Optical emission spectrometers

Thermo Scientific ARL iSpark Plus

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

ARL iSpark Plus

OES Spectrometers

Combining experience and innovation to meet the highest quality standards

For over 80 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™ Plus Metal 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 Plus 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. Dependably working 24/7, the ARL iSpark Plus Metal 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:

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

The ARL iSpark Plus
is a high-performance OES spectrometer platform based on the best PMT (photomultiplier tube) optics. It features enhanced functionality and other innovative technologies:

- 15% faster analysis
- Unique PMT optics
- Revolutionary digital spark generator
- Innovative spark stand design
  - 30% increase in maintenance intervals
  - Stability improvement for almost all elements
  - Virtually no memory effects
- Advanced signal acquisition and processing algorithms
- Single Spark Acquisition with diffuse spark intensity removal algorithm to improve accuracy on PMTs
- Most advanced OES analysis of non-metallic micro-inclusions
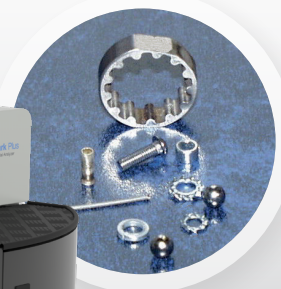- Smart argon management with argon saving modes

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

The ARL iSpark Plus OES Spectrometers include several models meeting the needs of the industries and processes

Precious metals

Small samples

Full automation

MgO TiO_2
Al_2O_3-CaO
Al_2O_3 CaS
MnS

Metals and alloys
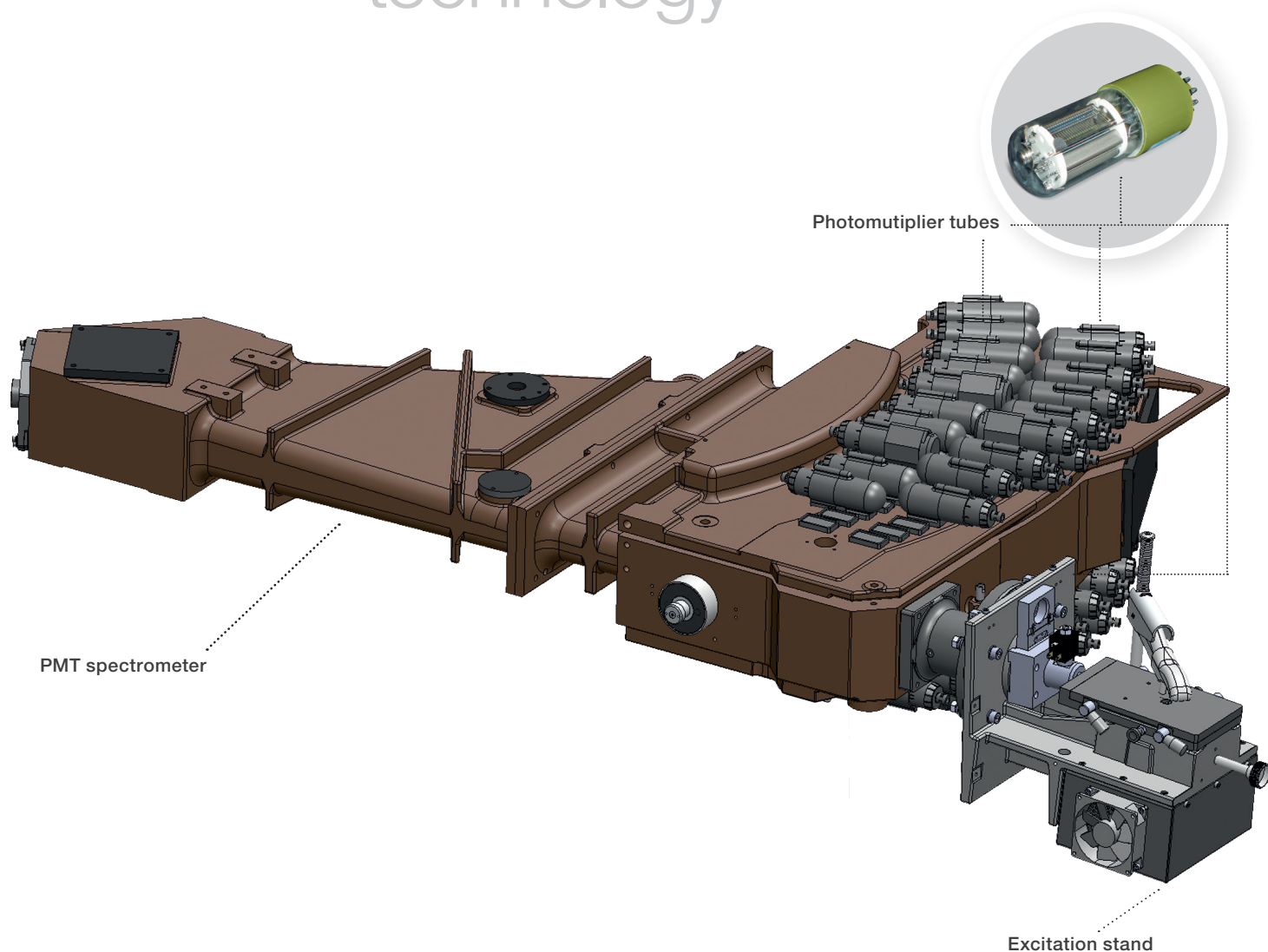
Non metallic micro-inclusions

Ultimate optical design offering the best solution to all your needs

The ARL iSpark Plus OES Spectrometer is designed around the world's most famous one-meter focal length PMT optics of the ARL 3460 and ARL 4460 OES Spectrometers. The ARL iSpark Plus addresses the requirements of all market and application segments. Its unique optical design concept offers an optimum solution for everyone looking for analytical excellence.

unmatched
technology

Photomutiplier tubes
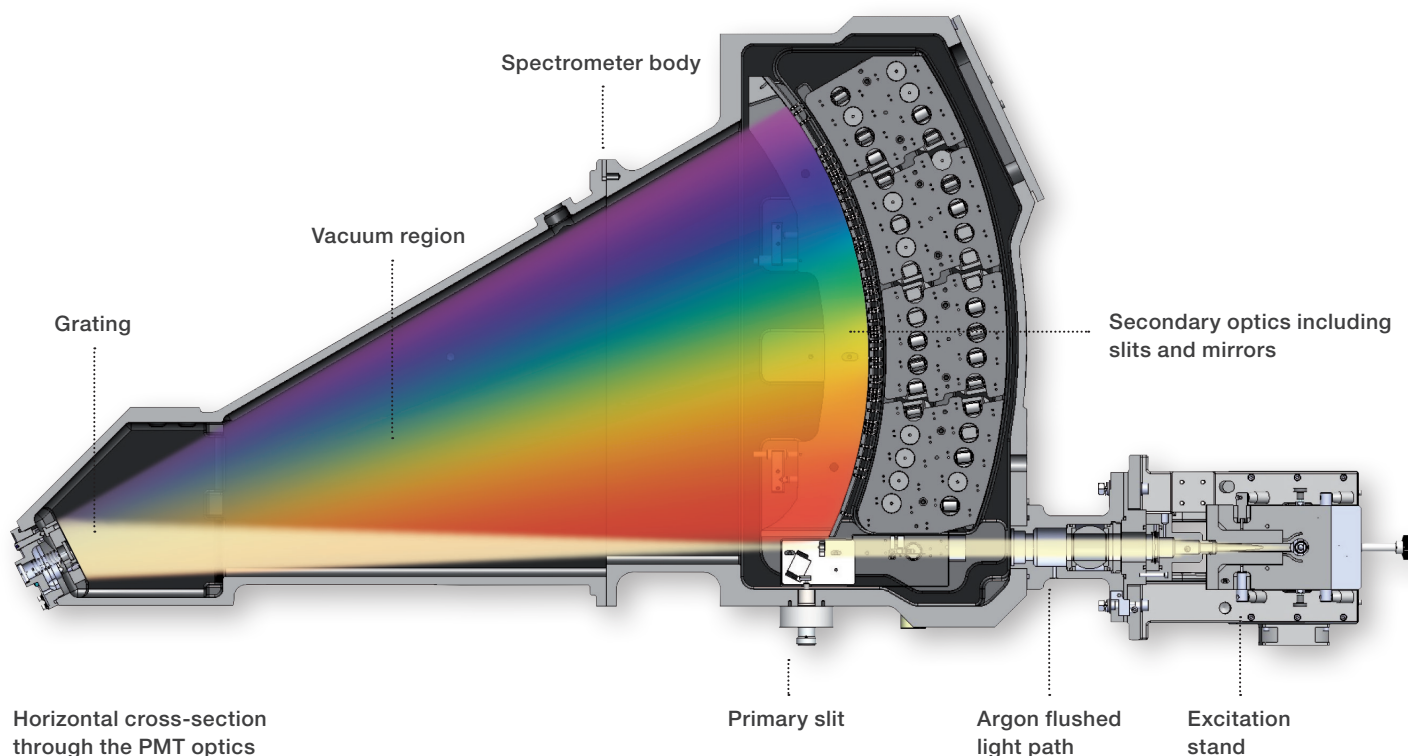
PMT spectrometer

Excitation stand

PMT optics

The one-meter focal length spectrometer in Paschen-Runge mounting with PMT detection offers outstanding dispersion, with resolving power for optimum element coverage in one optical cell—ideal for dedicated and multi-base applications. Direct light path view ensures the highest possible sensitivity.

unmatched
technology

Spectrometer body

Vacuum region

Grating

Secondary optics including slits and mirrors

Horizontal cross-section through the PMT optics

Primary slit

Argon flushed light path

Excitation stand

The spectrometer body is made of cast iron, operates under clean vacuum, and is temperature controlled for ultimate stability, simplifying operation for users. PMTs with the most advanced signal acquisition and processing technologies offer the best possible performance available on the market. These attributes yield unmatched performances on all major, minor, and trace element constituents over short and long-term periods.

Technological breakthroughs to your benefit

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

outstanding
design

Improvements and benefits of the ARL iSpark Plus

- A new spark stand design
- New temparature stabilization
- Improved shutter system
- Faster analysis
- Faster return on investment thanks to cost and energy savings and potentially more heats produced
- Higher stability, availaibity, less maintenance and higher speed

Quick table changeover

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

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 new argon flow design has been optimized for each phase of the analytical sequence (flush, pre-burn, integration), allowing optimal performance while requiring the minimum argon consumption. It extends maintenance intervals by 30% and minimizes memory effects down to almost zero.
- 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).
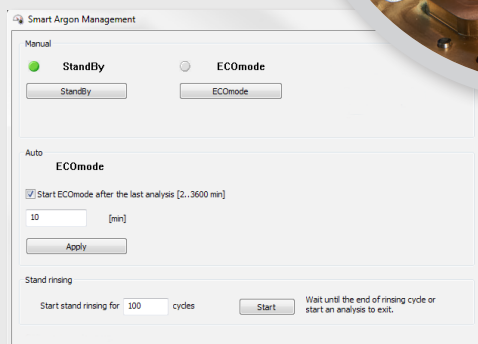
Spark stand

The design of the spark stand of the ARL iSpark Plus Spectrometer 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

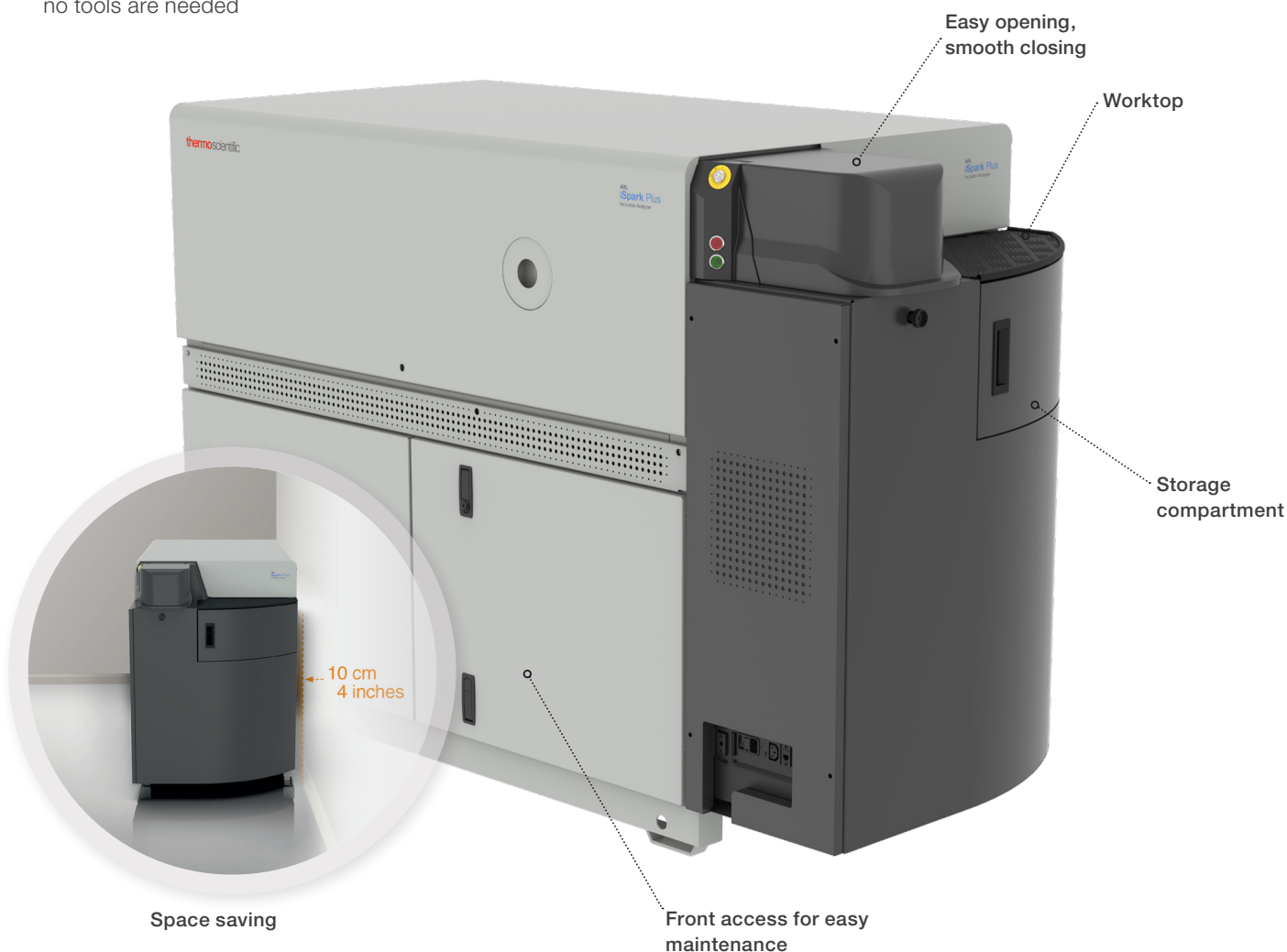# High degree of functionality delivering many advantages

The ARL iSpark Plus 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

- Quick analytical table changeover and maintenance; no tools are needed

- 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

- All components are accessible from the front, so 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

Easy opening, smooth closing

Worktop

Storage compartment

10 cm
4 inches

Space saving

Front access for easy maintenance

Innovative signal acquisition and processing for unequalled performance

The ARL iSpark Plus 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

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 improved 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 acquisition of 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 improves 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 non-metallic micro-inclusions
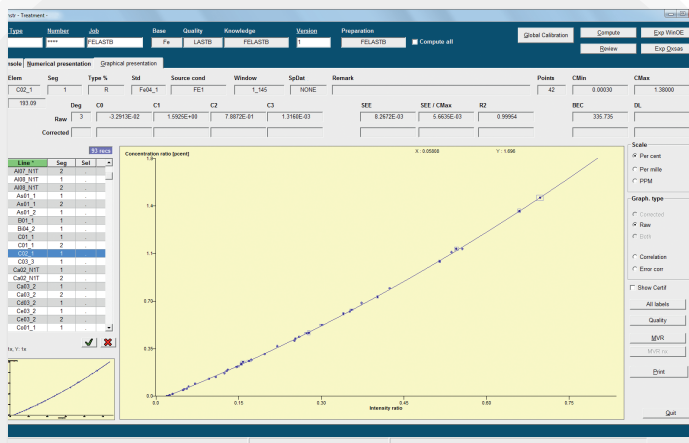
Our quality system: your best guarantee

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.

Applications

The ARL iSpark Plus 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.

Calibration

Accuracy, which depends on the calibration of the instrument, is the most important figure of merit required for a spectrometer. The ARL iSpark Plus 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, ensuring the highest possible accuracy.

Calibration curve established with CARL

Quality assurance

Every ARL iSpark Plus 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.

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.
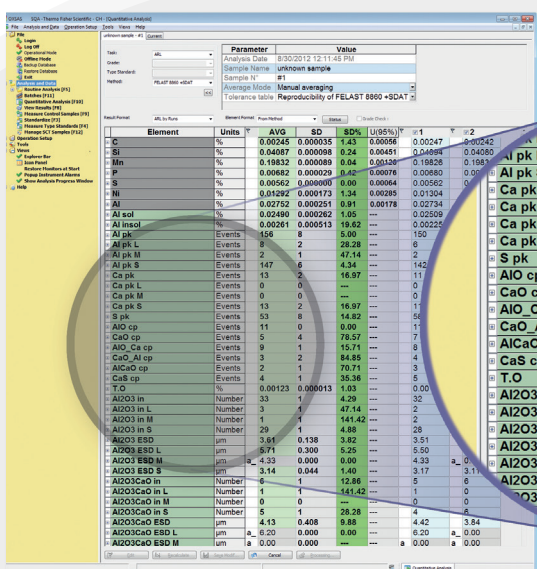
Analysis of non-metallic micro-inclusions: a rapid analysis for a quick return

Optional methods using the Spark-DAT algorithms allow ultra-fast analysis of non-metallic micro-inclusions, such as Al_2O_3, CaO, Al_2O_3-CaO, MnS and CaS in steel, or TiB_2, oxides, carbides, nitrides and chlorides in aluminum. The inclusion data 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.
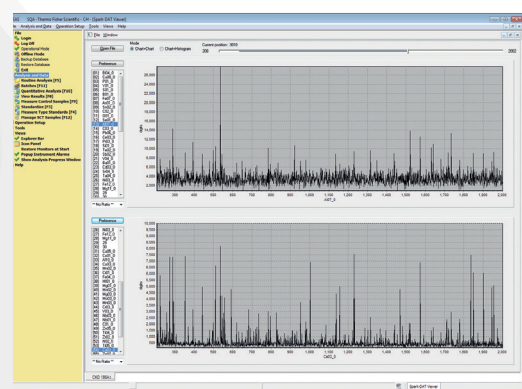
unrivaled features

Main attributes and benefits of the Spark-DAT methods

- Routine characterization of inclusions during metal production

- Simultaneous inclusion and elemental concentration analyzes

- As fast as a standard OES analysis

- 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)

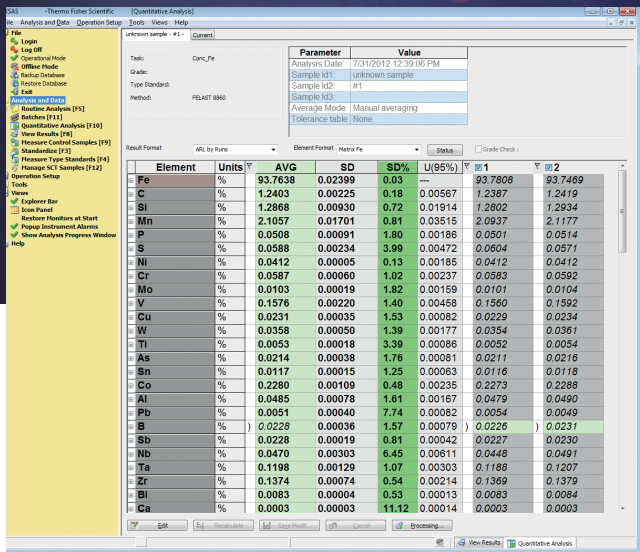- See the dedicated application notes for more details.

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 run charts allowing visualization of the inclusion signals of the two elements Al and Ca in steel.
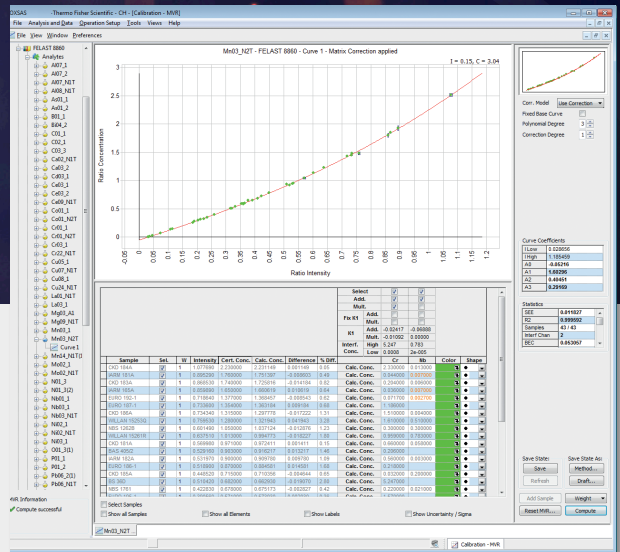
OXSAS analytical software: simple, flexible and powerful

Typical OXSAS display showing the result of a two-run analysis in concentration in terms of average, standard deviation, measurement uncertainty and the two individual runs

Display of a calibration curve using OXSAS MVR tool

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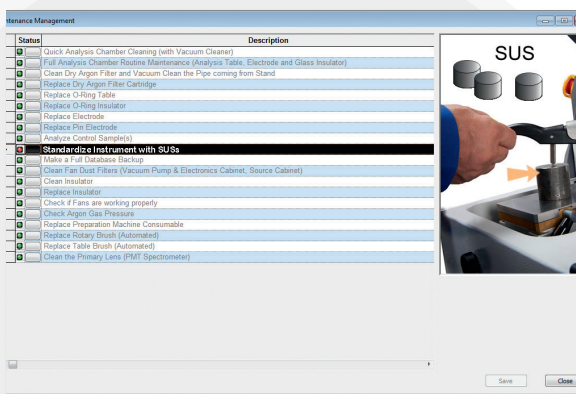
OXSAS gives the ability to work at various functional levels, from simple operations for routine analysis to a wider access for managers or users performing more critical operations (e.g. calibration or user account management).

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.

Maintenance Management tool showing status of the maintenance tasks programmed in function of the instrument usage. The image on the right illustrates the operation to be performed.

A choice of automation solutions for unmatched productivity

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

Thermo Fisher Scientific's series of SMS automation solutions meet the range of industry requirements, from large aluminum smelters to modern steel works, including foundries and metal 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 Plus 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 to advise on analytical tasks from sample preparation to delivering the accurate result

- Dedicated training that allows you to exploit the full capabilities of your ARL iSpark Plus Spectrometer

Learn more at **thermofisher.com/isparkplus**

thermo scientific