DATASHEET

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 the shooter's hand and surroundings.
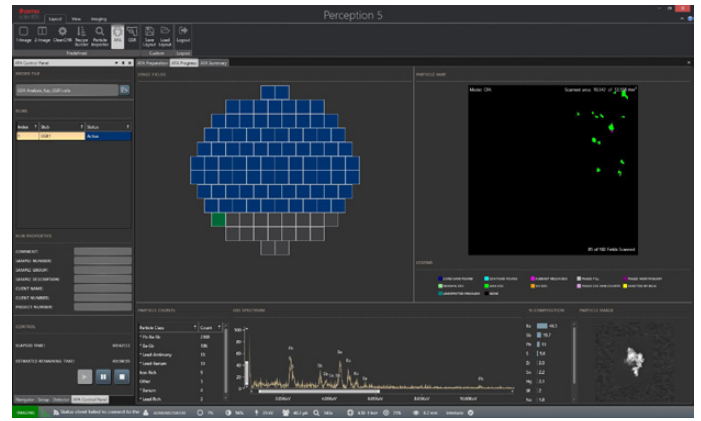
GSR user interface.

Unique: GSR analysis on a Phenom desktop SEM

Gunshot residue (GSR) analysis plays an important role in the determination of 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) 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 Desktop SEM is the world's first dedicated desktop SEM that can run automated GSR analysis. It is based on the Thermo Scientific Phenom XL G2 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 G2 Desktop SEM
- Perception software: automated gunshot residue analysis and classification software package
- Integrated BSD and EDS detector
- Calibration sample

The Phenom Perception GSR Desktop SEM is equipped with a CeB_6 source. A CeB_6 source ensures 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, the Phenom Perception GSR Desktop SEM 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: 80–200.000x
	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 kV and 20.5 kV
Vacuum levels	Low - medium - high 0.1, 10, 60 Pa
Resolution	≤10 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	
256x256, 512x512, 1024x1024, 2048x2048, 960x600, 1920x1200 and 3840x2400 pixels	
Data storage	
USB flash drive, network, analysis PC	
Sample stage	
Computer-controlled motorized X and Y (optional morotized-Z)	
Additional options	
Eucentric sample holder, motorised Z sample holder, SED, EDS mapping	
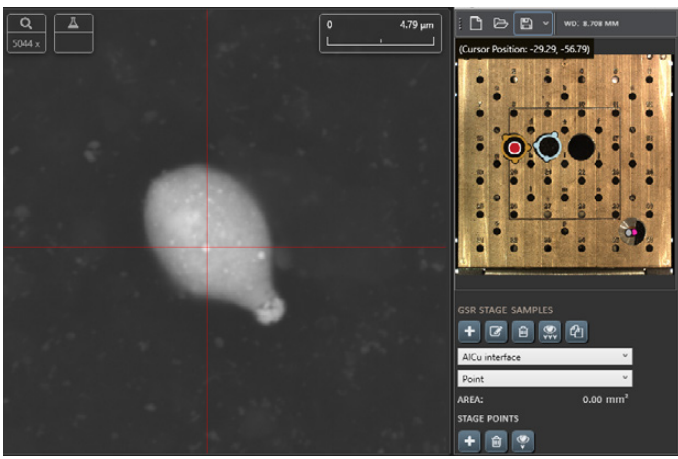
Gunshot residue particle with optical overview and stage layout.

Sample holder with up to 30 12 mm pin stubs.

High throughput, reliable results

Thanks to the fully motorized stage, the Phenom Perception GSR Desktop SEM can handle a scan area of 100x100 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 12 mm GSR pin stubs plus the necessary calibration samples.

Perception GSR Software works based on recipes that are easy to custom build from standard building blocks. 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. Fully 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 Desktop SEM is easy to set up and transport and can be relocated without difficulty. The system does not require any special facilities or components, such as compressed air, chillers, liquid nitrogen, EM shielding or cooling water. Additionally, it has a low CO_2 footprint (energy usage of maximum 300 Watts).

Sample holder for Phenom 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. 100x100 mm (up to 30 12 mm pin stubs)	
Max. 40 mm (h)	
Scan area	
100x100 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 customizable 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 as part of the Phenom Perception GSR Desktop SEM. 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 desktop SEM is used to generate the highest X-ray count rate in its market segment, allowing fast and accurate results.

The EID software package allows you 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 offline.

The EID software package runs smart algorithms with advanced peak analysis to optimize the auto-identification functionality, while still allowing for manual adjustments at any time in the analysis process. The intuitive step-by-step process within the software helps you collect all X-ray results in an organized and structured way.
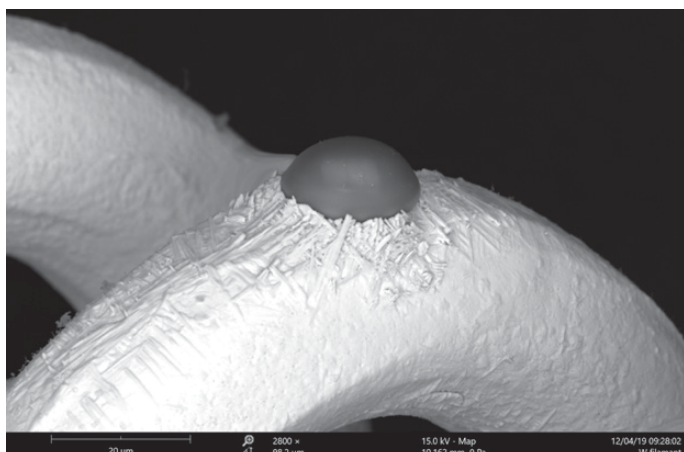
Tungsten filament with glass droplet.
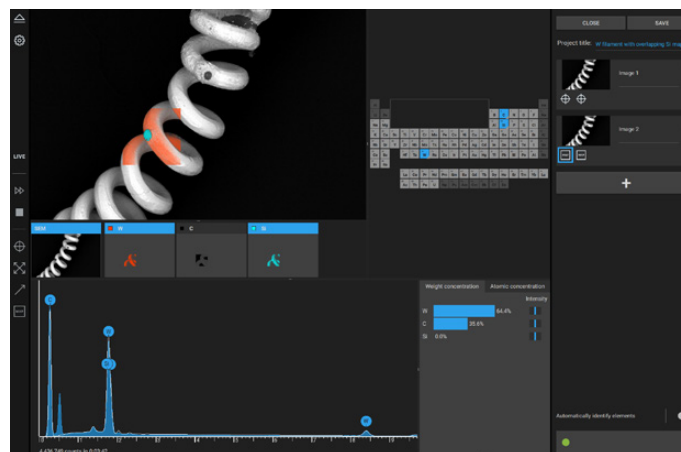
EDS map on a tungsten filament with a molten glass droplet.

EDS specifications

Detector types

Silicon drift detector (SDD)

Thermoelectrically cooled (LN$_2$ free)

Detector active area	25 mm^2
X-ray window	Ultra thin silicon nitride (Si$_3$N$_4$) window allowing detection of elements B to Am
Energy resolution	Mn. Kα ≤132 eV
Processing capabilities	Multi-channel analyzer with 2,048 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

PDF format

System specifications

Dimensions and 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	24" widescreen monitor 528(w) x 250(d) x 513(h) mm, 9.1 kg
Analysis computer	Standard workstation 92(w) x 290(d) x 345(h) mm, 7.5 kg

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

150x75 cm, load rating of 150 kg

Find out more at
thermofisher.com/phenom-gsr

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