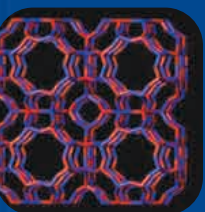
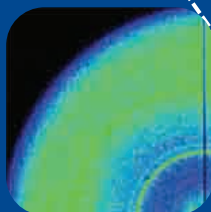
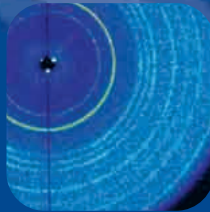


+ Optics and Beam Delivery Systems Product Range

**Enhanced
performance for
your application**

Xenocs
Brighter solutions



The evolution and multiplication of advanced X-ray analysis applications bring new challenges in X-ray instrumentation. More photons onto the sample is the way to go for many applications.

For many years this has been synonymous with high price tag rotating anodes.

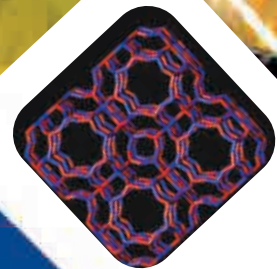
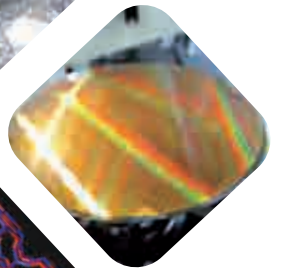
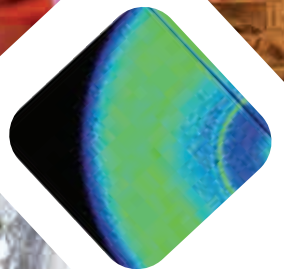
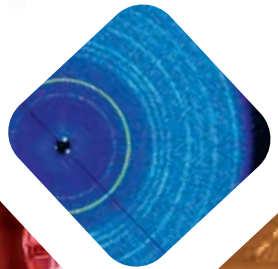
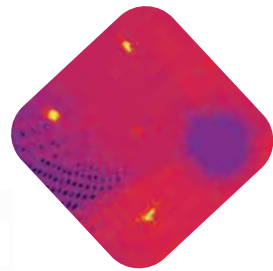
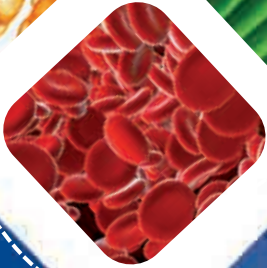
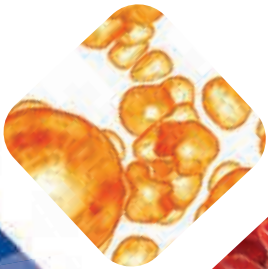
With its add-on product range, Xenocs offers a real alternative to researchers who wish to enhance the performance of their existing diffractometer either by replacing or upgrading their existing generator.

Xenocs has developed a complete range of advanced single reflection optics that brings unmatched performances. These optical components are available as upgrades for existing rotating anode generators, standard sealed tubes or imbedded into Xenocs new generation beam delivery system: GeniX 3D.

Since its creation in 2000, Xenocs has been dedicated to offer to its customers, leading edge solutions for advanced X-ray analysis.

Based on its unique product concepts and proprietary technologies, Xenocs brings an unprecedented level of performance to its customers.

Hundreds of research groups around the world and renowned Original Equipment Manufacturers in the X-ray analytical market trust Xenocs to provide them with the best solution to fulfill their requirements.



Product Range at a Glance

GeniX^{3D}

GeniX 3D is a real alternative to the most advanced rotating anodes in a more compact, stable and low cost of ownership package. It is definitely the solution to consider for any new setup investment or replacement of an existing rotating anode.

GeniX 3D comes in different energy, focal length and beam geometry configurations to adapt to any kind of X-ray material analysis.



FoX^{3D} add-ons

When it comes to increasing the performance of new generation rotating anodes, FOX 3D optics is the way to go. Based on its unique technology and single reflection optical design, FOX 3D brings unprecedented level of performance and ease of use.

FOX 3D alignment housing is compatible with most of the rotating anode generators available on the market.



Sealed tube FoX^{3D} add-ons

Traditional sealed tubes remain largely present on the market as a standard solution for many XRD applications. When 2-dimensional resolution is required, a 2D highly collimated beam is necessary. Unfortunately traditional optics on diffractometers often do not offer this capability.

Adapted to most of the diffractometers on the market, Xenocs sealed tube FOX add-on enables new 2D beam shaping capabilities for advanced XRD applications.



GeniX^{3D}

The alternative for High End beam solution



GeniX 3D is a further step in Xenocs' tradition of high performance, ease of use and integration to

serve the continuous demand for advanced and reliable X-ray source systems.

GeniX 3D is designed to be easily integrated as a standard sealed tube system and adaptable to any type of diffractometer. It is available in various energy, focal length and beam geometry configurations covering most of the techniques for advanced X-ray analysis.

Coming with a 3 year warranty, GeniX 3D is the perfect solution for trouble free high performance beam.

Enhanced performance

Based on its unique design, GeniX 3D brings unprecedented level of performance in a compact, stable and low cost of ownership package.

GeniX 3D is empowered by Xenocs proprietary FOX 3D optics, providing unmatched intensity and control of the beam parameters.

This combination makes GeniX 3D the brightest micro focus sealed tube X-ray beam delivery system available on the market.

Trouble free operation and installation

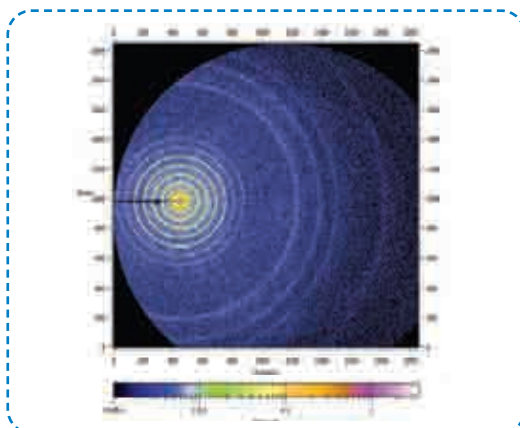
GeniX 3D benefits from a fixed and referenced output beam for a straightforward installation and

alignment. It is provided with a smart user interface for efficient and intuitive control and

monitoring of key operating parameters, ensuring long life time.

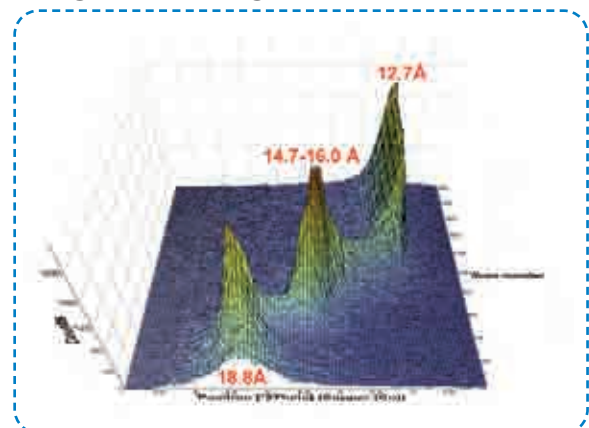
Customer references

- One shot SAXS/WAXS measurement done with Genix Mo ULD at CEA Marcoule



© Data courtesy of Dr Olivier Diat, ICSM - CEA Marcoule, France

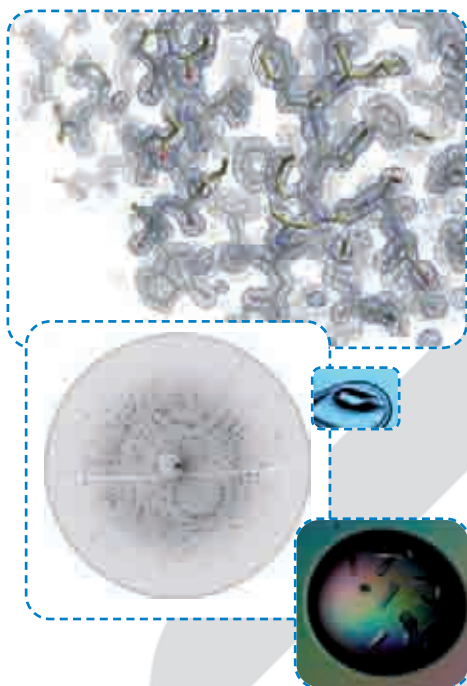
- Monitoring of dehydration kinetic in clays using GeniX Cu High Flux at NHM London



© Data courtesy of Dr Gordon Cressey & Dr Jens Najorka, Dept of mineralogy, National Museum History, London, UK.

Customer references

Trypsin structure resolved at EMBL with GeniX 3D Cu High Flux



Crystal name	Trypsin 1	Trypsin 2	Trypsin 3
Crystal size ($\mu\text{m} \times \mu\text{m} \times \mu\text{m}$)	200 x 200 x 600	150 x 150 x 600	80 x 80 x 600
X-ray Source	GeniX 3D	GeniX 3D	GeniX 3D
Cell parameters ($\text{\AA}, \text{\AA}, \text{\AA}$)	60.10 64.17 69.95	61.35 63.69 68.90	60.22 64.15 69.91
Mosaicity ($^\circ$)	0.72	1.04	0.69
Total rotation range ($^\circ$)	180	180	180
Oscillation amplitudes ($^\circ$)	1	1	1
Number of spot recorded (% of increase versus GeniX)	104 552 (+6%)	116 330 (+5%)	112 003 (+31%)
Unique reflections	15 889	16 153	15 956
Overall completeness (%)	>99	>99	>99
Redundancy	6.6	7.2	7.0
(I/ σ) low – high resolution (% of increase versus GeniX)	67-8.5 (+41%)	77-9.9 (+80%)	57-5.7 (+128%)
Resolution limits ($\text{\AA} - \text{\AA}$)	20-2.1	20-2.1	20-2.1
Linear Rf overall (low-high res) %	4.9 (2.9-16)	3.8 (2.0-17)	8.7 (2.7-42)
Exposure time (sec)	45	60	120

© Data courtesy of Dr Hassan Belrhali, EMBL (European Molecular Biology Laboratory), Grenoble, France.

Table III: Crystallographic data statistics. 3 bovine trypsin crystals of various sizes have been used. All trypsin crystals used belonged to orthorhombic $P2_1 2_1 2_1$ space group and were large needle shaped. The crystal long axis was roughly oriented along the spindle axis during data collection.

Product range

High Flux solutions

Model	Beam size at focus (μm)	Divergence (mrad)	Flux (ph/sec)	Typical application
GeniX 3D Cu High Flux	< 190	6	> 400 x 10 ⁶	Protein Crystallography Stress Analysis Powder diffraction
GeniX 3D Mo High Flux	130	5	> 25 x 10 ⁶	Small Molecule crystallography High pressure
GeniX 3D Cr High Flux	< 190	6	> 300 x 10 ⁶	Stress Analysis

Small spot solutions

Model	Beam size at focus (μm)	Divergence (mrad)	Flux (ph/sec)	Typical application
GeniX 3D Cr Micro Spot	< 30	17	> 12 x 10 ⁶	Stress Analysis Micro-XRF Micro-XRD
GeniX 3D Cu Micro Spot	< 30	17	> 18 x 10 ⁶	Stress Analysis Micro-XRF Micro-XRD
GeniX 3D Cu High Convergence	60	70 x 35	> 400 x 10 ⁶	Rapid X-ray Reflectometry (full-option) Scanning X-ray reflectometry (with slit) Micro X-ray fluorescence Small spot diffraction on thin film

Collimating solutions

Model	Beam size at focus (μm)	Divergence (mrad)	Flux (ph/sec)	Typical application
GeniX 3D Cu Ultra Low Divergence	1000 x 1500 at mirror exit	0.4	> 100 x 10 ⁶	Small Angle X-ray scattering HRXRD
GeniX 3D Mo Ultra Low Divergence	750 x 1200 at mirror exit	< 0.4	> 5 x 10 ⁶	Small Angle X-ray scattering HRXRD



FoX^{3D} add-ons



Enhanced performance for new generation rotating anode generators

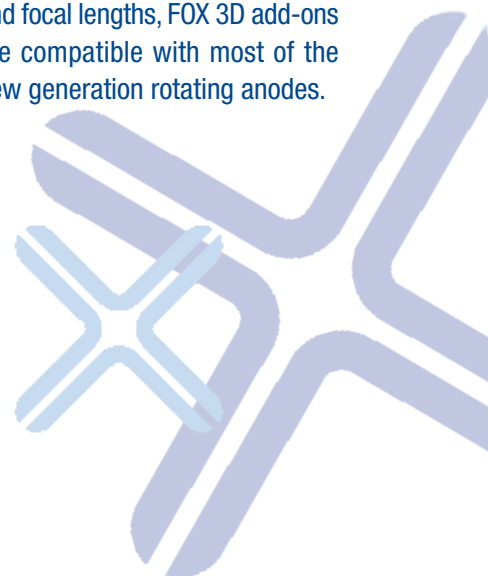


FOX 3D is the most recent evolution of Xenocs proprietary single reflection optics. Based on its unique design, FOX 3D brings unmatched performances compare to traditional Montel optics.

With its smart alignment stage and X-ray beam monitoring camera, alignment procedure of a FOX 3D optic takes only few minutes!



This allows a straightforward installation and keeping optics performances after maintenance of the source.

Available for different energies and focal lengths, FOX 3D add-ons are compatible with most of the new generation rotating anodes.



Increased flux

X-ray multilayer coatings do not have 100% reflectivity. When using Montel optics, significant useful flux is consequently wasted since multiple reflections are necessary to generate the 2D focalized or collimated beam.

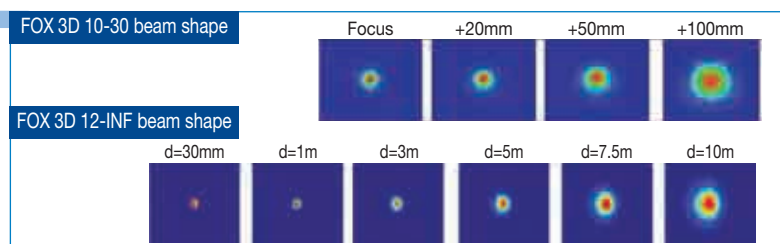
Mirror Type	 MontelMirrors	 FOX 3DMirrors
Optic Efficiency (Calculated over mirror length for 70µm source, Cu energy)	Eff = 42 %	Eff = 62 %

FOX 3D optics benefit from Xenocs proprietary single reflection concept to bring higher flux onto the sample.



Better beam shape

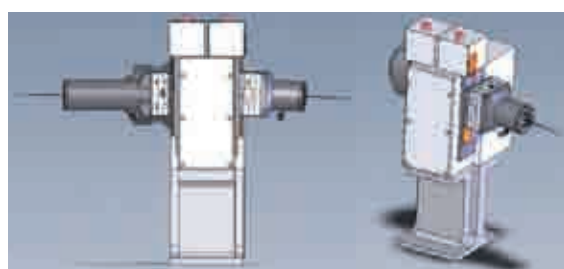
Based on Xenocs proprietary replication technology, FOX 3D optics are based on a truly aspheric design, providing high precision beam shaping for ultimate performances.



Ease of integration

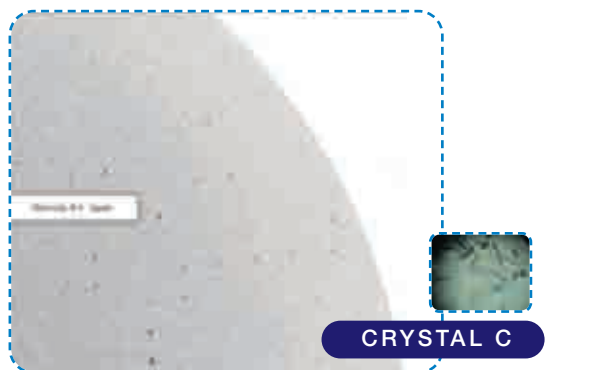
FOX 3D optics comes in a compact and stable alignment housing that fits most existing new generation rotating anodes, allowing a trouble free installation.

FOX 3D add-ons operate under vacuum ensuring no degradation of the optic over many years of intensive use.



Customer references

Protein crystallography at Sanofi-Aventis done with FOX 3D Cu 14-39 on a 70 µm rotating anode generator



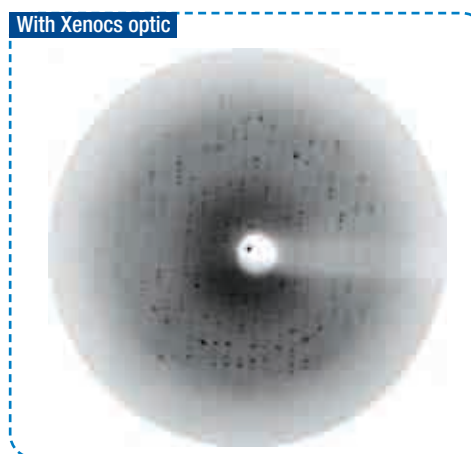
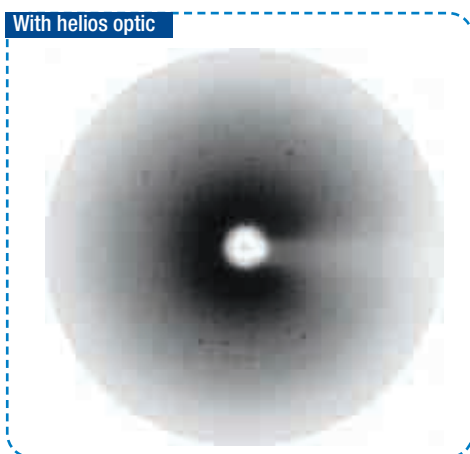
Size : 100*60*60 µm³
 MA345ddb slits : 1*1/0.8/0.8 mm
 Distance : 175 mm
 Dphi/image : 1°
 Exposure time : 5'
 Space group : I222
 # collected images : 120

FOX 3D Cu 14-39P			
	Overall	InnerShell	OuterShell
Low resolution limit	24.69	24.69	2.14
High resolution limit	2.03	6.42	2.03
Rmerge	0.128	0.045	0.455
Rmeas (within I+/-)	0.144	0.051	0.514
Rmeas (all I+ & I-)	0.144	0.051	0.514
Rpim (within I+/-)	0.064	0.023	0.233
Rpim (all I+ & I-)	0.064	0.023	0.233
Fractional partial bias	-0.014	-0.007	-0.144
Tot. # of observations	91220	2994	11383
Total number unique	19263	676	2529
Mean(I)/sd(I)	13.5	45.4	3.0
Completeness	98.3	98.1	89.4
Multiplicity	4.7	4.4	4.5

© Data courtesy of Magali Mathieu and Valérie Steier, Sanofi-Aventis-Vitry, France

FOX 3D Cu 14-39: the ideal optic for crystal screening and structure resolution on large range of crystals (tiny crystals or large poorly diffracting crystals)

Comparison of Helios and Xenocs FOX 2D Cu 25-25P mirrors on a Bruker-AXS MicroStar



Comparative Measurement on a 30 µm crystal.

FOX 2D Cu 25-25 optic: the ideal optic for dedicated small crystal analysis (typically smaller than source size)

© Data courtesy of Ingrid Vetter, Max-Planck-Institut für Molekulare Physiologie, Dortmund, Germany

Product range

Typical Performances on 1200 W/70 µm Rotating Anode Generator, operating at full power

High Flux solutions				
Model	Beam size at focus (FWHM)	Divergence (FWHM)	Integrated Flux on rotating anode 1200w/70µm (vacuum)	Typical application
FOX 3D Cu 14-39	220 µm	5,4 mrad	4000 Mph/s	Protein Crystallography Powder diffraction
FOX 3D Cu 12-53	350 µm	2 mrad	1500 Mph/s	Protein Crystallography (long unit cell) Powder diffraction
FOX 3D Mo 12-30	160 µm	3 mrad	100 Mph/s	Small Molecule Crystallography High pressure diffraction

Small spot solutions				
Model	Beam size at focus (FWHM)	Divergence (FWHM)	Integrated Flux on rotating anode 1200w/70µm (vacuum)	Typical application
FOX 3D Cu 21-21	100 µm	8 mrad	1100 Mph/s	Protein Crystallography
FOX 2D Cu 25-25	100 µm	5,3 mrad	700 Mph/s	Protein Crystallography Micro-diffraction, Micro-XRF
FOX 2D Mo 25-25	100 µm	3,6 mrad	60 Mph/s	Small Molecule Crystallography Micro-diffraction, Micro-XRF

Collimating solutions				
Model	Beam size (FWHM)	Divergence (FWHM)	Integrated Flux on rotating anode 1200w/70µm	Typical application
FOX 3D Cu 12-Inf	1,3 mm by 1,5 mm	0,6 mrad	2000 Mph/s	Small Angle X-ray scattering HRXRD, Surface scattering Thin film analysis (XRR, Stress)
FOX 2D Mo 25-Inf	0,85 mm by 1,3 mm	0,5 mrad	60 Mph/s	Small Angle X-ray scattering HRXRD, Surface scattering

Please inquire for other wavelengths.



Sealed tube FoX add-ons

Bringing advanced 2D resolution capabilities to standard diffractometers

Standard sealed tube is a solution of choice when high flux is needed on large surface. Unfortunately traditional diffractometers do not offer high performance 2-dimensional resolution capability.

Taking full advantage of the unique capabilities of its single reflection optics, Xenocs is now offering a smart solution for high performance 2D XRD on standard diffractometer.



High flux 2D beam capability

Xenocs sealed tube FOX add-ons take full advantage of the single reflection concept for ease of alignment and high flux.

The advanced optical design used in the FOX add-ons allows very low beam divergence, bringing high resolution 2D capabilities to

standard diffractometer. As an exemple, low divergence in both directions will enable texture measurement of sample mounted on a cradle.

Ease of use

Sealed tube FOX add-ons are a reliable solution for intensive use.

Based on Xenocs proprietary single reflection design, FOX add-ons are very easy to align.

With a smart alignment stage and X-ray beam monitoring camera, alignment procedure takes only few minutes!

This allows a straightforward installation and quick change of

configuration from point to line source.

FOX add-ons are operating under vacuum ensuring no optic degradation over many years of intensive use.

Product range

Typical performances on 1600 W sealed tube generator (40kV/40mA, point focus, copper radiation)

Collimating solutions				
Model	Beam size at mirror exit	Divergence (Full Beam)	Total Flux at mirror exit	Typical application
FOX 2D Cu 12_INF	1,5 mm	1,3 by 3 mrad	7 x 10 ⁸ ph/s	Texture analysis Stress analysis HRXRD

Customer references

High resolution 2D powder diffraction with Sealed tube FOX add-on on Bruker D8 at OC Oerlikon Balzers

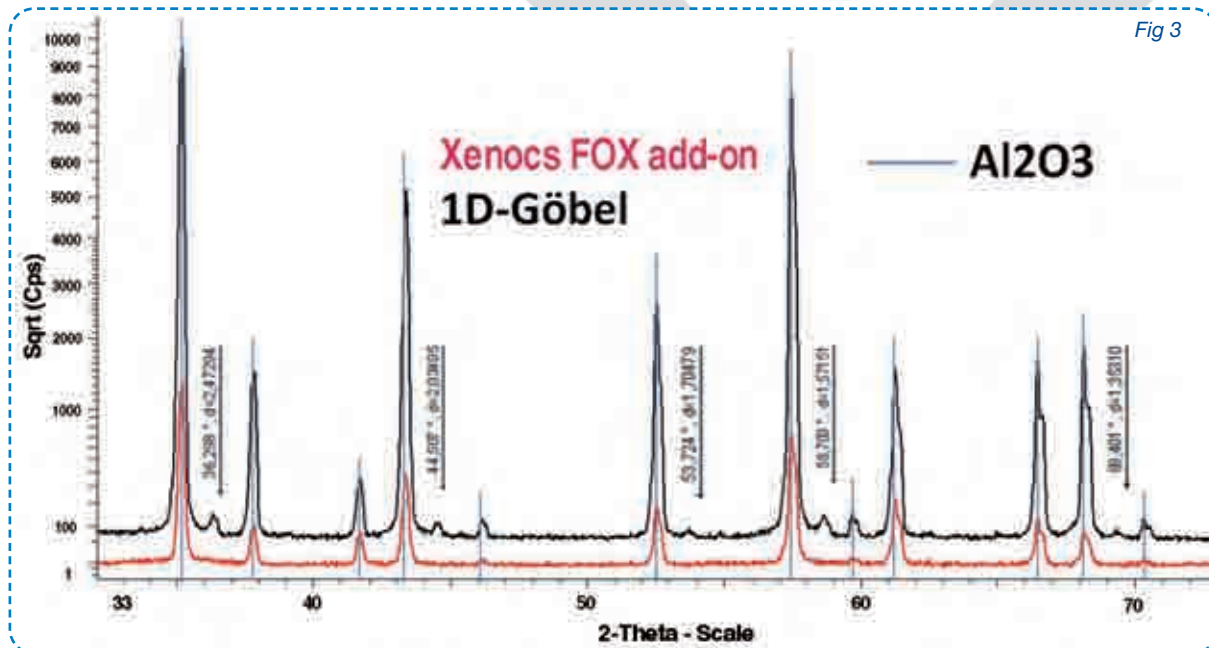


Fig 3

© Data courtesy of Dr. Matthias Sobiech Analytics Department/BRAN Oerlikon Balzers, Liechtenstein.

ii) The comparison of X-ray diffraction survey scans on pure Al₂O₃ reference material (ceramic plate from NIST) measured with two different X-ray mirrors is shown in Fig. 3. The difference in diffracted intensity is due to significantly different beam sizes of the optics used (1D-Göbel with about 15x1.5 mm²; Xenocs FOX add-on with about 1x1 mm²). However, it is clearly obvious that by using Xenocs FOX add-on, only diffraction lines belonging to Al₂O₃ appear, i.e. "artificial" diffraction lines which do not belong to Al₂O₃, as observed by use of the 1D-Göbel, can be avoided.

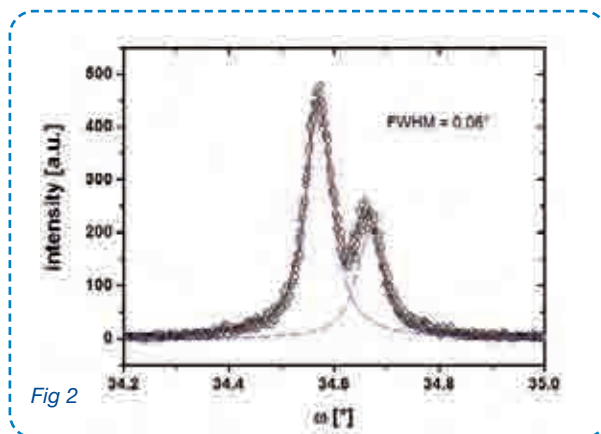


Fig 2

A residual beam divergence of 0,05° (< 1mrad) was measured on a {100} cut single crystal Si wafer, i.e. the X-ray beam is highly parallel.

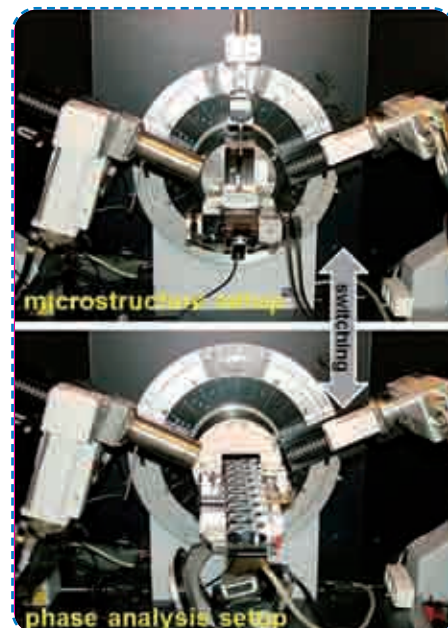
Fig 1

Report from Dr. Matthias Sobiech, OC Oerlikon Balzers AG

Our motivation to use Xenocs FOX add-on

In order to enable state-of-the-art X-ray diffraction stress and texture analyses of modern nano-sized coatings, the primary X-ray optic used must fulfill the following major requirements: i) high beam brilliance, ii) a parallel beam and iii) low residual beam divergence. The Xenocs FOX add-on mirror meets all these requirements. With this instrumentation diffraction analysis of very near-surface regions of coatings (by employing "small" incident angles), as e.g. the determination of depth-gradients of stress, elastic grain interaction and composition, becomes possible.

Details to Figure 3: $\theta/2\theta$ scan with step size of 0.02° and step time of 1 sec.



Customer references in europe and overseas

Optic add-on

AUSTRALIA	<i>St Vincent Institute</i>
AUSTRALIA	<i>Canberra University</i>
AUSTRIA	<i>JKU Linz</i>
CANADA	<i>Simon Fraser University</i>
CANADA	<i>Ontario Cancer Institute</i>
DENMARK	<i>Risoe</i>
FRANCE	<i>CNRS</i>
FRANCE	<i>IBMC Strasbourg</i>
FRANCE	<i>IBS Grenoble</i>
FRANCE	<i>Sanofi Aventis</i>
FRANCE	<i>ESRF</i>
FRANCE	<i>Laboratoire Pierre Sue</i>
FRANCE	<i>IFP</i>
FRANCE	<i>ONERA</i>
FRANCE	<i>CEA</i>
GERMANY	<i>Boehringer Ingelheim Biberach</i>
GERMANY	<i>EMBL Heidelberg</i>
GERMANY	<i>Philips University Marburg</i>
GERMANY	<i>Sanofi Aventis Frankfurt</i>
GERMANY	<i>MPI Dortmund</i>
GERMANY	<i>FZ Rossendorf</i>
GERMANY	<i>MPI Stuttgart</i>
GERMANY	<i>University of Siegen</i>
GERMANY	<i>Roentgenphysik Uni Göttingen</i>
GERMANY	<i>TU Darmstadt.</i>
INDIA	<i>RRI Bangalore</i>
INDIA	<i>Indore University</i>
ITALY	<i>Istituto di Cristallografia</i>
POLAND	<i>ITPM</i>
SLOVENIA	<i>Josef Stefan Institute</i>
SPAIN	<i>IBMB – Barcelona</i>
SWEDEN	<i>Karbio Huddinge</i>
SWITZERLAND	<i>EPFL/ESRF-SNBL</i>
SWITZERLAND	<i>Paul Scherrer Institut.</i>
UNITED KINGDOM	<i>Celltech Ltd</i>
UNITED KINGDOM	<i>Institute of Cancer Research</i>
UNITED KINGDOM	<i>Glaxo Smith Kline</i>
UNITED KINGDOM	<i>MRC Cambridge</i>
UNITED KINGDOM	<i>University of Exeter</i>
UNITED KINGDOM	<i>University of Leicester</i>
UNITED KINGDOM	<i>Institute of Cancer Research</i>
USA	<i>Monsanto MO</i>
USA	<i>Harvard Medical School</i>
USA	<i>Pfizer Ann Arbor</i>
USA	<i>The Scripps Research Institute</i>
USA	<i>University of Vermont</i>
USA	<i>UTMB</i>
USA	<i>Sanofi Aventis Bridgewater</i>
USA	<i>CARB Rockville</i>
USA	<i>Illinois Institute of Technology</i>
USA	<i>Princeton University</i>
USA	<i>Columbia University</i>
USA	<i>Illinois Institute of Technology</i>
USA	<i>UT El Paso</i>
USA	<i>Carnegie Mellon University</i>
USA	<i>University Missouri</i>

GeniX beam delivery system

AUSTRALIA	<i>ANSTO</i>
AUSTRALIA	<i>CSIRO</i>
AUSTRIA	<i>IBN</i>
AUSTRIA	<i>RCPE</i>
CANADA	<i>University Halifax</i>
CANADA	<i>Ryerson University</i>
CHINA	<i>USTC Hefei</i>
CHINA	<i>Biophysics Institute Beijing</i>
DENMARK	<i>Carlsberg</i>
FRANCE	<i>Universite Rennes</i>
FRANCE	<i>EMBL Grenoble</i>
FRANCE	<i>Institut Neel</i>
FRANCE	<i>CEA LETI</i>
FRANCE	<i>ESRF</i>
FRANCE	<i>ENSAM</i>
FRANCE	<i>LSPES</i>
FRANCE	<i>LCVN</i>
GERMANY	<i>Karlsruhe University</i>
GERMANY	<i>MPI Tübingen</i>
GERMANY	<i>TÜ FRM II München</i>
INDIA	<i>CLCR Bangalore</i>
INDIA	<i>RRI Bangalore</i>
INDIA	<i>IIT Kampur</i>
INDIA	<i>CCMB Hyderabad</i>
INDIA	<i>University of Hyderabad</i>
IRAN	<i>IPPI</i>
ISRAEL	<i>Hebrew University of Jerusalem</i>
ITALY	<i>LENS</i>
ITALY	<i>University of Cagliari</i>
ITALY	<i>University of Firenze</i>
NORWAY	<i>Institute for Energy Technology</i>
NORWAY	<i>Institutt for Fysik Trondheim</i>
RUSSIA	<i>Borekov Institute of Catalysis</i>
RUSSIA	<i>Kurchatov Institute</i>
RUSSIA	<i>RAS Inst. of Chemistry Vladivostok</i>
SPAIN	<i>CSIC Barcelona</i>
SWITZERLAND	<i>GENEVE University</i>
SWITZERLAND	<i>EPF Lausanne</i>
SWITZERLAND	<i>Hoffmann La Roche Basel</i>
SWITZERLAND	<i>Lausanne</i>
UNITED KINGDOM	<i>Warwick University</i>
UNITED KINGDOM	<i>Natural History Museum London</i>
UNITED KINGDOM	<i>University Sheffield</i>
UNITED KINGDOM	<i>Manchester University</i>
USA	<i>Univ of Wisconsin-Milwaukee</i>
USA	<i>UC Santa Barbara</i>
USA	<i>UC Los Angeles</i>
USA	<i>Oak Ridge National Laboratory</i>
USA	<i>Washington University-Saint Louis</i>

Customer testimonials

+ Princeton University, Dr. Phil Jeffery

“The FOX 2D 25-25 has a smaller native beam, greater intensity and flux, and much better spectral purity... Each feature leads to better data, or faster data collection, or both. Its physically compact design and ability to use more of the focal spot than multilayer optics designed for microfocus generators meant that we could make the most of our existing hardware. It is also easy to adjust and requires minimal maintenance.

Smaller beam size is a gain when working with the progressively smaller crystals that are of the norm. We also gained in brightness and the substantial reduction in CuKB contamination that was previously an issue in some circumstances. We would unhesitatingly recommend this optic for others in a similar situation to ours.”

+ Max-Planck-Institut für Molekulare Physiologie, Dortmund, Germany, , DR. Ingrid Vetter

“For analyzing small crystals using a standard MAR345 setup with a Bruker-AXS MicroStar X-ray generator, the FOX 2D Cu 25-25P mirror (which was designed for measuring small crystals) yields significantly better data than the HELIOS optics. The results obtained confirm this capability of the mirror.”

+ Sanofi-Aventis, Dr. Magali Mathieu

“FOX 3D Cu 14-39P mirrors provide good quality data for large, strongly-diffracting crystals. For medium to small size, moderately or weakly diffracting crystals, the enhanced collection angle and focusing properties of the FOX 3D Cu 14-39P lead to a significantly improved S/N ratio.”

+ Marresearch, Dr. Claudio Klein

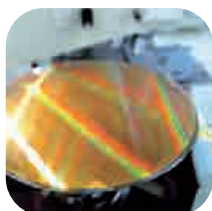
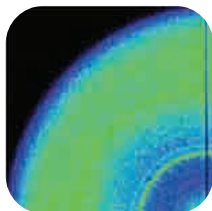
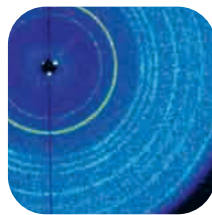
“Marresearch needs a reliable supplier of a powerful X-ray source in order to offer a complete X-ray setup for macromolecular and small molecule X-ray crystallography. Together with the mar345 image plate detector and the mardt b goniostat we are able to setup a relatively low cost X-ray data collection system (under the trademark “marmuX”), that fulfills today’s requirements for most X-ray applications. The GeniX 3D narrows the performance gap between sealed X-ray sources to rotating anode generators.”

+ European Molecular Biology Laboratory, Dr. Hassan Belrhali

“GeniX 3D delivers a beam which is 2 times more intense in small dimensions (lower than 150 microns) compared to the previous GeniX system. This is of particular interest in the Macromolecular Crystallography field where typical samples dimension are of 100 microns or smaller. GeniX 3D beam intensity stability and moderate divergence enable excellent crystallographic data to be recorded. The achieved crystallographic performances when compared to the latest generation of microfocus Rotating Anode Generators for these Trypsin crystals turned out to be of comparable quality with measurement times only twice longer with GeniX 3D.

GeniX 3D Cu HF operating at 30 Watts is a compact, reliable, low-maintenance system providing good performances for MX applications. It turns out to be an excellent low-cost-of-ownership alternative to high power rotating anode generators for data collections, cryogenic condition optimizations and protein crystal screenings prior to synchrotron trips !

w w w . X e n o c s . c o m



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