Bettersize

BETTER PARTICLE SIZE SOLUTIONS

Bettersizer S3 Plus

Strive For Excellence In All You See

PARTICLE SIZE

PARTICLE SHAPE



Strive for Excellence in All You See

The Bettersizer S3 Plus combines laser diffraction and dynamic image analysis in one instrument. It can measure the size and shape of particles from 0.01 μm to 3500 μm. Its exceptional sensitivity for either ultrafine particles or oversized particles, and unsurpassed resolution, make it the most powerful size and shape analyzer for users across various industries, offering new possibilities for comprehensive particle characterization solutions.



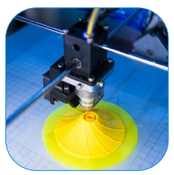
"The combination of laser diffraction and dynamic image analysis perfectly meets the needs of coarse particle measurement in polymer product development and the results obtained are reliable and highly accurate."

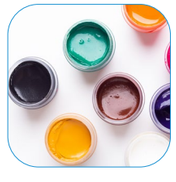
XI'AN Thermal Power Research Institute Co., Ltd.

Measured Lunar Soil

See Page 9

Applications and Industries

Industries	Samples	Significance
Soils & Sediments 	Stones, clay, gravel, marine sediments, lunar surface, etc.	Particle size and shape are two fundamental properties of any sediment or soil that can provide important clues to its nature and origin. The Bettersizer S3 Plus offers accurate and reliable particle size and shape information in the range 0.01-3500 µm for various sample types including soils, marine sediments and even lunar samples returned from space missions.
Ceramics 	Silica, quartz, flint, silicates, alumina, etc.	The particle size distributions of raw ceramic materials significantly impact the final product's surface smoothness, shapes, degree of agglomeration and dimensional stability. The dual camera optical system in Bettersizer S3 Plus effectively captures the images of agglomerated oversized particles during R&D processes.
Abrasives 	Calcite, emery, pumice, sandstone, garnet, borazon, etc.	Optimizing particle size and size distribution in abrasive materials maximize final products' performances while minimizing material waste. Monitoring particle size and identifying agglomerations in raw material could be achieved via the dynamic image analysis technology in Bettersizer S3 Plus.
3D Printing Materials 	Polylactic acid (PLA), Acrylonitrile butadiene styrene (ABS), bronze, nickel, alloy, etc.	The flow property, surface roughness, and quality of 3D printed products greatly depend on its raw material's particle size and size distribution. The Bettersizer S3 Plus helps optimize particle size distribution, thereby controlling the final product's quality.
Food & Beverages 	Sugar, chocolate, flour, additives, etc.	Many important characteristics of food products, namely taste, dissolution, and extraction behavior, are affected by particle sizes and shapes of raw materials. Equipped with dynamic image analysis technology, the Bettersizer S3 Plus is an ideal particle analyzer in the food and beverage industry.

Industries	Samples	Significance
Battery & Energy 	Graphite, cobalt, manganese, etc.	It is crucial to utilize the Bettersizer S3 Plus to measure and control the particle sizes and morphological properties of raw materials in the battery industry because they account for central battery performances, including energy storage, stability, and life cycle.
Paints, Inks, & Coatings 	Epoxies, polyurethanes, silicon, zinc-rich primers, etc.	Storage time, color consistency, flowability, and stability of pigment-based inks resulted from proper controls in the pigment particle shape, size, and size distribution. The Bettersizer S3 Plus characterizes these pigment properties, maximizing final product performances.
Pharmaceuticals 	Cefixime, gliclazide, glimepiride, paclitaxel, etc.	The Bettersizer S3 Plus is extremely helpful in industries where quality control standards are exacting, namely the pharmaceutical industry. The particle size and size distributions of both active and inactive ingredients significantly impact drugs' dissolution, body absorption, efficacy, and safety.
Building Materials 	Cement, asphalt, sands, wood, synthetic polymers, etc.	The hardening rate, strength, and fluidity of concrete are greatly affected by the particle size distribution of cement. The Bettersizer S3 Plus provides accurate, repeatable, and reliable measurements of cement size and size distribution, increasing the efficiency in the concrete manufacturing process.
Powder Metallurgy 	Steel, tin, nickel, copper, aluminum, etc.	The production rates of final powdered particles at the end of the powder metallurgy process are influenced by grains' size and size distribution. Using the Bettersizer S3 Plus to monitor final products' size greatly improves the production efficiency.

Evolutionary Technologies

Ⅰ - Patented DLOI (Dual Lenses & Oblique Incidence) System: Laser Diffraction

Laser diffraction technology for routine particle size analysis remains the method of choice across various industrial sectors. The Bettersizer S3 Plus applies the patented DLOI system, which is designed based on the Fourier structure to guarantee the accurate measurement of ultrafine particles from 0.01 μm.

Features & Benefits

- Measures **ultrafine particles** accurately with the large angular range (0.02 - 165°) with 96 detectors
- **Robust optical system** with superior resolution using the dual lenses design
- Single short-wave laser system (532 nm) delivers a **continuous scattering spectrum** with a consistent wavelength
- **Zero stabilization and preheating time** needed with solid-state light source

Ⅱ - Dual-Camera System: Dynamic Image Analysis

Dynamic image analysis can strengthen your understanding of materials with comprehensive shape or morphological information that is independent of laser diffraction. Individual particles with specific geometric properties such as agglomerates, crushed particles, and foreign particles can be effectively tracked through the dual-camera system.

Features & Benefits

- 0.5x and 10x cameras - photograph **extremely wide size range of particles**
- High speed strobe lights - capture up to **10,000 particle images in 60 seconds,** offering authentic **shape results**
- Suitable for **measuring heterogeneous samples** with unknown optical properties

Ⅲ - Groundbreaking Combination: Laser Diffraction with Dynamic Image Analysis

The Bettersizer S3 Plus integrates laser diffraction and dynamic image analysis into one instrument to simultaneously characterize particle size, size distribution, and particle shape over a wide dynamic range. Working in tandem, users can gain a deeper understanding of material behavior to fasten the troubleshooting process and method development process.

Features & Benefits

- DLOI System - precisely measures **ultrafine particles down to 0.01 μm**
- Dual-camera Imaging System - efficiently detects **oversized particles up to 3,500 μm**
- 2-in-1 System - simultaneously obtains **particle size and shape results**
- Fast time-to-result - rapidly generates results **in 10 seconds**

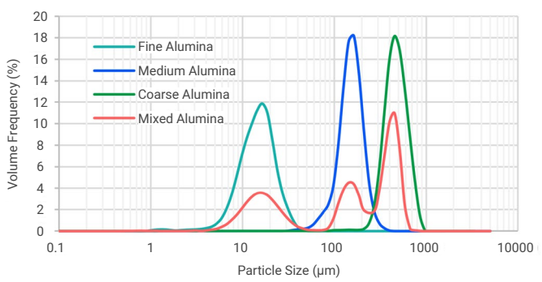
"The Bettersizer S3 Plus is easy to use and has brought excellent repeatability and high productivity to the research of abrasives."

North University of China

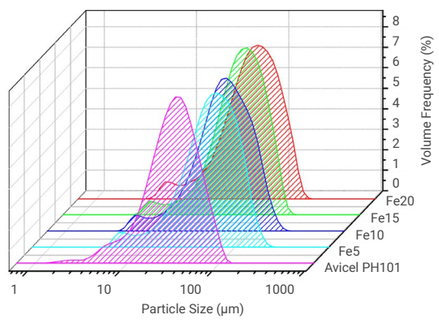
Patented DLOI System

Size Measurement

The Bettersizer S3 Plus achieves exceptional resolution and sensitivity for particle size measurements. The DLOI system allows the size distributions of polydisperse samples to be determined precisely, and the size changes of products to be detected sensitively.



A mixed alumina sample is investigated, and as to be expected, the analysis notes the existence of the three raw samples, suggesting the **high-resolution capability** of the DLOI system.

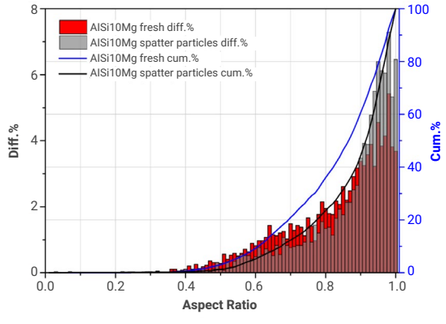


The sizes of as-prepared MCC (microcrystalline cellulose) exhibit a slightly decreased trend with the increasing Fe^{3+} concentration, suggesting the **high-sensitivity capability** of the DLOI system. (Adapted from Yue, Xiaopeng, et al. *Cellulose* 28.3 (2021): 1405-1419.)

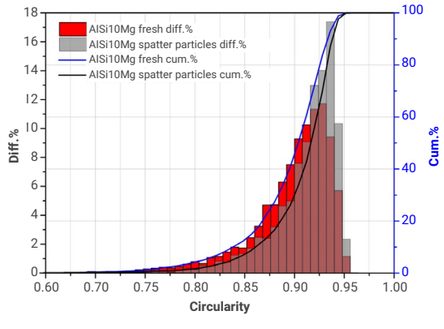
Dual-Camera Imaging System

Shape Measurement

An example of additive manufacturing for shape analysis using the Bettersizer S3 Plus is shown below. A representative number of individual particles are recorded from two AlSi10Mg samples, and the number-weighted aspect ratio and circularity are evaluated in compliance with ISO standards. (Adapted from F. Schleife, C. Oetzel. *Chem. Ing. Tech.* 93.8 (2021): 1199–1203.)



Compared to the fresh powders, the spatter particles show a significantly larger aspect ratio and thus a lower average elongation.



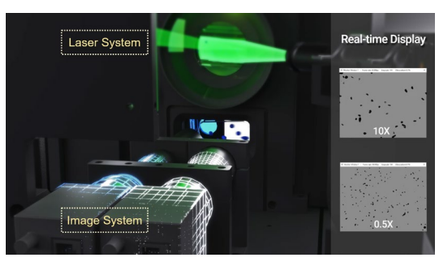
The spatter particles exhibit a higher average circularity and are expected to possess a lower shape anisotropy than the fresh powders.

Combination: Laser Diffraction and Image Analysis

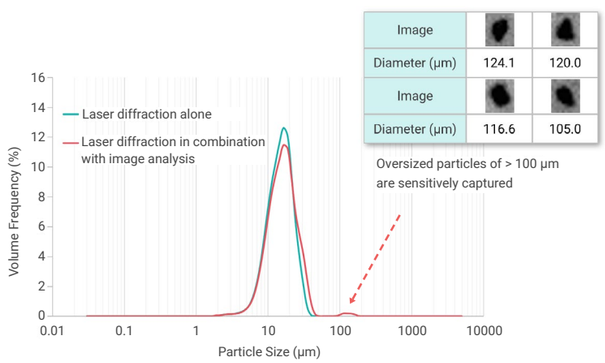
Oversized Particle Detection

Laser diffraction in combination with image analysis can sensitively detect oversized particles that are statistically underrepresented within a wide-distributed sample, such as oversized grains, agglomerates, air bubbles, etc.

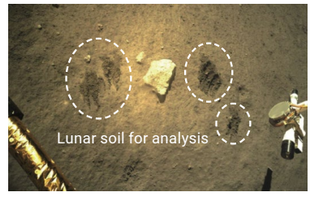
An example of an off-specification abrasive is displayed below. The Bettersizer S3 Plus confirms the presence of oversized particles, by showing a size peak at around 120 µm and the images of overly coarse particles.



Click to watch the video



Analysis of Samples with Extremely Broad Distributions



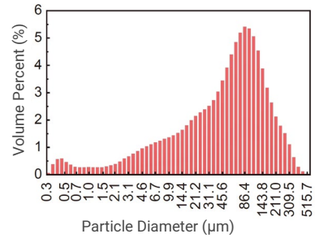
Lunar soil analyzed by the Bettersizer S3 Plus

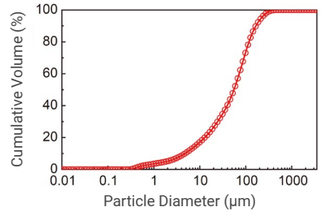
The combined measurement of the Bettersizer S3 Plus is an ideal solution to acquire accurate quantitative results of samples. Here shows an example to measure the soil sample returned from the Moon.

Based on the comprehensive size and shape results, the lunar sample can be described to be well-graded according to geotechnical criteria. (Adapted from Zhang, Hui, et al. *Science China Physics, Mechanics & Astronomy* 65.2 (2022): 1-8.)

Size Characterization

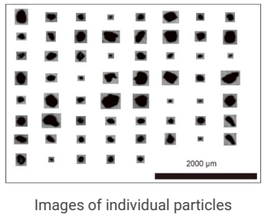
A very broad distribution of particle size occurs in the range of 0.3 - 516 µm. In the size range of 1 - 10 µm, there is a slow increase, suggesting the presence of **a noticeable amount of fine dust**.



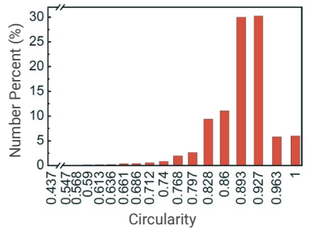


Shape Characterization

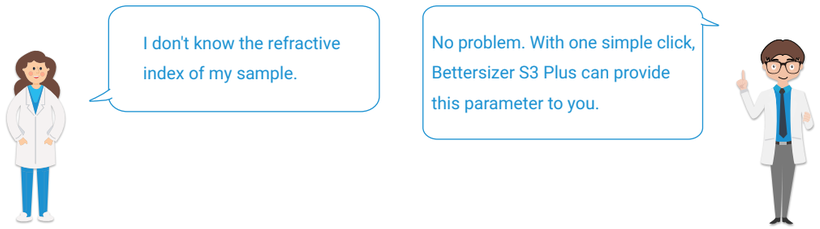
The circularity of individual particles of the lunar sample is analyzed based on particle images. Most lunar regolith particles possess high circularity and are thus **relatively regular in shape**.



Images of individual particles



Refractive Index Measurement



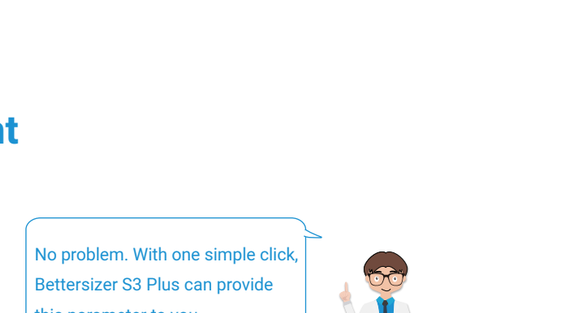
Under the Mie theory, measurements by laser diffraction are challenging for samples including:

- Samples with completely unknown complex refractive index;
- Samples with heterogeneous chemical composition;
- Samples with significantly different particulate optical properties compared to the bulk material;
- Samples having a distinctly strong optical dispersion (small Abbe number).

Refractive index measurement is one of the best solutions. Bettersizer S3 Plus is capable of the following:

- Determine comprehensive refractive index for unknown samples;
- Measure samples with unknown properties;
- Verify the known data of a material at a specific light wavelength;
- Provide key parameters to calculate particle size distribution in real time.

Material	Refractive index (literature)	Refractive index (measured)
Carbon black	1.88-0.55i	1.95-0.1i
$BaSO_4$	1.65-0.1i	1.71-0.1i
As_2O_3	2.65-0.1i	2.59-0.1i
$FeCO_3$	1.875-0.1i	1.83-0.1i
$CaCO_3$	(1.53-1.65)-0.1i	1.59-0.1i
SiO_2	1.54-0.00i	1.57-0.01i





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BT-A60 Autosampler

Bring Your Productivity to the Next Level

The BT-A60 is a robust, high-throughput autosampler. It measures up to 60 samples in a single run and reduces labor costs while improving laboratory productivity and efficiency. Compatible with the Bettersizer S3 Plus, the BT-A60 provides 24/7 fully automated sample analysis for a variety of analytical applications.

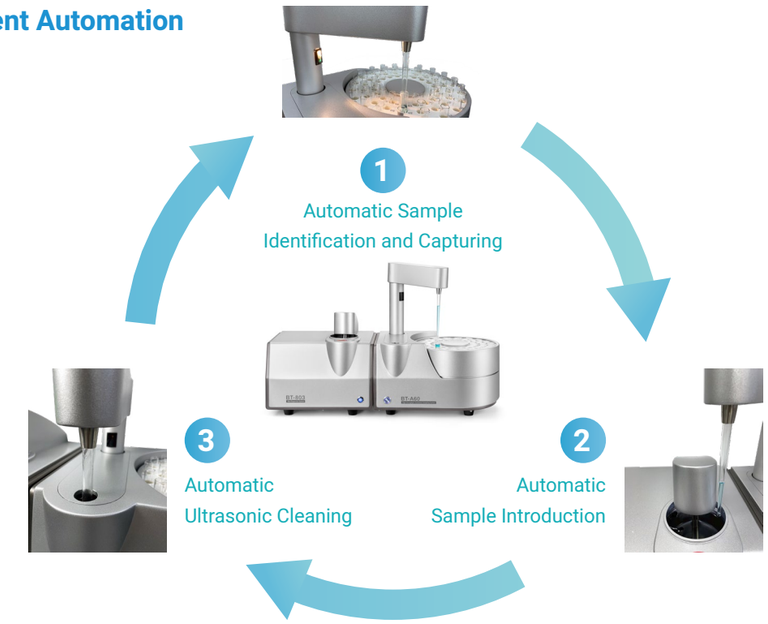
Manual Insertion VS **Measurement Automation**



× **Skilled operator** required
× Potential risk of **human error**
× Risk of **cross-contamination**
× **Messy** workbench
× **Longer** sample-to-sample run times

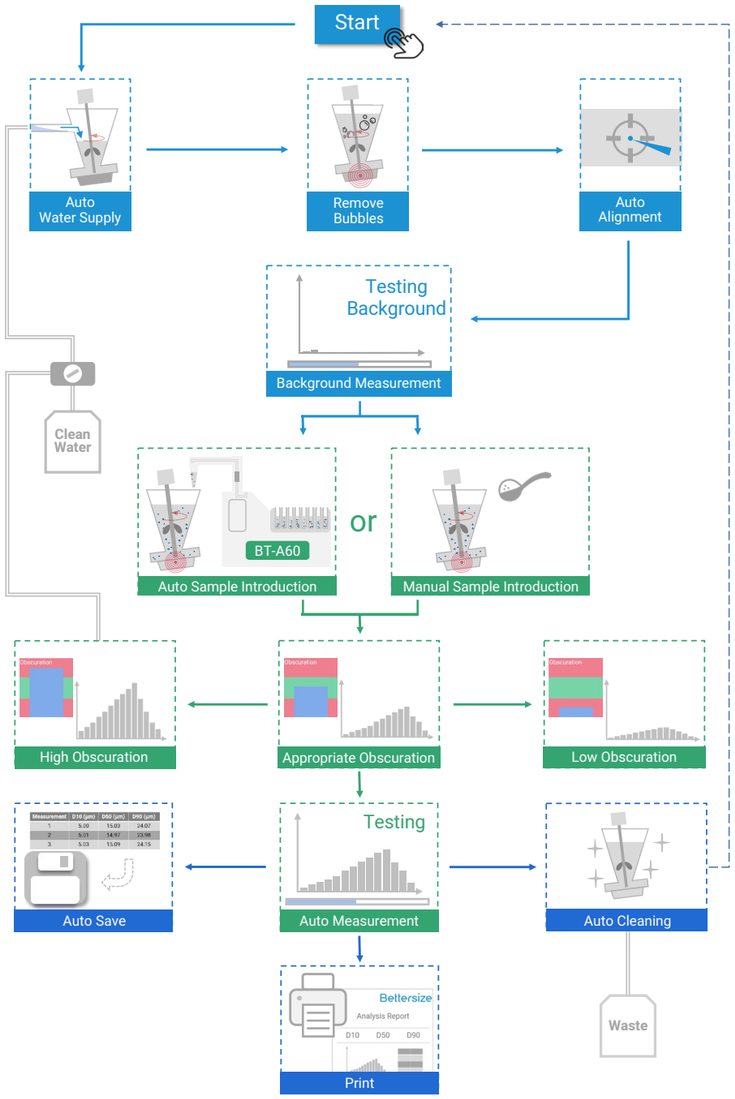
√ Save **labor costs**
√ Independent of **human error**
√ No risk of **cross-contamination**
√ **Well-organized** workbench
√ **Shorter** sample-to-sample run times

Measurement Automation



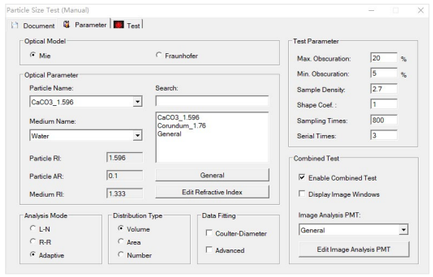
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Standard Operating Procedure (SOP)

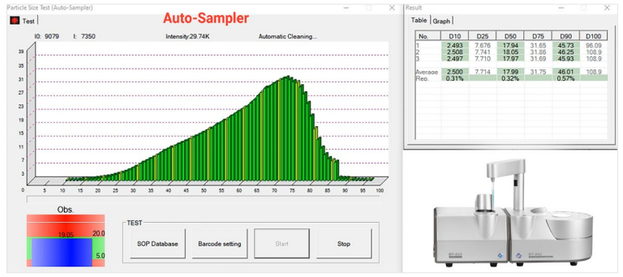


Intuitive and Workflow-oriented Software

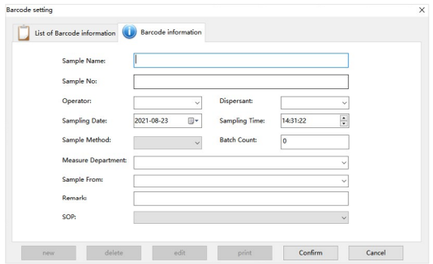
The Bettersizer S3 Plus comes with the workflow-oriented software that includes comprehensive built-in functions such as multilingual operating system, signal extraction, system inspection, SOP, etc. Integrated with these functions, the powerful software guarantees the accuracy and repeatability of results.



Template Settings



Measurement Interface



BT-A60Barcode Printing

Advantages of the software

- Real-time display for determining the optimal measurement conditions
- Fully automatic measurement and cleaning routine
- Commonly used particles and media refractive indices availiable
- Fully comply with 21 CFR Part 11



Accessories



BT-A60 - A durable, automatic, and high-throughput sampling system designed for automatic measurement for either dry or wet sample.

Autosampler	BT-A60
Measurable Upper Limit	200 μm
Sample Capacity	60 samples
Sampling Volume	0.5 mL - 5 mL

BT-A60 High-throughtput Autosampler



BT-803 Automatic Wet Dispersion Module

BT-803 - A large volume automated dispersion unit suitable for measurements with aqueous dispersants as the media or where large quantities of samples are required for better representation.

Dispersion Module	BT-803
Volume	600 mL
Automation	Fully automated
Compatibility	Samples in aqueous dispersants



BT-80N Anti-corrosive Wet Dispersion Module

BT-80N - A solvent-resistant dispersion unit designed for measurements with the organic solvents as the media or where only a small-volume sample is available.

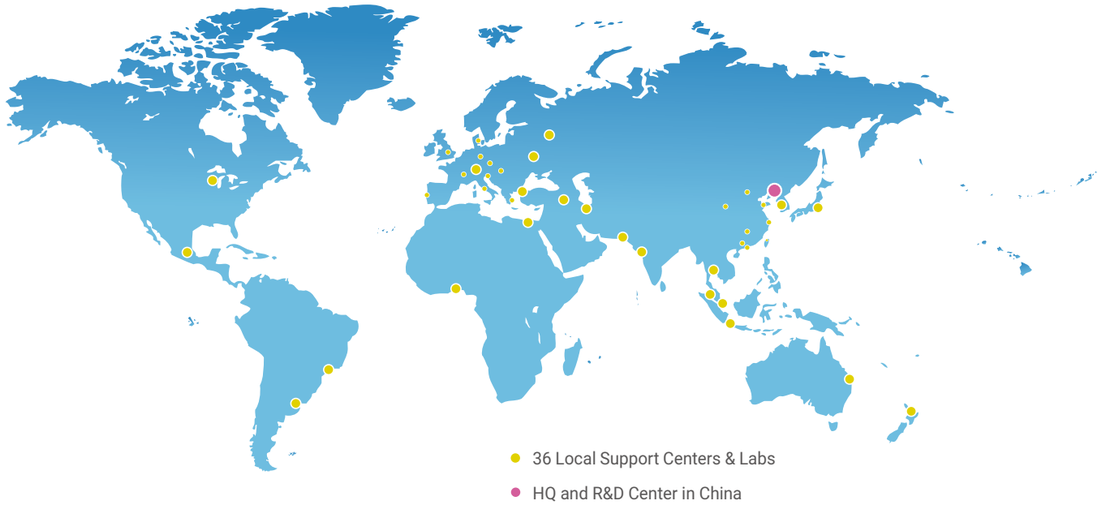
Dispersion Module	BT-80N
Volume	80 mL
Automation	Semi-automated
Compatibility	Samples in organic dispersants

Specification

Parameter Measured	
Particle size distribution	Suspension, emulsion, dry powders
Particle shape	
General	
Principle	Laser diffraction and dynamic image technologies
Analysis	Mie scattering theory and Fraunhofer diffraction theory
Typical measurement time	Less than 10 seconds
Measurement Performance	
Measuring range	0.01 - 3500 µm (Laser System) 2 - 3500 µm (Image System)
Accuracy	<0.5% (NIST certified standards)
Repeatability	<0.5% (NIST certified standards)
Number of size classes	≤100 (adjustable)
Feeding mode	Automatic circulation or semi-automatic circulation
Special functions	Refractive index measurement, SOP settings
Image recognition	Up to 120 fps, up to 10,000 particles per min
Main Device	
Optical system	Patented DLOI (Dual Lenses & Oblique Incidence) System
Laser	Polarized light-pumped solid-state laser (10 mW / 532 nm)
Detector	96 detectors (forward, lateral and backward arrangements)
Measuring angle	0.02 - 165°
CCD cameras	0.5x and 10x*
Image analysis	1.2 megapixels
Dispersion Module	
Circulation speed	300 - 2500 r/min
Circulation flow rate	3000 - 8000 mL/min
Untrasonication	Dry run protection, Max 50 W (adjustable)
Circulation tank capacity	600 mL
Software	
Conformity	21 CFR Part 11, ISO 13320, ISO 13322, USP <429>, CE
Report	Customizable reporting
System Parameters	
Dimensions (L x W x H)	820 × 610 × 290 mm
Weight	48 kg
Voltage	DC 24 V, 50 / 60 Hz, 20 W
Computer Configuration (Recommended)	
Computer interface	At least one high-speed USB 2.0 or USB 3.0 port required
Operating system	Windows 7 / Windows 10
Hardware specification	Intel Core i7, 8GB RAM, 500GB HD, two PCI-E X16 interfaces

* The Bettersizer S3 Plus is also available in a single camera (0.5x) model. Contact us for more information.

Global Footprint



Compliance

All series of Bettersize instruments are in compliance with **ISO 9001** and **CE certification**. The software complies with **U.S. FDA 21 CFR Part 11**, ensuring the validity and reliability of measurement results and meeting traceability requirements.







Certified Service and Support

We take great pride in our exceptional customer service, providing excellent application technical support and after-sales service throughout the product life cycle.

From product demonstration and installation, to regular product training and workshops, preventive maintenance programs, software and hardware upgrade, trade-in purchase program, to repair coverage and 24/7 emergency service, our certified service team have you covered.

Bettersize
CERTIFIED SERVICE

European Representative:

3P INSTRUMENTS

Characterization of
particles • powders • pores

3P Instruments GmbH & Co. KG

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Bettersize

BETTER PARTICLE SIZE SOLUTIONS

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