



**Malvern
Panalytical**
a spectris company

EMPYREAN NANO EDITION

Versatile X-ray scattering platform

- USAXS • SAXS • bio-SAXS • WAXS • PDF



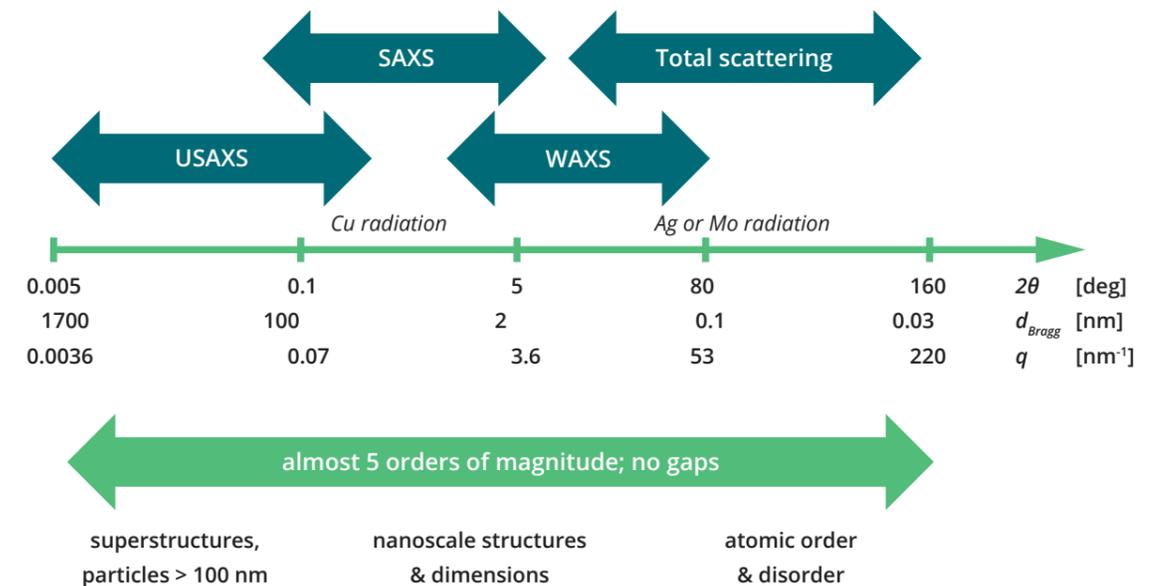
NANOMATERIAL ANALYSIS ON MULTIPLE LENGTH SCALES

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.



2θ : Scattering angle, the angle between the incident and scattered beam
 q : Scattering vector, $q = 4\pi\lambda^{-1} \sin(\theta)$
 d : Bragg spacing, $d = 2\pi/q$

Typical samples

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

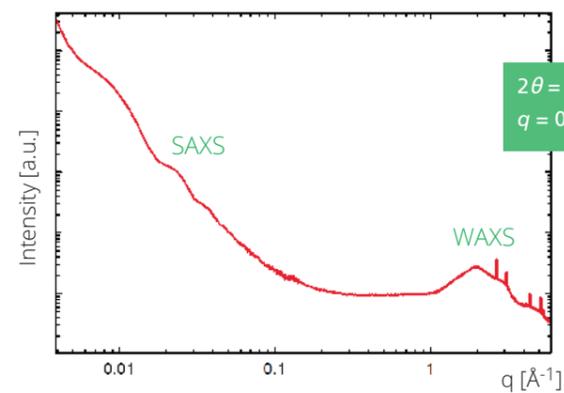
Typical applications

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

HIGH-PERFORMANCE SAXS AND WAXS

SAXS / WAXS features

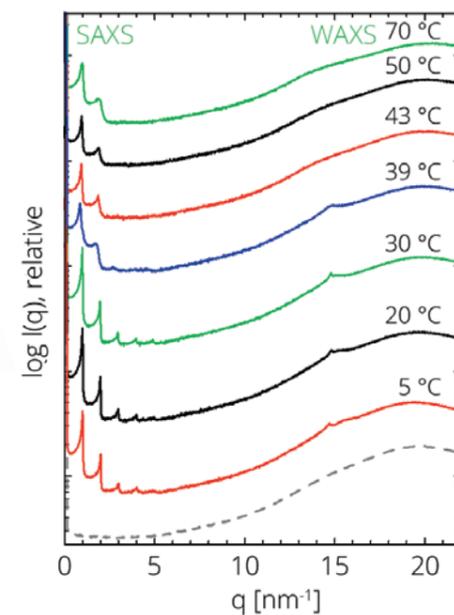
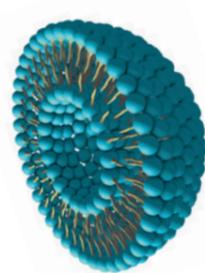
- Compact setup
- Easy to use
- Patented vacuum path (ScatterX⁷⁸)
- Semi-transparent beam stop
- High sensitivity
- 1D and 2D collimation



Colloidal gold nanorods

Sample temperature control

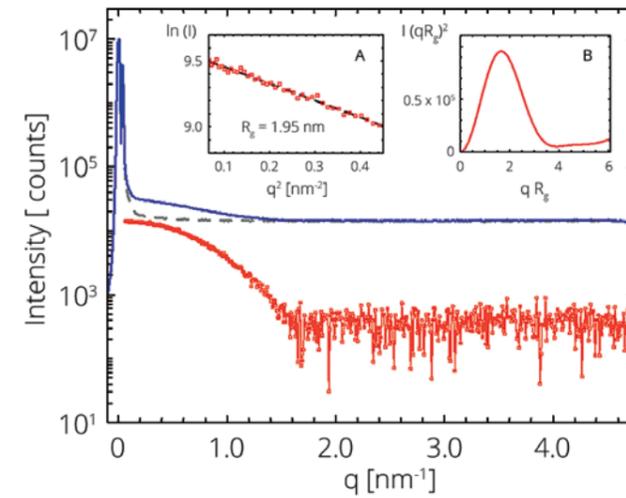
Soft matter analysis



Liposomes (DPPC)*

Bio-SAXS

Investigate size, shape, oligomerization and stability of dilute protein solutions

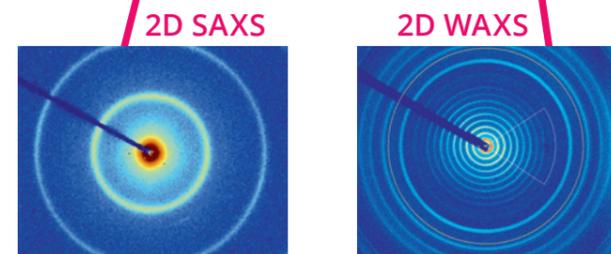
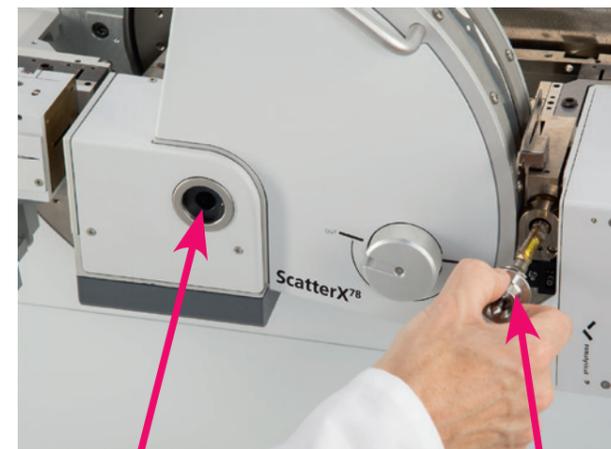


Commercial insulin (Novorapid®, 3.5 mg/ml)*

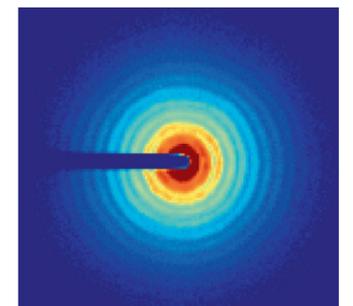


2D SAXS and 2D WAXS

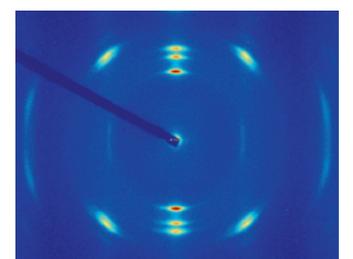
Dual sample position concept and switchable beam stop



Silver behenate*



Colloidal crystal; 2D SAXS*

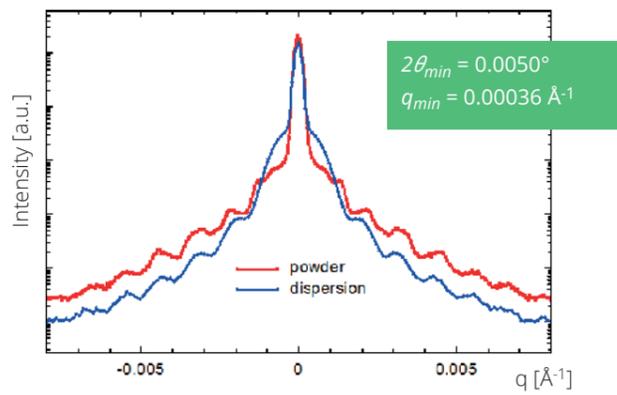


Polymer fiber; 2D WAXS*

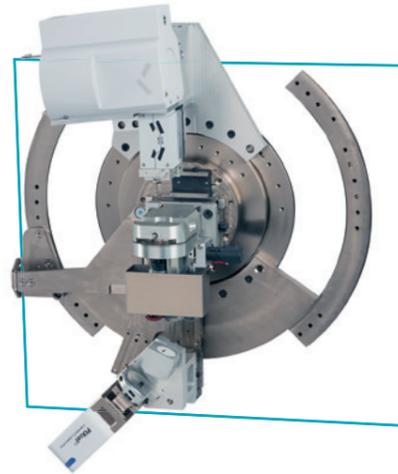
*Figure reproduced from J. Bolze, V. Kogan, D. Beckers, M. Fransen, 'High-performance small- and wide-angle X-ray scattering (SAXS/WAXS) experiments on a multi-functional laboratory goniometer platform with easily exchangeable X-ray modules'. *Review of Scientific Instruments* **89**, 085115 (2018),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

EXTEND THE MEASUREMENT RANGE

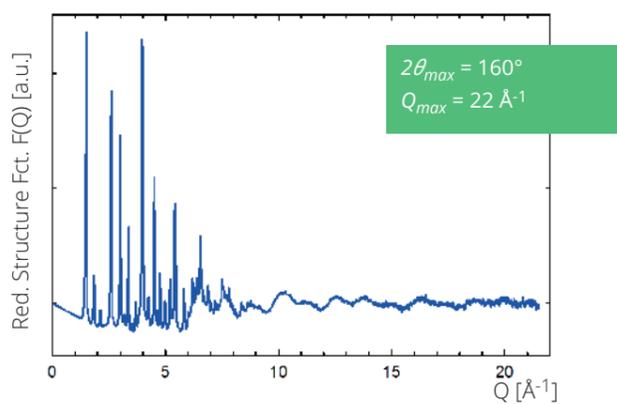
USAXS option - based on high-resolution optics



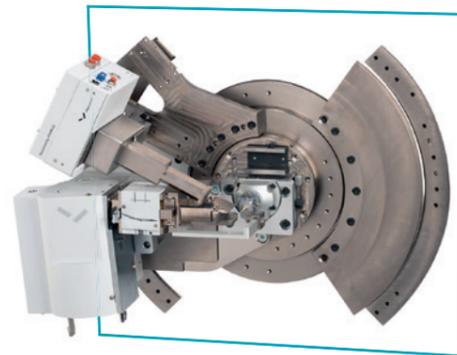
Silica particles (D = 560 nm)



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

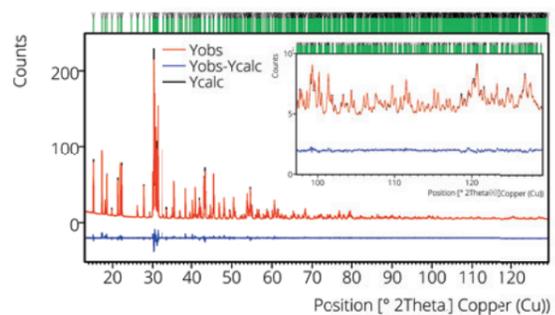


Powder of zinc cyanide



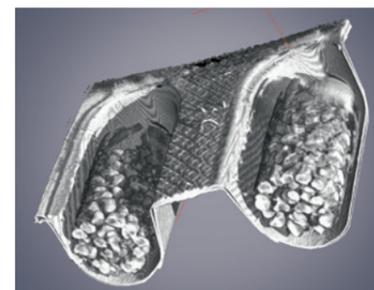
Several additional options upon request, also as later upgrades

Classical X-ray diffraction



NaSrVO₄ powder**

Computed tomography

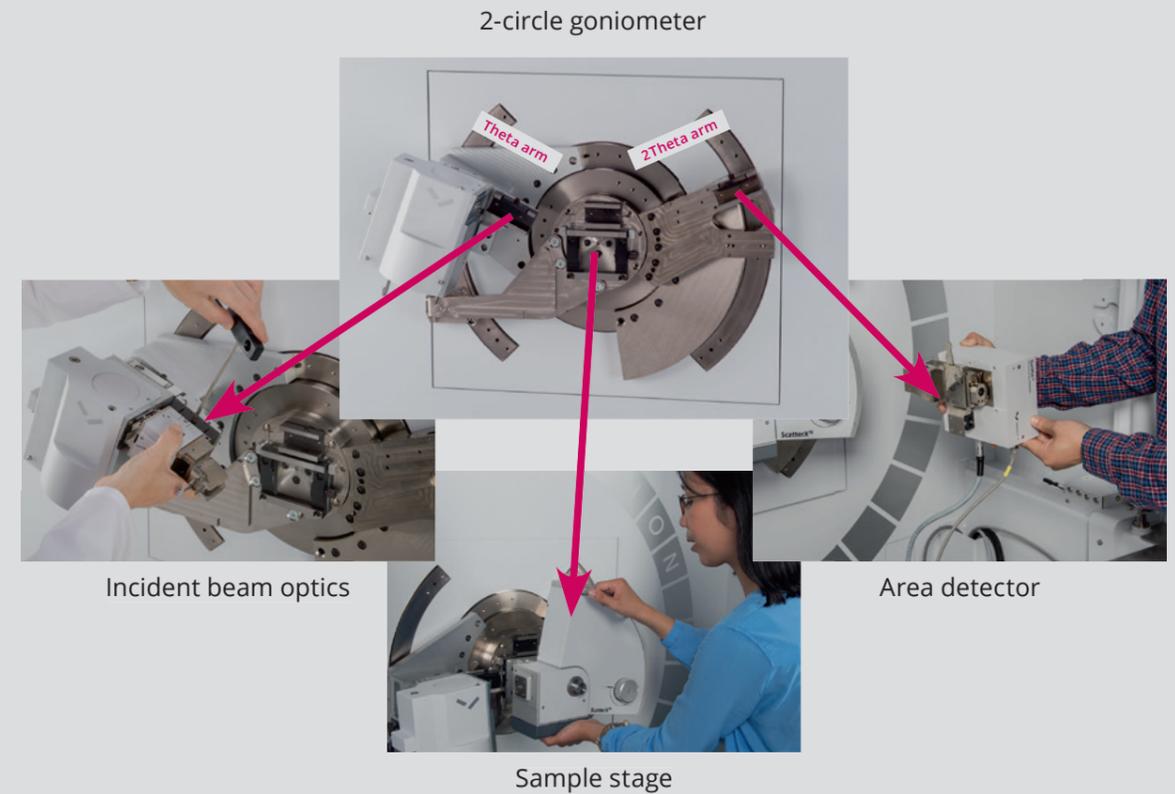


Blister-packaged drug capsules

** Reprinted by permission from Springer Nature Customer Service Centre GmbH: Springer Nature. Crystal structure and polymorphism of NaSrVO₄ (...). Phys Chem Minerals, G. Nenert et al. 44:455-463(2017).

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.



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



GaliPIX^{3D} (CdTe sensor)



PIXcel^{3D} (Si sensor)



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.

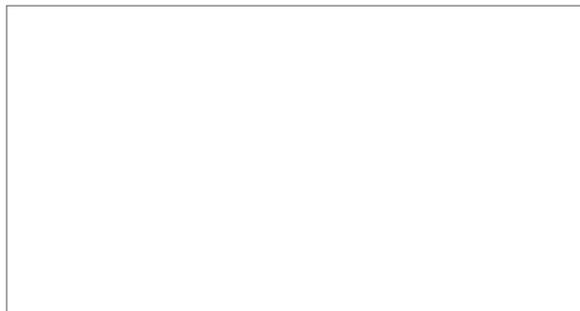
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www.spectris.com

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Malvern Panalytical provides the global training, service and support you need to continuously drive your analytical processes at the highest level. We help you increase the return on your investment with us, and ensure that as your laboratory and analytical needs grow, we are there to support you.

Our worldwide team of specialists adds value to your business processes by ensuring applications expertise, rapid response and maximum instrument uptime.

- Local and remote support
- Full and flexible range of support agreements
- Compliance and validation support
- Onsite or classroom-based training courses
- e-Learning training courses and web seminars
- Sample and application consultancy



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