optiMize – Plant Wide Automatic Process & Production Diagnostics

- Robust interface to machine data logging systems
- Detection of network issues and automatic recovery
- Secure long term data storage in database
- Extensive system configuration tools
- Detailed and flexible tools to view and analyse process data for individual slabs/coils or large groups
- Powerful search and filter features
- Dedicated analysis tools for key process variables like profile, gauge, flatness, coating, temperature and elongation
- Machine type specific analysis for casters, furnaces & reversing mills
- Mill dynamics analysis
- User interfaces to configure custom alarms and calculations
- Automatic tracking of material and machine performance through the whole process
- System Management
- Automatic Diagnostics
- Detailed Analysis
- Production Reporting
- Custom Dashboards

Benefits:
- Automatic detailed analysis of EVERY slab or coil
- Tracking of material throughout the process allowing checks and cross checks at each stage of process using one dedicated system
- Rapid automatic detection of process faults and identification of the root causes
- Early detection of quality failures and performance degradation
- Better use of valued process engineering resources
- Automated communication with production & process engineers via emails
- Automatic web based production reporting for production and process engineers
- Flexible web based dashboard system for custom reports presentable on all platforms
- Live streamed process and production data as well as machine status
- Scheduled emails with links & attached PDF report
optiMize

- Plant Wide Automatic Diagnostic System
The optiMize system provides automated analysis and diagnostic facilities plant wide, from casting, pre-heating, hot rolling, cold rolling through to finishing processes like edge trimmers, slitters and coating lines, delivering clear feedback to machine operators & supervisors, production & process engineers.

The purpose is to generate valuable information out of data!
optiMize – System Overview

❖ **ONE** solid data tracking & automatic diagnostic system for **ALL** machines in the plant

### Core System Configuration

- **optiMize Server** (IT Room):
  - optiMize Database (MySQL)
  - optiMize System Manager
  - optiMize Diagnostics
  - optiMize Web Reports (Web server)
  - optiMize Signal Configuration
  - optiMize Client

- **optiMize Machine Manager**

- **Data Logging PC**:
  - optiMize Machine Manager
  - optiMize Live Server
  - optiMize Signal Configuration

### Multi Machine Configuration

- **Customer (IT Room)**
- **optiMize Server** (IT Room)
- **optiMize Client & optiMize WebReport Users**

- **Plant Network**

- **Firewall**

- **Machine Network**

- **Switch**
  - Casting Data Logging
  - Hot Mill Data Logging
  - Cold Mill Data Logging
  - Leveler Data Logging
  - Slitter Data Logging
  - HOM Furnace Data Logging
  - Pre-Heat Furnace Data Logging
  - Annealing Furnaces Data Logging

**VLAN**
optiMize – Core Applications

Data Visualisation
- optiMize Client
- optiMize Dashboards
- optiMize Production Reports

Data Storage
- optiMize Database

Automatic Process & Production Diagnostics
- optiMize Diagnostics

System Management
- optiMize Live Server
- optiMize Machine Manager
- optiMize System Manager
- optiMize Signal Configuration
optiMize – Plant Integration

- The optiMize system can be integrated into a plant’s production planning system and provide key processes indicators used by the production planning system to validate pieces or coils for further processing.
System Management
optiMize – System Management: Diagnostics Control

- optiMize System Manager application is controlling the automatic diagnostics for all connected machines

- Robust communication between optiMize applications and machine data logging including automatic recovery from network failures
optiMize – System Management: Data Storage

- Centralised storage of automatic diagnostic configuration parameters, alarms limits as well as traces and calculated results for all connected machines
- Secure long term data storage using relation database (MySQL)
- High lossless data compression for high resolution traces
- Database replication available as option
- Built-in clean up and table optimisation
Data logging traces as well product and process information (PDI) to be used by the optiMize system are configured using a configuration tool.

Parameters and limits controlling the automatic process and production diagnostics are configured using intuitive user interfaces.
Automatic Diagnostics
-
optiMize Diagnostics
optiMize – Automatic Diagnostics: Gauge Analysis [Head Length]

**Detailed Specification**

- Min Length in Tolerance
- Head Length
- Point Inside tolerance

**Specific Analysis**

<table>
<thead>
<tr>
<th></th>
<th>Head</th>
<th>BOC</th>
<th>Tail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (m)</td>
<td>29</td>
<td>2538</td>
<td>30</td>
</tr>
<tr>
<td>Build Up (m)</td>
<td>0.02</td>
<td>0.52</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Upper (%)</th>
<th>Blip Out Tol.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.750</td>
<td>1.400</td>
</tr>
<tr>
<td>Lower (%)</td>
<td>-1.750</td>
<td>-1.400</td>
</tr>
</tbody>
</table>

Parameter Array/Parameter Comment (Blank Only)
Detailed Specification

- Set gap reference
- Wait for gas to settle
- Monitor servo offsets
- Monitor eccentricity
- Position idler tests
- Gap step response tests
- Gap swept sine tests
- Exit

Specific Analysis

- Test Control
- Test Frequencies (Hz)
  - Number of test frequencies: 3
  - Number of cycles per frequency: 12
  - Pause time (s): 3.0

- Monitor
  - Active Step: 4
  - Cycle Count: 0
  - Remaining Test Time: 24:20 s
  - Active Frequency: 0.0 Hz

Graphs showing test results and analysis data.
optiMize – Alarm Generation & Custom Evaluation

**Alarm Generation**

- Built-in industry standard alarms for key parameters like gauge, speed, tension etc.
  configured using intuitive user interfaces
- Email sent to designated individuals
- Alarm summary in email text for quick alarm review
- Alarm report (pdf) sent with email for quick alarm review

**Custom Evaluation**

- Feature to create custom:
  - Alarms
  - Warnings
  - Calculations
  - Events
- Basic or complex process and production parameter evaluations are created using an intuitive user interface
- Emails can be sent to designated persons
- Results can be viewed and analyse in the optiMize data visualisation tools
Detailed Analysis
-
optiMize Client
optiMize Client

- Detailed and flexible graphical tool used to view and analyse process data for individual slabs/coils or large groups
- Powerful search and filter features using product or process information provided in the data logging as well as results calculated by the optiMize Diagnostics application
- Dedicated tool to view and analyse multiple process parameters and calculated results for small or large groups (many thousands) of slabs/coils providing an unique way to find parameter relationships as well as long term follow up or catching slow drifts in process or productivity
- Features to quickly find outliers in large groups and navigate to detailed analysis tools for further analysis
- High resolution traces for visualisation of logged analog and digital traces as well as built-in detailed colour (heat) maps and FFT charts with built-in theoretical roll markers enables fast decision making.
- Features to save groups of slabs/coils for later use or as references as well as creating personalised views of favourite traces and calculated results in dedicated analysis tools
- Built-in dedicated analysis tools for display of key rolling mill and finishing line process traces and calculated results:
  - Profile
  - Temperature
  - Gauge
  - Flatness
  - Coating
  - Elongation
- Machine type specific analysis:
  - Casters
  - Furnaces
  - Reversing mills
- Mill dynamics analysis
  - Detailed analysis of a mills actuator performance (load cells, pressure transducers, position transducers)
- User interfaces to configure custom alarms and calculations
**optiMize Client – Data Search & Group Display**

- Powerful search and custom filter feature enables the user to find individual slabs/coils or groups using product information and calculated results

**Data Search & Analysis Group Generation**

- Group of slabs/coil can be ordered by Piece ID or process order

**Analysis Group Display**

- Group of slabs/coil can be ordered by Piece ID or process order
The power of group analysis... find patterns and relationships that cannot be found by looking at individual slabs or coils.

Large Groups
- Plot calculated results for thousands of slabs/coil

Display Options
- Time/Process Order
- X/Y

Multiple Parameters
optiMize Client – Rolling Mill Key Parameter Analysis

- Detailed analysis tools for key rolling hot and cold mill parameters
optiMize Client – Finishing Line Parameter & Machine Specific Analysis

- Detailed analysis tools for finishing line key parameters and specific machines

**Coating**

**Leveller Elongation**

**Reversing Hot Mills**

**General Traces**

- Caster and furnaces can be analysed in the Trace Display tool
optiMize Client – Mill Dynamics

- Evaluation of mill dynamics and actuator performance

Test Summary

Mill Stretch

Servo Valve Drift

Roll Eccentricity
optiMize Client – Mill Dynamics

- Evaluation of mill dynamics and actuator performance
Gauge Assessment:
Coil body of coil gauge performance against product tolerances

Mill Productivity:
Production management unaware that operators were operating the mill in two distinct speed bands

Flatness Issues:
Coolant temperature variability increases significantly

Mill Practises:
Large roll stress variation within each gauge range

The power of group analysis... find patterns and relationships that cannot be found by looking at individual slabs or coils
Gauge performance follow up after backup roll change

Gauge head length evaluation for two different coils

Flatness performance evaluation related to bend control
Custom Dashboards
-
optiMize Dashboards
**optiMize Dashboards**

- The web based dashboard system enables registered users to create dashboards containing widgets displaying calculated production or process results.
- The dashboards can be viewed on all platforms.
- Dashboards can be private, shared with other specified users or made public for any registered user within the company.
- Available widgets range from standard charts like scatter, line, pie, bar and table to more production specific widgets like time lines displaying machine run times (up time) and operator reported delay times (down time).
- Real time production and process data as well as machine status streamed directly from the machines data logging systems can be displayed in dedicated widget via built in real time web server.
- Dashboards can operate in history mode displaying data for the last day, week, month or any selected date range as well as in polling mode where the dashboard is automatically updated at regular intervals and the results are dynamically update in the widgets.
- Scheduled emails can sent containing links to a dashboard as well as a PDF report where PDF layout is defined using a report generator feature.

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**Dashboards**
optiMize Dashboards

Dashboard Creation

- **Add Dashboard**
  - Dashboard Name: Production Summary
  - Dashboard Style: Normal
  - Widget Margin: Select
  - Outer Margin: checked

- **Scheduled Emails**
  - Email Frequency: Daily
  - Schedule Name: Daily Production Summary
  - Dashboard End Time: 08:00
  - Schedule Comment: Update daily production data

Widget Creation

- **Edit Widget**
  - Widget Name: 
  - Display Type: Line Chart
  - Measure:
  - Signal Name: Signal Field
  - Signal Options:
    - Series Type: X, Y
    - Min X: 0
    - Max X: 1000
    - Time Series: Day
    - Time Bar Value: 0

Sharing options

- **Share Dashboard**
  - Share with:
    - Private
    - Share
    - Public
    - Email

  - Add users to dashboard:
    - Available Users:
      - Name: John Doe, Mark Smith
    - Selected Users:
      - Name: Jane Doe, Mark Smith
**optiMize Dashboards**

**Report Duration**

- Report duration for reports are easily configured using quick select options or manual entry.

**Real Time/Live Widgets**

- Real time product and process data as well as machine status streamed directly from the machines data logging system.

**Historic Mode**

**Polling Mode**

- Widgets are automatically update at regular intervals.
optiMize Web Report – Report Generation

- User friendly controls are used to generate the predefined standard production reports
- Automatic emails with a link to a report can be configured to be sent on a shift/day/weekly basis

**Report Generation**
Machine production summary available in one page accessible on any platform

Production Summary

Machine ID: START TIME: 04/29/2014 09:00 End Time: 04/29/2014 09:00

Production Summary
- Recorded Sections: 98
- Alarm Cells: 35
- Warning Cells: 0
- Error Cells: 0
- Good Cells: 52
- Number Of Slip Breaks: 34
- Total Weight (lbs): 2,190,161
- Rolled Length (ft): 2,050,278
- Average Gage Target (inches): 11.496
- Average Width (inches): 63.2

Language Support

- Utilization Rate (%): 77
- Quality Rate (%): 97
Machine dependent configuration of key production result parameters

Tension Leveller/Edge Trimmer

- Recorded Sections: 6
  - Levelling Passes: 5
  - Edge Trim Passes: 1
- Number Of Coils: 6
- False Starts: 0
- Invalid Sections: 0
  - Incorrect Coll ID: 0

Rolling Mill

- Recorded Sections: 98
- Number Of Coils: 98
- False Starts: 0
- Invalid Sections: 0
  - Incorrect Coll ID: 0
- Number Of Strip Breaks: 34
  - Stand 1: 0
  - Stand 2: 0
  - Stand 3: 1
  - Stand 4: 2
  - Last Stand: 26

Reversing Hot Mill

Pass Summary

Average Time Between Pass (seconds): 20.7
**Detailed production summary available in table format as well as search and data export features**

### Detail Production Summary

<table>
<thead>
<tr>
<th>Machine ID</th>
<th>Start Time: 04/20/2014 00:00</th>
<th>End Time: 04/22/2014 00:00</th>
</tr>
</thead>
</table>

#### Table 1: Production Summary

<table>
<thead>
<tr>
<th>Date &amp; Time</th>
<th>ID TBI</th>
<th>Run Time</th>
<th>Coil ID</th>
<th>Auth (h)</th>
<th>H (inches)</th>
<th>W (inches)</th>
<th>D (inches)</th>
<th>Head Build-up (inches)</th>
<th>Total L (ft)</th>
<th>Head L (ft)</th>
<th>Tail L (ft)</th>
<th>Max Speed (rpm)</th>
<th>Min Speed (rpm)</th>
<th>Mean Dev (mm)</th>
<th>Sigma (mm)</th>
<th>% in TOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr/20/2014 06:32:39</td>
<td>042315PF</td>
<td>125</td>
<td>14.02</td>
<td>63.3</td>
<td>82</td>
<td>4.15</td>
<td>257254</td>
<td>944</td>
<td>321</td>
<td>3429</td>
<td>3302</td>
<td>0.3005</td>
<td>0.33</td>
<td>0.110</td>
<td>90.09</td>
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<td>125</td>
<td>14.02</td>
<td>63.3</td>
<td>82</td>
<td>3.55</td>
<td>254207</td>
<td>793</td>
<td>431</td>
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<td>3365</td>
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<td>0.043</td>
<td>0.128</td>
<td>95.07</td>
<td></td>
</tr>
<tr>
<td>Apr/20/2014 07:33:37</td>
<td>042352GF</td>
<td>125</td>
<td>14.02</td>
<td>63.3</td>
<td>82</td>
<td>3.3</td>
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<td>793</td>
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<td>82</td>
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<td>2440</td>
<td>3361</td>
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<td>0.041</td>
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<td>243</td>
<td>2445</td>
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<td>0.121</td>
<td>96.02</td>
<td></td>
</tr>
<tr>
<td>Apr/20/2014 07:37:33</td>
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<td>14.02</td>
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<td></td>
</tr>
<tr>
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<td>82</td>
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<td>269227</td>
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<td>3365</td>
<td>0.006</td>
<td>0.039</td>
<td>0.116</td>
<td>97.66</td>
<td></td>
</tr>
<tr>
<td>Apr/20/2014 07:37:37</td>
<td>042315GF</td>
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<td>14.02</td>
<td>63.3</td>
<td>82</td>
<td>1.37</td>
<td>273288</td>
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<tr>
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<td>269227</td>
<td>786</td>
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<td>0.006</td>
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<td>0.116</td>
<td>97.66</td>
<td></td>
</tr>
</tbody>
</table>

Showing 20 to 35 of 98 entries

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### Table 2: Alarm Summary

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Coil ID</th>
<th>Auth</th>
<th>H</th>
<th>Alarm Value (Unit)</th>
<th>Alarm Limit (Unit)</th>
<th>Alarm Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr/20/2014 04:56:36</td>
<td>042493F</td>
<td>3104</td>
<td>100</td>
<td>16.52</td>
<td>0.051343 (mm)</td>
<td>Gauge offset (monitor vs control) above alarm limit</td>
</tr>
<tr>
<td>Apr/20/2014 04:56:37</td>
<td>042493F</td>
<td>3104</td>
<td>100</td>
<td>16.52</td>
<td>0.051311 (mm)</td>
<td>Monitor gauge deviation mean above alarm limit</td>
</tr>
<tr>
<td>Apr/20/2014 09:23:37</td>
<td>042389F</td>
<td>3104</td>
<td>100</td>
<td>16.52</td>
<td>0.000006 (mm)</td>
<td>Gauge offset (monitor vs control) above alarm limit</td>
</tr>
<tr>
<td>Apr/20/2014 09:33:37</td>
<td>042389F</td>
<td>3104</td>
<td>100</td>
<td>16.52</td>
<td>0.000007 (mm)</td>
<td>Monitor gauge deviation mean above alarm limit</td>
</tr>
<tr>
<td>Apr/20/2014 09:23:37</td>
<td>042389F</td>
<td>3104</td>
<td>100</td>
<td>16.52</td>
<td>0.055505 (mm)</td>
<td>Gauge offset (monitor vs control) above alarm limit</td>
</tr>
<tr>
<td>Apr/20/2014 09:33:37</td>
<td>042389F</td>
<td>3104</td>
<td>100</td>
<td>16.52</td>
<td>0.055508 (mm)</td>
<td>Monitor gauge deviation mean above alarm limit</td>
</tr>
<tr>
<td>Apr/20/2014 09:33:37</td>
<td>042389F</td>
<td>3104</td>
<td>100</td>
<td>16.52</td>
<td>780.11 (ft)</td>
<td>Tail length above alarm limit</td>
</tr>
<tr>
<td>Apr/20/2014 09:33:37</td>
<td>042389F</td>
<td>3104</td>
<td>100</td>
<td>16.52</td>
<td>516.42 (ft)</td>
<td>Tail length above alarm limit</td>
</tr>
<tr>
<td>Apr/20/2014 09:33:37</td>
<td>042389F</td>
<td>3104</td>
<td>100</td>
<td>16.52</td>
<td>498.47 (ft)</td>
<td>Tail length above alarm limit</td>
</tr>
<tr>
<td>Apr/20/2014 09:33:37</td>
<td>042389F</td>
<td>3104</td>
<td>100</td>
<td>16.52</td>
<td>498.47 (ft)</td>
<td>Tail length above alarm limit</td>
</tr>
<tr>
<td>Apr/20/2014 09:33:37</td>
<td>042389F</td>
<td>3104</td>
<td>100</td>
<td>16.52</td>
<td>0.121114 (mm)</td>
<td>Gauge offset (monitor vs control) above alarm limit</td>
</tr>
<tr>
<td>Apr/20/2014 09:33:37</td>
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<td>3104</td>
<td>100</td>
<td>16.52</td>
<td>0.055 (mm)</td>
<td>Monitor gauge deviation mean above alarm limit</td>
</tr>
</tbody>
</table>
optiMize Web Report – Process Overview

- Configurable process parameters used to quickly get an overview of any process issue

**Process Overview**

**Machine ID**

| Start Time: 04/20/2014 00:00 | End Time: 04/22/2014 00:00 |

- **Last Stand Speed Mean (fpm)**
  - Max: 3675
  - Min: 1315
  - Mean: 2337
  - Median: 2109
  - Range: 2160
  - Std Dev: 1020
  - 3 Sigma: 3060

- **Exit Gauge Deviation 3 Sigma (mils)**
  - Max: 0.1356
  - Min: 0.0005
  - Mean: 0.0875
  - Median: 0.0893
  - Range: 0.1351
  - Std Dev: 0.0324
  - 3 Sigma: 0.0972
Production delays and scrap reported by operators are summarised in bar charts and detailed in a table.
Data export (csv) of production and process feature enables data analysis in other software packages.

**Export Configuration**

Select the required signals by clicking and dragging them over to "Export Items". If you would like to save this configuration for later use, click the "Save" checkbox and give the export a save name, then click submit.

Available Signals
- Bin
- Available Signals
  - PDI
    - Coil ID
    - Crew ID
    - Entry Gauge
    - Exit Gauge
    - Exit Width
    - External ID
    - Lot No
    - Mill Speed Target
    - Operation
    - Top Backup Roll Diameter
    - Top Backup Roll ID
    - Work Roll Diameter
    - Work Roll ID
- Gauge Statistics
  - Blip-out Length
  - BOC Length
  - Entry Strip BOC Mean Speed
  - Entry Strip Max Speed
  - Entry Strip Mean Speed

Export Items
- End Time
- Start Time
- Aoy
- Gauge Tolerance
- Time Between Cols
- General Data
  - Coil Length
  - Coil Diameter

Save Configuration
- Name: ExportConfiguration

Large data sets may take several minutes to be retrieved, please wait until a box which looks similar to the one below appears.
Testimonials & References
constellium optiMize system

produced reports to assist with tracking performance and identifying equipment issues. We use optiMize daily to produce SPC charts using the Group Analysis tool. Process and electrical engineers use it for in-depth problem analysis. The optiMize system has proven to be invaluable for identifying and controlling key process variables at our five stand tandem mill.

joey bain, five stand mill superintendent
constellium

what our customer’s say – production management

production management uses the optiMize tools on a daily basis. the detailed web-based production reports are projected in the morning meeting to identify key production and quality issues and to direct any necessary corrective actions.
optimAI process technology Ltd was originally commissioned to replace an existing gauge monitoring tool with the optiMize system. The finished product far exceeded expectations when it was implemented back in 2007. Since then the system has been expanded to include key process variables, process evaluations, alarms/alerts and trending. The system is dynamic – if a variable (analog, digital or virtual signal) is captured it can be displayed and analyzed. Data storage and retrieval is fast and reliable.

The real beauty of the optiMize system is with a ten minute demo anyone can begin to use the tool effectively to analyze data. Constellium has implemented optiMize throughout the plant and relies heavily on it to monitor and maintain product quality. It is an integral part of our Electronic Lot Ticket System and SAP Quality Module.

Shelley Wolf, Senior Systems Engineer
Constellium
This is a powerful system which can provide us extensive tools for tracking the process, finding and solving process failures. This system improves my work efficiency and I use optiMize on a daily basis. It can search and track the coil through the whole process. By using different tools in the system, we can analyse gauge deviation issues and track the root cause.

For process follow up, we can select some coils (filter by gauge/ alloy etc. wide range of criteria) produced in a certain period, then use the group statistics tool to monitor the trend and find if there are any problems, such as gauge performance, flatness performance, etc. We also use the alarm mail facility to create process/production alarms. optiMize will automatically send alarm emails to the related person if any key process values are out of control set point.

Maria Dong, Process Department
Gränges Shanghai
### optiMize – References

#### Europe

- **Gränges AB (Sweden):**
  - 3 DC Casters
  - 1 Slab Scalper (Sold – to be installed)
  - 5 Homogenising furnaces
  - 16 Pre-heating furnaces
  - 1 Reversing hot mill
  - 1 Two stand finish hot mill
  - 1 Two stand cold mill
  - 2 Single stand cold mills
  - 6 Annealing furnaces
  - 6 Slitters (Sold – to be installed)
  - 1 Leveller (Sold – to be installed)
  - Material Testing (Sold – to be installed)

- **Novelis Rogerstone (UK):**
  - 1 Three stand cold mill
  - 1 Single stand cold mill

- **Novelis Bridgnorth (UK):**
  - 2 Single stand foil mills

*The Novelis plants are now closed*

#### Asia

- **Gränges Shanghai Ltd (China):**
  - 1 Reversing/finishing hot mill
  - 1 Two stand cold mill
  - 3 Single stand cold mills
  - 2 Tension levellers
  - 2 Heavy gauge Slitters
  - 5 Light gauge Slitters

- **Qixing (China):**
  - 1 Reversing hot mill
  - 1 Reversing/finishing hot mill

- **Huafeng (China):**
  - 1 single stand cold mill
  - 4 light gauge slitters

#### USA

- **Constellium, AL:**
  - 2 Reversing hot mills
  - 1 Four stand finishing hot mill
  - 1 Five stand cold mill
  - 1 Three stand cold mill
  - 1 Two stand cold mill
  - 1 Single stand cold mill
  - 2 Edge Slitters
  - 1 Coating line

- **SSAB, AL:**
  - 1 Reversing Steckel mill

- **SSAB, IO:**
  - 1 Reversing Steckel mill

### Summary

- **System is currently installed and active on 60 machines**
- **Installations on 7 new machines to start later this year and early next year (2017)**