

Physics Practical 9

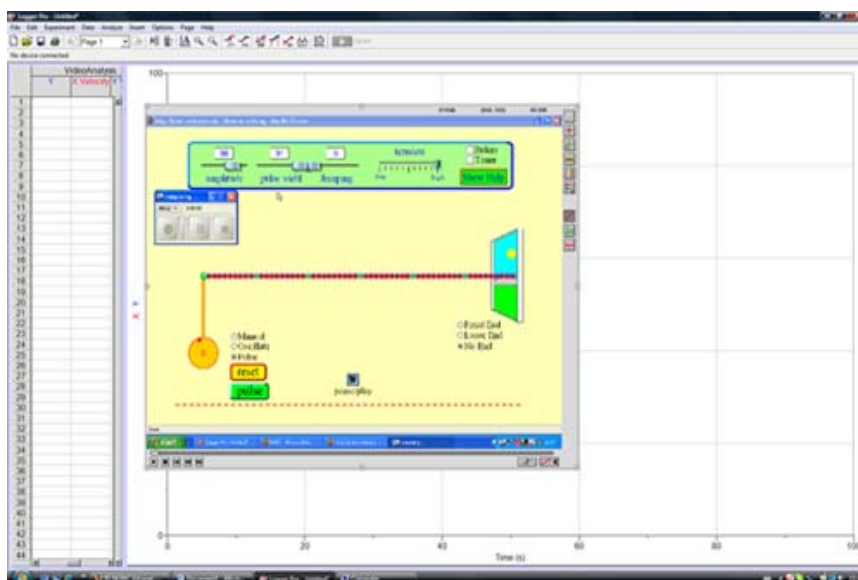
Measuring the velocity of a wave using video analysis

Introduction

In this practical the Phet simulation “waves in a string” will be used to investigate the relationship between the tension in the string and the wave speed. This is not really an experiment since you are not measuring real physical quantities but simulated ones, however it will introduce you to the use of loggerpro to analyse videos, and this might be useful later in the course.

Method

Open loggerpro, this is very similar to graphical analysis but can also be used to collect data using the vernier interface and analyse video. Open the video by selecting movie from the insert menu. The movie is in my public drive (ac90cham). I have already prepared the video to save time. You should see something like this



Run the video by clicking the arrow at the bottom of the video window. To analyse the video got to <http://home.no/champer/ict/Home/Home.html> “video analysis”. Here you will find step by step instructions on how to do it. When setting the scale assume the length of the string is 1m.

Analysis

The video shows the wave travelling through the string at different tension setting. The actual tension is not given but assume the tension scale is in Newtons (ON - 10N). Using loggerpro draw a graph of the displacement of the wave at each Tension setting (4N – 10N), find the wave velocity by plotting a best fit line for each graph and recording the gradient of the line. You should enter your results into a suitable table. Don't forget to estimate the uncertainties.

The velocity, v of the wave is given by the formula $v = \sqrt{\frac{T}{\mu}}$ T = Tension and μ = mass per unit length. By plotting a suitable graph show that v is proportional to \sqrt{T} and find μ .