

# DynaPro™ Plate Reader 4

Size, Stability, and Particle Concentration  
Measurements with Simplicity and Speed



# DynaPro Plate Reader 4

Transforming automated dynamic and static light scattering in microwell plates

## Cutting-Edge Technology, Made Effortless

The DynaPro Plate Reader 4 revolutionizes high-throughput dynamic and static light scattering (DLS/SLS) measurements. Engineered for simplicity and speed, it minimizes set-up time, optimizes workflows, and delivers results faster than ever.

With the intuitive DYNAMICS Touch™ interface, users are seamlessly guided through intuitive workflows with built-in data quality rules – ensuring high quality light scattering results with little to no training required.

## Transformative technology enables unprecedented productivity in:

- Measuring particle size, concentration, and aggregate content of viral vectors
- Identifying stable formulation conditions for proteins and peptides
- Optimizing drug-delivery or diagnostic nanoparticles
- Accelerating discovery of small-molecule and peptide therapeutics



Proteins



LNPs



EVs



Viral Vectors



Nanoparticles



Polymers

## Easy, automated with industry standard plates

- Acquire in one day the data that would otherwise take weeks to collect
- Screen dozens of samples with thousands of formulation and temperature combinations
- Analyze and visualize an entire dataset at once, then zoom in for a detailed study of the most promising conditions
- Measure non-destructively and transfer plates to other analytical instruments

## In-plate analysis saves you time and money!

- Measure directly in 96, 384 or 1536 well plates, simply load and walk away
- Industry-standard plates are readily available and more cost-effective compared to custom consumables
- Integrate with plate and liquid-handling robots for even more time savings

## Maximize Characterization with DLS and SLS

DLS is widely used to characterize proteins, nanoparticles, colloids and macromolecules from subnanometers to several micrometers. Requiring relatively small amounts of material, simultaneous measurements of DLS and SLS, help assess key factors:

- Size ( $R_h$ ) and size distributions, particle concentration
- Molar mass ( $M_w$ )
- Aggregation and stability indicators ( $T_m$ ,  $T_{agg}$ ,  $k_D$ ,  $A_2/B_{22}$ )
- Purity or contamination, viscosity



DLS



SLS



Size



Molar Mass

## Unlock high-speed insights into size, stability, and aggregation

Accelerate your research with easy screening across a range of plate formats (96-, 384-, 1536-wells). Achieve maximum throughput for assessing size, aggregation, polydispersity, molar mass, and critical colloidal stability parameters ( $k_D$ ,  $A_2/B_{22}$ ) in applications from biotherapeutics to protein crystallization.

## Enhance data confidence

Identify issues and build confidence in your results with automated data quality assessments. Confirm sample integrity using the integrated camera to detect the presence of dust, bubbles, or precipitate that could compromise accuracy.

## Walk-up measurements

DYNAMICS Touch interface guides users through a few clicks to analyze size ( $R_h$ ), particle concentration ( $N_p$ ), and molar mass ( $M_w$ ).

## Maximize efficiency with unattended automation

Free up valuable lab time and boost throughput by implementing seamless automation through our software API, which interfaces directly with liquid handlers. For added flexibility, partial integration with robotic arms for sample preparation is also supported.



## Uncover structural dynamics

Gain critical insights into your samples across a broad temperature range of 4 °C to 85 °C. Monitor key structural and conformational changes—including  $T_{agg}$ ,  $T_{onset}$ , and  $T_m$ —to better understand stability and behavior under varying conditions. Additionally, conduct comprehensive freeze-thaw studies to confidently assess sample robustness.

## Industry standard well plates: Seamless integration, exceptional value

Leverage cost-effective, readily available industry-standard plates. Seamlessly integrate into existing workflows with plates compatible across multiple plate-based instruments.

# DYNAMICS Touch On-board App

Particle size, concentration and molar mass measurements have never been easier

## Results with just a tap

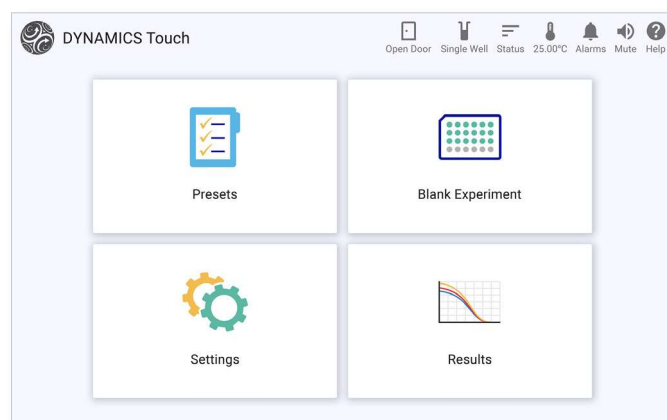
Designed with expert and casual user in mind, the DYNAMICS Touch software intuitively guides users to top-quality light scattering measurements with virtually no training. Working from a touch-screen display, you can run pre-defined methods, set up new methods, run samples, and easily assess data quality. DYNAMICS Touch software guides you every step of the way.



## You can set up a sample run in moments

1. Load a workflow specific preset
2. Modify settings on the fly – adjust temperature, replicates, and more
3. Press run

... and you're on your way! No prior training or DLS/SLS experience necessary. The DYNAMICS Touch software guides you down a path to results in just minutes.



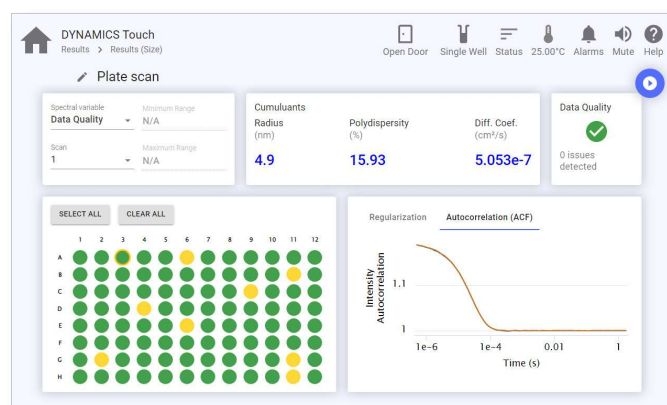
The Plate Reader features a large touch-screen display and an intuitive DYNAMICS Touch app interface, allowing users to quickly measure, analyze, and export data.



## Quality data on the go

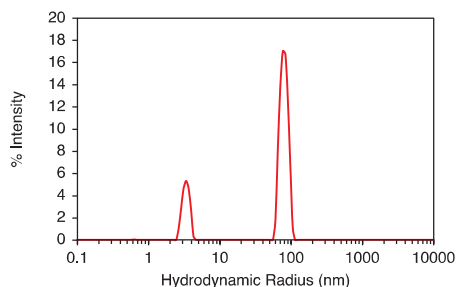
Automated data quality assessment allows even first-time users to understand their results and troubleshoot any issues that may have led to poor measurements.

Obtain quick size and stability data for individual samples or utilize the app for quick quality checks or initial assessments of sample quality before larger automated runs. The data may be kept securely on the Plate Reader or sent to a network location. For advanced analyses, the files can be imported to the powerful DYNAMICS™ desktop application.



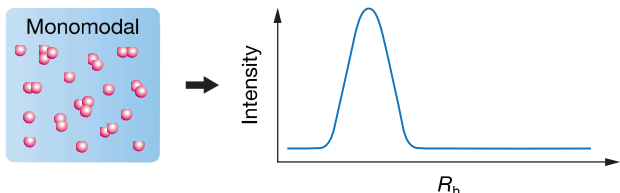
DYNAMICS Touch software automatically presents the user with a succinct results summary after each measurement, including a data quality rating.

## Size distributions from a fraction of a nanometer, to micrometers



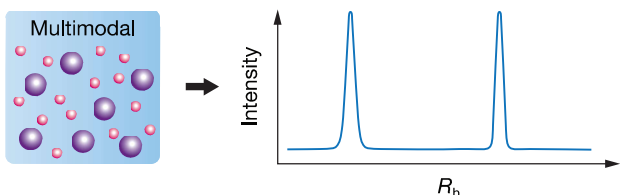
Dynamic light scattering determines size distributions without any separation or dilution. This regularization graph illustrates the presence of 80 nm aggregates in a protein solution.

## Polydispersity in one or multiple modes



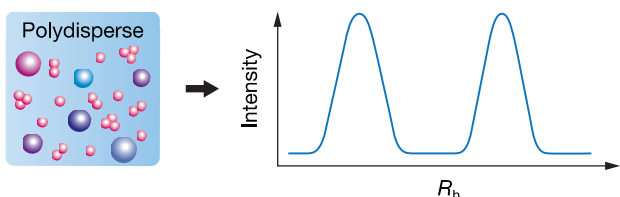
### Monomodal

Only a single population is observed in the size histogram. The population itself may be monodisperse, or polydisperse as in the example above.



### Multimodal/Monodisperse

Multimodal size distributions contain populations centered around more than one size. The regularization analysis can discriminate between populations with average sizes that differ by 3x - 5x.



### Multimodal/Polydisperse

DLS quantifies the width of each population as polydispersity index (PD Index) or %PD (percent polydispersity). The presence of small aggregates of the two distinct populations is apparent in the increased %PD relative to the monodisperse case.

## How dynamic and static light scattering work

### DLS

Particles in solution undergo random diffusion known as Brownian motion.



Dynamic light scattering measures the rate of diffusion,  $D_t$  which is related to particle size (hydrodynamic radius,  $R_h$ ) via the Stokes-Einstein equation:

$$D_t = \frac{k_B T}{6\pi\eta R_h}$$

where  $k_B$  is the Boltzmann constant,  $T$  is the temperature and  $\eta$  is the solution viscosity.

Colloidal stability by DLS can be measured via the dependence of the diffusion coefficient. Under dilute conditions,  $D_t$  is dependent on concentration:

$$D_t = D_0(1 + k_D c)$$

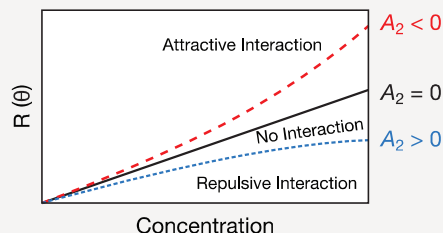
where  $D_0$  (which gives true particle size) is the self-diffusion constant,  $c$  is the analyte concentration and  $k_D$  the diffusion interaction parameter, is closely related to colloidal stability.  $D_0$  and  $k_D$  may be determined by measuring  $D_t$  as a function of concentration.

### SLS

Static light scattering (SLS) measures the time-averaged scattered intensity to determine weight-average molar mass,  $M_w$ . In the limit of dilute solutions of macromolecules smaller than ~ 10 nm in radius, the fundamental relationship linking the intensity of scattered light and the molar mass is:

$$I_s \propto M_w c \left( \frac{dn}{dc} \right)^2$$

Where  $I_s$  is the intensity of light scattered by the analyte;  $c$  is the sample concentration, and  $dn/dc$  is the specific refractive index increment of the analyte (sample-solvent specific).



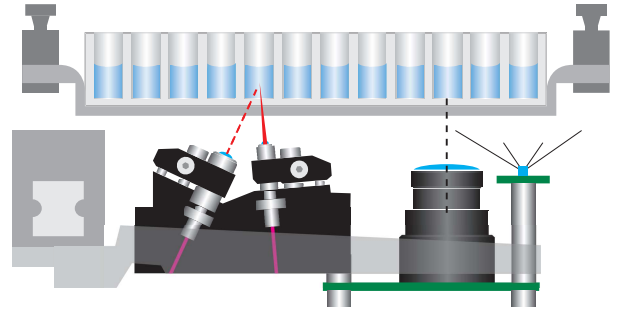
The second virial coefficient,  $A_2$  is a measure of solute-solvent interactions and closely related to colloidal stability. It is determined by measuring scattered light intensity as a function of concentration.

# High-Throughput DLS

Tackle comprehensive DLS experiments you never thought possible

## Advantages

- Compatible with industry-standard 96, 384 or 1536 microwell plates
- Enhanced thermal isolation prevents condensation
- Molar mass and particle concentration measurements directly in plates
- Sample volumes as low as 4  $\mu\text{L}$
- Measure from 4  $^{\circ}\text{C}$  to 85  $^{\circ}\text{C}$
- Infrared wavelength not susceptible to fluorescence
- DYNAMICS software records and reports particle size according to ISO 22412 and ASTM 2490-09



Static and dynamic light scattering, along with imaging acquisition, illumination, and detection, are performed sequentially from below.

## Standard plates, exceptional data

Use standard 96-, 384-, or 1536-well clear-bottom plates for high-sensitivity measurements with as little as 4  $\mu\text{L}$  per well. Rapidly screen dozens of formulations per plate using DLS and SLS to assess size, aggregation, molecular weight, colloidal stability, and viscosity of concentrated protein solutions.



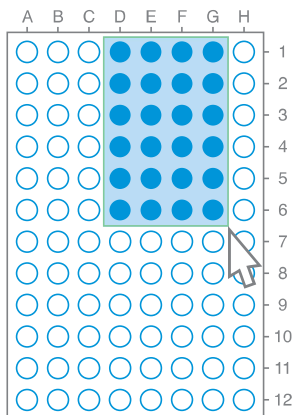
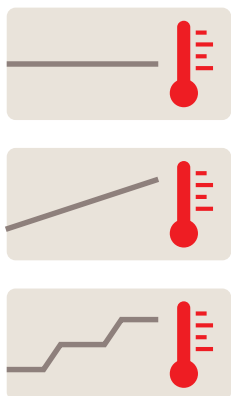
## Flexible Automation

The DynaPro Plate Reader instrument is compatible with industry-standard plates, allowing for seamless integration with automated liquid handling systems. This flexibility ensures adaptability to changing needs and configurations.

To maximize throughput, the DYNAMICS Automation API enables integration with a robotic arm for well plate transfer and liquid handling, while also automating data analysis.



## Design high-throughput experiments in 3 easy steps



**DLS Parameters**

|                               |     |
|-------------------------------|-----|
| Enable auto-attenuation       | No  |
| Acquire an image of each well | Yes |
| DLS acquisition time(s)       | 5   |
| Number of DLS acquisitions    | 5   |
| Laser power (%)               | 20  |
| Attenuation level (%)         | 0   |

Help me decide...

**Label Measurements**

Name:

Acquire Camera Images

### 1. Select temperature profiles

Combine multiple profiles for complex protocols.

### 2. Select wells

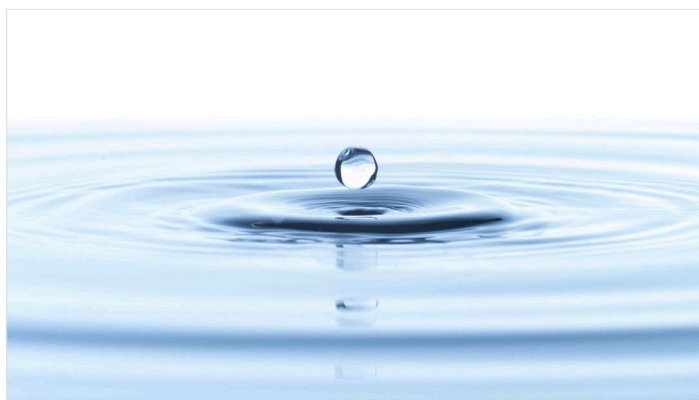
Include replicates and control samples.

### 3. Finalize design

Fine-tune parameters, add camera images.

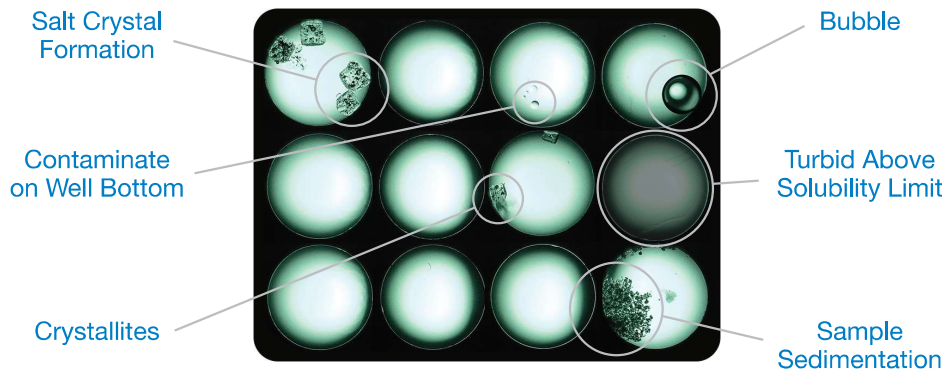
## Tiny drop, massive data

Obtain up to 5 critical parameters with just 4  $\mu$ L of sample. With a sample volume this small, valuable metrics like stability and aggregation can be obtained during earlier development stages.



## Advanced imaging

An onboard camera views each well from below, aiding in diagnostics by revealing sample behavior beyond nanoparticle size, showing clean wells, bubbles, crystals, and precipitates for confident data interpretation.

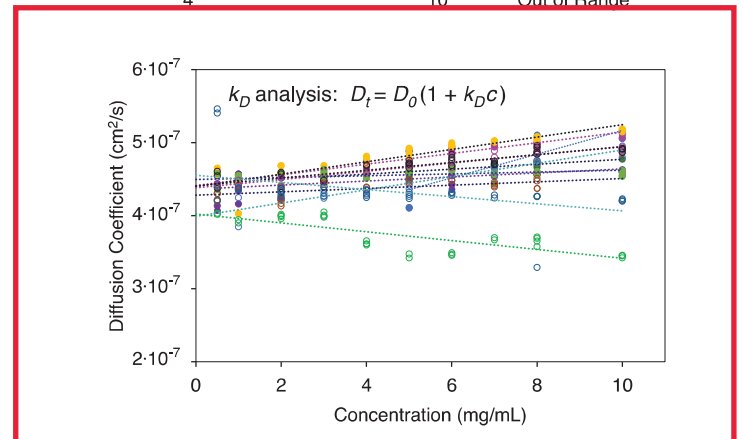
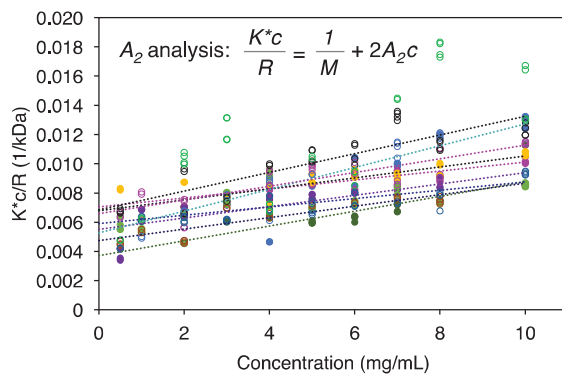
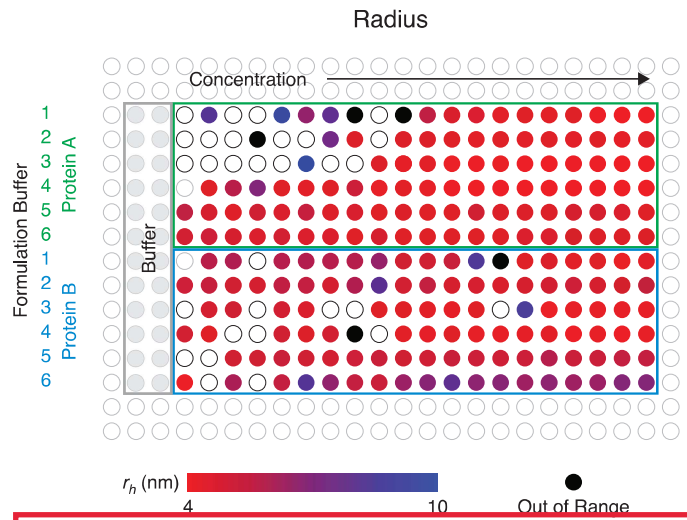
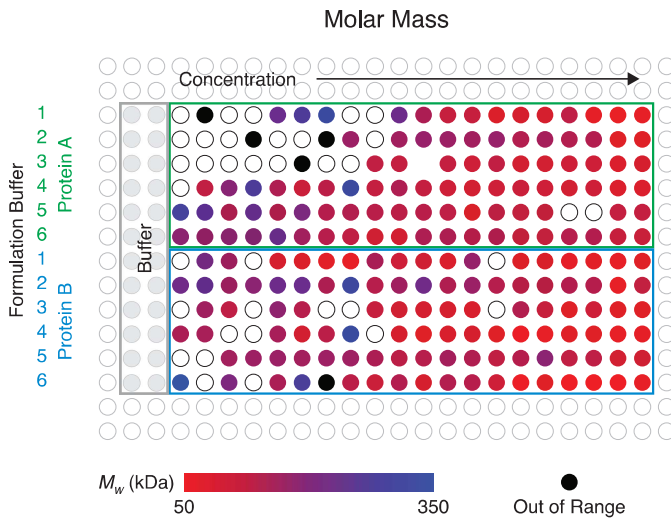
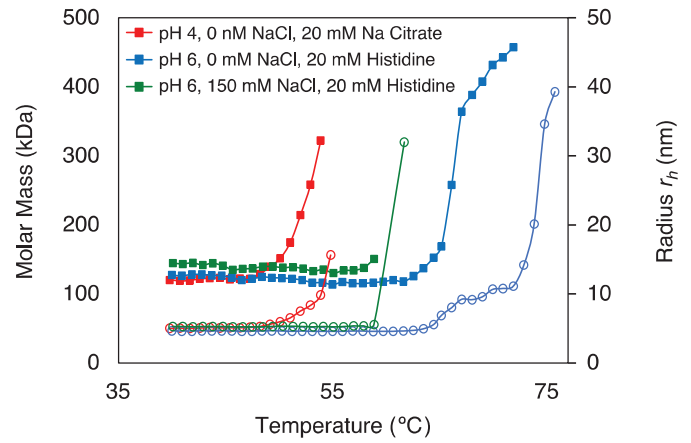


# Weeks of Experiments in Just Hours

## Biologics: Thermal and colloidal stability

The DynaPro Plate Reader performs high-throughput screening of biotherapeutic candidates to determine multiple properties of a plateful of candidates and formulations. Shown to the right and below is an analysis of proteins for thermal and colloidal stability.

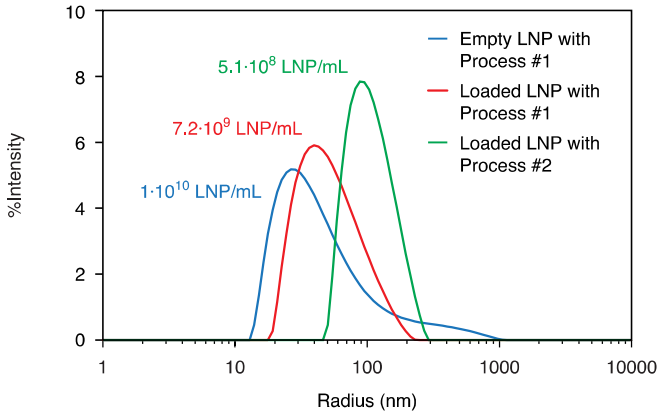
Right: The thermal stability of three formulations of an IgG is determined, in parallel, through changes in size ( $T_{\text{onset}}$  by DLS) and molar mass ( $T_{\text{agg}}$  by SLS) across a temperature ramp. Filled squares – molar mass; empty circles – hydrodynamic radii. One formulation exhibits multiple transitions.



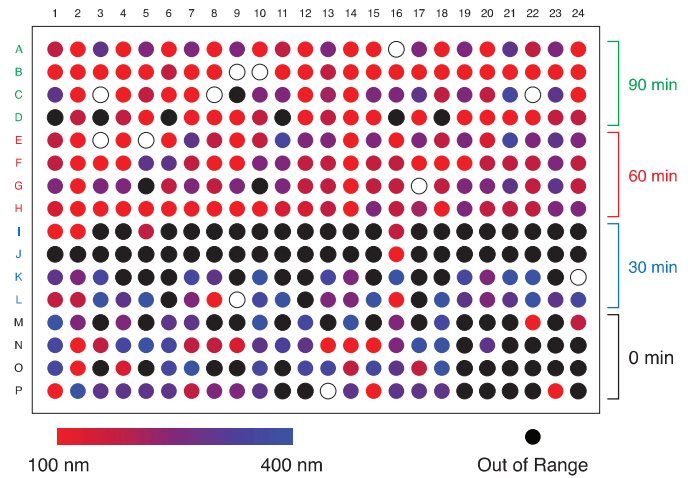
Analysis of aggregation and colloidal stability for two proteins via 10-point concentration series with two replicates at each concentration and condition. Size and molar mass are indicated

in the SpectralView™ heat maps, while plots of second virial coefficient  $A_2$  and diffusion interaction parameter  $k_D$ , two measures of colloidal stability are shown below.

## Lipid nanoparticles formulations and process optimization

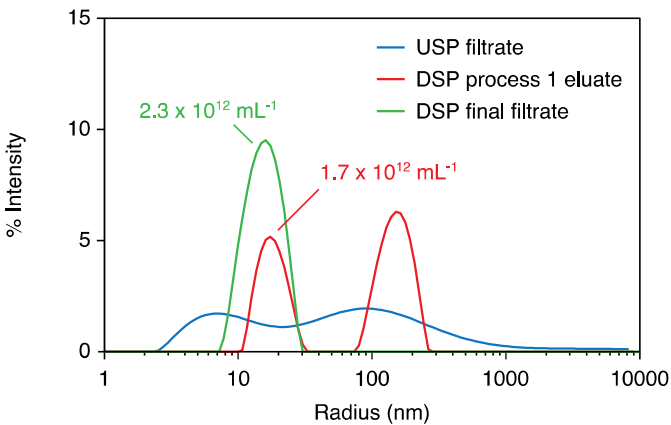


Particle size, crucial for biodistribution and cellular uptake, is an important property of LNPs. In the figure above, LNPs prepared using manual mixing (green) yielded larger particles with a 100 nm average radius, whereas microfluidic mixing (red) resulted in the desired radius.



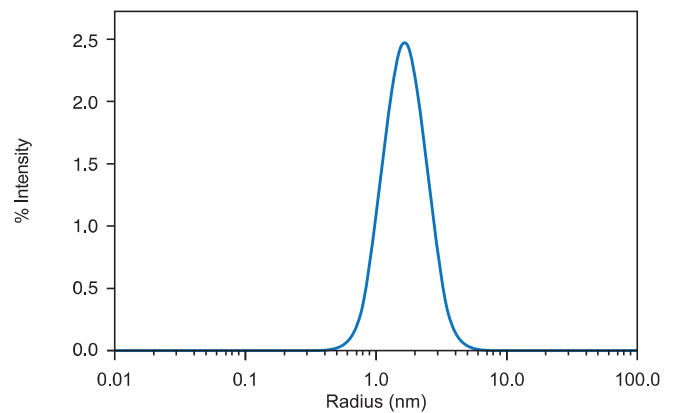
Development of nanoparticle formulations greatly accelerated when a matrix of processing conditions is combined with high-throughput particle sizing in the DynaPro Plate Reader 4.

## In-process AAV quantitation



Direct measurement of AAV attributes during upstream and downstream processing (USP and DSP) can be accomplished at-line with the DynaPro Plate Reader. Sample purity progresses from crude USP product (blue) to the first DSP purification (red) and the final DSP filtrate (green), where a single size population is present with concentration of  $2 \times 10^{12}$  particles/mL.

## Quantum dots characterization



Quantum dots' properties depend greatly on size. However, they are tricky to analyze because they absorb and emit light in the visible range. This isn't an issue with the DynaPro Plate Reader, as its near-IR laser source suppresses emissions, ensuring precise analysis of these challenging nanoparticles.

# Specifications

## Dynamic Light Scattering

|                                 |  |
|---------------------------------|--|
| Size Range                      | 0.5 to 1000 nm (hydrodynamic radius, $R_h$ )                 |
| Minimum Concentration at 14 kDa | 0.125 mg/mL (50 $\mu$ L lysozyme in Greiner 384 well plates) |

## Static Light Scattering

|                                 |   |
|---------------------------------|---|
| Particle Concentration          | For particles of $R_h$ up to 160 nm. Measurable concentration range varies with particle size and refractive index. Typical range for $R_h = 50$ nm: $10^8$ to $10^{11}$ particles/mL |
| Molar Mass Range                | 300 Da to 1 MDa <sup>†</sup>  |
| Minimum Concentration at 67 kDa | 1 mg/mL (50 $\mu$ L BSA in Greiner 384 well plate)  |

## Well Plates

|                       |  |
|-----------------------|--|
| Supported Formats     | 96, 384, or 1536<br>Many industry-standard well plates are supported |
| Minimum Sample Volume | 4 $\mu$ L (2 mg/mL lysozyme in 1536 well plate)                      |

## Optics

|                   |                          |
|-------------------|--------------------------|
| Laser Wavelength  | 830 nm                   |
| Laser Power       | Programmable 10% to 100% |
| Attenuation Range | 1 to $10^5$              |

|                     |                |
|---------------------|----------------|
| Temperature Control | 4 °C to 85 °C* |
|---------------------|----------------|

|                    |   |
|--------------------|---|
| Read Time per Well | 5 to 20 seconds (~1.5 hours for a 384 well plate) |
|--------------------|---|

## Electronics

|                       |  |
|-----------------------|--|
| Correlator            | 512 channels, 100 ns sampling time in a multi-tau layout |
| Onboard Camera        | Operates up to 85 °C                                     |
| Digital Communication | Ethernet (TCP/IP)  |

|            |                                   |
|------------|-----------------------------------|
| Dimensions | 60 cm (l) x 36 cm (w) x 25 cm (h) |
|------------|-----------------------------------|



Wyatt Technology provides absolute macromolecular and nanoparticle characterization solutions by developing the finest instrumentation and services to biotechnology, pharmaceutical, nanotechnology, chemical, and academic laboratories worldwide. We delight our customers with unparalleled levels of service and support, facilitating their cutting-edge research and development efforts.

DynaPro Plate Reader is one of many tools in Wyatt's light scattering toolkit used to characterize proteins, polymers and nanoparticles in solution.

[Learn more at www.wyatt.com](http://www.wyatt.com)

[Request a Quote](#)

**Warranty:** All Wyatt instruments are guaranteed against manufacturing defects for 1 year.

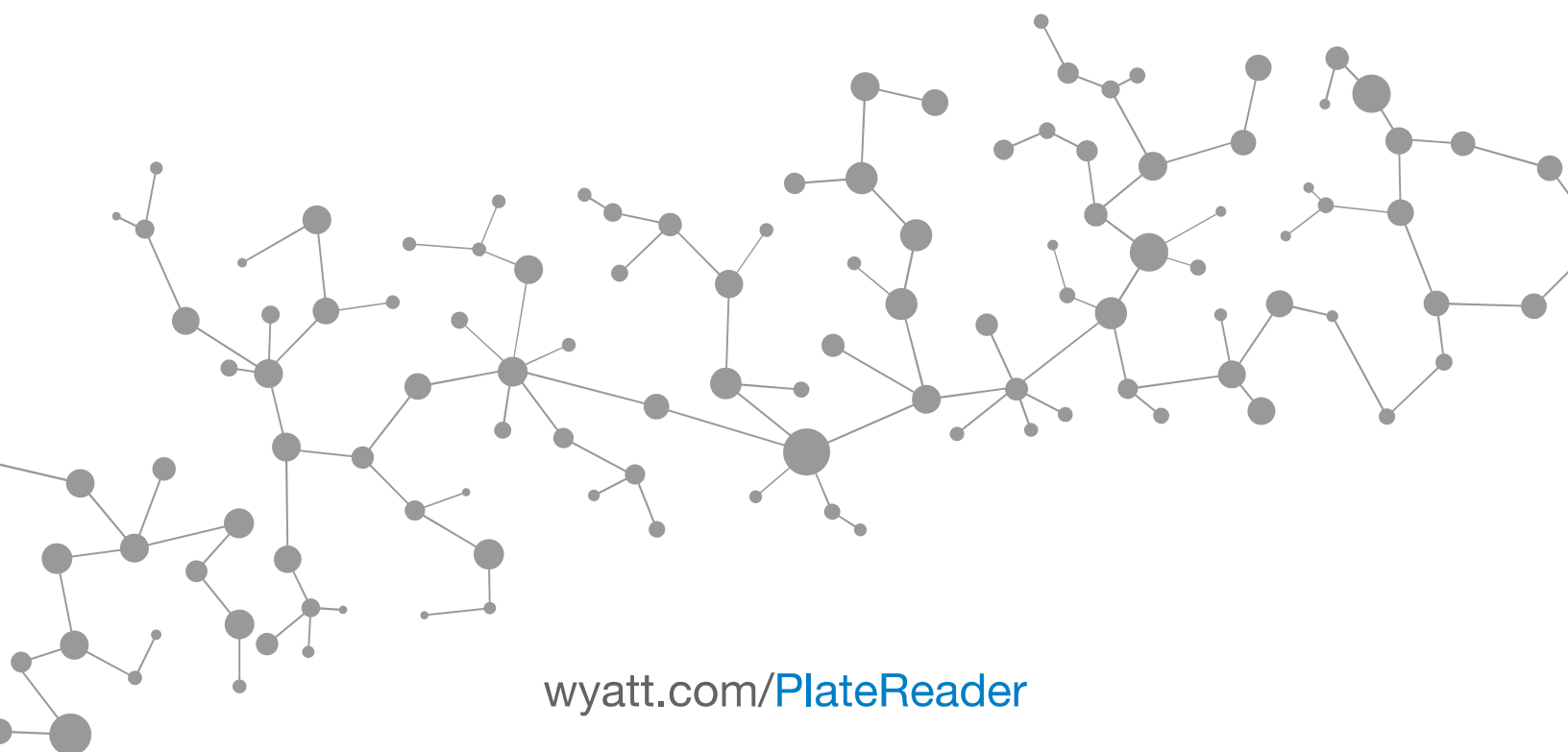
<sup>†</sup>Upper limit depends on conformation: It is limited to a maximum  $R_h$  of 12 nm.

\*Absolute accuracy of  $\pm 0.5$  °C from 4 °C to 50 °C, and  $\pm 1$  °C from 50 °C to 85 °C. Minimum temperature of 4 °C requires a laboratory ambient temperature of 24 °C or below.

Wyatt Technology is committed to continual improvement. Specifications are subject to change without notice.



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