

An Inexpensive Lab Timer That Enhances Student Learning

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I have designed a lab timer (provisionally named LabSplits) that is triggered by photogates or other digital inputs, and types the event times directly to a computer. Given that I already have a set of commercial interfaces (Pasco Science Workshop 750), *why would I bother doing such a thing?*

Well, let's start with a head-to-head comparison.

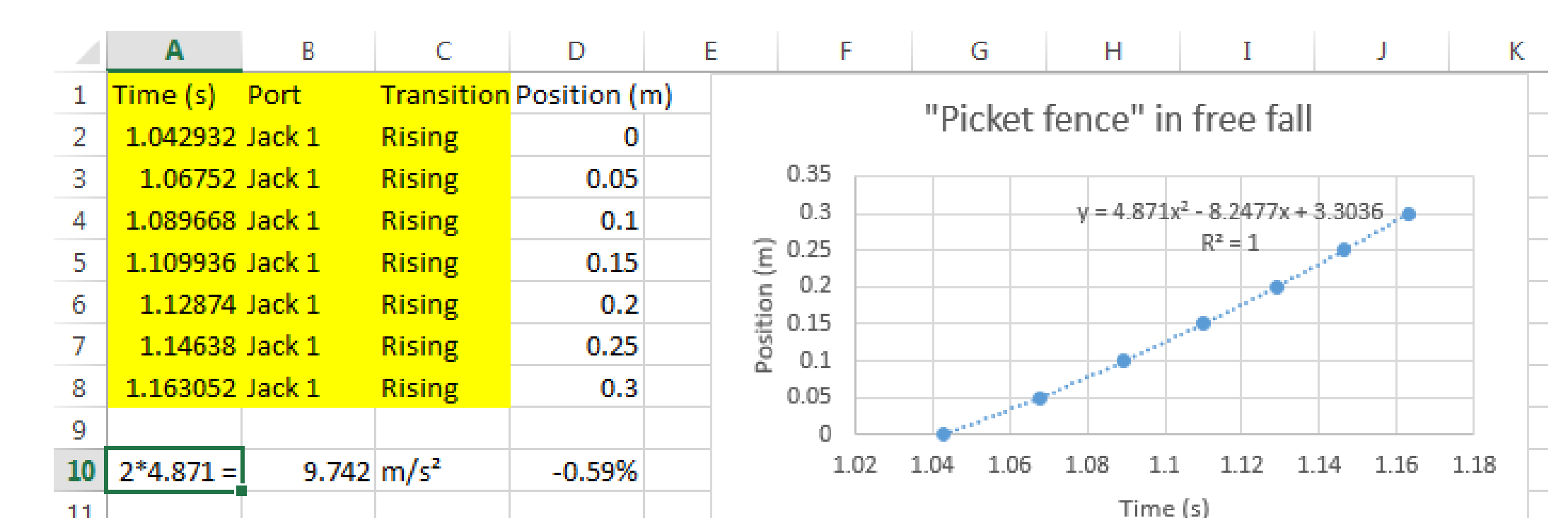
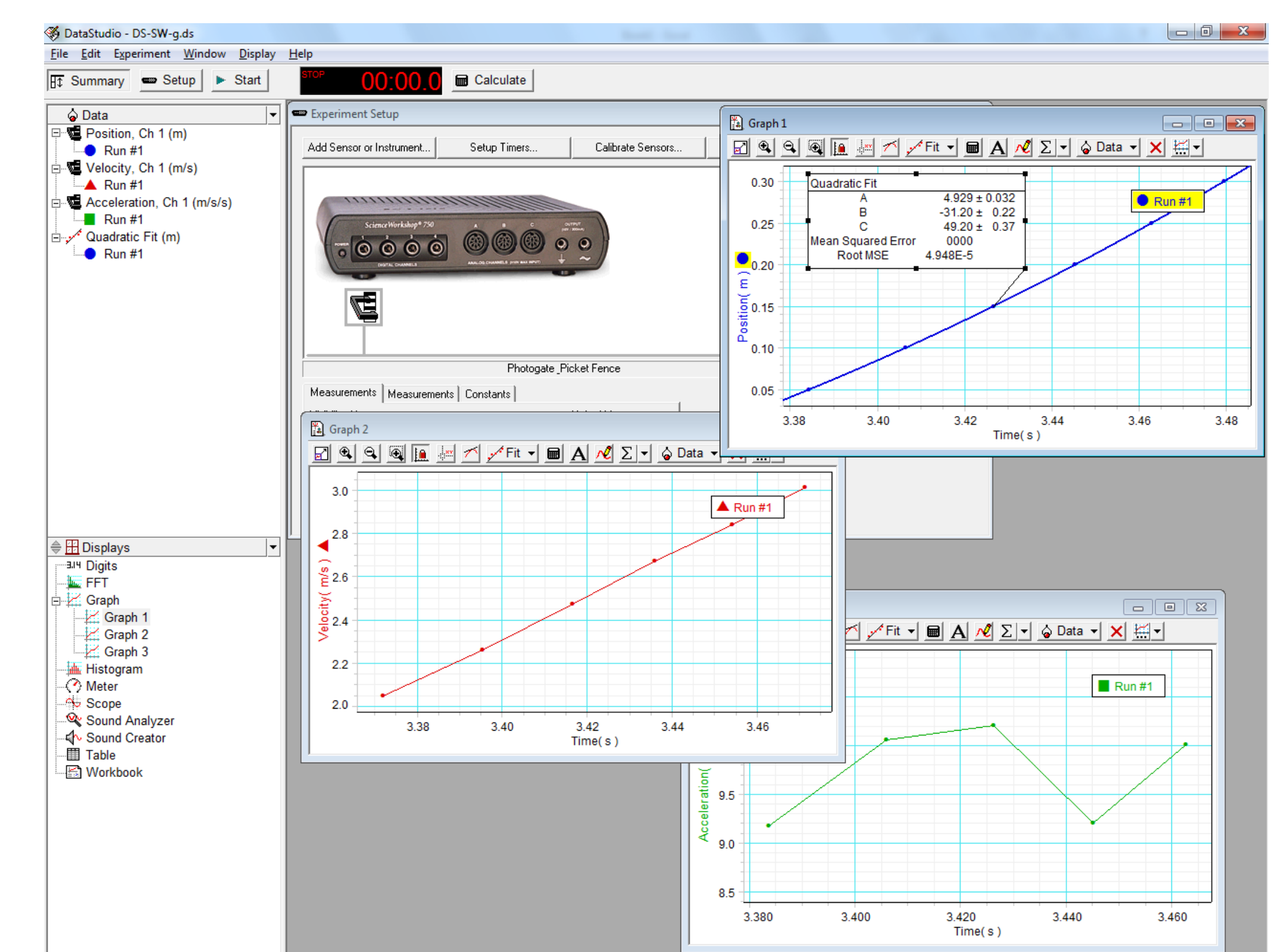


	Science Workshop 750	LabSplits	Which is better?
Ease of setup	Several steps, order is critical	Plug or unplug at any time	LabSplits
Reliability	5-10% non-start rate	No failures to date	LabSplits
Cost	Out of production; nearest equivalent is \$588 (including software)	\$40-\$50 for parts; you supply labor and software	Depends on your lab budget vs. your time and electronics skills
Computer and software requirements	Proprietary software must be used; limited computer/OS choices	Any computer/OS/software that can use a USB keyboard	LabSplits
Timing precision/error	100 μ s precision	1 μ s precision; <10 μ s estimated latency	LabSplits
Maximum event number	No limit encountered	250 event buffer	SW 750
Ports	4 digital, 3 analog, 1 output (0-5V)	2 digital, 1 manual pushbutton	SW 750
Automatic computation of related physical quantities	Yes	No	SW 750? No; LabSplits! Here's why...

An example: the free fall "picket fence" lab

In this classic experiment, a black/clear striped strip is dropped through a photogate.

- The upper right image shows the output from the standard Pasco equipment. All the student had to do was select "photogate/picket fence" and drop the strip. The software gives the position, velocity, and acceleration of the strip in the upper left corner of the screen; the student simply drags graph icons to each and selects fits. Notably absent from the screen is what was actually measured: the *times* at which the photogate was blocked or unblocked!
- The lower right image shows the results from the same apparatus using LabSplits and Excel. Only the yellow-highlighted portion was actually provided by LabSplits; the student must figure out how these times relate to physical quantities like position and acceleration (with more or less guidance from the lab instructor, as desired). As a result, the student [a] is in no doubt as to what is actually being measured, and [b] must think about the physical meanings and relationships of the kinematic quantities (and must actually measure the spacing of the stripes on the strip) to find a value of g .



Want to try it? It's open source! Details are at <http://tinyurl.com/LabSplits>

