

DE LA RECHERCHE À L'INDUSTRIE



DÉVELOPPEMENT D'UN COLLECTEUR SILENCIEUX ET PORTABLE POUR LA CAPTURE DE NANOPARTICULES

DEVELOPMENT OF A SILENT AND PORTABLE AIR SAMPLER SUITABLE FOR NANOPARTICLES

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Crédit photo: L. Godart

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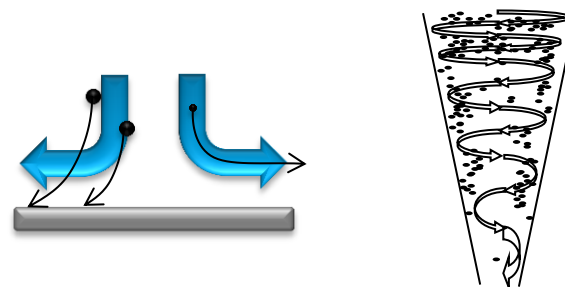
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SAMPLING TECHNOLOGIES

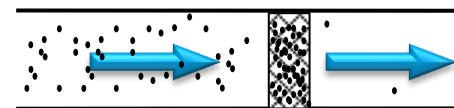
- **Impactors, impingers, cyclones - Inertial force based samplers**

- Well-known and widespread
- Samples can be extracted very easily
- Not suitable for sampling nanoparticles



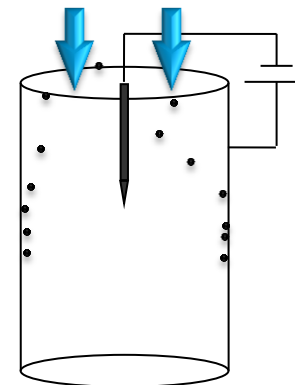
- **Membrane filters**

- Very high sampling efficiency for all kind of particles
- Particles may be difficult to extract
- High pressure drop

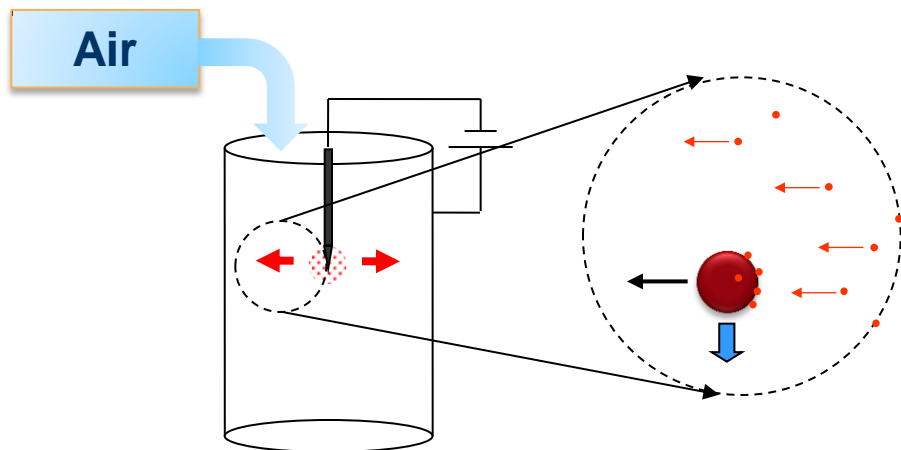


- **Electrostatic samplers**

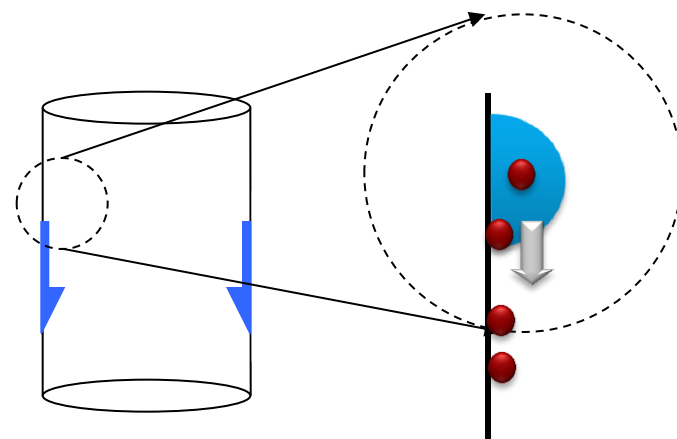
- Very high sampling efficiency for all kind of particles
- Used as air filters and not as air samplers at the moment



ELECTROSTATIC PRECIPITATION PRINCIPLE



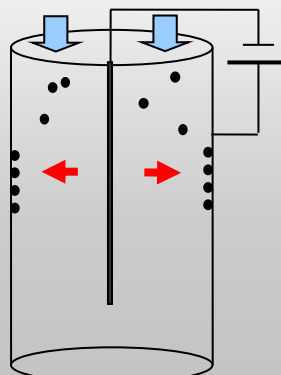
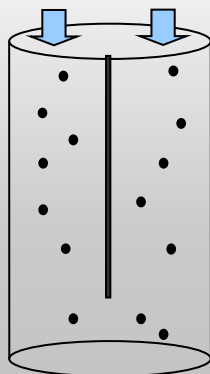
1. An electrical discharge produces electric charges (ions) and inject them between the two electrodes.
2. A unipolar ionic wind develops from the thin wire towards the counter-electrode.
3. Airborne particles get charges.
4. Particles are driven by the electric force to the collecting electrode.



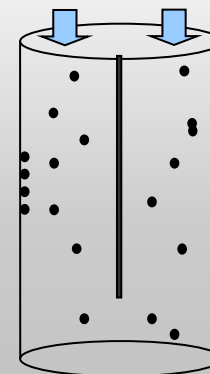
1. The collection area is rinsed with an aqueous solution.
2. The rinsing liquid flows over the stainless steel collecting electrode to transfer the captured particles.

ELECTROSTATIC PRECIPITATION PRINCIPLE

Sampling
principle

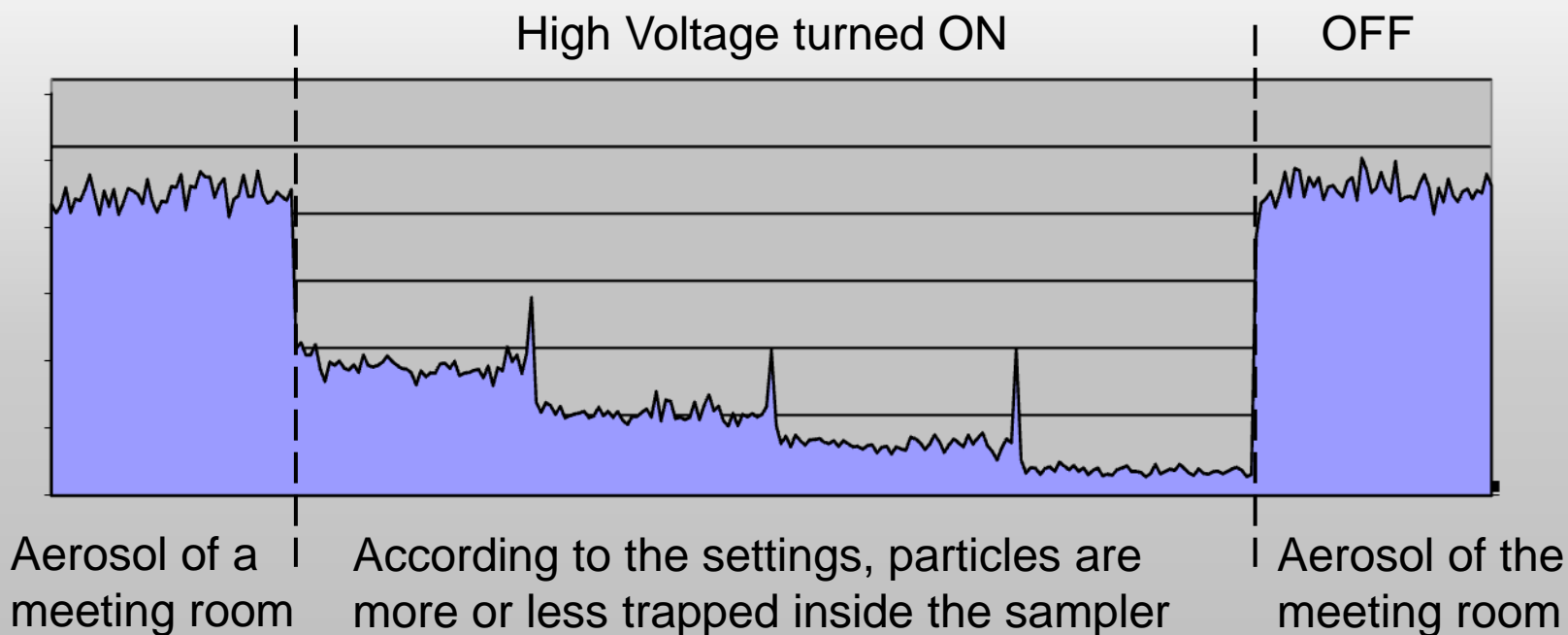


ON



OFF

Particles passing
through the sampler

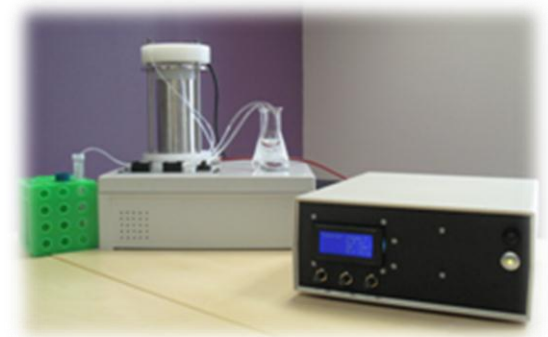
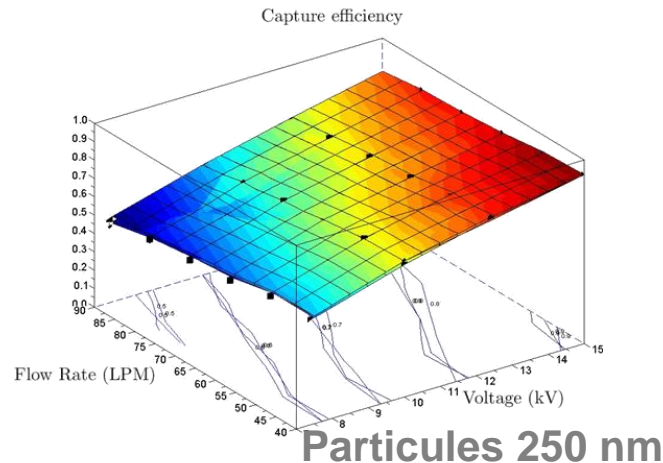


Electrostatic Air Sampling Technology

- Sampling efficiency > 85% yield in a large range of particles (**10 nm to few μm**)
- Sampling is not time limited, even continuous sampling is possible
- Micro-organisms are still alive: compatible with cells / pathogens culture



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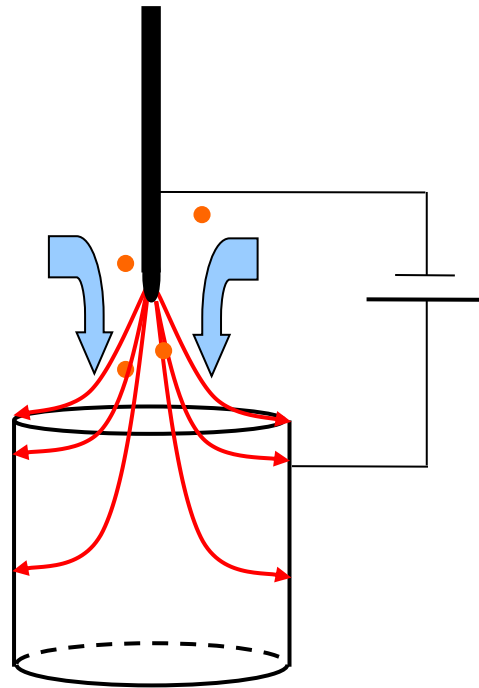
Personal Biodosimeter

- Personal system (550 g)
- Collection rate : 5-10 LPM
- For individual exposition, breath sampling

Portable Air Sampler

- Portable (8 kg)
- Collection rate : 50 - 100 LPM
- For environment monitoring

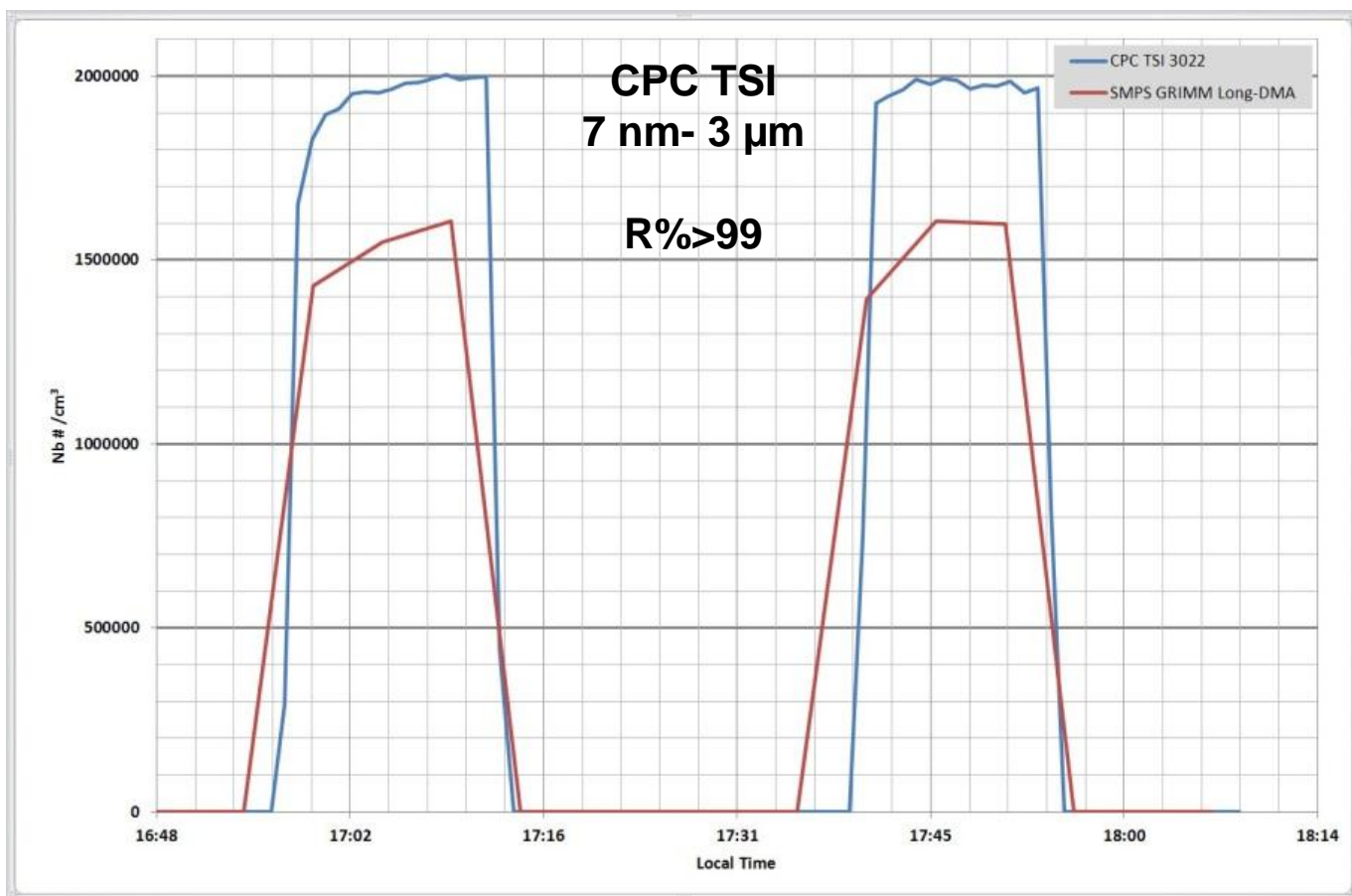
ELECTROSTATIC PRECIPITATION & PUMP PRINCIPLE



- 1- The electric discharge produces ions and airborne particles get them
- 2- The electric force forces them to be collected on a counter electrode (here, the conductive outer ring)
- 3- The ionic wind produced by the electrical discharge provides an air flow and acts as a blower

- Physico chemical qualification = **EXTREME CONCENTRATIONS** NaCl or KCl

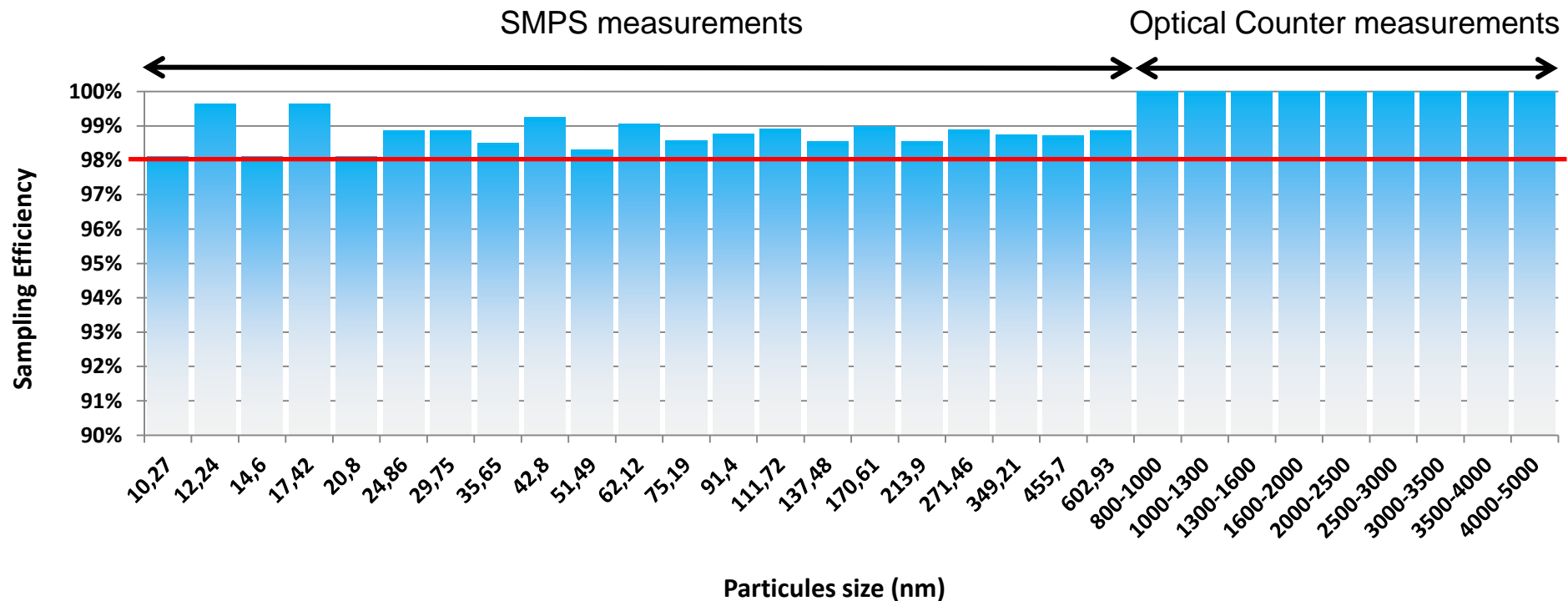
= 600 x [nb #/cm³ normal atmospheric conditions]



Experimental Setup



Salt stuck on the collection plate

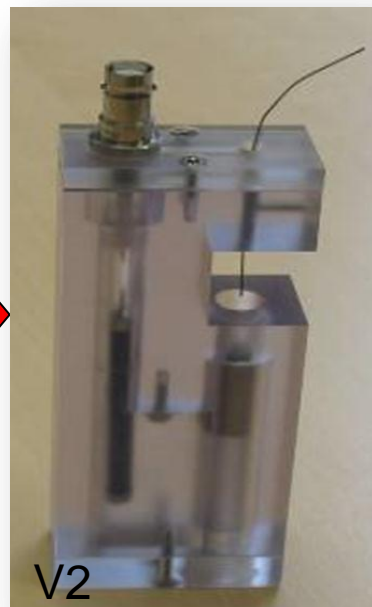


> 98% sampling efficiency from 10 nm to 5 μ m physical particles

2011



2012



2013 – first version



2013 – final version



Electronic enclosed
→ Safe & Compact

& now robust

1,12 kg with an
AC adaptator

0,55 kg with a battery
Autonomy : 15h

Monitoring individual exposure



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Monitoring indoor air quality



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Sampling to identify threats



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Monitoring outdoor air quality



Technological developments are now pursued with Bertin Technologies in a joint laboratory.



Bertin Technologies has already a range of air samplers dedicated to biocollection (Coriolis® products).

The present technology will complement their product range with a **ultraportable device** capable of collecting a **wide range of particles** from nanoparticles to microorganisms, with a **very high efficiency**.


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