Das Lebensministerium

# Characterization of environmental ultrafine particles with the UFP 330

## system calibration and evaluation

Freistaat Sachsen

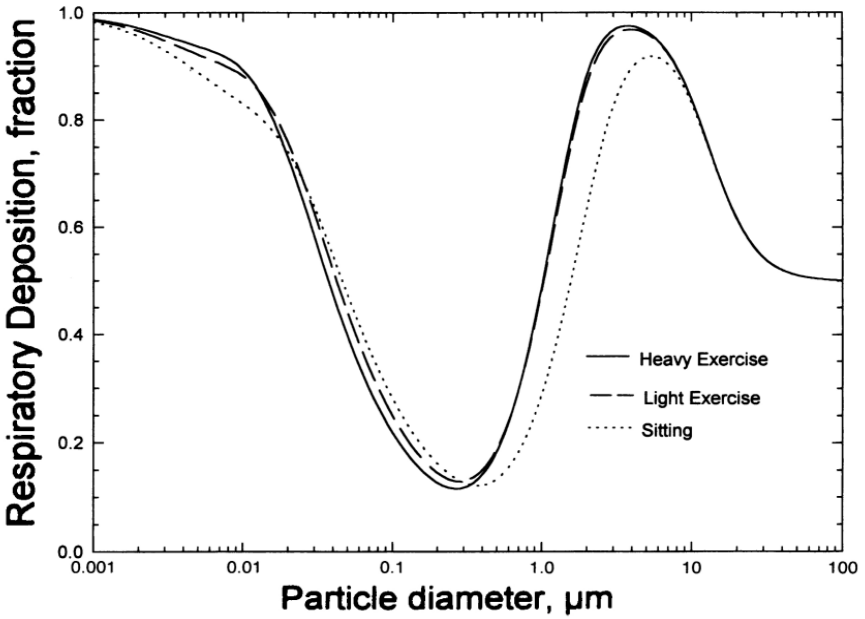
# Agenda

- Motivation
- Principal setup
- Calibration – charger characteristic
- Inversion
- Evaluation – comparison to reference
- Summary

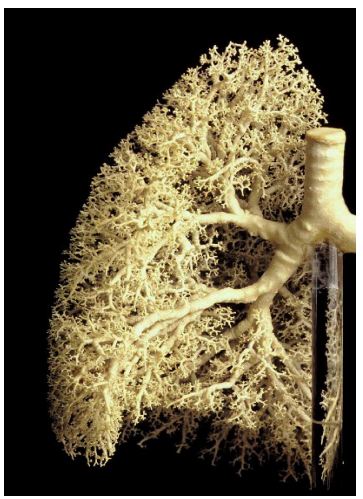
# Motivation

Ultrafine particles ...

- ... reach the deep lung
- ... are suspected to cause cancer
- ... induce respiratory ailment and reduce lung function
- ... shorten our life expectancy by 6 months

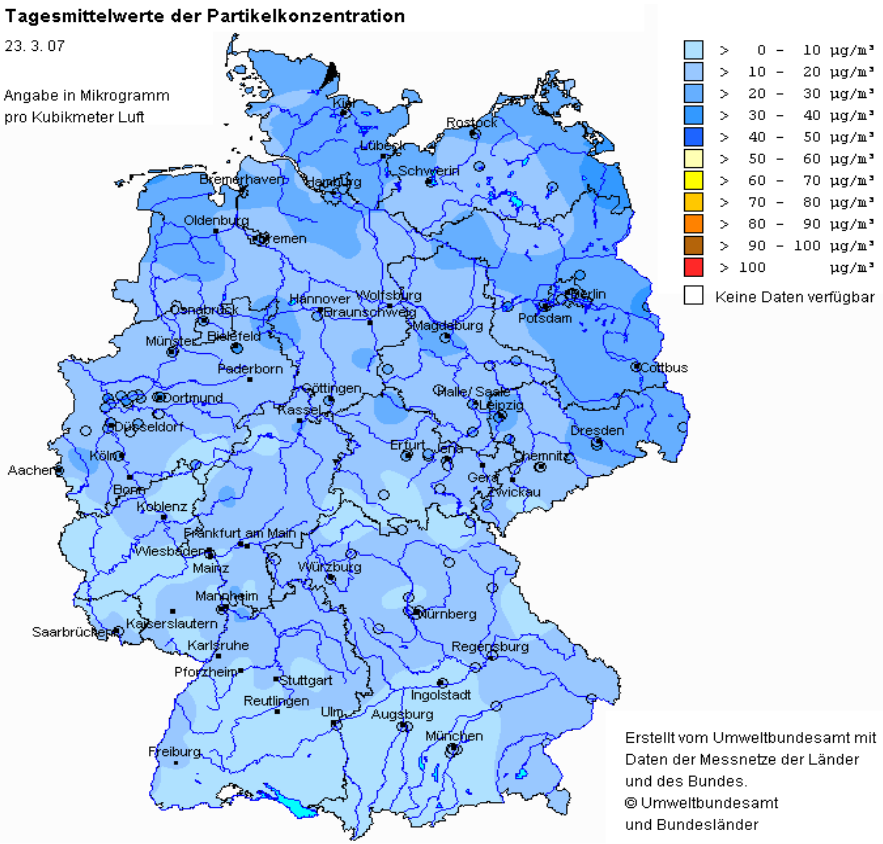



source: Hinds, Aerosol technology



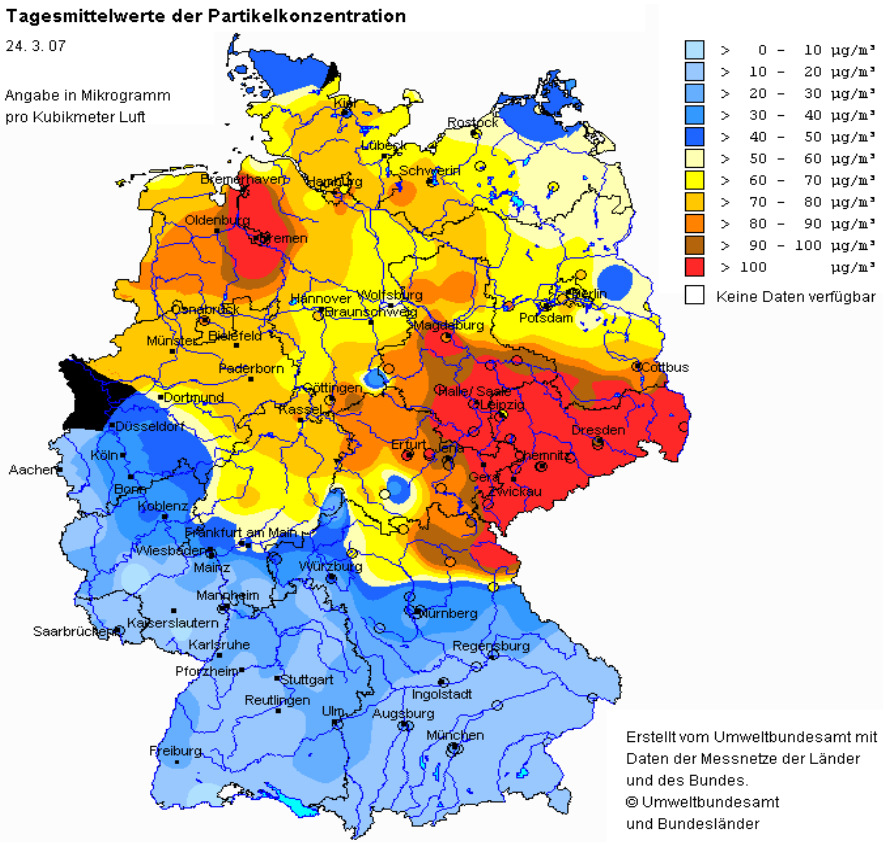
# Motivation

## march 23.




Die vom Umweltbundesamt zusammengestellten Karten und Daten zur aktuellen Immissionssituation dienen der orientierenden Information der Bevölkerung.
Auf Grund der weiträumigen Betrachtung ist eine kleinräumige Interpretation nicht zulässig.

## march 24.

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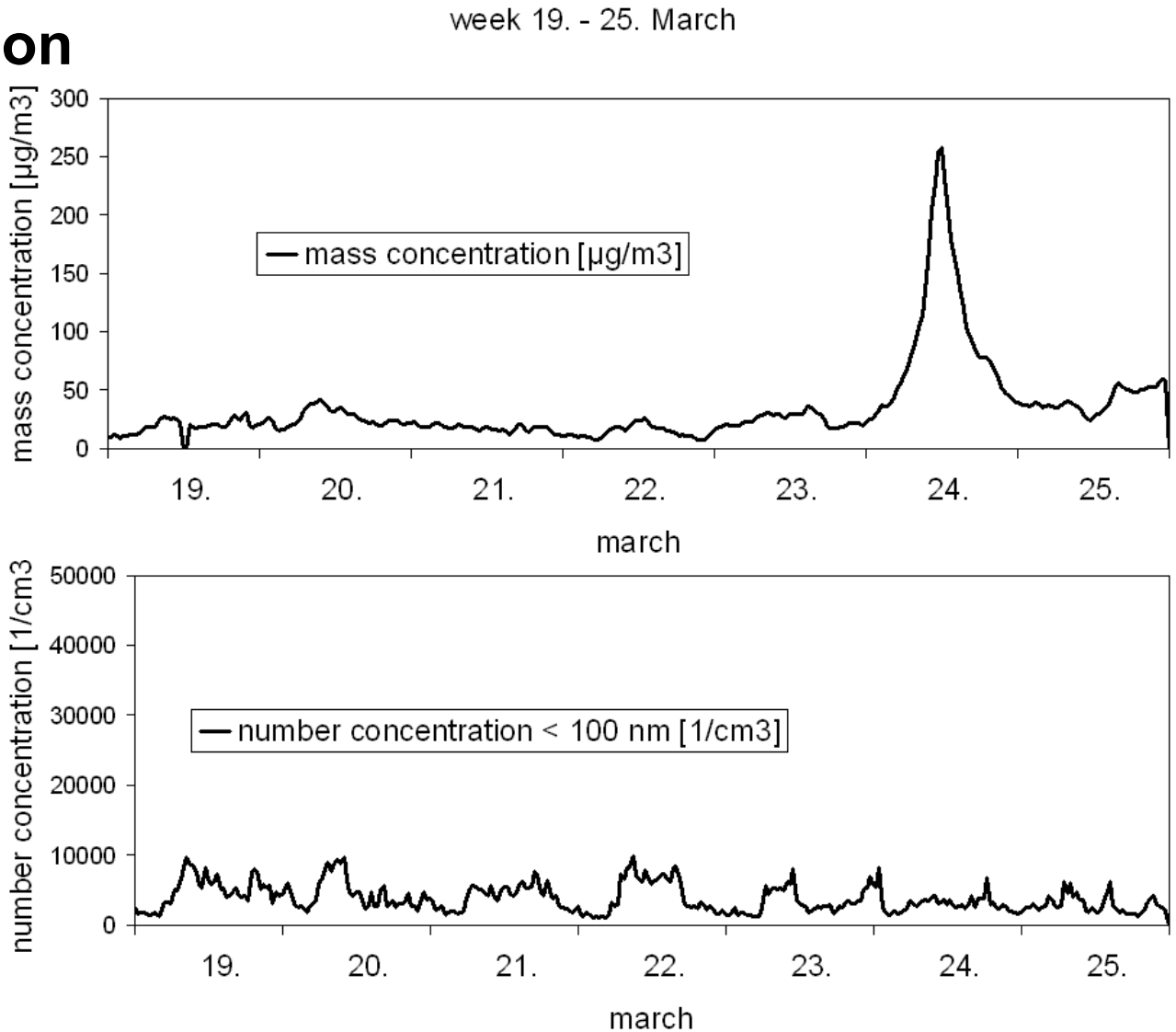
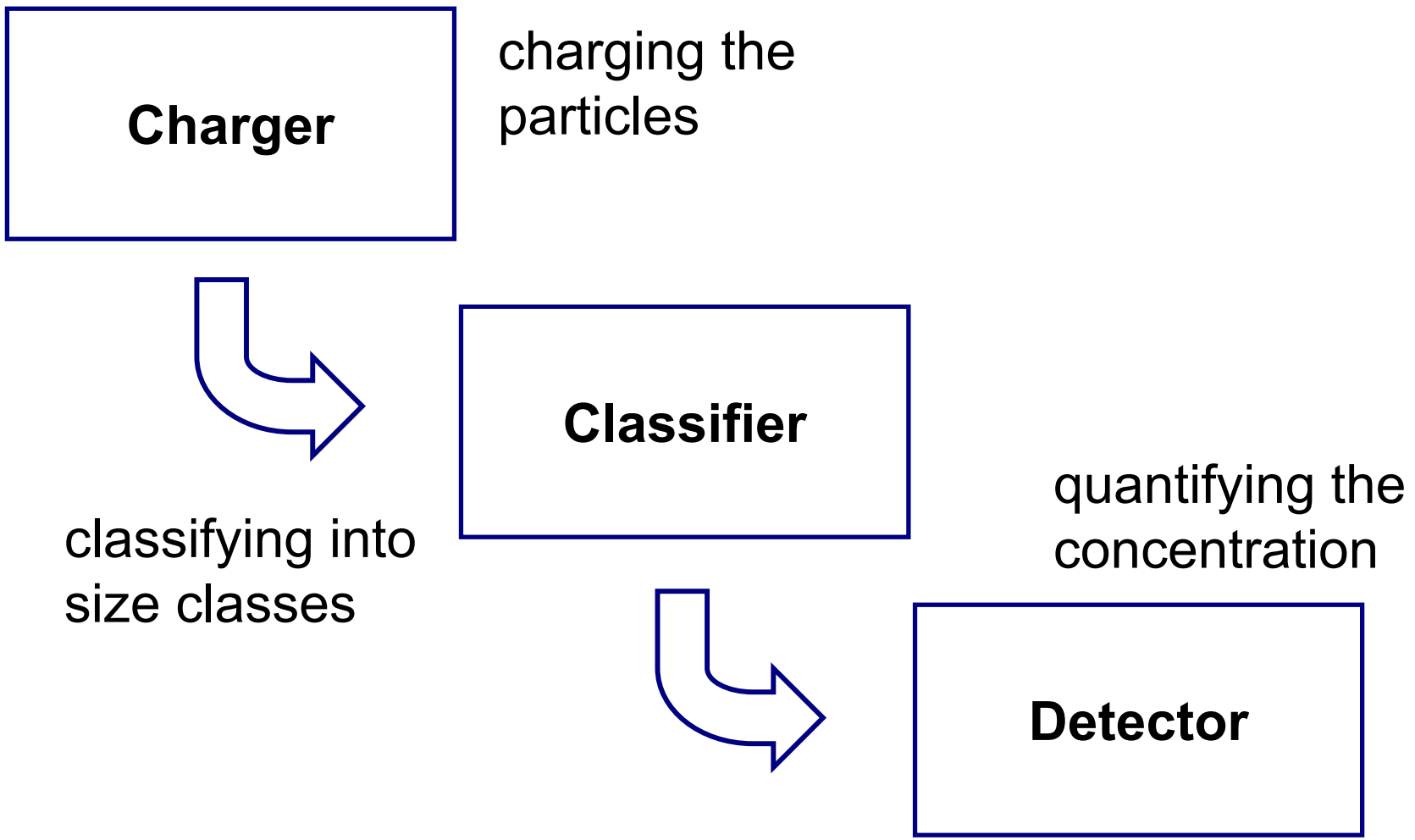
# Motivation


week 19. - 25. March
mass concentration [µg/m3]
300
250
200
150
100
50
0
mass concentration [µg/m3]
19.
20.
21.
22.
23.
24.
25.
march
number concentration [1/cm3
50000
40000
30000
20000
10000
0
number concentration < 100 nm [1/cm3]
19.
20.
21.
22.
23.
24.
25.
march

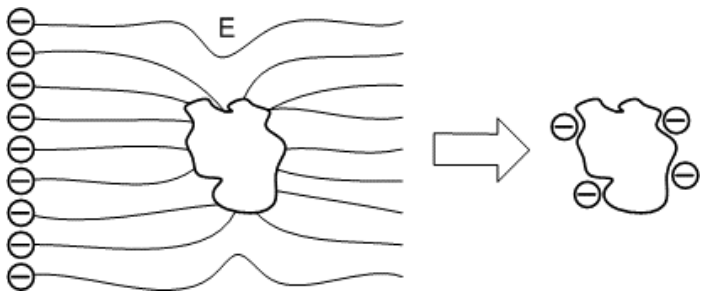
# Motivation

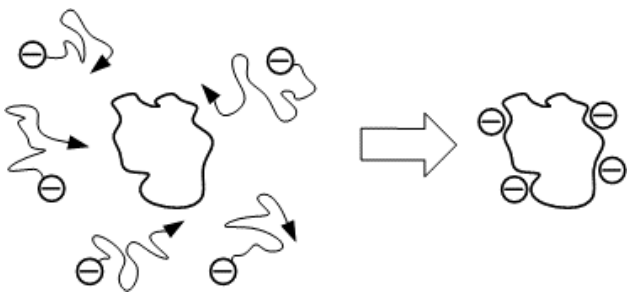

Charger
charging the particles
Classifier
classifying into size classes
quantifying the concentration
Detector

# Calibration

## Particle charging

- Field charging
- UV-radiation
- Diffusion charging



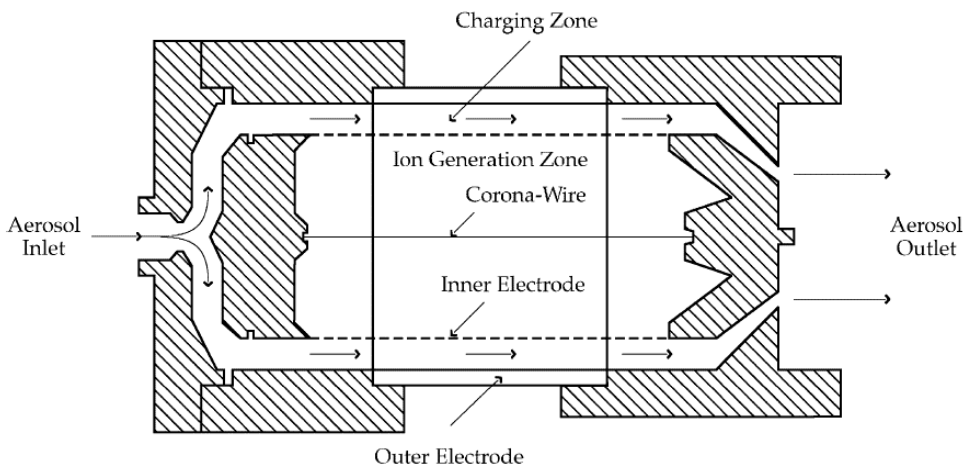



## Ion generation

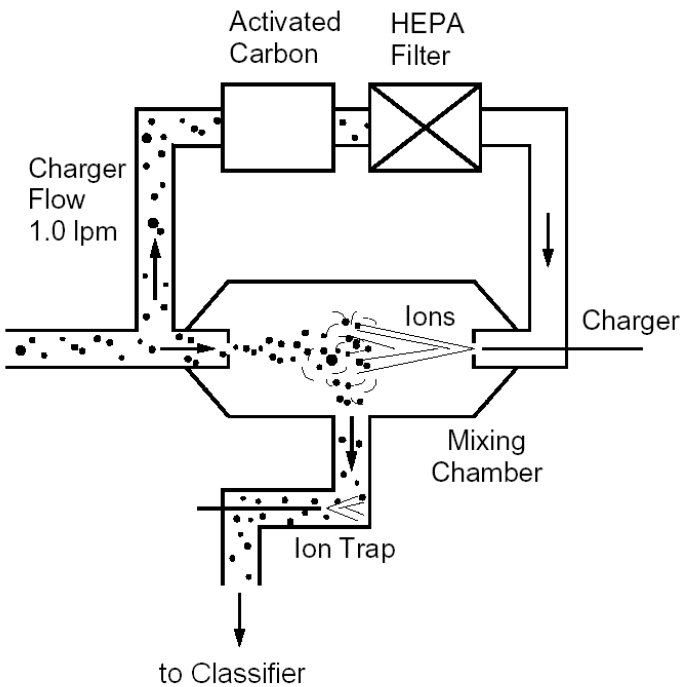
- Radioactive material
- Corona-discharge

# Calibration

## Hewitt-type charger




## Corona-jet-charger



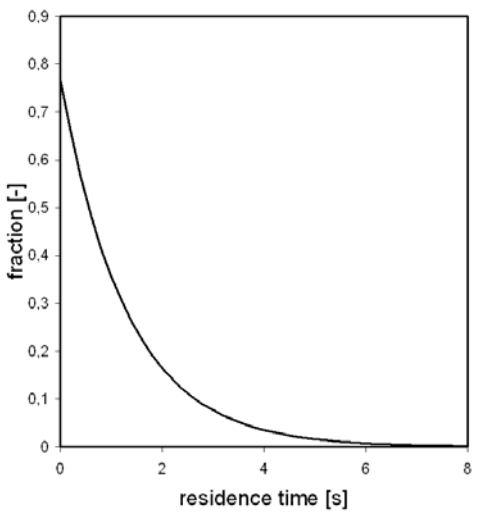
# Calibration

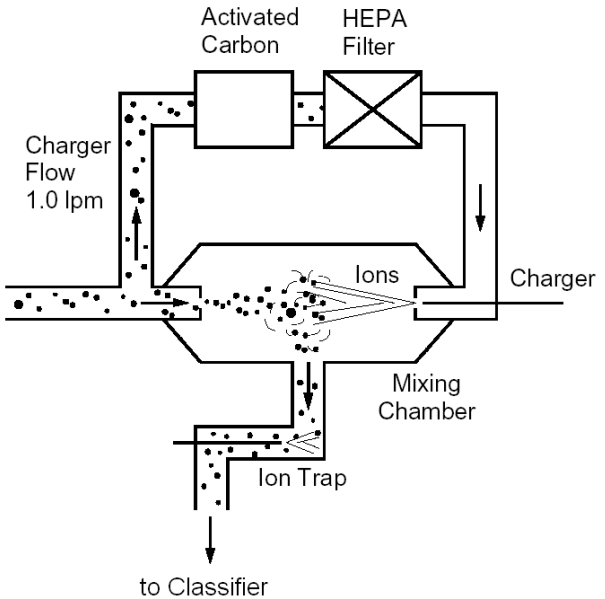
## Modeling

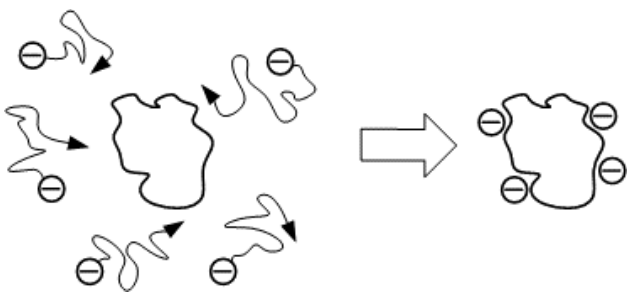
limiting-sphere-theory

+

flow model in mixing chamber

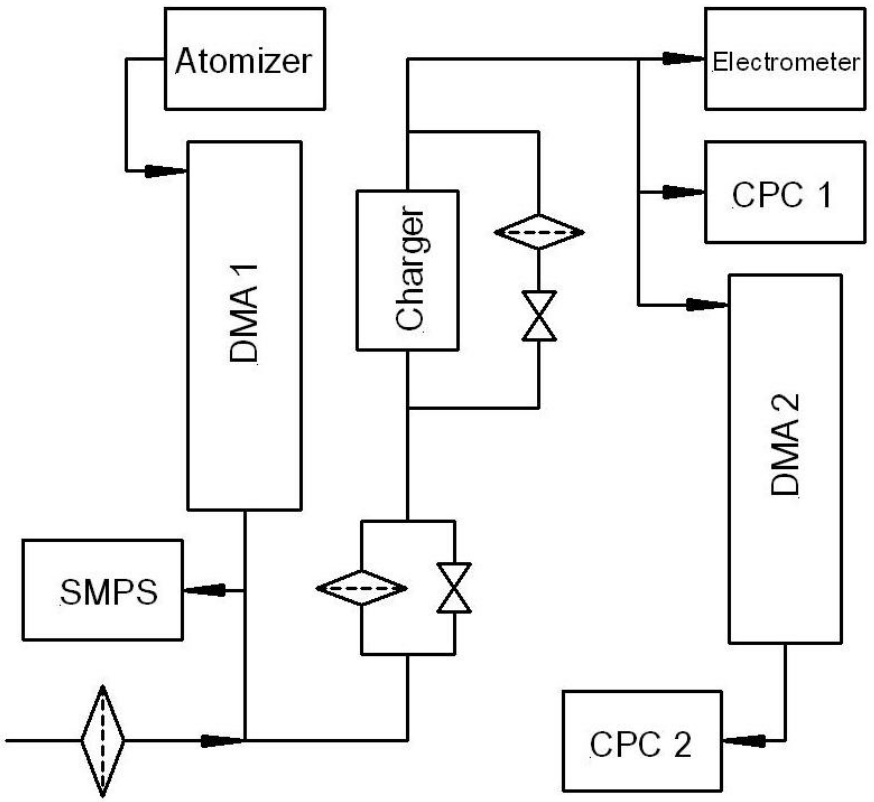


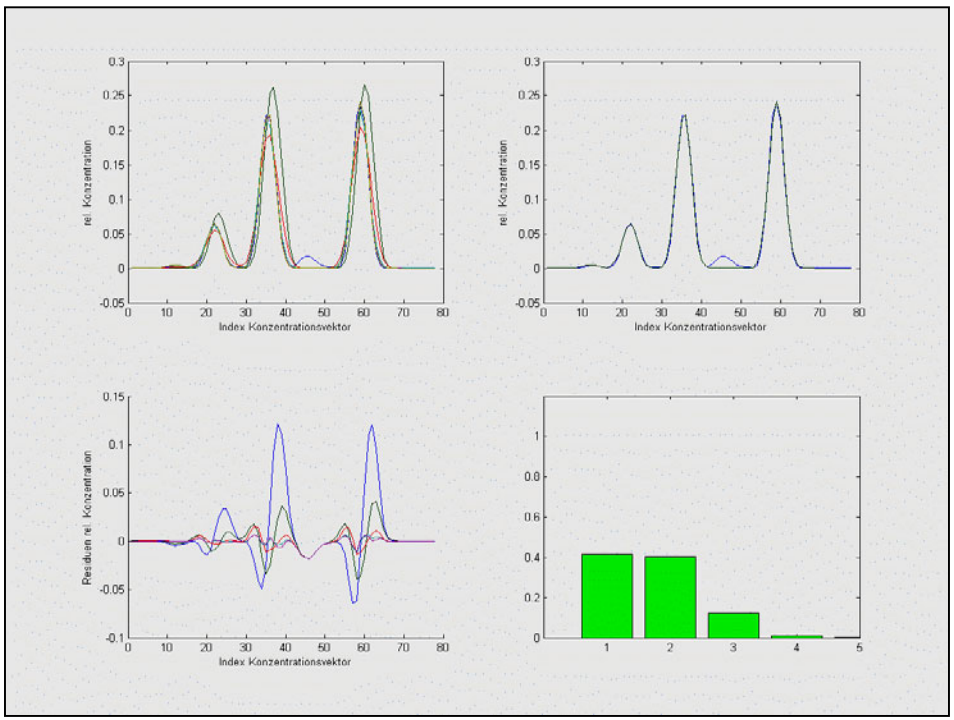



# Calibration

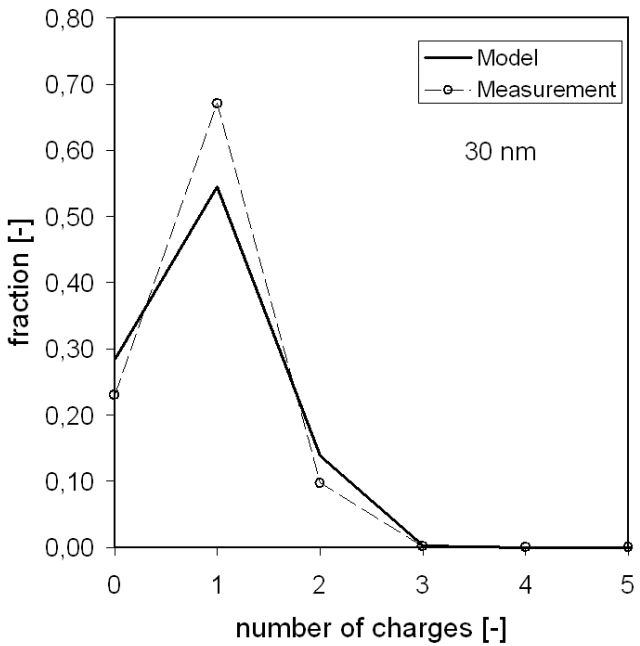
## Measurement

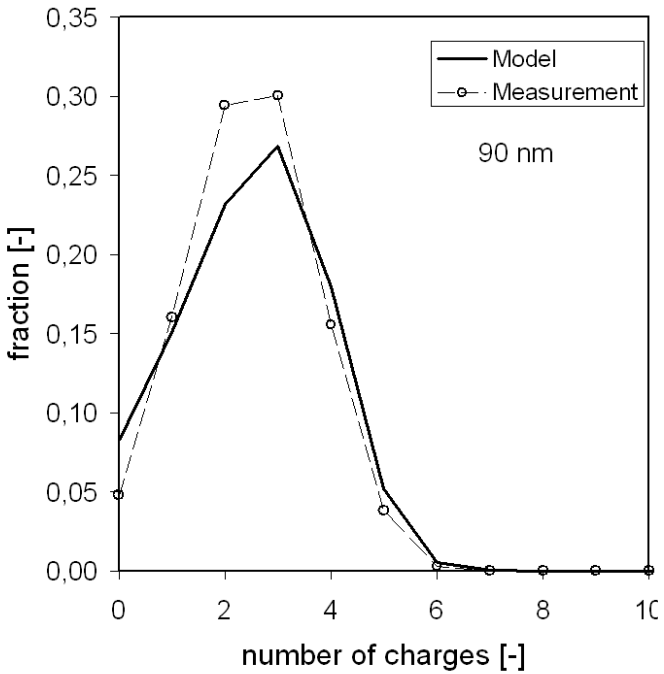


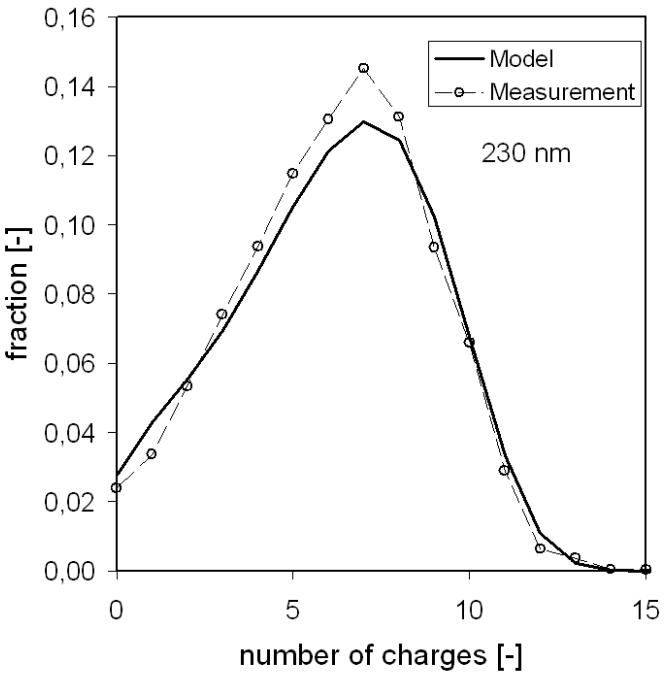



# Calibration

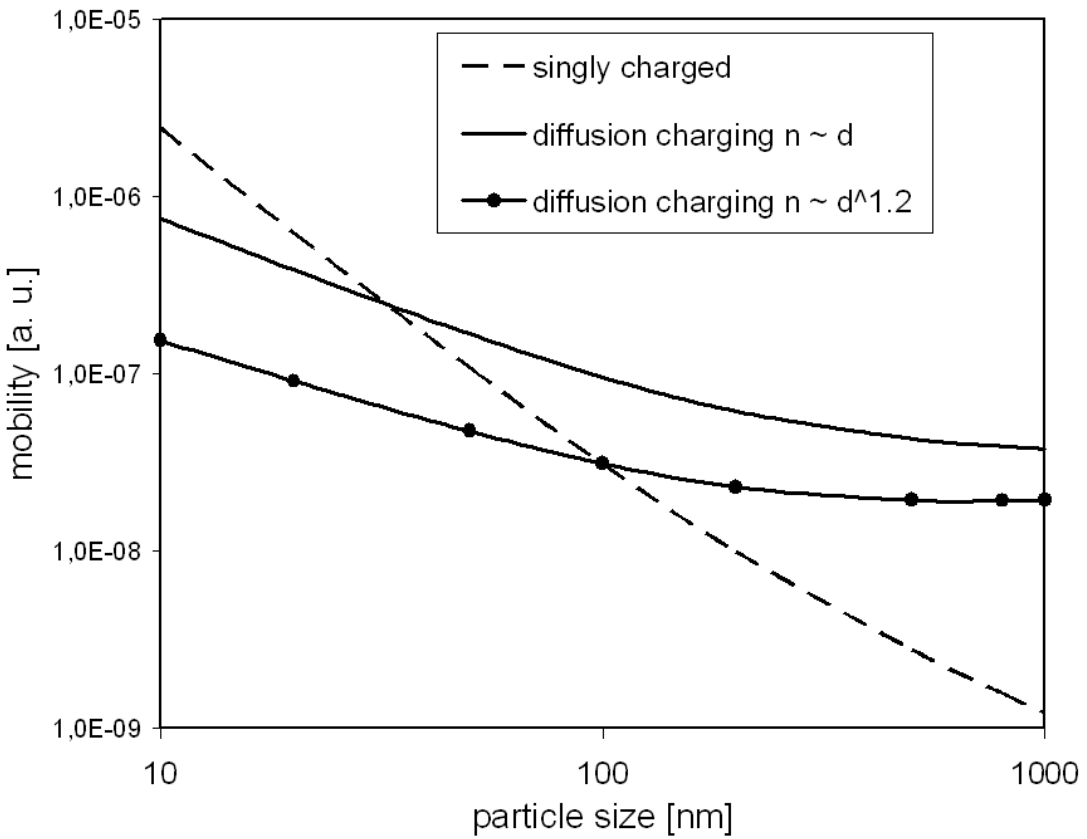
## Comparing Measurement - Model



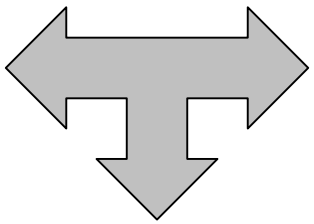



# Inversion


1,0E-05
1,0E-06
1,0E-07
1,0E-08
1,0E-09
mobility [a. u.]
singly charged
diffusion charging n ~ d
diffusion charging n ~ d^1.2
10
100
1000
particle size [nm]

# Inversion

minimum
size
~ 20 nm

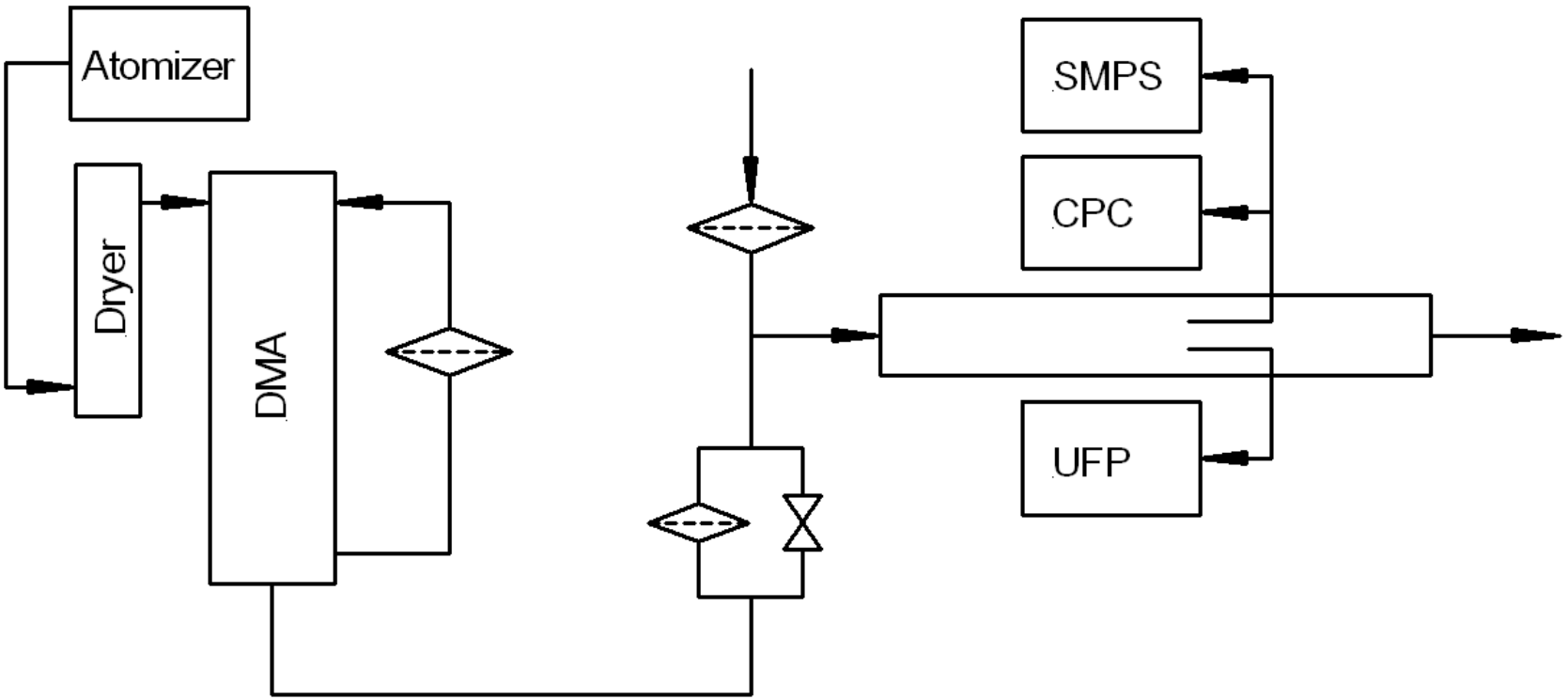


maximum
size
~ 800 nm

minimum
concentration
~ 1000 p/cm$^3$

# Evaluation

## Validation – test aerosols



# Evaluation

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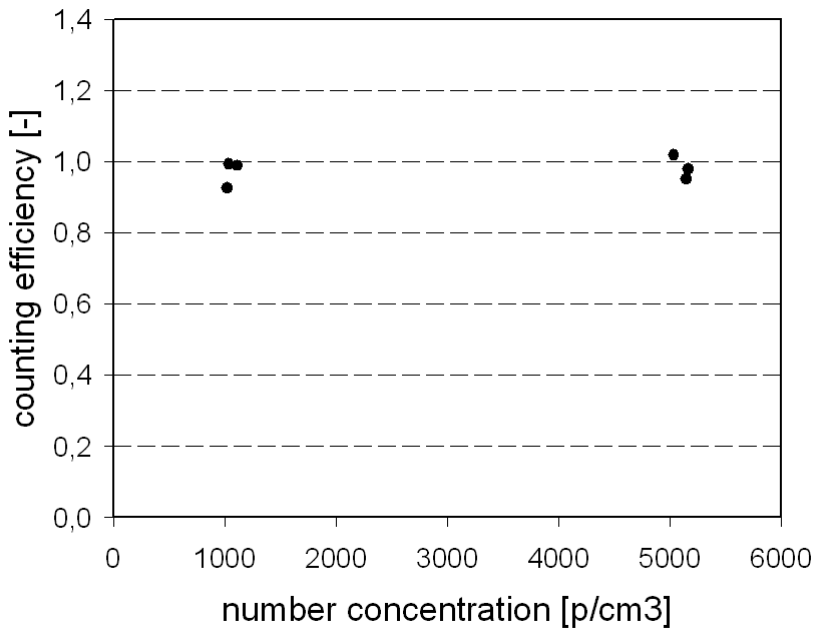
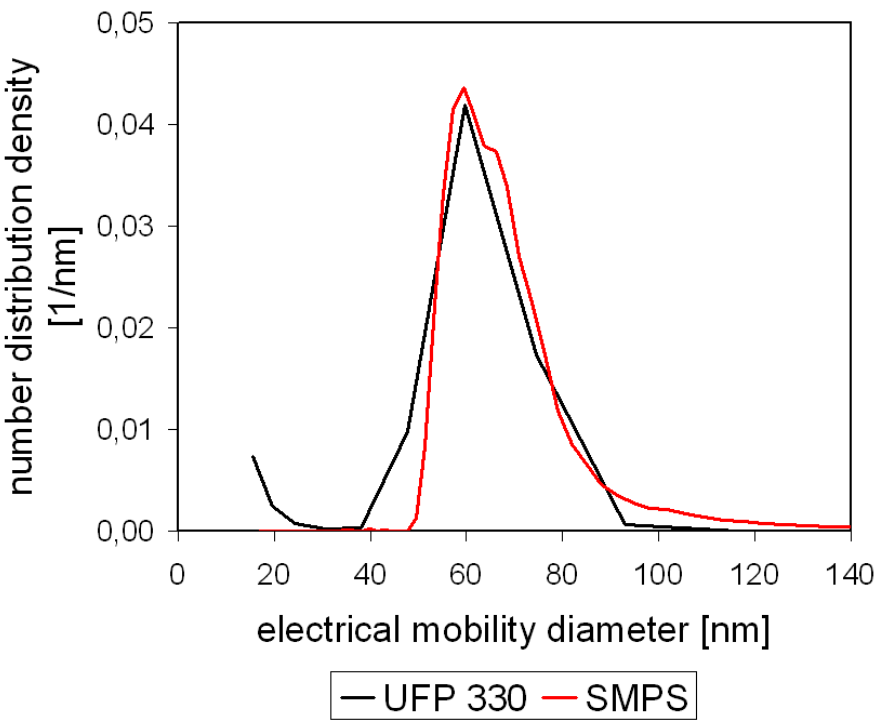


# Evaluation

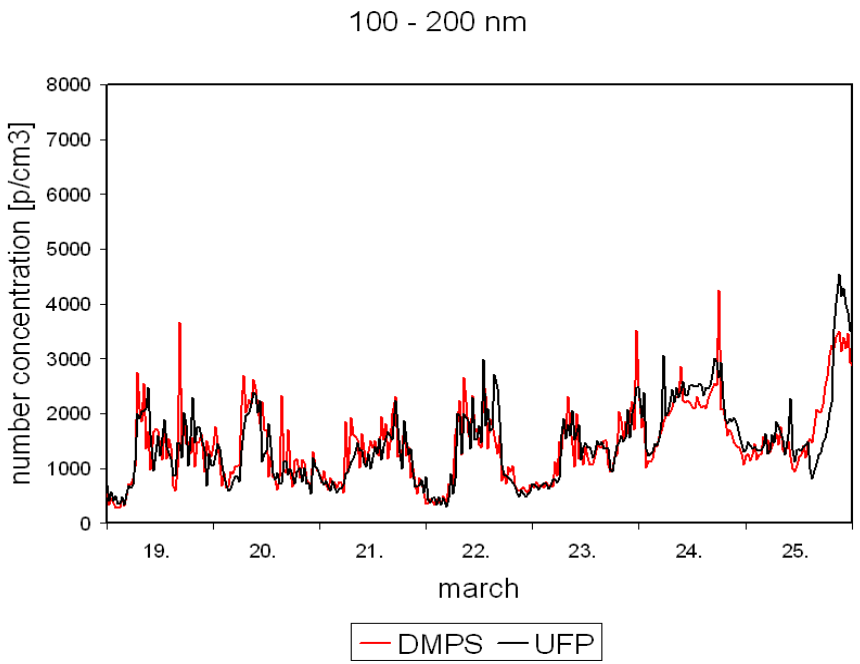
## Validation – in the field

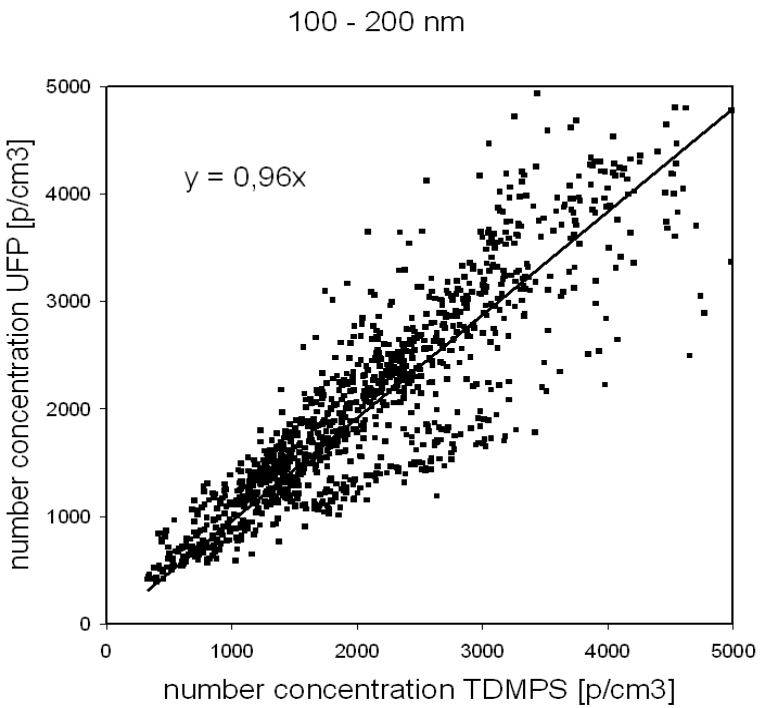
- IFT Leipzig


- Monitoring station Dresden Nord

# Comparison to reference

- TDMPS versus UFP
- size channel 100 – 200 nm



# Summary

UFIPOLNET (www.ufipolnet.eu) is financed by the LIFE financial instrument of the European Community under No. LIFE04 ENV/D/000054.

UFIPOLNET

ultrafine particle size distributions in air pollution monitoring networks

GSF – Forschungszentrum für Umwelt und Gesundheit in der Helmholtz-Gemeinschaft

# Thank you

Questions ?