

# D2 PHASER

## 2nd Generation

● Diffraction Solutions

- Compact all-in-one benchtop design
- Innovative high-end goniometer design
- Integrated PC / monitor
- DIFFRAC.SUITE software
- Leading detector technology



D2 PHASER – all-in-one benchtop design

# The whole world of benchtop X-ray diffraction – D2 PHASER

**What do you obtain when patented technologies, award-winning software, a fully functional PC with monitor and state-of-the-art detectors meet up with leadership in innovative X-ray diffraction? Perfect solutions for powder diffraction. And if it all fits onto a table, it is called: D2 PHASER!**

What enables this evolutionary leap to take place and how can the amazing performance of this space saving sensation actually be explained?

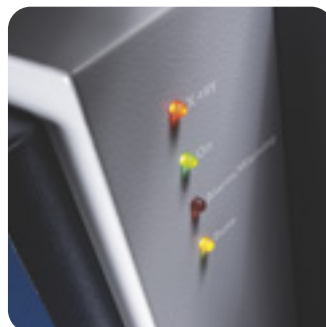
First of all, you develop an ultra compact goniometer, file a patent, complete the system with all the other components for autonomous operation and package the whole configuration together with a fully functional PC, monitor, keyboard and mouse, into a compact housing.

Second, you use the unique DIFFRAC.SUITE software for controlling the instrument and analyzing the data. Since its introduction the DIFFRAC software has developed into a high performance tool for the characterization of crystalline phases in research and industry.

Third, you use only the best components, for example the LYNXEYE detector. This state-of-the-art and extremely efficient 1-dimensional detector simultaneously captures a large angular range and radically reduces the measurement time: hours turn into minutes.

Combining all of these innovations creates a benchtop X-ray diffractometer which has the analytical performance and functions of a large instrument, but which is easy to transport and opens up the whole world of powder diffraction without a lot of infrastructure.

**D2 PHASER – never before was benchtop X-ray diffraction better, smaller and more powerful!**



Status display LEDs



Transport handles



1-dimensional LYNXEYE detector



Internal chiller



USB and Ethernet connectors



Integrated drawer for keyboard and mouse



Six position sample changer



X-ray on status LEDs



Holders with various cavities



Holder for automated sample preparation



Holder for clays



Low background holders for small sample amounts



Airtight holder for environment-sensitive samples



Holder for filter samples



D2 PHASER – slide-up front cover for sample loading, monitor remains active

- Phase identification and quantification
- Degree of crystallinity determination
- Phase properties (cell parameters, crystallite size, and lattice strain)
- Crystal structure analysis



# D2 PHASER – the benchtop giant!

**Wishes come true – comprehensive, unique and non-destructive characterization of crystalline samples by means of X-ray diffraction (XRD) with the D2 PHASER.**

Our D2 PHASER opens the door to modern XRD for you. This means qualitative and quantitative phase analysis, polymorphism investigation, the determination of crystallinity, all the way through to structure investigation – all of it fast, simple, efficient and with high quality.

It is not just its analytical performance that makes the D2 PHASER so revolutionary, but also its flexibility in handling very diverse samples. Different material properties require different sample preparations. Therefore, besides a series of standard sample holders made from PMMA or steel, the D2 PHASER also offers holders for small sample amounts, low-absorbing and weakly diffracting samples, for filters, for environment-sensitive samples and for examining materials that tend to show a preferred orientation.

## LYNXEYE fast-lane edition

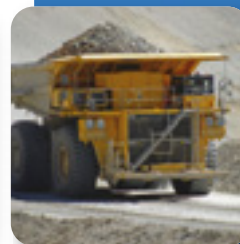
What makes the D2 PHASER absolutely unique is the integration of the world's leading 1-dimensional detector for X-ray powder diffraction: Our LYNXEYE.

With a performance enhancement in terms of intensity by a factor of more than 150, the D2 PHASER is actually playing in the top class. Additionally the LYNXEYE allows suppression of sample fluorescence providing an excellent peak-to-background ratio even for strongly fluorescent samples, eliminating any need for secondary monochromators.

**D2 PHASER – X-ray diffraction in a new dimension!**



**Cement &  
Raw Materials**



**Minerals  
& Mining**



**Oil & Gas,  
Exploration**



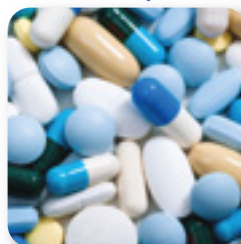
**Ceramics**



**Chemistry  
& Catalysts**



**Research  
& Education**



**Pharmaceuticals**



**Environment**

Plug'n  
Analyze™



On-Site  
Ready



Hand Carry  
Weight



No  
Water  
Supply



No  
High  
Power



No  
PC &  
Peripherals



## All-in-one is every- thing you need – D2 PHASER

**Can XRD – the best method for phase  
characterization – really produce high  
quality data without the need for a  
corresponding infrastructure?**

Yes! With our D2 PHASER a new era begins. All that is required is a simple domestic wall socket and you can start producing outstanding analytical results: Plug 'n Analyze. Since it is a benchtop system it requires only a minimum amount of space and is in no way inferior to a large system in terms of its analytical performance. Resolution, angular accuracy and data statistics set new standards in this class of analytical instruments; data quality which you can rely on and with which even complex questions can be answered.

Our D2 PHASER is a transportable all-in-one instrument that requires no additional cooling water or PC peripherals. This means that there is nothing to prevent it from being used on-site: simply switch-on a power generator, plug in the connector and start measuring!

Our D2 PHASER is fully network capable. This enables XRD experts in the central laboratory to access the data that has been collected, no matter if they are next door or at the other end of the world. Use the D2 PHASER where it is needed – on-site – and you will save time and money!

**D2 PHASER – X-ray diffraction tool for  
everyone – everywhere!**

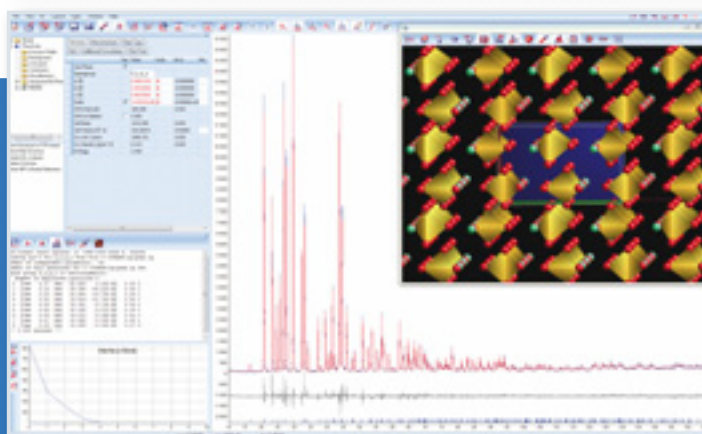
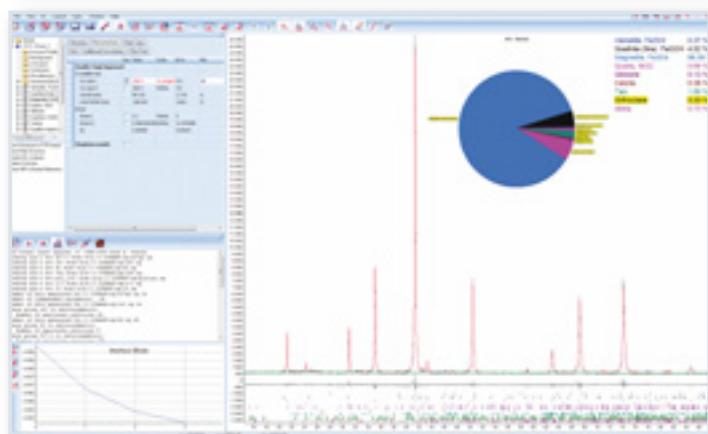
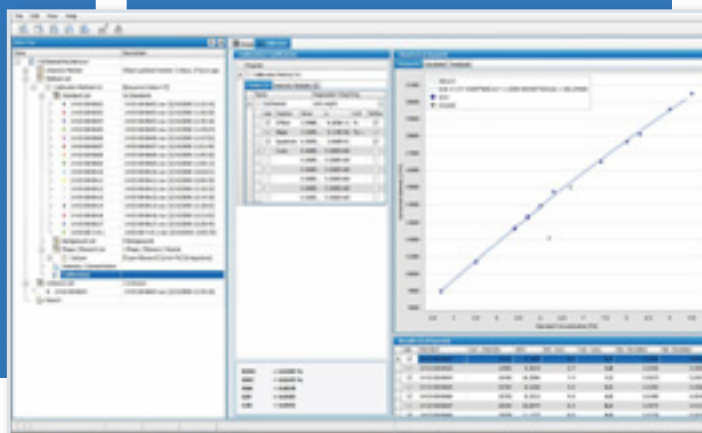
- Minimal electrical power consumption (650 W)
- No cooling water supply
- No significant tube ageing – practically endless tube lifetime
- Minimal space required

### DIFFRAC.EVA

- Qualitative phase identification
  - ICDD PDF2 and PDF4; COD
  - User-defined databases
- Semi-quantitative phase analysis
  - RIR method
  - Combined XRD-XRF analysis
- Cluster Analysis
- 21 CFR Part 11

### DIFFRAC.DQUANT

- Quantitative analysis
  - Calibration method, Ratio method, RIR method
  - Absorption correction for NIOSH 7500
  - Drift correction
- Operator levels
  - Expert to set-up a method
  - Operator batch-analysis of unknown samples
  - Fully automated analysis of single unknowns
- Reporting
  - Publication-ready tables
  - Database and Results Manager export
- 21 CFR Part 11



### DIFFRAC.TOPAS

#### Quantitative Analysis

- Quantitative phase analysis
  - Crystalline phases
  - Amorphous phases
- Degree of crystallinity determination
- Spiking method
- PONKCS method

### DIFFRAC.TOPAS

#### Structure Analysis

- Indexing (LSI and LP-Search methods)
- Pawley and LeBail fitting
- Rietveld structure refinement
- Ab-initio structure determination
  - Simulated annealing
  - Charge Flipping
  - 3D Fourier analysis
- Microstructure analysis

# D2 PHASER – data-quality, functionality and safety without any compromises

Our D2 PHASER delivers uncompromisingly good and reliable analyses. The strict quality standards of our entire product range are applied to the assembling, testing and certified safety of the D2 PHASER!

We give you our word: Good Diffraction Practice and Best Data Guarantee!

## Safety assurance:

Each instrument always complies with the world's highest statutory requirements regarding X-ray safety, machine and electrical safety. This certainty is obtained after stringent scrutiny by independent institutions.

Two independent, fail-safe safety circuits and "X-ray On" monitors guarantee that the most recent radiation and personal safety regulations are observed.

## Alignment guarantee:

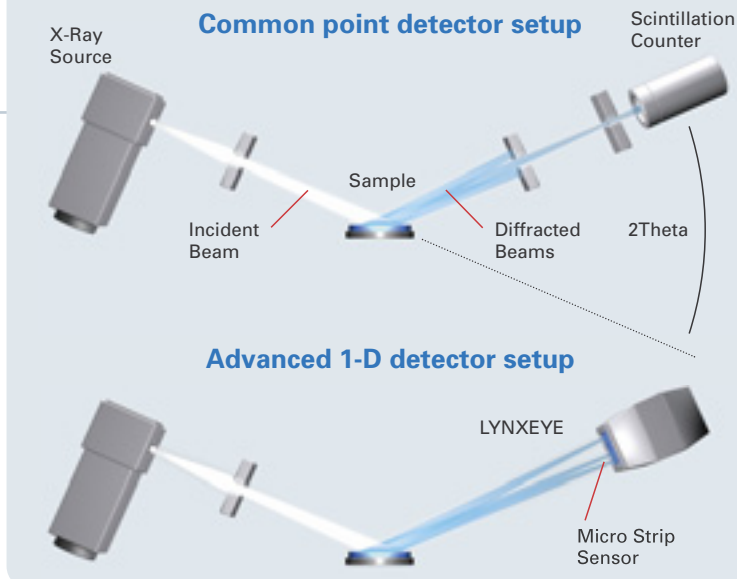
The D2 PHASER is pre-aligned at delivery. Every single instrument must pass our strict test procedure, which is based on the internationally accepted reference material corundum. The corundum reference is supplied with the instrument, so you can check your instrument at any time.

## Detector guarantee:

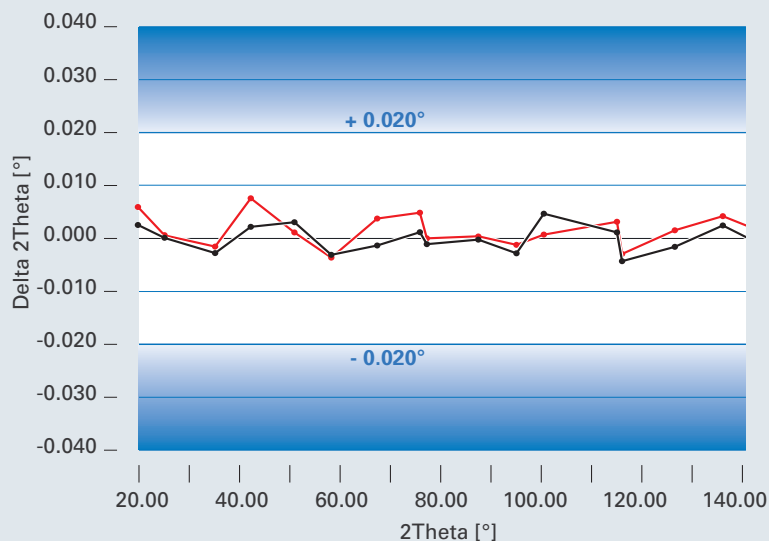
We guarantee that our 1-dimensional LYNXEYE is absolutely faultless! This is due to Bruker AXS' unique detector design. By integrating the LYNXEYE detector in the D2 PHASER it becomes the fastest and most efficient benchtop diffractometer in the world.

**The best in its class: the D2 PHASER.**

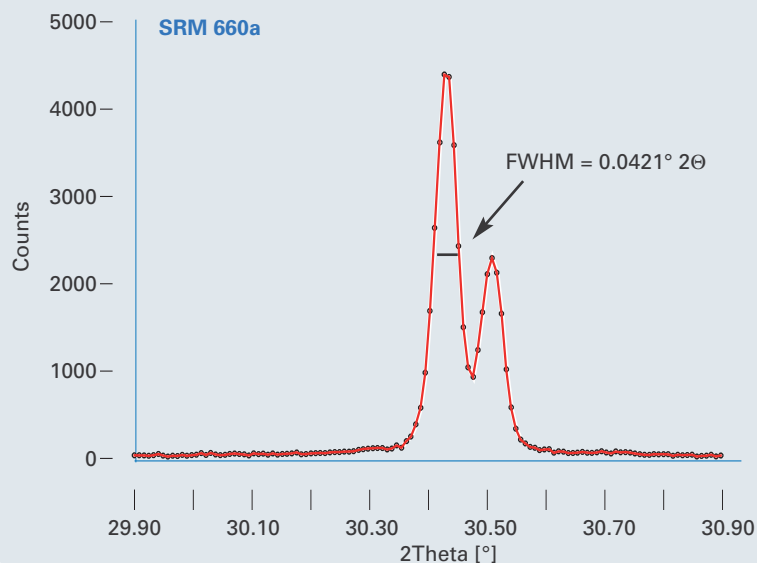
## XRD on polycrystalline material – more intensity with LYNXEYE detector



## Instrument alignment – a sound base for accuracy!



## Unrivalled resolution





- In an XRD experiment performed on polycrystalline material the incident X-ray beam is diffracted by innumerable crystallites in specific 2Theta directions.

To record the exact 2Theta positions a narrow slit in front of a point detector is required.

- The LYNXEYE literally provides more than 150 integrated slits, allowing more than 150 2Theta positions to be recorded simultaneously.

- Angular accuracy  $\leq \pm 0.02^\circ$  2Theta over the whole angular range – guaranteed!
- Why is this important? Accurate and verifiable instrument alignment is a basic requirement for accurate and reliable phase identification or structure analysis.

- LYNXEYE Detector
- Scintillation Counter

- Very small peak width of less than  $0.05^\circ$  2Theta obtained by high-resolution XRD measurement of LaB<sub>6</sub> (NIST SRM 660a) with LYNXEYE detector;  $0.1^\circ$  divergence and  $1.5^\circ$  Soller slit.
- Why is this important? Good instrument resolution is a prerequisite to resolve overlapping diffraction peaks in complex powder patterns.

#### Plug'n Analyze:

- A simple domestic wall socket is all you need
- No installation
- No alignment
- No instrument configuration
- No infrastructure
- No pre-installation requirements



#### LYNXEYE detector:

- Intensity increases by a factor of more than 150
- 100% working strips at delivery – guaranteed
- Energy discrimination for sample fluorescence suppression
- 1-D scanning and snapshot mode; 0-D mode
- Angular coverage  $> 5.5^\circ$  2Theta



#### Sample changer:

- 6 positions sample changer,  $\varnothing$  32 mm samples
- Motorized and fully integrated in DIFFRAC.SUITE software
- Programmable sample rotation
- Variety of sample holders



#### All-in-one analytics:

- Simple sample loading
- Industrial standard sample holders for single-sample stage
- Theta/Theta geometry, horizontal samples
- On-site and remote operation



#### X-ray source:

- Common sealed X-ray tube design
- Low power load – no tube ageing
- Virtually infinite tube lifetime
- Cr, Co, Cu radiation



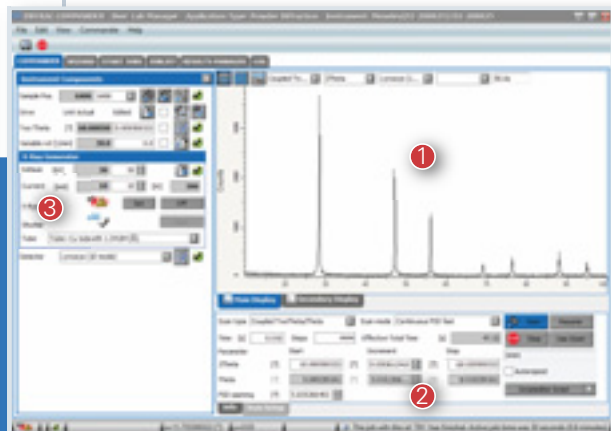
#### Island-mode:

- Internal cooling system
- High speed ethernet connection
- 2 USB ports
- Fully-fledged integrated PC



### Push-button-mode

- No operator training required
- Start combined measurement method and data evaluation just at the push of a button
- Operator only needs to provide sample ID and sample position.
- Data evaluation with DQUANT or TOPAS BBQ starts automatically after measurement is finished
- Results are stored in internal database and/or forwarded to external laboratory information systems (LIMS)



### Comander-mode

- ① Real-time measurement display
- ② Straightforward selection of scan parameters:
  - Angular range
  - Step size
  - Measurement time
- ③ Full access to all instrument parameters:
  - Drives
  - Detector settings
  - Generator settings

- Compatible with the entire Bruker AXS' Diffraction Solutions family
- cGxP / 21 CFR Part 11 compliant measurement and analysis software
- Support of different user levels and modes
- DQUANT - quantitative analysis for quality and process control
- EVA – powerful phase identification and cluster analysis
- TOPAS – full-pattern quantitative phase and structure analysis

# The ultimate in ease of use – **D2 PHASER** with **DIFFRAC.SUITE**

**X-ray analysis has never been easier!  
Even inexperienced users produce perfect  
measurements from the very beginning thanks  
to the DIFFRAC.SUITE.**

This is how X-ray analysis works:

Select COMMANDER plug-in, enter measurement time  
and angular range and start. That's all!

If a method has already been defined, it goes even faster:

Select START JOBS, click on method and off you go!

It goes without saying that the software solutions of our  
DIFFRAC.SUITE go beyond this. In the DIFFRAC.SUITE  
the full scope of functions is available. Using the  
COMMANDER, CONFIGURATION and TOOLS plug-in  
the expert has control over administration of experiment  
databases, user rights and all the way through to  
21 CFR Part 11. Everything on the system works  
in a safe, simple and reliable way.

**DIFFRAC.SUITE – performance made-to-measure:  
easy for anyone to operate, full functionality  
and control for experts. Integrated within a  
networked world.**

The D2 PHASER is a full-blown diffractometer: its  
measured data is fully compatible with all of our  
DIFFRAC.SUITE solutions. The familiar world of  
search/match and structure databases, EVA, TOPAS,  
DQUANT ,... all of this is available to the XRD specialist  
for identifying, quantifying and determining the  
characteristics of the crystalline phases.

**D2 PHASER – Welcome to the world of  
Bruker AXS!**



All-in-one analysis

## Technical Data

<b>Geometry</b>	Theta / Theta
<b>Max. useable angular range</b> (depending on detector)	-3 ... 160 ° 2Theta
<b>Accuracy</b>	± 0.02° throughout the entire measuring range
<b>Achievable peak width</b>	< 0.05°
<b>Alignment</b>	Not needed, factory aligned
<b>X-ray wavelengths</b>	Cr / Co / Cu, standard ceramic sealed tube
<b>X-ray generation</b>	30 kV / 10 mA
<b>Detectors</b>	Scintillation counter 1-dimensional SSD160 1-dimensional LYNXEYE
<b>Stages</b>	Single position, Ø 51 mm, programmable sample rotation Motorized 6 position, Ø 32 mm , programmable sample rotation
<b>Sample holders</b>	Various cavities, low background with and without cavity, air-tight, sealed, filter samples, back loading, oriented slides (clay)
<b>Instrument type</b>	Portable, benchtop
<b>Exterior Dimension</b>	61 x 60 x 70 cm (h x d x w) 24.02" x 23.62" x 27.56"
<b>Weight</b>	95 kg
<b>Power supply</b>	90 – 250 V
<b>External cooling water supply</b>	None
<b>Computer</b>	Built-in Optional additional PC connected via LAN interface
<b>Interfaces</b>	2 x USB and 1 x LAN

D2 PHASER™ US 7,852,983 B2, EP 2 112 505 B1,  
DE 102 008 020 108 B3 patent  
LYNXEYE™ EP 1 510 811 B1 patent.  
DIFFRAC is a registered trademark of the  
US Office of Patents and Trademarks.  
Goniometer EP 2 112 505 A1.

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