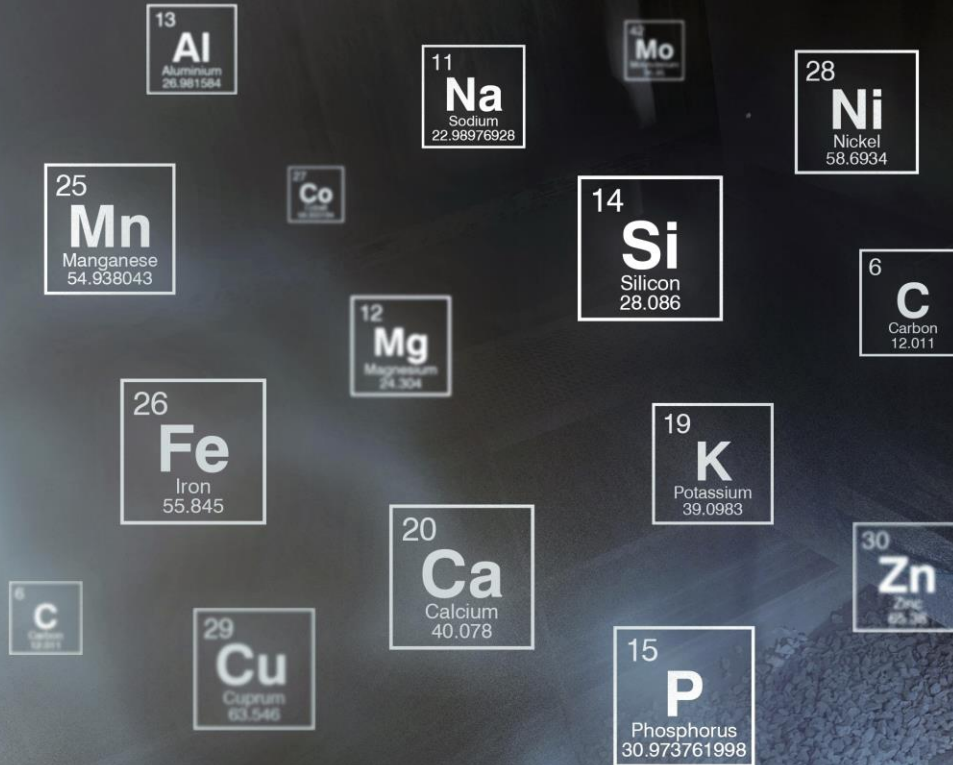


Radiation-Free Online Elemental Analyzer

Continues and safe online chemical analysis
of material streams for real time process
optimization and Industry 4.0 solutions



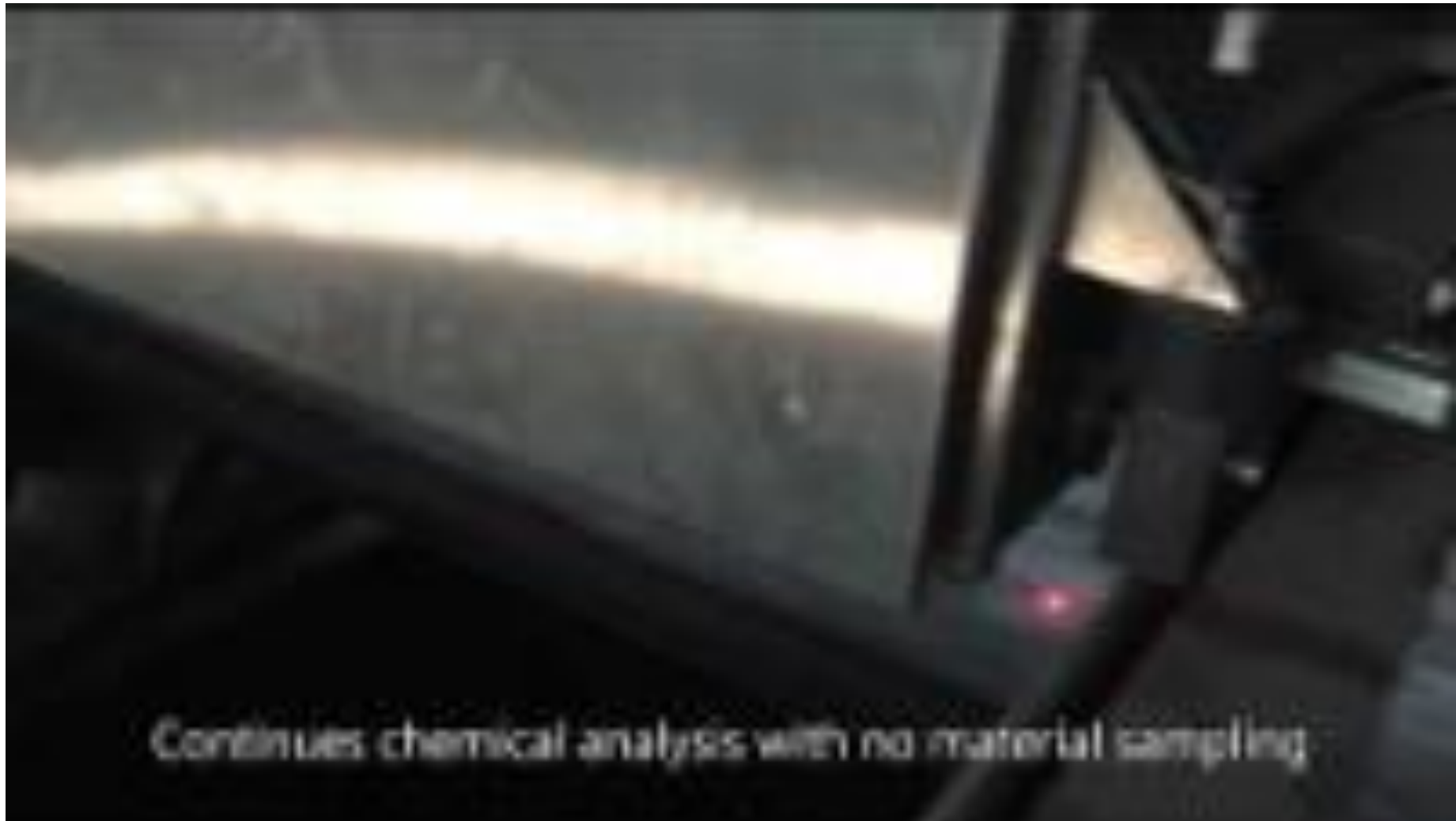
About Company

- **LYNCIS** is a laser measurements technology company based in Lithuania – one of the biggest European centres of laser and spectral technologies.
- **Expertise** – in material sampling, machine learning and chemometrics, laser spectroscopy
- Strong technical team including PhD specialists in technologies, physics and mathematics
- Member of **Lithuanian Laser Association**



Online Analyzer

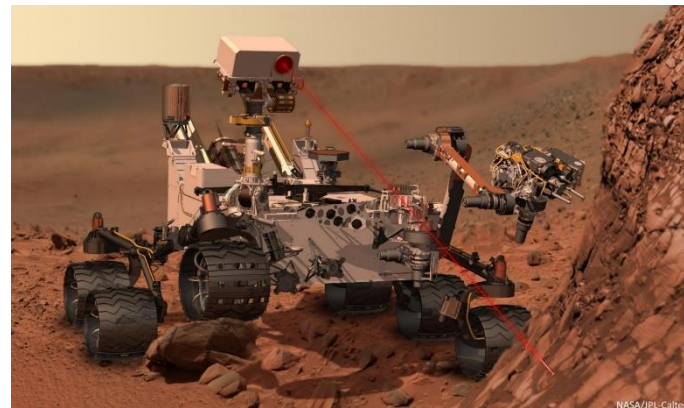
Some videos from installation sites: <https://www.youtube.com/channel/UCUxNTHDJiU--PcX6dIW9NBg>



Technology

Laser Induced Breakdown Spectroscopy (LIBS)

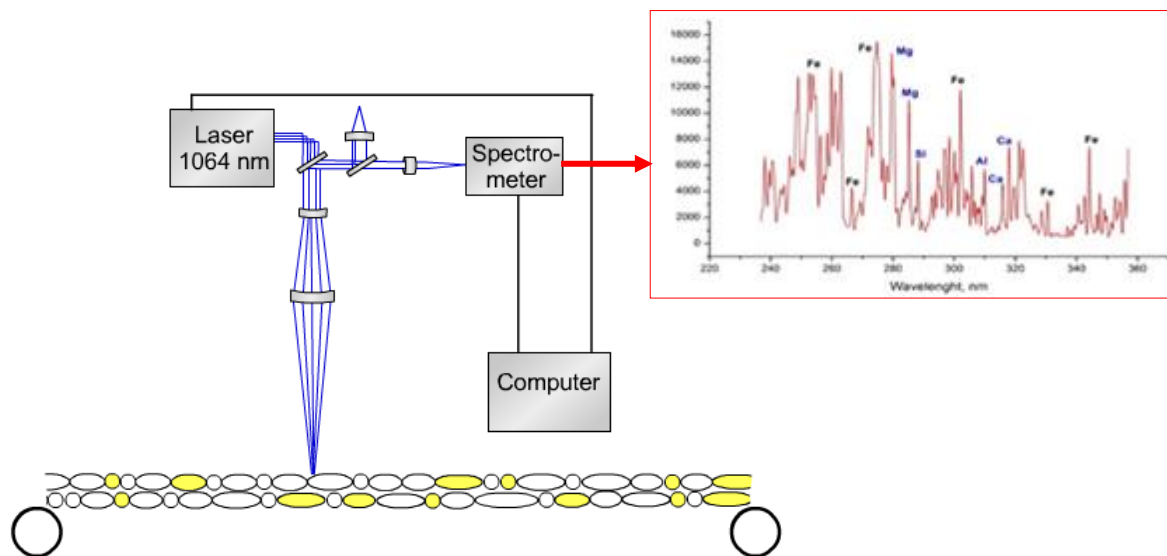
LIBS technology use laser-based optical emission spectrometry to analyze elemental composition of various materials. First practical application was developed in 1980 and now it used in Military, Industrial and Medical applications. NASA Curiosity rovers are equipped with LIBS instrument for chemical analysis of rocks in Mars.



This artists concept depicts the rover Curiosity as it uses its Chemistry and Camera (ChemCam) instrument to investigate the composition of a rock surface.

Operation Principles:

1. Pulsed laser beam is focused on the material on conveyor
2. Solid / liquid material transforms to plasma around the focus point
3. When cooling, plasma emits light
4. Spectrometer collects this light and produce wavelength-based spectrum
5. This process repeats with frequency up to 20 Hz



LIBS Spectrum

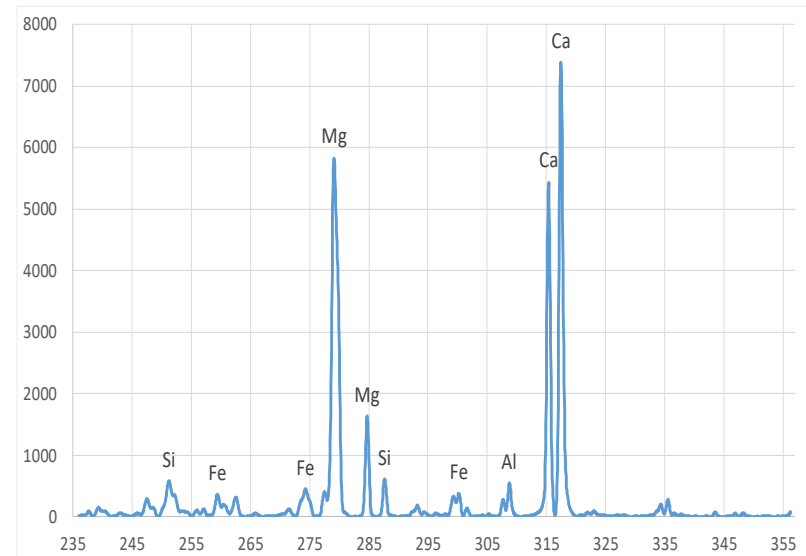
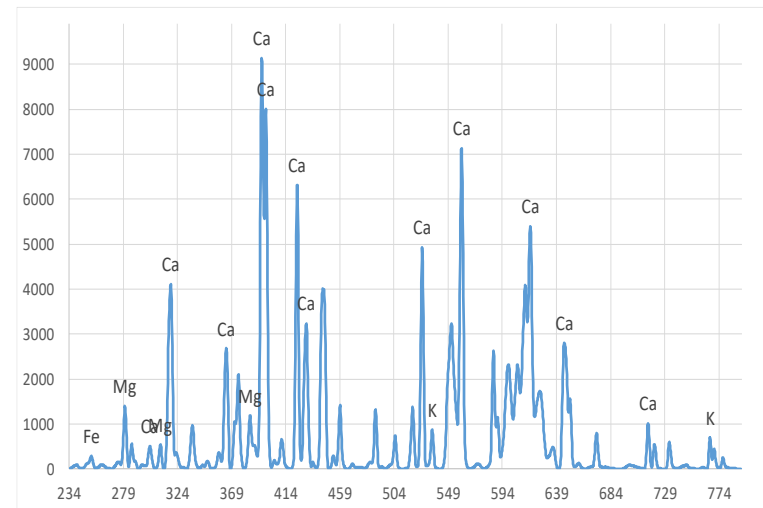
LIBS Signal Features:

- Clear analytical lines of Ca, K, P, N, Mg, Al, Fe other elements of interest with no interference
- High signal/background ration

Ability to perform:

- Bulk and fine materials analysis
- Slurry and liquor analysis

LIBS spectra



Industries

10+ years of experience in various industries

Industry-proven technology, used by clients in N. America, Europe and Asia.

We operate in the following industries:

- **Fertilizers** (phosphate, potassium, composite NPK – P, K, Na, moisture and others)
- **Iron and Steel** (iron ore and concentrate, sinter mix, limestone, coke -Fe, Si, Ca, Mg, Mn, C, moisture and others)
- **Cement** (limestone, raw meal – Ca, Si, Al, Fe...)
- **Refractories** (Mg, Si, Ca, Fe, Al, Cr, B, Mn and others)
- **Coal** (C, ash content, volatiles, moisture – Fe, Al, Si, Mg, Ca...)
- **Industrial Minerals** (quartz, clays, nepheline...)
- **Base metals** (Cu, Al, Co, Mo, Zn and others)
- **Bauxite and Alumina**

and others

Examples of Installations:

Iron



Fertilizers



Limestone



Slurry, brines



Refractories



Coal



Online Analyzer for Potash Industry

Applications:

- Analysis of KCl , $NaCl$, K_2SO_4 , insoluble for process control optimization
- Product Quality Control
- Grade Sorting

High accuracy and stable measurement in solids and brine



Our customers – biggest fertilizer producers



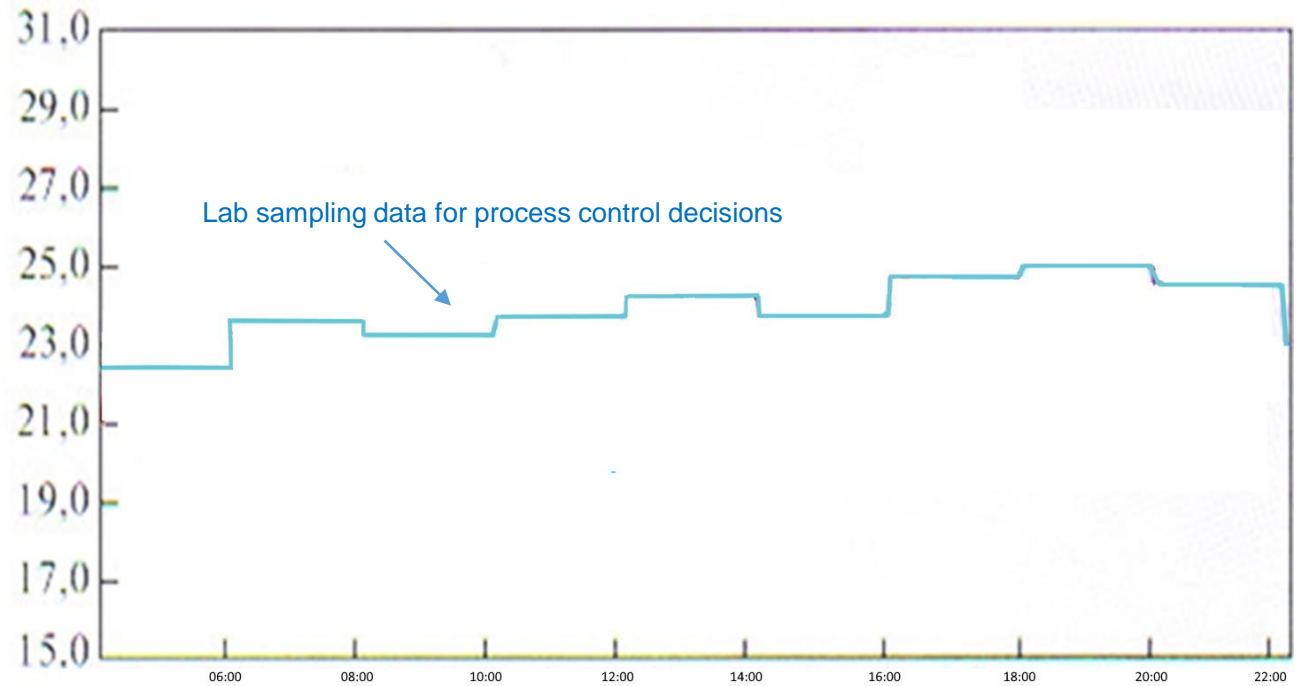
hall by



Why Online?

Conventional samplers and lab analysis might not tell you the true story of chemical composition variations in raw ore flow.

And if it does, the results come when it's often too late to change anything....



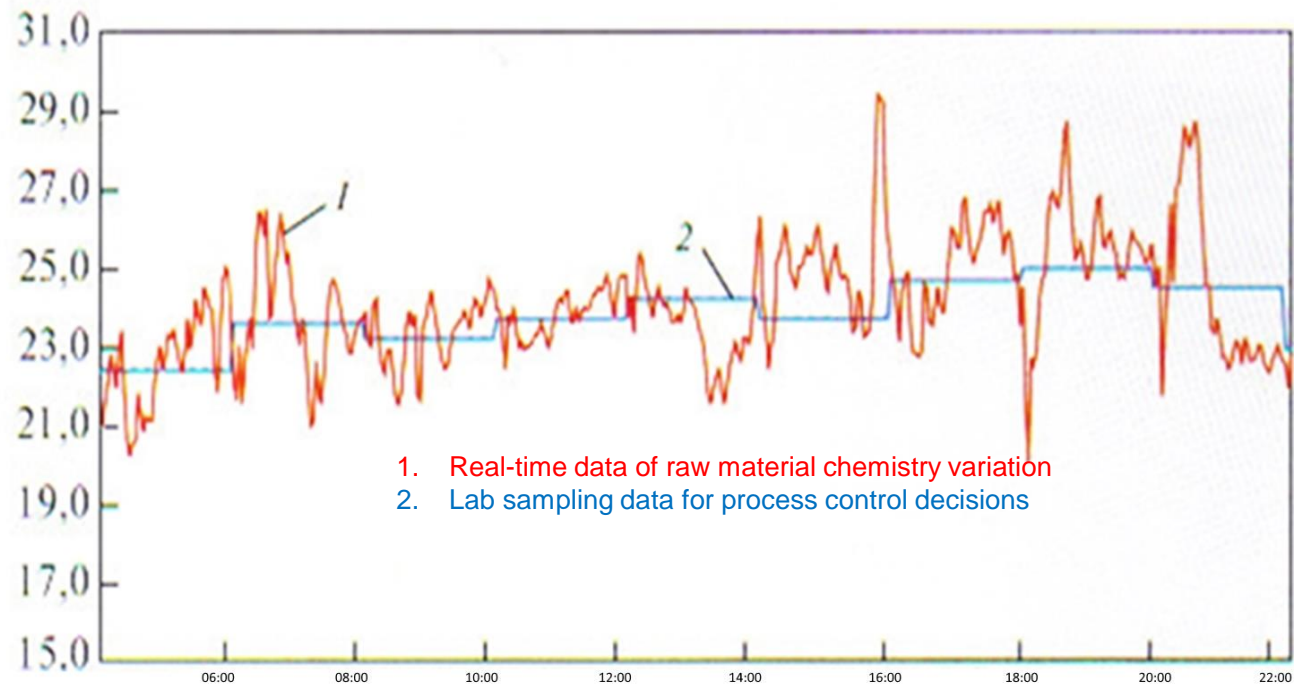
Why Online?

“If you cannot measure it, you cannot control it”

Lord Kelvin

The true variation might be not as you expected (red curve).

If you can control production parameters in real-time - you can create additional value from your raw ore.



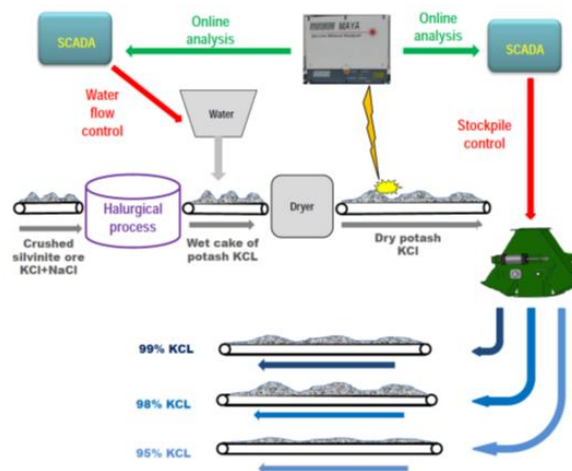
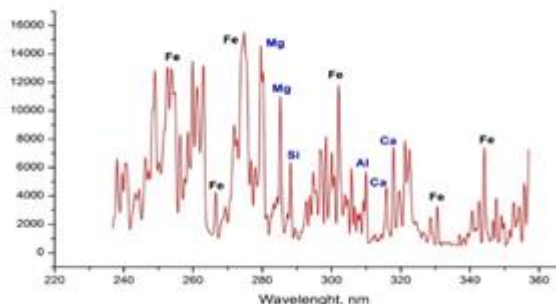
How you will benefit from online analysis?

Access to real-time elemental analysis enables you to make better decisions in the production process

Online chemical analysis

Real-time process control

Improved KPIs



- Higher recovery of potassium
- Additional earnings from high-grade fertilizers
- Reduced consumption of water and energy
- Elimination of quality claims

Case Study

MAYA is installed above the conveyor with final product – KCl (95-99%)

Technological tasks:

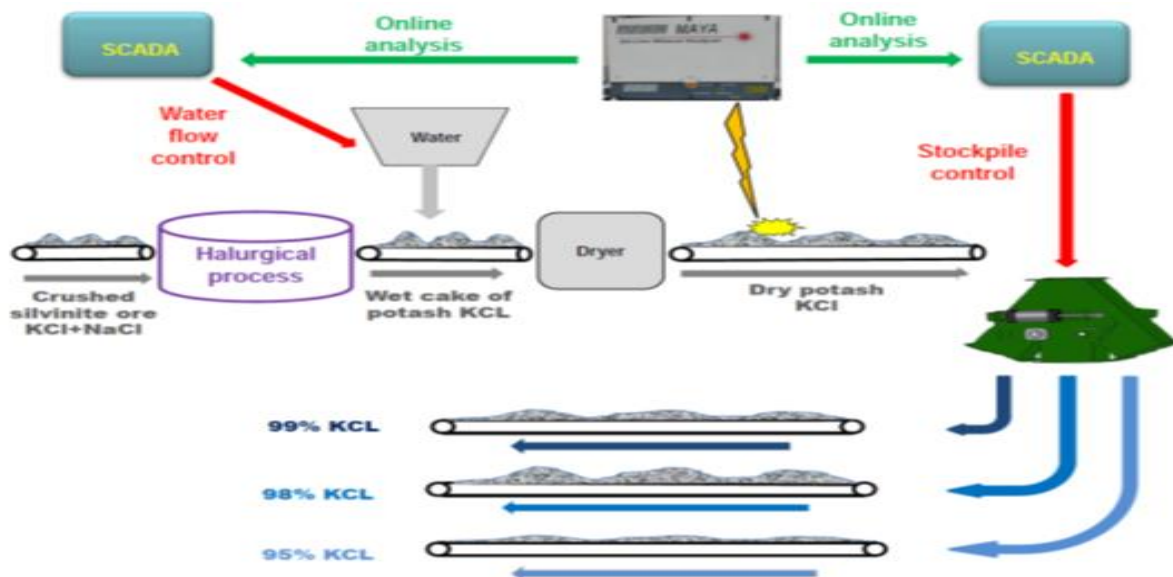
- Final product grade sorting (95%, 98% and 99% of KCl)
- Grade Sorting



Investment Payback – 3 months

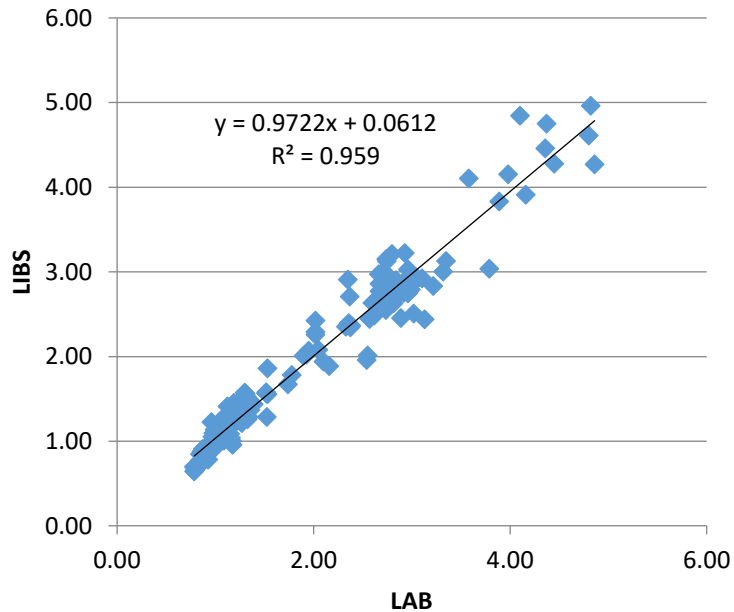
Operating environment:

- Extremely corrosion environment
- Temperature of material ~ up to 200C
- Ambient temperature ~ - 10C... +30 C
- Ambient humidity up to 100%



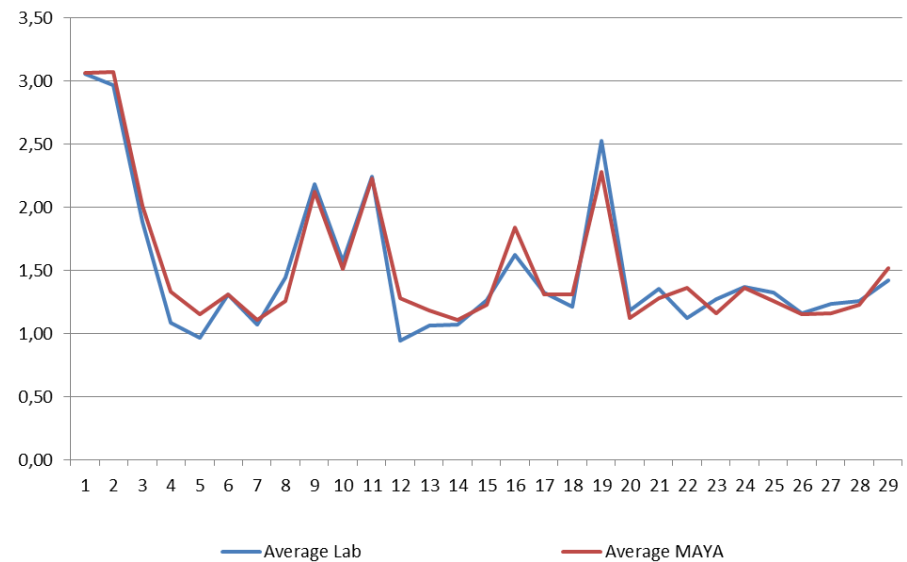
Measurements

Dynamic on-site calibration



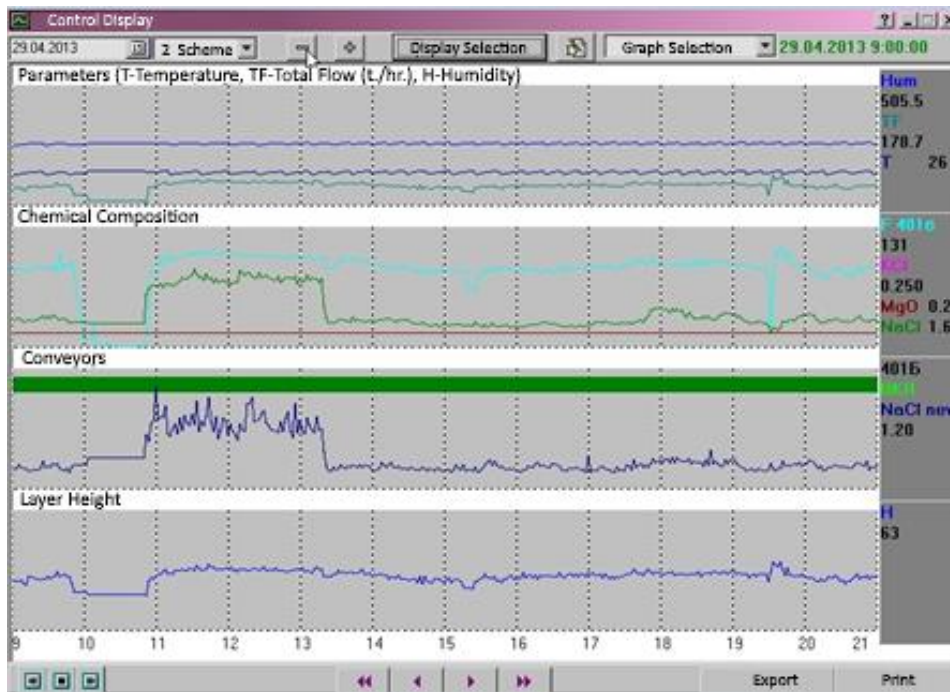
R2=0,96
RMSD = 0,3%

LIBS vs Lab long-term comparison
6-hours average data



Halurgy Process Control

SCADA interface



Source of economic benefits

- reduced reagents/water/energy consumption
- final product quality control
- reduction of product overload
- reduced losses of potassium in the tails

Case Study

MAYA online analyzer was installed on a production conveyor after hot leaching and crystallization process for feedforward control to monitor incoming product quality.

Source of economic benefits:

- Higher utilization of potassium
- Additional earnings from high grade fertilizers
- Elimination of quality claims
- Reduced consumption of water and energy

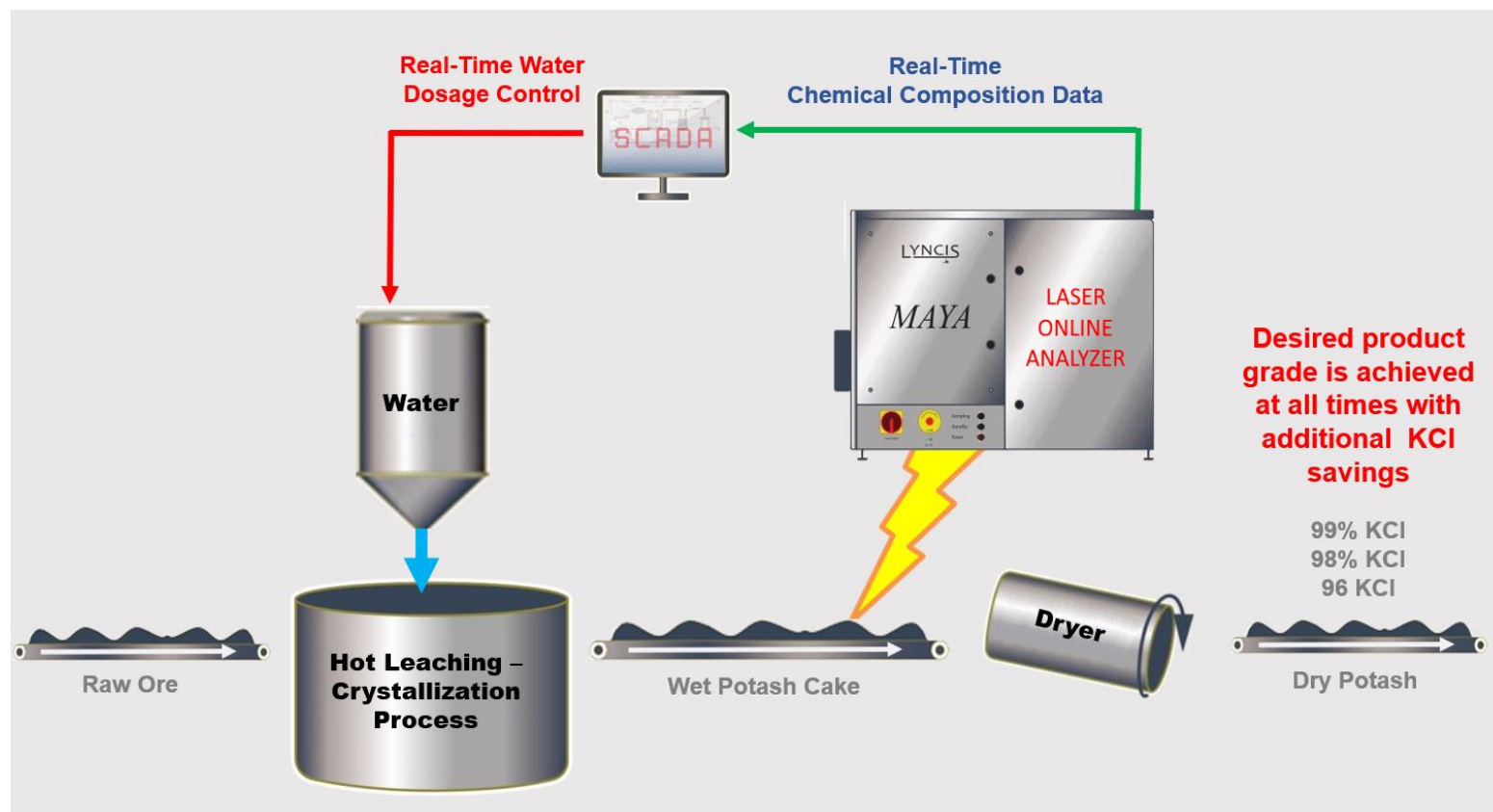
Investment Payback – 6 months



Case Study

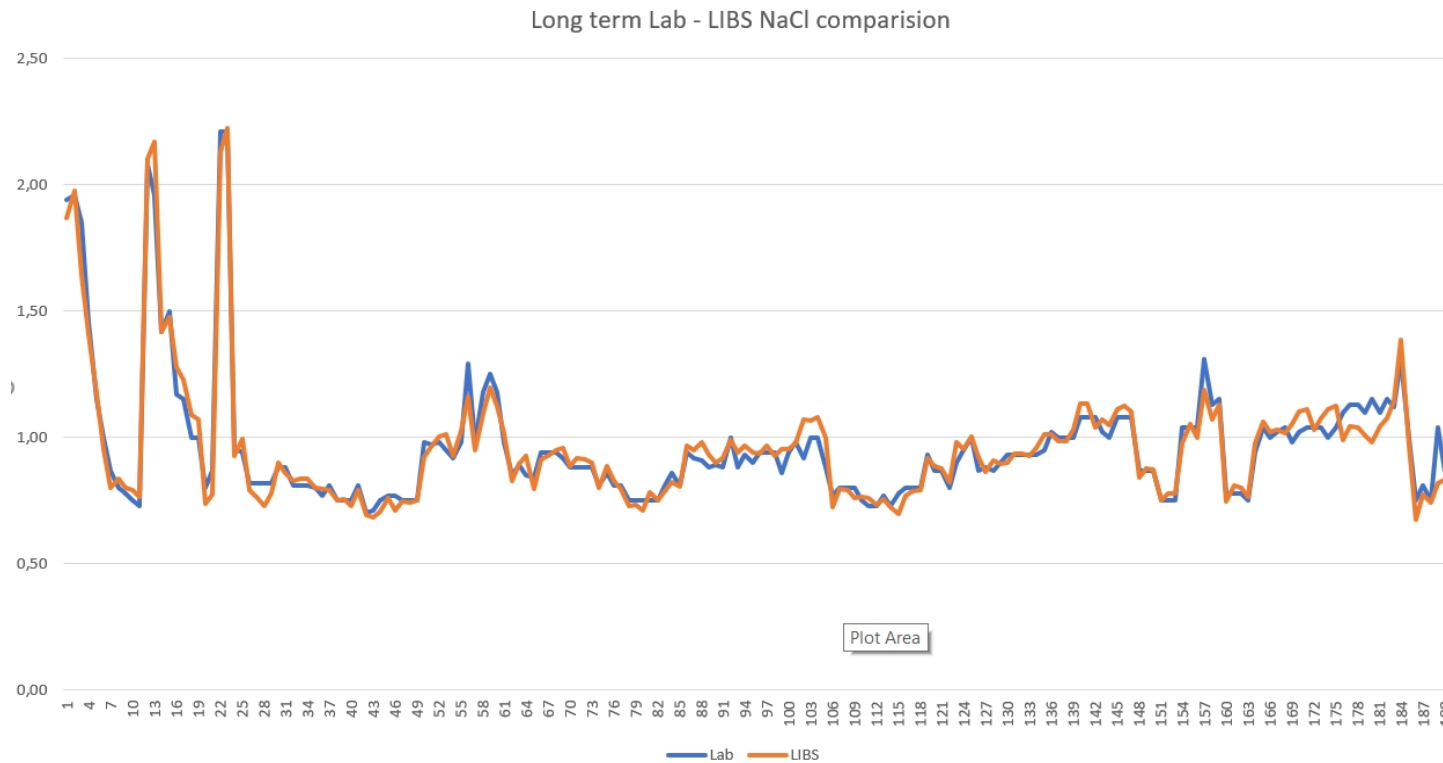
Technological tasks:

- Hot Leaching - Crystallization process control by water dosage to control NaCl level in the wet cake



Accurate real time measurements

Long lasting good correlation with laboratory analysis in real time conditions with materials on conveyor belt



Automated Process Control

At these points NaCl becomes higher than desired. Water supply is increased automatically to drive NaCl concentration down.

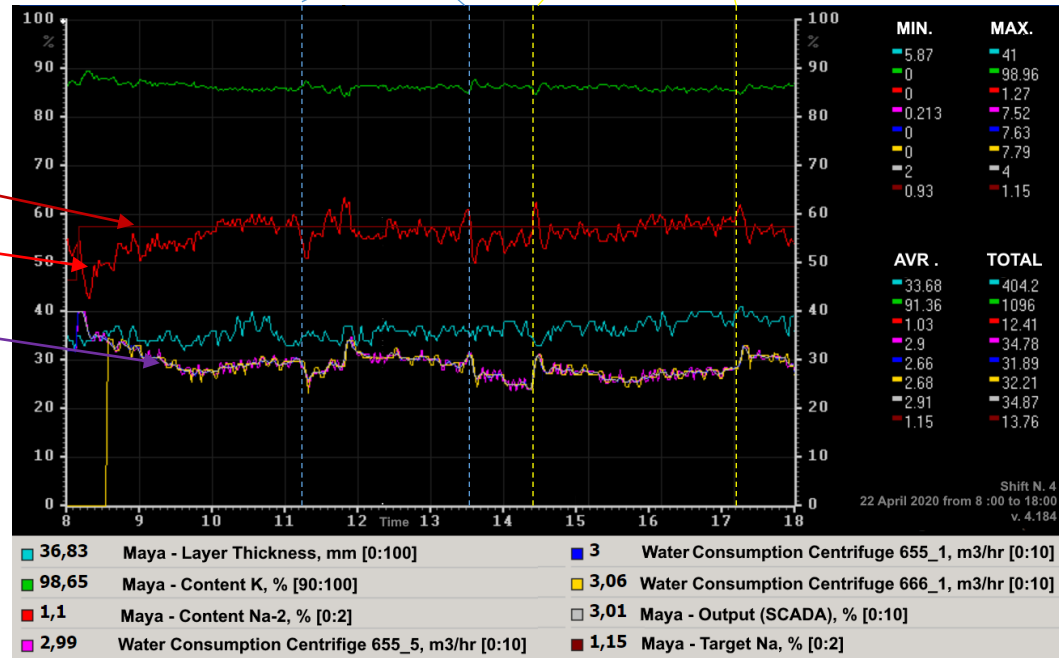
At these points NaCl becomes lower than required and the event triggers decrease the water supply in leaching process to increase NaCl content in the production.

Target level of NaCl (1.15%)

Actual (Measured by online MAYA analyzer) Concentration of NaCl in a product

Adjusted water supply level to control NaCl concentration in a product.

Water supply is increased if NaCl levels are too high, and decreased if is too low.



Case Study

MAYA online analyzer was installed to provide online measurement of brine from multiple sampling lines.

Analytical tasks:

- Measurement of NaCl (<300g/l) and KCl (<200 g/l) in brine



LIBS Technology

- **Environmentally and personal safe technology**
- No gamma-ray, neutron or X-ray radiation.
No governmental permissions and licenses are needed for operating and transporting the equipment making it simpler and cheaper to manage the production.



NO MORE RADIATION AT WORK PLACE

Technical specifications

Operation temperatures from -20 °C to +50 °C

Protection class - IP65

Corrosion, dust and vibration protection

Integration with all SCADA types; cloud and remote communication capabilities

Nd:YAG solid state impulse laser 1064 nm
Laser safety Class 1

Spectrometers detect 170 – 960 nm range

Fully safe LIBS technology generates only optical wave range during excitation and emission



24/7 continuous operation
Direct on-belt / pipeline analysis
NO sampling
Designed for harsh industrial environment

What is your Project?

1. Pinpoint potential locations
2. Assess The Benefit
3. Start the project witch could lead to high ROI



Benefits

- **Higher utilization of potassium**
- **Stable technology process with no product quality fluctuations**
- **High-grade product**
- **Reduced consumption of water and energy**
- **Reduced frequency and labor cost in lab testing and sample preparation**
- **Minimize Tailings**





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Surface Measurement – True Flow Measurement

LIBS provides accurate material flow measurement and is not affected by layer thickness, material load or conveyor construction and does not require measurement corrections based on additional sensors or assumed material distribution models.

To achieve representative measurement of the entire flow LIBS analyzer is installed at the location where material distribution has random nature. Locations after raw ore crusher, mill, discharge chute can be defined as having random material distribution and this can ensure that statistically accurate chemical composition of entire flow is measured.

If no random distribution exists at desired measurement point simple mechanical tools (plunges, chains) are used to mix the material on a conveyor and ensure the surface measurement statistically represents an entire flow.



Examples of mechanical aid to ensure entire flow chemical composition analysis is delivered

