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The STAR Q Punch AS and STAR Q Swab AS Instruments:
High-throughput reference sample assay setup
for Investigator® STR GO! Kits



Introduction

Working in high-throughput database, reference or paternity laboratories, you face unique challenges related to DNA sample processing every day. The demand for ever greater sample numbers, while maintaining the same high first-time success rates and cost per sample means a constant endeavor to maintain quality standards and sample continuity. As quality standards and cost must not be compromised, this usually means that throughput is. To address these challenges, and to enable you to realize the full potential of your laboratory, we have developed two instruments: the STAR Q Punch AS and the STAR Q Swab AS. These instruments automate STR assay setup from FTA® or other collection card samples, and swabs, respectively. Both instruments have been developed as part of laboratory workflows enabling hundreds of samples to be processed each day.

Table 1. Features of STAR Q Punch AS and STAR Q Swab AS Instruments

Feature	STAR Q Punch AS	STAR Q Swab AS
Daily throughput (as part of a sample to capillary electrophoresis workflow)	Capacity of 384 samples a day in batches of 96 samples	
STR assay setup	Pre-validated protocols for QIAGEN® Investigator STR GO! direct amplification assays	
Validated sample input types*	<ul style="list-style-type: none"> • GE Healthcare easiCollect® FTA cards • Copan NUCLEICards 	<ul style="list-style-type: none"> • GE Healthcare Omni swabs • Puritan® polyester swabs • Copan® Flocked swab • Sarstedt® cotton swabs
Pre-treatment	<ul style="list-style-type: none"> • 1.2 mm sample punch, into PCR reaction mix in PCR plate • Full image recording of punching step 	Swab pre-treatment with heating/shaking, followed by pipetting of an aliquot into the PCR reaction mix
Operation	Simple-to-use GUI and software for step-by-step setup and operation	
Pipet tip attachment	Compressed O-Ring Expansion (CO-RE)	
Liquid level detection	Capacitive LLD (c-LLD) and pressure-based LLD (p-LLD)	
Pipetting method	Air displacement pipetting	
% CV when pipetting 1 µl (under defined conditions)	4%	4%
Number of pipetting channels	4	8
Assay setup time from sample loading	96 samples in under 90 minutes	
Plastics/consumables	<ul style="list-style-type: none"> • Instrument plasticware available from QIAGEN (except for PCR plates† and reagent tubes) • Compatible with most commonly used output PCR plates† 	
Installation	Installation and IQ/OQ documentation provided by QIAGEN or QIAGEN's partners	
Service and support	Provided by QIAGEN or QIAGEN's partners	
Validation support services	Provided by QIAGEN Forensic Application Specialists‡	

* Contact us for compatibility with additional swab or card types.

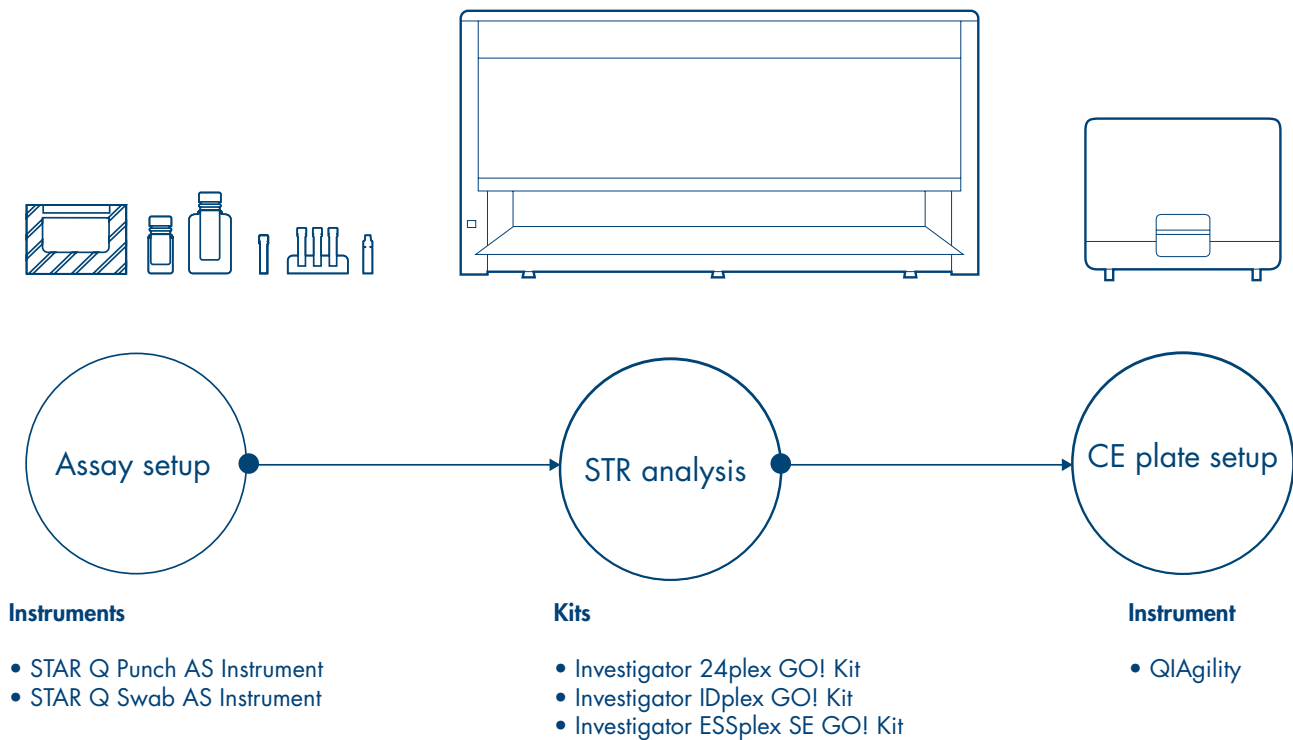
† Contact us for details of validated PCR plates.

‡ Not available in all countries; contact your local QIAGEN representative for details.

Complete workflow automation

To achieve the most efficient workflows using the STAR Q AS Instruments and to ensure that downstream detection of your DNA profiles keeps pace with your assay setup, a QIAgility® platform can be incorporated for capillary electrophoresis (CE) plate setup, enabling automation of the complete workflow up to capillary electrophoresis. With this workflow four plates of 96 samples can easily be processed each day, by a single analyst, working a typical 8-hour day.

Workflow overview of STAR Q Punch AS and Swab AS



STAR Q Punch AS Instrument

High-throughput punching and assay setup
for human identity paper samples



Figure 1. The STAR Q Punch AS Instrument.

The STAR Q Punch AS automates sample card punching and PCR assay setup, ensuring that a visual record of each punch is retained. Features include recognition of positively stained samples (e.g., blood on white card) and negatively stained sample (e.g., saliva on indicating cards), recognition of previously punched positions, and calculation of optimal

punching positions by sample detection according to preset parameters. Full traceability of samples is achieved through bar code reading of cards and card magazines, monitoring and reporting successful punch delivery to target well, and image retention of all punched samples.

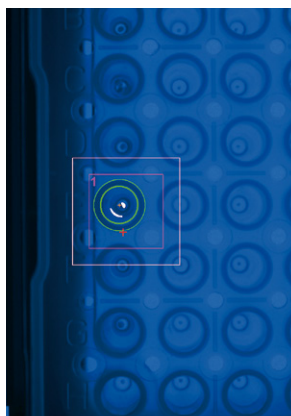
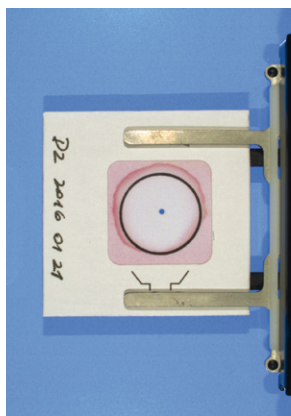


Figure 2. Elements on the STAR Q Punch AS Instrument worktable.

- Precision imaging of the correct sampling area for each collection card ensures the highest possible first pass success rates.
- Recording the successful punch into each sample well gives peace of mind and evidential continuity.

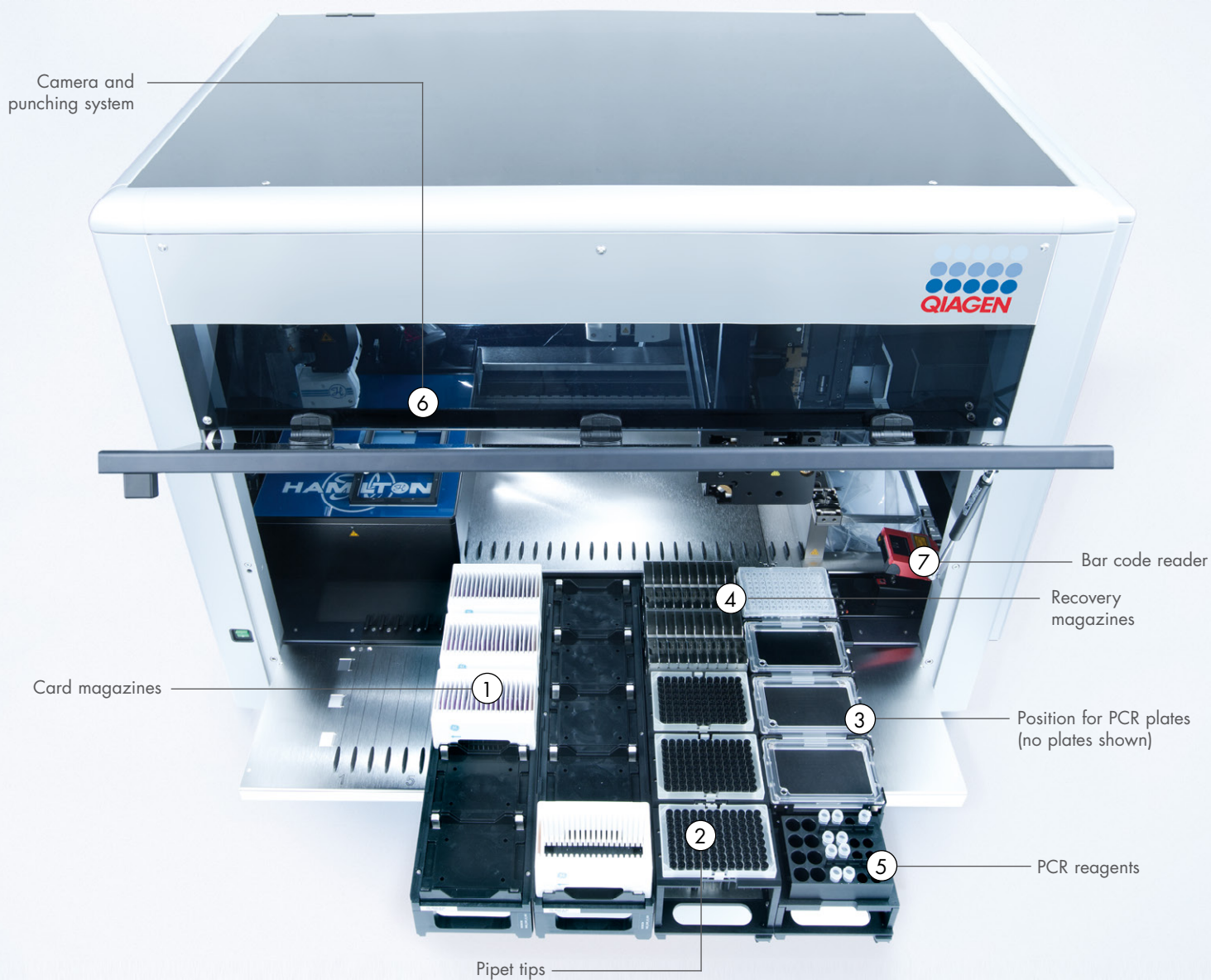


Figure 3. The STAR Q Punch AS Instrument deck layout.

STAR Q Swab AS Instrument

High-throughput lysis and assay setup for human identity swab samples



Figure 4. The STAR Q Swab AS Instrument.

The STAR Q Swab AS automates swab pre-treatment using a heater-shaker in addition to the assay setup. The validated protocol enables successful pre-treatment of a wide variety of commonly used swabs and removal of an aliquot of

lysate for PCR, without the risk of pipet tip clogging. Sample continuity is ensured thanks to comprehensive sample tracking and bar code reading of all plates.

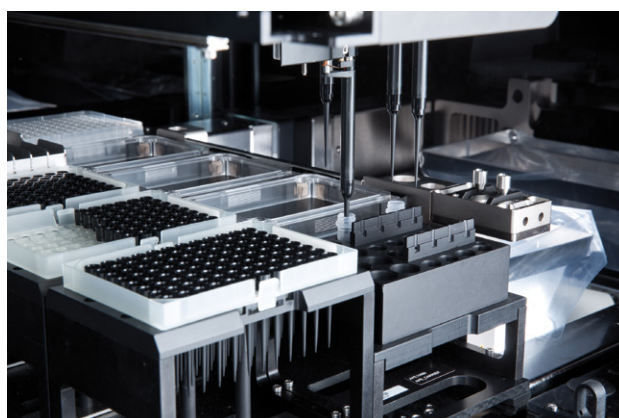


Figure 5. Elements on the STAR Q Swab AS Instrument worktable.

- Both STAR Q Instruments provide full sample bar-coding capability ensuring seamless sample tracking.
- Fully automated liquid handling enables high throughput with no compromise of quality.

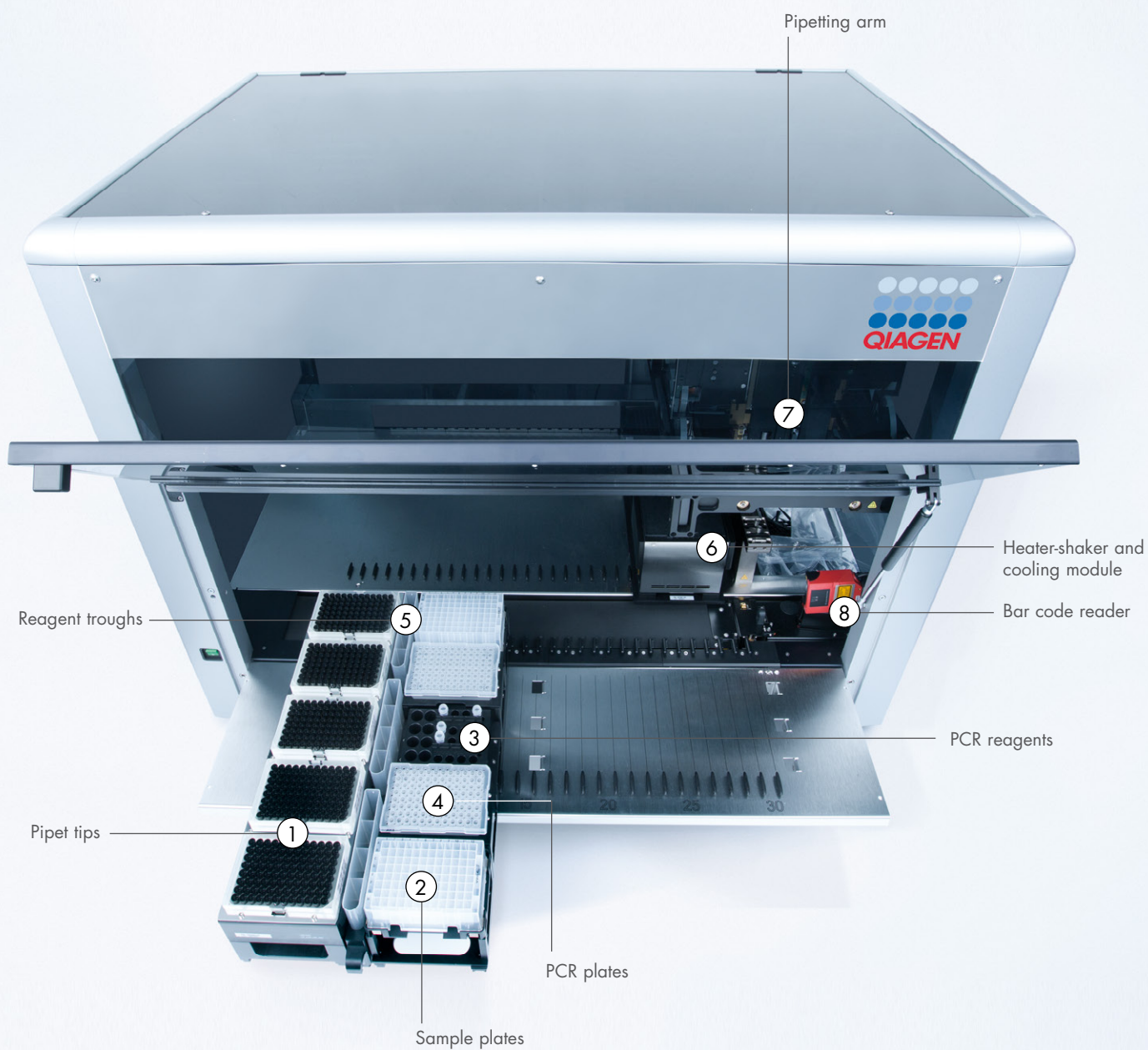


Figure 6. The STAR Q Swab AS Instrument deck layout.

Investigator STR GO! Kits and Quality Sensor™

When processing reference samples that may be used as evidence in court, or to determine the outcome of a paternity case, you need to have an STR profile you can trust, containing the right information. With this in mind, QIAGEN's Investigator STR GO! assay portfolio provides convenient direct amplification of all current international STR standards: the Combined DNA Index (CODIS) loci or the European Standard Set (ESS) loci.

Benefits of Investigator STR GO! Kits include:

- Ideal for reference samples from blood or buccal cells on FTA paper or from swabs
- Fully validated assay setup on STAR Q Punch AS and STAR Q Swab AS Instruments
- Optimized time-to-result attained as a consequence of fast process times
- Integrated performance control due the Quality Sensor
- Minimized allelic overlap, reducing the risk of misinterpretation and enhancing result quality
- Validated for use in human identification according to SWGDAM and ENFSI guidelines



Figure 7. The Investigator 24plex GO! Kit; NDIS approved.

Table 2. Technical specifications of Investigator STR GO! Kits

	Investigator 24plex GO! Kit	Investigator IDplex GO! Kit	Investigator ESSplex SE GO! Kit
Marker set	CODIS expansion	CODIS	ESS
Number of markers	22 + Amelogenin	15 + Amelogenin	16 + Amelogenin
Internal performance control	Quality Sensor	–	–
Volume per reaction	20 µl	25 µl	25 µl
Matrix	BT6	BT5	BT5
Fluorescence dyes	6-FAM™, BTG, BTY, BTO, BTR2, BTP	6-FAM, BTG, BTY, BTO, BTR	6-FAM, BTG, BTY, BTO, BTR
Genetic analyzers	Applied Biosystems® 3130/3130xl upgraded to 6 dyes or Applied Biosystems 3500 Genetic Analyzers	ABI PRISM® 3100/3100 Avant, Applied Biosystems 3130/3130xl or Applied Biosystems 3500 Genetic Analyzers	ABI PRISM 3100/3100 Avant, Applied Biosystems 3130/3130xl or Applied Biosystems 3500 Genetic Analyzers

To learn more about the full portfolio of QIAGEN's Investigator STR assays and solutions for human ID and paternity visit www.qiagen.com/STRtechnology.

Quality Sensor: Advanced STR analysis with an innovative and unique internal performance control

Better quality control checks for your STR analysis

The Investigator 24plex GO! Kit comes with an integrated quality control feature, the unique Quality Sensor, which allows the generation of additional, valuable data for performance checks. It is able to confirm a successful PCR amplification and to distinguish between the absence of DNA due to improper sampling and a failed PCR amplification, as well as differentiating between degradation and inhibition. This information can be used to choose the most appropriate rework strategy and streamline the overall workflow for direct amplification with higher first success rates.

With Quality Sensor you get information about:

- Successful PCR amplification
- Failed PCR amplification
- Absence of DNA
- Inhibited DNA
- Degraded DNA

For better quality control in your STR analysis, see www.qiagen.com/qualitysensor.

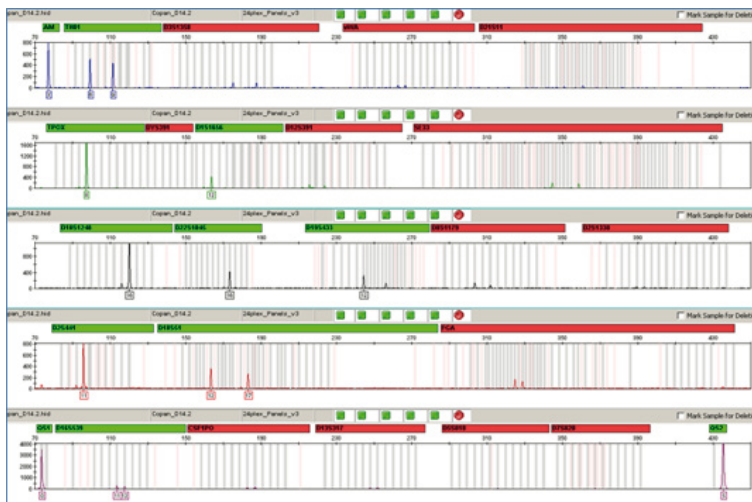


Figure 8. DNA profile generated from a buccal swab.

The sample shows “ski slope” morphology, characteristic of either degradation or inhibition. Because the rework strategy for these two issues is different it is important to understand which has occurred. Since the Quality Sensor peaks (bottom purple channel, far left and far right) have been successfully amplified, this demonstrates the absence of PCR inhibitors and therefore identifies DNA degradation as the problem. The lab should advise those collecting/storing/transporting this sample of appropriate conditions to prevent this and could try adding higher amounts of DNA to the PCR for this particular sample to achieve a full profile.

Reliable performance and high first pass success rates with Investigator STR GO! Kits

STAR Q Punch AS: Buccal cells collected on easiCollect

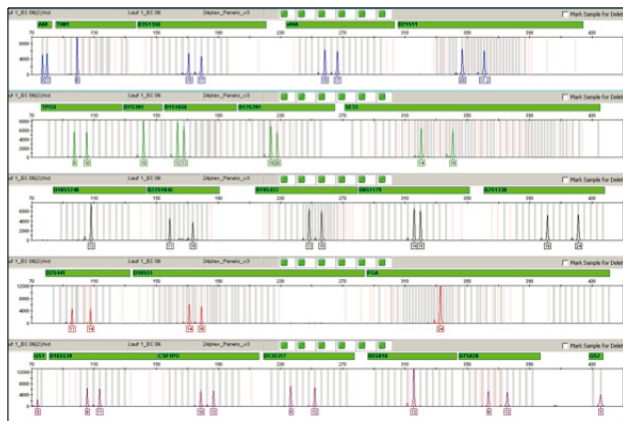


Figure 9. A typical, full, balanced profile generated using the Investigator 24plex GO! Kit, set up on the STAR Q Punch AS Instrument. The Quality Sensor confirms the successful result, as can be seen in the far right and far left of the bottom purple channel.

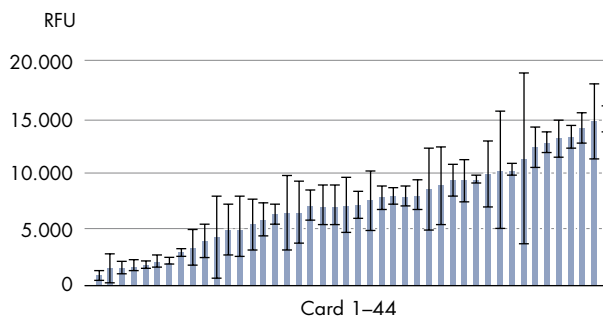


Figure 10. Investigator 24plex GO! Kit profile peak height variation for buccal cells collected on easiCollect. 44 cards were processed from 22 different donors with three independent runs (total 132 samples and 132 cross contamination controls). Each run comprised a checkerboard with alternating water samples. There were 3 cleaning punches between each sample and 98.5% full profiles at 200 RFU threshold (2 partial, total of 6 alleles missed). No peaks above 200 RFU in negative samples were observed. Peak height variation shows similar variation to that typically observed with manual PCR setup.

STAR Q Swab AS: Buccal cells collected on Puritan polyester swabs

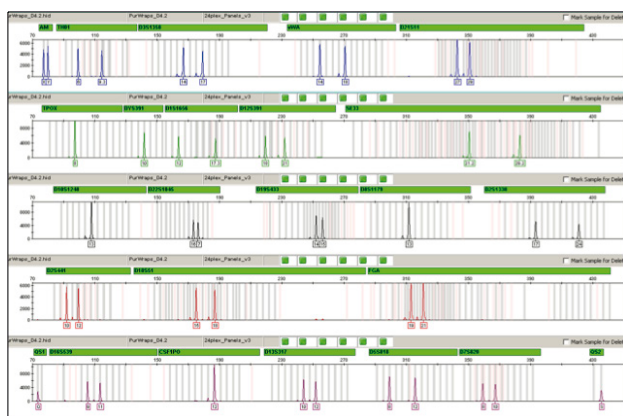


Figure 11. A typical, full, balanced profile generated using the Investigator 24plex GO! Kit, set up on the STAR Q Swab AS Instrument.

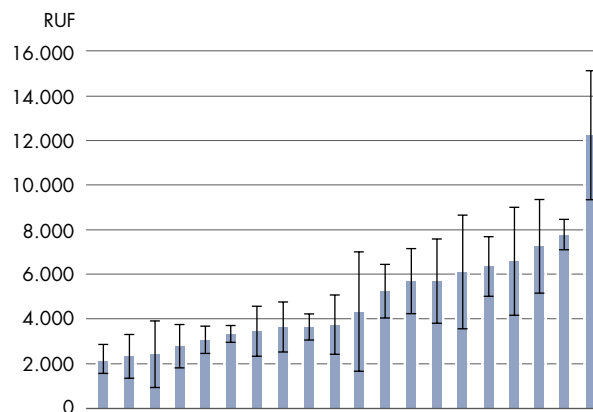


Figure 12. Investigator 24plex GO! Kit profile peak height variation for buccal cells collected on Puritan polyester swabs. Swabs from 20 donors, each with four replicates, were processed using checkerboards with alternating water samples (a total of 80 samples and 80 cross-contamination controls). All samples gave full profiles with RFUs over 200 and peak height variation showing similar variation to that typically observed with manual PCR setup. No sample carry-over was observed.

QIAgility: Reproducible automated pipetting for your capillary electrophoresis plate setup

The QIAgility is a compact benchtop instrument that enables rapid, high-precision pipetting, making it a highly suitable automation solution to prepare your sample plates for capillary electrophoresis following PCR.

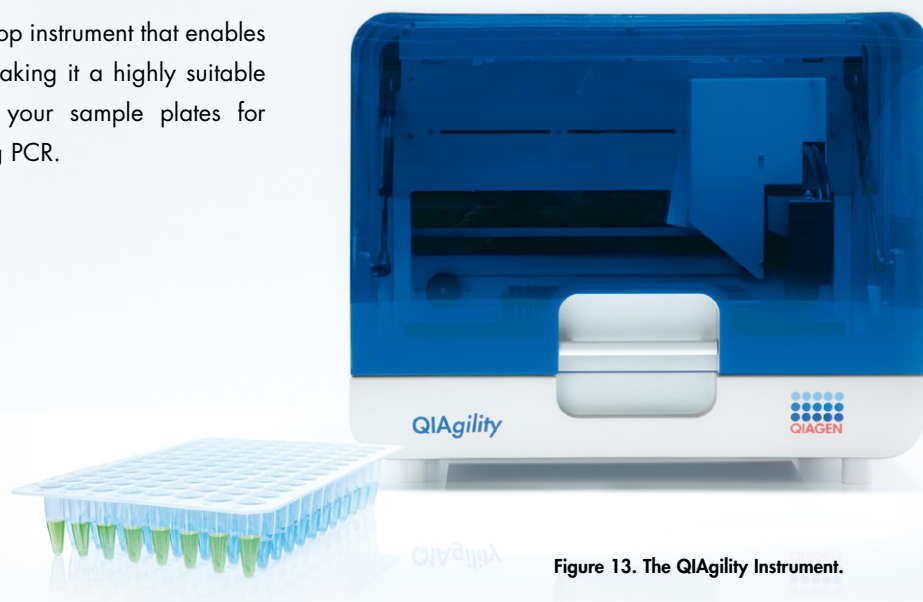


Figure 13. The QIAgility Instrument.

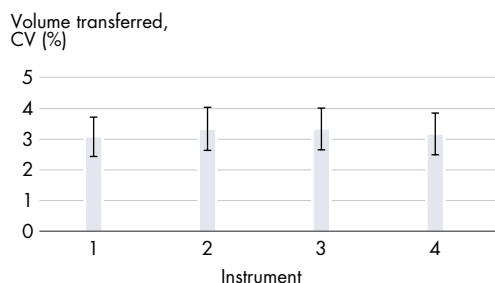


Figure 14. Precision and reproducibility across four QIAgility Instruments. A reaction mix was prepared manually from 5 parts Master Mix and 3 parts water. An experiment was defined in the QIAgility Setup Manager using the Rotor-Gene® SYBR® Green Kit with a total reaction volume of 25 μ l, resulting in a transfer of 20 μ l of ready-made reaction mix and 5 μ l sample input volume. The transfers were performed into weighted 200 μ l single tubes ($n = 36$ per instrument). The tubes were weighted again after the transfer and the weight difference taken to calculate the transferred volume. For each instrument, the pipetting precision was determined as coefficient of variation (% CV). The pipetting precision was approx. 3 % CV for all instruments tested.

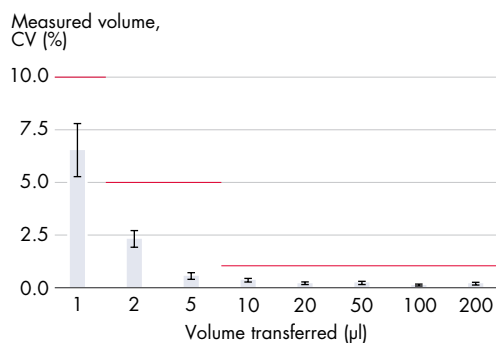


Figure 15. Pipetting precision. The Artel® MVS® system was employed to determine the pipetting precision of the QIAgility Instrument operated by the QIAgility Setup Manager software. Three runs including 12 data points per volume were performed on three QIAgility Instruments. The QIAgility transferred Artel solutions (selected according to the Artel MVS user manual) into the Artel buffer. For each run and volume ($n = 12$) the coefficient of variation was calculated to determine the pipetting precision of the QIAgility. The figure shows the mean value of the % CV values. Error bars indicate 1 x standard deviation. Pipetting variation for the 1 μ l sample was around 0.07 μ l.

QIAGEN Quality, Forensic Grade, and Investigator Brand



Figure 16. QIAGEN Quality, ISO 18385 Forensic DNA Grade.

High-quality Investigator solutions

Independent of the workflow you choose, you can trust in your results with QIAGEN Forensic Grade products. QIAGEN's entire Investigator product portfolio and corresponding manufacturing sites are compliant with the ISO18385 forensic standard to minimize the risk of human DNA contamination in products used to collect, store and analyze biological material for human identification purposes.



Figure 17. ISO 18385 Forensic DNA Grade.

For more Forensic Grade quality, see www.qiagen.com/forensicgrade.

Ordering Information

Product	Contents	Cat. no.
Instruments		
STAR Q Punch AS (EC)	Instrument with 1-year warranty on parts. For use with GEHC EasiCollect cards and Copan NUCLElcard system collection cards	9002651
STAR Q Swab AS Instrument	Instrument with 1-year warranty on parts. For use with all commonly used swab types for human identity reference samples	9002652
QIAgility System HEPA/UV (incl. PC)	Robotic workstation for automated PCR setup (with UV light and HEPA filter), notebook computer, and QIAgility Setup Manager Software: includes installation and training, 1-year warranty on parts and labor	9001532
STR assays and buffers		
Investigator 24plex GO! Kit (1000)*†	Primer Mix, Fast Reaction Mix 2.0 including Taq DNA polymerase, Control DNA, allelic ladder 24plex, DNA size standard 24plex (BTO)	382428
Investigator IDplex GO! Kit (1000)*†	Primer mix, Fast Reaction Mix including HotStarTaq Plus DNA Polymerase, Control DNA, allelic ladder IDplex GO!, DNA size standard 550 (BTO)	381638
Investigator ESSplex SE GO! Kit (1000)*†	Primer mix, Fast Reaction Mix including HotStarTaq Plus DNA Polymerase, Control DNA, allelic ladder ESSplex SE GO!, DNA size standard 550 (BTO)	381568
Investigator STR GO! Punch Buffer (1000)*	Lysis buffer for 1000 samples of epithelial cells on paper	386528
Investigator STR GO! Lysis Buffer (200)	Lysis buffer for 200 swab samples	386516
Accessories		
CO-RE Filter Tips, 50 µl (5760)*	50 µl CO-RE Filter Tip, sterile, black, for STAR Q Instruments	990065
CO-RE Filter Tips, 1000 µl (3850)*	1000 µl high volume CO-RE Filter Tip, sterile, black, for STAR Q Instruments	990084
Reagent Container, 120 ml (12)	120 ml Reagent Container 1T, self-standing, without lid; use with 8-/12-channel liquid handling arm; 3 wave breakers to avoid splashing during movements	990112
Biohazard Waste Bags (25)	25 Biohazard Waste Bags	990123

* Smaller kit sizes available.

† Not available in all countries.

Ordering Information

Product	Cat. no.
Validation Support Services	
Guided Validation Support Service*	Inquire
Accelerated Validation Support Service*	Inquire
Comprehensive Validation Service*	Inquire
Validation Competency Training*	Inquire
Implementation Support Services*	Inquire

* Not available in all countries.

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