



# Data Driven Brewing – Worth Sharing

Presented by Brian Faivre  
Tim Alexander

**DESCHUTES  
BREWERY®**

# Agenda

- Deschutes Brewery
- Data Challenges
- Solution
- A Quick Win
- Results
- Future Plans

# Agenda

- Deschutes Brewery
- Data Challenges
- Solution
- A Quick Win
- Results
- Future Plans

# Deschutes Brewery

- Located in Bend, OR
- Founded in 1988
- Pub opened in Portland, OR in 2007



# Deschutes Brewery – Production Facility

- 2 Brewhouses
- 50+ Vessels
- Bottling and Kegging
- 7<sup>th</sup> Largest Craft Brewer in the US











# Deschutes Brewery – Diverse Brand Mix

- Diverse Brand Mix
- Largest Brand is 22% of Production

ALL BREWS	
	<b>Black Butte Porter</b> Year Round Brews Porter Alc 5.2%   IBUs 30
	<b>Mirror Pond Pale Ale</b> Year Round Brews Pale Alc 5%   IBUs 40
	<b>Inversion IPA</b> Year Round Brews IPA Alc 6.8%   IBUs 60
	<b>Obsidian Stout</b> Year Round Brews Stout Alc 6.4%   IBUs 55
	<b>Chainbreaker White IPA</b> Year Round Brews IPA, Wheat Alc 5.6%   IBUs 55
	<b>Armory XPA</b> Year Round Brews Pale Alc 5.9%   IBUs 58
	<b>Cinder Cone Red</b> Year Round Brews Amber Alc 5.3%   IBUs 55
	<b>Deschutes River Ale</b> Year Round Brews Golden or Blonde Alc 4%   IBUs 28
	<b>Pine Mountain Pilsner</b> Year Round Brews Alc 5.2%   IBUs 40
	<b>Red Chair NWA</b> Seasonal Ales Pale IPA Alc 6.2%   IBUs 60 Available Jan - Apr

RESERVE SERIES	
Nowhere does our high-risk, high-reward mantra manifest like these small batches of audacious, experimental, outrageously coddled beers.	
	<b>The Abyss</b> Reserve Series Stout Alc 11%   IBUs 56
	<b>The Dissident</b> Reserve Series Sour Alc 10.7%   IBUs 18
	<b>Mirror Mirror</b> Reserve Series Barley Wine Alc 11.2%   IBUs 53
	<b>The Stoic</b> Reserve Series Quid Alc 11%   IBUs 20
	<b>Not The Stoic</b> Reserve Series Quid Alc 12.1%   IBUs 15
	<b>Black Butte XXVI</b> Reserve Series Porter Alc 10.8%   IBUs 60
	<b>Jubel 2015</b> Reserve Series Strong Ale Alc 10.4%   IBUs 55

BOND STREET SERIES	
Inspired by our original Bond Street Pub, these groundbreaking beers explore the many nuances and endless possibilities of the slimthy hop.	
	<b>Hop Henge</b> Bond Street Series IPA Alc 9.3%   IBUs 90 Available Dec - Apr
	<b>Hop Trip</b> Bond Street Series Pale, Fresh Hop Alc 5.9%   IBUs 38 Available Oct - Dec
	<b>Fresh Squeezed IPA</b> Bond Street Series IPA Alc 6.4%   IBUs 60
	<b>Chasin' Freshies</b> Bond Street Series IPA, Fresh Hop Alc 7.4%   IBUs 65 Available Oct - Dec
	<b>Pinedrops IPA</b> Bond Street Series IPA Alc 6.5%   IBUs 70
	<b>Foray</b> Bond Street Series IPA Alc 6.4%   IBUs 60 Available Jun - Sep

SEASONAL ALES	
Certain seasons call for certain flavors, depths or even, occasionally, the lack thereof. Fans await these periodic pleasures like beaches, fall colors and yule fires.	
	<b>Red Chair NWA</b> Seasonal Ales Pale IPA Alc 6.2%   IBUs 60 Available Jan - Apr
	<b>Twilight Summer Ale</b> Seasonal Ales Golden or Blonde Alc 5%   IBUs 35 Available May - Sep
	<b>Jubelale</b> Seasonal Ales Strong Ale Alc 6.7%   IBUs 60 Available Sep - Dec

# Agenda

- Deschutes Brewery
- Data Challenges
- Solution
- A Quick Win
- Results
- Future Plans



# Data Challenges – Paper & Tracking

[illegible]

Broken Top Back  
**PORTER NUMBER:**

**FERMENTATION:** Tank Number: Berm Gallons: \_\_\_\_\_

Date/Time O/G / Temperature  
7-11-97 / 7:10 / 1.060

7-11-97 / 6:00 PM / 1.066 @ 56°  
7-12-97 / 9:30 AM / 1.0635 @ 54°  
7-13-97 / 12:15 PM / 1.0615 @ 55°  
7-13-97 / 10:15 PM / 1.0535 @ 55°  
7/14 8:00 AM 1.052 53°  
7/14 1:00 PM 1.0485 53°  
7/15 4:30 PM 1.040 48°  
7/15 1:00 AM 1.0419 @ 42°  
7:00 AM 1.0495 46°

7/16 2:30 AM 1.047 @ 46°  
7/16 6:30 AM Set pt 150°  
7/17 6:30 AM 1.0425 50°  
7-18 8:00 AM 1.039 49°  
7-19 8:00 AM 1.037 48°  
7-20 8:15 AM 1.033 48°  
7-21 7 AM 1.032 48°  
7-22 6:45 AM 1.030 48°  
7-23 2:30 PM 1.027 48°  
7-24 1 PM 1.025 48°  
7-25 7 AM 1.0215 46°  
7-26 2 PM 1.020 46°  
7-27 1 PM 1.0185 44°  
7-28 4 PM 1.0165 42°  
7-29 3 PM 1.0145 40°  
7-30 4 PM 1.0125 38°  
7-31 4 PM 1.0105 36°

46°  
44°  
42°  
40°  
38°  
36°  
34°  
32°  
30°  
28°  
26°  
24°  
22°  
20°  
18°  
16°  
14°  
12°  
10°  
8°  
6°  
4°  
2°  
0°

**CELLAR:**

For Krausening  
O.G.  
To Brew #  
CO<sub>2</sub> Volumes  
Calculated  
Actual

**RACKING:**  
CO<sub>2</sub> Volumes \_\_\_\_\_

**Krausening**  
Date \_\_\_\_\_  
From Brew # \_\_\_\_\_  
O.G. \_\_\_\_\_  
Calculated \_\_\_\_\_  
Actual \_\_\_\_\_

**Booting**  
Date \_\_\_\_\_  
# of cs \_\_\_\_\_  
Total BBLs \_\_\_\_\_

**XFER/Filter**  
Date \_\_\_\_\_  
To Tank # \_\_\_\_\_  
Volume \_\_\_\_\_

**Date**  
# of 1/4's \_\_\_\_\_  
# of 1/2's \_\_\_\_\_  
Total BBLs \_\_\_\_\_

**Date**  
# of cs \_\_\_\_\_  
Total BBLs \_\_\_\_\_



# Data Challenges – Integrating Data Systems



*Compusense*<sup>®</sup>



**DELTA<sup>V</sup>**

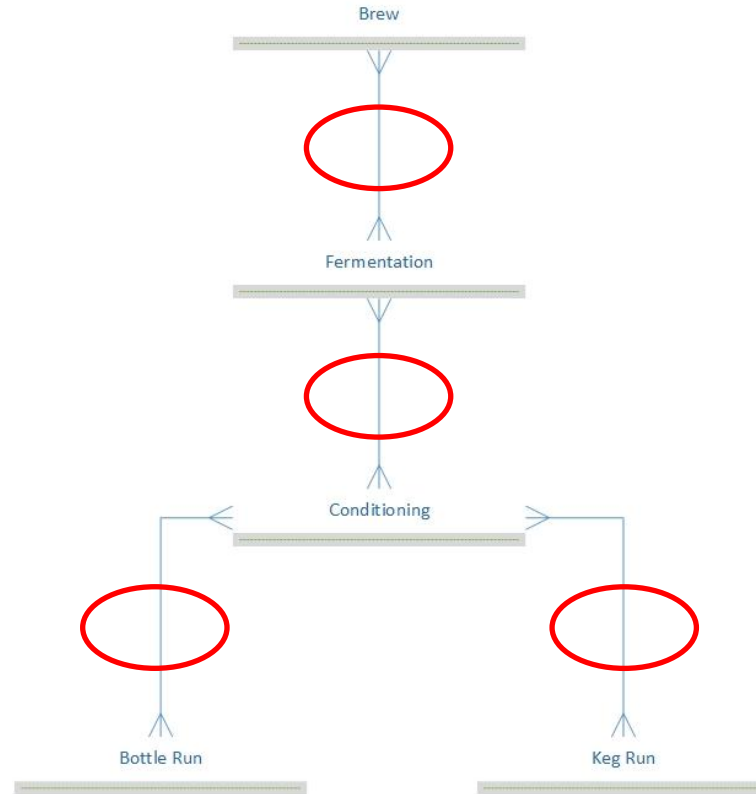


Others



# Data Challenges – Batch Reporting

- DeltaV / S88
- Many to Many Relations



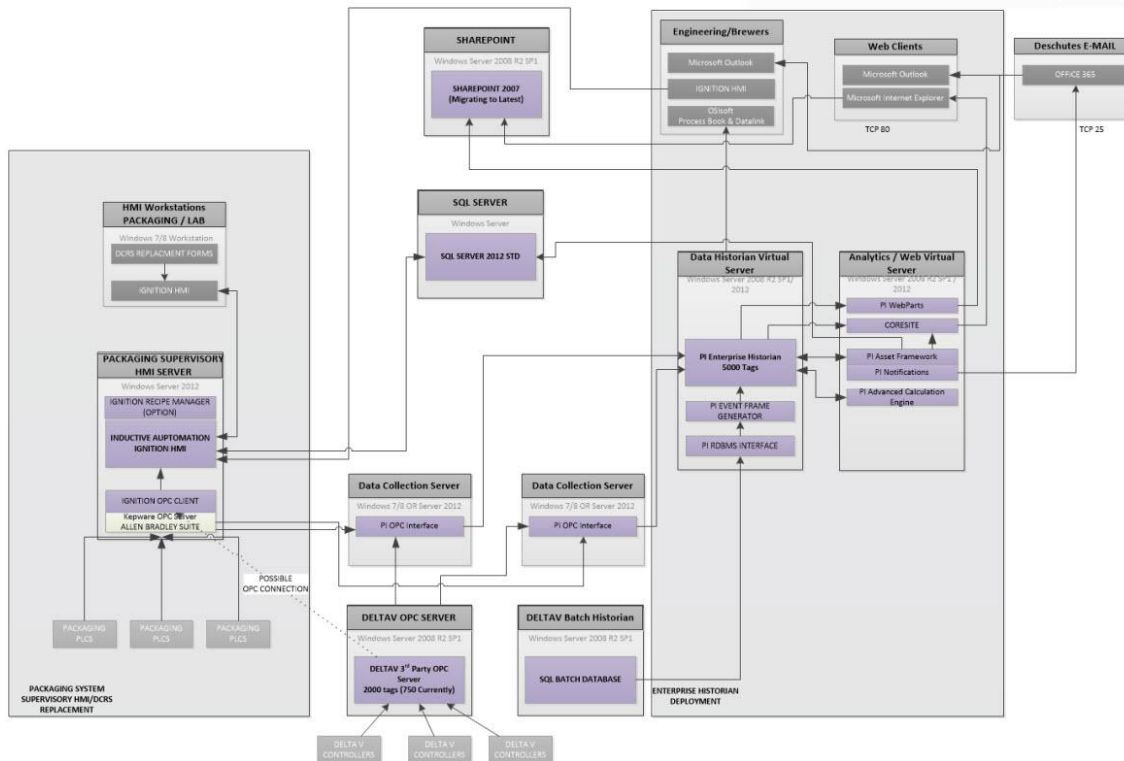
# Agenda

- Deschutes Brewery
- Data Challenges
- **Solution**
- A Quick Win
- Results
- Future Plans

# Solution

DESCHUTES BREWERY

August 12, 2014

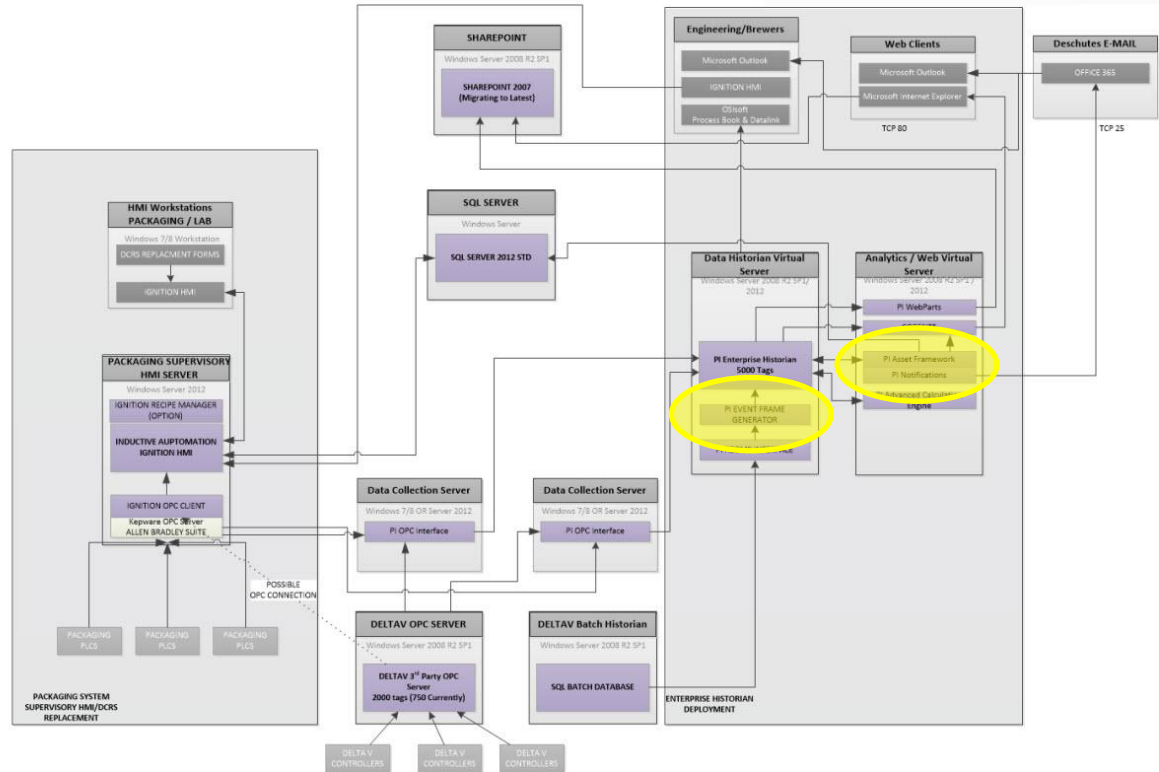


# Solution – PI Server

DESCHUTES BREWERY

August 12, 2014

- Asset Framework (AF)
- Event Frames
- Notifications

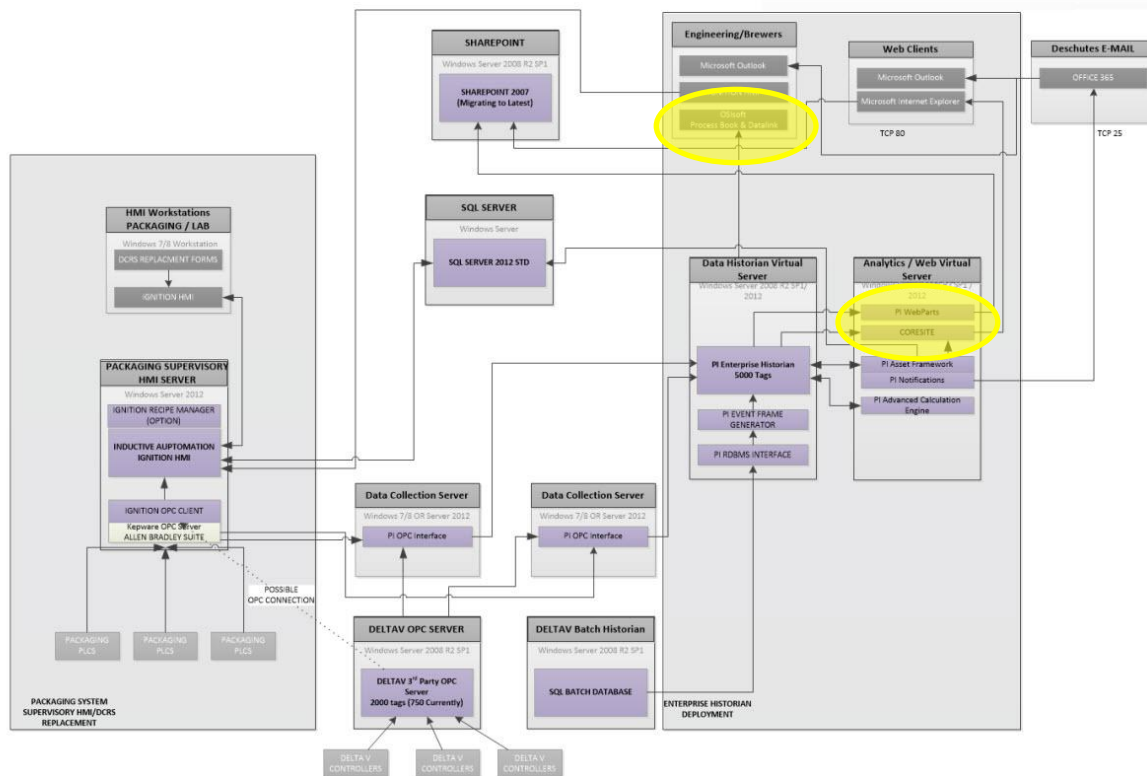


# Solution – Analysis & Visualization

DESCHUTES BREWERY

August 12, 2014

- PI ProcessBook
- PI DataLink
- PI Coresight
- PI WebParts



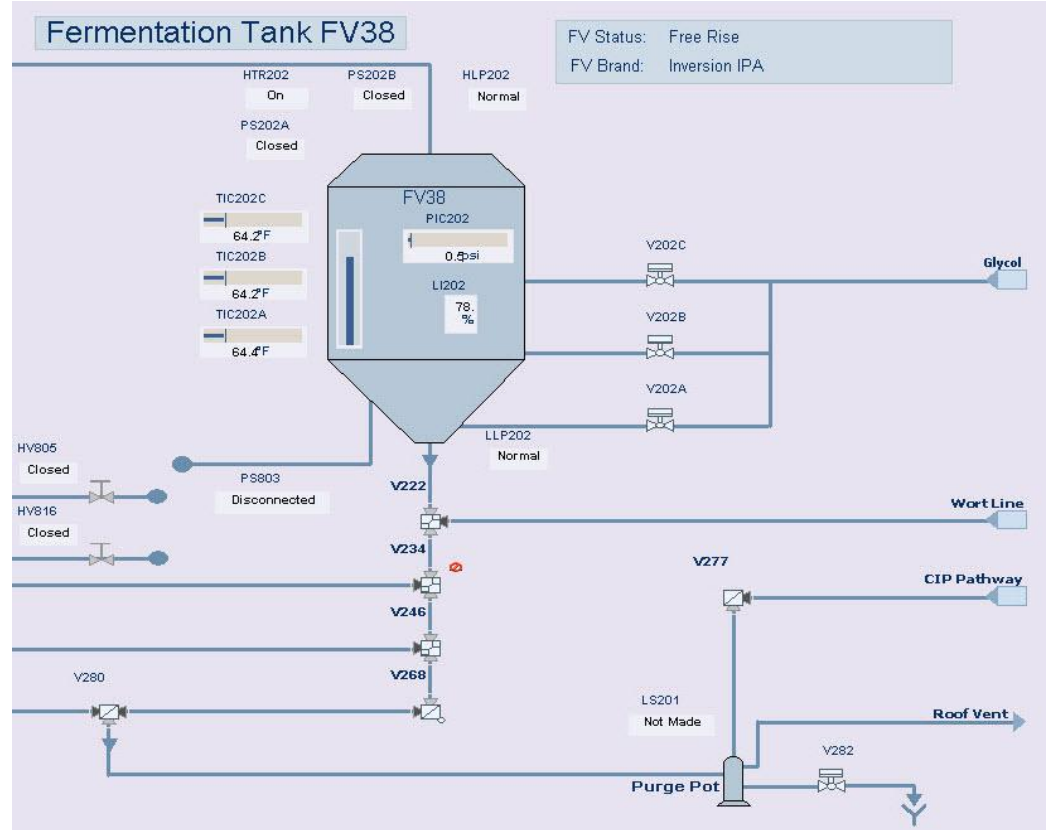
# Agenda

- Deschutes Brewery
- Data Challenges
- Solution
- A Quick Win
- Results
- Future Plans

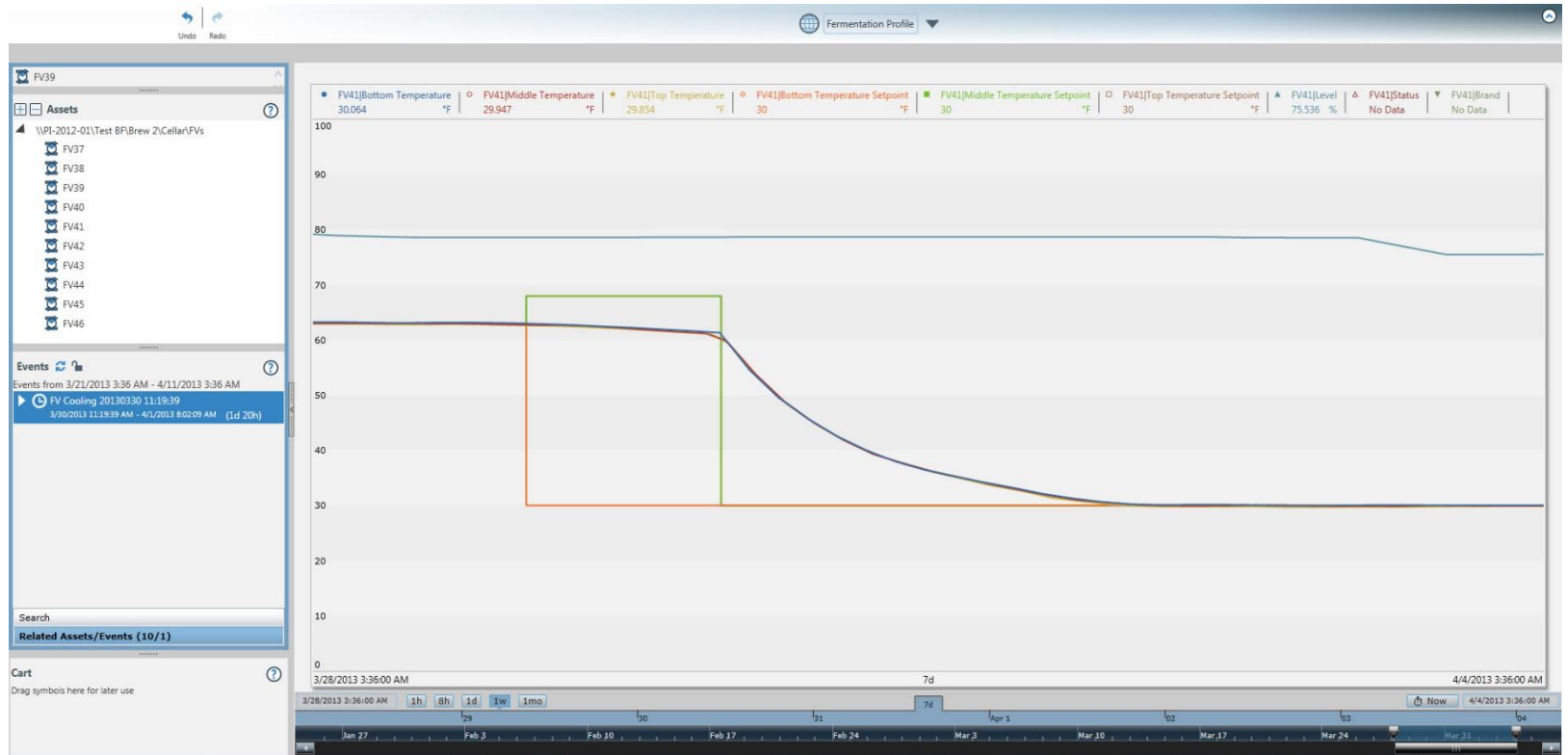


# A Quick Win - The Problem

- FV Stratification
- Phased Install of FVs
- Brewing's Theory
- Engineering's Theory



# A Quick Win – Ideal Cooling



# A Quick Win – Stratified Cooling



# A Quick Win – OSIssoft Learning

YouTube

What to Watch

My Channel

My Subscriptions

History

Watch Later

Purchases

7

## PLAYLISTS

- PI Performance Equatio...  
OSIssoftLearning
- PI Event Frames  
OSIssoftLearning
- PI AF (Asset Framework)  
OSIssoftLearning
- PI Coresight  
OSIssoftLearning

## SUBSCRIPTIONS

LegacyOfEquestria

Browse channels

Manage subscriptions

YouTube interface showing the Playlists section for the channel Brian Faivre. The page displays a search bar, navigation tabs (Videos, Playlists, Channels, Discussion, About), and a section for Saved playlists. The saved playlists are:

- PI Performance Equations (PE) by OSIssoftLearning (5 VIDEOS)
- PI Event Frames by OSIssoftLearning (11 VIDEOS)
- PI AF (Asset Framework) by OSIssoftLearning (80 VIDEOS)
- PI Coresight by OSIssoftLearning (21 VIDEOS)

The bottom of the page shows the YouTube logo, language settings (English), country (Worldwide), safety (Off), history, and help links. The footer includes links for About, Press, Copyright, Creators, Advertise, Developers, and +YouTube, along with Terms, Privacy, Policy & Safety, Send feedback, and Try something new!



OSIssoft.

USERS CONFERENCE 2015

© Copyright 2015 OSIssoft, LLC

19

# A Quick Win – Asset Framework (AF)

\\PI-2012-01\Test BF - PI System Explorer (Administrator)

File View Go Tools Help

Database Query Date Back Check In Refresh New Template New Attribute Template

Library

- Test BF
  - Categories
    - Analysis Categories
    - Attribute Categories
    - Element Categories
    - Reference Type Categories
    - Table Categories
  - Templates
    - Element Templates
    - Event Frame Templates
    - Model Templates
    - Transfer Templates
  - Enumeration Sets
  - Reference Types
  - Tables
  - Table Connections

FV

General Attribute Templates Ports Analysis Templates

Filter

Name	Description	Default Value
Bottom Temperature		0 °F
Bottom Temperature Setpoint		0 °F
Brand		
Level		0 %
LI Device ID		
Middle Temperature		0 °F
Middle Temperature Setpoint		0 °F
Status		
TIC Device ID		
Top Temperature		0 °F
Top Temperature Setpoint		0 °F

\\PI-2012-01\Test BF - PI System Explorer (Administrator)

File Edit View Go Tools Help

Database Query Date Back Check In Refresh New Element New Attribute

Elements

- Elements
  - Brew 2
    - Cellar
      - FVs
        - FV37
        - FV38
        - FV39
        - FV40
        - FV41
        - FV42
        - FV43
        - FV44
        - FV45
        - FV46
  - Utilities
  - Glycol System
  - Element Searches

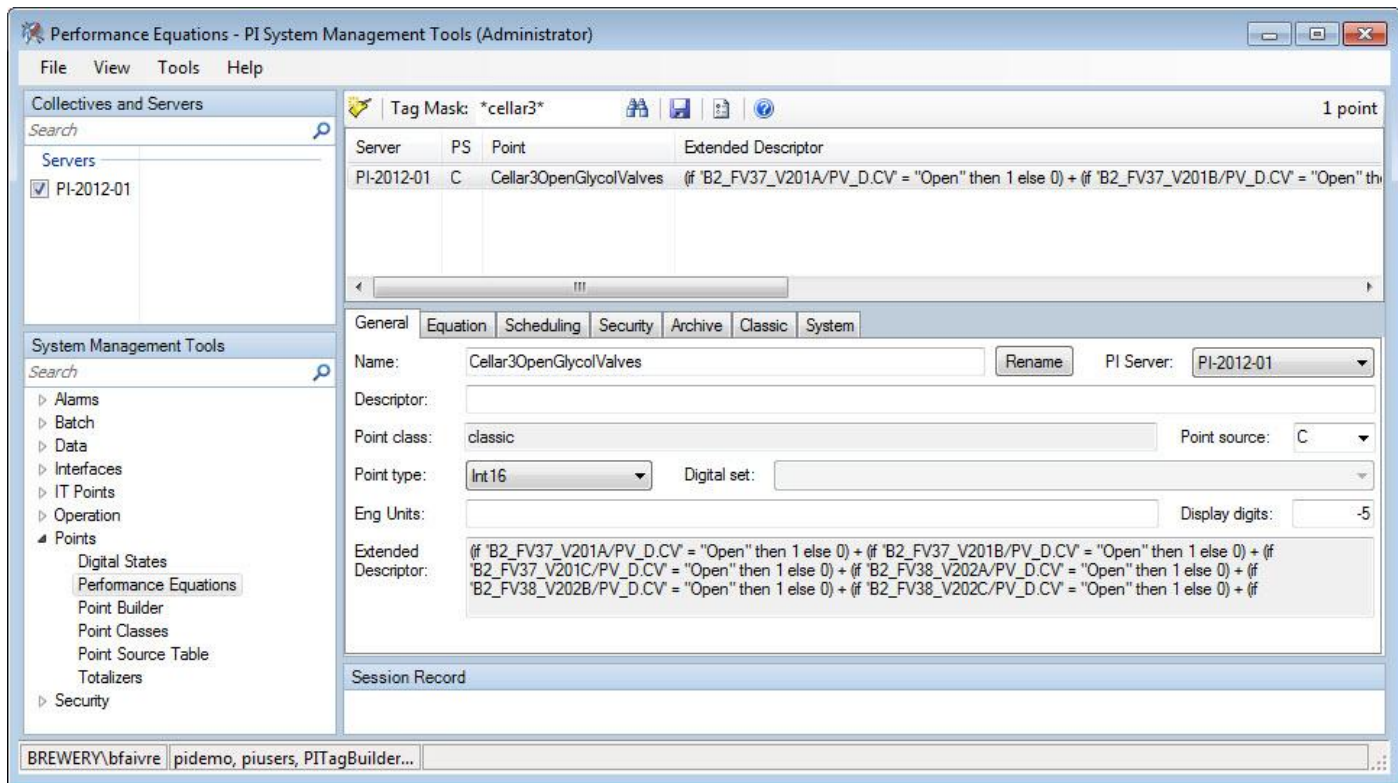
FV37

General Child Elements Attributes Ports Analyses Version

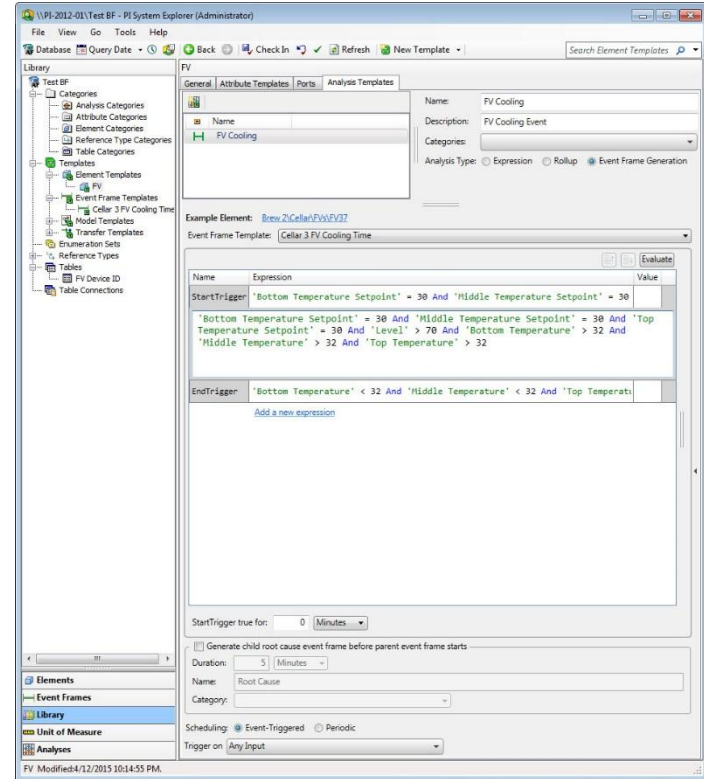
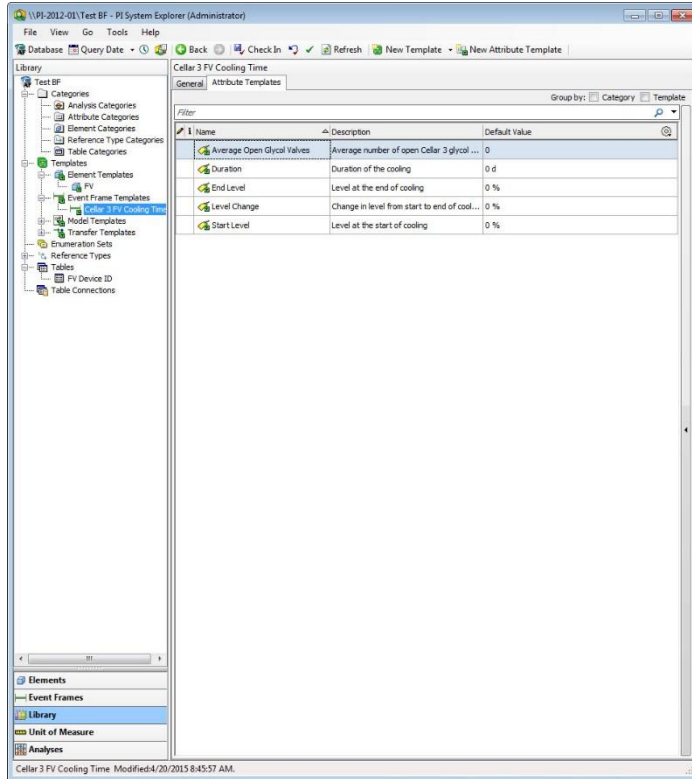
Filter

Name	Value
Bottom Temperature	29.8815879821777 °F
Bottom Temperature Setpoint	30 °F
Brand	Fresh Squeezed IPA
Level	72.844482421875 %
LI Device ID	201
Middle Temperature	29.7999057769775 °F
Middle Temperature Setpoint	30 °F
Status	Ready to Transfer
TIC Device ID	201
Top Temperature	29.981372833252 °F
Top Temperature Setpoint	30 °F

# A Quick Win – Performance Equations (PE)



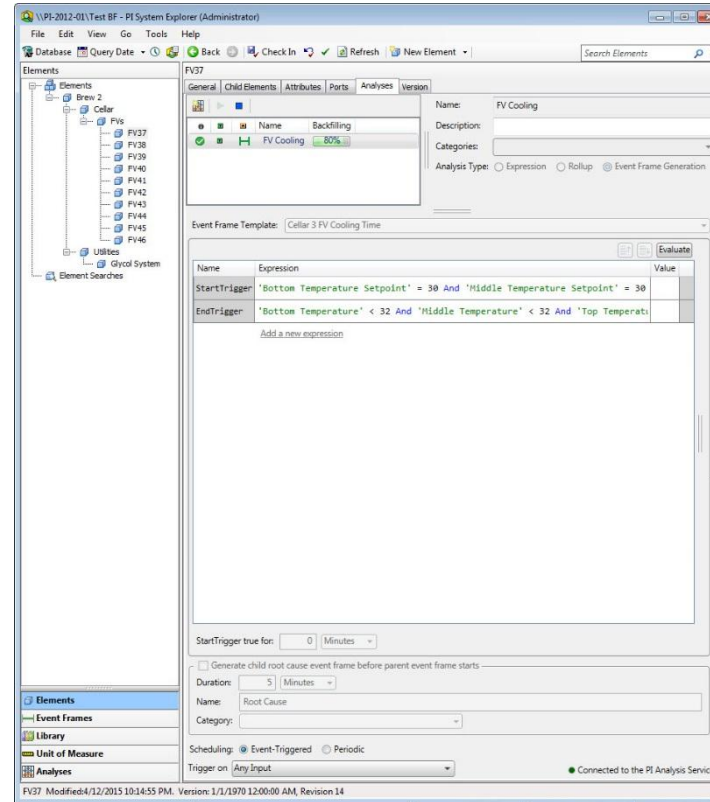
# A Quick Win – Event Frames Templates





# A Quick Win – Event Frames Backfill

- PI Interface for OPC DA
- Performance Equations Recalculator
- Backfill for each FV Cooling Event Frame



## A Quick – Event Frames for Asset Analysis

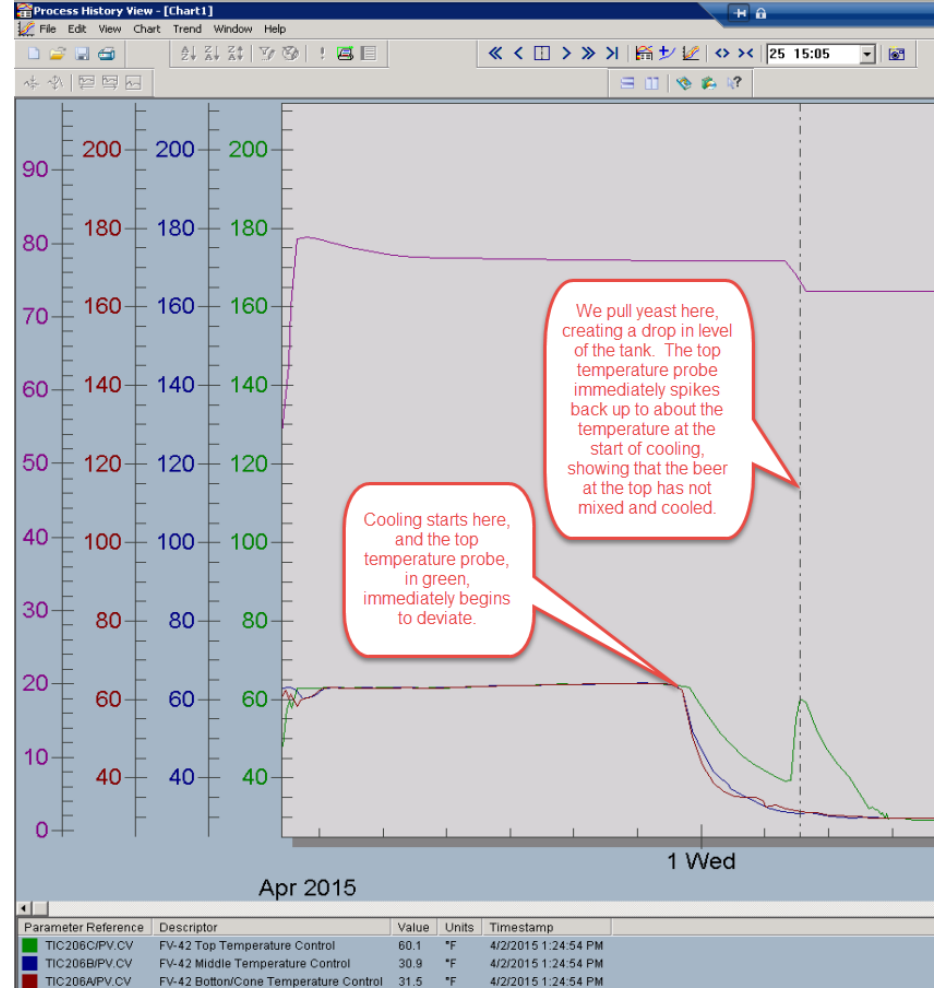
[illegible]

# Agenda

- Deschutes Brewery
- Data Challenges
- Solution
- A Quick Win
- Results
- Future Plans

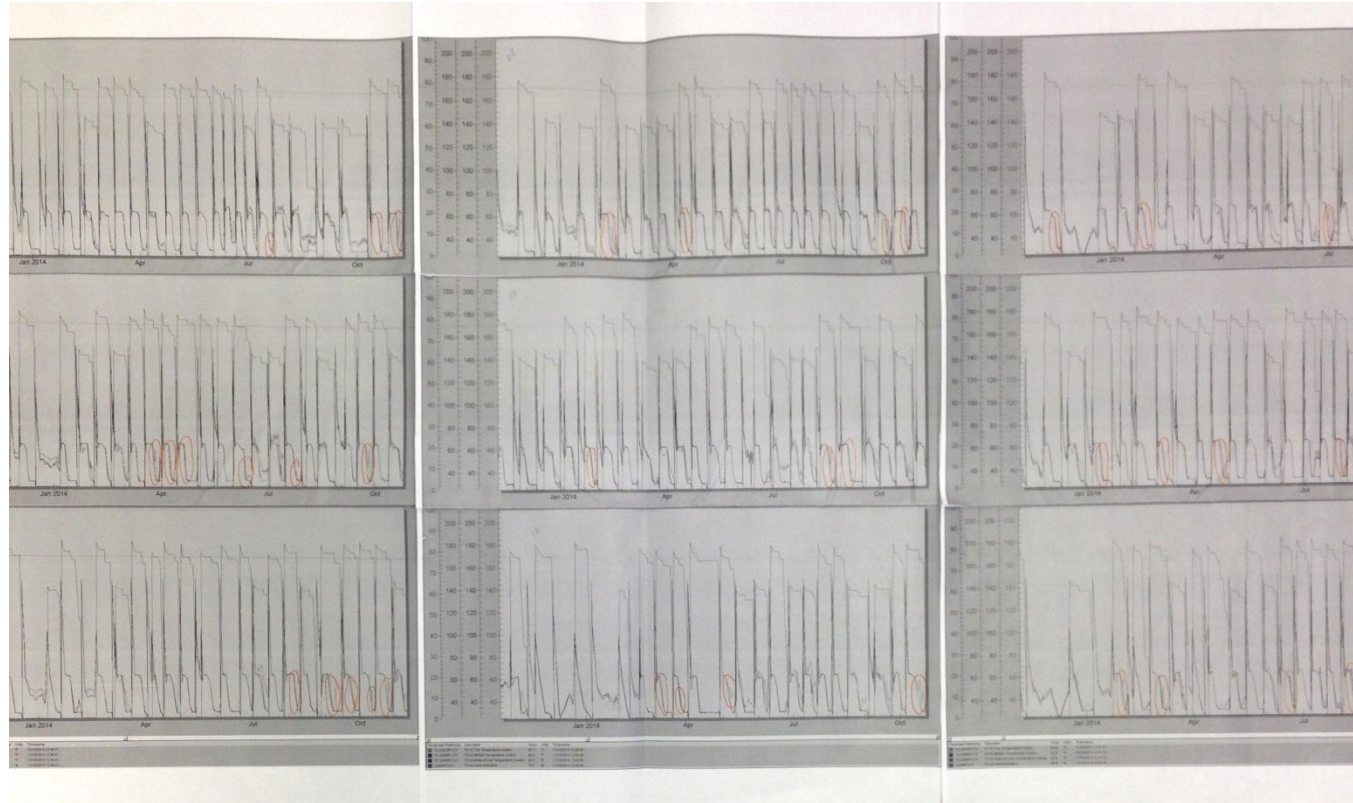
# Brewing Analysis Before

- From Delta V Process Historian, we could fairly easily create trends for individual coolings like the one to the right.
- The top of the tank is clearly stratified.
- Our conclusion is that no glycol is getting to the top jacket of the tank, looking at the intensity of the issue.
- When we look at longer periods of time, or multiple tanks, the process historian gets slow, and is time consuming to set up.
- We have trouble tying in and ruling out other possibilities by looking at a larger data set.



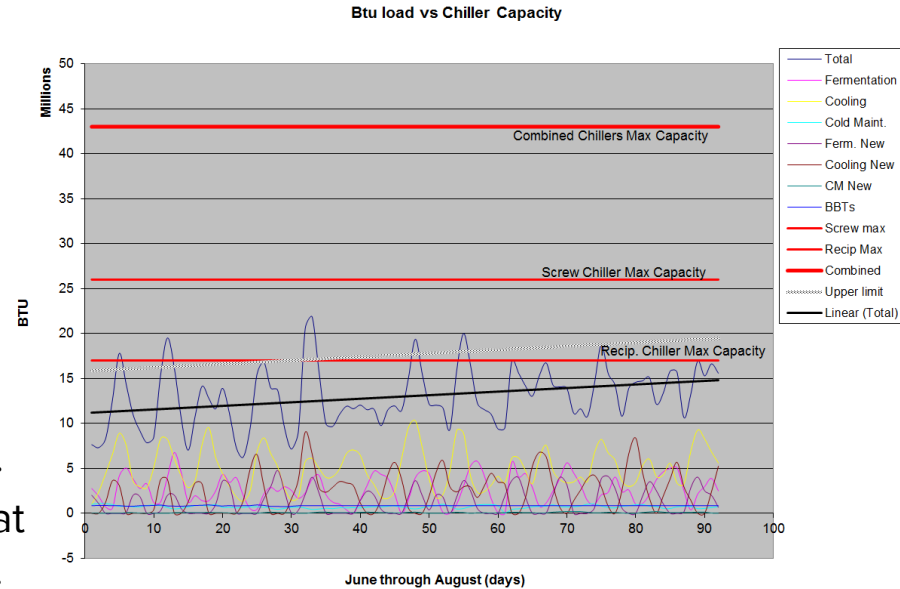
# Engineering Analysis Before

- This is a year's worth of data printed out and taped together for nine of our fermenters (10 did not arrange well).
- Deviations are circled in red and appear to be somewhat random.



# Engineering Analysis Before

- A spreadsheet is also assembled to try and link glycol capacity to cooling issues.
- With our data tools, this takes literally months to do; it takes a week just to get the data.
- After all the analysis, glycol capacity is deemed to be acceptable.
- Engineering has good reason to believe the glycol system design is sound (they designed it).
- They theorize from a set of the printed charts that the timing of our yeast pulls is causing the issue.
- As this theory is disproved, more are developed.
- We determine we need more instrumentation installed.
- This costs money and time; we are dragging our feet while we lose significant time in fermentation.





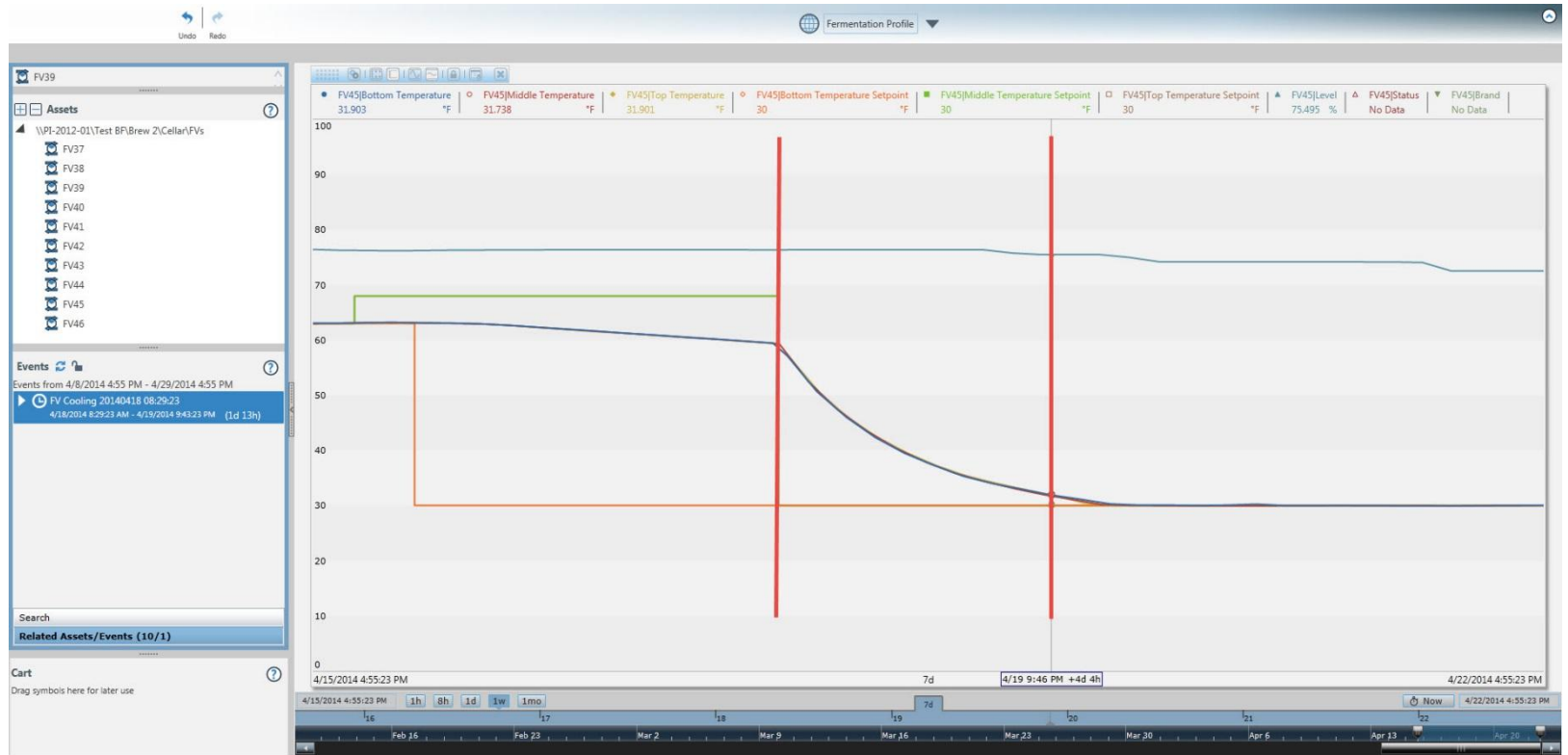
# Event Frame Analysis – Shortest Durations

Name	Duration ▲	Start Time	End Time	Primary Element	Start Level	End Level	Level Change	Average Open Glycol Valves
FV Cooling 20140418 08:29:23	1.6 Days	4/18/2014 8:29:23.5 AM	4/19/2014 9:43:23.5 PM	FV45	76.3667373657227 %	75.4946823120117 %	-0.872085571289063 %	4.0737757230428731
FV Cooling 20131121 16:01:15	1.6 Days	11/21/2013 4:01:15.25 PM	11/23/2013 7:01:16.25 AM	FV40	78.9901580810547 %	79.0834732055664 %	0.09326171875 %	3.9321501412323752
FV Cooling 20140414 08:26:43	1.6 Days	4/14/2014 8:26:43.5 AM	4/15/2014 11:36:13.5 PM	FV43	76.918701171875 %	76.9482650756836 %	0.029571533203125 %	8.433645456480102
FV Cooling 20141224 08:50:25	1.6 Days	12/24/2014 8:50:25.25 AM	12/26/2014 12:01:45.25 AM	FV43	79.5399703979492 %	79.6146850585938 %	0.07470703125 %	4.6196891834420191
FV Cooling 20140527 09:44:02	1.7 Days	5/27/2014 9:44:02.5 AM	5/29/2014 1:22:02.75 AM	FV41	77.0390472412109 %	77.0602264404297 %	0.0211334228515625 %	11.496402865118565
FV Cooling 20141228 17:45:06	1.7 Days	12/28/2014 5:45:06.25 PM	12/30/2014 9:33:36.25 AM	FV39	77.6915969848633 %	77.717155456543 %	0.0255355834960938 %	6.432432496278464
FV Cooling 20130810 16:17:36	1.7 Days	8/10/2013 4:17:36.75 PM	8/12/2013 8:11:31.75 AM	FV43	78.8426895141602 %	78.8823165893555 %	0.0396041870117188 %	9.8257841055453063
FV Cooling 20140202 12:44:06	1.7 Days	2/2/2014 12:44:06.25 PM	2/4/2014 4:44:06.25 AM	FV44	77.0441818237305 %	77.0890426635742 %	0.0448455810546875 %	9.452089753327547
FV Cooling 20140614 10:44:12	1.7 Days	6/14/2014 10:44:12.5 AM	6/16/2014 2:44:12.5 AM	FV43	75.2367401123047 %	75.2449798583984 %	0.0082550048828125 %	7.2317972366898147
FV Cooling 20140616 10:15:12	1.7 Days	6/16/2014 10:15:12.5 AM	6/18/2014 2:20:02.75 AM	FV42	79.205924987793 %	79.2060089111328 %	8.392333984375E-05 %	7.0374175598316588
FV Cooling 20140117 15:18:38	1.7 Days	1/17/2014 3:18:38.25 PM	1/19/2014 7:35:22.5 AM	FV37	77.883415222168 %	77.9121170043945 %	0.0287017822265625 %	3.910372519253746
FV Cooling 20141210 16:19:37	1.7 Days	12/10/2014 4:19:37.25 PM	12/12/2014 8:40:47.25 AM	FV37	78.8453369140625 %	78.9134140014648 %	0.068084716796875 %	4.6026519584222481
FV Cooling 20140410 15:30:05	1.7 Days	4/10/2014 3:30:05.5 PM	4/12/2014 8:00:45.5 AM	FV39	76.3443603515625 %	76.0817413330078 %	-0.262985229492188 %	6.5641490674712015
FV Cooling 20131003 17:33:58	1.7 Days	10/3/2013 5:33:58.25 PM	10/5/2013 10:09:18.25 AM	FV37	77.7919235229492 %	77.8379516601563 %	0.0460052490234375 %	5.9336677081907565





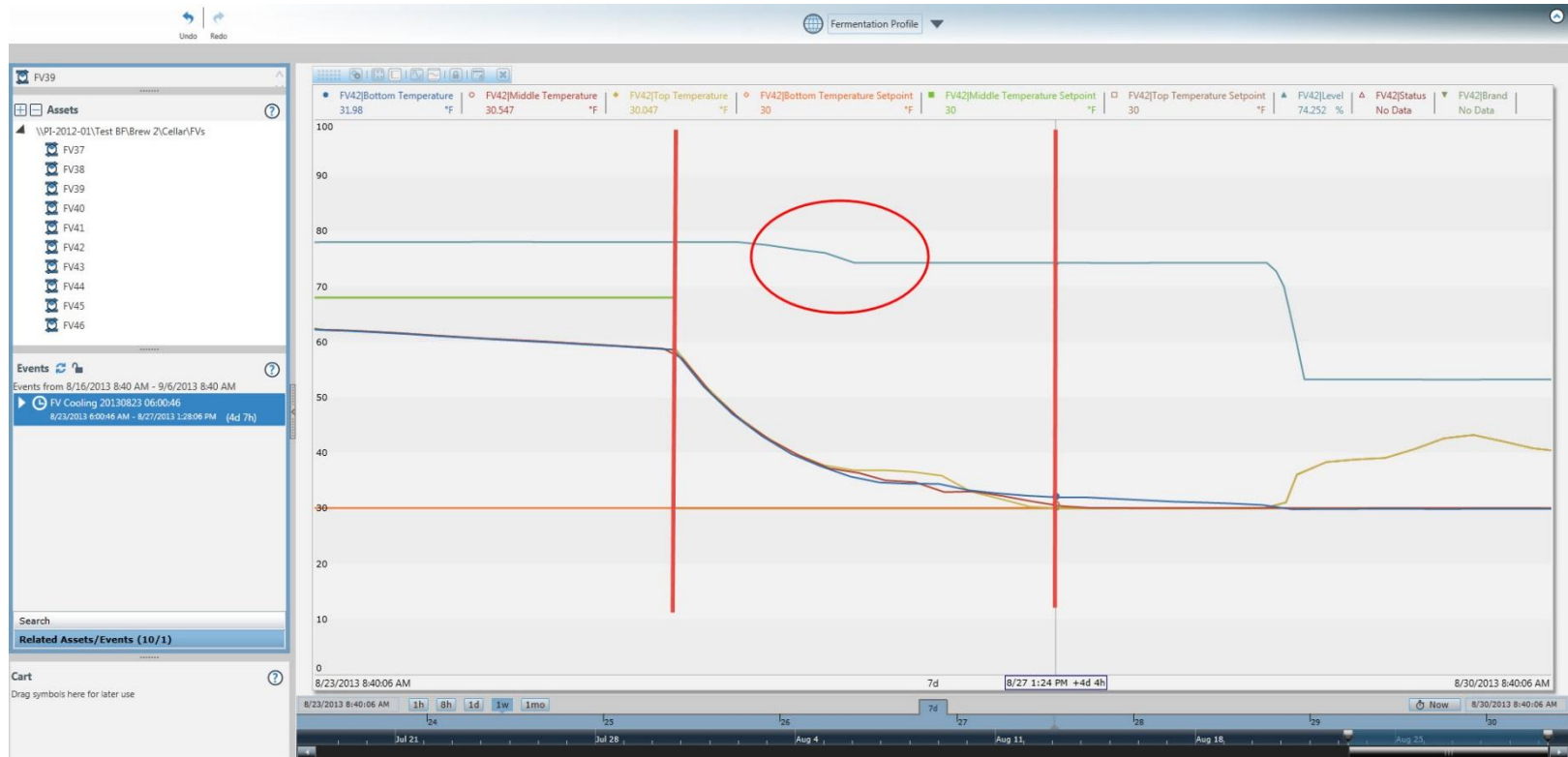
# Event Frame Analysis – Shortest Durations



# Event Frame Analysis – Longest Durations

Name	Duration	Start Time	End Time	Primary Element	Start Level	End Level	Level Change	Average Open Glycol Valves
FV Cooling 20141214 14:59:36	4.6 Days	12/14/2014 2:59:36.25 PM	12/19/2014 5:18:36.25 AM	FV38	78.5620880126953 %	74.6569061279297 %	-3.90522766113281 %	10.886848715713182
FV Cooling 20130918 20:41:24	4.4 Days	9/18/2013 8:41:24.25 PM	9/23/2013 6:58:14.25 AM	FV46	77.5207824707031 %	72.6069107055664 %	-4.91395568847656 %	5.5781738571369459
FV Cooling 20141017 18:00:55	4.4 Days	10/17/2014 6:00:55 PM	10/22/2014 3:32:35 AM	FV42	78.4429550170898 %	73.0975341796875 %	-5.34316253662109 %	7.7448796832499784
FV Cooling 20130823 06:00:46	4.3 Days	8/23/2013 6:00:46.5 AM	8/27/2013 1:28:06.5 PM	FV42	77.9475326538086 %	74.2516174316406 %	-3.69590759277344 %	4.2727392331650735
FV Cooling 20130726 10:02:56	4.3 Days	7/26/2013 10:02:56.75 AM	7/30/2013 5:03:35.75 PM	FV43	77.4938735961914 %	73.5756912231445 %	-3.91816711425781 %	7.0702933078775425
FV Cooling 20130625 14:58:59	4.2 Days	6/25/2013 2:58:59.75 PM	6/29/2013 8:50:19.75 PM	FV37	79.4979858398438 %	76.6395721435547 %	-2.85842895507813 %	4.8059684221710119
FV Cooling 20141214 15:00:24	4.2 Days	12/14/2014 3:00:24.25 PM	12/18/2014 7:42:44.25 PM	FV45	78.4905548095703 %	72.6208953857422 %	-5.86973571777344 %	11.355183009978209
FV Cooling 20141104 23:55:07	4 Days	11/4/2014 11:55:07 PM	11/8/2014 11:01:57 PM	FV37	79.0864105224609 %	73.3271560668945 %	-5.75927734375 %	8.9334119671349175
FV Cooling 20141228 12:34:45	4 Days	12/28/2014 12:34:45.25 PM	1/1/2015 11:26:35.25 AM	FV41	79.7449188232422 %	75.4286956787109 %	-4.31625366210938 %	6.0480373927557025
FV Cooling 20140810 11:20:01	3.9 Days	8/10/2014 11:20:01.25 AM	8/14/2014 8:58:41.25 AM	FV45	78.5662307739258 %	74.8937911987305 %	-3.67250823974609 %	11.455427553924913
FV Cooling 20141001 09:19:06	3.9 Days	10/1/2014 9:19:06 AM	10/5/2014 6:00:46 AM	FV40	77.9615249633789 %	73.4658584594727 %	-4.49568176269531 %	10.080265008490661
FV Cooling 20141214 14:59:56	3.8 Days	12/14/2014 2:59:56.25 PM	12/18/2014 11:22:36.25 AM	FV39	79.4332046508789 %	74.5328826904297 %	-4.90036773681641 %	11.74434277367242
FV Cooling 20141113 07:21:34	3.8 Days	11/13/2014 7:21:34 AM	11/17/2014 3:21:34 AM	FV45	76.9297866821289 %	75.199951171875 %	-1.72986602783203 %	9.7123742954911432
FV Cooling 20141001 09:19:14	3.8 Days	10/1/2014 9:19:14 AM	10/5/2014 5:19:14 AM	FV45	77.5227279663086 %	73.3457641601563 %	-4.17699432373047 %	10.113268015297907

# Event Frame Analysis – Longest Durations



# Agenda

- Deschutes Brewery
- Data Challenges
- Solution
- A Quick Win
- Results
- Future Plans

# Future Plans

## Short Term

- Minimize manual data entry
- Eliminate duplicated data input
- Use PI Coresight for quick data analysis and problem solving
- Gain process visibility with PI Coresight and PI ProcessBook
- Link process data to accounting data
- Link process data with quality data, including sensory analysis

## Longer Term

- Rationalize our alarm system and start to use PI Server Notifications
- Create a scalable system that can seamlessly integrate our second facility
- Use machine learning concepts and quickly accessible data to solve problems more quickly and adjust before large issues arise



# Questions

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

**Brian Faivre**  
**Tim Alexander**  
**Deschutes Brewery**





THANK  
YOU

