

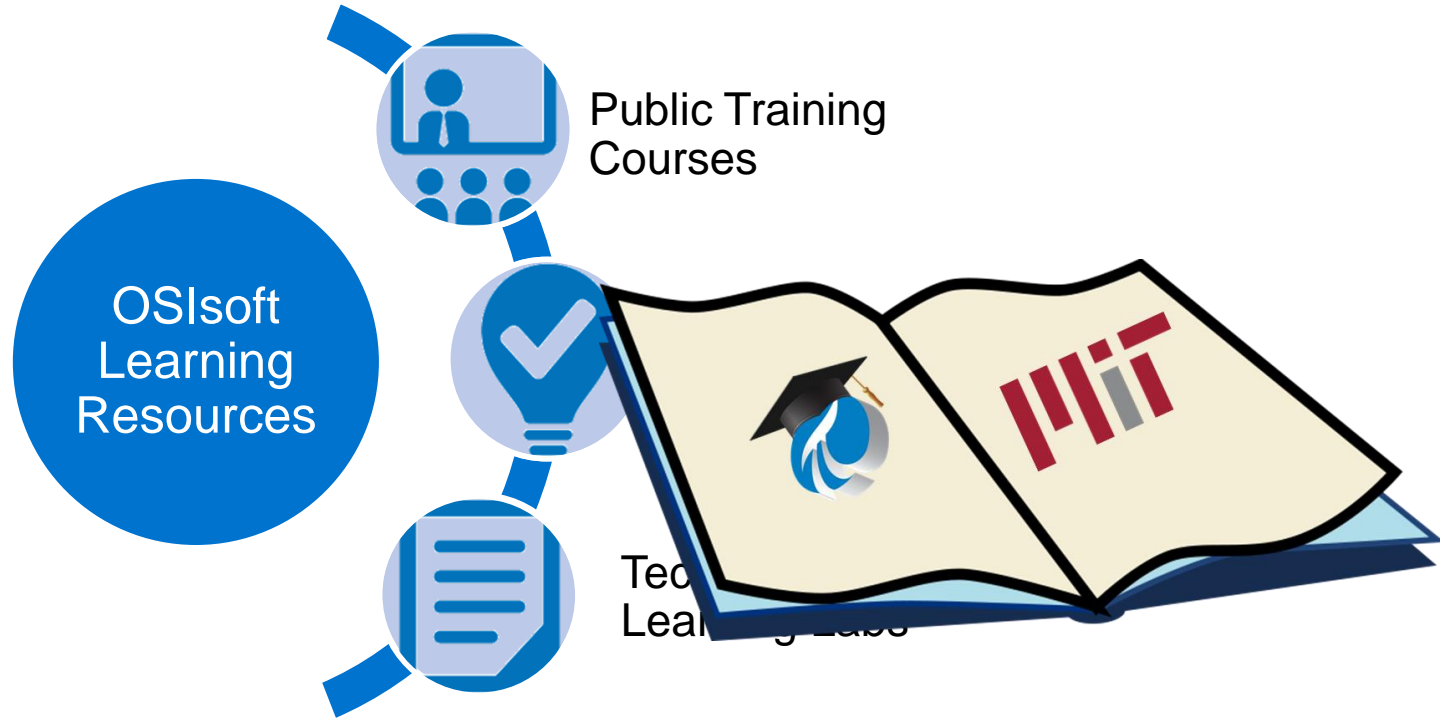


OSIsoft Learning Resources

Transform Your Classroom

Presented by **Dr. Erica Trump**

Transform Your Classroom

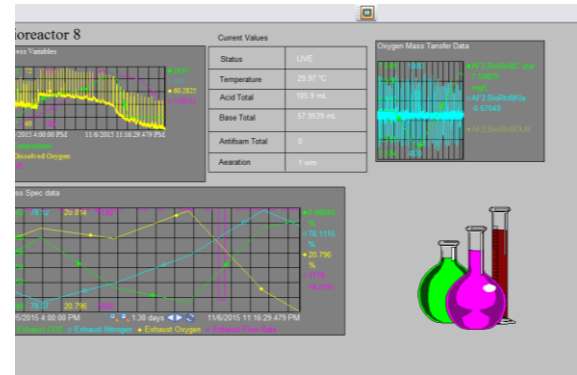


Make It Your Own! – Example from MIT

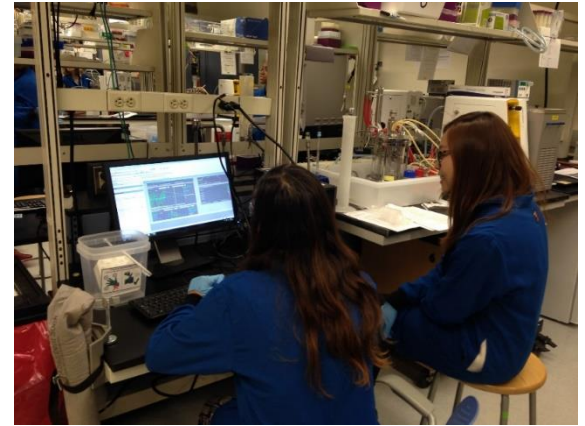
- MIT adapted materials from two OSIsoft public training offerings for use in an undergraduate engineering laboratory course
 - Students analyze experimental results in real-time
 - Students pool results to explore wide range of independent variables
 - Students gain hands-on experience with industry-standard tools



- **Visualizing PI System Data**
 - Students think critically to construct custom dashboards
 - Students monitor their experiments throughout the semester using dashboards



- **Building PI System Assets and Analytics with PI AF**
 - Students apply engineering concepts to model bioreactors
 - Students use PI with online analytics to accomplish *engineering in real time*





Public Training Courses

Public Training Courses

- **Visualizing PI System Data**
- Analyzing PI System Data
- **Building PI System Assets and Analytics with PI AF**
- PI System Administration for IT Professionals
- PI System Architecture, Planning, & Implementation



What's included in material for a public training class?

- Student and instructor workbooks
- PowerPoint slides
- Simulated training data with setup options
 - VLEs or your own software, using easily imported training databases
- Instructor Guide (Available upon request)
 - Class setup instructions, lesson plan, timeline, exercise overviews, general tips




Student workbooks

- Directed activities with step-by-step instructions
- Tie-ins to OSIsoft Learning YouTube channel
- Student exercises with defined objectives
- Discussion topics

Analyzing PI System Data

4.3.2 Exercise – Calculate Total Gross Generation for Each Station

7.4 Discussion

 This is a discussion designed to maximize learning in a specific topic area. Your instructor will have questions, and will prompt for communication within the class. This is an open ended section and the result depends on your needs.

Objective: The PI Integrator for Business Analytics can expose different attributes and filter different data sets within the PI AF Database for consumption by a BI client.

Approach

- What format would we like the data to be in for processing by BI clients?
- What should be added to the Asset Shape to improve the format?
- Do these queries match what we want in our reports?
- If not, what is lacking?

Estimated Completion time 15 minutes.

Station	Value
894510905 %	
9625345866 %	
9863382975 %	
8734130899 A	

PowerPoint presentations

- Assist with instruction and class delivery
- Guide students through course materials

The PI System Infrastructure


2.1: Explore an Existing Report

4.2.3: Calculate Generating Efficiency

Objective: Power generators require electricity to operate. The net generation is defined as the amount of gross generation, or the amount of electricity that a generator produces, less the electricity required to operate the unit.

Calculate the generating efficiency, or the ratio between the net generation to the gross generation, expressed as a percentage.

46



The pump is down - what's happening?

Get Time

Keep the process Healthy

Alert on data quality

Alert on hours

23

Materials for Your Use – Public Training Courses

- Download course materials from the OSIsoft Tech Support page
 - Go to *All Downloads* and search for course within the *Training Materials* category
 - Example: *Visualizing PI System Data*

The screenshot shows the OSIsoft Tech Support website interface. At the top, there are navigation links for 'OSIsoft Home', 'PI Square Community', 'Learning', and 'Live Library'. A search bar is located in the top right corner. Below the navigation, there are tabs for 'My Support', 'Contact Us', 'Resources', 'Downloads', and 'Products'. The 'Downloads' tab is selected. Underneath, there are sub-tabs for 'My Downloads' and 'All Downloads'. A search prompt reads: 'Type in part of the file name (please no special characters such as: %/,+,*,&,#) or select from the drop-down menus. By default you see only current'. Below this, there is a search input field with 'Visualizing PI System' entered, a dropdown menu set to 'Training Materials', and a 'Search' button. Two red boxes highlight the search input field and the 'Training Materials' dropdown menu. Below the search bar, a table titled 'Training Materials' is displayed, listing various training materials with columns for Name, Version, Type, Published, Platform, and Status.

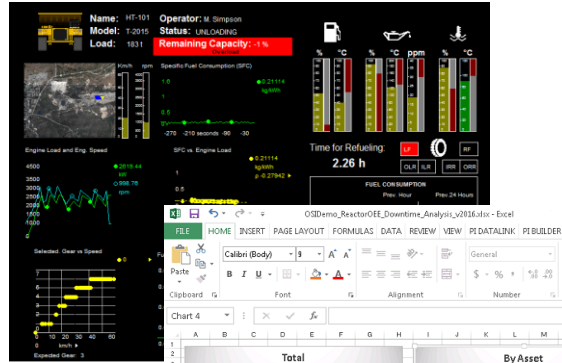
Name	Version	Type	Published	Platform	Status
Visualizing PI System Data	2016 R2	Training Materials	2017-03-09	Windows	Download
Visualizing PI System Data - French	2015B	Training Materials	2015-11-02	Windows	Download
Visualizing PI System Data - Japanese	2016A	Training Materials	2016-12-05	Windows	Download
Visualizing PI System Data - Portuguese	2013	Training Materials	2013-08-01	Windows	Download
Visualizing PI System Data - RU	2013	Training Materials	2014-02-04	Windows	Download
Visualizing PI System Data - Simplified Chinese	2015B	Training Materials	2016-01-26	Windows	Download
Visualizing PI System Data - Spanish	2013	Training Materials	2013-12-20	Windows	Download
Visualizing PI System Data - German	2016	Training Materials	2016-12-29	Windows	Download
Visualizing PI System Data - Korean	2013	Training Materials	2014-01-30	Windows	Download



Community Library

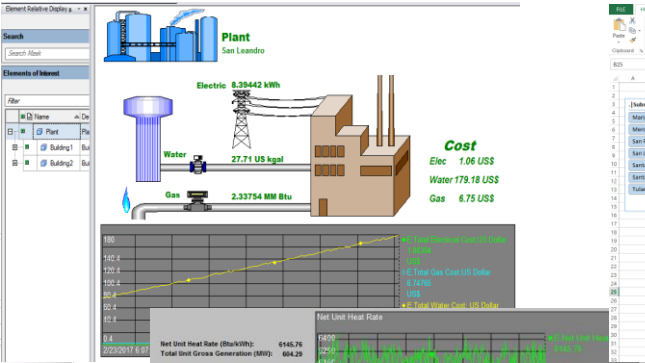
Growing resource library for examples and templates

Mobile asset monitoring



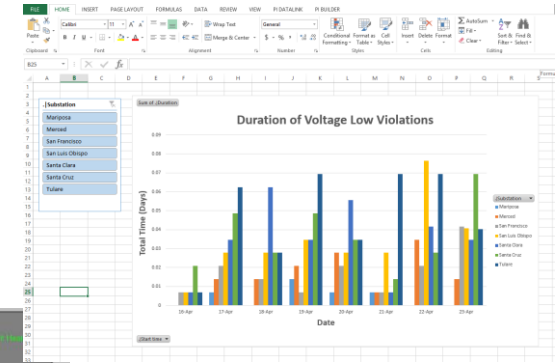
Reactor OEE

Utilities cost management

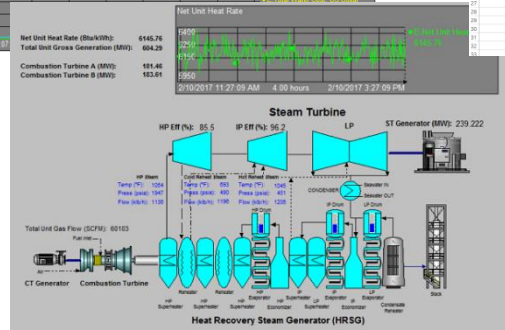


Turbine efficiency

Feeder voltage excursions

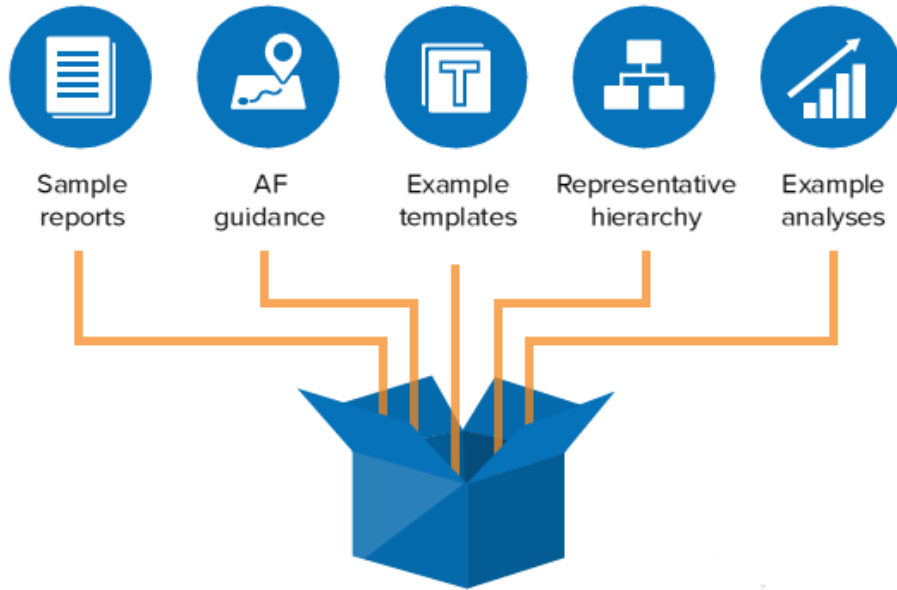


....And many more!



Asset Based PI Example Kits

Explore how business initiatives take shape.



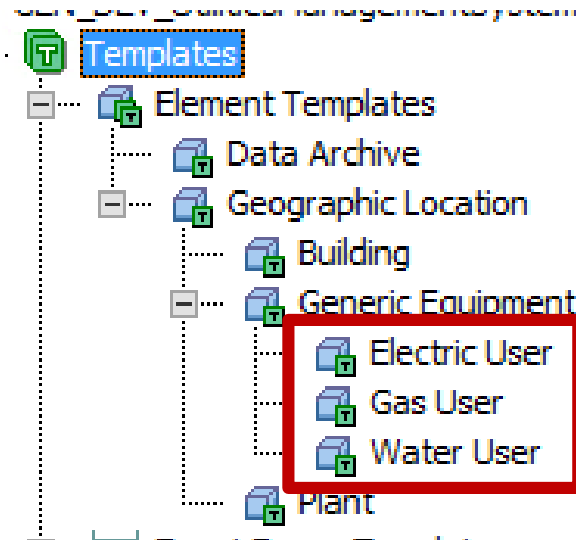
- Learning tool & starting point
- Installed on your PI Server
- Includes simulated data
- Available to everyone in the **AF Community Library** on PI Square

<https://pisquare.osisoft.com/community/all-things-pi/af-library>

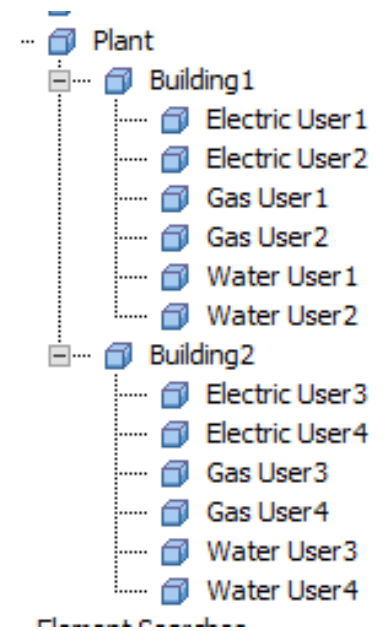
Getting started with the Utilities Cost Management kit



Templates



Example hierarchy



Attributes capture flows & meta data; analyses calculate usage and costs

Gas User1						
General	Child Elements	Attributes	Ports	Analyses	Notification Rules	Version
Filter						
	Name	Value				
	Asset Location	Plant				
	Average Gas Flow	0.01752868 scfs				
	Equipment Type	GPump				
	Fault Code	Running state				
	Gas Energy Usage Rate	62705.55 Btu/h				
	Gas Flow	0.01270436 scfs				
	Gas Flow Time	888 min				



Gas User1					
General	Child Elements	Attributes	Ports	Analyses	Not
Filter					
	Name	Backfilling			
	Gas Cost	✓			
	Gas Downtime	✓			
	Gas Usage	✓			
	Gas Usage Aggregates	✓			
	OSIDemo_Random Data	✓			



	Total Gas Cost	2.688456 US\$
	Total Gas Usage	0.9807071 MM Btu

Roll-ups sum up everything going on in the building and plant

Plant

General Child Elements Attributes Ports Analyses N

Name	Backfilling
Electrical Cost	✓
Electrical Downtime	✓
Electrical Usage	✓
Gas Cost	✓

Building1

General Child Elements Attributes Ports Analyses No

Name	Backfilling
Building Electrical Cost	✓
Building Electrical Do...	✓
Building Electrical Usa...	✓
Building Gas Cost	✓
Building Gas Usage	✓

Element Relative Display

Search

Search Mask

Elements of Interest

Filter

Name	De
Plant	Pla
Building1	Bui
Building2	Bui

Plant
San Leandro

Electric 8.39442 kWh

Water 27.71 US kgal

Gas 2.33754 MM Btu

Cost

Elec 1.06 US\$

Water 179.18 US\$

Gas 6.75 US\$

Legend:

- E.Total Electrical Cost; US Dollar 1.06398 US\$
- E.Total Gas Cost; US Dollar 6.74765 US\$
- ◆ E.Total Water Cost; US Dollar 179.176 US\$

2/23/2017 6:07:51 AM 8.00 hours 2/23/2017 2:07:51 PM

AF Community Library - How to Get Example Kits

- Download AF Community Library Example Kits from OSIsoft Tech Support page
 - Go to *All Downloads* and search for *Example Kit* within the *Training Materials* category

The screenshot shows the OSIsoft Tech Support website interface. At the top, there are navigation links: "OSIsoft Home", "PI Square Community", "Learning", and "Live Library". On the right, it says "Welcome, Erica" and "Sign Out". The main header features the OSIsoft logo and "Tech Support" text, along with a search bar labeled "Search All OSIsoft". Below the header is a navigation menu with tabs: "My Support", "Contact Us", "Resources", "Downloads", and "Products". Under the "Downloads" tab, there are sub-tabs for "My Downloads" and "All Downloads", with a "Request a Download >" link. A search filter section contains a text input field with "Example Kit" (highlighted with a red box), a dropdown menu for "Select or enter a product name" (highlighted with a red box and set to "Training Materials"), and other filters for "Current Version", "All Languages", and a "Search" button. Below this, a table titled "Training Materials" is displayed with columns for Name, Version, Type, Published, Platform, and Status. The table lists several example kits, such as "Asset Based PI Example Kit - Mineral Processing v2016" and "Asset Based PI Example Kit - Utilities Cost Management v2016B (Japanese)".

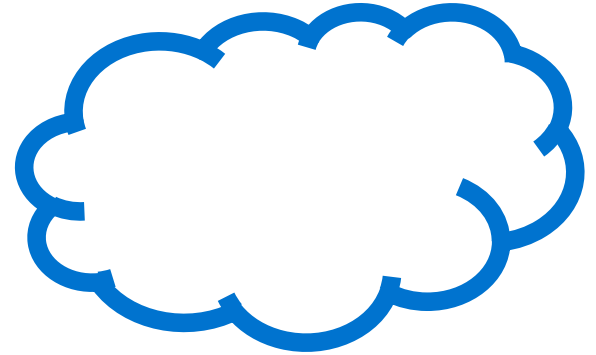
Name	Version	Type	Published	Platform	Status
Asset Based PI Example Kit - Mineral Processing v2016	2016	Training Materials	2016-11-01	Windows	Download
Asset Based PI Example Kit - Mobile Asset Performance Monitoring	2016	Training Materials	2016-04-01	Windows	Download
Asset Based PI Example Kit - Reactor OEE v2016	2016	Training Materials	2016-07-28	Windows	Download
Asset Based PI Example Kit - Utilities Cost Management v2016B (Japanese)	2016B	Training Materials	2016-11-09	Windows	Download
Asset Based PI Example Kit - Utilities Cost Management v2016C	2016C	Training Materials	2017-03-01	Windows	Download
Asset Based PI Example Kit Condition Monitoring	2016	Training Materials	2016-07-07	Windows	Download



TechCon Learning Labs

Our TechCon Learning Labs

- Teaching labs shared at OSIssoft Users Conferences
- Fully developed training documents
- Cloud-based learning environment



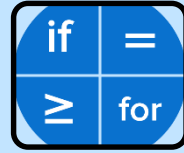
End-to-End Exercises

- Provide time-series datasets with asset context
- Motivated by industry need
 - Predictive maintenance – equipment failure
 - Predicting hourly energy usage – facility/building
- Well-defined problem with clear objectives
- Defined solutions

Popular TechCon Learning Labs



Condition Based
Maintenance



Apply Data Science with
Machine Learning



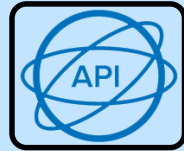
Geospatial Analysis in
Real Time



Using Forecast Data with
the PI System



Modeling Your Process



Building Applications with
PI Web API



Detect and Track
Important Events



Developing Cross-
Platform Mobile Apps

Data Science Labs

- TechCon Learning Labs show our customers how to use PI data with advanced tools for data science
 - R Framework
 - Azure Machine Learning
 - Power BI
 - Esri ArcGIS



TechCon Workbooks

Navigation

Search document

Headings Pages Results

Headings Pages Results

Learning Objectives

Part I - Extracting

Part II - Predict Equipment Failure Using Statistical Analysis

Read the PI

Do some st

Plotting en

Closer look

Use odd nu

Extract prin

Plot engine

Predictive E

Part III - Ready th

Appendix A: Usin

Appendix B: Usin

Appendix C: Follo

Follow up c

Reference Materi

Headings Pages Results

Learning Objectives, Problem Stateme...

Part I - Extracting PI System Data usin...

Part II - Predict Equipment Failure Usi...

Read the PI Integrator file output

Do some statistics and data mu...

Plotting engine failure distributi...

Closer look at Engine 1 - is ther...

Use odd numbered engines for...

Extract principal components

Plot engine cycle in terms of PC...

Predictive Equation

Part III - Ready the Prediction for Depl...

Appendix A: Using Power BI to Evalua...

Appendix B: Using PI WebAPI with R

Appendix C: Follow-up questions from...

Follow up questions

Reference Materials

Part II - Predict Equipment Failure Using Statistical Analysis

Part III - Ready the Prediction for Deployment using PI Analytics

With the model trained in R, we have developed the equations that will allow us to predict the failures before they occur based on the engine sensor and settings data. These can be expressed as arithmetic equations and configured into the engine template in AF. We can then run these calculations in AF using PI Analytics. By doing so, we are able to run the model in real-time, using any newly observed sensor and settings values to warn us when a failure is anticipated and prevent unexpected shutdowns.

In this part of the lab, we will be testing our predictive equations against the data we have already loaded in our PI system. Remember, the analysis we did using R only involved 50 of the 100 engines in our sample dataset. We have still not seen how well things will work with the remaining 50 engines. To perform this test, we will use the backfill feature of PI Analytics to see if our equations will accurately predict an engine failure before it actually occurs.

The predictive analytic equations developed in Part II of this lab have already been configured in the Engines AF model. To see them, go into the "Library" section and select the "Engine" template.

Category	Engine Sensor	Default Value
11	0%	
12	0%	
13	0%	
14	0%	
15	0.00a	
16	0.00a	
17	0.00a	
18	0rpm	
19	0rpm	
110	0	
111	0	

from the top toolbar and select "Engine" from the Select Database

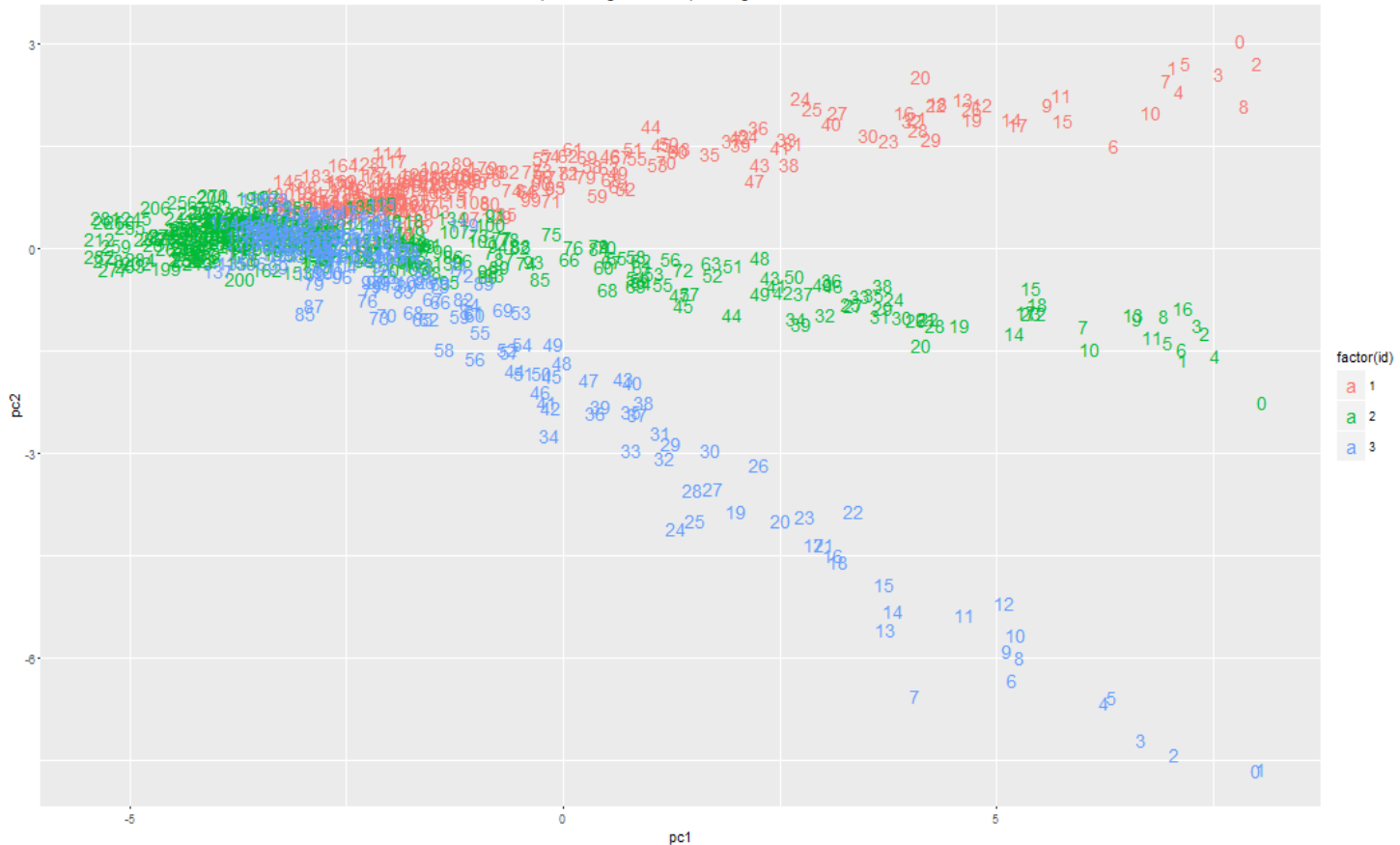
- Introductory information, exercises, walkthrough, and solutions

Engine data

	A	B	C	D	
1	id	cycle	setting1	setting2	set
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	set
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	
20625	100	193	-0.0001	0.0002	
20626	100	194	-0.0011	0.0003	
20627	100	195	-0.0002	-0.0001	
20628	100	196	-0.0004	-0.0003	
20629	100	197	-0.0016	-0.0005	
20630	100	198	0.0004	0	
20631	100	199	-0.0011	0.0003	
20632	100	200	-0.0032	-0.0005	

RUL (remaining useful life) for engines 1, 2 and 3



Engine failure prediction

```
# get pci equation
pcleq = ""
for (j in 1:17) {
  p
}

## +(
44*0.
984+-
5)/0
7'-(3

# get
pc2eq
```

File Search View Go Tools Help
Database Query Date Back Check I

Elements
Engine_1
Engine_10
Engine_100
Engine_11
Engine_12
Engine_13
Engine_14
Engine_15
Engine_16
Engine_17
Engine_18
Engine_19
Engine_2
Engine_20
Engine_21
Engine_22
Engine_23
Engine_24
Engine_25
Engine_26
Engine_27
Engine_28
Engine_29
Engine_3
Engine_30

General Child Elements
Name
zpc1 +('settl
+('setting1'-
+('s3'-(1590))
+('s8'-(2388))
+('s13'-(2388))
zpc2 +('settl
pcma3 (zpc1+Pr
Failure if pcma3
then "wi

Name Expression
zpc1 +('settl
+('setting1'-
+('s3'-(1590))
+('s8'-(2388))
+('s13'-(2388))
zpc2 +('settl
pcma3 (zpc1+Pr
Failure if pcma3
then "wi

Scheduling: Event-Triggered Periodic
Trigger on Any Input

Advanced...

Connected to the PI Analysis Service.

Trend
Start Time: 2/20/2016 11:59:00 PM End Time: 2/21/2016 5:00 am
Engine_1|Status Engine_1|Predicted Status
Stopped Will Fail
3 1
2.5
2
1.5
1
0.5
0 0
2/20/2016 11:59:00 PM 5.02 hours 2/21/2016 5:00:00 AM
Add Attributes... Add PI Points... Traces... Close

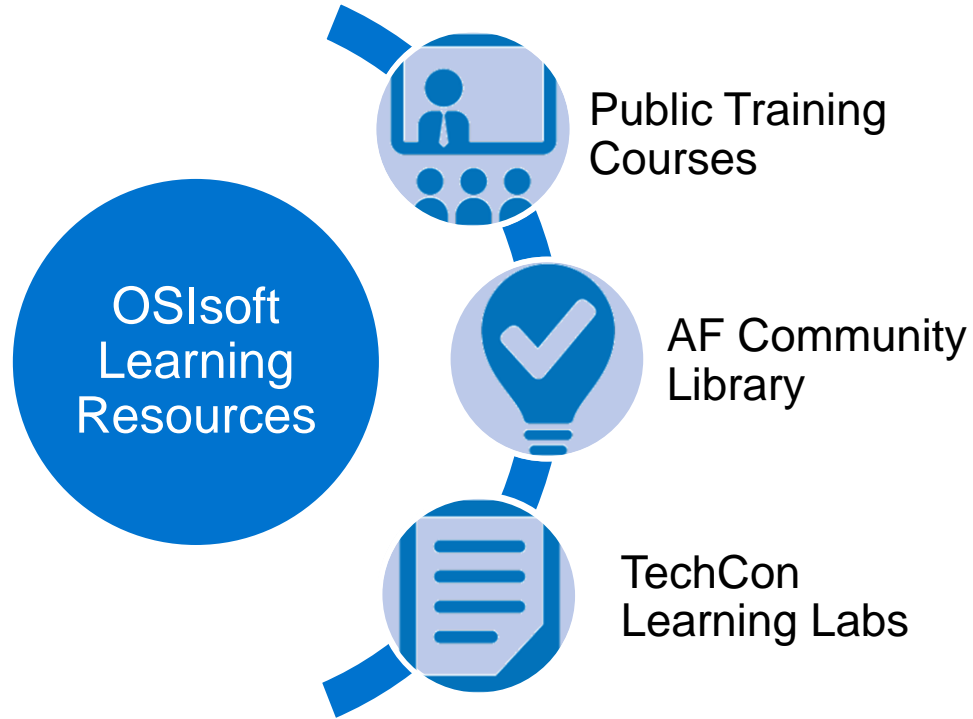
Materials for Your Use – TechCon Learning Labs

- Download TechCon materials from the OSIsoft Tech Support page
 - Go to *All Downloads* and search for TechCon within the *Training Materials* category

The screenshot shows the OSIsoft Tech Support website interface. At the top, there are navigation links for 'OSIsoft Home', 'PI Square Community', 'Learning', and 'Live Library'. A search bar is located in the top right corner with the text 'Search All OSIsoft'. Below the navigation bar, there are tabs for 'My Support', 'Contact Us', 'Resources', 'Downloads', and 'Products'. The 'Downloads' tab is selected. Underneath, there are sub-tabs for 'My Downloads' and 'All Downloads', with a 'Request a Download >' link. A search filter section contains a text input field with 'TechCon' entered, a dropdown menu with 'Training Materials' selected, and other filters for 'Current Version' and 'All Languages'. A blue 'Search' button is on the right. Below the search filters, a table titled 'Training Materials' displays search results.

Name	Version	Type	Published	Platform	Status
UC 2015 TechCon Hands On Labs	2015	Training Materials	2015-05-11	Windows	Download
UC 2016 TechCon Workbooks	2016	Training Materials	2016-04-13	Windows	Download

Transform Your Classroom



Contact Information

Dr. Erica Trump

etrump@osisoft.com

Instructional Systems Designer

OSIsoft, LLC



Visit PI Square to discuss and find presentation content



<https://pisquare.osisoft.com/groups/academic>

Questions

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



State your **name & company**

Please remember to...

Complete the Online Survey for this session

Download the Conference App for OSISOFT USERS CONFERENCE 2017



- View the latest agenda and create your own
- Meet and connect with other attendees



search OSISOFT in the app store

<http://bit.ly/uc2017-app>

감사합니다

谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado