Rapid Deployment of an Operational Intelligence Infrastructure with Asset Framework and Event Frames

Presented by Mark Massey, Tate & Lyle

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Tate & Lyle overview

- Founded in the UK in the mid 19th century, the Tate and Lyle businesses merged to form Tate & Lyle in 1921
- Headquarters in London and listed on London Stock Exchange:
  - constituent of FTSE 250
  - market capitalisation of £3.7 billion[1]
- Business built on Core Values of Safety, Respect and Integrity
- Operations including production facilities and laboratories in more than 30 countries
- Over 4,500 employees worldwide
- Sales of £3.2 billion[2] and adjusted profit before tax of £322 million[2][3]
- Over 70% of sales into food and beverage market
- Customers include many of the world's largest food and beverage manufacturers, and industrial and pharmaceutical businesses.

[1] At 11 June 2014
[2] For financial year ended 31 March 2014
[3] Excluding exceptional items and amortisation of acquired intangible assets and net retirement benefit interest

Tate & Lyle's locations

- SFI Production Facility
- SFI Regional Sales office
- BI Sites
- Global Shared Services

1) **US BI Sites:**
- Coles, IL
- Cowden, IL
- Dayton, OH
- Decatur, IL
- 1 Duluth, MN
- Findlay, IL
- Fowler, IN
- Francesville, IN
- Heyworth, IL
- Lafayette, IN
- Loudon, TN
- Mattoon, IL
- Parnell, IL
- Pittwood, IL
- Wapella, IL
- Watseka, IL
- Wilmington, DE

1. Chicago, IL *Commercial and food innovation centre*
2. Mexico City, Mexico Applications lab
3. Sao Paulo, Brazil *Regional sales office / lab*
4. Buenos Aires, Argentina *Applications lab*
5. Lille, France *Innovation centre*
6. Moscow, Russia *Regional sales office / Food systems*
7. Shanghai, China *Regional sales office / Lab*
8. Melbourne, AU *Applications lab*

1. Sycamore, IL *Food systems*
2. Van Buren, AR *Speciality starc*
3. Mcintosh, AL *Sucralose*
4. Sagamore, IN *Speciality starch*
5. Houlton, ME *Speciality starch*
6. Mold, UK *Food Systems*
7. Koog, NL *Speciality Starch*
8. Lubeck, Germany *Food Systems / Innovation centre*
9. Noto, Ossono, Bergamo, Italy *Food systems/Applications lab*
10. Singapore *Sucralose / Applications lab*
11. Brisbane, AU *Food Systems*
12. Johannesburg, SA *Food Systems*
13. Kimstad, Sweden *SFI , Tate & Lyle Oat Ingredients*
14. Suqian, China *Food Systems, Jiangsu Province, China*
Xuzhou, China *Food Systems applications lab*

2. Almex, Mexico
3. Casablanca, Morocco
4. Boleraz, Slovakia
5. Hungrana Hungary
6. Razgrad, Bulgaria
7. Adana, Turkey
1 Lodz, Poland
1 Head office / SFI Headquarters

Tate & Lyle's ingredients portfolio

Speciality Food Ingredients

Sales £983m[1] Adjusted Operating Profit £213m[1][2]

Starch-based Speciality Ingredients

- Speciality starches
- Speciality sweeteners
- Speciality fibres


High-Intensity Sweeteners

- SPLENDA® Sucralose
- PUREFRUIT™ monk fruit extract
- TASTEVA® Stevia Sweetener
- DOLCIA PRIMA Allulose

Food Systems

- Dairy stabilizer systems
- "Bespoke" blending


Bulk Ingredients

Sales £2,164m[1] Adjusted Operating Profit £172m[1][2]

US Sweeteners

- Corn syrups
- Dextrose
- Glucose


EU Sweeteners

- Corn syrups
- Dextrose
- Glucose


Industrial and other

- Starches for paper and paperboard
- Acidulants/fermentation/bio-based products and ethanol
- Corn co-products incl. animal feed


[1] For financial year ended 31 March 2014, [2] Excluding exceptional items and amortisation of acquired intangible assets

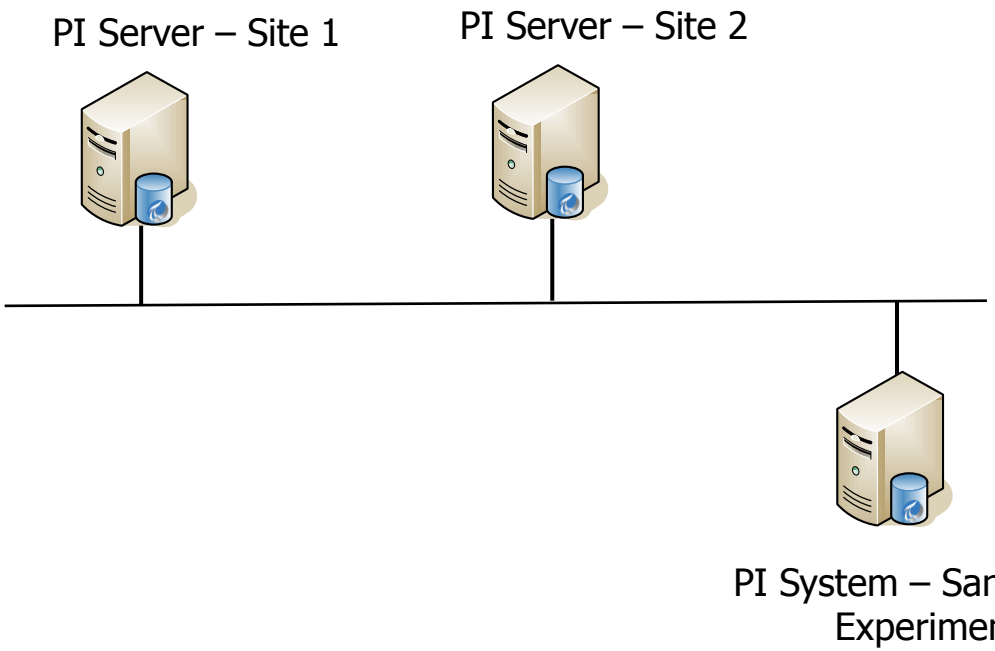
Tate & Lyle serves major customers worldwide

PI System at Tate & Lyle

- Tate & Lyle standardized on the PI System in 2000
- The PI System consists of 19 historian servers at 16 sites
  - Each site has a local PI Administrator but, in the past, little central oversight
  - 486,000 licensed tags
  - 57 interfaces
  - Centralized PI Server in Decatur, IL
  - Centralized PI Server in London, UK
- All servers running pre-PI Server 2010
- Primary tools in use are PI ProcessBook and PI DataLink
- Operations heavily relies on the PI System as a decision driver

"How can we move from being data consumers to information innovators?"

PI System Sandbox



Win 2008 R2 or Win 2012 (80GB disk and 16GB RAM)

Office Excel 64 bit - 2010 or 2013
PowerPivot or PowerView

PI Server (vCampus license is OK)
SQL 2012 (SQL Express is OK)
AF 2014 R2 (Server and Client)
EFGen
SMT
PI Builder
PI OLEDB Enterprise
PI DataLink 2014
PI ProcessBook 2014
PI Coresight 2014

Rapid Insights

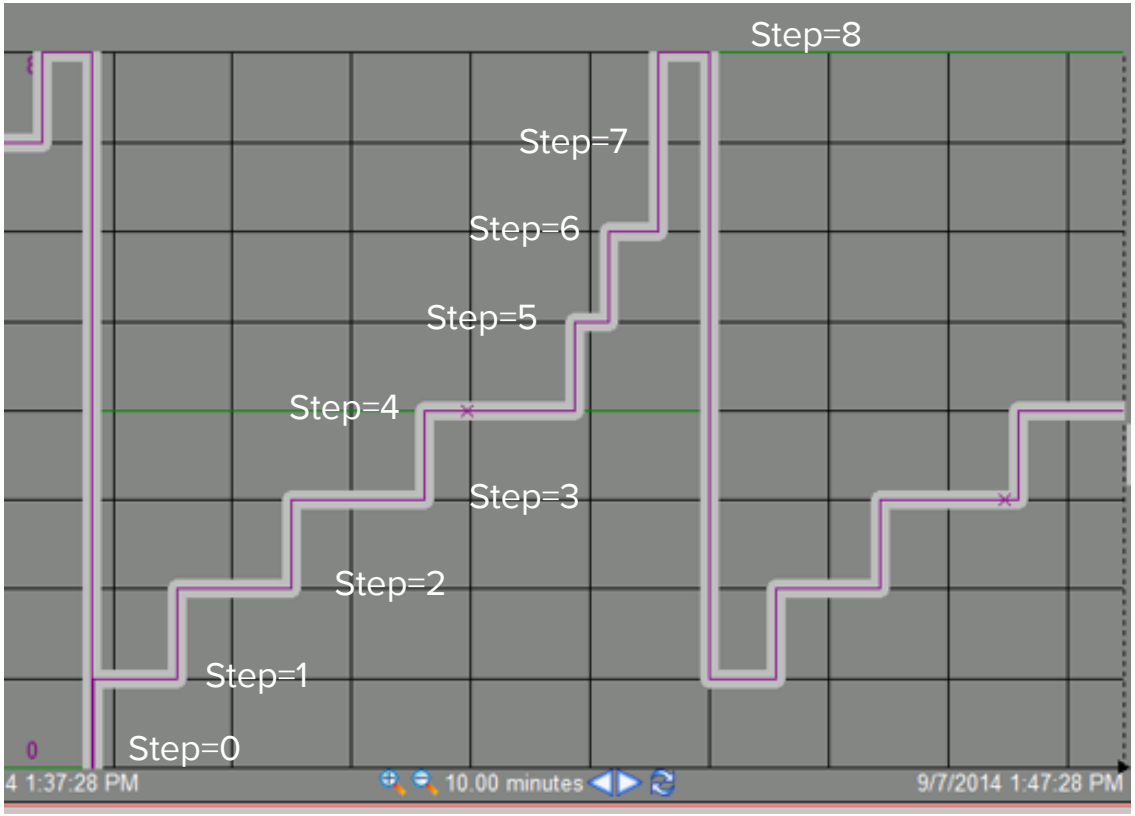
- Where is the process spending time?
- How can I monitor key metrics?
- Where are the downtimes? What is the OEE?
- How can I track energy?
- How can I improve throughput?
- … … … …
- Show me – by product, by process cycle, by day…
- Can the new tools bring any insight into my process?

And, we need all this in 2 weeks…

Project Charter

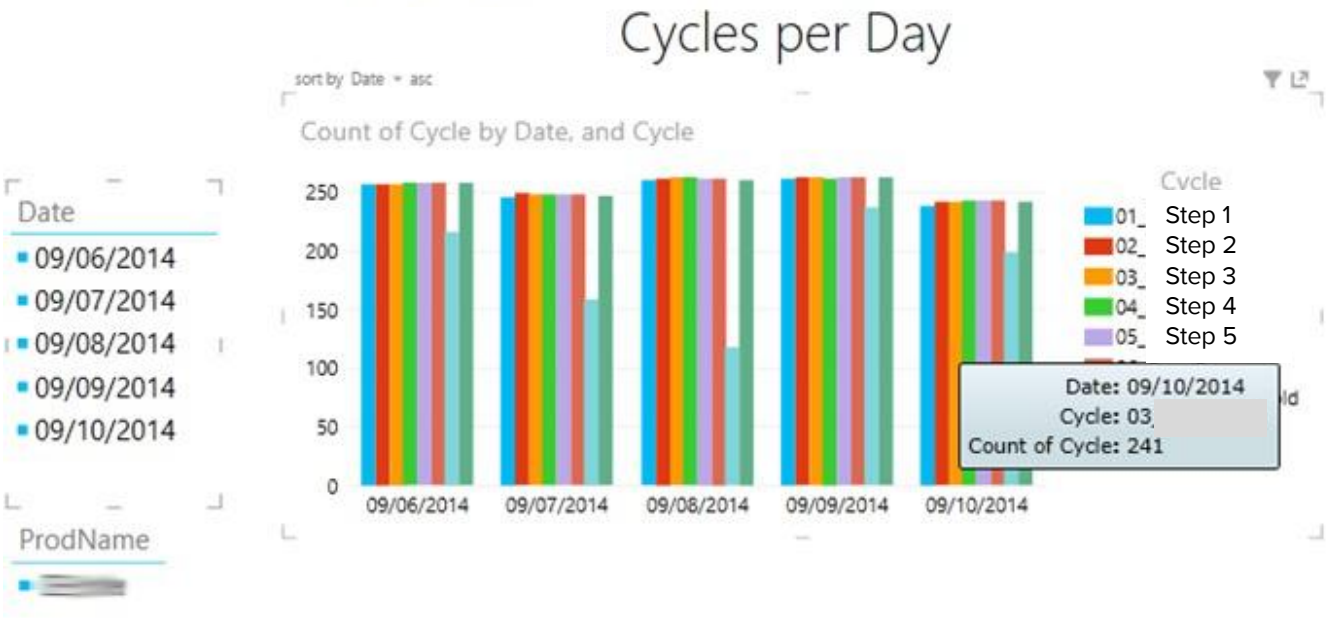
- Creating an agreed upon objective by stakeholders
  - Objective:
  - To increase the total pounds of product through the process by getting greater efficiency out of the batch operation.
  - The target improvement for this project is to generate a minimum of 5% daily increase in total product through the batch operation.
- Narrowing the scope of analysis to potential high yield opportunities
  - Improvement Opportunities
  - Reduce step 2 & 3 cycles times, while maintaining critical process specifications
- Data collection
  - Ensure critical data is flowing into the PI System, and that data was valid for analysis
- Outline any additional opportunities
  - Energy usage, process constraints and capacity, downtime analysis

Batch Operation



- PI ProcessBook view of the batch process.
- Extremely challenging to:
  - Accurately quantify comparative step times over a long period of time
  - Quickly detect excursions from optimum performance

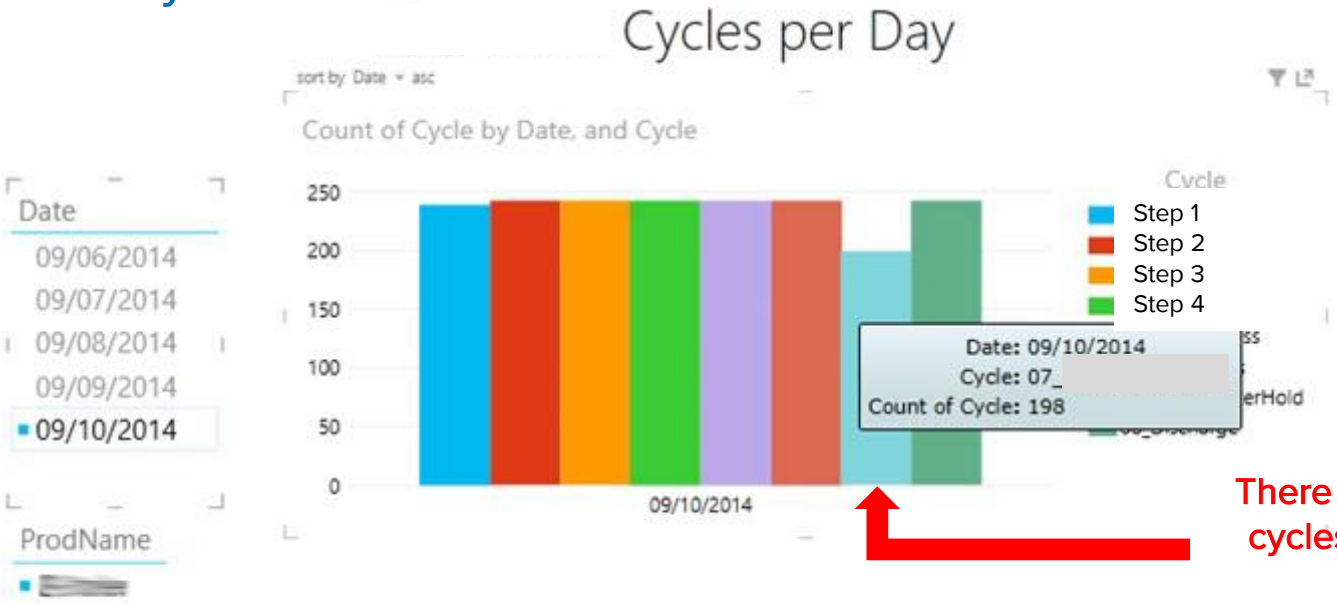
Batch Cycle Weekly Visualization



Date	Production
09/06/2014	519
09/07/2014	566
09/08/2014	521
09/09/2014	527
09/10/2014	537

Date	Downtime_Hours
09/06/2014	1.42
09/07/2014	2.33
09/08/2014	1.83
09/09/2014	1.75
09/10/2014	3.00

Batch Cycle Daily Visualization



There should be 0 cycles per day on this step

Date	Production
09/06/2014	519
09/07/2014	566
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Date	Downtime_Hours
09/06/2014	1.42
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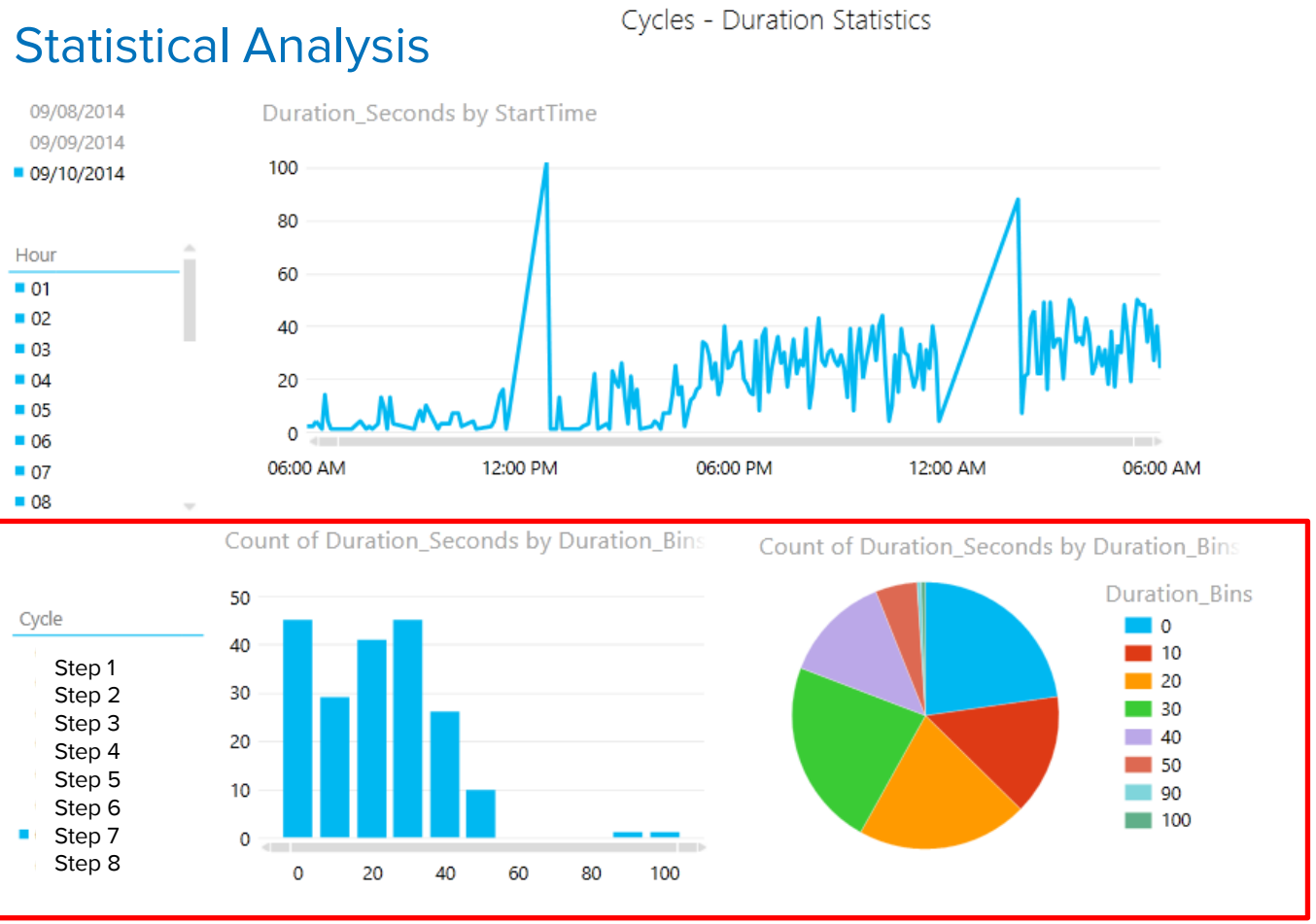
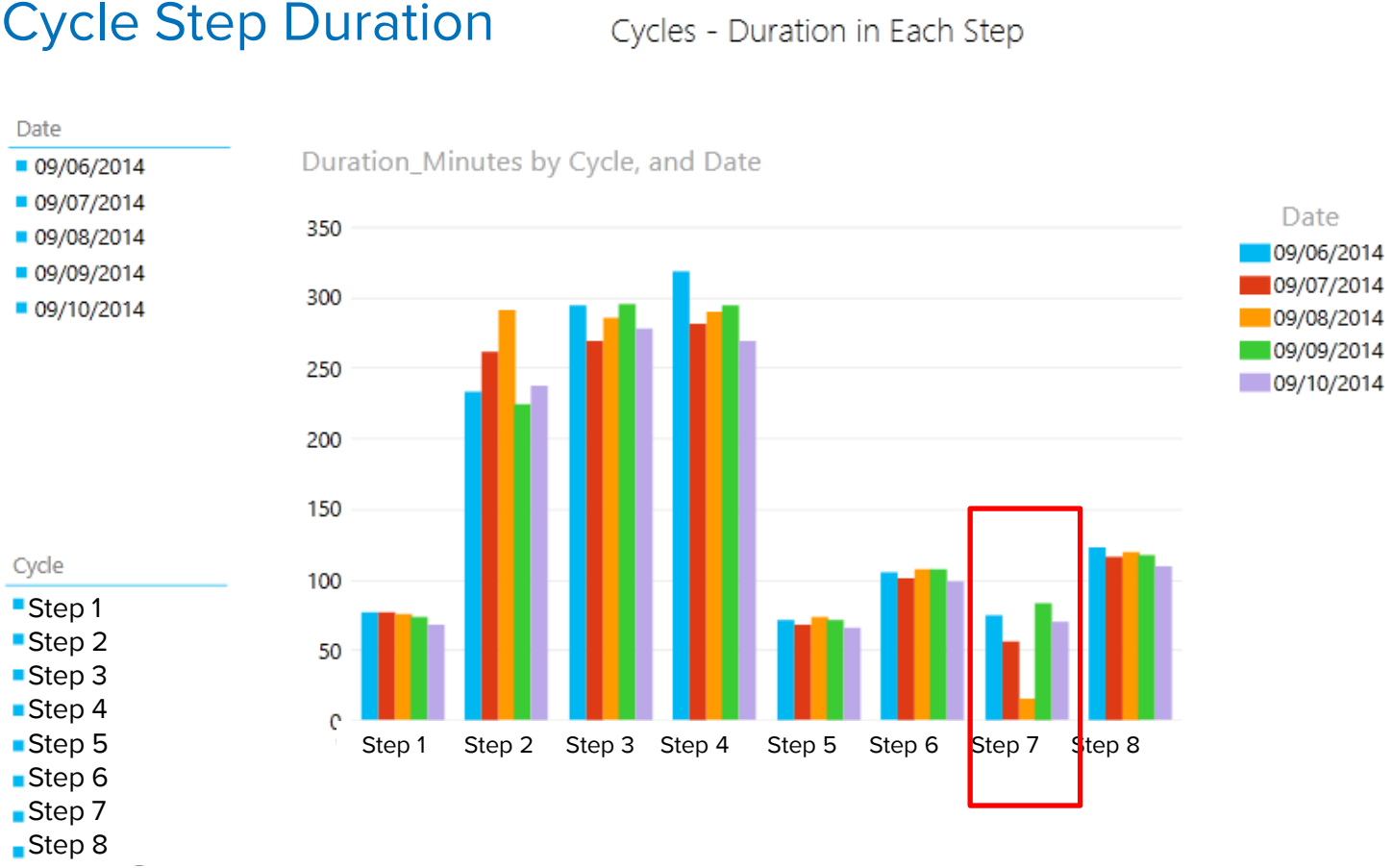
Batch Cycle Statistical Analysis



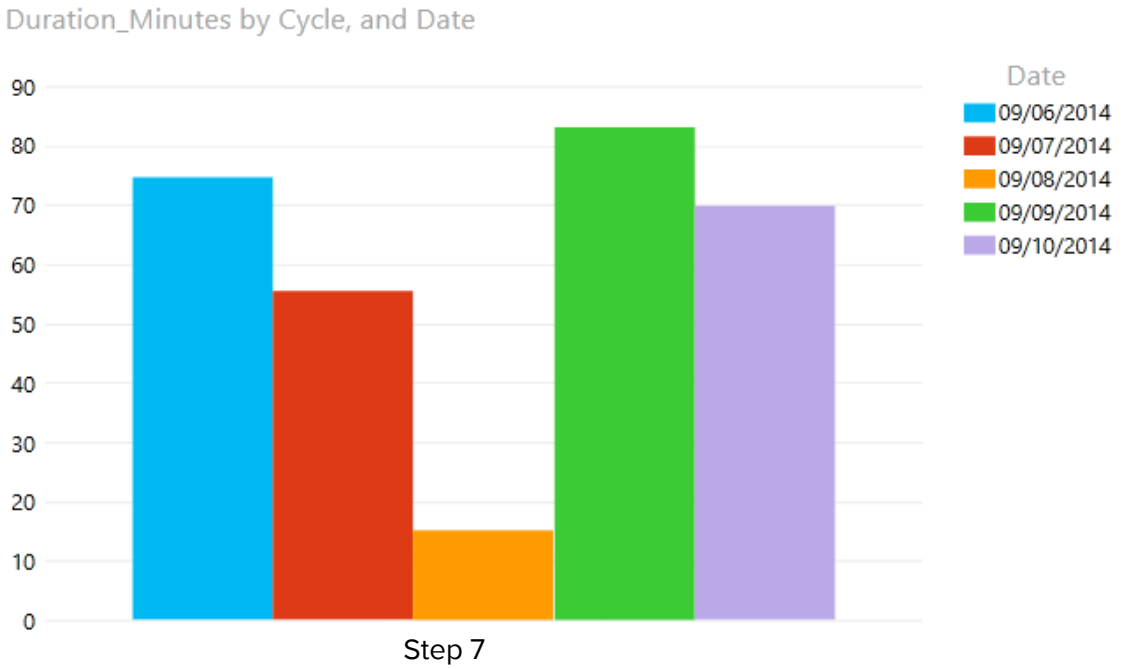
Batch Cycle Step Duration



Batch Cycle Step Duration

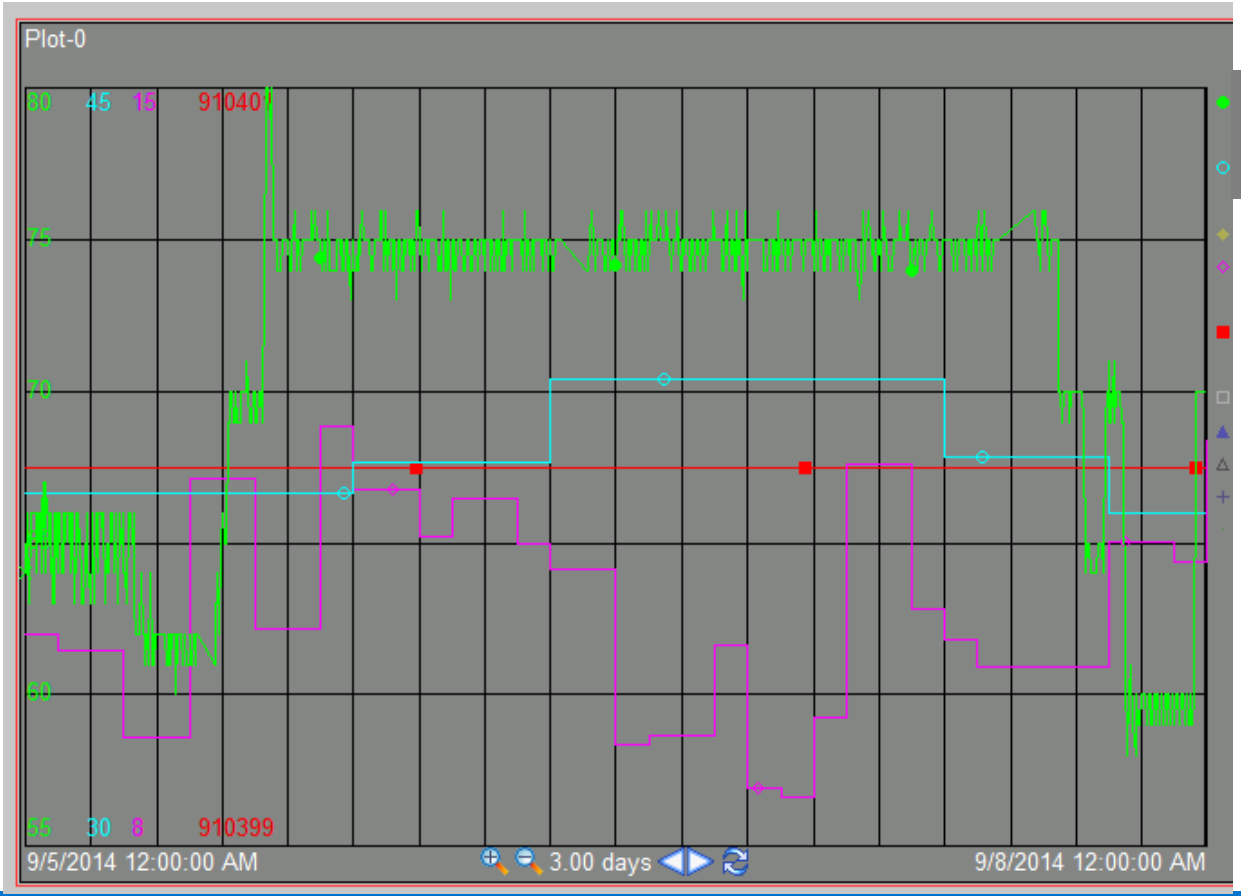
Cycles - Duration in Each Step

Date
- 09/06/2014
- 09/07/2014
- 09/08/2014
- 09/09/2014
- 09/10/2014



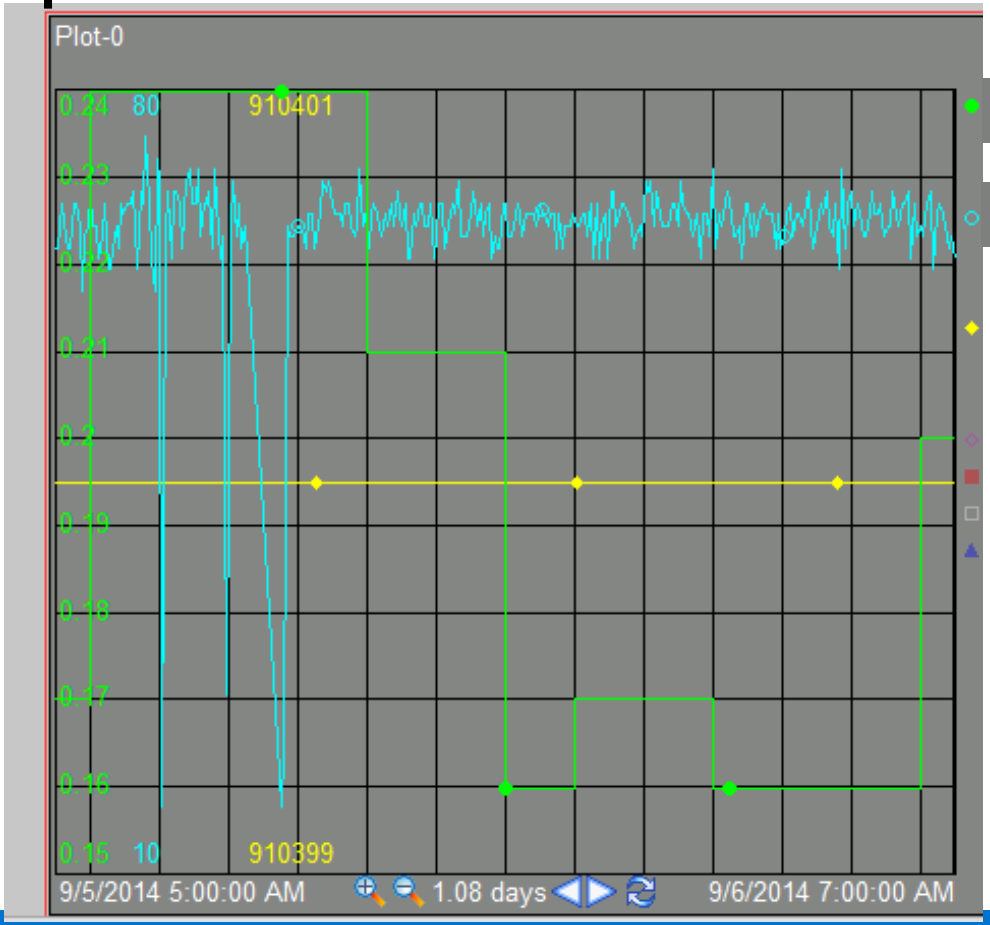
Cycle
- Step 1
- Step 2
- Step 3
- Step 4
- Step 5
- Step 6
- Step 7
- Step 8

Step 2 Process/Lab Data



The expected relationship between process operation changes did not have a direct relationship to the final product lab data.

Step 3 Process/Lab Data



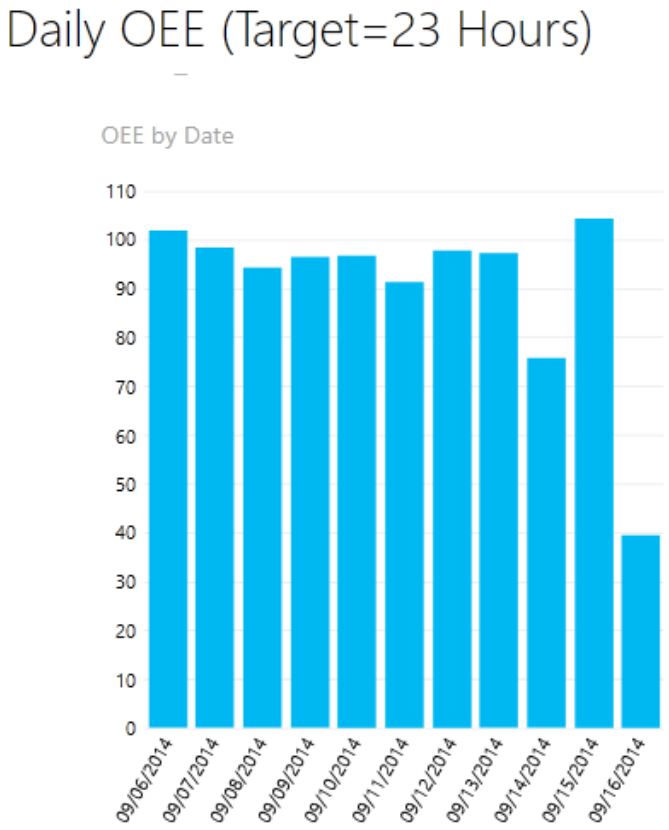
Lab Data

Process Data

Once again, the expected relationship between changes process data did not have a direct relationship to the final product lab data.

OEE Visualization

How available is the equipment?



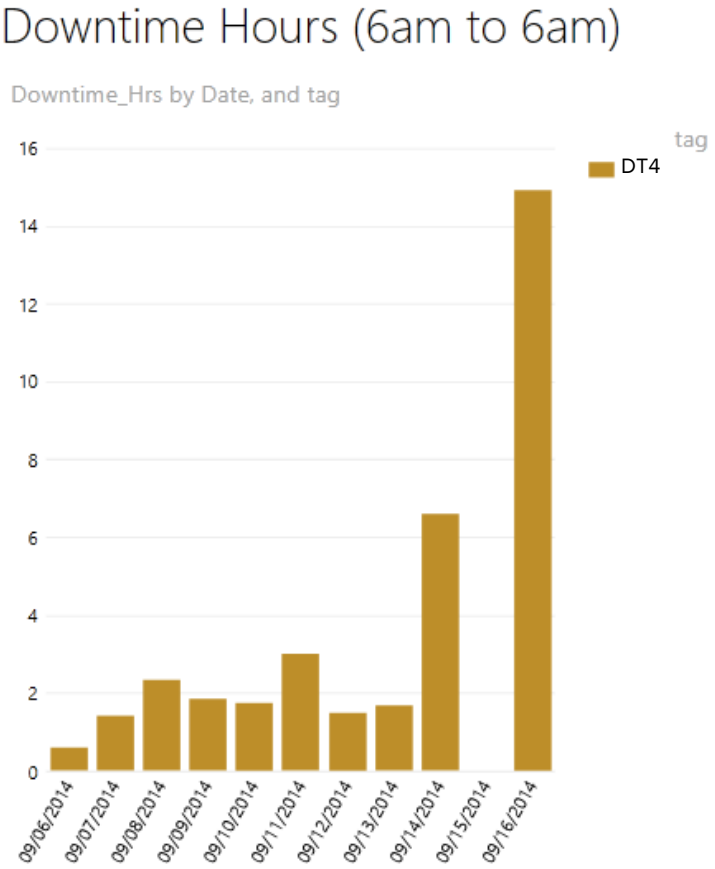
Downtime Breakdown

Item

- DT1
- DT2
- DT3
- DT4

Date

- 09/06/2014
- 09/07/2014
- 09/08/2014
- 09/09/2014
- 09/10/2014
- 09/11/2014
- 09/12/2014
- 09/13/2014
- 09/14/2014
- 09/15/2014
- 09/16/2014



What were we doing during our downtime?

Downtime Events

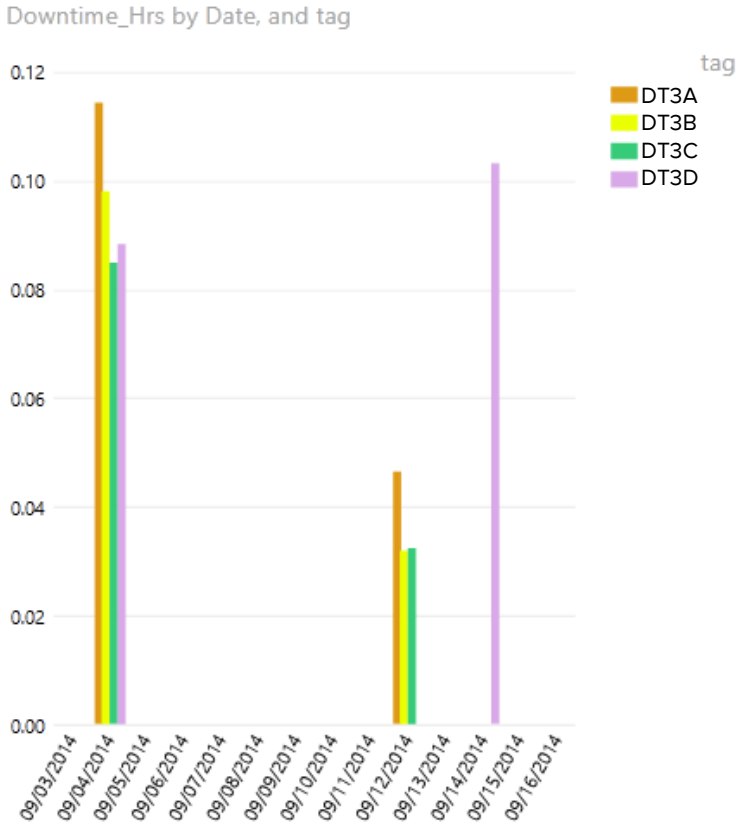
Item

- DT1
- DT2
- DT3
- DT4

Date

- 09/03/2014
- 09/04/2014
- 09/05/2014
- 09/06/2014
- 09/07/2014
- 09/08/2014
- 09/09/2014
- 09/10/2014
- 09/11/2014
- 09/12/2014
- 09/13/2014
- 09/14/2014
- 09/15/2014
- 09/16/2014

Downtime Hours (6am to 6am)



Did we accomplish all the tasks expected during our downtime?

How long did those tasks take?

Are those tasks consistent across production teams?

Daily Production Report

From: DoNotReply@OSIsoft_PINotif.com [mailto:DoNotReply@OSIsoft_PINotif.com]
Sent: Thursday, September 25, 2014 7:00 AM
To: [redacted]
Subject: Production KPIs] generated a new notification event.

Name: Daily Production KPIs

Trigger Time: 9/25/2014 6:00:00 AM Central Daylight Time (GMT-05:00:00)
Unit: Batch Operation

In the Last 24 hours:

Cycles = 259 count

Downtime = 2.583333 h

Feed 1 = 43062.45 US gal

Feed 2 = 20236.69 US gal

"Critical data should find stakeholders, not the other way around."

Daily Breakdown Report

From: DoNotReply@PINotif.com [mailto:DoNotReply@PINotif.com]
Sent: Thursday, September 25, 2014 8:00 AM
To: [redacted]
Subject: Maintenance] generated a new notification event.

Name: Daily Maintenance
Trigger Time: 9/25/2014 7:00:00 AM Central Daylight Time (GMT-05:00:00)
Target: Batch Operation

Batch **Downtime (6 am to 6 am):**

B1 : 0 min
B2 : 0 min
B3 : 73.38995 min

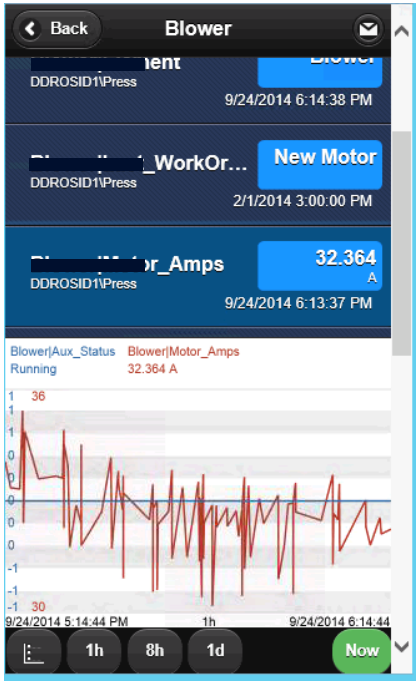
DT 24hr **(6 am to 6 am):**

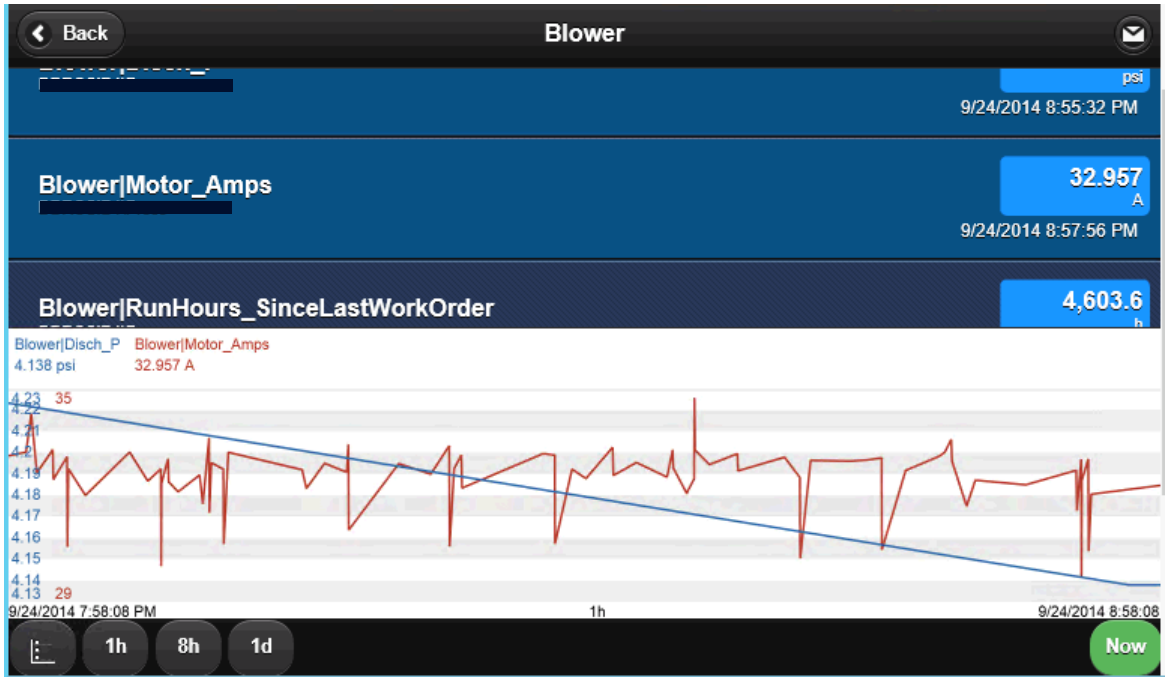
DT3A : 0 min
DT3B : 0 min

Blower

Blower Run Hours Since Last WO : 4627.563 Hours
Blower Number of Starts since Last WO : 87 Count

PI Coresight

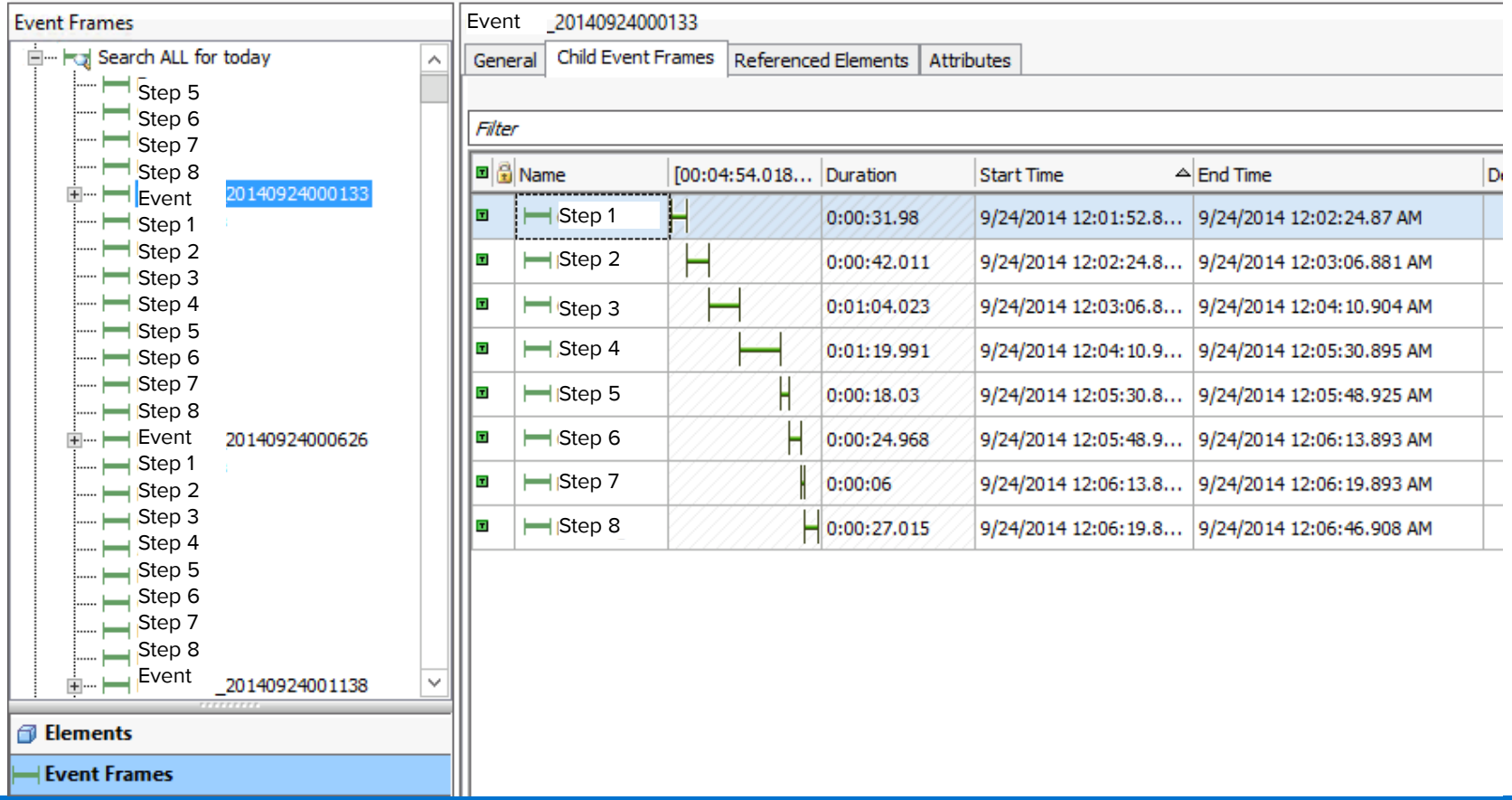




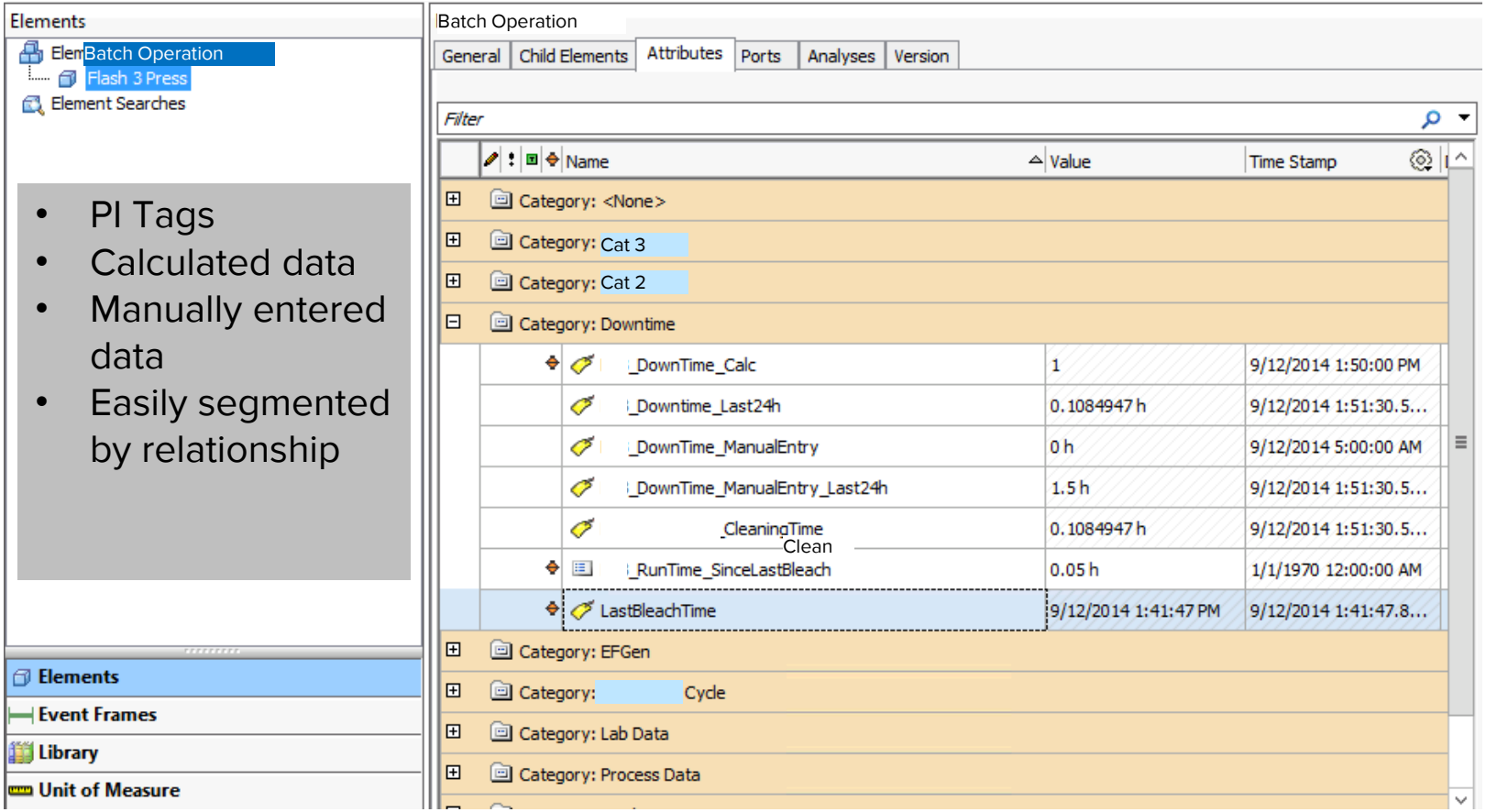
PI Coresight

PI Coresight

Event Frames



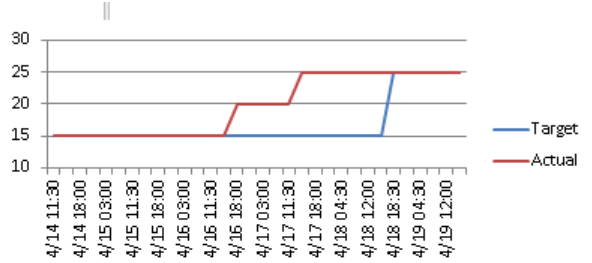
PI System Explorer

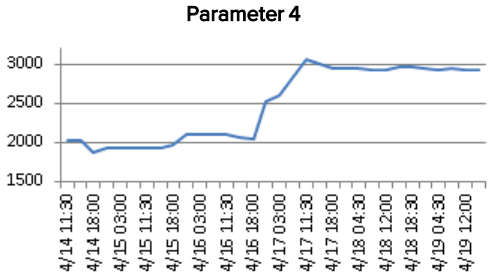


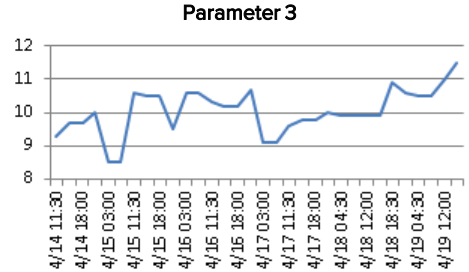
- PI Tags
- Calculated data
- Manually entered data
- Easily segmented by relationship

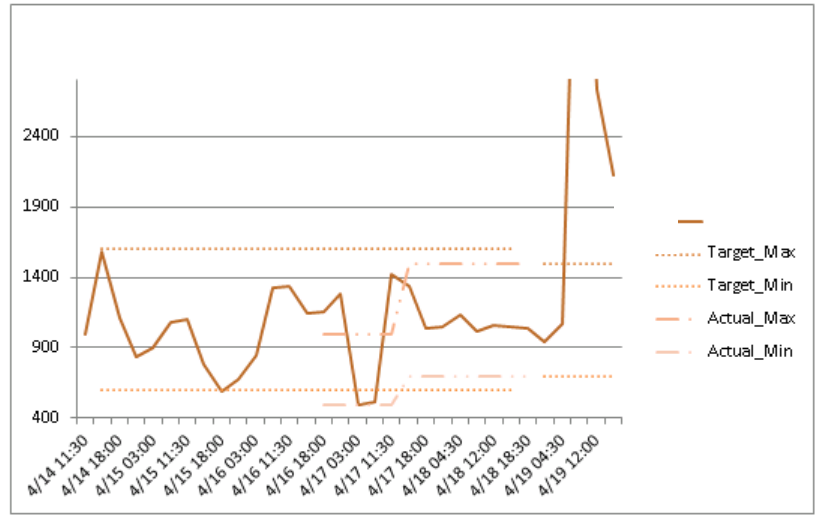
Product ABC – pH,

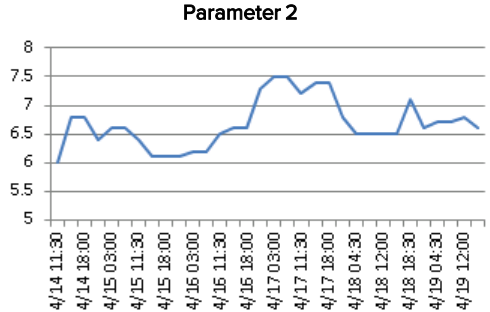
Month	Day	Parameter 1	Parameter 2	Parameter 3	Target	Actual
4	14	0.14	6.0	10	15	15
	15	0.16	6.5	11	25	20
	16	0.18	7.0	8		25
	17	0.20	7.5	9		
	18					
	19					

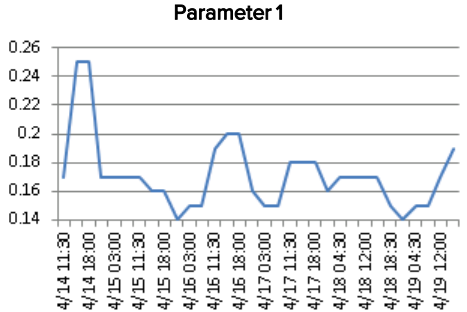












New Tools Used

- PI System Explorer
  - Created new databases for plants
- Asset Framework
  - Created Templates
  - Created Analysis
  - Created new UOMs (units of measure)
  - Created lookup tables
- Event Frame Generator
- Event Frames
  - Created new Event Frame Template and replicated to 3 additional units
- Notifications
  - Added Contacts
- PI Coresight

Project Results

- Within 2 weeks of presenting the data to operations, production increased by 7%, by refocusing on the PI System data analysis, surpassing our original target of a 5% increase.
- We were able to calculate the additional energy needed for the production increase and verify there were no constraints
- Downtime is automatically calculated
- Critical KPI's are received in daily emails
- The increase was achieved with no additional equipment or capital expenditure
- Calculated revenue increase between $300,000 and $500,000 annually
  - We have 15 of these units across the company!

- With these results in hand, we had quantifiable proof to share with critical stakeholders in the organization.

Post Project Results

- Since completing this project
  - We have attached our development server to other PI Servers to give the local administrators a hands on lab to work with
  - Created daily and monthly inventory notifications to critical ve… nd p… …nts
    - Created a Tank template to calculate levels, using raw and scaled values – use… …le sites
  - Replaced Excel reporting with Notifications for daily productio… …rts
  - Applied the batch template to 3 additional operations for ana… …s, in less than … days.

Name: Ingredient Inventory Daily Report
Trigger Time: 2/10/2015 6:00:00 AM Central Standard Time (GMT-06:00:00)

Starch			Vico		

Decatur Pla…
Monday, …

Day Shift Team - B, Night Shift Team - A

Wetmill			Refinery		
WParam1	244596	Bu	RParam1	245107	Bu
WParam2	188160	Bu	RParam2	20	Batches
WParam3	0.45	%	RParam3	3800000	lbs
WParam4	0.4	ml	RParam4	12	Batches
WParam5	0.28	ml	RParam5	2280000	lbs
WParam6	2.51	gal/Bu	RParam6	90000	lbs
WParam7	3.29	#ds/Bu	RParam7	385	GPM

Conclusion

- Time from start to finish, including software installation and data collection was 2 weeks
- Critical data is delivered to stakeholders, instead of stakeholders having to search for the data
- New tools highlighted an unanticipated opportunity
- Overall production levels have been elevated

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Questions

Please wait for the microphone before asking your questions

State your
name & company

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