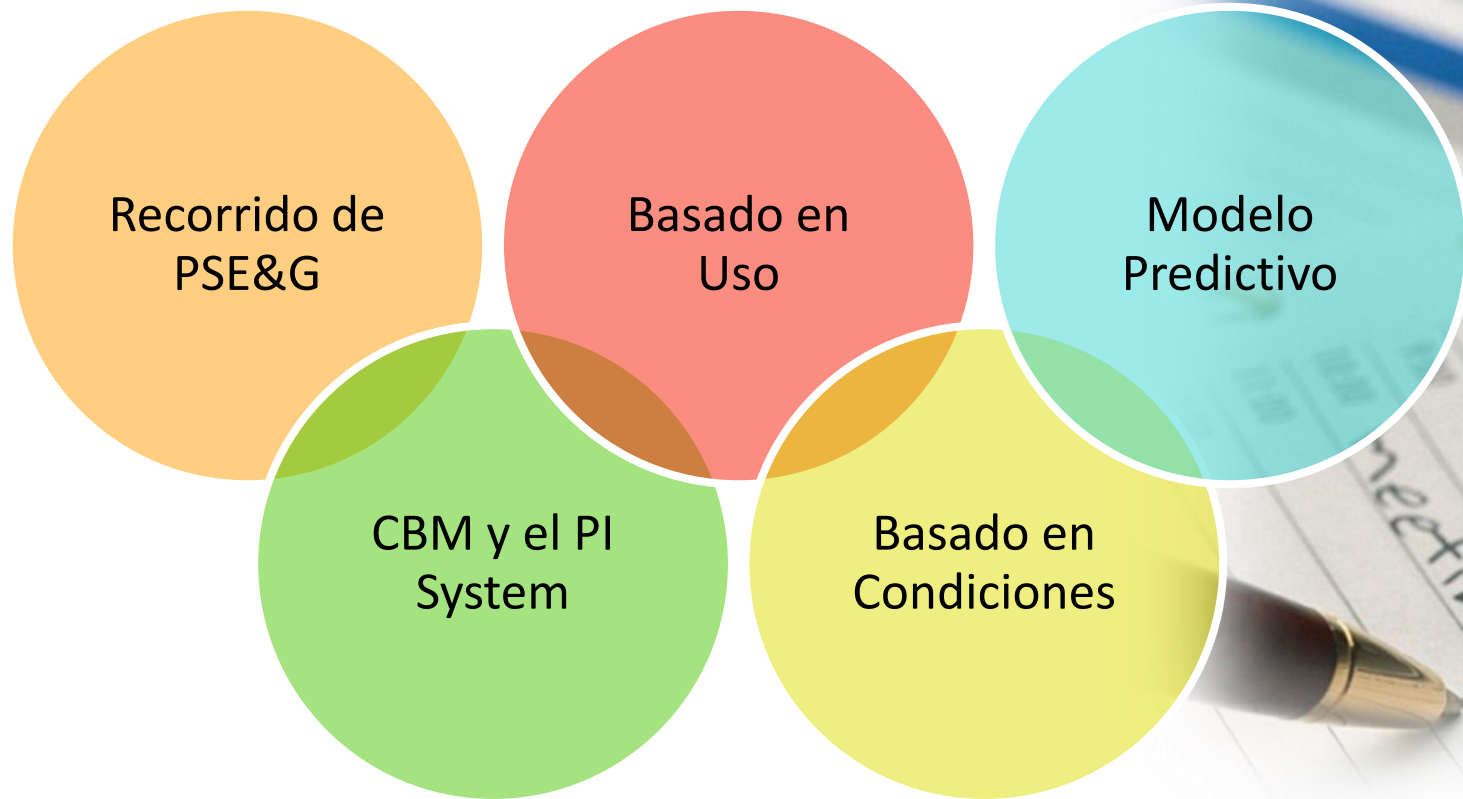




Habilitando el Mantenimiento Basado en Condiciones de Operación (CBM) y la Salud de los Activos con PI System

Agenda



Conditioned Based Maintenance (CBM)



Presented by:

Richard Wernsing

Asset Information and System Policy Leader

Presented for:

**San Paulo, Brazil
OSI Soft User Group
Richard Wernsing
June 8 2016**



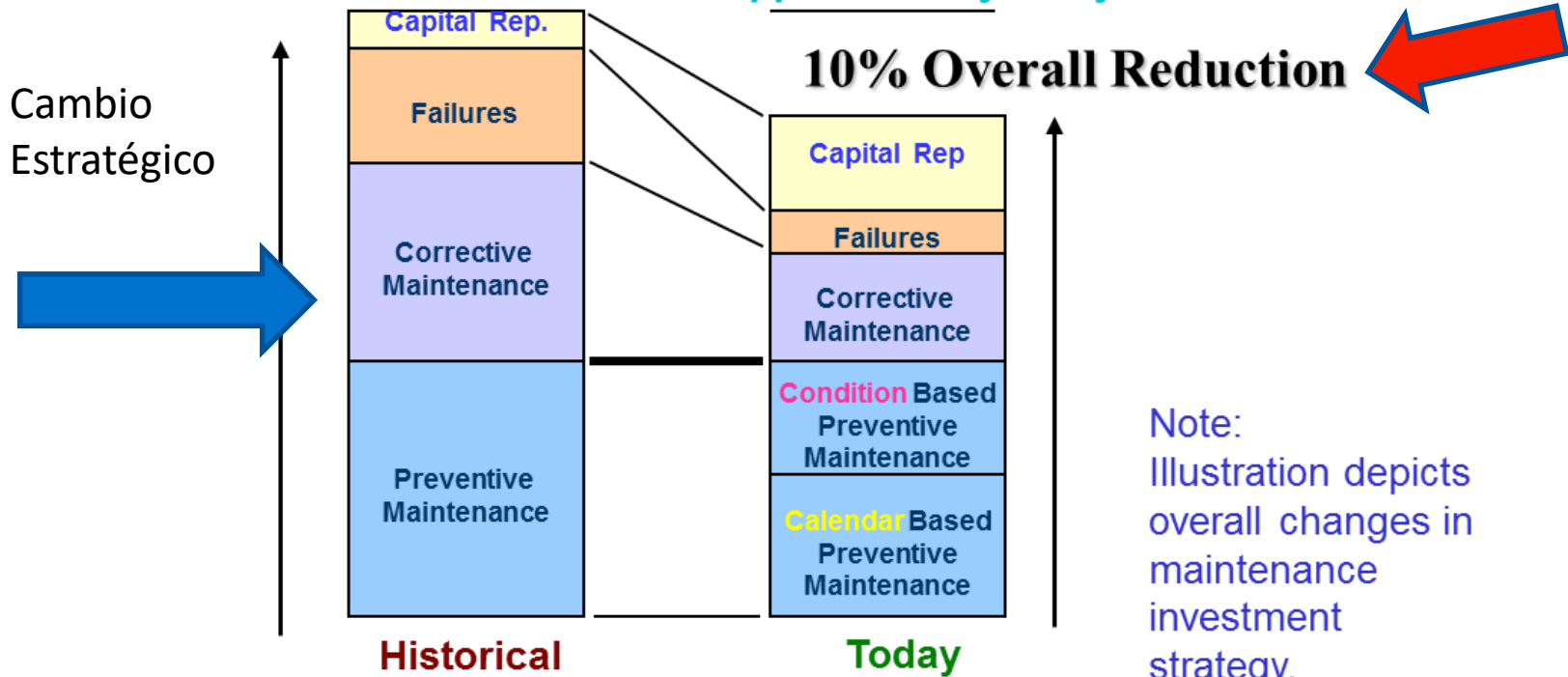
PSEG

We make things work for you.

1

Benefits Breakdown

*These annual expenditures protect \$1.7 B of inside plant assets and **full benefits after approximately five years.***



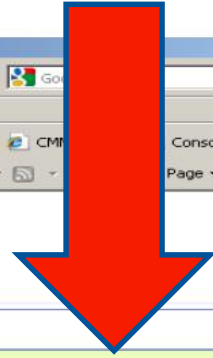
Asset Health Score

RIESGO / PRIORIDAD

FOCO



10
ACTIVOS



Webpages - LtcsCA-ReplaceSummary - Windows Internet Explorer provided by PSEG

http://mossapps.pseg.com/sites/CMMSAM/Webpages/LtcsCA-ReplaceSummary.aspx

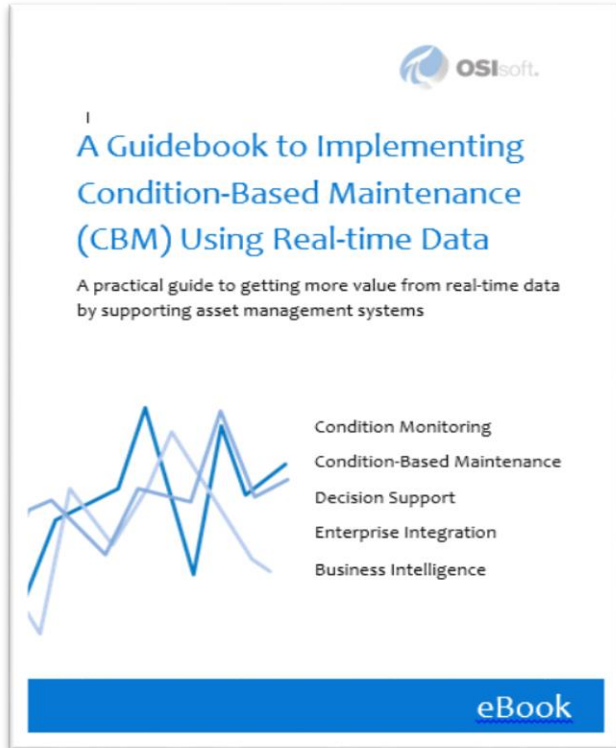
MS Asset Management

LTC CA-Replacement Summary Report

CA Records

Details	Division	Floc	Floc Descr	Equipment	Equip Descr	Score	Person	Status
	CE	IPE-CE-NED -T1	# 1 Transformer	000000000010023053	Load Tap Changer	5.7	NA	No action
	CE	IPE-CE-SOS -T1	# 1 Transformer	000000000010503188	Load Tap Changer (URT)	5.7	Shirish Patel	Awaiting Main
	CE	IPE-CE-SMN -2PM	132-2 Transformer	000000000010023219	Load Tap Changer 132-2	5.7	Mark	OK
	CE	IPE-CE-SMV -T2	# 2 Transformer	000000000010505774	Load Tap Changer T2	5.3	Lenny Torchia	Complete
	PA	IPE-PA-NRB -T1	# 1 Transformer	000000000010637892	Load Tap Changer	5.3		
	ME	IPE-ME-SES -2TRH	220-2 Transformer	000000000010509861	Load Tap Changer PHASE 1	5.2		
	ME	IPE-ME-SES -1TRH	220-1 Transformer	000000000010509859	Load Tap Changer	5.2	George Arthur	Awaiting Main
	PA	IPE-PA-BAO -T40	# 40 Transformer	000000000010542685	Load Tap Changer	5.2	George Arthur	No Action
	SO	IPE-SO-DVB -T2	# 2 Transformer	000000000010542963	Load Tap Changer	5	Angela Rothweiler	Thru Neutral
	ME	IPE-ME-SBV -2TRHB	220-2B	000000000010509499	Load Tap Changer	4.5	Angela Rothweiler	Thru Neutral
	PA	IPE-PA-WAD -T10	# 10 Transformer	000000000010542773	Load Tap Changer	4.4		
	PA	IPE-PA-LEO -T3	# 3 Transformer	000000000010542721	Load Tap changer	4.4		
	CE	IPE-CE-SAL -4TRH	220-4 Transformer	000000000010502666	Load Tap Changer	4.4	George Arthur	Awaiting Main
	CE	IPE-CE-SAL -4TRH	220-4 Transformer	000000000010502666	Load Tap Changer	4.4	George Arthur	Awaiting Main
	CE	IPE-CE-FRA -T1	#1 Transformer	000000000010671654	Load Tap Changer	4.4		
	CE	IPE-CE-SLI -132-5	132-5 Transformer	000000000010023211	Load Tap Changer 132-5 26Kv	4.3	Paul	OK
	ME	IPE-ME-SBV -1TRH	220-1 Transformer	000000000010509496	Load Tap Changer 1 A	4.3	George	OK

Orientación, Guía Prescriptiva de CBM de OSIsoft con PI System



Terms & Definitions

Implementation Guidance

PI System Overview for CBM

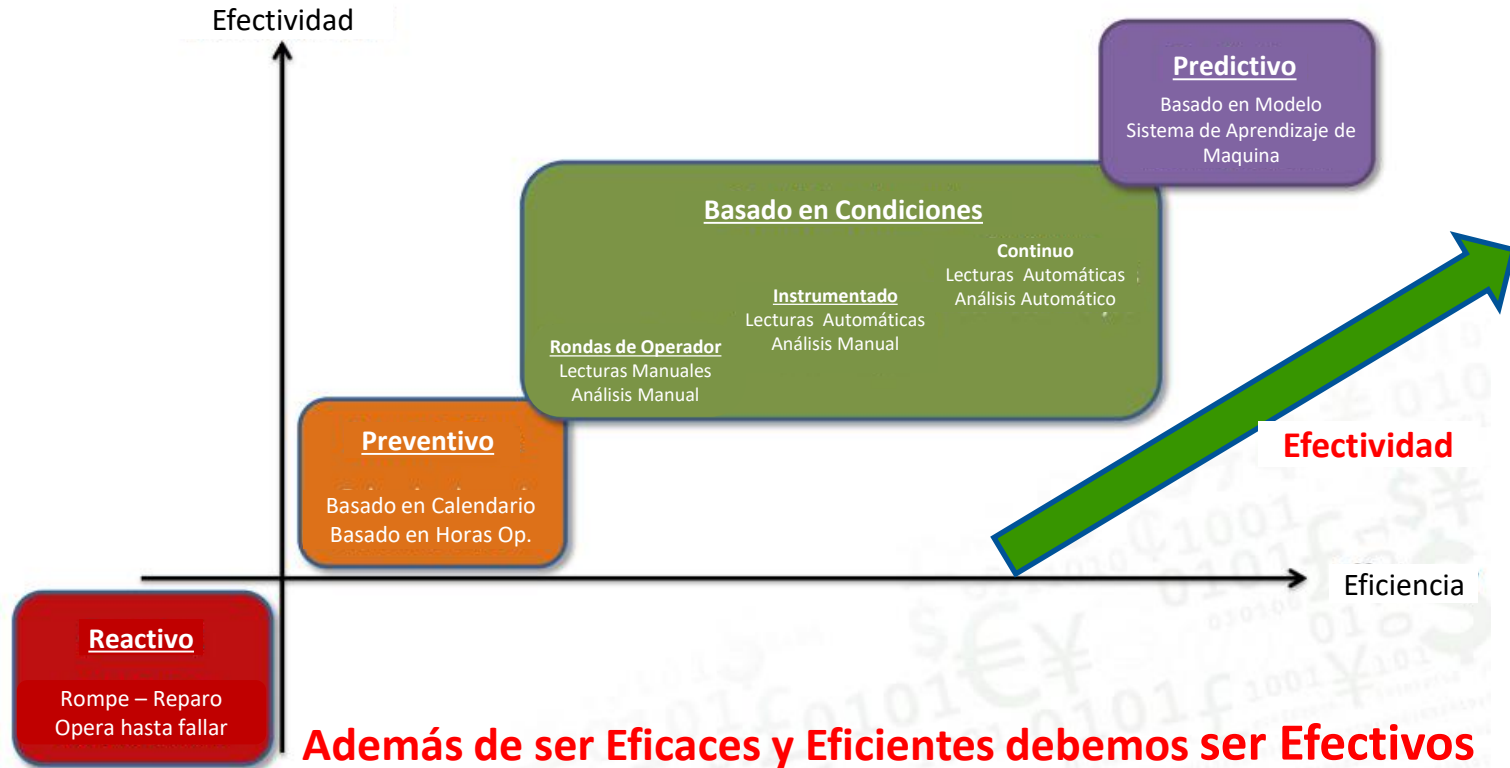
PI System Integration w/ CMMS

Enabling Opportunities

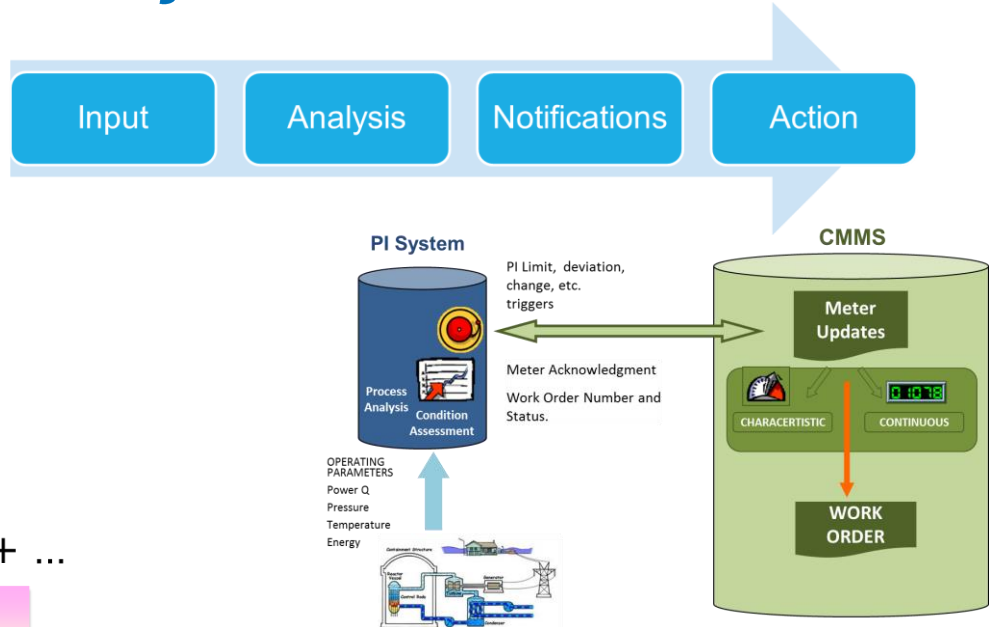
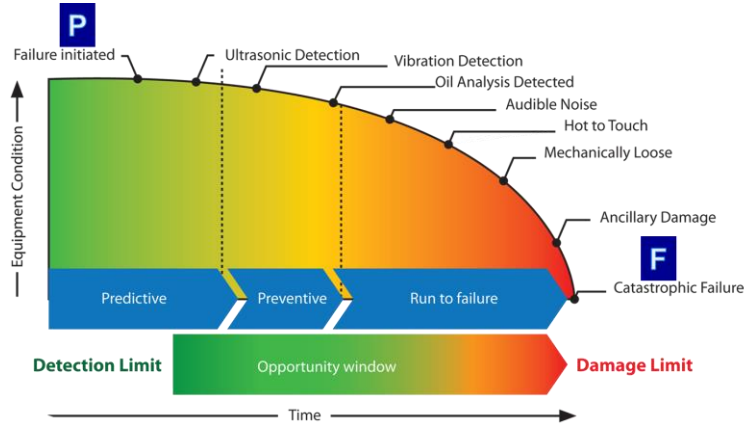
Solution Examples

Industry References

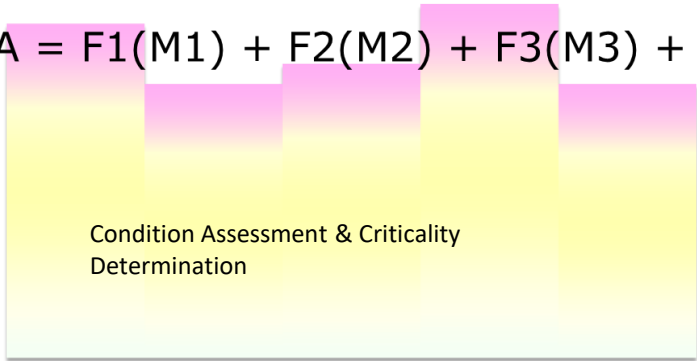
Gestión del Mantenimiento, Más allá del programado/basado en el Calendario



Las Posibilidades con el PI System

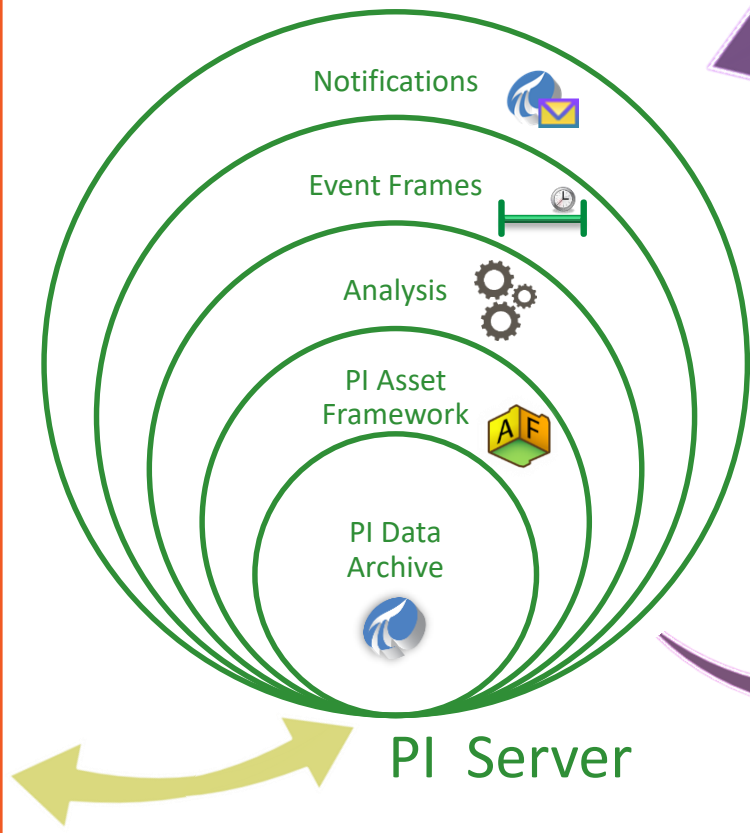


$$CA = F1(M1) + F2(M2) + F3(M3) + \dots$$



Transformer =
 Dissolved Gas Analysis = 4 (0.3) = 1.2
 + Useful Life Remaining = 3 (0.2) = 0.6
 + Asset Age = 4 (0.1) = 0.4
 + Winding Quality = 4 (0.2) = 0.8
 + Failure History = 2 (0.2) = 0.6
= 3.6 (of 5)

Los 6 pasos del CBM con el PI System

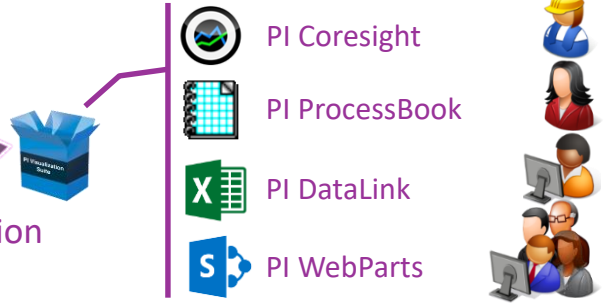


PI Integrators & PI System Access




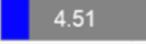








1. Conectar a las fuentes relevantes
2. Colectar y guardar los datos
3. Asignar contexto (Basado en activos)
4. Correr Lógica de Monitoreo de Condiciones
5. Visualizar condiciones en tiempo real
6. Alertar y notificar

PI Visualization Suite



Ejemplo 1 – Basado en Uso / Tiempo en Operación

 **Report - Critical Motors - Run Hours** Last Update: 3-12-2016

Equipment	Daily Run Hours	Lifetime Run Hours	During Last Period	Period	Since Last Service	Last Service	Next Service
Agitator 1204	 4.51	7,975	0	3mo	387	1/10/2016	11/10/2016
Agitator 1205	 23.79	10,119	2,154	3mo	409	2/23/2016	10/3/2016
Agitator 1304	 23.49	9,908	2,118	3mo	697	2/11/2016	12/13/2016
Agitator 1305	 23.49	9,908	2,118	3mo	697	2/11/2016	12/1/2016
Fan 5163	 19.71	8,554	1,174	3mo	2,664	10/1/2015	5/1/2016
Fan 5164	 23.97	9,292	2,022	3mo	3,566	10/2/2015	5/2/2016
Fan 8144	 14.44	9,839	2,112	3mo	3,635	10/5/2015	5/5/2016
Pump 3809	 15.16	8,587	1,949	3mo	3,218	10/10/2015	5/10/2016
Pump 3810	 23.97	9,618	2,079	3mo	3,837	9/23/2015	7/1/2016



Report - Critical Motors - Run Hours

Last Update: 7-11-2016

Equipment	Daily Run Hours	Lifetime Run Hours	During Last Period	Period	Since Last Service	Last Service	Next Service
Agitator 1204	0.00	8,373	398	3mo	395	1/10/2016	11/10/2016
Agitator 1205	24.00	13,037	2,907	3mo	3,327	2/23/2016	10/3/2016
Agitator 1304	24.00	12,828	2,908	3mo	3,616	2/11/2016	12/13/2016
Agitator 1305	24.00	12,828	2,908	3mo	3,616	2/11/2016	12/1/2016
Fan 5163	24.00	12,331	3,778	3mo	6,441	10/1/2015	5/1/2016
Fan 5164	24.00	12,155	2,862	3mo	6,428	10/2/2015	5/2/2016
Fan 8144	24.00	12,751	2,902	3mo	6,547	10/5/2015	5/5/2016
Pump 3809	0.00	8,983	387	3mo	3,614	10/10/2015	5/10/2016
Pump 3810	24.00	12,487	2,858	3mo	6,706	9/23/2015	7/1/2016
Pump 5301	24.00	11,999	2,841	3mo	5,342	11/20/2015	8/1/2016
Pump 5302	0.00	7,828	279	3mo	2,787	11/11/2015	8/23/2016
Pump 8209	0.00	10,310	470	3mo	2,818	12/2/2015	9/1/2016
Pump 8210	24.00	11,499	2,886	3mo	5,354	10/2/2015	5/2/2016

Fan 5164



Fan Medium

Lifetime RunHours 13,354.58

Daily RunHours 24

RunHours Since Last Maintenance 7,627.95

zLast Maintenance 02-Oct-15

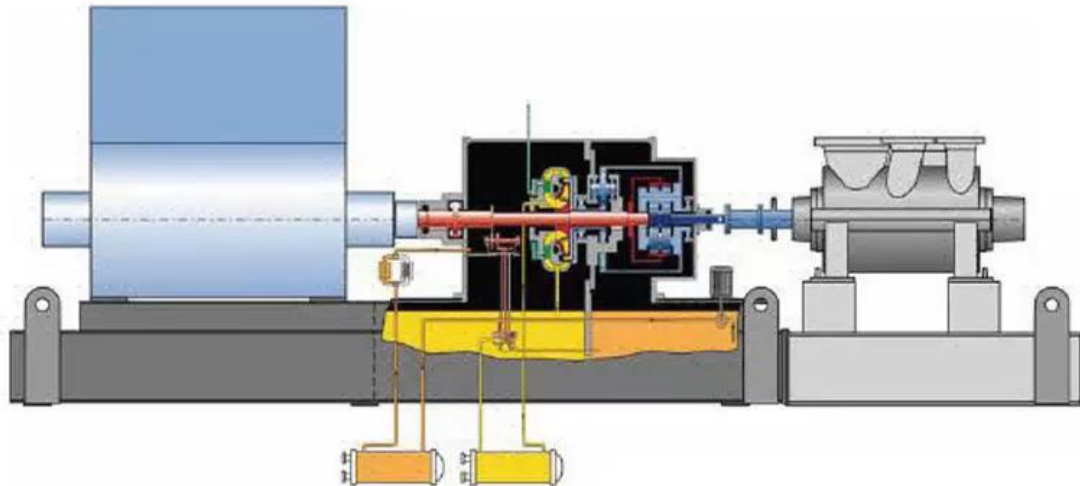
zNext Maintenance 02-May-16

Energy per Ton (Actual) 106.87

Energy per Ton (Expected) 108.52

Saved Energy (%) 2%

Production Rate (last 3 months)



- Elements
 - Assets
 - Devices
 - Rotating Assets
 - Agitator 1204
 - Agitator 1205
 - Agitator 1304
 - Agitator 1305
 - Fan 5163
 - Fan 5164
 - Fan 8144
 - Pump 3809
 - Pump 3810
 - Pump 5301
 - Pump 5302
 - Pump 8209
 - Pump 8210

Element Searches

General		Child Elements		Attributes		Ports		Analyses		Notifications		Version	
<i>Filter</i>													
		Name		Value		Description							
+		Category: Bearing Details											
+		Category: Identification											
+		Category: Performance											
+		Category: Raw Data											
-		Category: Run Hours											
					Daily RunHours	0 h							
					Last Update	8-30-2016							
					Lifetime RunHours	10310.34 h							
+			RunHours During Last Period		0 h								
+			RunHours Since Last Maintenance		2817.675 h								
			zLast Maintenance		12/2/2015		from Work Management System						
			zNext Maintenance		9/1/2016		from Work Management System						
			zPeriod		3mo								

Pump 8209

General Child Elements Attributes Ports Analyses



	Name	Backfilling
✓	High Bearing Vibration	✓
✓	Run Hours	✓

Name: Run Hours

Description:

Categories:

Analysis Type: Expression Rollup Event Frame Generation SQC

Evaluate Now

Name	Expression	Value	Output Attribute
DailyHrs	<code>TimeEq('Running Status','y','t',1)/3600</code>		<u>Daily RunHours</u>
LifeHrs	<code>If BadVal('Lifetime RunHours') And EventCount('Lifetime RunHours','*','*-50d')<=1 Then 0 Else If BadVal('Lifetime RunHours') Then NoOutput() Else 'Lifetime RunHours'+DailyHrs</code>		<u>Lifetime RunHours</u>
LastUpdate	<code>Concat(String(Month('*')), "- ", String(Day('*'))</code>		<u>Last Update</u>

Pump 8209

General Child Elements Attributes Ports A

High Bearing Vibration

Run Hours

Name	Expression
DailyHrs	TimeEq('Running Status
LifeHrs	If BadVal('Lifetime Ru
<pre>If BadVal('Lifetime RunHours', '*', '*-50d') <= 1 Then NoOutput() Else 'Lifetim</pre>	
LastUpdate	Concat(String(Month('*

Preview results for Run Hours

Start Time: *-80d

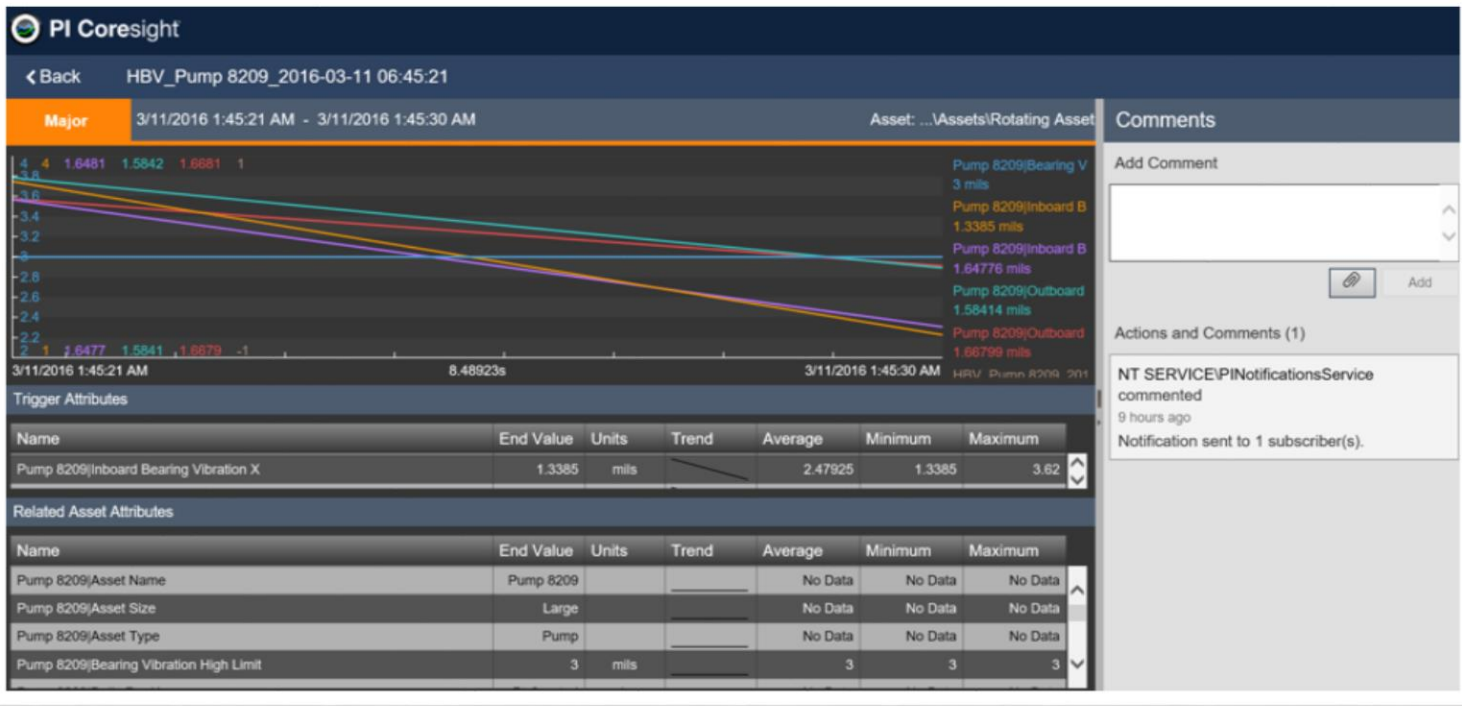
End Time: *-20d

Trigger Time	DailyHrs	LifeHrs	LastUpdate	Running Status	Lifetime RunHours (f
6/13/2016 12:30:00 AM	24	11659	6-13-2016	1	11635
6/14/2016 12:30:00 AM	24	11683	6-14-2016	1	11659
6/15/2016 12:30:00 AM	24	11707	6-15-2016	1	11683
6/16/2016 12:30:00 AM	24	11731	6-16-2016	1	11707

Value Scale: Single Multiple

Security...

Ejemplo 2 – Basado en Condiciones



Comments

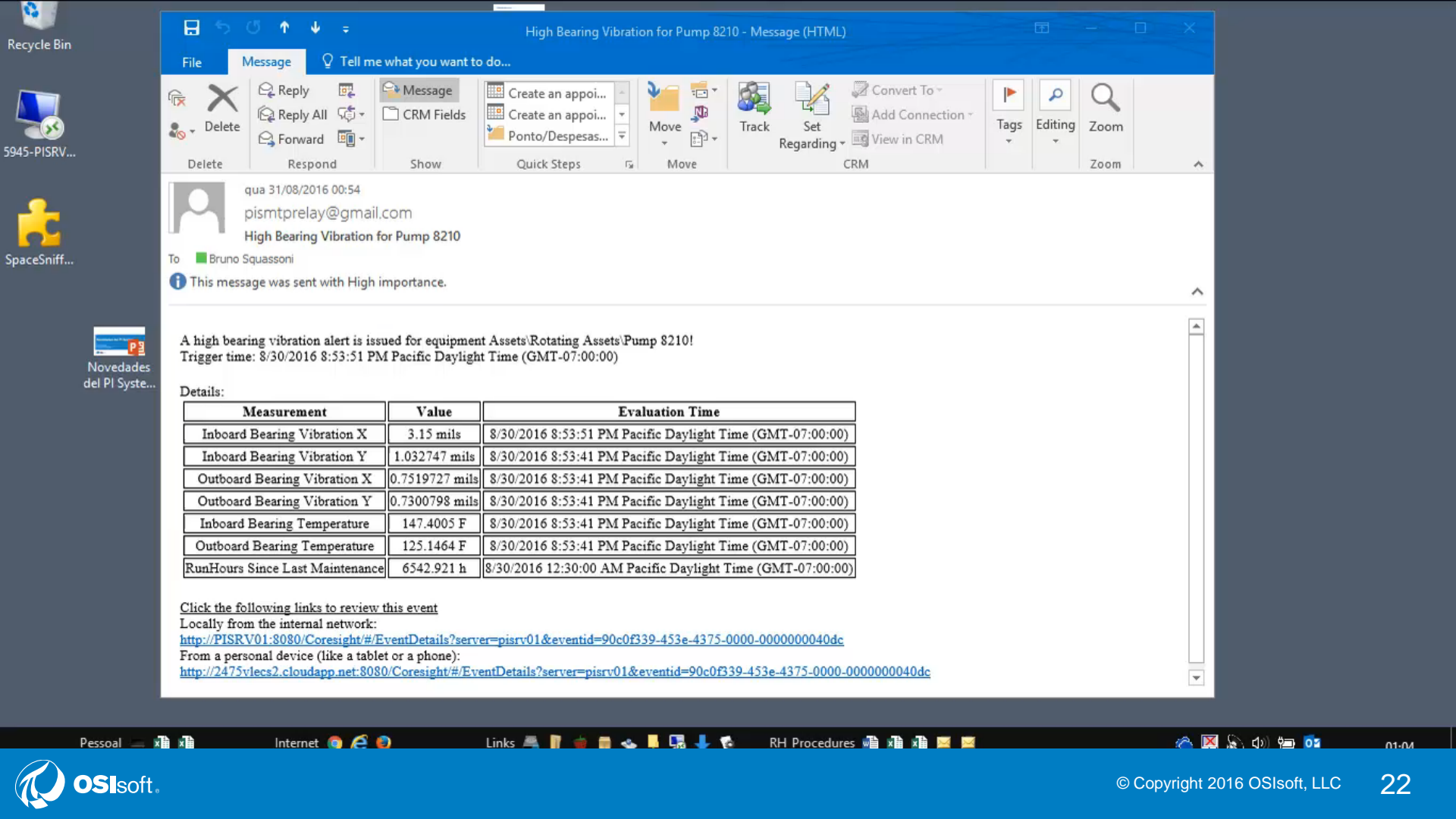
Add Comment



Add

Actions and Comments (1)

NT SERVICE\PINotificationsService commented
9 hours ago
Notification sent to 1 subscriber(s).



High Bearing Vibration for Pump 8210 - Message (HTML)

File Message Tell me what you want to do...

Delete Reply Reply All Forward CRM Fields Create an appoi... Create an appoi... Ponto/Despesas... Move Move Track Set Regarding Convert To Add Connection View in CRM Tags Editing Zoom

qua 31/08/2016 00:54
pismtprelay@gmail.com
High Bearing Vibration for Pump 8210

To Bruno Squassoni
This message was sent with High importance.

A high bearing vibration alert is issued for equipment Assets\Rotating Assets\Pump 8210!
Trigger time: 8/30/2016 8:53:51 PM Pacific Daylight Time (GMT-07:00:00)

Details:

Measurement	Value	Evaluation Time
Inboard Bearing Vibration X	3.15 mils	8/30/2016 8:53:51 PM Pacific Daylight Time (GMT-07:00:00)
Inboard Bearing Vibration Y	1.032747 mils	8/30/2016 8:53:41 PM Pacific Daylight Time (GMT-07:00:00)
Outboard Bearing Vibration X	0.7519727 mils	8/30/2016 8:53:41 PM Pacific Daylight Time (GMT-07:00:00)
Outboard Bearing Vibration Y	0.7300798 mils	8/30/2016 8:53:41 PM Pacific Daylight Time (GMT-07:00:00)
Inboard Bearing Temperature	147.4005 F	8/30/2016 8:53:41 PM Pacific Daylight Time (GMT-07:00:00)
Outboard Bearing Temperature	125.1464 F	8/30/2016 8:53:41 PM Pacific Daylight Time (GMT-07:00:00)
RunHours Since Last Maintenance	6542.921 h	8/30/2016 12:30:00 AM Pacific Daylight Time (GMT-07:00:00)

Click the following links to review this event
Locally from the internal network:
<http://PISR.V01:8080/Coresight/#/EventDetails?server=pisrv01&eventid=90c0f339-453e-4375-0000-0000000040dc>
From a personal device (like a tablet or a phone):
<http://2475vlecs2.cloudapp.net:8080/Coresight/#/EventDetails?server=pisrv01&eventid=90c0f339-453e-4375-0000-0000000040dc>

PI Coresight

Assets

Search in PI System

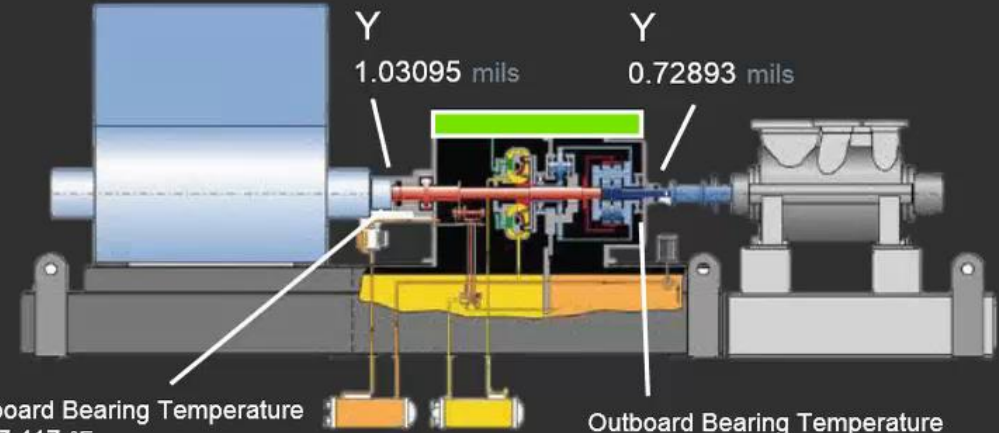
- Energy Management CBM
- PISRV01

Attributes

Display: Bearing Overview* Asset: Pump 8210

Pump 8210

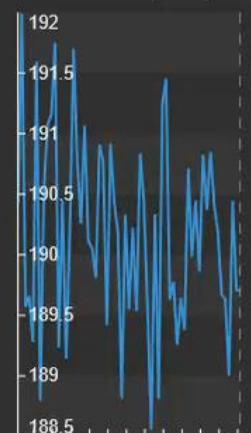
	Inboard Bearing	Outboard Bearing
X	0.94938 mils	0.74758 mils
Y	1.03095 mils	0.72893 mils



Inboard Bearing Temperature: 147.417 °F

Outboard Bearing Temperature: 125.14 °F

Power (kW)



Power (kW) graph showing fluctuations between 188.5 and 192 kW.

- Elements
 - Assets
 - Devices
 - Rotating Assets
 - Agitator 1204
 - Agitator 1205
 - Agitator 1304
 - Agitator 1305
 - Fan 5163
 - Fan 5164
 - Fan 8144
 - Pump 3809
 - Pump 3810
 - Pump 5301
 - Pump 5302
 - Pump 8209
 - Pump 8210
- Element Searches

General Child Elements Attributes Ports Analyses Notifications Version

Filter

	Name	Value	Description
Category: Bearing Details			
<input checked="" type="checkbox"/>	Bearing Vibration High Limit	3 mils	
<input checked="" type="checkbox"/>	Inboard Bearing Temperature	147.3664 °F	
<input checked="" type="checkbox"/>	Inboard Bearing Vibration X	0.9899486 mils	
<input checked="" type="checkbox"/>	Inboard Bearing Vibration Y	1.036482 mils	
<input checked="" type="checkbox"/>	Outboard Bearing Temperature	125.1602 °F	
<input checked="" type="checkbox"/>	Outboard Bearing Vibration X	0.7573254 mils	
<input checked="" type="checkbox"/>	Outboard Bearing Vibration Y	0.7324764 mils	
Category: Identification			
<input checked="" type="checkbox"/>	Asset Name	Pump 8210	
<input checked="" type="checkbox"/>	Asset Size	Large	
<input checked="" type="checkbox"/>	Asset Type	Pump	
Category: Performance			
Category: Raw Data			

Pump 8210

General Child Elements Attributes Ports Analyses Notifications

Name	Backfilling
High Bearing Vibration	<input checked="" type="checkbox"/>
Run Hours	<input checked="" type="checkbox"/>

Name: High Bearing Vibration

Description:

Categories:

Analysis Type: Expression Rollup Event Frame Generation SQC

Event Frame Template: High Bearing Vibration

Name	Expression	Time True	Severity	Value
InXFault	'Inboard Bearing Vibration X'>Lim			
InYFault	'Inboard Bearing Vibration Y'>Lim			
OutXFault	'Outboard Bearing Vibration X'>Li			
OutYFault	'Outboard Bearing Vibration Y'>Li			
Start triggers				
StartTrigger1	If InXFault Or InYFault Or OutXF	Not Set	None	
If InXFault Or InYFault Or OutXFault Or OutYFault Then True Else False				

Advanced Event Frame Settings...

Pump 8210

General Child Elements Attributes Ports Analyses Notifica

Name	Backfilling
High Bearing Vibration	✓
Run Hours	✓

Event Frame Template: High Bearing Vibration

Name	Expression
InXFault	'Inboards Bearing Vibration X'>
InYFault	'Inboards Bearing Vibration Y'>
OutXFault	'Outboards Bearing Vibration X'
OutYFault	'Outboards Bearing Vibration Y'

Start triggers

StartTrigger1 If InXFault Or InYFault Or Out

If InXFault Or InYFault Or OutXFault Or OutYFault Then True Else False

Advanced Event Frame Settings...

Pump 8209

General Child Elements Attributes Ports Analyses Notifications Version

Name Criteria

High Bearing Vibration Template = High Bearing...

Contacts

New Search contacts

- Contacts
 - New search...
 - Name = "Ingeniero**"
 - Ingeniero
 - Escalation Teams
 - Groups
 - Delivery Endpoints
 - student01

Ingeniero

Name: Ingeniero

Description:

Department:

Manager:

Web

Email address: MyEmail@outlook.com

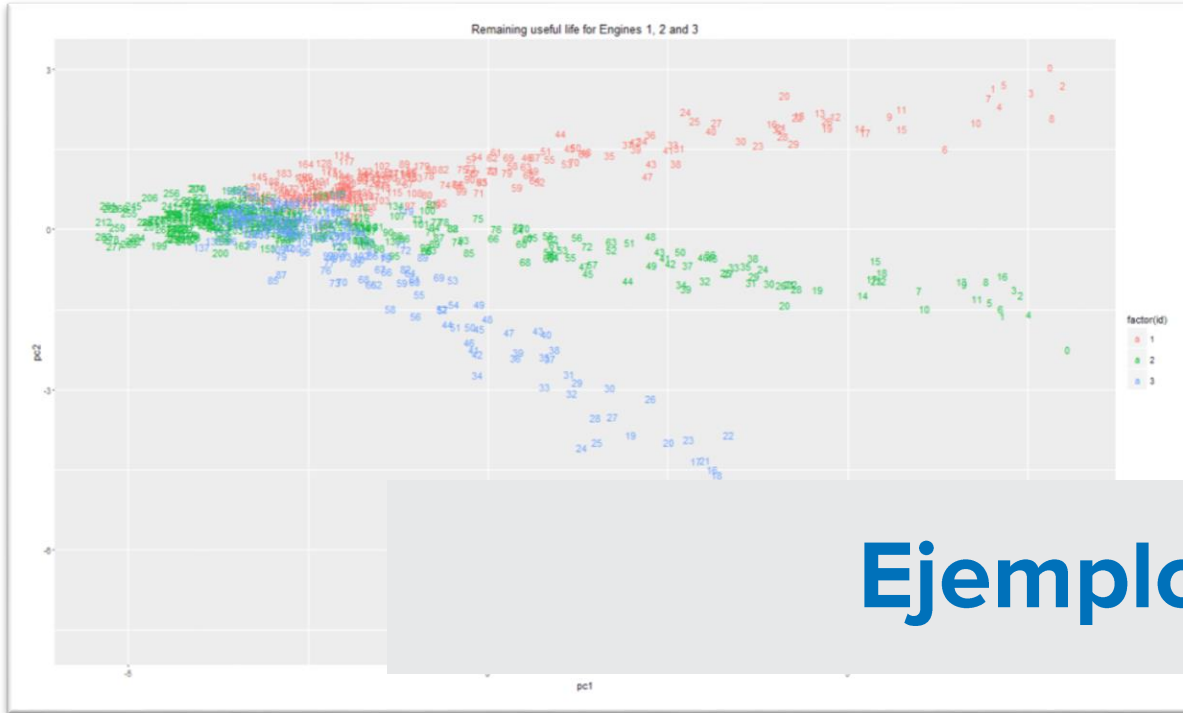
Trig

A notification these criteria.

Referenced Element = Pump 8209 Template = High Bearing Vibration

Asset Size = Large Asset Type = Pump

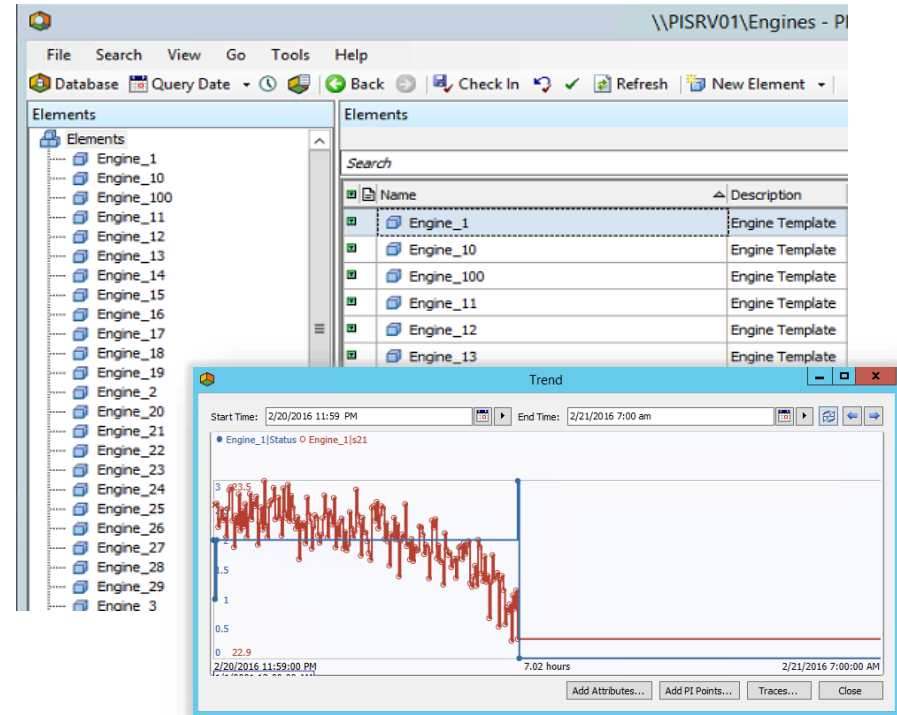
Edit Trigger



Ejemplo 3 – Predictivo

Datos de Laboratorio del PI System y Modelo AF de “Maquinas”

- Datos para 100 maquinas
 - 21 sensores
 - 3 ajustes
- El tiempo de operación entre fallas varia
 - La hora inicial es siempre 2/21/16 12 am
 - La hora de falla no excede 2/21/16 7:00 am
- Estatus de Operación
 - “Running”, “Failed”, “Stopped”



*A. Saxena, K. Goebel, D. Simon, and N. Eklund, “Damage Propagation Modeling for Aircraft Engine Run-to-Failure Simulation”, in the Proceedings of the 1st International Conference on Prognostics and Health Management (PHM08), Denver CO, Oct 2008.

“Event Frames” o eventos para detectar la falla de maquina

- Crear una Plantilla para el Evento (Event Frame)
- Agregar un análisis de “Event Frame Generation” a la plantilla de la Maquina “Engine”
 - StartTrigger: ‘Status’ = “Started”
 - EndTrigger: ‘Status’ = “Failed”
- Regenerar (Backfill) el análisis para generar los “Event Frames” para cada maquina

The screenshot displays the PI System Explorer interface for configuring an Event Frame Template. The main window is titled "Engine_11" and shows the "Event Frame Template: Engine Failure" configuration. The "Name" field is set to "Failure Event Frames". The "Analysis Type" is set to "Event Frame Generation". The "StartTrigger" is configured with the expression "'Status' = 'Started'" and the "EndTrigger" is configured with the expression "'Status' = 'Failed'". The "Duration" is set to 5 minutes. The "Scheduling" is set to "Event-Triggerred".

The "Functions" table below shows the generated event frames for various engines:

Name	Expression	Start Time	End Time
Engine_39	'Status' = 'Started'	2/21/2016 12:00:00 AM	2/21/2016 2:07:00 AM
Engine_91	'Status' = 'Started'	2/21/2016 12:00:00 AM	2/21/2016 2:14:00 AM
Engine_57	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:16:00 AM
Engine_70	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:16:00 AM
Engine_24	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:26:00 AM
Engine_58	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:26:00 AM
Engine_8	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:29:00 AM
Engine_65	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:32:00 AM
Engine_77	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:33:00 AM
Engine_90	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:33:00 AM
Engine_93	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:33:00 AM
Engine_27	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:35:00 AM
Engine_98	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:35:00 AM
Engine_19	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:37:00 AM
Engine_36	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:37:00 AM
Engine_45	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:37:00 AM
Engine_13	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:42:00 AM
Engine_29	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:42:00 AM
Engine_28	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:44:00 AM
Engine_74	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:45:00 AM
Engine_23	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:47:00 AM
Engine_12	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:49:00 AM
Engine_37	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:49:00 AM
Engine_60	'Status' = 'Failed'	2/21/2016 12:00:00 AM	2/21/2016 2:51:00 AM

PI Integrator for Business Analytics – Selección de Datos

- Crear un vista de los Eventos (PI Event View) y publicarla como archivo de texto.
- Datos Seleccionados “Select Data”
 - Event Frames
 - Asset Element
 - Attributes

The screenshot displays the 'Select Data' workflow in the PI Integrator for Business Analytics. The interface is titled 'Engine Failure Data by Event del' and includes a 'Next' button. It is divided into three main sections: 'Source Events', 'Search Shape', and 'Matches'. The 'Source Events' section shows 'Server' set to 'CHERTLER7450' and 'Database' set to 'Engines'. The 'Search Shape' section shows a tree view for 'Event Shape' with 'Engine Failure' selected, and 'Asset Shape' with 'Engine' selected, listing attributes like Runtime, Status, and s1-s13. The 'Matches' section shows 'Found 100 Matches' and a list of engine IDs such as Engine_39, Engine_91, Engine_70, etc. A search bar is present with the placeholder text 'Enter Event name or string match pattern'.

PI Integrator for Business Analytics – *Modificando la Vista*

- Crear un vista de los Eventos (PI Event View) y publicarla como archivo de texto.
- Datos Seleccionados “Select Data”
 - Event Frames
 - Asset Element
 - Attributes
- “Modify View”
 - Muestras de un minuto

The screenshot displays the 'Engine Failure Data by Event del' interface. At the top, there are navigation buttons for 'Select Data', 'Modify View', and 'Publish'. Below this, there are controls for 'Add Column' (26 columns), 'Edit Row Filters' (0 Row Filters), and 'Edit Value Mode' (Interpolated Values Every 1 minute). The 'Start Time' is set to 2/21/16 12:00 AM and the 'End Time' is empty. An 'Apply' button is visible. The main data table has columns for 'id', 'cycle', 's1', 's10', 's11', and a numerical value. A modal dialog titled 'Edit Value Mode' is open, showing options for 'Summarized Values' and 'Sampled Values'. Under 'Sampled Values', 'Sample values every' is set to 1 minutes, with 'Interpolate' selected. There are also 'Cancel' and 'Save Changes' buttons.

id	cycle	s1	s10	s11	
Engine_39	0				521.78
Engine_39	1				521.56
Engine_39	2				522.15
Engine_39	3				521.83
Engine_39	4				521.76
Engine_39	5				521.37
Engine_39	6				521.68
Engine_39	7				521.55
Engine_39	8				521.81
Engine_39	9				521.23
Engine_39	10				521.2
Engine_39	11				521.54
Engine_39	12	518.67	1.3	47.41	521.49
Engine_39	13	518.67	1.3	47.47	521.62
Engine_39	14	518.67	1.3	47.45	521.24
Engine_39	15	518.67	1.3	47.59	521.75
Engine_39	16	518.67	1.3	47.58	521.23
Engine_39	17	518.67	1.3	47.51	520.85

PI Integrator for Business Analytics – *Publicar (Publish)*

- Crear un vista de los Eventos (PI Event View) y publicarla como archivo de texto.
- Datos Seleccionados “Select Data”
 - Event Frames
 - Asset Element
 - Attributes
- “Modify View”
 - Muestras de un minuto
- Publicar “Publish”
 - Crear Archivos de texto (Create text file)

The screenshot shows the 'Publish' configuration screen in the PI Integrator. The breadcrumb navigation at the top reads 'Select Data > Modify View > Publish'. The 'Target Configuration' section has a dropdown menu set to 'Laptop Text File'. Below this, there are two radio button options: 'Run Once' (which is selected) and 'Run on a Schedule'. The 'Summary' section on the right provides details: 'Shape and Matches' indicates 'There are 100+ Matching Instances'; 'Timeframe and Interval' shows 'Your Start Time is 2/21/16 12:00 AM', 'Your End Time is *', and 'Your Time Interval gets an interpolated measurement Every 1 minute'. A blue 'Publish' button is located at the bottom of the summary box. A 'Back' button is visible in the top right corner of the main content area.

Resumen de R Script– *Vida Útil Remanente (Remaining Useful Life)*

Remaining Useful Life (RUL) = (Event Frame Duration – Cycle) + 1
(Example, for engine (id) 1: 191 - 1 - 1)

id	cycle	s11	s12	s13	s14	s15	s17	s2	s20	s21	s3	s4	s6	s7	s8	s9	setting1	setting2	rul
1	1	47.47	521.7	2388	8139	8.419	392	641.8	39.06	23.42	1590	1401	21.61	554.4	2388	9046	-0.0007	-0.0004	191
1	2	47.49	522.3	2388	8131	8.432	392	642.1	39.00	23.42	1592	1403	21.61	553.8	2388	9044	0.0019	-0.0003	190
1	3	47.27	522.4	2388	8133	8.418	390	642.4	38.95	23.34	1588	1404	21.61	554.3	2388	9053	-0.0043	0.0003	189
1	4	47.13	522.9	2388	8134	8.368	392	642.4	38.88	23.37	1583	1402	21.61	554.5	2388	9049	0.0007	0.0000	188
1	5	47.28	522.2	2388	8134	8.429	393	642.4	38.90	23.40	1583	1406	21.61	554.0	2388	9055	-0.0019	-0.0002	187
1	6	47.16	521.7	2388	8133	8.411	391	642.1	38.98	23.37	1584	1398	21.61	554.7	2388	9050	-0.0043	-0.0001	186
1	7	47.36	522.3	2388	8132	8.397	392	642.5	39.10	23.38	1592	1398	21.61	554.3	2388	9059	0.0010	0.0001	185
1	8	47.24	522.5	2388	8131	8.408	391	642.6	38.97	23.31	1583	1401	21.61	553.9	2388	9041	-0.0034	0.0003	184
1	9	47.29	521.8	2388	8126	8.373	392	642.1	39.05	23.41	1591	1395	21.61	553.7	2388	9046	0.0008	0.0001	183
1	10	47.03	521.8	2388	8129	8.429	393	641.7	38.95	23.47	1591	1400	21.61	553.6	2388	9052	-0.0033	0.0001	182
1	11	47.15	521.4	2388	8141	8.434	392	642.3	38.94	23.48	1582	1401	21.61	554.5	2388	9050	0.0018	-0.0003	181
1	12	47.18	521.8	2388	8134	8.394	391	642.1	39.06	23.37	1583	1400	21.61	554.5	2388	9049	0.0016	0.0002	180

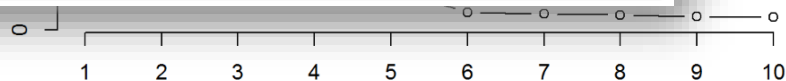
Resumen de R Script– Componentes Principales

Extract principal components

```
e.odd.pca = prcomp(e.odd.obs, scale = T, center = T) #fit principal components (PC), use only odd engine data
```

```
su  
# get pcl equation  
pcleg = ""  
## for (j in 1:17) {  
##   pcleg = cat(sep = "", pcleg, "+(", "", names(e.odd.pca$center[j]), "", "-(",  
##     e.odd.pca$center[j], ")", ")/", e.odd.pca$scale[j], "*", e.odd.pca$rotation[j,  
##       1])  
## }  
##
```



```
## +( 's11'-(47.51488))/0.2701003*0.3090913+( 's12'-(521.4901))/0.7517117*-0.3049236+( 's13'-(2388.09))/0.07484883*  
## 0.2845465+( 's14'-(8143.502))/19.7965*0.04163657+( 's15'-(8.438634))/0.03782789*0.2868222+( 's17'-(393.0714))/1.5619  
## 64*0.2685557+( 's2'-(642.638))/0.5043607*0.2734667+( 's20'-(38.83337))/0.1812555*-0.2819219+( 's21'-(23.29963))/0.10  
## 83872*-0.2834525+( 's3'-(1590.048))/6.186916*0.2604444+( 's4'-(1408.104))/9.077463*0.3006121+( 's6'-(21.60976))/0.00  
## 1539259*0.06360376+( 's7'-(553.4522))/0.8983562*-0.2995252+( 's8'-(2388.091))/0.07388822*0.2847322+( 's9'-(9064.65  
## 1))/22.72082*0.08204075+( 'setting1'-( -3.554925e-05))/0.002184843*0.003580013+( 'setting2'-(5.022518e-06))/0.000293  
## 1999*0.003136759
```



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Gracias

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