

# Clinical material production in Leiden pilot plant

## PDMS API LM - Leiden

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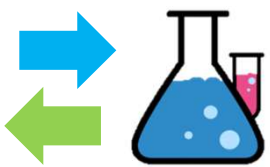
Pictured above: The structure of HIV.

# Background



Computer-based model

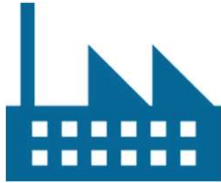
Tech-transfer projects



Repetitive tasks



Leiden pilot plant



Platform process



# Model features

Resource optimization



Multi-objective optimization

Resource assessment



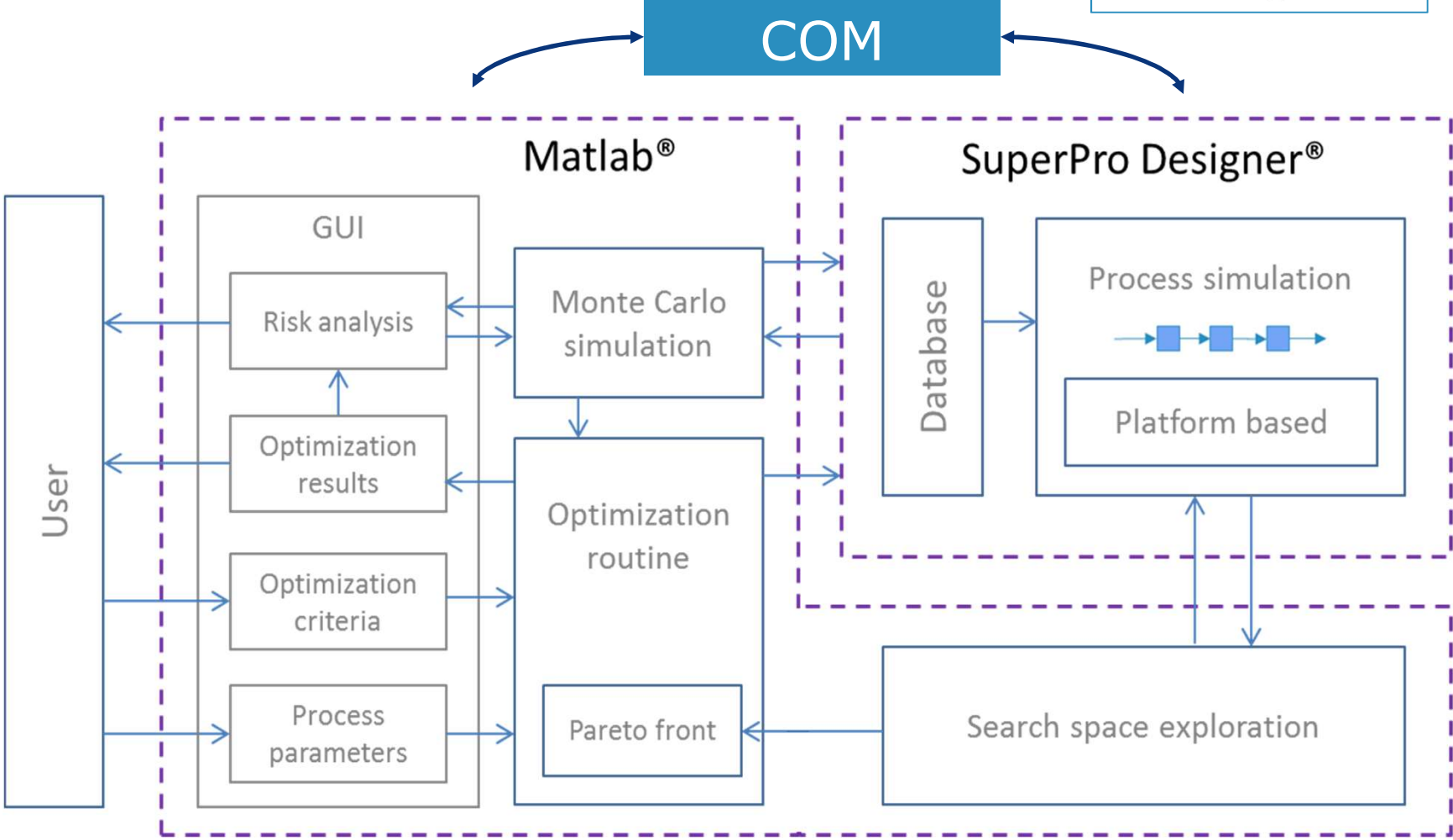
Techno-economic evaluation

Risk analysis



Monte Carlo simulation

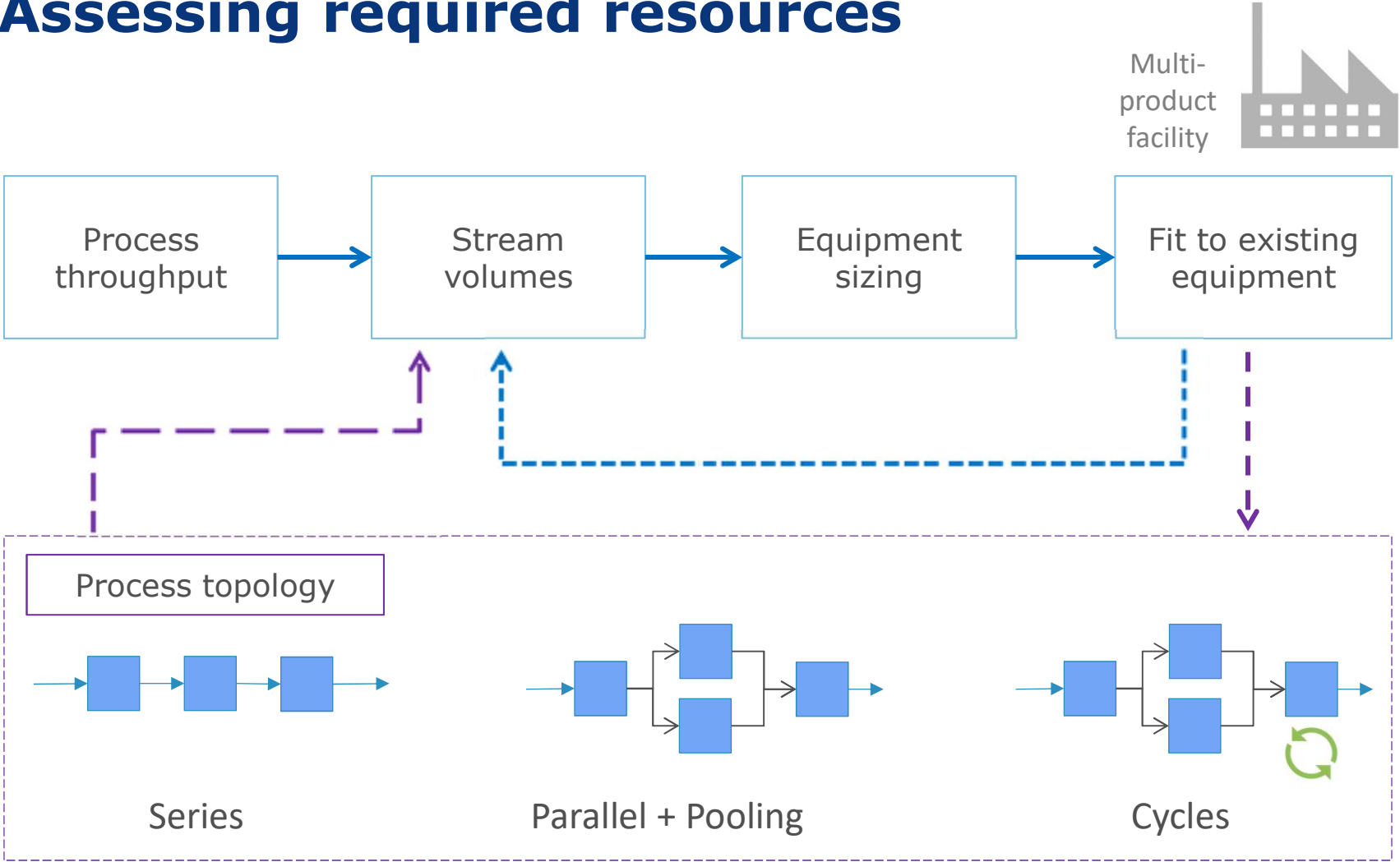
# Conceptual design





**How does it work?**

# Assessing required resources



Multi-product facility



Process throughput

Stream volumes

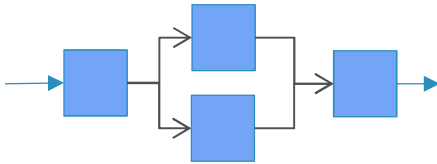
Equipment sizing

Fit to existing equipment

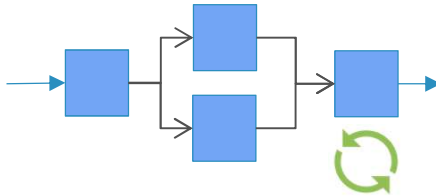
Process topology



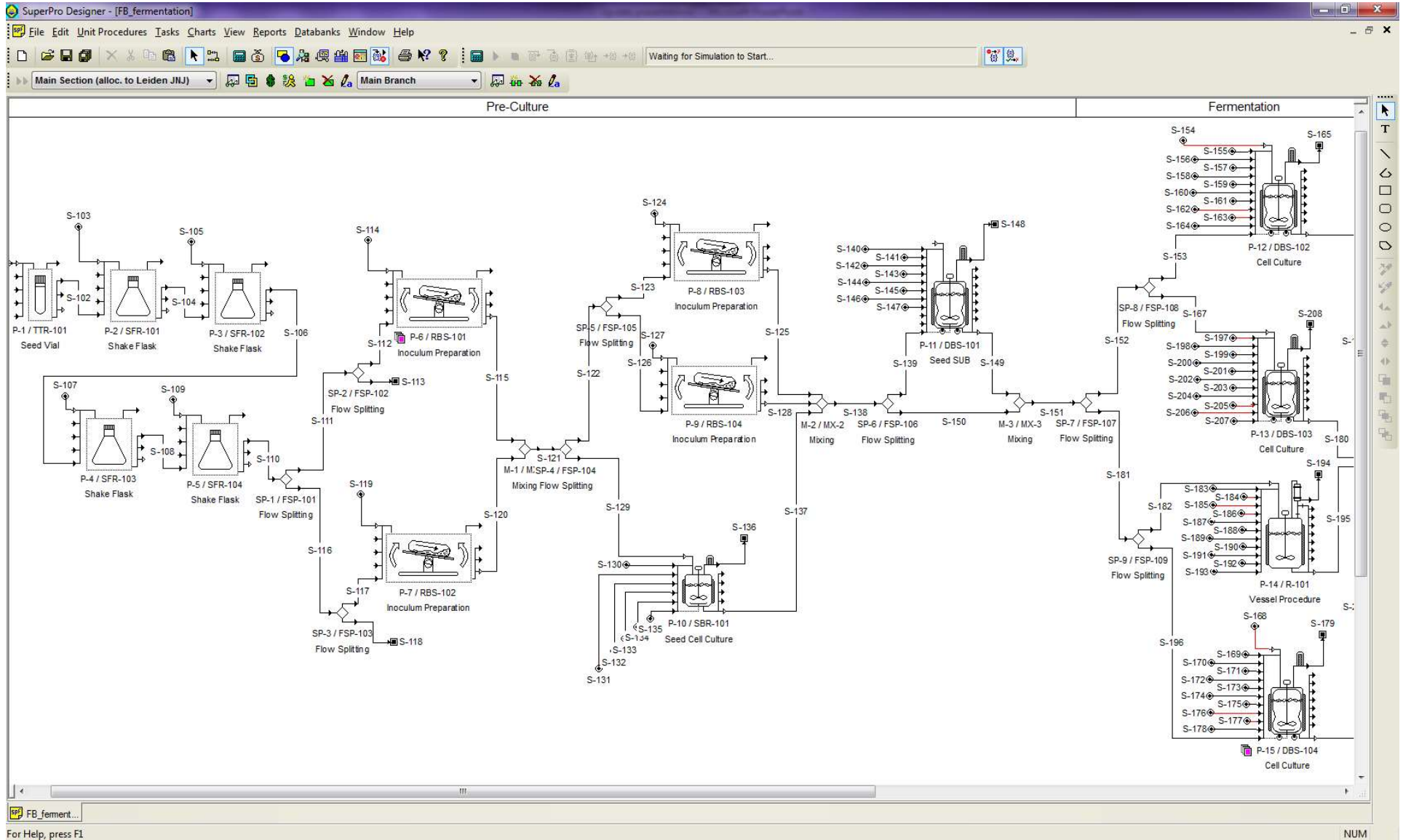
Series



Parallel + Pooling



Cycles



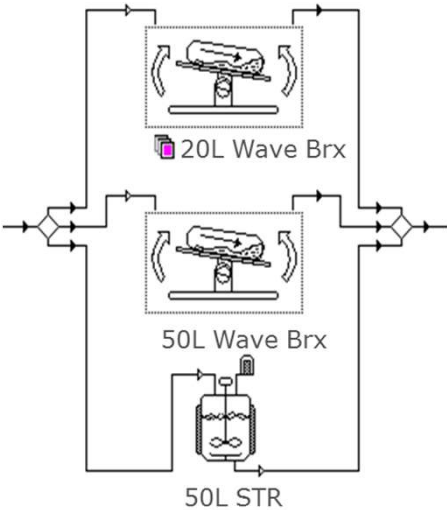
# Scenario Evaluation

```
_____  
_____  
for i=1:6  
_____  
_____  
_____  
_____  
_____  
for j=1:5  
_____  
_____  
_____  
end  
end  
end
```

USP: 30/60 scenarios  
DSP: 25 scenarios

```
[1 1 1 1 1  
1 1 1 1 0  
1 1 1 0 1  
0 1 1 1 1  
0 1 1 1 0  
0 1 1 0 1]
```

Scenario matrix



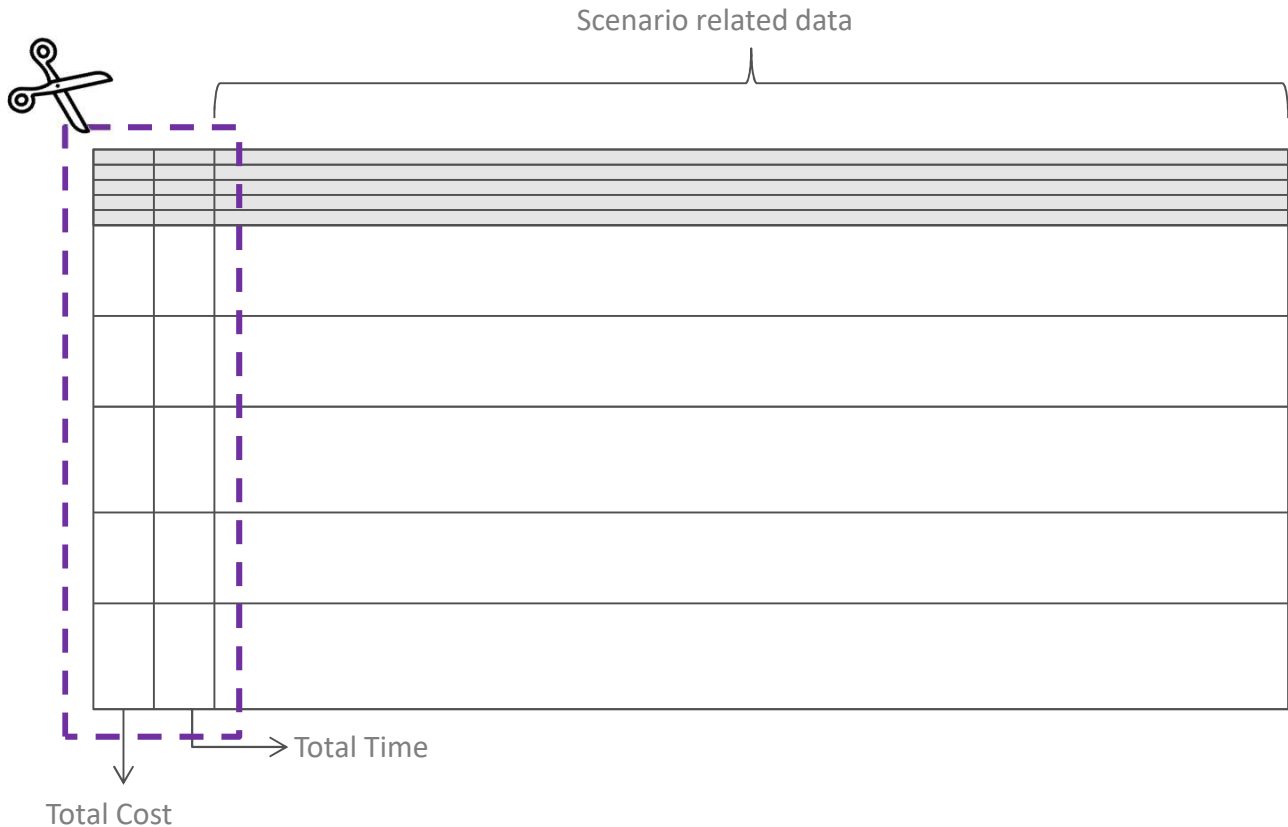
Scenario identifiers  
'Strings' & Doubles



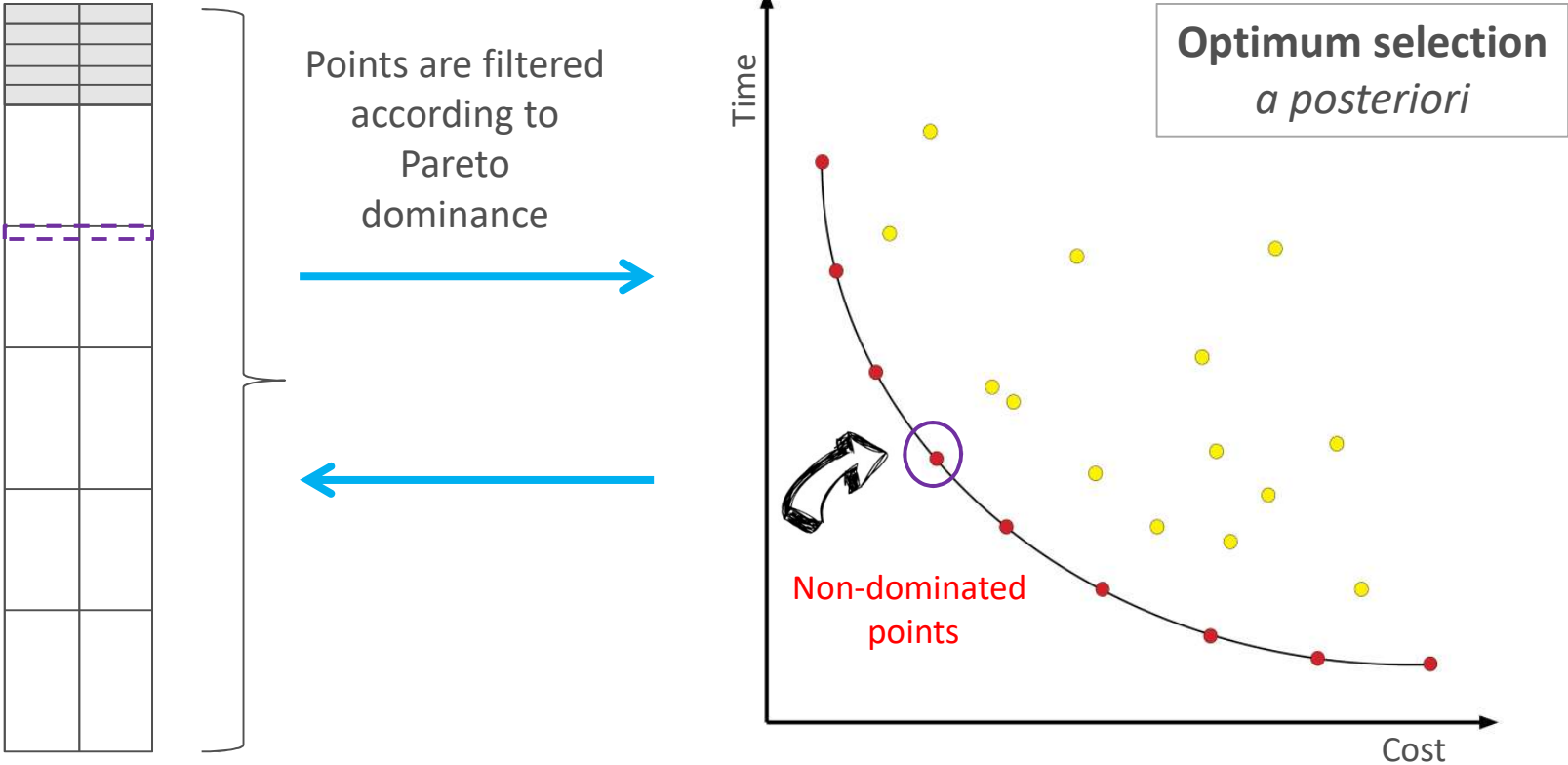
# Data processing



Cell array



# Determination of Pareto Front



# Reports



Process Overview

UPSTREAM

General Information

Criteria

Fermentation

Clarification

DPC

VIN

1

2

3

4

5

6

7

8

Process Overview

UPSTREAM

General Information

Criteria

Costs

Fermentation

Pre-culture

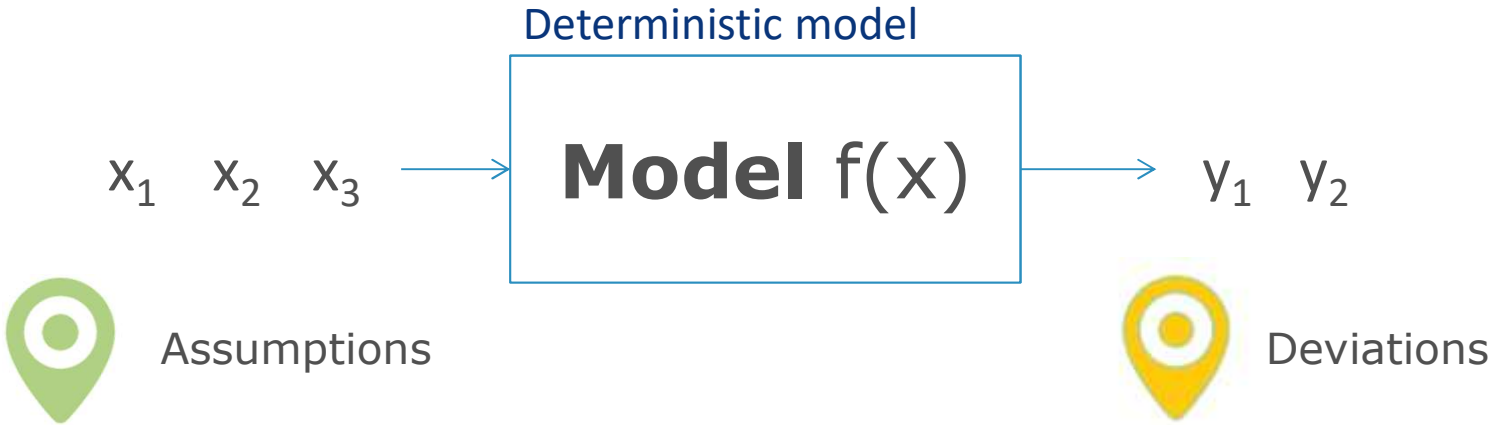
DPC

1

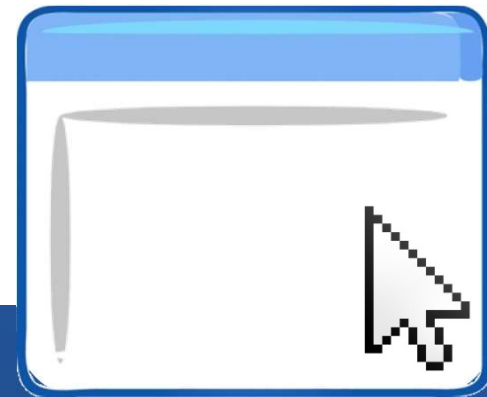
2

4

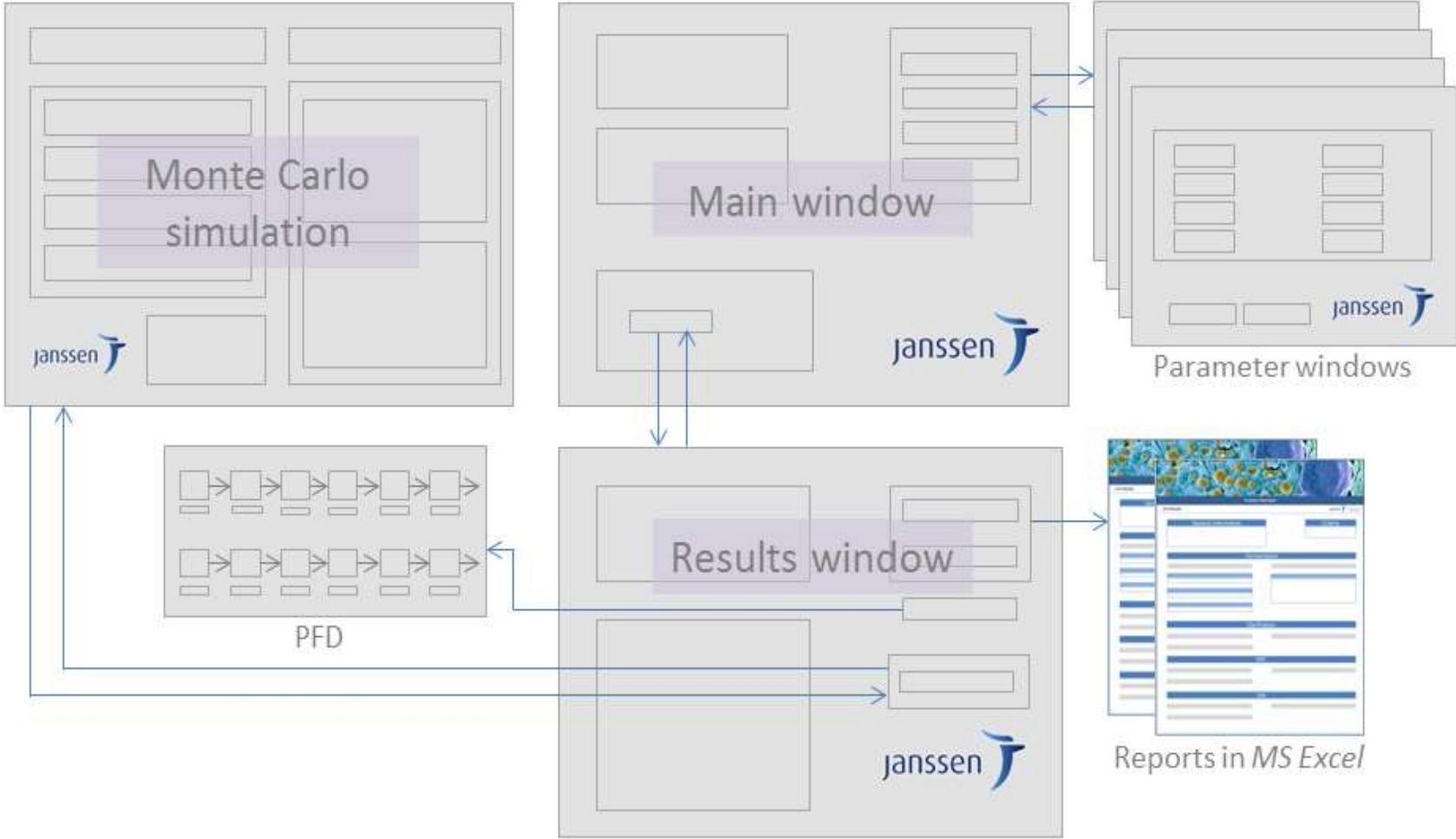
# Quantitative risk analysis



# Graphic user interface



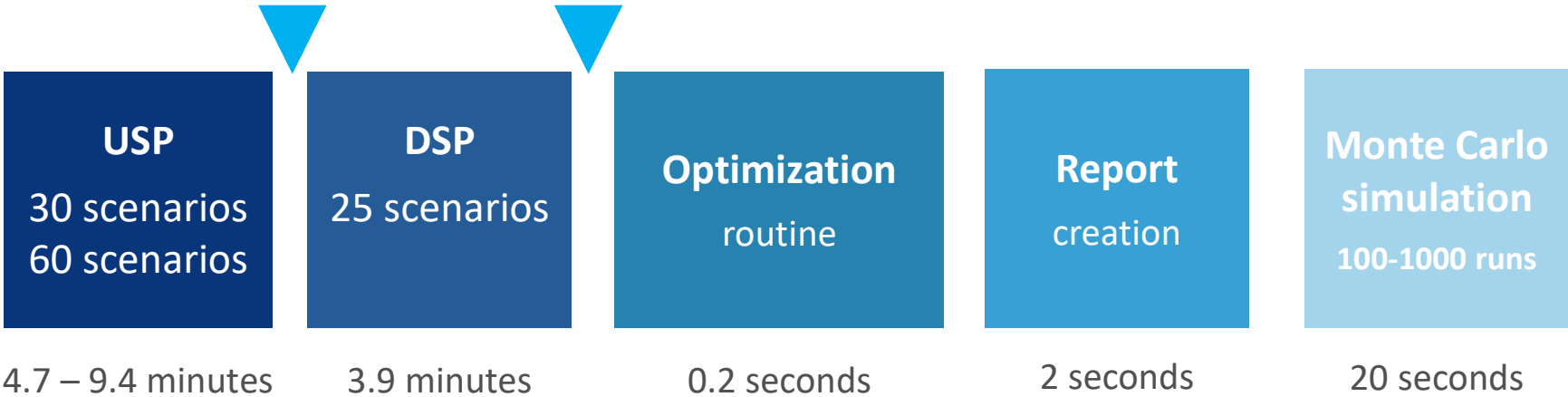
# GUI structure



# Computing time



**Nested Loops**  $\sim 9 \frac{\text{seconds}}{\text{scenario}}$



**Computer dependent**

Optimization 8.6 – 13.3 minutes

MC simulation 0.5 – 5.5 hours

# Conclusions

- Matlab® + SuperPro Designer® efficient approach
- Enhances capabilities of both specialized softwares
- Multiple applications
- VBA is the bottleneck
- Iterative process to prove robustness
- Continuous improvements





**What happened next?**



# Continuous improvements

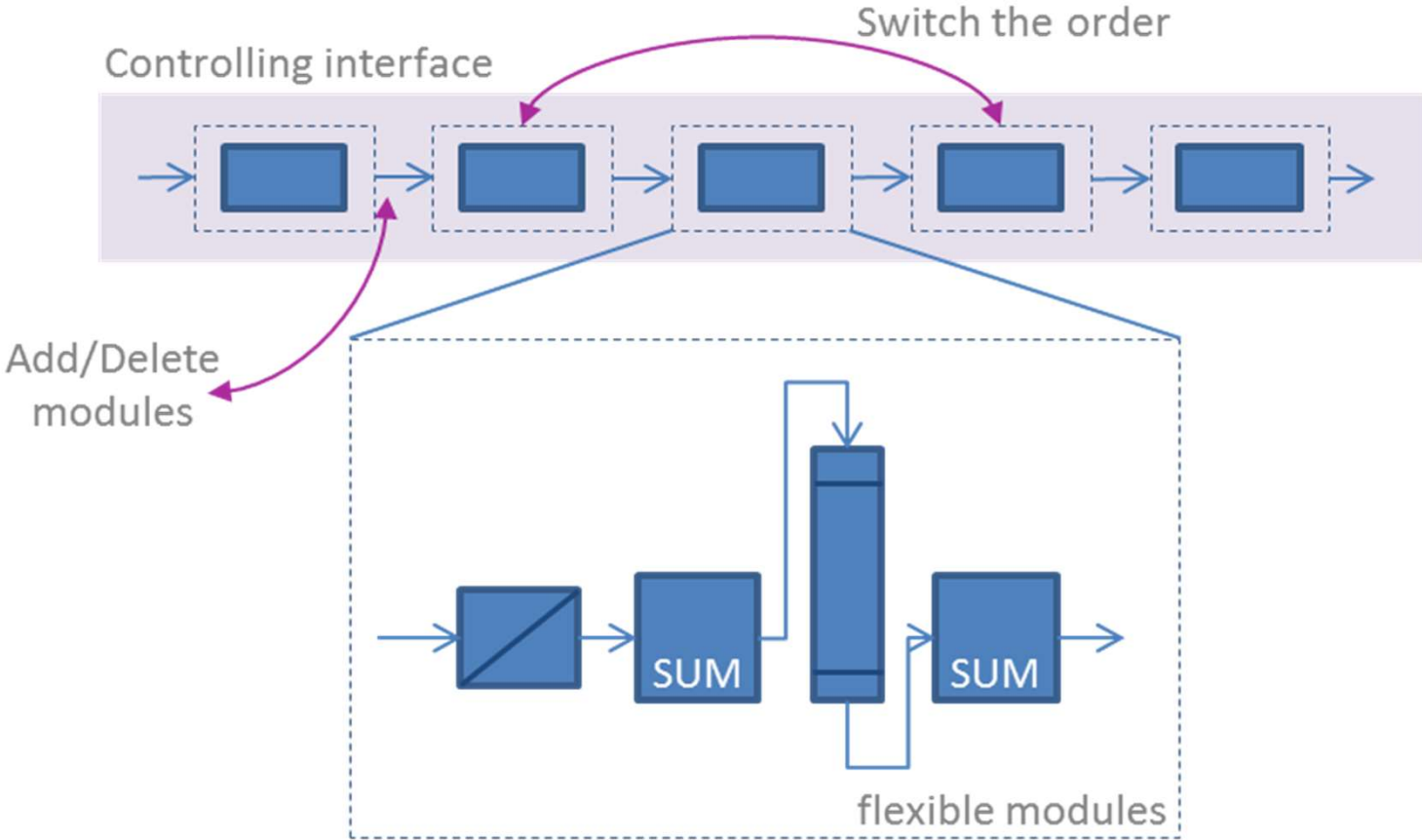
*Non-platform processes*



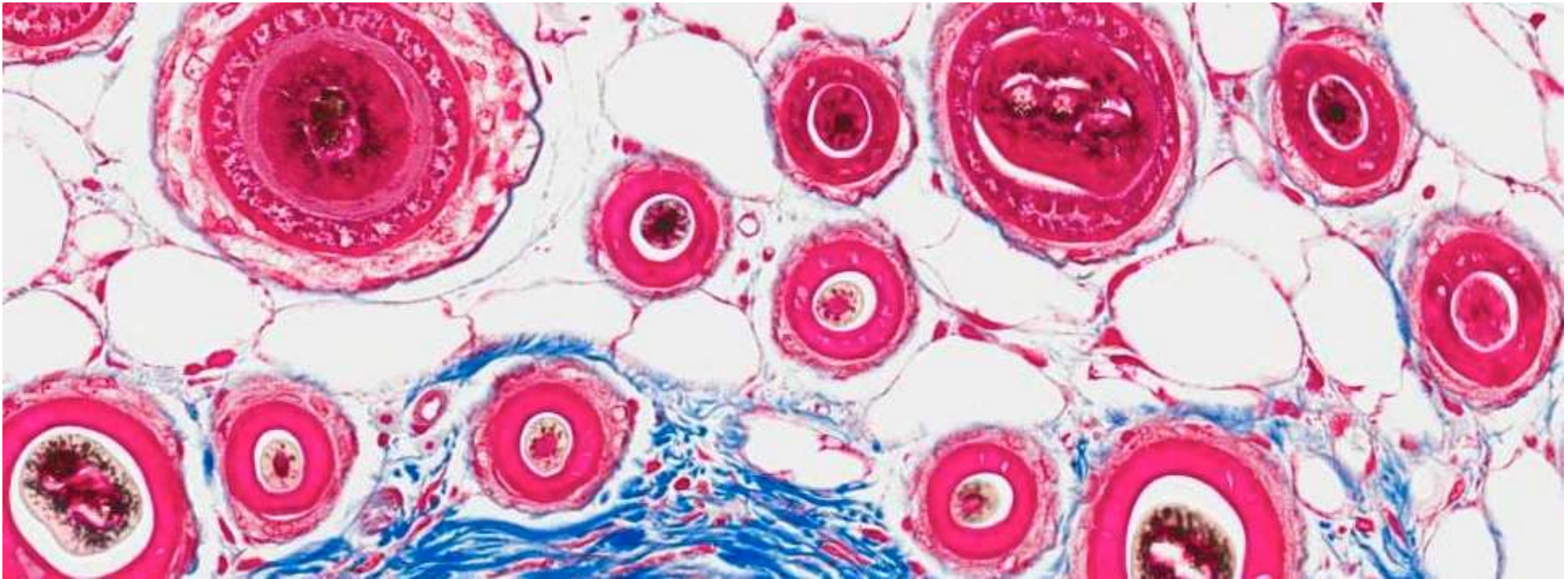
**Platform process**



**Non-platform process**



PDEng Elizabeth Valentin



# Questions?

**Thank you!**

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Pictured above: Skin cells at 20x magnification