



The PI System in Product Genealogy and Machine Learning

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Agenda

- Business Challenges to tackle
- The PI System for Continuous Slab Casting
- Using Machine Learning with Haul Trucks
- Conclusion

Integrated Steel Mill

Continuous Steel Casting



Problems/Reason

Tracking product quality is challenging due to variable speed of the caster. Huge savings by identifying issues and preventing equipment failure (e.g. caster breakout).

Specific Capabilities

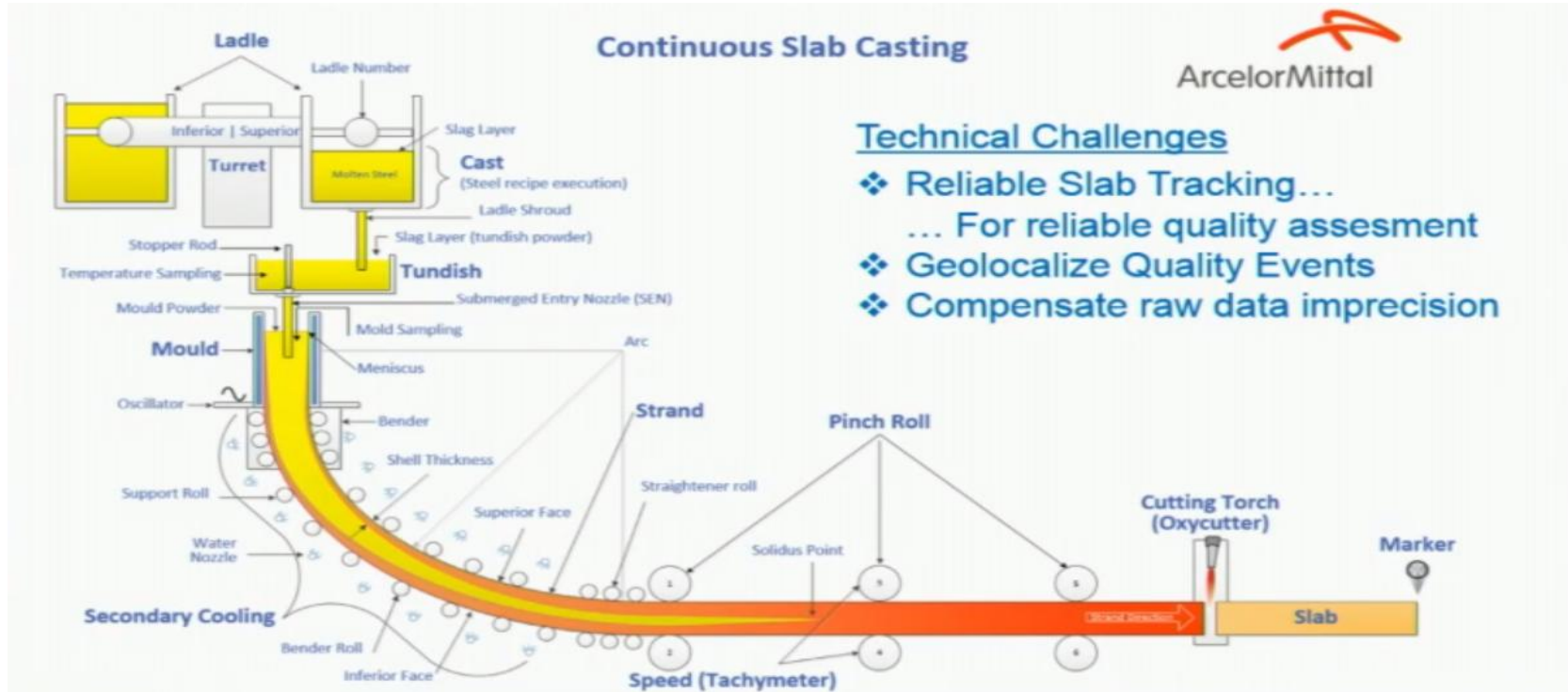
- 1) Tracking product through the caster
- 2) Identifying important events
- 3) Quick and reliable visualization

Change

Engineers can fix issues on the caster before a serious problem occurs

- Slow down to prevent breakout
- Potential to cut slab and sell before quality problem appears

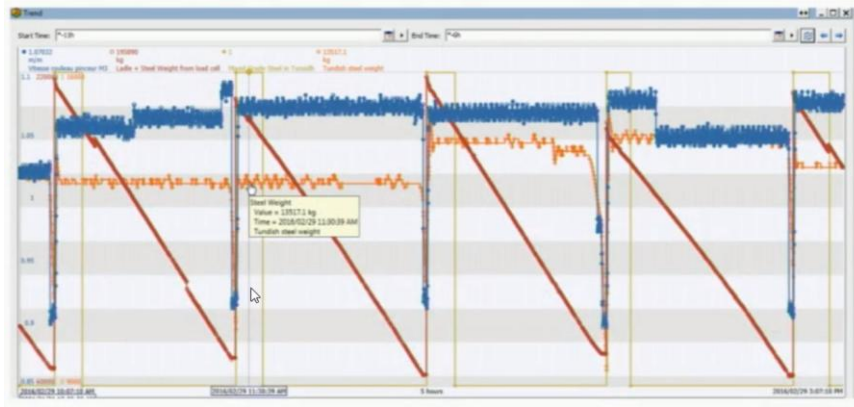
Continuous Slab Casting .. challenges



OSIsoft UC 2016 - Slab Casting Automation – Contextualize Raw Data into Operational Intelligence

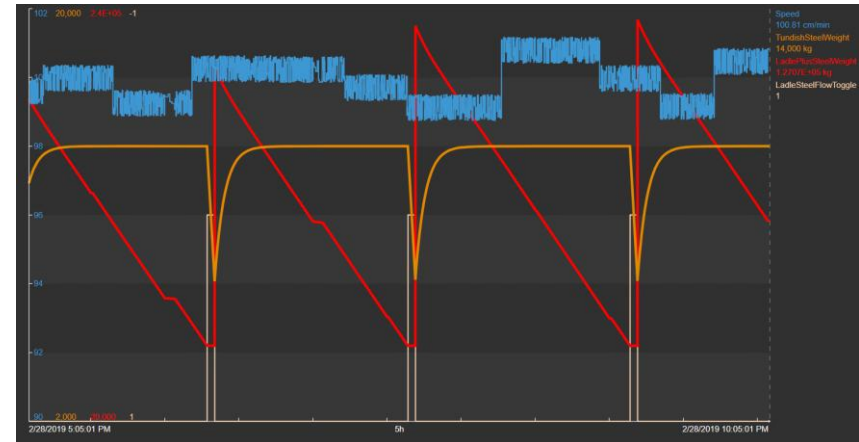
<https://www.osisoft.com/Presentations/Slab-Casting-Automation-%E2%80%93-Contextualize-Raw-Data-into-Operational-Intelligence/>

Continuous Slab Casting .. challenges



Screenshot from ArcelorMittal presentation

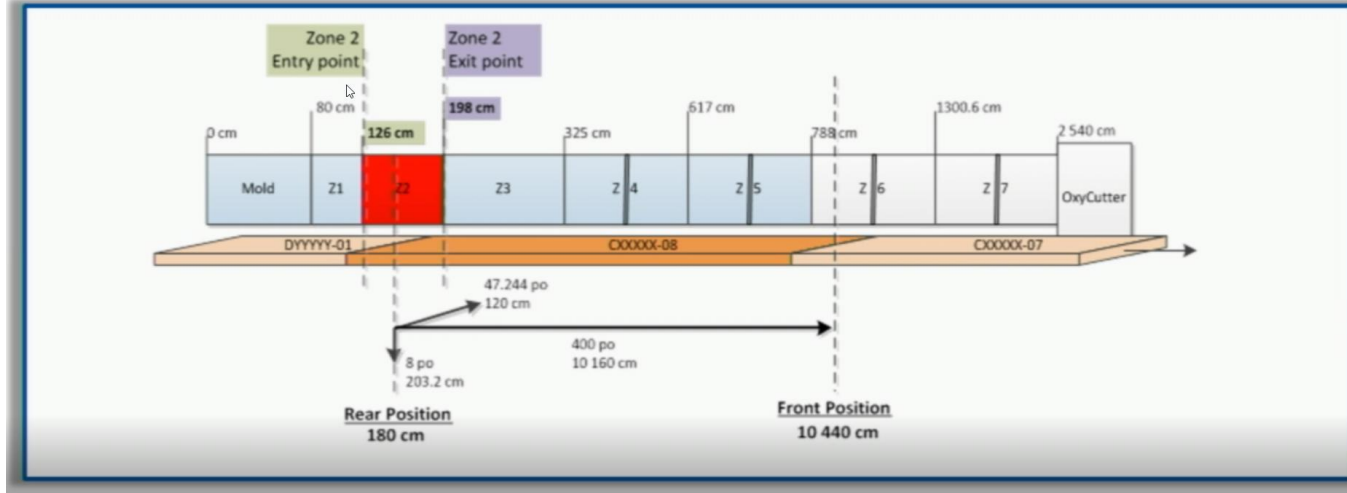
Raw data from our
Caster process simulation



Continuous Slab Casting .. Its all about Quality

Correlate time-context data from Event Frames

Its all about **Quality!**



Continuous Slab Casting .. Its all about Quality

Correlate time-context data from Event Frames

Its all about **Quality!**



DEMO

What is Predictive Maintenance?

- **Definition**

- A maintenance strategy driven by predictive analytics.

- **Features**

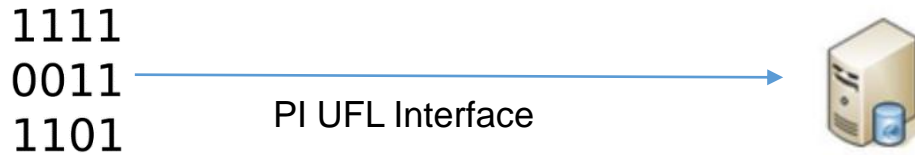
- Maintenance frequency is kept to a minimum
 - Requires condition monitoring

- **Advantages**

- Cost and Savings

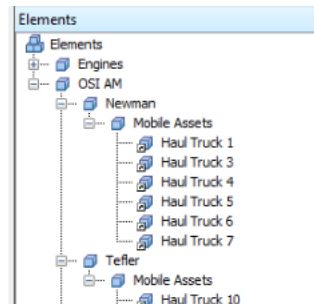
The Data

- 100 Engines
- 21 sensors



PI Asset Framework Hierarchy

- Modeled 12 Engines into Trucks
- Data Replay/Loop
- Event Frames



Name	Expression	Value at Evaluation	Value at Last Trigg	Output Attribute	
Now	<code>Int('*')</code>			Map	⊗
StartTime	<code>Int('Start Time')</code>			Map	⊗
Name	Expression	Value at Evaluation	Value at Last Trigg	Output Attribute	
Variable1	<code>PrevVal('setting1', Int('*'))-Time Difference'*86400)</code>			setting1	⊗ ^
Variable2	<code>PrevVal('setting2', Int('*'))-Time Difference'*86400)</code>			setting2	⊗
ResetCheck	<code>If BadVal('Reset') Then 1 Else If 'Reset' = 1 Then 0 Else NoOutput()</code>			Reset	⊗

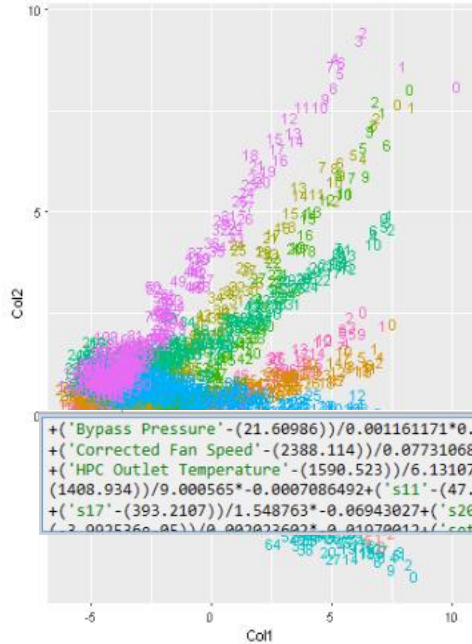


Machine Learning

- Azure Machine Learning Studio
 - In house functions
 - R programming
- Principal Component Analysis
 - Definition: Dimension-reduction tool used to reduce a large set of variables to a smaller set that still contains most of the information.
 - 21 variables \longrightarrow 2 variables

Machine Learning

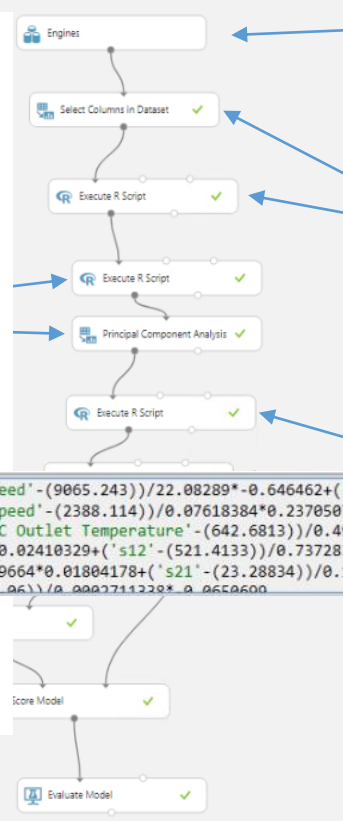
Graphics



factor(dataset1.ID_)

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

```
+('Bypass Pressure'-(21.60986))/0.001161171*0.04883092+('Core Speed'-(9065.243))/22.08289*-0.646462+('Corrected Core Speed'-(8143.753))/19.0761*-0.6705662
+('Corrected Fan Speed'-(2388.114))/0.07731068*0.2183571+('Fan Speed'-(2388.114))/0.07618384*0.2370507+('HPC Outlet Pressure'-(553.3684))/0.8847496*-0.06196883
+('HPC Outlet Temperature'-(1590.523))/6.131077*-0.06882387+('LPC Outlet Temperature'-(642.6813))/0.4997372*-0.009705514+('LPT Outlet Temperature'-(1408.934))/9.000565*-0.0007086492+('s11'-(47.54069))/0.2656701*0.02410329+('s12'-(521.4133))/0.737283*-0.0734451+('s15'-(8.453897))/0.04083235*-0.03617742
+('s17'-(393.2107))/1.548763*-0.06943027+('s20'-(38.8155))/0.1789664*0.01804178+('s21'-(23.28834))/0.10829*0.02113708+('setting1'-(2.003526*-0.95))/0.002023603*0.01070013+('setting2'-(2.658631*-0.95))/0.0007711228*0.0650600
```



Dataset

Data
Cleaning
and
Structuring

Finding out

DEMO

Questions?

Please wait for
the **microphone**

State your
name & company



Please remember

TO DOWNLOAD
APP, SEARCH
OSISOFT



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Google Play



PARTNER & PRODUCT EXPO

Today's Expo Hours
10:00 AM – 7:00 PM
Golden Gate and Yosemite



PARTNER & PRODUCT EXPO RECEPTION

5:00 – 7:00 PM

Located in both expo halls

Join us for appetizers and refreshments!

USER GROUP MEETINGS & INDUSTRY MEETUPS

taking place in most industry tracks
at end of day

All are welcome!

Refer to mobile app for exact location and timing

GET READY FOR DAY 3 !

HILTON

- Opening Session & Product Track
- Best Practices Track
- Partner Marketplace Showcase

PARC 55

- Developer Track & Tech Talks
- PI Security Workshop – Not just for Security Gurus!



TRAINING LABS START TOMORROW

All labs require pre-registration

*Check the back of your badge for room locations
and visit the registration desk with any questions!*

