ÄKTA™ avant

ÄKTA avant is a preparative chromatography system intended for method and process development (Fig 1). Available in two versions, ÄKTA avant systems have different flow rate/ pressure specifications but share the same hardware setup. With flow rates up to 25 ml/min, ÄKTA avant 25 system is designed for media screening and method optimization. ÄKTA avant 150 system, with flow rates up to 150 ml/min, is designed for scaling up to larger columns.

UNICORN™ 6 control software has been specially developed for ÄKTA avant to increase productivity and efficiency. ÄKTA avant offers a complete solution for fast, high-quality protein separations while maintaining flexibility and reliability.

Key features and benefits:

- Design of Experiments (DoE), an experimental design tool integrated in UNICORN 6, provides time and cost savings by capturing more precise information in fewer experiments
- Column recognition and run data history of individual columns provides traceability and operational security
- Integrated fraction collector with cooling functionality protects purified samples
- Automatic on-line buffer preparation using BufferPro reduces the time required for buffer blending and manual titration, increasing your productivity
- UNICORN 6 provides easy protocol transfer during scale-up and an improved visual interface for intuitive and flexible method editing

Fig 1. ÄKTA avant is a preparative chromatography system designed for process development, method optimization, and scale-up.

System components

The system consists of the ÄKTA avant instrument and UNICORN 6 control software. The instrument offers easy access to the working areas using a swivel foot (Fig 2A). ÄKTA avant has a modular design, with all valves, monitors, and columns mounted on the wet side of the system. The wet side of the instrument allows easy interaction with the system, and has a door and pump cover for safe handling during runs (Fig 2A and 2B). A buffer tray on top of the instrument provides a large storage area for vessels and bottles. On the front side of the instrument, ÄKTA avant has a built-in, cooled fraction collector that provides secure sample storage.

An interactive instrument display on the front panel informs the user of the current instrument and method state, and the chromatographic run can quickly be paused or continued from the display. To ensure reliability, the system performs self-diagnostic tests of appropriate settings at start-up.

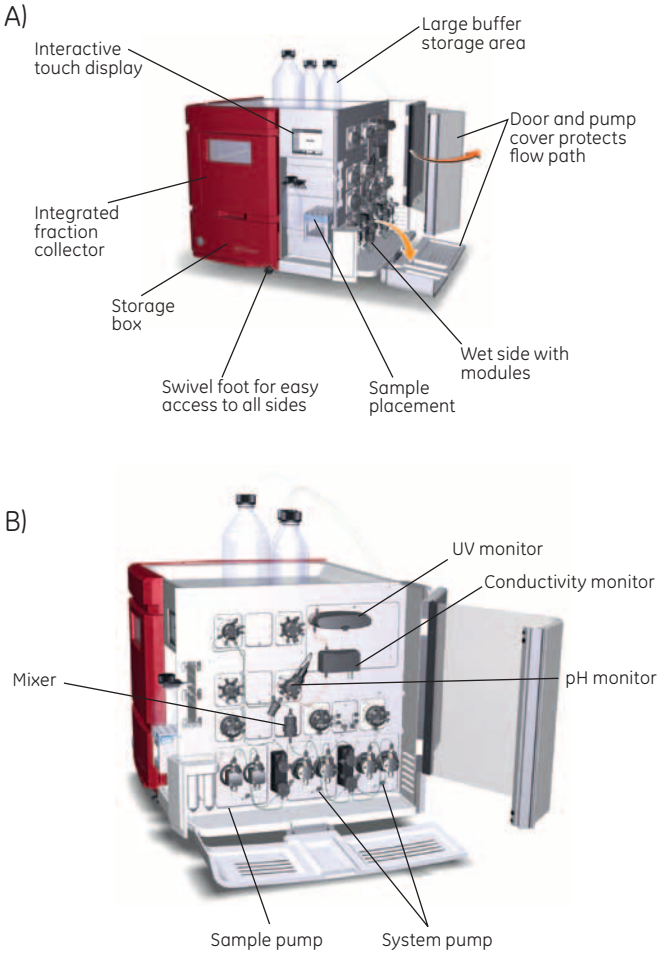


Fig 2. (A) Features of ÄKTA avant, **(B)** an illustration of the wet side, and **(C)** a diagram showing the wet side.

The flow path is designed to minimize band-broadening effects, and all wetted materials used in the flow path are biocompatible and resistant to commonly used solvents. ÄKTA avant system components are described in the following sections in more detail.

Pumps

The improved system and sample pumps are based on the well-known technology in ÄKTAexplorer™. Their robust construction delivers reproducible flow rates at both low and high back pressures, allowing short separation times and the use of modern scale-up chromatography media. Figure 2B shows a view of the wet side of ÄKTA avant and the location of the pumps. There are two pressure sensors connected to the pumps for monitoring the pressure.

- **System pump:** Provides continuous and accurate flow rates, to give reproducible isocratic or gradient elutions. This pump consists of two pairs of pump heads, which deliver synchronized, low-pulsation flow to the mixer. For ÄKTA avant 25, the maximum operating pressure is 20 MPa and the maximum working flow rate is 25 ml/min. For ÄKTA avant 150, the maximum operating pressure is 5 MPa and the maximum working flow rate is 150 ml/min. For column packing, ÄKTA avant 25 and 150 can be used at flow rates up to 50 ml/min and 300 ml/min, respectively.
- **Sample pump:** Dedicated pump for performing automatic sample application. The sample pump, consisting of two pump heads, is based on the same pump principle as the system pump. Due to its design, pump purging and air removal can easily be performed automatically. The air sensor protects columns by ensuring that no air is introduced into the column. The pump can apply samples directly to a column or indirectly via a capillary loop or Superloop™.

Valves

A series of motorized, multiport valves control the movement of liquid through the system (see Fig 2C). The different types of valves are described below.

- **Injection valve:** Enables automatic sample application onto the column, without replumbing capillaries between different injection modes. It allows for a variety of sample application techniques including: filling a capillary loop manually via a syringe or with the sample pump, filling a Superloop manually with a syringe or sample pump, or directly loading onto a column using the sample pump.
- **Sample inlet valve:** Allows automatic change between different samples. This valve has an integrated air sensor, ensuring safe and complete sample application. The valve has seven sample inlet positions plus a dedicated buffer inlet for filling the sample pump with solution before the sample is introduced and for washing out the valve and pump between runs.

- **Column valve:** Connected to the injection valve and used to select the column that is to be used. Up to five columns can be connected to the column valve for automatic column scouting. The column valve has an integrated column bypass function, eliminating the risk of overpressure on the columns, for example, during system and pump wash procedures. To increase the yield and performance when using absorption techniques, the column valve also has a built-in reverse flow functionality. Reversed flow may be used during column cleaning or when eluting a sample to give sharper bands and a more concentrated target molecule eluent. The column valve also has two integrated pressure sensors that measure pre- and post-column pressure for the calculation of delta pressure (refer to "Sensors and monitors").
- **Two inlet valves (A and B):** Enable automatic change between different buffers and wash solutions. The inlet valves have integrated air sensors (refer to "Sensors and monitors").
- **Quaternary valve:** Used for BufferPro and for creating quaternary gradients. The valve has four buffer inlets that enable automatic buffer preparation, with BufferPro, using four stock solutions.
- **pH valve:** Includes an integrated pH electrode that enables in-line pH monitoring during the run. A flow restrictor is connected to the pH valve and can be automatically included in the flow path to generate a back pressure that prevents the formation of air bubbles in the UV flow cell. The pH valve is used to direct the flow to the pH electrode and flow restrictor, or alternatively, to bypass one or both. It is recommended to bypass the flow restrictor when using low pressure columns at high flow rates.
- **Outlet valve:** Mainly used to direct the flow to the fraction collector, waste, or other outlet ports. The valve has dedicated ports for the fraction collector and waste, as well as ten other outlets for collecting large fractions.

Mixer

The mixer ensures homogeneous buffer composition during gradient runs (see Fig 2B). The mixer chamber size depends on the flow rate and buffers used, with a larger mixer volume required for higher flow rates or difficult-to-mix buffers. Table 1 shows the mixer chamber sizes available for each instrument. The in-line filter on the mixer is easy to change, and has a pore size of 10 µm. The mixer is also easily changed by snapping it in or out of the mixer holder.

Table 1. Mixer chamber sizes available

System	Mixer chamber sizes
ÄKTA avant 25	0.6, 1.4, and 5 ml
ÄKTA avant 150	1.4, 5, and 15 ml

Sensors and monitors

Air and pressure sensors increase operational security and protect the system. The UV, conductivity, and pH monitors allow real-time data from the chromatographic run to be accurately measured.

- **Air sensors:** Enable the safe exclusion of air from the system. Integrated air sensors are placed in the sample inlet valve and inlet valves A and B. When air is detected, the system is paused so that the air can be removed before further introduction into the flow path. During sample application, the air sensor detects when the sample has been completely injected so that the method can continue to the next step without air being introduced into the flow path or column.
- **Pressure sensors:** Integrated into the column valve to protect the column and media from overpressure. One pressure sensor measures the pressure before the column to protect the column hardware. Another sensor measures the pressure after the column and calculates the pressure difference over the packed media bed (i.e., Δp; Fig 3). If one of the pressures exceeds the preset limit, the run is paused. Alternatively, the user can activate pressure flow regulated mode, which automatically decreases the flow rate when the pressure exceeds the preset limit. Pressure sensors are also connected to the system and sample pumps to protect the connected columns and instrument hardware.

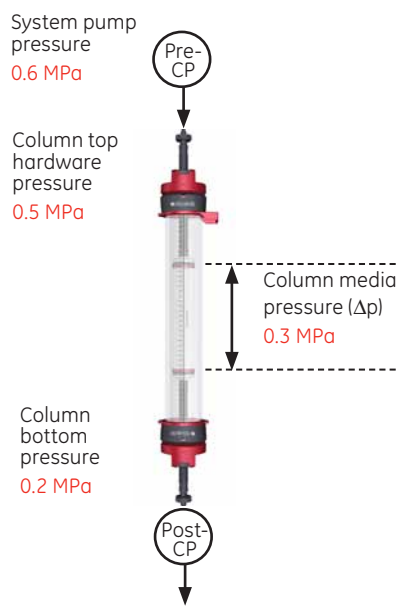


Fig 3. For increased operational safety, precolumn pressure (Pre-CP) and post-column pressure (Post-CP) are continuously measured during runs. The pressure difference over the packed media bed (Δp) is calculated by measuring the pressure before and after the column and calculating the difference.

- **UV monitor:** Provides real-time measurements of absorbance over the UV and visible range of 190 to 700 nm. To visualize protein separation at different wavelengths, the UV monitor has a flip-mode that allows monitoring of up to three wavelengths simultaneously. For optimum performance when purifying samples with different protein concentrations, there are three flow cell path lengths (0.5, 2 [default], and 10 mm). The optimal flow cell design, together with advanced fiber optics, provides a high signal-to-noise ratio without causing any local heating of the UV flow cell (especially critical when working with heat sensitive samples). The UV monitor contains a high intensity xenon lamp with a long lifetime that requires minimal start up time. Every time the instrument is switched on, the UV monitor is automatically calibrated.
- **Conductivity monitor:** Measures conductivity of buffer and samples for on-line monitoring of the true gradient. The conductivity monitor also has an integrated temperature sensor for monitoring temperature. Temperature changes can lead to variation in conductivity, but the integrated temperature sensor corrects for and minimizes this type of variation.
- **pH monitor:** Continuously measures pH of buffer and samples. The pH electrode is integrated into the pH valve, and the built-in calibration port allows for convenient calibration-in-place without having to remove the pH electrode.

Fraction collector

The built-in fraction collector provides sample security, flexibility, and high throughput. The fraction collector has a cooling functionality to prevent sample overheating and protect purified samples. A variety of cassettes are available for tubes (3, 8, 15, and 50 ml) as well as deep well plates (24-, 48-, and 96-well). Six cassettes can be loaded into the fraction collector in any combination that fits the user's needs (Fig 4). As an alternative to using six cassettes, loading capacity can be maximized by using a large tube rack for 50 ml tubes or a bottle rack for 250 ml bottles.

Fig 4. The built-in, cooled fraction collector holds up to six different cassettes. Cassettes are scanned, and the configuration is automatically validated.

Upon loading, the type of cassette is automatically detected by a sensor and the tube/bottle configuration is validated. Cassettes designed for tubes are equipped with a QuickRelease function that locks tubes into place when discarding liquid waste. Later, using QuickRelease, the tubes can be easily unlocked and discarded at the same time. The cassettes can also be used for convenient storage of fractions or holders for sample tubes.

ÄKTA avant has two beneficial features that minimize cross-contamination and spillage during fraction collection. DropSync can be used for flow rates up to 2 ml/min (ÄKTA avant 25 only) and minimizes spillage by timing fraction changes to occur between drops. At higher flow rates, the Accumulator function temporarily holds the liquid flow during the time it takes to move to the next tube or well.

Fraction collection can be based on time, volume, or automatic peak recognition. Automatic peak recognition minimizes cross-contamination and unwanted eluent can be diverted to the waste. Large fractions up to several liters can be collected using the outlet valve. By expanding the system with two extra outlet valves, 32 outlets can be used for fraction collection (refer to "Optional components").

UNICORN 6 control software

UNICORN 6 control software, specially developed for ÄKTA avant, gives you real-time control of your chromatography system. UNICORN 6 consists of four modules: ***Administration***, ***Method Editor***, ***System Control***, and ***Evaluation***. This section describes some of the valuable tools included in UNICORN 6 for increasing operational security, efficiency, and productivity.

Method Editor

The ***Method Editor*** contains all the instructions used for controlling the chromatographic run. In UNICORN 6, the improved ***Method Editor*** has a user friendly graphical interface for easy viewing and editing of the method and run properties. Figure 5 shows a screenshot of the ***Method Editor*** with customizable panes that provide a comprehensive overview of the run.

In UNICORN 6, methods are built by using phases. Each phase reflects a step in the chromatography run, such as equilibration, sample application, or wash phases (see ***Method Outline***; Fig 5). The ***Method Editor*** contains predefined methods for different chromatography techniques and maintenance procedures, as well as a library of predefined phases for creating or editing your own methods. A method is created or edited simply by dragging-and-dropping phases from the ***Phase Library*** into the ***Method Outline***.

In the ***Phase Properties*** pane, specific run parameters are set, and these settings are automatically programmed in the ***Text Instructions*** pane. When selecting a column type, parameter settings for that column type (e.g., default flow rates and pressure limits) are automatically set. The ***Phase Properties*** pane allows for easy editing of the method, while more advanced users may program the method directly in the ***Text Instructions*** pane. For quick editing, the toolbar contains useful icons such as ***Undo***, ***Redo***, and ***Save*** (Fig 6).

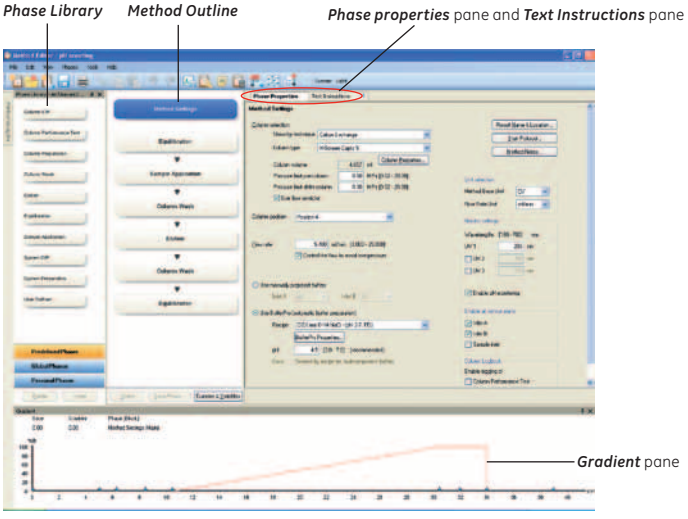


Fig 5. ***Method Editor*** has customizable panes that give a comprehensive overview of the method.

Fig 6. UNICORN 6 has an improved graphical interface that includes a toolbar with several convenient icons.

Column Logbook and UniTags

To increase operational safety, UNICORN 6 software features the ***Column Logbook***. This practical tool keeps track of important column and run data to provide traceability and operational security. Most prepacked columns from GE Healthcare are barcode labeled, and individual columns are identified using a 2-D barcode scanner, or the information may be entered manually into UNICORN 6 (Fig 7). UniTag sticker labels, with preprinted 2-D matrix codes (barcodes), are available for labeling columns that are not already barcode labeled (e.g., empty columns).

By tracking individual columns, information is recorded for each run regarding run data such as total number of runs and maximum delta pressure. Notification limits can be set, for instance, to define the number of times the column may be run between cleanings, and the user is notified when it is time for column maintenance. In the ***Column Logbook***, clicking on the ***Column History*** icon for a particular column provides a list of all runs that have been performed with that column.

In addition to ***Column Logbook***, UNICORN 6 offers security by utilizing electronic signatures, password protection, and audit trails. UNICORN 6 is 21 CFR Part 11 compliant and for more detailed information, please refer to the data file (28-9573-46).

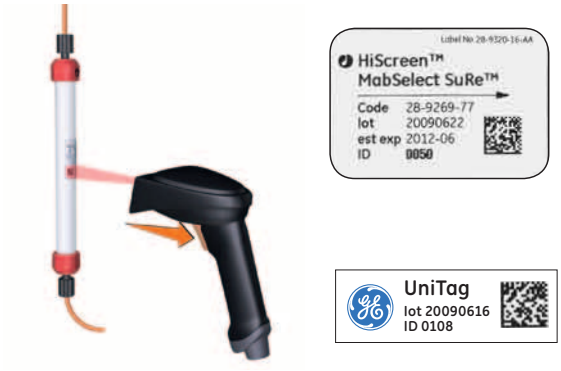


Fig 7. Several prepacked columns are manufactured with labels containing barcodes, allowing individual columns to have unique IDs for traceability. For columns without barcode labels, UniTag labels are available.

BufferPro

Automatic buffer preparation with BufferPro increases productivity by minimizing the need for manual preparation of buffers. BufferPro can be used for automatic pH scouting to find optimal buffer compositions. For screening, a broad pH range is scanned by testing large pH steps. For further optimization and to test robustness, smaller pH steps are tested (Fig 8). BufferPro can be used at flow rates up to 25 ml/min on ÄKTA avant 25 and up to 40 ml/min on ÄKTA avant 150.

BufferPro eliminates time-consuming buffer preparation and manual titration for experiments requiring pH changes. Using BufferPro, stable stock solutions can be prepared, stored, and used repeatedly. This saves time and reduces chemical waste. BufferPro has an improved algorithm and includes more buffer systems than its predecessor BufferPrep. BufferPro also features true buffer preparation using conjugated acid/base solutions for titration. This mimics the way manual buffer preparation is performed and increases buffering capacity and scalability.

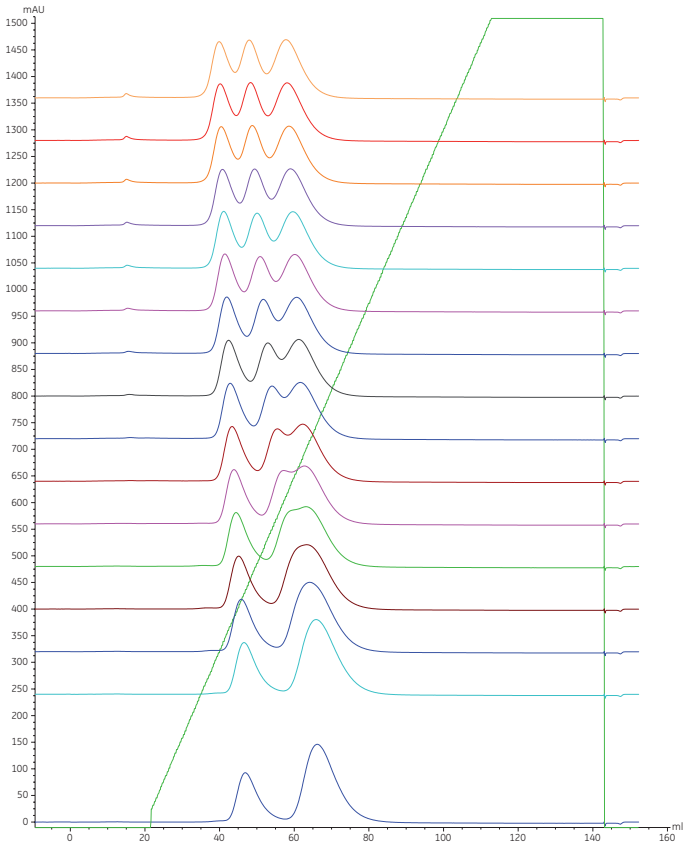


Fig 8. HiScreen™ Capto™ S was run using the CIEX buffer from pH 4.0 to 5.5. The chromatogram shows sixteen runs using small (0.1) pH steps. The full pH range of the CIEX buffer is 2 to 7.

Buffer is prepared on-line from four stock solutions (e.g., water, salt, buffer, and acid/base) and pH is monitored throughout the run, with changes in temperature compensated for automatically. BufferPro also compensates for the salt concentration in a gradient to achieve a more stable pH. Buffer substances can be selected from the ***Buffer Library*** to change the pH range and create the required pH elution conditions. After mixing, BufferPro verifies the buffer properties by showing the actual mixing ratios. The accuracy of pH is crucial in many separations and BufferPro gives accurate and highly reproducible data.

Design of Experiments (DoE)

Included as standard, UNICORN 6 software has an integrated Design of Experiments (DoE) functionality, a powerful tool for an efficient approach to method optimization. Traditionally, optimal conditions may be determined by varying one parameter while the rest of the parameters remain fixed. In DoE, selected parameters are varied simultaneously, which increases productivity by obtaining more information from fewer experiments (Fig 9). Since DoE is seamlessly integrated in UNICORN 6, methods are automatically generated from DoE schemes, allowing for fast and efficient process development.

Experimental workflows in DoE include:

- **Screening:** to determine which factors are important in your process
- **Optimization:** to find the optimal factor settings for your process
- **Robustness testing:** adjusting different factors to investigate how robust your process is

Using DoE, the entire experimental space can be explored efficiently by taking into account the important factors for your process, such as flow velocity and elution pH, and the appropriate range for each factor.

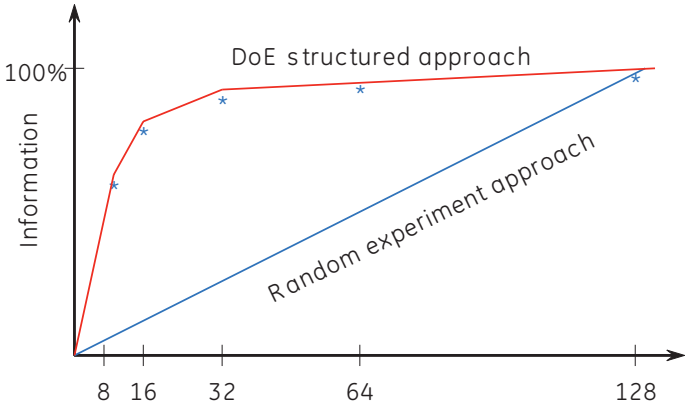


Fig 9. The DoE tool, integrated in UNICORN 6, is an efficient approach to optimization, capturing more information in fewer experiments.

The resulting data or "responses" (e.g., yield and purity) are used to create a statistical model (Fig 10). This model is automatically generated in UNICORN 6 and used to predict the response to changing a factor, and to produce maps (response contour plots) that support decision making. Because DoE estimates variability and noise as well as interaction effects between different factors, more precise information is obtained and better maps are generated, which leads to better decision making.

Applications

Rapid process development of a MAb purification

ÄKTA avant 25 system was used to develop a two-step chromatography process for purification of a monoclonal antibody (MAb). MabSelect SuRe™, a protein A-based chromatography media (resin) was used for the initial capture step while the multimodal anion exchanger Capto™ adhere was used for reduction of impurities in a second, polishing step. Table 2 summarizes the method development steps for the purification.

Table 2. Summary of the method development steps in a two-step MAb purification using ÄKTA avant 25 system

Step	Objective	Column
1	Determine elution pH on MabSelect SuRe	HiScreen MabSelect SuRe
2	Determine dynamic binding capacity with MabSelect SuRe	HiTrap MabSelect SuRe
3	MAb purification on MabSelect SuRe	HiScreen MabSelect SuRe
4	Prepare (scale-up) material for Capto adhere	XK 50/20 packed with MabSelect SuRe
5	Determine loading conditions on Capto adhere	HiScreen™ Capto adhere
6	Screen loading conditions on Capto adhere using DoE	HiTrap™ Capto adhere
7	Robustness study on Capto adhere using DoE	HiTrap Capto adhere

After determining the elution pH and dynamic capacity, MAb was purified on HiScreen MabSelect SuRe and resulted in 99% recovery (capture step; data not shown). For the polishing step, DoE was used to optimize loading conditions by varying the following factors: sample pH, conductivity, and load.

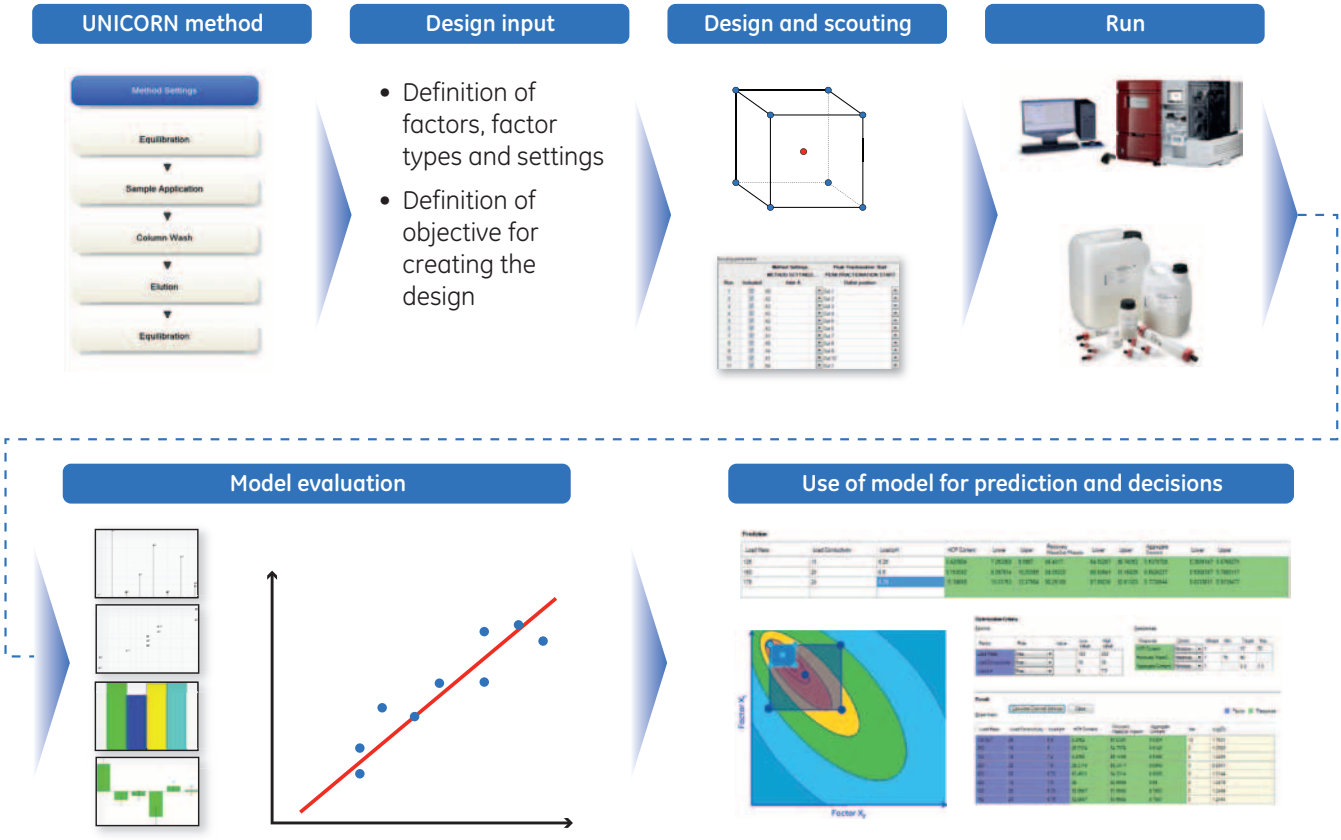


Fig 10. The basic DoE workflow is shown. Important process parameters (or factors) are varied simultaneously, and the resulting data (or responses) are used to create a statistical model. Using the model, maps are produced that support decision making.

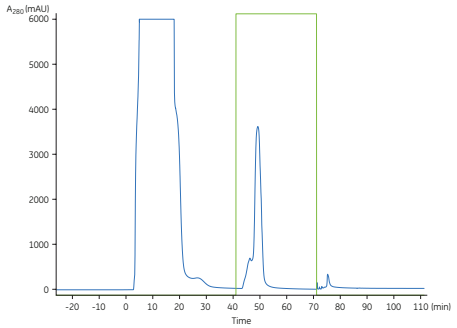
These factors were correlated to impurity levels in the MAb samples (i.e., host cell protein, antibody dimers, and aggregates) to determine the optimal loading conditions. After optimization, a DoE robustness study was performed to confirm that the process conditions were robust. For full experimental details, refer to the Application note (28-9573-47).

The feed material used for this study was challenging due to MAb aggregation and sample precipitation. Despite these challenges, high yield and purity of the target MAb was achieved. Using the integrated DoE functionality in UNICORN 6 together with HiScreen prepacked columns, optimization of the overall process was achieved in approximately one week.

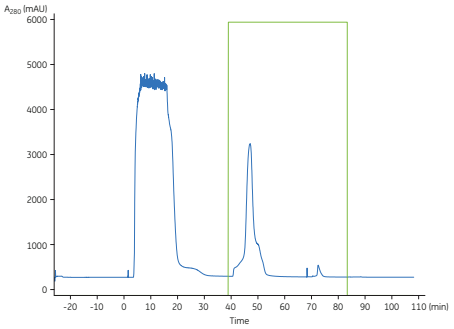
Seamless scalability

In UNICORN 6, methods are quickly rescaled using a time-saving functionality that automatically converts methods between the two ÄKTA avant systems. Figure 11 shows a scale-up study that utilized this feature.

Column:	HiScreen Capto MMC (two connected; 20 cm bed height)
Sample:	Insulin*
Start buffer:	50 mM acetate, 8 M urea, 150 mM NaCl pH 5.2
Elution buffer:	50 mM Na-phosphate, 8 M urea, 150 mM NaCl pH 8
Flow rate:	1.86 ml/min
System:	ÄKTA avant 25



Column:	AxiChrom 50 packed with Capto MMC media (20 cm bed height)
Sample:	Insulin*
Start buffer:	50 mM acetate, 8 M urea, 150 mM NaCl pH 5.2
Elution buffer:	50 mM Na-phosphate, 8 M urea, 150 mM NaCl pH 8
Flow rate:	80 ml/min
System:	ÄKTA avant 150



*Sample was kindly provided by Biomm SA (Brazil).

Fig 11. Predictable scale-up from a smaller column to a production-scale column using ÄKTA avant 25 and ÄKTA avant 150 systems.

Insulin was first purified using ÄKTA avant 25 with prepacked HiScreen columns. The purification was conveniently scaled up to an AxiChrom™ 50 column using ÄKTA avant 150 system.

Optional components

ÄKTA avant is a modular system that can be expanded to enhance the system capabilities and increase productivity. Due to the accessibility and design of the modules, they are easily changed which allows quick and efficient servicing.

ÄKTA avant can be expanded with three additional valves for extra samples, buffers, outlets, and columns. There are eight optional valves available, including two outlet valves. The system can also be expanded with an additional air sensor, placed for example before the sample inlet valve or after the injection valve. For the types of additional valves and air sensors available, refer to "Ordering information".

BioProcess™ media

GE Healthcare's BioProcess media cover all purification steps from capture to polishing, for all scales of work from development and pilot studies to routine production. BioProcess media are developed for production-scale chromatography to meet the demands of industrial biotechnology. All media are manufactured with validated methods and tested to meet stringent quality requirements.

Regulatory Support Files (RSF) are available to assist process validation and submissions to regulatory authorities.

ÄKTA avant has the flow rate and pressure specifications that support BioProcess media such as MabSelect™ and Capto. These high flow media provide increased dynamic binding capacity at high flow rates. Using ÄKTA avant together with modern BioProcess media reduces process time, increases productivity, and allows easy scale-up.

Columns

GE Healthcare offers an extensive range of prepacked columns that can be used with ÄKTA avant including HiTrap, HiPrep™, HiLoad™, and HiScreen columns. In addition to prepacked columns, empty HiScale™ columns are available for process development as well as AxiChrom columns for large-scale chromatography.

HiScreen prepacked columns

HiScreen columns are prepacked with a wide range of robust BioProcess media to allow repeated use with highly reproducible results. Designed for method optimization, HiScreen columns have a 10 cm bed height and can easily be connected in series to achieve a 20 cm bed height. To provide traceability, HiScreen columns have barcodes preprinted on their labels. For convenience, these columns can be connected to the ÄKTA avant system without unions by easily snapping them into the Flexible column holder.

HiScale columns

HiScale is a family of pressure-stable columns designed for process development and preparative chromatography. The columns are optimized for modern BioProcess media and have several features that enable precise column packing, easy handling, and high reproducibility. HiScale columns are available in sizes of 16, 26, and 50 mm i.d. and lengths of 20 and 40 cm.

AxiChrom columns

AxiChrom is a sanitizable column platform that simplifies column handling at all scales from process development to full-scale production. ÄKTA avant 150 supports Intelligent Packing of the smallest AxiChrom columns, 50 and 70 mm i.d. (Fig 12). Verified, preprogrammed packing methods are available to ensure optimally-packed beds and decrease operator dependence. AxiChrom columns are simple to operate and UNICORN guides the user through method creation, setup, and maintenance. Scale-up using AxiChrom columns is straightforward and predictable.

Fig 12. AxiChrom columns provide Intelligent Packing, intuitive handling, and predictable scale-up.

Accessories

ÄKTA avant accessories include holders and clamps for attaching columns, flasks, and tubing to the system (Fig 13). For HiTrap columns, the Column rod holder is available for holding up to five columns simultaneously. Smaller columns such as HiScreen are easily snapped into the Flexible column holder (to be launched at a later date).

A Column holder designed for larger columns is shown in the figure, as well as a Column clamp for holding smaller columns. Please refer to "Ordering information" for a list of accessories.

1 Flexible column holder
2 Column holder rod
3 Bottle holder
4 Tubing holder, spool
5 Tubing holder, comb
6 Column holder
7 Column clamp, o.d. 10-21 mm

Fig 13. ÄKTA avant accessories include holders and clamps for attaching columns, flasks, and tubing to the system.

System specifications

Control system	UNICORN 6.1 or later version
Dimensions (W × H × D)	860 × 660 × 710 mm
Weight (excluding computer)	116 kg
Power supply	100–240 V, ~50–60 Hz
Power consumption	800 VA
Enclosure protective class	IP 21, wet side IP 22

System pumps

ÄKTA avant 25

Pump type	Piston pump, metering type
Flow rate setting	0.001 to 25 ml/min (normal range) 0.001 to 50 ml/min (column packing flow)
Pressure range	0 to 20 MPa (2900 psi)
Viscosity range	0.35 to 10 cP

ÄKTA avant 150

Pump type	Piston pump, metering type
Flow rate setting	0.01 to 150 ml/min (normal range) 0.01 to 300 ml/min (column packing flow)
Pressure range	0 to 5 MPa (725 psi)
Viscosity range	0.35 to 5 cP

Sample pump

ÄKTA avant 25

Pump type	Piston pump, metering type
Flow rate setting	0.01 to 25 ml/min
Pressure range	0 to 10 MPa (1450 psi)
Viscosity range	0.7 to 10 cP

ÄKTA avant 150

Pump type	Piston pump, metering type
Flow rate setting	0.01 to 150 ml/min
Pressure range	0 to 5 MPa (725 psi)
Viscosity range	0.7 to 10 cP

Mixer, valves, and fraction collector

Mixer and gradient formation

Mixing principle	Chamber with a magnetic stirrer
Mixer volume	0.6, 1.4, or 5 ml (ÄKTA avant 25) 1.4, 5, or 15 ml (ÄKTA avant 150)
Gradient flow rate range	
Binary	0.25 to 25 ml/min (ÄKTA avant 25) 1.0 to 150 ml/min (ÄKTA avant 150)
Quaternary	0.5 to 25 ml/min (ÄKTA avant 25) 2 to 40 ml/min (ÄKTA avant 150)
Gradient composition accuracy	Binary: ± 0.5% Quaternary: ± 1%

Valves

Type	Rotary valves (except Quaternary valve)
Quaternary valve[1] type	4-port solenoid actuated membrane valve
Optional valves	Up to three extra valves

Number of inlets

Inlet A	7, expandable to 14
Inlet B	7, expandable to 14
Sample inlet	7, expandable to 14
Quaternary inlet	4, expandable to 18

Outlet valve fractionation

Number of outlets	10, expandable to 32

Integrated fraction collector[2]

Number of fractions	up to 576 (6 × 96-well deep-well plates)
Vessel types	3, 8, 15, or 50 ml tubes; 24-, 48-, or 96-well deep-well plates; 250 ml bottles
Fraction volumes	0.1 to 50 ml (ÄKTA avant 25) 1 to 50 ml (ÄKTA avant 150)
Spillage-free modes	DropSync or Accumulator (ÄKTA avant 25) Accumulator (ÄKTA avant 150)
Cooling specification	6°C to 20°C, temperature control
Organic solvents	No
Delay volume (UV – dispenser head)	518 µl (ÄKTA avant 25) 1807 µl (ÄKTA avant 150)

[1] The quaternary valve is not recommended for use with organic solvents.
[2] For safety reasons, organic solvents may not be used in the fraction collector during fractionation.

Sensors and monitors

Pressure and air sensors

Placement of pressure sensors	System pump, Sample pump, Pre-Column, and Post-Column
Placement of air sensors	Inlet A, Inlet B, and Sample inlet
Optional placement	Before sample inlet valve, after injection valve
Sensing principle	Ultrasonic

UV monitor

Wavelength range	190 to 700 nm in steps of 1 nm, up to 3 wavelengths simultaneously
Absorbance range	-6 to 6 AU
Linearity	within ± 2% at 0 to 2 AU
Operating pressure	0 to 2 MPa (290 psi)
Flow cells	0.5 mm optical path length, 1 µl cell volume 2 mm optical path length, 2 µl cell volume 10 mm optical path length, 8 µl cell volume

Conductivity monitor

Conductivity reading range	0.01 to 999.99 mS/cm
Accuracy	± 0.01 mS/cm or ± 2%, whichever is greater, (within 0.3 to 300 mS/cm)
Operating pressure	0 to 5 MPa (725 psi)

Temperature monitor

Reading range	0°C to 99°C
Accuracy	± 1.5°C within 4°C to 45°C

pH monitor

pH reading range	0 to 14
Accuracy	± 0.1 pH unit (within pH 2 to 12)
Operating pressure	0 to 0.5 MPa (72 psi)

Ordering information

System and software[1]	Code no.
ÄKTA avant 25	28-9308-42
ÄKTA avant 150	28-9763-37
UNICORN 6.1 local or remote workstation license with DVD	28-9806-84
UNICORN 6.1 local or remote workstation license without DVD	28-9835-31
UNICORN 6.1 DVD package	28-9806-81

Hardware[2]	Code no.
Computer with Windows XP	28-9573-31
HP 19" TFT Screen	18-1177-59
Keyboard International/US	28-4020-72

Optional components	Code no.
Optional valves for ÄKTA avant 25	
Column valve V9-C2	28-9572-36
Inlet valve V9-A2	28-9572-21
Inlet valve V9-B2	28-9572-23
Inlet valve V9-X1	28-9572-27
Inlet valve V9-X2	28-9572-34
Inlet valve V9-S2 (sample inlet)	28-9572-25
Outlet valve V9-O2	28-9572-38
Outlet valve V9-O3	28-9572-40
Optional valves for ÄKTA avant 150	
Column valve V9H-C2	28-9793-30
Inlet valve V9H-A2	28-9793-03
Inlet valve V9H-B2	28-9793-15
Inlet valve V9H-X1	28-9793-26
Inlet valve V9H-X2	28-9793-28
Inlet valve V9H-S2 (sample inlet)	28-9793-20
Outlet valve V9H-O2	28-9793-32
Outlet valve V9H-O3	28-9793-37
Optional air sensors[3]	
Air sensor L9-1.2 mm	28-9565-02
Air sensor L9-1.5 mm	28-9565-00
Adapter for air sensor	28-9563-42

Accessories	Code no.
Cassettes	
Cassette tray, holds up to six cassettes	28-9542-09
Cassette, holds six 50 ml tubes (2-pack)	28-9564-02
Cassette, holds fifteen 15 ml tubes (2-pack)	28-9564-04
Cassette, holds twenty-four 8 ml tubes (2-pack)	28-9564-25
Cassette, holds forty 3 ml tubes (2-pack)	28-9564-27
Cassette, holds one 96-, 48-, or 24 well deep-well plate (2-pack)	28-9542-12
Rack, holds fifty-five 50 ml tubes	28-9803-19
Rack, holds eighteen 250 ml bottles (to be launched)	28-9818-73
Tubing kits for ÄKTA avant 25	
Replacement tubing kit	28-9566-06
Sample tubing kit for 7 inlets, i.d. 0.75 mm	28-9572-17
Inlet tubing kit for 5 inlets	28-9572-15
Outlet tubing kit for 10 outlets, i.d. 1.0 mm	28-9572-19
Rinse system tubing (for ÄKTA avant 25 and 150)	28-9565-04
Tubing kits for ÄKTA avant 150	
Replacement tubing kit	28-9794-46
Tubing kit for 10 inlets (Teflon i.d. 2.9 mm, o.d. 3/16")	28-9809-87
Tubing kit for 10 outlets (Teflon i.d. 1.6 mm, o.d. 1/8")	28-9809-84
Barcode labels and scanner	
UniTag (1 sheet with 108 labels)	28-9564-91
Barcode scanner 2-D with USB	28-9564-52
Holders[4]	
Column holder	28-9562-82
Column holder rod	28-9562-70
Column clamp o.d. 10–21 mm	28-9563-19
Tubing holder, spool	28-9562-74
Tubing holder, comb	28-9562-86
Bottle holder	28-9563-27

[1] Computer ordered separately.
[2] For details about the computer and a complete list of the screens, keyboards, printers, and cables available, please contact your local GE Healthcare representative.
[3] The 1.5 mm air sensor is placed before the sample inlet valve; the position for the 1.2 mm air sensor is after the injection valve.
[4] For more information about HiScreen, HiTrap, HiPrep, and HiLoad prepacked column formats, please visit www.gelifesciences.com/protein-purification.

Related products	Code no.
UNICORN 6 eCourse	28-9500-00
IQ/OQ ÄKTA avant	28-9600-58
ÄKTA avant Service Agreement Gold	28-9611-27
ÄKTA avant Service Agreement Silver	28-9611-36
ÄKTA avant Preventive Maintenance Visit	28-9611-37

Related literature	Code no.
UNICORN 6 control software, Data file	28-9573-46
Validation Support File UNICORN software, Data file	28-9626-50
Rapid process development for purification of a MAb using ÄKTA avant 25, Application note	28-9573-47
Rapid method development for native protein purification using ÄKTA avant 25 chromatography system, Application note	28-9623-37
Fast process development of a single-step purification using ÄKTA avant systems, Application note	28-9827-80
ÄKTA avant, Brochure	28-9594-86
Prepacked chromatography columns for ÄKTA design systems, Selection guide	28-9317-78

For local office contact information, visit
www.gelifesciences.com/contact

www.gelifesciences.com/akta

GE Healthcare Bio-Sciences AB
Björkgatan 30
751 84 Uppsala
Sweden

imagination at work

First published Aug. 2009

GE Healthcare UK Limited Amersham Place
Little Chalfont, Buckinghamshire, HP7 9NA
UK

GE Healthcare Europe, GmbH
Munzinger Strasse 5, D-79111 Freiburg
Germany

GE Healthcare Bio-Sciences Corp.
800 Centennial Avenue, P.O. Box 1327, Piscataway, NJ 08855-1327
USA

GE Healthcare Japan Corporation
Sanken Bldg., 3-25-1, Hyakunincho, Shinjuku-ku, Tokyo 169-0073
Japan

28-9573-45 AD 09/2010