AUTOMATED, HIGHLY INTEGRATED CASEWORK SAMPLE PROCESSING

Tom Scholl, Timothy Kuperferschmid, Benoit Leclair, Corey Schwensen, Stephen Gresko, Victor Thompson
Myriad Genetic Laboratories, Inc., Salt Lake City, UT

It is currently estimated that across the United States, over 500,000 criminal cases with biological evidence are awaiting processing. The accumulation of such a large backlog is the consequence of the success of DNA-typing technologies in resolving crimes, but also a reflection of the throughput limitations of a largely manual processing system. Myriad Genetic Laboratories has extensive experience in high-throughput, fully integrated automated analytical platforms, and is completing the development of a scalable automated processing capability to address casework backlog issues to complement the activities of its NSFTC, ISO 17025 and ASCLD accredited traditional casework laboratory. The guiding principles of this development effort were: 1) the platform must be reliable, flexible, versatile, scalable; 2) generated DNA profiles must be of same or higher quality when compared to those obtained through a traditional process.

A LIMS system handles sample accessioning and chain-of-custody, interface with robots and users, data traffic management. Robotic protocols are designed to consume the least amount of evidence sample, and the LIMS supports extensive and flexible robotic re-work pathways. Customized robot worktable hardware and extensive use of barcodes allow for error-free transfer to 96-well plates of evidence material collected in standard Eppendorf tubes during exhibit search. Process pipelines are devised to handle different types of sample submissions, and the demanding differential extraction of vaginal swabs has been fully automated. DNA is captured on magnetic beads, quantitated with Quantifiler kits for autosomal and Y, normalized, used for PCR set-up of STR analysis and fed with a LIMS-generated sample sheet to AB 3100 instruments in one seamless process. A LIMS-generated sample processing history is embedded within every electropherogram file, allowing for context-sensitive STR data interpretation with data review software. The analyst retains the unrestricted ability to customize the automated re-processing of any challenged sample from any given step within the platform. The LIMS supports a number of reporting formats to assist the forensic scientist in the production of reports and returnable data, and robotic routines to re-package samples for shipping back to the customer.

The system has been built under a novel architecture that allows for new processes or customer preferences to be quickly implemented, and handles all commercial STR megaplexes. The batching of samples yields considerable efficiencies in process execution time. The use of robotic liquid handlers has yielded highly reproducible results with no loss in detection capability. 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.