



Spark Explorer: off-line exploration of single spark signals

Software option for optical emission spectrometers



ARL iSpark Plus OES Metal Analyzer

The Spark Explorer is an advanced software module for Thermo Scientific ARL iSpark and ARL iSpark Plus OES spectrometers, a very useful complement to OXSAS analytical software when performing Spark-DAT inclusion analysis.

The Spark Explorer offers a comprehensive set of tools and functions to explore the single spark signals used for the computation of inclusion data. In particular, it provides interactive views of these signals and calculation of key statistical parameters.

The Spark Explorer is the software module needed to examine the raw data from the inclusion analysis, whether to develop a new method, to adjust the parameters of the Spark-DAT algorithms or even for an in-depth investigation into an inclusion issue.

The main functions of the Spark Explorer, viewing single spark data, calculating key statistical parameters and reporting, are presented here.

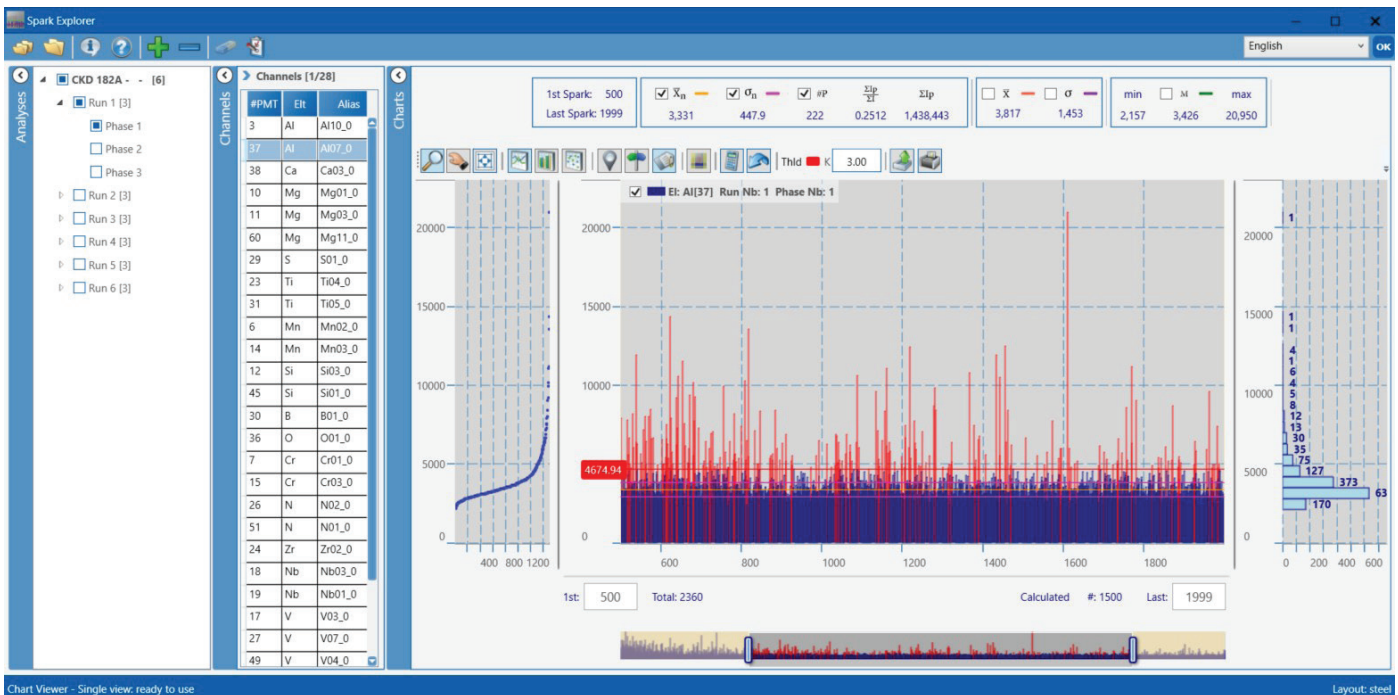
Highlights

- Three chart types: run chart, S-diagram and histogram
- Four display modes: Single view, Grid view, Single Chart view and Compare Charts view
- No limit on number of samples, runs and elements that can be displayed
- Interactive calculations of key statistical parameters of single spark signals and optimization of the peak detection threshold
- Reporting of charts and key statistical parameters.

Viewing single spark signals

There are four different modes to display single spark signals, the Single view, the Grid view, the Single Chart view and the Compare Chart view.

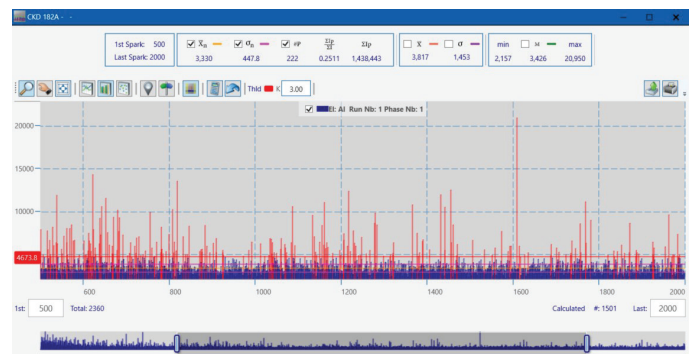
The **Single view** mode is used to display the different charts, i.e., S-diagram, run chart and histogram, as well as key parameters for a single element at a time. The three collapsible panes “Analysis”, “Channels” and “Charts” allow users to select the run, pick the element channel and display the corresponding charts and key parameters, respectively.



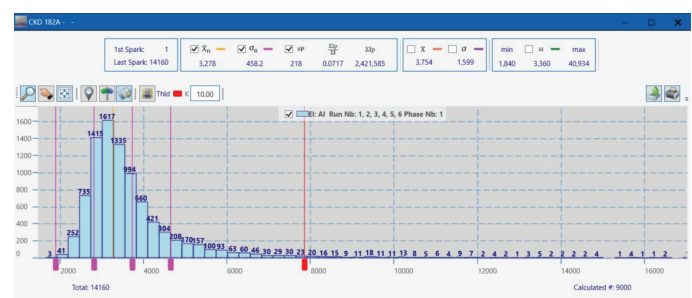
Display of single spark signals of Al in low alloy steel sample CKD 182A in the Single view with the three collapsible panels expanded, and the three types of charts and the key parameters displayed in the Charts panel.

Several sample analyses can be added for selection in the Analysis pane, making it the perfect tool for fast screening and evaluation of the single spark signals of the elements of interest in one or several runs of one or more analyses.

The **Single Chart view** mode allows advanced display of run charts, S-diagram and histograms of single spark signals with statistics. Charts are generated in individual windows for the selected sample analyses, runs and elements. Several runs of an analysis can also be concatenated in order to increase the statistical relevance of the data.



Single Chart view of the Al single spark run chart of one run of the analysis of sample CKD 182A. The horizontal red line is the peak detection threshold and the signals in red are the peaks.



Single Chart view of the histogram of Al single spark signals of the six runs of the analysis of sample CKD 182A grouped. The vertical red line indicates the position of the detection threshold (here 10). The other vertical lines correspond to statistical parameters selected and displayed in the Statistics tool bar.

Compare Charts

1st Spark: 500 Last Spark: 2000

Number of Sparks: ☒ Analytical Condition: ☒
 Signature: ☒ Run Number: ☒
 Method: ☒ Phase Number: ☒

Al - Al07_0 - Run Nb 4 - Phase Nb 1 - CKD 182A - -

\bar{X}_n	3,139	#P	204
σ_n	455.2	$\frac{\Sigma Ip}{\Sigma I}$	0.2538
Thld	K 3.00	ΣIp	1,393,249

Ca - Ca03_0 - Run Nb 4 - Phase Nb 1 - CKD 182A - -

\bar{X}_n	106.2	#P	13
σ_n	25.89	$\frac{\Sigma Ip}{\Sigma I}$	0.0215
Thld	K 3.00	ΣIp	3,482

Mg - Mg03_0 - Run Nb 4 - Phase Nb 1 - CKD 182A - -

\bar{X}_n	88.72	#P	43
σ_n	25.39	$\frac{\Sigma Ip}{\Sigma I}$	0.0731
Thld	K 3.00	ΣIp	10,242

S - S01_0 - Run Nb 4 - Phase Nb 1 - CKD 182A - -

\bar{X}_n	2,374	#P	207
σ_n	605.8	$\frac{\Sigma Ip}{\Sigma I}$	0.2810
Thld	K 3.00	ΣIp	1,258,372

Ti - Ti04_0 - Run Nb 4 - Phase Nb 1 - CKD 182A - -

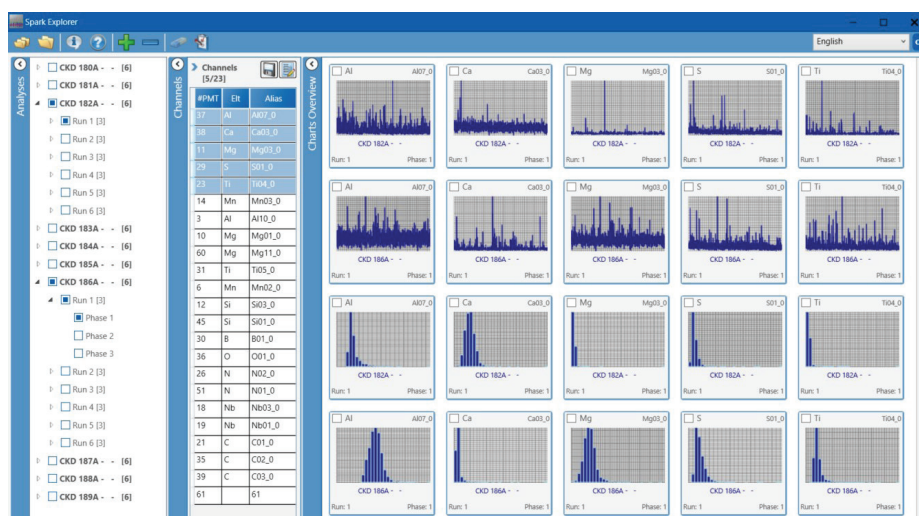
\bar{X}_n	321.4	#P	152
σ_n	57.43	$\frac{\Sigma Ip}{\Sigma I}$	0.2612
Thld	K 3.00	ΣIp	152,462

Mn - Mn03_0 - Run Nb 4 - Phase Nb 1 - CKD 182A - -

\bar{X}_n	10,219	#P	9
σ_n	898.0	$\frac{\Sigma Ip}{\Sigma I}$	0.0089
Thld	K 3.00	ΣIp	136,590

1st: Last:

The **Grid view** mode is primarily used to pick the charts to be displayed in the Single Chart or Compare Charts views. It can also be used in order to get a quick overview of charts of elements in different samples and analysis runs.



Grid view with overview of run charts and histograms for the samples, analysis runs and elements defined in the Analyses and Channels panes. The charts can be selected for display in Single Chart or Compare Charts views.

Interactive calculation of key statistical parameters

The Statistics toolbar is displayed in all the views, except the Grid view. It consists of boxes that contain key statistical parameters of the single spark signals, in particular normal statistics (mean and standard deviation of the normal signal distribution), with number of peaks, insoluble ratio and sum of the peak intensity values calculated for the selected detection threshold and range of single spark signals.



Two single Chart views of the same analysis run of sample CKD 182A with peak detection thresholds at 3σ (left) and 30σ (right) above background signal. The values of the key parameters are interactively recalculated when manually sliding the peak detection threshold up or down.

The chart and the key statistical parameters provide essential information for adjusting the parameters of Spark-DAT algorithms, when setting-up or optimizing an inclusion analysis method:

- The values of the statistical parameters can be updated when changing the range of single spark signals (either with the selection bar or via the dedicated text fields)
- The display of the chart and the statistical parameters are interactively updated when changing the peak detection threshold (either by sliding it up or down or typing the K factor value in the dedicated text field).

Reporting

The Spark Explorer contains two useful reporting tools:

- Export of charts to different file formats (.png, .bmp or .jpeg)
- Print of .pdf reports with run charts or histograms and key statistical parameters.

The first is used, for example, to illustrate a new inclusion analysis method in images, while the second could document the report of an investigation into a problem caused by inclusions.

This software product specification is valid for ARL iSpark Plus and ARL iSpark with OXSAS version 2.6 or above

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