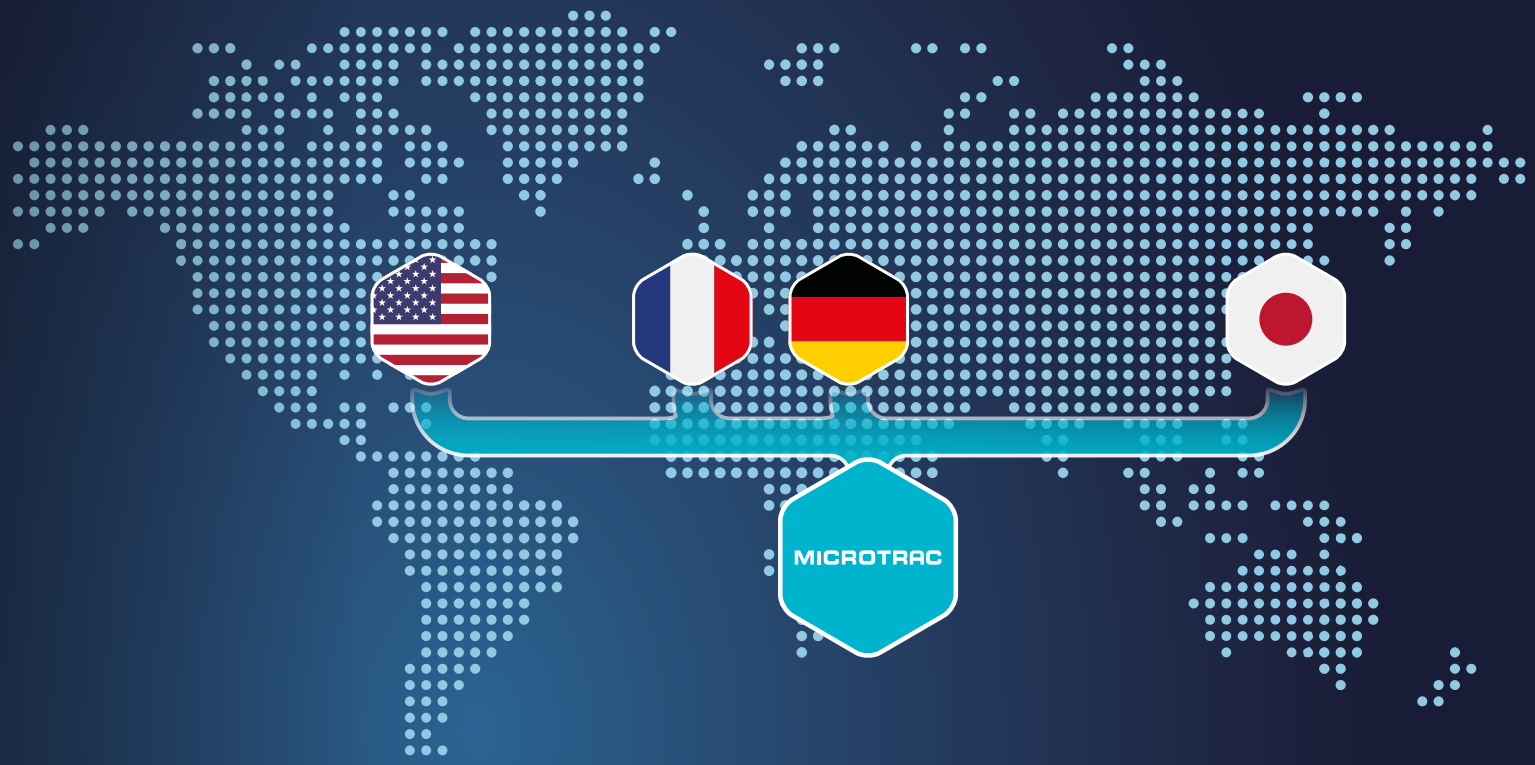
MICROTRAC
a VERDER company

CAMSIZER 3D

PARTICLE SIZE & SHAPE ANALYZER

UNIQUE, PATENTED 3D PARTICLE CHARACTERIZATION WITH DYNAMIC IMAGE ANALYSIS



MICROTRAC

PARTICLE CHARACTERIZATION AT ITS BEST

MICROTRAC is your preferred partner for the comprehensive characterization of particulate systems. We provide our customers with advanced technologies to obtain consistently reliable results. Innovation and quality are at the core of everything we do.

As part of Verder, we provide worldwide support through a network of subsidiaries and distributors.

Three Centers of Excellence

MICROTRAC: A SINGLE-SOURCE SOLUTION PROVIDER FOR PARTICLE CHARACTERIZATION

PARTICLE SIZE & SHAPE FOR PARTICLE ANALYSIS

Size & Distribution

Shape

Our expertise in particle size distribution and shape analysis ensures optimal product quality control and supports advanced research efforts. At the core of our technology are **Dynamic Image Analysis (DIA) used on the Camsizer** and a combination of **Laser Diffraction (LD) and Dynamic Image Analysis used on the SYNC** systems. These two technologies cover all your needs for particle size analysis, ranging from 10 nm to 135 mm, whether for dry or wet samples. Our unique size & shape analysis technology utilizes advanced light scattering, state-of-the-art cameras, and sophisticated computational software to deliver outstanding accuracy and repeatability.

COLLOIDS AND FORMULATIONS CHARACTERIZATION

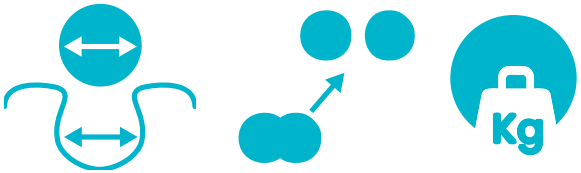
Particle size

Zeta potential

Stability & Shelf-Life

When working with colloids or formulations, the three main parameters to consider are **particle size, zeta potential and stability/shelf-life.** At MICROTRAC, we address all these needs with our comprehensive technology platforms: **NANOTRAC, STABINO, and TURBISCAN**. Our solutions analyze these critical factors to ensure rapid R&D and quality control for the highest product quality. Utilizing **Dynamic Light Scattering (DLS), Static Multiple Light Scattering (SMLS), and Zeta Potential (ZP),** our systems offer unique features such as non-dilution, high accuracy, and fast measurement—enabling you to make fast decisions based on reliable data.

GAS ADSORPTION FOR MATERIALS CHARACTERIZATION



Surface Area & Pore size

Catalysis

Density

We offer advanced solutions for measuring surface area, porosity, and catalytic properties of materials. The MICROTRAC analyzers, celebrated for their precision in **gas and vapor adsorption measurements,** determine BET surface area and pore size distribution for both porous and non-porous materials. These analyzers employ cutting-edge gas adsorption technology and are widely used in various sectors, including Research and Development, Quality Control, and Quality Assurance. These tools are trusted worldwide, reflecting the renowned craftsmanship and quality of Japanese engineering, with comprehensive support provided by our competence centers in Japan (Osaka), Germany (Haan), USA (Newtown, PA) and France (Toulouse). The **BELSORP** and **BELPORE** analyzers are essential for achieving accurate gas and vapor adsorption analysis.

CAMSIZER 3D

THE MOST POWERFUL DYNAMIC IMAGE ANALYSIS

CAMSIZER 3D combines all the advantages of **Dynamic Image Analysis** (ISO 13322-2) in a completely redesigned measuring system, setting new standards in the characterization of bulk solids.

Unique 3D Analysis

Thanks to the extended field of view and long drop distance, each particle is analyzed up to 30 times in different orientations, making the actual three-dimensional particle morphology accessible for analysis. The evaluation of the "3D tracks" also provides much more meaningful shape and volume analysis than ever before.

Proven 2-Camera System

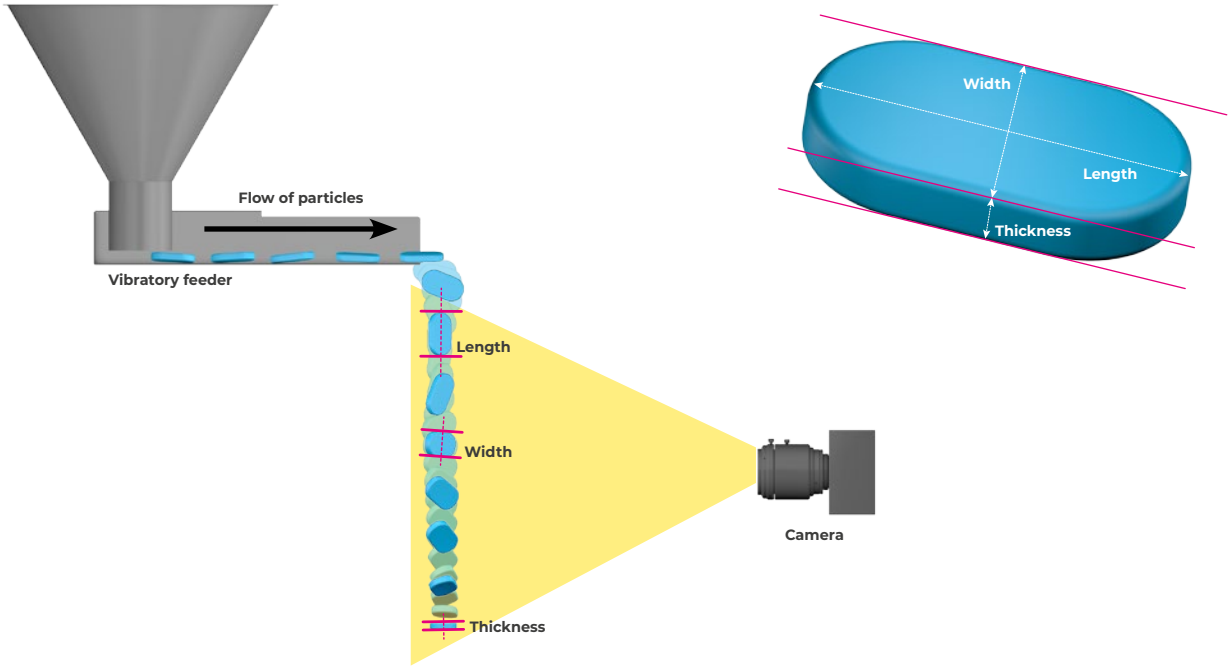
The new ZOOM camera inside the **CAMSIZER 3D** (9 MPixel) allows for the evaluation of fine particles with greater accuracy and precision. In combination with the BASIC camera (5 MPixel), this enables a wide measuring range from 20 µm to 30 mm. **CAMSIZER 3D** is the first choice for the analysis of dry, free-flowing bulk solids in both quality control and for research applications.

Particle Size & Shape Analyzer CAMSIZER 3D

- Patented 3D analysis with "Particle Tracking"
- Up to 30 images of every particle
- Particle size and shape analysis from 20 µm to 30 mm without hardware adjustment
- Short measuring time of 2 to 5 minutes
- High sample throughput
- 100% detection of oversize particles
- Excellent compatibility of results to sieve analysis
- Excellent reproducibility
- Evaluation of up to 250 images / second in real-time (3D mode)
- Powerful, long-life LED light source
- Maintenance-free

PARTICLE SIZE AND SHAPE ANALYZER CAMSIZER 3D

PATENTED METHOD FOR THE DETERMINATION OF PARTICLE MORPHOLOGY



3D PARTICLE ANALYSIS

UNIQUE TRACKING METHOD DETECTS THE TRUE MORPHOLOGY

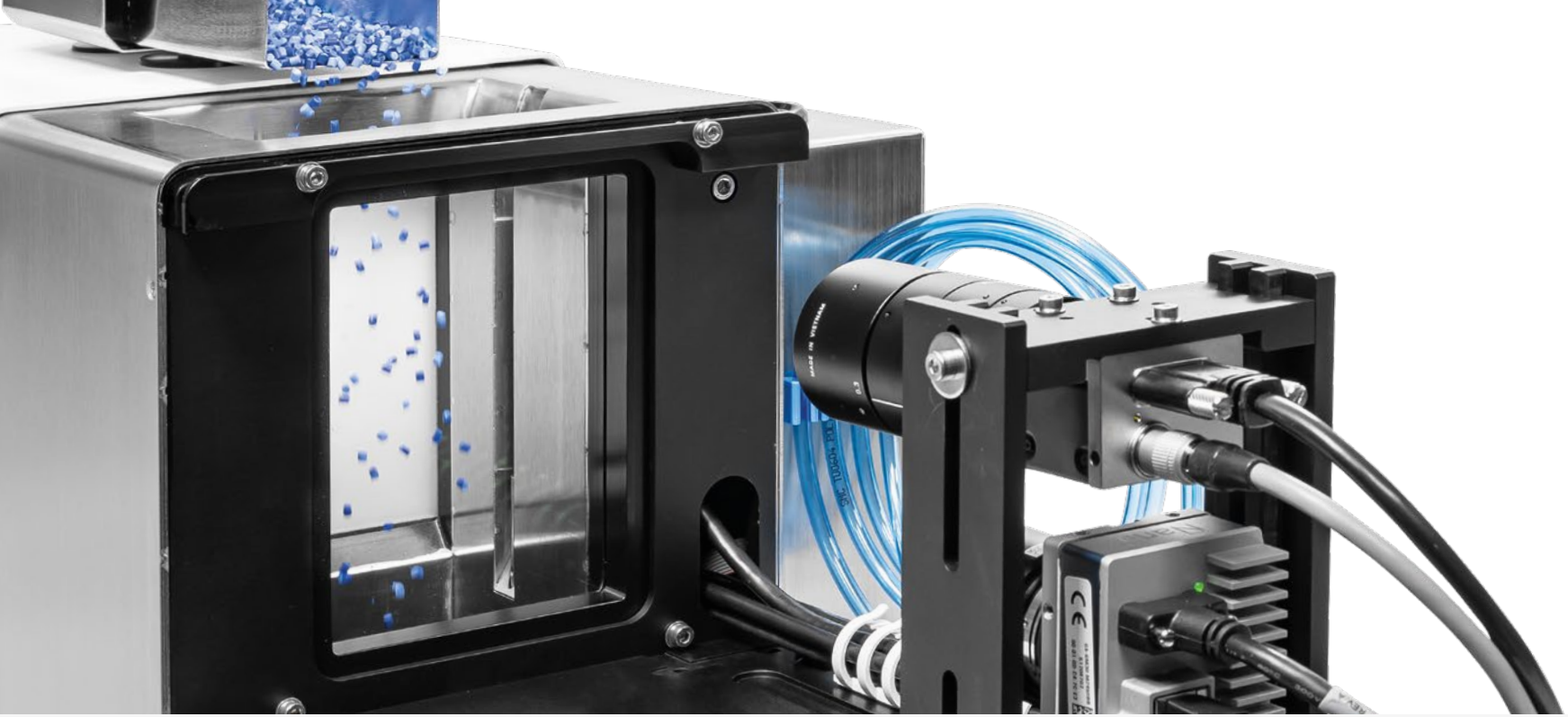
The **CAMSIZER 3D** utilizes a funnel, vibrating feed chute, LED strobe backlighting, powerful high-speed cameras, and sophisticated software to perform the measurements.

The particles travel down the vibrating feeder and fall into the sensing zone, creating a tumbling motion as they fall. The **CAMSIZER** software tracks each particle as it passes between light source and cameras, taking up to 250 images per second. As the particle is tracked, multiple images are recorded, measuring length, width, thickness, perimeter, area and various shape descriptors. The software automatically aligns the images for viewing, with up to 30 images per particle. This creates a "particle track", a sequence of images of the same particle in different orientations. From this, distributions can be calculated, based on one or more size or shape parameters. Filters can be applied to isolate groups of particles of particular interest for more targeted analysis.

In the particle track, the software determines the width and the length of each particle projection:

- the largest value of all length measurements within a particle track is the "3D length" of the particle
- the largest value of all width measurements within a particle track is the "3D width" of the particle
- the smallest value of all width measurements within a particle track is the "3D thickness" of the particle

Thus, for particles with three different dimensions (e. g. almonds), the size distributions of all three dimensions can be output separately.



3D Analysis is particularly advantageous for particles that are supposed to have a specific shape like spheres, rods (extrudates), lenses or ellipsoids (“rugby-ball”-shape). With the 3D tracking technology, each particle inevitably shows a wide variety of projections, which automatically also opens new possibilities in shape analysis.

In contrast, traditional 2D analysis captures only one image per particle in random orientation, even if the particle is measured multiple times at increased acquisition rate, there is no “mapping” of one image to another. Each individual image is treated as a new, independent measurement event. The true length, width, thickness, and shape is obscured by this. Rather, the “length” measured in 2D mode is a mixture between true 3D length and true 3D width; the “width” measured in 2D mode is a mixture between true 3D width and true 3D thickness. Only if the particles can be mechanically aligned, meaningful results are obtained in 2D mode. In the past, however, this was only feasible for some special particle shapes like cylinders.

Measurement in 2D Mode

- Particle size & shape measurement in random orientation
- Suitable for irregularly shaped material, natural products
- Results compatible with sieve analysis

Measurement in 3D Mode

- Separate distribution of length, width, and thickness
- Improved shape analysis
- Excellent detection of defective particles
- More accurate volume calculation

DUAL CAMERA TECHNOLOGY

EXTREMELY WIDE MEASURING RANGE WITH DUAL CAMERA TECHNOLOGY

Features

- 9 megapixel ZOOM camera
- 5 megapixel BASIC camera
- Calibration within a few seconds with certified reference objects
- Wide measuring range without hardware adjustment
- Non-contact and non-destructive measurement
- Dust protected housing
- Rugged construction for use in production environments
- Automatic dust extraction in the measurement chamber to protect the user and the instrument

MICROTRAC's unique dual camera technology is a landmark in the development of Dynamic Image Analysis. By simultaneously employing two cameras with different magnifications, extremely wide dynamic measuring ranges are achieved. This is accomplished without hardware adjustments or modifications and without compromising the accuracy.

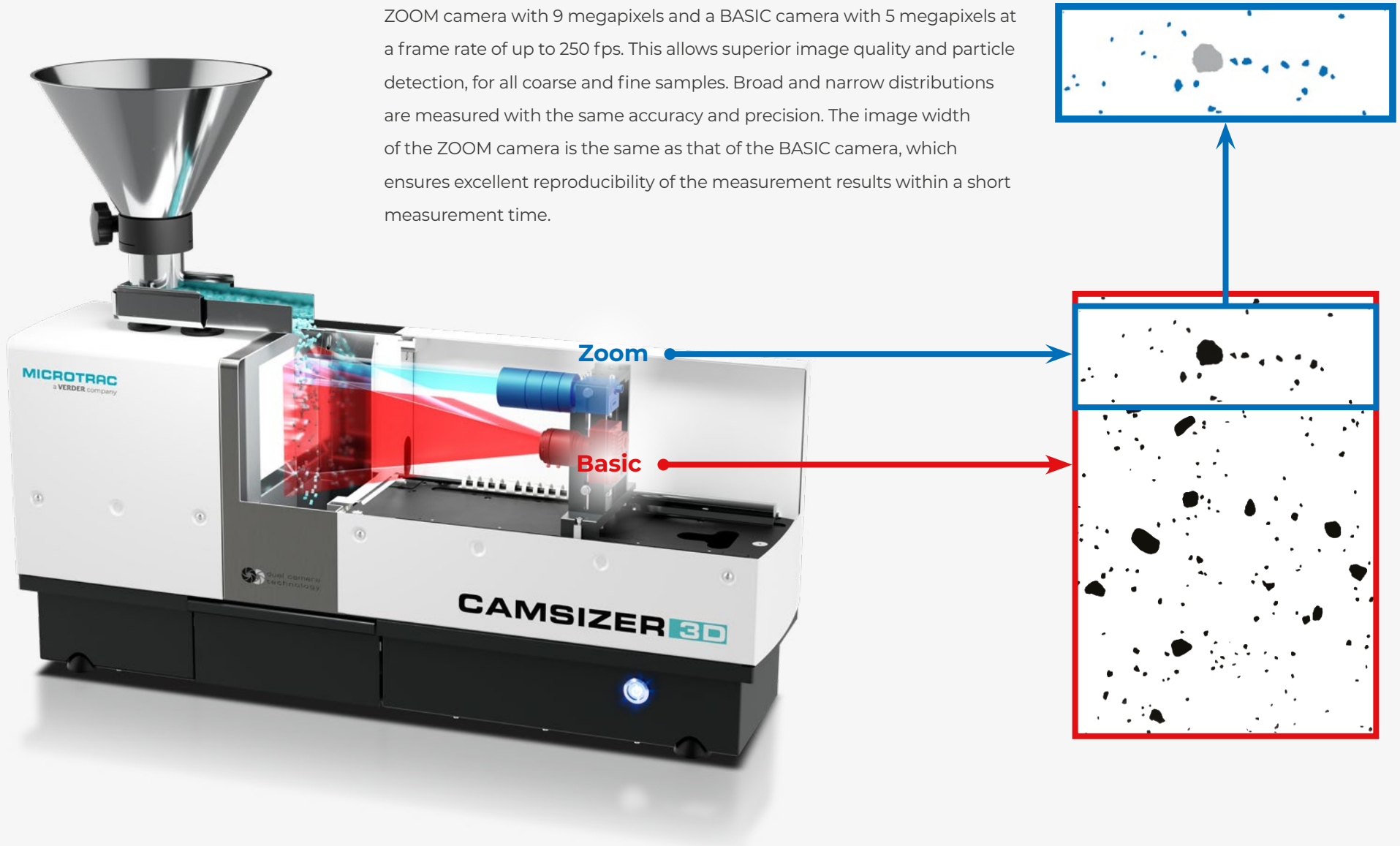
Each camera is specialized for one size range. The ZOOM camera analyzes fine particles with highest resolution whereas the BASIC camera detects the larger particles with excellent statistics. A special algorithm combines the information provided by both cameras, covering a size range of more than three orders of magnitude.

This arrangement resolves a significant drawback of many image analysis systems that employ only one camera, e. g. microscopes. Such instruments either cannot correctly report the fine particles in wide size distributions, or the large particles are not captured reliably due to the small field of view.

dual camera technology

MEASUREMENT PRINCIPLE

Compared to previous **CAMSIZER** models the **CAMSIZER 3D** features a significantly higher camera resolution and frame rate by employing a ZOOM camera with 9 megapixels and a BASIC camera with 5 megapixels at a frame rate of up to 250 fps. This allows superior image quality and particle detection, for all coarse and fine samples. Broad and narrow distributions are measured with the same accuracy and precision. The image width of the ZOOM camera is the same as that of the BASIC camera, which ensures excellent reproducibility of the measurement results within a short measurement time.



DIMENSIONS SOFTWARE FOR CAMSIZER 3D

EVERYTHING IN VIEW FROM START TO FINISH

- Intuitive operation
- Clear arrangement of workspaces
- User-defined report templates
- Comparison of measurement results at a glance
- Newly designed “Particle Viewer” workspace
- Consistent measurement conditions through SOPs
- Automatic testing of product specifications
- Different user levels
- LIMS connection
- 21 CFR part 11 compatible version available

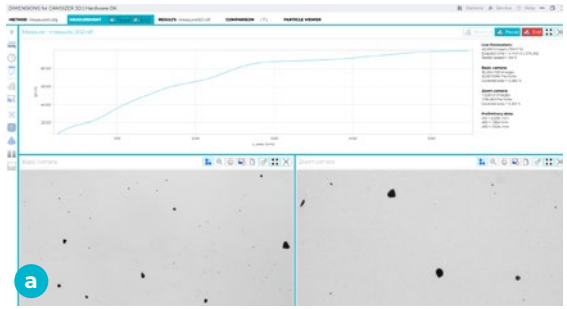
All parameters at a glance: **Dynamic Image Analysis** provides a wealth of information about the sample material at hand. The powerful **DIMENSIONS** software records dozens of parameters on each individual particle and presents the results in a clear, standard-compliant measurement report that can be adapted to individual needs.

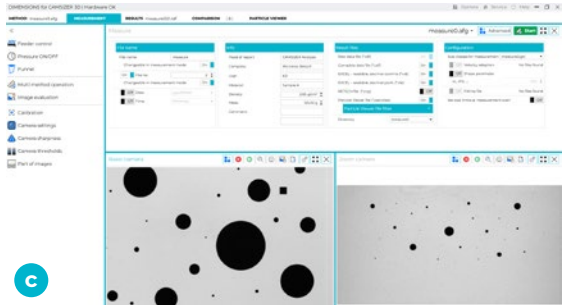
Extensive export functions and the creation of overview tables or trend analyses are naturally included in the software. Product specifications can be saved in the program and automatically checked.

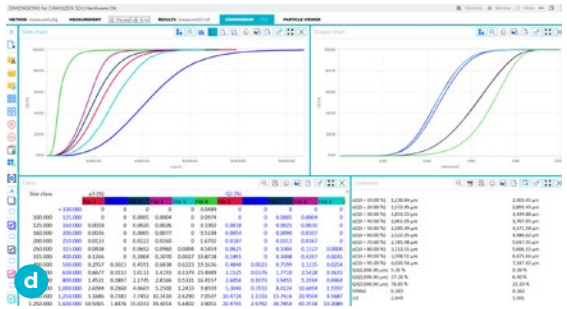
During the analysis, a preview of the measurement result is displayed, as well as live images from both cameras and status information. At the same time, it is possible to evaluate and display measurement results during operation.
DIMENSIONS also includes a simulation mode, that allows you to perform your evaluations conveniently at your desktop PC without having to connect a **CAMSIZER** device.

Untrained operators can carry out standard measurements after only a short introduction. By using different user levels, the measurement settings can be protected against unwanted changes. After the analysis, the recorded particle images are available in the new “Particle Viewer” workspace. This makes subsequent evaluation, which goes beyond pure routine analysis, extremely convenient.

All available 2D and 3D parameters can be displayed for each individual particle. By using custom filters, particles with specific properties or combinations of properties can be found and displayed conveniently.







a. Live preview of images and results during analysis

b. Detailed results overview directly after the analysis

c. Measurement start window showing relevant parameters at a glance.

d. Comparison workspace showing size and shape results of multiple samples.

MICROTRAC

APPLICATIONS

Many properties of bulk solids, such as flowability, dissolution behavior, filtering properties, reactivity, abrasiveness or even taste are decisively influenced by the particle size. Therefore, the determination of particle size distributions is widely used in many sectors and industries and is routinely employed for quality control. The time-consuming and error-prone sieve analysis is still widely used but is increasingly being replaced by dynamic image analyzers of the **CAMSIZER series.** High sample throughput, robustness and automation capability of this technique ensure smooth operation and consistently high product quality. Furthermore, image analysis provides shape information that cannot be obtained by any other measuring method with comparable reliability.

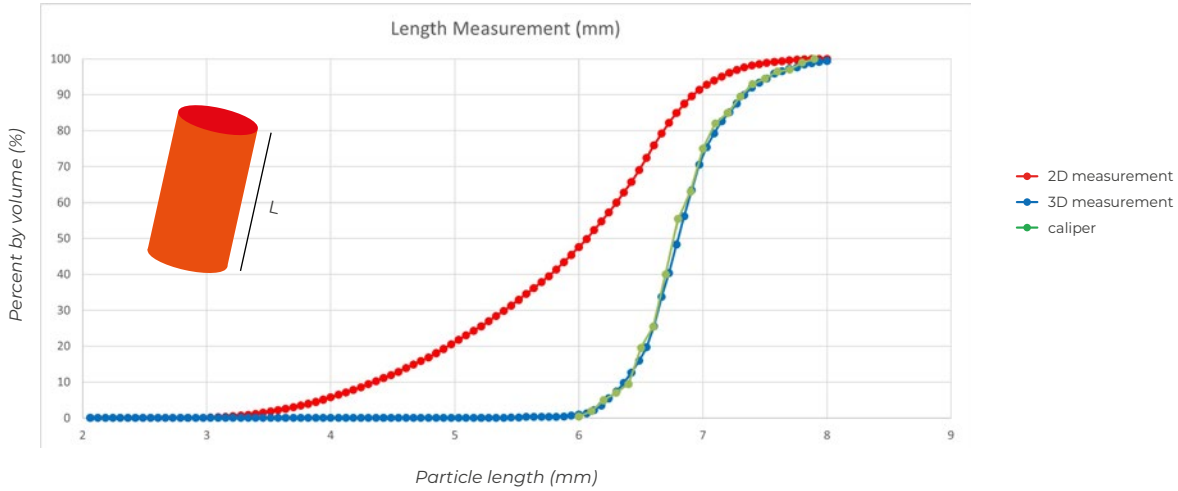
Especially when products with specific geometry are produced, such as extrudates, abrasives, pharmaceutical pellets or fertilizer granules, shape analysis with the **CAMSIZER 3D** provides important measurement data determining the quality of the sample within a few minutes. Another advantage is that the method can be largely automated via automatic sample feeding systems or online connection.

TYPICAL FIELDS OF APPLICATION

- ABRASIVES
- ACTIVATED CARBON
- BUILDING MATERIALS
- CATALYSTS
- CHEMICALS
- COAL / COKE
- EPS
- EXTRUDATES
- FERTILIZERS
- FOODSTUFFS
- GLASS / REFLECTIVE BEADS
- PHARMACEUTICALS
- POLYMERS
- REFRACTORY PRODUCTS
- SALTS
- SAND & GRAVEL
- SUGARS
- SUPERABSORBENTS
- SUPPORTING AGENTS (PROPPANTS)
- WOOD CHIPS
- ... AND MANY MORE

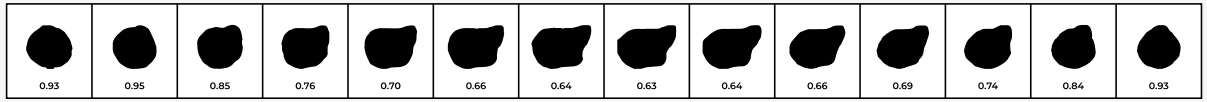
PRECISE LENGTH MEASUREMENT
EXTRUDATES

With the patented 3D particle measurement, the length distribution of extrudates can be determined accurately. A rod-shaped ceramic extrudate with a length of 6-8 mm was measured in 3D mode, in 2D mode and with a caliper. The result shows that the 3D length corresponds to the result of the caliper, but the 2D length gives a distribution that is “too short”. Thus, the 3D image analysis is as accurate as the caliper measurement but characterizes a significantly larger number of particles in a fraction of the time.

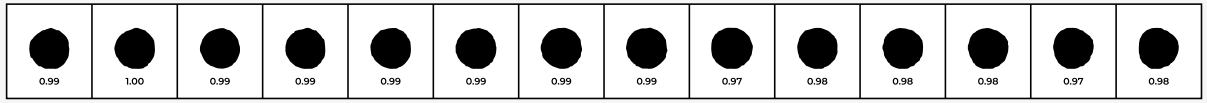


IDENTIFICATION OF DEFECTIVE PARTICLES
FERTILIZER

Particle size and shape are important parameters for the quality of fertilizers. During the granulation process the pellets will be shaped as nearly spherical particles. A non-optimal process will first be recognized by a change in particle shape as the granulate will be ellipsoidal rather than spherical. The diameter will stay the same and it will not be reported in the standard sieve analysis. By measuring the roundness and aspect ratio the **CAMSIZER 3D** will detect even the smallest changes in product quality.



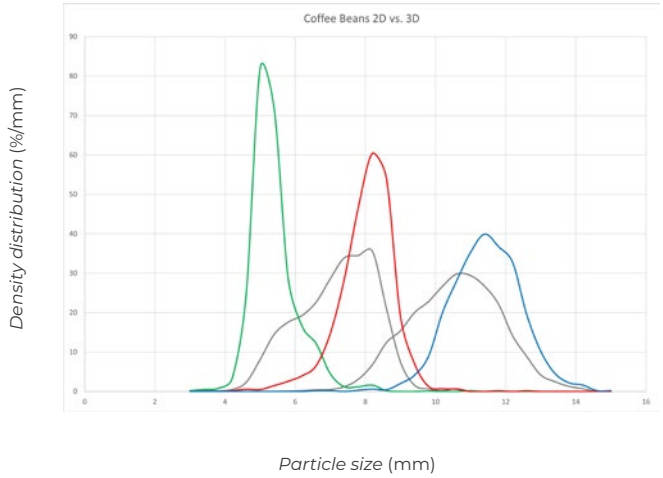
Non-spherical fertilizer pellet showing true shape on several images of the track, but also some circular projections.



Spherical fertilizer pellets: Circular projection on every image of the 3D track.

THE POWER OF 3D ANALYSIS
COFFEE BEANS

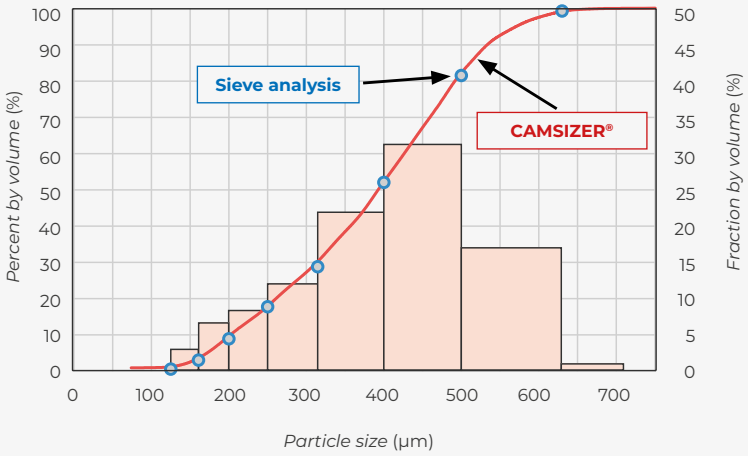
Many natural or man-made particles have three clearly distinguishable main axes. These include extrudates, pellets, or even almonds and coffee beans. The example shows the comparison of the length, width, and thickness measurement of a sample of coffee beans. For each size definition, the correct distribution is displayed. In comparison, the 2D length measurement is “too short” and the 2D width measurement is a mixture of the true thickness and true width. Consequently, the true thickness / length ratio of the 3D measurement is smaller and more narrowly distributed than the aspect ratio in the 2D analysis.



Particle size distribution of a sample of coffee beans.
— 2D width — 2D length — 3D thickness — 3D width — 3D length

CAMSIZER 3D REPLACES SIEVE ANALYSIS
SUPERABSORBENT POLYMERS

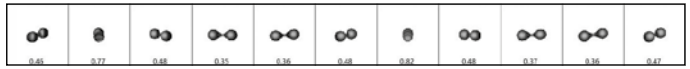
Superabsorbent polymers can absorb large amounts of a liquid relative to their own mass. They are used in granular form, for example in baby diapers as a drying agent. Particle size is an essential quality criterion with a distribution that is usually between 100 µm and 1000 µm. Small particle size equals high specific surface area, hence faster liquid absorption. The specifications are typically based on classic sieve analyses. The **CAMSIZER 3D** delivers 100 % equivalent results and can fully replace this established but time-consuming and error-prone technique.

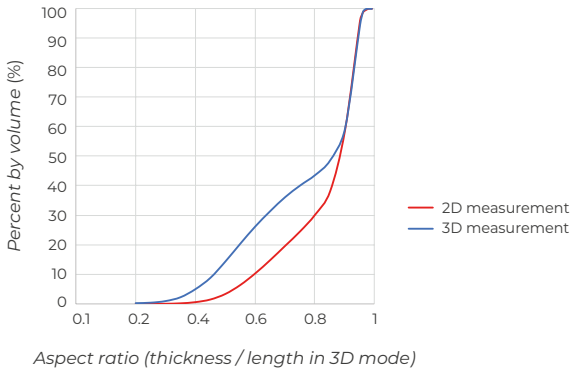


Comparison of **CAMSIZER** and sieve data for Superabsorber granules showing the excellent agreement between the two methods.

SHAPE ANALYSIS OF REFLECTIVE BEADS
GLASS BEADS

Glass beads are used, for example, in road markings to ensure traffic safety using high retro-reflectivity beads . Fused or deformed beads reduce the reflectivity, thus harming the product quality. The **CAMSIZER 3D** can measure the percentage of defective beads with better accuracy than conventional 2D detection because 2D only measures one random orientation, in which the true morphology of the particle can be obscured. The graph shows the distribution of the aspect ratio of a glass sample in 2D mode and in 3D mode. In the 3D measurement, more elongated particles are detected because each glass bead is examined from different angles which leads to a difference of 17% in this case.

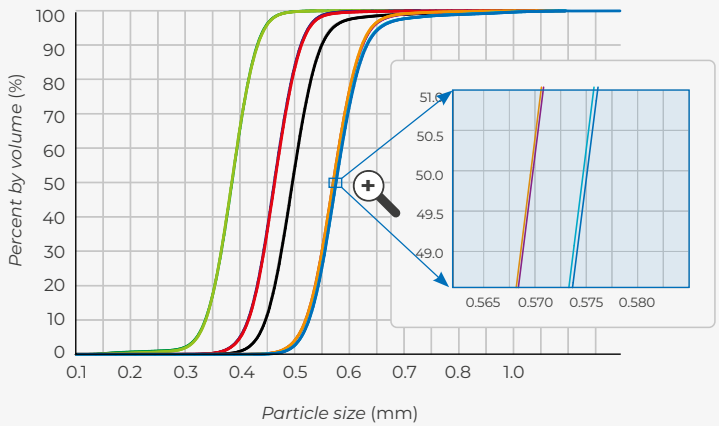




The 3D track shows two fused beads with an aspect ratio between 0.82 and 0.35 depending on the orientation. 3D analysis detects the true shape of particles from multiple projections and allows more accurate shape analysis.

HIGH RESOLUTION SIZE MEASUREMENT
PHARMACEUTICAL GRANULES & PELLETS

The **CAMSIZER 3D** is ideally suited to characterize the growth of granules and pellets, i.e. in a granulation process. The results provide information about the thickness and homogeneity of coatings, dust fractions or oversized particles (agglomerates). This information is the basis for the prediction of such complex parameters as the release rate of an active pharmaceutical ingredient (API) from the granule in the human body. The example shows the initial material (green) and four coating steps (two repeated measurements for each). Even the last process step with a coating thickness of only 2.5 µm is reliably detected thanks to the extremely high reproducibility.



Coating differences of only 2.5 µm can be detected reliably.

PARTICLE SIZE AND SHAPE ANALYZER CAMSIZER 3D

ACCESSORIES AND OPTIONS

AUTOSAMPLER

The Autosampler is a fully automatic sample feeding system for the **CAMSIZER 3D** which can be easily retrofitted to existing instruments. It processes up to 14 samples (extendable to 40 samples or more) in a row without the need for the operator's intervention. The correct measurement settings can be read from the barcodes on the sample beaker. The Autosampler is suitable for continuous operation.

CALIBRATION RETICLE

A certified reference object is available for the CAMSIZER 3D, which allows the user to calibrate the device in a few seconds. This object is a glass pane that is inserted precisely into the measuring zone. Circles of various sizes are lithographically applied to the calibration reticle. The reproduction scale of the cameras is determined by measuring the circles. After completion of the calibration process, a protocol can be printed to document the proper condition of the **CAMSIZER 3D**.

AUDIT TRAIL MANAGER

The Audit Trail Manager is a software extension that enables operation in accordance with the specifications of the 21 CFR part 11. This standard is particularly relevant in the pharmaceutical industry and its suppliers. The program option offers extensive user administration with various access levels and logs all processes in an encrypted database, the Audit Trail. Measurement results can be electronically signed for quality assurance.

FEEDER AND FUNNEL KITS

Different chutes and funnel sets are available for the **CAMSIZER 3D**, which are suitable for different sample volumes and particle size ranges. In 3D mode, the width of the feeder has an influence on the number of particle images in the 3D tracks, as narrower chutes enable a higher acquisition rate due to the reduced image size. However, the use of a narrow chute increases the measurement time. MICROTRAC will be happy to advise you on the selection of the most suitable configuration for your application.

GUIDANCE SHEETS

Guidance sheets are devices that channel the sample flow before it enters the measurement zone. This can be advantageous, for example, if particles jump on the chute due to their mechanical properties. The guidance sheet prevents the particles from being thrown over the measuring shaft and guides them into the focal zone. Guidance sheets also provide protection from air currents that could cause unwanted turbulence in the measurement zone.

SAMPLE SPLITTERS

Any measurement is only as good as the sampling and sample preparation that preceded it. Particularly in the case of flowable bulk solids with a broad distribution, segregation will occur and lead to a wrong distribution of particle sizes in the sample aliquot. By using a sample divider, representative subsamples can be easily generated, guaranteeing a representative and meaningful result. MICROTRAC strongly recommends riffle splitters and rotary sample dividers from RETSCH, also part of the Verder Group.

ADDITIONAL SOLUTIONS

FURTHER PARTICLE SIZE & SHAPE ANALYZERS

CAMSIZER XL

- For large particles up to 135 mm
- 3D analysis available
- Particularly suitable for harsh industrial environments

CAMSIZER ONLINE

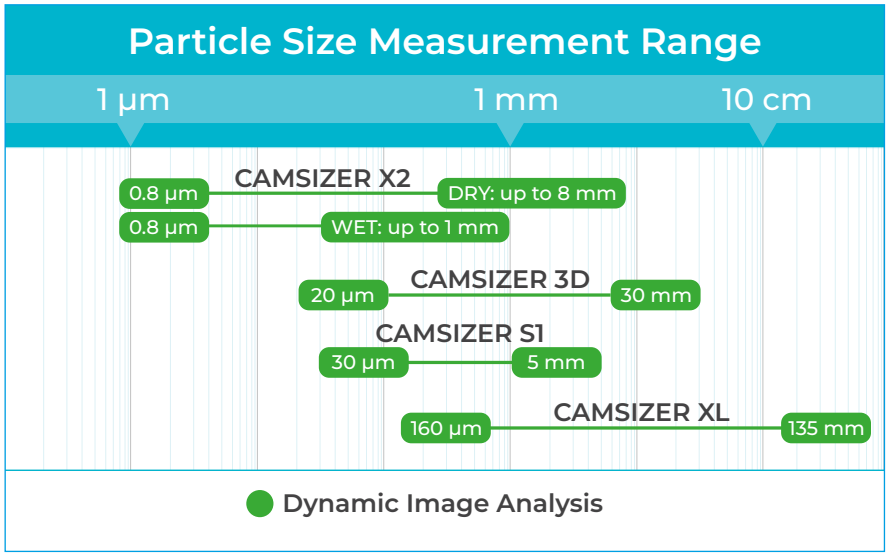
- For production-related use
- Also available as XL version
- Continuous process monitoring

CAMSIZER X2

- Measuring range 0.8 µm – 8 mm
- For powder samples
- Wet measurement available

CAMSIZER S1

- Measuring range 30 µm – 5 mm
- 12-Mpixel camera
- Optimized for quality control

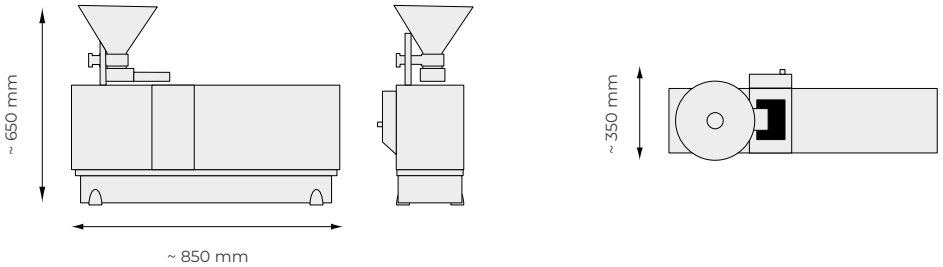


CAMSIZER 3D

TECHNICAL DETAILS

SPECIFICATIONS AT A GLANCE

Measuring principle	2D and 3D Dynamic Image Analysis according to ISO 13322-2
Measurement range	recommended range 20 µm to 30 mm (with no hardware adjustment)
Parameters	particle size, shape, volume, density, transparency and number
Camera	Dual Camera Technology, 9 MP + 5 MP; up to 250 images per second
Measuring time	approx. 2 to 5 min (depends on required measurement statistics)
Software	**Microtrac DIMENSIONS**
Dimensions (H x W x D), weight	850 (W) x 650 (H) x 350 (D) mm, approx. 40 kg
CE certified	yes



AUTOSAMPLER

Compressed air supply	6 to 8 bar
Compressed air consumption	max. 10 l/min
Instrument data	dimensions (H x W x D): approx. 900 x 1450 x 490 mm weight: approx. 60 kg
Sample feed	14 samples can be placed on the conveyor belt simultaneously (opt. up to 40 samples), for unattended operation, continuous operation is possible, sample feed by electro-pneumatic robot arm, emergency stop-button

APPLICATIONS

Scope and purpose	rapid and exact particle size and shape analysis of all dry, flowable bulk materials and powders
Sample material	abrasives, catalysts, chemicals, coffee beans & freeze-dried coffee, construction materials, coal / coke, fertilizer, food granulate, glass / ceramics, silicon granulate, pesticides, pharmaceutical pellets, plastic pellets and granules, proppants, refractory products, salt / sugar, sand, washing powder, wood chips and many more

MICROTRAC
a VERDER company

Microtrac Inc.
3230 N. Susquehanna Trail
York, PA 17406 · USA

Phone: +1 888 643 5880
marketing@microtrac.com

MicrotracBEL Corp.
8-2-52 Nanko Higashi, Suminoe-ku
Osaka 559-0031 · Japan

Phone: +81 6 6655 0360
info@microtrac-bel.com

Microtrac Retsch GmbH
Retsch-Allee 1-5
42781 Haan · Germany

Phone: +49 2104 2333 300
info@microtrac.com

Microtrac Formulaction SAS
5 rue Paule Raymondis
31200 Toulouse · France

Phone: +33 (0)5 62 89 29 29
contact.fr@mtf.verder.com

www.microtrac.com

VERDER

ENABLING PROGRESS

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CARBOLITE
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