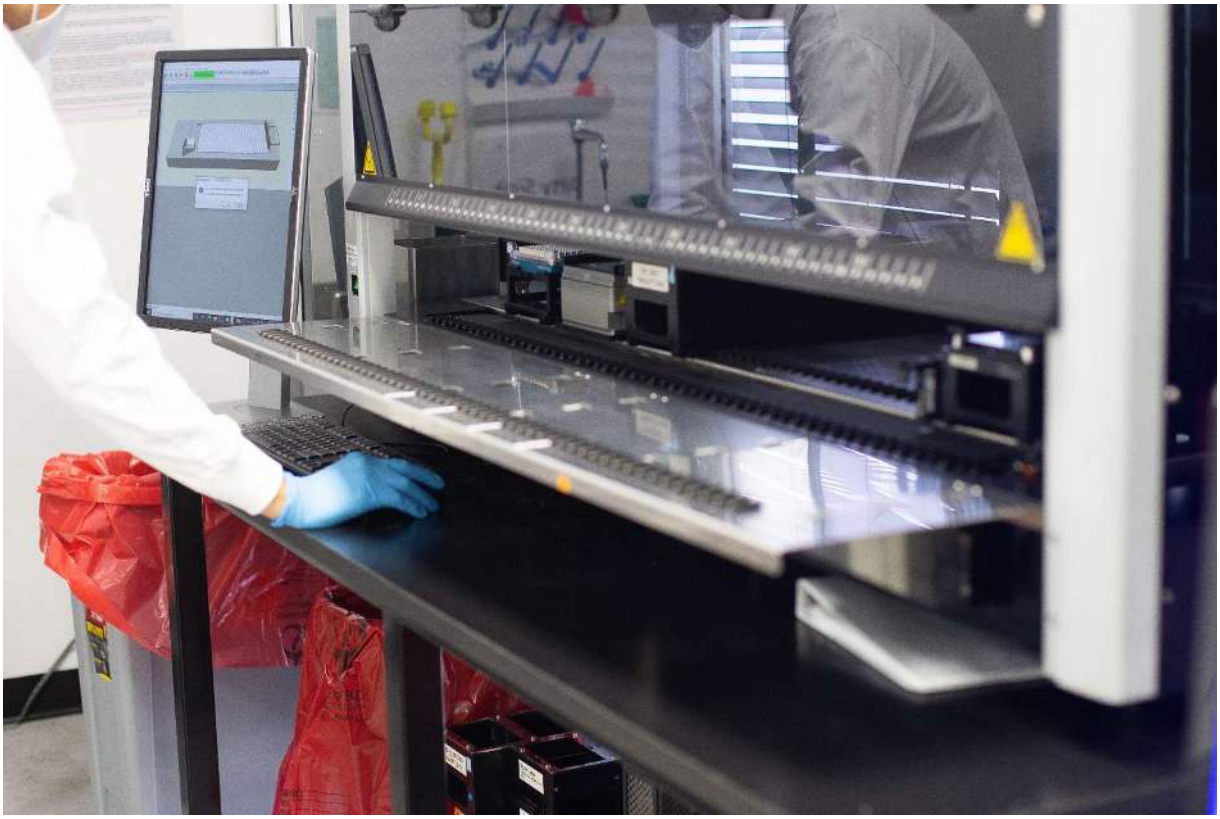

A Discovery on Process Improvement Opportunities on a Covid PCR Test Laboratory

Product: Covid Testing

KPI: throughput

Geography: United States

Industry: Healthcare

Project Time: 2 months

Customer: Undisclosed

The high demand on COVID testing during the pandemic generates high pressure on a laboratory to provide testing results in short amounts of time, while being able to leverage the current facility and resources, understand what new machines they need to invest in and understanding the current situation in the lab to confirm that the ideas proposed by management are followed by employees in the laboratory.

On this unique lab, they work with corporate entities in which the concept is to test multiple people in the group and provide results for all group in a pre-defined amount of time.

It was clear that a simulation model was needed to gather data on the maximum throughput possible in different scenarios.

The Process

The journey of a COVID swab sample follows a set of high-level processes that are described as follows:

1. A swab is used to collect the sample from the patient. The corporation pays as a default for 24 hours results but can also pay premium delivery for a 12-hour result.
2. A truck consolidates all the samples in coolers and moves from the location where the tests were made to the lab.
3. The coolers are removed from the trucks and received in the laboratory. All these samples are ready to be stored.
4. The samples are stored in a storage room based on testing priorities and scanned. Green samples have more than 12 hours remaining, yellow samples have between 4 and 12 hours remaining, and red samples are urgent and have less than 4 hours remaining.
5. The PCR process is executed on a set of samples by doing sample addition, extraction, elution, PCR plate preparation and resulting.
6. The PCR result is observed by a scientist and sent to the patient individually.

Simulation – First Attempt

The simulation of the processes governing the sample journey during the study was developed using the management undertanding on how things are done in the lab, and using the data provided by either the employees or the scanning information of each sample group during each step of the process. Figure 1 shows the layout of this lab.

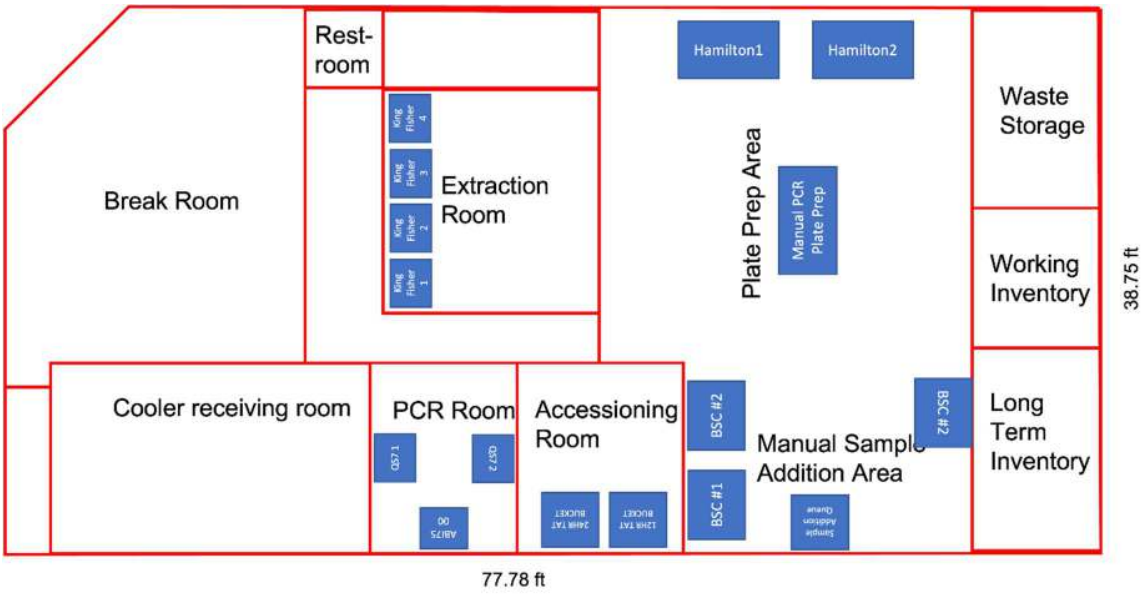

Figure 1. Layout

On this first simulation attempt, results didn't match the empirical data. The simulation showed that according to the processes that leadership provided the lab workers, it would be impossible to have deliveries below the promised times, nevertheless the data showed that in reality, they were covering almost 100% of the promises under the normal demand pressure.

At first, the hypothesis was that the simulation was wrong, but upon further inquiry it was discovered that the workers were doing things far better than what the management suggested. One example of this was that the management wanted to wait 3 hours to be able to process larger sample groups in case new samples arrived during the day, but the employees ignored this and other inefficient directives. When the new concept was entered into the simulation, the data finally did fit. This is a typical exploratory component that is often seen during simulation modeling work, in which management learns a lot about their own processes because a simulation forces them to do so.

Simulation – Second Attempt

It was the management directive for the samples to be scanned as soon as they are racked, but again the simulation showed that there were too many samples delivered after 24 hours, which was not something that was happening in the real lab. We proposed that maybe the samples were not actually scanned when racked, but instead, were scanned when removed from the rack. This is important because the 12 o 24 hours delivery period was not promised from the moment the sample was collected, but instead from the moment the sample was racked, without considering the traveling time from the location to the laboratory since in many cases it was very far away.

Upon further inquiry, it was discovered that to save time, lab assistants were scanning the samples not when racked but when the process starts, which is in a way, cheating the patient. This was also a new discovery for management. And as soon as this was implemented in the simulation, the data fit the results perfectly well. The simulation dashboard is shown in figure 2.

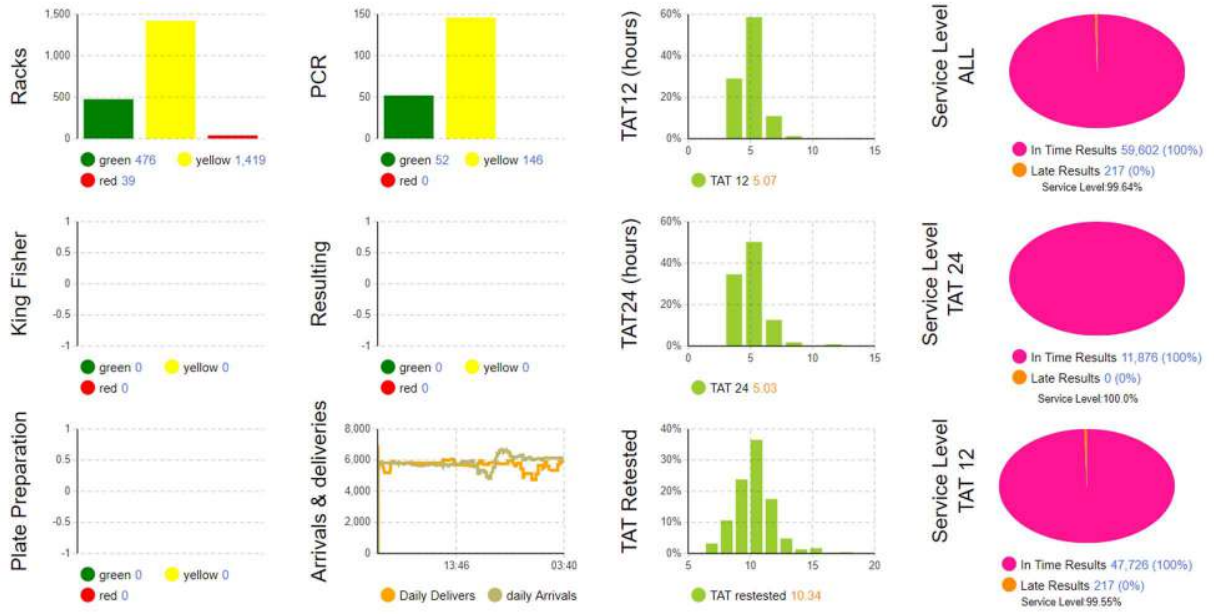

Figure 2. Results Dashboard

Conclusion

When a simulation is developed, beyond the costs savings and process improvements, it's very important to notice that it becomes a tool of self-discovery, in which process managers and stakeholders learn about their own business in a way that cannot be done without simulations.

This simulation tool was given to the customer for testing and experimentation to see if it's worth training staff to be able to do certain processes, to understand if they should invest in new machines, to understand if they should hire new staff for peak demand and to discover what strategies to use in general.

It was also important to test during the simulation work what was the maximum throughput that the laboratory could take under current conditions, which turned to be a bit more than 5000 samples per day. Nevertheless, the potential using shared resources, new machines, and some improvements in the processes, it was discovered that there was a potential of near 8000 samples per day with an undisclosed investment in new machines and a more abstract training cost that was going to be evaluated for new and current employees. This corresponded of between 40 to 50% throughput improvement.