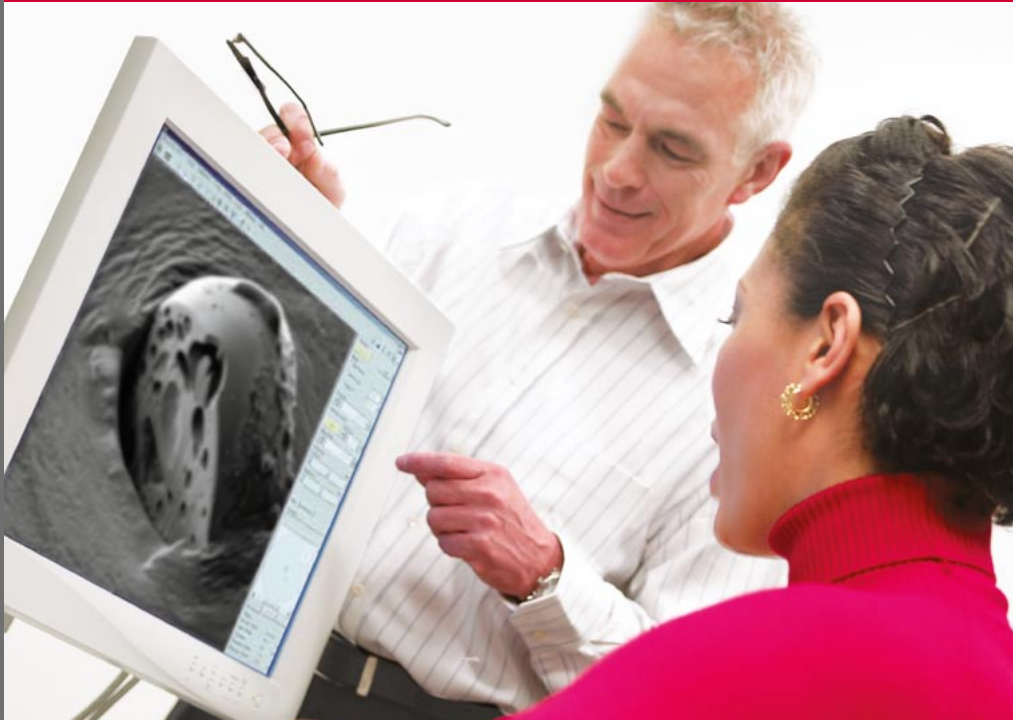




FEI Forensic Systems

Choose your armory for the next decade

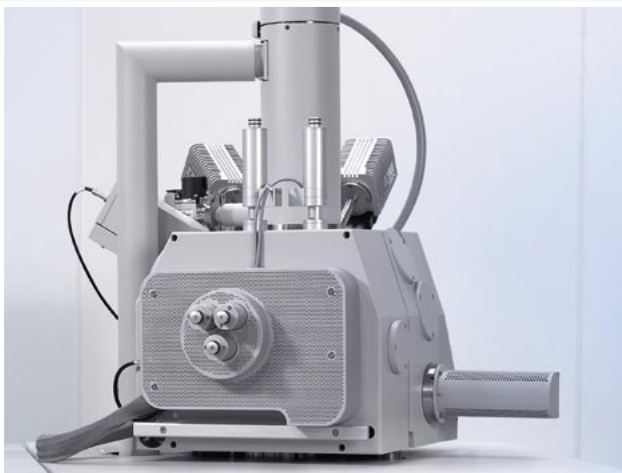


Choose your armory for the next decade



Forensic Quanta™ High vacuum, low vacuum and environmental SEM (ESEM™)

- Imaging of all kinds of forensic samples
- Reduction/elimination of sample preparation
- Microanalysis under all conditions



GSR S50 SEM for automated analysis and classification of GSR

- Automated analysis of Gunshot Residue (GSR) particles
- Fully automatic control of SEM and EDS
- Accurate revisiting possibility



Scanning Electron Microscopes (SEM) are used routinely to analyze Gunshot Residue, determine shooting distance, match firing pin and rifling marks, and much more. The potentially high human impact of forensic analysis demands the highest standards of accuracy, repeatability and validation. In addition to analyzing gunshot residue, typical forensic applications include the determination of shooting distance, the analysis of written and printed documents, tool marks, fabric, hair and the investigation of soil also called Forensic Geosciences.

FEI's Forensic Quanta™ is a dedicated solution for forensic analysis. It includes high vacuum, low vacuum and environmental SEM (ESEM) capability to accommodate the widest possible range of samples and operating conditions to preserve sample authenticity. It offers EDS for X-ray microanalysis, elemental composition and GSR analysis.

The GSR S50 includes the X-ray and GSR capabilities of the Forensic SEM, but does not offer the ESEM mode and has a smaller chamber.

The GSR F50 is the ultimate GSR analysis system based on field emission gun technology for even faster analysis.

The QEMSCAN is the ultimate tool for Forensic Geosciences. With its multiple EDS detectors and dedicated software it allows the fast analysis of all kind of minerals in forensic soil material.

FEI Forensic Systems are used successfully in forensic and other analytical laboratories throughout the world. Now, the new generation of microscopes builds on this success, while offering innovative features to make analyses faster, more efficient and more accurate.

We proudly present our complete spectrum of future forensic tools, which were designed to fight the crime of the next decade.

GSR F50

High throughput automated analysis and classification of GSR

- High throughput of GSR samples
- Improved imaging capabilities
- State of the art EDX system



QEMSCAN®

Forensic Geosciences investigation

- Forensic mineral classification
- Fast time to result
- Easy sample loading



Forensic Quanta™

The flexible Scanning Electron Microscope solution for all forensic investigations including automated GSR analysis.

Both the Forensic Quanta and Forensic Quanta FEG from FEI are the advanced, flexible solutions for current and future forensic applications and automation. Featuring three imaging modes – high vacuum, low vacuum and ESEM – they accommodate the widest range of samples of any SEM system.

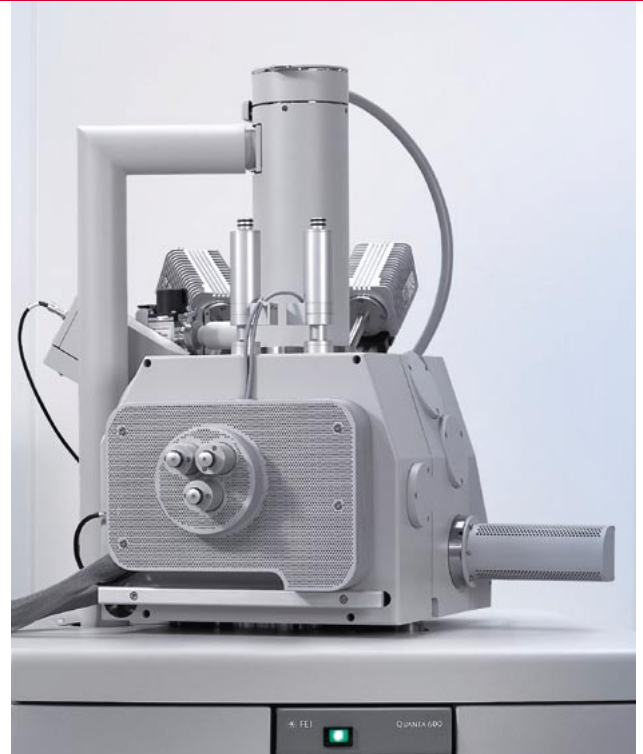
A primary requirement in forensic applications is the avoidance of analytical procedures that materially alter the sample, thus preventing follow-up analysis of the sample in its original condition by the opposing party in a legal procedure.

Environmental Scanning Electron Microscopy (ESEM) eliminates the fixing and coating procedures required for high vacuum SEM, permitting complete imaging and analysis while preserving the pristine condition of the original sample.

The Forensic Quantas are engineered to provide maximum data – imaging and microanalysis – from all specimens, with or without preparation.

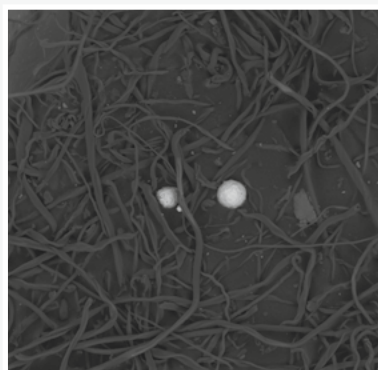
The availability of large specimen chambers of the Forensic Quanta and Quanta FEG allows large and heavy samples to be investigated, and can hold up to a maximum of 20 GSR samples in its dedicated holder.

The FEI Gunshot Residue Analysis (GSR Magnum™) package turns the system into true analytical system for analyzing and classifying GSR particles completely automatically and unattended.



Key points

- Imaging of all kinds of samples – wet, dirty, oily or even strong out-gassing
- Imaging in their natural state – no destruction of evidence
- Reduction / elimination of sample preparation
- Microanalysis of all kinds of samples under high and low vacuum conditions
- Fully automated analysis and classification of Gunshot Residue particles



GSR S50

Low vacuum Scanning Electron Microscope for automated analysis and classification of Gunshot Residue (GSR).

The GSR S50 is a dedicated system with fully integrated software to analyze and classify GSR, designed to run 24/7.

The GSR S50 includes basic X-ray functionality using state of the art EDS Silicon Drift Detectors (SDD). The system offers both high vacuum and low vacuum operation modes and can, in addition to dedicated GSR analysis, also be used as a versatile system for all of the most common forensic applications.

The FEI Gunshot Residue analysis (GSR Magnum) package allows analysis of GSR to be carried out completely automatically and unattended. The software controls the SEM column, its motor stage, the EDS X-ray spectrometer and the backscattered electron detector (BSED), enabling samples to be scanned fast and reliably for particles of compounds characteristic to GSR.

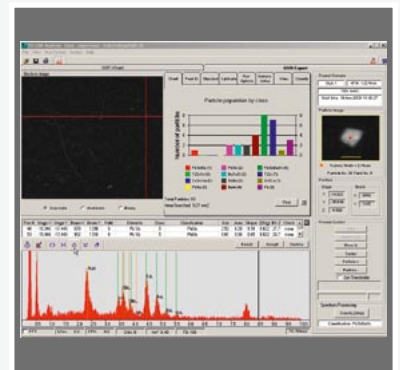
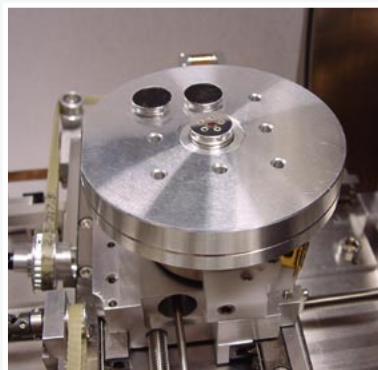
The GSR Magnum software has the built-in overlay possibilities of the latest Synthetic Particle Specimen (SPS-5P-2# series) for SEM/EDX calibration.

The GSR software is fully compliant with ASTM E 1588-2007 and the ENFSI best practice guidelines for GSR analysis by SEM/EDX (2006).



Key points

- Fast and automated searching and characterizing of Gunshot Residue (GSR) particles
- Classification according to user-definable classes
- Automatic optimization of SEM and EDS system
- Automated multi-field and specimen run using pre-defined substage layouts
- Dedicated sample holder with a maximum of 8 samples



High throughput Scanning Electron Microscope for automated analysis and classification of Gunshot Residue (GSR).

The GSR F50 is a dedicated system with fully integrated software to analyze and classify GSR. The high vacuum SEM equipped with Field Emission Gun (FEG) provides an extremely stable electron beam providing high beam current at small beam diameters. In combination with the new generation of EDS Silicon Drift Detectors (SDD) which allow extreme high throughput with excellent peak separation (< 133 eV), it will become the ultimate high-speed GSR analysis system with improved imaging capabilities.

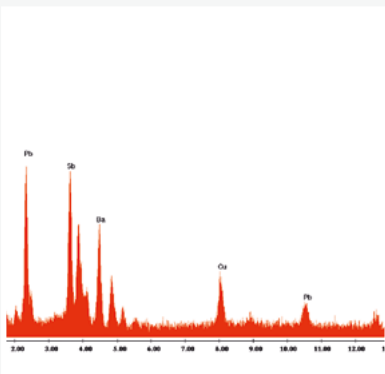
The high-precision motorized stage of the GSR S50/F50 allows the user to revisit each detected particle, easily and accurately. The motorized stage will drive back to the field of interest and the selected particle will be automatically centered and magnified, allowing the user to confirm the presence of specific elements characteristic of firearms discharge residue. The unique 3-step wizard allows for consistent setup of the software in order to get fast and reliable results from each run. A built-in validation procedure also helps to monitor the behavior of the system. An advanced automatic calibration procedure, which allows complete set-up and dynamic readjustment of the microscope column, motorized stage, Backscatter Electron Detector (BSED), and X-ray analysis system, is standard.

All data are stored in spreadsheet format to yield a complete results file. Automatic report generation meets the demands of time-to-result.



Key points

- High-resolution imaging capabilities
- High throughput of Gunshot Residue (GSR) samples
- Advanced automatic calibration procedures
- Sample holder kit with built-in GSR calibration sample
- Built-in validation procedures



	A	B	C
5	Time Sample Started	10-Nov-2008 16:35:30	
7	Time Sample Finished	10-Nov-2008 17:21:40	
8	Search Magnification		70
9	Search Geometry	CIRCULAR - WINDOW STUD	
10	Search Matrix Density	no 6	Yes 7
11	Search Type	SEQUENTIAL	
12	Number of Fields in Search Matrix		42
13	Search Field (mm)	no 10.00	Yes 13.00
14	Search Area (mm ²)		96.12
15	Number of Fields searched		42
16	Percent of Search Area searched		124.00
17	Reason for Stopping Run:	Completed Normally	
18	Laboratory	Forensic Nanopart	
19	Analyst	Mark Kressmann	
20	SUMMARY OF PARTICLES FOUND		
21	Number of Pb3Bi6 Particles		30
22	Number of Pb2Sb Particles		11
23	Number of PbSb Particles		7
24	Number of Bi2Sb Particles		5
25	Number of Sb2S Particles		4
26	Number of BiS Particles		4
27	Number of BiS2 Particles		20
28	Number of SiO2 Particles		2
29	Number of Pb Particles		7
30	Number of Bi Particles		27
31	Number of Sb Particles		1
32	Number of BiS Particles		4
33	Number of Si Particles		1
34	Number of SiO2 Particles		2
35	Number of Fe Particles		54
36	Number of Ag Particles		7
37	Number of Cu Particles		30
38	Number of Si Particles		3
39	Number of Sn Particles		4
40	Number of Lu Particles		4
41	Number of Unclassified Particles		200
42	TOTAL Number of Particles		613



Fully automatic analyzer of forensic soil and sediment using Automated Mineralogy Techniques.

It is now becoming recognised that soils and sediments (even traces) can provide compelling evidence in forensic investigation. QEMSCAN® is a scanning electron microscope-based, automatic mineral analysis system that provides rapid, statistically reliable, repeatable mineralogical data from virtually any sample containing particulates. It is well suited to samples where the mineralogy, chemistry, and texture of the matrix are site specific.

QEMSCAN allows the examination and quantification of soil, sediment, rock, and man-made materials, and linking of victims, offenders and vehicles to crime scenes and body deposition sites. QEMSCAN is using multiple EDS detectors based on the Silicon Drift Technology (SDD) and special sample holders for high throughput. Often the samples are embedded into a resin and afterwards polished; so optimised for imaging and analysis.

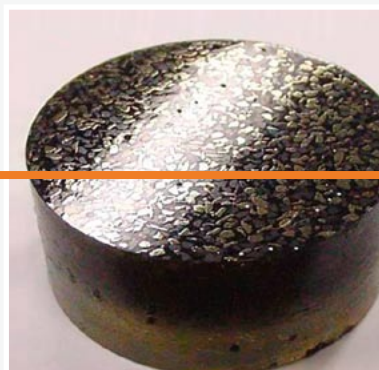
Some of the unique features of QEMSCAN approach are: digital image outputs; ability to measure up to thousands of particles in a practical time frame; presentation of numerical data in a variety of graphical ways; and rigorous comparison of multiple samples using the same particle parameters. These robust statistically sound data sets combined within visual images can be directly used for presentation of the evidence in court.

QEMSCAN can also be used in the automated analysis of other classes of trace evidence



Key points

- Rapid quantitative mineral and phase analysis using automated software
- Recovery of traces evidence of crime scenes
- Recovery of traces evidence of vehicles etc
- Soil and sediment mineralogy



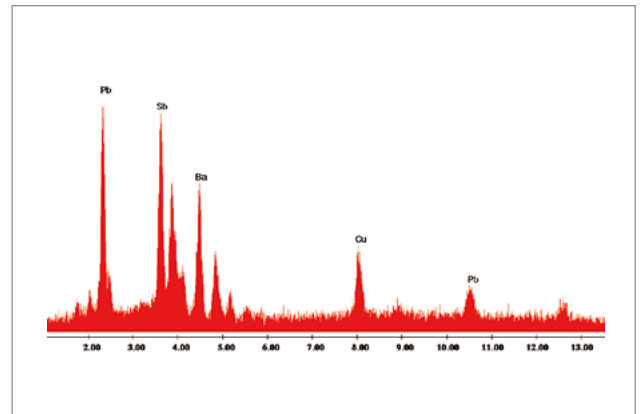
Investigation of Gunshot Residue particles

The analysis of Gunshot Residue can be performed through examination with an SEM linked to an X-ray microanalytical system equipped with a GSR Magnum software package. The GSR analysis software package allows automated, unattended classification of GSR particles (typically containing Pb, Sb and Ba).

Traditionally, GSR software is provided by the EDS supplier and in order to control the electron beam the EDS system is equipped with an own imaging engine. Using an own imaging engine makes it possible to control the SEM externally for image acquisition and X-ray microanalysis. This results in a different aspect ratio between the image of the SEM and the image produced by the EDS system. Correction procedures are needed to compensate for overlapping field or gaps between the fields. With GSR Magnum this all belong to the past. GSR Magnum uses the SEM imaging engine and employs the EDS system only for acquiring a spectrum of the particle.

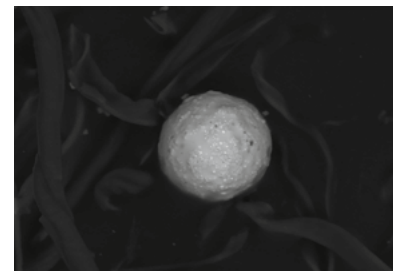
GSR Magnum is based on a unique 3-step wizard to consistently set up the software to receive fast and reliable results from each run. The 3-step wizard allows the user to run a batch of samples using the same parameter settings, or to run every stub with

completely different settings from the previous stub. The software is fully capable of running Pb-free primer samples. The built-in double-check mode allows the user to look for traditional primer residue particles such as Pb, Sb and Ba, and if no particles are found fitting this composition, the software will re-run the sample with a different set of parameters in order to achieve results with a higher accuracy or using a different set of search parameters, i.e. to search for Pb-free primers such as Ti – Zn.



Key points

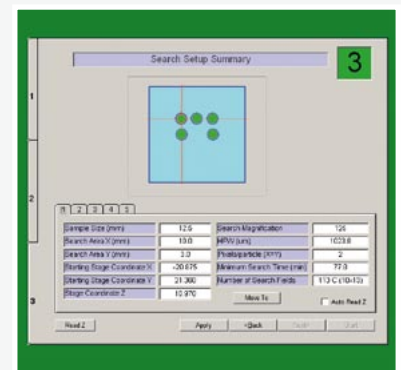
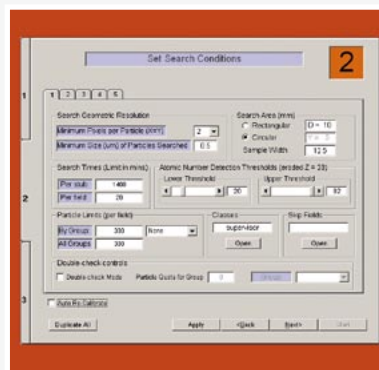
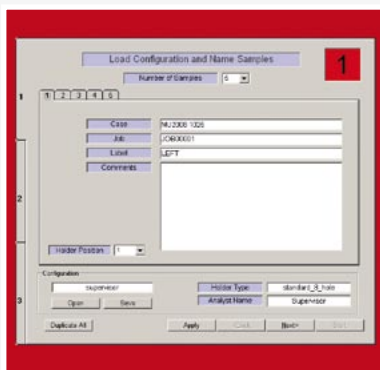
- Single scan generator application
- Fast and reliable GSR analysis using a 3-step wizard
- Automatic classification using user-defined classes
- Integrated double-check mode (fast and secure)
- Fully factory tested and validated using SPS standard



1 Load configuration and name samples

2 Set search conditions

3 Search setup summary



Validation of operation of SEM/EDS for GSR particle search applications

Validation refers to the need to demonstrate in court that the microscope was calibrated and working properly and the methods used conform to generally accepted standards. Special validation software is designed to automatically check several SEM functions, EDS and BSD detector efficiency, column alignment (from analytical point of view), and EDS imaging calibration. A sample mount containing several certified standards such as a tin ball sample and a special stub allows fully automatic SEM/EDS diagnosis. It also includes a certified particle test sample to test for field stitching errors and EDS classification. Special GSR standards are also available, designed for the adjustment, calibration and validation of analytical SEM/EDS systems when used for automatic analysis of GSR particles. All samples are certified and each one serialized, fully characterized and documented.

The software is a combination of a service and user tool in order to check the system for many vital points in order to guarantee correct performance.

Special synthetic GSR standards (SPS-5P-2# Plano GmbH, Germany) are designed for the adjustment, calibration and validation of analytical SEM/EDS systems when used for automatic analysis of GSR particles. The sample is distributed twice a year by the European Network of Forensic Science Institutes (ENFSI) in the form of a round-robin test. Particles are randomly distributed on the sample and the total number of these synthetic GSR particles, as well as their size and location on the standard, are well defined.

Key points

- Fully automatic check of SEM, EDS and GSR system
- Comes with certified standard block
- Possibility to mount your own SPS standard sample
- Beam current measurement included
- Beam stability acoustic test signal built-in

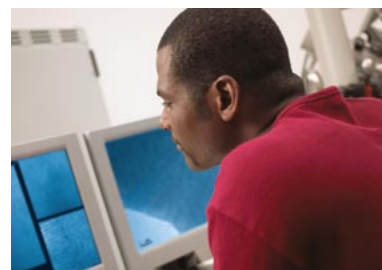


Figure 1: GUI of microValidator™ software

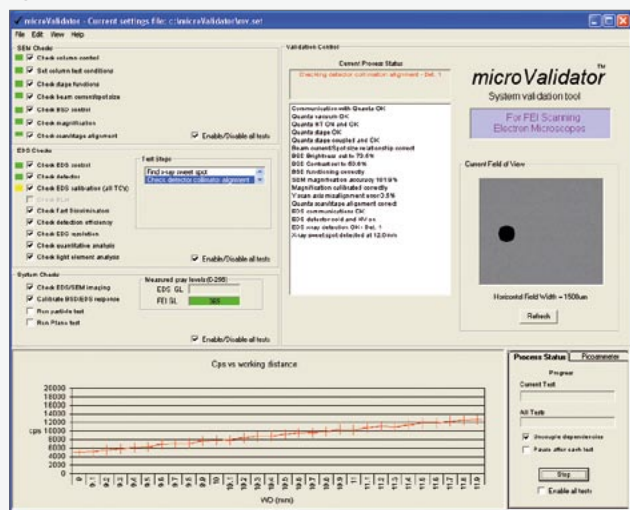
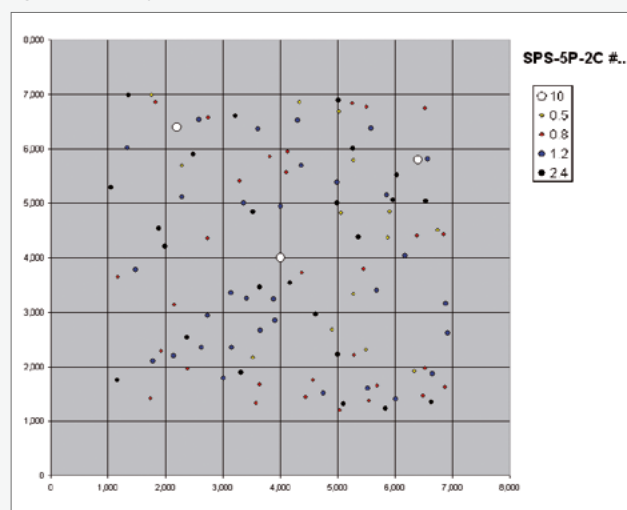


Figure 2: Particle layout of artificial GSR standard



Increase the value of your data and operation

Automation

The standard software supplied is easy to operate and feature-packed. Beside the possibility to operate in 4-Quad imaging mode (Forensic Quanta), the software has auto-focus, auto-stigmator, auto contrast and brightness, and an extensive online help function. The multi-user software allows every operator to store and create his own toolset. The Gunshot Residue software package also offers a multi-user environment.

Regions of interest can be dragged, centered and zoomed with a mouse-click.

Safeguard sample authenticity – safeguard credibility

The credibility of analytical data output is strongly dependent on preserving the original state of samples. Because samples for the FEI Forensic Quanta do not require any coating or other preparation prior to analysis, the tool preserves a specimen's authenticity while providing images with superb depth of focus. Once a sample is investigated in the SEM, it can be studied again, without additional preparation or alteration. Interpret your analytical results with the confidence that they are the most accurate data attainable.

Reproduce data with confidence

In forensic applications, the findings of the analytical lab can have tremendous legal consequences. Thus, absolute reproduction of artifact-free data is a vital quality requirement of today's forensic labs. With conventional SEMs, the ability to reproduce data depends on the exact duplication of sample preparation techniques.

By eliminating the need for sample preparation, the FEI Forensic Quanta delivers improved reproduction and reliability of data.

Reduce time-to-result

Making non-high vacuum compatible samples (such as bulky, oil-contaminated metal fragments) suitable for conventional high vacuum SEM environments is time consuming and can lead to unacceptable delays in the data-collection process. Eliminating the sample preparation phase and instead analyzing under low vacuum conditions reduces your time-to-result. Integrated microanalysis software is a significant contributor to achieving the shortest possible time-to-result.

Improve your return on investment

All FEI Forensic Quantas are capable of analyzing unprepared specimens, reducing time spent on the sample. This will significantly improve the return on your investment.

- Quality and repeatability of data
- Faster time-to-result
- Greater flexibility and higher utilization
- Prepared for any sample that might come your way



Gallery

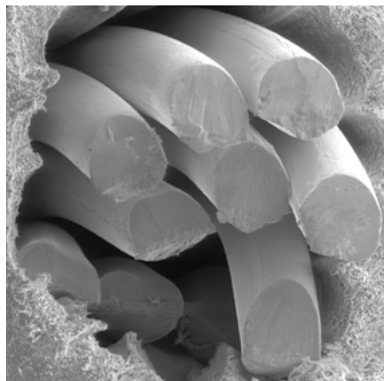


Figure 1. Copper threads inside plastic wire

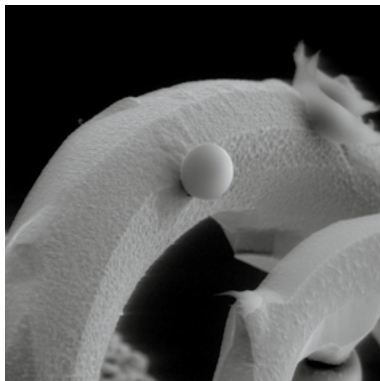


Figure 2. SE image of filament showing small melted glass fragments

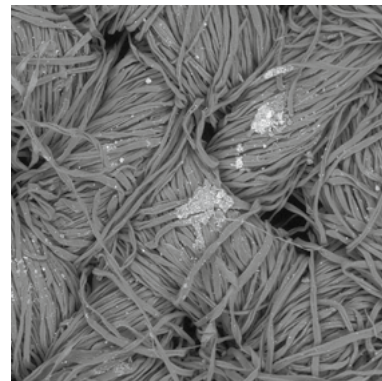


Figure 3. BSE image of fabric showing trace residue

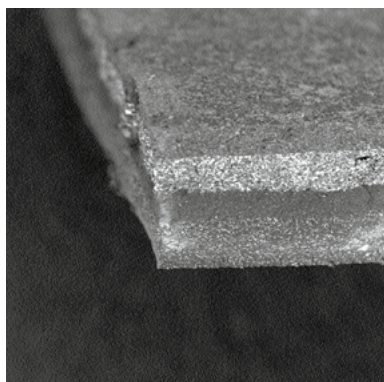


Figure 4. BSE image of car paint chip showing different layers of different composition

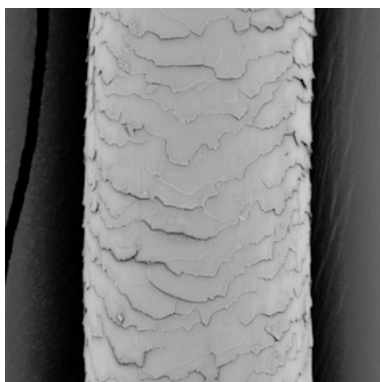


Figure 5. Dog hair



Figure 6. Diatoms



Figure 7. Pollen



Figure 8. Low voltage imaging showing ink on top of printed letter

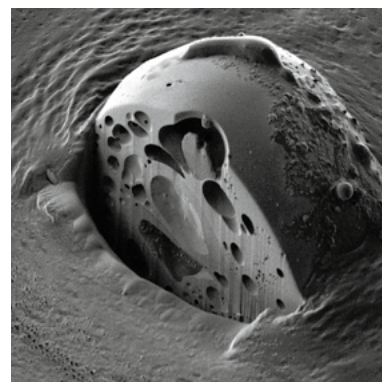


Figure 9. Cross-section of GSR particle

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