Phenom Perception GSR Desktop SEM

Dedicated Gunshot Residue analysis on a Desktop SEM

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GSR particles are carried in the cloud of smoke after a gun discharge and deposited on shooters hand and surroundings

GSR User Interface

Unique: Phenom Perception GSR on a Desktop SEM

Gunshot Residue (GSR) analysis plays an important role in the determination when a firearm has been used in a crime. Established GSR analysis techniques are based on the use of a Scanning Electron Microscope (SEM), which is used to scan the sample and find suspect GSR particles. If a suspect particle is found, Energy Dispersive Spectroscopy (EDS) technique is used to identify the chemical composition of that particle. Most common search criteria are the presence of Pb, Sb, and Ba. However, detection of Pb-free primers, such as Ti and Zn, is a requirement as well.

Thermo Scientific™ Phenom Perception GSR is the world's first dedicated Desktop SEM that can run automated GSR analysis. It is based on the Phenom XL Desktop SEM. Both software and hardware are fully integrated to enhance user-friendliness, reliability and analysis speed.

The Phenom Perception GSR Desktop SEM comes with the following items:

- Phenom XL Desktop SEM
- Automated Gunshot Residue analysis and classification software package, based on Perception software
- Integrated BSED and EDS detector
- Calibration sample

The Phenom Perception GSR desktop SEM is equipped with a CeB_6 source. A CeB_6 source ensure very stable beam current compared to the traditional Tungsten sources, while remaining affordable compared to a FEG source.

With a typical source lifetime of >1,500 hours, it is ideal for usability and uptime. On top of that the CeB_6 has a gradual degradation at the end-of-life, this makes the exchange of the source easy to plan, and no automated runs will be interrupted due to broken filaments.
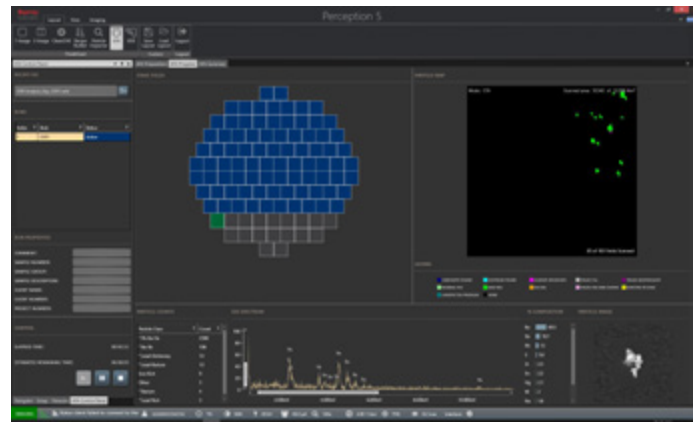
Imaging Specifications	
Imaging modes	
Light optical	Magnification range: 3 - 16x
Electron optical	• Magnification range: 80 - 100.000x • Digital zoom max. 12x
Illumination	
Light optical	Bright field / dark field modes
Electron optical	• Long lifetime thermionic source (CeB_6) • Multiple beam currents
Acceleration voltages	4.8 - 20.5 kV
Vacuum levels	Low - medium - high 0.1, 10, 60 Pa
Resolution	≤ 14 nm
Detector	
Standard	Backscattered electron detector (BSD)
Optional	Secondary electron detector (SED)
Digital image detection	
Light optical	Proprietary high resolution color navigation camera, single shot
Electron optical	High-sensitivity backscattered electron detector (compositional and topographical modes)
Image formats	
JPEG, TIFF	
Image resolution options	
456 x 456, 684 x 684, 1024 x 1024 and 2048 x 2048 pixels	
Data storage	
USB flash drive, Network, Analysis PC	
Sample stage	
Computer-controlled motorized X and Y (optional motorised-Z)	
Additional options	
Eucentric sample holder, Motorised-Z sample holder, Faraday cup beam current measurements, SED, 70mm2 EDS detector, EDS mapping	
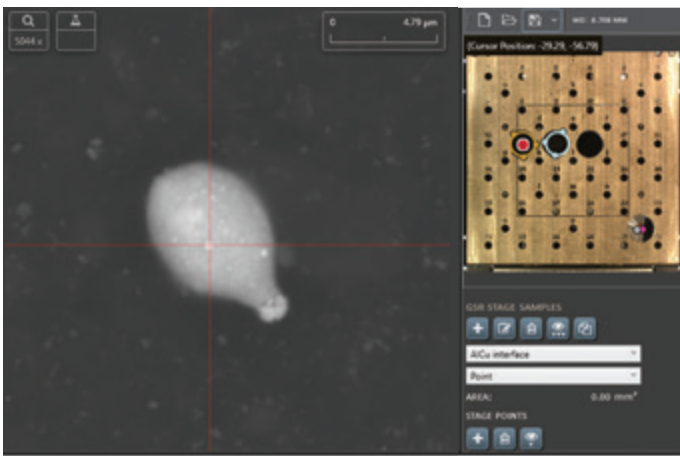
Gunshot residue particle with optical overview and stage layout.

Sample holder with up to 30 x 12 mm pin stubs

High throughput, reliable results

Thanks to the fully motorized stage the Phenom Perception GSR can handle a scan area of 100 mm x 100 mm. The software uses the internal scan control of the SEM. This enables more accurate beam positioning which especially helps when revisiting the particle in the GSR verification phase. A standard GSR sample holder, can hold 30 12mm GSR pin stubs plus the necessary calibration samples.

Perception GSR software works based on recipes that are easy to custom build from standard building block. Once a Standard Operating Procedure (SOP) is determined for your lab it is easy to execute pre-set recipes for different cases. The stage layout in combination with the Navigation Camera of the Phenom Desktop SEM makes it fast to adjust runs for multiple samples. Full automated particle location and EDS analysis will give repeatable results. Revisiting is intuitive with the high accuracy stage and will automatically generate detailed confirmation reports.

This desktop SEM can also be used for many other forensics applications, such as ballistics, paint analysis and fiber characterization. Moreover, the Phenom Perception GSR is easy to set up and transport and can be relocated without difficulty. The system does not require any special facilities, such as compressed air, chillers, liquid nitrogen, EM shielding, cooling water, and has a low CO_2 footprint (energy usage of maximum 300 Watt).

Sample Holder for Phenom Perception GSR

Sample Holder for Phenom Perception GSR	
Standard	Manual-Z sample holder in the form of a removable tray
Optional	4-axis eucentric motorized sample holder Motorised-Z sample holder
Sample size	
• Max. 100 mm x 100 mm (up to 30 x 12 mm pin stubs)	
• Max. 40 mm (h)	
Scan area	
100 mm x 100 mm (motorized)	
Sample loading time	
Light optical	< 5 s
Electron optical	< 60 s

Classification Software Specifications

Automated gunshot residue analysis

- Intuitive User Interface
- Compliant with ASTM E1588-17
- Typically ≤ 98% hit rate on plano artificial GSR sample
- Compliant with ENFSI Best Practice Guidelines 2006
- Extensive reporting capabilities with flexible customisable templates
- Supports manual revisiting and validation of particles

Fully integrated EDS

The dedicated software package Element Identification (EID) is used to control the fully integrated EDS detector. This EID software is standard delivered as part of the Phenom Perception GSR product. Analysis has become as easy as imaging, since there is no need to switch between external software packages or computers. The CeB_6 electron source in the Phenom is used to generate the highest X-ray count rate in its market segment, allowing fast and accurate r esults.

The EID software package allows the user to identify nearly all materials in the periodic table, starting from Boron (5) and ranging up to Americium (95). It is a perfect analysis tool for a wide range of samples and applications. Projects can be stored locally or on the network, where they can be analyzed at a later stage or offl ine.

The EID software package runs smart algorithms with advanced peak analysis to optimize the auto-identification functionality, while still allowing for manual adjustments by the user at any time in the analysis process. The intuitive step by step process within the software helps the user to collect all X-ray results in an organized and structured way.

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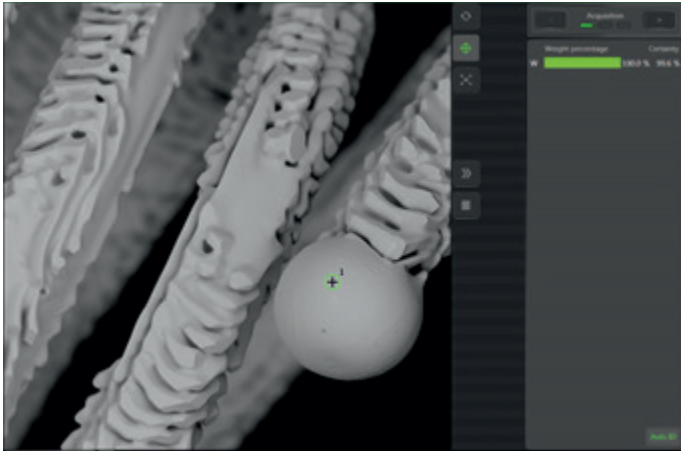
EDS analysis done on a car headlight filament wire
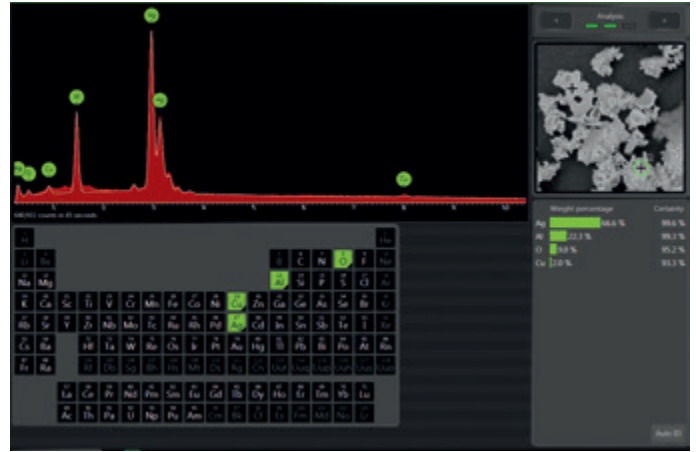
Spot mode analysis

EDS Specifications

Detector types

- Silicon Drift Detector (SDD)
- Thermoelectrically cooled (LN₂ free)

Detector active area	25 mm² (Optional: 70 mm²)
X-ray window	Ultra thin Silicon Nitride (Si_3N_4) window allowing detection of elements B to Am
Energy resolution	Mn Kα ≤ 132 eV
Processing capabilities	Multi-channel analyzer with 2048 channels at 10 eV/ch
Max. input count rate	300.000 cps
Hardware integration	Fully embedded

Software

- Integrated column and stage control
- Auto-peak ID
- Iterative strip peak deconvolution
- Export functions: CSV, JPG, TIFF, ELID, EMSA

Report

Docx format

System Specifications

Dimensions & weight

Imaging module	316(w) x 587(d) x 625(h) mm, 75 kg
Diaphragm vacuum pump	145(w) x 220(d) x 213(h) mm, 4.5 kg
Power supply	156(w) x 300(d) x 74(h) mm, 3 kg
Monitor	375(w) x 203(d) x 395(h) mm, 7.9 kg
Analysis computer	• Standard Workstation including: 24" widescreen monitor • 169(w) x 445(d) x 432(h) mm, 11kg

Requirements

Ambient conditions

Temperature	15°C ~ 30°C (59°F ~ 86°F)
Humidity	< 80% RH
Power	Single phase AC 110 - 240 Volt, 50/60 Hz, 300 W (max.)

Recommended table size

150 x 75 cm, load rating of 150 kg

Find out more at
www.thermofisher.com/phenom-gsr

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