EMPYREAN NANO EDITION

Versatile X-ray scattering platform

- USAXS
- SAXS
- bio-SAXS
- WAXS
- PDF
**NANOMATERIAL ANALYSIS** on multiple length scales

**SAXS / WAXS and more**

The Empyrean Nano edition is a hybrid laboratory instrument that enables for a variety of X-ray scattering techniques. It is based on a compact, high-resolution goniometer platform.

The Empyrean Nano edition offers the combination of SAXS / WAXS with the ultra-SAXS and total scattering techniques. Structures with Bragg spacings ranging from sub-Angstrom to almost two microns can be probed.

**Typical samples**
- nanoparticles
- colloids
- polymers
- protein solutions
- surfactants
- lipids
- nanocomposites
- nanopowders
- porous materials
- crystalline, semi-crystalline and amorphous materials

**Typical applications**
- particle size distribution
- shape of nano-objects
- surface area
- interparticle interactions
- nano-structure
- hierarchical structures
- liquid crystalline phases
- phase transitions
- atomic order & disorder

<table>
<thead>
<tr>
<th>2θ (deg)</th>
<th>Cu radiation</th>
<th>Ag or Mo radiation</th>
<th>0.005</th>
<th>0.1</th>
<th>5</th>
<th>80</th>
<th>0.03</th>
<th>220</th>
</tr>
</thead>
<tbody>
<tr>
<td>1700</td>
<td>100</td>
<td>2</td>
<td>0.07</td>
<td>3.6</td>
<td>53</td>
<td>0.1</td>
<td>0.01</td>
<td>20</td>
</tr>
</tbody>
</table>

q: Scattering vector, \( q = 4\pi\lambda \sin(\theta) \)
d: Bragg spacing, \( d = \frac{2\pi}{q} \)
HIGH-PERFORMANCE **SAXS** AND **WAXS**

**SAXS / WAXS features**
- Compact setup
- Easy to use
- Patented vacuum path (ScatterX78)
- Semi-transparent beam stop
- High sensitivity
- 1D and 2D collimation

Sample temperature control
Soft matter analysis

*Figure reproduced from J. Bolze, V. Kogan, D. Beckers, M. Fransen, ‘High-performance small- and wide-angle X-ray scattering (SAXS/WAXS) experiments on a multi-functional laboratory goniometer platform with easily exchangeable X-ray modules’. Review of Scientific Instruments 89, 085115 (2018), with the permission of AIP Publishing. Open access: https://doi.org/10.1063/1.5041949*
EXTEND THE MEASUREMENT RANGE

**USAXS option** - based on high-resolution optics

Silica particles (D = 560 nm)

PDF (total scattering) option - using Ag or Mo radiation

Powder of zinc cyanide

Several additional options upon request, also as later upgrades

Classical X-ray diffraction

Computed tomography

\[ 2Q_{\text{max}} = 0.0050^\circ \]
\[ 2Q_{\text{max}} = 160^\circ \]
\[ Q_{\text{max}} = 22 \text{ Å}^{-1} \]

\[ 2\theta_{\text{min}} = 0.00036 \text{ Å}^{-1} \]
\[ 2\theta_{\text{max}} = 160^\circ \]

\[ Q_{\text{max}} = 22 \text{ Å}^{-1} \]

**NaSrVO\textsubscript{4}** powder**


UNIQUE FLEXIBILITY

The Empyrean Nano edition can be used with a variety of hardware modules that can be easily exchanged. Changing between different experimental setups only takes a few minutes and does not require re-alignment.

2-circle goniometer

Incident beam optics

Area detector

Sample stage

HIGH-RESOLUTION HYBRID PIXEL AREA DETECTORS

The performance of the Empyrean Nano edition is largely driven by our detector technologies.

• high spatial resolution
• very low noise
• high linearity
• light and compact
• maintenance-free
• 100% efficiency for hard radiation
WHY CHOOSE MALVERN PANALYTICAL?

We are global leaders in materials characterization, creating superior, customer-focused solutions and services which supply tangible economic impact through chemical, physical and structural analysis.

Our aim is to help you develop better quality products and get them to market faster. Our solutions support excellence in research, and help maximize productivity and process efficiency.

Malvern Panalytical is part of Spectris, the productivity-enhancing instruments and controls company.

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We are global leaders in materials characterization, creating superior, customer-focused solutions and services which supply tangible economic impact through chemical, physical and structural analysis.

Our aim is to help you develop better quality products and get them to market faster. Our solutions support excellence in research, and help maximize productivity and process efficiency.

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