NCCR Trade Regulation
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Counting Nano-particles

Peter Gehr
Prof. em.
University of Bern
Institute of Anatomy
Bern
Switzerland

Realistic *in vitro* dose levels

- **Suspension cultures**

  Dose responses

  < 100µg/mL

  Krug and Wick et al. Angew Chem Int Ed 2011

- **Ambient urban exposure** and **occupational exposure**

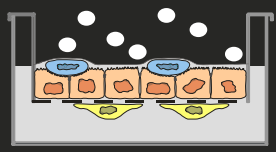
  5 mg/m^3 (maximum level allowed by Occupational Safety and Health Administration (OSHA))

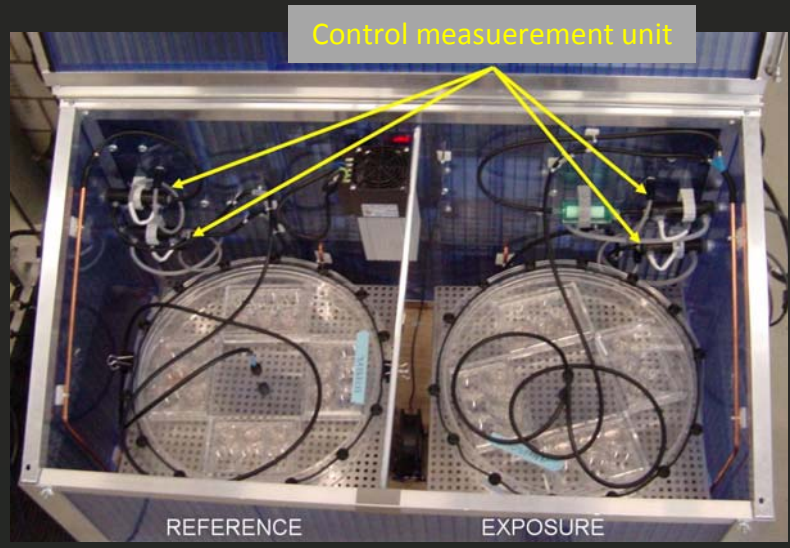
  $3x10^{-5}$-$5x10^{-3}$ µg per h per cm^2 of internal lung tissue surface

  2-300 particles per h per (epithelial) cells

  Paur et al. J Aerosol Sci, 2011 in press

Exposure of cells to DEP (Diesel exhaust particles) at the air-liquid interface

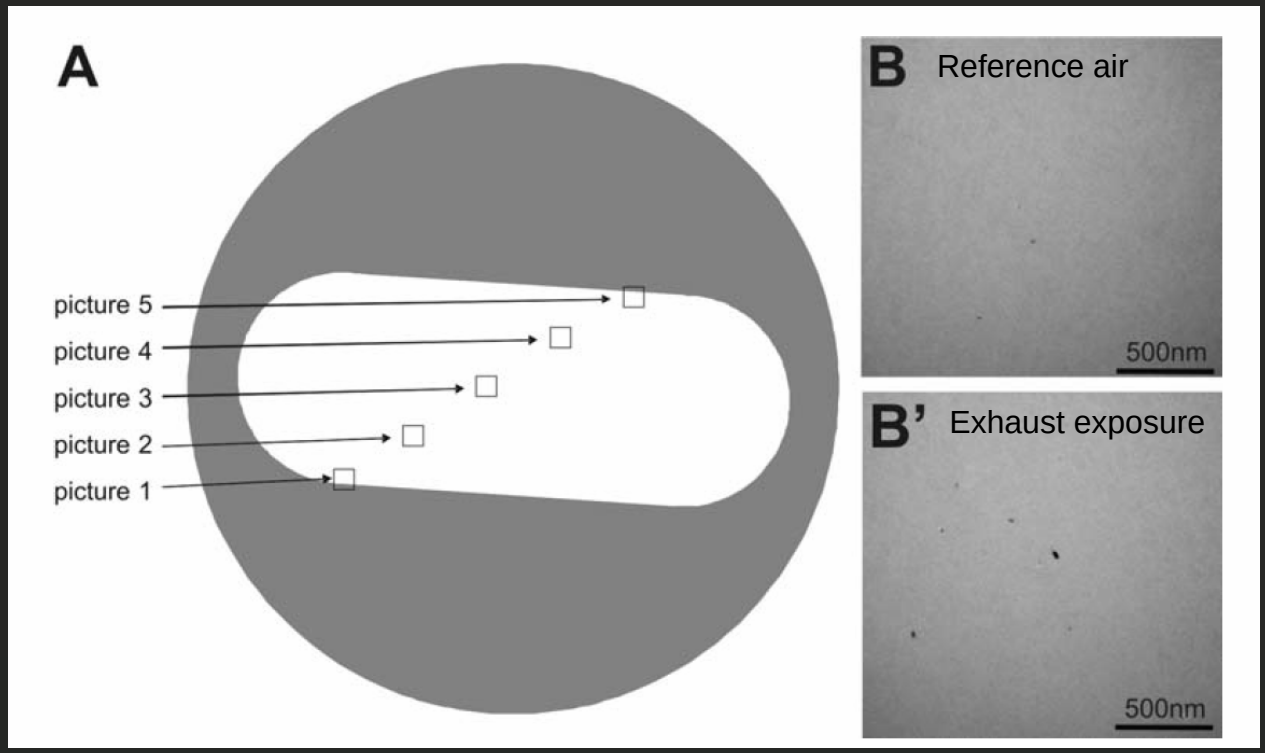




Müller et al. Environ Sci Technol 2009

Collaborators: Prof. Dr. Jan Czerwinski & Pierre Comte, Laboratory for Exhaust Emission Control, Bern University of Applied Sciences, Biel; **Dr. Markus Kasper**, Matter Engineering AG, Wohlen; **Dr. h.c. Andreas C.R. Mayer**, Technik Thermische Maschinen (TTM), Niederrohrdorf; **Prof. Dr. Heinz Burtscher & Peter Steigmeier**, Institute of Aerosol and Sensor Technology, University of Applied Sciences Northwestern Switzerland, Windisch; **Prof. Dr. Jean-Paul Morin**, INSERM, Université de Rouen, France; **Prof. Dr. Athanasios Konstandopoulos**, APTL, CPERI/CERTH & Aristotle University, Thessaloniki, Greece

Systematic sampling scheme

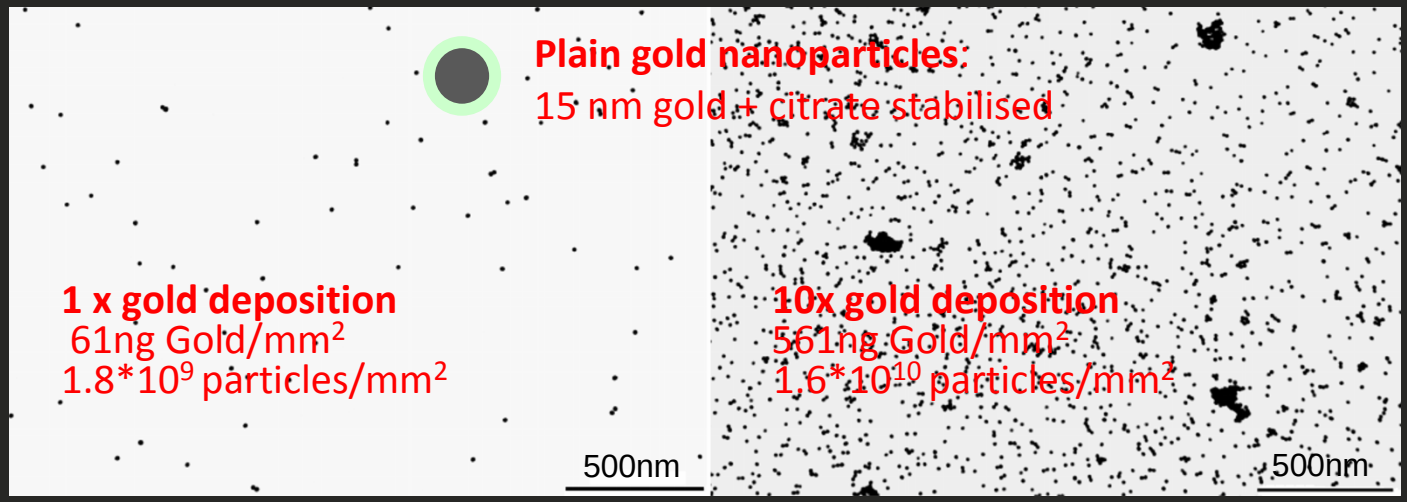


Low dose:
1.7×10^7 particles/cm^2
=> 134 particles/cell

High dose:
7.48×10^7 particles/cm^2
=> 587 particles/cell

Müller et al. Env Sci Technol, 2010; Müller et al. Tox Env Chem 2011, in press

Deposition/counting of gold nano-particles



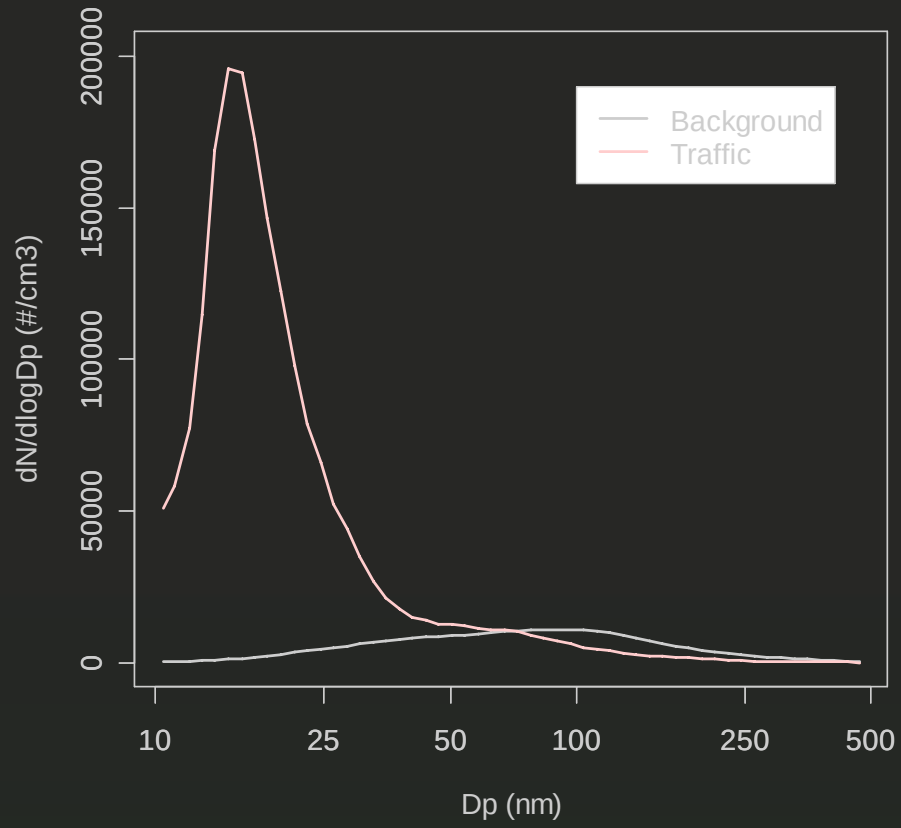
Brandenberger et al. SMALL 2010

- Shape: determine (spherical)
- Size: determine (diameter er volume)
- Number, number/size (size classes)
- Mean size (volume/number, i.e. diameter/number)
- Variation

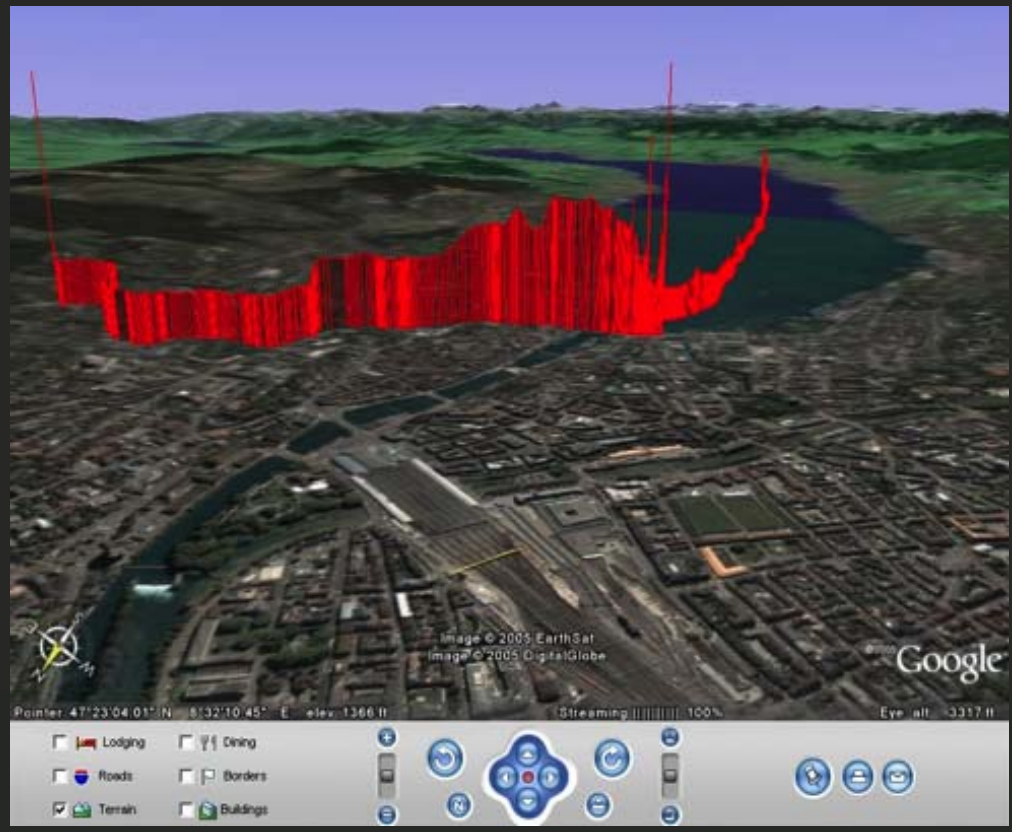
$$CV_N(V) = \sqrt{\frac{\hat{\bar{v}}_V}{\hat{\bar{v}}_N} - 1}$$

Typical variation of particle size in Härkingen

Measurement station

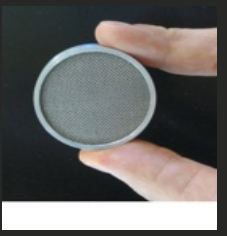


Portable Nanoparticle-Counter: A Sunday Afternoon Walk through Zurich



M. Kasper, Matter Aerosol AG
a testo company, Wohlen

DiSC – Priciple of measurement



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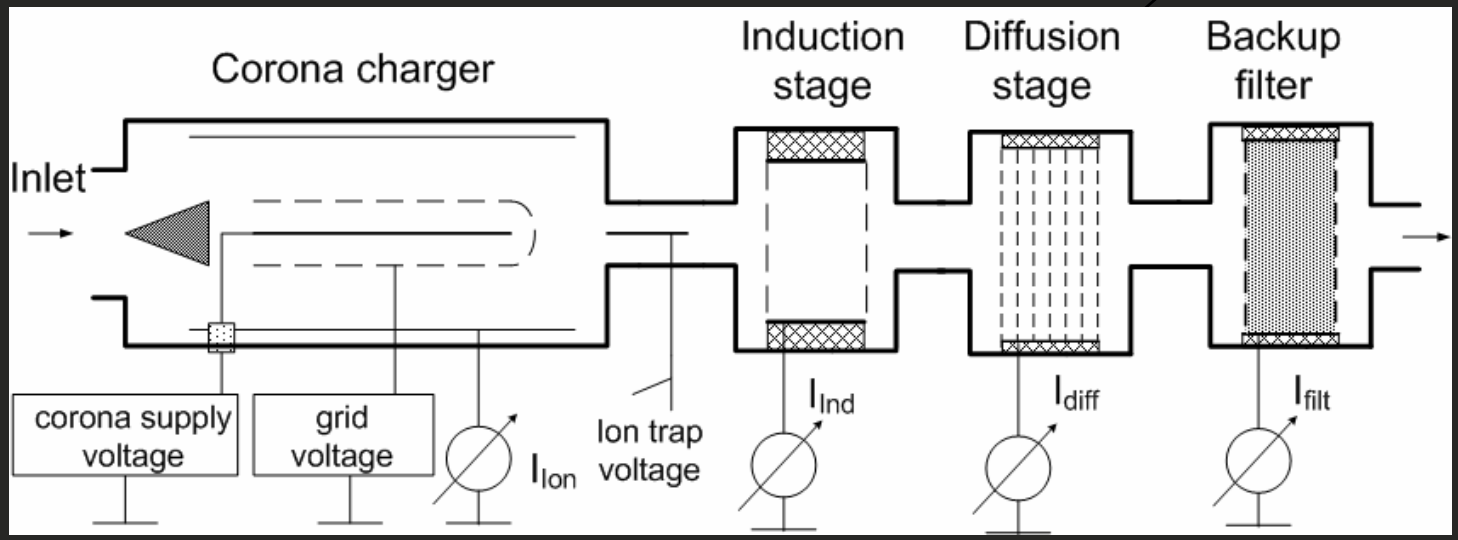


<u>Diffusions-Aufladung</u>

q K b^{-1} D^{-1}

<u>Diffusions-Abscheidung</u>

I_{diff} $D \cdot q \cdot N$

$q^{-1} \cdot q \cdot N$

N

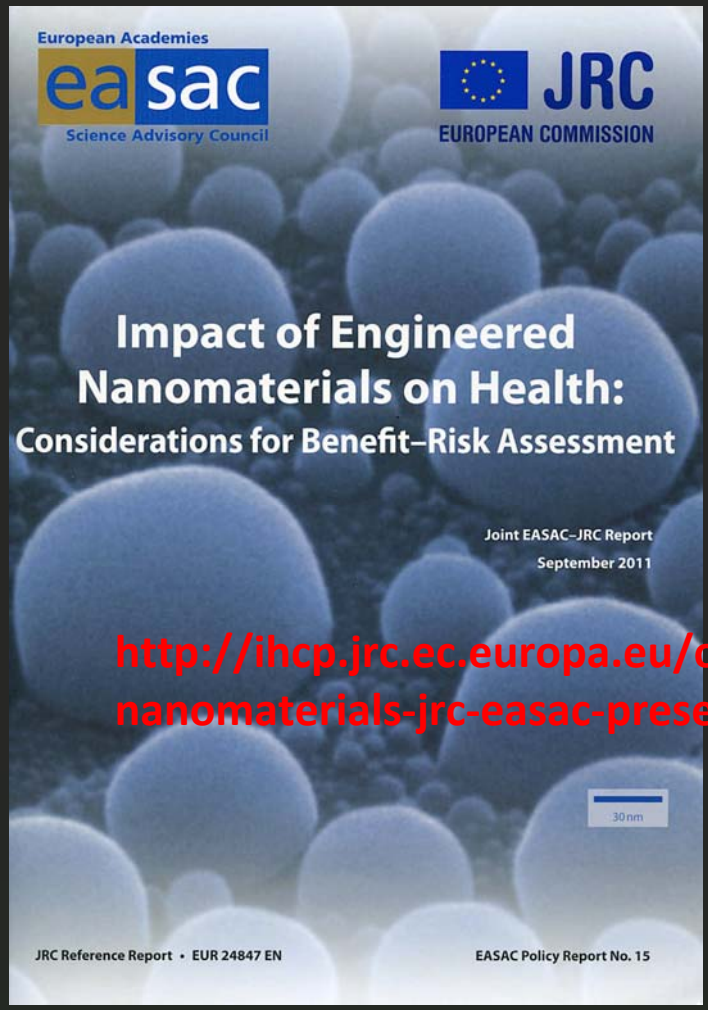
<u>Abscheidung im Filter</u>

I_{filter} / I_{diff} d

Diffusion charging combined with a sensitive aerosol electrometer:
size: 10-400 nm, conc.: 1'000-1'000'000 np/ cm^3, resol. time: 1 sec.

http://www.matter-aerosol.ch/index.php/products/discmini

Joint Research Centre and European Academies Science Advisory Council State-of –the-Art Report, October 2011



http://ihcp.jrc.ec.europa.eu/our_activities/nanotechnology/safety-of-nanomaterials-jrc-easac-present-state-of-the-art-report