NEXT GENERATION SDD FOR BEST EDXRF PERFORMANCE

HighSense™ XP Detector Superior EDXRF Performance

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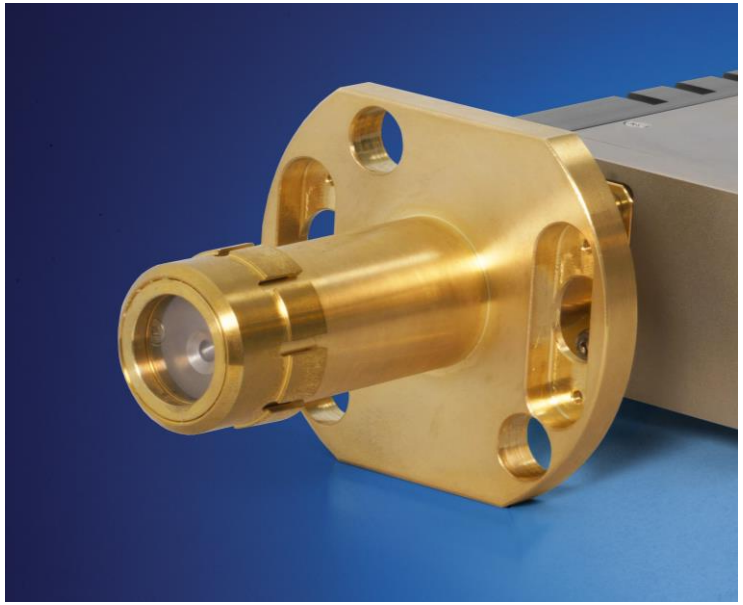
10 June 2021

HighSense™ XP Detector
Superior EDXRF Performance

HighSense™ XP Detector
Now available for the S2 PUMA Series 2

State-of-the-Art Hardware & Next Generation Software

- New premium detector for all elements (C to Am)
- Robust, high transmission Graphene window (non-toxic)
- Bruker's detector chip technology
- Further enhanced cooling (Peltier) performance

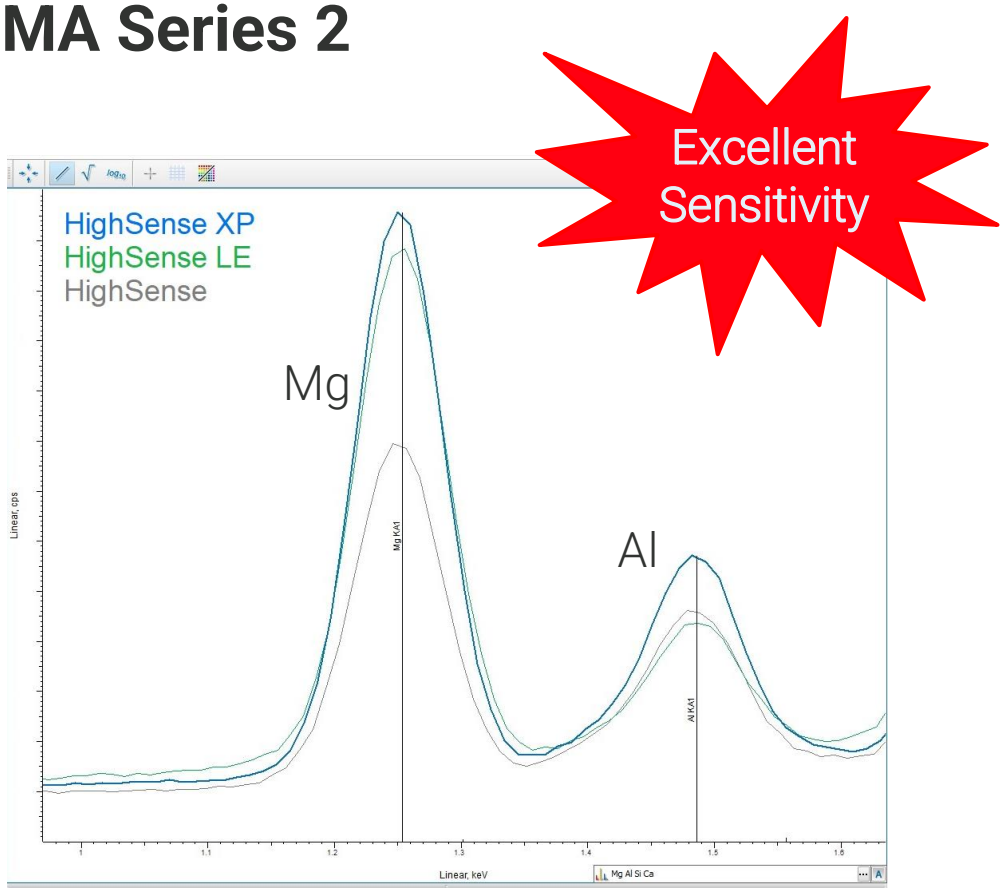


- New SPECTRA.ELEMENTS with **Dynamic Detector Profiling**

HighSense™ XP Detector
Now available for the S2 PUMA Series 2

Ultra-high transmission

- The 0.9 µm Graphene Window offers ultra high transmission
- Sensitivity improved by typically 30% compared to the HighSense LE
- A Si-grid is not required, minimizing diffraction peaks and improving the performance for Si



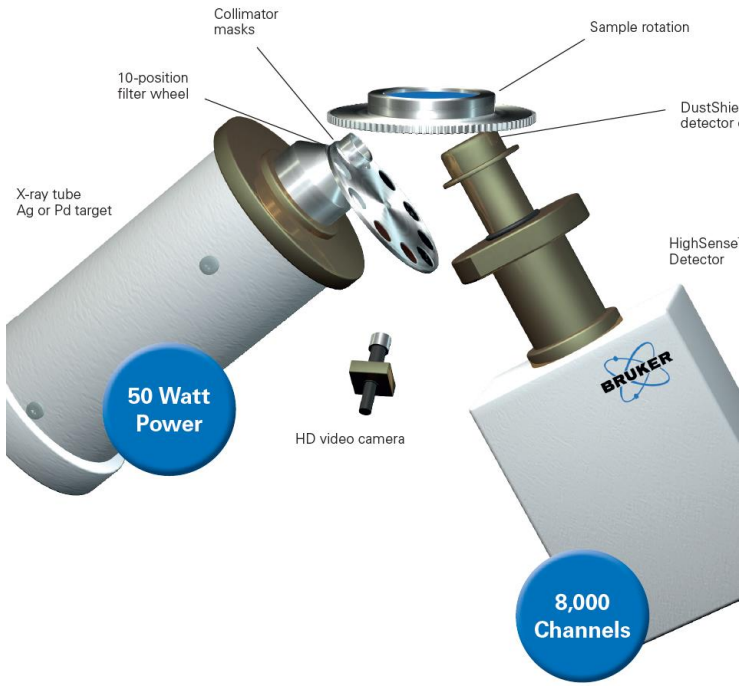
HighSense XP: Best performance for all element!

HighSense™ XP Detector
Now available for the S2 PUMA Series 2

	HighSense XP	HighSense LE	HighSense
Detector Type	SDD	SDD	SDD
Element Range	C – Am	(C) F – Am	(Na) Mg - Am
Window	Graphene (0.9 µm)	Polymere window	Be (8 µm)
Light element sensitivity (≤Si)	Excellent	Excellent	Good
Medium element sensitivity (>Si)	Excellent	Very Good	Very Good
Heavier element sensitivity (>Fe)	Excellent	Very Good	Excellent
Dynamic Detector Profiling	Yes	No	No
Best Energy Resolution at Mn kA	<132 eV*	~135 eV	~135 eV
Max. input count rate	2.400.000 cps	1.500.000 cps	1.500.000 cps

*At input count rate of max. 4000.000 cps

HighSense™ XP Detector
Now available for the S2 PUMA Series 2



Optimal excitation of the sample is ensured by:

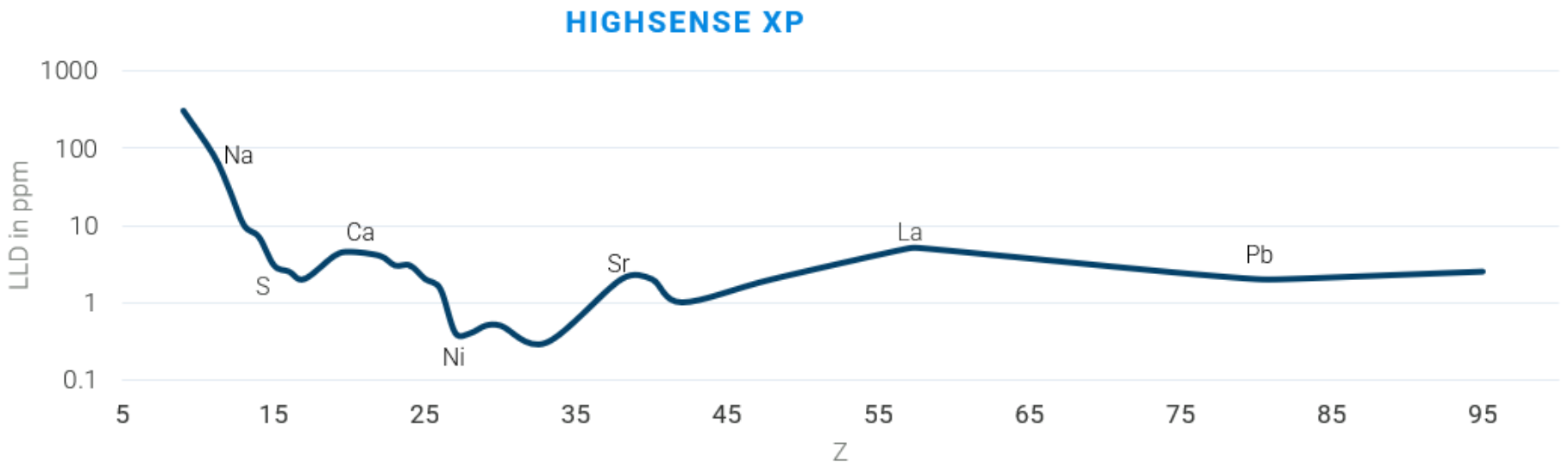
- High power 50 Watt X-ray tube
- Up to 2 mA and 50 kV (30 kV)
- 10-position primary beam filter
- Direct excitation
- Closely coupled optics

HighSense turns power into performance

HighSense XP
Optimal Performance even for Trace Elements

Lower Limit of Detection (LLD)

- Determined for optimal conditions
- LLD = 3 x Standard Deviation



GEO-QUANT Basic
S2 PUMA Series 2 with HighSense XP

Versatile Solution for Geo-Materials

- Powerful analytical solution developed for the analysis of major and minor oxides in geological materials.
- Based on 20 certified reference materials (CRM), incl. cement, clay, feldspar, limestone, dolomite, gypsum, bauxite, refractory, and more
- 4 dedicated QC samples
- 14 key elements covered

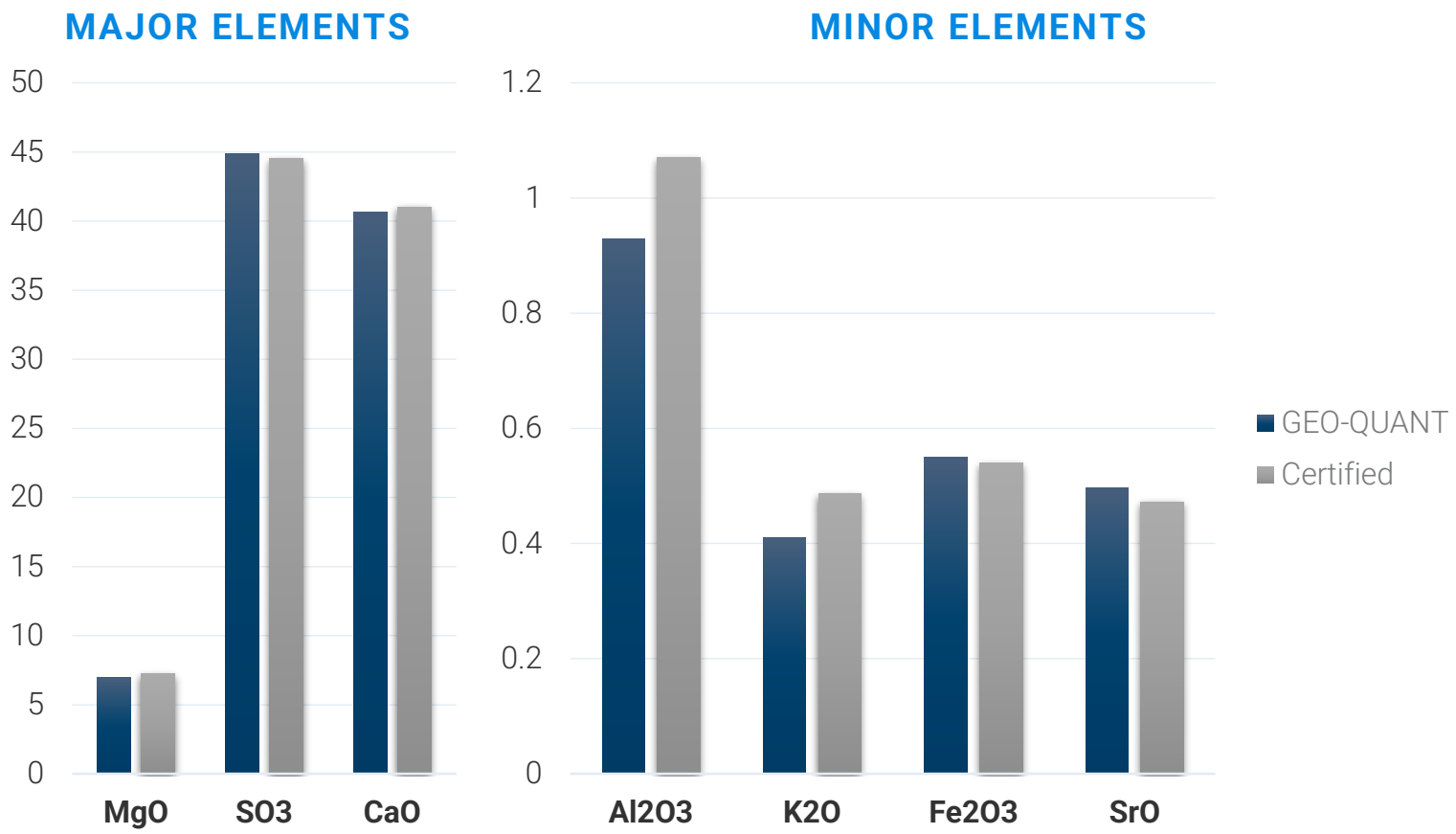
GEO-QUANT Basic
S2 PUMA Series 2 with HighSense XP

Ready for various applications

- Mining operations
- Industrial minerals
- Raw materials for cement and building materials
- Refractories
- Ceramics and glass
- Geochemical research
- Archaeology
- Environmental studies

Compound	Number of CRMs	Max. conc. (wt%)
Na_2O	16	11
MgO	18	40
Al_2O_3	19	85
SiO_2	19	100
P_2O_5	16	7.5
SO_3	13	58
K_2O	18	12
CaO	18	100
TiO_2	19	4
Cr_2O_3	14	0.1
MnO	16	0.9
Fe_2O_3	20	100
ZnO	11	0.2
SrO	13	0.3

GEO-QUANT Basic
S2 PUMA Series 2 with HighSense XP



Gypsum – concentrations in wt%

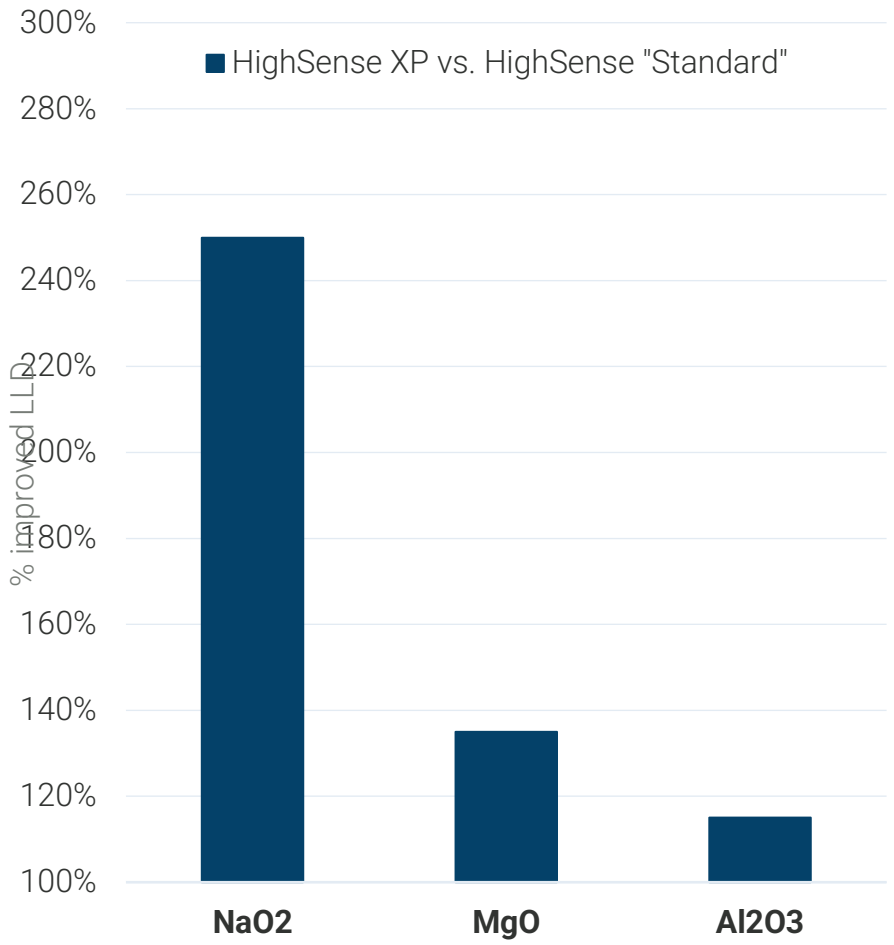
GEO-QUANT Basic
S2 PUMA Series 2 with HighSense XP

Detector Comparison

HighSense XP vs. HighSense

- QC samples tested:
  - Gypsum
  - Iron Ore Sinter
  - Limestone
  - Cement

- HighSense XP: Advantages for low levels of Na, Mg, and Al.



CEMENT-QUANT
S2 PUMA Series 2 with HighSense XP

- Provides a workflow to meet good laboratory practice (GLP)
- Includes a quality check procedure for instrument stability and a repeatability check for the sample preparation
- Contains a set of predefined applications for the XRF analysis of process materials like raw mix, clinker, and cement

CEMENT-QUANT: Makes you ready for ASTM C114 and DIN EN ISO 29581-2

CEMENT-QUANT Basic
S2 PUMA Series 2 with HighSense XP

CEMENT-QUANT comes with a set of international certified reference materials (CRM)

- Allows to create traceable and accurate calibrations in three steps:
- Step 1 – Preparation of the CRMs as fused beads
- Step 2 – Measurement of the beads with CEMENT-QUANT
- Step 3 – Calibration - Ready to analyze! Traceable to NIST!

CEMENT-QUANT: Makes you ready for ASTM C114 and DIN EN ISO 29581-2

CEMENT-QUANT Basic
S2 PUMA Series 2 with HighSense XP

Excellent repeatability!
Also for light elements like Na and Mg – thanks to HighSense XP

(wt%)	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Na_2O	K_2O	TiO_2	P_2O_5	ZnO	Mn_2O_3	Cr_2O_3	SrO
Rep-1	31.31	9.37	0.965	51.51	4.53	3.36	0.171	0.68	0.69	0.027	0.014	0.239	0.005	0.080
Rep-2	31.31	9.38	0.962	51.52	4.55	3.36	0.173	0.68	0.69	0.029	0.014	0.238	0.005	0.081
Rep-3	31.28	9.38	0.963	51.51	4.55	3.36	0.156	0.67	0.69	0.028	0.014	0.238	0.006	0.080
Rep-4	31.31	9.39	0.964	51.52	4.53	3.37	0.150	0.67	0.69	0.031	0.014	0.238	0.005	0.080
Rep-5	31.31	9.40	0.964	51.52	4.54	3.36	0.156	0.67	0.69	0.027	0.014	0.239	0.005	0.080
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Rep-20	31.27	9.37	0.964	51.52	4.54	3.37	0.157	0.68	0.69	0.032	0.014	0.238	0.006	0.080
Mean	31.29	9.37	0.962	51.51	4.53	3.36	0.155	0.68	0.69	0.028	0.014	0.238	0.005	0.080
Std.Dev	0.02	0.02	0.001	0.02	0.02	<0.01	0.018	<0.01	<0.01	0.002	<0.001	0.001	0.001	<0.001
Rel.Std.Dev	0.07%	0.17%	0.15%	0.04%	0.41%	0.11%	11.77%	0.30%	0.24%	7.55%	0.71%	0.38%	10.42%	0.39%

SMART-QUANT FP
Best standardless analysis with EDXRF

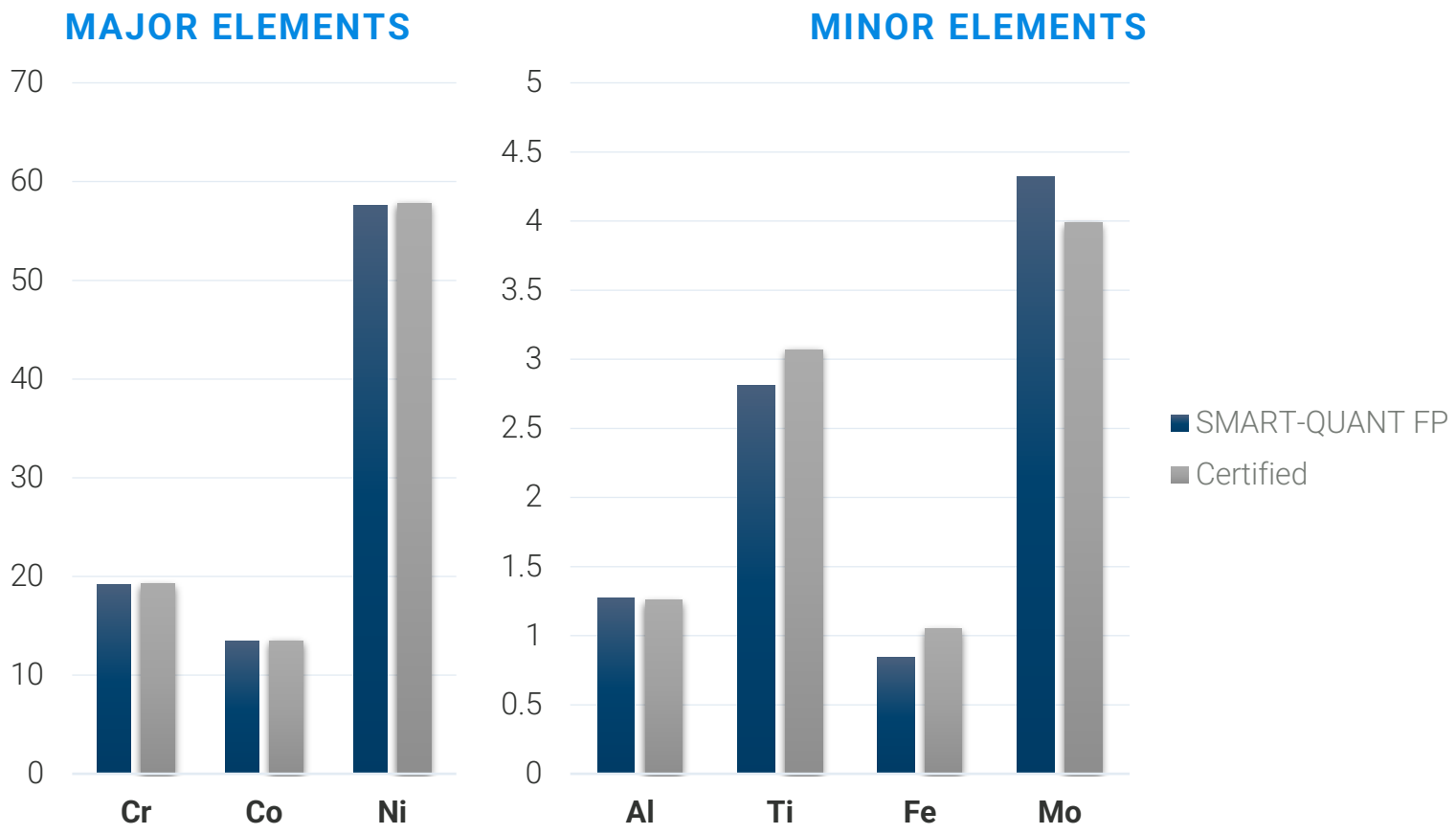
SMART-QUANT FP is set up to work in full Fundamental Parameter (FP) mode – this means no calibrations necessary!

Excellent for raw material testing and whenever special samples outside the analytical routing need to be measured.

- Fluorine to Americium
- ppm to 100%
- Air, Helium, Vacuum
- 30 and 50 kV

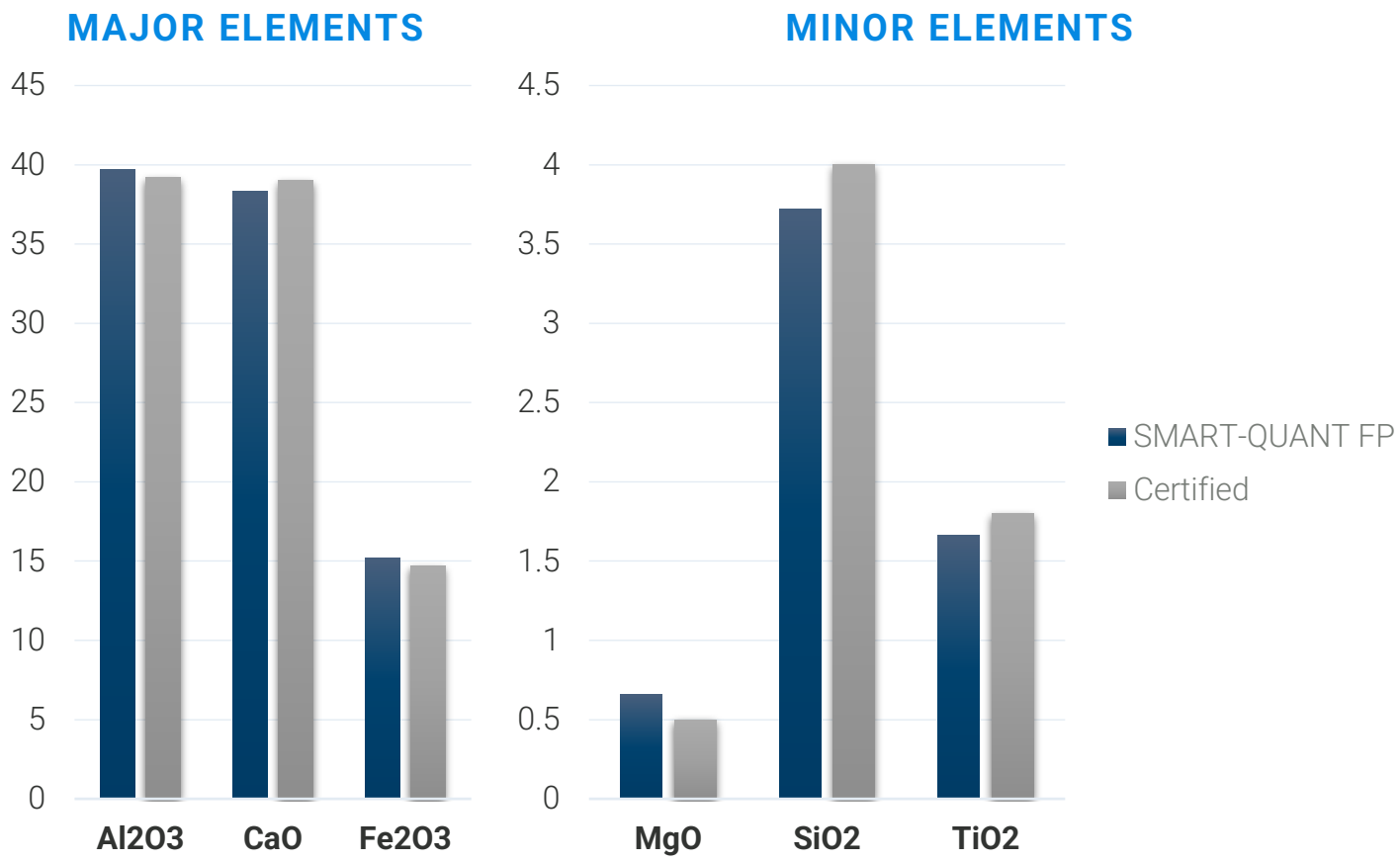
SMART-QUANT: Push-button solution for quick and reliable analysis of unknown samples

SMART-QUANT FP
Powered by HighSense XP



Nickel Alloy – Waspaloy, concentrations in wt%

SMART-QUANT FP
Powered by HighSense XP



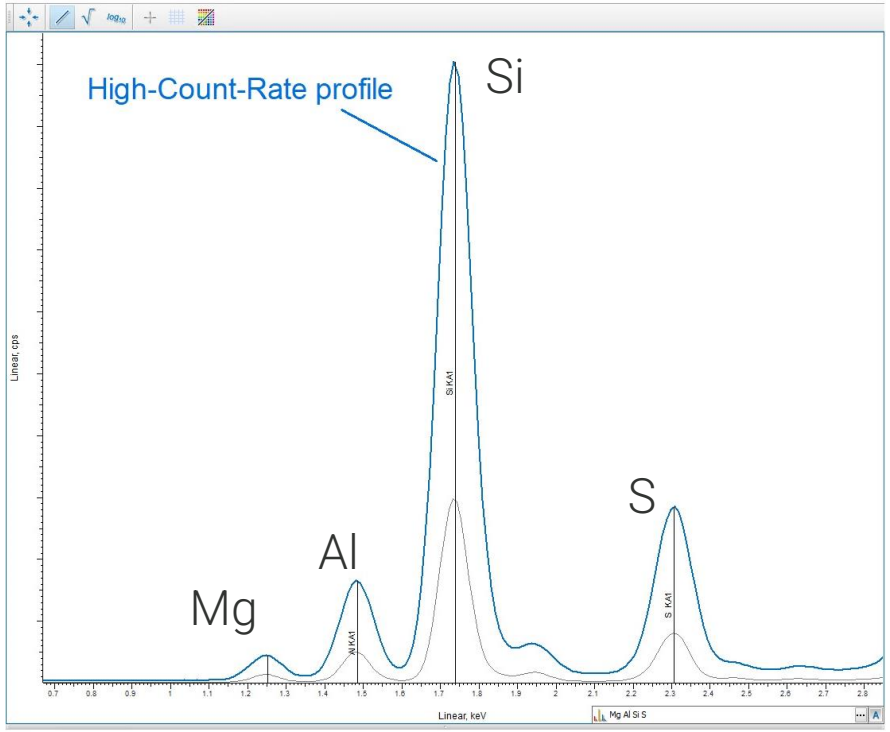
High Al Cement, concentrations in wt%

The Benefits of Detector Profiling

- New, fully integrated feature in SPECTRA.ELEMENTS
- Flexible: Make your selection each analytical range
  - **High Resolution** for optimal peak separation of neighboring elements
  - **High-Count-Rate** to boost the throughout or decrease LLD

SPECTRA.ELEMENTS

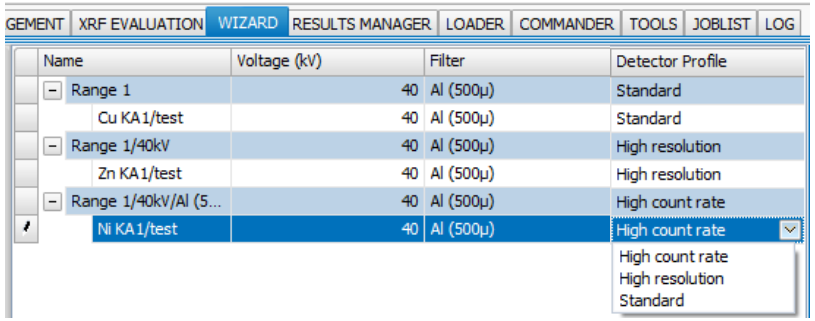
Easy. Fast. Smart. Powerful.



Example: Achieve 4 x higher net intensity for **Cement** samples with the High-Count-Rate profile

The Benefits of Detector Profiling

- New, fully integrated feature in SPECTRA.ELEMENTS
- Flexible: Make your selection each analytical range
  - **High Resolution** for optimal peak separation of neighboring elements
  - **High-Count-Rate** to boost the throughout or decrease LLD



Select the profile for each range when you setup your method.

SPECTRA.ELEMENTS

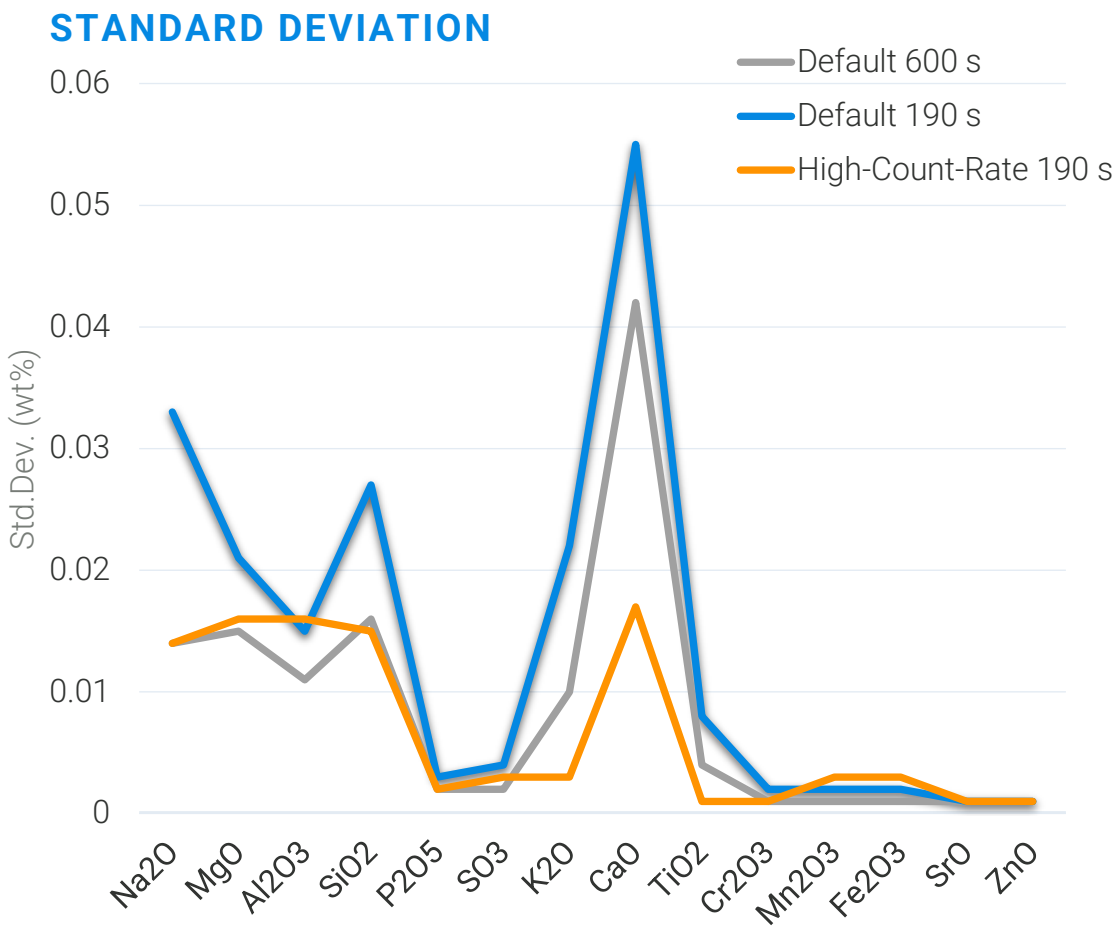
Easy. Fast. Smart. Powerful.

The Benefits of Detector Profiling

Precision Test

- Cement QC sample
- 3 ranges, 190 or 600 s total counting time, 25 repetitions

The High-Count-Rate setting allows to reduce the counting time factor of ~3

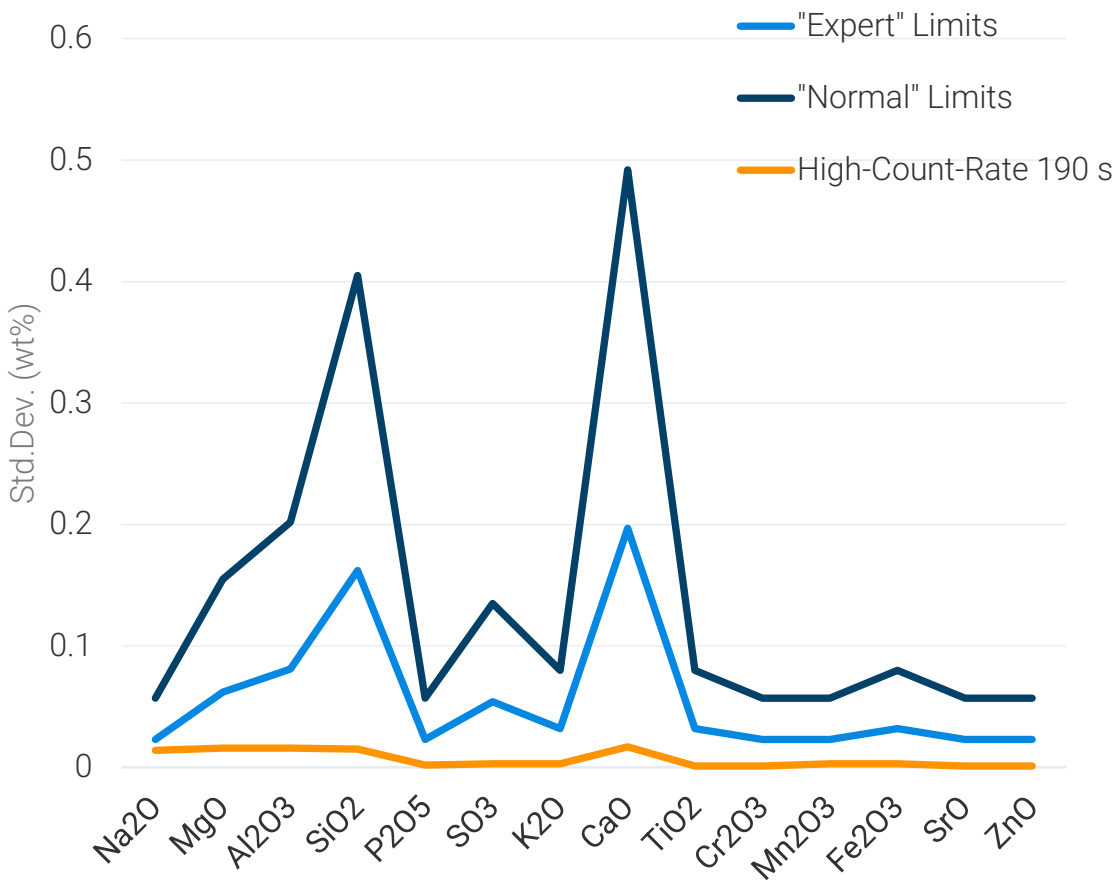


The Benefits of Detector Profiling

ISO 29581 / EN 196-2:

A Cement norm which defines two categories of precision (repeatability) :
“Normal” and “Expert”

- The S2 PUMA Series 2 with HighSense XP meets standard deviation limits easily.



What requirements for a modern spectrometer software?

- Intuitive user interface
- Full functionality
- Different user levels
- Short processing times
- High stability
- Flexible data management

Modern XRF software offers better analytical performance and safes time!

(training, operation, evaluation)

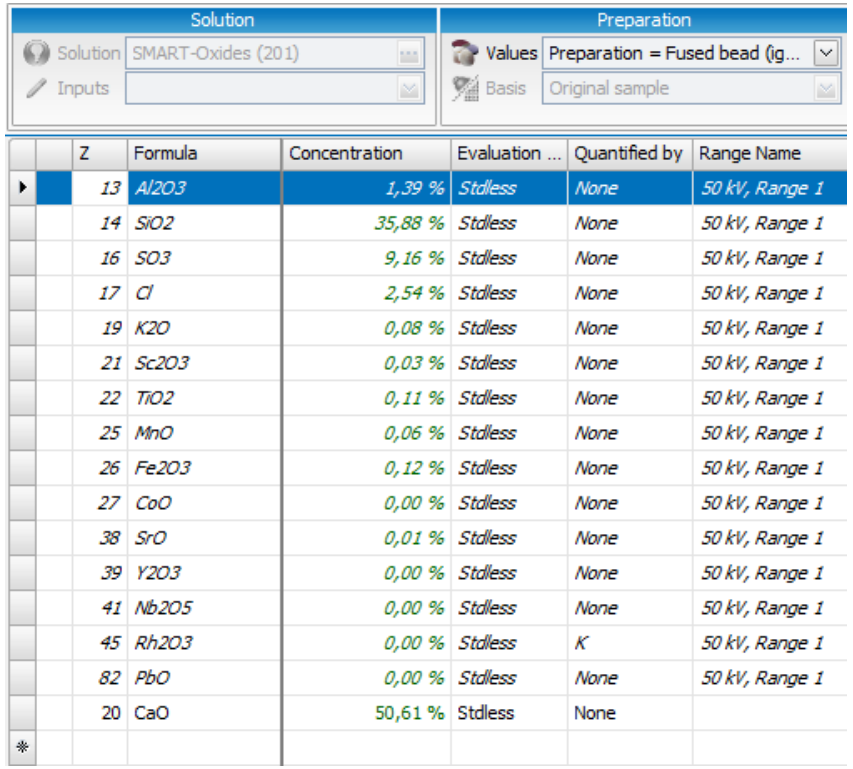
SPECTRA.ELEMENTS: Next Generation XRF Software Platform

SPECTRA.ELEMENTS
Next Generation Spectrometer Software

Faster. Smarter. Easier.

Faster operation

- Immediate data processing
- Smooth navigation
- Rapid access to database



	Z	Formula	Concentration	Evaluation ...	Quantified by	Range Name
▸	13	Al2O3	1,39 %	Stdless	None	50 kV, Range 1
	14	SiO2	35,88 %	Stdless	None	50 kV, Range 1
	16	SO3	9,16 %	Stdless	None	50 kV, Range 1
	17	Cl	2,54 %	Stdless	None	50 kV, Range 1
	19	K2O	0,08 %	Stdless	None	50 kV, Range 1
	21	Sc2O3	0,03 %	Stdless	None	50 kV, Range 1
	22	TiO2	0,11 %	Stdless	None	50 kV, Range 1
	25	MnO	0,06 %	Stdless	None	50 kV, Range 1
	26	Fe2O3	0,12 %	Stdless	None	50 kV, Range 1
	27	CoO	0,00 %	Stdless	None	50 kV, Range 1
	38	SrO	0,01 %	Stdless	None	50 kV, Range 1
	39	Y2O3	0,00 %	Stdless	None	50 kV, Range 1
	41	Nb2O5	0,00 %	Stdless	None	50 kV, Range 1
	45	Rh2O3	0,00 %	Stdless	K	50 kV, Range 1
	82	PbO	0,00 %	Stdless	None	50 kV, Range 1
	20	CaO	50,61 %	Stdless	None	
*						

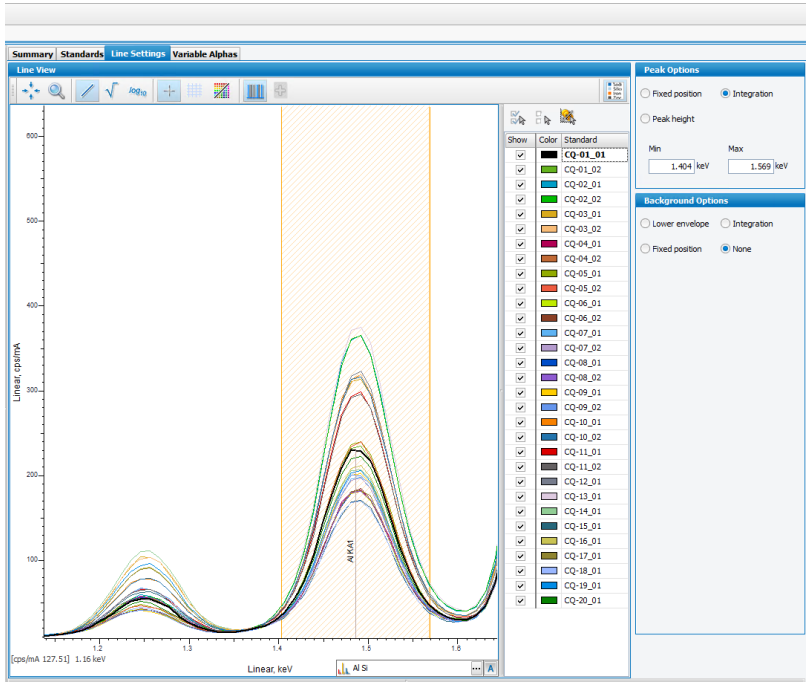
Evaluate your measurements in no time!

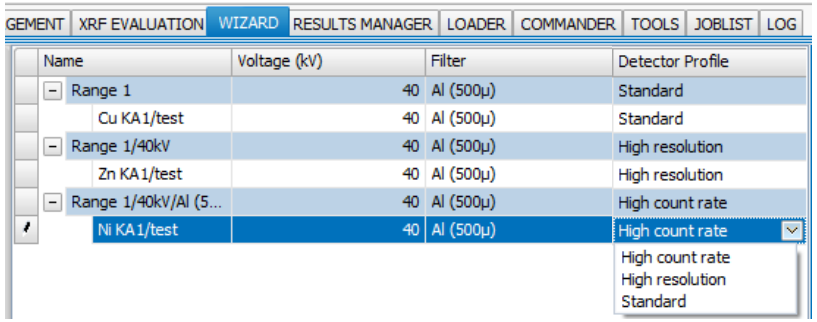
SPECTRA.ELEMENTS
Next Generation Spectrometer Software

Faster. Smarter. Easier.

Smarter features

- Dedicated User Levels
- Basic & Advanced Mode
- Detector Profiling
- Aut-O-Matrix
- Loss-Eliminated Alphas,
- Pressure compensation
- Blanks, duplicates, QC
- Post-Processing
- Automation ready



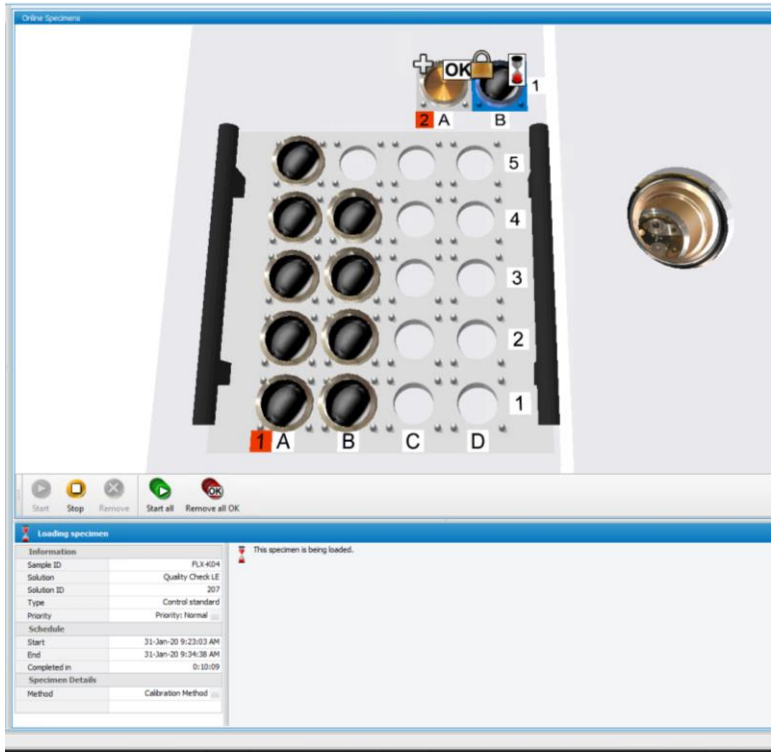


SPECTRA.ELEMENTS
Next Generation Spectrometer Software

Faster. Smarter. Easier.

Easier to use

- Quick learning with new User Interface
- Hints provide help when needed
- WIAZARD: the proven tree-structure guide you through the calibration process
- LOADER: Intuitive interface for routine operation
- RESULT MANAGER: Access all your data quickly and get extended reporting



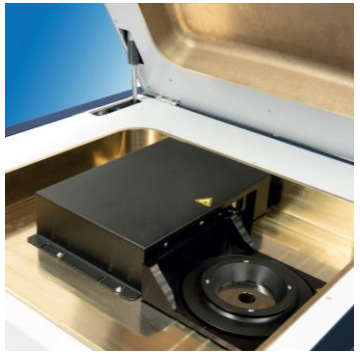
The LOADER: load / unload samples; adjust priorities; start / stop your measurements; view your results.

S2 PUMA Series 2
Taylor-made Solution for all Applications

Benefits of the S2 PUMA

- Sample Handling for all needs:
  - Single
  - XY-Autochanger
  - XY-Automation
  - Carousel
  - Mapping-Stage






S2 PUMA Series 2
Taylor-made Solution for all Applications

Benefits of the S2 PUMA

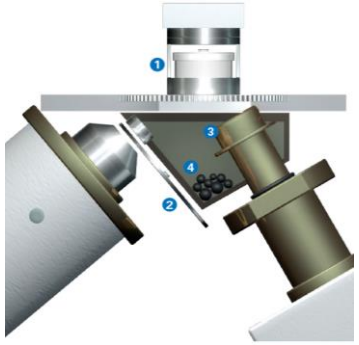
- All atmospheres
  - Air, Vacuum, Helium, Nitrogen.
- All samples
  - Liquid, Powder, Pressed Pellet, Solid, Bulk.




S2 PUMA Series 2
Taylor-made Solution for all Applications

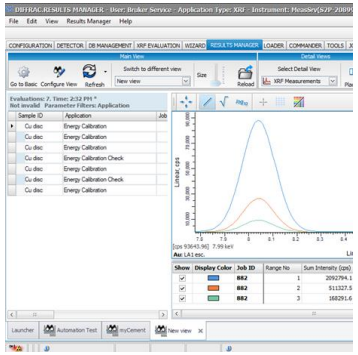
Benefits of the S2 PUMA

- Easy-of-Use
  - SPECTRA.ELEMENTS
  - TouchControl™
- High uptime and short maintenance
  - SampleCare™
  - Smart maintenance features
  - Self-diagnostic functions
  - Remote service & support



Summary
S2 PUMA Series 2 with HighSense XP

- HighSense XP combines ultra-high sensitivity with robustness
- Detector Profiling allows to reduce counting times or decrease LLDs significantly
- SPECTRA.ELEMENTS is now even faster and comes with additional features to make your life easy (e.g. Basic and Advanced mode)
- Ready to perform from day one with out-of-the-box solutions
  - SMART-QUANT, GEO-QUANT, CEMENT-QUANT



Q&A Session

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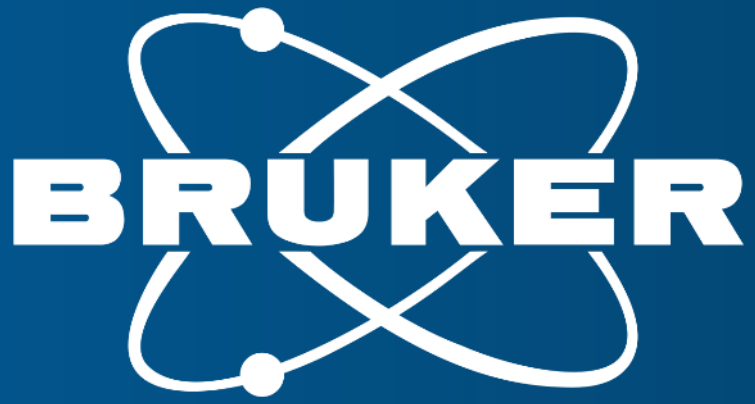

Innovation with Integrity