LS Spectrometer

DLS and SLS system for sophisticated research

Systems

Nanoparticles
Polymers
Peptides
Proteins
Emulsions
Gels

Industries

Academic research
Pharmaceuticals
Paint, inks & coatings
Cosmetics
Food

Applications

Concentrated systems
Particle size
Particle shape
Molecular weight
Viscosimetry

LS Instruments

LS Spectrometer

Dynamic and static light scattering for powerful particle characterization

Science is our passion and when it comes to light scattering, we make no compromises. With the LS Spectrometer, we provide you with the most reliable and precise equipment possible for static light scattering (SLS) and dynamic light scattering (DLS). Its modular design and manifold options allow custom configuration resulting in an optimized solution for your specific research area.

What can it measure?

- Particle size
- Polydispersity
- Particle shape
- Viscosity
- Molecular weight
- Sample structure

Your benefits

- Error-free measurements with the 3D option
- Best measurement sensitivity on the market
- Transparent data processing
- Characterize multimodal samples accurately

Powerful

The most advanced instrument on the market

Customizable

Taylor it to your needs

Versatile

Enables many applications

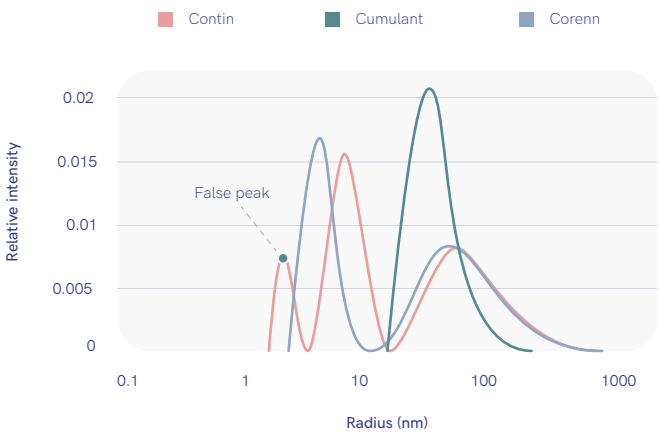
Customer support

Our team of experts is here to answer your questions

Software

Powerful analytical tools

We designed the software of the LS Spectrometer for both DLS experts as well as beginners without specific training. Anything from one simple, yet reliable measurement, to a complex series of multiple measurements can be configured with just a few clicks. The powerful analytical tools allow highly customizable data display and export, while saving all results in a well-organized and comprehensive database. Analytical tools include Cumulant, CORENN, and our LSI ZimmPlot software.



AI-powered algorithm

CORENN is a novel advanced machine learning algorithm to extract the particle size distribution (PSD) from a DLS measurement. CORENN is the only DLS inversion algorithm that leverages on advanced signal approximation techniques and a unique theoretical estimate of the signal noise to yield extremely reliable results, robust against experimental distortions, thus enabling the end-user to **obtain the true PSD from real world DLS experiments**. The figure on the left shows a DLS measurement of a particle mixture of 4 nm and 45 nm. Only CORENN is able to correctly determine the two populations.

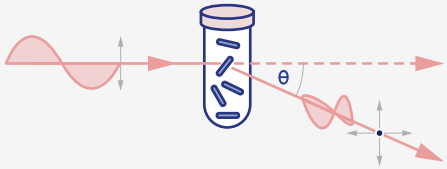
The most popular options at a glance

Laser

We are proud to offer a selection of Lasers manufactured by Cobolt, the leader for innovative Laser technologies. Specialized Laser technology was developed by Cobolt for LS Instruments within a European research project to optimize performance for light scattering. The LS Spectrometer can be equipped with a high performance Laser of your choice, selectable from a range of different wavelengths.

Depolarized DLS

This is the perfect technique to easily characterize anisotropic particles and is gaining increasing attention from scientists: a set of two polarizers allows you to characterize the rotational dynamics of your sample and the aspect ratio of anisotropic particles through a simple DLS measurement.

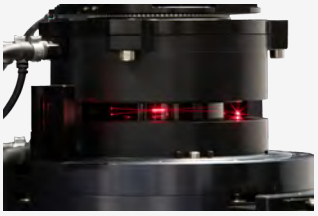


Temperature Control

Our powerful temperature circulator allows you to precisely control the temperature in your sample. It reduces heating and cooling times significantly compared to other circulators.
It can be pre-programmed to conduct measurement series at different temperatures with the LSI software module of LSI.

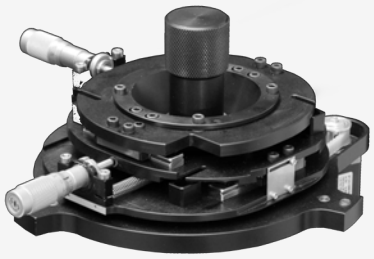
3D Cross-Correlation

Dilution is a thing of the past! If you've ever performed laser light scattering experiments you know how tedious and time consuming sample preparation can be. Often the sample concentration and cell diameter have to be selected with extreme care to avoid multiple scattering. In many cases this can be achieved only partially and it is well known that low-angle scattering is often hampered by multiple scattered light – sometimes unbeknown to the user! The 3D Cross-correlation unit suppresses multiple scattering: you can now study your systems in their native state and stop worrying about multiple scattering.



Sample Goniometer

Many gel-like samples suitable for light scattering show a non-ergodic behavior that results in measurement errors. LS Instruments has developed a sample goniometer that rotates non-ergodic samples at a suitable speed to obtain the correct results. Moreover, the sample goniometer can also be used to displace the sample from the center of rotation. This enables the use of square cells in which the path of the scattered light in the sample can be reduced to less than 200 micron, which significantly reduces multiple scattering.



Which configuration is best for you? Ask our experts!

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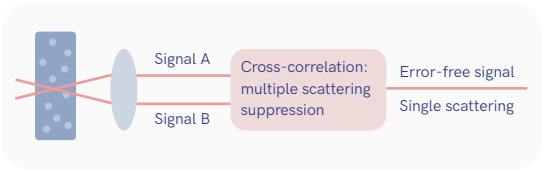
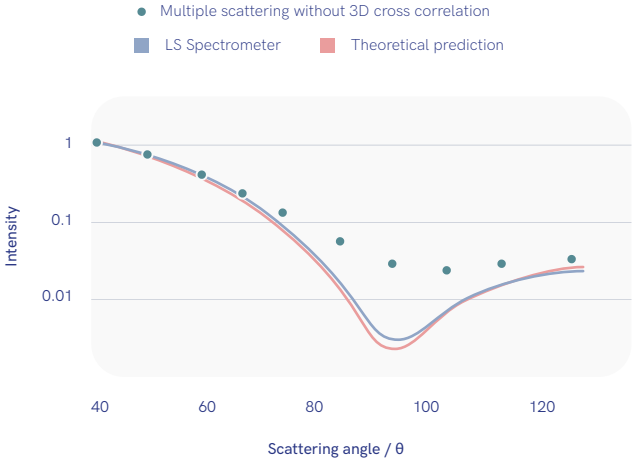
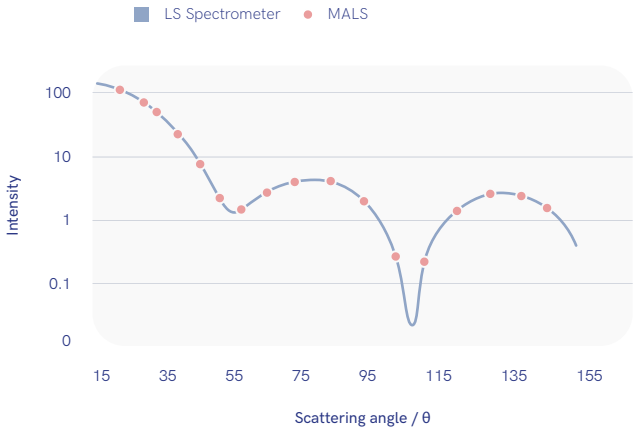
Technology

Multiple scattering and 3D

Both DLS and SLS technologies are based on the assumption that only single scattered light is detected. As particle concentration increases however, multiple scattering increases and gradually dominates the signal. This introduces an undetectable systematic error in both DLS and SLS. No matter how long or how many times you repeat the measurement, you can't remove or detect this error. To overcome this issue, LS Instruments has developed the optional 3D cross-correlation module that efficiently suppresses multiple scattering. The 3D cross-correlation technique uses two laser beams to perform two scattering experiments simultaneously. While the contribution originating from the single scattering is identical, the multiple scattering contribution is different in the two experiments. By cross correlating the signal, multiple scattering is thus suppressed. The 3D LS Spectrometer is the only instrument that offers 3D cross-correlation for both DLS and SLS, providing unique data for many outstanding publications.





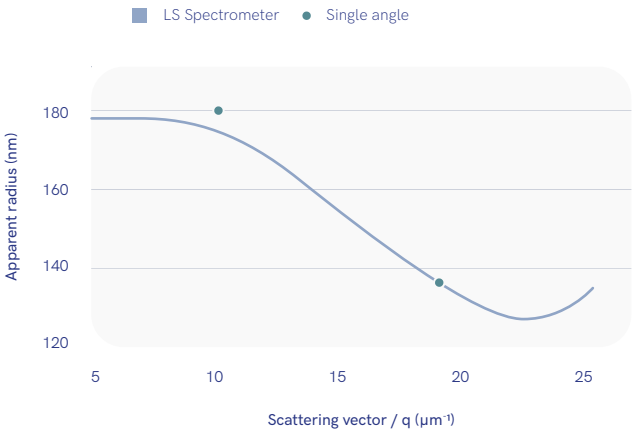


Form and structure factor

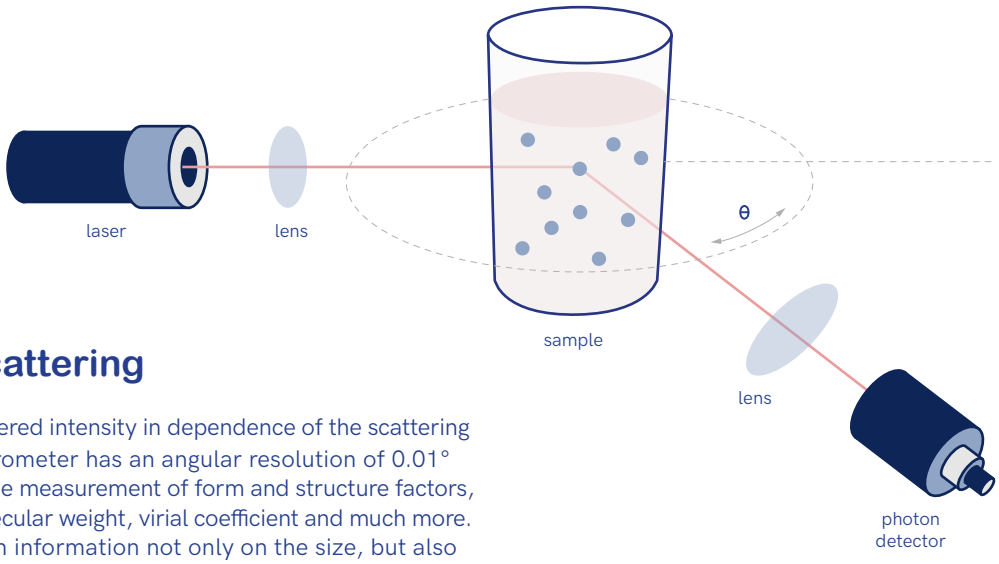
No other instrument measures form and structure factor with a higher precision than the LS Spectrometer. The powerful detectors can be rotated precisely to any selected scattering angle. Unlike Multi Angle Light Scattering (MALS) systems that can only measure the intensity at a limited number of scattering angles, you will never miss a peak with the LS Spectrometer! Furthermore MALS systems are typically not equipped to perform DLS at different scattering angles.

Advanced particle sizing

While most DLS instruments only measure at a limited number of fixed scattering angles, the LS Spectrometer can obtain precise DLS data at any angle within its vast angular range (8°-155°). This is important, because the particle size determined by a DLS experiment is based on the assumption that the particles are monodisperse hard spheres. Whenever this is not strictly true, the measured particle size is only an apparent size that is often dependent on the scattering angle. For unknown particles it is therefore important to confirm angular dependence and if necessary apply corrections that can be based on complementary SLS measurements. If measured at only 90° or 173°, which are typical angles employed by fixed angle instruments, the measured apparent size for certain samples can be two times smaller/larger than the actual size.

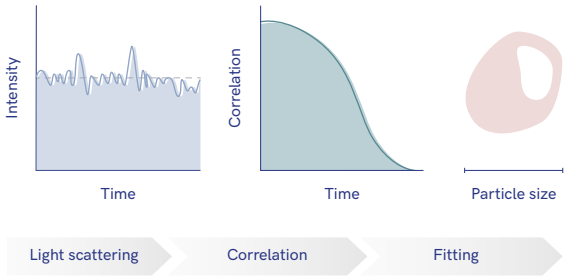


Technology



Static light scattering

SLS measures the scattered intensity in dependence of the scattering angle θ. The LS Spectrometer has an angular resolution of 0.01° and thus enables precise measurement of form and structure factors, radius of gyration, molecular weight, virial coefficient and much more. In this manner you gain information not only on the size, but also the shape, density and structure of your sample. The additional synergy resulting from the combination of SLS and DLS in the LS Spectrometer makes it the perfect tool for sophisticated research.



Dynamic light scattering

DLS is the technology of choice to measure the size of nanoparticles in solution. Driven by Brownian motion, the particles move within the solvent, causing the intensity of scattered light to fluctuate. Since the size of the particles influences the motion and thus the statistics of the fluctuations, the diffusion coefficient and particle size are obtained from the intensity correlation function. Unlike most DLS instruments, the LS Spectrometer can do this for a wide range of scattering angles (8° to 155°), therefore, significantly increasing the precision of your measurements.

Depolarized dynamic light scattering

The depolarized scattered light is a rich source of dynamic and structural information which is often not readily obtainable by other techniques. The sample illuminated by a vertically polarized beam may scatter both vertically (DLS) and horizontally (DDLS) polarized light. Using a rotatable polarizer placed in front of the detection unit, the horizontally polarized DDLS signal can be harvested. From there, the rotational and translational diffusion coefficient can be calculated. This in turns leads to an easy characterization of the aspect ratio of anisotropic nanoparticles.

Specifications

Technology	Dynamic and Static Light Scattering (DLS and SLS)
Scattering angle	8° to 155° +/- 0.01°
Hydrodynamic radius	0.15 nm to 5 µm*
Radius of gyration	5 nm to 5 µm*
Molecular weight	360 - 3'600'000 Dalton*
Correlator	320 channels, delay time 12.5 ns to 15 h, auto- and cross-correlation
Detectors	Two high performance APDs, QE 65%, dark counts < 250 count/s
Laser wavelength	Wide range of choices: 457 to 685 nm
Laser power	Wide range of choices: 20 to 500 mW
Laser control	Fully automated active Laser intensity optimization
Detection	Single mode fiber detection system with integrated collimation optics
Sample cells	Fits 5 and 10 mm diameter cylindrical cells
	(min sample volume 50 µl)
Software	Including Cumulant, CONTIN, CORENN and Zimm Plot analysis
Temperature	Up to 90 °C (optional 140 °C)
Modular system	Wide range of optional modules

* As for all DLS instruments, the maximum range is sample dependent.

Cuvettes

Seal your sample in the cuvette and characterize it over an extended period of time! You can choose between three different standard sizes of glass cuvettes. Simply select the size that best suits your sample. If only small quantities of your sample are available, select the smallest cuvette and fill it with as little as 50 µL. Standard disposable plastic cuvettes can also be used if you want to avoid cuvette cleaning and/or need sterile conditions.

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