

Newton's 2nd Law

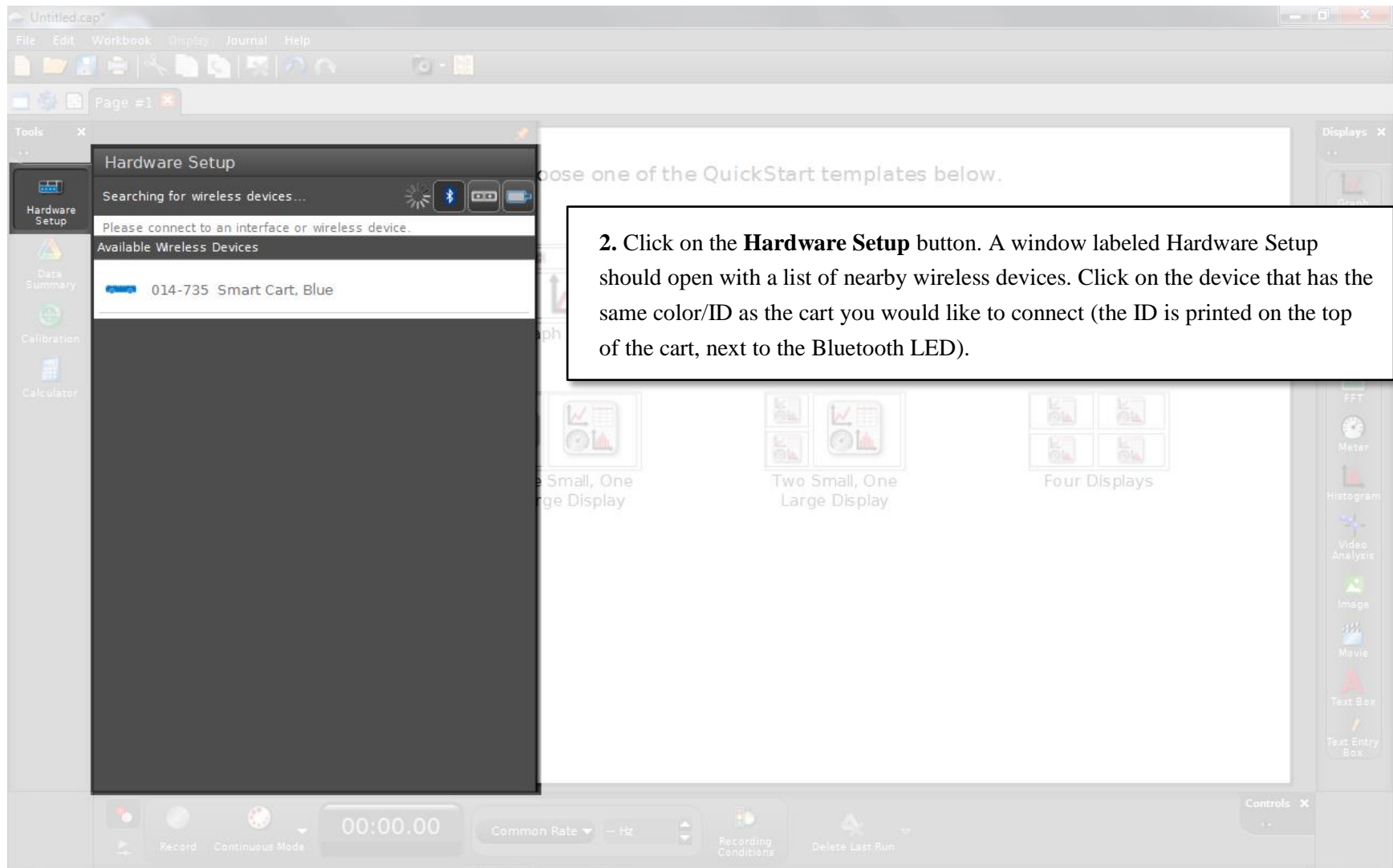
Apparatus

1. 1 - 2m Track, Bumpers
2. Wireless Smart Cart with Force Sensor Hook Attachment
3. 2 Track Pulleys
4. 2 Mass Hangers
5. 5 x 5g Slotted Masses
6. Electronic Balance
7. String
8. USB Bluetooth Adapter
9. Laptop

A demonstration of the apparatus is set up on one of the lab tables for reference.

Procedure

1. Plug the USB Bluetooth adapter into the laptop and power on the Wireless Smart Cart. The Bluetooth LED on the cart will begin flashing red, indicating that it is ready to be paired. Boot into Windows or OSX and open the Capstone software. A shortcut should be located on the desktop in Windows and on the dock in OSX. Note: The 850 interface is NOT required when using the Wireless Smart Carts.



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Page #1

Tools

Hardware Setup

Searching for wireless devices...

Smart Cart, Blue
014-735 Smart Cart, Blue

Smart Cart Position Sensor

Smart Cart Force Sensor

Smart Cart Acceleration Sensor

Smart Cart Gyro Sensor

Enable/Disable Sensor

Choose one of the QuickStart templates below.

One Small, One Large Display

Two Small, One Large Display

Four Displays

Record Continuous Mode 00:00.00 Ready Smart Cart Force Sensor 20.00 Hz Recording Conditions Delete Last Run

Displays

Graph

Table

Digits

Scope

FFT

Meter

Histogram

Video Analysis

Image

Movie

Text Box

Text Entry Box

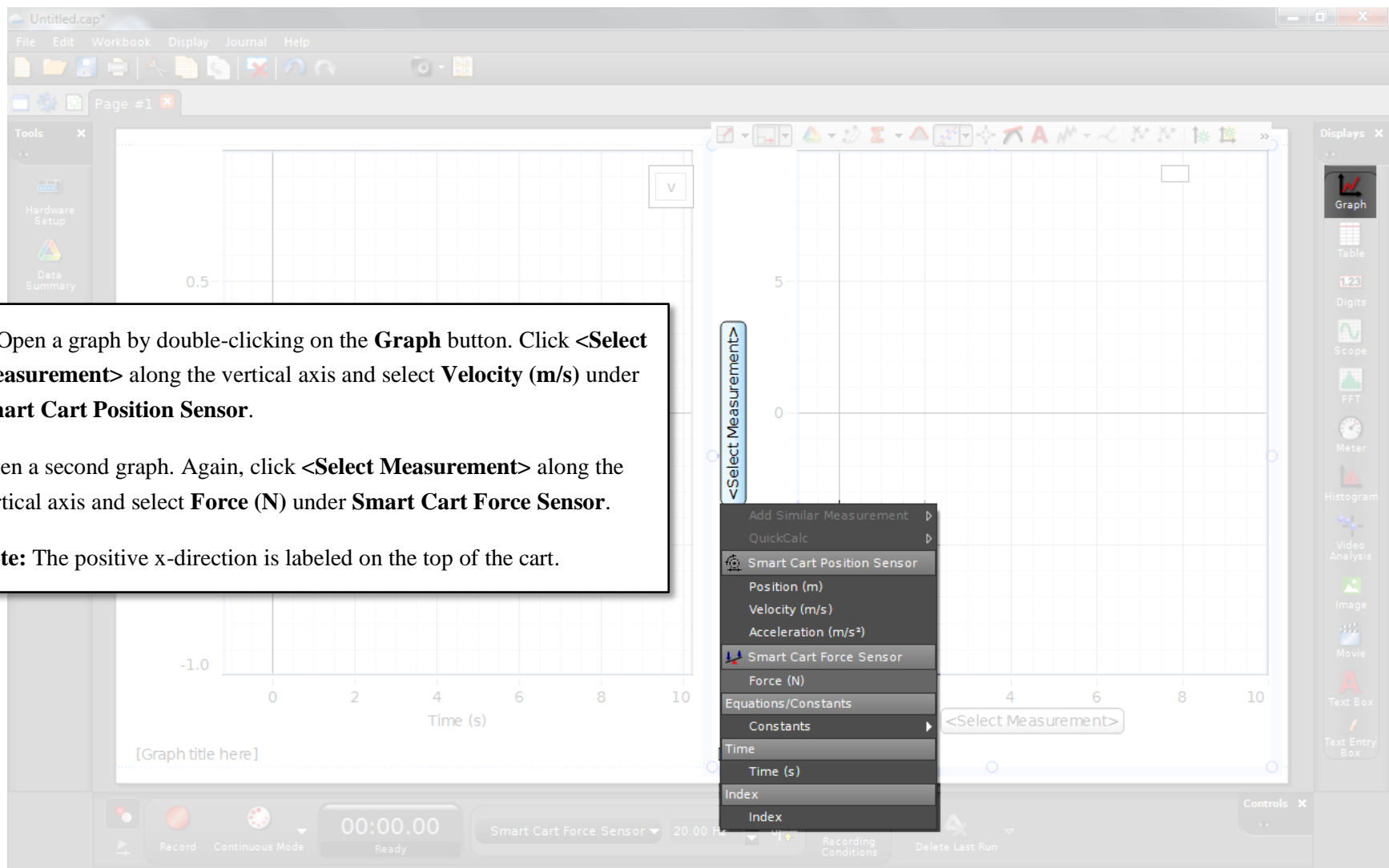
Controls

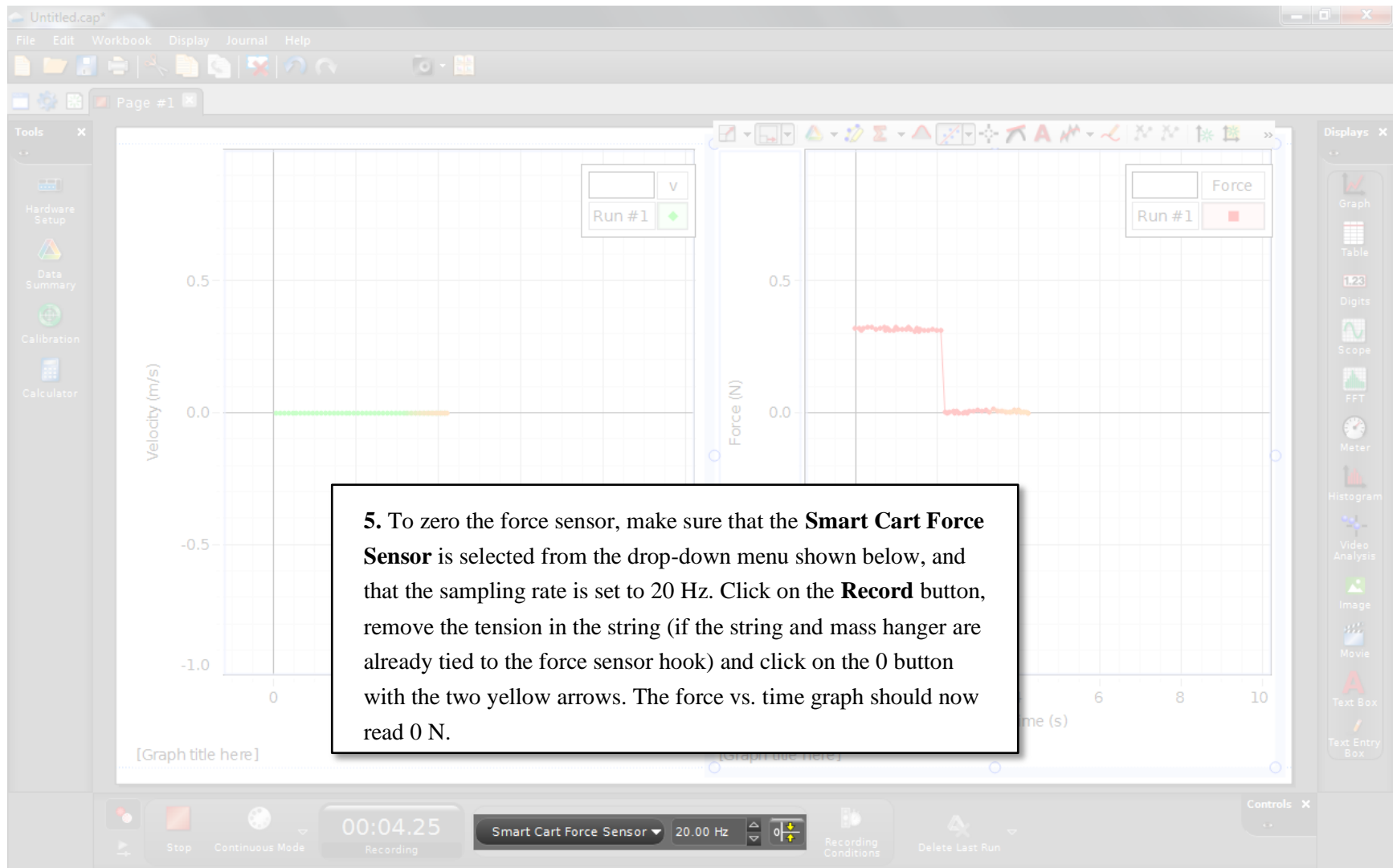
3. Once connected, click on the sliders to disable the **Acceleration Sensor** and **Gyro Sensor**. Only the **Position Sensor** and **Force Sensor** will be used in this lab.

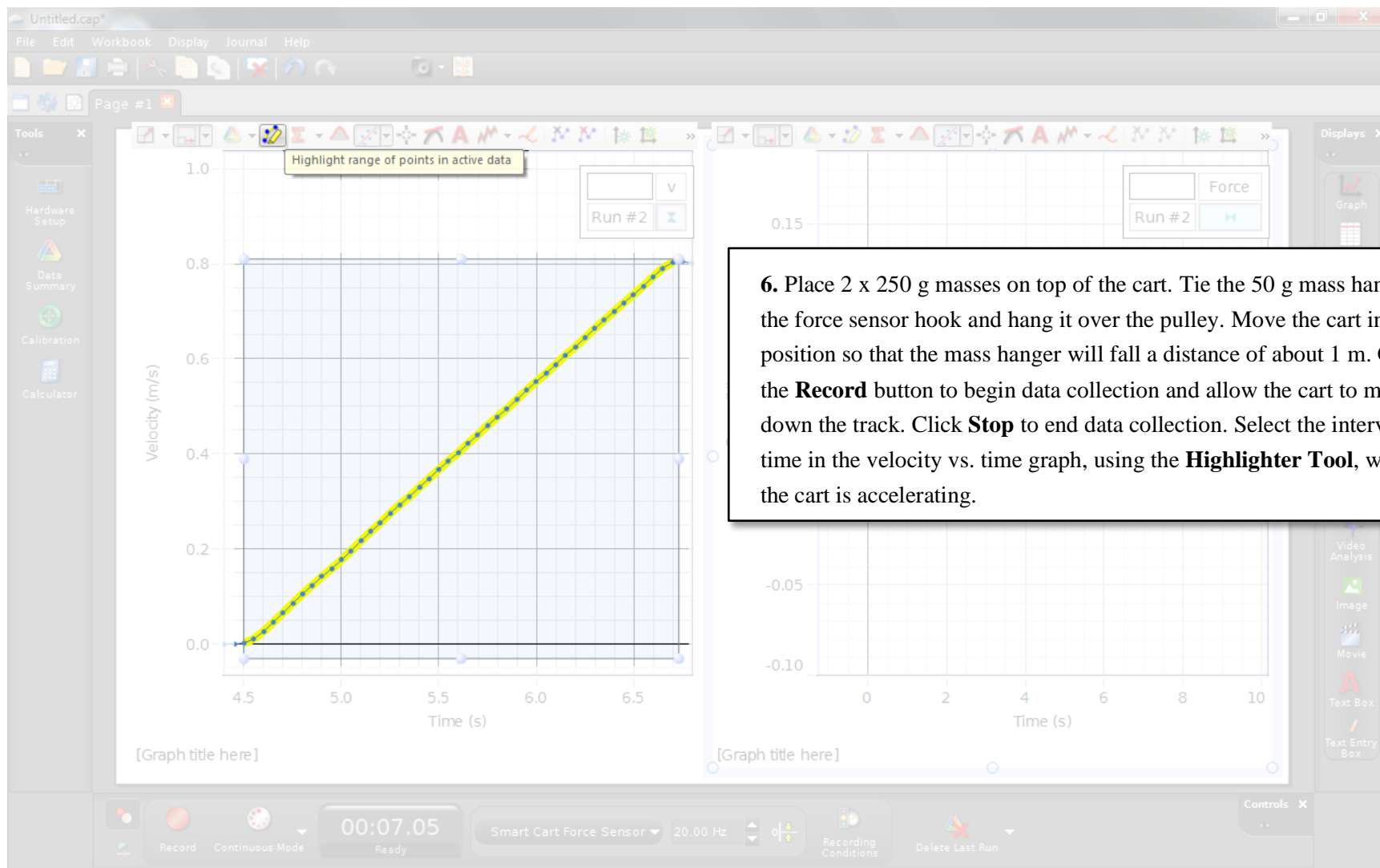
4. Open a graph by double-clicking on the **Graph** button. Click **<Select Measurement>** along the vertical axis and select **Velocity (m/s)** under **Smart Cart Position Sensor**.

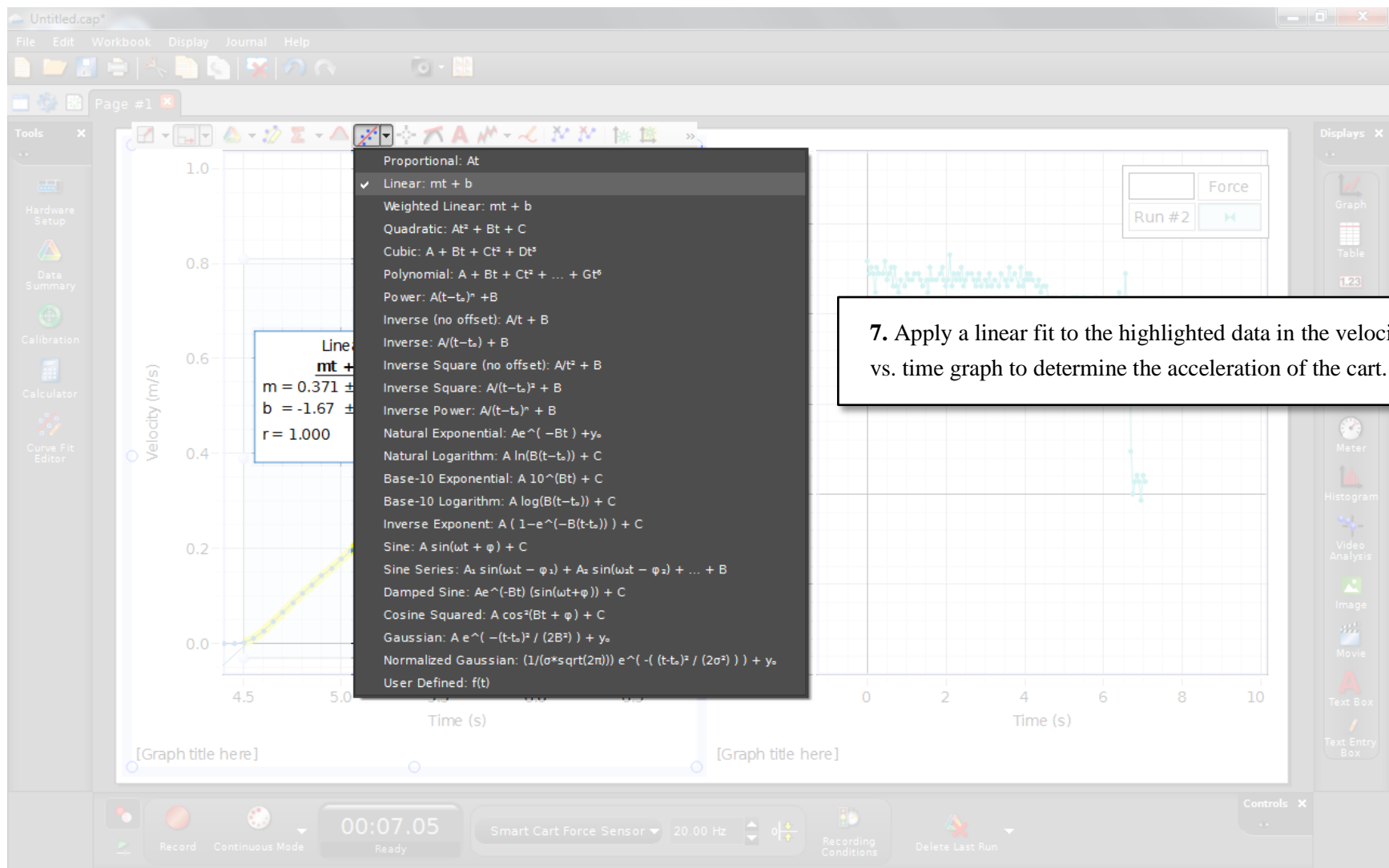
Open a second graph. Again, click **<Select Measurement>** along the vertical axis and select **Force (N)** under **Smart Cart Force Sensor**.

Note: The positive x-direction is labeled on the top of the cart.



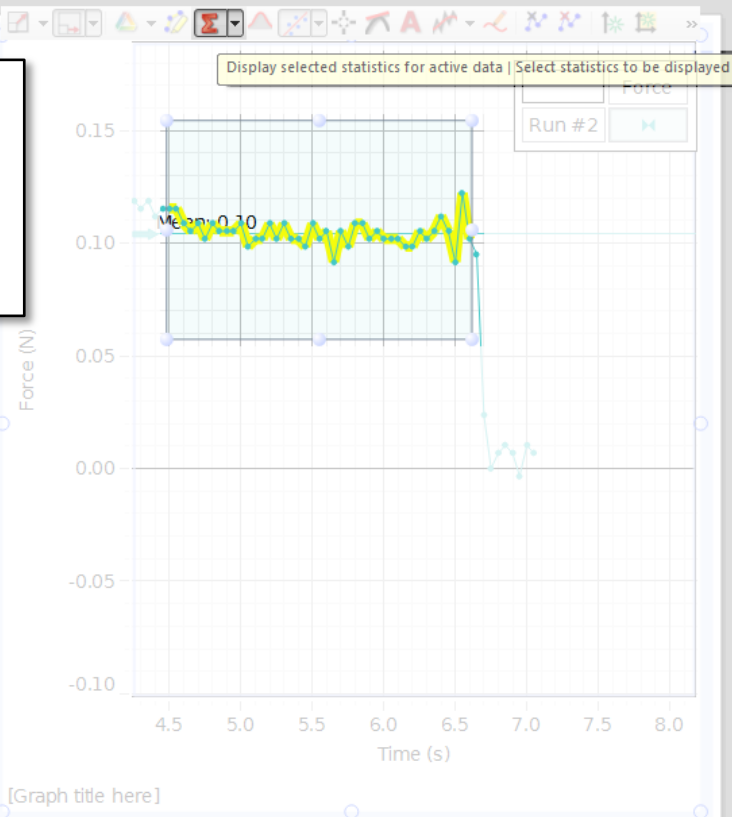
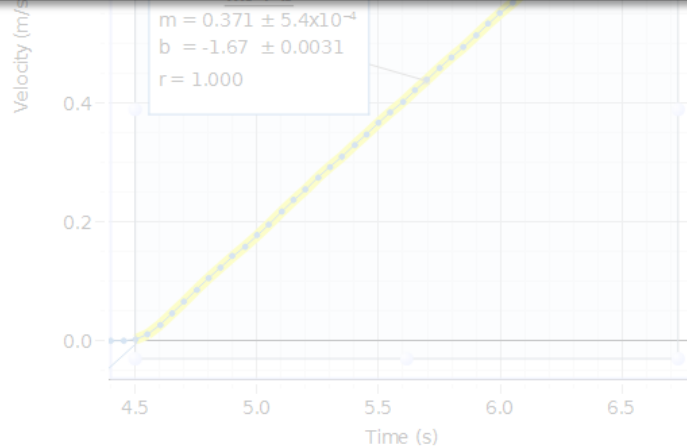






7. Apply a linear fit to the highlighted data in the velocity vs. time graph to determine the acceleration of the cart.

8. Highlight the same interval of time in the force vs. time graph. Click on the **Statistics Tool** to find the average value of F_{TI} . Add 5 g to the mass hanger, zero the force sensor (as described in Step 5), and reposition the cart on the track. Click the **Record** button to collect data for the next run.



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Tools

Hardware Setup
Data Summary
Calibration
Calculator

[Table title here]

	<No Data Selected> <Select Measurement>	<No Data Selected> <Select Measurement>
1		
2		
3		
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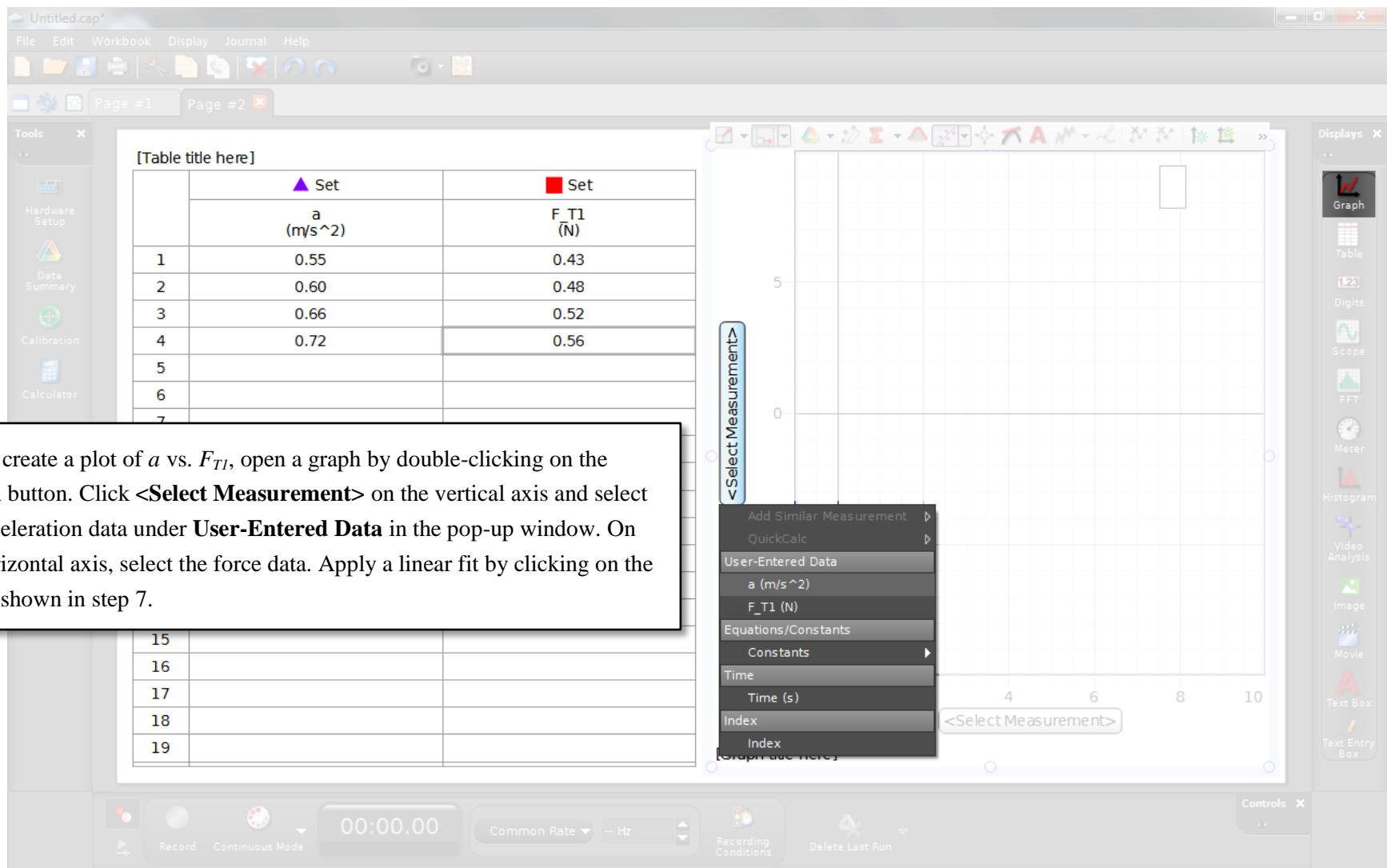
9. Open a table by double-clicking on the **Table** button. Click on <Select Measurement> in the first column and place the mouse cursor over **Create New**. Click on **User-Entered Data** from the pop-up window. Input the acceleration a of the cart for each trial. In the second column, input F_{Tl} .

Displays

Graph
Table
Digits
Scope
FFT
Meter
Histogram
Video Analysis
Image
Movie
Text Box
Text Entry Box

Controls

Record Continuous Mode 00:00.00 Common Rate -- Hz Recording Conditions Delete Last Run



10. To create a plot of a vs. F_{T1} , open a graph by double-clicking on the **Graph** button. Click <Select Measurement> on the vertical axis and select the acceleration data under **User-Entered Data** in the pop-up window. On the horizontal axis, select the force data. Apply a linear fit by clicking on the button shown in step 7.