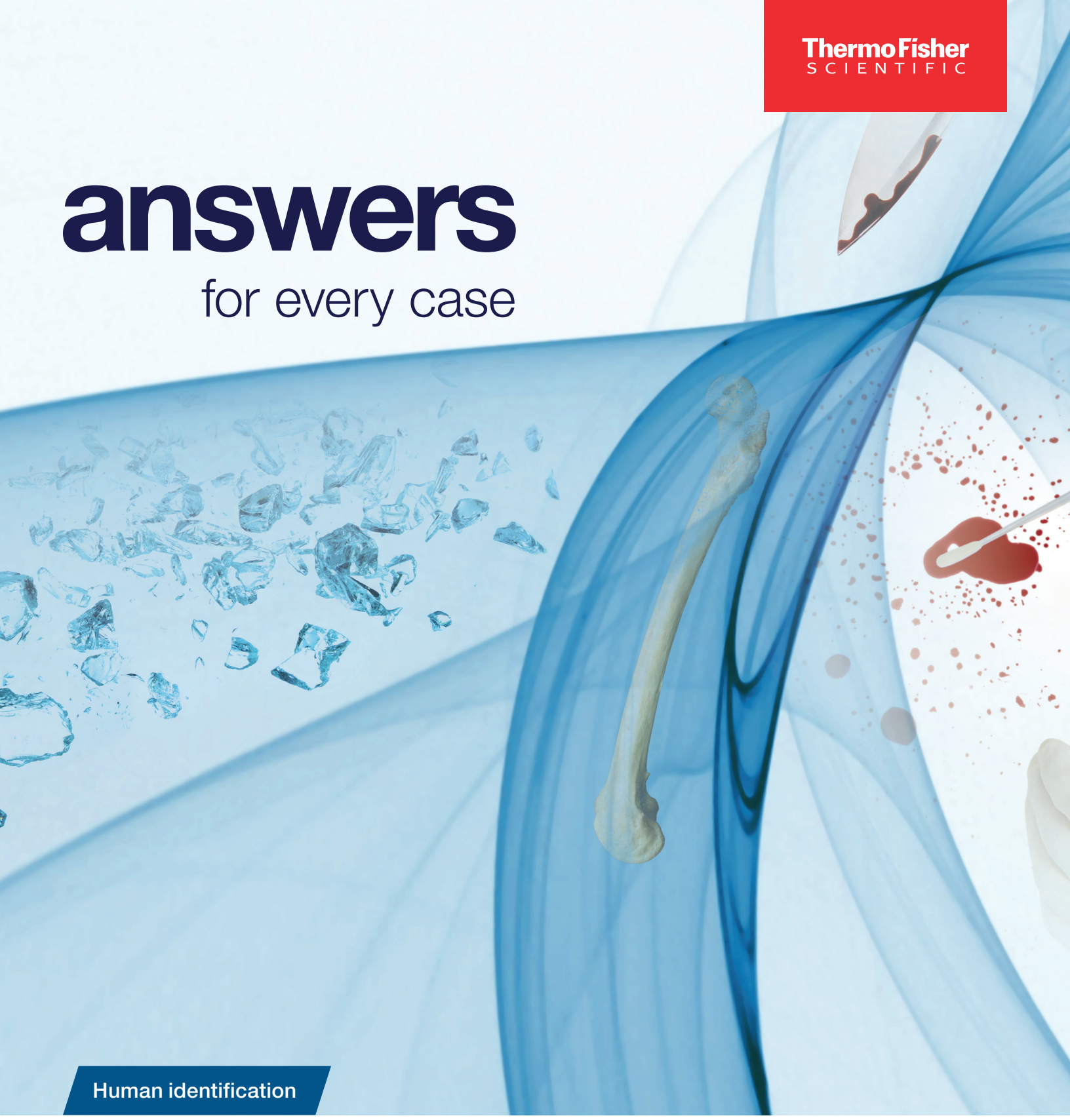
ThermoFisher SCIENTIFIC

answers

for every case



Human identification

Integrated human identification (HID) solutions

applied biosystems

From evidence to answers: your partner in forensics

When the world seeks the truth, it turns to you. But uncovering the truth presents complex challenges that require a partner you can depend on. That's why listening to and answering you is our highest priority, and informing everything we do—so you can focus on making a difference.

Thermo Fisher Scientific offers you simple, complete, end-to-end workflows for forensic DNA analysis to help resolve difficult cases and provide investigative leads in a forensically responsible and relevant manner. We are committed to delivering unparalleled support and continued innovation to meet your needs today and tomorrow.

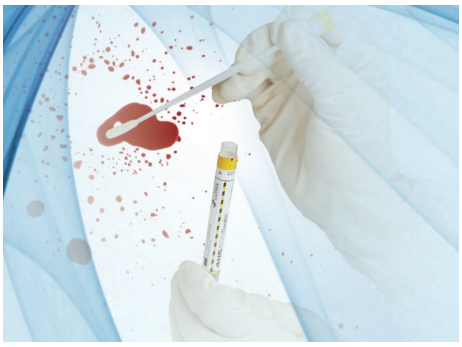
Bringing you ISO 18385 forensic DNA–grade products

ISO 18385 is a standard that addresses growing concerns within the forensic industry regarding the potential presence of low-level human DNA in consumables. The guidelines are intended to minimize the risk of human DNA contamination in products used to collect, store, and analyze biological material, as well as provide policies by which to assess products prior to release.

Many of our HID products are manufactured at our location in Warrington, UK—a facility that meets the guidelines for ISO 18385 certification. As part of our long-standing commitment to the continual adoption of new methods that help ensure high-quality manufacturing, we have made significant investments across all aspects of production to minimize human DNA contamination. The result: powerful forensic DNA–grade solutions that enable you to provide answers with certainty and confidence.

ISO 18385 Forensic DNA Grade

Contents



Sample preparation and extraction

Forensic samples are among the most difficult specimens to process. The quantity and quality of genomic DNA extracted and purified from a forensic sample is directly correlated to the success of downstream analysis. We provide a comprehensive range of sample preparation and extraction products, including the Applied Biosystems™ PrepFiler™ extraction chemistry product line, AutoMate *Express*™ extraction instrument, and Card Processing Automation 200 (CPA200™) system.

AutoMate *Express* Forensic DNA Extraction System and PrepFiler DNA Extraction kits

The Applied Biosystems™ AutoMate *Express*™ Forensic DNA Extraction System is an easy-to-use, robust benchtop instrument that offers maximum flexibility and utilizes the Applied Biosystems™ PrepFiler *Express*™ and PrepFiler *Express* BTA™ (bone, tooth, and adhesive) chemistries packaged in prefilled, foil-sealed cartridges.

The PrepFiler kits are specifically designed to improve the quantity and quality of DNA isolated from forensic samples, increasing the ability to obtain maximum information from downstream STR analysis.

Key features

- Designed to maximize results in a variety of samples—from high-quantity reference samples to compromised crime scene samples
- Offers easy setup and reduced hands-on time for faster time-to-results while minimizing the risk of contamination
- Optimized for the latest generation of Applied Biosystems™ quantification tools and STR kits
- Processes 1–13 samples in a single run
- Integrated circuit (IC) card with an unmatched range of variable elution options from 20 µL to 250 µL (Figure 1)

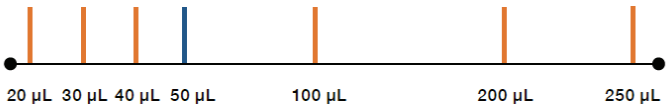


Figure 1. The AutoMate *Express* system comes with a preprogrammed card with a wide range of elution volumes.

Prep-n-Go Buffer

Applied Biosystems™ Prep-n-Go™ Buffer is a superior buffer designed to help enable high-quality direct PCR amplification of single-source samples collected on untreated paper or buccal swabs. This product expands direct PCR amplification capabilities to laboratories that use a wide variety of substrates, and is readily adaptable to both manual and automated workflows.

Card Processing Automation 200 instrument

The Applied Biosystems™ Card Processing Automation 200™ (CPA200™) instrument is a semiautomated puncher designed to process human blood or saliva DNA samples, collected on filter paper or cards, in forensic and paternity laboratories. The CPA200 instrument combines ease-of-use with full sample traceability and integrity to help improve downstream results in low- and medium-throughput laboratories.

ID NIMBUS Presto system with KingFisher technology

The fully automated ID NIMBUS™ Presto system allows you to efficiently purify nucleic acids from lysed samples in a 96 deep-well plate for use in sensitive downstream analyses such as DNA quantification and STR amplification. With rapid, automated processing and high-quality yields from even the most challenging samples, forensic laboratories can enjoy faster turnaround times with lasting confidence in results. The compact ID NIMBUS Presto system combines the Thermo Scientific™ KingFisher™ Presto Purification System with the Hamilton Microlab™ NIMBUS™ liquid handling workstation. The system is specifically scripted for use with the Applied Biosystems™ PrepFiler™ and PrepFiler™ BTA Automated Forensic DNA Extraction Kits.

The deck-mounted KingFisher Presto system utilizes magnetic particle–based technology to facilitate high-quality nucleic acid purification. A dual-position turntable allows processing of one plate while the integrated Microlab NIMBUS liquid handler simultaneously prepares and transports a second plate, without the need for manual intervention.

Key features

Less hands-on time

- Purify more samples with less hands-on time—up to 96 samples in about 1 hour
- Simple setup and walk-away workflow
- Minimal manual touchpoints to help reduce human error and contamination risk
- Highly skilled forensic scientists can focus on more complex tasks

High reproducibility

- Minimal variation in each sample and run
- Increased process standardization
- Consistent, reliable, accurate system providing results from a variety of forensically relevant sample types (Figure 2)

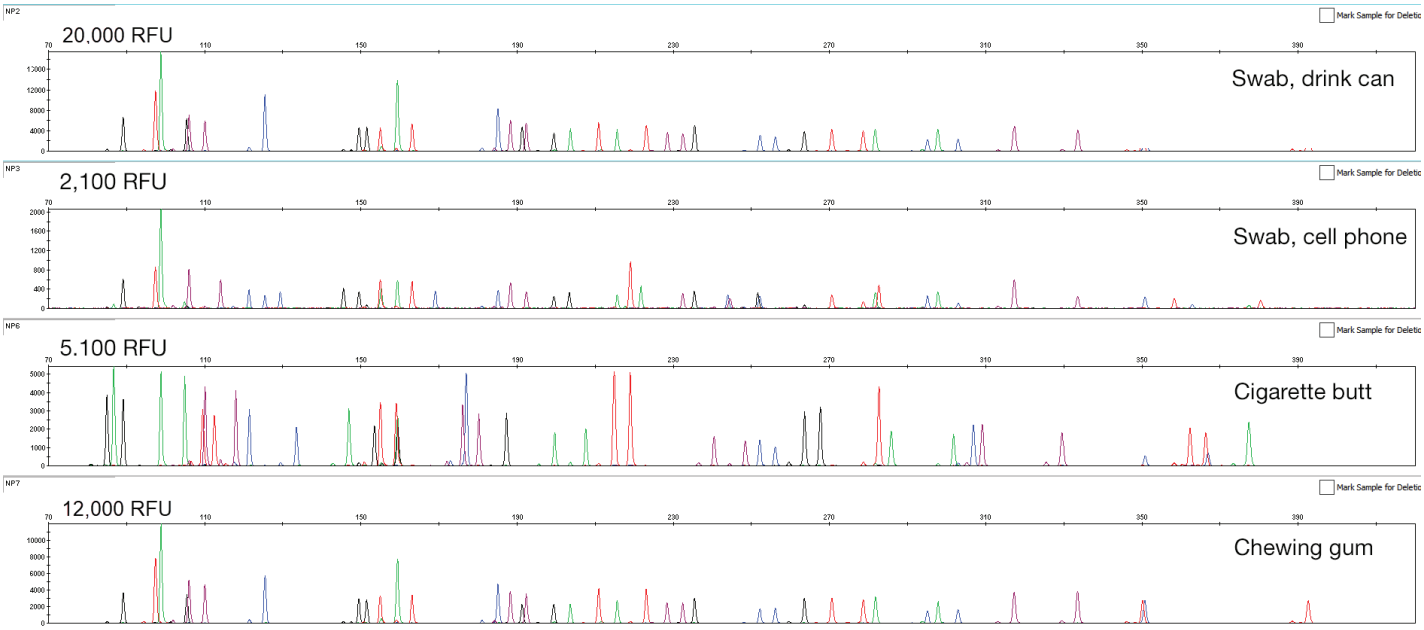


Figure 2. Applied Biosystems™ 3500xL Genetic Analyzer electropherograms of case-type samples purified on the ID NIMBUS Presto system with PrepFiler chemistry and amplified with the Applied Biosystems™ GlobalFiler™ PCR Amplification Kit.

DNA quantification

The quantification step of the casework workflow is key to determining how a sample will be processed downstream. Our quantification instrumentation, kits, and software enable forensic labs to achieve accurate results in less time for even the most challenging casework samples.

- Improved amplification efficiency results in fewer off-scale, over-amplified, or under-amplified samples and reduces the need for reanalysis
- DNA quantification provides key sample information that enables forensic workflow decisions

The Applied Biosystems™ Quantifiler™ Trio DNA Quantification Kit, which can be analyzed on the Applied Biosystems™ QuantStudio™ 5 Real-Time PCR System for HID, contains targets that measure both quantity and quality of total human DNA and Y-specific DNA. It may also be used to streamline processing of samples from sexual assault kits by assessing swab evidence directly to rapidly detect the presence of a male contributor, facilitating a Y-screen "direct to DNA" workflow.

The QuantStudio 5 Real-Time PCR System is designed for forensic scientists who need a simple, reliable, and affordable real-time PCR system that does not compromise on performance or quality. The system offers a sensitive, robust solution for forensic DNA quantification. With maximum dye versatility, this HID solution offers accurate, trusted results in a small benchtop footprint.

We have designed the Applied Biosystems™ HID Real-Time PCR Analysis Software v1.3 specifically for the HID application to help you take full advantage of the data and capabilities offered by the Quantifiler kits and maximize sample-processing efficiency. The software offers the ability to calculate DNA quantity from sample data with a virtual standard curve, which is defined by the user and reduces variation. The software includes quantification and STR setup features, as well as data quality review functionality (Figure 3). Since we have provided predefined templates for Quantifiler and STR kit runs, sample setup time is minimized.

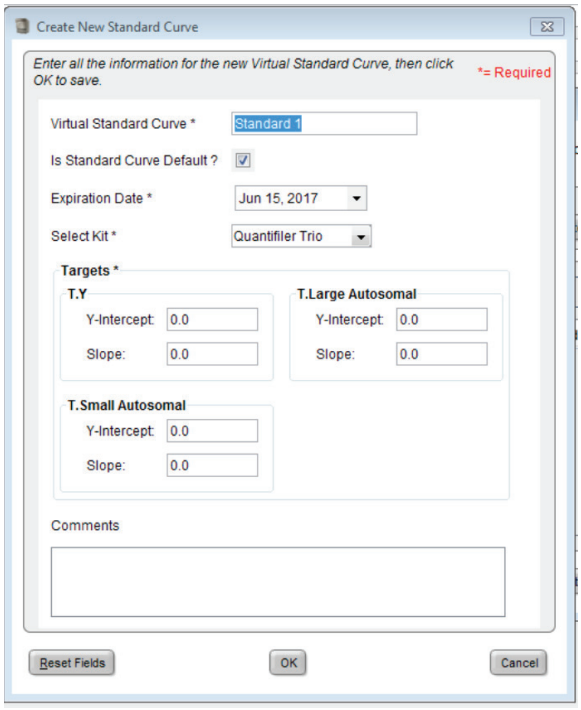


Figure 3. Enhanced data analysis using virtual standard curve functionality.

GlobalFiler PCR amplification kits

Around the world, forensic laboratories are asked to do more with less. That is why GlobalFiler STR kits are tailored to combine maximum data recovery power with reduced amplification time. As part of our fully integrated and validated forensic workflow, this 6-dye, 24-locus panel is designed to deliver superior laboratory performance—all facilitated by our comprehensive training, service, and support. One of the GlobalFiler kits is also available with an internal quality control system (IQC) as part of a fully integrated and verified forensic workflow.

Both the Applied Biosystems™ GlobalFiler™ and GlobalFiler™ Express kits are approved for use by laboratories generating DNA profiles for inclusion in the US National DNA Index System (NDIS) Combined DNA Index System (CODIS) database.

NDIS Approved

The GlobalFiler kits contain all of the STR loci commonly used in major global databases, including all markers recommended for inclusion by the CODIS Core Loci Working Group and those markers commonly used in Europe (Figure 4).

- Probability of identity (PI) values: 3.24 x 10^{-24} (Asian), 3.09 x 10^{-26} (US Hispanic), 3.71 x 10^{-26} (US Caucasian), 6.18 x 10^{-27} (African American)
- Includes 10 powerful mini-STR loci for increased information recovery from highly degraded samples
- Enhanced buffer system enables superior performance on samples containing inhibitors
- Expanded sensitivity and the flexibility to add up to 15 µL of sample enables increased allele recovery from low-quantity DNA samples
- Enables amplification times of 45 minutes for GlobalFiler Express kit and 80 minutes for GlobalFiler and GlobalFiler IQC kits (Figure 5)

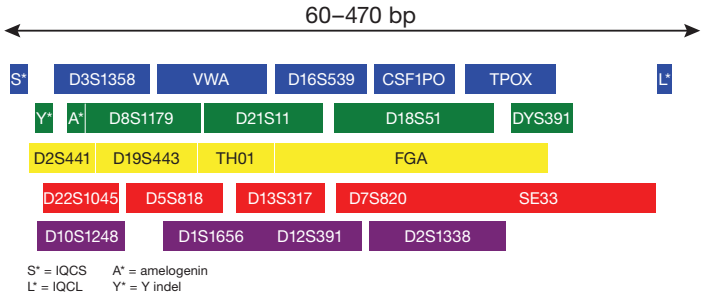


Figure 4. Multiplex configuration of the GlobalFiler kit. The kit includes all 24 loci, with only 1 locus partially exceeding 400 bp. Ten mini-STR loci are smaller than 220 bp, and all gender-specific markers are located in the green VIC™ dye channel for convenience of interpretation. The IQC Small (IQCS) and IQC Large (IQCL) markers are only present in the GlobalFiler IQC kit.

- GlobalFiler Express kit is compatible with Prep-n-Go Buffer, which significantly expands throughput capabilities while maximizing sample integrity and data quality
- Applied Biosystems™ GlobalFiler™ IQC kit has the added benefit of two internal quality control (IQC) markers to help assess degradation or inhibition in casework samples

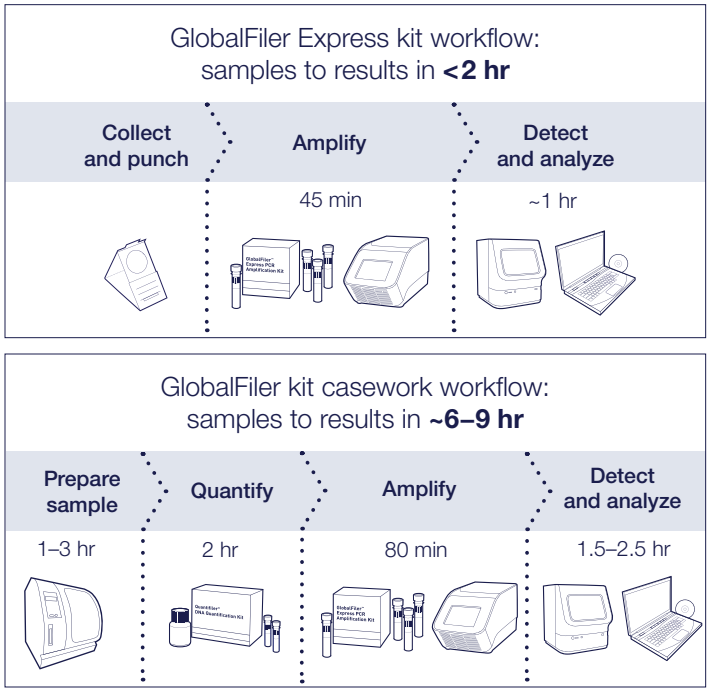


Figure 5. Typical workflow for up to 48 samples using Applied Biosystems™ thermal cyclers, genetic analyzers, and robust system analysis software.

NGM PCR amplification kits

The Applied Biosystems™ NGM™ family of kits delivers exceptional data quality and robustness along with powerful discrimination to support European cross-border data sharing initiatives. The NGM kits amplify all 10 Applied Biosystems™ SGM Plus™ kit loci together with 5 additional loci in the expanded European Standard Set (Figure 6). The kits are supported by our training, service, and applications teams.

Applied Biosystems™ AmpFLSTR™ NGM SElect™ kits amplify the expanded set of loci together with the highly discriminating SE33 locus. These kits leverage significant advances in PCR amplification technology to deliver high sensitivity and improved STR performance for forensic and database samples in one easy workflow. The NGM SElect Express Kit utilizes the same primer sequences as the NGM SElect kit, but employs a new master mix optimized to enable high-quality, direct amplification of single-source samples from swabs and treated or untreated paper substrates, and delivers rapid PCR cycling (<1 hr).

The Applied Biosystems™ NGM Detect™ PCR Amplification Kit offers excellent sensitivity and provides an alternate marker configuration to the NGM SElect PCR Amplification Kit format to maximize information recovery, even from degraded casework samples. With 7 mini-STRs, an optimized position for SE33 at <350 bp in the FAM™ dye channel and fast cycling time of <1 hr, the NGM Detect kit is the perfect companion product to NGM SElect kits for a dual amplification strategy to help generate maximum allele recovery and confidence in experimental replicates. In addition, the NGM Detect kit contains an additional gender marker, and two IQC markers to help assess degradation or inhibition in casework samples (Figure 7).

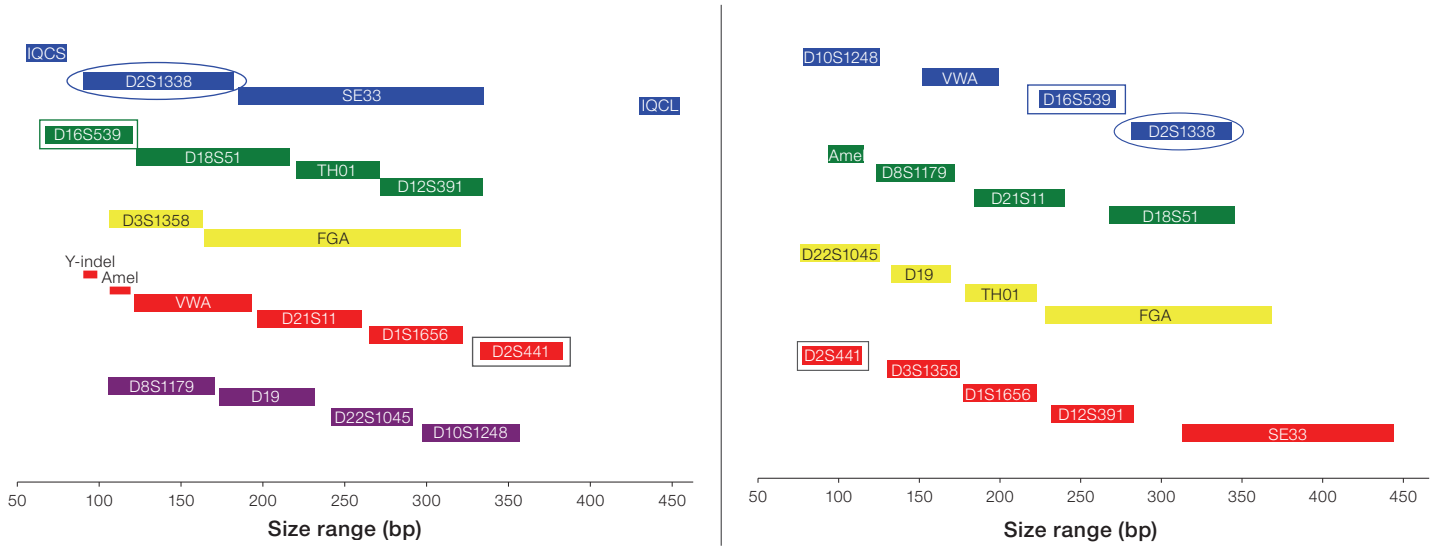
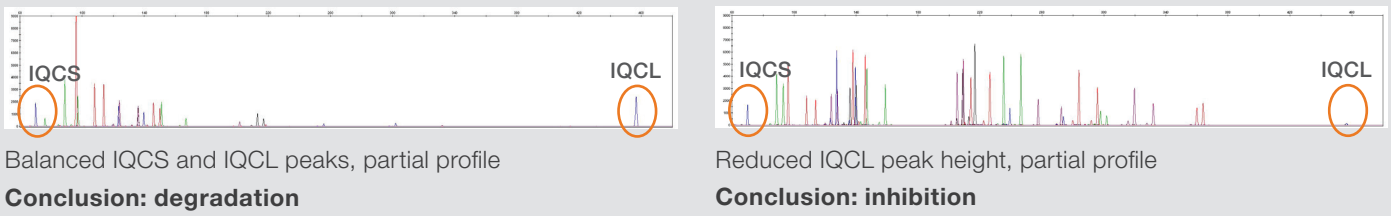


Figure 6. Relative positioning of markers in the NGM Detect kit (left) and the NGM SElect kit (right). Low MW markers in the NGM Detect kit are high MW markers in the NGM SElect kit, and vice versa.



Balanced IQCS and IQCL peaks, partial profile

Conclusion: degradation

Reduced IQCL peak height, partial profile

Conclusion: inhibition

Figure 7. Analysis of samples using the two quality markers, IQC Small (IQCS) and IQC Large (IQCL), of the IQC system to differentiate between sample degradation and inhibition.

VeriFiler PCR amplification kits

Applied Biosystems™ VeriFiler™ Plus and VeriFiler™ Express PCR Amplification Kits meet challenging forensic casework and databasing needs globally. Utilizing our 6-dye STR chemistry, the VeriFiler kits contain a total of 25 markers—23 autosomal STRs, including Penta D and Penta E, and 2 gender discrimination markers (Figure 8). The kits are supported by our comprehensive training, service, and applications teams.

The VeriFiler Express kit offers superior discrimination power and high throughput, with efficient processing—from single-source sample to profile in as fast as 2 hours.

With 11 mini-STRs, the VeriFiler Plus kit is specifically designed for challenging sample types—touch, inhibited, or degraded samples—with improved sensitivity and robustness to inhibition. In addition, an IQC system assesses for the presence of inhibitors in the sample to enable distinction between degraded and inhibited samples.

NDIS Approved

The VeriFiler Plus kit also offers a direct amplification protocol for single-source reference samples, enabling laboratories to process all sample types with a single amplification kit.

The VeriFiler Plus and VeriFiler Express kits are approved for use by laboratories generating DNA profiles for inclusion in the United States National DNA Index System (NDIS) CODIS database. The specifications for the VeriFiler Plus and VeriFiler Express kits are summarized in Table 1.

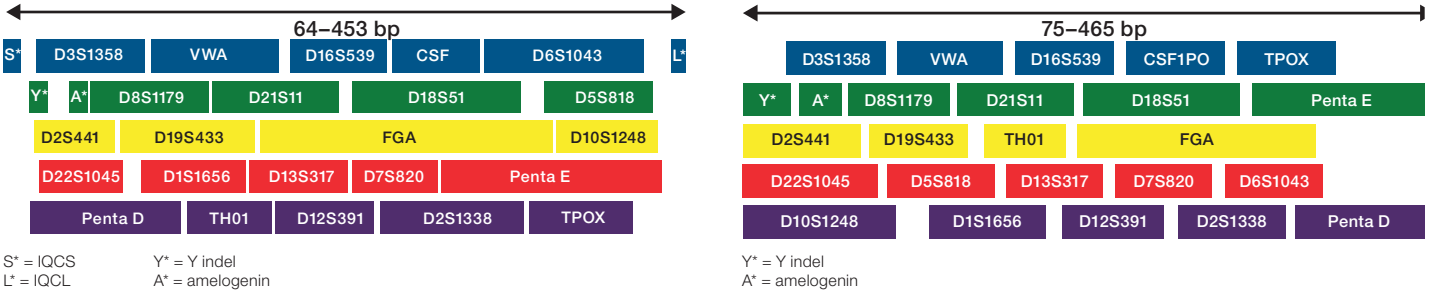


Figure 8. Marker layout comparison for the VeriFiler Plus kit (left) and VeriFiler Express kit (right).

Table 1. Specifications for the VeriFiler kits.

	VeriFiler Plus kit	VeriFiler Express kit
Improved sensitivity	Kit allows loading up to 17.5 µL of sample volume per 25 µL of reaction	–
Applications supported	• Casework: Optimized chemistry for challenging sample types: touch, inhibited, or degraded samples • Reference/database: Validated with multiple sample collection devices such as treated paper, untreated paper, and swabs for direct amplification of single-source samples	Reference/database: Validated with multiple sample collection devices such as treated paper, untreated paper, and swabs
IQC system	Yes: for distinguishing inhibited and degraded samples; positive control for PCR amplification	No
DNA input	• 500 pg of purified DNA or up to 17.5 µL of sample volume • Treated or untreated paper: 1.2 mm punch • Swab: 2 µL (of 400 µL) Prep-n-Go Buffer	• Treated or untreated paper: 1.2 mm punch • Swab: 2 µL (of 400 µL) Prep-n-Go Buffer
PCR cycling time	76 min for casework samples	45 min in direct amplification mode for single-source samples

Yfiler Plus PCR Amplification Kit

Y-STR loci can be valuable in forensic investigations because the Y chromosome can be used to trace male lineage due to its unique genetic inheritance from father to son. Y-STR loci have been serving as a supplementary tool for relationship testing, ancestry identification, familial searching, missing persons and mass disaster victim identification (Figure 9). Additionally, Y-STR loci analysis is used in sexual assault cases to detect minor contributions of male DNA in a high background of female DNA.

The Applied Biosystems™ Yfiler™ Plus PCR Amplification Kit can be used for extracted casework samples or for a direct amplification protocol for single-source reference samples.

NDIS Approved

The 6-dye Yfiler Plus kit can provide more information with its 25 Y-STR markers (or 27 Y-STR loci), including 7 rapidly mutating Y-STR loci and 11 mini-STRs of <220 bp (Figure 10), from low-quantity or low-quality casework samples with its high sensitivity and improved inhibitor tolerance. In particular, the inclusion of seven rapidly mutating Y-STRs with mutation rates above 1 x 10^{-2} helps to improve resolution of paternal lineages and discriminate between closely related males.

The Yfiler Plus kit is suitable for fast thermal cycling conditions, enabling shorter time-to-results. The kit is also designed to process single-source reference samples using direct PCR amplification (Figure 11).

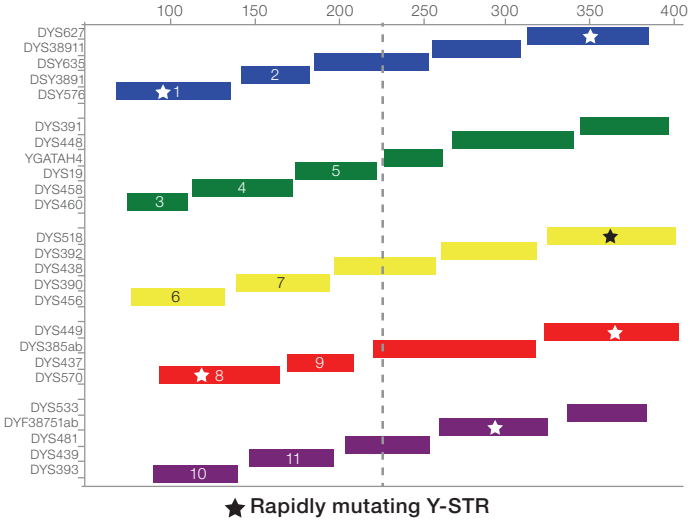


Figure 10. Marker design in the Yfiler Plus kit.

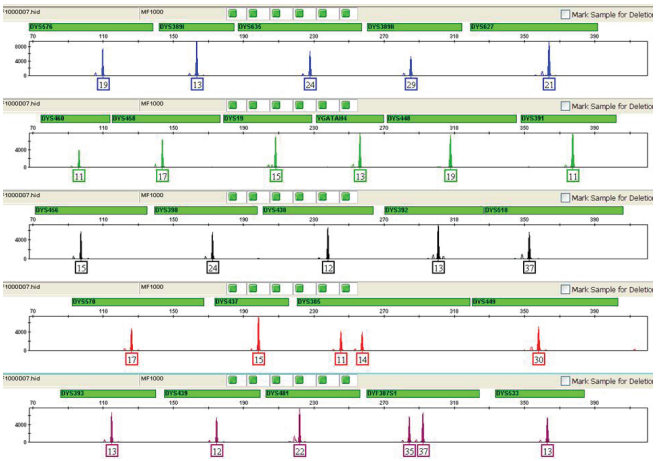


Figure 9. A 1:1,000 male:female mixture, amplified using the Yfiler Plus kit and 30 cycles on an Applied Biosystems™ 3500 Series Genetic Analyzer.

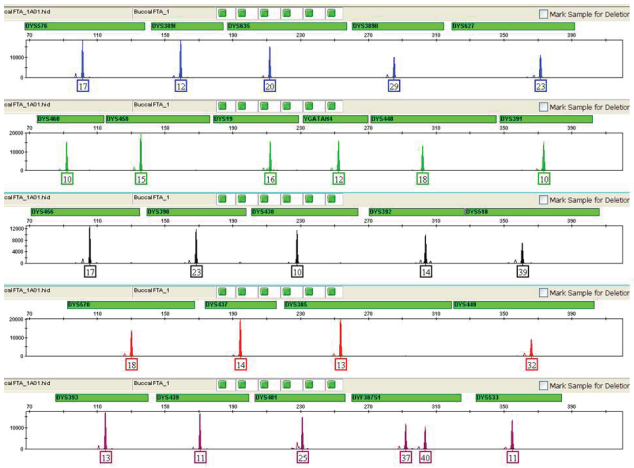


Figure 11. Direct amplification using the Yfiler Plus kit on a 1.2 mm Whatman™ FTA™ punch of buccal cells and 27 cycles on a 3500 Series Genetic Analyzer.

Thermal cyclers

HID VeritiPro Thermal Cycler

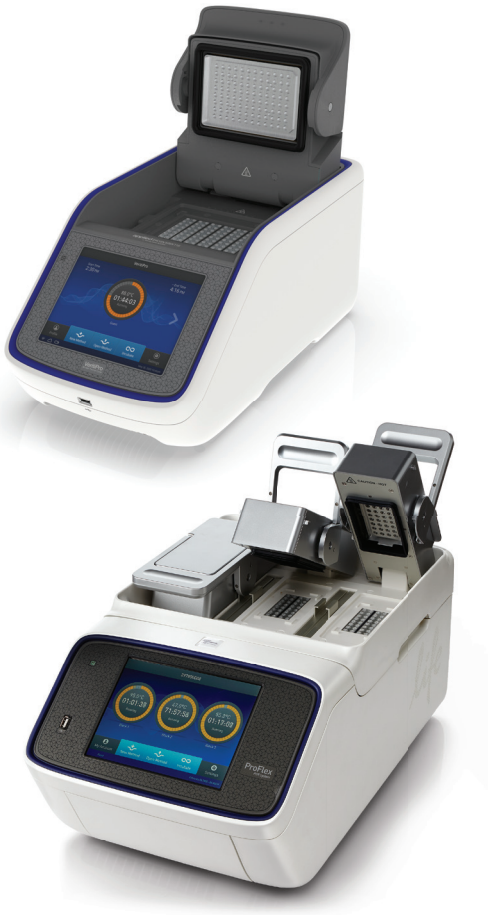
The Applied Biosystems™ VeritiPro™ Thermal Cycler for HID delivers high-end performance and proven reliability with advanced temperature control technology. It is validated according to the Scientific Working Group on DNA Analysis Methods (SWGDAM) in the 96-well, 0.2 mL configuration with Applied Biosystems™ STR PCR amplification kits and Precision ID NGS panels.

ProFlex PCR System

The Applied Biosystems™ ProFlex™ PCR System combines reliability and performance with flexible configuration and control features that fit how you work. Interchangeable block formats allow you to maximize your throughput or run independent experiments concurrently. The ProFlex PCR System has five different blocks that can be changed with the flip of a switch, including the first-of-its-kind 3 x 32-well block. A dual 96-well block is available for your high-throughput needs.

MicroAmp 96-well plates, PCR tubes, PCR strip tubes, and adhesive films

Applied Biosystems™ MicroAmp™ plastic consumables offer excellent performance in formats developed to meet your experimental needs. All of our plastic consumables are validated with Applied Biosystems™ instruments for optimal fit and performance.

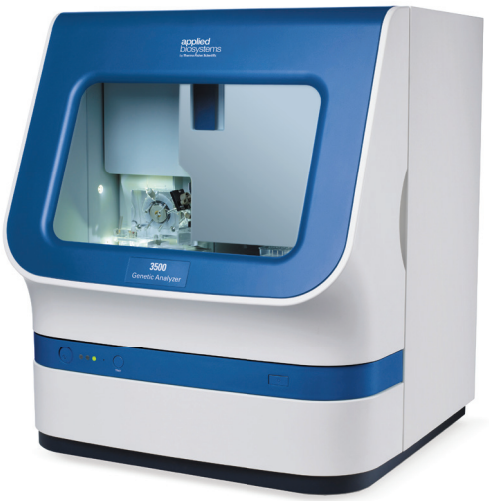


DNA analysis

The Applied Biosystems™ 3500 Series instruments, available in 8- or 24-capillary format, are the first genetic analyzers designed with a specific feature set and workflow for HID applications. The complete system combines the instrument with Applied Biosystems™ reagents, consumables, and software, as well as superior support—providing an integrated HID solution that significantly improves ease of use and application efficiency.

Key features

- The innovative "snap-in-and-go" consumable design uses radio frequency identification (RFID) technology to track and record key consumables data
- The HID-specific workflow preconfigured for Applied Biosystems™ STR kits simplifies run setup and software navigation
- Powerful, integrated data collection and QC analysis software provides real-time assessment of data quality and streamlined STR analyses
- Provides superior data quality, with more consistent peak height from capillary to capillary, run to run, and instrument to instrument



We have enhanced our 3500 Series instruments and Applied Biosystems™ GeneMapper™ *ID-X* Software to help decrease data analysis time, increase confidence in results, allow for more efficient throughput and performance (Table 2), and comply with IT requirements. Combined with our STR kits, Applied Biosystems™ 3500 Data Collection Software v4.0.1 and GeneMapper *ID-X* Software v1.6 offer an efficient workflow.

- **Improved data interpretation**—reduced pull-up edits, improved first-pass success rate for database laboratories, and more efficient data transfer to probabilistic genotyping
- **Enhanced user experience**—flexible plate loading, streamlined workflow, support languages, and 6-dye installation standard
- **IT support and compatibility**—Windows™ 10 system support, CODIS compatibility, and internationalization

Table 2. HID fragment analysis throughput and performance specifications.

						Performance				
Module name	Throughput			Configuration		General		Sizing precision of 100% of alleles in >90% of samples		Multirun sizing for 100% of alleles in >90% of samples
	Average run time (min)	Average throughput, 3500 system (samples/day)	Average throughput, 3500xL system (samples/day)	Array length (cm)	Polymer type	Resolution range in >90% of samples (bp)	Largest fragment collected in >90% of samples (bp)	50–400 bp	401–600 bp	50–400 bp
HID36_POP4	<26	>424	>1,272	36	POP-4	60-400	>420	<0.15 bp	<0.3 bp	<1 bp

The Applied Biosystems™ SeqStudio™ Genetic Analyzer for HID is an easy-to-use 4-capillary benchtop system that delivers gold-standard STR fragment analysis and Sanger sequencing with just a simple click. It is easily used across a broad range of Applied Biosystems™ STR kits and applications to help you get answers you can trust. The system offers the same data quality, service, and support you have come to expect from Applied Biosystems™ genetic analyzers, with a modernized experience at an affordable price.

Key features

Universal all-in-one cartridge—unique functionality integrates Applied Biosystems™ POP-1™ polymer, anode buffer, a polymer delivery system, and a four-capillary array to minimize instrument setup and maintenance time; this novel system design allows for an on-instrument reagent life of up to 6 months and 250 injections (1,000 samples) with no hard stops

- **Results you can trust**—optimized data collection software and validated performance (based on SWGDAM Dec 2016 guidelines) with Applied Biosystems STR kits
- **Concordant results**—compared with 3500 Series Genetic Analyzers (Table 3)
- **Reduced pull-up (false secondary peak) editing**—autocalibration utilizing sample-specific spectral data and marker-to-marker calibration reduces pull-up editing (Table 4)
- **Seamless data interpretation**—with GeneMapper *ID-X* Software v1.6
- **Protection and traceability**—with security, audit, and e-signature (SAE) software
- **Easy inventory management**—with RFID-enabled tracking of consumables usage
- **Get up and running quickly**—every SeqStudio system includes service installation and one-day FAS training

Table 3. Concordance results: 3500xL Genetic Analyzer to SeqStudio Genetic Analyzer.*

Kit	Concordance (%)
GlobalFiler	100
GlobalFiler IQC	100
VeriFiler Plus	100
NGM Detect	100
NGM Select	100
Identifiler Plus	100
MiniFiler	100
Yfiler Plus	100
Yfiler	100
GlobalFiler Express	100
VeriFiler Express	100

* Nine casework kits were used with 23 gDNA samples plus the positive control, and two direct amplification kits were used with 20 buccal and blood samples plus the positive control, at the kit-recommended inputs of DNA. Samples were injected on 4 instruments with a minimum of 3 injections each.

Table 4. Low pull-up percentage across sample data.**

Average pull-up peaks per injection	Mean pull-up percentage	Average percent of pull-up ≤3%
1.3	1.6%	88%

** Results are shown for 947 pull-up peaks observed in 730 injections of positive control and 5 gDNA samples amplified with the Applied Biosystems™ MiniFiler™, Identifiler™ Plus, NGM SElect, Yfiler™, GlobalFiler, Yfiler Plus, NGM Detect, or VeriFiler Plus kit at the recommended input. n = 92 injections/kit on 4 SeqStudio instruments; n = 86 for the NGM Detect kit due to failed injections being omitted from the analysis.

Data interpretation

GeneMapper *ID-X* Software

With the advent of higher-throughput instrumentation and more robust amplification technology, the bottleneck in the forensic laboratory has shifted from sample processing to data analysis. GeneMapper *ID-X* Software is a complete software solution that combines expert-system and expert-assistant capabilities to alleviate the time-consuming tasks associated with data review. Depending on whether you are processing database or casework samples, the user-defined thresholds and automated tools can either allow the software to make the final genotype call or support review, editing, and further processing of the sample (Figure 12). This software helps reduce manual effort in database uploading and offers better integration capabilities with third-party systems. The GeneMapper *ID-X* platform is recognized as the industry standard for forensic data analysis and is an NDIS-approved expert system.

When combined with 3500 Data Collection Software v4.0.1 packages and Applied Biosystems™ STR kits, the GeneMapper *ID-X* Software significantly helps to enhance productivity and confidence, as well as IT support and compliance, in your HID laboratory's data interpretation workflow. These software solutions offer the following benefits:

- **Improved data interpretation**—reduced pull-up edits with Applied Biosystems STR kits (Figure 13), maintaining of minor-allele detection while reducing pull-up in multiple-contributor samples, more efficient data transfer to probabilistic genotyping software, and improved first-pass success rate for database laboratories with off-scale data recovery
- **Enhanced user experience**—flexible plate loading, streamlined workflow, language support, and 6-dye installation standard
- **IT support and compliance**—Windows 10 system support, CODIS compatibility, and internationalization

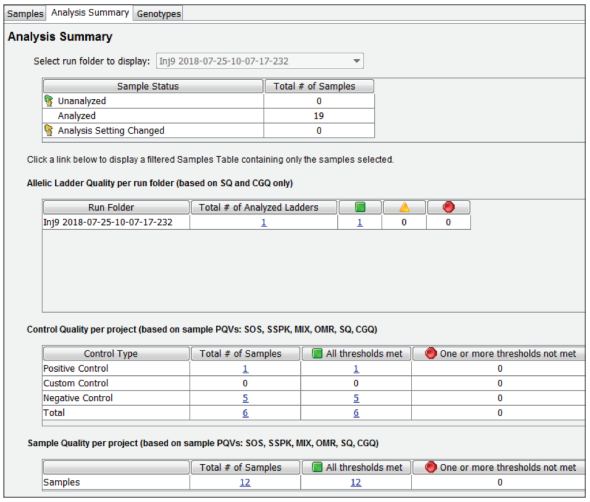


Figure 12. The "Analysis Summary" tab provides an easy-to-view summary of analysis results including ladder, control, and sample quality for efficient data evaluation. In this example, 6 control and 12 GlobalFiler Express reference samples were run on a 3500xL Genetic Analyzer with 3500 Data Collection Software v4.0 utilizing the off-scale recovery and pull-up reduction features. The green boxes indicate that there are no controls or samples needing manual review when the GeneMapper *ID-X* software is validated for use as an expert system.

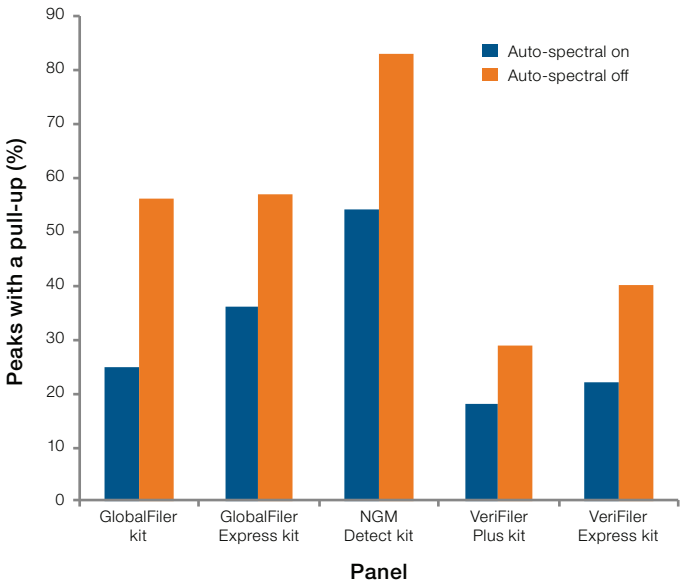


Figure 13. Pull-up reduction results. Samples were analyzed at 1 ng and 2 ng gDNA input using a selection of Applied Biosystems™ autosomal STR kits on the 3500 Genetic Analyzer with Data Collection Software v4.0 and GeneMapper *ID-X* Software v1.6. Each kit demonstrated a reduction of >35% in the number of peaks with a pull-up edit required when the auto-spectral algorithm was applied.

NGS applications

The Applied Biosystems™ Precision ID NGS System for human identification with Applied Biosystems™ Converge™ Software can help you solve tough cases by obtaining more information from your challenging samples. Now you have help moving those unknown samples from storage to investigative leads.

- mtDNA (Figure 14) from samples recovered at mass disasters and from other unidentified remains can be routinely analyzed to assist in HID and help establish links to maternally related family members
- Ancestry-informative or phenotypic single-nucleotide polymorphism (SNP) analysis may help generate investigative leads (Figure 15)
- Identity-testing SNPs can associate a degraded crime scene sample to a known reference when partial results are obtained with autosomal STR analysis
- Ion AmpliSeq™ HID community panels, designed by forensic scientists and verified for performance, provide expanded use in human identification applications

With as little as 125 pg of DNA input, you can go from extracted DNA to profile in as little as 5 pipetting steps and 45 minutes of hands-on time (Figure 16). Start processing unsolved and missing-persons cases with NGS in your laboratory.

The Applied Biosystems™ Precision ID mtDNA Whole Genome Panel, using the control region data for analysis, is approved for inclusion in the NDIS CODIS database.

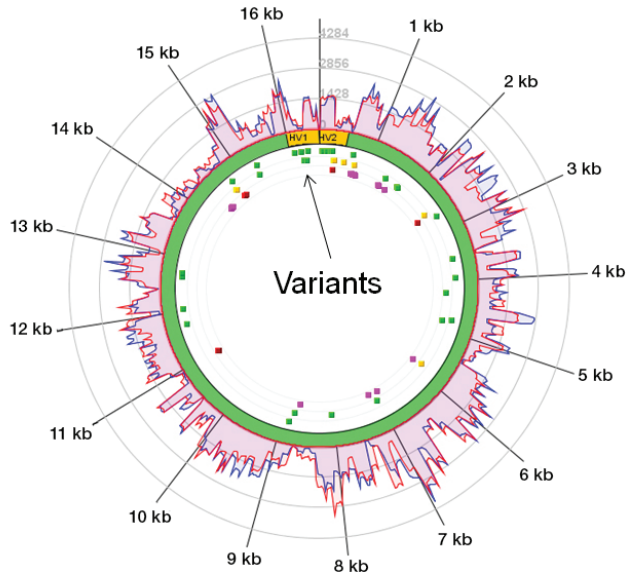


Figure 14. Circular plot analysis of the whole mtDNA genome from the "Converge mtDNA Analysis" module, used to visualize read depth across the genome and variant positions relative to the Cambridge Reference Sequence (CRS).

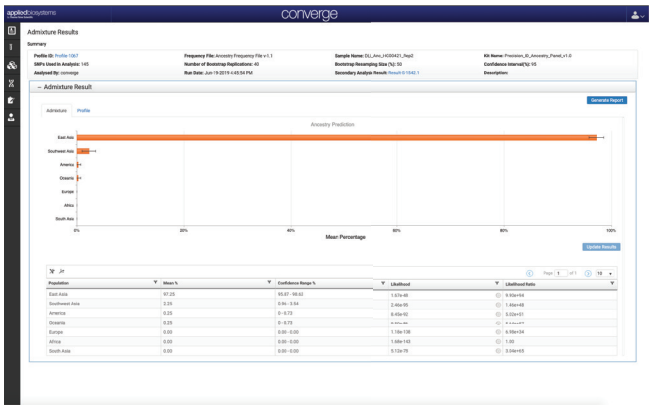


Figure 15. Graphical representation of ancestry analysis. Admixture prediction is shown with confidence range and population likelihoods, including variability estimates based on bootstrapping analysis.

NDIS Approved

Construct library
Hands-on time: 15 min
Total time: 7 hr

Precision ID panels

Prepare template
Hands-on time: 15 min
Total time: 11 hr

Ion Chef System

Run sequence
Hands-on time: <15 min
Total time: as low as 2 hr

Ion S5 GeneStudio System

Analyze data
Total time: as low as 5 hr

Converge and Torrent Suite™ Software

Figure 16. Adopting NGS for forensic DNA analysis in your laboratory is simpler than ever, when you combine the Ion Chef™ System and Ion GeneStudio™ S5 series systems with optimized Applied Biosystems™ Precision ID library preparation, template preparation, and sequencing kits and forensically relevant panels.

Rapid DNA analysis

The Applied Biosystems™ RapidHIT™ ID System, approved by the FBI for uploading to the National DNA Index System (NDIS)*, offers new ways for public safety agencies and crime laboratories to obtain more answers and solve more crimes. The compact, easy-to-use RapidHIT ID System is the ideal platform for generating laboratory-quality forensic DNA profiles from single-source samples. With minimal training and just one minute of hands-on time, the fully automated, mobile-ready RapidHIT ID System can generate STR DNA profiles in the laboratory or in the field. Compatible with established databases, DNA profiles are generated using FBI NDIS–approved GlobalFiler Express chemistry from the self-contained Applied Biosystems™ RapidHIT™ ID ACE GlobalFiler™ Express or the RapidINTEL™ Sample Cartridges.

Paired with Applied Biosystems™ RapidLINK™ Software, the system offers centralized data and full control of DNA results. Integrate rapid DNA data, RapidLINK Software, and the SmallPond™ DNA Profile Matching System to generate leads to help close cases faster. The SmallPond Database Software offers flexible search parameters analogous to the CODIS software with custom and *ad hoc* searches, performing searches of up to 1 million profiles in seconds. Transform DNA results into rapid intelligence with the activation of powerful sample matching, familial search, kinship, and staff-elimination database applications.

Insert swab or evidence sample into cartridge

Bring the analysis tools to the point of action, whether in the lab or in the field.

Insert cartridge into instrument

The fully automated system performs cell lysis, amplification, and capillary electrophoresis (CE) without human intervention.

NDIS Approved

DNA results in 90 minutes

The RapidLINK Software centralizes data and provides full control of results.

Solve more crimes and find more answers, together

In the police station or booking agency

Law enforcement can generate investigative leads and identify or eliminate suspects while they are still in custody

In the forensic laboratory

Labs can process urgent samples more efficiently and enable personnel with limited experience working with DNA

In the field

Thanks to the mobility, remote connectivity, and ease-of-use of the RapidHIT ID system, personnel can conduct rapid identification of disaster victims and missing persons, to provide closure and reunite families

* FBI NDIS–approved for use by booking stations and accredited forensic DNA laboratories with known reference DNA samples and the RapidHIT ID ACE GlobalFiler Express Sample Cartridge.

HID Professional Services

Since 2007, our HID Professional Services (HPS) team has been supporting customers like you in the successful validation and confident implementation of new technologies and workflows. With a consultative approach to all our services, the HPS team can work with you to design a service that meets your technical and budgetary needs. Whether you need a complete turnkey solution or just to validate a single workflow component, you can trust the experience of the HPS team to help you achieve your goals.

HPS provides services supporting all the workflows offered by HID including:

- Casework extraction, Y-screen, quantification, and amplification
- Direct amplification
- GeneMapper *ID-X* expert system analysis
- Automated liquid handlers
- Rapid DNA

1. Project planning

Your customized Scope of Work is converted to a detailed experimental design, in consultation with you about your laboratory's unique needs.

2. Wet work

HPS will either travel to your site to perform wet work or provide remote support for you to do the work. All applicable reagents and consumables are sent to your site.

3. Data analysis and report writing

HPS will perform detailed data analysis and conversion to a comprehensive validation report. All deliverables are technically reviewed independently to ensure quality.

4. Teachback training

An in-person or virtual review of your products and validation results can be scheduled at your convenience. A hands-on laboratory training can also be included.

Services designed in a bundle or *à la carte* to meet your needs:

- Basic forensic workflow training*
- Performance verifications
- Validations and performance checks
- Script development and optimization on automated liquid handlers
- Laboratory design and moves
- SOP development
- Advanced HID training*
- Accreditation support

* Live and virtual options are available.

Our **Laboratory Development Program** (LDP) is an option to partner with the HPS team to meet your needs before, during, and after your validation. It offers a simple, stepwise solution for laboratories that are starting out or that need help just in certain areas of implementation.

No project is too big or small for HPS to handle. Our global team of dedicated validation specialists is available to work with customers around the world. Let HPS help you identify and implement the best possible solution to meet your needs. Say yes to a better workflow, and we'll take it from there.

Ordering information

Product	Quantity	Cat. No.
Collection and sample preparation*		
4N6FLOQSwabs, regular tip, 2-mL cuvette, peel-pouch	100 swabs	4479431
4N6FLOQSwabs, regular tip, peel-pouch	100 swabs	4473979
4N6FLOQSwabs for Crime Scene, regular tip, peel-pouch	100 swabs	4479429
NUCLEIC-CARD matrix, 1 spot	50 cards	4474001
Evidence Collection Cotton Swab with SafeDry Tubing	1 piece	9022030
PrepFiler Express Forensic DNA Extraction Kit	52 reactions	4441352
PrepFiler Express BTA Forensic DNA Extraction Kit	52 reactions	4441351
PrepFiler Automated Forensic DNA Extraction Kit	960 reactions	4463353
PrepFiler BTA Automated Forensic DNA Extraction Kit	960 reactions	4463354
PrepFiler Forensic DNA Extraction Kit	100 reactions	4463351
PrepFiler BTA Forensic DNA Extraction Kit	100 reactions	4463352
Amplification kits and consumables**		
Quantifiler Trio DNA Quantification Kit	400 reactions	4482910
GlobalFiler IQC PCR Amplification Kit	200 reactions	A43565
GlobalFiler PCR Amplification Kit	200 reactions	4476135
GlobalFiler Express PCR Amplification Kit	200 reactions	4476609
NGM Detect PCR Amplification Kit	200 reactions	A31832
NGM SElect PCR Amplification Kit	200 reactions	4457889
NGM SElect Express PCR Amplification Kit	200 reactions	4472193
VeriFiler Express PCR Amplification Kit	200 reactions	A32014
VeriFiler Plus PCR Amplification Kit	200 reactions	A35495
Yfiler Plus PCR Amplification Kit	500 reactions	4482730
RapidHIT ID ACE GlobalFiler Express Kit	50 reactions	441831
Primary Cartridge GlobalFiler Express 100 Kit	100 reactions	A41841
Precision ID GlobalFiler NGS STR Panel v2	96 reactions (manual)	A33114
Precision ID Ancestry Panel	96 reactions (manual)	A25642
Precision ID Identity Panel	96 reactions (manual)	A25643
Precision ID mtDNA Whole Genome Panel	96 reactions (manual)	A30938
Precision ID mtDNA Control Region Panel	96 reactions (manual)	A31443
Optical 96-Well Reaction Plates, without barcode	10 plates	N8010560
Optical 96-Well Reaction Plates, without barcode	500 plates	4316813
Optical 96-Well Reaction Plates, with barcode	20 plates	4306737
Optical 96-Well Reaction Plates, with barcode	500 plates	4326659
Instrumentation†		
AutoMate Express Forensic DNA Extraction System	1 system	4441763
AutoMate Express Forensic DNA Extraction System, with service install	1 system	4456582

Ordering information (cont.)

Product	Quantity	Cat. No.
Instrumentation† (cont.)		
HID KingFisher Presto System with 96 DW Head	1 system	5400830CH
CPA200 Instrument	1 system	A34329
QuantStudio 5 Real-Time PCR System for Human Identification, 96-well, 0.2 mL, laptop	1 system	A34321
QuantStudio 5 Real-Time PCR System for Human Identification, 96-well, 0.2 mL, desktop	1 system	A34322
3500 Genetic Analyzer for Human Identification	1 system	4406017
3500xL Genetic Analyzer for Human Identification	1 system	4406016
SeqStudio Genetic Analyzer for Human Identification, laptop, with training	1 system	A46228
SeqStudio Genetic Analyzer for Human Identification, desktop, with training	1 system	A46229
RapidHIT ID System‡	1 system	A41810
HID Ion Chef System	1 system	A30070
HID Ion GeneStudio S5 System	1 system	A41431
HID Ion GeneStudio S5 Plus System	1 system	A41432
HID Ion GeneStudio S5 Prime System	1 system	A41433
HID VeritiPro Thermal Cycler	1 system	A52127
ProFlex 96-Well PCR System	1 system	4484075
Software†		
HID Real-Time PCR Analysis Software v1.3	1 license	A31150
GeneMapper *ID-X* Software v1.6, full installation	1 license	A39975
GeneMapper *ID-X* Software v1.6, client installation	1 license	A39976
GeneMapper *ID-X* Software v1.6, client installation	5 licenses	A39977
RapidLINK Software v1.0	1 license	A41813
Converge Software and Server	1 system	A35131
Case Management and Kinship & Paternity Analysis Module	1 user, 3 years	A31002
Case Management and NGS Data Analysis License	1 user, 3 years	A35987
HPS†		
STR-Casework Premium Validation		HPS10101
Quantification Premium Validation		HPS10201
STR-Direct Premium Validation		HPS10401
STR-Casework Performance Check		HPS10103
Quantification Performance Check		HPS10203

Additional package sizes are available. Please contact your representative for more information.

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