Improving Process Efficiency with the PI System

Presented by **Ryan Lenihan**

World Leader in Resin Technology

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About the Presenter

- Ryan Lenihan
  - B.S. in Chemical Engineering from the University of Florida
  - AOC employee for 3 years
  - PI System User for 3 years

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About AOC

- **1961** – Alpha Corporation began resin production
- **1994** – AOC was formed through a joint venture with Owens Corning
- **1998** – Alpha Corporation purchased the Owens Corning interest in the company
- **Today** – We are a leading global supplier of resin chemistries

World Leader in Resin Technology

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AOC & Me – One Year Ago

- AOC's PI System
  - PI Data Archive 3.4.375.80 (12/2008)
  - Client tools: PI Datalink, PI ProcessBook, and PI BatchView

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The Upgrade

- Goals
  - Hardware upgrade
  - Seamless migration for end users
  - Leverage new PI System technologies
  - Increase the flow of information between locations

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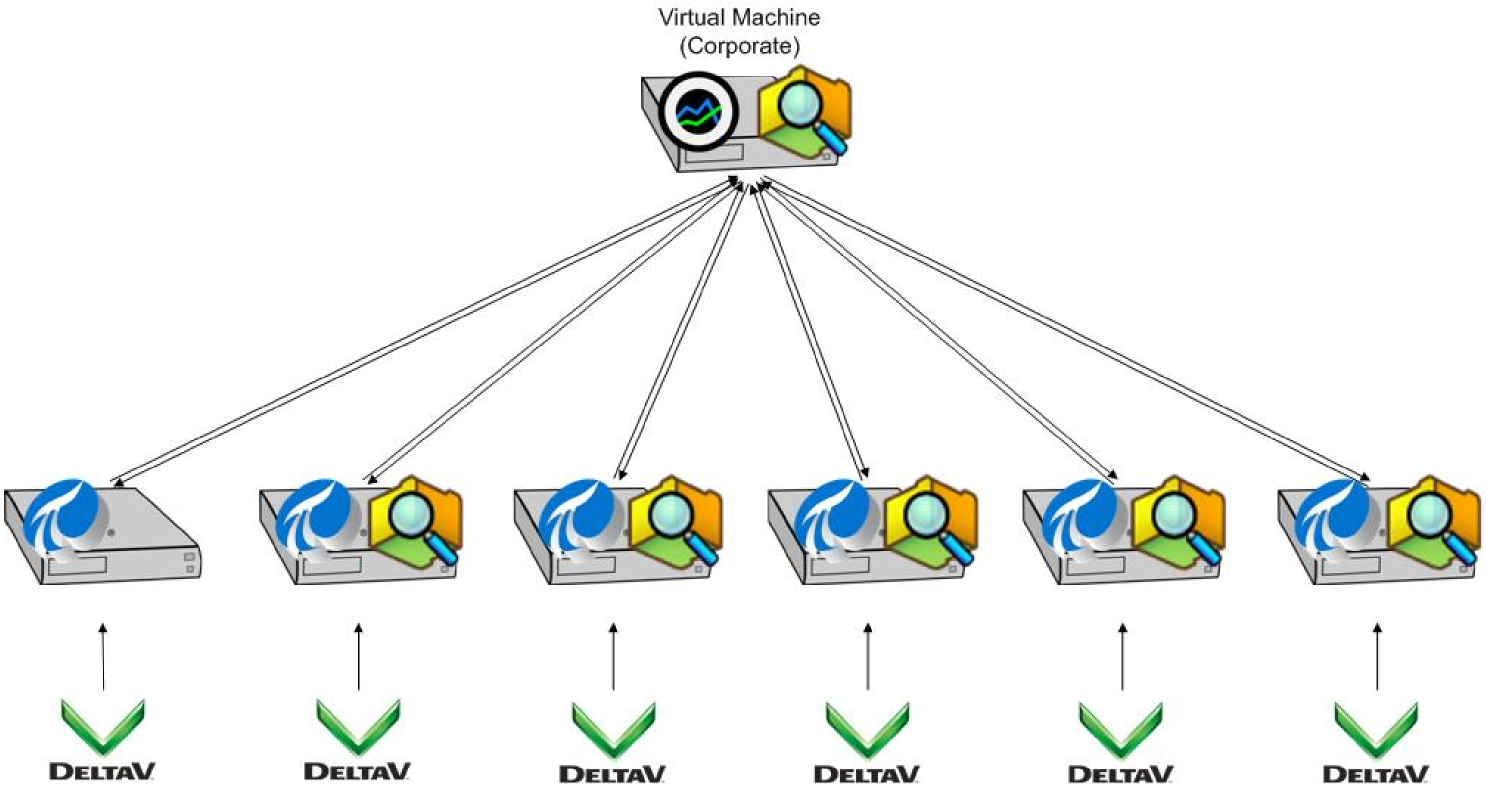
The Upgrade



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Building the Asset Framework

- PI Tag naming conventions follow the OPC instrument tag from DeltaV
  - *TIC-12304/PID1/PV.CV*
- To achieve a flow of information between plants, the information must be locatable
- Standardize!

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Building the Asset Framework

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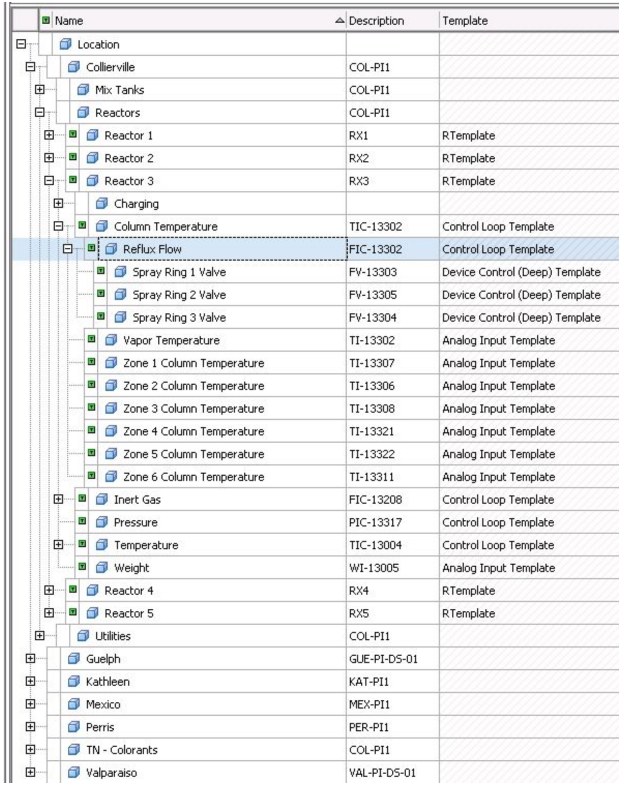
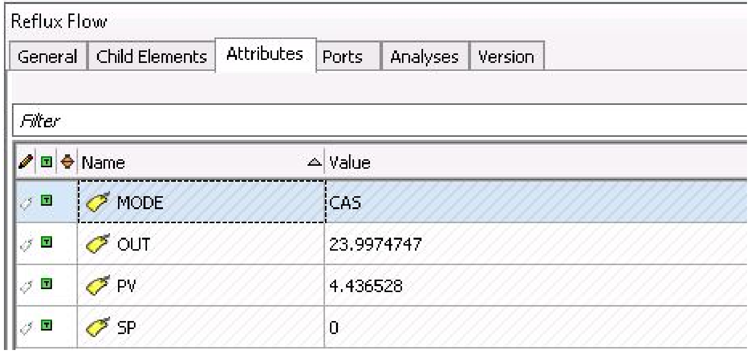
Building the Asset Framework



Name	Description	Template
Location		
Collierville	COL-PI1	
Mix Tanks	COL-PI1	
Reactors	COL-PI1	
Reactor 1	RX1	RTemplate
Reactor 2	RX2	RTemplate
Reactor 3	RX3	RTemplate
Charging		
Column Temperature	TIC-13302	Control Loop Template
Reflux Flow	FIC-13302	Control Loop Template
Spray Ring 1 Valve	FV-13303	Device Control (Deep) Template
Spray Ring 2 Valve	FV-13305	Device Control (Deep) Template
Spray Ring 3 Valve	FV-13304	Device Control (Deep) Template
Vapor Temperature	TI-13302	Analog Input Template
Zone 1 Column Temperature	TI-13307	Analog Input Template
Zone 2 Column Temperature	TI-13306	Analog Input Template
Zone 3 Column Temperature	TI-13308	Analog Input Template
Zone 4 Column Temperature	TI-13321	Analog Input Template
Zone 5 Column Temperature	TI-13322	Analog Input Template
Zone 6 Column Temperature	TI-13311	Analog Input Template
Inert Gas	FIC-13208	Control Loop Template
Pressure	PIC-13317	Control Loop Template
Temperature	TIC-13004	Control Loop Template
Weight	WI-13005	Analog Input Template
Reactor 4	RX4	RTemplate
Reactor 5	RX5	RTemplate
Utilities	COL-PI1	
Guelph	GUE-PI-DS-01	
Kathleen	KAT-PI1	
Mexico	MEX-PI1	
Perris	PER-PI1	
TN - Colorants	COL-PI1	
Valparaiso	VAL-PI-DS-01	



Reflux Flow

General | Child Elements | Attributes | Ports | Analyses | Version

Filter

Name	Value
MODE	CAS
OUT	23.9974747
PV	4.436528
SP	0

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Building the Asset Framework

- The complexity of the system in place can be daunting
  - Every control loop has 4 tracked parameters (*PV, SP, OUT, MODE*)
- Group the tags up into common groups
- Let templates do the heavy lifting

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Building the Asset Framework

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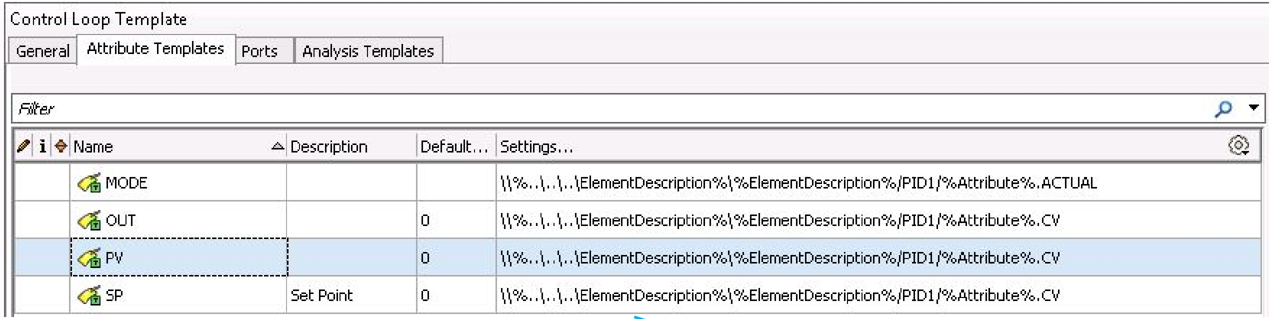
Building the Asset Framework

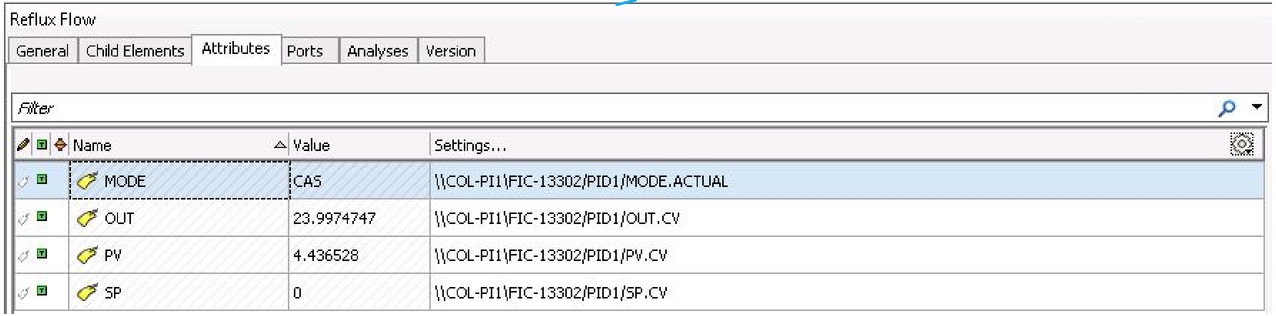


Control Loop Template

General | Attribute Templates | Ports | Analysis Templates

Filter

Name	Description	Default...	Settings...
MODE			\\%..\..\..\ElementDescription%\%ElementDescription%/PID1/%Attribute%.ACTUAL
OUT		0	\\%..\..\..\ElementDescription%\%ElementDescription%/PID1/%Attribute%.CV
PV		0	\\%..\..\..\ElementDescription%\%ElementDescription%/PID1/%Attribute%.CV
SP	Set Point	0	\\%..\..\..\ElementDescription%\%ElementDescription%/PID1/%Attribute%.CV



Reflux Flow

General | Child Elements | Attributes | Ports | Analyses | Version

Filter

Name	Value	Settings...
MODE	CAS	\\COL-PI1\FIC-13302/PID1/MODE.ACTUAL
OUT	23.9974747	\\COL-PI1\FIC-13302/PID1/OUT.CV
PV	4.436528	\\COL-PI1\FIC-13302/PID1/PV.CV
SP	0	\\COL-PI1\FIC-13302/PID1/SP.CV

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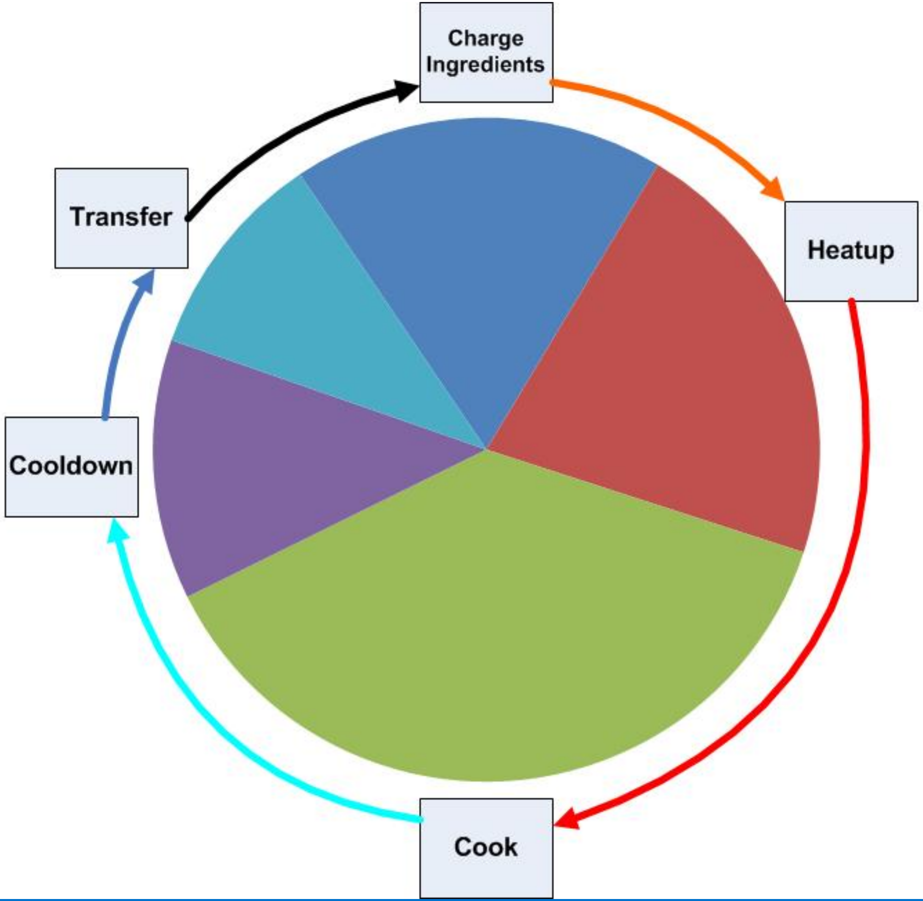
Define the Problem

- That's done. Now get back to work!
- Much of our reactor time is spent heating up



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Define the Problem

- Exotherms = Free heat
- R&D gives wide specifications on where to start/stop, but there's no standardization plant to plant
  - Too many products to go one by one to see where to improve and compare across facilities

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What’s it Worth?

- Product consistency is a strategic advantage
- Time is volume
- Natural gas for heating is a large overhead cost
- Process yield is volume

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The Solution

- To make decisions we need data on:
  - Distillation column differential (start and end)
  - Reactor temperature (start and end)
  - Heating and cooling control (maximums)
  - Product, plant, and vessel
- Event Frames can capture all of this

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The Solution

Name	[65.07:53:53....	Duration	Start Time	End Time	Template	Primary Element
CORP-AF Event Frames 1 ... Next						
Kathleen Reactor 4 MA Charge		0:20:17.29	9/11/2015 2:56:05.716 PM		MA Charge	Reactor 4
Perris Reactor 1 MA Charge		0:13:30.141	9/11/2015 2:55:08.594 PM	9/11/2015 3:08:38.735 PM	MA Charge	Reactor 1
Collierville Reactor 4 MA Charge		0:27:14.923	9/11/2015 2:49:08.085 PM		MA Charge	Reactor 4
Kathleen Reactor 3 MA Charge		0:44:42.419	9/11/2015 2:31:40.59 PM		MA Charge	Reactor 3
Collierville Reactor 1 MA Charge		0:07:51.439	9/11/2015 12:17:44.453 PM	9/11/2015 12:25:35.891 PM	MA Charge	Reactor 1
Valparaiso Reactor 2 MA Charge		0:15:24.61	9/11/2015 11:29:40.236			
Collierville Reactor 2 MA Charge		2:06:42.061	9/11/2015 11:15:01.059			
Collierville Reactor 5 MA Charge		1:05:58.206	9/11/2015 1:45:54.994			
Perris Reactor 2 MA Charge		0:27:30.445	9/10/2015 11:29:29.177			
Kathleen Reactor 2 MA Charge		1:19:09.276	9/10/2015 10:27:59.212			
Perris Reactor 1 MA Charge		1:18:30.503	9/10/2015 6:53:57.175			
Valparaiso Reactor 2 MA Charge		0:15:01.299	9/10/2015 5:14:45.991			
Kathleen Reactor 4 MA Charge		0:49:01.069	9/10/2015 1:07:56.789			
Mexico Reactor 2 MA Charge		0:21:56.682	9/10/2015 1:00:27.475			
Kathleen Reactor 3 MA Charge		1:06:43.343	9/10/2015 11:47:04.254			
Perris Reactor 2 MA Charge		0:28:30.225	9/10/2015 10:50:53.197			
Collierville Reactor 4 MA Charge		1:06:28.985	9/10/2015 10:29:48.052			
Mexico Reactor 7 MA Charge		1:15:11.381	9/10/2015 9:35:17.219			
Collierville Reactor 5 MA Charge		1:37:20.023	9/10/2015 9:21:11.37			
Collierville Reactor 2 MA Charge		0:30:55.102	9/10/2015 7:33:47.936			
Valparaiso Reactor 2 MA Charge		0:29:10.585	9/10/2015 7:10:17.94			
Collierville Reactor 1 MA Charge		1:47:42.853	9/10/2015 4:53:07.253			
Perris Reactor 1 MA Charge		1:04:00.705	9/10/2015 1:57:48.413			

Name	Value	Settings...
Batch		.\Elements[.]|Batch
Column End Differential	23.567138671875 C	A=Column PV End;B=Column SP End;[B - A];UOM=C
Column PV End	77.3946533203125	.\Elements[.]\Column Temperature|PV
Column PV Start	83.334159851074219	.\Elements[.]\Column Temperature|PV;TimeRangeMethod=StartTime
Column SP End	100.9617919921875	.\Elements[.]\Column Temperature|SP
Column SP Start	100.9617919921875	.\Elements[.]\Column Temperature|SP;TimeRangeMethod=StartTime
Column Start Differential	17.6276321411133 C	A=Column PV Start;B=Column SP Start;[B - A];UOM=C
Plant	'	%..\..\ELEMENT%
Product		.\Elements[.]|Product;TimeRangeMethod=StartTime
Temperature End	166.23283386230469	.\Elements[.]\Temperature|PV
Temperature Out Max	55	.\Elements[.]\Temperature|OUT;TimeRangeMethod=Maximum
Temperature Out Min	28.015268510977435	.\Elements[.]\Temperature|OUT;TimeRangeMethod=Minimum
Temperature Start	141.83805847167969	.\Elements[.]\Temperature|PV;TimeRangeMethod=StartTime
Vessel		%ELEMENT%

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The Solution

- PI DataLink brings this data into Excel
- Use Pivot Tables to make the data actionable

	A	B	C	D	E	F
1	Row Labels	Average of Column End Differential	Average of Temperature End	Count of Batch	Average of Temperature Out Min	Average of Temperature Out Max
2	Collierville	26.82528483	126.9111384	340	27.70	60.47
3	Reactor 1	23.45009801	149.972597	61	33.66	75.48
4	T	1.596498108	220.0394974	10	50.00	100.00
5	T	50.32099628	124.8897514	8	6.25	50.00
6	T	19.91613865	80.10670948	8	0.00	100.00
7	T	49.5494363	127.6152158	7	50.75	50.78
8	T	1.908731079	179.3558533	5	49.48	89.17
9	T	1.939239502	195.1473419	5	50.00	100.00
10	T	2.968238831	182.6625175	4	12.50	50.81
11	X	19.18088913	123.5893631	4	50.00	50.00
12	T	7.443344116	173.9727402	2	50.00	50.00
13	T	62.29173088	135.7850952	2	50.00	100.00
14	T	56.91582108	90.6293869	2	50.00	50.00
15	T	72.63325882	91.81455994	1	50.00	50.00
16	T	1.07421875	166.7196655	1	0.74	100.00
17	P	65.39385986	81.6084137	1	0.20	100.00
18	T	5.508369446	176.2146606	1	50.00	50.00
19	Reactor 2	20.25147761	149.444654	52	35.65	58.52
20	Reactor 3	46.99271756	118.3722134	82	25.24	51.64
21	Reactor 4	16.52296289	109.917739	77	21.78	68.56
22	Reactor 5	22.22636834	118.5316066	68	25.93	49.99
23	Kathleen	35.1950198	141.469351	163	34.16	79.83
24	Mexico	50.35846586	111.4461519	154	20.85	42.51
25	Perris	47.06891726	135.0908415	163	14.28	83.35
26	Valparaiso	38.52626336	127.8772442	174	19.77	40.81

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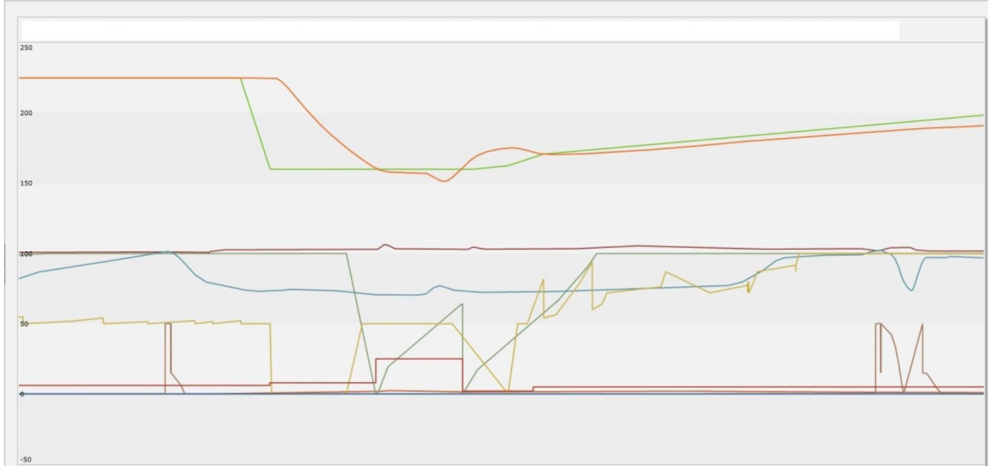
The Solution

- Use visualization to confirm the data and determine the needed adjustments
  - PI ProcessBook or PI Coresight in conjunction with PI BatchView



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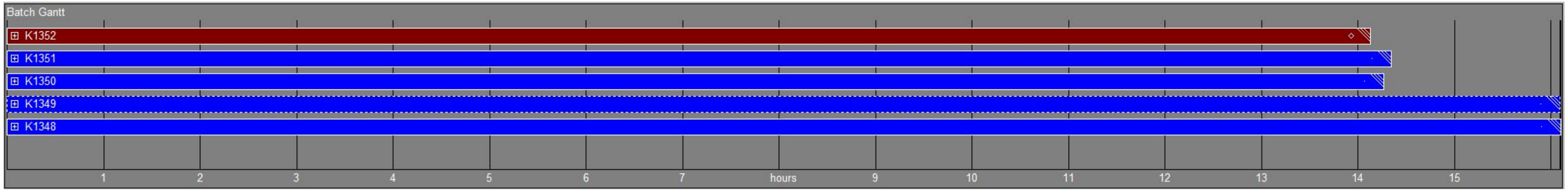
The Result

- Early big win
  - Found discrepancies between plants that, when fixed, resulted in a 10% cycle reduction and 5% natural gas reduction in one of that plant’s highest volume products



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The Result

- Found a couple ‘types’ of failures
  - Unnecessarily quenching exotherms
  - Cooling too much before exotherms
- Plan to prioritize and attack in waves while maintaining quality and customer satisfaction

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Summary

"Some plant to plant comparisons on this data set produced a fast, big win that made the Event Frame analysis worth it almost instantly. We dropped cycle and utility usage on these batches significantly after addressing the discrepancy."

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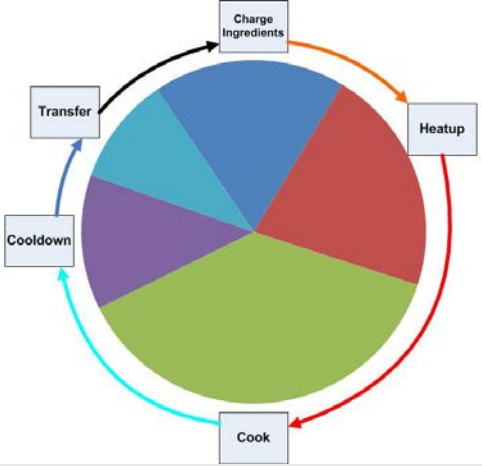

BUSINESS CHALLENGES

A. Aging hardware
B. Plant to plant consistency
C. Process goals – increase yield, improve efficiency

SOLUTION

A. Upgrade hardware and implement new technology
B. Compare and contrast at a corporate level using Event Frames
C. Use trend visualizations to fine tune process

RESULTS AND BENEFITS

- Strategic advantage of consistency between plants
- Efficient use of utilities
- Decreased batch cycle time increases volume (10% cycle reduction!)

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Contact Information

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Questions

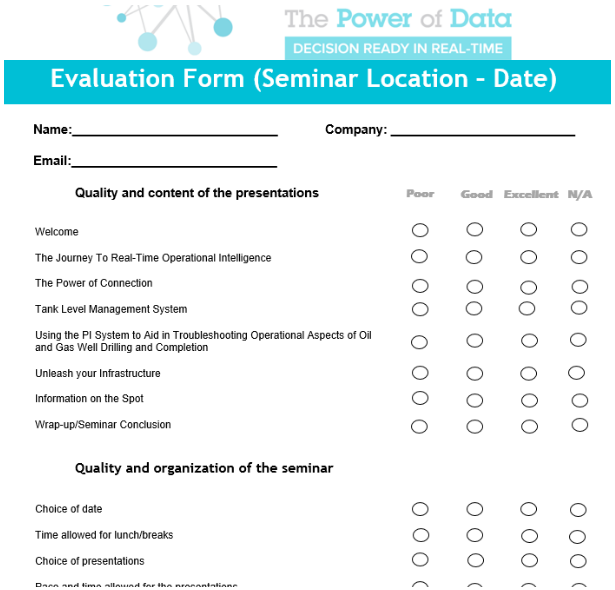
Please wait for the **microphone** before asking your questions

State your

name & company

Please don't forget to…

Complete the Survey for this session



The Power of Data

DECISION READY IN REAL-TIME

Evaluation Form (Seminar Location - Date)

Name:________________ Company: ________________

Email:________________

Quality and content of the presentations	Poor	Good	Excellent	N/A
Welcome	◯	◯	◯	◯
The Journey To Real-Time Operational Intelligence	◯	◯	◯	◯
The Power of Connection	◯	◯	◯	◯
Tank Level Management System	◯	◯	◯	◯
Using the PI System to Aid in Troubleshooting Operational Aspects of Oil and Gas Well Drilling and Completion	◯	◯	◯	◯
Unleash your Infrastructure	◯	◯	◯	◯
Information on the Spot	◯	◯	◯	◯
Wrap-up/Seminar Conclusion	◯	◯	◯	◯
Quality and organization of the seminar				
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Time allowed for lunch/breaks	◯	◯	◯	◯
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감사합니다

谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado

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