

Blood, sweat, and
breakthroughs

Human identification

Integrated human identification (HID) solutions

Together, we find the truth

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 informs 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 world-class support and continued innovation to meet your needs today and tomorrow.



Ion GeneStudio
S5 System



SeqStudio Flex
Genetic Analyzer



RapidHIT ID
System



SeqStudio
Genetic Analyzer



HID NIMBUS Presto
QNA System

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.

Our PrepFiler family of DNA extraction chemistries, Quantifiler quantification kits, and STR PCR amplification kits 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.



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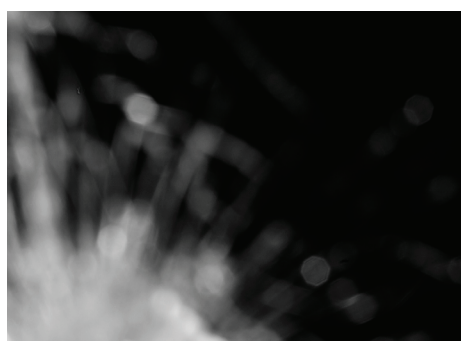
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[Register](#) for our human identification product communications and newsletters.

Forensic evidence collection solutions

Forensic samples are among the most difficult specimens to process, so it's important to use a device that collects, transports, and preserves your sample for the best possible result. Our patented sample collection devices are designed and manufactured according to ISO 18385 guidelines and are certified DNase-free, RNase-free, and human DNA-free, as well as free of PCR inhibitors.

We offer a variety of Applied Biosystems™ 4N6FLOQSwabs™ collection devices. Each 4N6FLOQSwabs device includes a plastic applicator with variable tips, coated with nylon fibers that create a thin absorbent layer, which allows for quick sample uptake and complete sample elution. These are better than cotton swabs because they:

- Help maximize DNA collection and elution efficiency
- Are purposefully designed with perpendicular nylon fibers to facilitate improved collection and elution of cellular material
- Contain a non-absorbent core to prevent absorption of critical samples, enabling maximum sample recovery
- Allow samples to stay close to the swab surface for faster and more efficient elution



Our HID solutions team also offers the Applied Biosystems™ NUCLEIC-CARD™ collection system as an alternative to FLOQSwabs collection devices. These materials are specifically designed to collect, transport, and store human DNA from buccal cells, saliva, blood, and other sample types. The unique chemical treatment preserves DNA for 20+ years at room temperature. These cards are:

- Chemically treated to enable cell lysis and protein denaturation for maximum DNA extraction
- Designed to enable direct PCR amplification from a card punch, eliminating extraction and quantification steps
- Ideal for long-term storage and well suited for databasing workflows



Card Processing Automation 200 instrument

The Applied Biosystems™ Card Processing Automation 200 (CPA200™) instrument is a semi-automated 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.

The CPA200 puncher:

- Is an easy-to-use, semi-automated device
- Includes an ionizer to remove static and a camera for sample presence control
- Uses filter paper or cards
- Can process a full plate in under 10 minutes





Sample preparation and extraction

PrepFiler Forensic DNA Extraction Kits

Applied Biosystems™ PrepFiler™ and PrepFiler™ BTA Forensic DNA Extraction Kits are part of an integrated solution designed to provide reliable, simplified, and efficient DNA extraction and purification according to various (low, medium, or high) throughput needs.

PrepFiler kits use magnetic particles with multi-component surface chemistry, and are optimized to support extremely efficient DNA-binding capacity and maximum DNA recovery from a wide range of forensic sample types. With these kits, you can:

- Help improve the overall yield, concentration, and purity of DNA isolated from forensic samples, while enabling effective removal of PCR inhibitors
- Help improve the downstream genotyping success rate to enable critical and often limited casework samples to be successfully analyzed
- Optimize DNA-binding and elution of DNA in a small volume using the kits' specially developed magnetic particles and reagents
- Streamline protocols to process an extensive variety of forensic sample types
- Successfully process more challenging samples with the included PrepFiler BTA Lysis Buffer



PrepFiler Forensic DNA Extraction kits can be used for routine forensic sample types, such as:

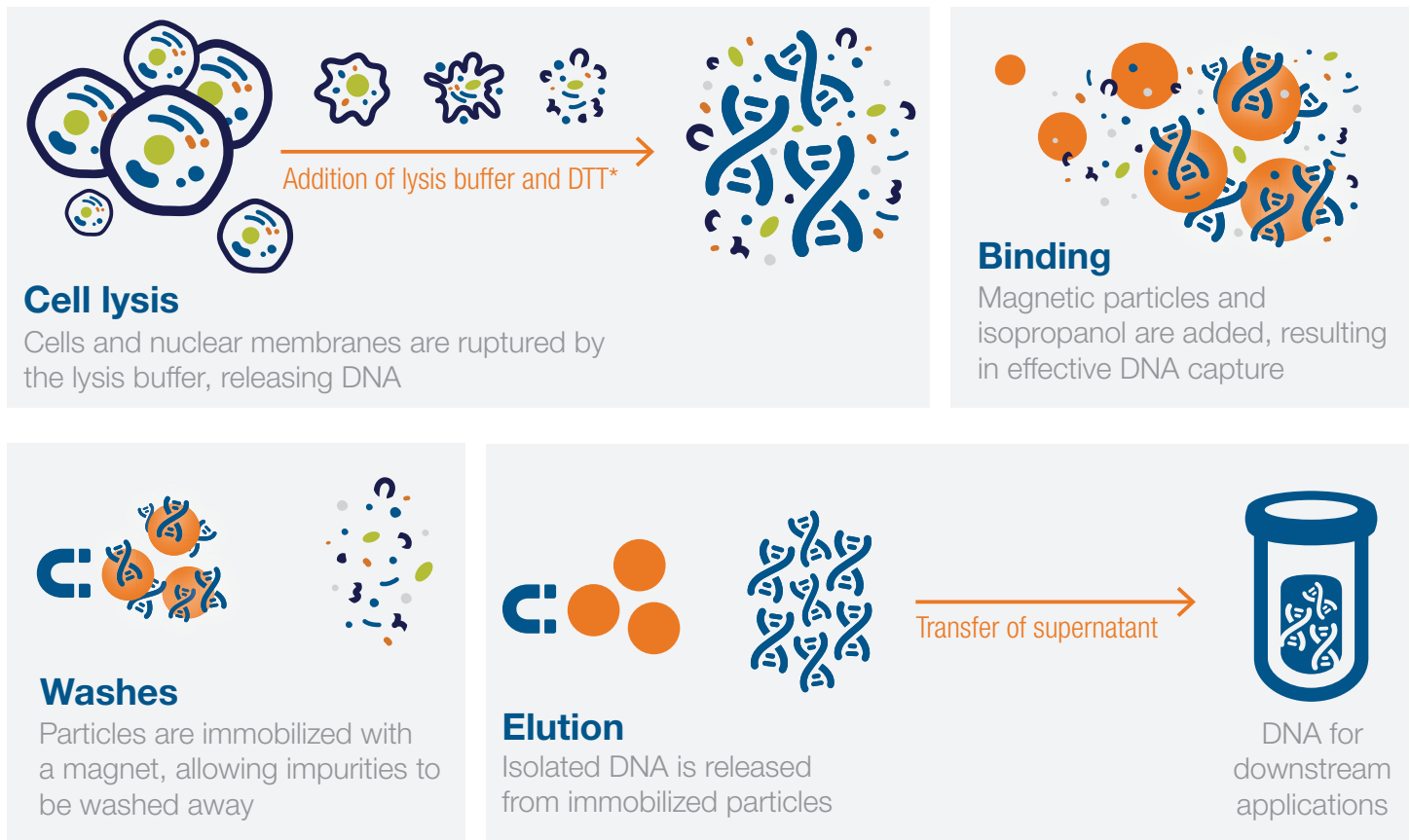
- Body fluids (blood, saliva, semen)
- Stains and swabs of body fluids
- Hair roots
- Touch or trace DNA samples

PrepFiler BTA Forensic DNA Extraction kits can be used for the most challenging forensic sample types, including:

- Bone
- Teeth
- Adhesive substrates (chewing gum, cigarette butts, tape lifts)
- Touch or trace DNA samples



The PrepFiler DNA Extraction kit purification process



* Proteinase K is also added during this step in the PrepFiler BTA kit protocol. The lysis buffer contains detergent for cell disruption and a high salt concentration for DNA capture. See individual protocol for lysis buffer preparation.

Prep-n-Go Buffer

Applied Biosystems™ Prep-n-Go™ Buffer is an exceptional buffer designed to 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 it is readily adaptable to both manual and automated workflows.

PrepFiler and PrepFiler BTA Lysis Buffer

Applied Biosystems™ PrepFiler™ and PrepFiler™ BTA Lysis Buffers are included in the kit packages for the off-deck lysis processes.

PrepFiler LySep Columns

Applied Biosystems™ PrepFiler™ LySep™ Columns are intended for use with the PrepFiler Forensic DNA Extraction kits and allow you to easily perform lysis and substrate removal in a single tube assembly. There is no transfer of the substrate to another tube for removal, thus minimizing hands-on time and helping to reduce the risk of cross-contamination and sample transposition events. The only analyst interaction and handling of the substrate occurs during the addition of the substrate to the PrepFiler LySep Column for lysis.



For medium- to high-throughput labs: automated purification, quantification setup, normalization, and amplification setup

The fully automated Applied Biosystems™ HID NIMBUS® Presto QNA System offers efficient purification of nucleic acids from lysed samples with automated quantitation and amplification setup, as well as automatic dilution protocol calculations and normalization—all in one instrument. The system is specifically scripted, optimized, and validated for use with Applied Biosystems™ chemistries. Its rapid and automated processing enables forensic laboratories to benefit from faster turnaround times with increased confidence in their results.



Automated workflow on the HID NIMBUS Presto QNA System

Workflow	Purification	Quantification setup	Normalization	Amplification setup
Automated functions	<ul style="list-style-type: none"> Purifies up to 96 lysed samples 	<ul style="list-style-type: none"> Quantification setup (choose from 5-point, 6-point, or virtual standard curves) 	<ul style="list-style-type: none"> Normalizes DNA samples Calculates dilution protocols 	<ul style="list-style-type: none"> Amplification setup
Automatically calculates labware and chemistry requirements				
Chemistries	PrepFiler and PrepFiler BTA Automated Forensic DNA Extraction Kits	Quantifiler Trio DNA Quantification Kit	N/A	GlobalFiler, GlobalFiler IQC, VeriFiler Plus, Yfiler Plus, and NGM Detect PCR Amplification Kits
Saves time, improves reproducibility, and helps ensure consistent results				

With the HID NIMBUS Presto QNA System, forensic labs can streamline their operations and save up to 5 hours of hands-on time* so analysts can focus on more complex analyses.

* Results are based on internal data for purifying 96 samples on the Applied Biosystems™ AutoMate Express™ system vs. the HID NIMBUS Presto QNA System.

Key features

High reproducibility

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

Less hands-on time

- Plug-and-play (optimized and validated for AB chemistries)
- Process more samples with less hands-on time
- Simple setup and walk-away workflow
- Minimal manual touchpoints to help reduce human error and contamination risk
- Reduces demand on highly skilled forensic scientists so they have more time to focus on more complex analyses



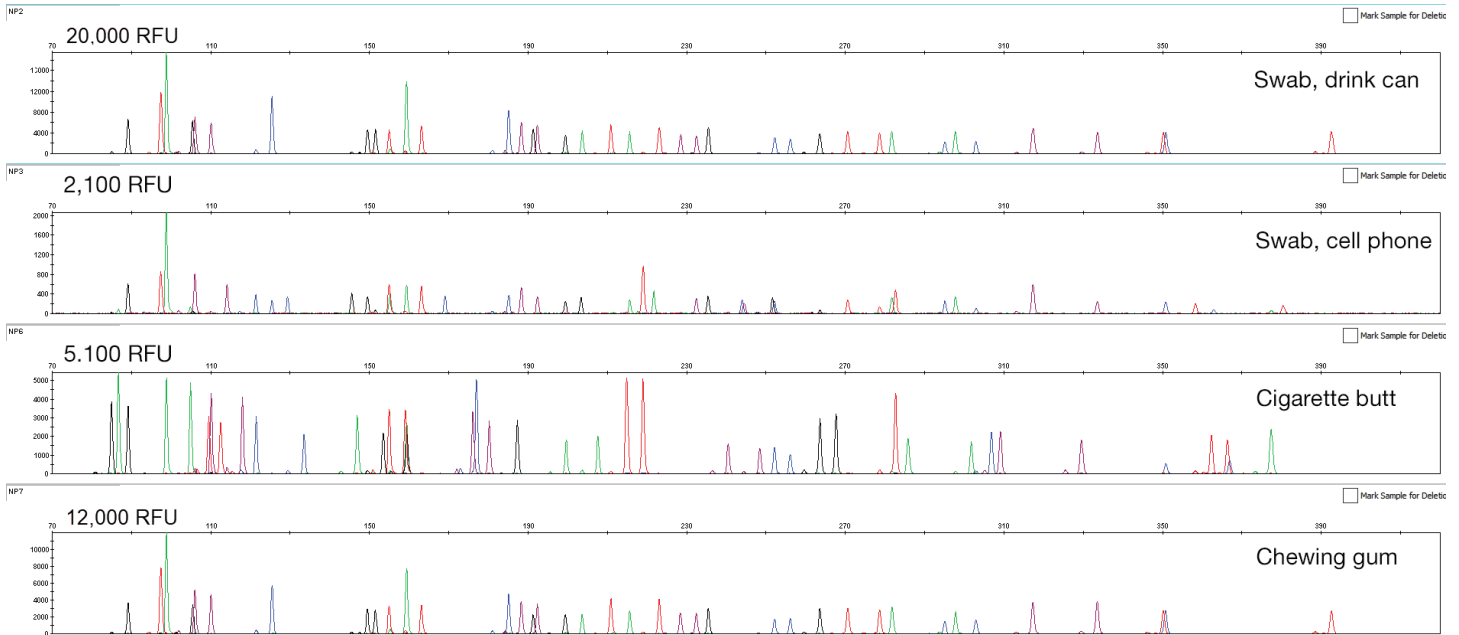


Figure 1. Applied Biosystems™ 3500xL Genetic Analyzer electropherograms of case-type samples purified on the ID NIMBUS Presto system with PrepFiler chemistry and amplified with the Applied Biosystems™ GlobalFiler™ PCR Amplification Kit.

Automated purification for low-throughput workflows

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

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 reducing 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 a comprehensive range of variable elution options from 20 µL to 250 µL (Figure 2)

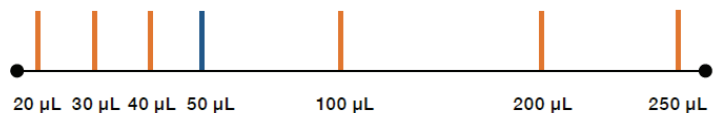


Figure 2. The AutoMate Express system comes with a preprogrammed card with a wide range of elution volumes.





DNA quantification

The quantification step of the casework workflow is key to determining how a sample will be processed downstream. Our quantification solutions enable informative integrated workflow decisions for the downstream processing of forensic samples.

Key features and benefits



Accuracy

More informative and comprehensive casework sample assessment for improved downstream results



Efficiency

Increased workflow efficiency with faster time-to-results and flexible sample-processing protocols



Flexibility

Flexible protocols allow for configurable output and display features

DNA quantification solutions

Applied Biosystems™ Quantifiler™ DNA Quantification Kits can be analyzed on the Applied Biosystems™ QuantStudio™ 5 Real-Time PCR System for HID and contain targets that measure both the quantity and quality of total human DNA and Y-specific DNA. The innovative quality index functionality enables a more comprehensive view of sample quality (both degradation and inhibition), while increased sensitivity and robustness correlate with Applied Biosystems™ STR chemistries. This enables you to screen samples and make critical workflow decisions (e.g., autosomal vs. Y-STR) with greater confidence. This may also be used to streamline the 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.

The **Applied Biosystems™ HID Real-Time PCR Analysis Software** is specifically designed for the HID application to help you take full advantage of the data and capabilities offered by Quantifiler kits while maximizing 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.

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.



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: 3.24×10^{-24} (Asian), 3.09×10^{-26} (US Hispanic), 3.71×10^{-26} (US Caucasian), 6.18×10^{-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

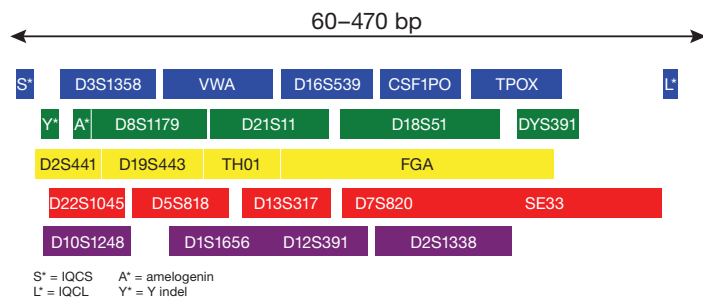


Figure 4. Multiplex configuration of the GlobalFiler kit. The kit includes all 24 loci, with only 1 locus partially exceeding 400 bp. Ten mini-STR loci are smaller than 220 bp, and all gender-specific markers are located in the green VIC™ dye channel for convenience of interpretation. The IQC Small (IQCS)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

- Enables amplification times of 45 minutes for GlobalFiler Express kit and 80 minutes for GlobalFiler and GlobalFiler IQC kits (Figure 5)
- 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
- GlobalFiler and GlobalFiler IQC kits are validated with HID NIMBUS QNA Systems and can save up to 5 hours of hands-on time

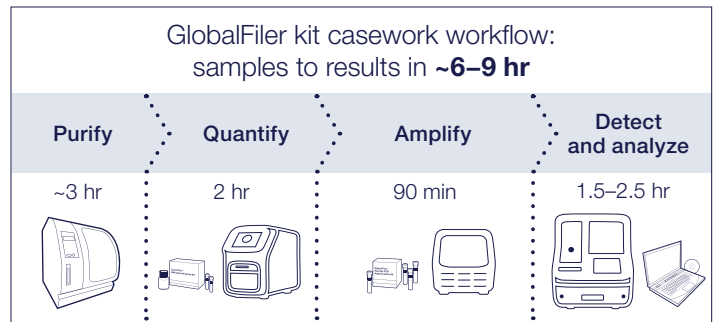
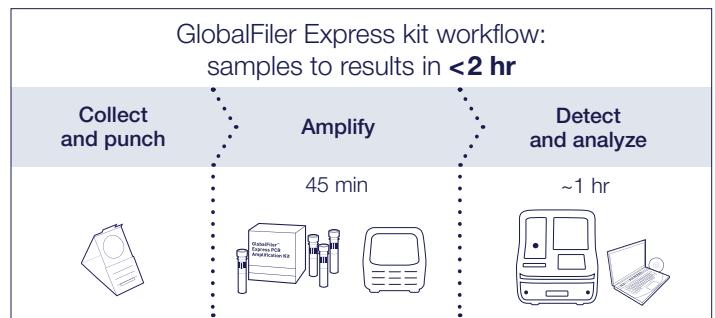


Figure 5. Typical workflow for up to 48 samples using Applied Biosystems™ thermal cyclers, genetic analyzers, and robust system analysis software.



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 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 help 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).

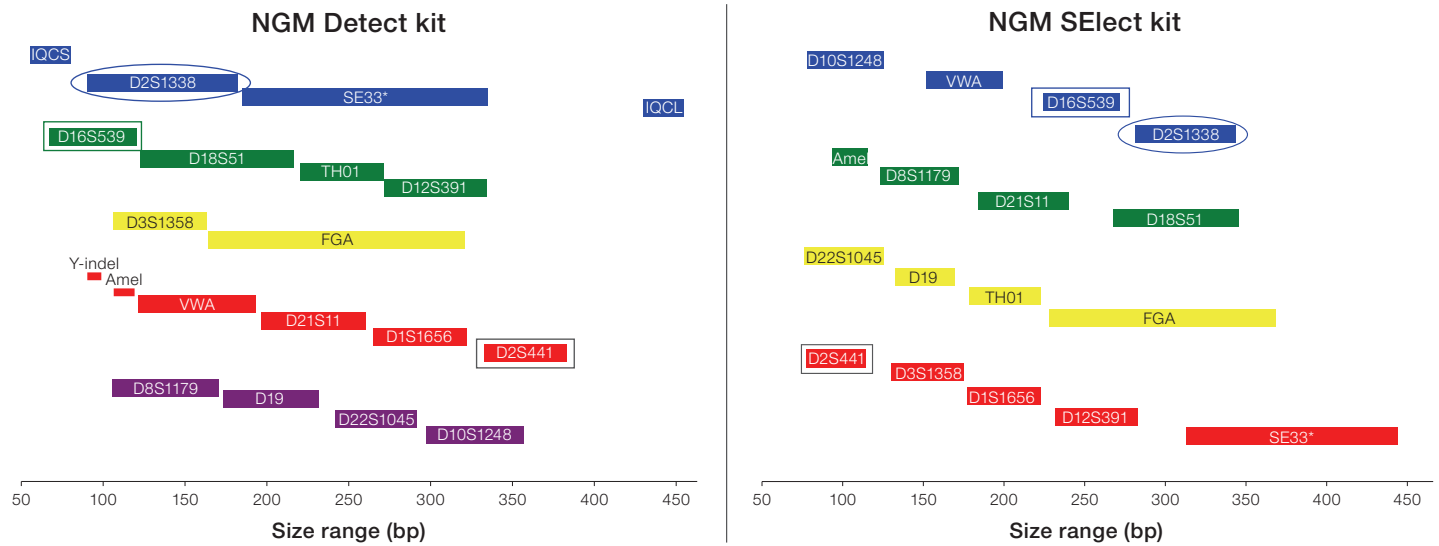


Figure 6. Relative positioning of markers in the NGM Detect kit (left) and the NGM Select kit (right). Some of the low MW markers in the NGM Detect kit, including SE33*, are high MW markers in the NGM Select kit, and vice versa.

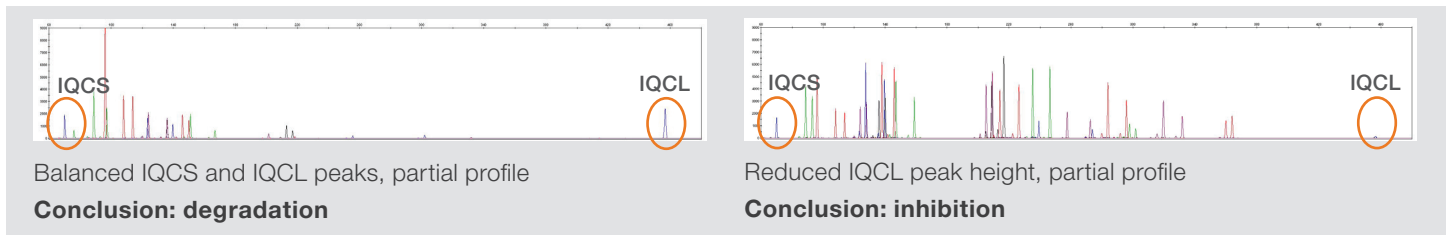


Figure 7. Analysis of samples using the two quality markers, IQC Small (IQCS) and IQC Large (IQCL), of the IQC system to differentiate between sample degradation and inhibition.



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.

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.

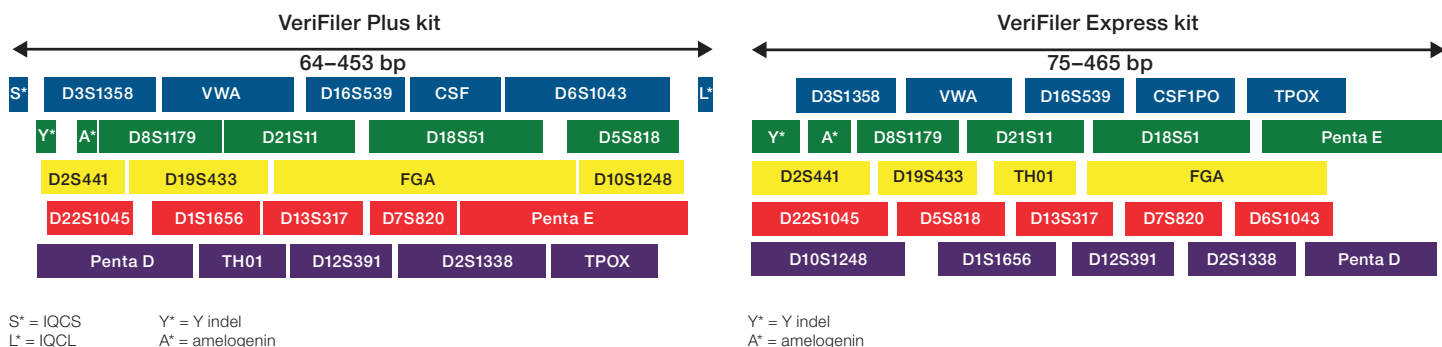


Figure 8. Marker layout comparison for the VeriFiler Plus kit (left) and VeriFiler Express kit (right).

Table 1. Specifications for the VeriFiler kits.

	VeriFiler Plus kit	VeriFiler Express kit
Improved sensitivity	Kit allows adding up to 17.5 µL of sample volume per 25 µL of reaction	–
Applications supported	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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.



The Yfiler Plus PCR Amplification Kit enables multiplex amplification of the 17 Y-STR marker set included in Applied Biosystems™ AmpFLSTR™ Yfiler™ kits, as well as 10 new Y-STRs. The 6-dye Yfiler Plus kit provides 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 7 rapidly mutating Y-STRs with mutation rates above 1×10^{-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).

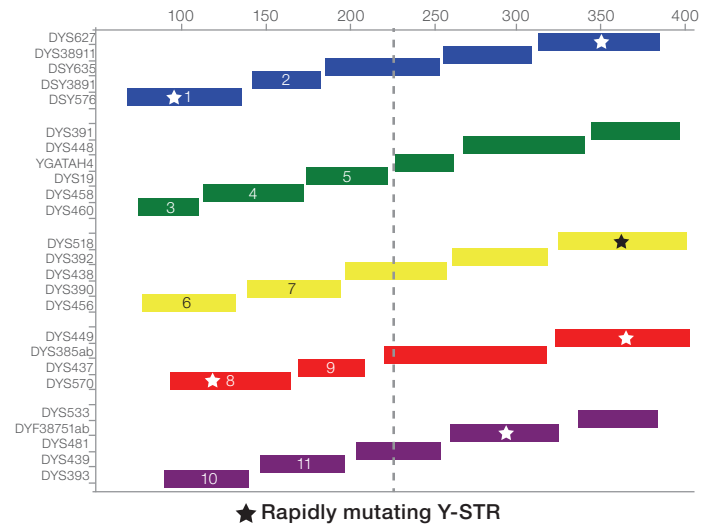


Figure 10. Marker design in the Yfiler Plus kit.

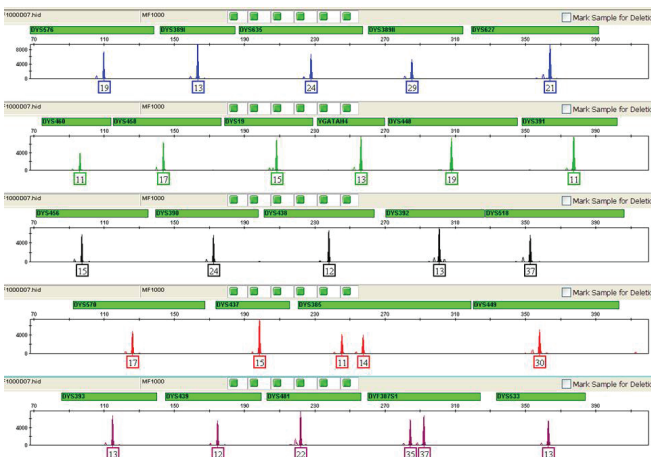


Figure 9. A 1:1,000 male:female mixture, amplified using the Yfiler Plus kit and 30 cycles on an Applied Biosystems™ 3500 Series Genetic Analyzer.

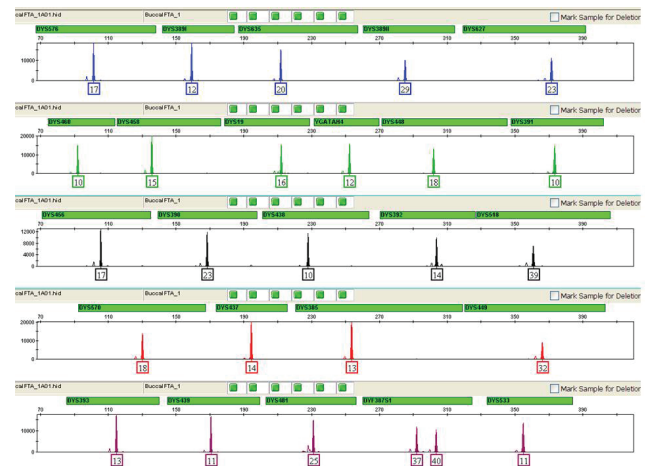


Figure 11. Direct amplification using the Yfiler Plus kit on a 1.2 mm Whatman™ FTA™ punch of buccal cells and 27 cycles on a 3500 Series Genetic Analyzer.



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 (SWGDM) December 2016 guidelines 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

Designed using capillary electrophoresis (CE) technology trusted by human identification (HID) labs for over 25 years, Applied Biosystems™ SeqStudio™ Flex Genetic Analyzers deliver the flexibility and accuracy your work demands. Innovative capabilities including a continuously accessible four-plate deck can help you achieve reliable short tandem repeat (STR) results efficiently. Features such as lab-friendly connectivity and easy, on-instrument training videos can help get you started quickly and minimize downtime.

Features

- **Configuration**—8- and 24-capillary systems with a 4-plate deck as well as flexible loading options
- **Results you can trust**—optimized data collection software and validated performance with Applied Biosystems™ STR kits, compatible with other 5- and 6-dye kits
- **Reduced pull-up (false secondary peak)**—auto-spectral calibration that utilizes sample-specific spectral data to reduce pull-up editing
- **Seamless data interpretation**—with Applied Biosystems™ GeneMapper™ ID-X Software v1.7
- **Web-enabled services**—remote monitoring, run setup, and instrument control
- **Lab-friendly connectivity**—integrate your instrument into the lab with local area network (LAN), Wi-Fi, USB, and laboratory information management system (LIMS) compatibilities
- **Get up and running quickly**—every SeqStudio Flex system includes expert service installation and a one-day HID field application specialist (FAS) training to help you get started faster
- **Protection and traceability**—with optional security, audit, and e-signature (SAE) software

Flexibility

- **Versatile scheduling**—continuously load plates and reprioritize urgent samples without having to terminate the current run
- **Increased walk-away capacity**—four plate positions accommodating 8-tube strips and 96-well plates for samples
- **Work when and where you want**—set up your plate and monitor run progress from anywhere using the Thermo Fisher™ Connect Platform

* Network connectivity is required for Smart Help, Remote Support, and remote monitoring.



Usability

- **Designed for all levels of experience**—simple one-button startup, autocalibration, and on-screen step-by-step routine maintenance instructions as well as onboard self-help training videos
- **Simplified capillary array installation**—redesigned, more robust arrays with “click-and-slide” retractor tabs and enhanced detection cell housing, enabling improved capillary protection, insertion, positioning, and ease of handling
- **Easy inventory management**—compatible with Applied Biosystems™ 3500 Series Genetic Analyzer buffers and polymers, with onboard radio frequency identification (RFID)–enabled tracking of consumable usage
- **No desktop computer required**—integrated touchscreen computer, intuitive software, walk-through wizards, and Applied Biosystems™ Plate Manager software for simplified plate setup and instrument operation



Serviceability

- Applied Biosystems™ instrument innovation continues through a digital service ecosystem for remote troubleshooting.*
- **Less instrument downtime**—remotely resolve issues in minutes, not days, using onboard Smart Help and Remote Support features
 - **Real-time audio/video collaboration**—the Remote Support feature brings our technicians into your laboratory using cutting-edge, security-minded digital tools
 - **Secure transfer of instrument performance data**—send log and run files directly from the instrument with the push of a button using Smart Help

 **70%** of issues resolved in minutes, not days, using our remote digital support tools





The Applied Biosystems™ SeqStudio™ Genetic Analyzer for HID is an easy-to-use 4-capillary benchtop system that delivers trusted 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 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 according to the SWGDAM December 2016 guidelines
- **Concordant results**—compared with 3500 Series Genetic Analyzers (Table 2)

- **Reduced pull-up (false secondary peak) editing**—autocalibration utilizing sample-specific spectral data and marker-to-marker calibration reduces pull-up editing (Table 3)
- **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 2. 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 3. 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.



GeneMapper *ID-X* Software

Advancements in instrumentation and amplification technology have shifted the bottleneck in forensic laboratories from sample processing to data analysis. GeneMapper *ID-X* Software is a comprehensive solution that combines expert-system and expert-assistant capabilities to streamline data review tasks. It offers user-defined thresholds and automated tools for genotype calls and supports sample review, editing, and processing. The software also simplifies database uploading and integrates well with third-party systems. GeneMapper *ID-X* Software is the industry standard for forensic data analysis and is an NDIS-approved expert system.

GeneMapper *ID-X* Software v1.7 continues the proven legacy of trusted analysis algorithms while adding new functionality and expanding compatibility. GeneMapper *ID-X* Software v1.7 supports data analysis from the SeqStudio Flex Genetic Analyzer for HID as well as legacy CE instrumentation going back to the ABI PRISM™ 310 Genetic Analyzer and includes support for Microsoft™ Windows™ 11. GeneMapper *ID-X* Software v1.7 validation follows the DNA Advisory Board (DAB) Quality Assurance Standards (July 1, 2020) and SWGDAM December 2016 guidelines.

New database

GeneMapper *ID-X* Software v1.7 utilizes a new PostgreSQL™ database. This database implementation was designed in compliance with Center for Internet Security™ CIS Benchmarks™ guidelines. The incorporation of the database includes new features and maintenance improvements in GeneMapper *ID-X* Software v1.7. Your lab will now be able to schedule automated database backups (Figure 12).

Manual (ad hoc) database backups and the restore function are available in the GeneMapper *ID-X* Software v1.7, along with the new scheduled backup feature.

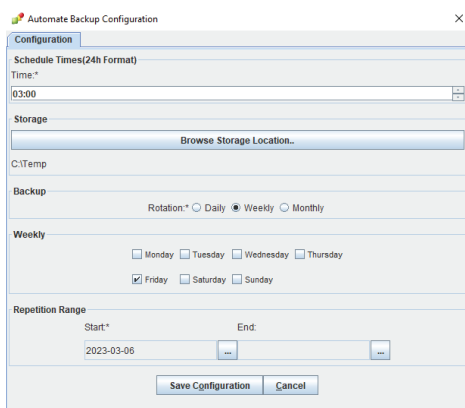


Figure 12. The automated backup configuration menu contains options to best suit your laboratory requirements.

User Interface

With new options for multiple projects and multiple plots, GeneMapper *ID-X* Software v1.7 allows analysts to open multiple projects at once (Figure 13) and compare samples across all open projects using the Profile Comparison tool as well as compare annotation differences between multiple projects. Analysts can open electropherograms in separate windows and compare them side by side, rather than scrolling back and forth between the profiles.

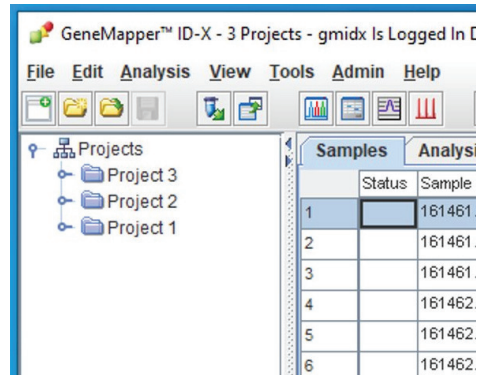


Figure 13. Multiple projects are open at the same time in the left-hand navigation panel.

You can annotate directly on sample plots. These notes can be moved anywhere within the dye channel by clicking and dragging. The notes are auditable, and all changes are recorded. The notes are printed on the PDF export and any associated printouts.

Analysis parameters

Forensic DNA laboratories have requested the ability to add their own data filters. In GeneMapper *ID-X* Software v1.7, forensic DNA laboratories can add data filters as there are a variety of optional settings. You can add your own allele-specific stutter parameters (Figure 14), marker-specific filters, and spectral pull-up filter settings.

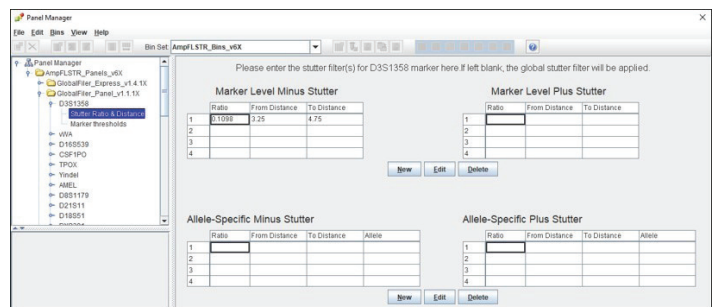


Figure 14. In the Analysis Method menu, optional allele-specific stutter and additive stutter options are enabled.



Rapid DNA analysis

With minimal training and just one minute of hands-on time, the fully automated, mobile-ready Applied Biosystems™ RapidHIT™ ID System is an exceptional platform for generating lab-quality forensic DNA profiles from reference and crime scene samples, in the laboratory or in the field. Compatible with established databases, the system generates DNA profiles using FBI NDIS–approved* GlobalFiler Express chemistry from the self-contained Applied Biosystems™ RapidHIT™ ID ACE GlobalFiler™ Express or the RapidINTEL™ Plus sample cartridges.

Paired with Applied Biosystems™ RapidLINK™ Software, the system offers full control of DNA results with 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.

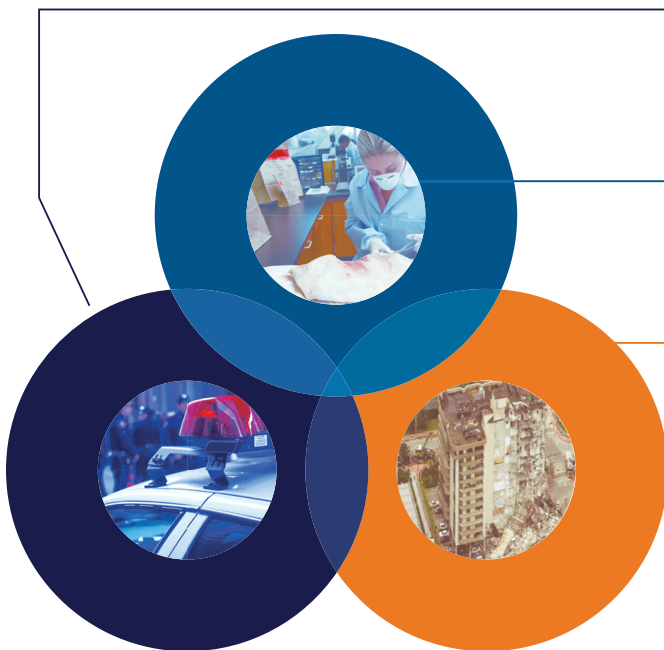


DNA results in 90 minutes

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



DNA-led investigations and identifications: 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 DNA samples more efficiently and enable personnel with limited experience

In the field

Personnel can conduct rapid identifications for mass casualty events, unidentified persons, or suspected human trafficking situations to provide answers and reunite families thanks to the system's portability and ease of use

* 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.



NGS applications

The Applied Biosystems™ Precision ID Next-Generation Sequencing (NGS) System for human identification with Applied Biosystems™ Converge™ Software can help you solve tough cases by obtaining more information from challenging samples. The analysis of alternative marker types (e.g., SNPs) to complement CE-STR results can help generate investigative leads in cold cases.

Our panels utilize Ion AmpliSeq™ technology, which applies the simplicity of PCR to targeted sequencing and enables from tens to thousands of genomic regions to be amplified simultaneously in a single PCR tube. 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.

Converge Software

Simplify the complexities of forensic DNA analysis with streamlined solutions NGS analysis, CE-NGS comparisons, and kinship and paternity analysis, with Converge Software. Designed to centralize all case data under one powerful solution, it's an intuitive—and integrated—system for getting answers. Modules are available for:

- mtDNA analysis (Figure 15)
- SNP analysis
- STR analysis
- Kinship and paternity
- Case management

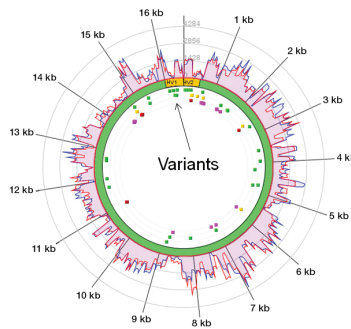


Figure 15. Circular plot analysis of the whole mtDNA genome from the “Converge mtDNA Analysis” module, used to visualize read depth across the genome and variant positions relative to the Cambridge Reference Sequence (CRS).

Table 4. HID applications and suggested panels.

Application	Panel
Victim identification, DVI, missing persons	Precision ID mtDNA Whole Genome Panel Precision ID mtDNA Control Region Panel Precision ID Identity Panel Ion AmpliSeq HID Y-SNP Research Panel v1 Combination: Ion AmpliSeq VISAGE-Basic Tool Research Panel, Ion AmpliSeq HID Y-SNP Research Panel v1, and Precision ID mtDNA Whole Genome Panel
Investigative leads	Precision ID Ancestry Panel Ion AmpliSeq PhenoTrivium Panel Ion AmpliSeq VISAGE-Basic Tool Research Panel
Externally visible traits	Ion AmpliSeq PhenoTrivium Panel Ion AmpliSeq VISAGE-Basic Tool Research Panel Ion AmpliSeq DNA Phenotyping Panel
Biogeographical ancestry	Precision ID Ancestry Panel Ion AmpliSeq PhenoTrivium Panel Ion AmpliSeq VISAGE-Basic Tool Research Panel Ion AmpliSeq MH-74 Plex Research Panel
Number of contributors, mixture deconvolution	Ion AmpliSeq MH-74 Plex Research Panel Precision ID GlobalFiler NGS STR Panels

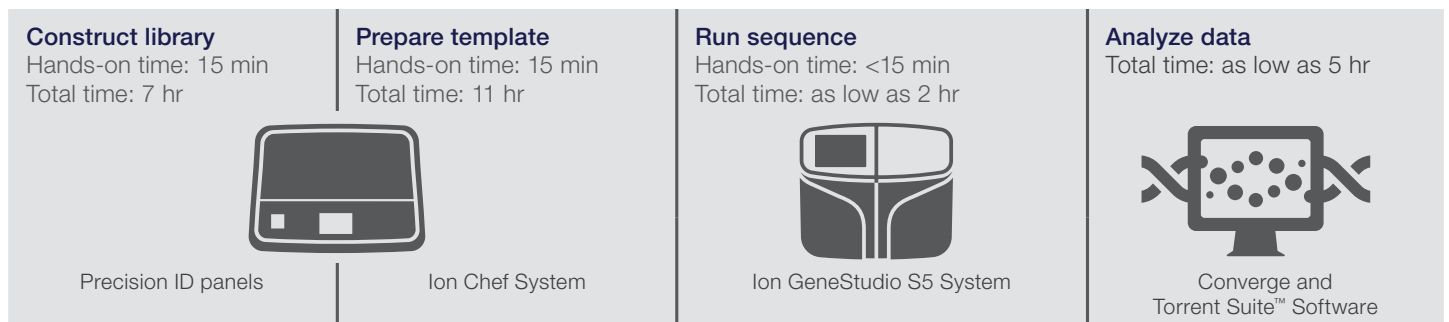


Figure 16. Adopting NGS for forensic DNA analysis in your laboratory is simpler than ever, when you combine the Ion Chef™ System and Ion GeneStudio™ S5 series systems with optimized Applied Biosystems™ Precision ID library preparation, template preparation, and sequencing kits and forensically relevant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



NGS applications (continued)

Panels

Precision ID Panels

Applied Biosystems™ Precision ID mtDNA Whole Genome Panel is an innovative approach to mitochondrial DNA sequencing specifically developed for forensic applications, particularly in missing persons investigations and disaster victim identification. Precision ID mtDNA Whole Genome Panel, using the control region data for analysis, is approved for inclusion in the US National DNA Index System (NDIS) CODIS database.



Applied Biosystems™ Precision ID mtDNA Control Region Panels are based on the same tiling approach used in the Precision ID mtDNA Whole Genome Panel. This targeted control region panel spans the entire 1.2-kb control region, which encompasses HV-I, HV-II, and HV-III and can be used when whole genome sequencing is prohibited.



Applied Biosystems™ Precision ID Ancestry Panels contain 165 SNPs and can provide you with biogeographic ancestry information and provide investigative leads.

Applied Biosystems™ Precision ID Identity Panels contain 34 upper Y-clade SNPs and 90 autosomal SNPs and provide unique genotypes to identify degraded samples for HID applications. This kit enables discrimination of individuals similar to STR genotype match probabilities used by forensic analysts (between 1×10^{-31} and 6×10^{-35}).

Applied Biosystems™ Precision ID GlobalFiler™ NGS STR Panels v2 include 36 markers, including the same 21 autosomal STRs along with Y markers and amelogenin sex markers found in the GlobalFiler PCR Amplification Kit, as well as 14 additional informative markers for forensic analysis. When analyzed with NGS, these markers reveal more alleles (74%) than identified with traditional CE analysis due to sequence diversity within CE alleles of the same size. These isometric alleles can be used to help resolve complex profiles and mixtures.



Ion AmpliSeq community panels

Growing research on the application of alternative markers in the field of forensic genetics has aided in identifying methods to obtain more genetic information from challenging samples. The use of biogeographical ancestry, DNA phenotyping, and lineage markers can provide investigative leads in cold cases and cases where there are no suspects.

Ion AmpliSeq™ PhenoTrivium™ Panels contain ancestry, DNA phenotyping, and male lineage markers for a total of 200 autosomal SNPs and 120 Y chromosomal SNPs in a single panel.

Ion AmpliSeq™ VISAGE (Visible Attributes through Genomics)-Basic Tool Research Panels consist of 153 SNPs, allowing prediction of EVCs and biogeographical ancestry, and incorporating 41 SNPs of the HirisPlex-S assay and 115 BGA markers chosen for differentiation of seven continental populations.

DNA phenotyping can be useful for generating investigative leads in cases where STR profiles have not resulted in a database match. The **Ion AmpliSeq™ DNA Phenotyping Panel** is used to predict hair and eye color using 24 phenotype SNPs from the HirisPlex system. This panel targets 23 SNPs and one indel.

Microhaplotypes provide additive enhanced mixture analysis and biogeographical ancestry prediction capabilities that favor its use for forensic samples. The **Ion AmpliSeq™ MH-74 Plex Research Panel** is a 157–325 bp assay covering 74 microhaplotypes. These markers can enhance mixture deconvolution and provide biogeographic ancestry prediction capabilities.

Y-chromosomal haplogroups assigned from male-specific Y-chromosomal single nucleotide polymorphisms (Y-SNPs) allow paternal lineage identification and paternal bio-geographic ancestry inference, both being relevant in forensic genetics. The **Ion AmpliSeq™ HID Y-SNP Research Panel** enables analyses of 859 Y-SNPs to infer 640 Y haplogroups.

Learn more on [Ion AmpliSeq community panels](#)



HID Professional Services

Since 2007, our Human Identification Professional Services (HPS) team has been partnering with forensic laboratories and law enforcement agencies to help optimize their forensic workflow for efficiency and reliability. HPS offers a wide array of services, including validation, education and training, verification and performance checks, and implementation support programs based on internationally recognized standards. HPS technical project managers and field specialists bring extensive knowledge and experience to each project, helping forensic labs to seamlessly implement a new workflow while minimizing impact on daily operations. Forensic labs can rely on the HPS team to deliver high-quality services to help achieve their goals.

HPS services cover a wide range of validated solutions, spanning the entire HID product catalog. These services are designed to ensure your casework, database, and rapid-DNA workflows are optimized for forensic applications:

- Validation
- Performance checks and verifications
- SOP templates
- Competency test design
- Consultancy
- Operational efficiency packages
- HID education programs
- Lab relocation support
- Rapid DNA solutions

Experience

The HPS team has the depth of experience and expertise to meet your specific workflow needs. The group is available to work with customers nearly everywhere worldwide and works closely with local support, including field application specialists (FAS) and distributors, to enable a seamless experience before, during, and after HPS projects.

Service spotlights

Rapid DNA Services

A rapid DNA workflow adds a powerful investigative tool to your laboratory or law enforcement agency. Understanding the performance of your Applied Biosystems™ RapidHIT™ ID System enables you to establish informed procedures and an effective rapid DNA program. The HPS team delivers services that are carefully designed to meet the needs of your agency, including:

- A test plan that correlates to your rapid use case
- Remote or on-site wet work assistance to complete your workflow implementation
- An optional mock sample set to help accelerate your implementation



HID education programs

The training programs required in accredited labs can be time-consuming to maintain and deliver. Whether you need training for new analysts, new workflows, or continuing education, the HID Education Program course catalog offers education programs that are flexible and range from basics to practical hands-on training to suit a variety of needs.

- Virtual content offers flexible, self-paced, and budget-friendly options
- In-person training at your site or at a local Thermo Fisher Customer Experience Center includes classroom lectures and practical laboratory exercises
- Personalized training packages offer a unique opportunity for a hands-on experience of the full HID workflow



1. Project planning

HPS validation specialists and project managers consult with you and develop a detailed experimental design that defines clear expectations of every laboratory process included in the project.



2. Laboratory wet work

HPS provides the consumables, stock DNA samples, and on-site specialists needed to develop the laboratory data for your service. Once the work is complete, HPS will provide the instrument data files associated with your project.



3. Data analysis and report writing

HPS completes a thorough and detailed data analysis. The data are converted to a comprehensive report package that is reviewed by an independent technical project manager and includes detailed figures, tables, and references.



4. Teachback training

Teachback trainings provide a summary of the key results from your validation. Teachback and supplemental trainings engage your staff to actively listen, participate in, and understand their workflow.



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
NUCLEIC-CARD matrix, 1 spot	50 cards	4474001
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
Quantifiler Trio Automated DNA Quantification Kit	960 reactions	A58787
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 50-Sample Kit with Swab†	50 reactions	A46069
RapidINTEL Plus 50 Sample Cartridge Kit†	50 reactions	A54338
RapidHIT ID ACE GlobalFiler Express Kit†	50 reactions	441831
RapidHIT ID Primary Cartridge GlobalFiler Express 150 Kit†	150 reactions	A53084
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



Ordering information (cont.)

Product	Quantity	Cat. No.
Instrumentation		
AutoMate <i>Express</i> Forensic DNA Extraction System	1 system	4441763
AutoMate <i>Express</i> Forensic DNA Extraction System, with service install	1 system	4456582
HID NIMBUS Presto System	1 system	A55395
HID NIMBUS Presto QNA System	1 system	A55769
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
SeqStudio 8 Flex Genetic Analyzer for Human Identification	1 system	A56532
SeqStudio 24 Flex Genetic Analyzer for Human Identification	1 system	A56534
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
RapidHIT ID DNA Booking System [†]	1 system	A51271
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
HID Real-Time PCR Analysis Software v1.4	1 license	A78901
GeneMapper <i>ID-X</i> Software v1.7, full installation	1 license	A71700
GeneMapper <i>ID-X</i> Software v1.7, client installation	1 license	A71701
GeneMapper <i>ID-X</i> Software v1.7, demo installation	1 license	A71702
RapidLINK Software DNA Booking Station v1.0 [†]	1 license	A43976
RapidLINK Software v2.0 [†]	1 license	A59138
Matching Suite v1.0 [†]	1 license	A59805
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

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

* For Research, Forensic, or Paternity Use Only. Not for use in diagnostic procedures.

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