

IrSens: QCL based MIR spectroscopy for fluids and gases

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Objective: Realization of a compact platform for spectroscopy of low concentration molecules in liquids and gases.

Means: Use of the strong absorption lines in the Mid-Infrared (MIR) due to fundamental vibrational and rotational modes of molecules.

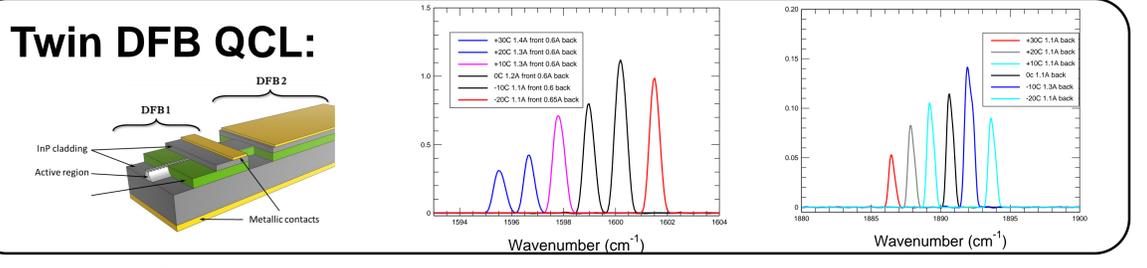
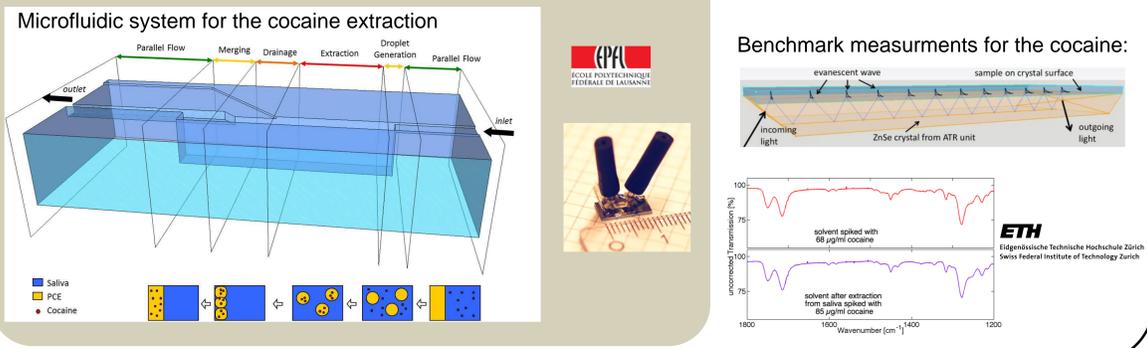
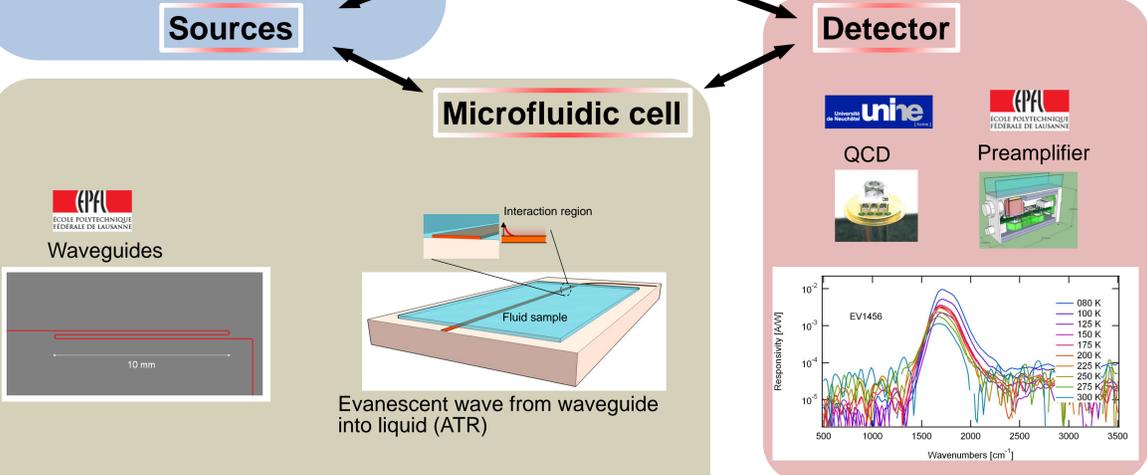
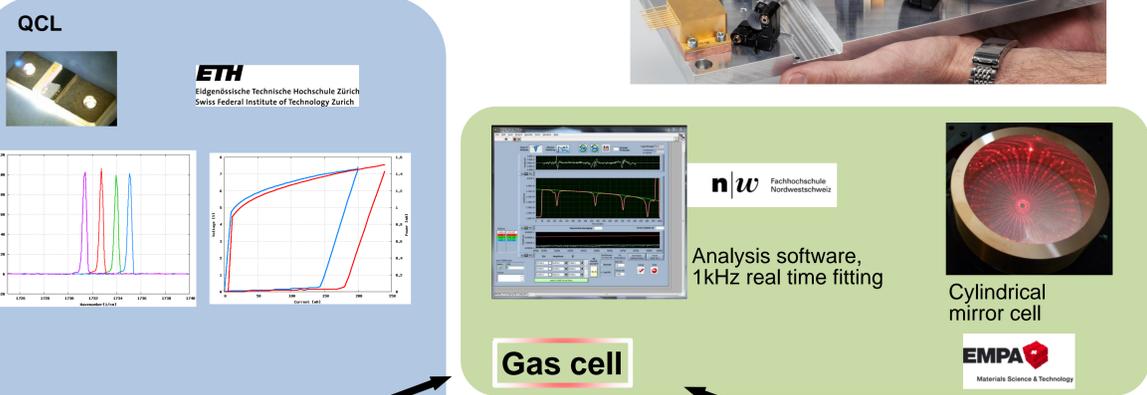
Targets for demonstrator:

- Fluids: detection of cocaine in the saliva. Challenging goal due to the complex composition of saliva which can be different for every persons
- Gases: measurement of CO₂ isotopes. Challenging because of the very low concentrations involved.

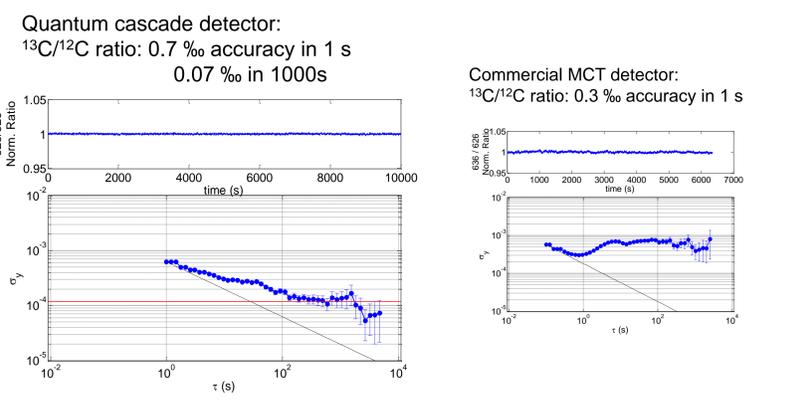
Collaboration:



Systems and Components



Gas measurements: CO₂ isotopes

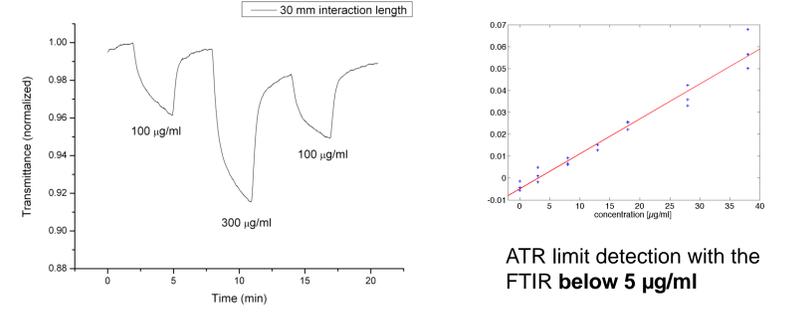


- High accuracy isotope measurements with toroidal cell achieved
- Goal of 0.1 ‰, necessary for health and environmental applications, is reached
- First successful combination of QCL with QCD: all III-V detection

Direct Absorption	Wavelength Modulation	Photoacoustics	Picarro (CRDS reference)
0.47	0.76	58.0	0.67
0.05 (250s)	0.07 (450s)	0.60 (8000s)	0.1 (300s)

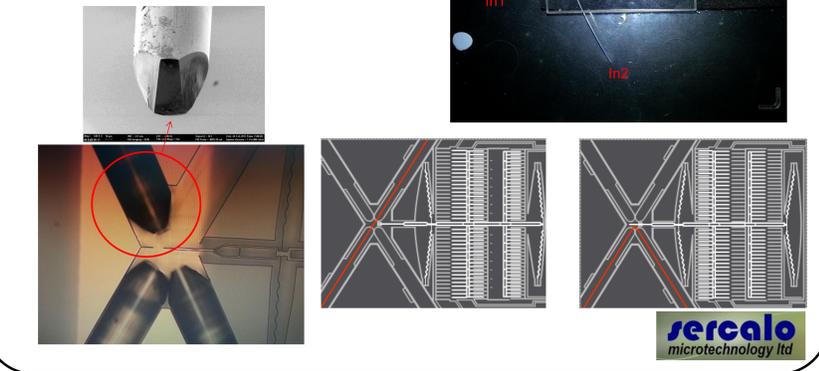
1 sec (first line) and best precision values (last line, with integration time) in ‰ for different techniques with IrSens prototype 1st generation cell with commercial MCT detector, in comparison to commercial (Picarro) CRDS NIR system
Manninen et al., Applied Physics B (2012)

Fluid measurements: cocaine



Absorption due to different concentrations of cocaine measured with the microfluidic system on top of the waveguide.
Concentration in saliva after one dose of cocaine ~500 µg/ml

Optical switch: coupling of optical fibers



Add-on IrNox:
Approaches for single optical output of several independent single mode lasers

