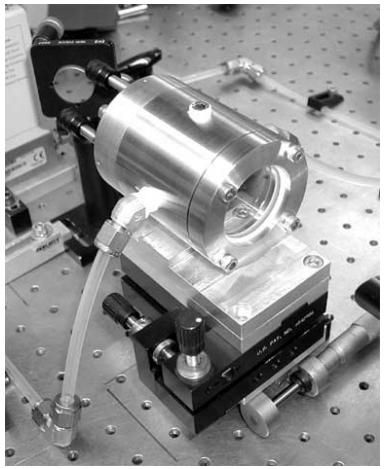
Proposed Method for Chemical Detection Using Acoustic Beamforming and Photoacoustic Spectroscopy

Background & Introduction

- The development of the Quantum Cascade Laser holds the key to effective chemical sensing

- Many sensing systems require that a sample must first be obtained and then confined within a cell adjacent to the system, limiting practical applications



- We propose a method that combines acoustic beamforming (BF) with photoacoustic spectroscopy to achieve remote sensing capabilities

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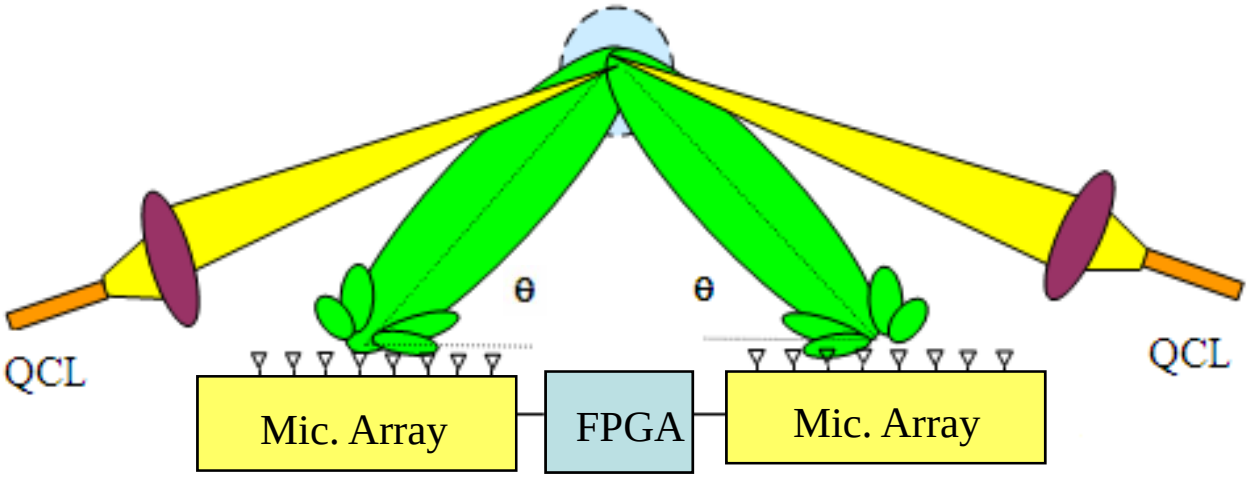
Experimental Setup



- Two microphone arrays whose beams are aimed at remote point
- Two tunable QCLs are aimed at the same location
- Sound from excited molecule amplified by BF with higher SNR
- The focal point of QCLs and acoustic beams can be dynamically changed to obtain a concentration map of a species in a given area

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Results & Future Work

- Single microphone amplification and digitization setup designed and tested
- Interface with FPGA and LabVIEW provides digital waveform for beamforming techniques

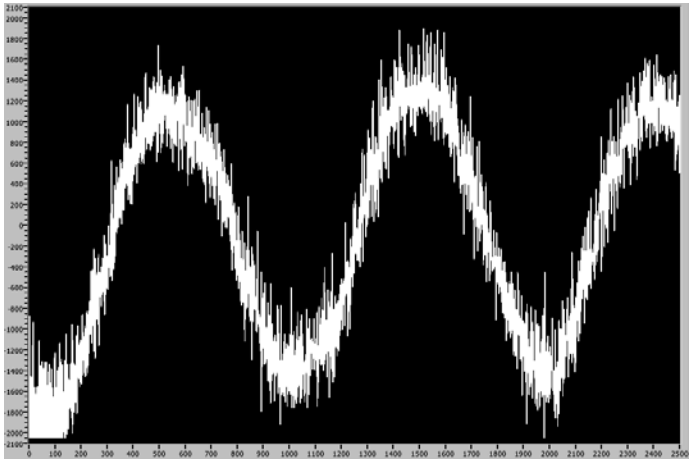

Fig. 1 FPGA output of a periodic analog signal picked up by the microphone

- Complete array system ready to be implemented