example, if an HD-XG is being used, each Subject will only have Glucose, Temperature, and Activity Channels available. In this case, the user may choose to only display three **Derived Parameters** per Subject – Average Glucose, Average Temperature, and Average Activity – for the **Logging Period**. Users can change the **Derived Parameter List View** to Aggregate mode by selecting **Setup | Experiment Setup | Settings** and check the check box associated with **Aggregate Parameter Window**.

Note: Once data has been acquired, the **Derived Parameter List View** organization cannot be augmented. The organization used for Acquisition will also be used during Review.

B. Alarms List View:

Enumerates any alarm conditions met during the acquisition, based on user-defined settings defined within **Subject Setup | Channel Details**.

The following provides more detail on the **Alarms List View**:



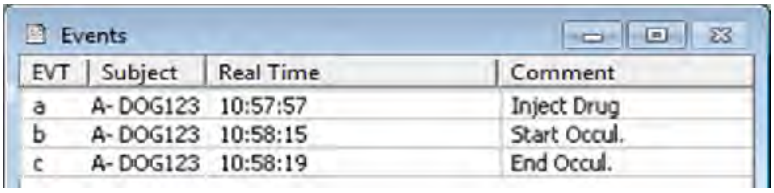
Alarm	Subject	Channel	Parameter	Low	High	Condition
1	Rat1	1	Mean	80.00	120.00	124
2	Rat1	2	HR	50.00	100.00	

- **Alarm** is the number of the alarm.
- **Subject** is the subject name that is assigned to the alarm.
- **Channel** is the sampling channel
- **Parameter** is the derived parameter that is assigned to the alarm.
- **Low** is the low alarm value.
- **High** is the high alarm value**.**
- **Condition** is the condition of the alarm. If the field is blank, then no alarm condition exists for that parameter. If a value is in the field, that value is the alarm value.

C. Events Toolbar:

Buttons labeled "a" through "j" are used to enter an **Event**. These are defined within the **Setup | Experiment Setup** dialog, and can be executed by selecting the appropriate Subject(s) within the **Sampling Control** dialog and selecting the appropriate event.

The following provides more detail on the **Alarms List View**:



- **EVT** is an identification mark. It is a letter between a through j if the User gave the Event a predefined name, or it contains an x (for external). External refers to a hand-entered Event through the Events dialog.
- **Subject** references the Subject Name assigned to the signal. (See Subject Details).
- **Real Time** is the actual time the Event happened.
- **Comment** is the name the User gave the Event in the Groups and Events configuration.

D. Validation Mark Toolbar button

Toggles the display of **Validation Marks** on the **Primary** graph page ON/OFF. **Validation Marks** are tick marks placed on the **Primary** graph page by the Analysis Modules to indicate key points of interest on the waveform. These are used to visually verify that the analysis is triggering properly. See the **Validation Marks** section.

Note: Toggle **Validation Marks** ON/OFF using the <**F10**> keyboard key.

E. Events List View

Enumerates executed **Events** by Subject for the acquisition period.

F. Primary Graph

Displays the signal's waveform data in raw (physical) format over a specified period of time.

G. Trend Graph

Displays the derived parameter data located in the **Derived List View** as a graph.

H. Auto Scale Toolbar button

Auto scales all axes on the graph page. To auto scale a single channel's axis, double-click that channel and click auto scale.

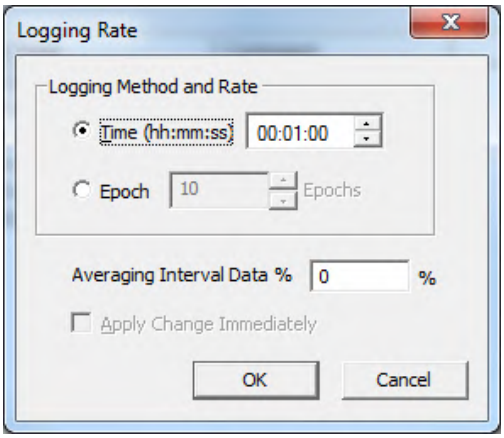
Logging Rate

The **Logging Rate** defines how often derived data is logged to the **Derived Parameter List View** or plotted to graphs that use derived parameter data (See Graph Types). The **Logging Rate** dialog allows the user to change the rate at which the derived parameters are logged to the **Derived Parameter List View** and graphs that display the derived parameters (**Trend** and **Scatter**) as the data is being acquired or while in Review. The **Logging Rate** can be augmented at any time during Acquisition or Review.

Note: The rows of data listed in the **Derived Parameter List View** are referred to as **Log Lines**.

To open the **Logging Rate** dialog, select one of the options below:

- From the **Actions menu | Logging Rate…**
- Pressing the **<F8>** key from the keyboard
- Left-clicking the **LR** button on the Acquisition toolbar



The following define the settings available within the **Logging Rate** dialog:

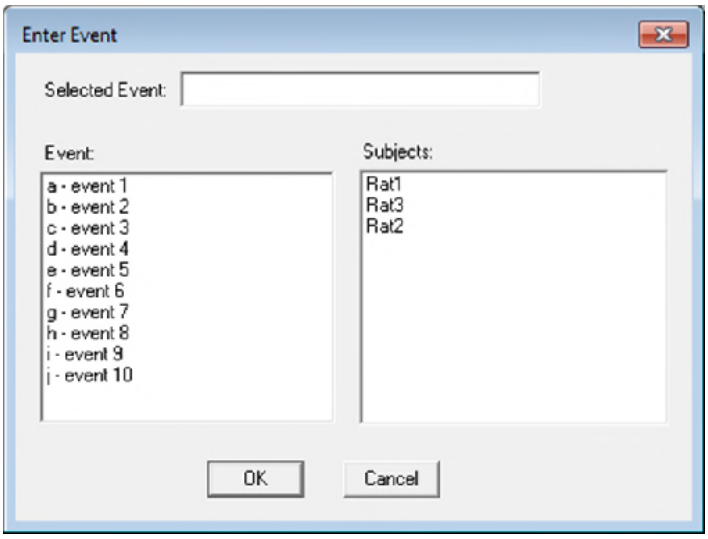
Logging Method and Rate	Determines how often data is plotted on the graphs and logged into the files.
Time (hh:mm:ss)	Sets the **Logging Rate** to a specified time interval.
Epoch	Sets the **Logging Rate** to cycles (beats, breaths, contractions, etc.).
Averaging Interval Data %	The Logging Interval will be rejected and will not be reported if the % of available data within a Logging Interval is less than the Averaging Interval Data % value.
Apply Changes Immediately	Causes the system to begin using the new logging rate immediately and not to wait for the current logging period to finish. The line of data associated with this logging period will be based on fewer values averaged in the logged line of data. If this is not used the system will finish the last logged line of data before using the new logging rate. For example, if the last logging rate was 30 seconds, but only 20 seconds has elapsed, choosing **OK** without checking this causes the system to wait 10 seconds, log the full 30 seconds of data to the **Derived Parameter List View**, then begin using the new logging rate.
OK	Applies the Logging Rate setting changes – see **Apply Changes Immediately** section.
Cancel	Closes the **Logging Rate** dialog without applying any changes.

Marking Events

The User may predefine a set of **Events** (a - j). During Acquisition, the user can execute one of the predefined Events. The executed Event will be marked in the **Primary** graph and in the **Derived Parameter and Event List Views** during the Acquisition for availability within Review**.**

To mark an Event:

1. Select **Actions | Events…** or press <F9> key form the keyboard.



2. Select the **Event** you wish to mark from the **Events** column.
3. Select the **Subjects** you wish to apply the **Event** to from the **Subjects** column.
4. Select **OK**.

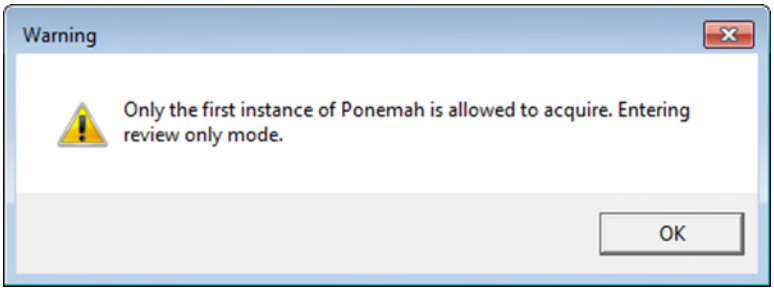
Note: The user has the option to display **Events** as a string. This will display the complete Event message on the graph screen. To display Events as a string, see Settings Configuration section.

Review During Acquisition

Review mode can be accessed from the main Ponemah window: **Actions | Start Review….** However, this option is not available during an active data Acquisition. To enter Review mode during data Acquisition, a second instance of Ponemah can be activated from the **Windows Start Menu** or by **double-clicking** the **Ponemah icon**.

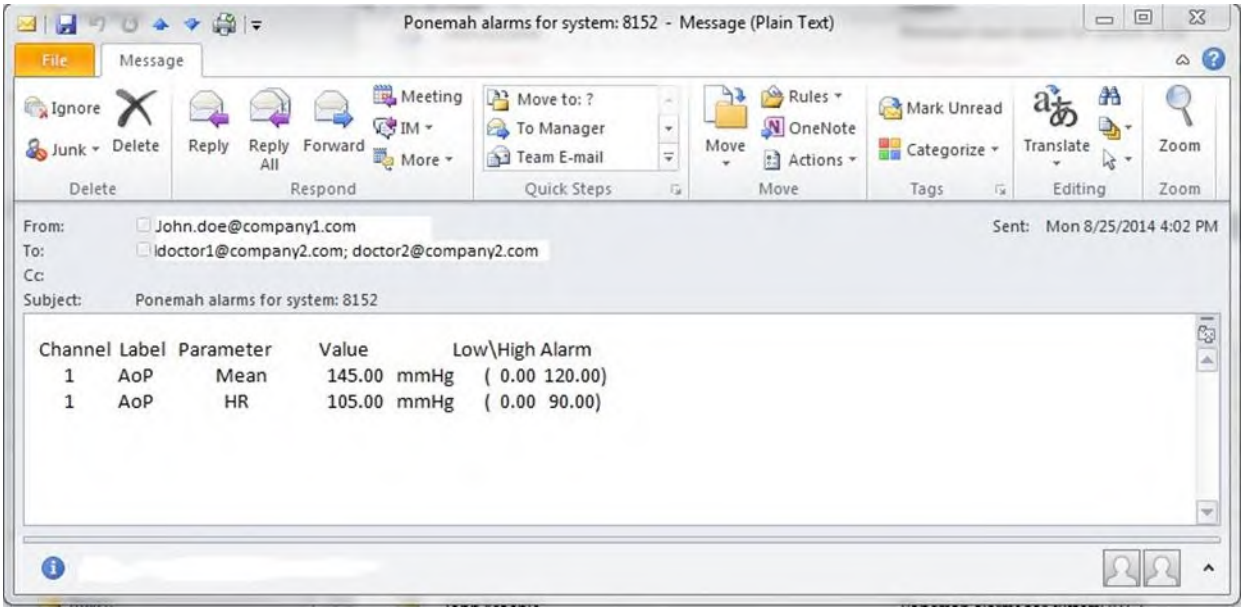
This will initiate a **Review Only Mode** and provide access to data from previous Experiments, as well as the currently acquiring Experiment.

Note: If reviewing data from the currently acquiring **Experiment**, all data will be available up to the point of selecting **Start Review**. To gain access to data collected after this point, close and re-start Review. Additionally, at least 5 minutes of data is required to **Start Review** during the Acquisition; Ponemah will display a notification if less than 5 minutes have been acquired.



Remote Notification – Email Alerts

The Ponemah application supports the sending of an informational **Remote Notification** using **Email Alerts** for two types of conditions by using Simple Mail Transfer Protocol (SMTP).



One type of the email alert is for parameters that go into an alarm condition during acquisition. The alarm thresholds can be set by the user for any **Derived Parameter** and are updated for every **Logging Period**. The user may set a time, in minutes, that set the frequency of the alerts.

This will help prevent sending many email alerts for an alarm if the logging period is set for a short duration but the user would only want to be notified of the alarm condition every 30 minutes. With the delay of sending emails this helps prevent a non-physiological event from sending multiple alarms with a short duration logging period.

The second type of email alert is for an application failure and fatal hardware events. The application failure would be for Data Buffer Overflows. Data Buffer Overflows occur when an application uses many of the resources of the system and starves the Ponemah application from processing incoming data, such as when a virus checker starts

scanning. The processing of this data gets too far behind and causes the failure which then sends out an email alert allowing the issue to be addressed. Fatal hardware events include hardware disconnects and reboots.

As email alerts are sent out, these actions are also logged in the **Ponemah Application log**.

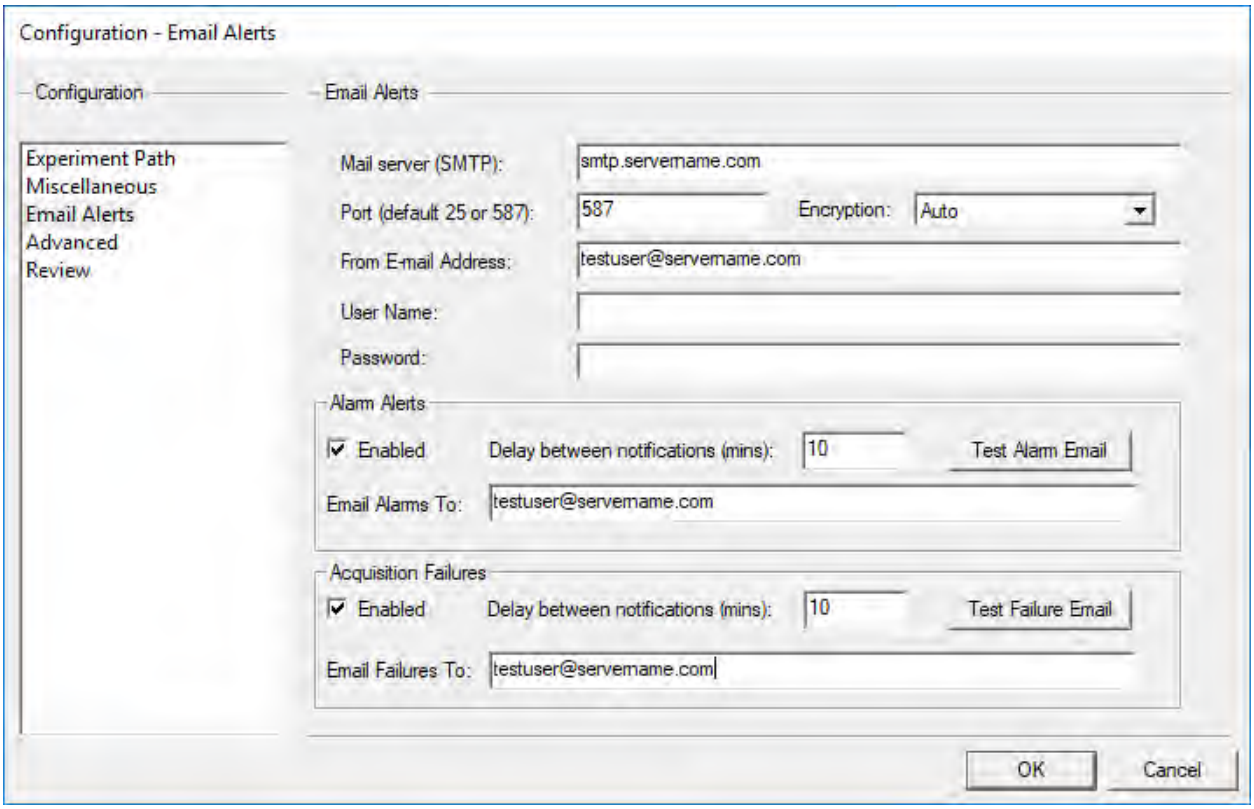
Note: To send emails as text messages, please see the **Remote Notification – Email Alerts** appendix.

Email Alert Configuration

To setup the Email Alert notifications, the first step is to setup the Email server that will be used to allow sending the emails, the recipient addresses to which the alerts will be sent and setting up the desired alarm conditions to trigger the alerts.

To access the Email Alert settings, choose **Setup | Application Configuration | Email Alerts**.

Note: If are using an account that requires a password change, be sure to update the password used in this configuration.



Depending on the email server that will be used to send the email alerts, the configuration can be accomplished by setting the appropriate fields to match the server configuration. In certain cases, such as for Exchange Server, specific configuration settings may be needed to allow access. If you are unsure of settings, please contact your IT systems administrator. See Appendix 1 for typical Exchange Server configuration.

- **Email Server**: This field should have the name of the email server that will be used for sending the emails. In the above example mail.company1.com would be email server that would be authenticated against with the provided logon credentials to send the email.
- **Port**: This is the SMTP host port that is used and defaults are listed below. If the email server uses a different port, that specific port number should be entered in this field.
    - Exchange Server: 25
    - Microsoft Live: 587
    - Gmail: 587
- **Encryption**: allows the connection to use an encrypted connection.
    - **None**: No SSL or TLS encryption should be used.
    - **Auto (default)**: Allow the mail service to decide which SSL or TLS options to use. If the server does not support SSL or TLS, then the connection will continue without any encryption.
    - **SslOnConnect**: The connection should use SSL or TLS encryption immediately.
    - **StartTls**: Elevates the connection to use TLS encryption immediately after reading the greeting and capabilities of the server. If the server does not support the STARTTLS extension, then the connection will fail and a not supported exception will be displayed.
    - **StartTlsWhenAvailable**: Elevates the connection to use TLS encryption immediately after reading the greeting and capabilities of the server, but only if the server supports the STARTTLS extension.
- **Logon Name and Password**: These fields contain the email address and password of the user that will authenticate the email communication connection.

  Note: this email address will be the one used in the **From** field of the sent email.

Alarm Alerts

The user can choose to have the alarms generated from out of limit derived parameters to send a detailed email of the alarm condition. This only works when the application has alarms defined in the protocol.

- **Enabled**: This allows the user to enable or disable the sending the email alerts when using alarms.
- **Delay between notifications (min):** The system may set a time-delay, in minutes, between consecutive alerts triggering an email notification to be sent out. For example, if the time-delay is set to 1 minute and Ponemah is logging data every 10 seconds, then when a parameter is in an alarmed condition for 3 consecutive logging periods, 30 seconds, Ponemah will only send out one email notification instead of three notifications.
- **Email Alarms To**: This field contains the recipients email addresses that will receive the alarm email alert. Multiple names can be entered separated by a comma or semicolon.
- **Test Alarm Email**: Click this button to test the configured mail server and send a test email to the recipients listed. The email subject will be Test Email along with the body of the email containing Ponemah workstation serial number.
    - This will save the current configuration even if Cancel is used to exit Application Configuration.

- For failures see **Remote Notification – Email Alerts Appendix**.

Note: Invalid email addresses will be ignored and no warning is posted.

Application Failures

The user can choose to have an email notification sent to them for alarms generated from certain application failures.

- **Enabled**: This allows the user to enable or disable the sending the email failures.
- **Email Failure To**: This field contains the recipients email addresses that will receive the failure email alert. Multiple names can be entered separated by a comma or semicolon.
- **Test Failure Email**: Click this button to test the configured mail server and send a test email to the recipients listed. The email subject will be Test Email along with the body of the email containing Ponemah workstation serial number.
  - This will save the current configuration even if cancel is used to exit Application Configuration.
  - For failures see **Remote Notification – Email Alerts Appendix**

Note: Invalid email addresses will be ignored, and no warning is posted.

Parameter Viewer

Ponemah Parameter Viewer is a powerful, flexible visualization tool that permits users to quickly view Derived Parameter data over an entire Experiment; this may be hours, days, weeks, or months of data.

Use Parameter Viewer to:

- Observe long-term trends in derived data or view historic data during acquisition.
  E.g. did core body temperature rise or fall over the 30-day collection period.
- Quickly locate outliers to perform targeted data analysis within Ponemah Review.
  E.g. non-physiologic measurements for blood pressure parameters are observed between 10:00 AM and 1:00 PM on day two of collection, enter Ponemah Review to assess the waveform data within this time range and reanalyze if necessary.
- Perform averages of averages to determine the perfect level of depth at which to report.
  E.g. overlay 1 minute, 1 hour, 4 hour, and 12 hour averages of Pulse Pressure data to determine which provides the most insightful visualization.
- Compare changes in Derived Parameters caused by a dose response.
  E.g. align the heart rate based on an event to see intra-subject effect based on dose level or to see the heart rate response across all subject for low dose.

Opening Parameter Viewer

To access Parameter Viewer from within an Experiment, select the **Actions menu | Open Parameter Viewer.**

Parameter Viewer may be used during Acquisition or Review, also available through the **Actions menu**. It may also be run outside of Ponemah (without having to open Ponemah) by selecting **Ponemah Parameter Viewer** from the Windows Start Menu.

Multiple instances of Parameter Viewer may be opened at once for flexibility in viewing preferences. Simply select **Actions menu | Open Parameter Viewer** additional times to launch additional instances. Similarly, launching **Ponemah Parameter View** from the Windows Start menu multiple times will launch additional instances. Ponemah does not enforce a limit to the number of instances that may be opened, performance will be dependent on the specifications of the computer being used.

Note: If running Parameter Viewer without the main Ponemah application being open, the USB security key is still required to be plugged into the computer.

Loading Data

When opened, Parameter Viewer will load the current Experiment opened in Ponemah. If running a standalone instance of Parameter Viewer, it will load the last Experiment opened by the main Ponemah application.

Once launched, Parameter Viewer will have access to all data available up to the point of opening. If not actively acquiring data, this means all data is accessible. However, if Parameter Viewer is opened during an Acquisition, it will load all data up to the last line of data as logged within the Ponemah Derived List Views.

Data will be loaded based on the logging rate used to calculate and save the Derived Parameter data. By default, the logging rate is 60 seconds. To learn more about logging rates, please see the **Logging Rate** section of this manual.

To dynamically load data as it is being acquired, check the **Dynamic Load** checkbox under the **Options** menu. This will sync the Experiment every 15 seconds.

Users may also refresh the data within Parameter Viewer to reflect updated results should changes be made while in Review by selecting **File | Sync Experiment** from the *Parameter Viewer* dialog.

Note: Different sections of data may have different logging rates depending upon when they were changed; e.g. If the original 24 hour Acquisition used the default logging rate of 60 seconds, but an 8 hour section of data was opened in Review and reanalyzed using a 10 second logging rate, then Parameter Viewer will display 1 point every 10 seconds for that 8 hour section, while displaying 1 point every 60 seconds for the other 16 hours of data.

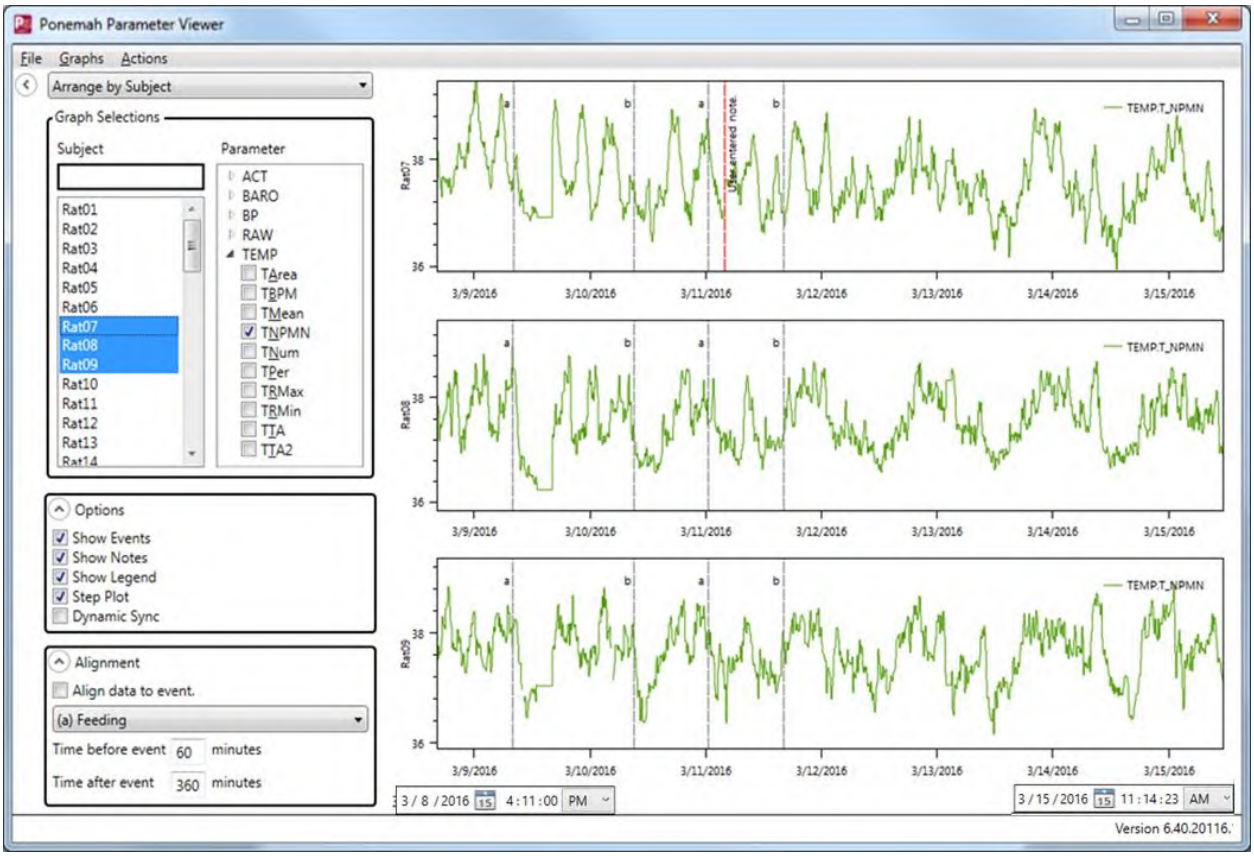
To load data from a different Experiment:

- Select the **File menu | Open Experiment**.
- Navigate to the folder containing Experiment of Interest.
- Select the Ponemah Experiment File **(.PnmExp**)
- Select **Open**.

The 5 most recent Experiments loaded into Parameter Viewer will also be listed under the file menu to quickly switch between Experiments.

Note: Different instances of Parameter Viewer may display data from the same Experiment or from different Experiments.

Parameter Viewer Dialog Overview



The Parameter Viewer dialog is split into two sections: **Setup** is on the left and the **Graph** section is on the right.

Setup

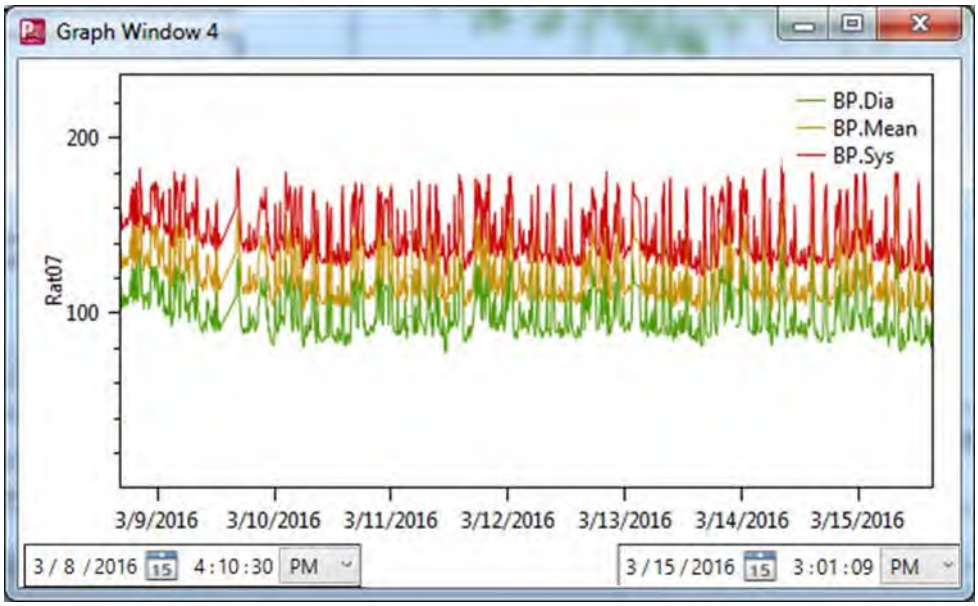
The **Setup** section allows the user to configure which data is to appear in the **Graph** pane and how the data should be displayed. Once settings are configured, the Setup may be collapsed to display the Graphs using the collapse icon. 

ARRANGE BY

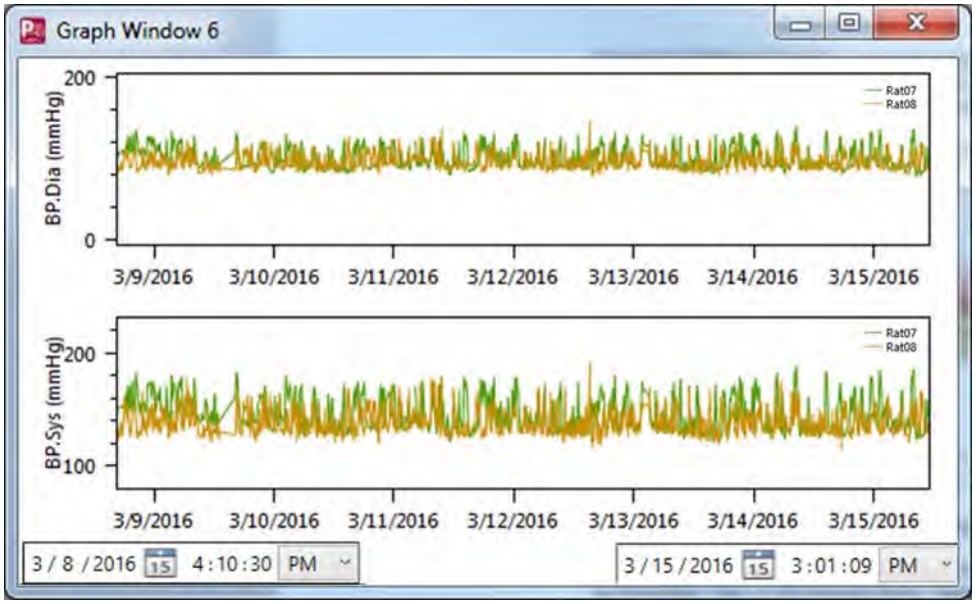
The **Arrange by** dropdown menu permits the user to arrange graphs by Subject, Parameter Type, or Parameter.

Arrange by Subject will result in a separate graph being created per Subject. All parameter selections will be displayed together for that Subject.

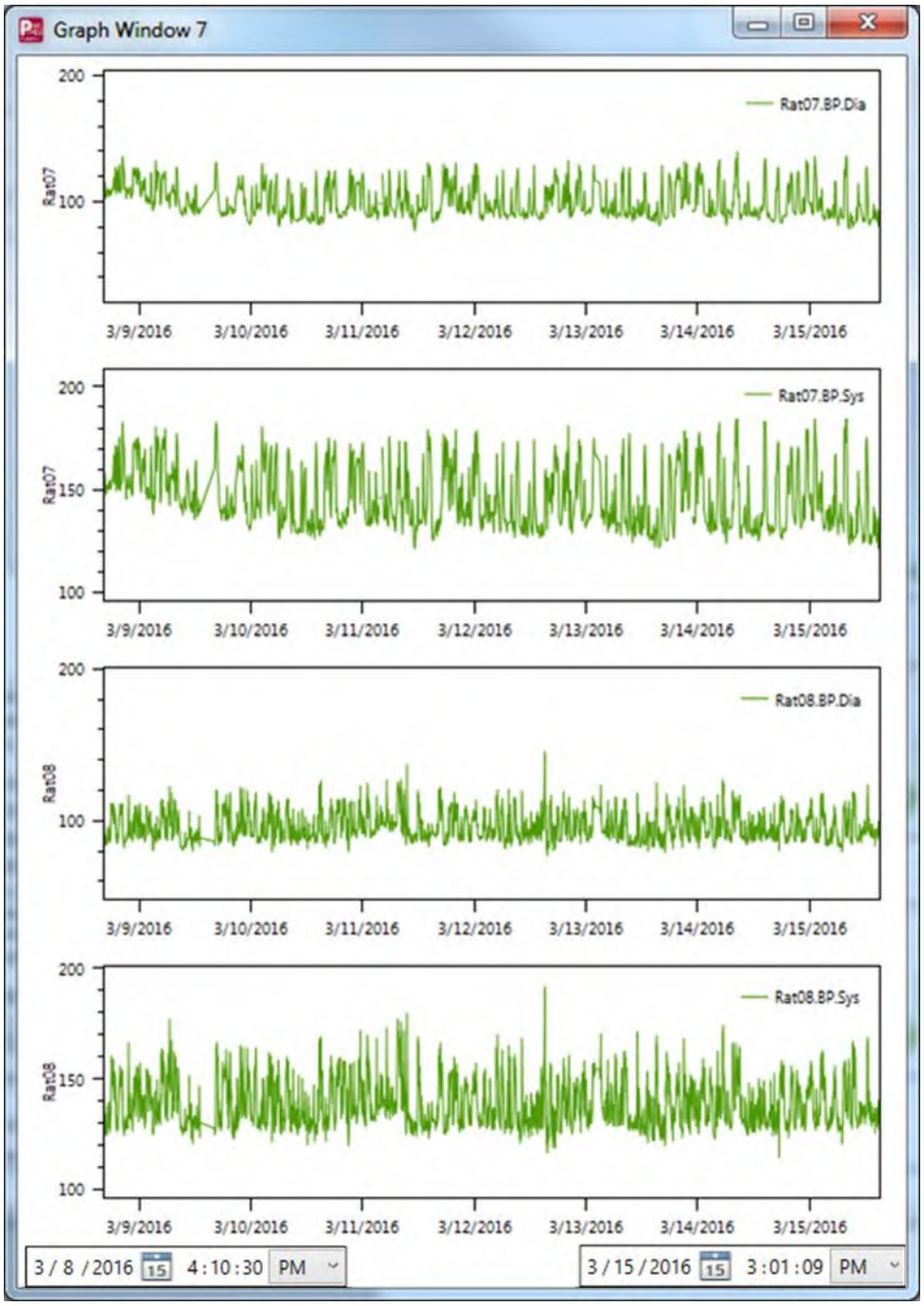
In the example below, 7 days of Systolic, Mean, and Diastolic blood pressure data is displayed for Subject Rat07.



Arrange by Parameter Type permits the user to graph multiple Subjects on a single graph by Parameter Type. In the example below, separate Diastolic and Systolic pressure graphs are displayed containing data from Subject Rat07 and Rat08.



Arrange by Parameter will create a separate graph per Subject and Parameter. In the example below, separate Diastolic and Systolic pressure graphs for Subject Rat07 and Rat08.



GRAPH SELECTIONS

The **Graph Selection** allows the user to select which Subjects and Parameters should be displayed within the Graph pane. The **Subject** list includes all Subjects with available Derived Parameter data that may be selected for display within the graph. A single left-click of a **Subject Name** will select that Subject to be included in any graphs created. The text box at the top of the list permits users to filter the Subject list for a more efficient method of locating a Subject without scrolling through the list. Multiple Subjects may be selected.

The **Parameter** list displays all Derived Parameters available for graphing, organized by Analysis Module used within the Experiment. Expand the Analysis Module and select the checkbox associated with the Derived Parameter desired to be graphed. Multiple Parameters may be selected.

The example used at the beginning of this manual section has the non-pulsatile mean of the Temperature channel for Subjects Rat07, Rat08, and Rat08 selected.

OPTIONS

The **Options** section allows the user control of the following graphical features:

- **Show Events**

  Displays user entered **Event Markers** associated with Subjects within the graph pane. Events will be represented by one of the **a – j** Event characters. Hovering the mouse cursor over the displayed Event in the graph pane will display its associated user-define text as entered within the **Experiment Setup | Events** dialog (see the **Data Acquisition | Marking Events** section for details). The example used at the beginning of this manual section includes events **a** and **b** across all Subjects graphed.

- **Show Notes**

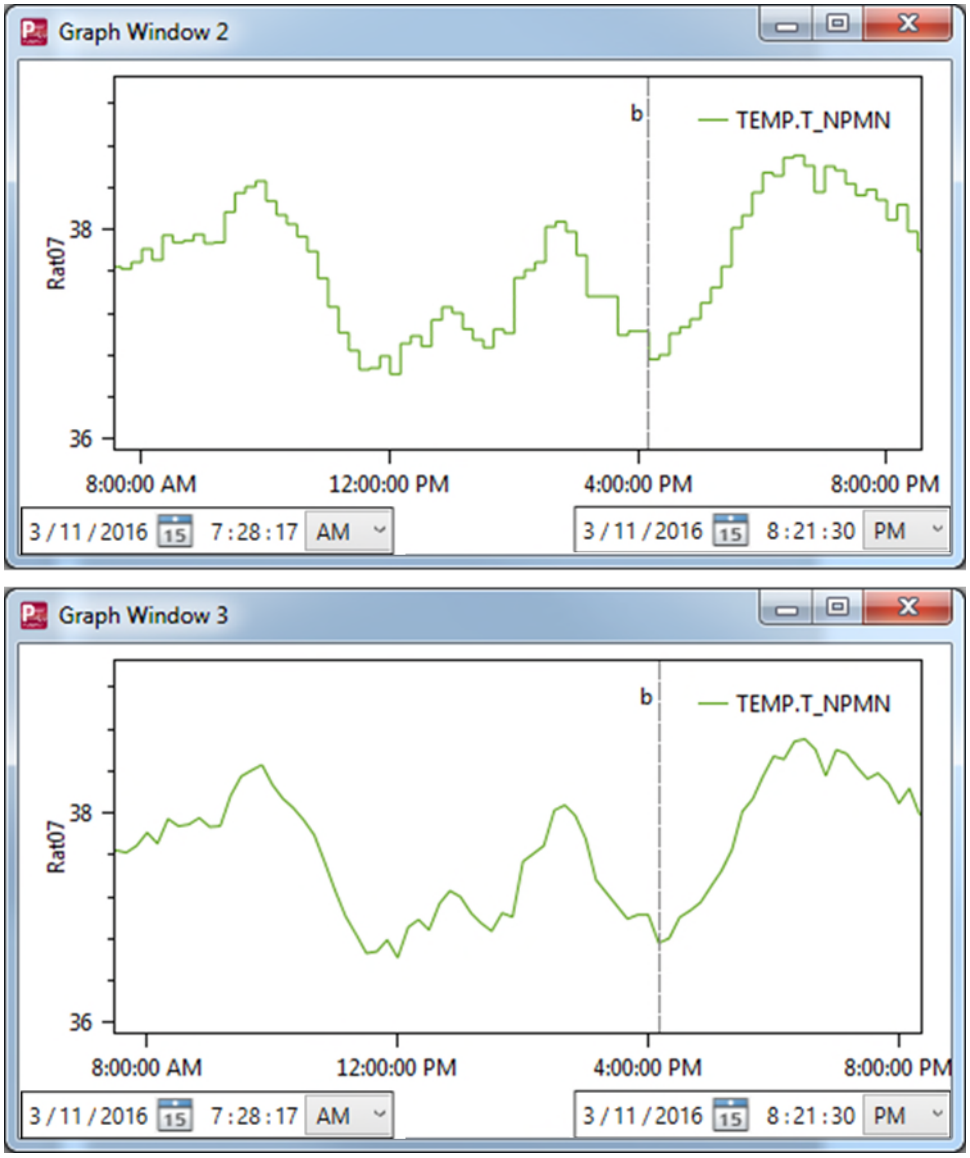
  Displays any **Freeform Notes** entered during Review that is associated with the selected Subject Parameter data. Notes are displayed as vertical, dashed red lines with associated text. Should the text extend past the visible graph pane, hovering the mouse cursor over the Note will display the full text. The example used at the beginning of this manual section includes a Freeform Note associated with Subject Rat07.

- **Show Legend**

  Toggles the graph legend ON (checked) and OFF (unchecked).

- **Step Plot**

  Toggles between a Step Plot (checked) and a Line Plot (smoothed). The example below displays the non-pulsatile mean of Subject Rat07's Temperature data over an 8-hour period using a Step Plot (*top*) and a Line Plot (*bottom*).



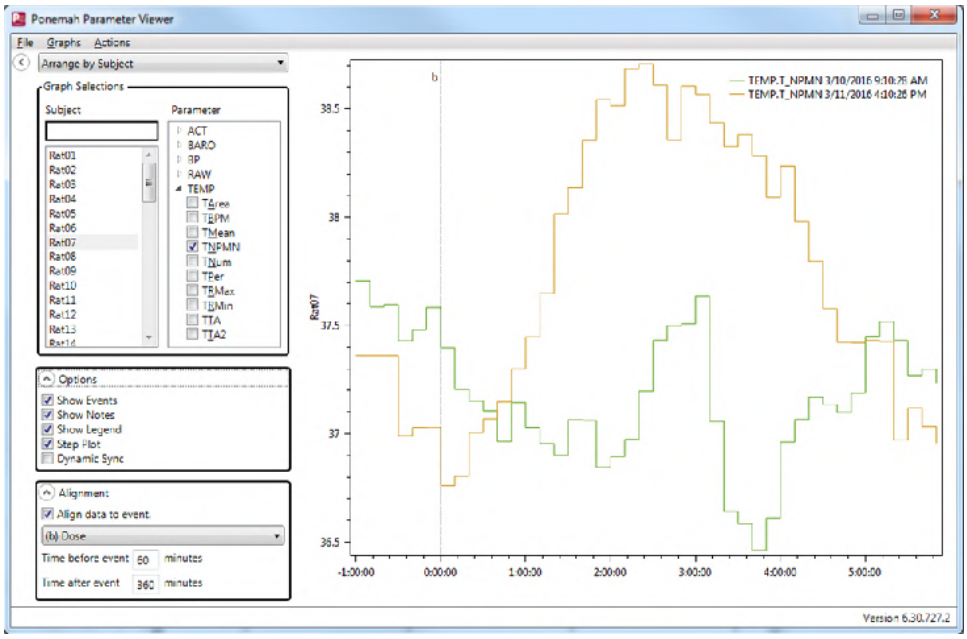
- **Dynamic Sync**

  When actively acquiring data with Parameter Viewer opened, checking this Option will update the Derived Parameter data within Parameter Viewer every 15 seconds, automatically.

ALIGNMENT

Permits the user to align the data to an Event. Check the associated checkbox to enable data alignment. Select the Event to which the data should align using the dropdown menu. Specify a time (in minutes) to display within the graph pane before and after the event.

In the example below, the graph has been configured to aligned Subject Rat07's data to the Dose Event b and to display data from 60 minutes (1 hour) prior to the Event to 360 minutes (6 hours) after the Event. Notice, two data series are graphed as only two b Events existed in the data set.



Note: Changing the Arrange by dropdown to Arrange by Parameter Type and selecting multiple Subject Names from the Subject list will allow multiple Subjects' data to align to an Event, if the Event is present within the selected Subjects.

Graphs

The Graph displays the generated graphs based on the selections made in the Setup section. Up to 16 graph panes may be displayed within the Graph section at one time.

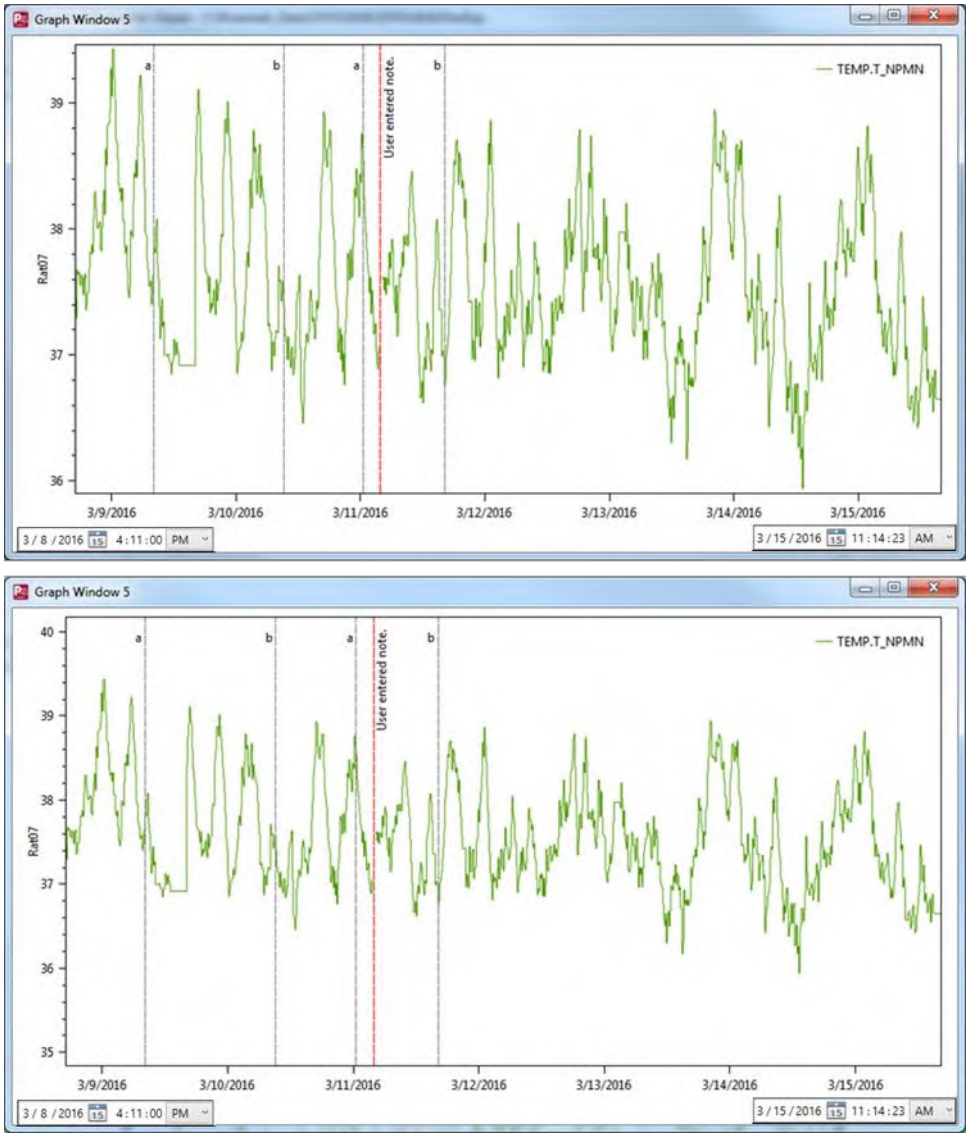
SCALING/ZOOM

The Graph Pane autoscales the y-axis range based on the match results being displayed. The x-axis range defaults to the display the entire duration of the Experiment.

To change the scale of the x- or y-axis, hover the mouse over the desired axis and use **<Ctrl> + Mouse Wheel** to change its scale. Scrolling down will zoom out, expanding the axis ranges and compressing the data to effectively

displaying more points within the associated Graph Pane. Scrolling up will zoom in, compressing the axis range and expanding the data to display fewer points. Select **<Shift> + <F9**> to autoscale the y-axis of the selected graph or **<Ctrl> + <F9>** to autoscale the y-axis of all graphs within the Graph Pane section.

Mouse cursor position on the axis dictates how the axis scaling will change. The position of the mouse cursor acts as an anchor at the position, expanding out or compressing to that position. In the example below, the autoscale was used for the top graph. However, to display a scale from 35 to 40 °C as in the bottom graph, the mouse cursor was first placed at the bottom of the y-axis and the Mouse Wheel was scrolled down until 40 came into view, then the Mouse Wheel was placed at the top of the y-axis and scrolled up down to bring 35 into view.

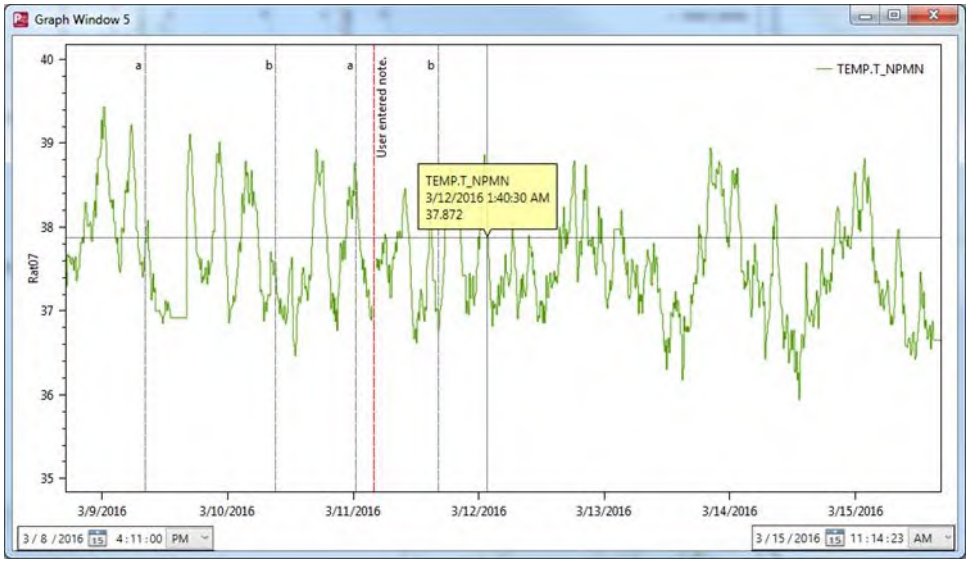


Note: Window size will affect the axis resolution.

Alternatively, **left-click-and-drag** may also be used to zoom in on graph, providing more control of exactly which data points will be displayed by the zoom. While zoomed into the data, the **Mouse Wheel** may be used to navigate forward (toward the end of the data series) and backwards (toward the beginning of the data series) within the data.

Right-click the x-axis to undo a zoom. Each right-click will expand the axis until the entire data series is displayed in the graph pane.

Hovering the mouse cursor on a point within the Graph Pane will display the series the point belongs to, the time of the point, and the point value.



The user may also position the x-axis based on a user defined time. Simply click into the date/time fields and make the appropriate changes based on the desired times to display.

Actions

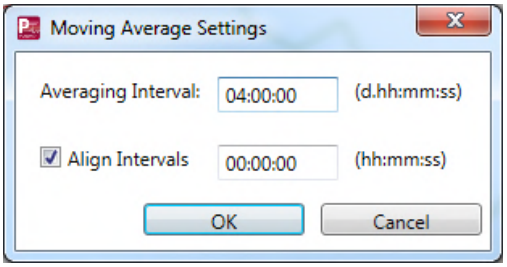
The **Actions** menu permits the user to perform **Averaging** and **Clipping** functions on the data series. Once an **Action** is created for one Subject, it is available for any Subject selected.

AVERAGE

The **Average Action** averages data from frequent intervals to longer intervals for ease of analysis or practical usage. In some cases, this function may make trends in the data easier to discern with less data outside of reasonable limits (averaging out any outliers). A typical use of the Average Action is to average data collected over a certain period to show circadian patterns in the data.

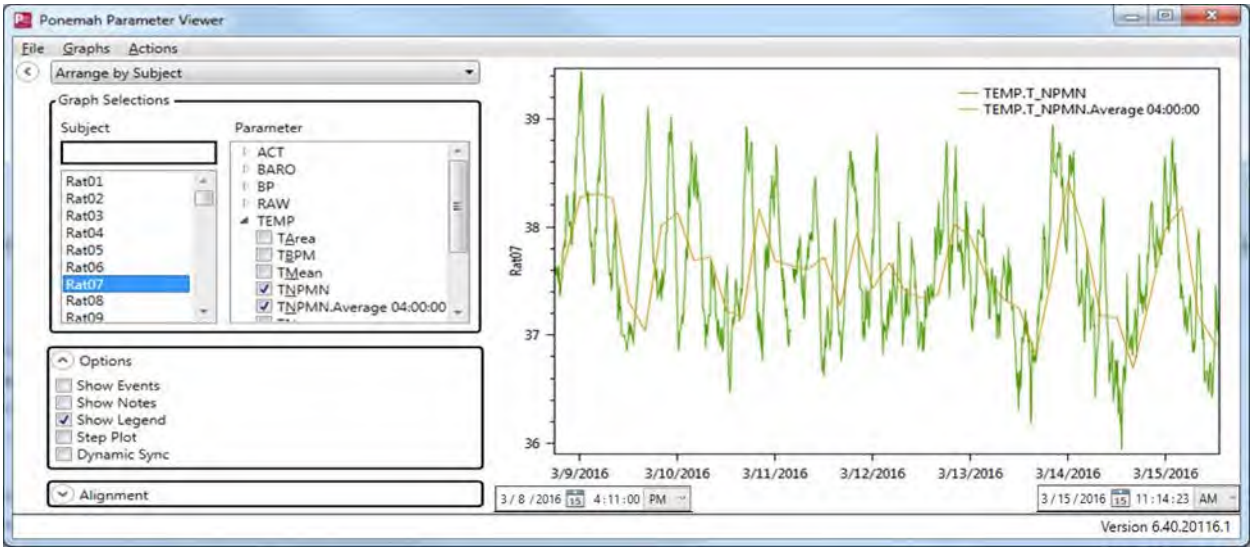
To apply an Average Action:

1. Select a **Subject Name** from the *Subject* list.
2. Check the checkbox associated with the desired **Derived Parameter(s)** within the *Parameter* list on which the *Action* will apply.
3. Select **Actions menu | Average…** or right-click and select **Average…**
   The *Moving Average Settings* dialog will display.



4. Enter the desired **Averaging Interval**.
   This is the interval over which the data points that make up the data series will be averaged. The resultant averaged point will be placed at the end of the Averaging Interval specified. For instance, if the original data series was logged with a 60 second logging rate and started at 08:00:00 AM and was then averaged with an Averaging interval of 04:00:00 (hh.mm.ss), then the first point of the resultant averaged series will be placed at 12:00:00 PM.
5. *(Optional)* Check the **Align Intervals** checkbox and enter the desired alignment interval.
   Enabling Align Interval will align the averaging interval such that the result averaged points fall on the specified time. The alignment time is based on a 24 hour clock; i.e. 00:00:00 (hh:mm:ss) is 12:00:00 AM. If the Align Intervals is disabled, averaging will start at the beginning of the available data.
6. Select **OK**.
   This will generate a new Derived Parameter selection within the Parameter list, just beneath the Parameter from which it was generated. The new Parameter will append the Action name (e.g. Average) to the end of the Parameter name, along with the Averaging Interval used (e.g. TNPMN.Average 04:00:00).

The example below shows the Average Action applied to the non-pulsatile mean of Subject Rat07's Temperature channel as outlined in the procedure described above.



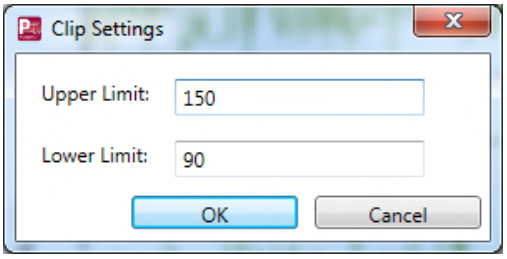
CLIP

The **Clip Action** eliminates data points outside of a user defined range. A typical use of the Clip Action is to exclude outliers or data known to be bad or erroneous (non-physiological).

All values above the specified upper limit will be considered outside the data range and will be removed from the graph. The lower clipping limit does the same for values below this limit. The system will not recognize any data values outside the clipping limits if the Clip Action is performed prior to the Average Action.

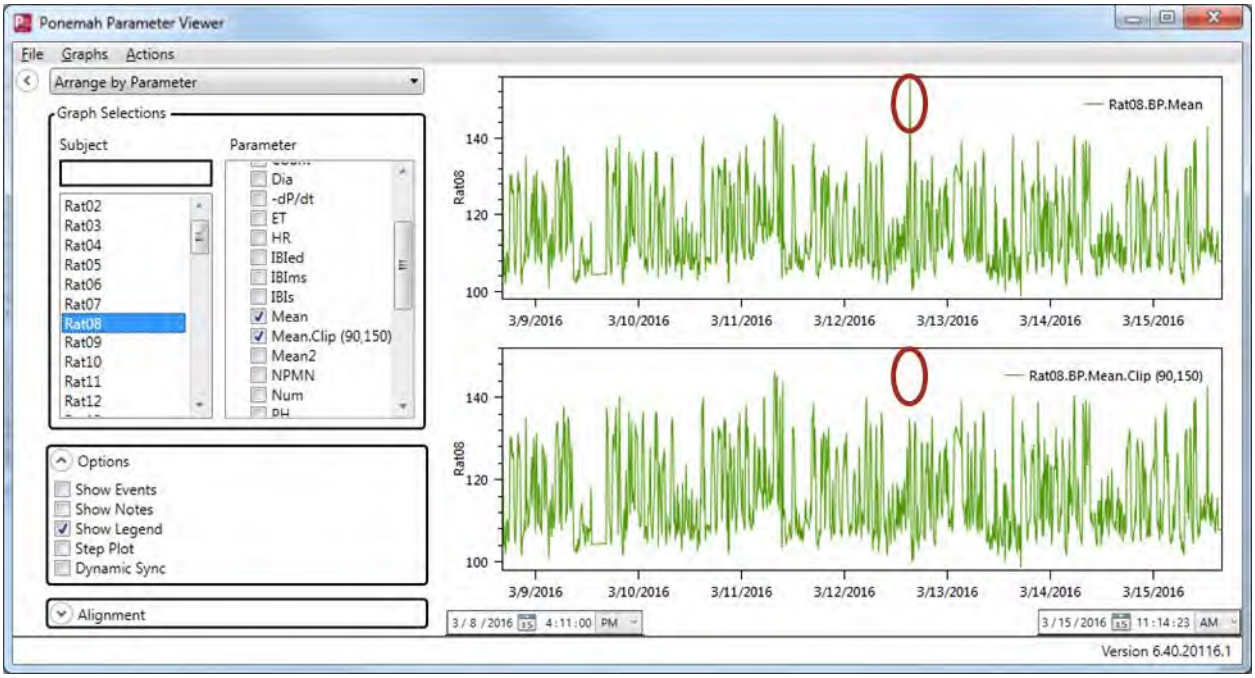
To apply a Clip Action:

1. Select a **Subject Name** from the *Subject* list.
2. Check the checkbox associated with the desired **Derived Parameter(s)** within the *Parameter* list on which the *Action* will apply.
3. Select **Actions menu | Clip…** or right-click and select **Clip…**
   The *Clip Settings* dialog will display.



4. Enter an **Upper Limit** and a **Lower Limit**.
5. Select **OK**.
   This will generate a new Derived Parameter selection within the Parameter list, just beneath the Parameter from which it was generated. The new Parameter will append the Action name (e.g. Clip) to the end of the Parameter name, along with the Lower and Upper Limits used (e.g. TNPMN.Clip (90,150)).

The example below shows the Clip Action applied to the Mean Pressure of Subject Rat08's Blood Pressure channel as outlined in the procedure described above. Notice, the circled point was removed from the Clipped series graph display.



Using Generated Graphs

Once the Graph is configured for the Subject or set of Subjects to display the Parameter data as desired, the graph may be opened in a **New Graph Window** to preserve the setup. This is useful if additional Graphs need to be generated, but require to be **Arranged by** different settings to illustrate a particular occurrence or trend in the data. New Graph Windows will only display the graphical data within the **Graph** section of Parameter Viewer at the time the New Graph Window was generated; the **Setup** section of Parameter Viewer is not accessible. New Graph Windows are ideal when screen shots of Graphs are needed for inclusion in presentations or publications. New Graph Windows are not preserved upon exiting Parameter Viewer.

Zoom/Scaling functions the same within the New Graph Windows as it does in the main Parameter Viewer dialog.

To create a New Graph Window:

1. Make the appropriate selections within the Setup section of Parameter Viewer to display the data as desired.
2. Select the **Graph menu | New Graph Window**.
   This will create the New Graph Window with the identical setup as displayed in Parameter Viewer. Graph Windows will be numbered. Selecting the Graph menu | Graph Windows will display a list of the New Graph Windows generated since the Parameter Viewer was opened.
3. Repeat steps 1-2 for any additional views desired.

To capture the New Graph Window for inclusion in a presentation or publication, select the desired Graph Window to include, strike **<Alt> + <Print Screen>**, and then paste into desired third-party tool (e.g. Microsoft PowerPoint).

Data Export

Once the Parameter Viewer graphs are setup in the desired configurations, users may export the derived data that compose these graphs. This is important should the use of third-party programs be desired for further data manipulation or visualization.

Only data visible within the *Parameter Viewer* dialog will be exported, meaning the user may zoom into a desired area of the data to export only that specific section of data. To export all data in the experiment for the derived data selections, the user much zoom out to display the entire trend graph.

Two export options are available from the Parameter Viewer **File** menu:

- **Export**

  This export option will export derived parameter data filtered by the selected parameters from the selected subjects within the Graph Selection section of Parameter Viewer. A separate .csv file will be generated for each subject. Additional .csv files will be generated for Events and Notes associated with each subject.

  .csv File Naming Convention:

  - "<Experiment name>_<Subject name>_Parameters_<yyyymm>_<hhmmss>.csv"
  - "<Experiment name>_<Subject name>_Events_<yyyymm>_<hhmmss>.csv"
  - "<Experiment name>_<Subject name>_Notes_<yyyymm>_<hhmmss>.csv"

  If the Parameter Viewer Alignment feature **IS NOT** used, the .csv files will contain the following columns

  - Time column yyyy/mm/dd hh:mm:ss.mmm
  - Column per parameter <algorithm abbreviation>.<parameter abbreviation>

  If the Parameter Viewer Alignment feature **IS** used, the .csv files will contain the following columns:

  - Time column yyyy/mm/dd hh:mm:ss.mmm
  - Time from Event hh:mm:ss.mmm
  - Column per parameter <algorithm abbreviation>.<parameter abbreviation>

  Note: If trying to export Clipped or Averaged data together with standard parameter selections, an **Inconsistent number of rows** error will be displayed and the .csv files will not be generated. To export these

data together, please use the **Export to Pivot Format** option described below.

- **Export to Pivot Format**

This export option will export derived parameter data filtered by the selected parameters from the selected subjects within the Graph Selection section of Parameter Viewer to a single .csv file.

.csv File Naming Convention:

- "<Experiment name>_<yyyymm>_<hhmmss>.csv"

If the Parameter Viewer Alignment feature **IS NOT** used, the .csv files will contain the following columns

- Subject — Subject name
- Parameter Name — <algorithm abbreviation>.<parameter abbreviation>.<averaging if any>
- Date and Time — yyyy/mm/dd hh:mm:ss.mmm
- Parameter Value

If the Parameter Viewer Alignment feature **IS** used, the .csv files will contain the following columns:

- Subject — Subject name
- Parameter Name — <algorithm abbreviation>.<parameter abbreviation>.<averaging if any>
- Date and Time — yyyy/mm/dd hh:mm:ss.mmm (parameter date and time)
- Event Date and Time — yyyy/mm/dd hh:mm:ss
- Time from Event — hh:mm:ss.mmm
- Parameter Value

Data Review

Ponemah Data Review is a powerful, flexible post-processing tool that permits the user to tailor data visualization, analysis and reporting on any acquired data contained within the Experiment.

Use Review to:

- View results graphically using a combination of graphic display windows and numerically using the Derived Parameter and Data Reduction List Views.

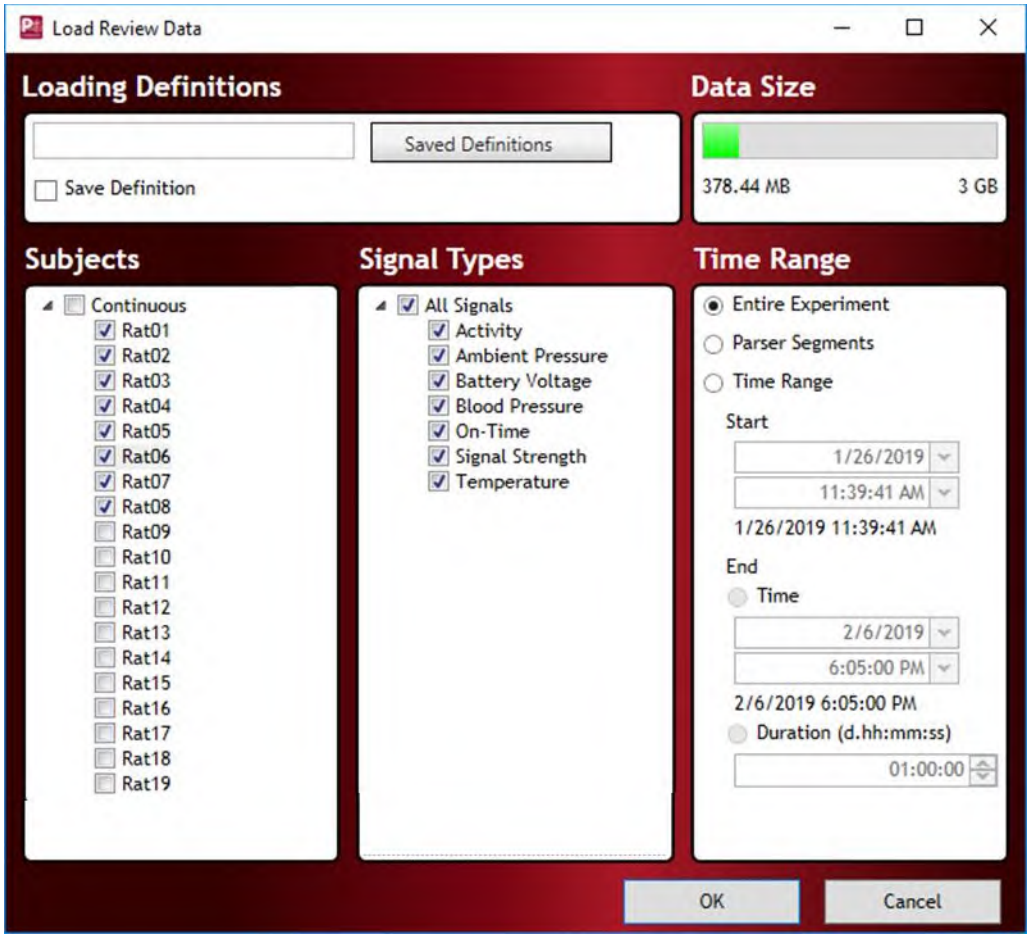
- Refine results for greater accuracy should the default analysis module settings not be suitable for your subjects' signal morphologies.

Loading Data into Review

Ponemah provides a simple data loading tool to allow you to choose specific data sections to load into **Review**.

To load data into **Review**

1. Select **Start Review** from the **Actions** menu to launch the **Load Review Data** dialog.



2. Select Subject(s) from the **Subjects** column using the associated checkboxes. Select the checkbox associated with the Continuous option to **Select/Deselect All**.

   Note: Subjects are arranged by the *Sampling Method* they are assigned to upon entering the **Load Review Data** dialog. In the example above, all subjects were assigned to **Continuous** sampling and are therefore listed under a **Continuous** sampling group. If subjects are defined to **Schedule 1** or **Schedule 2**, they will be listed under their respective Sampling Method.

3. Select the desired Signals from the **Signal Types** column to be loaded into *Ponemah Review* using the associated checkboxes.

Important: *Selecting a Blood Pressure of Left Ventricular Pressure channel will automatically select the Ambient Pressure channel. The Ambient Pressure must be loaded when loading Blood Pressure or Left Ventricular Pressure to appropriately display and calculated derived data as expected.*

4. Select the data range for the selected data from the **Time Range** column. Options include:
   a. **Entire Data**
      This will load all data available for the selected **Subjects** and **Signals**.
   b. **Parser Segments**
      If **Parser Segments** were added during a previous **Review** session, you may also choose to load only data contained within the **Parser Segments** by selecting the **Filter** radio button for **Parser Segments**.
   c. **Time Range**
      This permits specific time ranges to easily be loaded into *Ponemah Review*. Enter the specific **Start Time** after which the data is desired to be loaded. Next, enter the specific **End Time** or a time **Duration** (e.g. load 1 hour of data from Start Time of 12:00 PM January 26, 2019.

5. Select **OK** to load the selected data into **Review**.

Definitions

Definition allow the user to save the selected **Load Review Data** settings to more easily load this same section of data in a future Review session without having to remember the exact selections.

- **Definitions** are saved when a name is entered into the associated text box and the Save Definition checkbox is selected.
- To load a previous saved **Definition**, select the Saved **Definitions** button and select the desired Definition. Once selected, the *Load Review Data* dialog will populate with the previously configured Subject, Signal, and Time Range settings.

Data Size

The **Data Size** bar will update based on the selection within the *Load Review Data* dialog to provide the User with an indication of how much data is being loaded into *Ponemah Review*. Ponemah will currently permit up to 3 GB of data to be loaded into Ponemah Review.

Please contact DSI Technical Support for assistance, should the User need to load more than 3 GB of data at a time into *Ponemah Review*.

Using Review

Data Navigation

Many methods are available to navigate, search, and work with the graphical data.

SCROLL BAR

Each graph page includes a horizontal scroll bar that provides a representation of the data currently being viewed, relative to the entire data set. The scroll bar may be used to view different portions of the data. Clicking on the left/right arrow moves the data by a tenth of the Axis time. Clicking on the scroll bar to the left/right of the bar moves the data by a page. The bar may be dragged to move through the data as well.

AUTOSCALE

AutoScaling the Channel signals configured within the graph pages is a quick, easy way to correct the y-axis value of the **Display Pane** to get a full-scale view of the signal. **Primary** and **Trend Graph** pages treat each **Display Pane** disparately for the user to scale each based on the amplitude of its signal. Users can **AutoScale** a signal **Display Pane** by double-clicking within the **Display Pane** and selecting the **AutoScale** button.

To **AutoScale** all **Display Panes** configured within the **Primary** and **Trend Graph** page, use the hotkey **<Ctrl>+<F9>** or by select the **Edit menu | AutoScale – All Panes**.

PAGE UP AND PAGE DOWN

The **Page Up** and **Page Down** keys page through the data. **Page Up** moves forward in time and **Page Down** moves back in time.

SEARCH FUNCTIONS

Search capabilities have been provided to search for the next/previous Mark, Change Marker, Note, Event, unmatched cycle (Template), bad data mark, and for searching by Time. These search functions are directed towards the selected display pane in a graph page.

Searching for Change Markers, Notes, Events, Time, unmatched cycles, and bad data marks have corresponding tool bar/menu items. Searching for the next mark is achieved using the Tab key, previous mark, by using the Shift-Tab key.

Note: If the Shift key is pressed when selecting search for events, a dialog with available events will be displayed, permitting selection of a specific event.

LIST VIEWS

Various **List Views** are available within Review to display **Derived Parameter** data, **Data Reduction** data, and **Events**. **List Views** may be sorted by clicking on the column header that is desired for sorting. A second click will invert the sorting order. To return the values to their original order, click on the Time column.

Note: Convenient examine outliers by sorting Log Lines of data or Events and synchronizing them with the graphical data.

SYNC

The graphical and derived data can be synchronized with each other as follows:

- Synchronizing the Derived Data with the Graphical Data
  Position the Review **Cursor** at the point of interest and ensure that a display pane belonging to the channel to be synchronized is selected. Select the **Synchronize with Derived Data** tool bar button/menu item. The **Derived Parameter** and **Data Reduction List Views** will be adjusted to bring the associated data into view.

- Synchronizing the Graphical Data with the Derived Data
  To view the graphical data that was used in the calculation of derived data or data reduction information,

double-click on the **Log Line**. All graph pages that contain data associated with the double-clicked channel will be adjusted to bring the associated data into view.

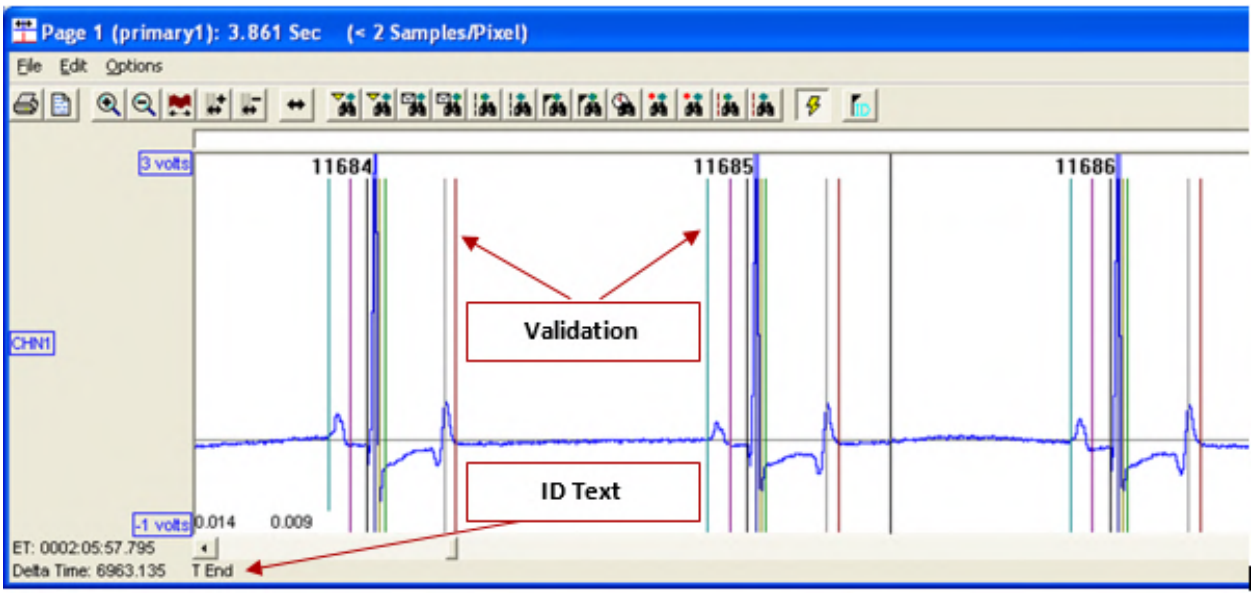
When a **Derived Parameter List View** is clicked on, affected **Primary** graph pages' X axes (time) will scroll the data range associated with the **Log Line** of data into view and will scale the Y axes to display the waveforms appropriately. **Trend** graphs will not scale their axes but will scroll data into view as follows: If the time range associated with the **Log Line** fits on the trend graph page, it will be centered on the graph page. If not, the start of the time range will be set to the left edge of the graph page. **Scatter** graphs will also not scale, however the data point that is associated with the synchronized data line will be selected.

When data in a **Data Reduction List View** is clicked on, associated **Primary** and **Trend** graph pages' X axes (time) will scroll the relevant data range into view. The time range used is the time associated with the **Data Reduction** interval/control interval that is clicked on.

The user may also drag and drop multiple **Log Lines** of data from the **Derived Parameter** and **Data Reduction List Views** to the graph pages. This allows the user to easily select specific data from the **List Views** and to view in the graph pages. For example, if using an **Epoch** based **Logging Rate** of one (every marked Cycle is logged to the **Derived Parameter List View**) and three **Log Lines** of data are dragged and dropped onto the **Primary** graph page, those three cycles will be the only ones displayed.

Validation Marks

Validation Marks are tick marks placed on the **Primary** graph page by the analysis modules to indicate key points of interest on the waveform. Validation Marks are represented by different color, solid vertical lines. Hovering over the **Validation Mark** with the mouse cursor will indicate what the line depicts in the **ID Text** area (displayed in the lower left corner after Delta Time).



The positioning of the **Validation Marks** are used to calculate the **Derived Parameters** from the waveform data and logged to the **Derived Parameter** and **Data Reduction List Views.** These are also used to visually verify that the analysis is triggering properly during Acquisition and Review. The **Validation Marks** placed during real-time analysis can be viewed and augmented during a Review session.

Validation Marks are stored in the **Marks** database when a **Marks Section** is saved.

Display of **Validation Marks** in a graph page is controlled by the **Toggle Validation Marks** toolbar button ( ). The display of **Validation Marks** can also be controlled on a mark-by-mark basis through the **Analysis Attributes** dialog (see **Analysis Modules | Analysis Attributes Dialog** section). In other words, if the **End of T mark** of an **ECG** signal is not needed because the user is only interested in Heart Rate, this **Mark** can be turned off and no longer displayed. Positioning the mouse cursor over a mark will identify the mark in the **ID Text** field at the bottom left of the graph page.

Note: Each analysis module identifies one of the marks in a cycle as the **Logging Mark.** This mark is used to record the time at which the cycle occurred within the **Derived Parameter List View** when in **Epoch** mode. See the analysis module section of interest to learn which mark is the cycle's **Logging Mark**.

MOVING MARKS

Validation Marks can be moved when the mouse cursor is positioned over a Mark such that the mouse cursor changes from a pointer to a double-sided (East-West) arrow. A **Mark** can be moved by clicking the left mouse button and dragging it to a new location. On repositioning the **Mark**, the associated derived output will be recalculated to display the updated calculation in the **Derived Parameter** and **Data Reduction List Views**.

Right-clicking on a moved mark will present an **Undo Move** menu option. Selecting **Undo Move** will return the mark to its original location and will remove the change marker. Alternatively, the mark could be repositioned manually. If any other marks interfere with the return of the moved mark, **Undo Move** will not be present in the right click menu.

Notes:

- Marks cannot be moved past adjacent marks, **Bad Data Marks**, or **Data Breaks**.
- Calculated Marks, whose positions are calculated from the location of other marks (such as **Percent Recovery**) Marks cannot be moved.
- Instead of moving **Marks** manually, the user may instruct Review to reanalyze a portion or all of the waveform data. See **Reanalyzing Data** for more information.

DELETING/INSERTING A MARK

Deletion/insertion options exist from the **Display Pane's** right-click menu.

To delete a mark:

1. Position the mouse cursor over the no longer desired **Mark**.
2. Right-click to display the right-click menu.
3. Select the appropriate **Delete** option.

Note:

- To delete all **Marks** associated with a cycle, position the mouse cursor over the **Logging Mark.**
- Some analysis modules permit deletion/insertion of certain marks while some analysis modules only permit insertion/deletion of cycles. Please refer to the analysis module section for more information.
- Change Markers can be displayed to provide a visual representation of any change to Mark location. Change Markers are **OFF** by default, but can be turn **ON** in the **Setup | Application Configuration | Advanced Settings** dialog.
    - When a mark or cycle is inserted the new mark(s) is/are tagged with a green **Change Marker**.
    - When a mark or cycle is deleted, the deleted mark(s) are drawn with red dashed lines and are tagged with red **Change Marker(s)** lines.
    - When a mark or cycle is changed/moved, the original Mark location is tagged with a yellow dashed line and are tagged with yellow **Change Marker(s).**

Events

All **Events** created in Acquisition are available during a Review session. Events can be seen within the Events List View and are also displayed at the appropriated time points within the **Primary** and **Trend** graph pages.

Note: The **Events List View** can be sorted by clicking on the column headers. All information within the list view will be sorted based on the column selected and the direction of the arrow in the column header.

Placing the mouse cursor over an event will display its text string in the **ID Text** field in the lower left corner of the graph page. **Events** can be added and deleted while in Review.

To add an Event:

1. Right-click on a **Primary** or **Trend** graph at the point where the **Event** should be inserted.
2. Select **Add Event** from the right-click menu.

To delete an Event:

1. Position the cursor over the **Event** to be removed.
2. Right-click and select **Delete Event** from the right-click menu.

Note:

- **Events** can also be moved by clicking on them and dragging them to a new location.
- If Data Reduction is triggered off an event that is added, deleted, or moved, the Data Reduction output will be updated.
- Double-clicked on an Event from the **Events List View** to synchronize the data within the graph pages and list views associated with the selected **Event**.

Bad Data Marks

Bad Data Marks enable the user to eliminate sections of noisy or erroneous data from calculations. Bad Data Marks are represented by two dashed burgundy colored lines, a **Start Bad Data Mark** and an **End Bad Data Mark**.

 *IMPORTANT: Introducing Bad Data Marks will not remove the enclosed waveform data. Only the marks associated with the enclosed cycles will be removed to ensure that the data is not used to calculate derived parameters.*

ADDING BAD DATA MARKS

Bad Data Marks can be inserted in two ways:

1. Automatically by the analysis modules if the Noise tab is enabled and its user-defined criteria are achieved. See the appropriate analysis module Noise tab section for more information on available configuration settings.
2. Manually from the right-click menu.

Note: **Bad Data Marks** may be introduced anywhere in the data as long as they do not span over an existing **Bad Data Mark** or **Data Break**, or are placed within a bad data region. If **Bad Data Marks** are inserted/moved within a cycle, the cycle's marks will be deleted. If **Bad Data Marks** are inserted/moved between two cycles, their cycle marks will not be deleted.

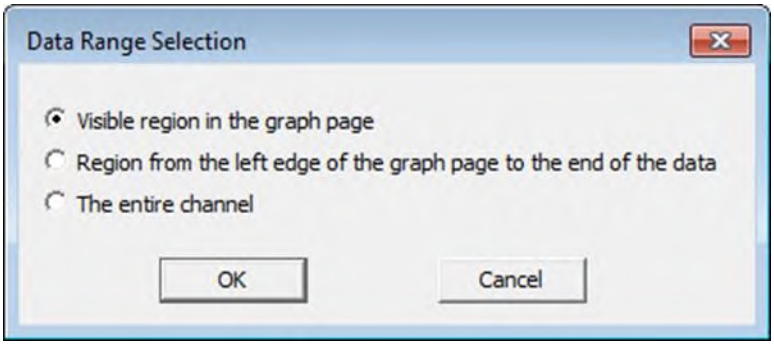
DELETING BAD DATA MARKS

To delete **Bad Data Marks:**

1. Right-click on a **Bad Data Mark**.
2. Select **Delete Bad Data Marks – Single.**
   This will delete the current **Bad Data Marks**.

   OR

   Delete Bad Data Marks - Range.
   This will display the **Data Range Selection** dialog. Select the radio button associated with the desired option and click **OK**.



   a. **Visible region on the graph page** – all **Bad Data Marks** from the current graph page view will be deleted.
   b. **Region from the left edge of the graph page to the end of the data** – all **Bad Data Marks** from the currently visible left edge of the graph page to the end of the data loaded into the Review session will be deleted.
   c. **The entire channel** – all **Bad Data Marks** within the data loaded into the Review session for the entire channel will be deleted.

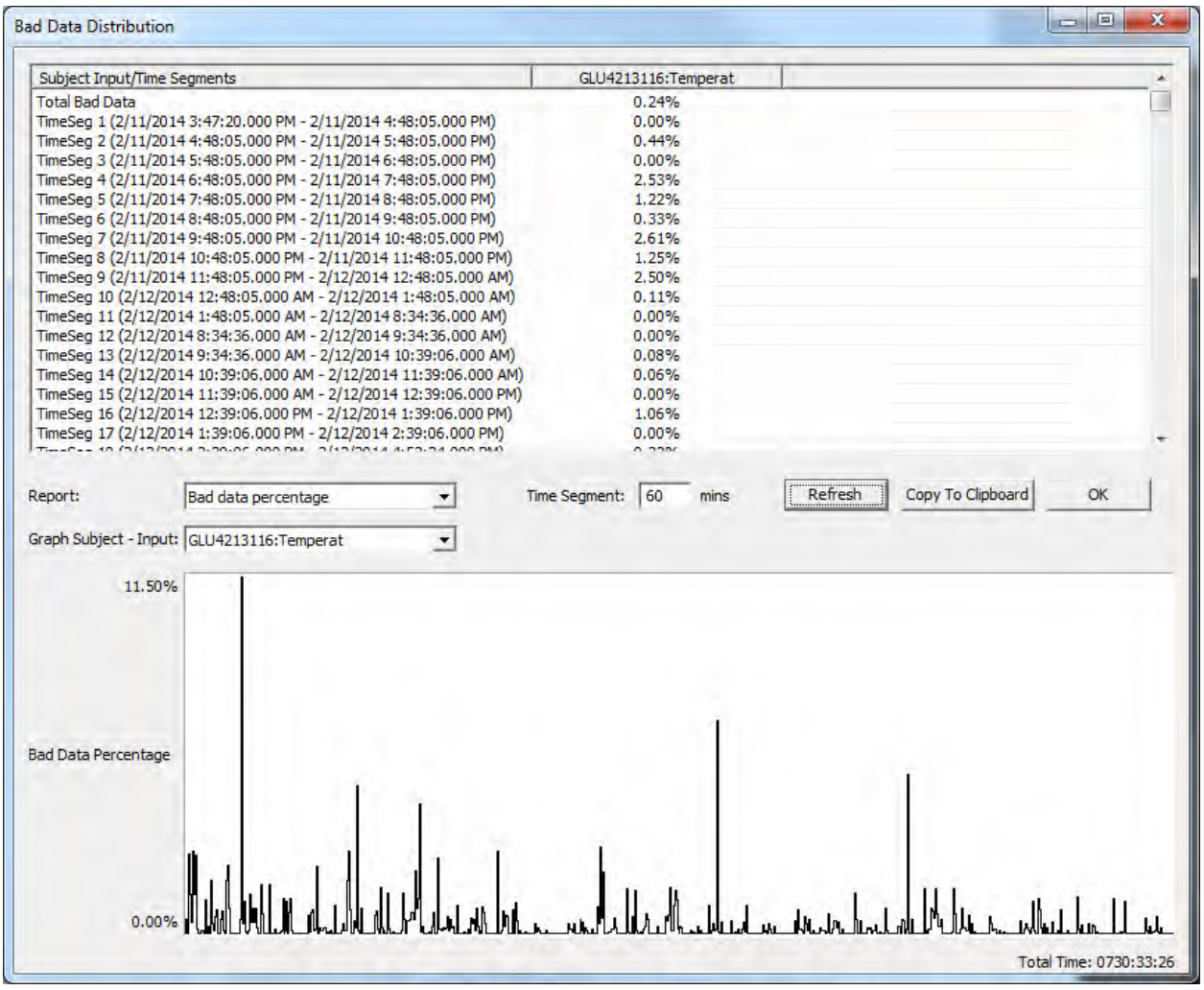
A toolbar is provided to toggle **Bad Data Marks** ON/OFF. By default, the button is enabled to show all **Bad Data Marks** in the graph. When disabled, the visible marks will disappear, however all data within the marks will remain excluded from derived parameter calculations.

Note: When Bad Data Marks are toggled OFF, the only available right-click options will be **Add Bad Data Mark** and **Delete Bad Data Marks - Range**. Adding **Bad Data Marks** here will remain invisible until the option has been enabled again.

BAD DATA MARK PERCENTAGE

Bad Data Mark Percentage provides the ability to view the percentage and distribution of data removed by **Bad Data Marks**. This allows the user to determine if too much data has been excluded from analysis. Additionally, this feature allows the user to report on the number of “Good” cycles.

Available channels are listed along with a Channel/Time Segments column defaulting to 1 minute segments. The channels display the percentage of Total Bad Data for the study (first line in the spreadsheet) as well as percentages for each segment. A graphical representation of the bad data distribution is provided in the bottom half of the window.



The following defines the options available from this dialog:

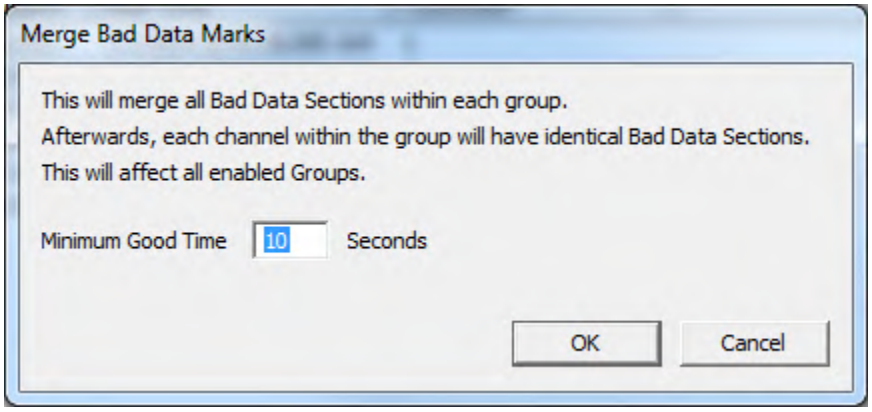
Report This field allows the user to select **Bad Data Percentage** or **Number of Good Cycles** in a Segment. Choosing of one of these selections will automatically update the data columns with the appropriate information.

Time Segments **Time Segment** determines how the data is averaged and displayed. The default value is 1 and the units are in minutes. The maximum value that can be entered is 9999.

Refresh	After changing the value in the **Time Segment** field, the **Refresh** button must be selected to update the data.
Copy to Clipboard	This feature allows the calculated data to be copied and placed into another format such as Microsoft Excel or Word.
OK	This button closes the dialog.
Graph Subject Input	This feature allows the user to switch between inputs. Only one channel may be displayed at a time.

MERGE BAD DATA MARKS

Merge Bad Data Marks is a Review only option. Selecting **Actions | Merge Bad Data** will instruct Review to merge all **Bad Data Mark** sections within a **Subject**, such that all **Subject Input** channels will have identical **Bad Data Mark** sections. If new **Bad Data Marks** are placed within any **Input** channel after the button has been pressed, these will not be applied across all **Input** channels within the **Subject**. The button should be pressed again to merge any newly added **Bad Data Marks** across the associated **Subject Input** channels. The **Minimum Good Time** defines the upper limit of the time interval between **Bad Data Marks** to determine if the **Bad Data Marks** sections should be marked as a single section or marked separately as distinct sections. The default time is 10 seconds. This will affect how data is reported by **Subject** in the **Derived Parameter** and **Data Reduction List Views** and the corresponding data output.

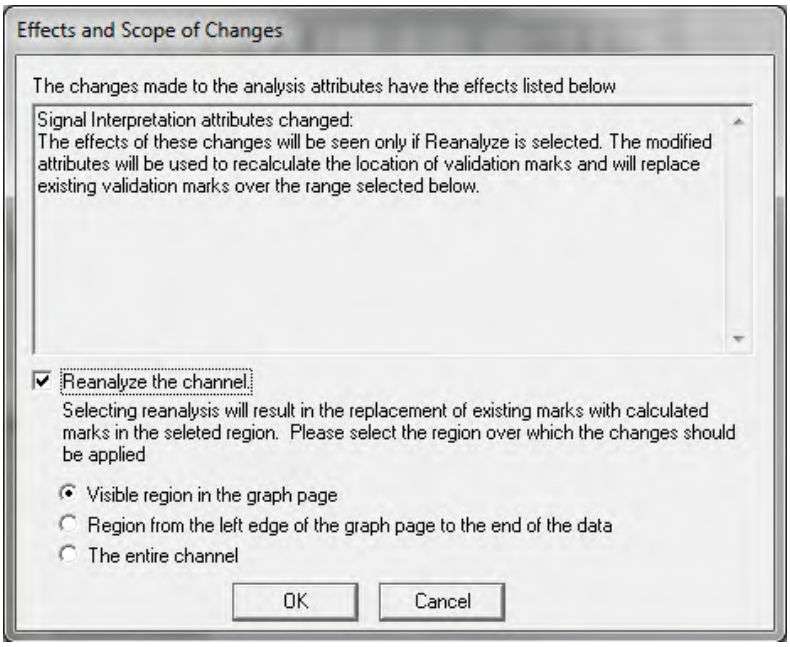


Freeform Notes

Freeform Notes are supported in Review and may be placed anywhere in a **Display Pane**. **Notes** are added and deleted using the right-click menu. The text associated with a **Note** may be viewed by hovering the mouse cursor over the **Note**. Drawing of **Notes** for a **Display Pane** may be suppressed by selecting **Display Options** from the right-click menu and disabling the check box. **Notes** can be applied to one or all channels by selecting or deselecting the **Apply to all changed channels** checkbox at the bottom of the **Notes** dialog box.

Reanalyzing Data

Ponemah Review easily allows results to be refined for greater accuracy should the default analysis module settings not be suitable for your subjects' signal morphologies. Instead of moving **Validation Marks** manually, reanalyze using the automated analysis modules by updating their settings and choosing to reanalyze the channel.



To reanalyze a channel:

1. Right-click on the channel of interest from its **Primary Graph Display Pane**.
2. Select **Analyze [Attributes]** from the right click menu. The analysis attributes dialog will be displayed with the current data in the waveform window.
3. Adjust the attributes as necessary to ensure the analysis is triggering correctly
4. Select **OK** to launch the **Effects and Scope of Changes** dialog.
   This dialog outlines the effects of the modifications to the attributes and allows you to select the range over which the reanalysis should be performed. See the **Analysis Attributes Dialog** section to learn about **Attribute Types** and how they impact data analysis.
5. Select the **Reanalyze the channel** check box and select the desired reanalysis range.
   Ponemah allows you to reanalyze the entire channel, the data visible in the graph, or the data from the left edge of the visible region from the primary graph forward to the end of the loaded data set.
6. Select **OK** to begin the reanalysis.
   Changes to marks positions will be displayed and derived data will be recalculated.

Note: The **Marks** tab within the **Attributes** dialog can be altered to enable/disable the visible **Validation Marks** without having to reanalyze the entire channel. Simply enable/disable the **Validation Marks** of choice, select **OK**, and then, without checking the **Reanalyze the channel** check box, select **OK**.

To learn about **Attribute Types** and which **Types** trigger a reanalysis or a redraw of the signal, please see the **Analysis Modules | Analysis Attributes Dialog | Attribute Types** section of this manual.

Hotkeys

Certain hotkeys have been made available within Review to help facilitate quicker execution of certain functions from the keyboard and/or mouse without having to click additional icons or access menu options. Please note that they hotkeys are currently available only within Ponemah Review and cannot yet be augmented by the user.

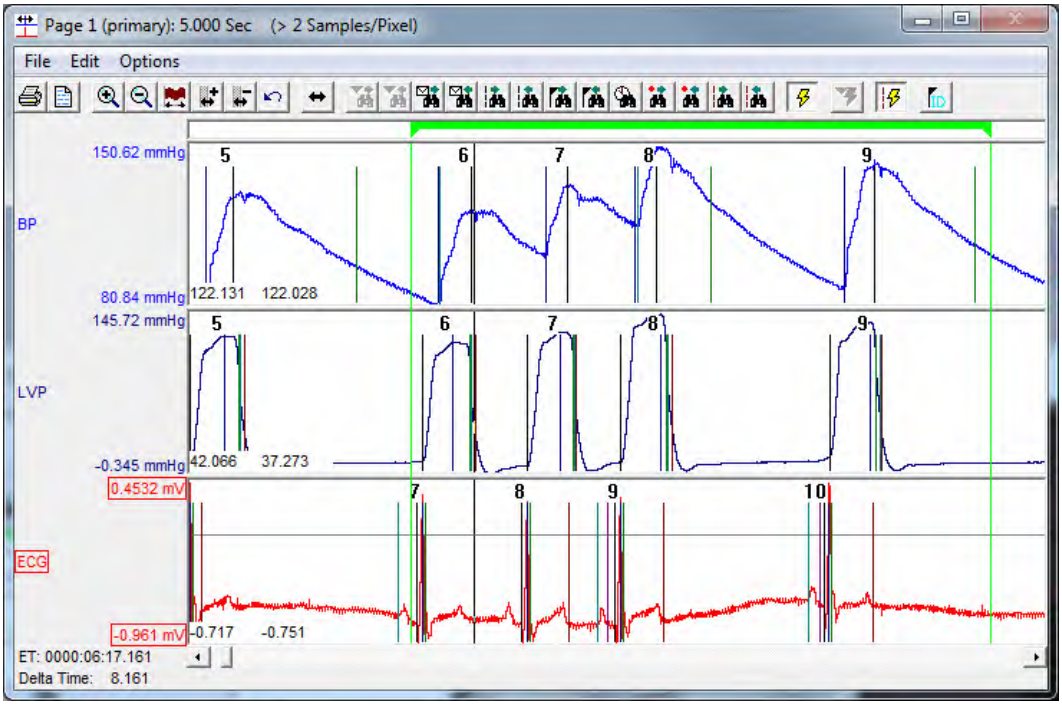
Key Combination	Description of Action
Zoom/Graphical Navigation	
<Alt>+<s>	Synchronize **Primary**, **Trend**, and **Scatter** graphs with associated spreadsheet
<+> (on keypad)	Expand graph
<-> (on keypad)	Compress graph
<Ctrl>+<+> (on keypad)	Expand graph by factor
<Ctrl>+<-> (on keypad)	Compress graph by factor
<Shift>+Mouse wheel	Expand/Compress
<Ctrl>+Mouse wheel	Expand/Compress graph by a factor
Mouse Wheel	Scroll graph page left/right
Page Up	Scrolls waveform window to the left (increase in time) by screen time
Page Down	Scrolls waveform window to the right (decrease in time) by screen time
<Shift>+<F9>	**Auto scale** waveform in a window
<Ctrl>+<F9>	**Auto scale** all pans within graph page
<Ctrl>+<1> - <Ctrl>+<5>	Change time scale to predefined entries defined within Advanced settings of **Setup	Application Configuration**: Review.Graph.Times***n***
<Ctrl>+<6> - <Ctrl>+<9>	Scale all Y axis to one of the 4 defined entries (see above)
<Shift>+<6> - <Shift>+<9>	Scale one Y axis to one of the 4 defined entries (see above): Review.Graphs.High.Scale***n*** Review.Graphs.Low.Scale***n***
<Ctrl>+<z>	Undo zoom on waveform (only one level)
<↑>	Move up one trace area – activate trace area
<↓>	Move cursor down one trace area – activate trace area
<←>	Move cursor left
<→>	Move cursor right
<Ctrl>+<←>	Move cursor the left by a factor
<Ctrl>+<→>	Move cursor the right by a factor
<Shift>+<F6>	Moves to the previous Parser Segment
<Shift>+<F7>	Moves to the next Parser Segment
Add Events	
<Shift>+<a> - <Shift>+<j>	Add **Event** to currently selected Group
<Shift>+<Ctrl>+<a> - <Shift>+<Ctrl>+<j>	Add **Event** to all Groups
<Del> on **Event**	Delete selected Event
Mark Placement/Positioning	
<Tab>	Move to next validation mark

<Shift>+<Tab>	Move to previous validation mark
<Shift>+<X>	Add **Bad Data Mark**
<Shift>+<F2>	Move to next **Bad Data Mark**
<Shift>+<F3>	Move to previous **Bad Data Mark**
<Shift>+<F4>	Find next change (only if **Change Markers** are enabled)
<Shift>+<F5>	Find previous change (only if **Change Markers** are enabled)
<Ctrl>+ <←> or <→> on **Validation Mark** or **Bad Data Mark**	Move selected mark left of right
<Alt>+<v>	Executes reanalysis for the visual region of the selected channel within a Primary graph.
<Del> on **Validation Mark**	Delete selected mark *Note*: If on main Cycle mark (e.g. R-mark) deletes complete cycle
<Del> on **Bad Data Mark**	Delete selected **Bad Data Mark**
<Alt>+<r>	Deletes all Bad Data Marks within the selected channel and automatically executes a reanalysis of the channel
<Alt>+<b>	Adds Bad Data Marks across the visible region of data within Primary and Trend graphs for the *currently selected channel*
<Alt>+<z>	Adds Bad Data Marks across the visible region of data within Primary and Trend graphs for *all groups and their associated channels*
ECGPRO	
<Ctrl>+<N>	Add New **Template Cycle** and analyze
<Shift>+<U>	Delete **Unmatched Cycles** on a Channel (user will be prompt for confirmation)
Data Insights	
Mouse Wheel	Scroll waveform window left/right
<Ctrl> + Mouse wheel	Expand/Compress graph by a factor Scroll Wheel up – zoom in (expand time span) Scroll Wheel down – zoom out (compress time span)
Left-click-and-drag	Zoom in to selected area
<Enter> or **Double left-click**	Sync to Match Result within Primary graph, Trend graph, Scatter Graph and Logged Line of Derived List View.
<Ctrl> + <r>	Reject selected Match Result(s)
<Ctrl> + <b>	Add Bad Data Marks around selected Match Result(s)
<Ctrl> + <d>	Delete cycle validation marks from selected Match Result(s)

Data Parser

The Data Parser is a tool designed to permit the selection of sections of data at specific time points of interest. Data Parser functionality is only available from within a Review session.

Parser Segments are represented in the Parser Bar located at the top of the Primary and Trend graph pages. The Parser Bar may be displayed/hidden by selecting **Display Parser Bar in Graphs** from the Data Parser menu. The default selection is visible.



Parser Segments may be defined using any of the three methods described below:

- Automatically based on user-defined rules.
- Graphically via the **Primary** or **Trend** graph.
- Manually by typing in start and end times for each segment

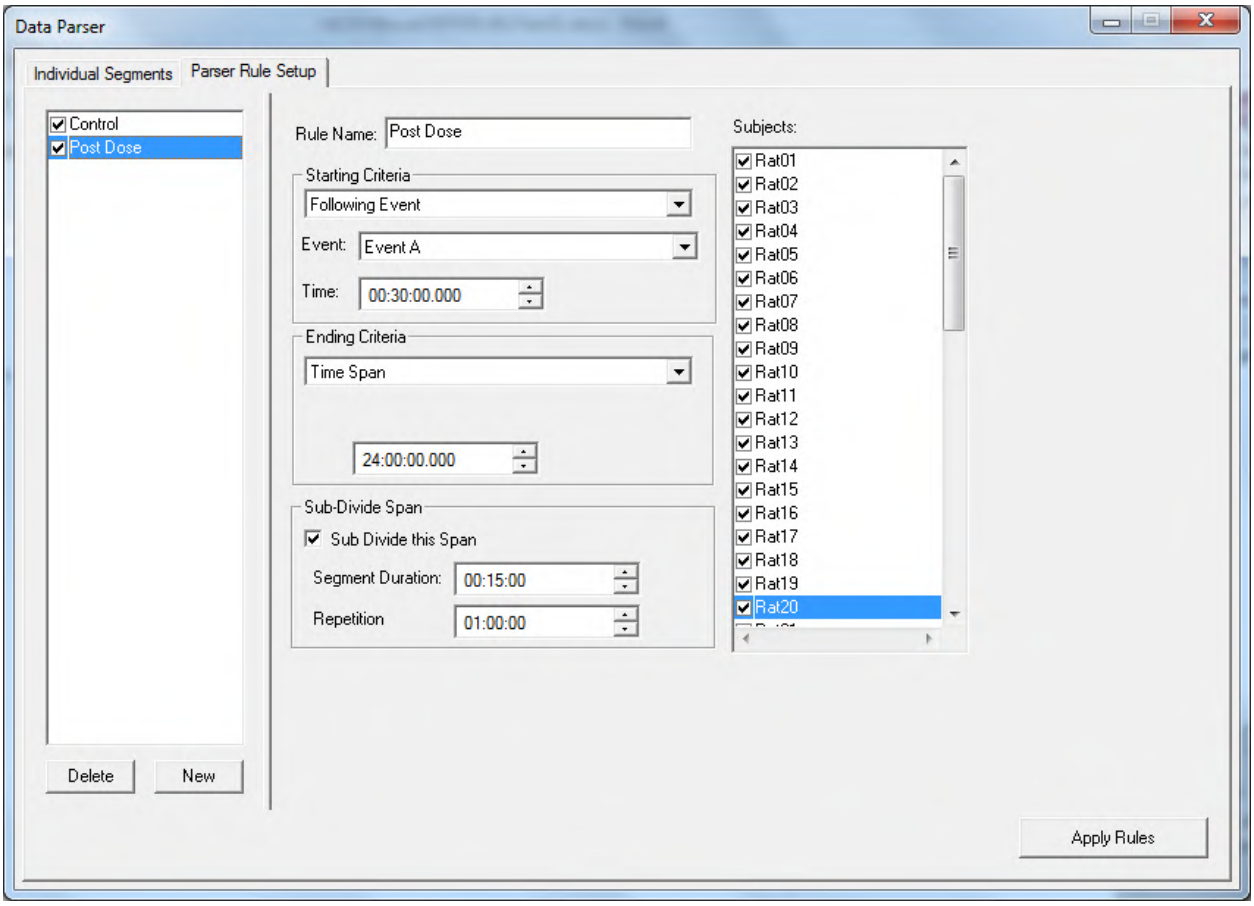
Adding Parser Segments using the Parser Rule Setup

Here's how to do this.

1. Open the Data Parser dialog by selecting **Open Data Parser Dialog** from the **Data Parser** menu.
2. Select the **Parser Rule Setup** tab.
3. Click on the **New** button.
4. Enter a unique name into the **Rule Name** text box to identify the rule.
5. Set the **Starting Criteria**. The options are as follows.
    a. **Real Time**
    Enter the starting time needed for the parser section.
    b. **Prior to Event** (Note that an existing event is needed for this function to work)
    Select the Event and Subject that the event is associated with and enter the amount of time prior to the event that will be used.
    c. **Following Event** (An existing event is needed)
    Select the Event and Subject that the event is associated with and enter the amount of time after the event that will be used as the starting point.

d. **Time Span**
Enter the desired time duration of the Data Parser starting from the Starting Time and ending once the duration has been achieved.

6. Set the **End Criteria**.
The end criteria are the same as the starting criteria except for one addition, setting the **Time Span**, which is the length of time from the start point of the **Parser Segment** to the end point of the **Parser Segment**.
7. Set the **Sub-Divide Span** (Optional)
This allows the user to configure multiple, iterative **Parser Segments**. The time over which **Parser Segments** will be configured is based on the start and end criteria and each segment will be configured for the length of time set up in the **Segment Duration** for every **Repetition Interval** set. For example, if a rule is set up like the one below, 24 Data Parser Segments will be configured, each with a duration of 15 minutes.
8. Add additional Rules as necessary based on desired goal.



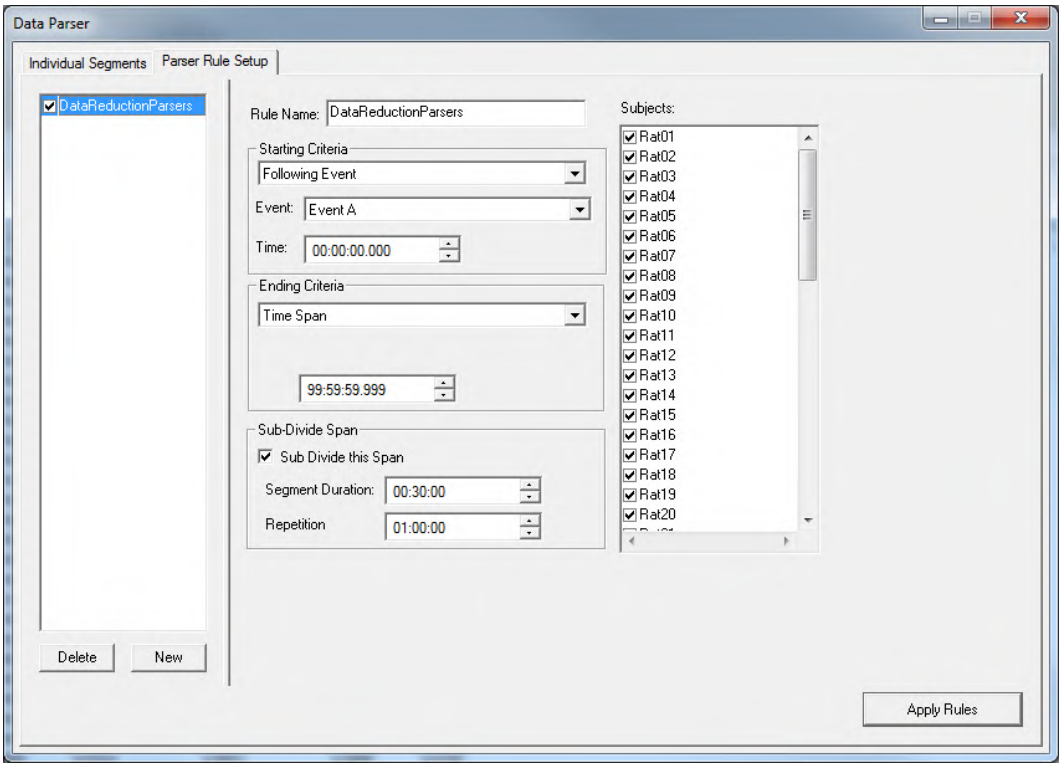
Notes:

- When using the same **Event** letter to specify the start and end criteria, two separate events must be entered. Data Parser will not use a single event to trigger both start and end. If a fixed time is desired from the start, **Time Span** should be used.

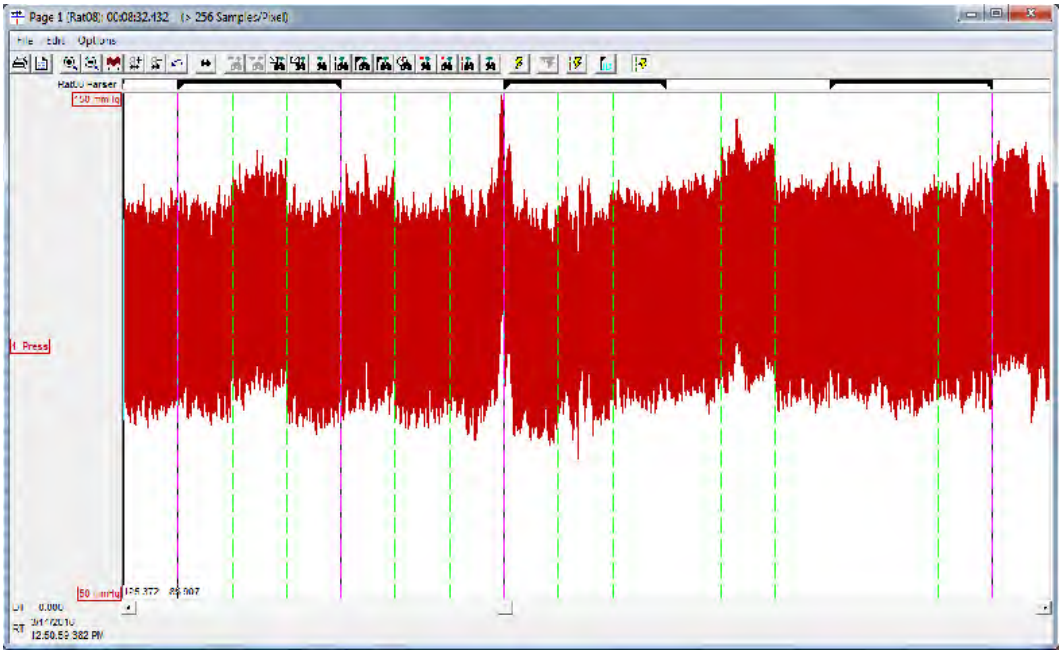
- Once segments have been created, they are no longer directly associated with the underlying rules. Thus, in the case of rules based on **Events**, any subsequent changes to Events will not affect the Parser Segments unless the underlying rules are reapplied. The rules and the Parser Segments may be modified independently. The Parser Segments may be modified graphically on time based graph pages.

- Data Parser Segments may span across **Data Breaks**. Data Parser is based on real-time and Parser Segments will span accordingly. For example, if using Scheduled Sampling to sample 30 seconds every 10 minutes and have configured your Parser Rules to include a repetition of 30 mins every 60 minutes, then the Parser Segment will span three Scheduled Sampling Segments. This scenario is depicted below.

Data Parser Setup:



Resultant Data Parser Segments visible on Graph page:



Adding Parser Segments using Individual Segments

The following outlines the process to add Parser Segments using Individual Segments:

1. Open the *Data Parser* dialog by selecting **Open Data Parser Dialog** from the **Data Parser** menu.
2. Select the **Individual Segments** tab.
3. Select the appropriate group desired to parse.
4. Select the **Insert** button.

Adding Parser Segments from the Graph Page

To add Parser Segment directly from the **Primary** or **Trend** graph page:

1. Right-click on the **Parser Bar**.
2. Select **New Parser Segment**.
3. Adjust the position and the size of the **Parser Segment** as described in that section.

Altering the Size and Location of the Parser Segment

Parser Segments can be augmented directly from the graph.

To compress/expand the **Parser Segment** size:

1. Hover over the left boundary of the **Parser Segment**. The mouse turns into a left-right arrow.
2. Left-click and drag the side to the desired location.
3. Repeat for the right-hand boundary.

To move the entire **Parser Segment** to a new location:

1. Left-click on the top boundary of the **Parser Segment**
2. Drag to the desired location.
4. Repeat the above steps for multiple segments.

Parser Segments can also be augmented using the **Data Parser** Dialog:

1. From the main Ponemah window, select **Data Parser | Segments…**
2. Adjust the **Start** and **End** times to the times needed.
3. Select hours, minutes, seconds, or milliseconds, and either type a new number in or use the up/down arrow buttons to change the times.

Data Reduction

The Data Reduction function allows the system to be configured to reduce the amount of derived parameter data into user-defined summary intervals.

For example, if you require an averaged value at 1-, 5-, 10-, and 30-minute post-dose, **Data Reduction** can be configured to produce this output. Data Reduction can be configured for all Subjects in the Experiment and begins when triggered by a **Time-0 (T0) Event.** The data will be broken down into Control and Dosing periods, based on this **Event**, as defined by the user during **Data Reduction Setup**. This provides a time-aligned output based on the **T0 Event** that can then be used to determine Group means and standard deviations, as well as in statistical packages in a more advanced statistic calculations.

The **Data Reduction** output will be displayed in the **Data Reduction List View** located in the main Ponemah window during an Acquisition or Review session. A separate **List View** will be available for each **Subject** and will contain all Parameters listed in the **Derived Parameter List View** for the **Subject**. If in **Aggregate** mode, the **Data Reduction List Views** will not aggregate the **Derived Parameter** data from all subjects into one **List View**. See the Subject **Channel Details** section to learn how to control which parameters are reported on within these two **List Views**. See the **Data Acquisition Dialog** section's **Derived Parameter List View** description for more information on Aggregate mode.

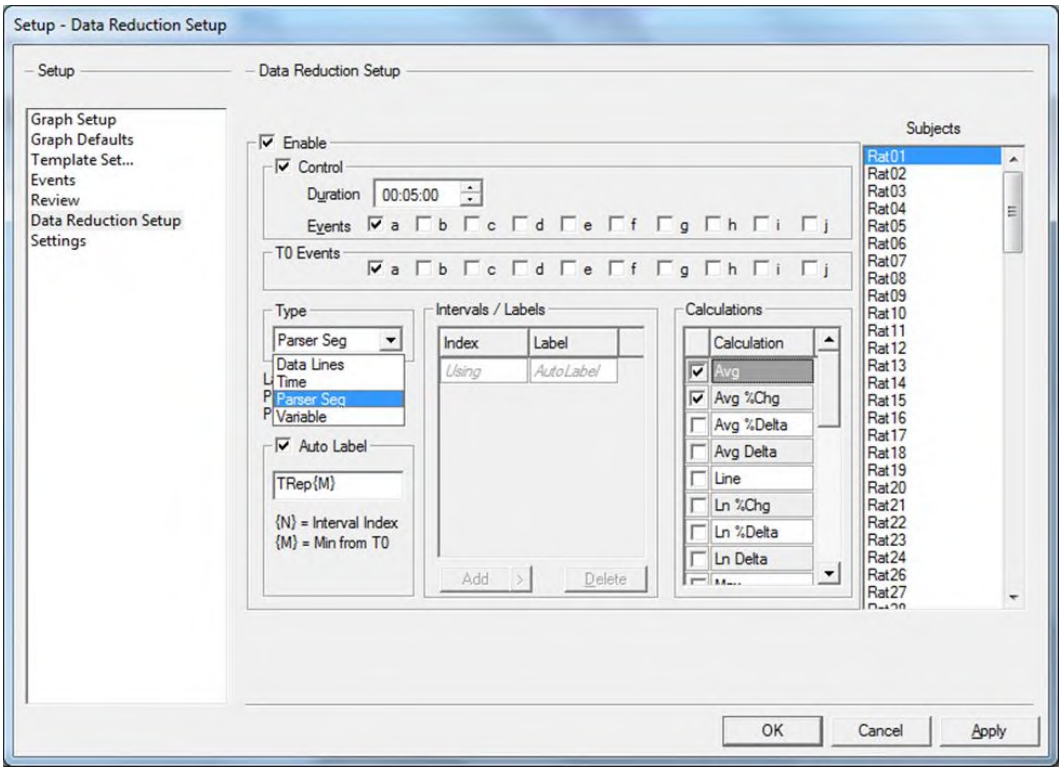
Note: Data Reduction can be setup to report summary averages and standard deviations based on time intervals, the number of **Logged Lines** in the **Derived Parameter List View**, or **Data Parsers**. Configuring Data Reduction to use Data Parser Segments can be an extremely useful method to tightly control which data is chosen for the summary intervals.

Data Reduction Setup

The **Data Reduction Setup** dialog is used to configure how the summary intervals will be executed and to which Subjects the Data Reduction will apply.

To configure **Data Reduction**:

1. Select **Setup | Experiment Setup| Data Reduction Setup**.



2. Select the Subject(s) to which the **Data Reduction** will be applied from the **Subjects** list on the right of the dialog.
3. Enable **Data Reduction** for the selected Subjects by checking the **Enabled** check box.
4. (Optional) Enable the **Control** period by checking the associated check box.
   The **Control** period permits the user to define a pre-dose period to which to compare all other **Data Reduction** intervals for **%Change**, **%Delta**, and **Delta** calculations.
   a. Define the time **Duration** over which logged data is averaged for the **Control** period.
      The **Control** duration works relative to the **Event(s)** that are selected in **Control | Events**. For

example, a **Control Duration** of 5 minutes (00:05:00) will report the average and standard deviation of the **Derived Parameters** for the data range beginning 5 minutes prior to the **Event** and ending at the **Event**.

Note: If **Data Parser** is selected as the **Data Reduction Type**, the **Duration** will be ignored and the first available **Data Parser** will be used for the **Control**.

b. Select the **Event** to be used to trigger the Control period calculation.
The **Control** Duration is defined relative to the location of the Event placement in the data. For example, a **Control Duration** of 5 minutes (00:05:00) will report the average and standard deviation of the **Derived Parameters** for the data range beginning 5 minutes prior to the **Event** and ending at the **Event**

5. Select the **T0 Event** that will be used to trigger the commencement of the post-dose **Data Reduction** intervals. Which **Events** used for **Control** and **T0 Events** will depend on the experimental protocol and how the **Data Reduction** is desired to be controlled.
6. Select the **Data Reduction Type** to define the method used.
    a. **Data Lines**
    This allows you to define the number of **Log Lines** data from the **Derived Parameters List Views** that will be repeated after the activation of an **Event** (**T0**). If the **Logging Rate** is set to 10 seconds and the desired interval to report on is 60 seconds, then set the **Data Lines** to 6.
    b. **Time**
    This allows you to define a time interval over which you would like the summary data to be reported to the **Data Reduction List View**. This interval will be repeated after the activation of an **Event** (**T0**). For example, defining **Time** to 60 minutes will result in reporting summary data to the **Data Reduction List View** every 60 minutes from the **T0 Event**.
    c. **Variable Intervals**
    This allows you to insert a list of times in the system that will start after the activation of the **T0 Event**. The maximum number of variable intervals that can be entered is 100.
    d. **Parser Segments**
    This allows you to summarize data based on defined **Parser Segments**.

    Note: If **Parser Segment** is defined as the **Data Reduction Type** and is triggered during an Acquisition, Data Reduction will be running in Time mode, as Data Parser is a Review Only tool. Once the data is loaded into Review, the **Data Reduction** will update to use the **Parser Segments**.

Calculations

When a summary interval has reached its user-defined duration, calculations are reported to the **Data Reduction List View,** along with the Start Time, End Time and **Duration** of the interval in elapsed time**.** The calculations are enabled by checking the associated check box within the **Calculations** column of the dialog. The following defines the calculations available from **Data Reduction**.

Note: If a calculation requires a **Control** period to be enabled and the **Control** is not enabled, then the calculation will be grayed.

Calculation	Description
Line	The **Log Line** of data from the **Derived Parameter List View** at the specific time interval being logged within the **Data Reduction List View**.
Ln Delta*	Difference between current **Log Line** of data and the **Control Log Line** from the **Data Reduction List View**. (Current - Control)
Ln %Chg*	Log Line/Control * 100
Ln %Delta*	(Log Line - Control)/Control *100
Avg	Average of the Parameter data within the **Data Reduction** interval.
Avg Delta*	Difference between the Average **Log Line** and the Control (Average - Control)
Avg %Chg*	Average/Control * 100
Avg %Delta*	(Average - Control)/Control *100
SDev Samp	The Standard Deviation of the data between the last Monitoring Time and the current.
SDev Est	The Standard Deviation estimate of the entire population of data between the last Monitoring Time and the current.
Max	The Maximum parameter value of the data within the **Data Reduction** interval.
Max Delta*	Difference between Maximum parameter value and the Control (Max - Control)
Max %Chg*	Maximum/Control * 100
Max %Delta*	(Maximum - Control)/Control *100
MaxT	The time at which the Maximum parameter value of the data occurred within the **Data Reduction** interval.
Min	The Minimum parameter value of the data within the **Data Reduction** interval.
Min Delta*	Difference between Minimum parameter value and the Control (Minimum - Control)
Min %Chg*	Minimum/Control * 100
Min %Delta*	(Minimum - Control)/Control *100
MinT	The time at which the Minimum parameter value of the data occurred within the **Data Reduction** interval.
Median	The Median parameter value of the data logged within the Data Reduction interval is reported. If an odd number of data lines are being summarized, the median is calculated by sorting the parameter data values in order and reporting the middle value. If an even number of data lines is being summarized, the median is calculated by sorting the data to be summarized in order and reporting the average of the two middle values.

*Indicates a calculation which cannot be used when **Control** is disabled.

Variability Analysis

Introduction

Variability Analysis permits Heart Rate Variability (HRV) analysis via ECG and Blood Pressure waveform data. Variability Analysis functionality is only available from within a Review session.

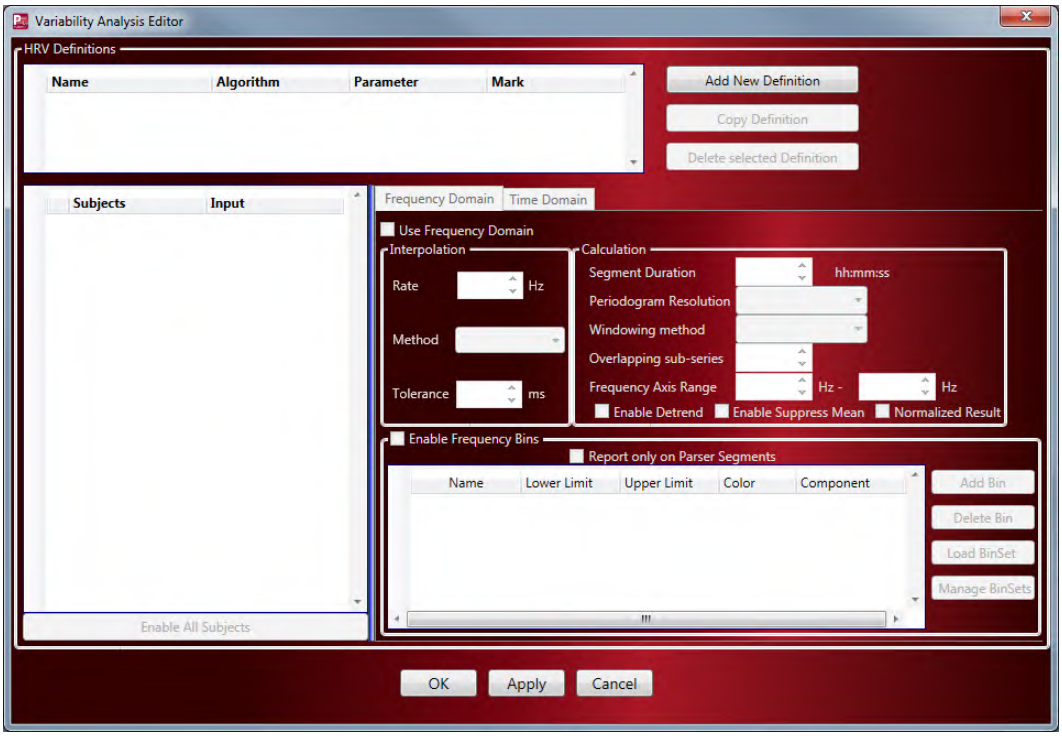
HRV provides a representation of the balance between sympathetic and parasympathetic branches of the autonomic nervous system. High HRV is an indication of healthy autonomic and cardiovascular response, while low HRV indicates that sympathetic and parasympathetic nervous systems are not properly coordinating to provide an appropriate heart rate response. There are several factors that can affect HRV (both positively and negatively) including: reflexes, respiration, renin-angiotensin system, physical or mental stress, exercise, cardiovascular and non-cardiovascular disease states, age and drugs.

Setup

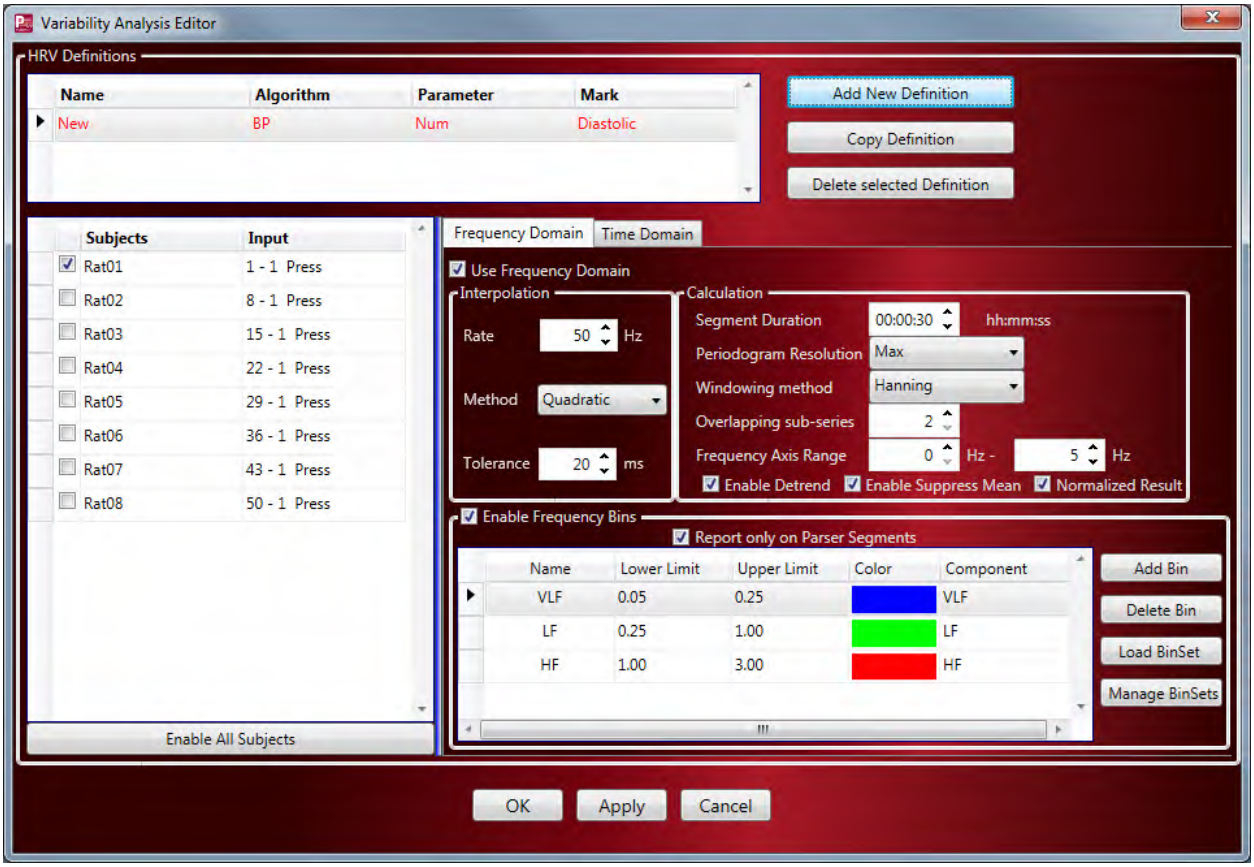
To use Variability Analysis, at least one channel needs to be set to ECG, BP or LVP for the analysis option.

To configure:

1. Start a *Review Session* by selecting **Actions | Start Review**
2. Select the desired Subjects, Channels, and Time Range
   (see the **Loading Data into Review** section of the manual for details.)
3. Select **Setup | Variability Analysis…**



4. Select the **Add New Definition** button.
   A new *HRV Definition* will be added for configuration. *HRV Definitions*, allow you the user to configure multiple analyses based on different setting selections for additional analysis results reporting or to compare results.



5. From the **HRV Definitions** settings box, enter a unique **Definition Name**, select the **Algorithm**, **Parameter**, and **Mark** to use.

- **Algorithm**

  Defines the analysis module this definition will use for the HRV analysis. If deriving HRV from ECG, choose ECG as the Algorithm. If deriving HRV from blood pressure, choose BP as the Algorithm.

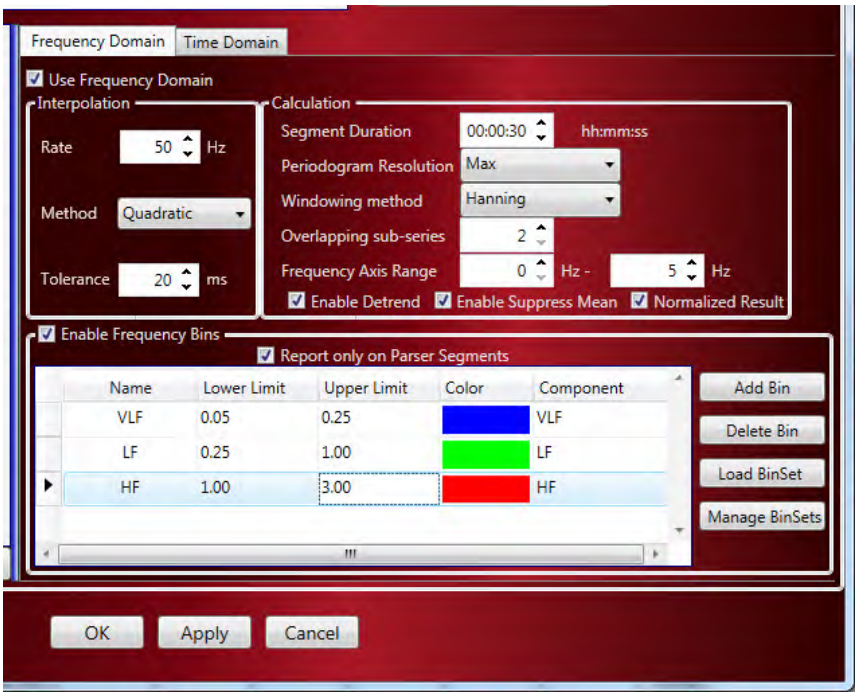
- **Parameter**

  Defines the parameter used for the variability analysis. **RR-I** is typically used for ECG, while **IBIms** is typically used for Blood Pressure.

- **Mark**

  Used as the time stamp for reporting parameter data. Typically, the **R-wave** is used for ECG, while **Diastolic** is typical used for Blood Pressure.

6. Select the **Subjects** to analyze with the defined HRV settings using the checkboxes associated with the Subject IDs listed.
7. Select the dropdown menu under the **Input** column to choose the channel to analyze. The **Input** dropdown menu will only list channels associated with the **Algorithm** selected; e.g. if BP is selected as the **Algorithm**, only BP channels will be listed. This is important if the implant being used has multiple ECG or BP channels to ensure the intended channel is the one being analyzed.
8. If interested in HRV Analysis using the *Frequency Domain*, enable the checkbox associated with **Use Frequency Domain**.



a. Define the *Interpolation* settings. This will equally space the selected data series to accurately calculate the Periodogram.

- **Rate**

  Defines the numerical frequency value used for the interpolation interval.

- **Method**

  Defines the interpolation method. Options include Linear, Quadratic and Cubic.

- **Tolerance**

  Allows the user to permit interpolation over data gaps to prevent aborting analysis of the segment when Bad Data Marks are encountered. Default is 20 milliseconds. Time entry format: ss.mmm.

b. Define the *Calculation* settings used to calculate a high resolution Periodogram of the selected data. The Periodogram splits the data into multiple overlapping windows (smaller data sets or sub-series) and performs a mathematical operation called a Fast Fourier Transform (FFT) on each sub-series.

- **Segment Duration**

  Time interval used for Variability Analysis calculations. The segment duration is different from the Logging Rate used in other areas of Ponemah.

- **Periodogram Resolution**

  Defines the number of points used to calculate the Periodogram.

- **Windowing Method**

  The mathematics behind the FFT assumes that the input waveform repeats cyclically. This is not the case with most waveforms, so to avoid sharp discontinuities that would cause additional frequency components in the result, a windowing method is used. Windowing is used to taper the sub-series endpoints to better approximate a truly periodic signal. By tapering the window smoothly to zero at each end, the height of the side lobes resulting from a rectangular window can be diminished; this is achieved at the expense of a wider main lobe (coarser response at the true center frequency). Choose a windowing method to define how the time domain signal will be truncated. Options include:

  - **Rectangle** - This windowing method does not modify the data signal and produces the sharpest spectral peaks, but produces the worst side lobes due to 'border artifact'.
  - **Hanning** - Similar to a bell curve, this windowing method provides greater weighting for points in the center of the window. This is a good general-purpose window; however, it does remove most of the signal. If unsure about which window would be best, try this one first. In comparison with the rectangular window, it reduces border artifact by virtue of its smaller first side lobe amplitude. However, non-rectangular windowing affects the average power of a signal because some of the time samples are attenuated when multiplied by the window.
  - **Hamming** - Similar to the Hanning window, this windowing method provides another way to taper endpoints of the sub-series and preserves more of the original signal than a Hanning window, but at the price of unpleasant side lobes. The Hamming window has slightly more attenuation in the first side lobe than the Hanning window, but the subsequent side lobes trail off more slowly than with the Hanning window.

- **Overlapping Subseries**

  Used to subdivide the data segment into smaller segments that are windowed individually to provide the desired frequency resolution. Values can be between 2 and 50.

- **Frequency Axis Range**

  Range of the x-axis to display the Periodogram data.

- **Detrend**

  Removal of any baseline wander in the data.

- **Suppress Mean**

  Removes the baseline offset so that all data averages to 0. Enabling this option helps to ensure precise statistical measures.

- **Normalized Result**

  Normalizes the Periodogram result so that the maximum y-axis value is equal to 1.

c. **Enable Frequency Bins** to create a Periodogram. The power contained within each of the bins is determined and used for further analysis. The default values provided in the list are examples and may be adjusted.

   Enable **Report only on Parser Segments** to only report HRV Frequency analysis results from waveform data contained within defined **Parser Segments**. This is important as it allows the use to have equally spaced segments of data that should be signal noise free to ensure the Periodogram are accurate. Noise within the waveform segment select will lead to unexpected results.

   To setup the Frequency Bins, define the following items:

   - **Name**

     Name assigned to the frequency bin. Default values are shown, but can be changed by clicking within the box that contains the name.

   - **Lower Limit**

     Numerical frequency value used for the Lower Limit for the specific frequency bin. The Lower Limit must be less than the Upper Limit. The value can be changed by clicking within the box that contains the Lower Limit value.

- **Upper Limit**

  Numerical frequency value used for the Upper Limit for the specific frequency bin. The Upper Limit must be greater than the Lower Limit. The value can be changed by clicking within the box that contains the Upper Limit value.

- **Color**

  Color used on graph pages for the specific frequency bin. The color can be changed by clicking on the color box.

- **Component**

  The Variability Analysis calculates parameters specific for HRV. For the calculations to perform correctly, the specific frequency components must be identified. Options are ULF, VLF, LF, HF and Unspecified. The Unspecified option is the only frequency option that can be used more than once. For the named frequency components, the Upper Limit of VLF must be less than the Lower Limit for LF and the Upper Limit for LF must be less than the Lower Limit of HF.

- **Add Bin**

  Used to add additional frequency bins.

- **Delete Bin**

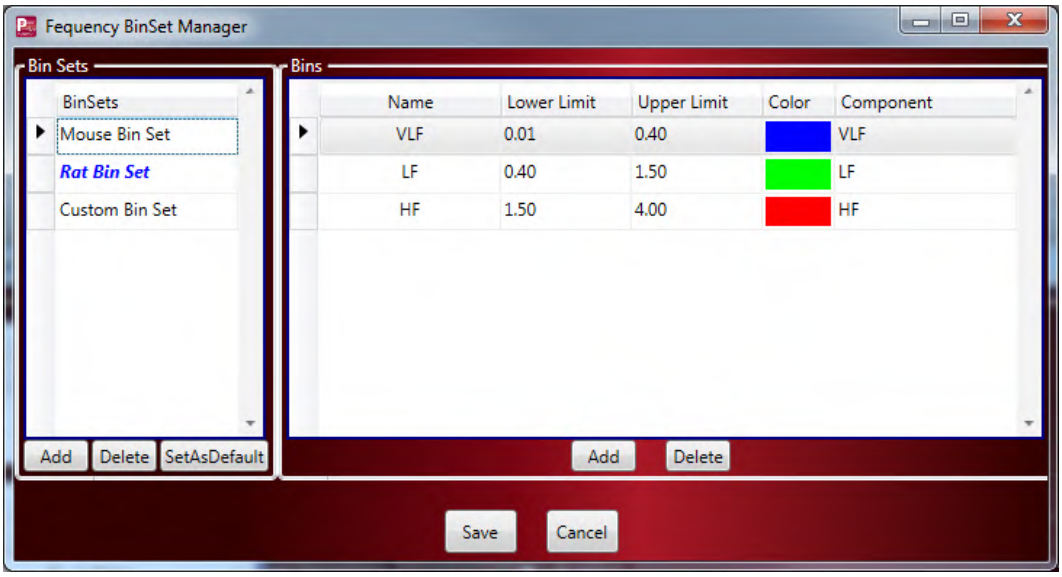
  Used to delete additional frequency bins.

- **Load BinSet**

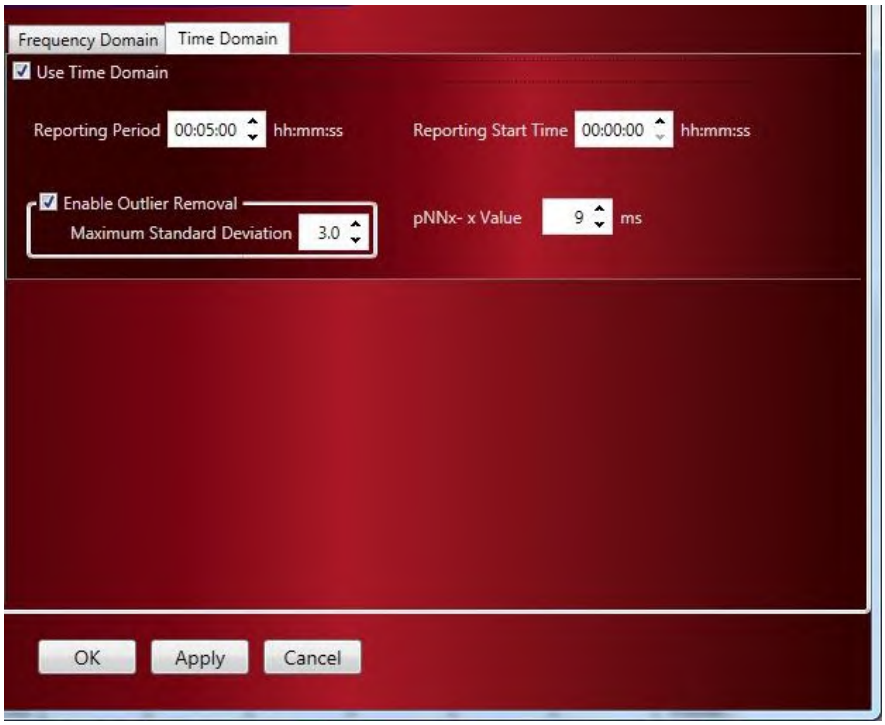
  Selecting the **Load BinSets** button will display the available, predefined frequency bin sets. Mouse and Rat bin sets are available as defaults. However, any user-defined bin set will be listed if they exist. Selecting the bin set will load it into the *Variability Analysis Editor* dialog for use with the currently displayed HRV Definition analysis.

- **Manage BinSets**

  Choosing **Manage Bin Sets …** will display the **Manage Frequency Bins** dialog. This displays the bin sets available for use and allows the user to create customer bin sets for easy selection. The default bin set used for calculations can be customized by selecting the desired bin set to load by default and then selecting the **SetAsDefault** button. The default bin set is identified by bold, blue font.



9. If interested in HRV Analysis using the *Time Domain*, select the Time Domain tab and enable the checkbox associated with **Use Time Domain**.



Configure the following Time Domain settings:

- **Reporting Period**

  Defines the rate at which data is reported to the **Variability Analysis Derived List Views**.

- **Report Start Time**

  This defines the time offset at which to start reporting **Time Domain** HRV Results to the **Derived List View**. For example, if the experiment data is loaded at 7:00 AM but you want the analysis to start at 10:00 AM, then enter a **Report Start Time** of 03:00:00 to indicate a 3 hour offset.

- **pNNx – x Value**

  The time, in milliseconds, used to calculate the number of valid adjacent NN values not separated by data breaks or bad data marks that differ by more than this value. The number of counts based on this setting are reported as the Derived Parameter NNx.

  Note: Default values by species are:

  a. Mouse 6 milliseconds
  b. Rat 9 milliseconds
  c. Monkey 25 milliseconds
  d. Dog 50 milliseconds

- **Outlier Removal**

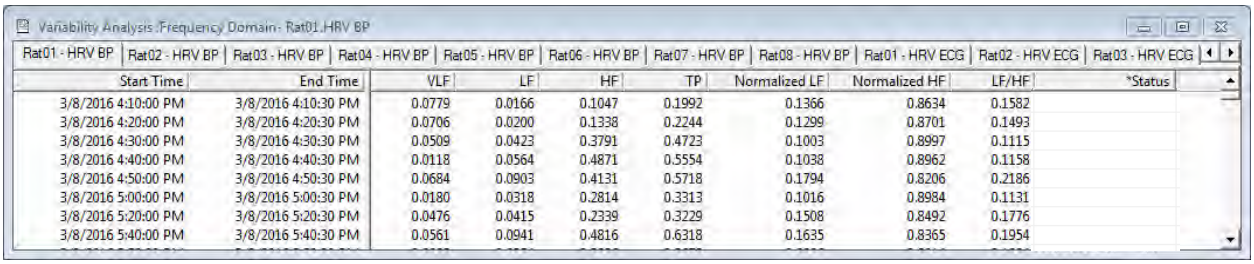
  Enable the checkbox for **Enable Outlier Removal** and define the **Maximum Standard Deviation** above which values will be removed.

  Note: **Outlier Removal** is disabled by default.

Derived Parameters

Derived Parameters from the *Variability Analysis* operations is made available as separate **Variability Analysis List View** in the main Ponemah window. Disparate *List Views* will be displayed for **Frequency Domain** and **Time Domain Variability Analysis**. Each *List View* will be titled with the domain type of the Derived Parameters it contains within. The *List Views* contain separate tabs per **Subject** and per **HRV Definition**. The example *List View* below displays the Frequency Domain Derived Parameters for Rat01 – Rat08 when two separate HRV Definitions have been applied (HRV BP and HRV ECG). A similar List View contains the Time Domain Derived Parameters.

Note: For **Frequency Domain** Analysis, the **Derived Parameters** will only be available if binned analysis was setup during creation of the Variability Analysis, as described in **Step 8c** above.



Start Time	End Time	VLF	LF	HF	TP	Normalized LF	Normalized HF	LF/HF	*Status
3/8/2016 4:10:00 PM	3/8/2016 4:10:30 PM	0.0779	0.0166	0.1047	0.1992	0.1366	0.8634	0.1582	
3/8/2016 4:20:00 PM	3/8/2016 4:20:30 PM	0.0706	0.0200	0.1338	0.2244	0.1299	0.8701	0.1493	
3/8/2016 4:30:00 PM	3/8/2016 4:30:30 PM	0.0509	0.0423	0.3791	0.4723	0.1003	0.8997	0.1115	
3/8/2016 4:40:00 PM	3/8/2016 4:40:30 PM	0.0118	0.0564	0.4871	0.5554	0.1038	0.8962	0.1158	
3/8/2016 4:50:00 PM	3/8/2016 4:50:30 PM	0.0684	0.0903	0.4131	0.5718	0.1794	0.8206	0.2186	
3/8/2016 5:00:00 PM	3/8/2016 5:00:30 PM	0.0180	0.0318	0.2814	0.3313	0.1016	0.8984	0.1131	
3/8/2016 5:20:00 PM	3/8/2016 5:20:30 PM	0.0476	0.0415	0.2339	0.3229	0.1508	0.8492	0.1776	
3/8/2016 5:40:00 PM	3/8/2016 5:40:30 PM	0.0561	0.0941	0.4816	0.6318	0.1635	0.8365	0.1954	

The **Derived Parameter** data for **Variability Analysis** will be saved when **Save Derived Data** or **Save Mark Section** is executed, as described in the **Saving Analysis Sessions** section of this manual. Once saved, the **Derived Parameters** will be available via Excel as separate tabs.

Frequency Domain Derived Parameters

The following details the available **Derived Parameters** from the Frequency Domain Variability Analysis.

Name	Definition
VLF	The Very Low Frequency (VLF) as defined in the Variability Analysis Frequency Domain Frequency Bins over the user-defined Segment Duration.
LF	The Low Frequency (LF) as defined in the Variability Analysis Frequency Domain Frequency Bins over the user-defined Segment Duration.
HF	The High Frequency (HF) as defined in the Variability Analysis Frequency Domain Frequency Bins over the user-defined Segment Duration.
TP	The Total Power (TP) over the user-defined Segment Duration.
Normalized LF	The normalized Low Frequency (LF) as defined in the Variability Analysis Frequency Domain Frequency Bins over the user-defined Segment Duration. This removes the VLF component.
Normalized HF	The normalized High Frequency (HF) as defined in the Variability Analysis Frequency Domain Frequency Bins over the user-defined Segment Duration. This removes the VLF component.
LF/HF	The power ratio of Low Frequency content divided by High Frequency content over the user-defined Segment Duration.
Status	Provides an indication to the user should an issue be encountered with the analysis over the user-defined Segment Duration. See Variability Analysis | Trouble Shooting section for more information.

Time Domain Derived Parameters

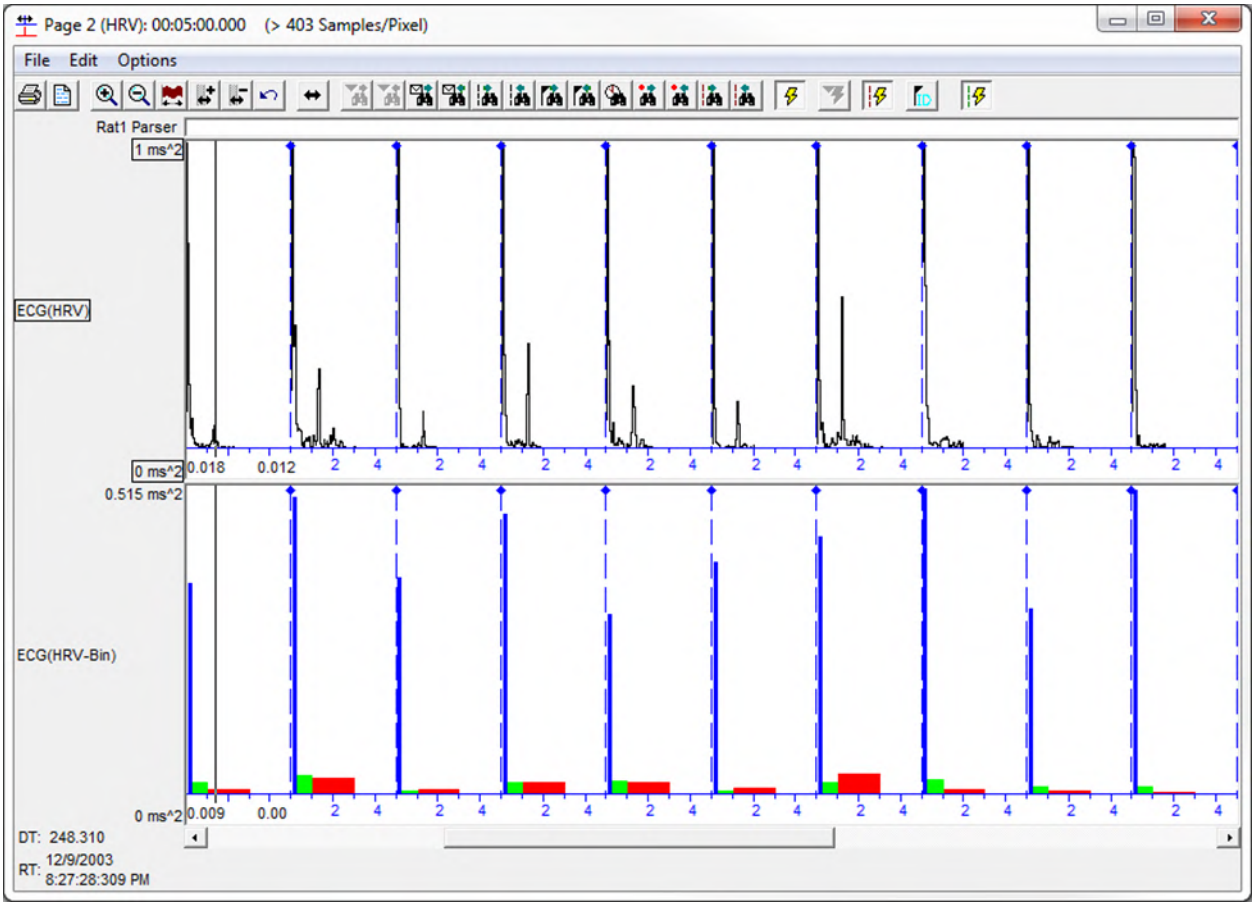
The following details the available **Derived Parameters** from the Time Domain Variability Analysis.

Name	Definition
NNInterval	The average of all Normal-Normal (NN) intervals in milliseconds over the user-defined Time Domain Reporting Period.
SDNN	The standard deviation of the averaged Normal-Normal (NN) intervals in milliseconds over the user-defined Time Domain Reporting Period.
RMSSD	The root mean square of successive differences in milliseconds. sqrt(1/N* ∑(NNn – NN(n-1))^2) Where N is the number of valid adjacent NN values that are not separated by data breaks or bad data marks.
NNx	The number of valid adjacent NN values that are not separated by data breaks or bad data marks that differ by more than x milliseconds. X is defined in the Time Domain pNNx – x Value setting.
pNNx	The proportion of valid adjacent NN values that are not separated by data breaks or bad data marks that differ by more than x milliseconds (NNx) divided by the total number of Normal-Normal intervals (Cycles).
Cycles	The number of available NN values.
Status	Provides an indication to the user should an issue be encountered with the analysis over the user-defined Segment Duration. See Variability Analysis | Trouble Shooting section for more information.

Graph Page Setup

Results from Variability Analysis can be shown graphically via **Primary** and **Trend** Graph pages.

High resolution Periodogram and binned Periodogram can be viewed in a **Primary** graph, by selecting the dedicated items in the **Presentation** column. Since Variability Analysis is a Review Only feature, these Presentation graphs are only available while in a Review session. The Presentation dropdown box will list the Variability Analysis Name, which will display the Periodogram, and the Variability Analysis Name – bins, which will display the binned data as shown below:



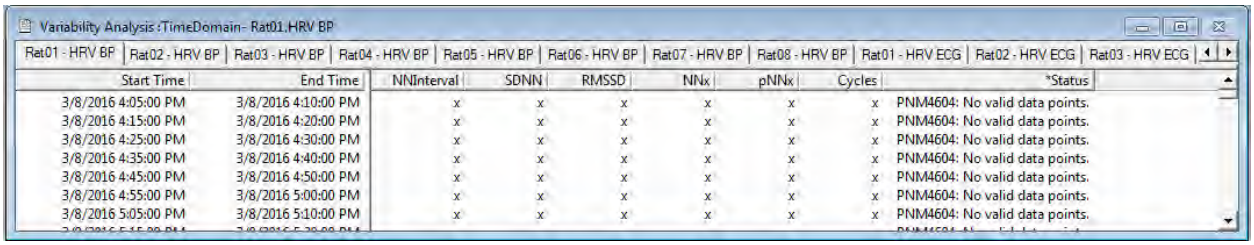
Note: All derived variability analysis data (e.g. LF/HF) can be viewed in **Trend** graphs.

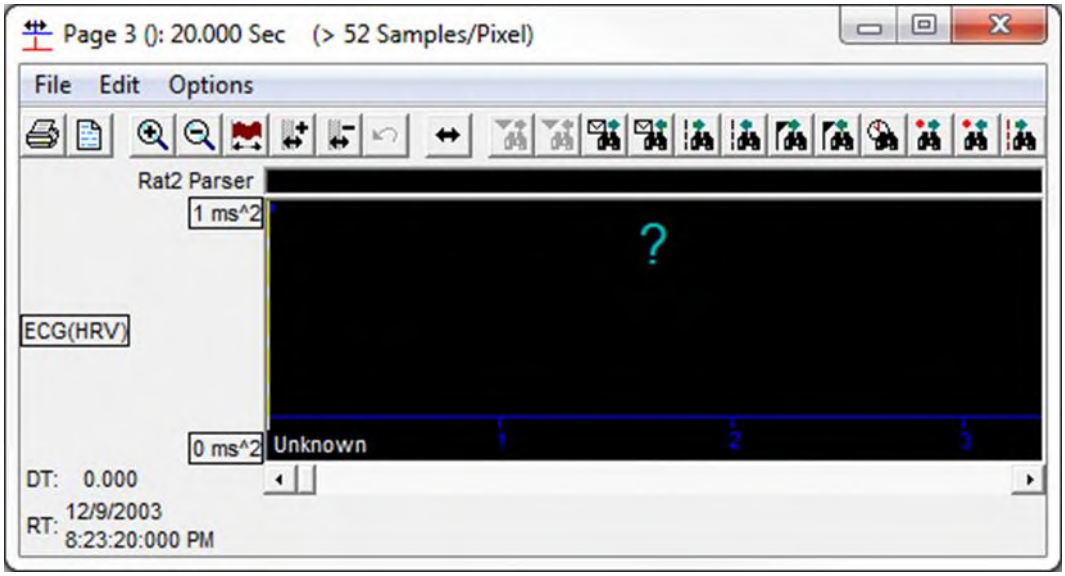
Troubleshooting

In order for the Variability Analysis to work correctly it is important to include the analysis attributes for the ECG or blood pressure raw signal. If this is not done, then the Derived Parameter data and graph pages will not display the variability analysis data.

Ponemah will provide visual feedback regarding any potential error

s related to Variability Analysis. The screenshots below provide an example for when no valid data points are available for the Variability Analysis. The error condition can also be verified by right-clicking the mouse in the axis for the Periodogram or binned data. This is shown in the last screen capture.





Data Insights

Data Insights allows researchers to assess the quality of their data analysis and target problem areas for additional cleaning and analysis without having to manually over read the dataset. Data Insights reveals these problem areas by applying user-defined search rules to the dataset and displaying cycles that match the search criteria. Match results are displayed in graphical and tabular formats to provide researchers a multi-faceted view of each search result and how the results are distributed throughout their dataset. This provides researchers the necessary

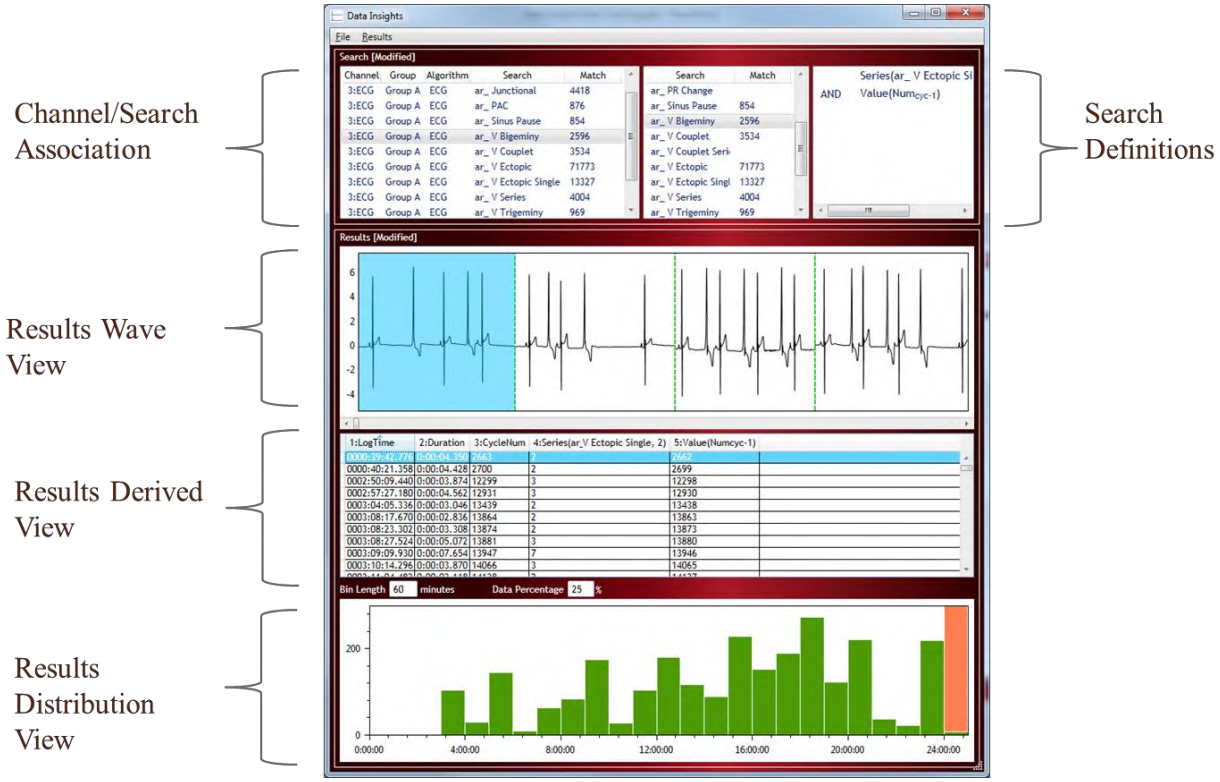
information to better understand their data and make an informed decision on whether or not to exclude certain sections of data due to signal artifact or data dropout without investing a significant amount of time.

In addition to searches for data validation and analysis, researchers may create Data Insights searches to locate, present, and report on any data pattern or anomaly within the dataset, e.g., cardiac arrhythmias. The use of Data Insights permits the user to move beyond snapshots of data for efficient coverage of large volumes of data.

Using Data Insights searches, researchers can optimize their data review and analysis process to achieve consistent, reproducible results for reporting purposes.

Data Insights Dialog Overview

Data Insights is accessed from the **Experiment menu** when in Review. All active channels loaded into Review will be available for use within Data Insights.



SEARCH SECTION

The **Search** section of the dialog provides a means to define search criteria and associated desired searches to channels to populate the **Results** section. The Search section is split into three grids:

- **Channel/Search Association and Match Results**
  (left grid)

  The Channel/Search Association grid includes the physical channel, Subject name, analysis module assigned to that channel and all searches that have been applied to that channel. In the above example, the ar_V Bigeminy search has been applied to channel 3.

- **Search and Match grid**
  (middle grid)

  This section of the dialog displays the names associated with the defined Searches and the total number of occurrences matching that rule or search criteria. If the same rule is applied across multiple channels, the Match field will list the total number of matches across all associated channels. A list of predefined Searches is present by default and available for use.

  The list of default Searches follow the following naming convention:

  - an_ Searches used to aid in data analysis. Currently used to help construct high value ECG PRO Template Libraries.
  - ar_ Searches used to aid in arrhythmia detection.
  - dv_ Searches used to aid in data validation by quickly exposing outliers and potentially mismarked data that may require focused attention.

  To learn more about the default Searches, please see the **Data Insights** section of the **Software Appendix**.

- **Search Definition**
  (right grid)

  This section displays the Search Definition for a given Search. Click on any Search under the **Search** header and the search criteria used to define the search will be displayed within this grid. Searches are composed of one or more Search Clauses that may be combined using Boolean operators (AND, OR). One or more Search Definitions may be associated with each acquired signal.

  See **Customizing Search Definitions** to learn more about Search Definitions.

RESULTS SECTION

The **Results** section of the dialog contains graphical and numerical information based on the results from the searches that have been performed. This section is also divided into three sections:

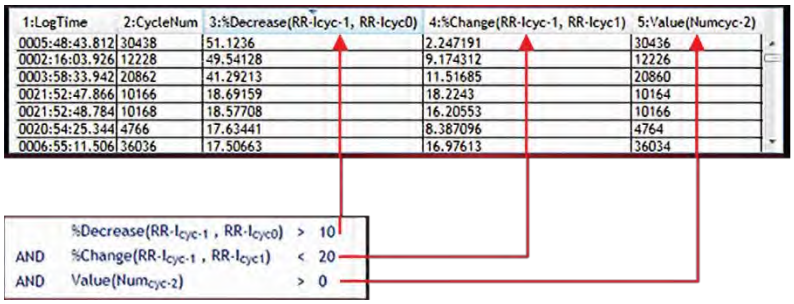
- **Results Wave View**
  (top)

  Displays the waveform data that matches the search criteria assigned to that channel. Dashed green lines indicate the cycles that match the

search criteria for a contiguous time segment. The number of segments displayed in the graphical view corresponds to the number of matches found.

- **Results Derived View** *(middle)*

  Displays numeric data for each clause within the search, as well as the Log Time associated with the match. The example below illustrates how each clause of the Search Definition Clauses is associated with its own column in the Derived View.



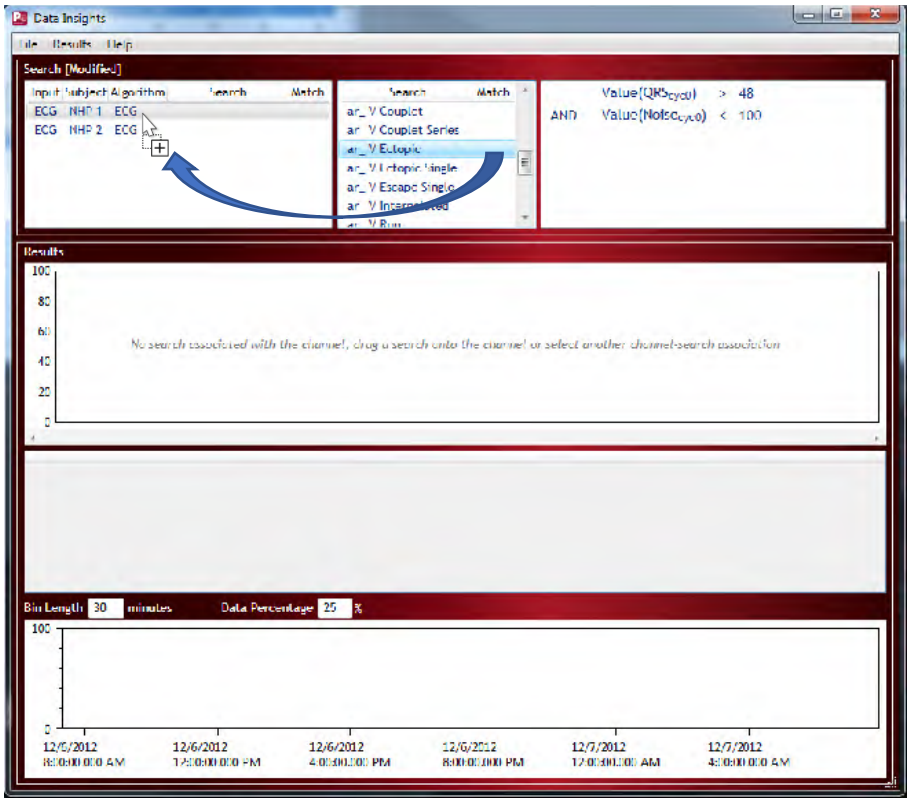
- **Results Distribution View** *(bottom)*

  Displays a histogram graph of the match results binned into user defined time segments to visualize the result distribution across the period of data loaded into Ponemah Review.

Executing Searches

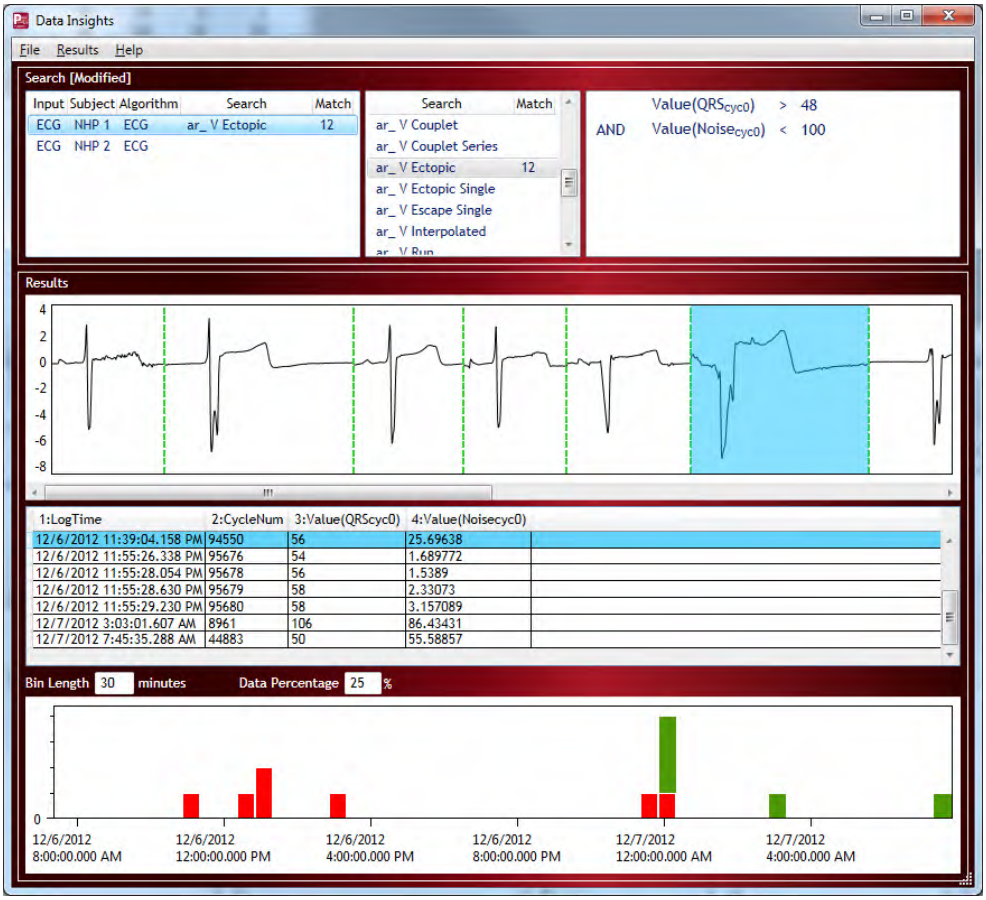
To apply a **Search** to a channel, click-and-drag a Search from the **Search and Match** grid to the channel of interest. Selection of multiple Searches is also supported to apply two or more at the same time by multi-selecting the Searches of interest. Drag-and-dropping the search to a single channel will apply that search only to that channel, while dropping it on the grid header will apply that search to all channels loaded into Review to which that search is applicable.

Note: Searches are specific to a channel and specie type. For example, Searches constructed using ECG parameter information cannot be applied to pressure channels. Searches should be created specific to both specie and signal type. Searches that do not match the signal type will not be allowed to be drag-and-dropped on that channel.

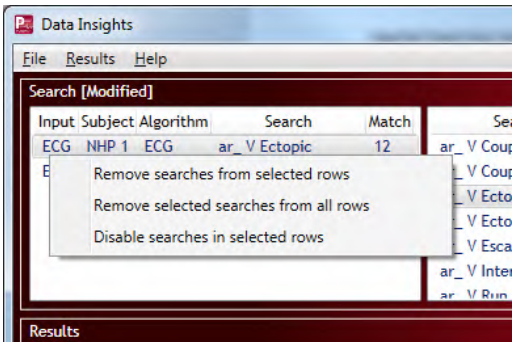


Once associated with a channel, the Search name will appear under the **Search** column next to the channel information. Analysis will automatically be performed, populating the number of occurrences matching the search criteria under the **Match** column and the **Results** section.

Warning: The Data Insights match results reflects the current state of the cycle marks and, therefore, dynamically updates if the cycle marks are changed; e.g. reanalyzing data with the analysis module or manually moving marks may change the match results.



Applied Searches may be disassociated from a channel by right-clicking the mouse on any of the Channel/Searches pairs. This will display a pop-up menu to permit the Search to be removed or disabled across one or multiple channels.



Navigating Results

Data is displayed in the **Results** section by clicking on a specific Channel/Search. Only one signal may be viewed at a time. Data is scaled in user units.

NAVIGATING THE WAVE VIEW

The following may be used to move forward (toward the end of the data) and backward (toward the beginning of the data) through the results in the Wave View

- Scroll Bar

  The scroll bar below the Wave View is used to move through the data by using the mouse to drag the scroll bar left and right.

- Mouse Wheel

  The mouse wheel may also be used to scroll through the match results. With the cursor hovering within the Wave View, scrolling the mouse wheel up will move forward in the data, while scrolling down will move backwards in the data.

- Arrow Keys

  The Right Arrow key moves forward in the data, while the Left Arrow key moves backwards. Progression will be one result at a time.

- Page Up/Page Down

  The Page Up key moves forward in the data, while the Page Down key moves backwards in the data. Progression will be one result page at a time.

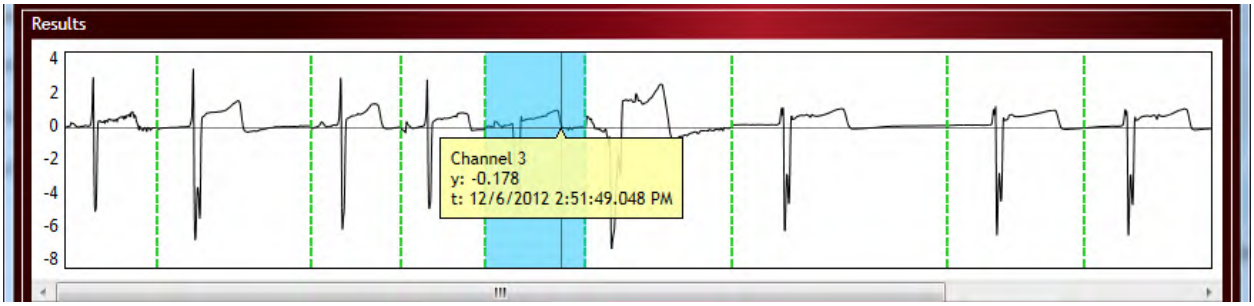
SCALING/ZOOM

The Wave View autoscales the y-axis range based on the match results being displayed.

Use **<Ctrl> + Mouse Wheel** to change the x-axis range. Scrolling down will zoom out, compressing the data and effectively displaying more results within the Wave View. Scrolling up will zoom in, expanding the data to display fewer results. Alternatively, **left-click-and-drag** may also be used to zoom in on results, providing more control of exactly which Results will be displayed by the zoom.

Note: Zooming out may not be performed via a click-and-drag function. Use the **<Ctrl> + Mouse Wheel** to zoom out as described above.

Additionally, pressing **<Ctrl> + Left-click** on a point in the Wave View will display its corresponding x- and y-axis values at that point.



Processing Results

The following features assist in the processing of large sets of results and the identification of appropriate thresholds for use in search definitions.

SORTING RESULTS BY SEARCH INPUT

By default, the search results are ordered chronologically. However, the search results may be sorted by any of the columns in the Results Derived View by clicking on the column header. Sorting updates the order of results in both the Results Derived View and the Results Wave View. Clicking the **LogTime** column header will bring the results back to their sort default by time.

RESULT ACTIONS

The following are a list of actions that can be taken on each result and their associated hot keys and definitions:

- **Reject**
  <Ctrl> + <R>

  Removes the match result(s) from the Wave View, Derived View, and Distribution View and reduces the number of matches listed in the **Match** columns of the associated searches. Rejecting a match result does not affect the derived data outside of the Data Insights dialog, it simply removes it as a match.

- **Add Bad Data Marks**
  <Ctrl> + <B>

  Adds Bad Data Marks around the currently selected match result(s) within the Ponemah Review graph pages. This feature functions the same as using Bad Data Marks in Review (outside of using Data Insights). This will result in the match result being removed from the Search Results, as well as the cycle being removed from the data reported to the Derived Parameter and Data Reduction List Views.

- **Delete Cycles**
  <Ctrl> + <D>

  Removes the validation marks from match result cycle without adding Bad Data Marks. This will result in the match result being removed from the Search Results, as well as the cycle being removed from the data reported to the Derived Parameter and Data Reduction List Views.

Multiple results may be selected and either rejected as not belonging to the set of results or marked as bad data to prevent further analysis on the data samples. The number of results that may be selected at once is limited to less than 5000 results. A notification will popup if this limit is exceeded.

Note: These Result Actions may be executed from the Results Wave and Results Derived Views.

SYNCHRONIZING RESULTS

A single mouse left-click on a result in the Wave View will highlight the result and synchronize it with its associated numerical Result in the Derived View. Similarly, if a numeric result is selected from the Derived View, Data Insights will select and synchronize to the result in the Wave View.

A double left-click on the result from either the Wave View or the Derived View will also synchronize with the Parameter and Data Reduction List Views within the main Ponemah dialog, as well as with all other configured graph pages.

To aid in locating the exact match being synchronized to within the Ponemah Primary Graph page for additional observation, a background color may be applied to the match results. This is also helpful when over-reading data to determine if regions have already been identified by an applied Search within Data Insights.

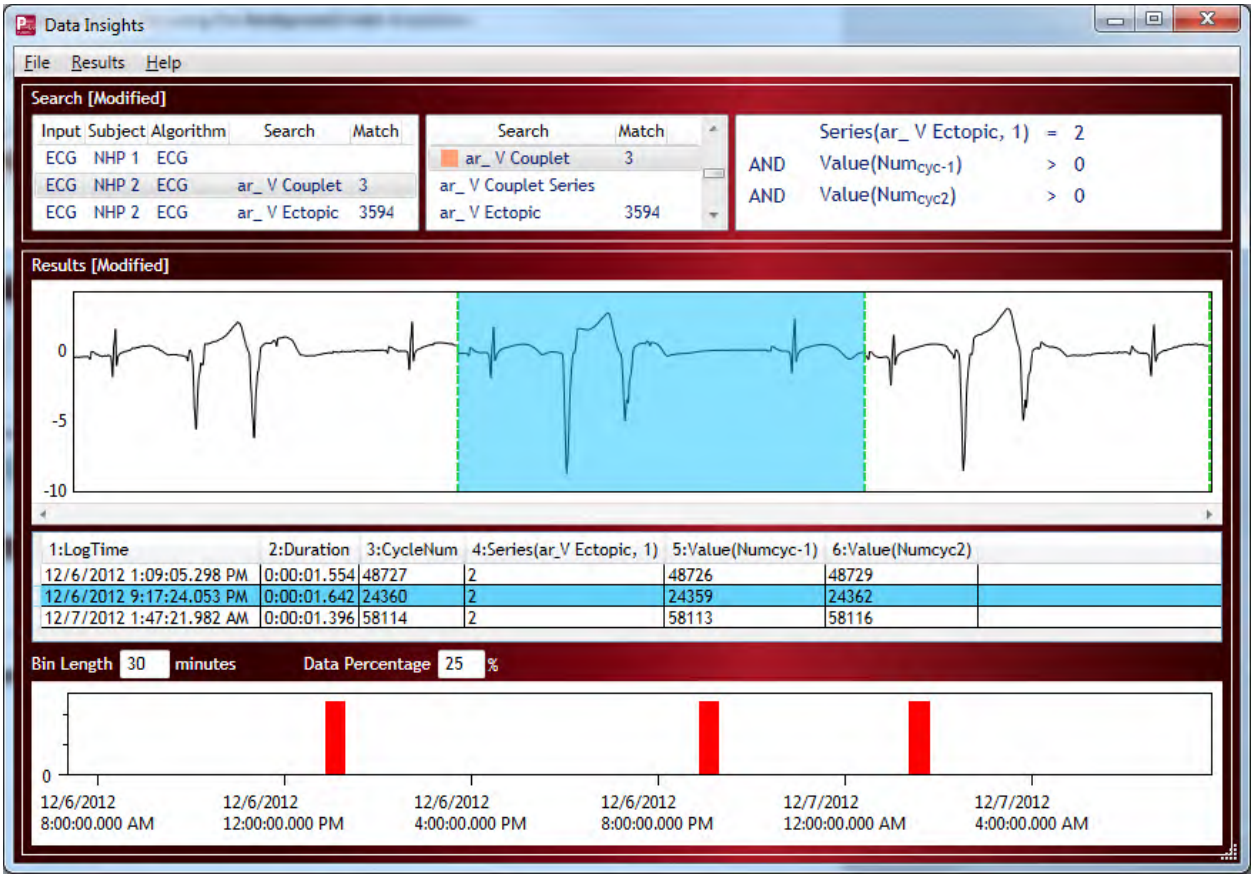
To add a background color for a particular Search:

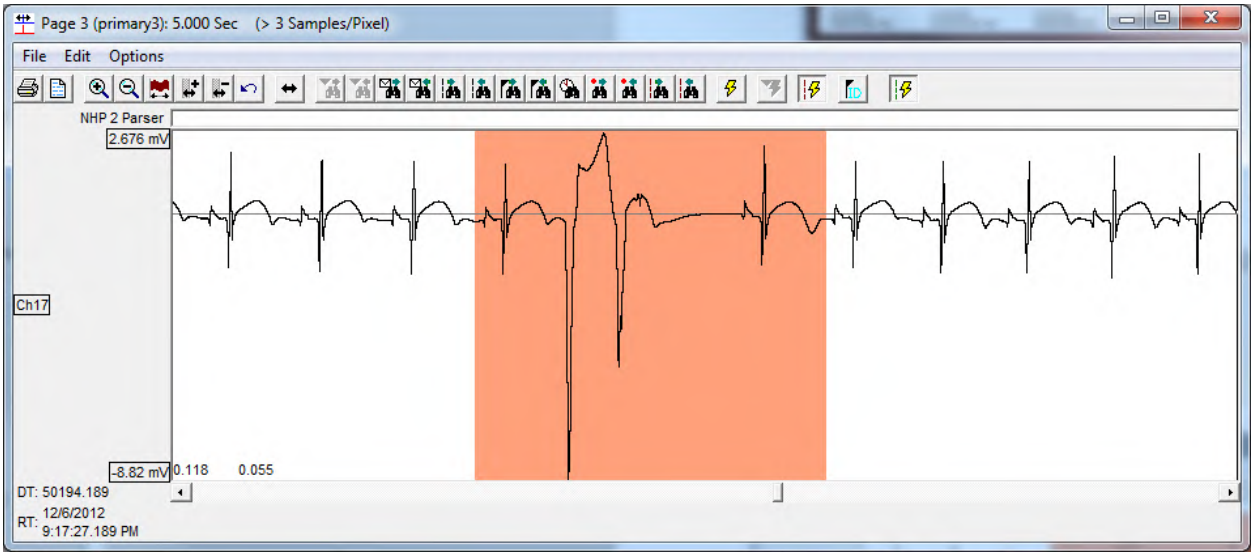
1. Locate the Search of interest within the **Search and Match Grid** (center grid in the top section).
2. Double-click the Search name.
3. Check the checkbox for **Display Background Color**.
4. Select the desired background color using the **Background Color** dropdown.
5. Click **OK**.
6. Double-click a match result to synchronize with the **Primary Graph**.

If the user decides the result within a colored region should not be included as a match, it may be rejected by right-clicking the mouse on the colored waveform segment in the Primary Graph and select **Reject Selected Search Result.** Match Results will be removed from Search Results and added to the Reject Results. Rejecting a result does not affect the derived data outside of the Data Insights dialog. In addition, A**dd Bad Data Marks** and **Delete Cycles** can be used from the Primary Graph page to remove mismarked data from the Derived Parameter and Data Reduction List Views and subsequently the Data Insights Search Results. To view data that has been removed using the **Reject** function, select **Results** from the pull-down menu from the top of the Data Insights dialog and select **Rejected Results**.

Note:

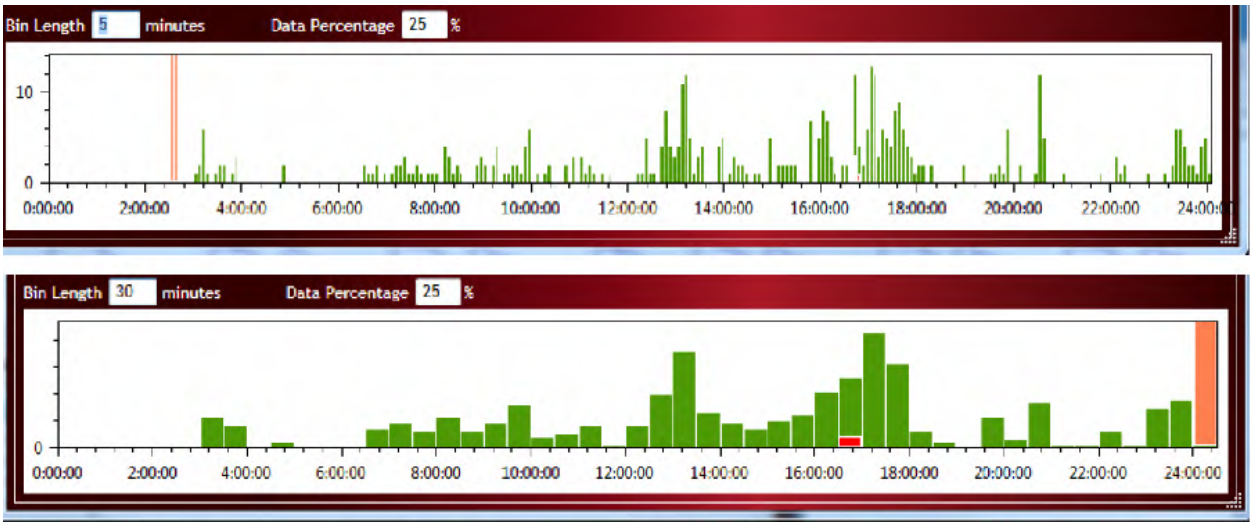
- The Search column within the **Search and Match Grid** will display the selected color associated with the search.
- Background colors will also be displayed in **Page View Graphs**.
- Should a region be matched by multiple applied Searches with associated background colors, these colors will stack within the graph pages to allow the user to see both background colors.



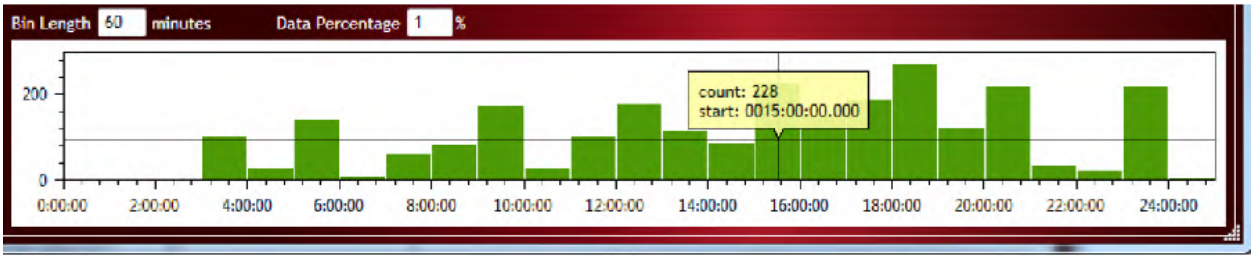


RESULTS DISTRIBUTION VIEW

Match results are also displayed in a histogram. The width of each histogram bar corresponds to a user defined **Bin Length** (time in minutes), which only impacts the visualization of the data. To modify the Bin Length, simply type in the desired length, in minutes, and the graphical component will update automatically. In the examples below, the **Bin Lengths** have been set to 5 minute and 30 minute intervals for comparison.

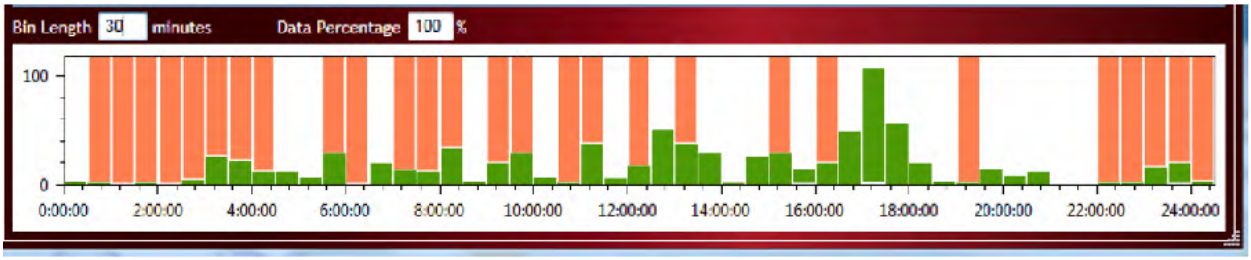


The height of each green histogram bar corresponds to the number of matches in the bin. Left-click the mouse and hold for information on the search results for a given bin. In the example below, 228 matches were found for the search. The start time for each bin is also provided.



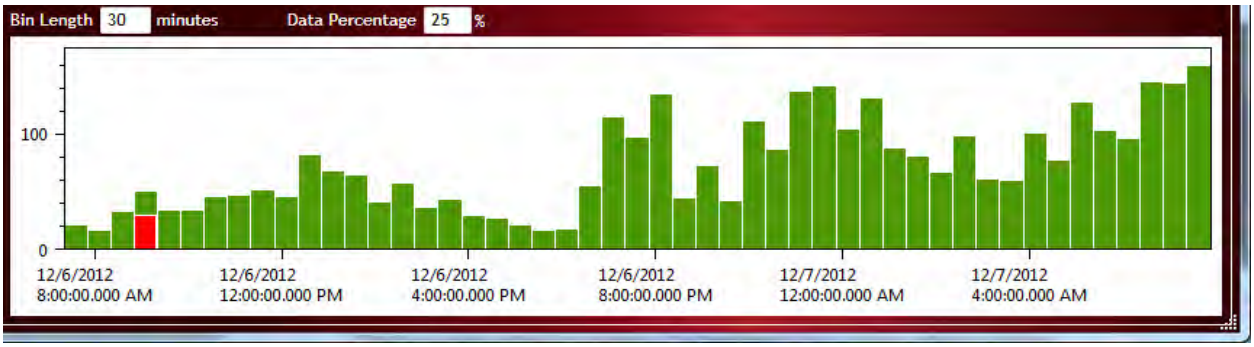
If the usable data in a bin drops below the value specified in the **Data Percentage** field, the background of the bin will change to a coral color. This alerts the user to regions that have a break in acquired data or have lost a significant amount of data to noise. In the example below, the Data Percentage was changed to 100% to illustrate the color change.

Note: The last column in the histogram will likely always contain a coral color bin, as the end of the data set typically does not align with the Bin Length. This is based on when the acquisition was stopped.

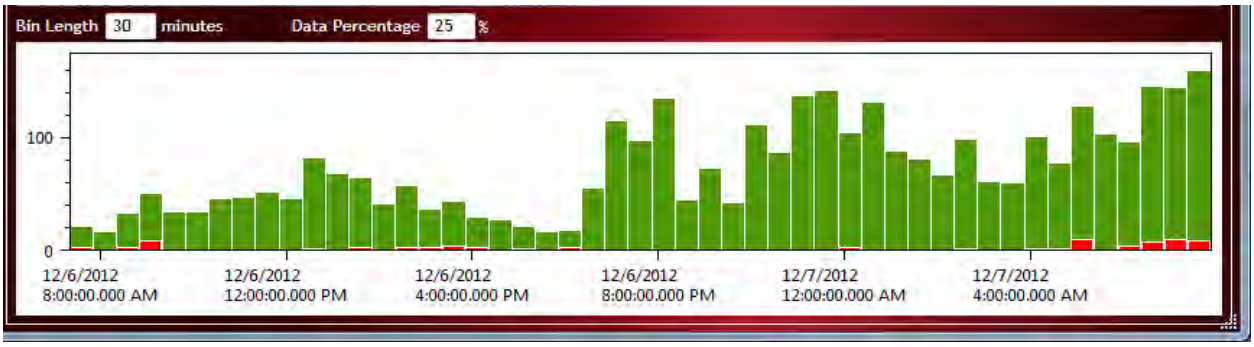


The red regions within the green bins indicate the location and number of matches currently displayed in the *Results Wave View*. If red segments are not visible, it is likely that too few match results are visible within the *Results Wave View* as compared to the total number of matches present within each bin, making the red match indicator very thin and difficult to see. To see the match indicator, reduce the size of your bins or zoom out within the *Results Wave View* to bring more matches into the viewing area.

The red segment updates automatically based on your location in the *Results Wave View*. Using one of the scrolling functions to move forward or backward through the match results also move the location of the red segment to the green bin location where the match was found.



If sorting is performed within the Results Derived View, the red segments may appear across multiple bins since data is no longer sorted chronologically. This provides an easy way to see if the results with the highest or lowest match values are spread throughout the dataset or are localized to a particular area. To restore chronological order, simply click on the **LogTime** column header.

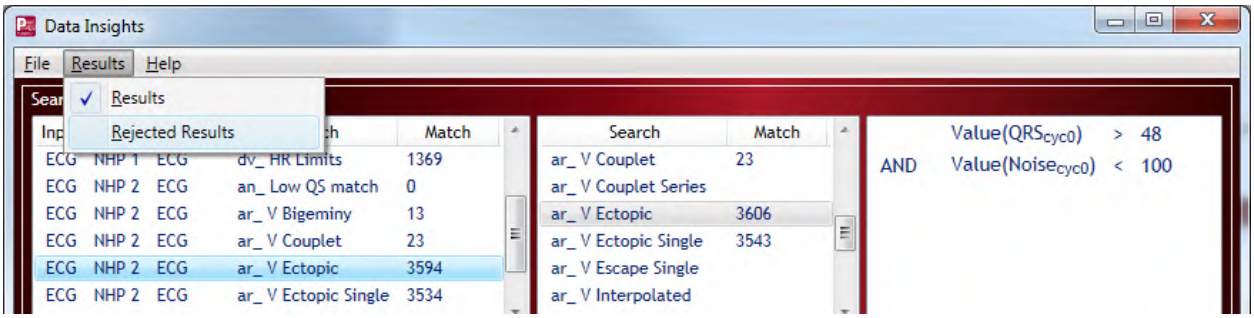


Note: Right-click the Results Distribution View to enable or disable the **Time Axis**.

RECOVERING REJECT RESULTS

Each Search will track the match results, as well as any match results that has been **Rejected**. The Results dropdown menu allows the use to toggle between displaying **Results** and **Reject Results**. When Reject Results is selected, each Channel/Search pair Match Count will update with the number of rejected match results. The Results Wave View, Derived View, and Distribution View will also update to display the rejected results for the active (selected) Channel/Search pair.

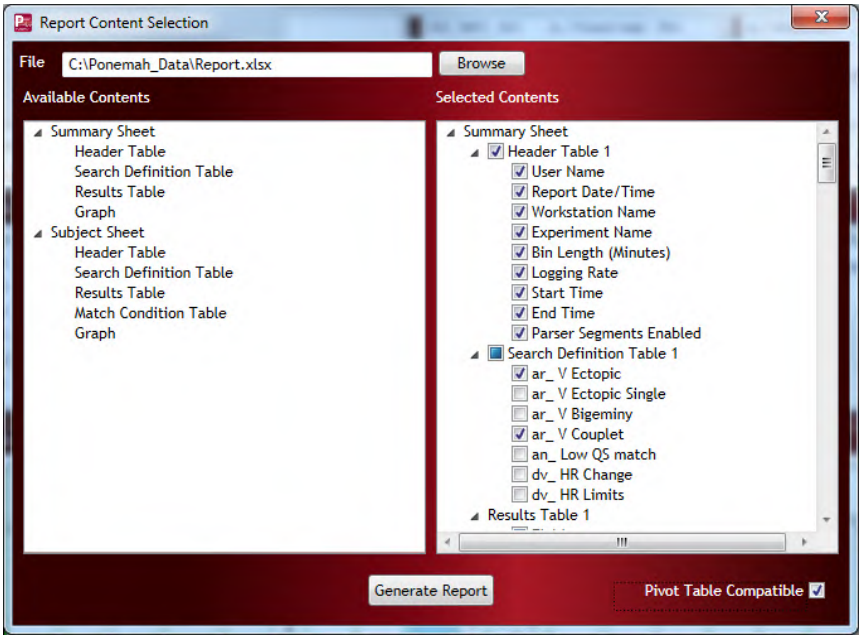
Rejecting a Rejected Match Result, ultimately moves the match result back to the Results view and effectively recovers that match result from being rejected.



Note: Adding or removing search clauses will result in all rejected data to be removed. Changing values in the clauses will not affect those results that have been rejected.

Reporting Results

The **File** menu provides access to the Data Insights report functionality. Selecting **Report** will open the **Report Content Selection** dialog. This dialog allows customization of the report output including file information, search criteria, graphical information, and table information.



A report name and file location can be inputted and a report generated in Microsoft® Excel format. To enable specific output, ensure that the feature is checked. Uncheck to remove the information from the report output.

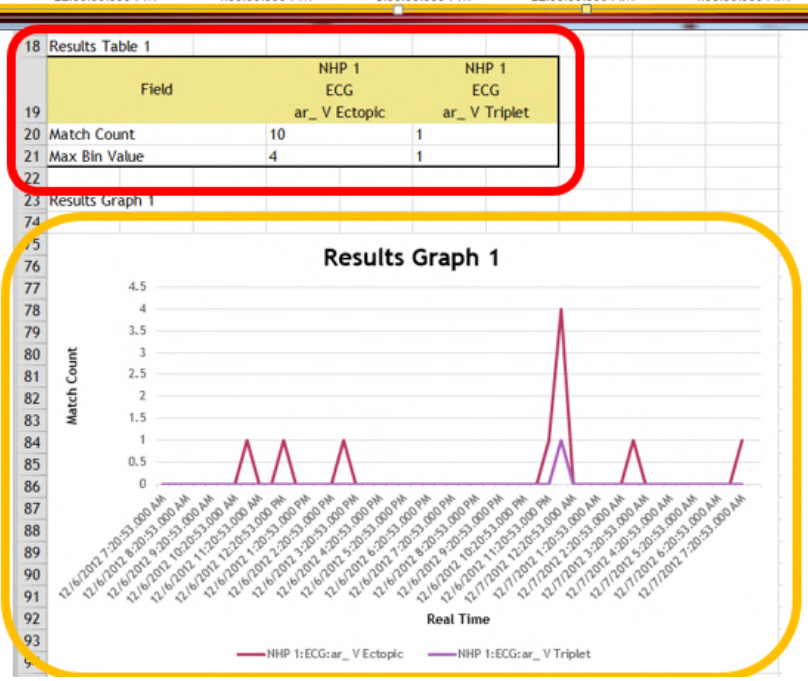
All information displayed within the Data Insights dialog is available as a selection within the Report. Reports are generated in the form of a Microsoft Excel Workbook and consists of one Summary sheet and a Subject sheet for each subject included in the report.

PRINTING RESULTS

Data Insights Match Results may also be printed to a PDF or an external printer. To do this, please see the **Printing** section of this manual in the Software Appendix.

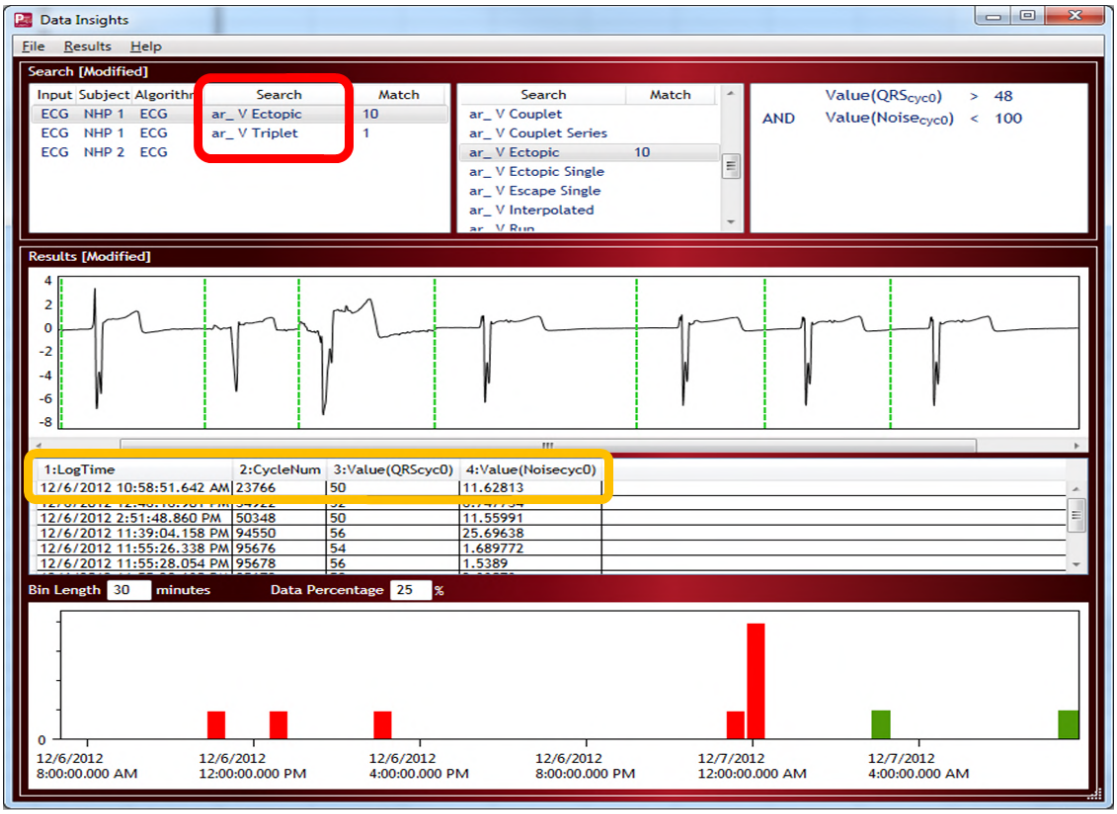
SUMMARY SHEET

The Summary Sheet Results Table contains the high-level match information as displayed in the Data Insights Channel/Search Pairs area for all subject that have searches associated. In the example below, only 1 subject group is being used, resulting in only the search results from this 1 subject being displayed. The Summary Sheet may also contain a Results Graph, which represents the Results Distribution View



SUBJECT SHEET

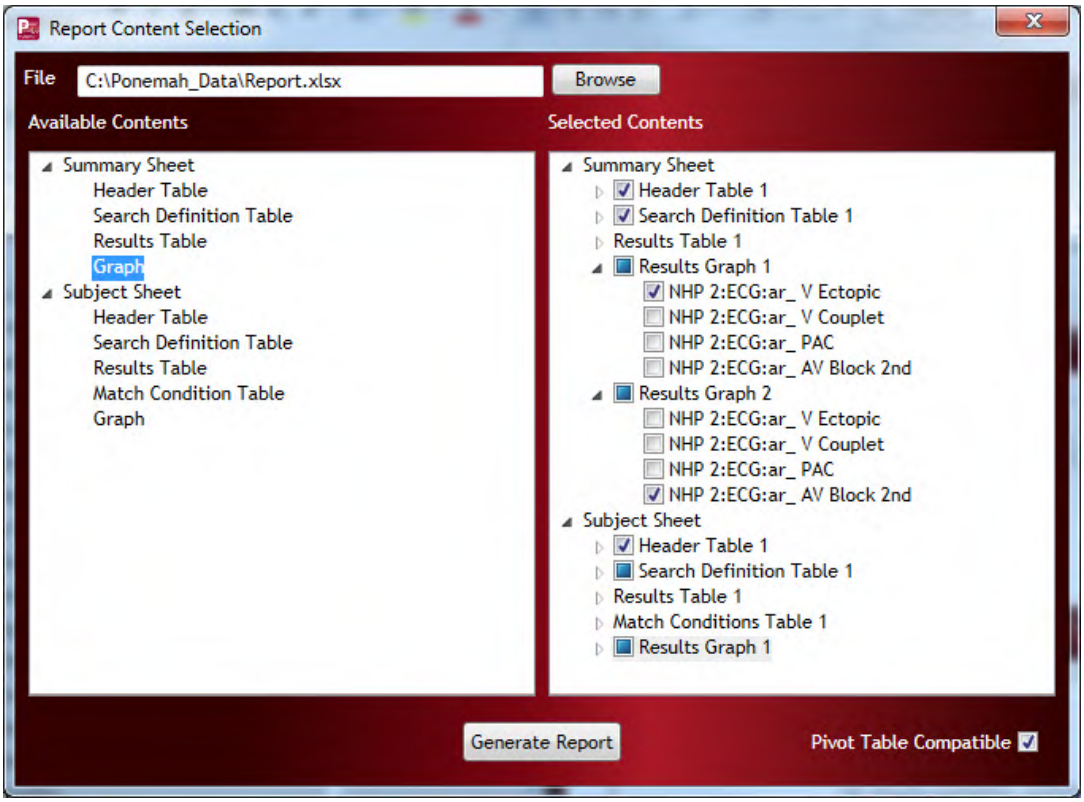
The Subject sheet contain the same information as the Summary sheet broken out by subject. The Subject sheet also contains a **Match Conditions Table**. The Match Conditions table contains all Channel/Searches pairs. In the example below, the V Ectopic and V Triplet searchers are listed, along with their associated Results Derived View values.



73	Match Conditions Table 1						
74	Match ID	Channel	Search	Condition	LogTime	Log Duration	Value
75	1	ECG	ar_ V Ectopic	Value(ECG:QRScyc0)	12/6/2012 10:58:51.642 AM	406	50
76	2	ECG	ar_ V Ectopic	Value(ECG:Noisecyc0)	12/6/2012 10:58:51.642 AM	406	11.628
77	3	ECG	ar_ V Ectopic	Value(ECG:QRScyc0)	12/6/2012 12:46:16.901 PM	673	52
78	4	ECG	ar_ V Ectopic	Value(ECG:Noisecyc0)	12/6/2012 12:46:16.901 PM	673	6.748
79	5	ECG	ar_ V Ectopic	Value(ECG:QRScyc0)	12/6/2012 2:51:48.860 PM	439	50
80	6	ECG	ar_ V Ectopic	Value(ECG:Noisecyc0)	12/6/2012 2:51:48.860 PM	439	11.56
81	7	ECG	ar_ V Ectopic	Value(ECG:QRScyc0)	12/6/2012 11:39:04.158 PM	635	56
82	8	ECG	ar_ V Ectopic	Value(ECG:Noisecyc0)	12/6/2012 11:39:04.158 PM	635	25.696
83	9	ECG	ar_ V Ectopic	Value(ECG:QRScyc0)	12/6/2012 11:55:26.338 PM	940	54
84	10	ECG	ar_ V Ectopic	Value(ECG:Noisecyc0)	12/6/2012 11:55:26.338 PM	940	1.69
85	11	ECG	ar_ V Ectopic	Value(ECG:QRScyc0)	12/6/2012 11:55:28.054 PM	597	56
86	12	ECG	ar_ V Ectopic	Value(ECG:Noisecyc0)	12/6/2012 11:55:28.054 PM	597	1.539
87	13	ECG	ar_ V Ectopic	Value(ECG:QRScyc0)	12/6/2012 11:55:28.630 PM	590	58
88	14	ECG	ar_ V Ectopic	Value(ECG:Noisecyc0)	12/6/2012 11:55:28.630 PM	590	2.331
89	15	ECG	ar_ V Ectopic	Value(ECG:QRScyc0)	12/6/2012 11:55:29.230 PM	872	58
90	16	ECG	ar_ V Ectopic	Value(ECG:Noisecyc0)	12/6/2012 11:55:29.230 PM	872	3.157
91	17	ECG	ar_ V Ectopic	Value(ECG:QRScyc0)	12/7/2012 3:03:01.607 AM	257	106
92	18	ECG	ar_ V Ectopic	Value(ECG:Noisecyc0)	12/7/2012 3:03:01.607 AM	257	86.434
93	19	ECG	ar_ V Ectopic	Value(ECG:QRScyc0)	12/7/2012 7:45:35.288 AM	239	50
94	20	ECG	ar_ V Ectopic	Value(ECG:Noisecyc0)	12/7/2012 7:45:35.288 AM	239	55.589
95	21	ECG	ar_ V Triplet	Series(ar_ V Ectopic, 1)	12/6/2012 11:55:28.054 PM	2064	3

CUSTOMIZING REPORTS

Additional content may be added by right-clicking a content section from the *Available Contents* column and choosing **Add**. This provides a method to generate specific tables and graphs based on the desired reporting needs. For instance, instead of graphing all arrhythmia types on a single summary graph, the user may configure a specific graph to display only Ventricular Ectopics from all subjects and another graph to display the occurrences of AV Blocks across all subjects. This is done by adding a second Summary Graph content section and making the appropriate selections, as illustrated below as selected in the Summary Sheet's Result Graph 1 and Results Graph 2.



Checking the **Pivot Table Compatible** checkbox will output the data with minimal formatting to permit Excel Pivot Tables to be created from the Results Tables. This is useful when additional analysis is desired or if importing into third-party programs is desired.

Please see the **Software Appendix | Data Insights** section for a description of each of the Content sections.

Customizing Search Definitions

A list of predefined Searches is present and available for use by default in *the Search and Match Grid*. Existing Search Definitions may be modified or new Search Definitions may be created by the user. Before modifying or creating new Search Definitions, it is import to understand how Searches are composed.

UNDERSTANDING SEARCH DEFINITIONS

Searches are composed of one or more **Search Clauses** that may be combined using Boolean operators (AND, OR). Each Search Clause is a Boolean expression composed of the following:

- **Function**

  The functions (Value, %Increase, % Change, etc.) determine how inputs are used when evaluating the Boolean expression that forms a Search Clause.

- **Input**

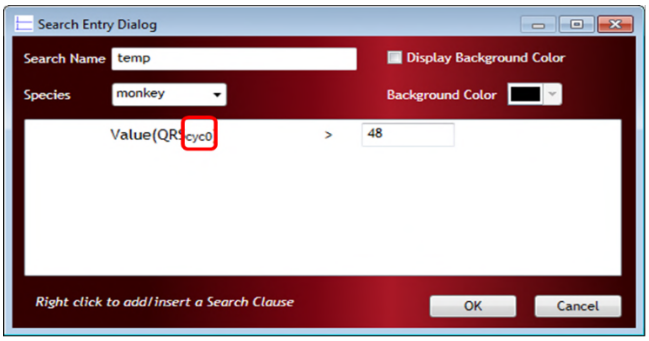
  The inputs include amplitude and timing data calculated by Ponemah (RR interval, Heart Rate, LVEDP, etc.), pattern matching results, and time of day information. When selecting an input, the Analysis Algorithm (ECG, BP, LVP, etc.) must be selected first, then choose the desired input.

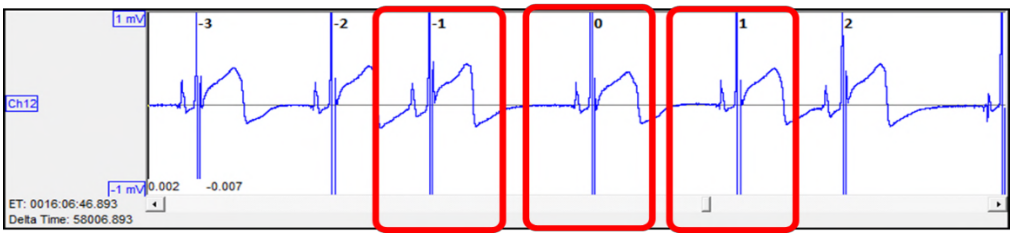
- **Range**

  Specifies whether cycle information, averaged data, or standard deviation will be used for purposes of determining the type of change desired. The clause will look at changes from the reference cycle to a surrounding cycle. If averaged data or standard deviation is used, the data from the Derived Parameter List Views will be used at the active logging rate defined.

- **Offset**

  The Offset is used to specify the location of the cycle relative to the cycle of interest. An Offset of 0 denotes the current cycle of interest. An offset of -1 denotes the cycle just prior to the current cycle. The permitted range is +/- 10.





- **Operator**

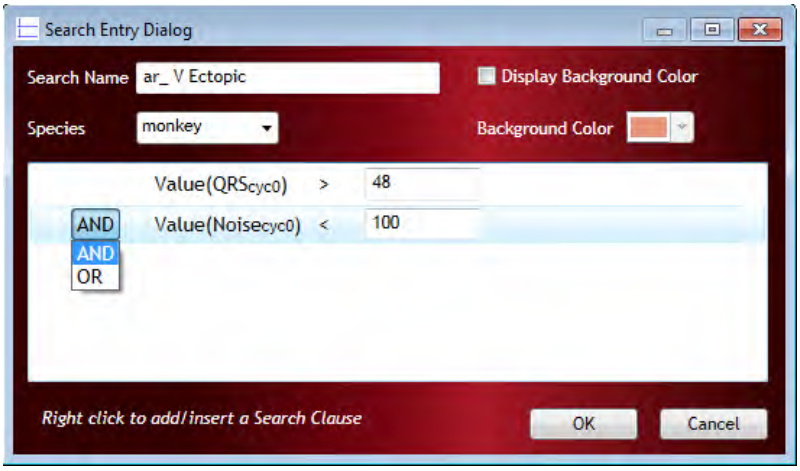
  Operators include greater than (>), less than (<), greater than and equal to (>=), less than and equal to (<=), equal to (=), not equal to (!=). However, those offered change with the Function being used.

- **Value**

  The value is also dependent on the Function and is used as a threshold for the Function to determine a match. Values are in user units; i.e. if the signal is calibrated in mmHg, then amplitude values will also be in mmHg.

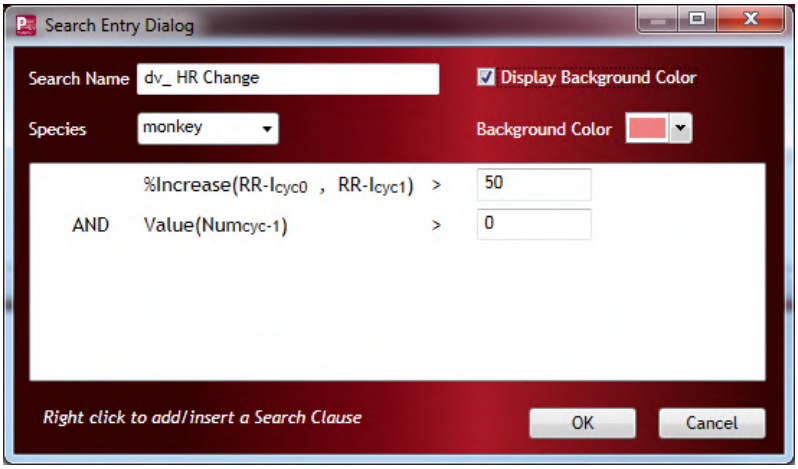
- **Boolean Operators**

  Boolean AND or OR operators are used to combine clauses. When AND is used to combine clauses, each condition must be satisfied to be considered a match. When OR is used, either condition may be satisfied to be considered a match.



Note: Clauses may be grouped to create more elaborate searches.

In the example below, a set of conditions is defined to locate Heart Rate changes using the RR Interval. To be a valid match in this example, a percent increase of greater than 50% in the RR Interval from the current cycle (RR-I_{cyc0}) to the following cycle (RR-I_{cyc1}) must occur, as well as the Cycle Number from the previous cycle (RR-I_{cyc-1}) must be greater than a value of 0.



In this example the components of the search are as follows:

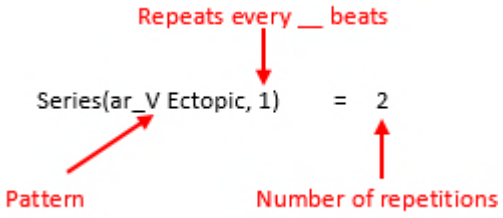
- Function: Percent Increase
- Input: RR-1 (from ECG)
- Range and Offset: Cycle-based from the previous cycle to the current cycle
- Operator: Greater than (>)
- Value: 50%

Note: Data Insights will only display the cycles directly called out within the search in the Results Wave View. In the example below, it was desired to also see the previous ECG cycle. Therefore, a condition that is always true was added to ensure the inclusion of that particular cycle; i.e. Ponemah numbers waveform cycles starting at cycle 1, consequently all cycle numbers are greater than 0.

FUNCTIONS

The basic functions and their definitions are listed below.

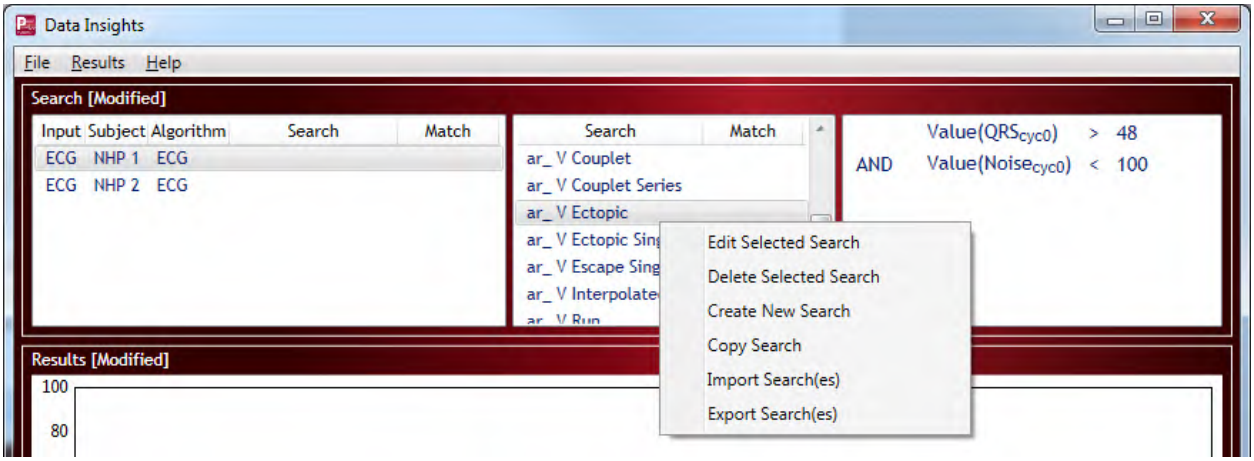
Function	Definition	Example
Value	Represents a given value for a parameter.	Identifies all cycles where the Systolic value is greater than 170 mmHg. $Value(Sys_{cyc0}) > 170$
Increase, Decrease, Change	Represents an increase, decrease, or change in value from parameter 1 to parameter 2.	Identifies all cycles that show an increase in the RR interval of more than 300 milliseconds from the previous cycle (cyc -1) to the current (cyc0). Functions that are similar to Increase() are Decrease() and Change(). $Increase(RR\text{-}I_{cyc\text{-}1}, RR\text{-}I_{cyc0}) > 300$
%Increase, %Decrease, %Change	Represents a percent increase, decrease, or change in value from parameter 1 to parameter 2.	Identifies all cycles that show a decrease in the RR interval of more than 30% from the previous cycle (cyc -1) to the current (cyc0). Functions that are similar to %Decrease() are %Increase() and %Change(). $\%Decrease(RR\text{-}I_{cyc\text{-}1}, RR\text{-}I_{cyc0}) > 30$

Template	Used in conjunction with ECG PRO, Template searches can be performed to pull specific ECG complexes/morphologies that match a tagged Template Cycle into the Data Insights dialog for review. See the **Tutorials | Data Insights | Finding Morphology Changes using Template Tags** for an example.	Identifies all cycles that match templates tagged with a Ventricular Ectopic tag. Template(ECG_{cyc0}) = Ventricular Ectopic
Search	Permits users to utilize existing Searches as part of the criteria used within the Search Definition. *Note*: The search used within the Search-based search must also be applied to the channel. If not, the Search-based search will not be able to be applied to the channel.	Identifies all cycles that do not match a PAC search. A Search() function would typically be used in conjunction with other clauses. Search($_{cyc0}$) != ar_PAC
Series	Used to define sequences or patterns within the data utilizing an existing search. *Note*: The search used within the Series search must also be applied to the channel. If not, the Series search will not be able to be applied to the channel.	Identifies multiple occurrences of a pattern. In this example, all instances where exactly two consecutive cycles match an *ar_V Ectopic* search are identified. 
Real Time	Used to find cycles within a specific time range; such as before and after dosing, during light and dark cycles, or during any other period of interest.	Identifies all cycles that fall between 8:00 AM and 8:00 PM within each 24 hour cycle, such a search would typically be used in conjunction with other clauses. RealTime() > 08:00:00

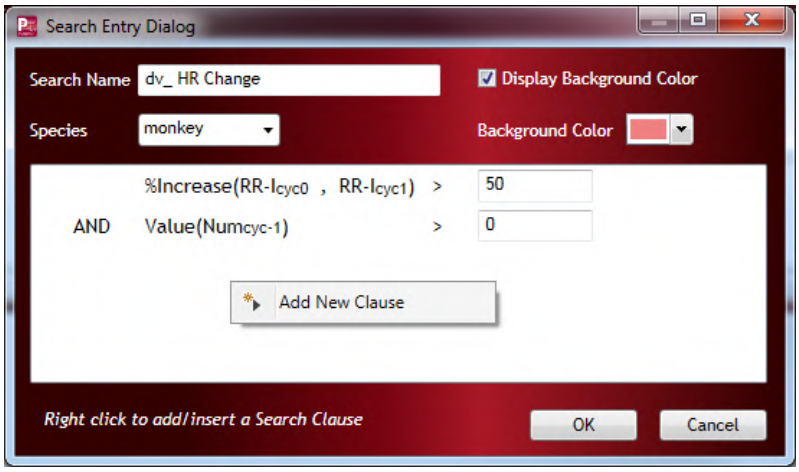
		AND RealTime() < 20:00:00

EDITING SEARCHES

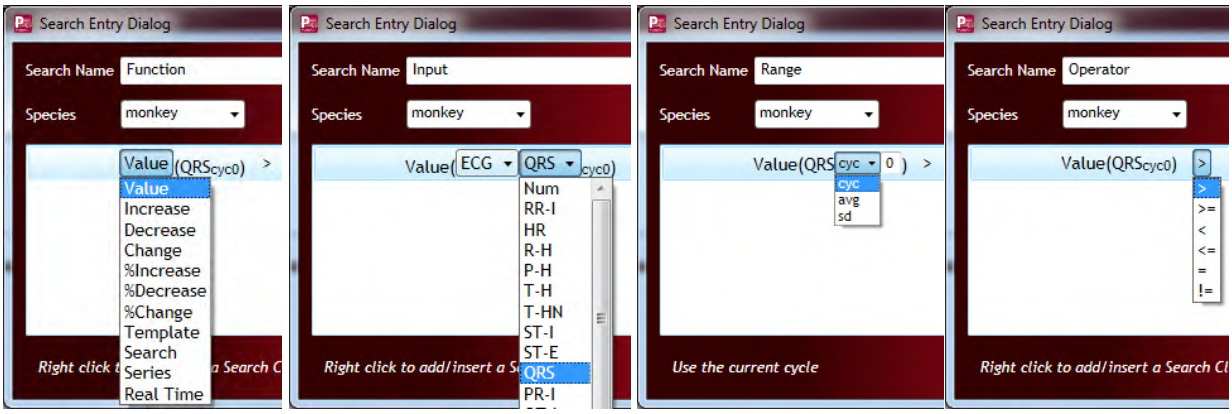
Existing Search Definitions may be modified or new Search Definitions may be created by the user. Right-click the *Search and Match Grid* to access the Search modification menu.



Select **Edit Selected Search** or **Create New Search** to launch the *Search Entry* dialog. This dialog is also accessible by double-clicking a Search. The *Search Entry* dialog displays the criteria used to define the Search. Additional **Search Clauses** may be added by right-clicking within the white box and selecting **Add New Clause**.

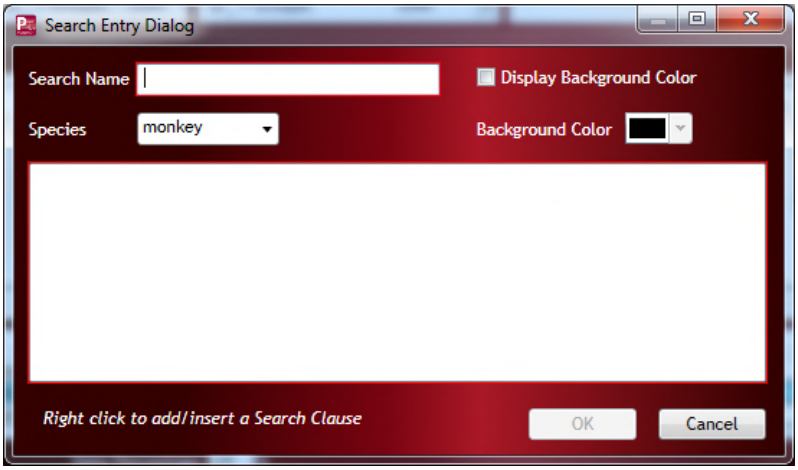


Selecting the **Function**, **Input**, **Range** or **Operator** will display a dropdown menu to permit selection of the desired method, while **Offset** and **Value** are text fields for direct user entry.



CREATING/DELETING/COPYING SEARCHES

Right-click the **Search and Match Grid** and select **Create New Search**. The user will be presented with an empty *Search Entry* dialog. Any edit field that expects an input to be provided will be outlined in red. Below, the **Search Name** and field to enter search clauses are both highlighted along the border of the edit field in red. A **Search Name** and a complete search clause is needed to save the search. The **OK** button will not be available until all edit boxes expecting information have been updated completely.



The **Delete Selected Search** allows you to remove the selected search from the list. Once removed, the search will no longer appear in the **Search and Match Grid** and be available for use. In addition, if the Search was associated to any channel or group of channels, that search will be removed from analysis and all data associated with that search will be removed.

The **Copy Search** function copies the currently highlighted Search in the list. Once copied, the duplicate Search will be visible below the copied Search and be denoted by "_Copy" appended to the end of the Search name. This permits the utilization of previously constructed Searches without needing to start from an empty Search.

EXPORTING/IMPORTING SEARCHES

The **Export Search(es)** function allows users to export customized searches for deployment across all workstations. This is intended to help improve consistency in data analysis and cleanup to ensure results are consistent and repeatable. Exported custom Searches are saved to an .xml file in the Ponemah directory or the directory where the program is installed, by default. Alternatively, Searches may be saved to a location of the users' choice, such as external USB drives or network locations. Exported Searches can then be imported to other systems using the **Import Search(es)** function.

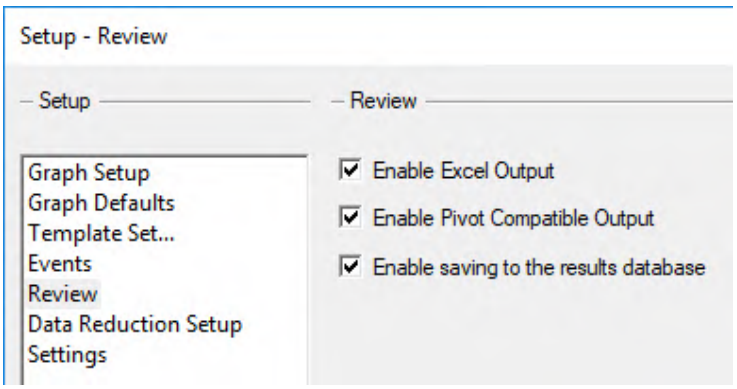
Both the Export and Import functions are available from the **Search and Match Grid** right-click menu.

Note: When importing searches that reference other searches, the referenced searches must also be present in the.xml file that is being imported. If the referenced search is not contained in the xml file, the search or searches using the missing reference will not be loaded. Additionally, none of the searches in the .xml file being imported should be present in the current Search list. Remove any duplicates before importing. In some cases, it may be advisable to remove all searches prior to importing a new list.

Saving Analysis Sessions

The three saving options are located in the **Experiment** Menu and are defined as follows:

- **Save Experiment** – This saves any configuration changes that occur, such as graph pages, analysis attributes.
- **Save Derived Data** – This saves the **Derived Parameters** and **Data Reduction** values from the data currently loaded in Review to an Excel file only. The type of data output when this option is selected is controlled by the options located in **Setup | Experiment Setup | Review**.



Save Options:

- Enable Excel Output

  If enabled, generates an Excel file with Derived Parameter and Data Reduction data from the currently loaded data section. If disabled, the Excel file will not be generated.

- Enable Pivot Compatible Output

  If enabled, the Excel file will contain two pivot table compatible tabs, one for Derived Parameter and one for Data Reduction data. If disabled, the Excel file will not contain the two pivot tabs generated. Note, if Excel Output is disabled, the Pivot Output will automatically disable.

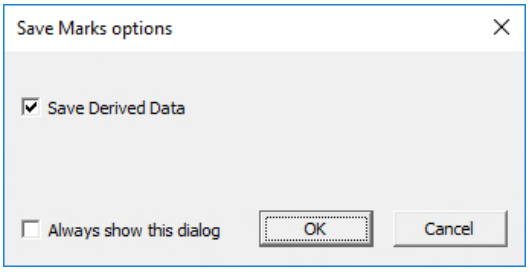
- Enable Saving to the Results Database

  If enabled, the calculated Derived Parameter and Data Reduction data will update the Results Database, replacing the previous values with the current data from the loaded section. If disabled, the Results database will not be updated with the newly calculated data from the current Review Session.

  IMPORTANT. The data exported outside of Review (**Experiment | Export Data**) and/or displayed in **Parameter Viewer** are based on the data within the Results Database. If analysis is updated within Review and saved with this check box unchecked, the new results will not be reflected in subsequent exports or be viewable in Parameter Viewer.

- **Save Marks Section** – This saves the **Marks** positions in the **Marks** database so they can be loaded in subsequent Review sessions. Saving a **Mark Section** will only save the **Marks** associated with the data loaded into the Review session from which the **Save Marks Section** action is executed. By default, this will also create a new Excel file with the **Derived Parameter** and **Data Reduction** outputs from the currently loaded data. This output is also based on the selections from Setup | Experiment Setup | Review dialog, as outlined above.

  Holding the **<CTRL>** key when selecting **Save Mark Section** will display the following dialog:



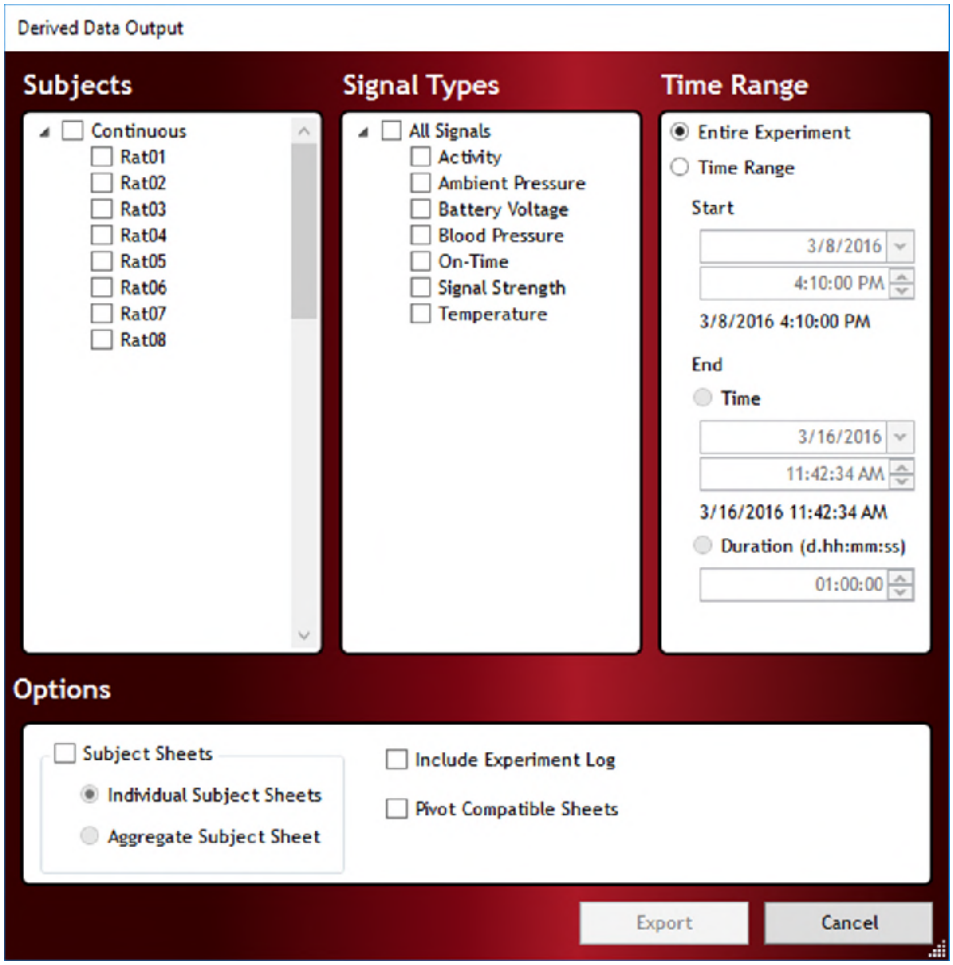
  Unchecking the **Save Derived Data** checkbox will only save the Marks positions and will not output derived data to Excel. This is beneficial, as it drastically improves the time required to save the Marks Section.

Data Export

Ponemah's Derived Data Export allows you to efficiently export derived data from multiple Subjects and across multiple acquisition days without requiring the raw waveform data to be loaded into Review. Exporting data using

this method will generate an Excel file in the Experiment folder containing the Derived Parameter data based on the user-defined setting.

1. Choose **Export Data…** from the **Experiment** menu to launch the **Derived Data Output** dialog.



2. Select the Subjects whose data is desired to be exported using their associated checkboxes.
3. Select the Signal Types desired from which to export derived parameter data.
4. Select to export data across the **Entire Experiment** or across a specific user-defined **Time Range**.
5. Optional selections:
    a. **Include Experiment Log** – this will include a separate tab with the log information listed in the **Experiment menu | Experiment Log…** dialog as part of the export.
    b. **Subject Sheets** – this permits the user to include Derived Parameter and Data Reduction calculations in an easy-to-read formatted data table. This can be unchecked to reduce the size and improve the performance of Excel, should Pivot Compatible Sheets be the performed output method.
        i. **Individual Subject Sheets** – when this is selected, a separate Excel sheet will be created for the **Derived Parameter** and **Data Reduction** data per Subject.
        ii. **Aggregate Subject Sheets** – when this is selected, the **Derived Parameter** and **Data Reduction** data from all Subjects will be listed in a single Excel sheets.

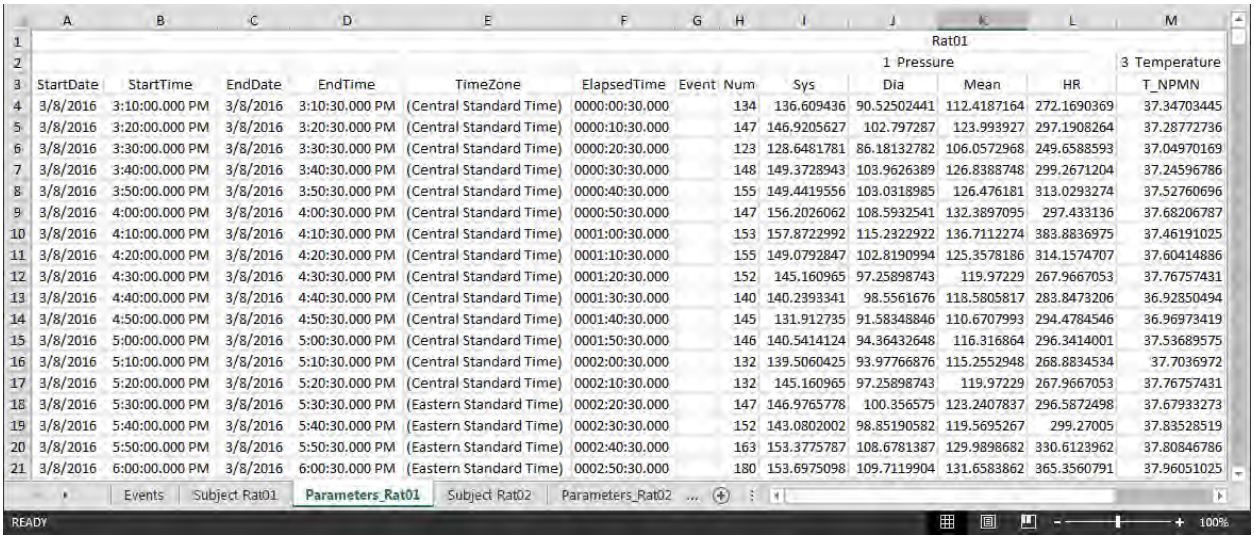
c. Pivot Compatible Sheets – when checked, this will generate a Normalization Table for the **Derived Parameter** and **Data Reduction** data. Normalization tables may be used to create Excel Pivot Tables for an efficient method of obtaining summarized data tables and graphs.

6. Select **Export**.

Note: Export may occur from the main Acquisition instance of Ponemah, as well as a Review while Acquiring instance should Derived data need to be obtain without stopping the acquisition.

Subject Sheets

Individual Subject Sheets are created during an acquisition session, as well as in Review upon Saving a Marked Section. Each Subject will have a Subject sheet and Parameter sheet. The *Subject* sheet will list the Subject Name, Species, and Sex. The *Parameter* sheet will list all user-defined Derived Parameters for each Input Channel configured to that Subject in an easy to read format. An example of a Subject's Parameter sheet is below.



	A	B	C	D	E	F	G	H	I	J	K	L	M
1											Rat01		
2										1 Pressure			3 Temperature
3	StartDate	StartTime	EndDate	EndTime	TimeZone	ElapsedTime	Event	Num	Sys	Dia	Mean	HR	T_NPMN
4	3/8/2016	3:10:00.000 PM	3/8/2016	3:10:30.000 PM	(Central Standard Time)	0000:00:30.000		134	136.609436	90.52502441	112.4187164	272.1690369	37.34703445
5	3/8/2016	3:20:00.000 PM	3/8/2016	3:20:30.000 PM	(Central Standard Time)	0000:10:30.000		147	146.9205627	102.797287	123.993927	297.1908264	37.28772736
6	3/8/2016	3:30:00.000 PM	3/8/2016	3:30:30.000 PM	(Central Standard Time)	0000:20:30.000		123	128.6481781	86.18132782	106.0572968	249.6588593	37.04970169
7	3/8/2016	3:40:00.000 PM	3/8/2016	3:40:30.000 PM	(Central Standard Time)	0000:30:30.000		148	149.3728943	103.9626389	126.8388748	299.2671204	37.24596786
8	3/8/2016	3:50:00.000 PM	3/8/2016	3:50:30.000 PM	(Central Standard Time)	0000:40:30.000		155	149.4419556	103.0318985	126.476181	313.0293274	37.52760696
9	3/8/2016	4:00:00.000 PM	3/8/2016	4:00:30.000 PM	(Central Standard Time)	0000:50:30.000		147	156.2026062	108.5932541	132.3897095	297.433136	37.68206787
10	3/8/2016	4:10:00.000 PM	3/8/2016	4:10:30.000 PM	(Central Standard Time)	0001:00:30.000		153	157.8722992	115.2322922	136.7112274	383.8836975	37.46191025
11	3/8/2016	4:20:00.000 PM	3/8/2016	4:20:30.000 PM	(Central Standard Time)	0001:10:30.000		155	149.0792847	102.8190994	125.3578186	314.1574707	37.60414886
12	3/8/2016	4:30:00.000 PM	3/8/2016	4:30:30.000 PM	(Central Standard Time)	0001:20:30.000		152	145.160965	97.25898743	119.97229	267.9667053	37.76757431
13	3/8/2016	4:40:00.000 PM	3/8/2016	4:40:30.000 PM	(Central Standard Time)	0001:30:30.000		140	140.2393341	98.5561676	118.5805817	283.8473206	36.92850494
14	3/8/2016	4:50:00.000 PM	3/8/2016	4:50:30.000 PM	(Central Standard Time)	0001:40:30.000		145	131.912735	91.58348846	110.6707993	294.4784546	36.96973419
15	3/8/2016	5:00:00.000 PM	3/8/2016	5:00:30.000 PM	(Central Standard Time)	0001:50:30.000		146	140.5414124	94.36432648	116.316864	296.3414001	37.53689575
16	3/8/2016	5:10:00.000 PM	3/8/2016	5:10:30.000 PM	(Central Standard Time)	0002:00:30.000		132	139.5060425	93.97766876	115.2552948	268.8834534	37.7036972
17	3/8/2016	5:20:00.000 PM	3/8/2016	5:20:30.000 PM	(Central Standard Time)	0002:10:30.000		132	145.160965	97.25898743	119.97229	267.9667053	37.76757431
18	3/8/2016	5:30:00.000 PM	3/8/2016	5:30:30.000 PM	(Eastern Standard Time)	0002:20:30.000		147	146.9765778	100.356575	123.2407837	296.5872498	37.67933273
19	3/8/2016	5:40:00.000 PM	3/8/2016	5:40:30.000 PM	(Eastern Standard Time)	0002:30:30.000		152	143.0802002	98.85190582	119.5695267	299.27005	37.83528519
20	3/8/2016	5:50:00.000 PM	3/8/2016	5:50:30.000 PM	(Eastern Standard Time)	0002:40:30.000		163	153.3775787	108.6781387	129.9898682	330.6123962	37.80846786
21	3/8/2016	6:00:00.000 PM	3/8/2016	6:00:30.000 PM	(Eastern Standard Time)	0002:50:30.000		180	153.6975098	109.7119904	131.6583862	365.3560791	37.96051025

Events | Subject Rat01 | Parameters_Rat01 | Subject Rat02 | Parameters_Rat02 ...

READY 100%

Note: If using the **Experiment | Export Data** dialog with the **Aggregate Subject Sheet** selected, only one *Subject* sheet will be available contain the Subject Name, Species, and Sex of all Subjects selected for the export. Similarly, only one *Parameter* sheet will be available containing the **Derived Parameter** data from all Subjects selected for the export in the same format as the example displayed above.

Pivot Compatible Sheets

Pivot Compatible Sheets allow users to create Normalization tables by exporting formatted Derived Parameter and Data Reduction data tables used to create Excel Pivot Tables, providing an efficient method of generating summarized data tables and graphs. Normalization tables are used to simplify and eliminate data consolidation errors from the data summarization process. They are also useful for importing data into 3rd party software for further data processing and reporting, e.g. LIMS, SAS, and R. Normalization table will also aid in converting data into SEND format.

Normalization tables are created during an acquisition session, as well as in Review upon Saving a Marked Section. These tables consolidate data from all subjects into a single tabular format per data type. They are the first two sheets within the Excel output file. Additionally, these table may be created to include data from the entire Experiment through the **Experiment menu | Export Data…** feature by enabling the **Pivot Compatible Sheets** checkbox.

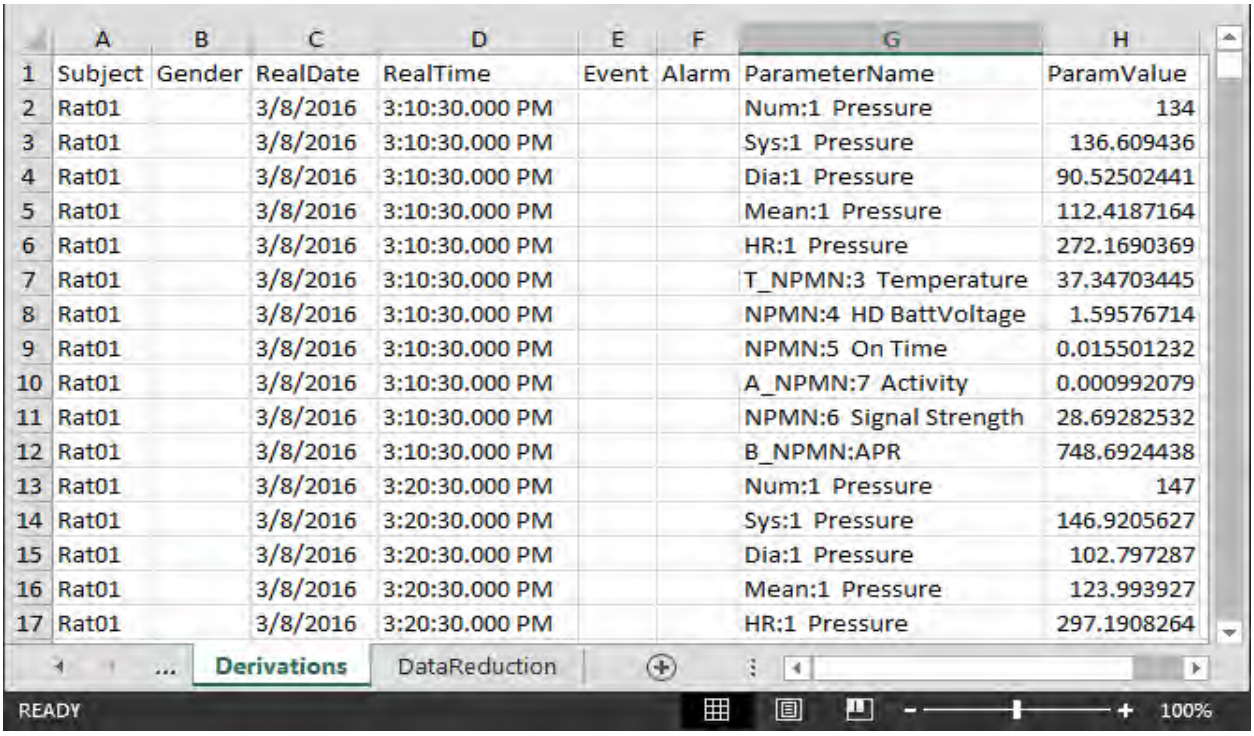
The two tables are:

- **Derivations**

  This table is created from the Derived List View within Ponemah and contains all derived parameter data averaged at the user-specified logging rate.

- **DataReduction**

  This table is created from the data reduction tables and contains all derived data configured within the user-define **Data Reduction** setup menu.



	A	B	C	D	E	F	G	H
1	Subject	Gender	RealDate	RealTime	Event	Alarm	ParameterName	ParamValue
2	Rat01		3/8/2016	3:10:30.000 PM			Num:1 Pressure	134
3	Rat01		3/8/2016	3:10:30.000 PM			Sys:1 Pressure	136.609436
4	Rat01		3/8/2016	3:10:30.000 PM			Dia:1 Pressure	90.52502441
5	Rat01		3/8/2016	3:10:30.000 PM			Mean:1 Pressure	112.4187164
6	Rat01		3/8/2016	3:10:30.000 PM			HR:1 Pressure	272.1690369
7	Rat01		3/8/2016	3:10:30.000 PM			T_NPMN:3 Temperature	37.34703445
8	Rat01		3/8/2016	3:10:30.000 PM			NPMN:4 HD BattVoltage	1.59576714
9	Rat01		3/8/2016	3:10:30.000 PM			NPMN:5 On Time	0.015501232
10	Rat01		3/8/2016	3:10:30.000 PM			A_NPMN:7 Activity	0.000992079
11	Rat01		3/8/2016	3:10:30.000 PM			NPMN:6 Signal Strength	28.69282532
12	Rat01		3/8/2016	3:10:30.000 PM			B_NPMN:APR	748.6924438
13	Rat01		3/8/2016	3:20:30.000 PM			Num:1 Pressure	147
14	Rat01		3/8/2016	3:20:30.000 PM			Sys:1 Pressure	146.9205627
15	Rat01		3/8/2016	3:20:30.000 PM			Dia:1 Pressure	102.797287
16	Rat01		3/8/2016	3:20:30.000 PM			Mean:1 Pressure	123.993927
17	Rat01		3/8/2016	3:20:30.000 PM			HR:1 Pressure	297.1908264

Analysis Modules

This section provides detailed information on all available analysis modules for the Ponemah.

The Analysis Attributes dialog covers common functionality between all analysis modules. The common functionality is not discussed within the individual analysis sections unless there is a change from the standard operation.

Analysis Attribute Dialogs

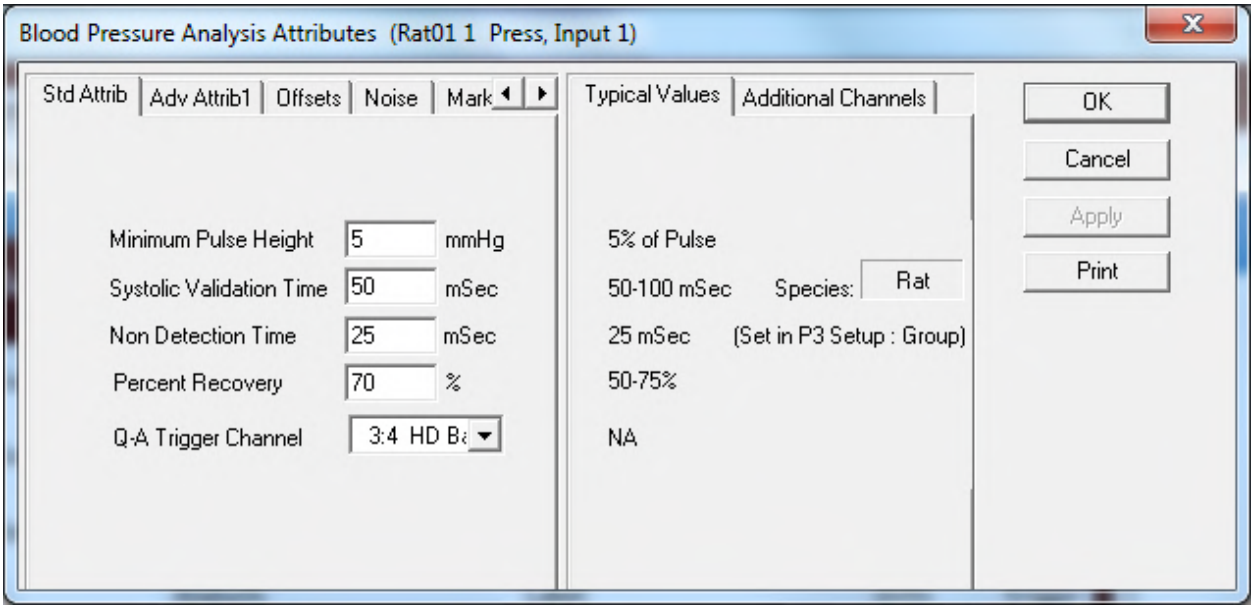
All analysis modules have a common setup dialog with specific attributes for the type of analysis being set up.

Accessing the Attributes dialog

To access the analysis attributes:

1. During Experiment Setup and Acquisition
    - Select Setup | Subject Setup
    - Choose the  icon associated with the desired analysis module.
2. During Review
    - From the **Primary** graph page, select the **Display Pane** associated with the channel whose analysis attributes are desired to be viewed/updated.
    - Right-click and select **Analyze [Attributes].**

Displayed below is a typical **Blood Pressure Attributes** dialog.



The **Attributes** dialog is organized as a tabbed dialog and will always have the following selections:

- **Std Attrib** are the standard attributes that are the most common attributes that would need to be changed during acquisition for the specific analysis module.
- **Adv Attrib1** are advanced attributes that normally do not need to be changed during the acquisition. The attributes in this tab require greater knowledge and understanding of how these attributes affect the analysis module.
- **Offset** is where a pressure adjustment can be made based on either a measured offset before implantation and / or if an APR is not being used, the actual barometric pressure and be entered. This tab is only available in the Blood Pressure and left Ventricular Pressure modules.
- **Noise** is where additional Noise Detection and Dropout Detection can be enabled. and
- **Marks** allow the turning on and off individual validation marks and the cycle count. This helps un-clutter the validation marks on the signal if certain validation marks are not needed. The marks are turned on and off by the on-line menu Functions - Validate F10.
- **Notes** allow a user to select a predefined note or enter a free form text note for the attribute change.
- **Precision** allows the user to specify how the derived parameters are going to be reported.
- **Typical Values** displays recommended values for a particular set of criteria. This tab will be updated according to which tab on the left has been selected. The values are for reference only, and the values in this tab have no effect on the analysis.
- **Additional Channels** will display all Inputs that have the same type of analysis that the attributes can be applied to. Select all channels that would need the attributes assigned to them and select Apply or OK to apply the attributes.

  Note: Changes are not applied to attributes that require the selection of a dependent channel for calculating data when using the Additional Channels feature. This is done to ensure that the sample rates don't vary between both channels to ensure proper calculation of parameter data. Examples would be Blood Pressure's Q-A Trigger Channel or Upstream Channel.

Attribute Types

Analysis attributes deal with several distinct features such as, interpretation of the input signal, filtering, identifying associated channels, etc. The effects, on Review, of changing different types of attributes differs, with some changes only affecting the region to which they are applied and some affecting the entire signal or all marks sections. When changes are made to analysis attributes, the effects of these changes may be previewed in the **Effects and Scope of Changes** dialog, prior to putting the changes in effect.

Signal Interpretation Attributes	These are attributes that are used by the analysis to aid in the identification of cycles and in the placement of marks that are dictated by signal morphology. Such attributes are used during Acquisition to determine the placement of marks. Thereafter Review uses the marks positions rather than the attribute settings for its calculations. A user can request the analysis to reanalyze data using the displayed attributes. This requires the user to select the **Reanalyze** check box and specify the range over which the analysis should be performed, as described above. *h*All other attributes take effect on selecting **OK** from the **Effects and Scope of Changes** dialog, whether or not the **Reanalyze** check box is checked.

If a **Signal Interpretation Attribute** is changed, the following text will be displayed in the Effects and Scope of Changes dialog:

Signal Interpretation attributes changed:

The effects of these changes will be seen only if Reanalyze is selected. The modified attributes will be used to recalculate the location of validation marks and will replace existing validation marks over the range selected below.

Signal Conditioning Attributes

These are used to precondition the input signal prior to analysis. This may be low/high pass filtering, conversion from a volume signal to a flow signal, subtraction of atmospheric pressure, inverting a signal, etc. During Acquisition, changes to these attributes affect future processing of the input signal. During Review, the current setting is applied to the entire loaded dataset.

The user will be notified that changes to these attributes may result in the invalidation of existing marks due to changes in the input signal. Calculated marks will be recalculated following such a change. The **Derived Parameters** will automatically be recalculated.

If a **Signal Conditioning Attribute** is changed, the following text will be displayed in the **Effects and Scope of Changes** dialog:

Signal Conditioning attributes changed:

These changes affect all data in this channel and may result in the modification of the primary signal. If these changes are accepted, previously generated marks may be rendered invalid for this channel. Marks may be recalculated by reanalyzing the entire channel.

Calculation Attributes

These are attributes that are used to provide numeric input that is used in the calculation of some marks positions and some derived parameters. Examples include Percent Recoveries, etc. During Acquisition, changes to these attributes affect future calculations only. During Review, the current settings are applied to the entire loaded dataset.

Changes to such attributes will result in recalculation of all Derived Parameters and marks that depend on the attribute.

If a **Calculation Attribute** is changed, the following text will be displayed in the **Effects** and **Scope of Changes** dialog:

Calculation attributes changed:

These changes will be applied to the entire channel and will result in the recalculation of marks and derived parameters that are dependent on Calculation attributes.

Precision Attributes

These are attributes that are set in the precision tab. Changes to **Precision Attributes** will result in a reformatting of the channels values displayed in the **Derived Parameter List View(s)**.

If a **Precision Attribute** is changed, the following text will be displayed in the **Effects and Scope of Changes** dialog:

Precision information changed:

The affected derived parameters will be updated.

Redraw Attributes

These are attributes that if changed require a redraw of the graph pages. Examples of such attributes include filters, marks, cycle numbers, etc.

If a **Redraw Attribute** is changed, the following text will be displayed in the **Effects and Scope of Changes** dialog:

Redraw required:

These changes require a redraw of this channel.

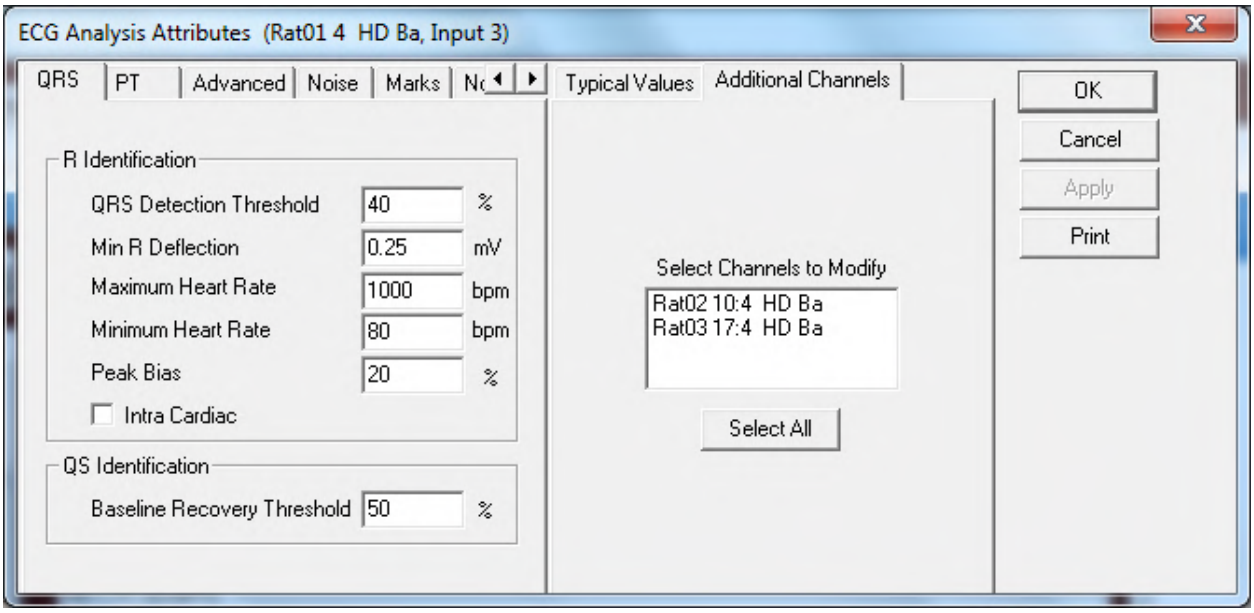
Executing Data Analysis

See the **Reanalyzing Data** section within **Data Review | Using Review**.

Additional Channels Tab

This displays all channels that are using the same type of analysis module.

Select all channels that will use the same attribute settings as this channel. Then select the **OK** or **Apply** button. This automatically sets the attributes in the selected channels.



Additional Channels

RAW, BARO, TEMP, and ACT

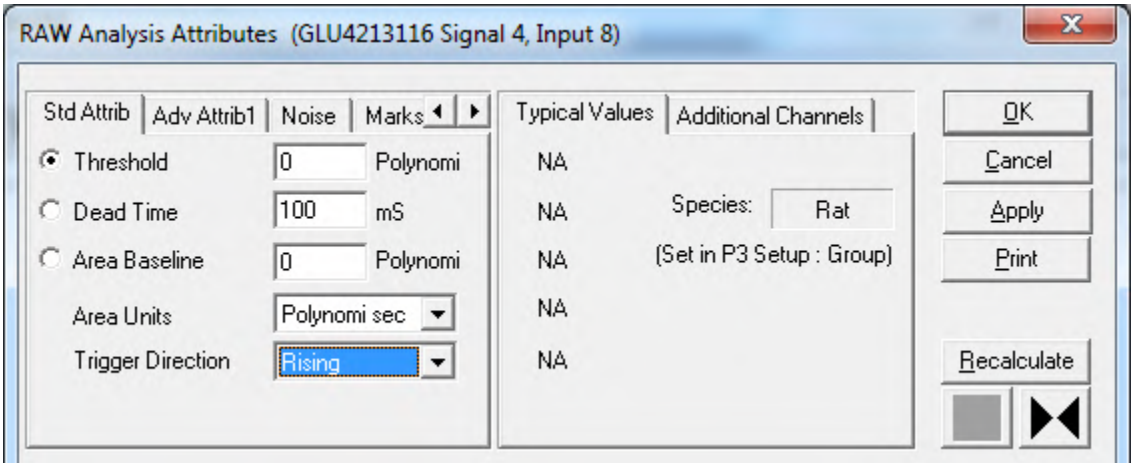
The **RAW** Electrical Mean analysis module is designed to record and measure any signal that does not have a specific signal analysis (e.g. EEG). Three additional modules are available and are identical in function to the RAW analysis. These modules include Barometric (**BARO**), Temperature (**TEMP**) and Activity (**ACT**). The primary reason for distinct names is to ease setup. This allows the user to easily identify a specific RAW channel based on function. Otherwise, the modules are identical except where noted.

Attributes Dialog

The **RAW Analysis** attributes dialog allows you to modify the signal analysis for different types of signals and signal conditions. If an analysis change in the **Attributes** dialog is performed mid-cycle, then the attribute change will not take effect until the following cycle.

STANDARD ATTRIBUTES TAB

The **Standard** attributes allow setting the most common attributes that would need to be changed during Acquisition or Review.



RAW Electrical Mean Standard Attributes Tab

Threshold

Specifies the threshold that the incoming signal must cross before the analysis will trigger and track the maximum and minimum value from the previous threshold level. The signal must go above and below this level before the derived parameters **Rmax**, **Rmin**, **Period**, **BPM**, and **Area** are updated.

The **Threshold** level does not function if the **Trigger Direction** is disabled.

Dead Time

This is the amount of time that the analysis does not look for a threshold once the analysis module has been triggered. The **Dead Time** does not function if the **Trigger** Direction is disabled.

Area Baseline

This is the reference line in which area is calculated to. The **Area Baseline** does not function if the **Trigger Direction** is disabled.

Area Units

This is the reference line in which area is calculated to. The **Area** Baseline does not function if the **Trigger Direction** is disabled.

- **msec** – for units * milliseconds
- **sec** – for units * seconds
- **min** – for units * minutes
- **hr** – for units * hours

Trigger Direction

Specifies the direction of the slope for which the analysis will track **Rmax**, **Rmin**, **Period**, and **BPM**. If **Trigger Direction** is disabled, these derived parameters will

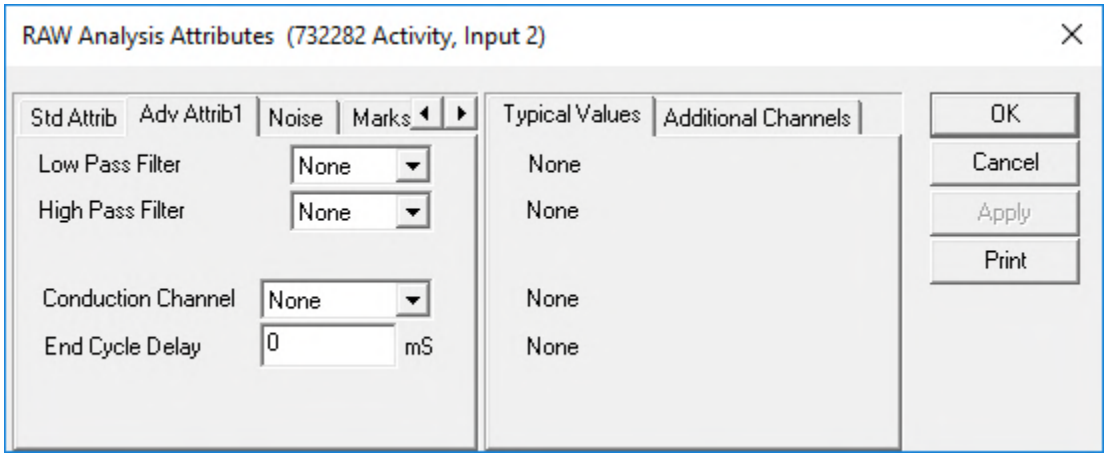
contain 0, which is invalid data. The **Mean Derived Parameter** will produce a mean for the entire **Logging Period**.

Valid choices are:

- **Disable** disables the **Trigger Direction**. A RAW cycle will be generated every second, permitting all derived parameters to be reported.
- **Rising** specifies that the slope must be going in the positive direction when the **Threshold** level is met.
- **Falling** specifies that the slope must be going in the negative direction when the **Threshold** level is met.

ADVANCED ATTRIBUTES

The **Advanced** attributes allow selection of attributes which are not commonly changed during Acquisition or Review.

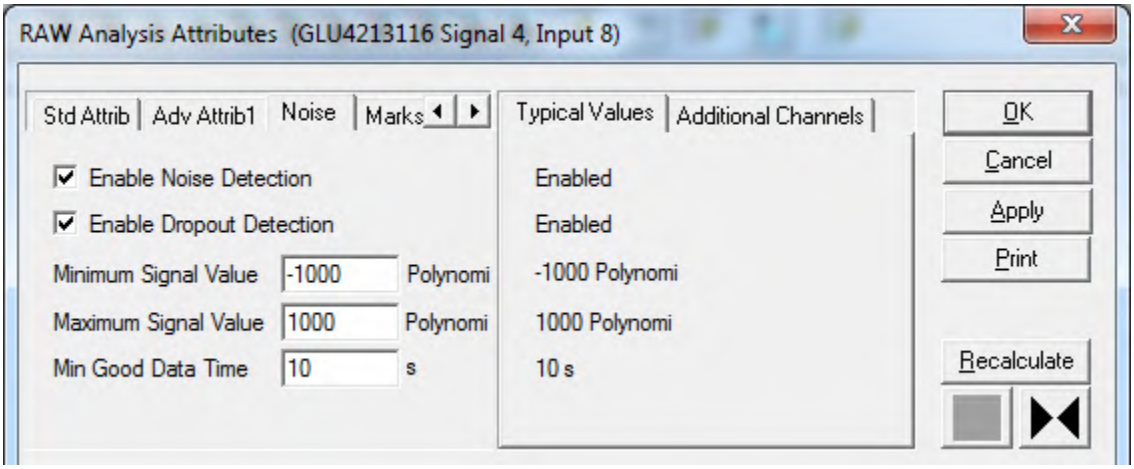


RAW Electrical Mean Advanced Attributes 1 Tab

Low Pass Filter	Selection of **Low Pass** filter in hertz.
High Pass Filter	Selection of **High Pass** filter in hertz.
Conduction Channel	Lists all available RAW channels for selection to calculate the Conduction Time (CT) derived parameter.
End Cycle Delay	Specifies duration after the Trigger Channel report to spreadsheet event occurs to wait in order to capture the cycle mark of the Conduction Channel when calculating Conduction Time. This is useful when the Trigger Channel's cycle occurs prior to the Conduction Channel's cycle.

NOISE TAB

The **Noise Tab** contains attributes that are used to identify noisy data. On identifying "noisy" data, as defined by the user, **Bad Data Marks** will be placed to span the noisy sections.



RAW Electrical Mean Noise Tab

Enable Noise Detection — Enables the **Noise Detection** attributes for the automatic placement of **Bad Data Marks**.

Enable Dropout Detection — If **Dropout Detection** is enabled, any negative dropout data encountered when analyzing data shall be bracketed **by Bad Data Marks** such that the dropout data falls within the **Bad Data Start** and **End** marks. The dropout check shall be performed on unfiltered samples.

Minimum Signal Value — User defined threshold for determining the minimum value for acceptable data. Data that falls below this threshold will be considered noise and bracketed by **Bad Data Marks**.

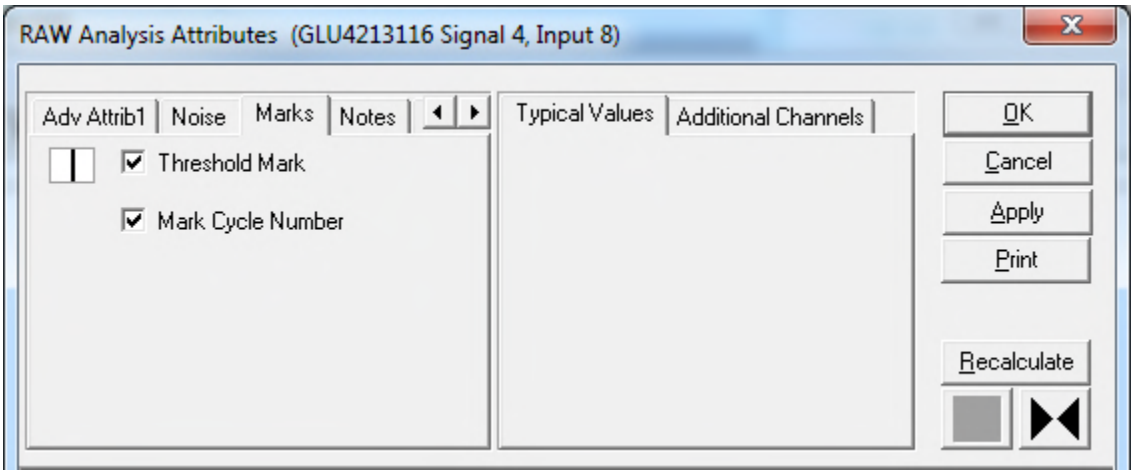
Maximum Signal Value — User defined threshold for determining the maximum value for acceptable data. Data that exceeds this threshold will be considered noise and bracketed by **Bad Data Marks**.

Minimum Good Data Time — Provides the user the ability to mark data as bad between two **Bad Data Mark** regions. If the time between the regions is less than the value specified. If the time is less than what is specified, the **Bad Data Mark** region will appear as one contiguous segment.

MARKS (VALIDATION) TAB

The **Marks** dialog allows turning on and off the validation marks for threshold and the cycle numbers that are placed on the signal during processing. This also allows the turning off and on of the cycle number that is placed on a graph page.

Displayed below is the **Raw Electrical Mean Marks** tab:



RAW Electrical Mean Marks Tab

The validation marks and their meanings are listed below:

Color		**Meaning**
Black		Threshold Mark
		Mark Cycle Numbers

TYPICAL VALUES

The typical values cannot be specified here since they are specific to the application and this is a general analysis module.

Derived Parameters

Derived Parameters are selected within the **Channel Details** of the **Subject Setup** dialog. The **Derived Parameters** selected in this dialog will be calculated, and the results will be placed in the Derived Parameter List View(s). The following details the available **Derived Parameters** from the Blood Pressure module and the averaging method used within Review.

Name	Definition	Review Averaging Method
Num	**Num** is the number assigned to the cycle when using a **Threshold**. When running in a logging mode other than 1 epoch, the last cycle number will be reported.	Recent
Mean	**Mean** is the sum of all the samples that occurred for a cycle divided by the number of those samples.	Mean
Rmax	The maximum value that occurred within a cycle.	Mean
Rmin	The minimum value that occurred within a cycle.	Mean
Per (Period)	The **Period** is the amount of time (in milliseconds) between **Validation Marks**.	Mean
BPM	Beats per minute is computed in cycles per minute and is the reciprocal of the time interval for the cycle multiplied by 60. BPM = (1/period)* 60	Harmonic Mean
Area	**Area** is calculated over a cycle between the signal and the **Area B**aseline. The **Area** is reported in the selected **Area Units**.	Mean
TA	**Total Activity** parameter reports the integral of the input signal over a 60 second duration.	Mean
NPMN	**Non-Pulsatile Mean** integrates the input samples over the entire **Logging Period**.	Mean
TA2	**Total Activity 2** parameter reports the integral of the input signal over the **Logging Period**.	Mean
Count	**Count** reports the number of cycles within a logging interval or data reduction interval.	Sum
CT	**Conduction Time** measures the time difference between logging marks in two RAW channels, in milliseconds.	Mean
SampSD	**Standard Deviation of Samples** reports the standard deviation of the samples in the current logging interval, calculated as Excel's STDEVP	Standard Deviation

Presentation Signals

Below is a list of presentation signals that are available for the **RAW** analysis module:

Signal	Description
Input	This is the input signal (after applying any software filters).
Derivative	This will display the derivative of the signal.
Activity	This is the instantaneous value of the TA parameter.

Data Review

This is a list of the Data Review related features of the **RAW** analysis module. The analysis specific portion of Data Review centers on the marks that the User is permitted to display, insert, and delete and how the user is permitted to move them.

Action	Description
Displaying Marks and Cycle Numbers	The marks and cycle numbers displayed in a Review **Primary** graph page **Display Pane** are controlled through the **Marks** Tab in the **Analysis Attributes** dialog. The **Analysis Attributes** dialog is accessed through the right click menu – **Analyze [Attributes]**.
Mark Operations	The **Threshold** mark is the only mark supported by **RAW, BARO, TEMP**, and **ACT** and defines a **RAW** cycle.
Inserting Marks	A **Threshold** mark may be inserted by right clicking at the point of insertion in the **Primary Graph Display Pane** of the Channel of interest. The pop-up menu that is displayed will provide the option to insert a **RAW** cycle.
Insert RAW Cycle	Inserts a **RAW** cycle. When a **RAW** cycle is inserted, it is assigned a sequential cycle number and subsequent cycle numbers are incremented.
Deleting Marks	Marks are deleted by positioning the mouse cursor on the mark to be deleted and bringing up the right click menu.
Moving Marks	Moving the **Threshold** mark follows the standard rules used in Data Review.
Calculations	The calculations of **Derived Parameters** are identical to those performed during Acquisition.
Logging Mark	The Logging Mark for a **RAW** cycle is the **Threshold Mark**. The time at the logging mark is the time used to report a cycle's derived data. If a **RAW** cycle's logging mark falls within a logging interval, the **RAW** cycle's data will be included in the logging interval.
End of Cycle	The start of a **RAW** cycle is at the point after the previous **Threshold** mark. The end of a **RAW** cycle occurs one nano second after the **Threshold** mark.

ATTRIBUTE TYPES IN REVIEW

The following table describes the effects of changing RAW attributes in Review. Please refer to the **Analysis Attributes | Attribute Types** section for details on the effects of each attribute type.

Attribute	Effect On Review
Threshold	Signal Interpretation
Dead Time	Signal Interpretation
Area Baseline	Calculation
Area Units	Calculation

Trigger Direction	Signal Interpretation
High Pass Filter	Signal Conditioning, Calculation, Redraw
Low Pass Filter	Signal Conditioning, Calculation, Redraw
Marks and cycle Numbers	Redraw
Precision	Precision

Troubleshooting

Use the following table to assist in troubleshooting the analysis:

Issue	Solution
Rmax, Rmin, Period, BPM**, and/or** Area **not responding (all zeroes or incorrect values).**	The **Threshold** Level is not properly set. The input signal must go above and below the Threshold Level to report the **Rmax**, **Rmin, Period,** and **BPM** values.
"x" in Derived Parameter List View **window instead of a number**	The **Derived Parameter** value is too large for the field. An "x" was placed here, so that a truncated number would not be displayed.

Blood Pressure (BP)

The **Blood Pressure** analysis module can analyze any pressure from the circulatory system and can derive, on a beat-to-beat basis, values for the cardiac cycle.

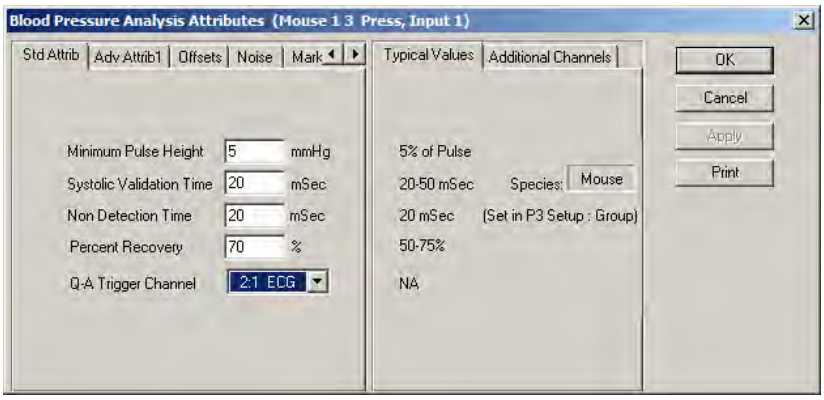
Note: Even though the Blood Pressure Analysis Module can be used on a Left Ventricular Pressure, it is highly recommended that the Left Ventricular Pressure Analysis Module be used when analyzing left ventricular pressure from the heart. This will assure that the pressure is analyzed correctly due to the different waveform morphology.

Attributes Dialog

The **Blood Pressure Analysis Attributes** dialog allows you to modify the signal analysis for different types of blood pressure signals and signal conditions. If an analysis change in the **Attributes** dialog is performed mid-cycle, then the attribute change will not take effect until the following cycle.

STANDARD ATTRIBUTES TAB

The **Standard** attributes allow setting the most common attributes that would need to be changed during Acquisition or Review.



Blood Pressure Standard Attributes Tab

Minimum Pulse Height

Sets the minimum developed pressure that must be achieved before the analysis will detect and validate a cardiac cycle. The **Minimum Pulse Height** is useful for preventing the analysis from triggering on artifacts.

Systolic Validation Time

Specifies the period, in milliseconds, a valid peak must be held before the cardiac cycle is terminated.

This value helps the system determine the correct systolic pressure.

Non Detection Time

Specifies the period, in milliseconds, of ***dead time*** that the analysis does not look for a pulse pressure. This is used to move the peak analysis past the dicrotic notch.

Percent Recovery

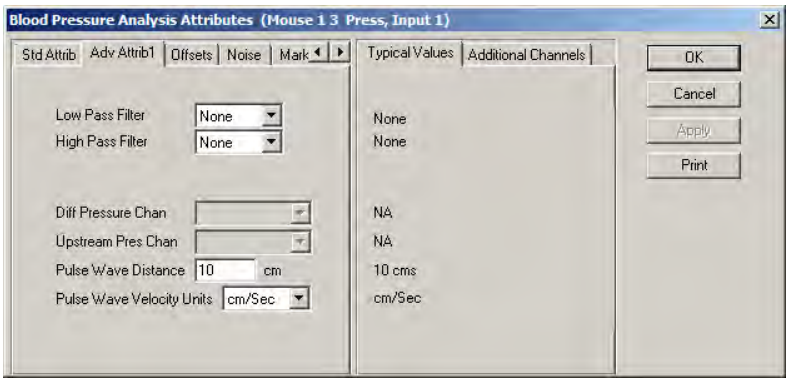
Defines a **Percent Recovery Point** from the developed pulse pressure. The **%REC** derived parameter reports the amount of time it takes to reach this pressure.

Q-A Trigger Channel

Permits the selection of an ECG channel for the calculation of the Q-A Interval. If no ECG channels are set up, this control is disabled. ECG channels must be set up prior to using this attribute.

ADVANCED ATTRIBUTES TAB

The **Advanced** attributes allow selection of attributes which are not commonly changed during Acquisition or Review.



Blood Pressure Advanced Attribute Tab

Low Pass Filter — Selection of Low Pass filter in hertz.

High Pass Filter — Selection of High Pass filter in hertz.

BP Epoch Channel — When the **Respiration from Blood Pressure** option has been installed, the Blood Pressure channel can update the logging buffer when in beat mode either by the cardiac cycle (check box enabled) or by respiratory cycle (check box disabled).

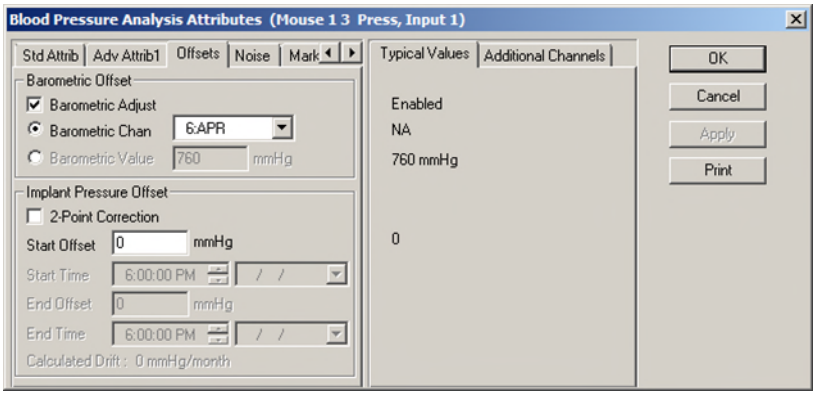
Diff Pressure Chan — This list box allows the selection of a channel that can be used to subtract another channel from the input. The only effect that this has is for display. To display the difference, the **Presentation** field in a **Primary** graph must be set to **Diff**.

Upstream Pres Chan — Sets the upstream pressure channel for calculating Pulse Wave Velocity. This drop down list will display all BP channels within a single group that are sampled at the same sampling rate.

Pulse Wave Distance — User defined distance (in cm) used in the calculation of Pulse Wave Velocity. The default setting is 10cm.

Pulse Wave Velocity Units — The units for the Pulse Wave Velocity (PWV) derived parameter are user selectable and can be specified as cm/Sec or m/Sec.

OFFSET TAB



Offsets Tab

The Offsets tab allows the designation of barometric channels, barometric values and implant offset values to be used for compensating pressures from the BP analysis.

Barometric Adjust

This check box enables the correction for barometric pressure. This is used for certain telemetry systems that do not compensate for barometric pressure internally. The correction factor is applied by using a RAW channel as the input. The pressure offset is in kilopascals.

Barometric Chan

This list box will display the available RAW inputs that could be used for the offset adjustment and is only used when the **Barometric Adjust** check box is enabled.

Barometric Value

User defined value that can be used to account for pressure offset when not continuously monitoring barometric pressure using the APR.

2-Point Correction

When checked, permits the user to define an offset value at the date and time prior to implant and another offset value at the date and time once explanted to apply a linear pressure drift correction if desired.

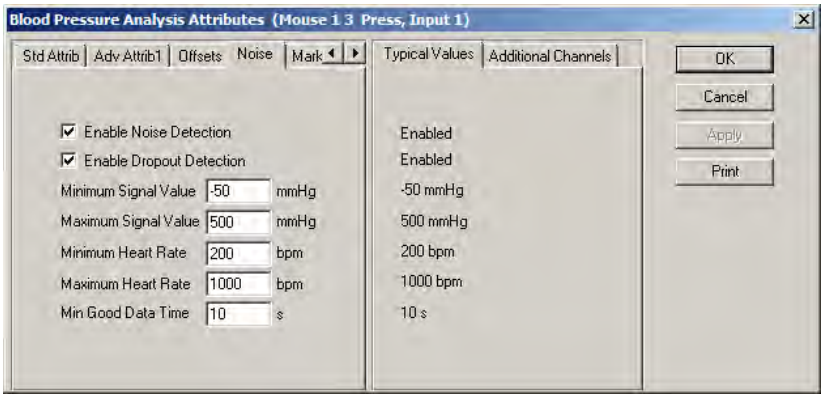
Start Offset

Allows the entry of an implant offset that will be used to adjust the pressure output of the BP analysis. This may be manually typed in by the user or physically measured by selecting the Measure button. Performing an acquisition will allow the user to Measure the pressure offset from the implant.

This feature is disabled in **Review** mode.

NOISE TAB

The **Noise Tab** contains attributes that are used to identify noisy data. On identifying "noisy" data, as defined by the user, **Bad Data Marks** will be placed to span the noisy sections.



Noise Tab

Enable Noise Detection — Enables the **Noise Detection** attributes for the automatic placement of **Bad Data Marks**.

Enable Dropout Detection — If **Dropout Detection** is enabled, any negative dropout data encountered when analyzing data shall be bracketed **by Bad Data Marks** such that the dropout data falls within the **Bad Data Start** and **End** marks. The dropout check shall be performed on unfiltered samples.

Minimum Signal Value — User defined threshold for determining the **minimum value** for acceptable data. Data that falls below this threshold will be considered noise and bracketed by **Bad Data Marks**.

Maximum Signal Value — User defined threshold for determining the **maximum value** for acceptable data. Data that exceeds this threshold will be considered noise and bracketed by **Bad Data Marks**.

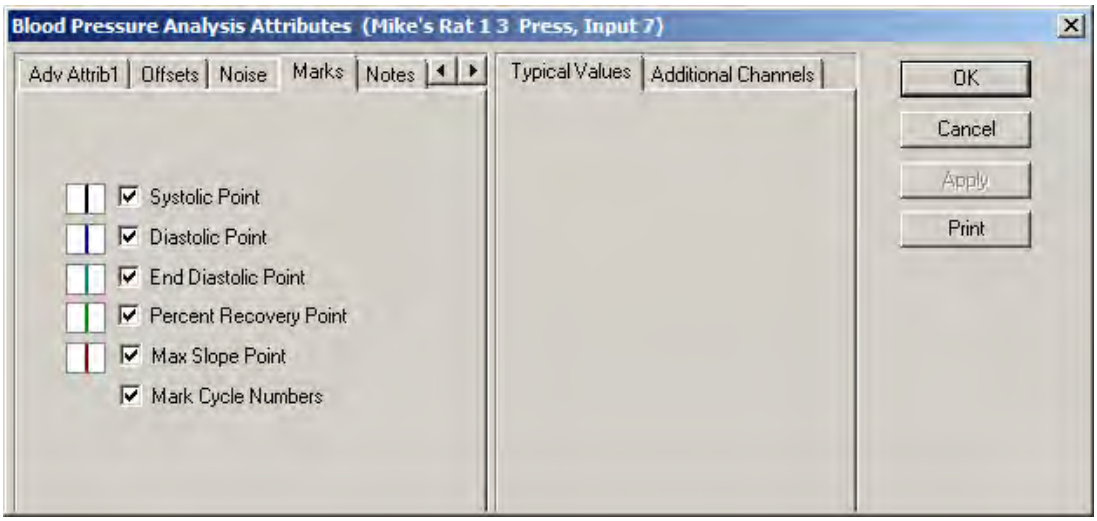
Minimum Heart Rate — User defined threshold for determining the **minimum HR** for acceptable data. Data that falls below this threshold will be considered noise and bracketed by **Bad Data Marks**.

Maximum Heart Rate — User defined threshold for determining the **maximum HR** for acceptable data. Data that exceeds this threshold will be considered noise and bracketed by **Bad Data Marks**.

Minimum Good Data Time	Provides the user the ability to mark data as bad between two **Bad Data Mark** regions. If the time between the regions is less than the value specified. If the time is less than what is specified, the **Bad Data Mark** region will appear as one contiguous segment.

MARKS (VALIDATION) TAB

The **Blood Pressure** analysis displays validation tick marks for each cardiac cycle. Each cardiac cycle should have only one set of validation marks. These marks verify that the system is analyzing the blood pressure signal correctly. If there is more than one set of validation marks per cardiac cycle, correct the problem by changing the analysis attributes.



The validation marks and their meanings are listed below:

Color		**Meaning**
Black		Systolic Point
Blue		Diastolic Point
Cyan		End Diastolic Point
Green		Percent Recovery Point
Red		Max Slope Point
		Mark Cycle Numbers