

Freistaat  Sachsen

Saxon State Agency for Environment and Geology (LfUG)



UFIPOLNET LIFE04 ENV/DE/000054



LIFE Project Number  
**LIFE04 ENV/D/000054**



**TECHNICAL FINAL REPORT**  
**Covering the project activities from 01/12/2004 to 31/03/2008**  
Reporting Date  
**18-Jun-2008**  
LIFE PROJECT NAME  
**UFIPOLNET**

**Data Project**

Project location	Dresden / Germany
Project start date:	<01/12/2004>
Project end date:	<30/11/2007>; Extension date: <31/3/2008>
Total Project duration (in months)	<36> months; Extension months: 4
Total budget	€ 868 639
EC contribution:	€ 397 196
(%) of total costs	45.7%
(%) of eligible costs	46.3%

**Data Beneficiary**

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## 2 ABBREVIATIONS

<b>CHMI</b>	Czech Hydro Meteorological Institute (CHMI)
<b>CS</b>	Czech
<b>DE</b>	German
<b>EN</b>	English
<b>GSF</b>	National Research Centre for Environment and Health, Munich
<b>IfT</b>	Institute for Tropospheric Research
<b>LfUG</b>	Beneficiary: Landesamt für Umwelt und Geologie: Saxon State Agency for Environment and Geology
<b>ITM</b>	Department of Applied Environmental Science (ITM), University Stockholm
<b>SV</b>	Swedish
<b>TOPAS</b>	Technologie-orientierte Partikel-, Analysen- und Sensortechnik (TOPAS GmbH)
<b>TSI</b>	TSI GmbH, Aachen (Co financier)
<b>UBG</b>	LfUG Staatliche Umweltbetriebsgesellschaft (dependent on LfUG)
<b>UFIPOLNET</b>	Ultrafine particle size distributions in air pollution monitoring networks
<b>VDI</b>	Verein Deutscher Ingenieure

### units

<b>%</b>	percent
<b>°C</b>	Grad Celsius
<b>a</b>	year
<b>d</b>	day
<b>K</b>	Kelvin
<b>m</b>	Meter
<b>mg/m<sup>3</sup></b>	milligram per cubic meter
<b>µg/m<sup>3</sup></b>	microgram per cubic meter
<b>mm</b>	millimetre
<b>ng/m<sup>3</sup></b>	nanogram per cubic meter



### 3 EXECUTIVE SUMMARY

The four workshops for all partners in January 2005, May 2006, May 2007 and October 2007 as well as several internal meetings at the LfUG, with the assembly team, with TOPAS, IfT and other organisations (LfL, LANU, VOR and SAB) were organised and 40 documented. The project was visited by the monitoring team in July 2005 as well as May and November 2006. The visit from the commission took place in November 2007.

Task Design (T2) was running all through 2005 and needed a 10 month extension. Therefore Task Implementation (T3) and Task Measuring (T4) have been shortened to 2 respectively 12 months in comparison to the plan of 5 (T3) and 18 (T4) months. Task 4 measurements started 12 months later than expected. Therefore, a 4 month project extension was needed to meet the objective of measuring one year at all 4 stations. A lot of work has been done by TOPAS and IfT with the help of TSI (co financer), who provided more than the initially planned device parts for the prototypes. Instead of August 2005, finalisation of the first prototype was in June 2006. Technical problems occurred in the middle to the end of 2005 and were completely solved by the assembly team. The particle size distributions of ultrafine particle number concentrations were planned to be specified within a size range of approx. 12 - 500 nm. This objective has to be changed to about 20 – 800 nm. The lower limit had to be higher because of technical problems not foreseen before start of the project. Because of deviations of sensitivity between four UFP 330 measured in comparison tests in August 2006 in Leipzig at IfT, the instruments had to be checked at TOPAS. Some special parts of the instrument were identified as problematic and exchanged during December 2006. The comparison measurements in January 2007 and January 2008 at IfT showed good correlations to the reference instrument. Since February 2007 all 4 instruments deliver results with a data availability of 75 - 95 %, showing typical diurnal variations at roadside stations and changing number concentrations through the year. After first comparison measurements in January 2008 deviations between instruments were shown. Cleaning of some parts of some instruments resulted in almost the same better sensitivity in all 6 ranges. Additionally to the proposal a standardized sampling system was used to make all measurements better comparable at all 4 measuring stations. Management and Dissemination were running from begin until the end of the whole project life.

A dissemination plan for past and future events was created. A homepage with a short address was updated about every month: [www.ufipolnet.eu](http://www.ufipolnet.eu). Flyer in English, German, Swedish and Czech were created in September 2006. The project UFIPOLNET informed the public via the media about the objectives of the project and ultrafine particles in general during January 2005, February 2007 (including TV-broadcast), October 2007 in Saxony and March 2007 in Sweden. Signboards were installed at all 4 measuring stations during February 2007. On 23 to 24 October 2007 the final conference with 120 participants from 14 countries with 45 oral and poster presentations and on 22-October 2007 a public presentation for public took place in Dresden accompanied with public announcements.

Potential target groups were contacted personally, by newsletter, webpage or printed media in case of conference announcements. The VDI will publish "VDI 3867 Blatt 3 Mobilitätsspektrometer" UFP 330 as an example in first half year of 2008. There is a positive presumption, that some routine measurement networks and health experts will use the successor of UFP 330. To measure number concentrations of particulate matter at different locations over a longer period will be one way of showing the reduction of number concentrations of particulates in European cities according to new directives aiming to reduce particulate matter. This can prove the reduction effect of the TSAP (Thematic Strategy on Air Pollution, Sep-2005) on particles, which have a negative health effect. It is planned to measure with the UFP 330 at all 4 stations for the next 5 years.

All payments to partners based on subpayment requests. About 89 % of the planned costs have been spent and some small budget modifications have been made. Due to the need for a better sampling system for receiving comparable results, money has been shifted between the cost categories to durable goods, without the need of a substantial amendment.





## 4 INTRODUCTION

About two years ago the EU-Commission proposed a clean air strategy to protect human health and the environment (TSAP) (Reference: IP/05/1170 Date: 21/09/2005, IP/05/1170). Margot Wallström as Vice-President of the EC and Stavros Dimas (EC, Environment) participated in an experiment to measure the level of air pollution by particle matter to underline the importance of this strategy.

“American researchers recently investigated the potential health risks of ultrafine particles in rats. The results show that the nano-sized materials inhaled by rats follow a rapid and efficient pathway from the nasal cavity to several regions in the brain. Exposure also caused signs of inflammation and stress. The ultrafine particles used in the study are the same size as nano particles, which are controversial due to concern about their security to humans (DG ENV; Science for Environment Policy 14 September, 2006 Issue 34).”

A revision of the air quality directive is planned for 2013 by the European Commission, where they will discuss whether PM<sub>10</sub> and PM<sub>2.5</sub> limits will be changed to or complemented by other metrics, like PM<sub>1</sub> or the number of ultrafine particles. In Germany, the VDI-Clean Air Standards Commission KRdL is completing a series of guidelines (VDI 3867 parts 1 to 6). These standards give guidance about instruments and methods to measure particle number concentration and size distribution in ambient aerosol.

In many European countries, including Germany, a broad discussion about particulate filters for cars is underway. In the EU regulation 715/2007 (20.6.2007) about Euro 5 and 6, particle number emission measurements are introduced: "In order to ensure that emissions of ultra fine particulate matter (PM 0.1 µm and below) are controlled, the Commission should adopt (...) a number based approach to emissions of PM (...)." Meanwhile, the Commission has proposed a limit of  $5 \times 10^{11}$  particles/km and the amendment of vehicle certification regulation 83 for light duty vehicles, which describes the detailed sampling and measurement procedures (e.g. conditioning at 300°C and measurement of particles larger than 23 nm) is progressing.

The proposal for Euro VI (heavy duty vehicle emissions) COM(2007) 851 final, in annex I also introduces emission limits for particle number (PN) per kWh. In the Swiss New Norm SNR 277205 from 2007, measurement and certification of Diesel Particle Filter Systems with respect to nano particles and secondary emissions is defined. In 2007, ISO TC24/SC4 started a new work item to standardise the calibration of particle number concentration measuring instruments.

The relevance of ultrafine particles has also reached the political stage. In answers to questions by members of the German parliament dealing with PM emissions from power plants and industry (Bundestag Drucksache 16/8128), the relevance of UFP was discussed.

This underlines the importance of the EU-project UFIPOLNET, which aims to make routine measurements of the number of particulates in ambient air easier, cheaper and more reliable. To measure number concentrations of particulate matter at different locations over a longer period will be one way of showing the reduction of number concentrations of particle numbers in European cities according to new regulations aiming to reduce particle emissions.

The objective of the project is to demonstrate an applicable and affordable measuring device for ultrafine particles, which can be implemented all over Europe. The 4 prototypes have demonstrated that reliable and comparable data for various kinds of analysis can be provided by the device. To produce system was standardised using a dryer unit and a critical orifice.

The new UFP 330 will cost about the same price as common PM<sub>2.5</sub> sampler. The reliable instrument will therefore be ready for use in all measuring networks of Europe. It has more advantages, like low costs for maintenance and less costs for personnel because of its easy to use software and interfaces compared to other instruments comparable data, the sampling measuring size distributions of particles. The UFP 330 will measure particles between 20 and above 200 nanometres in 6 size classes based on a technique using a diffusion charger and an electrometer. These classes are: >20 | >30 |



>50 | >70 | >100 | >200 (up to 800) nanometre. Neither butanol nor radioactive source is needed; therefore neither waste nor emissions of volatile organic compounds are made. There is also no danger of handling radioactive parts.

The practical experiences in the routine measuring networks resulted in a user orientated handbook and implemented practical knowledge in the instrument.

## 5 LIFE-PROJECT FRAMEWORK

The Project was divided in different Tasks (s. Fig 1). Task 1 (Management) and Task 6 (Dissemination) ran throughout the duration of the whole project. Task 2 (Design), Task 3 (Implementation), Task 4 (Measuring Activities) and Task 5 (Evaluation) ran sequentially with exception of Evaluation, which has been partly running during Task 3 and Task 4.

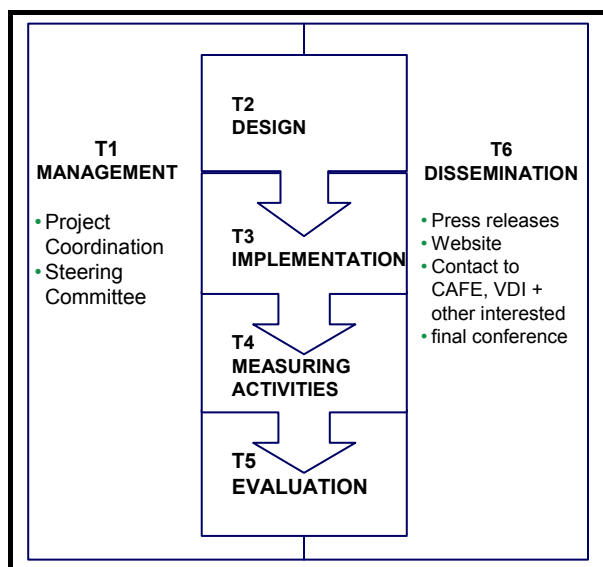
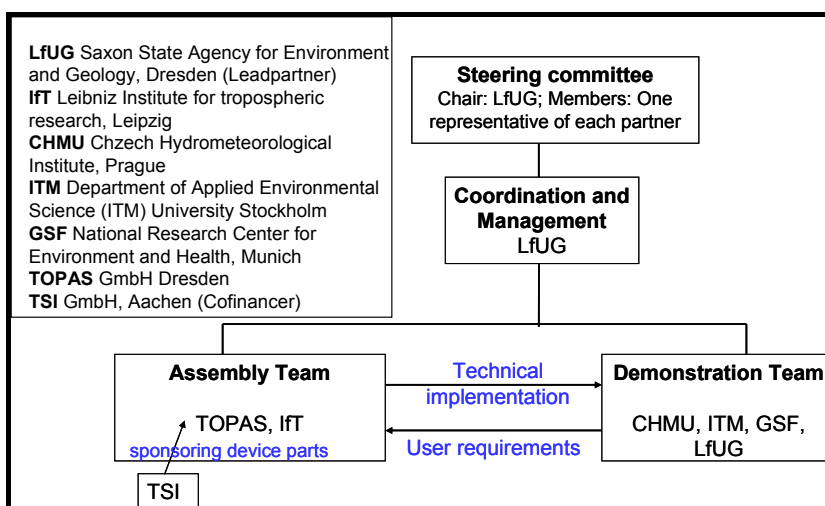


fig. 5.1 Organ gram of the Tasks in UFIPOLNET

The partners of the project were divided in the user (demonstration) team (CHMU, ITM; GSF and LfUG<sup>1</sup>) and the assembly team (TOPAS, IFT with help of co financier TSI). The assembly team builds the instrument and is responsible for the implementation at the measuring sites. The user team gives the user requirements to the assembly team during all phases of the project. They are responsible for the maintenance in cooperation with the assembly team.



<sup>1</sup> The LfUG delegate all measuring tasks to the UBG (depended on LfUG) like in the Saxony Air Quality Network. So the tasks in the demonstration team and user team were delegated to the UBG and were carried out by the UBG.

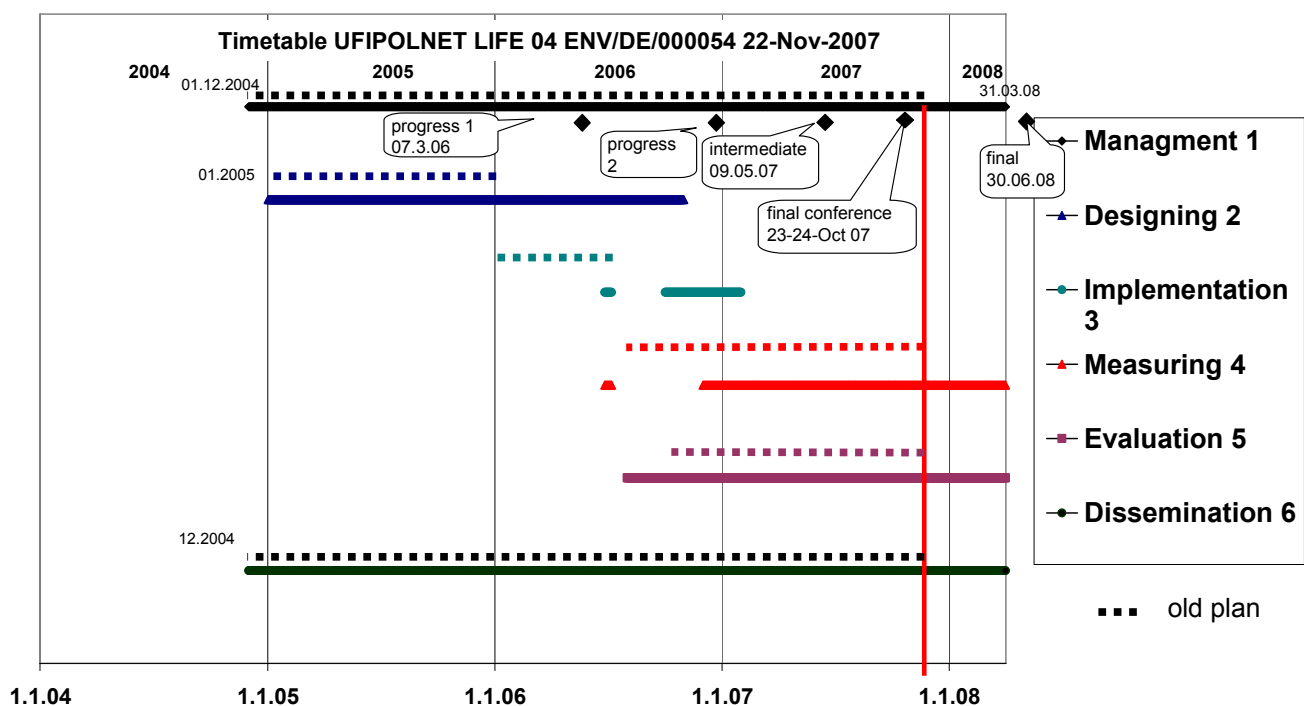


**fig. 5.2** Organisation of partners

In February 2007 implementation was completed in all stations. Measurements going on since and results are collected at IfT in a centralised database. Comparisons of UFP 330 with DMPS are promising.

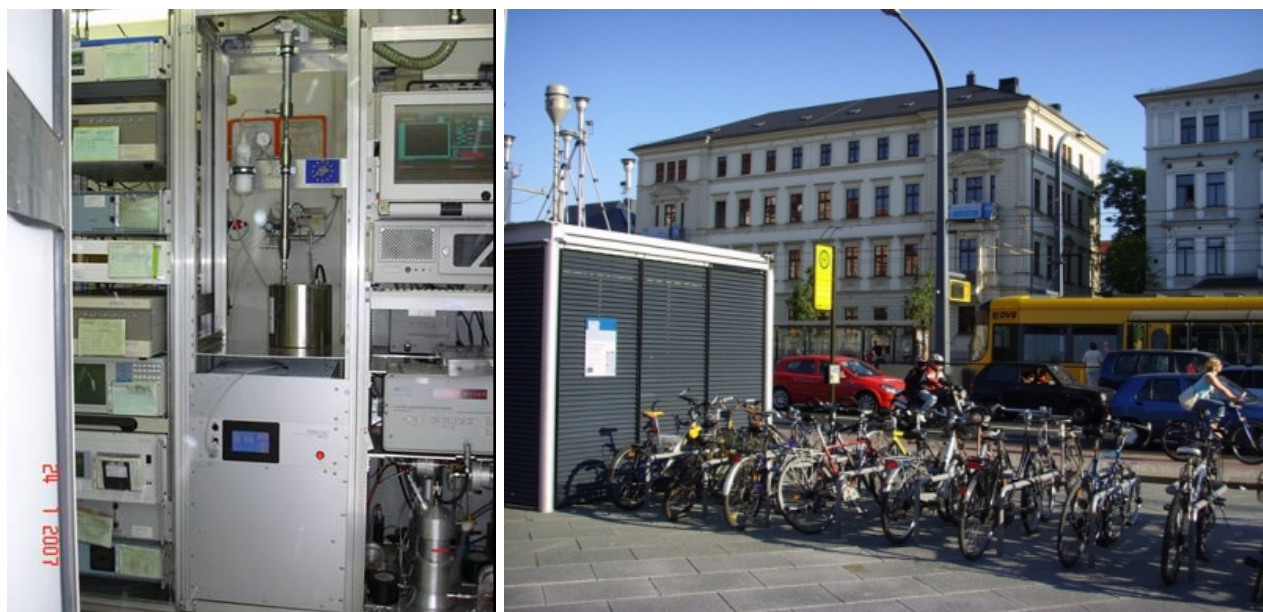
The beneficiary LfUG was responsible for finance management. In the beginning of the project it was decided to harmonise the sampling procedures using a dryer unit and a critical orifice. Therefore, more costs were necessary (about 5 - 8 k€) for each sampling stations. It was possible to shift the money from different cost categories to equipment respectively to prototype costs, within the SAP-rules.

Dissemination of project results was communicated via the final conference in October 2007 with 120 participants and during scientific conferences and papers as well as press events and a website.

**fig. 5.3** Progress of tasks

## 6 TECHNOLOGY

The UFP 330 is an electrical mobility spectrometer. It quantifies particles between 20 and 800 nanometres in 6 size classes by classification of the particles in an electric field after charging them using a diffusion charger. These classes are: >20 | >30 | >50 | >70 | >100 | >200 (<800) nanometre. Neither butanol nor radioactive source is needed. The particle sizes are calculated by an inversion program. One value for every size class every 10 minutes is produced. This is reduced to half-hour averages for the measuring networks.

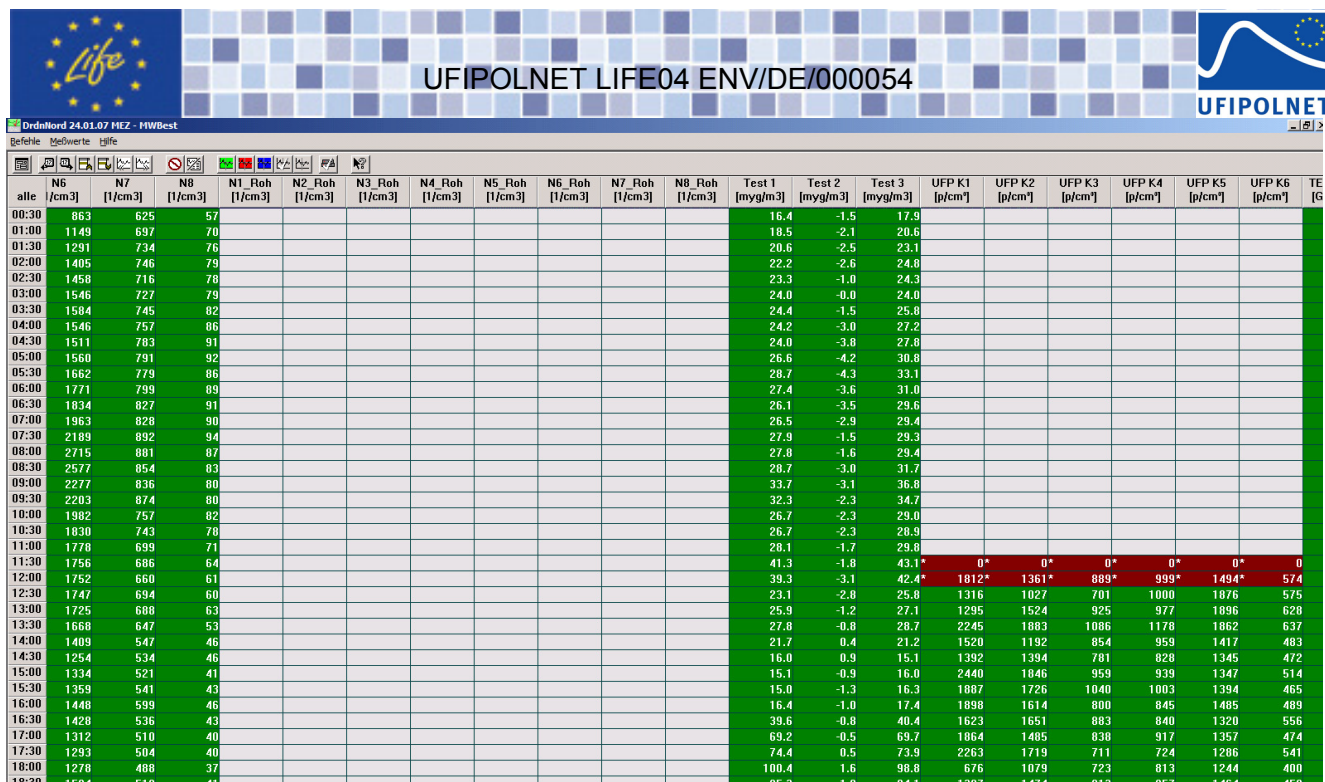


**fig. 6.1a, b** UFP 330 at the pilot station Dresden Schlesischer Platz (Photo: left L. Hillemann; right: H. Gerwig)

The 4 Prototypes are implemented in 4 different measuring stations in Stockholm, Augsburg, Dresden and Prague. All data including measuring results and error as well as operation status are saved on the internal hard drive of an internal computer. The data will be transferred to a laptop at least every 4 weeks. The data will be evaluated by the user team and IfT.

The Data-interface is individual for each station. The solution for Dresden and Prague are based on the Bayern-Hessen protocol for Augsburg and Stockholm on IP-Protocols.

In Dresden, the data is transferred online to a measuring network computer and from there to a central computer by modem. There, all data of 30 measuring stations are saved, validated and presented to the users of the data. Most of the data are made public via Internet. Data from all 4 UFP 330 measuring stations were published on the website from March to August 2007.



**fig. 6.2** Measurements UFP 330 implemented in the software ADVIS in the Saxony measuring network (Start 24-Jan-2007)

## Measuring Principle

The operating principle of the UFP is based on diffusion charging of particles, followed by size segregation within a DMA and detection of the aerosol via a sensitive electrometer.

**Charger:** The charging device in the UFP is the "Corona-Jet" charger. Unipolar air ions from a corona needle-tip discharge are swept by clean air (1.0 L/min) through an orifice into a field-free mixing chamber of about 10 cc volume, forming a jet which collides with an opposing jet of the incoming aerosol (4.0 L/min). The turbulence of the two colliding jets improves the mixing of the aerosol with the unipolar ions, so that even within the residence time of about 0.25 seconds in the mixing chamber, most of the aerosol has reached its limiting charge state.

For aerosols charged by the corona-jet method, the mean charge per particle was found in detailed experiments to be accurately proportional to the particle's electrical-mobility diameter in the range from 10 nm to 1000 nm diameter. Thus, aside from size-dependent losses, the net current in the electrometer is proportional to the sum of the diameters of all particles per unit volume. Actual performance deviates from this ideal, due to size-dependent losses in the particles transmitted from the charger to the electrometer.

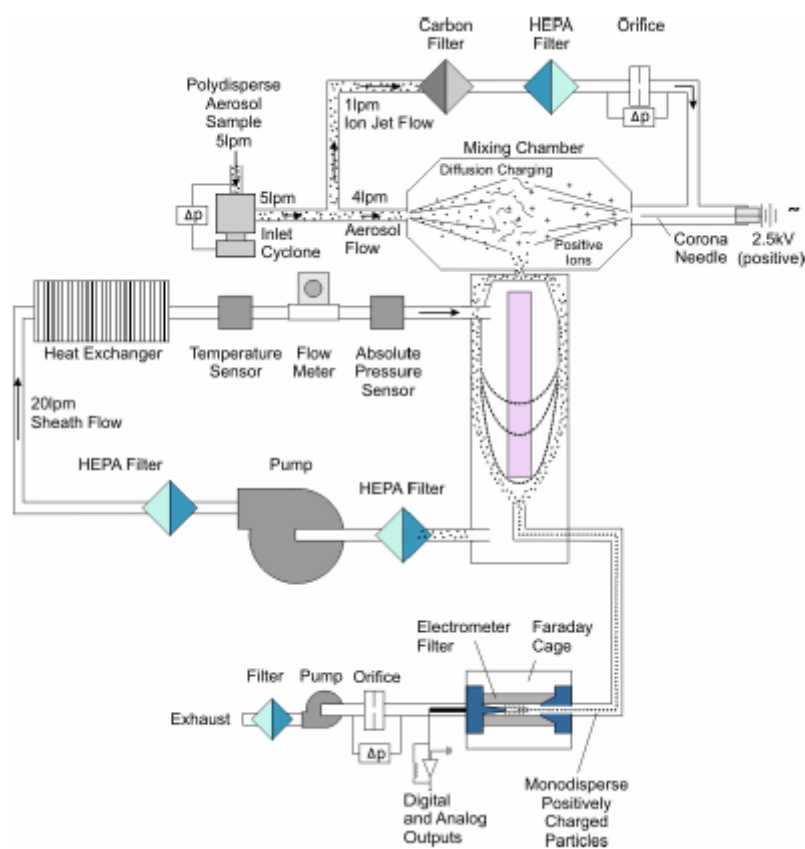
**DMA:** The charged aerosol passes into the main part of the Differential Mobility Analyzer (DMA). The DMA contains two concentric metal cylinders. The polydisperse aerosol and sheath air are introduced at the top of the Classifier and flow down the annular space between the cylinders. The aerosol surrounds the inner core of sheath air, and both flows pass down the annulus with no mixing of the two laminar streams. The inner cylinder, the collector rod, is maintained at a controlled negative voltage, while the outer cylinder is electrically grounded. This creates an electric field between the two cylinders.

The electric field causes positively charged particles to be attracted through the sheath air to the negatively charged collector rod. Particles are precipitated along the length of the collector rod. The location of the precipitating particles depends on the particle electrical mobility, the Classifier flow rates, and the Classifier geometry. Particles with a high electrical mobility are precipitated along the upper portion of the rod; particles with a low electrical mobility are collected on the lower

portion of the rod.

Particles within a narrow range of electrical mobility exit with the monodisperse air flow through a small slit located at the bottom of the collector rod. These particles are transferred to a particle sensor to determine the particle concentration. The remaining particles are removed from the Classifier via the excess air flow.

**Electrometer:** After leaving DMA, the aerosol enters a faraday cage where the particles, and their charge, are collected on particle filter. The filter is conductive, and is electrically connected to the input of a sensitive electrometer amplifier. The electrometer's critical circuits are contained in a small enclosure placed near one end of the filter to minimize input capacitance and to maintain mechanical stiffness of the leads and thus avoid micro phonics. The filter may be replaced provided proper precautions are taken to prevent electrostatic-discharge damage to the sensitive electrometer circuit.



**fig. 6.3** Flow Scheme UFP 330

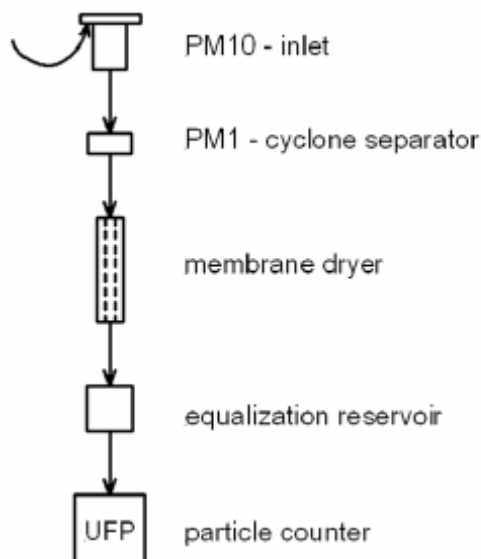
### The sampling system

The sampling system consists of a pre-impactor and a dryer. Conductive and non corrosive tubing material such as stainless-steel that is weather- and sunlight-resistant is used (see fig 6.4).

**Dryer:** Atmospheric aerosols may change their size and physical properties if ambient conditions vary such as temperature and relative humidity. Low volatile compounds may evaporate with increasing temperature. On the other hand particle size may increase with increasing relative humidity due to hygroscopic growth. Thus, the measured particle number size distribution depends strongly on the relative humidity within ambient air but also in the instrument. In humid environments with high ambient temperatures and high dew points, the water may even condense when entering the air conditioned measurement container leading to an increase in particle diameter. To avoid these



problems, the usage of a membrane dryer within the aerosol sampling is recommended. The method is based on water vapour diffusion through a membrane (Nafion) into a dry air flow. This instrument does not need any regular maintenance, but it does require initial buying costs.



**fig. 6.4** Sampling system of UFP 330 implemented at all 4 stations (Hillemann/Wehner)

**Inlet:** The sampling head (PM10) removes larger particles to avoid contamination of the instrument. The pre – impactor (PM1 inlet, standard flow 1m<sup>3</sup>/h or 16.7 lpm) is needed in order to sample with highest velocities and laminar flow. The flow scheme of the instrument is documented in the users manual.

## Data Collecting and Processing

A measurement cycle can be divided into the two parts:

a) Raw data collection from the electrometer; b) Data inversion through mathematical routines. Raw data is taken from the electrometer and stored in a local database, containing the system parameters like sheath flow and sheath temperature. The second part, the inversion program, takes the stored values and calculates the result. Therefore, the inversion algorithm can be changed afterwards without influence to the data collection.

## Instrument Design

The instrument is placed in a 19" Rack, 710 mm height and 410 mm depth and its weight is about 30 kg. The instrument needs a direct environment of 10 - 40°C and 0 – 90% relative humidity, which are mostly the conditions inside a measurement container. A sampling volume of 5 litres per minute is required. An internal PC and a Front panel display (240×128 pixel) Touch screen LCD are included. Output ports are Serial (user programmable), Ethernet and USB.



## 7 PROGRESS RESULTS

### 7.1 General

As you can see from fig. 5.3 Management and Dissemination were running from the beginning until the end of the whole project life. Task Design (T2) was running all through 2005 and needed a 10 month extension. Therefore Task Implementation (T3) and Task Measuring (T4) was shortened to 2 respectively 12 months in comparison to the plan of 5 (T3) and 18 (T4) months.

### 7.2 Task 1 Coordination activities (Management)

The project manager created and updated the **project time plan**. The project manager helped the finance coordinator respectively its predecessor in producing individual **finance plans for the partner contracts** and to write the **financial guidelines UFIPOLNET**. A **dissemination plan** has been made.

The **Beneficiary employed the project manager** from Jan/05 with 80 % and from Mai/05 with 100% of a full time position until the end of the project. The **finance coordinator was employed** in Jun/05 for 16 h per week until Dec/05. From Jan/06 until Mar/08 it was 8 h per week. In **May/06 the Engineer was employed** as planned for 20h per week until the end of the project.

#### Project meetings with partners:

- 3-day **kick off meeting** in Jan/05; 2-day **2<sup>nd</sup> annual meeting** from 16-17/May/06, **3<sup>rd</sup> annual meeting** from May/07 and last meeting with all participants 22/Oct/2007.
- **Assembly team** (TOPAS, IfT and co financier TSI) **meeting** with minutes: at the European Aerosol Conference (30/Aug/05), 06/Dec/05, 20/Mar/06, Sep/07, 4/Mar/08. The **assembly team** also organised telephone conferences. The assembly team had a lot of contacts via email and telephone with each other. During the International Aerosol Conference in St. Paul/USA a meeting took place on the 13/Sep/06. Telephone conference on the 27/Oct/05 (with minutes) and during spring 06.
- Meetings with **TOPAS** and UBG (9/Mar/06) to visit the measuring container in Dresden and in spring with TOPAS, regarding financial guidelines.
- The project manager organised and documented **meetings with IfT** (30/Jun/05) and **with TOPAS** (25/May/05) and 14/Dec/05 with TOPAS regarding financial guidelines.

The EU commission visited the project by desk officer Mr. Grzesiskowski and finance officer Mrs. Scherzer on 22-Nov-08. The project manager organised, with the help of the partner IfT and TOPAS, the **visit of the project by PARTICIP** (Mr. Reisenberger) on the 20/May/05, 17/May/06 and Nov/06.

**Project meetings inside the beneficiary organisation (LfUG, UBG):** Inside LfUG: more than 5 half days meetings (14/Dec/04; 26/Jul/05; 03/Aug/05, 11/Aug/05 (without minutes), 25/Aug/0805, 29/Nov/05. Coordination meeting LfUG / UBG 15/Nov/05 presenting up-to-date news on UFIPOLNET, 20/Dec/05 preparation employment engineer at UBG, 22/Mar/06 and 9/May/06. A half day for the half time meeting with LfUG/UBG/LfL: 5/Jul/06. Meetings with the press officer: Half day meetings 1/Aug/06, 20/Sep/06. Financial manager + Sub department 13: half day meeting 1/Feb/06 and 15/Mar/06 regarding financial management. Sub department 14: half day meeting 23/Mar/06 regarding dissemination: Logo, leaflet, Layman report, notice boards.

#### Project meetings with other organisations (LfL, SAB, LANU, VOR, TMGS):





- LANU (Landesstiftung für Natur und Umwelt): Half day meeting at the Blockhaus, Dresden as a possible location for final conference on 14/Jul/06
- VOR, advertising agency: Half day meetings at VOR on the 9/May/06, half day meeting on 19/May/06.
- SAB (Sächsische Aufbaubank): Half day meeting at the SAB, Dresden city as a possible location for the final conference on 15/Aug/06. In Oct/2007 for detailed planning.
- LfL (Landesanstalt für Landwirtschaft): First half day meeting with auditor of the project on 12/Sep/06; Additional meetings after Nov/2007 to discuss the audit. Auditing process started Feb/08.
- TMGS (Tourismus Marketing Gesellschaft): Mar/07 and also later on for preparation of final conference.

The updated **contract** for the **rooms + catering** for the final conference at the SAB (Oct/07) were signed in Jan/07.

The project manager created and updated the **project time plan**. The finance coordinator helped the project manager to write the **financial guidelines UFIPOLNET**. A **dissemination plan** (past and future events) has been made.

The project coordinator updated the **address file (see Attachments)**, **dissemination plan** and distribution list with postal address, with email address (now 900). The **numbers of internet hits** are counted and documented since Aug/05.

The financial plan has been made and sub plans attached to the partner contracts. The financial plan has been updated continuously.

#### **Representatives of the beneficiary:**

- **The finance coordinator:** Coordinates the Sub-Payment-Requests by partners and checks the invoices and other financial papers.
- **Sub department 14** helped to produce the **leaflets, sign boards** and to **organise the final conference** as well as the **public event**.
- The **press department** has launched press releases in Jan/05 and Feb/07 and in Oct/07.
- The **president of LfUG** attended the press meeting in February 2007. His deputy attended the final conference in Oct/07.
- The desk officer in **sub department 22** is responsible for particle measurements in Saxony attended different meetings, like the annual meetings and the assembly team meetings.

Following **reports have been delivered** since the start of the project to the commission:

- Documentation of the kick off workshop (5 - 7/Jan/05) incl. DVD-ROM
- Short minutes including pictures during the visit of PARTICIP (20/Jul/05)
- Financial Guidelines UFIPOLNET (Ver. 12/Oct/05)
- Documentation of the 2<sup>nd</sup> annual workshop (16 - 17/May/06) incl. DVD-ROM
- Progress report 1 (7/Mar/06) (including partner contracts)
- Progress report 2 (29/Sep/06)
- Intermediate report (4/May/07)

#### **Partner:**



Last partner contracts have been signed in 2006. Amendments of partner contracts were necessary because of prolongation of the project for 4 months until 31/Mar/08. Partner contract with UBG was signed in Dec/07 and cancelled in Jan/2008. No amendment of the project was needed.

An extension of the project duration for 4 months was needed to keep the measuring phase for all measuring stations at the aim of one year, especially at the partner stations Augsburg, Prague and Stockholm.

### 7.3 Task 2 Designing and planning, assembly and calibration of the prototype

This is the main task in the beginning of the project. A lot of work has been done from TOPAS and IFT with the help of TSI providing more than planned device parts.

Objectives according to the proposal	Outcome
Definition of user requirements	O.K., see attachment to progress report 2.
Planning of the prototype	O.K., a <b>Report with blue prints</b> and pictures in the <b>users' manual</b> attached.
Assembly of first prototype + Assembly of the other three prototypes	<b>O.K.</b> ; TOPAS assembled last 3 of 4 UFI 330 in Jul/06. Interfaces are ready.
Calibration of first prototype	<b>O.K., first measurements in comparison to other DMPS</b> with promising results (May/06).  These measurements are documented in the pre version of the users' manual.
Tests and calibration of the other 3 prototypes	<b>O.K.</b> They have been tested during Aug -Sep/06, Jan/07 and Jan/08 by IfT. A <b>test report</b> of the 4 instruments is attached to this report.
Delivery of the prototypes	<b>OK: Dec/06</b> Dresden + <b>other 3 in Feb/07</b> by TOPAS/IfT

Technical problems occurred in middle to end of 2005 and were be solved by the assembly team with success. This problems caused a temporarily delay of about 10 months inside Task 2 Designing which. The delay will be compensated by a shorter respectively parallel working Task 3 Implementation and shorter Task 4 Measuring Activities. The aim of the project to measure at least one year during the project duration has been realised.

After the results of tests with ambient aerosol Aug-Sep/06 at IfT/UfZ-Eisenbahnstr. (s. fig 5a,b), not all individual instruments produced the expected results (s. Task 5). The assembly team found that one part of the devices was not working well. These parts have been identified and were exchanged in the beginning of 2007. After these parts were exchanged, further tests were done. These comparisons showed good results between the 4 prototypes and the reference instrument (DMPS) in January 2007 (s. Task 5). Another test with all instruments in Jan/08 showed good results after some cleaning procedures (see Task 5 and attachment).

In Dresden, special monthly evaluations and checks have been performed to monitor the parts causing the past problems as well as to determine the necessary time for filter changing. Particle number concentration is tested in parallel with a CPC respectively distinct particle diameter samples are tested in parallel with a SMPS.



**fig. 7.1a, b** Photos of the 4 prototypes UFP 330 Sep-2006 at the common IFT/ UfZ (Helmholtz Zentrum für Umweltforschung – UfZ) calibration test laboratory in the Eisenbahnstr. in Leipzig situated in a flat. High polluted ambient air of a street canyon was measured. (Photo: TOPAS)

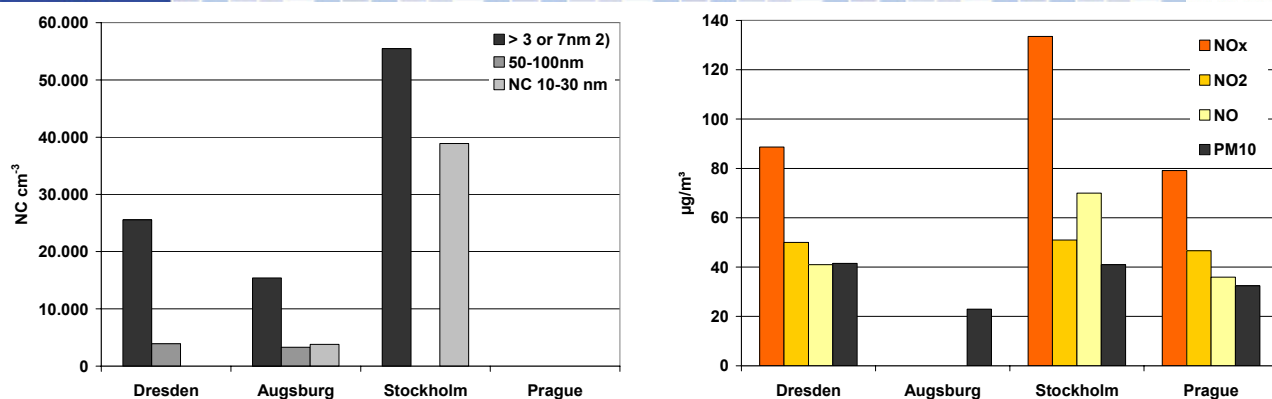
#### 7.4 Task 3 Implementation at the test sites / training for the participants

Task 3 started in June 2006, not in January 2006, as it was planned in the beginning. First, theoretical subjects were discussed during the annual workshop in May 2006.

The assembly team recommended a sampling system including an inlet and a dryer (see attached documents for details: Suggestion inlet and necessary main components). The parts for sampling have been bought by the user group as it was discussed at the 2<sup>nd</sup> annual meeting.

The descriptions of the 4 measuring stations were made by the user team, air quality parameter were compared (see. fig. 6 a, b) and presented at the second annual workshop in Leipzig (May 2006).

Objectives according to the proposal	Outcome
<b>1<sup>st</sup> Prototype</b> installed in Dresden	26/Jun – 09/Jul/06 <b>report about first test</b> runs in the measuring station for two weeks. (see attachment)
<b>Documentation of training sessions</b> (Workshop May 2006, technician training Jan/08)	<b>photodocumentation technician training</b> Jan/08 (see attachment)
<b>Interface</b> communication at all station	Works at all stations Feb/07
<b>Delivery of 3 prototypes</b> to user group after test at IFT	Dec/06: Dresden; Feb/07: Augsburg, Stockholm, Prague
<b>Installation prototype 3 locations + on site training</b> at the locations LfUG station: <b>October</b>	Dec/06: Dresden; Feb/07: Augsburg, Stockholm, Prague
First <b>test runs Dresden + structured data</b>	Nov/06 - Dec/06, first data in Measuring network Dresden Jan/07
First test runs <b>Augsburg, Prague, Stockholm + structured data</b>	Feb/07

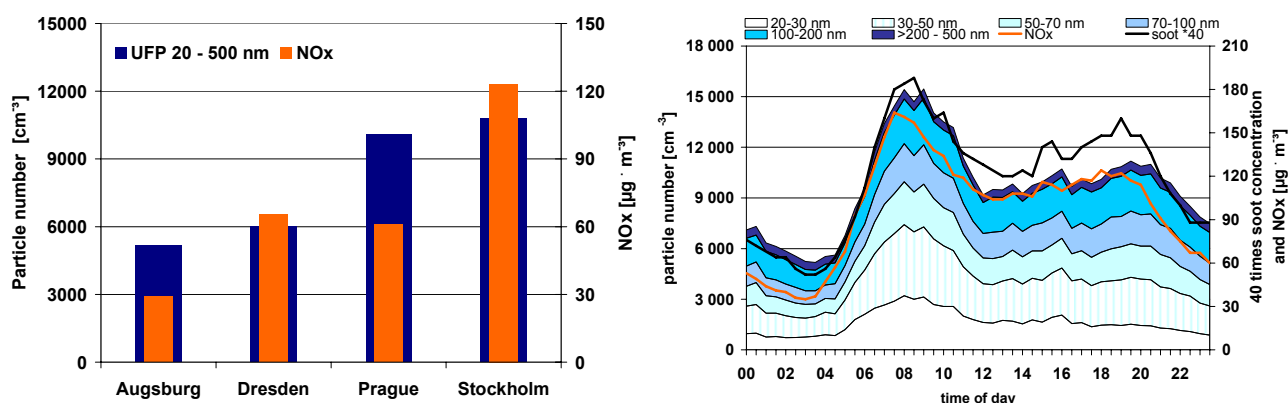


**fig. 7.2 a, b** Comparison of annual averages of particle numbers of different particle diameters of other installed measuring devices at the measuring stations; NO<sub>x</sub>, NO<sub>2</sub>, NO and PM<sub>10</sub>.

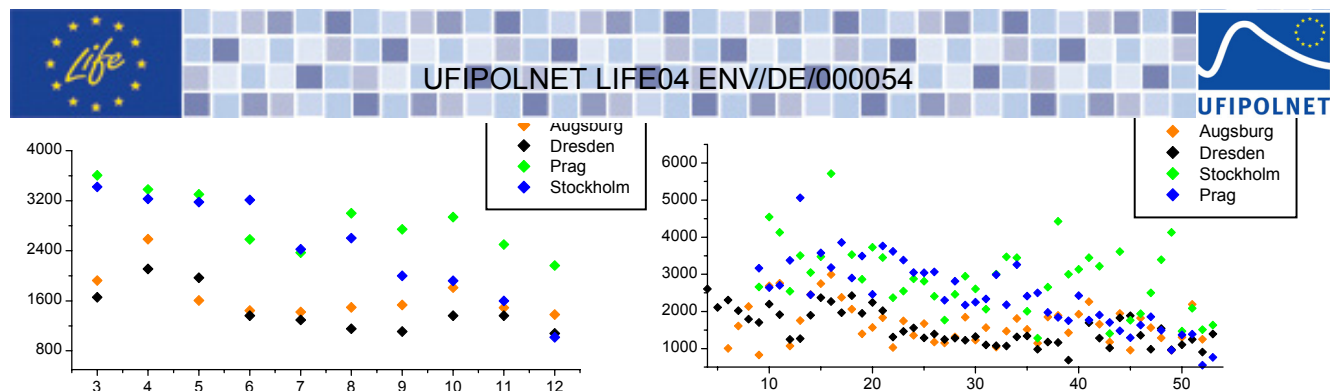
## 7.5 Task 4 Measuring activities and demonstration

Task 4 started partly in October and again after a break in December 2006 in Dresden, not in June as it was planned in the beginning of the project. The other measuring stations started to work in February 2007.

Objectives according to the proposal	Outcome
End of <b>first test runs</b> (February until March 2007)	All stations delivered reasonable data on first glance. Discussion of results in May at project workshop.
<b>Database of all 4 stations</b>	All stations deliver <b>data to the database at IfT</b> since Mar/07 until Mar/08 and in future (attached on DVD)
<b>Log book every 2 months</b>	Included in <b>Report with presentation of data</b> attached
	<b>Report of improvements of the device</b> attached



**fig. 7.3** **a** Comparison of 4 measuring stations: Jun/07 averages of particle numbers and NO<sub>x</sub>. **b** Dresden half hour average particle number concentrations UFP 330 compared to NO<sub>x</sub>, soot b average weekday 24/1 – 19/Mar/07

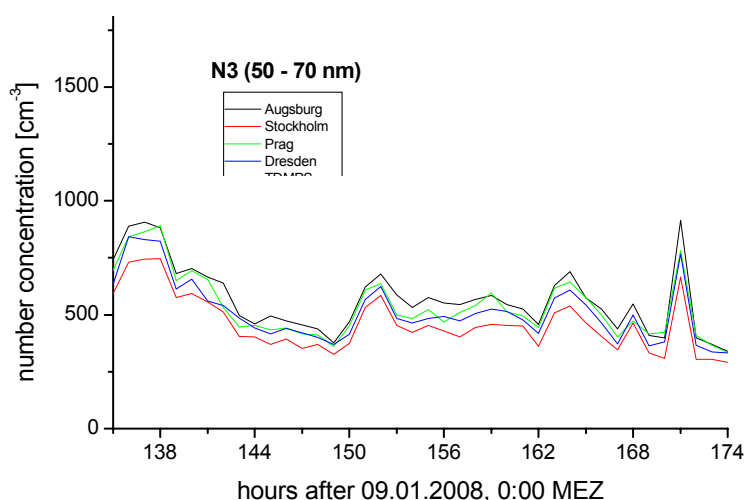


**fig. 7.4** Comparison of 4 measuring stations, particle number concentrations 30 - 50 nm Mar-Dec/07: **a** average month **b** Average week

## 7.6 Task 5 Evaluation

Task 5 has been already started in August, not in Sep/06, by running 4 devices in parallel at the IfT at a place with high traffic load and high concentrations of ultrafine particles (Leipzig, Eisenbahnstr.) (s. fig 5a,b) not all individual instruments produced the expected results. The second comparison took place in Jan/07 at the same place. The Status Evaluation Prototypes Report by IfT, Jan/07 report says: "As a result of the comparison measurements, IfT is very convinced by the measurement accuracy and recommends installation of systems at four test sites. Now, experiences with long term measurements concerning quality stability are required. The comparison measurements in Jan/08 gave also good results for all instruments after cleaning procedures. In the beginning of comparisons especially the instrument from Augsburg (site with cleanest air in > 500 m distance to next street) showed good results of counting efficiency in contrast to the instrument from Stockholm. These findings influenced the definition of time between periodic cleaning and other maintenance procedures as described in the user's manual (attached).

Objectives according to the proposal	Outcome
<b>Evaluation: comparison</b> to reference instrument in Aug/06 + Jan/07 + Jan/08	Jan/07 + Jan/08 gave good results. See text for details ; <b>Evaluation report</b>
<b>Report on evaluation procedures</b>	see attachment in <b>users manual</b> + <b>report about questionnaire users</b>



**fig. 7.5** Comparison of 4 UFP 330, particle number concentrations 50 - 70 nm Jan/08 showing comparable results +/- 10%.





## 7.7 Task 6 Dissemination

For details see: 8 Dissemination.

A dissemination report and plan for past and future events was created. A homepage in German and English is updated every month. A logo and notice boards were created together by all partners and an advertising agency. A leaflet in English and German was created in September 2005. Additional leaflets were printed in English, German, Czech and Swedish in the middle of 2006. The homepage address was shortened to: [www.ufipolnet.eu](http://www.ufipolnet.eu). A newsletter was 19 times distributed to 900 people dealing with air quality. More than 15 oral presentations of the project were held at conferences/meetings, professional trainings or a university by LfUG, IfT and TOPAS. 3 press releases in Dresden respectively 1 in Stockholm were sent and several press organs published the results as well as 2 TV-Broadcasts (Saxony (MDR) in German and Sweden (TV2) in Swedish). A two-day international conference with simultaneous interpreter was hosted by LfUG in Oct/07 in Dresden dealing with ultrafine particles in urban air and presenting results from UFIPOLNET project to 120 participants from 14 nations. Also a citizen's podium discussion was organised by LfUG for the first time ever in Oct/07. This was also presenting information about ultrafine particles to 30 persons in Dresden.





## 8 DISSEMINATION ACTIVITIES AND DELIVERABLES

Deliverables / Event	Lang.	Date	Audience	Contribution from
<b>Homepage</b> <a href="http://www.umwelt.sachsen.de/lfug/luft-laerm-klima_ufipolnet.html">http://www.umwelt.sachsen.de/lfug/luft-laerm-klima_ufipolnet.html</a> ; Old address, links to other projects/institutions, English; Newsletter (see DVD-ROM for screenshots)	DE, EN	17/Jan/05; 16/Sep/05; 3/Feb/06	scientists, network-managers, public in general interested in fine particles	LfUG
<b>Homepage</b> <a href="http://www.ufipolnet.eu">www.ufipolnet.eu</a> changed short address,	DE, EN	4/Aug/06	- " -	LfUG
<b>Homepage</b> <a href="http://www.ufipolnet.eu">www.ufipolnet.eu</a> changed internal address to server SMUL, layout changed to "green", German and English separated (see DVD-ROM for screenshots)	DE, EN	Feb/08	- " -	SMUL/LfUG
<b>Flyer (Leaflets) in the languages of all partners:</b> - German, English (800 first circulation)	DE, EN	Sep/05	scientists, network-managers, public in general interested in fine particles + general public	LfUG
<b>Flyer (Leaflets) in the languages of all partners:</b> - English (5000 second circulation); - New professional Leaflet circulation: 3000 De, 1500 S, 1500 Cz (see DVD-ROM)	DE, EN, Cz, S	Aug/06; Sep/06	scientists, network-managers, public in general interested in fine particles + general public	LfUG
<b>Leaflets at congress/event:</b> - 500 "In motion visions for urban mobility and clean air" in London; - 20 copies Kick-off LIFE Projects in 2005; - 200 leaflets "PM 10 - Challenge or fait ?" in Graz; - 10 VDI AG Partikelmessungen	EN	15-16/Sep/05; 26-27/Oct/05; 17-18/Nov/05; 30/Sep/05	Air Quality Experts and authorities and media; VDI Working group Particle counting	EU Commission / Mr. Kaschl; Astrale GEIE - Particip GmbH Mr. Reisenberger; LfUG in cooperation with LIFE 04 project KAPA GS; LfUG/Dr. Löschau
<b>Leaflets at congress/event:</b> - 500 EN "International Air Conference" in St. Paul USA, 1600 participants; - 100 – 300 EN to all partners;	EN/DE	11-15/Sep/06  Aug/06	Air Quality Experts; scientists, network-managers  Members of partner organisations	LfUG in cooperation with TOPAS  LfUG in coop. partners
- 100 GdCh meeting in Halle/Germany 4-6-Oct-2006		Oct/06	Chemist	LfUG
- 20 Workshop "Ultrafeinstaub" UBA, IfT, Leipzig		Mar/07	German scientists, network experts	LfUG in coop. partners



- 30 "Die Einrichtung von Umweltzonen in den Städten", Dortmund		Mar/07	Local + regional Authorities	LfUG
- 300 KAPA GS, Klagenfurt, Austria (28 - 30-Mar-2007)		Mar/07	authorities, politicians, NGOs, scientists, network managers	LfUG in Coop. with KAPA GS
100 MTK 42 (Messtechnisches Kolloquium) in Germany	DE	May/07	network-managers	LfUG in Coop. with LANU NRW
750 EAC Salzburg, Austria (9- 14-Sep-2007)	DE/EN /CZ/SV	Sep/07	Scientists, authorities	LfUG, TOPAS
<b>Newsletter:</b> UFIPOLNETnews No. 1-19 (s attachment example No. 18)	EN	27/Sep/05 until 4/Mar/08	500 – 900 experts and authorities, other persons	LfUG
<b>Oral + Poster presentation</b>				
GdCh meeting in Halle/D	DE/EN	4- 6/Oct/06	Scientists/Chemists	LfUG
KAPA GS, Klagenfurt/Au		28-30/Mar/07	authorities, politicians, NGOs, scientists, network managers	LfUG/all
	DE/EN			
MTK 42 (Messtechnisches Kolloquium) in Langenargen/D oral pr. (s. attach.)	DE	14-16/May/07	network managers	LfUG/UBG/IFT
EAC Salzburg/Au	EN	9 - 14/Sep/07	Scientists	LfUG/IFT/ TOPAS + all
4 Poster, 3 oral pr. (s. attach.)				
Kongress "Medizin und Gesellschaft" GMDS, Augsburg	DE/EN	17-21/Sep/2007	Epidemiologist	GSF, All
Particles and Photo-oxidants in Europe, Prague/CR (1 poster, s. DVD)	EN	25–26/Sep/07	Scientists	LfUG, CHMU, All
Ultrafine particles in urban air, Dresden/D (7 oral, 3 poster s. DVD)	DE/EN	23-24/Oct/07	Scientists	All
<b>Press release:</b> (DVD-ROM)				
- Germany Kick-off	DE	23/Jan/05	general public, local authorities, local politicians	LFUG
(3 articles in newspapers, 2 online articles, 2 press agencies)				
- Germany begins measurements	DE	7/Feb/07		LfUG
(5 articles in newspapers, 3 online articles, 1 press agency, 1 TV)				
- Sweden begins measurements	SV	5/Mar/07		ITM
(2 online articles, 1 TV broadcast SV2)				
- Germany: Final Conference + panel discussion (s. attachment)	DE	Oct/07	general public, local authorities, local politicians	LfUG
<b>kick off meeting</b> minutes with next actions to follow + Documentation DVD_ROM + Booklet	EN	5-7/Jan/05	LfUG officials, employee of partners	partners

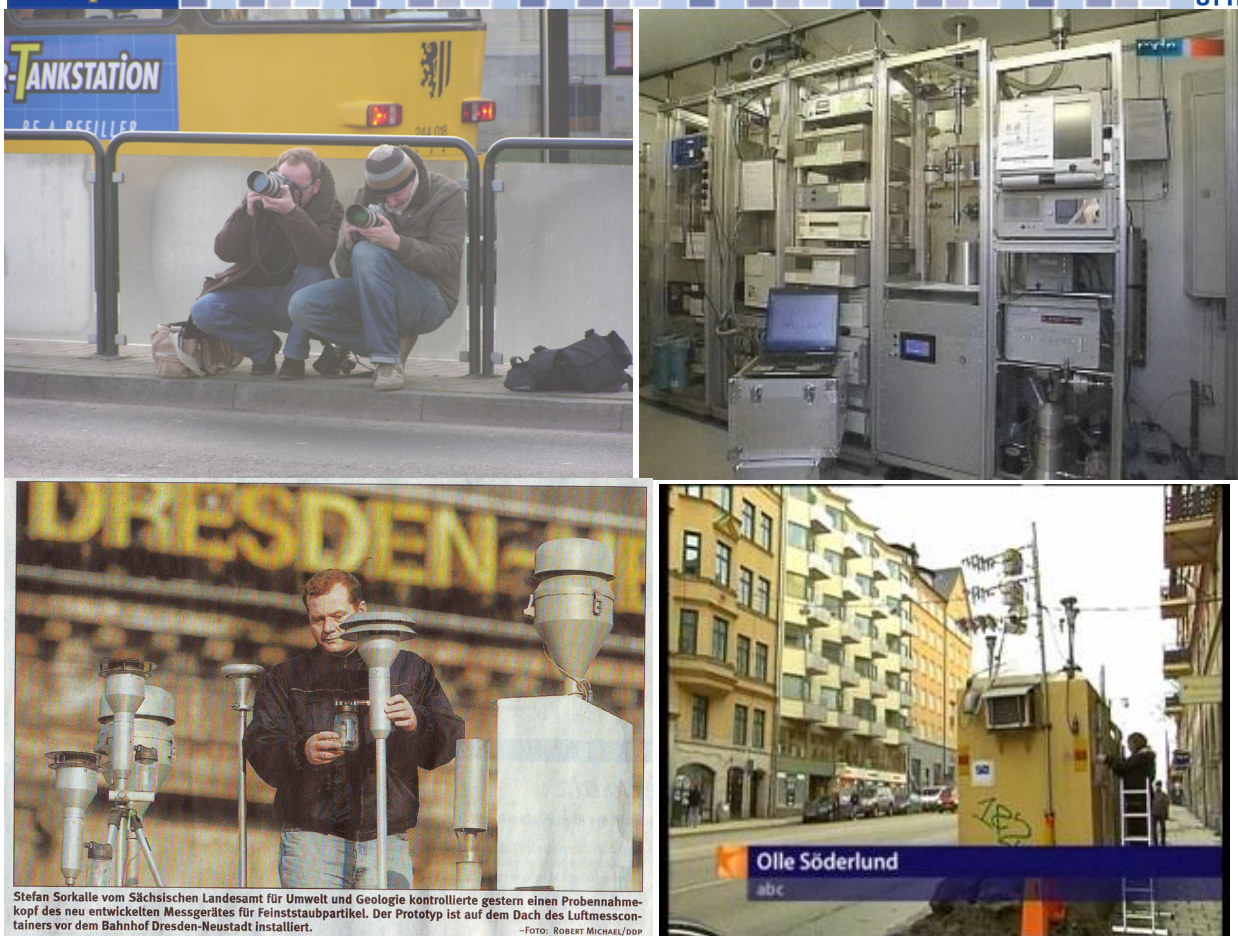


<b>Layman report</b> Brochure (5 000 cp) with short information about project results and background	DE, EN, (SV, CS)	Dec/07	general public, network-managers	LfUG
<b>Final Conference:</b> 120 participants from 14 nations; (s. attachment:) Abstract book, PowerPoint presentations + poster on website, picture documentation	EN	Dec/07	scientists, network-managers	LfUG, all Partners
<b>Citizens Information, Dresden</b> 22-Oct-2007: s. attachment: picture documentation, invitation, feedback: 2 reports	DE	Oct/07	general public	LfU, IFT
<b>Scientific papers:</b>				
UMID 2/2007 (see attachment)	EN	2007	Scientists	LfUG
4 EAC Poster and 2 oral presentations	EN	2007	Scientists	LfUG, IFT, TOPAS, all partners
In Annual report Saxon Air Quality	DE	2007	Authorities, general public	LfUG
<b>Report with recommendations for the expert groups</b> (Send to 900 email addresses)	EN	Mar/08	scientists, network-managers	LfUG, all Partners
<b>UFIPOLNET Pen</b> (1000) distributed at events, meetings, send with material (see attachment)	Int.	2007	All	LfUG

## Indicators

Description	Outcome
Use of the <b>homepage: Number of hits</b>	200 – 2000 per month (s. below for details) From 10/05 - 12/07: about <b>20,000 contacts</b>
Published releases: Number of published <b>press releases</b>	1 in 05; 3 in 07 Pressecho 7/Feb/07: press > 2 Mio readers (Sächsische Zeitung, Freie Presse, Leipziger Volkszeitung, Bild Dresden, Morgenpost Dresden <sup>1)</sup> ), 3 min spot on TV MDR-aktuell 19:00 (about 1 Mio? viewers) and TV1 in Sweden 19:00 in Mar/2007 (about 2 Mio? viewers), Oct/2007 (see attachment) (0.2 Mio) > <b>5 Mio contacts</b> <sup>1)</sup> Numbers from article in Sächsische Zeitung, 26+27.10.2007
<b>Brochures</b> (leaflets) available in the languages of all project partners	German (3,000), 2 English (800 + 5,000), Swedish (1,500), Czech (1,500); <b>about 12,000 contacts</b>
<b>Newsletter</b>	1 in 05, 9 in 06, 7 in 07, 2 in 08 (19 newsletter for 500 - 900 email addresses, more than <b>10,000 contacts</b> and > <b>4000 downloads</b> .)
<b>Number of participants at final conference</b>	<b>120</b> (30 at citizens podium discussion)
<b>Layman report</b>	<b>5,000</b> distributed in Dec/07 - Jan/08





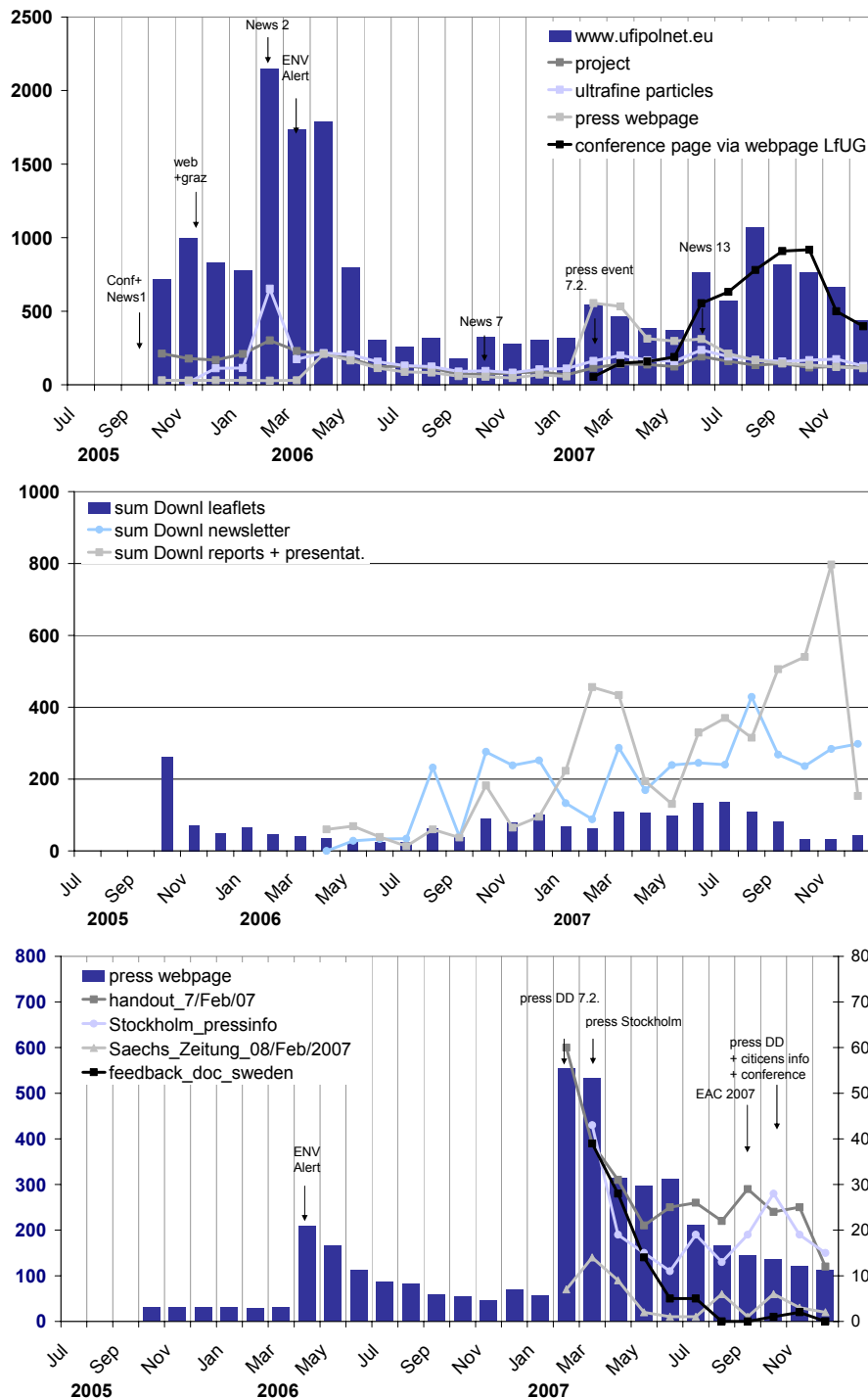
**fig. 8.1** Press event on 7/Feb/07 in Dresden: Photographers at work (photo: H. Gerwig); picture from TV-broadcast on same day by MDR (editor: F. Wend) and in newspaper (Freie Presse, page 3, 8/Feb/07); Press event Mar/07 in Stockholm: picture from TV-broadcast (TV2 20/Mar/07, ABC-editor: O. Söderlund).



**fig. 8.2** Info plates and running instruments at all 4 stations Feb/07: Stockholm, C. Johansson (up, left),



Augsburg (up, right), Prague (down, left), and Dresden, Dr. Rudolph/TOPAS and H. Biele president LfUG (down, right) (Photos: ITM, GSF, CHMU, lft, LfUG).



**fig. 8.3** a: Number of hits UFIPOLNET homepage Jul-2005 – Dez-2007  
 b: Number of downloads of leaflets and UFIPOLNETnews  
 c: Number of hits press releases and press articles

The usage of the homepage was monitored via the number of hits since Oct/05 (s. fig 8.3a). Between 200 and 2000 hits per month were monitored. The announcement of the website by leaflet at conferences in Sep and Nov/05, UFIPOLNETnews 2 in Feb/06 and a short hint to the website in Science of



Env Policy Mar/06 showed a positive effect on the number of hits. Also the press event on 7/Feb/07 and the announcement of the conference showed this positive effect. The UFIPOLNETnews2 had a significant advertising effect for the sub-page, where ultrafine particles are described. UFIPOLNET-News 7 was sent around to more than 500 email addresses but without attachment – only a link. This could be the reason for doubling hits from Sep-Oct/06. The advertising effect of the press conference in February 2007 doubled the homepage hits from January (s. fig. 8.3c). The interest in the press-webpage was roughly the same in February as for the project itself because of a direct link from the top-page of LfUG to that page.

In Oct/06, the sum of all downloaded newsletters increased by a factor of 5 and the sum of leaflets doubled (s. fig. 8.3b). The presentation of UFIPOLNET presented at the TU-Dresden in Nov/06 was very popular (362 downloads in Feb/07 only higher with 433 in Nov/07 directly after the final conference) which led the sum of downloads and presentations to rise from Dec/06 to Feb/07. The Power-Point presentation from the MTK 42 for example was 231 times downloaded in Nov/07.



**fig. 8.4** Final Conference, 23-24/Oct/07, Dresden (up, left), Cover Layman report (up, right), Citizens information evening 22/Oct/07 (down, left), and invitation (down, right) (Photos: LfUG).



**Deliverables not mentioned in UFIPOLNET proposal**

<b>Deliverables / Event</b>	<b>Lang.</b>	<b>Date</b>	<b>Audience</b>	<b>Contribution from</b>
<b>HTML and PDF-File</b> in Database	EN	End 04	Internet user, in LIFE-Programme interested people	EU COM
<b>PDF-File</b> introducing LIFE 04 Projects	EN	End 04	LIFE-Programme interested people	EU COM
<b>Bullet board messages:</b> EU-project <a href="#">INTEGAIRE</a> ; <a href="#">Werkstatt Feinstaub</a>	EN, DE	27/Sep/05	readers of web-sites: scientists, network-managers, public in general	Sergio Ferreira; LfUG
<b>short description on website + weblink</b> from: <a href="#">Feinstaub-Werkstatt</a> Berlin; <a href="#">NANOSAFE 2</a> ; <a href="#">ITM</a> ; <a href="#">GSF</a>	DE, EN	17/Oct/05; 18/Nov/05; 30/Nov/05	scientists, network-managers, public in general interested in fine particles	Berlin authorities; EU FRP6 Project NANOSAFE2; partner ITM and GSF
<b>announcing UFIPOLNET:</b> 88th Meeting of LAI-Unterausschuss "Luft/Überwachung", Minutes; European Aerosol Conference contact to Mr. Jacob (CAFE)	DE	22-23/Feb/05;	Air Quality Experts of federal and national authorities; CAFE	Ministry of Environment Saxony; LfUG (Gerwig)
<b>oral presentations:</b> 1 hour during a professional training: "UFIPOLNET – ein transnationales EU-Projekt"	DE	31/Jan/06;	10 co-workers at Saxon authorities;	LfUG (Gerwig)
VDI AG Partikelmessungen	DE	14-15/Feb/06	Members of VDI AG	LfUG (Gerwig)
Workshop Immissionsschutz	DE	10/Nov/06	10 co-workers at Saxon ministry for Environment	LfUG (Gerwig)
EU-Projekt misst Ultrafeinstaubpartikel an Verkehrsschwerpunkt in Dresden (1,5 h incl. discussion)	DE	29/Nov/06	Kolloquium Inst. f. Verkehrsplanung und Straßenverkehr	LfUG (Gerwig)
Werkstatt Ultrafeinstaub	DE	5/Mar/07	30 scientists from UBA and other nations (CH, AU)	LfUG (Gerwig), IFT
Abteilungsleiterkonferenz, LfUG	DE	8/May/07	head of departments and co-workers (15)	LfUG (Gerwig)



## 9 EVALUATION AND CONCLUSIONS

### Project implementation

The **process** of Task Management and Dissemination were completed. Task 2 needed more time, than expected (10 months), therefore Task 3 implementation was shortened and Task 4 measurements started 12 months later than expected. Consequently a 4 month project extension was needed to measure during a one year period as stated in the proposal. Task 5 evaluation started earlier than planned to aid Task 2 designing. There was an added value when the user perspective influenced the planning of building the new instrument as well as during the deciding process, that a standardized sampling system was needed, which was not planned in the proposal.

The **problems encountered** where of technical reasons and were all solved. There were problems with hard and software. The **partnerships** show good developments regarding dissemination activities as well as the cooperation in technical questions between assembly and user team. This project unites six partners from three countries. They include experts on air quality from universities, authorities and companies. Almost all partners were able to attend every time all of the annual meetings.

The **technical application** looks good and the aim of the task to develop and to test an instrument in routine measuring networks will be fulfilled. The results of different instruments are similarly reproducible. The limiting factors for the application at places with less number of particles in a city background (Augsburg) will be evaluated.

The **commercial application** in terms of economic feasibility shows potential. The UFP 330 was presented on the European Aerosol Conference Sep-2007 and final UFIPOLNET conference Oct-2007 to aerosol scientists and people from administrations. A couple of interested persons asked for more information when the instrument will be available. The publications at the European Aerosol Conference will help to underline the good quality of the UFP 330 with respect to data quality at a reasonable price.

**Comparison against the project-objectives:** The objective of the project to use a measuring instrument with the following characteristics to determine the particle count and size distribution has been met: > Affordable price and easy integration into routine monitoring systems > Using neither chemicals (butanol) nor radioactivity > Measuring six particle size categories (K1 – K6) > 20 | > 30 | > 50 | > 70 | > 100 | > 200nm. The project-objectives were almost all reached or evenly balanced in such areas as dissemination activities. The exceptions from this are: The range of particle sizes to be measured had to be reduced from minimum limit 12 to 20 nm. The upper limit of 500 nm will be met. The objective to measure during one year has been met due to extension time of 4 months at all 4 stations. Additional measurement activities are scheduled for a subsequent period of five years as promised in the proposal. The results have been made available to interested parties such as CAFÉ-members and VDI (the Association of German Engineers).

**Effectiveness of dissemination activities:** Potential target groups were contacted personally and by newsletter, webpage or printed media in case of conference announcements. The VDI will publish as VDI 3867 Blatt 3 (Mobilitätsspektrometer) UFP 330 as an example. Members of the CAFÉ working group were met at different conferences and held a lecture at the final conference in October 2007. Other interested groups like health experts were contacted by 19 newsletters and are invited to the final conference. The "Recommendation to Expert groups" was send to the newsletter distribution list (900). The Layman report (5000 copies) has been sent for example to members of parliament of Saxony, Germany and Europe besides air quality interested people all over Europe (> 1000 addresses).

**Continuation of the project:** All 4 user team partner will continue to measure with UFP 330 for five years after end of the project (31-Mar-2013). This was fixed in partner contracts and also between TOPAS and user partners. TSI will support the user team in the first year with necessary consumables and TOPAS give technical help. It is planed to publish two peer-reviewed scientific papers in 2008 dealing with technical descriptions and results of comparison measurements respectively also



about one year measurements at 4 places in comparison with other air quality parameters like NO<sub>x</sub> and PM<sub>10</sub>. Some of the partners want to extend the places where UFP are measured and will improve the data quality with an instrument, which delivers particle number and size standard.

### **Analysis of long-term benefits**

**Environmental benefits** like **direct quantitative environmental benefits** will be no volatile organic compounds (butanol) or radioactive source compared to common particle size classifier. Therefore no waste of organic compounds or radioactive waste will result from using this instrument. The instrument will bring the possibility to monitor ultrafine particles in routine measuring networks with only basic understanding of the subject by the persons working with it. There is a positive presumption, that some routine measurement networks and health experts will buy the UFP 330. Therefore ultrafine particles will be monitored on a routine basis in much more places in Europe than nowadays with the help of a reliable and cost effective technique. Another advantage will be **energy savings** compared to similar instruments which needs more electricity.

### **Relevance for environmental policy areas:**

To measure number concentrations of particulate matter at different locations over a longer period will be one way of showing the reduction of number concentrations of particulates in European cities according to new directives aiming to reduce particulate matter. This can prove the effect of the TSAP (Thematic Strategy on Air Pollution, Sep-2005) on the particles, which have a negative health effect. The EU-project UFIPOLNET aims to show, that measurements of number of particulates in ambient air with a routine measuring container can be easy, cheap and reliable to fulfil the possible new limit value for different particle number concentrations in a new EU-directive. A revision of the AIR QUALITY FRAMEWORK DIRECTIVE (96/62/EC) is planned for 2013 by the European Commission. It will be discussed if PM<sub>10</sub> limits will be changed to other metrics, like PM<sub>2.5</sub> or PM<sub>1</sub> or perhaps numbers of ultrafine particles. There will be limit values for measuring ultrafine particles in the exhaust of cars in EU-directives (EU regulation 715/2007 (20.6.2007) about Euro 5 and 6). Therefore a need to monitor the effects of these regulations in ambient air is needed.

### **Long-term sustainability:**

**Qualitative environmental benefits:** In particular, the social and economic costs resulting from exposure to concentrations of ultrafine particles can only be estimated with great difficulty as reliable data are missing. One might consider if measurement stations in Europe's routine monitoring systems could measure size distribution of the ultrafine particles in the future by using the instrument developed in this project. Measurements from many areas can be compared with one another over many years to understand the long-term trends. It would then be possible to verify the improved air quality, for example, through the introduction of particle filters.

**Qualitative economic benefits:** A cost-benefit analysis of a potential user of the new instrument shows, that a user friendly and adequately tested device for measuring network container will be more reasonable than only comparable devices with a couple of disadvantages.

**Qualitative social benefits:** As the instrument is to be produced in small series starting in 2008, one can assume that this will also create new jobs.

### **Replicability, demonstration, transferability, cooperation:**

**Transferability & Potential for Commercialisation:** The price is comparable to a PM<sub>2.5</sub> sampler used generally in routine monitoring networks and cheaper than other similar instruments. There are possibly a couple of thousand routine air measuring stations in Europe which could use this instrument, but it is not yet known how many other applications beside high traffic roads are possible. There are also potentials to measure at other environments, like in traffic tunnels, perhaps at working places with high loads of natural or anthropogenic particles. The limiting factor will probably be caused by lower particle numbers below 1000 cm<sup>-3</sup>. The monitoring of the size distributions of high number of particles in environments equal or less humid as in ambient air will be possible as well.

Benefit for users are very low barriers to use the new instruments, because no handling authorisation



for radioactive parts is needed, high availability (>90%), instrument checking interval about 14 days or longer, low price for consumables, no need of scientific knowledge about the instrument, solutions for interfaces to routine measuring container / networks. There will be also no unwanted (stinking) butanol vapour in the measuring container and the breathing air of the user as well as no possible danger from nuclear radiation.

The results of the measurements at the 4 stations are applicable to a lot of other European measuring places from northern Europe to middle Europe.

**Specific target group information:** The dissemination activities showed the impact on relevant groups. Leaflets in all languages of partners are available; therefore every one of partner organisation is able to present the project at internal and external meetings. A couple of presentation have and will reach important groups and possible future users. The general public was already reached by press and TV-, radio-broadcastings in Saxony and Sweden. Every press release had a good impact, mostly in a local to regional area, and also in Sweden on a national level. Because of the invitations and announcement for the final conference, the professional interested groups have been reached in a broad way. The webpage gives information to the general public as well as to the scientists or practical users or authorities. The monitoring of the page hits showed the impact of newsletter, conference presentations and press activities.

The project has an **innovative aspect** on international **level**, because the instrument is one of the first to be put easily into a routine measuring container including proven connections to the peripherals up to the central database at the 4 measuring places. For the first time a standardised inlet / sampling system was considered from an instrument developer of ultrafine particles to be very important. This is the base for comparable results at all places measuring with similar instruments. This idea was also brought into the VDI boards producing VDI-guidelines (3867).



## 10 AFTER-LIFE COMMUNICATION PLAN

In short the Plan to continue disseminating and communicating:

- Setup of a short and **stand alone After Life Communication Plan** (up to 4 pages) including project objectives, methodology and results as well as communication strategy including main target groups as well as future additional dissemination activities (see LIFE-website for a form).
- The "**recommendations for the expert groups**" about measuring ultrafine particles has been send around by email to 900 addresses of the UFIPOLNETnews distribution list. This will underline the importance of measurements of ultrafine particles in Europe.  
-> External support with disseminating this via **LIFE-website or Newsletter of the EU-COM** would be helpful. Reason: A remark about UFIPOLNET + website address in the newsletter ENV Alert of Science for Environment Policy showed a strong effect on the number of hits on the webpage, which were tripled compared in March to two months before. Therefore a remark in a newsletter from LIFE might be helpful too.)
- **Two scientific articles** in peer review periodicals will distribute the results of UFIPOLNET worldwide to the scientific community of aerosol and applied scientists. Lead author will be L. Hillemann/UBG, B. Wehner/IfT until Jun/08 for "Concept: Charging; Inversion, Intercomparison between different UFP 330" and J. Cyrus/GSF for "background city, street canyons, city, above street tunnel - comparison with other air pollutants" until end of 2008.
- **Two posters** will be **presented at EAC 2008** in Thessaloniki/GR with about 800 scientists from Europe and the world. Lead author of abstracts are L. Hillemann/UBG and B. Wehner/IfT.
- The **Layman report will be reprinted** unchanged. This will support the knowledge the reasons and methods to measure ultrafine particles. It will be distributed worldwide.
- **VDI-Guideline work** will continue by LfUG and TOPAS. In **VDI 3867 part 3** UFIPOLNET and the developed UFP 330 will be mentioned. This guideline is at the moment in draft modus. Also the needs for routine measuring networks will be put into the VDI 3867 parts 1-6 where appropriate.  
-> It would be helpful to **support guideline work** also on the international level, like in **CEN or ISO**.
- **Further presentations** about UFIPOLNET results will be planned later  
-> If **EU-COM** plans sessions of **working groups** or **conferences/meeting/congress** concerning air quality in cities it might be a good idea to invite project partner of UFIPOLNET to present there data and there results concerning ultrafine particles.
- **5 years Measurements** at all 4 stations are planed. This will lead to a database of ultrafine particles measurements. These data can be used for new projects in the field of environmental analytics and also for effect studies together with epidemiologists.  
-> To support research in this field it would be helpful to put needs of ultrafine particles measurements in the next calls of the 7th FWP.
- **Comparison measurements** in Jan 2009 at IfT of all UFP 330. This would be a the third comparison in a yearly  
-> Extra costs, like travel costs and personnel costs are needed for IfT and 4 user group member: CHMU, ITM, GSF and LfUG.
- **Additional instruments** of UFP 330 successor will be bought in 2008 from LfUG.





## 11 APPENDICES

This is a list of all deliverables mentioned in the proposal (D) and extra material (E), attached to this final report. Some deliverables are only complete on DVD-ROM (C).

### T1 Management

- List of deliverables (D)
- List of partner's data: Contact persons (E)

### T2 Design

- Users manual (48 p) (D)
- Test report of the first prototypes (D)

### T3 Implementation

- Technician training Jan 2008 (3 p) (D)

### T4 Measurements

- Report with the presentation of the data (D)
- Database of all 4 measuring stations March 07 - Feb 08 (C)
- Report with improvements of the device and the methods (D)

### T5 Evaluation

- Evaluation report (16 p) (D)
- Report on evaluation procedures incl. user friendliness (D)
- "Qualitätssicherung und Datenvalidierung für UFP 330" for Dresden (7 p) (E)

### T6 Dissemination:

- Recommendations to Expert Groups (D)
- Dissemination list (D)

#### Dissemination examples:

- UFIPOLNETnews No. 18 (3p) (D)
- Press release 7-2-2007 in Dresden (D) and press echo for photo-date at the measuring container: Invitation, Photos (C), TV-spot (C), press articles (C), radio-broadcasts (C)
- A novel device to quantify ultrafine particles in urban environment (D)
- European Aerosol Conference (EAC): poster abstracts: 4 in 2007, 2 in 2008; 2 poster prints (2007); 2 oral presentations (2007) (D)
- Messtechnisches Kolloquium 2007: Abstract of oral presentation (D)
- Article in UMID 2/2007) (3 p) (D)
- Report in Materialien zur Luftreinhaltung in Sachsen (3 p) (D)
- Photodocumentation: Ultrafine Particles in Urban Air Conference, Dresden 23 to 24-Oct-2007 (8 p); Evaluation of participants (2 p) (E)
- Articles about conference: Gefahrstoffe Reinhaltung der Luft (3/2008) (1/4 p); Mitt. Umweltchem. Ökotox., 14, (1/2008) (2 p) (E)
- Photodocumentation: "Bürgerinformationsveranstaltung" 22-Oct-2007 (3 p) (E)
- VDI 3867 Blatt 3 (Vorentwurf) (5 p) (E)





**Attachments:**

- DVD-ROM incl. final report and deliverables (E)
- **Layman Report** (Bürgerbericht / Citizens report) (24 p A4/3) (D)
- Abstractbook final conference (74 p A4) (D)
- Einladung/Invitation final conference (D)
- Postcard "Bürgerinformationsveranstaltung" (E)

## 12 LAYMAN REPORT

See appendices respectively is attached.



## 13 Imprint

### UFIPOLNET TECHNICAL FINLA REPORT 6/2008

*Cover picture:*

UFP 330 in Dresden, Schlesischer Platz. Jan 2007; Conference room at SAB Dresden during "Ultrafine particles in urban air" Oct - 2007  
Photos: L. Hillemann, H. Gerwig

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