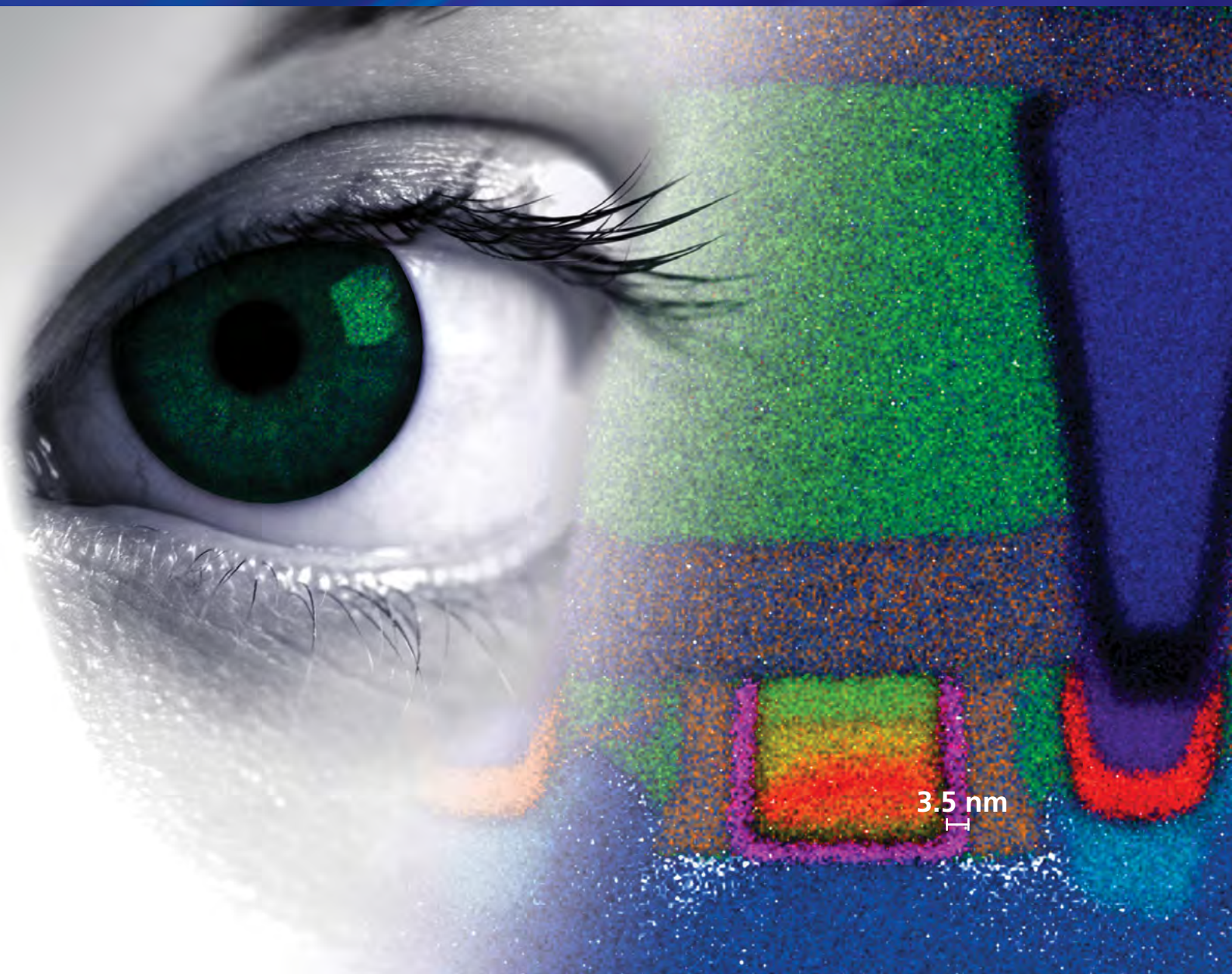
AZtecTEM

The complete solution for advanced EDS on the TEM

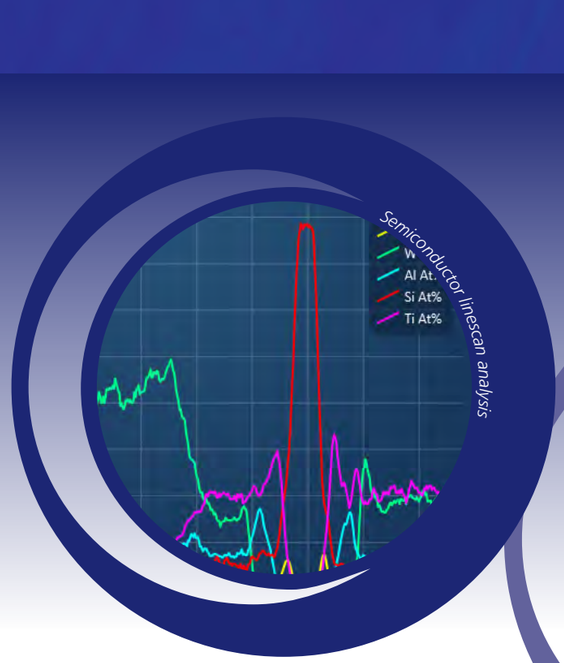


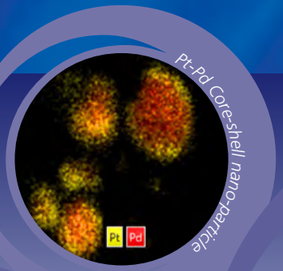
OXFORD INSTRUMENTS

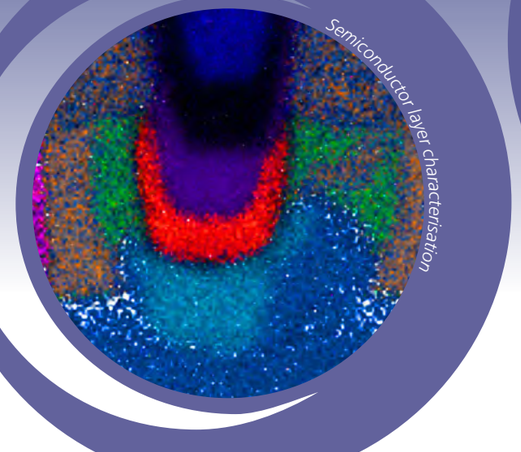
The Business of Science®

AZtecTEM

Advanced materials characterisation at the atomic level







AZtec® provides the ultimate materials characterisation system for TEM and STEM applications operating at the frontiers of analytical performance.

It's all about getting the right results in real-time. Large area **X-Max^N** Silicon Drift Detectors combine to create a system with up to 2 steradians* solid angle for fast acquisition, while windowless technology results in outstanding sensitivity and low energy performance. **AZtec**TEM software then processes the raw data automatically and displays the results in the form of qualitative and quantitative spectral maps and linescans.

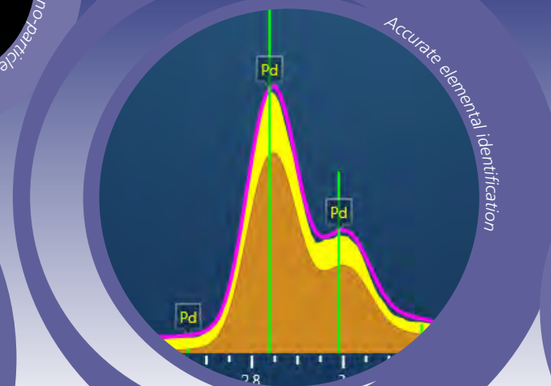
Combining power and ease of integration, **AZtec** is developed by the market leader in nanonanalysis systems to meet the ever more challenging requirements of analysis at the nano and atomic scale.

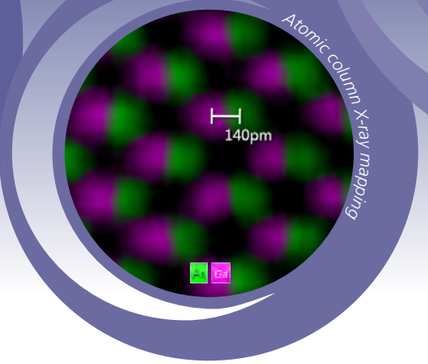
** Microscope and configuration dependent.*

The innovative EDS system specifically optimised for advanced TEM applications

AZtecTEM

At a glance...





Powerful

- Unleashes the potential of the latest generation of large area **X-Max^N** SDDs - delivering sensitivity when count rates are low and a high capacity when count rates are high.
  - Choice of detectors, including 100 mm² active area with a special design that maximises solid angle
  - Multiple detector system enables over 2 sr solid angle*
  - Windowless options for outstanding low energy performance
- **AZtec** has a 64-bit performance and a true multi-tasking capability so you work at the maximum detector speed, visualise final results in real-time, report in parallel... and get the job done faster than ever
- Enables superfast simultaneous EDS/EELS integration for the complete characterisation of materials

Flexible

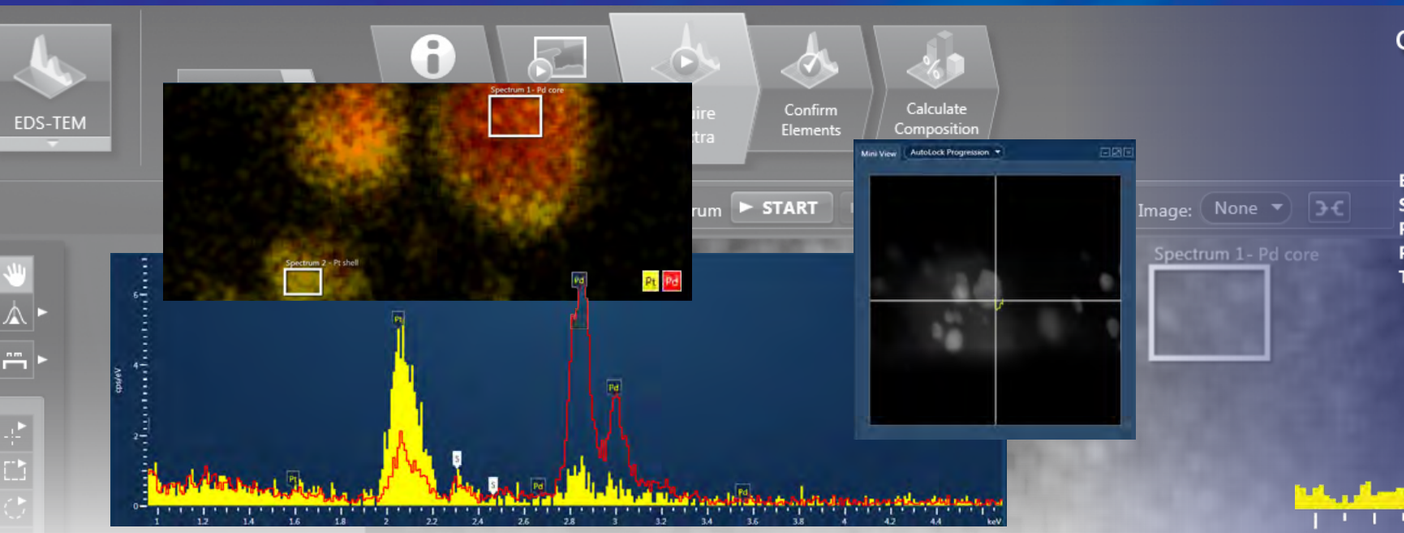
- **AZtec**TEM provides the tools to explore data in your own way with a variety of options for data collection, processing and export

Accurate

- Incorporates Tru-Q® technology to provide high accuracy AutoID and quantitative analysis - so you get the right results in real-time, time after time
- AutoLock™ provides a unique blend of predictive and reactive drift correction routines - vital when working at the nano and atomic scales
- TruMap and TruLine correct for overlaps and other artefacts in real-time, then automatically visualise the data in the best way possible

Qualitative Results

Real-time analysis and reporting



Spectrum characterising Pt/Pd core-shell nano-particles.

Point & ID

Often the first step in analysing the sample. With **AZtec** this is fast, accurate and reproducible - you simply select the areas to analyse then, in the short time it takes to collect a spectrum:

- All elements are automatically identified
- Composition is displayed in the unique miniQuant window
- You can quickly annotate points of interest for others to note

...and send your mini report with a single click

AutoID

Accurate and reliable, AutoID allows users to identify peaks in real-time as spectra are being collected during the scan.

- No need to know which elements are present beforehand
- Exclude elements from the analysis, if required
- Uses Tru-Q technology to correctly identify elements at all count rates - even where peaks overlap

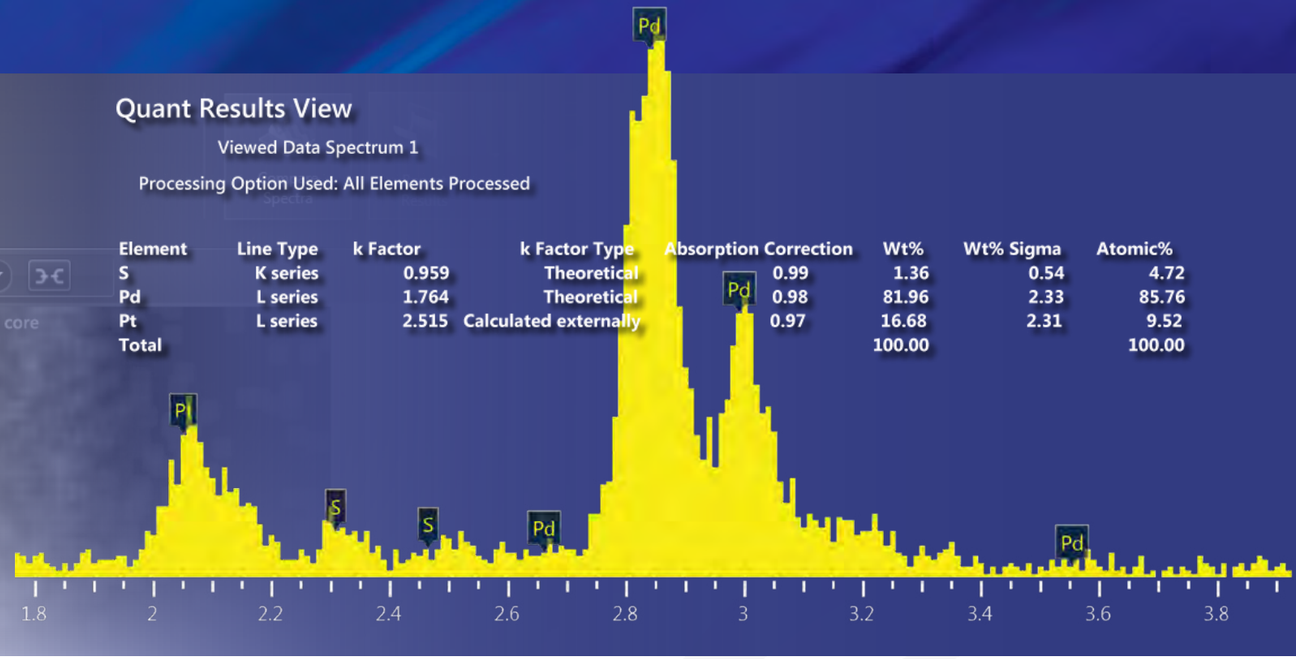
AutoLock

Automatically keep the field of view locked to the same area. This is of special relevance to STEM when collecting high resolution images and maps.

- Enables analysis at resolutions that are normally difficult to achieve because of drift
- Provides live updates of corrective actions being taken
- A unique blend of predictive and reactive correction routines cope with different types of drift

Quantitative Results

Providing the accuracy for automatic real-time quant analysis



Tru-Q®

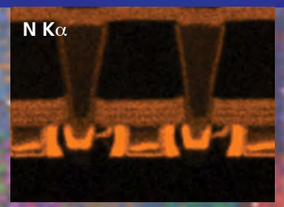
Tru-Q is a unique Oxford Instruments' technology that provides high accuracy AutoID and quantitative analysis. It uses a combination of technologies:

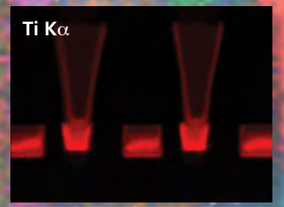
- Complete detector and hardware characterisation for a true standardless analysis
- Robust FLS spectrum processing that works in all situations. For example, there is no need for any background fitting adjustment
- Modified Cliff-Lorimer – TEM quant that allows sample thickness and density to be taken into consideration
- Theoretical or user-defined k-factors can be applied
- K, L or M lines can be chosen for quantitative analysis
- PPC - Automatic correction for pulse pile-up at high count making accurate quant at 200,000 cps a reality
- Removal of unwanted non-sample peaks (e.g. Cu from grid)

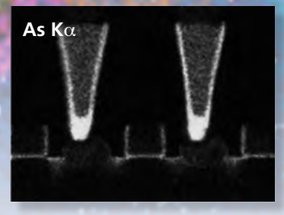
Now everyone can achieve reliable results

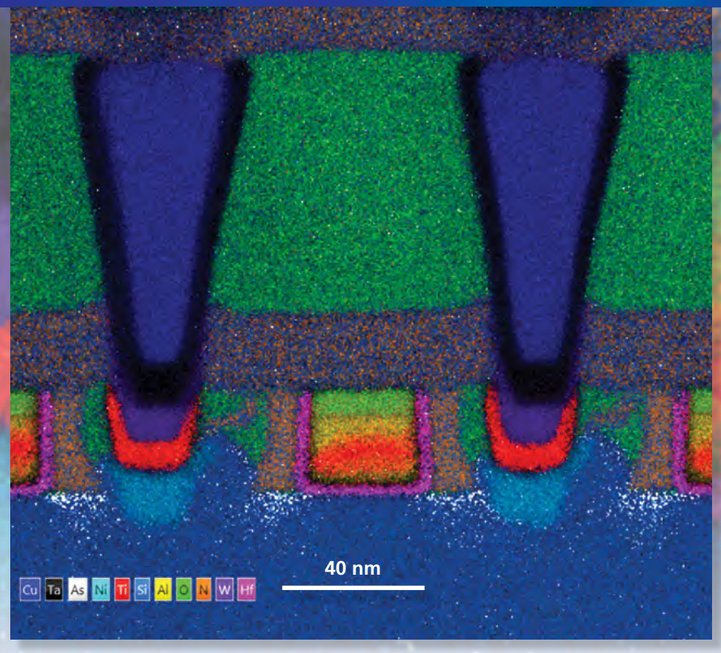
Mapping

Bring new levels of certainty and detail to specimen investigation









Smart Mapping

SmartMap spectral mapping brings the benefits of automatic qualitative analysis into two dimensions to identify elements and visualise their distributions.

- The traditional 'Windows Integral' mapping method
- Maps are automatically generated
- Elements may also be manually defined
- Mapping resolution up to 4k pixels
- All the informtion is saved at every pixel for post-processing

AutoLayer

At the click of a button, AutoLayer takes the often complex information contained in a set of X-ray maps and turns it into a single image that helps visualise both phase and element distribution in the specimen.

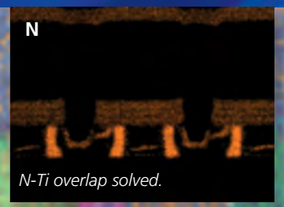
- Instantly and automatically interprets your specimen
- Colours automatically selected to highlight what's important in a single image
- Unravels the complexity of real specimens

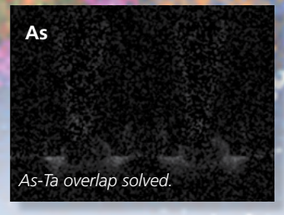
EELS Integration

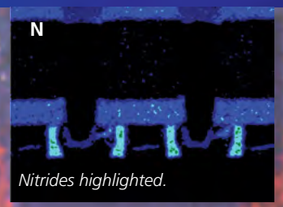
Superfast EELS integration delivers accurate simultaneous data acquisition. **AZtec** is capable of working at speeds well in excess of 1000 spectra per second.

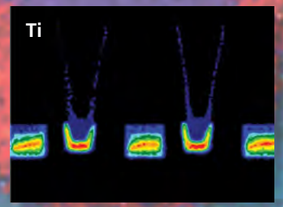
- Seamless integration with Digital Micrograph™
- Fastest acquisition possible
- Easy switching between integrated and stand-alone modes.
- Highest EDS collection efficiency

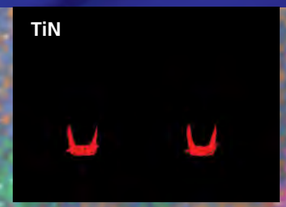
Powerful mapping modes extract the real data

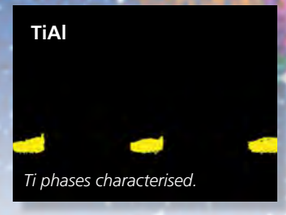












TruMap

TruMap is a unique real-time mapping solution that removes background and peak overlaps on the fly.

- Eliminates erroneous data automatically
- Corrects overlaps such as:
  - Si K and W M lines - vital to the semiconductor indusry
  - Pb M, Mo L and S K for minerals analysis
- Can be applied to legacy data

QuantMap

QuantMap displays real quantitative chemical X-ray maps by recalculating SmartMap data to correct for X-ray background, peak overlaps, sample matrix effects and pile up artefacts. QuantMaps can be calculated and displayed on-line - eliminating the need to reprocess SmartMap data off-line.

- Display results in atomic%, weight%, oxide% or atomic concentration
- Export data to spreadsheet

AutoPhaseMap

AutoPhaseMap creates a phase map of the specimen using statistical measures to optimise phase groupings rather than clustering or principle components. It provides an unrivalled qualitative and quantitative analysis of automatically identified phases.

- Distribution of each phase
- Spectrum, composition and area fraction for each phase
- Finds phases for all size ranges, including nanomaterials
- Finds elements which are present in trace amounts

POWERFUL

Linescan

Simple, flexible and the right results in real-time

TruLine Hf-W overlap solved.

LineScan

LineScan brings the concepts of **AZtec** real-time acquisition and reporting to the study of linear variations

- All the data is always collected and saved at every pixel
- Easy and flexible interpretation
- Automatically acquire multiple horizontal or vertical LineScans
- Align image and LineScan for clear visual comparison
- Normalised intensity scales make comparison of major and minor elements simple

TruLine

TruLine Incorporates Tru-Q technology tocalculate true elemental peak variation from a line scan.

- Corrects for peak overlaps automatically
- Enhances real elemental differences by removing X-ray background variation
- Real-time calculation and display

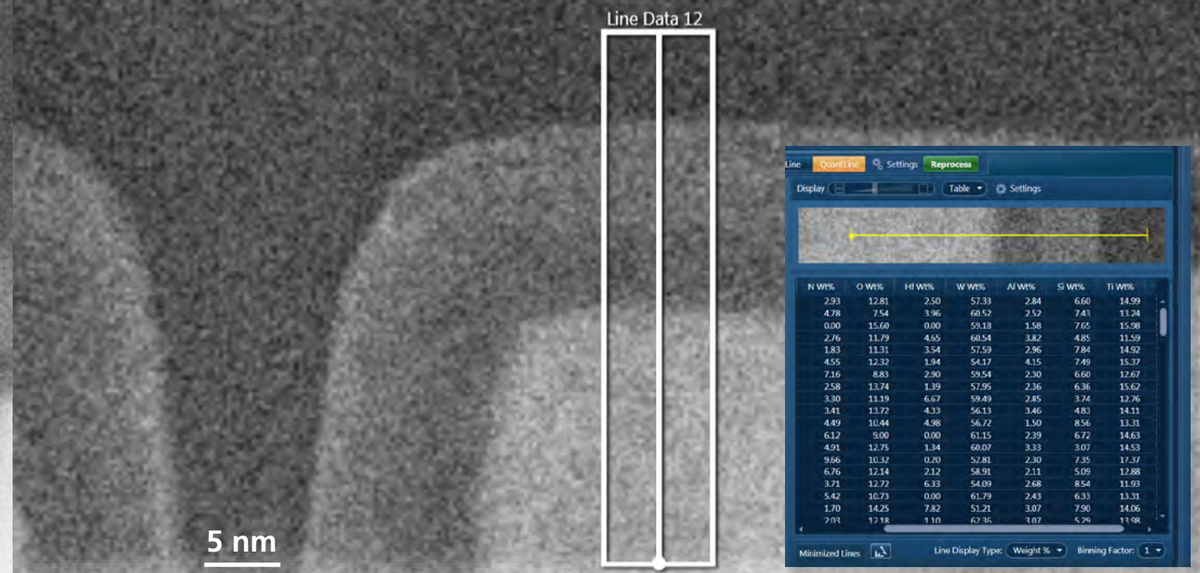
QuantLine

QuantLine displays real quantitative chemical linescans by recalculating SmartMap data to correct for the X-ray background, peak overlaps, sample matrix effects and pile up artefacts.

- No need to wait for lengthy data processing...see quantitative linescans live!
- Display results in atomic%, weight%, oxide% or atomic concentration
- Export data to spreadsheet
- Can work on legacy datasets

Data transparency

Flexible offline data processing



Reconstruction

Maps, linescans and spectra maybe reconstructed from previously collected SmartMap or Linescan data. This allows users to :-

- Reconstruct TruMaps from previously collected SmartMaps
- Reconstruct QuantMaps from previously collected SmartMaps
- Reconstruct TruLines and QuantLines from previously collected Linescans
- Reconstruct spectra from areas and points on maps or linescans
- Variable thickness linescans can be extracted from stored map data for detailed analysis of grain boundaries

Data Transfer

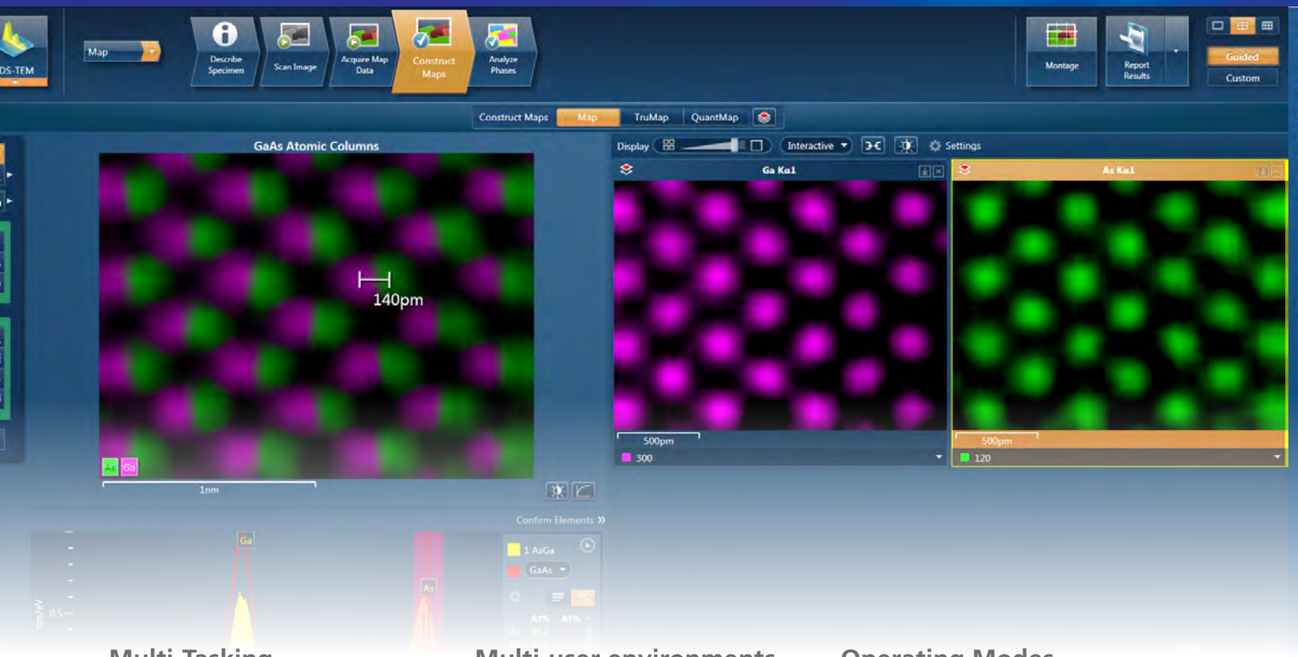
In (S)TEM it is often desirable to transfer data collected in **AZtec** to other programmes for further investigation. **AZtec** gives the capability to transfer data as:-

- Datacubes in the form of raw files to programmes such as Lispix and multivariate statistical analysis packages for evaluation of data such as atomic column mapping
- Excel for further processing of spectra (EMSA format), maps and linescans

FLEXIBLE

Usability

Powerful for the expert - yet scalable to any user



Multi-Tasking

AZtec has true multi-tasking capability, meaning that every second of data acquisition can also be used for processing and reporting.

- Data interaction in real-time
- Many tasks that used to take minutes now take seconds
- Interrogate data from one project while acquiring data for a new project
- Enable new ways of working to give a large increase in productivity

Multi-user environments

- Profiles contain all the settings required to repeat an analysis and obtain the same results no matter who the user is
- Step Notes and Standard Operating Procedures (SOP) help at every step of your analysis and can be easily modified for personalised SOPs

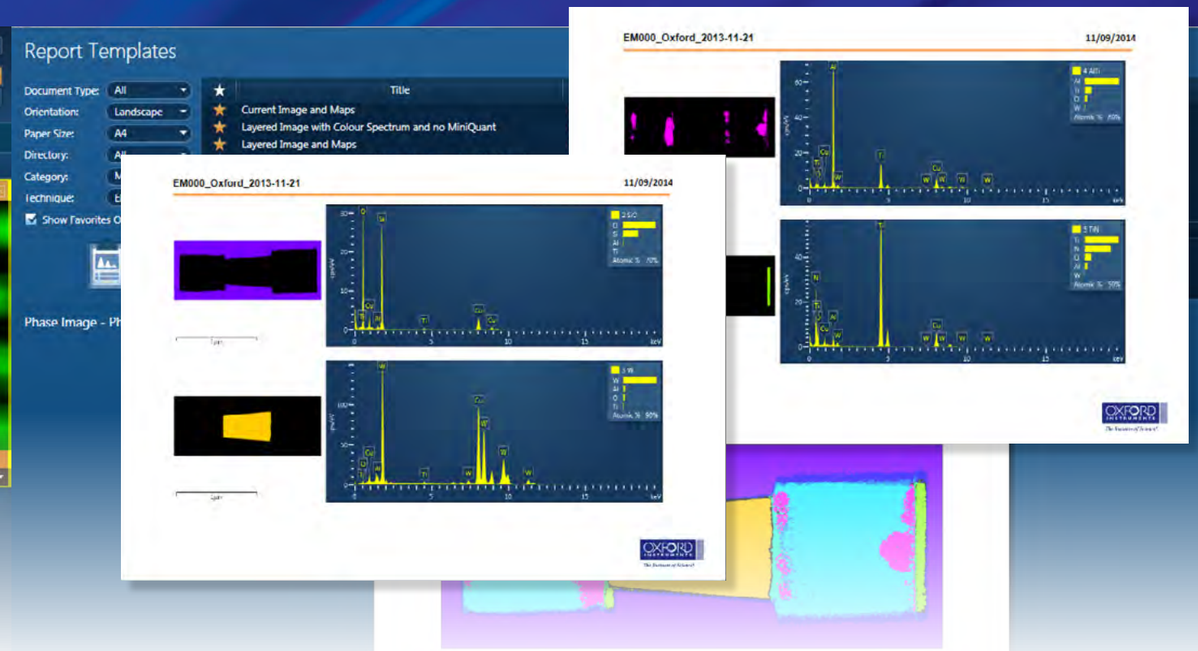
Now everyone can achieve reliable results

Operating Modes

- **Guided Mode** Ideal for those who prefer a 'step by step' approach to analysis. Each step of the Navigator has a clear purpose. You can always see what is happening and what to do next
- **Custom Mode** Ideal for those who prefer the freedom and flexibility to decide what functionality they want to see and where they want to see it

Reporting

Comprehensive reports - automatically created



Reporting

No matter what your requirements, **AZtec** will help you present the reports you need in the format you want them

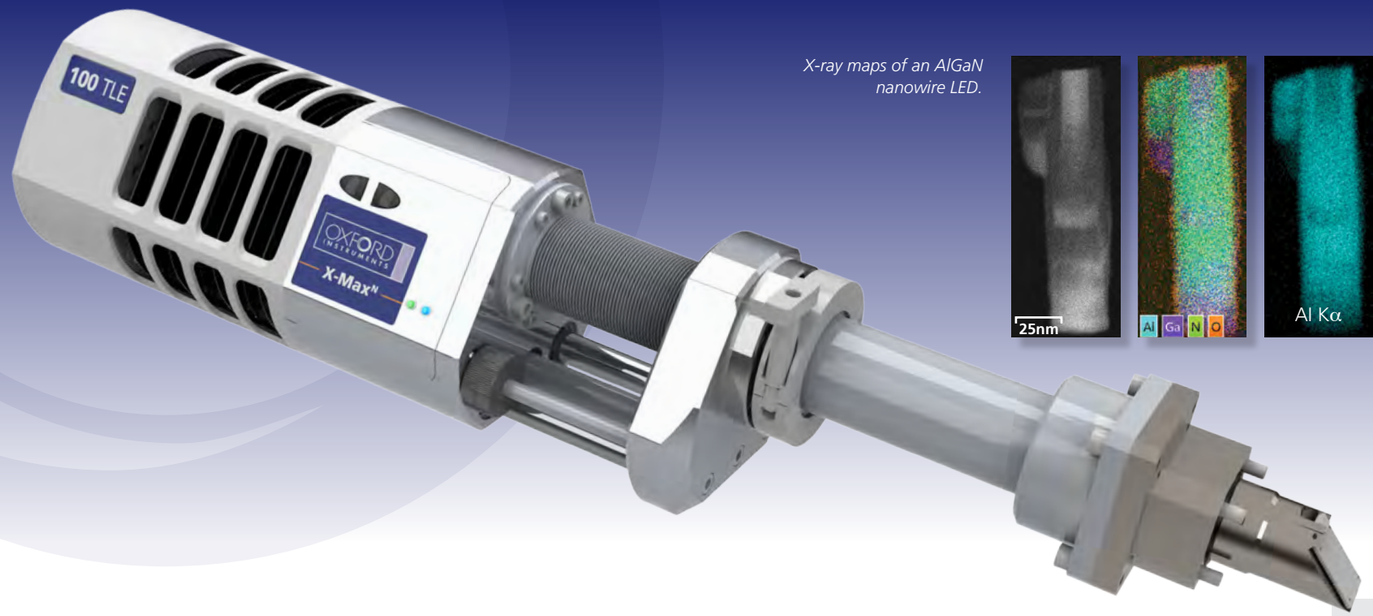
- **Fast:** reporting direct from the interface - a simple right click and data can be e-mailed direct to your customer
- **Flexible:** a dedicated application enables you to export your data in the format and resolution you want
- **Structured:** a comprehensive list of report templates tailored to each application enables you to print a professional report with a single button press
- Create your own templates!
  - Simple easy to use interface
  - Create templates for use across multiple techniques
  - Create multi-page templates
  - Create templates for single or multiple users

Report your data quickly and in the way you want

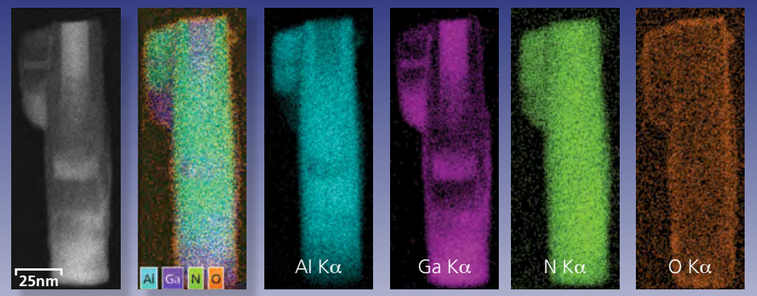
PERFORMANCE

X-Max^N Silicon Drift Detectors for TEM

Breakthrough detector technology



X-ray maps of an AlGaN nanowire LED.



Wide range of detectors

X-Max^N TEM detectors use the latest low noise designs for excellent resolution and sensitivity - even at high count rates.

- **X-Max^N** 100TLE provides the ultimate collection efficiency for abberation-corrected FEG TEMs
- **X-Max^N** TSR, provides a large solid angle for conventional 200kV TEMs
- **X-Max^N** 80T is the ideal solution for routine TEM applications

Windowless technology

Windowless technology provides greatly enhanced collection efficiency over the entire spectral range, and particularly for light elements. This means more counts at all energies and a superb low energy performance - without compromising peak-to-background ratio or resolution.

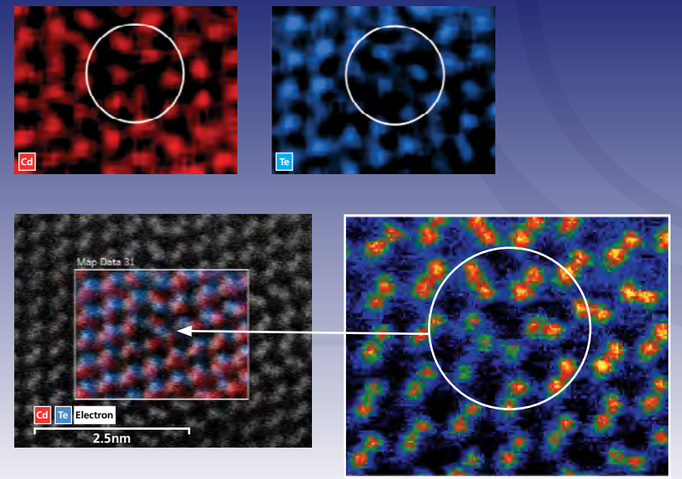
- Collection efficiency significantly improved compared to conventional thin window detectors
- Provided as standard with **X-Max^N**100TLE and **X-Max^N** TSR

Outstanding practicality

- All detectors are easily installed and retrofitable to existing columns
- Auto-retraction with flap for protection against electron flux damage
- LN_2-free operation
- No need to tilt sample to optimise solid angle
- Pressure sensor automatically protects windowless detectors in case of vacuum loss

X-Max^N 100 TLE

...delivers superior solid angle, sensitivity, and speed



Atomic column mapping of Cd and Te to determine the atoms at Lomer- Cottrell dislocations in CdTe. Images courtesy University Illinois Chicago (UIC).

High angle annular dark field.

X-Max^N 100TLE - our flagship detector

The **X-Max^N** 100TLE exploits a new sensor shape, a windowless configuration, and an innovative mechanical design to deliver truly 'next generation' SDD performance.

- Solid angle in the range 0.5 to 1.2 steradians*
- Ideal solution for aberation-corrected TEMs
- Detect much lower concentration of elements
- The breakthrough solution for semiconductors, biological and other beam sensitive materials, collecting more data before sample beam damage
- Analyse nanoparticles and nanotubes to unprecedented levels of detail
- Analyse impurities and dopants at the nanoscale

Outstanding performance

- Maximises count rate at the nano- and pico-scale
- Proven capability for atomic column mapping of lattice dislocations and material interfaces
- Unique sensor design brings 100 mm^2 active area closer to the sample for ultra high solid angle
- Windowless configuration ensures the best sensitivity for all elements and unrivalled detection of low energy X-rays
- Performs accurate quant at count rates >100Kcps with accurate pulse pile up correction

** Microscope and configuration dependent.*

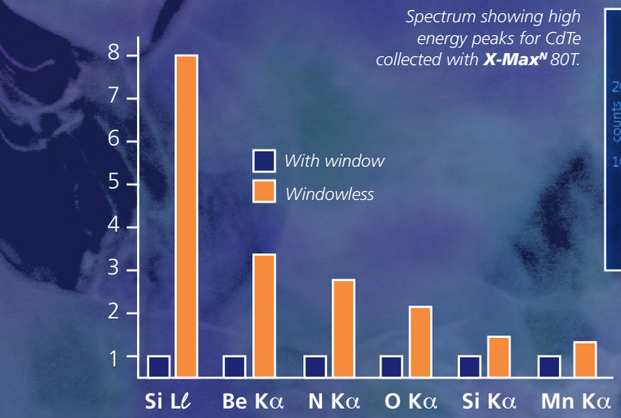
FLEXIBLE

X-Max^N TSR and 80T

Powerful, proven performance for TEM applications

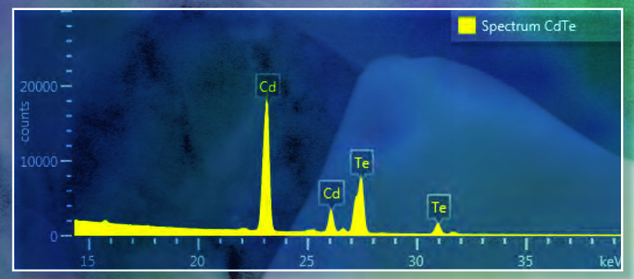
Multiple Detectors

Double performance for work at the frontiers of nanoanalysis

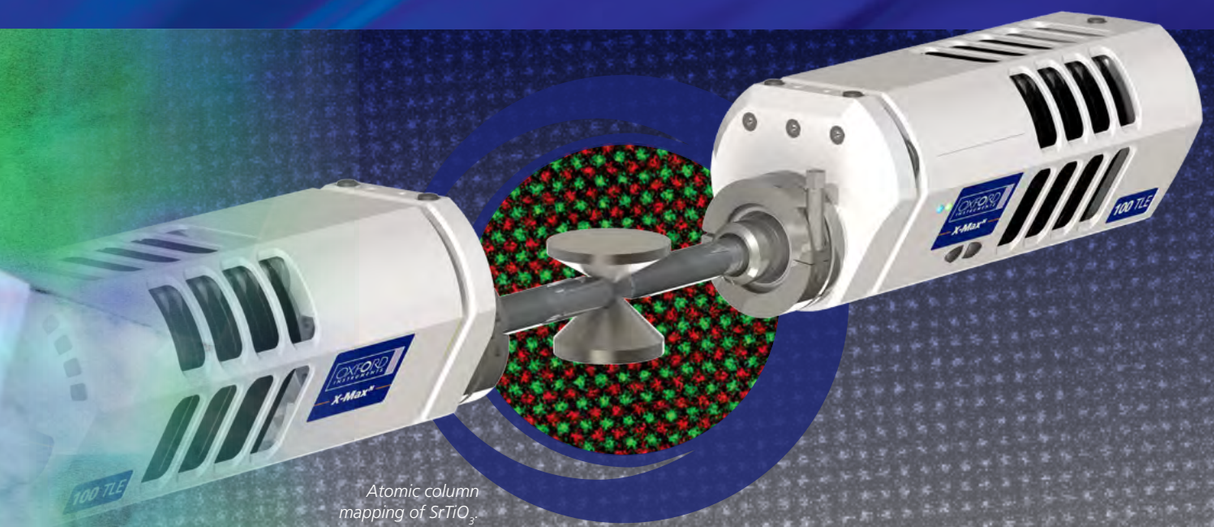


Improvements in collection efficiency using windowless detector (orange) compared to detector with a window (blue) for selected X-ray lines.

*Spectrum showing high energy peaks for CdTe collected with **X-Max^N** 80T.*



Background image is $NaKNbO_3$ and BiTa oxide ceramic.



Atomic column mapping of $SrTiO_3$.

X-Max^N TSR Extended Solid Angle

This windowless detector sensor provides a collection solid angle in the range 0.3 to 0.7 steradians*. Its superb collection efficiency over the entire spectral range, particularly for light elements, means more counts at all energies.

- Ideal for conventional 200 kV Field Emission TEMs
- Up to 3x collection efficiency for light elements
- No compromise in low energy performance, peak-to-background ratio, or resolution.

X-Max^N 80T detector

The **X-Max^N** 80T is a high performance yet cost effective detector for routine applications.

- Large sensor guarantees good throughput and low energy sensitivity
- Incorporates ultra-thin window, for secure performance with all classes of TEM
- Excellent resolution with guaranteed Mn specification at 50,000 cps
- Count rates conducive to acquiring X-ray maps quickly, including TruMaps with real-time background removal and peak deconvolution

** configuation, pole piece and TEM dependent.*

Double count rate with no trade-off in performance.

With **AZtec**TEM and **X-Max^N**, data from two detectors can be seamlessly combined for even greater sensitivity and throughput

- Up to two detectors on one microscope
- Increase count rate, with no loss in spatial or spectrum resolution
- Up to 200 mm^2 real active area, equivalent to over 2 steradians on some TEM systems*

Benefits

- Collect X-ray maps using only a few pA on the most unstable samples
- Maximise information from the smallest nano-particles and features
- Detect low concentrations of minor elements faster

Multiple detector systems provide even greater sensitivity and throughput - with no compromise in resolution.

OISERVICE

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

visit **www.oxford-instruments.com/TEM**

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