



AirCheck



A portable and automated system for collecting and identifying bioaerosols using biomolecular amplification

What is AirCheck?

AirCheck can detect pathogenic microorganisms in the air. It consists of an airborne sampling module for bioaerosols and a microfluidic analysis system.

Thanks to CEA-Leti's design, it is:

- **Fast:** analysis results in less than 30 minutes
- **Portable:** weighs less than 1 kg, useable for analysis in the field
- **Modular:** multiplexing enables the simultaneous identification of several targets/strains (viruses, bacteria, etc.)
- **Simple:** automation makes the system accessible and easy to use

Applications

The AirCheck project is part of the "One Health" approach and designed to address:

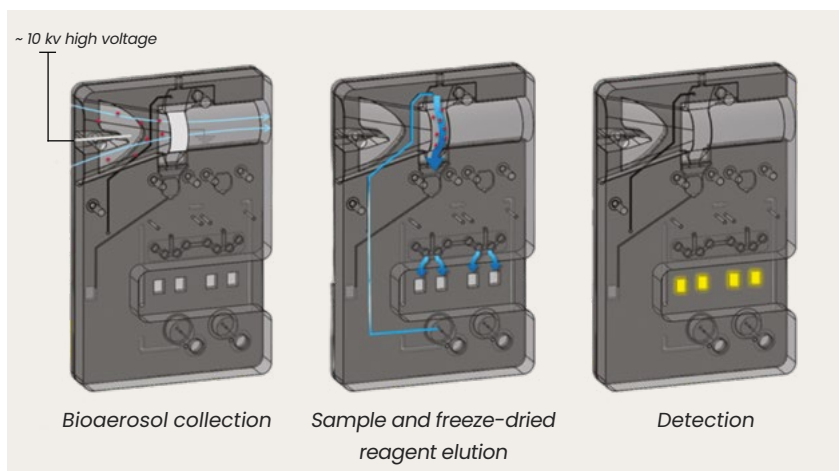
- **Animal health:** By enabling the detection of viruses and bacteria in livestock, it could help reduce the use of antibiotics and assist in decision-making for vaccination, isolation or slaughter.
- **Human health:** Developed in response to the Covid-19 pandemic, this instrument is suitable for non-invasive human screening in civilian and military sectors (detection of biological threats).

What's new?

An automatic 3-in-1 workflow: Without any manual steps, the system automatically **collects** and **prepares** a sample for target pathogen **identification** in just a few minutes. Compact and lightweight, it enables remote analysis while guaranteeing laboratory-grade analytical performances.

How does it work?

Aerosols are collected using electrostatic precipitation (Corona effect) at a flow rate of 5 to 15 l/min. As the sample is eluted by a microfluidic device in less than 100 μ l, it is nearly 150 to 200 times less diluted than in current systems. Detection is carried out by isothermal biomolecular amplification (LAMP). The microfluidic chip can be equipped with several specific detection chambers containing lyophilized primers for multiplexing/multi-targeting.



What's next?

CEA-Leti teams will be expanding its analytical capabilities:

- Targets (yeasts, spores, mycotoxins, etc.): developments of new sample preparation steps (lysis, grinding, etc.)
- Multiplexing
- Automation for successive analyses

The aim is also to improve the card's recyclability/reusability thanks to the regeneration of the bio-sampling membrane.

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Key facts

- **Efficient:** 90% collection efficiency over the 10 nm to 1 μ m range at 6 l/min
- **Quiet:** Thanks to the absence of a pump, it is silent and requires little energy (\leq 23 dB).

Publications

- "A microfluidic cartridge to sample and analyze airborne virus in high risk areas", 5th International Conference CBRNE, Research & Innovation, 3-6 mai, Lille (France), 2022 G. Blaire, M. Baque, M. Alessio, J. Vanhomwegen, C. Batejat, J.-C. Manuguerra, F. Navarro, J.-M. Roux
- "Development of a new portable air sampler based on electrostatic precipitation", J.-M. Roux, R. Sarda-Estève, G. Delapierre, M.-H. Nadal, C. Bossuet, L. Olmedo, 2016. xEnviron Sci Pollut Res 23, 8175-8183. doi.org/10.1007/s11356-015-5522-3
- "Ionic wind generator derived from a liquid filled capillary pin. Application to particle capture" E. Quinton, J.-L. Achard, J.-M. Roux, 2013. Journal of Electrostatics 71, 963-969. doi.org/10.1016/j.jelstat.2013.08.002

Interested in this technology?

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