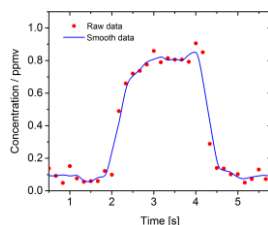
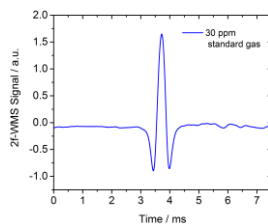


The [Applied Laser Spectroscopy Group](#) at the [Department of Applied Physics and Electronics](#), Umeå University announces thesis projects in the field

Real-time breath gas analysis using laser spectroscopy

The **Applied Laser Spectroscopy Group** develops laser-based spectrometers and techniques for detection of atomic and molecular species in gas-phase. Current applications are quantification of biomarkers in exhaled breath and in situ combustion diagnostics to investigate thermochemical biomass conversion. The Department of Applied Physics and Electronics hosts strong research environments in medical technology and energy science.

A research topic of particular interest is to study the health effects of air pollution, i.e. of exposure to gaseous and particulate emissions from (incomplete) combustion of fossil and biomass fuels. To this end, we have recently developed an instrument for real-time detection of carbon monoxide (CO) in exhaled breath using absorption spectroscopy with mid-infrared laser sources, such as a quantum cascade laser (QCL). Exhaled breath CO (eCO) is a potential biomarker for air pollution health effects.



Thesis project 1: Design and implement an online sampling system for exhaled human breath. The sampler will include a buffer tube and enable real-time measurements of eCO₂ and exhalation flow rate using an available commercial capnograph and a flow meter, respectively. LabVIEW code should be developed that handles data acquisition and display and provides audio-visual feedback for patients to keep a constant tidal volume and respiration rate.



Thesis project 2: Use the existing eCO instrument to conduct a detailed study of the baseline of exhaled breath CO in healthy persons (e.g. your breath). Investigate, for example, how the CO concentration varies over time (day, month), after food and drink intake, exercise and exposure to external CO sources (e.g. combustion gases and cigarette smoke).



The projects are suitable for students who have an interest in medical diagnostics and knowledge in **sensor design**, **signal processing** and **electronics**. Experience with experimental work and **LabVIEW** and **Matlab programming** is desired. The student has the opportunity to get involved with laser spectroscopy and exhaled breath gas analysis. Thesis topics other than the above mentioned can be discussed.

For more information contact [Florian Schmidt](#) (florian.schmidt@umu.se).