MONOPOLY PROJECT 2020 – WP9

Report on the 2023 Multidisciplinary Collaborative Exercise

A MULTIDISCIPLINARY COLLABORATIVE EXERCISE INVOLVING DNA, FINGERPRINTS, EXPLOSIVES AND HAIR/FIBRES, ORGANISED BY THE MONOPOLY PROGRAMME 2020-WP9[1] TEAM PROJECT

2023

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FINAL REPORT

1. SUMMARY

This report summarises the concepts, planning, design, preparation, implementation, co-ordination and evaluation of the 2023 Multidisciplinary Collaborative Exercise (2023-MdCE) covering a range of forensic disciplines. This approach to testing of forensic disciplines also allowed the project team the opportunity to examine good practice within the various scientific areas, as well as examining the process and sequence of events for examining this material within a laboratory.

2. INTRODUCTION

The use of collaborative exercises (CE) and proficiency tests (PT), as part of the governance programme for any forensic science laboratory, is commonplace. Traditionally, these have been discipline specific exercises, i.e. they have tested a laboratory's ability in a single area of forensic science. The European Network of Forensic Science Institutes (ENFSI) Working Groups have successfully delivered collaborative exercises (CE) within their own domains for many years. They are a useful tool for participating laboratories to benchmark themselves against other comparable organisations and identify where improvement to their practices could be made.

The first attempt to run a multidisciplinary CE occurred in 2019, via a STEFA (Step Towards European Forensic Science Area) Project (779485 – STEFA -ISFP-2016-AG-IBA-ENFSI). To build on this, it was decided that a component of the ENFSI-EU funded project CERTAIN-FORS "Competency, Education, Research, Testing, Accreditation, and Innovation in Forensic Science" would develop one multidisciplinary collaborative exercise per year (in 2022 and 2023), covering at least three forensic disciplines each time. Therefore, the experience gained in 2019 and 2022 provided valuable insight into how to improve the interdisciplinary challenges associated with running such an exercise.

3. PILOT STUDY

A pilot study was conducted by the following organisations in November/December 2022: RaCIS/RIS Carabinieri (Parma, Italy), RaCIS/RIS Carabinieri (Messina, Italy), the Institute of Forensic Science (Bratislava, Slovakia) and the Service National de Police Scientifique (Marseille, France). The test material suitability was successfully verified. It is important to note that individual laboratories did not complete the entire exercise. Instead, they focused on specific disciplines in order to verify if it/they could be correctly recovered and/or analysed.

The pilot study was found to be a worthwhile phase, as it provided useful information that helped to establish the exercise's feasibility and inform the final design.

4. FINAL DESIGN

On completion of the pilot study, the final design of the CE was determined in March 2023. It was agreed that the exercise would consist of a glass jar with black adhesive tape around it (**Figure 1**).

Figure 1 Final design of the CE

Figures 2 and 3 outline the location of the traces deposited on the item.

Inside the glass jar:

- Traces of explosives on the bottom corner, corresponding to the number (different for each participant) in front of the number "60" inscribed on the bottom of the jar.
- Latent fingermark **FM1** - on the internal side of the jar in correspondence of the number (different for each participant) in front of the number "60" impressed on the bottom.
- Human hair.

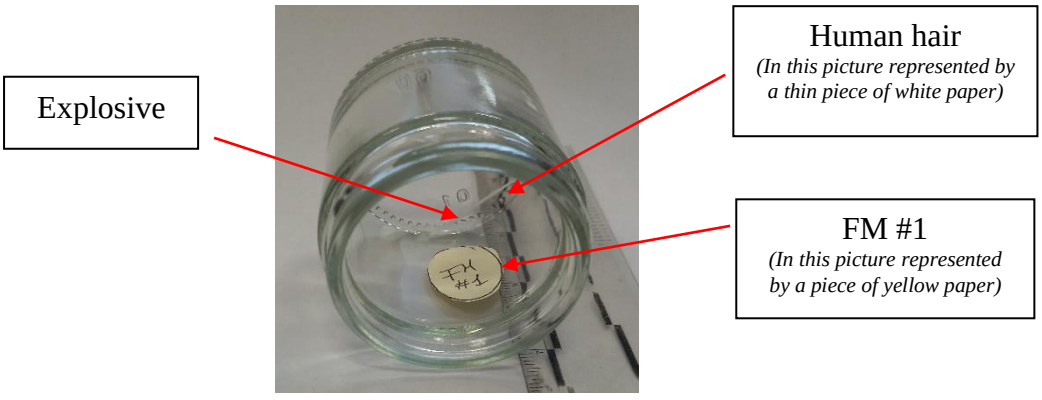

Figure 2 Traces inside of the glass jar

Black adhesive tape (T1) – top, towards the cap:

- Latent fingermark **FM2** - adhesive side of the right edge.
- Saliva – both sides of the adhesive tape in correspondence of the FM2.

Black adhesive tape (T2) – bottom, toward the bottom:

- Latent fingermark **FM3** - adhesive side, in the middle.
- Animal hair and fibres – separated, in correspondence of the FM3.

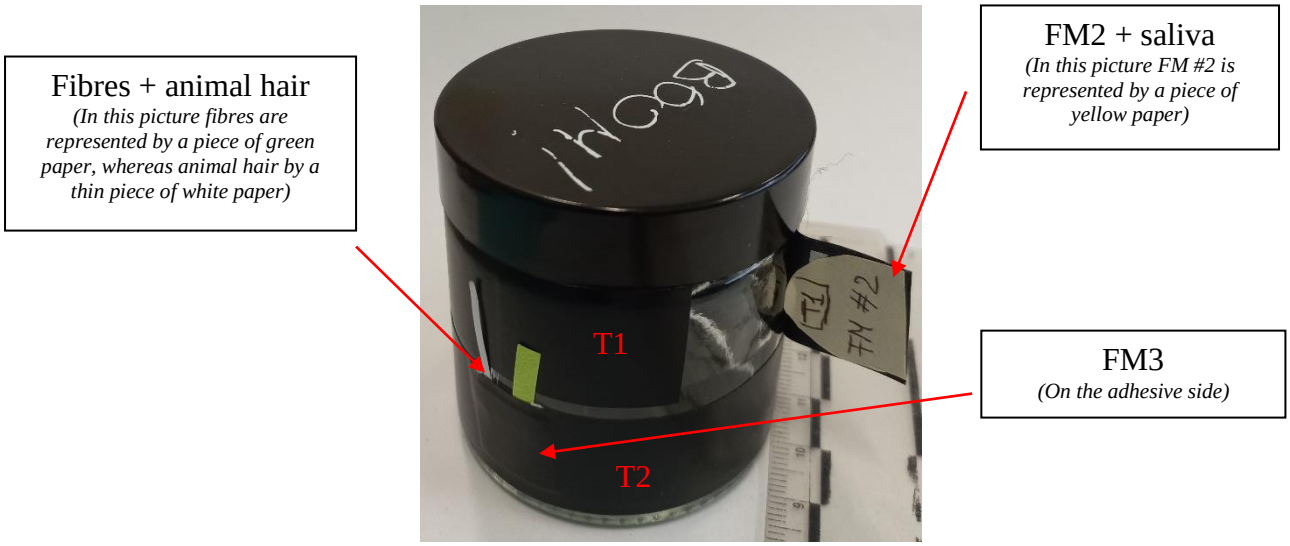

Figure 3 Traces on the adhesive tapes around the glass jar

4.1 Deposition of fingermarks

Three fingermarks were deposited on the item:

- **FM1** – a *latent fingermark*. The real donor washed their hands and donned clean powder-free nitryl gloves for 20 minutes, before donating eccrine-enriched fingermarks. Immediately after this deposition, the donor placed another impression of the same finger on a slide that acted as a control. The donor did not deposit a fingermark using the same finger on all samples. Thumbs, index and middle fingers of both hands were exploited. The organisers noted which finger was used on each sample.

- **FM2 and FM3** – two *latent fingermarks*. A real donor (different to the donor that provided FM1) washed their hands and then rubbed their nose before deposition (sebaceous fingermarks). Immediately after this deposition, the donor placed another impression of the same finger on the adhesive side of the same tape that acted as a control.

The donor did not deposit a fingermark using the same finger on all samples. Thumbs, index and middle fingers of both hands were exploited. The organisers noted which finger was used on each sample.

4.2 Deposition of DNA

DNA sources could be found in five traces:

- **Human hair** – inside the glass jar (the organisers took a general picture of this hair before screwing on the cap).
- **Saliva on the edge of adhesive tape (T1) in correspondence of FM2** – a sample of saliva was collected from a real donor and quantified for the DNA content. Seven µL (not diluted) were then deposited on the adhesive side (on the edge) and seven µL (not diluted) on the non-adhesive side (always on the edge).
- **FM1, FM2 and FM3**– potentially, the latent fingermarks could be analysed as a "touch-DNA" trace.

4.3 Deposition of the explosives

3 µL of RDX (hexogen - 1,3,5-Trinitroperhydro-1,3,5-triazine) standard solution (certified reference material provided by AccuStandard - 1µg/1µL) were pipetted on the bottom corner of the glass jar (see Fig. 2) and then dried.

4.4 Deposition of the animal hair and of the fibres

Two animal hairs and a clump of fibres were deposited on the adhesive side of the tape (T2) with the aid of a microscope at the site of FM3 (previously deposited). The clump of fibres protruding from the tape consisted of a mixture of light green Polyamid (PA) 6.6 fibres dyed with "Lanaperlgrün" 1 % and dark green Polyamid (PA) 6.6 fibres dyed with "Lanaperlgrün" 2.8 %.

4.5 Fibres reference (comparison) material

The reference material for the fibres was a transparent tape, originating from the proposed taping of the car seat (as described in the scenario of the exercise). On the tape there were two different fibre types: light green Polyamid 6.6 fibres dyed with "Lanaperlgrün" 1 % and dark green Polyamid 6.6 fibres dyed with "Lanaperlgrün" 2.8 %. In order to guarantee comparable and identical comparison material, the fibres were placed onto the lift tapes. There was no actual car tape lifted. This explains the absence of further fibres types on the tape lift.

4.6 Fingerprint reference (comparison) material

The reference material consisted of fingerprint/palm-print samples from two suspects (#A and #B). The reference material was scanned at a resolution of 1000 dpi (including a ruler) and saved in jpeg format. The files were placed in a folder reachable via a link kindly provided by the University of Lausanne (UNIL).

5 MATERIAL PREPARATION

All the samples were prepared in the laboratories of RaCIS-RIS Carabinieri Parma (Italy) between 20th and 29th March 2023, according to the following procedure:

- Three µL of explosive-containing solution were pipetted on the bottom corner inside the jar as detailed in section 4.
- The latent fingermark FM1 was deposited inside the jar by "suspect" #A as detailed in section 4.1.
- The cap was screwed on.
- The latent fingermark FM2 was deposited on the adhesive side of tape T1 (corresponding with one edge) by "suspect" #B as detailed in section 4.1.
- Tape T1 was attached on the glass jar (towards the cap).
- The latent fingermark FM3 was deposited on the adhesive side of tape T2 (in the middle) by "suspect" #B as detailed in section 4.1.
- Fibres and animal hair were deposited (with the aid of a microscope), corresponding to FM3. As far as possible, they were kept separate and protruding upwards.
- Tape T2 was attached on the glass jar (towards the bottom).
- A decontamination step was carried out (254 nm – 10 min).
- After opening, a human hair was placed inside the jar and a picture was taken.
- Saliva was deposited on the edge of tape T1, corresponding with FM2 as detailed in section 4.2. Then it was left to dry.
- The exhibit was placed inside a plastic bag and then into a white cardboard box.

Suitable control methods to prevent DNA and fingerprint contamination were implemented throughout the process.

6 DISTRIBUTION

The exercise was distributed to the laboratories that registered and confirmed to have the capability to carry out examination in all five fields of expertise. The package containing the exercise material was distributed via express courier.

The instructions for the participants can be seen in Appendix 1.

7 PREDICTED RESULTS

7.1 Ground Truth

The test was set up knowing that laboratories will not get exactly the same test set.

The "ground truth" reflects the process of the CE development, but does not necessarily correspond to the expected results (see paragraph 7.2), or the consensus results (see section 9). These outcomes were known to the exercise setters before the material was sent out and relates more directly to the process of exercise development.

7.1.1 DNA

- DNA was present in detectable levels (at least 10 ng) within the saliva trace.
- Human hair was collected to ensure that the root was included and this was visually checked for. Therefore, a DNA profile was expected to be obtained. All the control samples resulted in a DNA profile.
- The latent fingermarks (FM1, FM2, FM3) were not in the main scope of the test for DNA, but it could be expected that laboratories would try to obtain a DNA profile from them.

Thus, DNA came from three different individuals with the following typed markers (**Table 1**).

Locus	FM#1 (inside the jar) Donor #A	Saliva (on the edge of tape T1) FM#2, FM#3 (on adhesive tapes (T1 and T2) Donor #B	human hair (inside the jar) Donor #C
Amelogenin	X,Y	X,Y	X,Y
CSF1PO	11,12	12,12	12,14
D10S1248	16,16	13,17	13,15
D12S391	18,20	15,19	17,18
D13S317	11,11	12,13	12,12
D16S539	9,12	12,13	8,11
D18S51	13,19	12,15	14,18
D19S433	14,15	12,14	12,12
D1S1656	16,17	17,17.3	14,19.3
D21S11	30,31	29,30	29,30
D22S1045	11,15	14,16	16,16
D2S1338	20,23	22,25	17,18
D2S441	10,11	11.3,13	11,11.3
D3S1358	14,16	15,18	15,15
D5S818	12,13	9,12	11,14
D7S820	10,10	9,10	10,10
D8S1179	13,13	10,12	10,11
FGA	20,24	22,23	22,23
Penta D	11,12	11,14	14,14

Penta E	11,11	13,15	13,15
SE33	15,21	16,28.2	28.2,29.2
THO1	6,8	8,9	8,9
TPOX	8,9	10,11	8,9
vWA	15,18	15,17	16,17

Table 1 DNA profiles related to the exercise

7.1.2 Fingerprints

- The fingermark FM1 (inside of the glass jar) was left by suspect #A. The exact finger depends on the specific sample received by each participant.
- The fingermarks FM2 and FM3 (on the tapes) were left by suspect #B. The exact finger depends on the specific sample received by each participant.

7.1.3 Explosives

- The explosive was RDX and it was inside the jar, on the bottom.

7.1.4 Fibres

- The two fibre types [light green Polyamid (PA 6.6) fibres dyed with "Lanaperlgrün" 1 % and dark green Polyamid (PA 6.6) fibres dyed with "Lanaperlgrün" 2.8 %] were placed both on the adhesive side of the tape T2 on the jar and on the tape lift (as reference).

7.1.5 Hairs

- One human hair from a different donor than the FM and saliva donors was inside the glass jar and some rabbit hairs were on the adhesive side of the black adhesive tape (T2).

7.2 Expected Results

Trying to determine the expected results is extremely difficult and liable to a sizeable error margin as there are many factors to consider. This process was easier for some of the test areas than for others, and the expectations must be treated with caution.

Considering the expertise of the project team members and the relevant literature in the forensic field, the following points constitute best practice when facing such a specific item/sample:

- Visual examination should have allowed observation of the (human) hair inside the jar. Consequently, it should have been sampled before further operations.
- Visual examination should have allowed observation of the fibres/hair on the adhesive tape. Consequently, particular care had to be taken during the following operations.

- Visual/Forensic Light Sources (FLS) examination should have allowed observation of some residues on one of the edges of the adhesive tape. Presumptive testing for saliva should have resulted in a positive outcome. Consequently, a DNA sample could have been collected from this edge taking care of potential fingermarks: targeted sampling on the non-adhesive side of the tape could be carried out without affecting the adhesive side.
- Visual examination should have allowed observation of some ridge details on the inside of the glass jar.
- Investigation of the explosives traces could have been rationally and firstly focused on the inside of the jar. Sampling should have considered the presence of ridge details.
- Before detaching the adhesive tapes, a development technique for fingermark should have been undertaken.
- The detachment of the tapes could have been done mechanically, without affecting the fibres/hair on the adhesive side of one of them.

7.2.1 DNA

It was expected that:

- For the saliva trace on the edge of the upper tape, DNA profiling would result in the single source profile of the donor B suitable for comparison and database uptake.
- For the latent fingermark FM2, DNA profiling would result in the single source profile of the donor suitable for comparison and database uptake.
- Transferred saliva traces of donor B could be detected on the item when multiple manipulation/handling occurred.
- Blind sampling covering the area with saliva trace would result in the single source profile of donor B.
- Random/Blind sampling would not yield any DNA profile, or DNA database uptake, when the saliva trace in the edge of the upper tape is excluded from sampling.
- For the human hair inside the container, DNA profiling would result in the single source profile of the donor suitable for comparison and database uptake.
- For the latent fingermarks (FM1, FM3) revealed by the application of fingermark visualisation techniques, sampling the whole mark may lead to the identification of a partial to complete DNA profile suitable for comparison or DNA database uptake.

7.2.2 Fingerprints (visualisation)

It was expected that:

- The latent fingermarks (FM1, FM2 and FM3) would be developed.

7.2.3 Fingerprints (identification)

It was expected that:

- The latent fingermarks (FM1, FM2 and FM3) would be analysed.
- The latent fingermarks (FM1, FM2 and FM3) would be positively associated as coming from the suspect A (FM1) and the suspect B (FM2 and FM3), thumb, index or middle finger (right or left) depending on the specific item.

7.2.4 Explosives

It was expected that each laboratory would be able to detect traces of RDX inside the jar.

7.2.5 Fibres

It was expected that:

- The two different fibre types on the jar would be identified as light green and dark green PA 6.6 fibres. Nylon or Polyamid are acceptable answers. The description of the colour as Bluish-green was also acceptable.
- The two different fibre types on the tape lift (reference) would be identified as light green and dark green PA 6.6 fibres. Nylon or Polyamid are acceptable answers. The description of the colour as Bluish-green was also acceptable.
- The question regarding the common origin of both fibre types on the jar and on the tape lift would be answered with "yes" (the two fibre types from the jar and the two fibre types from the tape lift (reference) could have originated from the same source).
- The fibre comparison would be made between the questioned fibres from the jar and the tape lift. It is not a comparison between questioned fibres and reference fibres from a textile (specific source), but a comparison between questioned fibres that potentially originate from the same source (common source).
- The fibre comparison would be carried out using low and high-power microscopy, colour comparison techniques (if no MSP available, then alternative methods; see Best Practice Manual for the Forensic Examination of Fibres, ENFSI-THG-BPM-04, Issue 01-July 2022) and chemical composition analysis (if no FTIR available, then alternative methods). Stated fibre matches that are not undermined with colour comparison techniques will be accepted with limitations, because a match based

solely on morphology (and fibre type identification) can lead to wrong results. Green PA fibres can differ in their colour properties and thus the colour should be assessed. Please see also Best Practice Manual for the Forensic Examination of Fibres, ENFSI-THG-BPM-04, Issue 01-July 2022, especially chapter 5.

- The wording of the conclusion should indicate that a common source is likely; the strength of evidence can differ, as laboratories have different scales/options/ wording when performing evaluative reporting.

7.2.6 Hairs

It was expected that:

- The hairs from the adhesive side of tape T2 were morphologically described and characterized as animal hairs and more specifically rabbit hairs.
- The hair inside the glass container was morphologically described as human hair suitable for DNA analysis.

8 PARTICIPATION

It was agreed by the project team that only those laboratories that carried out the full range of activities themselves (or had direct access and an agreement with a secondary laboratory to undertake aspects of the work) would be considered eligible to take part in the exercise.

The project team received responses from 37 laboratories, of which 36 met these criteria. Laboratory #17 did not perform the fibres analysis declaring that they don't use fibre as a valid method, but this was not noted in the registration form. Therefore, it was agreed not to include the outcomes of this participant in report, although the report would be shared with them.

Laboratory #32 did not perform the fibres analysis, due to an unforeseen occurrence in the laboratory of which the team was promptly informed. Therefore, it was agreed to include the outcomes of this participant in the report. In Appendix 2 the list of the participating laboratories can be seen.

Figure 4 gives a general overview of the participants' accreditation status according to ISO/IEC 17025 for each forensic discipline involved. For the hair analysis, it is important to underline that four laboratories specified hair being not accredited for morphological investigation, but for DNA examination from root.

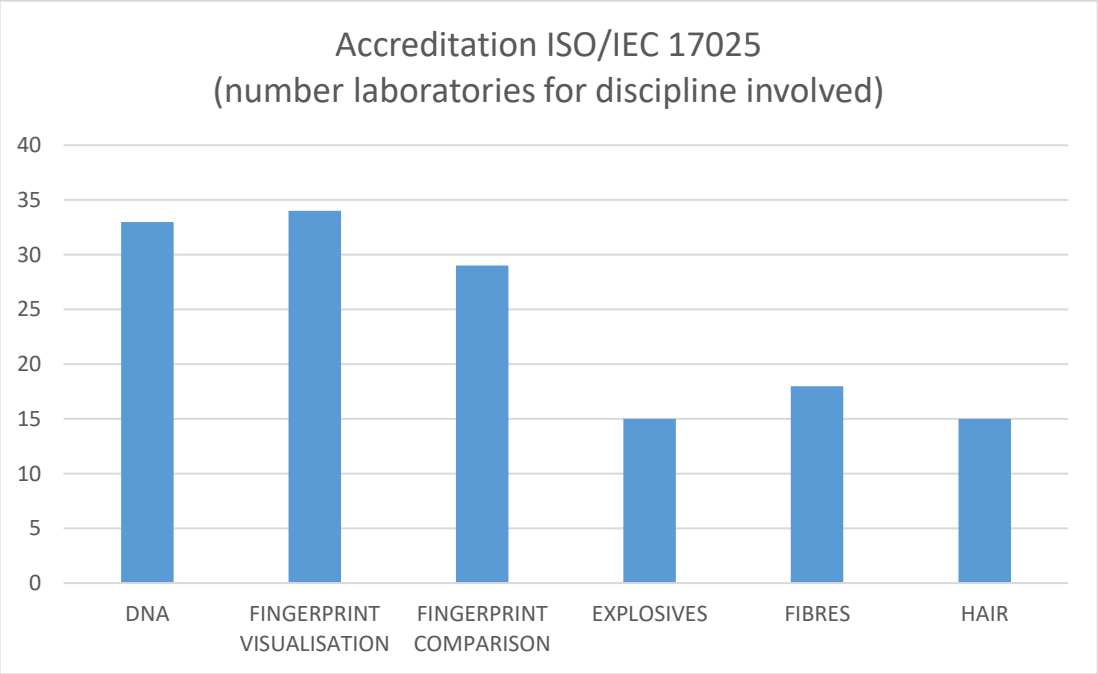

Figure 4 Participants' accreditation status according to ISO/IEC 17025

9 REPORTED RESULTS and DISCUSSION

As a general comment, it is important to note that during the evaluation of the results, some specific questions were sent to a number of participants in order to clarify some points. This means that the reporting process was not always clear. From the organiser's perspective, this can be ascribed to the response form that was extensive and not always self-explaining. This fact could have discouraged some people. From the participants' perspective, the provided level of details varies. In addition, typing/clerical errors, e.g., wrong indication of tapes, displacement of traces/donors, in filling the response form made the evaluation more difficult. With this regard, it seems important to underline the importance of a careful revision of the response form (in case of a test) or of the forensic report (in casework).

An overview of the results obtained by each laboratory is given in Appendix 3.

Disclaimer: ***the team project made its best to correctly report on the outcomes of the exercise. Given the above-mentioned matters, it is anyway possible that some discrepancies (numbers, procedures, etc.) could be present in this report.***

9.1 Sequence of examinations

As part of the reporting process, each participant was asked to describe the sequence of the examination processes. Given the different level of details provided by the participants, it does not make sense trying to capture the sequence of the examinations in order to group the different laboratories. An overview is given in Appendix 4.

In the specific scenario of the exercise, three main areas in which the sequence of analyses could change have been identified: the searching for the explosives, the opening of the lid and the tapes removal**.**

From an investigative perspective, the detection of the explosives can be deemed as relevant, because this information makes clear the level of seriousness of the threat. Given this, if we look at the recovery of the traces (RDX, fingermarks, DNA from saliva and from the human hair) without considering the outcome of the analysis of fibres/(animal) hair,[2] six laboratories (#1, #3, #11, #12, #14, and #21) were able to obtain the expected information. The respective sequences of operations are summarised in **Table 2**.

[2] The sampling of (animal) hair/fibres was done by all the laboratories and the multidisciplinary aspects will be discussed later in this report. Here, the outcome of the analysis is not relevant from the sequence of the operations perspective.

Lab →	**#1**	**#3**	**#11**	**#12**	**#14**	**#21**
Step #1	H-FIBR-DNA	opt	DNA	H-FIBR	DNA-out	DNA/H-FIBR/DNA-in-h
Step #2	*tapes removal*	H-FIBR-DNA-EXPL-out	EXPL	DNA-out	DNA-in-h	FP-out
Step #3	FP	FP-out	H-FIBR	DNA-t	*tapes removal*	EXPL
Step #4	EXPL	DNA-in-h	*tapes removal?*	EXPL-out	H-FIBR	*tapes removal*
Step #5		EXPL-in	FP	FP-out	FP	FP
Step #6		*tapes removal*	DNA-t	*tapes removal*	EXPL	DNA
Step #7		FP-t		DNA-in-h		
Step #8		DNA-t		EXPL-in		
Step #9				FP-in-out		
Step #10				DNA-out		

Table 2 Examination sequences of the six laboratories that recover the expected traces. Abbreviations are: **H** – hair sampling, **FIBR** – fibres sampling, **DNA** – sampling of biological traces, **FP** – fingerprint visualisation, opt – optical methods, **-out** – the activity interested the external surfaces of the item, **-in** – the activity interested the external surfaces of the item, **DNA-t** – specific sampling on the tapes of biological traces, **DNA-in-h** – sampling of the hair inside the jar for DNA profiling, **tapes removal** – the tapes were detached from the jar.

It can be noted that:

- All these laboratories firstly collected the biological traces on the outside together with fibres and (animal) hair. As discussed later in this report, it is important to underline that two laboratories (#1 and #11) visualised the fingermark inside the jar with optical methods before all the other disciplines.
- The relative order between explosive recovery and fingerprint recovery did not affect the outcomes.

9.2 *Results from the DNA examination*

9.2.1 Responses

All 36 laboratories returned the results for the DNA part of this exercise, of which all met the criteria for further evaluation.

9.2.2 Results

The results of the DNA examination will be discussed per the DNA containing trace that was deposited.

Since the laboratories were asked to examine the exhibit in full, most laboratories produced more trace samples for DNA profiling in a range of 2 to 18 samples, with an average of eight samples. In total, 271 samples over all 36 laboratories were produced. In **Figure 5,** the number of stains taken for each laboratory is presented.

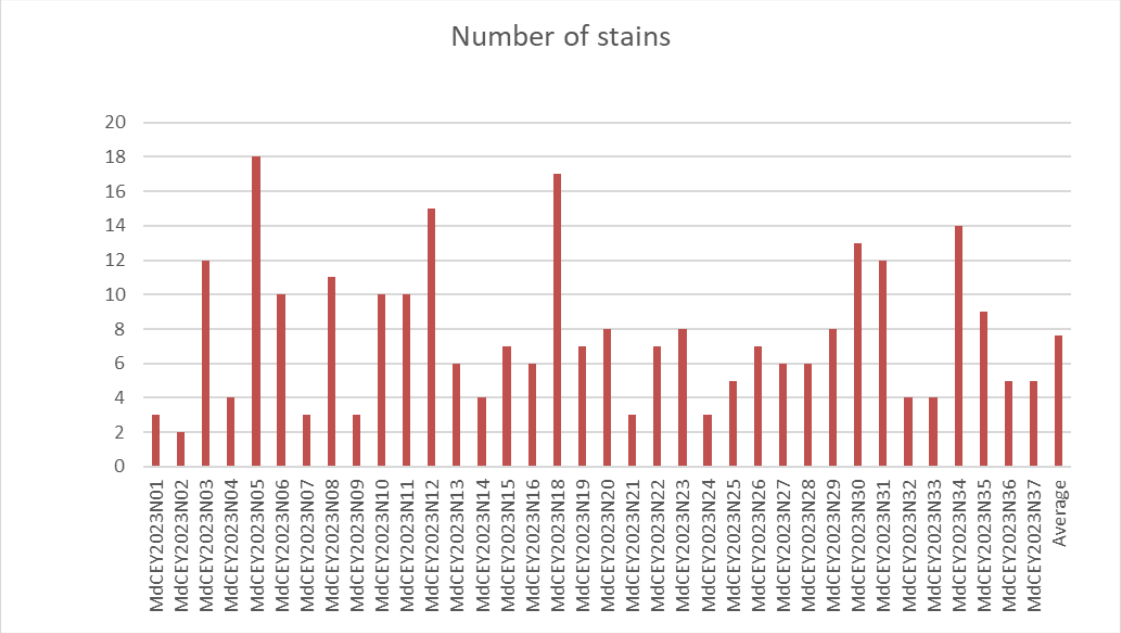

Figure 5 Number of stains in the collaborative exercise for all laboratories

In **Figure 6** the distribution of sampling of all the 271 stains taken is given.

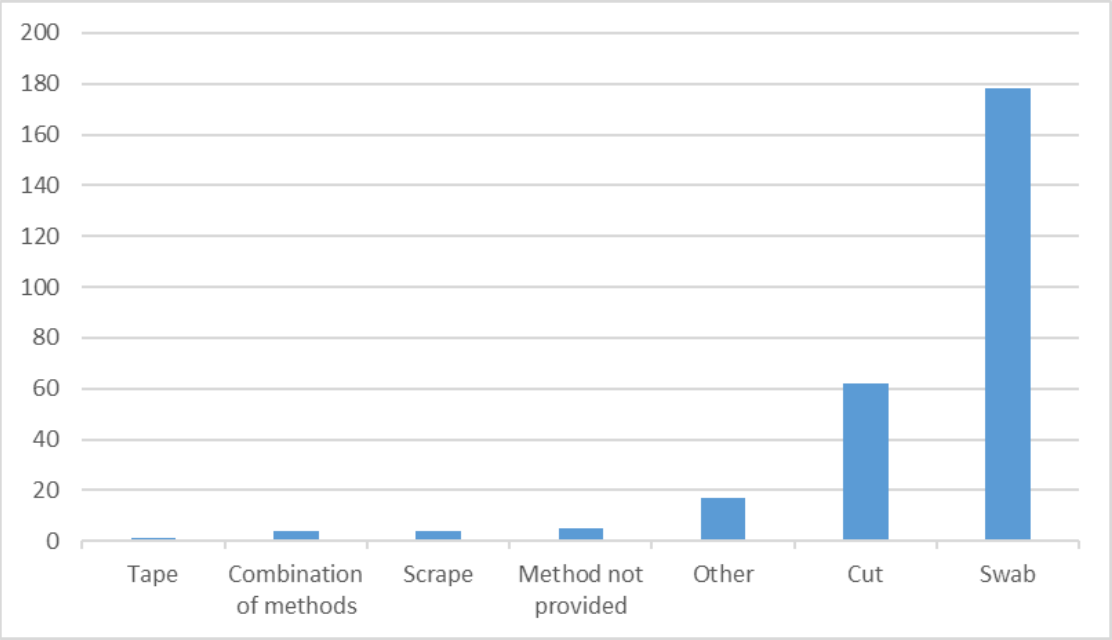

Figure 6 Method of sampling for all stains in the CE

The main method used to extract DNA from the stains (84 % of stains) is the silica based method, either the column method or the magnetic beads based method (**Figure 7**).

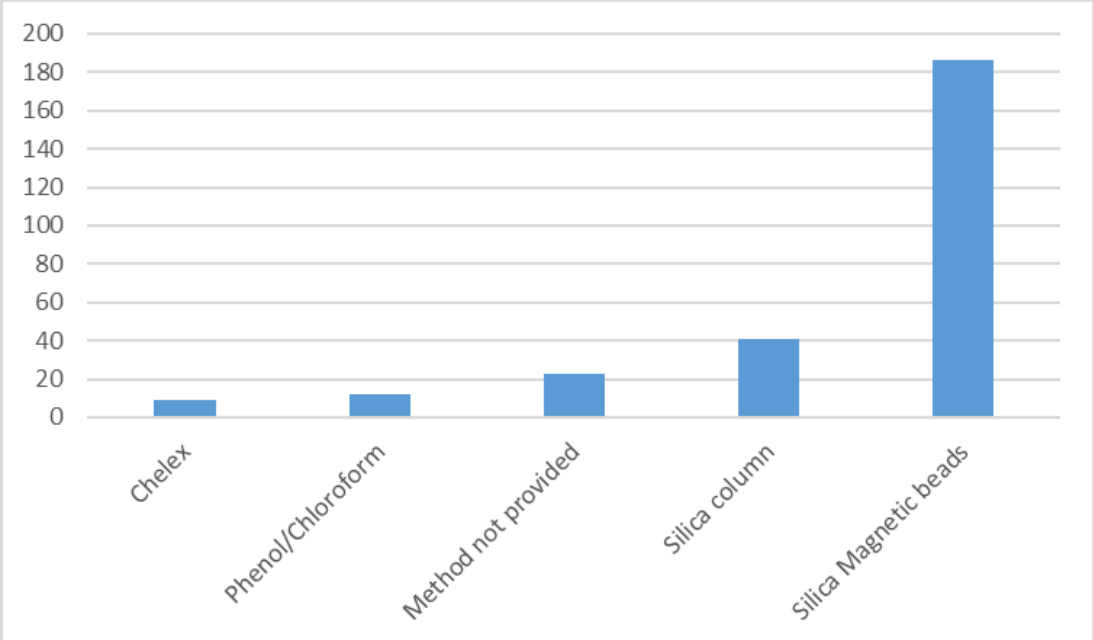

Figure 7 Method to extract DNA

For 248 of the stains, information was also given for the level of automation used in the extraction method. As expected, the silica based methods are more likely to be semi-,

or fully automated. The main extraction method used to extract DNA from these samples was the silica based magnetic beads extraction method (76 %). This method was used in a fully automated process (53%), a semi-automated process (44 %) and only in 3 % performed manually (**Figure 8**).

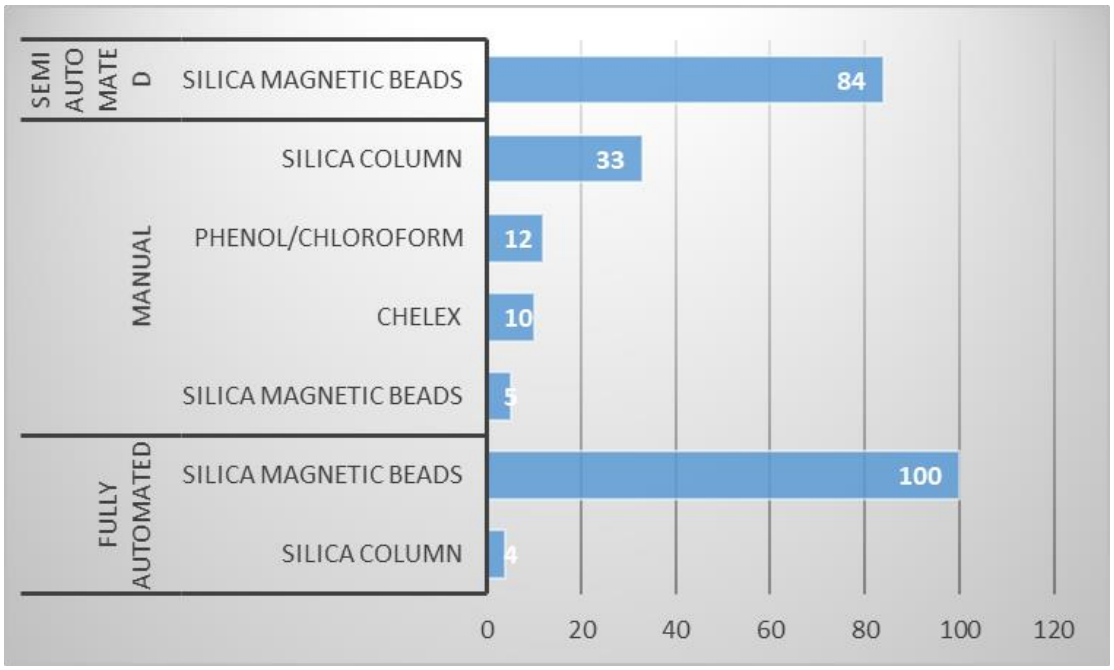

Figure 8 Extraction methods used and the process the method is used in

The laboratories were asked to present the allele tables of the profiles they obtained and to classify them as a single (partial to full), or mixed profiles. The results of the stain origin, sometimes deduced by the lack of information or categorised as 'stain of unknown origin' are presented in **Figure 9**. Since the FM2 and the saliva trace were placed next to each other (and often detailed information about the sampling of these traces was missing), for the purpose of analysis these traces were combined. In addition to the sampling of the specific traces after visual or chemical examination, random sampling was also performed in 36 % of all trace collections. The animal hair was taken for (human) DNA profiling in four cases.

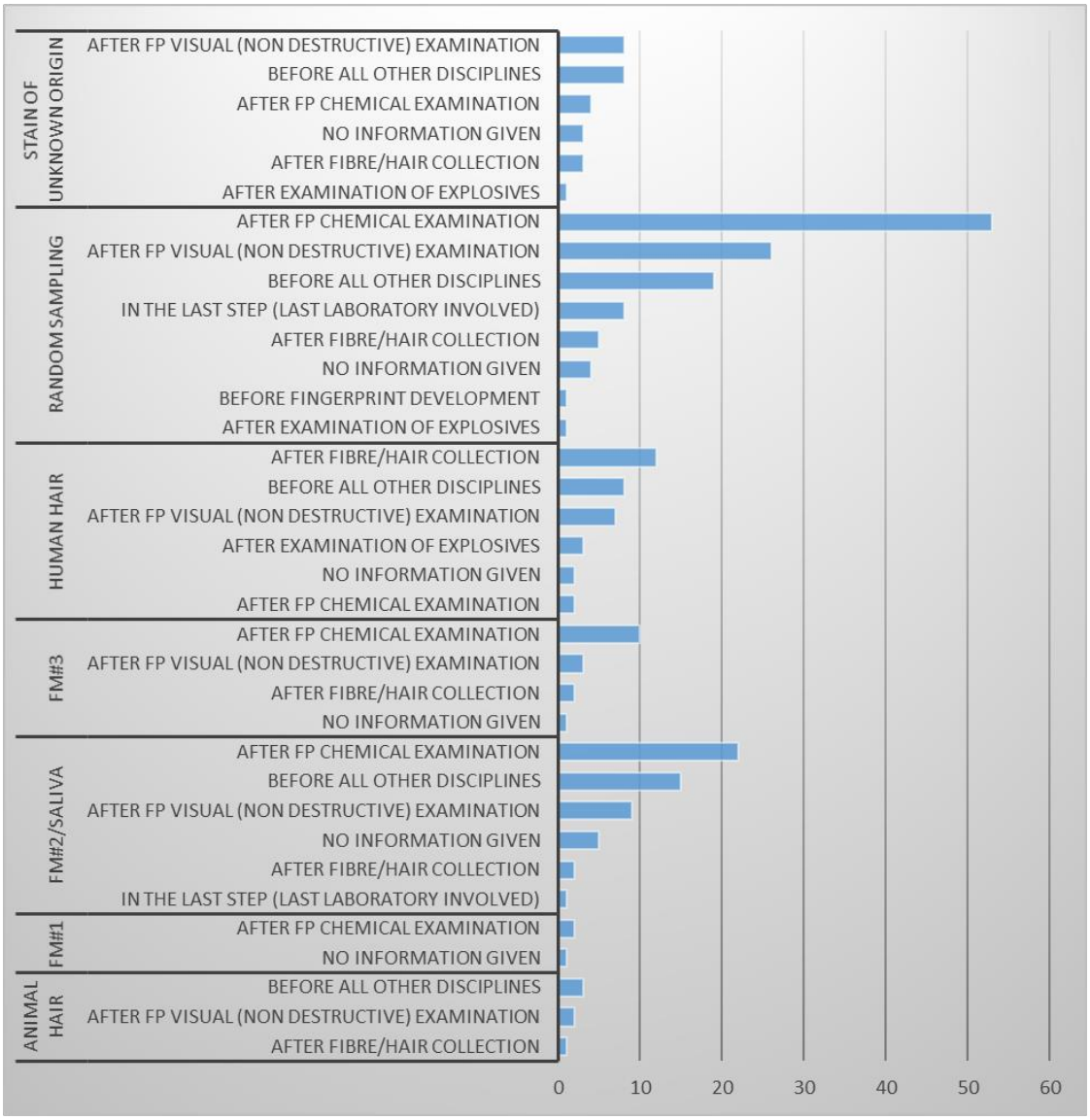

Figure 9 Origin of stain and process step of examinations when sample was taken

The results of DNA profiling (could a DNA profile be obtained and was it partial to full or mixed) was related to the origin of the trace sampled. Results are presented in **Figure 10**. In 51 % of cases, the traces sampled led to a partial to full or mixed DNA profile. In 13 %, where the sampling was performed randomly, still a profile could be obtained (mostly from the FM2/saliva trace). In 23 % of all traces, where random sampling was performed, a DNA profile could not be obtained.

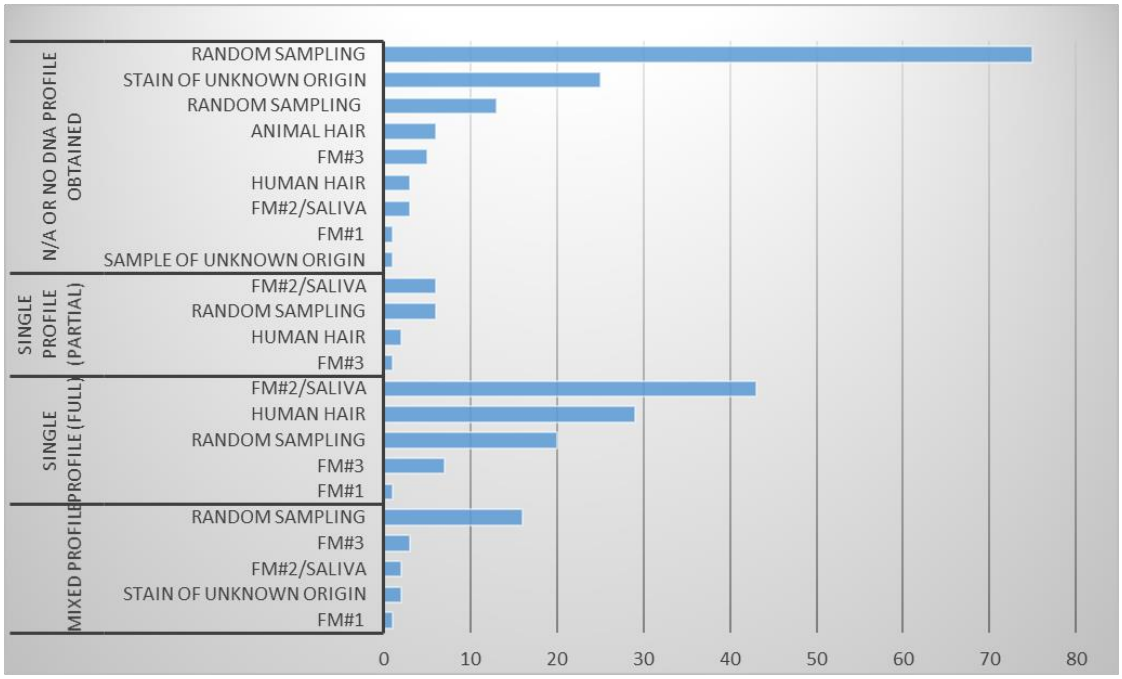

Figure 10 DNA results from the (deduced) origin of stains

HAIR (inside the glass container)

Most laboratories (32; 89 %) returned results from the hair after DNA profiling. When the laboratory processed the hair for further examination, the sampling technique most used was to cut the hair. One laboratory used a tape for safeguarding and 11 laboratories used another method. Three laboratories did not report on the sampling method used.

For the three laboratories that did not report on the DNA analysis, two laboratories (#4 and #6) only performed a morphological examination and did not continue with the DNA profiling. Laboratory #9 did not report on the DNA profiling of the hair, but stated that a hair root was not observed for the hair. However, in the process of preparing the exhibit, there was a visual check for the presence of the hair including the root and a picture for proof was taken.

For the extraction of DNA from the hair root, the most common methods were used. Most laboratories (23) used an extraction method based on Silica Magnetic Beads, of which ten used a fully automated system, ten a semi-automated system and three performed the extraction manual. Silica column method was used in four laboratories, of which one reported fully automated approach and three laboratories manual. Three laboratories used the Chelex method (manual) and two laboratories used the manual phenol/chloroform method. One laboratory reported the use of another method. Laboratory #11 reported the use of QIA Symphony.

As expected, almost all laboratories managed to obtain a partial to full DNA profile from the hair root. Laboratory #18 reported two samples of hair (#16 and #17), where only the first produced a full DNA profile. Laboratory #25 next to the extraction of DNA

from the root took a swab from the surface of the human hair shaft. The complete root produced a partial DNA profile, whereas the swab did not. Only one laboratory (#20) reported that a DNA profile could not be obtained following another (not specified) extraction method.

FM1 (fingermark inside of glass container)

The majority of the laboratories, 32 in total, did not report on this trace in terms of DNA profiling. Of the four laboratories that did find the trace and went on with profiling the trace, #3 swabbed the fingermark after fingerprint chemical examinations for an area of 20x20 mm and used the semi-automated silica magnetic beads extracting method. The resulting DNA profile obtained was reported as a mixed profile suitable for comparison or search against a DNA database. However, the actual profile reported was a partial single profile, where the consensus method was used to interpret the profile.

Laboratory #12 followed the same procedure, but swabbed a 30x30 mm area. The laboratory could however not obtain a DNA profile.

Laboratory #26 reported the finding of three fingermarks, all observed after fingermark visual examination, but without presenting the pictures of the marks. Therefore, it is not clear if the actual fingermark deposited for this CE was one of them. The laboratory could not obtain any DNA profile.

The laboratory #31 also performed the same method-sampling and extraction method and reported a single DNA profile, suitable for comparison or search against a DNA database. However, the laboratory reported the DNA profile for donor B, while the fingermark examination reported a match with suspect A. So this should be regarded as a mix-up/contamination in the process for DNA analysis.

SALIVA (trace on the upper adhesive tape with #FM2)

All laboratories but one handled this trace for DNA analysis. Most laboratories (28) swabbed the trace for subsequent DNA extraction. Eight laboratories cut part of the adhesive tape and used it for subsequent DNA extraction. Laboratory #31 reported swabbing and cutting. Laboratory #9 only used a blind sampling strategy not specifically addressing this area for swabbing.

For the DNA extraction, again most laboratories (24) used the silica gel based magnetic beads method, of which 11 used a fully automated approach, another 12 semi-automated and one a manual procedure. The other extraction methods used were silica column (6), of which one lab reported fully automated approach and five laboratories manual, the manual Chelex method (two laboratories) and one laboratory used the manual phenol/chloroform based method. Laboratory #11 reported the use of the QIA Symphony. Laboratory #20 reported the use of another method for DNA extraction.

Of the 35 laboratories that sampled the area and performed the DNA profiling 34 laboratories reported the expected DNA profile. Laboratory #26 obtained no profile.

FM 3 (trace on the lower adhesive tape)

Only 17 laboratories (46 %) performed analysis of the trace on the lower adhesive tape. The other 20 laboratories did not report on the DNA analysis of this tape.

Of the laboratories that did analyse, 11 obtained the correct profile of donor B. These were laboratories #3, #10, #12, #15, #18, #19, #28, #29, #30, #33 and #37. In some cases, information was deduced together with information of the fingermark identification. The majority of laboratories (7, 64 %) used the swabbing method as the collection method. Three laboratories (27 %) cut a piece of the adhesive tape and one laboratory (9 %) used to scrape off the trace. Predominantly, again the silica based magnetic beads extraction was used (three fully automated, four semi-automated and one manual procedure), silica column manual (2), next to a manual procedure for one lab using the chelex method and another for the phenol/chloroform extraction method.

Laboratory #15 reported a mixed profile but in profile table recorded the correct (single) profile of donor B so this was considered a correct result.

Laboratory#19 used the swabbing method for collection of the black tape after FP chemical examination and after fibre/hair collection. However, the size of the swabbing area was not reported so it is assumed it was covering FM3 area since a correct profile was reported.

Laboratory #29 prepared two samples from the tape. Sample 1M04 was a part cut out from the 1.1.PC fingerprint (middle area of the adhesive tape on the top of the canister). The correct profile of donor B was obtained. Another sample (1M05) was cut out from 1.2.PC fingerprint which was described as on one end of the adhesive tape on the bottom of the canister. Also, here the correct profile of donor B was reported. It might however be that the position of the tapes were changed in the excel file by the laboratory, since the position of the marks do not correspond to the ground truth.

One laboratory, #8 – reported a mixed profile, with a minor match for donor B, and a major contamination by lab personnel. The collection method used was to swab the fingermark (swabbed area 20x18 mm) after FP chemical examination, followed by the manual silica column method. The obtained (mixed) profile was reported suitable for comparison.

Five laboratories reported results that were not consistent with the ground truth (#11, #13, #21, #26, #31). All of these laboratories used the swabbing method without reporting what area was swabbed. The extraction method used was mainly the silica based magnetic beads extraction method (two fully automated and two semi-automated) and one the use of the QIA Symphony.

Of these laboratories, laboratory # 21 reported a low level mixed profile (contamination) not suitable for comparison, sampling after fingerprint chemical examination, and the four other laboratories (#11, #13, #26, #31) obtained no DNA profile.

Presumptive testing

Presumptive testing to determine the origin of the biological sample was performed by only 11 laboratories (30 %), where some laboratories used multiple presumptive tests. Eight laboratories tested for saliva, two laboratories (PSA#11, semen test #28) tested for the presence of semen, two laboratories tested for the presence of blood (#20, #28) and one lab used the nuclear fast red method.

Laboratory #18 performed a Multiplex MSRE-PCR (DNA methylation profiling of tissue-specific markers for human blood, saliva, semen and vaginal fluid) and reported suspect B with a DNA methylation profile of human saliva.

Profiles not in line with the ground truth

From the reported results DNA profiles of expected traces four extraneous profiles were observed (for laboratories #3, #31, #8, #21):

For FM1, one laboratory reported a mixed profile not suitable for comparison (laboratory #3) and one reported a single DNA profile suitable for comparison (laboratory #31), which was not from the expected donor A.

For laboratory #3, a contamination was observed for the swabbed fingermark inside of the container (stain #9), identified after fingerprint chemical examination. The laboratory swabbed an area of 20x20 mm and used the silica magnetic beads in a semi-automated process. The result was reported as a mixed profile suitable for comparison or search against the DNA database. However, the reported profile was a single profile (with not more than two alleles per locus) using a consensus method when interpreting the profile.

For laboratory #31 a contamination for donor B was observed for the swabbed fingermark (swabbed area not reported), identified after fingerprint chemical examination. The laboratory processed the trace with the silica magnetic beads in a semi- automated process. The reported profile was a single profile suitable for comparison or search against the DNA database. However, the laboratory recorded the DNA profile of donor B whereas with the fingerprint examination a match with suspect A was reported.

For fingermark trace FM3 two laboratories (#8, #21) reported a mixed DNA profile:

Laboratory #8 reported a mixed profile on stain #9 (FM3) suitable for comparison, with a minor contribution of donor B and a major contribution of what was stated a contamination by the laboratory personnel. In this process, the laboratory swabbed an

area of 20x18 mm after fingerprint chemical examination, and used the silica magnetic beads in a manual process.

Laboratory #21 for stain #3 (FM2/Saliva) reported a low peak heights mixed profile (with a contribution of donor B). The area swabbed was inside of the adhesive tape where the area of fingerprint was visualised after fingerprint chemical examination. The laboratory reported the DNA profile as not suitable for comparison.

Next to the targeted sampling which led to contamination events laboratories #3, #6, #10, #12, #16, #18, #30, #33, #36 reported extraneous profiles when sampling from different places on the exhibit. Most of the extraneous profiles were reported as mixtures. It is not known if for these mixed profiles a (cross) contamination/Elimination Database check was performed. An overview of the laboratories:

- Lab #3 - stain #3 sampled after FP chemical examination.
- Lab #6 - stains #5, #7, and #9, sampled after all disciplines.
- Lab #12 - stains #4, #11, sampled before all disciplines/after FP chemical examination.
- Lab #16 - stains #4, #6, sampled after FP visual (non-destructive) examination.
- Lab #30 - stain #13, after FP chemical examination.
- Lab #33 - stain #4 (*no further details are available*).
- Lab #36 - stain #RDG1/3, sampled after FP visual (non-destructive) examination.

All of the laboratories, except one (#30) would report profiles as not suitable for comparison. Two laboratories reported a single partial profile (#10 stain #4, #12-stain #5) not suitable for comparison and one lab (#18 stain #9) single profile suitable for comparison. All of these DNA profiles reported should be regarded as contamination events. In total, 14 contamination events were reported.

Additional donor B profiles

Some laboratories reported profile of donor B after sampling targeted areas (surfaces) of the item where a biological trace was not deposited and therefor a DNA profile would not be expected. However, laboratories reported a single or single partial profile of donor B in the following instances:

- Lab #6 - stains #2, #3 sampled after all disciplines and #10 before FP development.
- Lab #8 - stains #1, #3, sampled after fibre and hair collection.
- Lab #10 - stain #2 sampled after FP chemical examination.
- Lab #15 - stain #4 sampled after FP chemical examination.
- Lab #18 - stain #6 sampled after FP chemical examination.

- Lab #27 - stain #3 sampled after FP visual examination.
- Lab # 30 - stains #1, #4 sampled after FP visual examination.

The DNA profile of donor B was also observed when samples were collected from larger areas of the item or adhesive/non-adhesive sides of the tapes where saliva traces and FM2, three could be included into sampled area. When the sampling was done after other disciplines, mostly fingerprint examination, in most of these cases laboratories reported mixture DNA profiles with donor B:

- # 6 sample #8, sampled after all disciplines
- # 8 sample #7 sampled after FP chemical examination
- # 10 samples #5, 6, 9 sampled after FP chemical examination
- # 30 stain #13 sampled after FP chemical examination (donor B and profile of personnel from fingerprint unit)
- # 23 sample #6 sampled after FP chemical examination
- # 20 sample #4, sampled after FP chemical examination.

9.2.3 Discussion

In this collaborative exercise, four true DNA containing traces were left on the exhibit. The human hair with root inside the glass container, the fingermark on the glass surface side of the inside of the container (FM1), the saliva with the fingermark on the edge of the upper tape (FM2) and the fingermark in the middle of the lower tape (FM3).

In order to have the results obtained from the DNA profiling in a clear format, two excel spreadsheets needed to be filled in, one for the complete process of stain searching and the subsequent DNA profiling and another sheet for the DNA profiles obtained. From the stain number and stain description (and other information regarding the stain searching and sampling) it was not always clear where the sample was taken from the results obtained for the stain description was not always unambiguous. Also, even if the same stain was examined by different disciplines it was named differently without further description.

The main method for sampling on the traces (hair, fingermarks, saliva, random sampling) that was used was the swabbing method. This is in line with the origin of biological traces that were placed in this collaborative exercise (saliva and contact traces/fingermarks).

Laboratories were, in general, able to obtain DNA profiles that where of good quality for comparison to other DNA profiles or uptake/search in a DNA databank for three of the traces. Only the fingermark inside the glass container did not produce the expected DNA profile in any of the laboratories that analysed this trace.

Evaluation (single profile, mixed profile, partial profile) was based on interpretation provided by laboratories since the corresponding electropherograms were not asked for. However, during evaluation of the results we observed discrepancies between how the profiles of the samples were reported and how the same samples were recorded in the profiles table by some laboratories. Reference profiles of suspect were not given in this exercise leaving the DNA profiling process completely blinded for the participants.

Given the large variety of sequences, a specific trend for DNA profiling was not observed. Random sampling was reported even after fingermark visual and/or chemical visualisation. Since the saliva stain was also visible after visual examination, this stain was also sampled before all other disciplines. Surprisingly, the human hair was only collected in eight laboratories before all other disciplines.

The hair inside the glass container should have been visible by the analyst performing the examination of the exhibit. The human hair root produced a DNA profile in all cases where it was processed for DNA profiling except lab#20; 89 % of the laboratories reported the correct profile.

The FM1 was not easy to detect and the majority of the laboratories, 32 in total, did not report on the fingermark in terms of DNA profiling. Of the four laboratories that did find and analyse this fingermark inside the jar, none of the laboratories was able to report the correct profile of donor A.

The saliva trace, in combination with FM2, was the most successful to produce a good quality DNA profile where 97 % of all the laboratories succeeded. This of course because of the presence of saliva on both inner and outer parts of the upper tape, on the sticky side overlapping with the fingermark FM2.

As saliva trace, as source of a high yield DNA, was present on the outer surface of the exhibit, it could not be excluded, that manipulation with the item during the examination could let to transfer of the trace also to other parts of the exhibit that were sampled after that. That could be possible explanation to detect donor B profile in non-expecting areas.

On the other hand, if laboratories did final sampling (after all/FP disciplines) from larger areas of the item or adhesive/non-adhesive sides of the tapes where saliva traces and FM2/FM3 could be included, we observed mixture DNA profiles with donor B, so except donor B additional biological material from previous actions (examination) could be introduced.

Random sampling on the outside of the jar, was most likely to also produce a (mixed) DNA profile of donor B since the saliva was also deposited on the outside of the end of the upper tape. Random sampling of other parts of the exhibit sometimes also produced a profile for this donor but this should be regarded as a (cross)-contamination event. It is of importance to clearly report the sampling of the traces in terms of location on the exhibit to prevent false conclusions as to the exact location a biological trace was found.

When working with several disciplines on exhibits the awareness of the unwanted introduction of DNA contamination during the examination is crucial and all necessary and possible measures must be undertaken to avoid this. However, also in this exercise, it was found that external contamination was not a big issue. Contamination was not detected in many cases. In the total number of traces processed in the laboratories only 14 contamination events (5 %) were observed

9.3 Results from the Fingerprint (Visualisation) Examination

All the laboratories that met the exercise criteria returned responses for fingermark visualisation. In this section, the processes used for visualisation will be reported.

The outcomes specifically relating to the latent mark in the inside of the jar (FM1), the end of the upper tape (FM2) and the middle of the lower tape (FM3) will be discussed in Section 9.4: Results for the Fingerprint (Identification) Examination.

9.3.1 Visualisation Processes Overview

For this exercise, the order and extent of sequential processing was complex. The item could be treated as received, so that any marks on the outer surface could be visualised. The item could also be dismantled by removing one, or both, pieces or tape and/or the lid. Once taken apart, the components (glass jar, two pieces of black electrical tape and a black plastic lid with white plasticised cardboard insert) could be treated separately.

Figure 11 (top) shows the popularity of visualisation processes used at any stage of fingermark recovery and independent of the target substrate. In total, 14 different processes were used. The combined use of visual examination and Superglue fuming were most commonly used (32 organisations). Eight processes were used by less than three laboratories.

In order to break this down further, **Figure 11** (middle) shows processes used on the item before tape removal, whereas **Figure 11** (bottom) reports the processes used on the jar and on the tape after tape removal. For clarity reasons, and because the documentation related to the lid management is limited, any specific processing of the lid is not included in the bottom chart. Pre-tape removal, the vast majority of laboratories utilised optical methods and Superglue Fuming. This is a sensible approach due to the smooth, non-porous nature of all accessible surfaces (glass jar, electrical tape and plastic lid (if left on)). Post-tape removal, the number of chemical and physical methods used increased as additional surfaces became accessible (adhesive side of tape, underside of lid (if applicable) and/or other evidence types had been recovered (hairs, fibres, DNA).

The table below (**Table 3**) summarises how each mark was visualised. More detail for each mark is provided in the next sections.

Mark	# laboratories	Optical	Superglue Fuming	Superglue Dye Staining	Lifting	Powders	Powder Suspension
FM1	14	8	10	1	2	1	0
FM2	32	17	6	5	0	0	19
FM3	33	18	5	4	0	0	20

Table 3 Summary of the how many laboratories found each mark and which processes were successful

Figure 11 Number of laboratories using each process overall (top), pre-tape removal (middle) and post-tape removal (bottom). Abbreviations are: DYE (SG) – Superglue dye staining, GV – Gentian violet, IND - 1,2-Indanedione, IR – Reflected IR, LIFT – Lifting, MMD – Multimetal deposition, NIN – Ninhydrin, NY3 – Natural Yellow 3, POW – Powder dusting, PS – Powder suspension, SG – Superglue fuming, UVR – Reflected UV, VIS – Visual examination, VMD – Vacuum metal deposition.

9.3.2 Initial examination

Overall, preliminary examination was highly efficient for FM1, as well as for FM2 and FM3 after tape removal. Indeed, when considering the number of laboratories having observed these marks, more than half of them observed them upon preliminary observation (see Table 3).

9.3.3 Tape removal

Out of 36 laboratories, 23 (64 %) chose to apply a detection technique on the item before removing the tapes. Of these, 22 applied superglue (e.g., Cyanobloom or Lumicyano), followed with dye staining for three laboratories. Only one laboratory decided to opt for powder dusting. On the other hand, 12 laboratories (33 %) decided to remove the tapes without applying any detection technique, among which six did not report preliminary examination of the item beforehand. Unless this is due to incomplete reporting of the steps carried out in the frame of the MdCE, this raises some concerns. Also, one laboratory conducted the MdCE without removing the tapes.

The added value of applying a detection technique before the removal of the tapes lies in the detection of marks that would be overlapping between the tapes and the jar. Given that all the elements constituting the outer surface of the item were non-porous, superglue appeared as the most suited technique at this stage. After tape removal, the question of the newly exposed surfaces, i.e. adhesive side of the tapes and previously covered glass area, must be addressed (see next sections).

Given that the adhesives were placed on glass, their removal from the jar could be performed mechanically, mostly using tweezers. For most participants, the tape removal process was performed without major issues. However, there is always the risk of leaving tweezer marks on the tape (see Section 9.3.8).

9.3.4 Marks on the adhesive side of the tape

As it can be seen in **Table 4**, most participants (86 %) detected both FM2 and FM3, whereas one and two participants detected FM2 or FM3 only, respectively. One participant did not process the tapes, resulting in the absence of detection of these marks. Preliminary observation and powder suspension were the two most popular exams/techniques that were carried out on the adhesive side of the tapes (see **Table 5**). Both processes were quite efficient, mostly due to the nature of FM2 and FM3, i.e. sebum-rich secretions. It is quite hard to understand how some laboratories detected only one of the two, for they had the same likeliness to be detected. The most likely explanation is that they were missed (lack of scrutiny). Also, for those laboratories that processed the tapes with powder suspension and got no results, the reagent/recipe or the application protocol may be at fault.

9.3.5 Transferred marks

Once the tapes were removed, several participants reported the detection of fingermarks on the jar, below the tapes. These marks (called FM2T and FM3T) were transferred from the tapes to the glass, most likely because FM2 and FM3 were composed of sebum-rich secretions. As it can be seen in **Table 4**, 19 participants (53 %) reported the detection of both those marks, whereas four and two detected FM2T or FM3T only, respectively. Preliminary examination and superglue fuming were the two most popular exams/techniques that were carried out on the jar after tape removal (see **Table 5**). The choice for superglue fuming is quite logical, with regards to the nature of the item, i.e. glass. What is more difficult to explain is the non-systematic application of dye staining afterwards, i.e. only 15 laboratories from the 26 that applied superglue. Also, it can be pointed out that the performance of detection is lesser compared to FM2 and FM3. Two main reasons can explain this. First, laboratories dedicated a lower detection effort on the jar after tapes were removed, i.e. four laboratories did not consider the jar anymore and two carried out optical examination only. Second, the transfer process occurring without any possibility to control it, so the presence/detection of these marks cannot be guaranteed.

	# laboratories		# laboratories
FM2 + FM3	31	FM2T + FM3T	19
FM2 only	1	FM2T only	4
FM3 only	2	FM3T only	2
None	1	None	10

Table 4 Summary of the performance of the laboratories to detect the fingermarks present on the adhesive side of the tapes (i.e., FM2 and FM3) and their transfer onto the jar (i.e., FM2T and FM3T).

Mark	Optical	Superglue Fuming	Superglue Dye Staining	Powders	Powder Suspension	Other (GV,VMD)
FM2 (tape)	**27/17**	12/6	6/5	0/0	**21/19**	0/0
FM3 (tape)	**27/18**	12/5	6/4	0/0	**21/20**	0/0
FM2T (jar)	**24/16**	**26/14**	15/5	4/3	1/0	1/(0)
FM3T (jar)	**24/12**	**26/12**	15/5	4/2	1/0	1/(0)

Table 5 Summary of the popularity and efficiency of the different exam/techniques applied to the adhesive side of the tapes. Each cell is characterized by two numbers: the first is the number of laboratories having carried out this exam/technique, the second the number of laboratories having visualized the corresponding mark at this step.

9.3.6 The lid

Details about activities relating to the lid are not reported sufficiently for a meaningful analysis.

9.3.7 Mark on the inside of the jar (FM1)

Key points for FM1 are outlined below:

- 14 laboratories (38 %) found the mark on the inside of the jar using the processes outlined in **Table 6**.
- Only eight laboratories found the mark with optical processes (#1 – **Figure 12**, #2, #4, #5, #11, #13, #16, and #24) and seven (#24 is excluded) went on to conduct subsequent chemical/physical methods.
    - Laboratory #30 observed the mark but chose not to image it as the priority was given to explosive examination.
    - Laboratory #16 cleaned the jar, post-processing, so that a better image of FM1 could be taken through the glass.

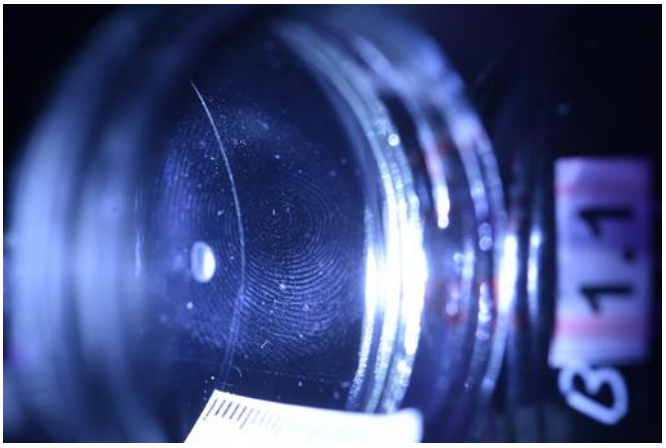

Figure 12. Lab #1 – the FM1 observed with optical methods before any treatment.

- 10 laboratories found FM1 with Superglue Fuming; for six of these, it was the only successful process (#3, #7, #12, #14, #21 and #31)
- Lifting and powders were only used on marks that had been previously seen with optical methods. Only one laboratory enhanced the Superglue mark with a dye stain.

Number of laboratories that found FM1	Successful processes				
	Optical	Superglue Fuming	Superglue Dye Staining	Lifting	Powders
14	8 (2)	10 (6)	1	2	1

Table 6 Summary of results for the recovery of FM1. The number in brackets indicates the number of laboratories where the mark was found with that process only.

There is no reason to believe that the recovery of the human hair from the inside of the jar would inhibit in any way the visualisation of the mark.

9.3.8 Other types of mark

Six laboratories (17 %) reported finding glove marks (#3, #5, #16, #20, #31 and #35). It is possible that more laboratories observed glove marks but did not report them. In some cases, poor quality ridge detail could be observed. These marks may have been left during the preparation of the item, or during handling by the laboratory. A recent study has shown that even freshly worn gloves have the potential to leave marks due to a coating deposited during manufacture on their outer surface.[3]

At least one laboratory developed tweezer marks with Powder Suspension on the adhesive side of the tape, although not in the region of the fingermarks.

These extra marks highlight the need to handle items at little as possible even with gloved hands or when using tweezers.

[3] T. Lee et al., Composition of friction ridge detail transferred through nitrile gloves, I.A.I. Educational Conference, National Harbor, Maryland (USA), 2023, poster session.
In addition: W.J. Gee, Disposable gloves: An innate source of transferable chemical residues, Forensic Science International, 353 (2023) 111874.

9.4 Results from the Fingerprint (Identification) Examination

For the evaluation, the results of 36 laboratories were available. Three marks were designed to be analysed and compared with the available reference material. As anticipated, the outcome is dependent upon what was deposited and developed after the application of visualisation techniques.

9.4.1 Latent fingermark FM1 inside the glass jar

Fourteen laboratories (#1, #2, #3, #4, #7, #11, #12, #13, #14, #16, #21, #24 and #31) were able to visualise the latent fingermark and correctly associated it with the corresponding finger of the donor A. The remaining laboratories did not visualise the mark. Among them, one laboratory (#30) noted to have been observed "a little fingermark fragment" on the inner surface during the optical examination. This fingermark was neglected for explosives examination purposes. It is important to underline that no pictures are available proving that it was actually the FM1.

As expected, the results related to the FM1 could be linked with the strategy used for the analysis of the explosive inside the jar. This will be further discussed in section 10.1.

9.4.2 Transfer of the fingermarks from the adhesive tapes

As a general comment, being as adhesive tapes were involved, the participants should have considered the possibility of the transfer of the marks[4] to the glass. This means the marks should have been compared after lateral reversion. In section 9.3.5, the overview of the laboratories that developed the transferred marks has been given.

As for latent fingermark FM2 (on the edge of the top tape T1), five laboratories (#2, #6, #9, #10, and #28) observed the fingermark on the glass and, after comparison, correctly identified it, clearly noting that the source came from the adhesive side of the tape. One laboratory (#20) did the same, but the possible origin of the fingermark was not mentioned. Six laboratories (#5, #8, #12, #18, #22, and #25), being aware of the transfer, did not evaluate the mark developed on the glass given the better quality of the one on the adhesive tape. Nine laboratories (#16, #23, #24, #29, #31, #32, #34, #35, #36) judged the mark on the glass "not of value". Three of them (#16, #29, #32) made a specific notation to the transfer.

As for latent fingermark FM3 (in the middle of the bottom tape T2), five laboratories (#4, #6, #9, #28, and #36) observed the fingermark on the glass and, after comparison, correctly identified it, clearly noting that the source came from the adhesive side of the tape. Seven laboratories (#8, #12, #16, #18, #22, #25, and #37), being aware of the transfer, did not evaluate the mark developed on the glass given the better quality of the one on the adhesive tape. Eight laboratories (#2, #5, #24, #29, #31, #32, #34, #35)

[4] An example in: Anderson E., Transfer of latent prints on duct tape, *Journal of Forensic Identification*, 73(2), 143-168, 2023.

judged the mark on the glass "not of value". Two of them (#29, #32) made a specific notation to the transfer.

Lab #7 visualised both the FM2 and the FM3 on the glass (namely as "mark X1" and "mark X2") but it was not considered the possibility that the marks could come from the adhesive side of the tape. For this reason, after evaluating the marks "of value", they concluded excluding the two donors. We recommend this organisation to review their internal procedures regarding the possibility of the fingermark transfer when adhesive surfaces are involved.

9.4.3 Latent fingermark FM2 – on the edge of the top adhesive tape (T1)

Twenty-nine laboratories were able to visualise the latent fingermark and correctly associated it with the corresponding finger of the donor B.

The outcomes of the laboratory (#7) have been discussed in the previous section. Here, it should be noted that the mark FM2 was not visualised on the adhesive side of the tape.

Six laboratories (#2, #6, #9, #16, #32, and #35) visualised the mark but it was then judged "not of value":

- Laboratories #2 and #9 – A difference exists between the mark on the adhesive side and the correspondent on the glass. This can justify the final evaluation (an example is given in **Figure 13**).

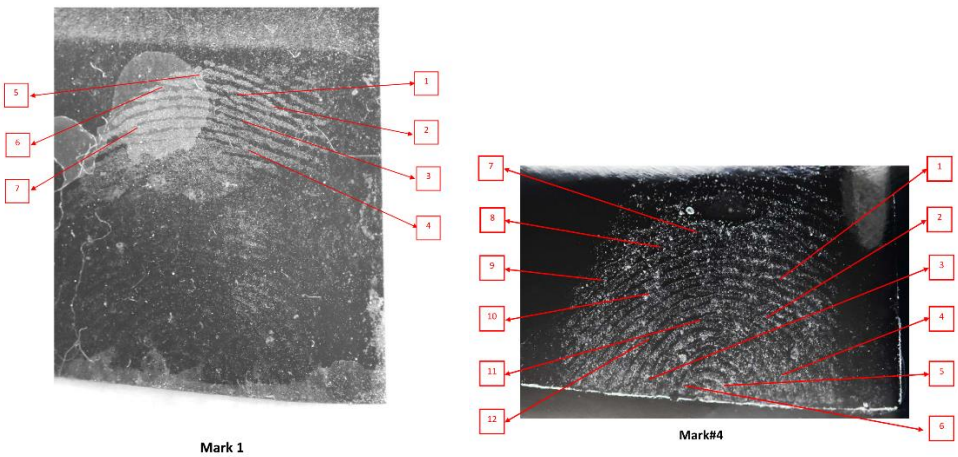

Figure 13 Lab #2 – on the left, the fingermark (namely, "mark 1") developed on the adhesive side of the tape. This mark was judged not of value. On the right, the fingermark (namely, "mark 4" – laterally reversion is applied) developed on the glass. The transfer has been clearly noted by the lab.

- Lab #6 - During the processing for fingerprints, the adhesive tapes were first removed from the glass and then treated for fingermarks visualisation. After that, they were sampled for DNA profiling. FM2 was visualised both on the adhesive

side of the tape (namely as #2.6) and on the glass (namely as #2.4) (**Figure 14**). It should be noted that the core area is totally absent in the mark #2.6.

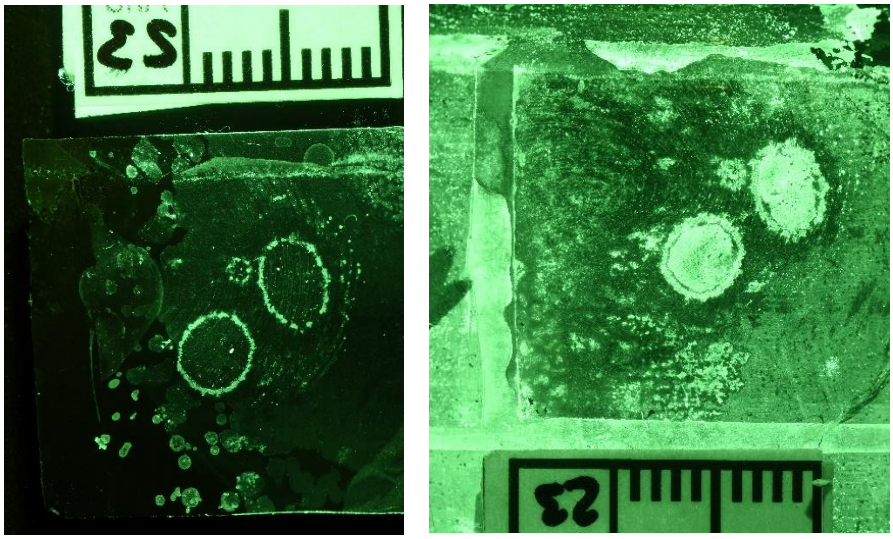

Figure 14 On the left, the latent fingermark FM2 visualised by the lab #6 on the adhesive side of the tape (namely #2.6) and, on the right, on the glass (namely #2.4).

As a result of the comparison, the mark #2.4 was identified with the correct finger of donor B whereas the mark #2.6 was deemed "not of value", with the following comment "[…] *Note that 2.6 could also be 2.4, but according to our quality criteria it is worthless.*"

- Lab #16: refer to the section 10.2.
- Laboratory #32 visualised the mark #FM2 on the adhesive side. (**Figure 15**)

Figure 15 Lab #32 - The latent fingermark FM2 visualised by the lab.

In this case, the mark was judged "not of value" and the evaluation is in line with the declared standard of the laboratory (numerical with a threshold of 16 minutiae). On the one side, it can be noted that the area of the fingermark towards the edge is missing (whereas it is visible on the glass). This could be the result of the detachment process,

or of a differential transfer to the glass. On the other side, it is believed that the quantity and quality of the features in the visualised fingermark could allow, under different standards, the correct association with the left middle of donor B, as shown in **Figure 16**.

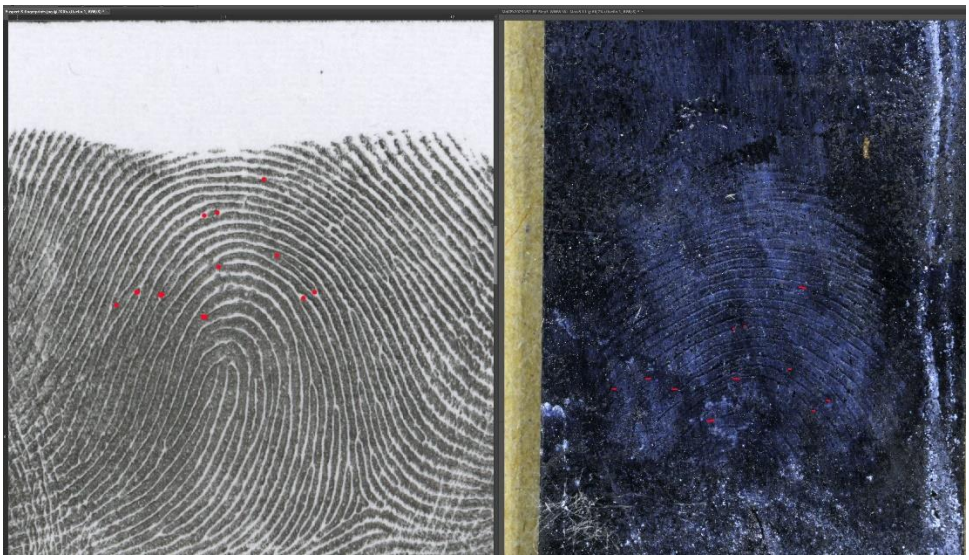

Figure 16 Lab #32 - The side-by-side comparison prepared by the organisers

- Lab #35 observed the FM2 as the transferred mark on the glass. (**Figure 17**)

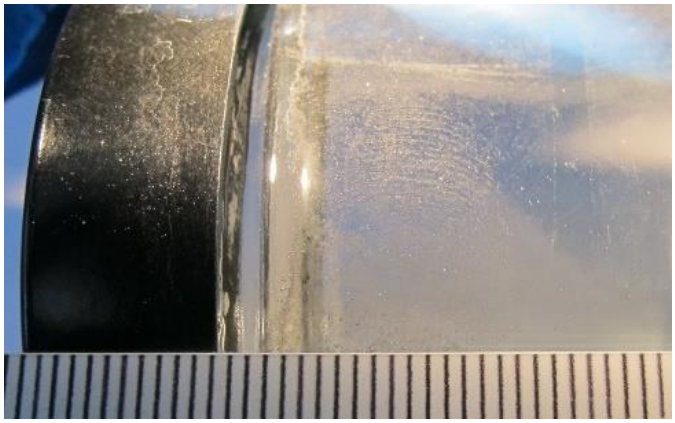

Figure 17 The latent fingermark FM2 visualised by the laboratories #35 on the glass (laterally reversed)

Given the available picture, nothing can be said about the evaluation done by the laboratory. However, considering that only non-magnetic powders were used as visualisation method, we recommend this organisation to apply further chemical treatments on the items in order to verify if it is possible to improve the quality of the mark(s).

Lab #22 visualised the mark and concluded with an "inconclusive" with the correct print. Given the low quality of the available pictures (and the use of an old-style fingerprint comparator) nothing can be said about this outcome.

Finally, three laboratories (#20, #26, and #34) did not visualise this fingermark on the adhesive side of the edge.

The lab #20 visualised FM2 apparently only on the glass (namely as "mark 1") and it was then correctly identified. The transfer was assumed but the specific source was not found nor noted.

As for the lab #26, this outcome can be explained given that no chemical treatments were carried out on the adhesive side of the tapes. Therefore, we recommend this organisation to reconsider this case according to their internal procedures.

The lab #34 visualised FM2 apparently only on the glass (namely as "#RD2" or "mark 2") and it was judged "not of value". Given the available picture, nothing can be said about the evaluation done by the lab.

The potential impact of DNA sampling on the quality of the mark will be discussed in section 10.2.

9.4.4 Latent fingermark FM3 – on the bottom adhesive tape (T2)

Thirty-three laboratories were able to visualise the latent fingermark and correctly associated it with the corresponding finger of the donor B. Among them, only one laboratory (#22) concluded with an "inconclusive" with the correct print. Given the low quality of the available pictures (and the use of an old-style fingerprint comparator), nothing can be said about this outcome.

The outcome of the lab #23 is quite peculiar and will be discussed in section 10.3.

Lab #35 observed the FM3 both on the adhesive tape and on the glass (as a result of a transfer) and it was always judged not of value. The same comments made in relation to mark FM2 apply.

Lab #5 observed the FM3 only on the glass (as a result of a transfer) and it was then judged "not of value". The procedure of this lab will be discussed in section 10.

Finally, one laboratory (#26) did not visualise this fingermark. This outcome can be explained given that no chemical treatments were carried out on the adhesive side of the tapes. Therefore, we recommend this organisation to reconsider this case according to their internal procedures.

9.5 Results from the Explosives Examination

9.5.1 Responses

Participating laboratories were asked to sample the collaborative exercise test sample for the presence of explosives. The scope of the exercise was purely a qualitative assessment, i.e. to identify any explosives present. Quantification of any identified explosives was not required. The collaborative exercise test sample had been spiked with 3 µL of a 1 µgµL^{-1} (acetonitrile 50 % / methanol 50 %) solution containing the organic high explosive RDX (equivalent to 3 µg or 3000 ng).

RDX (also commonly known as hexogen, cyclonite, or 1,3,5-trinitro-1,3,5-triazacyclohexane) is an organic secondary high explosive, that is commonly used within military munitions and can be combined with a binder to form plastic explosives (see **Figure 18**). Secondary high explosives require a shock wave, normally supplied by a detonator containing a primary high explosive, to initiate them. When initiated, they will detonate, i.e. explode, without the need for confinement.

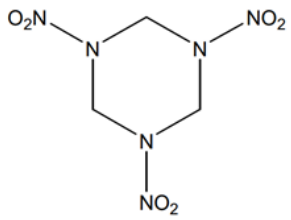

Figure 18 Molecular structure of RDX

In total, 36 laboratories returned results for the explosives part of the exercise.

9.5.2 Results

Nine (25 %) laboratories reported that **no explosives** were detected from any samples taken from the collaborative exercise test sample.[5] Consequently, these laboratories did not pass the explosives-related part of the exercise.

25 (69 %) laboratories reported the presence of **RDX** on samples taken from the collaborative exercise test sample.[6] These laboratories passed the explosives-related part of the exercise.

Of these, six provided quantification of the identified explosives (although this was not required for the purposes of the exercise).[7] Four of the participants also reported the

[5] Participating laboratories that declared **no explosives detected** included #02, #07, #08, #10, #13, #16, #23, #29 and #31
[6] Participating laboratories that declared the presence of **RDX** included #01, #03, #04, #05, #06, #09, #11, #12, #14, #15, #18, #19, #20, #21, #22, #25, #26, #27, #28, #30, #32, #33, #35, #36 and #37
[7] Participating laboratories that included quantification of **RDX** included #18, #21, #22, #25, #26 and #36

presence of the organic secondary high explosive **HMX** (also commonly known as octogen, or 1,3,5,7-tetranitro-1,3,5,7-tetrazocane, see **Figure 19**).[8]

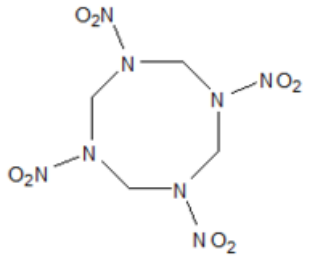

Figure 19 Molecular structure of HMX

HMX is a known by-product of the chemical reaction of the Bachmann process, used to commercially produce RDX. Consequently, it is likely that the commercially obtained RDX containing solution used to prepare the collaborative exercise contained trace amounts of HMX, which were detectable by sensitive instrumentation. For example, one participant that detected ~1500 ng of RDX, also detected ~10 ng of HMX.

Two (6 %) laboratories reported the presence of a range of ionic species that could be related to the presence of explosives, e.g. potassium nitrate based explosives compositions, but did not detect RDX. These laboratories did not pass the explosives-related part of the exercise.

9.5.3 Assessment of sampling and analysis techniques

In forensic explosives investigation, trace evidence can often possess the highest evidentiary value (traces are defined as invisible quantities on the order of ng - µg masses). In a forensic context, there are few legitimate explanations for the finding of high (molecular) explosives traces, other than in association with criminality, or terrorism related activities.

Effective physical recovery of high explosives traces from various evidence types / surfaces can be a critical step in any forensic investigation involving the misuse of explosives. It can be achieved using a range of sampling techniques, such as swabbing, vacuuming, solvent washing, headspace, etc.; the choice of which will depend on the type and size of surface being examined.

Recently, through a range of proficiency tests and technical workshops, the FINEX Working Group has observed that explosives trace recovery procedures vary considerably across international forensic laboratories, having been developed against the level and types of explosives employed for criminality in the national context. In general though, most are based on some variation of swabbing or solvent washing

[8] Participating laboratories that declared the presence of **RDX and HMX** included 18, #27, #33 and #36

procedure. Furthermore, there is little published information available regarding which techniques, or variations of techniques, may be most efficient for trace recovery of different explosives types from different surfaces that may be relevant in a forensic context.

In broad terms, and as expected based on observations from the FINEX Working Group, most laboratories conducted **sampling** of the collaborative exercise test sample using a variety of swabbing, solvent washing, or headspace sampling techniques. Following removal of the hair from the inside of the glass vial, swabbing of the internal surfaces of the vial was conducted, either using dry swabs, or solvent moistened swabs, e.g. 50:50 ethanol:water, acetone, methanol, etc. In most cases, some form of swab extraction, sometimes including sonication, was conducted to prepare the sample for chemical analysis. Where solvent washing was conducted, a variety of solvents were used, e.g. acetone, acetonitrile, etc., and in some cases pre-concentration of the solvent was conducted, prior to chemical analysis. In less instances, headspace sampling was conducted, using techniques such as solid phase micro extraction (SPME).

In addition to effective sampling, the detection of high explosives traces is often conducted using extremely sensitive hyphenated analytical techniques, e.g. gas chromatography – thermal energy analysis (GC-TEA), gas chromatography – mass spectrometry (GC-MS) or liquid chromatography – high resolution mass spectrometry (LC-HRMS), that are capable of reaching limits of detection of low pg quantities.

A range of **analytical techniques** were used by the participants, including ion-trap mass spectrometry (ITMS), a variety of hyphenated high-performance and ultra high-performance (HPLC and UPLC) with ultraviolet (UV) spectroscopy and mass spectrometry (MS) techniques, a variety of hyphenated gas chromatography (GC) with thermal energy analysis (TEA), mass spectrometry (MS) or electron capture detection (ECD), thermal desorption techniques, thin layer chromatography (TLC), Fourier transform infrared (FTIR) or Raman spectroscopy and spot tests.

9.5.4 Discussion

In general, when comparing the 11 laboratories that did not report the presence of RDX, with the 25 laboratories that detected RDX, a number of observations can be made that may explain the different results, focusing on the differences in the combinations of sampling and analysis techniques used in the collaborative exercise.

Several participants that did not detect RDX on the glass vial used headspace collection as the sampling technique. This may explain the negative results, since RDX has a relatively low vapour pressure when compared to other explosives, such as ethylene glycol dintrate (EGDN) or triacetone triperoxide (TATP). Consequently, it is likely that there was insufficient RDX in the headspace sampled to achieve detection.

It was also observed that several participants that did not detect RDX on the glass vial used GC-MS. Since RDX has a relatively low vapour pressure, it can be difficult to analyse with gas chromatography methods, especially those that use a cooler injection port temperature, and this may explain the higher correlation between no detection of RDX with the use of GC-MS.

When RDX was detected, it is clearly observed that sensitive analytical techniques were used, including liquid chromatography – mass spectrometry techniques and gas chromatography with thermal energy analysis (TEA) or electron capture detection (ECD). These observations are not unexpected.

Table 7 gives a general overview.

Reported method	**RDX detected**	**RDX not detected**
ITMS	#1, #4	#21
LC/MS-MS	#3, #11, #32, #37	
LC/MS	#18, #20, #27, #33	#8
GC/TEA	#4, #15, #22, #30	
HPLC	#11	
HPLC/DAD	#5	
HPLC/DAD-MS	#25	#29
HPLC/HRMS	#15, #22(c), #36	
HPLC/PDA		#7
HPLC-ToF	#21	
UHPLC-Q-ToF	#6, #25	
LC/MS-ToF	#14	#10
HPLC-UV	#6, #9	
GC/MS	#11, #19(c), #26, #32,	#2, #7, #8, #10, #12, #13, #14, #16, #23, #24, #29, #31, #34
GC/ECD	#12, #19, #26	
TD-GC/NCD		#13
TLC	#28,	#2
Sprays /Spot/ Meisenheimer reagent	#11(s)	#7, #8
FT-IR / IR		#8, #10

* Lab #35 is not included in the table due to the lack of information about the specific outcome for each method.
(c) = confirmation method
(s) = screening test

Table 7 Summary of results for the recovery of RDX

Two participating laboratories found traces of RDX on the adhesive tape (#14 and #37). Since no RDX had been deliberately deposited on the tape during preparation of the collaborative exercise, it is likely that the RDX was present due cross-contamination during preparation,[9] or during manipulation of the sample by the participating laboratory.

Additionally, the two participants (#24 and #34) that declared the presence of ions used ion chromatography (IC) based techniques for analysis, which are not capable of detecting RDX. Since there is no quantitative data for these results, it is difficult to assess whether the quantities of the ions detected were comparable to the background level of inorganic ions that would have been expected to be found on the collaborative test sample. Applying forensic significance to the detection of trace levels of ions that may be associated with explosives is much more difficult than for organic high explosives. This is because environmental surveys have shown that the prevalence of trace levels of organic explosives, e.g. RDX, HMX, TATP, is rare in the background. However, trace levels of inorganic ions are prevalent in the background, since they are associated with many chemicals and natural processes; most notably with the exception of perchlorate ions, often used in pyrotechnics, which are less prevalent in the background.

[9] RDX was deposited inside the jar when the tapes were not on the glass. Lab #14 detected the RDX from the whitish stain on the outside of the edge of tape T1. Therefore, for this lab, cross-contamination during preparation can be excluded.

9.6 Results from the Fibres Examination

For the evaluation, the results of 35 laboratories were available. A summary is given in **Figure 20.**

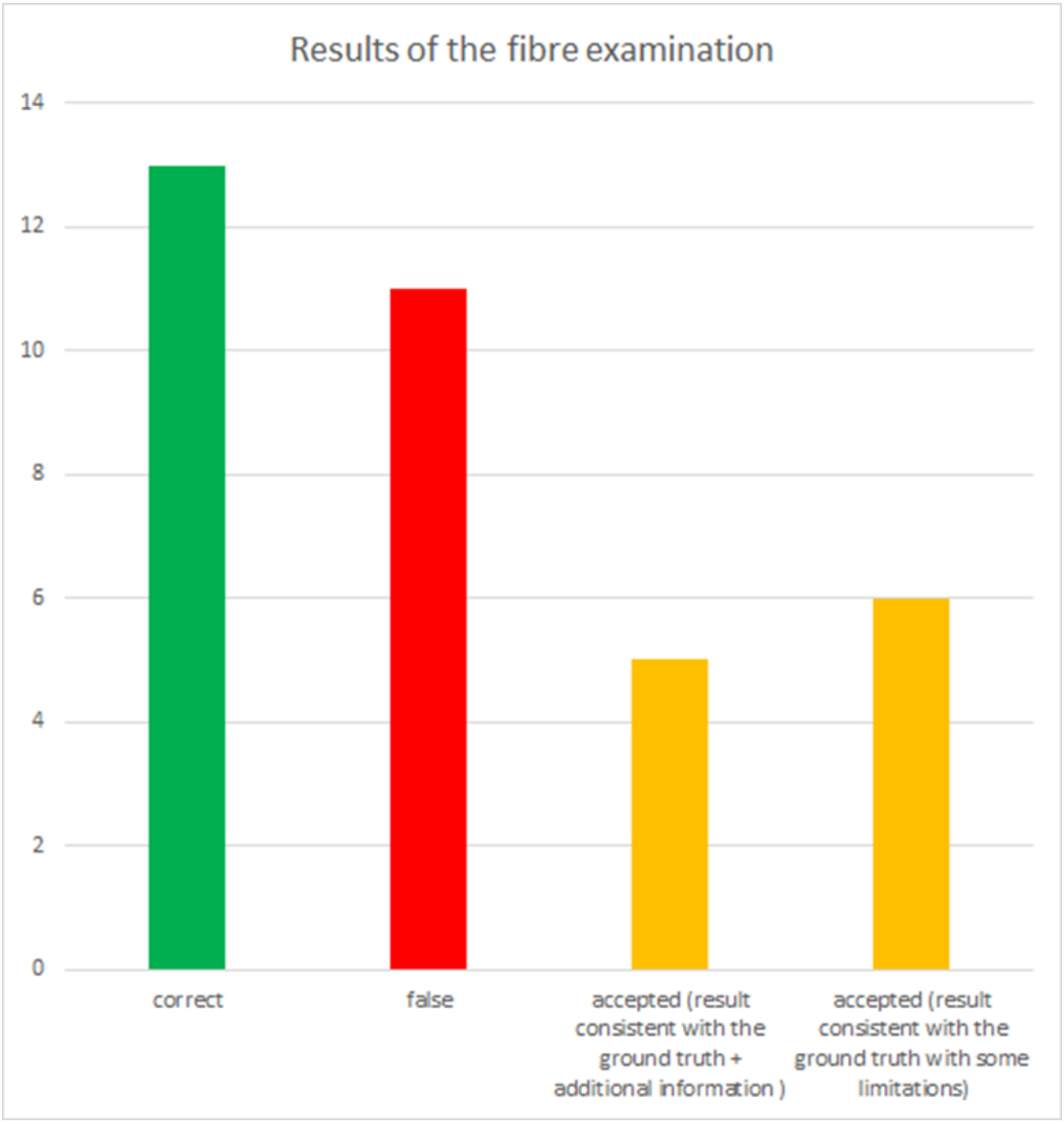

Figure 20 Fibres examination - summary of the results

Thirteen out of thirty-five laboratories (#4, #5, #10, #13, #14, #15, #16, #23, #25, #28, #33, #35 and #36) identified correctly both fibre types on the jar, as well as on the tape lift, stated correctly that both fibre types on both exhibits could have originated from the same source and based their conclusions on the results from low and high-power microscopy, colour comparison techniques (MSP or alternative methods) and chemical composition analysis, e.g. FTIR, as expected.

Five laboratories (#18, #21, #22, #27 and #30) did all the above, but identified incorrectly further fibre types. These answers were also accepted.

Six laboratories (#3, #6, #9, #12, #24 and #29) stated correctly a match, but didn't assess the colour properties of the fibres dyes. MSP or any other alternative colour comparison technique were not performed. Thus, the results are consistent with the ground truth with limitations.

Eleven answers (Laboratories #1, #2, #7, #8, #11, #19, #20, #26, #31, #34 and #37) were not accepted as correct. The reasons therefore were various:

- **One** laboratory (Lab #1) did not recognise/identify correctly the two fibre types on the glass jar and stated that there is no match.
- **One** laboratory (Lab #8) stated a match for only one out of the two fibre types.
- **One** (Lab #34) laboratory didn't recognise correctly both two fibre types and recognised some further fibers and involved them into the comparison. Regarding the additional fibres, since the fibre sampling took place after the DNA sampling, the additional white natural fibres found on the tape could originate from the swab.
- **Eight** laboratories (#2, #7, #11, #19, #20, #26, #31 and #37) stated a match, but did not recognise correctly both fibre types**. Five** of them (#2, #11, #31 and #37) did not perform any high-power microscopy. Drawing conclusion about fibre comparison without performing high-power microscopy is unacceptable.

Conclusion/resulting measures

Eleven laboratories (#2, #3, #6, #7, #9, #11, #12, #20, #26, #29 and #37) did not perform MSP or other colour comparison techniques (see chapter 7.2.5). Lab #12 stated that their MSP is currently out of order.

It is rather worrying that so many laboratories stated matches, although they did not perform any MSP. Even if an MSP is not available, it is crucial to assess and compare the fibre dyes, as they can be distinguished. Stating that two green PA fibres are identical without comparing their dye properties can lead to wrong results. Even if a match is correct, the scientific basis for this conclusion is missing.

It is important to raise awareness regarding the role and importance of colour comparison techniques when assessing a potential fibre match. This could be done within the ENFSI expert working ETHG (European Textile and Hair Group).

9.7 Results from the hair examination

From the jar, it was expected to find some hairs on the adhesive side of the tape T2 and one hair inside. For the analysis of hairs, it was expected to morphologically characterise all hairs found as human, or animal.

Human/Animal characterisation of the hair inside the jar

This hair was a human brown/dark head hair with root (suitable for DNA analysis), see **Figure 21** and **Figure 22** below.

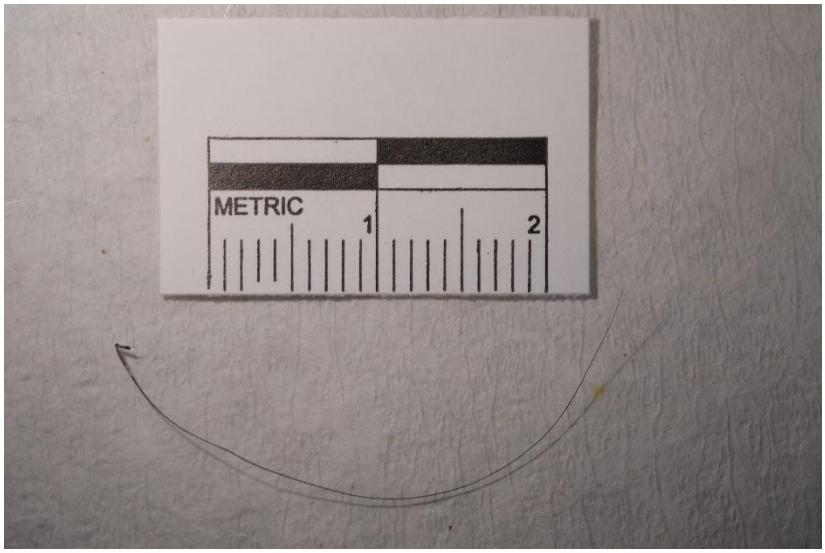

Figure 21 Lab#3: hair inside the jar

Figure 22 Lab#21: internal medulla structure of the hair inside the jar

On the 36 participants:

- 32 laboratories correctly characterised the hair inside the glass container as human.
- Three laboratories (Lab#15, Lab#16, and Lab #32) did not morphologically characterise the hair.
- Lab#9 was inconclusive about this hair (it should be noted that this hair was also analysed for explosives.

As the majority of participants were able to correctly describe the hair as human, it could be assumed that this sample was good enough for a PT/CE. This hair was not supposed to be challenging, but the interaction with explosive residues and DNA analysis was interesting. This will be discussed in the multidisciplinary part.

Animal hair on the adhesive tape T2 and specie determination

The second aim of the hair analysis was to characterise the animal hairs under the tape T2 and determine the specie, if possible.

Thirty participants correctly characterised the hairs outside the jar as animal hairs and their answer was considered as correct. The determination of the species was not considered as a part of the expected ground truth, because the experience of hairs PT/CE in the ETHG has shown that it is a particularly difficult part of animal hair analysis and only a few laboratories do it routinely. (**Figure 23** and **Figure 24**)

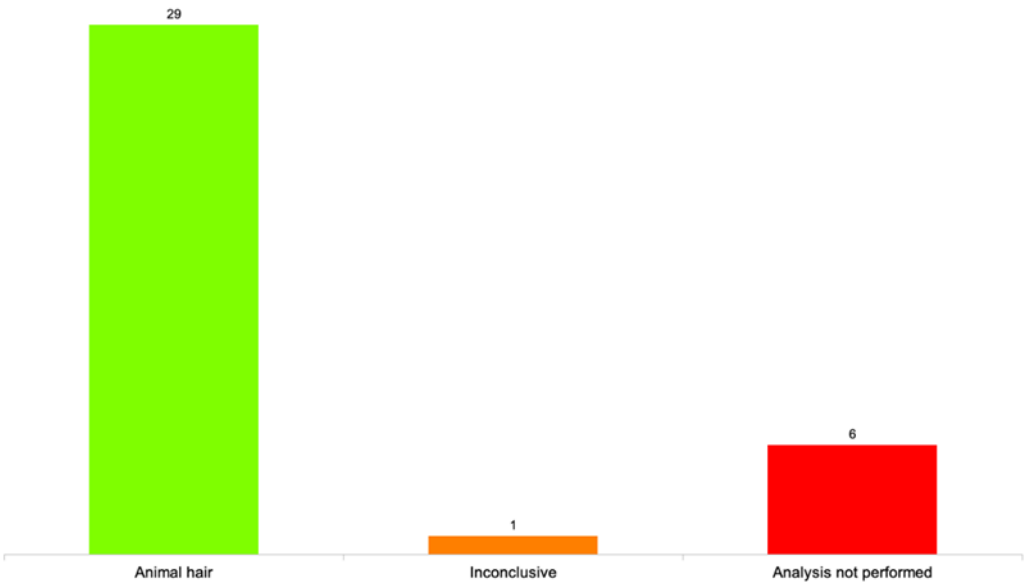

Figure 23 Results of hairs on tape T2 morphological analysis

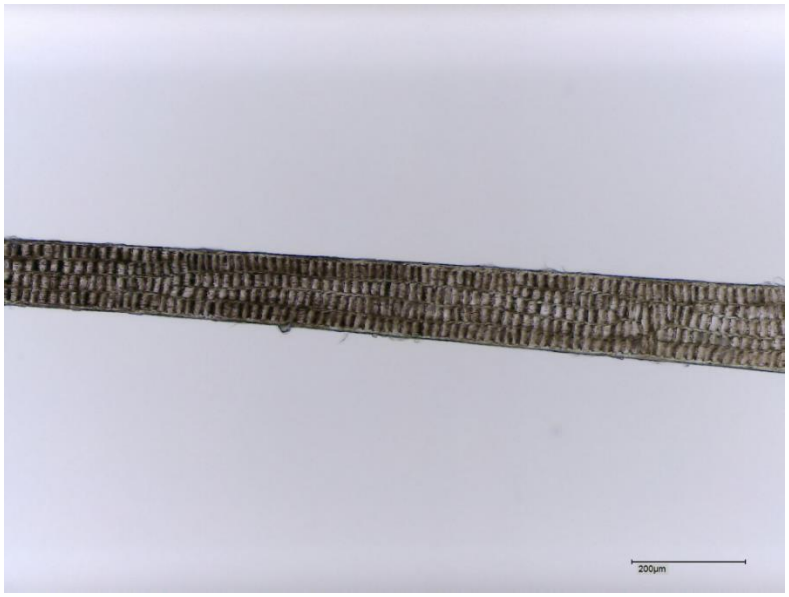

Figure 24 Lab#23: internal medulla structure of the hair on the adhesive face of tape T2

Regarding specie determination on animal hairs, 12 laboratories (#3, #5, #7, #12, #13, #21, #22, #24, #25, #27, #31, and#32) did not perform this analysis; six were inconclusive (#4, #9, #11, #20, #34, and #36) and 18 laboratories correctly characterised the animal hairs as rabbit hairs. As in the 2022 Hair ETHG CE/PT, *Lagormoph* and *Leporidae* were considered as correct answers. Indeed, even *Leporidae* is a family including the species of Rabbits and Hares and *Lagomorph* includes Leporidea and Ochotonidea (Pika), an animal only found in America. (**Figure 25**)

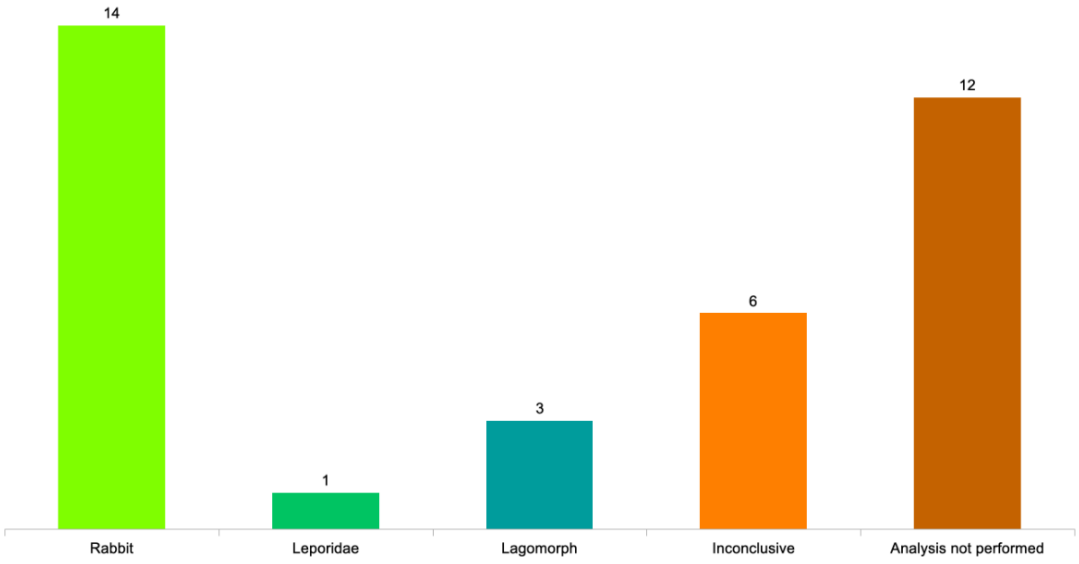

Figure 25 Specie determination of tape T2 animal hairs

Lab#16 reported an unexpected "wool hair", not found by any other participants. This extra hair could have originated from the preparation of the item, even if all precautions were taken to avoid any kind of contamination during the process.

Discussion

The results of MdCE2023 show that the morphological analysis of hairs is done in a majority of the participating laboratories. The answers highlight the good training of the majority of the laboratories in this discipline. This knowledge allow them to correctly characterise hairs (animal vs human) in casework and makes a selection of the samples suitable for a DNA analysis.

Regarding animal hair species determination, knowing that rabbit hair was present on the item could lead the investigation team to a specific area and combined with all other evidence, it is a valuable result. The fact that only one half of the participants have correctly determined the species underlines the need for training and competence maintenance in animal species determination; already observed in hair PT/CE results organised by the ETHG.

10 MULTIDISCIPLINARITY - DISCUSSION

From a multidisciplinary point of view, some aspects arise from this collaborative exercise and deserve further discussion.

In the first instance, regarding the sequence of examination followed by the lab #5, they noted, "*The tape attached to the surface of the jar was sequentially divided into fragments using a scalpel, which were then detached and subjected to visual examination. Depending on the examination results, the detached fragments were destined for fiber analysis (2 fragments), fingerprint analysis (1 fragment), explosive material analysis (1 fragment), and DNA analysis (14 fragments).*" This affected the fingerprint results. Indeed, the mark FM3 was not visualised on the adhesive side of the tape, but it was developed only on the glass (namely as "mark 2") and judged "not of value". Therefore, it is possible that the part of the adhesive tape containing the mark was destined to another discipline. This means a loss of evidence in the case.

It is believed that this process does not constitute best practice. We recommend this organisation to reconsider this case according to their internal procedures.

10.1 Explosives analysis and fingermarks

See **Table 8** for a summary of the laboratory results for FM1 and trace explosives recovery from the inside of the jar. Optical methods for fingermark visualisation are not included in this analysis, as they are non-destructive. Of more interest is the potential incompatibility between chemical and physical fingermark visualisation and trace recovery methods. In summary:

- 14 laboratories found FM1, 25 found RDX, eight found both and five failed to find either.
- 28 laboratories prioritised explosives trace recovery over fingerprints, including 11 that did not do destructive fingerprint recovery at all.
- Eight laboratories prioritised fingerprint recovery over explosives trace recovery.
- For laboratories who conducted explosives recovery prior to fingerprint recovery, 7/17 (41 %) found FM1 and 14/17 (82 %) found RDX.
    - Swabbing or rinsing the whole of the inside of the jar was extremely detrimental to fingermark recovery with only one laboratory (#5), out of nine who attempted, able to recovery FM1.
    - Seven laboratories opted for a targeted swabbing approach for trace explosives recovery. This was less damaging to FM1 with a recovery rate of 5/7 (71 %), although one of these laboratories (#7) failed to identify RDX.
- For laboratories who conducted destructive fingerprint processes prior to explosives recovery, 6/8 (75 %) found FM1 and 4/8 (50 %) found RDX.

- Only lab #13 used a targeted visualisation method (lifting) to recover the mark that had been previously seen with optical methods. Unfortunately, they were not able to identify RDX.

Evidence recovered	Number of laboratories	Individual laboratory results		
		Fingerprints (destructive) – Explosives	Explosives – Fingerprints (destructive)	Explosives only
FM1 only	6	#13, #16, #31	#2, #7	#24*
FM1 and RDX	8	#1, #14, #21	#3, #4, #5, #11, #12	
RDX only	17	#26	#6, #19, #20, #22, #25, #27, #32, #36, #37	#9, #15, #18, #28, #30, #33, #35
Neither	5	#8	#29	#10, #23, #34
Total	**36**	**8**	**17**	**11**

** Lab #24 visualised FM1 with optical methods*

Table 8 Results for the recovery of FM1 using destructive methods and the explosives trace, including a detail of the order of recovery. Red laboratory numbers indicate possible interference between evidence recovery types, whilst green indicates targeted recovery.

The procedure of the eight laboratories that found both FM1 and RDX is summarised in **Table 9**.

Sampling for the explosives after fingermark chemical visualisation methods						
Lab ↓	*Optical methods for fingerprints*	*FM1 observed and acquired?*	*Fingermark visualisation with?*	*EXPL: method of sampling*	*EXPL: location of sampling*	*EXPL: instrumentation RDX detected*
#1	Yes	Yes	Superglue	Wipe with sample traps	Inner walls	ITMS
#14	Yes	No	Superglue	Washing with 0.1 mL methanol	Inside the jar	LC/MS-ToF
#21	Yes	No	Superglue	Swab	White spot on the bottom	HPLC-ToF
Sampling for the explosives before fingermark chemical visualisation methods						
Lab ↓	*Optical methods for fingerprints*	*FM1 observed and acquired?*	*EXPL: method of sampling*	*EXPL: location of sampling*	*EXPL: instrumentation RDX detected*	*Fingermark visualisation with?*
#3	Yes	No	Swab (70% ethanol soaked)	Whole bottom	LC/MS-MS	Superglue
#4	Yes	Yes	Swab	Inside bottom	GC-TEA; ITMS	Superglue + BY40
#5	Yes	Yes	Washing (2mL acetonitrile)	Internal surface	HPLC-DAD	Superglue
#11	Yes	Yes	Swabs (acetone and water)	Inner part of the jar	Spot test; GC-MS, HPLC, LC/MS-MS	Superglue
#12	Yes	No	Swab	Inside the jar	LC/MS-ToF	Superglue

Table 9 Procedures of the eight laboratories that found both the RDX and the FM1

It is important to note that, independently of the prioritisation, four laboratories observed and acquired the FM1 using optical methods. This secured the recovery of the fingermark.

Regarding the remaining four laboratories:

- Both the laboratories (#14 and #21) that prioritise the fingermark chemical visualisation used superglue with no consequence on the recovery of the explosives. The analysis of the latter ones was conducted using high sensitive methods, that, only for lab #21, was also associated with a targeted sampling.
- Both the laboratories (#3 and #12) that prioritise the recovery of the explosives over the fingermark visualisation used high sensitive methods for the explosives.

The fingerprint perspective

Six laboratories (#2, #7, #13, #16, #24, and #31) found only the FM1. This could be expected from those that prioritised the fingermark search (#2, #13, #16, and #31 - lab #24 was able to visualise the mark simply using the optical methods). In this context, the outcome of the lab #7 is of particular interest, as they were able to visualise the fingermark after the sampling for explosives. In this case, they specifically swabbed with acetone the internal bottom ring. The positive consequence was the recovery of the fingermark, while the negative one was the failure to detect the explosives.

Twenty-two laboratories (#6, #8, #9, #10, #15, #18, #19, #20, #22, #23, #25, #26, #27, #28, #29, #30, #32, #33, #34, #35, #36, and #37) did not visualise the fingermark inside the jar.

Firstly, it should be noted that this outcome could be the consequence of a precise strategy in which priority was assigned to the explosives recovery (ten laboratories - #9, #10, #15, #18, #23, #28, #30, #33, #34, and #35[10]). These laboratories did not search for the fingermarks on the inside of the jar neither using optical methods nor chemical ones. Indeed, from an investigative perspective, for the scenario involved, the confirmation of the presence of some residues of explosives could have been relevant. Therefore, the risk was accepted to lose some further traces (a fingermark in this case). On this point, given also the outcomes of the other participants, we recommend these organisations to verify if a different procedure/method could be applied in order to maximise the recovery of traces.

Two laboratories (#8 and #26) did not develop the fingermark with superglue, despite it being applied before the sampling for explosives. This outcome is surprising. As explained in section 4.1, a control fingermark was available and it is shown in **Figure 26**.

[10] In the response form, this lab noted that magnetic powders were used on the inside of the jar. However, no evidence of this treatment is available.

Figure 26 Control fingermarks for the FM1 - lab #8 (on the left), lab #26 (on the right) - Each one was deposited, on a slide, immediately after the fingermark on the inside of the jar. The quantity of deposit is lower but the fingermark was anyway visible after the treatment with superglue (carried out on the day after the deposition).

As previously said, 17 laboratories priorities the explosives search and then tried to visualise the fingermarks with chemical methods. This may explain the negative outcome regarding the FM1 for ten of them (#6, #19, #20, #22, #25, #27, #29, #32, #36, and #37). Indeed, the explosives sampling involved swabbing/washing with solvents (basically, methanol, acetone, isopropanol, and water).

Interestingly, the remaining seven laboratories (#2, #3, #4, #5, #7, #11, and #12) were able to find the FM1 and these outcomes have been previously discussed in this report.

The explosive perspective

Five laboratories (#19, #21, #25, #35, and #37) observed a whitish stain on the inside of the jar with optical methods (an example is given in **Figure 27**). Therefore, after a targeted recovery, they all were able to detect the RDX.

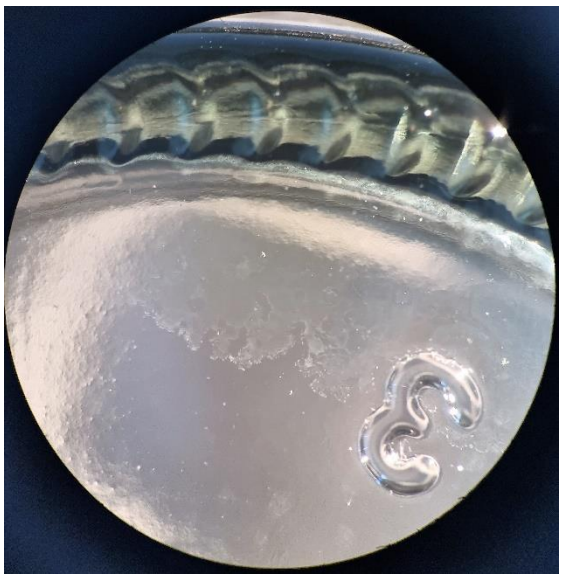

Figure 27 Lab #35 – the whitish stain observed on the bottom inside the jar.

Seventeen laboratories (#6, #9, #15, #18, #19, #20, #22, #25, #26, #27, #28, #30, #32, #33, #35, #36, and #37) found only the RDX. All these laboratories prioritised explosive recovery over fingerprint recovery, with the exception of lab #26, which apparently[11] used superglue before the explosives sampling.

Six laboratories (#2, #7, #13, #16, #24, and #31) found only the FM1. This outcome is surprising for laboratories #2, #7 and #24 as the sampling for the explosives was performed before the fingermark chemical visualisation methods (if any). The respective procedures for the explosives recovery are summarised in **Table 10**.

Lab (#)	**Method of sampling**	**Method(s) of analysis for organic explosives**
2	Washing with acetone	TLC; GC-MS
7	Swab with acetone	Sprays; HPLC-PDA; GC-MS
24	Swabs (acetone and water)	GC-MS

Table 10 Laboratories that sampled for the explosives before fingermark chemical visualisation methods but that did not detect the RDX

A possible explanation of this outcome can be a wrong combination "sampling/technique", that means ineffective sampling and/or poor sensitive technique for the specific scenario involved.

As for the laboratories that prioritised fingerprint recovery with destructive methods (#13, #16, and #31), **Table 11** summarises the respective procedures.

Sampling for the explosives after fingermark chemical visualisation methods						
Lab ↓	*Optical methods for fingerprints*	*FM1 observed and acquired?*	*Fingermark visualisation with?*	*EXPL: method of sampling*	*EXPL: location of sampling*	*EXPL: instrumentation*
#13	Yes	Yes	lifting	Washing with acetone	Inner surfaces	TD-GC-NCD; GC-MS
#16	Yes	Yes	Magnetic powders + lifting	SPME	Inside glass container	GC-MS
#31	Yes	No	Superglue	SPME and washing with solvent	Inside	GC-MS

Table 11 Procedures of the laboratories that applied destructive methods for fingermark visualisation and then sampled the inside for explosive recovery

[11] The lab clarified that "Cyanoacrylate superglue was applied on all parts of examined subject, not applied on the adhesive parts of the sticky tapes". Therefore, it has been assumed that they mean also the inside of the jar.

In these cases, a possible explanation of the negative outcome for RDX can be a wrong combination "sampling/technique", that means ineffective sampling and/or poor sensitive technique given that an invasive method for fingerprint recovery was firstly applied.

Finally, as for the five laboratories (#8, #10, #23, #29, and #34) that did not find neither FM1 and RDX, all except one (#8) prioritised explosives recovery over fingerprint recovery.

Lab #8 prioritised fingerprint recovery using superglue. Then, they sampled the explosive both with SPME and with solvent (methanol) using different methods for the analysis (LC-MS; GC-MS; Meisenheimer reagent; IR). It can be supposed that the superglue affected in some way the explosives recovery, even if the results of other laboratories in this test differ from this.

Table 12 summarises the procedures of the remaining four laboratories.

Sampling for the explosives before fingermark chemical visualisation methods						
Lab ↓	*Optical methods for fingerprints*	*FM1 observed and acquired?*	*EXPL: method of sampling*	*EXPL: location of sampling*	*EXPL: instrumentation*	*Fingermark visualisation with?*
#10	Yes	No	Swab with methanol	Inner surfaces	LC/MS-QToF; GC/MS; FTIR	*no chemical methods inside*
#23	Yes	Yes	Washing with solvents (water 5mL and then acetone 5mL)	Inner surfaces	GC-MS	*no chemical methods inside*
#29	Yes	Yes	SPME + swab (methanol and water)	Whole bottom	GC-MS; HPLC-DAD	Superglue + Ardrox
#34	Yes	Yes	Swabs (acetone and water)	Inner surfaces	GC-MS	*no chemical methods inside*

Table 12 Procedures of the laboratories that prioritised explosive recovery but did not find both the RDX and the FM1

The outcome of these laboratories is unexpected (as said, this was a precise strategy for laboratories #10, #23, and #34). For two of them (#23, #34) a possible explanation can be the use of GC/MS as analytical method.

10.2 DNA and fingermark: the sampling of the free edges

A fingermark (FM2) was on the adhesive side of one free edge of the top tape (T1). On the same edge, a trace of saliva was present (both on the non-adhesive side and on the adhesive side). Both the fingermark and the saliva trace could have been visualised using common light sources (**Figure 28** as an example).

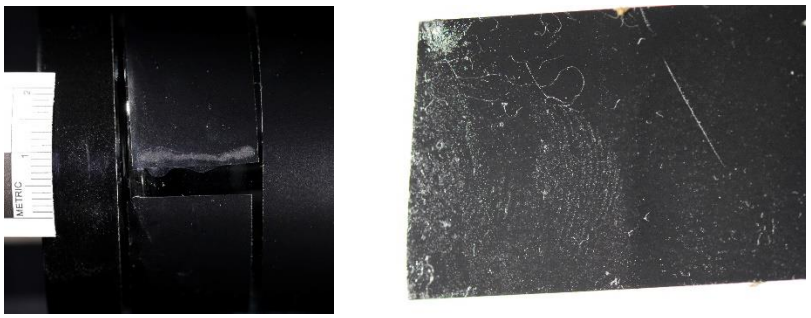

Figure 28 On the left: lab #3 – the saliva trace visible on the free edge of the top tape. On the right: lab #2 – the fingermark visible on the adhesive side of the edge of the top tape.

Regarding these traces, **Figure 29** summarises the strategy followed by the laboratories. It seems clear that the majority (25 laboratories - #1, #2, #4, #5, #7, #8, #11, #12, #13, #14, #16, #19, #20, #21, #22, #24, #25, #26, #27, #29, #30, #31, #32, #36, and #37) preferred to sample potential DNA traces before the chemical treatments for fingermark visualisation.

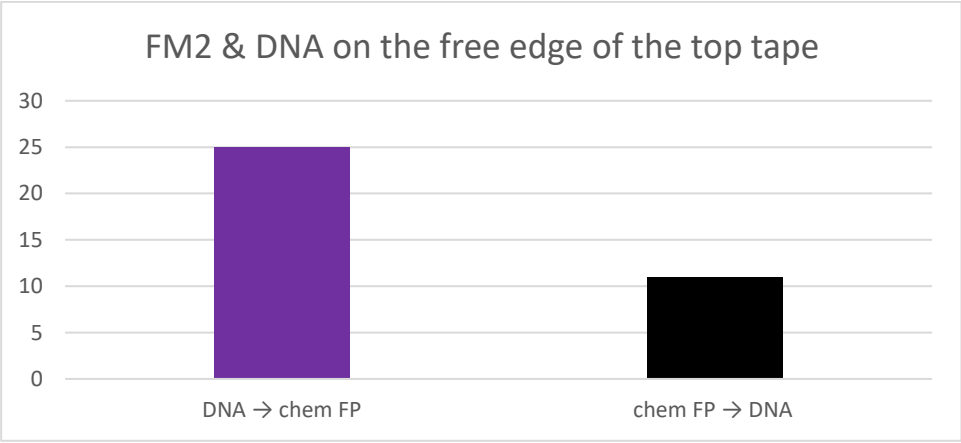

Figure 29 Free edges of the tapes – laboratory strategy regarding DNA&fingerprints

Overall, nine laboratories (#8, #18, #23, #24, #28, #29, #32, #34 and #37) used a presumptive test to confirm the presence of saliva.

Given this, as a general comment for the laboratories that performed the DNA search before fingermark visualisation methods, a targeted sampling for DNA could be carried out without affecting the adhesive side. With this regard, three main groups can be noted.

Group 1 – swab only on the outside of the tape

Twelve laboratories (#1, #8, #14, #19, #25, #27, #28, #29, #30, #32, #35, and #36) swabbed only the non-adhesive side of the tape (where the white stain of saliva was visible).

As expected, all the laboratories were able to obtain the correct DNA profile and to identify the fingermark. The only exception is represented by the lab #35 in relation to the fingermark; this specific outcome has been discussed in the section 9.4.3.

Group 2 – random sampling

Fifteen laboratories (#2, #4, #6, #7, #9, #10, #11, #13, #15, #18, #22, #23, #24, #33, and #37) applied a generic swabbing (or a combination of methods) that could interest also the adhesive side.

Only one laboratory (#9) was not able to obtain the DNA profile. In this case, the DNA sampling was generically performed on the outside of the jar after the fingermark visualisation methods (lumicyano and rhodamine 6G). Despite being strange (the quantity of DNA in saliva was relatively high), it is possible that;

- The area containing saliva was not swabbed.
- The chemical treatments and the non-targeted sampling affected the capacity to recover this biological trace.

Laboratory #26 also applied some generic swabbing, but it is not possible to understand if this action interested the edges of the top tape. None of these samples resulted in a DNA profile.

Laboratory #24 visualised the mark #FM2 on the adhesive side. In **Figure 30**, the possible area interested by the sampling for DNA analysis (swab – 0.5x0.5 cm) can be noted in the red ellipse.

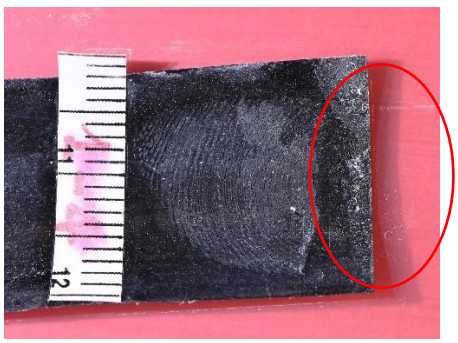

Figure 30 The latent fingermark FM2 (namely #1A) visualised by the lab #22

Two laboratories (#7, #32) visualised, but did not identify the FM2. These specific outcomes have been discussed in the sections 9.4.2 and 9.4.3.

Group 3 – cutting

Eight laboratories (#3, #5, #12, #16, #20, #21, #31, and #34) cut the edge in order to obtain a DNA profile.

Except for lab #3 (targeted DNA sampling after fingermark visualisation), cutting should be considered a risky approach. From the fingerprint perspective, this is the most aggressive way of sampling. The extent of the cutting varies (**Table 13**).

Lab	Extent of cutting	Notes
#5	0.5 cm	white stain observed in advance
#12	Corner of the top tape	Fig. 31
#16	2 cm	
#20	0.3 cm x 1cm	
#21	0.2cm x 1cm	
#31	*not provided*	
#34	0.5 cm x 2cm	

Table 13 FM2: the extent of cutting for DNA profiling.

Laboratories #12 (**Figure 31**) and #21 were more cautious, thus demonstrating awareness of the possibility of affecting the potential fingermarks.

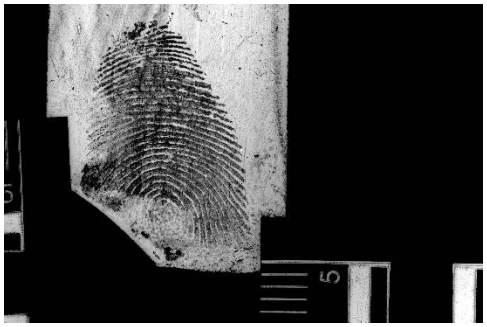

Figure 31 Lab #12 – FM2 developed on the adhesive side of the top tape. It is evident the cutting of the corner for DNA sampling done before.

All the above-mentioned eight laboratories were able to recover the correct profile, whereas two laboratories (#16, #34) did not identify the fingermark:

- Lab #16 cut (2cm) the edge of the tape T1 for DNA analysis. A residue of the mark was indeed later developed (with superglue) but it was not sufficient for a comparison. In this case, it should be also interesting to understand why the white

powder suspension worked very well on the FM3 but apparently not on the FM2 (pictures not available).

- As discussed in section 9.4.3, the lab #34 did not visualise the FM2 on the adhesive side of the tape but only on the glass.

  Based on the procedure noted in the response form, the (closed) jar underwent first a superglue fuming and, then, the biological traces on the edges were sampled only from the outside of the tape. Therefore, apparently, it seems that there is not a correlation between DNA and fingerprints.

  We recommend this organisation to review the results considering the ground truth.

10.3 Sampling of fibres/hair &fingermark.

A fingermark (FM3) was on the adhesive side in the middle of the bottom tape (T2). Fibres and (animal) hair were deposited over this fingermark (on the adhesive side) in a way that they protruded from the tape.

Since the fibres and the animal hair were protruding from the tape lift and it was easy to remove them without opening the tape, the sequence of examination should not affect the analysis of these two traces. The majority of laboratories removed the protruding fibres and animal hairs before using any destructive methods. In addition, the fingermark could have been visualised using common light sources.

Few laboratories (#5, #23, #27, and #32) sampled the fibres/(animal) hair in a way that could have affected (#23, #27, #32) or affected (#5) the recovery of the fingermark .

As previously outlined, lab #5 "divided [*the tape*] into fragments using a scalpel, which were then detached and subjected to visual examination. Depending on the examination results, the detached fragments were destined for fiber analysis (2 fragments), fingerprint analysis (1 fragment), explosive material analysis (1 fragment), and DNA analysis (14 fragments)".

For three laboratories (#23, #27, and #32), the cut was carried out where FM3 was located, which resulted in the degradation of FM3 or a partial loss of ridge details (**Figure 32)**. Specifically for lab #23 (**Figure 32 (a)**, the tape T2 was cut in a previous step before the fingermark visualisation methods in order to sample the fibres/hair. The cutting interested exactly the area where the fingermark FM3 was. Later, the lab visualised the fingermark on the two different pieces of tape resulting in two fingermarks that were correctly associated. It seems anyway evident that this was a risky approach.[12]

[12] Specifically asked, lab #23 reported that "*The bottom tape was cut in with a scalpel and opened with tweezers to secure the fibers and hairs from under the tape in that section. It was originally just cut-in a few millimeters, but the cut widened during the securing of the trace material. In our institute the securing of fiber (and hair)*

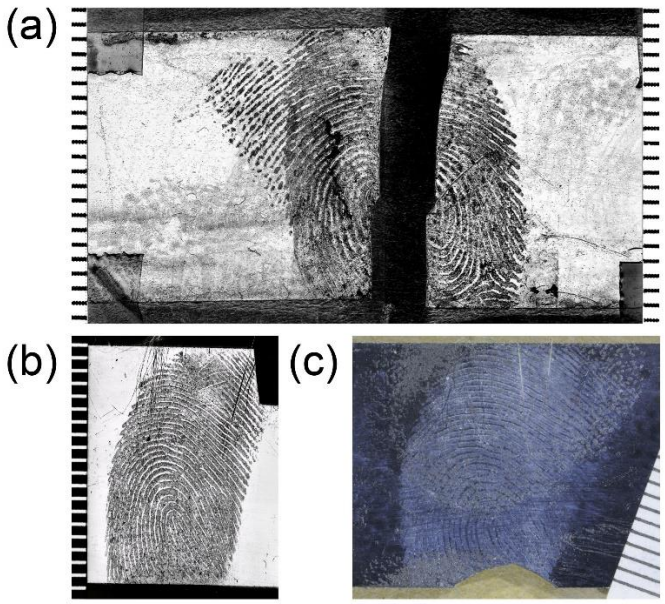

Figure 32 Illustrations where the cutting of the lower tape resulted in degradation of FM3. The reasons for the cutting were the following (a) Lab #23, for fibre recovery – not routine, (b) Lab #27 - for chemical research/analysis, (c) Lab #32 - not clearly specified but most likely for body fluids/DNA.

In all these cases, there appears to be no valid reason for cutting tapes before having carried out the detection of fingermarks. Indeed, the sampling of the fibres/(animal) hair could be done using common tweezers without impact on the fingermark. For this reason, we recommend the interested organisations to review their internal procedure with this specific regard.

10.4 Morphological and DNA analysis of the hair inside the glass container.

By comparing the results of hair morphological and DNA analysis we can see that even if they have correctly characterised the hair as human, not all the participants were able to obtain the expected DNA profile (in a quality suitable for databases). On the 36 participants:

- Twenty-five participants correctly characterised the hair inside the jar as human and obtained the expected DNA profile
- Three laboratories (#15, #16, and #32) obtained the expected DNA profile, but did not describe the hair.

evidence routinely precedes DNA recovery in most cases and fingerprint evidence in nearly all cases. So the damage to the bottom tape was done well before the treatment for fingerprints. It is, however, not a routine treatment to cut a tape to secure fiber evidence, in most comparable cases the tape is usually already lifted from the original surface and the fibers are easily accessible, only in this case it seemed preferable to cut-in the tape rather than to lift it from the surface".

- Five laboratories (#4, #6, #7, #20, and #22) correctly characterised the hair as human, but were not able to obtain a DNA profile.
- Lab#9 reported the hair inside the glass container as «inconclusive» and no DNA analysis was performed from those hairs. Apparently, this hair was only analysed for explosives, which was unexpected.

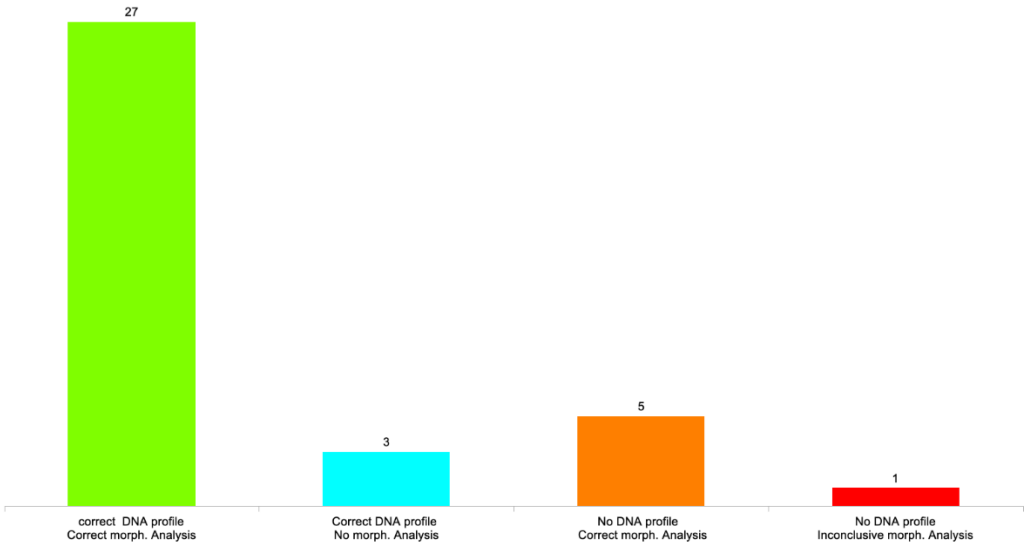

Figure 33 Combined morphological and DNA analysis results of the hair inside the glass container

11 FEEDBACK FROM THE PARTICIPANTS

Appendix 5 summarises all the feedbacks received.

The MP2020-WP9 thanks the participants for their feedback that will guide the conceptualisation and organisation of future exercises.

If you have any comments about this report please do not hesitate to contact the project leader to the email address francesco.zampa@carabinieri.it

12 CONCLUSIONS

The 2023 Multidisciplinary Collaborative Exercise provided the possibility for participants to compare the processes and sequences used by the forensic laboratories across Europe with respect to the same item.

Although different approaches emerged, overall the results obtained by the vast majority of participants are in line with the expectations of the test organisers. However, some specific areas for improvement within individual organisations have been identified. From a multidisciplinary perspective, the following summary is provided in relation to the traces deposited on the item:

- The preliminary optical examination could have allowed the participants to observe most of the traces. When the experts of the disciplines involved did this jointly, a targeting recovery was possible and a minimisation of the influence of a discipline over the other was reached.
- Some critical issues emerged in relation to the explosives/fingerprint sampling strategies.
- Some minor issues came to light in relation to the DNA/fingerprint sampling strategy on the edge of the adhesive tapes.
- Also in this exercise, some laboratories developed and noted additional contact marks, some of which may contain friction ridge detail on the item that were different from those deposited by the organiser. As it has been demonstrated that it is possible to deposit ridge detail through the glove[3], it is important for the forensic laboratories and for the crime scene investigators to start reviewing their operative procedures in order to minimise the impact of these extraneous fingermarks (and potentially DNA). A possible solution could be to limit the time of wearing of the gloves[13].
- Especially for those laboratories where fingermark visualisation and fingermark identification are in charge of different teams, it is important the increase the awareness about the possibility of laterally reversed fingermarks.
- In some instances, a discrepancy in the labelling of the same trace across different disciplines within a laboratory was observed. It is believed that this does not constitute best practice, especially in a multidisciplinary case.

11th December 2023

The Monopoly Project 2020 – WP 9 team

[13] This is probably dependent on the specific brand/model of gloves used. Therefore, each laboratory should undertake the appropriate detailed studies.

Appendix 1 – Instructions for the 2023 Multidisciplinary Collaborative Exercise

Appendix 2 – Project Team and participating Laboratories

Appendix 3 – Results overview

Appendix 4 – Sequences of examination

Appendix 5 – Feedback from the participants

Appendix 1

Instructions for the 2023 Multidisciplinary Collaborative Exercise

CERTAIN-FORS
"Competency, Education, Research, Testing, Accreditation, and Innovation in Forensic Science"
ISFP-2020-AG-IBA-ENFSI

MONOPOLY PROJECT 2020 – WP9

MULTIDISCIPLINARY COLLABORATIVE EXERCISE

INSTRUCTIONS

A MULTIDISCIPLINARY COLLABORATIVE EXERCISE INVOLVING EXPLOSIVES, DNA, FINGERPRINTS, TEXTILE AND HAIRS, ORGANISED BY THE MONOPOLY PROGRAMME 2020-WP9 TEAM PROJECT

2023

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Instruction Sheet for the MP2020-WP9 2022 Collaborative Exercise

Checks

- Ensure that you have received the package and associated electronic files (as detailed below in 'Timescales').
- Read and follow this Instruction Sheet. If you have any questions, please contact Francesco Zampa (francesco.zampa@carabinieri.it).

Examination procedure

Please examine the material as you would in routine casework.
Please fill in appendices A-F in the excel file as appropriate.

Note: Reporting Scale

A series of Answer Sheets (A to F) are provided as an excel file. It is accepted that these may not be your usual method of reporting casework, but it has been agreed by the MP2020-WP9 Project Team to standardise the reporting process. Each method of reporting the results is consistent with the methodology used by the individual working groups in their collaborative exercises.
Please add any comments that you have with regards to each questioned item in the appropriate section, or any other comments you have with regards to this new scale. This will help the MP2020-WP9 Project Team assess the results of the CE.

Case Details

You have been supplied with the following material for examination:

- The item to be analysed (a transparent glass container with black tape around it)
- Reference material (fibres) from a crime scene investigation
- A link to the reference material for fingerprints

Purpose of submission

Examine the material submitted to determine the forensic information that is available to you for the five different disciplines (DNA, Fingerprints, Explosives, Fibres and Hair) and report using the appendices B to F respectively.

Background[1]

Over the past few months, the Prime Minister of Krakozhia has received several threats stating that he will be attacked using explosives because of recent economic measures of the government.
An object has since been found at the entrance to the house of the Prime Minister. Due to circumstances the object has been classified as an alleged Improvised Explosive Device (IED).
The first intervention of the bomb squad made it possible to verify that there was no possibility of an explosion.[2]
The intelligence and the investigative teams want information about the object.

Requests from the investigative team

The police are investigating the case. A car, which was potentially involved in the incident, has been identified by CCTV near the crime scene. This car was seized at a farm. Given that some potential fibres/hair protruding from the tape on the object were immediately noted, the police took some tape lifts from the driver's seat[3].
Therefore, the requests for the forensic lab are the following:

---

[1] The background is intended to provide a plausible but not strictly realistic scenario.
[2] This means that the exhibit is not dangerous.
[3] On the tape lift you will find only material to be used for comparison purposes.

- Are there any traces of explosives associated with the object?
- Are there fingerprints? If so, do they belong to the suspects (#A and #B)?
- Are there biological traces? If yes, can you specify the type? Is it possible to obtain a DNA profile?
- Are there any hairs? If yes, can you specify the type[4]?
- Can you provide more information about the fibres protruding from the tape? Please, determine if the fibres sampled from the item have the same origin as the ones on the tape lift recovered from the seized car.

Timescales

- **April 2023**: Distribution of the package containing the item and reference material (fibres) to participants via express courier.
- **April 2023:** To download the electronic files (instructions, answer sheets and reference material for fingerprints), please send an email to Francesco Zampa (francesco.zampa@carabinieri.it), after receiving the exercise package.
- **April-June 2023:** Completion of the CE by participating organisations.
- **20th June 2023**: Deadline for submission of the CE findings by participating organisations. Files (pictures + excel file containing the appendices A to F and the feedback form as appendix G) must be **uploaded using the file drop interface, accessed via the following link**

  https://drive.switch.ch/index.php/s/X2Haq6AXcqW0lPr
  password: MdCEY2023

  IMPORTANT - File naming and data sending
  Upon completion of the CE, you will be asked to take pictures and fill in an Excel file. You are requested to place ALL your files in a unique directory (following the naming convention described here-below). Once you are ready to send all the requested data (pics and Excel file), please DOUBLE-CHECK that your files are correctly named. Create a .ZIP file named similarly to the directory and send this compressed file through our secured depository server.

  IMPORTANT: please check that the names of your file are correct BEFORE creating the ZIP file and uploading it, since it won't be possible to modify the files afterwards.

  - directory name: [LAB_CODE]
  => ex. MdCEY2023N22

  - Excel tables: [LAB_CODE].XLS
  => ex. MdCEY2023N22.XLS

  - DNA picture(s):
  [LAB_CODE]_DNA-[SAMPLE#].[FORMAT]
  => ex. MdCEY2023N22_DNA-Sample#1.JPG

  - fingermark visualisation picture(s):
  [LAB_CODE]_FP-Step[STEP#]-[TECHNIQUE_NAME]-Mark[MARK#].[FORMAT]
  => ex. MdCEY2023N22_FP-Step1-NIN-Mark1.JPG
  (please limit the name of the technique to 3 characters)

[4] Animal DNA profiles will not be assessed.

- fingermark detection technique and application protocol:
[LAB_CODE]_FP-[TECHNIQUE_NAME]-RCP.PDF
=> ex. MdCEY2023N22_FP-NIN-RCP.PDF
(please limit the name of the technique to 3 characters)

- fingermark comparison:
[LAB_CODE]_FP-[COMP (if identified), A (only analysis)]-[NAME of the MARK].JPG
=> ex. MdCEY2023N22_FP-COMP-Mark#1.jpg

- Explosives picture(s):
[LAB_CODE]_EXP-[SAMPLE#].[FORMAT]
=> ex. MdCEY2023N22_EXP-Sample#1-sampled_area.JPG

- Fibres picture(s):
[LAB_CODE]_FIB-[SAMPLE#].[FORMAT]
=> ex. MdCEY2023N22_FIB-Sample#1-detail.JPG

- Hair picture(s):
[LAB_CODE]_FIB-[SAMPLE#].[FORMAT]
=> ex. MdCEY2023N22_H-Sample#1-detail.JPG

- zip file (to file drop): same as the directory name
=> ex. MdCEY2023N22.zip

- **November 2023:** A final report for the CE will be produced by the Project Team.

Notes:
The Project Team of the Multidisciplinary Collaborative Exercise Project (MdCEP) understands that the reporting processes shown in appendices B to F (of the excel file) may not be the usual method of reporting casework in your organization. If you have any confusion then please do not hesitate to contact Francesco Zampa.

The exercise is not intended to allow laboratories to bench-mark themselves against other laboratories in terms of the strength of conclusion but is primarily concerned in determining the sequence of examinations in a laboratory.

It is understood that the material may not be consistent with CEs in individual forensic disciplines and therefore care must be taken when comparing individual discipline results across laboratories.

Appendix 2

Participating Laboratories and Project Team

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List of the participating Institutes in the 2023 Multidisciplinary Collaborative Exercise

Country	Institute
Austria	Crime Intelligence Service Austria
Bosnia and Herzegovina	CENTER FOR FORENSIC TESTING, EXPERTISE AND RESEARCH
Croatia	Forensic Science Centre "Ivan Vučetić"
Cyprus	Criminalistic Services
Czech Republic	Institute of Criminalistics Police of the Czech Republic
Denmark	National Forensic Services Denmark Special Crime Unit
Estonia	Estonian Forensic Science Institute
Finland	NBI
France	SNPS/LPS59 (Lille-France)
France	IRCGN – Forensic Science Institute for the French Gendarmerie
Germany	Landeskriminalamt Nordrhein-Westfalen KTI
Germany	Bayerisches Landeskriminalamt, Abt II
Germany	Federal Criminal Police Office of Germany (BKA)
Germany	LKA Niedersachsen, KTI, Dezernat 55, Fachgruppe 55.1 – Zentrale Erfassungsstelle (State Office of Criminal Investigation of Lower Saxony, Forensic Science Institute, D 55, FG 55.1 Central Registration Office)
Germany	Landeskriminalamt Schleswig-Holstein Kriminaltechnisches Institut Sachgebiet 435
Germany	Police Berlin, State Criminal Office-Forensic Science Institute
Italia	Servizio Polizia Scientifica
Italy	RaCIS Carabinieri - RIS Cagliari
Latvia	The State Police of Latvia, Main Criminal Police department Forensic Service department
Neherlands	Netherlands Forensic Institute
North Macedonia	Department of Forensic Examinations - Ministry of Interior of the Republic of North Macedonia
Northern Ireland (UK)	Forensic Science Northern Ireland
Poland	Institute of Forensic Research
Portugal	Polícia Judiciária
Romania	General Inspectorate of the Romanian Police - National Forensic Institute
Slovak Republic	Institute of Forensic Science
Slovenia	National forensic laboratory
Spain	General Commissary of Scientific Police (CGPC), Madrid
Spain	Criminalistics Service
Spain	Forensic Science Unit of Basque Country Police
Spain	Cos de Mossos d'Esquadra
Sweden	NFC - Swedish police
Switzerland	Zurich Forensic Science Institute
Turkey	Turkish Gendarmerie Forensic Department Ankara Forensic Science Laboratory
Turkey	Department of Police Forensic Laboratories
Ukrain	THE STATE SCIENTIFIC RESEARCH FORENSIC CENTER OF THE MIA (MINISTRY OF INTERNAL AFFAIRS) OF UKRAINE
United Kingdom	Metropolitan Police Service

Project Team

- *Project Leader*: Francesco Zampa (RaCIS Carabinieri, Italy)
- DNA-WG: Livia Zatkalikova (Institute of Forensic Science-IFS, Slovakia) and Sander Kneppers (NFI, The Netherlands)
- EDE-WG (Documents): Kairi Kriiska-Maivali (FSI, Estonia)
- ENFHEX (Handwriting): Maria João Branco (University of Porto, Portugal) with Jonathan Morris (Scottish Police Forensic Services, Scotland (UK) as external advisor
- FIN-WG (Fingerprints): Helen Bandey (DSTL, UK), Aldo Mattei (RaCIS Carabinieri, Italy), Andy Becue and Alexandre Anthonioz (UNIL, Switzerland)
- ETHG-WG (Textile and Hair): Maria Kambosos (BKA, Germany) and Eric Bouzaid (SNPS, France)
- FINEX (Explosives): Matthew Beardah (DSTL, UK) and Jürgen Bugler (LKA Munich, Germany)

Appendix 3

Results overview

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	Traces inside the glass container				Traces on the adhesive tape (upper)		Traces on the adhesive tape (lower)					Accreditation ISO/IEC 17025					
	Fingermark FM1		explosive	human hair	Saliva	Fingermark FM2	Fingermark FM3		Fibres	Animal hair		DNA	FP-vis	FP-comp	Expl	Fibers	Hair
Ground truth →	*Suspect #A*	*DNA profile A*	*RDX*	*Morphological analysis / DNA profile C*	*DNA profile B*	*Suspect #B*	*Suspect #B*	*DNA profile B*	*match*	Animal	Rabbit						
Code																	
MdCEY2023N01	✓	n.a.	✓	✓/✓	✓ (swab of the external edges of the containers cap and the sticky tape)	✓	✓	n.a.	×	✓	✓	YES	YES	YES	YES	YES	YES
MdCEY2023N02	✓	n.a.	×	✓/✓	✓ (from free edges)	✓	✓	n.a.	×	✓	✓	NO	YES	NO	NO	NO	NO
MdCEY2023N03	✓	contamination	✓	✓/✓	✓	✓	✓	✓	✓	✓	n.a.	YES	YES	YES	NO	NO	NO
MdCEY2023N04	✓	n.a.	✓	✓/n.a.	✓	✓	✓	n.a.	✓	✓	inconcl.	YES	YES	YES	YES	YES	YES
MdCEY2023N05	✓	n.a.	✓	✓/✓	✓	✓	×	n.a.	✓	n.a.	n.a.	YES	NO	YES	NO	YES	NO
MdCEY2023N06	×	n.a.	✓	✓/n.a.	✓ (nonadhesive side)	✓	✓	n.a.	✓	✓	✓	YES	YES	YES	NO	NO	NO
MdCEY2023N07	✓	n.a.	×	✓/✓	✓ (from free edges)	×	✓	n.a.	×	×	×	YES	YES	YES	?	?	NO
MdCEY2023N08	×	n.a.	×	✓/✓	✓	✓	✓	profileB+lab contam	×	✓	✓	YES	YES	YES	NO	YES	NO
MdCEY2023N09	×	n.a.	✓	inconcl./n.a.	n.a.	✓	✓	n.a.	✓	✓	n.a.	YES	YES	NO	NO	NO	NO
MdCEY2023N10	×	n.a.	×	✓/✓	✓	✓	✓	✓ (sticky side of black tape 1.4).	✓	✓	✓	YES	YES	YES	NO	NO	NO
MdCEY2023N11	✓	n.a.	✓	✓/✓	✓ (upper tape)	✓	✓	×	×	✓	inconcl.	YES	YES	NO	YES	YES	NO
MdCEY2023N12	✓	×	✓	✓/✓	✓ (tape upper left)	✓	✓	✓	✓	✓	n.a.	YES	YES	YES	NO	NO	YES
MdCEY2023N13	✓	n.a.	×	✓/✓	✓	✓	✓	×	✓	✓	n.a.	YES	YES	YES	YES	YES	YES
MdCEY2023N14	✓	n.a.	✓	✓/✓	✓ (from free edges)	✓	✓	n.a.	✓	✓	✓	YES	YES	YES	YES	YES	YES
MdCEY2023N15	×	n.a.	✓	n.a./✓	✓	✓	✓	✓	✓	✓	✓	YES	YES	YES	YES	YES	YES
MdCEY2023N16	✓	n.a.	×	n.a./✓	✓ (from free edges)	×	✓	n.a.	✓	✓	✓	YES	YES	YES	NO	NO	NO
MdCEY2023N18	×	n.a.	✓	✓/✓	✓ (from FM2 on the edge)	✓	✓	✓	✓	✓	✓	YES	YES	YES	NO	YES	YES
MdCEY2023N19	×	n.a.	✓	✓/✓	✓	✓	✓	✓	×	✓	✓	YES	YES	YES	YES	YES	YES
MdCEY2023N20	×	n.a.	✓	✓/×	✓	✓	✓	n.a.	×	inconcl.	n.a.	NO	NO	NO	NO	NO	NO
MdCEY2023N21	✓	n.a.	✓	✓/✓	✓ (from free edges)	✓	✓	×	✓	✓	n.a.	YES	YES	YES	YES	YES	NO
MdCEY2023N22	×	n.a.	✓	✓/✓	✓ (jar edges)	✓	✓	n.a.	✓	n.a.	n.a.	YES	YES	YES	YES	YES	YES
MdCEY2023N23	×	n.a.	×	✓/✓	✓ (from non-adhesive side))	✓	✓	n.a.	✓	✓	✓	YES	YES	YES	NO	NO	NO
MdCEY2023N24	✓	n.a.	×	✓/✓	✓ (from non-adhesive side)	✓	✓	n.a.	✓	✓	n.a.	YES	NO	NO	NO	NO	NO
MdCEY2023N25	×	n.a.	✓	✓/✓	✓ (from the observed stain)	✓	✓	n.a.	✓	✓	n.a.	YES	YES	YES	NO	YES	YES*
MdCEY2023N26	×	×	✓	✓/✓	×	×	×	×	×	✓	✓	YES	YES	YES	YES	YES	YES
MdCEY2023N27	×	n.a.	✓	✓/✓	✓ (whole non-adhesive side)	✓	✓	n.a.	✓	×	×	YES	YES	YES	NO	YES	YES
MdCEY2023N28	×	n.a.	✓	✓/✓	✓ (whole non-adhesive side)	✓	✓	✓(adhesive side of the tape 2)	✓	✓	✓	YES	YES	YES	YES	YES	YES
MdCEY2023N29	×	n.a.	×	✓/✓	✓ (a white substance observed on one end of the adhesive tape/FM2)	✓	✓	✓	✓	✓	✓	YES	YES	YES	NO	NO	NO
MdCEY2023N30	×	n.a.	✓	✓/✓	✓ (complete outer surfaces of tapes)	✓	✓	✓	✓	✓	✓	YES	YES	YES	YES	NO	NO
MdCEY2023N31	✓	contamination (DonorB)	×	✓/✓	✓ (bio residue on the tape)	✓	✓	×	×	n.a.	n.a.	YES	YES	YES	NO	NO	NO
MdCEY2023N32	×	n.a.	✓	n.a./✓	✓ (outside edge of upper tape)	×	✓	n.a.	missing	n.a.	n.a.	?	YES	?	?	?	?
MdCEY2023N33	×	n.a.	✓	✓/✓	✓ (FM2+FM3 swab on the jar)	✓	✓	✓ (FM2+FM3 swab on the jar)	✓	✓	✓	YES	YES	NO	YES	NO	NO
MdCEY2023N34	×	n.a.	×	✓/✓	✓	×	✓	n.a.	×	✓	✓	YES	YES	YES	NO	NO	YES
MdCEY2023N35	×	n.a.	✓	✓/✓	✓ (from the observed stain)	×	×	n.a.	✓	✓	✓	YES	YES	YES	NO	NO	NO
MdCEY2023N36	×	n.a.	✓	✓/✓	✓	✓	✓	n.a.	✓	✓	n.a.	YES	YES	YES	YES	YES	YES
MdCEY2023N37	×	n.a.	✓	✓/✓	✓	✓	✓	✓	×	✓	✓	YES	YES	NO	YES	YES	YES

* accredited in nuclear and mitochondrial DNA, not in morphological study.

Legend	✓	result consistent with the ground truth
	×	result not consistent with the ground truth
	n.a.	not applicable (analysis not performed)
	✓	result consistent with the ground truth + additional information (e.g.,extra hair found, etc...)
	×	result not consistent with the ground truth but in line with the used standard
	✓	result consistent with the ground truth with some limitations
	×	result not consistent with the ground truth with additional issue
	inconcl.	inconclusive

Appendix 4

Sequences of the examinations

Code	Step #1	Step #2	Step #3	Step #4	Step #5	Step #6	Step #7	Step #8	Step #9	Step #10	*Notes*
MdCEY2023N01	H-FIBR-DNA	tapes removal	FP	EXPL							
MdCEY2023N02	opt	DNA-out-H	FIBR	tapes removal	DNA-in-h	FP	EXPL				
MdCEY2023N03	opt	H-FIBR-DNA-EXPL-out	FP-out	DNA-in-h	EXPL-in	tapes removal	FP-t	DNA-t			
MdCEY2023N04	DNA-out	FP-opt	H-FIBR	tapes removal	EXPL	FP					
MdCEY2023N05	opt	DNA-out	tapes removal/DNA-FIBR-EXPL-FP	DNA-in-h	EXPL-in	FP					*adhesive tapes cut and destined to the different disciplines*
MdCEY2023N06	H-FIBR	EXPL	DNA-out	tapes removal	FP	DNA					
MdCEY2023N07	DNA	H-FIBR	EXPL	FP							*tapes removal during the fingerprint step*
MdCEY2023N08	opt	FP-out	DNA-out	tapes removal	H-FIBR	FP-out	DNA-t	EXPL	DNA-in-h	EXPL	*EXPL first search headspace*
MdCEY2023N09	FP-out	DNA-out	tapes removal	H-FIBR	FP	DNA	DNA-in-h	EXPL			
MdCEY2023N10	H-FIBR	FP-out	tapes removal	H	FP	DNA-in-h	EXPL	DNA			
MdCEY2023N11	DNA	EXPL	H-FIBR	tapes removal?	FP	DNA-t					
MdCEY2023N12	H-FIBR	DNA-out	DNA-t	EXPL-out	FP-out	tapes removal	DNA-in-h	EXPL-in	FP-in-out	DNA-out	
MdCEY2023N13	opt	DNA-out	tapes removal	FP-t-opt	H-FIBR	DNA	DNA-in-h	FP-in	EXPL		
MdCEY2023N14	DNA-out	DNA-in-h	tapes removal	H-FIBR	FP	EXPL					*tapes removal during the fingerprint step*
MdCEY2023N15	H-FIBR	FP	DNA	EXPL							*tapes removal during the fingerprint step*
MdCEY2023N16	H-FIBR	FP-out	DNA-out	DNA-in-h	tapes removal	FP	EXPL				
MdCEY2023N18	FP-opt	H-FIBR	FP-out	tapes removal	FP	DNA	EXPL				
MdCEY2023N19	opt	FP-opt+out	DNA-out	tapes removal	H-FIBR	DNA-out	FP	DNA-in-h	EXPL	FP-in	
MdCEY2023N20	DNA-out	H-FIBR	FP-out	DNA-out	tapes removal	H-FIBR	EXPL-out	DNA-in-h	EXPL-in	FP	
MdCEY2023N21	DNA/H-FIBR/DNA-in-h	FP-opt	EXPL	tapes removal	FP	DNA					
MdCEY2023N22	H-FIBR	EXPL	tapes removal	DNA	FP						*tapes removal during the fingerprint step*
MdCEY2023N23	H-FIBR	FP	DNA-out	EXPL	DNA-in-h	DNA-in	EXPL-in				*EXPL first search headspace; tapes removal during the fingerprint step*
MdCEY2023N24	opt	DNA-out	tapes removal	DNA-in-h	H-FIBR	FP	EXPL				
MdCEY2023N25	DNA	FP-opt	DNA/DNA-in-h	H-FIBR	EXPL	FP					*tapes removal during the fingerprint step*
MdCEY2023N26	H-FIBR	FP-opt	DNA/DNA-in-h	FP	DNA	EXPL					*tapes removal during the fingerprint step*
MdCEY2023N27	H-FIBR	FP-out	DNA-out	DNA-in-h	tapes removal	FP-opt-in	EXPL	FP-in	DNA-in/out	FP-t	
MdCEY2023N28	FP-opt	H-FIBR	FP-out	DNA-out	DNA-in-h	tapes removal	FP	H-FIBR	DNA-t	EXPL	
MdCEY2023N29	opt	DNA-out	H-FIBR	FP-out	tapes removal	H-FIBR	FP-out	DNA	DNA-in-h	EXPL	
MdCEY2023N30	X-ray	H-FIBR	FP-opt	DNA-out	tapes removal	H-FIBR	FP	DNA-t	EXPL	DNA-in-h	
MdCEY2023N31	FP-opt	DNA	DNA-in-h	H-FIBR	FP	DNA-in-f	EXPL				*tapes removal during the fingerprint step*
MdCEY2023N32	DNA/DNA-in-h	H-FIBR	FP-opt	DNA	EXPL	FP					
MdCEY2023N33	opt	FP-out	DNA-out	tapes removal	H-FIBR/DNA-in-h	FP	DNA-t	EXPL	DNA		
MdCEY2023N34	opt	DNA-out	FP	tapes removal	H-FIBR	FP	DNA-in	EXPL			
MdCEY2023N35	FP	tapes removal	FP	H-FIBR	DNA	EXPL					
MdCEY2023N36	FP-opt	DNA-out	DNA-in-h	EXPL	H-FIBR	tapes removal	DNA-t	FP			
MdCEY2023N37	opt	DNA/DNA-in-h	H-FIBR	DNA-in-h	EXPL	FP	DNA	EXPL			*tapes removal during the fingerprint step*

Legend suffixes			
opt	optical		
sampling DNA out	DNA out		
sampling DNA in (hair)	DNA in-h		
sampling DNA in (fingerprint)	DNA in -f		
Sampling DNA on tapes	DNA-t		
sampling fibres and hairs	H-FIBR		
sampling fibres	FIBR		
sampling explosives	EXPL	EXPL-in	EXPL-out
FP chem vis methods	FP	FP-in	FP-out
FP opt vis methods	FP-opt		

Appendix 5

Feedback from the participants

2023 Multidisciplinary Collaborative Exercise

Feedback from the participants – Summary

The next figures summarise the answers received (36 out of 37).
One laboratory (MdCEY2023N27) did not fill the feedback form.

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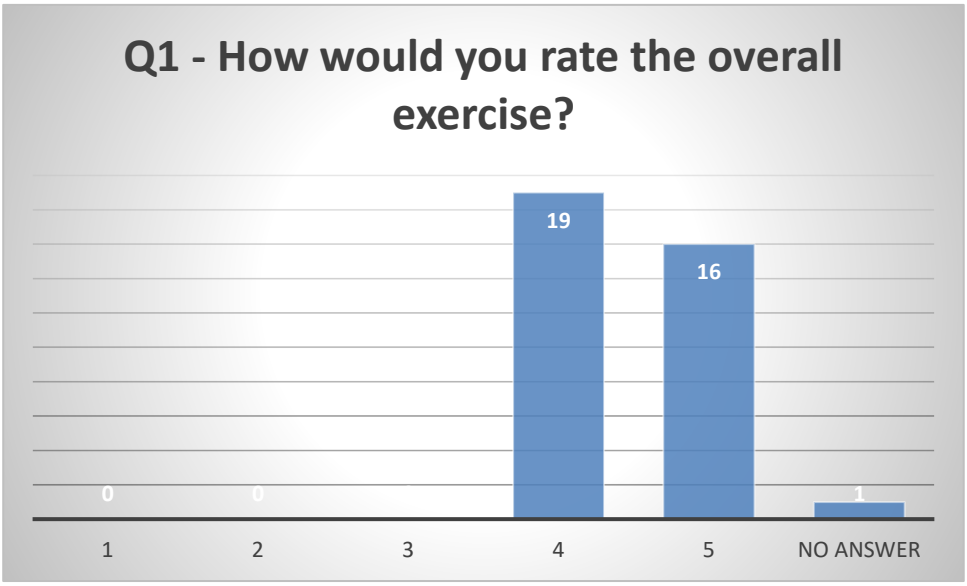
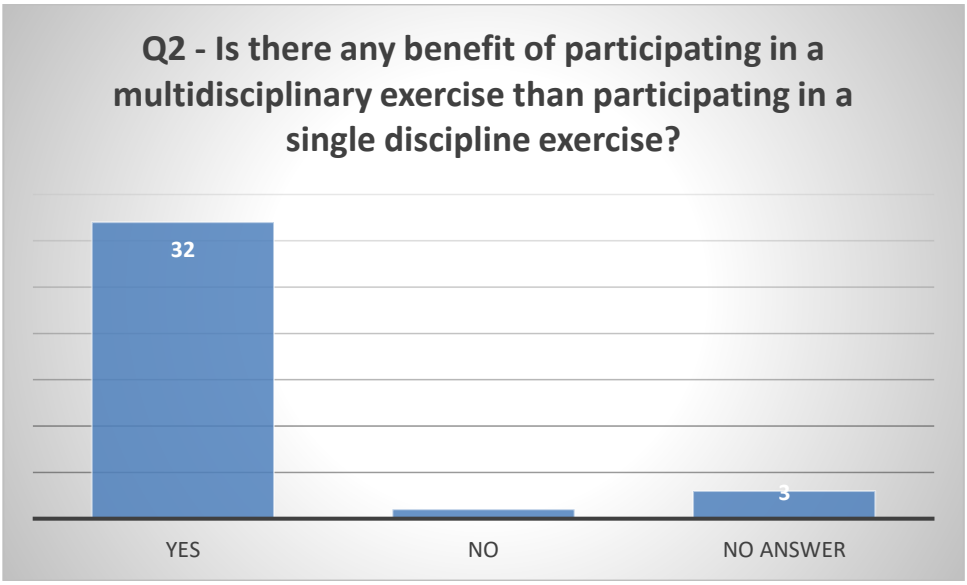


Q1 – Specific comments from the Participants:

- We were satisfied that the tests required good collaboration between experts of different fields.
- We find the combination of techniques chosen particularly satisfactory.
- The exercise was beneficial for all participants.
- We are welcomed the opportunity to verify the cooperation of several forensic disciplines in the analysis of the submitted exhibit.
- The fictional case/background could be more realistic in regard of the exhibit. The "IED" was very small and did not resemble a potentially explosive device at all (no wires, buttons, etc.).
- Processing the response form was a bit difficult this year. Since all disciplines had to enter their results in the same Excel spreadsheet, simultaneous processing was not possible. Response form for each individual discipline would be better.
- The correspondence with the organizers of this exercise worked out very well. Due to limited work time of all participants, the requested photo documentation was not very viable and is usually not conducted in this way for our routine casework.
- This is a very comprehensive exercise, requiring the collaboration of all the disciplines concerned to complete it within a reasonable timeframe. Without meticulous prioritization between disciplines, it cannot be carried out successfully.
- I was satisfied with exercise itself, the information provided and the reporting process. I have a dissatisfaction on the quality of the friction ridge skin images provided for comparison
- This test was an overall very exciting experienced. With one exception, see below, all participating areas of expertise were satisfied with the scope of the exercise and the obtained results.

- This multidisciplinary collaborative exercise results particularly satisfied because of the involvement of several forensic disciplines
- Real case scenarios or multidisciplinary collaborative exercises are always the best approach to simulate complex examinations by multiple experts
- It was a very complex and challenging exercise.
- Satisfactory: the overall exercise and collaboration with other forensic disciplines; the possibility to examine a realistic sample with the difficulty of securing complex evidence.
  DNA stains were well prepared (e.g. skin particle) and suitable for detection and analysis.
  Detailed consultations between the different departments were mandatory for the trouble-free processing. In addition to the close and constant consultations, the definition and adherence to the order in the processing was also particularly important.
- It is really interesting to participate in a multidisciplinary exercise because every laboratory tends to see the casework in its specific way and there is a lack of an holistic view of the casework that helps to match all the pieces of the puzzle
- The sequence given in sheet A_General_2 is difficult to define as in such cases some examination are performed in parallel, when the sub-items have been separated (like hairs and fibres from the tape).
- I was satisfied and pleased how well the different forensic laboratories worked together.

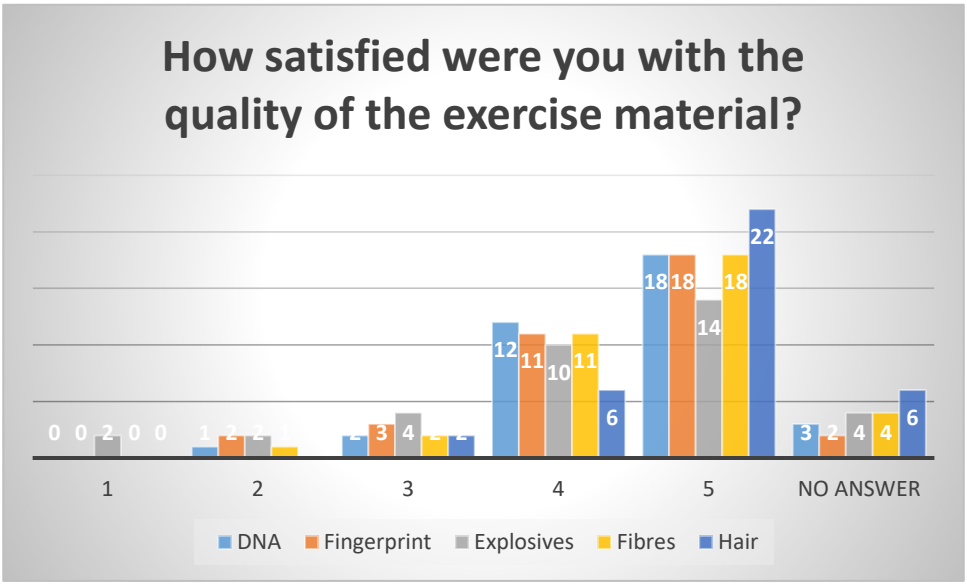


Q2 – Specific comments from the Participants:

- Lessons learned from the exercise, like better order for the specialties work development
- Good for internal arrangements, refreshing understanding of the different disciplines
- Most of our real cases are multidisciplinary
- Multidisciplinary work is daily business for us. But every test give us a chance to improve our work.
- We have only analyzed single discipline PTs or ILCs in the Department of Chemistry and Toxicology up to now.
- Multidisciplinary exercises are far more interesting and beneficial when testing the overall quality and performance of the Forensic examinations.
- It helps to get to know other disciplines and colleagues and it promotes cooperation which could be useful in future casework.
- In my opinion, a multidisciplinary exercise often resembles the real life cases more than a single exercise. In our particular case, usually the crime scene officers handle the specimen and collect different traces in their laboratories, which are sent to the forensics labs afterwards. For this exercise, the forensic scientists have collected the traces by themselves, so it was necessary to discuss a strategy collaboratively before dealing with the specimen. Therefore, we expect new insights in how our strategy worked out.
- This type of exercise is extremely beneficial, as prioritizing examinations is crucial to exploit all traces (fingermarks, biological, explosives, fibers) without risking damaging them (existing incompatibility between cyano revelation/explosives traces).
- I do not have sufficient experience of the two models to answer correctly
- This test was very interesting in regards to the needed case assessment and the collaboration between the involved areas of expertise. We are looking forward for the publication of the test report to analyze the quality of our case assessment and our predefined sequences for routine casework, or if adjustments are necessary.
- It allows knowing the workflow in other disciplines, thus helping to better understand forensic work. It's an interesting and original exercise, but we think there is no need to do it every year.
- The necessity to find compromise on sampling between various demands for different fields of expertise is what enables to maximize the value of the evidence material
- The test involved a brainstorming and a good collaboration between our departments.
- This type of multidisciplinary exercises allows not only to check the performance of the different disciplines separately, but also to evaluate to what extent the final results can be

improved taking into account the needs of the other disciplines involved in the study of an item.

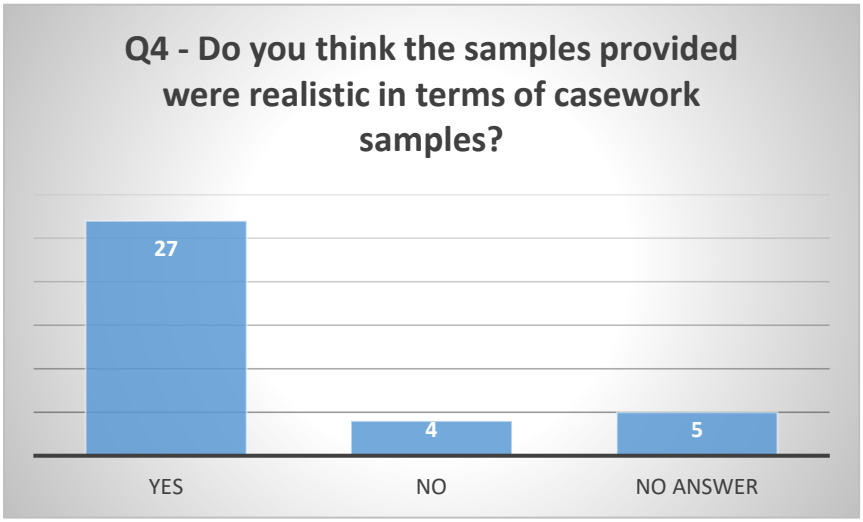
- Great value from interdisciplinary cooperation. The influence of the individual examination methods on the following examinations of different departments were particularly important in this exercise.
- It's a good exercise for knowing about other forensic disciplines and which sequence is the best so we can take the maximum information of an important item in a case.
- Such exercises help to train the correct process on handling traces from different disciplines, shape the understanding of contamination or loss of information/sub-items during the process.
- In the *xx*, explosive analysis is performed by the *xxxxxxxx*, which is a single discipline laboratory. In real casework we will carry out joint examinations with other laboratories where other evidence types are considered important. This exercise is the first we have been able to participate in that involves joint working outside the organisation. It was extremely useful. From an overall perspective it was an opportunity to work together as this rarely happen on this extent with this amount of evidence types.



Q3 – Specific comments from the Participants:

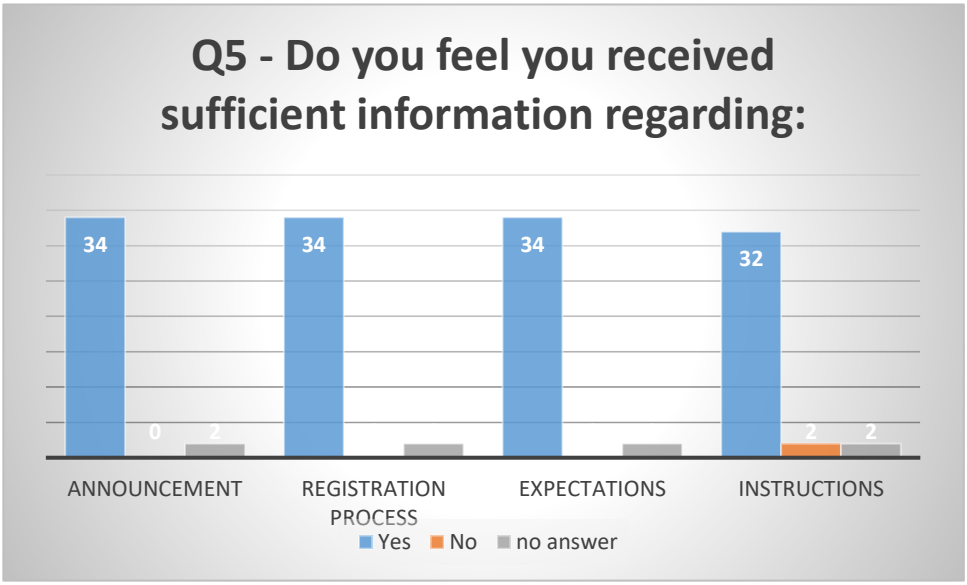
- Over all very realistic story and realistic exercise materials.
- According to the DNA trace, our experience is that the preparation of the DNA was a bit unrealistic (one drop) but this is probably because it is otherwise very difficult to ensure that the DNA has been deposited where you want it to be deposited... so we fully understand it.
- Fibres: The test involves comparing two types of evidence fibres with each other. There is no typical comparative material (fragment of textiles). These types of fibres analysis are not routinely performed. There are cases of conducting such research, but they are sporadic. Due to the vast amount of fibres found on the bomb (about 40) and the tape lift (about 50), the amount of work required to perform the test was enormous. For this reason, we compared selected 3 green fibres from the bomb with 3 green fibres from the tape lift, and then selected 3 light green fibres from the bomb with 3 light green fibres from the tape lift and we drew general conclusions on this basis.
- Explosives: if there was a content of explosives, the amount was to less for analyzing.
- It is sufficient for physical analysis of fiber samples seen on the proficiency test sent. However, it thought that they are insufficient in quantity for chemical analyzes and because the fiber samples taken on the adhesive band come into contact with the adhesive band, they interact with the chemical substance on the band surface and cause differences in chemical analysis comparison results.
- Fingerprint - Good method to create a research object.
- The glass container was very small. There was little space to carefully touch the container during unpacking / examining without destroying fingerprints on the glass.
- Fingerprint feedback: In this year, the item had high demands for the fingerprint visualisation. Maybe the volume of necessary treatments for each discipline could be more balanced for the next Coll. Exercise?
- Fingerprints: a lot of steps to complete the exercise.

- In the case of DNA, a better framework would allow a more precise sample collection and a lower number of analysis and cost of carrying out the exercise. Once again, the lack of reference samples for DNA comparison is highlighted.
- I have answered dissatisfied as the quality of the friction ridge skin images was of a poorer than average standard making 3 of the 4 images insufficent for individulisation / exclusion and the remaining image inconclusive due to poor quality
- Our explosives department used different sampling methods but were not able to detect any traces inside the glass container. They are therefore very disappointed with this part of the exercise. A statement from our explosives department: "Routine explosives analysis is focused on bulk material or post-blast analysis. Applied methods are not sufficient to determine ultra-traces of explosives (at least a visible quantity of material is needed)."
- DNA: the high DNA concentration recovered from the forensic item provides full quality autosomal and Y-chromosome STR profiles.
  Hair: the high quality of the hair allows to easily reveal its different anatomical structures (hair bulb, cortex and medulla).
  Fingerprint: the overall quality of the fingermarks are quite similar to that of real caseworks.
- It was enough material to be processed and identified by all the disciplines.
- Explosives: there was an explicit trace of a dried sample visible. It would be more challenging, if the trace material was less visible (if possible). Hair / Fibres: sufficient test material was available.
- DNA- I suspect that the ceeding process for DNA would have been very variable across participant items. Hence, I predict the outcomes would be variable and, dependent on what the intention was, potentially of limited value.
  Fingerprints - The deposition of detail is difficult to replicate exactly and therefore it is hard to judge whether the expected result has been achieved. Fingerprint practitioners were not involved in initial discussions and this may have affected timescales for completion.
  Hair - The instructions re the hair were unclear as to whether DNA was to be undertaken rather than evaluation of the hair only.



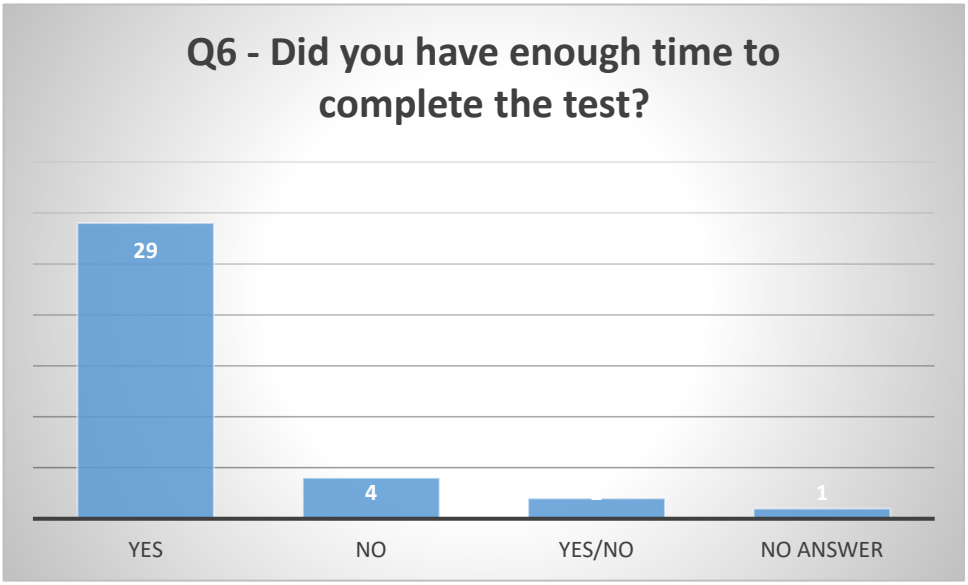
Q4 – Specific comments from the Participants:

- Usually fibers are thinner in real cases.
- Fibers: In the real cases, we usually compare the evidence fibres with the fibres from known material (garment, fragment of textiles, etc.).
- Hair: The placement/embedding of the trace fibres & hairs in the tape would probably be a little different in a real case.
  Explosives: An IED without visible traces of explosives is not very realistic.
  Fingerprints: very realistic
- Rather good example.
- In a realistic setting, I assume the adhesive tapes from a driver's seat show much more contamination with foreign fibres.
- DNA: Traces of lower quantity and qualtity (mixtures) may be more realistic.
- Although we probably never had a case constellation like this before, we do think that the scope of this test provides a near realistic situation. If this had been a real case, the case assessment and subsequent casework would have been probably the same or close to that.
- The quality and quantity of the biological evidence are higher than those analyzed routinely in our laboratory.
- Well, especially from the point of view of a fibre expert, provided samples were better than real case work - no contamination with environmental material, other fibres, etc.)
- Hair / Fibres: the overlapping of the fibres were realistic in terms of rivalling traces. The fibres on the adhesive tape from the car were very homogeneous. In the casework, there are many more different fibres on the adhesive tapes.
- For the explosives test, it was strange the fact that there was no any powder or similar. In a real case the explosives squad would take a sample and send it to the lab. On the other hand, for fingerprint test, the situation is quite real: the place where fingerprints were, for example.
- A reference from the car seat fibres (a piece of textile or tape lift collection) would be more realistic than selected individual fibres.
- I have never worked on an item such as this, however most devices/items that form a submission that involves this amount of collaboration has included tapes attached to a surface with explosives, DNA, finger marks, hairs and fibres considered as part of the forensic strategy.



Q5 – Specific comments from the Participants:

- Fingerprints: The instructions regarding filling the report sheet were very laconic and it took much longer filling the form than performing the test task itself.
- We think all the process was well designed and communicated.
- Communication was extremely professional.
- Most of the pre-work (registration etc.) were performed by quality manager. Expectations were mixed, after the work (as a coordinator) I was rather satisfied for the exercise.
- The information provided was very clear and easy to understand.
- I was not part of the process to be made aware of the announcement or registration process stages.
- For now, we are positive that all communications and instructions to the test were sufficient. However, regarding the disappointing results for our explosives department, this will be evaluated anew with the publication of the final report.
- The communications with the Project Team for MP2020-WP9 was comprehensive and satisfactory.
- Communications have been perfect.
- I did have some question for Francesco Zampa and all these were responded to promptly.



Q6 – Specific comments from the Participants:

- We manage to complete the exercise in time this time with some weeks to spare but the over all feeling is that it is a little short on time. There is not much room for unforeseen events. The second half of June is the holiday season in *xxxxx* and this may affect the final stages of the test.
- DNA was ending on the line.
- Each discipline has to deal with the real cases in parallel of this exercise. Thus, it is uneasy to organise the meetings between the disciplines and send the results in time since it is not considered as a priority.
- Yes, there was plenty of time.
- Well… as there was plenty of regular case work, there was a delay in the beginning of the work. After we started, the process were quite straightforward and examinations were performed quite smoothly.
- Yes and No! Yes, because under normal circumstances the laboratory work doesn´t take too much time for this kind of analysis. No, because it is hard for a small lab to rally experts from 4 different forensic disciplines and their supervisors to discuss the analytical strategy and the results beside their daily case and administrative work
- We did finish the test within the given time frame, but it was a close call! Regarding the needed adaptions to the sequences of securing evidence and subsequent analyses on different kinds of trace material, especially when different disciplines had to do examinations of the same piece of trace material (e.g. fingerprint+DNA or Hairmorphology and DNA) we would highly recommend a substantial extension of the time given for examination.
- For internal reasons of our organization we did not had the right time to complete the test. Some labs had other prioritized caseworks and we had to rush in order to accomplish the timeline
- Due to the fact that multiple disciplines were involved in the process and the "evidence" had to travel from one laboratory to the next and at times, even had to return to the same laboratory again, there was barely any time allocated for each individual discipline.
- This was difficult for all the forensic laboratories to complete whilst continuing with existing casework and other duties

Q7 – Specific comments from the Participants:

- I´m the quality manager
- What do you mean? Yes, Quality manager decided that we are going to participate and we performed the examinations according the quality system. All reports / results were reported by individual experts, quality management did not check the answers.
- This test, like the one carried out last year, was not considered an interlaboratory trial by our quality department.
- As quality manager, I can say that I found the exercise excellent, being able to provide a vision of interlaboratory comparison tests that until now was not common in this type of test.

Any additional comments:

- Well done!
- In excel table where the DNA profiles are insert, the format cells is in „text„
- Multidisciplinary exercises need much time for all involved disciplines - therefore multidiscipline exercises should be more rarely and not regularly.
- Why do you need recipes /application protocols for Fingerprints? Those documents are now included, but are in Finnish as we don't have English translations. Please be noted, as those documents are stamped as "limited access", if you want to translate them, you cannot use google etc., but you need to use Interpol/Europol translators or similar services inside your organisation as these documents are not allowed to share in public.
- The given hairs do not allow an identification on species level but only on the level of order. For further characterisation of hairs from rabbits and hares molecular methods should be applied if not tanned.
- It was very circumstantial to do the reporting.
- Thank you very much for your effort and for organizing this inspiring exercise! Kudos!
- Thank you for setting up this test. Hopefully this will be repeated in the future!
- Thanks to the coordinators to offer this multidisciplinary CE and bearing the workload which comes with it.