OSIsoft®

USERS CONFERENCE 2016

April 4-8, 2016 | San Francisco

TRANSFORM YOUR WORLD

Mill Use Cases with Today's PI System

Presented by **Gopal GopalKrishnan, P.E.**
Solution Architect
OSIsoft, LLC.

UC 2016 - Industry Day - Paper and Pulp Track

Mill Use Cases with Today's PI System

This is part 2 of a UC 2015 presentation titled What if Expedia Showed your Mill's Operations Data - your goal is to get rapid insights from data to drive operational and business intelligence. Self-service data analytics tools are now easier to use and deploy; they are also extensible and include the integration of open source packages such as R (http://cran.r-project.org/), d3js http://d3js.org and others. Join us in this session for an end-to-end walk-through – from data collection, data modeling, extraction, to creating web based dashboards and KPIs, including support for mobile devices. The demo uses PowerBI Desktop (free download) and the PowerBI extensibility framework (Visuals Gallery) along with PI Integrator for Business Analytics (Learning Videos). We will also discuss use cases for predictive analytics and machine learning.

For hands-on experience, please enroll in the TechCon Labs:
http://www.osisoft.com/uc2016/sf/day4.html - Operational Insights Using Real-time Dashboards and Self-service Business Intelligence
http://www.osisoft.com/uc2016/sf/day3.html (or on Day 4) **- Use Data Science for Machine Learning and Predictions based on PI System data**
http://www.osisoft.com/uc2016/sf/day3.html (or on Day 4) **- Condition-based Maintenance with AF**

Speaker: Gopal GopalKrishan, gopal@osisoft.com
Duration: 30 minutes

What we'll cover

- UC 2015 talk recap
- New capabilities in AF, EF…
- PI Integrator for BA
  - Visual and Statistical Analytics - BI tools
    - Production Reporting - Dashboards, KPI, …
    - Energy Reporting
    - Custom visuals
  - Predictive Analytics - machine learning, R, open-source
- Call to Action + Q & A

UC 2015 talk re-cap

- Asset Framework (AF) and Event Frames (EF) applied to the forest products use cases
- Use of interactive Business Intelligence
- Self-service visual analytics tools

What if Expedia Showed your Mill's Operations Data

Paper Mill

PULPING - Bleach Plant

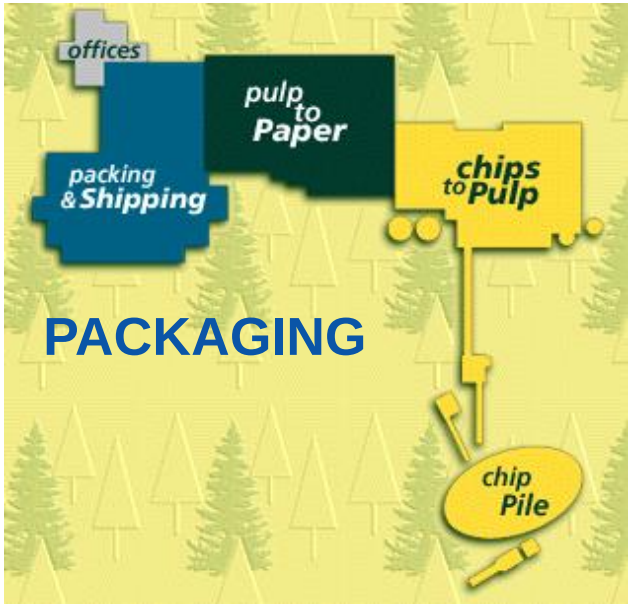
PULPING - Digester

PAPER MACHINE

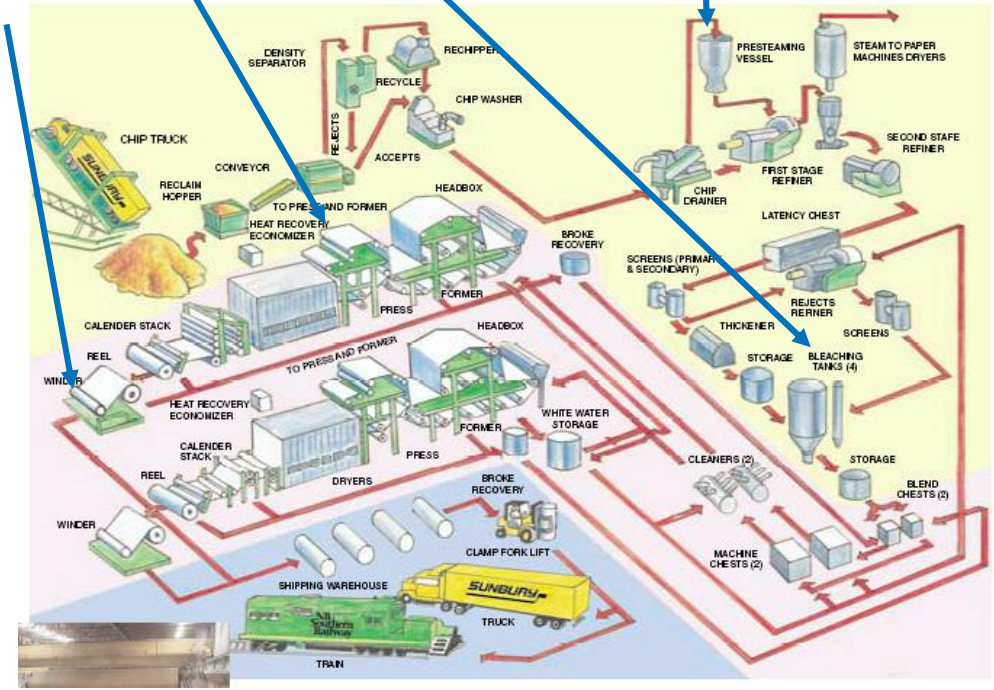
PACKAGING

Winder

PAPER MACHINE

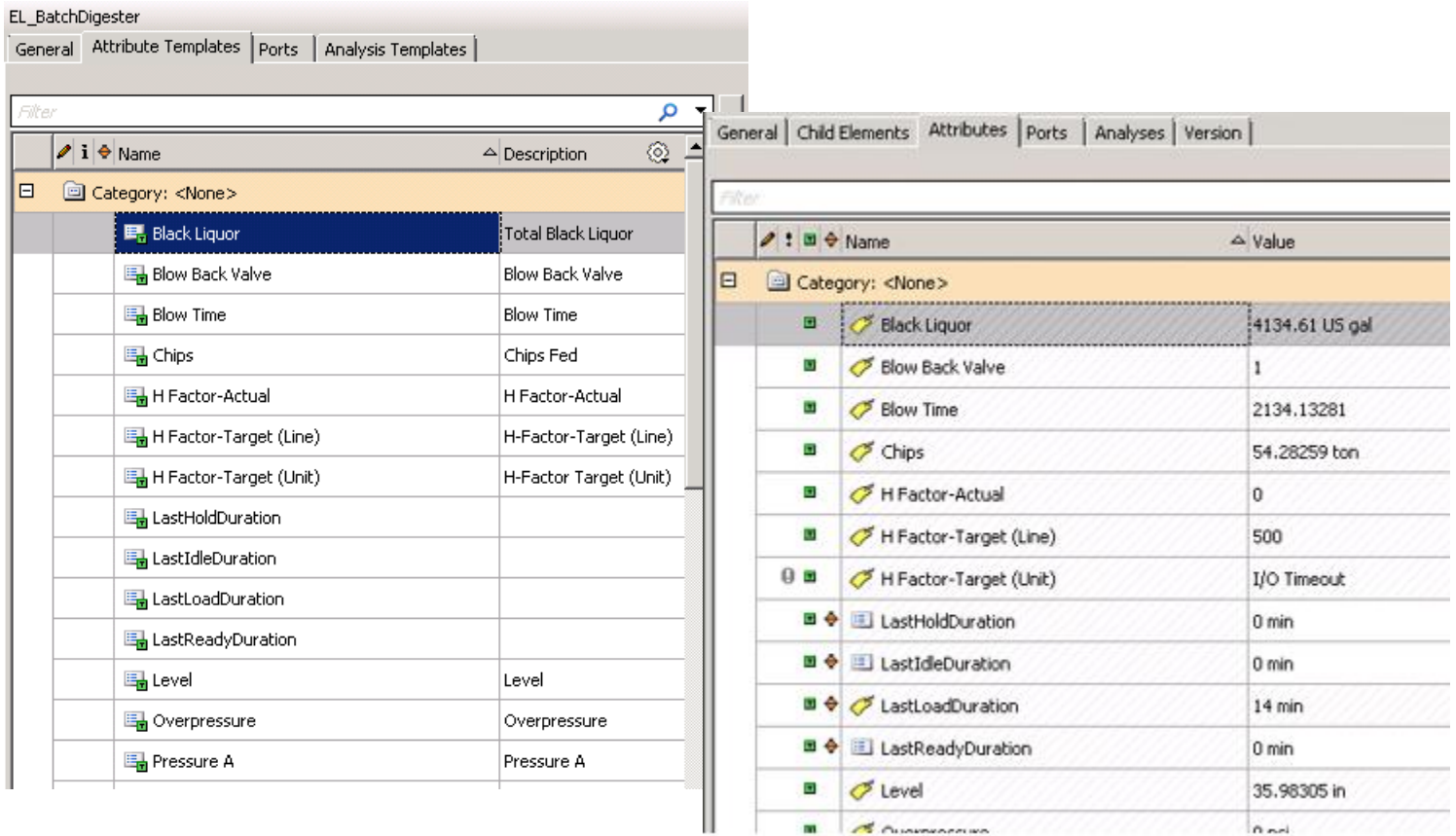


PULPING

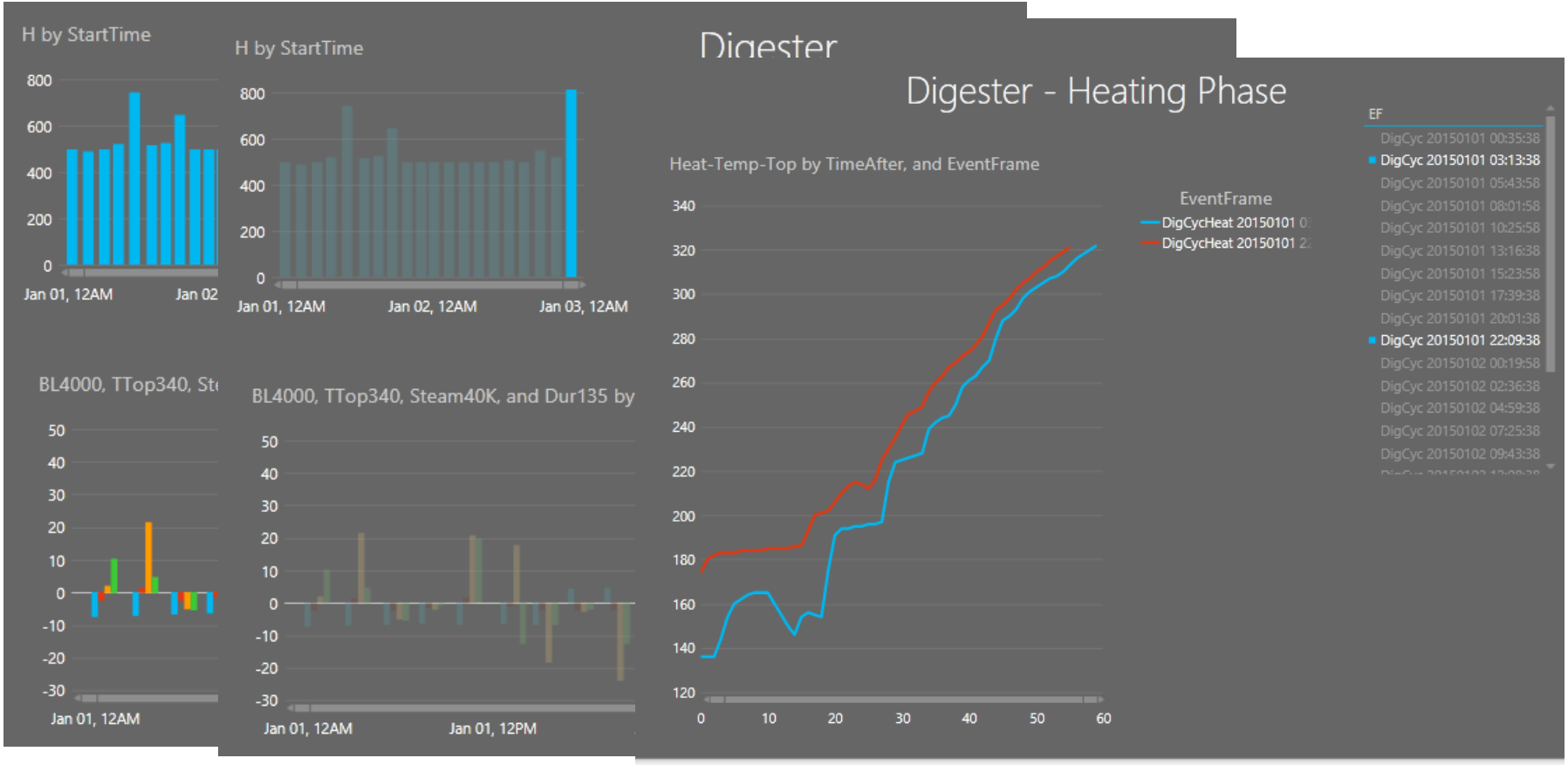


http://www.glatfelter.com/learning/interactive_tour.aspx
http://www.tappi.org/paperu/all_about_paper/paperClips.htm

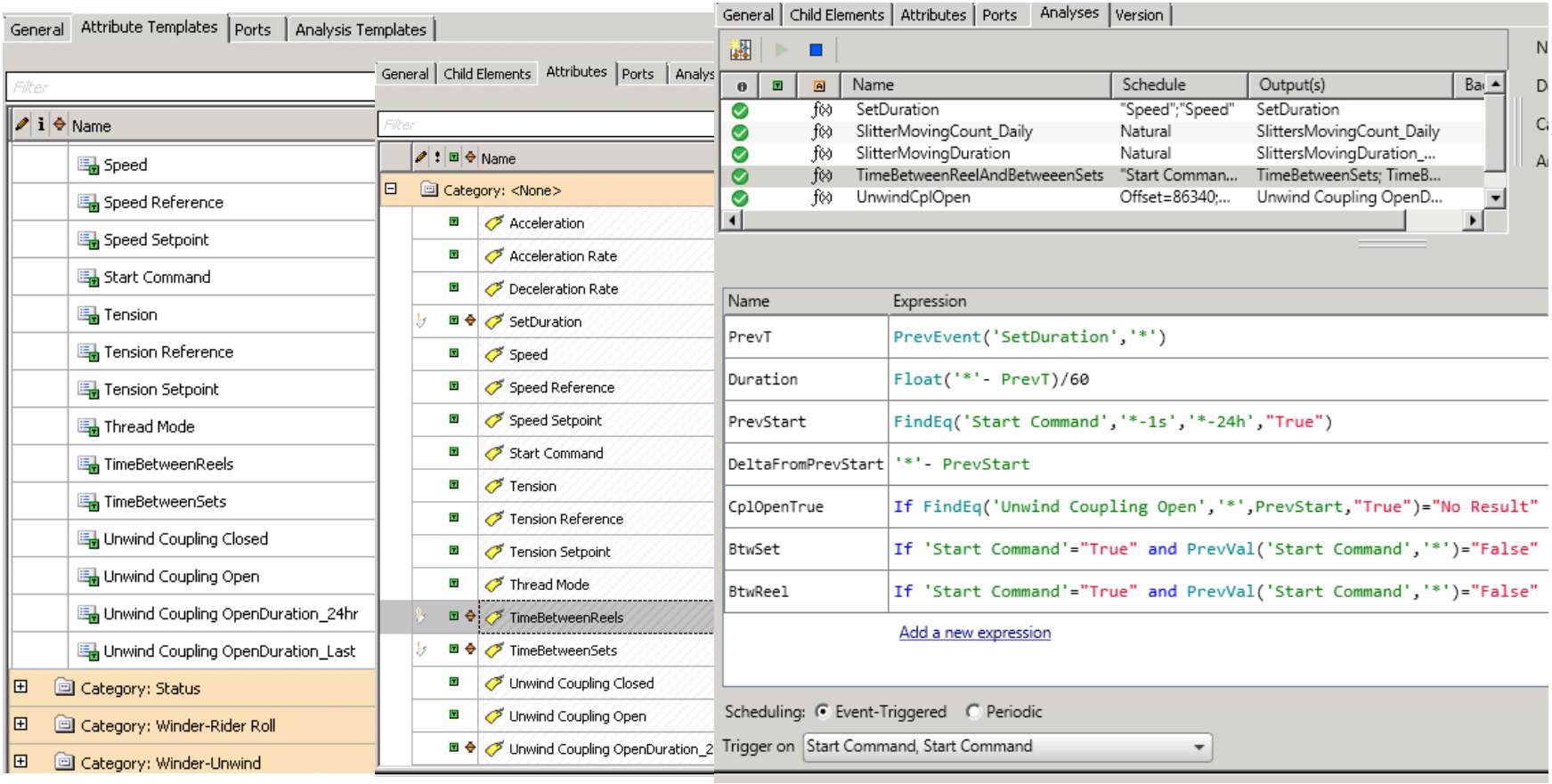
Digester - Templates and Calculations



Digester – Operations Analysis

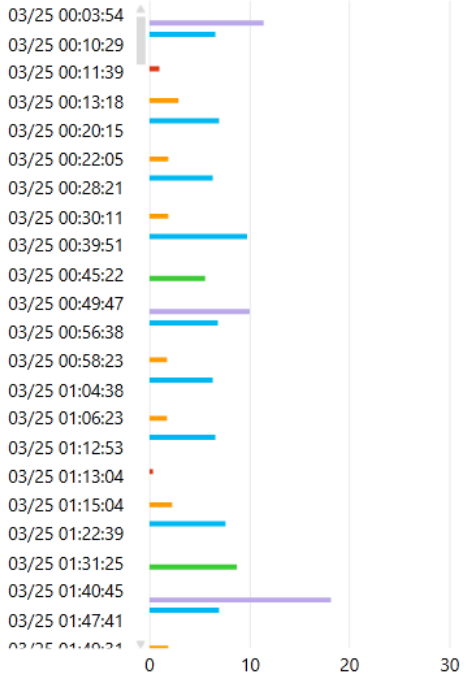


Winder – Template and Calculations



MakingReel, SlittersMoving, BtwReels, CplOpen,BtwSets

MakingReel, SlittersMoving, BtwReel, CplOpen, and



Making Reel, SlittersMoving, BtwReels, CplOpen, BtwSets

DateTime	MakingReel	SlittersMoving	BtwReel	CplOpen	BtwSets
03/25 00:03:54					11.42
03/25 00:10:29	6.59				
03/25 00:11:39		1.00			
03/25 00:13:18			2.82		
03/25 00:20:15	6.94				
03/25 00:22:05			1.84		
03/25 00:28:21	6.26				
03/25 00:30:11			1.84		
03/25 00:39:51	9.68				
03/25 00:45:22				5.51	
03/25 00:49:47					9.93
03/25 00:56:38	6.85				
03/25 00:58:23			1.75		
03/25 01:04:38	6.26				
03/25 01:06:23			1.75		
03/25 01:12:53	6.50				
03/25 01:13:04		0.33			
03/25 01:15:04			2.17		
03/25 01:22:39	7.59				
03/25 01:31:25				8.68	
03/25 01:40:45					18.10
03/25 01:47:41	6.92				
03/25 01:49:31			1.83		
03/25 01:55:57	6.43				
03/25 01:57:46			1.82		

Crew
- 6 AM
- 6 PM

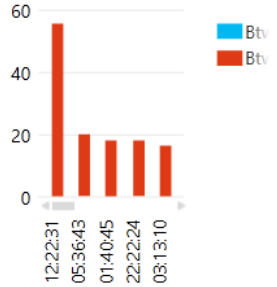
Date
- 03/16
- 03/17
- 03/18
- 03/19
- 03/20
- 03/21
- 03/22
- 03/23
- 03/24
- 03/25
- 03/26

Hour
- 4
- 5
- 6
- 7
- 8
- 9

Between Sets and Reels (minutes)

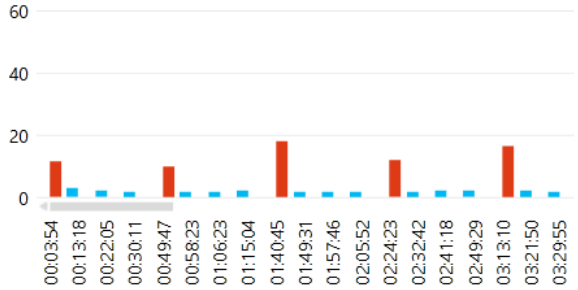
Winder by day - MakingReel, BtwReels, BtwSets

BtwReel, and BtwSets by T

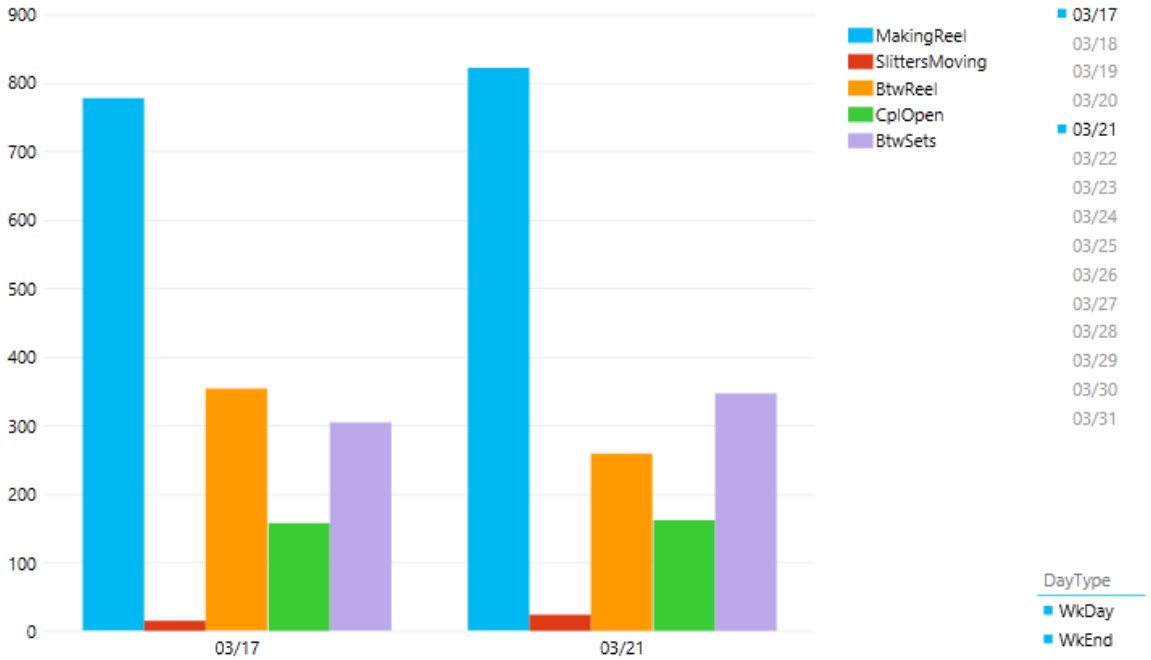


TimeOnly	Date	BtwSets
12:22:31	03/25	55.56
05:36:43	03/25	19.94
01:40:45	03/25	18.10
22:22:24	03/25	17.87
03:13:10	03/25	16.51

BtwReel, and BtwSets by TimeOnly



MakingReel, SlittersMoving, BtwReel, CplOpen, and BtwSets by Date



Live auto-refresh interactive BI screens

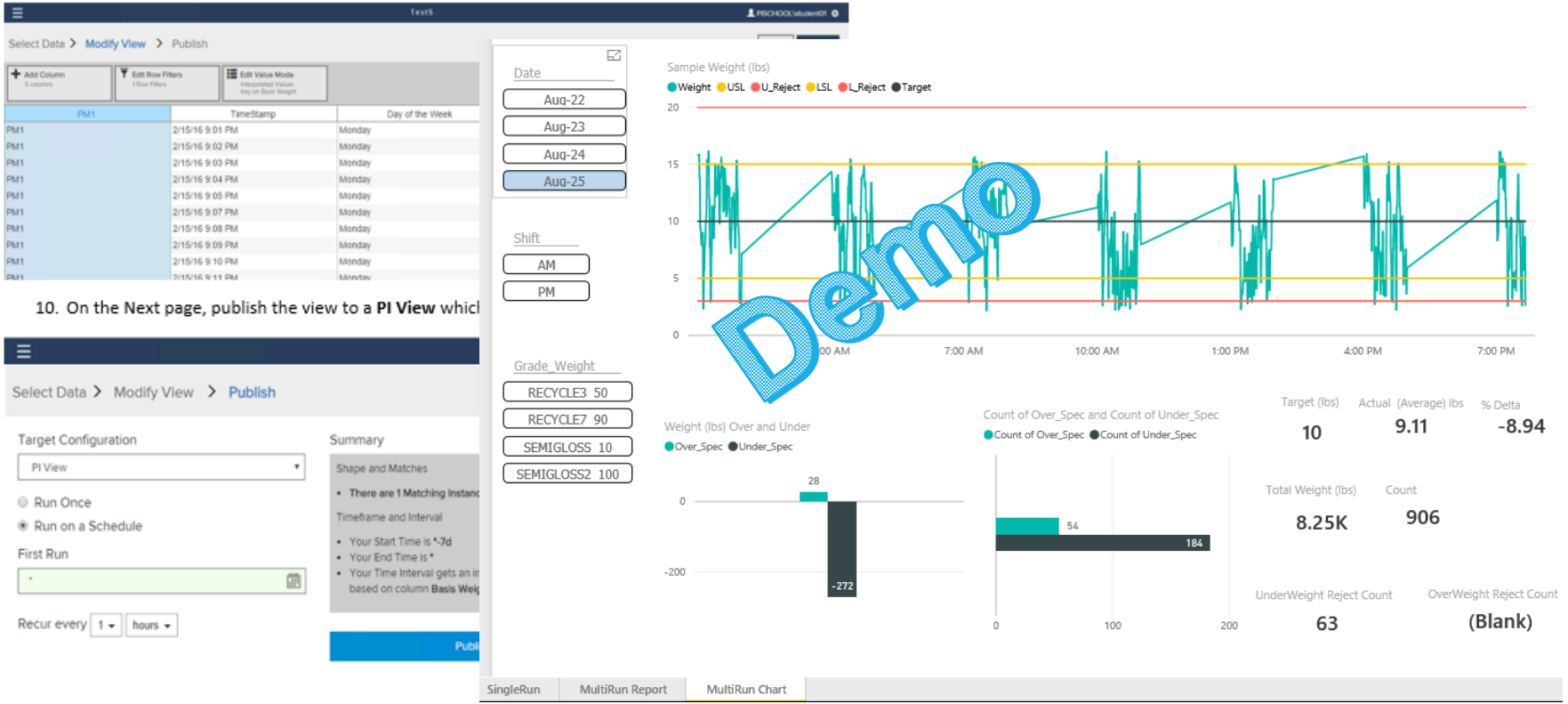
- Production Reporting - Packaging line
- Energy reporting – Motors, Fans, Agitators…
- Refresh – hourly, daily etc.

For hands-on experience, please enroll in the TechCon lab

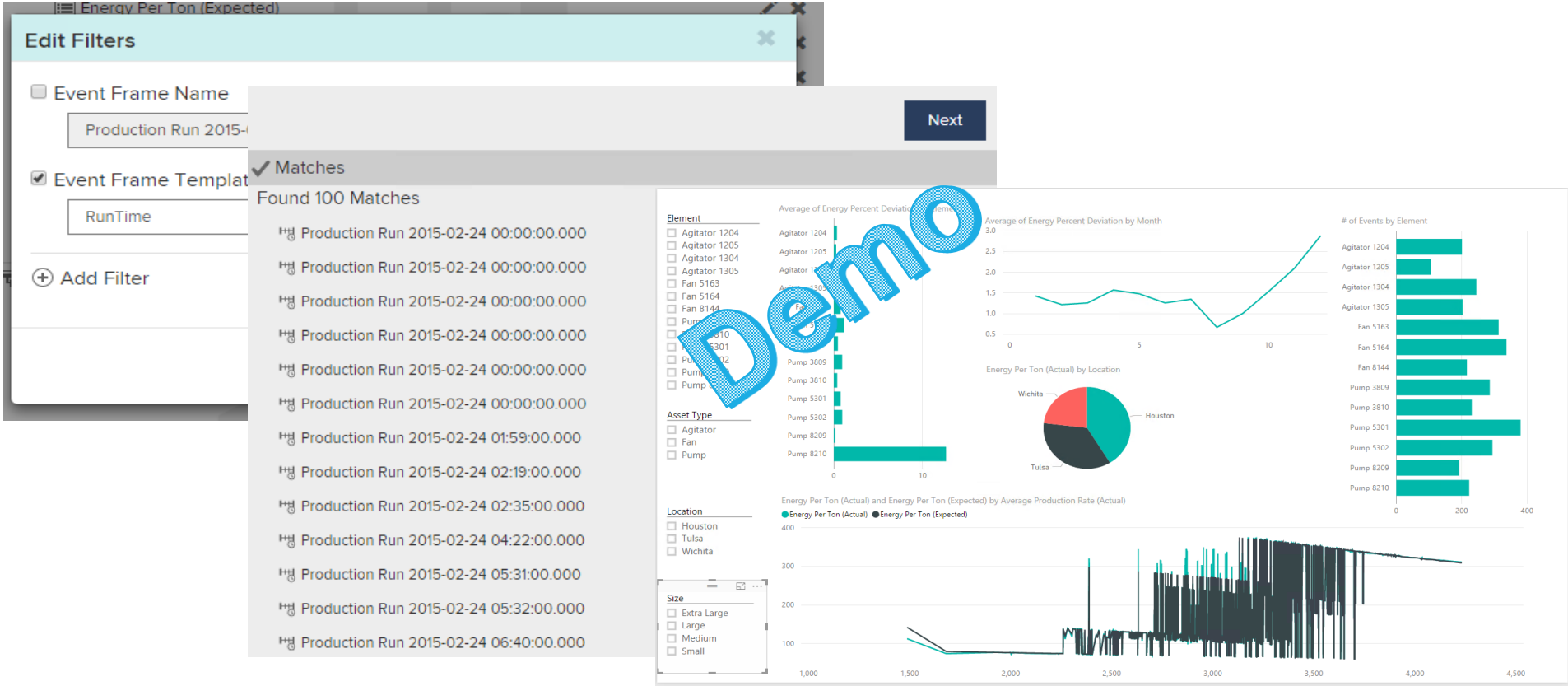
http://www.osisoft.com/uc2016/sf/day4.html - Operational Insights Using Real-time Dashboards and Self-service Business Intelligence

Production Reporting

https://app.powerbi.com/view?r=eyJrIjoiNWVjYzM0OWEtZmJkNy00ZWQ3LTgzNmUtMzM3MThjMTIyOGIwIiwidCI6ImE0NDVlZTgxLTJiOTEtNDgwNi04ODNiLTFkYzY3M2Q1OTE0NyIsImMiOjZ9



Energy Usage Reporting

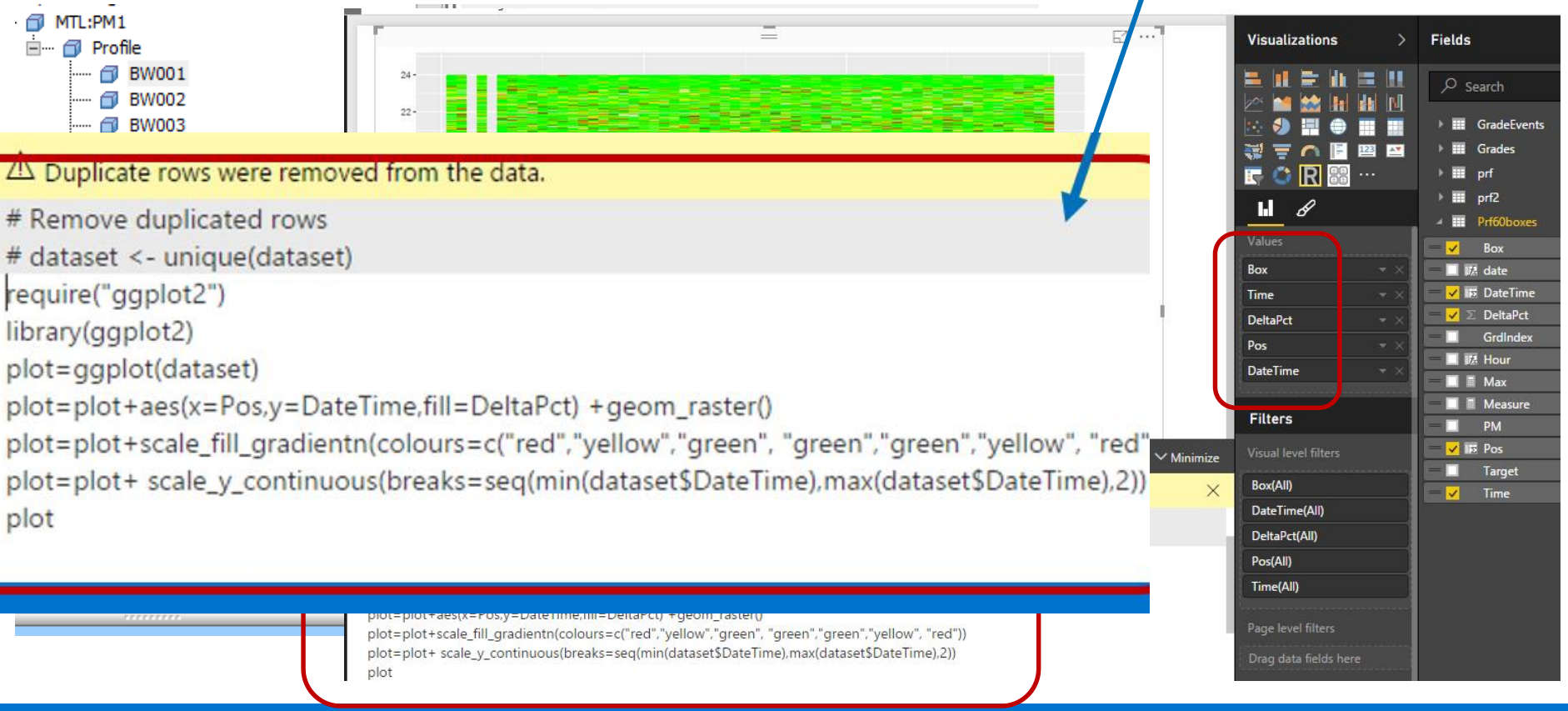


Custom visuals

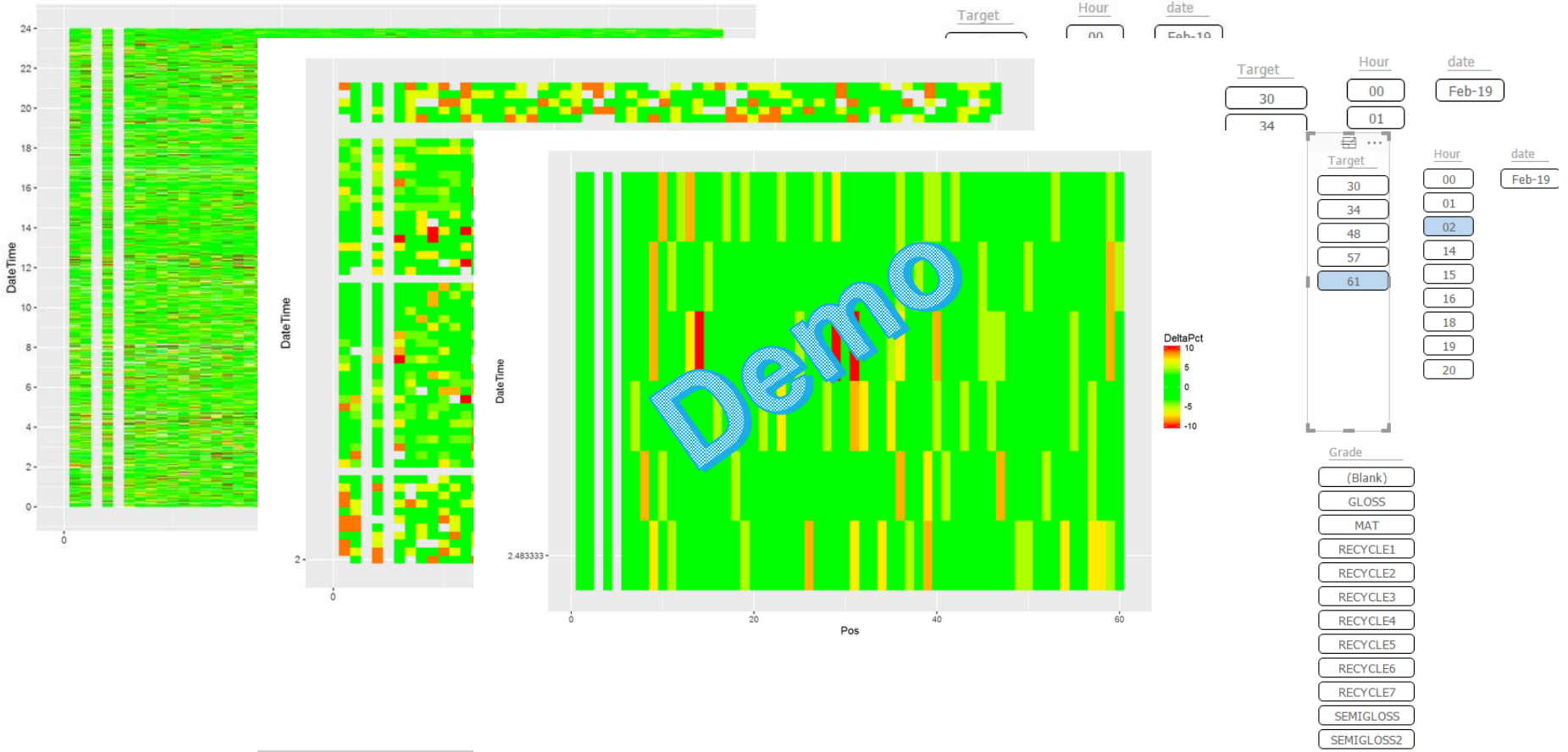
https://app.powerbi.com/visuals/

Custom Visuals with R script

R Script



Basis Weight - Profile



Predictive Models and Statistical/Machine Learning

- Multivariate techniques
  - Reduce time for grade change
  - Lab data – predict quality
  - Equipment failure
  - Sheet-break
  - …
  - …

Predict engine failure/remaining useful life

Lab Exercise

In a deployment with about 100 engines which are similar, sensor data such as rpm, burner fuel/air ratio, pressure at fan inlet, and twenty other measurements plus settings for each engine – for a total of about 2000 tags – are available. On average, an engine fails after 206 cycles, but it varies widely - from about 130 to 360 cycles.

Using an open source tool such as R for machine learning, you will create a multivariate model to predict engine failures within approximately a 10 cycle window ***before they fail***. The lab will walk through the end-to-end data science process – preparing the dataset, visually exploring it, partitioning the data for training and testing, validating the models using previously unseen data, and finally deploying the model with AF asset analytics for predictive maintenance.

Level: 300 (familiarity with R will be useful but is not a requirement)

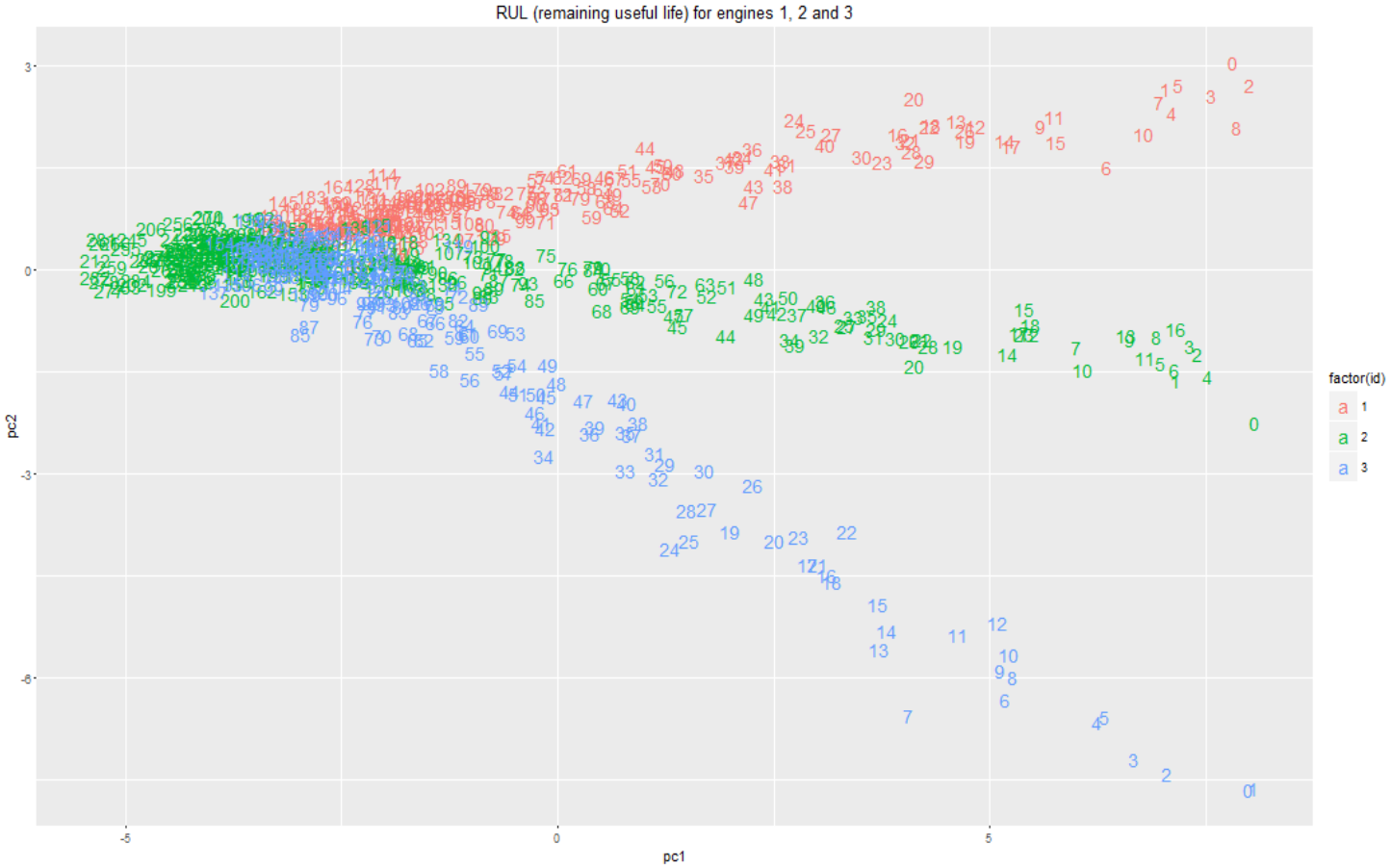
For hands-on experience, please enroll in the TechCon lab – Day3 or Day 4

http://www.osisoft.com/uc2016/sf/day3.html - Use Data Science for Machine Learning and Predictions based on PI System data

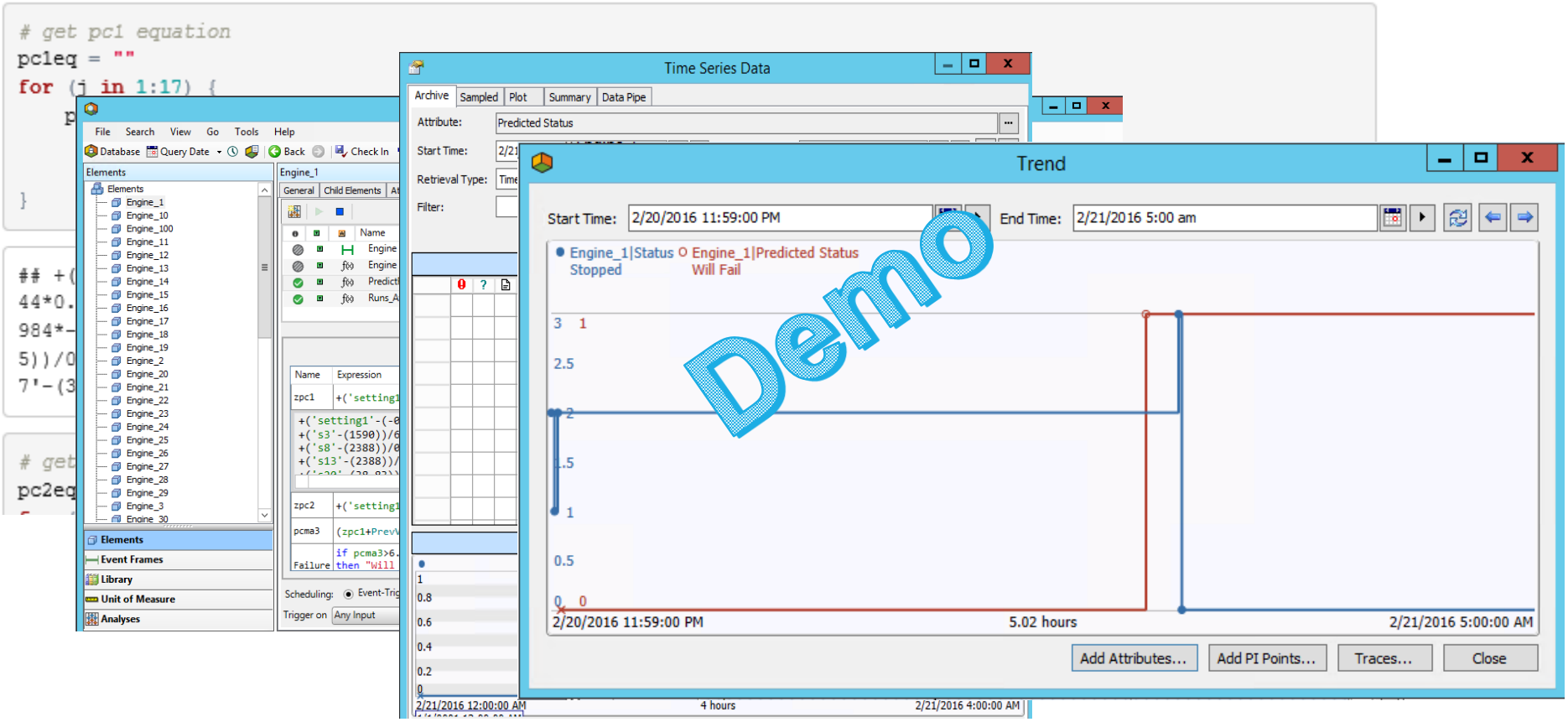
Engine data

	A	B	C	D
1	id	cycle	setting1	setting2
2	1	1	-0.0007	-0.0004
3	1	2	0.0019	-0.0003
4	1	3	-0.0043	0.0003
5	1	4	0.0007	0
6	1	5	-0.0019	-0.0002
190	1	189	-0.0006	0.0002
191	1	190	-0.0027	0.0001
192	1	191	0	-0.0004
193	1	192	0.0009	0
194	2	1	-0.0018	0.0006
195	2	2	0.0043	-0.0003
196	2	3	0.0018	0.0003
197	2	4	0.0035	-0.0004

	A	B	C	D
1	id	cycle	setting1	setting2
2	1	1	-0.0007	-0.00
3	1	2	0.0019	-0.00
4	1	3	-0.0043	0.00
5	1	4	0.0007	
6	1	5	-0.0019	-0.00
20625	100	193	-0.0001	0.00
20626	100	194	-0.0011	0.00
20627	100	195	-0.0002	-0.00
20628	100	196	-0.0004	-0.00
20629	100	197	-0.0016	-0.00
20630	100	198	0.0004	
20631	100	199	-0.0011	0.00
20632	100	200	-0.0032	-0.00

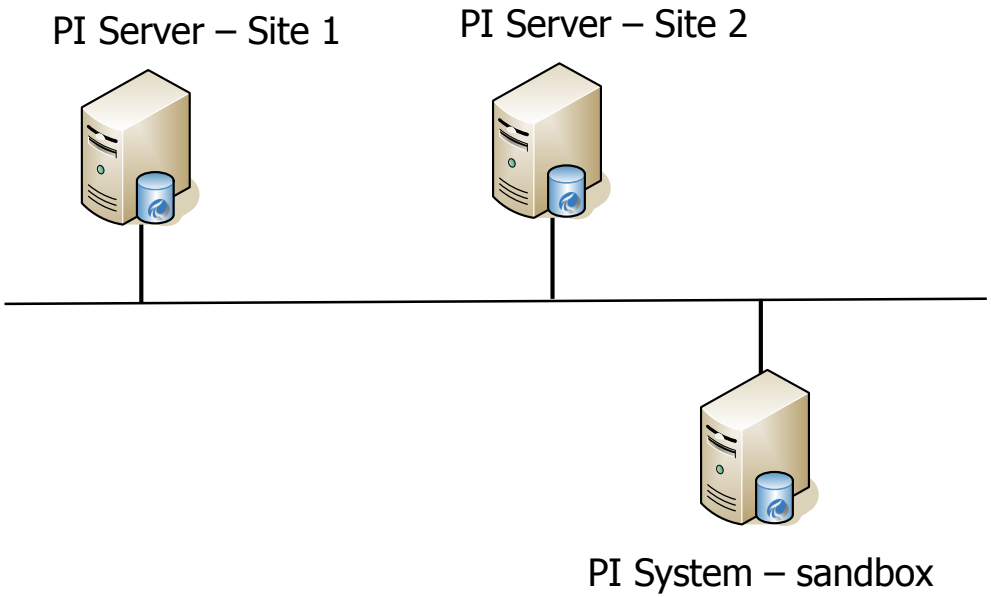


Engine failure prediction



PI System Sandbox

https://pisquare.osisoft.com/community/developers-club



Win 2008 R2 or Win 2012
- 80GB disk and 8GB RAM

Office Excel 64 bit – 2010 or 2013
Power BI (does not depend on Office)

PI Server 2015 (PI DevClub license is OK)
SQL 2014 (SQL Express is OK)
AF 2015 (Server and Client)
EFGen
PI SMT
PI Builder

PI ODBC, PI Integrator for BA

PI DataLink 2015
PI ProcessBook 2016
PI Coresight 2016

Call to Action

- Get a PI Developers Club subscription
  https://pisquare.osisoft.com/community/developers-club
- Deploy a PI System sandbox
- Start with simple AF/EF models and calculations to answer specific questions
- Get started with ***visual*** and ***predictive*** analytics

Contact Information

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OSIsoft, LLC.

Questions

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

State your **name & company**

Please remember to…

Complete the Online Survey for this session

http://ddut.ch/osisoft

감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado


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