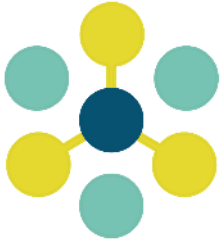


DOWNSTREAM SOLUTIONS

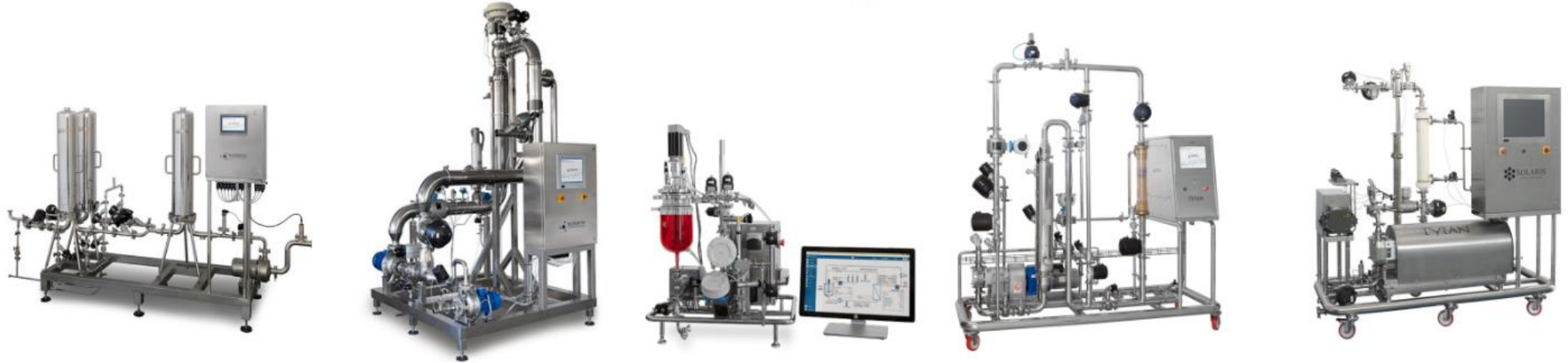


SOLARIS™

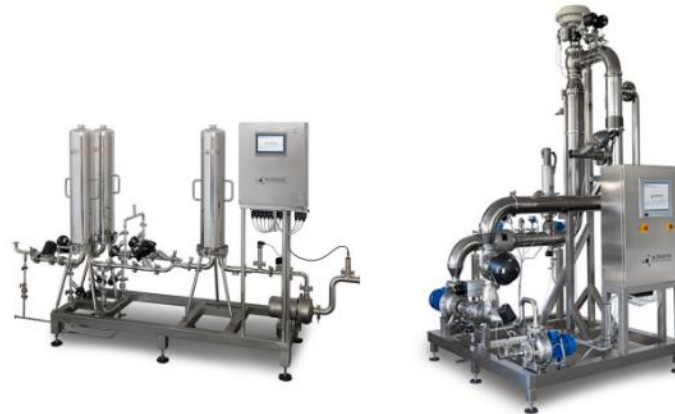
A Donaldson Brand



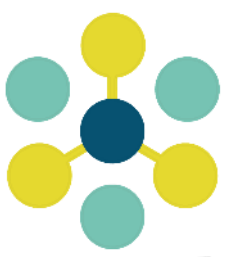
SOLARIS PRODUCTS RANGE



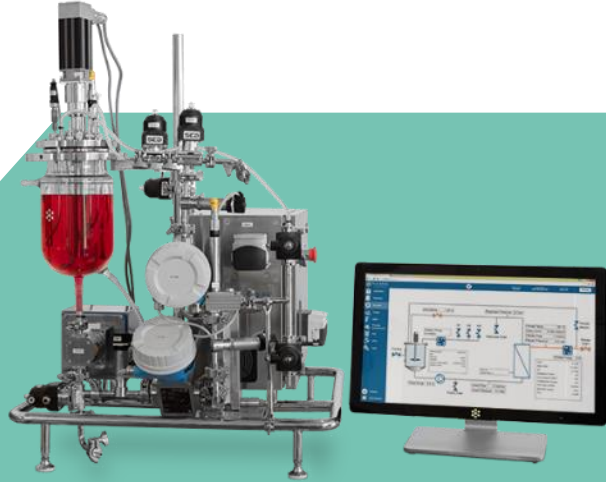
Cross flow filtration skids



Full flow filtration skids



TFF SOLUTIONS: **KRONOS** & **TYTAN**



KRONOS is a benchtop automatic Tangential Flow Filtration (TFF) system, designed following the most updated criteria of cGMP.

KRONOS can handle up to 0.5 m² total filtration area and is equipped with multiple modules which make it ideal for innovative process development as well as for automatic process sequences.

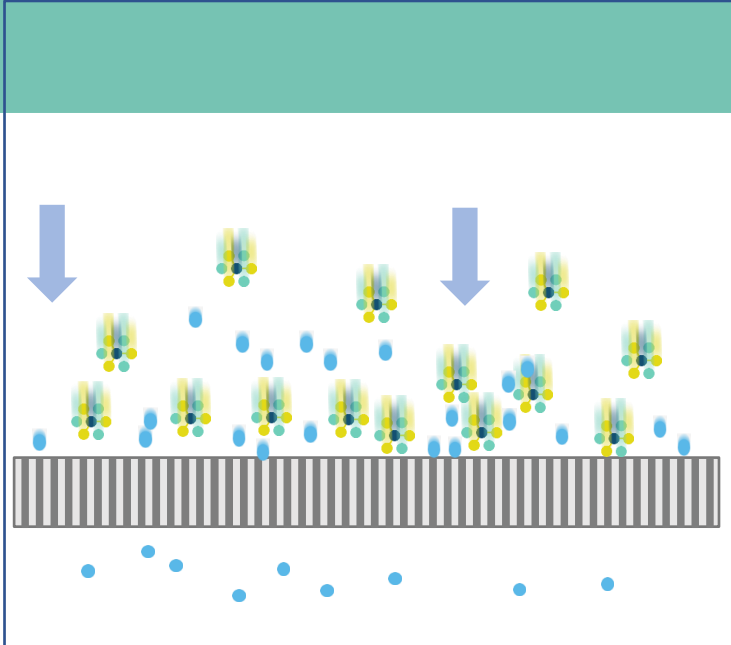
TYTAN is Solaris' completely customisable pilot / industrial scale Tangential Flow Filtration (TFF) system based on microfiltration and ultrafiltration techniques and operating at low pressure ranges (1-5 bar).



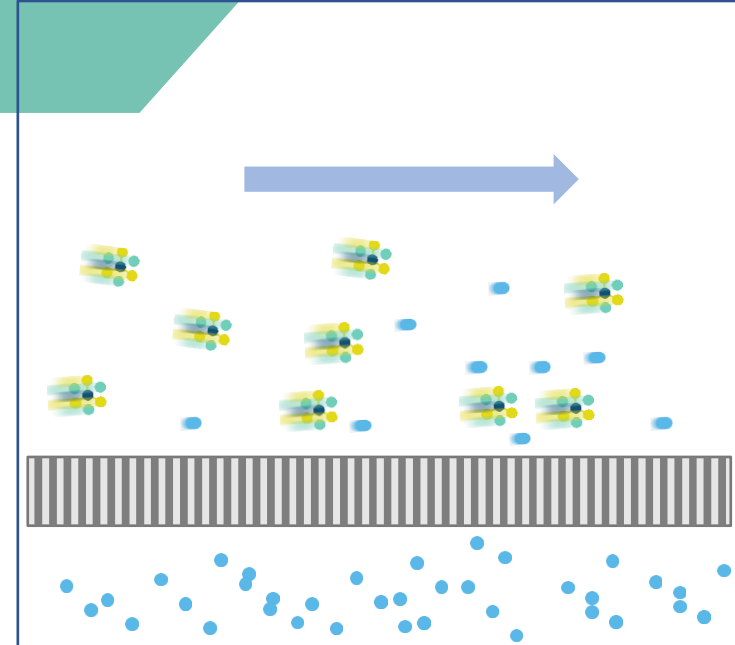


WHY CROSS FLOW FILTRATION?

Conventional filtration Dead End
Filtration Normal Flow filtration



Tangential Flow filtration
Cross Flow Filtration

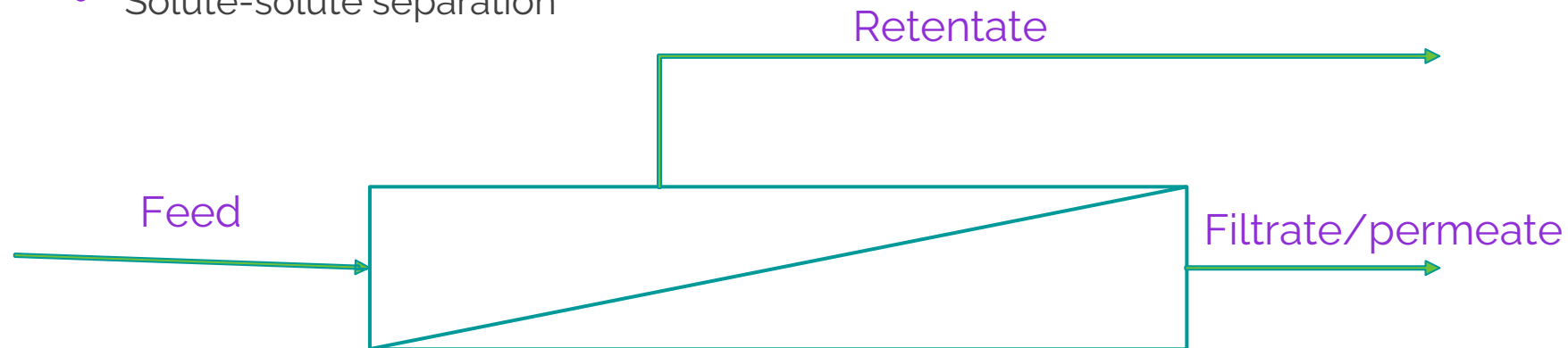




MEMBRANE BASED BIOSEPARATION

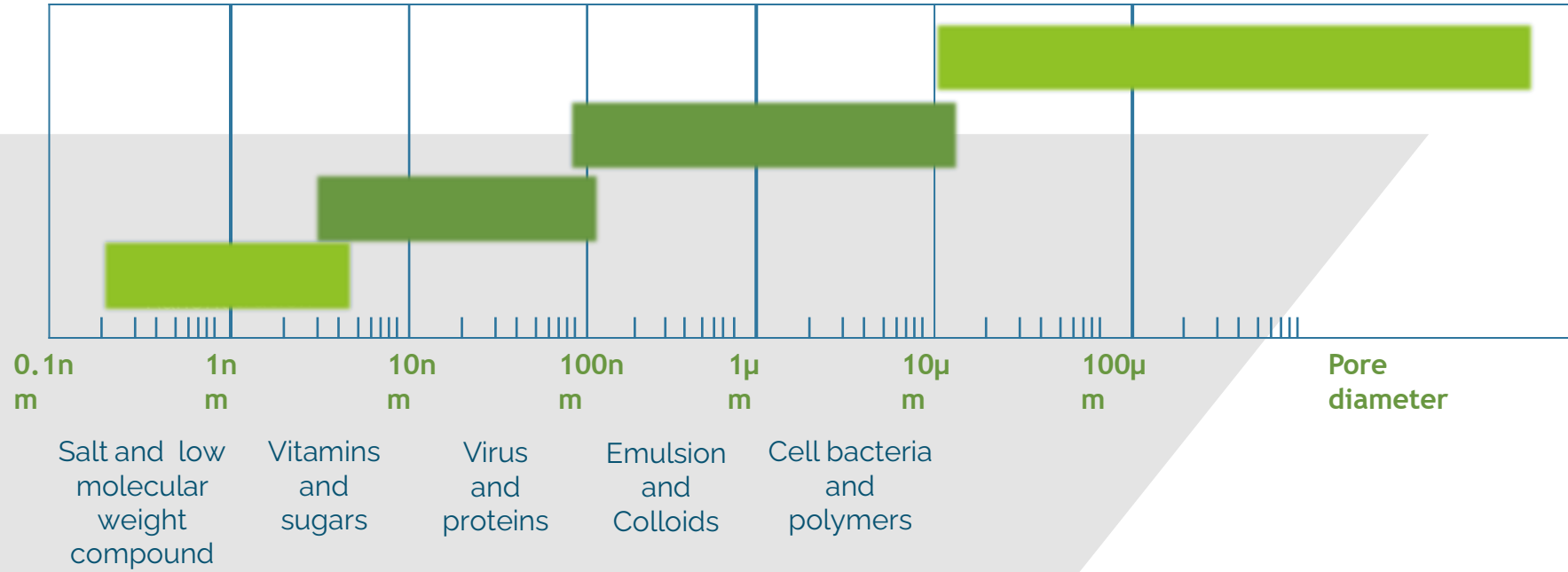
A membrane is a thin semi permeable and selective barrier that permits the separation of certain species in a fluid by combination of sieving and diffusion mechanisms such as:

- Particle-liquid separation
- Particle-solute separation
- Solute-solvent separation
- Solute-solute separation





MEMBRANE CATEGORIES BY PORE SIZE



1nm Sucrose
7nm Hemoglobin

100nm Influenza virus

0.28micrometers Pseudomonas Diminuta

1micrometer Staphylococcus Bacteria

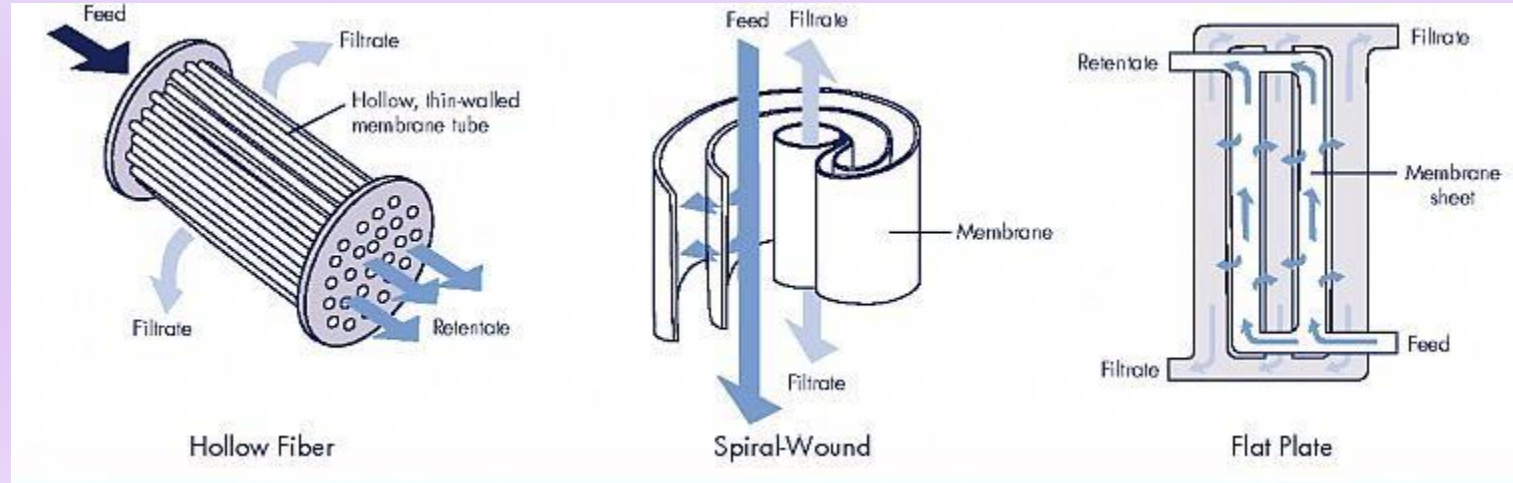
10micrometers Yeast cell

Microfiltration (MF) 0.1-10micrometers
Bacteria, suspended particles

Ultrafiltration (UF) 0.005-0.05micrometers
Colloids, macromolecules



FILTER TYPE





TMP AND ΔP

The transmembrane pressure (TMP) in cross-flow UF is given by:

- where: $TMP = \frac{P_f + 2P_r}{3} - P_p$
- P_f = inlet pressures on the feed side .
- P_r = outlet pressures on the feed side (retentate). P_p = pressure on the permeate side.
- *the TMP in UF is usually generated by pressurizing the feed side with a valve on the retentate line.
- ΔP determine the feed flow :
- $\Delta P = \text{Feed Pressure} - \text{Retentate Pressure}$



FLUX

Permeate flux in UF determines its productivity. Permeate flux depends on:

- the properties of the membrane and the feed solution
- transmembrane pressure
- the solute mass transfer coefficient (which affects the concentration polarization)
- membrane fouling (permeate flux decreases with time due to fouling)
- Process temperature.

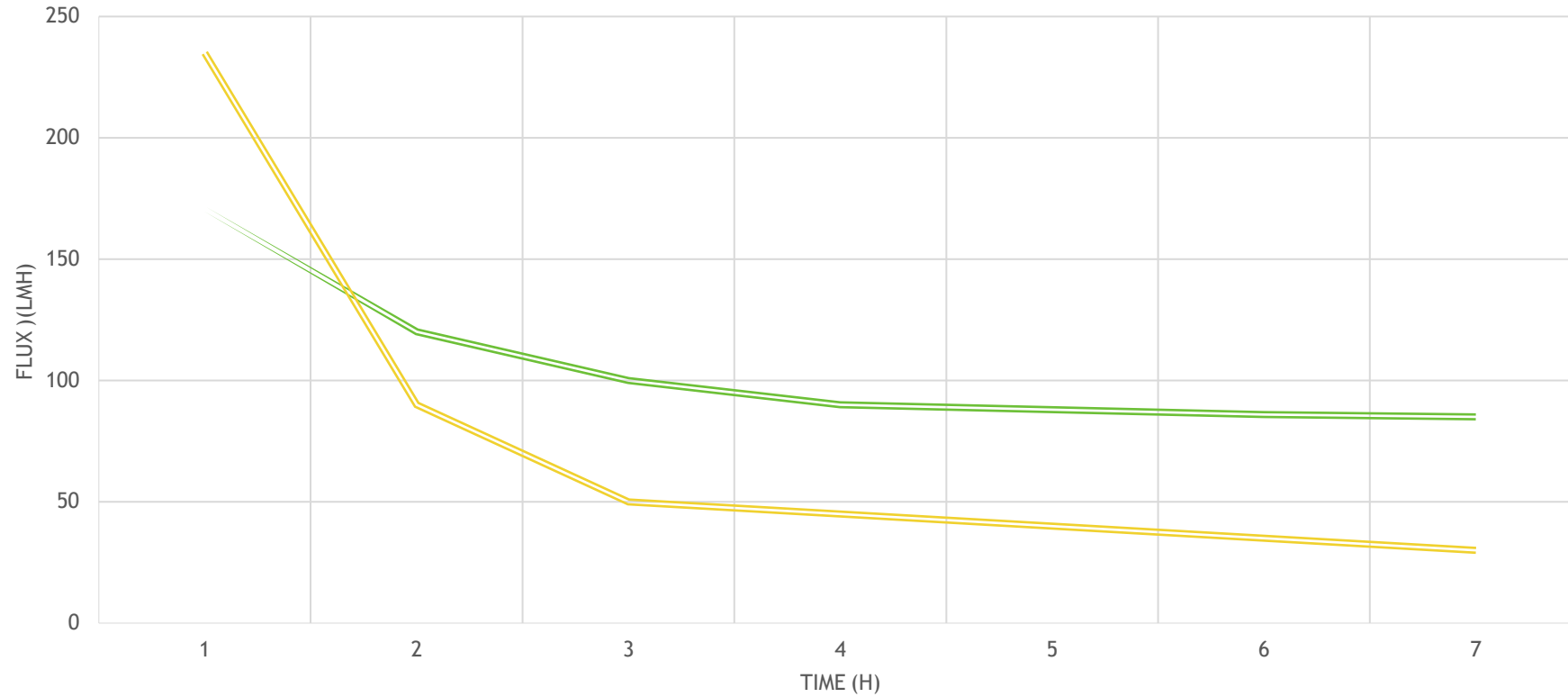
High permeate flux in UF is important.

This can be done by controlling the extent of concentration polarization (gel layer) and membrane fouling

$$\text{Flux rate (LMH)} = \frac{\text{Filtrate flow rate} * 60}{\text{filter area}}$$



FLUX AND PROCESS TIME

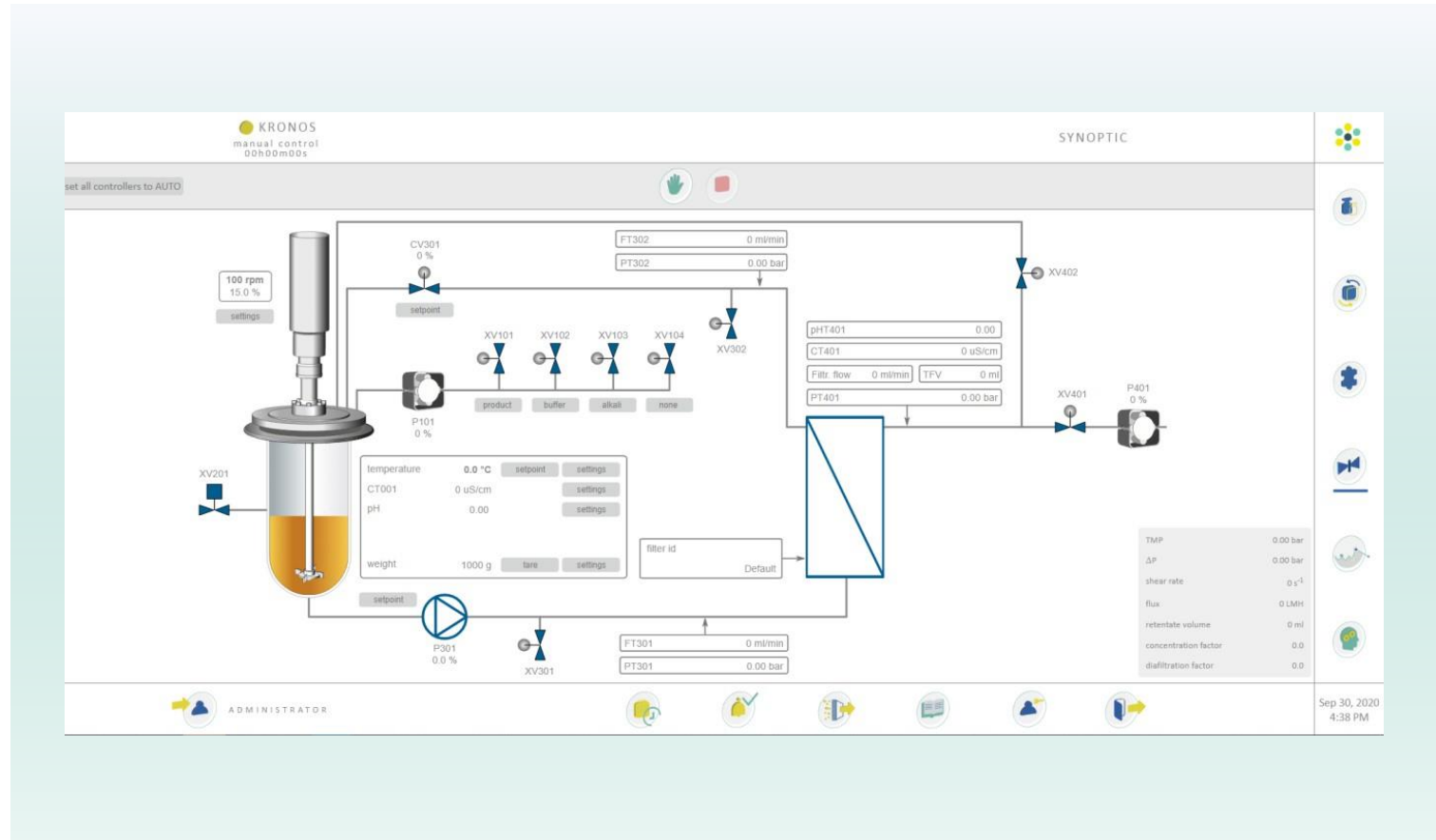


SOFTWARE PLATFORM



GALILEO SOFTWARE

- One view synoptic
- Automated process sequence
- All data trends
- Automated NWP test.
- Automated process development module.
- Filter management module





GALILEO SOFTWARE

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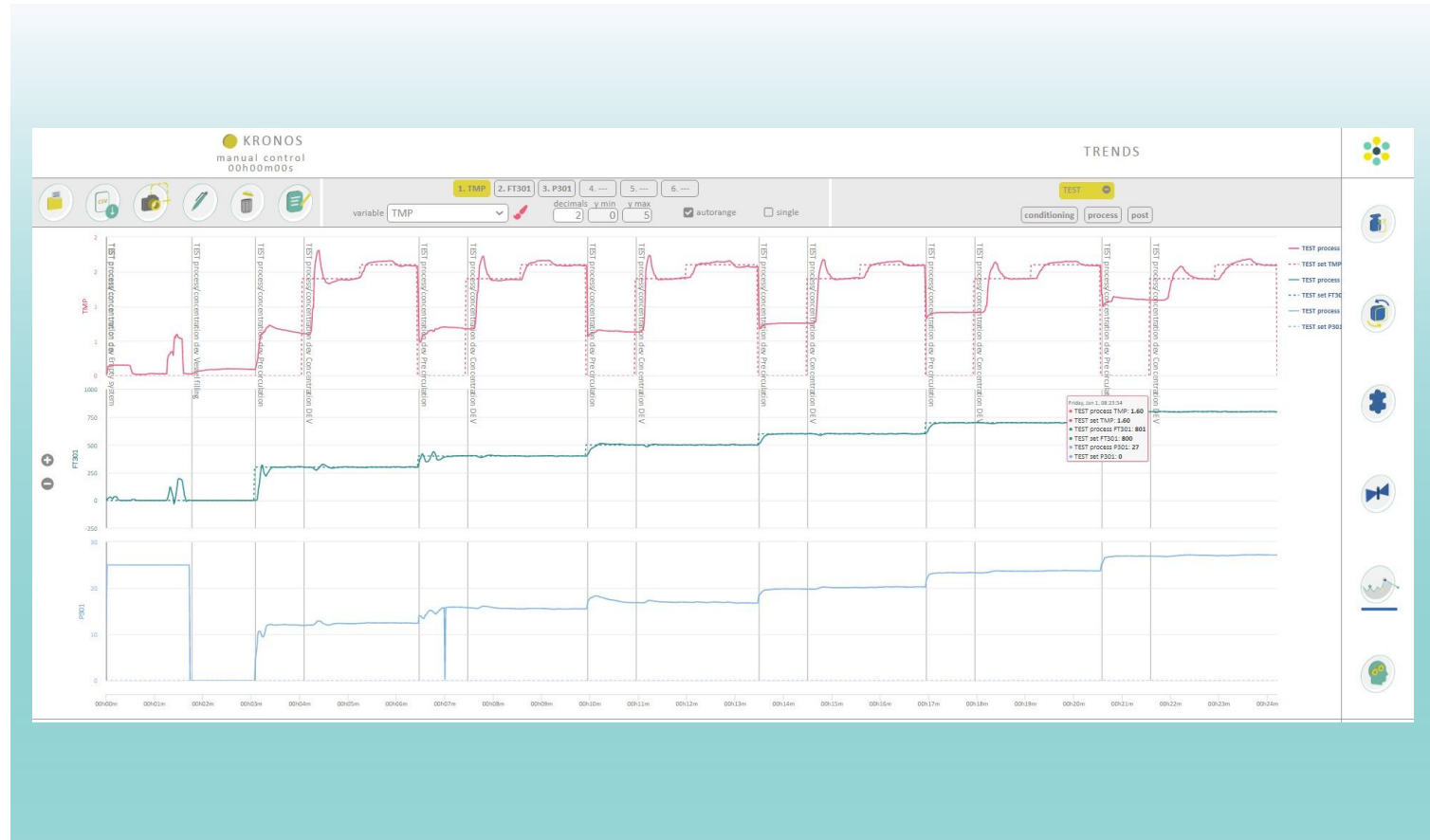
The screenshot displays the KRONOS manual control interface. At the top, it shows 'KRONOS manual control 00h00m00s' and 'WORKFLOW compact'. Below this is a control bar with icons for home, settings, manual control, play, stop, and a dropdown menu set to 'diafiltration'. A workflow sequence is listed: 1. water flush, 2. NWP, 3. buffer conditioning, 4. 1st concentration, 5. product recovery.

● stirring	100 rpm	100 rpm	settings	change
● temperature	0.0 °C	25.0 °C	settings	change
empty system		YES		change
vessel filling weight		500 g		change
pump mode		vol. flow		change
pump setpoint		500 ml/min		change
recirculation time		2 min		change
diafiltration TMP		1.50 bar		change
diafiltration stopping condition		COND LINE		change
conductivity stop condition		lower than		change
conductivity stop point		0 uS/cm		change
stable measure drift		0.010		change
stable measure timeout		60 s		change
post diafiltration recirculation time		60 min		change



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KRONOS
manual control
00h00m00s

Control panel with icons for home, play, stop, and next, and a dropdown menu set to NWP.

stirring	100 rpm	100 rpm	settings	change
temperature	0.0 °C	25.0 °C	settings	change
vessel filling weight		500 g		change
pump mode		vol. flow		change
pump setpoint		500 ml/min		change
recirculation time		1 min		change
recirculation TMP		1.00 bar		change
filtrate flow drift		20 ml/min		change
filtrate flow stable time		30 s		change
filtrate flow stable timeout		10 min		change



GALILEO SOFTWARE

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- **Automated process development module.**
- Filter management module

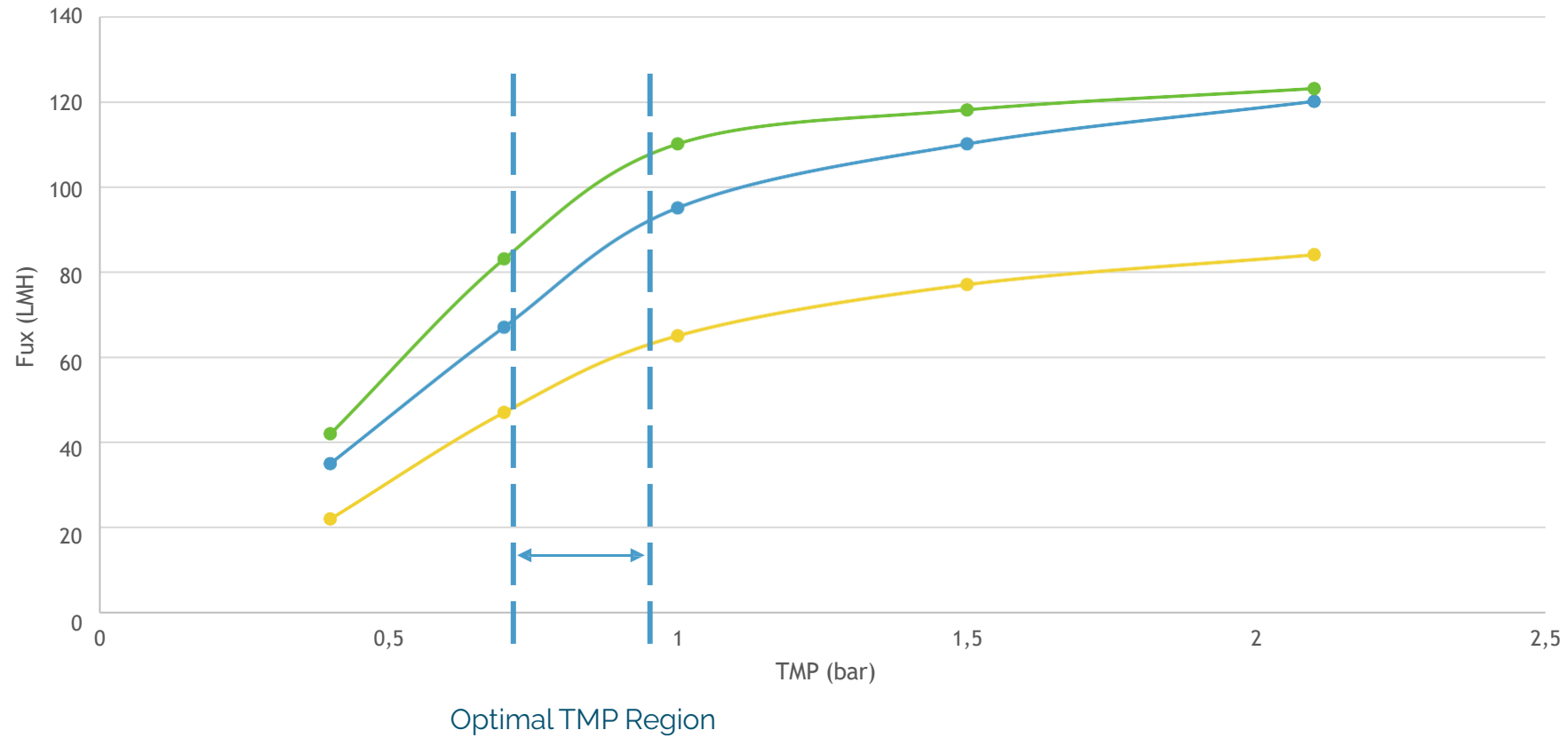
The screenshot displays the KRONOS software interface for manual control. The top bar shows the system name 'KRONOS manual control 00h00m00s' and the 'WORKFLOW compact' mode. A navigation bar includes icons for home, settings, and workflow, along with a dropdown menu set to 'concentration optimization'. The main area is a table of process parameters with 'change' buttons for each.

Parameter	Value 1	Value 2	Action
stirring	100 rpm	100 rpm	settings change
temperature	0.0 °C	25.0 °C	settings change
empty system	YES		change
vessel filling weight	500 g		change
recirculation time	60 min		change
pump mode	vol. flow		change
1st flow	300 ml/min		change
2nd flow	400 ml/min		change
3rd flow	500 ml/min		change
4th flow	600 ml/min		change
5th flow	700 ml/min		change
6th flow	800 ml/min		change
1st TMP	0.50 bar		change
2nd TMP	0.60 bar		change
3rd TMP	0.70 bar		change
4th TMP	0.80 bar		change
5th TMP	0.90 bar		change
6th TMP	1.00 bar		change
FLUX drift	5.0 LMH		change

The workflow sequence is: 1. water flush 2. NWP 3. buffer conditioning 4. 1st concentration 5. product recovery. A right-hand sidebar contains icons for various system functions.



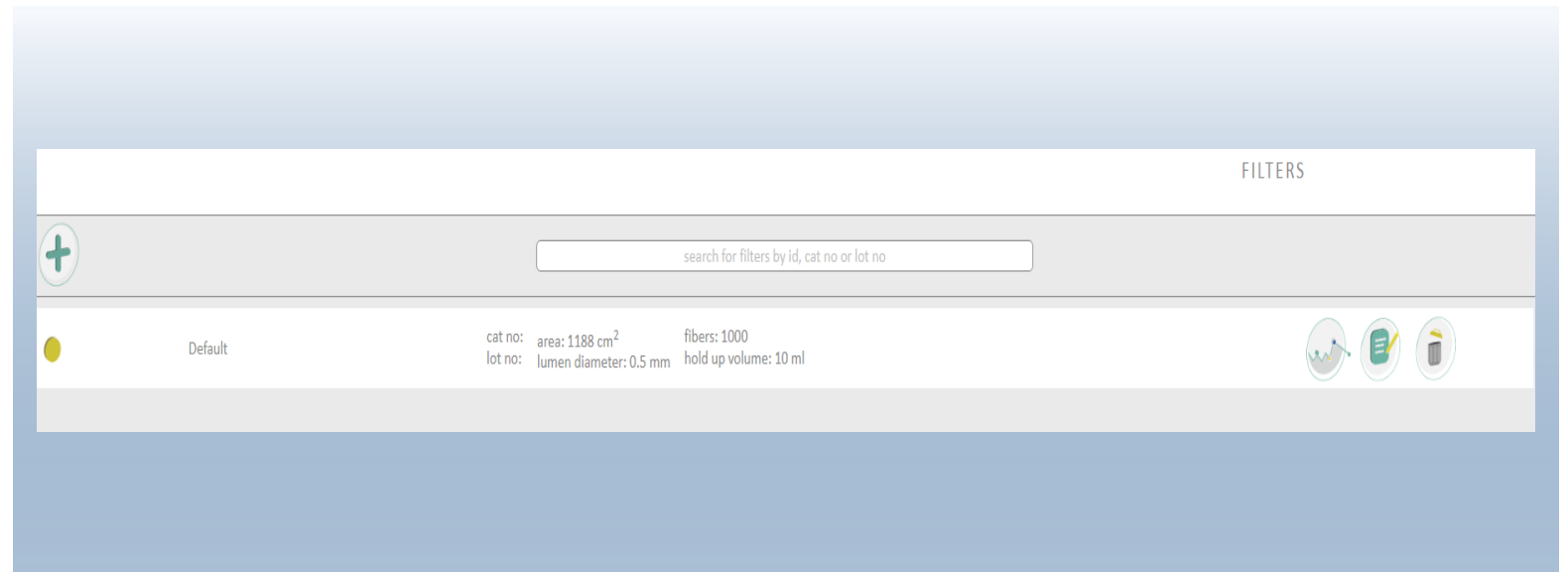
TMP OPTIMIZATION





GALILEO SOFTWARE

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- Automated process development module.
- **Filter management module**





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