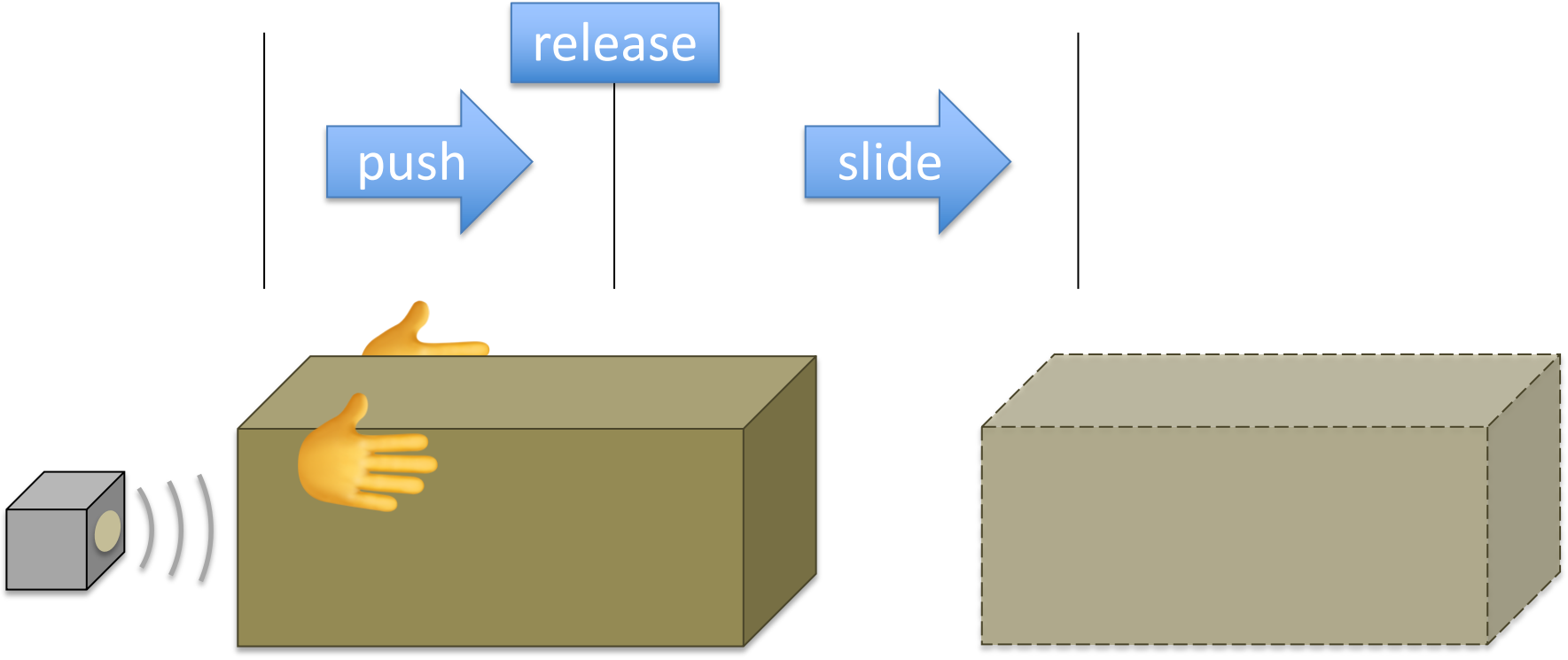
Friction Mini-Lab

- Goal: verify model of friction, explore effect of surface area and speed.
- 8 groups of 2 or 3 students.
- Use Graphical Analysis app on laptop and GoDirect Motion Detector.
- Spread out and make sure sound can reflect only off of the sliding box.
- Start the box sliding and then let go so that it slides freely to a stop.

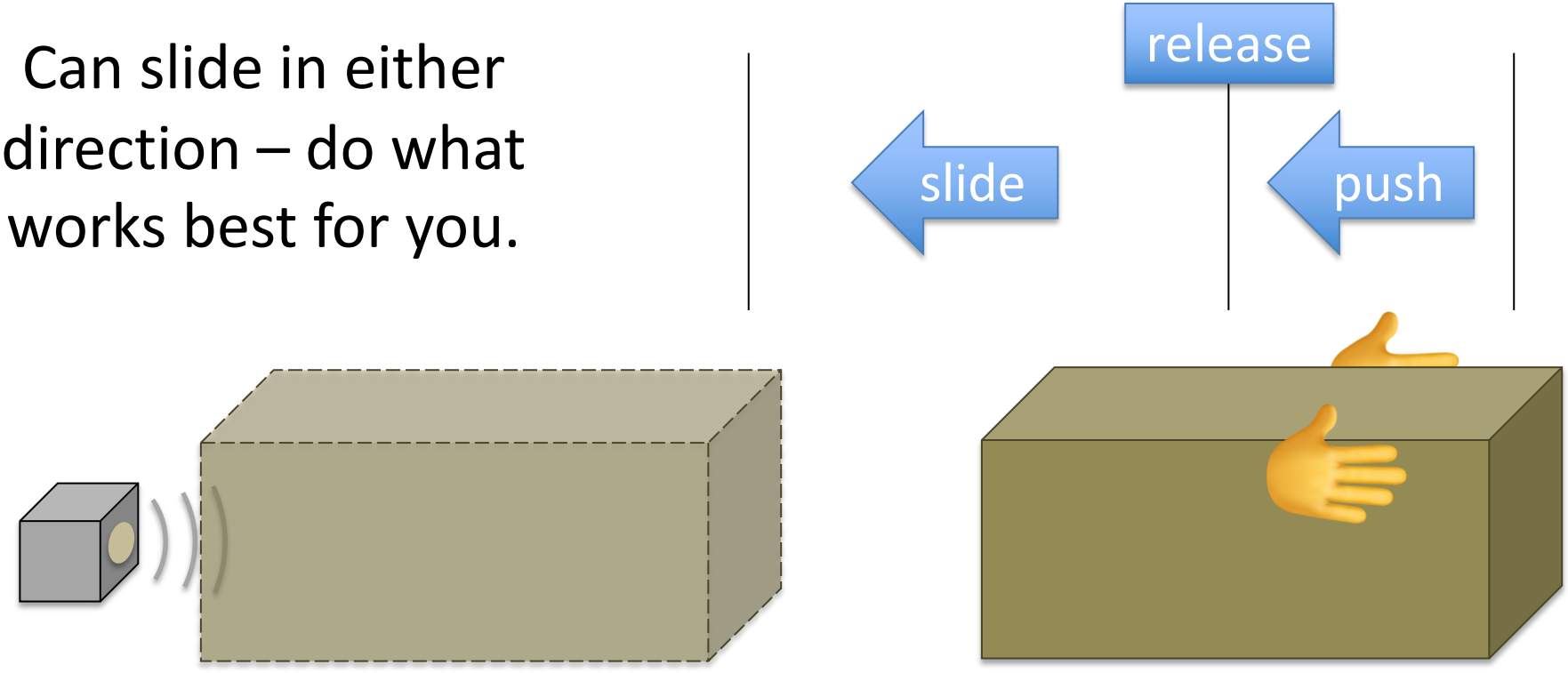
1. Measure, calculate, and record the surface area of two sides of the box.
2. Determine the acceleration of your box sliding freely across the floor. Use a linear fit on a velocity vs. time graph.
3. Repeat with a different side of the box down so that the surface area is different. Again determine the acceleration.
4. Using the mass of the box and the acceleration you can find the amount of friction and/or the coefficient of sliding friction for each trial.



Motion Detector

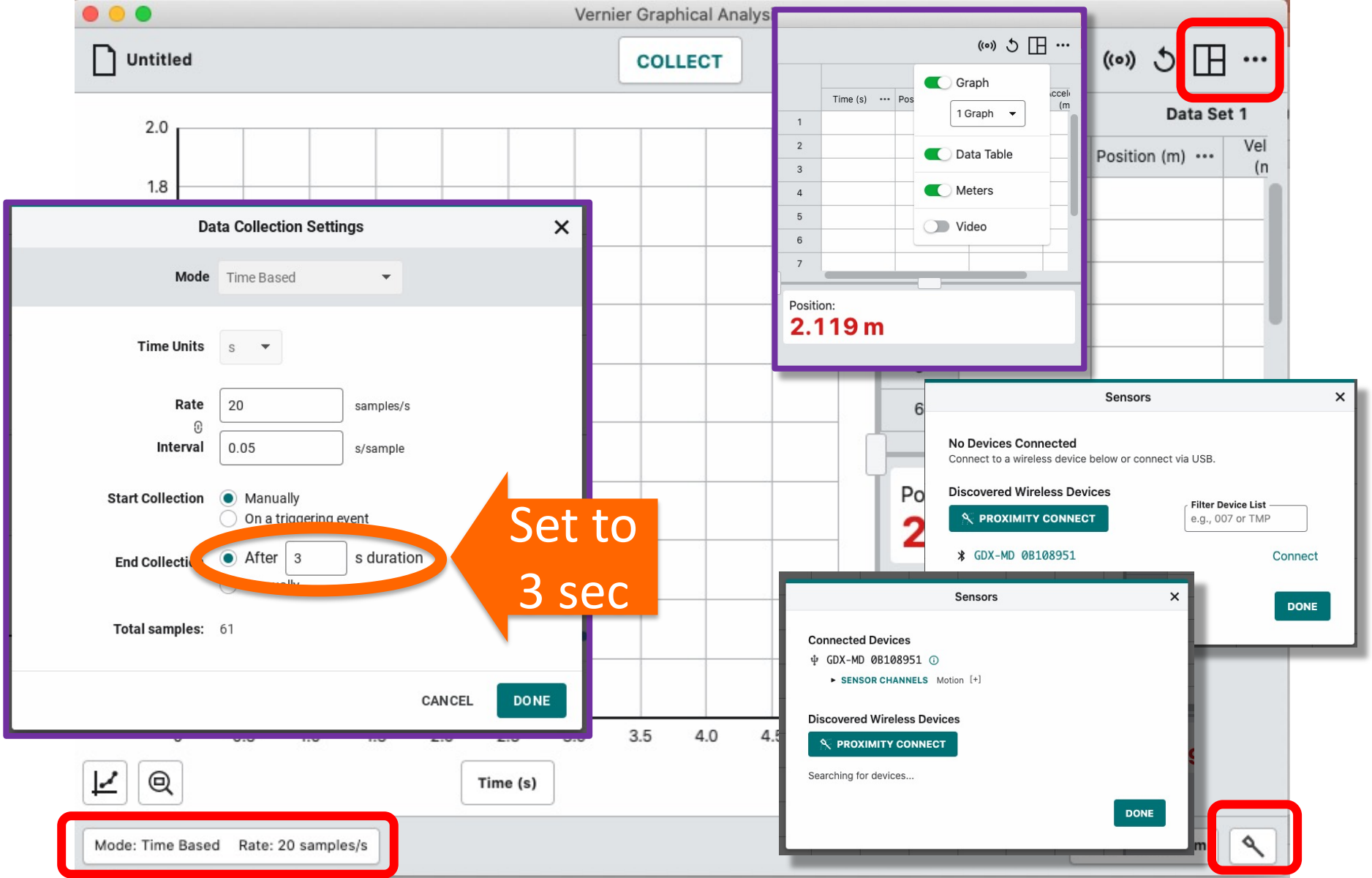
Freely Sliding Box

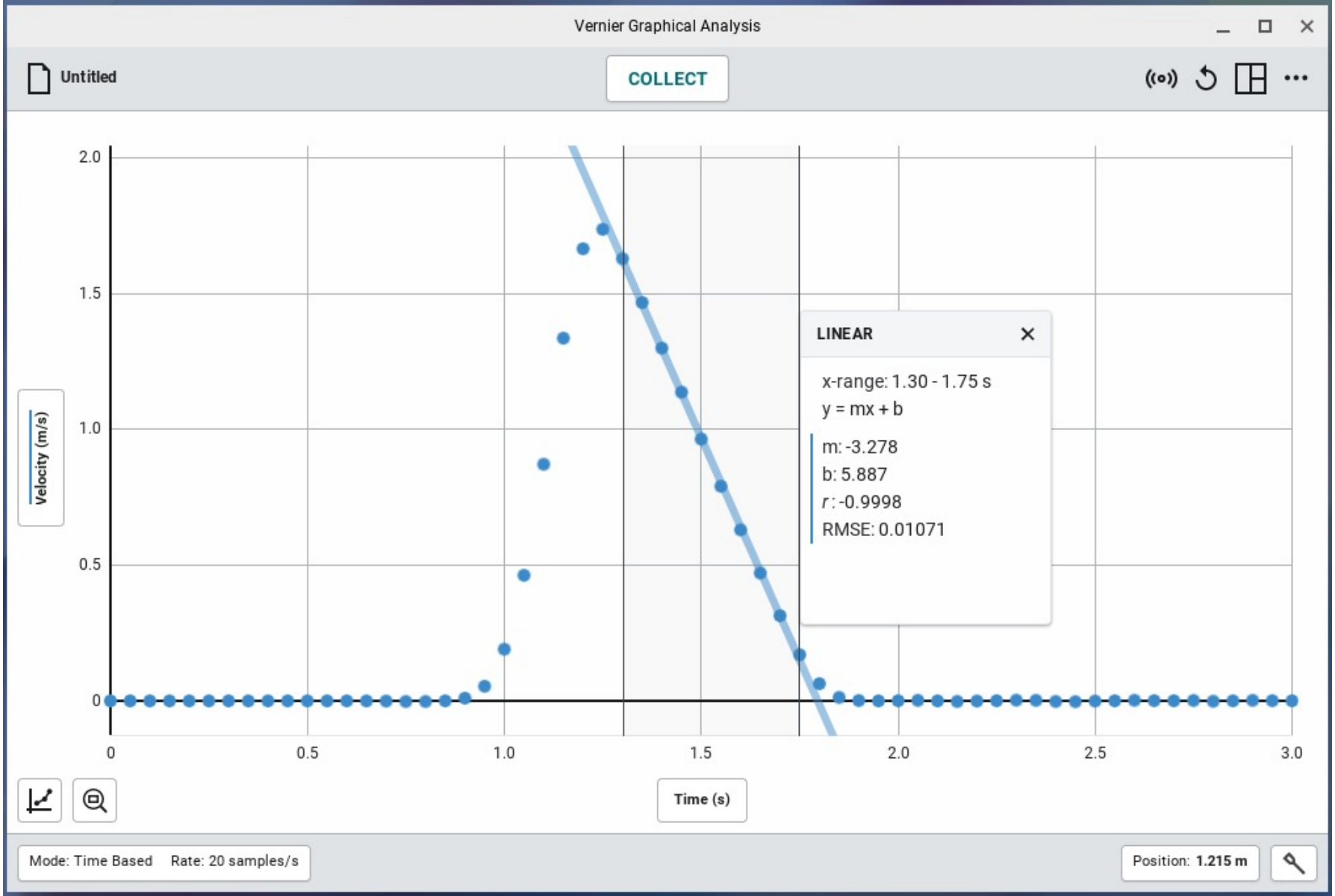
Can slide in either direction – do what works best for you.

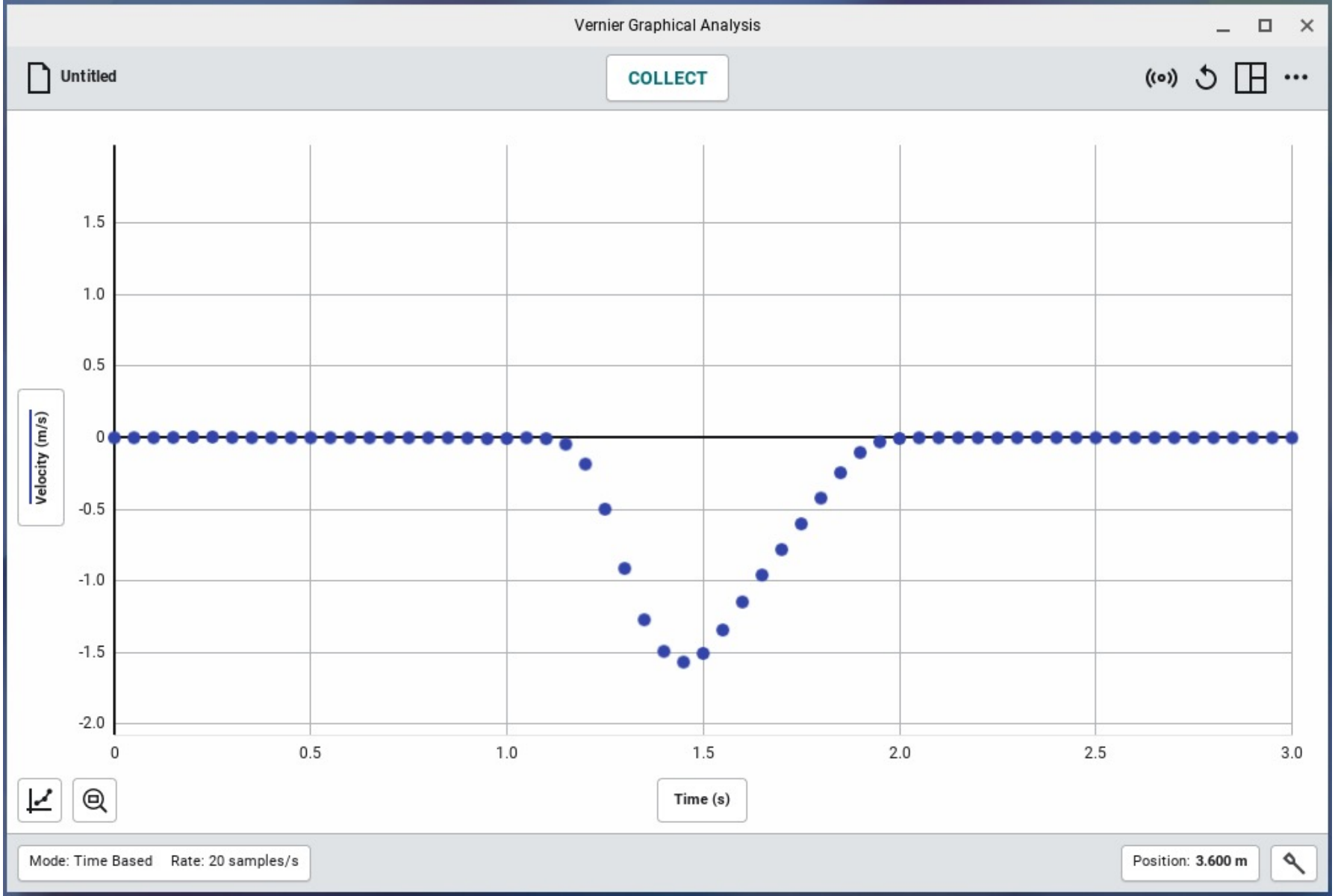


Motion Detector

Freely Sliding Box


Vernier Graphical Analysis
Untitled
COLLECT
Data Set 1
Position (m)
Vel (n
Graph
1 Graph
Data Table
Meters
Video
Position:
2.119 m
Data Collection Settings
Mode
Time Based
Time Units
s
Rate
20
samples/s
Interval
0.05
s/sample
Start Collection
Manually
On a triggering event
End Collecti
After
3
s duration
Total samples:
61
CANCEL
DONE
Set to 3 sec
Sensors
No Devices Connected
Connect to a wireless device below or connect via USB.
Discovered Wireless Devices
PROXIMITY CONNECT
Filter Device List
e.g., 007 or TMP
GDX-MD 0B108951
Connect
DONE
Sensors
Connected Devices
GDX-MD 0B108951
SENSOR CHANNELS
Motion [+]
Discovered Wireless Devices
PROXIMITY CONNECT
Searching for devices...
DONE
Time (s)
Mode: Time Based
Rate: 20 samples/s


Vernier Graphical Analysis
Untitled
COLLECT
LINEAR
x-range: 1.30 - 1.75 s
y = mx + b
m: -3.278
b: 5.887
r: -0.9998
RMSE: 0.01071
Velocity (m/s)
Time (s)
2.0
1.5
1.0
0.5
0
0
0.5
1.0
1.5
2.0
2.5
3.0
Mode: Time Based Rate: 20 samples/s
Position: 1.215 m


Vernier Graphical Analysis
Untitled
COLLECT
Velocity (m/s)
1.5
1.0
0.5
0
-0.5
-1.0
-1.5
-2.0
0
0.5
1.0
1.5
2.0
2.5
3.0
Time (s)
Mode: Time Based
Rate: 20 samples/s
Position: 3.600 m

- Effect of speed: carefully inspect the velocity vs. time graphs. What does this show about the acceleration of the sliding object? What does this indicate about the effect of speed on friction?
- Effect of surface area: What do the results indicate about the effect of increasing the surface area?