REVERBERATIONS

OCEAN ACOUSTICS AND THE ENVIRONMENT

Speed of Sound

For this demonstration, you'll measure the speed of sound. The sensor will record sound at the top of the cardboard tube and again as the sound reflects from the bottom and returns.

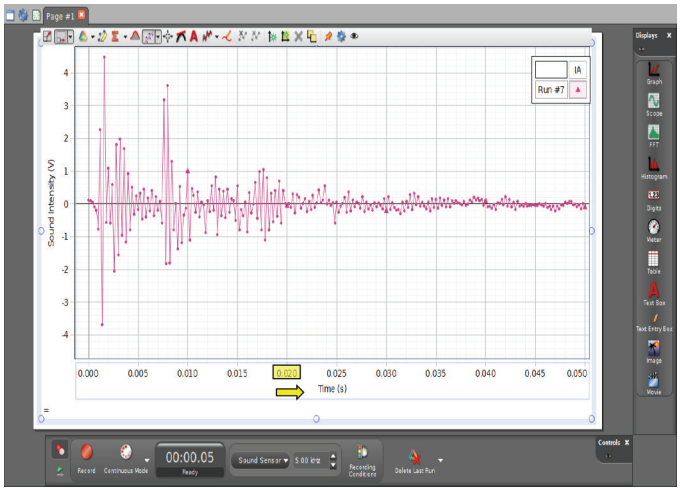
1. Click on the record button near the bottom left.

2. Snap your fingers inside the top of the cardboard tube, near the sound sensor.

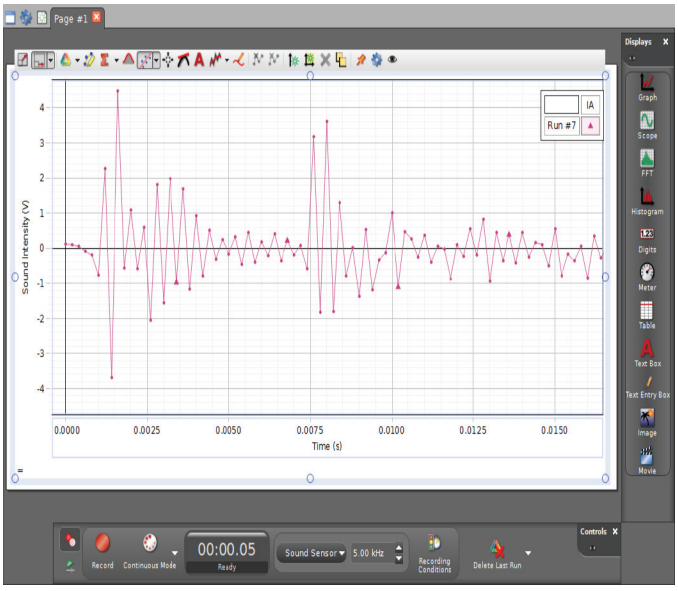
3. The display will show how sound intensity depends on time for 0.05 s after your snap. The display in (I.) has two main peaks. Beyond about 0.010 s, echoes from many different paths along the tube slowly fade away. These are reverberations. You will need to "click-and-drag" on one of the numbers on the time axis, indicated with a yellow box in (I.), to scale the amount of time shown in order to clearly see the time difference between peaks.

4. The axis has been adjusted for (II.) to focus on the two peaks. One is the sound crossing the sensor immediately after the snap. The second is the reflection returning to the sensor. The 2.4 m round trip is completed in about 0.007 seconds, giving a result of 340 m/s for the speed of sound. This speed would increase if the temperature were higher. This effect enables us to measure the temperature in the ocean using sound.

I.



II.



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Wavelength and Frequency

For this demonstration, we'll show the relationship between wavelength and frequency using tuning forks. These forks emit a well-defined, single frequency tone. The longer the arms of the tuning fork, the longer the wavelength of the sound it produces. This means that the frequency must be lower to give the same speed of sound.

1. Click on the record button near the lower left. Then, lightly tap one of the tuning forks with the rubber portion of the hammer.

2. Hold the tuning fork near the sound sensor as shown in the picture. The display shows sound intensity in the vertical direction and time in the horizontal direction.

3. The longer fork makes longer wavelengths, so the frequency will be lower. The shorter one makes shorter wavelengths, so the frequency is higher, showing more peaks. Frequency times wavelength is the speed of sound.

4. Test your singing abilities by trying to make a pure tone into the sensor. How close can you get to a smooth wave? Notice that when you talk, many different frequencies are displayed.