Noorjax Consulting

Pharmaceutical Lab Expansion Amid Uncertainty of Future Processes

About Us

Noorjax Consulting develops simulation models using mostly AnyLogic for companies and governments worldwide.

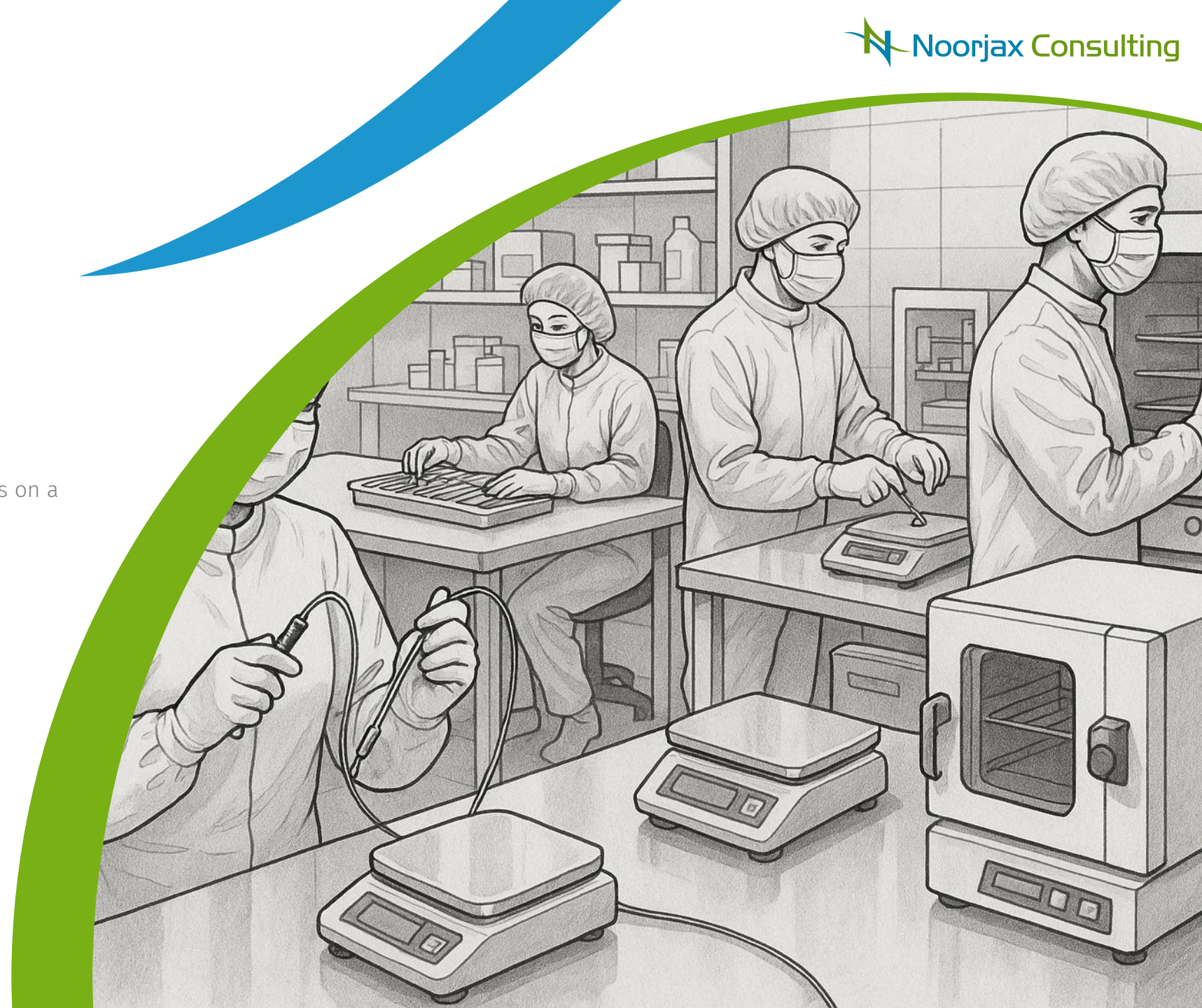We also have a simulation modeling school with 15 different courses.

https://www.noorjax.com

What Is
The Project

One of the big pharma companies produces patches in a laboratory

- They produce thousands of these products on a yearly basis
- They want to scale the production to 10x
- Same facility, different technology
- Disagreement within the company

Why is this **Interesting**

Unknown future process
Needs quick results

Current Process Validation

Basics: build the model, validate it

Unknown future Operations

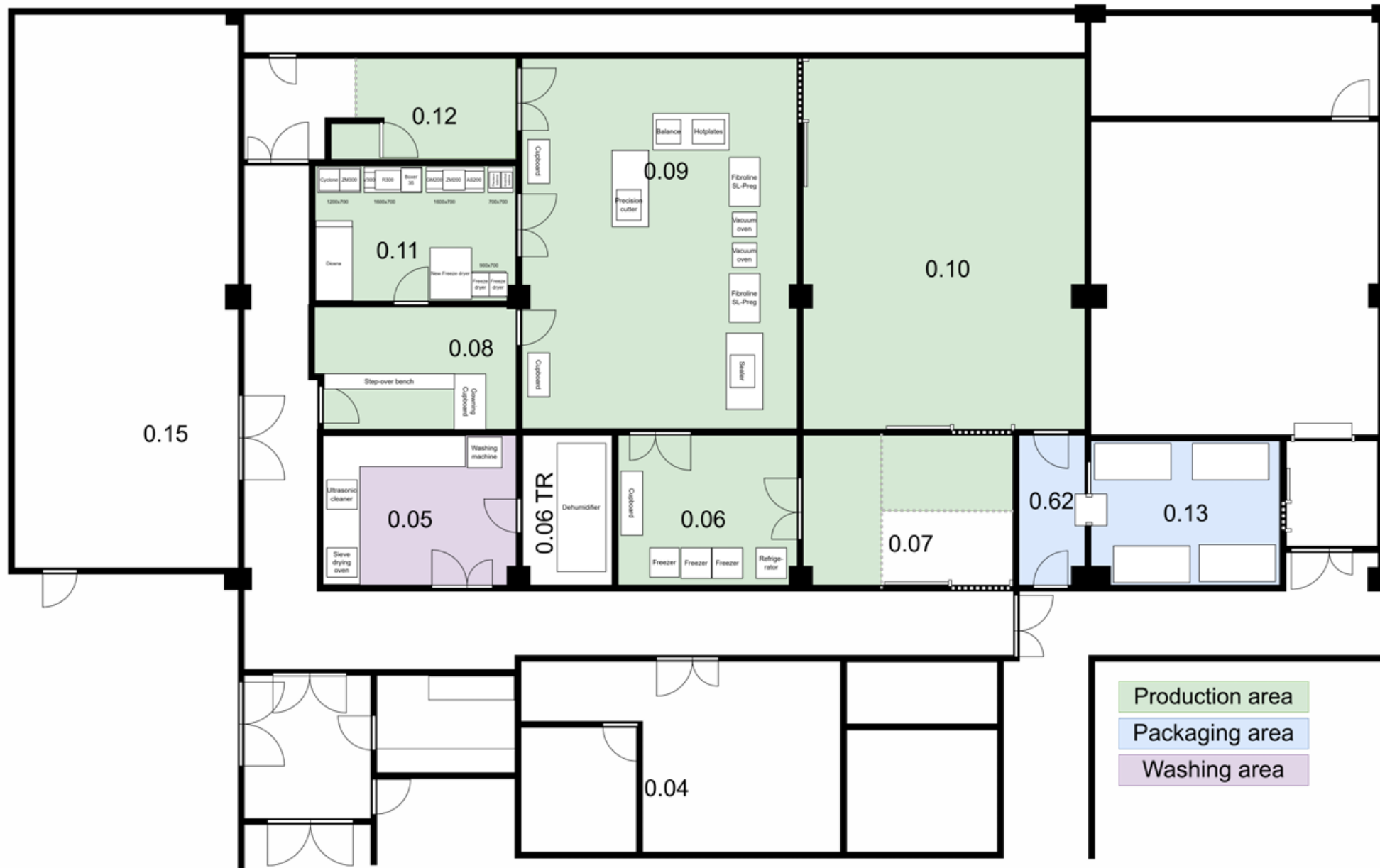They are still working on a future technology that can take multiple shapes
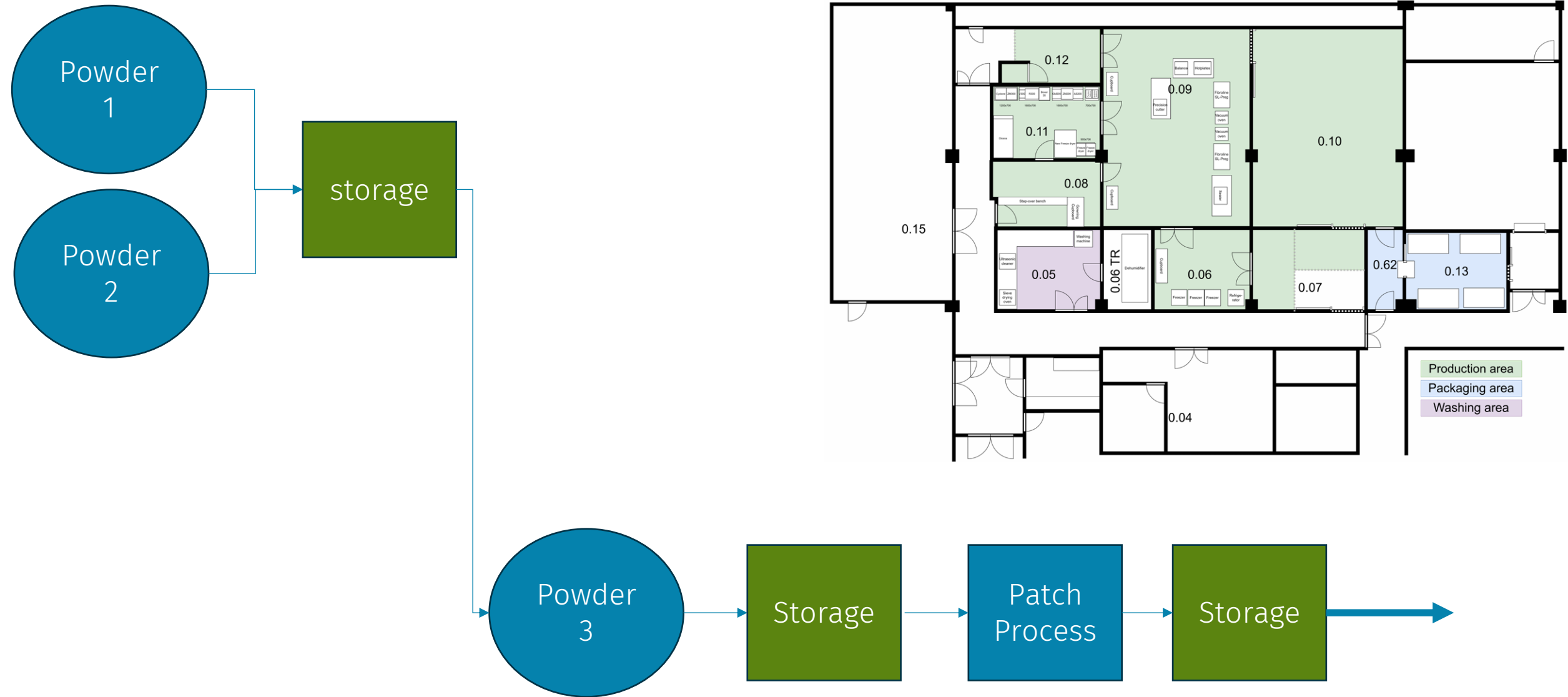
Work Fast

Unknown model must be functional in an impossibly short time

Maximum Flexibility

What to do?

How to develop it

Build the Processes

Classic Discrete Events

Easy to read the simulation, easier and faster to build, difficult to change

Full Recipe

Processes defined in Excel

Absolute flexibility, complicated user interface, classes hold process information
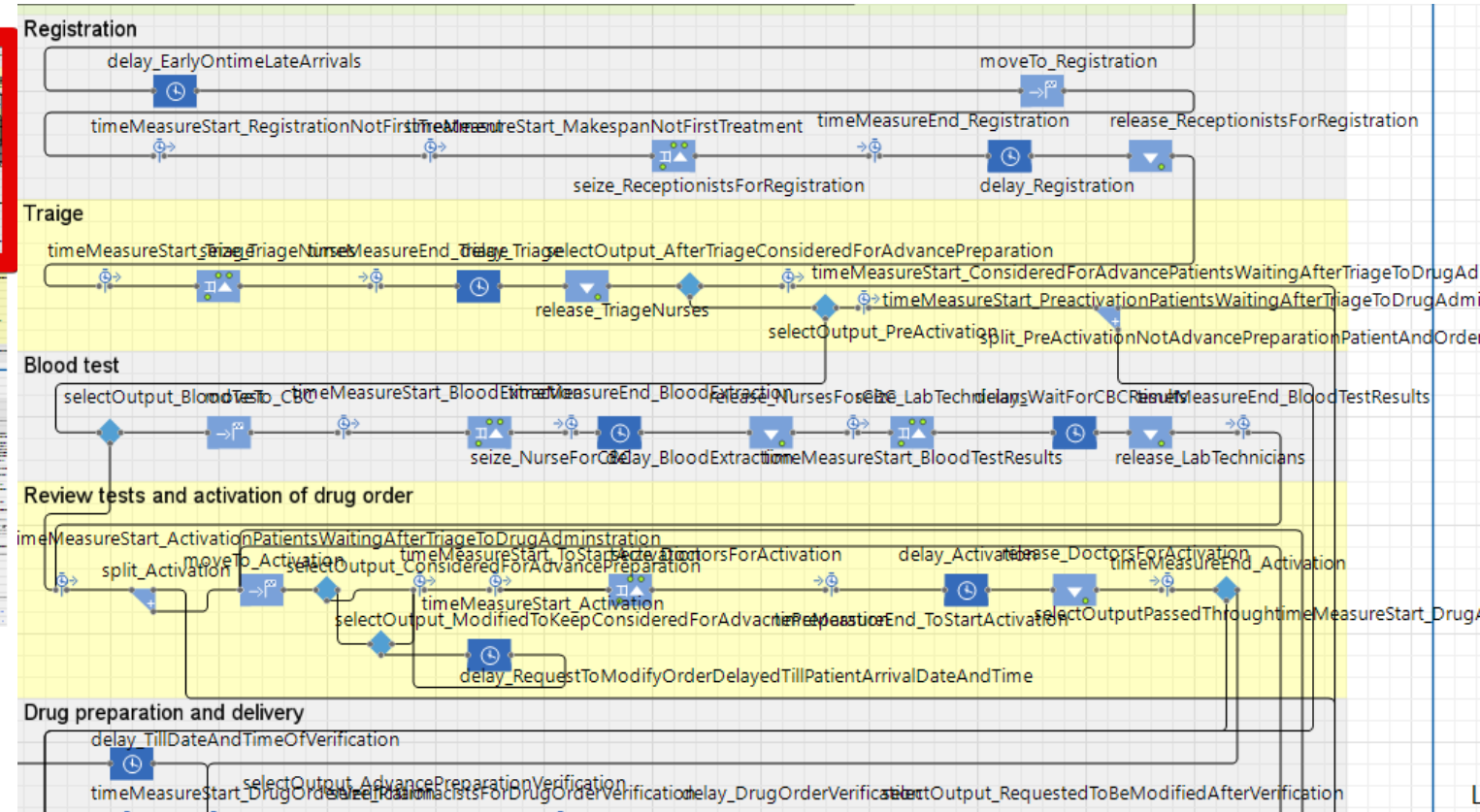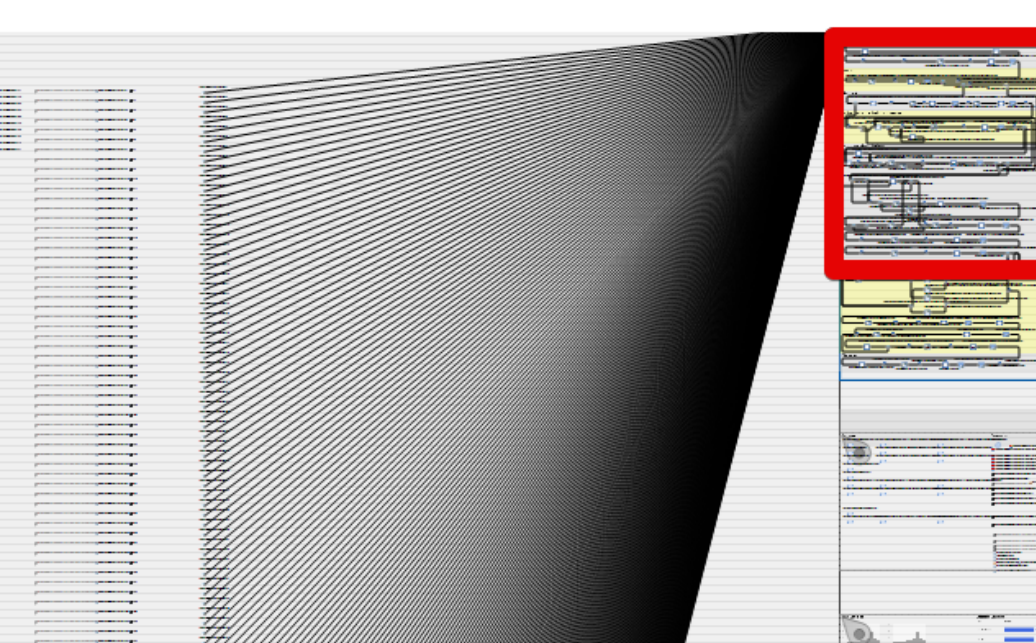
Partial Recipe

Limited Processes in Excel

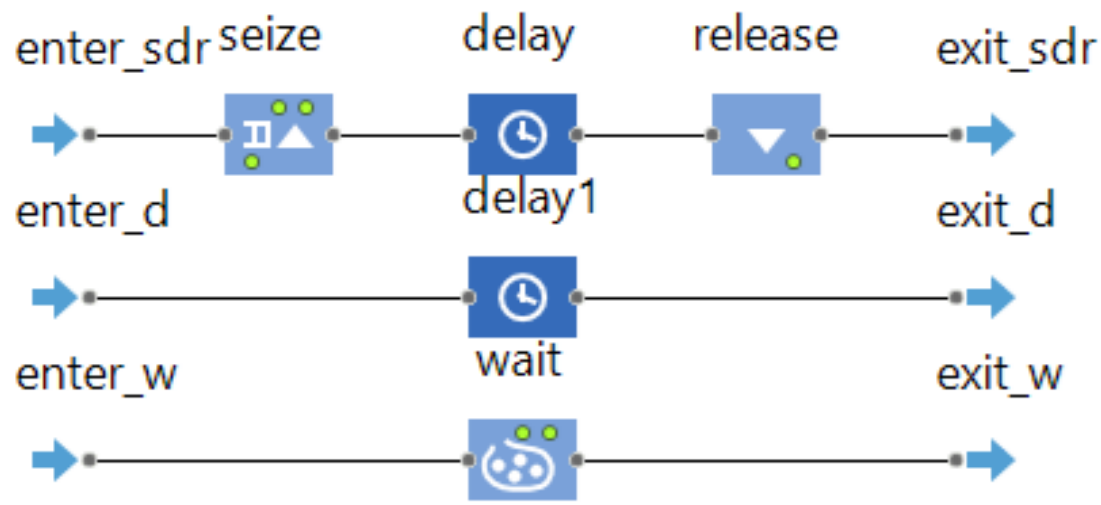High flexibility, more control, easier to read

7

Classic Discrete Events – Worst Case Scenario

Full Recipe – Worst Case Scenario

id	Name	Time in minutes	Seize resources id normal	Release resources	Number of predecessor	Condition normal	True normal	False normal	True subprocess	Seize resources	Release resources	Number of predecesso	Condition preactivation	True preactivation	False preactivation	True subprocess preactivation	Seize resource	Release resources	Number of predecesso	Condition advancePrep	True advanc	False advanc	True subprocess
0	Dummy	0			0		{2}					0		{2}					0		1		{DrugBatch_13}
1	Time between advance pre	time between advance prep and arriv																	1		2		
2	Arrival	0			1		{3}					0		3					1		3		
3	Registration	weibull(1.42, 4.01, 0.90)	6	6	1		{4}			{6}	6	1		4			6	6	1		4		
4	Triage	weibull(1.42, 4.47321, -0.42438)	7	7	1		{5}			7	7	1		20		{DrugBatch_17}	7	7	1		20		
5	Decide blood test same da	0			1	blood same day?	{7}	{6}															
6	Blood test day before	0			1	has drugs?		{20}	{DrugBatch_9}														
7	Blood test same day	triangular(2, 7, 4)	5	5	1		{8}																
8	Wait for results	triangular(5, 51, 11)	8	8	1	has drugs?		{20}	{DrugBatch_9}														
20	Seize bed	0	{9}		1	has drugs?	21	26		{9}		1		21			{9}		1		21		
21	Premedication	weibull(1.32, 1.2)	{5}	5	1		22			{5}	5	2		22			{5}	5	2		22		
22	After premedication	triangular(3, 15, 8)			1		23					1		23					1		23		
23	Drug injection	normal(2.13,2.92)	5	5	1		24			5	5	1		24			5	5	1		24		
24	Administer drugs	administration_time_in_hours			1	more drugs?	23	25				1	more drugs?	23	25				1	more drugs?	23	25	
25	Drug removal	beta(0.67, 0.577, 0, 3.43)	5	5	1		26			5	5	1		26			5	5	1		26		
26	Check patient health	lognormal(3.72197, 0.89038, -2.70147)			1		27					1		27					1		27		
27	Patient is discharged	weibull(1.42, 4.01, 0.90)	5	{5,9}	1					5	{5,9}	1					5	{5,9}	1				

enter_sdr seize   delay   release   exit_sdr
enter_d   delay1   exit_d
enter_w   wait   exit_w

Operation Components

A room has:

- Equipment that stays in room
- Utensils that need washing

A room Process Requires

- Paperwork before, after and during process
- Safety protocols
- Raw Material
- Operators with knowledge on the process

|	name	code	washable by hand	time to wash unit by hand (minutes)	fraction of washing machine used
2	Round bottom flasks	rbf	FALSE	20	5%
3	Splash heads	sh	FALSE	20	5%
4	Erlenmeyer	er	FALSE	20	5%

Partial Recipe – Our Preferred Methodology

Process	step	setup (minutes)	number of cycles	cycle process (minutes)	materials in	equipment
ELPOX	blue coloration	uniform(120,180)	12	uniform(20,25)	{"elp":500.0,"wfi":1000.0,"dye":250.0,"wb":10.0}	{"ab":1,"pb":1,"km":1,"rv":2,"tm":2}
ELPOX	lyophilization	uniform(0,0)	1	3600	{}	{"fd":6,"dsp":6}
ELPOX	milling	uniform(30,45)	12	uniform(2,3)	{}	{"pb":1,"km":1}
ELPOX	drying1	uniform(0,0)	1	960	{}	{"rv":2}
ELPOX	fine milling	uniform(60,80)	3	uniform(10,12)	{}	{"ucm":1,"pb":1}
ELPOX	sieving	uniform(0,0)	4.5	uniform(10,12)	{}	{"ss":1,"pb":1}
ELPOX	drying2	uniform(0,0)	1	960	{}	{"rv":2}
ELPOX	packaging	uniform(30,40)	110	uniform(1,2)	{"lb":50.0,"po":50.0}	{"pb":1,"ab":1}
ELPOX	storage	uniform(0,0)	1	uniform(1,2)	{}	{}
NUPOX	milling	uniform				
NUPOX	drying1	uniform				

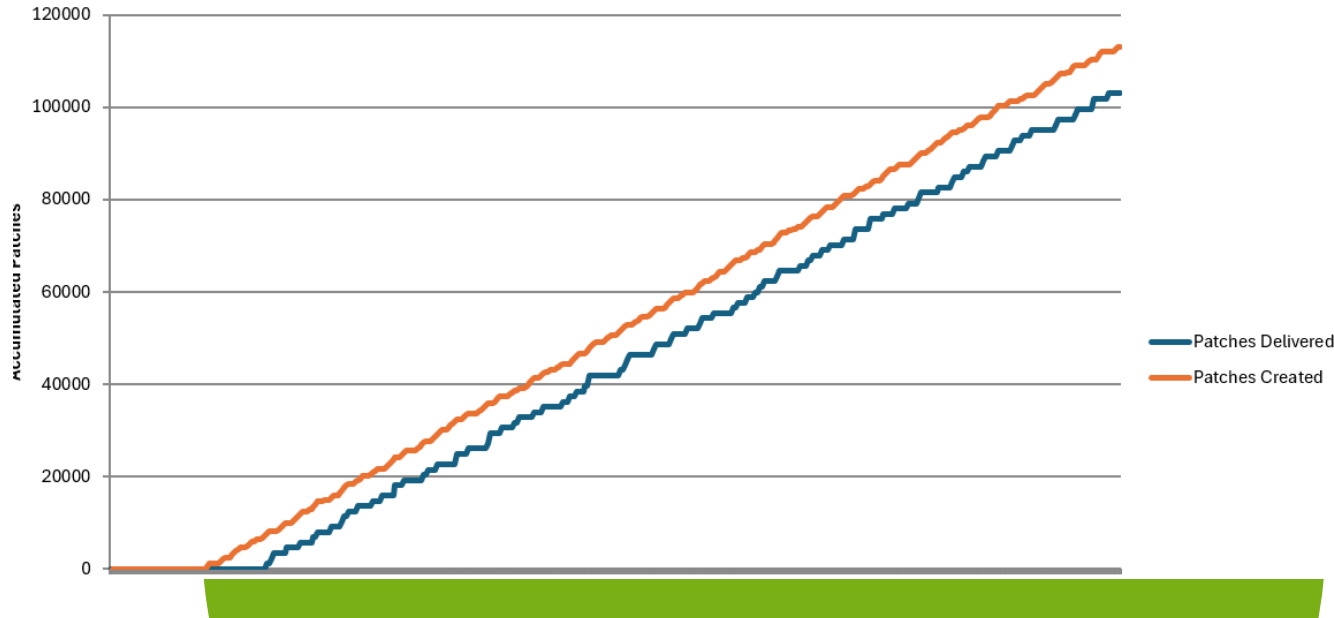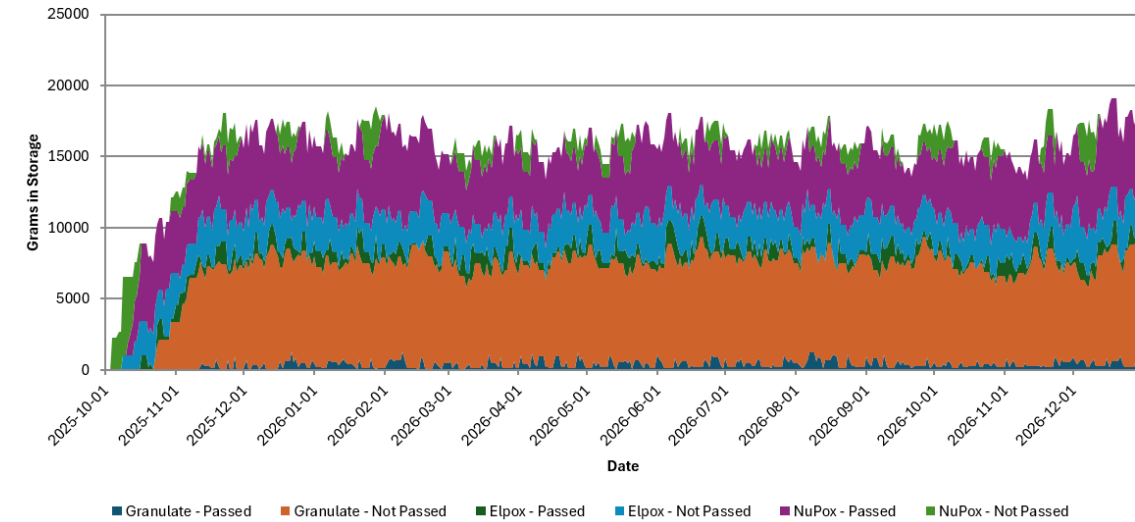blueColoration · lyophilization · powderSharedLogic · onExit

12
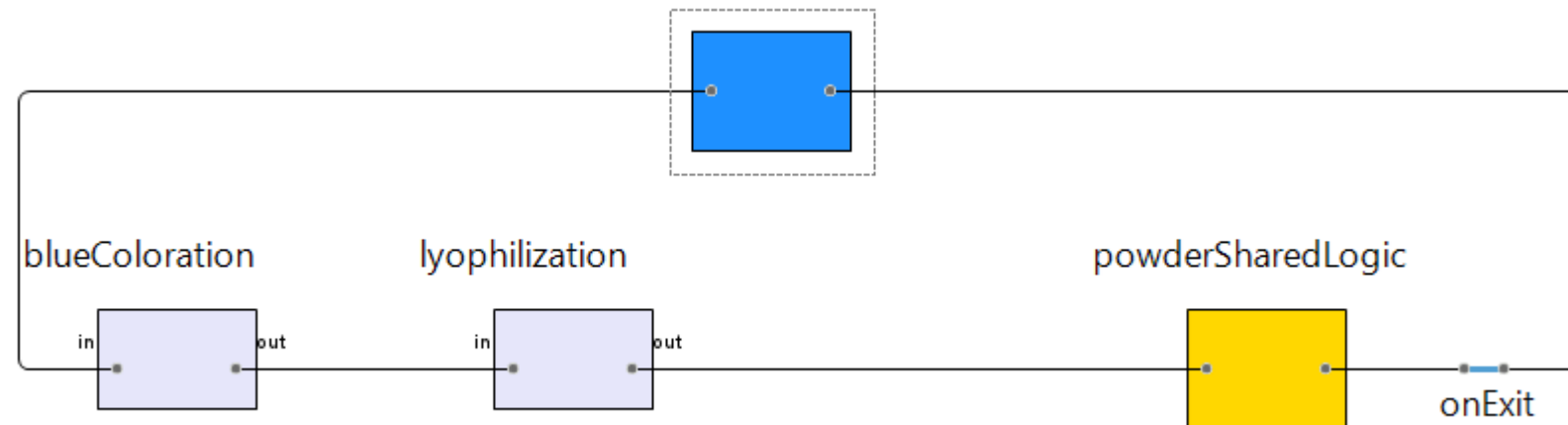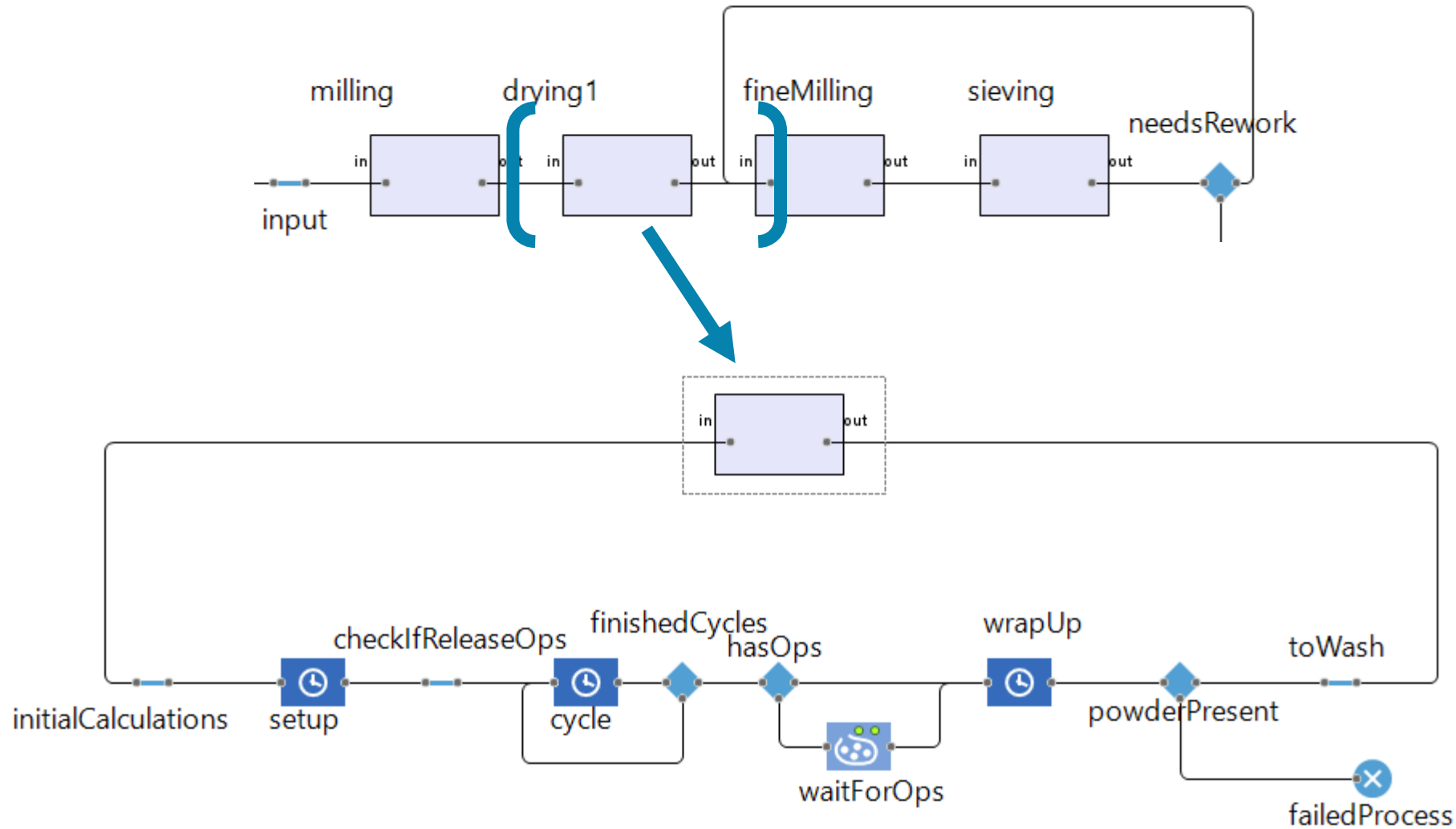
Results

- They generated 100s of scenarios
- Exported information was used to report

- Scenarios
  - What to do with current equipment
  - What to do in the short term
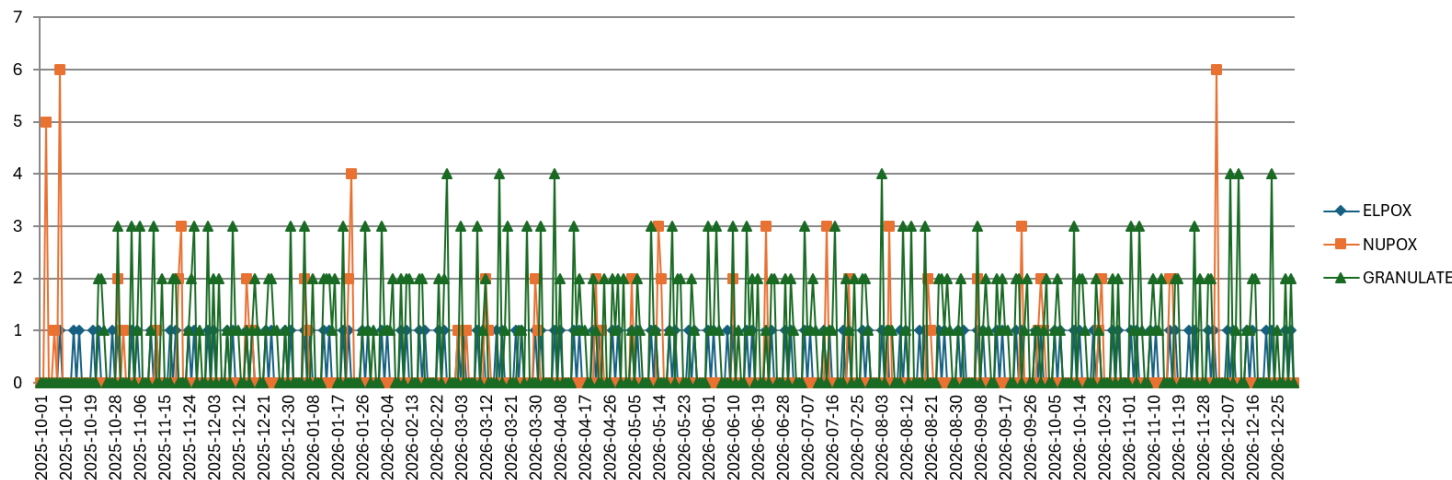 - How to transition technology
  - What to do in the long term

Accumulated Patches Over Time

Daily Storage Amounts (g) by Material & QC Status

Daily QA Entries per Process

Other Data
- Utilization of Resources
- Flow of Utensils
- Utilization of Equipment
- Raw Material Requirements
- Storage Requirements
- Washing Room Utilization

12/2/2026 7:00	12/2/2026 8:00	12/2/2026 9:00	12/2/2026 10:00	12/2/2026 11:00	12/2/2026 12:00	12/2/2026 13:00	12/2/2026 14:00	12/2/2026 15:00
off	PATCHPOSTDRYING	PATCHPOSTDRYING	idle	idle	idle	idle	idle	off
off	PATCHPOSTDRYING	PATCHPOSTDRYING	idle	idle	idle	idle	idle	off
off	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	idle	idle	idle	off
off	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	idle	idle	idle	off
off	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	idle	idle	idle	off
off	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	idle	idle	idle	off
off	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	idle	idle	idle	idle	off
off	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	NUPOX	NUPOX	idle	idle	off
off	ELPOX	ELPOX	ELPOX	ELPOX	idle	idle	idle	off
off	ELPOX	ELPOX	ELPOX	ELPOX	idle	idle	idle	off
off	NUPOX	NUPOX	NUPOX	NUPOX	NUPOX	idle	idle	off
off	NUPOX	NUPOX	NUPOX	idle	NUPOX	NUPOX	NUPOX	off
off	NUPOX	NUPOX	idle	PATCHNORMAL	PATCHNORMAL	idle	idle	off
off	NUPOX	NUPOX	idle	PATCHNORMAL	PATCHNORMAL	NUPOX	NUPOX	NUPOX
off	idle	idle	PACKAGING	PACKAGING	PACKAGING	PACKAGING	idle	off
off	idle	idle	PACKAGING	PACKAGING	PACKAGING	PACKAGING	idle	off
off	idle	idle	NUPOX	NUPOX	NUPOX	NUPOX	NUPOX	off
off	idle	idle	NUPOX	NUPOX	idle	NUPOX	NUPOX	NUPOX

12/9/2026 7:00	12/9/2026 8:00	12/9/2026 9:00	12/9/2026 10:00	12/9/2026 11:00	12/9/2026 12:00	12/9/2026 13:00	12/9/2026 14:00	12/9/2026 15:00
off	GRANULATE	GRANULATE	idle	idle	idle	idle	idle	off
off	GRANULATE	GRANULATE	idle	idle	idle	idle	idle	off
off	ELPOX	ELPOX	ELPOX	ELPOX	idle	idle	idle	off
off	ELPOX	ELPOX	ELPOX	ELPOX	idle	idle	idle	off
off	GRANULATE	GRANULATE	GRANULATE	GRANULATE	idle	idle	idle	off
off	GRANULATE	GRANULATE	GRANULATE	GRANULATE	idle	GRANULATE	GRANULATE	GRANULATE
off	idle	idle	idle	idle	GRANULATE	GRANULATE	GRANULATE	off
off	idle	idle	idle	idle	GRANULATE	GRANULATE	GRANULATE	off
off	idle	idle	idle	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	off
off	idle	idle	idle	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	off
off	idle	idle	idle	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	idle	off
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off	idle	idle	idle	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	off
off	idle	idle	idle	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	PATCHPOSTDRYING	off
off	idle	idle	GRANULATE	GRANULATE	GRANULATE	GRANULATE	GRANULATE	GRANULATE
off	idle	idle	GRANULATE	GRANULATE	GRANULATE	idle	idle	off

Conclusions

Flexibility Performance
How flexible is the model

They were able to generate all scenarios with minimal interaction with us

Is the Model Useful
What did they get from it

Created a comprehensive report with short- and long-term plans, working with the Engineers to implement new technologies and test the effects

Future Work
New Technology

There is more to do and there might be a phase 2 when there's better understanding on the technology that can be used.

Noorjax Consulting

Information

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