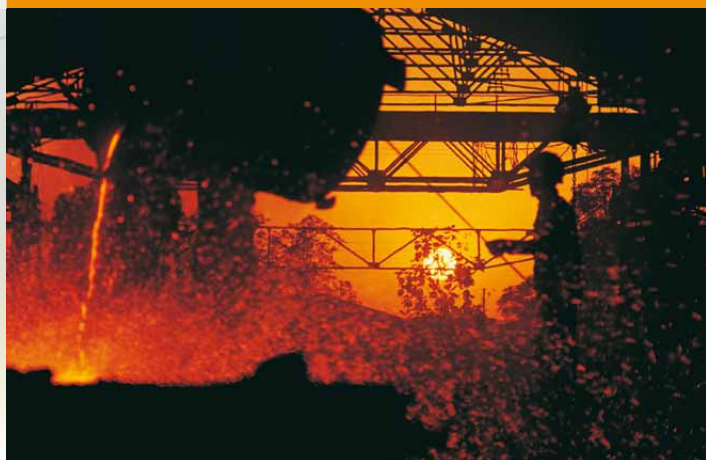




Thermo Scientific ARL iSpark Series
Optical Emission Spectrometers



Innovative OES

for reliable quality metals

Iron and steel • Non-ferrous metals and alloys •
Fine precious metals • Micro-inclusions

Thermo
SCIENTIFIC

ARL iSpark Series

Combining experience and innovation to meet the highest quality standards

For over 75 years, our company has set the standard of quality for spectrochemical analysis of metals. Throughout these years, performance, stability, reliability and longevity have been the key attributes of our optical emission spectrometers. The Thermo Scientific™ ARL iSpark™ metals analyzers combine these guiding principles with our experience and technical innovation to bring our customers the complete value based solution they have come to expect from our company.

The ARL iSpark spectrometer can analyze all the elements necessary in your current and future applications. It is the answer to your analytical needs, whether for incoming material or metal quality control and production analysis. Working 24/7, the ARL iSpark metals analyzers deliver reliable performance year after year.

Spark optical emission spectrometry (OES)

is the most widely used technique for elemental concentration analysis of solid metallic samples. With industry leading quality and performance, Thermo Scientific OES spectrometers excel in every aspect of this process with:

- Very fast elemental analysis of most metals and alloys
- Analysis of all necessary elements from trace to percentage level
- Outstanding accuracy, precision and stability
- Simple instrument operation and maintenance
- Low capital investment and operating costs

The ARL iSpark Series

is a high performance OES spectrometer platform based on the best PMT (photomultiplier tube) optics. It features the most sensitive CCD (charge-coupled device) optics, enhanced degree of functionality and other innovative technologies, including:

- Unique PMT or dual CCD/PMT optics
- Revolutionary digital spark generator
- Innovative spark stand design
- Advanced acquisition technologies and processing algorithms for PMT and CCD signals
- Single Spark Acquisition with diffuse spark intensity removal algorithm to improve accuracy on PMTs
- Most advanced analysis of micro-inclusions
- Smart argon management with argon saving modes

Made-to-measure spectrometers to answer a variety of needs

The ARL iSpark Series consists of three models meeting the needs of the various metals industries and processes.

ARL iSpark 8820

Experience and innovation

- Dual CCD/PMT optics
- Single and multi-matrix configurations
- Excellent performance on a wide range of elements
- For foundries and metals processors and any companies wanting an economical solution allowing efficient quality control
- Spectral investigation

ARL iSpark 8860

Experience and performance

- PMT optics
- Single and multi-matrix configurations
- Best performance for trace analysis
- Instrument of choice for metal producers and refiners
- Inclusion analysis available

ARL iSpark 8880

Experience and versatility

- Dual CCD/PMT optics
- Single and multi-matrix configurations
- Ideal for metal recycling industries, laboratories or any companies that need high analytical versatility
- Inclusion analysis available
- Spectral investigation
- Flexibility to accommodate future needs

Precious
metals



Full
automation



Small
samples

Metals
and alloys



MgO
Al₂O₃-CaO
Al₂O₃
CaS
MnS
TiO₂

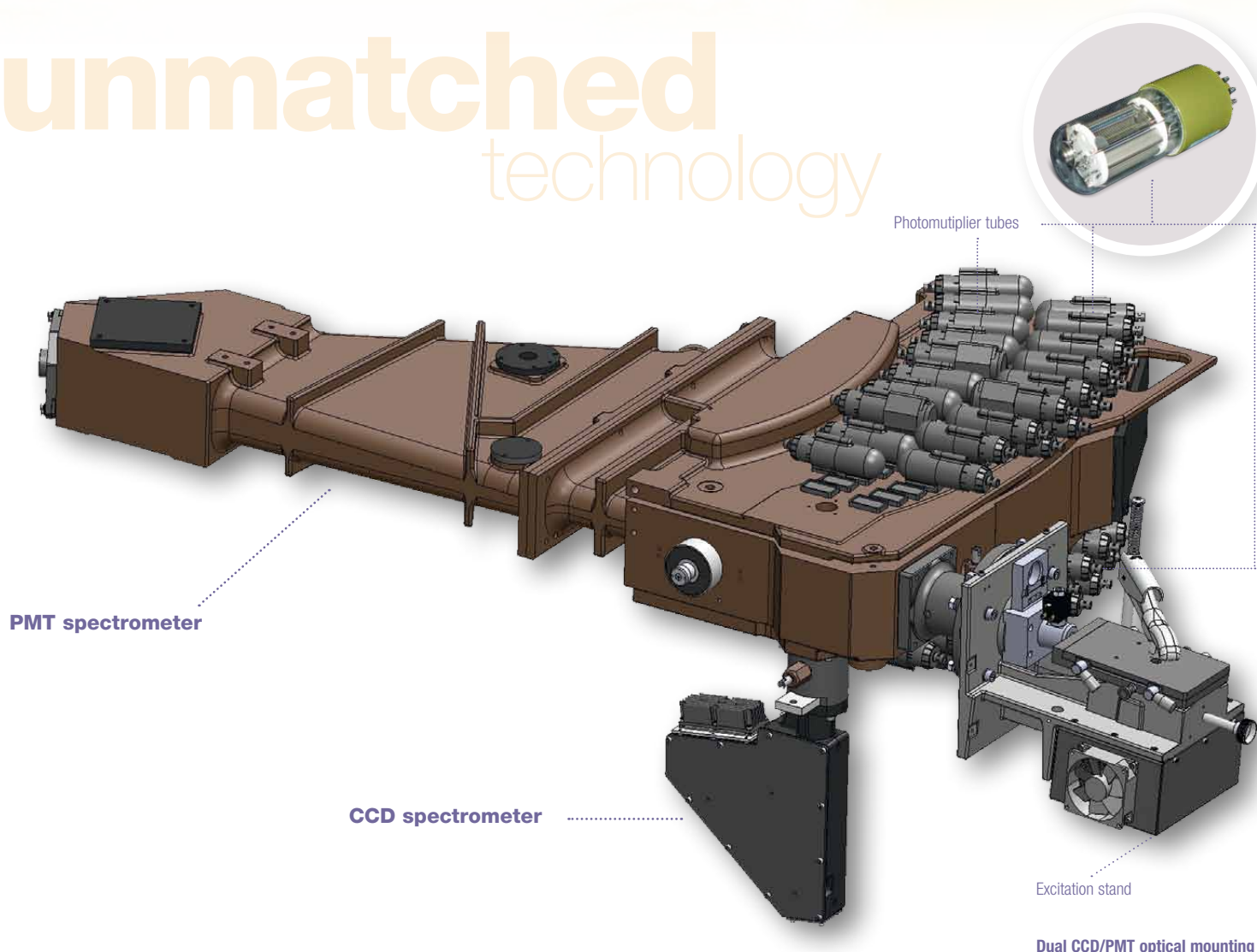
Non metallic
micro-inclusions

Ultimate optical design

offering the best solution to all your needs

The ARL iSpark Series is designed around the world's most famous one-meter focal length PMT optics of the ARL 3460 and ARL 4460 OES spectrometers. With the addition of a high performance flat field CCD module on some models, the ARL iSpark Series addresses the requirements of all market and application segments. Its unique optical design concept offers an optimum solution for everyone.

unmatched technology



Dual CCD/PMT versus all PMT optics

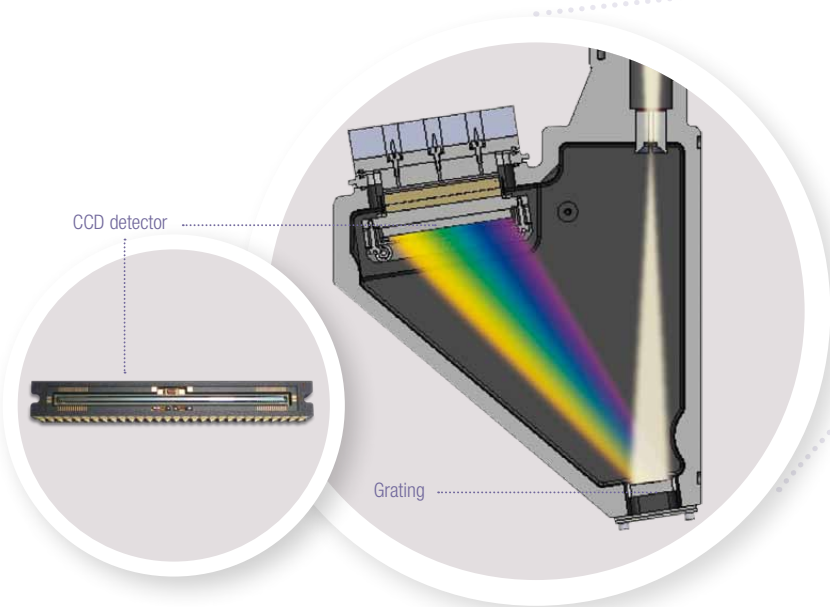
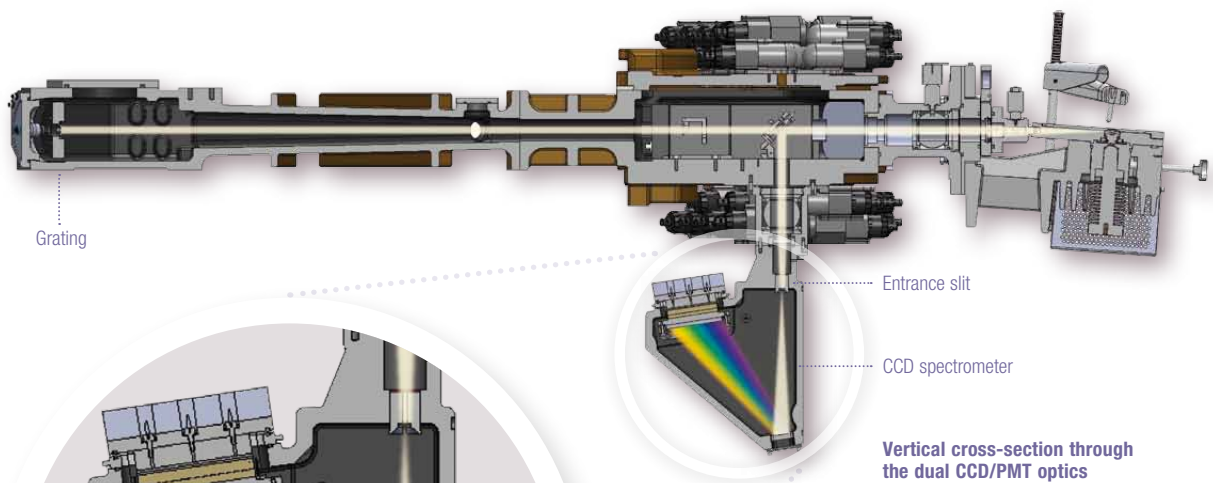
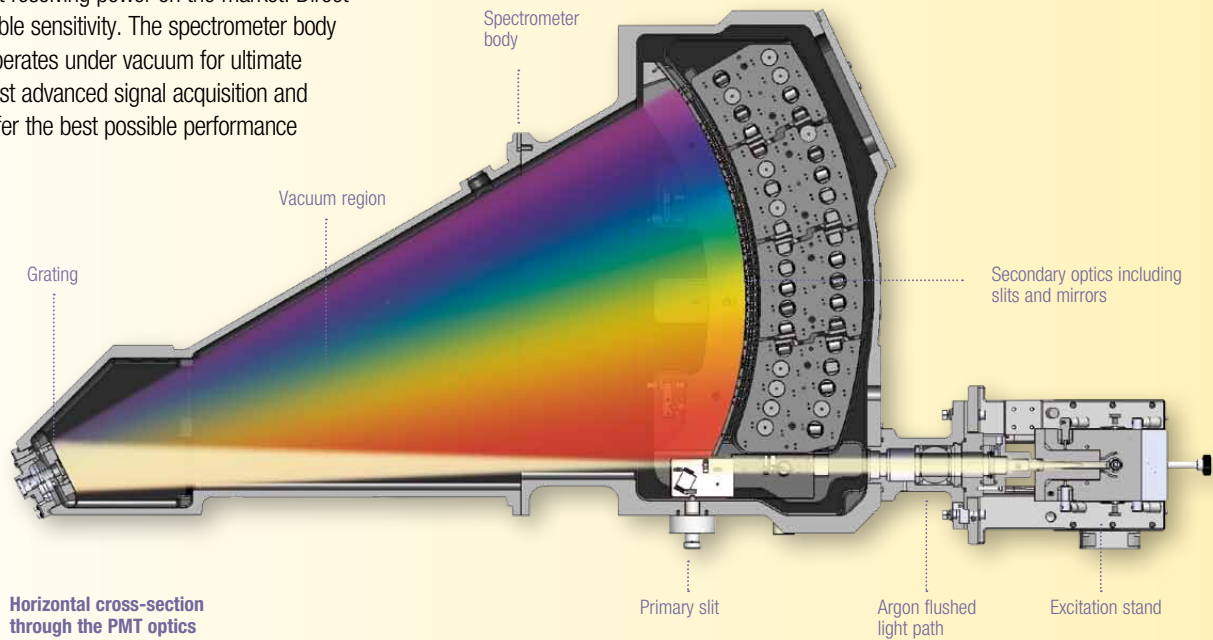
The CCD detector of the ARL iSpark allows outstanding analysis for a majority of the elements. PMTs are generally preferred for the determination of the critical elements and the analysis of traces, mainly in pure and ultra-pure metals. They are also required for the analysis of micro-inclusions.

The dual optics offers the opportunity to select a PMT or CCD type of detector for each element according to the principle of "best of both technologies". Applied with the ARL iSpark 8820 model, this principle ensures optimal analysis on all elements.

The continuous spectral coverage of the CCD detector also provides unique capability for spectral investigations, making it a powerful tool for metals research.

PMT optics

The one-meter spectrometer in Paschen-Runge mounting with PMT detectors has the best resolving power on the market. Direct view ensures highest possible sensitivity. The spectrometer body is made of cast iron and operates under vacuum for ultimate stability. PMTs with the most advanced signal acquisition and processing technologies offer the best possible performance available on the market.



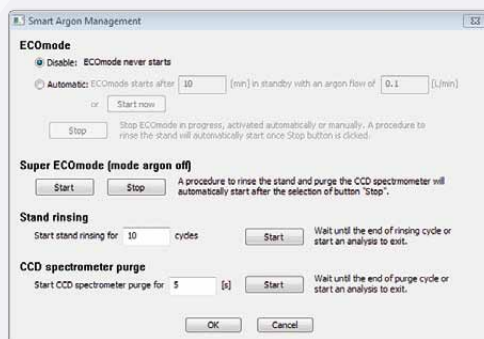
CCD optics

The flat field argon purged CCD spectrometer is equipped with a high-performance scientific grade tri-linear CCD for highest sensitivity. Innovative signal acquisition and processing technologies ensure optimal resolution, precision and accuracy.

Technological breakthroughs to your benefit

The main modules of the spectrometer have been newly designed, leading to improved instrument performance, reliability, ease of use, as well as a reduction in maintenance and argon consumption.

outstanding design



Smart Argon Management (SAM) interface allowing starting or programming argon saving modes



Quick table changeover

IntelliSource

The Thermo Scientific IntelliSource is a double current controlled source (CCS) and the most innovative spark source on the market. More flexible and precise than the other digital sources, it allows discharge shapes to be tailored for most efficient sample surface preparation, material ablation and light emission in any metallic matrix.

Other innovative features contribute to the performance of this spark source. For example, superior trace element analysis is obtained thanks to DISC (Discharge Interrupt by Short-Circuit) technology which improves the spark repeatability at low current values.

Argon management

Thanks to an innovative computer controlled argon circuit design, the argon consumption has been significantly reduced.

- The argon flows are optimized for each phase of the analytical sequence (flush, pre-burn, integration), allowing best performance while requiring the minimum argon consumption
- Argon saving modes are user definable with the software tool SAM (Smart Argon Management) that allows significant savings when the instrument is idle:
 - With ECOmode the standby flow in the stand is stopped or reduced to a minimum level (e.g. 0.1 L/min)
 - Super ECOmode may be used to turn argon off during extended idle periods (0 L/min)

Spark stand

The design of the spark stand of the ARL iSpark spectrometers brings several important benefits:

- Optimized spark chamber design to achieve efficient sample ablation and repeatable spark plasma with reduced argon consumption
- Efficient air-cooling for high analytical throughput
- Robust, wear-resistant analysis table
- Tool-free system for simple and fast maintenance
- Optimum design and post-analysis argon pulses ensuring less frequent stand maintenance operations

High degree of functionality

delivering many advantages

The ARL iSpark was designed for increased safety, convenience and ease of use in daily operations:

- The stand cover allows simple operation with maximal operator security. A hydraulic cylinder makes the opening easy and acts as a braking system that allows a smooth and unassisted closing
- Samples to be analyzed, among other things, can be placed on the worktop located next to the stand
- The setting-up samples and other accessories can be placed in the storage compartment
- Front access to all modules of the instrument (e.g. vacuum pump, argon filter and electronics) facilitates maintenance and service
- Space saving: the housing cover requires very little clearance behind when opened
- Furthermore, all components being accessible from the front, the instrument can be installed against a wall or even in a corner
- The sample clamp with ergonomic design accommodates right- or left-handed operation
- Quick analytical table changeover and maintenance: no tools are needed



Space saving

Innovative signal acquisition and processing for unequalled performance

The ARL iSpark spectrometer has several innovative signal acquisition and processing features that contribute to the superb performance and stability of the instrument, and make it a totally unique OES spectrometer.

unique attributes

PMT signal acquisition and processing

The PMT signal is integrated during TGA (Time Gated Acquisition) windows, i.e. time windows synchronized with the single sparks. TGA is an ultra-high precision version of TRS (Time Resolved Spectroscopy) that allows improving sensitivity and accuracy by collecting the signal with minimal noise, background emission and spectral interference. In addition, PMT acquisition features include Single Spark Acquisition (SSA) and low noise integrator to suppress dark current and offset.

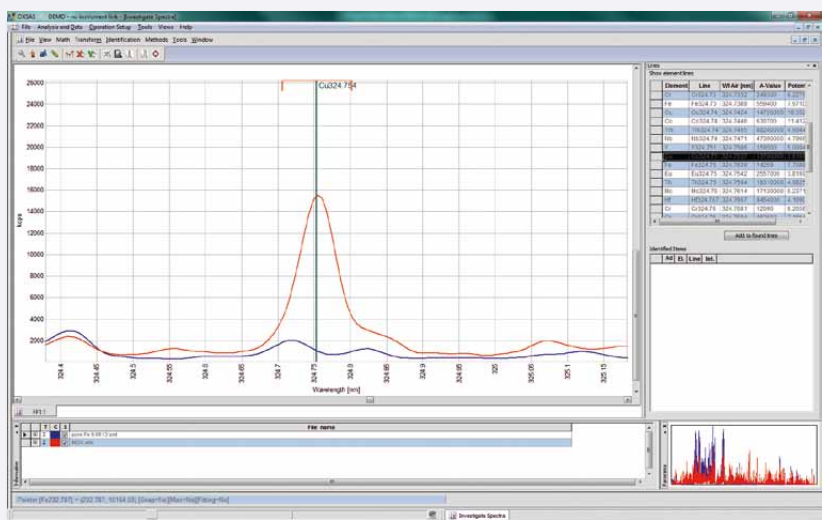
The following features also contribute to the quality and the reliability of the analysis:

- The FAST (Flexible Acquisition START and stop) algorithm allows acquiring an optimal subset of single spark intensities – the most stable and steady part of the signal data – on each channel for improved accuracy
- DISIRE (Diffuse Spark Intensities REMoval) is an algorithm that increases precision by discarding abnormally low intensity signals detected with the internal standard channel response
- Spark-DAT (Spark Data Acquisition and Treatment) algorithms enable the determination of the soluble/insoluble fraction of an element (e.g. Al, B, Ca and Ti in low alloy steel) or the characterization of micro-inclusions

CCD signal acquisition and processing

Several innovative techniques and methods significantly improve the performance of the CCD detector:

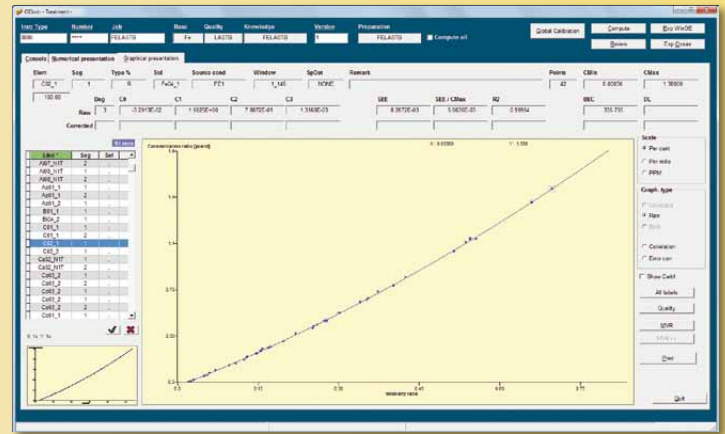
- Sensitivity is increased thanks to binning, i.e. simultaneous readout of the CCD lines and on-line dark current subtraction
- Precision and long-term stability are maximized with multiple, homologous internal standards, dynamic spectrum alignment and digital resolution enhancement for every measurement



Spectra Viewer display showing a zoom on the analytical Cu line in the spectra of a pure iron sample (blue) and a CrNi steel sample (red).

Our quality system your best guarantee

The quality of our instruments is recognized by thousands of customers around the world. This quality is ensured by our many comprehensive protocols and tools that compose our manufacturing process, some of which are outlined below.



Calibration curve established with CARL

Applications

The ARL iSpark spectrometers are delivered as turn-key systems with ready-to-use applications, pre-configured and calibrated in our factory. Analytical conditions, parameters and calibrations optimized by our specialists provide the best accuracy and performance at the highest speed with the lowest argon consumption. Element coverage and calibration ranges can be extended upon request. Comprehensive application notes for various metal matrices are available.

Quality Assurance

Every ARL iSpark instrument undergoes rigorous quality tests before and after calibration:

- Key figures of the instrument modules and components are checked to assure that the functions work according to specifications
- Performance figures are monitored in order to make sure that the instrument performs according to analytical specification
- Calibration accuracy is validated with CRMs and RMs

These steps are documented in the Quality Assurance Report delivered with the instrument.



Calibration

Accuracy, which depends on the calibration of the instrument, is the most important figure of merit required for a spectrometer. The ARL iSpark metal analyzers are individually calibrated in our factory. The calibrations are performed using certified reference materials (CRMs) and reference materials (RMs) validated in the factory. The calibration curves are established with CARL (Calibration ARL), a highly sophisticated multi-variable regression (MVR) software tool that corrects for matrix effects and spectral interferences, all this ensuring the highest possible accuracy.

Installation Qualification and Operational Qualification (IQ/OQ)

The Installation Qualification (IQ) performed by our service engineer demonstrates that the spectrometer is properly installed in a suitable environment.

The Operational Qualification (OQ) certifies that the instrument is working as specified. This comprehensive automated procedure based on instrument information is performed during the Quality Assurance process at the factory and on-site by our service engineer after the installation. It can be repeated anytime by the user who wants to check the state of his instrument.

Comprehensive software procedures allow performing and documenting these two important steps of the instrument validation.

Analysis of micro-inclusions

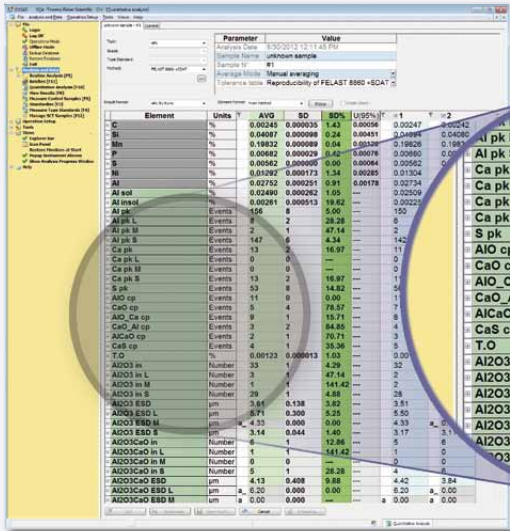
a rapid analysis for a quick return

Optional methods using the Spark-DAT algorithms allow ultra-fast analysis of micro-inclusions, such as Al_2O_3 , CaO , $\text{Al}_2\text{O}_3\text{-CaO}$, MnS and CaS in steel, or TiB_2 , oxides, carbides, nitrides and chlorides in aluminum. The inclusion information can be obtained simultaneously without any change in operation or maintenance compared to standard OES analysis. The Spark-DAT methods offer powerful tools for quality improvement, ideally complementing the OES analysis when metal cleanliness is a concern. The Spark-DAT methods offer the quickest return on investment.

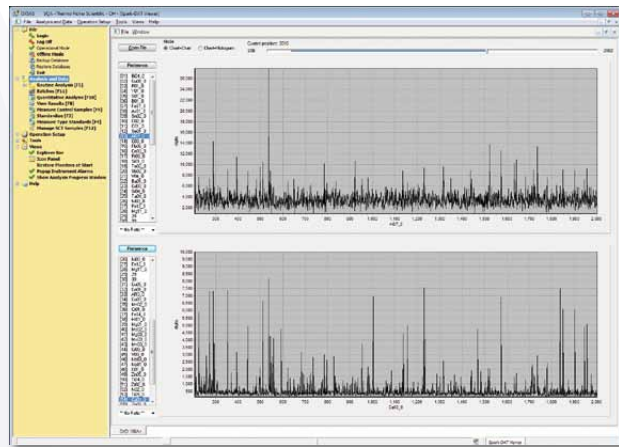
Main attributes and benefits of the Spark-DAT methods:

- As fast as a standard OES analysis
- Routine characterization of inclusions during metal production
- Simultaneous inclusion and elemental concentration analyzes
- Easy sample surface preparation and maintenance, no need for polishing
- Standard spectrometer operations
- Evaluation of number and size of different inclusion types (Standard Inclusion Analysis)
- Quantitative inclusion size determination in steel (Advanced Inclusion Analysis)
- Quantitative determination of total oxygen content down to a few ppm in killed steels (Advanced Inclusion Analysis)

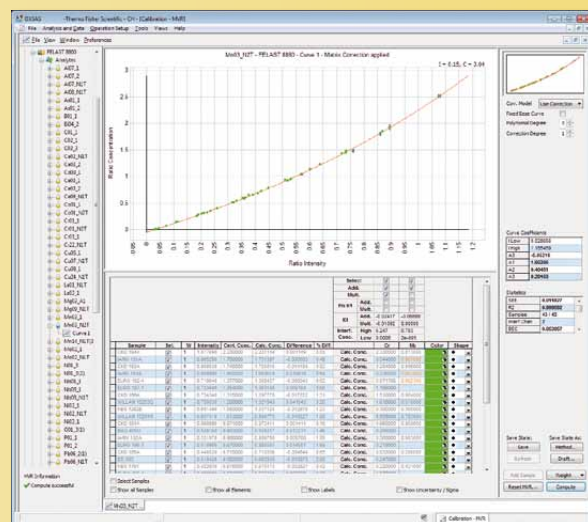
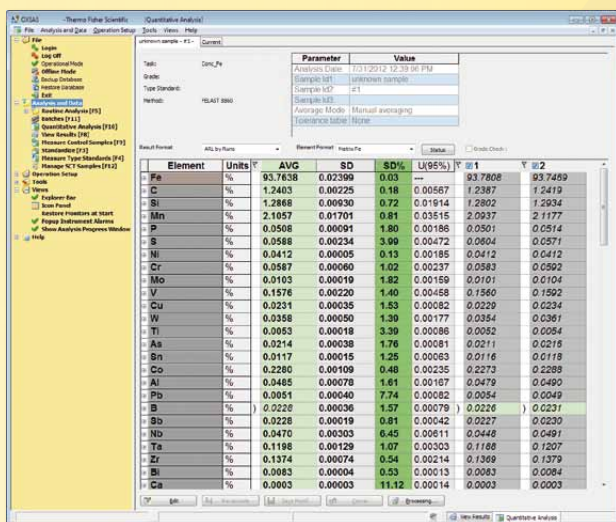
See the dedicated application notes for more details.



Detail of OXSAS display showing the result of simultaneous elemental concentration and inclusion analysis of a low alloy steel sample. The top results in % are from elemental analysis. All other results are from Spark-DAT methods. They include Al sol, Al insol and total oxygen (TO), peaks and coincidental peaks, and inclusion size.



Single Spark Analysis charts allowing visualization of the inclusion signals of the two elements Al and Ca in steel



OXSAS analytical software

simple, flexible and powerful

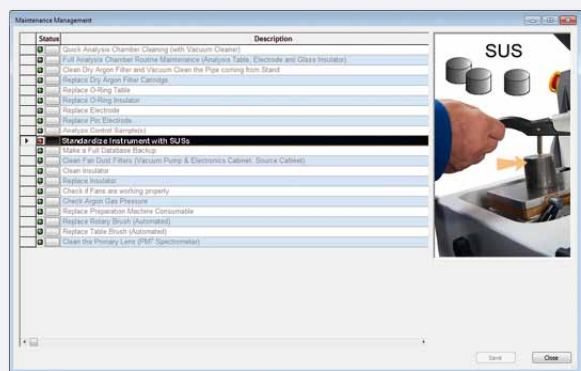
Thermo Scientific OXSAS analytical software provides virtually unlimited analytical capacity and flexibility, and includes all the features allowing data management, instrument control, calibration, instrument set-up and diagnostic.

OXSAS gives the ability to work at various functional levels from simple operations for routine analysis to a wider access for managers or users performing more critical operations (e.g. calibration or user account management).

OXSAS offers important features (e.g. measurement uncertainty and full traceability) for companies looking for accreditation

of their analytical methods. It also includes a comprehensive set of tools for quality and maintenance management. The Maintenance Management module assists the operator in the management of routine and preventive maintenance. This simple and efficient tool helps to guarantee the performance all through the life of the instrument.

Thanks to regular free Internet software updates, OXSAS will continue to meet your requirements throughout the lifetime of your instrument. All features and details can be found in the separate OXSAS software product specification sheet.



A choice of automation solutions for unmatched productivity

The ARL iSpark models are not limited to manual operation: if you wish to achieve more, meet tighter and tighter product specifications and time schedules without increasing overhead costs, then our automation solutions will help you bringing your quality control operations a step ahead with fully automated sample preparation and analysis.

Thermo Scientific series of SMS automation solutions meet the range of industry requirements, from large aluminum smelters to modern steel works, including foundries and metals processors with varied capacities and needs.



Worldwide customer support

Excelling in optical emission spectrometry since 1934, we provide you the support of a major international corporation:

- A comprehensive worldwide after-sales service network assists with resolution of day to day queries and ensures that the ARL iSpark series spectrometer achieves the very high standards of reliability and durability it is designed for
- Operational performance validation and possible online support with diagnostic help
- Application product teams can advise on analytical tasks from sample preparation to delivering the accurate result
- Dedicated training allows you to exploit the full capabilities of your ARL iSpark series spectrometer



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