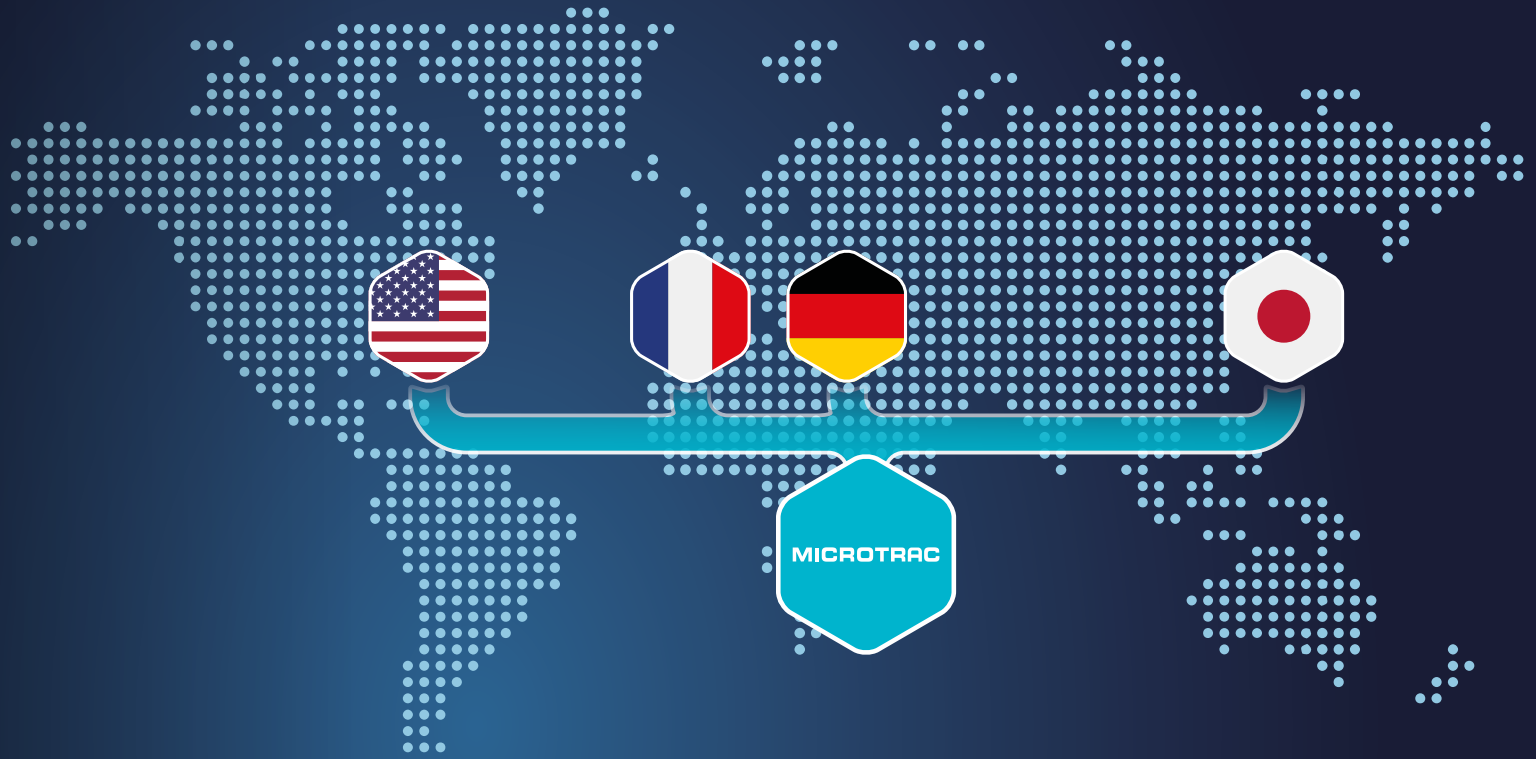
MICROTRAC
a VERDER company



SYNC

PARTICLE SIZE & SHAPE ANALYZER

COMBINING LASER DIFFRACTION AND DYNAMIC IMAGE ANALYSIS IN ONE INSTRUMENT



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



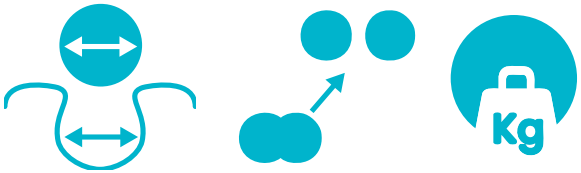
Particle size

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.

A NEW DIMENSION IN PARTICLE ANALYSIS

SYNC

With the **SYNC** analyzer, MICROTRAC integrates its highly accurate tri-laser diffraction technology with its versatile image analysis capability to provide particle characterization practitioners with a unique measuring experience. The patented synchronous measurement technology allows users to make both a laser diffraction measurement and an image analysis measurement on a single sample, in the same sample cell at the same time:

- One sample
- One optical bench
- One flow path
- One sample cell
- One analysis

This makes the **SYNC** ideally suited for routine QC applications. It also provides valuable information to researchers as they develop new materials and processes. The powerful software interface provides both particle size distribution information as well as a multitude of morphological parameters. The patented BLEND routine allows users to examine materials over a wide range of sizes from 0.01 µm to 4,000 µm.



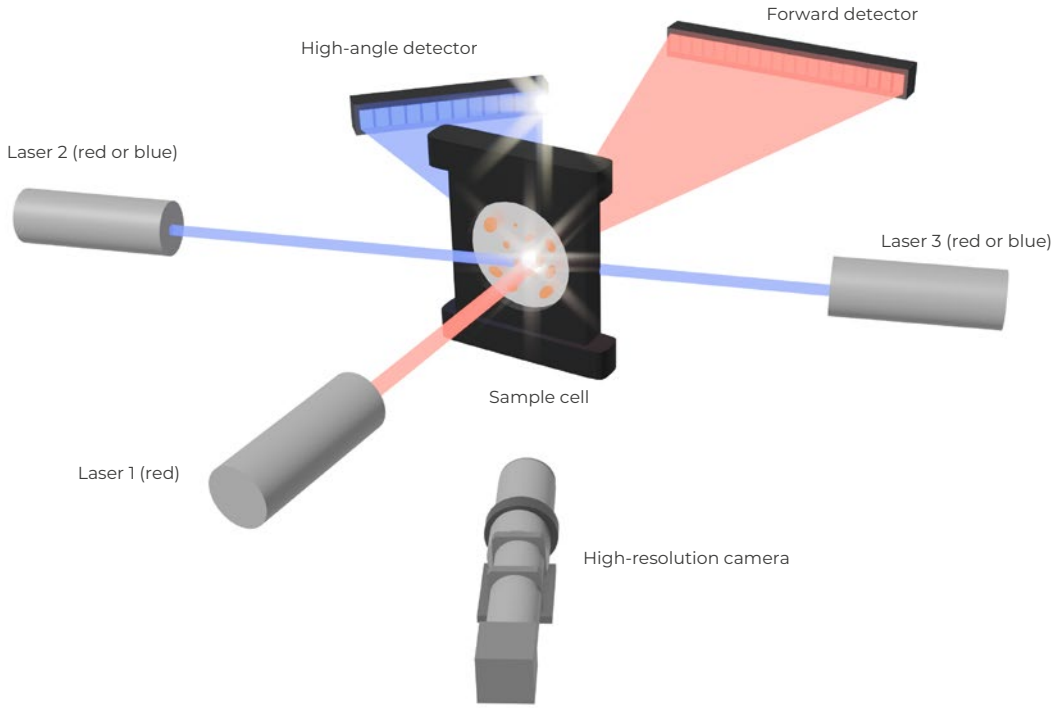
Particle Size & Shape Analyzer

SYNC

- Particle size and shape analysis from 0.01 to 4,000 microns using laser diffraction (ISO 13320:2020) and dynamic image analysis (ISO 13322-2)
- Excellent sub-micron detection using blue laser technology. Ability to resolve narrow and multi-modal distributions in the sub-micron range
- Detection of small amounts of oversized or undersized fractions in the size distribution
- Patented synchronous measurement technology and BLEND distribution analysis. One analysis yields a particle size distribution and over 30 morphological parameters
- Fast measurement time – typically 30 seconds
- Fast and easy switch between wet and dry measurement modules. Change from wet to dry mode in less than 15 seconds
- Full IQ / OQ validation package compliant with FDA 21 CFR Part 11 guidelines

ADVANCED LASER DIFFRACTION ANALYSIS

PATENTED TRI-LASER SYSTEM



Particle size measurement by **Laser Diffraction (LD)** has become the most used technology in research and industry and is the *de-facto* standard for incoming and outgoing product quality control. During the measurement, a laser beam illuminates a well dispersed particle sample and the size distribution is calculated from the scattered light pattern. In MICROTRAC's technology, this scattered light is measured at various angles from 0 to 165 degrees. This is achieved by using two detector arrays and three lasers that illuminate the sample from different angles. The **SYNC** can be equipped with all red lasers or a combination of red and blue lasers.

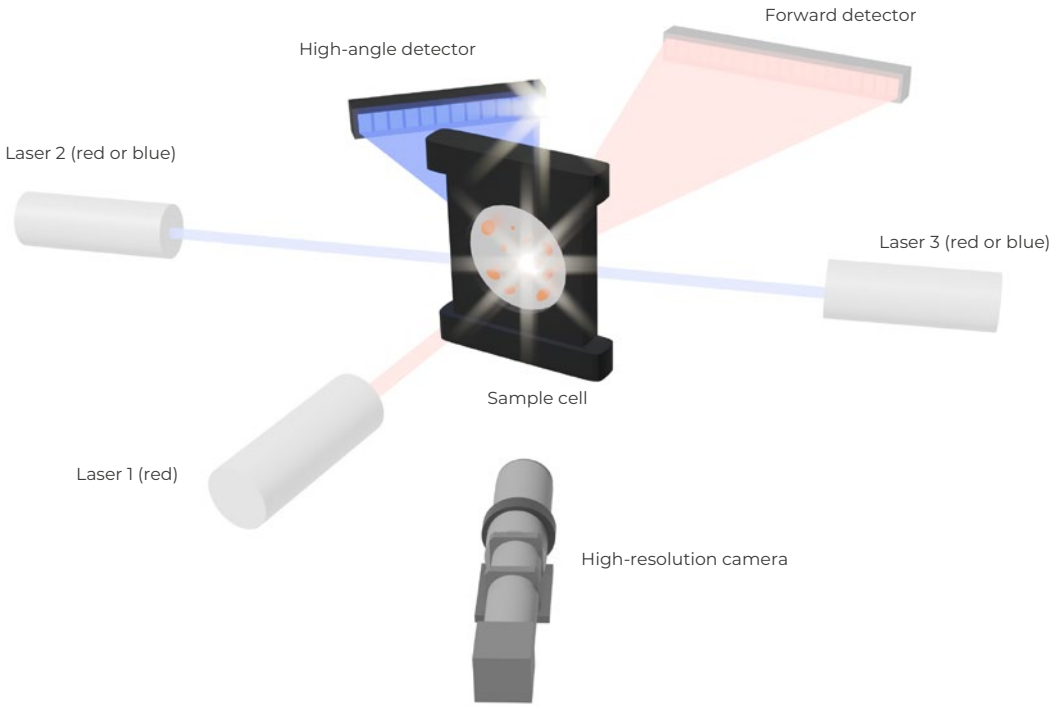
Small particles scatter light at large angles while large particles scatter light at small angles. The scattered light intensity is collected continuously throughout the measurement. The evaluation is done using MICROTRAC's innovative modified Mie scattering theory. This algorithm produces accurate particle size distributions for both spherical and non-spherical particles as well as for both transparent and absorbing materials.

Features

- Configurations:
  3 red lasers
  1 red laser + 2 blue lasers
  2 red lasers
- Patented Tri-Laser design
- Fixed optics with solid state laser diodes provide long-lasting ruggedness and reliability
- Zero stabilization time
- Fourier optical system delivers the optimal pattern of light by assuring that the angle of incidence is constant

NEW OPPORTUNITIES

INTEGRATED DYNAMIC IMAGE ANALYSIS



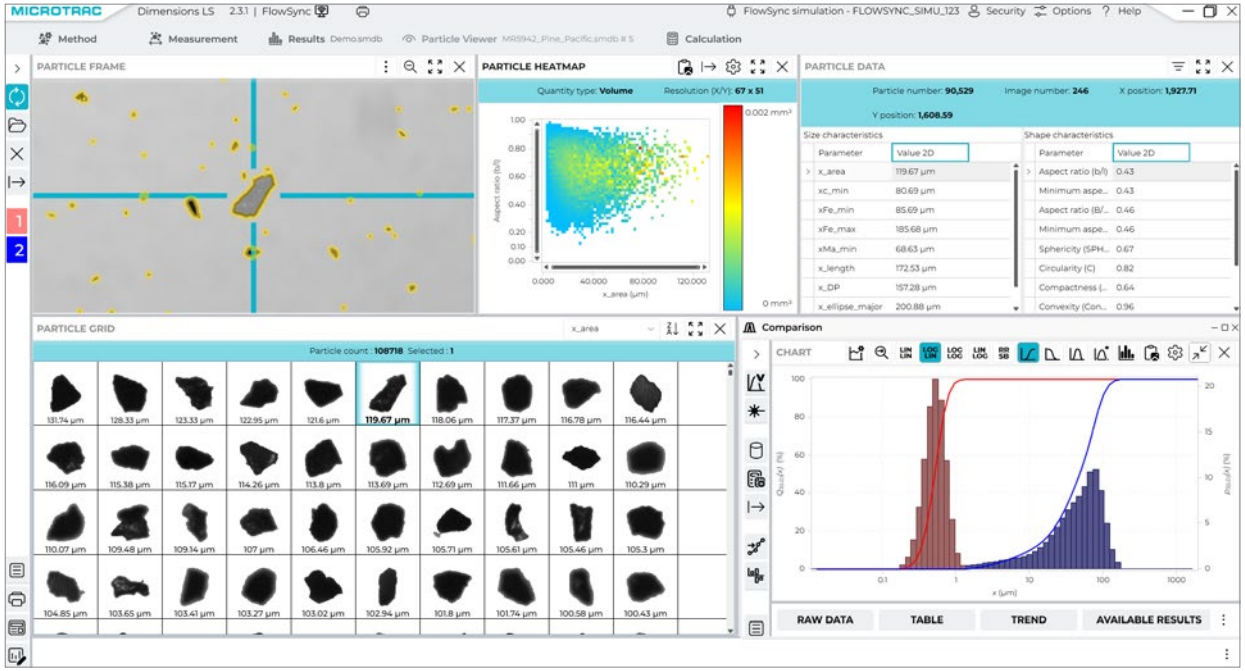
The characterization of particulate systems, once dominated strictly by size analysis, is evolving. **Dynamic Image Analysis (DIA)**, which measures important parameters related to particle morphology, provides detailed information regarding the physical properties of materials. These key properties and the resulting manufactured product can change drastically with no significant differences reported in the **LD** size distribution. Image analysis can rapidly identify problems and significantly reduce troubleshooting time. Particles in a flowing stream, backlit by a high-speed strobe light, are photographed by a high-resolution digital camera to create a video file of images for the flowing particles. More than 30 size and shape parameters are acquired for every particle. Although the measurement technology of **DIA** is straightforward, the data analysis used to identify and solve problems is very powerful. The software includes filter functions to search, display, and evaluate particles with specific properties or a combination of properties. Data can also be presented in scatter plots, in which each data point represents a single particle image.

Features

- Integrated, synchronized Dynamic Image Analysis (ISO 13322-2)
- Powerful strobe light for excellent image quality
- 5.2 Megapixel camera
- Up to 60 frames per second
- Live view and video file
- More than 30 morphological parameters from every particle: width, length, aspect ratio, sphericity, circularity, roundness, solidity, transparency, and many more

OUR CONCEPT OF

COMBINING LASER DIFFRACTION WITH DYNAMIC IMAGE ANALYSIS



The **SYNC** particle analyzer by MICROTRAC provides traditional users of laser diffraction technology with exciting new capabilities to characterize their materials. The proven Tri-Laser technology provides accurate and repeatable laser diffraction results from light collected over 165 degrees of angular scatter. When combined with state-of-the-art camera technology capturing images of the particle stream at the same time, the **SYNC** offers not only size data but significantly more information about the shape of the materials and the quality of the dispersion.

Material is either dispersed in a carrier fluid for wet measurements in the **FLOWSYNC** or dispersed in air for dry powder measurements in the **TURBOSYNC**. As the sample stream passes through a single measurement cell in the optical module, it is interrogated by the lasers. The sample stream is simultaneously illuminated by stroboscopic LED to allow the high-speed camera to take images of the same sample. This allows users the flexibility to determine particle size distributions from an ensemble sample dispersion as well as the ability to examine single particles or groups of particles from the hundreds of thousands of images captured by the camera. The user ultimately has the ability to look individually at a laser diffraction analysis or an image analysis, or at a combination analysis using the patented **BLEND** feature.

This combination analysis provides QC users the ability to qualify their data using two methodologies at the same time and provides R&D users with a powerful tool to characterize new materials.

SYNC

MAXIMUM PERFORMANCE BY DESIGN

- Patented Tri-Laser design (red & blue lasers are available)
- Detector array covering 0 - 165 degrees
- Stroboscopic light source and integrated camera for dynamic image analysis
- Same bench & dispersion system for diffraction & image analysis
- Wet and dry analysis, easy change
- Small footprint



SYNC

MAXIMUM FLEXIBILITY BY DESIGN

Not all users are the same! While some require basic measurement capability, others need more comprehensive features for more detailed information on their materials. MICROTRAC has designed the SYNC configurations to allow the user to select the functionality that best meets their laboratory needs.

SYNC GO



- 3 Red Lasers
- Range 0.1 to 2,000 microns
- Manual Sample Dispersion

PARTICLE SIZE MADE SIMPLE

For users with a limited budget, the **SYNC GO** provides the best cost/benefit ratio in the market. The **SYNC GO** offers a measurement size range of 0.1 to 2,000 microns. The system uses laser diodes delivering low cost of ownership through reduced maintenance. The “plug-and-play” feature offers the choice of either the **FLOWSYNC GO** for wet measurements or the **TURBOSYNC** for dry measurements.

SYNC PLUS



- 3 Red Lasers
- Range 0.02 to 4,000 microns
- Automatic Sample Dispersion

PARTICLE SIZE AND SHAPE IN THE SAME OPTICAL BENCH

The **SYNC PLUS** measures materials between 0.02 and 3,500 microns (4,000 microns with camera). The automated **FLOWSYNC** can be configured for fill, flow, measure and rinse sequences reducing user interaction. The Synchronous measurement technique provides valuable particle/sample data way beyond a simple Laser Diffraction measurement. Particle shape and morphology can be examined as well as dispersion efficiency in the sample delivery systems. Agglomerates or outlier particles are easily determined.

SYNC PRO



- 1 Red 2 Blue Lasers
- Range 0.01 to 4,000 microns
- Automatic Sample Dispersion

PRECISION MEASUREMENT IN THE SUB-MICRON RANGE

The **SYNC PRO** is a multi-wavelength optical bench measuring materials in the range of 0.01 to 4,000 microns. The **DIMENSIONS LS** software operating system provides the user with a wealth of useful features in terms of instrument operation, data presentations and data processing. **AI** adoption enhances the use of image analysis with capabilities for component differentiation in mixed materials, contamination detection and the creation of customized AI models.

CONNECTIVITY & MODULARITY

CHANGE BETWEEN DRY & WET MODULES

No other particle analyzer allows more rapid change from wet to dry and vice versa. The modules can be removed from the analyzer with a single movement and reinstalled just as easily. All necessary cables and hoses are permanently connected to the back of the analyzer. This means that no changes to the measuring instrument or modules are required during the actual changeover. Removal of measuring cells or tedious plugging and un-plugging of mechanical and electrical connections is no longer necessary. This makes the process a real plug-and-play operation.



FLOWSYNC

DISPERSION MODULE FOR WET MEASUREMENTS



The **FLOWSYNC GO** offers the user a simple manual recirculator. Fluid is introduced to the device by pouring directly into the sample vessel. The pump is controlled by icons in the **DIMENSIONS LS** software allowing the user to activate the pump, alter the speed of the pump and drain the vessel. It is suitable for both aqueous and non-aqueous fluids.

The **FLOWSYNC** models' automated filling, de-aerating, pre-circulating and circulating operation means that each sample is handled with a consistency that improves the repeatability of particle size distribution and imaging data. The **FLOWSYNC** has a volume of 200 mL, the **FLOWSYNC GO** goes from 150 to 300 mL, and the **FLOWSYNC MINI** has only 40 mL.

Consistency: Only the **FLOWSYNC** has an in-line ultrasonic probe with variable power. It disperses agglomerated materials to ensure consistent sample dispersion during measurements.

Versatility: Users can program, save and recall unlimited SOP routines for fill, disperse, measure, rinse and run commands.

Connectivity: An integrated fill pump allows the user to connect any water or solvent source. The recirculator fills, de-aerates and dilutes automatically.

Auto-Dispersion: The fluid dynamics of the **FLOWSYNC** / **FLOWSYNC MINI** feature built-in turbulence to ensure that all particles are moving constantly within the system, negating the need for an external stirrer.

Resistiveness: The **FLOWSYNC** / **FLOWSYNC MINI** can be operated with a wide variety of carrier fluids. In addition to water and alcohol, this includes organic solvents like hexane or toluene.

Self-Cleaning: The washing feature ensures that the walls of the sample vessel are thoroughly cleaned during the rinse cycle. This eliminates cross contamination from one sample to the next.

TURBOSYNC

DISPERSION MODULE FOR DRY MEASUREMENTS





The **TURBOSYNC** delivers a properly dispersed sample to the measuring cell, allowing for consistent and repeatable particle size analysis. A moving sample tray introduces the powder into the measurement system.

Flexibility: Compressed air and flow condition settings up to 50 psi (345 kPa) allow the operator to achieve optimal dispersion, even for highly agglomerated materials. Dispersion conditions can be fine-tuned for measurement of even the most fragile materials.

Small Sample Volumes: Sample volumes can be as small as 0.1 cm^3. This is ideal for applications where the sample is expensive or produced in small volumes.

Large sample volumes: The removable sample tray can hold larger quantities of powder. If required, multiple trays can be processed and combined into one measurement record.

Automatic sampling: The **MICROTRAC DIMENSIONS LS Software** facilitates the automation of measurement cycles. Simply place the sample in the tray and press RUN. All data is saved on the system PC or can be exported to user networks.

Rapid Measurements: Measurement time is usually 10 - 40 seconds, depending on the properties of the sample material.

Repeatability: Consistent control of aspiration settings delivers excellent sample-to-sample and instrument-to-instrument repeatability.

MICROTRAC

APPLICATIONS

Versatility is a great strength of laser diffraction analysis. This makes the method suitable for a variety of applications in both research and industry. **MICROTRAC** laser diffraction analyzers are characterized by particularly convenient, easy-to-learn operation. Thanks to their robust design, the instruments are practically maintenance-free and fit for 24/7 operation. The high sample throughput and the extremely wide particle size range from nanometers to millimeters are the reasons for the method's popularity in so many laboratories.

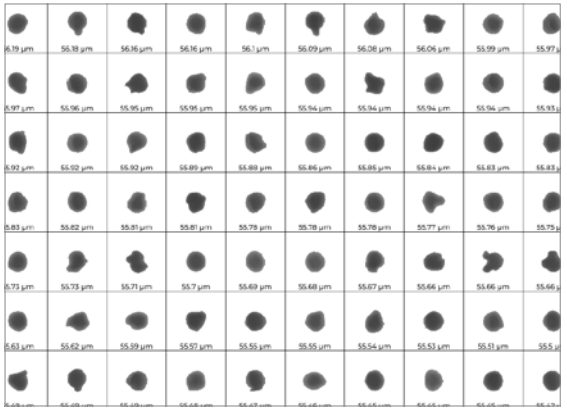
However, drawbacks of laser diffraction are poor resolution for large particles, limited sensitivity for oversize and the inability to measure particle shape. These downsides of laser diffraction, however, are the strengths of image analysis. Thanks to the unique combination of both techniques, the SYNC provides information which is not available from laser diffraction alone and improves the overall accuracy of size measurement.

TYPICAL FIELDS OF APPLICATION

- INDUSTRIAL MINERALS
- CERAMICS
- PHARMACEUTICALS
- CHEMICALS
- PAINTS & PIGMENTS
- METAL POWDERS
- CONSTRUCTION MATERIALS
- GLASS BEADS
- COATINGS
- 3D PRINTING
- FOODSTUFF
- COSMETICS
- BATTERY MATERIALS
- POLYMERS
- EMULSIONS

SIZE & SHAPE ANALYSIS – ADDITIVE MANUFACTURING

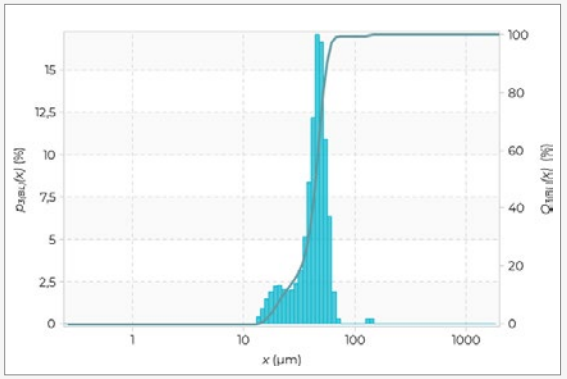
Particle size distribution has long been an important characterization metric used to quantify materials. Size and shape are extremely important parameters that can drastically impact material performance in additive manufacturing. Raw powders must be broad in their size distribution, as well as round in shape. It is important to detect oversized particles to assure uniformity in the size distribution and detect deviations from spherical particles so that the packing density and flowability can be controlled. These size and shape characteristics can lead to imperfections / defects in printed parts. With the **SYNC**, size and shape information can be obtained simultaneously on the same sample through the addition of dynamic image analysis to a laser diffraction instrument. Reliable oversize detection and detailed shape information are possible with a single measurement.



Particle images of metal powder which are used for Additive Manufacturing: Some particles have satellites, i.e., small particles fused to large ones.

OVERSIZED PARTICLE DETECTION – ABRASIVES

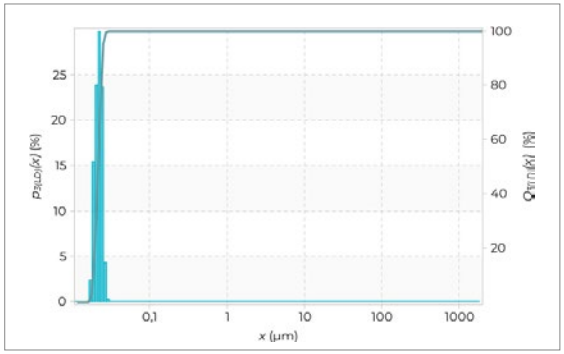
Reliable oversized particle detection is often a challenge for laser diffraction. Many industries manufacture materials whose usage and effectiveness can be greatly hindered by the presence of even a few oversized particles. In particular, the performance of abrasives is tied directly to the size distribution. There are a wide variety of uses for abrasives that each require a specific size and size distribution to maximize efficacy. Some applications are incredibly susceptible to large particles reducing the effectiveness of the grinding media or producing an unacceptable surface. In addition to size, shape parameters such as roundness and angularity are important in predicting the performance of the material. The incorporation of dynamic image analysis as a complementary technique allows for all the advantages of laser diffraction, as well as the added benefits of reliable oversize detection.



Accurate detection of oversize particles in an abrasive sample with the BLEND algorithm.

MODIFIED MIE ANALYSIS
– SUBMICRON MATERIALS

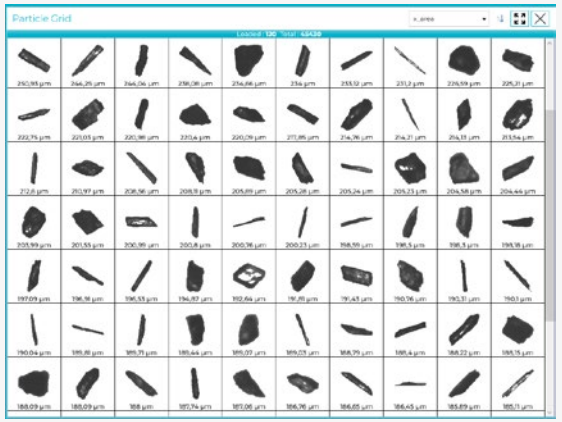
Mie scattering theory is widely used in laser diffraction. However, Mie theory was originally developed using transparent, spherical particles. Compensation must be made to adapt Mie theory to non-spherical particles. MICROTRAC's proprietary modified-Mie analysis was developed to do just that. This analysis is chosen by simply selecting irregular for the particle shape. No imaginary RI, no absorption or extinction coefficients are required. At sizes below 30 microns, spherical particles have a strong resonance feature in the scattering pattern. Irregularly shaped particles, on the other hand, have significantly reduced intensity of this resonance. Modified Mie calculations easily and accurately account for the reduction in scattering and will not result in an over or under reporting of fines dependent on the input parameters. All MICROTRAC laser diffractors include Modified Mie calculations.



Accurate reporting of 26 nm polystyrene spheres.

DRY POWDER MEASUREMENTS
– ACTIVE PHARMACEUTICAL INGREDIENTS (API)

Dry measurements are becoming increasingly popular in particle size analysis, due in part to larger sample volumes being easily measured. Difficult samples such as soluble, fragile, or agglomerated materials can be properly dispersed and measured without being damaged using the **TURBOSYNC** module. Active pharmaceutical ingredients (API) are often soluble in many carrier fluids, are very cohesive, and need to be handled with care. Without the need for exotic organic carrier fluids, dry measurements reduce cost, eliminate time-consuming sample prep, and increase safety. Determining the correct particle size is important for assessing drug efficacy and bioavailability. Typically, API can contain a wide variety of shapes and sizes in a single sample portion, both of which are measurable with the **SYNC**. **DIMENSIONS LS** software has password protected security and is FDA 21 CFR Part 11 compliant.



Particle images of an API measured with the TURBOSYNC.

TECHNICAL DETAILS

SPECIFICATIONS AT A GLANCE

02/2026 Subject to technical modifications and errors

Measuring range	**SYNC GO** 0.1 to 2,000 microns **SYNC PLUS** 0.02 to 4,000 microns **SYNC PRO** 0.01 to 4,000 microns
Precision	Spherical glass beads, D50 = 642 microns, Precision as CV = 0.7% Spherical glass beads, D50 = 57 microns, Precision as CV = 1.0% Spherical latex beads, D50 = 0.4 microns, Precision as CV = 0.6%
Laser class	Red 780 nm, blue 405 nm – class 1 laser product per 21 CFR 1040.10 & IEC60825-1
Laser power	Red laser 0.35 to 2 mW nominal; blue lasers 10 mW nominal
Detection system	Two fixed photoelectric detectors with logarithmically spaced segments are placed at correct angles for optimal scattered light detection from 0.02° to 165° using 151 detector segments
Data handling	Data integrity ensured using FDA 21 CFR Part 11 compliant security features including password protection, electronic signatures and assignable permissions.
Typical analysis time	10 to 30 seconds
Electrical	AC input: 90 - 264 VAC, 50/60 Hz, single phase
Power consumption	Approx. 30 VA maximum, depending on options installed
Environmental	Temperature: 5°C to 40°C (41°F to 104°F) Humidity: 90% RH, non-condensing maximum Storage temperature: -10°C to 50°C (14°F to 122°F) (dry only) Pollution: Degree 2
Compliance	ISO 13320 Laser Diffraction ISO 13322 Dynamic Image Analysis
Image analysis	5.2 megapixels (2560 x 2048 px), up to 60 fps at maximum resolution
Wet operation	Volume: 200 mL nominal Flow rate: 0 to 65 mL/s maximum with water Inlet pressure: 50 psig (345 kPa) maximum
Dry operation	50 psi (345 kPa) maximum pressure 3 CFM (0.0014 m^3/h) at 50 psi (345 kPa) minimum flow rate Free of dry contaminants, moisture and oil
Vacuum	Vacuum must meet or exceed 80 CFM (38 l/s)
Physical specifications	Case material: Impact resistant plastic Exterior surfaces: Finished with solvent-, stain-, and corrosion-resistant paint or plating Chemically compatible with a wide choice of organic and inorganic dispersants
Dimensions (H x W x D)	18 x 31 x 12 in (457 x 787 x 305 mm)
Weight	53 lbs (24 kg)

ADDITIONAL SOLUTIONS

AEROTRAC II



The **AEROTRAC II** is an analyzer for particle size distribution & concentration ratio analysis for suspended particulates in air such as atomized droplets, powders, spray particles, mist etc. It is suitable for a wide range of applications including nebulizers and sprays.

Measurement modes are available to support various applications. The short measuring time intervals (0.02 ms) allow for measuring the size distribution directly after spraying and the analysis of the size distribution over time.

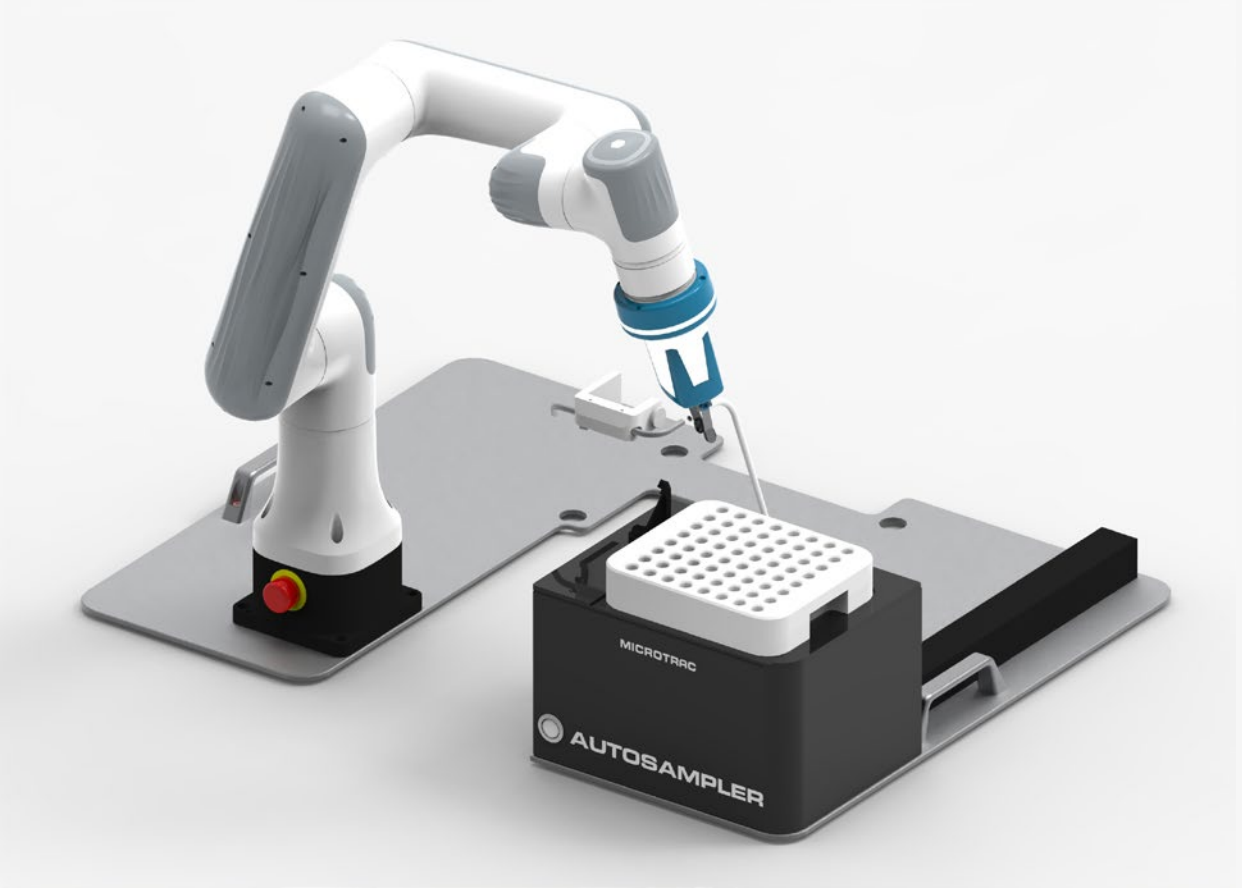


Features

- **AEROTRAC II** measurement range:
  0.5 µm – 2,000 µm (different lenses required) for sprays, nebulas, aerosols, etc.
- Small footprint, robust design

ADDITIONAL SOLUTIONS

AUTOSAMPLER



The MICROTRAC **AUTOSAMPLER** enables complete automation of Particle Size Characterization in laboratories. Users can prepare samples in vials and insert up to **64 vials** in a sample tray. The **DIMENSIONS LS** software allows the user to schedule a measurement sequence to fully measure the samples as required. Standard Operating Procedures are programmed and saved for specific material requirements. Analysis time, flow speed, refractive index (if required), particle shape and rinse functions are fixed and saved.

A **COBOT** arm is used to select the sample vial from the sample tray and introduce the sample to the measurement vessel. Sample vials can easily be identified using an integrated bar-code reader. The **AUTOSAMPLER** also features a unique vial washdown feature that ensures the complete sample is transferred for measurement and no residual sample is left in the vial.

An emergency button is installed to allow users to abort a sequence, if necessary.

MICROTRAC
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ENABLING PROGRESS

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Subject to technical modifications and errors.
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