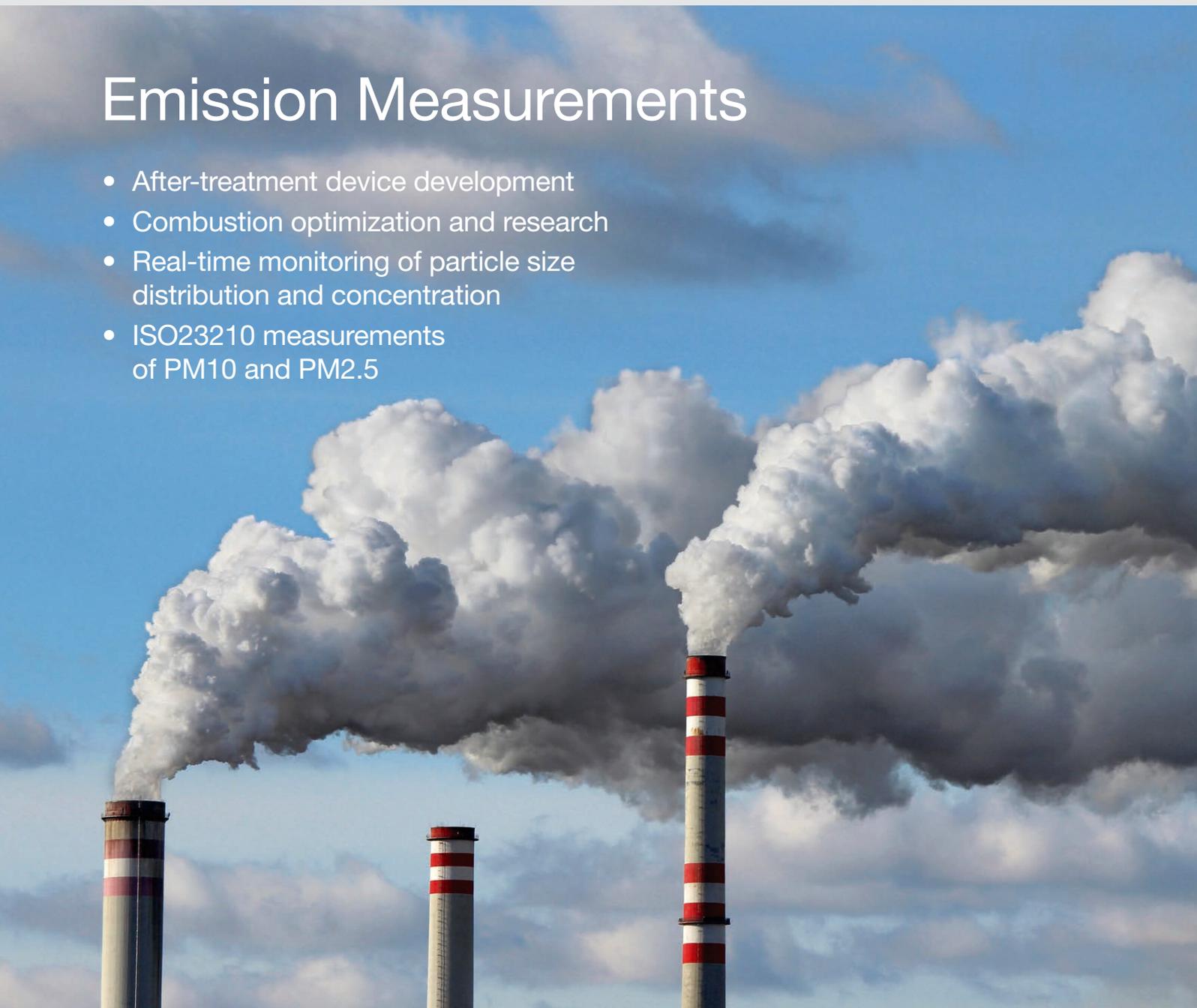


Emission Measurements

- After-treatment device development
- Combustion optimization and research
- Real-time monitoring of particle size distribution and concentration
- ISO23210 measurements of PM10 and PM2.5



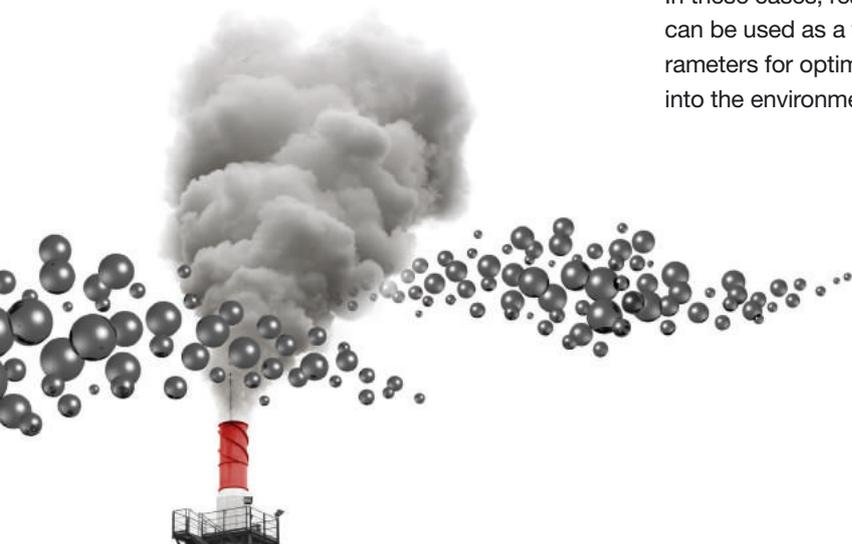
Excellence in Particle Measurements





Emissions and Combustion Generated Particles

Measurements of combustion generated particles are most commonly made to determine emissions from the combustion source to the atmosphere, as particle emissions have found to have adverse effects on human health, environment and the climate. The allowed emission values are regulated and vary slightly depending on the region and local legislation but typically focus on PM10 and PM2.5 values. Besides measuring directly from the outlet of the power plant stack, particle measurements can also be used as tool to develop and optimize the operation of the flue gas cleaning and treatment devices as well as the actual combustion process. Short-time scale changes happen regularly in the combustion processes and these may quickly affect not only the emitted particle concentration but also particle size distribution. In these cases, real-time particle size distribution measurement solutions can be used as a fast and cost efficient way to adjust different process parameters for optimal use of fuel and energy while achieving low emissions into the environment.



Dekati® Applications

- Emission measurements
- After-treatment device optimization for reduced energy and water consumption
- ESP charging efficiency studies
- Combustion process optimization for reduced fuel use and NOx emissions
- General combustion research
- Coal, oil, natural gas and biomass combustion process measurements

Dekati® Solutions

Dekati Ltd. has provided high quality instrumentation for fine particle measurements successfully for over 20 years. Our measurement solutions for combustion process measurements include emission monitoring, after-treatment device development and combustion process optimization instruments. All our instruments are developed, manufactured and calibrated in Finland with strict quality requirements and provided with a standard two year warranty.

Dekati® particle measurement solutions for measuring combustion generated particles:

- Real-time monitoring of particle concentration and size distribution
- ISO23210 measurements of PM10 and PM2.5
- Detailed gravimetric size distribution analysis

Each and every Dekati® Instrument is thoroughly tested with traceably calibrated flow, pressure, temperature, voltage, current and particle measurements. Additionally, all Dekati® Instruments go through rigorous type-approval tests, including instrument response tests for changes in temperature, pressure and humidity. The robustness of our instruments is guaranteed through misuse tests making sure that the instruments are ready for any environment. These procedures ensure that every instrument shipped operates according to their specifications and the measurement data is reliable and reproducible.

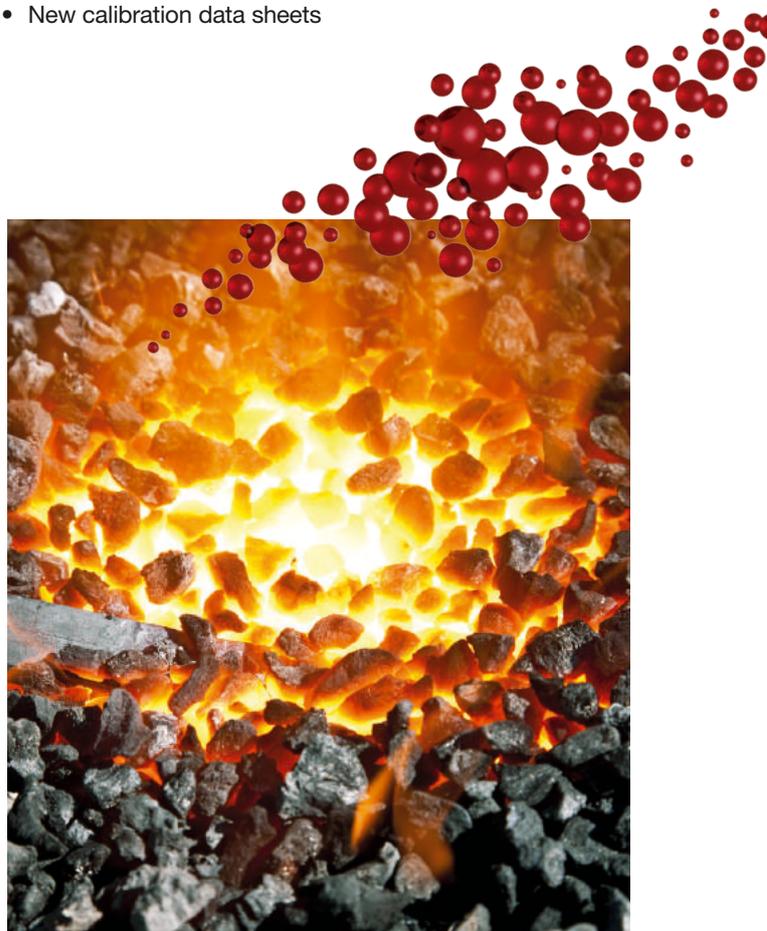
Dekati® Instruments

- All units original Dekati® design
- Over 20 years of experience in aerosol instrumentation
- All units manufactured and calibrated in Finland
- All units individually calibrated
- Provided with two year warranty
- Robust structure designed for use in field conditions
- Software and data processing spread sheet always included

Dekati® Calibration Services

Dekati provides detailed and accurate calibration and maintenance services for all Dekati® Products. Our instrument calibration services include:

- Arrival inspection of the instrument in its arrival condition
- Cleaning and overhauling of the instrument
- Change of seals, filters and other aging parts
- Adjustment of electronics (if any)
- Calibration of the instrument
- Final operation and/or reference test
- Detailed report on the service
- New calibration data sheets





ISO 23210 Measurements of PM10 and PM2.5

Dekati® PM10 Impactor fulfills all requirements of ISO standard 23210: Stationary Source Emissions – Determination of PM10 / PM2.5 Mass Concentration in Flue Gas - Measurement at Low Concentrations by Use of Impactors. This standard describes the method to measure PM10 and PM2.5 concentrations with a two-stage Dekati® PM10 Impactor Model No. PMS-510. Due to the principle of the described method, it is especially suitable for mass concentrations below 40 mg/m³. The standard recommends measurements with the impactor placed inside the flue gas channel directly against the flue gas flow. Isokinetic sampling is achieved with the use of straight isokinetic nozzles. Alternatively, the impactor can be placed



Dekati® PM10 Impactor

outside the stack and heated to the flue gas temperature during the measurement to eliminate condensation and sample transformations.

The Dekati® PM10 Impactor size classifies and collects different sized particles on filters analyzed after the measurement for gravimetric mass size distribution and/or chemical composition. The unit is manufactured from stainless steel to ensure reliable operation in long term use and even in harsh environments. Aluminium or polycarbonate foils can be used on the impactor stages as a particle collection surface depending on the preferred particle analysis method.

Dekati® PM10 Impactor Setup

- Dekati® PM10 Impactor with heating jacket
- Pump with flow control
- Isokinetic sampling probes for different flow velocities
- Dekati® Cyclone for removal of >10 µm particles (optional)

Dekati® PM10 Impactor Features

- Complete compliance for ISO23210 measurements
- PM10 and PM2.5 detection. Upgradable for PM1.0 measurements
- Gravimetric, chemical or SEM/TEM analysis of size classified particles
- 10 and 30 lpm flow rate versions available
- Robust stainless steel construction
- Heating up to 200 °C, optional
- Available individually or as part of a complete measurement solution
- Calibrated with aluminium and quartz fiber filters according to the ISO23210 standard



Particle Mass Size Distribution

DLPI+ (Dekati® Low Pressure Impactor) is a widely used and well characterized cascade impactor for detailed particle size distribution analysis. This impactor gives information on particle size distribution in 14 size fractions 16 nm – 10 µm. The size classified particles can be collected on different material substrates, such as aluminium or polycarbonate, for either gravimetric or chemical analysis. The High Temperature DLPI+ allows sampling from up to 180 °C making it an ideal choice for stationary source emission measurements and other applications where particle sample is at high temperature.

Each individual DLPI+ impactor unit is calibrated for exact flow rate and impactor stage cut points to ensure accuracy of the measured data. 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.

DLPI+ Features

- Wide particle size range; 16 nm – 10 µm
- Particle size distribution in 14 size fractions
- 10 lpm sample flow rate, Classic DLPI available for 30 lpm
- Integrated impactor low pressure measurement and adjustment
- Gravimetric, chemical, SEM/TEM analysis of size classified particles
- Stainless steel stages for operation even in harsh environments
- Sampling from up to 180 °C with High Temperature DLPI+
- Excellent calibration data
- Can be upgraded into a full ELPI®+ system for real-time data
- Complete measurement solutions for wide range of measurement applications available from Dekati Ltd.



*Dekati®
Low Pressure
Impactor
DLPI+*

DLPI+ Setup

- High Temperature DLPI+ Impactor
- Vacuum pump, no additional flow control needed
- Isokinetic sampling probes for different flow velocities
- Dekati® Cyclone for removal of 10 µm particles (optional)





Dekati® ELPI®+



Real-Time Size Distribution and Concentration

ELPI®+ is a real-time particle size distribution measurement instrument for measurements both from large-scale and small-scale combustion processes. Emissions from different combustion processes contain particles from a very wide size range. The ELPI®+ enables detection of all these particles with one single instrument. The wide particle size range of 6 nm – 10 µm and fast time response of 10 Hz make the ELPI®+ an excellent choice for monitoring emissions whether the fuel is coal, oil, natural gas or biomass. In addition to monitoring emissions, the ELPI®+ setup options also enable measurements before and after flue gas after-treatment devices and even directly from the combustion source.

ELPI®+ Features

- Wide particle size range from 6 nm up to 10 µm gives detailed information on the size distribution in coarse, fine and nucleation mode particles
- 10 Hz sampling rate enables detection of short time scale changes in the process
- Wide particle concentration range enables measurements from different combustion sources, and before and after flue gas cleaning devices
- Possibility for chemical or SEM/TEM analysis of the collected size classified particles
- High Resolution ELPI®+ for detailed particle size resolution, up to 500 size channels available
- Automated function for measuring particle charge size distribution allows efficiency studies on ESP filters
- Automated features for long term emission monitoring
- High Temperature ELPI®+ model available for direct sampling from the hot processes and wet stacks
- Sample temperatures up to 1000 °C possible with Dekati® Sample Conditioning Instruments

The ELPI®+ can be used e.g. in the following areas:

- Real-time emission monitoring of particle concentration and size distribution
- After-treatment device development and optimization
- ESP charging efficiency studies
- Combustion process optimization for reduced fuel use and NOx emissions
- General combustion research

ELPI®+ Setup

The measurement setup options for the ELPI®+ in emission measurements include direct sampling from the emission source into the High Temperature ELPI®+, or use of ELPI®+ with a well designed sample conditioning unit. The choice between direct sampling and sampling via a sample conditioning unit depends on the location of the sampling points from the process and the sample particle concentration. If measurements are made before flue gas cleaning and treatment devices, it is recommended to use a dilution system except in the case where the fuel is natural gas. Dekati provides a wide range of state-of-the-art solutions for particle sample conditioning, e.g. the Dekati® Diluter and Dekati® Fine Particle Sampler are widely used in combustion emission studies. Besides standard dilution solutions, Dekati also provides custom made solutions for extreme sample conditions such as temperatures up to 1000 °C.



High Temperature ELPI®+



Dekati® Diluter

Comparison of different setups

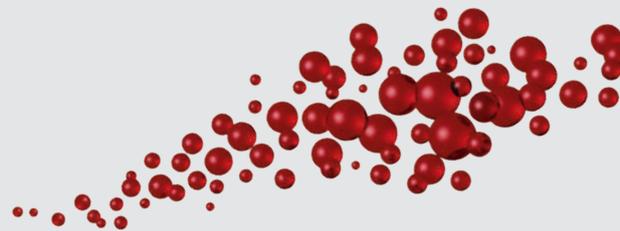
	Sample Max Temperature (°C)	Sample Pressure (mbar)	Sample Particle Concentration (mg/m³)*	Dilution Factor (DF)
High Temperature ELPI®+	200	750 – 1200	0.001 – 20	NA
High Temperature ELPI®+ with Dekati® Diluter	450	800 – 1200	0.010 – 1000	8 – 50 Fixed
Dekati® Double Diluter and ELPI®+	450	800 – 1200	0.07 – 5000	64 – 2500 Fixed
Dekati® FPS and ELPI®+	600	750 – 2000	0.02 – 4000	20 – 200, Adjustable
Customized Sample Conditioning with ELPI®+	1000	500 – 10000	0.001 – 5000	0 – 3000

* Estimates, depend on particle size.

	Dekati® ELPI®+	Dekati® DLPI	Dekati® DLPI+	Dekati® PM10
Size Range	6 nm - 10 µm	30 nm - 10 µm	16 nm - 10 µm	< 10 µm
Number of Size Fractions	14 or 100/500**	12	14	3
Analysis	Real-time, 10 Hz (also option for gravimetric)	Gravimetric	Gravimetric	Gravimetric
Option for Chemical Analysis	Yes	Yes	Yes	Yes
Sample flow rate	10 lpm*	30 lpm	10 lpm	10 or 30 lpm

* ~6 lpm with Dekati® Diluter and Dekati® Double Diluter. 1-10 lpm with FPS depending on the used dilution factor.

** 100 or 500 size channels available with the High Resolution ELPI®+ at 1 Hz.



Dekati Ltd. is specialized in the design and manufacture of innovative fine particle measuring and sampling devices. Since its founding in 1993, Dekati has become the technological market leader in producing high-class fine particle measurement instrumentation for various applications and thousands of customers.

For more information, please contact: sales@dekati.fi

Excellence in Particle Measurements



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