



B110 Quality and Throughput From a Highly Integrated, Automated Casework Sample Processing Platform

Benoît Leclair, PhD, Timothy D. Kupferschmid, MFS, Corey L. Schwensen, MS, Stephen Gresko, BS, Victor Thompson, BS, Brian E. Ward, PhD, and Tom Scholl, PhD, Myriad Genetic Laboratories, Inc., 320 Wakara Way, Salt Lake City, UT 84108*

The attendee should have a clear understanding of what current automated sample processing technologies can do for current casework loads and backlogs, in terms of process quality, flexibility and throughput.

Currently, long manual processing times give offenders ample opportunity to re-offend. Highly integrated automated solutions have the potential to eliminate backlogs, provide quick turn-around on newly submitted cases, increase crime resolution rates, and deny repeat offenders the opportunity to re-offend. Countless victims of violent crimes could be spared their ordeal.

The demanding nature of forensic casework evidence makes of sample processing a labor-intensive manual undertaking. Submissions of criminal casework involving biological evidence currently exceed installed processing capacity in numerous jurisdictions. It is currently estimated that across the United States, over 500,000 criminal cases with biological evidence are awaiting processing.

Highly integrated, automated biological specimen processing platforms have been in use in high-throughput clinical and large-scale genetic research facilities for many years, and more recently in felon genotype data banking initiatives. These systems have reached a level of maturity that warrants leveraging this experience into the casework sample processing arena, despite the demanding nature of casework biological evidence. This report presents the result of the development efforts towards the implementation of highly integrated, automated casework sample processing platform.

The development goals were to achieve performance standards comparable to or better than a traditional manual process with regards to genotyping results, sample consumption, process flexibility, and chain-of-custody. In addition, the platform fully exploits process tracking, throughput and scalability capabilities. The entire process is overseen by a custom-built LIMS addressing the specific requirements of forensic casework. It tracks samples, their derivatives and associated process-generated data from the moment the samples enter the facility. It controls all robotic processes, ensures process integrity and sample tracking through the extensive use of barcodes. It automatically computes quality metrics and performs trend analysis to monitor / document process quality.

Experienced analysts manually search exhibits for biological stains. According to the specifics of the case, cuttings enter the automated processing platform under the "Differential" or "Non-Differential" pathways. TECAN robotic liquid handlers perform all processes from cell lysis to the production of capillary loading plates. Robot-based chemistries are optimized to deliver quantitative DNA extraction yields from scarce samples. DNA is extracted with ChargeSwitch para-magnetic beads, and quantification is performed with the Quantifiler Autosomal and Y kits. All commercial STR megaplexes are supported. The high precision, accuracy and reproducibility of robotic pipetting contribute significantly to overall process quality. The batching of samples for robotic processing yields considerable efficiencies in process execution time.

To support process flexibility and minimal exhibit/extracted DNA consumption, the LIMS provides the analyst with customizable re-work pathways from any given step within the platform, as well as process branch-off points to return a sample to offline processing. The LIMS incorporates numerous user interfaces that allow the analyst to follow / audit the processing path of a sample and maintain total control on the processing of samples. The entire system is built under a novel architecture that allows for new processes or submitting agency preferences to be quickly integrated, extensively tested and validated.

A complete developmental validation study was conducted according to SWGDAM guidelines and demonstrated the reliability of the platform. This presentation will showcase case examples processed by this high quality, automated system.

Automation, Casework, Validation