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# Speed of sound in a closed pipe using a sound card

Many Fourier analysis programs are now available for use with a sound card on a computer; some can be downloaded as free demo versions (e.g. Cool Edit available at [www.syntrillium.com](http://www.syntrillium.com)). Using a glass cylinder (2.2 cm diameter) filled with various amounts of water, and by blowing over the end, we made a tube resonate at different frequencies. The sounds were picked up with a microphone connected to a computer which measured the frequencies. With lengths of air from 4.9 cm to 18.5 cm the resonant frequencies were measured to be between 1484 Hz and 446 Hz. By assuming that the tube predominantly resonates sound waves whose wavelengths are  $4 \times$  length of the pipe we can deduce that length  $L = v/4f$  where  $v$  is the speed of sound in

the pipe and  $f$  is the resonant frequency. A suitable graph (for example  $f$  versus  $1/L$ ) yields the speed of sound—we made it  $345 \pm 3 \text{ m s}^{-1}$ .

The ease of analysis makes this arrangement ideal for further investigations. The change in frequencies can be measured in other musical instruments—from milk bottles containing water (blowing over the top or using them as percussion instruments) to strings of different lengths and tensions.

**S Nedev**

*Department of Physics, University of Chemical  
Technology and Metallurgy, Sofia, Bulgaria  
[Nedev@uctm.edu](mailto:Nedev@uctm.edu)*