European Network on New Sensing Technologies for Air Pollution Control and Environmental Sustainability - *EuNetAir*

COST Action TD1105

INTERNATIONAL WG1-WG4 MEETING on

New Sensing Technologies and Modelling for Air-Pollution Monitoring

Institute for Environment and Development - IDAD

Aveiro, Portugal, 14 - 15 October 2014

Action Start date: 01/07/2012 - Action End date: 30/06/2016 - Year 3: 2014-15 (*Ongoing Action*)

Parallel measurements of particulate matter and pollen in Berlin

Federal Environment Agency

Umwelt Bundesamt

Dr Hans-Guido Mücke

Function in the Action: Invited Expert and Advisor

Berlin, Germany

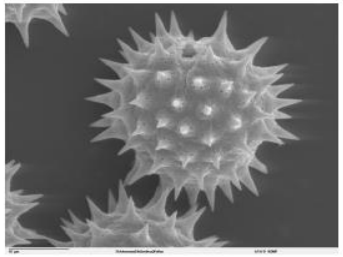
COST is supported by the EU Framework Programme

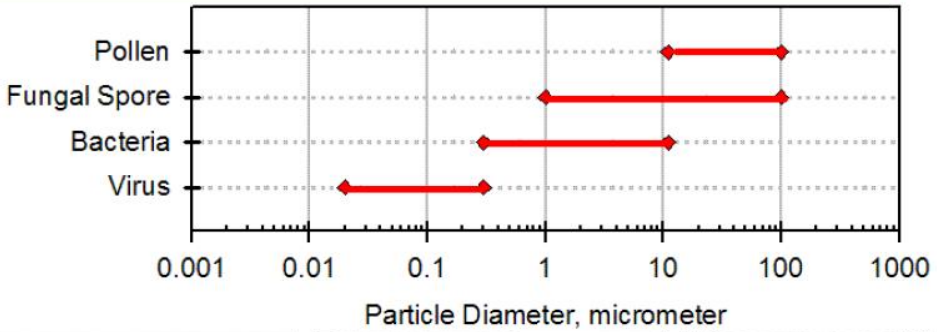
ESF provides the COST Office through a European Commission contract

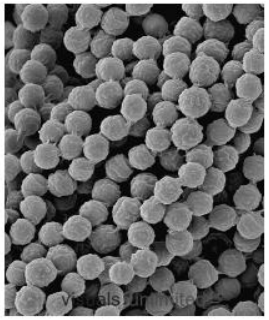
Primary Bioaerosols

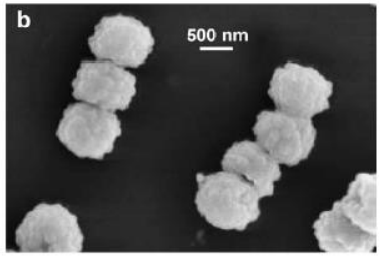
Bioaerosol Definition :

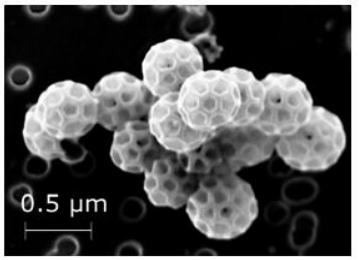
• Airborne solid particles (dead or alive) that are or were derived from living organisms, including microorganisms and fragments of any living thing

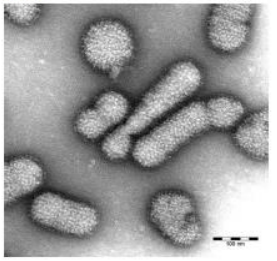












Life-time prevalence hay-fever
German adult population between 18 – 79 years

Langen U. Bundesgesundheitsbl 2013;56:698-706

- Female 16.5 %
- Male 13.0 %
- Total 14.8 %

Epidemiology of allergic diseases in Germany

Percentage (within) of allergic diseases in Germany	
Pollen allergy	86%
Dog- ore cat allergy	41%
House dust mite allergy	38%
Fungal allergy	14%

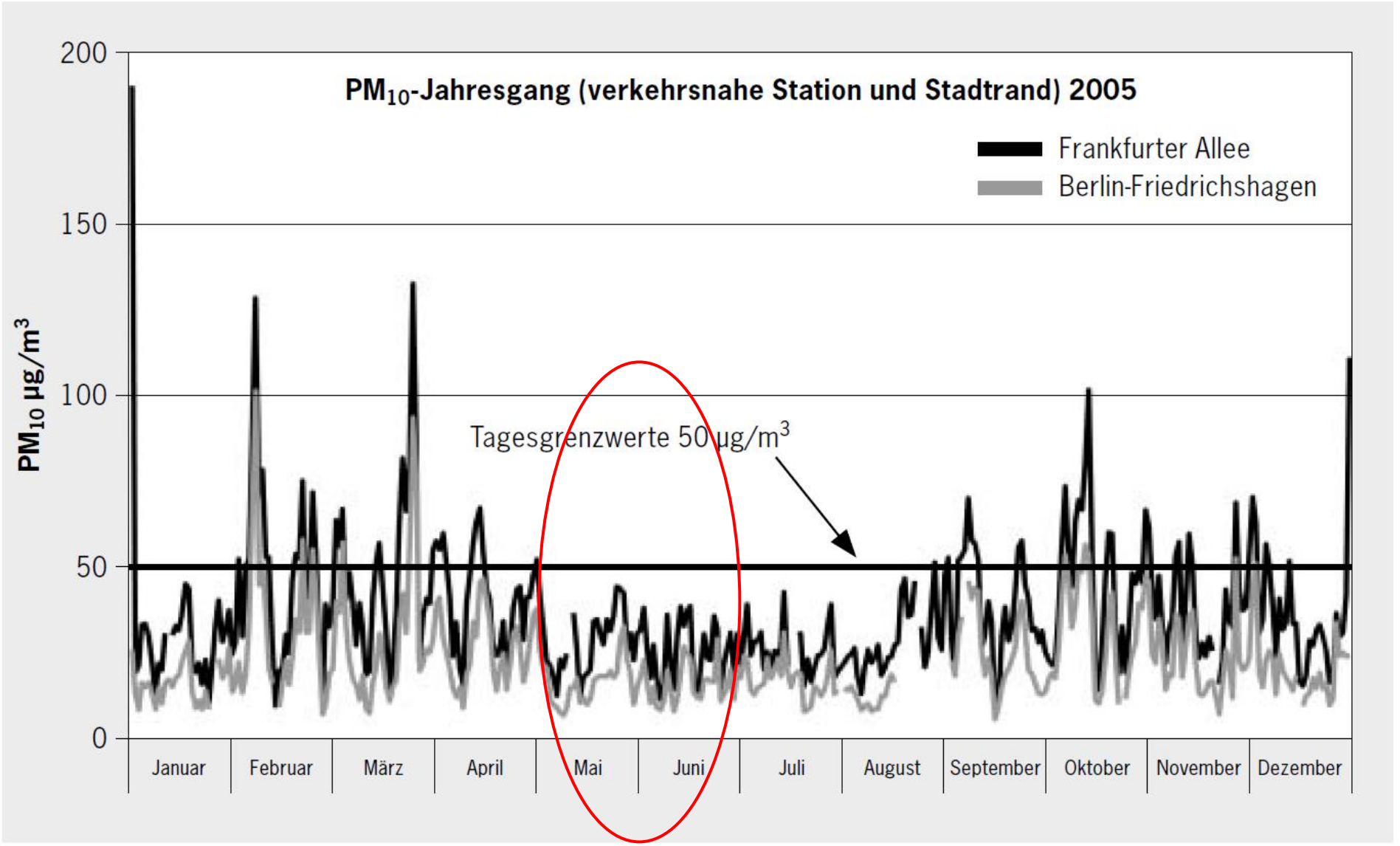
Scientific context

- Up to 20% of the European population is suffered by pollen allergies (e.g. allergic airway responses, rhinitis and/or asthma bronchiale)
- Climate change will lead to an earlier and longer pollen season, and more days with high pollen counts/burden
- Rare information on human exposure to pollen/bioaerosols and particulate matter in cities

Scientific objectives

- How is the distribution/variation of pollen concentration at different monitoring city sites (centre vs. sub-urban vs. traffic)?
- Because *(usually)* pollen quantities are higher in rural areas, are pollen counts relevant for human health in a ‚green' and big city like Berlin?
- Six weeks parallel $PM_{10/2.5}$ and pollen measurements during the high grass pollen season in May/June 2011 in Berlin

Background on PM



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Background on pollen

Gesamtdeutscher Pollenflugkalender

(nach Pollenflugdaten von 2000 bis 2007)

© Stiftung Deutscher
Polleninformationsdienst
Charitéplatz 1, 10117 Berlin

	Dez.	Jan.	Feb.	März	April	Mai	Juni	Juli	Aug.	Sept.	Okt.	Nov.
Hasel												
Erle												
Pappel												
Weide												
Esche												
Hainbuche												
Birke												
Buche												
Eiche												
Kiefer												
Gräser												
Spitzwegerich												
Roggen												
Brennessel												
Beifuß												
Traubenkraut												

Hauptblüte
Vor- und Nachblüte
mögliches Vorkommen

www.pollenstiftung.de

Dr Hans-Guido Mücke, UBA, Berlin

Project partner

Foundation German Pollen Information Service (PID)

- PID, University Medicine, Charité Berlin
- PID pollen monitoring at 45 sampling sites in GER (n=10 continuously); pollen forecasting in cooperation with the Weather Service / DWD
- Rare information on spatial pollen distribution (pollen counts) in urban areas/agglomerations

Dr Hans-Guido Mücke, UBA, Berlin

Measurement methods

- PM low volume sampler, Derenda glass fiber filter
- Burkard pollen trap (Hirst 1952)

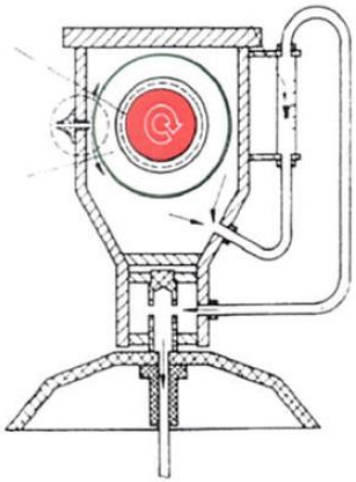


Abb. 1.: Schematische Darstellung einer Burkard-Pollenfalle

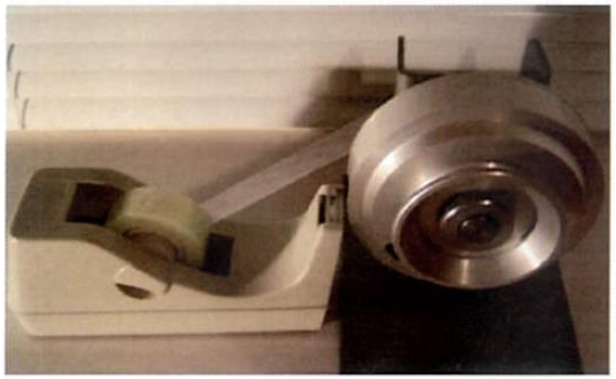
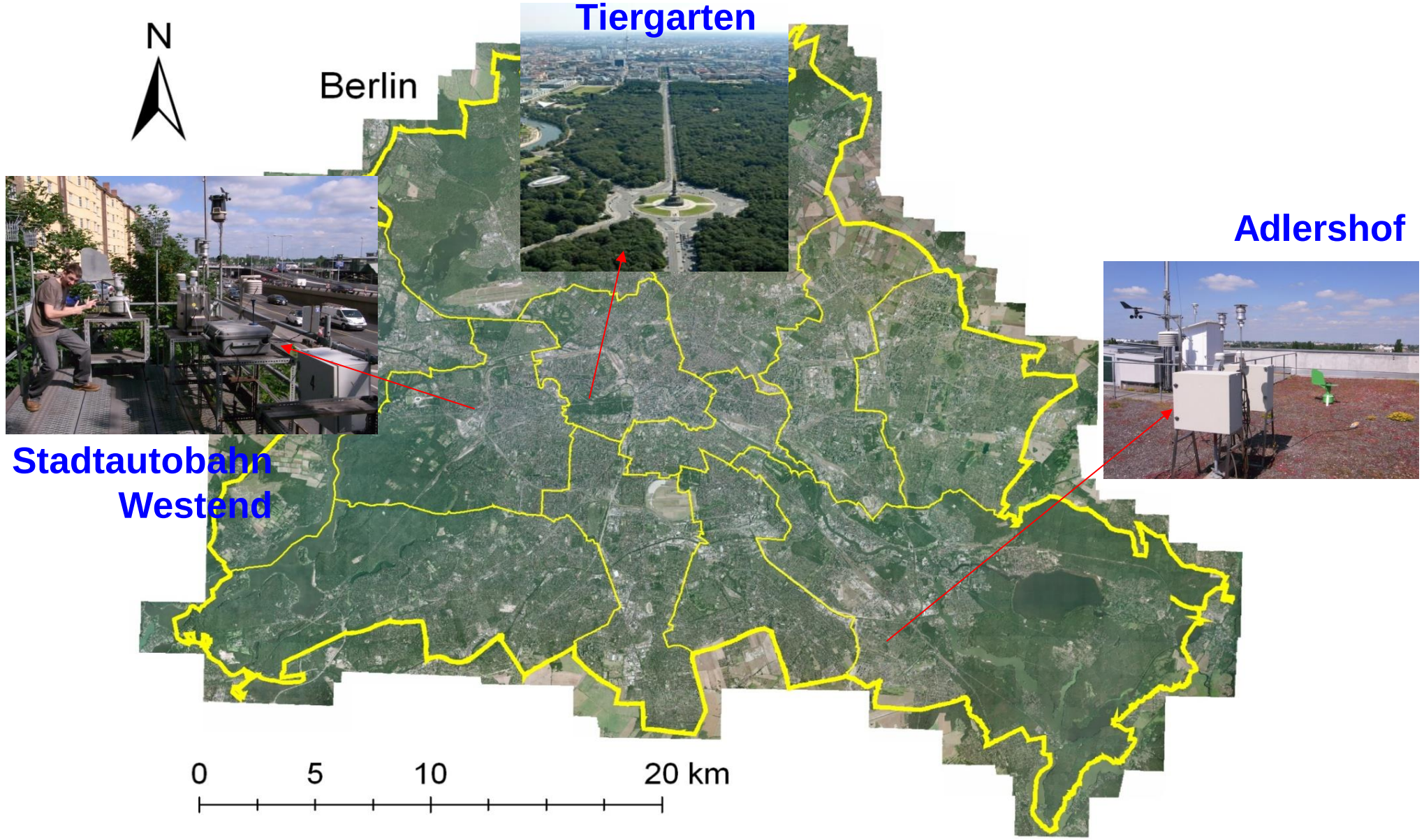


Abb. 2: Trommel beim Beschichten mit einer klebenden Folie.


N
Berlin
Tiergarten
Adlershof
Stadtautobahn
Westend
0
5
10
20 km

PM results (UBA)

- PM_{10} and *$PM_{2.5}$* gravimetrically determined (µg/m³); 12 May to 23 June 2011

		n	mean	st.dev.	min	max
Tiergarten **‚city centre'** 34.400 veh/24h	*$PM_{2.5}$*	*28*	*10.8*	*4.1*	*2.8*	*17.6*
	PM_{10}	28	18.9	6.6	8.5	34.4
Adlershof **‚sub-urban'** 4.400 veh/24h	*$PM_{2.5}$*	*39*	*9.5*	*3.9*	*3.9*	*19.8*
	PM_{10}	39	15.2	5.2	7.3	29.5
Stadtauto-bahn **‚traffic'** 152.200 veh/24h	PM_{10}	40	22.6	7.5	8.4	35.5

„BLUME" PM_{10} results (mean May/June): ‚city centre' 20.0 µg/m³
‚sub-urban' 15.0 µg/m³
‚traffic' 21.0 µg/m³

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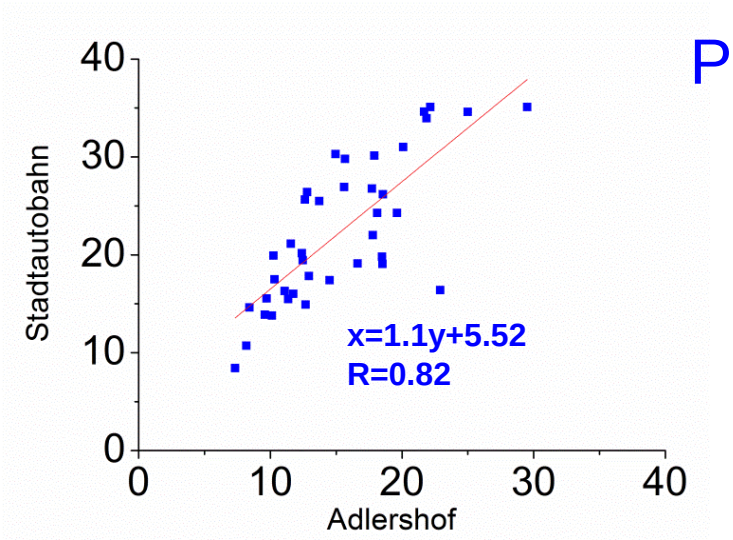
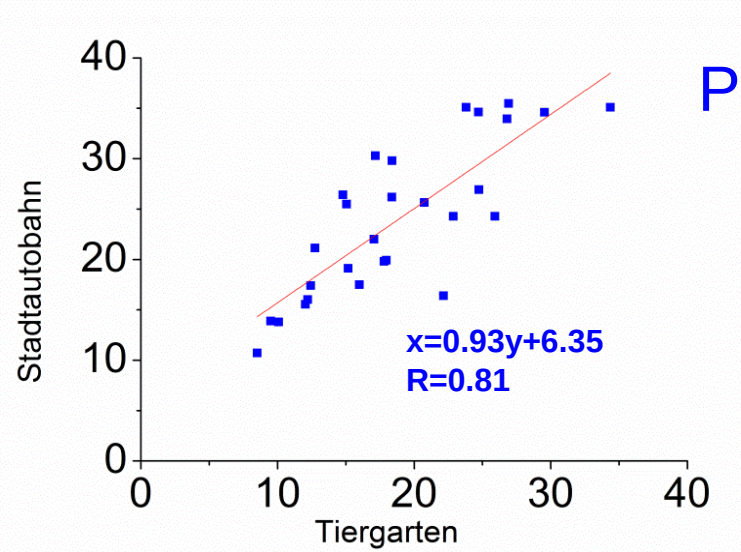
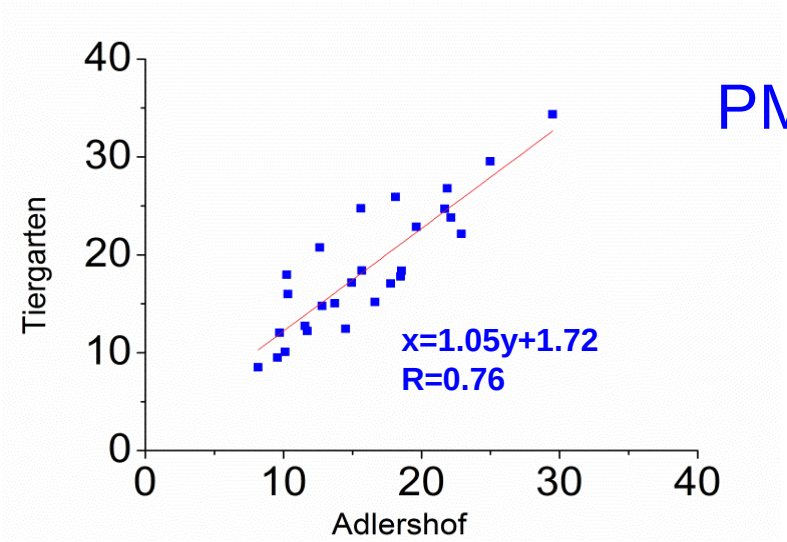
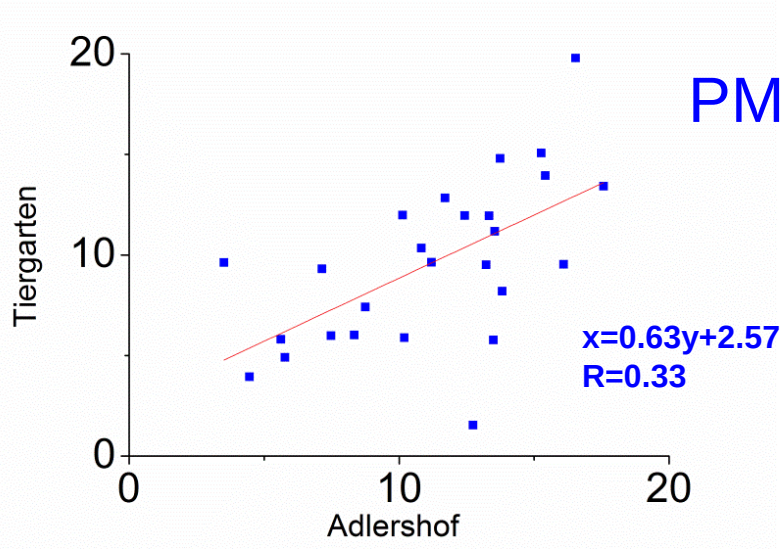
Site-related PM correlations (UBA)









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Pollen results (PID)

Pollen sampled and optically determined (*counts/m^3 air per 24h); 12 May to 23 June 2011

	pollen	n	mean	st.dev.	max
Tiergarten ‚city centre'	grass	43	7.9	7.9	33
	total	43	62.1	34.3	136
Adlershof ‚sub-urban'	grass	43	11.8	15.5	65
	total	43	55.8	41.6	185
Autobahn ‚traffic'	grass	43	17.2	18.2	83
	total	43	72.3	36.9	163

	N of days (43)	zero	weak (1-5*)	medium (6-30*)	strong (>30*)	max
Tiergarten ‚city centre'	grass	3	18	21	1	33
Adlershof ‚sub-urban'	grass	4	16	19	4	65
Autobahn ‚traffic'	grass	2	10	23	8	83

Ref: H.Behrendt et al. 2007

PM/pollen correlations

Modellzusammenfassung und Parameterschätzer

Abhängige Variable:GräserTier

	Modellzusammenfassung				
Gleichung	R-Quadrat	F	Freiheitsgrade 1	Freiheitsgrade 2	Sig.
Linear	.676	85.361	1	41	.000

Modellzusammenfassung und Parameterschätzer

$r = 0{,}822^{**}$

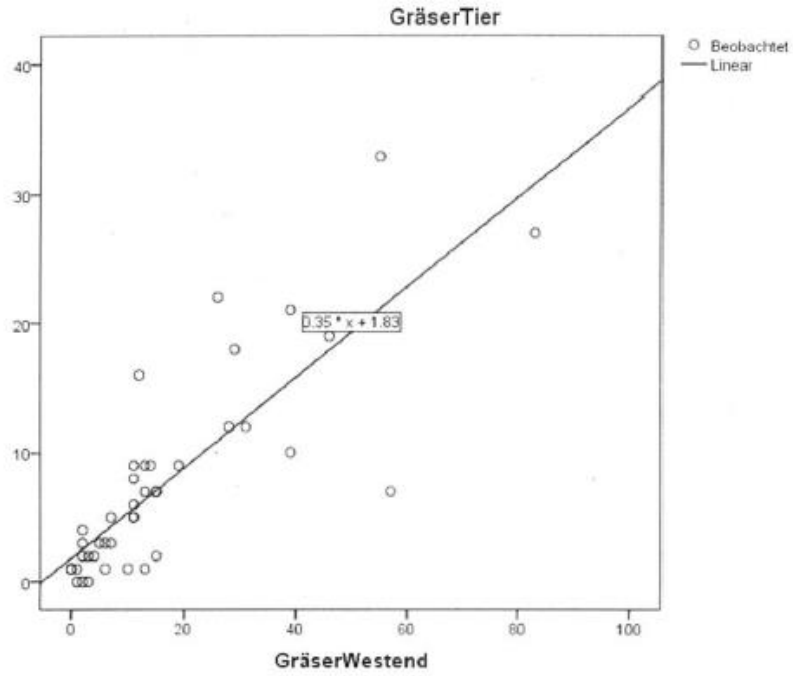
Abhängige Variable:GräserTier

	Parameterschätzer	
Gleichung	Konstante	b1
Linear	1.826	.354

Die unabhängige Variable ist GräserWestend.

r	PM10	grass pollen
Adlershof – Tiergarten	0.87	0.84
Tiergarten – Stadtautobahn	0.81	0.82
Adlershof – Stadtautobahn	0.77	0.81

Table 3. Pearson correlations coefficient for PM10 and grass pollen; (** $p < 0.01$)



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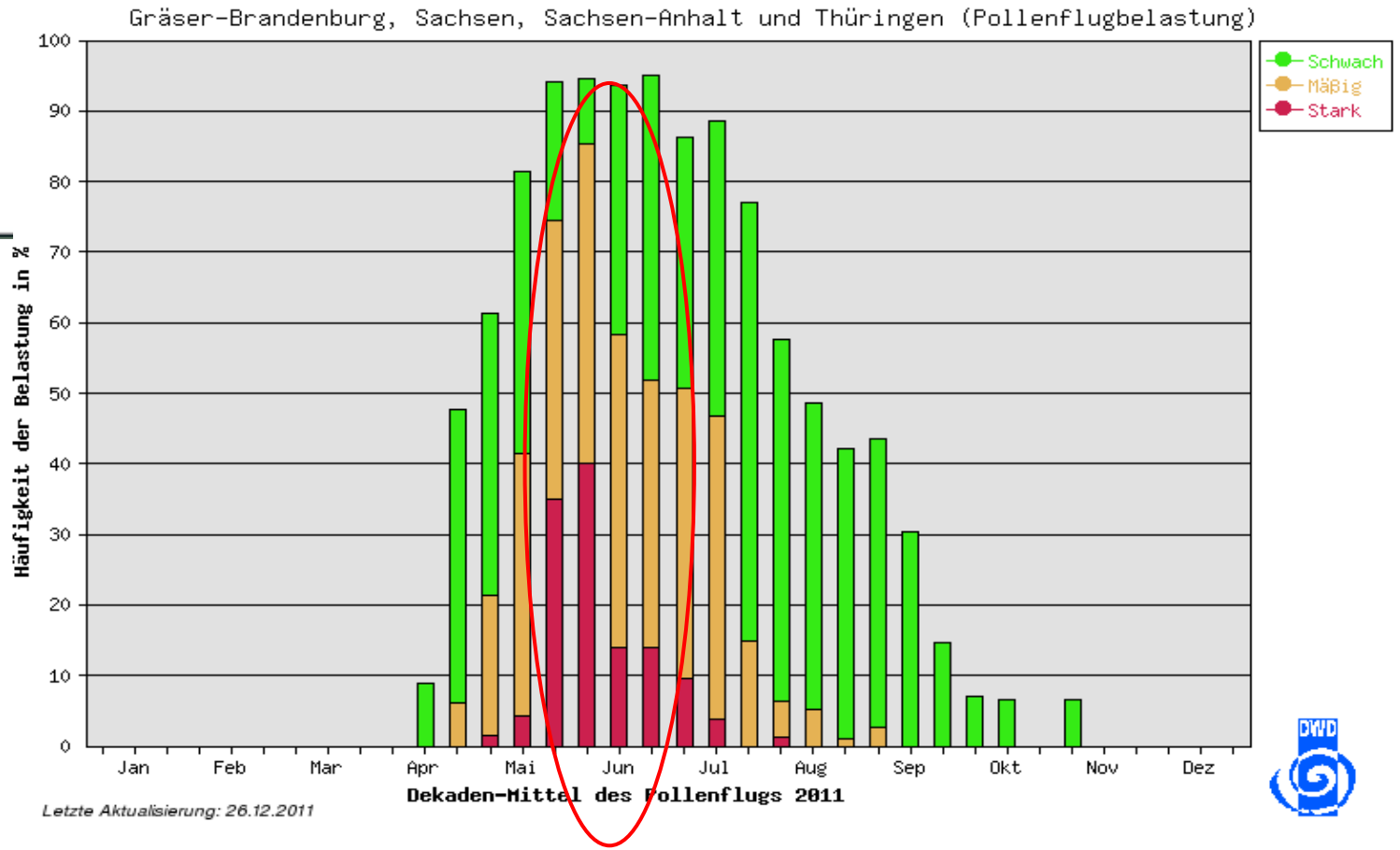
Pollenflight statistic 2011 (DWD)

Pollenflugstatistik

2011 | Berlin / Brandenburg / Sachsen / Thüringen / Sachsen-Anhalt | Gräser | **Anzeigen**



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Conclusions

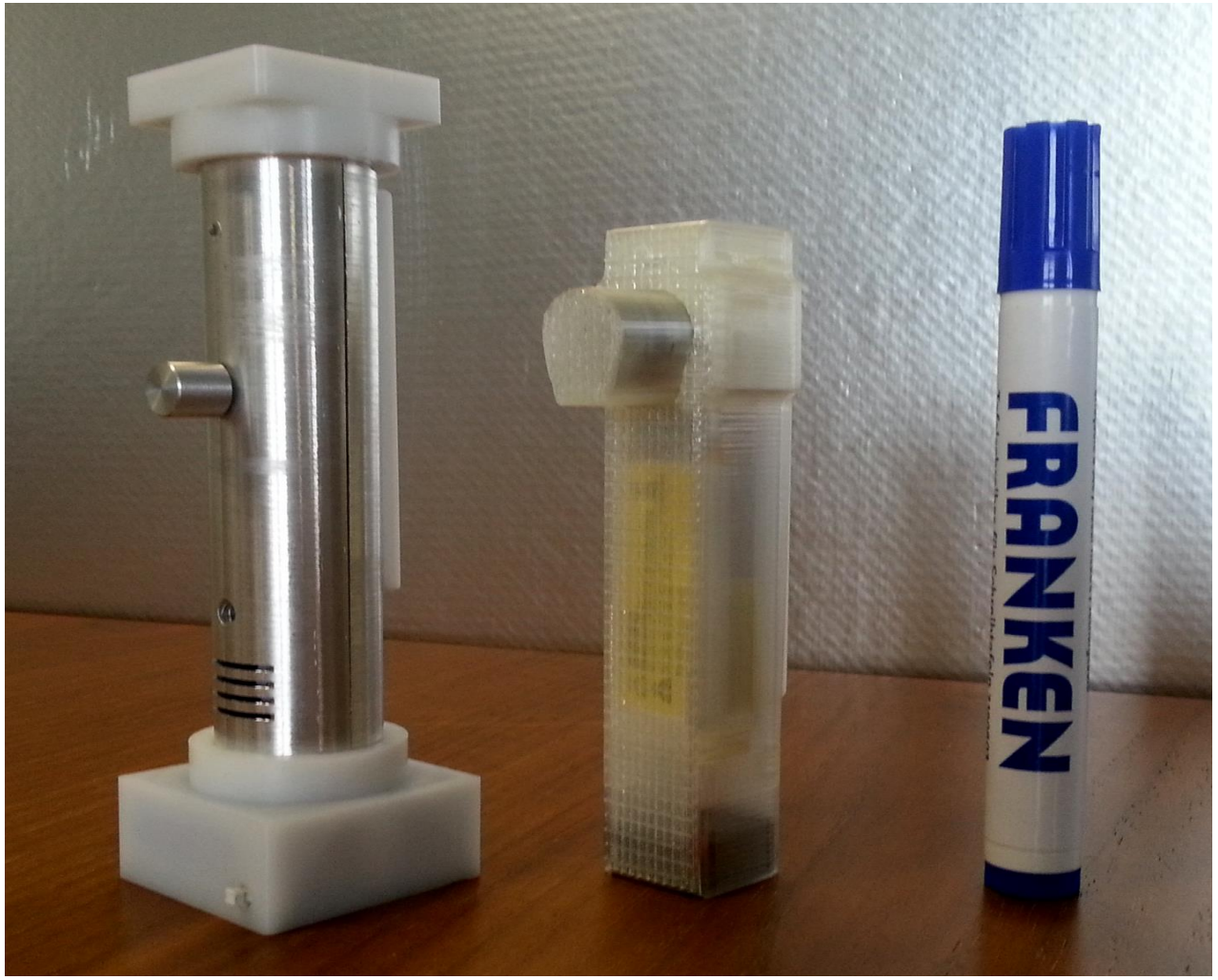
- Allergenic pollen exposure could be very high and health-relevant in an urban agglomeration, like Berlin
- Exposure relevant peak pollen concentration close to busy roads
- No evidence on PM-related fraction of pollen/primary bioaerosols yet
- Repetition/verification of 2011 pilot parallel PM and pollen measurements in 2013/14 (March to August at motorway site Berlin)

Future planned **Activities**

- ‚Pollator‘ for personal pollen exposure assessment (PID) (2014; left prototyp)

  Bluestone Technology

  funded by MoRT



Future planned Activities

optics – electronics – precision mechanics

we bring technologies together

hund WETZLAR

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Sie sind hier: Startseite

Technologies
- Electronics
- Optics
- Fiber Optics
- Precision Mechanics

Contract Manufacturing
- Solutions
- Materials Management
- Logistics
- After Sales Service
- Quality

Instruments
- Microscopes
- Dust-Measuring Equipment
- Pollen Monitor

Technical specification

Pollen taxa determined and counted by the BAA500:

Allergologically relevant	Allergologically not relevant
Hazel (Corylus)	Maple (Acer)
Alder (Alnus)	Beech (Fagus)
Birch (Betula)	Yew (Taxus)
Grass without Rye (Poaceae)	Oak (Quercus)
Mugwort (Artemisia)	Hornbeam (Carpinus)
Ragweed (Ambrosia)	Rye (Secale)
	Willow (Salix)

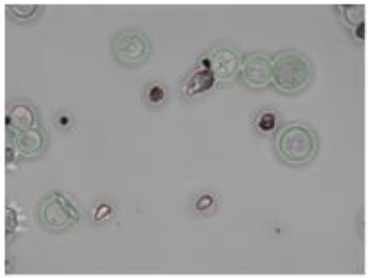
Pollenmonitor
- Technical specification
- Informations about Pollen Monitor

Videos
- Opening pollen monitoring control center
- Wirtschaftsstandort Lahn-Dill
- Company - Video
- Unternehmens-Video VoBa

Fairs, congresses and symposia
- Compamed 2014
- EMV-Labor in Betrieb genommen

Typical microscopic image:

classified pollen (green) and dirt particles (red)



Dimensions:

(L x W x H):

900 mm x

700 mm x

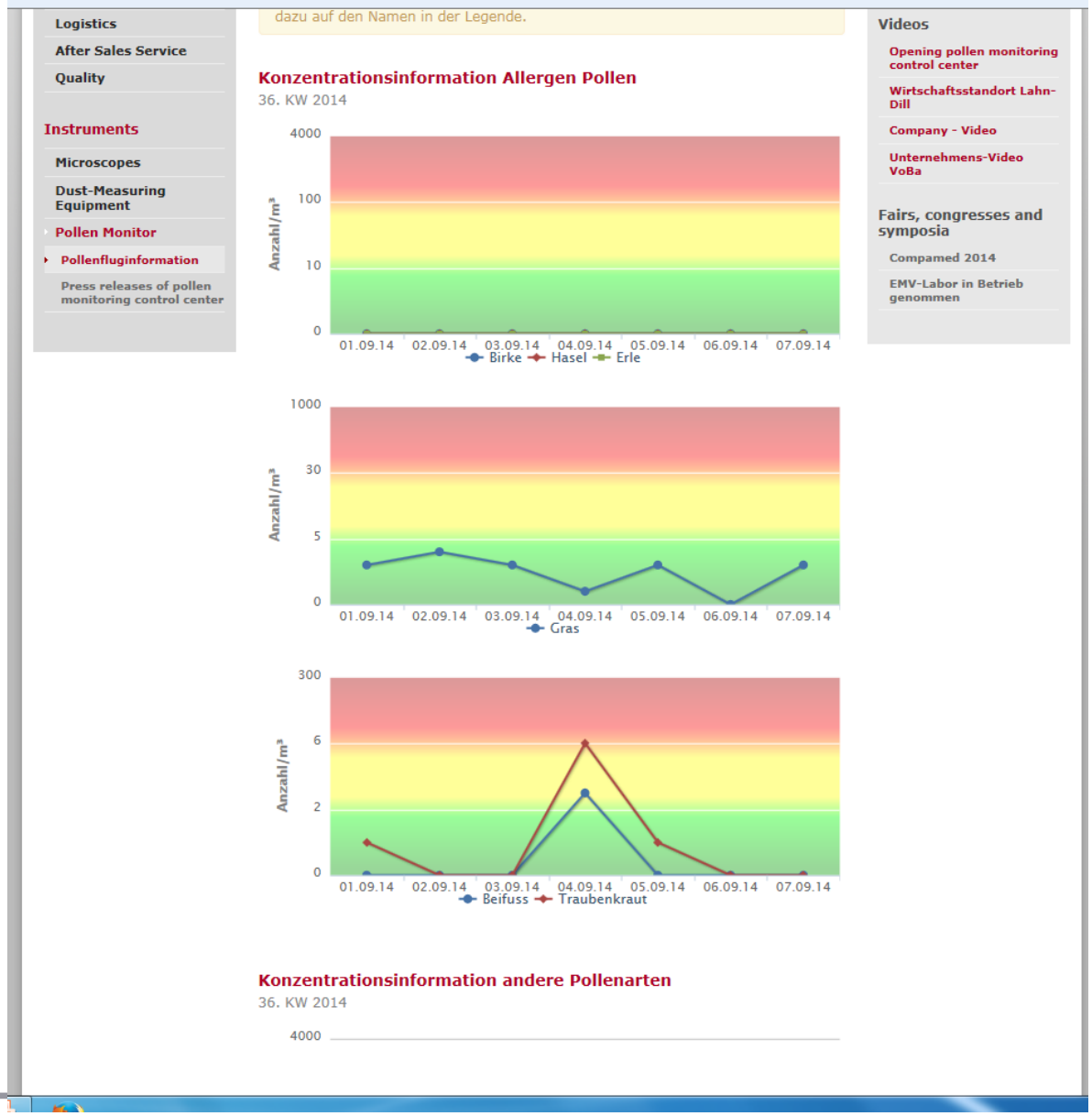
1800 mm

Power consumption:

3.7 kW (max.) at 230 V AC

cost EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

Future planned **Activities**



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Acknowledgement

- Sandra Wagener
  Umweltbundesamt (UBA) - Federal Environment Agency, Berlin

- Matthias Werchan and Karl-Christian Bergmann
  National Foundation Pollen Information Service (PID)
  and
  Allergy-Centre-Charité, University Medicine, Berlin

Thank you

Persönlicher Pollensammler “Pollator”
Entwicklung: Bluestone Technology GmbH in Kooperation mit Stiftung Deutscher Polleninformationsdienst. Gefördert vom BMFT.

- Saugleistung 10 L/min
- Erfassung der Pollen von 2 Stunden bis zu 7 Tagen durch Veränderung der Laufschnelligkeit
- GPS (zur Erkennung und Dokumentation, wann der Nutzer in Innenräumen oder draußen war)
- Auswertung zentral per Mikroskop; durch eingebauten Scanner in nächstem Update.
- USB-Eingang (auch zur Batterieladung)
- Erfassung und Speicherung von Temperatur
- Erfassung und Speicherung von Feuchtigkeit
- 9 cm hoch, ca. 100 g