# Next-Gen - Industrial scale HP-RFC Column
## performance preview

**Redefining Large-Scale Radial Chromatography:**

**The Next Generation of 350L High-Performance Radial Flow Columns**

**PROXCYS'** latest 350L HP-RFC columns set a new benchmark in bioprocessing performance. Delivering **truly linear scalability**, exceptional reproducibility, and robust operation. High-throughput separations with **low backpressure** providing a gentle, protein-friendly process environment at industrial scale.

**From Biopharma to Functional Food**
While designed for the rigorous demands of **Biopharma and Biotechnology**, the unique efficiency of HP-RFC makes it equally competitive for high-volume, lower-value applications as deployed at the **Functional Food and Nutraceuticals** industry. With process throughputs of over **20,000 L/h on just 1.2 m² of floor space**, our technology drives both performance and economy.

**Linear Scalability Beyond 1000×**
Unlike conventional systems, HP-RFC maintains - and even surpasses - lab-scale performance at industrial scale. With linear scalability factors greater than 1000, processes can move fast and seamlessly from development to full production in just a few steps. This rapid, risk-free scale-up offers significant economic advantage, to ensure production to keep pace with the demands of an expanding market.



**Model 2025 RS16350-E**

**350L bed volume**
**16 cm bed height**
**Biopharma range**

## INDUSTRIAL SCALE HP-RFC SCALE UP STUDY (RS16350)

The objective of this scaleup study is to verify and confirm linear scalability for the latest generation Industrial HP-RFC columns (>100L bed volume). The study is executed at Proxcys, in the summer of 2025. Primary goal of the study is to determine robust, repeatable packing conditions that yield the best efficiency at targeted process conditions. Since a large set of identical columns are produced, additionally, column to column reproducibility was a welcome quality check as well.

### Hardware selection:
Any scale up study starts from the selection of (available) scale down models of the final industrial scale column of choice. Here bed-height is the main selection parameter. Scale down models range from 5-20ml (Micro columns), 100-1000ml (Mini columns), 0.5-35 litre (section columns) followed by process or small Industrial columns. Most suitable size is selected as reference.
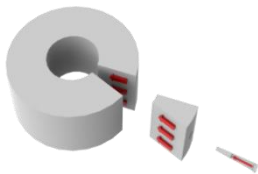
### Sorbent characteristics:
The scale-up study starts with an assessment of the sorbent characteristics: Bead size and distribution, shrinking and swelling properties, settling velocity, mechanical stability.
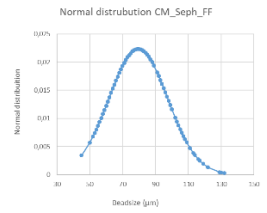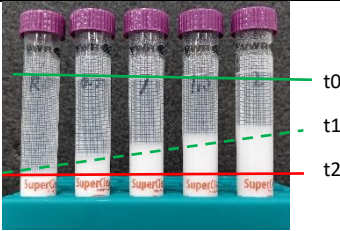
Next step is the testing of a series of packing conditions on the scale down model.

### Flow-Packing parameters tested:
With the proper packing buffer selected, optimization of the packing is done by optimization of only 2 leading packing parameters: Packing velocity & Packing duration.
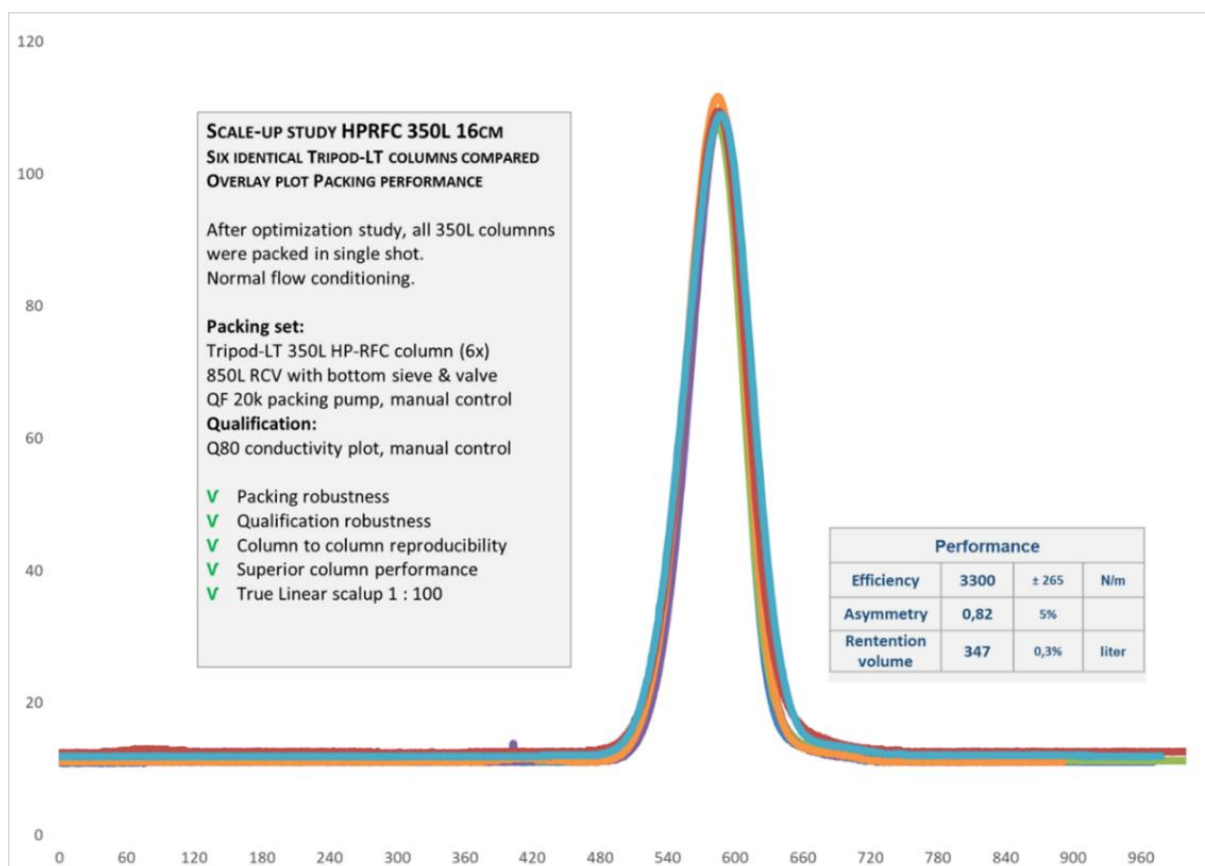These 2 parameters results in a differentiation of packed bed homogeneity and its compression.

| | |
|---|---|
| **Full radial and section columns** | Linear Scalability for HP-RFC columns Proxcys is achieved using the "Section columns". Schematically shown left, a "piece of the pie" column with identical bed height and flow characteristics but smaller bed volume.<br><br>Wall effects and related flow distribution differences should result in slightly reduced performance at this smaller scale when compared to the full scale HP-RFC column, hence the industrial column performance can typically be expected to be slightly superior to the small scale. |
| **Conical section columns up to 1 litre** | The conical "Mini-RFC" column line pairs performance with robust design and excellent handling.<br>The "frits" installed will be identical to the sieves applied in the full radial HP-RFC columns. Therefor not only testing the bare chromatic performance but also feed related "clogging" issues will immediately surface during the experiments. |

Normal distrubution CM_Seph_FF

The quality of the sorbent, average bead size, but equally important, the width of the distribution are decisive parameters for the final HETP of a packed bed. Sorbent quality assessment therefore is an integral part of a most packing studies. Example mean bead size 85µm.



typical sedimentation pattern

During the sedimentation study, settling velocity is tested against a number of packing buffers.

Slow settling will yield best packing homogeneity hence packing performance.

The results of the packing study below are created with the following equipment:

**HP-RFC Column:**      **Multiple (6x) RS16350-E    Biopharma line (process-port size DN40)**

**Slurry vessel:**      **RCV 850L, stirred vessel with bottom sieve and discharge valve;**

**Packing pump:**      **Quattroflow 20k, operated by pressure control; IFM SM 2000 MAG flowmeter; Jumo Delos S1, pressure monitoring and termination pressure detection.**

**Qualification:**      **Q80 pumping system, manual injection 23 sec of 3M NaCl; Data collected on Companion-lite control system**



SCALE-UP STUDY **HPRFC** 350L 16CM
SIX IDENTICAL TRIPOD-LT COLUMNS COMPARED
OVERLAY PLOT PACKING PERFORMANCE

After optimization study, all 350L columnns were packed in single shot.
Normal flow conditioning.

Packing set:
Tripod-LT 350L HP-RFC column (6x)
850L RCV with bottom sieve & valve
QF 20k packing pump, manual control
Qualification:
Q80 conductivity plot, manual control

V   Packing robustness
V   Qualification robustness
V   Column to column reproducibility
V   Superior column performance
V   True Linear scalup 1 : 100

| Performance | | | |
|---|---|---|---|
| Efficiency | 3300 | ± 265 | N/m |
| Asymmetry | 0,82 | 5% | |
| Rentention volume | 347 | 0,3% | liter |

**Ready for BioSMB Integration**

Thanks to outstanding column-to-column reproducibility, HP-RFC is perfectly suited for **multi-column BioSMB applications**, even at elevated flow rates. For facilities accustomed to prepacked formats, it's reassuring to know that **prepacked HP-RFC columns beyond 100L** consistently deliver identical performance curves.

**Sustainability by Design**

Compact, mobile and built to the highest standards of **ASME-BPE,** every HP-RFC column combines durability with sustainability. By relying on precision-engineered stainless steel, these columns offer many years of reliable sanitary operation while reducing environmental impact.

Mobility enables fast changeover in multipurpose cleanrooms, resulting in maximum flexibility, full occupancy of cleanroom capacity and compliance to cGMP standards.

**Column details**

The reference RS16350-E column from this paper, has a fixed bed height of 16cm, a bed volume 350L and can be manufactured in volumes between 200L and 450L.

When 12cm bed height is preferred (faster & lower differential pressure). The target 250L bed volume column will be more slim, slightly taller and will have similar performance characteristics.

| Column type | Bed height [mm] | Bed volume [liter] | Column outer Diameter [mm] | Column height Incl. frame [mm] | |
|---|---|---|---|---|---|
| **16cm bed height** | | | | | |
| RS16250-E | 158 | 250 | 1000 | 160 | Targeted |
| RS16350-E | 158 | 350 | 1000 | 185 | Reference |
| RS16450-E | 158 | 450 | 1000 | 205 | Maximum |
| **12cm bed height** | | | | | |
| RS12250-E | 120 | 250 | 830 | 190 | Targeted |
| RS12300-E | 120 | 300 | 830 | 210 | Maximum |