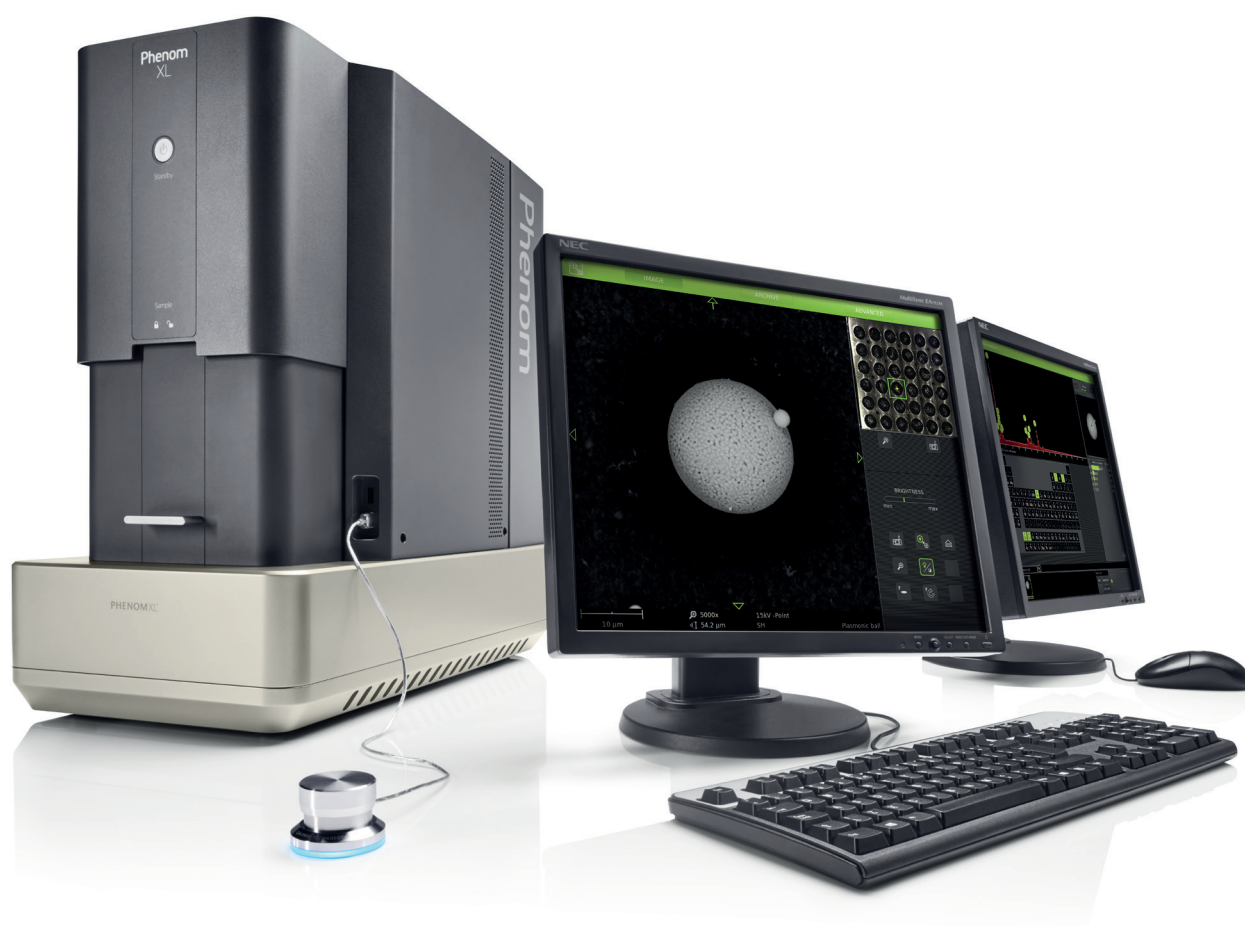


# Phenom GSR

Automated Gunshot Residue Analysis on a Desktop SEM



## **Intuitive and easy-to-use GSR software**

ASTM E1588 10e1 compliant

## **High throughput and speed**

Up to 36 sample pin stubs

## **Never lost navigation**

Permanent optical overview for swift navigation to any region on the sample

## **Phenom XL**

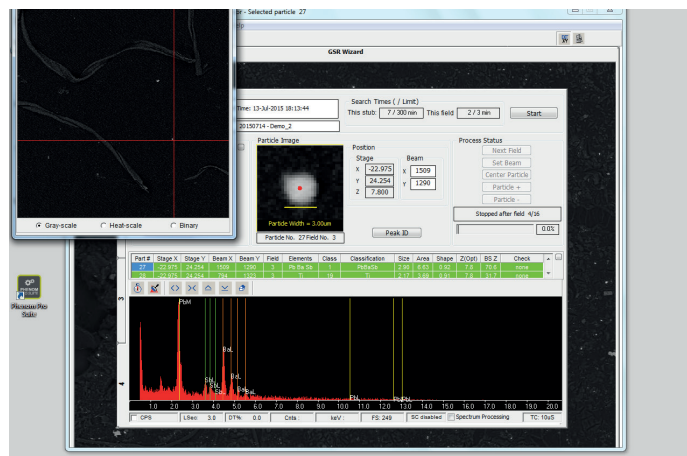
World's only desktop SEM for automated GSR analysis

## **Fully integrated EDS**

Elemental analysis is as easy as imaging, with fully integrated EDS

## **Ultimate versatility**

Wide range of forensic applications



### Gunshot Residue (GSR) Analysis

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) can be a requirement as well.

### Phenom GSR

Phenom GSR consists of the following three items:

- > automated Gunshot Residue analysis and classification package
- > Phenom XL desktop SEM
- > an integrated EDS detector.

Both software and hardware are fully integrated to enhance user-friendliness, reliability and analysis speed.

### Phenom GSR software

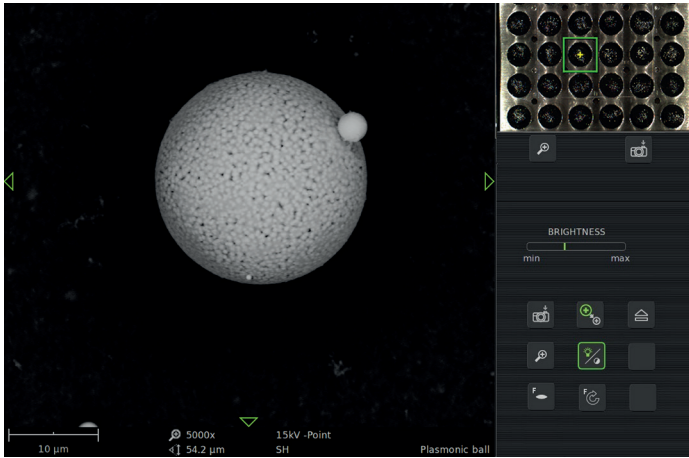
Phenom GSR software is based on a four-step wizard to consistently set up the software in order to receive fast and reliable results from each run.

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. Phenom GSR software also offers extensive reporting capabilities. The Phenom GSR software complies with the current ASTM E1588 10e1 standard guide for GSR and is equipped with the standard layouts as provided by ENFSI.

## Key Specifications Phenom GSR software

### Automated analysis and classification software

- > Four-step wizard
- > Compliant with ASTM E1588 10e1
- > 90% hit rate on plano artificial GSR sample
- > Compliant with ENFSI Best Practice Guidelines 2006
- > Extensive reporting capabilities
- > Supports manual revisiting and validation of particles



### Phenom XL

The Phenom GSR software is integrated into the Phenom XL SEM. The Phenom XL is a unique easy-to-use desktop SEM with a fully motorized stage that can handle a scan area of 100 mm x 100 mm.

Phenom GSR uses the internal scan control of the SEM. In combination with the motorized stage this enables more accurate beam positioning and thus better results. A standard GSR sample holder, which is in the form of a removable tray, can hold 36 standard pin stubs. This holder also contains a motorized height functionality, which allows the Phenom GSR software to maintain an optimal working distance while doing the analysis.



The Phenom XL is equipped with a  $\text{CeB}_6$  source that enables extremely stable operation and has a typical operational life time of >1500 hours, which is ideal from a usability, serviceability and uptime perspective. With a loading time of less than 1 minute, the Phenom XL is the ideal tool for highly automated applications such as Phenom GSR.

The Phenom XL does not require any special facilities, such as compressed air, chillers, liquid nitrogen, EM shielding, cooling water, and has a low  $\text{CO}_2$  footprint (energy usage of maximum 300 Watt). Moreover, the Phenom XL is easy to set up and transport and can be relocated without difficulty. The Phenom XL can also be used for many other forensics applications, such as ballistics, paint analysis, fiber characterization, etc.

## Key Specifications Phenom XL

### Imaging modes

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

### Illumination detector

- > Light optical      Bright field / dark field modes
- > Electron optical    Long-lifetime thermionic source ( $\text{CeB}_6$ )
- Multiple beam currents
- > Acceleration voltages    4,8 kV – 20,5 kV (continuous)
- > Resolution            ≤ 20 nm at 10 kV

### Detector

- > Standard            Backscatter detector
- > Optional            Secondary electron detector

### Digital image detection

- > Light optical      Proprietary high-resolution color navigation camera, single shot
- > Electron optical    High-sensitivity Backscatter 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

### Sample holder for GSR

- > Standard            Motorized height sample holder (Z) in form of removable tray
- > Optional            4-axis eucentric motorized sample holder

### Sample size

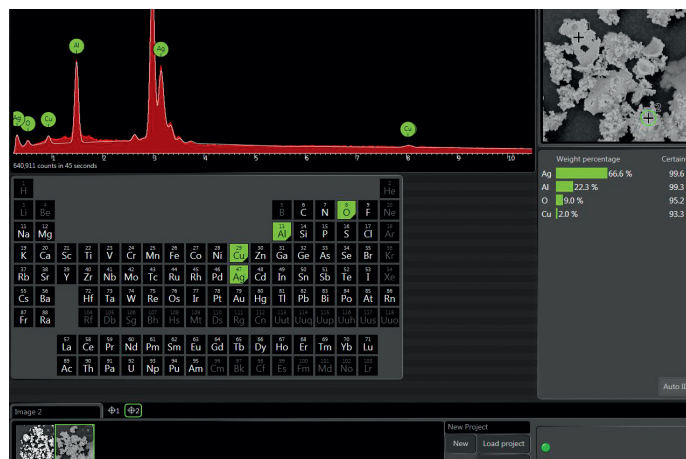
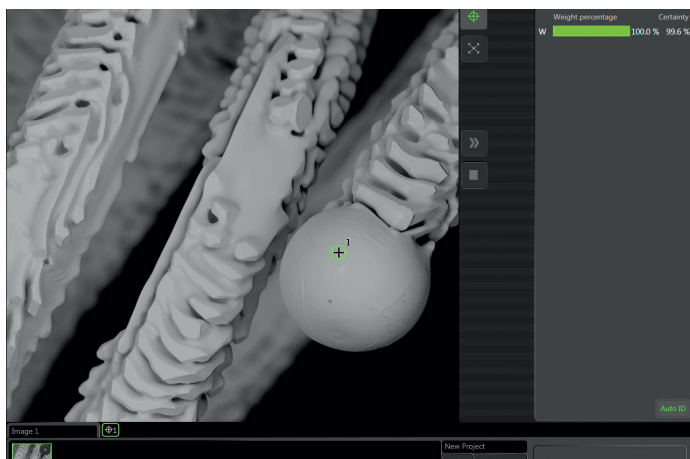
Up to 36 x 12 mm pin stubs  
100 mm x 100 mm fully motorized stage (X,Y)  
Max. 65 mm (h)

### Scan area

100 mm x 100 mm

### Sample loading time

- > Optical              < 5 s
- > From optical to SEM    < 60 s



### 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. Analysis has become as easy as imaging, since there is no need to switch between external software packages or computers. The  $\text{CeB}_6$  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 ( $\text{LN}_2$ free)
> Detector active Area	25 mm <sup>2</sup>
> X-ray window	Ultra-thin Silicon Nitride ( $\text{Si}_3\text{N}_4$ ) window allowing detection of elements B to Am
> Energy resolution	Mn K $\alpha$ $\leq$ 137 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