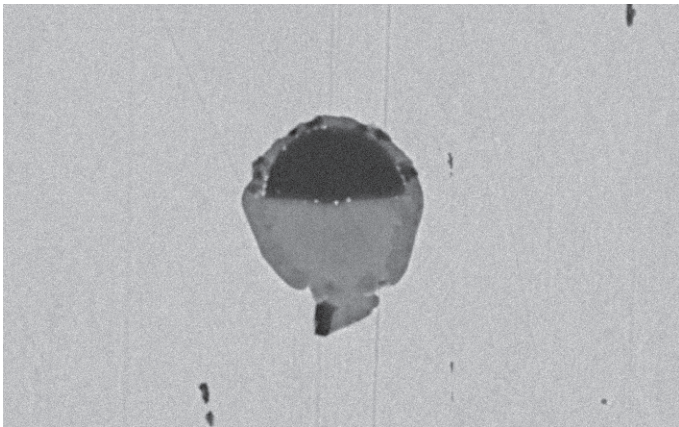


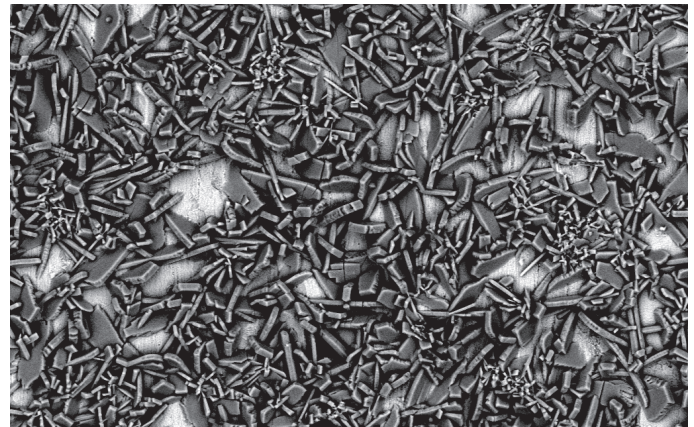
# Phenom ParticleX Steel

Multipurpose desktop SEM enabling high-quality steel manufacturing





SEM image of non-metallic inclusion in steel.



SEM image of Zinc-Phosphate on sheet metal.

The control over non-metallic inclusions during the steel making process is a key skill for the efficient production of modern steels demanded by today's customers. To be competitive in today's steel making requires knowledge of the many parameters that control the formation of the non-metallic inclusions in the steel. Timely and accurate data are the prerequisites for gaining the insight required for high-value steel making.

In addition to providing high-quality SEM analysis, the Thermo Scientific™ Phenom™ ParticleX Steel Desktop SEM is also designed to perform a number of specific functions. These include particle analysis of metal powders at the microscale for the additive industry, confirmation components fulfill technical cleanliness requirements, and analysis of inclusions in steel. All have now been made possible in-house and on your desktop.

#### **Phenom ParticleX Desktop SEM: general SEM usage**

The Phenom ParticleX Desktop SEM features a chamber that includes an accurate and fast motorized stage that allows analysis of samples of up to 100x100 mm. In spite of this larger sample size, a proprietary loading shuttle keeps the vent/load cycle to an industry-leading sample loading time of 40 seconds or less. In practice, this improves the throughput factors more than other SEM systems.

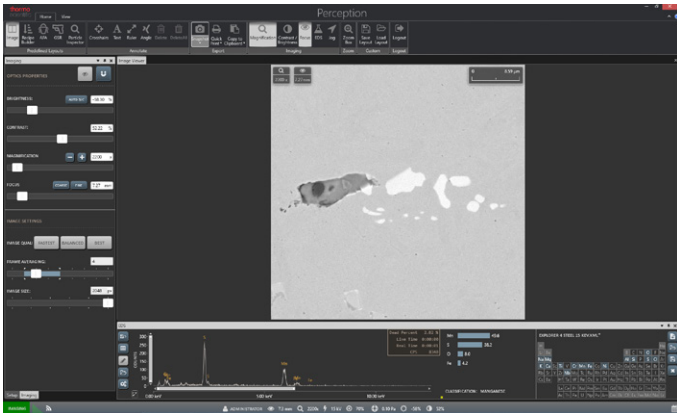
The user interface is based on the proven ease-of-use technology applied in our successful Phenom desktop SEM products. The interface enables both existing and new users to quickly become familiar with the system with a minimum of training.

The standard detector in the Phenom ParticleX Desktop SEM is a four-segment backscattered electron detector (BSD) that yields sharp images and provides chemical contrast information together with a fully integrated energy dispersive X-ray (EDX) system for elemental analysis. A secondary electron detector (SED) for surface sensitive imaging is optional.

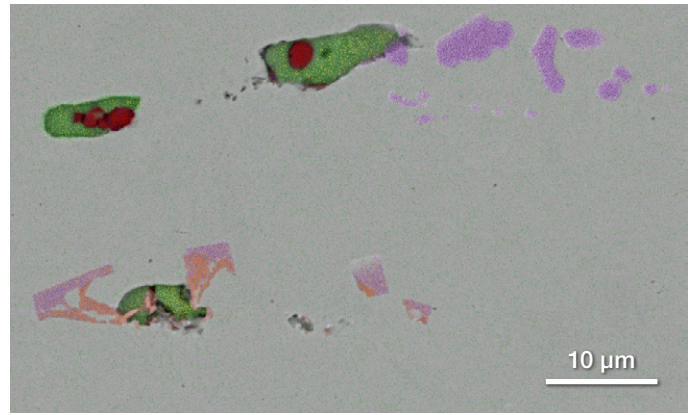
Elemental analysis is provided by EDX technology, which allows you to analyze the chemical composition of your samples. Detailed chemical composition can be obtained from a micro volume via spot analysis. Elemental distribution can be visualized with the elemental mapping option.

#### **Elemental mapping and line scan**

It is simply click-and-go to work with the elemental mapping and line scan functionality of the Phenom ParticleX Desktop SEM. The elemental mapping functionality visualizes the distribution of elements throughout the sample, and selected elements can be mapped at a user-specified pixel resolution and acquisition time. The real-time mapping algorithm shows live build-up of the selected elements. The line scan functionality shows the quantified element distribution in a line plot. This is especially useful for coatings, paints and other applications with multiple layers for analyzing edges, coatings, cross sections and more. Results of both the elemental mapping and line scan functionality can be easily exported by using an automated report template.



User interface ParticleX software.



Elemental mapping to analyze complex multiphase inclusions.

### Secondary electron detector

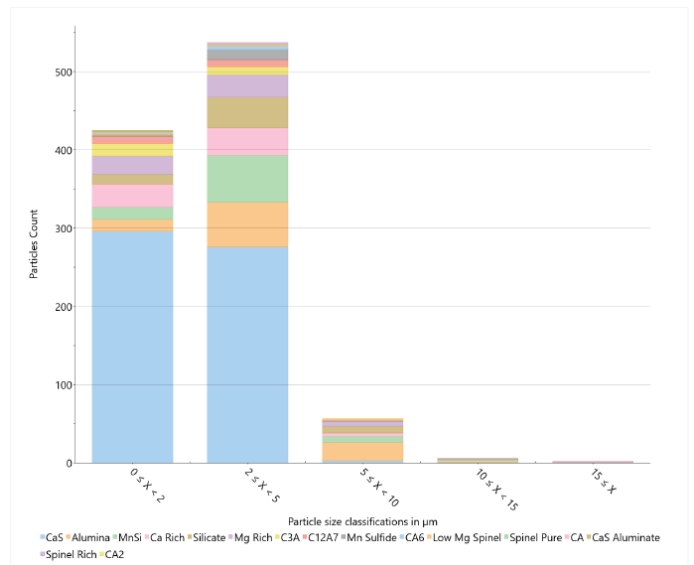
A secondary electron detector (SED) is optionally available on the Phenom ParticleX Desktop SEM. The SED collects low-energy electrons from the top surface layer of the sample, making it the perfect choice to reveal detailed sample surface information. The SED can be of great use for applications where topography and morphology are important. This is often the case when studying microstructures, fibers or particles.

### Phenom ParticleX Desktop SEM: analyzing inclusions in steel

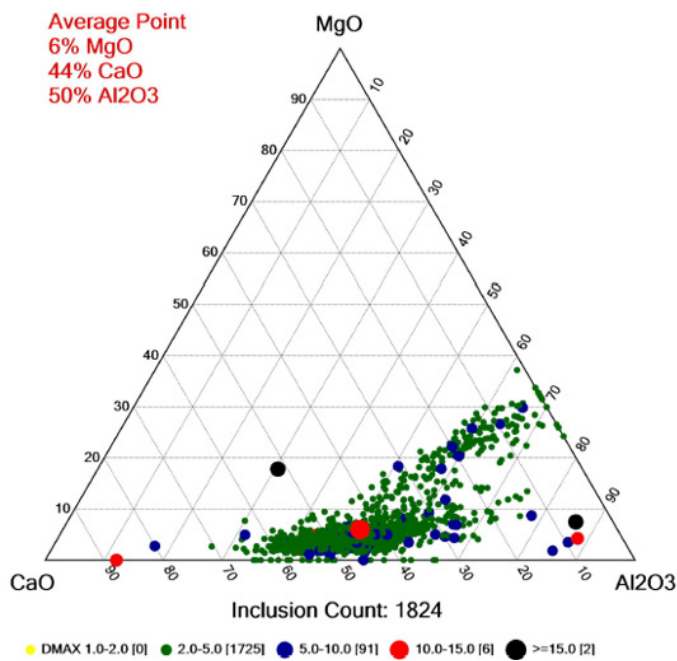
The Phenom ParticleX Desktop SEM for steel inclusion analysis is a versatile and easy to use SEM/EDX instrument for failure analysis and inclusion analysis. It is a proven solution for monitoring non-metallic inclusions in steel. The Phenom ParticleX Desktop SEM for steel inclusion analysis measures various size and shape parameters as well as chemistry of each individual inclusion.

The supplied recipes allow you to quickly get started with the analysis of Al-killed, Si-killed and Ca-treated steels. These recipes can be applied while specific parameters like inclusion size range, chemical classification rules, area of interest and stop criteria can be set for your specific application.

Once the data is acquired, a report can be generated according to user defined reports. Such customized reports can contain ternary plots, histograms, and inclusion density calculations to quickly visualize your results and compare your samples. After the automated analysis, every inclusion can be revisited manually for further analysis.



Plot inclusion size distributions to gain insight into relationships between inclusion chemistry and size.



Plot ternary diagrams to gain insight into inclusion chemistry.

Imaging specifications	
<b>Imaging modes</b>	
Light optical	Magnification range: 3–16x
Electron optical	<ul style="list-style-type: none"> <li>• Magnification range: 160–200,000x</li> <li>• Digital zoom max. 12x</li> </ul>
<b>Illumination</b>	
Light optical	Bright field / dark field modes
Electron optical	<ul style="list-style-type: none"> <li>• Long lifetime thermionic source (CeB<sub>6</sub>)</li> <li>• Multiple beam currents</li> </ul>
Acceleration voltages - Phenom UI	<ul style="list-style-type: none"> <li>• Default: 5 kV, 10 kV and 15 kV</li> <li>• Advanced mode: adjustable range between 4.8 kV and 20.5 kV imaging and analysis mode</li> </ul>
Vacuum levels	Low - medium - high
Resolution	<10 nm
Acceleration voltages Technical cleanliness EDX analysis	15 kV
<b>Detector</b>	
Standard	<ul style="list-style-type: none"> <li>• Backscattered electron detector</li> <li>• Energy dispersive spectroscopy detector</li> </ul>
Optional	Secondary electron detector
<b>Digital image detection</b>	
Light optical	Proprietary high-resolution color navigation camera, single shot
Electron optical	High-sensitivity backscattered electron detector (compositional and topographical modes)
<b>Image formats</b>	
JPEG, TIFF, BMP	
<b>Image resolution options</b>	
960x600, 1920x1200, 3840x2400, 7680x4800 pixels	
<b>Data storage</b>	
USB flash drive, Network, Workstation	
<b>Sample stage</b>	
Computer-controlled motorized X and Y	
<b>Sample size</b>	
<ul style="list-style-type: none"> <li>• Max. 100x100 mm (up to 36 x 12 mm pin stubs)</li> <li>• Max. 40 mm height (optional up to 65 mm)</li> </ul>	
<b>Scan area</b>	
<ul style="list-style-type: none"> <li>• 100x100 mm</li> </ul>	
<b>Sample loading time</b>	
Light optical	<5 s
Electron optical	<60 s

EDX specifications	
<b>Hardware</b>	
Detector type	<ul style="list-style-type: none"> <li>• Silicon drift detector (SDD)</li> <li>• Thermoelectrically cooled (LN<sub>2</sub> free)</li> </ul>
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 K $\alpha$ $\leq$ 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
<b>Software</b>	
<ul style="list-style-type: none"> <li>• Integrated column and stage control</li> <li>• Auto-peak ID</li> <li>• Iterative strip peak deconvolution</li> <li>• Confidence of analysis indicator</li> <li>• Export functions: CSV, JPG, TIFF, ELID, EMSA</li> </ul>	
<b>Report</b>	
Docx format	
<b>Elemental Mapping and Line Scan specifications</b>	
<b>Elemental Mapping</b>	
Element selection	10 individual user-specified maps, plus backscatter image and mix-image
<b>Backscatter image and mix-range</b>	
Selected area	Any size, rectangular
Mapping resolution range	16x16–1024x1024 pixels
Pixel dwell time range	1 - 250 ms
<b>Line Scan</b>	
Line Scan resolution range	16–512 pixels
Points dwell time range	50–250 ms
Total number of lines	12
<b>Report</b>	
Docx format	
<b>SED specifications</b>	
Detector type	Everhart-Thornley

## 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	531.5(w) x 515.4(h) x 250(d) mm, 6.7 kg
Workstation	169(w) x 456(d) x 432(h) mm, 15 kg

## Requirements

### Ambient conditions

Temperature	15°C ~ 30°C (59°F ~ 86°F)
Humidity	20% < RH < 80%
Power	Single phase AC 100 - 240 Volt, 50/60 Hz, 300 W (max.)

### Recommended table size

150x75 cm, load rating of 150 kg

### Workstation Specifications

- Lenovo workstation
- i5-9500 (6 cores)
- 16 Gb RAM
- 512 Gb SSD
- Keyboard, mouse
- Microsoft Windows® 10

