XRF WEBINAR SERIES 2021

Precision Counts! Fast Analysis Of Grades With XRF Is Key For Successful Metal Production

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10.11.2021

Precision Counts! Fast Analysis Of Grades With XRF Is Key For Successful Metal Production

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2001 Method Development Bruker AXS

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Product Management XRF

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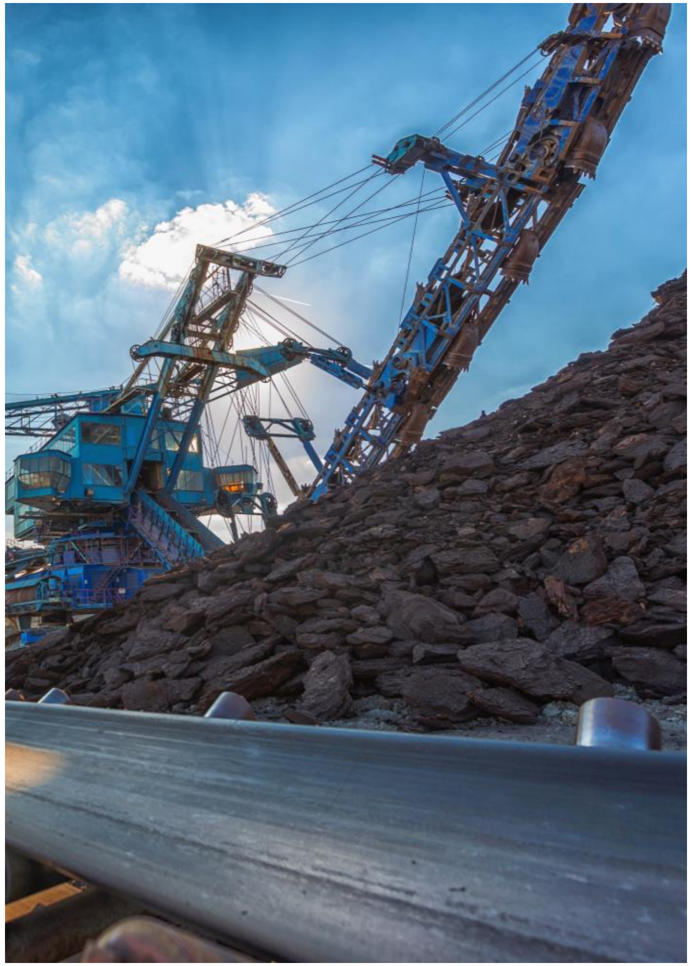
Outline

XRF: Mining for Money
Analytical Tasks in Mining Operations

- Exploration
  - Classification of mineral resources
- Process Control
  - Mining and Mine Planning
  - Mining Operations
  - Mineral Beneficiation
  - Grade Control
- Shipping
  - Grade verification along the supply chain
- Metal-Making
  - Process-Optimization
  - Final product control



XRF: Mining for Money
Why to measure chemical composition?

Element concentrations are vital information in mining operations:

Exploration

- Value of resource is determined by total amount of elements of interest: Fe, Cu, Au,…
- Hazardous elements will decrease commercial value
- Distribution and other elements present will determine cost of mineral beneficiation

Mine operation

- Mine output is based on separation of high grades, low grades and waste
- Process control will enable optimization steps to increase mine output and decrease production costs

Shipping

- Grade control and knowledge of penalty elements (P, Si in Fe ore)
- Agreement between seller, buyer and involved contract labs will ease payment

Metal Production

- Accurate element concentrations will enable efficient production (dosing of coke in steel making)

On your own!
Advantages of XRF

- Inherently non-destructive
- Simple and fast sample preparation
- Qualitative, semi-quantitative and quantitative analysis
- X-ray spectra are less complex than optical:

  Typically, 2 -3 lines versus 100s or 1000s of lines for ICP and AAS
- Environmentally clean and safe method
- Better precision
- Lab standardization
- Shorter learning curve
- Shorter analysis time
- Low analysis cost
- Standardless analysis

How XRF Solves Day-to-Day Industrial Challenges

The instrumentation for an analytical task must meet many different criteria:

- Time to result
- Instrument setup and calibration
- Cost of ownership
- Easy, fast sample preparation
- Safe investment for future applications
- Fit for purpose
- Experience and skill of laboratory employees
- Analytical performance

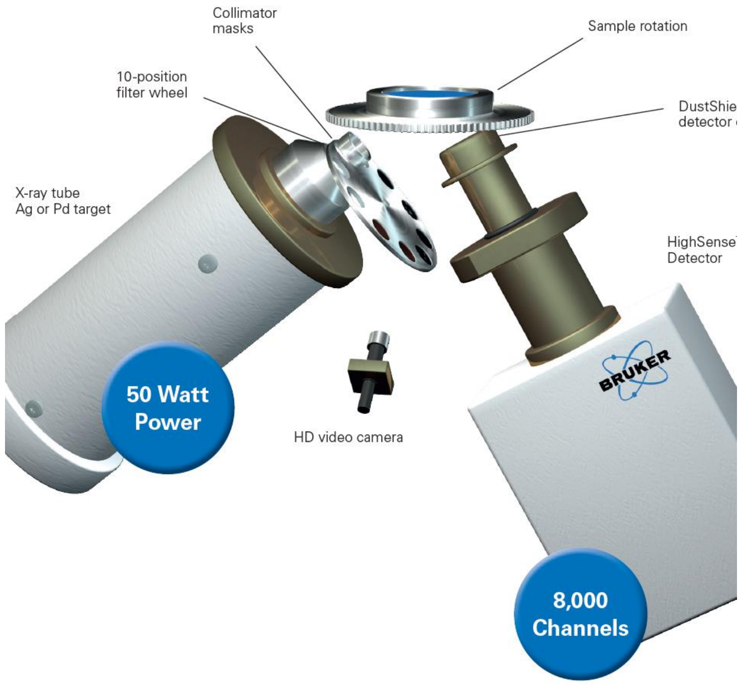
X-ray Fluorescence Analysis (XRF) Capabilities

- Qualitative Analysis
  - Identification of elements
  - “What’s inside?”
- Quantitative Analysis
  - Determination of concentrations
  - “How much is inside?”
- Semi-Quantitative Analysis
  - Estimation of concentration
  - “About how much?”

- Solid and liquid samples can be analyzed directly:
  - Little or no sample preparation required
- Analysis is non-destructive to the sample
- Sampling-to-analysis result time is relatively short (~3 to ~10 min)
- Quantitative and qualitative analyses are possible
- Accuracy and long-term stability
- Elemental range: (Be) Na to U
- Linearity from ppm to 100%

Energy-dispersive XRF (EDXRF)
Wavelength-dispersive XRF (WDXRF)

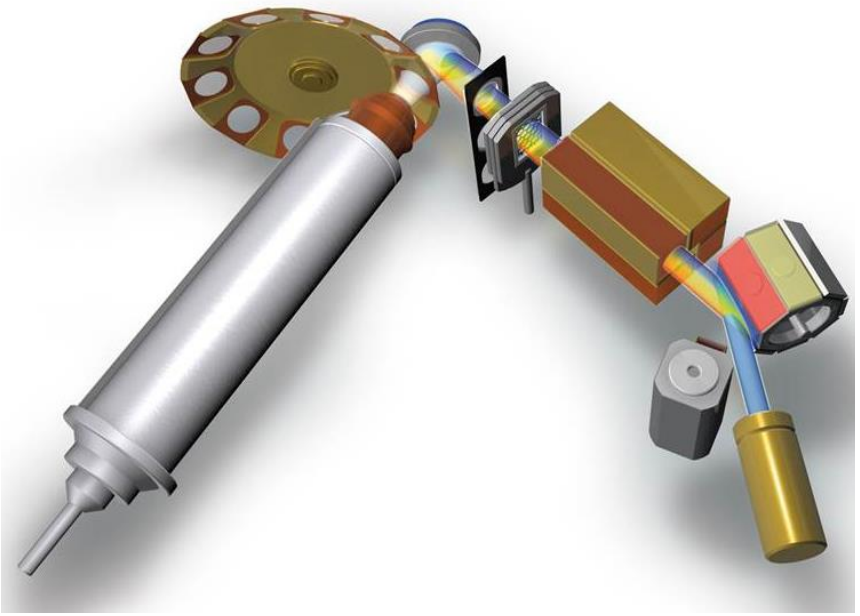
EDXRF



Direct or Polarized excitation

- Detects intensity & energy

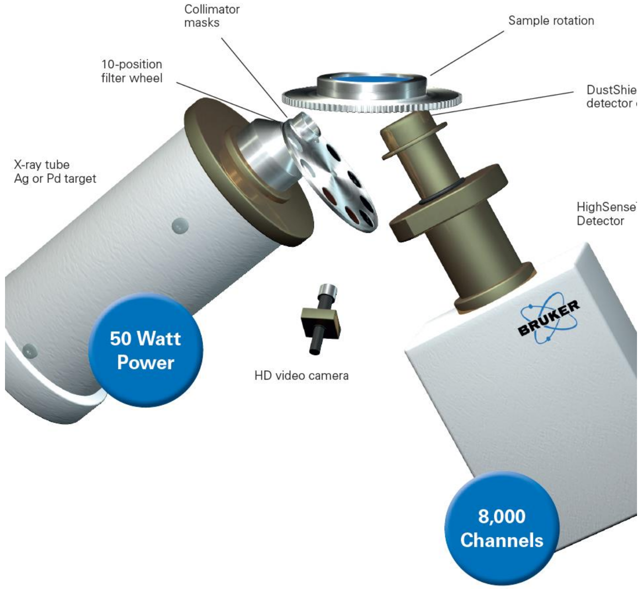
WDXRF



Benchtop (400 W) or floor standing (up to 4 kW)

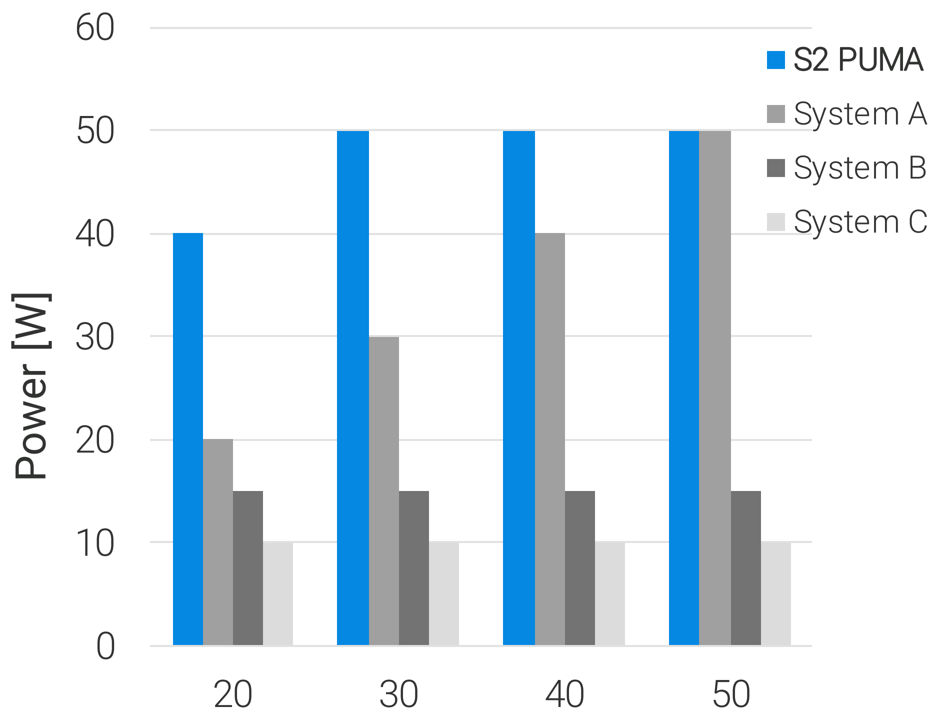
- Detects intensity at a given wavelength

High-performance EDXRF
S2 PUMA Series 2 with HighSense™ Technology



HighSense turns power into performance

Power [W] = Voltage [kV] x Current [mA]



Voltages typically used for Elements	C – Cl (K)	–	K – Mo	Tc – U

Voltage [kV]

Optimal excitation of the sample is ensured by:

- High power 50 Watt X-ray tube
- Up to 2 mA and 50 kV
- 10-position primary beam filter
- Direct excitation
- Large illuminated sample area of 34 mm
- Closely coupled optics

Taylor-made Solution for all Applications
S2 PUMA Series 2

The Single – Results and Best Performance at Your Fingertips

- Convenient and fail-safe sample handling for low sample volumes
- Intuitive TouchControlTM:
  - Load the sample, touch the button and get results within minutes.
- Rotation for heterogeneous samples

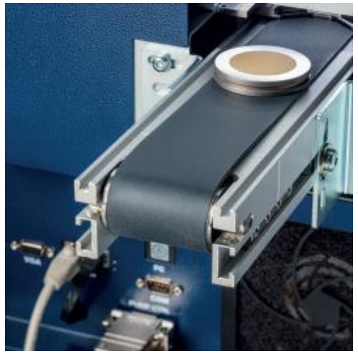
Taylor-made Solution for all Applications S2 PUMA Series 2

The XY Autochanger – Add Efficiency and Flexibility to your lab

- EasyLoad™ XY tray with 20 sample positions
- 2 fixed positions for QC and Drift samples
- Load mixed batches
- New samples can be loaded at any time

The XY Automation – No Compromise on Productivity

- Samples are fed directly, via robot or belt, from the automated sample preparation system
- LIMS-compatible: The AXSCOM interface connects to the process control software

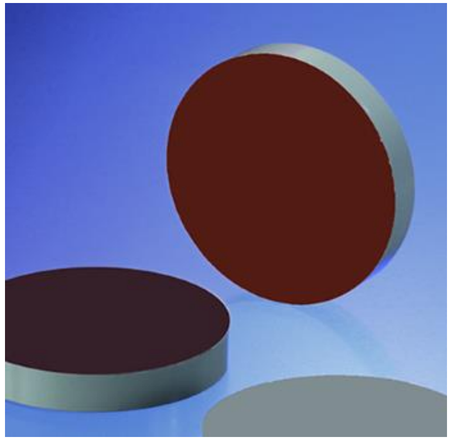



Elemental Analysis of Ni-Laterite Ore
Fast and reliable with the S2 PUMA Series 2

Nickel Laterite (low grade nickel ore) will likely be the dominant source of nickel in the foreseeable future.

EDXRF is used for grade control in mining operations and smelters.

- Accurate determination of Ni
- Analysis of waste rock elements:
    - Ca, Mg, Fe, Mn
- Evaluation of traces
    - Ti, Cr, Co, Cu, Zn
- Time-to-result, ease-of-use, and flexibility are major benefits of the XY Autochanger
- Bruker is a trusted supplier with various S2 PUMA installations at Ni-Laterite mines



Elemental Analysis of Ni-Laterite Ore
Fast and reliable with the S2 PUMA Series 2

Enhanced Speed

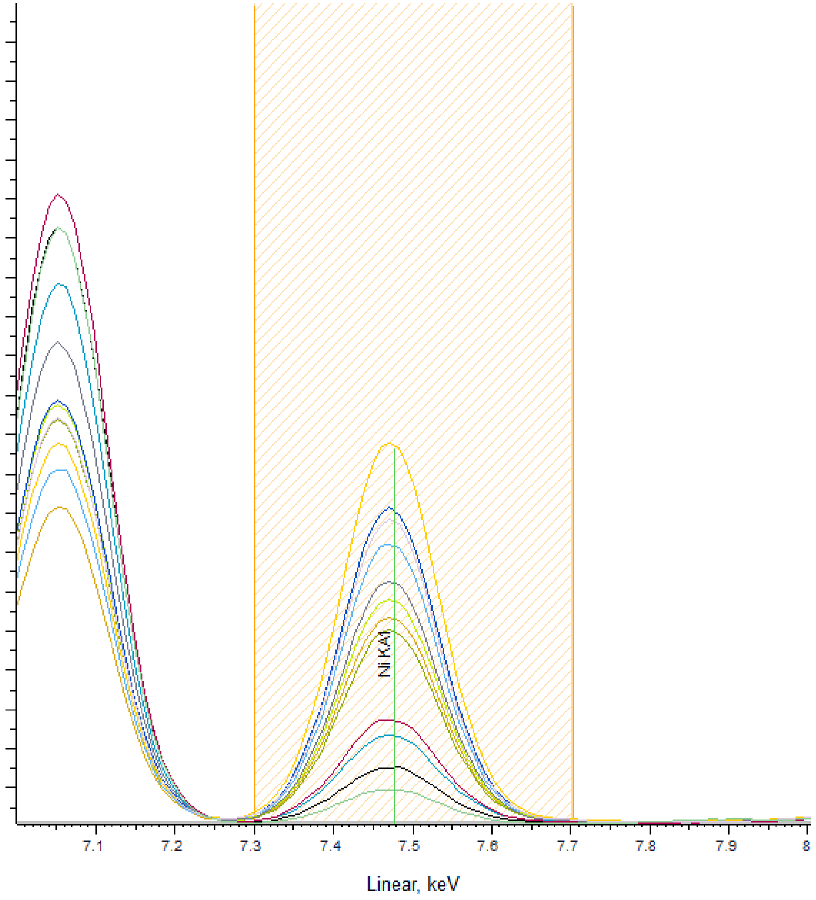
- 3 x Higher Count-Rate, thanks to HighSense technology
- 2 x Higher Pump-Rate
- Faster Software (up to 90%)

Enhanced Usability & Flexibility

- Improved User Interface
- New Features such as Advanced and Basic mode and Drift Monitoring tool
- … and much more

  - “High” and “Low” threshold for quick evaluation

Nickel Grade	Ni (%)
LOW	1.95
LOW	1.96
LOW	1.96
LOW	1.96
HIGH	2.10
HIGH	2.11
HIGH	2.10
HIGH	2.11



Elemental Analysis of Ni-Laterite Ore
Fast and reliable with the S2 PUMA Series 2

Sample ID	Time-to-Result [min:sec]	Ni (%)	MgO (%)	Al_2O_3 (%)	SiO_2 (%)	CaO (%)	TiO_2 (%)	Cr_2O3 (%)	MnO (%)	Fe2O3 (%)	Co (PPM)	Cu (PPM)	Zn (PPM)
Rep-1	01:37	1.388	24.05	2.094	48.24	0.32	0.03	0.77	0.21	14.02	375	32	119
Rep-2	01:39	1.393	24.19	2.077	48.17	0.32	0.03	0.77	0.21	14.00	377	31	125
Rep-3	01:39	1.403	24.00	2.102	48.10	0.32	0.03	0.77	0.22	14.05	416	35	119
Rep-4	01:31	1.383	24.08	2.102	48.19	0.32	0.03	0.77	0.21	14.00	376	32	116
Rep-5	01:39	1.393	24.00	2.107	48.13	0.32	0.03	0.77	0.22	14.05	374	33	116
Rep-6	01:32	1.382	24.28	2.086	48.35	0.32	0.03	0.77	0.22	13.96	400	34	124
Rep-7	01:39	1.39	24.18	2.102	48.26	0.32	0.03	0.77	0.22	13.97	369	33	122
Rep-8	01:32	1.384	24.09	2.094	48.19	0.32	0.02	0.77	0.21	14.03	336	33	123
...	..	..	..	..	..	..	..	..	..	..	..	..	..
Rep-120	01:31	1.407	23.84	2.088	47.85	0.33	0.03	0.78	0.22	14.11	357	33	120
Average measured value	01:31	1.391	24.09	2.101	48.19	0.32	0.03	0.77	0.22	14.02	358	33	120
Abs. standard deviation		0.007	0.08	0.012	0.10	0.00	0.00	0.00	0.00	0.04	21	1	5
Rel. Standard deviation		0.50	0.32	0.57	0.21	1.46	8.00	0.26	2.25	0.29	5.77	3.31	4.03

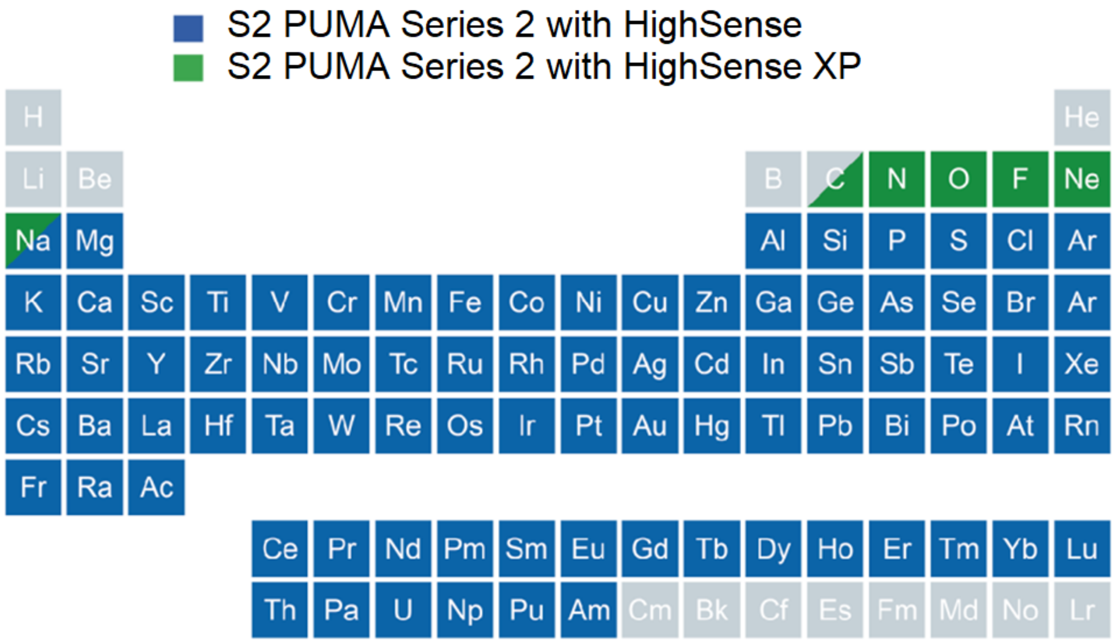
- Conditions: 25 kV, no beam filter, fixed current, 60 s counting time
- Excellent analytical performance in ~1.5 min (time-to-result); regular EDXRF require 4-5 min

BRUKER

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

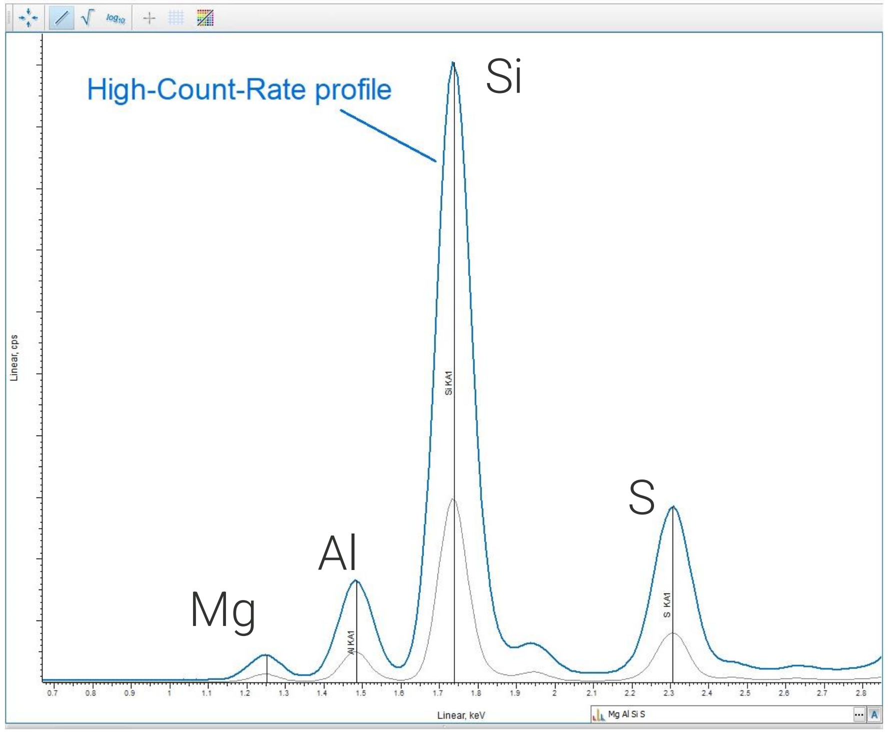
	HighSense XP	HighSense
Detector Type	SDD	SDD
Element Range	C – Am	(Na) Mg - Am
Window	Graphene (0.9 µm)	Be (8 µm)
Light element sensitivity (≤Si)	Excellent	Good
Medium element sensitivity (>Si)	Excellent	Very Good
Heavier element sensitivity (>Fe)	Excellent	Excellent
Dynamic Detector Profiling	Yes	No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

*At input count rate of max. 4000.000 cps



The Benefits of Detector Profiling S2 PUMA Series 2

- 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.

Achieve up to 4 x higher net intensity with the High-Count-Rate profile

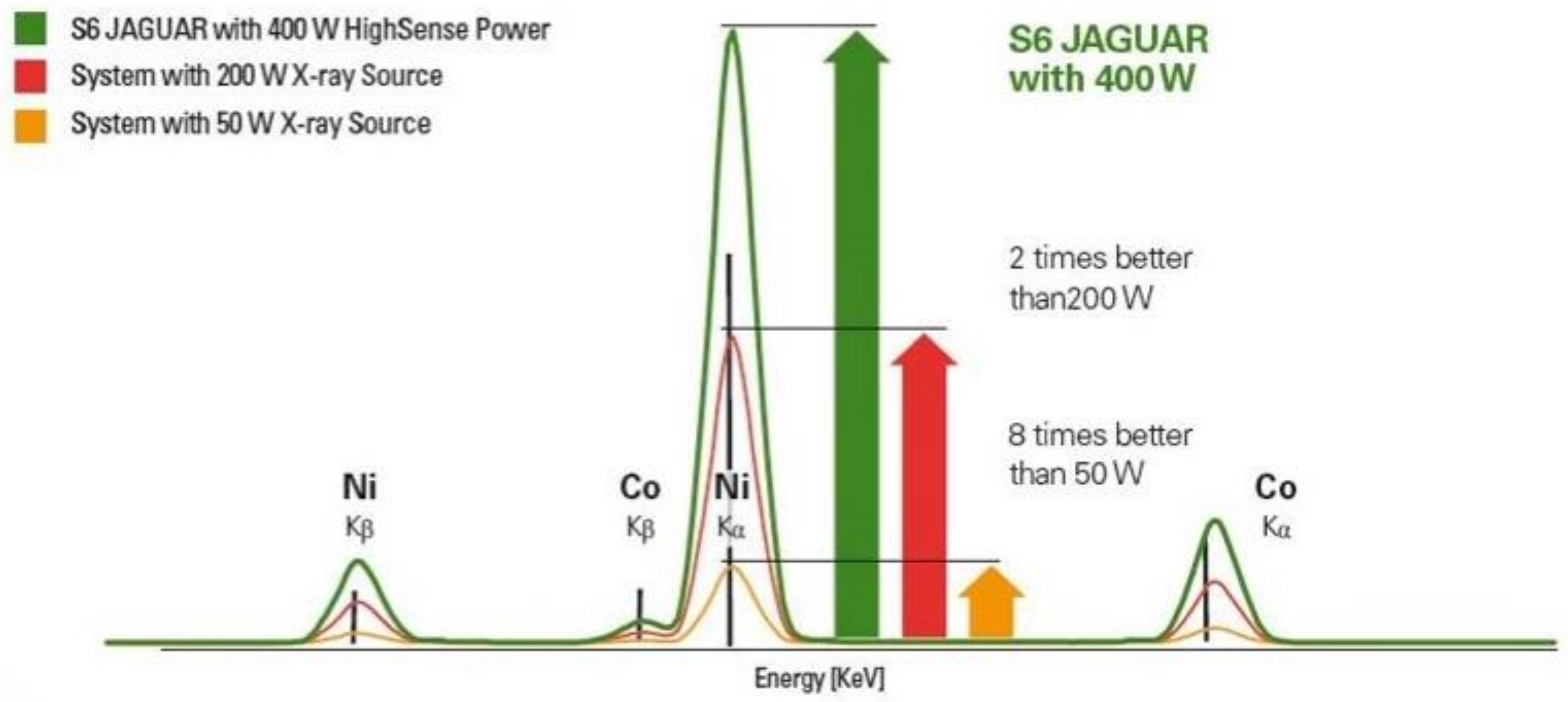
→ Enhance the performance for heavy trace elements in polymers

S6 JAGUAR
HighSense™ Goniometer: Impressive versatility & Performance

- 400 W excitation
  - 20 – 50 kV
  - 1 – 17 mA
  - Optimal settings for every single element at full power
- 5 position beam filter (optional) for improved peak-to-background ratio
- 4 sample masks (optional for different sample sizes)
- Vacuum seal for low-cost-of-operation
- Up to 4 analyzer crystals for the entire element range and specific demands
- Flow counter and HighSense XE detector for 2 Mcps countrates for high calibration ranges

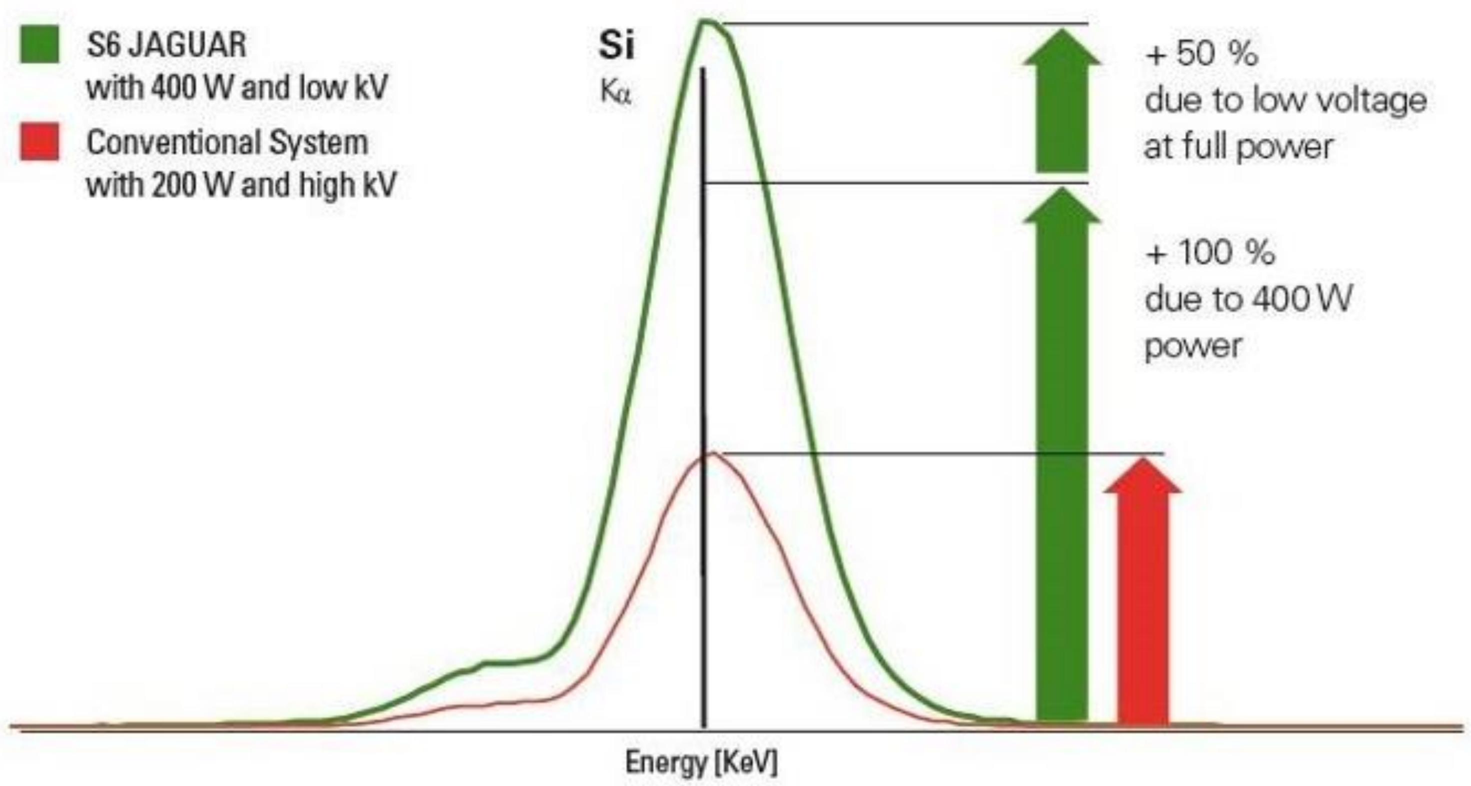
S6 JAGUAR: Benchtop WDXRF HighSense™: Full 400 W excitation power

S6 JAGUAR is twice as powerful as a 200 W system and 8 times more powerful than a 50 W system

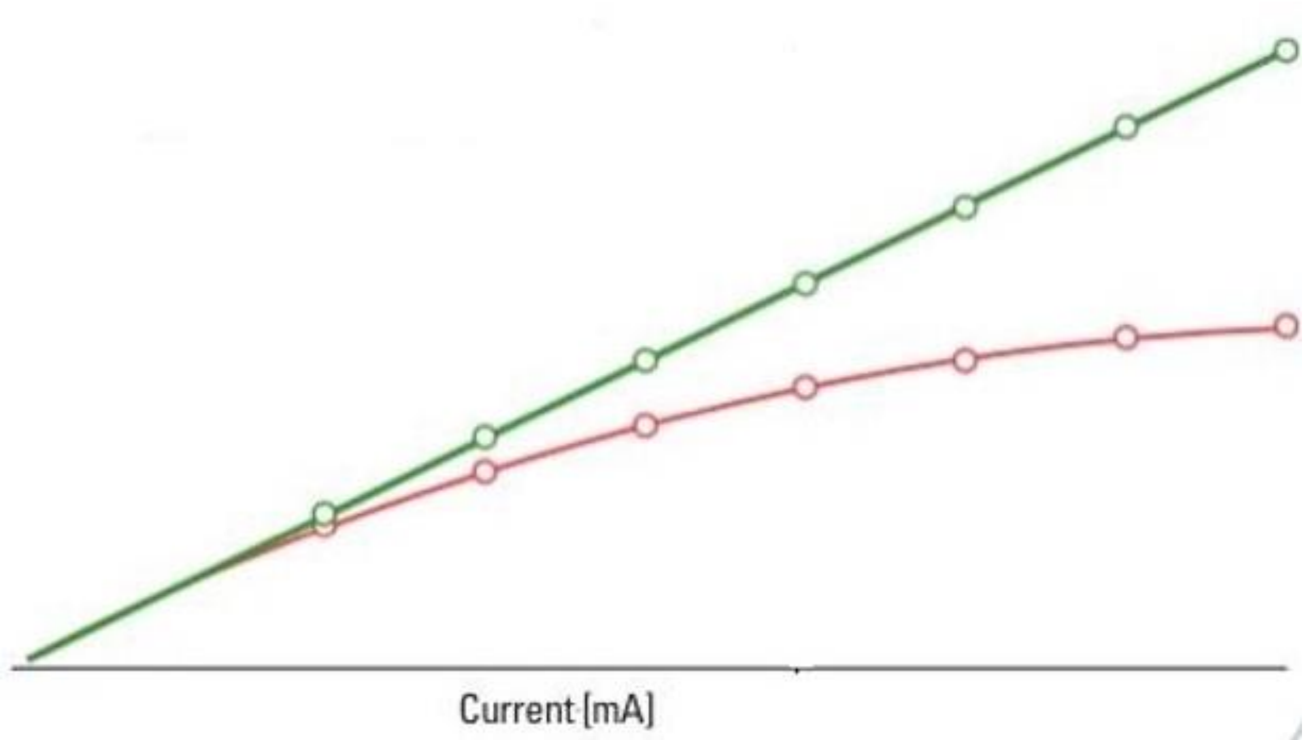


S6 JAGUAR
HighSense™: Light element performance

S6 JAGUAR analyzes light elements with optimal low voltage and full 400 W power settings!



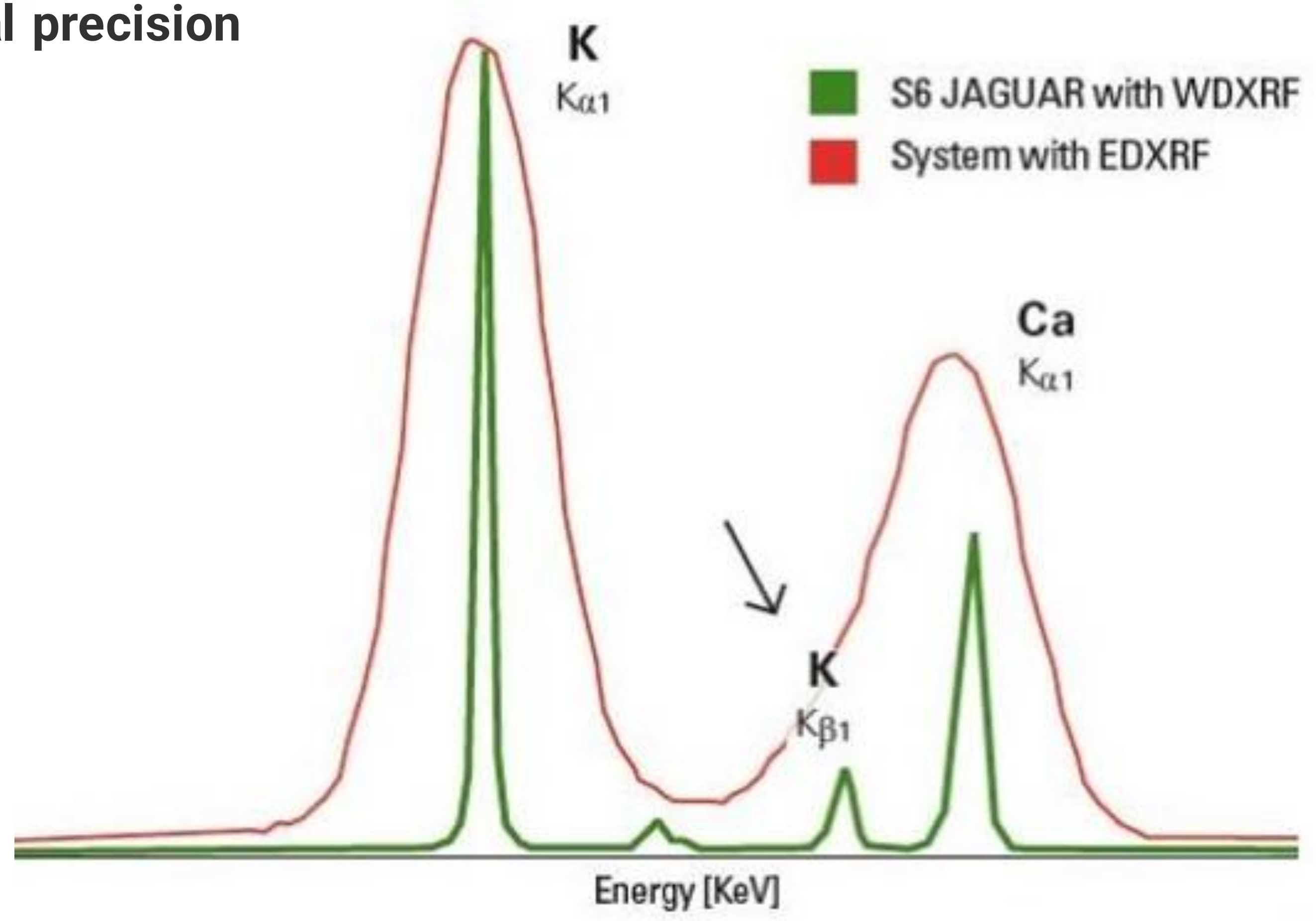
S6 JAGUAR
HighSense XE^{TM}: Unrivalled linearity



- New solid state HighSense XE detector:
- State-of-the-art technology
- Medium and heavy element detection
- Linear range of 2 Mcps for wide range calibrations
- 2 times better energy resolution than scintillation counters
- Significant reduction of element interferences and crystal fluorescence

S6 JAGUAR
HighSense^{TM} Goniometer: High Resolution

The S6 JAGUAR with WDXRF HighSense Goniometer excels ED based systems in resolution and analytical precision



S6 JAGUAR
EasyLoad™: High Productivity

Unattended operation of sample batches for high throughput

- Loading of new samples at anytime
- Quick analysis of high priority samples
- Loading of entire batches just by exchanging complete trays

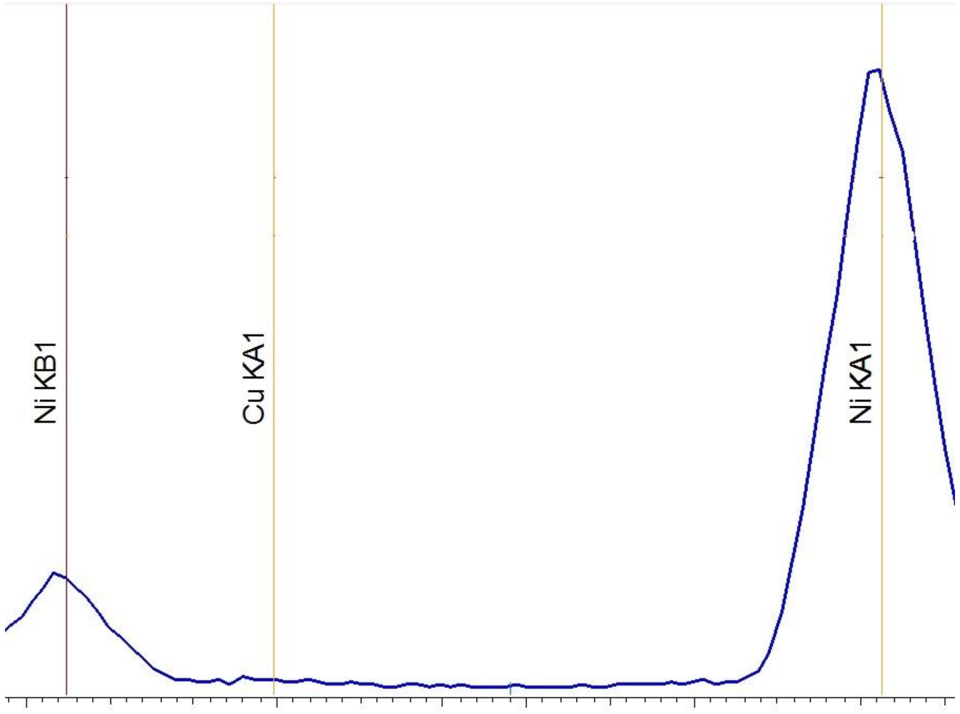
- EasyLoad 24 Positions
  - 20 pos. on a tray (51.5 mm rings)
  - 4 fixed pos. for QC samples
  - Automatic liquid sample recognition

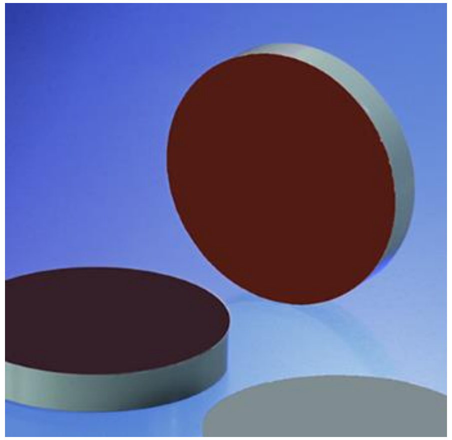
- EasyLoad ONLINE 22 Positions
  - 20 pos. on a tray (51.5 mm rings)
  - 2 fixed pos. for QC samples
  - Automatic liquid sample recognition
  - Automation for robot and belt

- 15 Positions XY Autochanger
  - 15 pos. for two-part sample cups

S6 JAGUAR in Minerals & Mining
Nickel Laterite Ore

- Separation of Cu Ka from Ni Kb with S6 JAGUAR's
- HighSense WDXRF goniometer
- Excellent Cu trace calibration: LOD 3 ppm
- Option: Even better resolution with 4th crystal: LiF220





“Based on the results of the S6 JAGUAR with the standardless SW SMART-QUANT WD we are able to optimize our products for the minerals industry. Longer uptime, better separation, higher output are benefits for our customers.”

S6 JAGUAR sold to minerals and mining:

- Smaller mining sides and mineral beneficiation w/o budget for big units, e.g., silicates

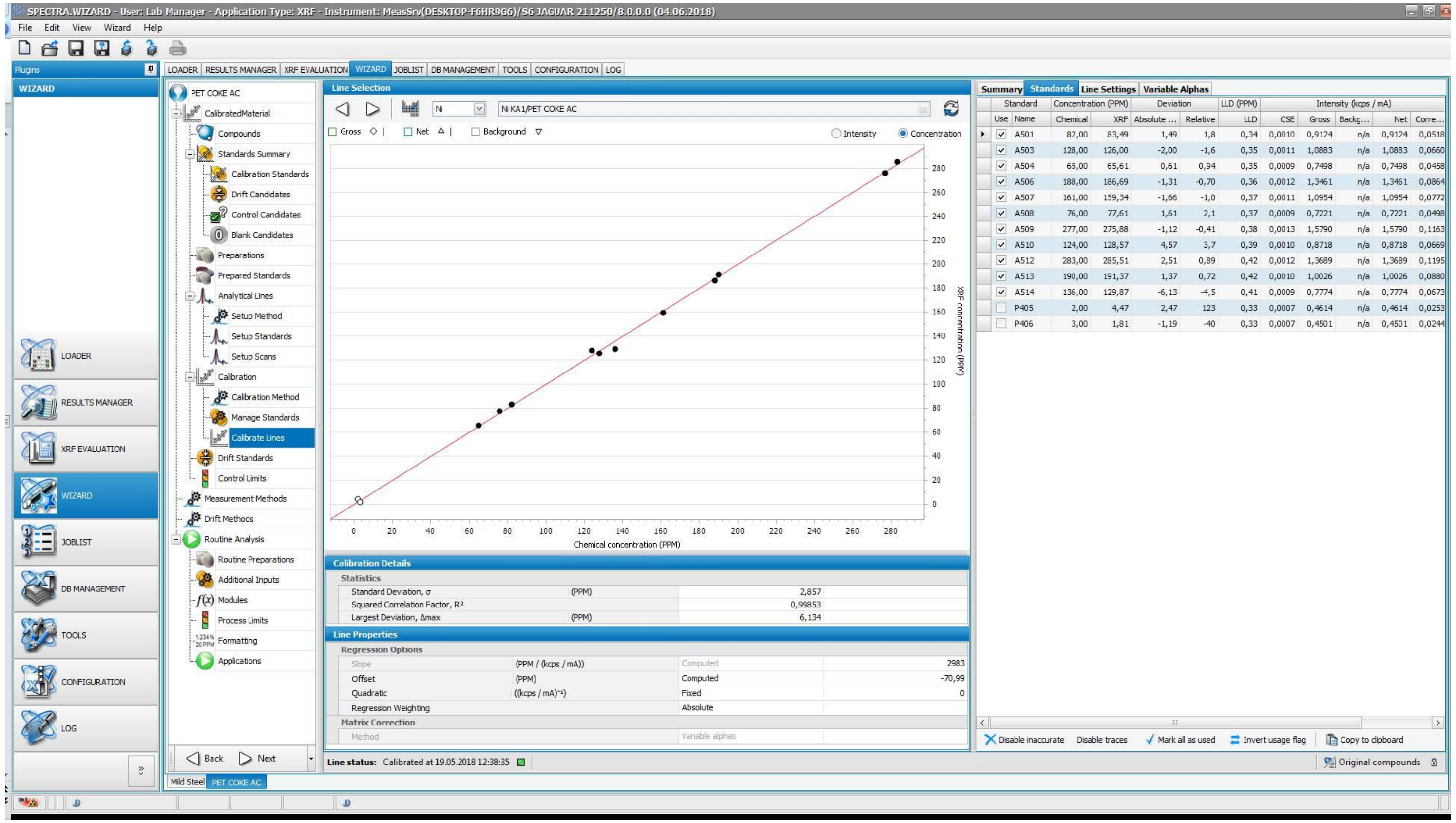
S6 JAGUAR in Minerals & Mining
Coal, Coke and Carbon

- Coal is widely used in metal making (aluminium, steel) and power generation (electricity)

- Analysis of coal, coke and carbon products is vital:
  - Prevent contamination of metals (impurities)
  - Inhibit corrosion (monitoring of Cl)
  - Reduce environmental impact (reducing S conc.)

S6 JAGUAR in Minerals & Mining
Coal, Coke and Carbon

Nickel trace calibration:
Squared. Corr. Coeff: 0.99853 LOD: 0.4 ppm



S6 JAGUAR in Minerals & Mining
Coal, Coke and Carbon

Optimal accuracy for
minor elements, such as S traces, e.g., Si, Cl, Fe

Element	XRF conc.	Cert. Conc.	Abs Std Dev.	Rel Std Dev.
S [%]	3.40	3.30	0.02	0.72
Ni [ppm]	128.00	124.00	4.48	3.50
Si [ppm]	24.00	28.00	1.15	4.80
Fe [ppm]	276.00	266.00	2.65	0.96
Na [ppm]	623.00	645.00	43.61	7.00
Al [ppm]	153.00	150.00	5.66	3.70
Ca [ppm]	112.00	107.00	2.35	2.10
K [ppm]	17.00	17.00	1.84	10.80
Cl [ppm]	100.00	n.a.		
Ti [ppm]	5.00	4.00	0.31	6.10
Zn [ppm]	40.00	41.00	0.10	0.25
V [ppm]	302.00	300.00	2.33	0.77

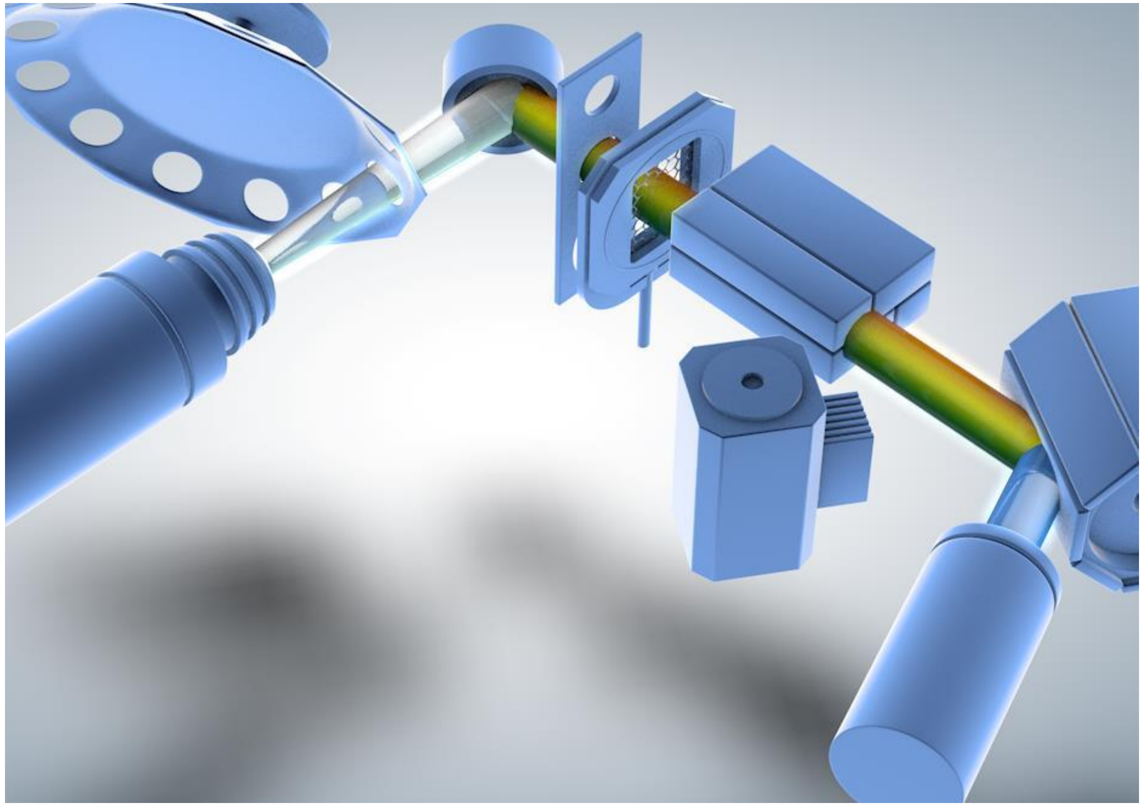
S8 TIGER Series 2
How a modern WDXRF supports mine operations!

- WDXRF spectrometer S8 TIGER Series 2:
  - Analytical Speed (Time-to-result)
  - Precision
  - Accuracy

    - Designed for highest count-rates!

    - Why are countrates so important?
    - XRF precision is mainly determined by the instrument:
    - Sample positioning, goiniometer drives, HV generator!
    - and the counting statistical error

The all-new S8 TIGER Series 2 HighSense

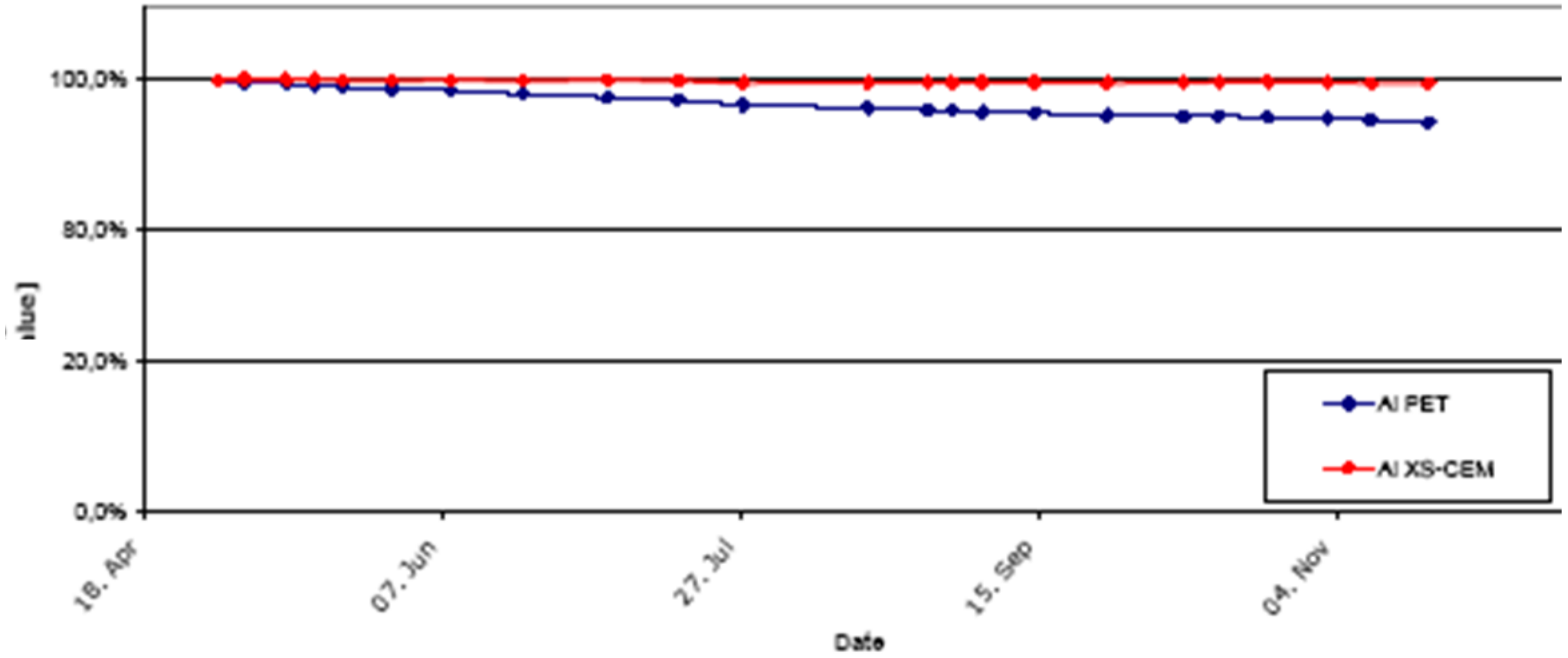


- Optimal detection for every element
- from Be – Am, ppm to 100%:
  - 20 – 60 kV, 5 – 170 mA for 4 kW
  - 10 primary beam filters
  - 8 collimator masks
  - HighSense vacuum seal
  - 8 analyzer crystals out of 18 available
  - Two detectors with HighSense counting electronics

Analyzer Crystal: XS-CEM
Temperature independent

Temperature influence:

PET vs. XS-CEM under worst conditions: No climatization, cold instrument after startup. The PET is stable after more than 5 h. The XS-CEM works immediately



XRF X-ray Fluorescence Analysis
Precision and Counting Statistics

Precision limited by counting statistical error

CSE(%) = 100% / SQRT (N)

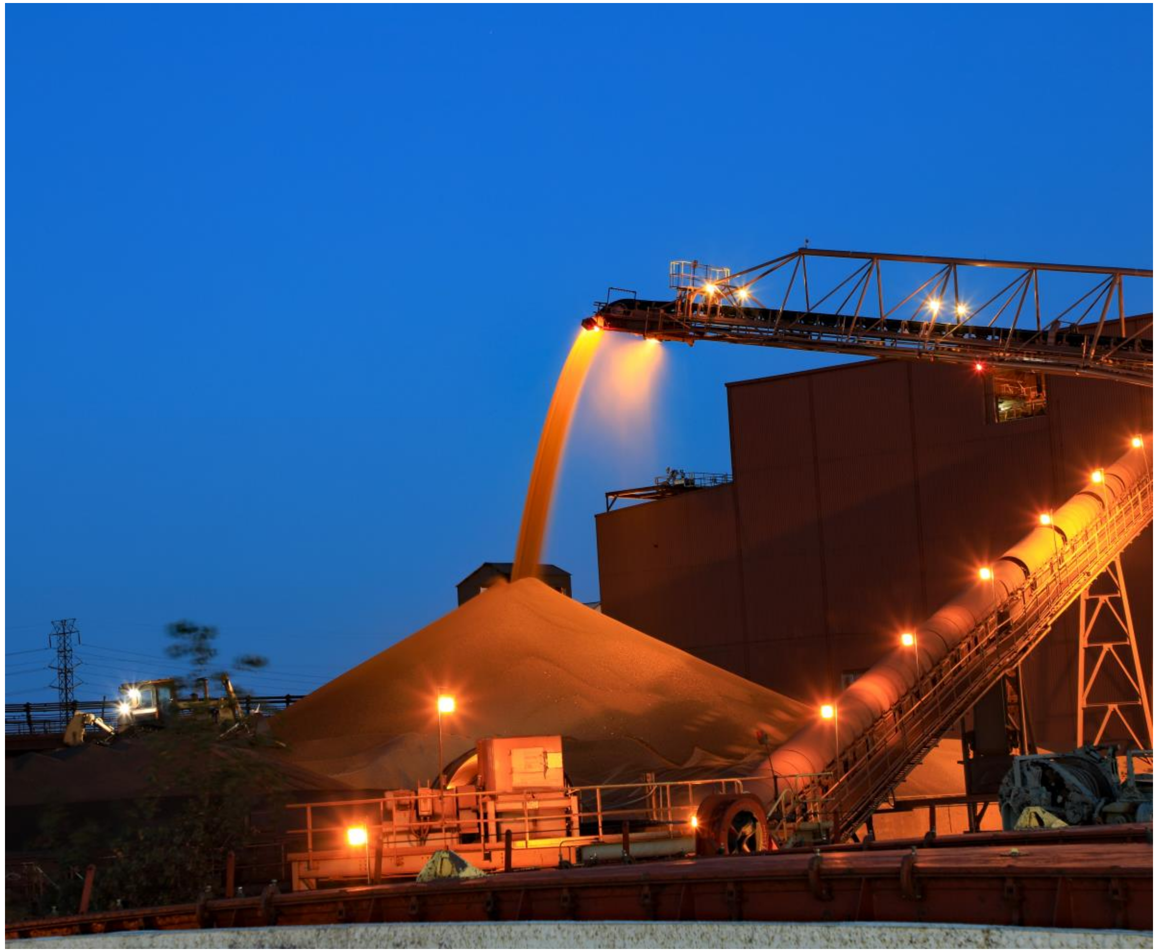
D c / c	=	SQRT (N) / N	=	1 / SQRT (N)
N = 100		SQRT (N) = 10		3*SQRT(N) / N = 30 %
N = 1000		SQRT (N) = 30		3*SQRT(N) / N = 10 %
N = 10 000		SQRT (N) = 100		3*SQRT(N) / N = 3 %
N = 100 000		SQRT (N) = 300		3*SQRT(N) / N = 1 %
N = 1000 000		SQRT (N) = 1000		3*SQRT(N) / N = 0.3 %
N = 10 000 000		SQRT (N) = 3000		3*SQRT(N) / N = 0.1 %

The all-new S8 TIGER Series 2 HighSense: Counting Electronics

- HighSense counting electronics
  - Quick application setup with instant display of PHA scan
  - On-the-fly dead time correction with fast data processing
  - Advanced MCA technology
  - Up to 4 Mcps for both detectors

- Excellent detector linearity
  - FC: up to 2 Mio cps
  - SC: up to 2 Mio cps
  - DynaMatch: up to 13 Mio cps
  - Five times better than conventional WDX spectrometers

- Better analytical precision
- Faster measurements
- Easy application setup due to wide range calibration

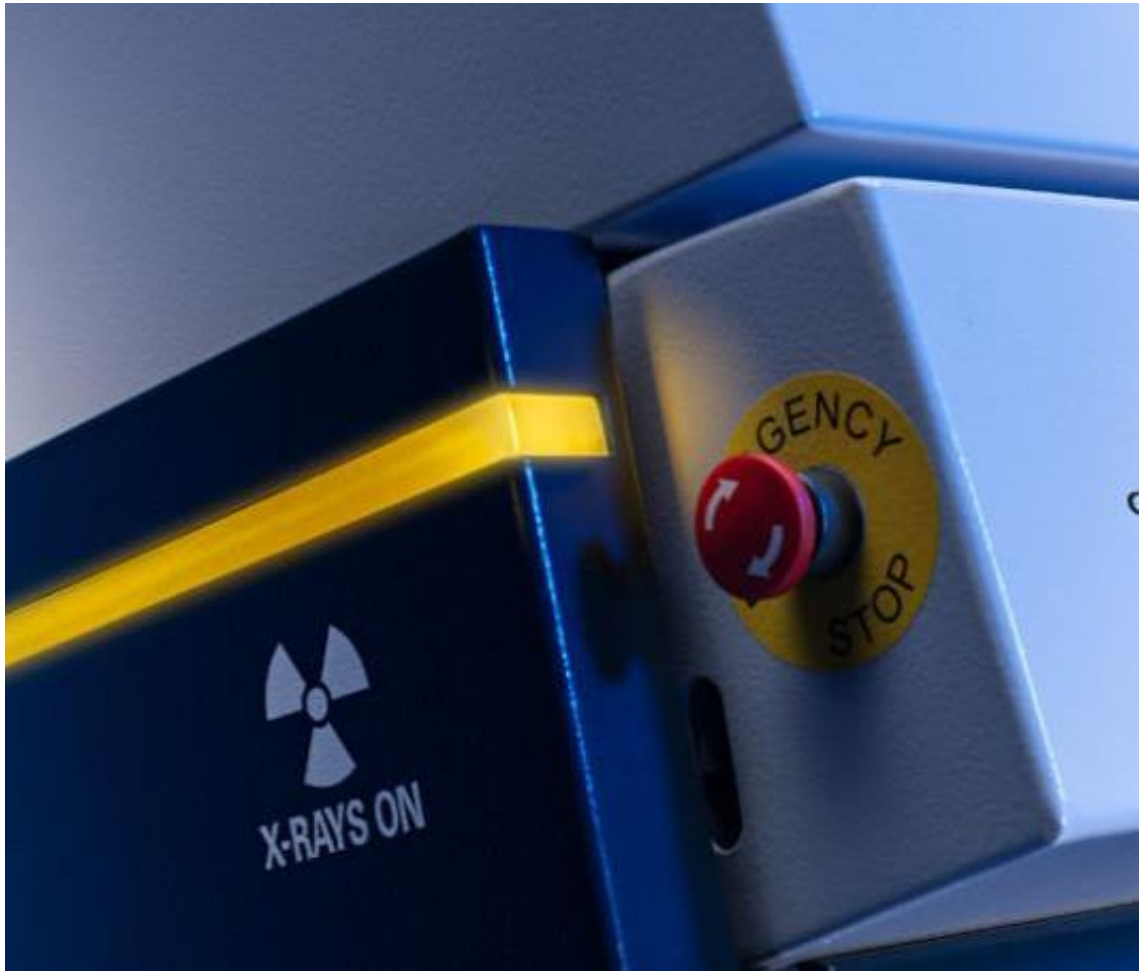


XRF: Mining for Money
Analytical Tasks in Mining Operations

- Exploration
  - Classification of mineral resources
  - The valuable elements are often not homogenously distributed, but enriched in special zones, bound in or to special minerals
  - This makes the mapping analysis of rocks so important to decide
    - Value of the minerals resource
    - Decision on later mineral beneficiation
    - e.g. decide for rock sorting, leaching or flotation
    - The bulk analysis might be similar in terms of concentration per ton, but in case of homogenous distribution the mine operation might become costly

S8 TIGER Series 2
Instrumental Setup for precision

- Hardware enhancers for precision
  - Temperature and aging independend multilayer optcis for short and longterm stability
  - High precision generator for precise photon emission from X-ray tube
  - Direct loading for optimal precise sample positioning w/o drives
  - HighSense X-ray tube for constant photon emission
- Hardware booster for precision
  - HighSense X-ray tubes for additional excitation
  - Analyzer crystals for additional sensitivity (XS-400)
  - HighSense counting electronics for countrates up to 4 Mcps, 2 Mcps linear



It's all about sample preparation

Material to be analyzed must be

- Representative
- Homogeneous
- Small enough in particle size so that several layers will be measured
- Flat on surface without irregularities
- Compatible with the sample geometry (fit in cups or rings)
- Thick enough to be infinitely thick for X-rays to be measured (analyzed layers)

Pressed Powders

Fused Beads

Sample Preparation
Pressed Pellets

Pros

- Low Dilution, best for Traces
- Highest Count Rate (Precision) & Lowest Limit of Detection
- No Loss of Volatile Elements
- Low Cost per Sample
- Speed
- Ease of Use / Ease of Training

Cons

- Reference Material must match matrix and mineralogy (Accuracy Problems)
- Fineness of unknowns must match that of standards
- Surface Roughness, Homogeneity Effects, Particle Size Effects

Sample Preparation
Fused Beads

- Fusion is dissolution of an oxide sample into borate flux at high temperature
- Dissolution takes place if and only if the sample is completely oxidized
- All oxides are soluble in lithium borate salts
- Non oxides and/or reduce materials can be fused by doing an oxidation before fusion

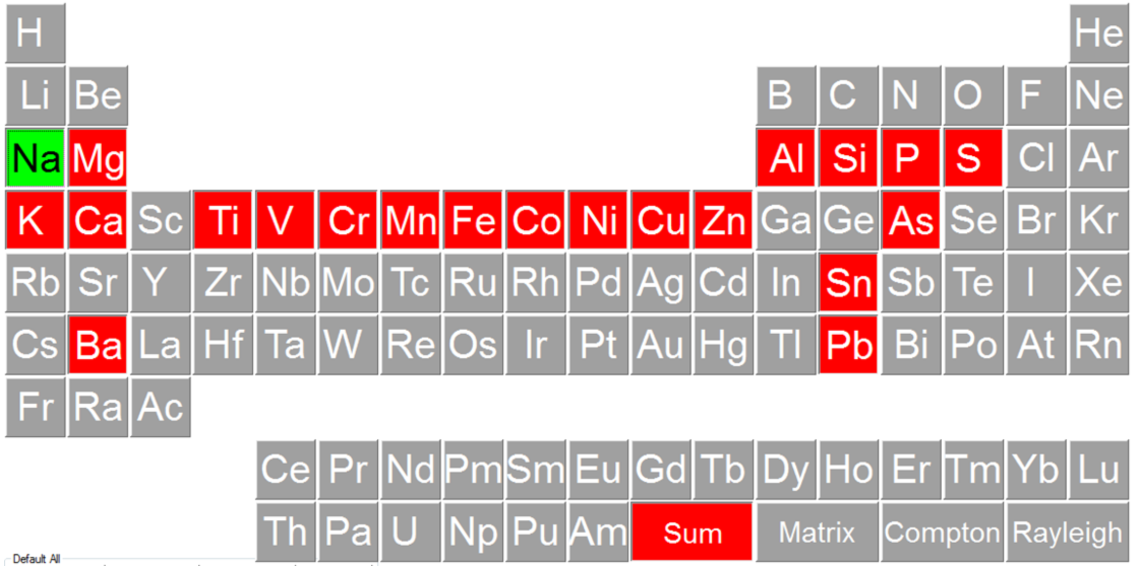
Fused Beads give

- Better homogeneity
- High accuracy
- Larger calibration range
- Solution for matrix match problems and mineralogical effect

GEO-QUANT Iron Ore
Norm compliant Analysis of Iron Ore

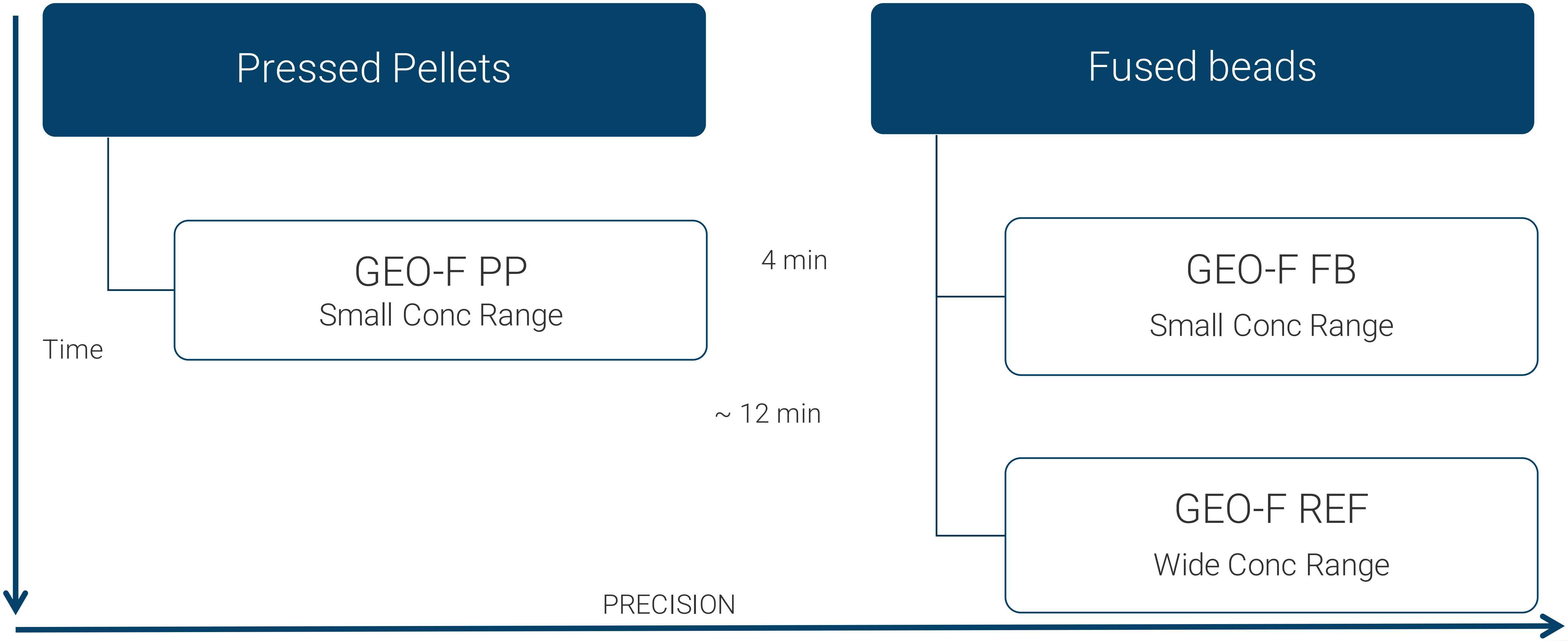
- The solution package for iron ore analysis (Grade control and process control
- Including methods for pressed pellets in process control applications
- Including methods for fused beads for grade control
- Recipes for all common fusion equipment vendors
- Norm compliant to ISO 9516
- Based on
  - variable alphas
  - Loss eliminated alphas (alternatively acc. to ISO 9516)

GEO-QUANT Iron Ore
Norm compliant Analysis of Iron Ore



- 21 elements, including Na
- (not required for ISO 9516)

GEO-QUANT Iron Ore Measurement Strategy



GEO-QUANT Iron Ore Hardware

- GEO-QUANT Iron Ore contains
  - 14 reference materials
  - Evaluation samples
  - Drift correction samples
  - User Manual
  - Preparation Manual

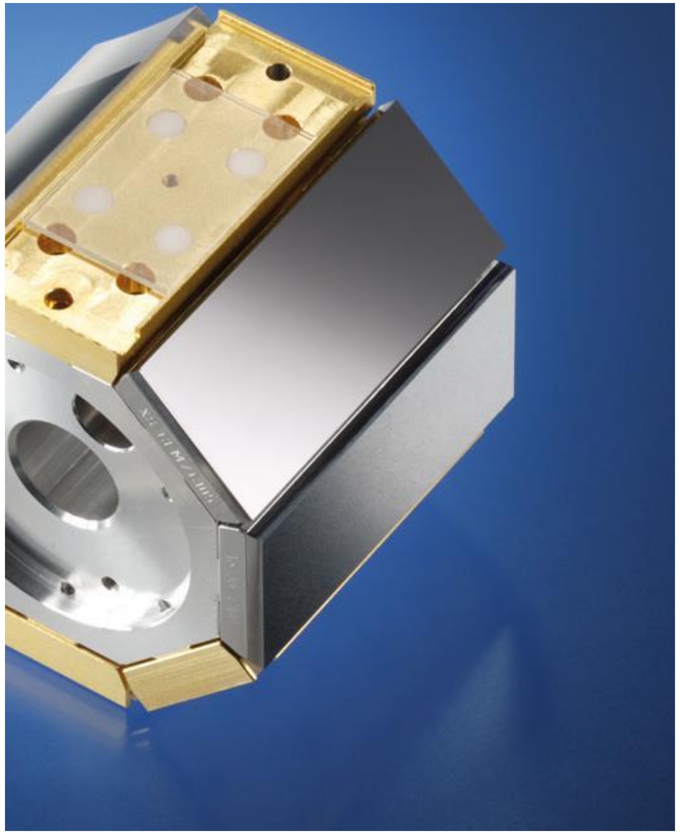
- GEO-QUANT Iron Ore works best with
  - LIF 220 crystals
  - XS-100 crystal

GEO-QUANT Iron Ore XS-100

The XS-100 is a synthetic multilayer:

- covers the elemental range from
  F to Cl
- increased sensitivity compared to the XS-CEM
- enhanced long term stability compared to the PET
- Stable, independent from temperature changes

- Advantages:
  - Time optimzed measurement from F to Cl in one run without crystal change
  - Sample throughput and analyzing speed
  - Shared background positions, less background measurements



GEO-QUANT Iron Ore
Application range – Precision test

	MIN	MAX	MEAN	ST.DEV	%RSD
Na2O (%)	0.096	0.096	0.096	0.000	0.15%
MgO (%)	38.994	39.213	39.092	0.059	0.15%
Al2O3 (%)	44.673	44.820	44.751	0.041	0.09%
SiO2 (%)	94.534	94.819	94.664	0.090	0.10%
P2O5 (%)	5.217	5.237	5.225	0.005	0.10%
SO3 (%)	38.003	38.153	38.092	0.052	0.14%
K2O (%)	3.634	3.651	3.640	0.006	0.16%
CaO (%)	6.271	6.299	6.289	0.008	0.12%
TiO2 (%)	14.782	14.856	14.832	0.026	0.17%
V2O5 (%)	5.449	5.483	5.466	0.011	0.20%
Cr2O3 (%)	5.097	5.126	5.112	0.009	0.17%
Mn3O4 (%)	5.205	5.225	5.211	0.007	0.13%
Fe2O3 (%)	92.561	92.844	92.668	0.092	0.10%
CoO (%)	4.283	4.293	4.290	0.003	0.07%
NiO (%)	1.492	1.496	1.494	0.001	0.08%
CuO (%)	1.989	1.995	1.992	0.002	0.10%
ZnO (%)	3.574	3.587	3.578	0.004	0.11%
As2O3 (%)	1.415	1.420	1.417	0.002	0.13%
SnO2 (%)	2.014	2.035	2.023	0.007	0.32%
BaO (%)	5.105	5.152	5.129	0.018	0.35%
PbO (%)	4.338	4.361	4.351	0.007	0.17%

- Covers the ISO 9516 application range
- Includes low grade materials
- Precision in the 0.1% range
- Enables close monitoring of material grades and defines commercial value

GEO-QUANT Iron Ore Accuracy

	MIN	MAX	MEAN	CERT	ST.DEV
Na2O (%)	0.073	0.074	0.073	0.860	0.000
MgO (%)	1.736	1.759	1.747	1.625	0.007
Al2O3 (%)	2.209	2.230	2.220	2.240	0.006
SiO2 (%)	11.498	11.572	11.541	11.900	0.026
P2O5 (%)	0.215	0.234	0.223	0.162	0.006
K2O (%)	0.626	0.631	0.628	0.557	0.002
CaO (%)	1.523	1.540	1.531	1.655	0.005
TiO2 (%)	0.457	0.465	0.461	0.544	0.003
V2O5 (%)	0.113	0.118	0.115	0.182	0.002
Fe2O3 (%)	81.462	81.899	81.729	81.616	0.138
CoO (%)	0.133	0.136	0.135	0.014	0.001
NiO (%)	0.074	0.075	0.074	0.025	0.000
CuO (%)	0.063	0.064	0.064	0.009	0.000
ZnO (%)	0.008	0.009	0.008	0.005	0.000

- Accuracy test with CRM NIST 690
- Excellent performance
- Passing ISO 9516

- Precision and accuracy at 0.1% level

- Bulk carriers with 100.000 tons load carrying this high grade ore with 81.616 tons of iron a value of 8,3 Mio USD

- 0.1 % less precision or accuracy will cost more than 8.000 USD

Iron Ore - Rapid Grade Control
S8 LION

- Rapid control of element concentrations for 21 elements (ISO 9516)
- Quality check
  - at the mining site
  - at shipping stations

Narrow concentration range and similar matrix allows pressed pellet preparation

- Quickest sample preparation
- Crushing, milling, pressing with cellulose as binder
  (15 g sample plus 2 g binder)
- Maximum 60 s measurement time
- Simple automation path, high sample throughput, easy operation, fast feedback

For Central Labs and Service Labs
S8 LION

Optimied for highest throughput and optimal cost effciency

Autonomous operation 24/7

- 90 samples in 6 racks
- 15 samples per rack

In addition to the internal loader

- with 10 positions

  or

- with 8 position in combination with online sample feed from automated sample preparation

Process Element Analyzer S8 LION

- Up to 16 fixed element channels
- Up to 24 WD elements channels with Dual Monochromators
- Optimized bent crystals for each element with high resolution and sensitivity
- Individually temperature controlled

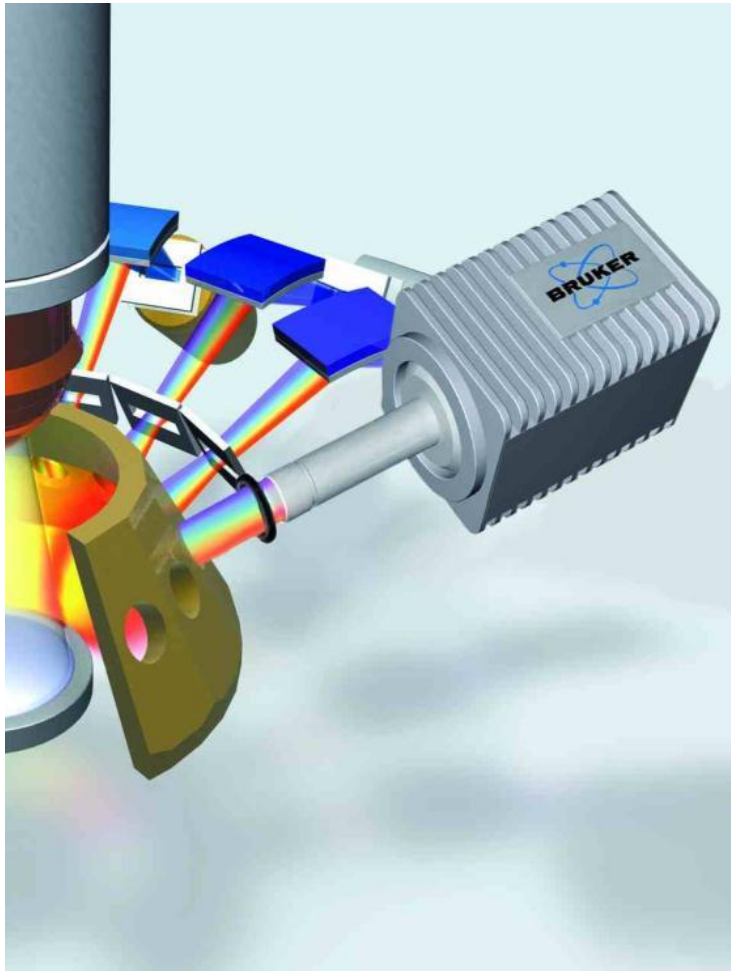
Attenuators (up to 6):

- Automated absorbers
- For high dynamic ranges

Detectors:

- Proportional and Scintillation counters for optimum detection

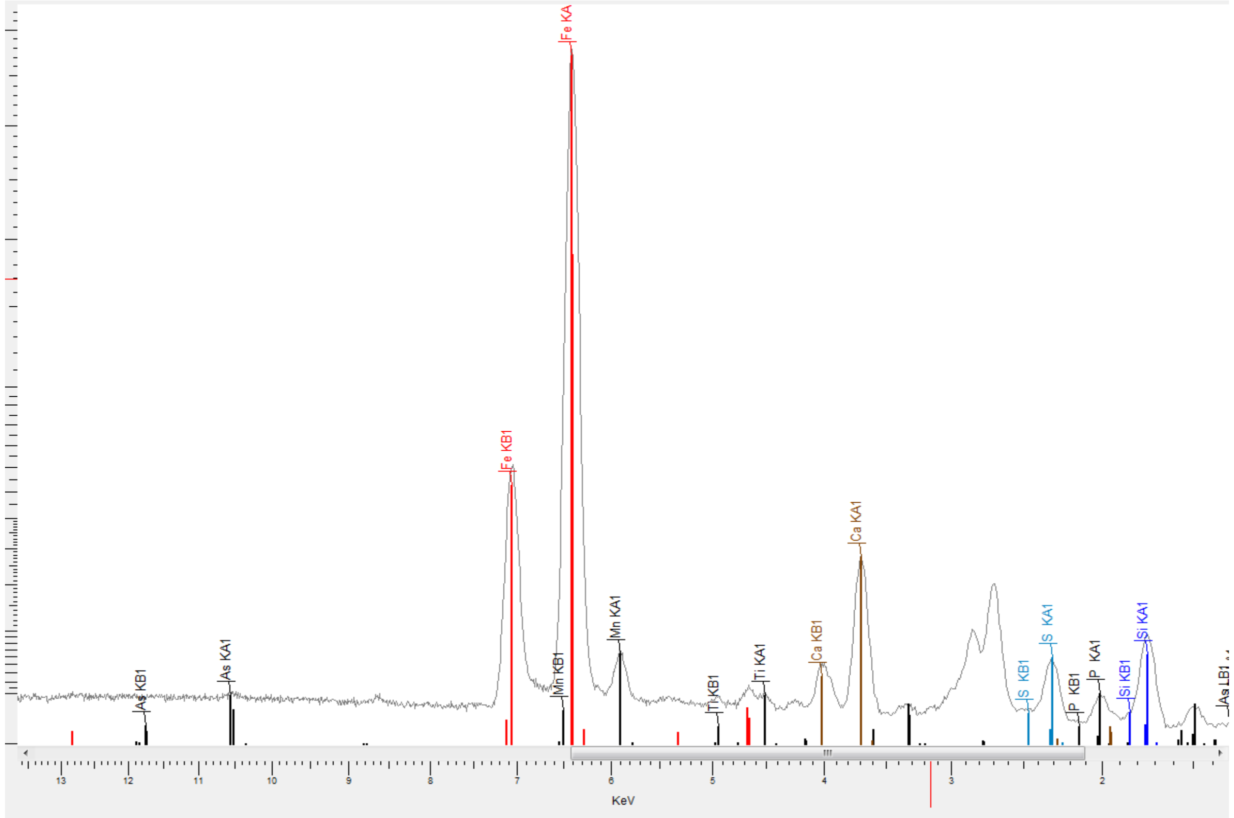
Multielement Channel (MEC)
S8 LION



- Essential Benefits of the unique Multielement Channel™
- Elemental fingerprinting
  - Identification and analysis of all elements from Na upwards
- Analytical flexibility
  - Contaminations can be traced
  - Analysis of non-routine samples
  - Upgrading of analytical methods with additional elements in minutes - no further installation of new hardware
- Dual Mode data acquisition
  - Internal backup for data safety with a second internal source

Spectrum Iron Ore - Dual Mode Data Acquisition S8 LION

SEC

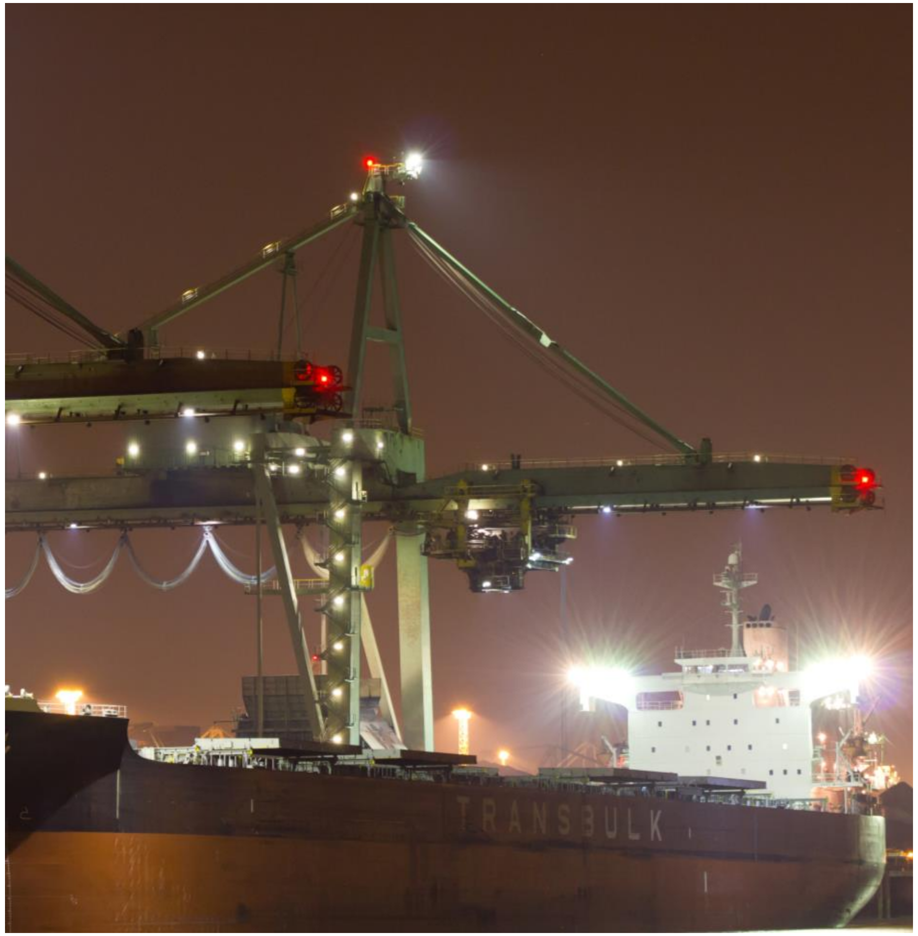


- Calibration Details for Fe: Range 34.67 -71.50 %
- Fe (SEC) – LiF 200: Calibration Std. Dev.: 0.563 %
- Fe (MEC) – SDD: Calibration Std. Dev.: 0.503 %

MEC

- Parallel measurement of Single Element Channel (SEC, WDX) and Multi Element Channel (MEC)
- Identification of trace elements, internal backup (second information source)

Mining: Iron Ore
S8 LION



Mineral processing:

- Iron Ore
  - with the S8 LION 4 kW

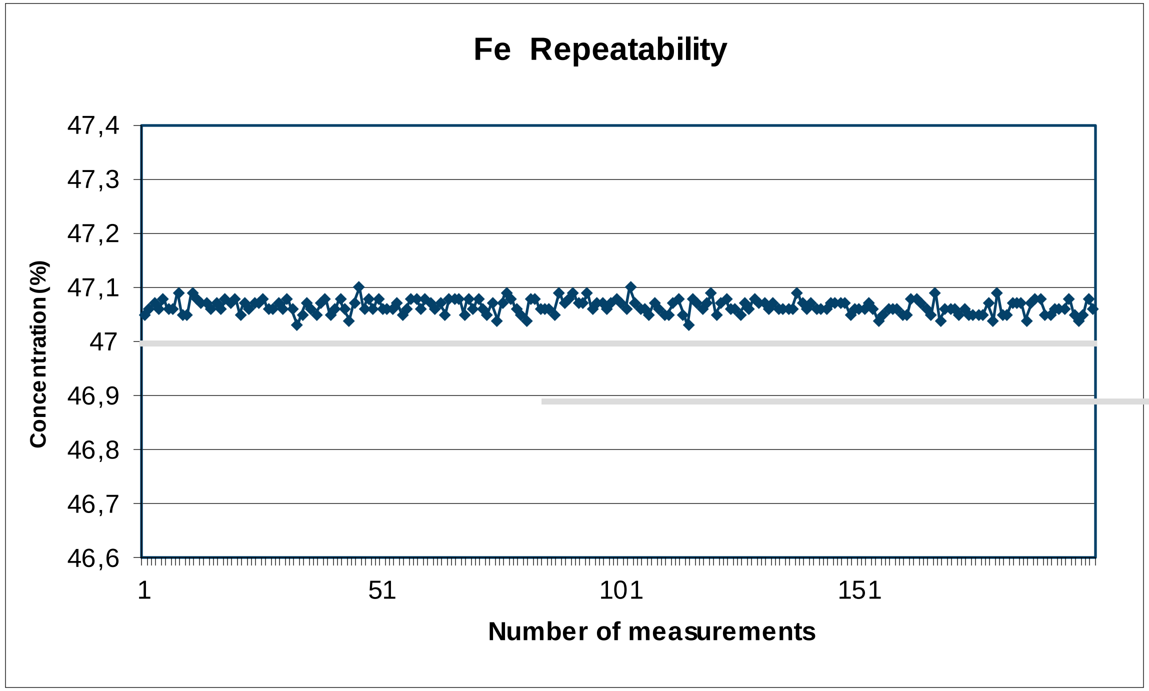
Time to result:

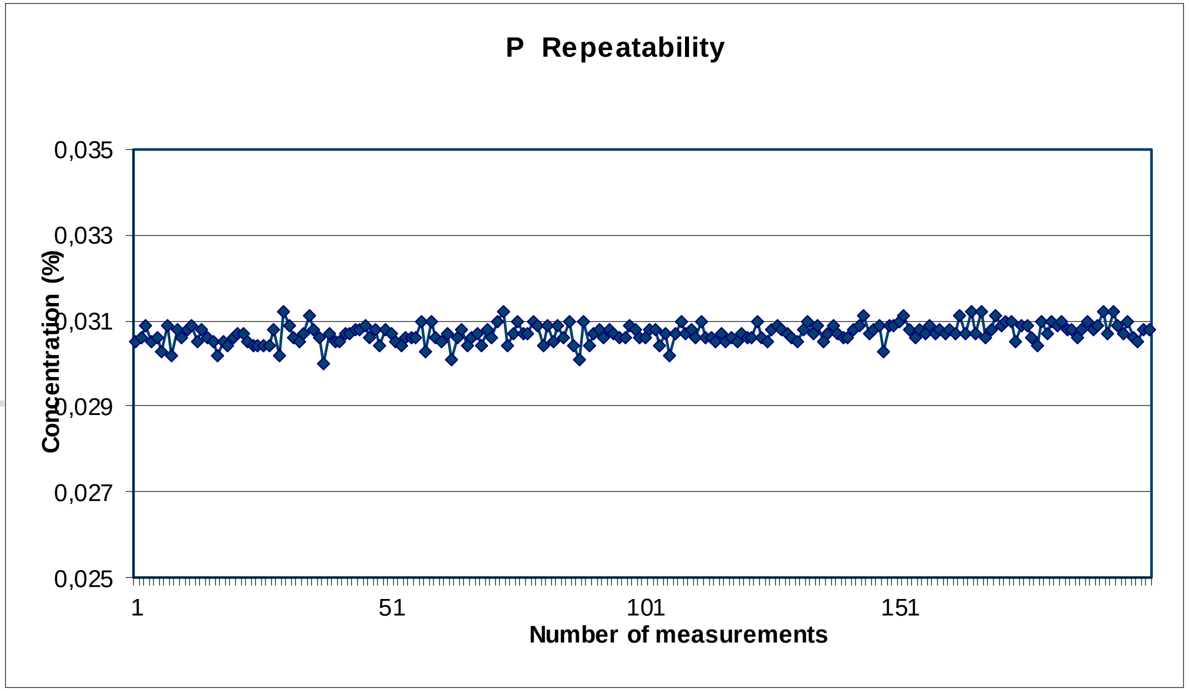
  - 56 sec per sample

Sample throughput:

  - at least 60 samples/h

SEC: Precision Test on Fe and P over One Week S8 LION



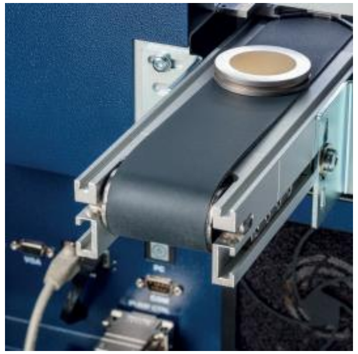


- 200 measurements: 47.065 % +/- 0.013 % Fe
- 200 measurements: 0.031 % +/- 0.001 % P

Powerful Benchtop units for dedicated tasks

- Compact X-ray fluorescence devices are now very powerful due to new detector technologies
  - Improved spectral resolution
  - High analytical precision thanks to higher counting rates
  - Simple operation and therefore quick integration into quality control
- Decision about the technology (ED or WD) by:
  - Elements of interest and concentration ranges
  - Required precision and LLDs
  - Required sample throughput

S6 JAGUAR Benchtop WDXRF



S2 PUMA Series 2 EDXRF

High-end floor-standing WDXRF

- Use sequential WDXRF for
  - Commercial Service Labs
  - Central labs in mining and minerals
  - Highest accuracy and precision
  - Sample throughput
  - Analytical flexibility (grade control, drill cuttings, exploration samples)
- Use simultaneous WDXRF for
  - Dedicated tasks for high analytical speed
  - Process Control applications with high accuracy and precision

S8 TIGER Series 2

S8 LION

Any Questions?

Learn more about Applications of XRF in the Animal Feed Industry

In our 24.11.2021 webinar – Sign Up Now!

Thank you!

Kai Behrens, Frank Portala, Adrian Fiege

Innovation with Integrity