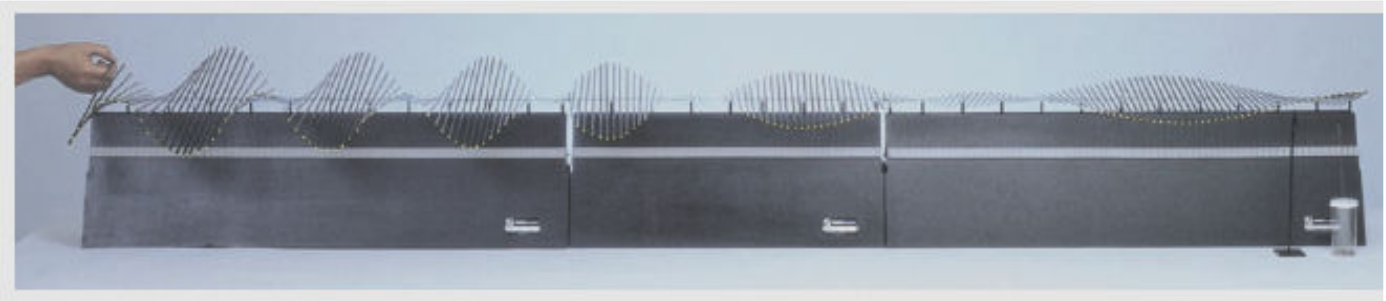
MODEL DE DEMONSTRATION DU MOUVEMENT D'ONDES
(Complete Wave Motion Demonstrator)



Complete Wave Motion Demonstrator: in three sections. The high-amplitude, slow-moving waves provide a fascinating introduction to basic wave phenomena.

- **Produces Slow-Moving, High-Amplitude Transverse Waves**
- **Demonstrates All the Basic Wave Phenomena**

- **Produire Des Déplacement Lente.Haute Amplitude Transversale D'onde.**
- **Démonstration de toutes Les Phénomène De Base d'ondes.**

The PASCO SE-9600 Complete (Transverse) Wave Motion Demonstrator allows mechanical waves to be created to demonstrate the behavior and properties common to many types of waves.

Features

- **2.3 Meters Long:** Plenty of room to watch the wave develop and interact.
- **Three Wave Sections:** Each section has rods of different lengths, allowing reflection and transmission demonstrations. - Section 1 is 92 cm long with 46 cm rods. - Section 2 is 92 cm long with 23 cm rods. The resulting wave velocity is three times as fast. - Section 3 is 46 cm long with rods that vary exponentially from 46 cm to 23 cm. This section acts as an impedance-matching unit.
- **Yellow Rod Tips:** For easy viewing and to highlight the wave motion
- **Folds for Compact Storage**
- **Easy Setup**
-

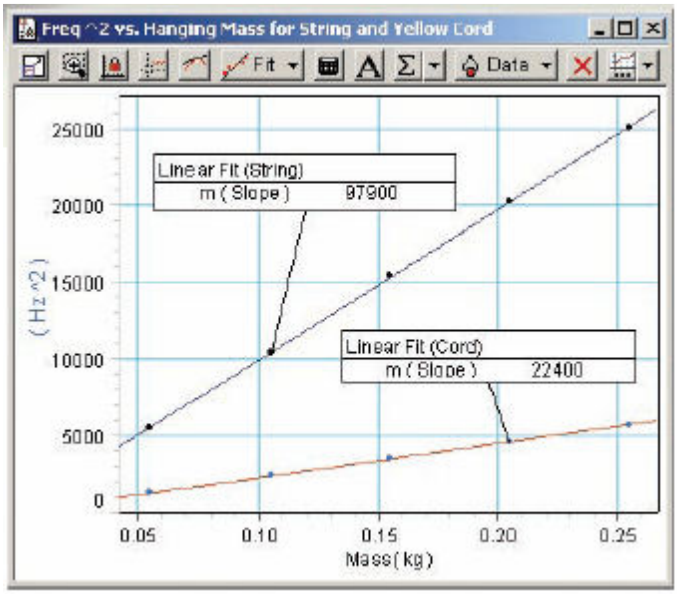
Demonstrations:

1. Wave Propagation
2. Velocity in Different Media
3. Wavelength versus Velocity and Frequency
4. Reflection at Fixed and Free Boundaries
5. Constructive and Destructive Interference
6. Standing Waves and Resonance
7. Reflection and Transmission at Media Boundaries

Démonstrations :

1. Propagation D'ondes.
2. Vélocité dans les Moyens Différents
3. Longueur D'onde en Fonction de La Vitesse et La Fréquences.
4. Réflexion à Limites Fixes et Libres
5. Interférence Constructive et Destructive.
6. Position De Vague et Résonance.
7. Réflexion et Transmission à Limites Médiatiques

EXPERIENCES SUR LES ONDES *(Waves)*



- **Speed of Waves in a String**
- **Speed of Sound in Air**
- **Resonance in Strings and Air Columns**
- **Harmonics**

- **La Vitesse D'Ondes Des cordes**
- **La Vitesse Du Son Dans l'Air**
- **Résonance Dans Les Cordes Et le Tube De Résonance**
- **Les Oscillations**

Standing waves in strings and air columns are studied. Using a sine wave generator to drive a string vibrator, the driving frequency, the length, density, and tension of the string are varied to explore standing waves in strings and to determine the speed of the wave. For the sound waves in the air column, a speaker is used to drive a resonance tube. The driving frequency and the length of the tube are varied for both open and closed tubes. The relationship between resonant frequency modes and tube length is determined for closed versus open tubes.

Advantage

The frequency of the vibration of the string is not limited to the line frequency so the frequency can be varied, as well as the length and the tension.

Experiment Includes:

String Vibrator WA-9857
Sine Wave Generator WA-9867
Open Speaker WA-9900
Economy Resonance Tube WA-9495
Elastic Wave Cord SE-9409
Physics String SE-8050
Yellow Braided Cord 699-067
Drilled Mass and Hanger Set ME-8967
Universal Table Clamp (2) ME-9376B
Adjustable Angle Clamp ME-8744
Super Pulley ME-9450
Pulley Mounting Rod SA-9242
45 cm Rod (2) ME-8736
Banana Plug Cord Set, Red SE-9750
Waves Experiment Maunal
DataStudio Lite Software (for graphing)

ETUDE DES ONDES DANS LES MILIEUS LIQUIDES (RIPPLE TANK SYSTEME)

Typical Experiments:

With Teacher's Guide and Sample Data.
1. **Reflection**
2. **Refraction**
3. **Diffraction**
4. **Interference**
5. **Image Formed by a Plane Mirror**
6. **Dependence of Wave Speed on Water Depth**

Expériences Typique :

1. **Réflexion.**
2. **Réfraction.**
3. **Diffraction.**
4. **Interférence.**
5. **Image formée par mirroire plan**
6. **Dépendance de la vitesse D'onde sur les profondeurs d'eau**

The PASCO Ripple Tank creates wave patterns superior
Produces clear, stable wave patterns that vividly demons
engineering has eliminated many traditional Ripple Tank

Features

- **Ripple Generator:** PASCO's mechanical rippler produces true sinusoidal waves resulting in crisp, clear interference patterns. Frequency may be adjusted from 2 to 20 Hz, amplitude from 0.5 mm to 2 mm p-p, and phase from 0 to 360 degrees.
- **Halogen Light Source:** A 50-watt halogen lamp provides an almost perfect point source for sharp wave patterns.
- **Mechanical Strobe Accessory:** Mechanical strobe can make wave patterns appear to slow down for easier viewing or completely stop for easy measurement. Strobe frequency adjusts from 0 to 18 Hz
- **Reflection-Free Tank Walls:** Neoprene rubber damps the waves that would otherwise reflect and disturb the interference patterns.
- **Glass Bottom Tank:** A 6 mm (1/4 in) tempered glass bottom plate ensures uniform water depth.
- **Durable Tank Construction:** Heavy-gauge steel for rigidity and minimal vibrations.
- **Easy Storage:** The legs unscrew and can be stored in the tank itself so multiple tanks can be stacked on top of one another.
- **Special Accessories Included:** Concave and convex lenses, a triangular prism, rectangular blocks, a curve and a plane wave attachment.
- **Optional Projection Screen:** An acrylic mirror projects wave interactions onto a vertical viewing screen for easy viewing.

Specifications Tank Dimensions:

Width: 47.5 x 47.5 cm (19 x 19 in.)
Height: 45 cm minimum (legs are adjustable)
Viewing Area: 39.5 x 39.5 cm (16 x 16 in).

Ripple Generator:

Frequency: 2-20 Hz
Actuator Diameters: 0.6, 2.0 and 3.2 cm diameter

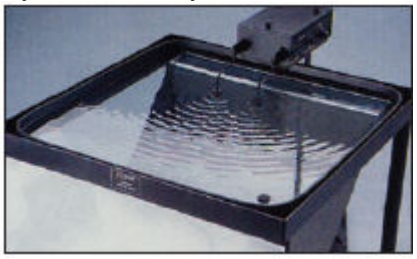
Volume of Water Used: 1.2-2 Liters or 6-8 mm deep (for refraction experiments: 8-10 mm deep)
Halogen Light Source: 50-watt bulb, 100/240 VAC input

Plane Wave Attachment: 30 cm long(12 in.)
Power Supply: 9 VDC, 500mA adapter

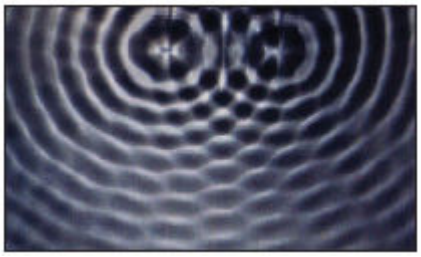
Experiments

Interference Patterns

Two-point sources create a classic Interference pattern. The gray bands, or nodal lines, show where the waves destructively interfere. Between the gray lines are antinodal lines, where they constructively interfere.



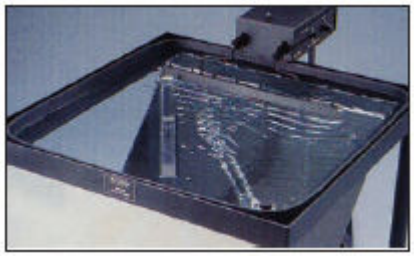
Two-Point Source Experiment Setup



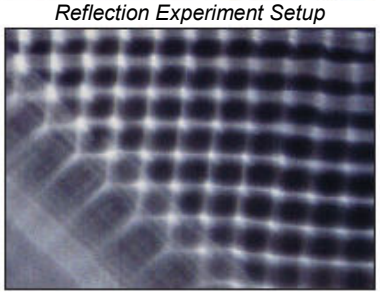
A two-point source experiment generates clean nodal and antinodal lines.

Reflection

Use the barriers to study wave interference due to reflection. The crests and troughs show up as bright and dark bands. Notice points of constructive and destructive interference.



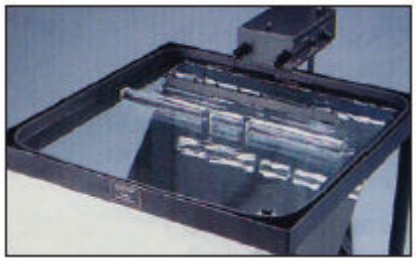
Reflection Experiment Setup



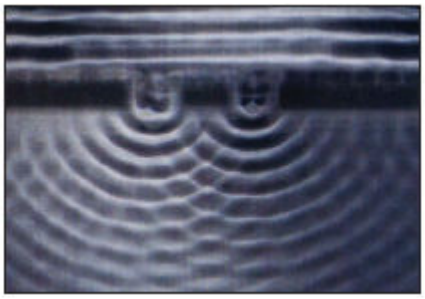
Waves reflected off the large rectangular barriers create the above crisscrossing wave pattern.

Double-Slit Diffraction

The large and small rectangular barriers can be used to form a double slit, simulating two-point sources.



Double-Slit Experiment Setup

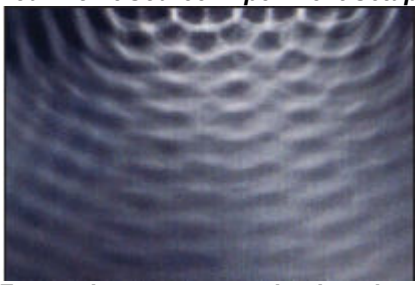


The plane wave actuator bar and one small and two large rectangular barriers can be used to form a double slit that generates the above pattern.

Multiple-Point Source

The plane wave actuator bar allows students to study the wave interactions generated by plane waves or by multiple point sources to a maximum of 8.

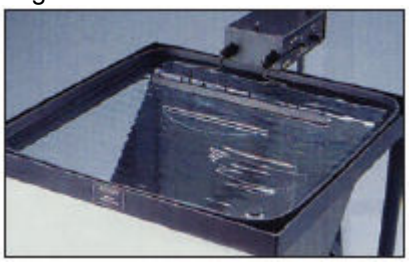
Four-Point Source Experiment Setup



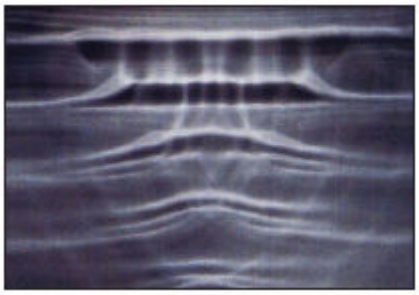
Four-point sources moving in unison produce the above pattern.

Refraction

Place the convex lens in the tank and cover with water. Observe that the section of the wave on top of the lens travels more slowly than the waves along the side of the lens.



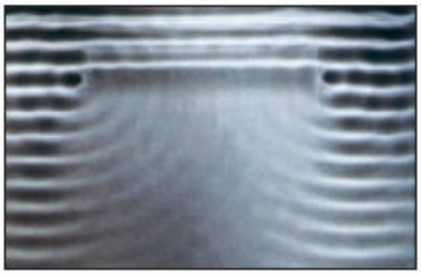
Refraction Experiment Setup



A convex lens, with the straight side facing the top of the screen, generates the above wave patterns.

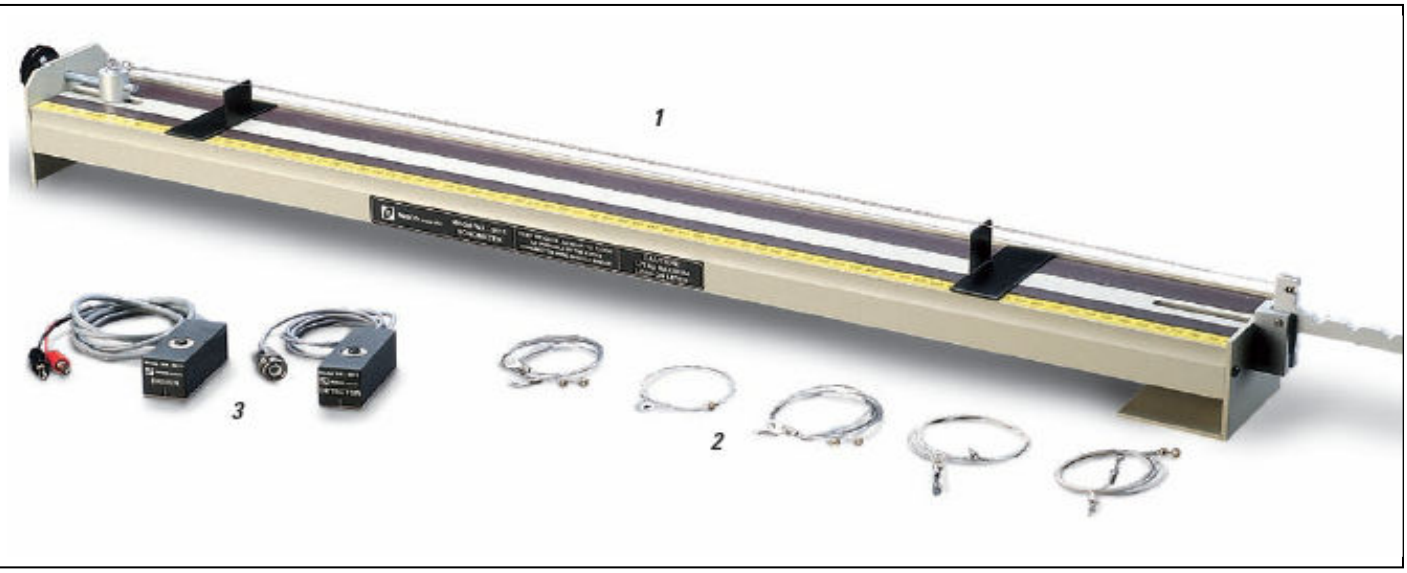
Diffraction Around Objects

Observe how waves spread around the rectangular barrier placed in the tank.



Use the plane wave actuator bar to produce plane wave forms and a rectangular barrier to produce the above wave pattern.

SYSTEME SONOMETRE
(9757 SONOMETER SYSTEM)



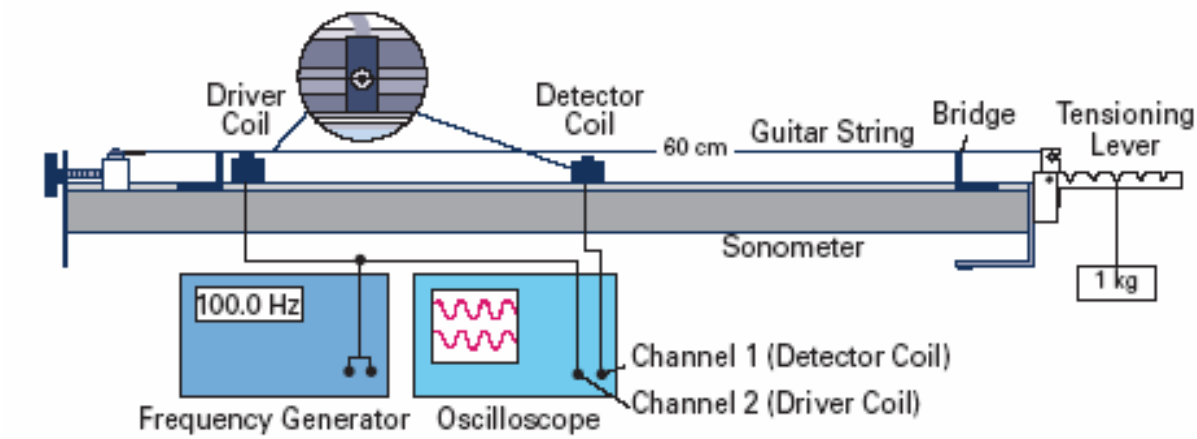
- **Investigate Waves on a Wire**
- **Control Length, Tension, Density and Driving Frequency**
- **Observe and Measure the Waveforms on an Oscilloscope**

- **L'Etude Des Ondes Dans Les Fils.**
- **Contrôle de longueur, Tension, Densité et Fréquence De Vibration.**
- **Observer et Mesurer La Forme D'ondes Sur L'Oscilloscope.**

With the classic sonometer, students can investigate waves on a wire by adjusting the wire tension and length and listening to the difference in tone when the wire is plucked or bowed. It is a useful demonstration, but it is only qualitative.
With the PASCO Sonometer and the Driver/Detector Coils, students can vary the density, tension and length of the wire, adjust the driving frequency and examine the resulting waveform in full detail on an oscilloscope or computer interface. This is all done quantitatively.
Features include a slotted tensioning lever, magnetic mounts, built-in scale and a sound box.

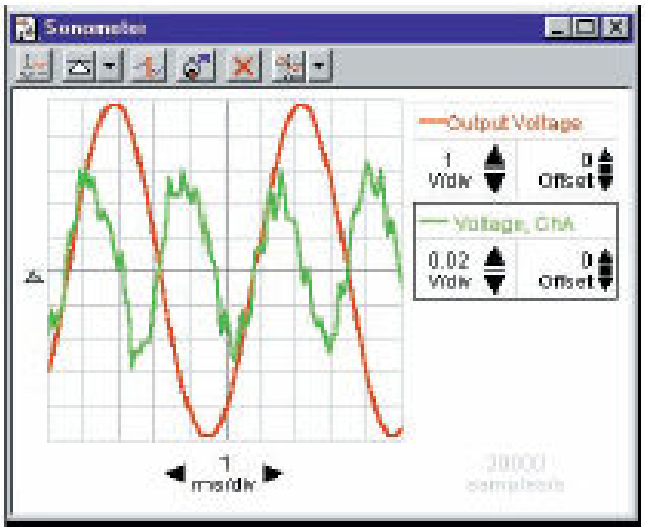
In the Laboratory

The included Sonometer Manual contains a discussion of the theory of waves on a stretched string, and student-ready experiments for investigating the resonant modes of a stretched string and for measuring the velocity of wave propagation on a string.

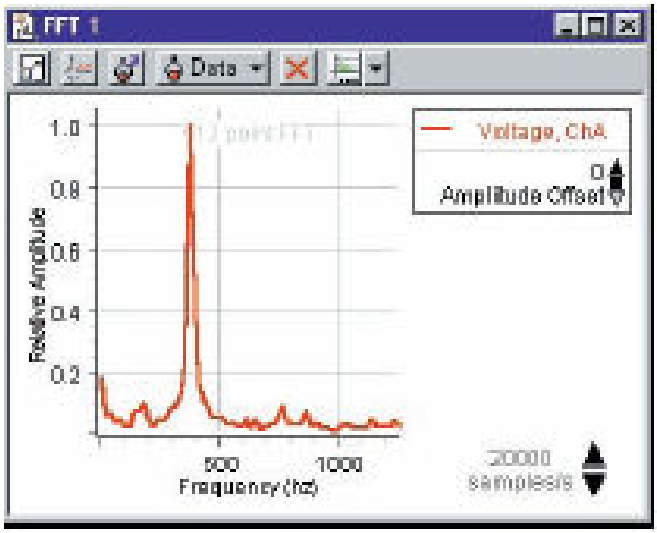


Experiments

Using a PASCO computer interface to monitor the detector signal makes it easier to measure and document the relationship between wave amplitude and frequency. Use the Fast Fourier Transform (FFT) mode for a more sophisticated analysis of wave behavior on a string. The Sonometer's immediate audio feedback from the vibrating string combined with DataStudio's sophisticated analysis techniques adds reality to advanced concepts.



This oscilloscope display shows the ouput signal generated from the power amplifier (red trace) and the input signal from the detector coil (green trace). The output frequency is 55 Hz.



This FFT display shows a fundamental frequency of 400 Hz for a plucked sonometer string.

The 9757 Sonometer with Driver/Detector Coils includes:

1. Base with magnetic mounting strip, sounding board, tensioning lever and wire positioning screw
2. 10 Solid Steel Wires— 2 each of 0.245, 0.356, 0.432, 0.508 and 0.559 mm diameter
3. Driver and Detector Coils
4. BNC-to-Banana Plug Adapter (not shown— used to connect to *ScienceWorkshop* interface)
5. Instruction Manual and Experiment Guide (not shown)

Equipment Required:

- **Scientific workshop 500 interface (or 700/ 750, Page) :**
  Ports: 2 Digital, 3 Analog
  Connection: Serial (also USB compatible with USB/Serial Converter)
  Data logging: Collect up to 17,000 Analog (force, voltage, etc.) data points or 7,000 Motion Sensor data points
  Portable: Built-in battery compartment
- Power Amplifier (*ScienceWorkshop 700* or *750* only) or Function Generator to drive the Sonometer
- Voltage Sensor to monitor the detector
- Dual Trace Oscilloscope.
- Slotted Mass Hanger.
- Slotted mass set.

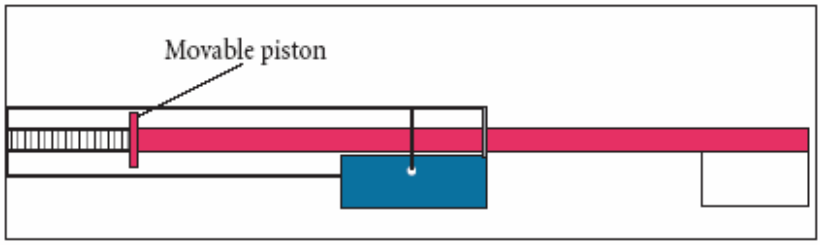
TUBE DE RESONANCE
(Resonance Tube)

- **Investigate Sound Waves in a Closed or Open Tube**
- **Observe the Waveforms on an Oscilloscope**
- **Movable Piston and Microphone**

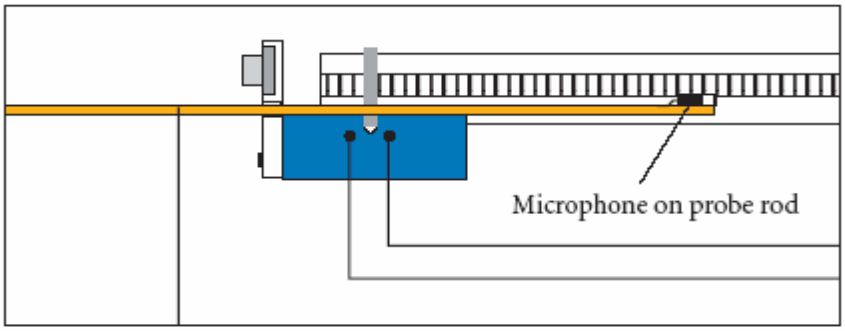
- **Etudie des Ondes Sonores Dans Un Tune Fermer ou Ouvert.**
- **Observer la Forme D'onde sur un Oscilloscope.**
- **Piston et Microphone Déplaçable.**

This Resonance Tube brings the same advantages to longitudinal wave experiments that PASCO's Sonometer brings to transverse wave experiments. Drive the speaker with a function generator to create stable wave patterns at specified frequencies. Then connect an oscilloscope or *ScienceWorkshop* computer interface to the microphone to examine the waveforms in detail. The 90 cm long, clear plastic tube is simple and rugged.

Two methods of investigating wave patterns:

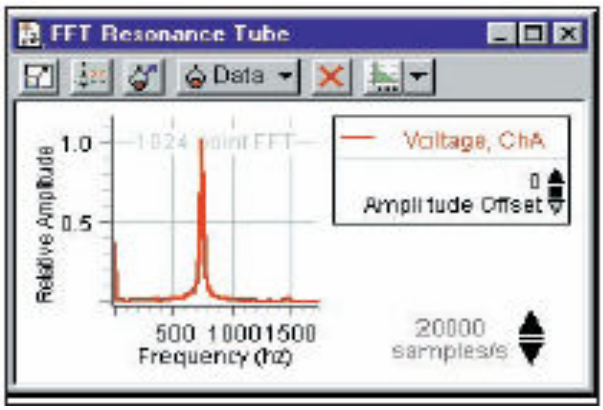


with a movable piston and fixed microphone...

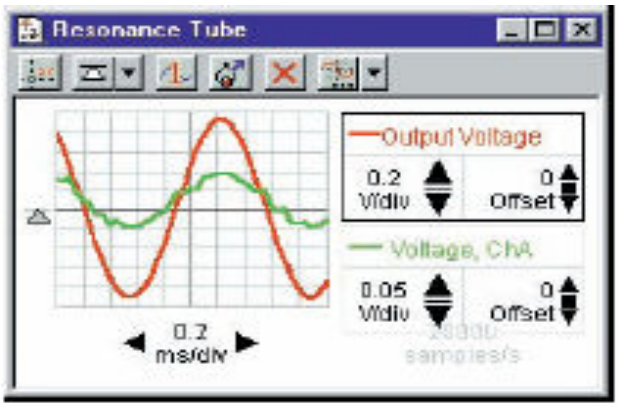


or with a fixed piston and movable microphone.

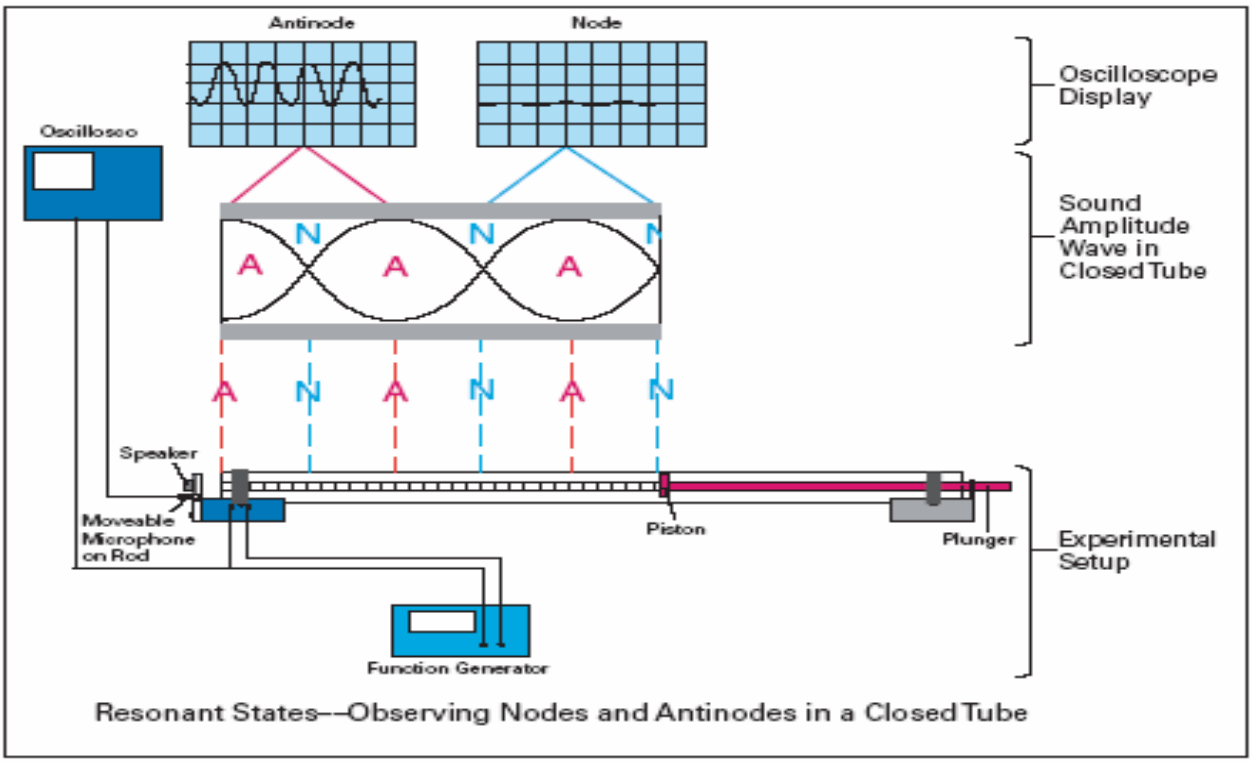
Typical Experiments:	**Expériences Typique :**
With Instructor's Guide and Sample Data.	Avec Le Guide D'instruction
1. Resonant Frequencies of a Tube	1. Fréquence de Résonance de Tube.
2. Standing Waves in a Tube	2. Etudie Les Ondes Dans Le Tube.
3. Tube Length and Resonant Modes	3. Modes de Résonance et longueur de Tube.
4. Speed of Sound in a Tube	4. La Vitesse dans Le Tube.



This DataStudio FFT display shows the frequency spectrum for a sound above 600 Hz recorded by the Resonance Tube's microphone.



The oscilloscope display above shows 2 traces: the green trace is the output signal from the Resonance Tube's microphone, and the red trace is the output signal from DataStudio's Signal Generator.



By fixing the length of the Resonance Tube with the movable piston, students examine the locations of nodes and antinodes using the movable microphone and oscilloscope display. They then determine the resonant frequencies (fundamental and overtones).

Includes:	**Equipment Required:**
1. 90 cm Acrylic Tube with mounting stand and built-in millimeter scale 2. Piston and Rod for adjusting tube length 3. Miniature Microphone4. Microphone Probe Rod for examining the waveform inside the tube 5. Speaker Assembly 6. Two holes with slip ring covers 7. BNC-to-Banana Plug Adapter (not shown— used to connect to *ScienceWorkshop* interface) 8. Instruction Manual and Experiment Guide (not shown)	**For Use With Science Workshop:** Science Workshop 750 interface (Page Voltage Sensor. Power Amplifier **For Use Without Sensors:** 20 MHZ Dual Trace Oscilloscope. Digital Function Generator