

Phenom ParticleX GSR Desktop SEM

Dedicated gunshot residue analysis on a desktop SEM





GSR particles are carried in the cloud of smoke after a gun discharge and deposited on the shooter's hand and surroundings.

The Thermo Scientific™ Phenom™ ParticleX GSR Desktop SEM is the first dedicated desktop SEM that can run automated GSR analysis. The full integration of hardware and software brings a unique user-friendly and reliable solution to any forensic lab.

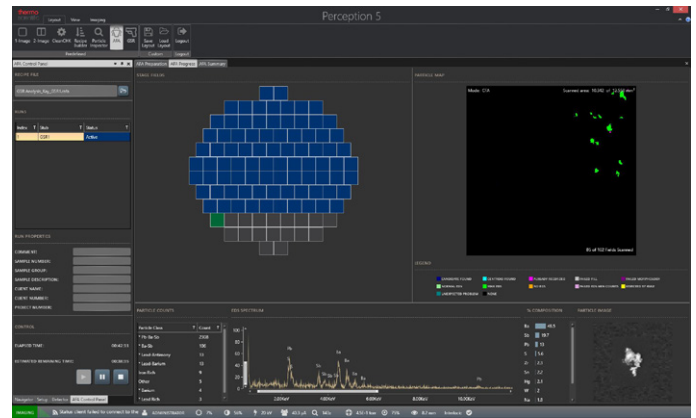
Introduction

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. The Phenom Perception GSR Desktop SEM is equipped with a CeB₆ source. A CeB₆ 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 ParticleX GSR Desktop SEM is ideal for usability and uptime. On top of that, the CeB₆ 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.

High throughput, reliable results

Thanks to the fully motorized stage, the Phenom ParticleX 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.



View during live gunshot residue analysis.

Perception software

Automated gunshot residue analysis

Intuitive user interface limits training time

Run your desktop SEM day and night to enhance efficiency

Extensive reporting options that support manual revisiting and validation of particles

Compliant with ASTM E1588 and ENFSI Best Practice Guidelines

Typically >98% hit rate on artificial Plano GSR sample

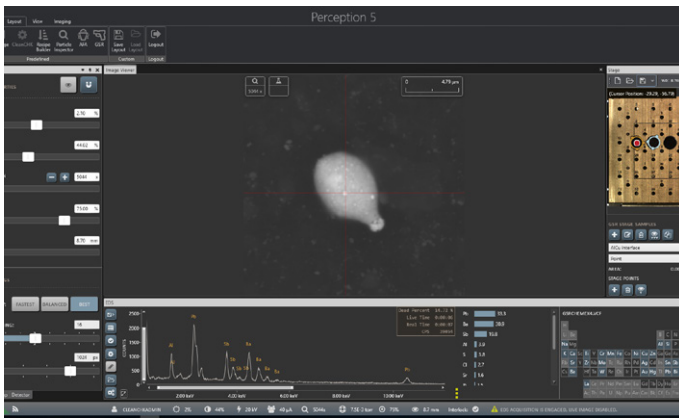
Reclassification and requantification of results

High-speed analysis while maintaining accurate and repeatable results

Versatile output formats: PDF, Word, Excel, CSV

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 ParticleX 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 CO₂ footprint (average energy usage of 163 Watts).



Gunshot residue particle with optical overview and stage layout.

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 ParticleX GSR Desktop SEM. Analysis has become as easy as imaging, since there is no need to switch between external software packages or computers. The CeB6 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.



Sample holder with up to 36 12 mm pin stubs.

Imaging

Detection modes

| | |
|----------|-----------------------------------|
| Light | Magnification range: 3–16x |
| Electron | Magnification range: 160–200,000x |

Illumination

| | |
|-----------------------|--|
| Light | Bright field / dark field modes |
| Electron | <ul style="list-style-type: none"> Long lifetime thermionic source (CeB₆) Multiple beam currents |
| Acceleration voltages | <ul style="list-style-type: none"> Default: 5 kV, 10 kV and 15 kV Advanced mode: adjustable range between 4.8 kV and 20.5 kV imaging and analysis mode |

| | |
|---------------|---------------------|
| Vacuum levels | Low - medium - high |
|---------------|---------------------|

| | |
|------------|--------|
| Resolution | <10 nm |
|------------|--------|

Detector

| | |
|----------|--|
| Standard | Backscattered electron detector, and energy dispersive spectroscopy detector |
| Optional | Secondary electron detector |

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, PNG

Image resolution options

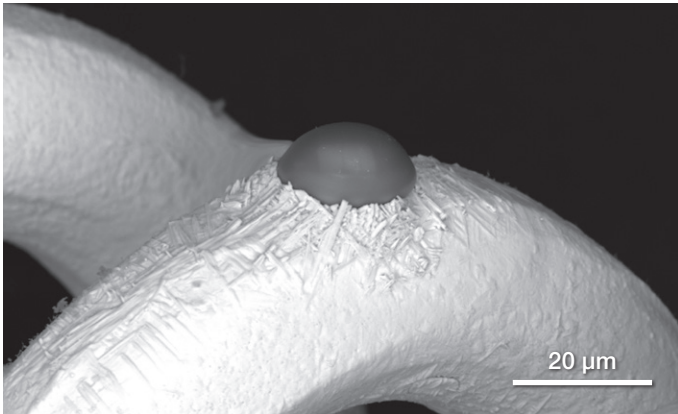
960 x 600, 1920 x 1200, 3840 x 2400 and 7680 x 4800 pixels

Data storage

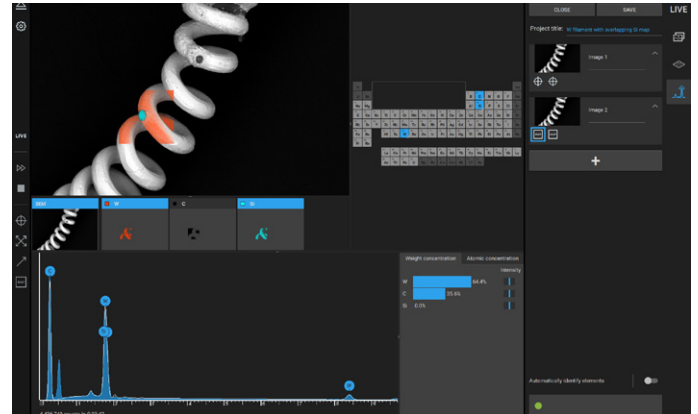
USB flash drive, Network, workstation with SSD

Sample stage

Computer-controlled motorized X and Y



Tungsten filament with glass droplet.



EDS map on a tungsten filament with a molten glass droplet.

EDS

| | |
|-------------------------|---|
| Detector type | <ul style="list-style-type: none"> Silicon Drift Detector (SDD) Thermoelectrically cooled (LN₂ free) |
| Detector active area | 25 mm ² or 70 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 2048 channels at 10 eV/ch |
| Max. input count rate | 300,000 cps |
| Hardware integration | Fully embedded |

Software

- Integrated in Phenom user interface
- Integrated column and stage control
- Auto-peak ID
- Iterative strip peak deconvolution
- Confidence of analysis indicator
- Export functions: CSV, JPG, TIFF, ELID, EMSA

Report

DOCX format

Elemental Mapping & Line Scan

Elemental mapping

| | |
|-------------------|---|
| Element selection | Individual user-specified maps, plus backscatter image and miximage |
|-------------------|---|

Backscatter image and mix-range

| | |
|--------------------------|-----------------------------|
| Selected area | Any size, rectangular |
| Mapping resolution range | 32 x 20 to 960 x 600 pixels |
| Pixel dwell time range | 1–500 ms |

Line scan

| | |
|----------------------------|---------------|
| Line scan resolution range | 16–512 pixels |
| Line scan dwell time range | 10–500 ms |

Report

DOCX format

SED

| | |
|---------------|-------------------|
| Detector type | Everhart Thornley |
|---------------|-------------------|

System

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 | 260(w) x 260(d) x 85(h) mm, 2.3 kg |
| Monitor (24") | 531(w) x 180(d) x 511(h) mm, 5.6 kg |
| Workstation | <ul style="list-style-type: none"> Powerful workstation including SSD storage 93(w) x 293(d) x 290(h) mm, 5.6 kg |

Sample size

- Max. 100 mm x 100 mm (up to 36 x 12 mm pin stubs)
- Max. 40 mm height (optional up to 65 mm)

Scan area

100 mm x 100 mm

Sample loading time

| | |
|------------------|-------|
| Light optical | <5 s |
| Electron optical | <60 s |

Site requirements

Ambient conditions

| | |
|-------------|--|
| Temperature | 15°C ~ 30°C (59°F ~ 86°F) |
| Humidity | Between 20% and 80% RH |
| Power | Single phase AC 100–240 Volt, 50/60 Hz, 163 W average, 348 W max |

Recommended table size

150 x 75 cm, load rating of 150 kg

Sample holders and inserts

- Manual-Z sample holder
- Motorized-Z sample holder (optional)
- 49-stub insert (optional)

Learn more at thermofisher.com/phenom-particle-x-gsr

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