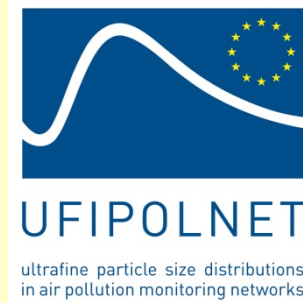




Ultrafine particles: Comparisons UFP 330/ DMPS



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Motivation

- Several epidemiological studies showed relationships between adverse health effects and high number concentrations of ultrafine particles ($D_p < 100$ nm)
- Most routine measurements of particulate matter are however limited to the mass concentration, e.g. PM10 or PM2.5.
- Commercially available instruments are expensive and need an increased maintenance in the routine network.

Objectives of the Project

**Need: Simple development measuring
ultrafine particles:**

- suitable for urban areas in Europe
- affordable and easy to use
- reliable data
- reduced data amount
- documentation of measurements over several years

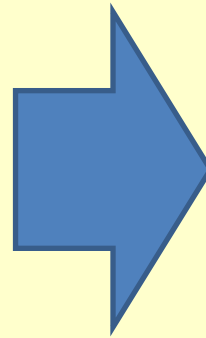
The new instrument: UFP 330

- Routine networks can only handle a limited number of variables.
- Number size distributions can be reduced to concentration for certain size classes.

The UFP 330 provides following the size classes:

Class	range
UFP1	20 - 30 nm
UFP2	30 – 50 nm
UFP3	50 – 70 nm
UFP4	70 – 100 nm
UFP5	100 – 200 nm
UFP6	> 200 nm

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ultrafine particle size distributions
in air pollution monitoring network

Comparison of UFP 330 and IfT-MSP

- Four prototypes instrument have been built and are in operation at 4 stations in Europe.
- For data quality and comparability, the instruments have been intercompared with a regular mobility spectrometer in Leipzig.
- Number size distributions obtained by TDMPS have been converted to size classes according to UFP1 – UFP6.

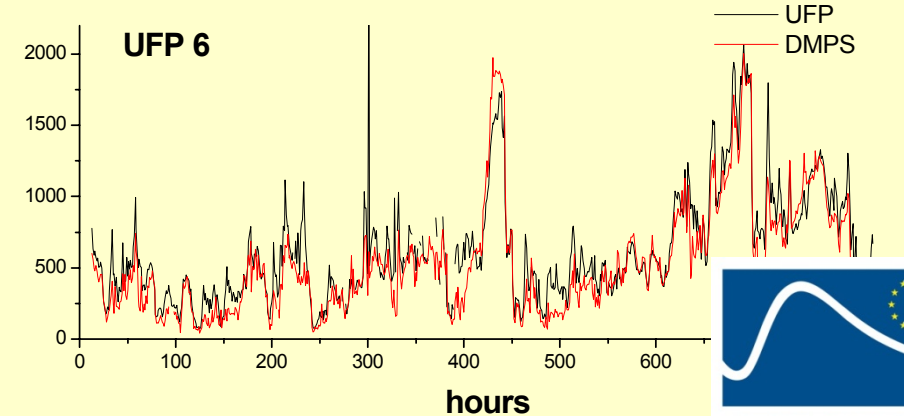
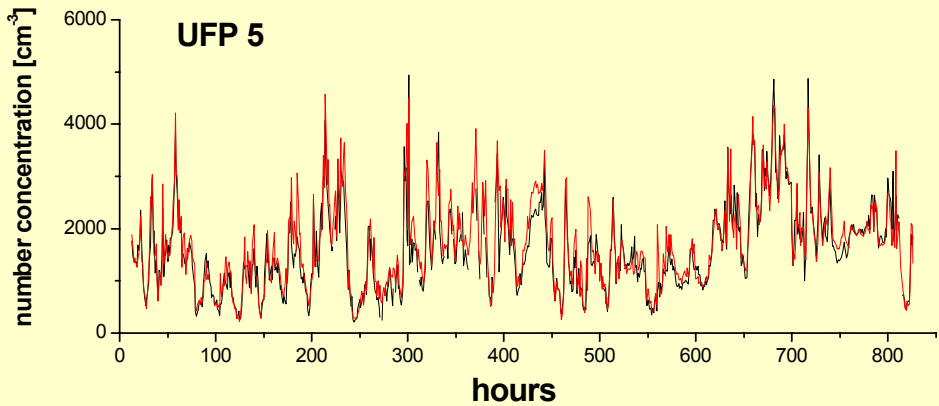
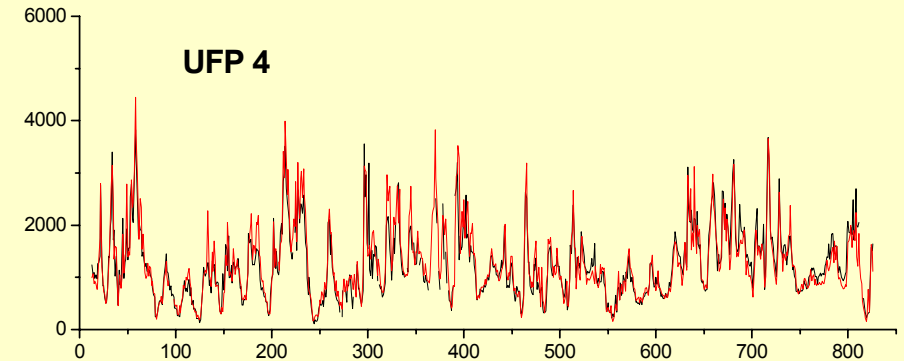
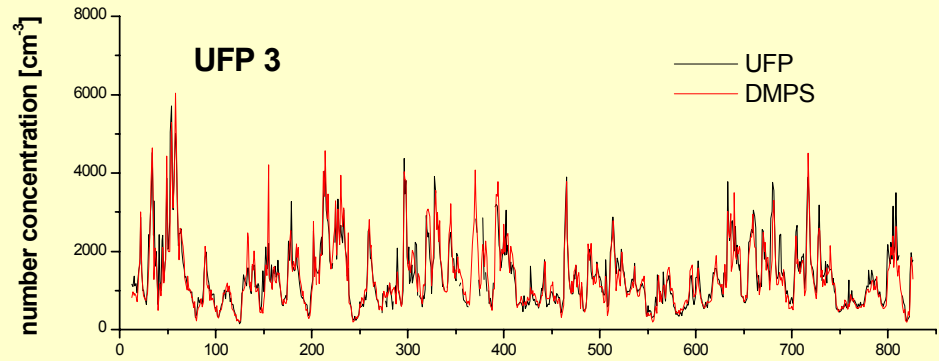
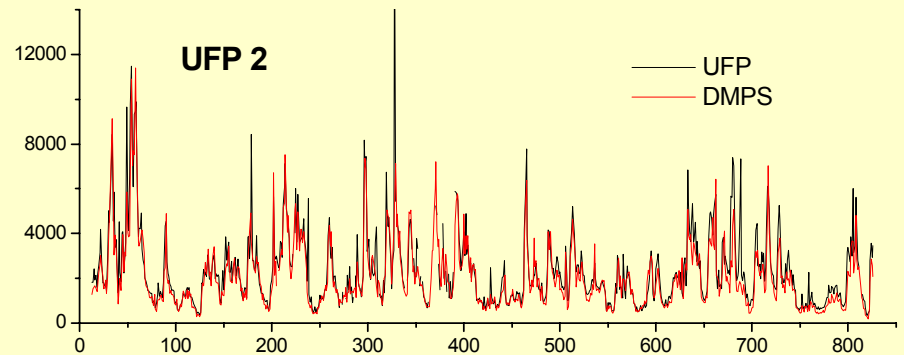
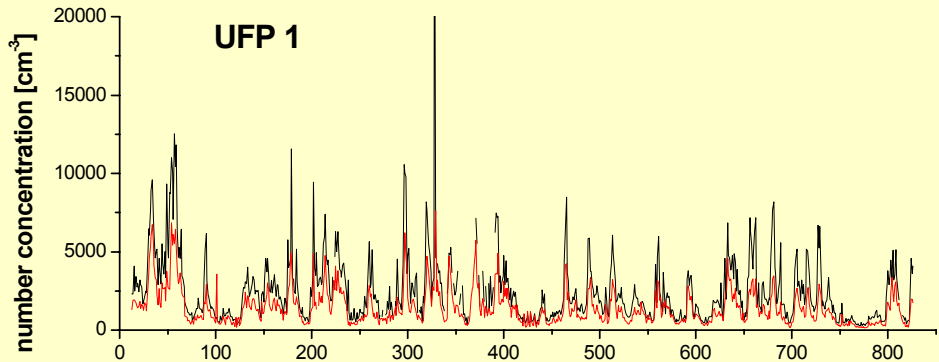
Comparison of UFP 330



Comparison of UFP 330 and IfT-MSP

- One instrument compared in Dresden from Dec. 2006
- Two instruments compared from Jan. 11 – Feb. 6, 2007
- One instrument compared from Feb. 2 – Feb. 20, 2007

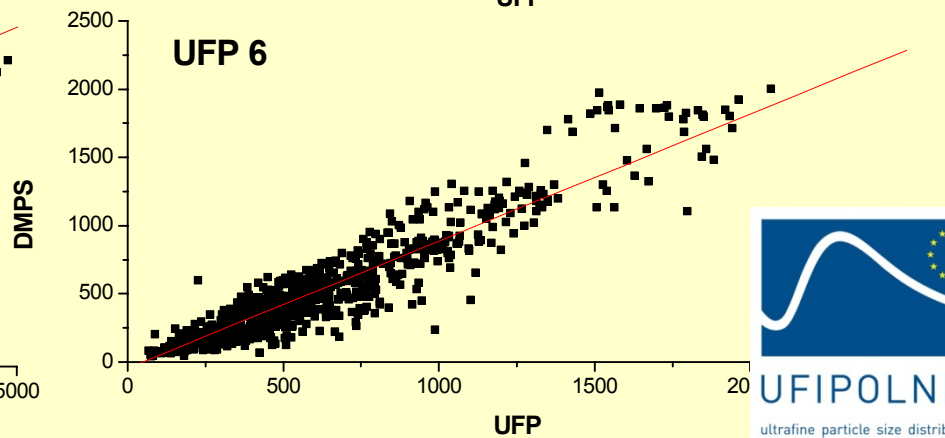
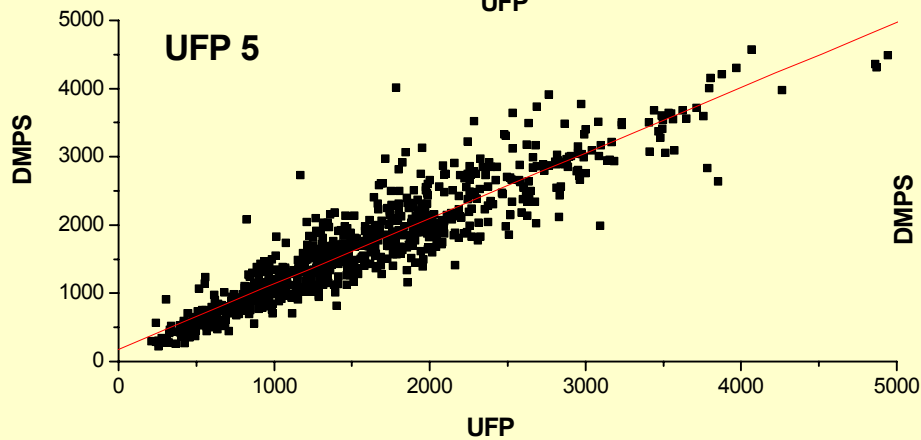
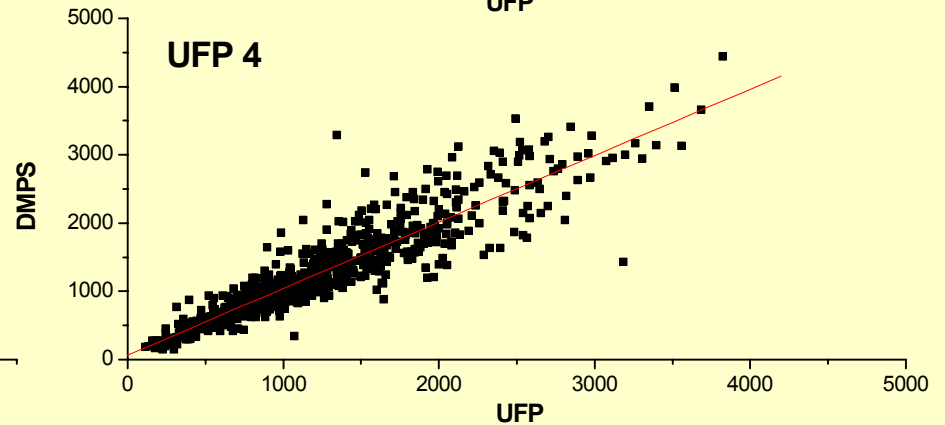
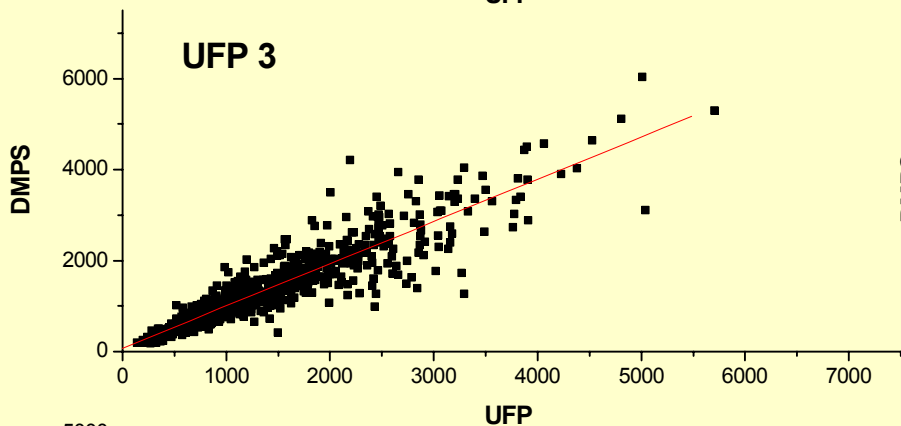
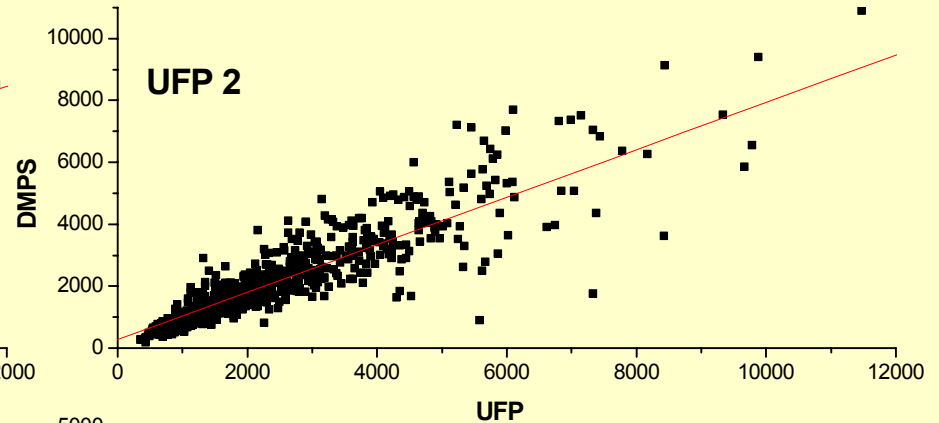
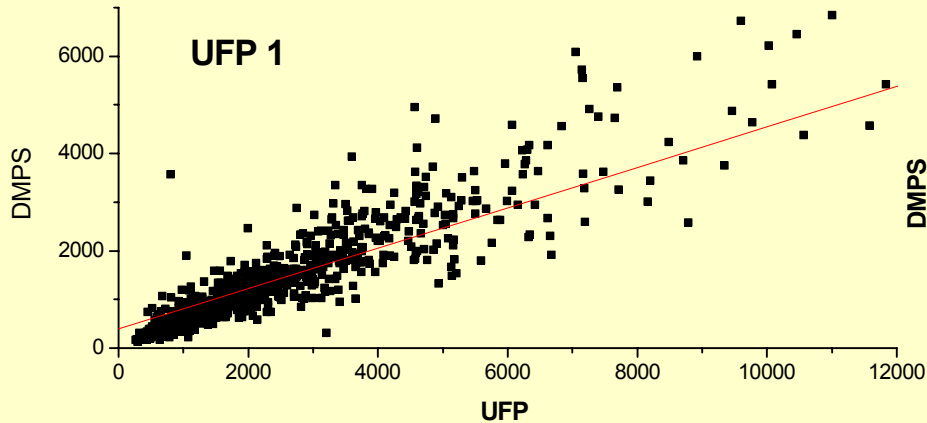
Comparison of UFP 330 and a MSP in Dresden



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Comparison of UFP 330 and a MSP in Dresden



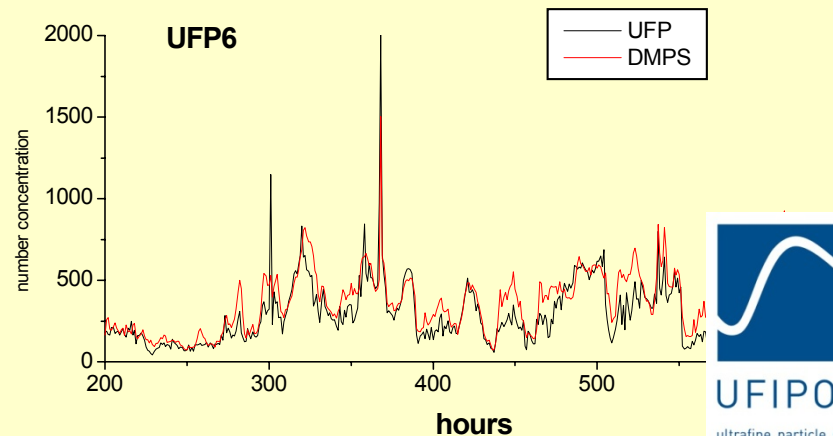
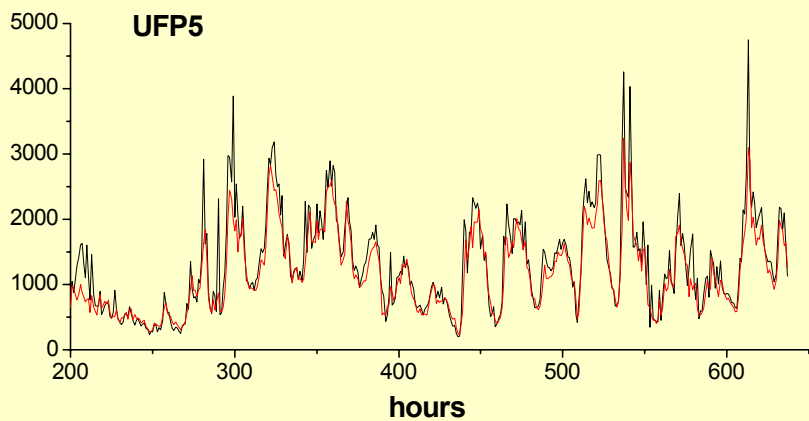
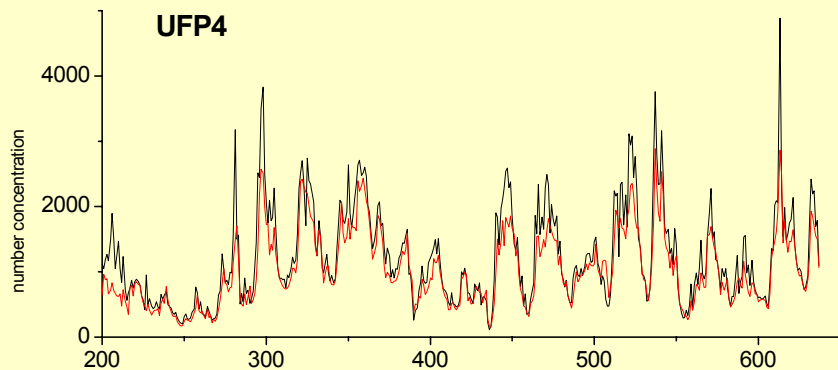
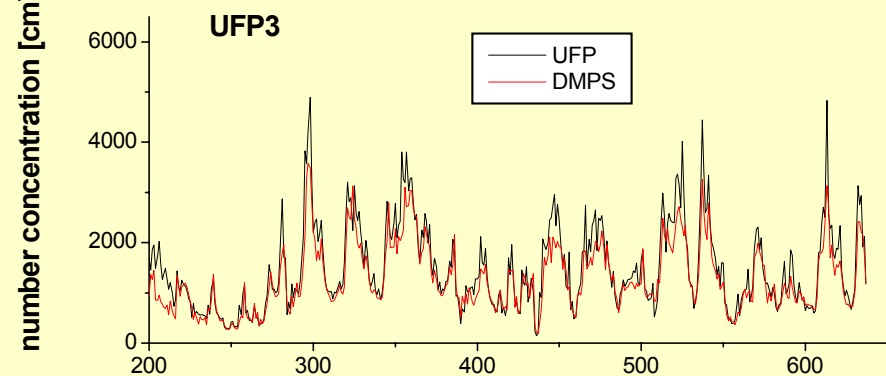
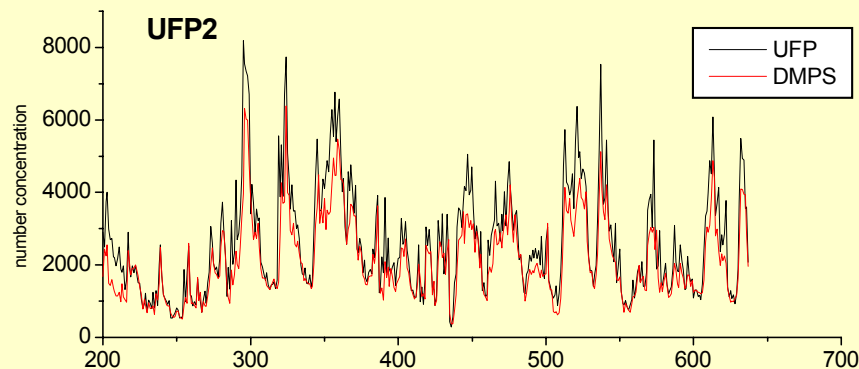
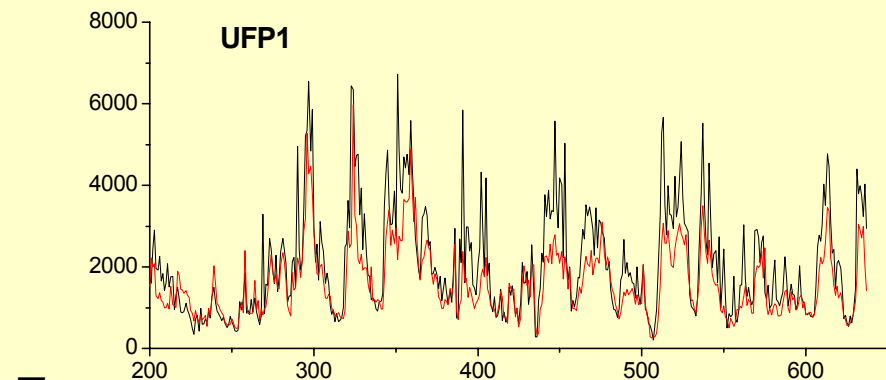
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Comparison of UFP 330 and a MSP in Dresden

Channel	UFP1	UFP2	UFP3	UFP4	UFP5	UFP6
R2	0.69	0.77	0.83	0.84	0.84	0.83
a	0.41	0.77	0.93	0.97	0.96	0.93

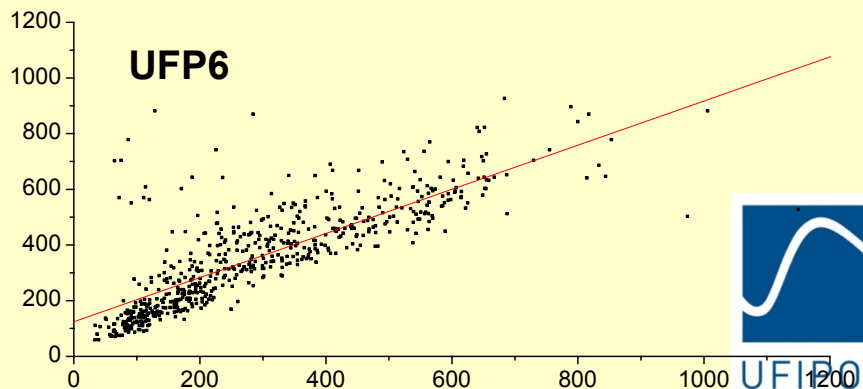
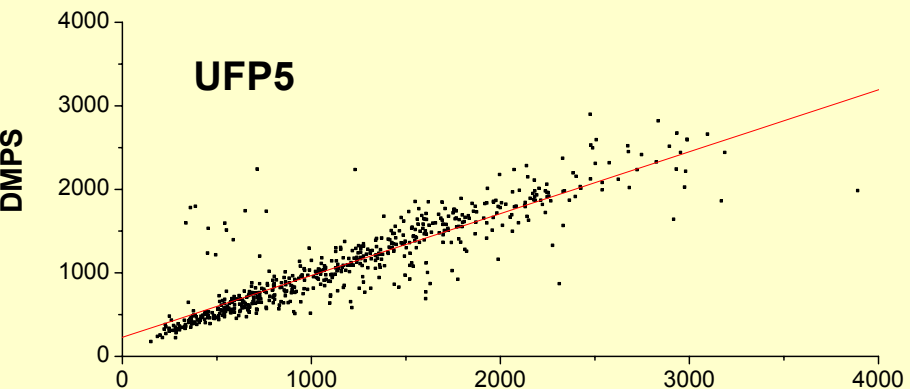
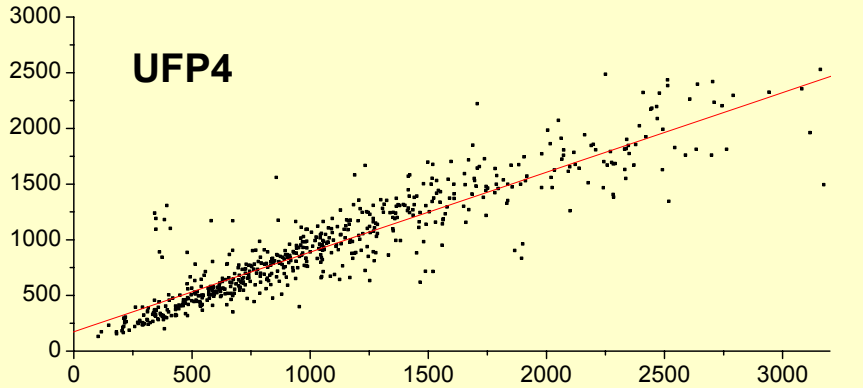
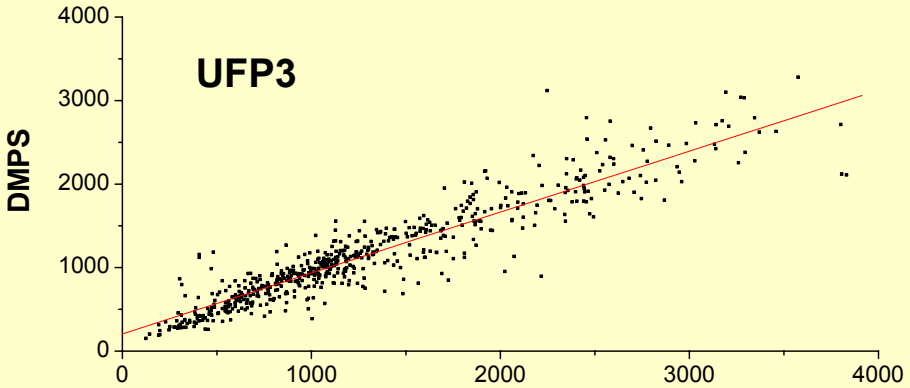
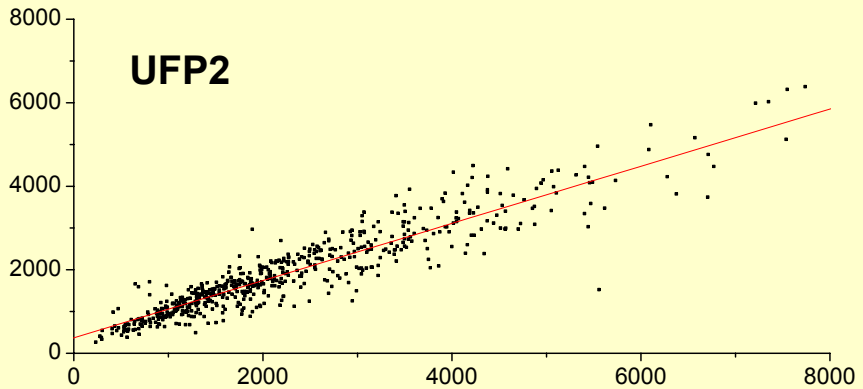
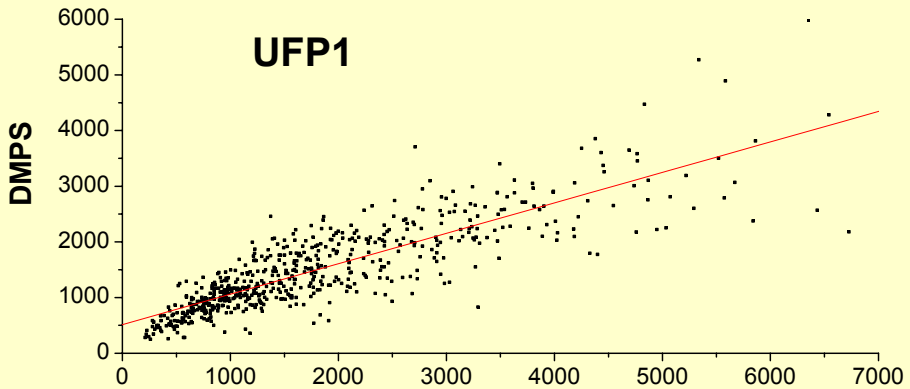
Comparison of UFP 330 and IfT-MSP in Leipzig



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ultrafine particle size distributions
in air pollution monitoring network

Comparison of UFP 330 and IfT-MSP in Leipzig



Comparison of UFP 330 and IfT-MSP in Leipzig

#3

Channel	UFP1	UFP2	UFP3	UFP4	UFP5	UFP6
R2	0.72	0.86	0.88	0.84	0.83	0.67
a	0.55	0.68	0.73	0.71	0.74	0.79

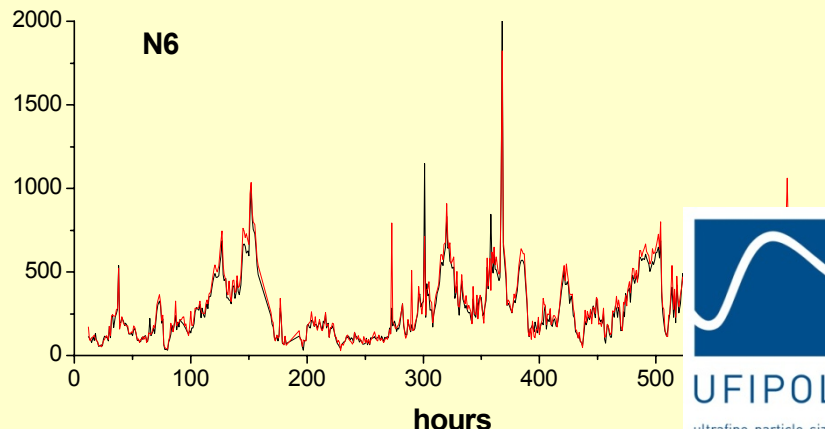
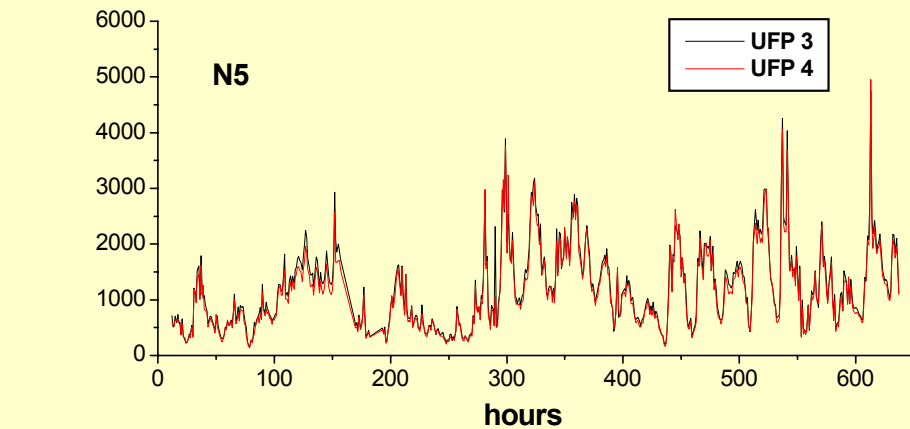
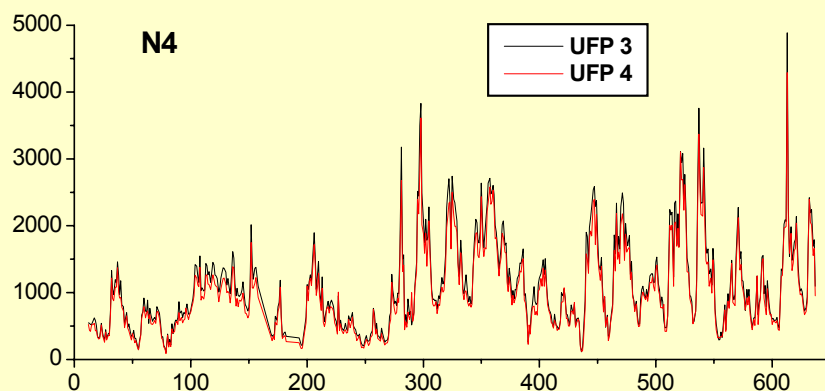
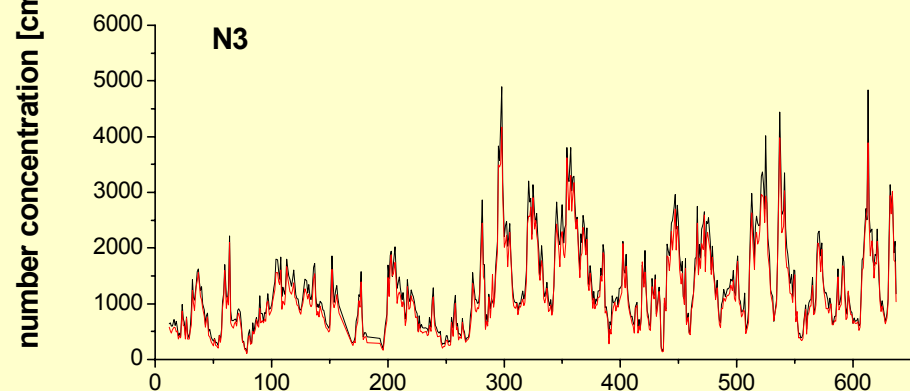
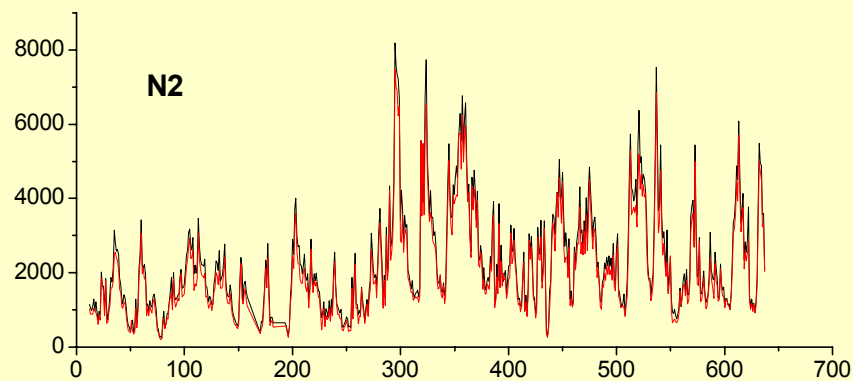
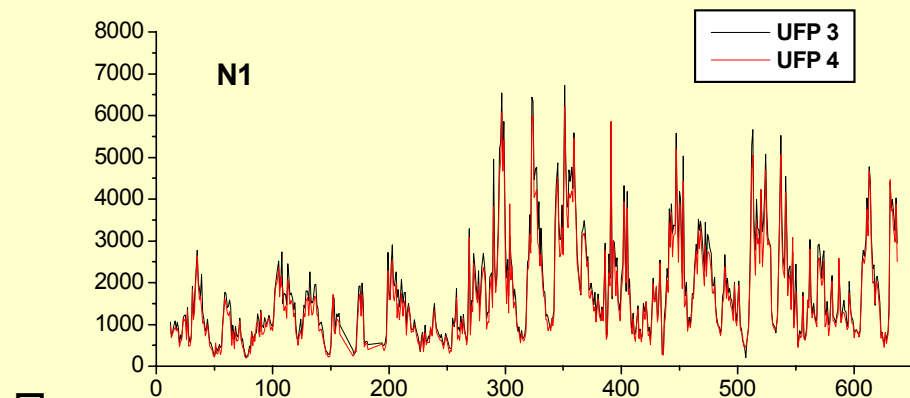
#4

Channel	UFP1	UFP2	UFP3	UFP4	UFP5	UFP6
R2	0.71	0.87	0.88	0.85	0.81	0.67
a	0.58	0.74	0.80	0.79	0.77	0.74

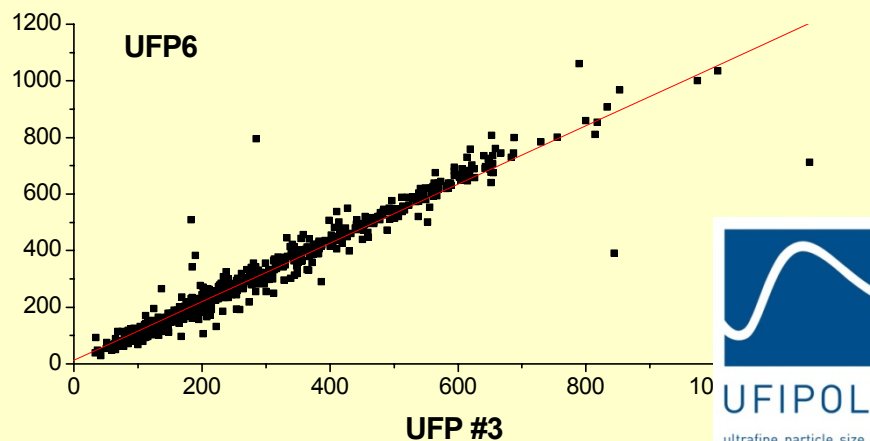
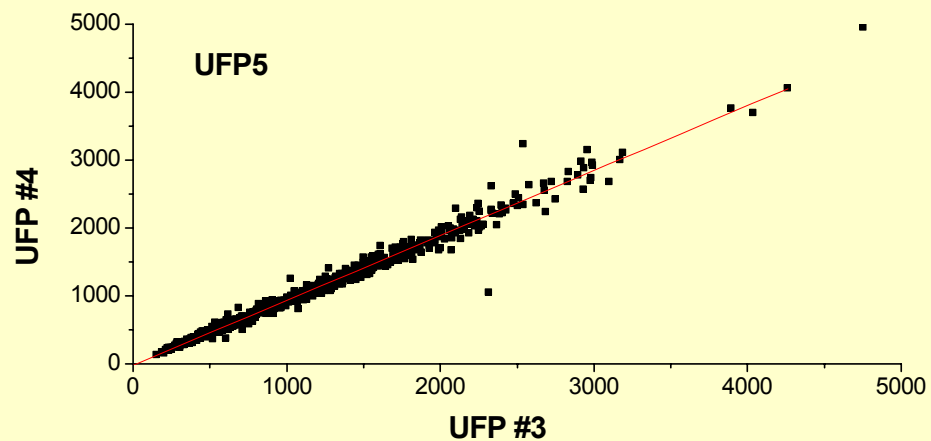
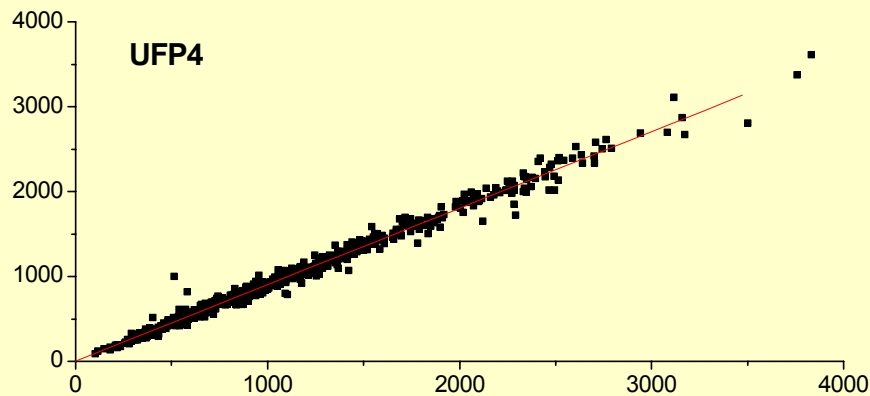
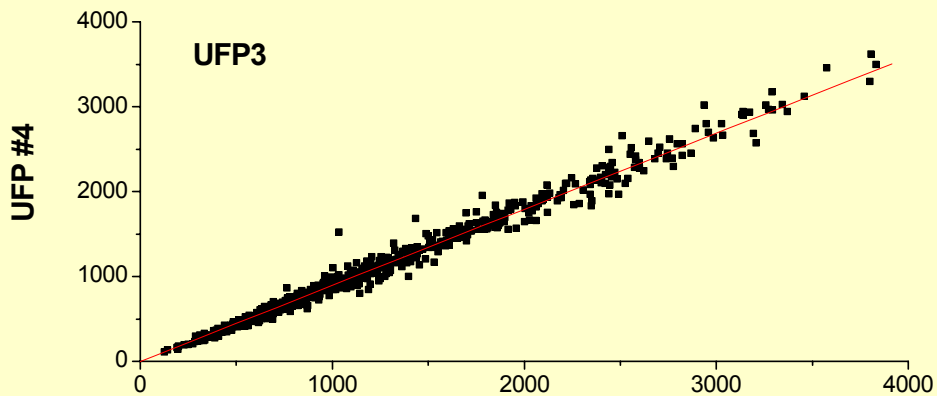
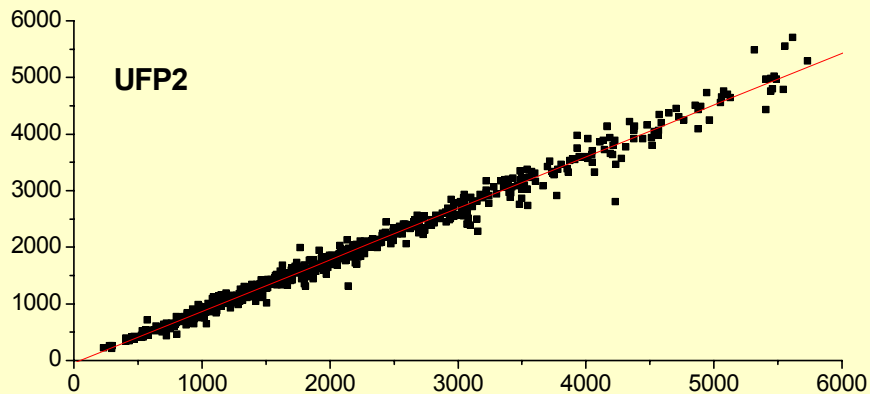
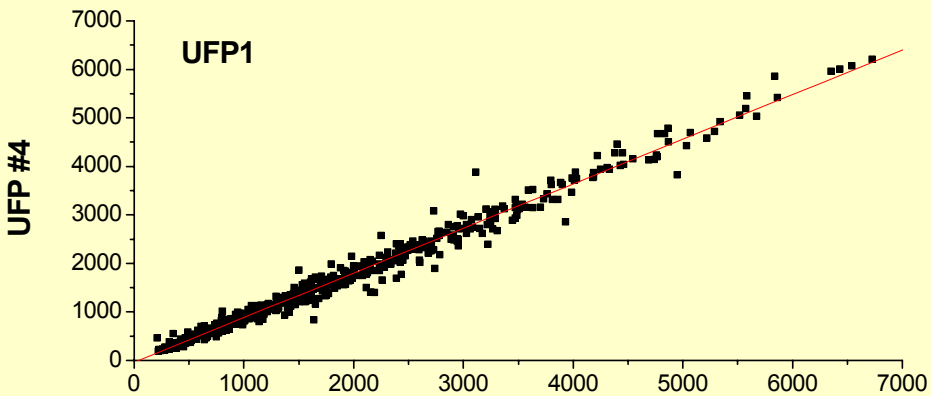
#1

Channel	UFP1	UFP2	UFP3	UFP4	UFP5	UFP6
R2	0.87	0.88	0.90	0.92	0.94	0.88
a	0.82	0.77	0.79	0.81	0.86	0.88

Comparison of two UFP 330 and the IfT-MSP



Comparison of two UFP 330 and the IfT-MSP



Comparison of two UFP 330 and the IfT-MSP

Channel	UFP1	UFP2	UFP3	UFP4	UFP5	UFP6
R2	0.98	0.98	0.98	0.98	0.98	0.94
a	0.92	0.91	0.90	0.90	0.96	1.04

Conclusions

- A new instrument has been developed to measure size resolved number concentrations of ultrafine particles: UFP 330
- The instrument is easy to operate and needs only little maintenance
- Comparison with the a well established mobility spectrometer shows good above 70 nm agreement
- Highest uncertainties occur below 30 nm and above 200 nm
- Reasons for these deviation are under investigation

Conclusions

- Comparison between two identical instruments shows high R^2 (≥ 0.94)
- After a final improvements and comparison (beginning of 2008) the instrument will be commercially available
- The instrument can be employed under urban conditions
- It can recommended to be integrated into the routine measuring stations