

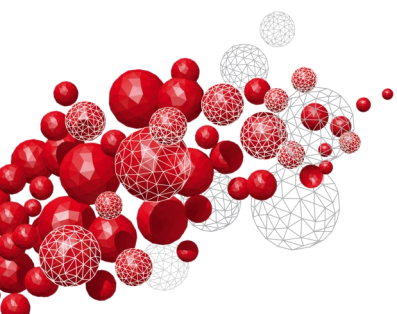


Tyre wear emission measurements have gained importance during recent years as they can have a significant impact on not only the environment but also performance of the tyres and therefore the vehicle. Particles are formed in the interaction of tyres and roads but can also be formed via evaporation due to heating of the tyres. Due to different particle formation processes, tyres emit particles on a broad size spectrum from a few nanometers up to a few micrometers. Since the particle emissions from the tyre wear are formed through different mechanisms and contain particles of various sizes, an instrument with a very wide particle size range is needed to accurately characterize these emissions.

Dekati has over 25 year of experience in providing high quality instrumentation for fine particle measurements. Our tyre wear emission measurement solutions include both real-time and gravimetric particle measurement systems, and today we have solutions for both for research and routine monitoring of tyre wear emissions from 6 nm up to 10  $\mu\text{m}$ .

## Dekati® Measurement Solutions for Tyre Wear Measurements

- Real-time measurement of total concentration and detailed particle size distribution
- Particle number, mass and LDSA concentration measurements
- On board and laboratory measurement instruments
- Option for chemical characterization of size classified particles



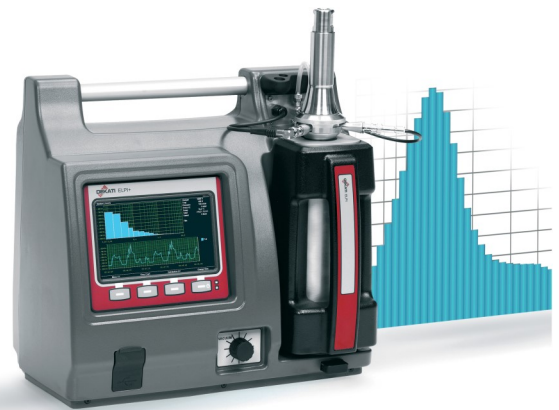
**Dekati Ltd.** ▶ Tykkitie 1 FI-36240 Kangasala, Finland ▶

Tel. int +358 3 3578 100 ▶ E-mail [sales@dekati.fi](mailto:sales@dekati.fi) ▶ [www.dekati.fi](http://www.dekati.fi)

## Dekati® ELPI®+ and HR-ELPI®+ for real-time particle number concentration and size distribution measurements

Dekati® ELPI®+ (Electrical Low Pressure Impactor) is a unique, 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. Due to its wide operational particle size range, ELPI®+ can be used to measure particles in ultrafine -, fine - and coarse modes covering the complete size range needed in tyre wear emission measurements. Additionally, ELPI®+'s real-time response of 10 Hz enables detection of rapid changes in the sample concentration and size distribution in up to 500 size fractions. Since ELPI®+ uses an impactor for size classification, particles can also be collected and analysed for chemical composition after the real-time measurement.

- Real-time particle concentration and size distribution measurement
- Size range 6 nm – 10 µm with one measurement method
- 14 size classes, up to 500 with the High Resolution ELPI®+ (HR-ELPI®+)
- 10 Hz time resolution
- Wide operational concentration range allows measurements from both high and low concentrations
- Measurement according to ISO technical specification 21361:2019
- High Temperature ELPI®+ for sampling from up to 180 °C



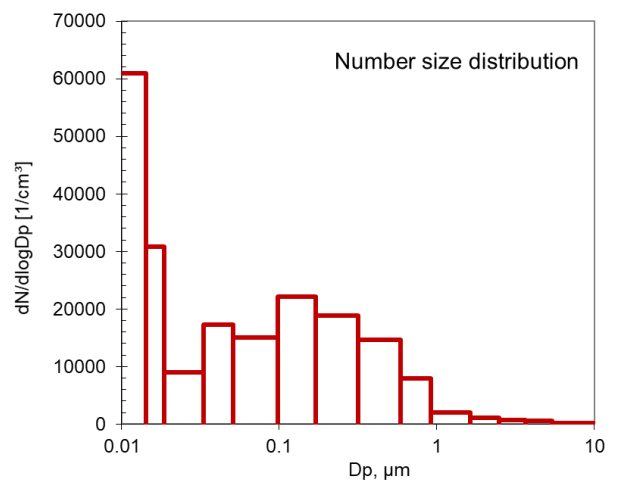
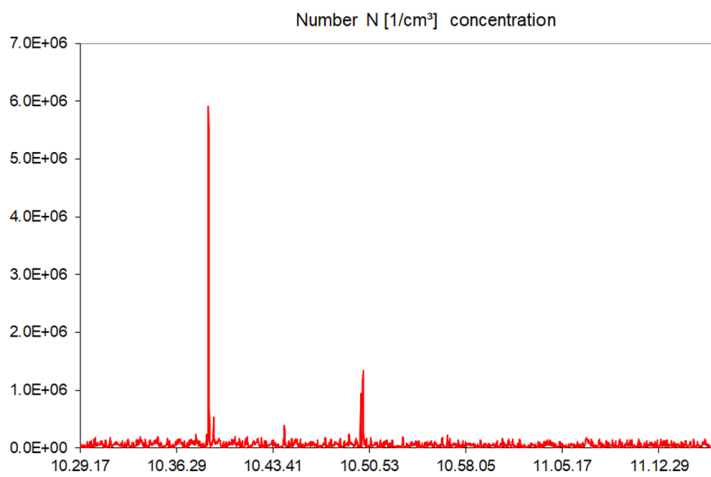
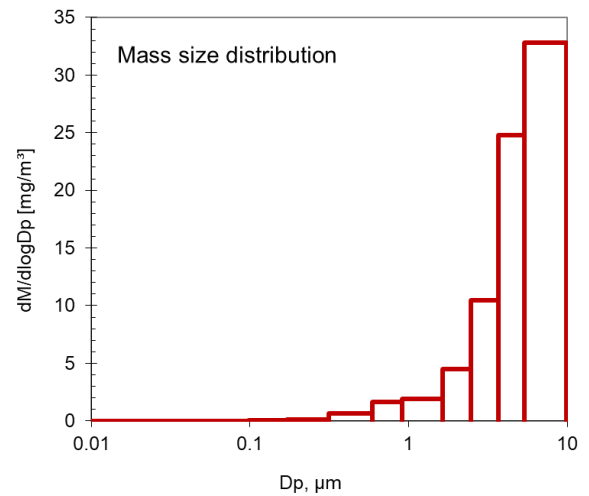
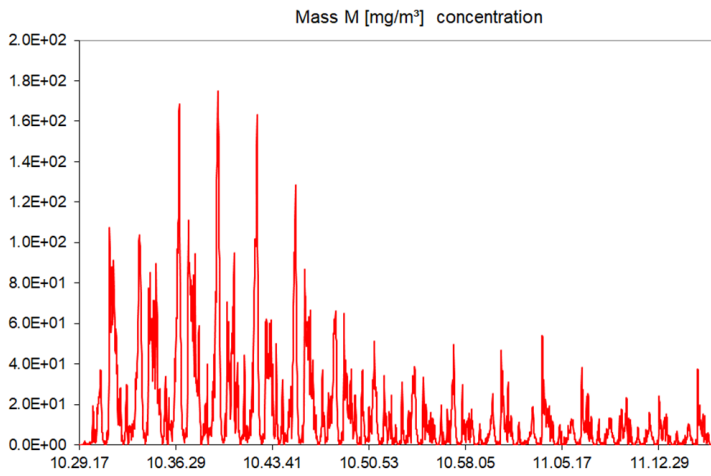
Both ELPI®+ and DLPI+ collect particles in different size fractions on 25 mm filters

## Dekati® Low Pressure Impactor DLPI+ for gravimetric particle size distribution measurements

Dekati® Low Pressure Impactor (DLPI+) is 14-stage cascade impactor for detailed particle size distribution analysis. This impactor gives information on particle size distribution in 14 size fractions from 16 nm to 10 µm. The DLPI+ design is the same as in the impactor used in the ELPI®+ (Electrical Low Pressure Impactor) enabling an easy upgrade from DLPI+ into a full ELPI®+ system for real-time particle size distribution measurements. The size classified particles are collected on Ø25 mm filters that are analysed gravimetrically or chemically after the sample collection.

- Particle size distribution in 14 size fractions 16 nm - 10 µm
- Sample flow rate 10 lpm
- Particle collection area Ø25 mm
- Gravimetric or chemical analysis of size classified particles
- Integrated low pressure measurement and control, no additional flow control device needed
- Can be upgraded to an ELPI®+ for real-time measurements
- Stainless steel stages for reliable operation even in challenging environments





Results from tyre wear particle measurements with the ELPI<sup>®</sup>+ are shown above. Measurements were made onboard a vehicle while driving on a test track. ELPI<sup>®</sup>+ results show that the mass size distribution is dominated by large particles while number concentration of the particles is dominated by ultrafine- and fine particles. Particle size distributions are average size distributions over the complete test cycle.



## Dekati® eFilter™

### for combined real-time detection and gravimetric measurement

The Dekati® eFilter™ is a unique instrument that combines a standard gravimetric filter holder and sensitive real-time PM detection in one compact instrument. The Dekati® eFilter™ assembly includes a standard gravimetric filter holder that is used to determine gravimetric mass of particles in the sample. In addition to the gravimetric filter measurement, the eFilter™ has a real-time particle detection module that monitors changes in particle concentration throughout the filter sampling period. The real-time measurement is made in a replaceable miniature diffusion charger – electrometer module and the resulting current signal can be directly converted to LDSA concentration. The eFilter™ software additionally allows PM and PN concentration calculations in real-time. Since the eFilter™ already includes the standard gravimetric filter holder, it is easy to compare the real-time signal to the gravimetric mass in different conditions.

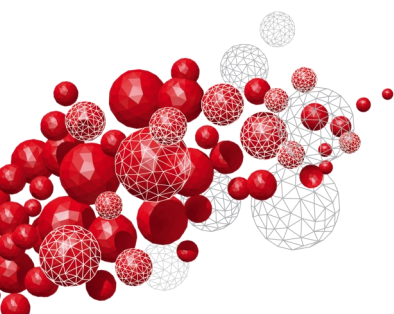
- Combined gravimetric PM and real-time LDSA, PM and PN measurement
- Standard gravimetric filter holder with 47 mm filter for gravimetric PM
- Real-time measurement in a miniature diffusion charger - electrometer module
- Maintenance free instrument with replaceable real-time detection module
- Battery operated with internal pump for the real-time measurement
- Fully automated operation with a touch screen user interface



## Dekati® Solutions for Tyre Wear Measurements

- ELPI®+ and HR-ELPI®+ for real-time particle size distribution
- DLPI+ for gravimetric particle size distribution
- Dekati® eFilter™ for gravimetric and real-time particle concentration

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



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