

Increasing Time Efficiency and Performance Consistency When Automating Acoustic Tube Storage and Downstream Workflow

A Case Study
featuring the Verso® Q20



Overview

A young pharmatech company seeks to challenge and change the status quo when engineering drugs to benefit patients. From a corporate standpoint, this company's strategy includes applying artificial intelligence (AI) to engineer novel therapies rapidly and efficiently. At the day-to-day tactical level, they leverage automated tools including the Verso® Q20 automated sample storage system from Hamilton to save valuable processing and labor time.

Introduction

The drug development pipeline is notoriously long and cumbersome, often taking 10 years or more to bring a single drug to market. While potential candidates are very slowly weeded out of contention due to inefficiencies, high failure rates, and other factors, disease and ailments continue to spread and negatively impact patient health and wellbeing.

This cutting-edge and AI-centric pharmatech is taking a leadership role in reducing the drug development timeframe. As it grows, it seeks additional ways to increase efficiencies and reduce time.

Challenges



Acoustic Tube
Compatibility



Consistency



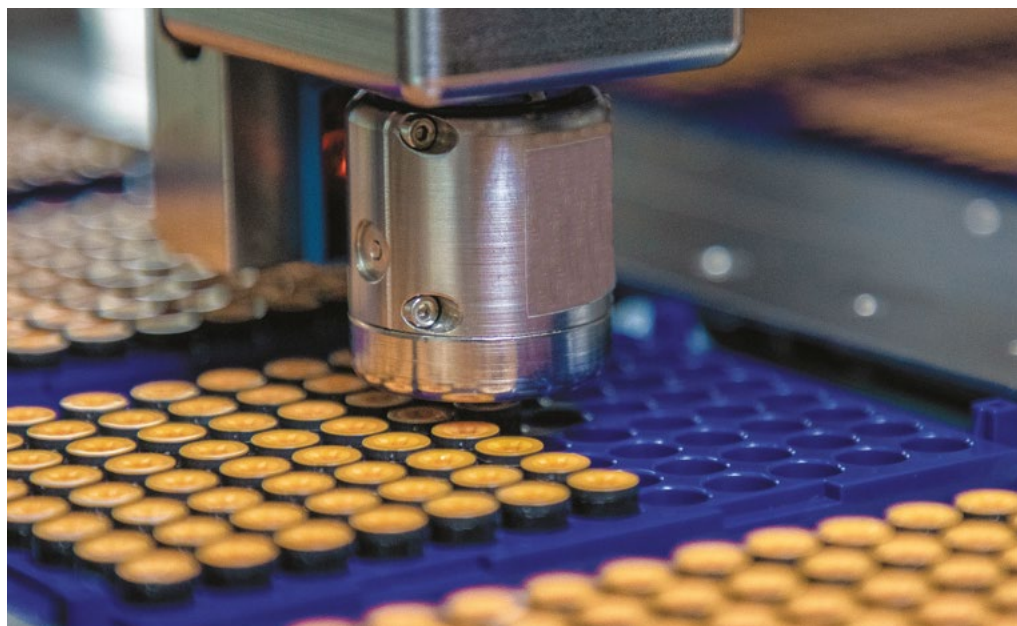
Time



Lab
Space

In the area of compound logistics, precious samples at the pharmatech were previously stored in tube racks and manually placed in a -20°C freezer. If users removed the wrong tube, or placed a tube in an incorrect location, this error would consume valuable time to correct, wreak havoc on downstream processes, and increase unplanned costs.

The sample management team had recently incorporated an acoustic liquid handler to dispense very small sample volumes into 96-, 384-, and 1536-well assay plates for downstream processing. Users were working with tweezers to manually pull acoustic tube-based samples from among the stored racks. This manual process of picking, confirming the sample, and decapping the tubes was incredibly time consuming.





In order to reduce picking and turnaround times, and also reduce the risk of human variability and error, they needed the speed and reliability of an automated storage system and started to search for a system that met their needs.

In addition to requirements for -20°C temperature, a dry storage environment, and hands-free operation, their automation search was bounded by two challenges.

The first challenge was size:

Stored sample quantities were in the range of tens of thousands, so large automated storage systems designed to manage hundreds of thousands to millions of samples were deemed inappropriate. As the company planned for growth and lab expansions, they needed a sample storage system that could be easily moved at any time.

The second challenge was in manipulating the acoustic tubes:

The acoustic liquid handler's transducer must contact the bottom of each acoustic tube. The 2D barcode is therefore split into four quadrants on the bottom of each tube so that the code does not interfere with the transducer's function. Their ideal sample storage system must both manipulate small acoustic tubes and read the barcode.

Solution

The pharmatech reached out to Hamilton to facilitate their very specific automated needs.

In mid-2022, after much testing, an automated workflow was put into daily use. It starts with the Verso Q20 automated sample storage system. This high-density store holds up to 36,000 sample tubes and is small enough to sit conveniently next to the lab bench. Its small footprint means that additional units may be added as the lab grows.

An I/O module facilitates easy sample placement, and the system is controlled via an intuitive touchscreen interface or remotely using an enabled mobile device. In addition, the pharmatech's laboratory information management system (LIMS) can be easily integrated, allowing the LIMS to start pick

jobs directly. The system can pick individual tubes or entire racks.

The Q20 in this lab was configured at -20°C temperature with a dry environment to protect the DMSO-based samples. Additionally, the Verso Q20 seamlessly operates with the uniquely designed acoustic tubes and their split barcodes.

With Hamilton's support, the pharmatech performed verification testing to ensure that acoustic dispensing retained high accuracy with tubes stored and picked from the Verso Q20. As seen in Figure 1, results indicated an excellent coefficient of variation (%CV) among reference samples and compound samples picked at different temperatures. This indicates a high degree of consistency in dispensing after processing in a Verso Q-Series system.

Dispensing Accuracy Verification after Tube Storage and Processing in the Verso Q20

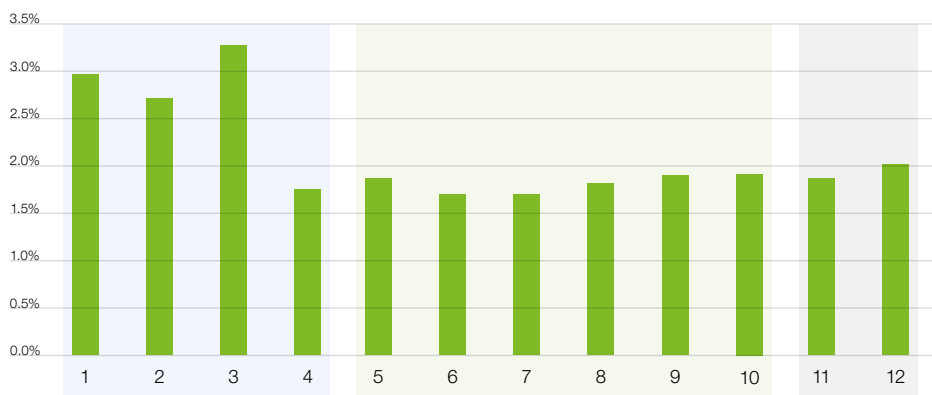


Figure 1. Acoustic dispensing accuracy of reference samples and compound samples picked at different temperatures showing %CVs consistently below 3.5%. Reference samples shipped and stored only are shaded in blue, samples picked at +20°C are shaded in green, and samples picked at -20°C are shaded in grey. Samples were picked between one and 100 times.



Users can create a pick list and attend to other tasks while the Verso Q20 automatically picks the samples. After a pick job is completed, the samples remain inside Verso Q20 at storage temperature. At any convenient time, the user selects the pick job and retrieves the entire rack (or multiple racks) within approximately 15-20 seconds per rack. This minimizes active user time so that they may focus on other high-value added tasks. The retrieved tubes are then centrifuged, identified, and decapped.

Finally, the decapped samples move to the acoustic liquid handler, where 15-70 nL volumes are dispensed into assay plate wells. After dispensing, the samples are recapped and placed back into the Verso Q20's optimized storage environment. Inventory and sample movement are precisely tracked and communicated in real time with the LIMS to reduce errors and maintain overall laboratory efficiency.

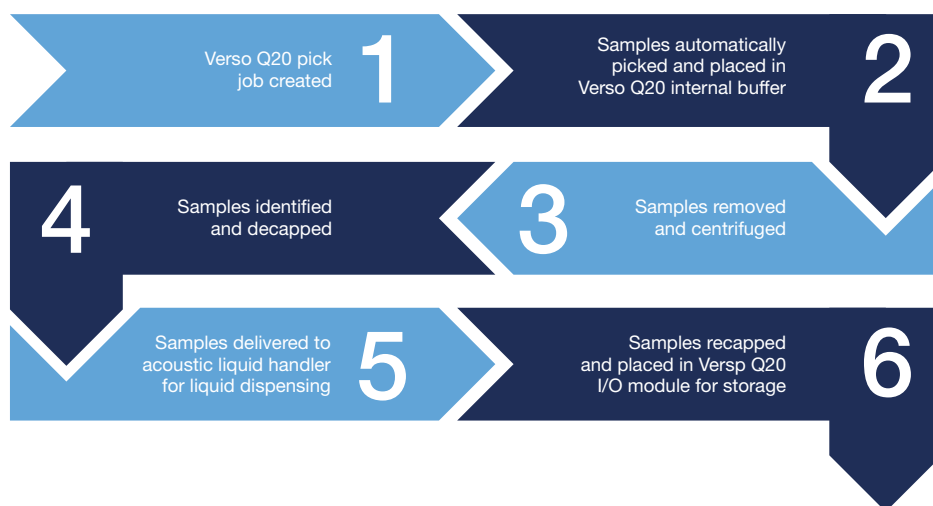
Summary

Using the automated workflow, anywhere from 10-300 compounds are prepared each day. Automated sample picking saves significant time in the workflow. For example, where it may have taken the team 30 minutes to manually pick 10 compounds, it now takes a single user one minute to start a pick job and collect the picked tubes.

Equally beneficial is the consistency gained by removing risks of human variability and error, and the freedom for users to attend to higher value tasks while the samples are automatically picked.

In the near future, the pharmatech plans to conduct sample integrity studies to compare how the sample changes over time in the automated store compared to manual storage. These studies will underscore the importance of the Verso Q20's automated functionality. The pharmatech also plans to incorporate two additional Verso Q20 units for compound management and an additional Hamilton store to be used in its biology department.

Automated Assay Plate Preparation Process



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