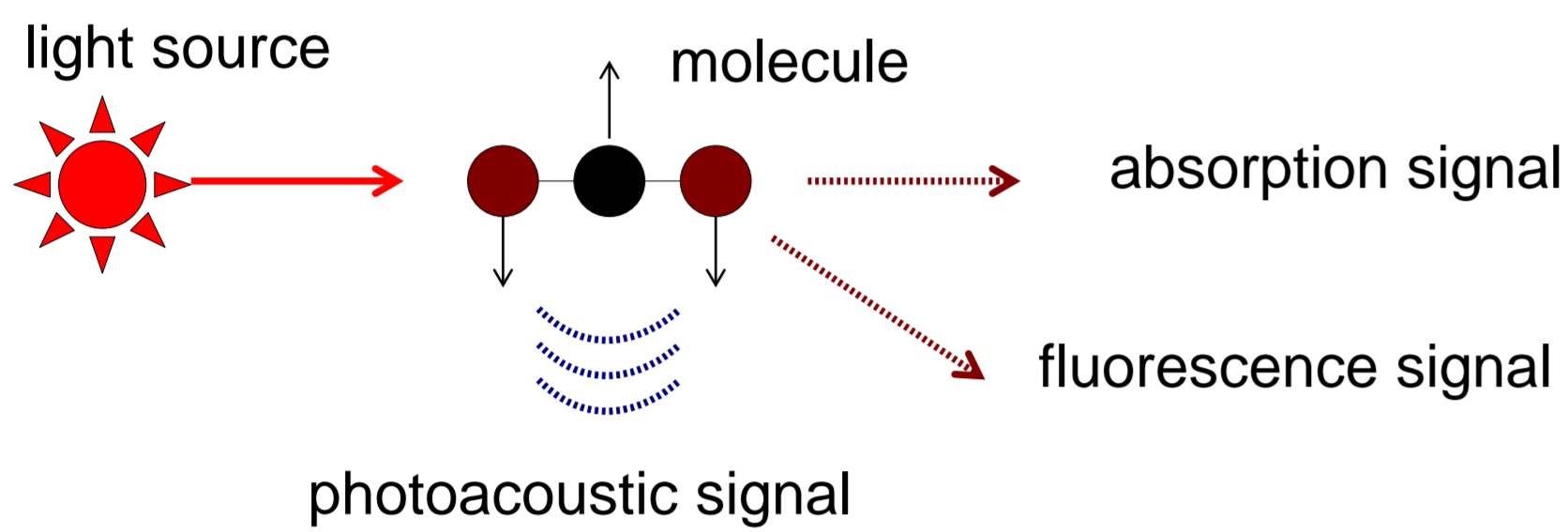


IrSens: from Ideas to Measurements in Mid-Infrared Spectroscopy

Pierre Jouy, Yargo Bonetti, Jérôme Faist

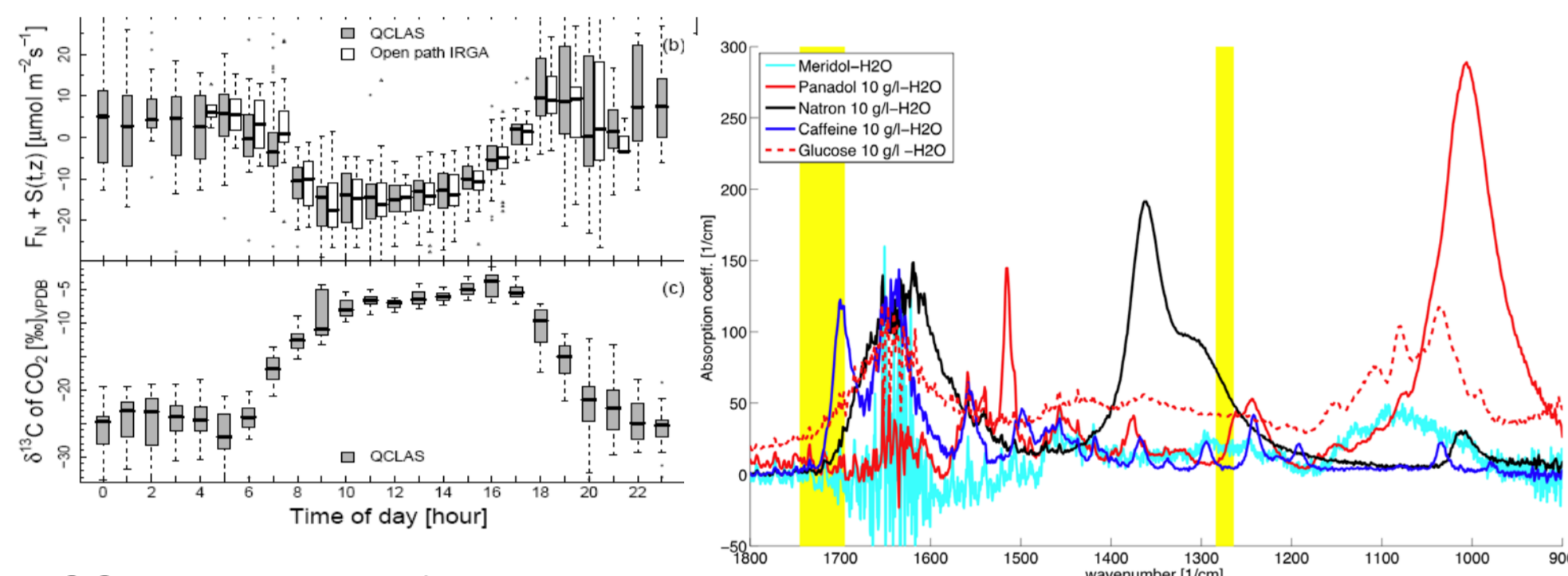
ETH Zürich, Institute of Quantum Electronics, Quantum Optoelectronics Group

Spectroscopy



Possible applications

- Environment: NO_x, NH₃, CO₂ (isotopes for plant respiration)...
- Body liquids, respiration: drugs, tracers



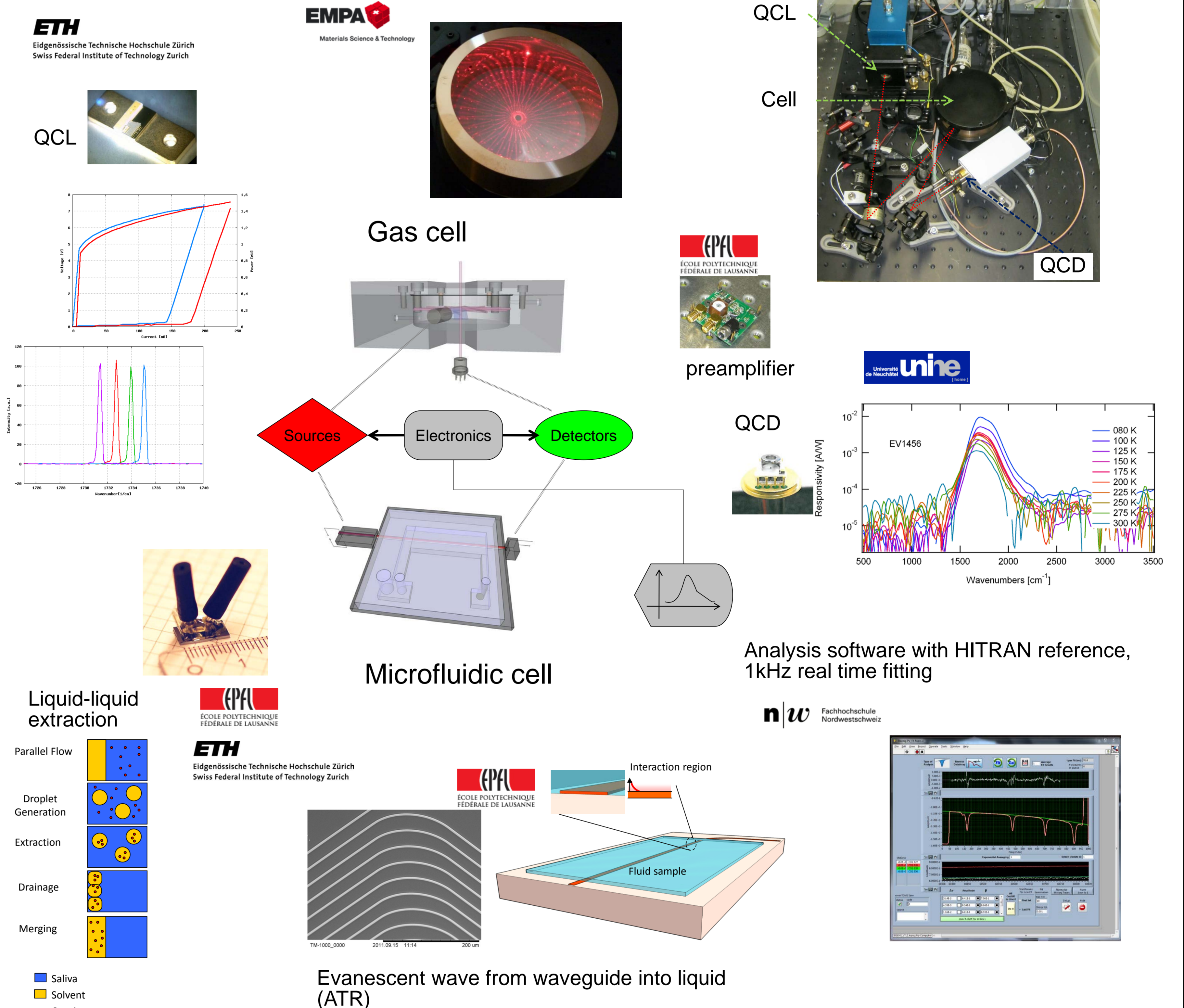
CO₂ isotopes and flux, showing daily plant respiration
Biogeosciences D (2009)

Spectra of various drugs in water
K.Hans, ETH Zürich 2009

Needs / Desires

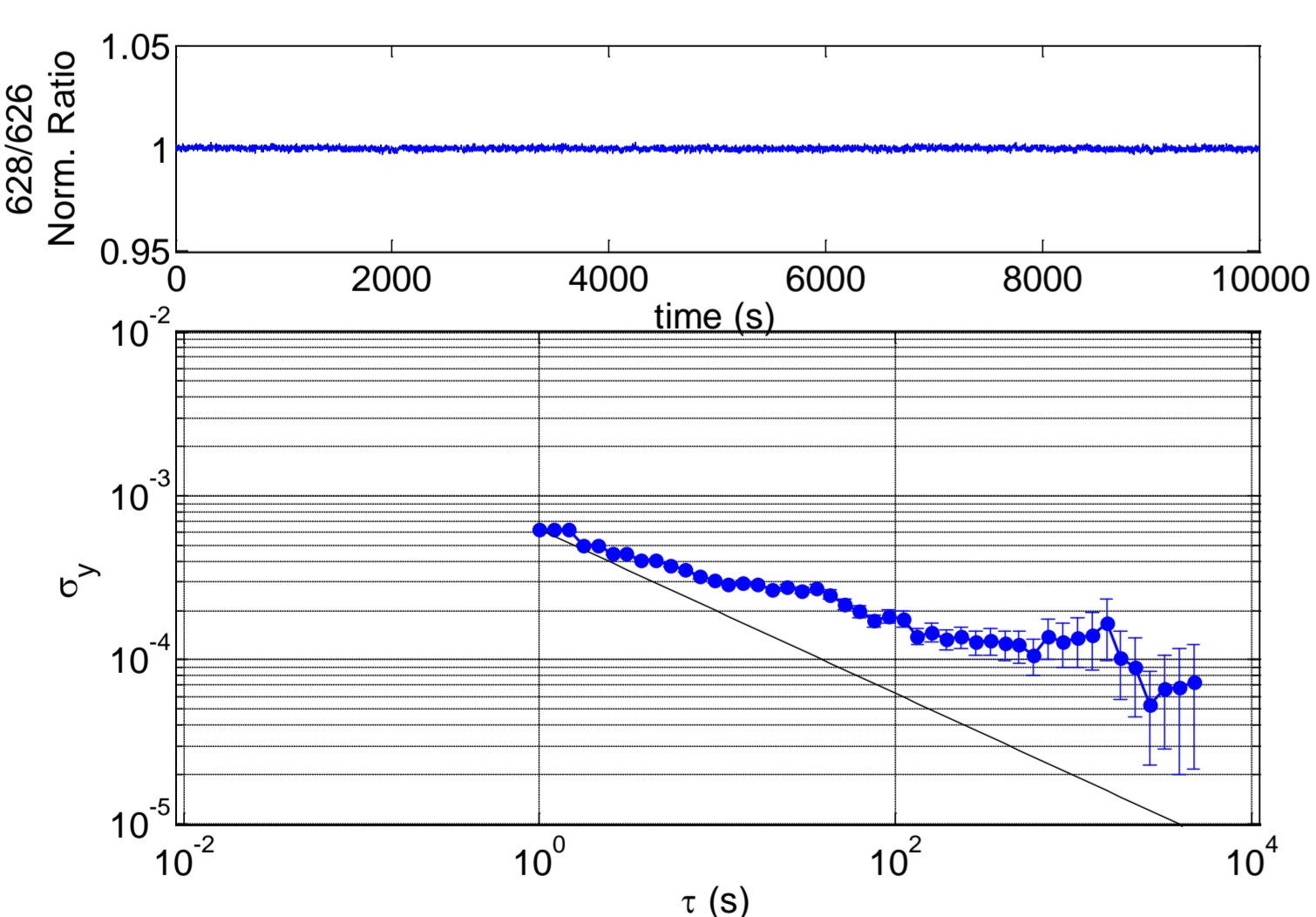
- Mid-infrared sources and detectors
- Scanning around molecular lines
- Easy interaction with user
- Reproducibility and Stability
- Portable and low consumption

System and Components



Gas measurements: CO₂ isotopes

¹³C/¹²C ratio: 0.6 ‰ accuracy in 1 s, measured with QCD and toroidal cell



1 sec (top) and best precision values (bottom, 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

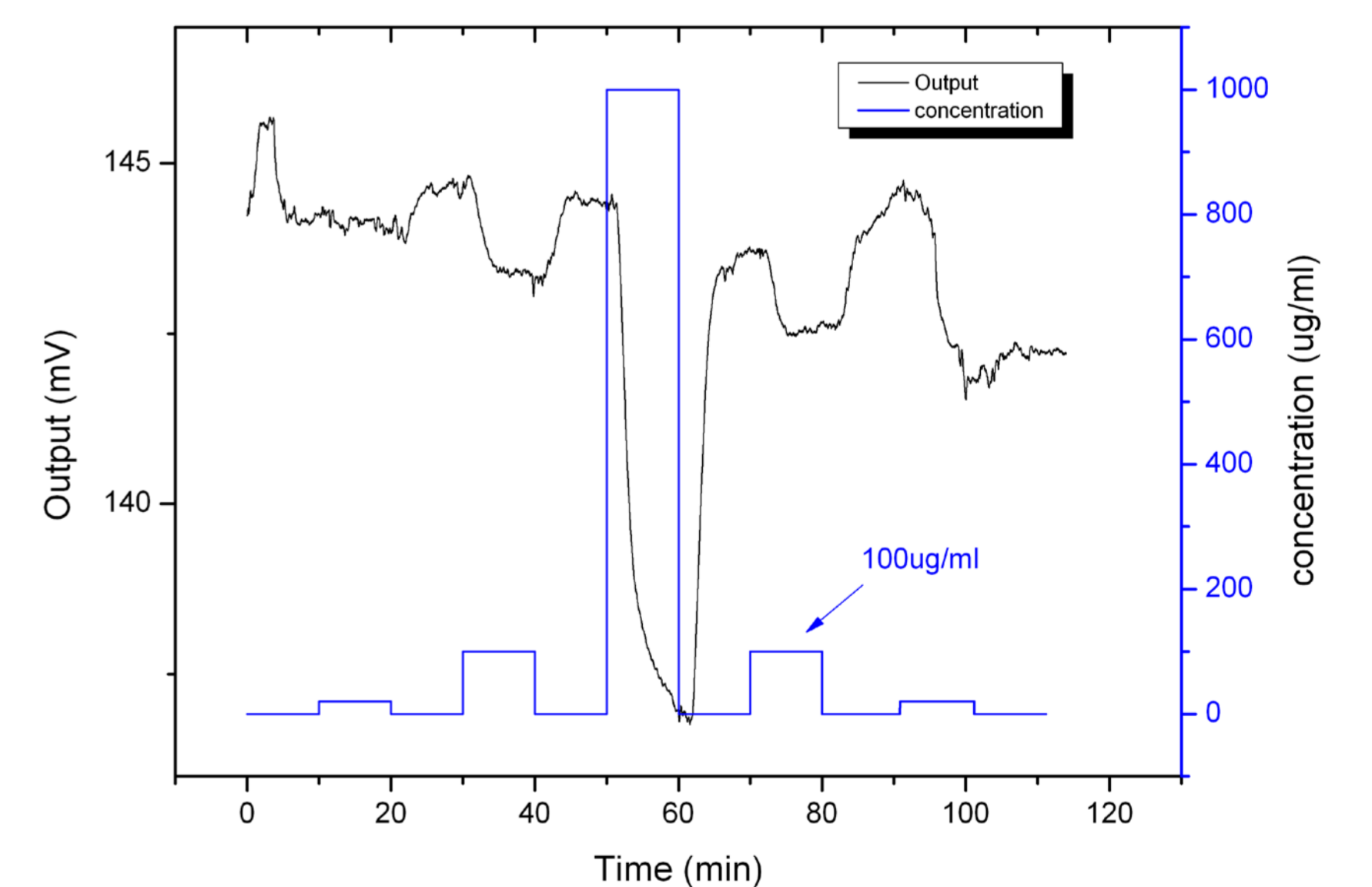
Direct Absorption	Wavelength Modulation	Photoacoustics	Picarro (CRDS reference)
0.47	0.76	58.0	0.67
0.05 (250s)	0.07 (450s)	0.60 (8000s)	0.1 (300s)

Manninen et al., Applied Physics B (2012)

Fluid measurements: cocaine

Microfluidic cell on top of Ge/Si waveguide
measurement of output signal from QCL emitting at 6µm

showing absorption of cocaine with different concentrations in C₂H₄ solutions



work in progress

- better integration for reduced sizes
- better QCD preamplifier for improved S/N
- better waveguides
- complete microfluidic system

