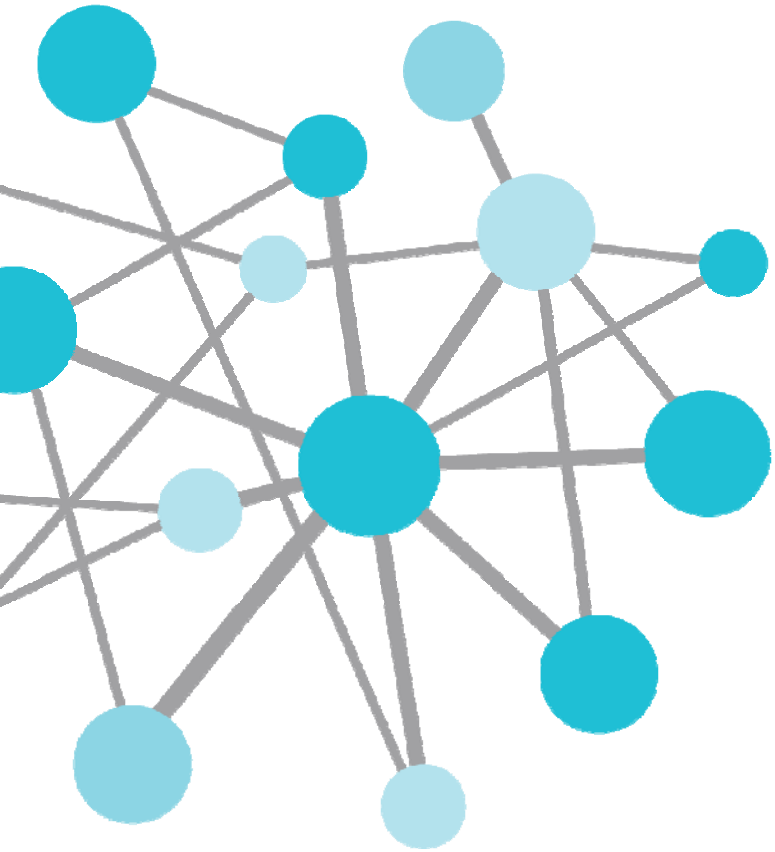


# The PI System

## 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

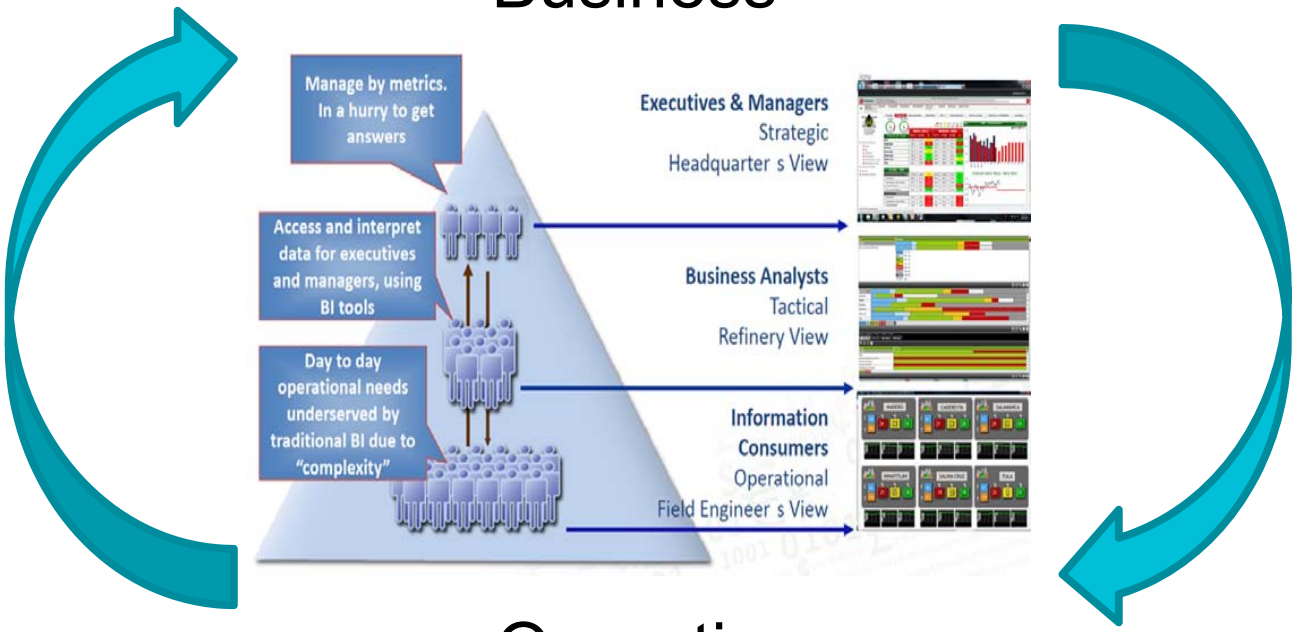
- Business to Operations Data Value Requisites:
  - Data Consistency and Context
  - Organizational Alignment
  - Applications/Solutions Simplicity
  - Data Transformation Methodology
- "Future Proofing" of the Data Infrastructure
- Resulting Value in O&G
- Closing Comments

# The Need for a Data Information Infrastructure

**Consistency**

**Alignment**

Business




Operations

**Transformations**

**Simplicity**



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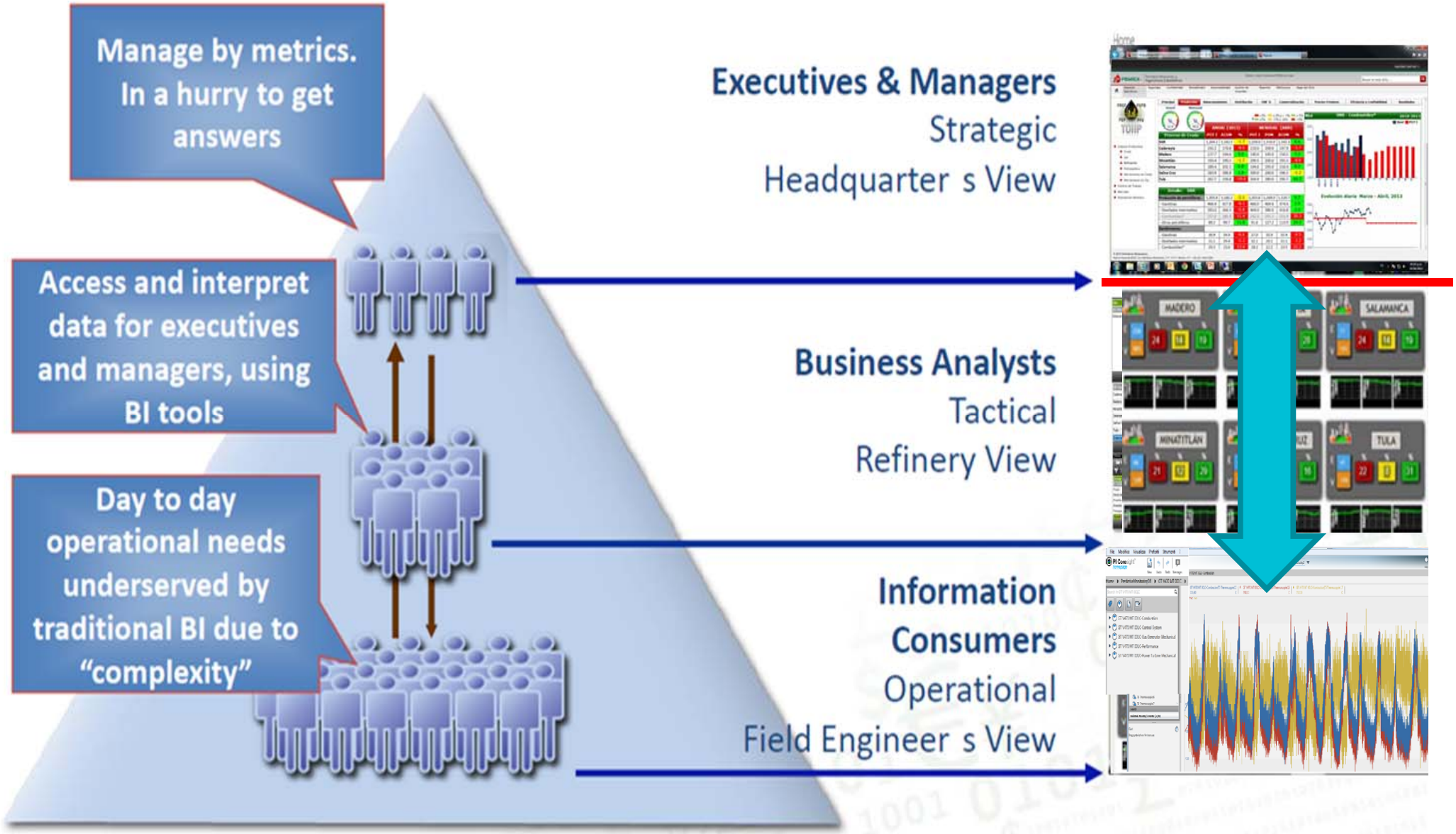
# Data and Information in Context with Integrated High Fidelity Drill Down – “Don’t Let Sexy override Functionality”



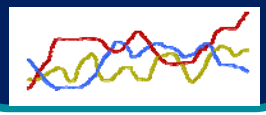
# Enterprise Consistency, Alignment, Simplification & Data Transformation

PI System Based Applications & Integration of "Best of Breed Models & Solutions"

Business & "Big Data" Systems, & Cloud

PI System Based Analytics, Visualization & Integration of "Best of Breed" Alternatives

Streaming Data and Events

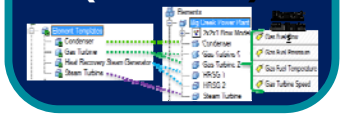


PI System Used as a Data Store

PI System Used as a Data Store

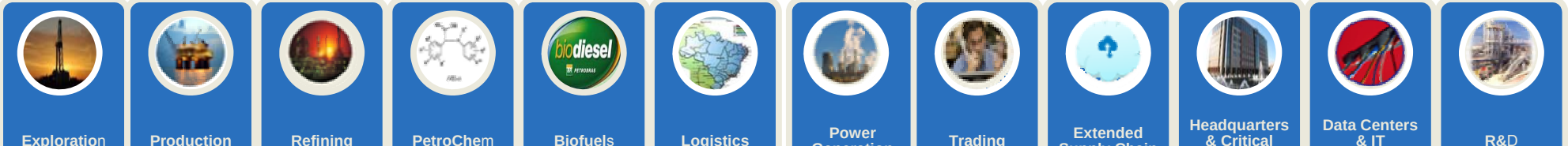
PI SYSTEM

Asset Structure (Context)



Across Value Chain & Extended Value Chain

Across the Infrastructure




DCS

SCADA

Other Control

Other Data

# Illustrative Case Study – Chevron GOM

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

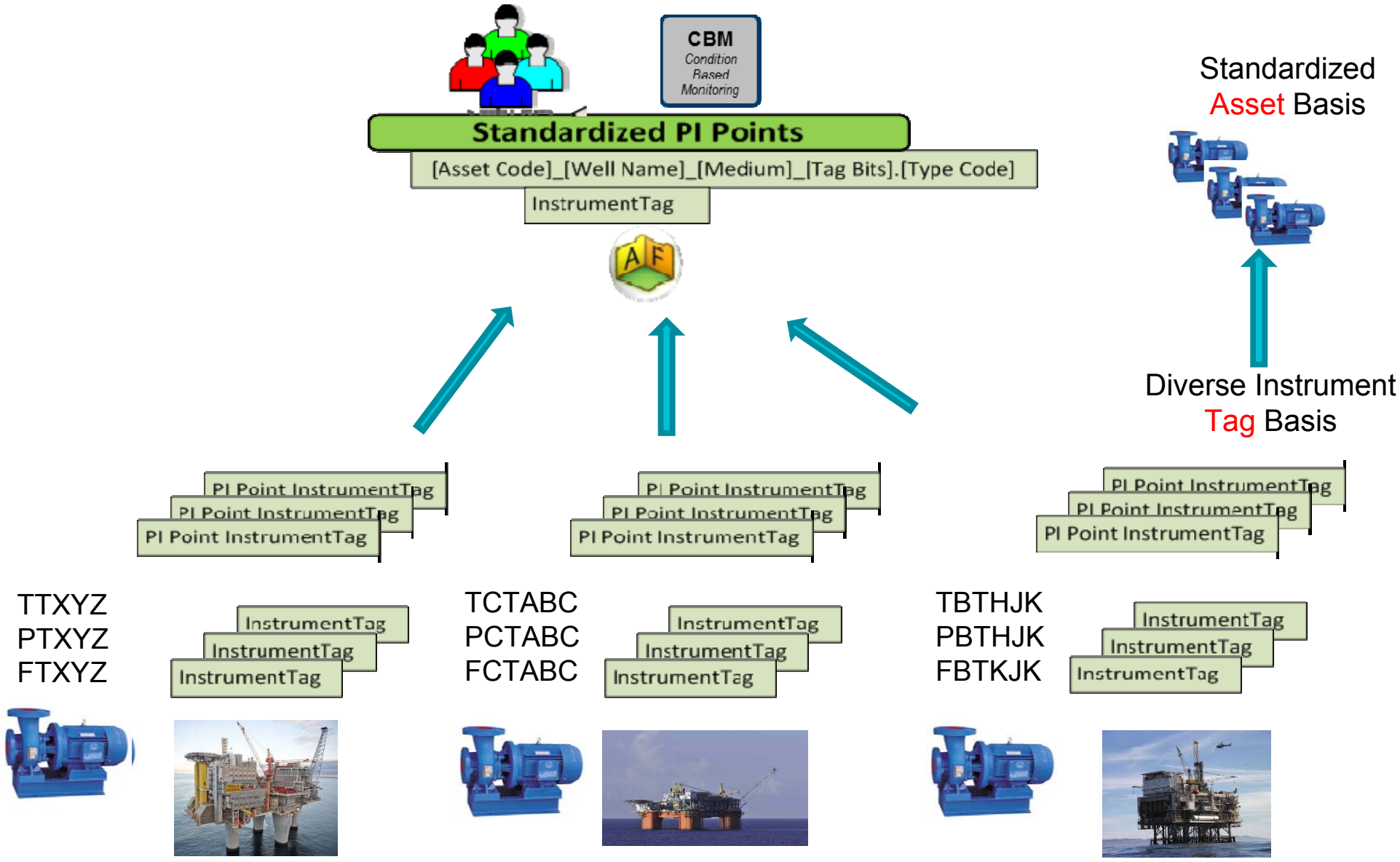
# Gulf of Mexico Business Unit (GOM) Who we are…


- **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

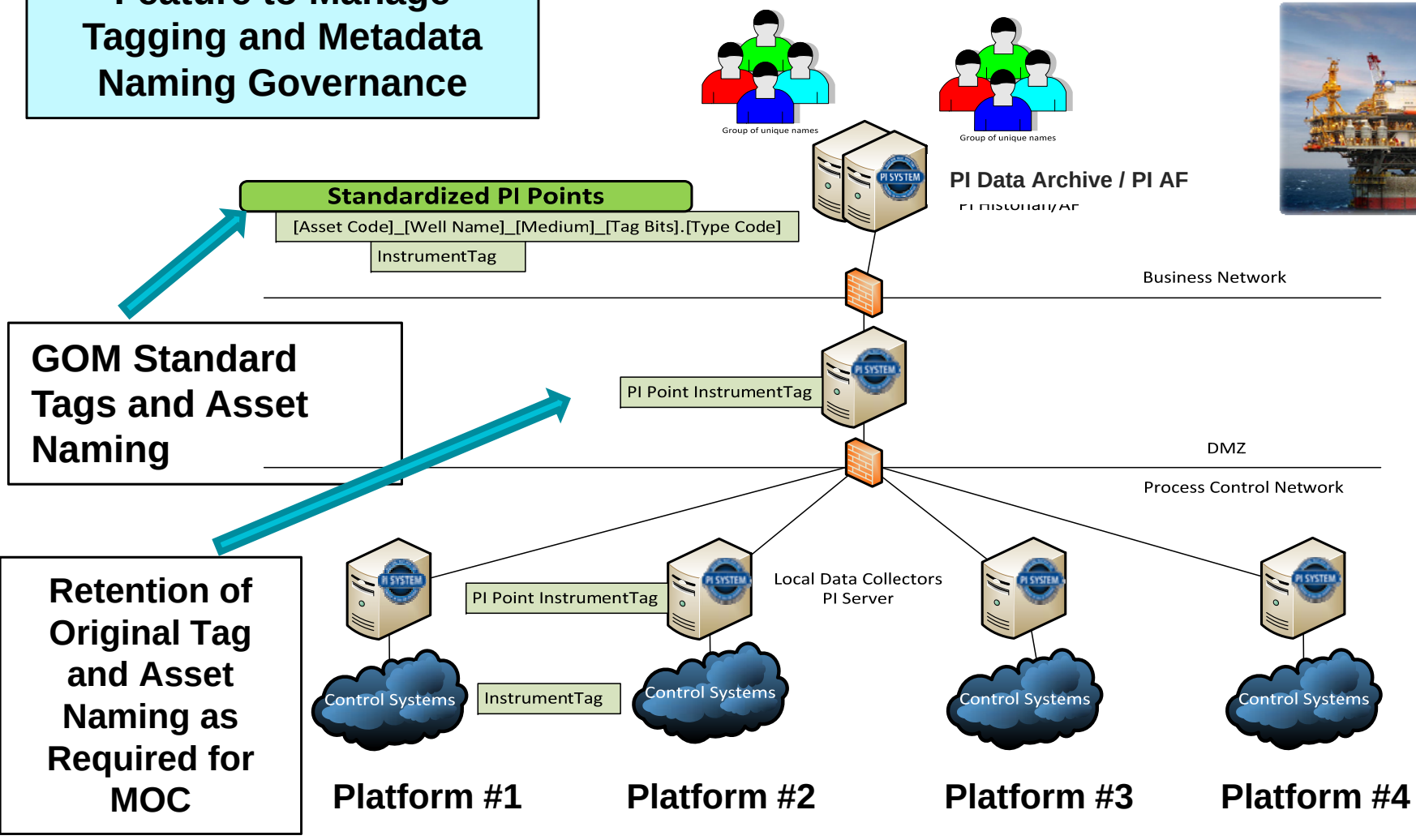
# Abstracting the Tag/Naming with PI AF

## Diversity in Tag Names to Standardized Asset Naming



# Chevron GOM PI System Infrastructure

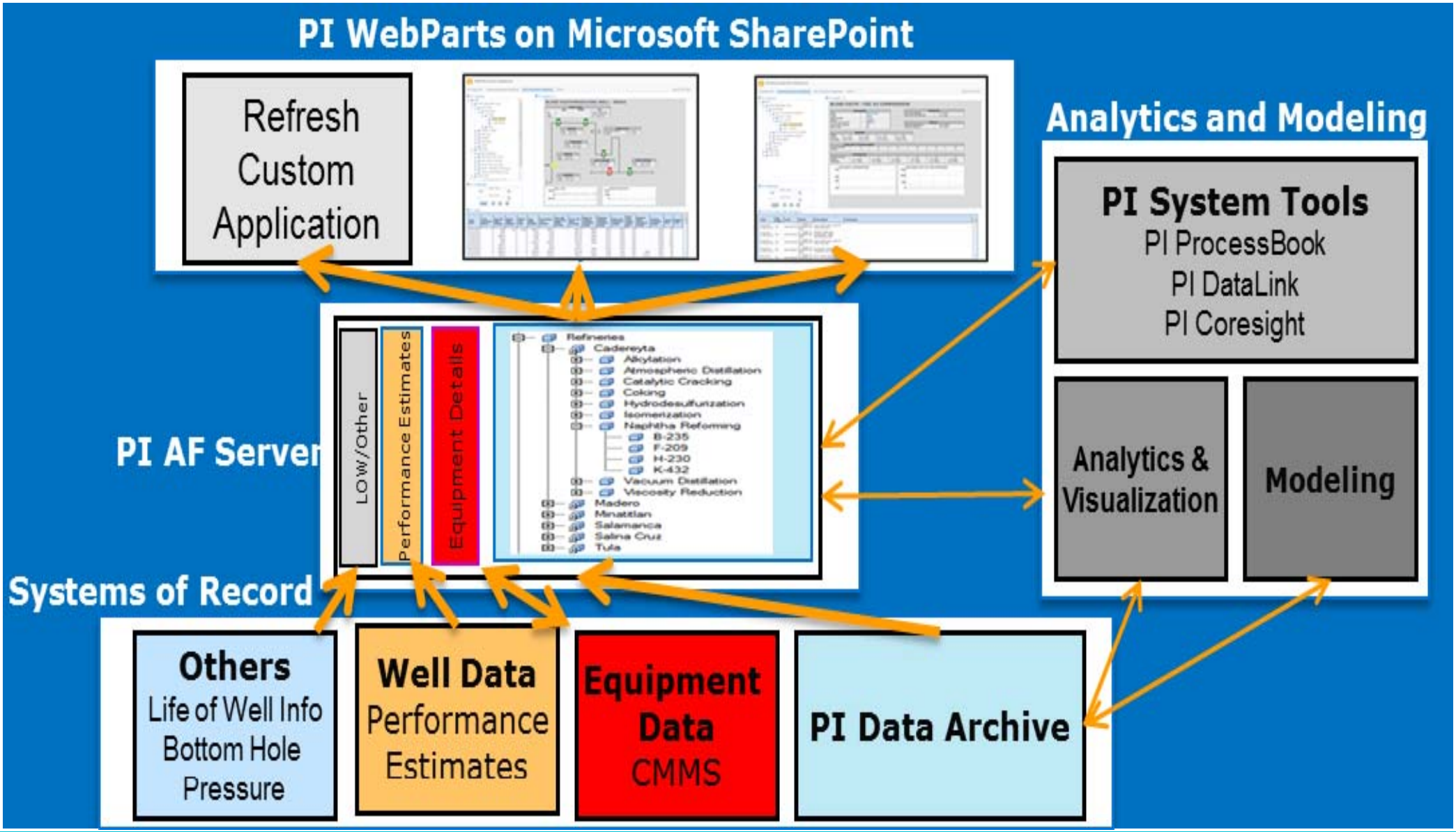
**Using PI AF as a Data Abstraction Layer & Alias Feature to Manage Tagging and Metadata Naming Governance**




**GOM Standard Tags and Asset Naming**

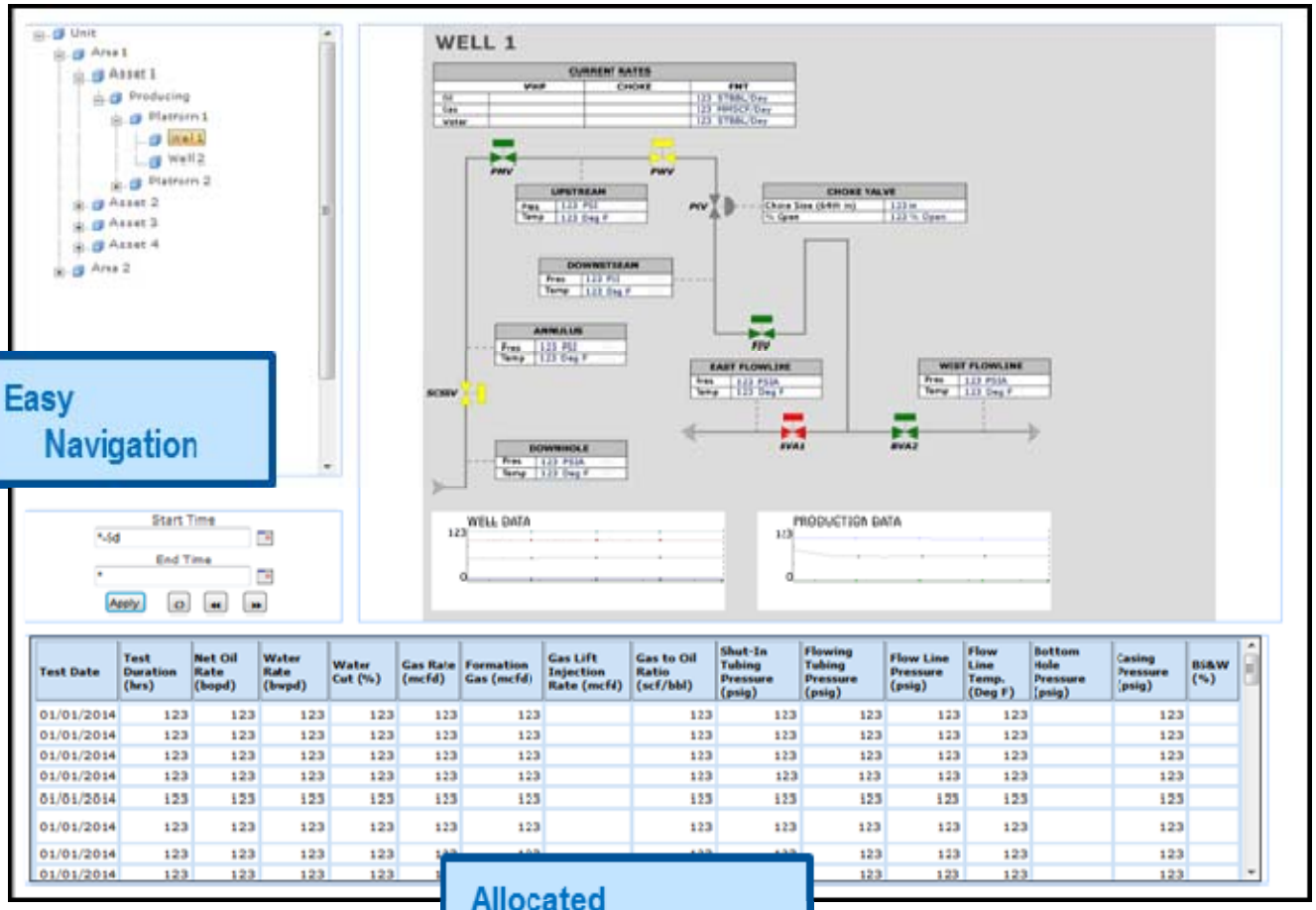
**Retention of Original Tag and Asset Naming as Required for MOC**

# Chevron – GOM PI System Data Infrastructure



# Chevron – Gulf of Mexico Business Unit

## Integrating Key Well Data with the PI System




Easy Navigation

Allocated Production Well Tests

## 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

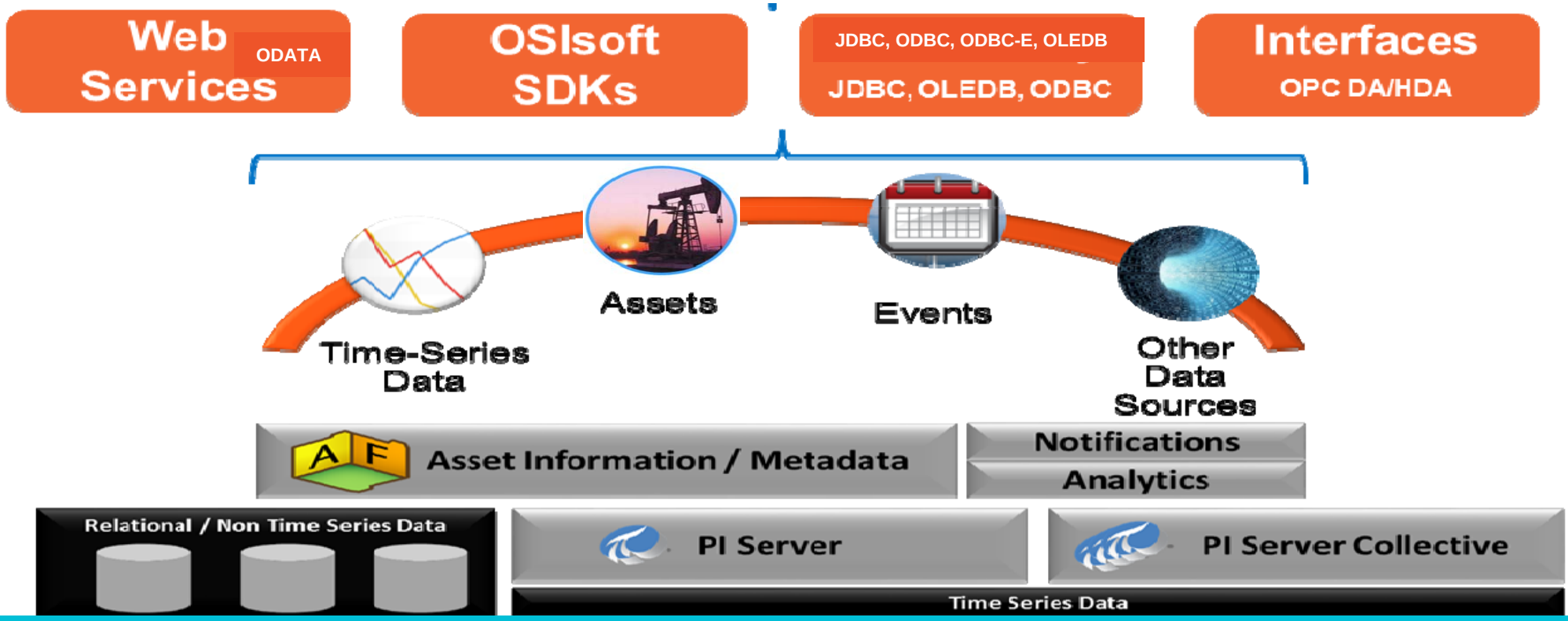
## Deployed Equipment Statistics

- **Over 180 Compressors, Pumps, Generators**

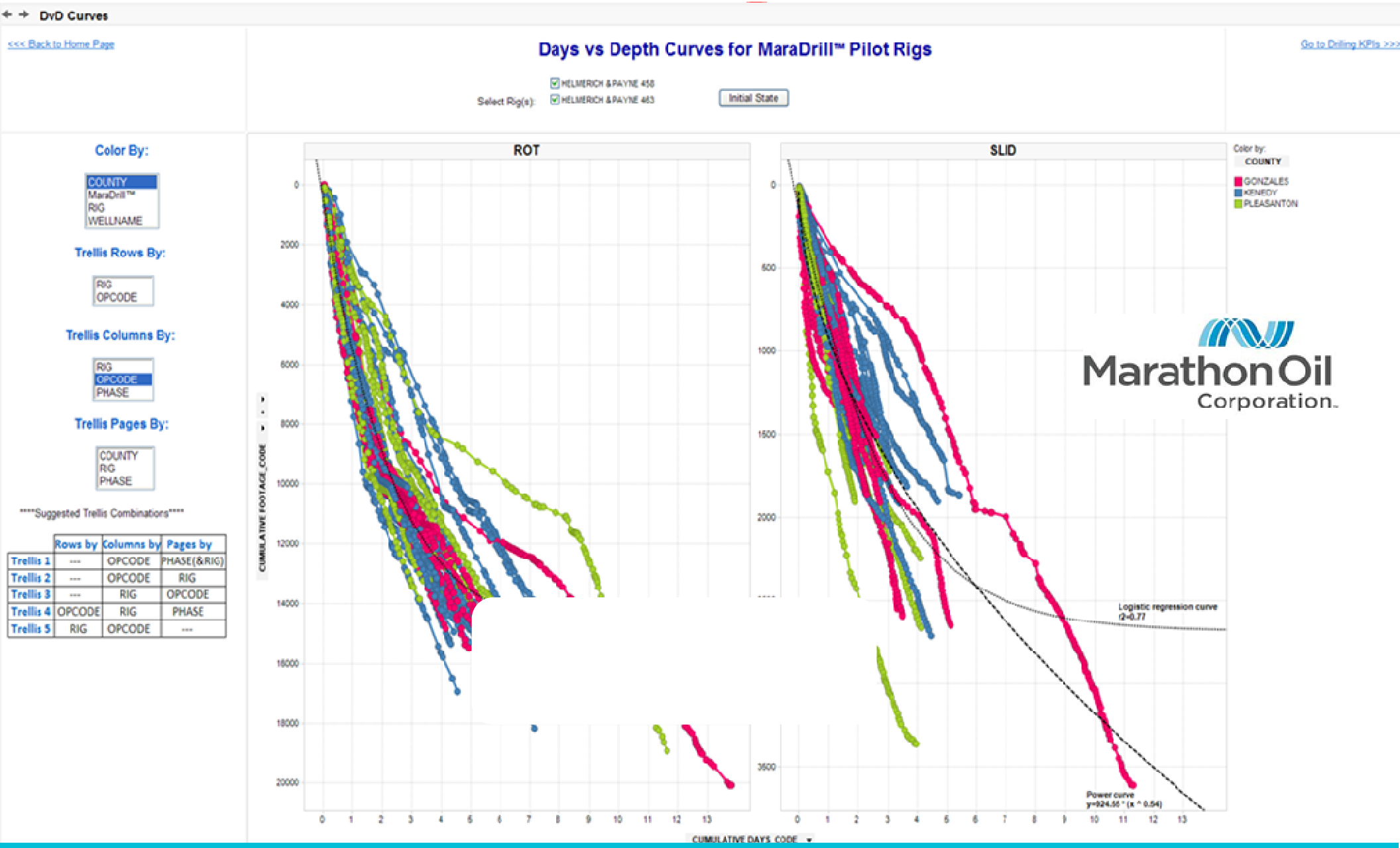
# Illustrative Case Study – Marathon Oil

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

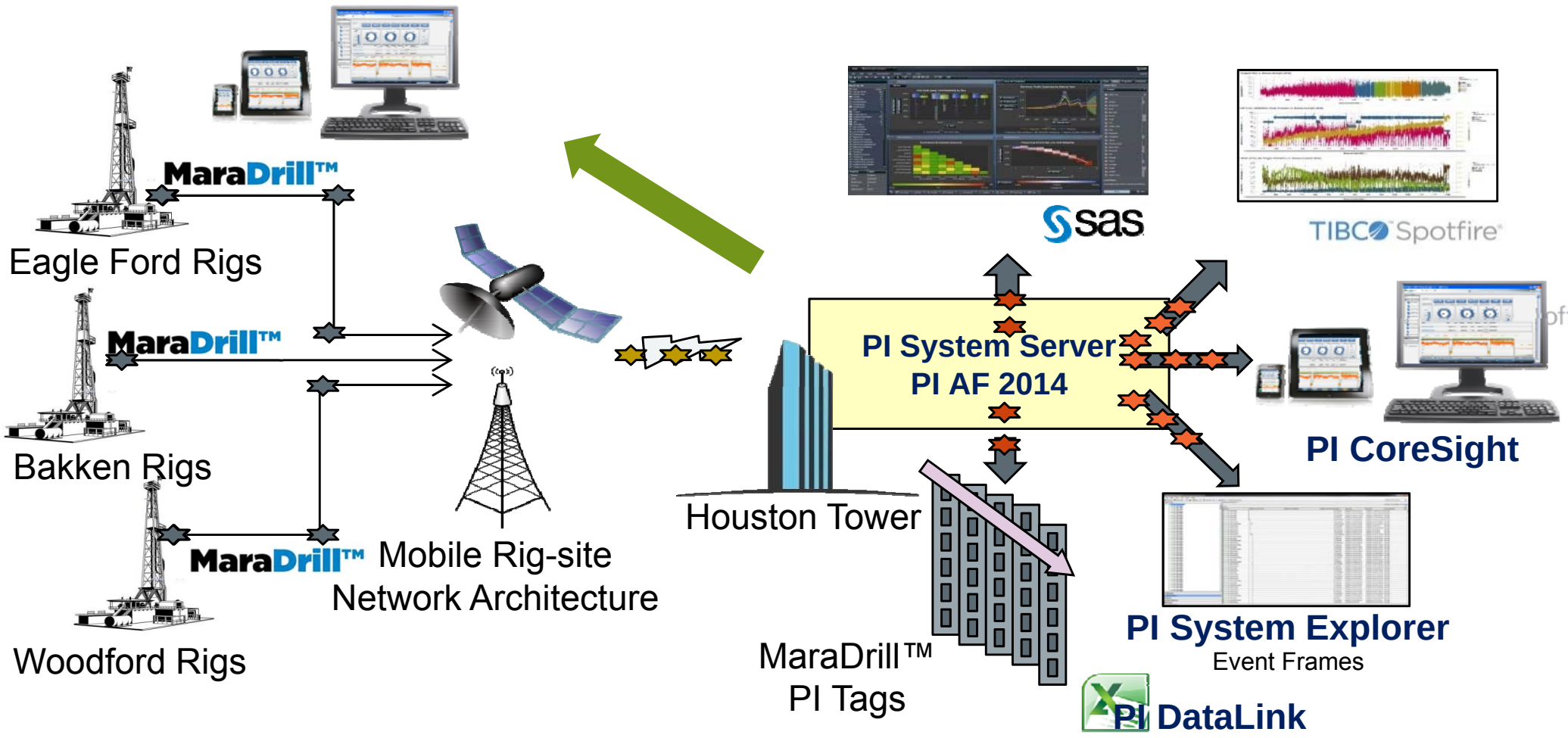
# Integration of 3rd Party Analytics and Visualization Capability – Infrastructure Enabled "Best of Breed"



# 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



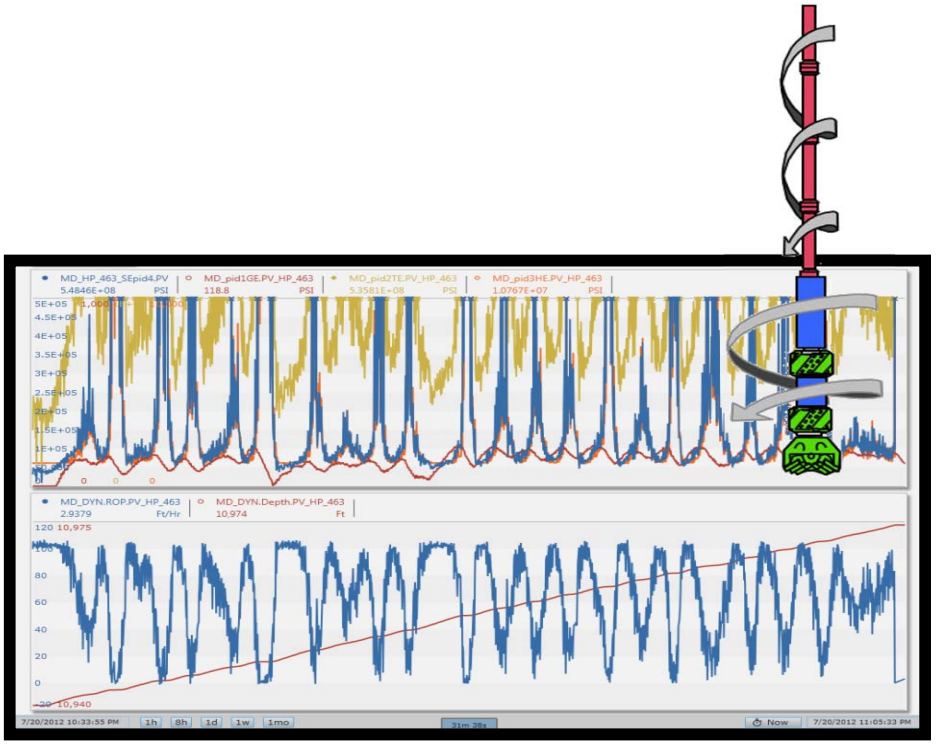
# PI Coresight – Stick-Slip Identification- Eagle Ford Rig

**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



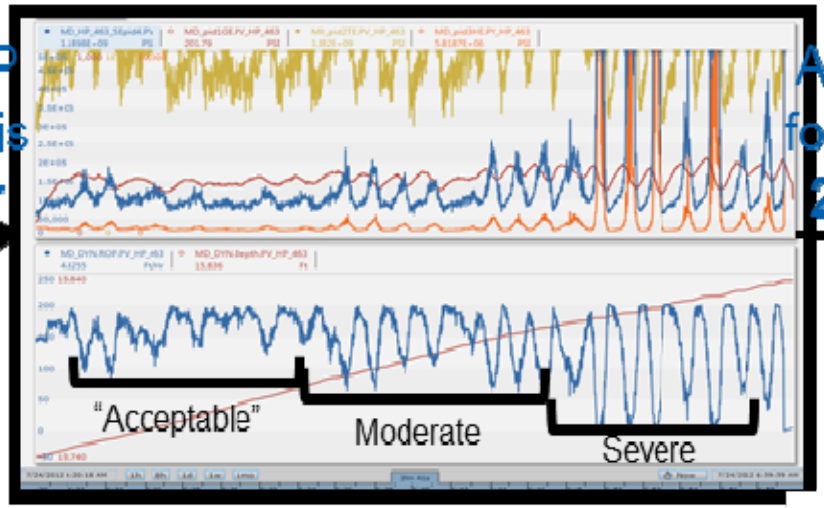

Stick-slip

# 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


Marathon Oil

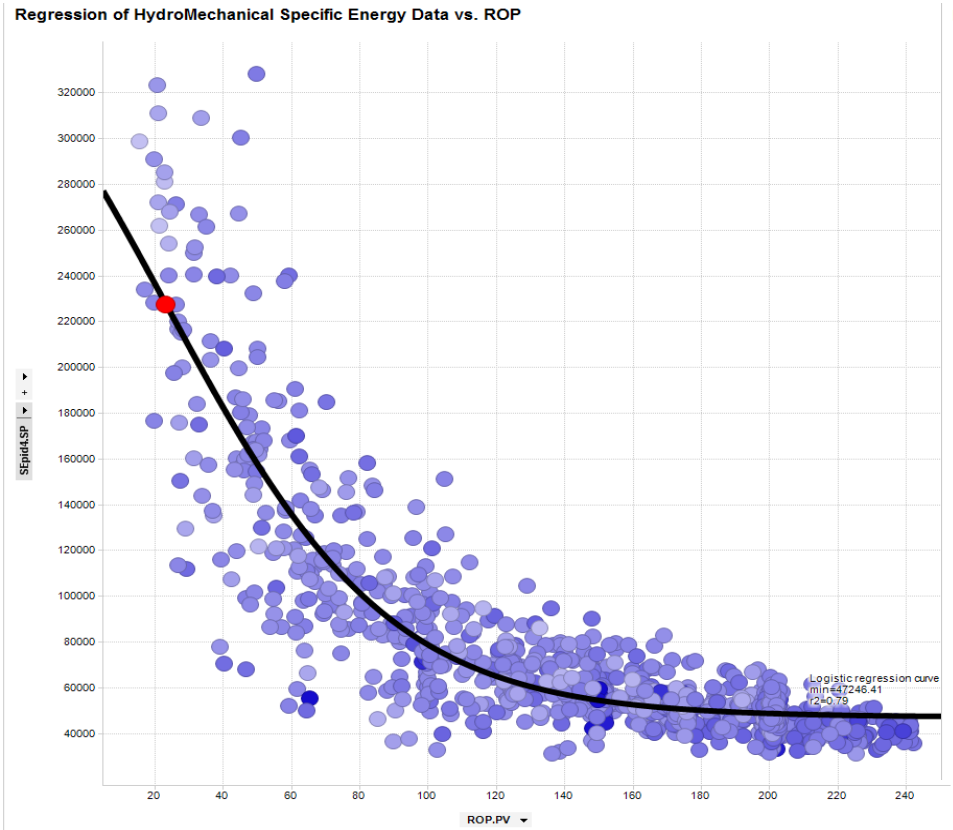
# PI Coresight View with XML Data Export

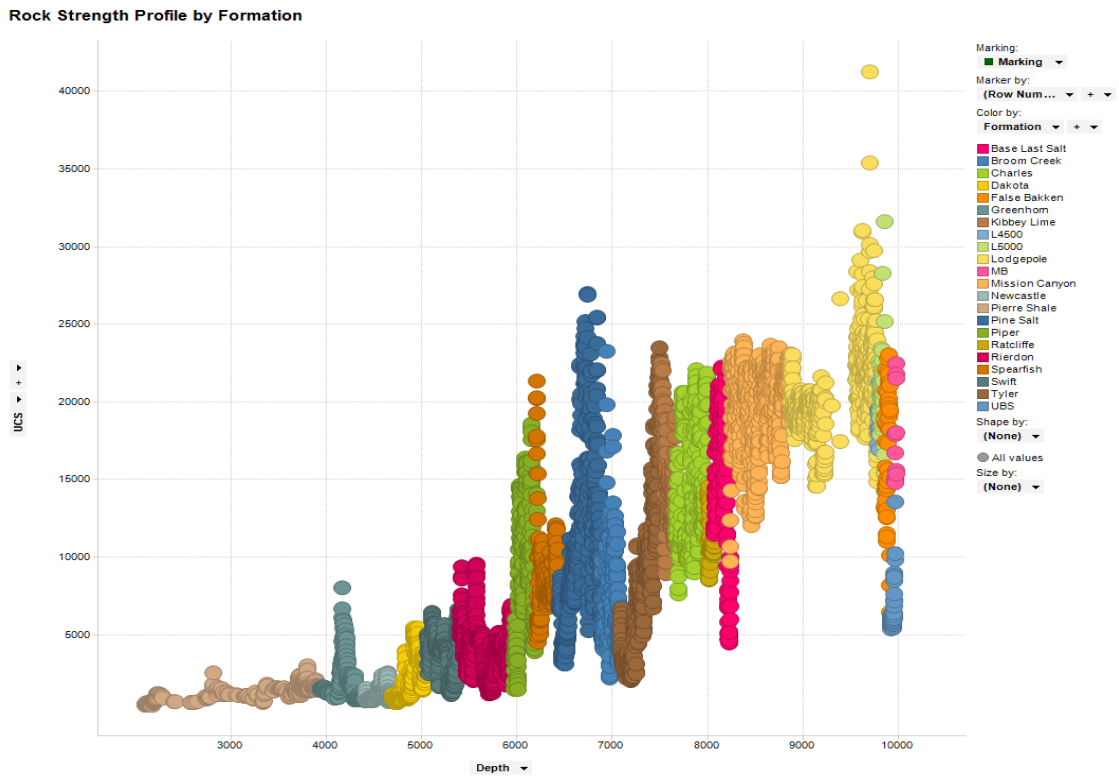

Enables Integration with WellView data

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



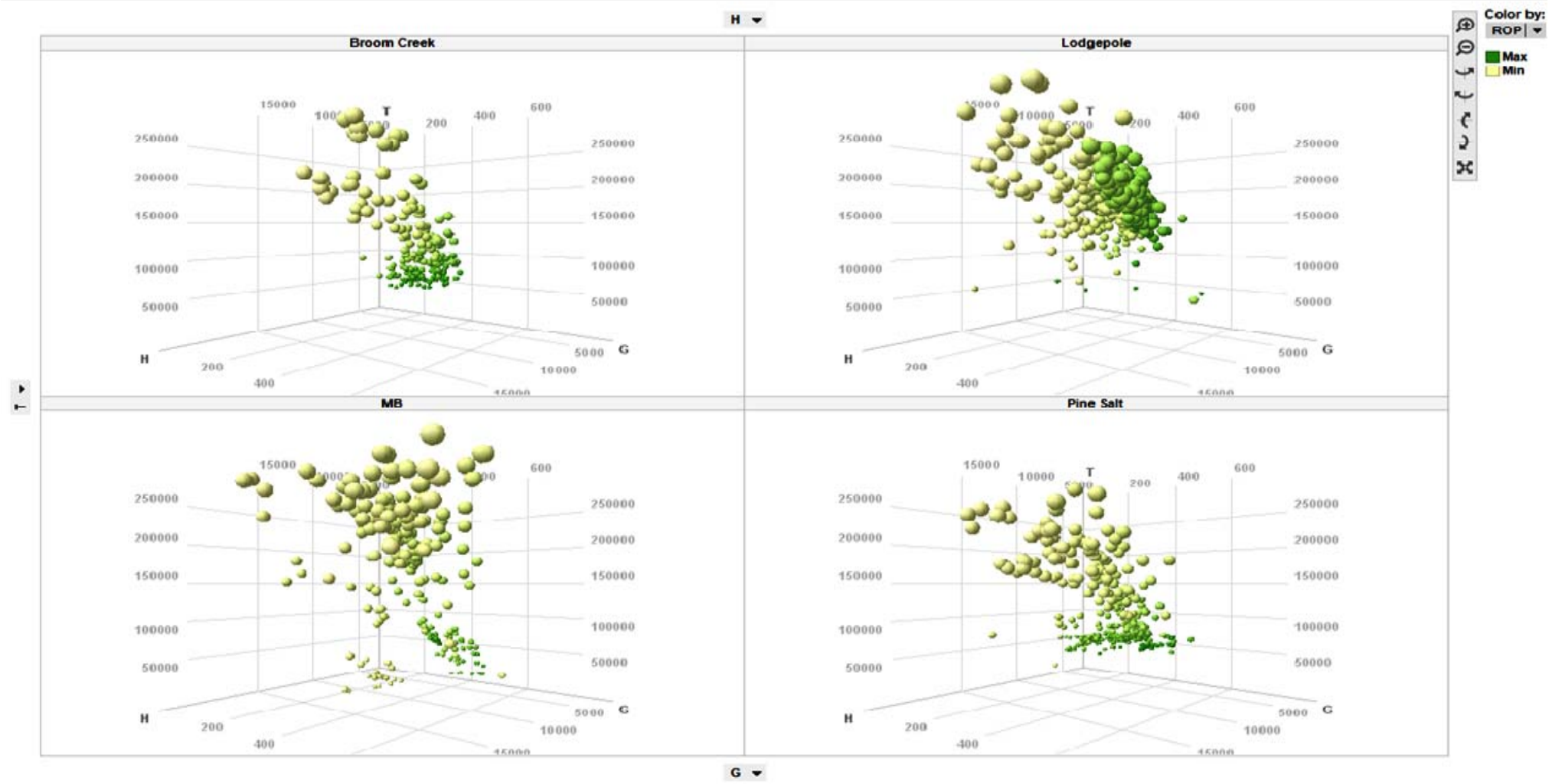



# Post-Well Science Using MaraDrill™ Data

## Formation Sweet-Spot Analysis

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

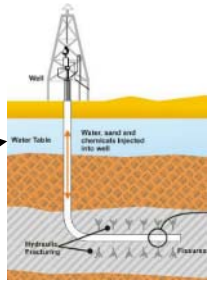
Sweet-Spot Analysis: Greener = Faster, Smaller = more efficient



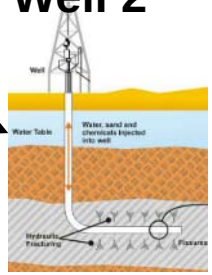
# Extending to PI AF and PI EF to Completions

## Drilling Rig 1

## Well 1



## Well 2



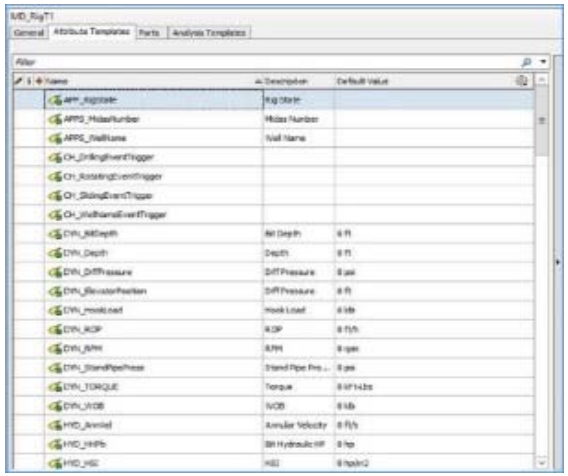
## Event Frames

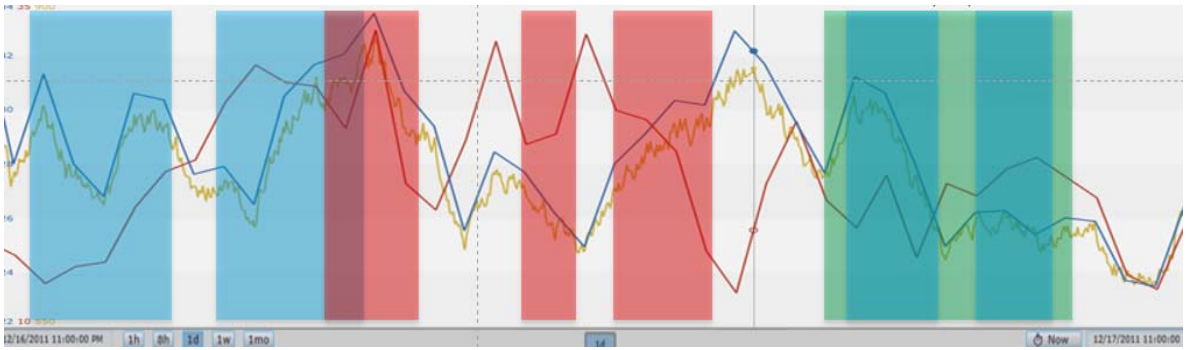
| | | | |
|---|---|---|---|
| Well 1 | 24:11:41:12 | 4/1/2014 2:00:00 AM | 4/25/2014 1:41:12 PM |
| Sliding | 0:19:00 | 4/1/2014 2:40:00 PM | 4/1/2014 2:59:00 PM |
| Rotary ... | 4:40:38 | 4/1/2014 3:33:45 PM | 4/1/2014 8:14:23 PM |
| Sliding | 0:28:30 | 4/1/2014 5:23:04 PM | 4/1/2014 5:51:34 PM |
| 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 9:43:49 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 |

## Event Frames

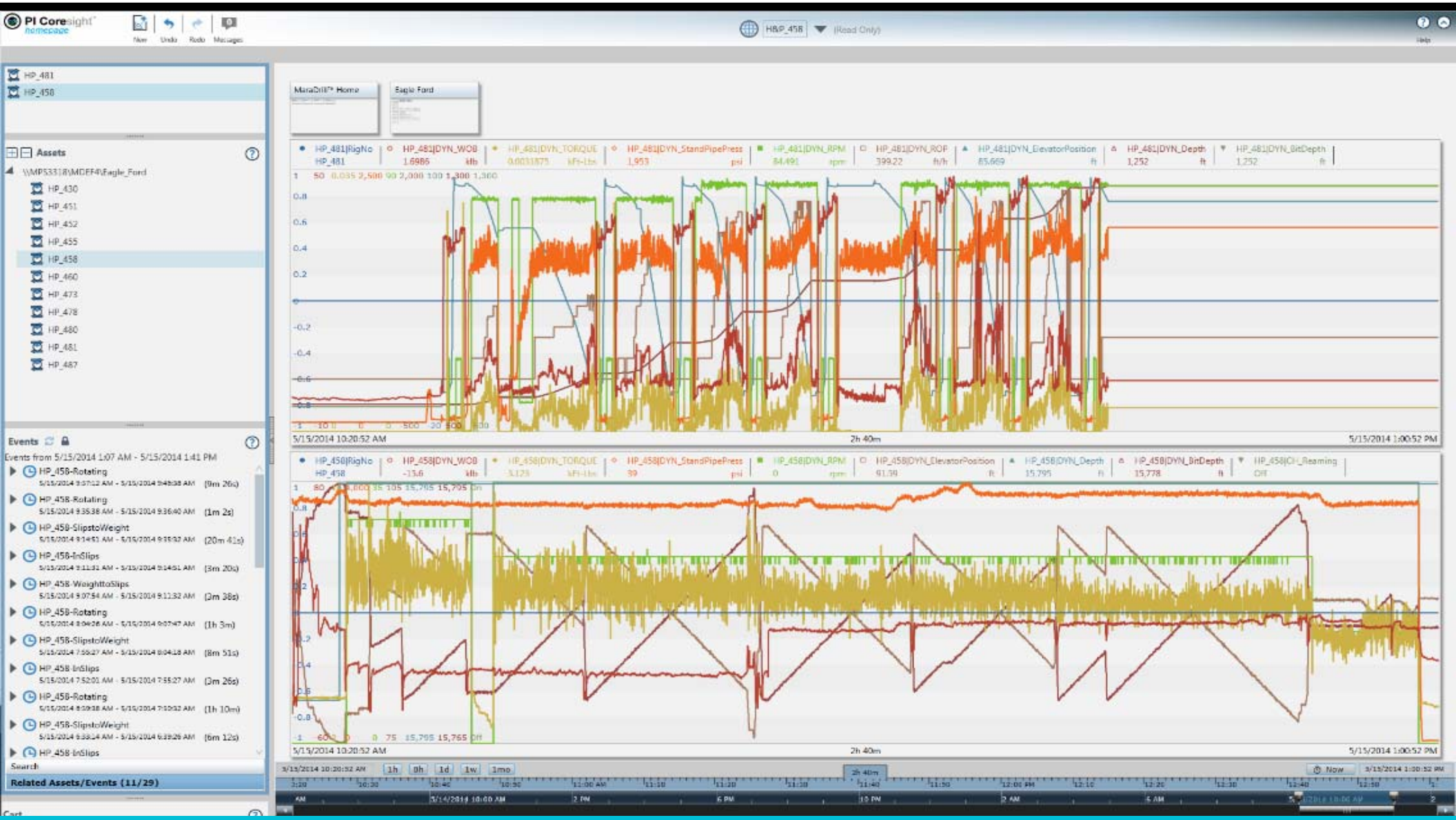
| | | | |
|---|---|---|---|
| Well 2 | 24:0:00:33 | 4/27/2014 1:42:00 PM | 5/21/2014 1:42:33 PM |
| Sliding | 0:18:50 | 4/28/2014 2:40:10 PM | 4/28/2014 2:59:00 PM |
| Rotary ... | 7:40:38 | 4/29/2014 3:33:45 PM | 4/29/2014 11:14:23 PM |
| Sliding | 1:11:30 | 5/1/2014 3:23:04 PM | 5/1/2014 4:34:34 PM |
| 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 |

## AF Element

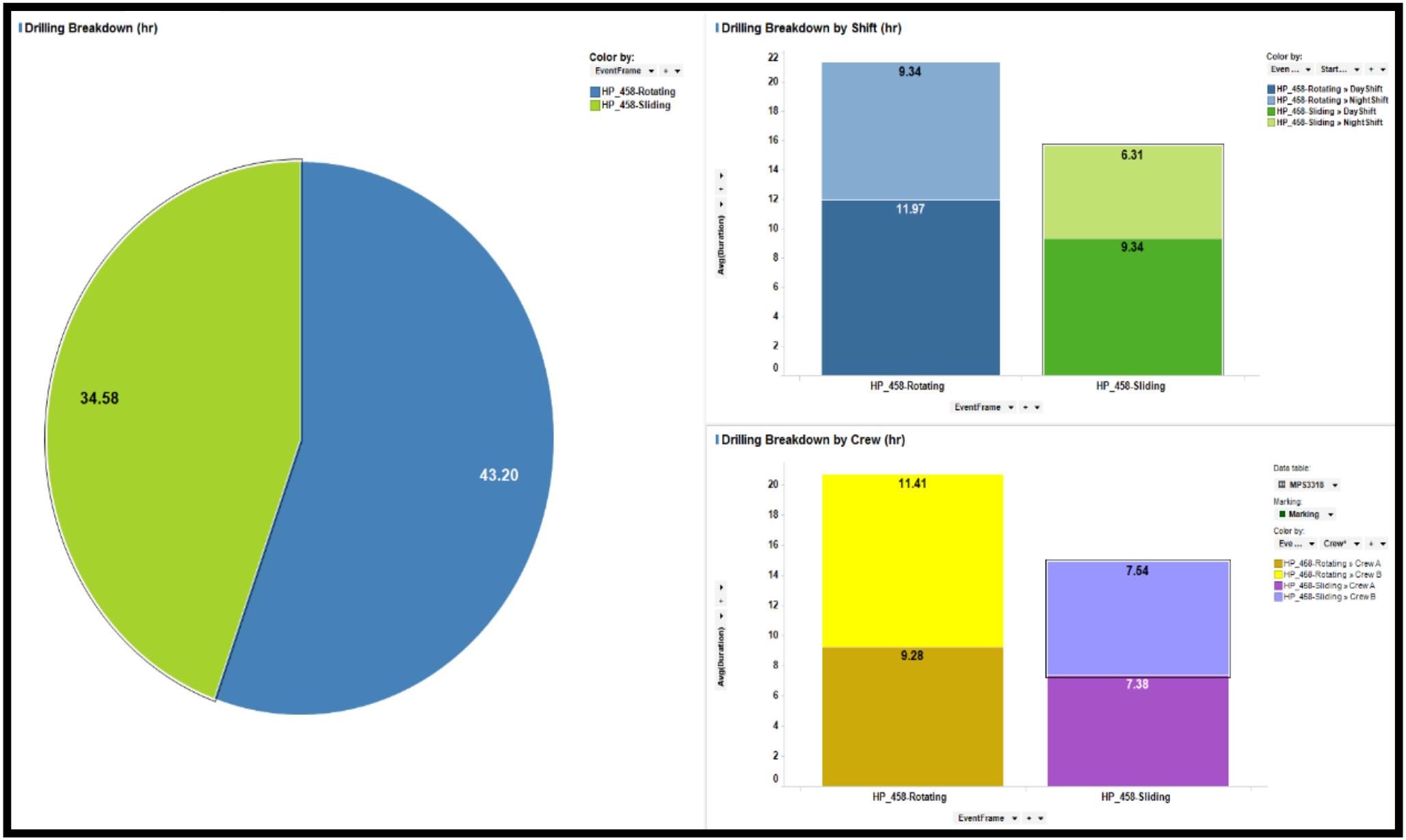




# Self Serve Analytics & Visualization, Mobility…..Consistency, Alignment, Simplicity, and in Context – Drilling Events



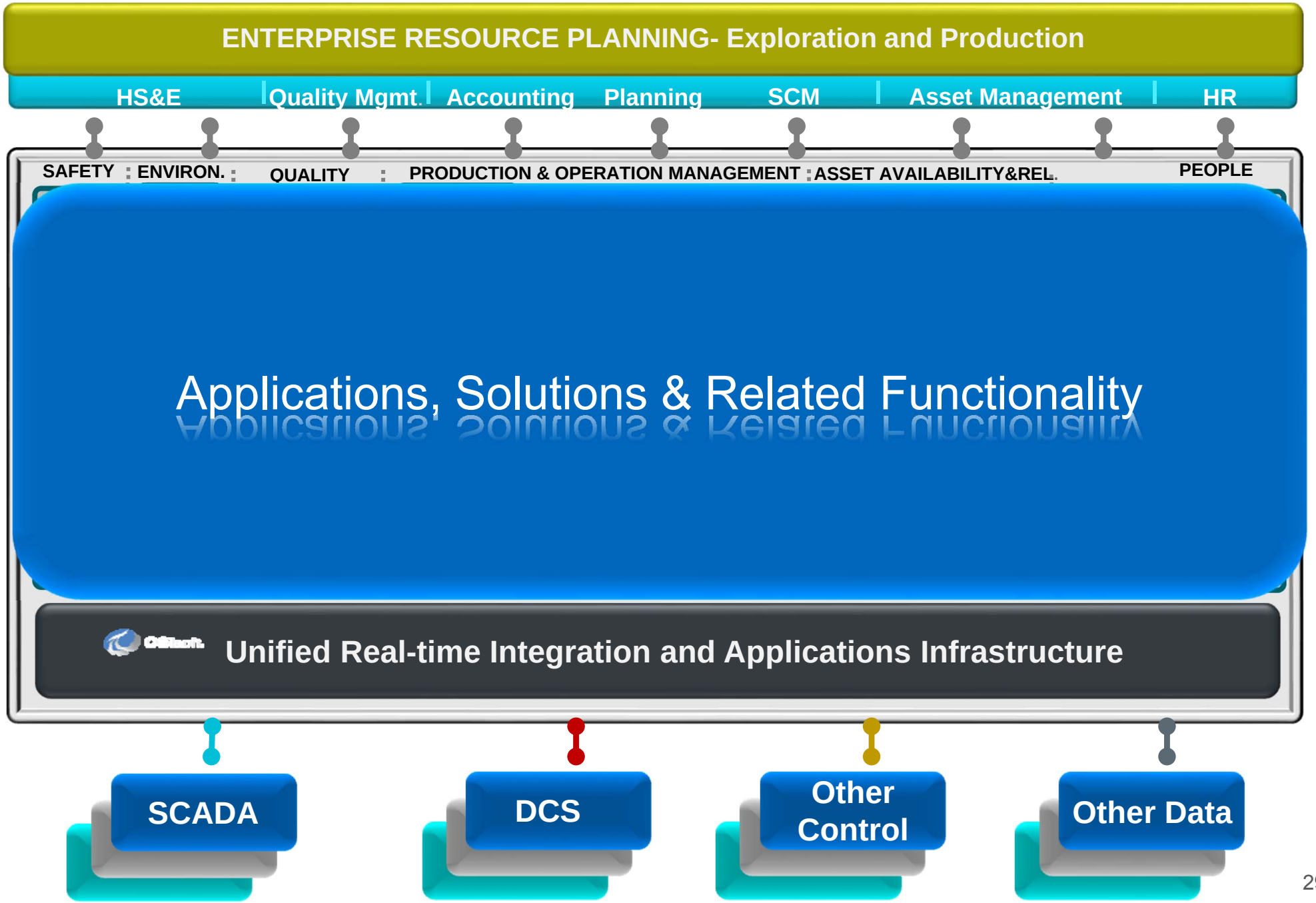
# Microsoft Power BI for Advanced Analytics



# Illustrative Case Study – Talisman Energy

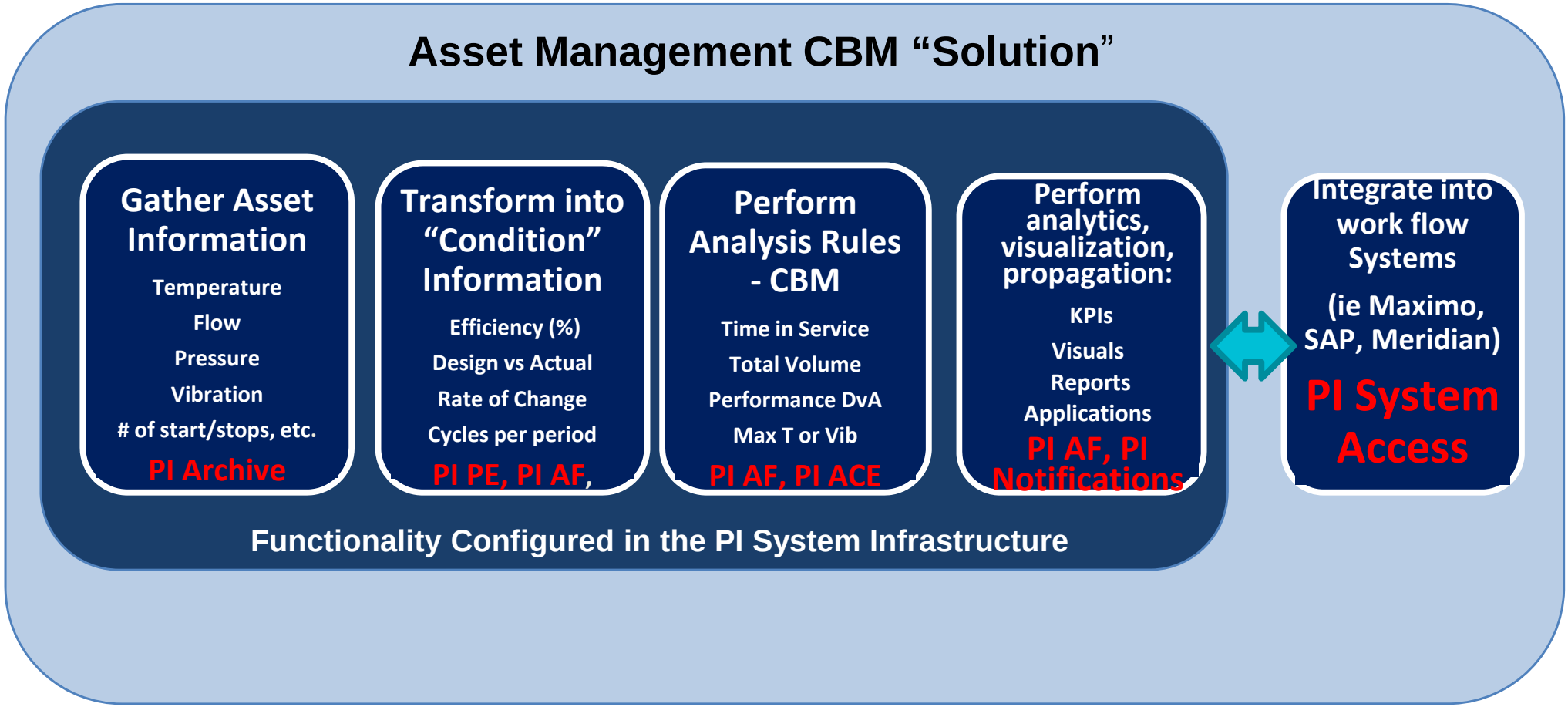
Data Consistency and Context
Organizational Alignment
Applications/Solutions Simplicity
Data Transformation Methodology

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

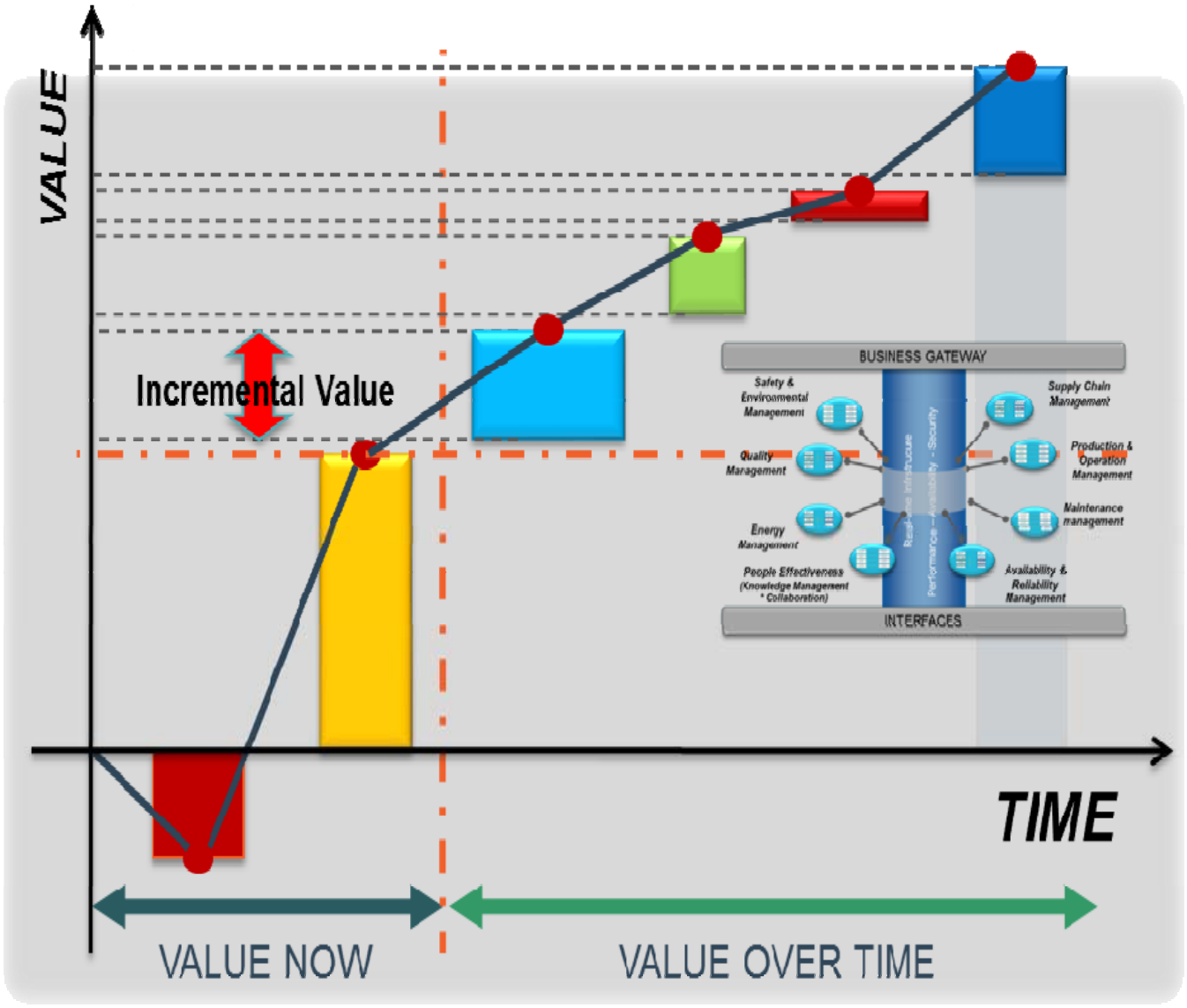


# Decomposition of Typical "CBM Solution"

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



# An Infrastructure Approach




Performance Management

Environmental Reporting

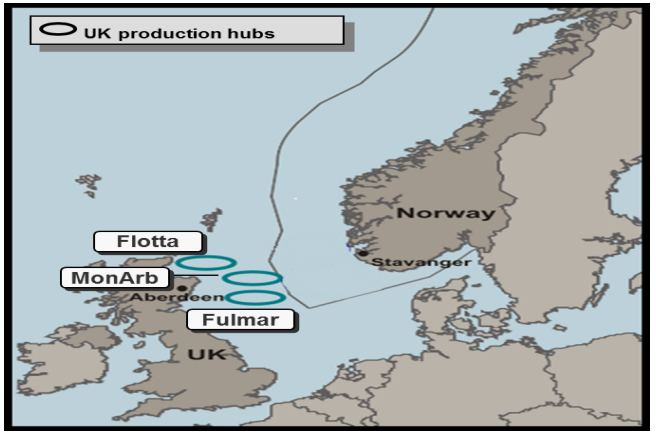
Equipment Health Mgmt.

Operations Management

Initial Infrastructure Value

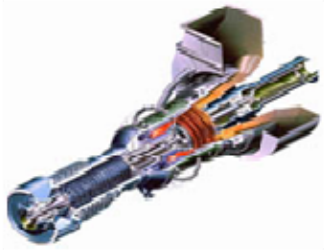
Infrastructure Initial Investment

# 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

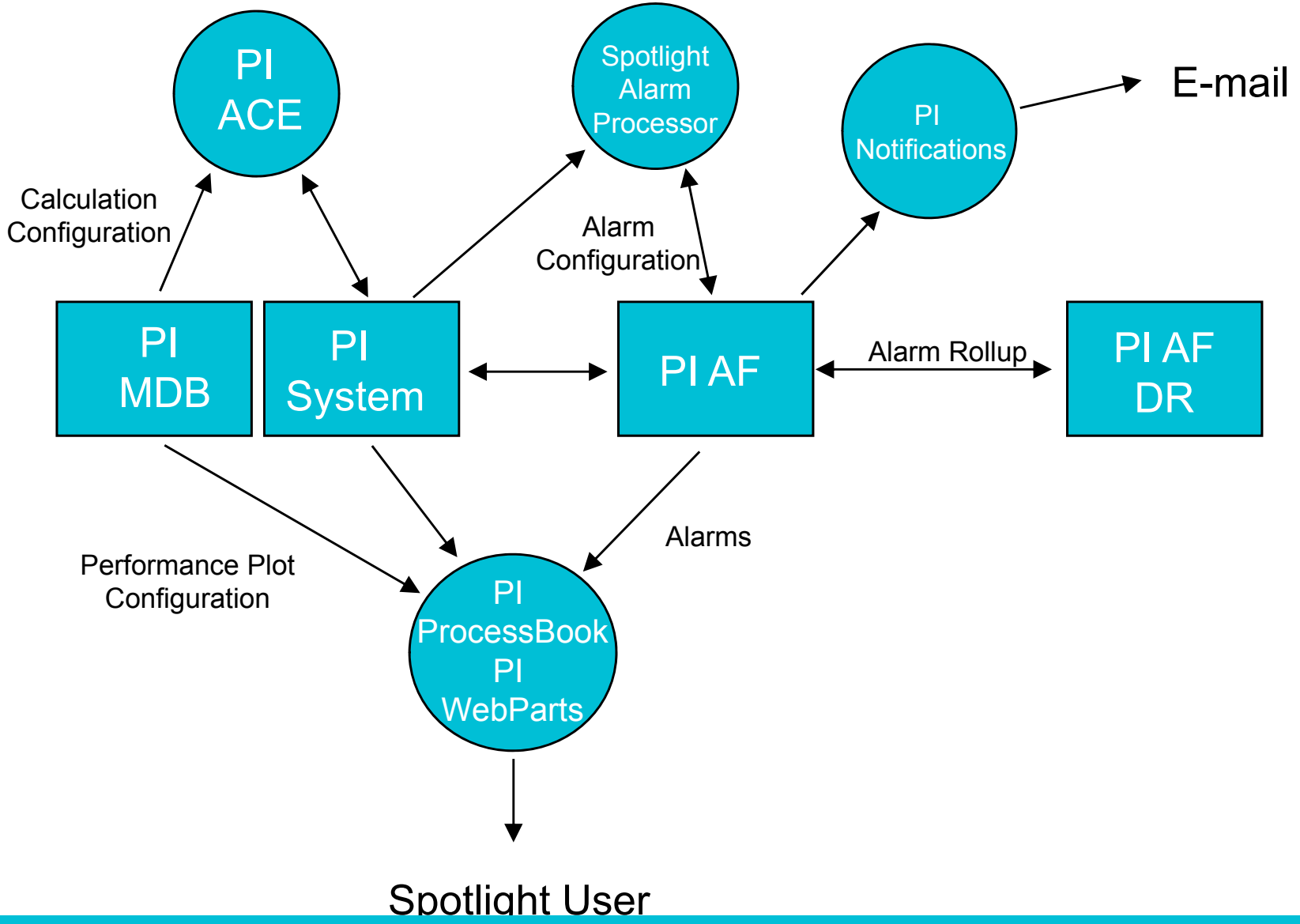


## Production Critical Equipment

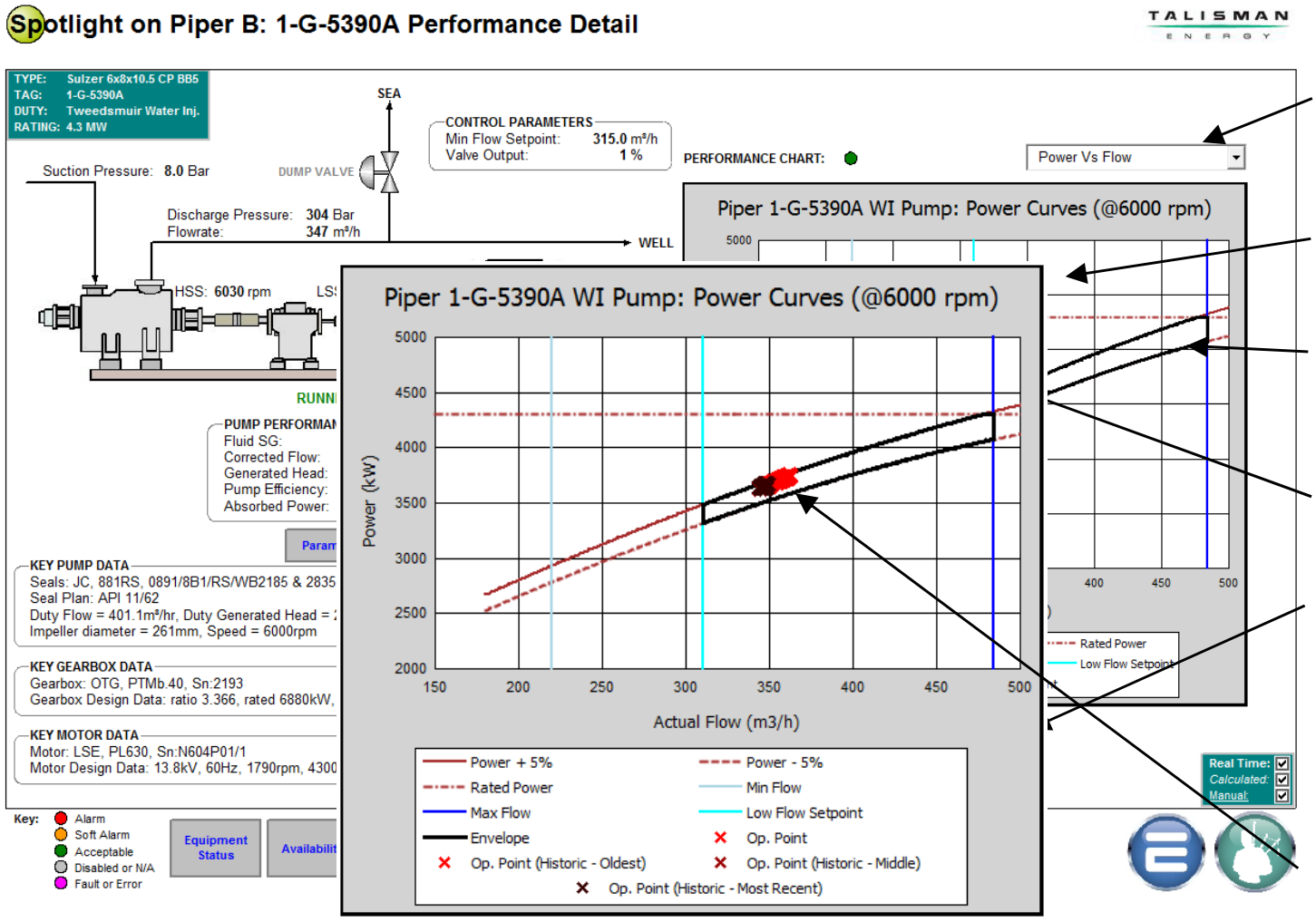
- 56 Gas Turbines
- 40 Gas Compressors
- 9 Diesel Engines for Main Power Generation
- 27 Main Water Injection, P.W. & Artificial Lift Pumps
- 35 Main Oil Line Pumps
- Circa 2711 Operational Pumps

A total of 2831 pieces of Major Rotating Equipment

# Spotlight Architecture



# Spotlight Display - Performance




User can select different charts associated with this item

Chart showing performance constraints

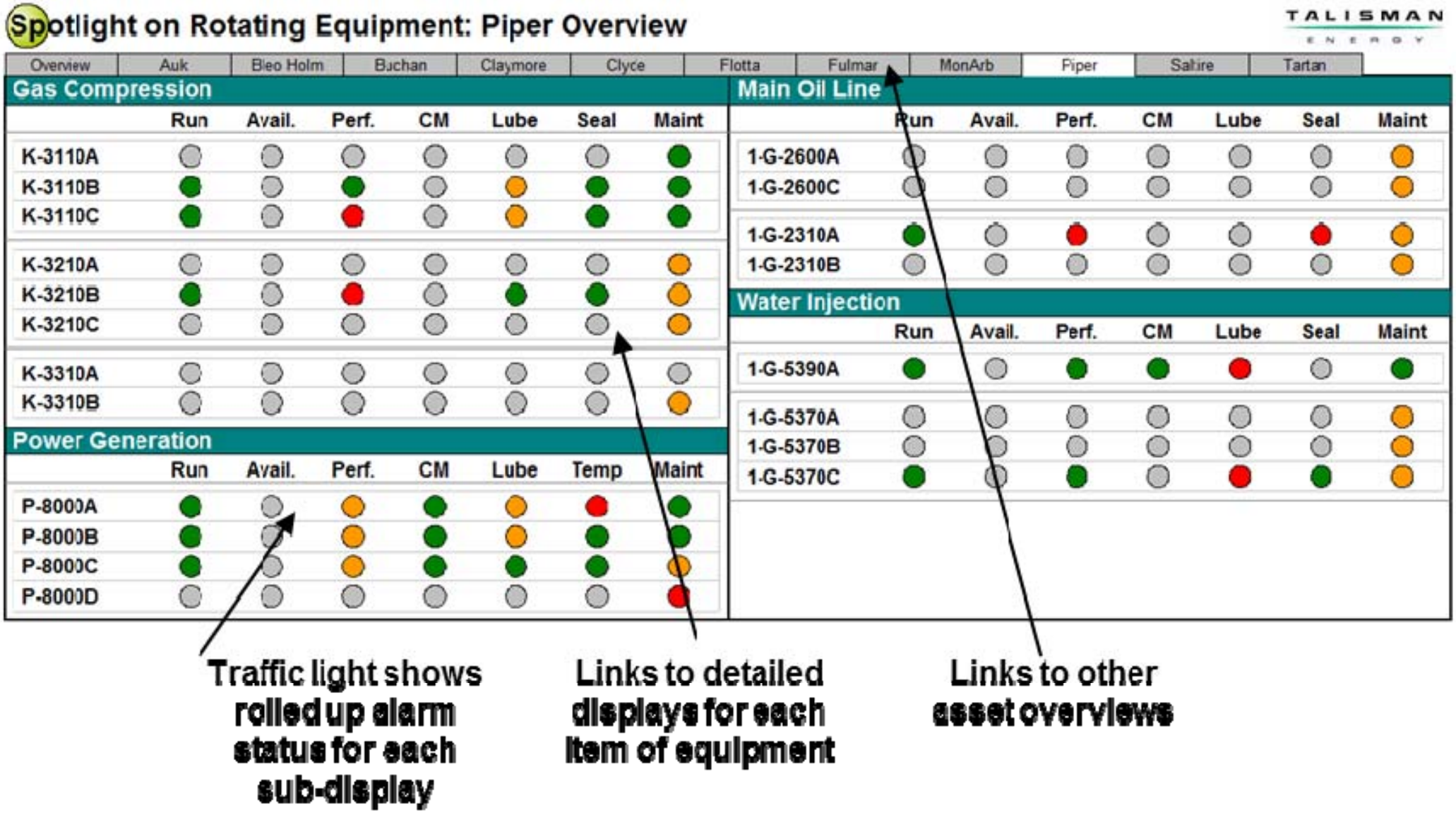
Operating Envelope

Current operating point

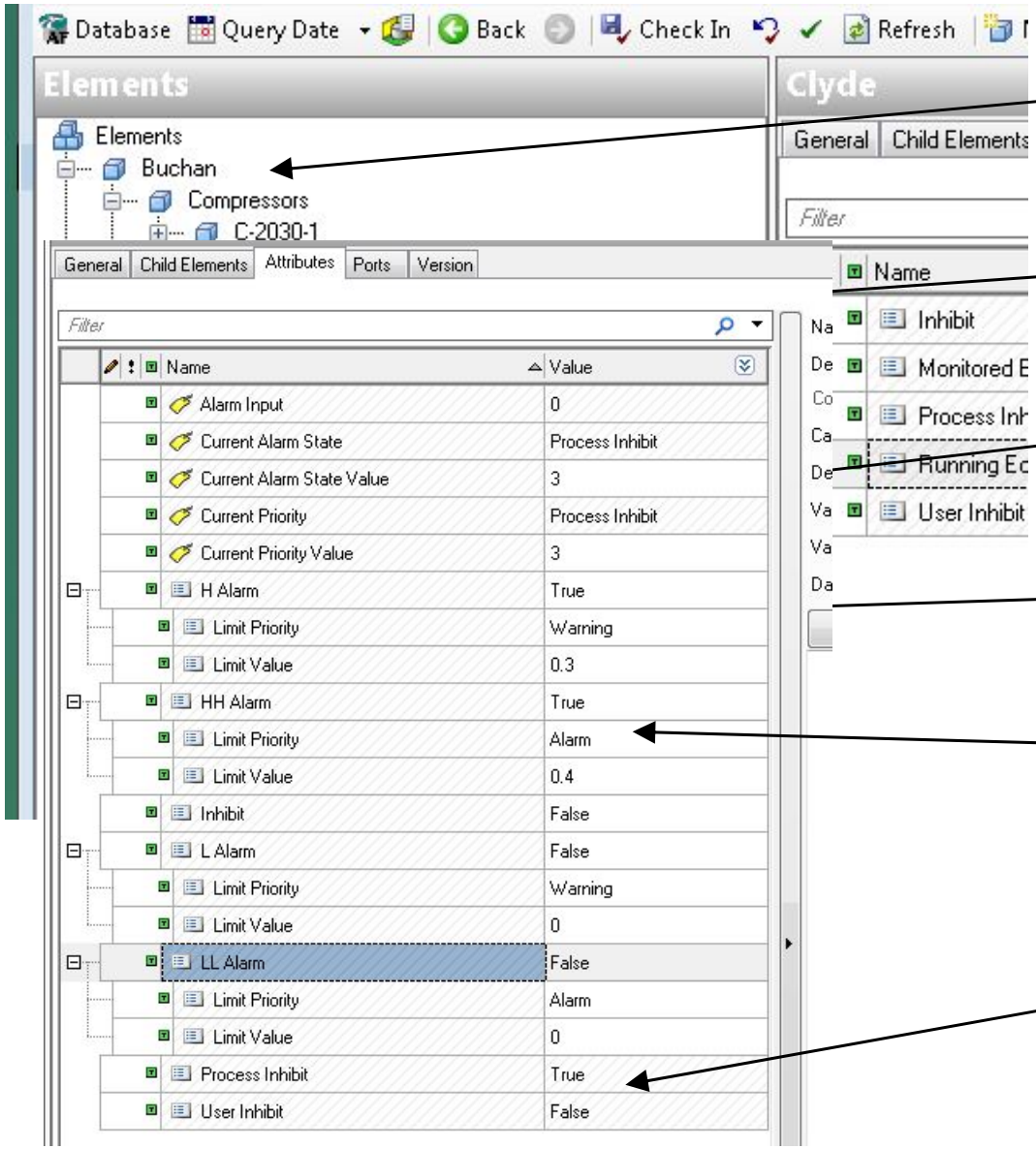
View operating point history over varying time periods

Operating point “cloud” shows history

# KPIs with High Fidelity "Live" Drill Down



# Consistency in KPIs, Alarms, & Transformations




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

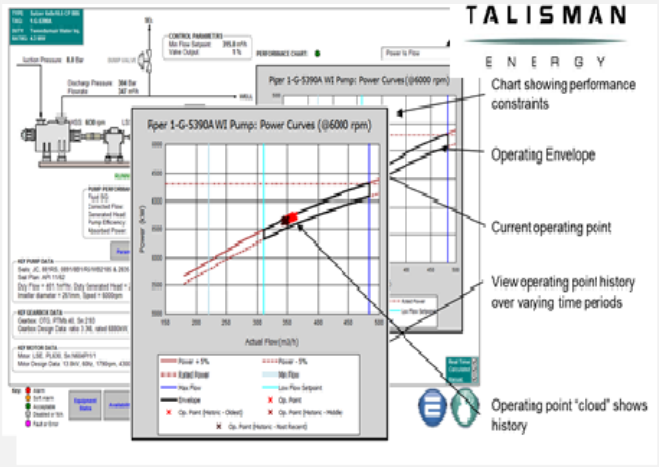
Process inhibit (run state)
User inhibit (cascaded down)

# Agenda

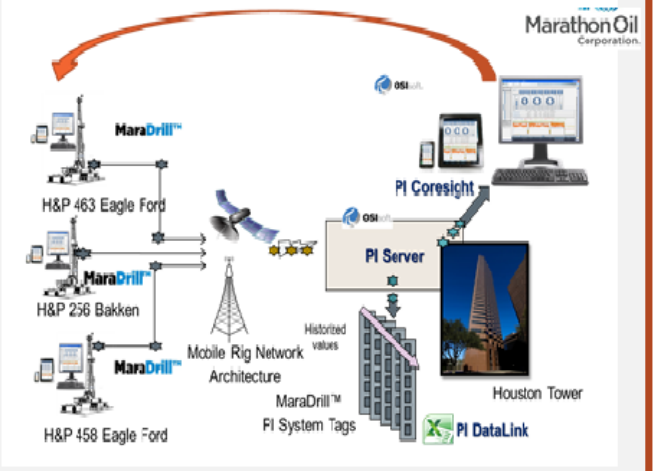
- Business to Operations Data Value Requisites:
  - Data Consistency and Context
  - Organizational Alignment
  - Applications/Solutions Simplicity
  - Data Transformation Methodology
- Resulting Value in O&G
- Closing Comments

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

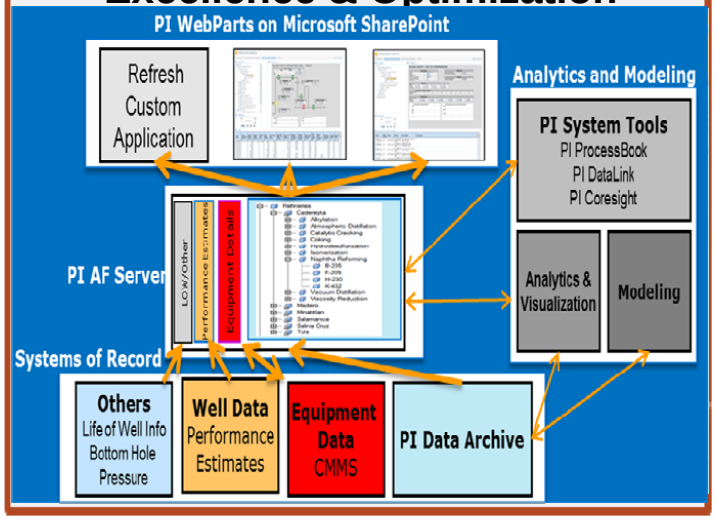
## Asset Performance, Reliability, & Portfolio Management



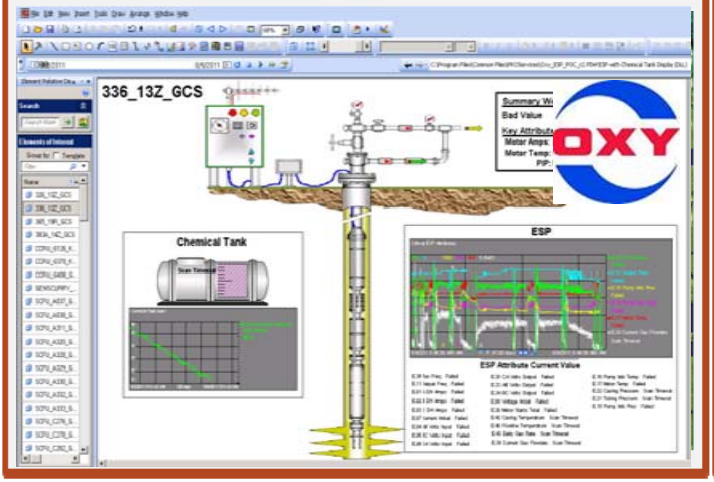

## Drilling and Completion Oversight & Optimization



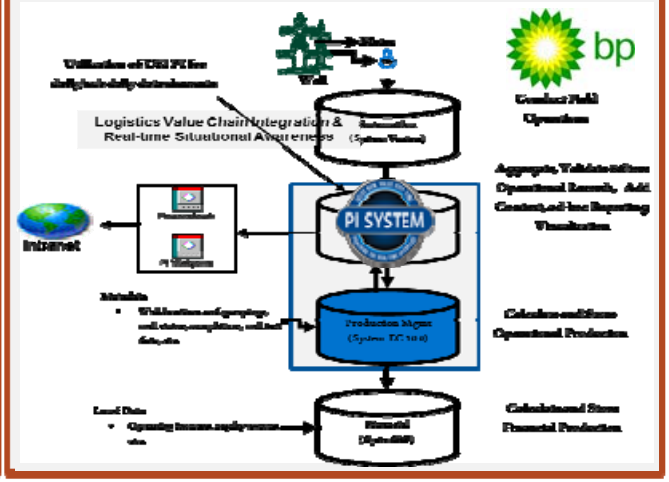

## Production Operational Excellence & Optimization



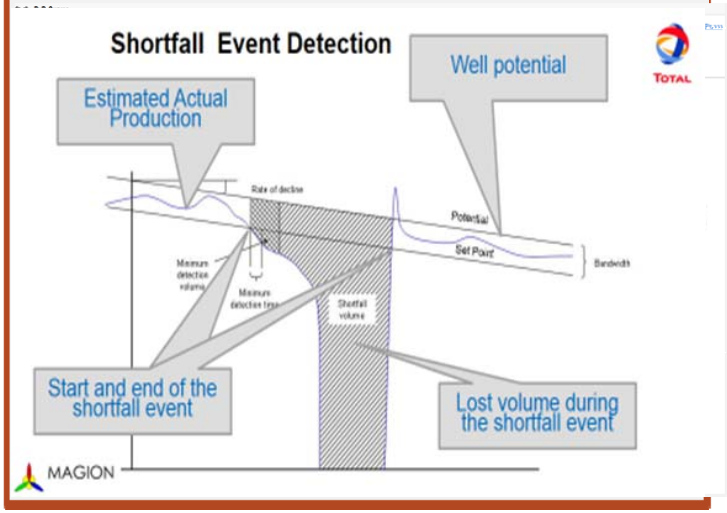

## Artificial Lift Reliability and Optimization




## Augmentation of "Best of Breed" Solutions

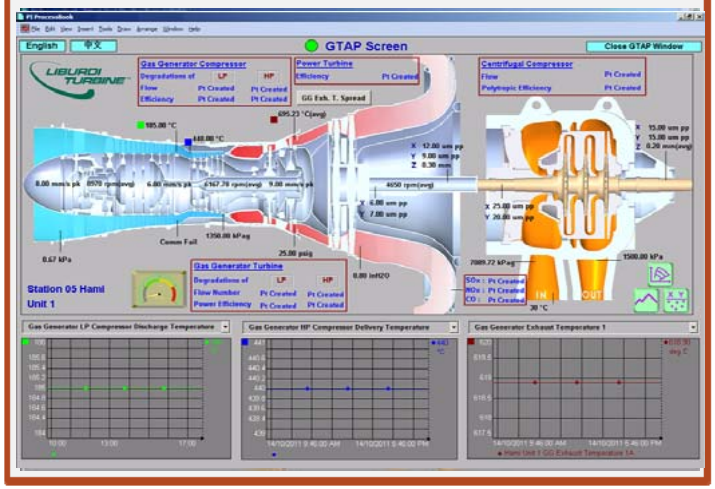



## Integration with E&P Analytics & Visualization/Post Well Science

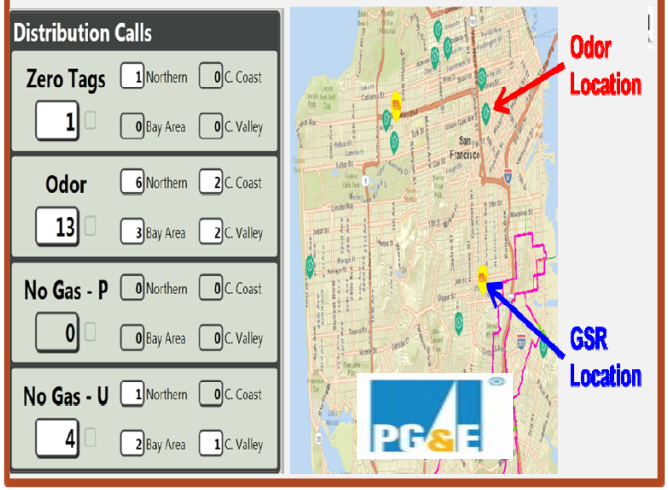


# Enabling Op Ex in All Areas in O&G Logistics

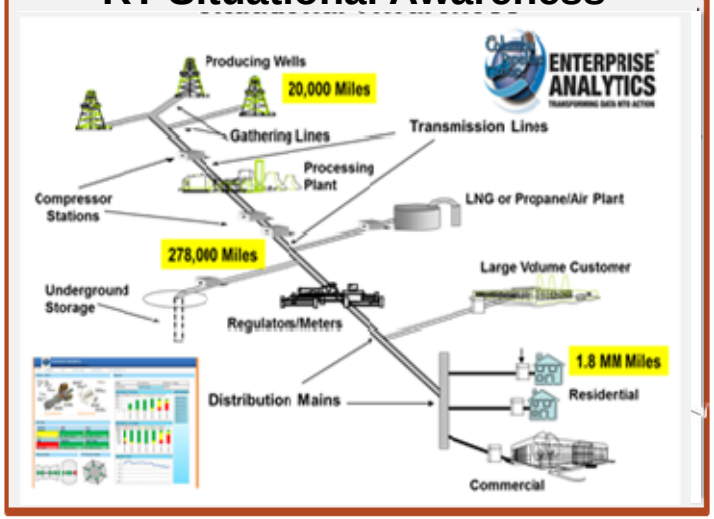
## Asset Performance, Reliability, & Portfolio Management



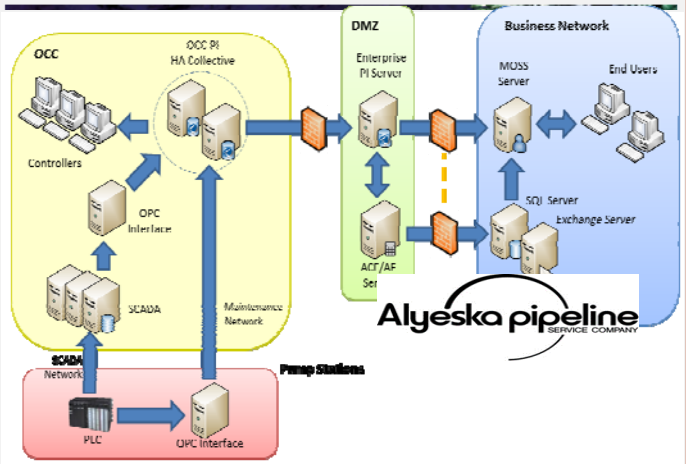

## Geospatial Integration "Real-Time & Space"



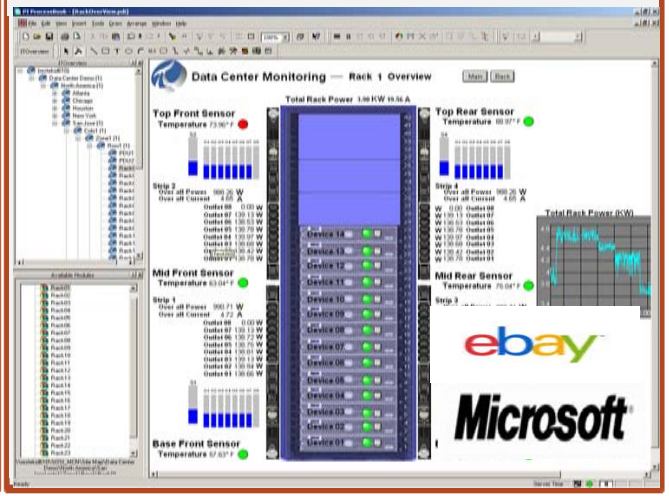

## Gas Value Chain Integration & RT Situational Awareness



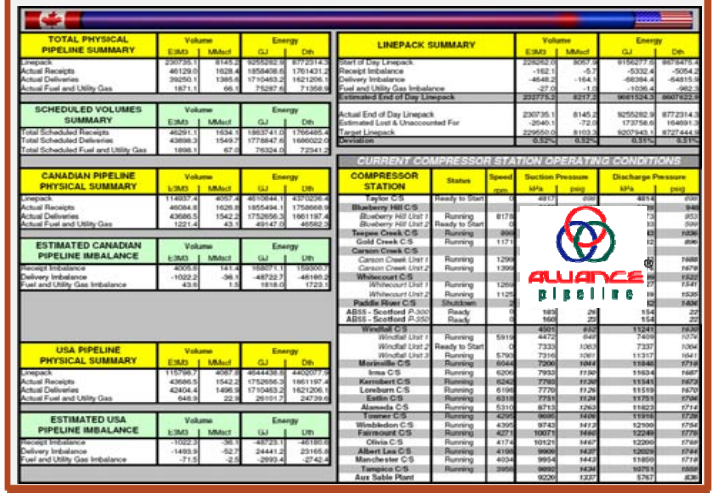

## SCADA/DCS Augmentation




## IT/SCADA Infrastructure Energy & Reliability Mgmnt

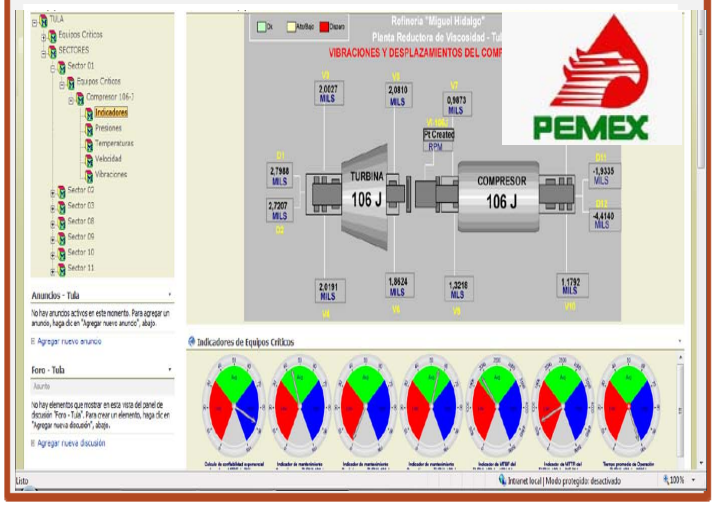



## Compliance Reporting, Environmental & Energy Mgmt.

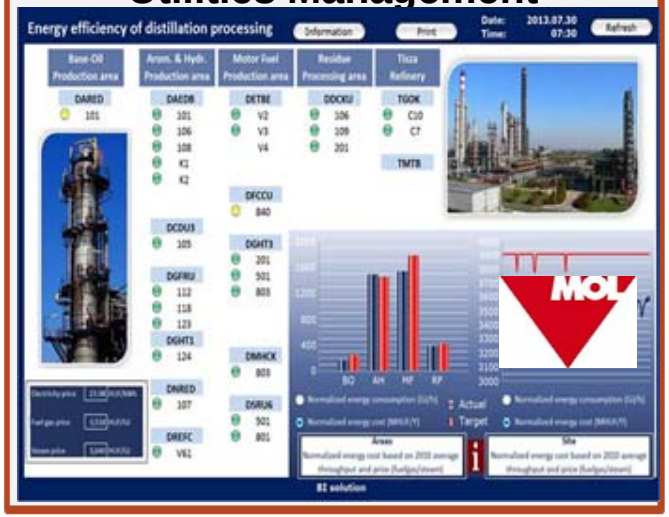


# Enabling Operational Excellence in Hydrocarbon Processing

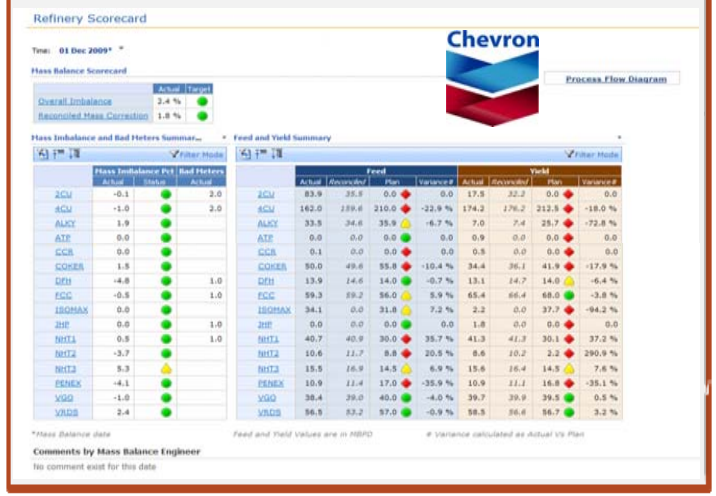
## Asset Performance, Reliability, & Portfolio Management - CBM



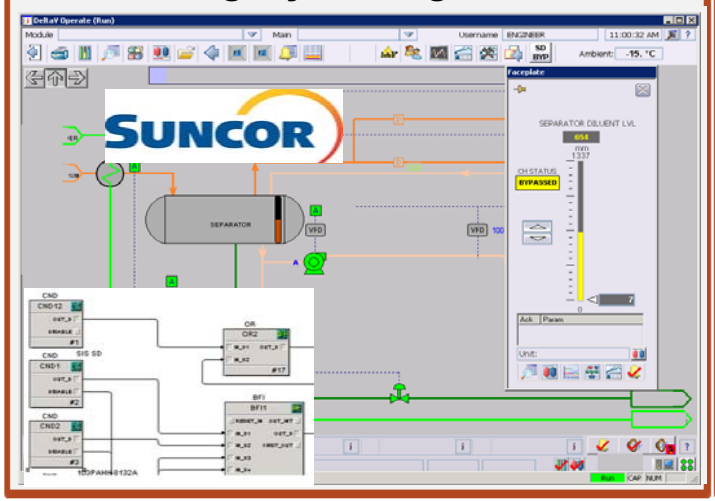

## Environmental, Energy & Utilities Management



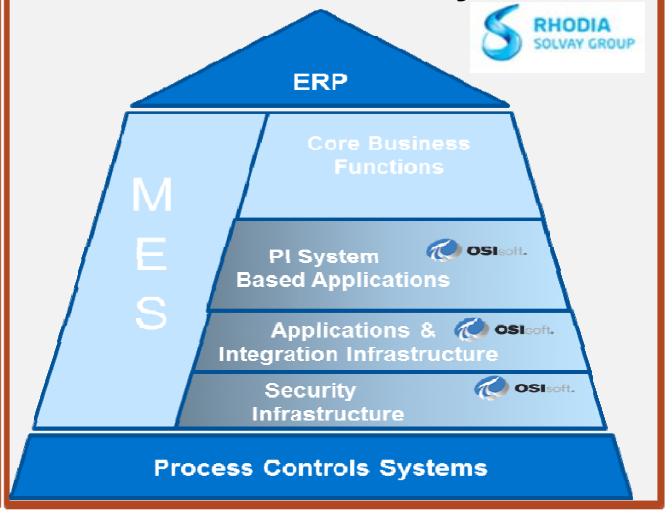

## Ops Visibility, Reporting & Analytics, YA, "live" KPIs, & Model Based PvA



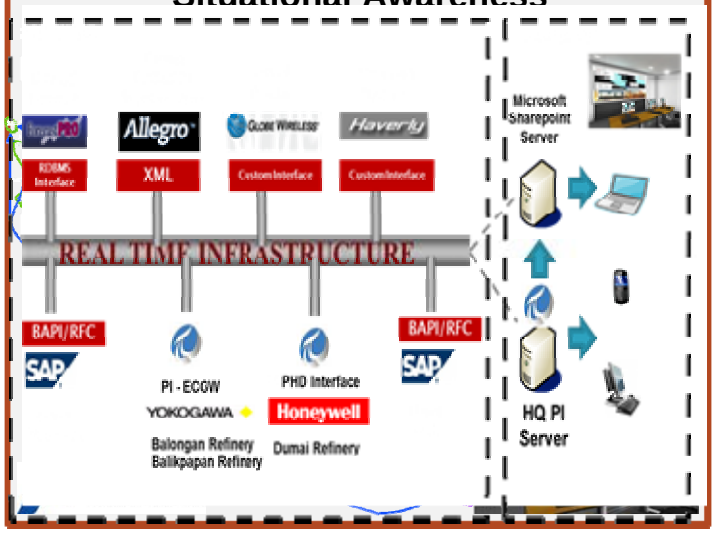

## Safety & Reactive/Proactive Integrity Management




## Infrastructure for MES MES AND The PI System




## Value Chain Integration & Real-time Situational Awareness



# Agenda

- 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

# 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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