Particle filtration research

Aerosol research is essential in various fields of air filtration from household air cleaning devices and face mask filters to industrial building/vehicle ventilation and oil mist filters. Filter performance including filtration efficiency, filter life time and pressure drop can be effectively optimized with advanced particle measurement methods that provide more detailed data than what filtration standards (EN 149, EN 13274, EN 14683) require. Dekati has over 25 years of experience in providing high quality instrumentation for fine particle and aerosol research. Today, our filtration measurement solutions include instrumentation for both advanced research and routine monitoring of particles from 6 nm up to 10 µm.

Dekati® Solutions for aerosol filtration research

- Advanced research and monitoring solutions
- 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 6nm-10µm 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®+ measures particles 6 nm - 10 µm using only one measurement method throughout the complete size range requiring no complicated calculation routines to combine data from several instruments into one particle size distribution. The ELPI®+ is commonly used in filtration research 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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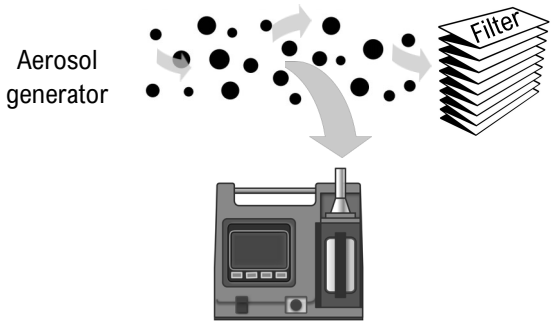
Dekati® ELPI®+ and HR-ELPI®+ for filtration efficiency measurements

Filtration efficiency measurements can be made with one ELPI®+ unit switching between pre– and post filter sampling or with two units measuring simultaneously. With dual units, it is possible to measure a size resolved filter penetration curve in a few seconds. Longer measurements can be made to determine the effect of loading effect on filter efficiency and pressure drop. If the measured filter efficiencies are >90%, the post-filter measurement unit can be operated 6-12 months without maintenance procedures.

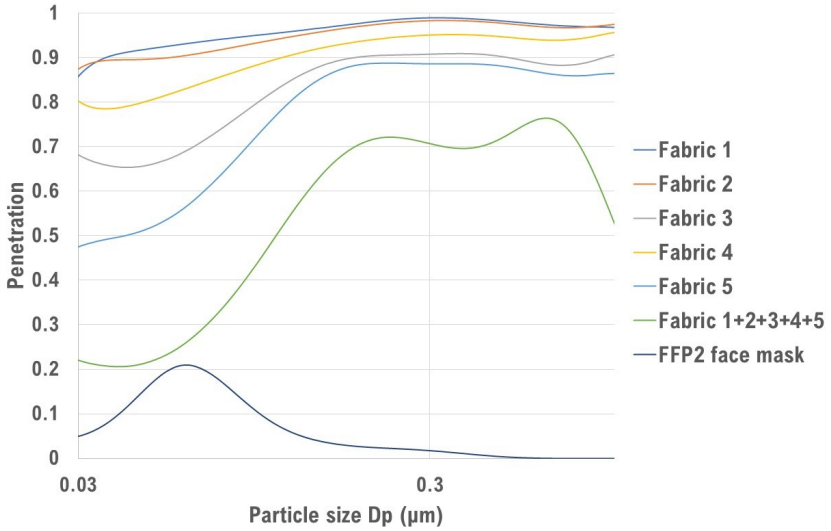


Measurement setup using two ELPI®+ units to measure filtration efficiency in real-time 6nm-10µm. Most penetrating particle size (MPPS) of a filter is typically between 100 and 300 nanometers but it can also be lower for filters that use electret material to increase collection efficiency.

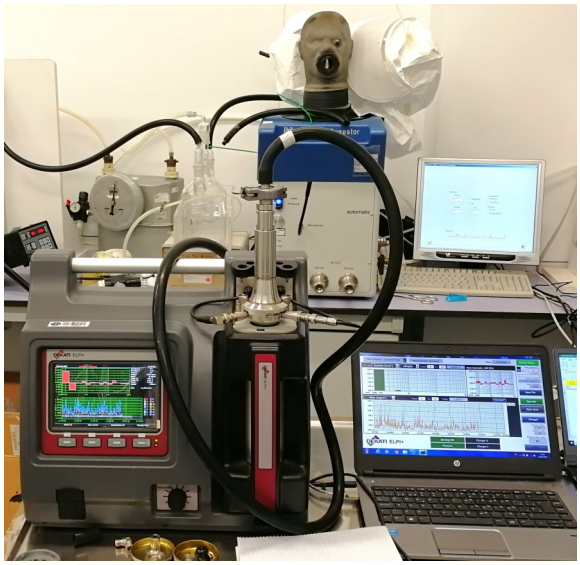
ELPI®+ and HR-ELPI®+ for filtration efficiency measurements

- Wide size range from 6 nm up to 10 µm covering all relevant particle sizes used in filter testing with a single instrument
- One measurement method used in the complete size range
- High size resolution (up to 500 size bins) to get detailed information on filtration efficiency for different particle sizes
- Real-time (up to 10 Hz) measurement to study effect of filter loading on size resolved filtration efficiency and pressure drop
- Wide dynamic range allows measurement of filtration efficiencies up to 99.999% without using a dilution system
- Unique feature to measure aerosol charge level/particle enables measuring the effect of aerosol charge stage or the charge effect on filtration efficiency
- ELPI®+ calibration is independent of measured aerosol - any liquid or solid aerosol can be used as a challenge aerosol
- Months of measurements possible without any maintenance procedures using sintered impactor collection plates
- Open and transparent calculation routine with no hidden factors or black box features

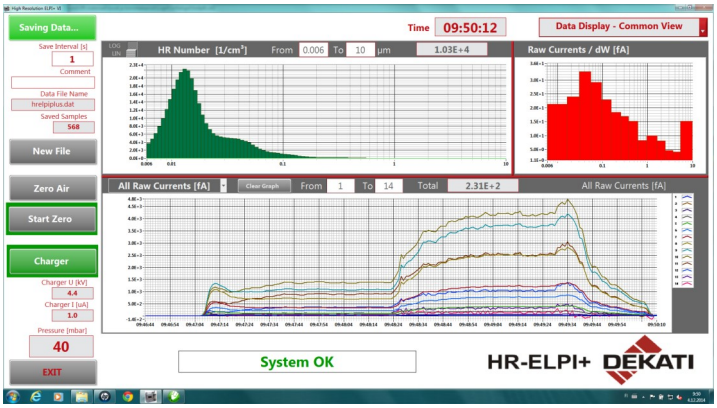
Particle penetration through household fabrics and through FFP2 face mask material as a function of particle size - Measured with DEHS oil aerosol and HR-ELPI®+ instrument.



Particle filtration research



Assessing facemasks to protect against COVID-19 using ELPI®+ at Instituto Nacional de Técnica Aeroespacial (INTA), Spain. Image courtesy of Victor Achilla (archillapv@inta.es).



HR-ELPI®+ software shows particle concentration and size distribution 6 nm –10 µm in real-time.

Dekati® Impactors for gravimetric PM mass measurements

Impactor technology is a well known and well characterized method for the determination of filtration efficiency of any type of air filter. 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 cascade impactors and the Dekati® PM10 Impactor and DLPI+ impactors are especially well-suited for filter testing applications.

Dekati® PM10 Impactor

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

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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Particle filtration research

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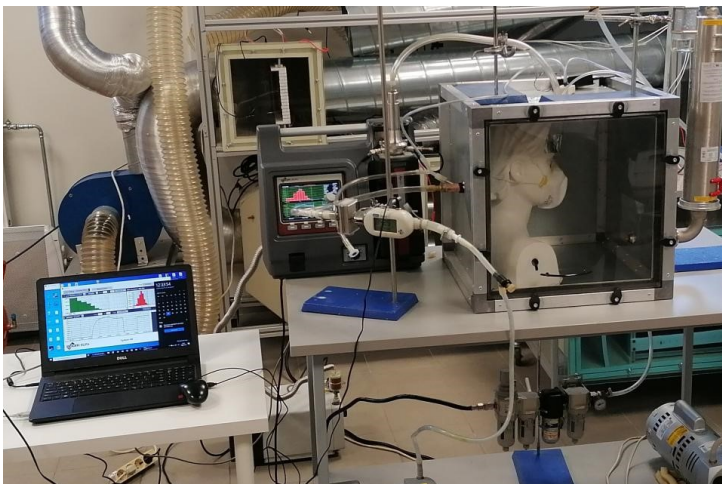
Contact us for details and we can recommend the best solution for your measurements!

ELPI®+ unit with impactor-charger unit removed from the assembly



Testing facemasks using ELPI®+ at Kaunas Technical University. Image courtesy of Dainius Martuzevicius.

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