Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Pressure-driven wave propagation in mm-scale channels JOANNA AUSTIN, University of Illinois at Urbana-Champaign — Miniaturized analysis systems, which may potentially revolutionize detection of air-borne biological or chemical agents through increased portability and real time response, also present exciting fundamental challenges. Development of integrated total analysis systems will depend on optimizing the interaction of multiple components such as valves, injectors, pumps, and channels. In pressure-driven systems, such components may produce finite amplitude waves and wave attenuation may then be a key design factor in optimizing both devices that operate on steady-state assumptions and devices where unsteadiness is cultivated, for example mixers. A fundamental experimental investigation of wave propagation as a function of the channel size was performed. A shock wave is transmitted into mm-scale channels to achieve a well-characterized initial condition. Wave attenuation and structure information is obtained from time-of-arrival data and pressure histories along the channel. Experimental results are compared with models developed for the analogous flow regime of wave propagation through macroscale channels in low pressure environments.

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Date submitted: 27 Jul 2005 Electronic form version 1.4