

Teaching Kinematics with Video Analysis



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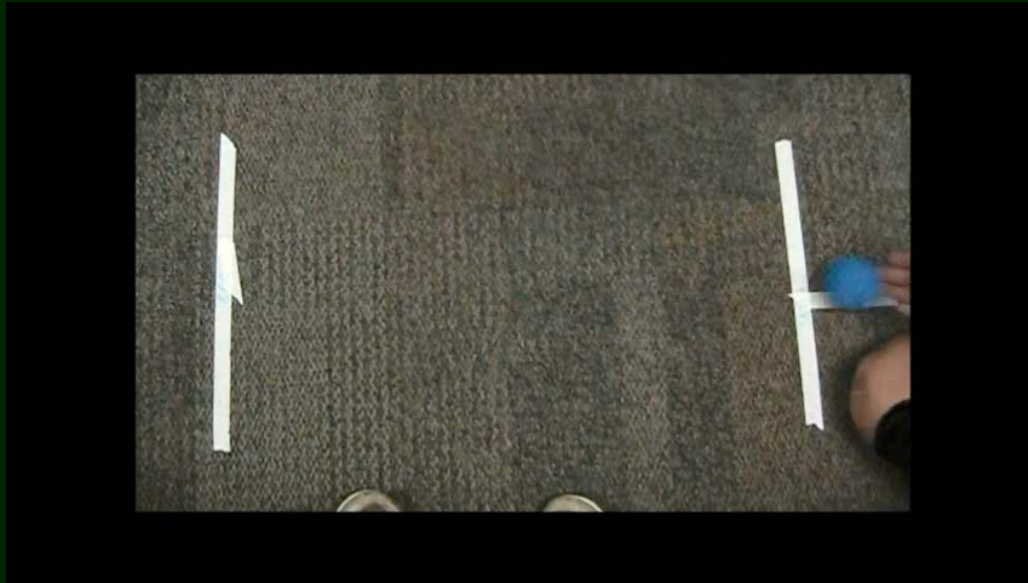
PTRA Summer Institute
Worcester Polytechnic Institute
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Quick Start Tutorial Steps

1. Open the video, select start and end frame
2. Calibrate the video (set the scale)
3. Set the origin and axis tilt
4. Create a Track and take (x,y) data ball as the ball rolls
5. Use the position vs. time graph to estimate the velocity.

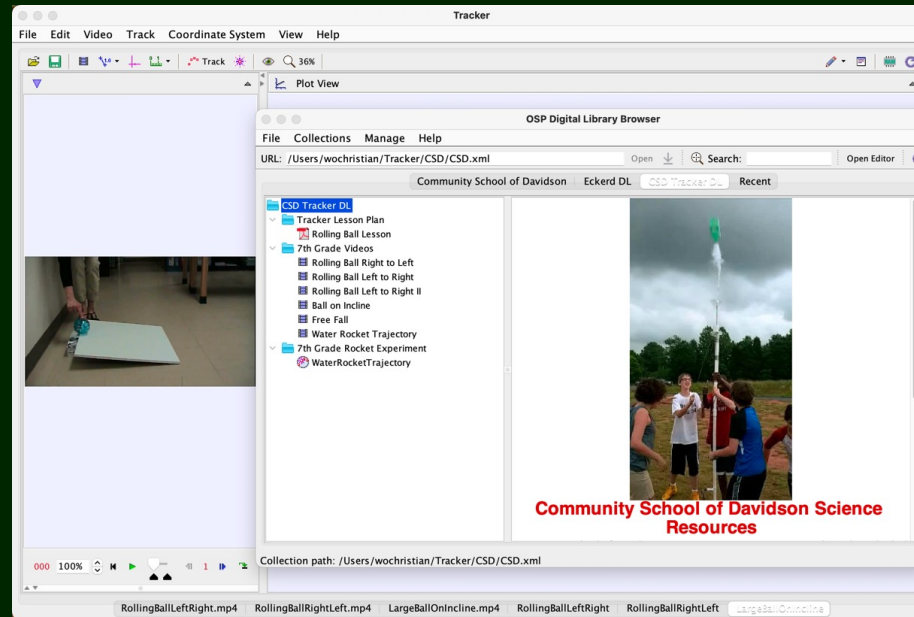
“An object if once set in motion, moves with uniform velocity if no force acts on it.” Galileo Galilei 1612



Exercise: Measure the speed of a rolling ball. Then measure the acceleration of a ball rolling down an incline.

<https://www.compadre.org/osp/items/detail.cfm?ID=16786>

Library Collections



Download teaching resources from Tracker Collections.

- [HPU Physics Lab Manual](#)
- [CINCY Physics Lab Manual](#)

Exercise: Complete an exercise from the HPU online Physics Lab Manual.

Tracker Resources

- Tracker YouTube Tutorials
<https://www.compadre.org/OSP/filingcabinet/share.cfm?UID=4856&FID=23747&code=873A9F5BC1>
- A. Titus Tracker Lab Manual
<https://www.compadre.org/osp/items/detail.cfm?ID=12037>
- Davidson College Collision Labs
<https://www.compadre.org/osp/items/detail.cfm?ID=16670>
<https://www.compadre.org/osp/items/detail.cfm?ID=16671>
<https://www.compadre.org/osp/items/detail.cfm?ID=16672>
- University of Cincinnati Force and Motion
<https://www.compadre.org/osp/items/detail.cfm?ID=16080>
<https://www.compadre.org/osp/items/detail.cfm?ID=16081>

Optional: Installing Desktop Tracker

MP4 video clips and Tracker Experiment Files (TRZ files) can be analyzed using either desktop Tracker or Tracker Online. There are advantages/disadvantages to each.

Desktop Tracker Advantages:

- Does not require an internet connection.
- Opens video formats not supported by Tracker Online.
- Supports creating and editing Tracker Collections.

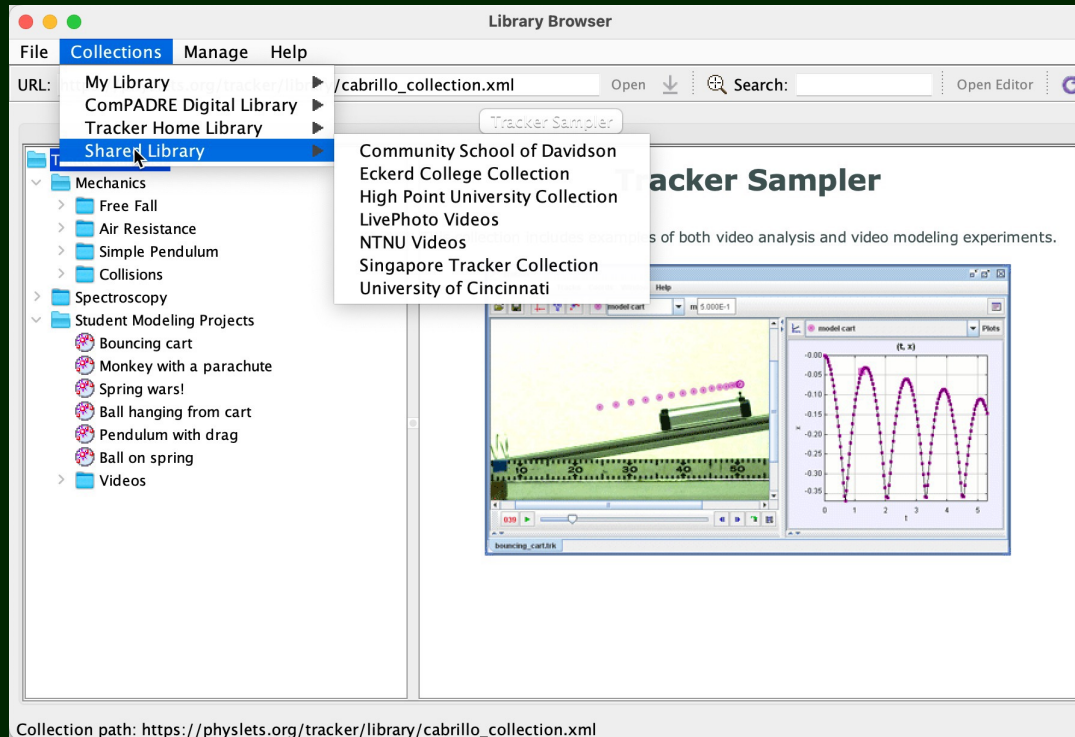
Desktop Tracker Disadvantages:

- Installation may require administrator permission.
- Will not run on computers that do not support Java, such as Chromebooks, tablets, or cellphone-like devices.

Download desktop Tracker here: <https://physlets.org/tracker/>

Tracker Digital Libraries

There are many online videos available on the internet.



Exercise: Find a video in a DL and report how you would use it in class.

Record your own videos!

Best Practice:

- bright, uniform lighting
- uniform background, contrasting object
- fast shutter speed
- motion perpendicular to view
- narrow field of view
- steady camera (tripod if possible)
- calibration object at same distance

Exercise: Create a video of a falling coffee filter and analyze it using Tracker.

Converting Clips to MP4 - H264

For unsupported videos, Tracker Online you can convert them to mp4 using the open source application HandBrake, available for Windows, Linux and MacOS platforms. Choose the default "Fast 1080p30" preset, then in the Video tab choose "Constant Framerate".

<https://handbrake.fr/>

If you cannot or do not want to install software on your computer, you use a web-based converter, such as [Cloud Convert](#).

To create image stacks, use the [Online Converter](#) website.

Interactive Engagement with Video Analysis



One problem with our system of education is....

...that we reward students for knowing the answers....

....to questions they have never asked.

[HS Student Projects](#)

Questions?



EXTRA! EXTRA! EJS is now available online.

Teachers interested in using computation to teach physics should explore the Easy JavaScript Simulations (EJS) modeling and authoring tool.

Unlike desktop EJS, Web EJS is written in JavaScript, runs in a browser, and does not require any software installation.

<https://www.um.es/fem/wikis/runwebejs/>

Simple examples:

- [Free fall](#)
- [Atwood machine](#)

Visit OSP-ComPADRE and search for over 200 ready-to-run EJS simulations.

<https://www.compadre.org/osp/index.cfm>