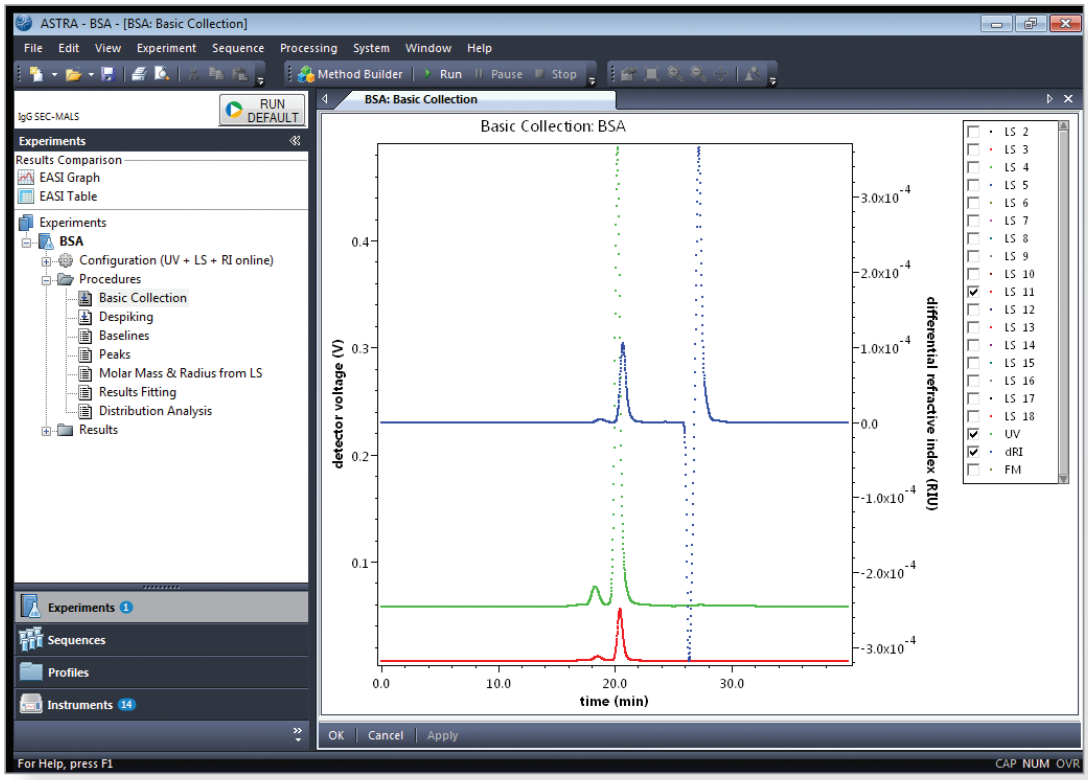
ASTRA 7

Luminary software for macromolecular and nanoparticle characterization



WYATT TECHNOLOGY

ASTRA® 7

A complete solution for SEC-MALS and beyond

Essential analytics

ASTRA has been recognized for decades as the premier software for analyzing macromolecules and nanoparticles by multi-angle light scattering (MALS). ASTRA acquires and analyzes data from Wyatt's industry-leading instruments.

ASTRA 7 provides absolute determination of:

- Molar mass and size
- Conformation, shape and conjugation
- Advanced properties

ASTRA integrates MALS, UV, differential refractive index (dRI), dynamic light scattering (DLS) and intrinsic viscosity (IV) data for comprehensive solution-based characterization.

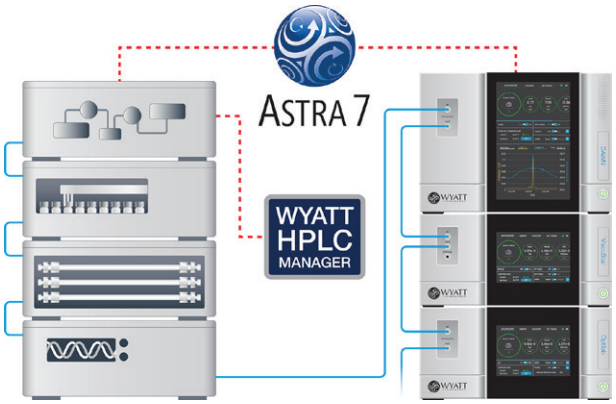
Evolving to meet more needs

Since first introduced in 1989, ASTRA has combined fundamental physical principles with current software practices to deliver results with confidence.

Automation Do more with less effort. ASTRA automates sequential runs and maintenance.

Intelligence Band-broadening correction, automated peak and baseline selection are just the beginning.

Accuracy ASTRA offers a comprehensive solvent database with extensive temperature correction.



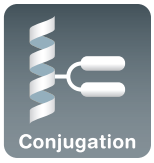
Take control with ASTRA's integrated HPLC service.

Full line-up

ASTRA's extended analyses include:

Distributions Molar mass and size, both differential and cumulative

Conjugation SEC-MALS-UV-dRI analysis for calculating the molar mass and fraction of each component in a glycoprotein or copolymer



Polymer Branching SEC-MALS-IV triple-detection analysis for branching ratio, number of branches per molecule, and long-chain branching analysis

Conformation SEC-MALS-dRI/DLS/IV analysis of radius or intrinsic viscosity vs. molar mass

Particle Distributions Number density (particles/mL) vs. size

Particle Shape Based on shape factor $\rho = R_g/R_h$ determined by MALS-DLS analysis

Custom Plots Plot any measured or calculated quantity against any other

UV Extinction Coefficient Determine online, from a known *dn/dc* value (ideal for proteins)

Diagnostics Evaluate the health of your light-scattering detectors

Absolute characterization means no column calibration or reference molecules required

Explore the power of Triple, Quadruple and even Quintuple Detection for characterization by GPC/SEC and FFF

Molar mass in a single click? Absolutely!

Load Sample → Click ‘Run’ → Get Results

Quick setup:

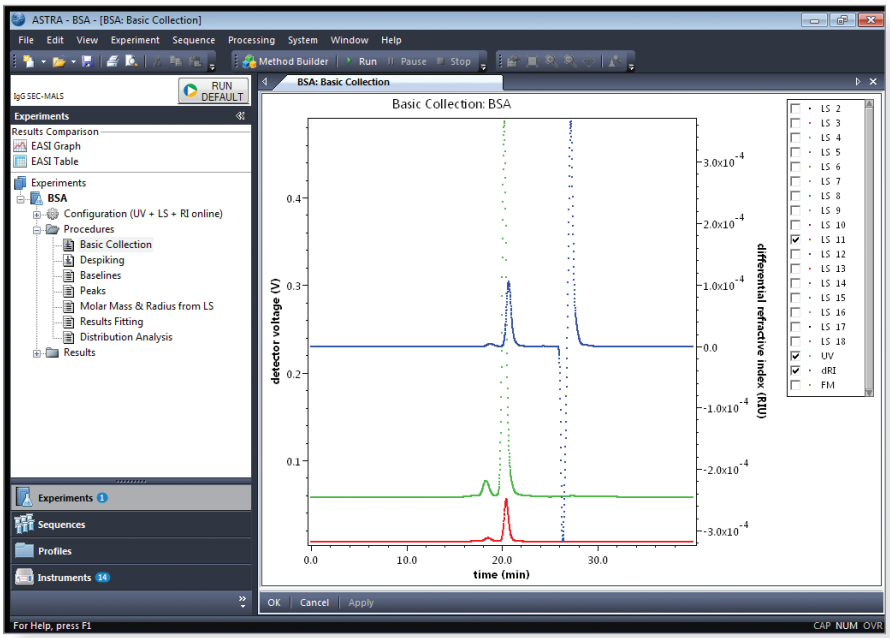
ASTRA’s Method Builder lets you set up a default method optimized for your sample type in three easy steps:

1. Select experiment type
2. Input parameters
3. Click ‘Run’

ASTRA will:

- Synchronize data collection with your HPLC
- Autoset parameters to determine MW and R_g
- Generate custom reports and graphs
- Prepare for the next run

Analyze your way, whenever you want



For power users, the ASTRA workspace is organized to present a clear outline of your instruments, methods, experiments and results:

- Set up and review the methods, sequences and instrument/sample/solvent profiles
- Optimize analysis procedures and save as templates
- Run simple or complex measurements
- Open multiple experiments for comparison of results
- Prepare publication-quality graphs or export the results to your favorite graphing package

ASTRA

Do more

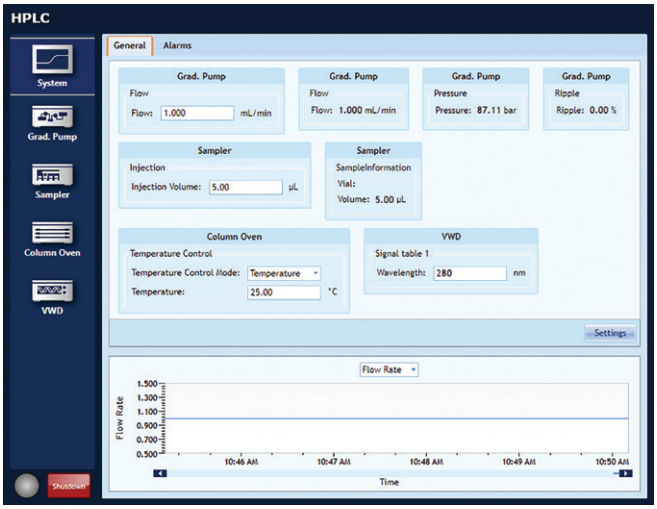
MALS & HPLC/UHPLC integration

ASTRA offers multiple paths to integrating MALS analysis with the most popular analytical HPLC/UHPLC instrumentation:

Classic ASTRA analysis, third party control—use native HPLC control software to send UV signals and triggers to ASTRA.

Import Similar to 'Classic' operation, but instead ASTRA reads in Empower and ChemStation sequences created in the native HPLC software. Sequence import saves operator time and eliminates human error in sequence transfer.

Full Service Eliminate HPLC software entirely and ensure perfect synchronization by letting ASTRA take control of pumps, autosamplers and UV detectors (only available for select HPLC systems).

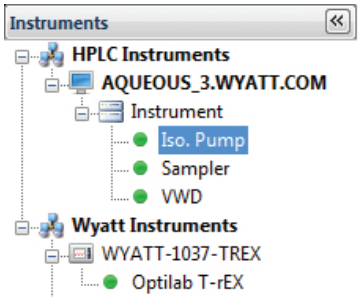


ASTRA's HPLC Manager app provides the convenience of a handheld controller with real-time indication and management of your HPLC system.

Integrated HPLC control

ASTRA's optional HPLC control module ensures full digital synchronization between your HPLC pump, autosampler, UV, light scattering and other detectors.

- Convenience and savings – a single software solution for control, acquisition and analysis
- Minimize user error
- Uniform look and feel

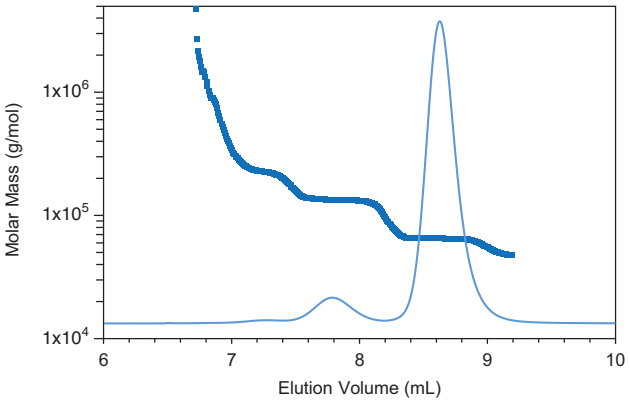


Regulatory compliance

Following industry standards, ASTRA offers an optional 21CFR(11) compliance package, including IQ/OQ documents and procedures.

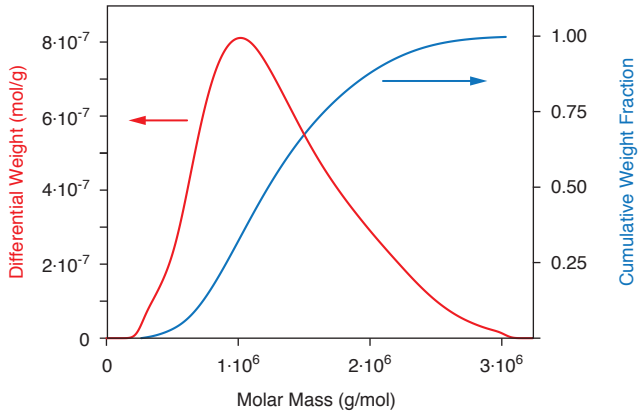
- Administrator, researcher, technician and guest access levels
- Full audit trails
- Electronic signatures
- Sign-in/Sign-out during a run
- Secure SQL Server database
- Local or remote database connectivity
- Data integrity validation
- Full IQ/OQ procedures and documentation validation

Absolute molar mass analysis



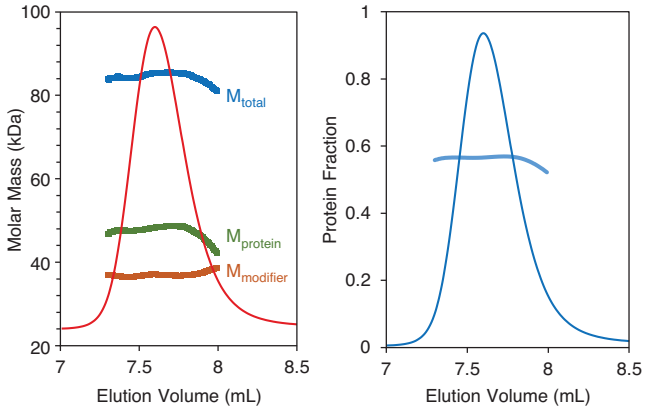
ASTRA's Band Broadening Correction accounts for interdetector dispersion, mathematically adjusting peaks so that each data slice provides matched signals from each detector in the chromatographic elution series. This algorithm is responsible for the uniform molar mass across the BSA monomer, dimer and trimer peaks plus additional oligomers eluting from the SEC column.

Molar mass and size distributions



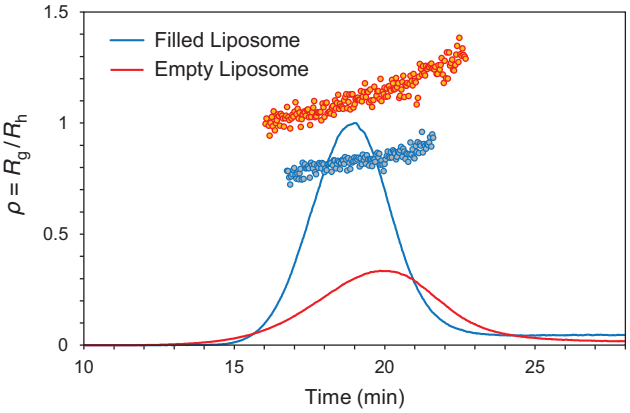
In addition to plotting the molar mass and size determined by MALS over a chromatogram or fractogram, ASTRA can convert the data into distributions. These graphs show differential and cumulative distributions of molar mass as measured for hyaluronic acid.

Protein conjugate and copolymer analysis



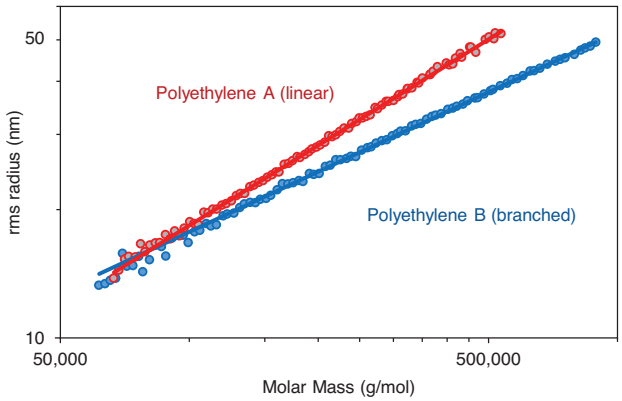
The ASTRA workspace has rich features for characterizing proteins using the Protein Conjugate Analysis algorithms with simultaneous signals from UV, RI, and MALS. The characterization includes molecular weight, extinction coefficient, stoichiometry, and composition analysis. The same analysis works for copolymers as well.

Shape factor



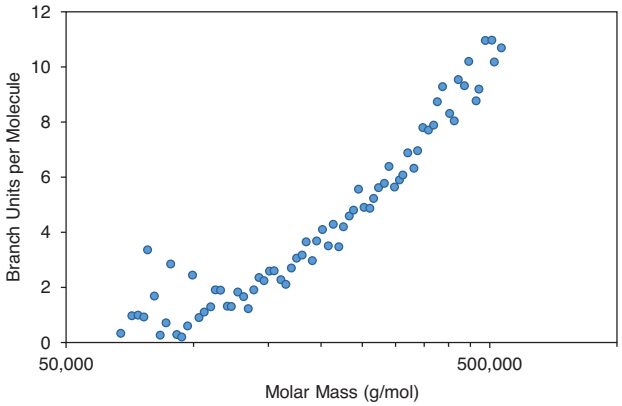
ASTRA's Burchard-Stockmayer plot shows the shape factor $\rho = R_g/R_h$, i.e. the ratio of rms radius (measured by MALS) to hydrodynamic radius (measured by DLS). In this figure, ρ clearly differentiates between empty and filled liposomes. The theoretical value of 0.77 corresponds to an empty shell, while the value of 1.0 corresponds to a uniform sphere. Values of $\rho > 1$ indicate an ellipsoid and directly relate to the ratio of major to minor axes.

Polymer branching



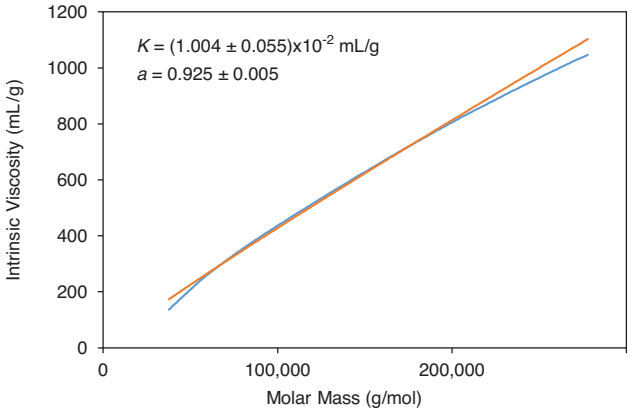
ASTRA's Conformation Plot reveals branching by comparing rms radius with molar mass for linear and branched polymers. Here, the value of the slope of $\log(R_g)$ vs. $\log(M_w)$ for Polyethylene A indicates that it is a linear polymer. The branching of Polyethylene B is apparent by its significantly smaller slope in contrast with Polyethylene A.

Branching calculations



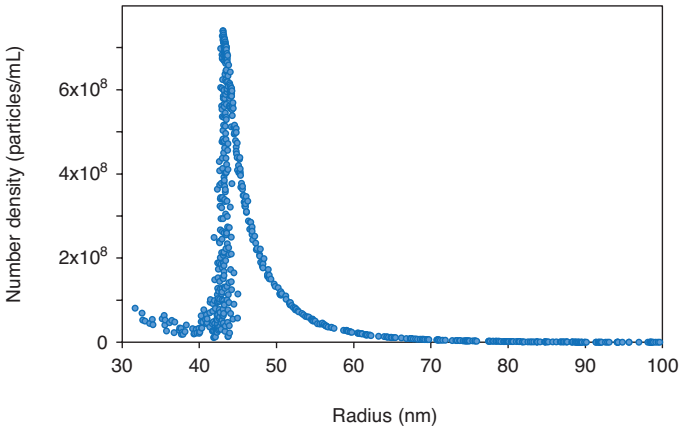
ASTRA compares linear and branched polymers in order to determine branching ratio. The data above were analyzed to yield the average number of branching units per molecule and its dependence on molar mass. Branching begins above a molar mass of ~100,000 g/mol.

Mark-Houwink parameters



Mark-Houwink parameters relate the molar mass of a polymer to its intrinsic viscosity. The determination of molar mass by the viscometric technique of Universal Calibration depends on accurate determination of these parameters. Here, the Mark-Houwink parameters of alginate are determined directly by triple detection, combining MALS (for absolute molar mass), differential viscosity and refractive index measurements. ASTRA fits the results to determine *K* and *a*.

Nanoparticle concentration



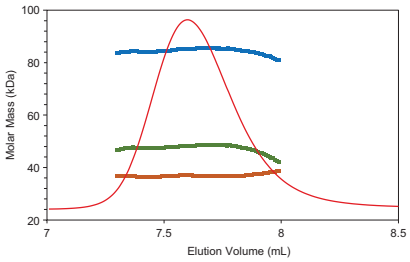
ASTRA utilizes MALS data alone to calculate the number of particles per mL throughout a fractogram or chromatogram. This capability provides truly quantitative, high-resolution size distributions with large particle ensembles, unlike other nanoparticle counting techniques that stumble on either size resolution or sampling efficiency. This graph shows the number density distribution of adenoviruses produced for a vaccine.

ASTRA 7

Productivity features

Complex analyses in a simple, intuitive presentation

ASTRA's EASI Graph lets you select from a large set of complex analyses such as Protein Conjugates, Conformation Plots and Polymer Branching, showing these key results for one or more samples overlaid on chromatograms.



Customized reports

ASTRA provides customized reporting options so you can export exactly the information you need. It even allows you to customize the report with your company's logo and descriptive text.

Compile key results from multiple peaks and samples

ASTRA's EASI Table gives you a quick and easy overview of the most important results of multiple samples in one compact table.

Sequence1: Configuration | 978TS - Aq1: Distribution Analysis | EA

Experiments: Peaks: Scalars:

	Peak 1		
	Mw (kDa)	Calculated mass (µg)	Mass fraction (%)
978TS - Aq1	65.4 (±0.6%)	196.84	100.0
Average	65.4	196.84	100.0
Standard deviation	n/a	n/a	n/a
% Standard deviation	n/a	n/a	n/a
Minimum	65.4	196.84	100.0
Maximum	65.4	196.84	100.0

Sequences and unattended runs

With ASTRA you can set up multiple, unattended runs synchronized with the HPLC system.

Sequence1: Samples

Changes to the Sequence will not take effect until you press the 'Apply' button.

	Well	Enable	Name	Description	Inj	Method	Duration (min)	Inj Vol (µL)	Delay	dn/dc (mL/g)	A2 (mol mL/g²)	UV Ext (mL/(mg
1	1	☑	Sample 1	blank	1	/System/Methods/Light ...	40.000	100.00	0.000	0.1850	0.0000e+000	0.000e+000
2	1	☑	Sample 2	mAb 1 pre-lyo	1	/System/Methods/Light ...	40.000	100.00	0.000	0.1850	0.0000e+000	0.000e+000
3	1	☑	Sample 3	mAb 2 pre-lyo	1	/System/Methods/Light ...	40.000	100.00	0.000	0.1850	0.0000e+000	0.000e+000
4	1	☑	Sample 4	mAb 1 post-lyo	1	/System/Methods/Light ...	40.000	100.00	0.000	0.1850	0.0000e+000	0.000e+000
5	1	☑	Sample 5	mAb 2 post-lyo	1	/System/Methods/Light ...	40.000	100.00	0.000	0.1850	0.0000e+000	0.000e+000
6	1	☑	Sample 5	blank	1	/System/Methods/Light ...	40.000	100.00	0.000	0.1850	0.0000e+000	0.000e+000

Left to Right
Geofrey K. Wyatt, Chief Executive Officer
Dr. Philip J. Wyatt, Chairman of the Board
Clifford D. Wyatt, President

For more than 35 years, we've operated as one of the very few remaining family-owned businesses in the analytical instrument industry. With installations in more than 65 countries, over 15,000 refereed journal publications citing our instruments and more than 25 PhD scientists on staff, we take great pride in the worldwide recognition that Wyatt Technology has received as a leading manufacturer of instruments and software for absolute macromolecular and nanoparticle characterization. Our dedication to providing customers with comprehensive training and personal support has made us the gold standard in this field.

ASTRA is one of many tools in Wyatt's Light Scattering Toolkit for Essential Macromolecular and Nanoparticle Characterization.

Learn more at www.wyatt.com

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