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Experimental studies of size distributions of ultrafine particles: emissions and concentrations in streets, indoor along streets and in urban background

Experimental studies of size distributions of ultrafine particles: Emissions and concentrations in streets, indoor along streets and in urban background

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5th International ETH-Conference on Nanoparticle Measurement

Background

- Traffic particulates, i.e. direct exhaust and particles from road, tires, brakes, re-suspension etc.
- On-road measurements of emissions and air quality from the actual car fleet
- Input to models for air quality and human exposure
- Ultrafine (nano) particles important in relation to health
- Limit values for PM_{10} or ?

Aims

- To characterise the geographic and temporal variability in particle composition and size distributions in Danish ambient air.
- To determine particle emission factors for various vehicle categories.
- Determine indoor - outdoor relationships for building along busy streets.
- Determine the role of traffic emissions in formation of indoors particulate irritants.

Approach

- Field measurements of particles in connection with other pollution measurements (routine monitoring)
- Measurements in streets, urban background and indoor
- Long time series and high time resolution
- Application of receptor modelling and source-receptor modelling
- Supplemented with emission measurements


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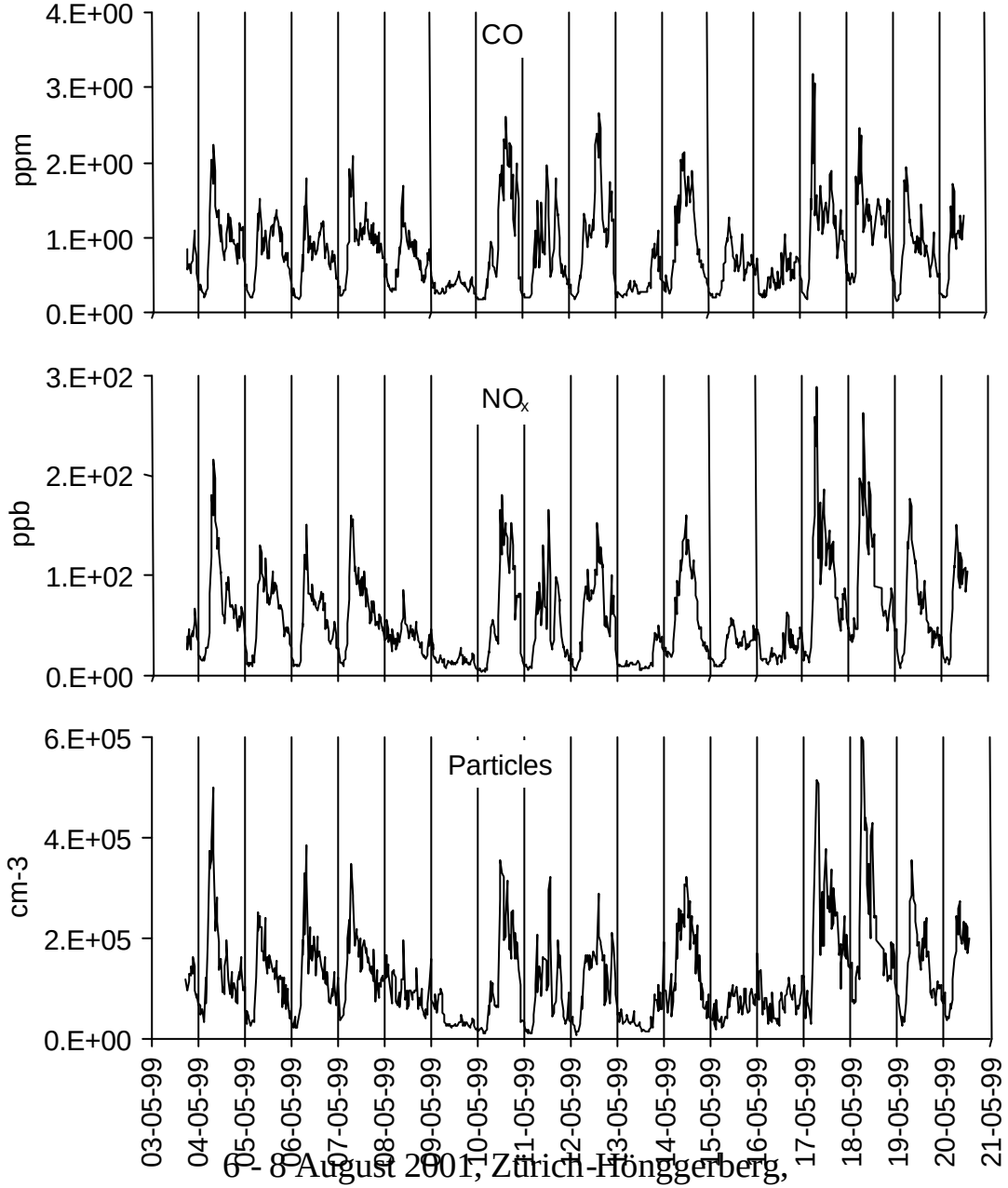
CO
ppm
4.E+00
3.E+00
2.E+00
1.E+00
0.E+00
NOx
ppb
3.E+02
2.E+02
1.E+02
0.E+00
Particles
cm-3
6.E+05
4.E+05
2.E+05
0.E+00
03-05-99
04-05-99
05-05-99
06-05-99
07-05-99
08-05-99
09-05-99
10-05-99
11-05-99
12-05-99
13-05-99
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15-05-99
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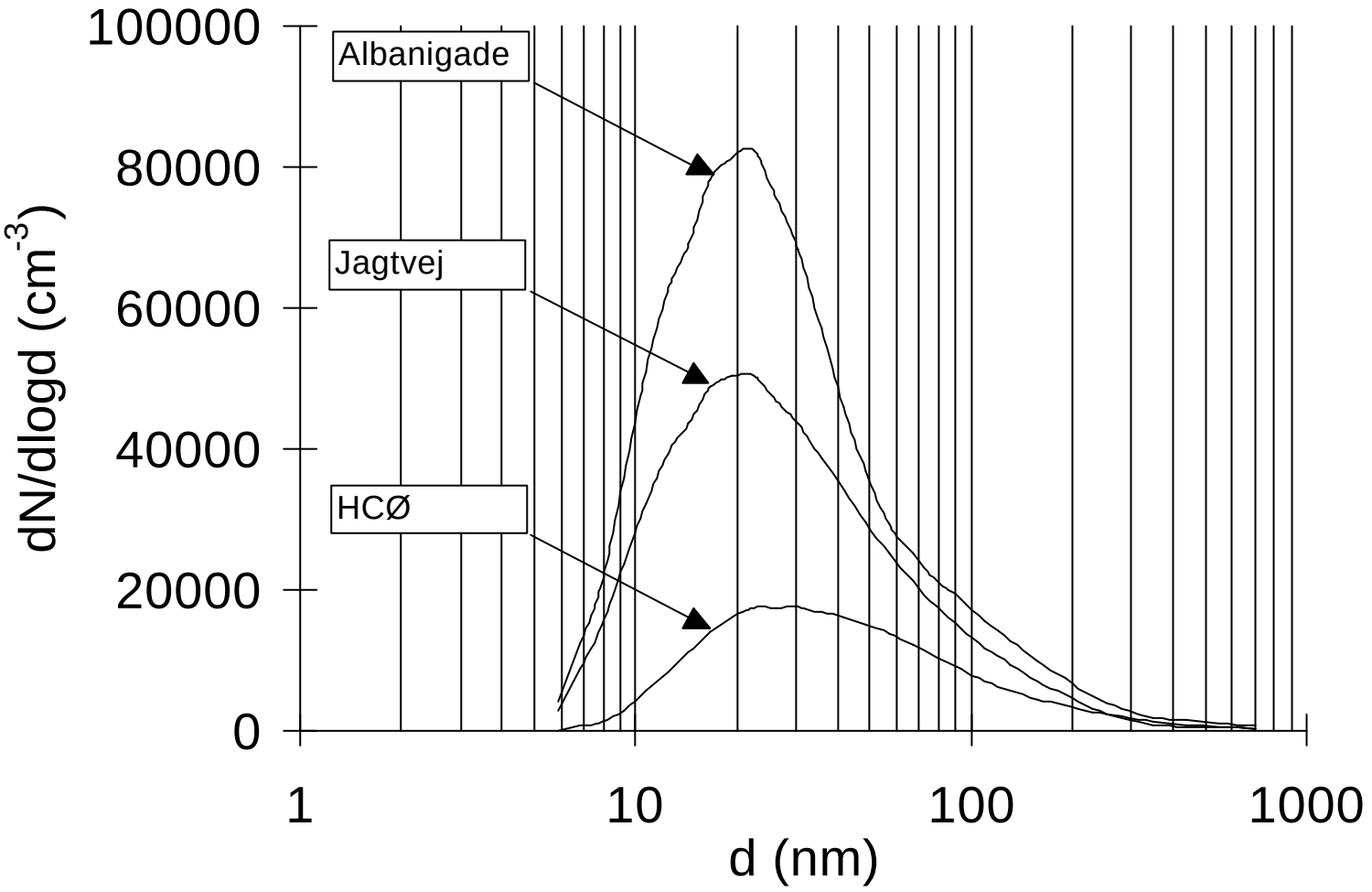
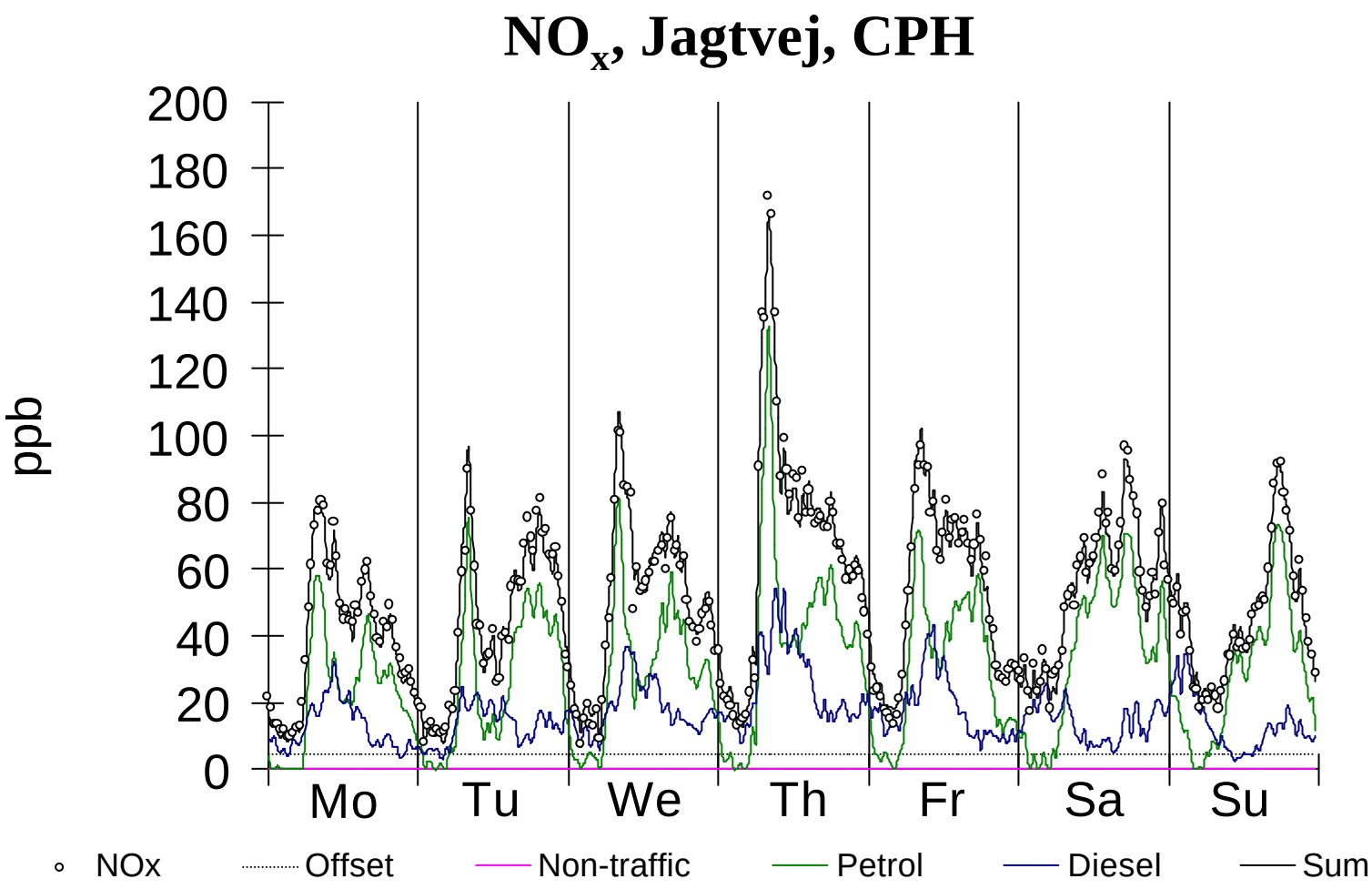
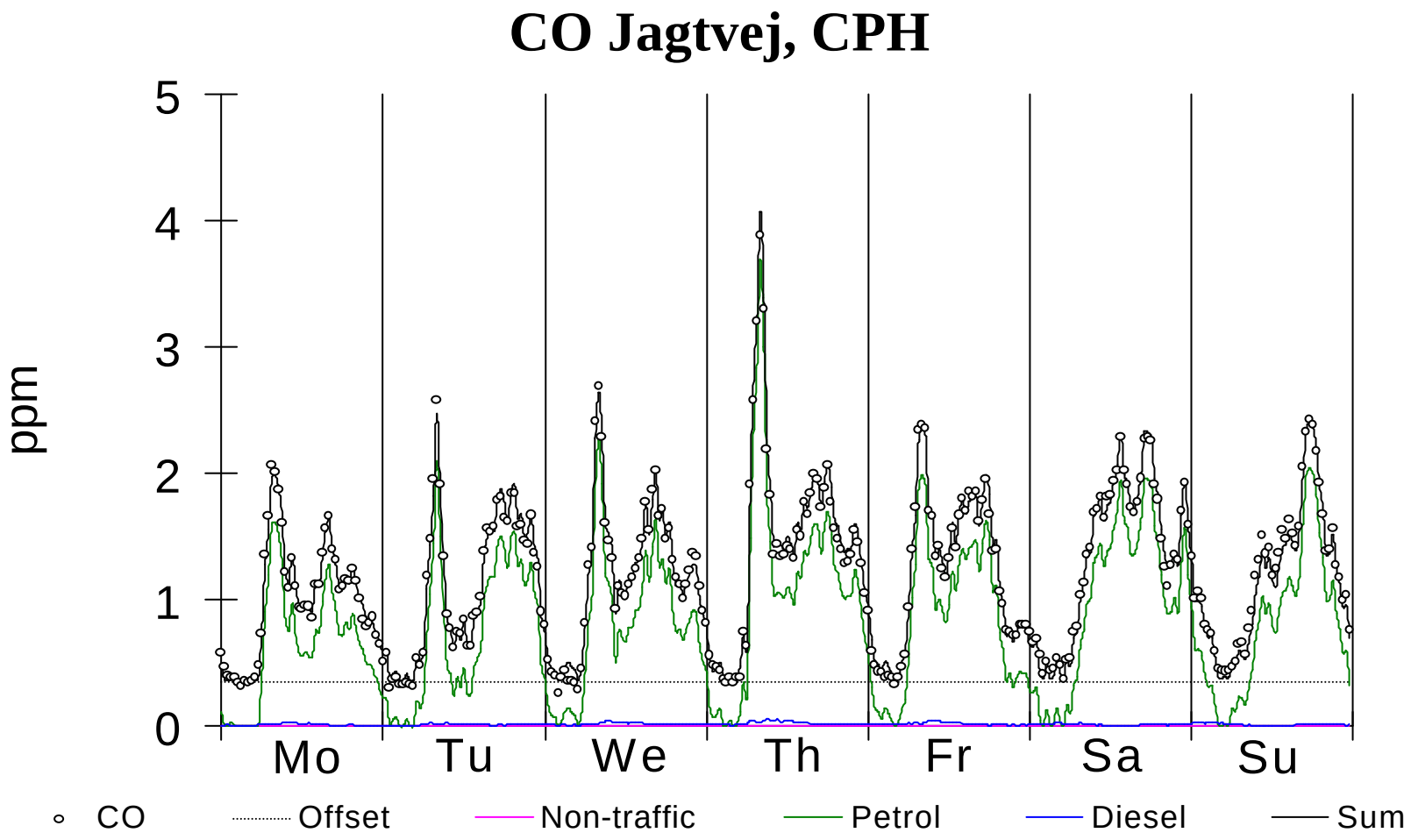
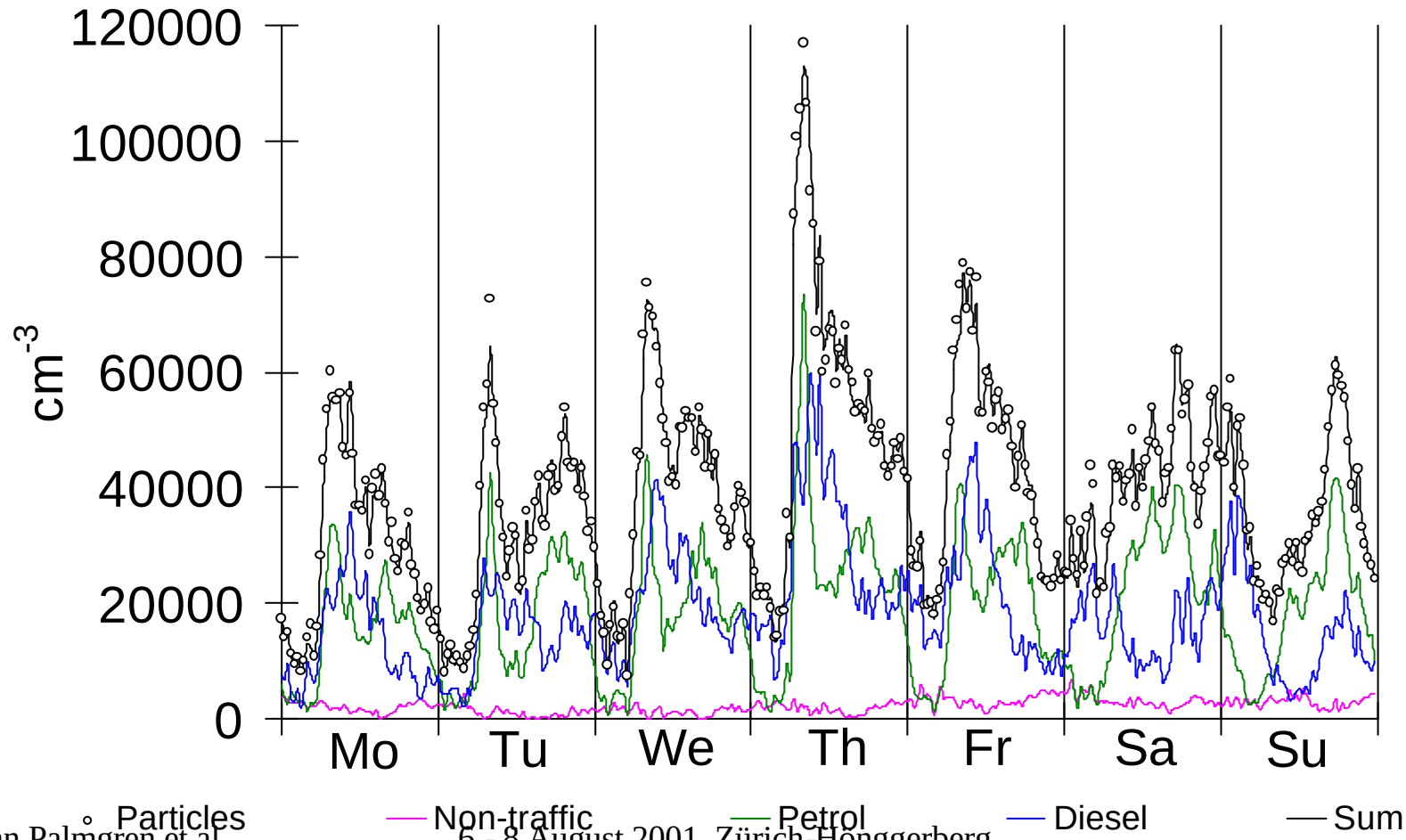
17-05-99
18-05-99
19-05-99
20-05-99
21-05-99


100000
80000
60000
40000
20000
0
dN/dlogd (cm-3)
Albanigade
Jagtvej
HCØ
1
10
100
1000
d (nm)

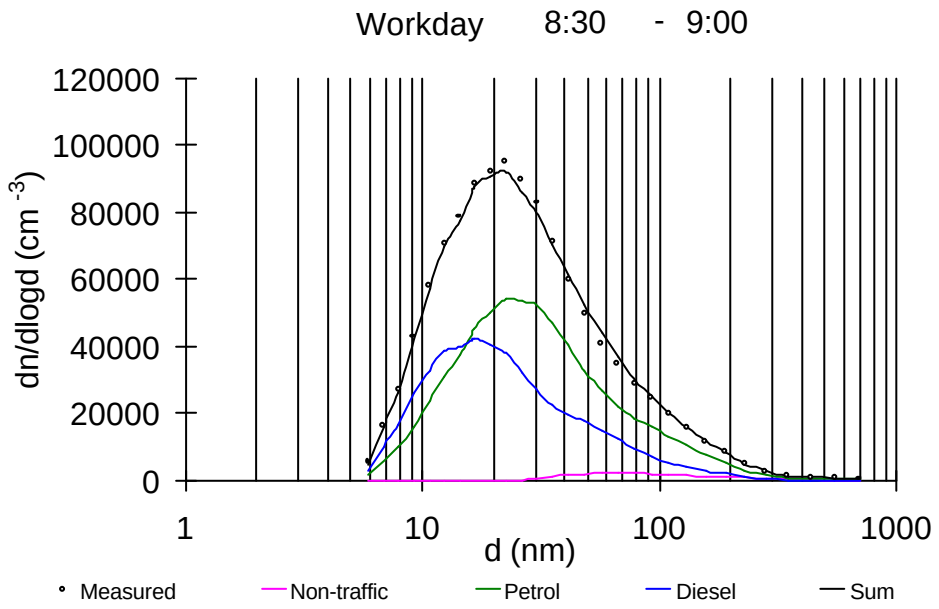

NOx, Jagtvej, CPH
ppb
200
180
160
140
120
100
80
60
40
20
0
Mo
Tu
We
Th
Fr
Sa
Su
NOx
Offset
Non-traffic
Petrol
Diesel
Sum


CO Jagtvej, CPH
ppm
5
4
3
2
1
0
Mo
Tu
We
Th
Fr
Sa
Su
CO
Offset
Non-traffic
Petrol
Diesel
Sum

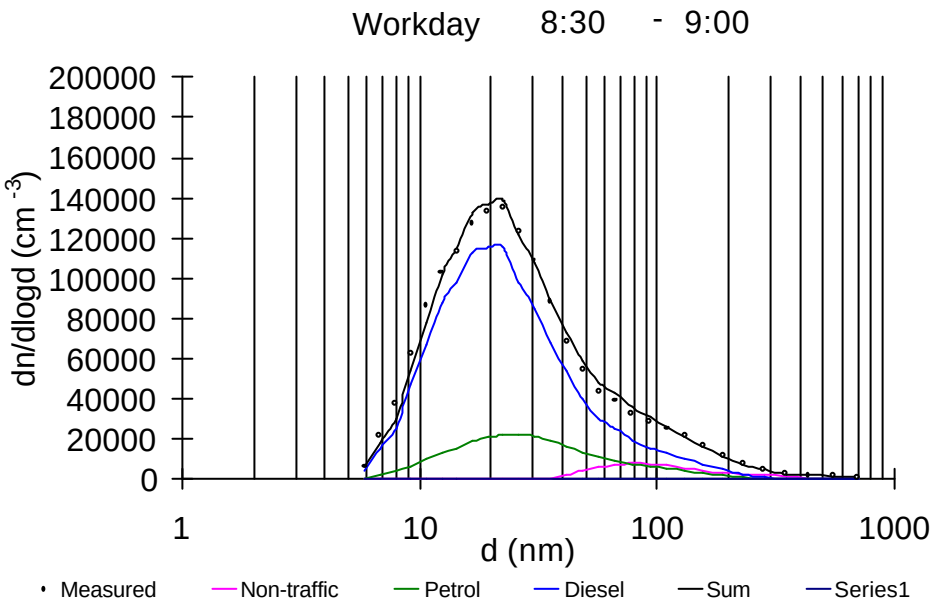
Particles, Jagtvej, CPH



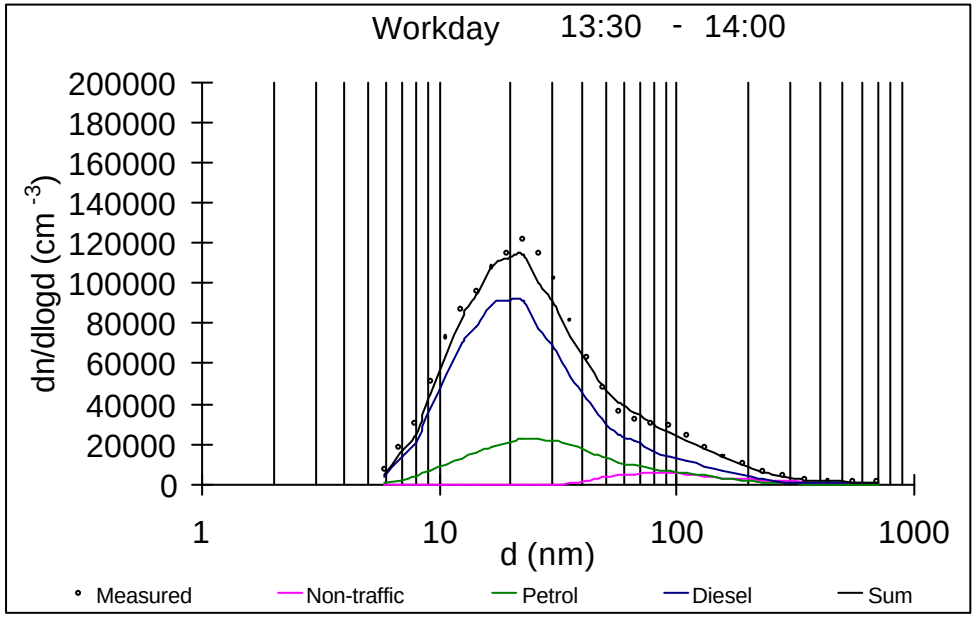
Jagtvej

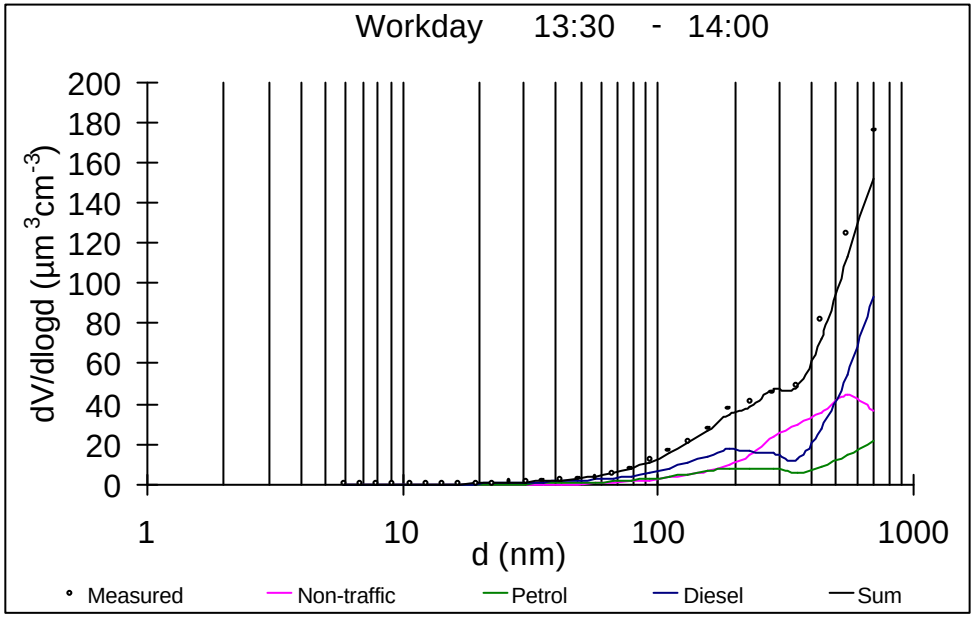


Albanigade



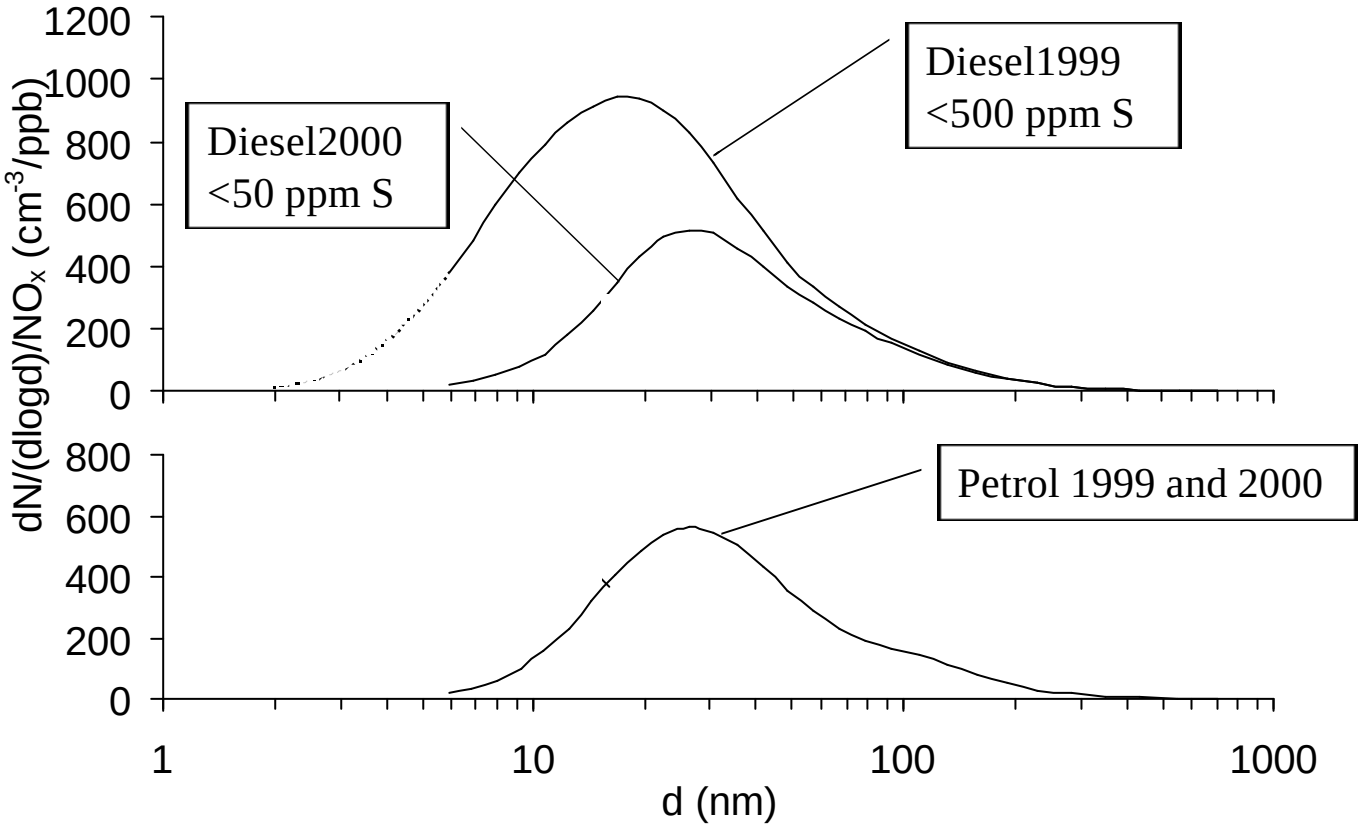
Number/Volume

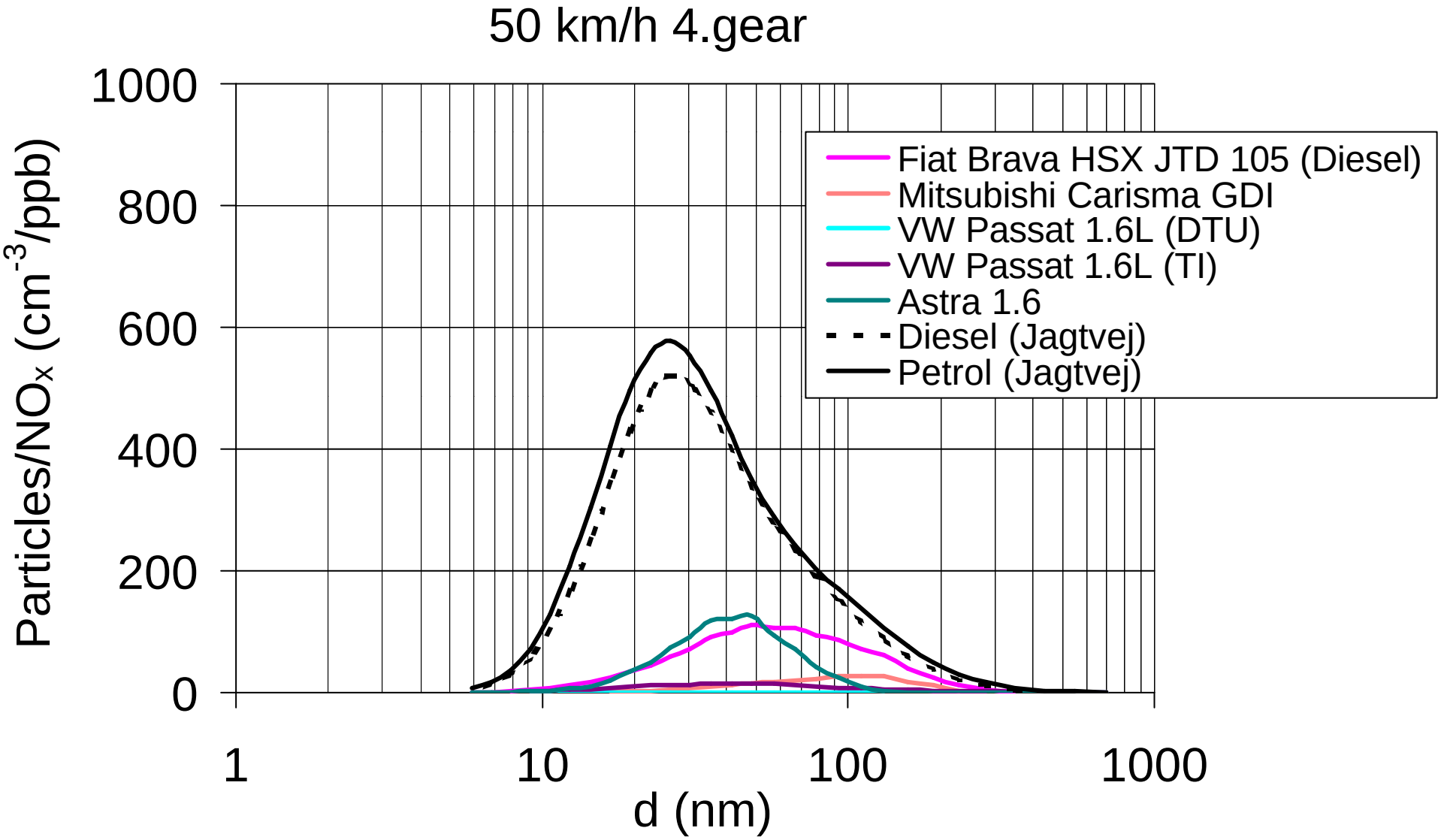


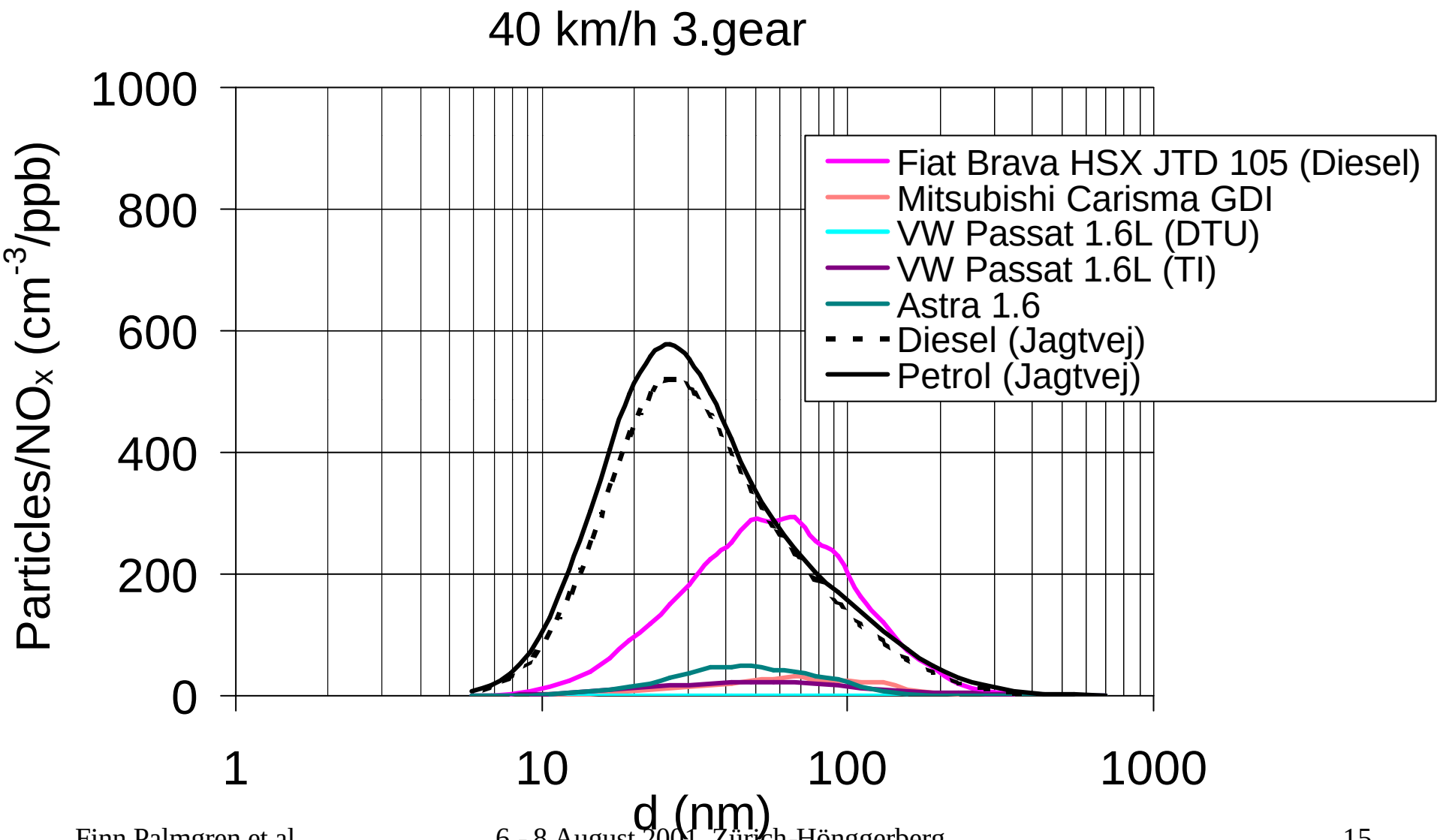


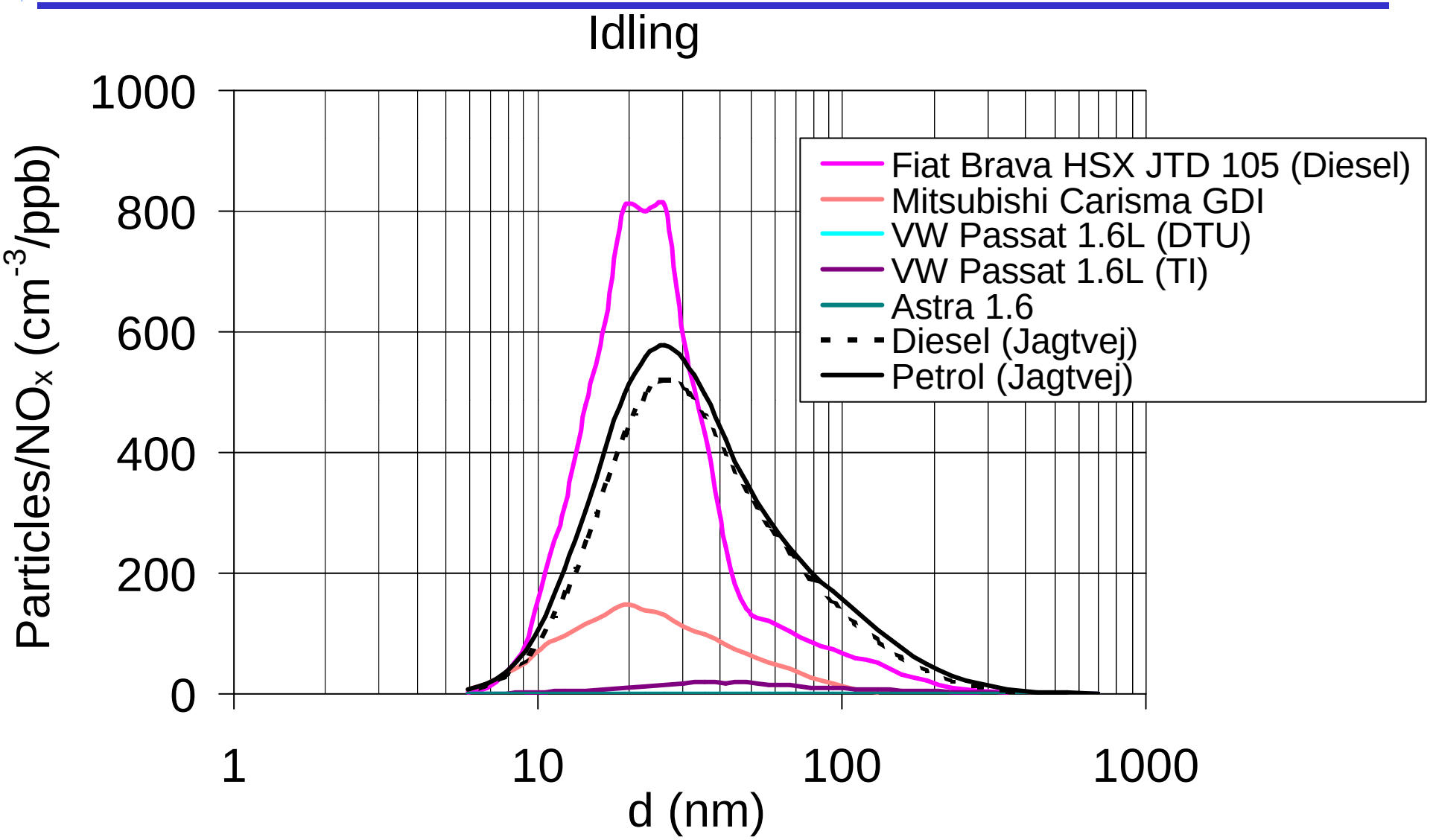
Reduced sulphur in diesel fuel

(Peter Wåhlin et al.)

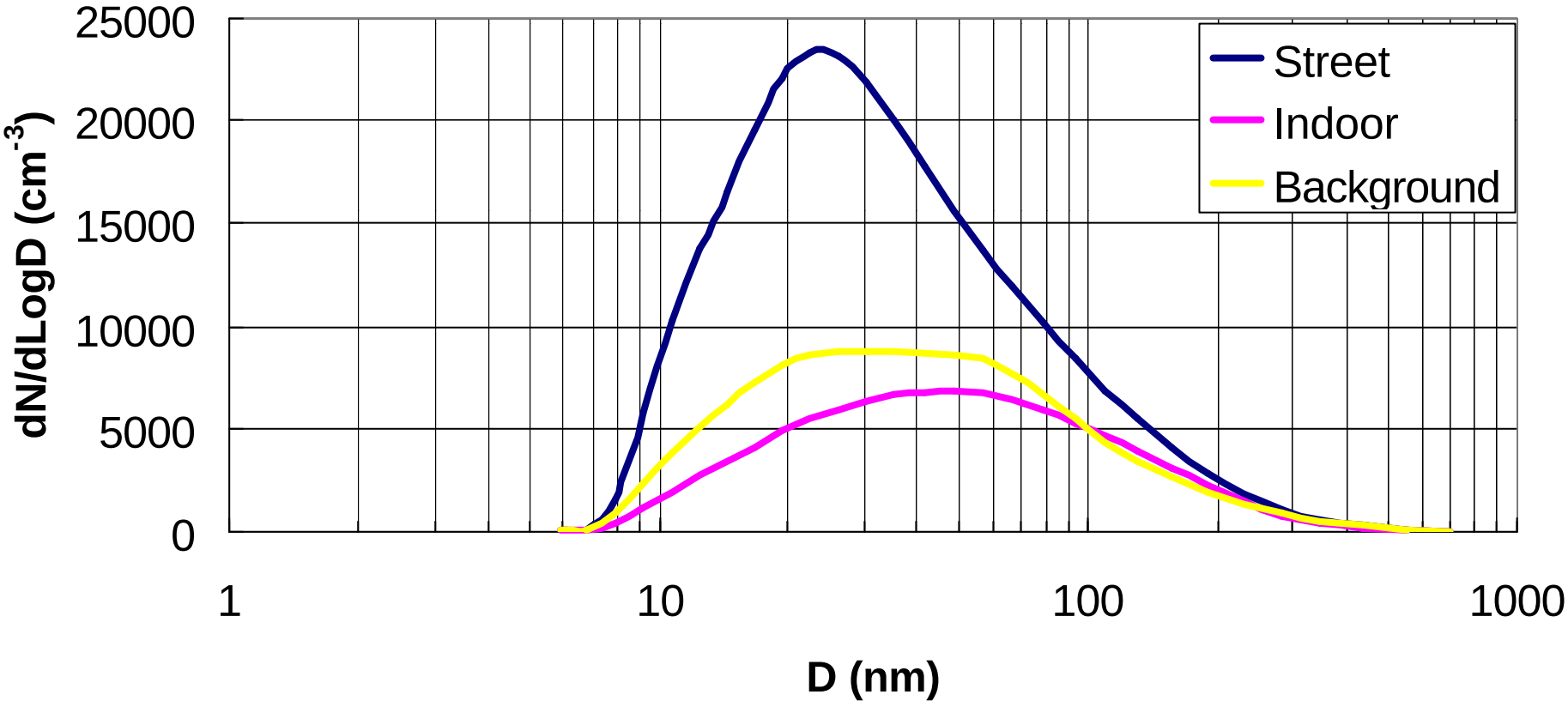



50 km/h 4.gear
Particles/NOx (cm-3/ppb)
1000
800
600
400
200
0
1
10
100
1000
d (nm)
Fiat Brava HSX JTD 105 (Diesel)
Mitsubishi Carisma GDI
VW Passat 1.6L (DTU)
VW Passat 1.6L (TI)
Astra 1.6
Diesel (Jagtvej)
Petrol (Jagtvej)

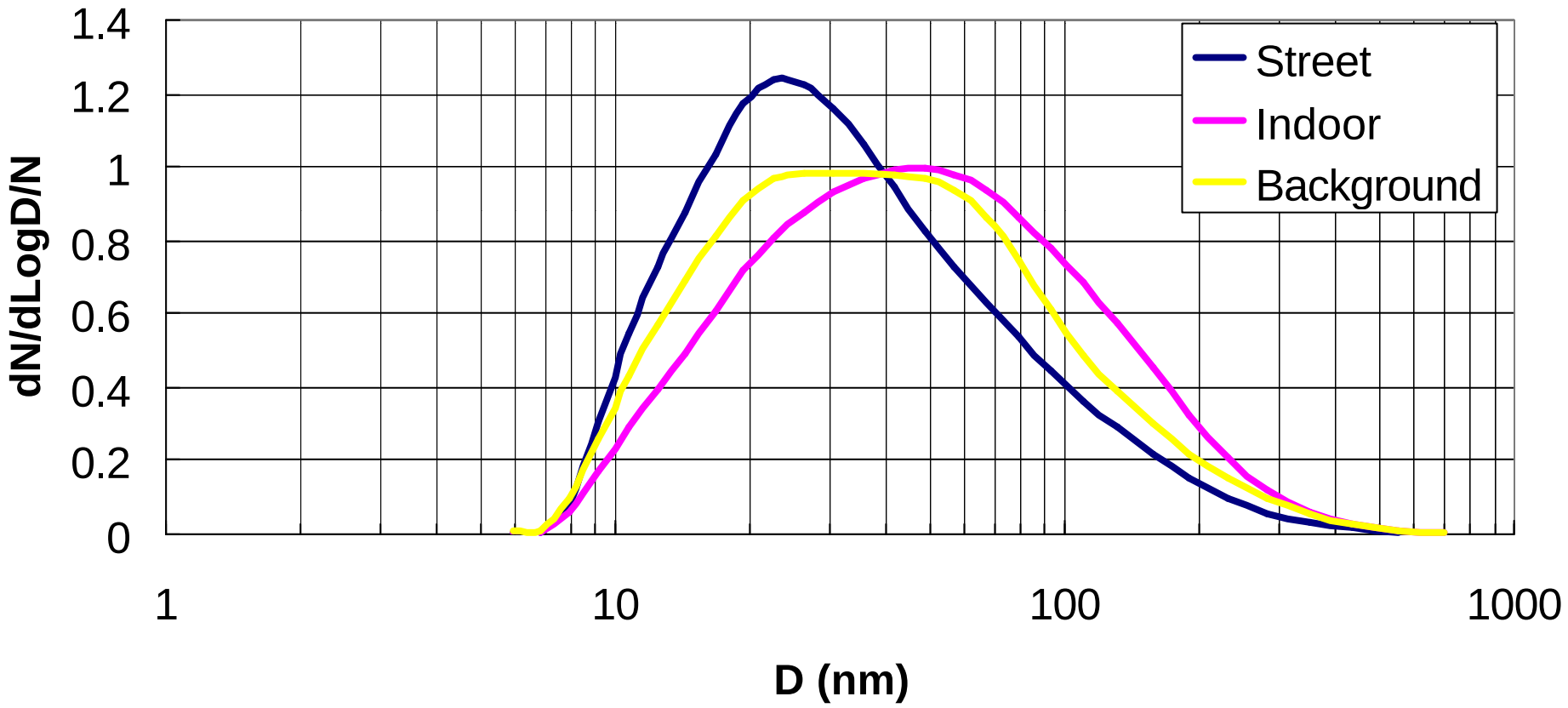

40 km/h 3.gear
Particles/NOx (cm-3/ppb)
1000
800
600
400
200
0
1
10
100
1000
d (nm)
Fiat Brava HSX JTD 105 (Diesel)
Mitsubishi Carisma GDI
VW Passat 1.6L (DTU)
VW Passat 1.6L (TI)
Astra 1.6
Diesel (Jagtvej)
Petrol (Jagtvej)


Idling
1000
800
600
400
200
0
Particles/NOx (cm-3/ppb)
1
10
100
1000
d (nm)
Fiat Brava HSX JTD 105 (Diesel)
Mitsubishi Carisma GDI
VW Passat 1.6L (DTU)
VW Passat 1.6L (TI)
Astra 1.6
Diesel (Jagtvej)
Petrol (Jagtvej)

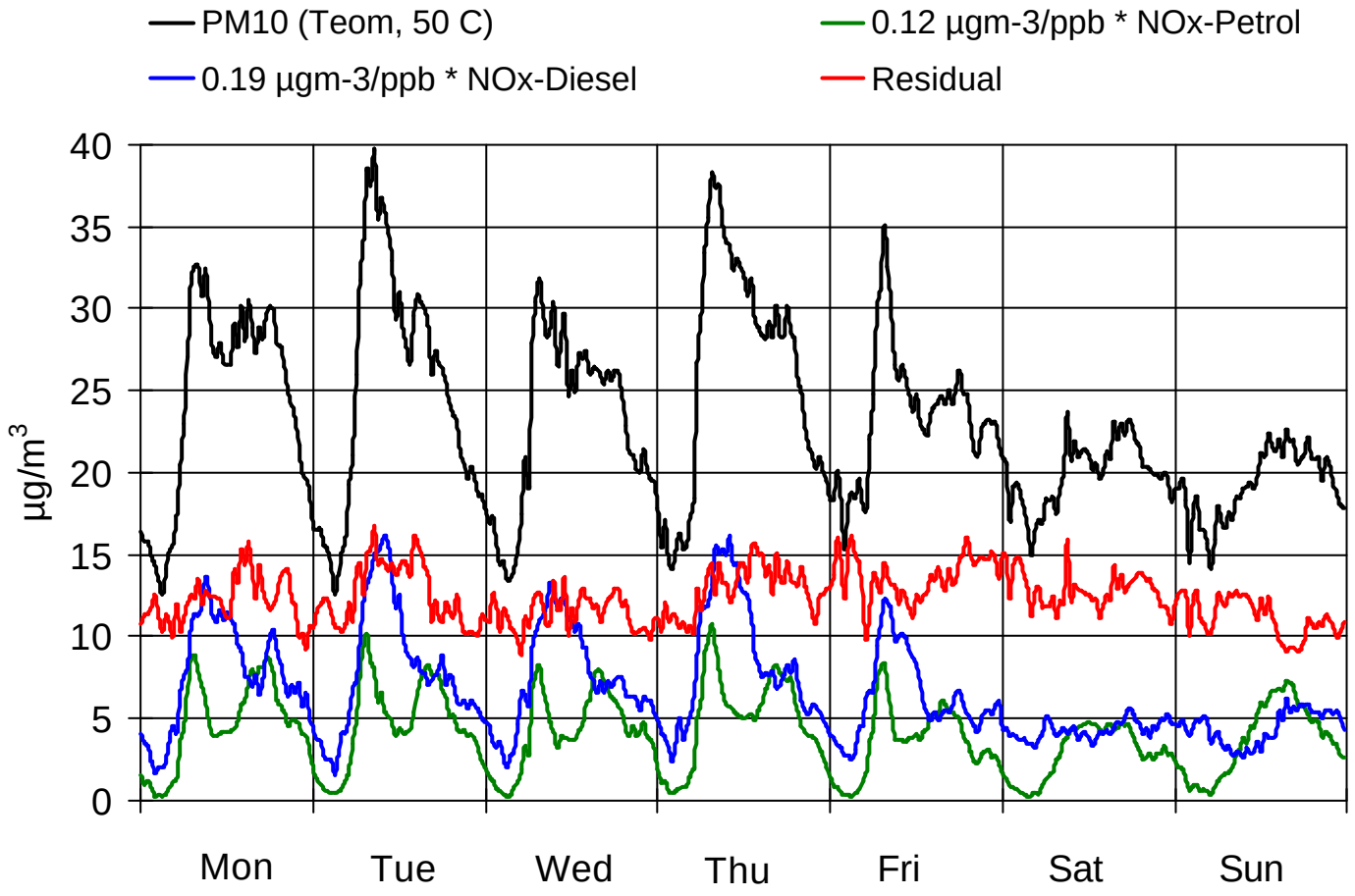
Particle distribution, CPH



Particle distribution, CPH



TEOM measurements



Plans for the coming years

- Measurements of ultrafine particles and PM_{10}/$PM_{2.5}$ at streets and urban background
- Emission measurements in the laboratory
- Chemical composition
  - BC, OC, PAH, metals, inorganic compounds etc.
- Physical properties
  - Solid/liquid/volatiles/condensates, Organic/inorganic?
  - Hygroscopic/hydrophobic?.
- Outdoor/indoor measurements
- Health impact assessment

References

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- WÅHLIN, P., PALMGREN, F. and VAN DINGENEN, R. (2001a), Experimental studies of ultrafine particles in streets and the relationship to traffic. Atmospheric Environment. Vol 35 / 1001, pp S63-S69

- WÅHLIN, P., PALMGREN, F., VAN DINGENEN, R. and RAES, F. (2001b). Pronounced decrease of ambient particle number emissions from diesel traffic in Denmark after reduction of the sulphur content in diesel fuel. Atmospheric Environment. Vol 35 / 21, pp 3549-3552.