Aerosol spray and dispersion studies

Human sneezing and coughing, medical inhalers, electrosprays, paint cans and nuclear steam tube ruptures have one thing in common; they all produce quick bursts of aerosol. The aerosol production in all these processes is based on the high velocity of carrier gas or the material itself.

Aerosol evolution from a high velocity jet of material can be divided into three main phases; Spray of the material which generates the aerosol, dispersion of the aerosol and finally deposition onto surfaces. While physics behind these phenomena is well understood, it can be challenging to model what happens in real-life conditions due to many variables. It is therefore valuable to have direct real-time measurement data of the aerosol behaviour.

Dekati® Solutions for aerosol spray and dispersion research

- Real-time 10 Hz particle size distribution and concentration measurements
- PM10, PM2.5, PM1.0, particle number, particle charge and lung-deposited surface area (LDSA) measurements
- Total concentration and detailed size distribution measurements
- Options for real-time monitoring and gravimetric cascade impactor measurements

ELPI®+ and HR-ELPI®+
One measurement method and one instrument 6 nm–10 µm in real-time

The Dekati® ELPI®+ (Electrical Low Pressure Impactor) is a widely-used and well-characterized instrument for real-time particle size distribution and concentration measurements. The ELPI®+ is commonly used in many research fields with well suited characteristics and features:

- Particle concentration and size distribution measurement
- Size range 6 nm – 10 µm with one measurement method
- 14 size classes standard, 500 with High Resolution ELPI®+ (HR-ELPI®+)
- Up to 10 Hz time resolution
- Wide dynamic range
- Long term measurements with minimum downtime

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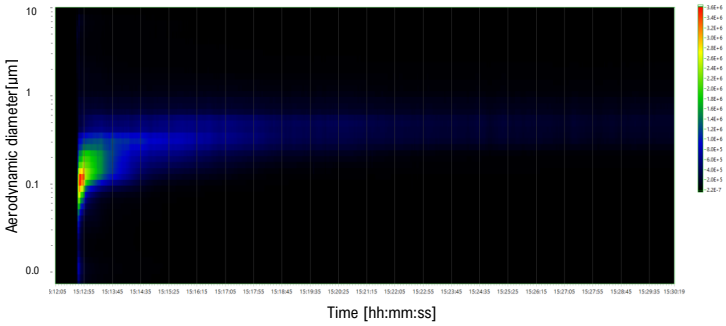
Typical Applications for Dekati® Instruments

- Medical DPI, MDI and nebulizer aerosol measurements - is the size distribution, dose and charge state of inhaled medicine repeatable?
- Filtration research - what is the size resolved filtration efficiency and how does it change over time?
- Lung deposition studies - what is the retention efficiency of lungs as a function of particle size and breathing pattern?
- Deposition studies of radioactive aerosols - when is it safe to enter a space where radioactive aerosol has formed through an accident?
- Ambient eddy flux covariance studies - what is the net movement of aerosol in a complex airflow field?



ELPI®+ measurement of aerosol puff from firing of a rifle. Aerosol change through agglomeration and deposition can be observed

- Aerosol charge state measurements - is a generated aerosol charged and what is the effect on agglomeration, deposition and filtration?
- Aerosol generation from rifles - what is the exposure level in repeated firing and how does bullet casing materials affect the level?
- Ambient dispersion of biologically active aerosol - which parameters affect dispersion and how much?
- E-cigarettes, vaping device and formulation studies - are the devices repeatable and effect of formulation on dose?
- Bioaerosol generation from faucets and sinks - what is the risk of airborne contamination with different designs?
- Filtration of radioactive aerosols - What is the filtration efficiency of ceramic filters in high pressure and temperature?
- Production of aerosols from nuclear steam tube ruptures - what is the size and concentration of aerosol and how does it disperse?

ELPI®+ and HR-ELPI®+ are powerful tools for aerosol spray and dispersion studies

- Wide measurement size range from 6 nm to 10 µm with a single measurement principle and up to 500 size classes - shows the entire particle size spectrum of interest from ultrafine to coarse particles
- Wide dynamic range over 5 orders of magnitude - capability to measure accurately from initial high concentration to long term decay
- Real-time measurement up to 10 Hz - see the evolution of the spray and the effect of air fluxes on the dispersion
- Only available instrument that measures Lung Deposited Surface Area (LDSA) size distribution from 6 nm to 10 µm - evaluate the aerosol based on the most health relevant metric
- Unique charge per particle measurement - study particle charging in the generation process and the effect of charge on agglomeration and deposition
- Sintered high-capacity collection plates - measure for extended periods of time without any maintenance
- Capability to measure in 100%RH and in elevated temperatures up to 200 °C - study the effects of temperature and relative humidity on evaporation and condensation or do the measurement in lung conditions

Two choices of impactor collection plates are available for ELPI®+

- *Analysis plates (back) allow collection of size classified particles on a filter/ foil for post real-time measurement chemical analysis*
- *Sinterered plates (front) allow long term measurements without maintenance needs*

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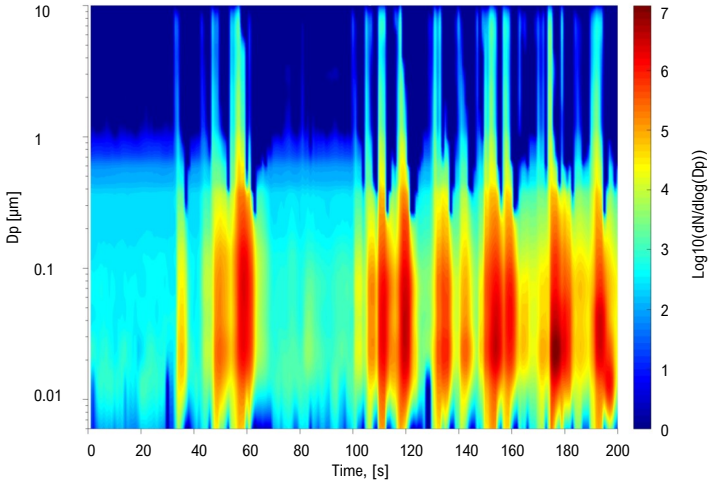
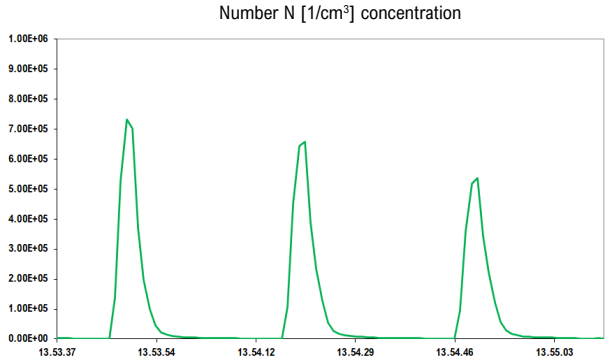
Aerosol spray and dispersion studies



ELPI®+ measurement of aerosol formation during MIG welding process and the effect on indoor air quality.



ELPI®+ measurement of vaping system repeatability as a function of total number concentration.

Dekati® Impactors for gravimetric PM mass measurements

Impactor technology is a well known and well characterized method for the determination of mass size distribution of any aerosol. In impactors, size classified particles are collected on collection filters or substrates that are either weighed or analysed to determine particle mass and/or chemical composition in different particle size fractions. Dekati has over 25 years of designing impactors and the Dekati® PM10 Impactor and DLPI+ impactors are especially well-suited for collection of aerodynamically size resolved samples.

Dekati® PM10 Impactor

- Gravimetric of chemical analysis of size classified particles
- PM10, PM2.5 and PM1 separation
- Particle collection area Ø25 mm, Ø47 mm for the smallest size fraction
- Sample flow rate 10 lpm or 30 lpm

Dekati® Low Pressure Impactor (DLPI+)

- Cascade impactor for gravimetric or chemical analysis of size classified particles
- Particle size distribution in 14 size fractions
- Particle size range 16 nm – 10 µm
- Sample flow rate 10 lpm
- Particle collection area Ø25 mm
- Integrated low pressure measurement and control, no additional flow control device needed
- Can be upgraded into an ELPI®+

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Contact us for details and we can recommend the best solution for your measurements!

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