

45 cm ID OPUS® Pre-Packed Disposable Chromatography Columns

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Summary

- Repligen's OPUS® (Open Platform User Specified) Pre-Packed Disposable Columns with internal diameters up to 45 cm, and column heights from 5 cm and up, offer a flexible, scalable, and economical solution for the purification of biological products
- Design of the columns permits uniform flow distribution, making OPUS® columns ideal for upscaling and downscaling purification processes. Column characteristics are not compromised during transportation
- Ability to reliably clean the column even of small molecules makes OPUS® platform ideal for multi-run campaign use

Packing Performance

Method:

- Column packed with Sepharose® 6 FF resin was testing for quality at 100 cm/h
- Resolution of molecular weight markers was tested at 30 cm/h

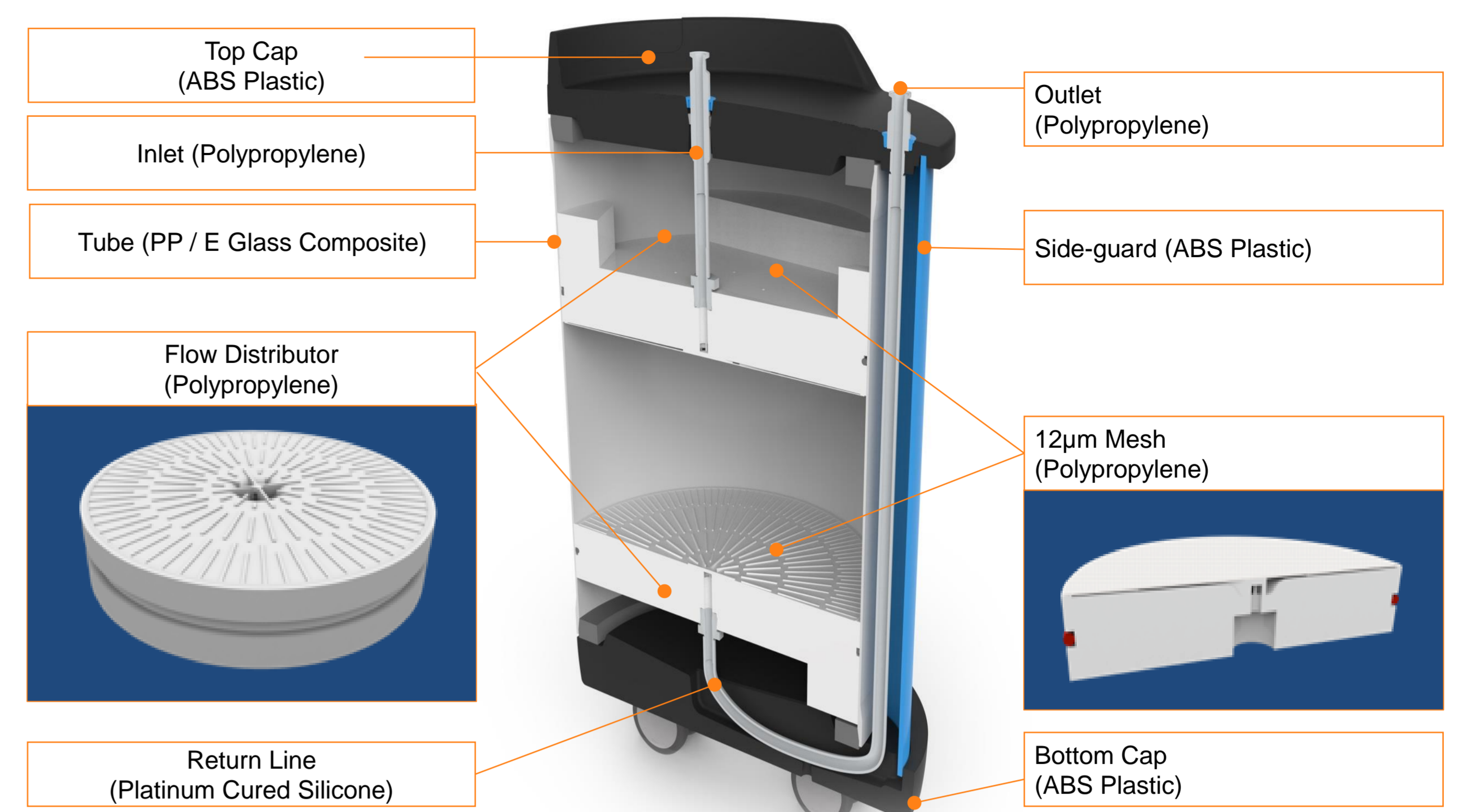
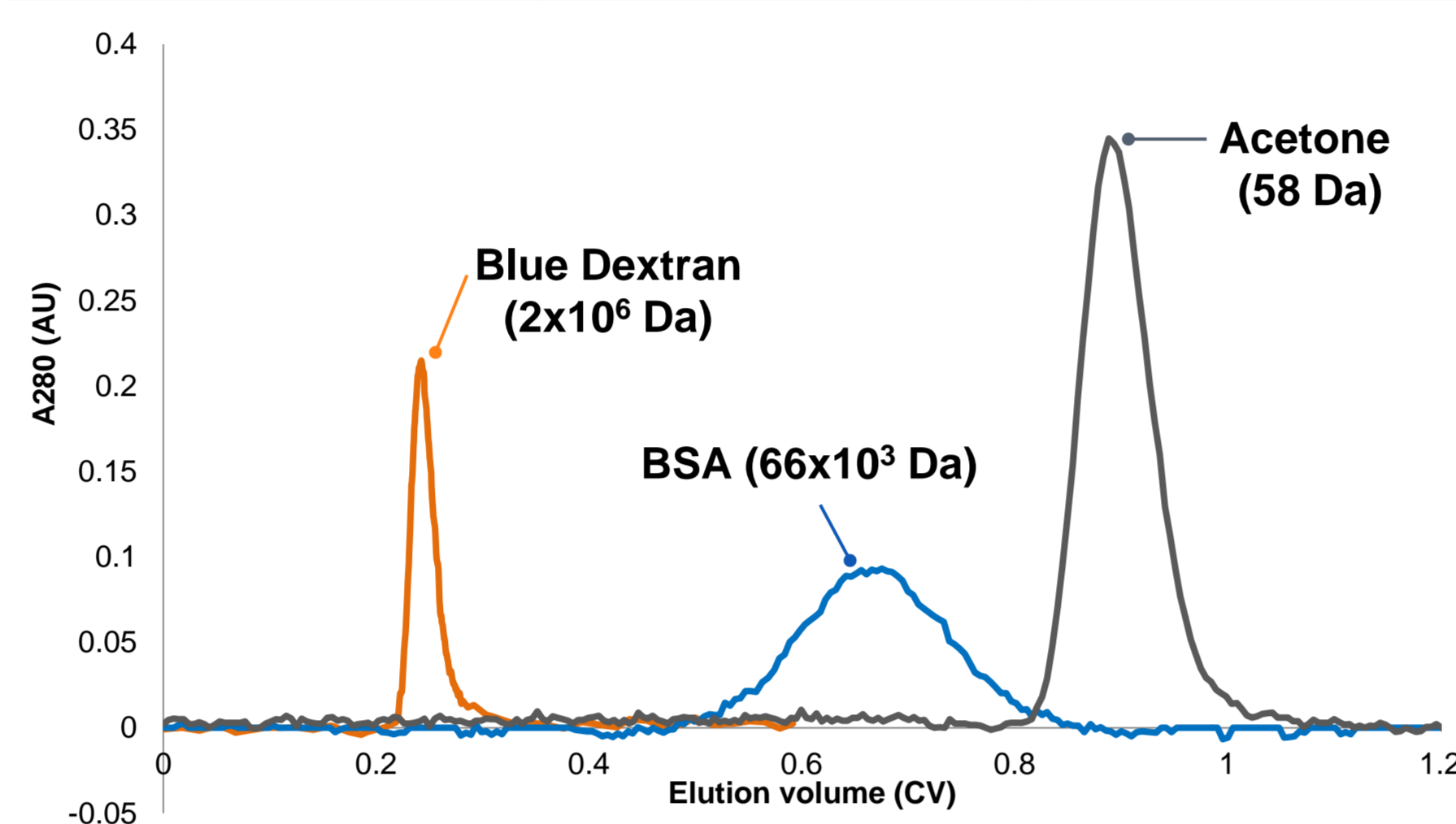
Plates/m @ 100 cm/h		Asymmetry @ 100 cm/h	
2636 ± 200		1.1 ± 0.1	
Resolution Dextran/Acetone	Resolution Dextran/BSA	Resolution BSA/Acetone	
4.1	1.8	0.8	

Packing Acceptance Criteria:

- Plates/m: >1500
- Asymmetry: 0.8-1.6

Conclusions:

- Symmetrical peaks – optimum flow distribution
- Well resolved peaks on SEC separation – column packed well



Scale-up of a Challenging Separation of Antibody Species to a 45 cm ID OPUS® Column



Uniquely Flexible CMO™

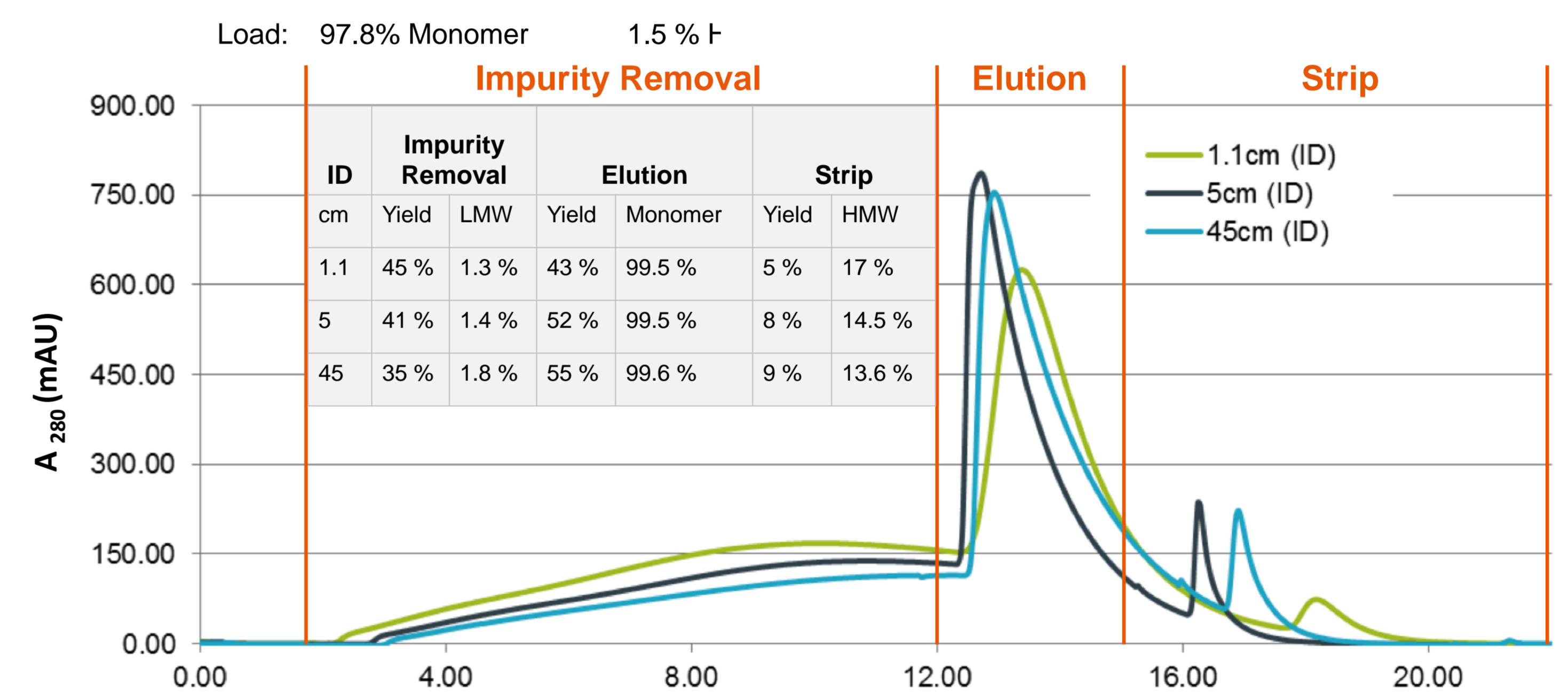
Gallus team:

Kelly Wei, Paul Jorjorian, Kristina Pleitt, John Kullman, Jennifer Saleh, Suite 5 team

Method:

- Separation of low molecular weight species from an antibody on 1.1 cm ID, 5 cm ID, and OPUS® 45 cm ID column packed with SP Sepharose®
- Challenging separation:
 - Wash of low molecular weight with 130 mM NaCl buffer
 - Elution of monomeric enriched fraction with 150 mM NaCl buffer

Results:



Conclusions:

Column Volumes (from the start of post-loading wash)

- 45 cm ID OPUS® columns deliver expected scalability outcome for a difficult separation process
- Product purified on 45 cm ID OPUS® column has similar quality attributes as that purified on smaller columns IDs

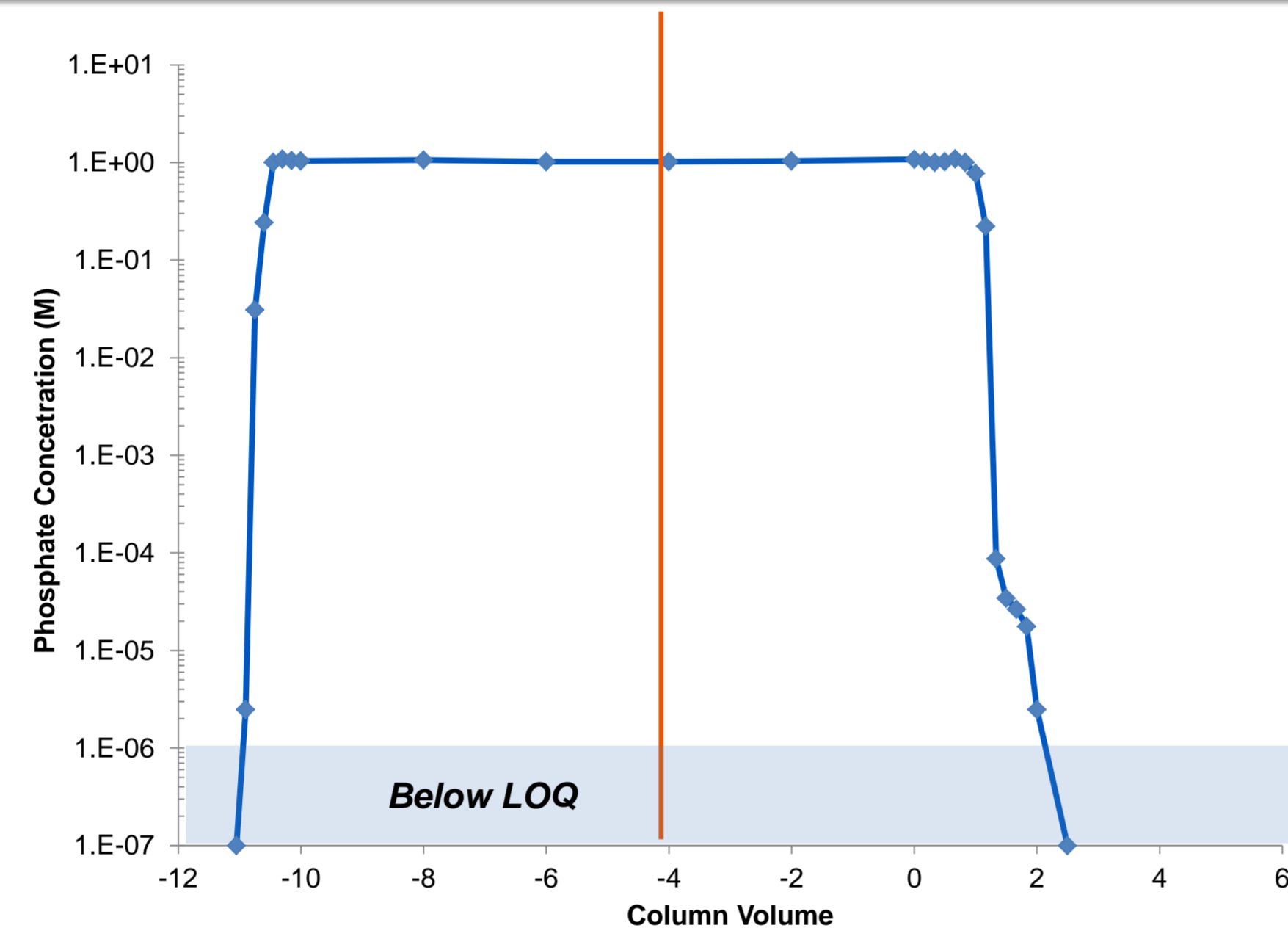
Cleanability of the 45 cm ID OPUS Column

Method:

- Colorimetric measurement of phosphate reduction on a 45 x 20 cm OPUS® Sepharose® 6FF column upon water washing

Conclusions:

- 45 cm ID OPUS® column design allows for perfect cleaning in less than 2 CVs
- Column can be used for multi-cycle campaigns that require cleaning in between runs



Transportation Qualification

Method:

- A 45 x 20 cm pre-packed OPUS® column was subjected to rigorous ISTA (procedure 2B) test for transportability:
 - High temperature (38 °C) and high humidity for 36 hours
 - Low temperature (4 °C) and low humidity for 36 hours
 - Compression testing (840 lbs or 381 kgs on top of crate)
 - 2 hours of random vibrational testing
 - 8 drop tests
- Visual inspection and packed column performance assessed

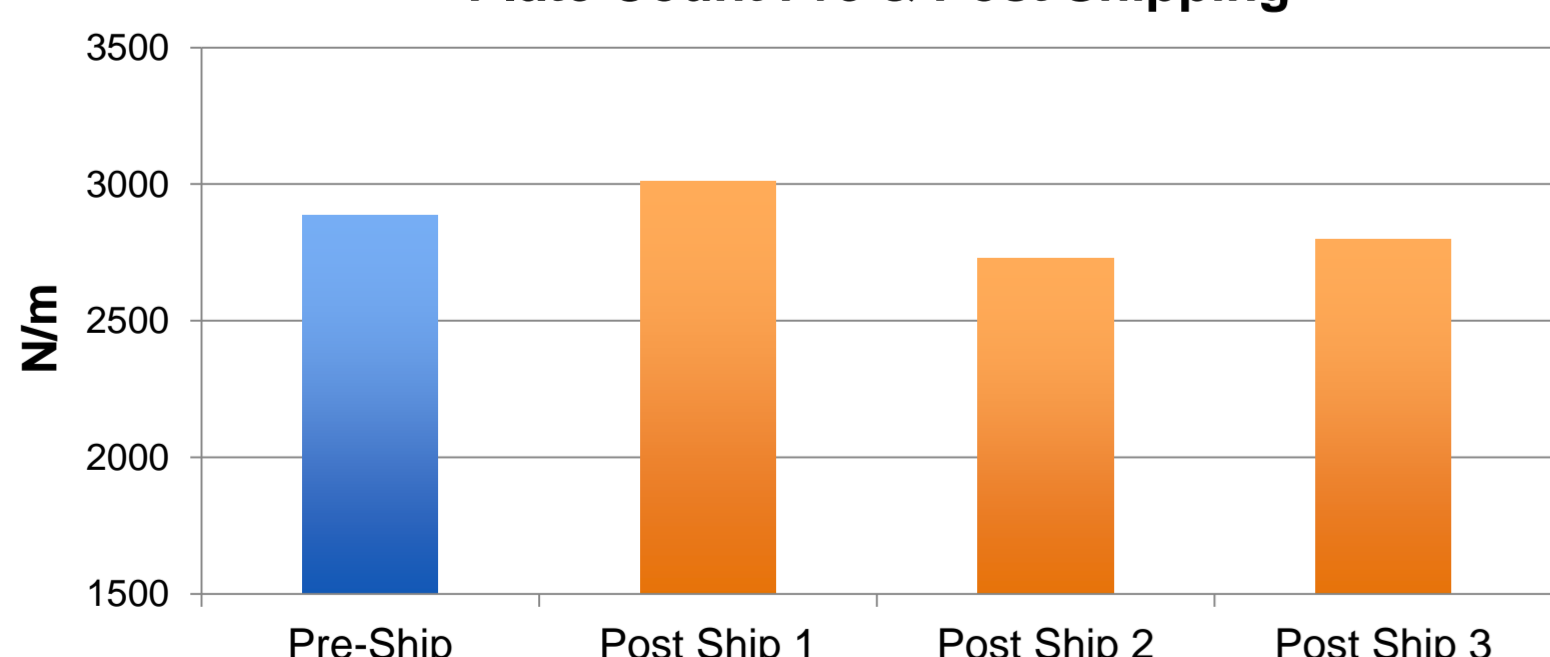
Conclusions:

- Packaging withstood the rigors of a commercial shipping environment
- Chromatographic performance maintained after shipping

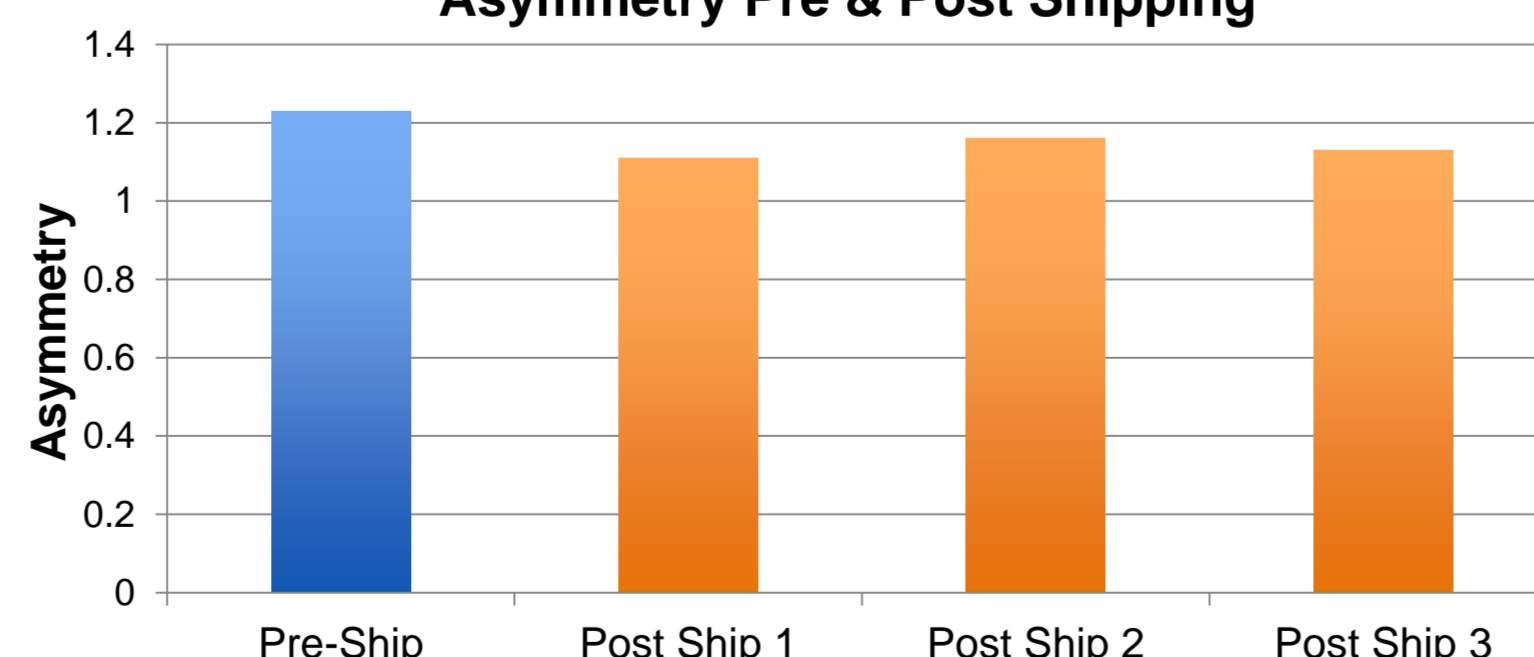
Crate model for 45 cm OPUS® columns shipping



Plate Count Pre & Post Shipping



Asymmetry Pre & Post Shipping



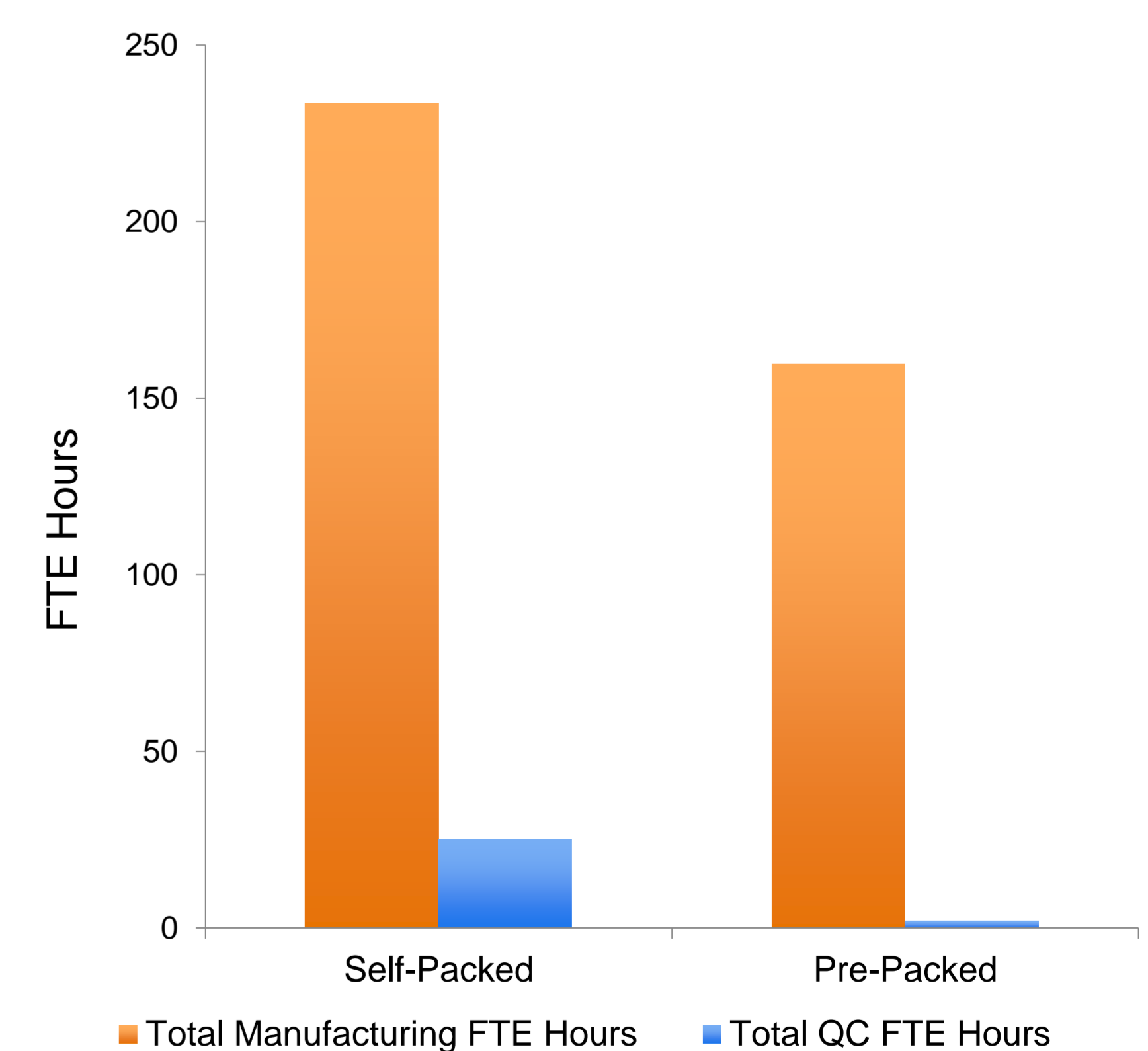
Economic Payoff

Model Assumptions:

- 1 batch/campaign, 2 cycles/batch
- Assumes no column re-packs
- Includes time required for procurement, documentation & engineering prep, packing, purification, and storage

Conclusions:

- Pre-Packed Columns Eliminate Many Steps
 - Column packing buffer prep
 - Resin prep (de-fine)
 - Column packing
 - IQ/OQ
 - Column packing documentation
 - Column unpacking
 - Unpacked column cleaning
 - Cleaning verification (unpacked column)



Conclusions

- The OPUS® platform is the only pre-packed column platform which can accommodate the needs of disposable manufacturing
- 45 cm ID OPUS® columns are designed to match up with 500 & 1000 L bioreactor harvests enabling increased plant flexibility at reduced cost
- Pre-packed disposable columns of the OPUS® platform are ideal for the purification of biological molecules due to the well-engineered design which delivers consistent chromatographic performance, robust packed bed stability for commercial shipping, and industry standard product contact materials
- Reliable cleaning and sanitization, along with demonstrated reusability make pre-packed disposable columns suitable for production scale manufacturing purifications in single-use or multi-cycle processes

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