Nordlys

The ultimate EBSD detector hardware

Characterise microstructures with accuracy, sensitivity and speed

OXFORD INSTRUMENTS

The Business of Science®

Nordlys EBSD Detectors: Overview

Superior hardware design…

Oxford Instruments **AZtec®** EBSD system combines superior **Nordlys** hardware and innovative software to create the highest performing EBSD solution available.

Optimised hardware solution

- **Nordlys**Nano delivers the best sensitivity and achieves the highest spatial resolution
- **Nordlys**Max² provides the fastest data acquisition, and is designed for in situ studies

Optimised optical design

Kikuchi bands detected at the pattern edge are key for correct phase identification. A conventional circular phosphor screen is either too large (orange) or too small (white).

- A rectangular phosphor screen maximises CCD use
- Ideal for difficult low crystal symmetry materials

Optimised collection geometry for simultaneous EDS and EBSD

Tapered detector noses enable closer and more detailed sample analysis:

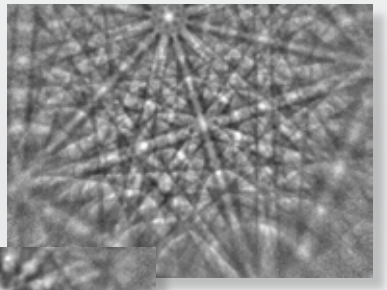
- Maximise signal to both detectors
- Achieve shorter working distances

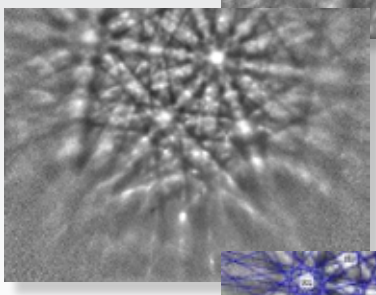
Outstanding sensitivity

Nordlys detectors are designed for operation over a complete range of kV and beam current regimes:

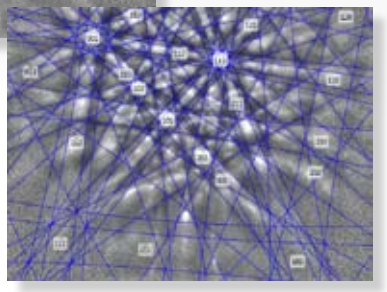
- Excellent operation at low kV and low beam energy for the best spatial resolution
- Analyse beam sensitive samples with lower beam energy
- High angular resolution: less than 0.1 degrees

Right: EBSP from tungsten at 20 kV.





Above: EBSP from tungsten at just 5 kV – the pattern is still indexed (right).



…optimum system performance

Orientation contrast imaging

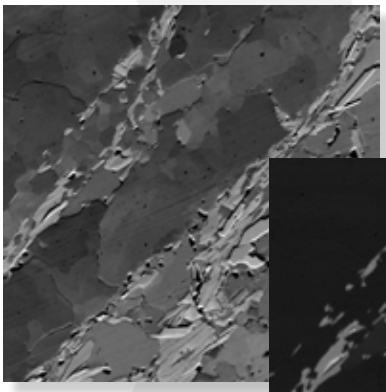
Forescatter detector (FSD) system, with up to 6 independently controlled detectors around the phosphor screen.

- Forescatter detector control is through the **AZtec** user interface
- **AZtec** includes an automated optimisation routine for orientation or atomic number contrast imaging
- This solution incorporates the flexibility and versatility for customised image acquisition

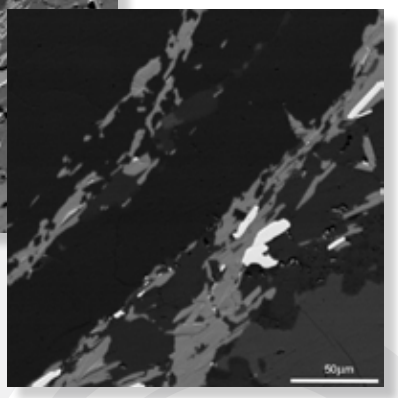
Innovative auto-calibration

The **AZtec** EBSD system uses accurate detector positioning to perform an automated calibration.

- Seamless geometric correction which automatically calculates calibration parameters based on changes in geometry
- Acquire accurate data routinely over a full range of working distance and detector insertion distances, without recalibrating



Orientation contrast image of a geological sample, (lower detector).

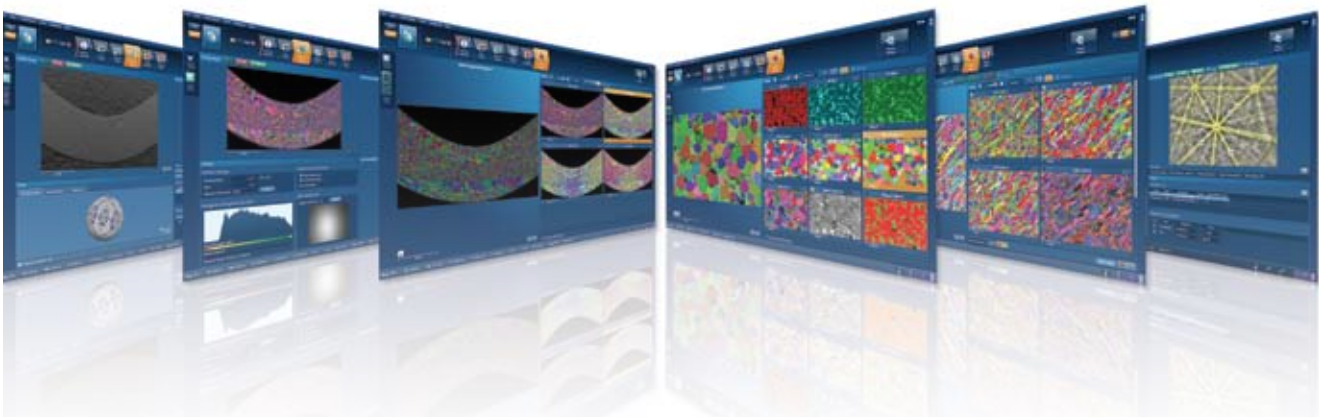


Atomic number contrast image, (upper detector).

AZtec EBSD System

The **Nordlys** detectors and **AZtec** analysis software create an innovative and accessible solution for EBSD.

- Optimisation tools automatically account for changes in acquisition conditions
- Tru-I® indexing engine for the most accurate real-time indexing
- Integrated EBSD and EDS in one user interface, for the best real time mapping and Phase ID



NordlysMax²

Fastest speed *and* high sensitivity

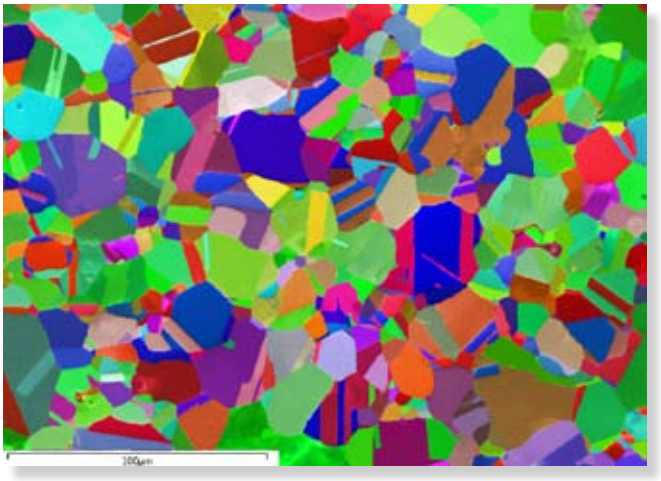
AZtec and the new generation **Nordlys**Max² detector deliver the fastest real-time indexing speeds and the sensitivity to operate in low kV and low beam current regimes. A unique design also incorporates the capability to acquire data at high temperatures.

Superior optics and CCD enables ultra fast acquisition speeds

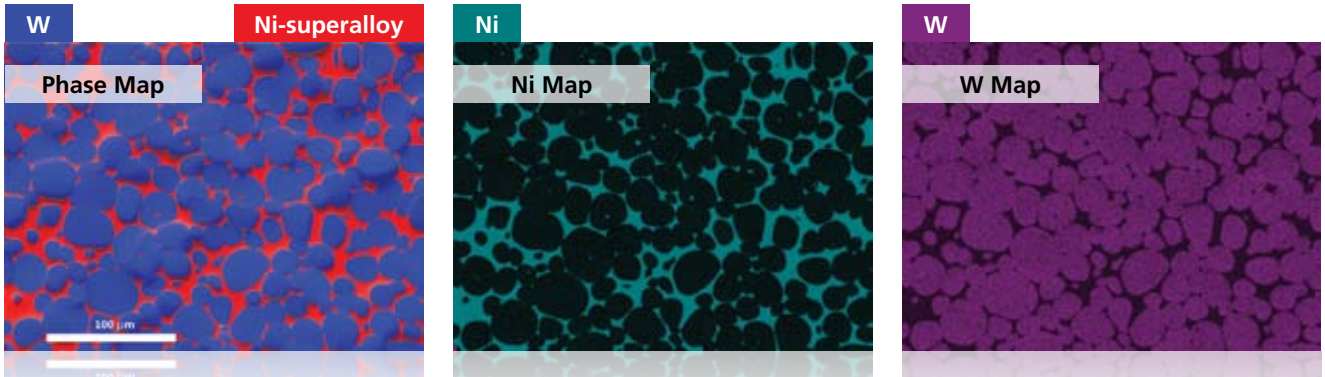
- Acquisition rates at 870 Hz acquired and solved at 99% hit rate
  - Achievable at beam currents down to 5 nA

AZtec for the fastest simultaneous EBSD and EDS acquisition

- Acquire and solve EBSD data and X-ray smartmaps at 870 points per second
- Combined data acquisition in real-time



Nickel Inverse Pole Figure (IPF) map. Data acquired and solved at fastest speeds of 870 Hz, with 99% hit rate. Raw data is shown.



*EBSD Phase map and X-ray spectral images acquired from an alloy of tungsten particles in a nickel matrix. Simultaneous data acquisition was at 870 points per second, indexing hit rate was 99%. Using **Nordlys**Max² and **X-Max** data acquisition is possible in minutes.*

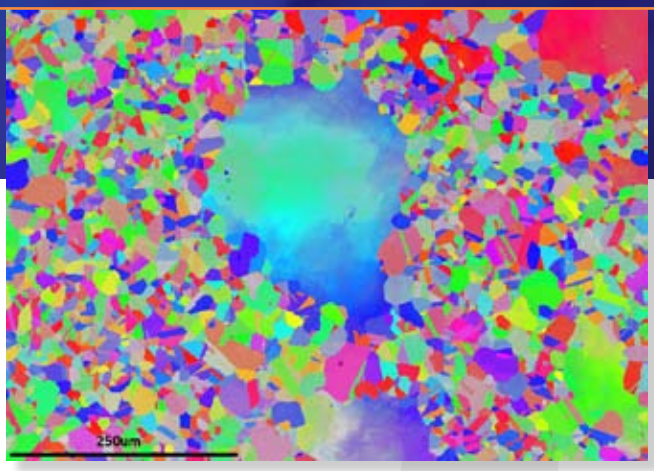
NordlysMax² combines high speed with optimal sensitivity

- Data acquisition at low kV (5 kV) to maximise spatial resolution
- Effective at low beam currents (100 pA)

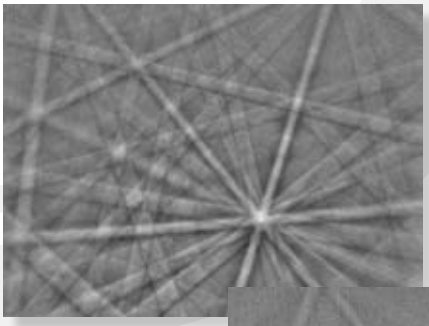
Designed for dynamic studies, where high speed acquisition is critical

Suitable for all types of dynamic studies, including in situ tensile experiments.

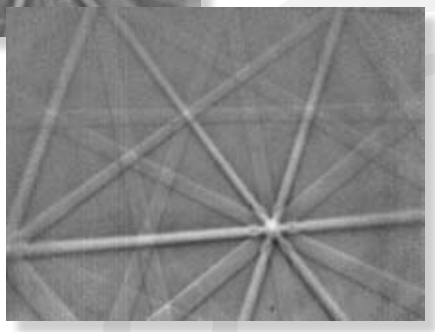
- Integrated infra-red (IR) filter for data acquisition during in situ heating experiments
- Delivers high sensitivity compared to conventional high temperature phosphor screens

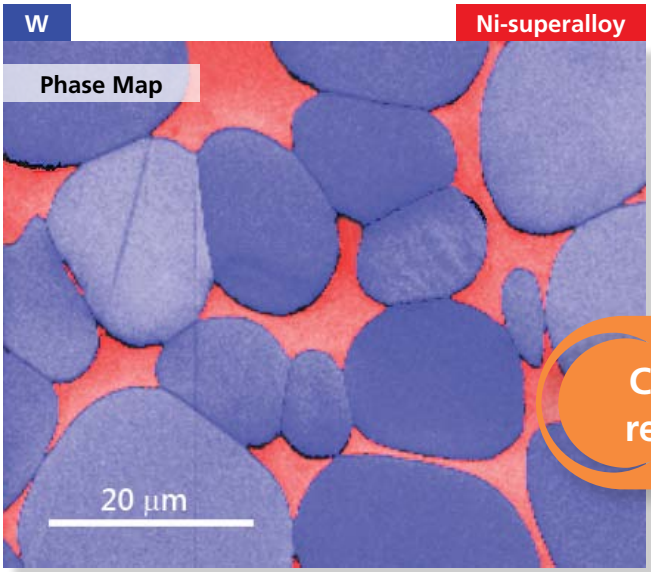


Nickel IPF map acquired at 5 kV to maximise spatial resolution of the smallest grains.



EBSD patterns from a Titanium sample, showing the transformation at 882 °C from alpha to beta phase.





Collect and solve in real-time at 870 pps

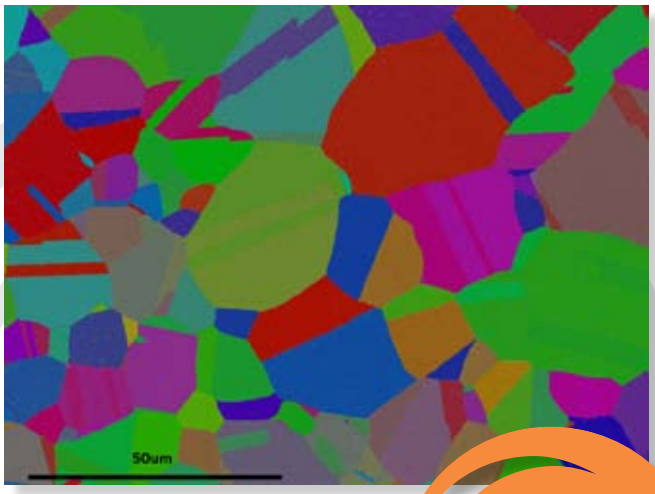
Phase map collected from tungsten alloy, at only 100 pA beam current.

NordlysNano

The ultimate accuracy – the ultimate sensitivity

The **AZtec** and **Nordlys**Nano system addresses the growing requirements of nanoscale applications: EBSPs are imaged with the best sensitivity, lowest optical distortion and highest resolution.

- Acquire and solve patterns in real-time at low beam currents and at low kV
- Highest sensitivity at the fastest possible speeds – minimise the time and the beam current required for data acquisition

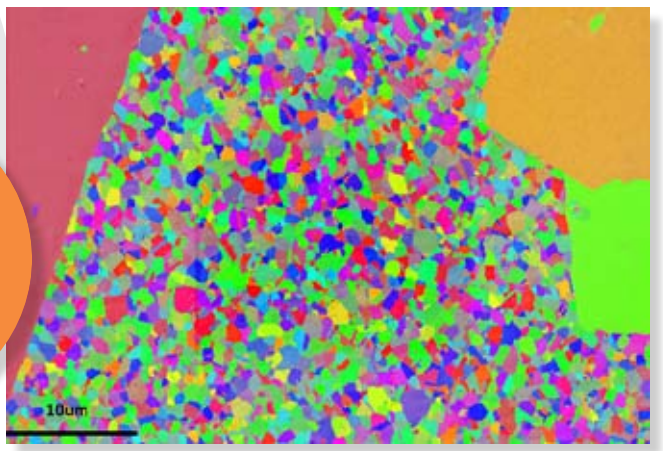


Steel IPF map acquired at 100 pA.

Highest spatial resolution

NordlysNano **is optimised for high spatial resolution EBSD**

- Designed for data acquisition at low kV, for the best spatial resolution EBSD analysis of nano materials
- Efficient low beam current operation, requiring only 100 pA to operate, ideal for:
  - Tungsten or LaB6 SEMs operated in high spatial resolution mode
  - Cold FE SEMs
  - Thermal FE SEMs that operate with low probe
  - Analysing beam sensitive materials



Fine-grained Ni IPF map,acquired at 5 kV to optimise spatial resolution.

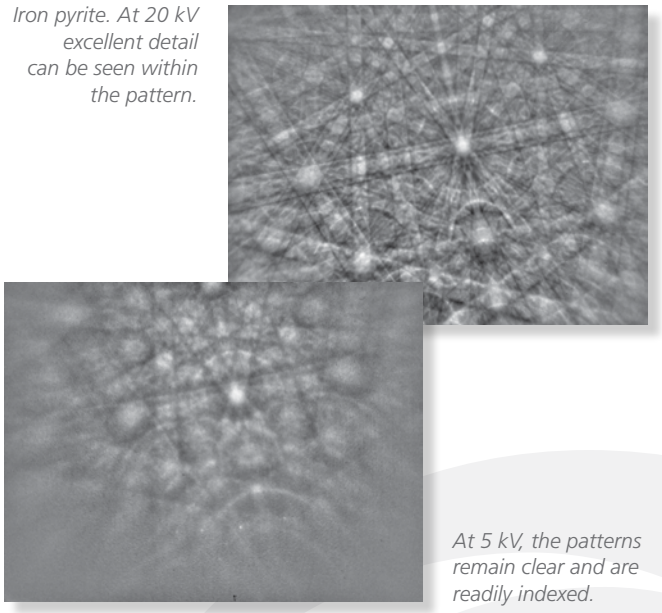
SENSITIVE

NordlysNano is optimised for high pattern resolution EBSD

NordlysNano at highest resolution uses the full 1344 x 1024 CCD array to digitize EBSPs. The acquisition of higher resolution patterns is crucial for certain applications:

- Difficult to index, lower symmetry materials, where higher pixel resolution can aid in phase identification
- Required for cross-correlation techniques, for example, elastic strain analysis
- Correct measure of orientation in pseudo-symmetric materials with c/a ratios as low as 2%

Iron pyrite. At 20 kV excellent detail can be seen within the pattern.



At 5 kV, the patterns remain clear and are readily indexed.

Which detector is better for you?

AZtec with either **Nordlys** detector delivers world-leading performance over all application regimes. For specific applications, the Nano and the Max² variants also provide distinct advantages:

Detector	Features	Specific applications
NordlysNano	• Highest sensitivity • High accuracy • High pattern resolution	• Nano materials/grains • Low kV or low beam current • Beam sensitive materials • Discrimination of pseudo symmetry (material with close c/a ratio) • Cold FEG applications
NordlysMax²	• Ultra fast data acquisition • 870 Hz at 5 nA • IR Filter • Specialist applications • Good sensitivity	• Higher beam current • Fast grain sizing or texture measurement • Phase identification • In situ sample heating experiments • Dynamic experiments within the SEM chamber • W-SEM or Thermal FEG SEM applications

Global Customer Support

Accredited, experienced, responsive, dedicated

Oxford Instruments recognises that your success requires not just only world-class products, but also world-class service and support. Our global service team is renowned for delivering outstanding service to customers and microscope vendors:

- Hands-on and theory classroom training
- On-site training tailored to your specific needs
- Web-based courses and training videos
- Consultancy and application support
- Multi-layered maintenance and service contracts

Please visit **www.oxford-instruments.com** for more information

OXFORD INSTRUMENTS
The Business of Science®

FM 571796