

# **The PI System**

**The Foundation for Enterprise  
Analytics, Visualization, &  
Collaboration in Context**

**Business to Operations  
Value**

Presented by **Craig Harclerode**  
**Industry Principal –in O&G and Petrochemicals**

# Agenda



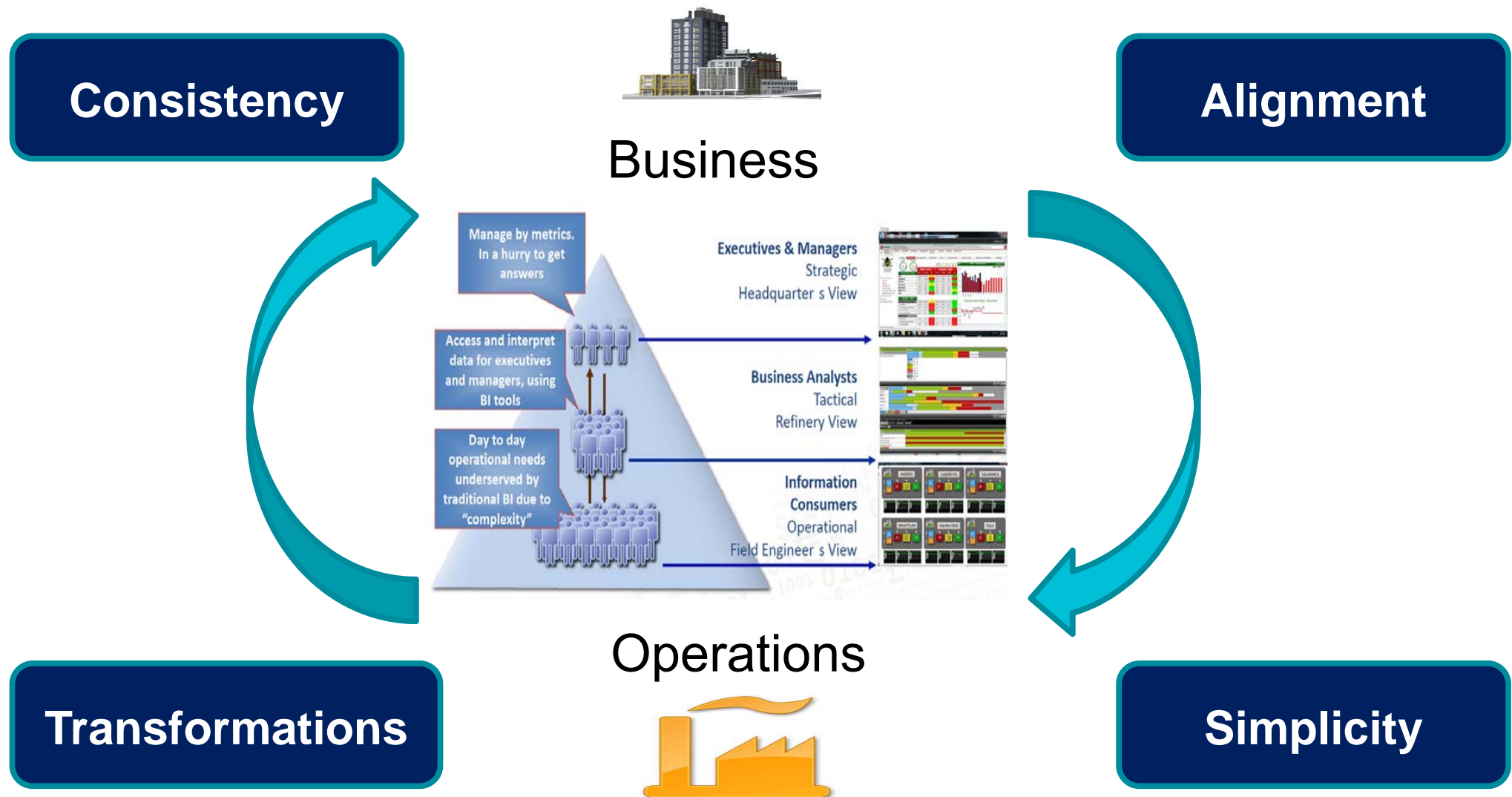
- Business to Operations Data Value Requisites:
  - Data Consistency and Context
  - Organizational Alignment
  - Applications/Solutions Simplicity
  - Data Transformation Methodology
- Resulting Value in O&G
- Closing Comments

# Agenda



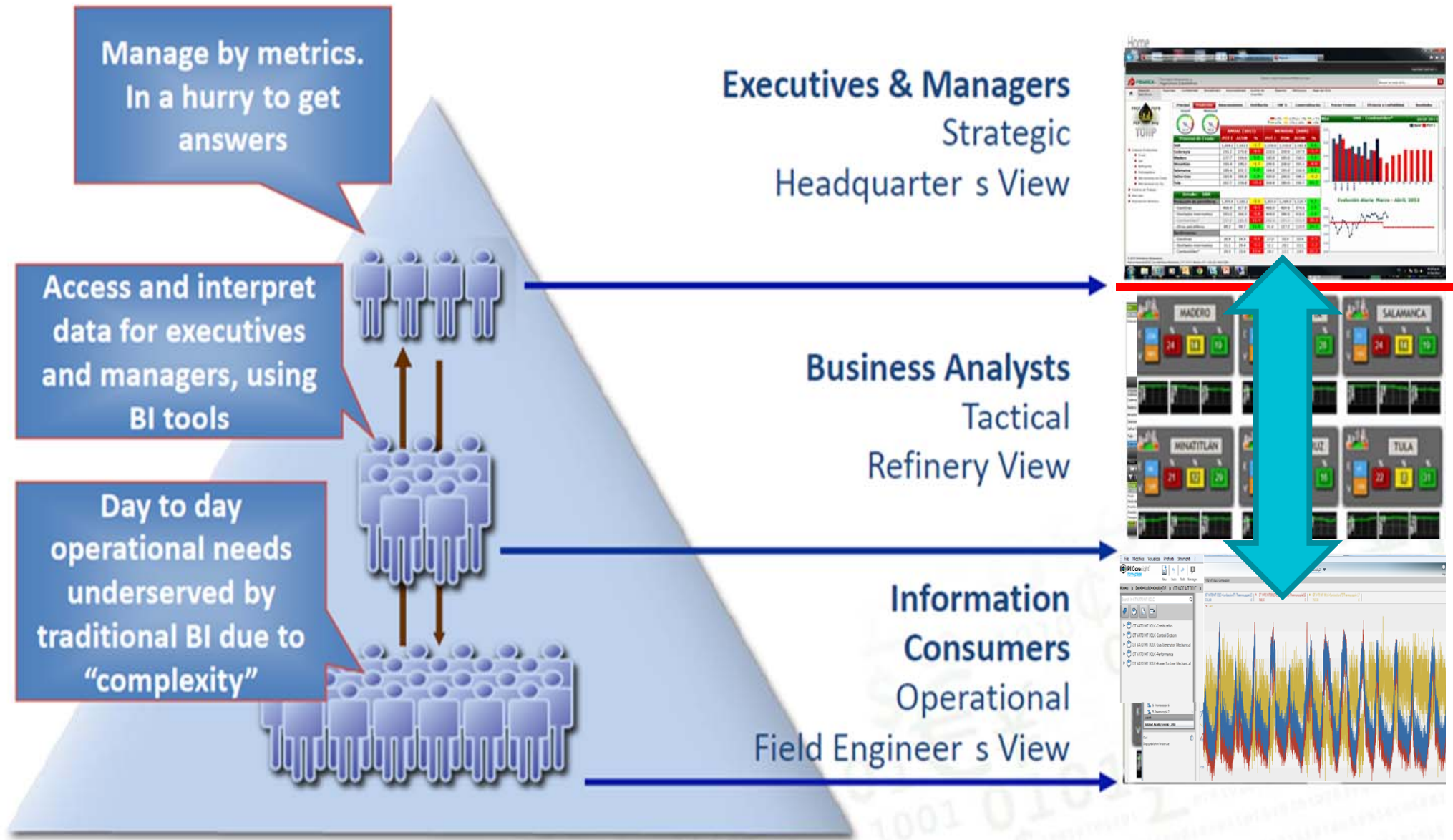
- Business to Operations Data Value Requisites:
  - Data Consistency and Context
  - Organizational Alignment
  - Applications/Solutions Simplicity
  - Data Transformation Methodology
- “Future Proofing” of the Data Infrastructure
- Resulting Value in O&G
- Closing Comments

# The Need for a Data Information Infrastructure

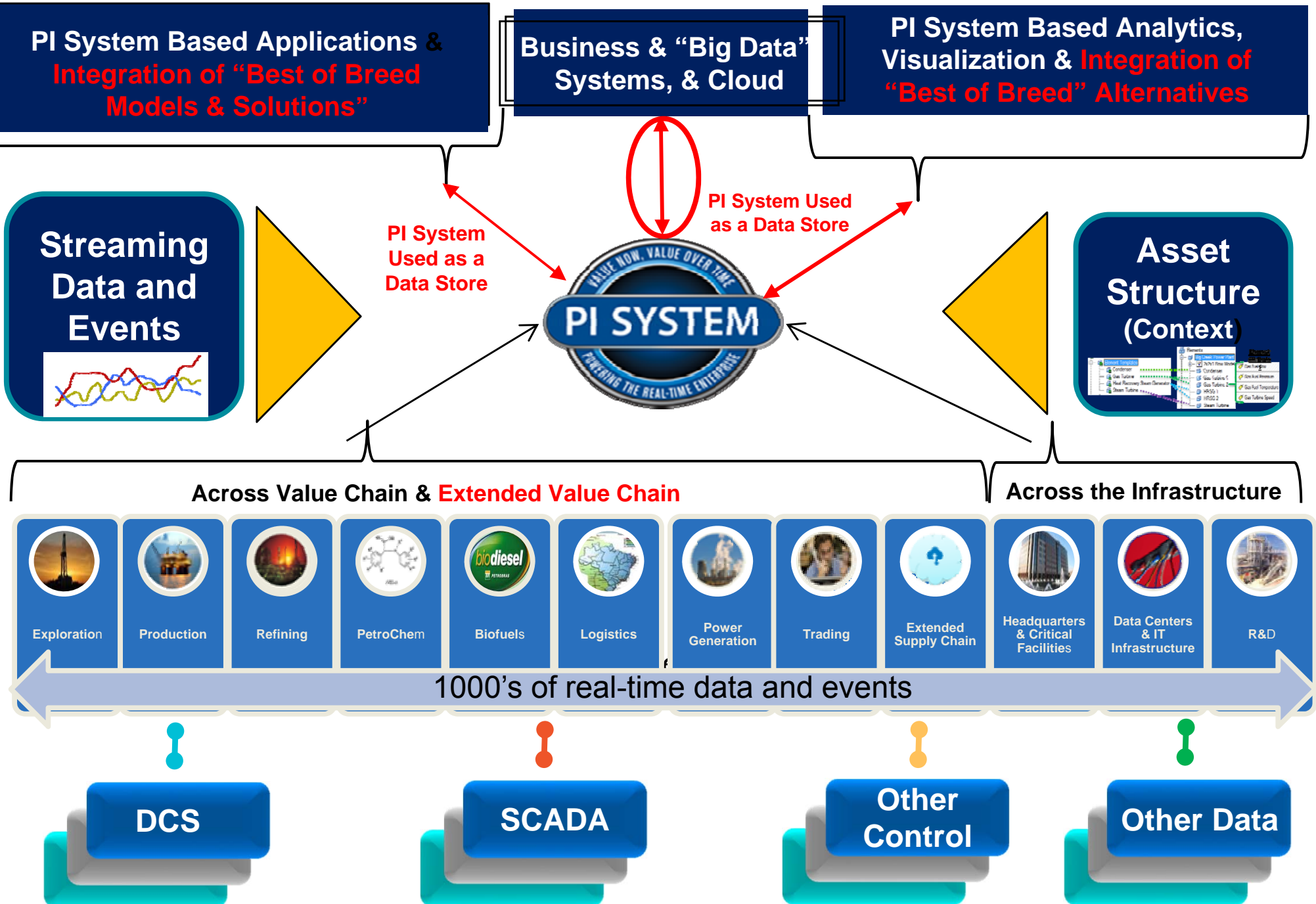




# Data and Information in Context with Integrated High Fidelity Drill Down – “Don’t Let Sexy override Functionality”



# Enterprise Consistency, Alignment, Simplification & Data Transformation





# Illustrative Case Study – Chevron GOM

Data Consistency and Context  
Organizational Alignment  
Applications/Solutions Simplicity  
Data Transformation Methodology

# Gulf of Mexico Business Unit (GOM) Who we are...

## ■ Overview

- Largest leaseholder in the Gulf of Mexico
- Over 500 structures
- Onshore facilities in Louisiana and Alabama
- Main headquarters in Covington, LA
- 6 shore bases

## ■ Process Control Network Overview

- Over 600 PCN servers, workstations & support machines
- Over 650 Control Systems
- Over 30 PCN Applications and 170 Utilities
- 25 historical databases
- 7 Firewalls, 150 routers and switches, 220 wireless radios





## Diversity in Tag Names to Standardized Asset Naming

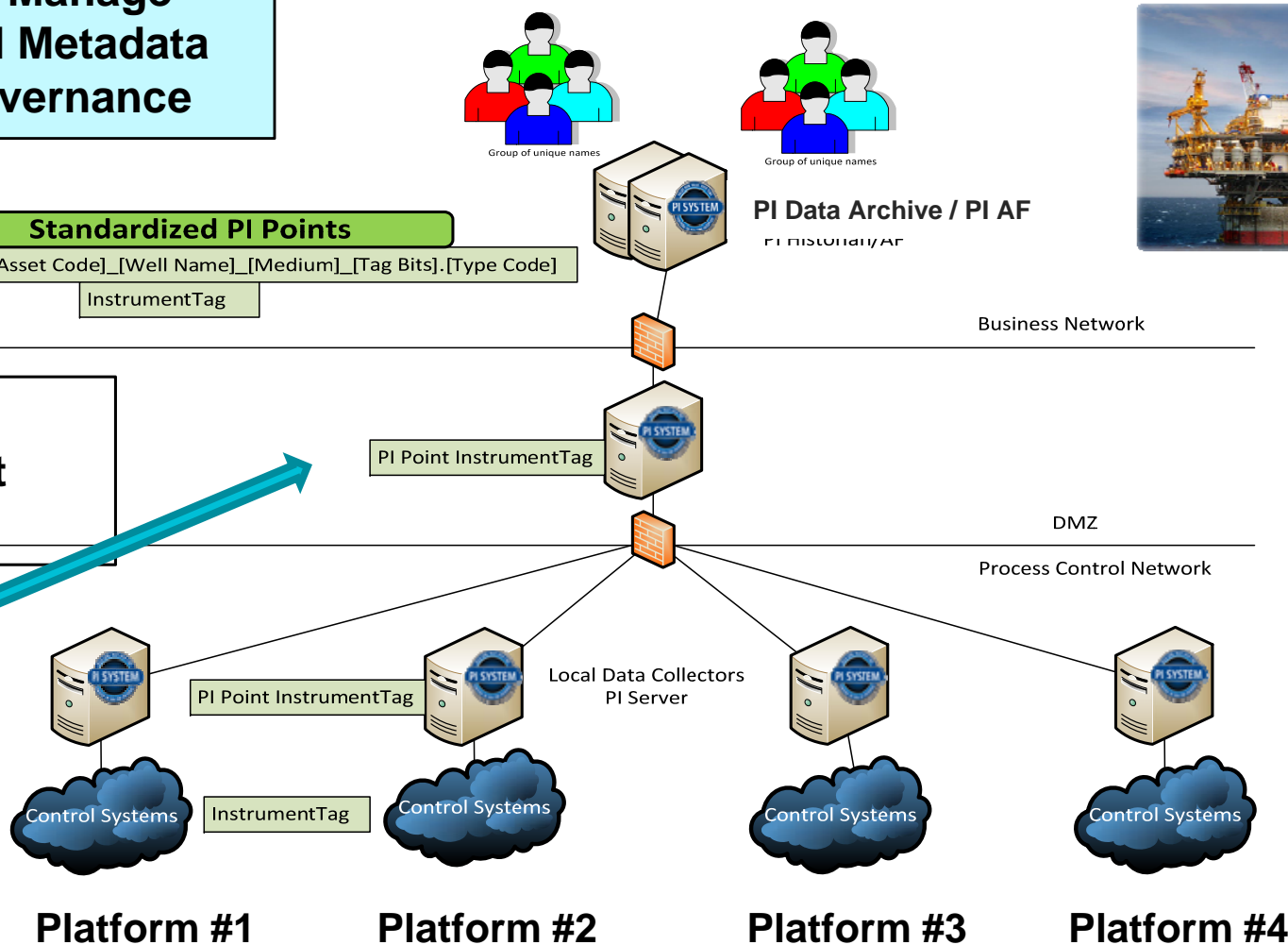


# Chevron GOM PI System Infrastructure

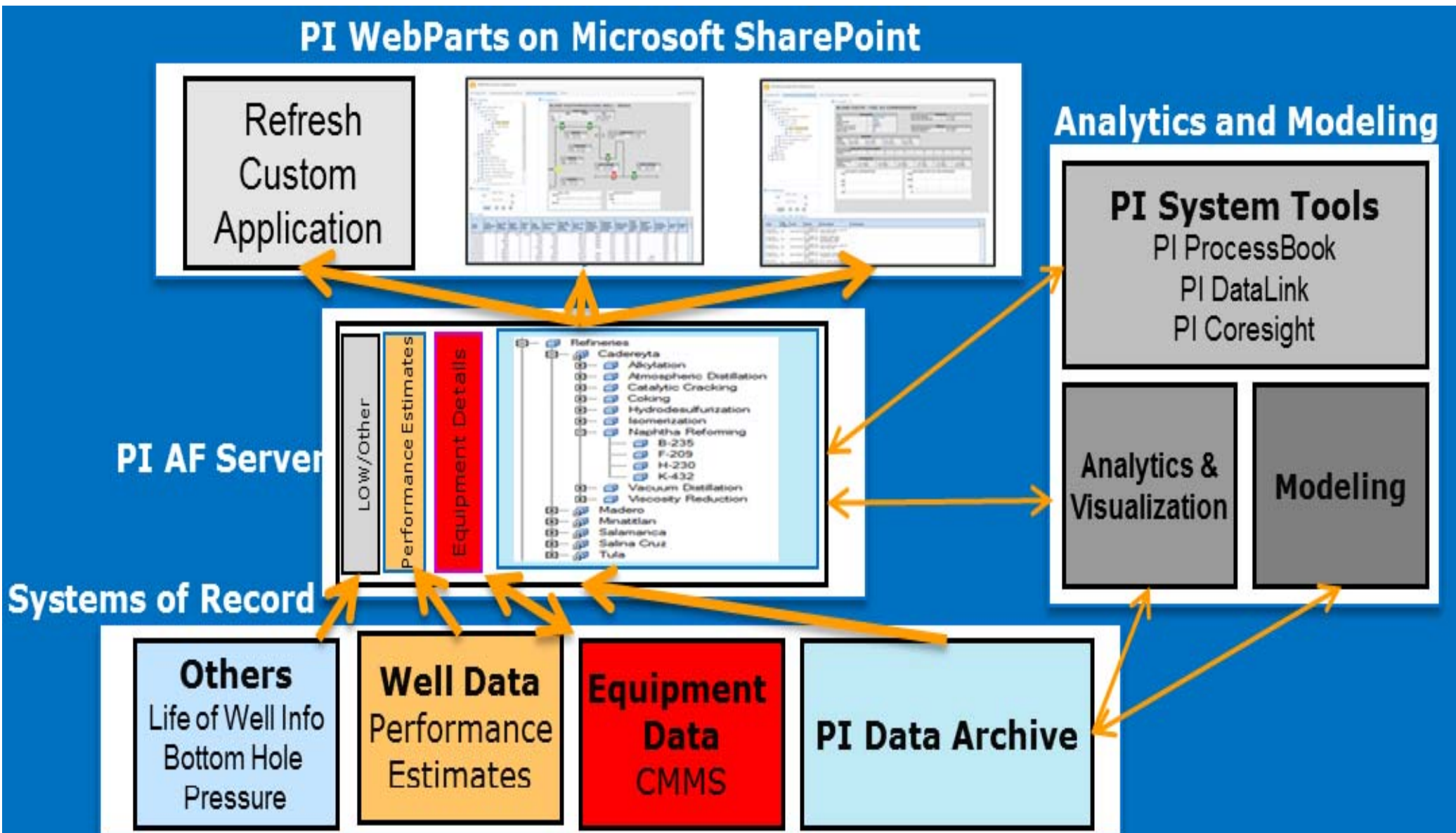
Using PI AF as a Data Abstraction Layer & Alias Feature to Manage Tagging and Metadata Naming Governance

GOM Standard Tags and Asset Naming

Retention of Original Tag and Asset Naming as Required for MOC

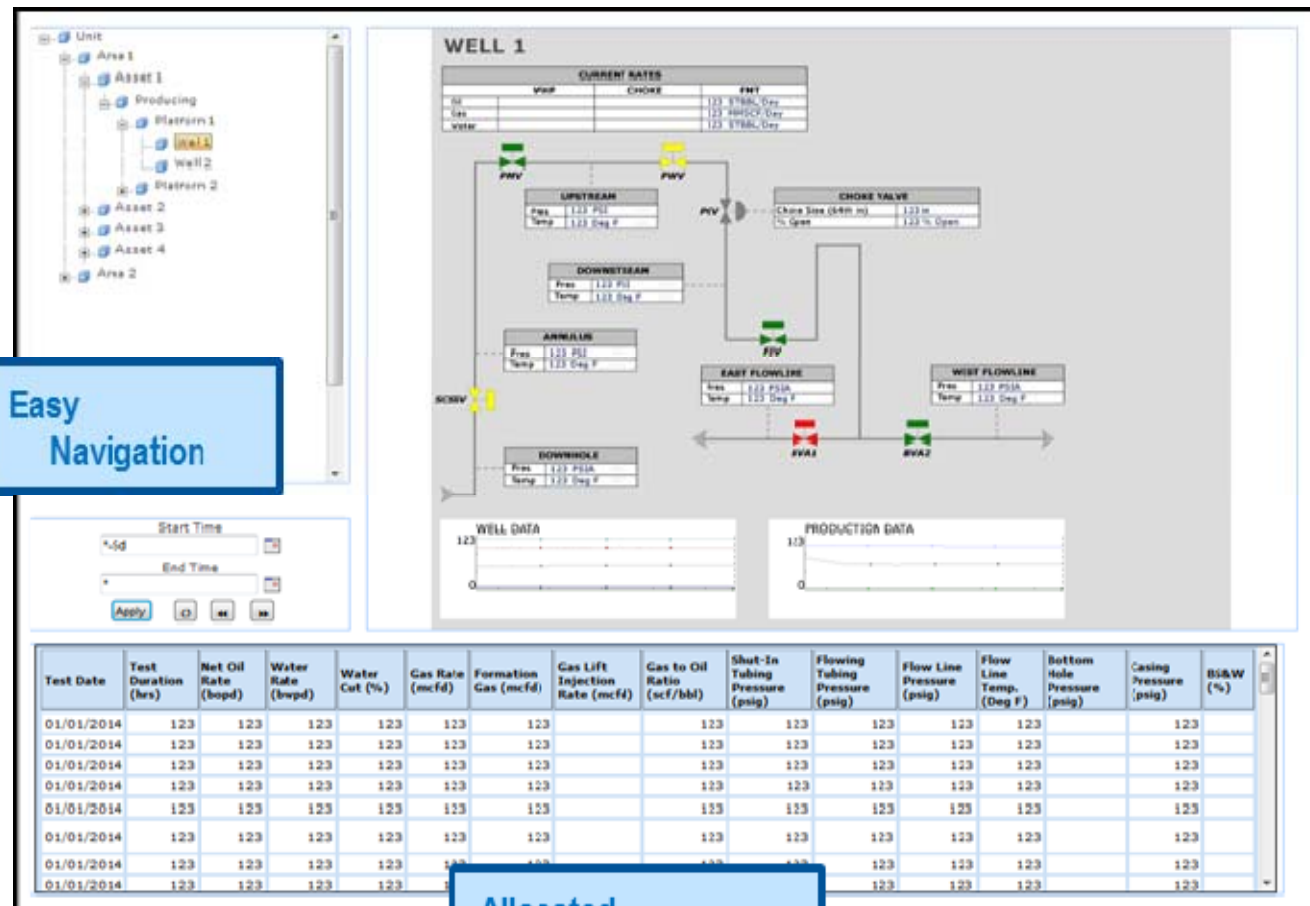


# Chevron – GOM PI System Data Infrastructure



# Chevron – Gulf of Mexico Business Unit

## Integrating Key Well Data with the PI System



### Project Benefits

- Consistent, Reliable Real-time Data
- Standard Tags
- **Graphic Templates**
- Easy Navigation
- Allocated Production
- **Well Tests**
- Sustainable Support Model

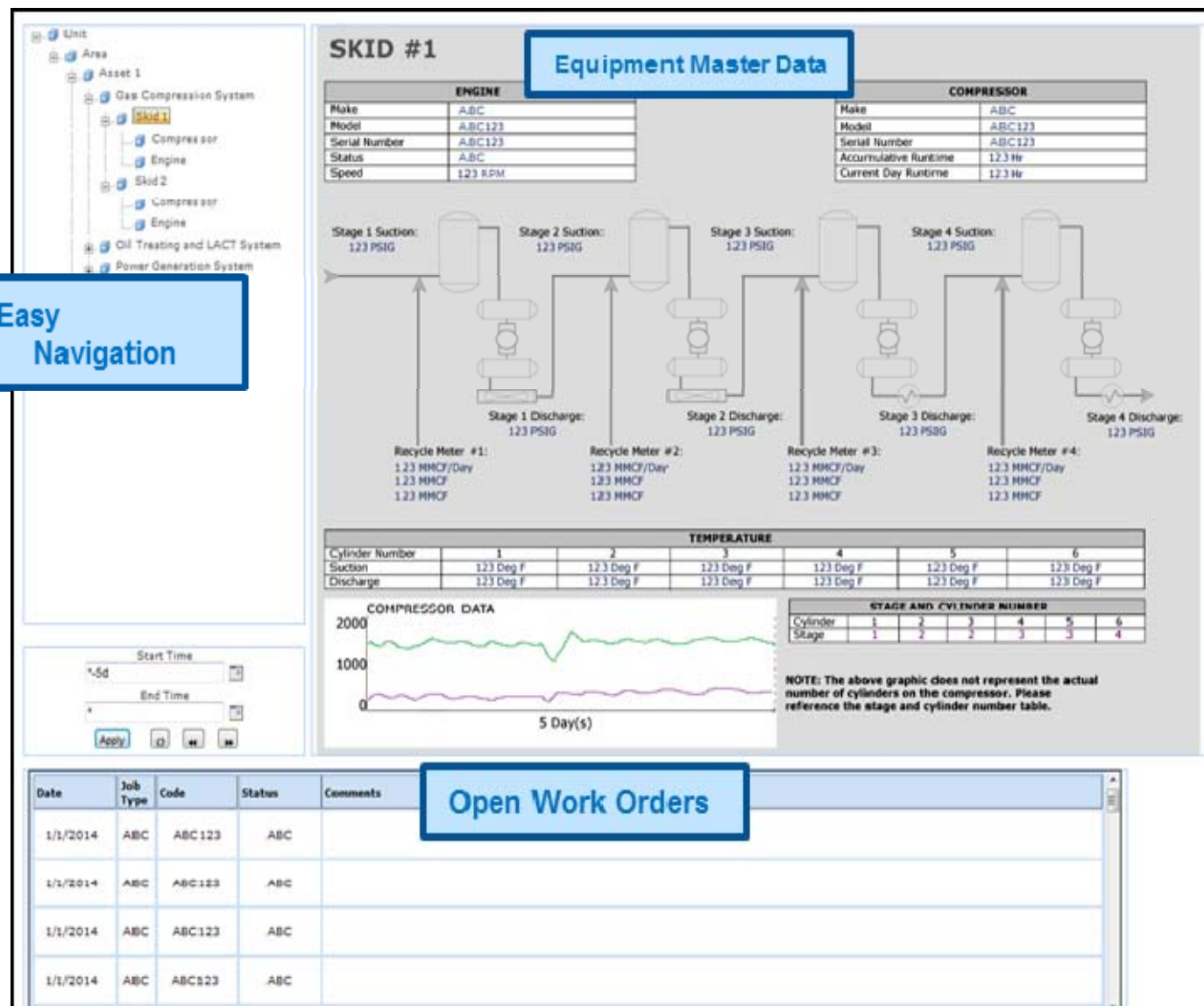
### Deployed Well Statistics

- **Over 700 Wells**



# Chevron – Gulf of Mexico Business Unit

## Integrating Key Equipment with the PI System



## Project Benefits

Consistent, Reliable  
Real-time Data  
Standard Tags

**Std. Graphic Templates**  
**Std. Calculations/Analytics**

**Easy Navigation**

**Equipment Master Data**

Open Work Orders

Sustainable Support Model

## Deployed Equipment Statistics

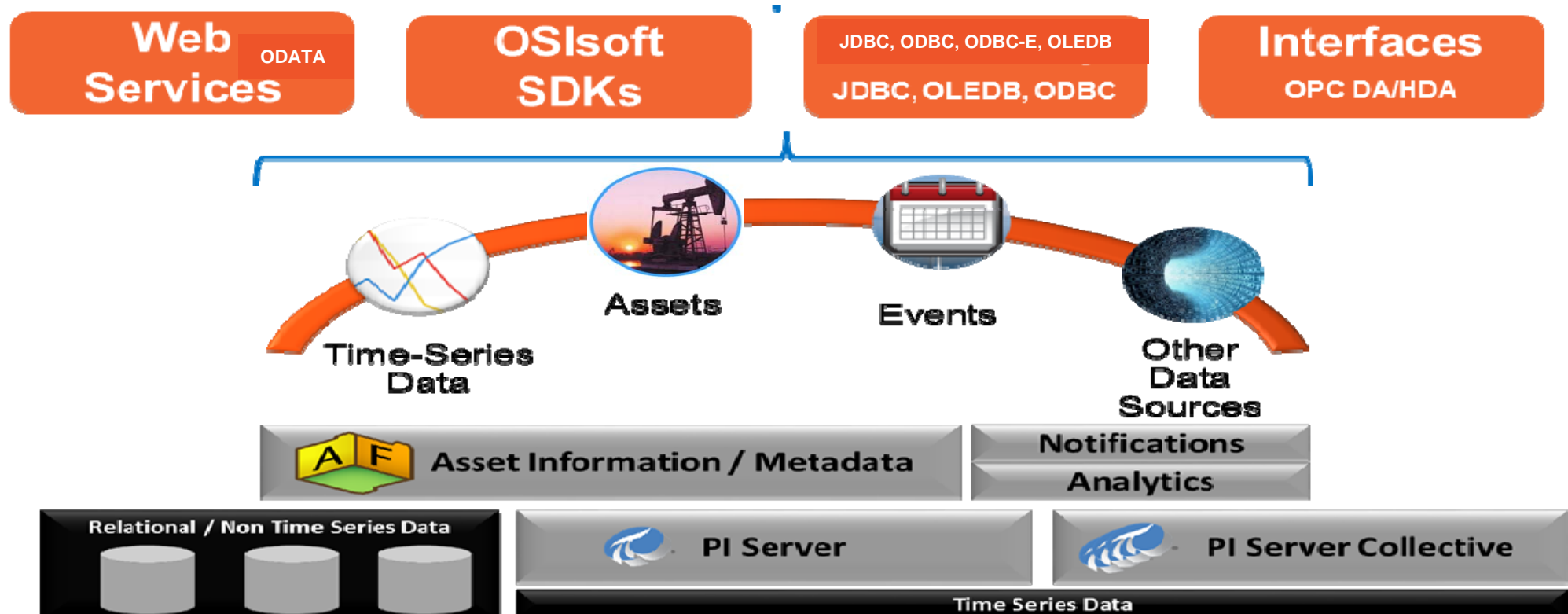
- Over 180 Compressors, Pumps, Generators**



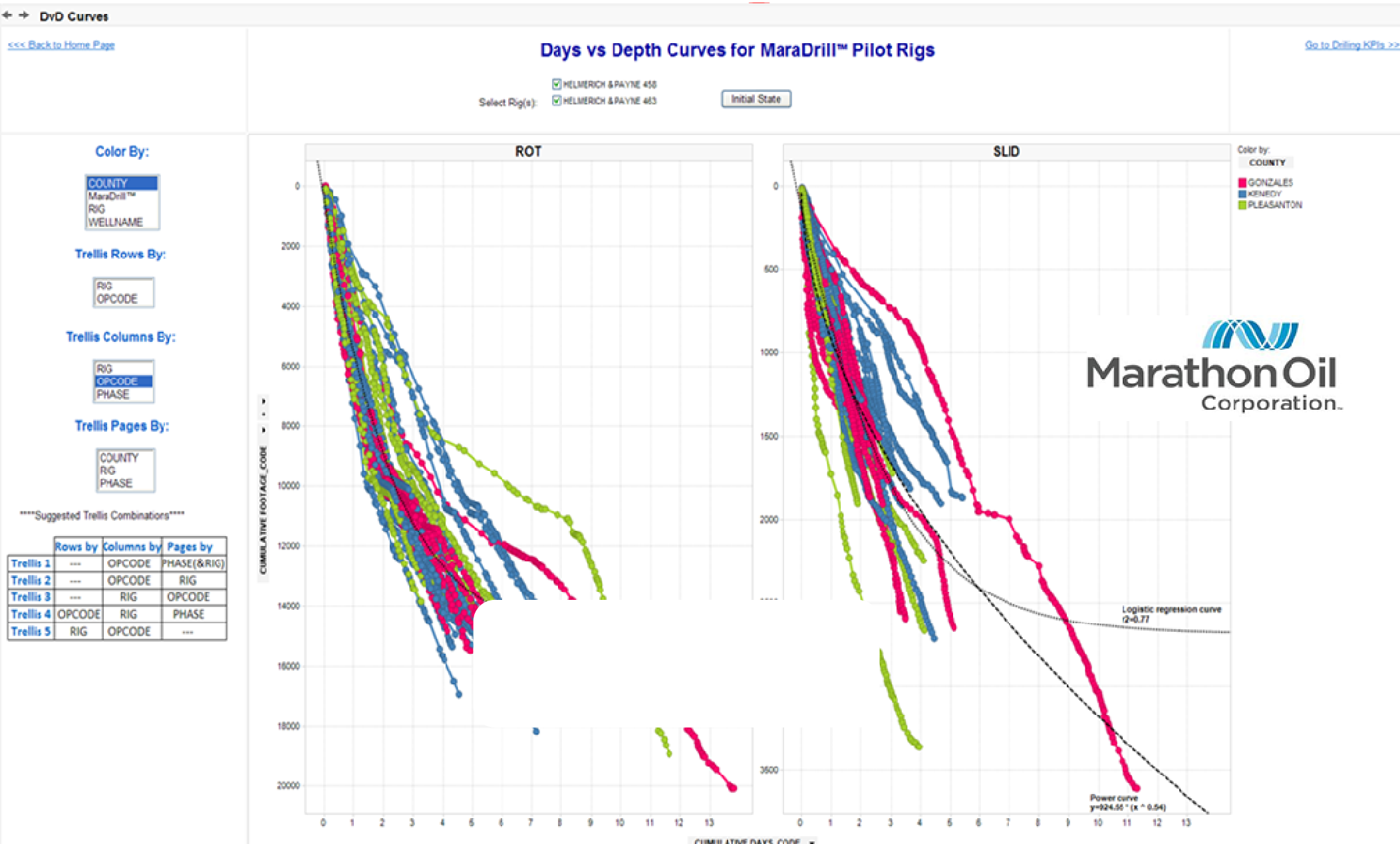
# Illustrative Case Study – Marathon Oil

Data Consistency and Context  
Organizational Alignment  
Applications/Solutions Simplicity  
Data Transformation Methodology

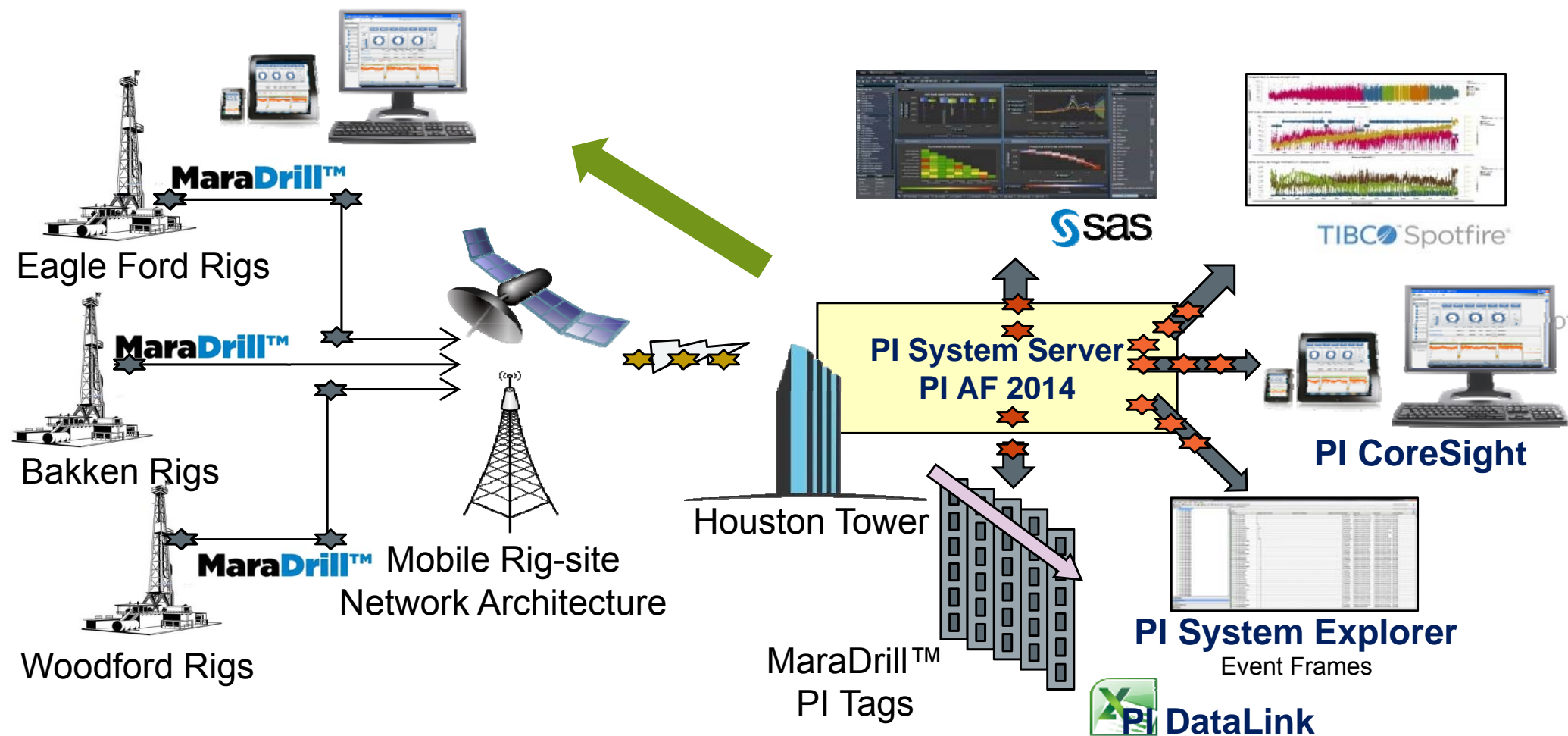
# Integration of 3<sup>rd</sup> Party Analytics and Visualization Capability – Infrastructure Enabled “Best of Breed”



# PI System/PI AF - The Foundation for Dashboards and Workflow Integration and Business to Operations Value



# Business to Operations Value – real-time Drill Site Guidance





# PI Coresight – Stick-Slip Identification- Eagle Ford Rig

## Eagle Ford Rig



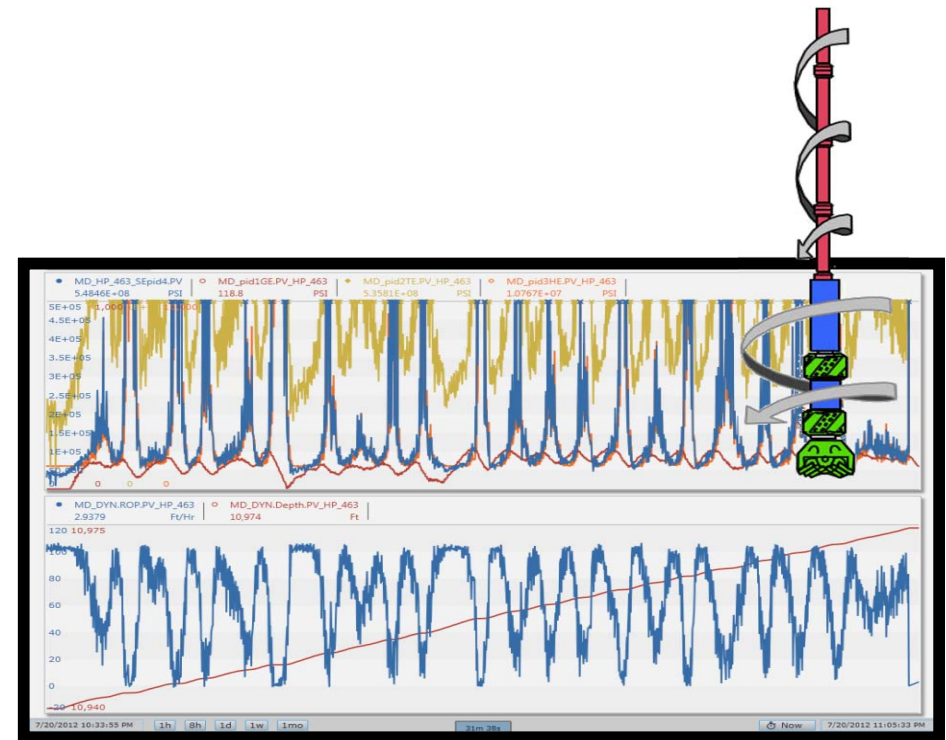
“Perfect” drilling

**Stick-slip:** Non-uniform rotation of the bit/BHA

Sticking phase → bit stops

Slipping phase → bit “breaks” free

Drillstring torsional oscillations



Stick-slip

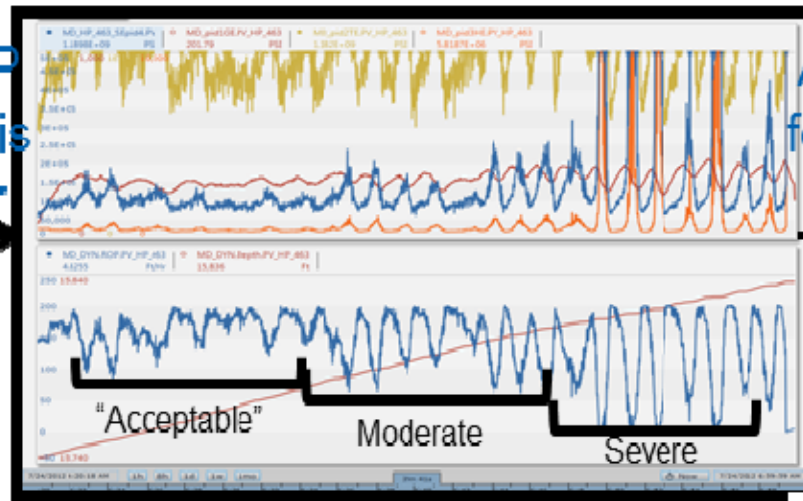
# Real-Time Optimization PI Coresight



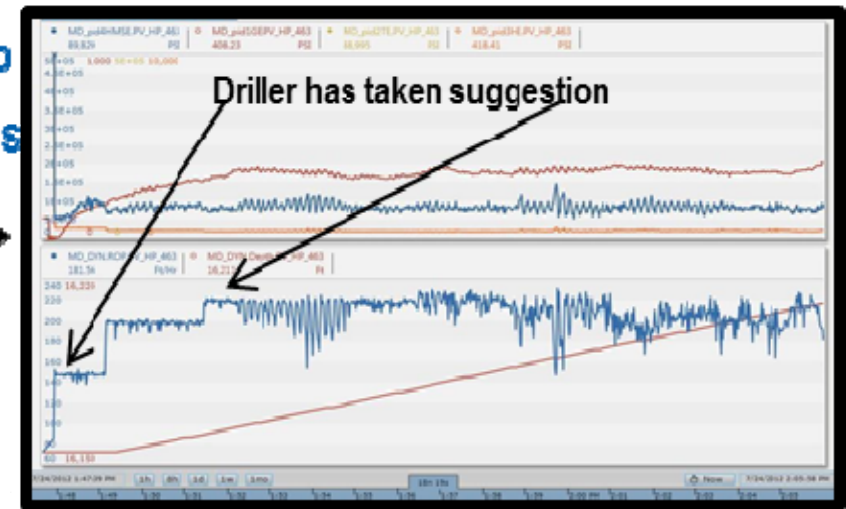
Stick-Slip Identification ...few stands later... Stick-Slip Mitigation

40% Sustained Increase in Rate of Penetration

Avg. ROP  
for stand is  
**144 ft/hr**



Avg. ROP  
for stand is  
**201 ft/hr**



# PI Coresight View with XML Data Export



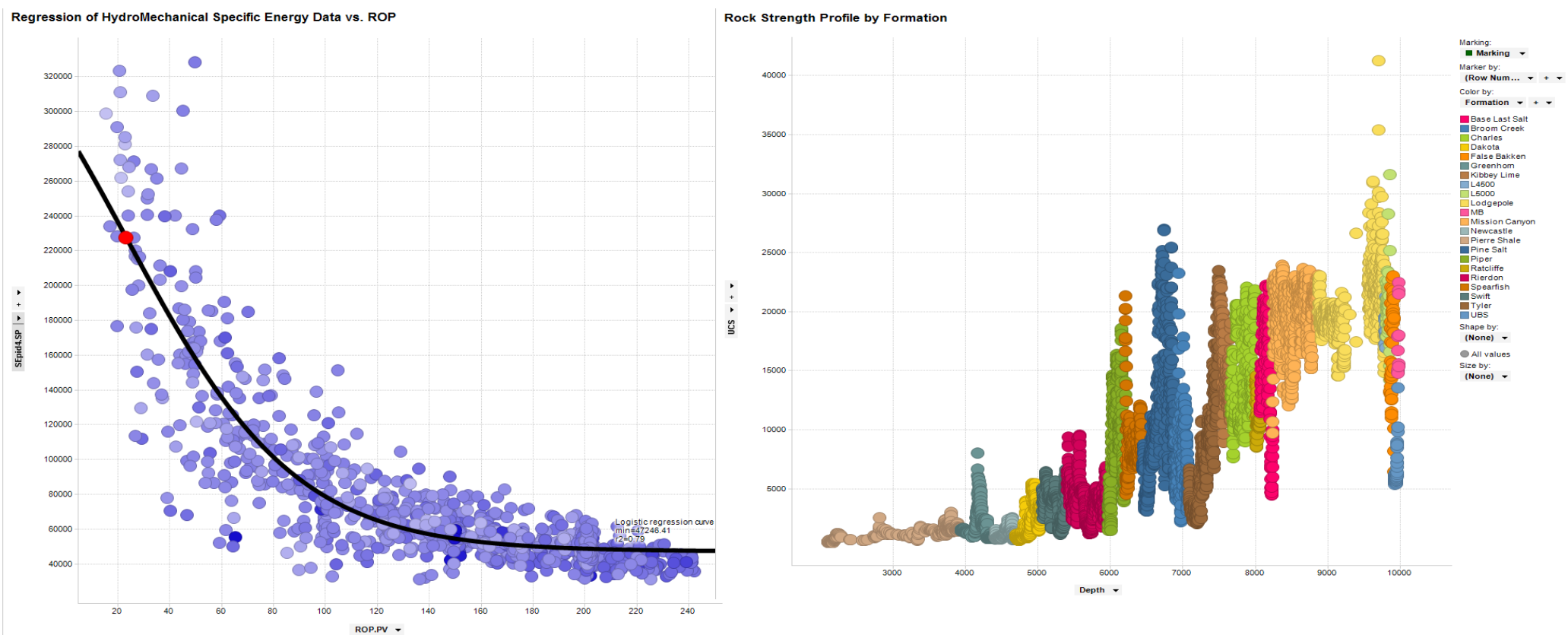
**Enables Integration with WellView data**

**Enables Integration with Spotfire visualization**



# Post-Well Science Using MaraDrill™ Data in SpotFire

Modeling the rock strength & predicting ROP's on subsequent wells in the area to improve logistics and planning

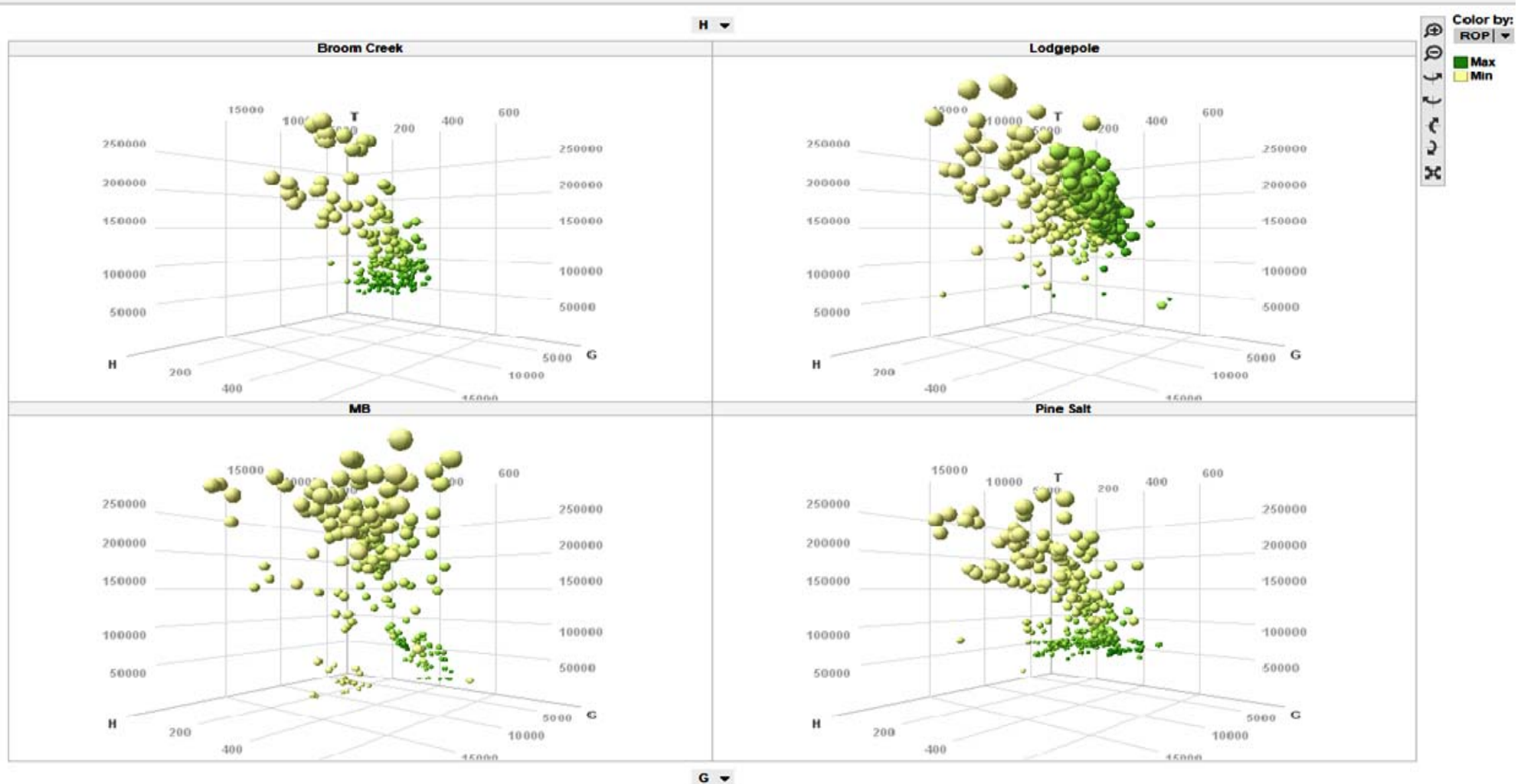


# Post-Well Science Using MaraDrill™ Data

## Formation Sweet-Spot Analysis

### 3D Scatter Plot: G vs T vs H

Sweet-Spot Analysis: Greener = Faster, Smaller = more efficient

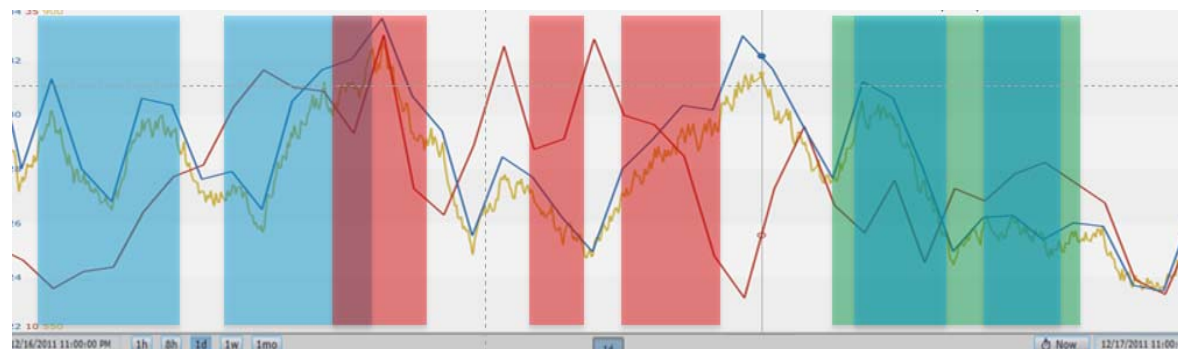


Name	Description	Default value
APP_Aggregate	Aggr Class	
APPS_MixerNumber	Mixer Number	
APPS_NutName	Nut Name	
CH_BlinkingEventTrigger		
CH_AntistickEventTrigger		
CH_StickingEventTrigger		
CH_ValveStuckEventTrigger		
CYLN_MaxDepth	Sit Depth	0 ft
CYLN_Depth	Depth	0 ft
CYLN_DiffPressure	Diff Pressure	0 psi
CYLN_SensorPosition	Diff Pressure	0 ft
CYLN_WeightLoad	Hook Load	0 lbs
CYLN_KOP	KOP	0 ft/s
CYLN_RPM	RPM	0 rpm
CYLN_StandPipePhase	Stand Pipe Pres.	0 psi
CYLN_TORQUE	Torque	0 ft/lbs
CYLN_VOB	VOB	0 m
HCD_Accel	Acceler Velocity	0 ft/s
HCD_HPRF	BH Hydraulic Off	0 hp
HCD_HSI	HSE	0 hph/G

The diagram illustrates the process of hydraulic fracturing. A well is drilled into the ground, passing through a water table and into a reservoir. Water and chemicals are injected into the well, creating fractures in the reservoir rock. The fractures are labeled "Hydraulic Fracturing". The well is labeled "Well" and the fractures are labeled "Fractures".

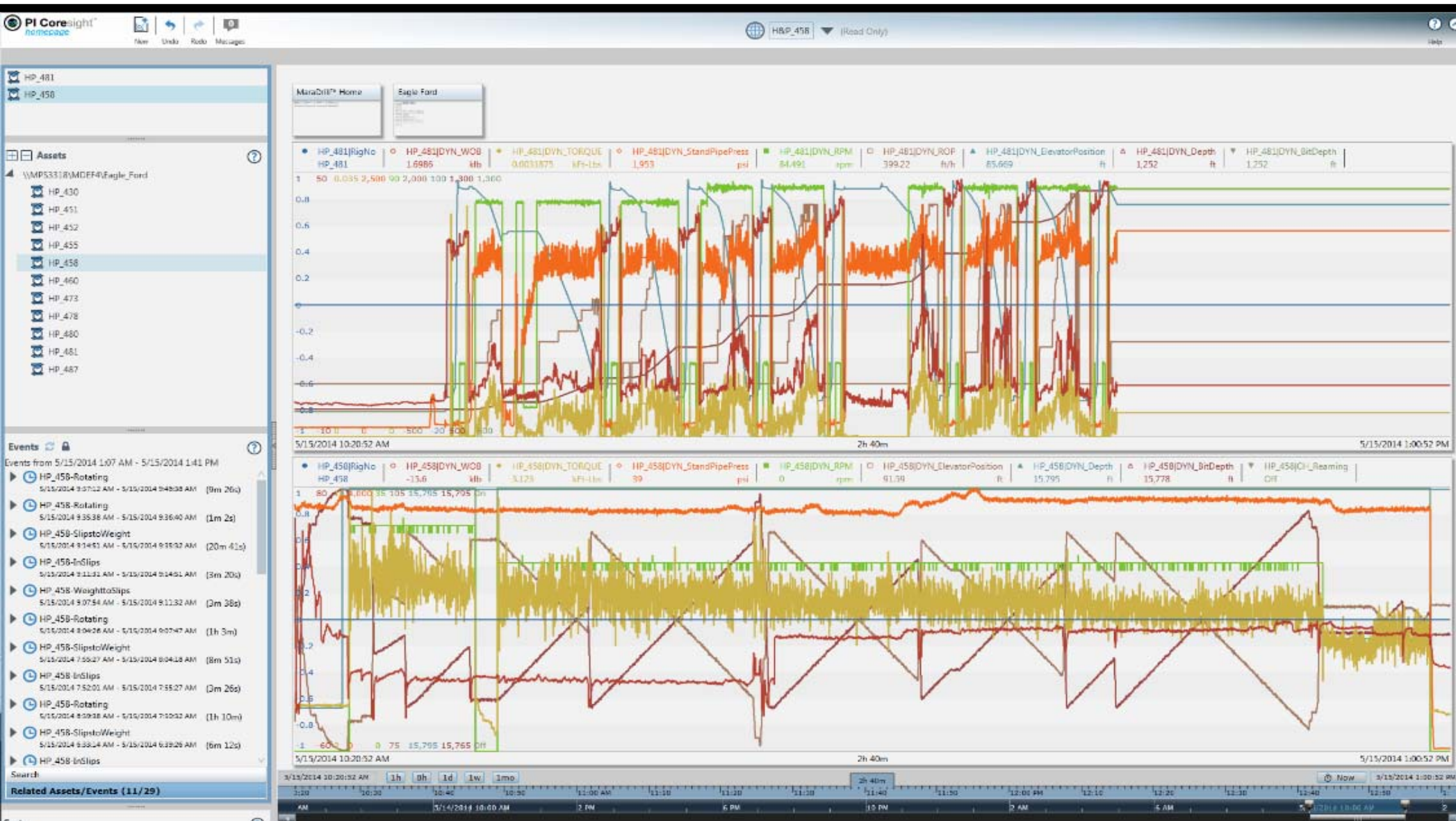
	Well 1	24:11:41:12	4/1/2014 2:00:00 AM	4/25/2014 1:41:12 PM
	Sliding	0:19:00	4/1/2014 2:40:00 PM	4/1/2014 2:59:00 PM
	Rotary ...	4:40:38	4/1/2014 3:33:45 PM	4/1/2014 8:14:23 PM
	Sliding	0:28:30	4/1/2014 5:23:04 PM	4/1/2014 5:51:34 PM
	Stick-Slip	0:03:30	4/2/2014 5:59:00 AM	4/2/2014 6:02:30 AM
	Sliding	0:20:33	4/3/2014 3:42:00 AM	4/3/2014 4:02:33 AM
	Rotary ...	8:10:26	4/4/2014 1:33:23 AM	4/4/2014 4:43:49 AM
	Stick-Slip	0:00:51	4/5/2014 3:33:45 PM	4/5/2014 3:34:36 PM
	Sliding	0:22:01	4/12/2014 10:41:10 AM	4/12/2014 11:03:11 AM
	Sliding	0:19:00	4/14/2014 8:41:05 AM	4/14/2014 8:59:34 AM

	Well 2		24:00:33	4/27/2014 1:42:00 PM	5/21/2014 1:42:33 PM	
	Sliding		0:18:50	4/28/2014 2:40:10 PM	4/28/2014 2:59:00 PM	
	Rotary ...		7:40:38	4/29/2014 3:33:45 PM	4/29/2014 11:14:23 PM	
	Sliding		1:11:30	5/1/2014 3:23:04 PM	5/1/2014 4:34:34 PM	
	Stick-Slip		1:23:35	5/2/2014 5:39:00 AM	5/2/2014 7:02:35 AM	
	Sliding		0:23:00	5/3/2014 5:32:30 AM	5/3/2014 5:55:30 AM	
	Rotary ...		8:49:59	5/4/2014 1:33:23 AM	5/4/2014 10:23:22 AM	
	Stick-Slip		0:11:29	5/5/2014 4:43:45 PM	5/5/2014 4:55:14 PM	
	Sliding		10:41:00	5/6/2014 10:41:10 AM	5/6/2014 9:22:10 PM	
	Sliding		0:35:04	5/7/2014 8:40:20 AM	5/7/2014 9:15:24 AM	

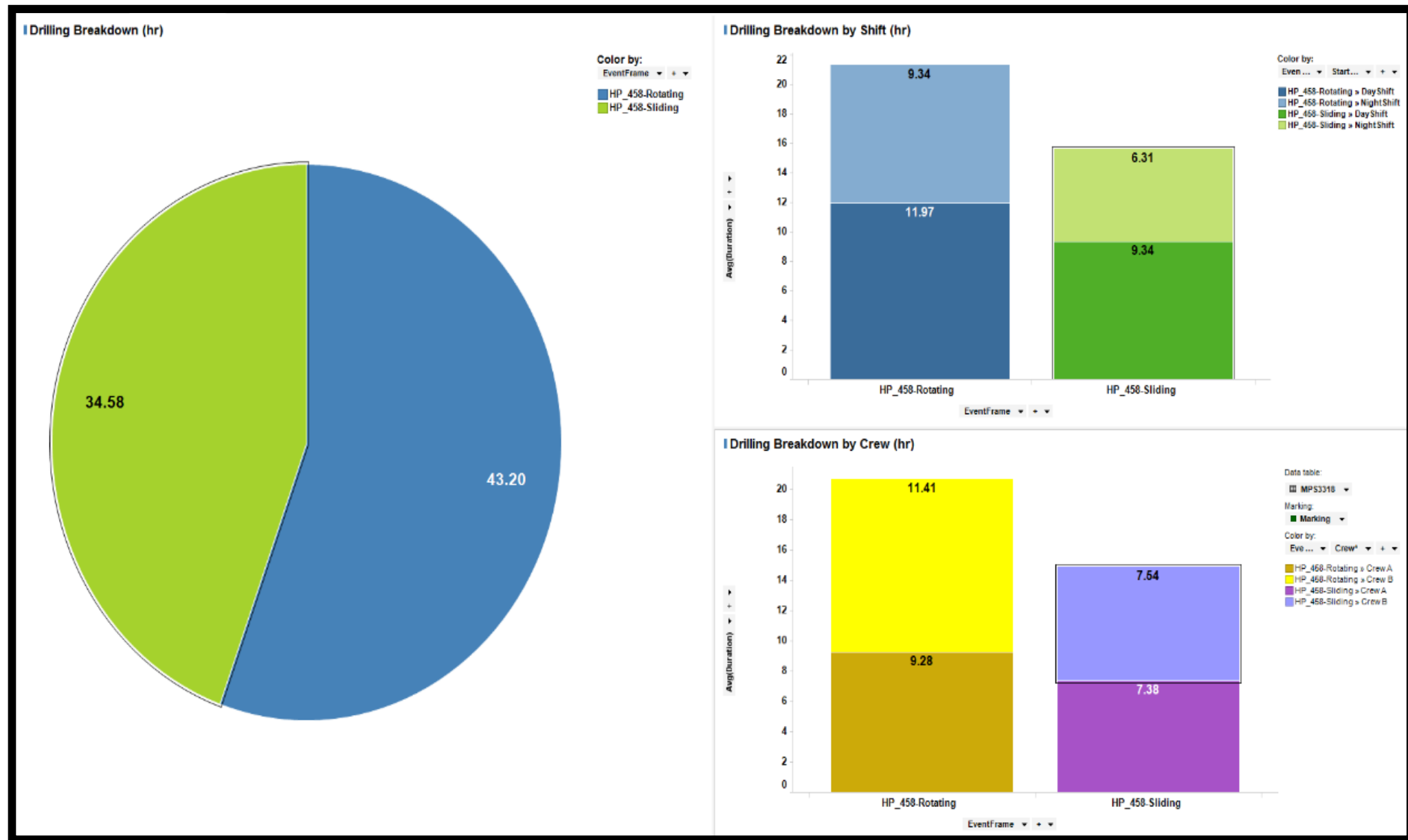




# Self Serve Analytics & Visualization, Mobility.....Consistency, Alignment, Simplicity, and in Context – Drilling Events



# Microsoft Power BI for Advanced Analytics





# Illustrative Case Study – Talisman Energy

Data Consistency and Context  
Organizational Alignment  
Applications/Solutions Simplicity  
Data Transformation Methodology

# Moving Applications to & Integrating Solutions with the Data Infrastructure – Simplification & Standardization



# Decomposition of Typical “CBM Solution”

(note: concept can be applied to a majority of solutions)

## Asset Management CBM “Solution”

### Gather Asset Information

Temperature  
Flow  
Pressure  
Vibration  
# of start/stops, etc.

**PI Archive**

### Transform into “Condition” Information

Efficiency (%)  
Design vs Actual  
Rate of Change  
Cycles per period

**PI PE, PI AF,**

### Perform Analysis Rules - CBM

Time in Service  
Total Volume  
Performance DvA  
Max T or Vib

**PI AF, PI ACE**

### Perform analytics, visualization, propagation:

KPIs  
Visuals  
Reports  
Applications

**PI AF, PI Notifications**

### Integrate into work flow Systems

(ie Maximo, SAP, Meridian)

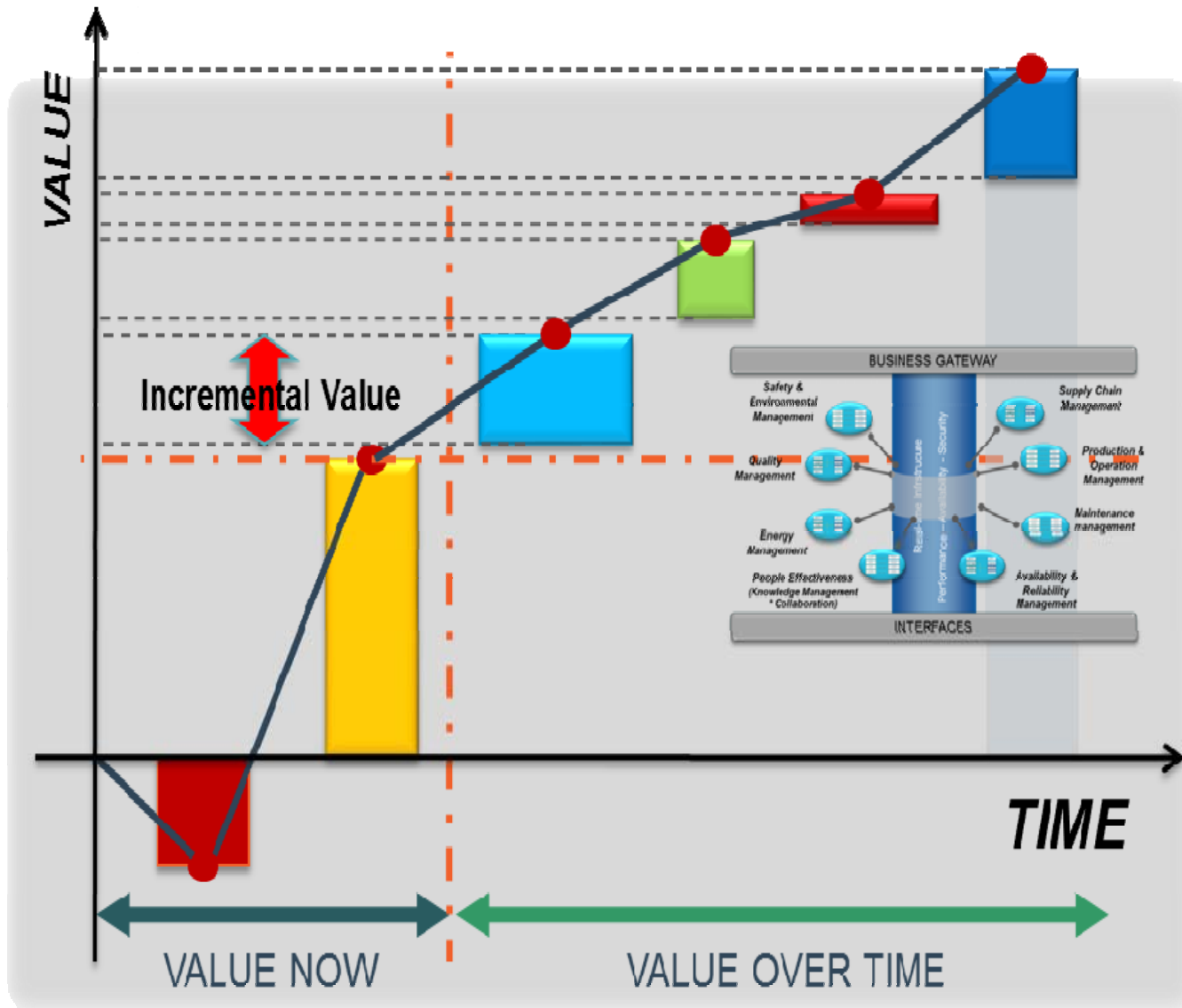
**PI System Access**

Functionality Configured in the PI System Infrastructure





# An Infrastructure Approach



- ← Performance Management
- ← Environmental Reporting
- ← Equipment Health Mgmt.
- ← Operations Management

← Initial Infrastructure Value

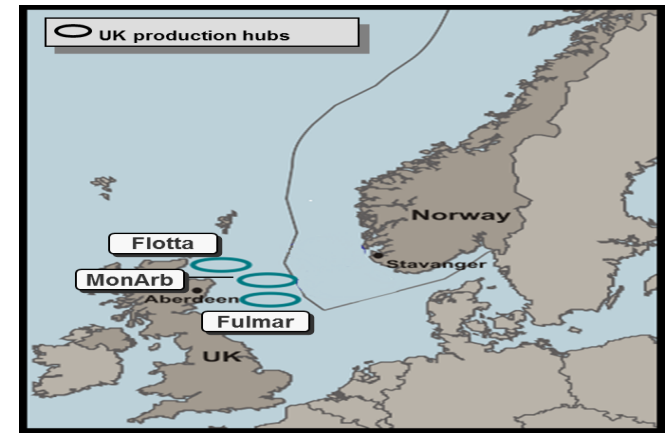
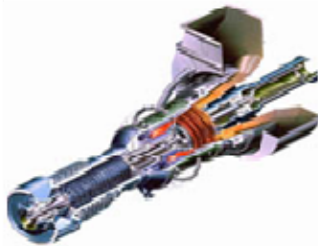
← Infrastructure Initial Investment

# Business Challenge

## Offshore – 8 Production Platforms

### Safety Critical Equipment

- 39 Diesel Drive Fire Pumps
- 6 Electric Drive Fire Pumps
- 8 Hydraulic drive fire pumps
- 15 Emergency Power Generation Packages
- 26 Bilge / Ballast Pumps
- 53 Other Safety Critical Pumps



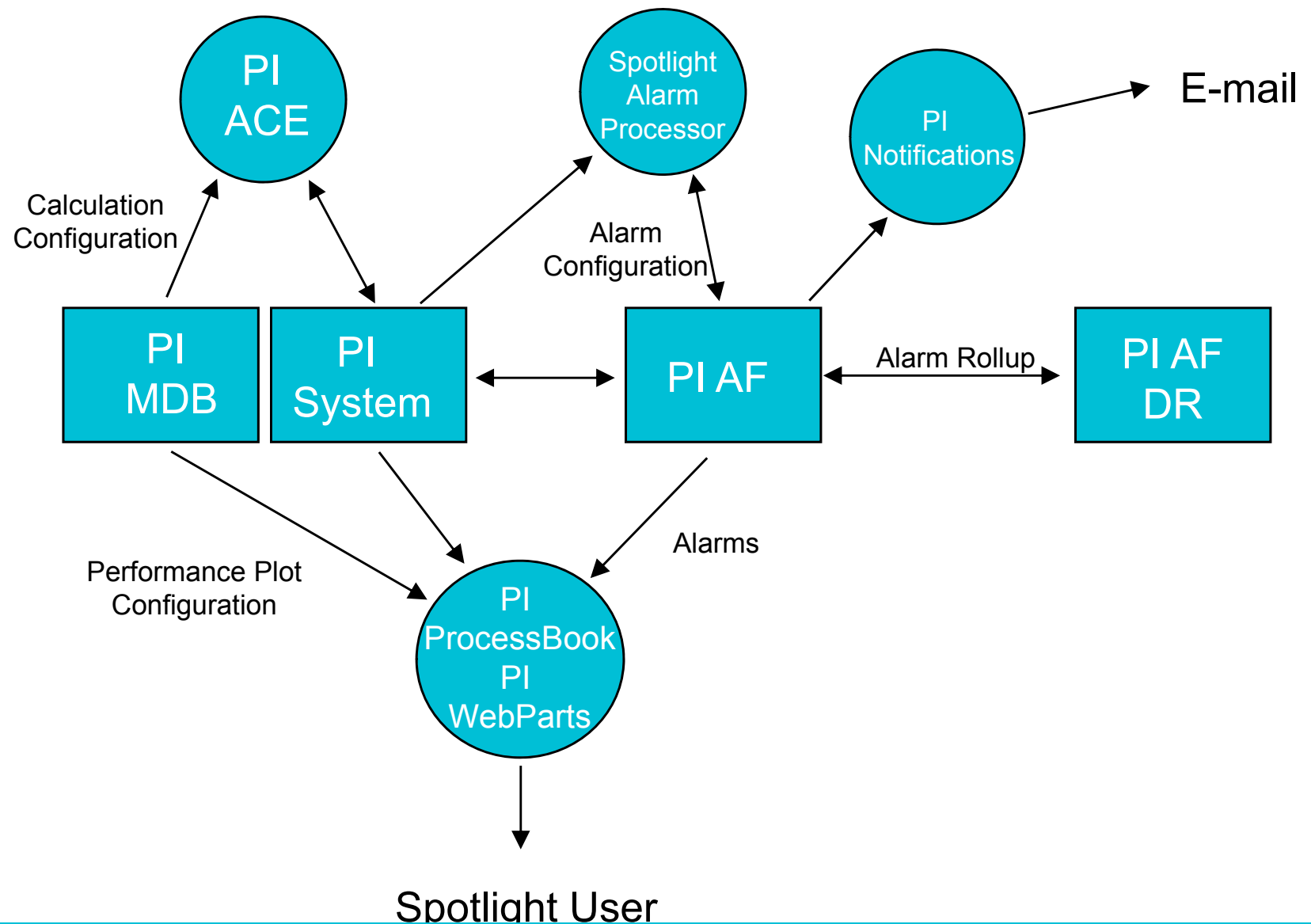
### Production Critical Equipment

- 56 Gas Turbines
- 40 Gas Compressors
- 9 Diesel Engines for Main Power Generation
- 27 Main Water Injection, P.W. & Artificial Lift Pumps
- 35 Main Oil Line Pumps
- Circa 2711 Operational Pumps



A total of **2831** pieces of Major Rotating Equipment

# Spotlight Architecture



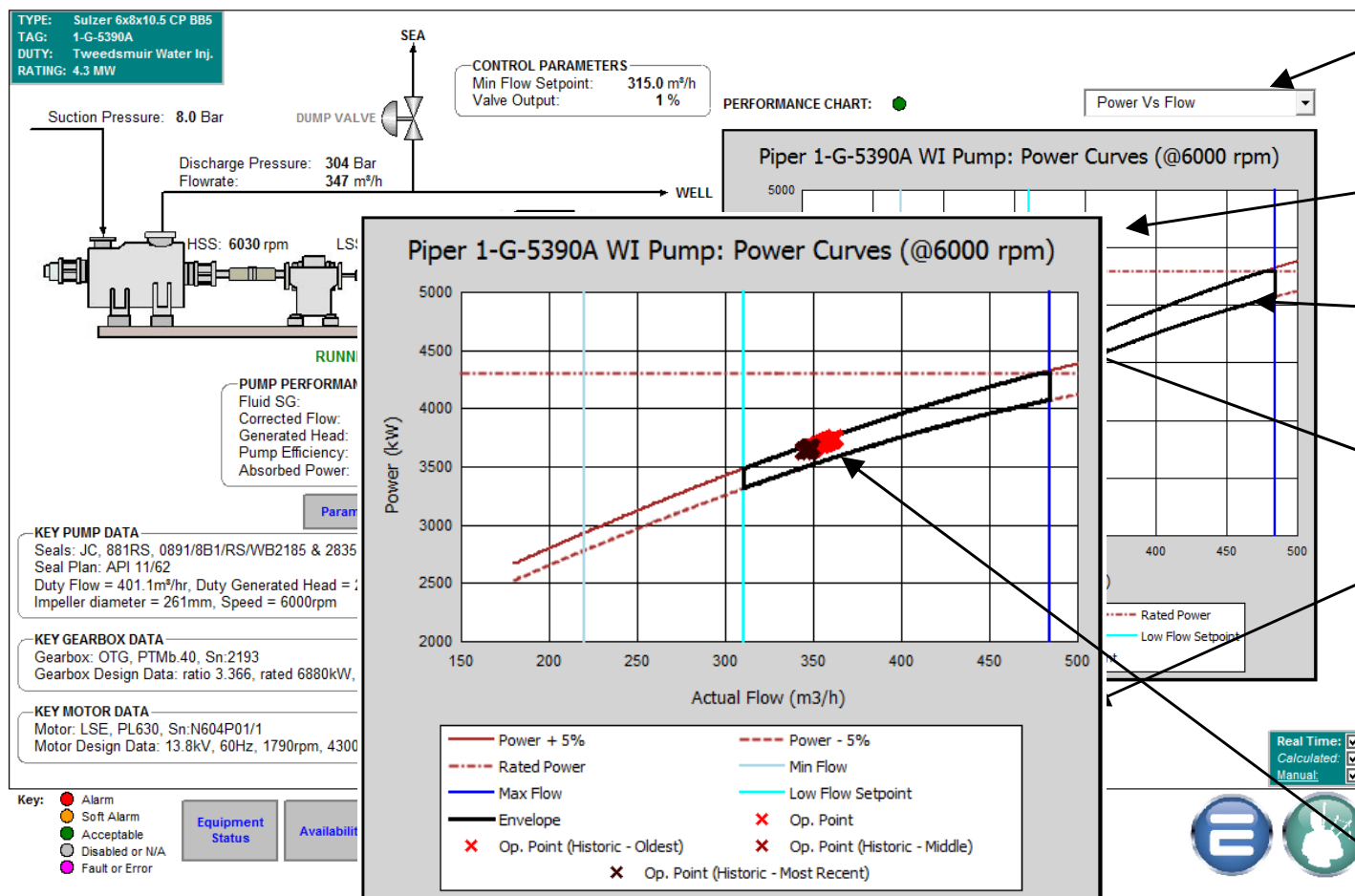
Spotlight User



# Spotlight Display - Performance

## Spotlight on Piper B: 1-G-5390A Performance Detail

TALISMAN  
ENERGY



User can select different charts associated with this item

Chart showing performance constraints

Operating Envelope

Current operating point

View operating point history over varying time periods

Operating point "cloud" shows history



# KPIs with High Fidelity “Live” Drill Down



TALISMAN  
ENERGY

## Spotlight on Rotating Equipment: Piper Overview

Overview	Auk	Bleo Holm	Buchan	Claymore	Clyce	Flotta	Fulmar	MonArb	Piper	Salire	Tartan				
Gas Compression							Main Oil Line								
	Run	Avail.	Perf.	CM	Lube	Seal	Maint		Run	Avail.	Perf.	CM	Lube	Seal	Maint
K-3110A								1-G-2600A							
K-3110B								1-G-2600C							
K-3110C								1-G-2310A							
K-3210A								1-G-2310B							
K-3210B								Water Injection							
K-3210C									Run	Avail.	Perf.	CM	Lube	Seal	Maint
K-3310A								1-G-5390A							
K-3310B								1-G-5370A							
Power Generation							1-G-5370B								
	Run	Avail.	Perf.	CM	Lube	Temp	Maint	1-G-5370C							
P-8000A															
P-8000B															
P-8000C															
P-8000D															

Traffic light shows  
rolled up alarm  
status for each  
sub-display

Links to detailed  
displays for each  
item of equipment

Links to other  
asset overviews

# Consistency in KPIs, Alarms, & Transformations



Database Query Date Back Check In Refresh

**Elements**

Elements  
Buchan  
Compressors  
C-2030-1

General Child Elements Attributes Ports Version

Filter

Name	Value
Alarm Input	0
Current Alarm State	Process Inhibit
Current Alarm State Value	3
Current Priority	Process Inhibit
Current Priority Value	3
H Alarm	True
Limit Priority	Warning
Limit Value	0.3
HH Alarm	True
Limit Priority	Alarm
Limit Value	0.4
Inhibit	False
L Alarm	False
Limit Priority	Warning
Limit Value	0
LL Alarm	False
Limit Priority	Alarm
Limit Value	0
Process Inhibit	True
User Inhibit	False

Na Inhibit  
De Monitored E  
Co Process Inp  
Ca Running Ec  
De User Inhibit  
Va  
Va  
Da

Asset/Equipment Tree Structure

Individual Equipment (run indicators, etc.)

Displays (alarm rollup for summary)

Individual Alarms (allows more than one alarm type per measurement)

Alarm limits configuration

Process inhibit (run state)  
User inhibit (cascaded down)

# Agenda

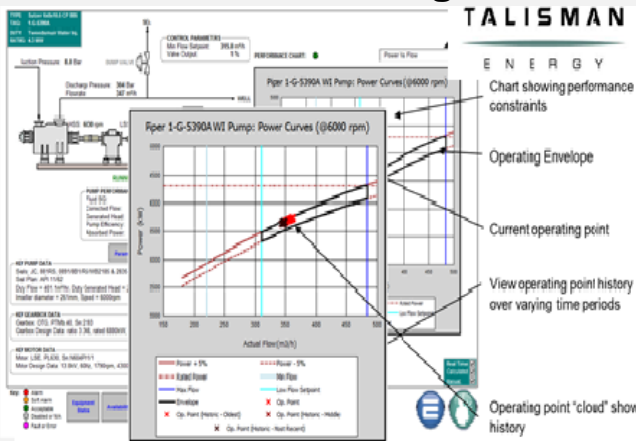


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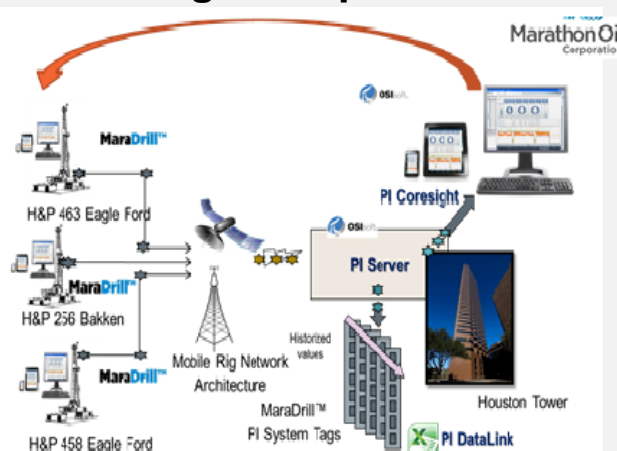


# Enabling Op Ex in All Areas of E&P/Logistics

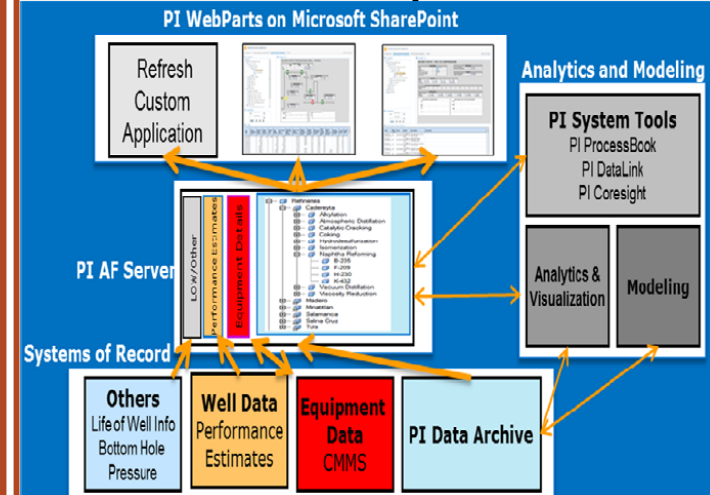
## Asset Performance, Reliability, & Portfolio Management



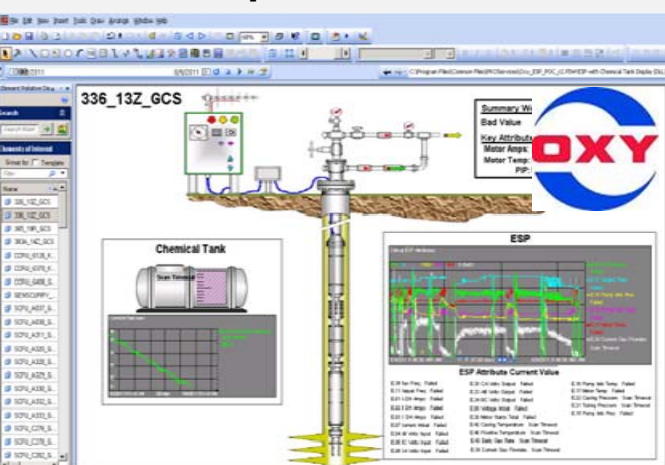
## Drilling and Completion Oversight & Optimization



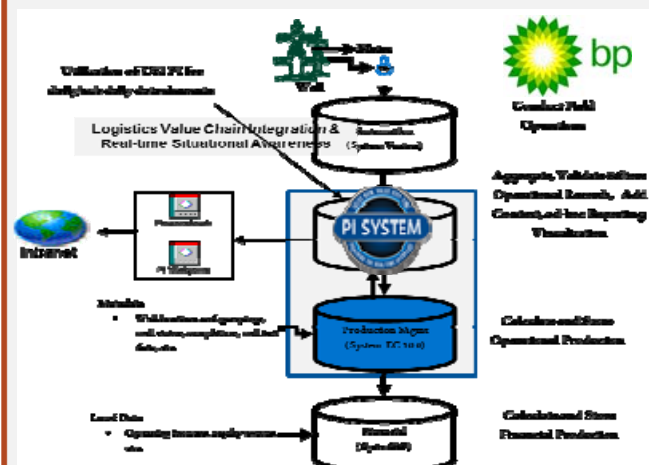
## Production Operational Excellence & Optimization



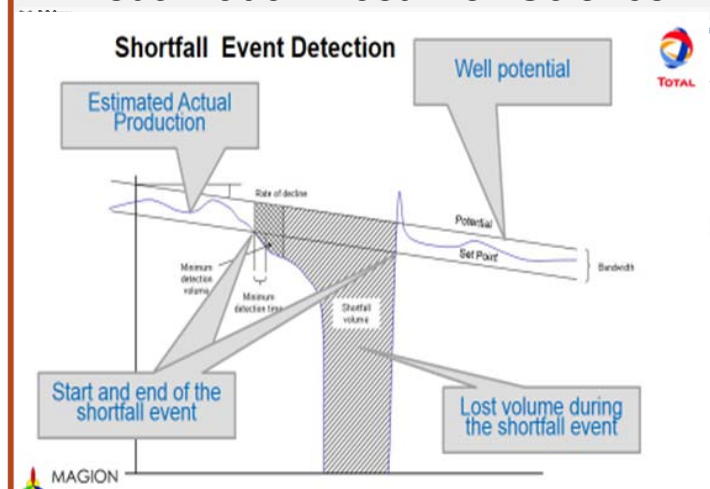
## Artificial Lift Reliability and Optimization



## Augmentation of "Best of Breed" Solutions



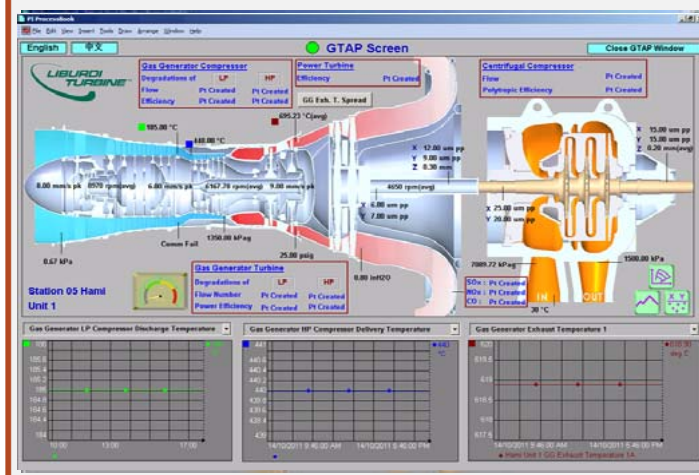
## Integration with E&P Analytics & Visualization/Post Well Science



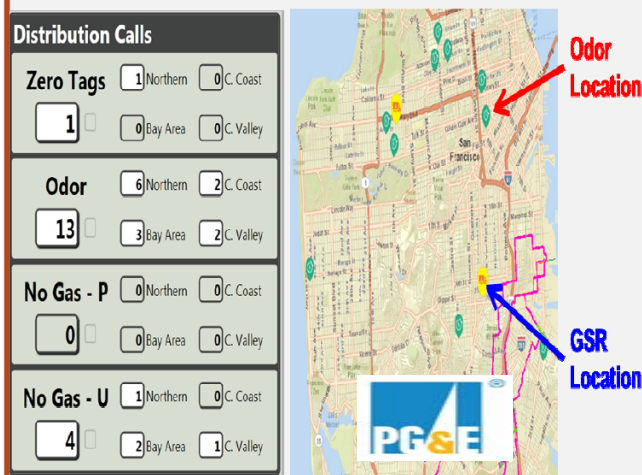


# Enabling Op Ex in All Areas in O&G Logistics

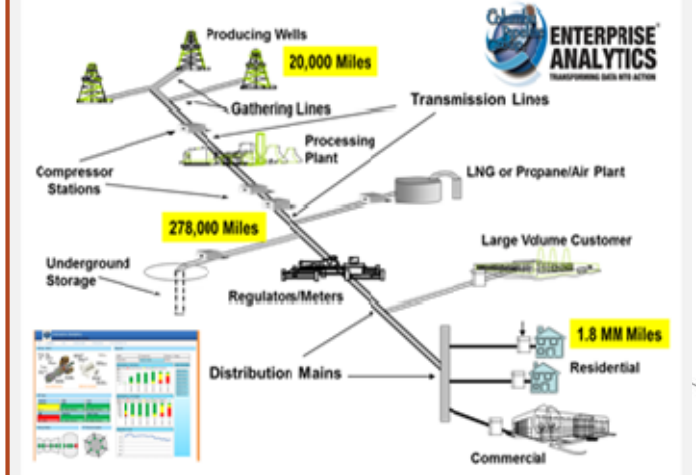
## Asset Performance, Reliability, & Portfolio Management



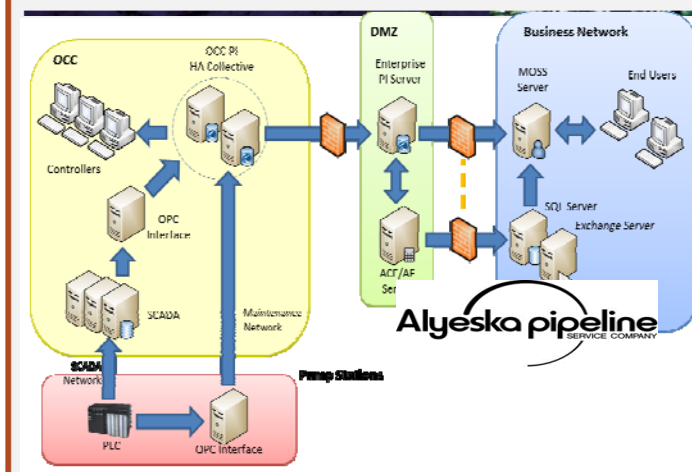
## Geospatial Integration "Real-Time & Space"



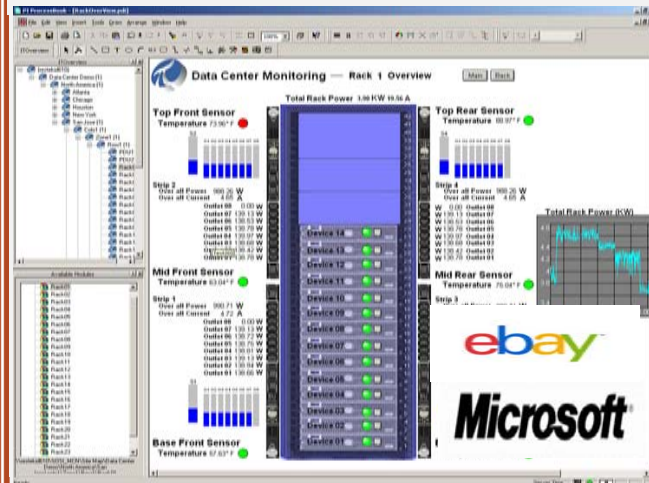
## Gas Value Chain Integration & RT Situational Awareness



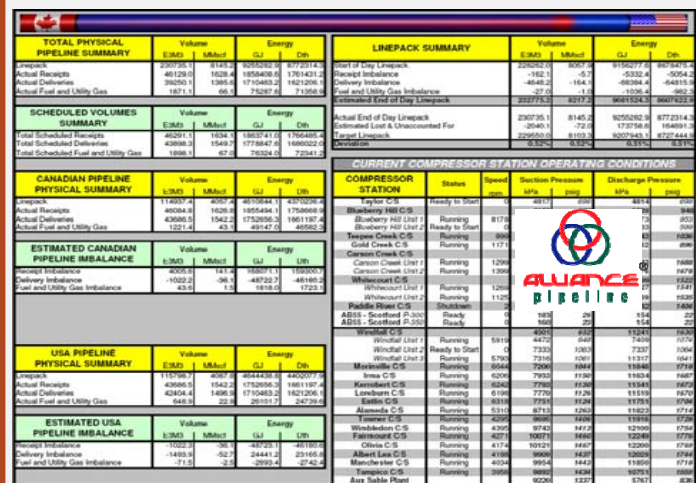
## SCADA/DCS Augmentation



## IT/SCADA Infrastructure Energy & Reliability Mgmt

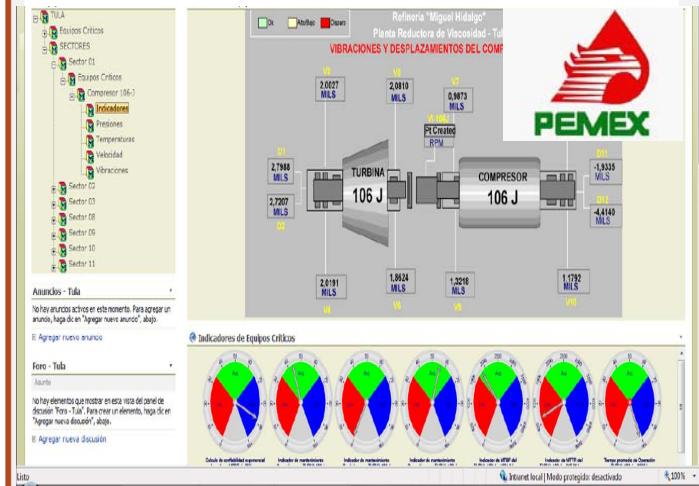


## Compliance Reporting, Environmental & Energy Mgmt.

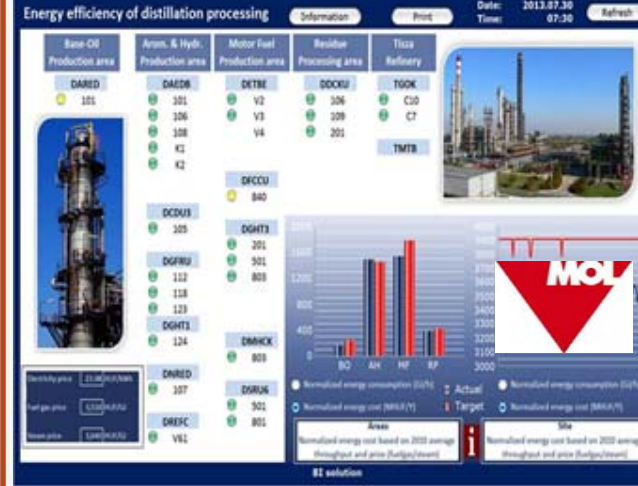


# Enabling Operational Excellence in Hydrocarbon Processing

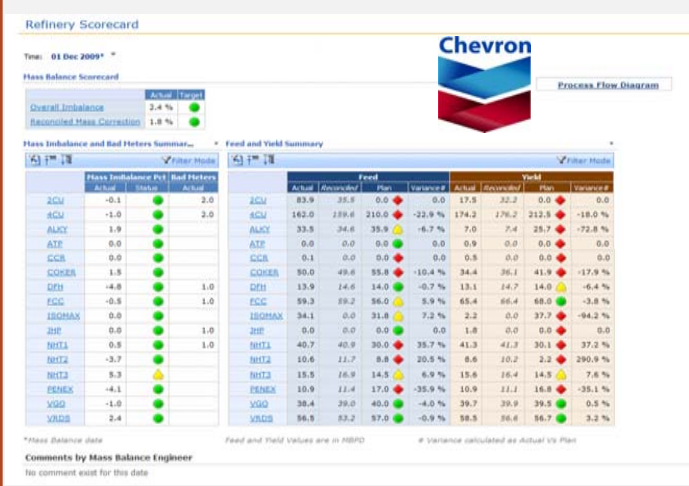
## Asset Performance, Reliability, & Portfolio Management - CBM



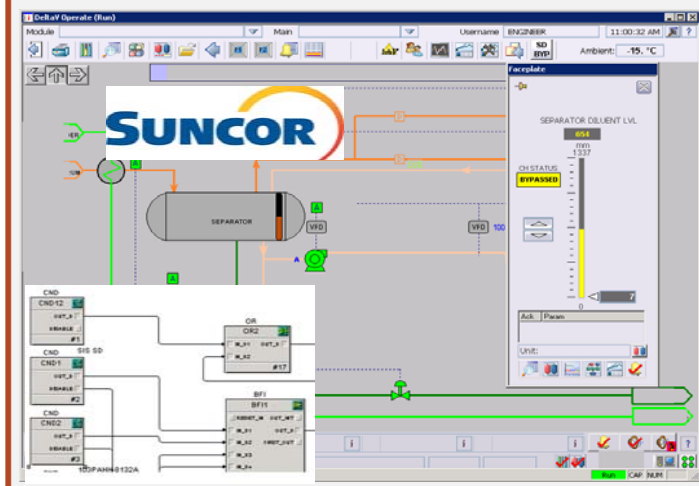
## Environmental, Energy & Utilities Management



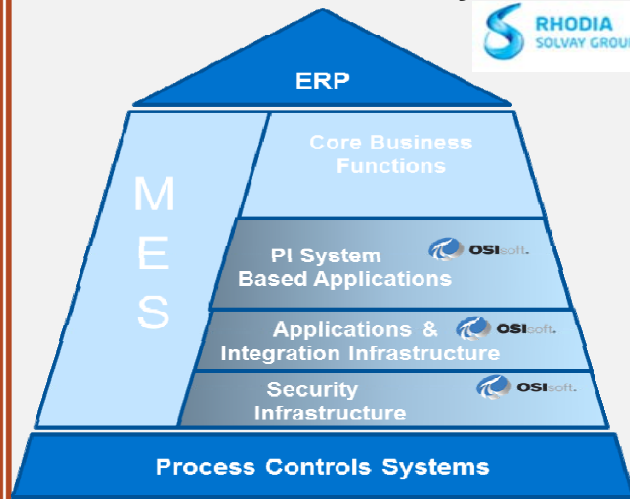
## Ops Visibility, Reporting & Analytics, YA, "live" KPIs, & Model Based PvA



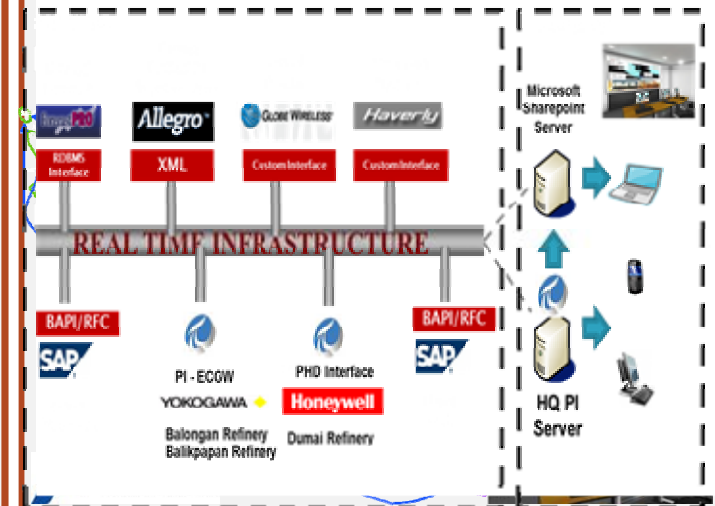
## Safety & Reactive/Proactive Integrity Management



## Infrastructure for MES MES AND The PI System



## Value Chain Integration & Real-time Situational Awareness



# Agenda



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# Key Takeaways....



- The key to Business to Operations Value is data :
  - Consistency
  - Alignment
  - Simplicity
  - Transformation in the infrastructure vs applications, solutions, and business systems where possible
- Infrastructure vs Custom applications & Solution approach
- PI AF can be and is a strategic enabler
- The PI System Future Proofs the data infrastructure

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# THANK YOU

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