A Guide to Logger Pro

Logger Pro is the main program used in our physics labs for data collection and analysis. You are encouraged to download Logger Pro to your personal laptop and bring it with you to lab. You then have the option of collecting and processing data with your own computer. The following guide covers many of the most common activates you will routinely do in lab. The topics covered are as follows:

1. **Button Descriptions**
2. **Adding a Sensor**
3. **Video Analysis**
4. **Making Plots**
5. **Trouble Shooting**

Button Descriptions

Along the top of the Logger Pro window are a series of buttons used to collect and analysis data. Here is a guide to the button you will commonly use.

Autoscale Graph	Automatically scale the graph to include all data points.	**Linear Fit**	Make a linear fit to the selected range.
Zoom In	Zoom in to the selected region of the graph.	**Curve Fit**	Perform general curve fits.
Zoom Out	Zoom out by a factor of two in both x- and y-directions.	**Data Collection**	Set data collection parameters.
Examine	Enter Examine mode, providing a cursor displaying the values of data points.	**Start Collection**	Begin or stop collecting data.
Statistics	Calculate statistics on selected data.		

Adding a Sensor

Logger Pro will auto-identify most sensors used in lab. The main exceptions are motion detectors and radiation sensors. The following steps will add these sensors to Logger Pro.

1. Check that the sensor is connected to the appropriate plug on the Vernier LabPro interface, either **DIG/SONIC1 or DIG/SONIC2.**

2. Add the sensor to Logger Pro by going to **Experiment → Set Up Sensors → Show All Interfaces** or by clicking on the LabPro icon in the upper left corner.

3. Add the **Motion Detector** or **Radiation** to either **DIG/SONIC1** or **2.** You should now see a meter appear in Logger Pro for the new sensor.
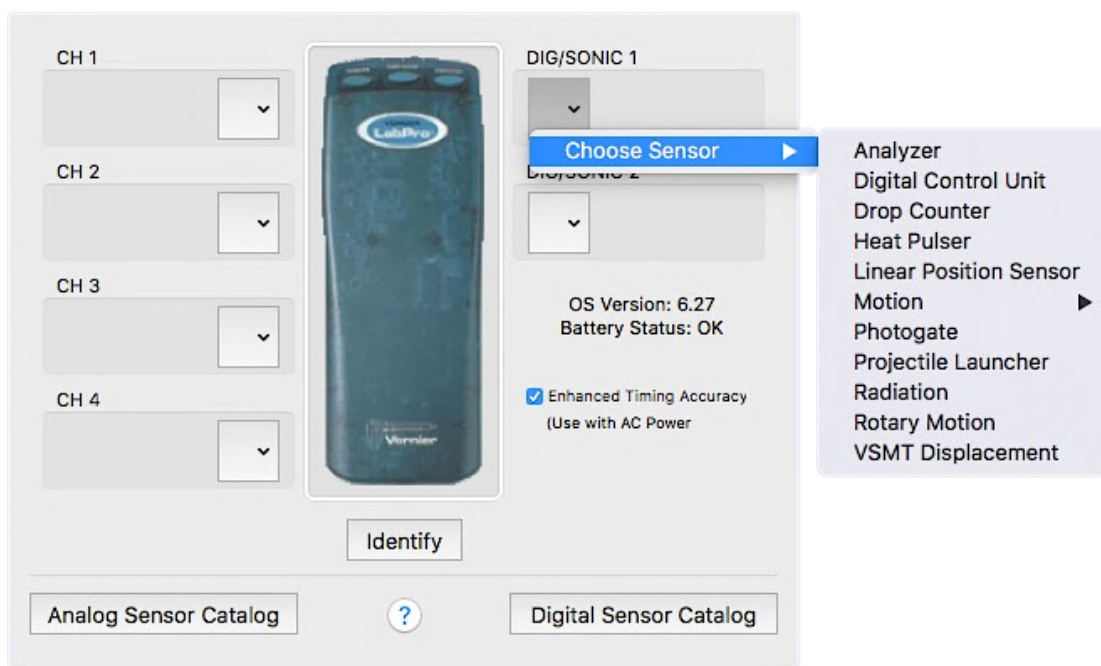

Logger Pro will also connect to the Wireless Dynamics Sensor. This Bluetooth device is a force sensor and a 3-axis accelerometer. The following steps will add this sensor to Logger Pro.

1. Be sure that Bluetooth is active on your computer. This is the default on all lab computers.

2. Turn on the Wireless Dynamics Sensor. You should see one green and one red light when the device is on. Each sensor has a name and number printed on its side. For example, "McNair44".

3. Go to **Experiment → Connect Interface → Wireless → Scan for Wireless Devices** or **Experiment → Connect Interface → WDSS → Scan for Wireless Devices**, depending on the device. Your computer will scan for wireless devices. It may fail to find any devices for the first time. If this is the case, select **Rescan**.

4. You should see a list of the names of wireless devices. Since there may be multiple sensors in the room, you may see multiple names. Select your sensor and connect to it. Once connected, the red light should turn green.

Video Analysis

Analyzing videos in Logger Pro is a powerful tool for determining the motion of objects. Here is a guide on tracking one or more objects.

Note: On the some of the cameras used in labs, the camera viewfinder is much larger than the area that will be captured in the video. There is a wide rectangle in the middle of the viewfinder that is the capture area.
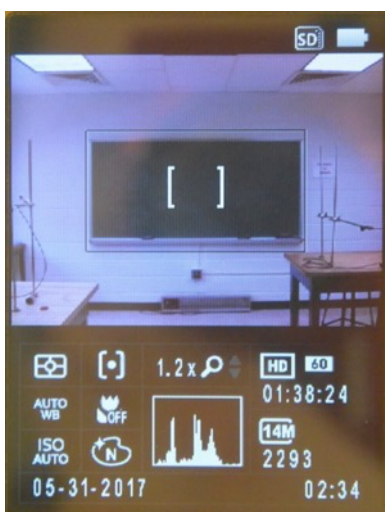

Camera Viewfinder   Video recorded

1. Record your video and import that video onto the computer you are using.

2. Go to **Insert → Movie…**, navigate to your video and click **Open**. You should now see the first frame of your video in Logger Pro.

3. Click on the **Enable/Disable Video Analysis** button ▄▄▶ in the bottom right corner of the video. You may have to resize the video in order to see this button. Your Logger Pro screen should look something like this:
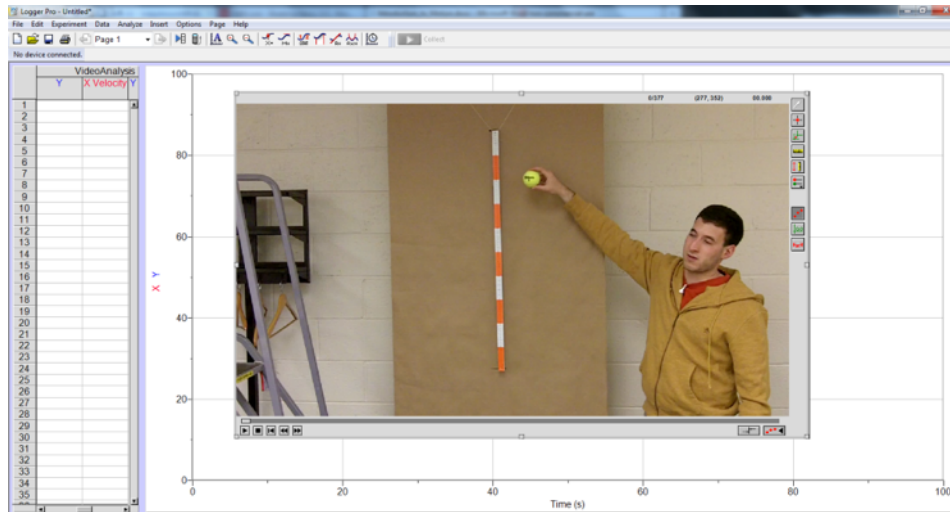
4. You will now define a length scale within the video. Click on the **Set Scale** button 📏 on the right-hand side of the window. Your cursor will turn into a crosshair. **Hold down** the left mouse button and **drag** to draw a green line a known distance. Let go of the mouse button to complete the line.
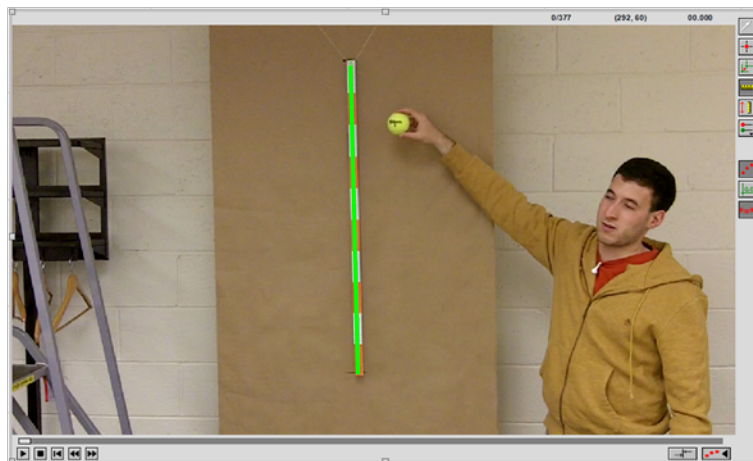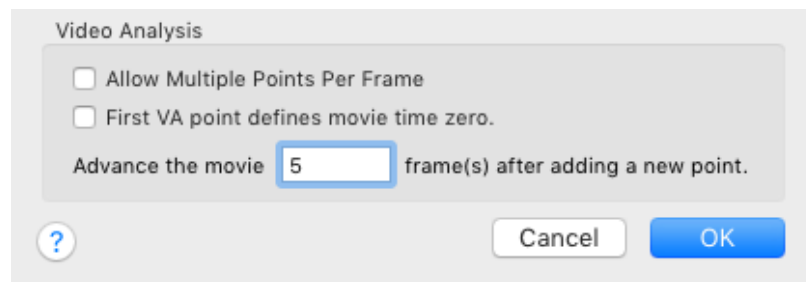

5. You will obtain a window like the one shown below when finished. Enter your known distance into the Scale window as shown below.
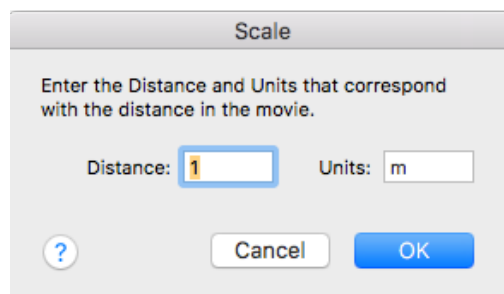
6. You will now add a series of points that marks the position of the object you are tracking in your video. Advance the video using the slider or the double arrow ◄◄ ►► buttons. The slider is good for coarse adjustments and the arrow buttons are good for fine adjustments as they advance or reverse the video one frame at a time.

7. Click on the **Add Point** button ⊞ on the right-hand side of the window. Your cursor will again turn into a crosshair. Click on the tracked object to add a point (blue dot). The video will automatically advance by a single frame. Add another point on the object. Be sure that the new point is on exactly the same place on the object as the previous point. Continue this process for the duration of the interested motion. You can show/hide points from previous frames by clicking the **Toggle Trails** button ⊡.

   Note: If you make an error you can either move or delete a point. Use the Select Point button ⊡ to select a particular point. Hit the Delete key to delete the point or move the point using the mouse to a new location.

   Note: If your object moves very slowly, you can reduce the amount of data points required by going to **Options → Movie Options…** and setting the movie to advance 5 frames after each data point.

   ```
   Video Analysis

     ☐ Allow Multiple Points Per Frame
     ☐ First VA point defines movie time zero.

     Advance the movie  [ 5    ]  frame(s) after adding a new point.

     (?)                          [ Cancel ]   [ OK ]
   ```

8. If you are tracking multiple objects, add another series of points by clicking on the **Set Active Point** button ⊟ and select **Add point series**. Track this next object by the same method as the previous object.

   Note: Since the points appear in the slide after the one they are measuring, if you are not marking every frame be sure to start one frame before you can see the first point from Dot 1. You can double check in the data table that both sets of points happen during the same slides. **If the data sets are offset in time, no Logger Pro calculation using both sets of points will work.**

Making Plots

Much of your work in Logger Pro will be displayed through graphs. Here are some basic steps to making effective graphs in Logger Pro.

New graphs are created by going to **Insert → Graph .** If you have several possible columns of data you can graph, you will chose which is displayed on either axis by clicking on the label for that axis. A list of available columns will appear. You can choose one or all column to be displayed on that axis.
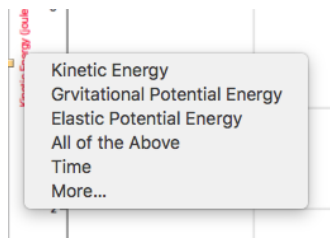

If you would like to choose specific columns, click on the option **More…** This will open a new window where you can check the boxes next to the columns you wish to graph.


Once you have chosen the columns you want to graph, you can refine the graph to better present your results. First you can scale the graph to the appropriate size using the Autoscale , Zoom In , and Zoom Out buttons.

By double-clicking on the graph or going to **Options → Graph Options…**, you will open the Graph Options window. Two very important options in this window are **Point Symbols** and **Connect Data Points** in the Plot Appearance section**.**
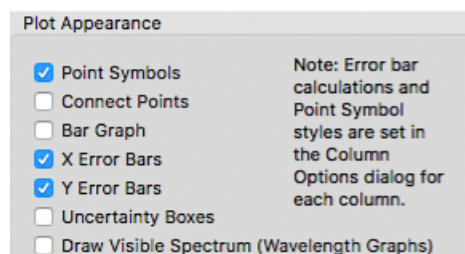
The **Point Symbols** option creates larger icons over individual data points. While this can increase the clarity of the graph under most circumstances, if there are a very large number of data points, the increased size can obscure details in the data.
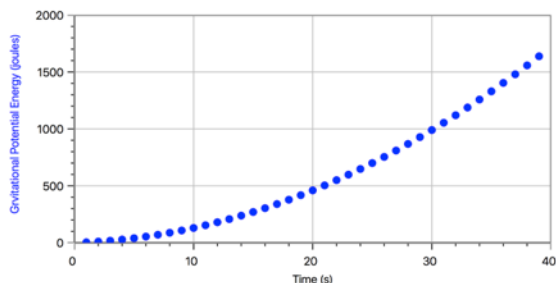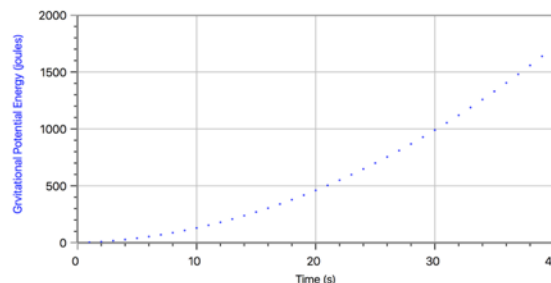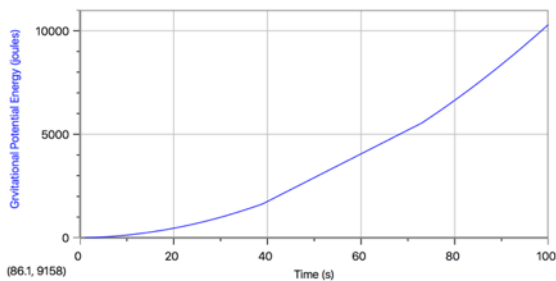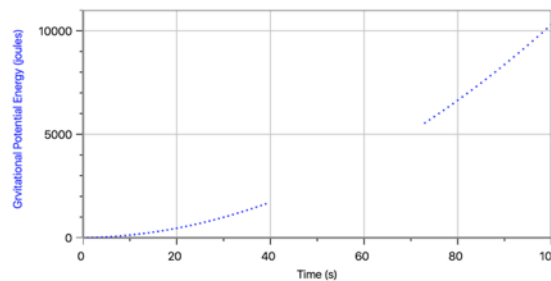

Point Symbols On   **Point Symbols** Off

The **Connect Data Points** option draws straight lines between data points. While this is effective at emphasizing trends, in can misrepresent the data especially when there are gaps, as shown by the examples below. More often than not, it is better to leave this option off.

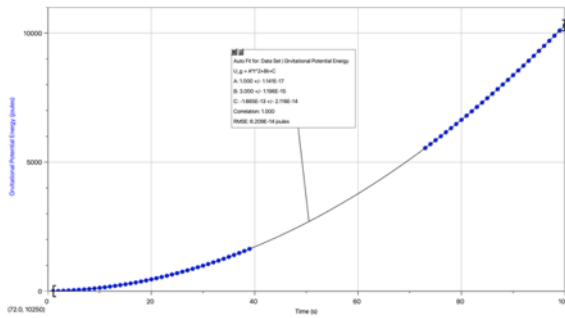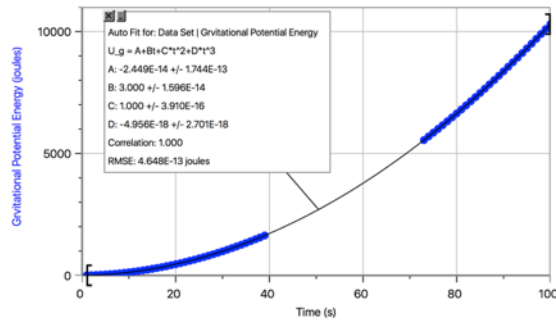**Connect Data Points** On   **Connect Data Points** Off

Lastly, when copy and pasting graphs into your reports, the text on the graph can often become hard to read at the smaller size. One great method of avoiding this is to scale down the graph in Logger Pro before copying it instead of resizing after in has been pasted into the report, maintaining a better text to graph ratio.

Scaled after pasting   Scaled before copying

Trouble Shooting

Here are a few common problems and the most common solutions.

The Collect button is greyed out and unclickable.

1. First, make sure that the green LabPro box is powered up and connect to the computer. When powered, there will be a green light in the box and the LabPro icon will be visible in the upped left corner.
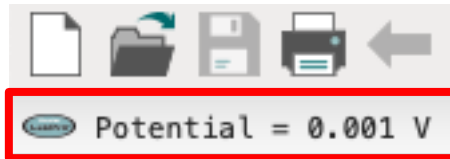

2. If the LabPro is powered up but the icon is not visible, try plugging the USB cable into a different port. Not all USB ports will support the LabPro.

3. If there is the LabPro icon, but there are no sensors listed next to it, check the sensor connections, or manually add the sensors as described earlier in this guide.
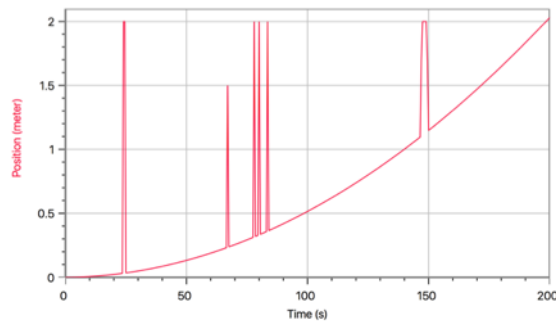

Motion sensor data is poor despite good performance of motion.

There are two types of bad motion sensor data, each with a different cause.
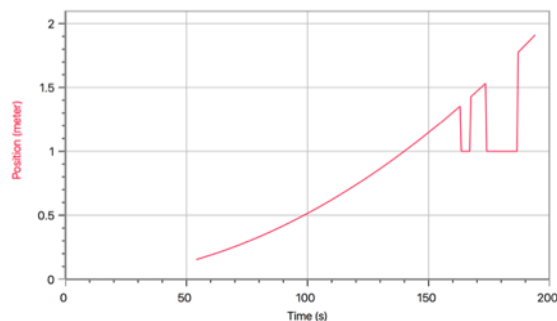
Sensor range settings   Aliasing Problems

Sensor Range Settings: If your data contains patches where the data seems to drop out or does appear until a certain distance, the likely cause is the distance setting on the motion sensor. There is a switch on the sensor where you can chose a smaller, more accurate range for objects between .15 m and 2 m and a larger, wider range for distances greater than 2 m. Try switching this switch.

Aliasing Problems: If your data contains spikes, the likely cause is aliasing. This means that the sensor is losing some of its ultrasonic clicks and interprets the gap being due to the object being further away. This is most common when the object is either not flat or not perpendicular to the sensor. This causes the sound waves to be reflected off at odd angles and they fail to return to the sensor. Try realigning the motion sensor and object to improve detection.

Variable not recognized in calculated columns

When using data from an existing column, it is always better to select the column from the drop-down menu **Variables (Columns)**. This is due to Logger Pro wanting standard quotation marks ("Time") while many computers automatically use smart quotation marks ("Time").
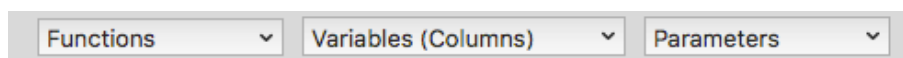
Graph shape not what expected while using very small or large numbers

Logger Pro is unable to perform mathematical operations in its data tables. This means that if you enter a number in scientific notation as "1.46*10^(-5)", Logger Pro will interpret this as text. The correct format for entering scientific notation is "1.46E-5".