



ANALYTICAL INSTRUMENTS GROUP

# Europe



BENCHTOP X-RAY DIFFRACTOMETER

[www.gnr.it](http://www.gnr.it)

# EUROPE

## BENCHTOP X-RAY DIFFRACTOMETER



### Europe, High Performance in a compact configuration



**GNR** is a worldwide market leader supplying advanced X-Ray (XRD, XRF) and Optical Emission Spectrometer (OES) systems for complete solutions in structural and elemental analysis.

**Europe** is the new GNR Benchtop Theta/2Theta powder diffraction system for XRD **qualitative** and **quantitative** analysis of polycrystalline materials.

With an achievable FWHM peak resolution  $< 0.04^\circ 2\theta$  and an angular accuracy  $< \pm 0.015^\circ$  over the whole 2theta angular range, Europe guarantees the necessary level of performance for the most demanding x-ray diffraction material investigation in a compact and low cost configuration.



### Which Measurements can be performed with EUROPE?

- Qualitative and Quantitative Crystalline Phase Analysis
- Degree of Crystallinity Calculation
- Polymorph Screening
- Cell parameters, Crystallite size and Lattice strain determination
- Rietveld refinement for structural characterization
- Retained Austenite Quantification



### EUROPE X-Ray Diffractometer Features

**Europe**, operating at 600 W, offers characteristics and options that provide maximum flexibility in a benchtop set up without quality compromises and with reliable data analysis.

**Compact Size:** its compact size and robust design enable installation in a lab bench and operations in a small space.

**Theta/2Theta Goniometer:** GNR develops an ultra-compact goniometer that, adopting stepper motors with optical encoders, ensure extremely precise angular positioning. The double axis goniometer provides two independent angular degrees of freedom with common centre of rotation.

**Optics:** X-Ray beam collimation is obtained by variable slits that guarantee a perfect alignment of the beam in the equatorial direction, while in the axial direction the divergence is limited by soller slits. Europe can mount glass and ceramic X-Ray tubes with high reproducibility and stability of focus position.

**X-Ray Detectors:** NaI(Tl) Scintillation Counter / Fast Detector

**Sample holders:** several sample holders are available to meet the specific needs of each laboratory (Rotating Sample Stage, Standard and Custom Sample Holders, Air Sensitive Sample Holder, 6 Position Automatic Sample Changer).

#### Safety Assurance

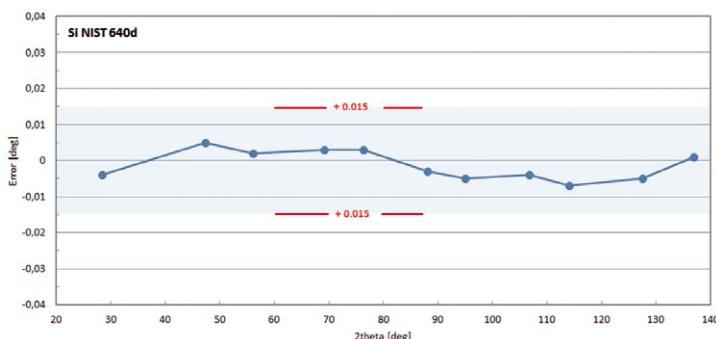
**Europe** complies with the complex statutory requirements regarding x-ray, machine and electrical safety.

Maximum x-ray safety with radiation level significantly below the annual dose limit for general public (1 mSv/year).

The radiation enclosure door cannot be opened when x-rays are on and the system immediately switch off if shutter is forced to open.

This function completely protects user from radiation exposure.

Alignment Guarantee

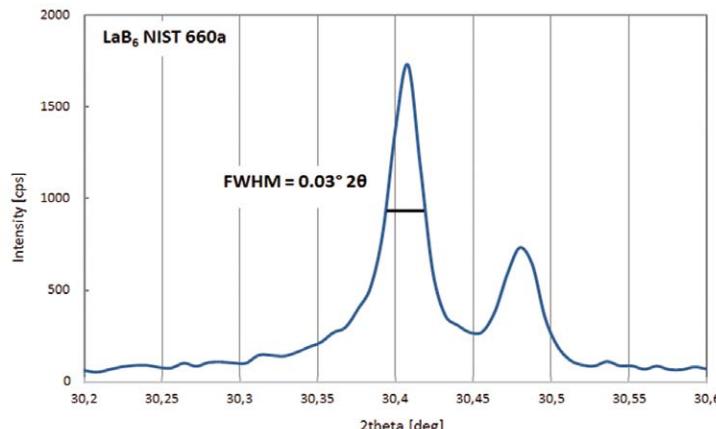


GNR develops an ultra-compact goniometer with outstanding performance.

An angular accuracy of  $\pm 0.015^\circ$  over the whole 2theta range guarantees optimal instrument alignment to support accurate and reliable analysis.

Every single instrument must pass our test procedure based on the internationally accepted reference material Silicon NIST 640d and Lanthanum Hexaboride NIST 660a.

Outstanding Resolution for a benchtop diffractometer



Optimal instrument resolution prevents peaks from overlapping in complex sample matrix, improving qualitative and quantitative phase analysis results.

Europe could support your analysis with an amazing resolution for a benchtop diffractometer.

Very small peak width of less than  $0.04^\circ$  2theta measured on (NIST SRM 660a) of  $\text{LaB}_6$  with linear fast detector ( $0.1^\circ$  Divergence;  $2.3^\circ$  Soller; 600 W).

Fast Detector, higher intensity and faster scanning

Europe is equipped in the basic configuration with a Scintillation Counter NaI(Tl) but if speed or high resolution scanning is your main issue a Multi Strip Detector is available too.

GNR adopts DECTRIS Mythen X-Ray detector.

Mythen, linear silicon strip detector, based on single photon counting technology, provides noise-free performance, high intensity measurement and fast data acquisition.

The high efficient 1-dimensional multi strip detector simultaneously captures a large angular range and reduces measurement time from hours into minutes.

- Mythen can decrease measurement time significantly down in comparison with a scintillator detector without affecting data quality like intensity, resolution and peak shape.
- Compact size, air cooled (no gas, water or liquid nitrogen needed) and maintenance-free detector.
- Fluorescence background suppression by setting an appropriate energy threshold

MYTHEN2 R	1D
SENSOR THICKNESS [ $\mu\text{m}$ ]	450
STRIP WIDTH [ $\mu\text{m}$ ]	50
STRIP LENGTH [mm]	8
DYNAMIC RANGE [bit]	4-24
ENERGY RANGE [keV]	5-40
READOUT TIME [ $\mu\text{s}$ ]	300
FRAME RATE [Hz]	25
POINT-SPREAD FUNCTION [strip]	1
Cooling	Air
DIMENSIONS [WHD mm]	38x62x22
MODULE WEIGHT [g]	100

# EUROPE

## SOFTWARE

### Software

**Europe** adopts a specific modular design software package able to support the user in all activities.

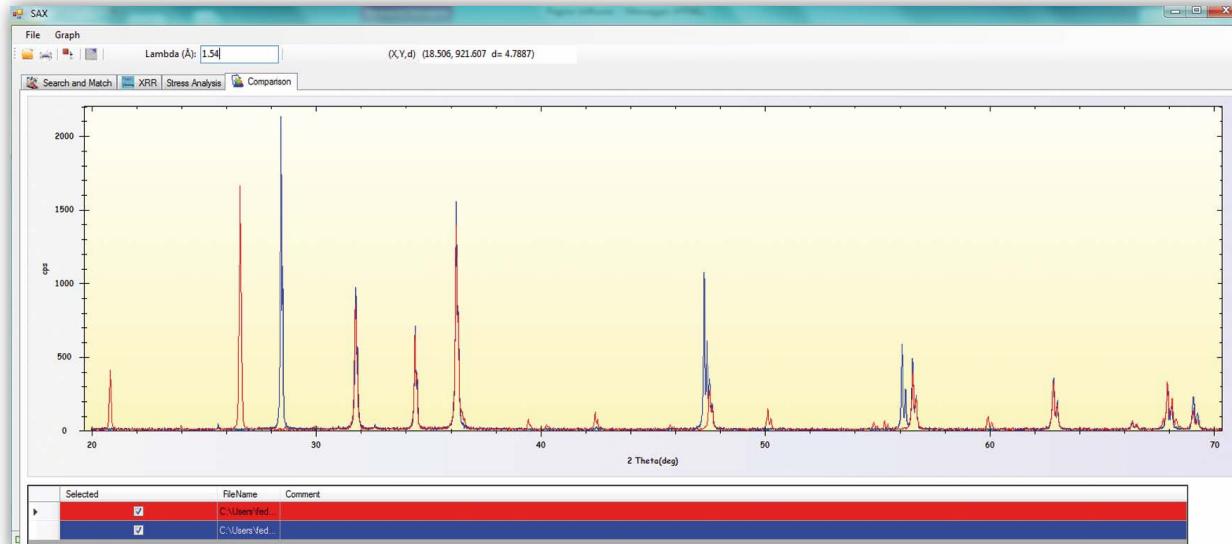
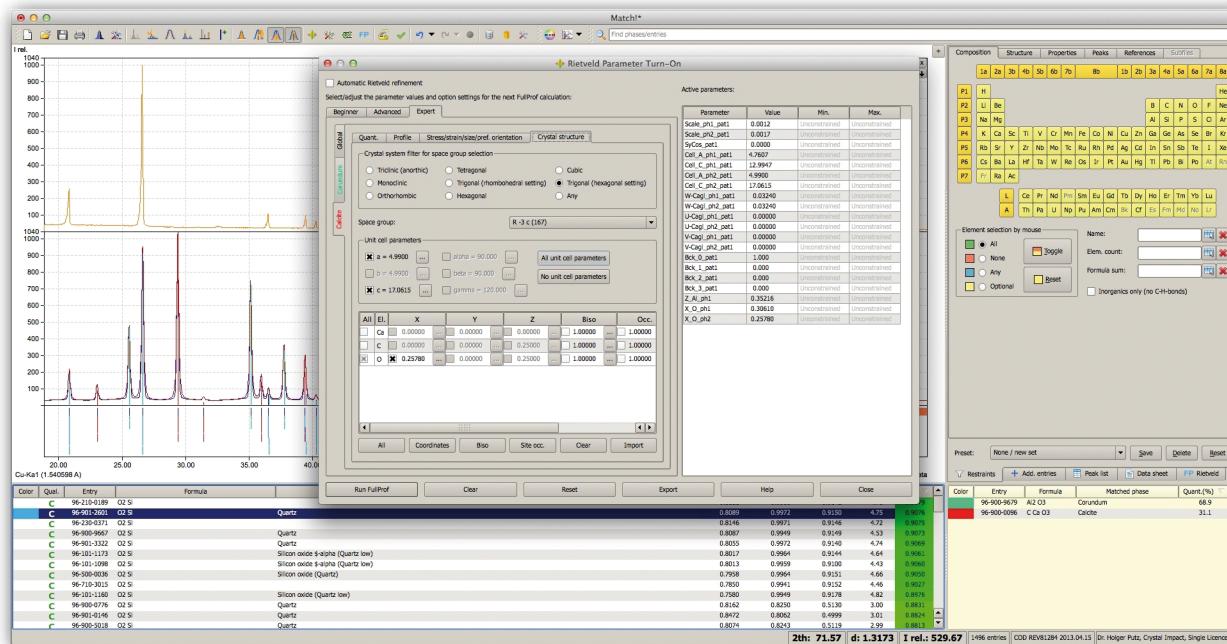
GNR software supports several type of analysis, from Data Acquisition, having the full control of all the process and hardware settings (motors, x-ray generator and tube, detector, measurements set up) to Data Analysis.

Match! is an easy-to-use software for phase identification from powder diffraction data.

It compares the diffraction pattern of your sample to a database containing reference patterns in order to identify the phases which are present. Additional knowledge about the sample like known phases, elements or density can be applied easily.

In addition to this qualitative analysis, a quantitative analysis (using Rietveld refinement) can be performed as well. You could easily setup and run Rietveld refinements from within Match!, with the actual calculations being performed automatically, using the well-known program FullProf in the background. Match! provides a gentle introduction into Rietveld refinement, from fully automatic operation to the “Expert” mode.

As reference database, you can apply the included free-of-charge COD database and/or ICSD/Retrieve (if you have a valid license), use any ICDD PDF product, and/or create a user database based on your own diffraction patterns.





## Accessories

Thanks to a wide offer of configurations and accessories EUROPE is a cost-effective instrument for fast-paced routine industrial quality assurance analysis, laboratory investigations and academic purpose.

### Sample Holders

Standard and Custom Sample Holders are available; different geometries (tray and through) and several materials (aluminum, plexiglass, silicon single crystal zero background) for different kind of specimens.

Air sensitive sample holder is available as optional, too.



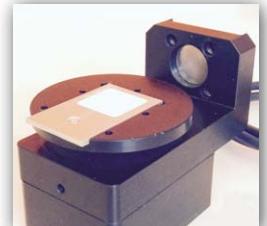
### Rotating Sample Stage

Rotating Sample Stage enhances measurement quality for sample with non-randomly oriented crystallites.



### Multi Sample Holder

Automatic sample positioning for long-time analysis without user attendance.



### Secondary Graphite Monochromator

Secondary graphite monochromator removes the continuous component of the spectrum, K $\beta$  as well as fluorescence from the sample.

It ensures an excellent signal to noise ratio.



## Applications

**Europe** fits well customer analytical needs in many fields:

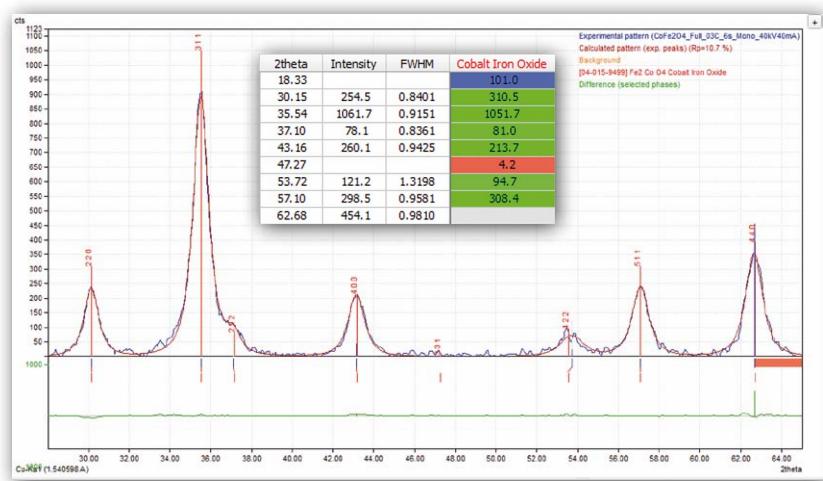
- Geology and Mineralogy
- Catalysts
- Chemicals
- Clays
- Polymers
- Pharmaceuticals
- Glass - Ceramics
- Forensics
- Cosmetics
- Cements
- Agricultural Sciences
- Enviromentals
- Petrochemicals
- Biosciences
- Art and Archeology



### Crystallite Size Calculation - Nanotechnology

XRD is a good solution to analyze nanostructured emerging materials: measuring FWHM of diffraction peaks and using Scherrer formula is possible to calculate the average size of the diffracting crystallites that is strictly related to the nanopowder activity higher than its bulk counterpart.

Cobalt Iron Oxide is an important nanoscale magnetic material with applications in molecular imaging and drug delivery. The dimension of cobalt iron oxide crystallites is a key point in product development in fact the process efficiency depends on the surface area of the material. In this example the average crystallite size is 10 nm.



Crystallite Size Calculation using Match!

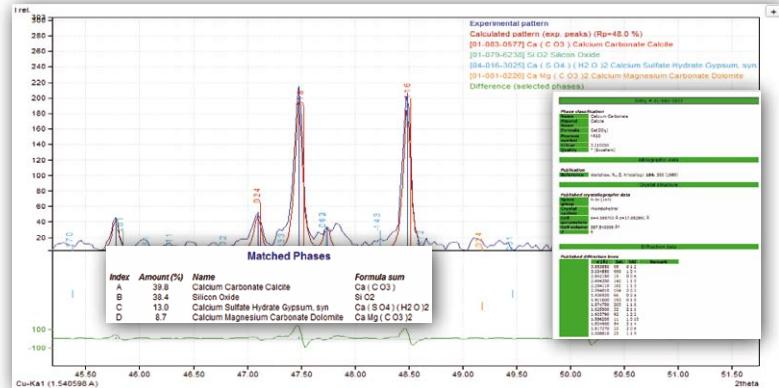
# EUROPE

## APPLICATIONS



### Phase Identification and Quantitative - Mineralogy

A mixture of unknown phase has been analysed, Match! can identify the phases present in the sample and report the weight percent composition. In this example the sample is a mixture of Quartz, Calcite, Gypsum and Dolomite.



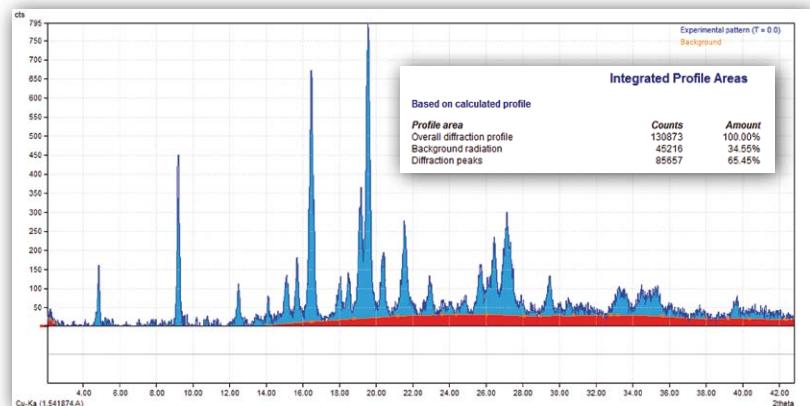
Quantitative Phase Analysis using Match!



### Crystallinity Degree Calculation - Pharmaceutical

In pharma industry product development and quality assurance is common to measure the amorphous phase amount in order to determine the degree of crystallinity.

Amorphous to crystalline phase mass ratio is proportional to background to diffraction peak area ratio. Match! can calculate the mass percentage of amorphous and crystalline phases in any sample.



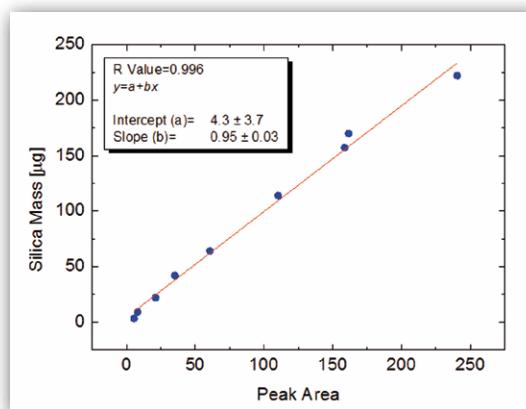
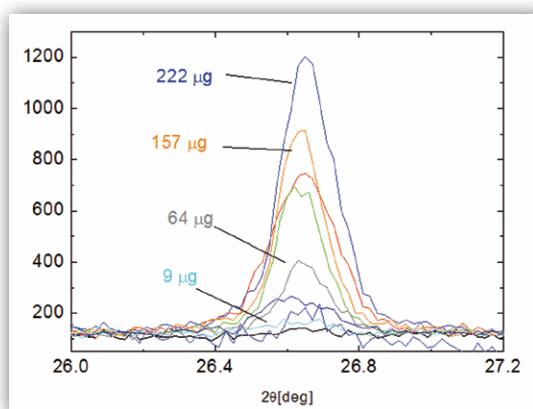
Crystallinity Degree Calculation using Match!



### Silica Dust Monitoring - Environmental

Crystalline silica is a basic component of soil, sand, granite, and many other minerals. Quartz is the most common form of crystalline silica. The seriousness of the health hazards associated with silica exposure is demonstrated by the fatalities and disabling illnesses that continue to occur in sandblasters and rock drillers. Crystalline silica has been classified as a human lung carcinogen. Measuring and quantifying silica dust collected on air filter is important to protect health of workers involved in activity exposed to silica dust.

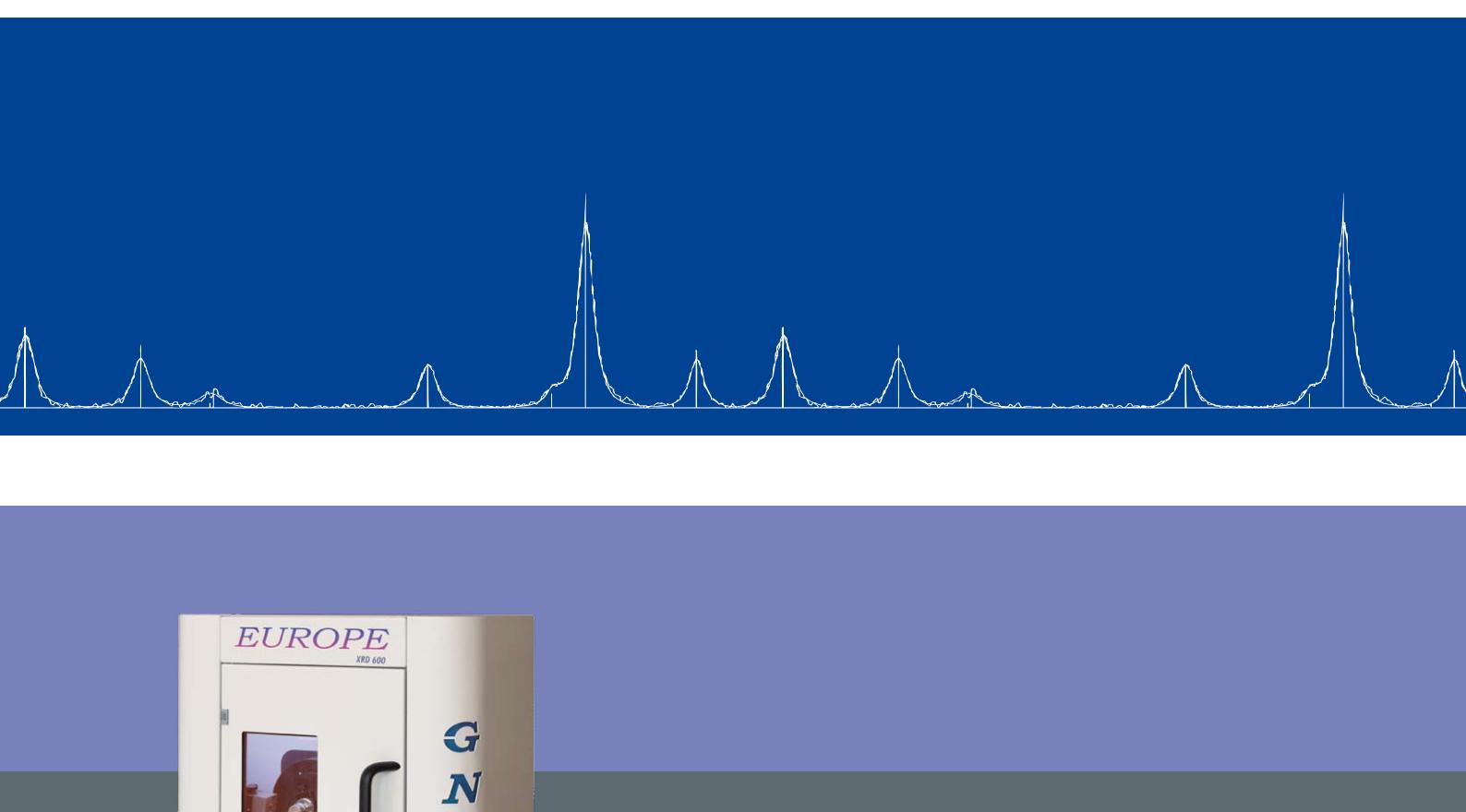
Quartz (101) diffraction peak area is proportional to the mass of silica dust deposited on a filter. Using NIST – SRM 1878 quartz standard is possible to calculate a calibration curve for silica dust mass quantification and monitoring.



Calibration curve for silica dust mass quantification

<b>Goniometer</b>	Geometry	Theta / 2Theta
	Type	Vertical
	Radius	150 mm
	Scanning Range	- 15° to + 145° (Theta/ 2Theta)
	Accuracy	± 0.015°
<b>Generator</b>	Minimum step width	0.002°
	Maximum Power	600 W
	Generation	40 kV / 15 mA
<b>Detectors</b>	Tube	Cr / Co / Cu - Glass or Ceramic Tube
	Scintillation Counter NaI (TI) Fast Detector (DECTRIS Mythen Multi Strip Detector)	
<b>Optics</b>	Divergence Slit	Variable 0-4°
	Scattering Slit	Variable 0-4°
	Receiving Slit	Variable 0-6 mm
	Soller Slit	Fixed 2.3°
<b>Accessories</b>	Secondary Graphite Monochromator (HOPG)	
	K <sub>B</sub> Filter	
	Aluminum / Plexiglas Sample Holder	
	Zero Background	
	Spinner Multiple Sample Holder (6 / 20 mm diameter) Air Sensitive Sample Holder	
Cooling Water Supply	External Compact Low Noise Version - 377 W x 615 H x 435 D (mm) / 32 kg	
Dimensions	700 W x 760 H x 460 D (mm)	
Weight	95 kg	
Power Supply	Main Body	90 - 250 Vac
Computer	External Desktop PC with Windows 8 - Interface / USB / Mouse / Keyboard	





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Local Agent



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