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$_2$, PM10, PM2.5) AND ITS APPLICATION AS NETWORK IN CITY OF EINDHOVEN

Rene Otjes

WG Member

Netherlands

ECN
Your energy. Our passion.

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_2

cost
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

Sensors to measure PM

Low cost means optical

Issues with
> specific weight,
> UFP (can't see),
> volatile fraction (NH_4NO_3 yes, H_2O no)
> size distribution (conversion by volume)

Sensors to measure NO$_2$

- 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 wavelenghts

- Drift performance in urban environment by comparison with local reference stations

- Characterization of precision by meteo conditions

- Equivalence testing (4 seasons / 4 different sites)
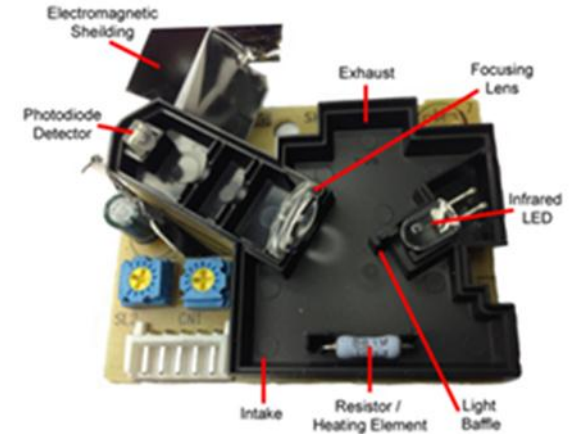
Current activities

NO$_2$

- Solving the rH cross sensitivity and baseline drift in situ

- Drift in sensitivity

- Equivalence testing by GGD Amsterdam

- Pending Patent

Current activities Network

- Progress pilot network in **Eindhoven** since 1 year

- at 35 locations for PM, O3, rH, T and GPS

- At 5 locations with UFP (Nanomonitor)

- This year 4 NO2 sensors planned

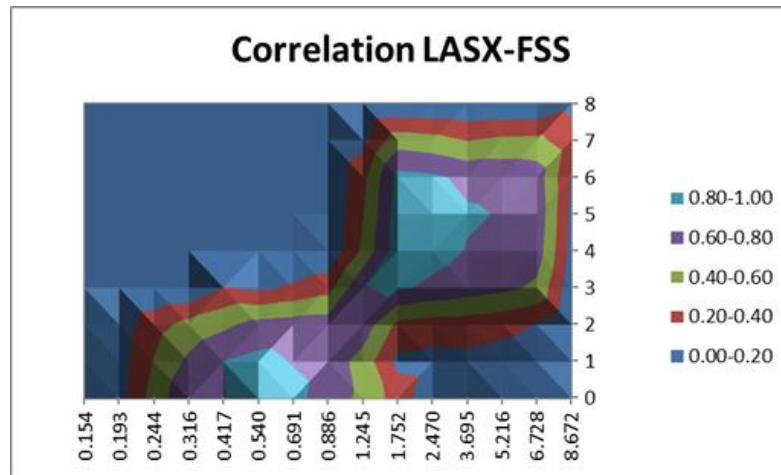- Next year NO2 for all 35 locations

- Adjacent Cities joining in
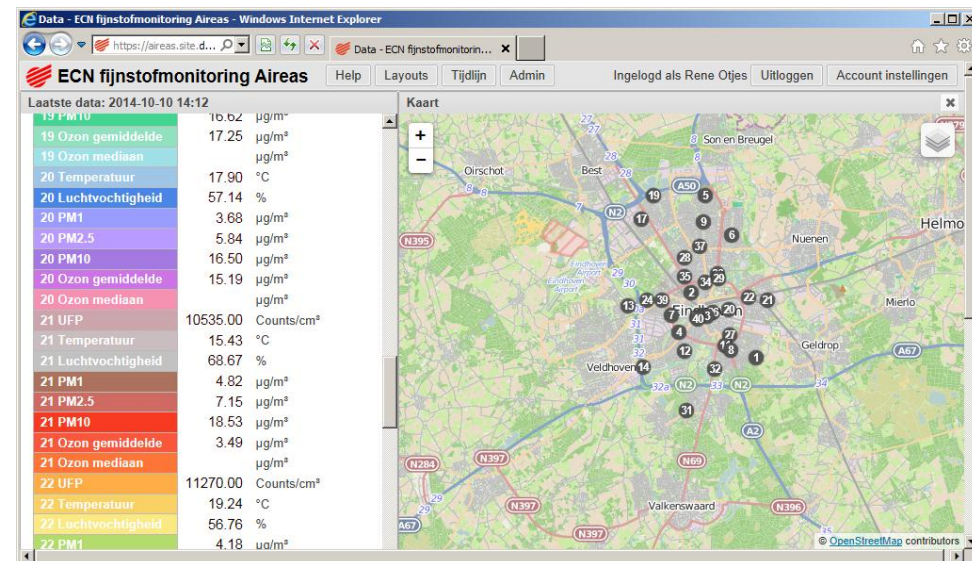
Achieved RESULTS PM

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

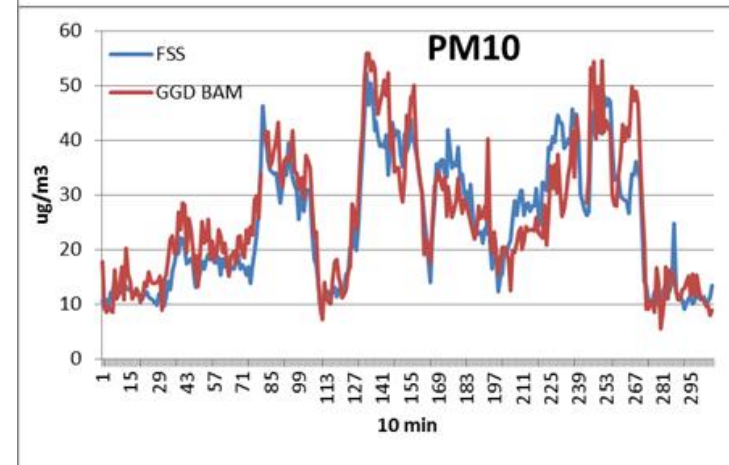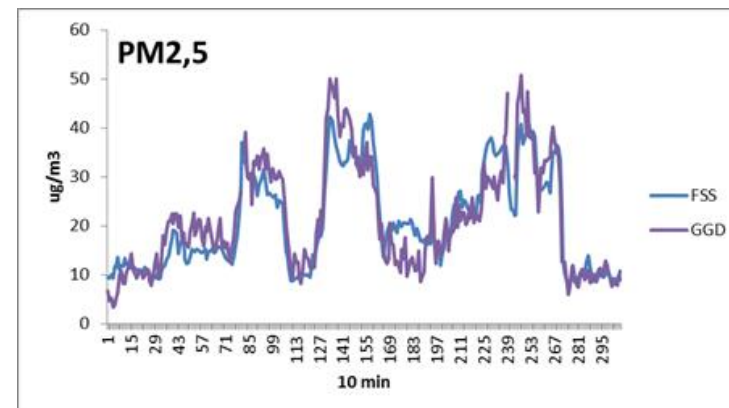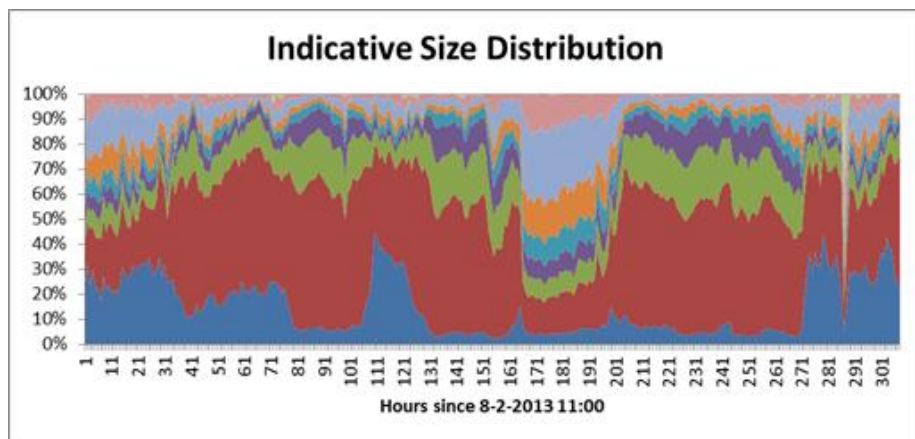Take time series for each size channel and determine correlation with all size channels of LasX
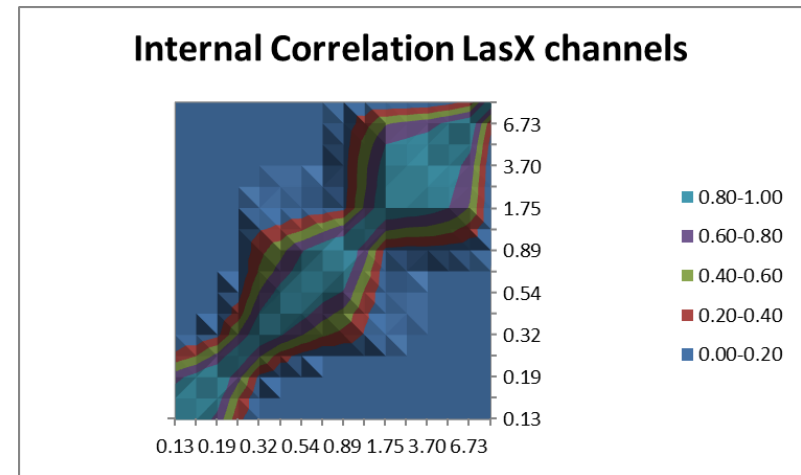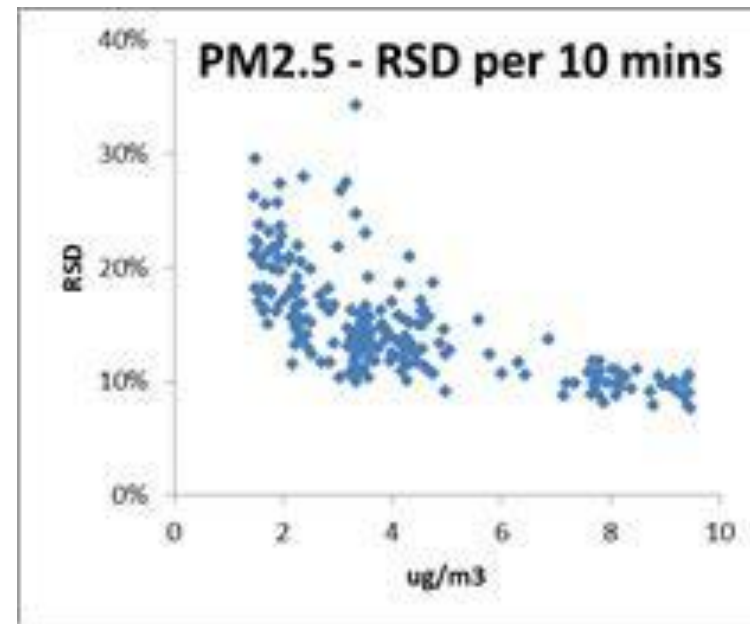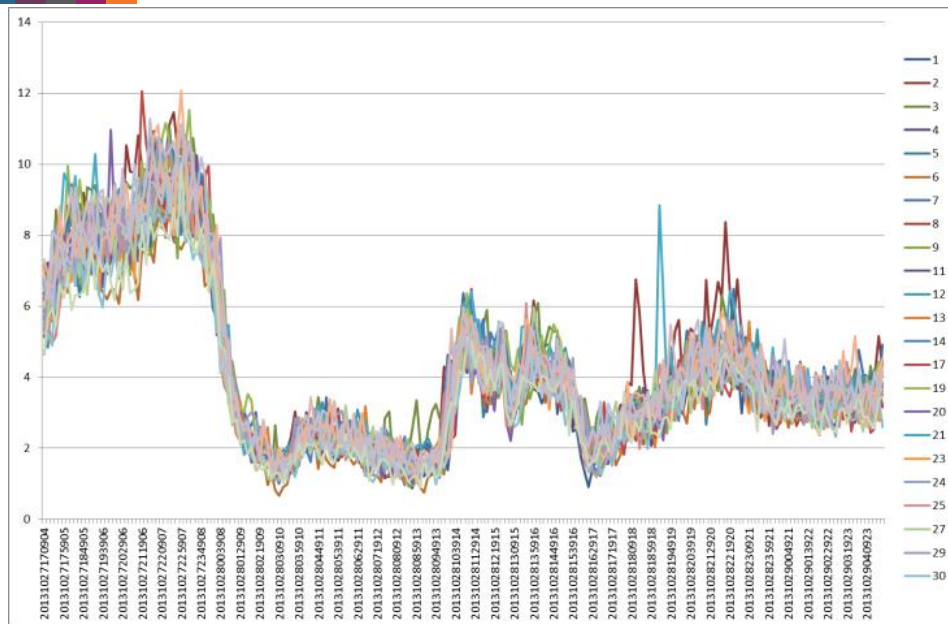
Achieved RESULTS

Good comparison with BAM

Measurement at city background site in Amsterdam

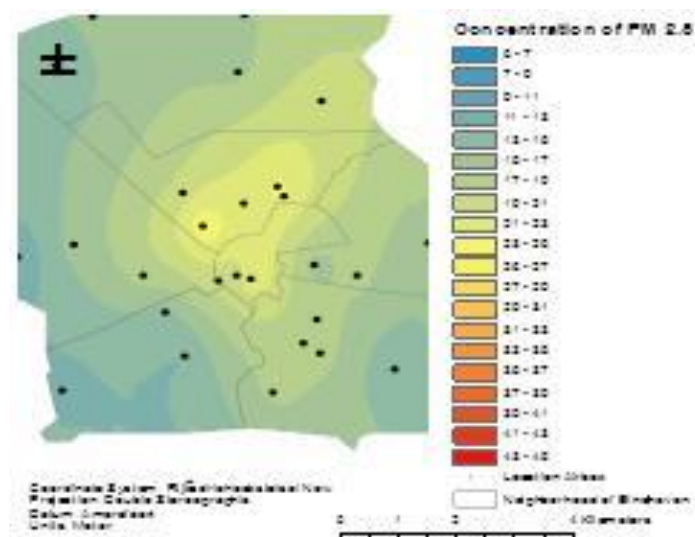Comparison with BAM for PM10 and PM2.5
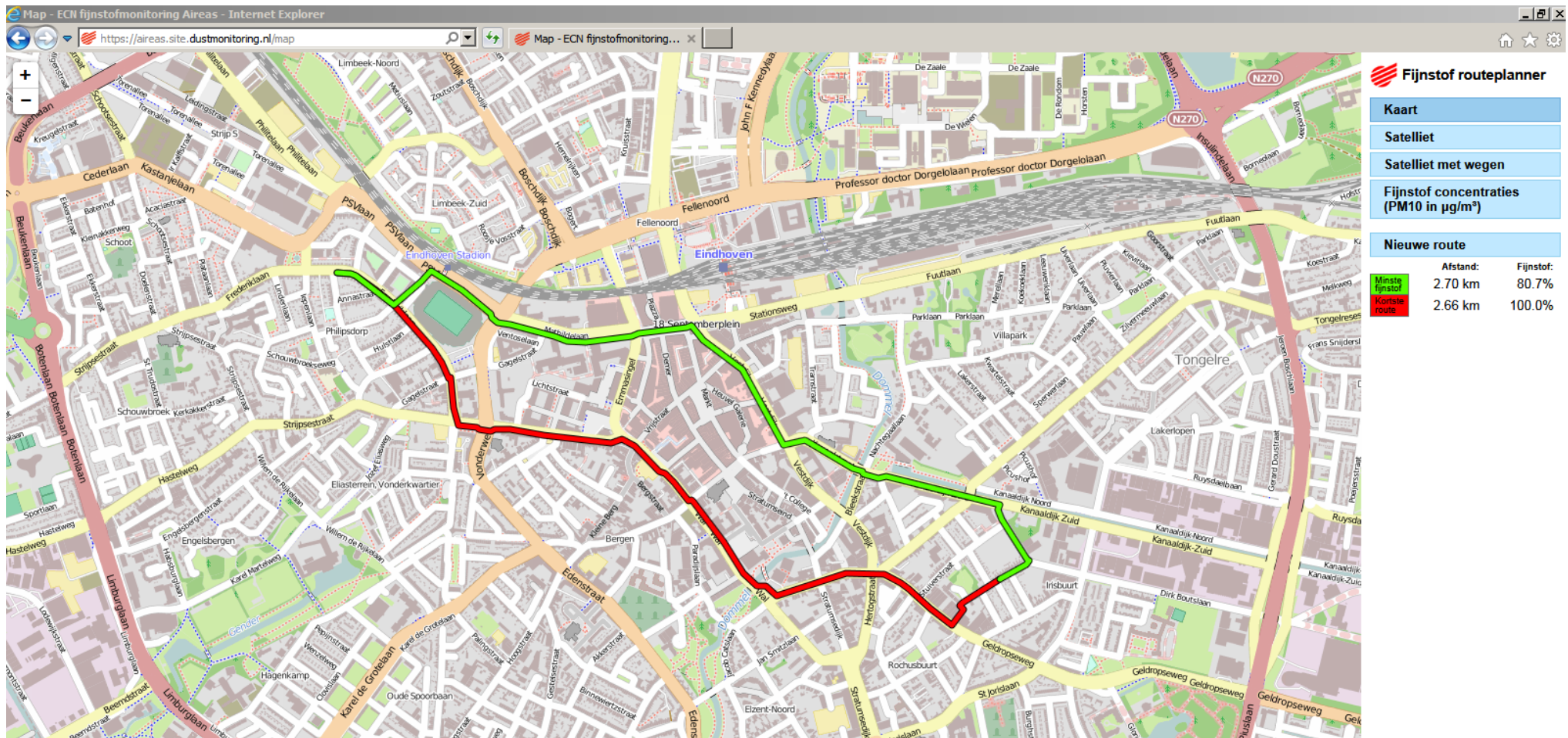Also PM1 and size distribution

Achieved RESULTS Network

PM2.5 - RSD per 10 mins

Precision shown at October storm 2013

Enough to reveal city gradients

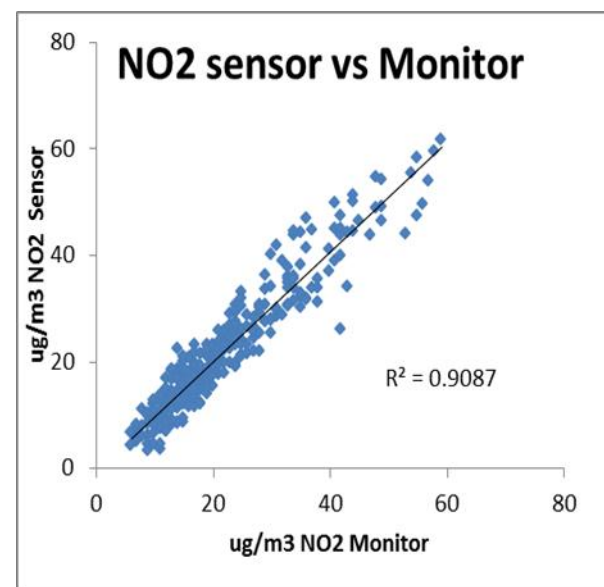Concentration of PM 2.5

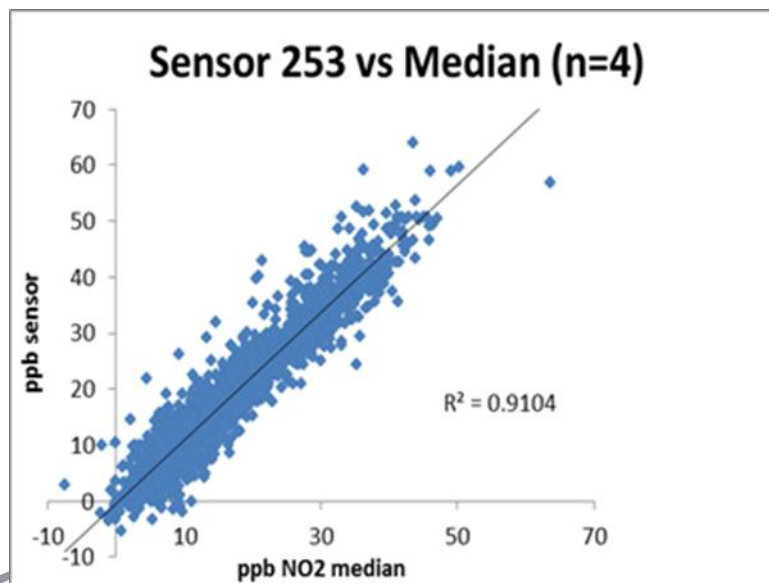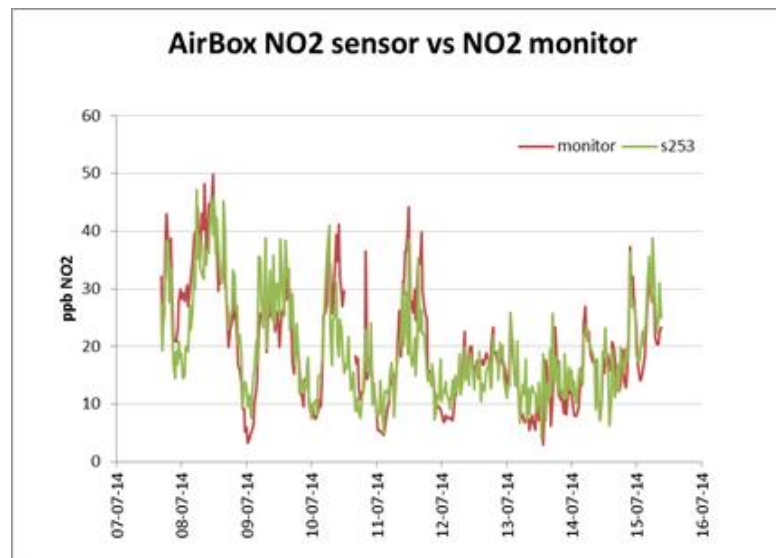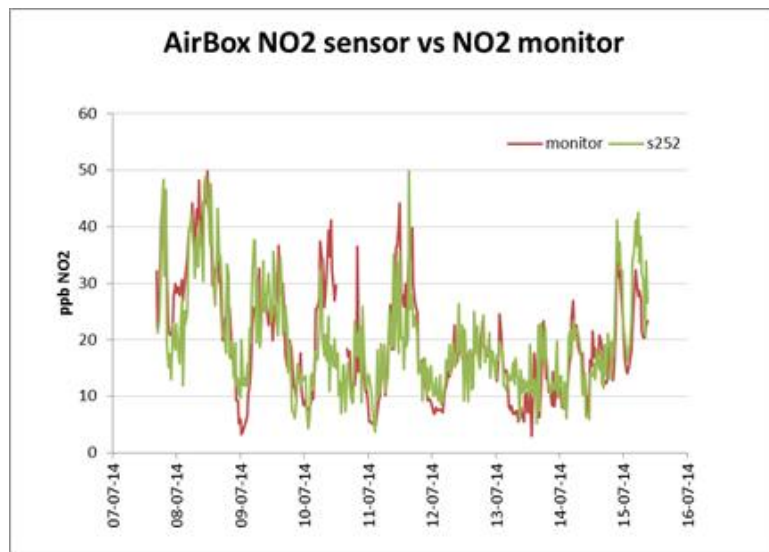EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

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

- NO2 sensor breakthrough, no visible sensitivity for rH and O3

- Research network (n=35) in operation for a year

- Equivalence measurements with standard being conducted

- Network QA/QC to be developed

cost
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY