

| Particle Insight



Particle Size and Shape Analyzer

Particle Size and Particle Shape

The Particle Insight is a state-of-the-art dynamic image analyzer that is ideal for applications where particle shape, not just the diameter, is critical information for predicting raw material performance. The fully automated Particle Insight is well suited for use in a full production environment where speed, accuracy, and ease of use with Pass/Fail shape control limits can be set.



For many years, particle size analyzers have rendered results with the assumption that all measured particles are spherical. However, in many applications, the shape of particles can affect both performance and flowability in manufacturing. Thus, particle shape information about raw materials enable manufacturers to control their process with a much higher level of sensitivity than by using particle size measurements alone.

- Particle Shape, Size and Concentration information in real-time.
- Flexible suspension design to adapt to many different customer sample needs.
- Fully automated for walk-away operation.
- Compliant to 21 CFR Part 11 as well as Data Integrity compliance of the FDA
- Records high resolution images of every particle analyzed for post-run processing

Wide Variety of Benefits...

High speed shape analysis

Flowing particles are analyzed in real time. 30 shape measures are calculated and particle thumbnails are all saved. Analysis time of tens of thousands of particles done in minutes.

Numerous post-analysis functions

Capturing thumbnails as well as 30 shape measures for every particle enables quantifying sub-populations of particles and view particles and data for outliers. Quality Control features offers pass/fail features as well as ability to compare material lots based on shape, not only size.

Adaptable to many processes

Unlike static image analysis using microscopes, the Particle Insight allows the user to adapt the system to meet many needs. Re-circulating sample allows for statistical assurance. System can be configured for single pass as well as adapted as a complement to any other particle size measurement system. Many users have also adapted the Particle Insight to on-line processes.

Optics & Imaging Upgrading

The Particle Insight is designed to allow the user to upgrade the high quality optics as their process needs change. In addition, Cameras can be upgraded by the user as higher resolution cameras become available.

Random Orientation

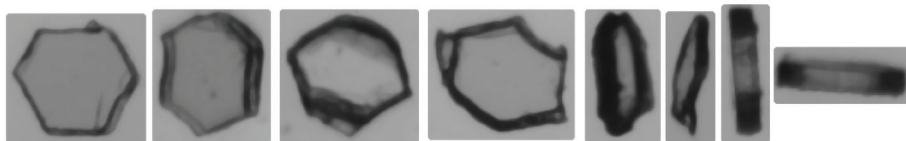
Particles are 3-Dimensional in nature. Analyzing them in only 2-dimensions using a flat-glass plate will only allow the user to analyze the largest orientation of their particles which is only part of the picture. The Particle Insight flowing system allows for a full 3-Dimensional analysis of your particles.

Regulatory Compliance

The Particle Insight as a full Instrument Qualification package for IQ / OQ requirements as well as software that is fully compliant to 21CFR Part 11 and Data Integrity guidelines.

Dedication to Image Analysis

Vision Analytical, having been established in 2008, is fully dedicated to Image Analysis and thus all service, support and application knowledge is focused on the Image Analysis needs of our customers.



Typical Applications

Oil Contamination Monitoring



Early detection of wear particles in lubricating and hydraulic fluids is critical to having a proper predictive maintenance program. It is this early detection and identification of wear particles that permits the extension of engine life and can minimize downtime of equipment. The Particle Insight combines the classification of particles required by industry standards (ISO 4406, NAS 1638) with the reporting of up to 30 shape classifications for all particles identified.

Abrasives



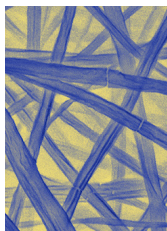
The surface roughness as well as the size of abrasive particles will influence the performance of the final cutting wheel or sandpaper. The Particle Insight can monitor raw abrasive materials not only on size but also on surface smoothness, a direct measurement that can be correlated to the particle's end use.

Toners



With the advancement of toner technology, there has been an expressed need to analyze not only the size of toner particles but also, the shape. Shape of printing toners can impact the flowability during the production process, as well as the effectiveness of the toner particles when in use. Controlling uniform shape of toners allows for more accurate color reproduction and more efficient toner use.

Fibers



Fiber particles are used in a vast array of applications ranging from adding strength to building materials to making effective filtration media. Particle analysis results expressed in equivalent spherical diameter do not give the user critical information needed to determine how fibers will perform in a final product. The Particle Insight can be used to calculate the fiber length and width along with the aspect ratio. Fiber curl (the degree of fiber curvature) can also be calculated.

Protein Therapeutics



Aggregation is an inherent property of proteins and the detection of this collection of sub-visible particles is critical to ensure the effectiveness of these therapeutic proteins. The Particle Insight is a complementary technique to USP <788> enabling the quantification and identification of select particles in any given set of ranges. In addition, thumbnail images can display for the user rare event particles found in these injectable fluids.

Battery & Energy Storage



Particle size and shape influences packing density which in turn affects electrode thickness and therefore energy density. It has been shown that particle size of graphite as well as particle orientation in the coated foil affects the electrochemical performance of graphite anodes. Purity is also an important issue and low levels of metallic impurities must be maintained in all powders and additives used in electrode manufacturing.

Additive Manufacturing



The shape of powder particles influences the bulk packing and flow properties of a powder feedstock. Spherical particles are expected to arrange and pack more efficiently than non-symmetrical particles. Spherical shape facilitates the flow ability of powders yielding more uniform powder layers in powder bed systems. Shape also directly influences the powder bed packing density and subsequently the final products apparent density. Irregular shaped particles lower the final component density and lead to an increase in porosity.

Pharmaceuticals

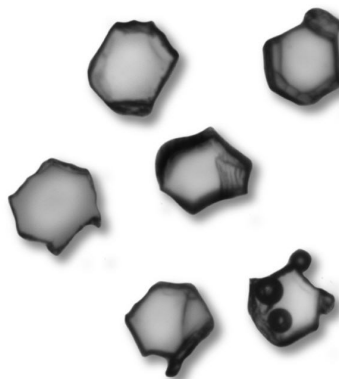
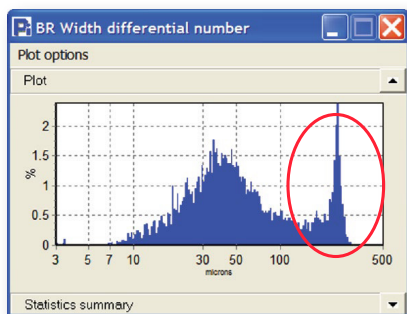


Particle shape can help in identifying and quantifying the different sub-components in a final product based on their differences in shape. Measuring particle smoothness over time can also enable the measurement of dissolution rate.

Particle Insight Features

Thumbnail Extraction from Specific Points in Histogram

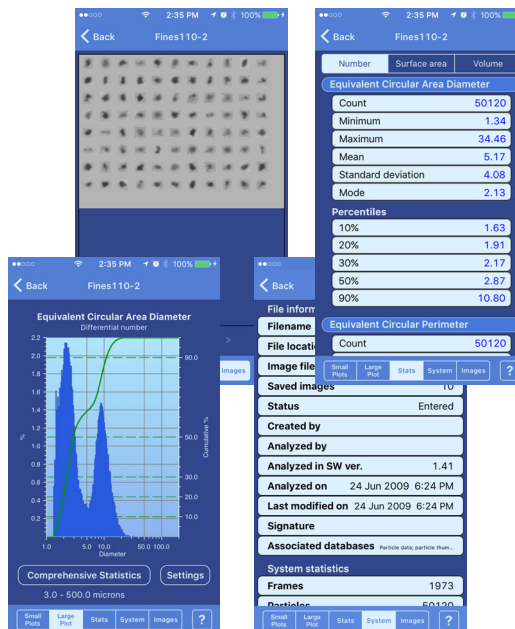
Being a number based system, the Particle Insight analyzes and capture images of each particle. Each particle thumbnail is assigned 30 measures. This allows for users to view and have statistics of all analyzed particles from anywhere in the statistical distribution.



The Particle Insight allows the user to have a true analysis of all dimensions of the particles. In addition, the user can selectively see each particle that created a certain area of any shape.

Smartphone and Tablet Application for Particle Insight

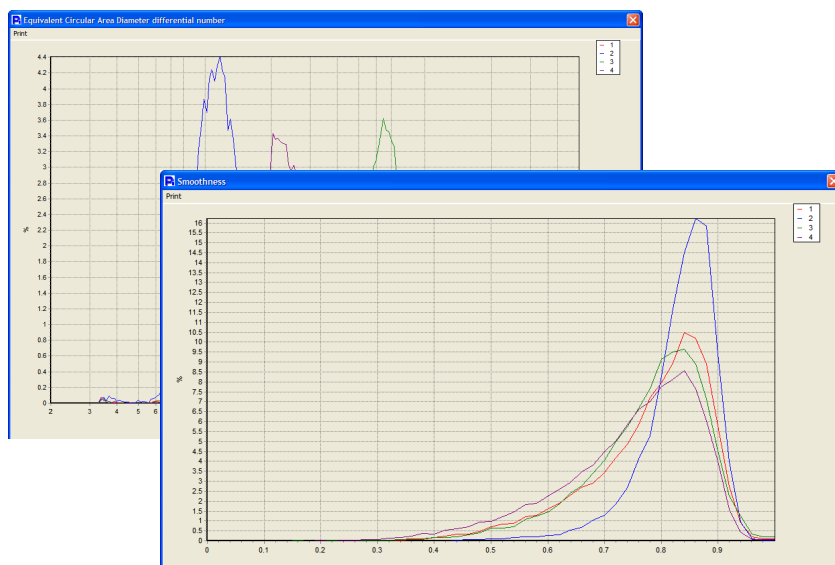
View and perform additional Statistical analysis on the go. A unique feature allowing automatic real-time secure cloud based data transfer from the Particle Insight to the palm of your hand. As results are completed, data is uploaded where authorized users can download and not just view results but also, perform statistical analysis.



Particle Insight Features

Compare Samples with Shape Overlays

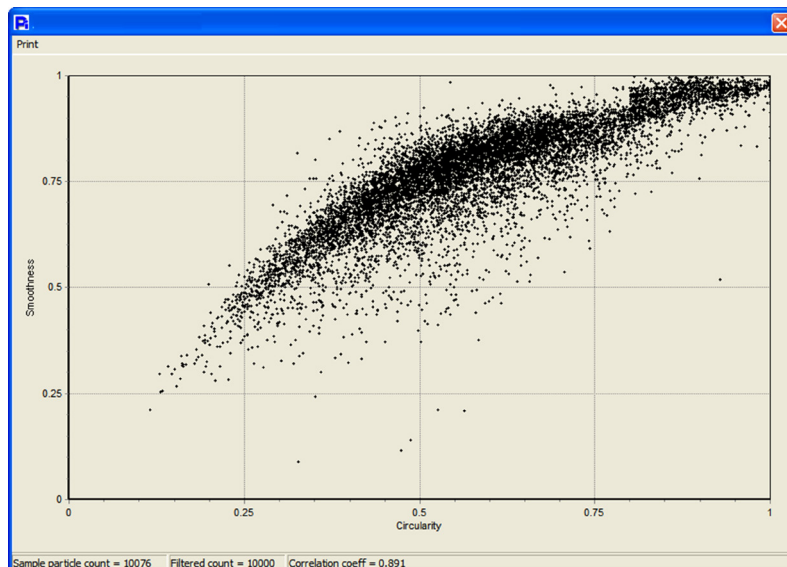
The Particle Insight allows for sample-to-sample comparisons to visually show differences in all shape aspects of particles. By overlaying sample shape and size histograms the user can compare lot-to-lot sample results or monitor how a milling process is changing.



Most particle size analyzers assume particles to be spherical without considering other critical shape factors. In the above example, the difference in two samples, similar in size when assumed to be spherical, are clearly demonstrated in overlays of both circularity and smoothness. Only a particle shape analyzer can render such critical shape information.

Scatter Plot Correlates Two Shape Measures

The correlation between any two shape results of the same sample can give the user unique information about their process and their particles. The correlation coefficient calculation can also be used as quality control criteria for process control. This Pearson coefficient is widely used as a measure of the strength of linear dependence between two variables.

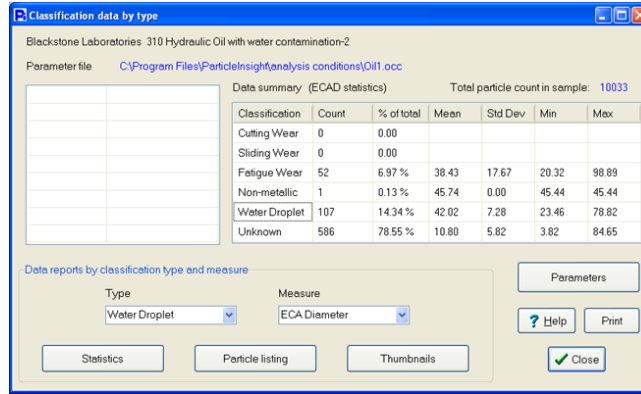


In this example, 10,000 flake-like particles analyzed in just minutes show an important trait of the sample. As can be seen by the correlation, as the flakes become more circular, they also become smoother.

Particle Insight Features

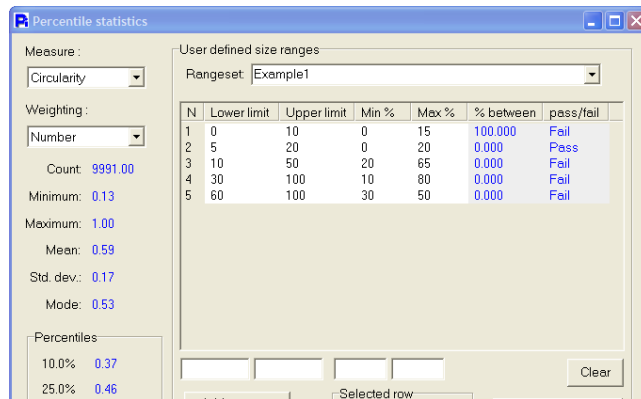
View Collected Data and Thumbnails of Each Sub-Component

The Classification window allows the user to view statistics for each desired type of particle, examine their statistical listing, modify any parameter to adjust what particles to classify, and most importantly, see each particle that has been classified.



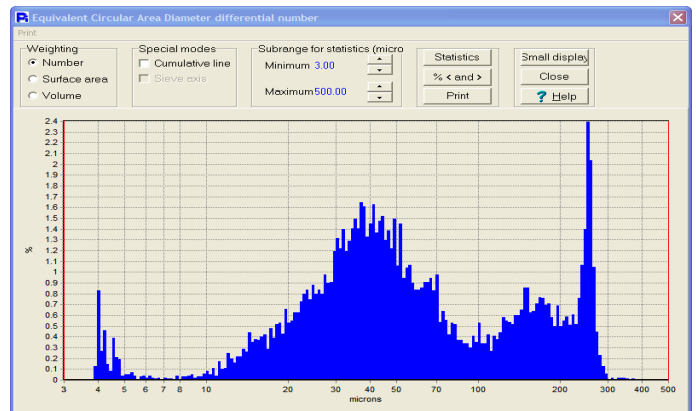
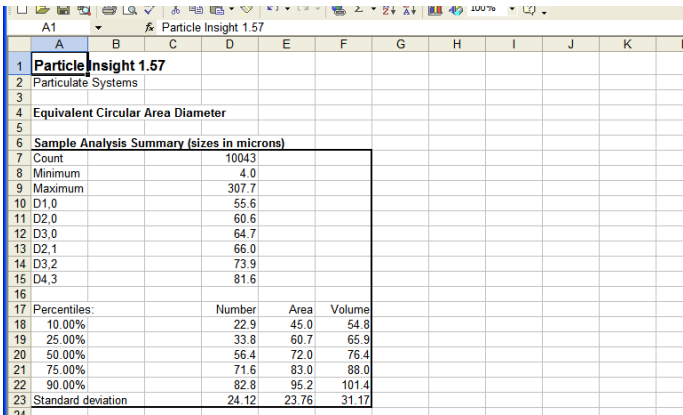
Process Monitoring

To simplify manufacturing process control, the Particle Insight incorporates a process monitoring feature that shows simple pass/fail indicators for any shape measurement. It is no longer necessary to control an incoming or outgoing process by particle size alone. This feature can also be used to classify particles as required by industry standards such as ISO 4406 and NAS 1638 for the oil industry, and USP <788> for therapeutics.



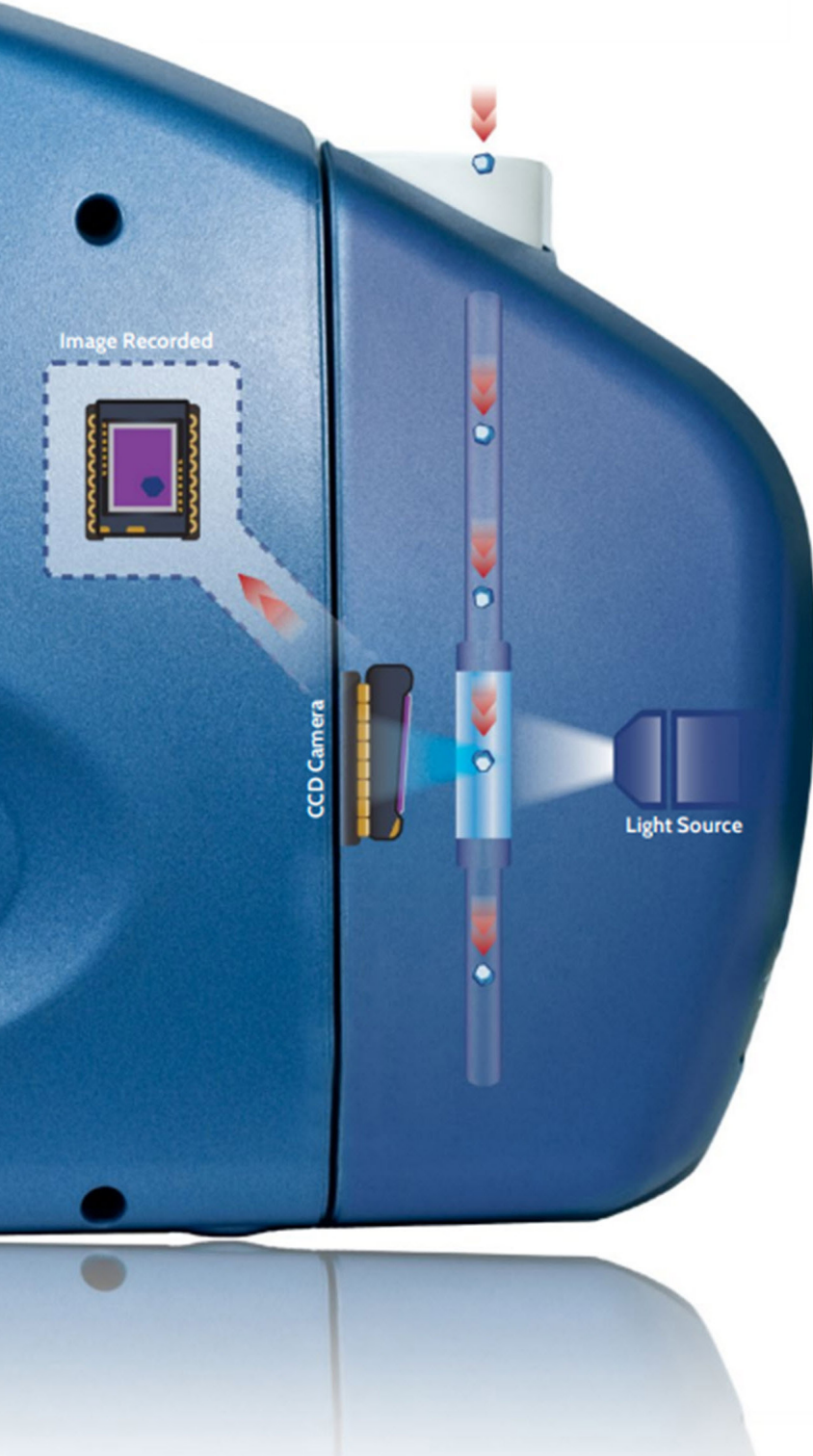
Data Generated in either Graphical or Spreadsheet Formats

In addition to creating up to 30 shape result histograms in real-time, the Particle Insight can also display data and images in many formats. Statistical information can be shown and printed for all shape measures including sieve-correlations and the automatic creation of spreadsheet files enabling users to have shape information for each particle analyzed.



Shape Measure Calculations

The standard Particle Insight uses a recirculating liquid system that transports the suspended sample through the analysis cell where a digital camera takes an image of the particles, converts the image to a digital format, and sends the information to the software for final analysis in real time.



Shape Model Descriptions

Circle Models

- Equivalent circular area diameter
- Equivalent circular perimeter diameter
- Bounding circle diameter
- Mean radius diameter
- Circularity
- Smoothness
- Compactness

Ellipse Models

- Equivalent elliptical area, width, length
- Bounding ellipse width, length
- Elliptical aspect ratio
- Ellipticity

Rectangle Models

- Bounding rectangle length, width
- Bounding rectangle aspect ratio
- Rectangularity

Polygon Models

- Polygon order
- Interior angle
- Convexity

Fiber Models

- Fiber length, width
- Fiber aspect ratio
- Fiber curl

Irregular Models

- Feret length, width
- Feret aspect ratio
- Surface uniformity

Pixel Intensity

- Opacity
- White Fractions

Size Range Model Options

1 μm to 150 μm , 3 μm to 300 μm , 10 μm to 800 μm , 100 μm to 2500 μm *

*available on Shape Module option

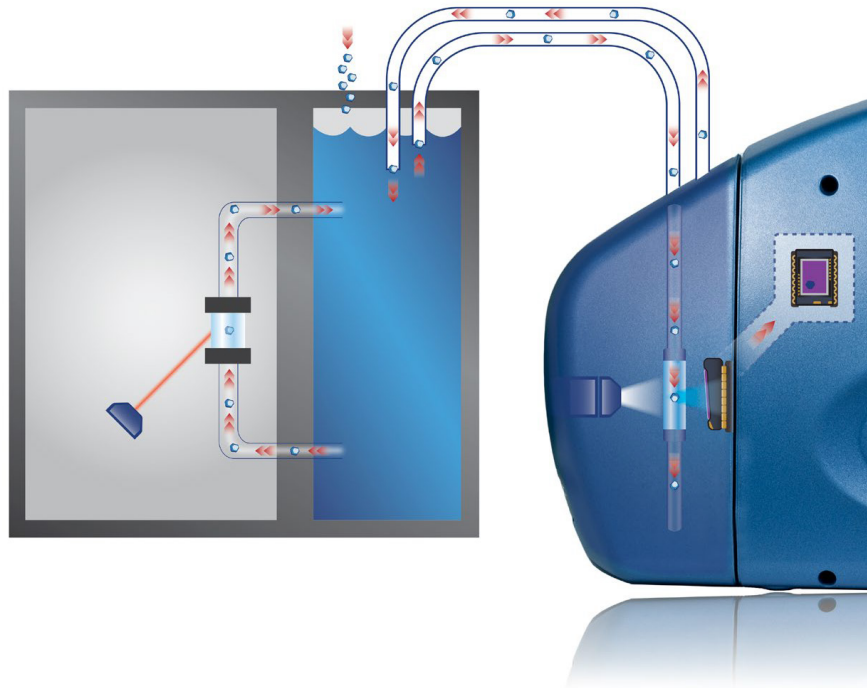
Particle Insight Shape Module

Fully integrates Into Your Current Particle Sizing Workflow Without Compromise...

The Particle Insight Shape Module automatically takes an aliquot of sample from the reservoir of your current laser light scattering instrument. The sample is analyzed in the Particle Insight Shape Module, data is collected, and then the sample is returned to the same reservoir of your sizing instrument. All of this is done in parallel with your current sizing instrument without compromising the results from either instrument.

No longer assume that particle size distribution, as a single measurement, assures the quality of your material. Utilize the knowledge of shape and its influence to product behavior and performance to optimize your material or process.

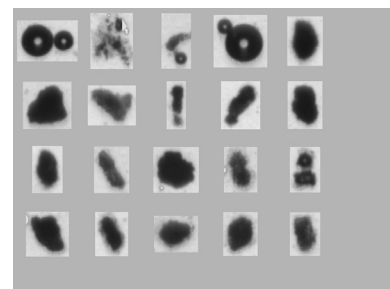
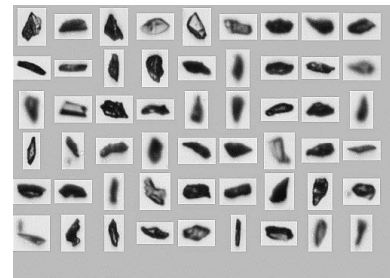
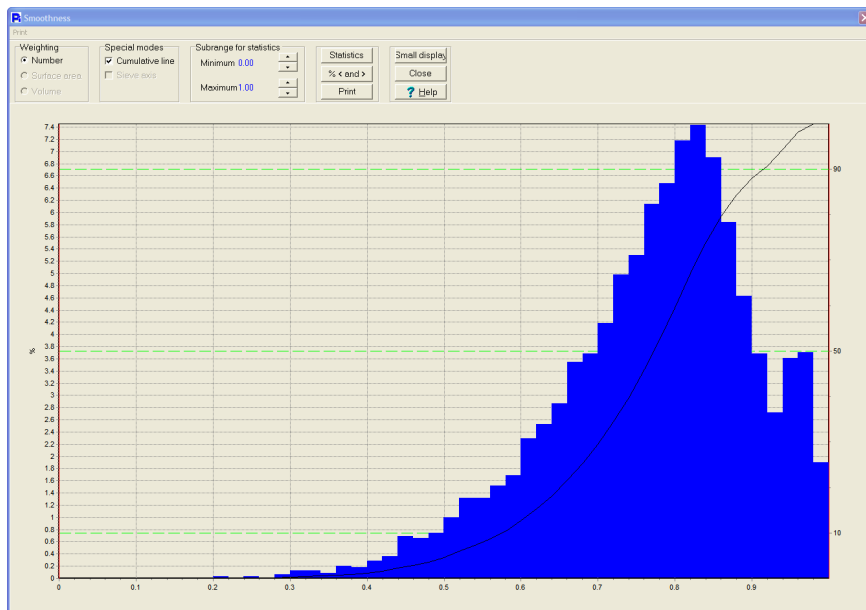
The Particle Insight Shape Module (PiSM) is a universal, full-featured, dynamic image analysis instrument that is designed to be fully integrated with many established particle size instruments. As a user of laser diffraction, electrical sensing zone, light blockage, or other methods the PiSM allows you to keep your current methods and add this shape module within your established workflow to give you a broad array of additional critical information.



Particle Insight Shape Module

Compliment Your Existing Processes

No need to change or re-validate your currently established method or process instead easily integrate the PiSM within your fluid path of your existing size-only instrumentation. As the sample is being analyzed, the Particle Insight taps into the sample reservoir of your sizing instrument, removes an aliquot of no more than 30ml of the sample, performs real-time shape analysis and returns the sample to the existing instrument without jeopardizing sample or instrument integrity.





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