

Particle size and shape characterization
by Static Image Analysis

CAMSIZER M1

MICROTRAC
MRB
PARTICLE CHARACTERIZATION





Microtrac MRB – Particle Characterization at Its Best

Comprehensive analysis of powders, granulates and suspensions

Microtrac MRB is your reliable partner for the characterization of disperse systems. Using high-end technology, we support our customers in consistently achieving excellent results. Innovation and quality form the basis of our success.

Microtrac MRB has three product lines with competence centers on three continents:

Scattered light analysis: Microtrac MRB is a leading provider of laser diffraction instruments (static light scattering), a versatile technique for particle size measurement. The portfolio also includes instruments for the reliable characterization of nanoparticles by means of dynamic light scattering. The production and development of this product line are located in Pennsylvania, USA.

Image analysis: With the devices of the CAMSIZER series, Microtrac MRB offers high-quality systems for determining particle size and particle shape using imaging methods. We develop and manufacture the image analysis instruments at our facilities in Haan, Germany.

Surface and porosity measurement: Specific surface area, BET value and porosity of powders are determined via gas adsorption. The competence center for surface analysis is located in Osaka, Japan.

As a member of the Verder Scientific Group, we provide worldwide support through numerous agencies and subsidiaries.

CAMSIZER Series

High-resolution image analysis of particle size and particle shape

With the ever-increasing demands for product quality, accurate evaluation of raw materials, intermediates and final products has become indispensable. Automation, high sample throughput and short measurement times make the CAMSIZER systems ideal tools for routine analyses and quality control. A sophisticated evaluation software offers a wealth of valuable information making the analyzers ideally suited for use in research and development.

Microtrac MRB has set the standard in dynamic image analysis with the development of the CAMSIZER X2 and CAMSIZER P4. The unique dual camera technology implemented in both instruments permits rapid analysis with highest accuracy and reproducibility and an extremely wide measuring range.

The latest innovation, CAMSIZER M1, is based on static image analysis. This technique is particularly suitable for analysis of particle size and shape in the low micron range with utmost precision.

- ▶ CAMSIZER X2: Dynamic Image Analysis for powders and suspensions
- ▶ CAMSIZER P4: Dynamic Image Analysis for free-flowing bulk materials and granulates
- ▶ CAMSIZER M1: Static Image Analysis for very fine powders





CAMSIZER M1

Fully Automated Static Image Analysis

CAMSIZER M1 uses the measuring principle of static image analysis to determine the particle size and particle shape in a range from 0.5 μm to 1500 μm .

The basis of the analyzer is a powerful microscope whose hard- and software is optimized for automated particle analysis. For static image analysis (acc. to ISO 13322-1) the sample needs to be placed on an object slide or other carrier and is moved by an automatic sample stage to be photographed step by step by an 18.1 Megapixel camera. The sample remains static during image acquisition which ensures images of high quality and richness of detail.

Up to six different magnifications and the precise sample stage with a position accuracy of $<3 \mu\text{m}$ ensure optimum measurement conditions over the entire measuring range.

The results are displayed as size and shape distributions with a variety of configurable measurement parameters. The Particle X-Plorer software allows for subsequent display and analysis of every single recorded particle.

As any analysis is just as good as the preceding sample preparation, the dispersion module M-Jet was developed to ensure a homogeneous distribution and efficient dispersion of dry powders before measurement in the CAMSIZER M1.

Particle Analyzer CAMSIZER M1:

- ▶ High-resolution static image analysis (ISO 13322-1) from 0.5 μm to 1500 μm
- ▶ 18.1 Megapixel color camera
- ▶ Up to 6 magnifications
- ▶ Accurate analysis of very small particles
- ▶ Excellent image quality
- ▶ Highly precise shape analysis
- ▶ Dispersion module M-Jet
- ▶ Automatic measurement, easy operation
- ▶ Stitching function
- ▶ Comprehensive evaluation possibilities with Particle X-Plorer



Superiority in Detail

ADVANTAGE CAMSIZER M1:
The analyzer is equipped with five objectives with magnifications from 2.5x to 50x. An additional objective (e. g. 100x) can be added on request.

ADVANTAGE CAMSIZER M1:
An 18.1 Megapixel color camera captures particle images with excellent resolution for highly accurate analysis results.

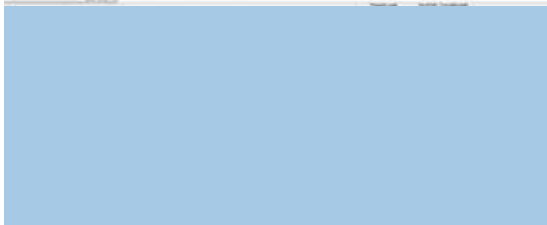
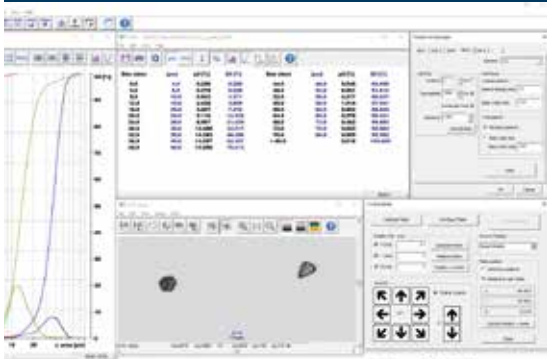
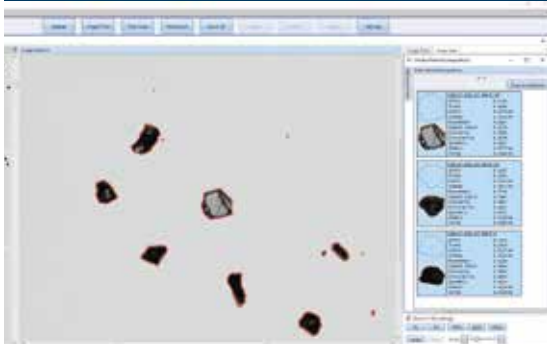
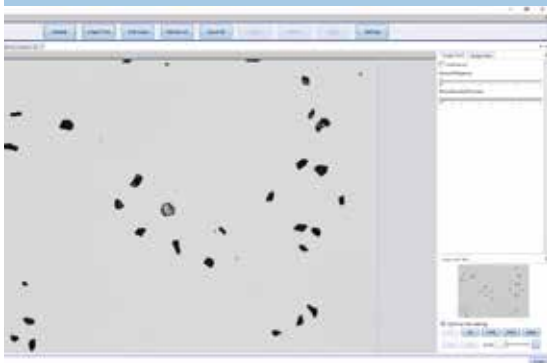
ADVANTAGE CAMSIZER M1:
The sample stage is controlled with a three-axis joystick with four programmable function keys.

ADVANTAGE CAMSIZER M1:
The highly precise sample stage has a wide traversing range of 225 mm x 76 mm with a position accuracy of $<3 \mu\text{m}$ and a positional repeatability of $<1 \mu\text{m}$. Thus, it is possible to analyze an area which corresponds to eight standard object slides.

ADVANTAGE CAMSIZER M1:
The sample can be analyzed in transmitted or incident light. Powerful LED light sources guarantee homogeneous illumination and excellent image quality.

ADVANTAGE CAMSIZER M1:
The highly efficient dispersion module M-Jet ensures perfect preparation of powder samples within seconds.





Intuitive Measurement and Evaluation Software

Detailed analysis and presentation with Particle X-Plorer

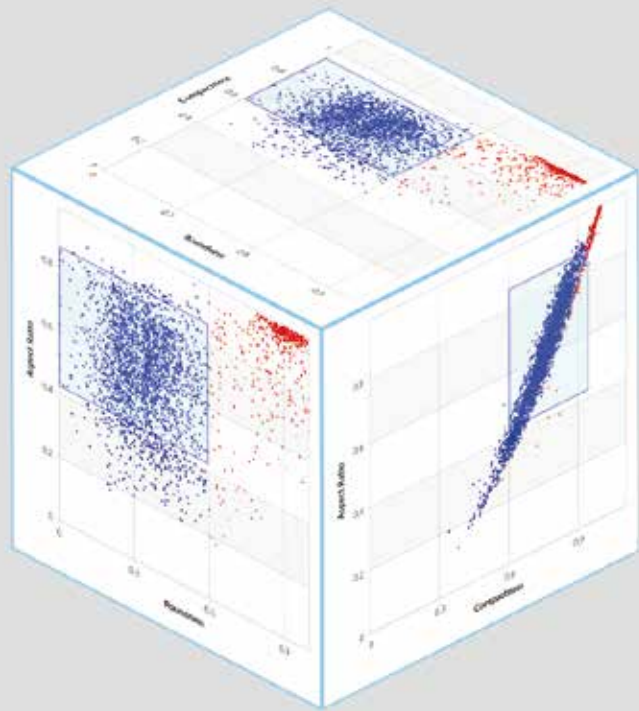
The CAMSIZER M1 software records a variety of different measurement parameters and offers comprehensive evaluation possibilities. The particle size is ascertained based on over 50 different parameters such as maximum or minimum Feret length, chord length or area equivalent diameter.

Available shape parameters include, for example, aspect ratio, circularity, symmetry, roundness and convexity. All measurement and evaluation parameters can be saved as standard operating procedures which makes operation of the CAMSIZER M1 particularly safe and comfortable. The Master Operation allows for automated subsequent analysis of several samples with optimum settings.

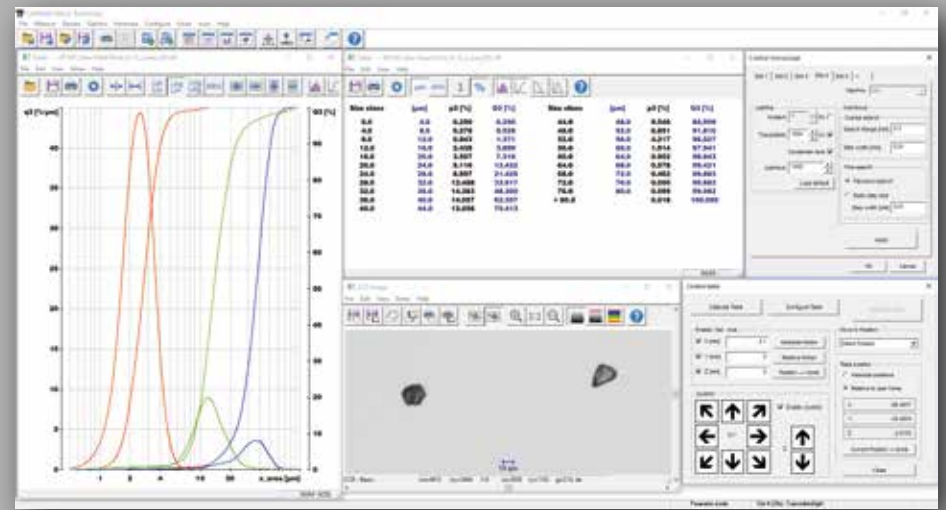
Results are conveniently displayed as diagrams or tables. A newly developed data manager facilitates administration of the measurement data.

A special feature of the software is the integrated Particle X-Plorer which permits detailed evaluation and presentation of all recorded particle images, even after the measurement. Thus, it is easily possible to find and quantify particles with specific properties or combinations of properties.

1

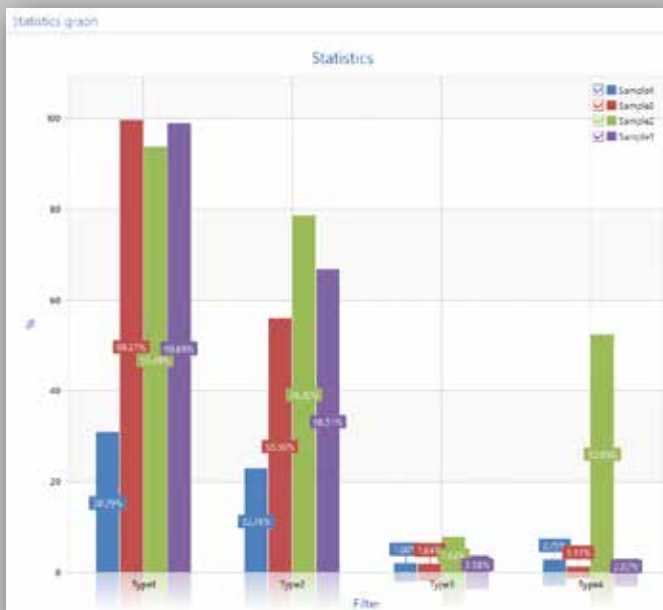


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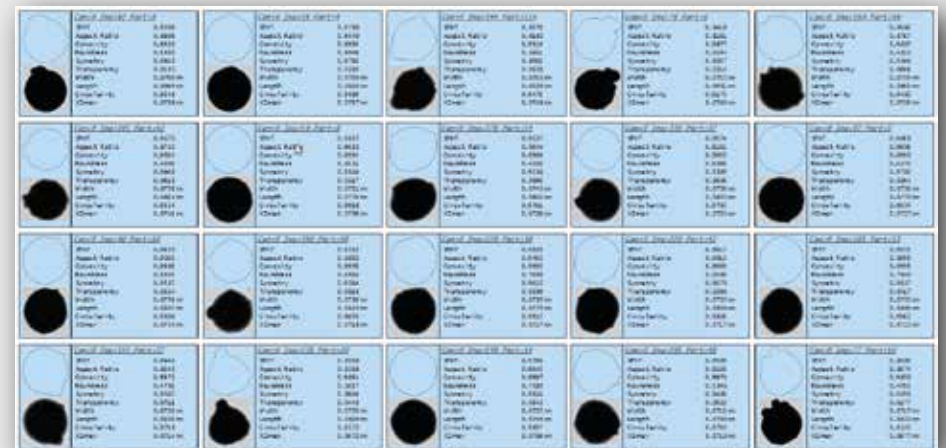


1. Display of particle properties in a „filter cube“ facilitates evaluation
2. Clearly structured and intuitive user interface
3. Statistics function allows to compare different samples
4. Display of particle images and corresponding size and shape values

3



4



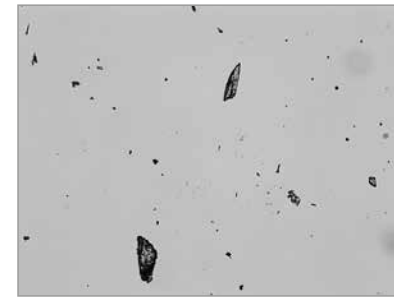
Pharmaceutical ingredients and excipients

The CAMSIZER M1 is perfectly suitable for analysis of pharmaceutical ingredients and excipients. Particle size and particle shape are precisely measured and clearly presented.

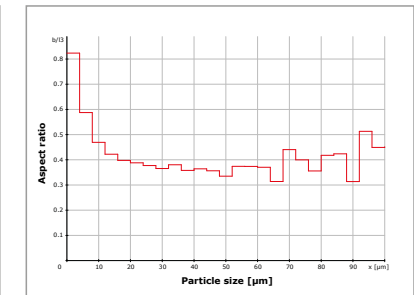
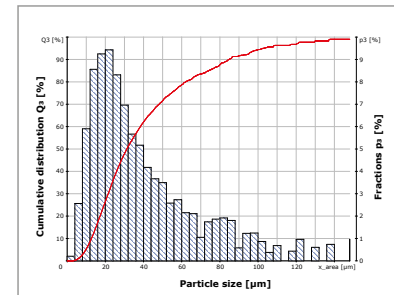
Thus, changes in product quality become immediately apparent.

The example shows the evaluation of a Paracetamol sample. Measuring time: 9 minutes, number of images: 1600, number of measured particles: 160 000.

Analysis of Paracetamol with CAMSIZER M1. Upper left: picture taken with 10x objective, transmitted light. Upper right: the particles on the picture are recognized and all relevant size and shape parameters are identified. Lower left: Clearly structured presentation of the size distribution. Lower right: shape analysis shows the aspect ratio for various particle sizes.

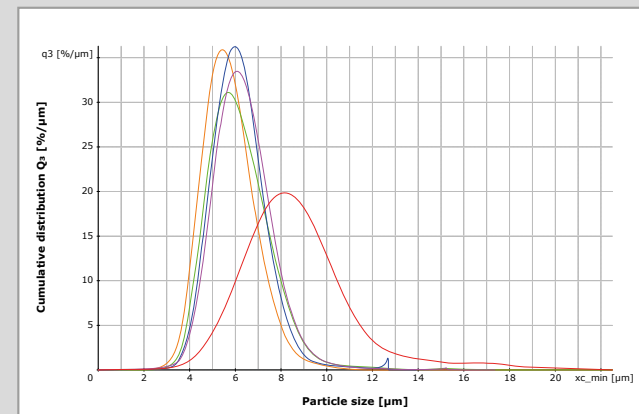


Particle Composition	
Particle ID	Particle Name
1	Paracetamol
2	Paracetamol
3	Paracetamol
4	Paracetamol
5	Paracetamol
6	Paracetamol
7	Paracetamol
8	Paracetamol
9	Paracetamol
10	Paracetamol
11	Paracetamol
12	Paracetamol
13	Paracetamol
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17	Paracetamol
18	Paracetamol
19	Paracetamol
20	Paracetamol



Toner

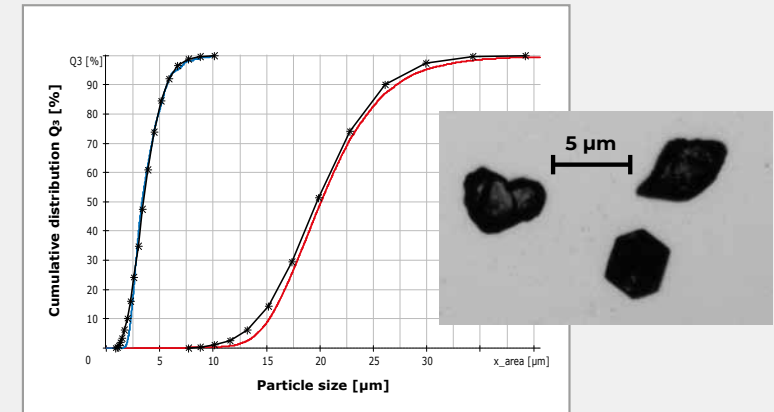
Toner for laser printers usually contains particles sized 5 microns and larger, with a very narrow size distribution. High-resolution image analyzers like the CAMSIZER M1 provide higher accuracy than alternative methods such as laser diffraction which measures particle size indirectly based on the evaluation of a diffraction pattern. Moreover, only imaging methods are suitable for describing the morphology of very small particles.



The example shows the results of measuring five toner samples with the CAMSIZER M1. Four samples have a mean particle size of approx. 6 µm, one sample has considerably larger particles and a wider size distribution.

Industrial Diamonds

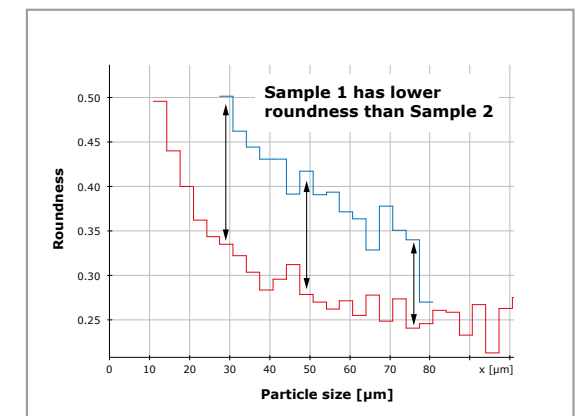
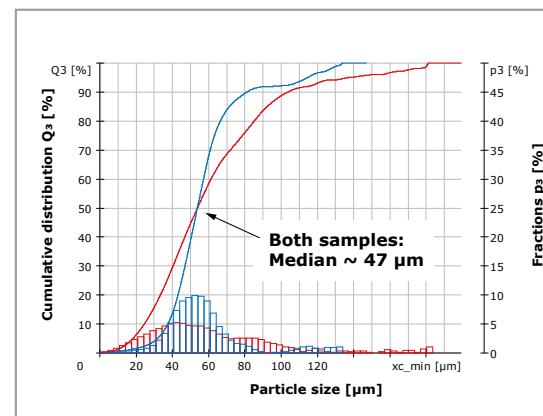
Fine grinding and polishing media consist of, for example, corundum, carbides or industrial diamonds. The relevant standards stipulate the use of sediment analysis for quality control. However, this method is very time-consuming and imprecise. The CAMSIZER M1 is able to generate more exact and comprehensive information which allows for profound evaluation of the material in question.



Size distribution of two industrial diamond samples measured with the CAMSIZER M1. The mean values are 3.1 μm and 20.3 μm. The black curves represent the result of laser diffraction analysis. The size is accurately measured even for the finest particles. High-resolution images illustrate the particle shape.

Polymers

A polymer sample was ground with two different mill types, a rotor mill and a ball mill. Both samples have an almost identical median of approx. 47 μm. However, the size distribution of the ball milled sample is more symmetrical and uniform. The rotor mill produces more fines and more oversized particles. The CAMSIZER M1 analysis also shows that the particles ground in the ball mill are more spherical.



Polymer sample ground in a rotor mill (red curve) and in a ball mill (blue curve). Size distribution (left) and shape parameter „roundness“ (right).



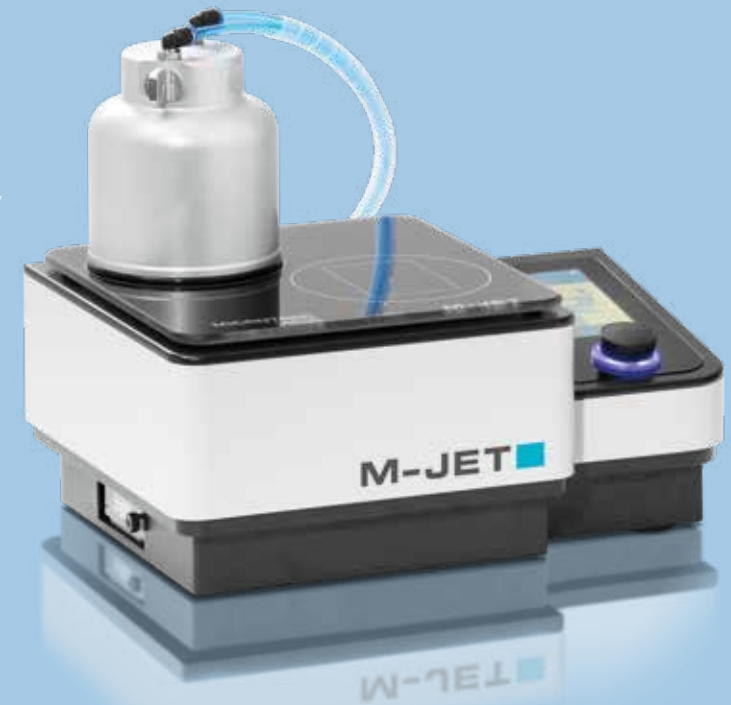
Perfect Powder Dispersion with M-Jet

Efficient sample preparation for microscopic analysis

The new dispersion unit M-Jet ensures optimum sample preparation on various carriers for microscopic analysis. The function principle is based on negative pressure, compressed air supply is not required. Thanks to the unique nozzle geometry even finest powders are effectively separated and distributed uniformly on the object plate.

Benefits at a glance:

- ▶ Dispersion by negative pressure 10 kPa – 70 kPa
- ▶ Variety of dispersion nozzles
- ▶ Storage of eight SOPs possible
- ▶ Comfortable operation via touch pad and control knob





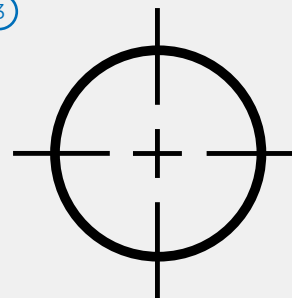
The wide range of accessories available for CAMSIZER M1 provides everything you need for successful particle analysis. Four different sample holders can be quickly and easily inserted into the sample stage and ensure a high degree of flexibility.

- ▶ Holder for eight standard object plates, 76 x 28 mm
- ▶ Holder for four object plates, 76 x 52 mm
- ▶ Glass plate, 147 mm x 313 mm
- ▶ Holder for round filter

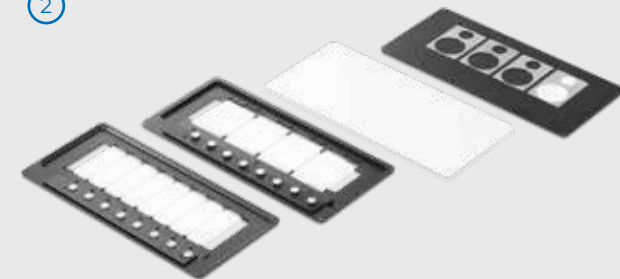
In addition to the standard objectives with magnifications of 2.5x, 5x, 10x, 20x and 50x, one more objective can be used, for example 1.25 or 100x.

1. Easy changing of sample holder
2. Sample holder for Camsizer M1
3. Position calibration
4. Reproduction scale calibration

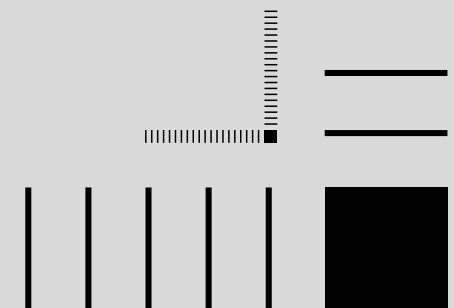
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Static or Dynamic Image Analysis?

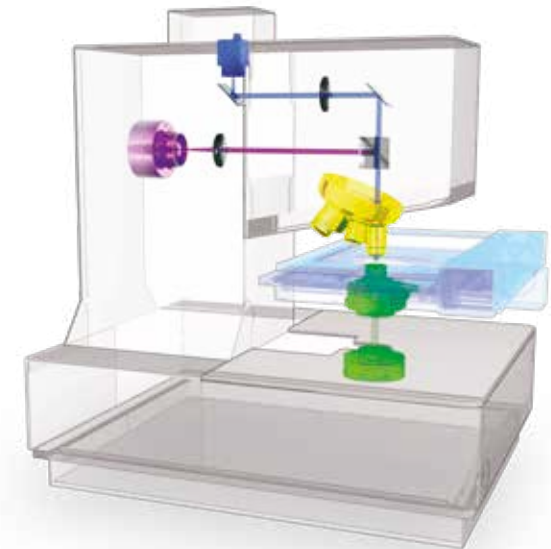
Particle characterization can be performed by Static or Dynamic Image Analysis. For Dynamic Image Analysis (ISO 13322-2), a particle stream is generated which is photographed and evaluated by cameras. Static Image Analysis (ISO 13322-1) is based on microscopy; the particles are placed on an object plate which is photographed step by step. Hence, the difference lies in the particle movement: for Dynamic Image Analysis the particles are captured in motion, for Static Image Analysis, they remain motionless.

Dynamic Image Analysis is ideally suited for routine measurements of bulk goods, powders, granules and suspensions. This method is characterized by high sample throughput, reliability and excellent reproducibility. It is often used as an alternative to conventional sieve analysis.

Static Image Analysis is predominantly used for measuring narrow size distributions with a focus on the characterization of very fine particles. This method provides high resolution and pin-sharp

particle images which allow for size and shape description with utmost accuracy. This technique is widely used in research & development applications.

With the CAMSIZER series Microtrac MRB offers powerful analysis systems for both measurement techniques. We are happy to advise you on which method is best suited for your requirements.



CAMSIZER M1 and M-Jet at a glance

Technical Data

CAMSIZER® M1

Measurement range	0.5 µm – 1500 µm (Stitching algorithm for measuring elongated particles)	
Measurement principle	Static Image Analysis (ISO 13322-1)	
Objective	2.5 x – 5 x – 10 x – 20 x – 50 x (Standard); 1.25 x or 100 x (optional)	
Camera	18.1 MPixel, color	
Max. digital resolution	35 nm	
Sample stage	Precision up to 3 µm / repeatability up to 1 µm	
Illumination	LED / Measurement with transmitted or incident light or both	
Measurement parameters	Particle size	Smallest diameter, length, mean diameter etc.
	Particle shape	Aspect ratio, circularity, symmetry, roundness, convexity etc.
Instrument data Camsizer M1	Dimensions (W x H x D))	450 mm x 540 mm x 550 mm
	Weight (without PC)	45 kg
	Control	PC with Windows 10, programmable Joystick
	Connections	USB 2.0 (analyzer); USB 3.0 (camera)
	Power supply	100 - 230 V / 50/60 Hz
M-Jet dispersion unit	Dimensions (B x H x T)	350 mm x 250 mm x 140 mm
	Weight	approx. 10 kg
	Pressure range	Negative pressure -10 bis -70 kPa

The CAMSIZER M1 is CE-certified and complies with the relevant regulations and standards.



Dynamic Image Analysis

Dynamic Image Analysis (DIA) is a modern, powerful method for the characterization of particle size and particle shape of powders, granules and suspensions.

The analyzers CAMSIZER P4 and CAMSIZER X2 operate based on Dynamic Image Analysis. Thanks to the unique dual camera technology, the two instruments each cover a very wide dynamic measurement range from 20 µm to 30 mm and 0.8 µm to 8 mm respectively. The two cameras share the work: one camera photographs the fine particles, the other records the large particles with high resolution and detection efficiency.

Dynamic Image Analysis is employed in many industries for quality and process control of powders and granules. Thanks to its superior performance, DIA frequently replaces conventional methods such as sieve analysis or laser diffraction.

For more information please visit
www.microtrac.com

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