

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

COST Action TD1105

WGs and MC Meeting at LINKÖPING, 3 - 5 June 2015

Action Start date: 01/07/2012 - Action End date: 30/06/2016

Year 3: 1 July 2014 - 30 June 2015 (*Ongoing Action*)

Development of SenseAir HPP High Performance Platform



Ingrid Bryntse

WG4 Leader

SenseAir AB / Sweden

 **cost**
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY



SenseAir an SME i northern Sweden

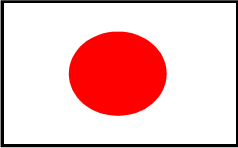
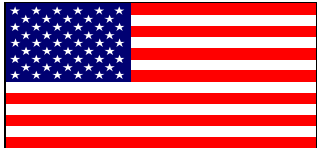

Founded by
Dr Hans Martin

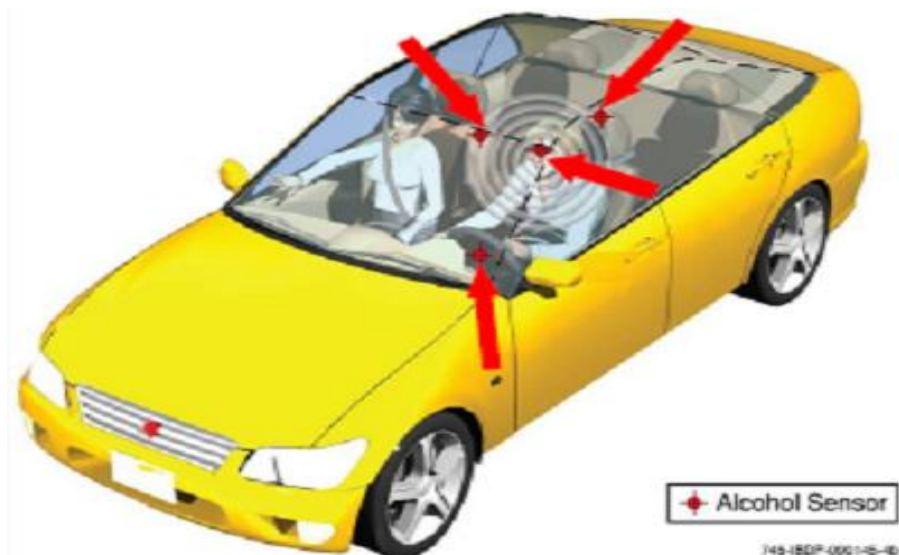


Traffic safety

Death injuries due to alcohol:

Sweden	Alcohol	Alcohol + other drugs
Killed drivers 2003-2007	242; 17%	73; 5.2%


		
10% death injuries	39% death injuries	25% death injuries



EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY



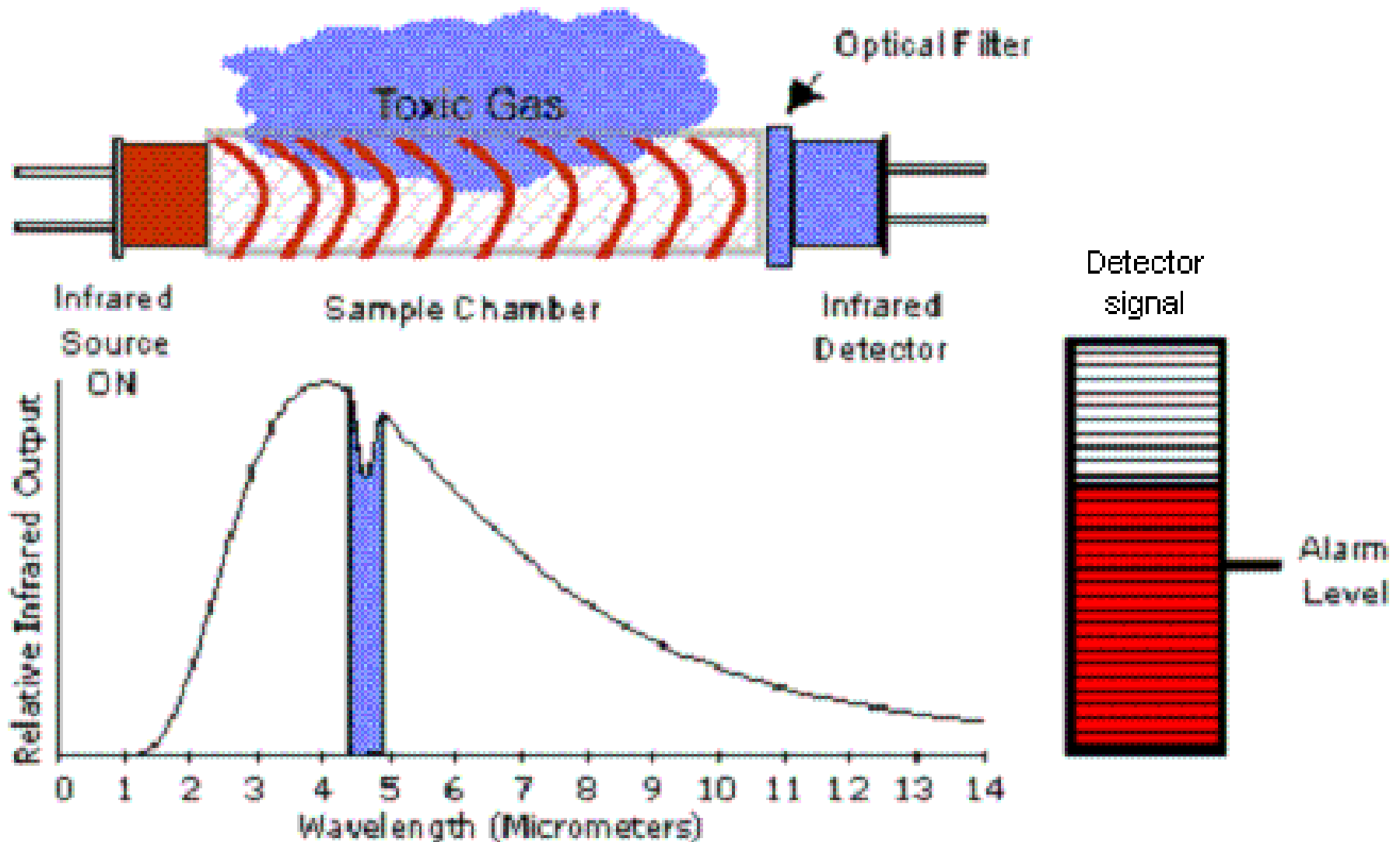
Every year, Autoliv's products save over 25,000 lives



New HPP High Performance Platform for sub-ppm measurements

- Three Swedish companies **Autoliv**, **SenseAir**, and **Hök Instrument**, have designed a new NDIR platform for **ethanol** and **CO₂** measurements, aiming at a future Alcolock for traffic safety
- **iBASS** = Integrated Breath Alcohol Safety System

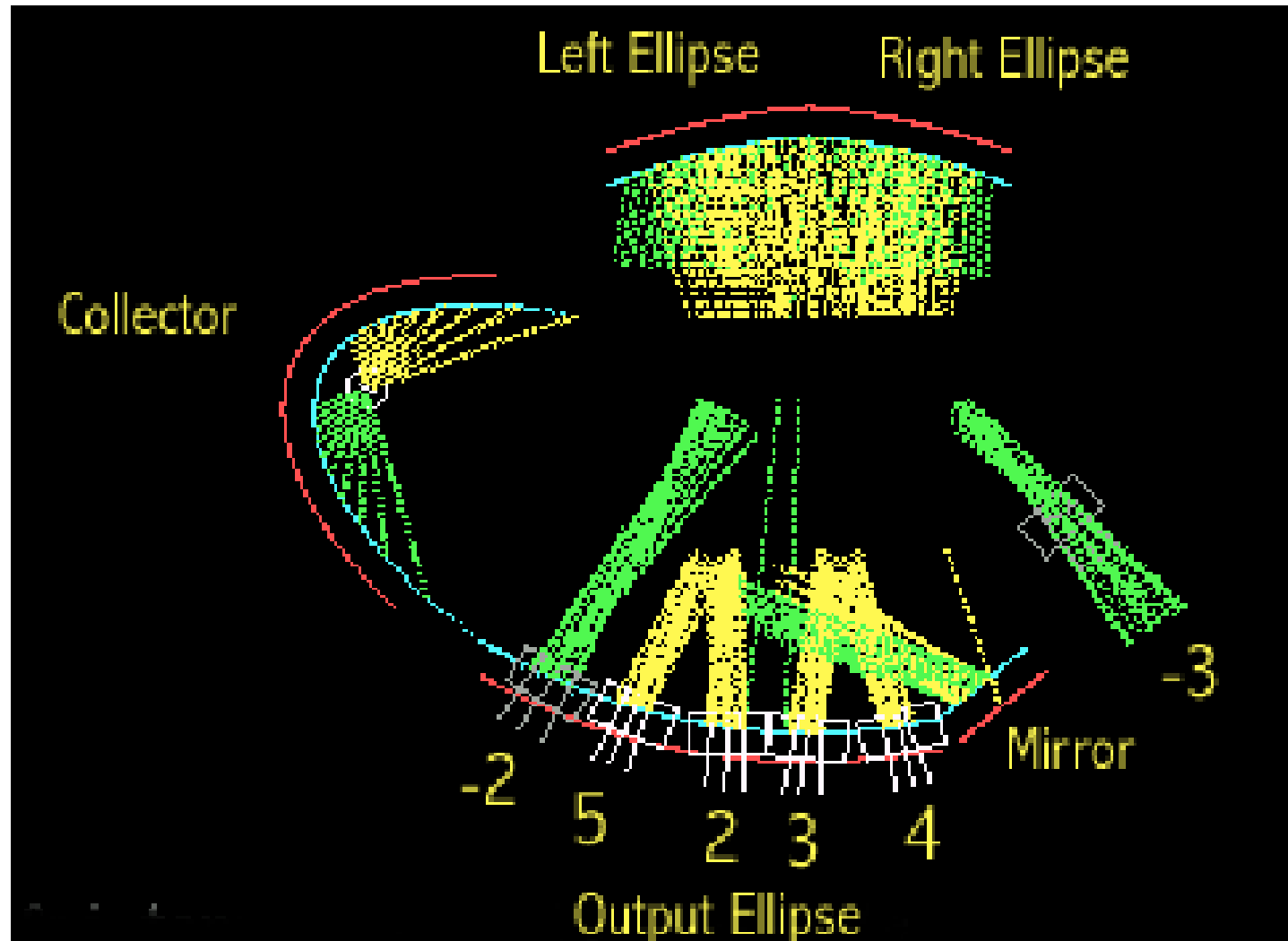
IR technique for gas sensing



Gen 0, based on existing sensor technology (2008)



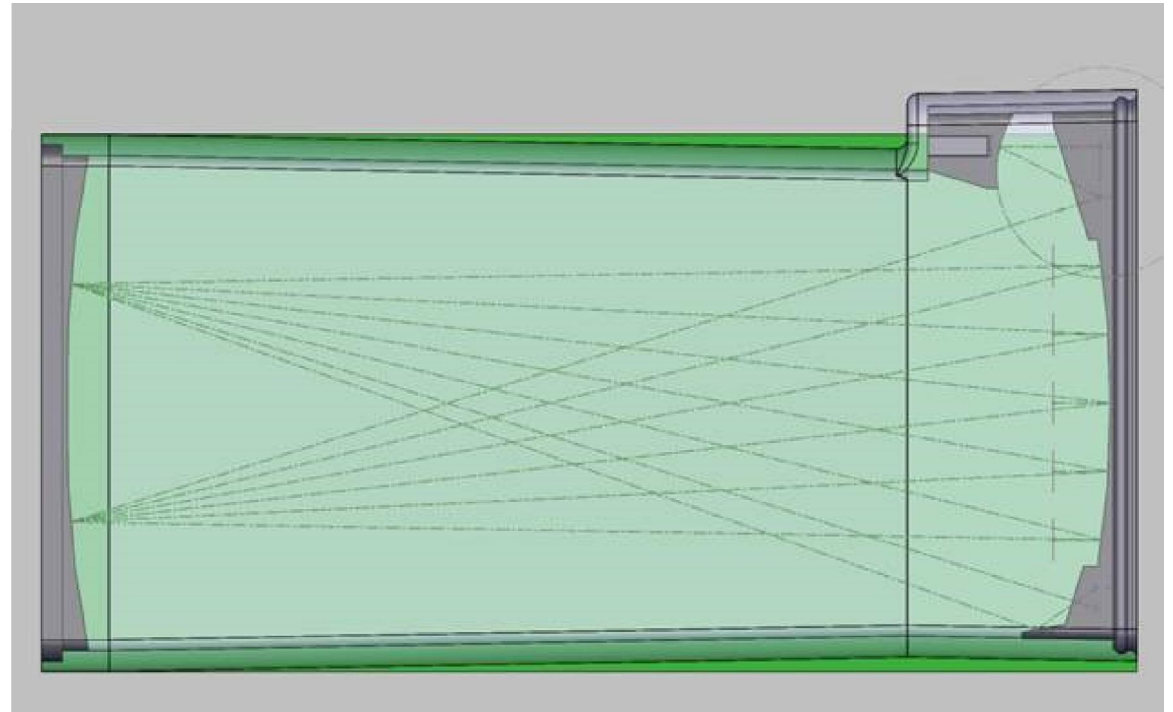
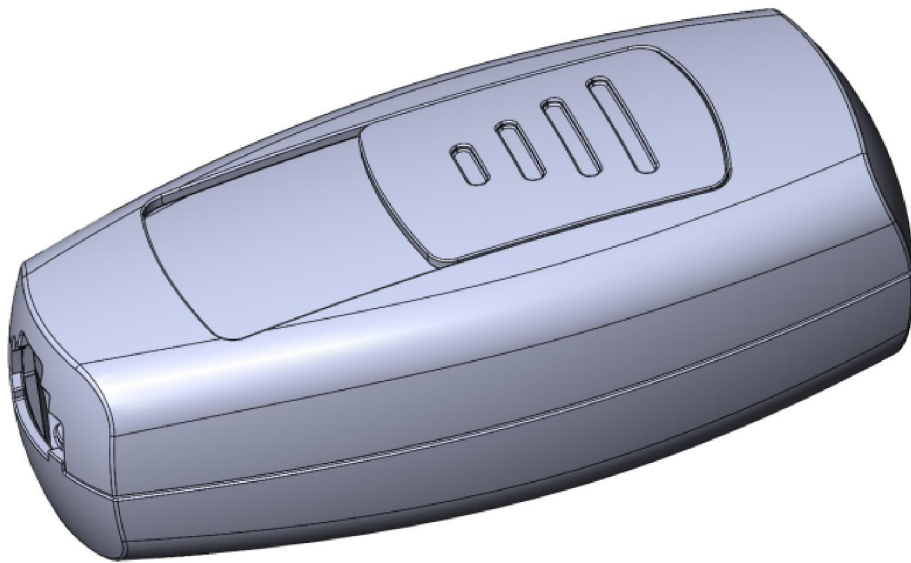
37 cm
optical
length





Gen I

Thermoplastic based optics (2009)



72/144 cm optical length
8/16 reflections

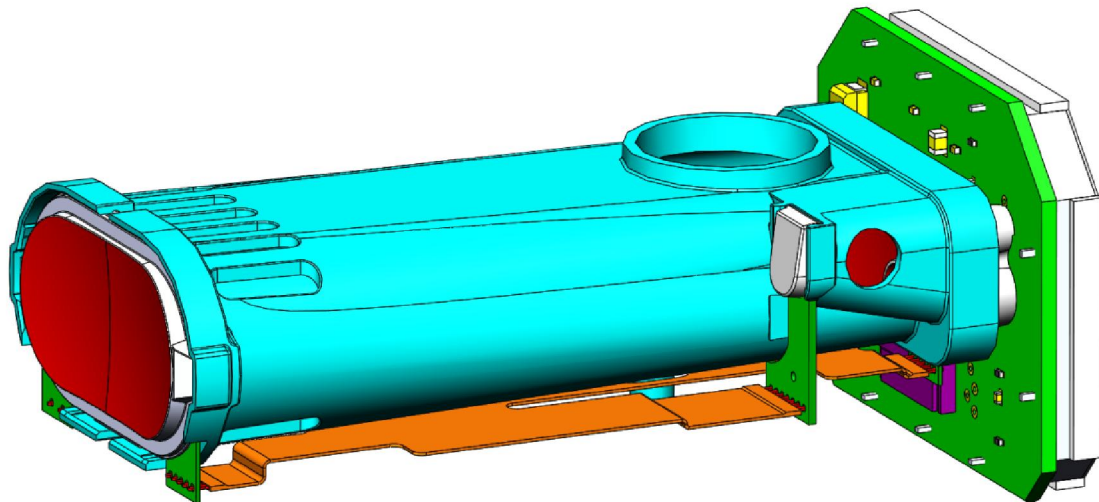
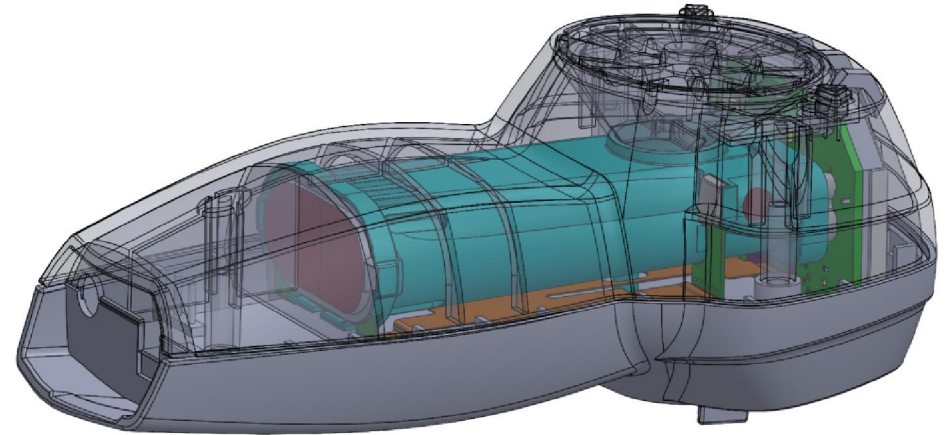
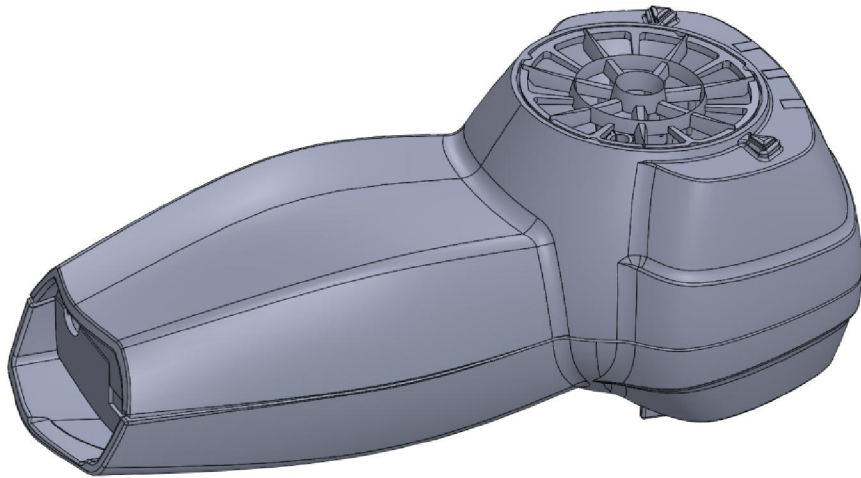
Alcolock & ethanol analyser projects





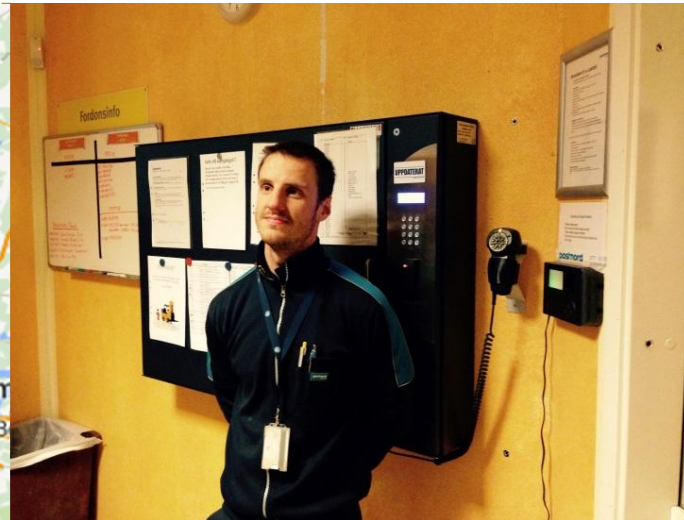
Gen II

More stable optics (2012)



128 cm optical length
16 reflections

Gen II Totally 125 000 alcohol tests at Swedish Post



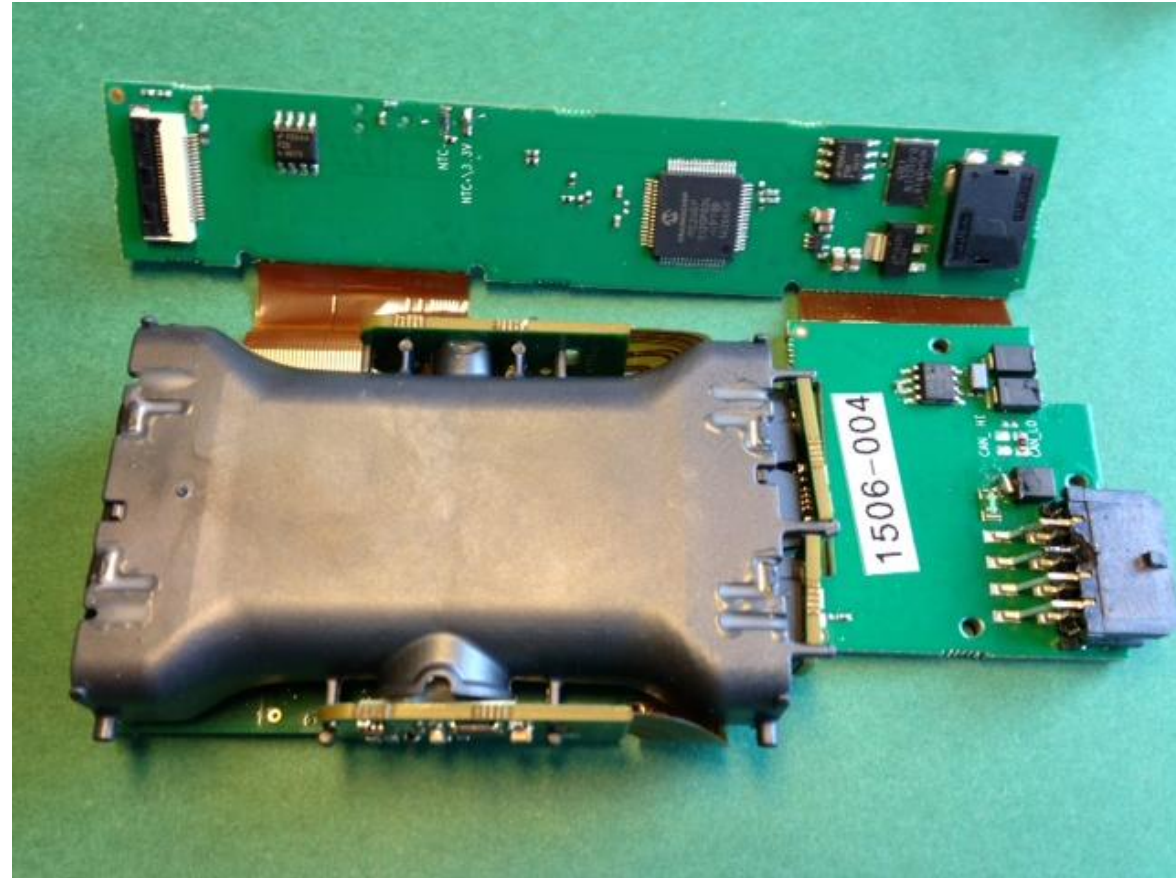
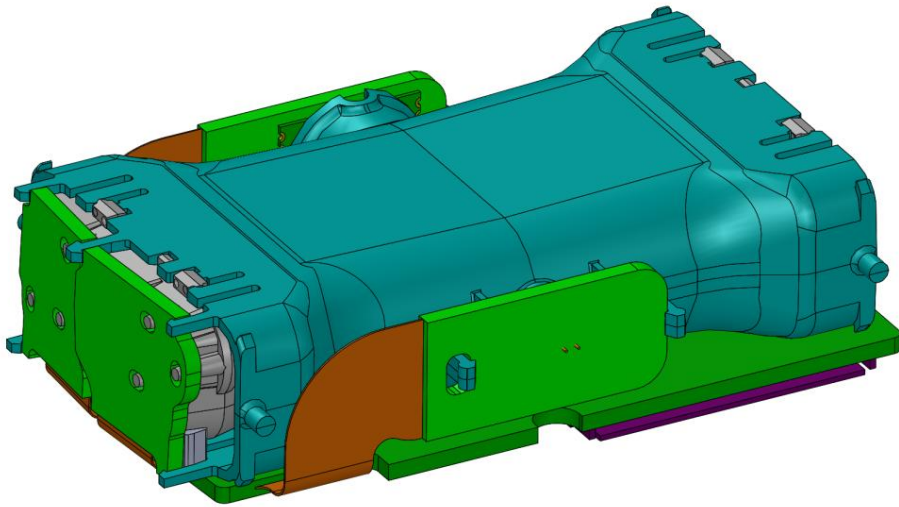
Plats	Sesame Start	Blows/ day	Days in use	Total blows
Västerås	Sept 2014	150	250	37500
Örebro	Sept 2014	170	20	42500
Veddesta (East)	March 2015	250	60	15000
Veddesta (west)	March 2015	400	60	24000
Eskilstuna	March 2015	100	60	6000



Gen III challenges

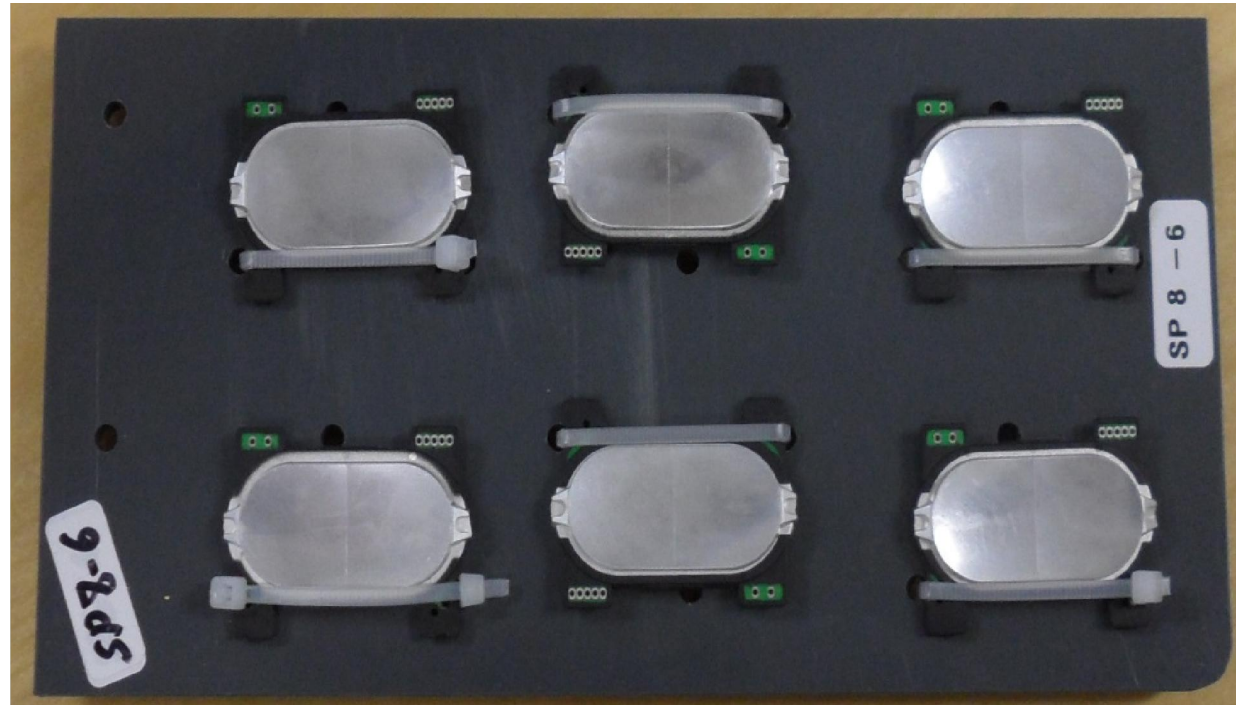
- **Minimize size to fit car integration**
- **Improve start-up time**
- **Improve gas filling behaviour and response time**
- **Mirror improvement**
- **Cost-down**

Gen III Improved design (2014)



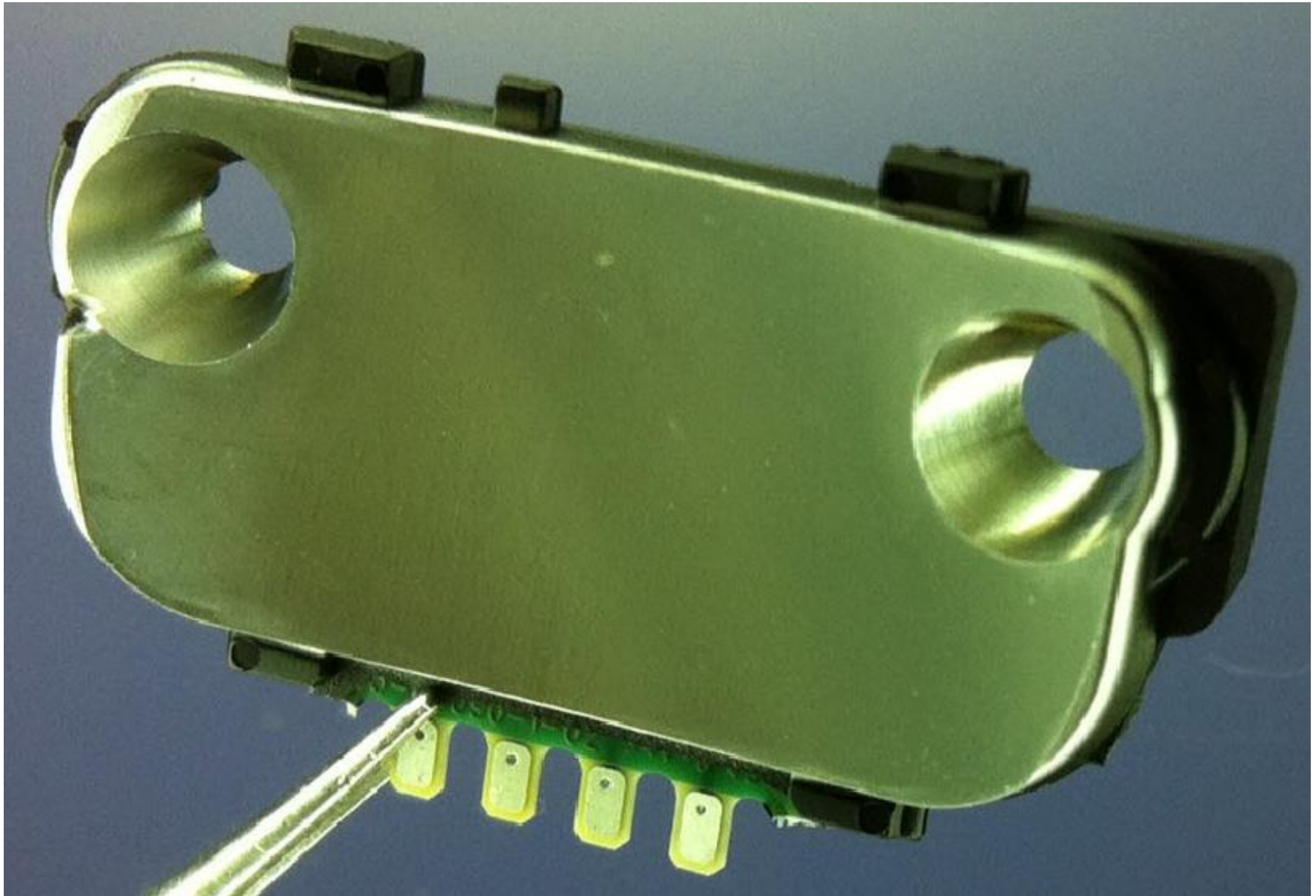
**96 cm optical length
16 reflections**

Development of mirror coating for alcolock

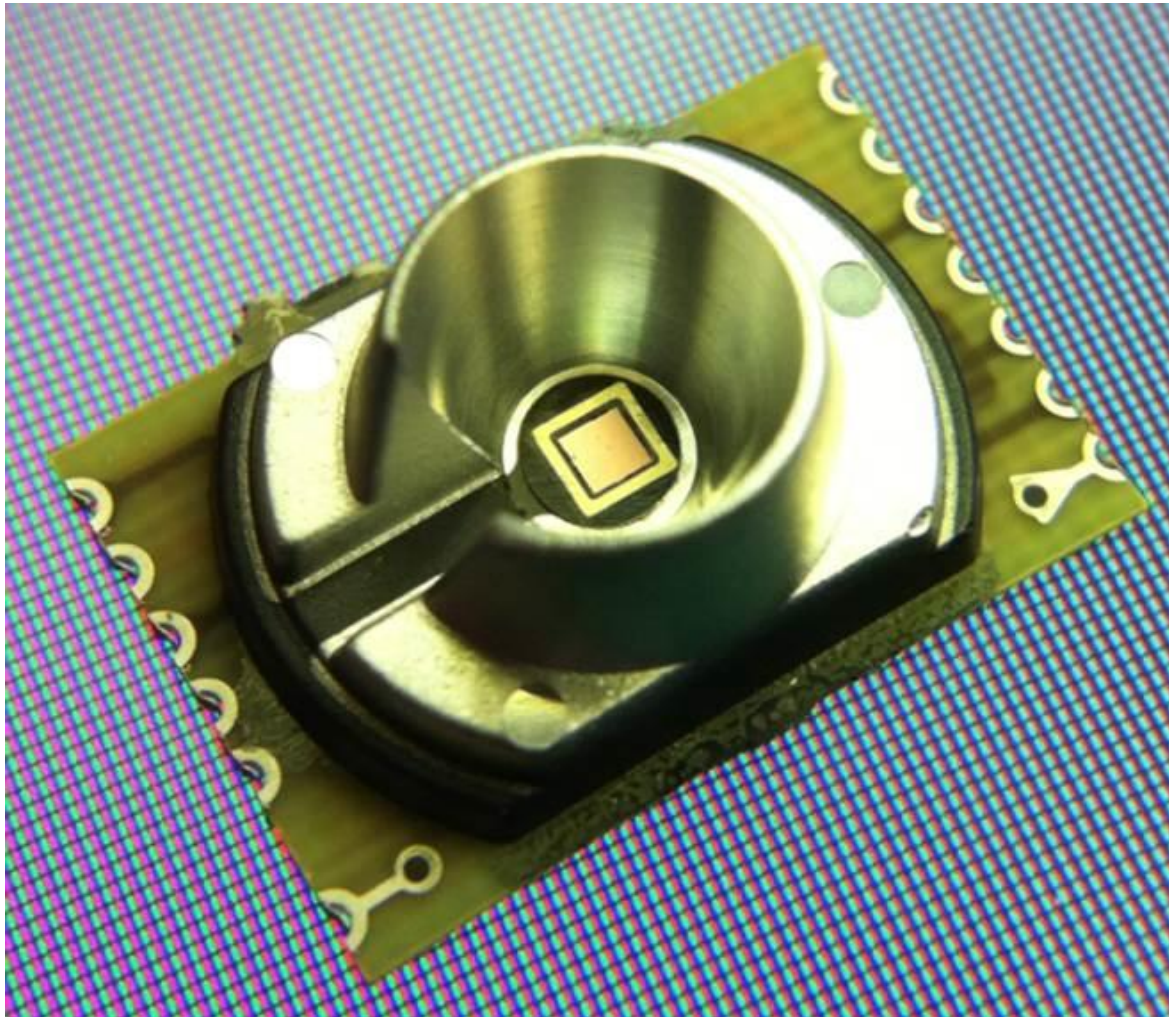


Two tracks:

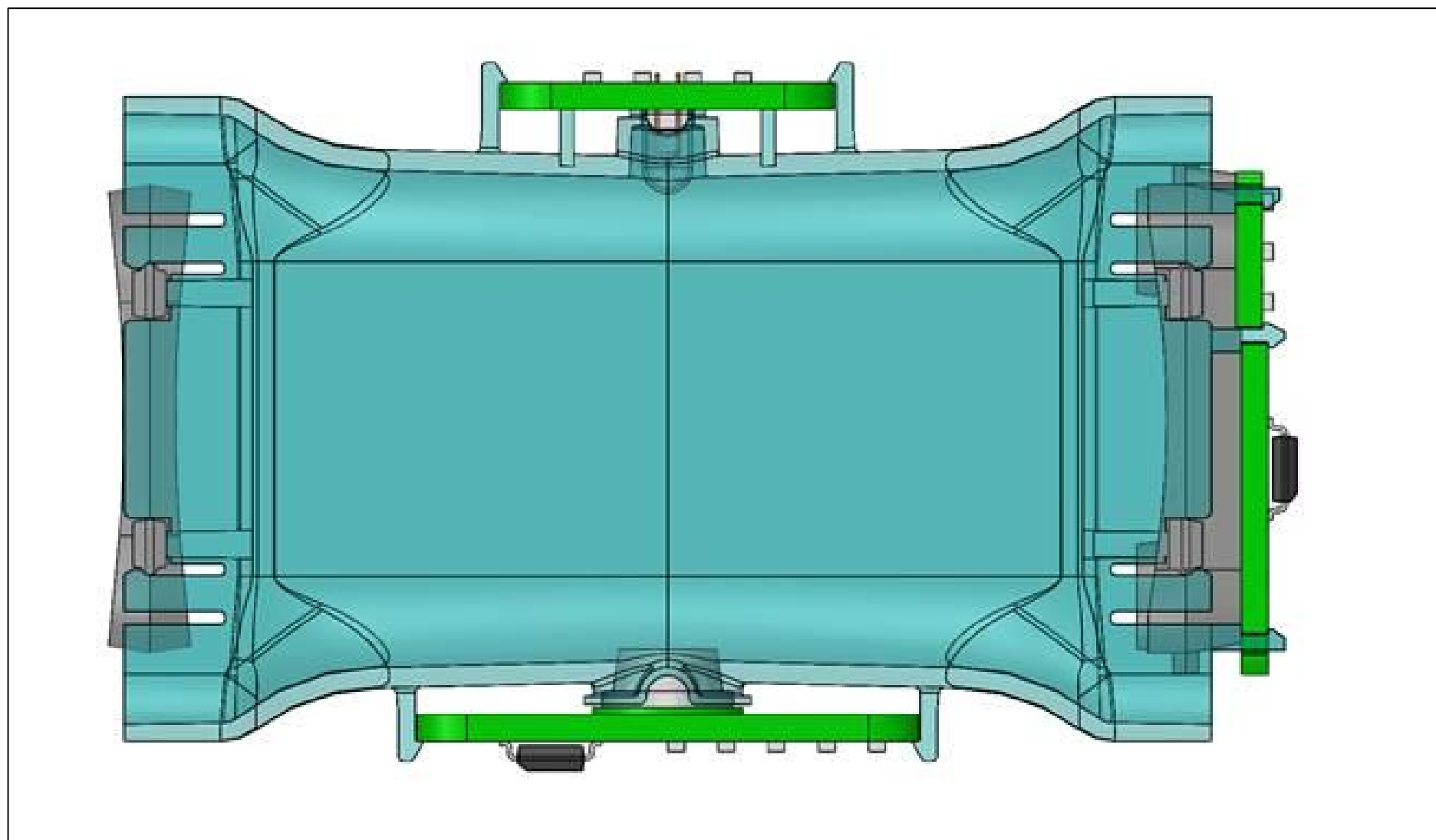
1. How narrow wells can be coated?
2. Optimising coating



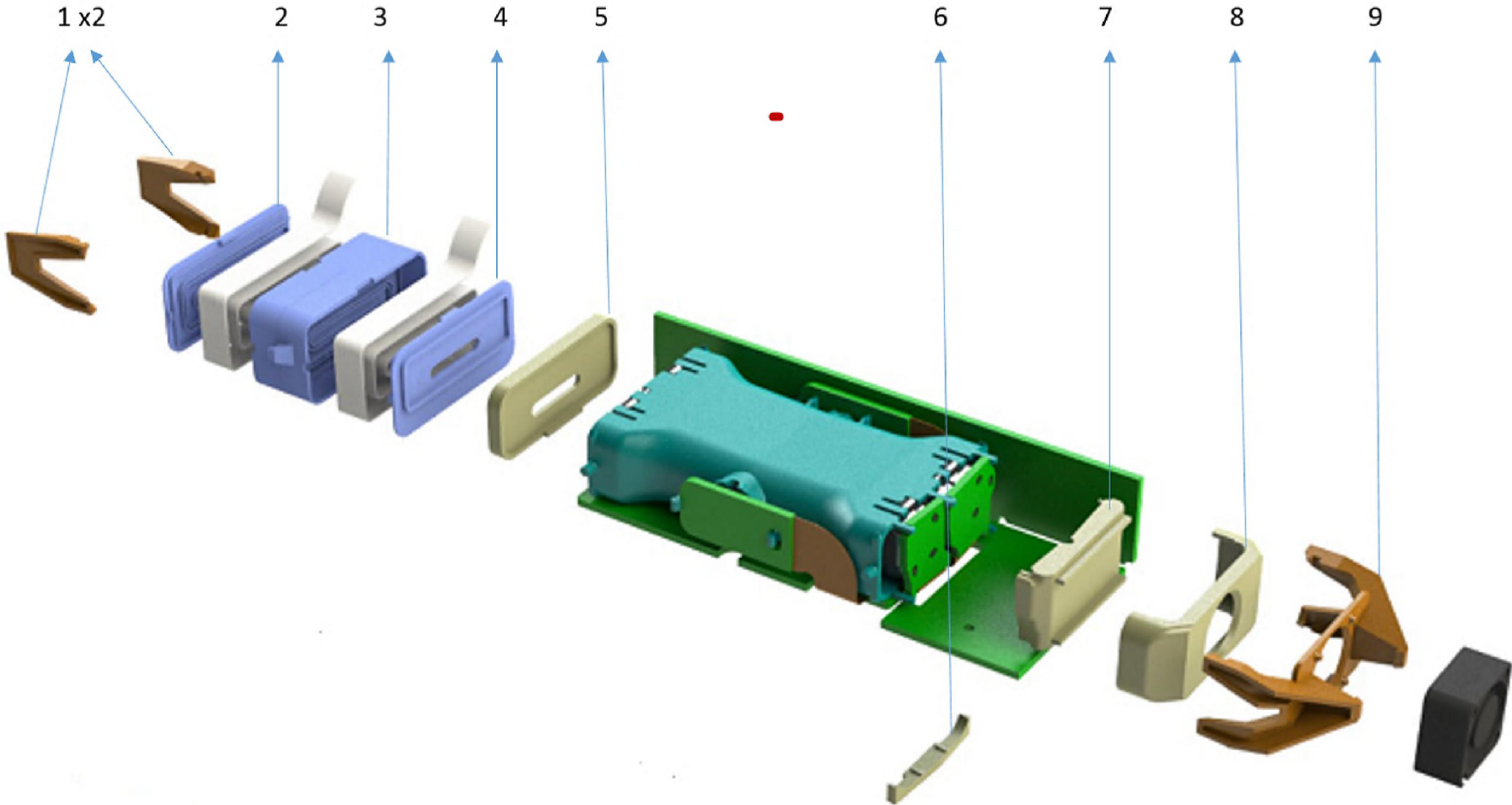
New supercomponent for CO₂ detection



Mirror fastening at gas cell volume / tube



Manufacturing process development



Our Alco-lock product on US market next year
Month-to-month lease
Camera for ID, avoiding tampering
Reports next day



Greenhouse gases also suitable for HPP

Other greenhouse or hazardous gases:

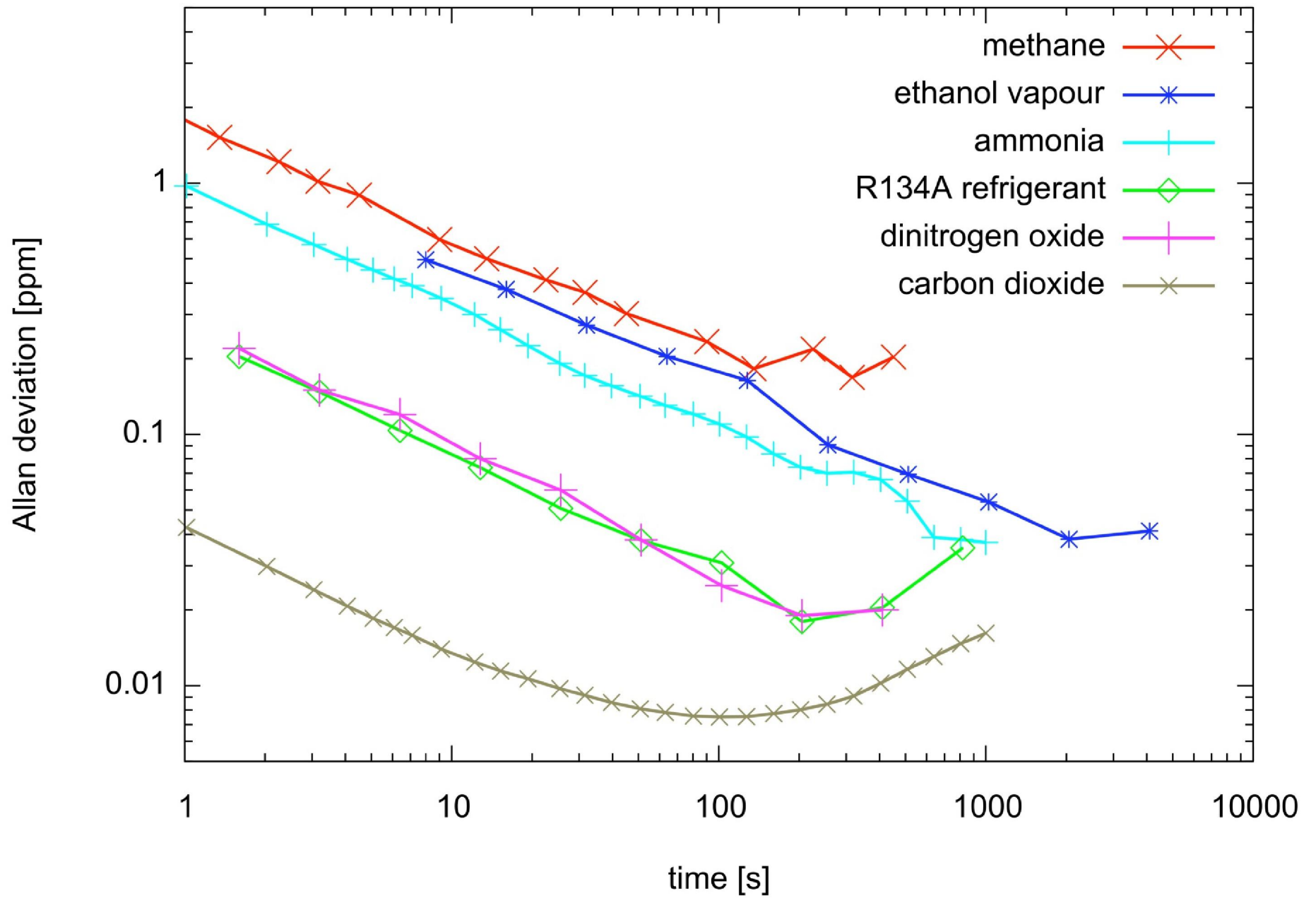
- CH_4
- CO_2
- N_2O
- H_2O_2
- O_3
- NH_3
- hydrocarbons
- freons
- ...

Greenhouse gases also suitable for HPP

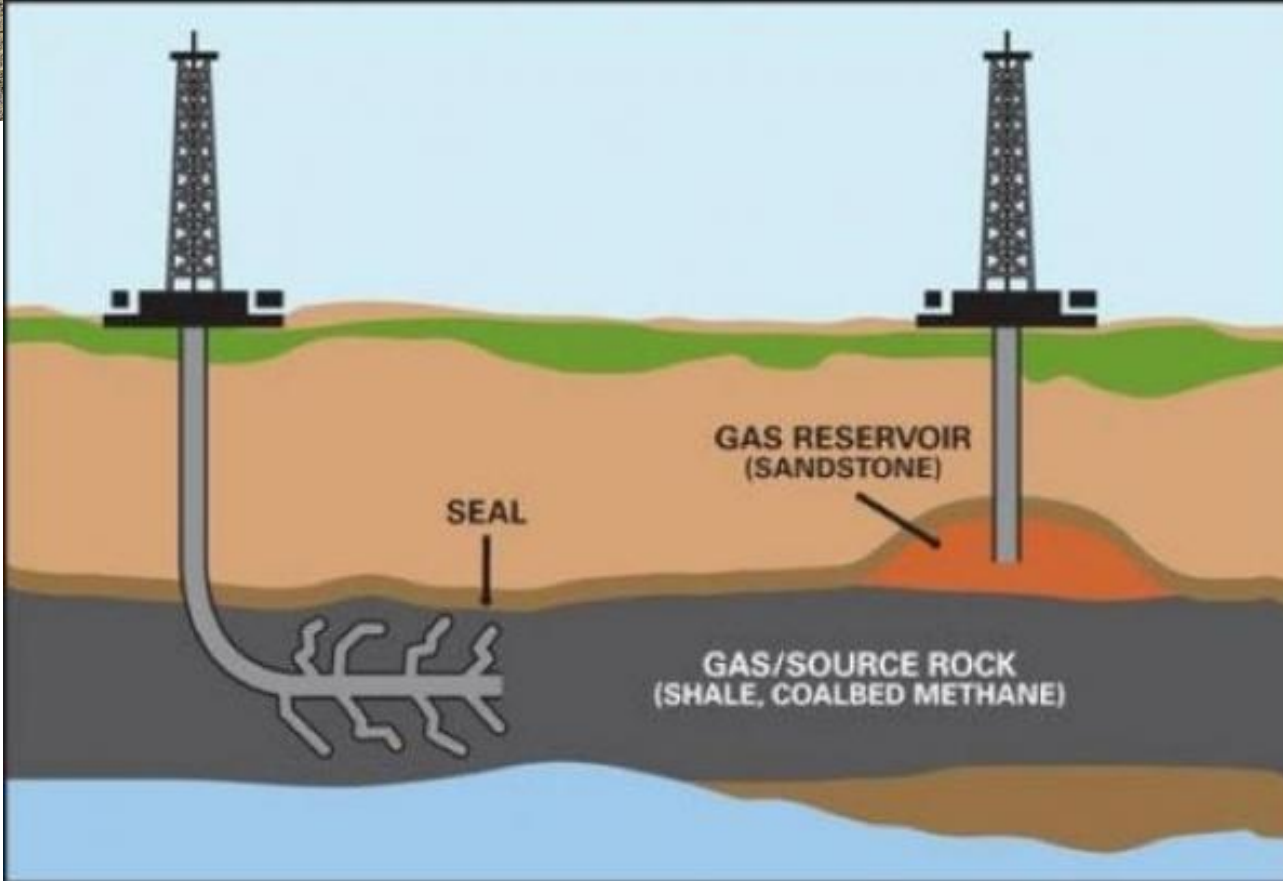
Other greenhouse or hazardous gases:

- CH_4
- CO_2
- N_2O
- H_2O_2
- O_3
- NH_3
- hydrocarbons
- freons
- ...

Gas / vapor	Min / ppm	Max / ppm (full accuracy)
$\text{C}_2\text{H}_5\text{OH}$	0.04	1000
CH_4	0.2	5000
CO_2	0.007	1000
NH_3	0.04	1000
N_2O	0.02	1000
R134A (refrigerant)	0.02	1000



Gas field in Texas, USA



Obama wants to lower methane emissions



In Jan 2015 president Obama and the White House announced a new goal to cut US methane emissions from the oil and gas sector by as much as 45% over the next decade.



Methane Detectors Challenge for EDF

The gas sensing technologies performed well in detecting methane concentrations over a range of temperature and humidity conditions.

Four technologies were selected by EDF

- Dalian Actech/SenSevere
- SenseAir AB
- Quanta3
- University of Colorado/NDP Group

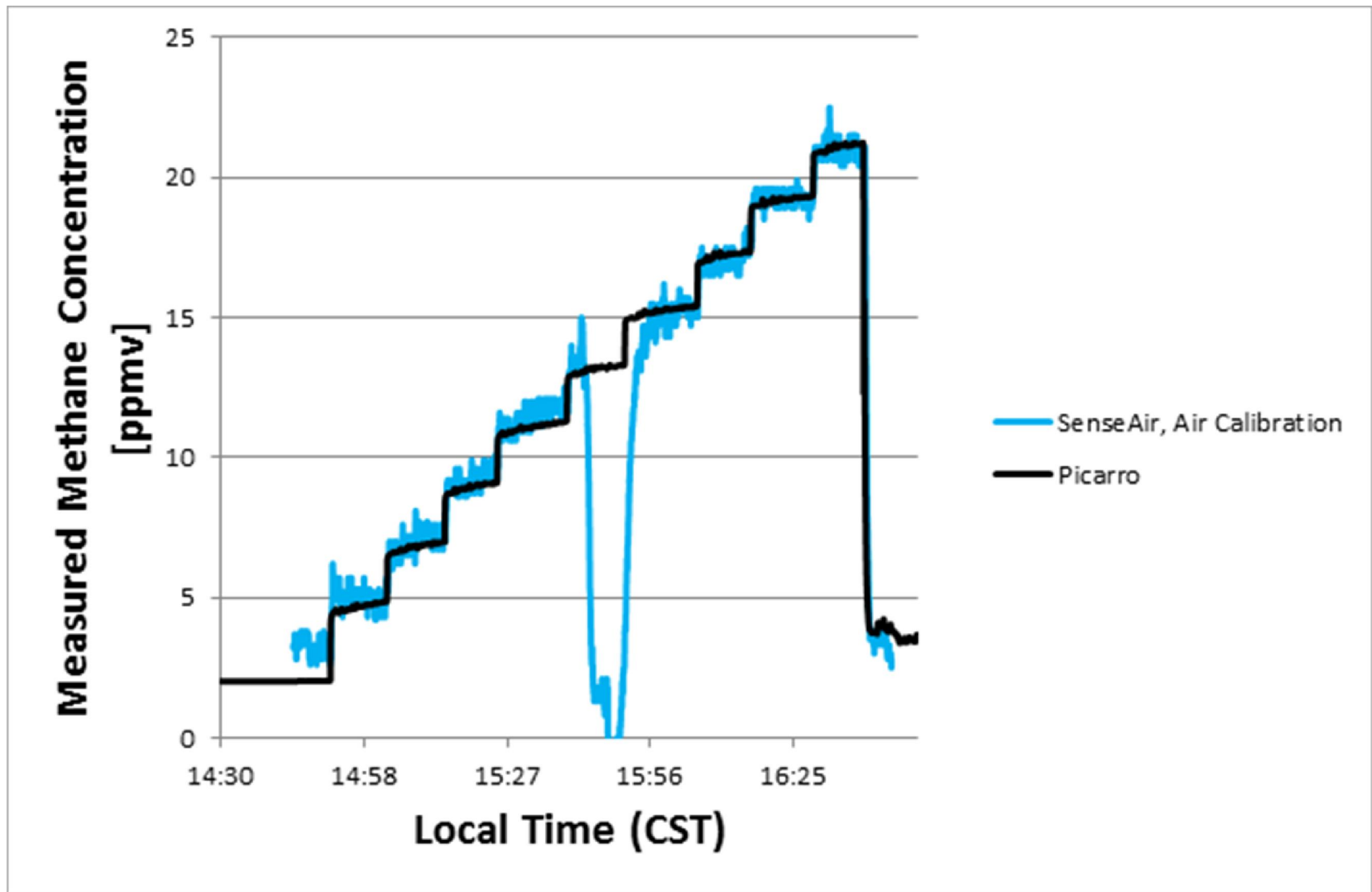
The remaining companies are advancing to second phase field testing, in San Antonio Texas, throughout spring and summer 2015, providing more intensive indoor and outdoor testing and evaluation.

Methane sensor unit



CH₄ vs time

Measured with SenseAir HPP



Balloon sonde for CO2 measurements
In the upper atmosphere
Prototypes to University of Cambridge
Co-operation with Rod Jones & Co

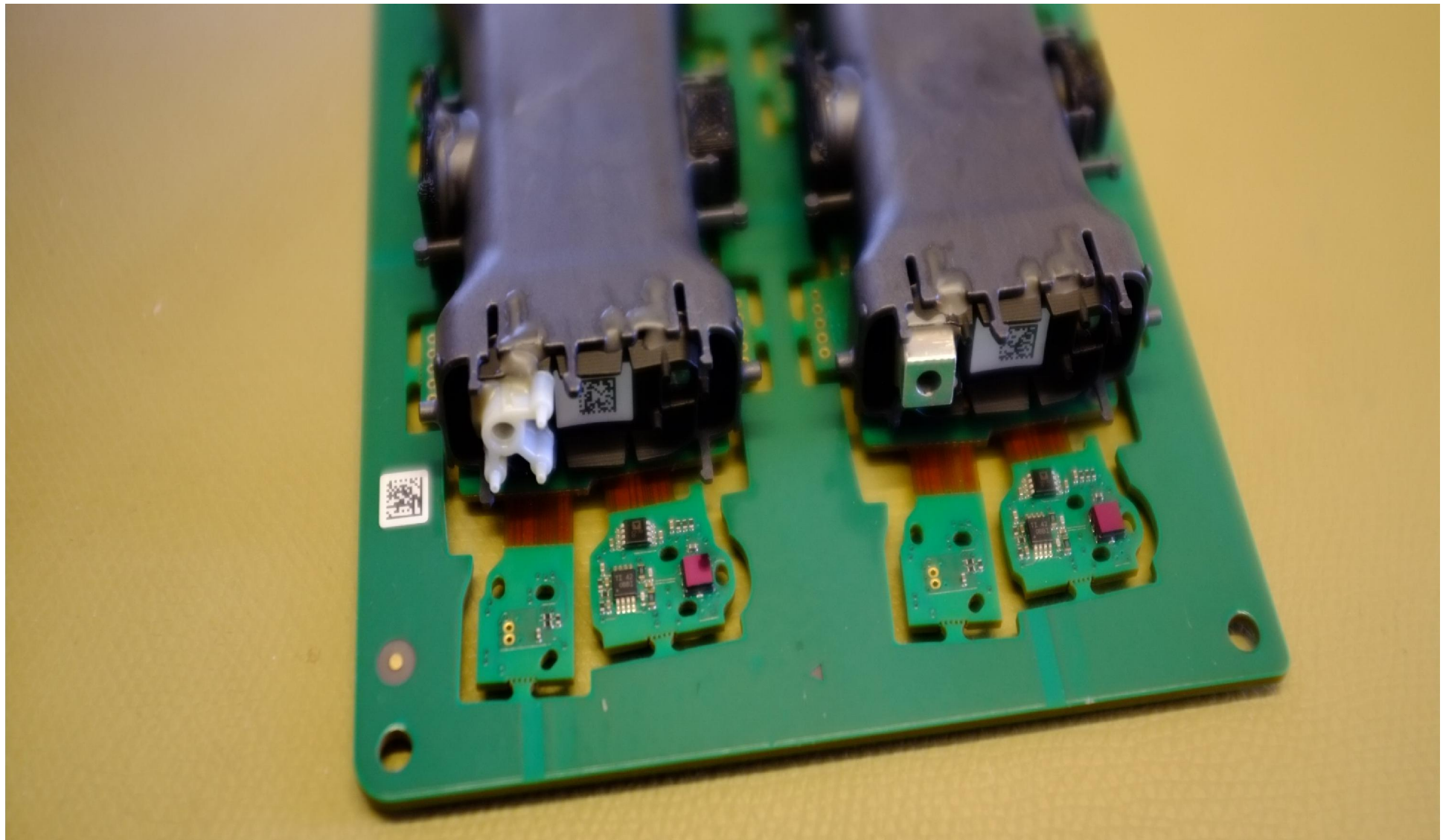




Paul Smith, STSM fellow from Cambridge at SenseAir:

“Investigation of SenseAir LPL (Long Path Length) platform iBASS for precise gas measurements” Scientific report *COST-STSM-TD1105-24560*

My research project at Cambridge University, is to integrate this sensor into a package suitable for use with weather balloons. The sensor therefore, needs to be able to withstand extremes of temperature and pressure, be cheap, and low power. I am working in partnership with SenseAir to find solutions to these problems.



Project with Brazil

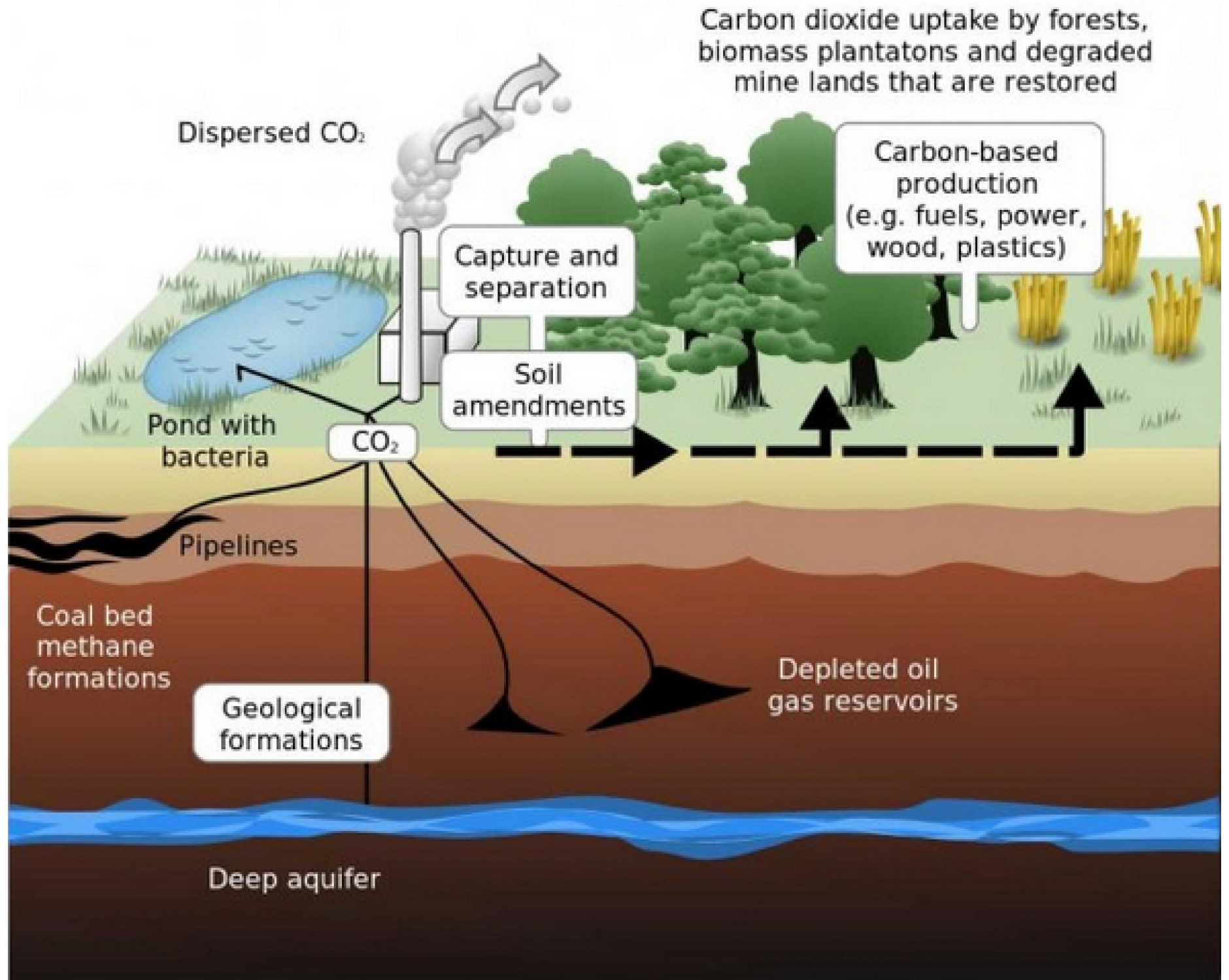
CCS, Carbon Capture and Storage





Swedish Brazilian project New technology for CCS

The EU has a climate target to reduce carbon emissions by 2020. One solution could be to store carbon dioxide in bedrock. Acreo Swedish ICT was part of a Swedish-Brazilian consortium with a mission to develop the necessary measurement techniques.

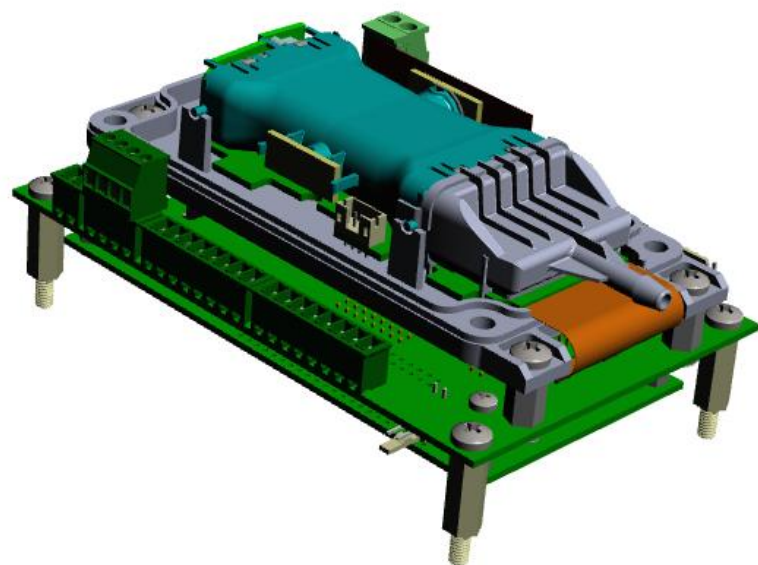


BOOST Innovation Prize for SenseAir and In Situ, two collaborating SME:s



Together SenseAir & In Situ were in Oct 2014 announced as one of three winners in the competition *Boost Innovation*™ for a new measuring system with sensor technologies to measure terrestrial greenhouse gas.

“An innovative collaboration that takes a known measurement technology to a new level”



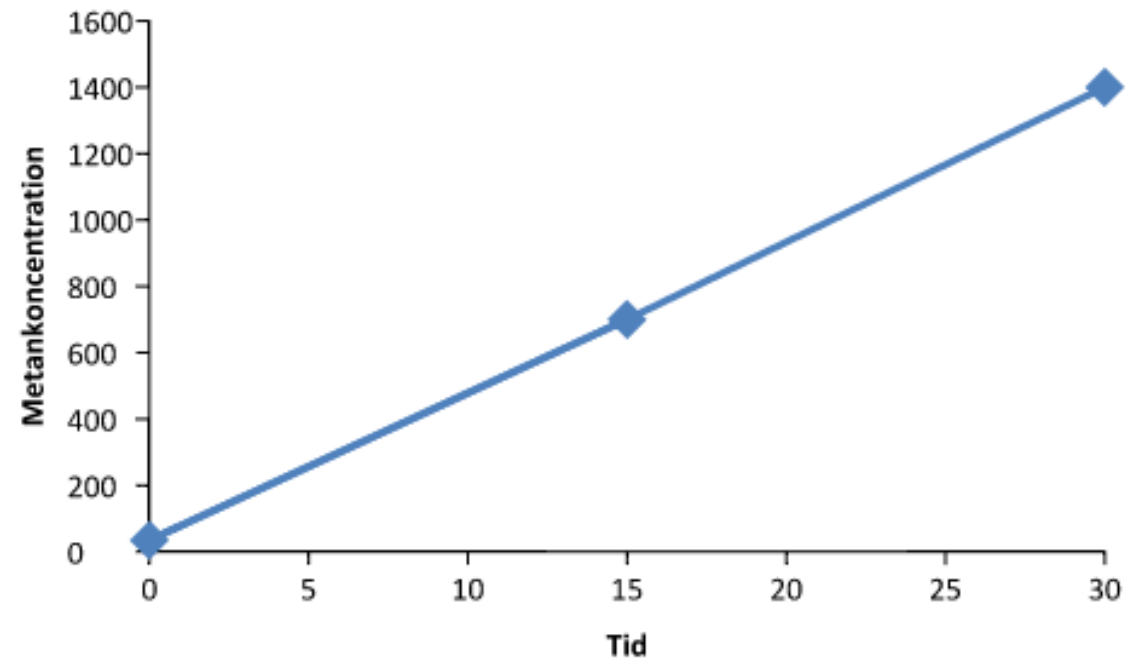
**SenseAir**[®]
Sensors for Life

**IN SITU** miljömätningar
mark • vatten • luft

Cuvette sensing of gas emissions from ground



JTI – Institutet för jordbruks- och miljöteknik
JTI – Swedish Institute of Agricultural and Environmental Engineering





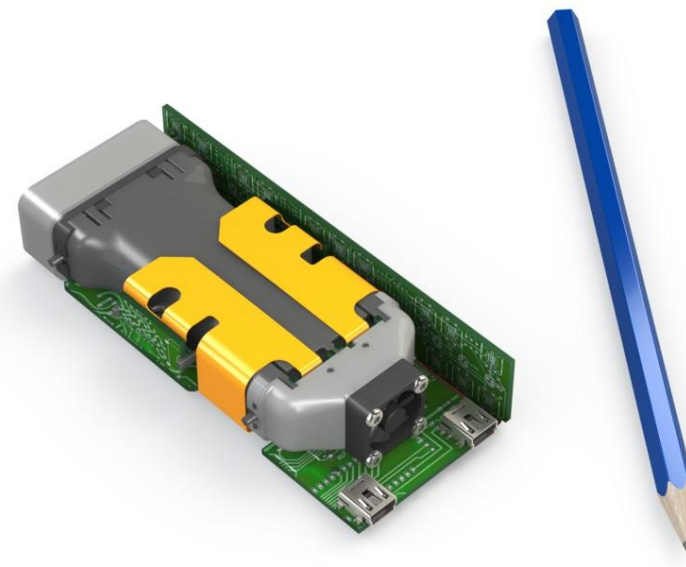
In Situ has been involved in almost all major greenhouse gas projects in Sweden during the last 15 years. They have supplied equipment for measuring greenhouse gases in the atmosphere to countries including Iceland, Czech Republic, South Africa, Russia and Germany.

In Situ has designed, built and installed the Swedish part of ICOS (Integrated Carbon Observation System), a new infrastructure for research on greenhouse gases

Also, they have worked with greenhouse gas measurements under water on behalf of Uppsala University

Conclusions SenseAir HPP

- **>50 % smaller**
- **Cuvette length ~1 m**
- **More robust materials**
- **Improved mirror coating**
- **Temperature stable gas cuvette**
- **Optimised PCB design**
- **Carefully chosen key components**
- **Perpendicular channels for EtOH and CO₂**





Conclusions SenseAir HPP

The new SenseAir HPP, High Performance Platform, has proven that it is suitable for greenhouse gas measurements in various demanding environments:

- Low gas concentrations
- Large temp variations
- Humidity
- Corrosive / polluted air

HPP will be produced at a reasonable cost

A fully equipped sensor unit can automatically recalibrate itself