Thermo Scientific ARL ADVANT'X Series

IntelliPower™ Technology

Sequential X-Ray Fluorescence Spectrometers

Geology/Environment

Petrochemicals/Polymers

Raw materials/Mining

Metals

Glass

ARL ADVANT'X Series
Sequential X-Ray
Fluorescence Spectrometers

ARL ADVANT'X IntelliPower™ Series

Sequential X-Ray Fluorescence Spectrometers

Advances in X-ray fluorescence analysis

The Thermo Scientific ARL ADVANT'X IntelliPower family of X-ray fluorescence (XRF) sequential spectrometers with IntelliPower technology provides the choice of performance and value to suit your true requirements. These high tech instruments allow analysis of up to 84 elements of the periodic table in conductive or non-conductive solids or liquids. Many application areas will find their perfect match within this new family of instruments, notably:

- Monitoring of trace elements in oils or polymers
- Analysis of major and minor elements in cement and quarry materials
- Full analysis of glasses, metals, ores, refractories and geological materials

Advantages over other analytical techniques are:

- Easy sample preparation
- Speed of analysis
- High stability
- Good precision
- Wide dynamic range (from ppm levels to 100 %)
- Simple and rapid analysis of totally unknown samples thanks to state-of-the-art standard-less analysis packages, i.e. QuantAS™, UniQuant® and OptiQuant™

IntelliPower technology

Thanks to a clever management of power, the ARL ADVANT'X IntelliPower spectrometers can operate at 1200 W and even 2500 W without requiring external water cooling. Therefore neither tap water, nor a water cooler is required in these cases. At higher power levels (3.6 kW or 4.2 kW), energy savings and reduced stress on the X-ray tube are obtained thanks to intelligent management of the X-ray tube power.

Unique Moiré fringe goniometers

At the heart of the ARL ADVANT'X Series XRF spectrometers, the exclusive Moiré fringe goniometers will ensure reliable and fast angular positioning of crystals and detectors. Their ingenious friction-free positioning system guarantees speed, flexibility and reliability of analysis.

Accurate angular positions are achieved thanks to electro-optical readers counting Moiré fringes resulting from the interference of two grating systems. This «no gear» design brings several important advantages:

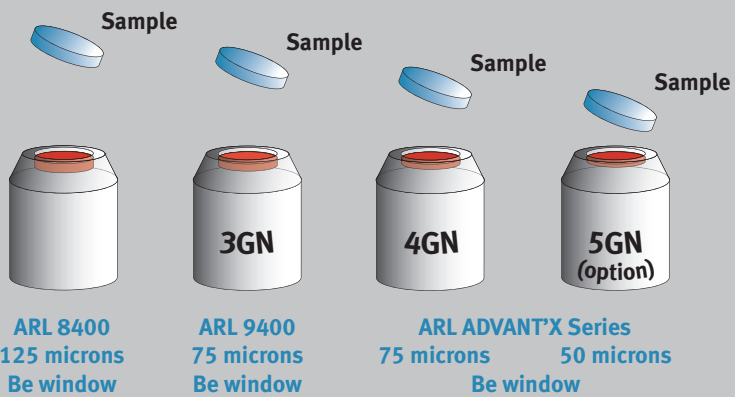
- Up to 4800 °/min slewing speed which is 5 times faster than a conventional goniometer
- The absence of friction means no wear with time, which assures an excellent angular reproducibility (< ± 0.0002 °)
- High accuracy of peak positions, e.g. 0.015 ° with LiF crystal, such that peaks are found at theoretical angles. This is up to 8 times better than on conventional systems
- Alignment of the crystal and detector θ/2θ relationship is performed automatically by the microprocessor. Unlike conventional systems, no mechanical adjustments are needed

Microprocessors working in multitasking mode ensure fast positioning of the crystals, collimators and detectors. In addition, the entire goniometer is under constant temperature control in the vacuum chamber to ensure long-term stability. Furthermore, as crystals are the most sensitive to temperature changes, they are themselves thermostatically controlled to ± 0.1 °C.

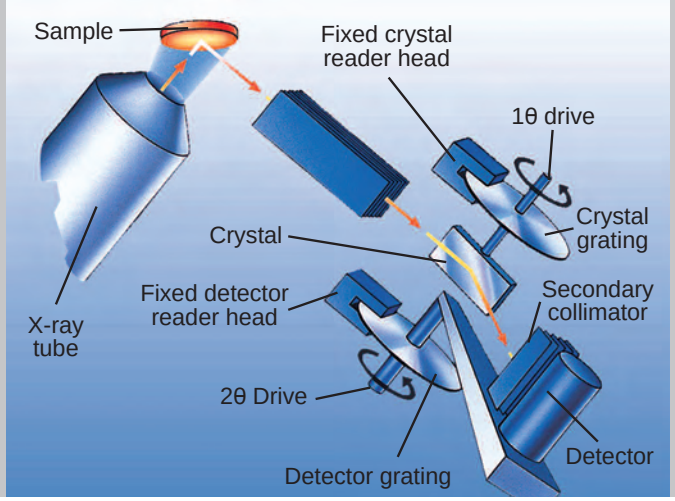
Evolution of the X-ray tubes over the last decade:

- **Closer coupling between anode and sample**
- **Thinner Be windows**

X-ray tube evolution



Universal goniometer principle of operation



Universal gearless goniometer

- **Quantitative analysis of any element from Be to U providing adequate crystals are fitted**
- **Angular positioning to ensure θ/2θ relationship between crystal and detector is achieved through Moiré fringe optical encoders:**
  - ***no friction***
  - ***no wear!***
  - ***excellent angular positioning accuracy***
- **Temperature regulation of crystals for best analytical stability**
- **Standard-less analysis when coupled to appropriate software packages (e.g. QuantAS™ or UniQuant®)**
- **Polarization effect for reduced background**

5th generation universal Moiré fringe goniometer

Universal Goniometer

Thanks to its versatility, the universal goniometer will be chosen for all demanding and advanced applications requiring best spectral resolution and sensitivity. Independent rotation of crystal and detector systems is achieved through direct drive provided by motors fitted directly on each axis of rotation.

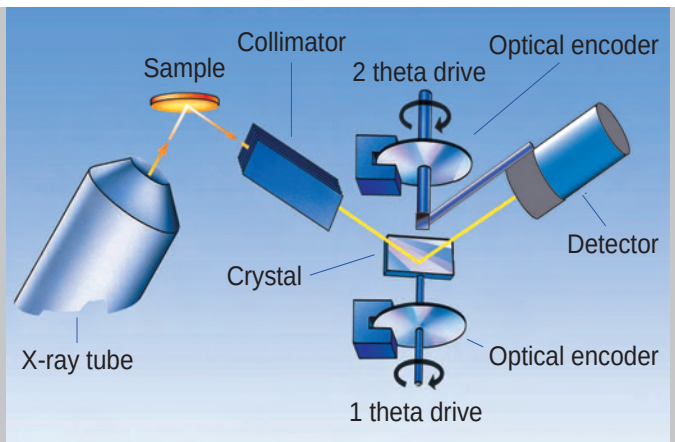
- Up to nine crystals can be fitted allowing the analyst to choose the best crystal for each region of the X-ray spectrum
- Up to 4 primary collimators are available with different angular divergence in order to optimize resolution or intensity
- The decoupling of movements allows mounting of two detectors side by side. Optimized secondary collimators are placed in front of each detector for improved countrate and resolution

Exclusive SmartGonio™

Alternatively to the universal goniometer, the ARL ADVANT'X Series XRF spectrometers can also be fitted with the new SmartGonio. It is a compact and affordable goniometer covering elements Fluorine to Uranium with a standard configuration of three crystals and two detectors.

All advantages of speed, angular reproducibility, accuracy, auto-adjustment and stability are identical to those featured by the universal goniometer.

SmartGonio principle of operation



Compact SmartGonio

- **Quantitative analysis of any element from F to U**
- **Angular positioning to ensure θ/ 2θ relationship between crystal and detector is achieved through Moiré fringe optical encoders:**
  - ***no friction***
  - ***no wear!***
  - ***excellent angular positioning accuracy***
- **Temperature regulation of crystals for best analytical stability**
- **Standard-less analysis when coupled to OptiQuant software package**
- **Smart optical coupling for highest sensitivities**

High performance included

These state-of-the-art instruments are equipped with the 4GN end-window X-ray tube with thin walled tapered nose allowing the closest coupling between anode and sample. This ensures very high performance measurements on all types of samples. As an option the latest development in X-ray tubes, the 5GN type, with **50 micron Be window** rather than 75 microns, can be fitted when light elements (up to Cl) are of particular interest. This thinner window is more transparent to the radiations that excite the ultra-long wavelengths of the lighter elements. Together with multilayer "crystals" and the extra-coarse collimator of the universal goniometer, it further improves measurement of elements below magnesium. The Rh anode is recommended for most applications as it provides very efficient excitation over the whole spectrum without interfering with the most commonly determined elements.

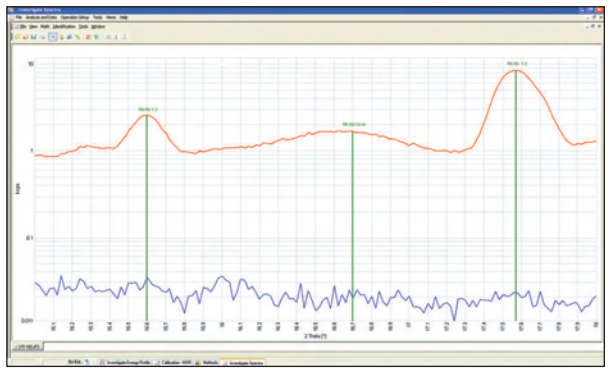
Choice of power, the power of choice

The ARL ADVANT'X IntelliPower Series spectrometers can be chosen with an integrated high frequency solid-state generator of varying power in order to best address any type of application.

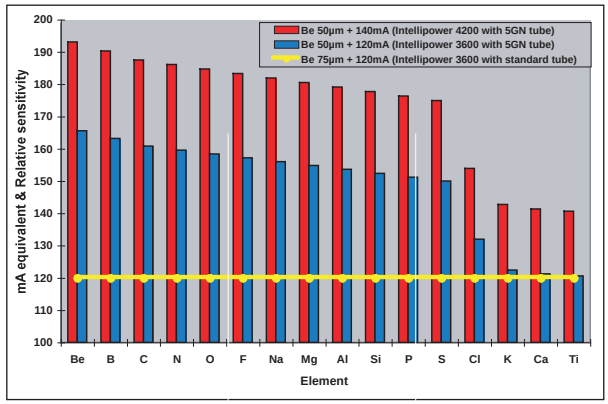
Thanks to a clever management of power, the 1200 W and 2500 W versions are cooled with their own independant circuit, thus **avoiding the need of external water cooling.**

The 3600 W version will suit most applications where low limits of detection and high performance is required. The maximum output for this generator is 60 kV. An optional 70 kV generator exists for applications where best limits of detection on heavy elements are important.

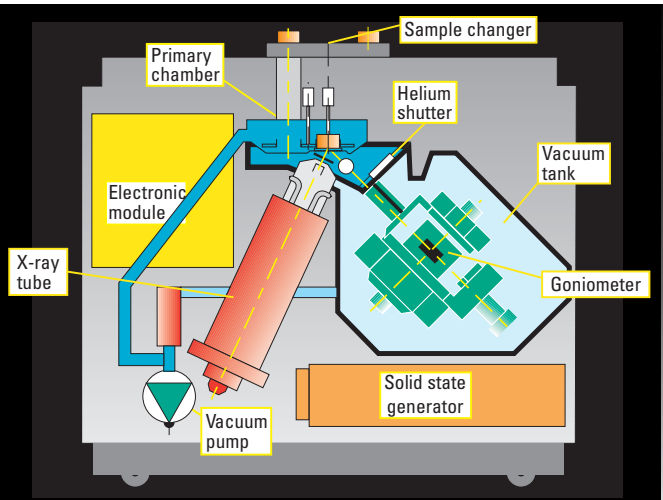
The top performer in the family is the 4200 W version for those applications where ultimate performance is mandatory. Two types of power supply can be chosen on this latter instrument. The optional **top performance generator** is capable of higher current and voltage. At 140 mA, it will provide the best performance on light elements (Be to Ca). Alternatively for ultimate excitation of the short wavelengths (heavier elements), it is operated at 70 kV.



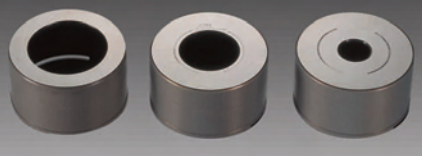
Removal of Rh lines with primary beam filter (Log scale)



Sensitivity comparison 4GN tube vs. 5GN tube & 140mA



A programmable aperture changer is used with cassettes of various openings



Advanced designs

Thanks to a **dual position primary chamber,** the compact ARL ADVANT'X Series spectrometers can load and pump down a sample while another is being analyzed, thus increasing the sample throughput.

For liquids analysis, a change of environment from vacuum to helium in the spectrometer is required. Thanks to a **unique shutter design**, only the small primary chamber (about 3 lt) is filled with helium. This allows a rapid changeover ($1^1/_2$ min), protects all measuring devices from liquid spillage, keeps them under vacuum and at a stable temperature. In addition, liquid cassettes are identified before loading, which removes any risk of exposing liquids to vacuum.

In case small samples must be analyzed routinely, a **programmable aperture changer** is used in conjunction with cassettes of matching apertures. This programmable system allows running series of samples of different dimensions automatically.

Intelligence and control every few seconds

The analyst is informed of current operations and main status by messages displayed either on the computer terminal or on a synoptic panel at the front of the instrument. The master microprocessor XQM and 7 dedicated microprocessors control the overall operation of the instrument, monitor more than 250 status points every few seconds and direct the goniometer functions. Remote diagnostics can be carried out through modem connection. This helps in case of software or service related problems, thus diminishing the time of intervention.

Programmable sample loading systems

Basically a single loading position is available. As soon as the need for automation of sample loading is required, the **12 position sample changer** can be fitted.

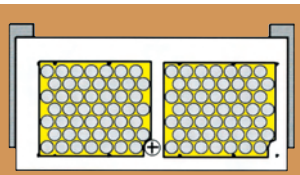
If the application calls for the analysis of larger series of samples in unattended mode overnight or during weekends, the X-Y sample changer is the answer. It fits directly on top of the instrument in a compact unit of less than a square meter. This large sample changer has been designed in view of the multiple sample shapes and applications that can be covered with a sequential XRF instrument. In its maximum capacity configuration, **176 samples can be loaded** and analyzed automatically. When series of samples of uniform size and shape must be loaded (e.g. fusion beads, pressed pellets, plastic discs, etc.) they can be positioned directly on trays without the need for cassettes. The X-Y manipulator ensures their automatic loading. **Urgent samples** can at any time be placed on top of the OXSAS task list to be run as first priority.

The X-Y magazine is available in 3 versions:

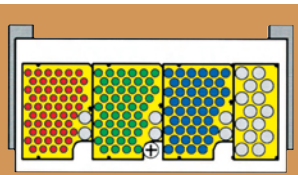
- 98 coded positions for samples loaded in cassettes
- A combination of 49 cassettes and 2 trays for samples of predefined diameters
- A combination of 14 cassettes and 3 trays for samples of predefined diameters

This large sample changer can be easily retrofitted on any ARL ADVANT'X IntelliPower Series instrument as soon as the workload increases in the laboratory.

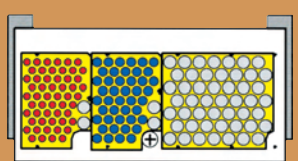
The large sample changer fits directly on top of the instrument



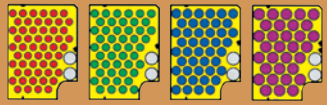
98 positions for cassettes



14 positions for cassettes and 3 trays for samples



49 positions for cassettes and 2 trays for samples



Available trays for other sample sizes

Instrument control and data handling: OXSAS - X-ray Fluorescence Analysis Software

The powerful and user-friendly OXSAS software supports spectrometer operation and data handling. OXSAS is a very modern software platform that is designed to evolve to meet customer's needs with up-to-date solutions throughout the lifetime of the XRF instrument.

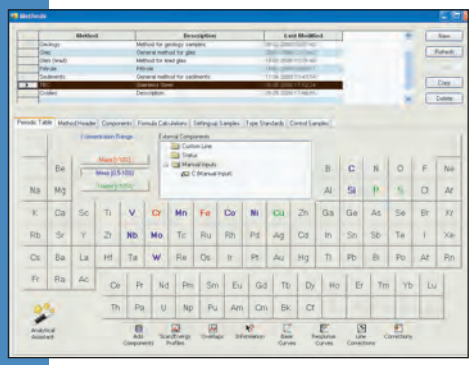
Key features and benefits

See also the OXSAS Product Specification data sheet for more details.

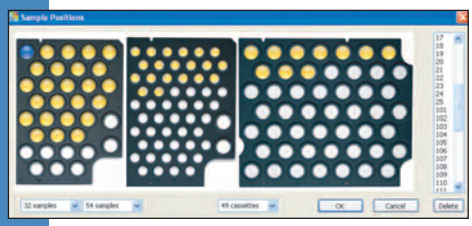
- State-of-the-art 32-bit software with very modern Graphic User Interface
- Complete and very rich functionality
- Mature software with many convenient features
- Ease of use, no matter what requirements are. From simple tasks to complex jobs, all are defined easily and performed quickly
- OXSAS allows performing rapid high quality analyses with templates leading through the analysis operation
- Simple definition and comprehensive operation of sample batches. With support of priority samples. Makes unattended analyses handy
- Integrated Analytical Assistant guides the creation or extension of methods with best analytical parameters for rapid and accurate analyses
- Fast calibration with multiple analyte curve display, instant base curve calculation, templates for edition and measurement of calibration standards. Calibration curve determination using multi-variable regression with a range of correction models and integrated theoretical alphas calculation
- Optional standard-less analysis packages: UniQuant, OptiQuant and the semi-quantitative QuantAS offer additional analysis versatility
- Display of multiple scans with graphical investigation tools
- Multi-purpose analysis display with wide-ranging optional data. e.g. the analysis calculation steps help the validation of methods
- Numerous customizable on-line processing functions, with manual or automatic application
- Comprehensive post-treatment of results, including direct export to Excel files (*.xls)
- Real on-line integrated SPC
- SCT Manager: Status and history of Setting-up samples, Control samples and Type standards give the overview of the analytical capability of the instrument and of each method at any time.
- Easy to use: one click creation of a batch with all samples requiring analysis
- Effective monitoring and maintenance tools maximize the system uptime
- Very comprehensive contextual Help including "How-To" guides
- Integrated Microsoft® SQL Server 2005 Express relational database which stores your set up and analyses data

Options for OXSAS software

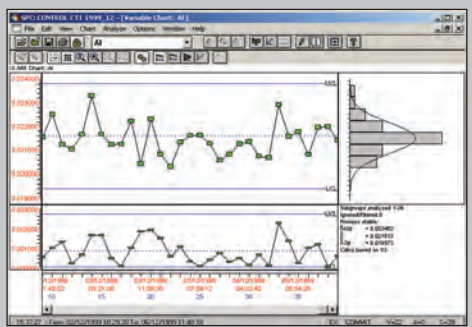
- QuantAS, semi-quantitative analysis package
- UniQuant, standard-less analytical software, full package
- OptiQuant, standard-less analytical software, optimized package for use with SmartGonio.
- SPC-Full: On-line Statistical Process Control, full graphical package extension
- ARLcom: Software package for the transmission of results using network and serial communication
  - *Network: result transmission solutions via Local Area Network to computer applications using TCP/IP or to files*
  - *Serial: result transmission solutions to computers, printers or terminals over serial RS-232 lines*
- OEM Mode: Connection to an external process computer for automation purposes



The Analytical Assistant helps definition of analytical programs, calibrations and instrument use



Selection of sample positions from a graphical view of the magazine



Statistical Process Control - Typical screen

Fast qualitative analysis

Two forms of digital scanning are available. Step scanning provides precise definition of peaks with a resolution of 0.001 °. For rapid qualitative analysis, continuous digital scanning allows fast acquisition of spectra at speeds up to 327 °/min. Peaks identification is automatic.

Quantitative analysis made easy

Analytical programs and calibrations are defined with the help of the on-line Analytical Assistant. Calibration curves are built using the Multi Variable Regression (MVR) program.

Correction models serve to minimize the influence of interfering elements in multicomponent matrices and achieve better accuracy of analysis. These models are:

- Line overlap correction
- Additive correction on intensities
- Additive correction on concentrations
- Multiplicative correction on intensities
- Multiplicative correction on concentrations
- Multiplicative and additive corrections on concentrations
- COmprehensive LAchance (COLA) with 3 term alphas to be used with NBSGSC fundamental parameters program, which can simulate analytical calibrations for homogeneous materials. Interelement correction factors (theoretical alphas) are calculated and used as known coefficients in the MVR. This minimizes the number of standards necessary to produce calibrations and improves the accuracy of analysis

In addition, ex-works calibrations can be delivered for various materials:

- Oil industry products using Petroil Quant™ or ASTM/ISO methods
- Iron and steel
- Copper, bronze and brass
- Aluminum and alloys
- Nickel, stellite and super-alloys
- Various oxides through the General Oxide calibration
- Traces in soils and sediments
- Ferro-alloys, slags and cement

Analytical specifications are available on request for all these calibrations.

Typical quantitative results

S, Ni, V in oil

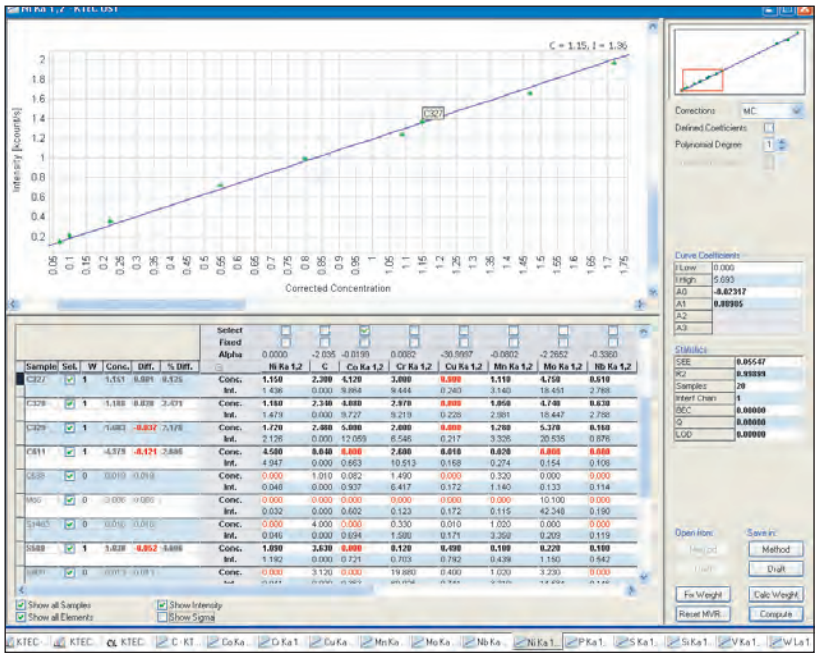
OIL NR 1	CHEM.	ARL ADVANT'X 3600
S (ppm)	11	11.6
Ni (ppm)	0.94	0.86
V (ppm)	5.17	5.5

3 OILS	CHEM.	ARL ADVANT'X 1200
S (ppm)	40	40.5
S (ppm)	450	460
S (ppm)	95	96

Super-alloys

ELEMENT	CHEM.%	XRF %
Ni	rest	61.21
Cr	16.27	16.25
Co	8.32	8.34
Ti	3.37	3.43
Al	3.52	3.6
W	2.62	2.69
Mo	1.86	1.82
Ta	1.7	1.74
Nb	0.8	0.79
Fe	0.07	0.064
Si	0.03	0.031
Zr	0.033	0.036
P	0.003	0.0042
Cu	0.002	0.002

Above results obtained on a global calibration for super-alloys. Type standardization can be used to further improve accuracy.

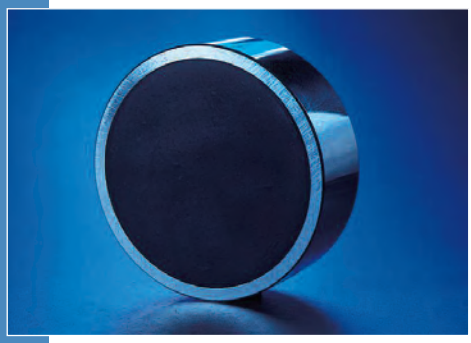


MVR calibration curve: real concentration vs. intensities

Total elemental analysis

QuantAS: Quantitative Analysis using Scans

Concentration levels in liquid or solid samples can be determined through the user-friendly QuantAS optional package. Only 3 minutes are necessary to perform a wide range scan covering 70 elements from F to U. Smoothing, background subtraction, peak identification, overlap and matrix corrections, calculation of semi-quantitative concentrations and normalization are all done automatically for a fast and easy semi-quantitative analysis of unknown samples. Type standardization is available for ultimate accuracy.



QuantAS is fully calibrated and installed in the factory on the universal goniometer. This means that immediately after installation of the ARL ADVANT'X Series XRF at the customer's site, the instrument is ready to perform meaningful analysis on unknown samples.

Four multi-element samples are provided for setting-up and maintenance.

Typical results

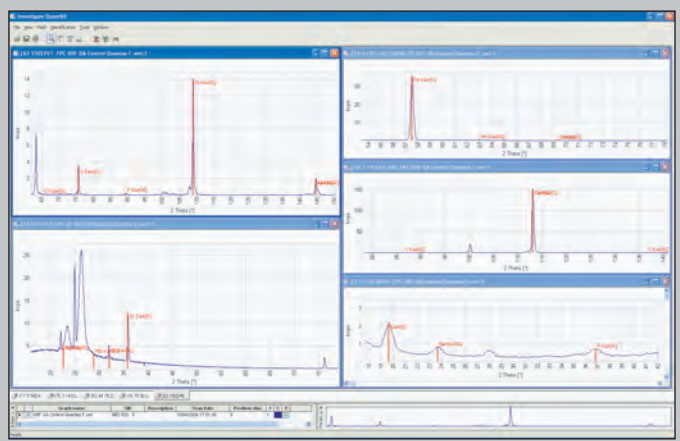
Ferro-silicon

ELEMENT	CERT.%	QUANTAS %
Si	75.3	75.1
Fe	23.6	24.3
Mn	0.17	0.16
Al	0.65	0.65
Ca	0.53	0.54
Cu	0.47	0.52
Cr	0.47	0.43
Ni	0.32	0.42
Ti	0.37	0.37
Zr	0.11	0.16

Clay

ELEMENT	CERT.	QUANTAS
SiO_2	42.4 %	45.7 %
Al_2O_3	39.2 %	40.2 %
TiO_2	2.39 %	2.44 %
Fe_2O_3	1.19 %	1.24 %
K_2O	0.618 %	0.707 %
MgO	0.187 %	0.297 %
CaO	348 ppm	740 ppm
ZrO_2	~ 675 ppm	690 ppm
P_2O_5	~ 458 ppm	590 ppm
Cr_2O_3	332 ppm	340 ppm
BaO	~222 ppm	160 ppm
SrO	99 ppm	120 ppm
ZnO	~108 ppm	110 ppm

Example of the five QuantAS scans from which concentrations for the various elements in the sample are derived



UniQuant® state-of-the-art standard-less analysis

The optional UniQuant package provides standard-less analysis for up to 79 elements when specific standards are not available or when samples can only be obtained in small quantities or as irregular shapes. Unknown samples in liquid form can also be analyzed very efficiently. An attractive feature of UniQuant is that the elements to be measured and their counting time can be pre-defined depending on the application requirements. UniQuant can also calculate the balance of unanalyzed elements present in the sample, e.g. organic and ultra-light elements.

The UniQuant package includes several well specified samples for setting-up and maintenance.

UniQuant is fully calibrated and installed in the factory on the universal goniometer. It is therefore ready to use right after installation of the ARL ADVANT'X Series XRF at the customer's site.

OptiQuant, optimized standard-less analysis

The optional OptiQuant package is an optimized version of UniQuant for use with the SmartGonio. It provides standard-less analysis for up to 75 elements when specific standards are not available or when samples can only be obtained in small quantities or as irregular shapes. Unknown samples in liquid form can also be analyzed very efficiently.

The package includes several well specified samples for setting-up and maintenance.

OptiQuant is fully calibrated and installed in the factory on the SmartGonio. It is therefore ready to use right after installation of the instrument at the customer's site.

Typical results

Polymer

ELEMENT	CHEM.(PPM)	UNIQUANT(PPM)
Si	378	317
Al	209	212
Ti	149	143
Ca	96	114
S	76	100
Cl	62	71
Fe	51	49
Zn	40	37
Mg	28	20
P	26	23

The unanalyzed rest 99.89 %$(CH_2)x$ is calculated by UniQuant

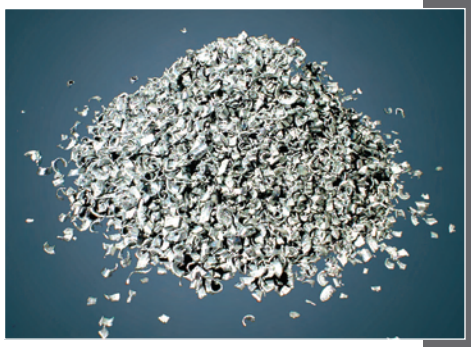
Coating on glass

ELEMENT	CHEM.(nm)	UNIQUANT(nm)
Ag	11.6	12.5
SnO_2	77.5	70
ZnO	6.5	7.4

Steel drillings

ELEMENT	QUARTER	HALF	FULL
Mn	1.34 %	1.37 %	1.37 %
Si	0.36 %	0.30 %	0.37 %
Cr	18.12 %	18.37 %	18.26 %
Ni	10.58 %	10.61 %	10.60 %
Mo	1.91 %	1.47 %	1.80 %
Cu	-	0.06 %	0.08 %
Ti	0.021 %	0.012 %	0.011 %
Fe	66.4 %	67.3 %	66.4 %
Nb	-	-	0.009 %

Loose drillings covering segments of cup as shown



UniQuant® is a registered trademark of Thermo Fisher Scientific

UniQuant, the world renowned "standard-less" analysis package from Thermo Fisher Scientific

UniQuant and OptiQuant use "peak hopping" to acquire intensities for up to 133 line positions

General specifications for ARL ADVANT'X IntelliPower Series

Spectrometer environment	Vacuum at all times (solids, liquids and loose powders)
Sample chamber environment	Vacuum for solids. Helium or dry Nitrogen for liquid and loose powder analysis (flow <1 lt/min + 3 lt/sample)
Spectrometer design	Goniometer contained in a small vacuum chamber made of grey cast iron and temperature controlled to ± 0.3 °C by a differential heating and cooling system. Crystals regulated to ± 0.1 °C.
Spectrometer arrangement	X-ray tube inclined at 60 °, with goniometer looking up at the sample surface.
Sample loading	Dual position as standard feature (analyzing one sample while pumping the next one)
X-ray tube	High performance 4GN Rh anode end window tube with thin Be window (0.075 mm). Optional 5GN end window tube with 50 micron Be window. 5 kW rating maximum. Optional W or Mo anodes. Other anodes on request.
Goniometer	**Universal Goniometer** Fully automatic, gearless, microprocessor controlled with programming of: • Up to 9 flat crystals • Up to 4 primary collimators: fine, medium, coarse, extra-coarse. • 2 detectors: scintillation and flow proportional ($Ar/CH_4$10 %: flow 5 to 10 ml/min.). • 2 secondary collimators Maximum slewing speed: 4800 ° 2θ/min Accuracy of peak positions vs. ASTM table on LiF crystals: 0.015 ° Angular reproducibility: < ± 0.0002 ° Total angle range: 0 °-153 ° 2θ (Flow proportional counter: 17 °-153 °. Scintillation counter: 0 °-115 °) Continuous digital scans: from 0.25 °/min to 327 °/min as function of measuring time and increment Step scan range: Minimum step: 0.001 °. Maximum practical: 1.00 ° Time of measurement for each step: 0.1 s. - 655 s. Oriented for reduced background due to polarization **SmartGonio** Gearless, microprocessor controlled compact goniometer using optical encoders. Fully automatic programming of: • 3 flat crystals • 2 detectors: scintillation and flow proportional (Ar/CH4 10 %: flow 5 to 10 ml/min). • 2 secondary collimators Fixed collimator selected according to customer's application Accuracy of peak positions vs. ASTM table on LiF crystals: 0.015 ° Angular reproducibility: < ± 0.0002 ° Total angle range: 0 °-150 °2θ (Flow proportional counter: 17 °-150 °. Scintillation counter: 0 °-90 °) Continuous digital scans: from 0.25 °/min to 320 °/min as function of measuring time and increment Step scan range: Minimum step: 0.001 ° Maximum practical: 1.00 ° Time of measurement for each step: 0.1 s. - 655 s. Oriented for highest sensitivity through optical coupling
Signal processing	Multi-channel analyzer to discriminate peaks of higher energies. Digital Automatic Gain Control (AGC) for pulse shrinking correction. Automatic dead time correction ensures linearity of response up to 2 Mcps on flow proportional counter and 1.5 Mcps on scintillation counter.
Sample changer	Basic: 12 cassettes. Large capacity: 98 cassettes or combination of 49 cassettes and 2 trays for samples of uniform size or combination of 14 cassettes and 3 trays for samples of uniform size. Trays can house either: 54 samples of Ø30.5 to 32 mm, or 48 samples of Ø32 to 35 mm, or 44 samples of Ø35 to 41 mm, or 32 samples of Ø41 to 50 mm. Easily retrofittable. Other trays for smaller samples available on request.
Sample cassettes	Maximum size of sample: height 30 mm, diameter 52 mm. Exposed opening 29 mm diameter (basic). Optional programmable aperture changer for use with cassettes of openings 38 mm, 29 mm and 15 mm diameter or 29 mm, 15 mm and 8 mm diameter. Rotation of cassettes in analysis position: 30 rpm.
Primary beam filter and anti-dust filter	3 position programmable primary beam filter for modifying X-ray excitation. • Cu: For analysis of Ru, Rh, Pd, Ag and Cd (elements that are interfered by Rh lines from the X-ray tube) in light and variable matrices. • Al: To improve peak to background ratio on Pb or As in light matrices • Fe: To improve peak to background ratio on Ni, Cu lines. Anti-dust filter on option replacing the Fe filter. Other filters on request.
Laboratory information	Optional support through modem connection. Safety standards: Electrical and protection: IEC 1010-1, IEC 950. Radiation (fully protected system): ORaP (CH) 414.501 and BGB1.I. norms. Electro-magnetic immunity: CENELEC EN 50081-2 + EN 50082-2 (industrial)

Since X-rays are used in these instruments, please check all local laws and regulations in advance of the installation to avoid any regulatory problems. Thermo Fisher Scientific reserves the right to vary these specifications without prior notice.

Particular specifications for ARL ADVANT'X IntelliPower 1200

Element range	Boron (Nr. 5) to transuranics (> Nr. 92) providing all necessary crystals are fitted on a universal goniometer. Fluorine (Nr. 9) to transuranics (> Nr. 92) with SmartGonio.
X-ray generator	Solid state 1200 W high frequency generator of maximum voltage 60 kV and maximum current 60 mA. All kV/mA combinations must be chosen to be less than 1200 W Max. line voltage variation: -15 % to +10 %. Stability: ± 0.0001% per 1 % variation
Power requirements	3.1 kVA single phase
Sample loading	Basic: 1 position. Optional: 12 cassette or large capacity X-Y magazine (see general specifications)
Cooling system	Closed circuit for deionised water flowing through liquid/air heat exchanger. Flow is regulated between 0.5 and 5 lt/min according to generator setting (to keep X-ray tube temperature constant)
Dimensions	H 94 cm (37 in.), D 83 cm (32.7 in.), W 109 cm (42.9 in.) + H 31 cm (12.2 in.), L 42 cm (16.5 in.), W 20 cm (7.87 in.)
System weight:	approximately 470 kg (1036 lb.)

Particular specifications for ARL ADVANT'X IntelliPower 2500

Element range	Boron (Nr. 5) to transuranics (> Nr. 92) providing all necessary crystals are fitted on a universal goniometer. Fluorine (Nr. 9) to transuranics (> Nr. 92) with SmartGonio.
X-ray generator	Solid state 2500 W high frequency generator of maximum voltage 60 kV and maximum current 100 mA. All kV/mA combinations must be chosen to be less than 2500 W. Max. line voltage variation: -15 % to +10 %. Stability: ± 0.0001 % per 1 % variation
Power requirements:	4.9 kVA single phase
Sample loading	Basic: 1 position. Optional: 12 cassette or large capacity X-Y magazine (see general specifications)
Cooling system	Closed circuit for deionised water flowing through liquid/air heat exchanger. Flow is regulated between 0.5 and 5 lt/min according to generator setting (to keep X-ray tube temperature constant)
Dimensions	H 94 cm (37 in.), D 83 cm (32.7 in.), W 109 cm (42.9 in.) + H 47 cm (18.5 in.), L 83.5 cm (32.9 in.), W 41 cm (16.1 in.)
System weight:	approximately 490 kg (1081 lb.)

Particular specifications for ARL ADVANT'X IntelliPower 3600

Element range	Beryllium (Nr. 4) to transuranics (>Nr. 92) providing all necessary crystals are fitted. Fluorine (Nr. 9) to transuranics (>Nr. 92) with SmartGonio
X-ray generator	Solid state 3.6 kW high frequency generator of maximum voltage 60 kV and maximum current 120 mA. Optional generator with maximum settings of 70 kV and 120mA. All kV/mA combinations must be chosen to be less than 3.6 kW. Max. line voltage variation: -15 % to +10 %. Stability: ± 0.0001 % per 1 % variation.
Power requirements:	6 kVA single phase
Sample loading	12 cassette or large capacity X-Y magazine (see general specifications)
Cooling system	Built-in closed circuit for deionised water flowing through liquid/liquid heat exchanger. External water needed: T < 20 °C, pressure ≥ 2 bar. Flow is regulated between 0.5 and 5 lt/min according to generator setting (to minimize water consumption).
Dimensions and weight	H 94 cm (37 in.), D 83 cm (32.7 in.), W 109 cm (42.9 in.). System weight: approximately 450 kg (992 lb.)

Particular specifications for ARL ADVANT'X IntelliPower 4200

Element range	Beryllium (Nr. 4) to transuranics (>Nr. 92) providing all necessary crystals are fitted. Fluorine (Nr. 9) to transuranics (>Nr. 92) with SmartGonio
X-ray generator	Solid state 4.2 kW high frequency generator of maximum voltage 60 kV and maximum current 120 mA. Optional top performance generator with maximum settings of 70 kV and 140 mA. All kV/mA combinations must be chosen to be less than 4.2 kW. Max. line voltage variation: -15 % to +10 %. Stability: ± 0.0001 % per 1 % variation.
Power requirements:	7 kVA single phase
Sample loading	12 cassette or large capacity X-Y magazine (see general specifications)
Cooling system	Built-in closed circuit for deionised water flowing through liquid/liquid heat exchanger. External water needed: T < 20 °C, pressure ≥ 2 bar. Flow is regulated between 0.5 and 5 lt/min according to generator setting (to minimize water consumption).
Dimensions and weight	H 94 cm (37 in.), D 83 cm (32.7 in.), W 109 cm (42.9 in.). System weight: approximately 450 kg (992 lb.)

Since X-rays are used in these instruments, please check all local laws and regulations in advance of the installation to avoid any regulatory problems.
Thermo Fisher Scientific reserves the right to vary these specifications without prior notice.

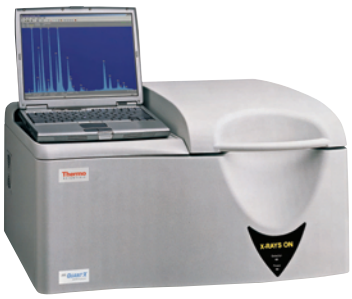
X-ray Elemental Analysis Capabilities from Thermo Fisher Scientific

In addition to these offices, Thermo Fisher Scientific maintains a network of representative organizations throughout the world.

X-ray spectrometry is a common and very powerful technique for fast, non-destructive, quantitative analysis of major, minor and trace components in all types of materials, including solids, powders, aqueous or organic solutions, and layered structures. It has numerous applications in every industry: pharmaceuticals, petrochemicals, environmental monitoring, metals, cement, electronics, and mining, just to name a few.

Thermo Fisher Scientific provides a full range of X-ray fluorescence and X-ray diffraction instrumentation (EDXRF, WDXRF, XRD, EDS, ESCA) that cover every aspect of X-ray spectrometry from routine to highly specialized research applications. From the versatile ARL QUANT'X to the ultra-precise and unique ARL 9900 X-ray WorkStation™, each instrument combines leading-edge technology with a long history of quality, durability and exceptional analytical performance.

Handheld NITON XRF Analyzer



ARL QUANT'X benchtop EDXRF

ARL OPTIM'X compact XRF

ARL 9900 X-ray WorkStation™ XRF/XRD

ARL X'TRA powder diffractometer

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