

**ACOUSTICS2008/1784**  
**Nonlinear effects in the propagation of outgoing and reflected pulses inside a trombone**

Pablo L Rendón<sup>a</sup>, Felipe Orduña-Bustamante<sup>a</sup>, Jacques Sorrentini<sup>b</sup> and Antonio Pérez-López<sup>a</sup>

<sup>a</sup>CCADET, Universidad Nacional Autónoma de México, Ciudad Universitaria, 04510 Mexico, Mexico

<sup>b</sup>Institut Fresnel, UMR 6133 CNRS, Campus de Saint Jérôme, Av. Escadrille Normandie 13397, Cedex 20  
Marseille, France

While sound propagation in a trombone can be generally quite properly described by linear models, it is commonly acknowledged that the "brassiness" of sound produced at high amplitudes is associated to nonlinear effects. Whether these effects are due principally to propagation inside a long, narrow pipe, or to the production of sound at the mouthpiece is still unclear. We present experimental measurements taken both from a long, narrow tube, and an actual slide trombone from which it is observed that the scale of nonlinear effects seems to be greater for outgoing pulses than for the reflected pulses at the open end of the trombone or tube. A theoretical model is also proposed, based on weakly nonlinear perturbations of linear theory, and is validated both by experimental results and by numerical simulations. The results indicate that both the amplitude and the shape of the initial perturbation produced at the trombone mouthpiece have an effect on the scale of propagation nonlinearity present inside the trombone resonator, and thus also on the "brassy" quality of sound.