

# Streamlined AAV Purification: End-to-End Solutions Powered by Beckman Coulter Life Sciences Technologies



## Abstract

Adeno-associated virus (AAV) vectors have become a cornerstone of gene therapy due to their favorable safety profile and ability to deliver genetic material to target cells. However, AAV expression and packaging are often inefficient, resulting in a heterogeneous mix of full, empty and partially filled capsids. Because only the full capsids provide the desired therapeutic benefit, they must be separated from other capsid species, which is a challenge due to their identical size and surface features. This variability poses significant obstacles for upstream control, downstream purification, and characterization.

Achieving high-resolution separation and detailed analysis of AAV particles is essential for ensuring therapeutic efficacy and product consistency. This poster outlines key steps in the AAV workflow—from cell health and metabolic monitoring to lysate clarification, purification, and analytical characterization—and highlights how technologies from Beckman Coulter Life Sciences can enable precision, reproducibility and efficiency at every phase.

## Cell Culture

### Vi-CELL BLU Analyzer

The Vi-CELL BLU Analyzer automates cell counting and viability analysis to deliver fast, reliable results with minimal hands-on time.

- Automates trypan blue staining and imaging for consistent monitoring of HEK293 or Sf9 cell health.
- Enables reliable cell density and viability tracking to support transfection or infection timing.
- Expedites upstream decision-making with walk-away operation and intuitive batch processing.



### Vi-CELL MetaFLEX Analyzer

The Vi-CELL MetaFLEX Analyzer provides rapid, at-line metabolic analysis to maintain optimal conditions for AAV production.

- Delivers accurate measurements of pH, pO<sub>2</sub>, pCO<sub>2</sub>, glucose, lactate and electrolytes in just 35 seconds.
- Supports upstream process control by tracking nutrient consumption and waste accumulation.
- Compact, easy-to-use system ideal for integration into cell culture labs and bioprocess suites.



## Clarification

### Allegra V-15R Benchtop Centrifuge

The Allegra V-15R is a compact, versatile centrifuge ideal for small-scale lysate clarification in AAV workflows.

- Delivers up to 13,500 rpm and 20,412 x g for efficient debris removal.
- Small footprint and optional mobile cart free up bench space and enable flexible placement within the lab.
- Refrigerated system with 10 rotor configurations supports consistent, reproducible performance for evolving lab needs.



### Avanti JXN-26 High-Performance Centrifuge

The Avanti JXN-26 delivers high-performance, large-capacity centrifugation to support rapid AAV lysate clarification.

- Capable of reaching up to 26,000 rpm and 81,770 x g, with a max capacity of 6 liters depending on rotor configuration.
- Features intuitive touchscreen interface, protocol storage, user-level access controls, and traceability tools for GMP-aligned labs.
- Compatible with over 25 rotors, including BioSafe options and HarvestLine consumables, and built for quiet, safe operation with advanced imbalance tolerance.



## AAV Production Workflow



## Purification

### Optima X Series Ultracentrifuge

The Optima X series instruments support scalable AAV workflows with intuitive controls, robust safety features, and sustainability in mind.



- Enable high-speed separations up to 802,000 x g—ideal for AAV purification at both research and production scales.
- Streamlines operation with a 15" touchscreen, eXPert simulation software, and remote monitoring for GMP-aligned environments.
- Minimizes environmental impact with CFC-free cooling, low idle energy use, and automated run history tracking.

### Optima MAX Series Benchtop Ultracentrifuge

The Optima MAX series instruments are designed for high-resolution separations in a small footprint.



- Reaches speeds up to 150,000 RPM (657,000 x g) for rapid and efficient separation of viral particles and macromolecules.
- Simplifies workflows with an intuitive touchscreen interface, broad rotor compatibility, and easy protocol customization.
- Designed with space efficiency and noise reduction in mind—ideal for benchtop use in high-throughput labs.

### OptiMATE Gradient Maker

For use with Optima X series ultracentrifuges, the OptiMATE Gradient Maker transforms density gradient ultracentrifugation by automating key steps for faster and more reliable results.



#### Minimize Error, Maximize Consistency

- Automated dispensing and tube sealing reduce hands-on steps and user variability.

#### Cut Run Times by 75%+

- Pre-formed gradients significantly speed up separations.

#### Train in Hours, Not Weeks

- Intuitive interface enables fast onboarding and method setup.

#### Standardize with Ease

- Create and share protocols for consistent, reproducible workflows.

#### Compact & Convenient

- Fits in biosafety cabinets or on bench near your ultracentrifuge.

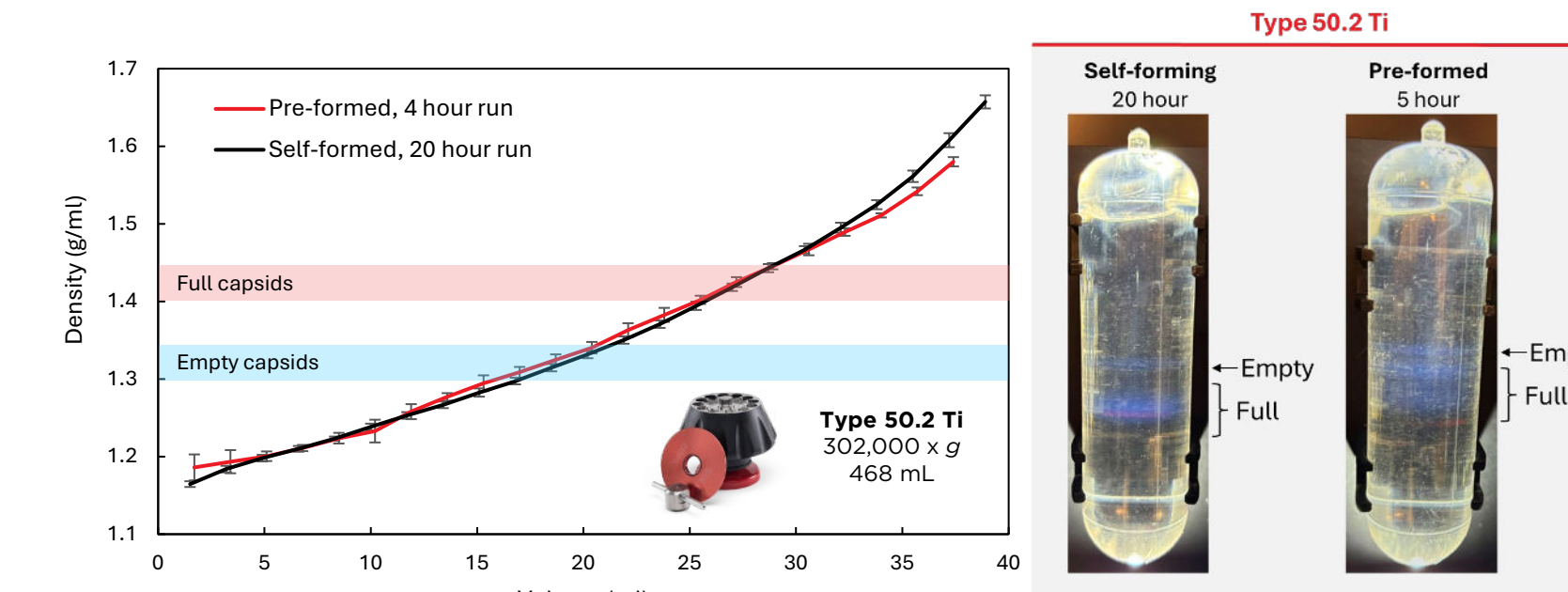
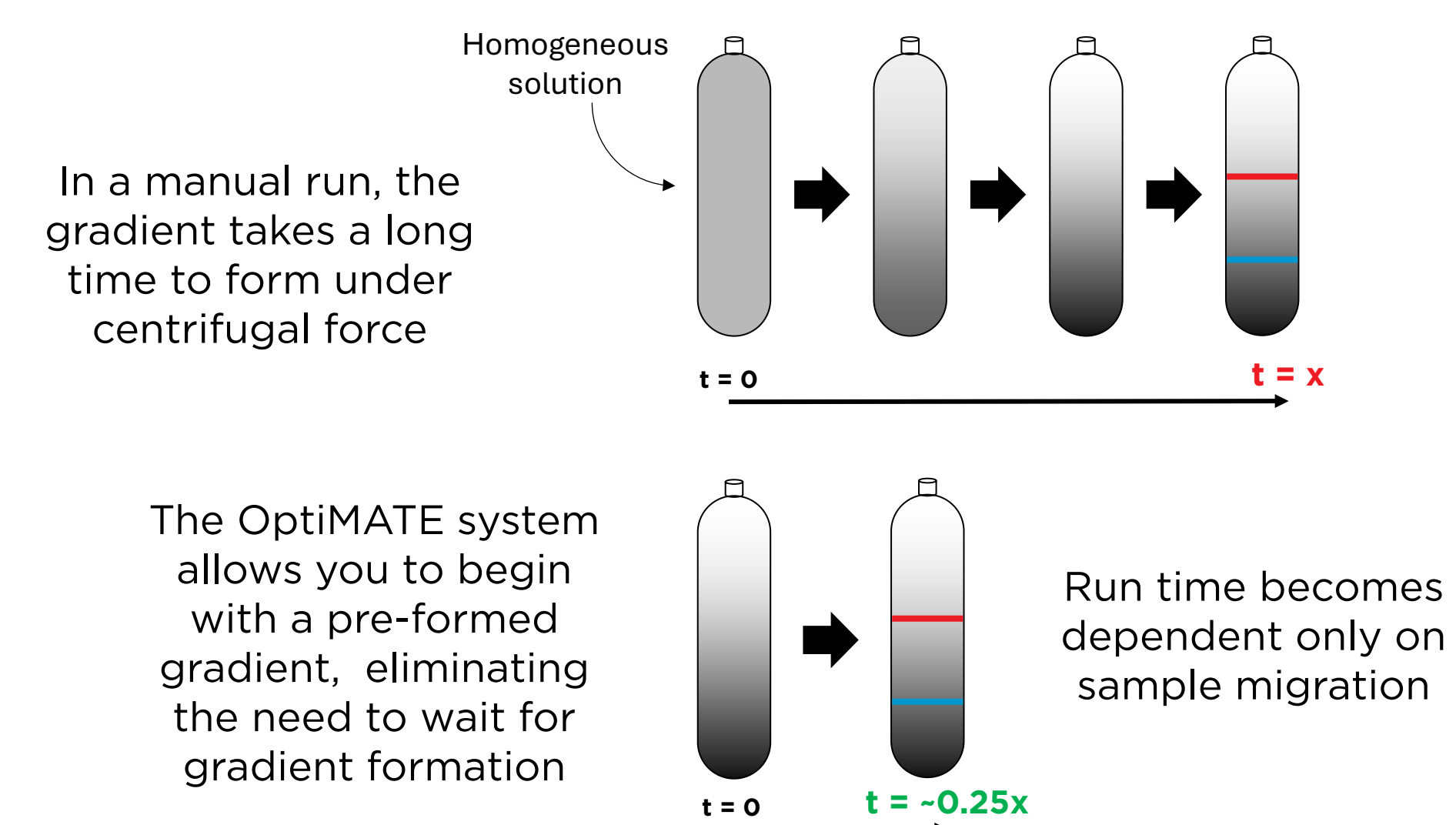
### OptiMATE Density Gradient Reagents



OptiMATE CsCl and IDX reagents simplify density gradient ultracentrifugation with ready-to-use, quality-controlled solutions.

- Pre-mixed at 80% (w/v) for iodixanol and 1.784 g/mL density for cesium chloride, enabling fast and consistent gradient preparation.
- Validated for use with the OptiMATE Gradient Maker, ensuring reproducibility across DGUC workflows.
- Sterile, low-endotoxin solutions suitable for GMP-aligned environments.

### The OptiMATE system can cut centrifuge run times by over 75%



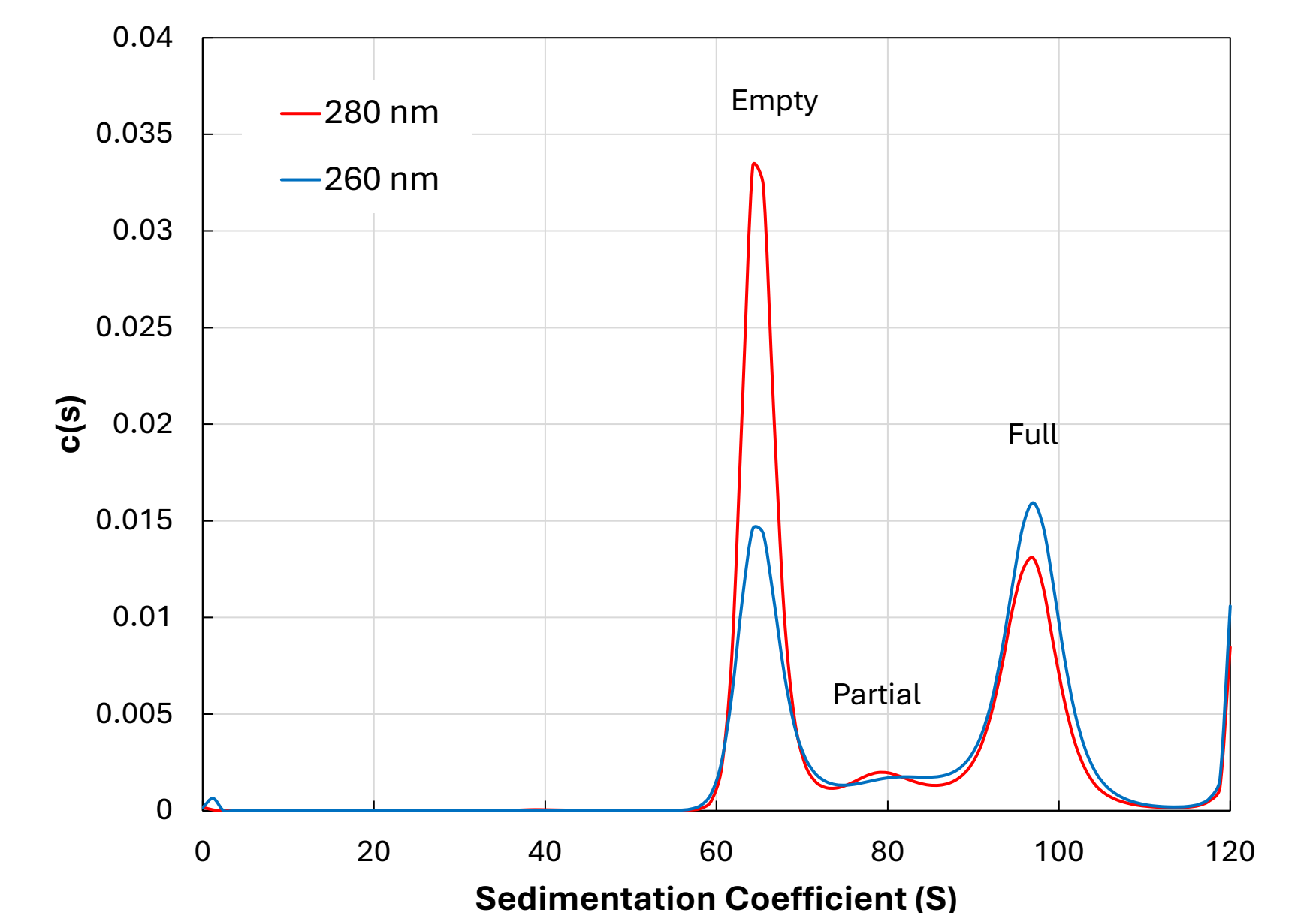
## Characterization

### Optima AUC Analytical Ultracentrifuge

The Optima AUC enables high-resolution, quantitative analysis of viral vector quality with unmatched precision.



- Equipped with multiwavelength absorbance and Rayleigh interference detectors.
- Resolves full, empty and partially filled AAV capsids in a single run - no labeling or standards required.
- Provides absolute quantification of particle distribution, size, and heterogeneity.
- Delivers reproducible, high-confidence data suitable for critical quality assessments.



## Conclusions

Beckman Coulter Life Sciences offers a comprehensive portfolio of preparative and analytical technologies to support nearly every stage of the AAV workflow, from upstream monitoring to downstream purification and final characterization. Each solution is designed to reduce variability, accelerate processing, and deliver reproducible results that meet the rigorous demands of gene therapy development.

By integrating tools such as the OptiMATE Gradient Maker, Optima ultracentrifuges, and Vi-CELL systems, laboratories can streamline operations, improve data confidence, and scale with confidence from research to production. Whether you're optimizing transfection conditions or separating full capsids with precision, Beckman Coulter empowers your AAV process with speed, consistency and clarity.

