HORIBA
Scientific

Unmatched Visualization and Measurement of Nanoparticles

Subpopulation • Size • Concentration • Fluorescence • Sedimentation

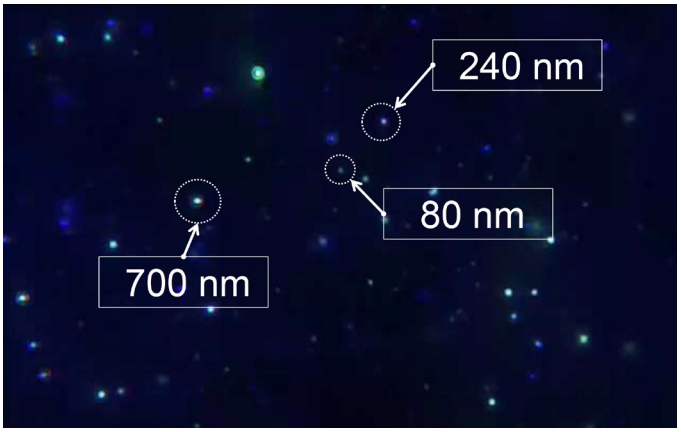
ViewSizer™ 3000

Simultaneous Multi-laser Nanoparticle Tracking Analysis

Introduction

Analyzing nanoparticles such as colloids, viruses, proteins, and extracellular vesicles (EV) is inherently challenging. These particles are too small to image with visible light and must be imaged by laborious electron or scanning microscopy. Dynamic light scattering and laser diffraction have been successfully used to determine particle size and size distribution. These techniques are fast and accurate for certain samples, however, as they are ensemble techniques, high resolution distribution information cannot be obtained.

The ultramicroscope and conventional single-laser nanoparticle tracking have been used with only partial success since the wide range of sizes present in many samples means that scattering from the largest particle is bright enough to saturate the detector and eliminate any hope of learning about smaller particles. This known problem is discussed in *ISO 19430:2016 Particle size analysis — Particle tracking analysis (PTA) method* where it states, "…Sample polydispersity affects the ability to track and therefore analyze different size fraction in particle number-size distribution." To overcome these long-standing problems, the ViewSizer 3000 integrates three simultaneous operating lasers with independently adjustable power to enhance particle detection from 10 nanometers to 15 microns.

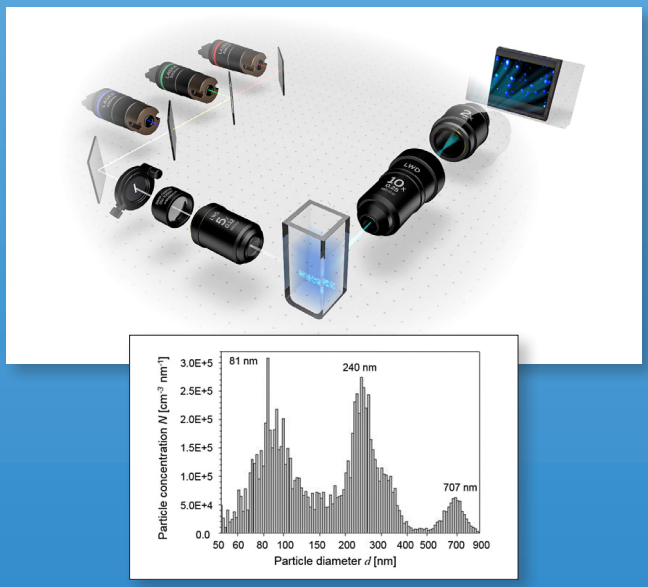


The ViewSizer 3000 exploits advanced hardware and software to visualize scattered light from individual particles in suspension. This data is then used to determine particle movement and infer particle size using the Stokes-Einstein relationship. Furthermore, since the illuminated sample volume is well known along with the number of particles imaged, particle number concentration is readily determined. Thus, from a single measurement, two critical pieces of information are determined: particle size distribution and particle concentration even for polydisperse samples. The screen capture from an analysis on the ViewSizer 3000 (shown above) demonstrates its unmatched ability to visualize highly heterogeneous samples.

How it works

The instrument characterizes nanoparticles by analyzing their thermal-induced motion (Brownian motion) and larger, micron-sized particles by analyzing gravitational settling. A schematic of light scattering is shown in the figure to the right. Particles are illuminated and images of scattered light from each particle are magnified by a microscope objective before they are recorded on a video camera. The obtained video shows each individual particle.

By taking advantage of modern high resolution video cameras and computer graphics processing speed, the motion of each particle is tracked to determine the diffusion coefficient, and, from that, the size of each particle. The particle size distribution from a mixture is shown to the right.



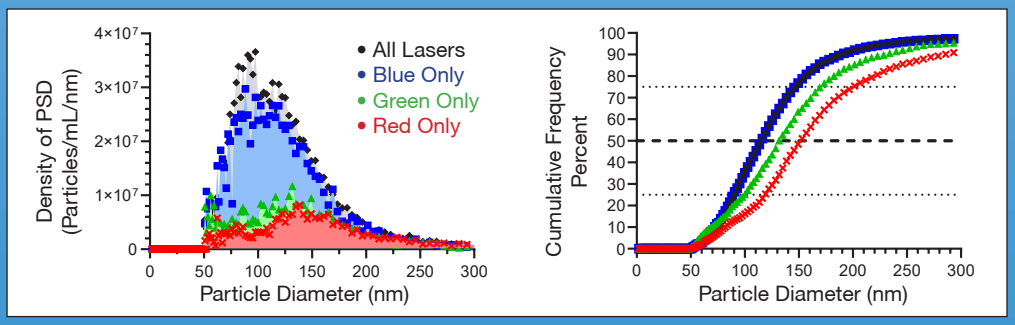

Cell with an insert

The ViewSizer 3000 enables unprecedented advantages over conventional NTA by introducing the sample vertically in a quartz cuvette fitted with an insert, a stir bar, and a cap (shown on the left). Those advantages include:

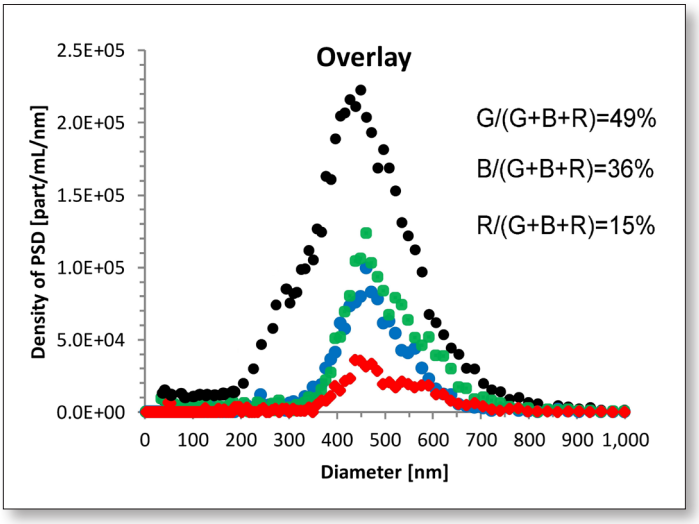
- The option to mix the sample in between video recording, offering a more representative analysis, repeatable and reproducible results.
- The ability to handle particles dispersed in non-aqueous solvents such as xylene or other alcohols.
- Safer transfer and handling of hazardous material by keeping the sample enclosed with a cap.

Influence of Laser Wavelength on Particle Detection

EVs isolated from plasma require multi-laser wavelengths for accurate analysis



	Average Size (nm)	Median Size (nm)	Particle Concentration (part./mL)
All Lasers	131	116	3.03E+09
Blue Only	132	116	2.58E+09
Green Only	153	132	1.07E+09
Red Only	178	153	8.65E+08

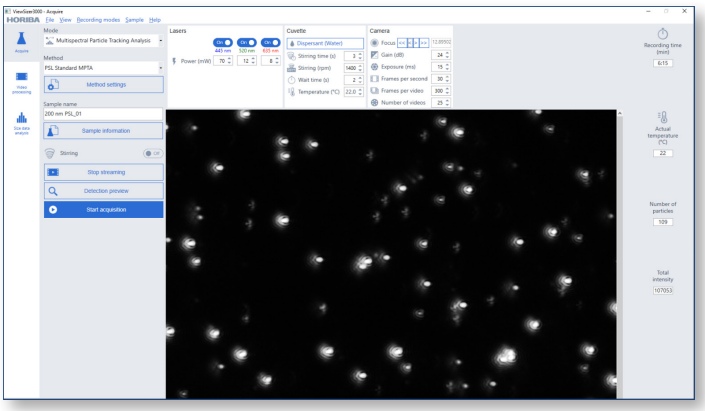


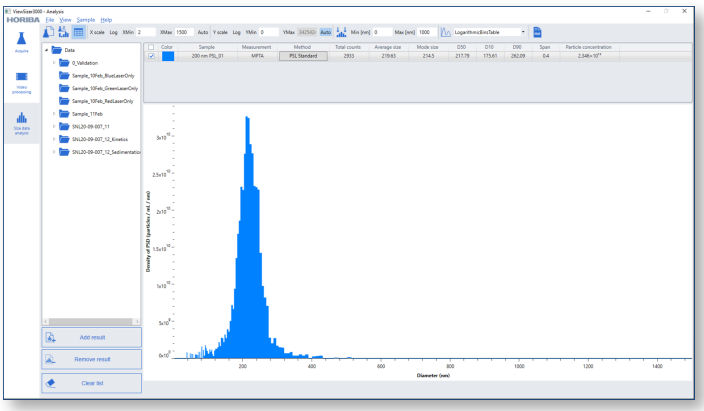
Advanced Software

The ViewSizer software was developed with the user in mind. Data collection can start with just a few clicks of the mouse and the final results are available in a number of formats to accommodate every user. All data can be analyzed and displayed directly within the software or exported for further analysis and plotting. The user interface includes real-time visualization of all particles in the sample - a valuable aspect of each analysis performed on the ViewSizer 3000.

Figure 1 *(above) Shows a mixture of three carboxylate fluorescent beads and its individual fluorescence result using red, green and blue lasers.*

Figures 2 and 3 *(below) show the ViewSizer software displaying image capture and the results screen.*





Specifications

Range of Particle Sizes Measured*	10 nm to 15 µm
Typical Sample Volume	350 µL to 2.5 mL
Typical Sample Concentration*	10^5 – 10^9 particles/mL
Sample Temperature Range (Controlled)	10 °C to 50 °C, ± 0.1 °C
Dimensions	55 cm W x 66 cm D x 35 cm H
Weight	27 kg
Operational Environment	15 °C to 30 °C with < 85% RH

* Sample dependent

Key Features

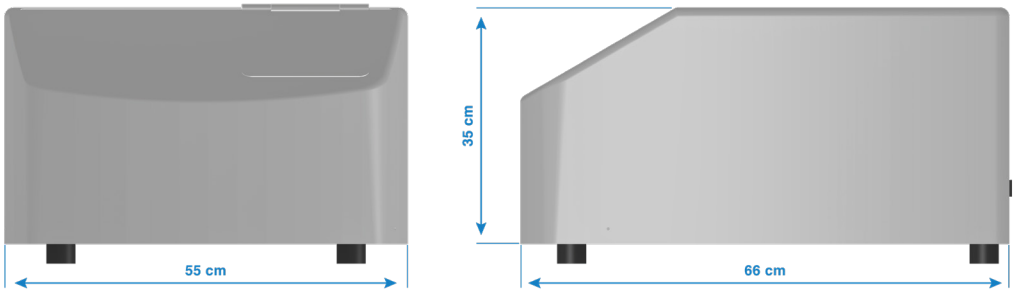
The ViewSizer 3000 offers the following:

- Improved optical design and algorithms allowing better known scattering volume and therefore better concentration data, even for polydisperse samples.
- No cross contamination with cuvettes.
- Analysis of larger particles by sedimentation (technique) possible with vertical design, allowing broader size range.

Applications Include

- Extracellular vesicles (EV's)/Exosomes
- Chemical Mechanical Planarization (CMP)
- Virus and Virus-Like-Particles (VLP's)
- Protein and Protein Aggregation
- Lipid Nanoparticles (LNP's)/Liposomes
- Nanobubbles
- Microplastics/Polymers
- Water Quality/Treatment
- Oceanography
- Colloids
- Metal (Nano)particles
- Graphene
- Batteries

External Dimensions



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