



David Shackleton

# Implementation of the RapidHIT<sup>®</sup> ID for Reference Samples within the UK Criminal Justice System



Human Identification Solutions (HIDS) Rome, May 2018

# Life of a PACE Sample



Collect sample from arrestee



Log sample into Police National Computer system



Transport sample to forensic lab



Log sample into lab's evidence system



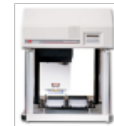
Place sample in secure store @ Lab

Meanwhile



Arrestee is released on bail

Process through Lab



National DNA Database search



Report database result to police



Find and re-arrest suspect



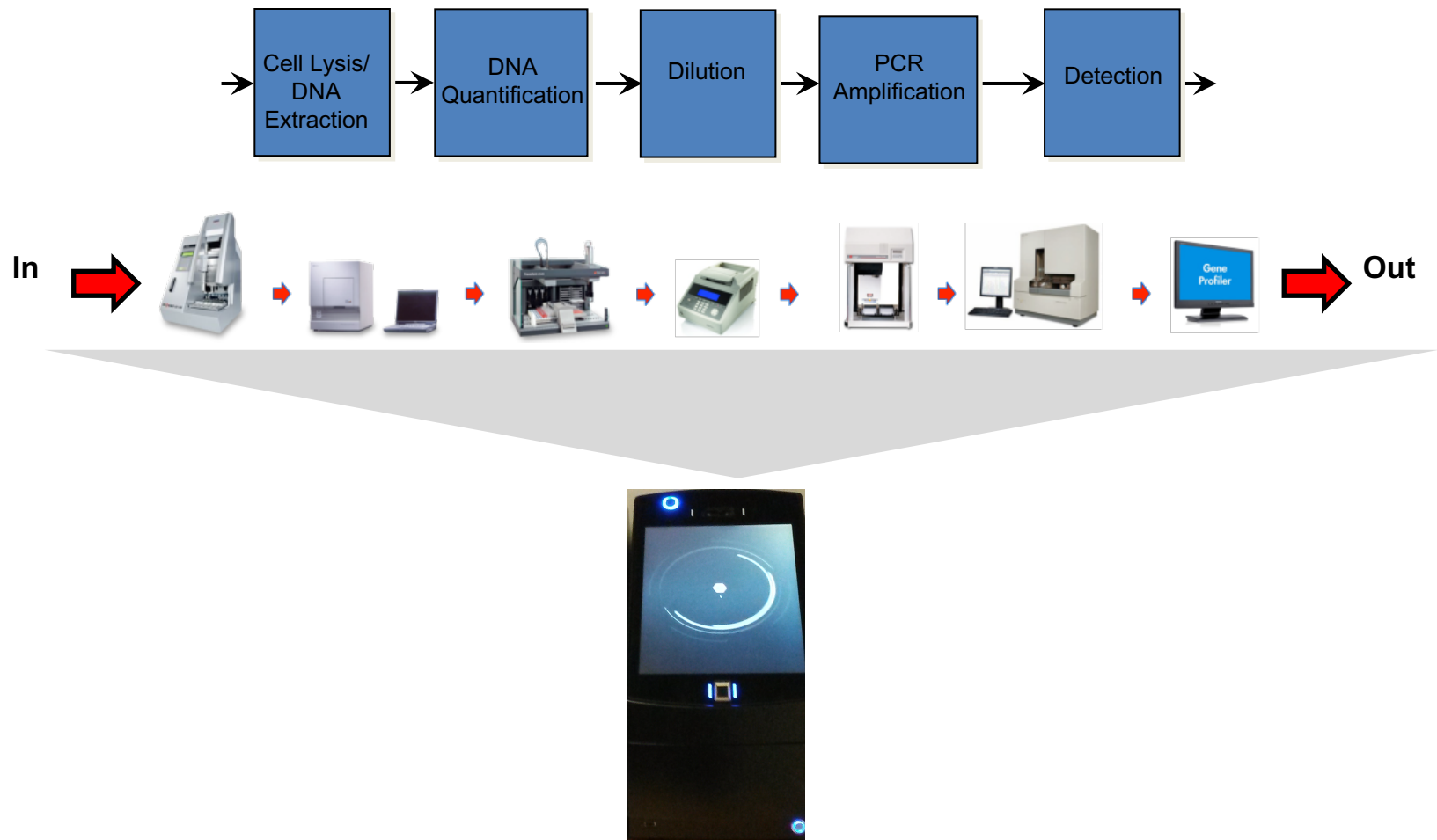
# Aims for Technology

- Rapid DNA process in less than 90 minutes
- Fully concordant DNA17 profiles

# Aims for Implementation

- At least 95% of buccal profiles suitable for loading to the National DNA Database without reworking
- Instrument suitable for deployment in custody suite and other, non-laboratory, environments
- Data handling and KFS processes compliant with the relevant legislation (PoFA, CPIA, Data Protection Act, etc.)
- All tracking measures are in place to ensure that chain of custody and process pathways can be identified for all samples processed using the RH-ID technology

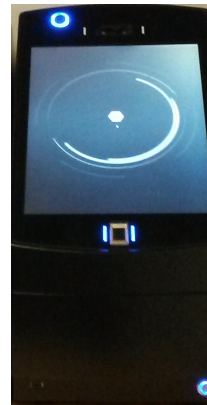
# What is the RapidHIT<sup>®</sup> ID?



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In →



→ Out

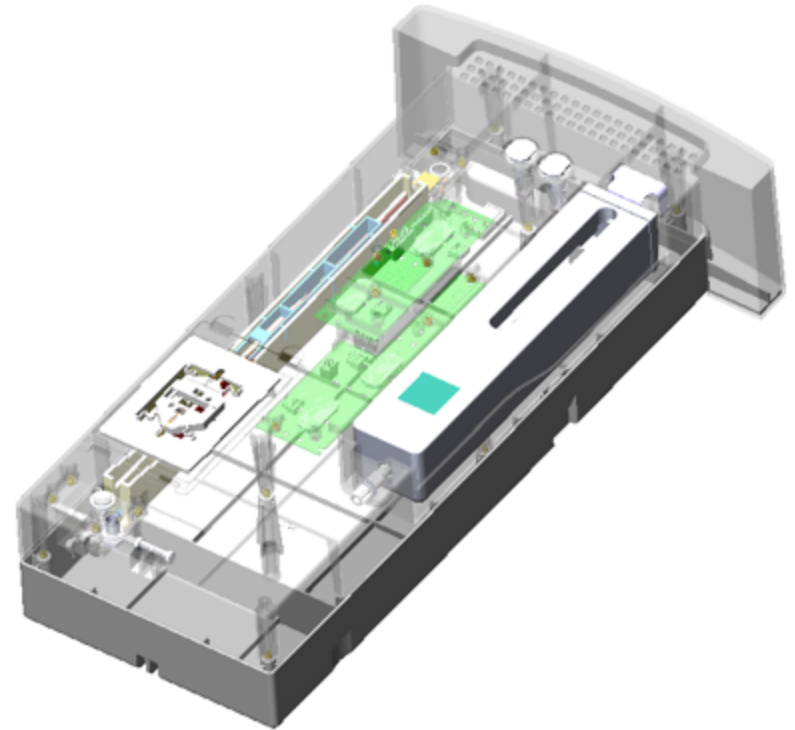
# Sample Cartridges



- Single Use
- RFID tagged  
(Expiry/Usage/Chemistry)
- Contains
  - PCR reagents (2x vials)
  - CE Loading cocktail (1x vial)
  - Absorbent waste pad

# Sample Cartridge & Primary Cartridge

- 150 or 250 samples
- RFID tagged  
(Expiry/Usage)
- Contains
  - Lysis Buffer
  - Capillary array
  - Gel syringe
  - CE Buffers
  - Waste

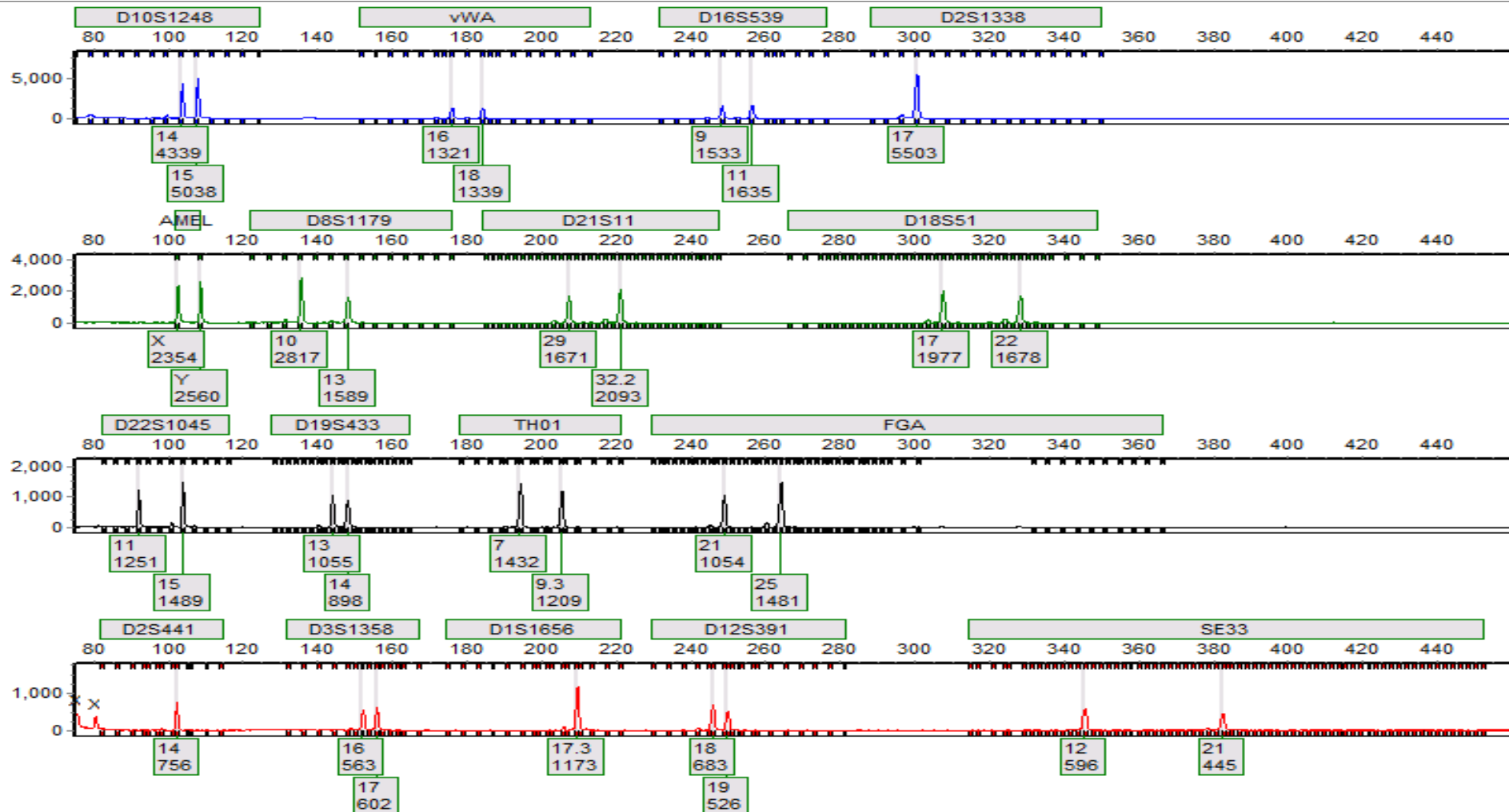


# KFS Development – Optimisation

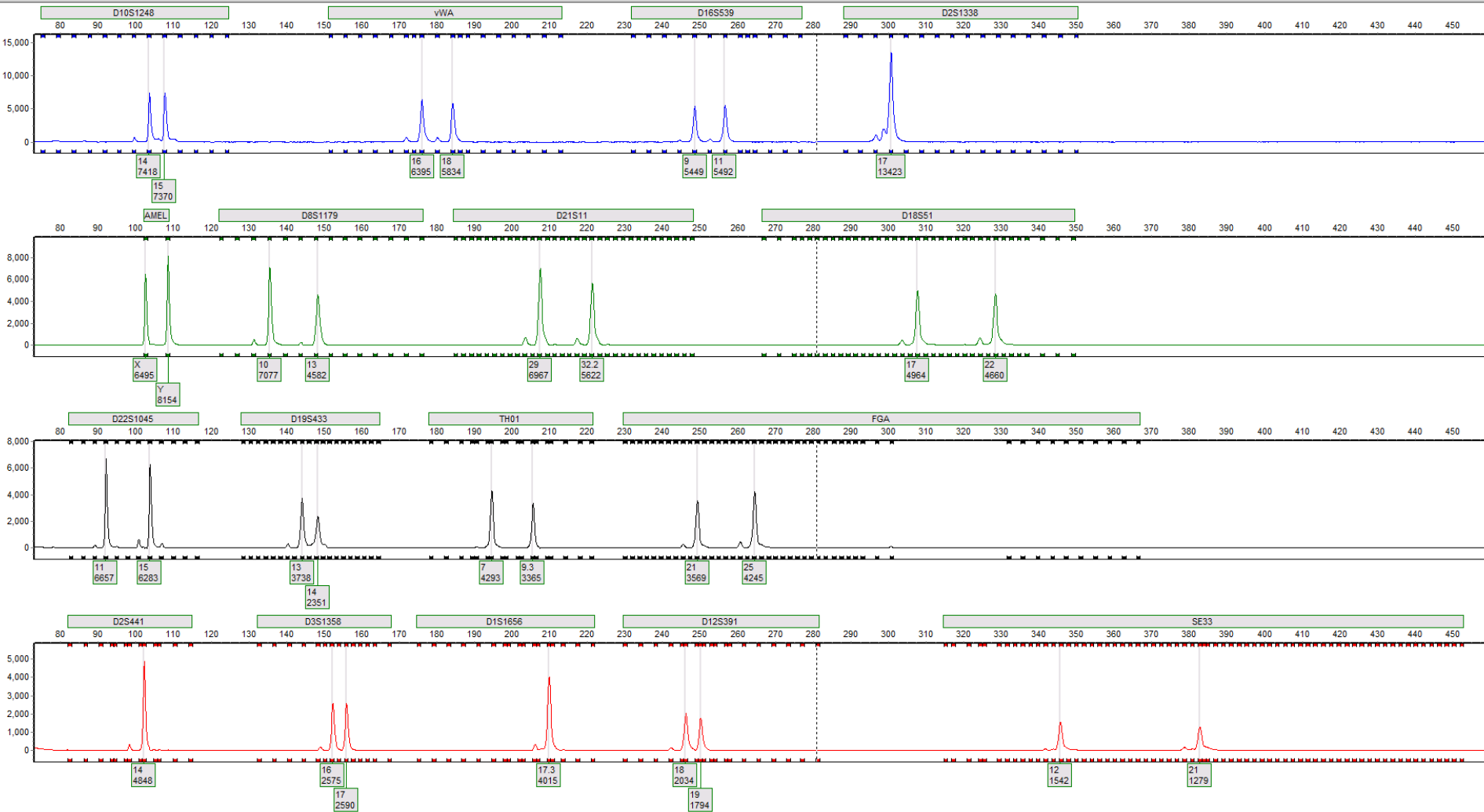
- Lysis
  - Volume (completed by IntegenX)
  - Temperature
  - Time
- PCR
  - All Parameters
- CE
  - Injection time
  - Injection Voltage



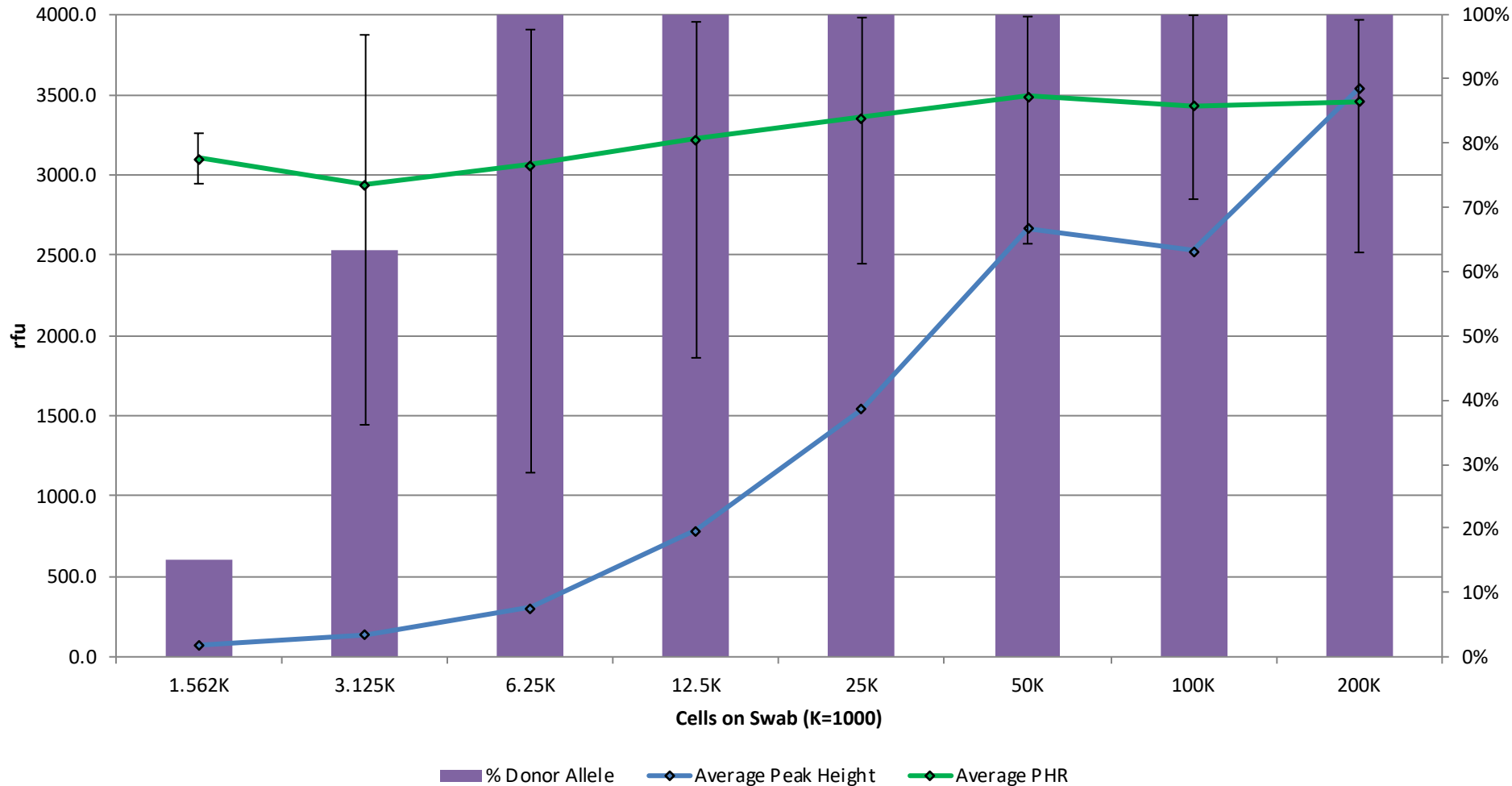
# Profile Before Optimisation



# Profile Post Optimisation



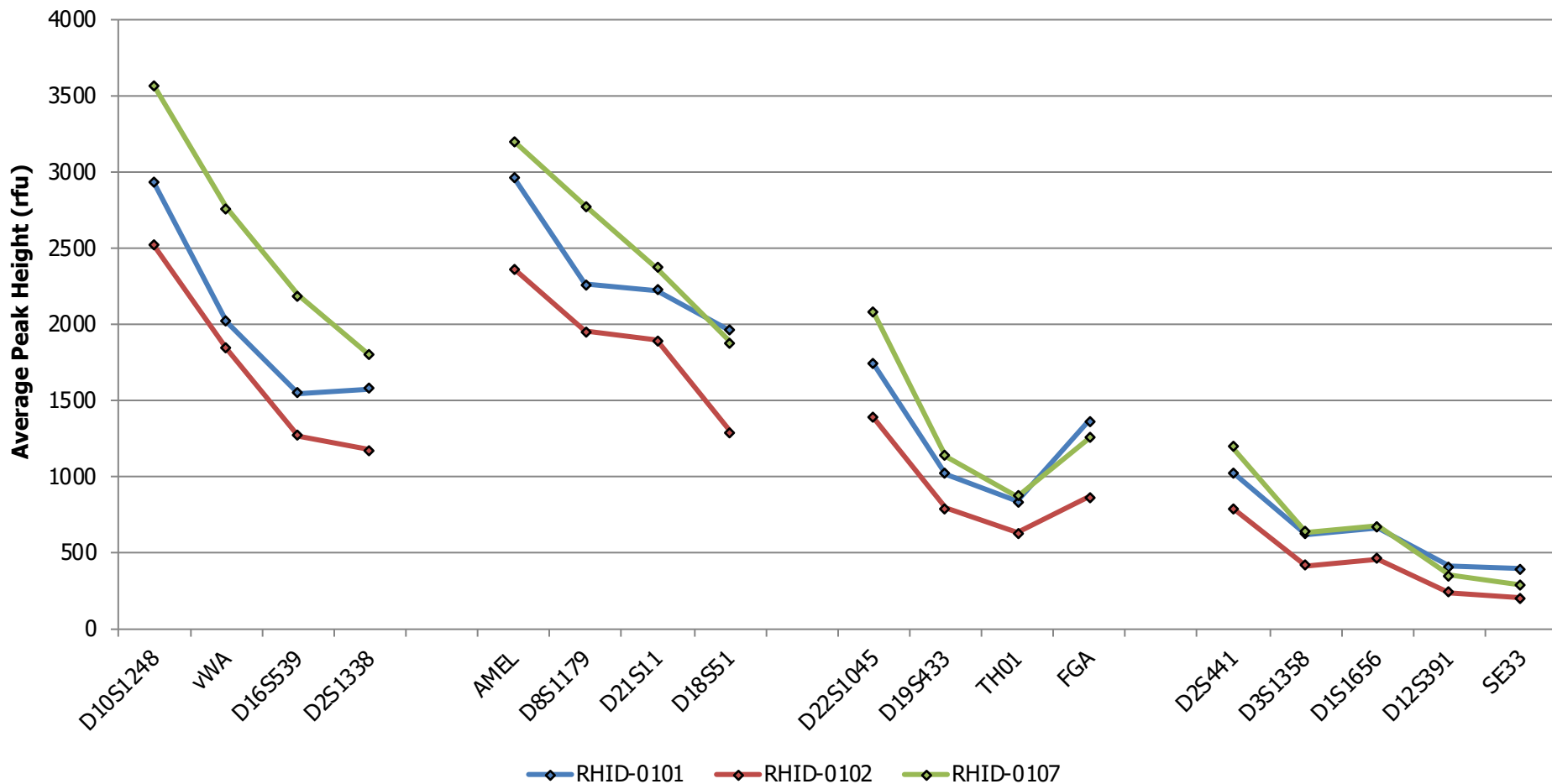
# Development Work – Sensitivity



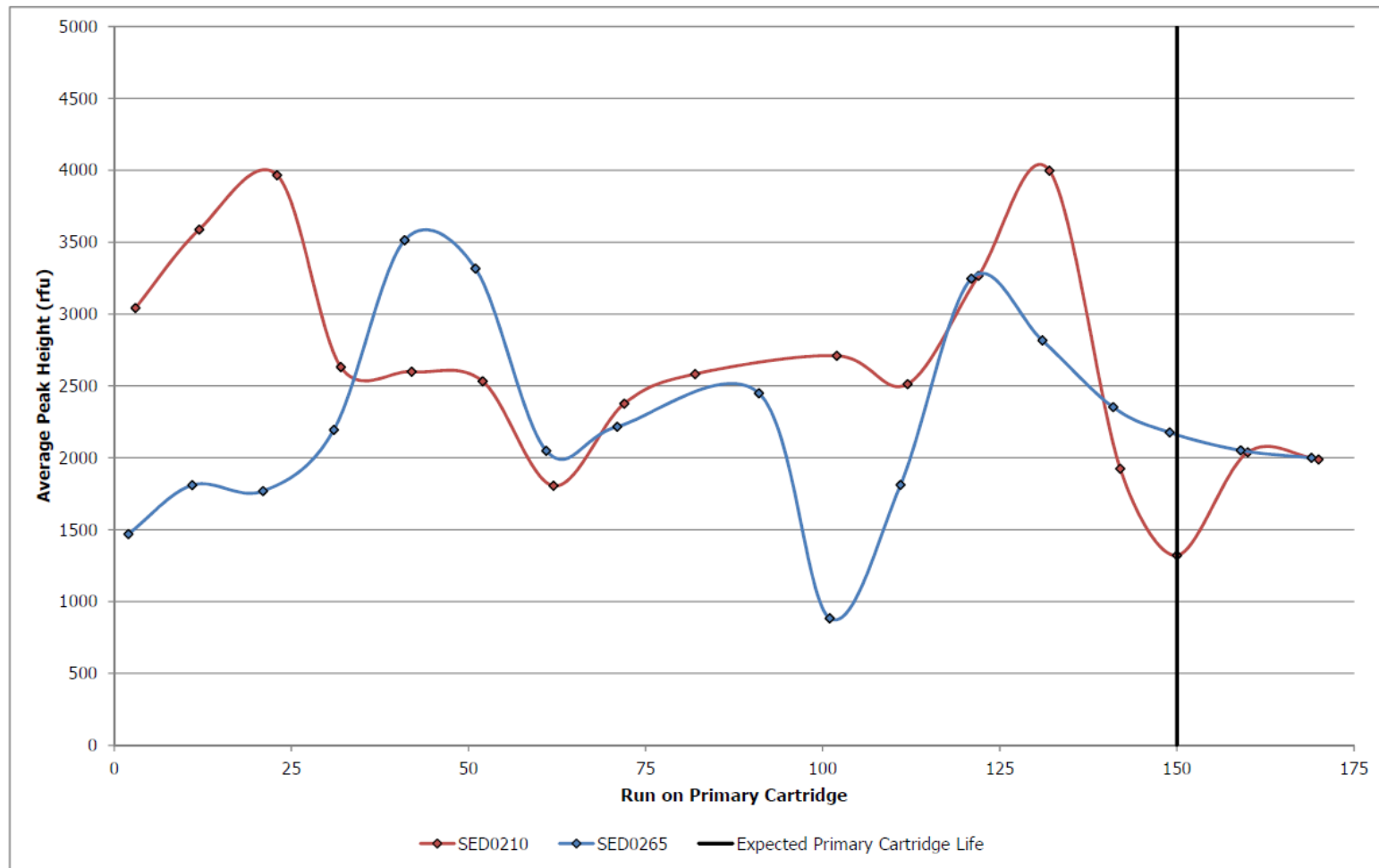
# Development & Validation Work – Profile Success & Concordance

- Manual review thresholds set
  - Limit of detection 35rfu
  - Homozygotes 350rfu
  - Peak height ratio 40%
  - $\pm$  Stutter Variable by locus
- 96.8% Full profile  
(150/155 sample on final method/analysis parameters)
- **All labelled peaks were concordant with the expected donor profile**

# Development & Validation Work – Inter Instrument Variation



# Development & Validation Work – Variation Throughout Life of Primary Cartridge





# Development & Validation Work – Implementation

- ISO17025/UKAS Sign Off
  - Received Jan 2018
- KFS to process PACE and reference samples through RapidHIT™ ID at Norwich site
- First PACE sample processed in 2 hours from receipt at lab to NDNAD report received; eliminating a suspect
- Beginning verification work of other KFS sites May '18



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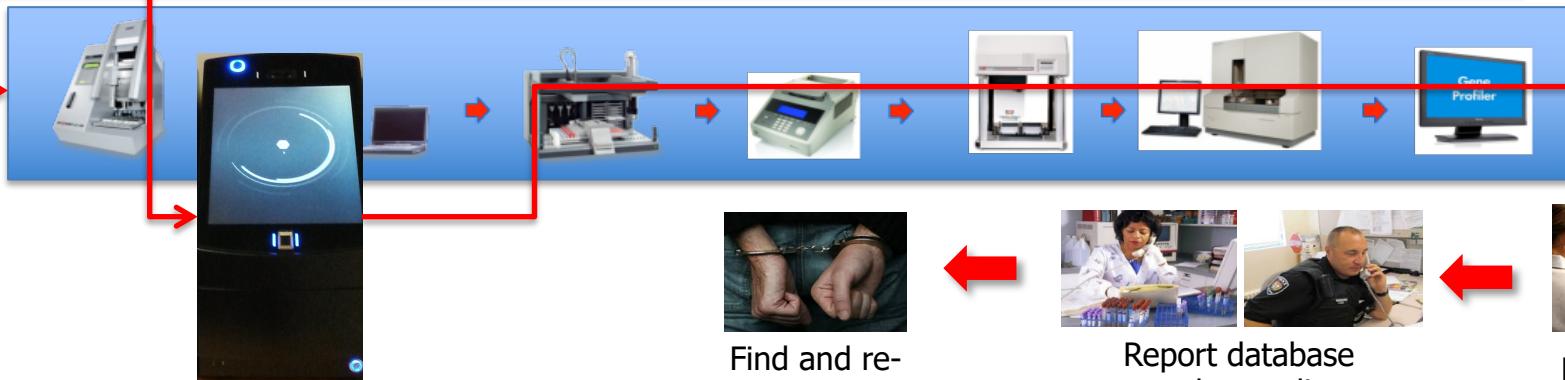
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National DNA Database search

# Putting the Instruments in Custody

## Advantages

- Major time saving can be made by placing instrument in custody environment
- Potential to get matches back from database before suspects are released
  - Saving time and money re-arresting
  - Preventing further offending

## Potential Issues

- Taking the experience away from the sample processing
- Remote control of instruments, troubleshooting and support required
- Transfer of responsibility for sample integrity and compliance
- IT Security

# Operator Experience

## Instrument Operation

- Simplistic, user friendly, interface
- On instrument instructions
- User levels to restrict advanced function to suitably trained users

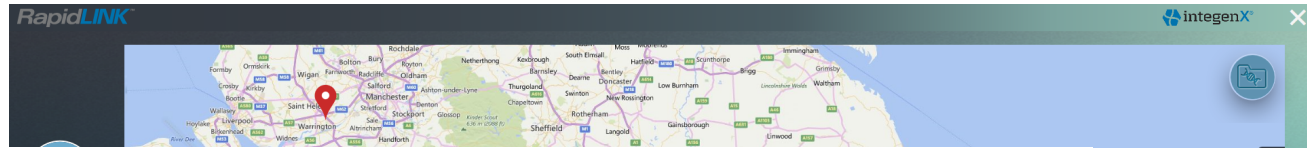
## Training

- Use experienced trainers to train relevant police staff
- Use a train the trainer model going forward
- Ensure that training includes all relevant information
  - Process
  - Legislation (e.g. PoFA, COSHH)
  - Explain wider implications of the technology

## On-going Competence

- User tracking on instrument to ensure suitable usage within timeframe
- Use QC or PT samples

# RapidLINK – Remote Control



GeneMarker HID - F\_000707\_17\_SIS\_NGMSE.sgf  
 File View Project Applications Tools Help

All Color Browser - Trace\_17CU623.fsa

Max Chart Numbers: 5 Show Selected Samples Trace\_17CU623.fsa

Sample Name	Marker	Allele1	Allele2
1	17CU623	D10S1248	13 16
2	17CU623	HVA	15 17
3	17CU623	D16S539	12 14
4	17CU623	D8S1398	17 25
5	17CU623	AMEL	X Y
6	17CU623	D8S1179	13 13
7	17CU623	D21S11	30 32.2
8	17CU623	D18S51	13 15
9	17CU623	D22S1045	15 17
10	17CU623	D19S433	14 14
11	17CU623	TH01	7 9.3
12	17CU623	FGA	22 22
13	17CU623	D28441	11 12
14	17CU623	D3S1358	14 18
15	17CU623	D181656	14 16.3
16	17CU623	D12S391	18 21
17	17CU623	SE33	30.2 30.2

Report

Page Up Page Down  
 Modified 2 samples PC error: 0/0 NC error: 0/0 Ladder error: 1/1 #Failed=0 #Flagged=1

3:31 PM 10/25/2017

RHD-0156 134 9/22/2017

RHD-0126 139 10/24/2017

# Troubleshooting & Support

**Live Help & Remote Assistance** – Already discussed

## **Hot Swap**

- Validating 'Hot swap' model
  - If an instrument fault is not repairable remotely it is swapped for spare working instrument
  - No further verification needed as spare is verified
  - Instruments shipped ready to run

# Transfer of Responsibility

**Training** – Already discussed

## **Legislation**

- Protection of Freedoms Act (PoFA)
  - Log in at end of run to record operator removing cartridge/responsible for A-Scrape destruction
  - Mark samples in RapidLINK for retention (CPIA rules)
  - Produce list of B-Scrapes for destruction and send to SPOC in custody
  - SPOC uses RapidHIT™ ID to mark as destroyed
  - Data delink function in RapidLINK – removes profile data

## **Accreditation**

- UKAS for ISO/ILAC/FSR codes of deployment model

# IT Security

## Issues

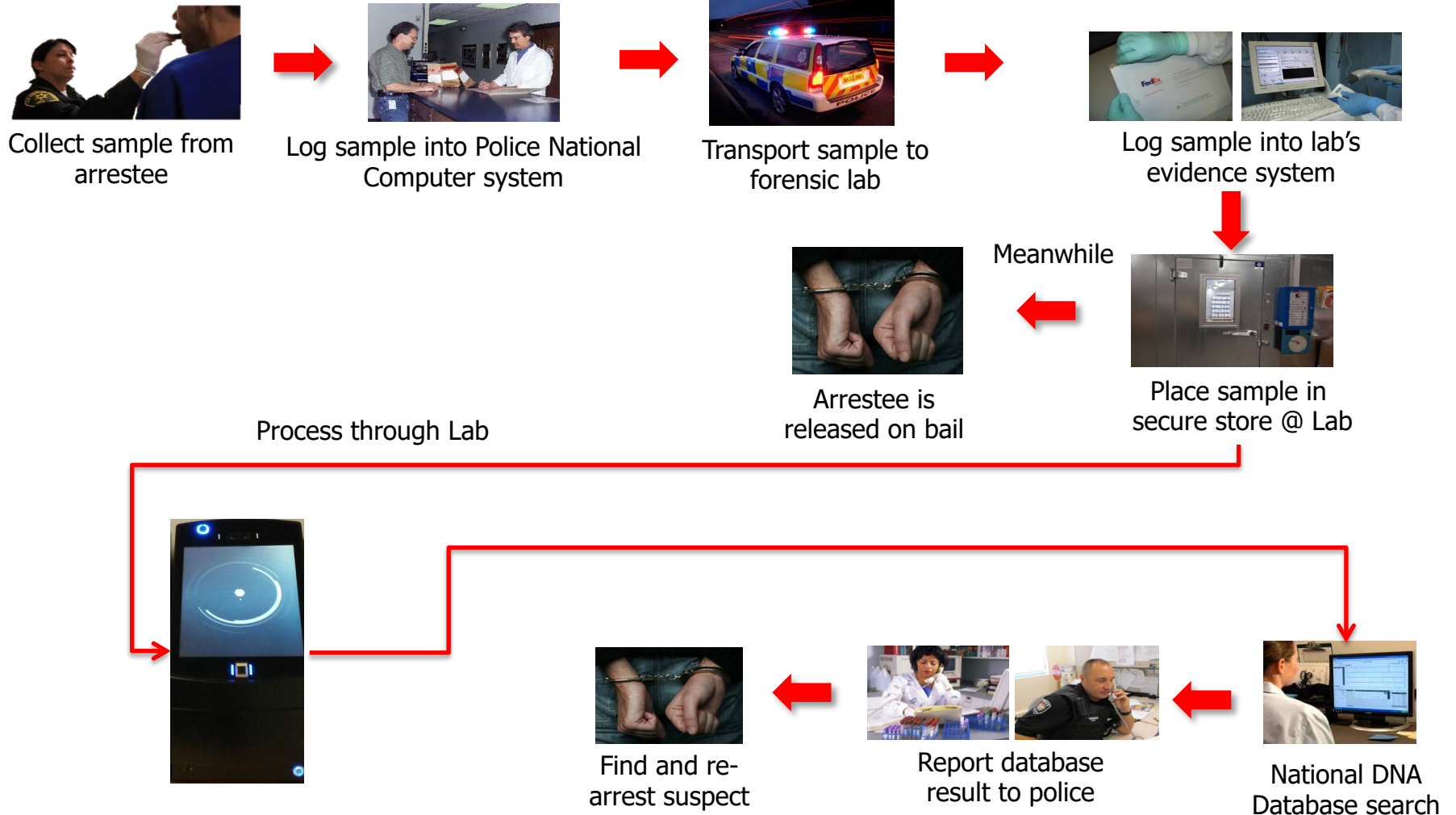
- RHID supplied 'Open'
- Uses internet to transmit data to RapidLINK
- Has camera, facial recognition, microphone and fingerprint reader (Biometrics)

## Solutions

- Hardened Mode
  - Domain joined instruments
  - Windows Kiosk mode
  - Data encryptions – three modes employed
  - Antivirus and Windows Update Server
  - Option to remove camera, disable finger print reader
    - This reduced functionality, in particular live help on instrument



# Life of a PACE Sample



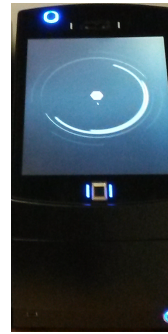
# Life of a PACE Sample – A New Story



Collect sample from arrestee



Log sample into Police National Computer system



Run sample on RapidHIT ID in Custody



Expert profile analysis



National DNA Database search



Report database result to police



Suspect still in custody!!

# Real Life?

- KFS using the RapidHIT ID for live case work in laboratory environment
- Two large scale trials undertaken with UK forces
- Promising data on success rates, turnaround times and impact on the CJS
- Other trials and implementations underway and in discussion with several UK Police Forces
- Fastest turn around time achieved 92 minutes!  
Instrument start to NDNAD load received

# Thanks & Acknowledgments

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Dean Tsou  
John Murphy



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# Questions?





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Experienced scientists delivering forensic effectiveness, unquestionable integrity, focused customer service and value for money.