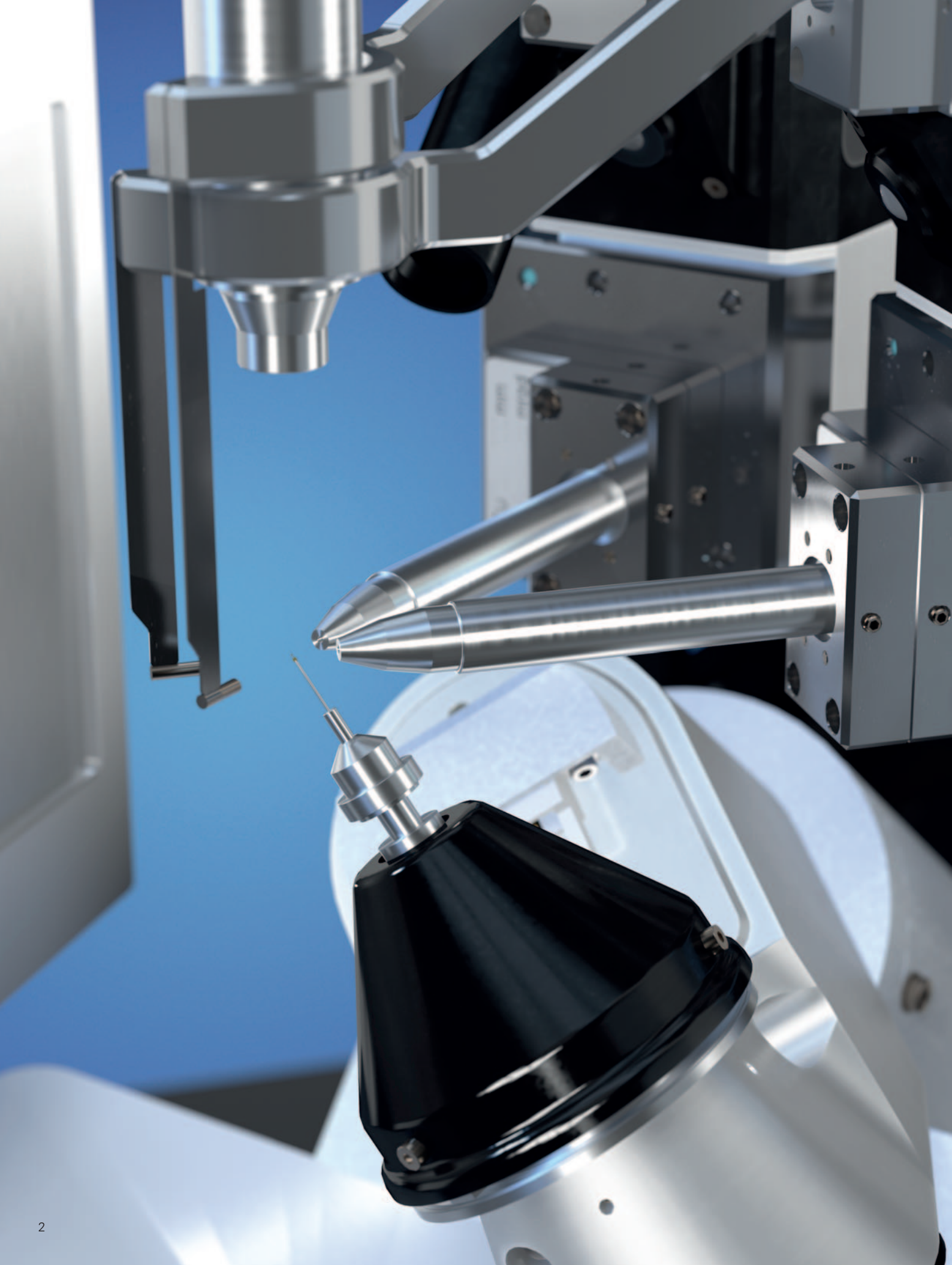
CRYSTALLOGRAPHY

IμS 3.0, IμS DIAMOND II, METALJET MC

X-ray Sources Illuminating the Future of Crystallography

Innovation with Integrity



See the Invisible—Solve the Impossible

Unleash the full potential of crystallography

Choosing the right X-ray source is essential to maximize the productivity and success of your laboratory. Key considerations include intensity, beam size, wavelength, flexibility, source lifetime, and uptime. The seamless integration of the sources into the systems ensures exceptional performance and stability, allowing you to focus on your research. Whether your priorities are efficiency or your research demands the highest performance, we have the X-ray sources to meet your requirements.

Efficiency solutions

The IμS 3.0 microfocus sources set new benchmarks for performance, reliability, and sustainability. Building on over two decades of innovation, the IμS 3.0 achieves X-ray brightness far surpassing that of conventional microfocus sources. Advanced X-ray optics conserve the brightness of these modern microfocus sources for a high intensity, stable X-ray beam to your sample.

Performance solutions

The IμS DIAMOND II provides much higher X-ray intensity than the IμS 3.0 enabling faster data collection and improved data quality from even smaller samples, due to a unique combination of patented diamond hybrid anode and high brilliance cathode. This unique technology ensures exceptional performance, replacing rotating anode sources for advanced crystallography.

In-house beamline solutions

The METALJET MC delivers outstanding intensity in a small beam allowing structure determination from crystals typically only addressable at synchrotron beamlines or by electron diffraction. The metal jet anode technology, combined with the latest advances in cathode technology, leads to a source brighter than any other available home source. The advanced capabilities of METALJET MC-based solutions will broaden your research scope and drive high impact science.

Strategic decision-making

With system lifetimes often exceeding a decade, choosing the right technology and wavelength is more critical than ever for long-term scientific success. An informed decision today will support your research for years to come.

Riding the Perfect Wave

Selecting the optimal X-ray source for your research requires careful consideration of several key factors. Begin by identifying your specific needs, such as working with organic samples, small crystals, or materials science applications. Different sources are suited to different sample types, whether large or small, stable or sensitive.

Next, choose the wavelength that best matches your application. Molybdenum (Mo) radiation is valued for its versatility, while Silver (Ag) radiation provides higher resolution with lower absorption and extinction effects, now available at impressive intensities from our latest sources.

It is also important to consider the source's lifetime, stability, and minimal intensity decay, as well as seamless integration into your system. Features such as alignment-free operation enhance convenience, and productivity.

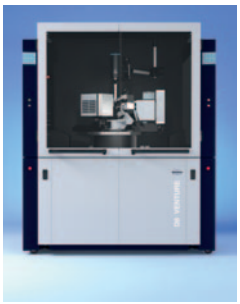
Thinking beyond conventional options will help you achieve new levels of research success.

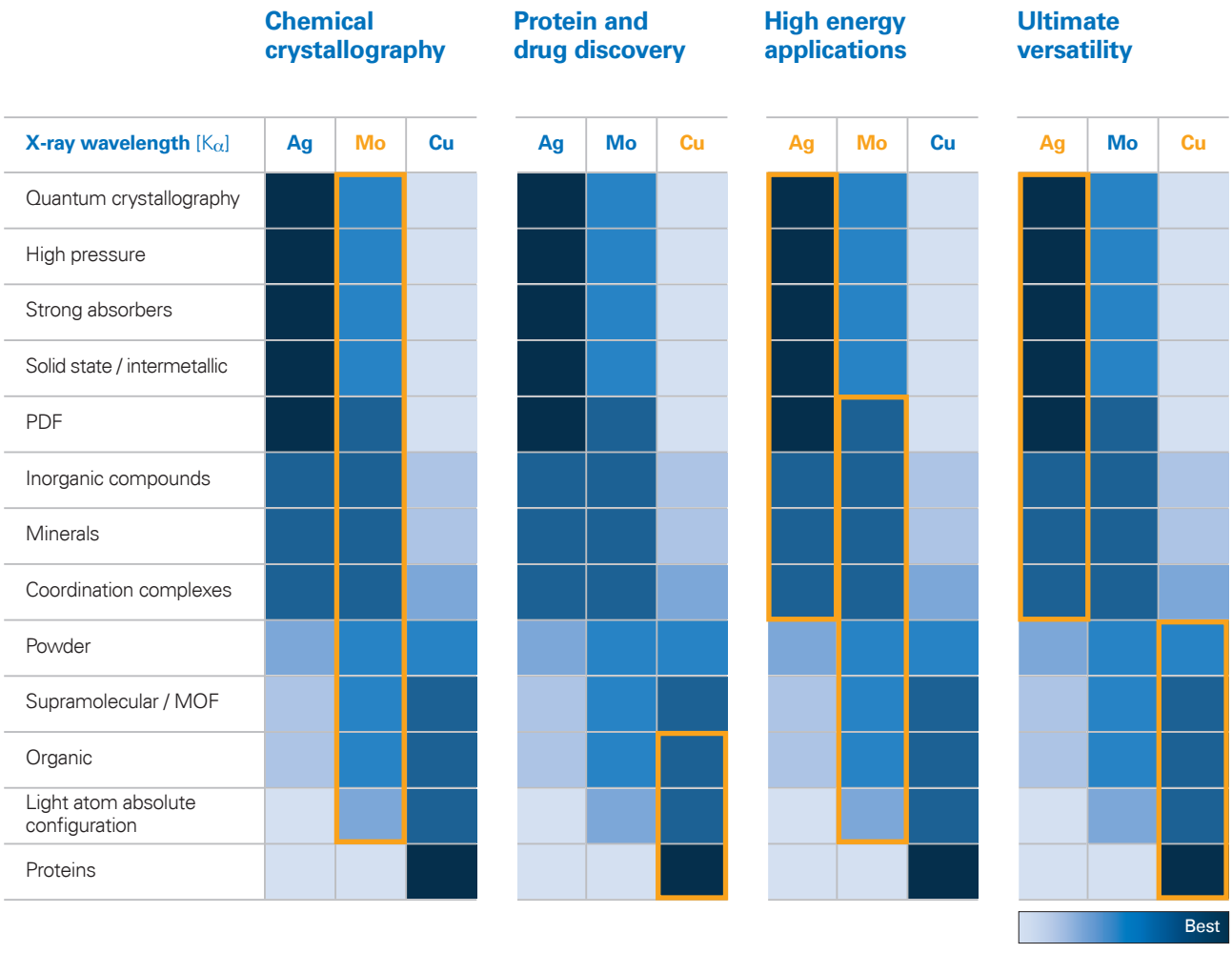
D8 QUEST

Compact design that provides experimental flexibility and supports single-source configurations without compromise.

D8 VENTURE

Spacious design supports both single- and dual-source configurations, providing maximum flexibility for advanced experimental setups.





Ag Kα 0.56 Å

Mo Kα 0.71 Å

Cu Kα 1.54 Å

Intensity multiplied—results amplified

No matter which wavelength your research requires, our sources deliver maximum intensity while keeping operating costs low.

Silver: The new gold standard

Silver (Ag) radiation is transforming a wide range of applications, including quantum chemistry, solid state research, and battery development. Using the shortest wavelength available from in-house sources, Silver radiation reduces absorption and extinction effects, enabling higher-resolution data collection.

Historically, traditional Silver sealed tubes produced weak intensities, limiting the use of Silver radiation despite clear advantages. Bruker's high-intensity microfocus sources have fundamentally changed the landscape, making Ag radiation the preferred choice for many samples that previously relied on Mo radiation.

Microfocus technology in the IμS 3.0 and ultra-brilliant IμS DIAMOND II series offers superb and stable intensities with minimal decay and long tube lifetimes, clearly outperforming all rotating anode alternatives. Silver radiation is now essential for all dual-wavelength solutions.

Molybdenum: The versatile choice

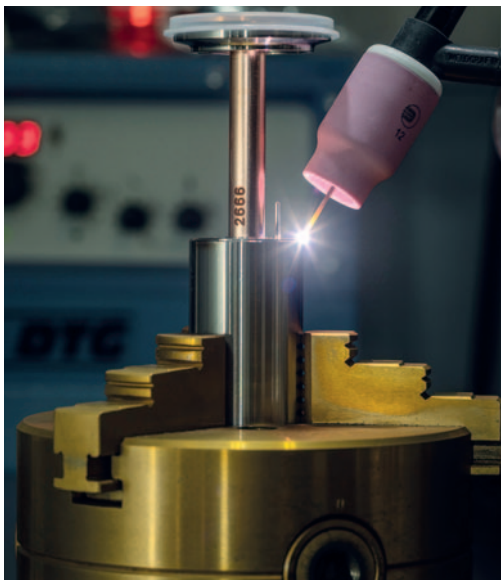
Molybdenum (Mo) radiation is the traditional favorite among crystallographers, thanks to its combination of low absorption, strong scattering power, and efficient data collection. Most published crystal structures today rely on this versatile wavelength. The IμS 3.0 is the leading source for Mo radiation, delivering more than four times the intensity of competing microfocus sources. For maximum performance in the home laboratory, the IμS DIAMOND II provides the highest intensity of all available Mo in-house sources.

Copper: Optimal for light atom analysis

Copper (Cu) radiation has seen increasing use over the past decade, especially for small organic samples and protein crystals where some radiation damage is acceptable. Cu is regarded as the preferred wavelength for light atom analysis. Our microfocus sources deliver intensities that match or exceed those of traditional microfocus rotating anode sources, while requiring less maintenance and offering significantly longer tube lifespans.

However, latest improvements in high-intensity sources and detector technologies have also highlighted certain limitations of Cu radiation, such as sample degradation, absorption, extinction effects, and longer data collection times.

Microfocus tube production at the Bruker facility in Geesthacht, Germany



Improve Crystal Analysis with Leading X-ray Source Technology

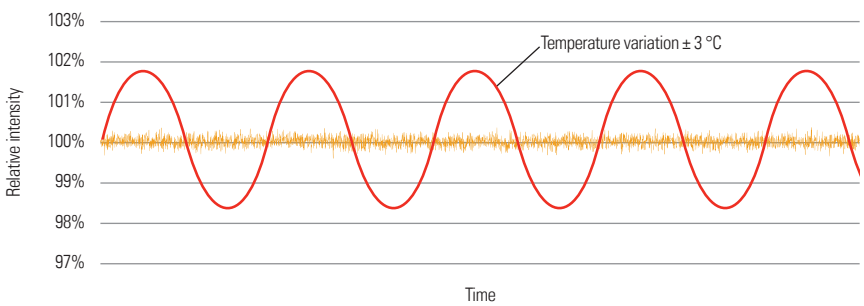
Our microfocus X-ray sources deliver exceptional source lifetime, beam stability, and user-friendly operation. Integrated into the D8 QUEST and D8 VENTURE single-crystal X-ray diffraction systems, they provide safe, high-intensity, and reliable X-ray beams around the clock. Automated standby modes further extend source life and support environmental sustainability.

Innovative alignment and beam conditioning

Bruker's backlash-free downstream alignment ensures long-term beam path stability without the need for realignment. Our microfocus X-ray sources are tailored for single-crystal X-ray diffraction, featuring a wavelength-optimized take-off angle for high brilliance and minimal intensity decay.

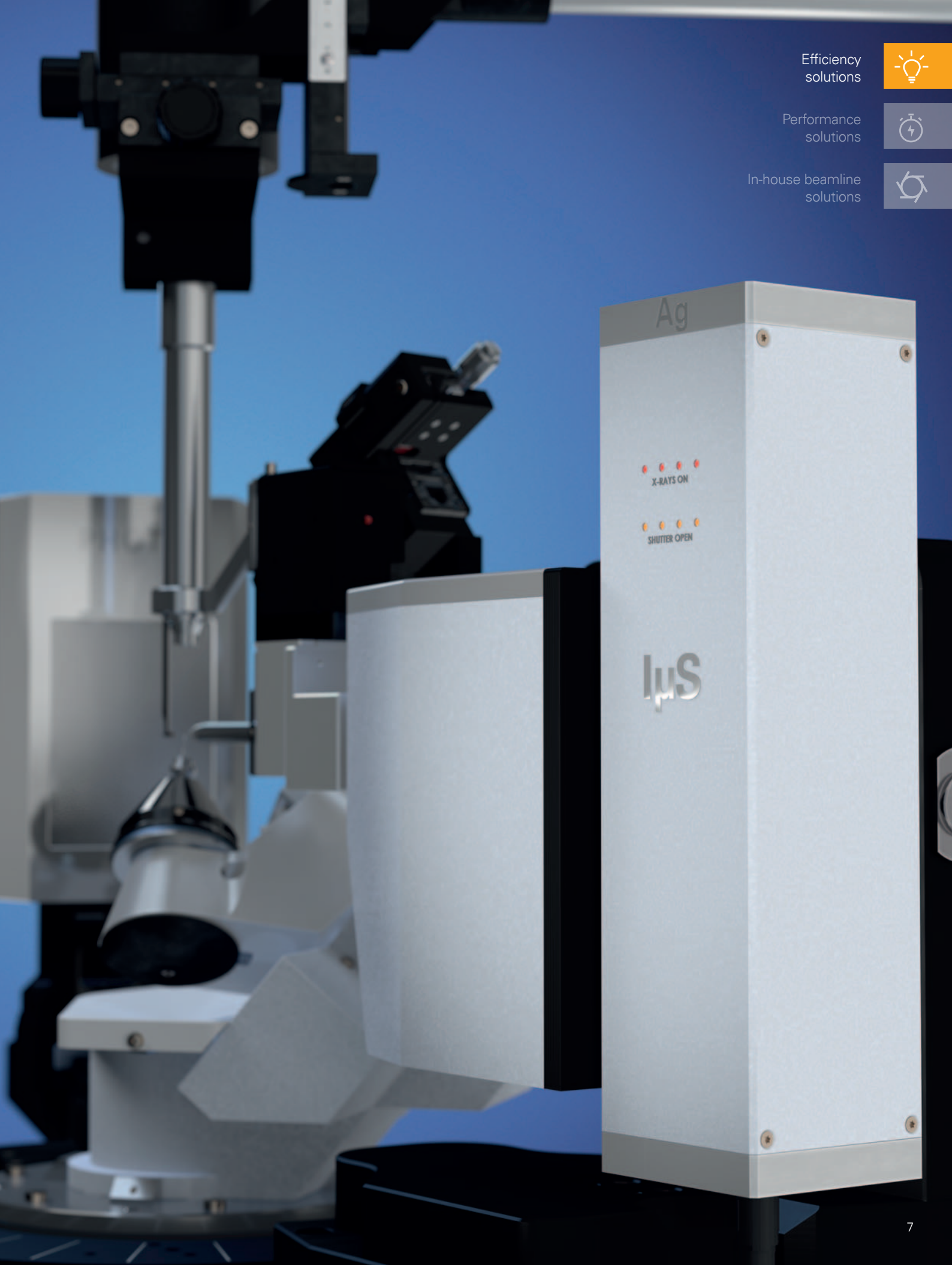
High-performance HELIOS optics

Our Montel multilayer optics are mounted on a precision cardanic cradle and sealed under He atmosphere, ensuring long-term beam stability and performance. Easy alignment makes beam conditioning fast and reproducible, always delivering the maximum possible X-ray photons for any crystallographic challenge your research presents.



Air cooling

Advanced air cooling, combined with precise mechanical engineering, ensures the exceptional beam stability that defines all IμS sources.


Efficiency solutions
Performance solutions
In-house beamline solutions
Ag
X-RAYS ON
SHUTTER OPEN
IμS

IμS 3.0 with HELIOS MX for Ag, Mo, and Cu radiation

The IμS 3.0 microfocus source excels with low maintenance and high reliability

Provides up to four times the intensity of conventional microfocus sources

First-ever microfocus source specifically designed and optimized for X-ray diffraction

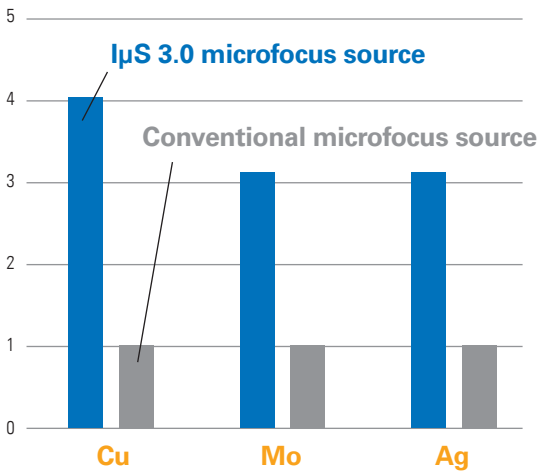
Third-generation optics deliver the best spectral purity, excellent reflectivity, and a near-zero X-ray background

Includes a three-year source warranty

1. Air-cooled source with long-life filament
2. Electron beam
3. Anode take-off angle optimized for crystallography
4. Microfocus technology enables efficient 3-dimensional heat transfer
5. High intensity X-ray beam
6. HELIOS MX optics

Relative intensities

The IμS 3.0 delivers top-tier intensity across all wavelengths required for your research.



The perfect match

Our HELIOS MX optics feature advanced multilayer-coated optical surfaces for brilliant X-ray focusing. Combined with the dedicated microfocus sealed tubes and optimized to the needs of crystallographers, the IμS 3.0 is an outstanding source—reliable and efficient.

IμS 3.0—
Performance by Design

Bruker and Incoatec pioneered the first modern microfocus sources, with more than 1,700 units in the field establishing an unrivaled record for performance and reliability. Unlike other microfocus sources that still use tubes designed for radiography applications in non-destructive testing (NDT), the IμS 3.0 features the first tube engineered and exclusively manufactured by Incoatec for crystallography.

These specialized tubes incorporate optimized take-off angles and advanced electron optics, delivering up to four times the intensity of competing sources based on NDT technology.

IμS DIAMOND II—
Simply Brilliant

At Bruker, we develop and manufacture the complete IμS DIAMOND II assembly in-house, enabling rapid integration of the latest technology. The result is higher power capacity, X-ray intensities that surpass standard microfocus rotating anode generators, and seamless compatibility with next-generation optics.

Redefining brilliance with the IμS DIAMOND II

Building on the proven design of our market-leading IμS 3.0, the IμS DIAMOND II sets a new benchmark for microfocus X-ray sources. This breakthrough system outperforms conventional small-focus rotating anode technology, delivering unmatched performance and long-term stability.

Diamond hybrid anode for exceptional heat management

At the core of the IμS DIAMOND II is our diamond hybrid anode. By leveraging the extraordinary thermal conductivity of diamond—up to five times higher than copper—we achieve maximum heat dissipation. This allows the anode to handle higher power densities at the focal spot, boosting X-ray intensity without compromising durability.

High-emission cathode and active electron lens for superior output

Our newly developed high-brightness cathode produces a denser, high-flux electron beam compared to traditional filaments. Paired with an active electron lens, it enables precise, real-time control of beam focus and instantaneous wavelength switching in dual-source setups—all while maintaining constant power to reduce thermal stress.

The result is outstanding intensity, excellent longevity, and minimized thermal stress on the system—ensuring maintenance-free, long-lasting source integrity and superior performance for demanding applications.


DIAMOND
Cu
X-RAYS ON
SHUTTER OPEN
IμS
DIAMOND
Ag
X-RAYS ON
SHUTTER OPEN
IμS

IμS DIAMOND II with HELIOS MX for Ag, Mo, and Cu radiation

Delivers 20% higher average intensity than microfocus rotating anode sources

Advanced optics deliver a monochromatic X-ray beam focused onto the sample, reducing scattered X-ray background by up to a factor of ten

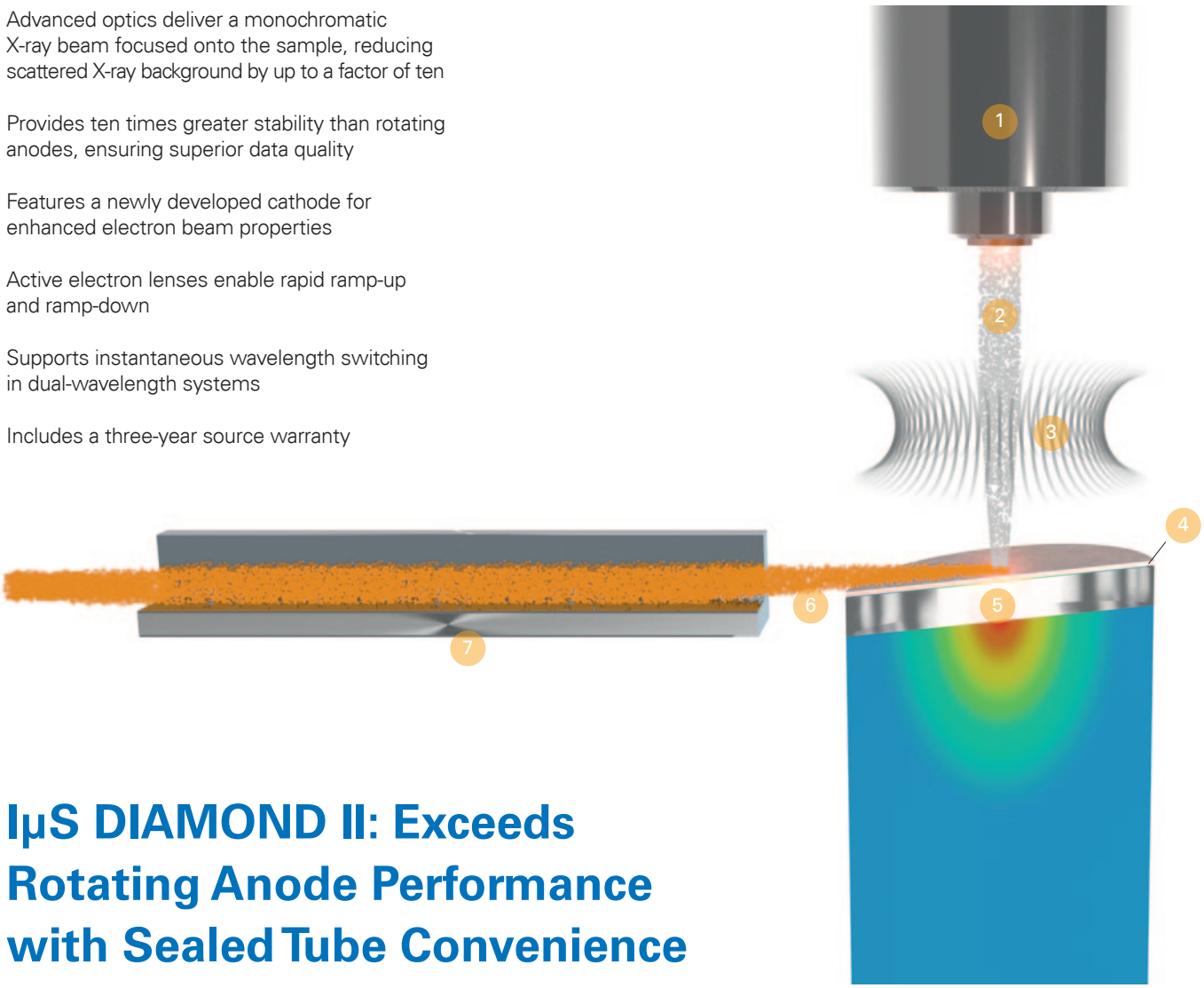
Provides ten times greater stability than rotating anodes, ensuring superior data quality

Features a newly developed cathode for enhanced electron beam properties

Active electron lenses enable rapid ramp-up and ramp-down

Supports instantaneous wavelength switching in dual-wavelength systems

Includes a three-year source warranty



IμS DIAMOND II: Exceeds Rotating Anode Performance with Sealed Tube Convenience

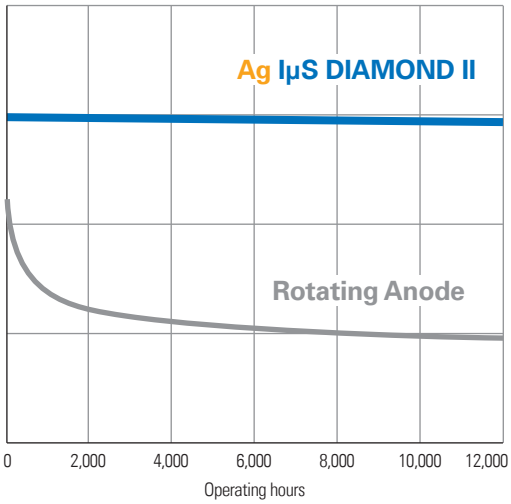
Diamond conducts heat five times better than copper, making it ideal for cooling the intense heat loads in modern microfocus sources. Incoatec has implemented this technology in the diamond hybrid anode, which is exclusively designed for crystallography. To fully leverage this innovation, the IμS DIAMOND II features a newly developed cathode that enhances electron beam properties, along with active electron lenses that enable fast ramp-up and ramp-down, as well as instantaneous wavelength switching in dual-wavelength systems. This unique source technology allows for an increased power load on the anode resulting in X-ray intensities that outperform conventional microfocus rotating anode generators.

Complementing the brilliance of the IμS DIAMOND II tube, our top-tier HELIOS MX mirrors deliver a highly uniform, high-intensity beam—surpassing the output of traditional rotating anode X-ray sources.

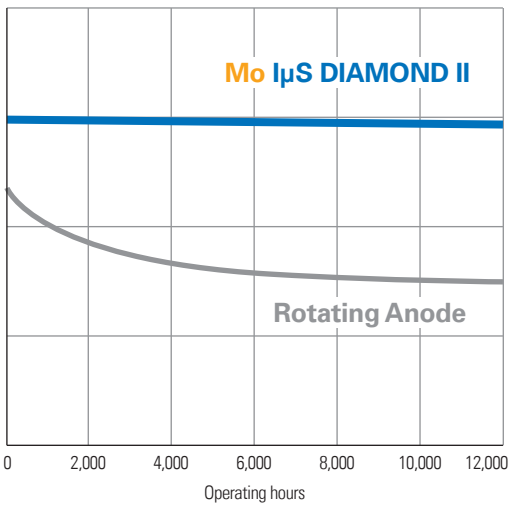
The IμS DIAMOND II is setting a new standard for high-intensity SC-XRD applications.

1. Newly developed cathode delivers a strong and homogeneous electron beam
2. Focused electron beam for optimal X-ray generation
3. Active electron lens enables instantaneous transitions from standby to operation mode
4. Take-off angle optimized for crystallography
5. Diamond hybrid anode provides the highest X-ray brightness, thanks to the diamond substrate's exceptional thermal conductivity
6. Very high intensity X-ray beam
7. HELIOS MX optics deliver synchrotron-quality performance with ultimate precision in d-spacing

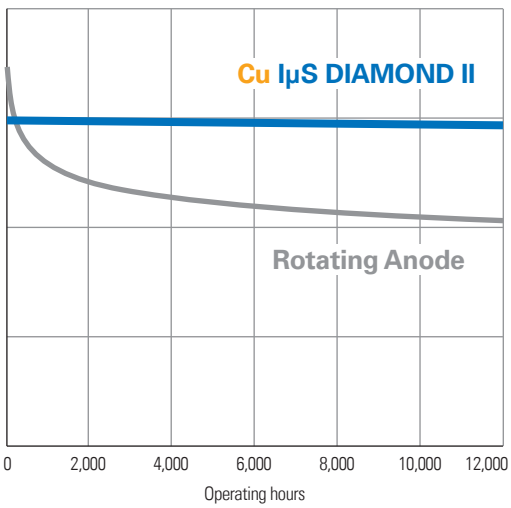
Ag radiation: Relative intensity over time



Mo radiation: Relative intensity over time



Cu radiation: Relative intensity over time

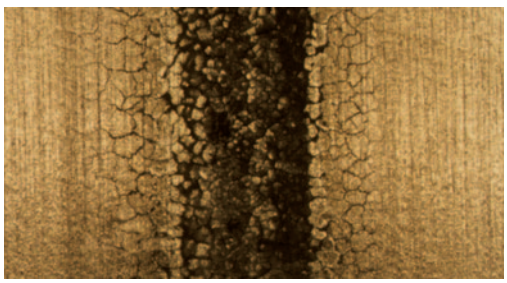


Did you Know?

Rotating anodes are excellent for line focus applications, as they produce high flux. However, for point focus applications like single-crystal X-ray diffraction (SC-XRD), they experience rapid intensity loss due to surface damage on the anode.

Crazing on a rotating anode X-ray tube refers to the formation of surface cracks and imperfections on the target material, which are caused by repeated heating and cooling cycles during operation. This is a common failure mode that negatively impacts tube performance and lifespan.

In contrast, the IμS DIAMOND II maintains a constant heat load on its surface, resulting in stable output over time. Thereby, the IμS DIAMOND II outperforms microfocus rotating anodes, offering superior stability and lower operating costs.

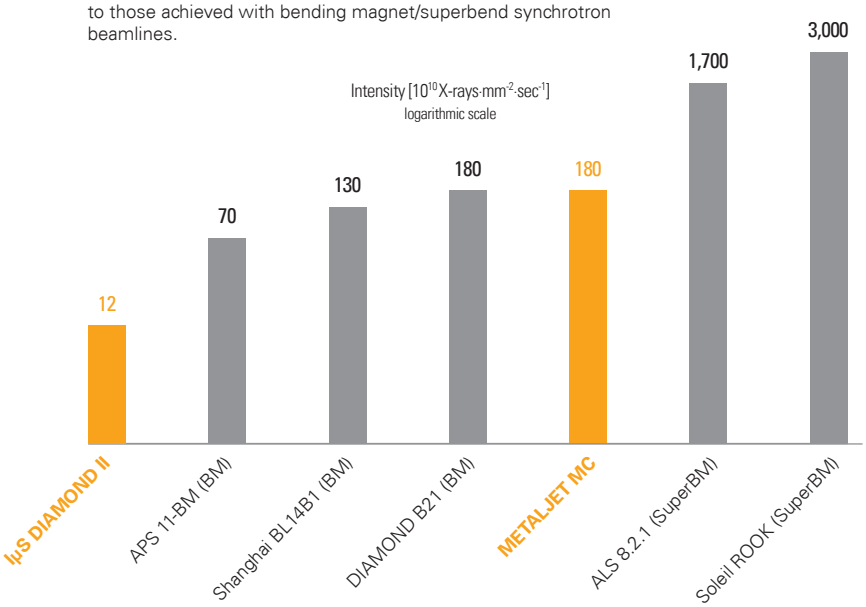


A dead rotating anode target

After twelve months of operation, the rotating anode target often suffers from surface damage. While the anode can sometimes be polished to restore performance, it will eventually require a costly complete replacement.

Home sources vs. synchrotron beamlines

The METALJET MC delivers in-house X-ray intensities comparable to those achieved with bending magnet/superbend synchrotron beamlines.



D8 VENTURE MC for top-tier in-house performance

METALJET MC: Beamline Capabilities in Your Lab

The METALJET MC opens up new research opportunities by enabling you to determine structures from crystals that previously could be only measured at synchrotron beamlines. It combines the data quality of a synchrotron source with the accessibility of an in-house system.

Equipping your laboratory with METALJET MC capability increases efficiency and productivity and makes it possible for you to measure sensitive crystals that do not survive the journey to the synchrotron.

Ten times brighter than other in-house X-ray sources

With an intensity over ten times higher than any other home source and a beam diameter comparable to that found at modern beamlines, the METALJET MC is the nearest you can get to a synchrotron beamline for the home-laboratory.

Beamline quality data

Integrated in the D8 VENTURE, the METALJET MC routinely achieves data quality similar to that achieved at beamlines. This is particularly beneficial when dealing with poorly diffracting microcrystals, crystals with high solvent content or disorder, commonly formed from proteins or porous materials.

Enhanced throughput and productivity

The METALJET MC collects complete data quickly, significantly increasing the number of datasets that can be processed per day. This makes it ideal for central facilities measuring large numbers of samples and for the high throughput required in drug discovery.

Always available

The METALJET MC is fully integrated into the D8 VENTURE platform to achieve superb stability and uptime. The instrument is always accessible when you need it, no waiting for beamtime, shipping delays or shutdowns.


METALJET

METALJET MC for Ga-radiation

Over ten times the intensity of rotating anodes, with significantly lower power consumption

Ideal for analyzing very small or weakly diffracting crystals.

Liquid gallium jet source delivers synchrotron-quality data from an in-house solution

High brilliance LaB_6 cathodes and advanced electron optics achieve a uniquely high-power density in a small focal spot

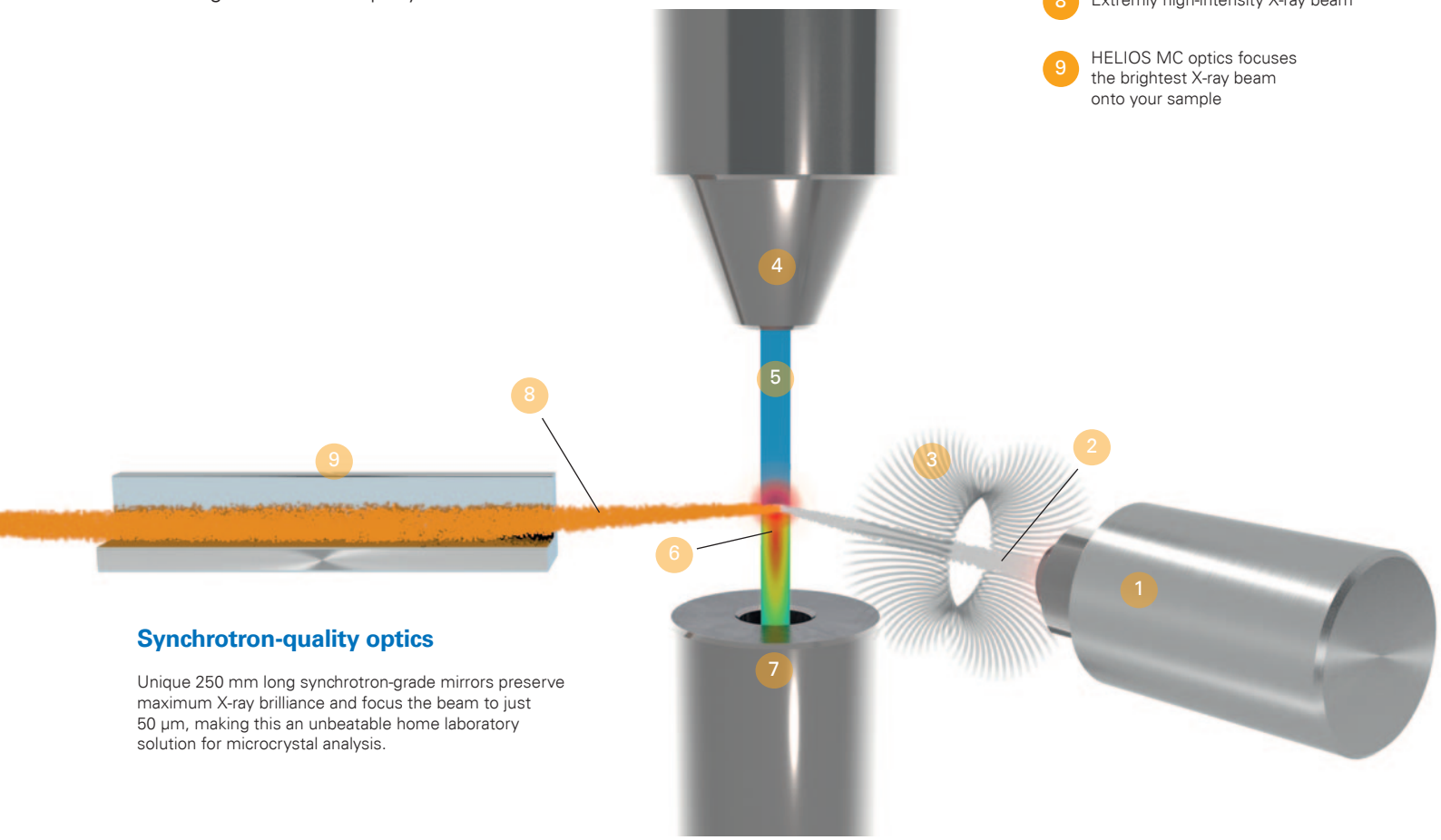
High speed liquid metal jet anode technology accepts higher thermal load resulting in a much brighter X-ray beam

25 cm HELIOS MC optics conserves the high brilliance for unparalleled microfocus beam intensity

Long lifetime cathode and constantly refreshed anode ensure long-term beam stability and minimized down time.

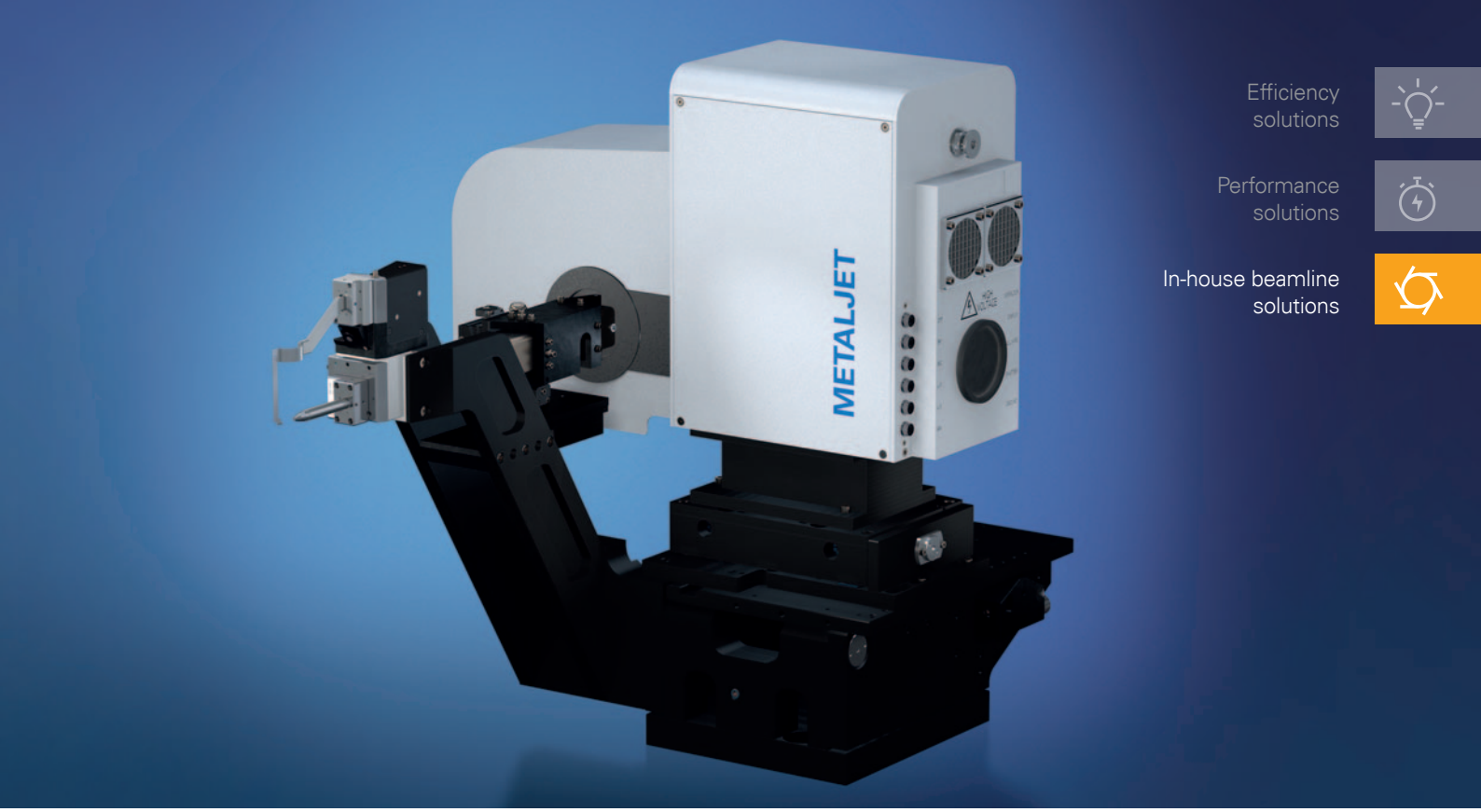
One single maintenance per year

1. Fully stabilized, high brilliance cathode
2. High flux electron beam, focused onto the liquid metal target
3. Electron lenses for beam positioning and focusing
4. Nozzle dispensing a continuous stream of fresh liquid metal
5. High speed liquid metal jet
6. Highly efficient heat dissipation provided by the high-speed metal jet stream
7. Liquid metal sink (alloy reservoir, closed loop)
8. Extremly high-intensity X-ray beam
9. HELIOS MC optics focuses the brightest X-ray beam onto your sample



Synchrotron-quality optics

Unique 250 mm long synchrotron-grade mirrors preserve maximum X-ray brilliance and focus the beam to just 50 µm, making this an unbeatable home laboratory solution for microcrystal analysis.



Ga
$K\alpha$ 1.34 Å

Why Gallium Radiation?

With a wavelength of 1.341 Å, the METALJET MC's Ga K_α radiation is slightly shorter than that of Cu K_α, making it especially suitable for analyzing samples composed of lighter atoms such as proteins, MOFs, COFs and organic compounds.

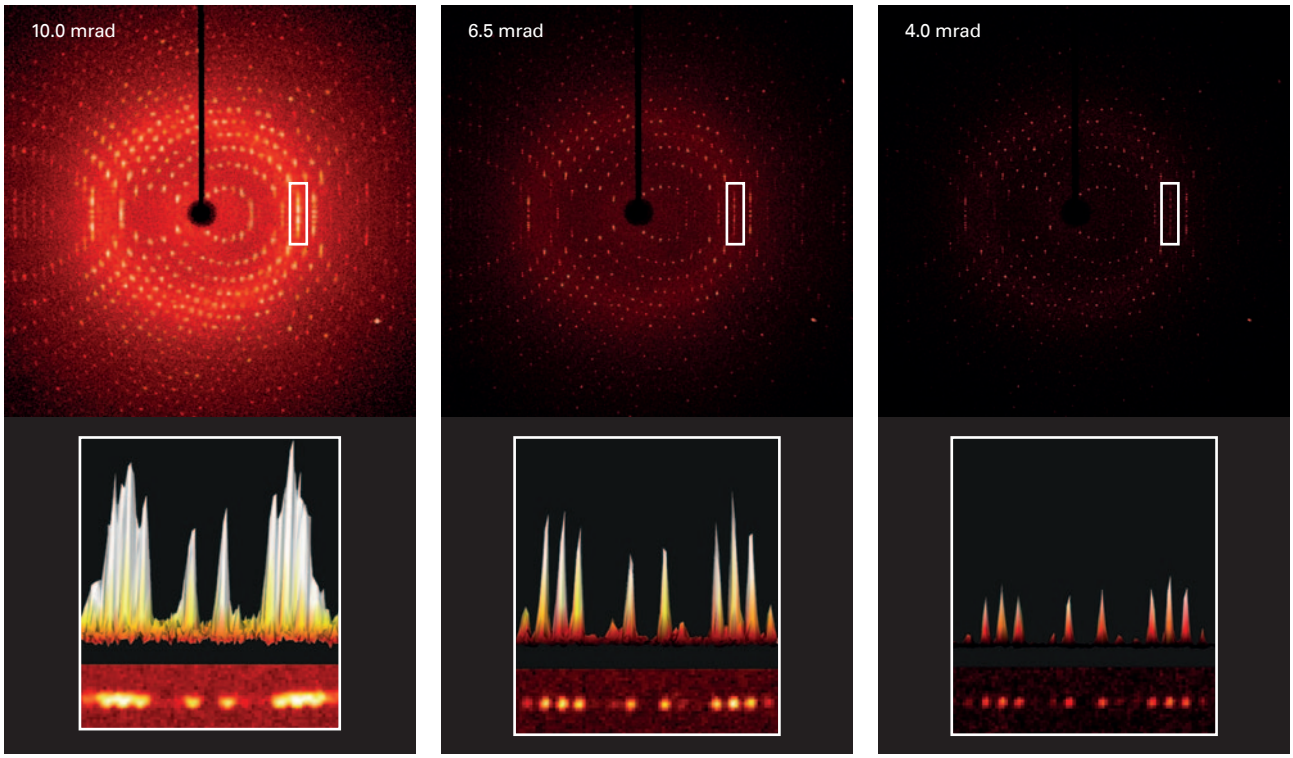
Like Cu K_α, Ga K_α interacts strongly with these materials and provides an excellent signal-to-noise ratio. The shorter wavelength of Ga K_α further reduces X-ray absorption and air scattering, enhancing data quality.

The METALJET MC is today's most intense in-house X-ray source.

Beam Conditioning — Simple, Fast, Reliable

Maximizing intensity on your sample is essential for obtaining the best signal from weak crystals and for reducing measurement times. When overlapping reflections are a concern, such as with large unit cells, modulation, or twinned crystals, the beam divergence can be easily adjusted to achieve optimal peak separation. Selectable collimators allow you to set the beam divergence anywhere from 2 to 13 mrad in just seconds, with no need for realignment. Component recognition automatically records the current settings in the experiment library and frame header.

A protein crystal was measured at a detector distance of 40 mm, using the same exposure time for each measurement. The insets demonstrate improved peak separation along the 150 Å c-axis as beam divergence is reduced. However, lower divergence also decreases primary beam intensity, so longer exposures are required to achieve the same resolution.



Our X-rays are "Green"

Environmentally friendly IμS sources are game changers for crystallography, delivering higher brilliance than traditional high-power rotating anode technology. In addition to outstanding intensity and beam stability, nearly 3,000 users appreciate the long tube lifetime and significantly lower cost of ownership compared to all other options.

Future-proof solutions saves 26 t of CO_2 per year *

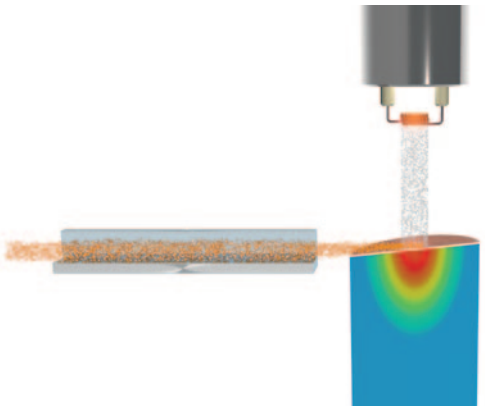
Single-phase power saves 43,000 kWh electrical energy per year *

No water supply saves 1,700 m³ cooling water per year *

*Based on 24-hour operation, 300 days per year with IμS DIAMOND II and PHOTON IV.

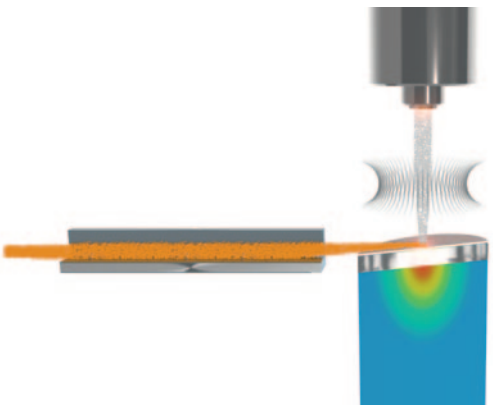
IμS 3.0, Ag, Mo, Cu

A high-performance X-ray source system, including tube, tube shield, and optics with optimized take-off angle. Each component specifically engineered to meet the demands of single-crystal X-ray diffraction.



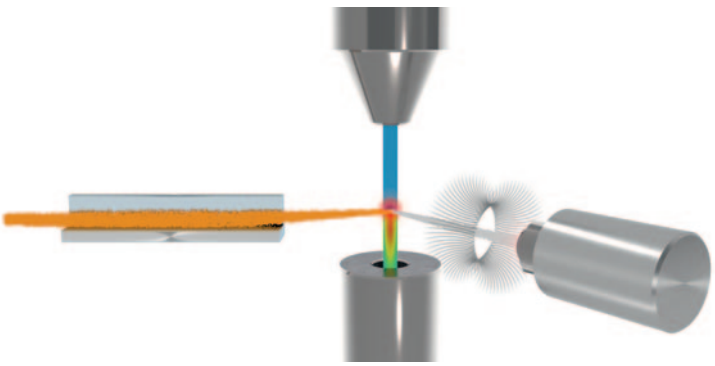
IμS DIAMOND II, Ag, Mo, Cu

Exceptional performance and the highest sealed tube intensities are achieved through advanced hybrid-diamond technology, high-brightness cathodes, and synchrotron-quality optics.



METALJET MC, Ga

Delivers beamline-level intensity for your home laboratory, tailored to the needs of the smallest crystals. METALJET MC is the world's most powerful in-house X-ray source for challenging microcrystal analysis.



Sources, Structures and Success

Choosing the ideal X-ray source is critical to the success of your research. Consider these key factors to ensure the best results:

Application Needs: Identify the specific requirements of your research. Are you working with organic samples, small crystals, or materials science applications? Our X-ray sources are optimized for a wide range of sample types, offering dependable and efficient performance.

Wavelength: Selecting the right wavelength is essential for your application. For example, brighter molybdenum (Mo) sources enhance versatility, while silver (Ag) radiation offers higher resolution with lower absorption and extinction effects—benefits that are increasingly recognized in advanced research.

Uptime and Stability: Evaluate the source's lifetime and stability. Long-lasting sources with minimal intensity decay, such as Bruker's sealed tube sources, ensure consistent performance and reliable results over time.

Features and Benefits

	Feature	Benefit
Efficiency solutions		
IμS 3.0 Microfocus source	All components are specifically engineered and optimized for single-crystal X-ray diffraction. Radiation / Beam size at focus [μm] / Intensity [X-rays·mm^{-2}·sec^{-1}] Ag 100 1.5×10^9 Mo 100 3.3×10^9 Cu 100 76.0×10^9	Dedicated, highly efficient X-ray source with long lifetime and minimized maintenance meeting the demanding requirements of SC-XRD.
Cooling	Active air-cooling	No anode corrosion and no risk of water leakage
Warranty	3 years on the complete source	
Typical tube lifetime	5 years, 99% uptime	
Performance solutions		
IμS DIAMOND II Diamond Hybrid Anode source	Sealed tube solution harnessing Diamond Hybrid Anode and new high-brightness cathode technology Radiation / Beam size at focus [μm] / Intensity [X-rays·mm^{-2}·sec^{-1}] Ag 80 3.8×10^9 Mo 80 10.6×10^9 Cu 80 120.0×10^9	High-performance microfocus sealed tube system delivers intensities previously only available from high-power rotating anode sources Proven to be the most energy-efficient solution on the market.
Tube design	Active electron lenses	Long source lifetime, instantaneous wavelength switch in dual wavelengths solutions
Cooling	Active air-cooling	Zero deterioration of the anode backside, zero risk of water leakage
Warranty	3 years on the complete source	
Typical tube lifetime	5 years, 99% uptime	
In-house beamline solutions		
METALJET MC Liquid metal jet source	Liquid metal jet technology provides a continuously renewed target Radiation / Beam size at focus [μm] / Intensity [X-rays·mm^{-2}·sec^{-1}] Ga 50 $1{,}8 \times 10^{12}$	Consistently high performance and intensity.
Cooling	Water-air chiller	Closed, low-pressure water circuit efficiently handles the higher power load at the anode.
Maintenance interval	1 year, 95% uptime	
All source solutions		
Optics	HELIOS optics in a hermetically sealed, helium-filled housing delivers high spectral purity at the sample.	Highest intensity at the sample position
Beam path	Ultra-stable downstream alignment	Sturdy beam positioning and maximum intensity. No realignment, no downtime..
Beam conditioning	Sets of collimators with matching beam stops feature component recognition and magnetic mounting for secure, precise, and convenient adjustment.	Beam properties can be adjusted easily, quickly, and reproducibly whenever needed.

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