SCO GERMANY ENG

PARTICLE SIZE

PARTICLE SHAPE

State-of-the-art Particle Size & Shape Analysis System

Breakthrough Particle Sizing Solution

Best Value • Better Performance

PA- S3 Series

BREAKTHROUGH PARTICLE SIZING SOLUTION

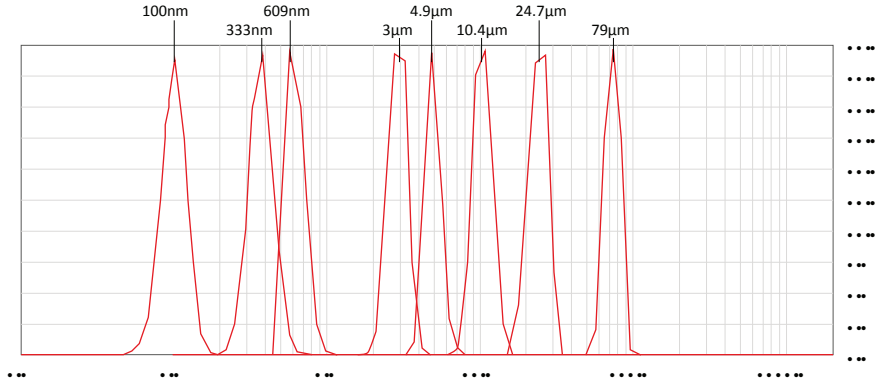
PA-S3 Analyzer Series delivers best-in-class performance through incorporating cutting-edge innovations and functionality into the development of world-class particle analysis system. With a compact yet flexible integrated body, Bettersizer S3 series combines our innovative Dual lenses & oblique incidence optical system (DLOIS) for the wide testing range from 0.01 to 3500μm, automated imaging analysis for shape results of larger particles, smart operation functions, and software for quick and productive measurement.

These innovative technologies contribute to the unique dynamic analysis of particle size and shape and provide the most accurate, high-resolution, high sensitivity, excellence repeatability, cost-effective, and easy-to-use **PA-S3 Analyzer Series** you can ever imagine possible.

Model	PA- S3	PA- S3 plus
Measuring range	0.01-3500μm (Particle size)	0.01-3500μm (Particle size) 4-3500μm (Particle shape)
Measuring method	– Laser diffraction	– Laser diffraction – Automated Imaging
Dispersion system	Wet	Wet
Auto Refractive Index measurement	Yes	Yes

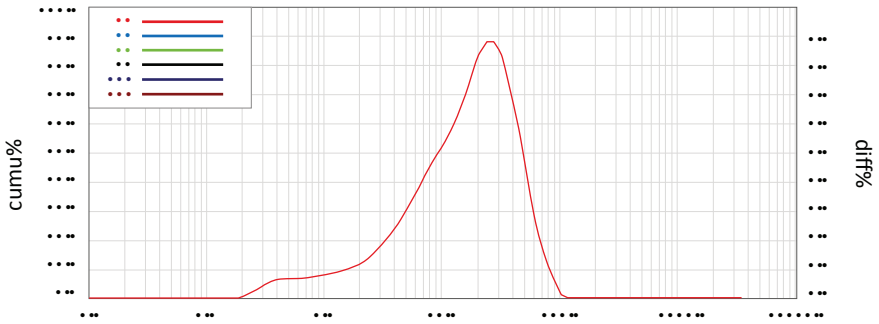
PA-S3 Analyzer Series defines a new era in particle sizing and shape measurement and a culmination of our years of experience excel in particle sizing and shape analysis instrumentation.

The accuracy of S3 series as verified by measurements of eight standard samples.



No.	D03	D06	D10	D16	D25	D50	D75	D84	D90	D97
1	0.067	0.073	0.077	0.082	0.087	0.100	0.114	0.121	0.127	0.140
2	0.232	0.248	0.260	0.277	0.292	0.333	0.378	0.401	0.419	0.467
3	0.482	0.493	0.508	0.530	0.553	0.609	0.684	0.721	0.761	0.828
4	2.333	2.401	2.491	2.627	2.741	3.006	3.308	3.419	3.545	3.870
5	3.994	4.073	4.180	4.339	4.558	4.919	5.375	5.629	5.798	6.355
6	7.988	8.331	8.789	9.044	9.400	10.40	11.44	12.13	12.62	13.49
7	18.53	19.67	20.21	21.03	22,25	24.76	27.44	28.43	29.09	31.98
8	64.40	65.73	67.06	69.05	72.03	78.08	86.13	89.97	92.53	95.51

PA-S3 Analyzer Series measures samples with a wide distribution range. Six replicate results under same analysis conditions yield good repeatability as shown in the following graph. Average repeatability deviation of D50 is 0.31%.

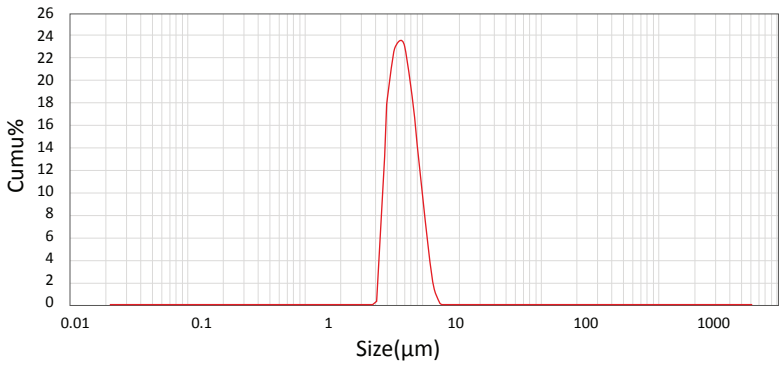


No.	D3	D6	D10	D16	D25	D50	D75	D84	D90	D97	D98
96	0.675	1.403	2.695	4.593	7.448	17.17	30.15	37.36	44.56	61.89	67.30
97	0.666	1.372	2.653	4.530	7.365	17.05	29.97	37.13	44.20	61.41	66.61
98	0.675	1.403	2.695	4.593	7.448	17.17	30.15	37.36	44.56	61.89	67.30
99	0.666	1.372	2.653	4.530	7.365	17.05	29.97	37.13	44.20	61.41	66.61
100	0.670	1.388	2.672	4.562	7.406	17.11	30.06	37.24	44.38	61.66	66.95
101	0.670	1.388	2.672	4.562	7.406	17.11	30.06	37.24	44.38	61.66	66.95
Rep.	0.60%	1.00%	0.70%	0.62%	0.50%	0.31%	0.27%	0.28%	0.36%	0.35%	0.46%

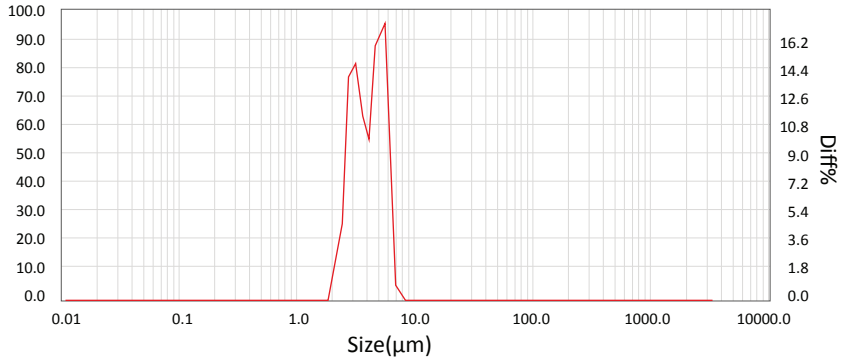
RESOLUTION

Detection limit test: A mixture of reference standard samples of 3.1µm and 5.1µm nominal diameter was used to gauge the resolution of S3 series against the industry benchmark particle sizing instrument. The mixing ratio of 1.65 was used for the test. Bettersizer S3 series clearly out-resolve the benchmark instrument as shown in the graphs.

BENCHMARK INSTRUMENT



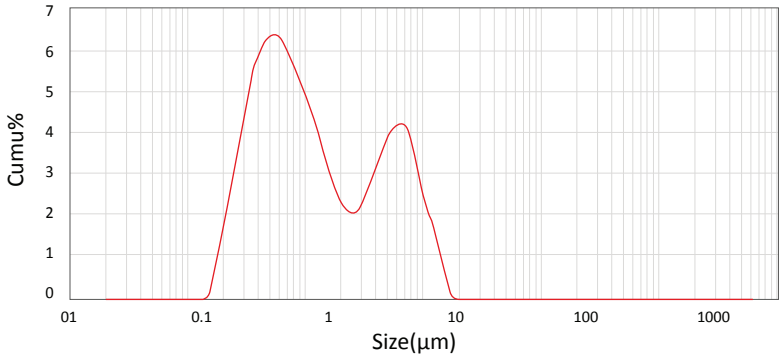
BETTERSIZE S3



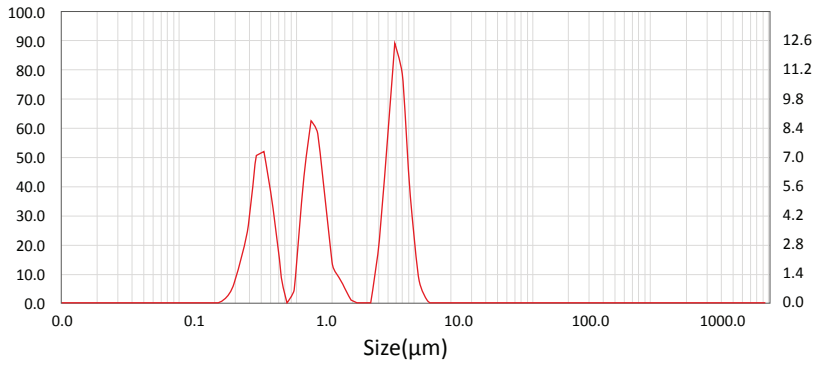
SENSITIVITY

Test methodology: Measurement with a mixed reference standard samples of 0.3mm, 0.85mm, and 3.5mm was performed against a benchmark instrument. Bettersizer S3 series resolves three peaks in the measurement result, while the benchmark instrument only able to resolve two peaks.

BENCHMARK INSTRUMENT

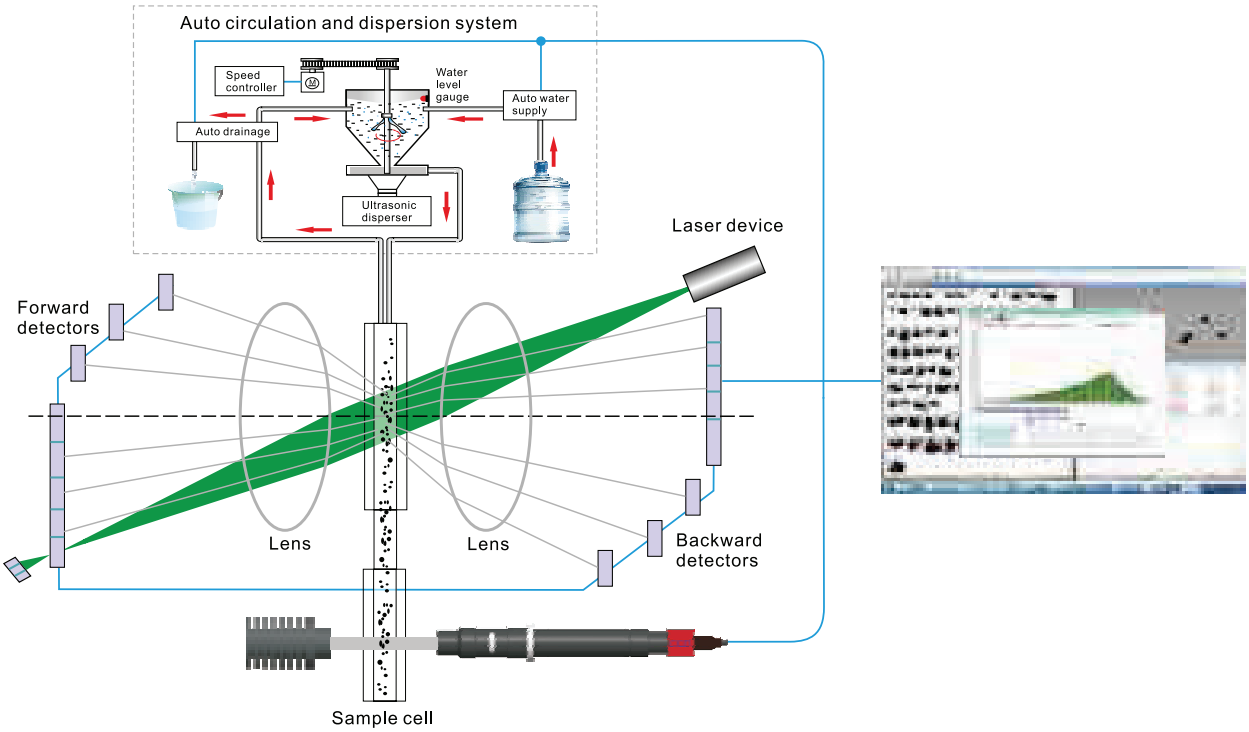


BETTERSIZE S3



Dual Lenses & Oblique Incidence Optical System (DLOIS)

PROVIDE WIDE MEASURING RANGE FROM 10nm TO 3500μm

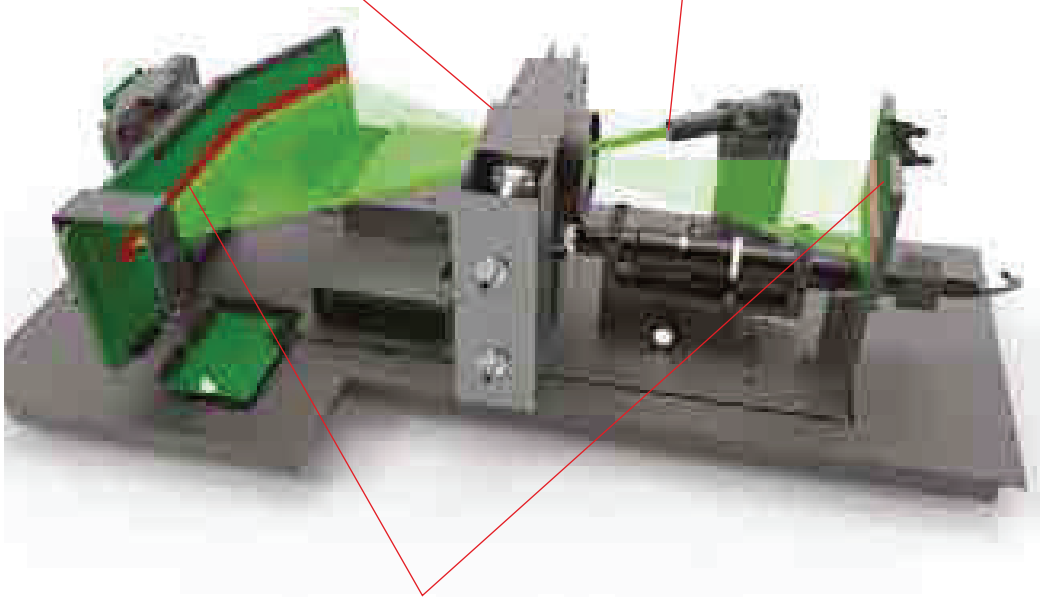


INNOVATION OF FOURIER OPTICAL SYSTEM

DLOIS is a novel technology based on Fourier optical system. By an addition of the second lens at the symmetric path behind the sample cell, DLOIS can detect backward scattered laser light. The second lens also functions as a collimating lens which turns the diverging laser beam into parallel beam before the sample cell. The parallel beam impeding on the sample cell have the advantage of large and constant intensity circle of illumination of the samples inside the cell. In a laser diffraction measurement, the forward and backward diffraction lasers are generated by a single laser source will have a consistent wavelength, datum, and continuity.

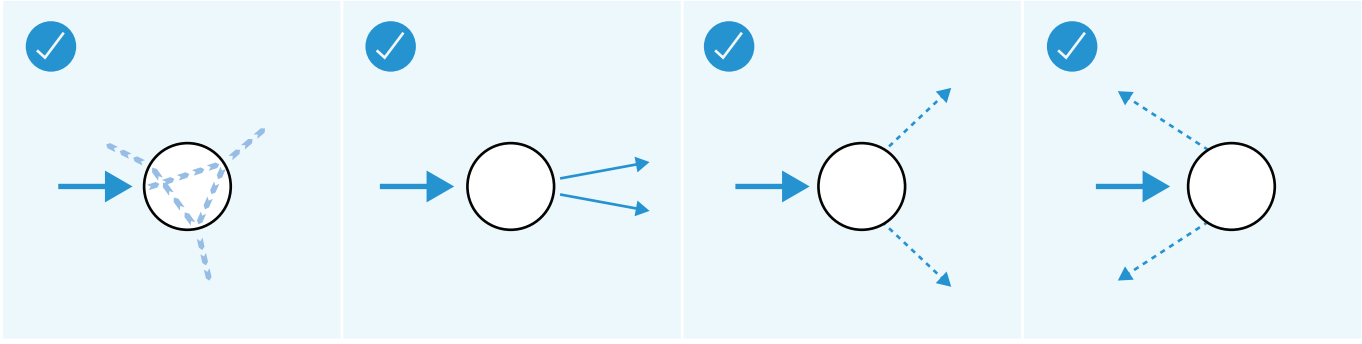
The back-positioned lens is both the laser beam collimating lens and the backward scattering laser detection lens.

Oblique incidence structure achieves the detecting angle of 0.02-165degree and the measuring range of 0.01-3500μm.



96 surrounded detectors on the dual-lens focal plane improve the resolution ratio and measuring accuracy.

The revolutionary DLOIS in **PA-S3 Analyzer Series** changes the position of the laser beam from the conventional parallel optic to the oblique angle optic. The oblique angle beam widens the scattering angle of the laser beam, providing a wider measuring range from 10nm to 3500μm and broaden detection angle up to 165 degrees. This advantage when used in the computation of the particle size with the Mie theory, produce an impressive precision and accuracy results.

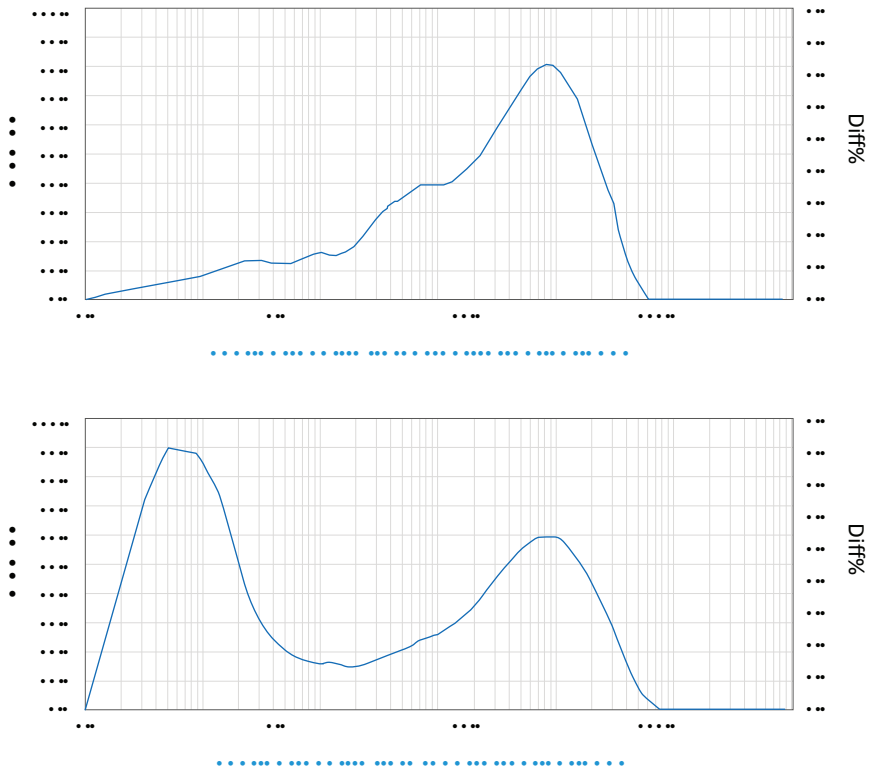


MEASURE THE UNKNOWN REFRACTIVE INDEX & VERIFY THE KNOWN ONES

The automatic material refractive index measurement is a powerful solution especially for researchers working on the synthesis of novelty materials without any prior literature of refractive index available.

Mie theory uses refractive index at specific light wavelength of a material as one of the key parameters to calculate particle size distribution. The lack of reliable refractive index for a particular powder material would result in measurement without confidence.

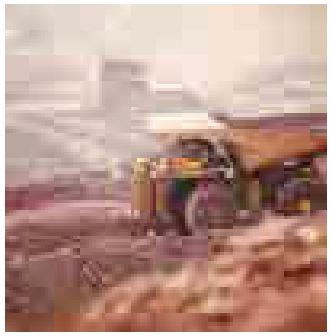
THE REFRACTIVE INDEX IMPACT ON RESULTS (EXTREME CASES)

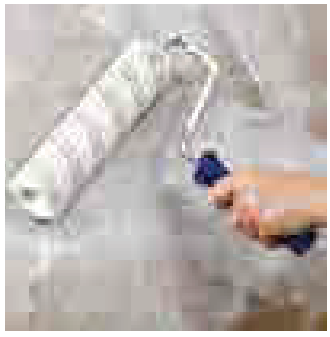


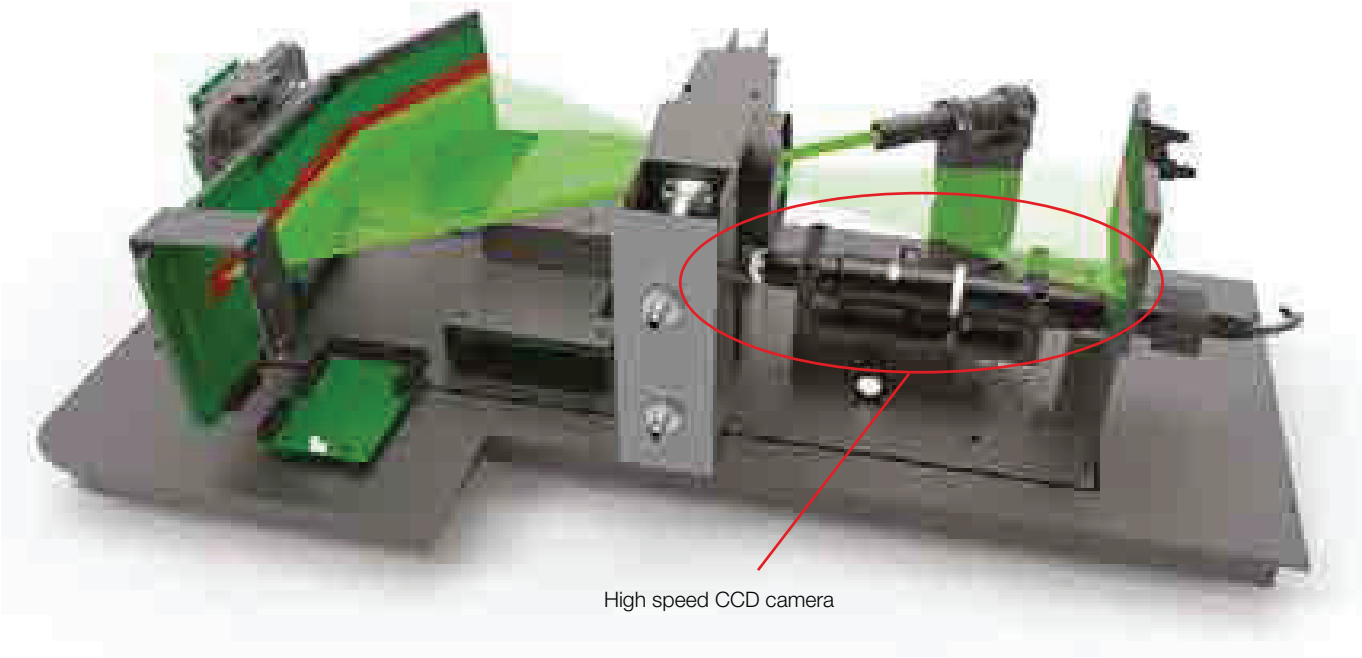
PA-S3 Analyzer Series

automatic material refractive index measurement in real time for materials with unknown refractive index. It provides a solution for statistically reliable, high confidence data that guarantees the accuracy of particle size analysis results. The objective measured data guarantees the accuracy of particle size analysis results. With the incorporation of refractive index measurement
S3 series produces the results with high precisions and low variations.

Material	Refractive index (reference)	Refractive index (measured)	Material	Refractive index (reference)	Refractive index (measured)
Calcium carbonate	(1.53-1.65)-i0.1	1.62-i0.1	Manganese oxide	2.46	2.42-i0.5
Barite	1.645-i0.1	1.68-i0.1	Aluminum powder	1.4-i3.9	1.42-i3
Carborundum	2.61-i0.1	2.74-i0.1	Terbia	none	2.1-i0.5
ZnO	2.008-i0.1	2.02-i0.1	Lithium ironpgosphate	none	1.9-i0.5
Silicate glass	1.89	1.94-i0.001	Resinous material	none	1.86-i0.01
Carbon black	1.88-i0.55	2.0-i1.0	Sediment	none	1.58-i0.1
Hematite	2.94	2.96-i0.5	Powder coating	none	3.5-i1





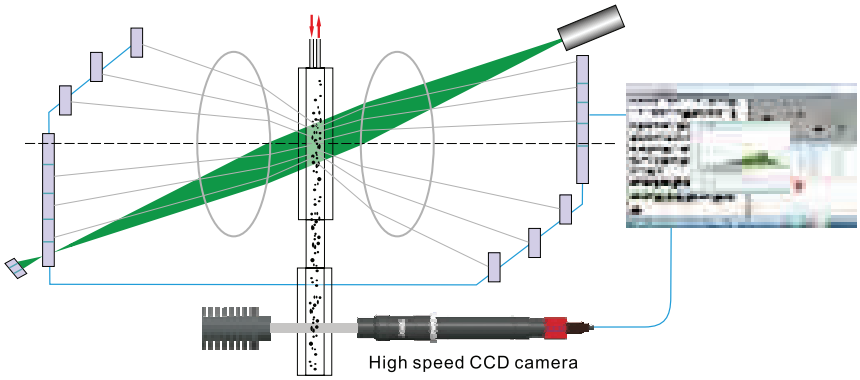


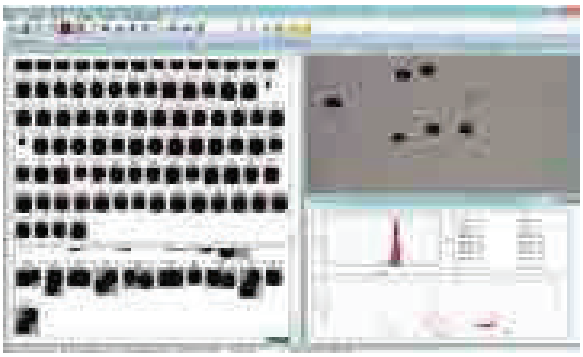
SINGLE SOLUTION FOR PARTICLE SIZE AND SHAPE ANALYSIS

Model PA - S3 plus is an upgraded model of **PA - S3** with an addition of a microscopic particle shape analysis system. The S3 Plus model contains two testing windows working in series under the same set of circulation and dispersion system. The particle size distribution and particle shape could be analyzed simultaneously with the option to perform individual analysis independently. The two function work in tandem, cross-referencing the particle size analysis results with the shape imaging analysis results for the coarse particle, enhancing a better understanding of the particles as well as improves the accuracy and confidence in the results.

The features of laser diffraction + automated imaging:

- High precision telecentric lens, high speed CCD camera, high definition imaging without tailing effects.
- Advanced edge recognition + multithreading software, high-speed image processing of 10000 particles per minute, shooting and processing data concurrently.
- Accurate fine particles measurement by laser diffraction method, compliments by high fidelity microscopic imaging method for coarse particles, offers an unprecedented advantage for characterization of particles.
- Particle shape analysis including L/D, circularity, acutance, radio of thickness and radius.



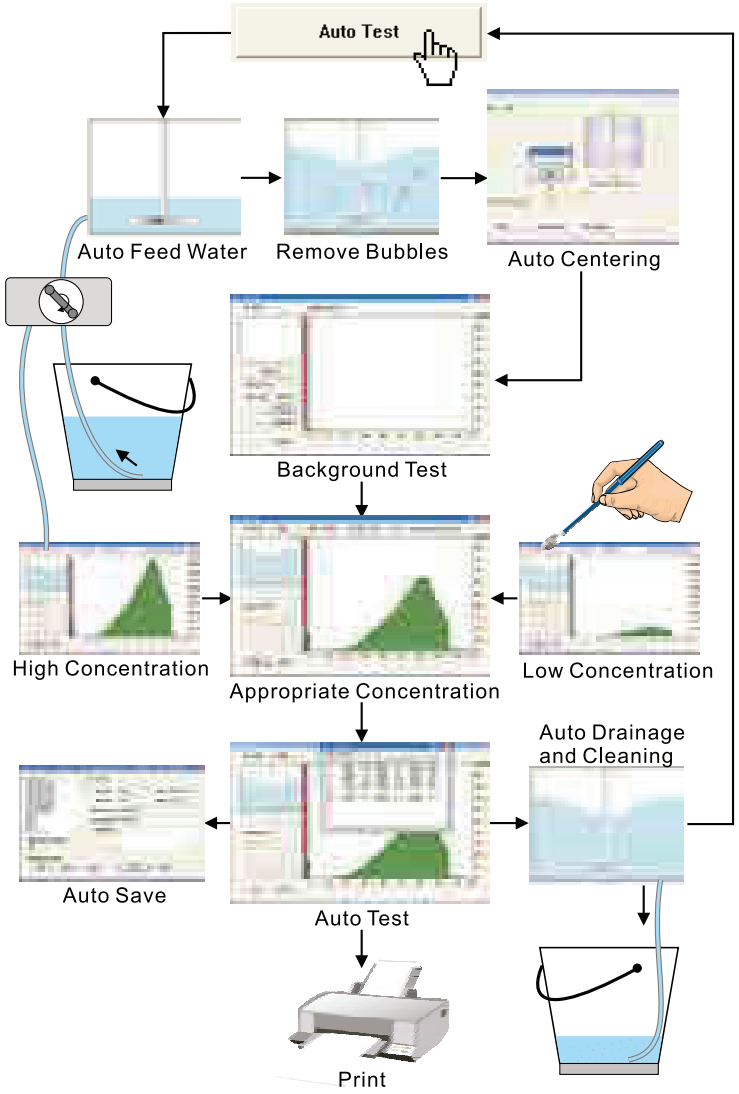


MAKE MEASUREMENT EASY, QUICK AND PRODUCTIVE

1. STANDARD OPERATION PROCEDURE (SOP)

SOP of **Model PA-S3 series** provides an intuitive solution for standardized and automatic testing. Click once on the auto test button, the testing procedure will run by itself, including water intake, bubble removal, background and obscuration measurement, testing, rinsing, and result save and print. Just add sample and the automatic analysis procedure is just one mouse click away.

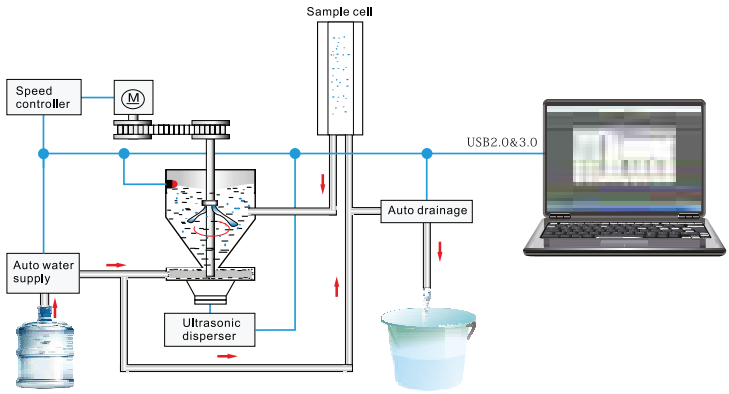
SOP not only provides a simplified procedure but also avoids human operation error; therefore, SOP ensures the repeatability and accuracy of testing results.



2. AUTO CIRCULATION & DISPERSION SYSTEM

The circulation & dispersion system of **Model PA-S3 series** is consist of centrifugal circulation pump, dry burning-protect ultrasonic disperser, stirrer, electronic liquid level sensor, auto water feeding / draining / overflow protection system, fogging alarm for sample cell, plumbing, and controller. The hardware system and controlling software ensure a complete sample dispersion hence make sure that each particle would be accounted for through the laser and camera system.

- Upgradeable to solvent circulation & dispersion system for the special sample.
- Adjustable stirring speed coupled with a powerful pump will prevent the large/dense particle from sedimentation inside the circulation vessel.
- Intelligent dry run protection ultrasound disperser protects the disperser from heat damage when operating the disperser without water.
- Adjustable ultrasonic power give users the control over best dispersion for all types of particles.



3. AUTO CENTERING FUNCTION

The diameter of laser detector center point is only 100 microns. When processing the analysis, the laser detector center point must coincide with the focus point of the back lens; otherwise, measuring error will occur. The auto centering function of **Model PA-S3 series** alleviates alleviate the alignment problem altogether. Automatically moves the laser detector center point to the focus point of back lens before each test, centering function guarantees the perfect condition of optical system; therefore, provides accurate and repeatable testing results.

4. ACCURACY CALIBRATION

Model PA-S3 series features an accuracy calibration function allowing aged or repaired instrument quickly conform to datum status by analyzing the standard sample. This function makes operate parameters maintained at consistent conditions, producing consistent and reproducible measurement across the board for all old and new instrument alike.

5. RELIABLE ULTRASONIC DISPERSER WITH DRY RUN PROTECTION FUNCTION

Ultrasonic disperser will be damaged if water runs out during operation.

Model PA-S3 series improves its ultrasonic disperser by detecting a dry run situation a dry burning situation and invoke the protection mode. This will safeguard it from damage due to unintentional operating errors.

USER-FRIENDLY INTERFACE & POWERFUL FUNCTIONS

Model PA-S3 series adopts an easy to operate and intuitive software interface. It utilizes the full-screen display for all experimental parameters make it a breeze to run an experiment effortlessly and efficiently.

Export results in multiple formats like PDF, txt, jpg, etc. The flexibility help eases the effort for reporting, data publication, data sharing and archival.

Customizable report format	Reporting form could be tailored to suit the format according to the user's preference.
Luminous flux compensation	Compensate the loss of diffraction light due to the reflection by the glass wall in sample cell. Thus, high accuracy would be achieved. 
Large particle recognition	Instrument will accurately identify any large particle by their first appearance at the detection window.
Real-time repeatability monitor	Allow users to gauge the repeatability of their measurement in real-time.
Merge calculation	Average result for one sample can be calculated by merging of repeat-tested results.
Re-analysis window	Data can be re-processed when parameters are changed or modified, so that re-acquisition is not necessary.
Full screen visualized interface	The main interface is result orientated. Acquired data and spectra can be viewed and processed simultaneously.
Certification	21CFR PART 11, CE. **Model PA-S3 series** compliance to international standard, and are qualified by pharmacopoeia, food and other industry's specific requirements.
Operation video	Operation video has been added to the software, which guides the user through a step-by-step measurement procedure.

PA - S3 plus

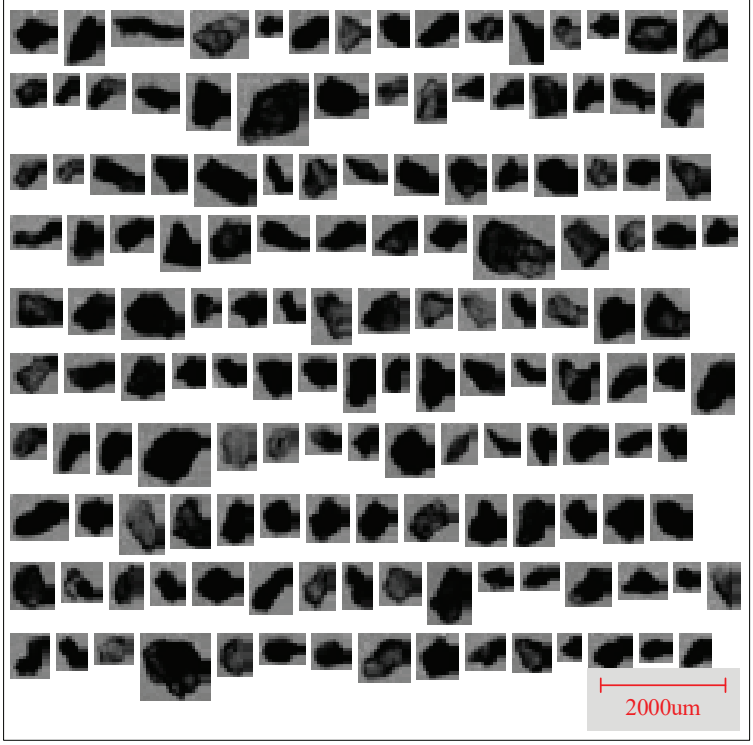
Particle size and shape analysis report

Range : 4 - 3500 um

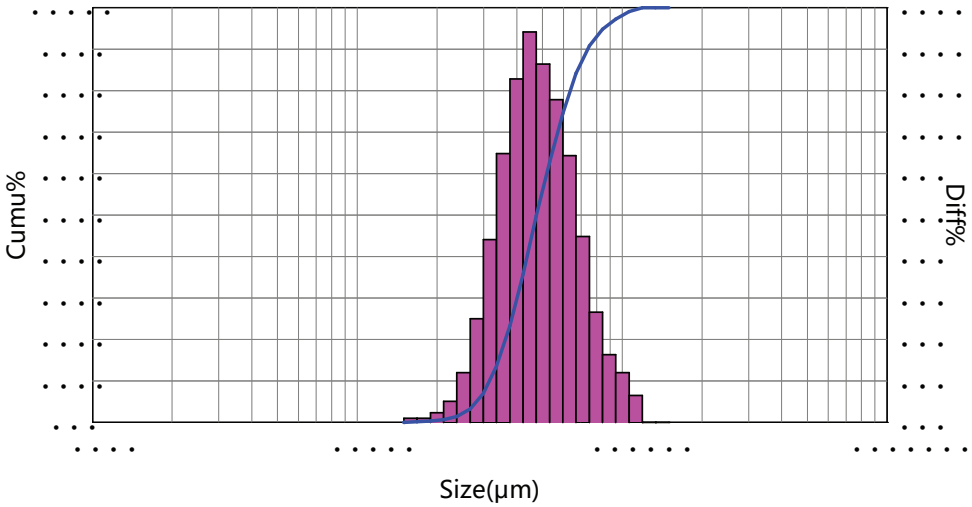
Sample:	202	Sample Owner:	
Sample ID.:		Measured By :	
Operator:	LM	Date: 2017-01-25	Time: 13:26:33
Remark:		Distribution:	Volume

Size(um)	Diff%	Cum%
150.0 - 168.3	0.14	0.14
168.3 - 188.8	0.15	0.29
188.8 - 211.8	0.35	0.64
211.8 - 237.7	0.76	1.40
237.7 - 266.7	1.79	3.19
266.7 - 299.2	3.75	6.94
299.2 - 335.8	6.61	13.55
335.8 - 376.7	9.72	23.27
376.7 - 422.7	12.42	35.69
422.7 - 474.3	14.12	49.81
474.3 - 532.2	12.96	62.77
532.2 - 597.1	11.67	74.44
597.1 - 670.0	9.65	84.09
670.0 - 751.7	6.72	90.81
751.7 - 843.5	3.98	94.79
843.5 - 946.4	2.44	97.23
946.4 - 1061	1.80	99.03
1061 - 1191	0.97	100.00
1191 - 1336	0.00	100.00
1336 - 1500	0.00	100.00

Single Particle Image



D03: 264.0 um	D06: 292.6 um	D10: 320.0 um	D16: 346.6 um	D25: 38.0 um
D50: 474.9 um	D75: 600.3 um	D84: 669.1 um	D90: 736.3 um	D97: 931.5 um
Quantity: 7577	Max Dia.: 1112 um	Min Dia.: 150.0 um	SSA: 0.004 m2/g	Span: 0.76



Diam um	Percent
200.0	0.46
300.0	7.05
400.0	29.55
500.0	55.61
600.0	74.94
700.0	87.49
800.0	93.38
900.0	96.24
1000	98.09
1500	100.00

TESTING PARAMETER	MATERIALS	
Particle size distribution	Suspension, emulsion, dry powder	
GENERAL	**PA- S3**	**PA- S3 plus**
Theory	Laser diffraction	Laser diffraction +automated imaging
Anslysis thoery	Mie and Fraunhofer	
Testing speed	3kHz	
Typical measurement time	≤10 second	
SIZE		
Size range	0.01 - 3500μm (particle size)	0.01 - 3500μm (particle size) / 4-3500μm (particle shape)
Number of size classes	More than 100 customized grades	
Particle shape	None	Circularity,L/D,kinds of equivalent particle size
Refractive Index	Refractive Index measurement	
Accuracy	≤0.5% (GBRM D50)	
Repeatability	≤0.5% (GBRM D50)	
Resolution ratio	Single peak, double peak, multi-peak	
OPTICS		
Green light source	Max. 5mW, DPSSL pumping, 532nm	
White light source	None	Parallel homogenized light source, Image light
Lens arrangement	Dual lenses on the right and left of sample cell, oblique incidence	Dual lenses on the right and left of sample cell, oblique incidence
Lens design	F-Theta Lenses	F-Theta Lenses, 0.5X telecentric lens
Effective focal length	223mm	223mm, image focal length 110mm
DETECTOR		
Arrangement	Log-spaced array	
Quantity	96 pieces (forward, sideway, backward)	
Angular detection range	0.02 - 165 degree	
Light path adjustment	Intelligent automatic alignment	
SAMPLE DISPERSION SYSTEM		
Wet dispersion system	Standard configuration	
Dispersion system	Ultrasound 50W, 38 KHz dry run protection system	
Water circulation	Centrifugal pump, 500 -2500 ml/min, auto water intake and rinsing	
Water capacity	600 ml	
SOFTWARE		
21 CFR Part 11	Enable	
SOP Designer	Enable	
Report	More than 14 formats	
Auto test	Enable	
Data export	EXCEL, PDF, WORD, JPG and etc.	
SYSTEM COMPLIANCE		
Laser class	Class I laser product	
SYSTEM		
Supply voltage	220VAC, 180W	
Dimension	820mm x 610mm x 290mm (L x W x H)	
Weight	47kg	48kg
COMPUTER SPECIFICATION		
Computer interface	At least a USB2.0 port required	
Operation system	Windows XP, Windows 7,8 or 10	
Hardware specification	Intel Core I5, 4GB RAM, 250GB HD	500GB HD, CPU: I7 2600 or above; Memory: 4G or above; Mainboard: With PCI-E interface, long and short card slot. Monitor resolution: 1680*1050 or above

APPLICATION INDUSTRIES

We offers a wide range of models to suit all testing requirements and budget. The instruments cover an expanded measuring range of particles from nanometer to millimeter (or micrometer). Each model is pack with exceptional performance and quality, providing reliable measurement day-in-day-out.

The Instrument find Applications in following fields

- Fuel cells
- Pharmaceutical development
- Agrochemical analysis
- Paints, inks and coatings
- Chemicals
- Mining and minerals
- Metal powders
- Ceramic
- Electronics
- Abrasive
- Cement
- Plastics and polymers
- Soil science
- Oil and petrochemicals
- Coal industry
- Food and drink
- Cosmetics