

3.019 Open-Path Hydrocarbon Laser Sensor for Oil and Gas Production Facility and Fenceline Monitoring.

Early Career Scientist

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Abstract:

We are developing a new open-path laser absorption sensor for measurement of unspeci-ated hydrocarbons for oil and gas production facility monitoring. Such measurements are necessary to meet regulations, to quantify greenhouse gas emissions, and to detect volatile organic compounds (VOCs) that may have adverse health effects or act as precursors to ozone formation. The present contribution presents a proof-of-principle demonstration of an open-path laser absorption sensor. Our initial design employs a single path measurement system though future implementations may use multiple paths for large scale facility monitoring. For example, a laser at a central location could be directed to multiple retro-reflectors around a perimeter or could target equipment and areas of interest given specific operational conditions. The laser sensor uses a compact mid-infrared (MIR) interband cascade laser at $\sim 3.41 \mu\text{m}$ to measure absorption of several contributing hydrocarbon species over open-paths of $\sim 50\text{-}100 \text{ m}$. Spectral simulations show that for typical concentrations of interest, the laser transmission drops by greater than $\sim 10\%$ providing a robust measurement. The contribution will include: design and laboratory (closed-path) testing of the sensor and initial outdoor open-path field tests. We will discuss signal levels, sensitivity, and signal fluctuations due to turbulence (beam steering) and aerosol extinction over the long path.