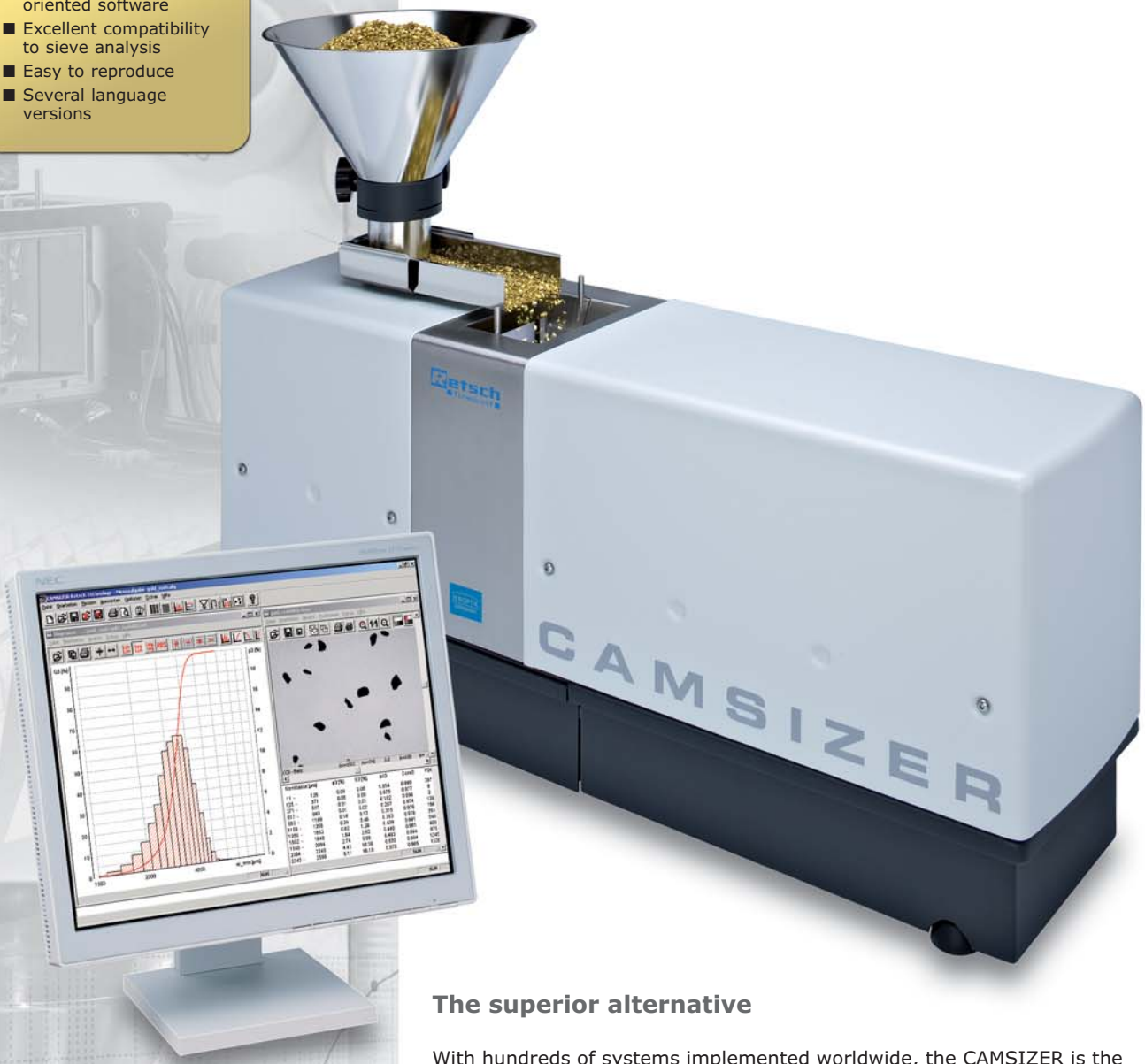
NEW FEATURES

- 100% higher resolution
- New LED-stroboscope light source with 20 times higher intensity
- Extreme depth of sharpness
- Improved shape and size analysis across the entire measuring range
- Optimised, process-oriented software
- Excellent compatibility to sieve analysis
- Easy to reproduce
- Several language versions

CAMSIZER®

Particle analysis with digital image processing



The superior alternative

With hundreds of systems implemented worldwide, the CAMSIZER is the most successful instrument for particle size and particle shape measurement of dry, pourable bulk materials using dynamic digital image analysis. Due to the wide measuring range from 30 µm to 30 mm and the sophisticated sieve correlation, the CAMSIZER is a high-performance alternative to traditional sieve analysis.

The main fields of application of the CAMSIZER are to be found in quality control, research and production monitoring. It is possible to partially or completely automate the measuring procedure making continuous sample analysis achievable with substantial economic benefits.

Retsch® TECHNOLOGY

Solutions in Particle Sizing

The CAMSIZER® system

Particle size and particle shape analysis

The CAMSIZER has been developed to comprehensively characterise dry, pourable bulk materials. For example, whereas traditional sieve analysis can only determine the approximate particle size, the CAMSIZER simultaneously determines both the particle size and shape – very detailed and at a high resolution. The CAMSIZER is the result of cooperation between Retsch Technology GmbH, Haan and Jenoptik AG, Jena.

100% Quality control

The CAMSIZER is a time and cost-saving alternative whenever permanent quality assurance is demanded during production, immediate checks on incoming and outgoing goods are required or meaningful laboratory measurements are to be made on a wide range of different samples. Typical examples of applications are:

- Salt/sugar
- Plastics
- Catalysts
- Abrasives
- Carbon products
- Sand
- Carbon black/coal
- Coffee
- Refractory products
- Foodstuffs
- Polystyrene
- Glass/ceramics
- Fertilisers
- Drugs
- Metal powder

The robust construction and interference-proof measuring principle of the CAMSIZER allow operation even under rough industrial conditions. Therefore, Retsch Technology also supplies online versions for the continuous monitoring of production processes.

Unique design

Patented measuring method with 2 adaptive full-frame matrix cameras

- Maximum resolution
- Extremely large dynamic measuring range
- Complete and therefore exact particle recording with each digital image

Software-controlled Venturi air flush

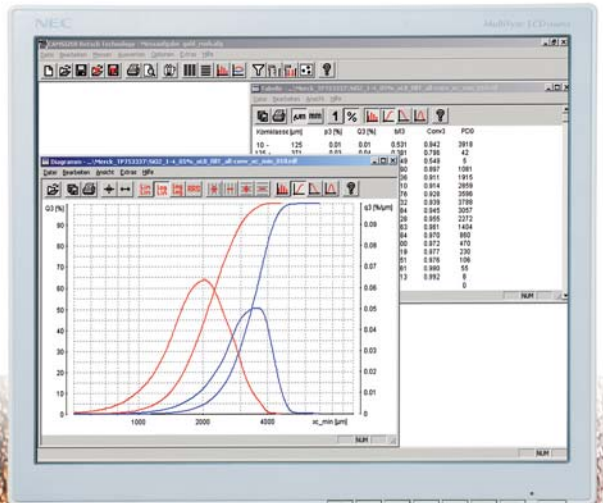
- Avoids instrument contamination even with very dusty samples
- Optimal particle focusing
- Representative measurements even with strongly varying densities and particle sizes

Certified calibration standard

- High degree of measuring accuracy and reliability with more than 50 reference objects
- Calibration throughout the whole measuring range
- Compatibility with national and international standards and other measuring methods

CAMSIZER® versus sieve analysis – maximum benefits from minimal effort

	Effort	Results	Benefits/Advantages
Sieve analysis	■ Assemble sieve tower ■ Weigh/tare sieves ■ Feed in sample material ■ Start sieving ■ Weigh fractions ■ Evaluate ■ Clean sieves	**Analysis** ■ Particle size distribution from a few sieving fractions ■ Sample fractioning ■ High reproducibility ■ Established measuring method	**Effects** ■ Further analysis of individual fractions possible ■ Wet sieving possible
CAMSIZER®	■ Feed in sample material ■ Start measurement ■ Remove sample material	**Analysis** ■ Detailed particle size analysis ■ Simultaneous analysis of the particle shape and volume ■ Highest degree of accuracy and reproducibility ■ Very fast: results in real time ■ Avoidance of random errors by extremely simple handling	**Effects** ■ Drastic reduction in the amount of work and time ■ Automatic, individual evaluation of size, shape, density, transparency and number ■ Contact-free and therefore nondestructive analysis ■ Online measurement is the best possible process and quality monitoring ■ Self-cleaning and almost wear-free ■ Can be recalibrated in seconds



The measuring procedure of the CAMSIZER is fully automated to prevent random errors. Manual operating steps are reduced to filling the hopper and removing the material.

The CAMSIZER is virtually maintenance-free. Continuous air flushing of the optical components together with the contact-free measuring procedure ensure convenient work.

The patented CAMSIZER® principle

From 30 µm to 30 mm: accurate – quick – reliable

The innovative CAMSIZER measuring system is based on the digital image processing principle. The bulk material flow falls between light source and cameras. The particles are optically recorded, digitised and processed in the connected computer.

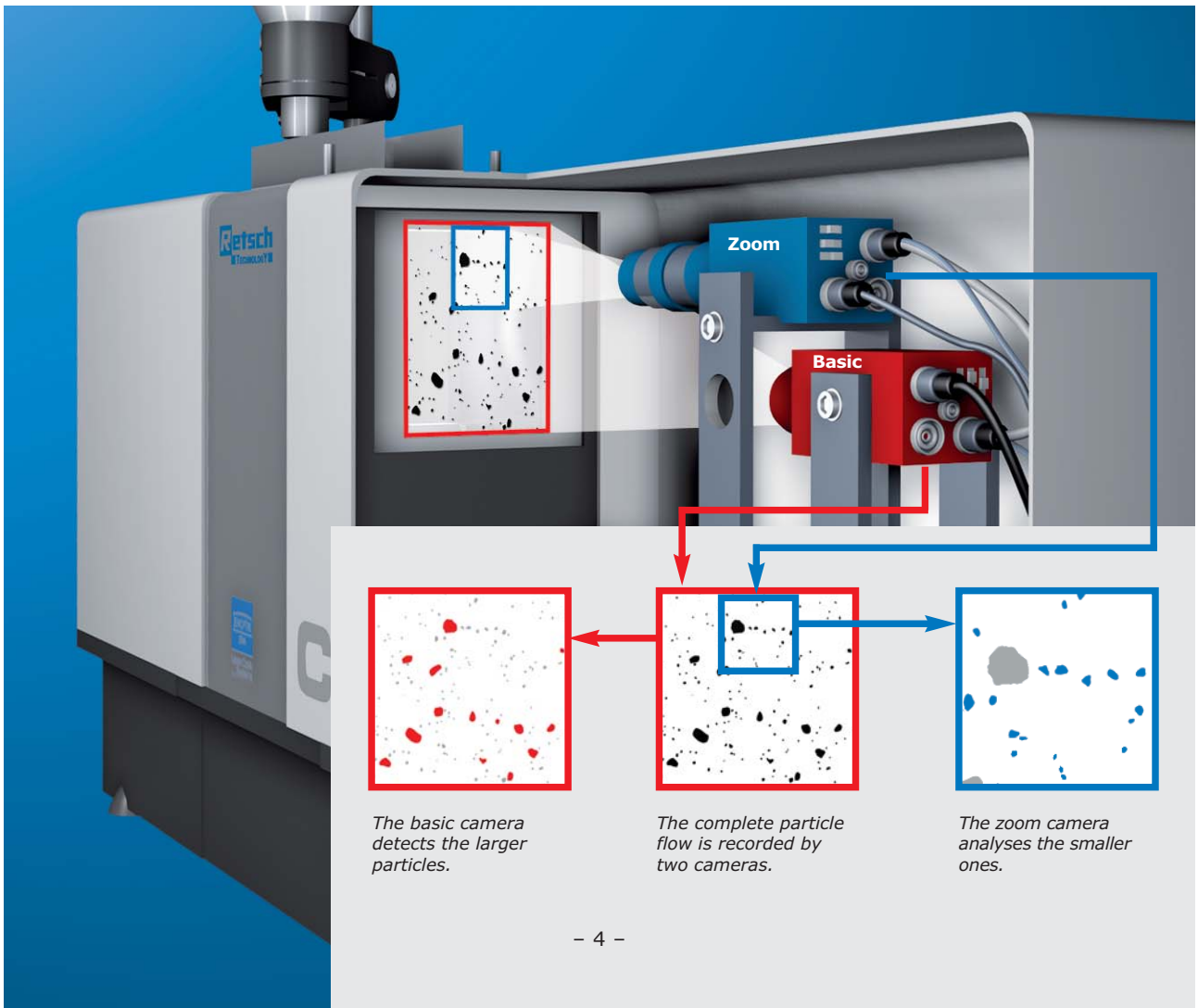
Simultaneous analysis of number, size and shape

The patented measuring setup of the CAMSIZER – two digital cameras as an adaptive measuring unit – improves and optimises particle analysis by digital image processing. Therefore, it is possible to measure a wide range of particles from 30 µm to 30 mm with extreme accuracy, **without having to switch measuring ranges or make adjustments**.
The sample is fed in from the feed channel so that all particles fall through the measurement field. During the measurement procedure the two digital cameras (CCD) perform different tasks. The basic camera (CCD-B) records large particles, the zoom camera (CCD-Z) records the small ones. The contact-free optical measurement is carried out in real time and simultaneously obtains all the required information about particle size and particle shape.

A modularly configurable online version of the instrument has been developed to allow automated measurements to be conducted continuously.

Maximum resolution

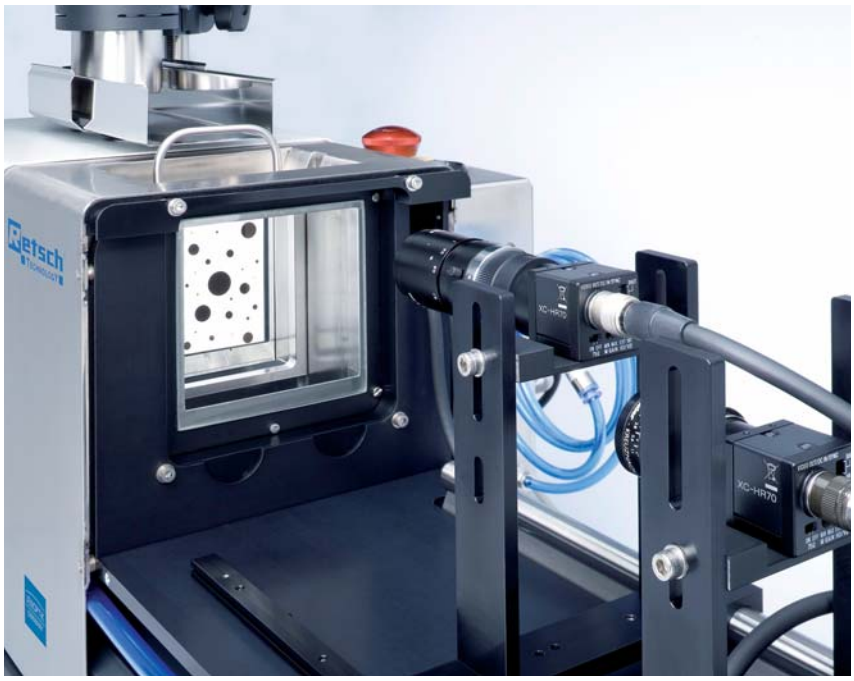
The resolution capacity of the CAMSIZER lies in the micrometre range. This means that detailed studies are easily possible even on very narrow and multi-modal particle size distributions. After the digital images have been processed electronically, the analytical results are saved in more than 1,000 size classes according to the density of information. The user can define the size class to be shown conveniently and individually according to the features that are relevant to the particular sample.



The basic camera detects the larger particles.

The complete particle flow is recorded by two cameras.

The zoom camera analyses the smaller ones.



Quick analysis of representative samples

The sample amount can vary from grams to kilograms per minute. The size range being analysed is an important factor. For small particle sizes a very small amount of the sample may be adequate.
The feed hopper has a capacity of 3.5 litres but for a CAMSIZER measurement there is no limit to the maximum sample volume.
With the 75 mm feed chute, the measurement field is used to full capacity which helps to measure very big particles. Therefore, a high sample throughput is guaranteed.
By using two cameras the highest possible resolution is achieved over the entire measuring range. No adjustment of the instrument is required.
Depending on the sample and the particular requirements, a measuring time of approximately 3 minutes is typical. This means that real-time monitoring of the production process is possible at any time.

LongLife light source

The high intensity of the CAMSIZER's new LED strobe light source (90 Hz) allows for extremely short exposure times and very sharp images with optimum depth of sharpness and strong contrast. In this way the CAMSIZER ensures precise shape analyses even of very fine particles. After each measurement the light source is switched to the standby mode, which enables a service life of almost 20 years of the light source.

Auto adjustment

The automatic height adjustment of the filling hopper guarantees correct feeding of the sample and eliminates manual working steps. This enables the CAMSIZER to provide measuring results with excellent reproducibility.

Certified calibration standard

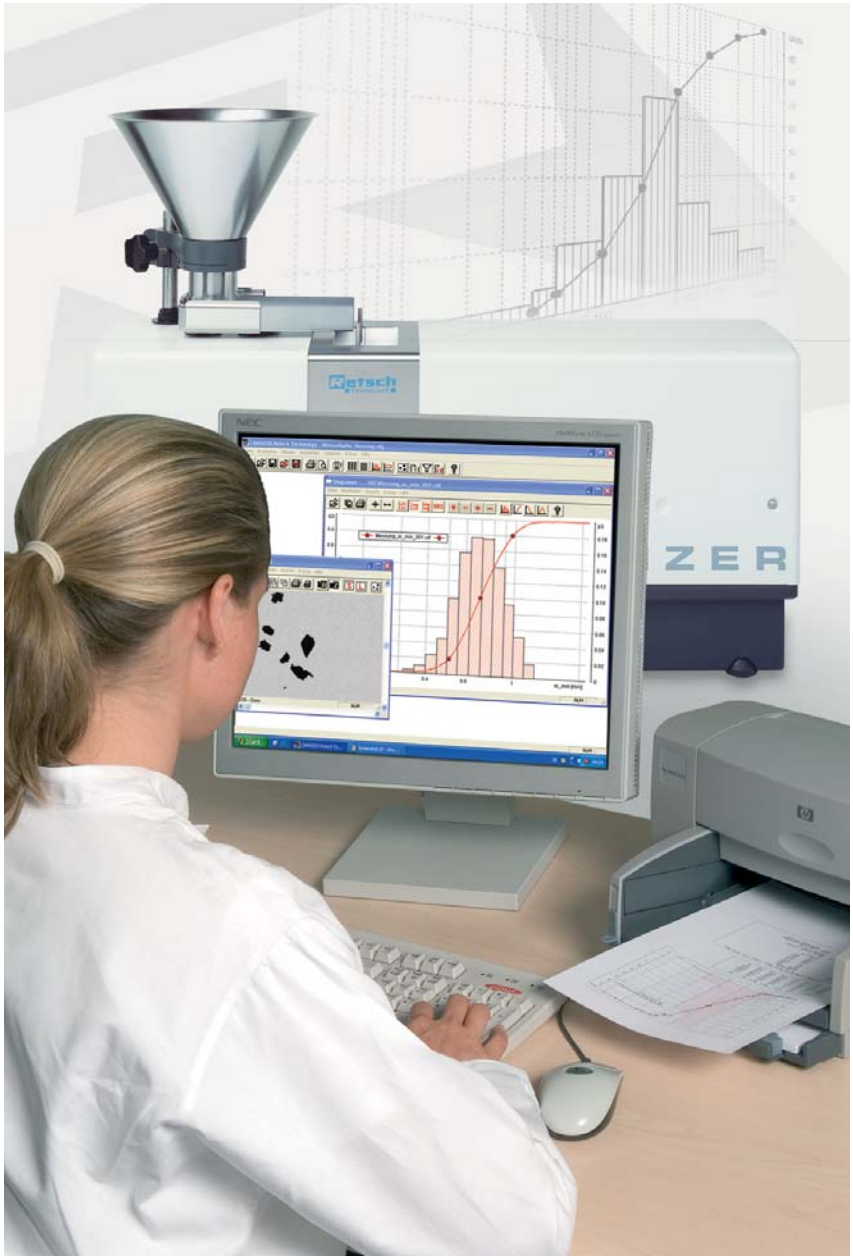
By using a high-precision reference object (precision ±0.1 µm) made by electronic lithography, which simulates differently sized particles, the CAMSIZER can be recalibrated quickly at any time. This means that the requirements of modern test agent monitoring are fulfilled.

CAMSIZER® results

Evaluation and documentation

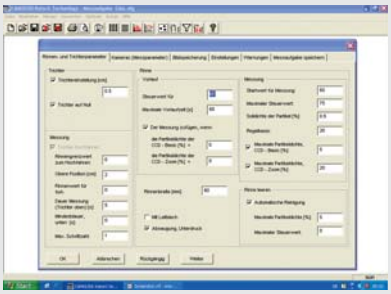
Real-time results

A major advantage in the practical application of the CAMSIZER is the evaluation of the results in real time. Graphical presentation of the results is even available while the measurement is still running. At the same time the measurement process can be checked visually by observing the digital images. Any irregularities detected in the sample material can be archived and evaluated at the touch of a button. Retsch Technology supplies the CAMSIZER with a powerful, process-oriented control and evaluation software. Export of the results to office programs is quick and convenient.

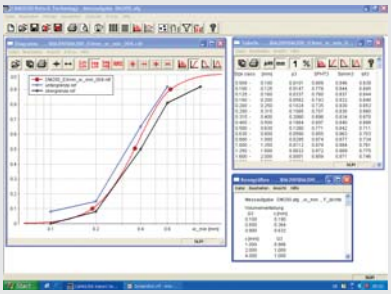


Simple and reliable operation

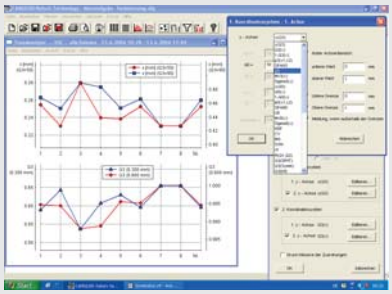
Setting measurement and evaluation parameters is made easy by a "Wizard" function in the software which guides the user through this process. Product-specific settings for the measurement parameters can be saved which simplifies the change between different repetitive measuring tasks, which are known as standard operating procedures (SOPs). These SOPs can be protected against manipulation by a password that ensures that the same instrument settings and output formats are always used with the highest degree of reliability. This effectively eliminates operator errors.



Process-oriented entry mask
Quick and simple parameter entry due to intuitive user interface



Quality control during measurement
Comparison of the measurement result with upper and lower specification limits



Trend analysis of production processes
Up to 4 selectable parameters of the sample material can be continuously monitored

More detailed information due to efficient technology

The basis of the precise and quick measuring results is the processing of the particle projections in real time. At a recording rate of 60 images per second, each with more than 780,000 pixels, the CAMSIZER processes information from more than 45 million measuring points per second. In the presentation of the results as graphs, tables, characteristics or digital images, a wide range of customers' wishes have been taken into account.
The computer calculates all standard particle distributions (volume, area and number-related) as well as the characteristics of the particle size, particle shape and their distributions and standard deviations.

The results obtained can be presented graphically and in tabular form as size fractions, frequency distribution or cumulative distribution.

In addition, the CAMSIZER can determine the number of particles in the sample as well as the specific surface area, the density and transparency of the sample material. All measured variables are determined precisely and with excellent reproducibility. The CAMSIZER software also allows the presentation of daily reports, trend analyses, mean value calculations and much more. A clear, individually configurable measuring protocol based on DIN 66 165 can be produced.

Smooth changeover from sieve analysis to CAMSIZER®

The traditional sieve analysis frequently forms the basis for quality standards and product specifications on which the communication between suppliers and customers is based.

A rapid and efficient alternative to sieve analysis must take this into account and produce **results that are fully compatible**. This is why the CAMSIZER software is provided with algorithms for simulating sieve analysis. In this way many users have been able to replace the time-consuming sieve analysis by using the CAMSIZER without having to dispense with the familiar quality features.
The automated and wear-free measurement means that the results obtained are more reliable and reproducible.

Particle shape analysis and its applications

In many applications particle shape information provides an important process and quality indicator. Based on digital image processing the CAMSIZER is immediately able to analyse the particle shape of the sample material in a detailed and representative manner.

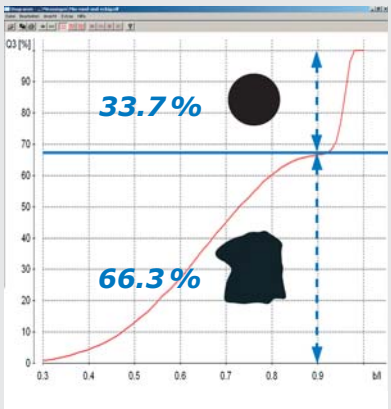
As a result of the high information content obtained from the digital images made during the measurement procedure, the particle projections can be evaluated in many different ways. Depending on the application, the CAMSIZER measures the particle projections according to various areas, circumferences and lengths by making a high-resolution scan of each individual particle in 64 directions. The results obtained can be, for example:

- chord length
- Martin diameter
- Feret diameter
- straight length
- width/length aspect ratio
- roundness
- symmetry
- convexity

The advantages of the full-frame cameras used in the CAMSIZER for the distortion-free recording of all the particle projections is particularly obvious when measuring the particle shape.

Examples of particle shape analysis applications are:

- **determination of fractions of mixture components (see graph)**
  e.g. of ion exchangers and active charcoal for water filters as well as glass beads and corundum in colours used for road markings
- **determination of edge-holding property (angularity)**
  e.g. quality assessment of abrasives as a preliminary to further processing
- **analysis of the broken fraction of granules**
  e.g. as a replacement for time-consuming breakage studies on the rolling properties of granules
- **simultaneous determination of diameter/length distribution of extrudates ("rods")**
  e.g. determining the volumetric density of catalysts in reactor containers
- **prediction of flow and compacting behaviour**
  e.g. press-molding powders and granules in the form of tablets



CAMSIZER® automation options

AutoSampler and online version

The use of the CAMSIZER is very economical, particularly with high sample throughput. In combination with the AutoSampler efficiency can be increased due to the automated sample measurement. A further improvement is possible by using continuous quality monitoring in online operation.

The AutoSampler – automatic, reliable, flexible

Whenever varying sample materials are to be analysed or series measurements need to be carried out, the AutoSampler adapts itself perfectly to the defined measuring routine. The hopper position automatically adjusts to give the correct material feed gap, even for samples with a greatly differing particle size distribution. The sample is fed in by an electro-pneumatic robot arm which lifts the beakers and empties them into the feed hopper. A built-in shaking function ensures complete emptying. The sample beakers are collected in a container for reuse. During operation a laser-based sample recognition device enables the user to alter the priority of individual samples on the conveyer belt. The use of the AutoSampler maximises the utilisation of the CAMSIZER.

Increased flexibility due to barcode reader

The barcode reader ensures that defined instrument and measurement settings (SOPs) are read automatically for all the products to be analysed. Even specific evaluations, depending on the identification of the product or batch number, can also be carried out automatically. This effectively avoids operator errors and ensures constant measuring conditions for each analysis.

Optimised safety

With Retsch Technology, safety is not limited to the analytical process. The CAMSIZER and AutoSampler safety devices comply with the relevant guidelines and standards. Moveable parts are located behind covers which are permanently monitored by safety switches. If anything unexpected should occur, an emergency stop-button brings all moving parts to an immediate standstill.

Online application

Even in the powder and granule processing and production sector many customer requests indicate a trend towards continual process automation in order to optimise quality costs and to avoid reject material. This requires continuous and integral quality assurance within the framework of online registration of product features.

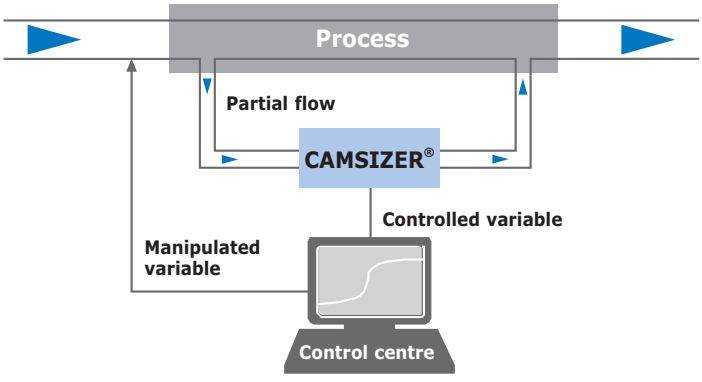
Due to its robust construction and interference-free measuring principle, the CAMSIZER is particularly suitable for integration in the production line in online operation. In such applications, the online version of the CAMSIZER is matched to the specific "on-site" needs. Usually, this includes some individual adjustments to the design, electronics and software. Typically, a representative sample of the bulk material is removed from the process for online analysis and fed to the CAMSIZER.

Immediately after the measurement has been completed, the next batch of the product is automatically transferred and analysed. Thus, an up-to-date measurement result is available at all times, which guarantees uninterrupted quality control.

The process parameters can then be continuously optimised through a closed loop control circuit, which means that the reject quota can be minimised.

In order to ensure long operating periods even in a dusty environment, the online version is equipped with an additional air flushing device and an automatic cleaning system. The robust housing usually stands on vibration absorbers which means that the system can also be used at sites subjected to intensive vibrations. Air conditioning is also available at different performance levels as an option. This guarantees that the system can function properly throughout an extended temperature range of -20 °C to +50 °C.

Enclosed CAMSIZER for extreme operation conditions



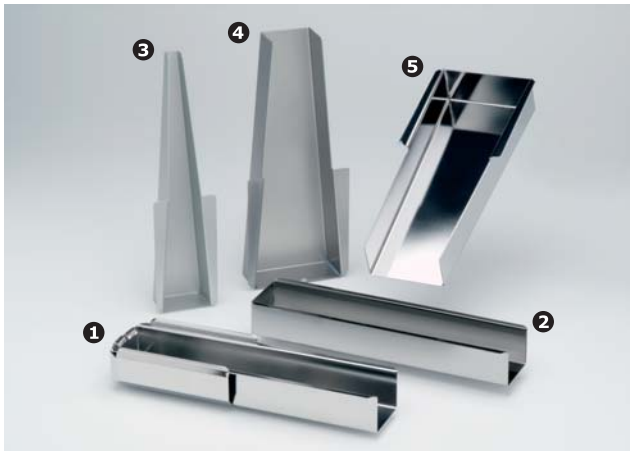
Schematic diagram showing the inclusion of the CAMSIZER in a continuous quality monitoring system

CAMSIZER® accessories

Retsch Technology offers a comprehensive range of accessories for the CAMSIZER in order to fulfil the individual requirements for each and every application. The individual components are selected according to the sample material properties.

Push-fit feed chutes

The flow behaviour of the sample can be considerably improved by a favourable choice of feed chute surface material and shape. Feed chutes made from high-quality stainless steel are used as standard, but even difficult materials such as coffee or cocoa can be fed in uniformly and continuously by choosing the most suitable chute coating. For example, for oily/fatty materials chutes made from aluminium hard-coat are recommended. The push-fit attachment means that the feed chute can be exchanged within a few seconds whenever necessary.
For the effective feed of different-sized particles chutes with different widths are available.



1. 40/40 mm feed chute (stainless steel) with holder
2. 40/40 mm feed chute
3. 40/15 mm feed chute (aluminium hard-coat)
4. 75/40 mm feed chute (aluminium hard-coat)
5. 75/60 mm feed chute (stainless steel)

Push-fit feed chutes						
	Width at hopper side	Width at feed side	for Holder	Application	Aluminium hard-coat	Stainless steel
Feed chute	120 mm	75 mm	–*	for coarse materials	–	✓
Feed chute	75 mm	75 mm	75	for coarse materials	–	✓
Feed chute	75 mm	60 mm	75	for coarse materials	✓	✓
Feed chute	75 mm	40 mm	75	for medium-sized granules	✓	✓
Feed chute	40 mm	18 mm	75	for powders and finely grained samples	✓	✓
Feed chute	40 mm	40 mm	40	for medium-sized granules	✓	✓
Feed chute	40 mm	15 mm	40	for powders and finely grained samples	✓	✓
Holder for push-fit feed chutes					Aluminium hard-coat	Stainless steel
Holder 75	for 75 mm feed chutes (width at hopper side)				–	✓
Holder 40	for 40 mm feed chutes (width at hopper side)				–	✓

**No holder necessary, feed chute will be screwed on*

Sample division – as important as the analysis itself

A non-representative sample will not give a correct result, even using the most up-to-date analytical instruments. This is why Retsch Technology offers a range of sample dividers for obtaining representative partial samples.

Our application laboratory will be pleased to advise you about choosing a suitable sample divider.

Feed hoppers

Different hopper sizes are available for different amounts of sample. Hoppers can be supplied with a capacity from 0.4 litres up to 7.8 litres. For optimal sample feed these hoppers are available in different materials and with different coatings (stainless steel, aluminium hard-coat, etc.).

Feed hoppers					
		Hopper capacity	Ø Outlet	Aluminium hard-coat	Stainless steel
Feed hopper	for 120 mm feed chutes (width at hopper side)	7.8 litres	100 mm	–	✓
Feed hopper	for 75 mm feed chutes (width at hopper side)	3.5 litres	60 mm	–	✓
Feed hopper	for 40 mm feed chutes (width at hopper side)	2.8 litres	30 mm	–	✓
Feed hopper	for 40 mm feed chutes (width at hopper side)	0.4 litres	30 mm	✓	✓

Feed guides

The use of a feed guide ensures that even the finest materials fall through the focusing range of the cameras without any unwanted turbulence and can therefore be measured accurately. For special applications feed guides are available to orient the particles in a preferred direction. For example, this allows the precise and direct measurement of the length and width when analysing extrudates.

Feed guides		
		Stainless steel
Feed guide "Standard"		✓
Feed guide "Extrudate"		✓

Further information about us and our products can be found at: www.retsch-technology.com

As additional information we recommend our CAMSIZER and AutoSampler video presentations.

The videos are available at www.retsch-technology.com for downloading or can be requested as a CD-ROM free-of-charge.

CAMSIZER® at a glance

Technical data

CAMSIZER®

Measuring range:	recommended range 30 µm to 30 mm
Parameters:	particle size, shape, density, transparency and number
Measurement:	60 images/s, each with more than 780,000 pixels (corresponds to more than 45 megapixels per second)
Measuring time:	approximately 2 to 3 min (depends on required measurement statistics)
Instrument data:	dimensions (H x W x D) approximately 650 x 850 x 350 mm weight (without PC): approximately 40 kg

The CAMSIZER is CE-tested and follows the relevant guidelines and standards.
It can be supplied with software complying with FDA rule **21 CFR Part 11**.

AutoSampler

Compressed air supply:	min. 6 bar
Compressed air consumption:	max. 10 l/min
Instrument data:	dimensions (H x W x D) approximately 900 x 1450 x 490 mm weight: 60 kg
Sample feed:	control of the endless conveyor belt by light barrier interruption during sample container positioning, sample feed by electro-pneumatic robot arm, emergency stop-button

The AutoSampler is CE-tested and complies with the relevant guidelines and standards.

CAMSIZER®-Online

Measuring data:	see CAMSIZER for measuring range, measurement, measuring time
Working range:	temperature range -20 °C to +50 °C (air-conditioned), enclosed for rough surroundings by housing (IP 54), shock and vibration-absorbing installation
Instrument data:	dimensions (H x W x D) approximately 800 x 1600 x 600 mm weight: approximately 250 kg compressed air supply: 4 - 8 bar
Interfaces:	Ethernet, Profibus, various digital and analogue contacts and signals (e.g. 4 - 20 mA)

Fields of application

Scope and purpose:	rapid and exact particle size and shape analysis of all dry, pourable bulk materials and powders
Sample material:	e.g. salt/sugar, plastics, catalysts, abrasives, carbon products, sand, carbon black/coal, coffee, refractory products, foodstuffs, polystyrene, glass/ceramics, fertilisers, pharmaceuticals, metal powder, etc.
Operating sites:	factory laboratories, research institutes, locations close to the production line as well as online for optimal quality control of products and processes

Retsch® TECHNOLOGY

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Retsch Technology – your specialist for particle analysis offers you a comprehensive range of instruments. We would be pleased to provide you with further information about our analytical instruments for size and shape measurement.

Printed in Germany
Subject to technical modification without notice
99.011.0001/E-07-2007