



**European Network on New Sensing Technologies for Air Pollution
Control and Environmental Sustainability - *EuNetAir***
COST Action TD1105

INTERNATIONAL WG1-WG4 MEETING on

New Sensing Technologies and Methods for Air-Pollution Monitoring

European Environment Agency - EEA

Copenhagen, Denmark, 3 - 4 October 2013

Action Start date: 01/07/2012 - Action End date: 30/06/2016 - Year 2: 2013-2014 (*Ongoing Action*)

**Low-Cost NDIR based Sensor Platform for sub-ppm
Gas Detection**

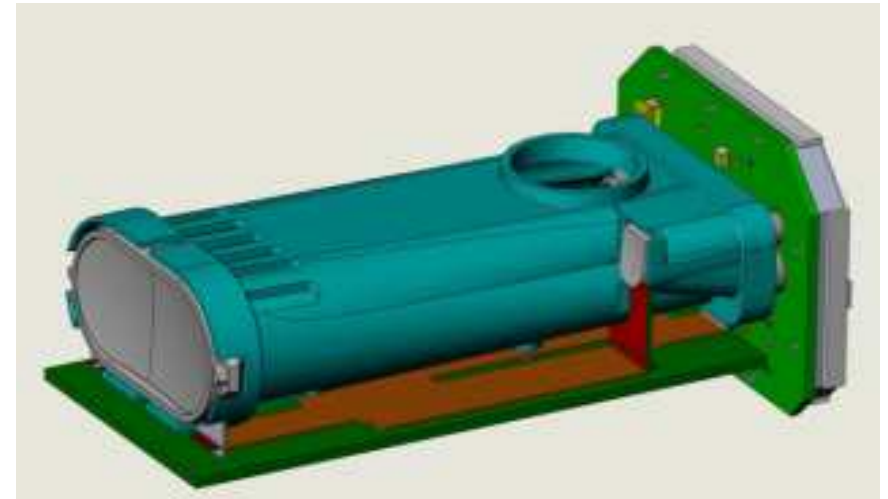


Markus Norén

Senseair AB / Sweden

Low-Cost NDIR based Sensor Platform for sub-ppm Gas Detection

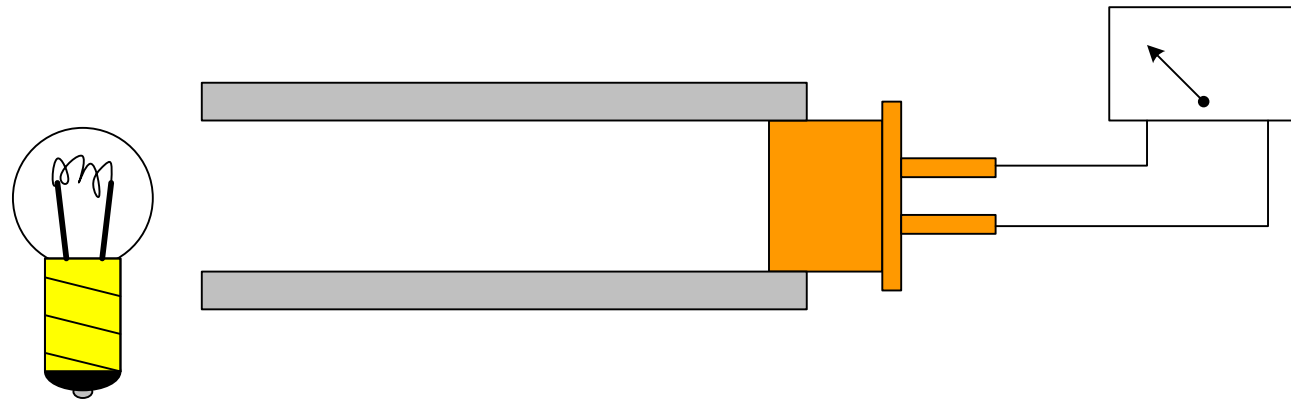
- A spin off from our driver assistance system for alcohol detection development in cooperation with Autoliv.
- Robust and suitable for mass production.
- Sub-ppm resolution.
- Adaptable for other gases.



The platform itself is a resource for the gas sensing community.

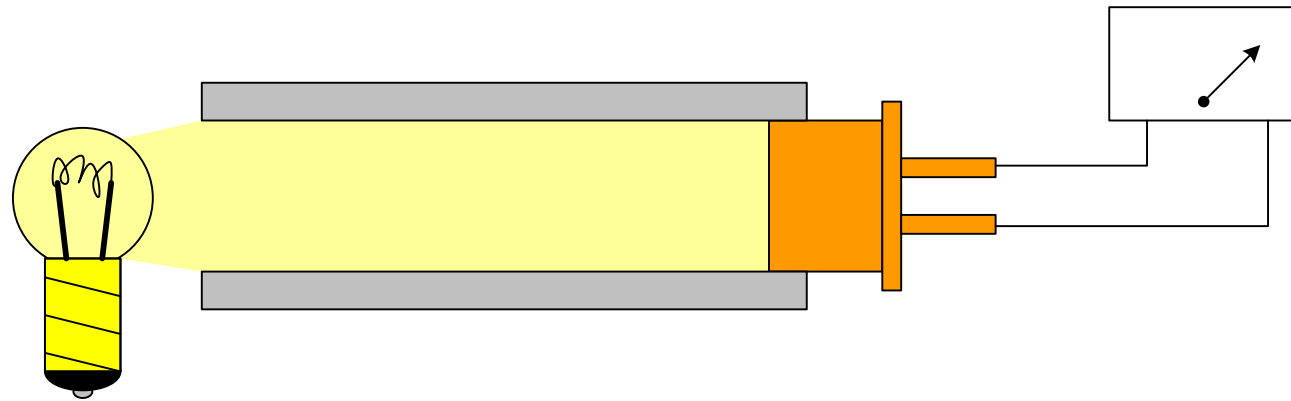
Low-Cost NDIR based Sensor Platform for sub-ppm Gas Detection

A reminder on NDIR technology...



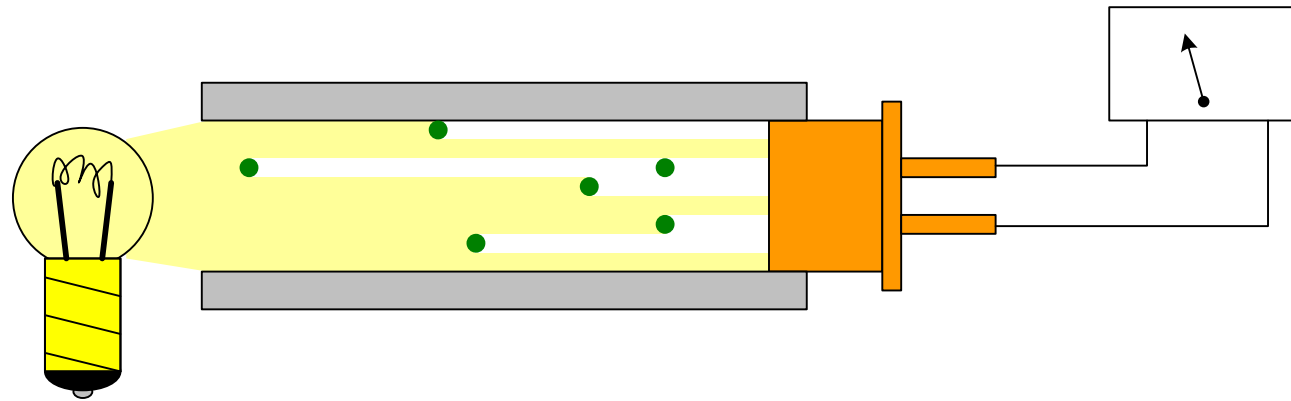
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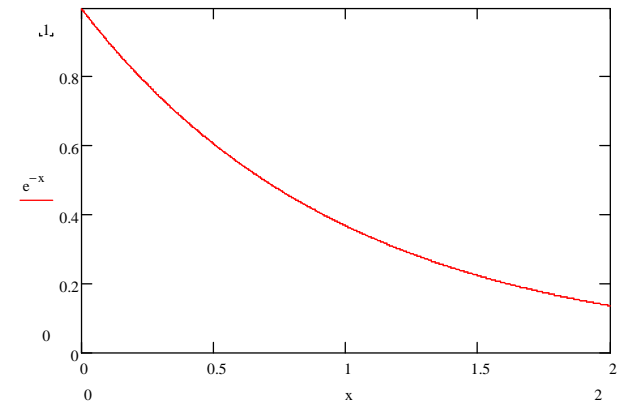


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A reminder on NDIR technology...

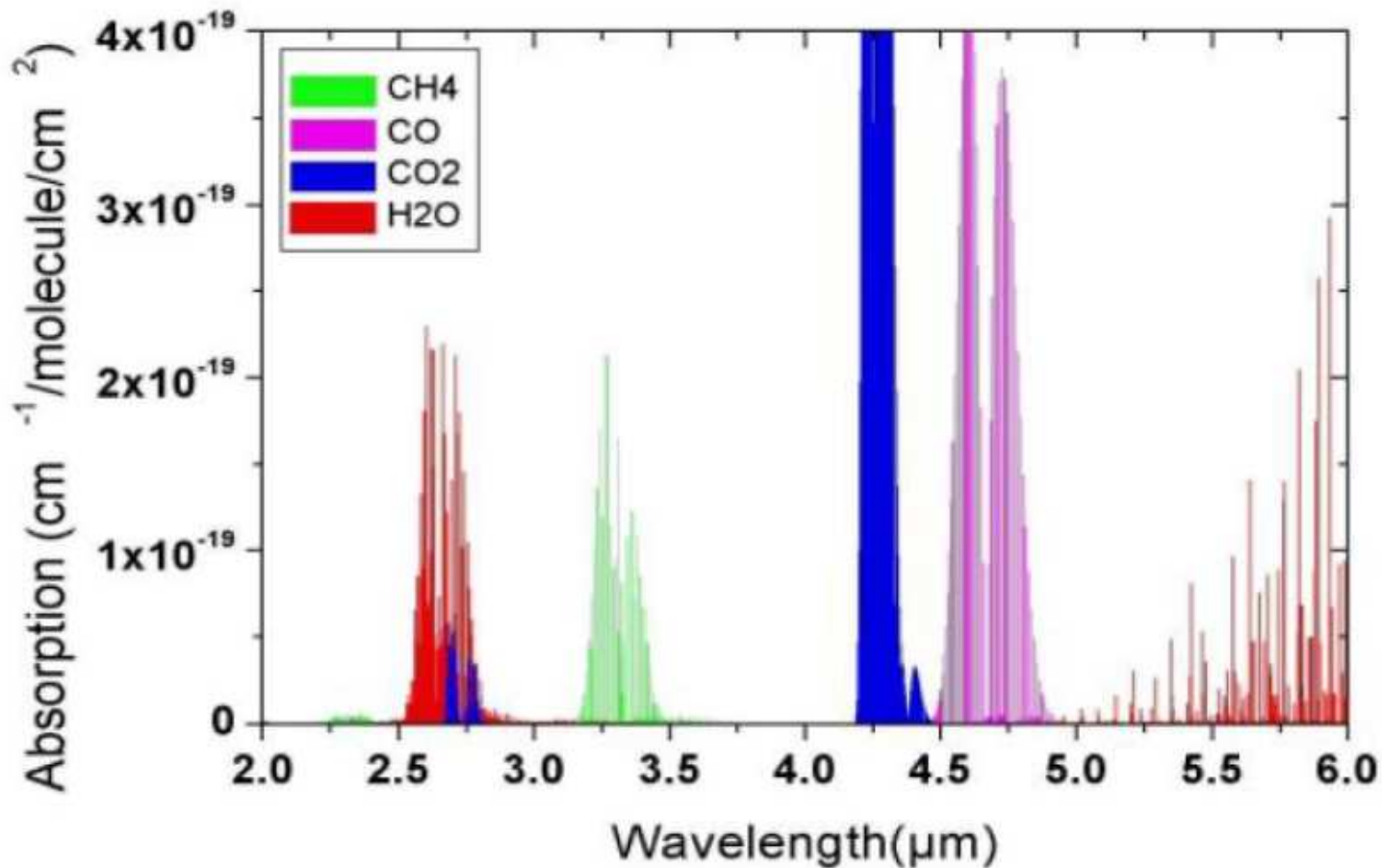


$$T = \frac{I_1}{I_0} = e^{-\alpha' l} = e^{-\sigma l N}$$



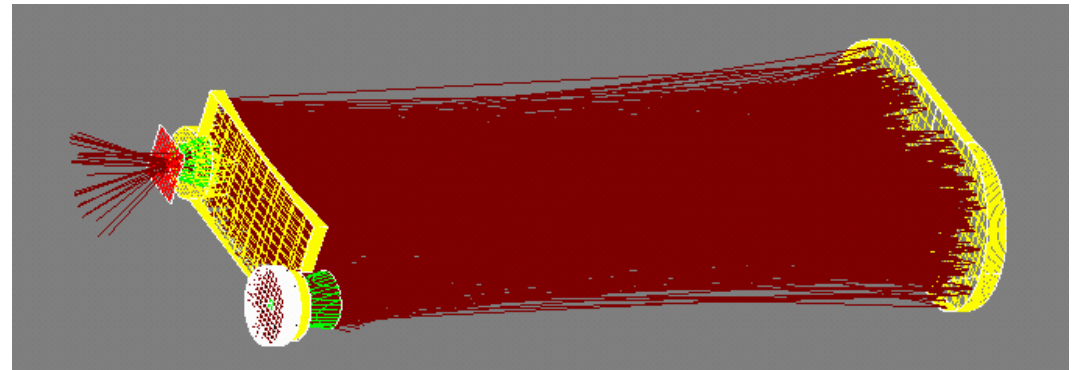
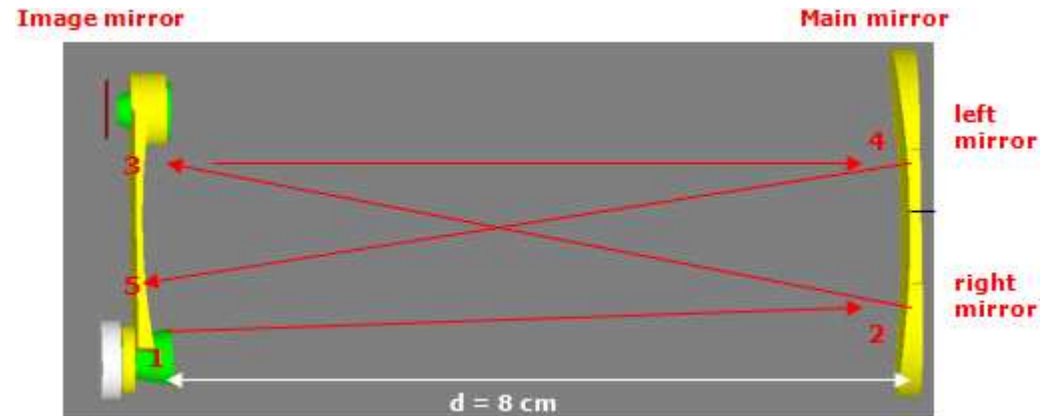
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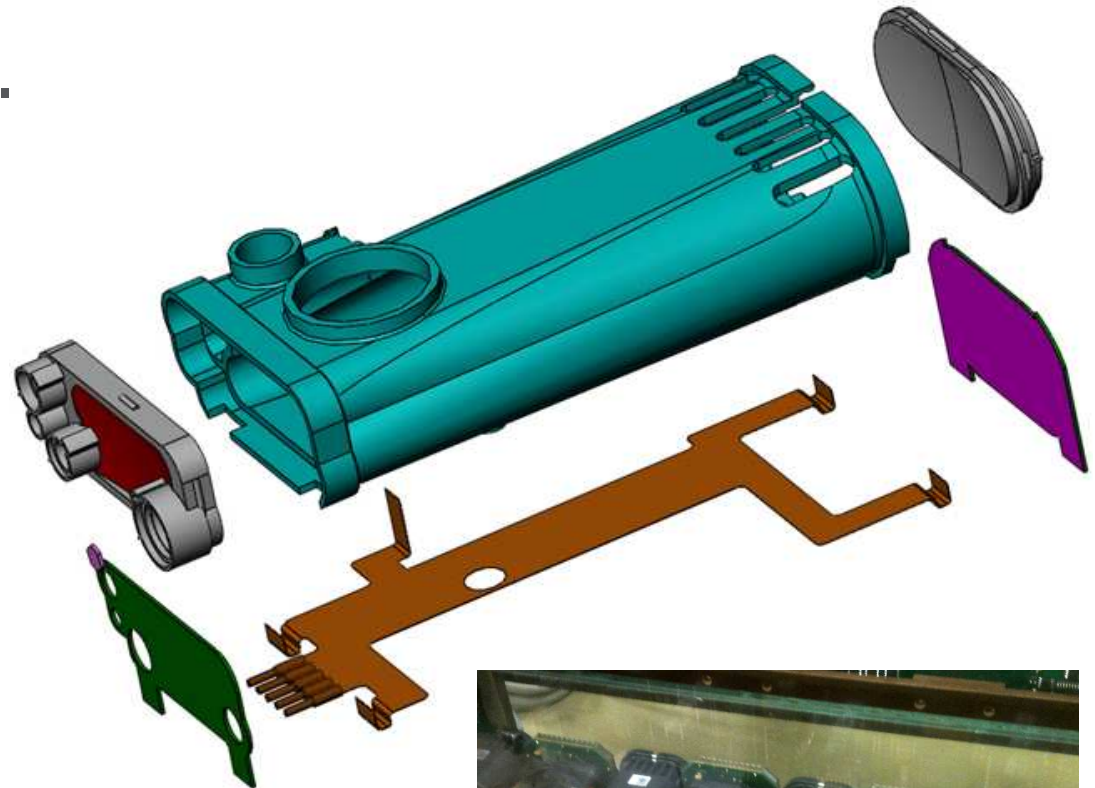
Low-Cost NDIR based Sensor Platform for sub-ppm Gas Detection

- White cell implementation.
- 1.28 m optical path.
- Stable and accurate plastic material (CRE).
- Temp. controlled optics.
- Electronics with high resolution, high stability and high electro magnetic immunity.
- Advanced measurement scheme and algorithms.
- Large temperature span -40°C -- $+85^{\circ}\text{C}$



Low-Cost NDIR based Sensor Platform for sub-ppm Gas Detection

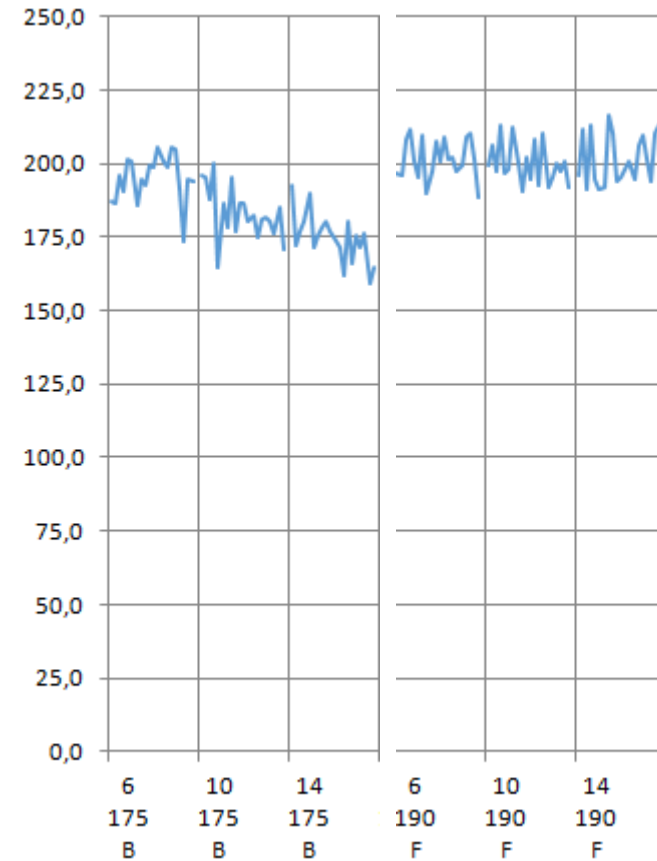
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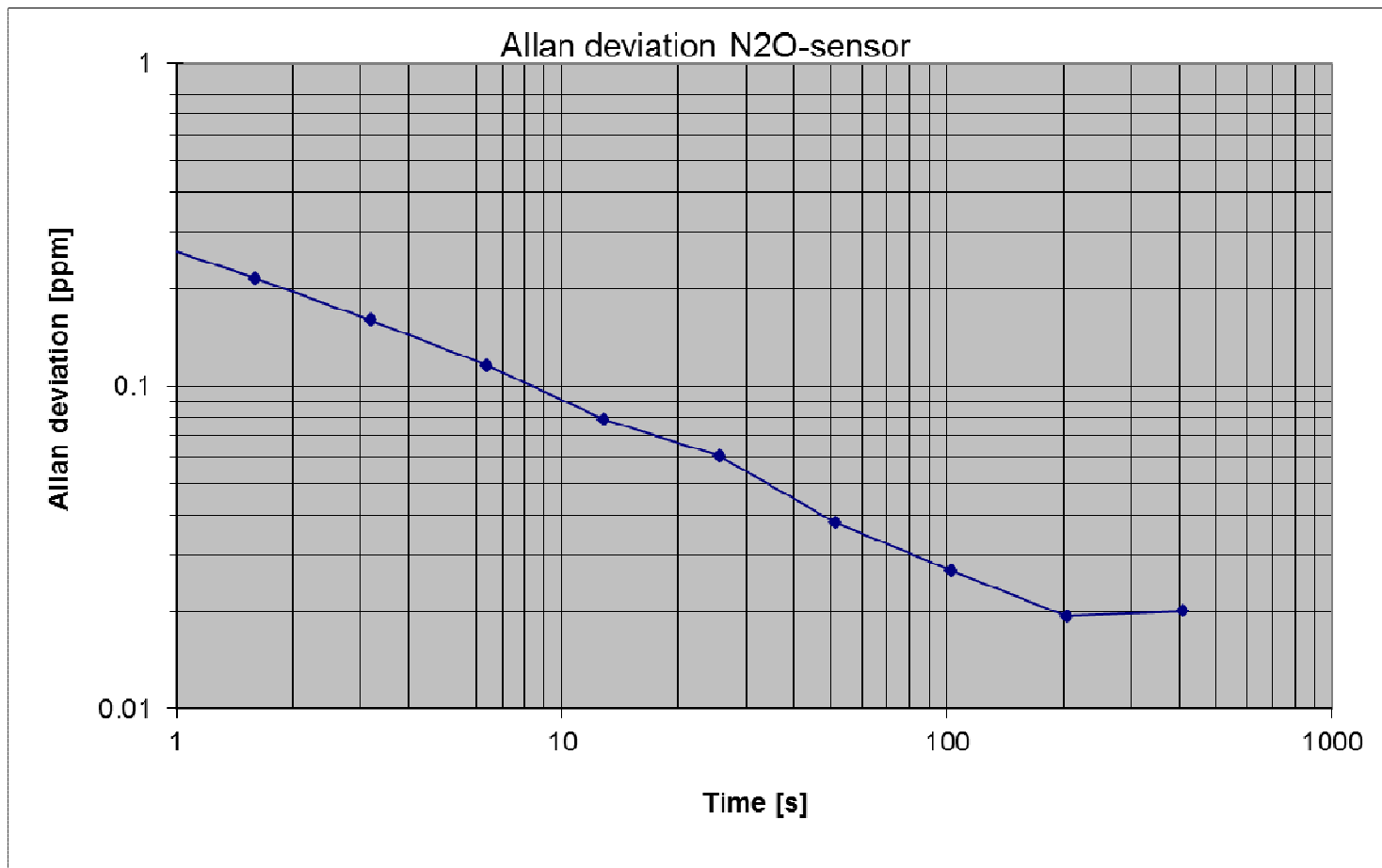
- Large effort spent to improve process stability.
- Here an sample of a DOE for production of the main mirrors.
 - 2 Materials and 2 independent process settings included
 - Material F outstanding the material B since low sensitivity to the process parameters.

IR Signal, each mirror, in order of marking
(Test fixture #1, small collimator)



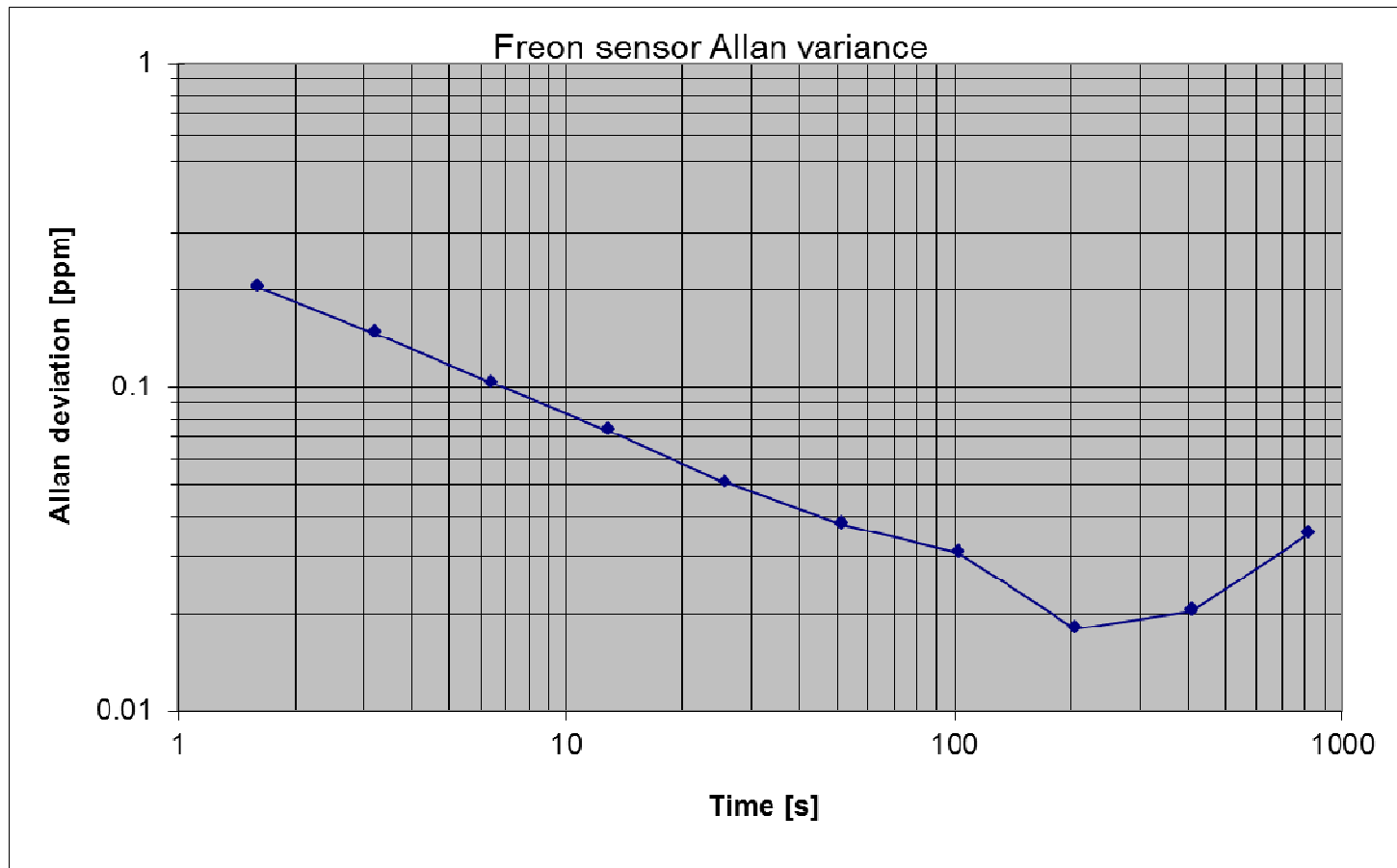
Low-Cost NDIR based Sensor Platform for sub-ppm Gas Detection

Allan variance – Nitrous oxide



Low-Cost NDIR based Sensor Platform for sub-ppm Gas Detection

Allan variance – Freon (R134A)



Low-Cost NDIR based Sensor Platform for sub-ppm Gas Detection

What is next?

- CO₂
- Ethylene
- CO
- SF₆
- NH₃
- ...

