



The *next* generation in
particle *sizing* and *counting*.



Multisizer™ 3

COULTER COUNTER®

Real-Time Analysis Digital
COULTER COUNTER®
high resolution
Volume
number

Introducing

The Multisizer™ 3
COULTER COUNTER®

The most versatile particle sizing and counting analyzer available today. Using the Coulter Principle, also known as ESZ (Electrical Sensing Zone), the Multisizer™ 3 provides number, volume mass and surface area size distributions in one measurement, with an overall sizing range of 0.4 µm to 1200 µm.

Whatever the industry – abrasives, pharmaceuticals, polymers, CMP, paint/pigments, or biological cell studies – you will get the ultra-high resolution, multiple channel analysis and accuracy you need. Its response is unaffected by particle color, shape, density, composition or refractive index.

Equally at home, in a quality control environment or the Research & Development laboratory, the Multisizer™ 3 COULTER COUNTER provides the analyst with a system which is easy to use, yet so technologically advanced that it is able to solve most particle sizing or counting problems.

The History of Beckman Coulter Particle Characterization

For over 40 years the Particle Characterization Group (PCG) of Beckman Coulter has provided answers and solutions to those involved in the testing and measurement of the physical properties of particles.

History of Innovation

- Coulter Counters – 1954
- Pore Characterization Analyzers – 1975
- Photon Correlation Spectroscopy Analyzers – 1983
- Zeta Potential Analyzers – 1988
- Laser Diffraction Analyzers – 1989
- Surface Area/BET Analyzers – 1993
- Digital Pulse Processing – 1999
- Image Analyzers – 2000

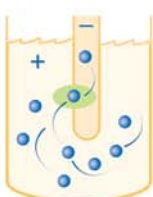
We are in a unique position to offer solutions for most particle analysis needs. World-class support, including being listed as an ASTM approved laboratory, and with service only a company such as Beckman Coulter can provide, purchasing an instrument from us will deliver performance, versatility and peace of mind.



The Beckman Coulter Technology Center

The Coulter Principle

Particles suspended in a weak electrolyte solution are drawn through a small aperture, separating two electrodes that have an electric current flowing between them. The voltage applied across the aperture creates a “sensing zone”. As particles pass through the aperture (or “sensing zone”) they displace their own volume of



electrolyte, momentarily increasing the impedance of the aperture. This change in impedance produces a tiny but proportional current flow into an amplifier that converts the current fluctuation into a voltage pulse large enough to be measured accurately. The Coulter Principle states that the pulse is directly proportional to the volumetric size of the particle that produced it. Analyzing these pulses enables a size distribution to be acquired and displayed. In addition, a metering device is used to draw a known volume of the particle suspension through the aperture, a count of the number of pulses can then yield the concentration of particles in the sample.

Proven Coulter Technology ensures your results are accurate and reliable...

- Nearly half a century of experience counting and sizing particles and cells.
- Nine approved ASTM methods.
- Technology defined by the International Standard ISO 13319.
- The highest resolution available in the industry for particle counting and size distribution. It provides a direct measurement of a real parameter of a particle: its volume.
- Capable of counting and sizing particles at concentration levels not detected by other technologies.
- Color or refractive index does not affect results.

Improved instrument design...

- Easy to operate. Instrument completely controlled through the computer with user-friendly software.
- Digital Pulse Processor. The resolution, range and other parameters can be changed at anytime after the analysis is complete without re-analyzing the sample.
- Resolution can be selected from 4 to 300 channels at any selected range.

- Detection of any change in the sample over the length of the analysis. The pulse distribution offers information about the sample behavior such as dissolution, agglomeration, flocculation, etc.
- Suitable for both aqueous and organic electrolytes.
- Environmentally friendly. Mercury-free metering system.
- New Quick-Connect aperture system (no grease) makes it easy to reconfigure for a desired size range.

Quality Assurance functions put you in control of the results...

- User defined Standard Operating Procedures.
- Multiple security levels.
- 21 CFR Part II Compliant.
- Powerful and flexible software allows the processing and presentation of data to fit all needs.
- Trending capability allows for quick and easy monitoring of any process.
- Certification Program to ensure instrument performance.
- V-Check (IQ, OQ, PQ) instrument validation.

Designed

With The User In Mind



High Sensitivity



Overlay



Multi-Tube
Overlap



Size Trend



Size Interpolation



Standard Operating
Procedures



Particle Count /
Size Distribution

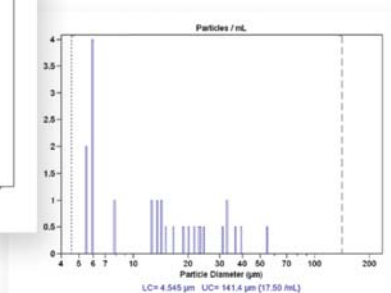
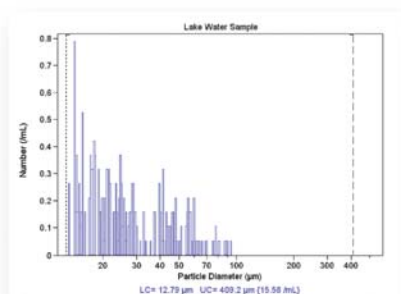


Digital Pulse
Process (DPP)



High Sensitivity

Solid Contaminants in Water



The determination of particle size and number is used to establish the level of insoluble material contaminating water. Usually the concentration of non-soluble contaminants in water is too low to be characterized with any other technology, but with the Multisizer™ 3, water purification effectiveness can easily be monitored.



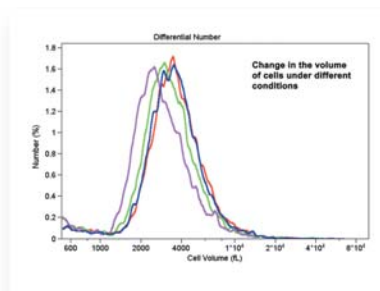
Overlay

MCV (Mean Cell Volume) Changes

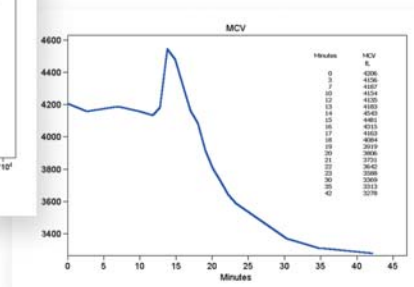
When cells and microorganisms are subjected to changing conditions, they attempt to compensate by adjusting themselves to the new environment. In other cases, cells need to change their volume to achieve a physiological desirable goal.

These changes can be monitored by using the **Overlay** function.

MCV variations can then be easily and accurately recorded using the **Size Trend** capability built into the Multisizer™ 3 software.



Overlay



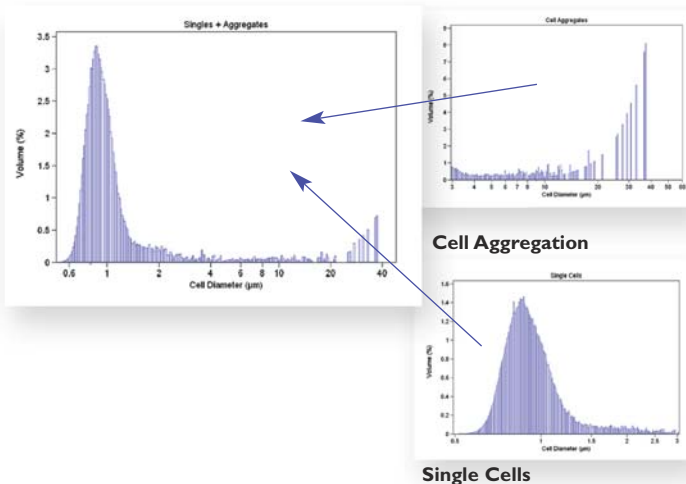
Size Trend

Applications and Industries

Abrasives Bacteria Biomedical Biotechnology Construction Industry
Cell Biology Ceramics Chromatographic Material Clays
Cosmetics Crystals CMP Environmental Emulsions
Electronic Industry Filtration and Filter Efficiency
Food Industry Fish Farming Fuel Hydraulic Fluids Lubricants Metals
Marine Biology Microspheres Paints and Pigments Paper Industry
Pharmaceuticals Petrochemical Industry Pesticides
Photo Industry Oils Toners Water Contamination

Multi-Tube Overlap

Determining Bacterial Aggregation in a Culture

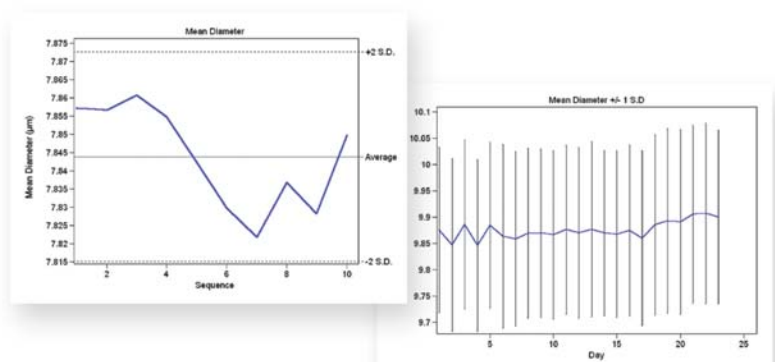


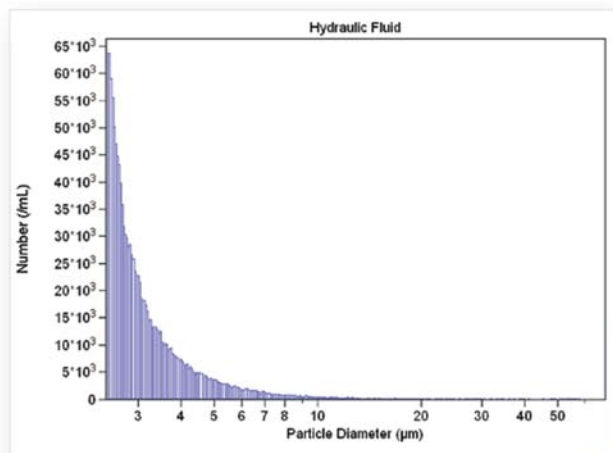
Bacterial aggregates can reduce the effectiveness of antimicrobial agents. A combination of detergents and filters can be used to decrease the amount of 'clumps'. The percentage of 'clumps' relative to single cells can be determined by using two different apertures. The **Multi-Tube Overlap** function merges the results into a single continuous distribution.

Size Trend

Quality Control

The Trend data function is used to plot statistics from a number of sample runs on one graph or report. This is useful in a process where a sample is measured at specific time intervals for example. These individual data files can then be used to create a **Size Trend**. These 'trend files' can then be updated and added to as often as is necessary.





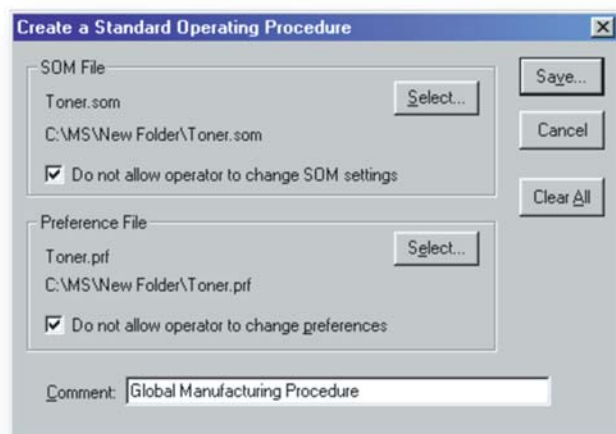
Particle Diameter (µm)	Number /ml >
5	103509
10	12333
15	3745
25	1009
50	285

The Multisizer™ 3 software can be used to create sample data reports that will arrange the data to conform to a set of user defined boundaries, also called “channels”, “bins”, or “size classes”. (This is similar to how particle data points are reported when different size sieves are used.) The

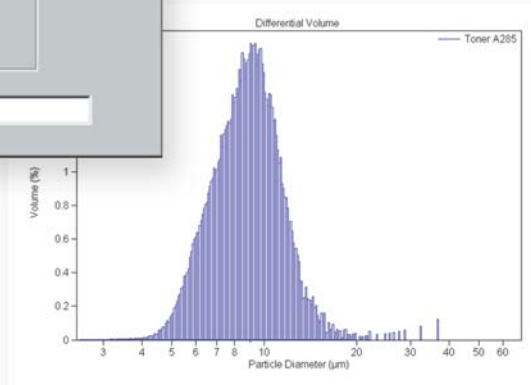
ISO Solid Contaminant Code for Hydraulic Fluids and Lubricants is based on the number of particles larger than a series of given sizes. The **Size Interpolation** function allows the arrangements of the data to classify oils and lubricants as defined by this international standard.

Standard Operating Procedures

Consistency and Uniformity for Analysis and Results



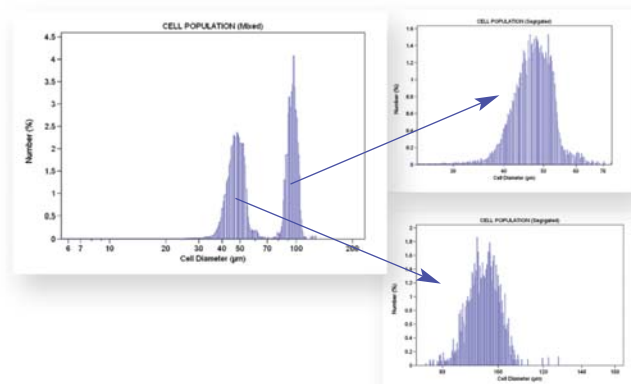
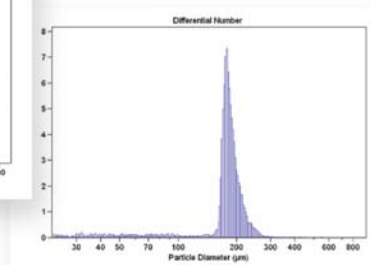
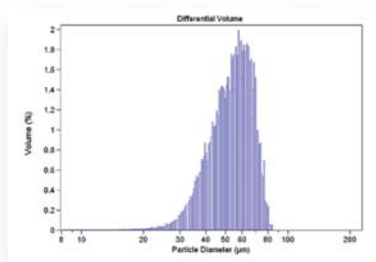
◀ The easy creation of SOP's allows the standardization of analysis methods and the reporting of results. The use of SOP's guarantee consistency and uniformity regardless of the number of applications, operators, instruments and locations involved.



◀ Any number of different SOP's can be created and stored ready to be used when required.



The pharmaceutical industry closely monitors many of its products for **particle count** and **size distribution**, both of these parameters can play a role in the behavior of the final product and its intended use.



In the biomedical field the applications range from bacteria to large cells. The Multisizer™ 3 is the best tool for biomedical research involving cell counts and the tracking of size changes. It is also capable of detecting very low concentrations of cells present in a population.

The **Digital Pulse Processor (DPP)** can recalculate the pulse data for any particular portion of the total range providing the information for the selected range without any loss in resolution.

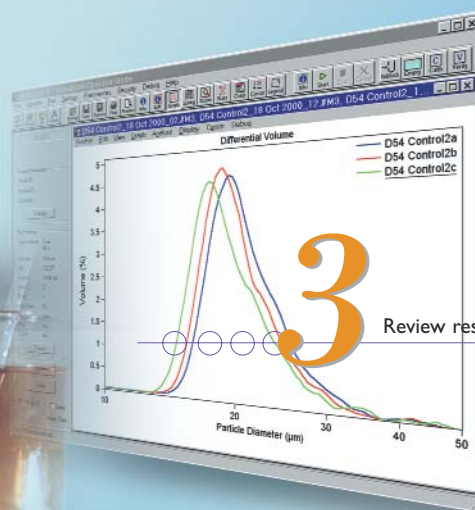
Sample Analysis

Has Never Been So Simple

The User-defined Standard Operating Procedure (SOP) make using the Multisizer™ 3 incredibly simple. Load the SOP and you can produce results quickly, accurately and easily. **Running samples is as easy as...**

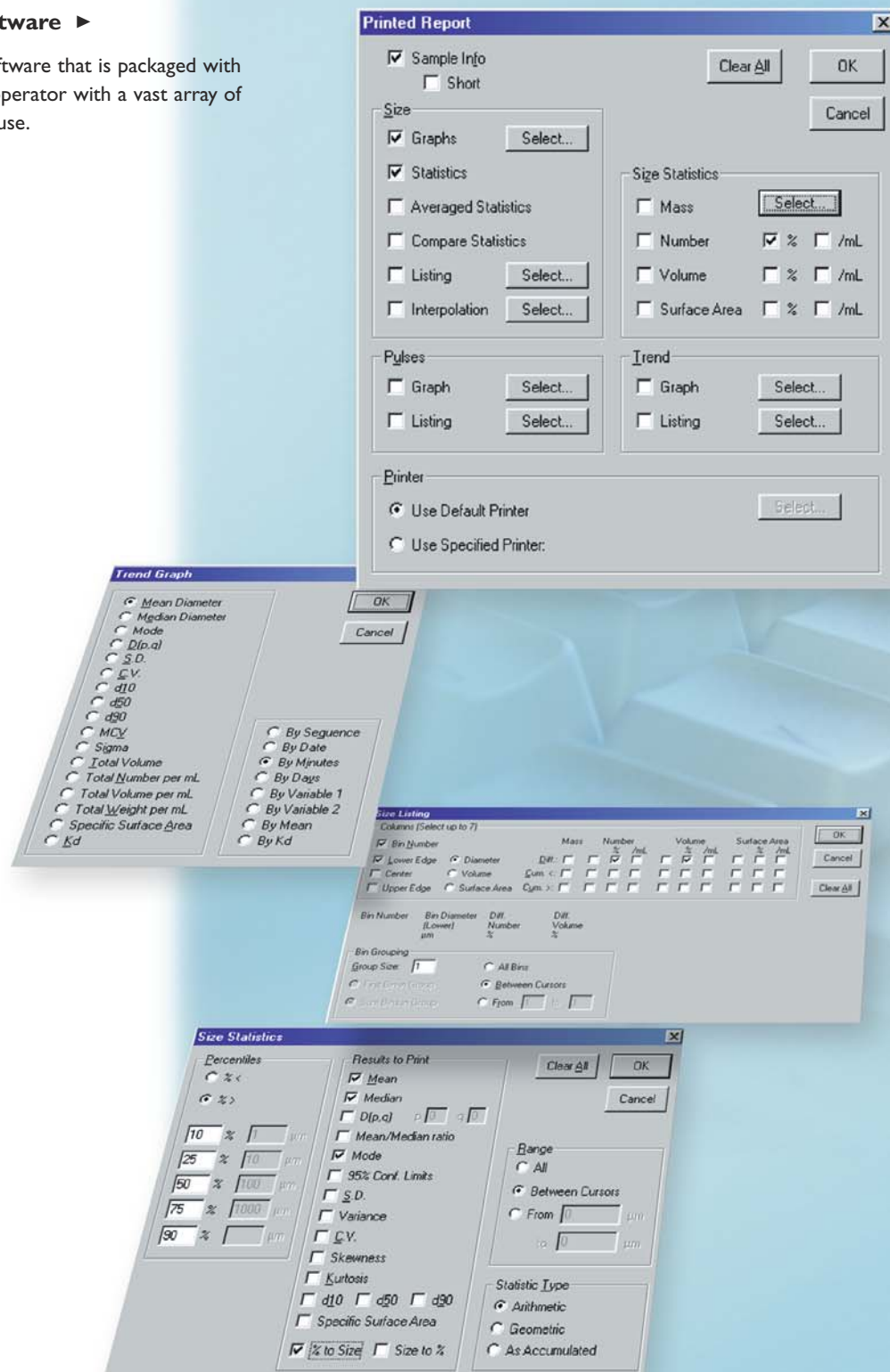
1 Prepare sample and select user defined SOP...

2 Place sample beaker into sample compartment...



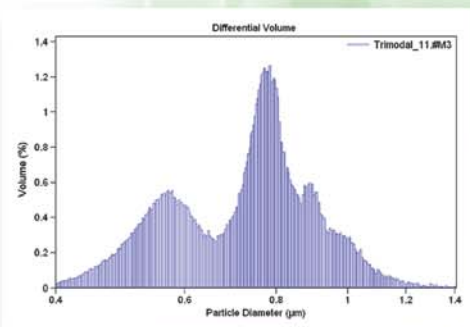
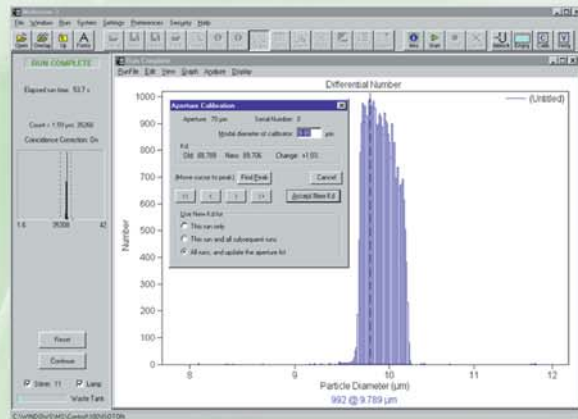
Powerful and Flexible Software ►

The user-friendly and flexible software that is packaged with the Multisizer™ 3 provides the operator with a vast array of information at the click of a mouse.

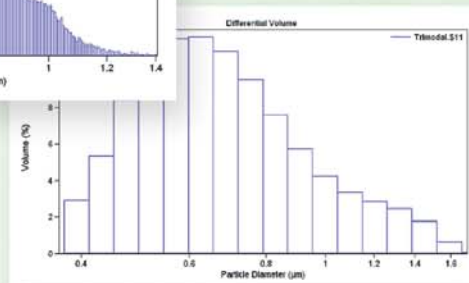


Automatic Calibration ►

Calibration of the Multisizer™ 3 is simple and quick. The software automatically performs the calibration of the Multisizer™ 3. It provides consistency and confidence in the results of the analysis. In addition to the auto calibration, the software may perform a verification of the calibration any time it is requested by the operator. As a result of the verification, the software will determine if the instrument is calibrated or needs to be re-calibrated.



Analysis of a narrow size trimodal sample using the Multisizer™ 3



Analysis of a narrow size trimodal sample using a lower resolution instrument

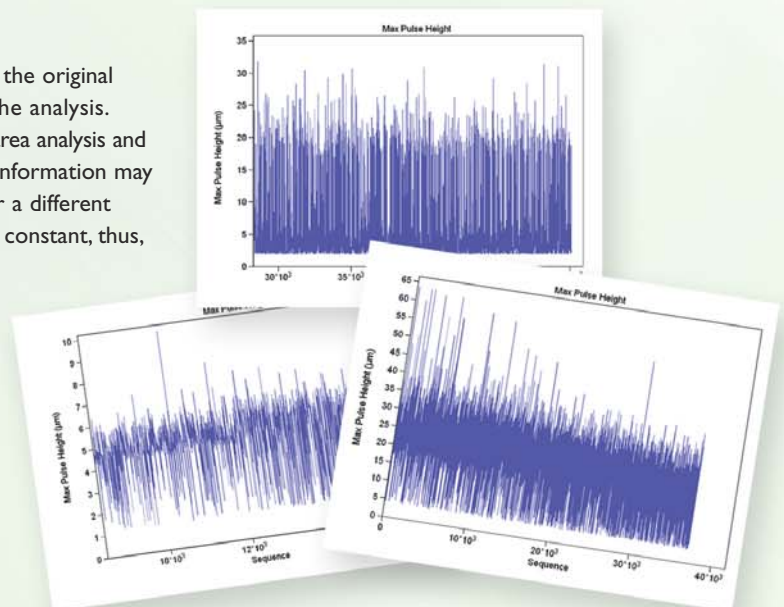
◀ Resolution

Resolution is the ability to differentiate between different particle sizes. Higher resolution means more detailed size information. The Multisizer™ 3 provides the highest resolution available for particle size distributions by measuring a real parameter of a particle: its volume. It can discriminate

between two particles similar in size better than any other instrument. Particles that are distributed under different size classes by the Multisizer™ 3 may be viewed as one size class by other instruments or technologies. In many cases, if your particles or cells change in size, they will not be detected using an instrument other than the Multisizer™ 3. The Digital Pulse Processor (DPP) allows recalculation of the original data over a narrower range, to increase significantly the resolution of the desired range.

Pulse Distribution ►

The use of a Digital Pulse Processor (DPP) allows storing all the original information from the pulses generated at the moment of the analysis. High-speed digitization of the signal allows the use of pulse area analysis and other techniques for additional particle characterization. This information may be used at a later time to recalculate the size distribution for a different range, number of channels, or even to change the calibration constant, thus, eliminating the need for re-analysis of the sample. In addition to the size distribution, the DPP data also calculates the pulse distribution. By looking to the pulse distribution graph, it is possible to know if the sample preparation was stable over the length of the analysis. An unevenly distributed pulse pattern is an indication of changes in the dispersed sample that otherwise would not be possible to detect with the size distribution graph.

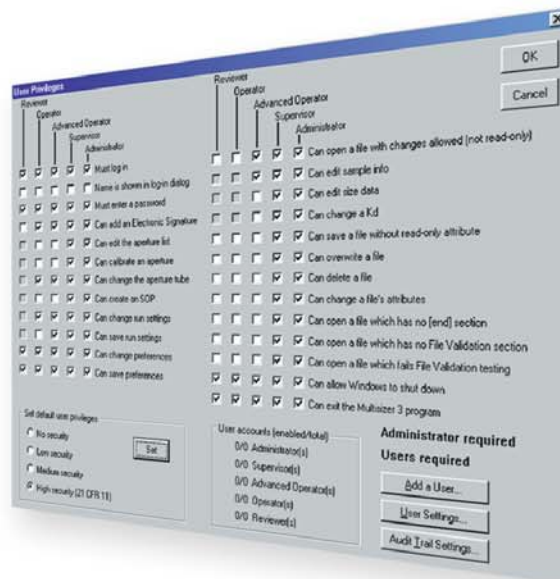


Establishing a *strong* *partnership* for the future.

Regulatory Compliance ►

21 CFR Part 11

The Electronic Records and Electronic Signatures Rule (21 CFR Part 11) was established by the FDA to define the requirements for submitting documentation in electronic form and the criteria for approved electronic signatures. This rule, which has been in effect since August 20, 1997, does not stand in isolation; it defines the standards by which an organization can use electronic records to meet its record-keeping requirements. Organizations that choose to use electronic records must comply with 21 CFR Part 11. It is intended to improve an organization's quality control while preserving the FDA's charter to protect the public. Since analytical instrument systems such as the Multisizer™ 3 generate electronic records, these systems must comply with the Electronic Records Rule. By selecting the 21 CFR Part 11 option in the software, the system automatically reconfigures



to comply with these regulations. In addition to the 21 CFR Part 11, the software offers other security levels that may be customized by the user.

V-Check Program ▼

Beckman Coulter Inc. is regulated by the United States Food and Drug Administration (FDA) for compliance with current Good Manufacturing Practices (cGMP's) for medical devices. This gives Beckman Coulter a unique understanding of the strict requirements that users in regulated industries are subjected to. As a result, Beckman Coulter has established a comprehensive program to address all aspects of the instrument validation.



The V-Check program is a comprehensive package that addresses all appropriate aspects of a product's life cycle, from instrument development to ongoing performance verification (SQ, DQ, IQ, OQ, PQ). The V-Check program contains all the necessary documentation for instrument validation. This documentation is required to show auditors and investigators proof of proper instrument validation. It consists of a number of functional inter-linked components, which have been designed to give the user assurance that the product is fit for the purpose that it has been designed for and will perform on a consistent basis for these tasks. Where other instrument manufacturers leave off, Beckman Coulter and the V-Check program assists with ongoing quality checks of the instrument (PQ). This proves that it is important to consider products from a manufacturer that not only understands your needs, but is also willing to develop a *Partnership* for the future.

WORLDCLASS GLOBAL SUPPORT

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CHINA

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EASTERN EUROPE, MIDDLE EAST AND AFRICA

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SWITZERLAND

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UNITED KINGDOM

(44) 1494 429162

UNITED STATES

(1) 800-523-3713

Visit our web site: www.beckmancoulter.com

TECHNICAL SPECIFICATIONS

OVERALL ANALYSIS RANGE:

0.4 μm to 1200 μm diameter
0.0336 to 904.8 $\times 10^6$ fL
or μm^3 volume

DYNAMIC RANGE OF

APERTURE:

30 : 1 by diameter
27,000 : 1 by volume

RESOLUTION:

User selectable

LINEARITY:

Linear response $\pm 1\%$ of pulse
height over selected range

INTERFACE:

TCP/IP connection from
analyzer to IBM compatible
PC, running Windows 95,
98, 2000, NT 4.0

DIMENSIONS:

45 cm (17 3/4") height
43 cm (17") width
63.5 cm (25") depth

WEIGHT:

34 kg (75 lb)

POWER REQUIREMENTS:

100-120V AC $\pm 10\%$
50/60 Hz
220-240V AC $\pm 10\%$
50/60 Hz

POWER CONSUMPTION:

Less than 250W

ORIFICE TUBE SIZES:

Aperture (μm) Range (μm)

20	0.4 – 12
30	0.6 – 18
50	1.0 – 30
70	1.4 – 42
100	2.0 – 60
140	2.8 – 84
200	4.0 – 120
280	5.6 – 168
400	8.0 – 240
560	11.2 – 336
1000	20 – 600
2000	40 – 1200

NUMBER OF CHANNELS:

Pulse data is digitized and can
be processed to achieve up
to 300 size channels for any
selected range. Number
of channels and range can be
reprocessed as necessary.

ASTM APPROVED METHODS

C-690-86 (1997)

"Particle Size Distribution
of Alumina or Quartz by
Electronic Counting"

E-1772-95 (1995)

"Particle Size Distribution
of Chromatography
Media by Electric Sensing
Zone Technique"

F-751-83 (1997)

"Measuring Particle
Size of Wide-Size
Range Dry Toners"

F-577-83 (1997)

"Particle Size Measurement
of Dry Toners"

D-4438-85 (1997)

"Particle Size Distribution
of Catalytic Material by
Electronic Counting"

D-3451-92 (1992)

"Testing Polymeric Powders
and Powder Coatings"

C757-90 (1996)

"Nuclear Grade Plutonium
Dioxide Powder, Sinterable"

F-660-83 (1993)

"Comparing Particle Size
in the Use of Alternative
Types of Particle Counters"

F-662-86 (1992)

"Measurement of Particle
Count and Size Distribution
in Batch Samples for Filter
Evaluation Using an Electrical
Resistance Particle Counter"

INTERNATIONAL STANDARDS ISO 13319

Determination of Particle Size Distributions –
Electrical Sensing Zone Method



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