Malvern Panalytical
a spectris company

Aeris

The future is compact

On a journey together

Modern X-ray diffraction

Across academia, more and more researchers are joining the race to push scientific frontiers. In industry, speed-to-market is essential for getting ahead. Meanwhile, regulations are tightening when it comes to pharmaceuticals, food, or environment. Whatever your organization's challenges, efficient and compliant solutions give you the confidence to face them.

At Malvern Panalytical, we listen to you and create solutions based on your needs. Your input informs our output. In partnership with our colleagues and customers like you, we've created a modern compact XRD solution to help you succeed.

Simplify your workflow

With Aeris, you can either introduce samples manually or via fully integrated automated systems. Sample holders are easily and precisely handled via external positioning stations and can be changed without disturbing any ongoing measurements. With Aeris, not everyone needs XRD expertise. Multilevel user accounts and pre-programmed methods and analyses combine with an easy-to-use touchscreen to ensure that great results are accessible to all.

Meet Aeris: future-proof, compact X-ray diffraction

How can you best optimize your materials and qualify your product? X-ray powder diffraction is a well-established, non-destructive way of getting to the heart of crystalline materials and finding the answers you need. Building on over 70 years of experience, we're proud to present Aeris – our super-compact, fully capable X-ray powder diffractometer.

With its economy and flexibility in measurement and automation, it's sure to provide the right solutions for you. Aeris provides a simplified, customized and integrated workflow whilst offering the opportunity for configuration changes and upgrades should your requirements evolve in the future.

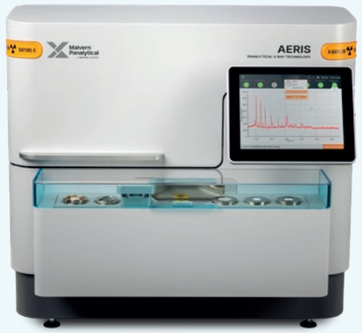
Flexibility to obtain the best data for you

Aeris offers a range of measurement configurations so you can achieve the best possible powder diffraction data for your sample type:

- Bragg-Brentano reflection powder diffraction
- Transmission diffraction with alignment-free capillaries or foils
- Grazing incidence diffraction Thin film analysis on pre-aligned samples, even with sample changer
- Residual Stress
- Small spot diffraction
- 2D diffraction
- Microdiffraction
- Non-ambient measurements
- In-operando measurements on batteries

Maximize efficiency with speed and accuracy

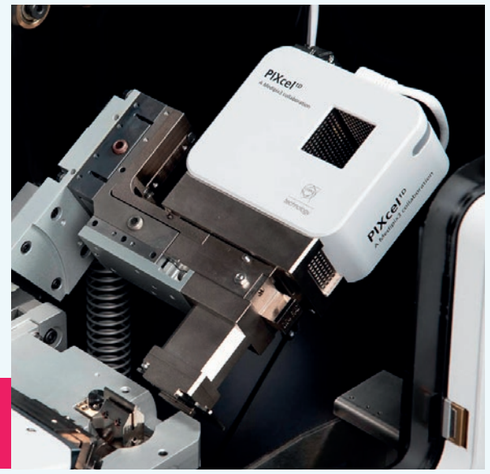
Aeris combines easy external sample handling with clear, simple, push-button operation. Thoughtfully designed using the highest-quality components, Aeris provides speed and data quality at a reduced power setting. This costs less for both you and the planet. Combining an onboard computer and a classic goniometer, Aeris' high-performance components and precision sample stages can perform a full scan in less than five minutes.



Detector Technology

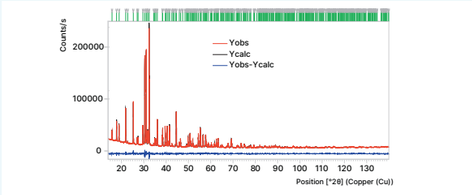
Choose from:

- **PIXcel^{1D}:** Medipix technology as a dedicated strip detector for 0D and 1D applications
- **PIXcel^{3D}:** Based on Medipix3 technology, the first detector to bring 0D-1D and 2D data to your diffractometer
- **1Der:** Ultimate versatility and clarity in 0D-1D detection with exceptional energy resolution for fluorescence-free data



Want to know more? Take a closer look...

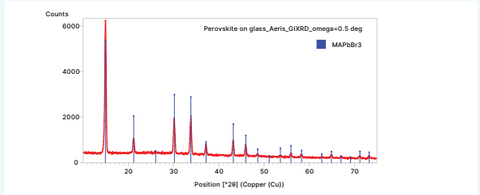
Higher-quality powder data



Rietveld refinement of synthesized and heat-treated AgCaVO4, Ref: G. Nénert, Z. Kristallogr. 2017; 232(10).

Reflection

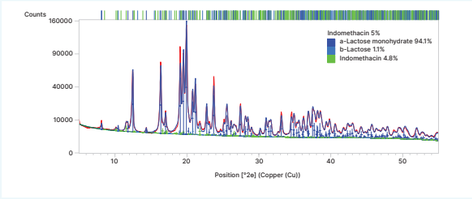
Combining low noise, high resolution, and true reproducibility, Bragg-Brentano results reveal new insights into your materials' structure-property relationships. This data can take you all the way from phase identification to crystal structure solution.



A 36 min GIXRD measurement of a MAPbBr3 Perovskite layer deposited on a glass substrate.

Grazing Incidence

With **grazing incidence X-ray diffraction,** you can now explore your samples' surfaces. The result? Better measurement of crystallographic properties in thin films and coatings.

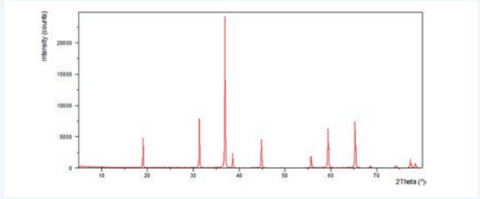


Transmission XRD measurements and quantitative analysis of an Indomethacin formulation prepared between mylar foils.

Transmission

Transmission measurements let you minimize preferred orientation effects. They are an especially great match for low-absorbing organic materials in the pharmaceutical industry.

A true innovation in transmission measurement mode is achieved by incorporating a beam stop to maximize the speed provided by the full width of the strip detectors. This results in an unmatched low-angle performance for transmission measurements, with exceptionally low background and remarkably high speed.



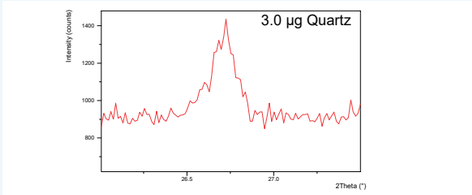
Co3O4 measured with Copper radiation on an Aeris with 1Der detector.

Supressing Fluorescence with 1Der

With the addition of the 1Der detector, an energy dispersive solid state strip detector featuring exceptional 340 eV energy resolution at 8 keV, Aeris has now the capability to eliminate background effects by suppressing unwanted radiation (white radiation, Kβ, fluorescence). Also measurement results improve by rejecting noise from sample-fluoresced radiation. Furthermore 1Der allows to switch from Kα1/2 to monochromatic Kβ-radiation.

Fluorescence is typically found measuring battery materials, measuring mining ore samples, as well as in additive manufacturing (metals, transition metals and their oxides).

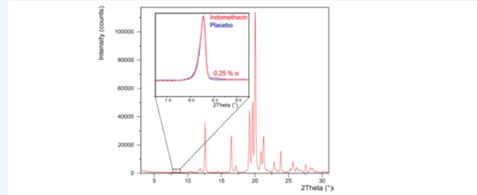
More indepth insights



Caption 5 minutes scan of the (1 0 1) peak of 3 ug quartz deposited on a silver mesh.

Identify Potential Hazards in Mineral Mixtures

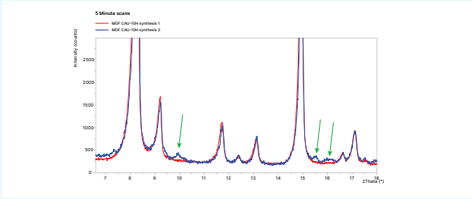
Low detection limits help to make sure you're complying withenvironmental regulations. And Aeris can reliably quantifyeven a few micrograms of hazardous substances – such as respirable silica, asbestos, and rutile – in minimal time.This figure shows of a 5-minute reflection scan of a Silver filter with 0.003mg of quartz, the most common polymorph of respirable silica. The quantification limit determined from the peak-to-noise ratio for the scan is 0.001mg. Aeris can push the quantification limit below 0.005mg in less than 5 minutes.



0.25 w% of alpha-Indomethacin in a formulation of 5% gamma-Indomethacin in a lactose based formulation.

Trace Analysis of Pharmaceuticals

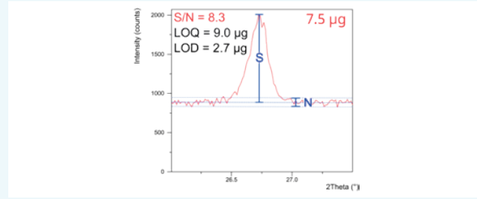
When you're working with pharmaceutical formulations, it's essential to pick up on potential polymorph contamination. Aeris' high sensitivity enables you to do just that, improving your product quality and preventing unnecessary risks. Figure 2 shows the diffraction pattern of a formulation containing about 5% of indomethacin in lactose (placebo). Zooming in on the weak reflection at 8.3° reveals the presence of only 0.25% of α-indomethacin, an unwanted polymorph when comparing with a pattern of a placebo.



Comparison of two 5 minutes scans of 2 different syntheses of MOF-CAU 10H. Green arrows show impurities in synthesis 2.

Identify the Best Process for Your Advanced Materials

To refine your processing parameters, you need to analyze them quickly. With Aeris, even five-minute scans can immediately show whether a processing parameter is affecting crystalline phase purity. This figure shows two five-minute measurements of two metal-organic framework (MOF) samples in reflection mode, each processed under different conditions. Using Aeris, you can rapidly optimize these processing parameters for the best quality material – every time.



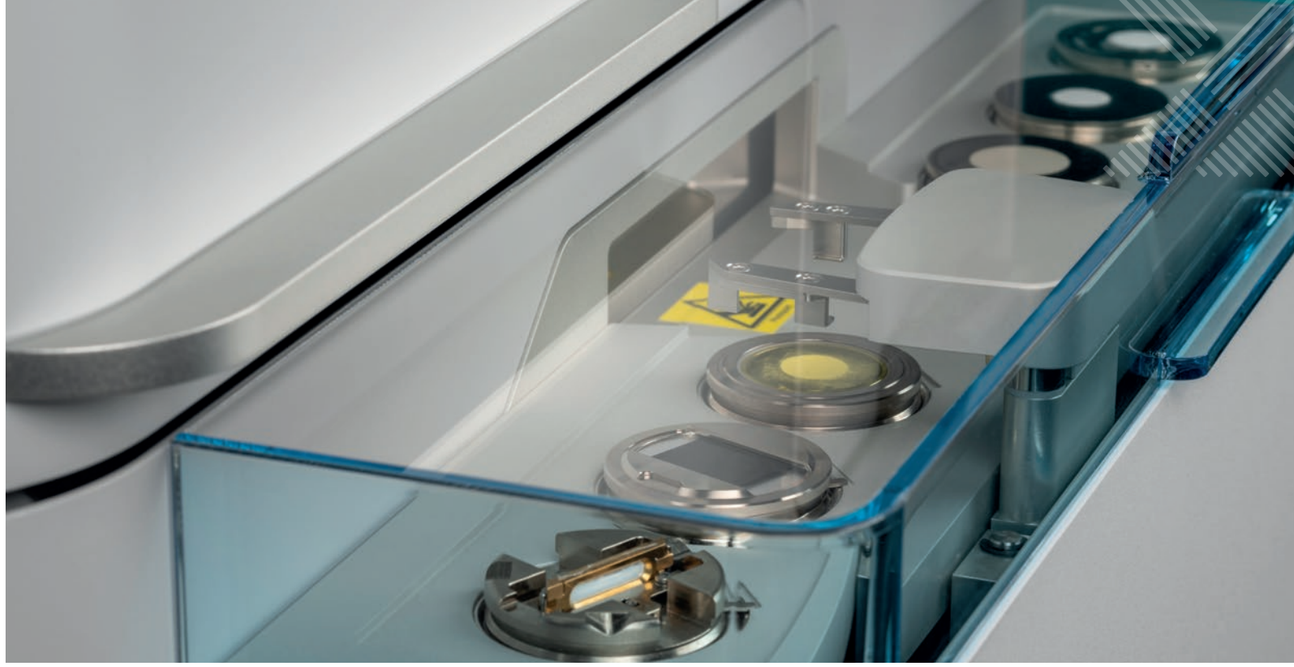
7.5 µg of Quartz on a silver mesh. Measured in 6 minutes. A signal to noise ratio of 8.3 is achieved. With this measurement speed 9 micrograms quartz are above the limit of quantification (NIOSH 7500).

Improved Detection Limits

Low detection limits help to make sure you're complying with environmental regulations. And Aeris can reliably quantify even a few micrograms of hazardous substances – such as respirable silica, asbestos, and rutile – in minimal time. Figure 3 shows part of a 6-minute reflection scan of a silver filter with 7.5 µg of quartz, the most common polymorph of respirable silica. The signal to noise ratio was determined with HighScore using the method layed out in the European Pharmacopeia. The quantification limit (LOQ) determined from the peak-to-noise ratio for the scan is 9 µg the limit of detection (LOD) is at 2.7 µg. The Aeris easily exceeds the requirement of NIOSH 7500 rev 4, which requires a limit of detection of 5 µg and a limit of quantification of 20 µg.

Automate your future

Aeris gives you a full range of upgradeable handling options to place your sample on its external sample platform. So, it’s easy to start small and scale up. Aeris is also designed to integrate fully into your own automated environments. If you need support incorporating it into your LIMS system, our expert group will be happy to help.



Sample handling

Choose from:

- Manual sample platform with a single position for the sample loader
- Integrated 6-position sample changer with automatic external sample handling
- High-Capacity Sample Changer for high-throughput sample handling
- A connection for belt automation (operated via UAI interface)
- Full integration into multi-system automated labs

Easy and precise loading for all sample types

We all know how important accurate sample handling is, but the right sample holder is equally essential. Correct loading is easy for all Aeris users – every single time. Precision-built sample holders can accommodate a wide range of sample types, including powders, solids, liquids, or slurries.

Their quantities can range from standard-sized pressed pellets to milligrams. And if you’ve got air-sensitive or potent samples, we’ve got sealed holders for those too. Whatever your application may be, we can help you find the right holder – so, let’s talk!

It’s your lab – do it your way

High-Capacity Sample Changer

For high-throughput environments, look no further than the Aeris High-Capacity Sample Changer. Its proven robotic sample handling technology enables unattended analysis of over 60 samples, delivering 50% better resource efficiency.

The power of combining technologies

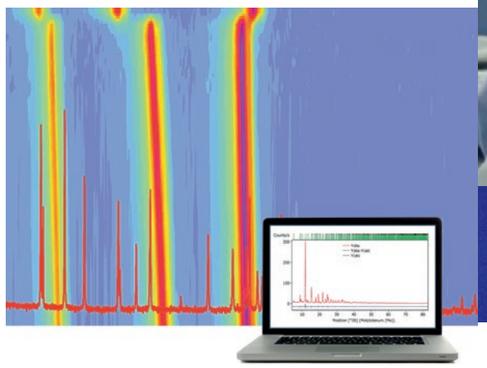
You can easily integrate the Aeris with other instruments and sample preparation equipment via a belt connection. The result? An automated lab that supports both mineralogical and elemental analysis which means higher productivity and lower process cycle times.

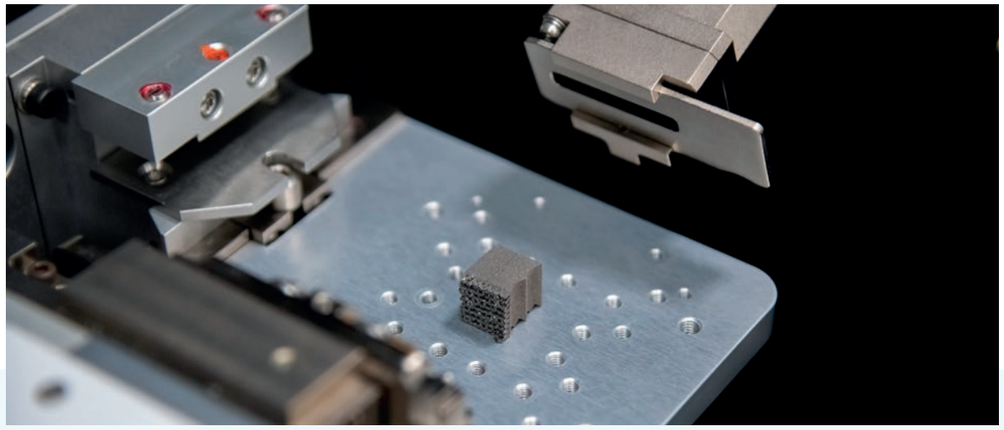
We provide a twin system package including hardware, software, and expertise support to streamline the connection between Aeris and Zetium.

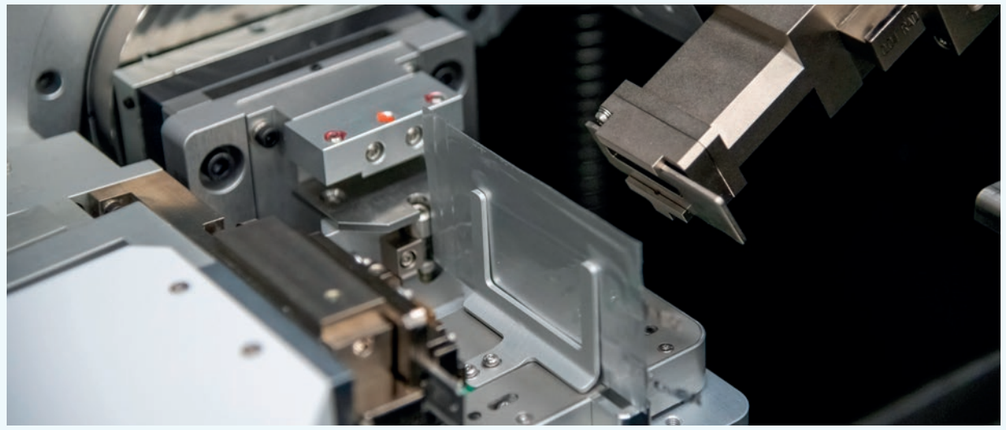
Test the boundaries

You've found a materials system that fits your requirements, but how can you be sure of the range of conditions it can operate in before unwanted changes occur? With Aeris, you can investigate a range of material variants to see how processing, environmental, and compositional changes affect performance. The HighScore Suite is designed to process, analyze, and display large data sets, and this software enables you to identify and optimize key stages in your processes and unique properties in your materials.

At the same time, an integrated non-ambient stage gives you the tools to model your material's robustness in tough operating conditions.
Talk to us about options for your research! We can provide bespoke multipurpose stages for unusual samples, chambers for non-ambient conditions, electrochemical cells, and more.







Extend your vision

Simple 2D diffraction measurements are the ideal way to visualize your material and plan further investigations. They also provide better peak shapes for low angle data, and are a great choice for MOFs, clays, and pharmaceuticals. With Aeris 2D, incorporating our high-resolution PiXcel3D detector, you can easily perform such 2D measurements. You'll instantly see whether your microstructure is a problem, whether your crystallites are smaller or larger, and whether they have a random or a preferred orientation.

Look out for our new microdiffraction optic that expands your 2D capability further! This proprietary solution, combined with 2D data collection, enables you to collect position-sensitive data across your sample plus simultaneously collect multiple XRD data sets across a heterogenous sample.

Get Instant Results

Aeris' reliable onboard RoboRiet software makes analysis faster for the experts, easier for non-experts and saves time for everyone. RoboRiet automates the entire measure-analyse-report sequence, providing rapid quantitative-phase analysis by means of Rietveld refinement. With Aeris' easy-clean touchscreen, you have instant access to instrument status, live measurement progress, and analytical results. What's more, our expert team can also develop operating procedures for you – from touch-screen setup and sample preparation advice to method setup, automated analysis, and reporting formats.

21 CFR Part 11 compliance built in

From instrument qualification to compliance and auditing, we understand how important data integrity is – and we're here to help you minimize risk. Our OmniTrust solution supports working in regulated environments on multiple analytical instruments, including Aeris. Designed in collaboration with industry experts, OmniTrust ensures record accuracy and best practices in data integrity. How? By providing tools to define user roles suitable for individual companies' workflows, as well as by trailing each step of a user's interaction with Aeris: from the creation of measurement routines up to the review of data analysis. Its system controls help prevent user errors and ensure data integrity, enabling you to comply with all relevant regulations. And if there is a potential integrity issue, the information is at your fingertips thanks to OmniTrust. You can save time and say goodbye to stress.

OMNITRUST

Traceability and control at your fingertips

Step into the future

With Aeris, you'll have state-of-the-art X-ray powder diffraction data – whatever the type of polycrystalline sample you have. You'll have peace of mind in the lab, thanks to a unique internal interlocked enclosure providing complete radiation protection. External loading will protect components from tampering, spillage, or accidents across the entire optical path. With different user interfaces designed for entry-level or advanced users, even users with minimal training can contribute. A true uncoupled theta-2theta goniometer will keep samples horizontal, ensuring flexibility and top-quality measurements. By providing the data quality of a floor-standing system in a compact instrument, Aeris will deliver unrivalled cost savings. And you can do all this at the push of a button.

Ready for Industry, Flexible for Research

Aeris doesn't compromise on compatibility. Its XRDML data files are compatible with all our industry-leading analytical software solutions – including HighScore, HighScore Plus, Stress, and Industry. It supports straight-line calibration for rapid quality control and is fully compatible with LIMS systems.

In other words, you'll have access to a full suite of analysis capabilities, including:

Phase identification

Phase quantification

Crystal structure refinement

Crystallinity

Size, strain, and stress analysis

Statistical clustering

Calibration line-based quantification methods

...and more

So, what are you waiting for?

With the options available, why not put them together to make a unique instrument for your unique requirements? A Malvern Panalytical diffractometer is built for you so that you get the right data, just how you need it.

Talk to us today!

Malvern Panalytical
a spectris company

About Malvern Panalytical

We draw on the power of our analytical instruments and services to make the invisible visible and the impossible possible.

Through the chemical, physical and structural analysis of materials, our high precision analytical systems and top-notch services support our customers in creating a better world. We help them improve everything from the energies that power us and the materials we build with, to the medicines that cure us and the foods we enjoy.

We partner with many of the world's biggest companies, universities and research organizations. They value us not only for the power of our solutions, but also for the depth of our expertise, collaboration and integrity.

We are committed to Net Zero in our own operations by 2030 and in our total value chain by 2040. This is woven into the fabric of our business, and we help our employees and customers think about their part in creating a healthier, cleaner, and more productive world.

With over 2300 employees, we serve the world, and we are part of Spectris plc, the world-leading precision measurement group.

Malvern Panalytical. We're BIG on small™

Service & Support

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

Malvern Panalytical

Grovewood Road, Malvern,
Worcestershire, WR14 1XZ,
United Kingdom

Tel. +44 1684 892456
Fax. +44 1684 892789

Lelyweg 1,
7602 EA Almelo,
The Netherlands

Tel. +31 546 534 444
Fax. +31 546 534 598

www.malvernpanalytical.com