

Comments on "Lung Cancer Screening by Breath Analysis"

Groups Involved:

1. Quadrivium LLC, POB 1421, Pebble Beach CA (venture capital group?)
2. U. Cal San Diego Medical Center
3. Argonne National Labs
4. Texas A&M
5. New Star Lasers : lasers for medical uses, collaboration with Beckman Laser Institute of U. Cal., mainly Nd:YAG and Ho:YAG (no mention of CO₂ lasers on their web site)
6. UCLA
7. HARC (?)

As best I can tell from the limited scientific content of the video, the researchers propose to use a photoacoustic gas cell and a CO laser to measure specific selected VOCs in expired breath as a biomarker for the early detection of lung cancer. There is certainly evidence in the scientific literature that this technique should be able to detect a concentration of ppbV (ca. ng) of a specific analyte in a complex gas mixture (see attached literature search). Advantages include: high spectral resolution (0.017 cm⁻¹) from the laser, high power density from the laser, large linear range of PA signal vs concentration (4 orders of magnitude), a zero background technique (like an emission expt) where all the signal is from the sample. In the experimental set-up, the laser is continuous wave (CW) and the light is chopped (amplitude modulated, AM), so that the resulting PA signal can be demodulated by a lock-in amplifier. I think AM rides on top of a constant DC offset which lowers the dynamic range of the LIA. Other types of modulators other than a chopper wheel are available, but I don't think they are applicable here (photoelastic modulator, opto-acoustic modulators, phase modulation from a Michelson interferometer).

Most studies in the literature have used a CO₂ laser (9.2 - 10.8 μm or 1020-926 cm⁻¹). I am not sure why they propose to use a CO laser here, unless the researchers already know what lines of what analytes (acetone and 2-butanone) they need to monitor.

I believe the uncertainty lies in the physiology of the malignant lung cancer itself: does it produce a large enough concentration of the chosen analyte to quantify (to choose a line free from interferences with a sufficient level of detection). The initial proof of principle study, growing cell cultures in a petri dish, should establish feasibility.