

# Development of AirBox (NO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>) and its Application as Network in City of Eindhoven

R.P. Otjes

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**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 Modelling for Air-Pollution Monitoring***

**Institute for Environment and Development - IDAD**

**Aveiro, Portugal, 14 - 15 October 2014**

Action Start date: 01/07/2012 - Action End date: 30/06/2016 - Year 3: 2014-15 (***Ongoing Action***)

**DEVELOPMENT OF AIRBOX (NO<sub>2</sub>, PM10, PM2.5) AND ITS  
APPLICATION AS NETWORK IN CITY OF EINDHOVEN**



**ECN**

Your energy. Our passion.

**Rene Otjes**

WG Member

**Netherlands**

# Scientific context and objectives

## Background / Problem statement:

- Need for sensors for urban air quality measurements
  - High density network in larger cities
  - Measurement info for smaller cities
- Can this be done low cost and with sufficient quality?
- Primary focus on PM and NO<sub>2</sub>



## Sensors to measure PM

Low cost means optical

Issues with

- specific weight,

- UFP (can't see),

- volatile fraction ( $\text{NH}_4\text{NO}_3$  yes,  $\text{H}_2\text{O}$  no)

- size distribution (conversion by volume)

## Sensors to measure NO<sub>2</sub>

- Electrochemical Cells showed potential in the lab
  - USEPA test, sufficient sensitivity
- Severe Issues with
  - Relative Humidity
  - Base line drift
  - Cross contamination



## How to maintain network quality?

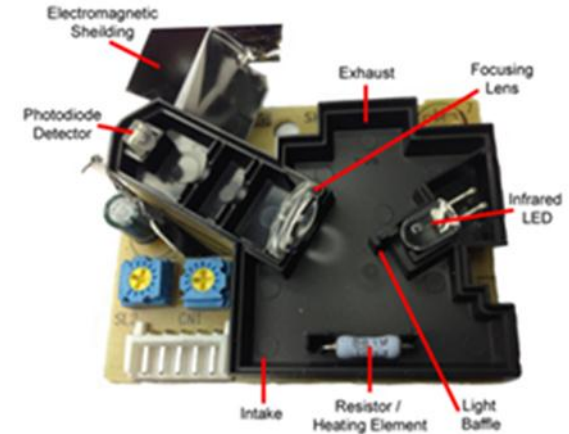
- Accuracy:  
Classic calibrations are **not** low cost  
(calibration gas – monodispers PM)
- Precision:  
Roulation with reference systems are not low cost either
- Find in situ solutions



# Current activities

## PM

- Lower threshold diameter by using shorter wavelengths
- Drift performance in urban environment by comparison with local reference stations
- Characterization of precision by meteo conditions
- Equivalence testing (4 seasons / 4 different sites)



# Current activities

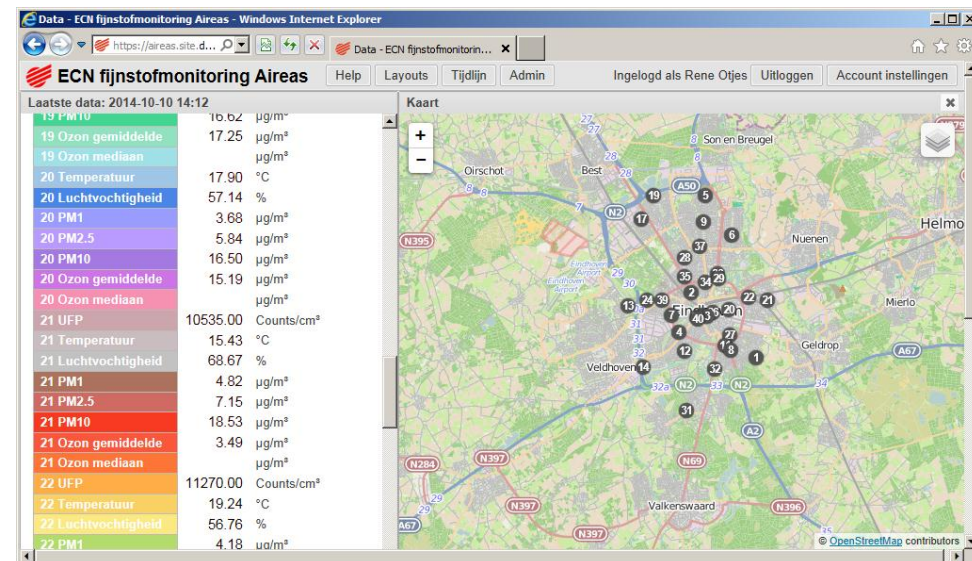
## NO<sub>2</sub>

- Solving the rH cross sensitivity and baseline drift in situ
- Drift in sensitivity
- Equivalence testing by GGD Amsterdam
- Pending Patent



- Progress pilot network in **Eindhoven** since 1 year
- at 35 locations for PM, O<sub>3</sub>, rH, T and GPS
- At 5 locations with UFP (Nanomonitor)
- This year 4 NO<sub>2</sub> sensors planned
- Next year NO<sub>2</sub> for all 35 locations

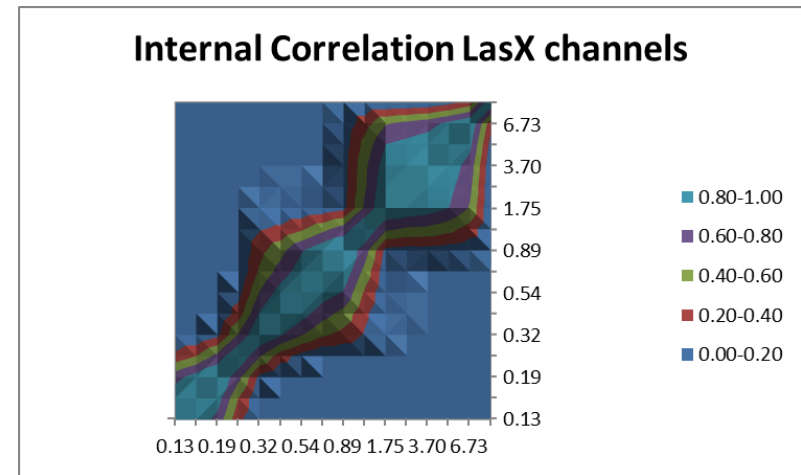
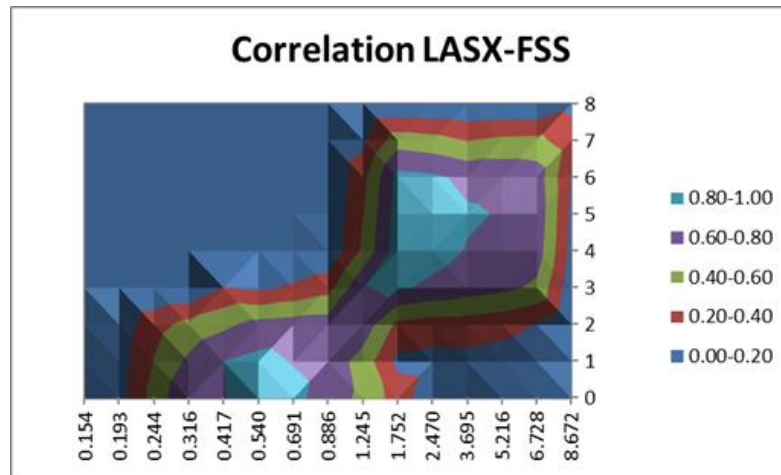
- Adjacent Cities joining in



# Achieved RESULTS PM

- Single particle observation
- Size classification by comparison with LasX through correlation

Take time series for each size channel and determine correlation with all size channels of LasX

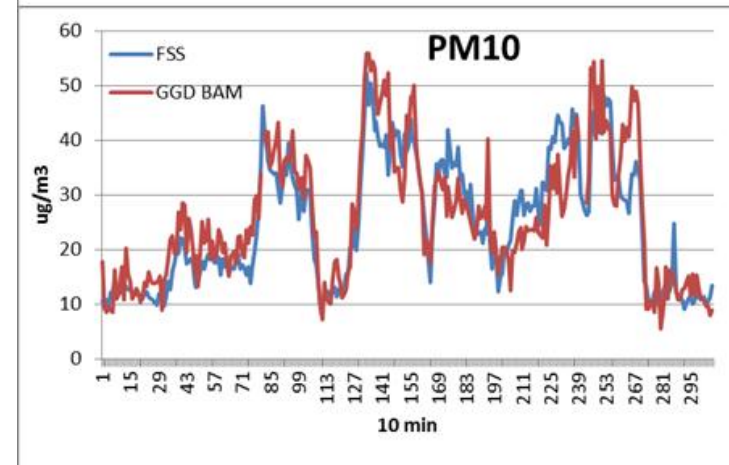
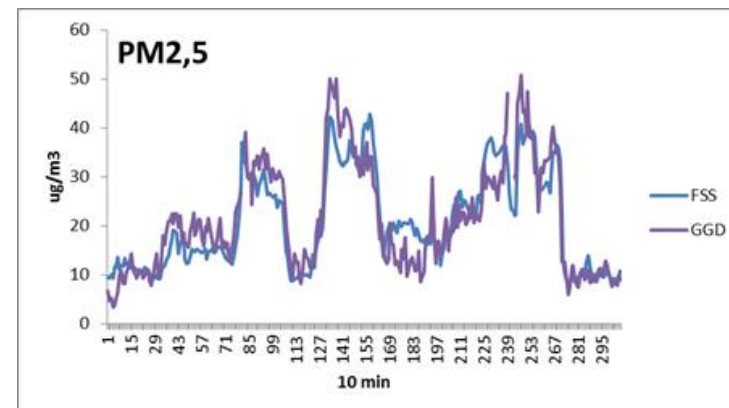
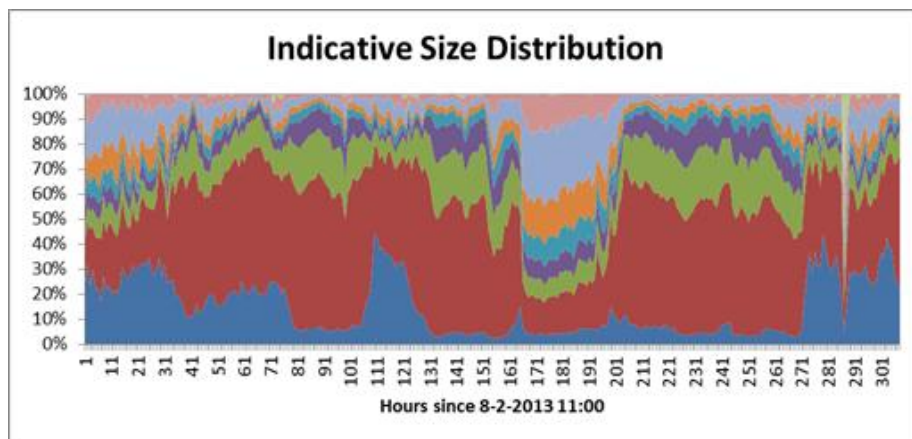


# Achieved RESULTS

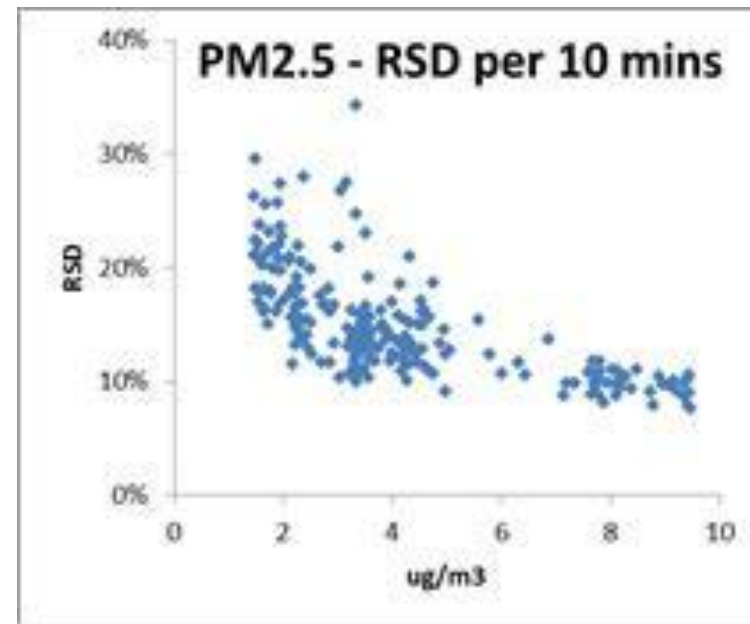
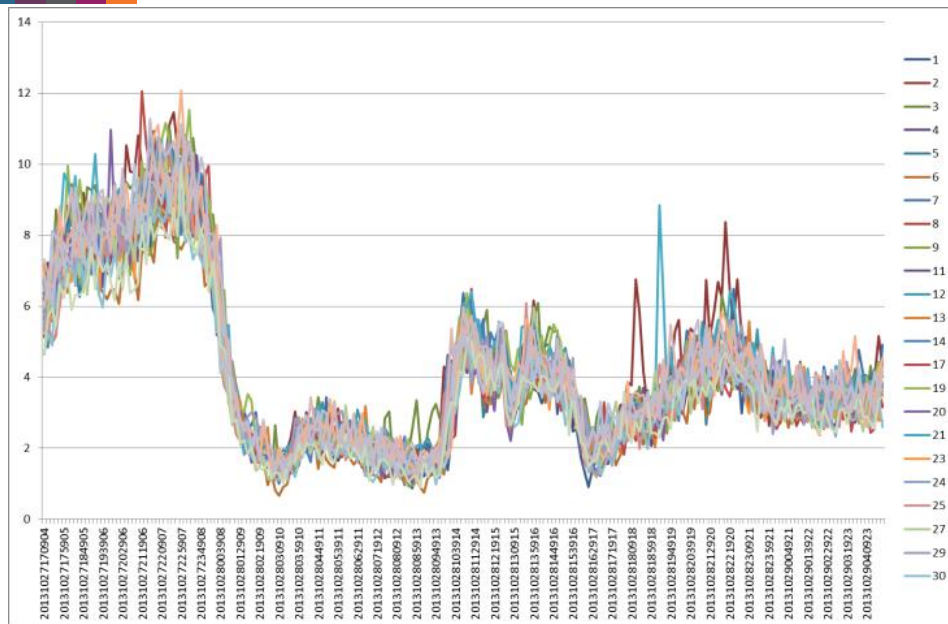
## Good comparison with BAM

Measurement at city background site in Amsterdam

Comparison with BAM for PM10 and PM2.5  
Also PM1 and size distribution

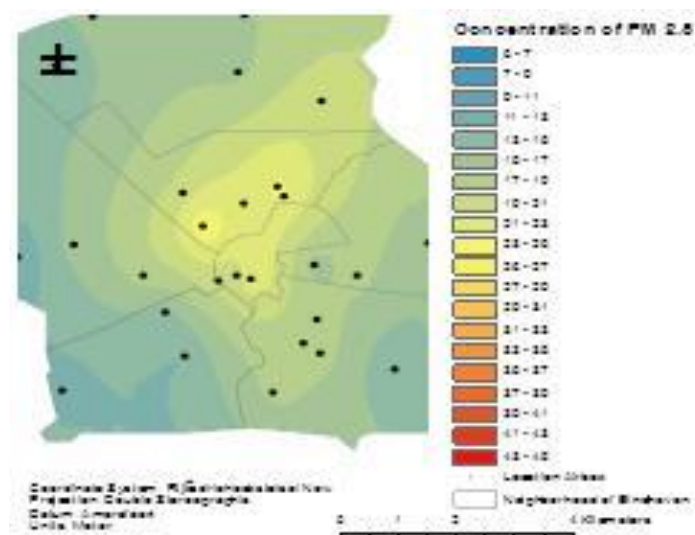


# Achieved RESULTS Network

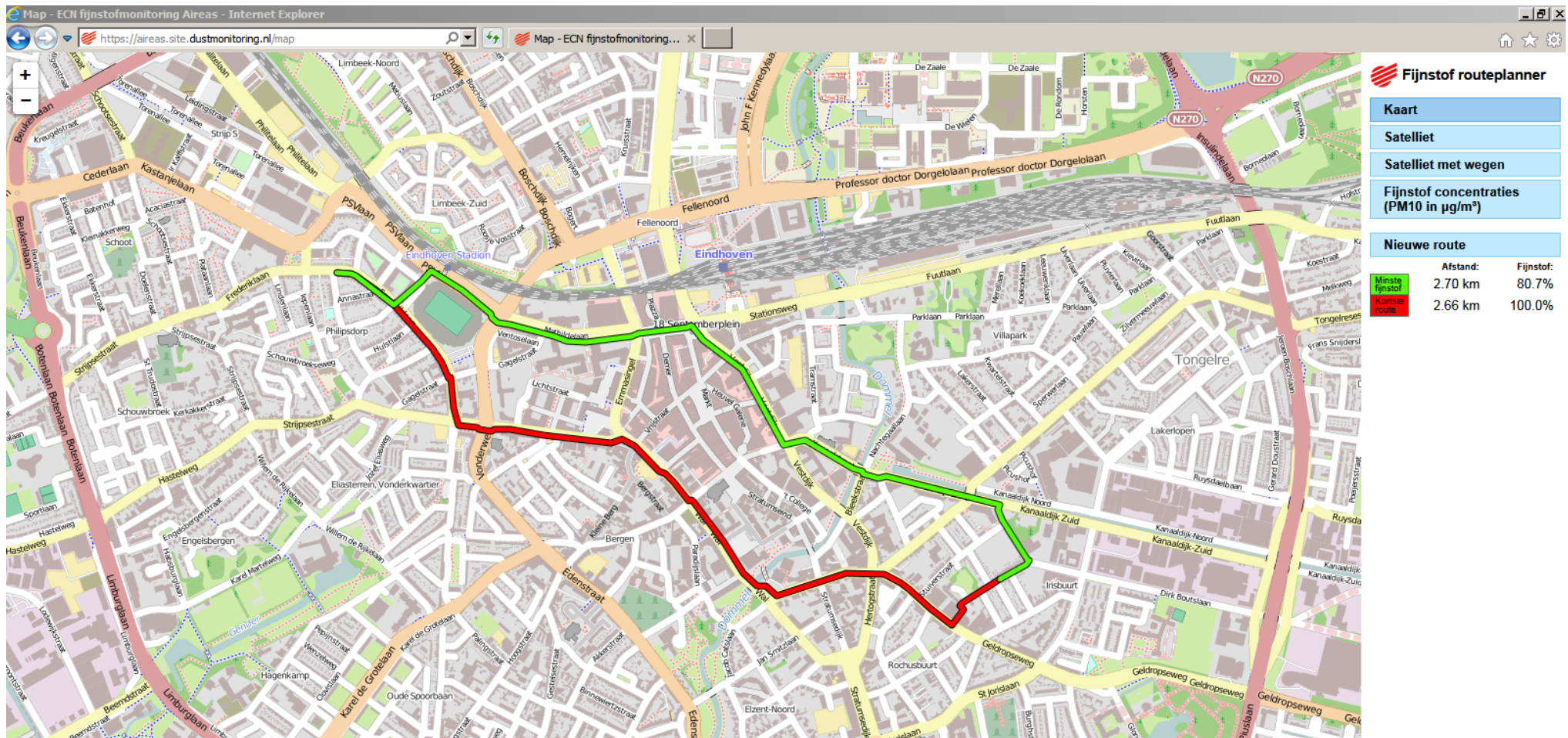


Precision shown at  
October storm 2013

Enough to reveal city  
gradients

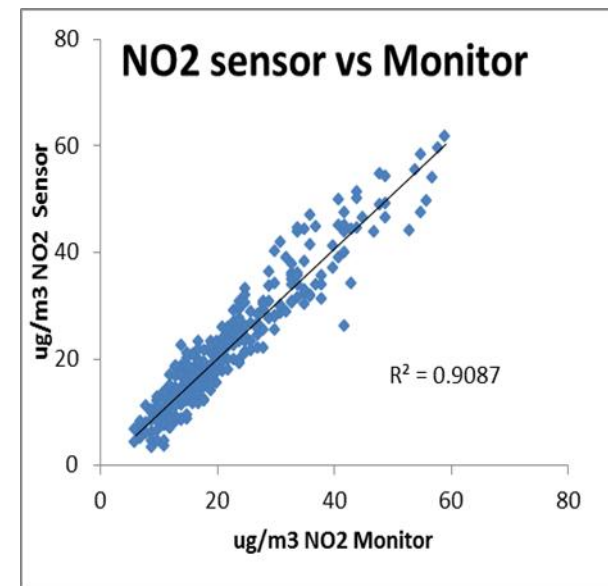
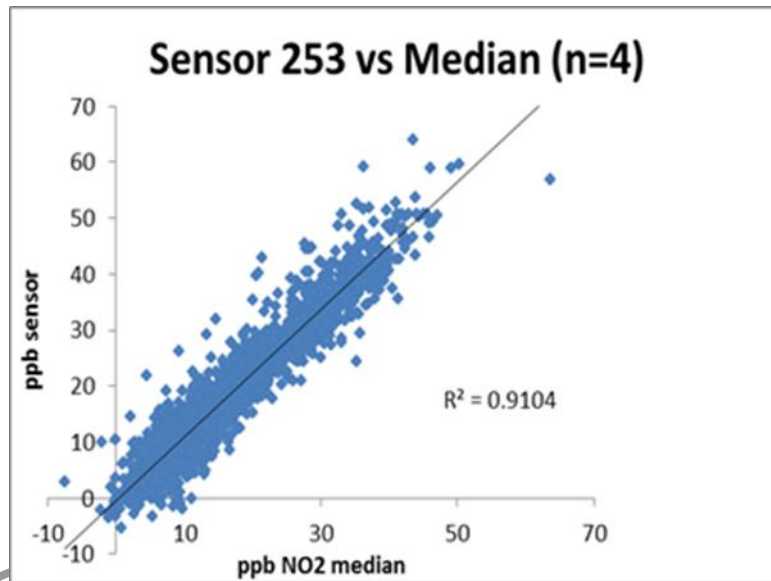
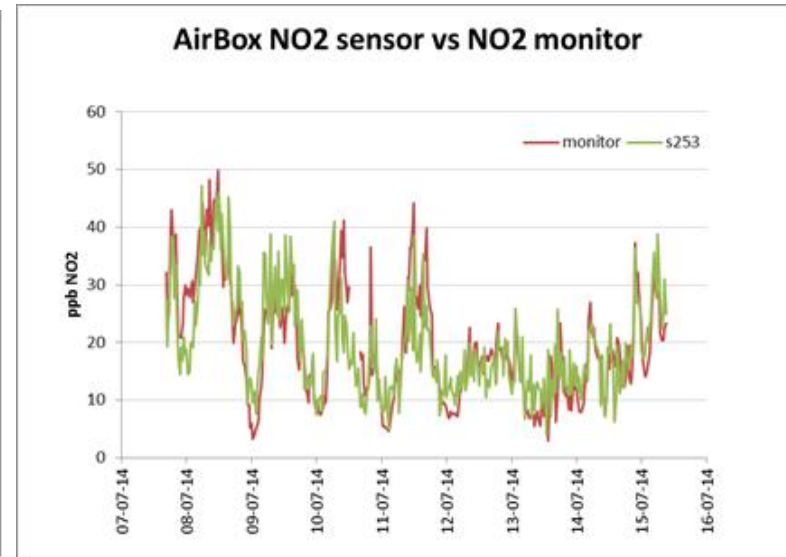
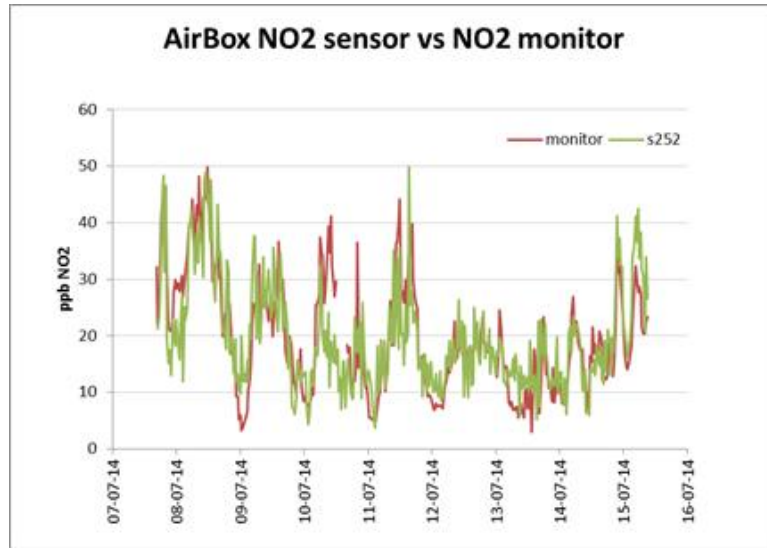


# Most healthy route per component



# Achieved RESULTS NO2

Eindhoven summer 2014





# Future planned Activities

Development and assessment of full service networks for urban air quality and bulk goods transit areas.

Highly interested in projects in these fields of application

# CONCLUSIONS

- PM 10 and 2.5 fair precision and accuracy
- NO<sub>2</sub> sensor breakthrough, no visible sensitivity for rH and O<sub>3</sub>
- Research network (n=35) in operation for a year
- Equivalence measurements with standard being conducted
- Network QA/QC to be developed



**ECN**

Westerduinweg 3  
1755 LE Petten  
The Netherlands

P.O. Box 1  
1755 LG Petten  
The Netherlands

T +31 88 515 4949  
F +31 88 515 8338  
info@ecn.nl  
www.ecn.nl

