

# Phenom GSR

Automated gunshot residue analysis on a desktop SEM



## Reliable results

Excellent results on plano reference samples

## Best cost of ownership

Lowest operational costs combined with high throughput

## ASTM E1588-16 compliant

GSR software fully conforms to the ASTM standards

## Ultimate ease of use

"Never-lost" camera for swift navigation

## High throughput and speed

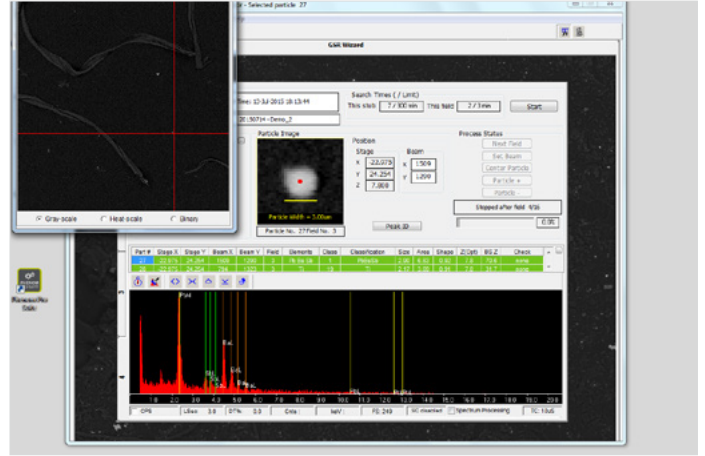
Up to 30 samples

## Great versatility

Capability to handle wide range of forensic applications



A weapon being fired



GSR user interface

### Unique: GSR on a desktop SEM

Gunshot Residue (GSR) analysis plays an important role in the determination if 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, an Energy Dispersive Spectroscopy (EDS) technique is used to identify the elements in 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.

Phenom GSR is the world's first 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 GSR desktop SEM comes with the following items:

- Automated Gunshot Residue analysis and classification software package
- Integrated BSED and EDS detector
- Calibration sample

The Phenom GSR desktop SEM is equipped with a  $CeB_6$  source that enables stable operation and has a typical operational life time of >1,500 hours, which is ideal from a usability, serviceability and uptime perspective. With a loading time of less than 1 minute and its fast stages, the Phenom GSR is the ideal tool for highly automated applications, such as automated gunshot residue analysis.

## Imaging Specifications

### Imaging modes

- Light optical Magnification range: 3 - 16x
- Electron optical Magnification range: 80 - 100,000x
- Digital zoom max. 12x

### Illumination

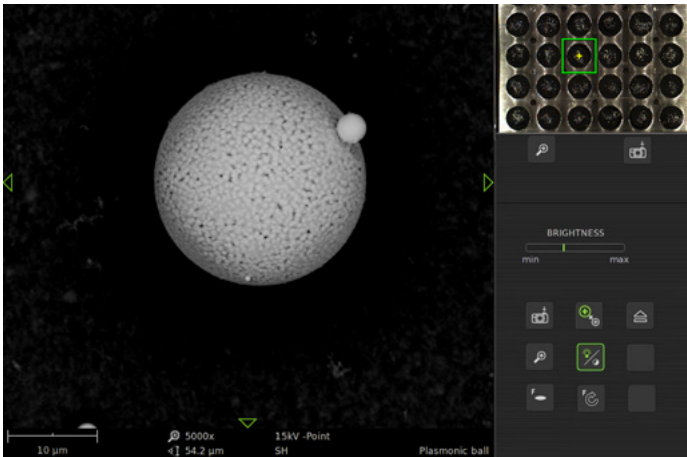
- Light optical Bright field / dark field modes
- Electron optical Long lifetime thermionic source ( $CeB_6$ )
- Acceleration voltages Multiple beam currents
- Vacuum levels Default settings: 5 kV, 10 kV and 15 kV
- Resolution Advanced mode: adjustable acceleration voltage range between 4,8 kV and 20,5 kV
- Detector Low - medium - high
- Optional Medium or high is recommended for GSR analysis
- Resolution ≤ 20 nm

### Detector

- Standard Backscattered electron detector (BSED)
- 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, BMP
- Image resolution options 456 x 456, 684 x 684, 1024 x 1024 and 2048 x 2048 pixels
- Data storage USB flash drive
- Network
- ProSuite PC
- Sample stage Computer-controlled motorized X and Y



Stainless steel nanoparticle



Sample holder with up to 30 x 12 mm pin stubs

This desktop SEM can also be used for many other forensics applications, such as ballistics, paint analysis and fiber characterization. Moreover, the Phenom 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<sub>2</sub> footprint (energy usage of maximum 300 Watt).

#### High throughput, reliable results

Thanks to the fully motorized stage the Phenom 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, which is in the form of a removable tray, can hold 30

standard pin stubs. This holder also contains a motorized height functionality, which allows the GSR software to maintain an optimal working distance while doing the analysis.

GSR software is based on a four-step wizard to consistently set up the software in order to receive fast and reliable results from each run. The wizard is highly intuitive and allows the user to analyze multiple samples automatically. Both EDS results and SEM images are stored for all detected particles, and the software allows the user to quickly and easily revisit each particle to validate results. The software also offers extensive reporting capabilities. The GSR software complies with the current ASTM E1588 standard guide for GSR and is equipped with the standard layouts as provided by ENFSI.

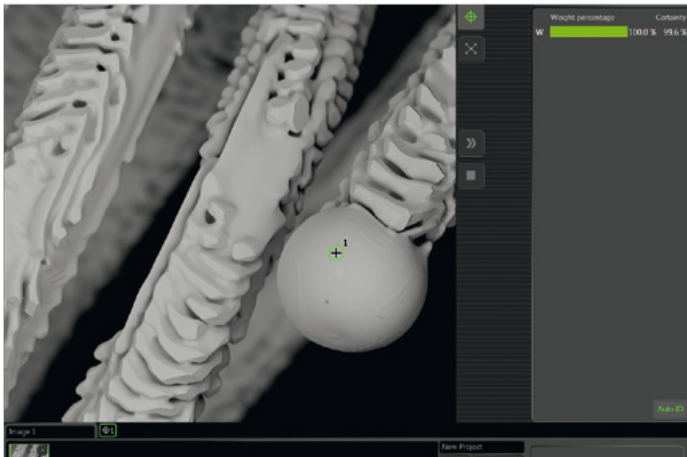
## Sample Holder for GSR

### Sample holder for GSR

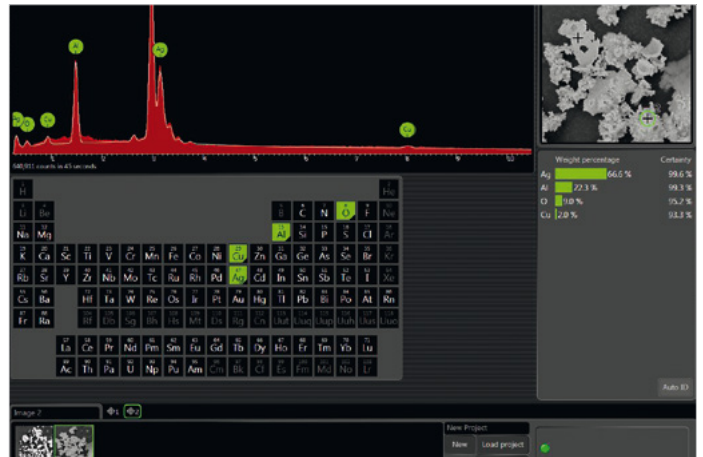
- Standard Motorized height sample holder (Z) in form of removable tray
- Optional 4-axis eucentric motorized sample holder
- Sample size**
  - Max. 100 mm x 100 mm (up to 30 x 12 mm pin stubs)
  - Max. 40 mm (h) with motorized sample holder
- Scan area** 100 mm x 100 mm (motorized)
- Sample loading time**
  - Light optical < 5 s
  - Electron optical < 60 s

## Automated Gunshot Residue Analysis and Classification Software Specifications

- Four-step wizard
- Compliant with ASTM E1588-16
- Typically ≥ 98% hit rate on plano artificial GSR sample
- Compliant with ENFSI Best Practice Guidelines 2006
- Extensive reporting capabilities
- Supports manual revisiting and validation of particles



Tungsten wire



EDS analysis on particles

### Fully integrated EDS

Energy Dispersive Spectroscopy (EDS) allows users to analyze the chemical composition of their samples. Detailed chemical composition can be obtained from a micro volume via a spot analysis. Elemental distribution can be visualized with the elemental mapping option.

### Step by step data collection

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 GSR product. Analysis has become as easy as imaging, since there is no need to switch between external software packages or computers. The CeB<sub>6</sub> electron source in the Phenom is used to generate the highest X-ray count rate in its market segment, allowing fast results. 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 offline. 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.

## EDS Specifications

<b>Detector type</b>	• Silicon Drift Detector (SDD) • Thermoelectrically cooled (LN <sub>2</sub> free)
• Detector active area	25 mm <sup>2</sup>
• X-ray window	Ultra thin Silicon Nitride (Si <sub>3</sub> N <sub>4</sub> ) window allowing detection of elements B to Am
• Energy resolution	Mn Kα ≤ 133 eV
• Processing capabilities	Multi-channel analyzer with 2048 channels at 10 eV/ch
• Max. input count rate	300,000 cps
• Hardware integration	Fully embedded
<b>Software</b>	• Integrated in Phenom ProSuite • Integrated column and stage control • Auto-peak ID • Iterative strip peak deconvolution • Confidence of analysis indicator • Export functions: CSV, JPG, TIFF, ELID, EMSA
<b>Report</b>	Docx format

## System Specifications

<b>Dimensions &amp; weight</b>	
• 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
• ProSuite	Standard ProSuite System including: 19" monitor with PC and network router mounted 375(w) x 250(d) x 395(h) mm, 9 kg

## Requirements

<b>Ambient conditions</b>	
• 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.)
<b>Recommended table size</b>	150 x 75 cm, load rating of 150 kg