

Fall 11-2-2015

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## Recommended Citation

Fabien Rousset, "BioSC<sup>®</sup> predict simulation software: FLeXibility and optimization of your multi-column process" in "Integrated Continuous Biomanufacturing II", Chetan Goudar, Amgen Inc. Suzanne Farid, University College London Christopher Hwang, Genzyme-Sanofi Karol Lacki, Novo Nordisk Eds, ECI Symposium Series, (2015). [http://dc.engconfintl.org/biomanufact\\_ii/122](http://dc.engconfintl.org/biomanufact_ii/122)

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# BioSC® Lab and Predict® simulation software: flexibility and optimization of your multi-column process

Fabien Rousset Ph.D, Head of Product Development Manager

## Introduction

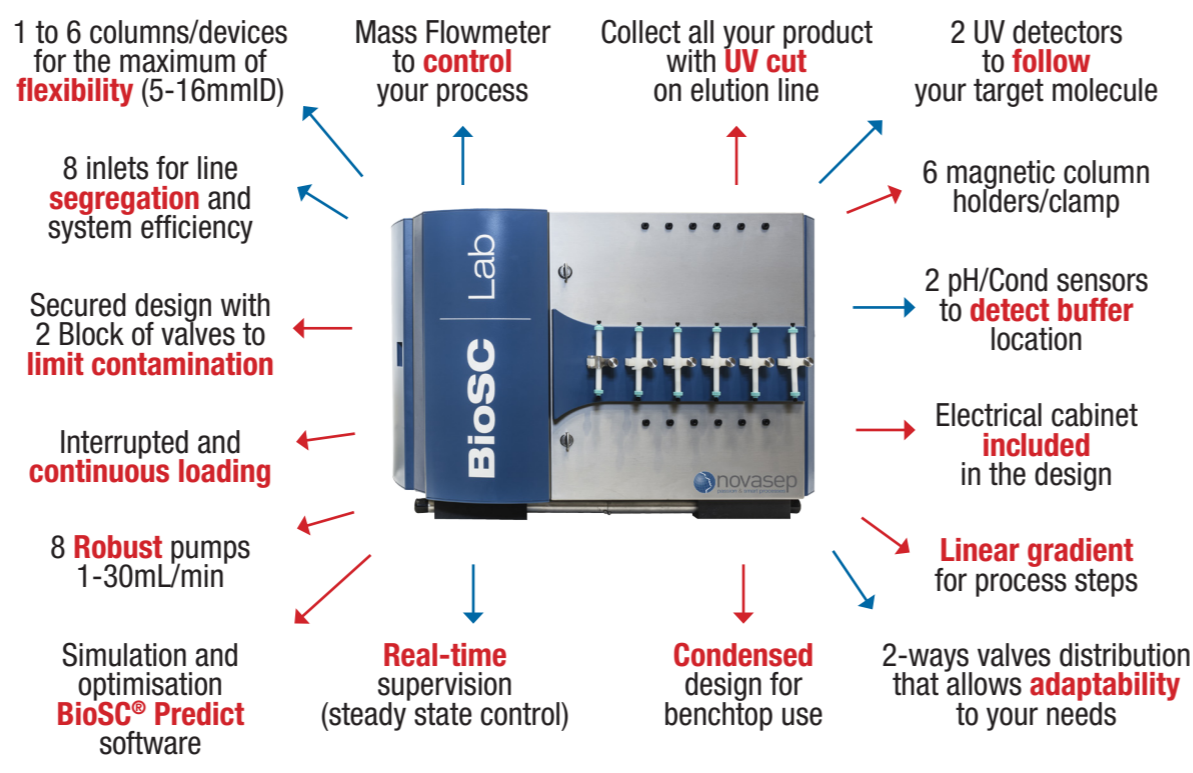
Biopharma companies often need to flexibly accommodate large to small volume of biologics, preferably within the same manufacturing facilities. They are developing alternative processes that bring continuous manufacturing operations with consistent product quality, streamlined process flow, low process cycle times and reduced capital and operating cost. Many reasons that explain the growing interest in realizing the benefits of continuous processing in biologics manufacturing that are more and more encouraged by guidance as FDA mentioned in recent conference presentations.

The ability to rapidly adjust production capacity to accommodate fluctuating and/or mis-forecasted market demands, reducing the cost impacted by growing competition from biosimilar products and by government regulations, concerning about the sustainability of the traditional batch manufacturing facility model involving DSP trains with large chromatographic columns, the consistent improvements in upstream product and the associated DSP limitation with current technology, led R&D departments to accelerate the introduction of continuous process culture in their PD phase.

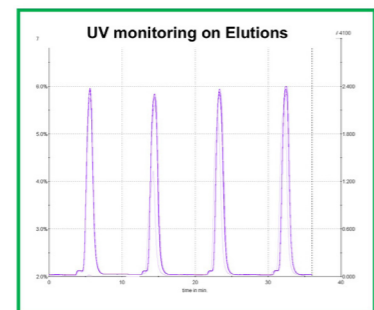
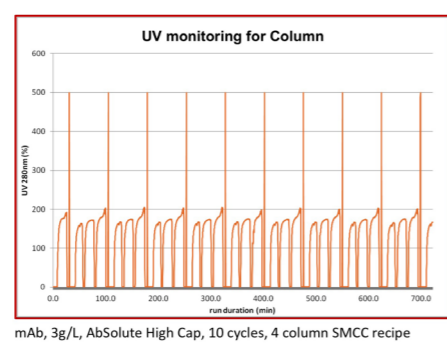
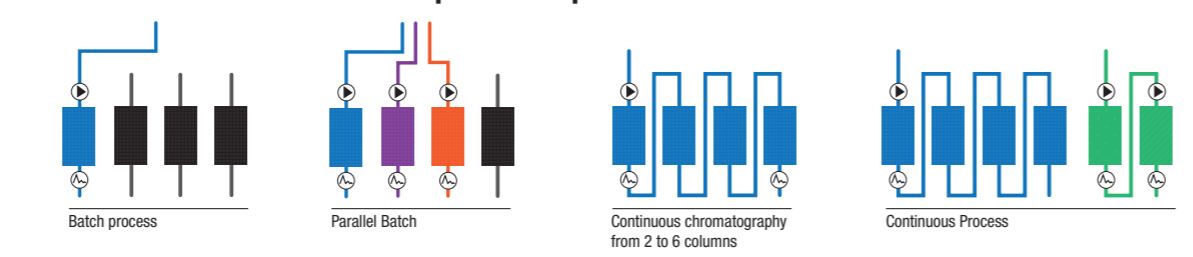
Hybrid systems (combination of continuous and batch operations) and fully integrated continuous process are developed now for many biologics such mAbs, recombinant proteins and vaccines... Continuous operations require software and hardware systems that provide a high degree of automation, PAT approach and possibly in silico simulation that predict the evolution of the system to make the integration easier and faster.

All these needs and requirements are present in Novasep's unique lab equipment called BioSC® Lab to accommodate the process development of continuous operation from lab to large scale with a smart simulation software called BioSC® Predict to facilitate and fasten the process of improving overall operation efficiency.

## BioSC® Lab



### Various processes possible with BioSC® Lab

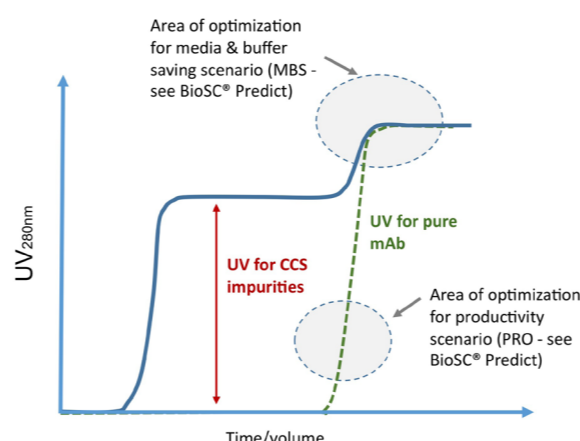


### PAT Approach:

- UV detection (190-700nm):
  - after a column (IPC for process deviation)
  - elution line for UV-cut and product quality control
- Flow-rate with mass flow-meter for mass balance control
- Temperature on the first column for process control
- pH and conductivity sensors for process control
- Pressure sensors for cycling control

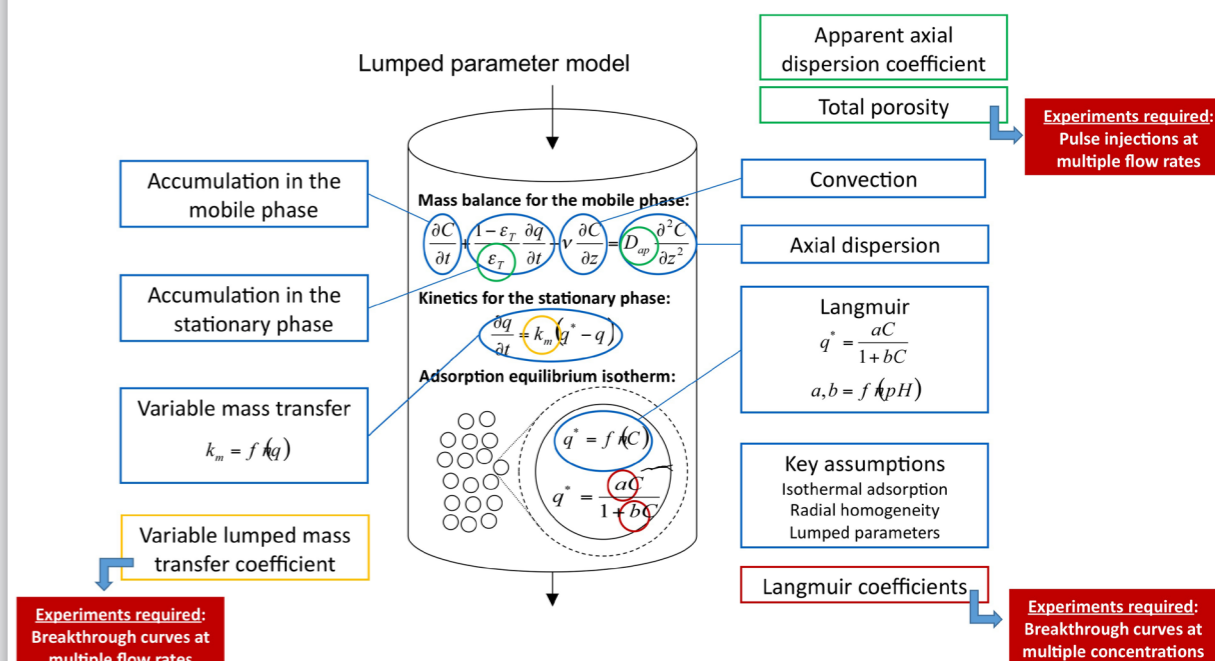
### Time/volume-based recipe to:

- Avoid process control at signal saturation where submitted non-linear Beer Lambert's law
- Maintain the system design (no UV cell change required)
- Allow maximisation of buffer & media consumption at saturation compared to UV-based recipe
- Less risky with UV detector accuracy independency

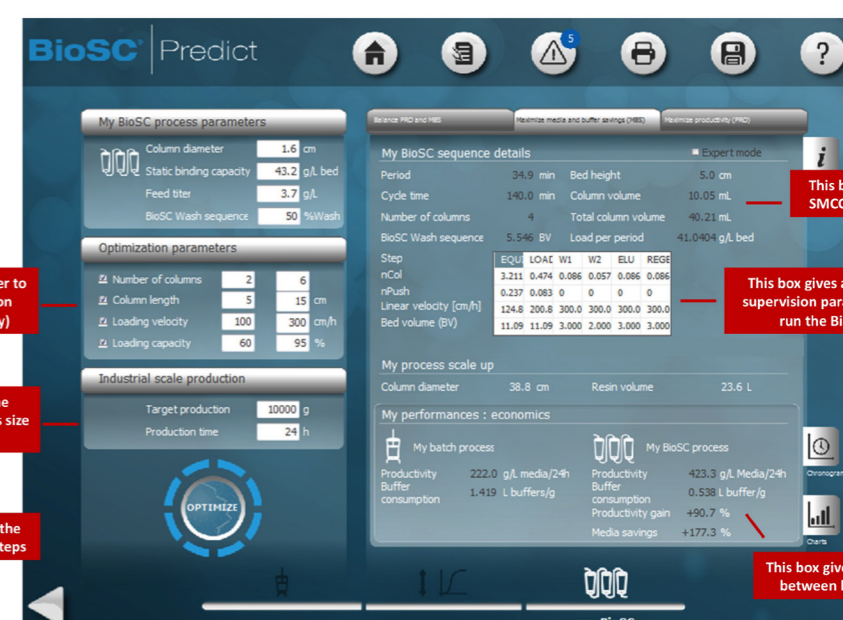


## BioSC® Predict™

BioSC® Predict is a simulation software using optimization algorithms (lumped kinetics model) to provide the most adapted operational conditions (number and geometry of columns, flowrates, etc.). With few batch data, the user can play with the optimization parameters to quickly generate a large amount of data on the chromatographic system (media and protein) and select the best process conditions. Replacing tens of experiments, BioSC® Predict saves your time and resources in process development.



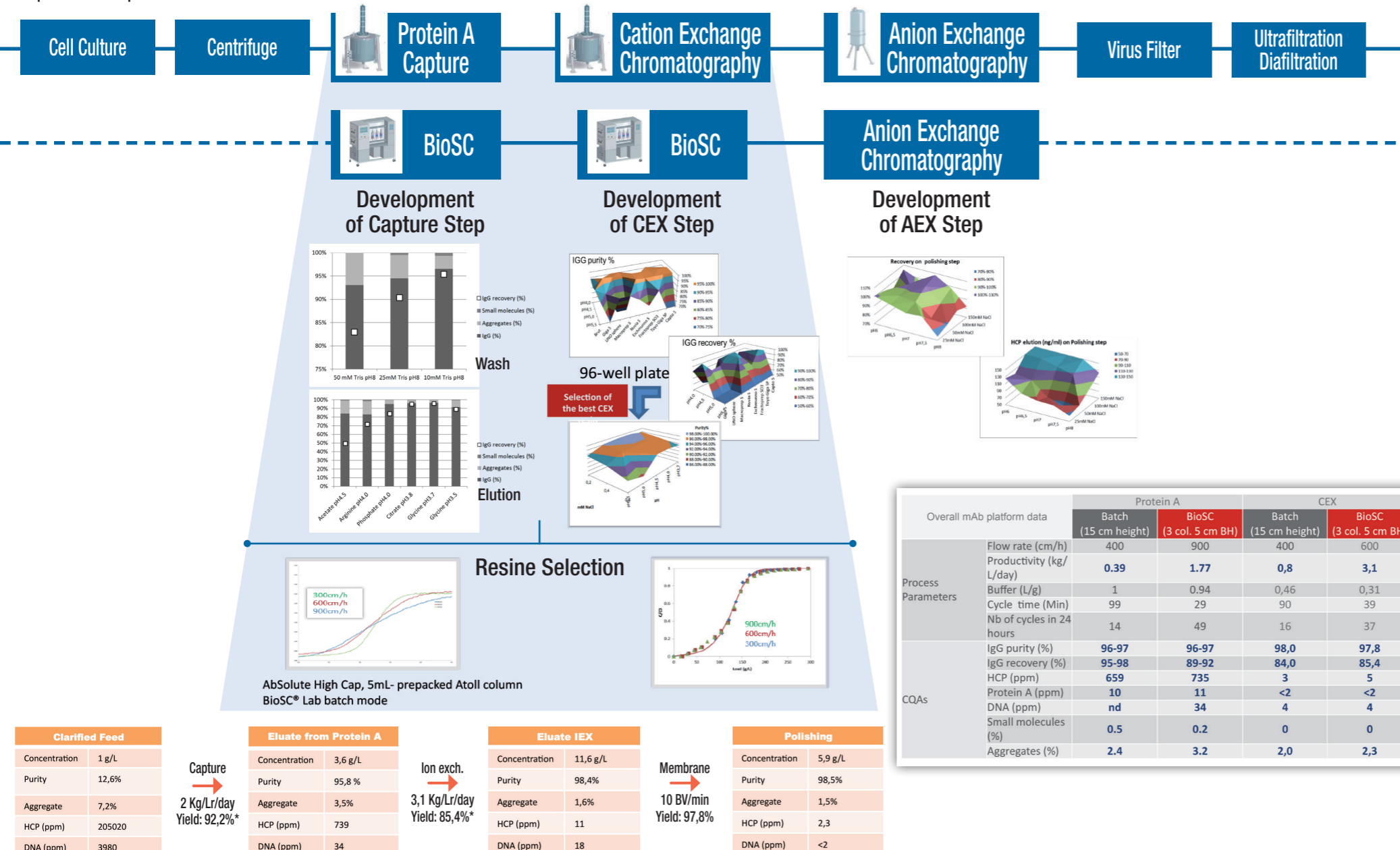
- Maximise productivity PRO
- Maximise Media & Buffer savings MBS
- Balance between PRO & MBS



- This box enables the user to define the optimization parameters (flexibility)
- This box gives the optimal SMCC process parameters
- This box gives automatic supervision parameters to run the BioSC®
- This box enables the production equipment's size (opex/capex)
- This model is used for the combination of SMCC steps
- This box gives a comparison between batch & SMCC

## Application to a mAb Platform

A purification process of monoclonal antibodies based on two continuous chromatography steps (capture and intermediate ion exchange) has been developed and optimized using batch data. Significant gains have been observed on productivity, buffer consumption and on the volume of resin required. Based on these results, a chained process from capture to polishing steps has been implemented. This process demonstrated significantly better performance compared to the batch equivalent while reaching the qualitative specifications.



## Conclusion

The development of a batch chromatography step typically requires many experiments to be designed and performed in the lab before finding the right operating conditions. This work costs time (up to several weeks) and money while consuming precious materials which are often limited. BioSC® Predict provides the user with a solution to reduce this development step to 2-4 experiments and perform the rest in-silico. By providing the software with a few data generated from common batch chromatography experiments, the user can generate a first continuous chromatography recipe and directly run it on BioSC® Lab equipment. The software will also generate a first performance comparison between batch and continuous chromatography.

Since the implementation of continuous processing is a big challenge right now, the design of the BioSC® Lab has been accomplished to introduce flexibility in the design of SMCC recipes, with a user-friendly environment associated with a PAT approach that enables safe and robust process development.