

Tom Stephenson, Senior Consultant

# Improving Laboratory Flow With Simulation

Identify and test improvements to deliver quality, cost-effective results within the shortest time frame.



## Tom Stephenson

- Senior Consultant
- Works globally
- Specialism in healthcare
- Clinical flows, population health, disease pathways



## Laboratory simulation experience

- Worked as a consultant over 5 years
- Seen a growing need to test changes in a laboratory in recent years
- Had the opportunity to work on many different projects across the globe
- Projects have varied significantly



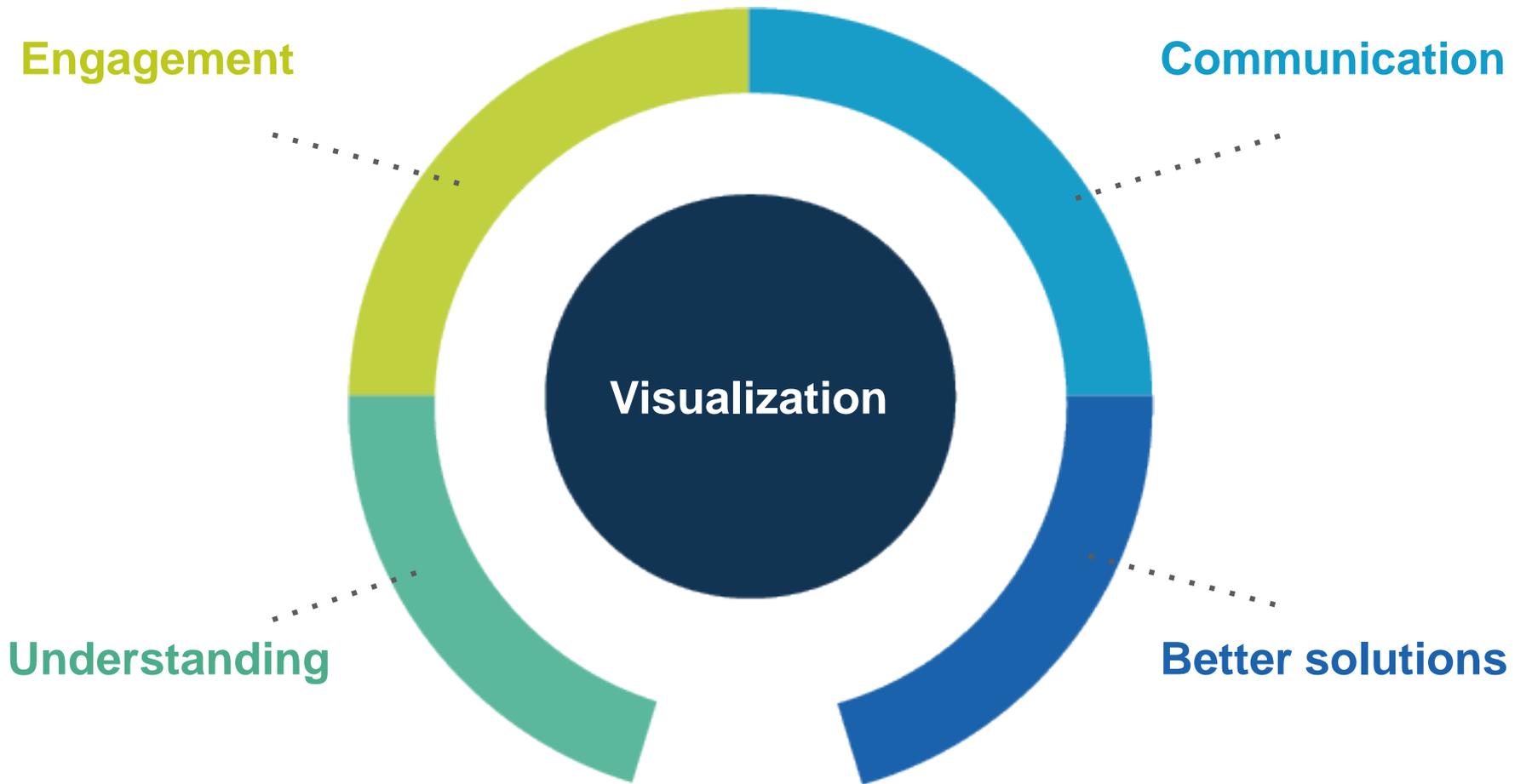
# Agenda

- Benefits of simulation to analyze laboratory flow
- Common uses and case studies
  - Assessing the impact and ROI of new machinery
  - Selecting optimal layouts
  - Understanding how the current system will cope with demand changes
  - Testing total lab automation
  - Impact on hospital flows
- Useful simulation techniques



# *Why* use simulation?

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# Easily capture real life variability

	Serum	Citrat	EDTA	others	Total
12:00 AM	0	0	0	0	0
1:00 AM	0	0	0	0	0
2:00 AM	0	0	0	0	0
3:00 AM	0	0	0	0	0
4:00 AM	0	0	0	0	0
5:00 AM	2	3	2	3	10
6:00 AM	1	3	1	1	6
7:00 AM	7	5	15	4	31
8:00 AM	10	12	18	9	49
9:00 AM	12	15	4	8	39
10:00 AM	6	7	8	4	25
11:00 AM	9	10	9	6	34
12:00 PM	4	3	2	2	11
1:00 PM	13	12	7	3	35
2:00 PM	14	11	8	10	43
3:00 PM	7	6	9	4	26
4:00 PM	9	8	4	1	22
5:00 PM	10	8	6	5	29
6:00 PM	4	5	3	2	14
7:00 PM	3	4	1	6	14
8:00 PM	4	3	6	3	16
9:00 PM	3	2	1	1	7
10:00 PM	2	2	2	1	7
11:00 PM	1	2	1	1	5
Total	121	121	107	74	423

# Can model complex logic and rulesets

*“How many samples should be loaded into my machinery before it starts?”*

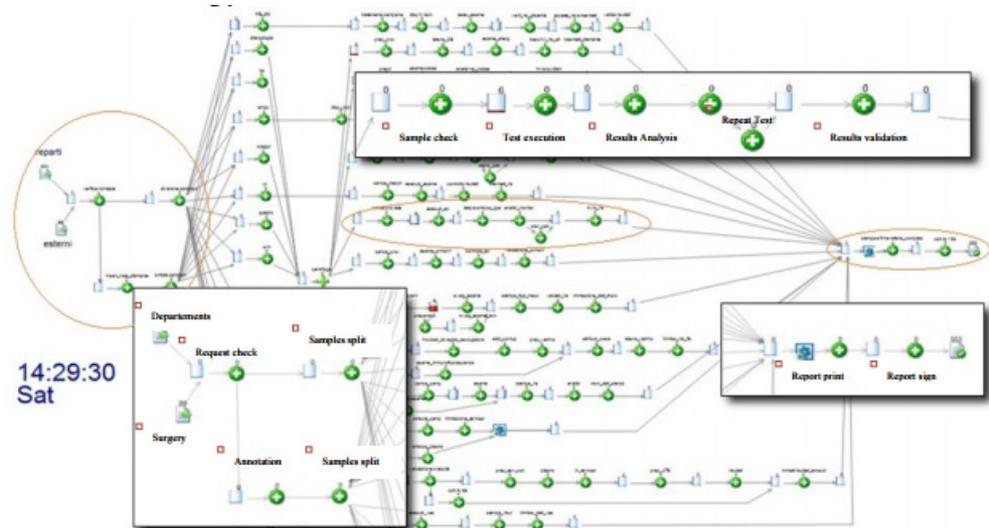
*“What is the chance of resampling based on product information?”*

*“What hours of the day do staff work and how does that impact flow?”*



# Whole systems thinking

- Visualization of bottlenecks
- Throughput
- Time in system



# Common uses

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# Assessing the impact and ROI of new machinery

## Buying

Acquiring new equipment is a significant investment, so ensuring the machine you buy is suited to your product and process is essential.

## Selling

To give a visual and accurate sense of the positive impact of using different products.



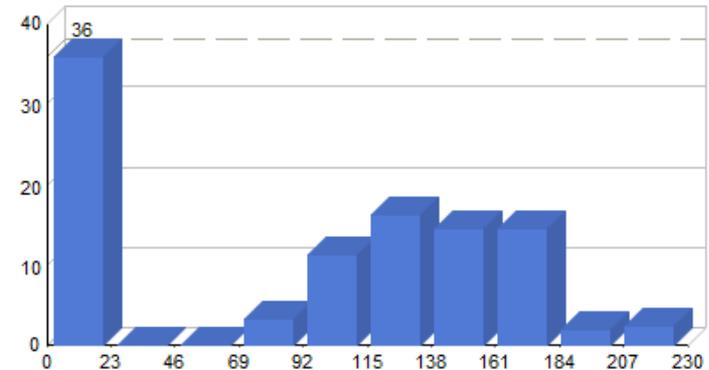
# Simulation use

## Does new machine remove bottleneck?

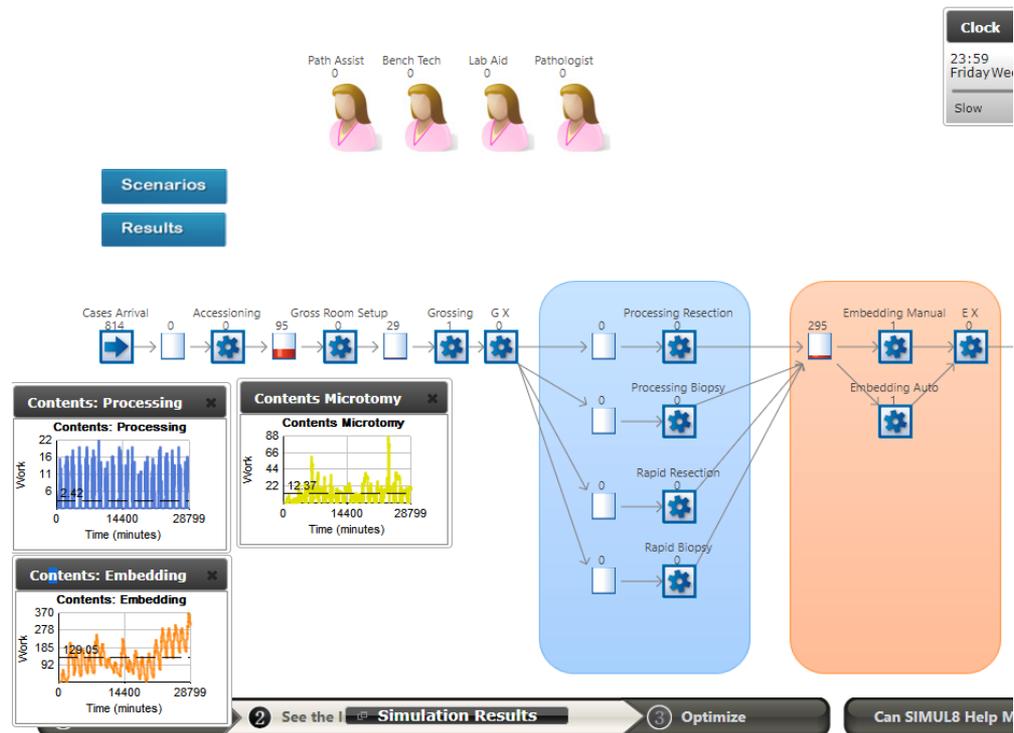
- Impact on waiting time
- Impact on time in part of system
- Utilization of machine

## How does this impact the rest of the system?

- Has the bottleneck moved
- Time in system results
- Results against targets



# Case study - Comparison of tissue processors in a complex anatomic pathway



# Total or partial lab automation

## Automating a laboratory can bring several benefits

- Faster, more accurate results (better patient care)
- Increased reliability with less chance of human error
- Repetitive and boring tasks can be completed by machinery

Lab automation could be considered inevitable. With costs of implementing these laboratories being so high how can we quantify their impact to show a clear return on investment

# Simulation uses

## Assess:

- ✓ Expected speed of access to results
- ✓ Staffing requirement
- ✓ Long term cost benefit analysis

# Example - Sysmex GLP Track System



Located in Hamburg, Germany, GLP systems develops cutting-edge automation systems for clinical laboratories, including total-automation and modular solutions.

# Different layouts and demand patterns

## Laboratory growth

Until the early 1980s, most laboratories experienced increasing work loads. A growth rate of 15% per year was not unusual.

## Using current space more efficiently

Now there is an emphasis on more efficient processes in current work areas, but the lab layout is still a common simulation use.

## Moving the laboratory to a new location

# Simulation uses

## Testing of layouts

- Re-configuration of machines
- Changes in lab size
- Analysis of space availability

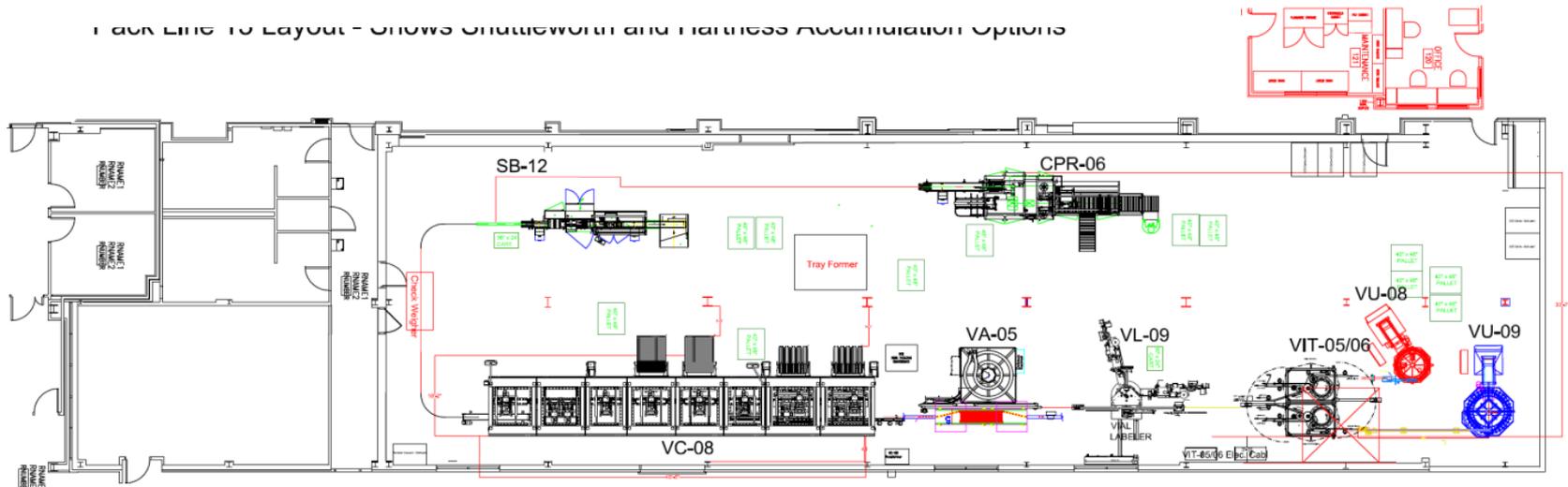
## Testing demand changes

- What is the limiting factor
- Impact of changing
- Can I still meet targets
- Impact of outsourcing

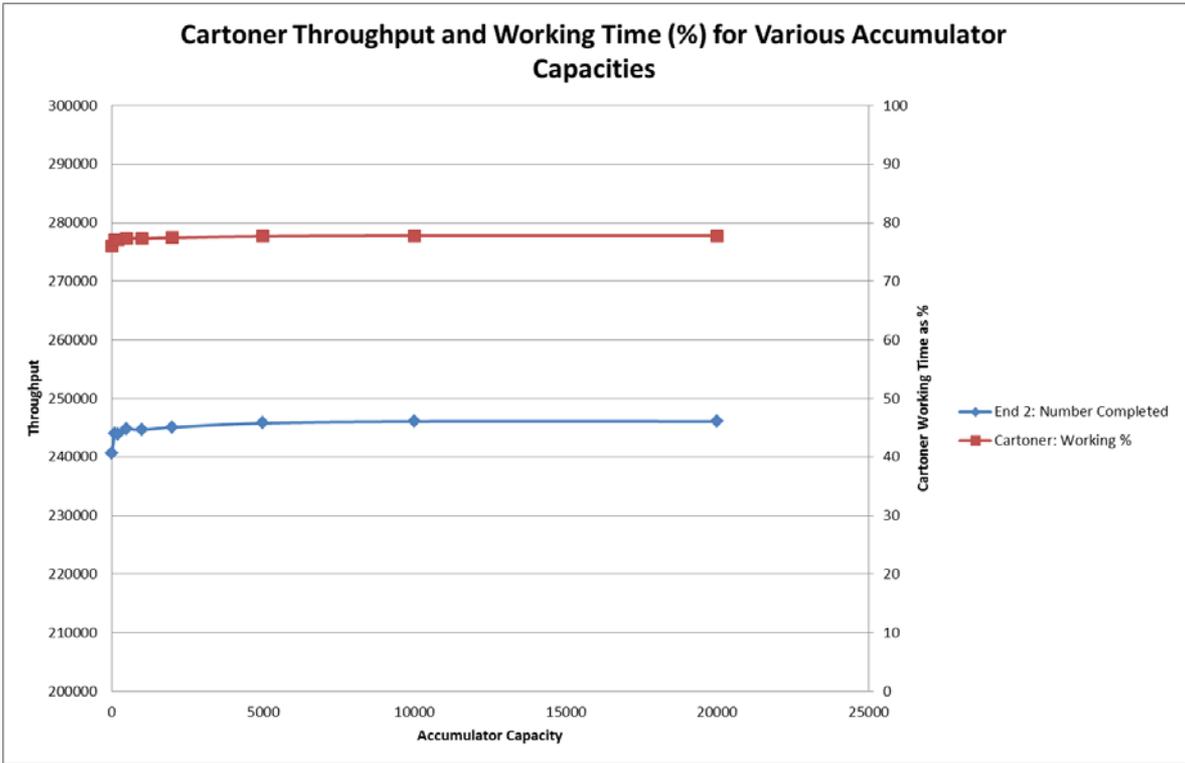
# Example 1: Large Pharmaceutical Client

To explore the affects of positioning an Accumulator ahead of the Cartoner. This preliminary report examines the throughput and machine performances that were recorded when testing various Accumulator capacities.

Track Line 10 Layout - Shows Shuttleworth and Harness Accumulation Options



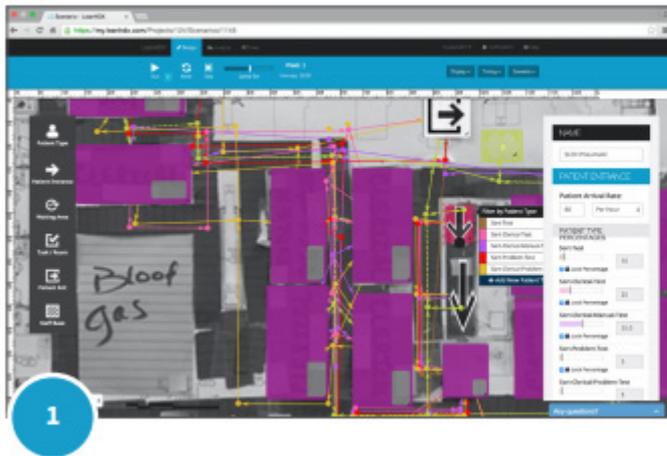
# Results



# Example 2: BJC Diagnostic Labs

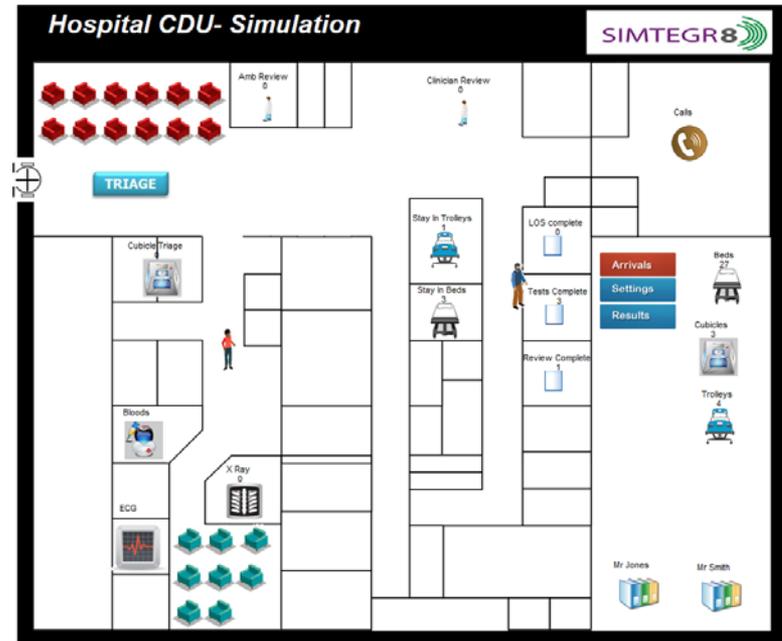
- Consolidation of labs into a single location- with two potential designs
- Reduce waste in staff travel time by 37% at the sort station
- Determine the right staffing levels

The two proposed lab layouts:

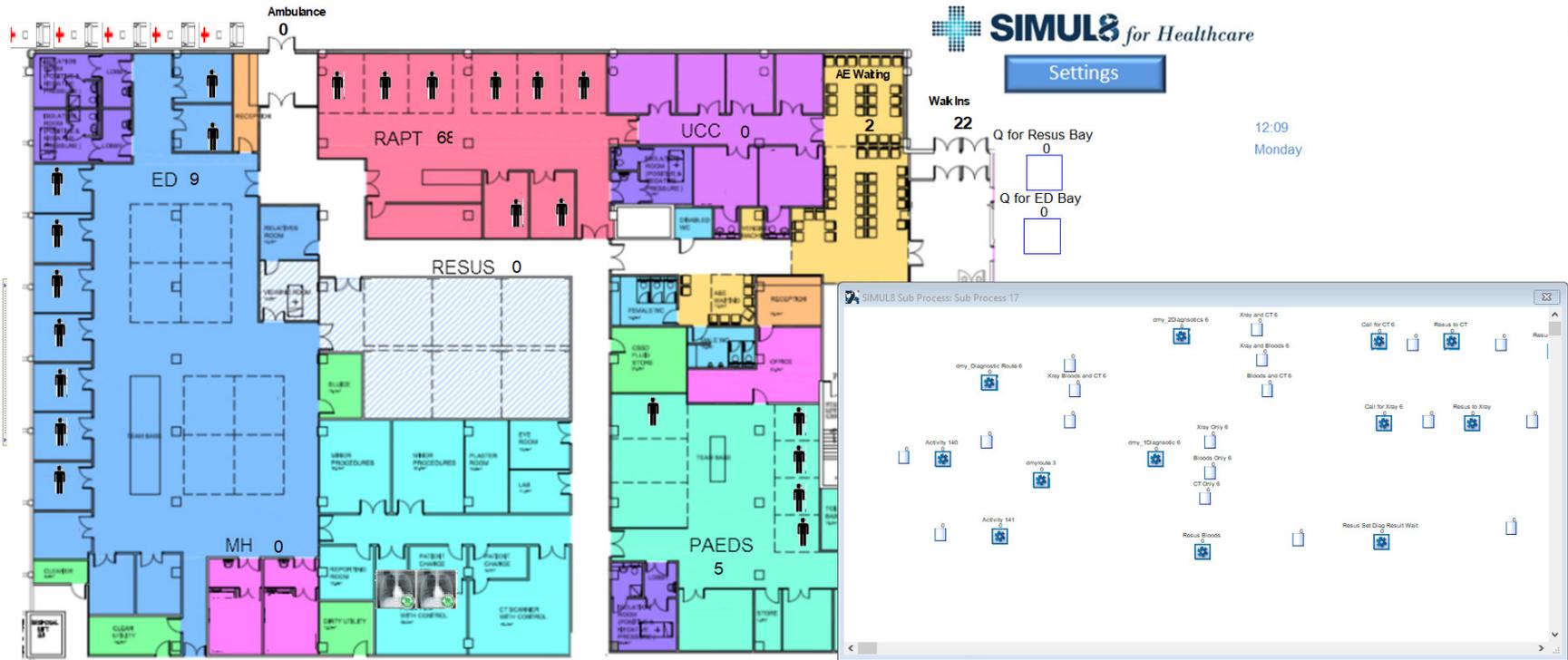


# Impact on the hospital

- If test results are not received quickly this can block patient flow in the hospital.
- Simulation allows parallel processing to be tested
- Isolate the time associated with waiting for test results



# Example: UK Emergency Department



# Useful results

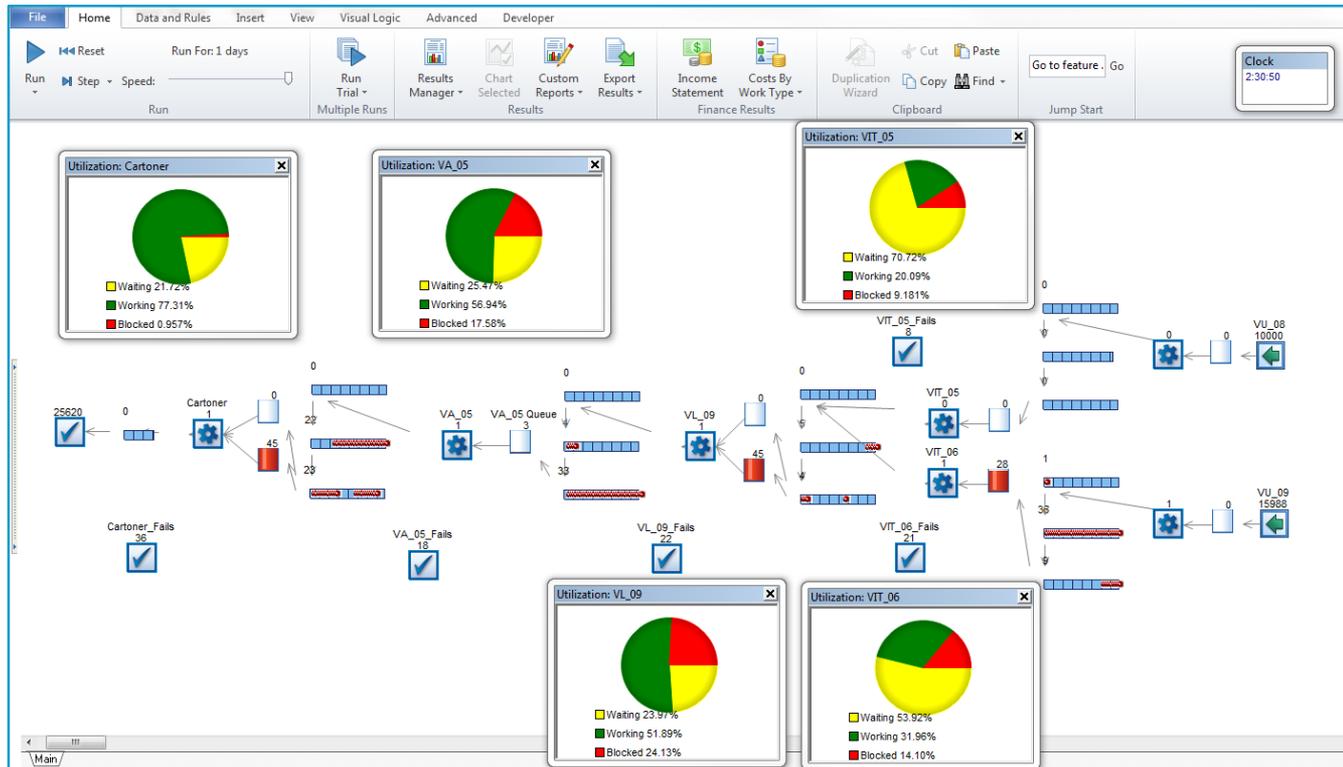
## Individual area

- Utilization
- Waiting time results
  - Maximum, minimum, average
  - Time within limit

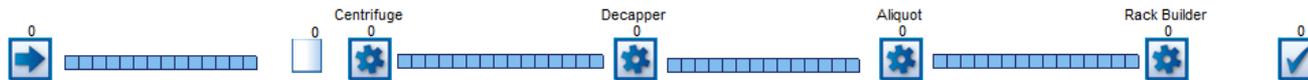
## The system

- Throughput
- Average time in system
- Cost

# Useful results



# Useful simulation techniques (live demonstration)





Thank you for listening.

Do you have any *questions*?



Recording will be available on *[SIMUL8Healthcare.com](https://www.SIMUL8Healthcare.com)*

Continue the discussion on our  
LinkedIn group, **SIMUL8 in Health**

