Product Sheet SC-XRD 55

Microfocus made perfect: IμS 3.0

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

The launch of the first Incoatec Microfocus Source (IμS) marked the dawn of a new era in X-ray sources for crystallography.

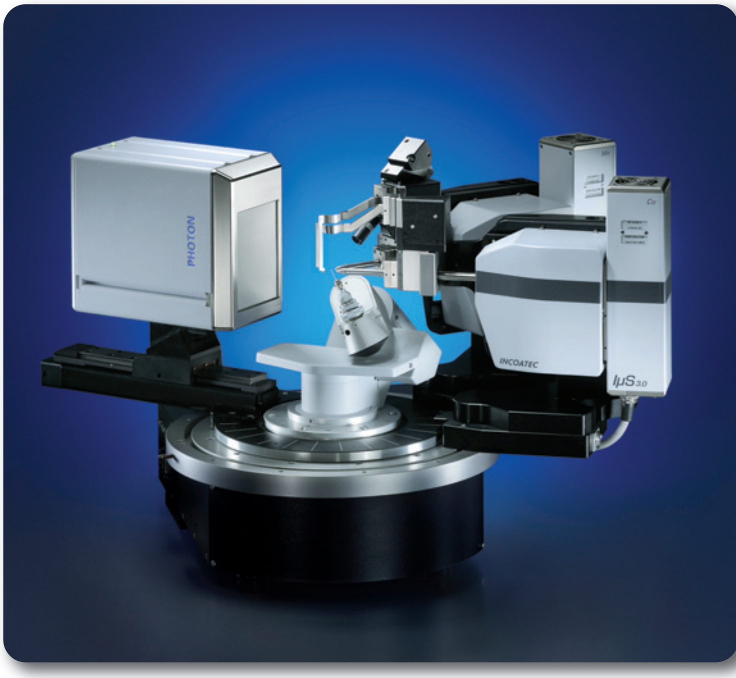
Today, 10 years later, with nearly 700 sources operating worldwide, the IμS has set the standard for performance and reliability. It is therefore with great pleasure and excitement that Bruker and Incoatec unveil the latest breakthrough in microfocus technology: the IμS 3.0.

The IμS 3.0 is the first-ever microfocus source designed from the ground up for crystallography. This means that the IμS 3.0 makes no compromises: every aspect of the source is specifically designed and manufactured for X-ray crystallography.

Features

- Up to twice the X-ray intensity of conventional X-ray microfocus sources
- Completely air-cooled
- Very low power consumption
- Very long tube lifetimes
- Very little decay of intensity with time
- Most stable X-ray output
- Hermetically sealed, He-purged beampath
- High-reliability, 3-year warranty

IμS 3.0: a source optimized for crystallography



Dual-source configuration with
Mo IμS 3.0, Cu IμS 3.0, KAPPA, and PHOTON II

This means that you get a much brighter beam than ever before: up to twice the intensity of conventional microfocus sources.

Conventional microfocus sources are designed primarily for NDT (that is, non-destructive testing methods such as radiography) and are only imperfectly adapted for crystallography. To produce radiographs of extended objects (for example, of pipe welds), an NDT source must produce a broad fan of radiation. In crystallography, however, the source must produce exactly the opposite: an intense, focused beam of radiation. NDT sources are not designed for producing such focused beams, and thus much of the X-ray flux is simply wasted.

The IμS 3.0 is different; it was specifically designed for crystallography and only crystallography. There are, therefore, none of the performance compromises inherent in conventional microfocus sources. This allows the IμS to achieve an astonishing increase in performance: up to twice the intensity of other, conventionally-designed microfocus sources.

The most advanced beampath: better stability and less absorption

A stable incident beam is crucial when it comes to challenging experiments, such as charge-density investigations in chemical crystallography, or SAD-phasing experiments in structural biology.

The IμS 3.0 combines tube and tube shield into a single, precision-aligned unit: the source. This completely new, high-precision mechanical design allows the source to be aligned with a degree of precision never before possible. This means that the high-brilliance beam is perfectly centered, and it also remains perfectly stable over time—ensuring the best possible data quality.

Finally, the new IμS 3.0 is the first and only microfocus source to feature a hermetically-sealed, Helium-purged beampath. This eliminates the expensive waste of Helium in open-purged designs or the vacuum pump needed in other conventional sources (which is a potential failure mechanism and also a source of vibrations). Purging the entire beam path also significantly reduces air absorption.

The IμS: a tradition of proven reliability

With almost 700 installed tubes, the IμS has an enviable record of reliability and long, trouble-free tube lifetimes. The IμS 3.0 continues this tradition of superb reliability, still backed by the unparalleled, industry-leading 3-year intensity warranty.

Air-cooling: good for you, good for the environment

The IμS pioneered the use of air cooling, and the IμS 3.0 is still the only microfocus source that is completely air-cooled. Because air cooling is technically challenging, other conventional microfocus sources still use simpler water-cooled designs. However, though water cooling is easier to implement, it has a number of serious disadvantages.

First of all, the water chillers used to cool conventional tubes require routine maintenance (including filter and coolant replacement), and they are also relatively prone to failure because they employ a large number of moving parts in the pumps and compressors. Secondly, water cooling requires the use of noxious, environmentally-unsafe coolant additives to reduce corrosion and algae growth. Thirdly, water cooling is relatively energy-inefficient; water-cooled sources require significantly more total energy consumption. Finally, despite the best corrosion inhibitors, water cooling corrodes the anode assembly, gradually leaving a coating of insulating oxide. For this reason, water-cooled tubes gradually lose cooling efficiency and their X-ray output becomes seriously degraded over time.

The IμS 3.0's advanced air cooling completely eliminates the unreliable water chiller, improving overall reliability.

It also eliminates the need for routine maintenance, and uses up to 80% less power, saving money and protecting the environment. Best of all, the air-cooled tubes' corrosion-free design features significantly longer lifetimes and less degradation of output. This is the reason why the IμS 3.0 can offer its unique intensity guarantee: less than 30% degradation of tube output after 3 years.

Thus, the IμS 3.0 protects your investment even as it protects the environment.

HELIOS optics: the best source demands the best optics

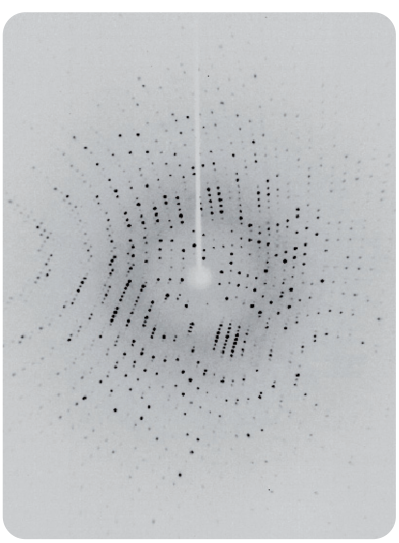
Bruker invented the very first multilayer X-ray optics and, together with our partner Incoatec, has since pioneered a number of key innovations including high-reflectivity multilayers and very low-figure-error substrates. Our latest-generation HELIOS optics are based on this unparalleled wealth of experience—offering, very simply, the best beam quality possible.

"Figure errors" are imperfections in the optics' surface which lead to scattering of the X-ray beam. By dramatically reducing figure errors, the HELIOS optics offer a better quality, higher-brilliance beam.

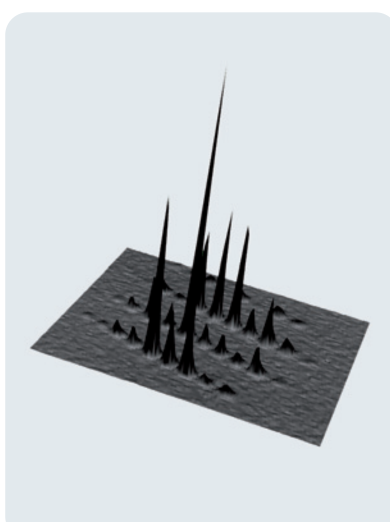
The bottom line: a great source is now even better!

The IμS has already been the most reliable and brightest microfocus source available. So… why mess with success?

Simply because science cannot stand still. Neither can we. Ever-more-challenging crystallographic experiments demand ever-brighter, higher-quality beams. The IμS 3.0 delivers the ideal source for your most demanding experiments—today and tomorrow.



Diffraction pattern from a D8 VENTURE system, equipped with IμS 3.0 and PHOTON II detector



Detailed diffraction peaks demonstrating very low background and excellent spatial resolution

HELIOS optics, Helium-filled and hermetically sealed

Technical Specifications

Specification	Value
Beam intensity (HELIOS optics) [10^9 photons $s^{-1}mm^{-2}$]	
Copper (1.5418 Å)	24
Molybdenum (0.7107 Å)	2.5
Silver (0.5599 Å)	1.2
Beam size at the sample position [µm]	
Copper (1.5418 Å)	100
Molybdenum (0.7107 Å)	110
Silver (0.5599 Å)	80
Cooling	air-cooled
Beampath and optics purge	He-filled, hermetically sealed (featuring UHV techniques)
Power load	up to 80 W, single-phase power

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Selecting the right wavelength for your sample can significantly improve the quality of the experiment.

Cu radiation (1.5418 Å)

is the optimum X-ray wavelength for macromolecular crystallography and organic samples in the home lab.

- Copper photons' strong interaction with the light atoms found in biological macromolecules and organic samples ensures the highest diffracted intensity
- Copper's longer wavelength expands the diffraction spacing giving access to very large cell edges; it also helps with the deconvolution of twins and handling of modulated structures
- Copper radiation provides a sufficiently large anomalous signal for both absolute structure determination from chiral organic samples and SAD phasing from proteins and nucleic acid crystals

Mo radiation (0.7107 Å)

is the optimum X-ray wavelength for chemical crystallography in the home lab.

- Molybdenum photons interact strongly with the heavy atoms typically found in chemical crystallography samples, enabling the collection of high quality data from a wide range of samples
- Molybdenum radiation is ideal for efficient coverage of reciprocal space, streamlining collection of high-multiplicity data
- If absorption correction is required, efficient and easy-to-use empirical and numerical absorption corrections are available and very well-established

Ag radiation (0.5599 Å)

is the optimum X-ray wavelength for charge density and high-pressure experiments in the home lab.

- Silver radiation has the benefit of lowest absorption and extinction effects
- Silver radiation's shorter wavelength allows higher-resolution data collection for charge-density experiments
- Silver's small beam and compressed diffraction pattern are ideal for diamond anvil cells with small apertures and limited accessible diffraction angles

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