Automation and optimization: the importance of the health check

By Alistair Gammie, PhD

Automation is one of the biggest investments a laboratory can make. The goals of automation are to make workflow more efficient, improve the turnaround time and predictability of test results, and reduce errors. Many factors must be considered when exploring automation solutions. One important requirement is the need to choose an automation partner that has the expertise and capability to help manage the changing needs of the lab over the course of the automation contract.

The implementation of laboratory automation begins well before any contract is signed, with selection and institution of the project-management methodology that will be used throughout the project. As the engagement proceeds, it is important to manage the installation and implementation process according to the project plan as well as to establish the key performance indicators that will demonstrate that the process has been successful.

Health checks: what and why?

The period following the implementation go-live date is the beginning of a new phase in project management—the health check or optimization phase. There are three main reasons why health checks are necessary: internal forces, external forces—and peace of mind.

Internal forces include change-management issues that prevent necessary process changes, even though the implementation of the automation system proceeds as originally planned. Also, changes to service-level agreements often challenge the planned-for test volume and utilization.

External forces include changes to regulations such as ISO 15189 and to working terms and conditions, both of which can refocus staff activity. Healthcare as a whole is going through a period of consolidation, and workloads may change dramatically due to mergers and acquisitions.

Even without disruptive forces such as these, it is still essential to ensure that this expensive acquisition is delivering the appropriate level of production and return on investment.

Initial health check

It is critical to perform an initial health check on an automation installation within three months of go-live; the initial timing depends on the complexity of the installation. The goal of this first health check is to take the pulse of the system and understand how it is performing as a whole.

During implementation, the focus is on ensuring that the track, individual modules and analyzers, and requested IT workflow are in place and functioning correctly. In contrast, the health check assesses how the entire production system is working, from the time the sample enters the laboratory until the result is generated and the tube is disposed. The health check examines the human-machine interaction and takes a snapshot of the laboratory's current performance characteristics.

Making adjustments: action plan

The results of the initial health check help to set the performance benchmark for the laboratory moving forward. If performance is below target, an action plan is devised.

The action plan may include a rapid improvement event which may involve dissecting and rebuilding the current process, removing non-value-added steps. The new process is then implemented, measured, and refined as necessary, following the Plan-Do-Check-Act steps of traditional continuous improvement.

The action plan may also include specific training events, technical refinement of the system, or a combination.

If an action plan is required, the health check is repeated within a month of its completion to ensure that the improvements have been realized.

Health check

After the initial health check and any required improvements, health check events should be performed annually, although they may need to be conducted more frequently.

In an optimization, it's recommend that two to three days' worth of log and middleware files be collected and then analyzed in four distinct categories: production, utilization, turnaround time (TAT) analysis, and errors.

In the production analysis, each module and analyzer should be assessed to see how many tubes and tests are being processed per hour. Analysis criteria may include the distribution of processing within module and analyzer groups, the load balance, and how samples are being processed (e.g., batch size, front loading, etc.).

Utilization looks at the theoretical and effective capacity of each module and analyzer (depends on tube and test density) in order to monitor the effect of annual growth rates, identify capacity for service improvements, and make decisions to increase capacity by adding individual modules. The utilization analysis can identify specific pressure points and help the laboratory make informed decisions for service improvement.

TAT analysis looks at routine and STAT samples, measuring standard deviation, mean, and 95th percentiles, and considers other statistical parameters if necessary. The TAT analysis is conducted holistically but can be driven down to analyzer, analyzer group, and test level. It can also be stratified by time segment. For example, TAT analysis could assess test order time to time the tube is first seen on the track, which allows an understanding of pre-analytical TAT. It could also look at time on track to time out of centrifuge to determine whether the centrifuge operating characteristics are set correctly to manage the workload.

Error analysis assesses the number and type of errors and information messages recognized and recorded by the automation system and attached modules; many of these messages are unimportant when seen in isolation, but very high numbers or patterns seen across days can highlight sample-handling issues that reflect on the human-machine interface. This is particularly helpful when looking across operation of all three shifts.

After data collection and analysis, a one-day, on-site observational analysis allows integration of the collected data with what is actually happening in the laboratory. A review of the analysis and observations may result in a clean bill of health, or a few recommendations, or a full action plan.

This brings us back to peace of mind. A deep understanding of laboratory performance provided by health checks can help the laboratory director to achieve that often-elusive goal. □

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