



# Improving Runtime Through Actionable Insights from the PI System

Presented by **José Aljovín**



# Presentation Brief

- UNACEM is a Peruvian Corporation, that is a leader in the Cement and Concrete market, in continuous research and development.
- Innovation is the main focus for improving our process and quality.
- We will show how using the PI System, our expertise and innovation we improve profitability through actionable insights.

# Agenda

- About UNACEM
- Business Challenge
- Use Case
- Implementation Details
- Results Obtained and Business Impact
- Conclusion

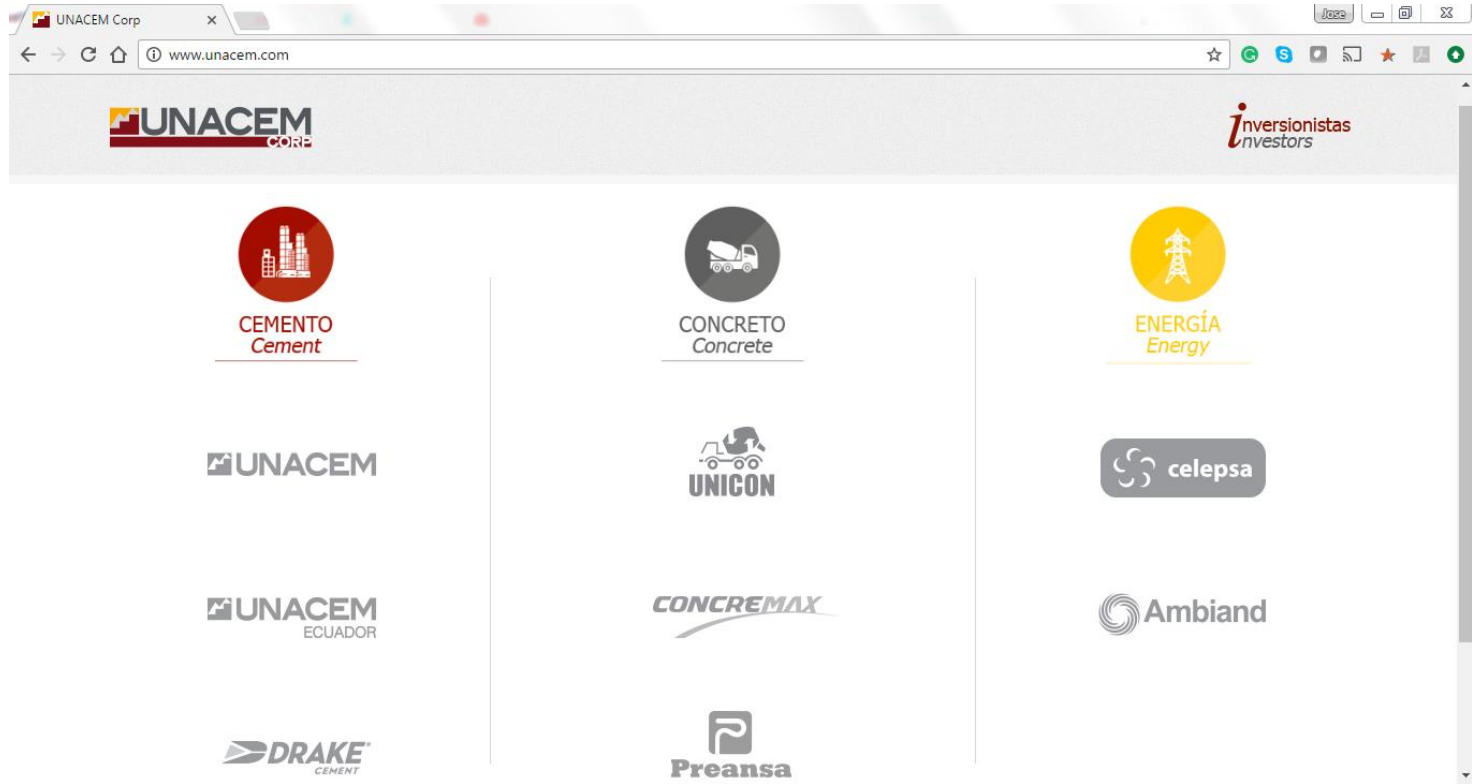


# About UNACEM

# About UNACEM

- UNACEM is a Peruvian Corporation, with presence in Ecuador, Colombia and the USA
- Main Products are Cement, Concrete and Energy
- Our Operations:
  - Perú Cement Plants
    - Lima's Coast (Atocongo)
    - Highlands over 3800 m.a.s.l. in Junin (Condorcha)
  - Cement Plants in Ecuador and in Arizona, USA
- The Cement Dispatch is in Bulk and bag packing

# About UNACEM





# Business Challenge

# Business Challenges

- Face Increasing Market Competition
- Cost Reduction, Competitive Prices
- Maintain Our Well-Known Quality
- Operational Sustainability
- Advanced Process Control







# Improving Cement Grinding

# Production Process

- Mining (Limestone)
- Primary Crushing
- Secondary Crushing
- Pre-Homogenization
- Raw Grinding
- Heating and Cooling
- Cement Grinding
- Packing and Shipping



# Production Process



For further information about our production process visit our website [www.unacem.com.pe](http://www.unacem.com.pe)  
or click the next link to watch a video [http://www.unacem.com.pe/?page\\_id=1717](http://www.unacem.com.pe/?page_id=1717)

# Improving Cement Grinding

- Improve the Operational Performance
- Standardize Operational Process
- Reduce the Operator Workload
- Accurate Data Signals and Events
- Scope: Atocongo Plant Cement grinding
- Project Leveraged: PI Server, AF, SQC, Notifications, AFSDK, PI OLEDB and BI App



# Improving Cement Grinding

## Ball Mills



## Roller Press





# Implementation Details



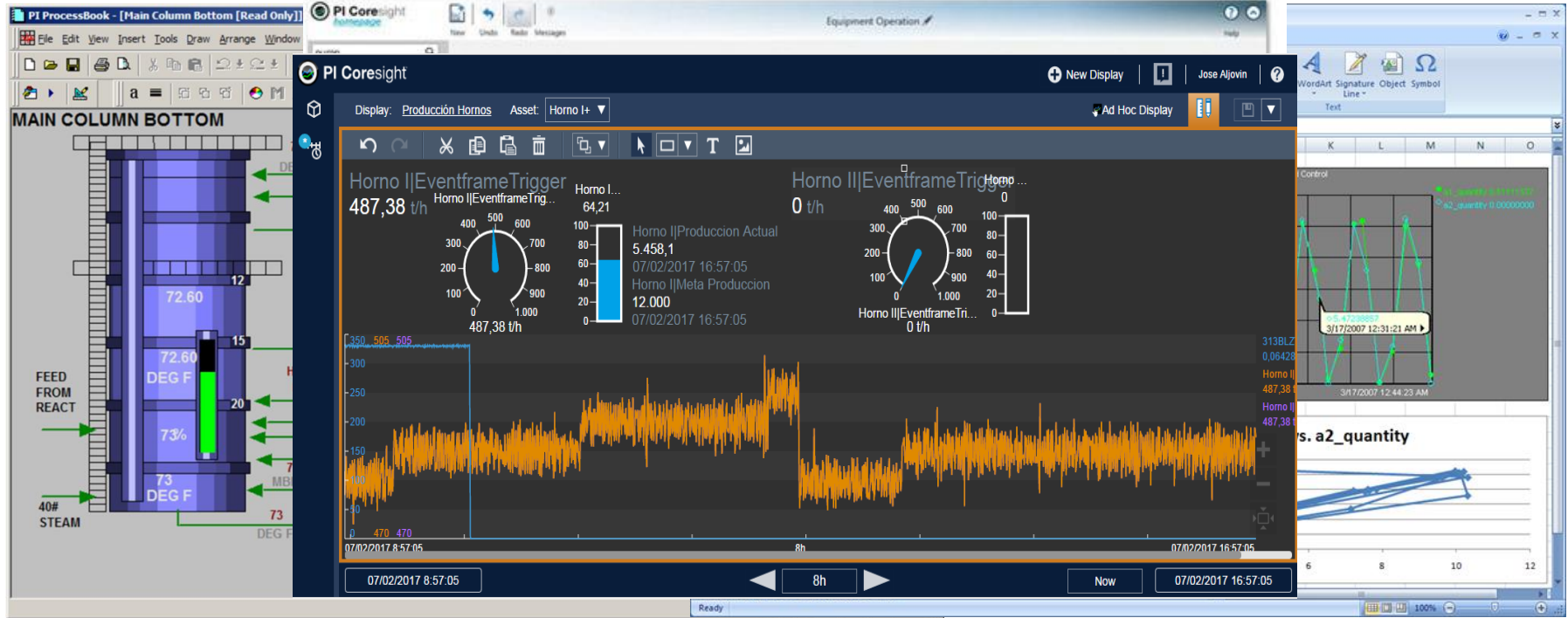
# Implementation Details

- Types of Display Visualization
- Road Map and Methodology
- Machine Status Redefinition
- KPI Definition
- Use Plants' Expertise

# Types of Display Visualization

SCADA Visualization

Analytical Visualization





# Road Map

5 steps for a Chinese factory to improve its efficiency

Home Articles Best Of About Contact

You are here: [Home](#) / [In The Factory](#) / 5 steps for a Chinese factory to improve its efficiency

JUNE 15, 2012 BY RENAUD ANJORAN

## 5 steps for a Chinese factory to improve its efficiency

8+ 2 Tweet in 27

The attitude of many Chinese manufacturers can be very frustrating.

The boss is usually focused on negotiating favorable prices and pushing production out the door. Not on learning from mistakes and looking for solutions. I explained all this in [Why few Chinese factories are adopting lean principles](#).

I am reading a practical guide called [Becoming Lean: Inside](#)

This blog is written by Renaud Anjoran, an ASQ Certified Quality Engineer who has been involved in Chinese manufacturing since 2005. Renaud's company performs factory audits/evaluations, product QC inspections, and factory process improvements.

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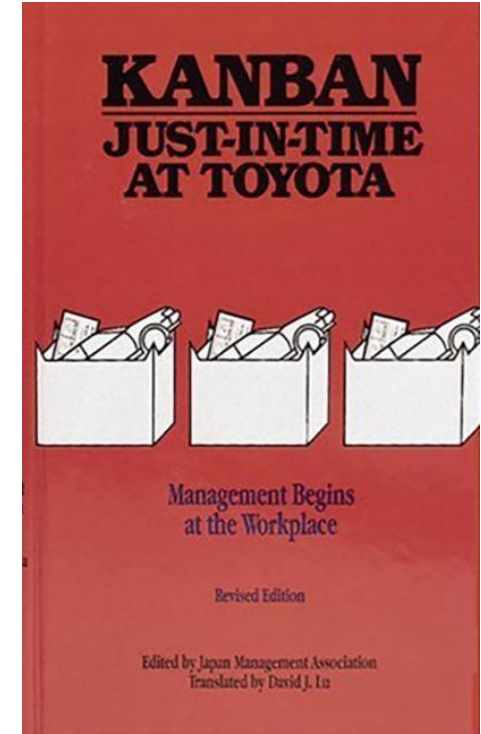
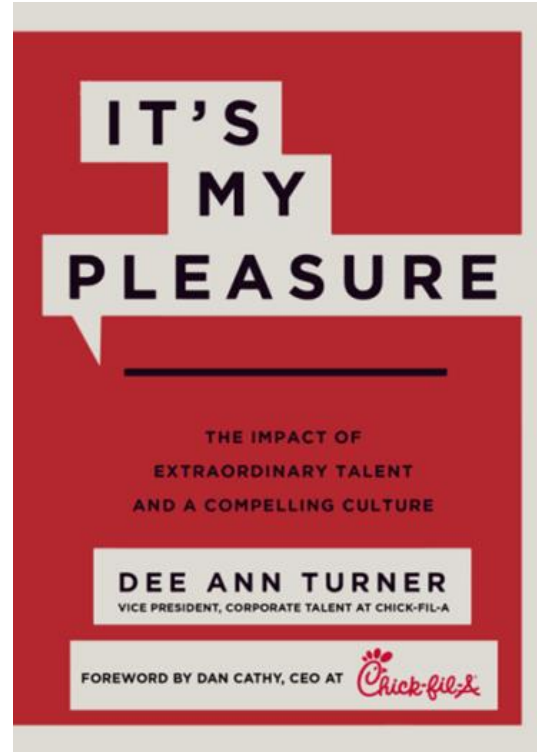
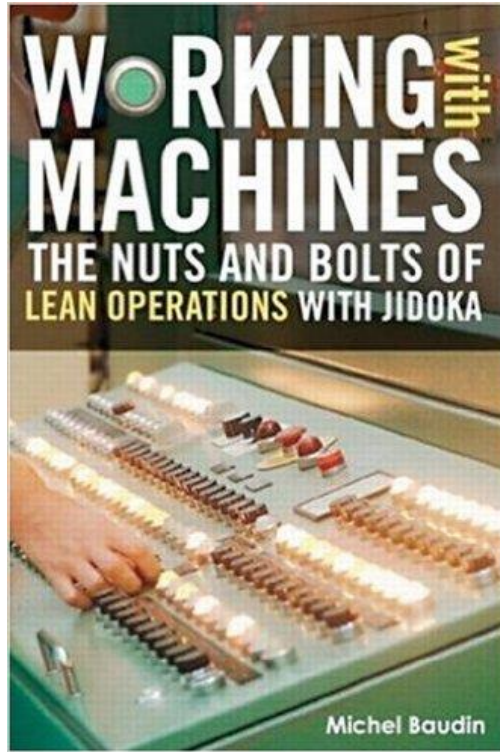
# Road Map

- Step 1: Stabilization of Processes
- Step 2: Improve the Product Flow
- Step 3: Products Follow a Certain Sequence
- Step 4: Pull, Don't Push
- Step 5: Try to Level Production

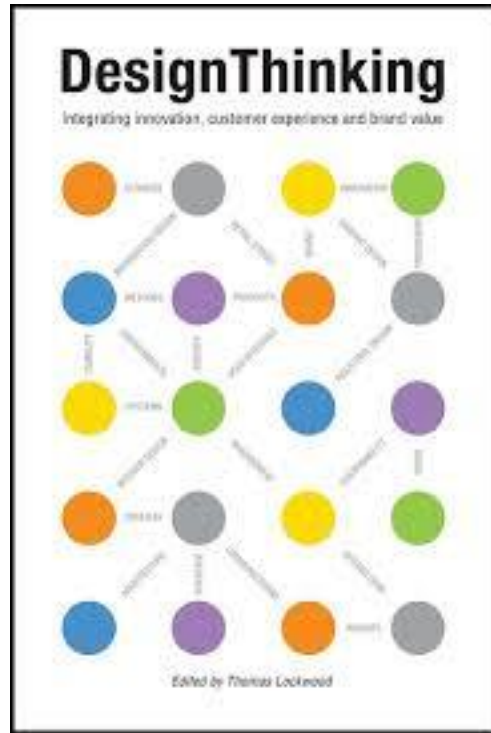
# Road Map Step 1: Stabilization of Processes

- 1. Standardized Work Instructions
- 2. Jidoka
- 3. Product-Oriented Production Flow
- 4. Preventive Maintenance
- 5. Mistake Proofing
- 6. 5S, Kaizen, Just in Time

# Methodology



# Methodology – Proposal and Testing



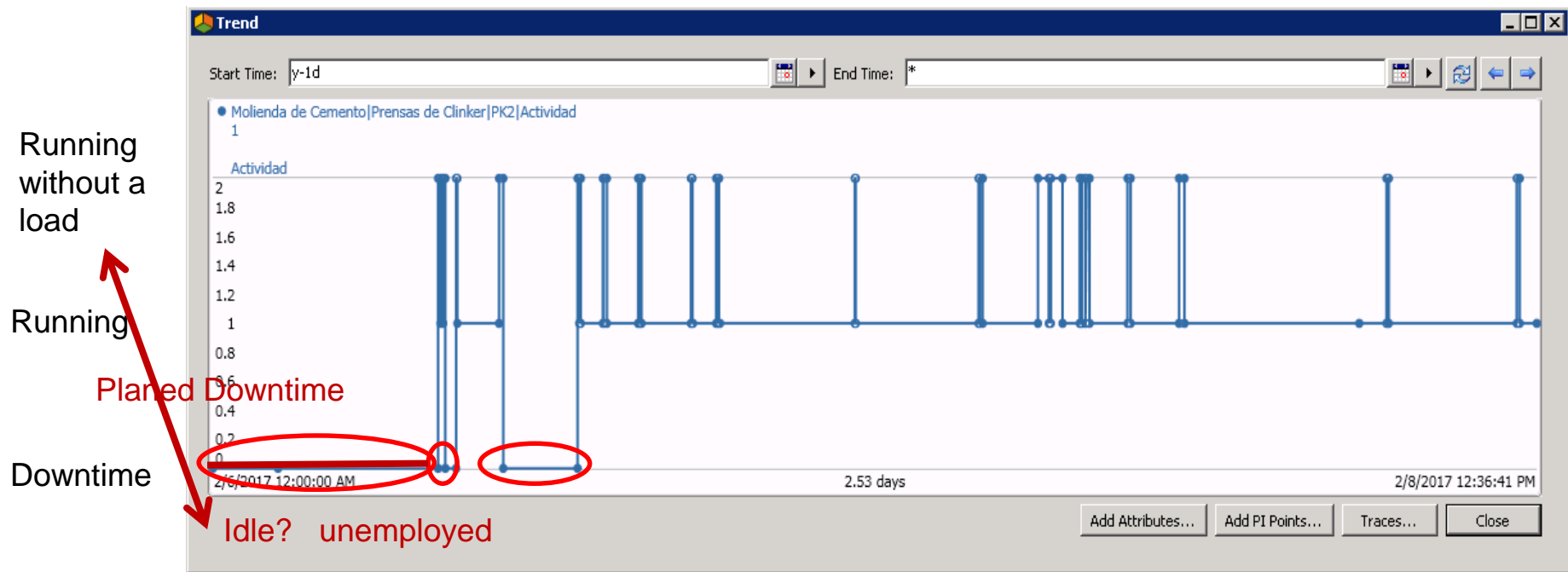
# 5S Explanation



# Road Map Step 1: Stabilization of Processes

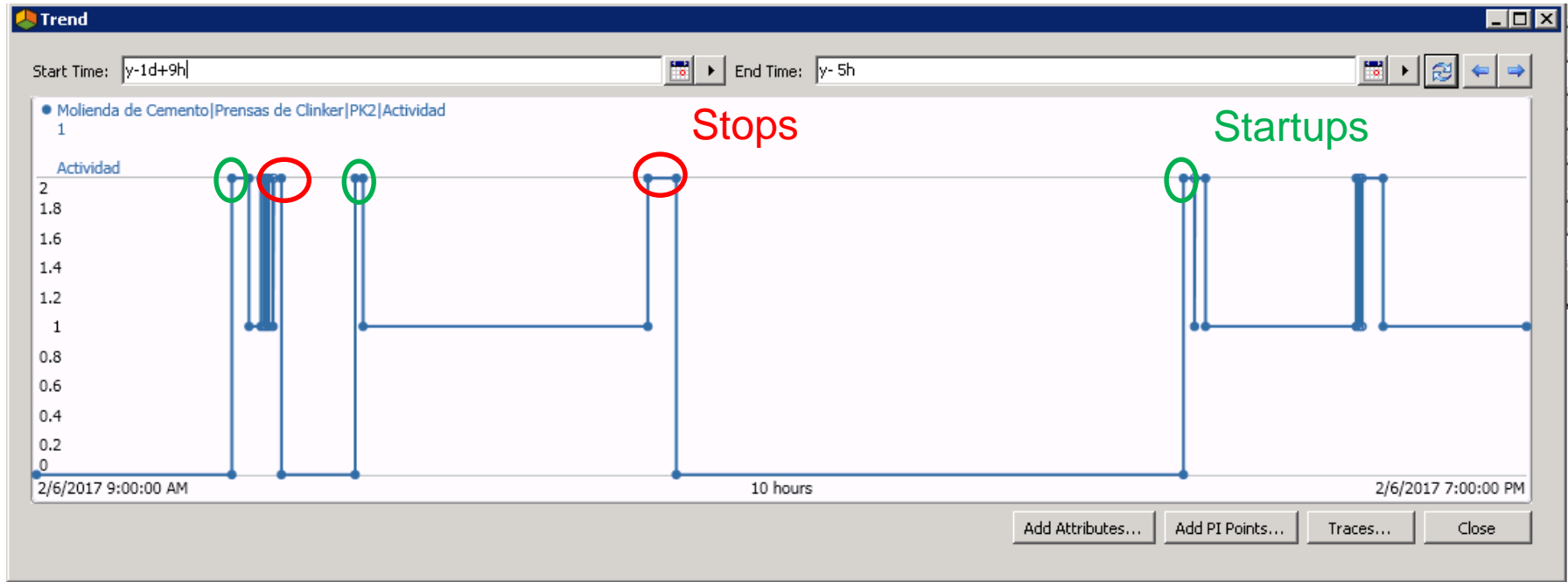


# Machine Status Redefinition

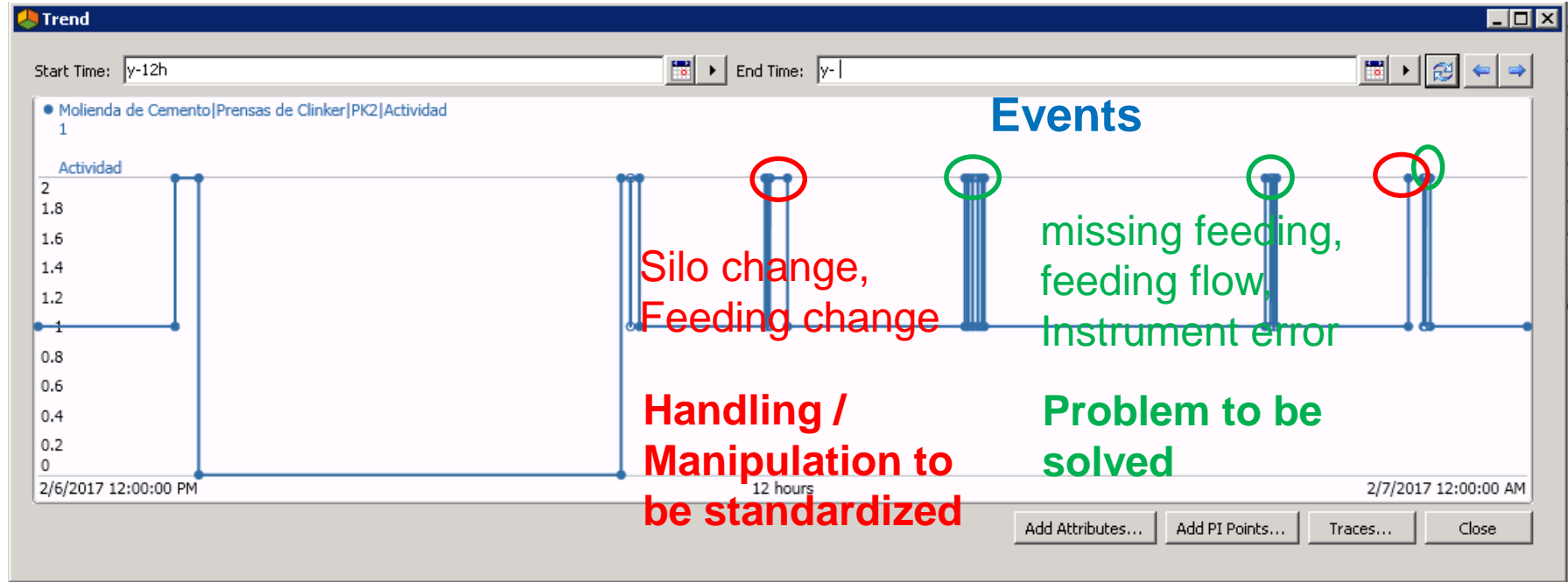




# Machine Status – Well-Known Behaviors



# Machine Status – Looking for Behaviors



## KPI's definition

- OEE (Overall Equipment Effectiveness)
- Real-Time Production Data
- Real-Time Events
  - Downtime, Out of Control, Running Without Load
- Online Totalizers (day, shift, hour)
- Self-Service KPIs and Operational Intelligence

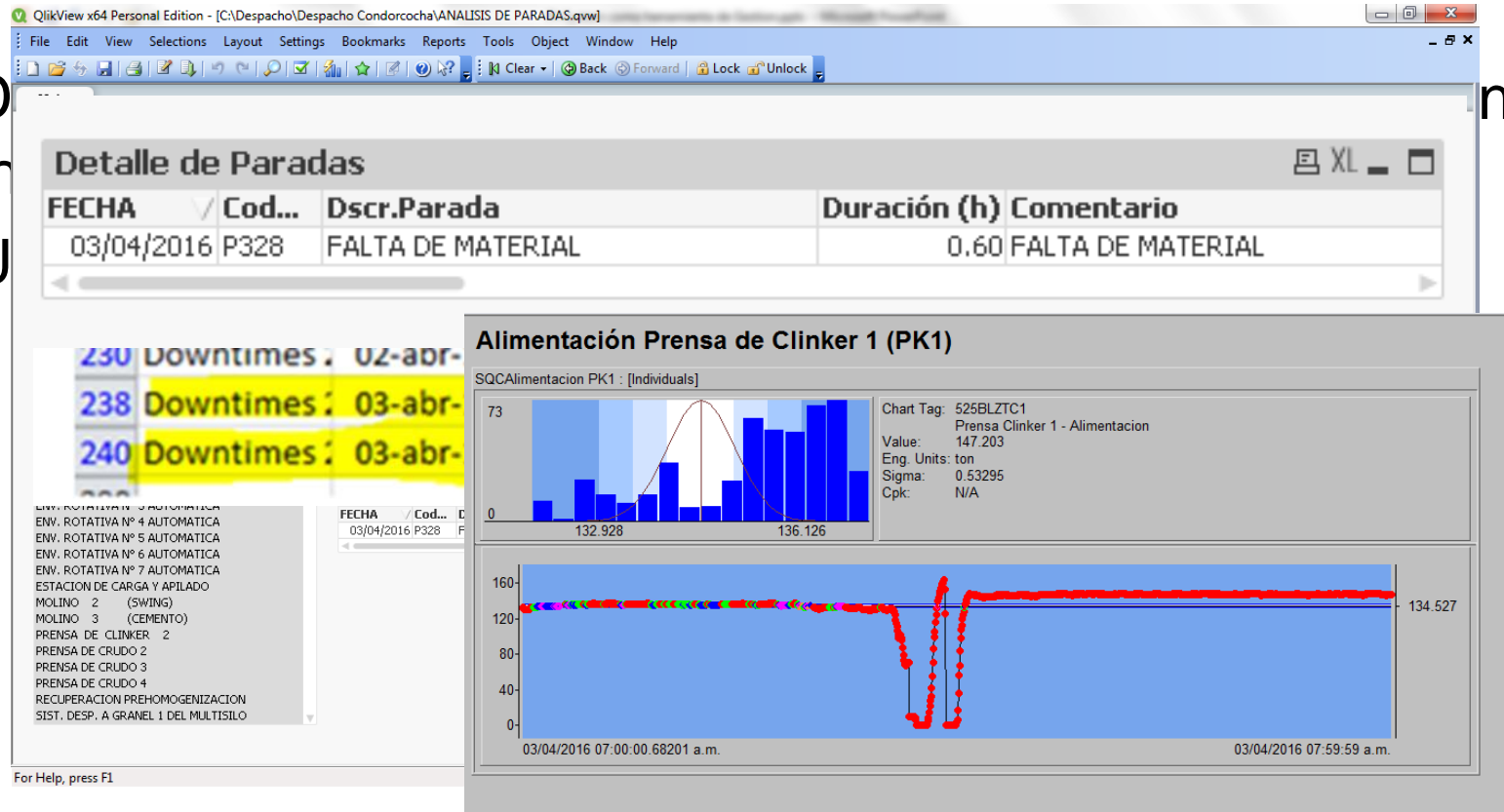
# KPI Definition

The screenshot displays the PI System Explorer (Administrator) interface. The left pane shows a tree view of elements, with 'Calcínación', 'Chancado Secundario', 'Molinos de cemento', and 'Prensas de Clinker' highlighted by red circles. The main pane shows the 'PK1' KPI definition table, with the '1T' row in the 'Cumplimiento Meta T' KPI highlighted by a red circle. The right pane shows the 'Settings...' dialog for the selected KPI.

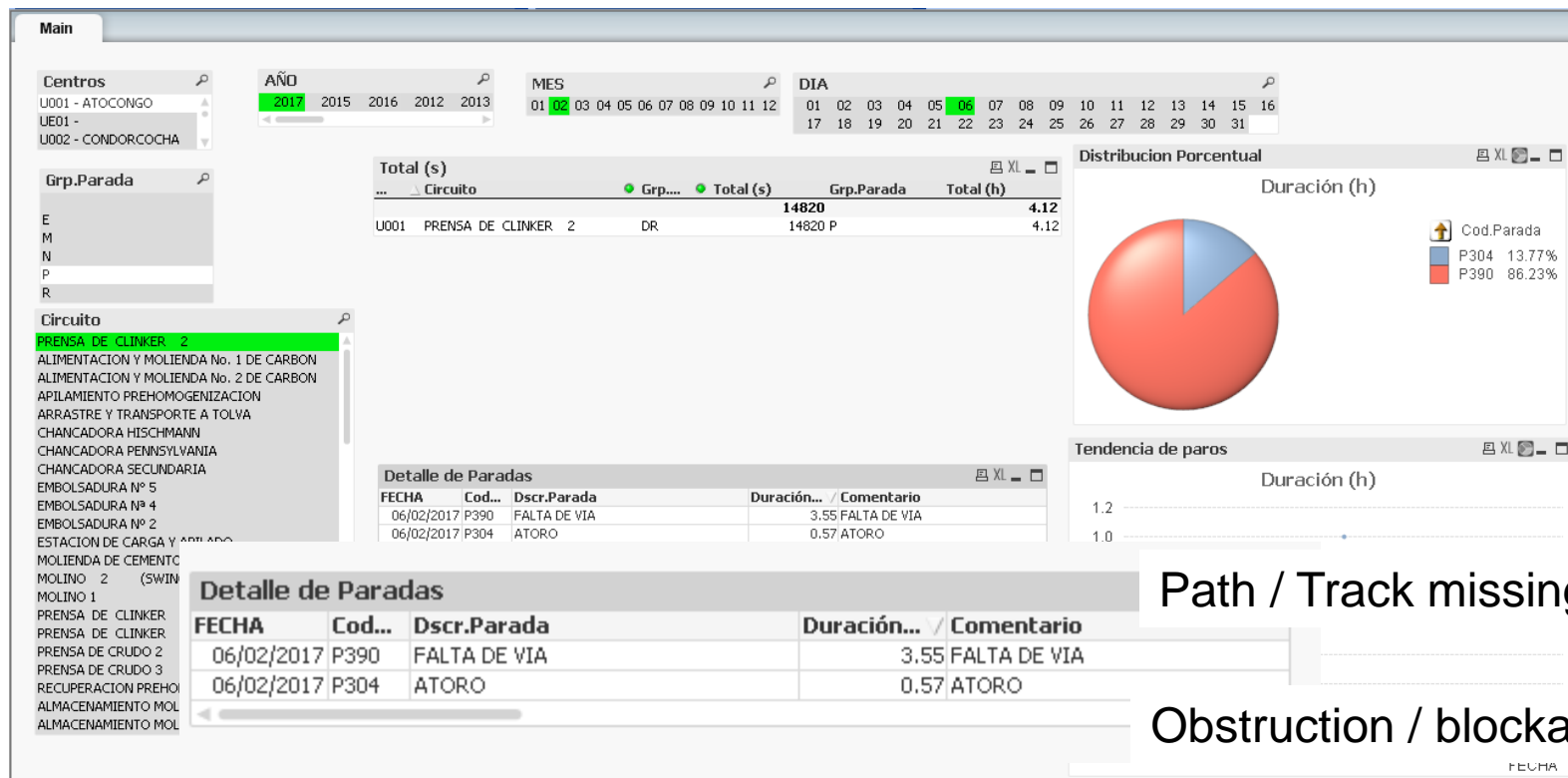
Name	Value	Settings...
Datos x Turno		
Cumplimiento Meta T	91.420322448786 %	\\SRVPI02\PK1.Cumplimiento Meta T;pointtype=base
1T	88.765552156992 %	\\SRVPI02\PK1.Cumplimiento Meta T.1T;pointtype=base
2T	92.755594043669 %	\\SRVPI02\PK1.Cumplimiento Meta T.2T;pointtype=base
3T	92.7539503845696 %	\\SRVPI02\PK1.Cumplimiento Meta T.3T;pointtype=base
Eficiencia Maquina T	128.91579425811497	\\SRVPI02\PK1.Eficiencia Maquina T;pointtype=base
1T	131.8939706424873	\\SRVPI02\PK1.Eficiencia Maquina T.1T;pointtype=base
2T	127.53894119725447	\\SRVPI02\PK1.Eficiencia Maquina T.2T;pointtype=base
3T	127.53668177878319	\\SRVPI02\PK1.Eficiencia Maquina T.3T;pointtype=base
Horas Trabajadas T	28.483075483833334	\\SRVPI02\PK1.Horas Trabajadas T;pointtype=base
Produccion T	3017.0260640809925	\\SRVPI02\PK1.Produccion T;pointtype=base
EventframeTrigger	127.6973876953125	\\SRVPI02\S25BLZTC1
Meta Produccion	3300	
Produccion Actual	786.82130888429583	*Molienda de Cemento\Prensas de Clinker\PK1\Produccion A...
Produccion de ayer	3031.1304334038778	*Molienda de Cemento\Prensas de Clinker\PK1\Produccion d...
Ubicacion Tecnica Sup.	A050305	A050305
Ubicacion Tecnica Superior Desrip.	PRENSA DE CLINKER 1	SELECT PLTXT FROM [Ubicaciones Tecnicas] WHERE TPLNR ...


# Statistical Analysis

- D
- th
- U



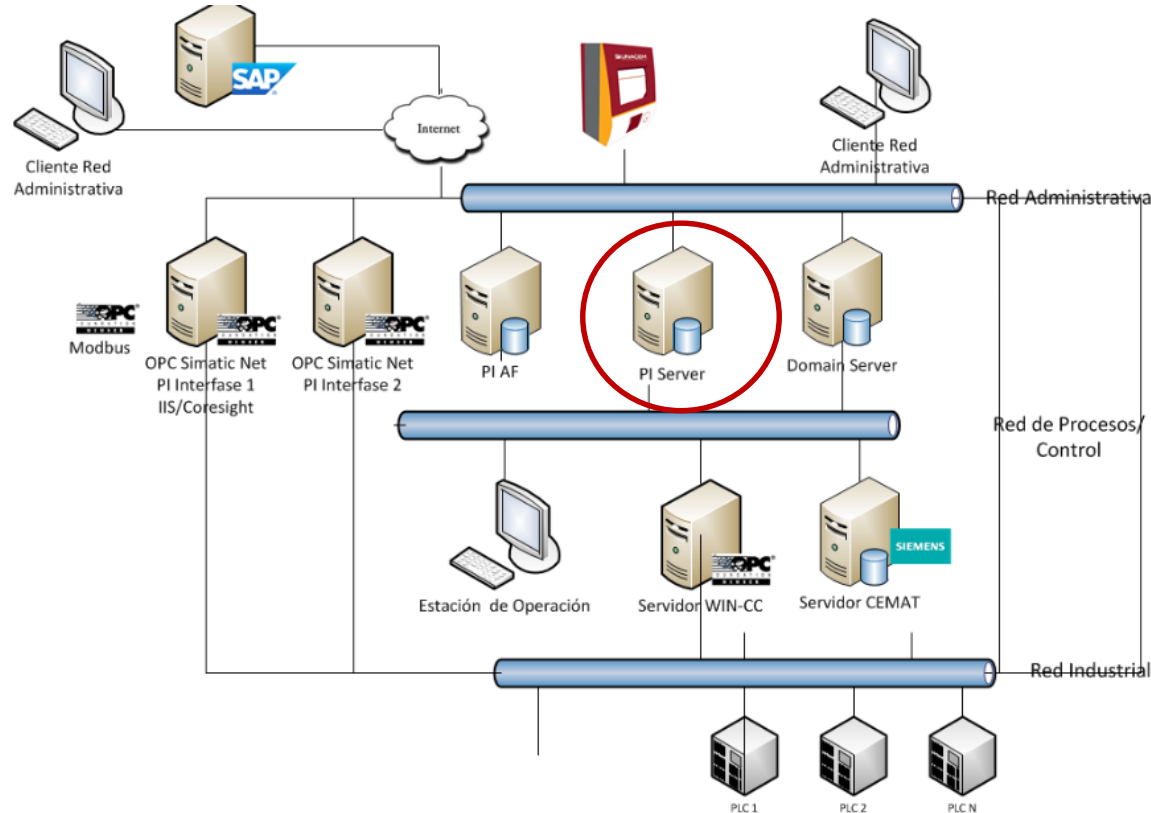
# Events in BI Tool





# How Individual Product Capabilities Solved Your Business Challenge

# PI System Architecture





# Asset Hierarchy

File Search View Go Tools Help

Database Query Date Back Check In Refresh New Element New Attribute Search Elements

Elements

- Elements
  - Calcinación
    - Contraste horario GN
    - Horno I
    - Horno II
  - Chancado Primario
  - Chancado Secundario
  - Envase
  - Molienda de carbon
    - Notificaciones DMPA
      - 931VE02SR101
  - Molienda de Cemento
    - Molinos de Cemento
      - MC
      - MCRUDO
      - MS
    - Prensas de Clinker
      - PK1
      - PK2**
      - Notificaciones DMPA
        - PK3
        - PK4
    - Molienda de Crudo
    - PreHomogeneización
    - Recuperación
  - Element Searches

PK2

General Child Elements Attributes Ports Analyses Notification Rules Version

Filter

Name	Value	Time Stamp	Settings
Category: <None>			
Horas Continuas	16.16	2/10/2017 9:23:54.685 AM	'Molienda...
Produccion Efectiva	0	2/10/2017 9:23:54.801 AM	'Molienda...
Ultima Parada	2/9/2017 5:14:21.524 PM	2/9/2017 5:14:21.524 PM	'SRVP10...
Category: Availability			
Actividad	2	2/10/2017 9:23:01.873 AM	'SRVP10...
Status	Funcionando sin carga	2/10/2017 9:23:01.873 AM	A=Activi...
Turno	1	2/10/2017 9:23:54.607 AM	'Molienda...
Category: Downtime Event			
EventframeTrigger	0	2/10/2017 9:23:50.577 AM	'SRVP10...
Category: Performance			
% Alcanse	26.58	2/10/2017 9:23:54.685 AM	'Molienda...
Alcanse Actual	1375	2/10/2017 9:23:54.685 AM	'Molienda...
Datos x Turno		1/1/1970 12:00:00 AM	
Produccion Actual	365.45027308647144	2/10/2017 9:23:54.685 AM	'Molienda...
Produccion de ayer	2404.5157326611643	2/10/2017 9:23:54.717 AM	'Molienda...
Category: Specification			
Meta Produccion	3300	1/1/1970 12:00:00 AM	

Group by: ☒ Category ☐ Templates

Name: Horas Continuas

Description: Horas Continuas

Properties: <None>

Categories:

Default UOM: <None>

Value Type: Double

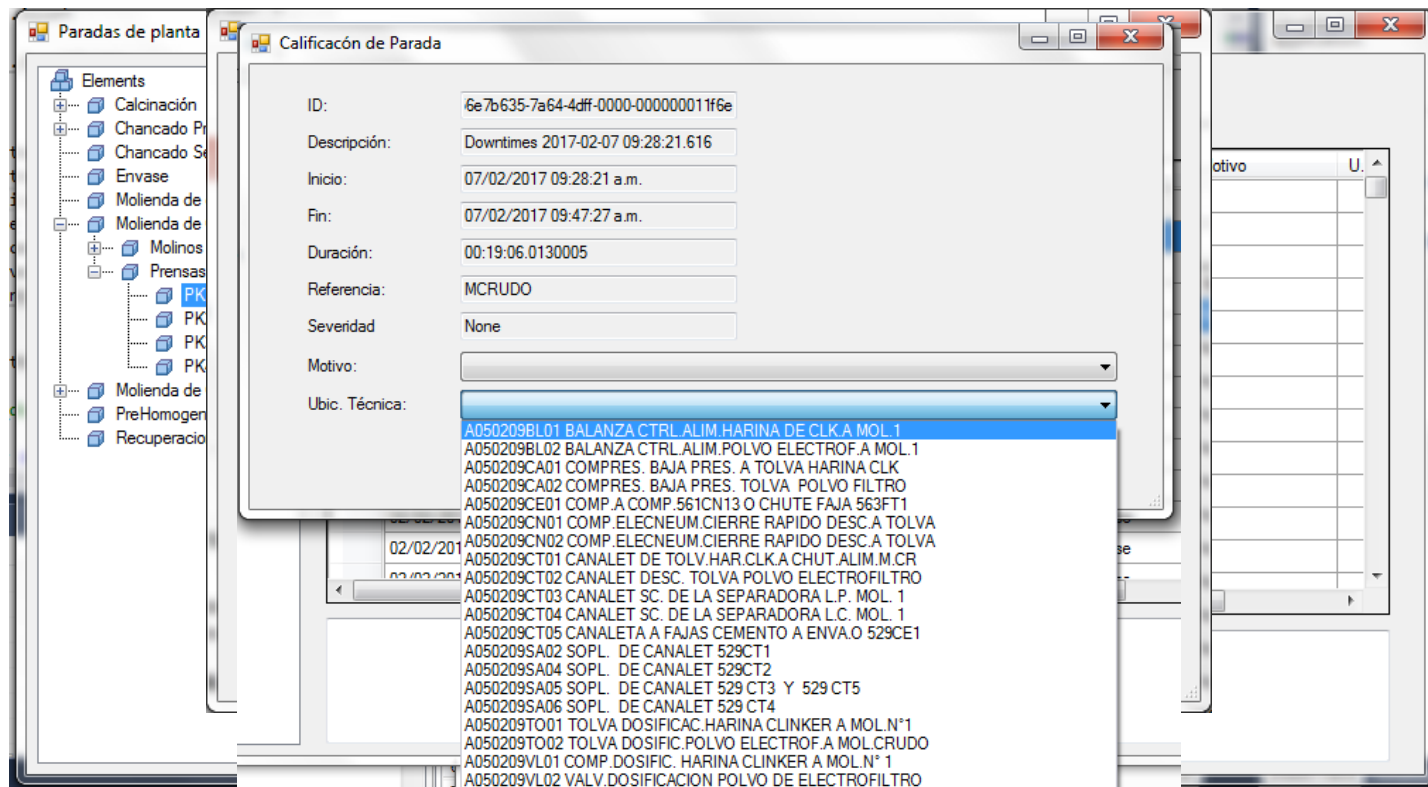
Value: 16.16

Data Reference: Analysis

Settings...

'Molienda de Cemento\Prensas de Clinker\PK2\Horas Continuas' is mapped as an output for: 'Horas Continuas'.

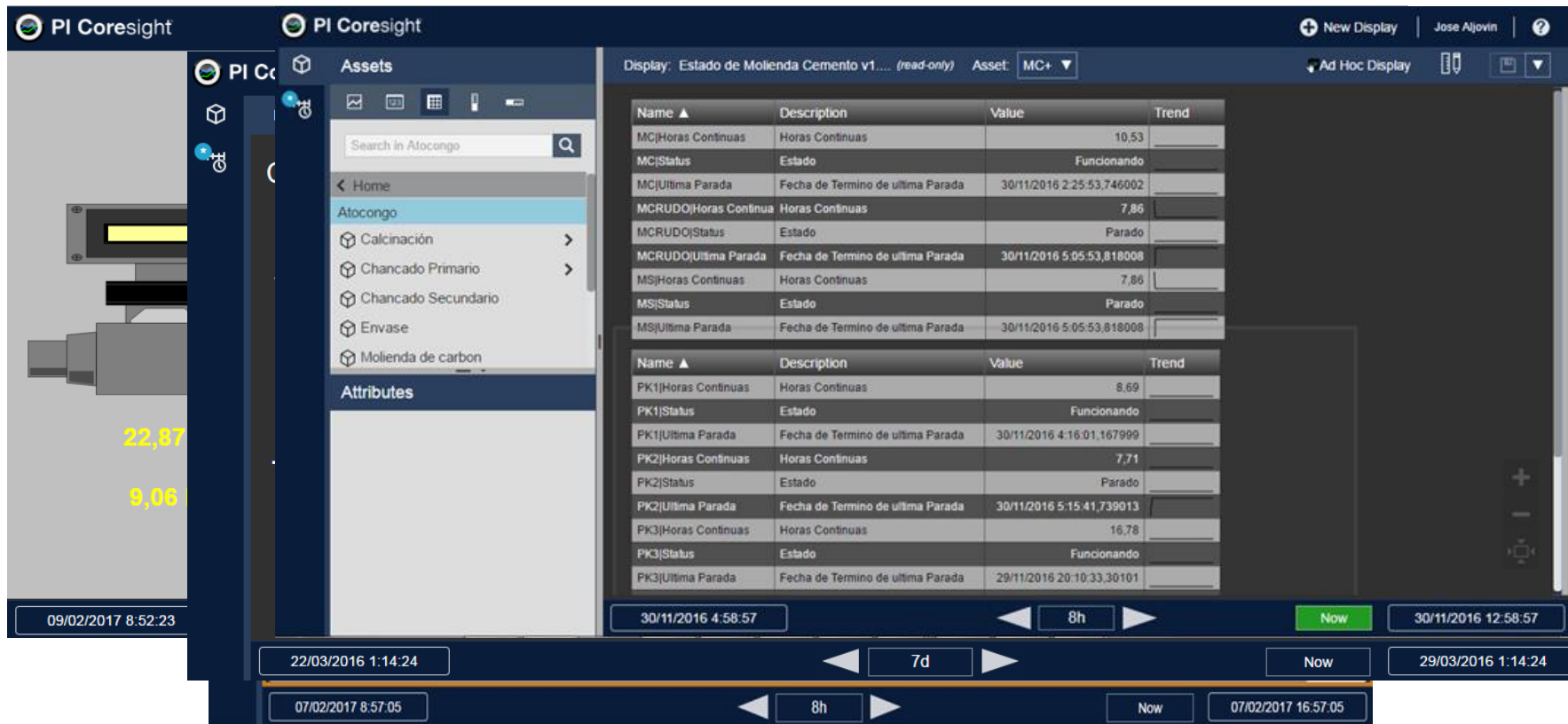
# AFSDK Application



# PI Web API Application

The screenshot displays the PI Web API application running in a web browser at `localhost:34385`. The application interface includes a sidebar with navigation options like 'Data Base', 'Elements', and 'Lista Equipos'. The main content area shows a form with fields for 'Inicio' (set to 'T-7d'), 'Fin' (set to '\*'), and 'Index' (set to '3'). Below these fields are tabs for 'Eventos' and 'Atribut'. The Chrome DevTools console is open, showing the 'Sources' panel with the file `piwebapifunctions.js` selected. The console log displays a series of events, including 'PK1 Downtimes' and 'PK4 Downtimes', with timestamps and event IDs. The console also shows the execution of JavaScript code, such as `var starttime = $("starttime").val();` and `var endtime = $("endtime").val();`.

# PI Coresight



# PI ODBC & PI OLEDB Enterprise

The screenshot displays the QlikView x64 application interface. The main window is titled "Edit Script [C:\Despacho\Despacho Condorcoca\PIAF\_Downtimes.qvw]". The script editor shows two SQL queries. The first query selects elements from the PIFD.dbo.AFELEMENT table. The second query selects event data from the PIFD.dbo.AFEVENTFRAME table, including timestamps and duration.


**SQL SELECT**

```
20 SQL SELECT
21     [name] as Element
22     , [description] as Ruta
23     , [strrid]
24 FROM PIFD.dbo.AFELEMENT
25 WHERE rid > 0;
26
27
28 SQL SELECT
29     name
30     , description
31     , StartTime
32     , EndTime
33     , [Fecha] = CONVERT(VARCHAR(10), DATEADD(SECOND, ((starttime/10000000) - 62135596800 - 5*60*60), '19700101'), 20)
34     , [Año] = DATEPART(yy, DATEADD(SECOND, ((starttime/10000000) - 62135596800 - 5*60*60), '19700101'))
35     , [Mes] = DATEPART(mm, DATEADD(SECOND, ((starttime/10000000) - 62135596800 - 5*60*60), '19700101'))
36     , [Dia] = DATEPART(dd, DATEADD(SECOND, ((starttime/10000000) - 62135596800 - 5*60*60), '19700101'))
37     , [F.Inicio] = DATEADD(SECOND, ((starttime/10000000) - 62135596800 - 5*60*60), '19700101')
38     , [F.Fin] = DATEADD(SECOND, ((endtime/10000000) - 62135596800 - 5*60*60), '19700101')
39     , [Duración] = CONVERT(DECIMAL(12, 4), DATEDIFF(SECOND, DATEADD(SECOND, ((starttime/10000000) - 62135596800 - 5*60*60),
40     , DATEADD(SECOND, ((endtime/10000000) - 62135596800 - 5*60*60), '19700101')) / 60) / 60
41     , [fkprimaryreferenceelement] as [strrid]
42 FROM PIFD.dbo.AFEVENTFRAME
```

The interface also shows a list of elements on the left, including PK2, 2do Piso NOX, 2do. Piso CO, 2do. Piso NOX, 2do. Piso O2, 2do. Piso SO2, 421EX2VI1, 931VE02SRI01, ChPrimaria, Horno II, MC, MCRUDO, MS, PCR1, PCR2, and PCR3. The right pane displays a table with two columns: "F.Inicio" and "F.Fin".

F.Inicio	F.Fin
04:39:59 AM	02/02/2017 04:46:52 AM
10:41:12 AM	03/02/2017 01:53:57 PM
04:15:01 PM	03/02/2017 04:51:02 PM
05:15:33 PM	04/02/2017 05:21:58 PM
05:48:58 PM	05/02/2017 02:37:53 AM
11:41:00 AM	05/02/2017 12:20:11 PM
06:59:16 PM	06/02/2017 10:18:40 AM
10:38:36 AM	06/02/2017 11:08:20 AM
01:17:38 PM	06/02/2017 04:41:52 PM
04:09:41 PM	08/02/2017 06:18:56 PM

# Notifications



Correo ▾

←

📁

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Más ▾

35 de 975

REDACTAR

Alarma DMPA TAG: 421EX2VI2  Recibidos x

🖨️

📧

Recibidos (5)

Destacados

Enviados


Borradores

Capacitacion


Comunicados

Concreteras

Condorcocha

 Jose ▾ 

+



**PISystem@unacem.com.pe**  
para mí ▾

2 feb. (hace 5 días) ☆ 

↩️ ▾

**Evento:** High Level Alarm 2017-02-02 12:13:08.596  
**Ubicación:** Calcinación\Horno I\notificaciones DMPA\421EX2VI2\EXHAUSTOR II DEL HORNO (1ER. PISO) Vibracion chumacera ventilador lado libre  
**TAG:** 421EX2VI2  
**Valor Señal:** 5.06  
**Valor Limite Alto:** 5  
  
**Nombre:** Alarma DMPA  
**Hora Inicio:** 2/2/2017 12:13:08 PM SA Pacific Standard Time (GMT-05:00:00)



# Results Obtained and Business Impact

# Operational increase

Circuito	Paradas Total (h)	Paradas por no Requerido (h)	% del total de paradas	Dias de analisis	Horas trabajadas teoricas	Total de Horas Teoricas	% de paradas respecto del teorico	No requerido respecto del teorico	INCREMENTO OPERATIVO
MOLINO 2 (SWING)	7258.62	6194.95	85.35	333	24	7992	90.82	77.51	13.31
MOLINO 3 (CEMENTO)	5420.36	4483.69	82.72	333	24	7992	67.82	56.10	11.72
PRENSA DE CLINKER 1	1921.25	670.87	34.92	333	24	7992	24.04	8.39	15.65
PRENSA DE CLINKER 2	1940.13	847.00	43.66	333	24	7992	24.28	10.60	13.68
PRENSA DE CLINKER 3	2123.53	736.93	34.70	333	24	7992	26.57	9.22	17.35
PRENSA DE CLINKER 4	1824.19	596.17	32.68	333	24	7992	22.83	7.46	15.37
Total general	20488.08	13529.60				47952	42.73	28.21	





# Conclusion

# Conclusion

- Accurate, Realible Data
- Quantitative Analysis
- Standarize Process and Handing
- Identify Best Shift and Operator
- Leadership & Democratization
- Addressing to achieve the Advanced Process Control (APC)

# Improving Runtime Through Actionable Insights from the PI System

## COMPANY and GOAL

UNACEM's priority is to maintain a portfolio of high-quality cement products at competitive prices to meet all of our customers' needs.



## CHALLENGE

Face the increasing market competition, reducing production cost and standardizing process.

- Silos availability.
- New products.
- APC.

## SOLUTION

Choose the process directly involved with our challenges, grinding cement, and use the powerful of AF.

- Found a Road Map and agile Methodology.
- Generate and analysis data to identify trend, standardize time, relevant signal and process operation.

## RESULTS

We achieve an improvement between 11 and 17% in cement grinding, it means profits of US\$ 6 millions in a first year.

- This methodology can be use in all the process of our factories.
- We can continue improving our profits.

## Contact Information

**José Aljovín**

[jose.aljovin@unacem.com.pe](mailto:jose.aljovin@unacem.com.pe)

*Functional Consultant*

UNION ANDINA DE CEMENTOS S.A.A.

## Questions

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



State your **name & company**

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谢谢

Danke

Merci

Gracias

**Thank You**

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Спасибо

Obrigado