S8 DRAGON

Truly Simultaneous X-ray Fluorescence (XRF)

for Precise, High-speed Elemental Analysis in Metals
New truly simultaneous XRF S8 DRAGON
New truly simultaneous XRF S8 DRAGON

- Truly simultaneous XRF spectrometer combining single element channels with the new Multielement Channel™
- Covers almost the whole periodic table from C upwards in one run in less than 40 seconds
- 4 kW high excitation power
- Unmatched precision for all relevant elements in metal production and foundries
- Footprint more than 25% smaller compared to traditional instrument
S8 DRAGON
Multielement Channel

- 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
Simultaneous XRF Spectrometer for Metal Applications

Customer for process labs in metallurgy: Buy an analytical tool – dedicated analyzer for specific tasks:

Primary focus on analytical specifications
• Element list with accuracy and precision
• Limited number of materials (alloy types)

Second focus on reliability:
• Instrument uptime
• References
• Service and application support
• Analytical technology of no or less concern

Different Story:
S8 DRAGON – focus on analytical specs
S8 LION – focus on analytical technologies
• Accuracy
  • Example Copper based alloy with CRM and calibration

• Precision
  • Example with Nickel, explanation of traditional single element channels SEC

• Detection
  • Explanation of USP Multielementchannel

• Ease of use
  • TouchControl

• Uptime guaranteed
  • SampleCare, S8 Tools

• Teamwork
  • Automation with Bruker OES
S8 DRAGON
Applications
S8 DRAGON
Copper based alloys

Brass and Bronze
• Analysis of major elements: Fe, Ni, Co,…
• Analysis of expensive components with best precision
• Analysis of wide material ranges in combination with OES

Market price Nickel:
## S8 DRAGON
### Copper based alloys - Calibration

<table>
<thead>
<tr>
<th>Stand.</th>
<th>Cu(%)</th>
<th>Pb(%)</th>
<th>Fe(%)</th>
<th>Sn(%)</th>
<th>Al(%)</th>
<th>Mn(%)</th>
<th>Ni(%)</th>
<th>Si(%)</th>
<th>Zn(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45-343</td>
<td>58,87</td>
<td>0,45</td>
<td>0,42</td>
<td>0,042</td>
<td>1,73</td>
<td>2,13</td>
<td>0,073</td>
<td>0,63</td>
<td>35,676</td>
</tr>
<tr>
<td>45-361</td>
<td>57,85</td>
<td>0,47</td>
<td>0,39</td>
<td>0,053</td>
<td>1,58</td>
<td>1,96</td>
<td>0,15</td>
<td>0,6</td>
<td>37,049</td>
</tr>
<tr>
<td>45-378</td>
<td>57,82</td>
<td>0,72</td>
<td>0,38</td>
<td>0,063</td>
<td>1,61</td>
<td>2,01</td>
<td>0,169</td>
<td>0,57</td>
<td>36,639</td>
</tr>
<tr>
<td>45-381</td>
<td>58,39</td>
<td>0,59</td>
<td>0,19</td>
<td>0,067</td>
<td>1,05</td>
<td>2,12</td>
<td>2,09</td>
<td>0,3</td>
<td>34,832</td>
</tr>
<tr>
<td>45-388</td>
<td>58,32</td>
<td>0,63</td>
<td>0,1</td>
<td>0,055</td>
<td>1,1</td>
<td>1,96</td>
<td>2,43</td>
<td>0,061</td>
<td>34,985</td>
</tr>
<tr>
<td>45-393</td>
<td>58,79</td>
<td>0,67</td>
<td>0,08</td>
<td>0,043</td>
<td>1,02</td>
<td>1,87</td>
<td>2,46</td>
<td>0,084</td>
<td>34,534</td>
</tr>
<tr>
<td>15-059</td>
<td>58,27</td>
<td>1,83</td>
<td>0,089</td>
<td>0,1</td>
<td>0,028</td>
<td>0,024</td>
<td>0,035</td>
<td>0,011</td>
<td>39,998</td>
</tr>
<tr>
<td>15-060</td>
<td>58,74</td>
<td>1,69</td>
<td>0,085</td>
<td>0,094</td>
<td>0,018</td>
<td>0,016</td>
<td>0,03</td>
<td>0,011</td>
<td>39,798</td>
</tr>
<tr>
<td>15-151</td>
<td>58,12</td>
<td>1,84</td>
<td>0,087</td>
<td>0,091</td>
<td>0,006</td>
<td>0,005</td>
<td>0,027</td>
<td>0,002</td>
<td>40,204</td>
</tr>
</tbody>
</table>

- Measurement of 9 elements parallel with Single Element Channels and the Multielement Channel
## S8 DRAGON Calibration

Comparison of Calibration Curves:
- Nickel with fixed single element channels
- Mangan with Mutilelement Channel

No limitation of linear range

<table>
<thead>
<tr>
<th>Element</th>
<th>Single Element Channel (%)</th>
<th>Multielement Channel (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al</td>
<td>0,017</td>
<td>0,014</td>
</tr>
<tr>
<td>Si</td>
<td>0,014</td>
<td>0,031</td>
</tr>
<tr>
<td>Mn</td>
<td>0,018</td>
<td>0,018</td>
</tr>
<tr>
<td>Fe</td>
<td>0,007</td>
<td>0,014</td>
</tr>
<tr>
<td>Ni</td>
<td>0,012</td>
<td>0,029</td>
</tr>
<tr>
<td>Cu</td>
<td>0,14</td>
<td>0,14</td>
</tr>
<tr>
<td>Zn</td>
<td>0,08</td>
<td>0,13</td>
</tr>
<tr>
<td>Sn</td>
<td>0,005</td>
<td></td>
</tr>
<tr>
<td>Pb</td>
<td>0,014</td>
<td>0,032</td>
</tr>
</tbody>
</table>
S8 DRAGON
Copper based alloys

Parallel measurement in Dual Mode acquisition, means internal backup of Single Element Channels
S8 DRAGON
Copper based alloys

Dual Mode Acquisition:
• Elemental fingerprinting with the Multielement Channel
• Tracking of contaminations
### Long term precision test for copper based alloys

- Best alignment of accuracy between both technologies

<table>
<thead>
<tr>
<th></th>
<th>Cu</th>
<th>Pb</th>
<th>Fe</th>
<th>Sn</th>
<th>Al</th>
<th>Mn</th>
<th>Ni</th>
<th>Si</th>
<th>Zn</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEC</td>
<td>57,869</td>
<td>0,481</td>
<td>0,390</td>
<td>0,062</td>
<td>1,563</td>
<td>1,934</td>
<td>0,153</td>
<td>0,609</td>
<td>37,050</td>
</tr>
<tr>
<td>Abs. Dev. (%)</td>
<td>0,012</td>
<td>0,0005</td>
<td>0,0005</td>
<td>0,0003</td>
<td>0,003</td>
<td>0,0012</td>
<td>0,0004</td>
<td>0,0007</td>
<td>0,02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Cu</th>
<th>Pb</th>
<th>Fe</th>
<th>Sn</th>
<th>Al</th>
<th>Mn</th>
<th>Ni</th>
<th>Si</th>
<th>Zn</th>
</tr>
</thead>
<tbody>
<tr>
<td>MultiCh</td>
<td>57,875</td>
<td>0,447</td>
<td>0,410</td>
<td>0,062</td>
<td>1,527</td>
<td>1,944</td>
<td>0,120</td>
<td>0,605</td>
<td>37,175</td>
</tr>
<tr>
<td>Abs. Dev. (%)</td>
<td>0,104</td>
<td>0,0202</td>
<td>0,009</td>
<td>0,0003</td>
<td>0,056</td>
<td>0,0207</td>
<td>0,0063</td>
<td>0,0149</td>
<td>0,10</td>
</tr>
</tbody>
</table>
S8 DRAGON
Copper based alloys

Excellent alignment of SEC and Multielement Channel (MEC):
• Accuracy of elements is perfectly matching customer expectations
• Precision is within the requirement of the process engineers

Unique advantages with Dual Mode Data Acquisition:
• Fingerprinting of additional elements by MEC
• Second dataset as backup for SEC
• Continuous consistency check between MEC and SEC results
Elements to be analyzed: Si, P, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Zr, Nb, Mo, Sn, Ta, W, Pb (19)

- Measurement time = 40s, plus handling
- Dual Mode acquisition with Multielement Channel and 15 SEC
Steel Calibration S8 DRAGON for Mn

Mn KA1 Minor
Range: 0 – 1,2 %
RMS = 0,01%

• Two ranges with automatic switch depending on intensity

Mn KA1 Major
Range: 0 – 19,5 %
RMS = 0,07%
# Precision Test for Steel

40 s measurement time - Dual Mode

<table>
<thead>
<tr>
<th>Element</th>
<th>Concentration [%]</th>
<th>RSM [%]</th>
<th>LLD [PPM]</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Si KA1</td>
<td>0 – 4.1</td>
<td>0.056</td>
<td>350</td>
<td>Multielement Channel</td>
</tr>
<tr>
<td>P KA1</td>
<td>0 – 0.1</td>
<td>0.004</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Ti KA1</td>
<td>0 – 2.2</td>
<td>0.08</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>V KA1</td>
<td>0 – 9.7</td>
<td>0.15</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Cr KA1</td>
<td>0 – 30</td>
<td>0.07</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Mn KA1</td>
<td>0 – 2</td>
<td>0.01</td>
<td>3</td>
<td>Two ranges</td>
</tr>
<tr>
<td>Fe KA1</td>
<td>50 – 100</td>
<td>0.8</td>
<td></td>
<td>Multielement Channel</td>
</tr>
<tr>
<td>Co KA1</td>
<td>0 – 2</td>
<td>0.02</td>
<td>2</td>
<td>Two ranges</td>
</tr>
<tr>
<td></td>
<td>0 – 10</td>
<td>0.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ni KA1</td>
<td>0 – 6.2</td>
<td>0.008</td>
<td>2</td>
<td>Two ranges</td>
</tr>
<tr>
<td></td>
<td>0 – 35</td>
<td>0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Concentration [%]</td>
<td>RSM [%]</td>
<td>LLD [PPM]</td>
<td>Comment</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------------</td>
<td>---------</td>
<td>-----------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>Cu KA1</td>
<td>0 – 3.3</td>
<td>0.02</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Zn KA1</td>
<td>0 – 0.1</td>
<td>0.004</td>
<td>16</td>
<td>Multielement Channel</td>
</tr>
<tr>
<td>As KB1</td>
<td>0 – 0.1</td>
<td>0.002</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Zr KA1</td>
<td>0 – 0.1</td>
<td>0.007</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Nb KA1</td>
<td>0 – 1.1</td>
<td>0.01</td>
<td>75</td>
<td>Multielement Channel</td>
</tr>
<tr>
<td>Mo KA1</td>
<td>0 – 0.3</td>
<td>0.003</td>
<td>1</td>
<td>Two ranges</td>
</tr>
<tr>
<td></td>
<td>0 – 3.2</td>
<td>0.013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sn KA1</td>
<td>0 – 0.2</td>
<td>0.002</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Ta LB1</td>
<td>0 – 0.3</td>
<td>0.008</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>W LA1</td>
<td>0 – 11</td>
<td>0.06</td>
<td>6</td>
<td>Two ranges</td>
</tr>
<tr>
<td></td>
<td>0 – 20</td>
<td>0.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pb LA1</td>
<td>0 – 1.1</td>
<td>0.009</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
Raw Materials in Metal Production with the S8 DRAGON

Mineral processing
- Iron Ore
- with the S8 DRAGON 4 kW

- Time to result:
  - 56 sec per sample

- Sample throughput:
  - at least 60 samples/h

- Same configuration than Steel
# Raw Materials in Metal Production with the S8 DRAGON

<table>
<thead>
<tr>
<th>Element</th>
<th>Conc. Range</th>
<th>Calib. Std. Dev.</th>
<th>LOD [3σ, 30s]</th>
<th>Sample [%]</th>
<th>RSD. 30s [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mg</td>
<td>0.01 – 3.01</td>
<td>0.21</td>
<td>3</td>
<td>0.18</td>
<td>0.25</td>
</tr>
<tr>
<td>Al</td>
<td>0.08 – 1.3</td>
<td>0.05</td>
<td>2</td>
<td>0.39</td>
<td>0.24</td>
</tr>
<tr>
<td>Si</td>
<td>0.2 - 20.0</td>
<td>0.99</td>
<td>3</td>
<td>3.49</td>
<td>0.08</td>
</tr>
<tr>
<td>P</td>
<td>0.002 - 0.2</td>
<td>0.002</td>
<td>1</td>
<td>0.007</td>
<td>0.001</td>
</tr>
<tr>
<td>Ca</td>
<td>0.01 - 0.03</td>
<td>0.001</td>
<td>1</td>
<td>0.05</td>
<td>1.01</td>
</tr>
<tr>
<td>Ti</td>
<td>0.04 - 0.15</td>
<td>0.01</td>
<td>1</td>
<td>0.04</td>
<td>0.91</td>
</tr>
<tr>
<td>Mn</td>
<td>0.02 - 5.3%</td>
<td>0.005</td>
<td>2</td>
<td>&lt; 2PPM</td>
<td>n.a.</td>
</tr>
<tr>
<td>Fe</td>
<td>Matrix</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Low alloy steel with one smart combination of SEC and Multielmentchannel:

• 19 elements in 40 s measurement time
• Excellent precision
• Best Accuracy

• Additional analysis of iron ore and slags

• Monitoring of process materials to track contaminations
S8 DRAGON Technology
The new S8 DRAGON spectrometers are the unique full simultaneous XRF models for the complete element range on the market with most modern technology!

Two basic configurations

- S8 DRAGON 3K
- S8 DRAGON 4K

with

- TouchControl
- SampleCare
- EasyLoad
S8 DRAGON
Single Element Channel

Up to 15 Single Element Channels plus Multielement Channel:

Crystals
• 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
S8 DRAGON
The optimal solution - Less Is More

- Best analytical performance with max 15 channels plus Multi Element Channel:
  - Highest intensity due to most compact beam path (close coupling of tube-sample-detector)
  - Stable vacuum due to small volume of sample and spectrometer chamber with pre-evacuation step
- Less channels offer more performance
S8 DRAGON
Multielement Channel

XFlash technology of Bruker
• 4th generation Silicon Drift Detector (SDD)

High transmission window
• Unique energy resolution
• 129 eV FWHM
• @ Mn Kα
• @ 100 000 cps

Unmatched count rates
• up to 300 000 cps input count rate
• up to 100 000 cps output count rate
• without resolution degradation

Peltier cooled
• Maintenance free
**S8 DRAGON TouchControl**

- Easiest operation due to intuitive touch screen interface: Three steps to accurate results
  - Select sample position and application
  - Enter sample ID
  - Press “Measure”
- No operator training required
- Island mode: Reliable operation in rough environments (no PC)
- Unmatched Data Safety: Routine analysis is separated from advanced tasks like calibration, evaluation, and extended reporting
- Online language switch with huge selection
Accurate positioning of the sample surface:
• no tolerances in tube-to-sample distance

Pre-evacuation step:
• separation of sample and spectrometer chamber for highest vacuum stability
• Compact vacuum system

Shortest time-to-result:
• Preloading position with internal sample changer
Essential Hardware Components for precision and reliability

Tube-above-sample geometry:
• No contamination and damage of the X-ray tube window
• No damages of flow counter foils

The S8 DRAGON is not affected by:
• Sample failures
• Dust from pressed powder samples
• e.g. analyzing slag samples

Reliability by design
Sample Handling:
Sample cups
• 8 positions stand alone

40 mm steel rings
• 12 positions stand alone
• 9 positions - ONLINE

51.5 mm steel rings
• 10 positions stand alone
• 8 positions – ONLINE

Bare samples with a diameter of
• e.g. 33 mm - (cylindric)
• Thickness: max. 30 mm
• Weight: max 500g
Connection path

Standalone operation in rough environments
• connection via TCP/IP for data exchange:
  • 1 TCP/IP port
  • 2 USB ports

Maximum uptime
• no PC with keyboard, mouse and monitor required for instrument operation
S8 DRAGON
Teamwork to Perfection

- Automated sample transport and pickup at the back of the unit
- Interface for belt connection or robot
- Sample Magazine accessible for non routine samples from the front
- Easy and simple integration path to automated sample preparation:
  - AXSCOM Interface
  - TCP/IP Connection
  - Link to Bruker OES
The S8 DRAGON delivers:
• Best accuracy
• Ultimate Precision
• Shortest time to result

... for Rapid Process Control in:
• Iron
• Steel
• Nickel, Cobalt, Copper based alloys
• Aluminum

Elemental fingerprinting
• Analytical flexibility
• Dual-mode data acquisition
  • Internal Backup for data safety with a second internal source
S8 DRAGON
Sales opportunities

• Group 1: S8 DRAGON USER
  • Producers of single materials: Sim-XRF for metals and Slags
    • Iron and low alloy steel
    • Copper
    • Aluminium

• Group 2: S8 DRAGON USER
  • Producers of wide range of materials: Sim-XRF plus OES for metals and evtl. slags and raw materials
    • Brass
    • Bronze
    • high alloy steel

• Group 3: NON S8 DRAGON USER
  • Producers of wide range of materials: only Sim-XRF for metals and Slags
    • Stainless Steel
Roadmap

- 14.3.2011 Launch of the S8 DRAGON @ PittCon
  - SAP: ready, part of the M8 Konfigurator
  - Brochure: printed, available for download
  - Press release
  - Web page ready

- Sales Platform
  - Powerpoint for distribution

- 1.5.2011 AIST in US
- 16.5.2011 CETAS in D
- 27.6.2011 GIFA in D
The new link

The perfect combination of OES and XRF for fast furnace control
• Complete product portfolio for single instrumentation in
  • Optical Emission Spectrometry
  • Combustion Analysis
  • X-ray fluorescence Spectrometry

• for metals
  • Foundries
  • Small metal production
  • Central labs
  • Commercial service labs

• The missing piece for large companies (Thyssen, Arcelor,…) is now available:
  • Twin Automation
Bruker Solution for Fast Furnace Control

Full Automation with
• Sample preparation
  • High speed milling
  • High speed grinding
• X-ray fluorescence Analysis
  • Major and minor elements in less than 40 s
• Optical emission spectrometry
  • Traces and light elements

• For fast furnace control
  • High analytical speed
  • Best precision
  • Best accuracy
  • Enhanced trace element
  • Optimal uptime
Bruker Automation Market

- Be attractive for major metal producers
- Be competitive versus
  - Thermo
    - SMS 2000 for OES automation
    - SMS 3000 and SMS 3500 for twin automation
  - PANalytical + OBLF
    - Teamworks
- Be Complete solution provider
  - Process Labs
  - Central Labs
  - R&D Labs
  - Service Labs
Bruker Automation

• Solutions for
  • Cast iron
  • Pig iron
  • low alloy steel
  • high alloy steel
  • Copper base
  • Nickel base
  • Aluminium base

• Container Lab
  • Furnace control
  • Close to the furnace
  • Quickest feedback on the process
  • Consistent analytical quality
  • Reliable turn-around times
High-end Vacuum OES Q8 MAGELLAN

- Vacuum spectrometer with high-resolution optical system
- Optimized for demanding applications
- Latest channel photomultiplier detector technology (CPM)
- Single-spark detection up to 1000 Hz
- Time-resolved spectroscopy
- 750 mm focal length, highest spectral sensitivities, low detection limits
- Up to 128 channels
Spark Stand for routine operation

- Pneumatic sample holder
- Automatic electrode cleaning (optional)
- Self-centering plate
- Quick-open spark stand plate
- Newly Optimised argon flows
- Ready for automated Sample manipulation
## Typical Nitrogen Performance

<table>
<thead>
<tr>
<th>Sample</th>
<th>93554-10</th>
<th>3FE 28664</th>
<th>RN 14/36</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0,0039</td>
<td>0,0072</td>
<td>0,031</td>
</tr>
<tr>
<td>2</td>
<td>0,0039</td>
<td>0,0067</td>
<td>0,0303</td>
</tr>
<tr>
<td>3</td>
<td>0,0039</td>
<td>0,007</td>
<td>0,0303</td>
</tr>
<tr>
<td>4</td>
<td>0,0042</td>
<td>0,0068</td>
<td>0,0297</td>
</tr>
<tr>
<td>5</td>
<td>0,0043</td>
<td>0,0077</td>
<td>0,0308</td>
</tr>
<tr>
<td>6</td>
<td>0,0038</td>
<td>0,007</td>
<td>0,0306</td>
</tr>
<tr>
<td>7</td>
<td>0,004</td>
<td>0,0068</td>
<td>0,0306</td>
</tr>
<tr>
<td>8</td>
<td>0,004</td>
<td>0,0069</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0,0035</td>
<td>0,0071</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0,004</td>
<td>0,0069</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>0,0038</td>
<td>0,0068</td>
<td></td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>0,0039</strong></td>
<td><strong>0,007</strong></td>
<td><strong>0,0305</strong></td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td><strong>0,0002</strong></td>
<td><strong>0,0003</strong></td>
<td><strong>0,0004</strong></td>
</tr>
</tbody>
</table>
Long Term Stability of Key Elements

![Graphs showing long-term stability of key elements (C, Si, Mn, P, Cr, Ni).]
Q8 CORONADO
Twin Automation XRF & OES
Q8 CORONADO Twin Setup

S8 DRAGON

Container Cabin

Milling Machine

Q8 MAGELLAN

Robot Cell

Sample Entry
Automation Configuration
Q8 CORONADO Twin

- Double-size Container or
- Laboratory automation
- Free Q8 & S8 configuration
- Flexible workflow definitions
- Integrated backup functionalities
- One-stop shop solution
- Global sales & service coverage
- Joint BE / BAXS approach
Twin-Automation
XRF & OES Containerlab
S8 LION:
- Installation at TPI Polene Thailand, first installation in Asia
- Successful trial period at Lafarge Martes France
  - Order and addition to frame agreement due to better performance than Thermo 9800
- Recent orders at Cementos Yura Peru, Oriental Cement India

S8 DRAGON
- Container laboratory with OES and automation in Kalkar
- Trial period at VALE in Brazil for Iron Ore
- First Purchase Order North America at ThyssenKrupp Stainless in Calvert, AL
Satisfied Bruker Users @ Holcim Sehnde

Automation in cement plant Holcim Sehnde Germany with Herzog Sample Prep, Robot, 2 D4 ENDEAVOR, S8 TIGER and S8 LION
Satisfied Bruker Users @ Holcim Sehnde