CETIEB
WP3 – Monitoring

Task 3.2: Development of an infrared optical VOC sensor based on tunable filter technology

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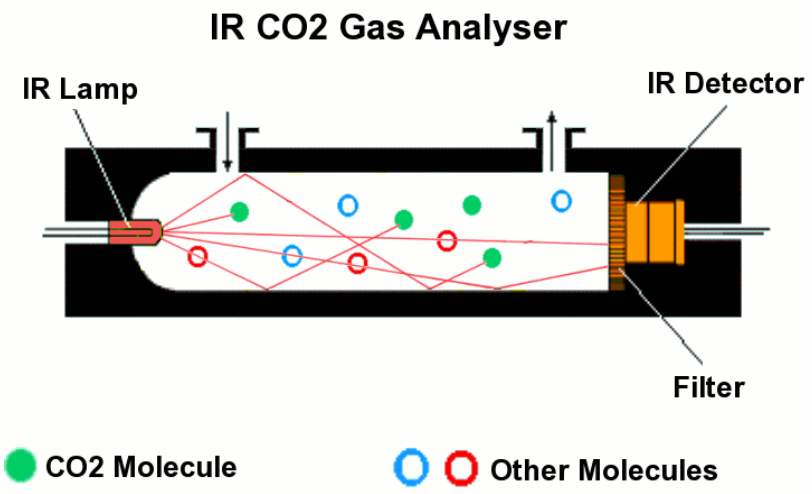
Jochen Huber, Katrin Schmitt
Fraunhofer IPM

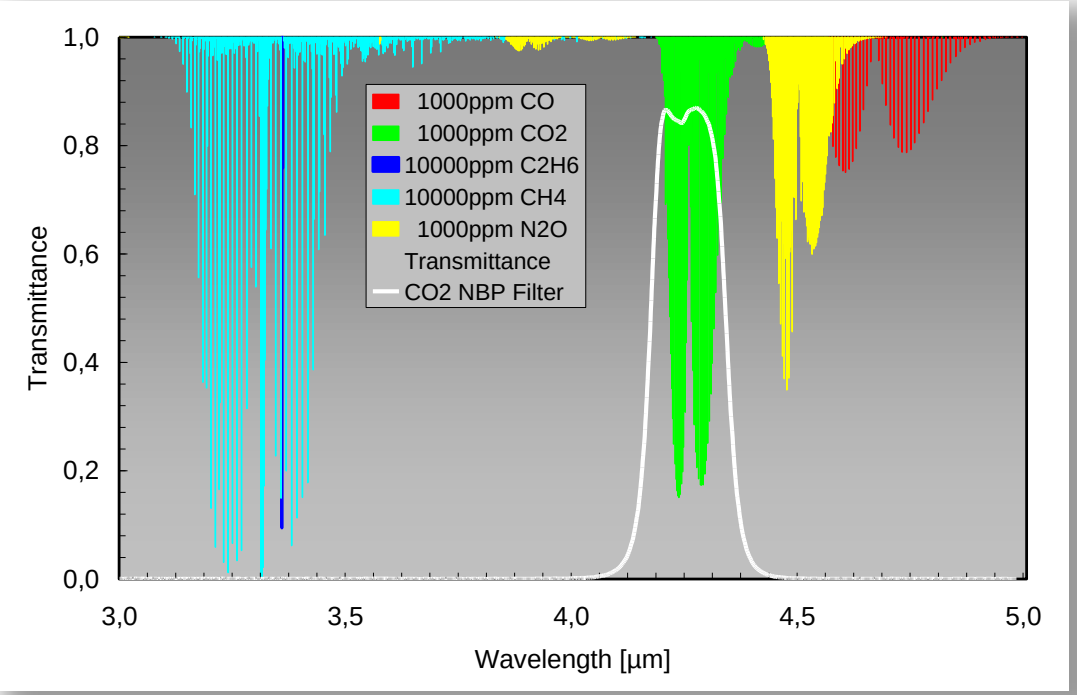
Martin Ebermann, Norbert Neumann
InfraTec GmbH

Objectives

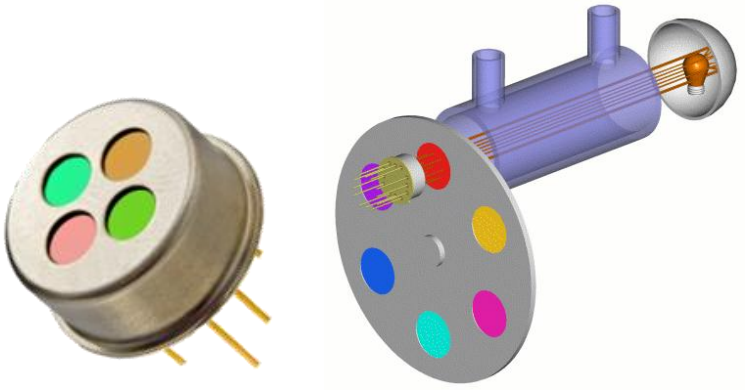
- Volatile Organic Compounds (VOCs) are harmful/toxic substances
- Possible sources: furniture, carpets, paints, cleaning agents, …
- Big impact on the indoor environment, comfort and health
- Development of a VOC sensor:
  - with high sensitivity (ppb range)
  - able to discriminate different VOCs
  - portable and able to measure online
- Up to now, no such sensor exists on the market.

IR Absorption Spectroscopy



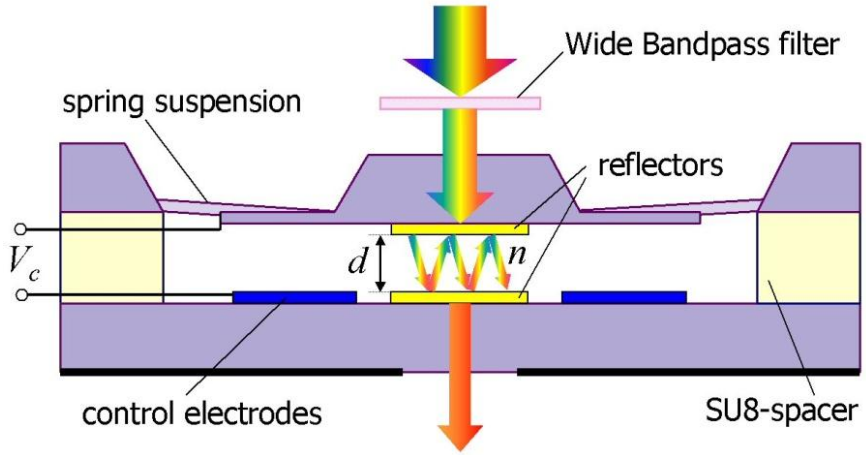


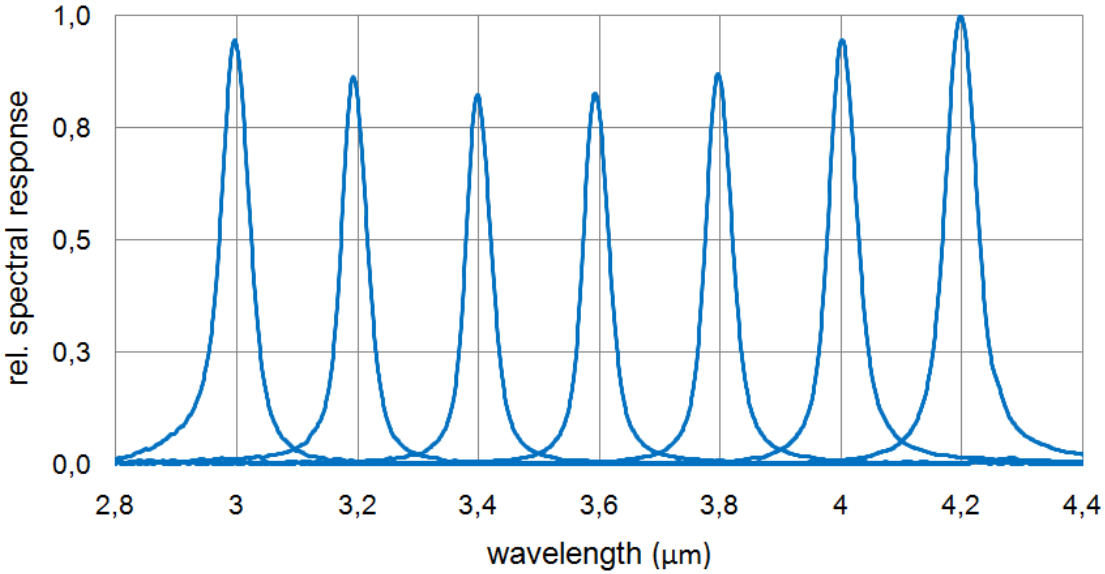
- Substance specific absorption spectra
- NDIR (nondispersive IR) gas analyzers:
  - broad band IR source and detector
  - narrow band filters (fixed wavelength)

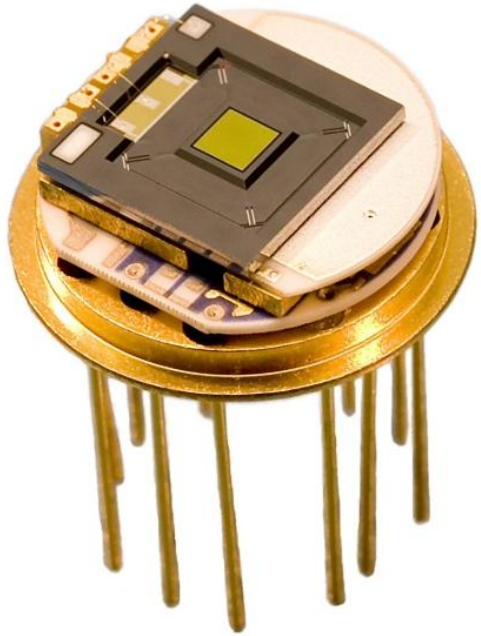


Microspectrometer engine (3 – 4,3 µm)

- tunable MEMS Fabry-Pérot filter
- pyroelectric detector







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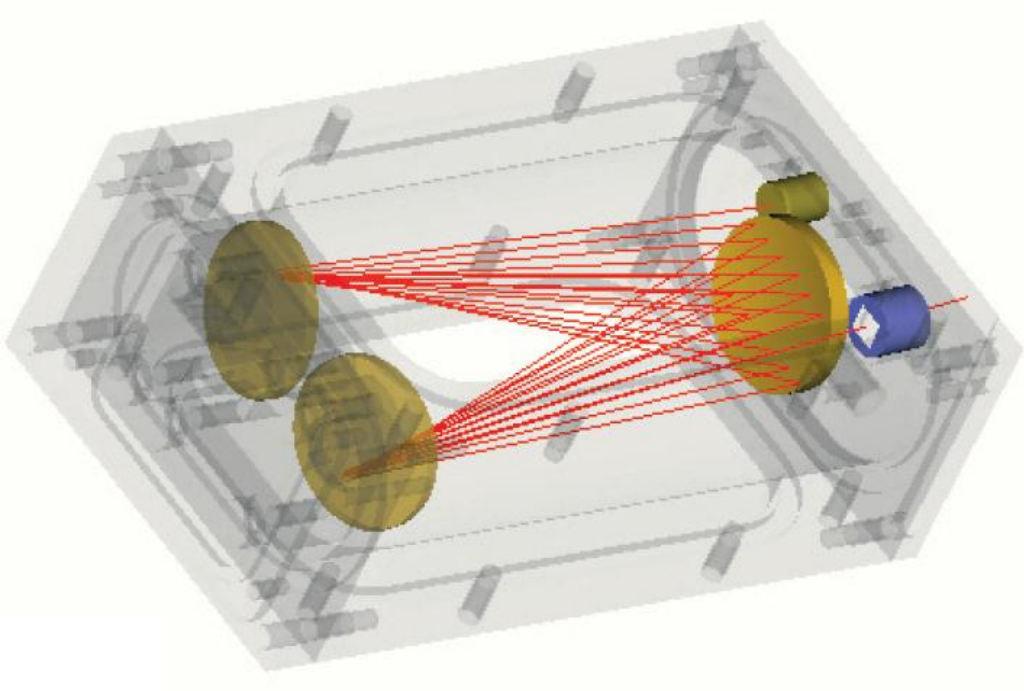
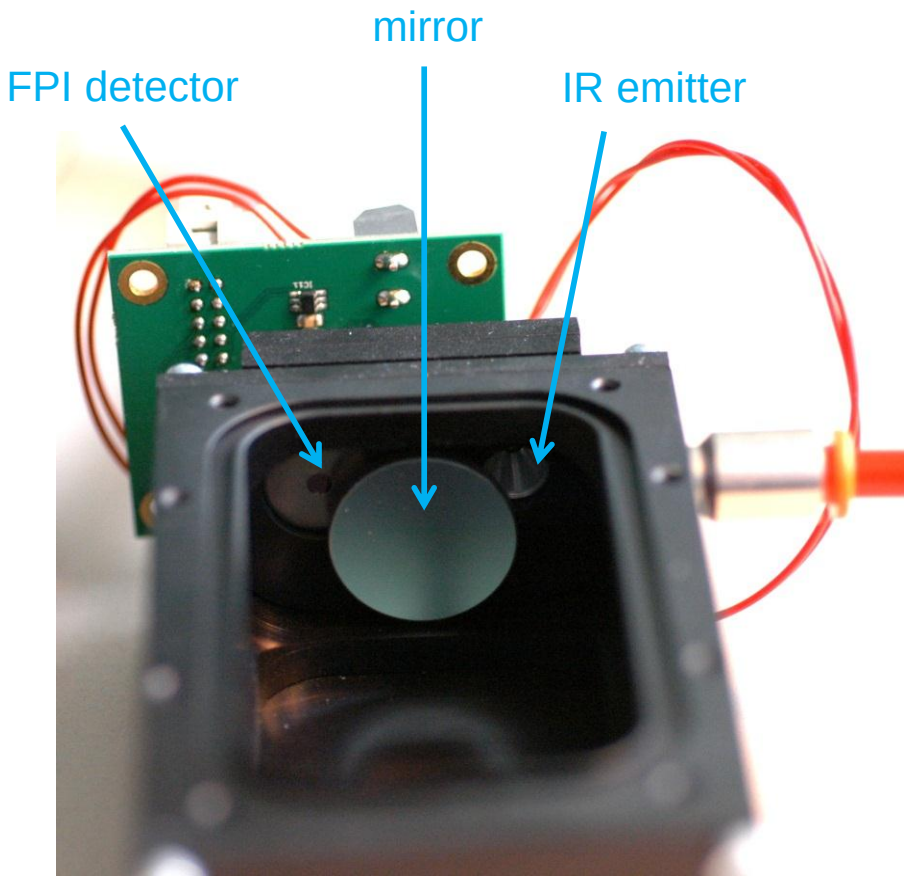
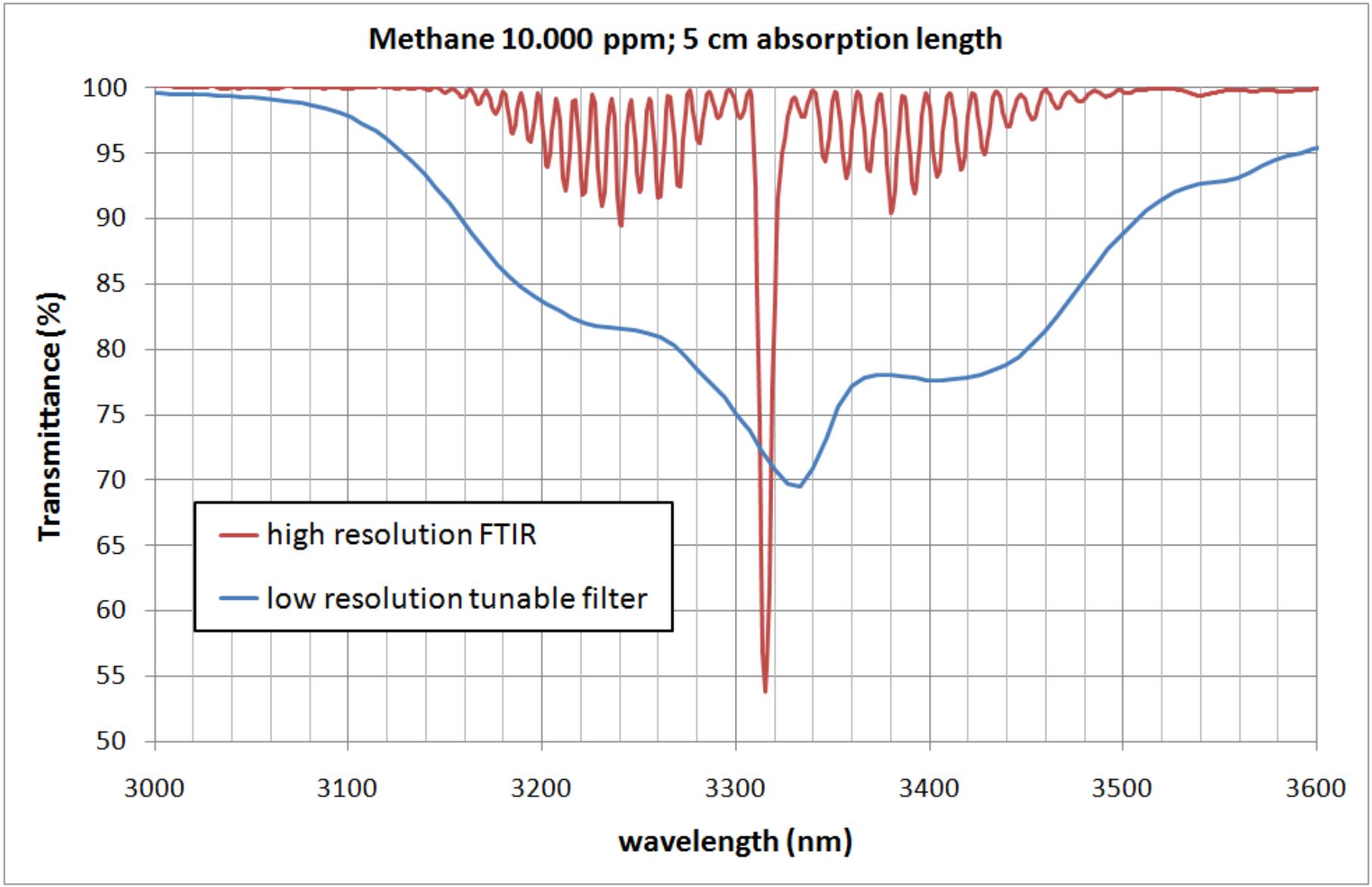
Sensor prototype



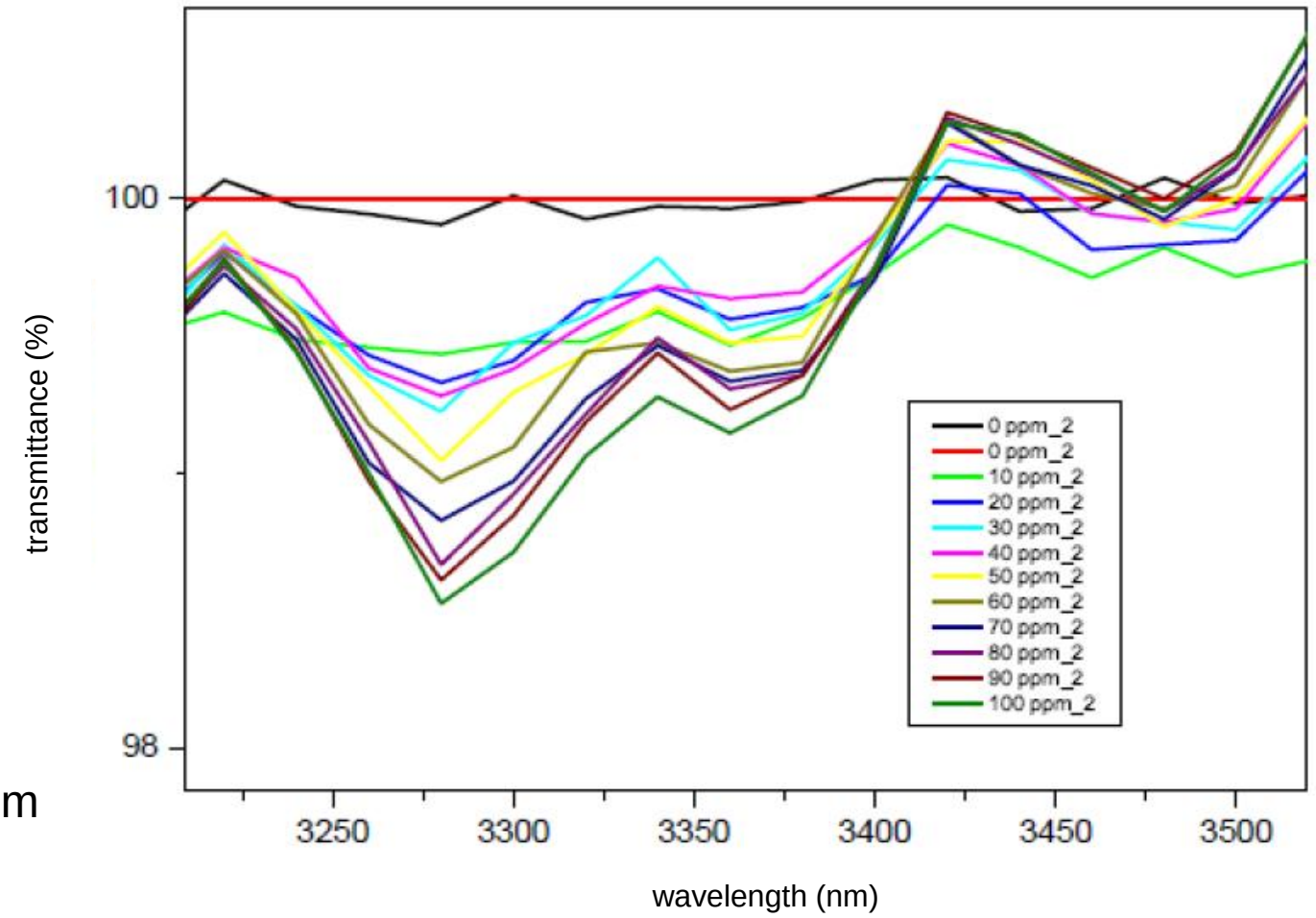


- IR long-path cell (~1,6 m, multireflection)
- Thermal infrared emitter (pulsed, 5 Hz)
- Small concentrations can be measured

Infrared absorption of methane (CH_4)



CH_4 measurement

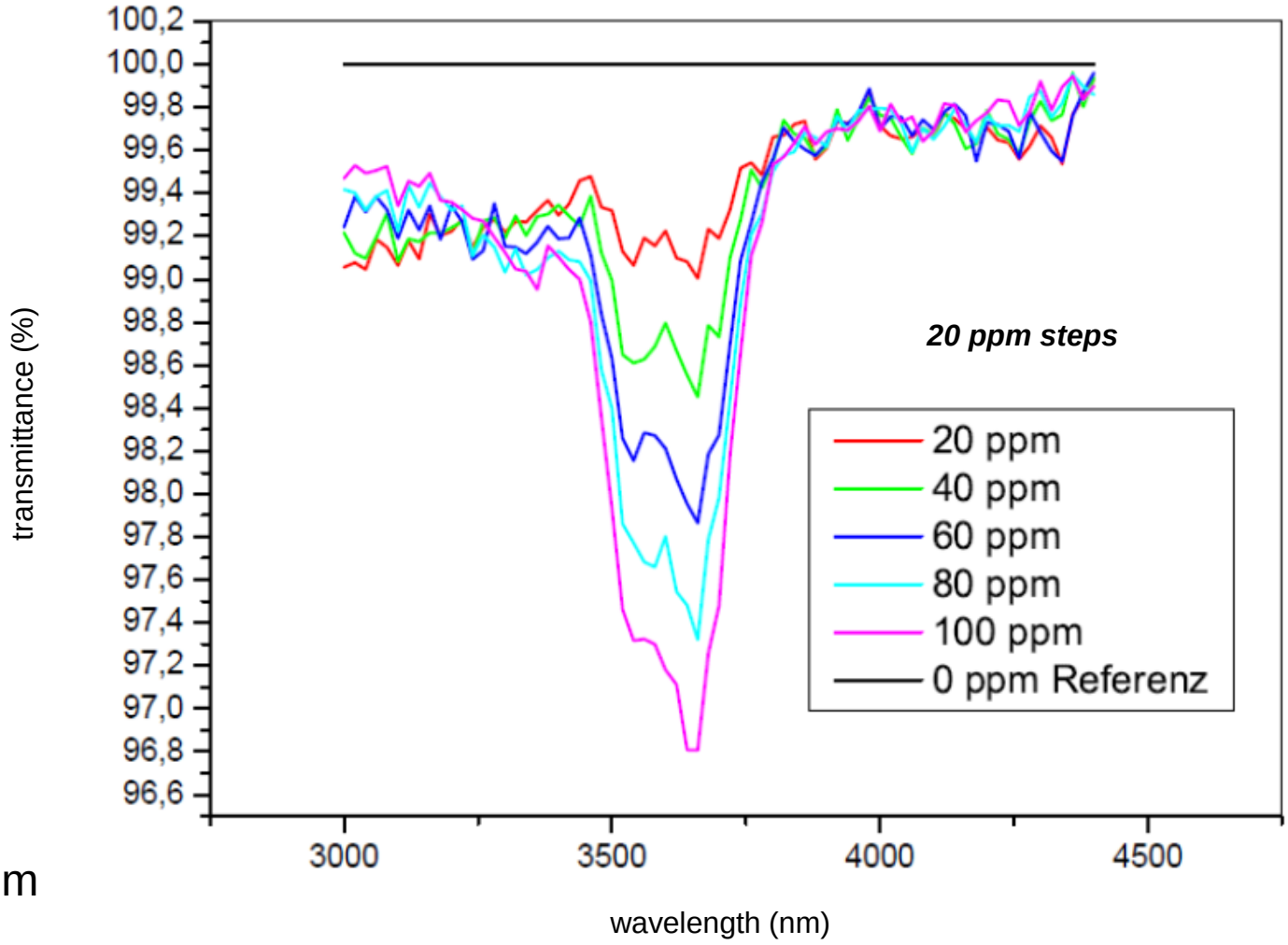


- detection limit ≈ 2 ppm
- resolution ≈ 5 ppm
- specific pattern visible
- normal ambient CH_4 concentration 1,75 ppm

Fraunhofer IPM InfraTec

Acetaldehyde

(Ethanal, C_2H_4O)



- detection limit < 5 ppm
- resolution ≈ 5 ppm
- specific pattern visible

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Summary

- Portable mid IR spectrometer
- High sensitivity and resolution for methane and acetaldehyde demonstrated
- Storage of measured spectra over sensor node

To be done:

- Test with more gases / VOCs, other wavelength ranges
- Automatic pattern recognition and calibration, combination with other sensors
- Field test