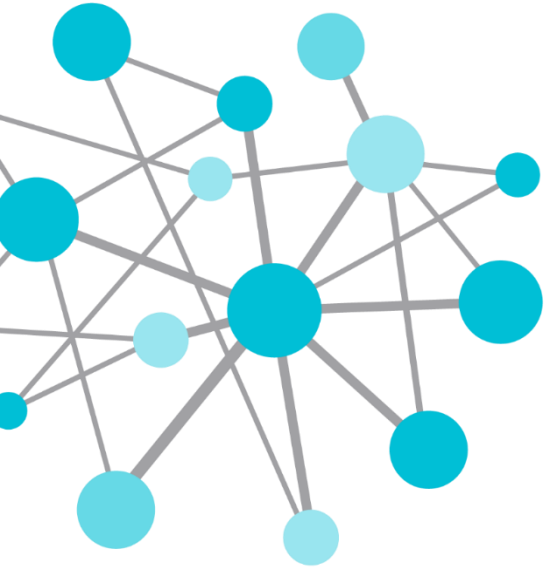
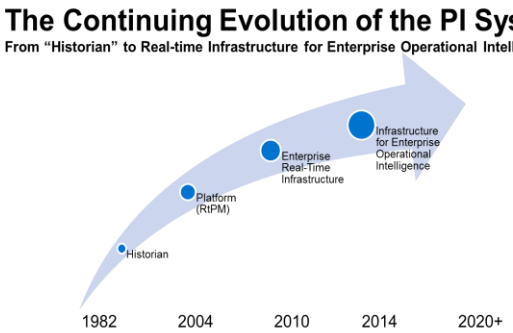





# Topics in O&G and Petrochemicals

## "The Evolution Continues"

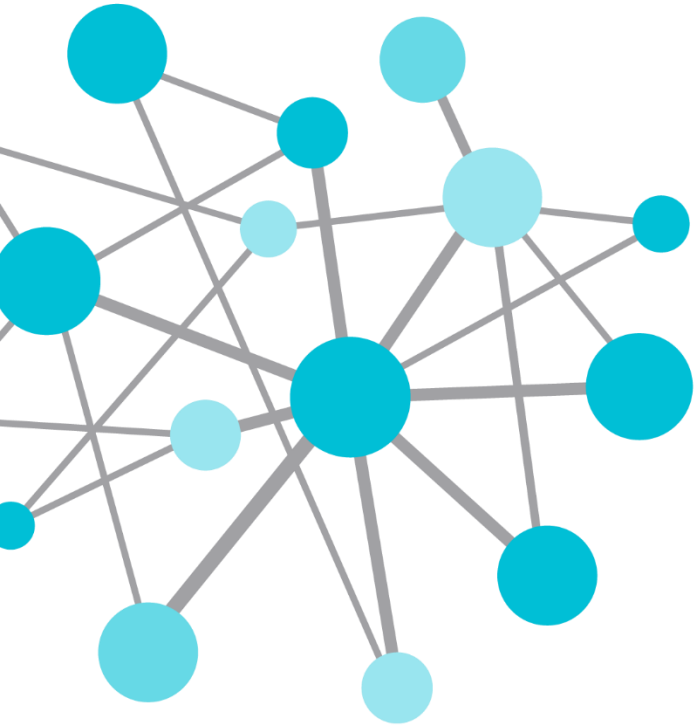
Moderated by: **Craig Harclerode**

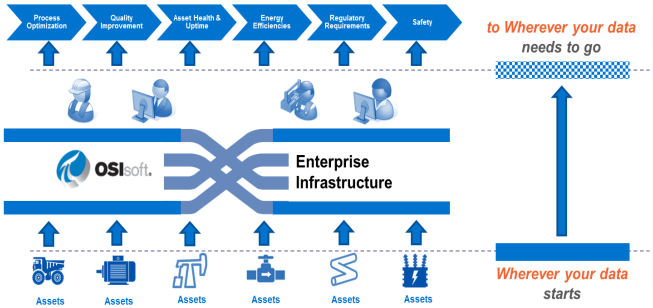
**O&G Industry Principal**

OSIsoft.

# Segment Overview

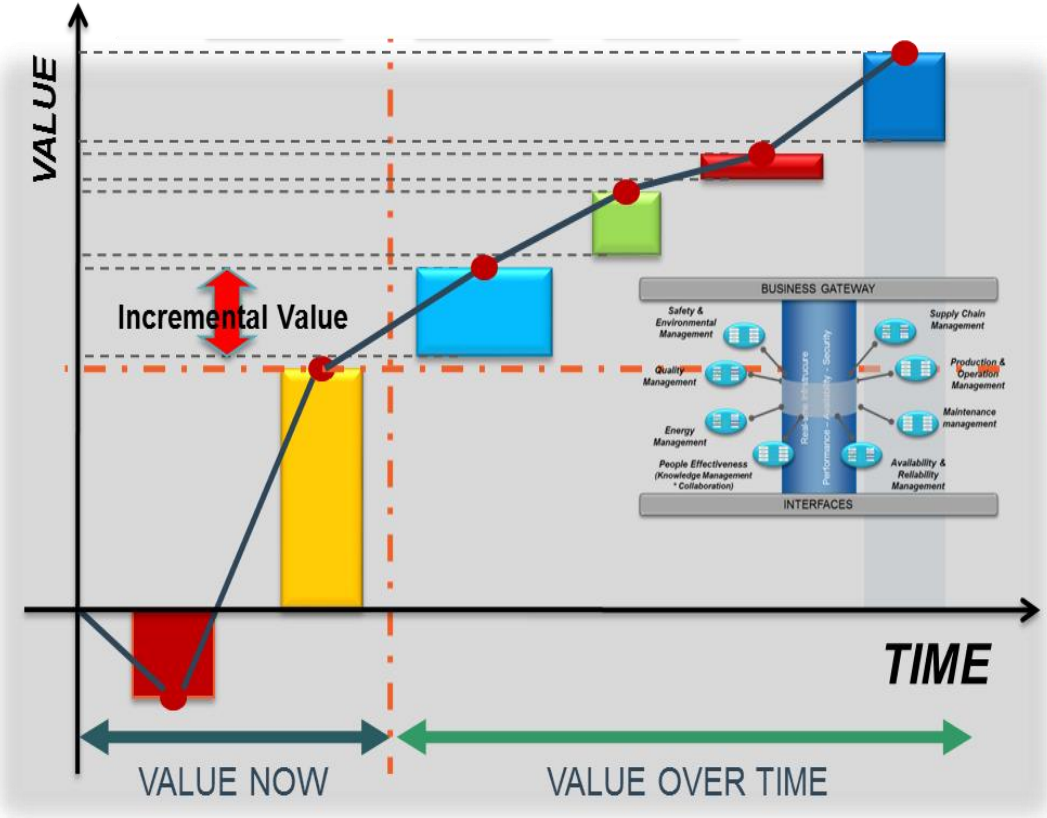
- Introduction and Context
- The Integrated Value Chain
- Update on Key E&P Interfaces & Connectors
- Advanced Analytics and Visualization
- Concluding Remarks and Q&A






# The Big Picture

# An “Infrastructure vs Solutions Approach




Performance Management

Environmental Reporting

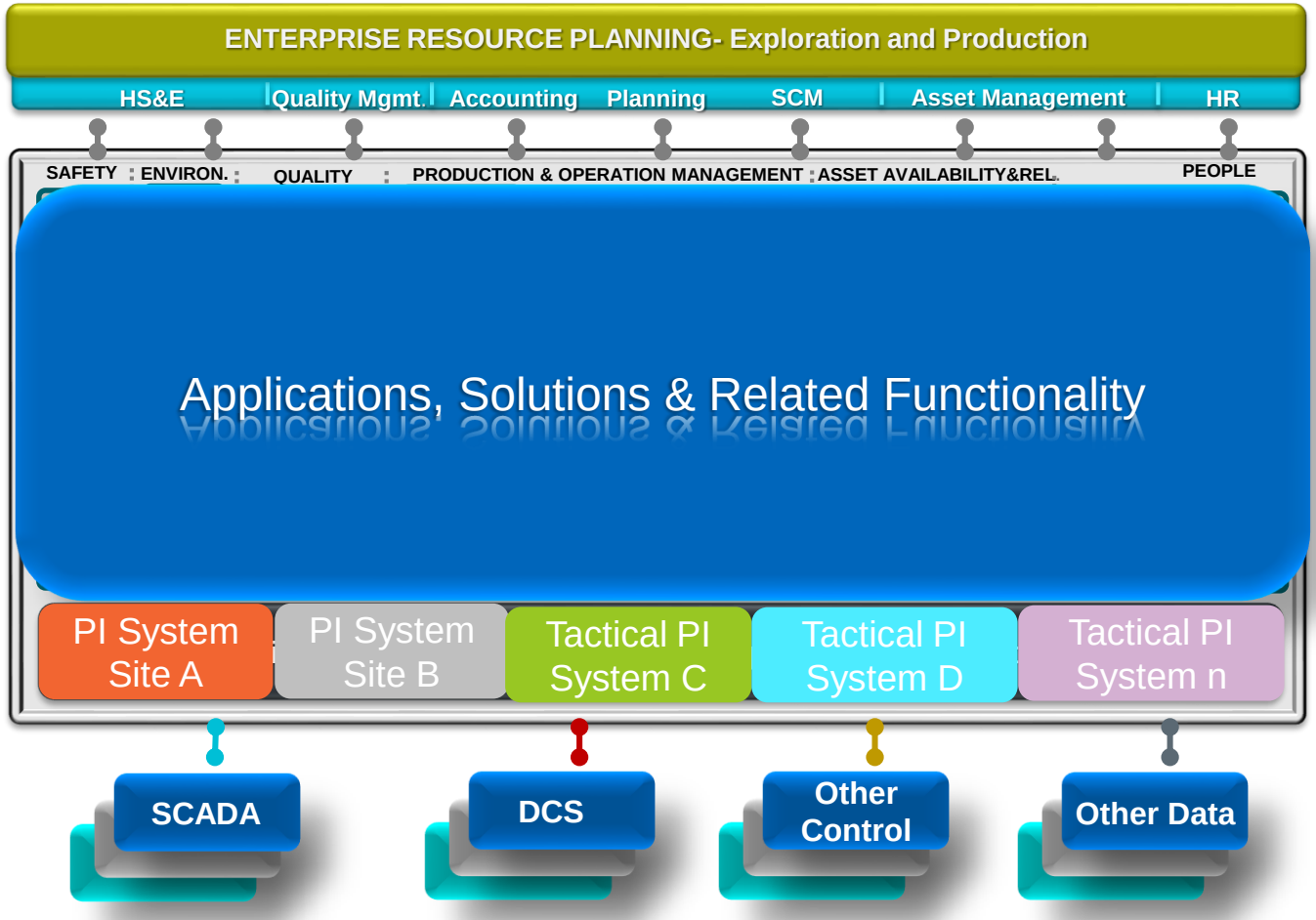
Equipment Health Mgmt.

Operations Management

Initial Infrastructure Value

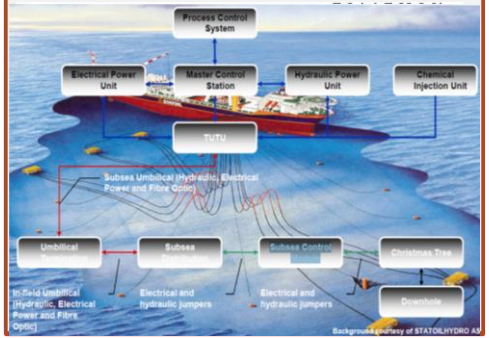
Infrastructure Initial Investment

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

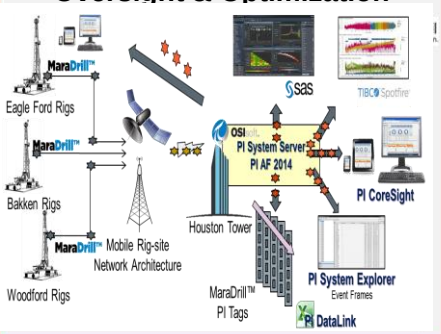


# Enabling Op Ex in All Areas of E&P

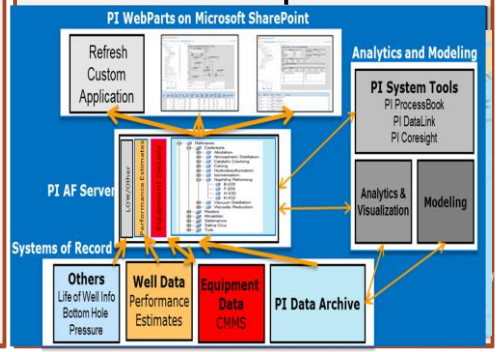
## Asset Performance, Reliability, & Portfolio Management



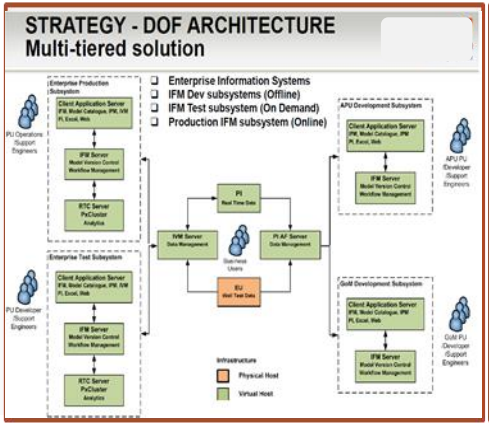

## Drilling and Completion Oversight & Optimization



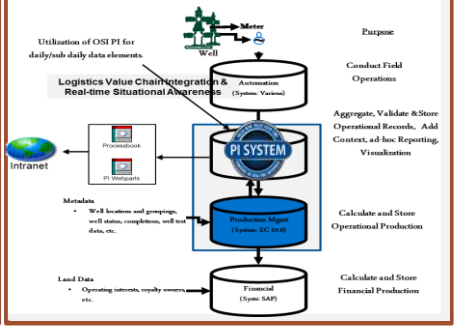

## Production Operational Excellence & Optimization



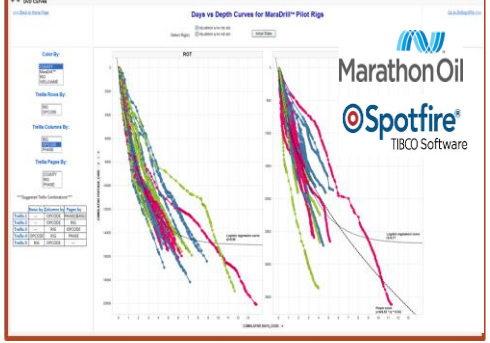

## STRATEGY - DOF ARCHITECTURE
## Multi-tiered solution



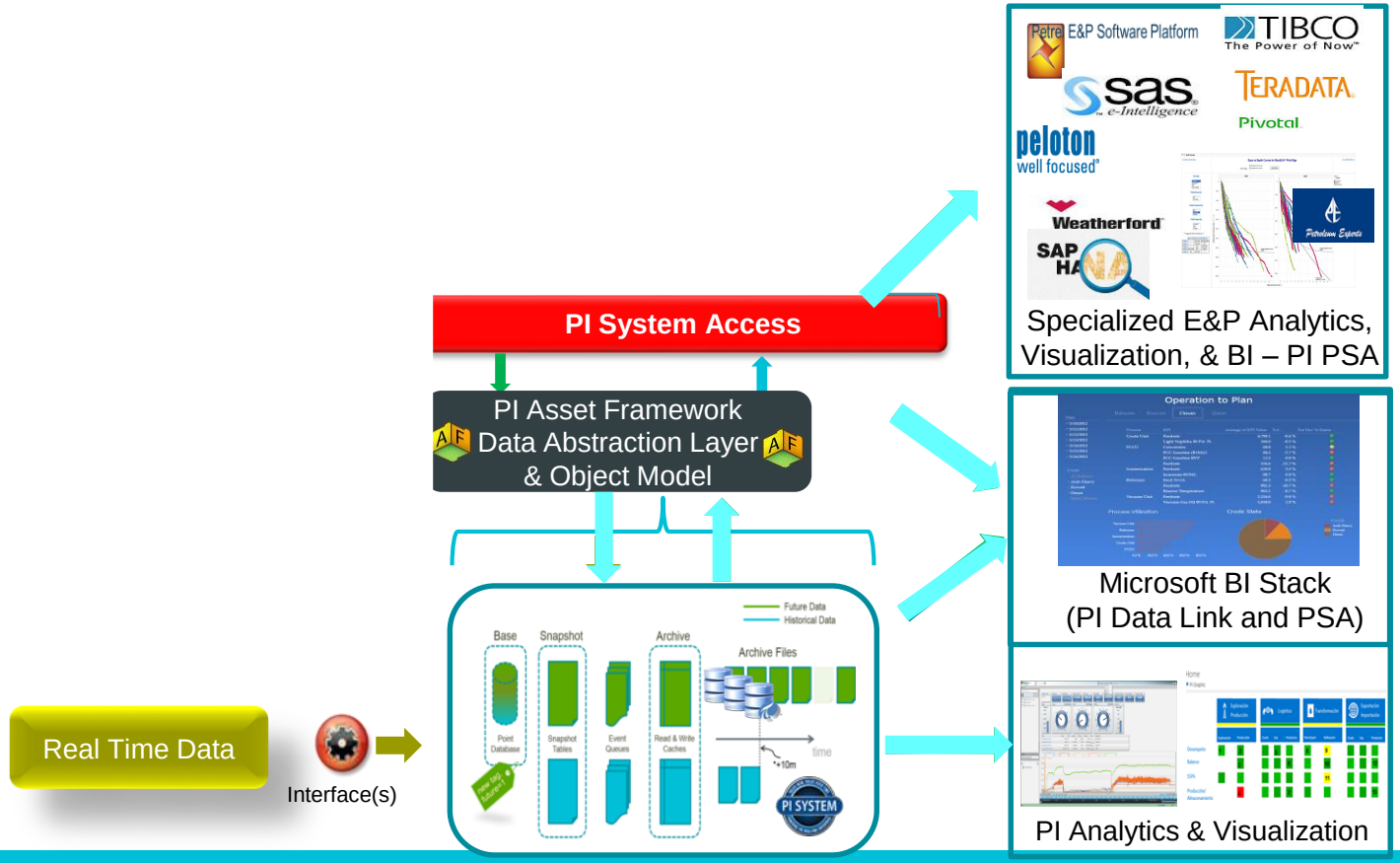

## Augmentation of "Best of Breed" Solutions




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

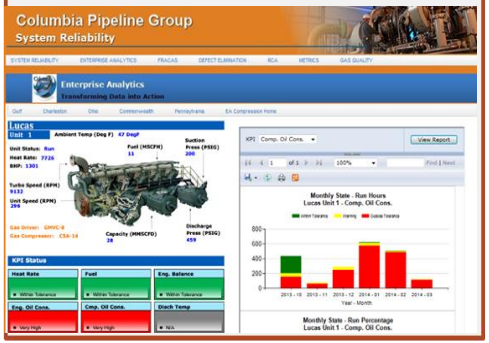


# OSIsoft PI System Analytics and Visualization - The Foundation for E&P Dashboards and Workflow Integration



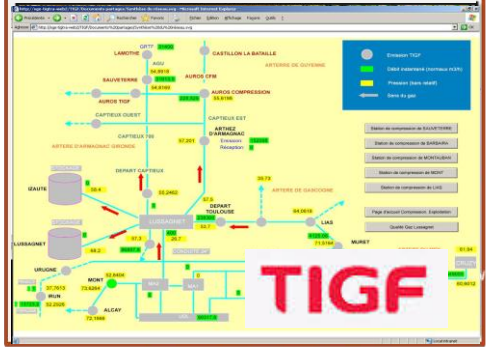
# Enabling Op Ex in All Areas of O&G Logistics

## Asset Performance, Reliability, & Portfolio Management

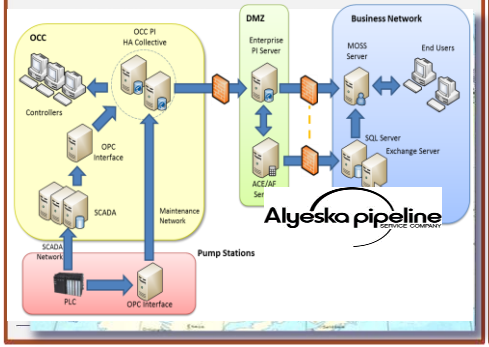



## Geospatial Integration "Real-Time & Space"

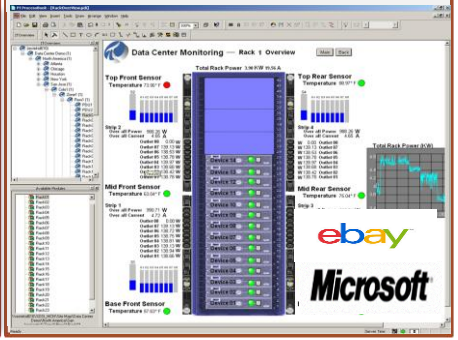
## Gas Value Chain Integration & RT Situational Awareness



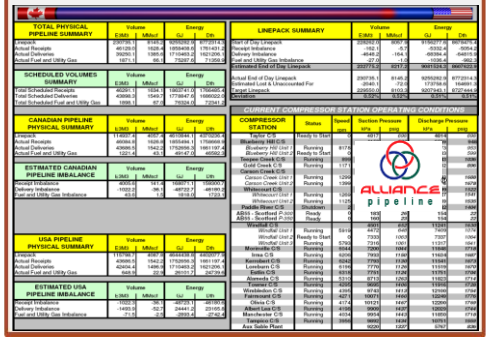

## SCADA/DCS Augmentation




## IT/SCADA Infrastructure Energy & Reliability Mgmnt

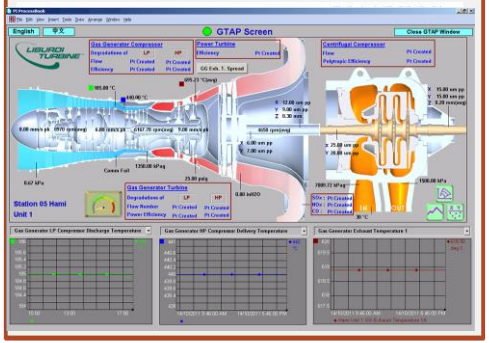



## Compliance Reporting, Environmental & Energy Mgmt.

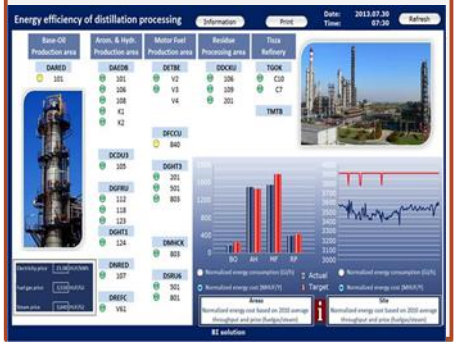


# Enabling Op Ex in Hydrocarbon Processing

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

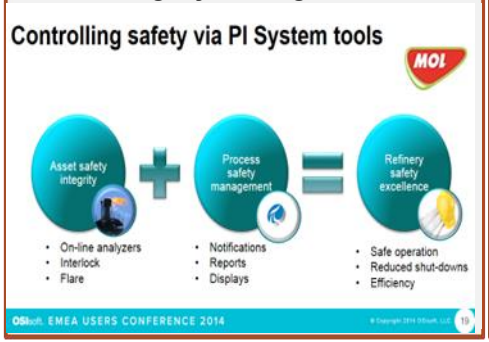



## Environmental, Energy & Utilities Management

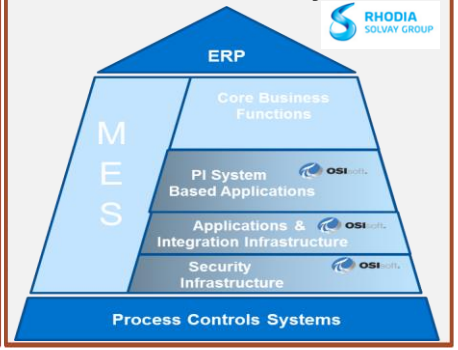



## Ops Visibility, Reporting & Analytics, YA, "live" KPIs, & Model Based PvA

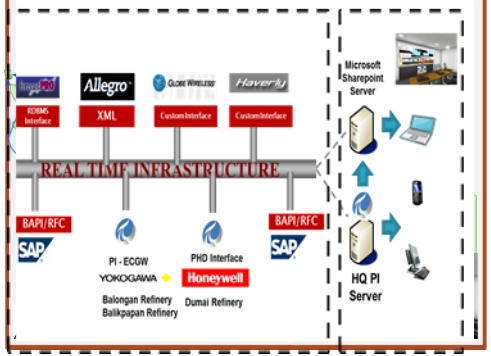

## Safety & Reactive/Proactive Integrity Management




## Infrastructure for MES MES AND The PI System




## Value Chain Integration & Real-time Situational Awareness

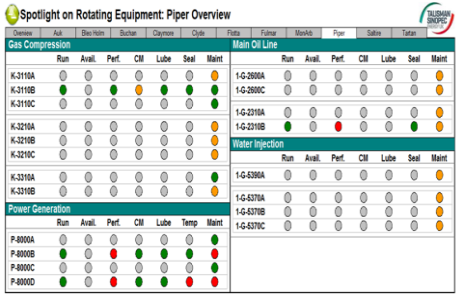


# Case Study –
# Talisman Sinopec

## Leveraging PI AF for Critical Equipment Reliability Improvement on a Fleet of Remote Assets

# Real-Time Monitoring of Rotating Equipment

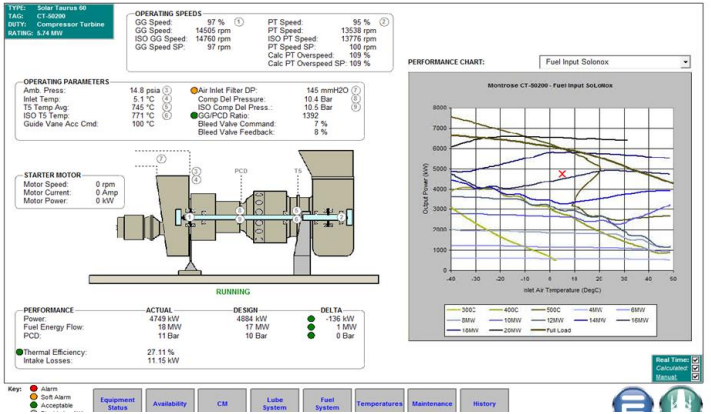
Talisman Sinopec




SPOTLIGHT

TALISMAN SINOPEC ENERGY UK

UC2013
UC2014




## CHALLENGES

**Globally diverse** critical rotating equipment environment

Issues with **integrity**, **reliability**, and related **production losses**

Inability to **capture** and leverage **knowledge** of subject matter experts

**Inconsistency** in analytics, visualization/KPIs, and reporting

## SOLUTION

Implemented the Strategic Rotating Equipment **Excellence Program**

PI System based solution **SPOTLIGHT** to monitor 2,900 safety, production, and water critical pieces of rotating equipment

**Goals**:
Improve reliability
Improve equipment integrity
Reduce production losses

## RESULTS

**Standardization and Consistency** in displays, calculations, and points

Continuous **monitoring** of values against alarm limits

**Reduced** the amount of critical rotating equipment **failures**, saved about 220K BOE in 6 months

Improved **visibility** of water related systems

# Business Challenge
# Increase Reliability on 8 Offshore Production Platforms

## Safety Critical Equipment

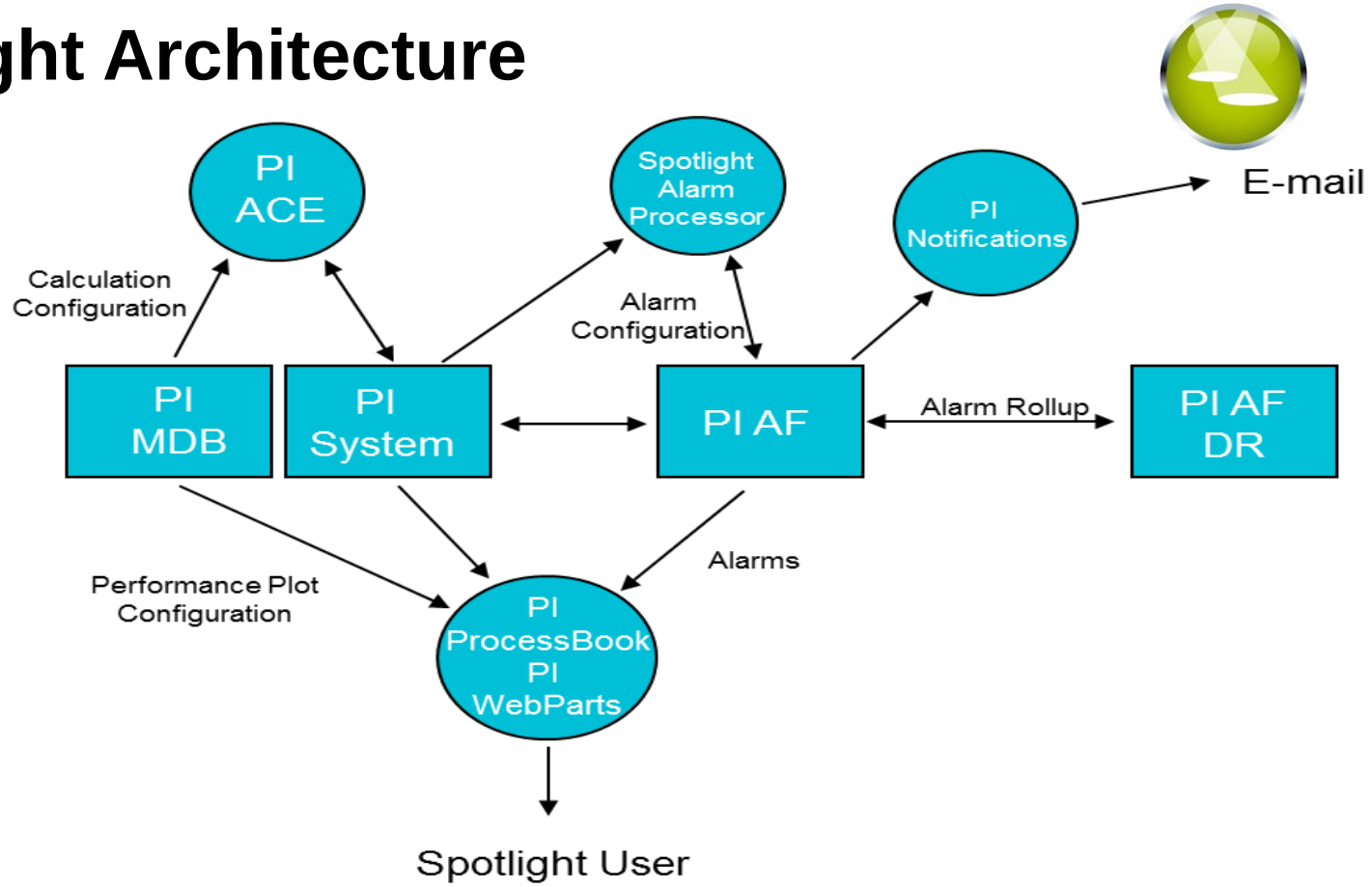
- 39 Diesel Drive Fire Pumps
- 6 Electric Drive Fire Pumps
- 8 Hydraulic drive fire pumps
- 15 Emergency Power Generation Packages
- 26 Bilge / Ballast Pumps
- 53 Other Safety Critical Pumps

## Production Critical Equipment

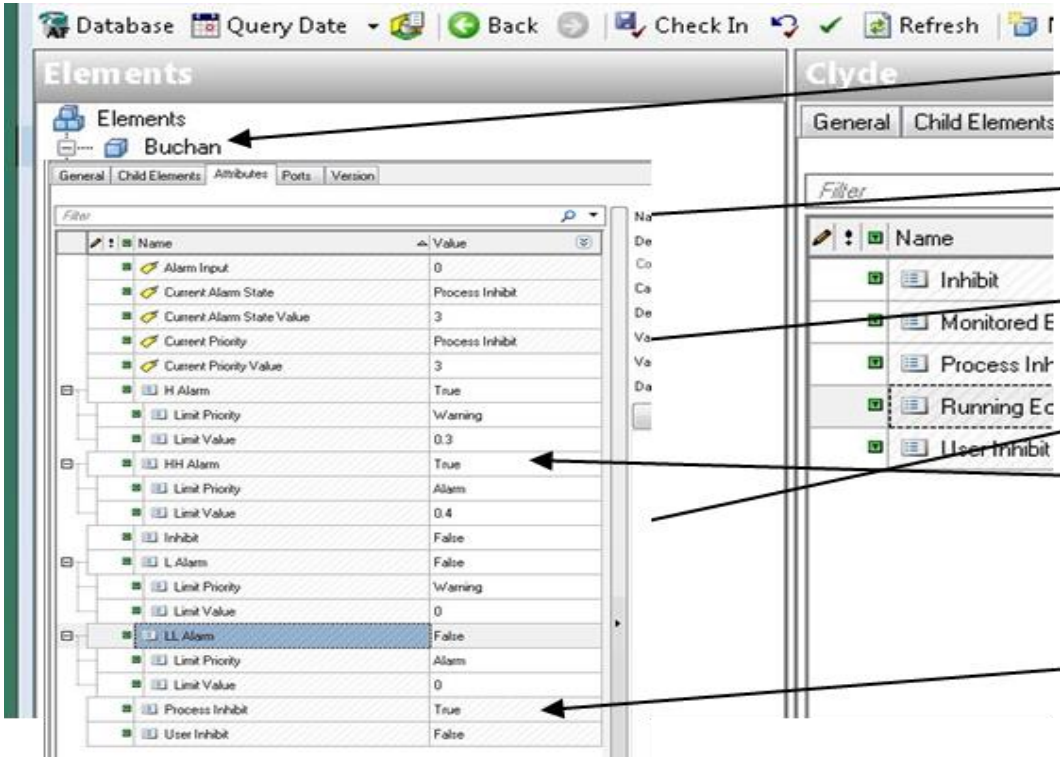
- 56 Gas Turbines
- 40 Gas Compressors
- 9 Diesel Engines for Main Power Generation
- 27 Main Water Injection, P.W. & Artificial Lift Pumps
- 35 Main Oil Line Pumps
- Circa 2711 Operational Pumps

A total of 2831 pieces of Major Rotating Equipment

# Spotlight Architecture



# PI AF Is the Foundation




Asset/Equipment Tree Structure

Individual Equipment (run indicators, etc.)

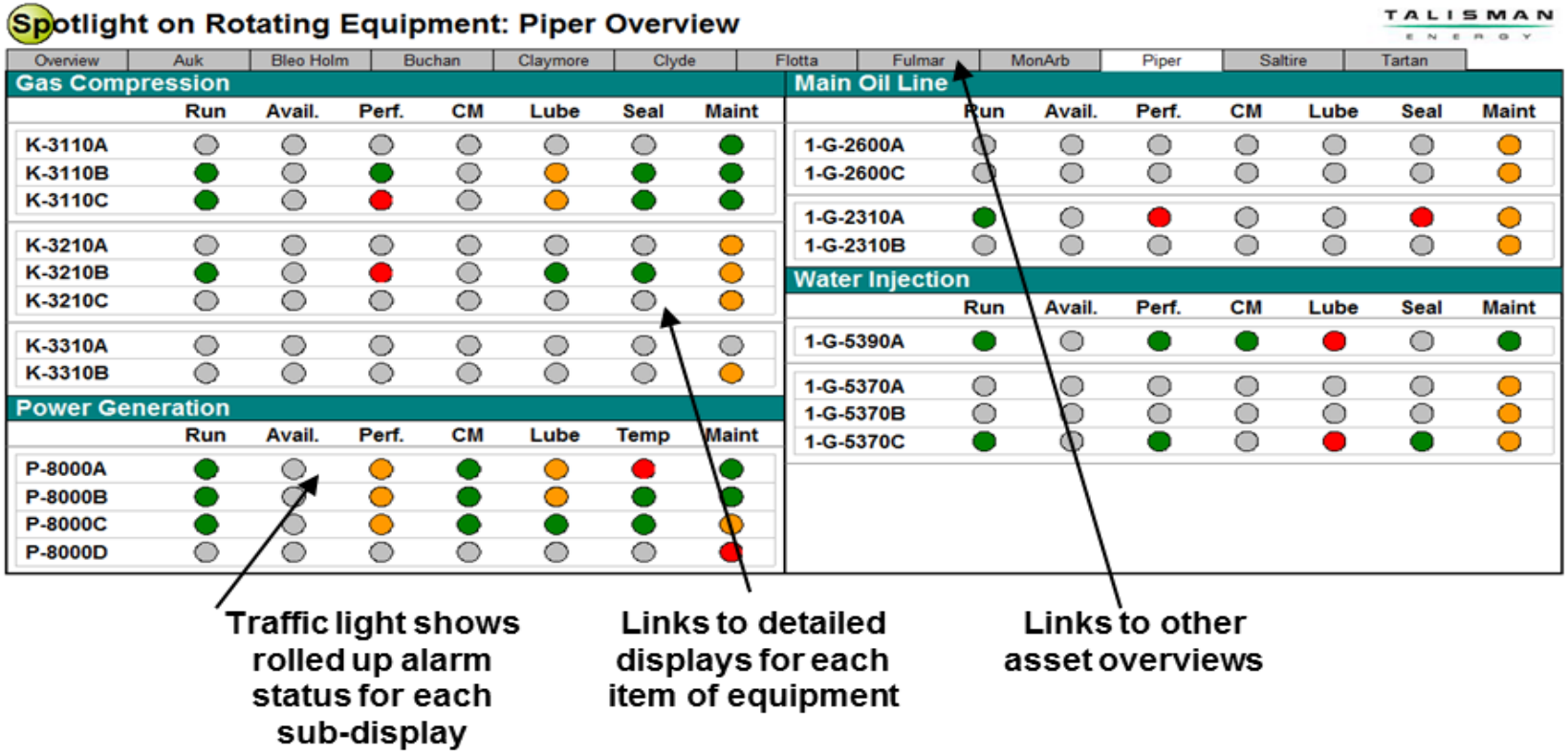
Displays (alarm rollup for summary)

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

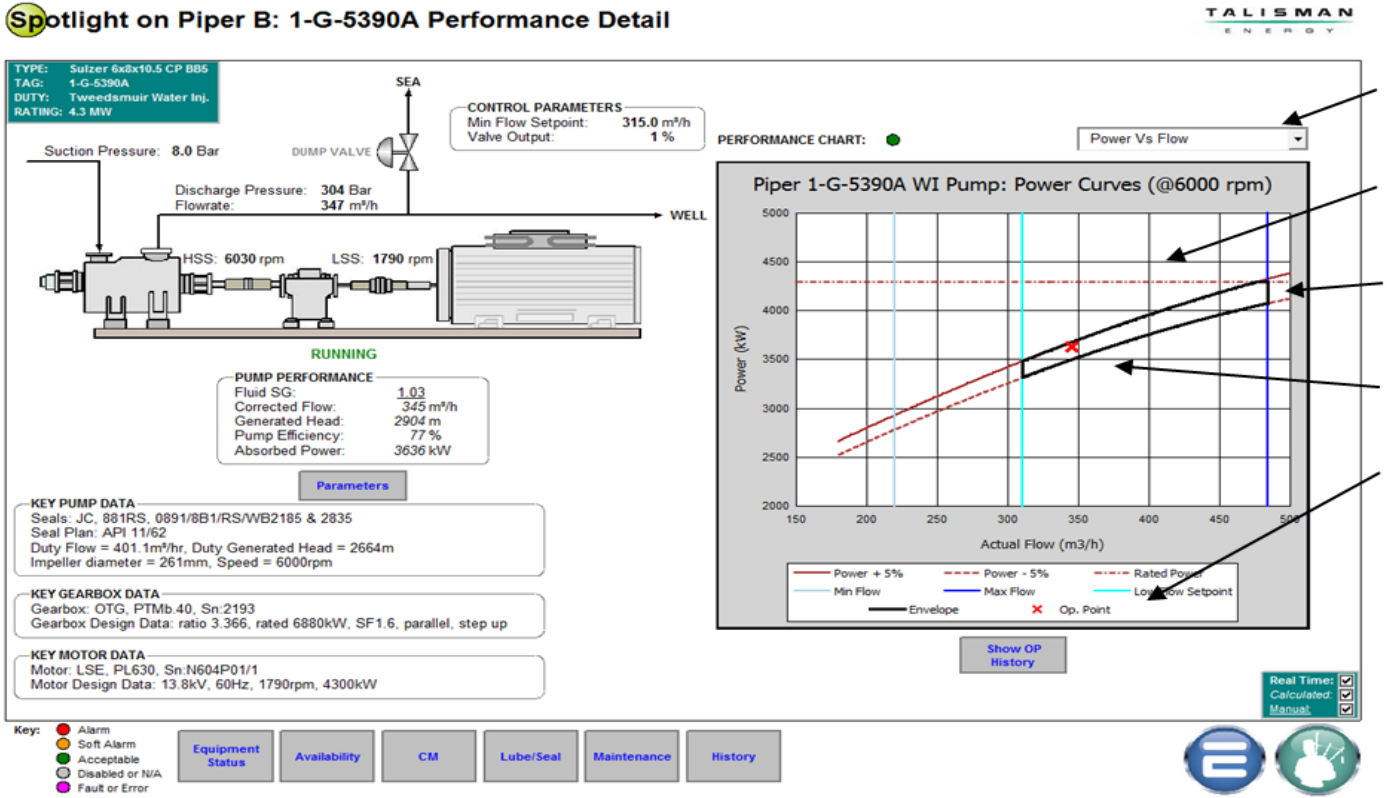
Alarm limits configuration

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

# Displays – KPI with High Fidelity Drill Down



# Improving Critical Rotating Equipment Reliability and Performance



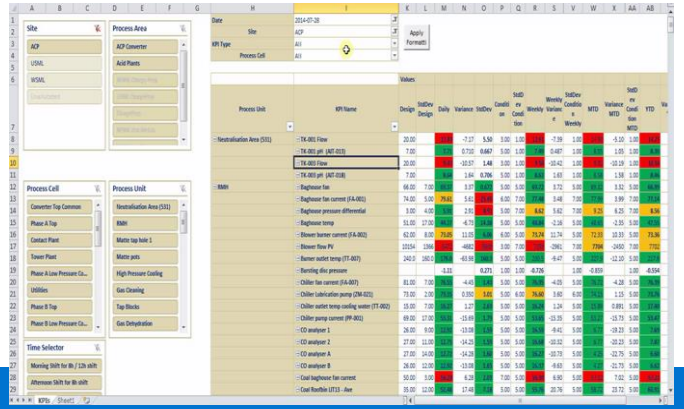

User can select different charts associated with this item

Chart showing performance constraints

Operating Envelope

Current operating point

View operating point history over varying time periods

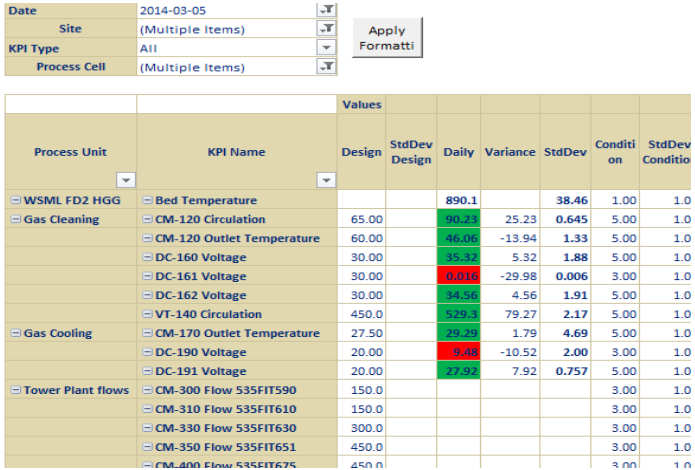


# Case Study –
# Anglo American

## Dynamic KPIs with End User Governance and Business Intelligence Capabilities Leveraging PI AF

# Going BI with KPIs

*“KPI building and maintenance was a nightmare, creating a lot of frustration due to long lead times. New KPI Applications standardizes, simplifies, and gives users ability to create and manage their own KPIs with ability to perform business intelligence and analytics”*



| Date | 2014-03-05 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Site | (Multiple Items) | | | | | | | |
| KPI Type | All | | | | | | | |
| Process Cell | (Multiple Items) | | | | | | | |

Apply Formatti

| | | Values | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Process Unit | KPI Name | Design | StdDev Design | Daily | Variance | StdDev | Condition | StdDev Conditio |
| WSML FD2 HGG | Bed Temperature | | | 890.1 | | 38.46 | 1.00 | 1.0 |
| Gas Cleaning | CM-120 Circulation | 65.00 | | 90.23 | 25.23 | 0.645 | 5.00 | 1.0 |
| | CM-120 Outlet Temperature | 60.00 | | 46.06 | -13.94 | 1.33 | 5.00 | 1.0 |
| | DC-160 Voltage | 30.00 | | 35.32 | 5.32 | 1.88 | 5.00 | 1.0 |
| | DC-161 Voltage | 30.00 | | 0.016 | -29.98 | 0.006 | 3.00 | 1.0 |
| | DC-162 Voltage | 30.00 | | 34.56 | 4.56 | 1.91 | 5.00 | 1.0 |
| | VT-140 Circulation | 450.0 | | 529.3 | 79.27 | 2.17 | 5.00 | 1.0 |
| Gas Cooling | CM-170 Outlet Temperature | 27.50 | | 29.29 | 1.79 | 4.69 | 5.00 | 1.0 |
| | DC-190 Voltage | 20.00 | | -9.48 | -10.52 | 2.00 | 3.00 | 1.0 |
| | DC-191 Voltage | 20.00 | | 27.92 | 7.92 | 0.757 | 5.00 | 1.0 |
| Tower Plant flows | CM-300 Flow 535FIT590 | 150.0 | | | | | 3.00 | 1.0 |
| | CM-310 Flow 535FIT610 | 150.0 | | | | | 3.00 | 1.0 |
| | CM-330 Flow 535FIT630 | 300.0 | | | | | 3.00 | 1.0 |
| | CM-350 Flow 535FIT651 | 450.0 | | | | | 3.00 | 1.0 |
| | CM-400 Flow 535FIT675 | 450.0 | | | | | 3.00 | 1.0 |

## Business Challenge

- KPIs were onerous to create and troubleshoot
- Configuration was complex
- KPIs were growing
- More plants wanted KPI reports
- KPIs were inflexible

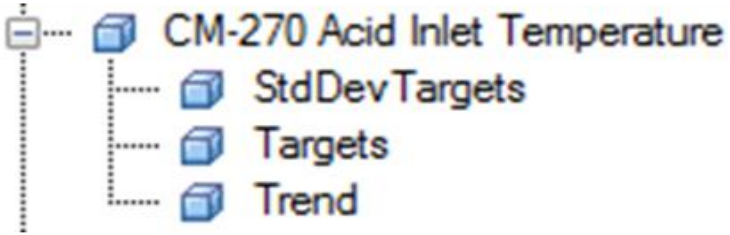
## Solution

- PI System for daily/ shift totals
- PI Asset Framework for KPIs and hierarchy configuration and data extraction
- Microsoft Analysis Service tabular model to aggregate up
- Excel Pivot table for reporting

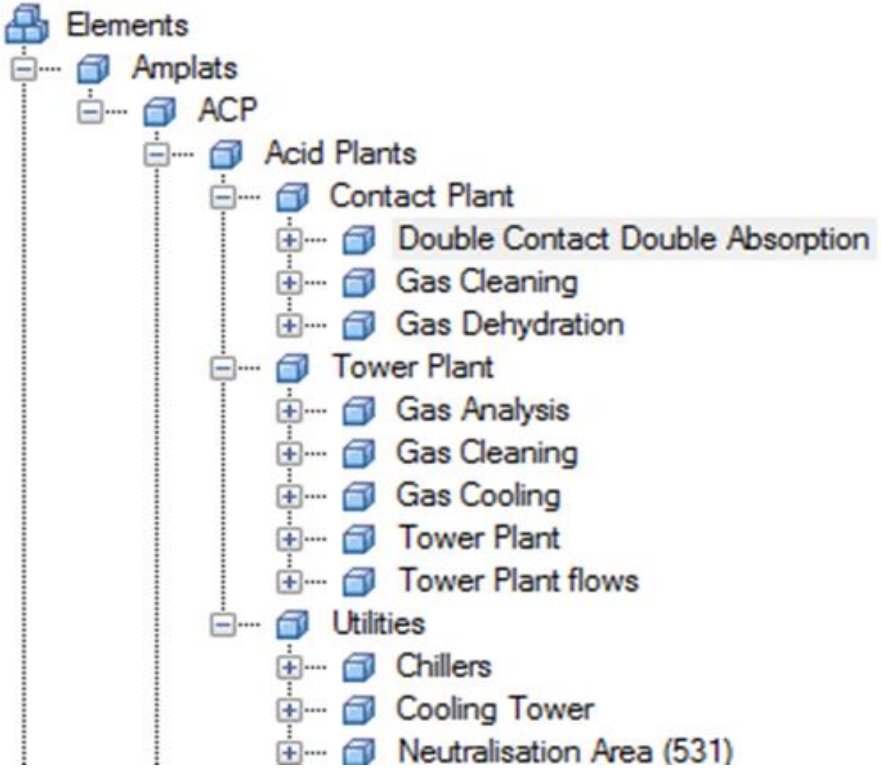
## Results and Benefits

- KPI creation from 6 to 3 steps
- One report
- Quick rollout (30min)
- More user control
- Flexible reporting
- Enterprise Alignment

# Standardized PI AF Structure for the Enterprise

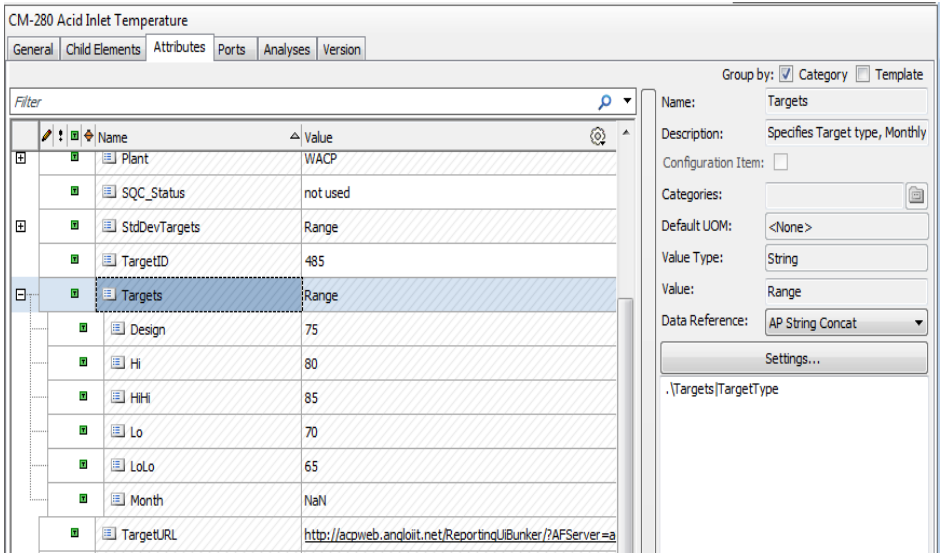


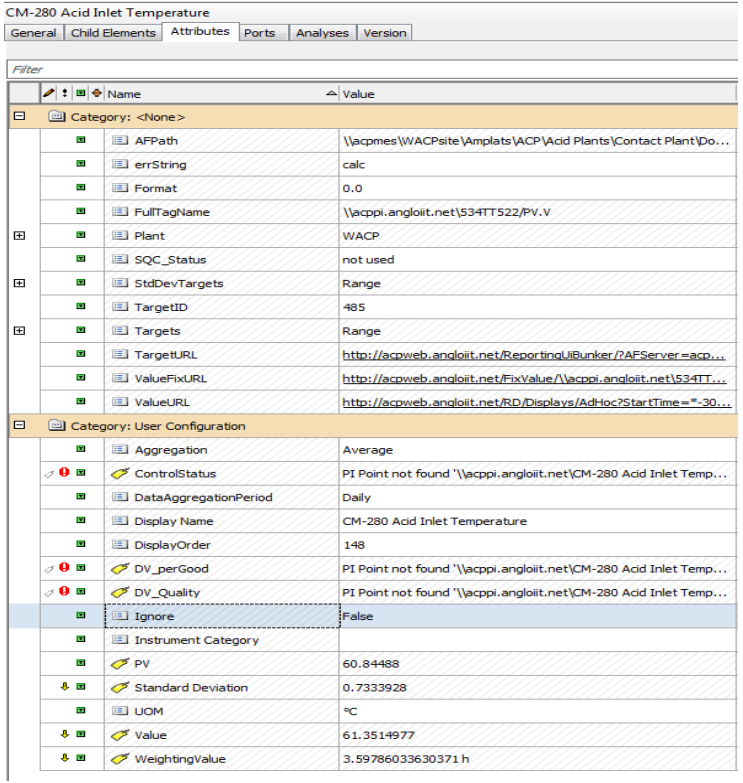

- **PI AF Configuration**
- **Structure and Values**
- **Ad-hoc trends**



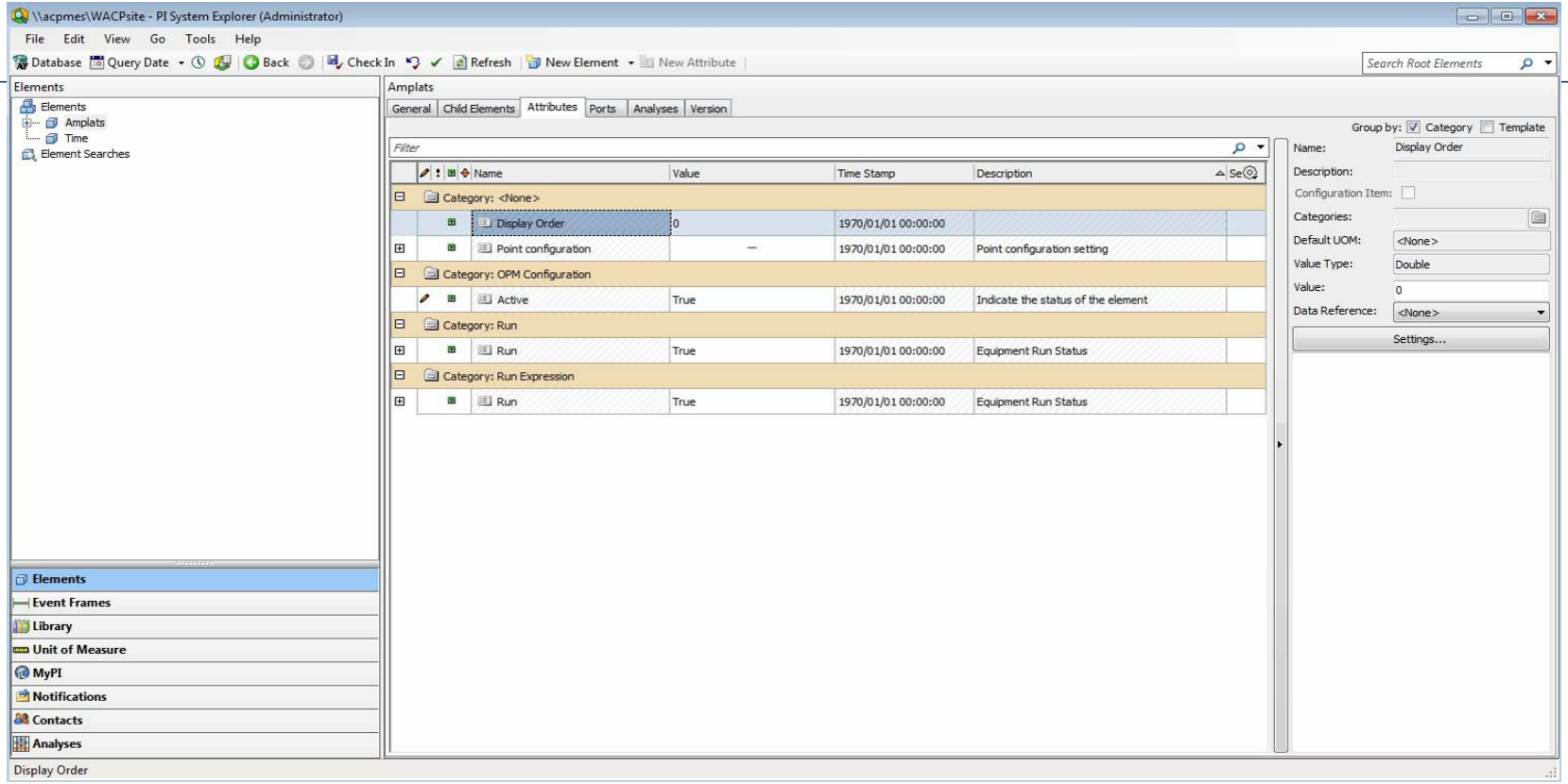
# Use Configurable KPI Capability

- **39 Attributes**
- **14 are user configurable**

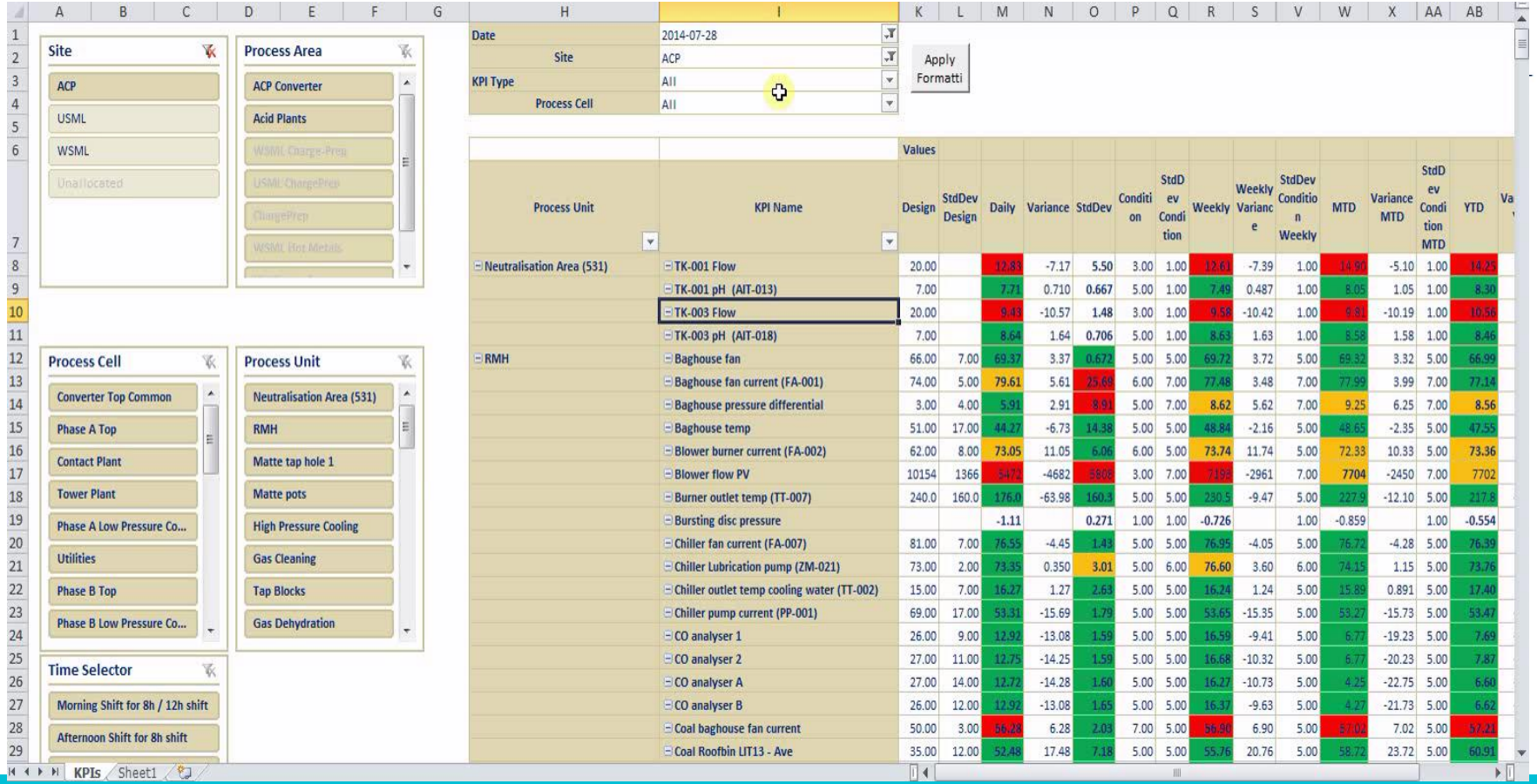


# Demonstration – PI AF configuration



# Demonstration – Report



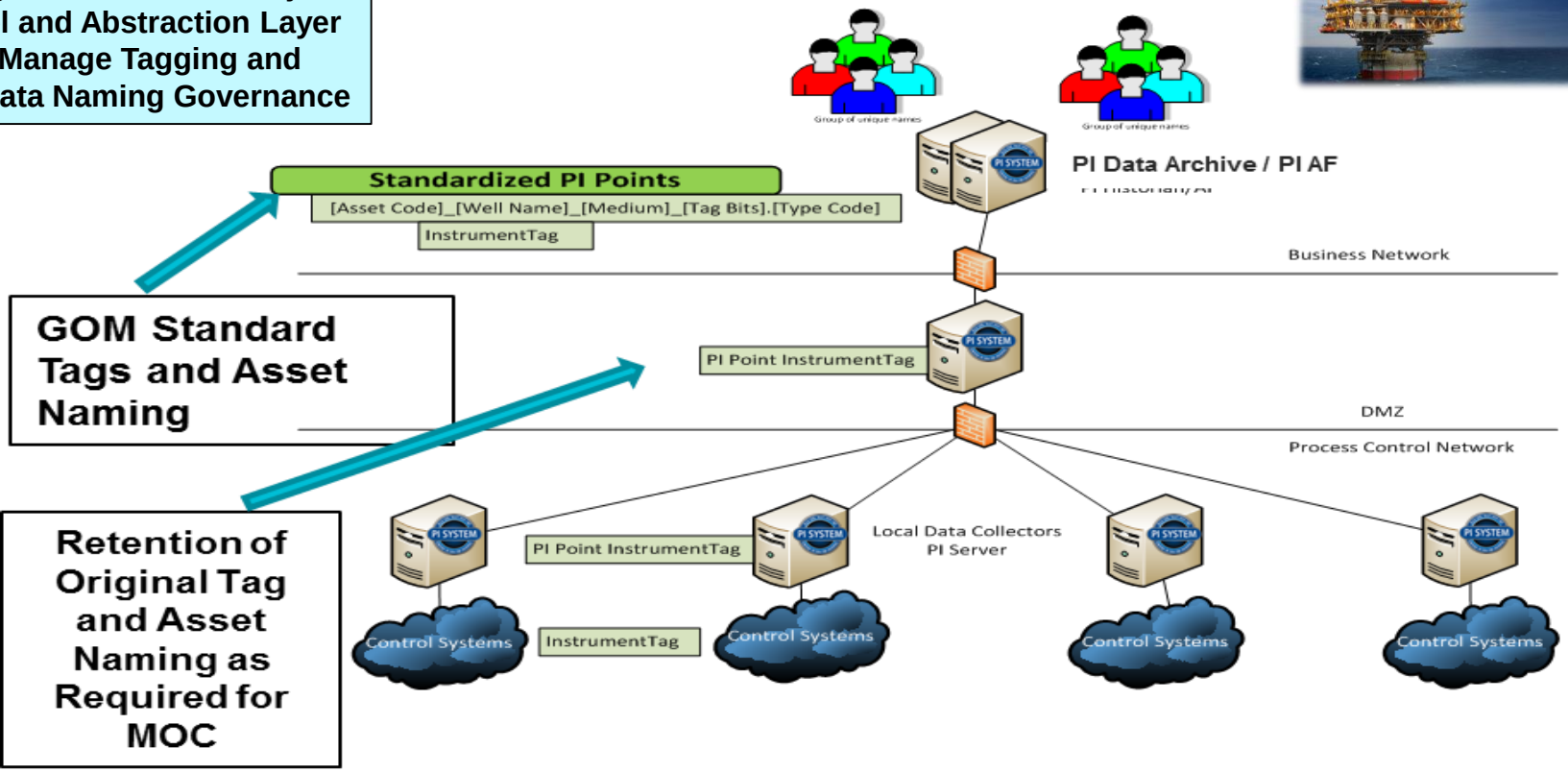

| Process Unit | KPI Name | Values | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Design | StdDev Design | Daily | Variance | StdDev | Condition | StdDev Condition | Weekly | Weekly Variance | StdDev Condition Weekly | MTD | Variance MTD | StdDev Condition MTD | YTD | Va |
| Neutralisation Area (531) | TK-001 Flow | 20.00 | | 12.83 | -7.17 | 5.50 | 3.00 | 1.00 | 12.61 | -7.39 | 1.00 | 14.90 | -5.10 | 1.00 | 14.25 | |
| | TK-001 pH (AIT-013) | 7.00 | | 7.71 | 0.710 | 0.667 | 5.00 | 1.00 | 7.49 | 0.487 | 1.00 | 8.05 | 1.05 | 1.00 | 8.30 | |
| | TK-003 Flow | 20.00 | | 9.43 | -10.57 | 1.48 | 3.00 | 1.00 | 9.58 | -10.42 | 1.00 | 9.81 | -10.19 | 1.00 | 10.56 | |
| | TK-003 pH (AIT-018) | 7.00 | | 8.64 | 1.64 | 0.706 | 5.00 | 1.00 | 8.63 | 1.63 | 1.00 | 8.58 | 1.58 | 1.00 | 8.46 | |
| RMH | Baghouse fan | 66.00 | 7.00 | 69.37 | 3.37 | 0.672 | 5.00 | 5.00 | 69.72 | 3.72 | 5.00 | 69.32 | 3.32 | 5.00 | 66.99 | |
| | Baghouse fan current (FA-001) | 74.00 | 5.00 | 79.61 | 5.61 | 25.69 | 6.00 | 7.00 | 77.48 | 3.48 | 7.00 | 77.99 | 3.99 | 7.00 | 77.14 | |
| | Baghouse pressure differential | 3.00 | 4.00 | 5.91 | 2.91 | 8.91 | 5.00 | 7.00 | 8.62 | 5.62 | 7.00 | 9.25 | 6.25 | 7.00 | 8.56 | |
| | Baghouse temp | 51.00 | 17.00 | 44.27 | -6.73 | 14.38 | 5.00 | 5.00 | 48.84 | -2.16 | 5.00 | 48.65 | -2.35 | 5.00 | 47.55 | |
| | Blower burner current (FA-002) | 62.00 | 8.00 | 73.05 | 11.05 | 6.06 | 6.00 | 5.00 | 73.74 | 11.74 | 5.00 | 72.33 | 10.33 | 5.00 | 73.36 | |
| | Blower flow PV | 10154 | 1366 | 5472 | -4682 | 5808 | 3.00 | 7.00 | 7192 | -2961 | 7.00 | 7704 | -2450 | 7.00 | 7702 | |
| | Burner outlet temp (TT-007) | 240.0 | 160.0 | 176.0 | -63.98 | 160.3 | 5.00 | 5.00 | 230.5 | -9.47 | 5.00 | 227.9 | -12.10 | 5.00 | 217.8 | |
| | Bursting disc pressure | | | -1.11 | | 0.271 | 1.00 | 1.00 | -0.726 | | 1.00 | -0.859 | | 1.00 | -0.554 | |
| | Chiller fan current (FA-007) | 81.00 | 7.00 | 76.55 | -4.45 | 1.43 | 5.00 | 5.00 | 76.95 | -4.05 | 5.00 | 76.72 | -4.28 | 5.00 | 76.39 | |
| | Chiller Lubrication pump (ZM-021) | 73.00 | 2.00 | 73.35 | 0.350 | 3.01 | 5.00 | 6.00 | 76.60 | 3.60 | 6.00 | 74.15 | 1.15 | 5.00 | 73.76 | |
| | Chiller outlet temp cooling water (TT-002) | 15.00 | 7.00 | 16.27 | 1.27 | 2.63 | 5.00 | 5.00 | 16.24 | 1.24 | 5.00 | 15.89 | 0.891 | 5.00 | 17.40 | |
| | Chiller pump current (PP-001) | 69.00 | 17.00 | 53.31 | -15.69 | 1.79 | 5.00 | 5.00 | 53.65 | -15.35 | 5.00 | 53.27 | -15.73 | 5.00 | 53.47 | |
| | CO analyser 1 | 26.00 | 9.00 | 12.92 | -13.08 | 1.59 | 5.00 | 5.00 | 16.59 | -9.41 | 5.00 | 6.77 | -19.23 | 5.00 | 7.69 | |
| | CO analyser 2 | 27.00 | 11.00 | 12.75 | -14.25 | 1.59 | 5.00 | 5.00 | 16.68 | -10.32 | 5.00 | 6.77 | -20.23 | 5.00 | 7.87 | |
| | CO analyser A | 27.00 | 14.00 | 12.72 | -14.28 | 1.60 | 5.00 | 5.00 | 16.27 | -10.73 | 5.00 | 4.25 | -22.75 | 5.00 | 6.60 | |
| | CO analyser B | 26.00 | 12.00 | 12.92 | -13.08 | 1.65 | 5.00 | 5.00 | 16.37 | -9.63 | 5.00 | 4.27 | -21.73 | 5.00 | 6.62 | |
| | Coal baghouse fan current | 50.00 | 3.00 | 56.28 | 6.28 | 2.03 | 7.00 | 5.00 | 56.90 | 6.90 | 5.00 | 57.02 | 7.02 | 5.00 | 57.21 | |
| | Coal Roofbin LIT13 - Ave | 35.00 | 12.00 | 52.48 | 17.48 | 7.18 | 5.00 | 5.00 | 55.76 | 20.76 | 5.00 | 58.72 | 23.72 | 5.00 | 60.91 | |

# Case Study –

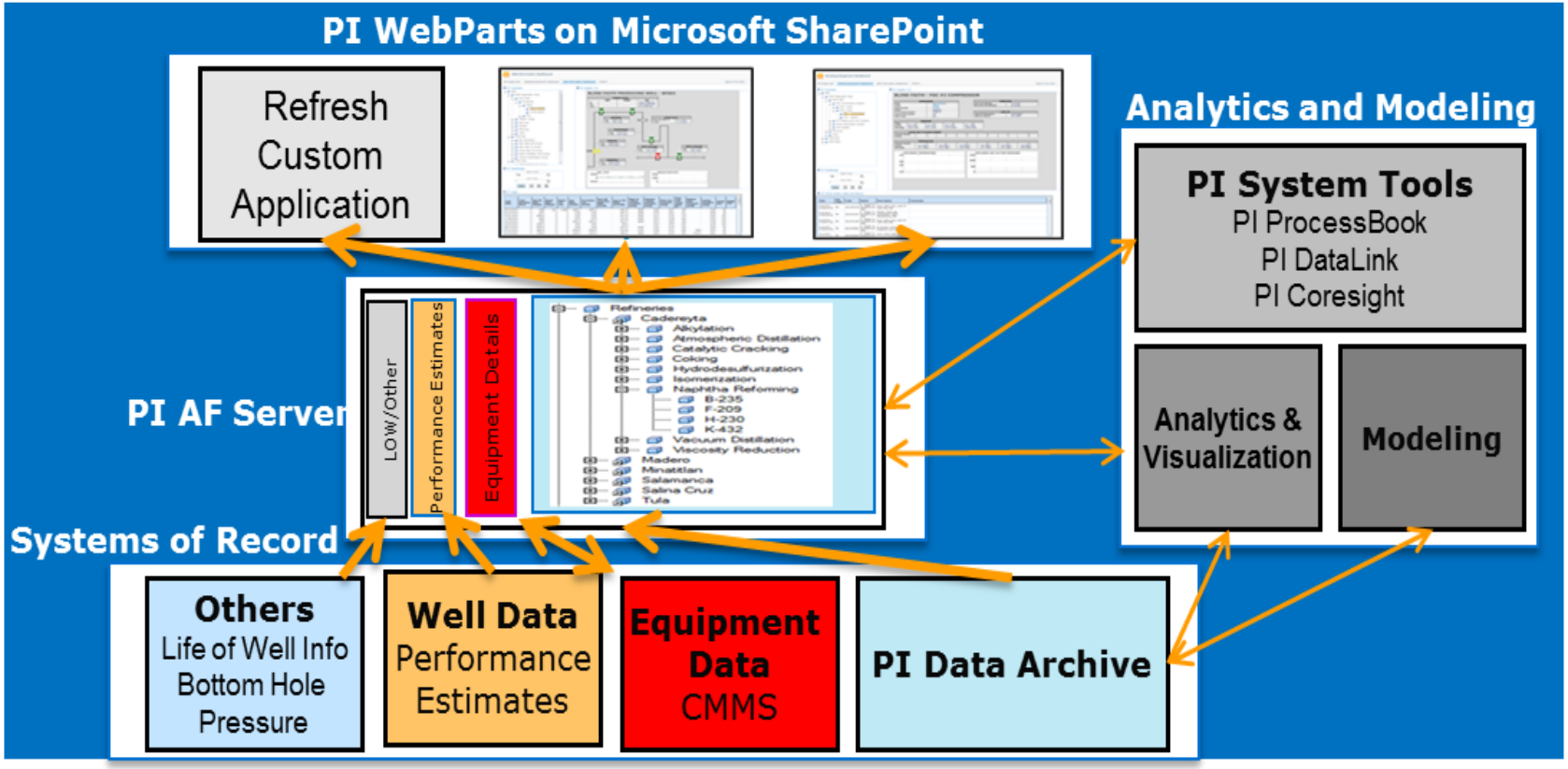
## Leveraging PI AF as a Data Object Model and Abstraction Layer for Migrating from Diverse Tags to Normalized Asset Naming

# GOM PI System Infrastructure

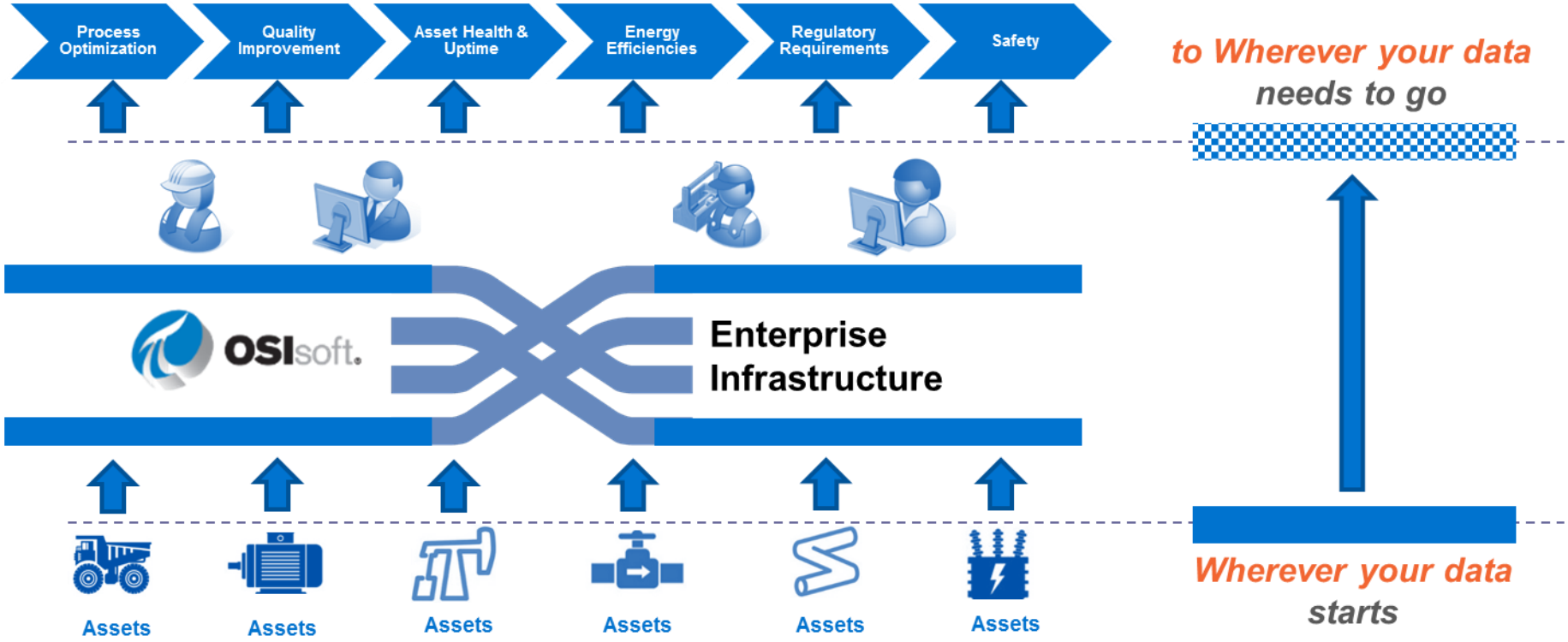
**Using PI AF as a Data Object Model and Abstraction Layer to Manage Tagging and Metadata Naming Governance**



# GOM PI System Solution



# An Enterprise Real Time Data Infrastructure

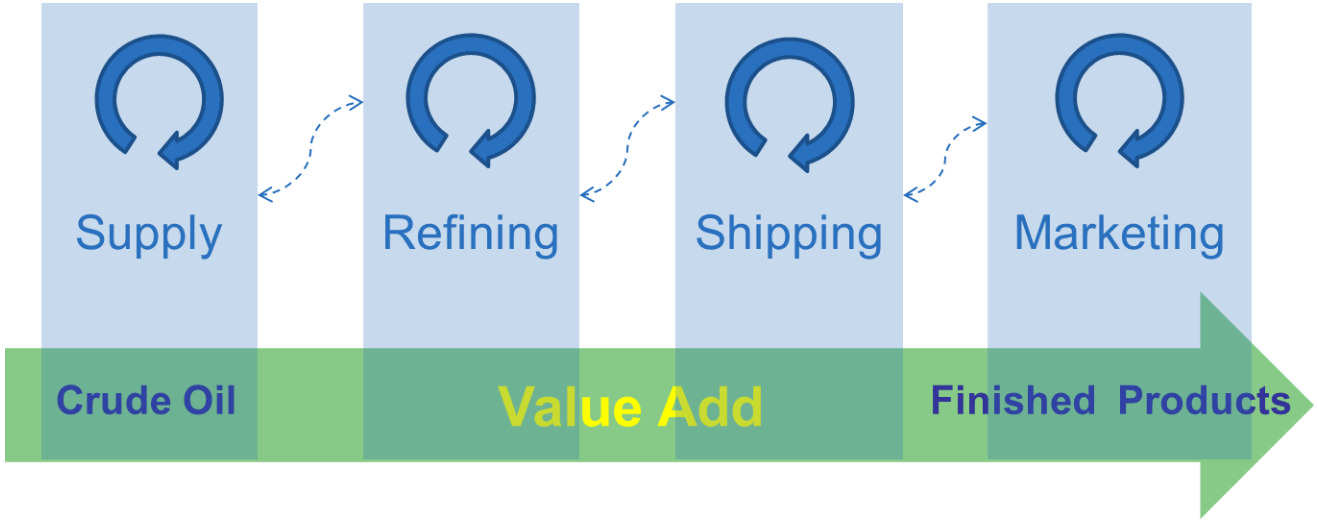


# Marine Fleet Condition Based Monitoring at Marathon Petroleum Company

Presented by **Joshua Schaublin**

Marathon Petroleum Company LP

# Fuels Value Chain Integration



Marathon Petroleum Company LP

# Condition Based Monitoring

Josh Schaublin

Adv IT Systems Integrator



# Agenda

- Marathon Petroleum Overview
- Marathon and PI
- MPC Marine - Condition Based Monitoring
- PI System
- Business use of The PI System
- Results and Benefits
- Dashboards
- Conclusion

# Marathon Petroleum Statistics at a Glance

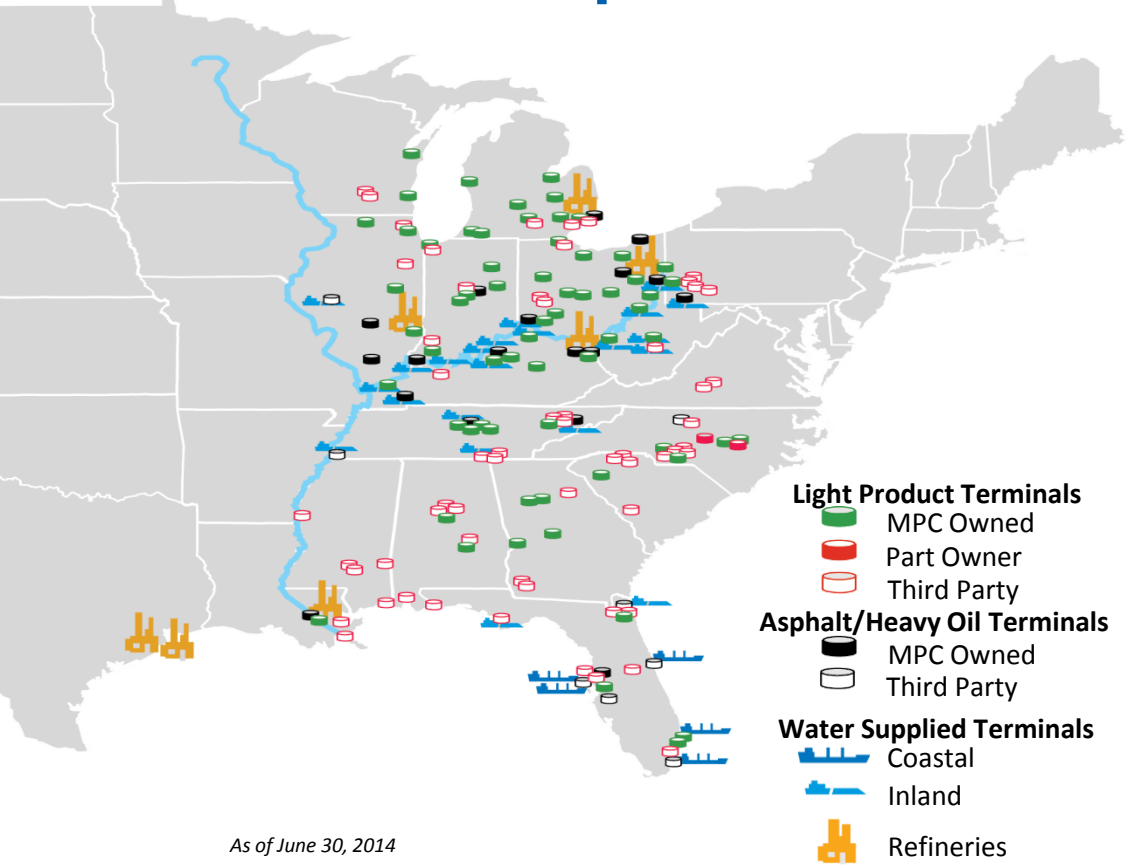
- Fortune 25 company
- Established in 1887
- Fourth largest U.S. refiner
  - Largest in Midwest
- 2013 Revenues and other income:
  $100.3 billion
- 2013 Net income attributable to MPC:
  $2.11 billion
- Employees: ~30,000
- Headquartered in Findlay, Ohio
- Approximately 2,740 Speedway convenience stores
- Approximately 5,300 Marathon Brand retail outlets

# Marathon Petroleum Corporation and PI



- PI System License since mid 80's
  - 2nd ever Production PI server in Cattlesburg
- Current Usage
  - 7 Refineries
  - Terminal Visualization
  - Terminal of the Future
  - Marine Vessels
- 1.1 million PI Tags
  - Refinery ~715,000
  - Terminals ~200,000
  - EA&S ~140,000
  - SD&P ~35,000
  - Marine ~15,000

# Terminals, Transport and Rail




*As of June 30, 2014*

- 63 owned and operated, two part-owned and non-operated and approximately 60 third-party light product terminals (gasoline, diesel, kerosene, jet fuel)
- 18 owned and operated and eight third-party asphalt terminals
- 170 owned transport trucks and 262 transport loading lanes
- 2,165 owned or leased railcars

# Marine

- Large private inland petroleum products barge fleet
- Operations include 18 owned/leased inland waterway towboats and 184 owned and 16 leased barges
- Charters additional equipment for brown and blue water movements
- Transports crude, light products, ethanol, feedstocks, and other specialty chemicals

# Business Challenge / Project Overview

- Condition Based Monitoring:
  - This effort is expected to reduce extended downtime of equipment due to equipment failure, reduce costs for failure by having better information available, increase mechanical availability, enable a safer working environment, and improve efficiency of the Marine work force.

- Project Scope
  - Marine vessels
    - Engines
    - Gears
    - Generators
    - Steering
    - Ship Service
    - Tank Alarms
  - Marine Repair Facility
    - Waste Water Treatment Plant
    - Thermal Oxidizer
    - Maintenance Float
    - Tank Farm
    - Boiler house

# Project Progress

- Marine Repair Facility
  - Cleaning Dock
  - Tank Farm
  - Waste Water Treatment Plant
  - Boiler house
  - Thermal Oxidizer
- Currently nine vessels implemented (~400 data points per vessel)
  - M/V Speedway
  - M/V Cincinnati
  - M/V Ohio Valley
  - M/V Nashville
  - M/V Paul G. Blazer
  - M/V Detroit
  - M/V Kentucky
  - M/V Marathon
  - M/V Map Runner

# The PI System Architecture Overview

- PI Interface for Modbus Ethernet
  - Leveraging the buffering capability
- PI ProcessBook for viewing graphical representations
- PI DataLink for data analysis
- PI Notifications to identify system outages
- PI Coresight for future mobile analysis
- PI AF for future analytics

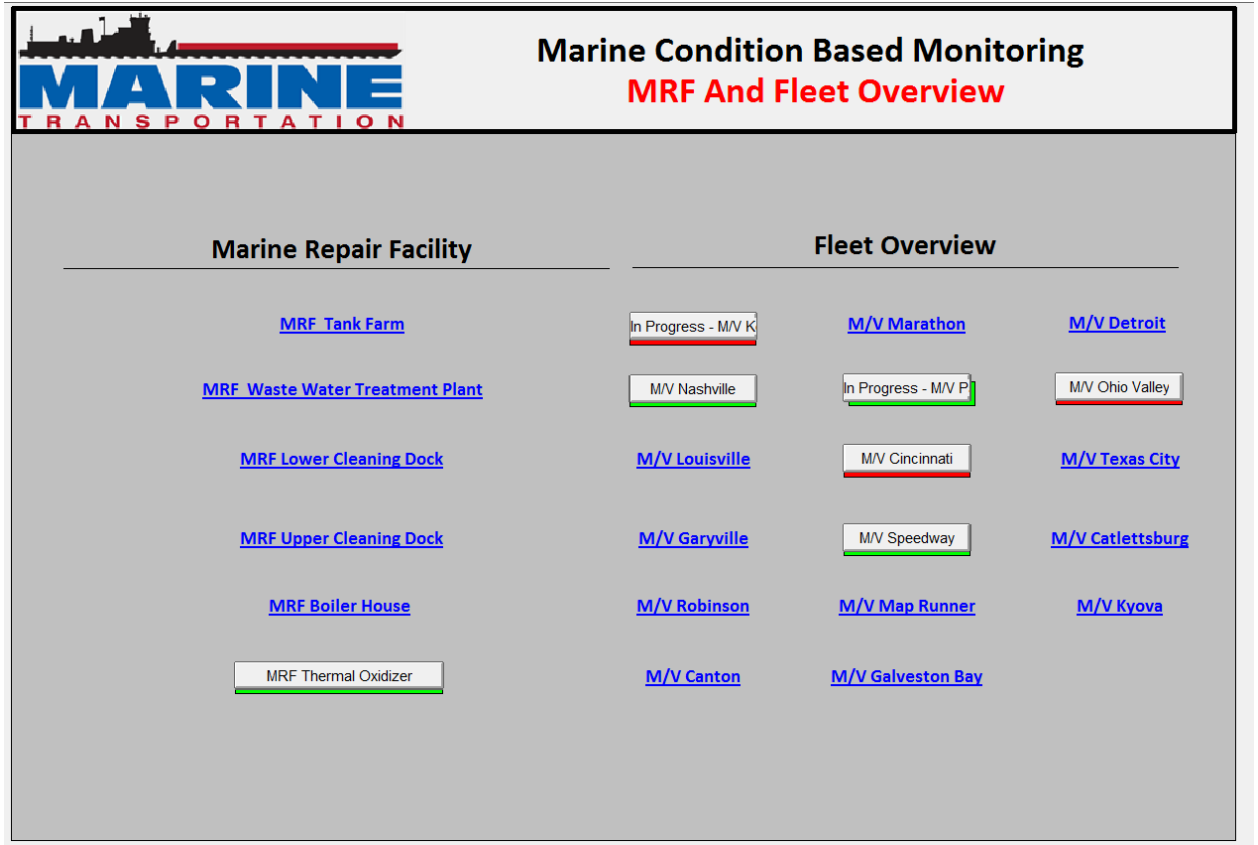
# MPC Marine Use of the PI System

- Preventative maintenance potential
- Updates existing alarm panels
- Fuel burn metrics
- Historical data for incident investigation and trouble shooting
- Move workforce from data capturing to data analysis

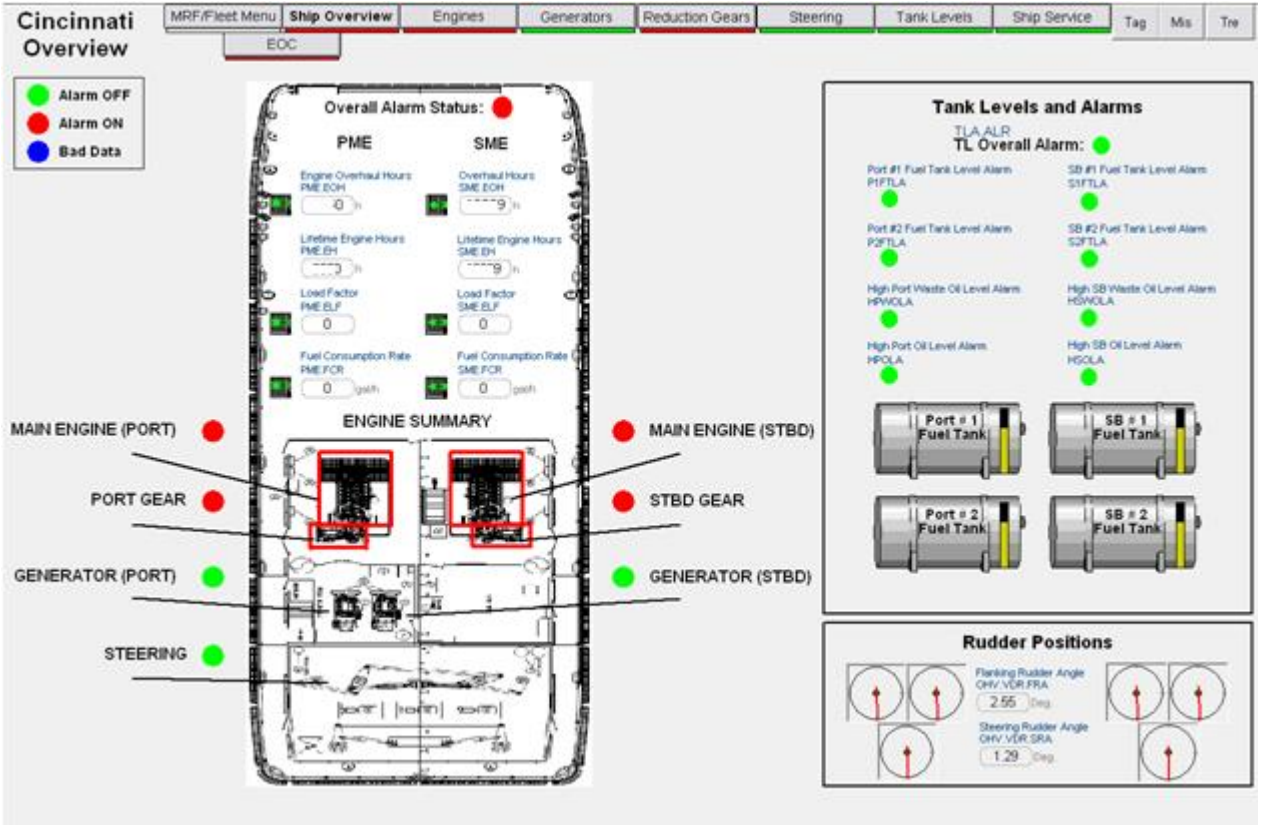
# Results / Benefits

- Leverage previous initiatives to provide network access to the Marine Fleet
- On average 7% of the CDM data being pulled over the network was being lost when vessels traveled during bad weather, under bridges or through locks. This issue has been mitigated by placing the PI Interface for Modbus Ethernet on the vessels to buffer data that would be otherwise lost.
- Reduced downtime and increased mechanical availability through better understanding of equipment performance
- Enable safer working environment by reducing unnecessary equipment maintenance
- Overall efficiency improvement with the workforce

# Dashboards – Marine Overview



# Dashboards – Vessel Overview



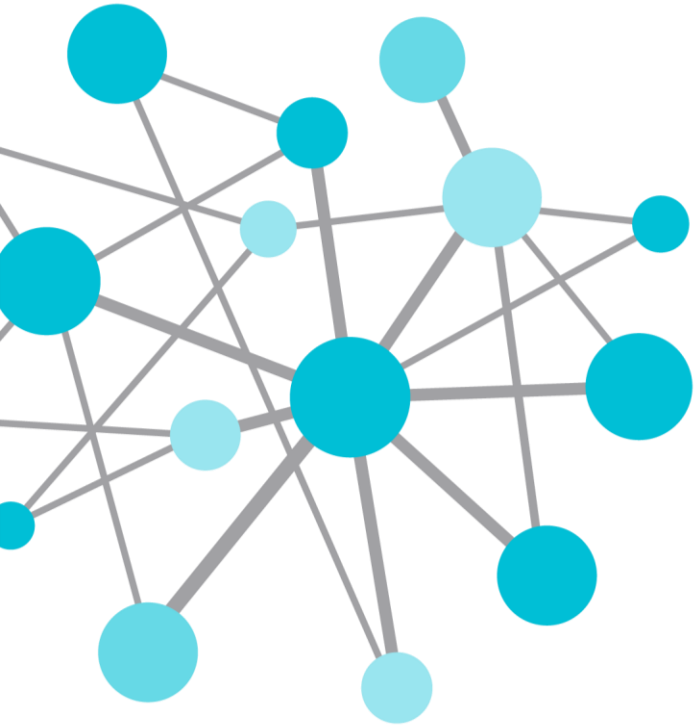
# Summary

- Innovative method of connecting real-time business data to end-users and de-silo business systems to a single platform.
- Leveraging past expertise within Marathon Petroleum and the industry to benefit the Marine organization
- Continuing to learn, adapt and utilize new technology

# Questions

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

**Please state your name** and your company

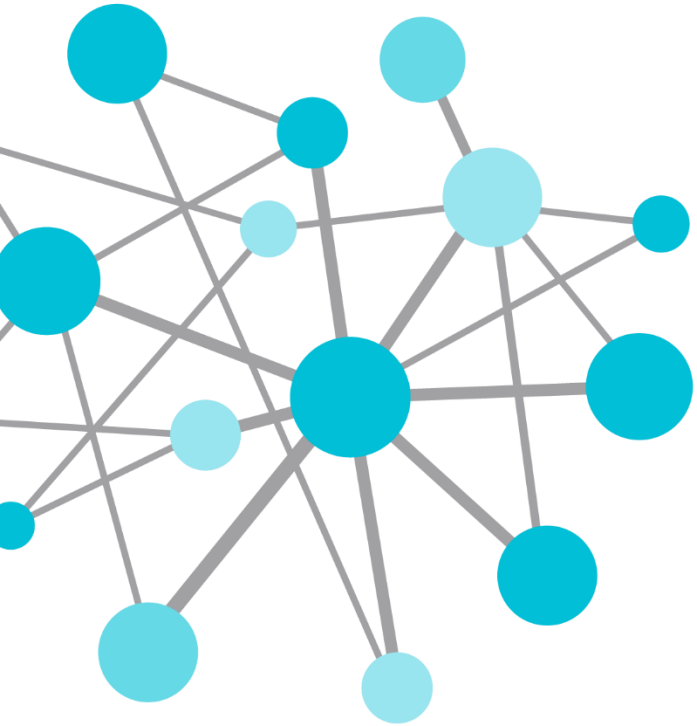


# THANK YOU

Brought to you by OSIsoft.

# Joshua Schaublin


- OJSchaublin@MarathonPetroleum.com
- Advanced IT System Integrator
- Marathon Petroleum Company LP



devon

# The WITSML Service
## For Devon Energy

<WITSML/>™

## A WITSML Compliant Real-Time Drill Data Management System

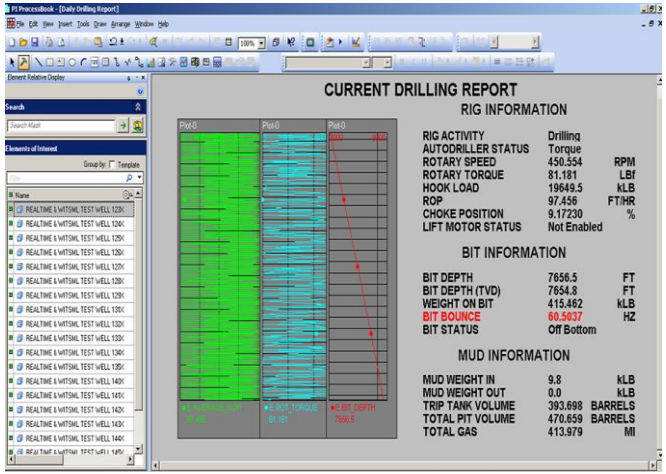
Presented by **Rick Howell, Devon Energy**

**Shaun Wright, Industrial Evolution**

INDUSTRIAL evolution

# Agenda

- About Devon Energy
- Challenge – Problem(s) to Solve
- PI System based WITSM Solution
- Progress and Future Plans
- Illustrations
- Case Study Summary



# About Devon Energy

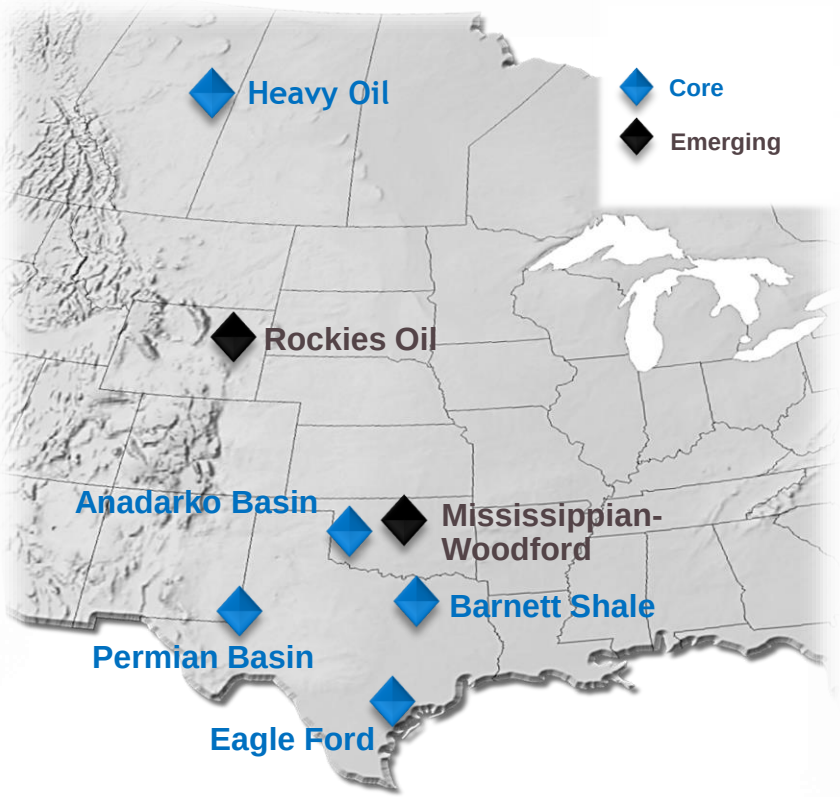

- One of North America's leading independent producers of oil and natural gas
- Engaged in exploration and production
- Corporate headquarters in Oklahoma City
- More than 5,000 employees
- Member of the S&P 500
- On Fortune magazine's 100 Best Companies to Work For list each year since 2008.

# Devon Today

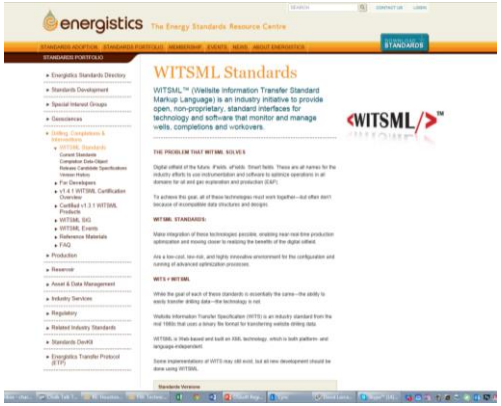
- Q3 2014 net production: 640 MBOED(1)
- Deep inventory of oil opportunities
  - Top-tier Eagle Ford development
  - Strong Permian Basin position
  - World-class heavy oil projects
  - Upside potential in emerging plays
- Strong liquids-rich gas optionality
- EnLink ownership valued at ≈$8 billion
  - Additional midstream value in Access and Victoria Express pipelines

(1) Excludes non-core divestiture assets.

**Devon's Core & Emerging Assets**



# Drilling Data Management




- **What is WITSML and what is it used for?**
  - Industry Standard focused on protocol for subsurface data – Depth as primary dimension
  - Wellsite Information Transfer Standard Markup Language
  - Based on the WITS (Wellsite Information Transfer Specification) from the 1980s using XML instead of binary files
  - Oil and Gas upstream companies use WITSML to standardize data definitions between themselves, drilling contractors, vendors and regulatory agencies
- **Why we need it**
  - Many systems are reliant on immediate and up-to date down-hole and related top side information
    - Drill operations management: drill bit conditions, revs, torque, bit pressures, down-time
    - Reservoir management: rock type evaluation, oil, gas, and pore pressure management
    - Production planning: reservoir production estimates
    - Drill fleet management: time on site and availability
    - Safety: mud, cement, casing, operations intensity
- **Requirements**
  - Systems integration and interoperability
  - Reliable, high quality real-time data collection, storage, and utilization
  - Standard format (WITSML)

# Challenges – Decrease Time to First Oil, Safety, & Costs
# Capture “high fidelity” Data for Complete Well Data Set

- **Drill Phases**
  - Plan new well
  - Set-up and commence drill operations
  - Sustain and manage drilling until full completion
  - Change status to cap or produce

- **Challenges**
  - Vast amounts and types of data from and to different systems
  - Missing information
  - Out of date information
  - Information in many different locations
  - Lots of manual work that needs to be digitized
  - Difficult to follow life-of-well cycle
  - Need to search and report on time stamped dynamic and static data (eg time and depth)

# PI System Based WITSML Solution

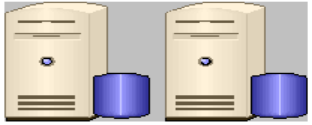
- Use PI System to gather, validate, normalize and manage real-time data
- Use PI AF to establish system over-arching integration framework:
  - Integration with mud, surveys and BHA data through WellView
  - WITSML data is available through the PI AF elements
  - Data from other sources, such as SQL and Oracle databases are also made available through PI AF elements
- Make extensive use of PI AF templates, particularly well templates
- Automate as much data management as possible, eg. WITSML provider selection, addition of new wells, tags and even mnemonics not in template
- Use CoreSight and EventFrames to manage data availability and reporting
- Maintain WITSML compliancy

# Data Flow

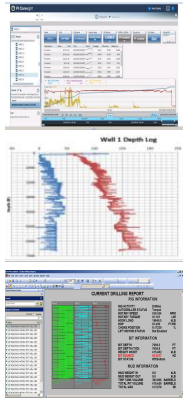
Wellsite

Data Provider
Data and Web Servers

Server Hosting the
Industrial Evolution
WITSML Service

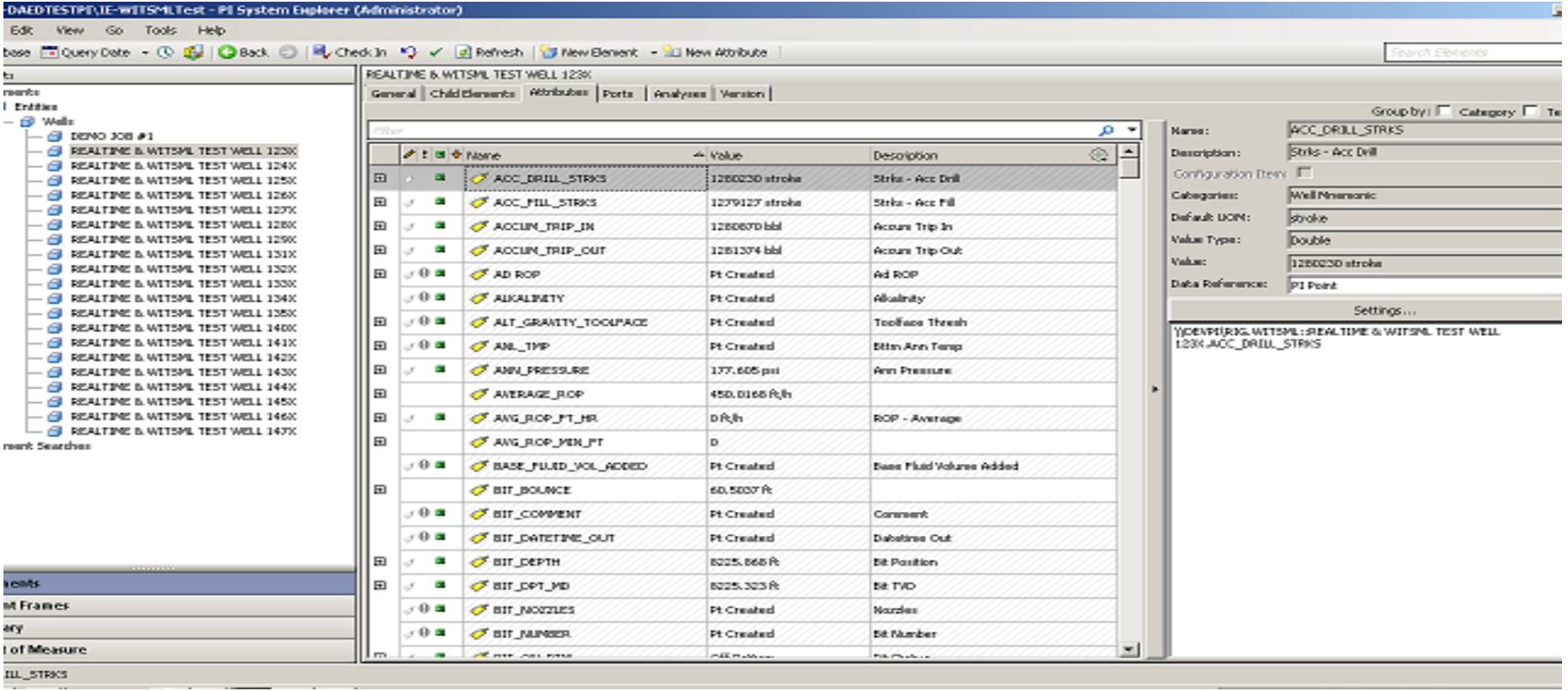


Operator (ie Devon)
PI Servers and PI
AF Server



Clients
Running
PI DataLink,
ProcessBook,
Coresight, or
WebParts

# Example - Element in PI Asset Framework

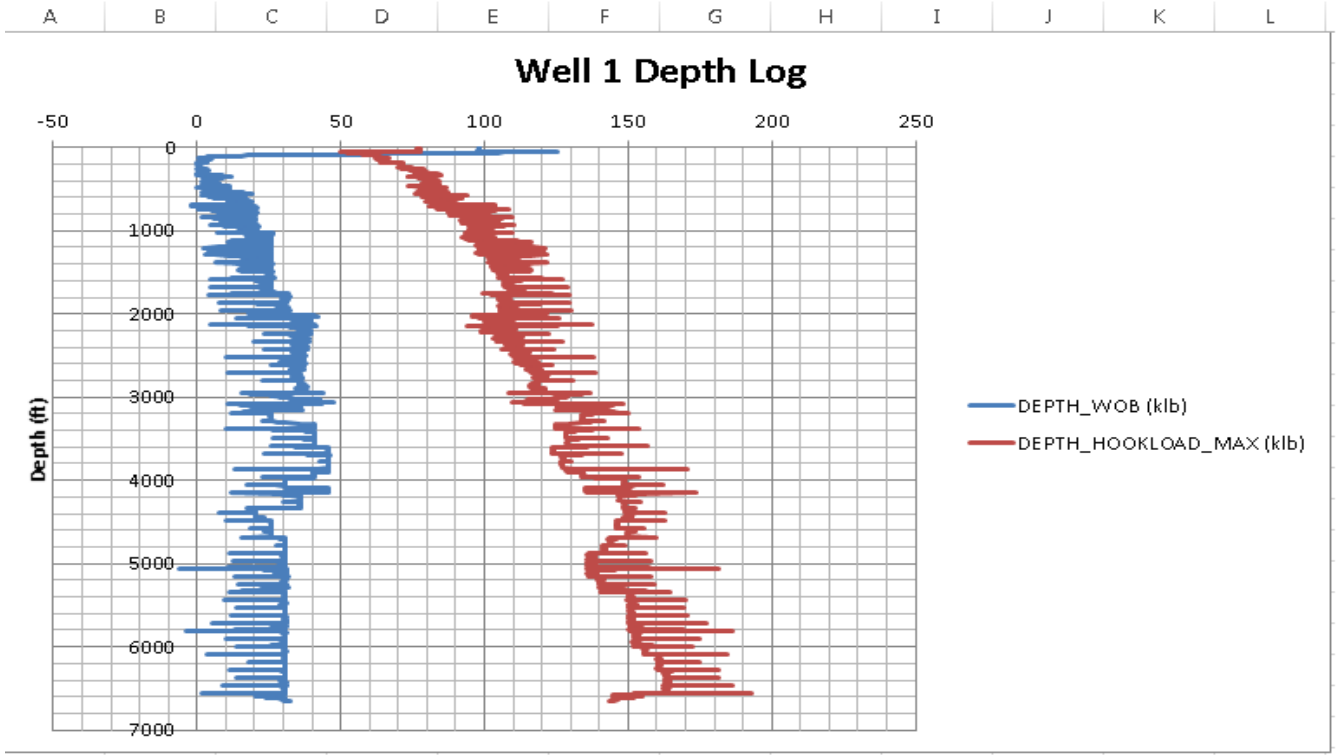


# Progress and Plans

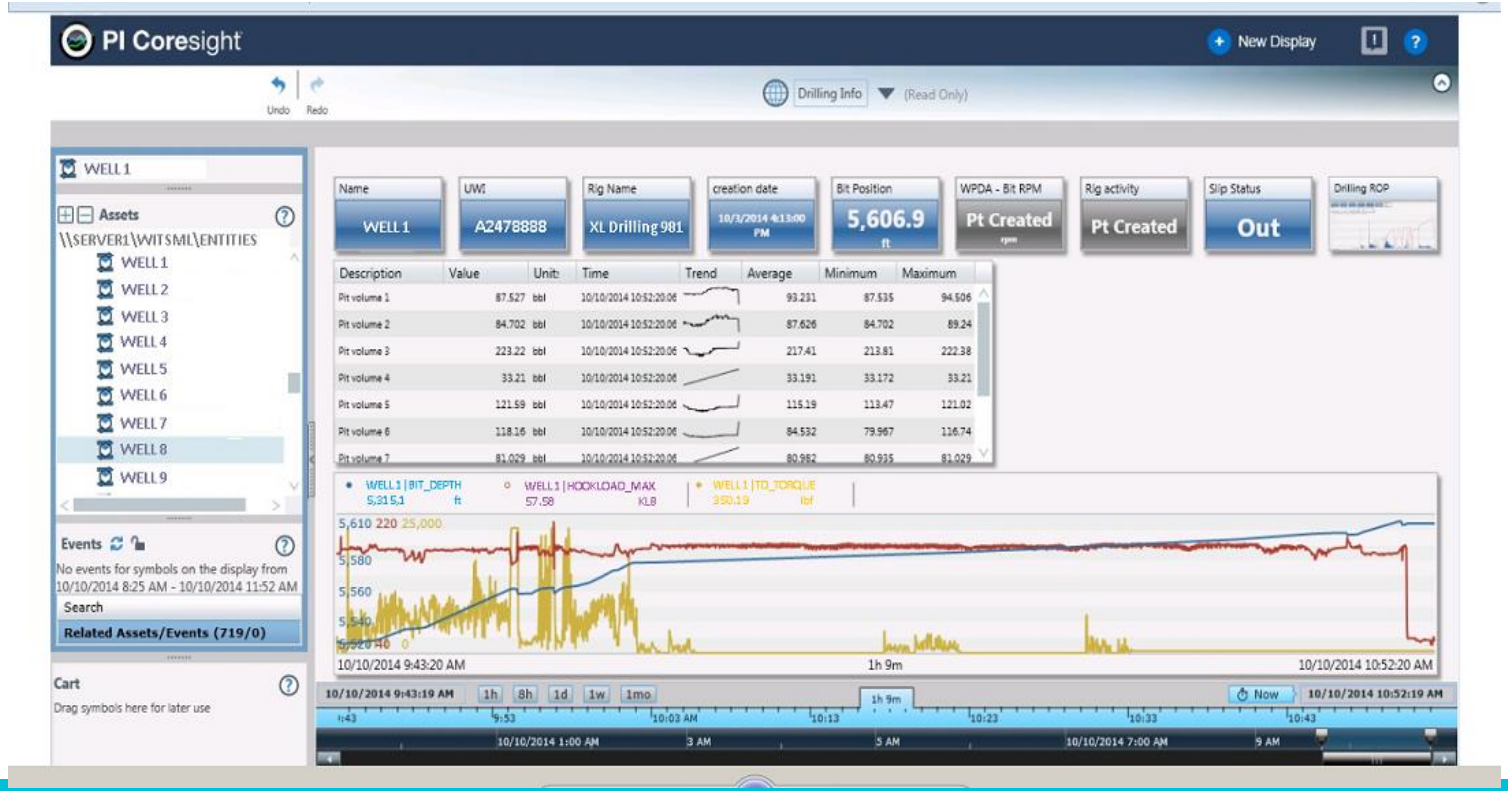
- **Progress and plans for the future**
  - System is in production at Devon Energy
  - Currently interfaced to 30+ rigs and 2 distinct vendors, NOV and Pason
  - Automatically creates PI AF elements, PI AF attributes and PI tags
  - Automatically creates PI AF attributes and PI tags for new mnemonics
  - Integrating PI Event Frames to organize data
  - WITSML output interface

- **Demonstration and Discussion**
  - Slide 1 utilizes PI DataLink Microsoft Excel spreadsheet
  - Slide 2 utilizes an element relative PI Coresight graphic accessing PI AF
  - Slide 3 utilizes an element relative PI ProcessBook graphic accessing PI AF

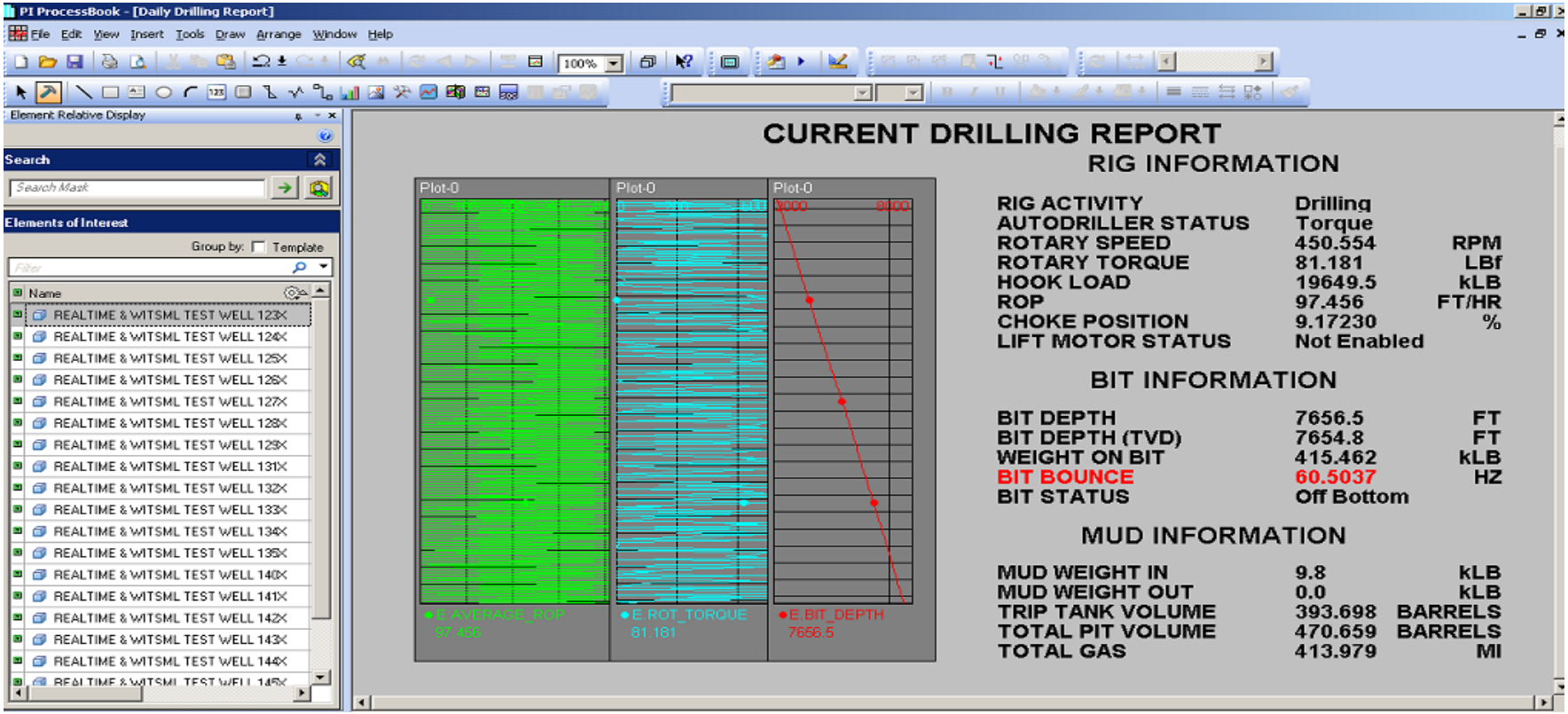
# Example - Depth Log



# Example - Drilling Data in Coresight



# Example - Drilling Data in ProcessBook

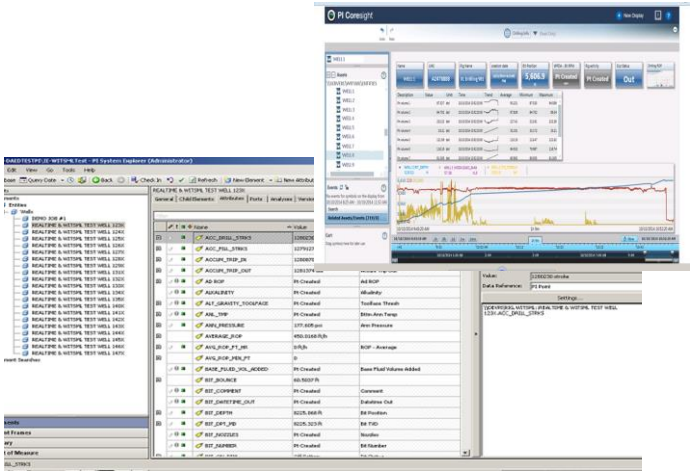


# PI System WITSM Integration Improves Drilling Performance

The PI System and in particular PI AF provided a foundation to enable integration of real-time drill site data including WITSML sources. The resulting solution is enabling vastly improved drilling analytics, visualization, and collaboration resulting in improved drill fleet optimization, costs, ROP, safety, and reduced time to first oil.

devon

INDUSTRIAL evolution



## Business Challenge

- Develop infrastructure for acquiring one second drilling data to improve analytics and visualization
- Diverse data sources, many using “WITSML” which is not standard between providers
- Desire to have a complete real-time data set for wells from drilling, completions, to production

## Solution

- Used the PI System as an integration & applications infrastructure and the EA
- Developed a WITSM client interface for PI System (by IE)
- Developed PI AF model with heavy use of well templates
- Used PI PSA for WellView integration

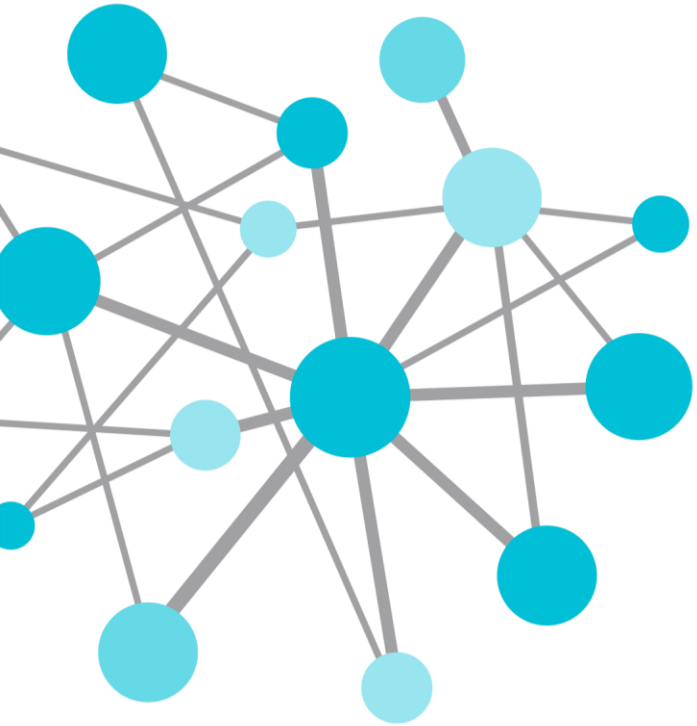
## Results and Benefits

- System is operational on 30+ rigs, expanding to drilling fleet
- Real-time drilling visibility of current depth vs planned
- Engineering access to real-time data with improved SME collaboration
- Optimized drilling schedule

# Questions

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

**Please state your name** and your company

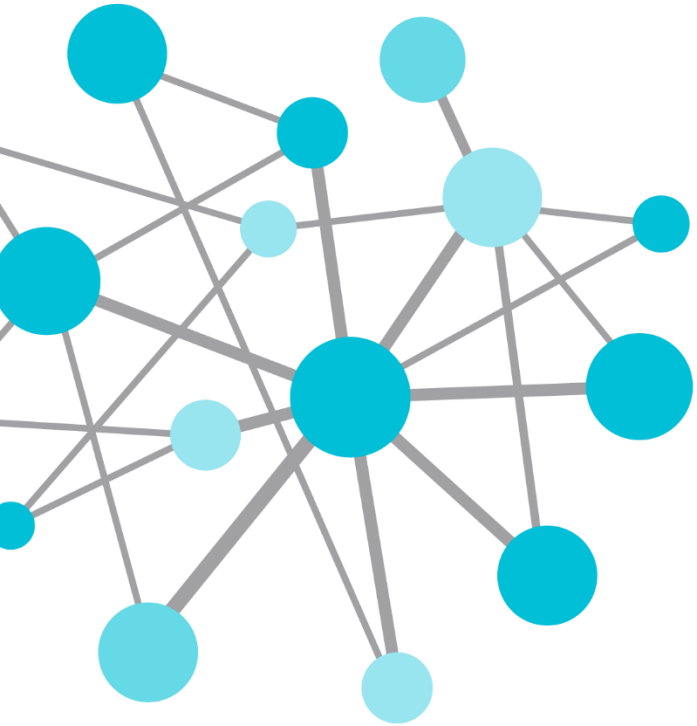


# THANK YOU

Brought to you by OSIsoft.

# Firstname Lastname

- Rick.Howell@dvn.com
- Real-Time Data Supervisor
- Devon Energy
- Shaun.Wright@industrialevolution.com
- VP Business Development, Oil and Gas
- Industrial Evolution



# PI Connector for CygNet

Presented by **John Miller**

**John.Miller@cse-icon.com**

# Background



CygNet is a powerful enterprise class SCADA system which collects operations data, including numerous types of attributes for each data point.

Many companies would like to bring their CygNet data into their PI Systems and PI AF for enhanced storage, archiving, analysis, and reporting.

CSE Icon is the largest CygNet SCADA Integrator in the US.

CSE Icon has been integral with OSIsoft to create the smart connector from CygNet to the PI System.

CSE Icon worked together with OSIsoft to create requirements and beta test the PI Connector for CygNet on our CygNet and PI System development servers

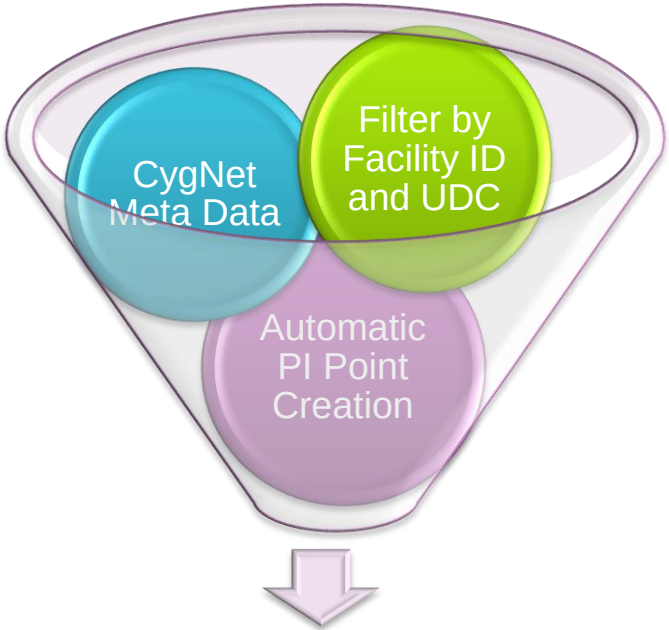
# Why the Need for a PI Connector for CygNet?

## Existing Interface Choice

- Only offers collection of current point value
- Previous OPC methods were problematic
- Has issues with scalability and performance
- All PI System points must be manually created
- Meta data must then be manually exported
- Both these processes are incredibly time consuming in terms of both schedule and budget
- Inability to perform advanced analytics, visualization, and reporting on Cygnet Data

# Simplifying Integration and Data Structures

PI Connector for CygNet




**Automatic PI AF Structure Creation and Synchronization**

# CygNet Connector Advantages

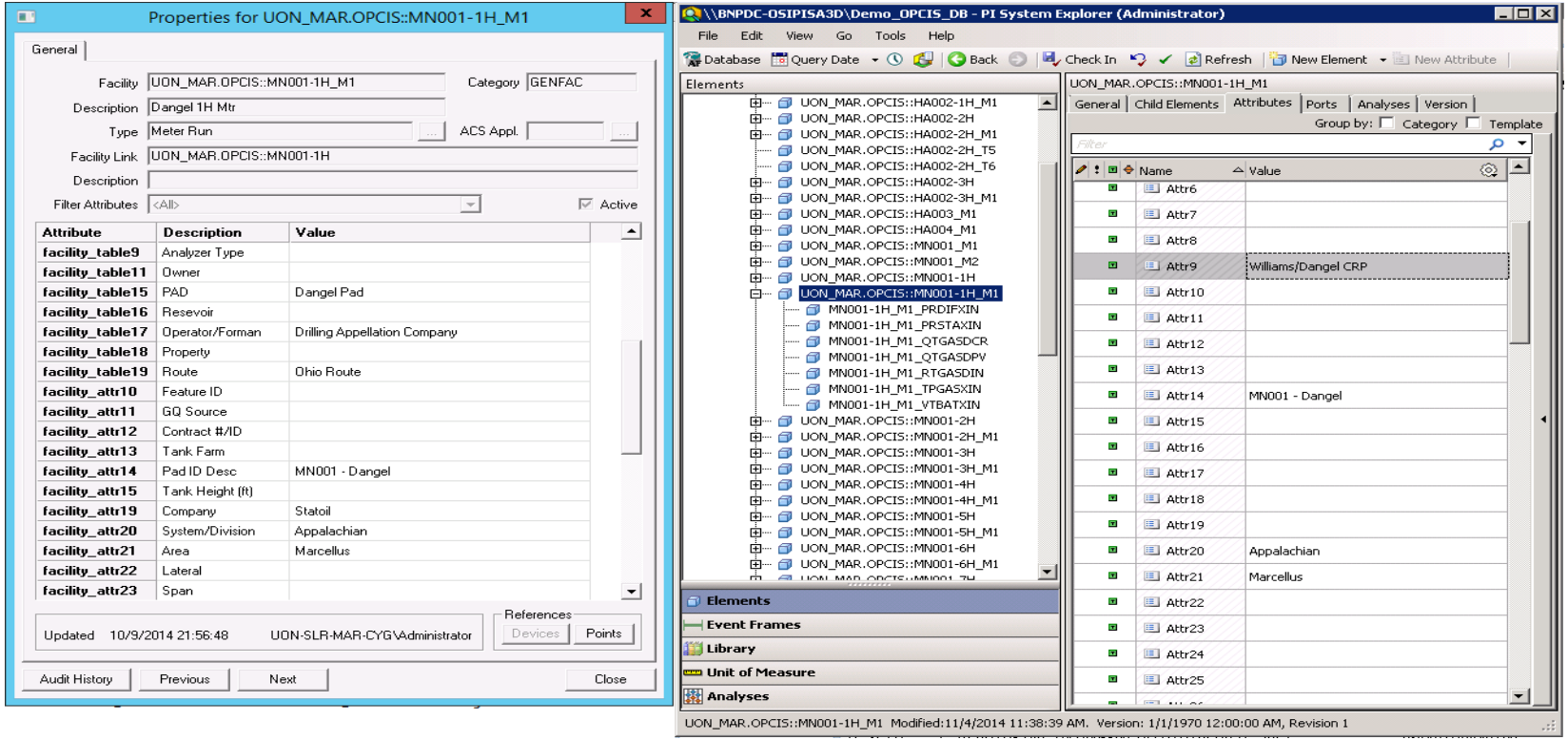
- Collects Point State (High Alarm, Unreliable, etc.)
- Collects Base Status (If customer wants to export tag status)
- Collects CygNet Facility Attributes (Meter Descriptions, Routes, Field, etc.)
- Collects CygNet Point Attributes (Data Descriptions, Alarm Settings, etc.)

- Filtering CygNet points by Facility ID and UDC
- Automatic PI Point Creation
- Automatic PI AF structure Creation

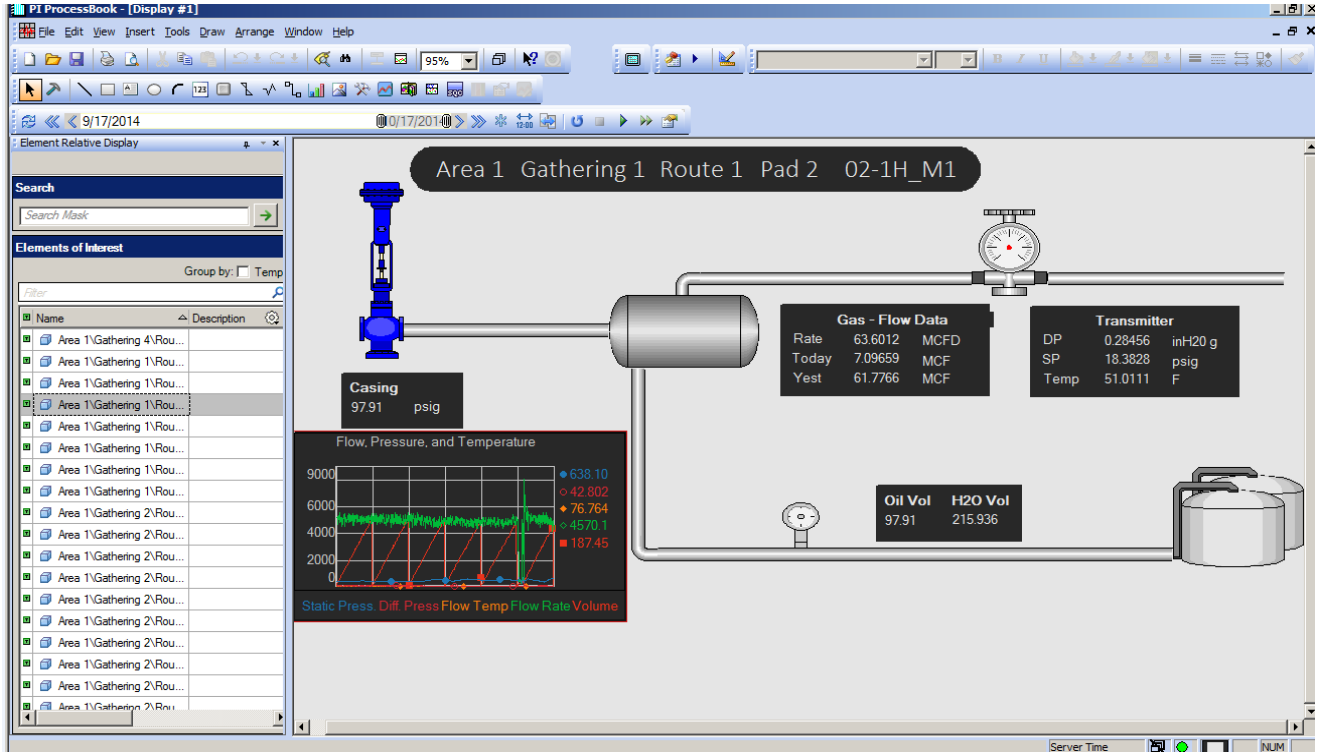
- Can run from CygNet server, PI Server, or independent server
- Data travels over a static port and communication is firewall friendly

- Opens up the CygNet SCADA to the “Power of the PI System” and PI AF for enhanced analytics, visualization, and reporting

# CygNet Data Structure = PI AF Structure



# Leveraging PI AF Asset Based Analytics & Aggregation to Provide Flexible Analytics & Visualization



# CygNet Alarms Analytics, Visualization, & Reporting in the PI System

| | |
|---|---|
| Gathering 1 | Gathering 1 |
| Asset | * |
| StartTime | 10/10/2014 |
| EndTime | 11/5/2014 |
| Duration | 50s |

Alarm and Event Status

| Start time | Duration | Area | Well | Meter | PAD | Route | Status |
|---|---|---|---|---|---|---|---|
| 10-Oct-14 00:07:51 | 0 0:03:00 | Area 1 | | 02-1H_M1 | Pad 2 | Route 1 | High Flow Rate |
| 10-Oct-14 00:07:51 | 0 0:03:00 | Area 1 | | 02-3H_M1 | Pad 2 | Route 1 | High Flow Rate |
| 10-Oct-14 00:56:48 | 0 0:01:59 | Area 1 | | 10-1H_M1 | Pad 13 | Route 3 | High Flow Rate |
| 10-Oct-14 01:22:52 | 0 0:02:59 | Area 1 | | 02-1H_M1 | Pad 2 | Route 1 | High Flow Rate |
| 10-Oct-14 02:14:51 | 0 0:02:09 | Area 1 | WZ010-1H | | Pad 13 | Route 3 | Low Casing Pressure |
| 10-Oct-14 02:25:33 | 6 10:48:02 | Area 1 | WZ009-1H | | Pad 11 | Route 3 | Low Casing Pressure |
| 10-Oct-14 02:27:34 | 6 10:46:00 | Area 1 | | 09-1H_M1 | Pad 11 | Route 3 | Low Flow Rate |
| 10-Oct-14 03:06:50 | 0 0:14:01 | Area 1 | | 10-1H_M1 | Pad 13 | Route 3 | High Flow Rate |
| 10-Oct-14 03:24:48 | 0 0:06:01 | Area 1 | | 10-1H_M1 | Pad 13 | Route 3 | High Flow Rate |
| 10-Oct-14 03:48:57 | 0 0:08:23 | Area 1 | WZ010-1H | | Pad 13 | Route 3 | Low Casing Pressure |
| 10-Oct-14 03:59:15 | 0 0:11:51 | Area 1 | WZ010-1H | | Pad 13 | Route 3 | Low Casing Pressure |
| 10-Oct-14 04:45:19 | 0 0:01:32 | Area 1 | WZ010-1H | | Pad 13 | Route 3 | Low Casing Pressure |
| 10-Oct-14 05:13:52 | 0 0:02:58 | Area 1 | | 02-2H_M1 | Pad 2 | Route 1 | High Flow Rate |
| 10-Oct-14 05:17:36 | 0 0:01:58 | Area 1 | WZ010-1H | | Pad 13 | Route 3 | Low Casing Pressure |
| 10-Oct-14 05:29:13 | 0 0:13:42 | Area 1 | WZ010-1H | | Pad 13 | Route 3 | Low Casing Pressure |
| 10-Oct-14 06:16:54 | 0 0:02:11 | Area 1 | WZ010-1H | | Pad 13 | Route 3 | Low Casing Pressure |
| 10-Oct-14 06:24:59 | 0 0:06:16 | Area 1 | WZ010-1H | | Pad 13 | Route 3 | Low Casing Pressure |
| 10-Oct-14 06:33:03 | 0 0:01:48 | Area 1 | WZ010-1H | | Pad 13 | Route 3 | Low Casing Pressure |
| 10-Oct-14 06:43:03 | 0 0:02:06 | Area 1 | WZ010-1H | | Pad 13 | Route 3 | Low Casing Pressure |
| 10-Oct-14 07:25:51 | 0 0:03:00 | Area 1 | | 02-1H_M1 | Pad 2 | Route 1 | High Flow Rate |
| 10-Oct-14 07:44:51 | 0 0:04:04 | Area 1 | WZ010-1H | | Pad 13 | Route 3 | Low Casing Pressure |

# Leveraging PI AF and Microsoft BI for Greater Insight to CygNet Information

# Customer Perspective…….

"The CygNet-PI Connector opens up new choices for Statoil. Previously, the process to export CygNet data in the PI System was very cumbersome – which made it cost and time prohibitive. The Cygnet-PI Connector allows us to quickly export not only the data points but also the valuable meta data from CygNet directly into the PI System, straight into a PI AF structure. Once in the PI System, the analysis and reporting options are at our fingertips."

*Matthew Fleharty, SCADA/Automation Lead, US Onshore, at Statoil*

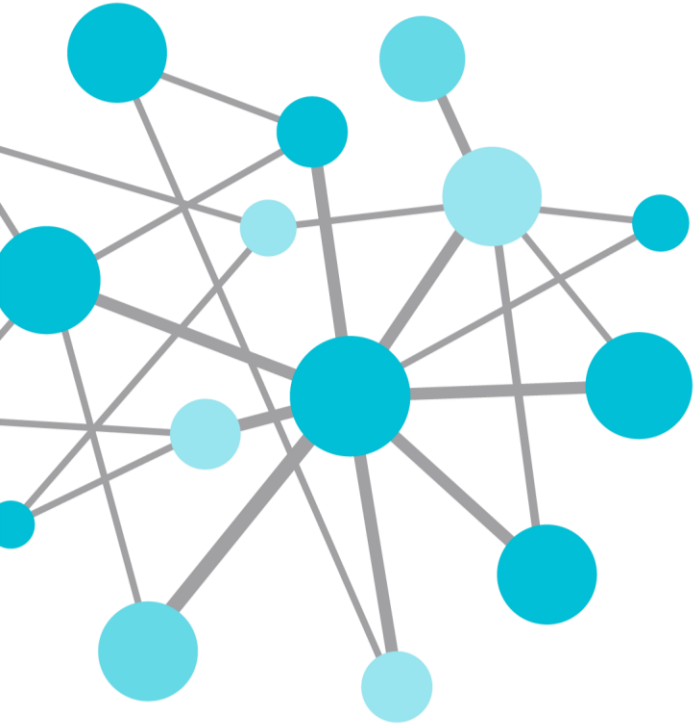
# A “Best of Breed Model”:  CygNet & the PI System

- Excited about the Cygnet Connector
- Opportunity to address current pain points
- Ready for use…continuing to evolve features & functionality
- CES-Icon Ready to Engage
- Come Visit us at the CSE-Icon Table Top for a Demo

# Questions

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

**Please state your name** and your company



# THANK YOU

Brought to you by OSIsoft.

# John Miller

VP Operations

John.Miller@cse-icon.com

CSE-ICON

# Using PI 2014 for Advanced Analytics and Visualization in the Drilling of Oil and Gas Wells

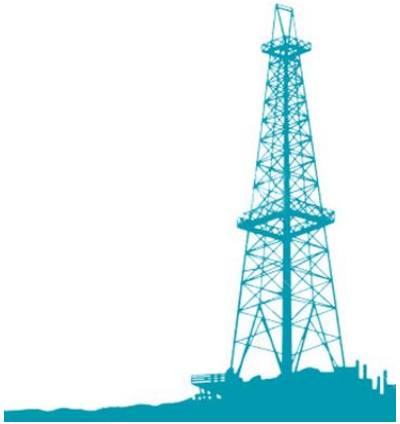

(Highlights from the UC2014 EMEA Talk)

Drilling and Completions with Real-Time Operational Intelligence

Presented by **Ken Startz – Marathon Oil**

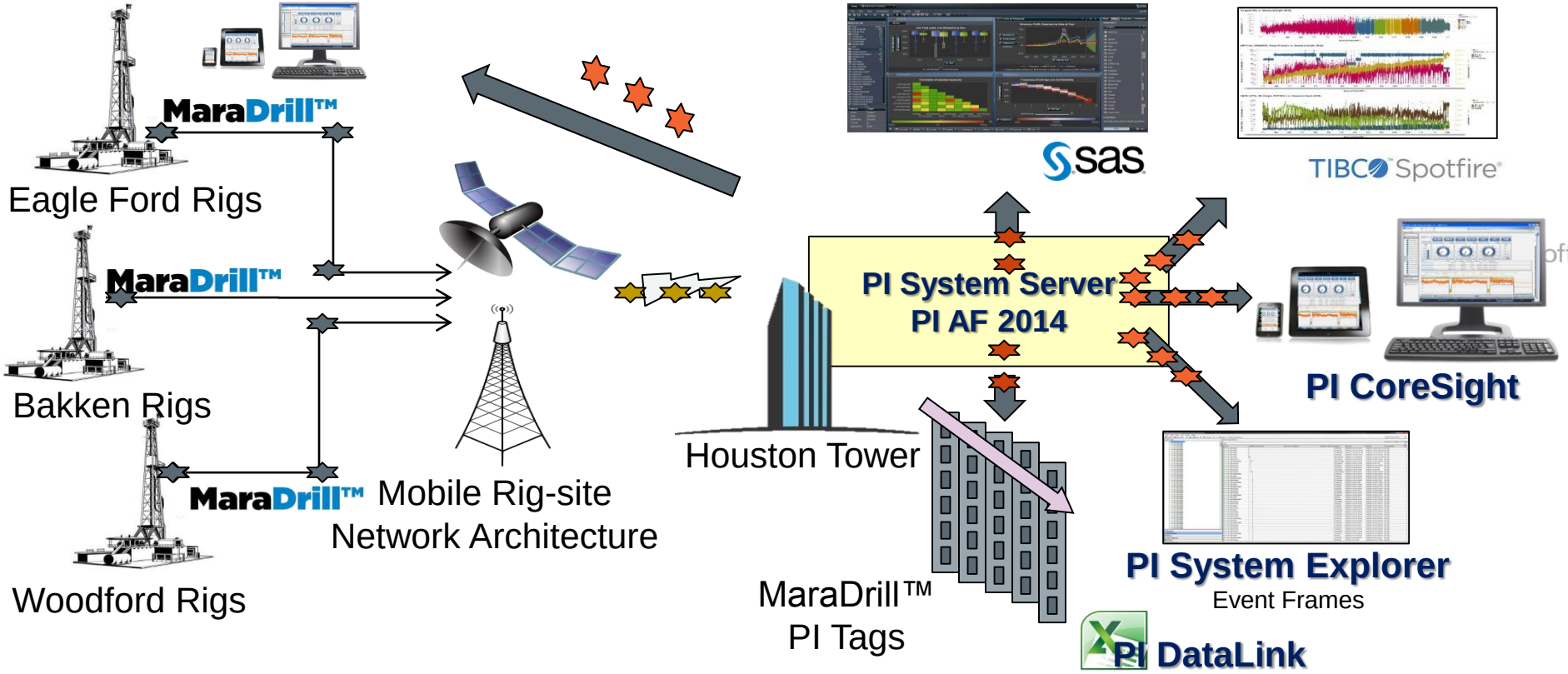
Marathon Oil

# Agenda



- Brief Update on MaraDrill tm
- Using PI 2014 for Drilling Performance Analytics
- Concluding Remarks

# Data Workflow – Collaboration & Guidance at the Drill Site



# Common Drilling Data Tags

## Engineering Units

ROP = Rate of Penetration – Ft / Hr

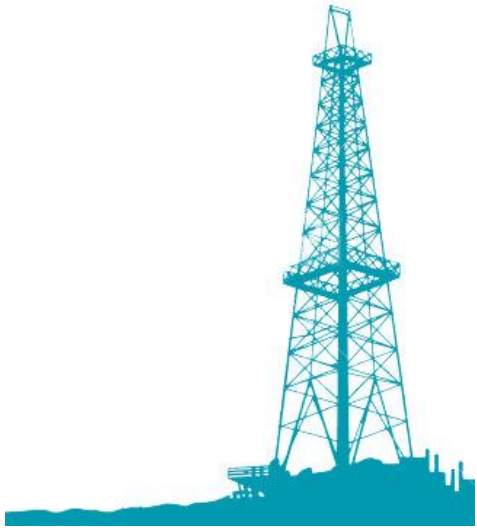
WOB = Weight on Bit – K Pounds

RPM = Revolutions per Minute – RPM

Mud Flow Rate – GPM

Torque – kFt*Lbs

**Need 1 second time stamp resolution!**

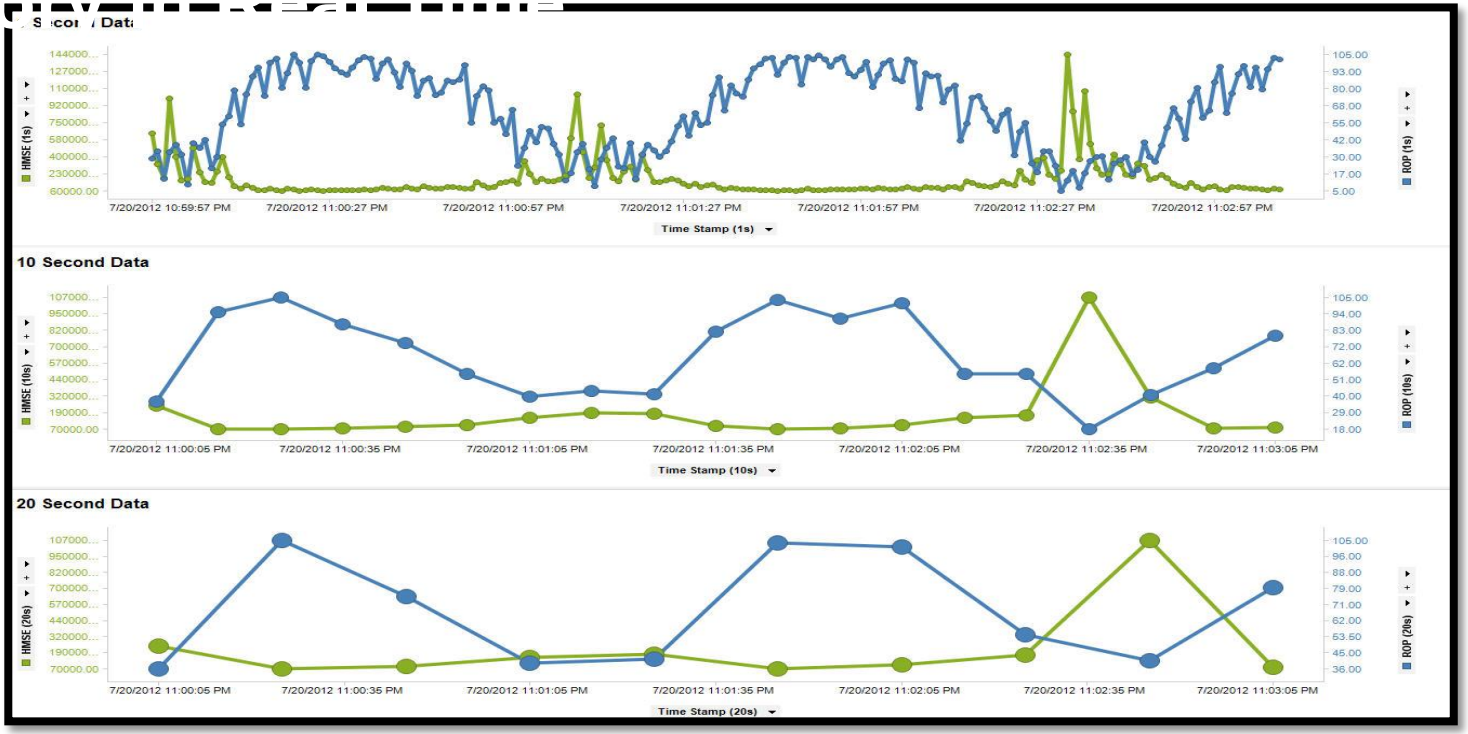


# Importance of <1 second data

MaraDrill™

Other vendors

Rig Display



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

**Eagle Ford Rig**

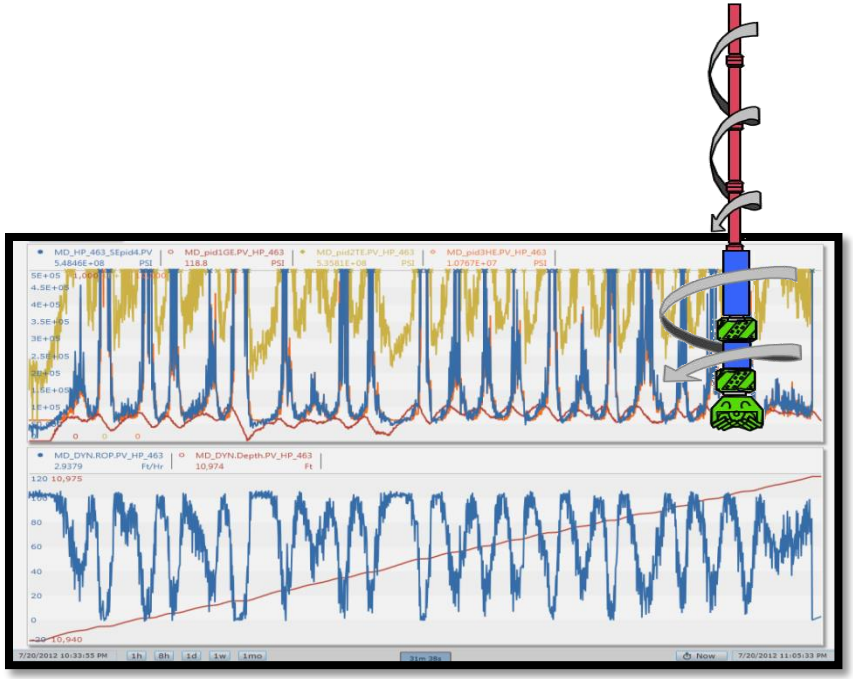
"Perfect" drilling

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

Sticking phase → bit stops

Slipping phase → bit "breaks" free

Drillstring torsional oscillations



Stick-slip

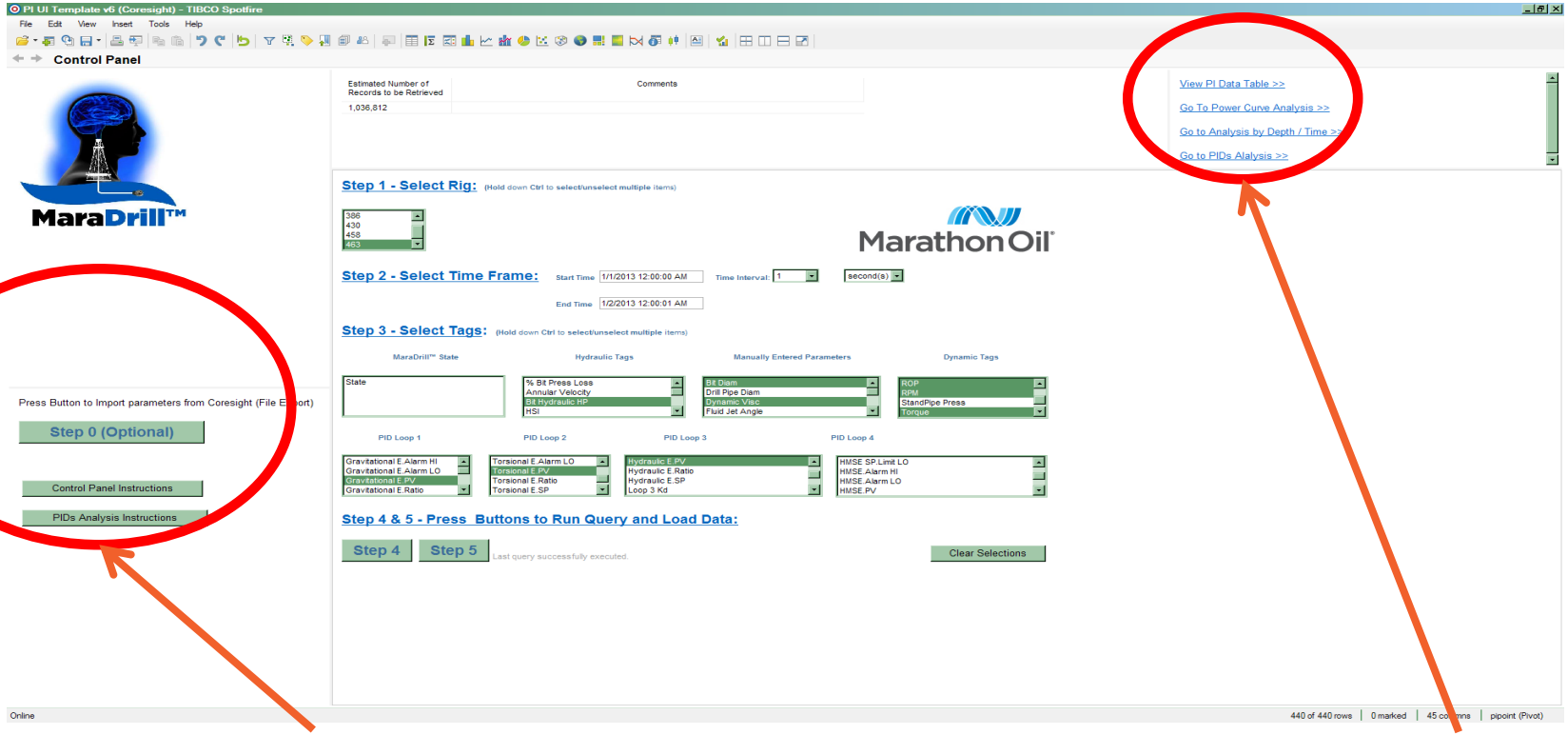
# PI Coresight View with XML Data Export


**Enables integration with WellView data**

**Enables integration with Spotfire visualization**

# Custom Spotfire Interface

**Import from PI Coresight Data or Manual Selection**

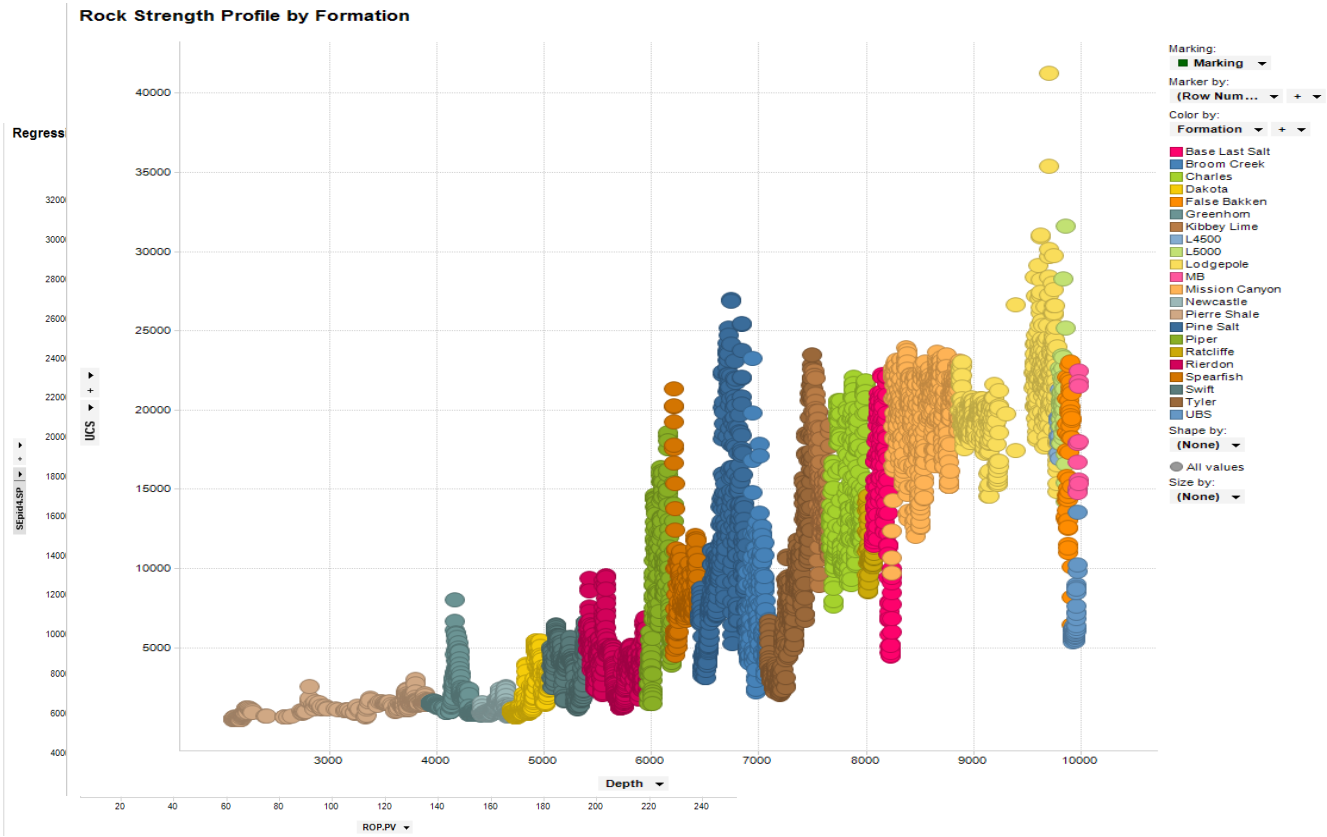



Enables integration with PI data from PI Coresight

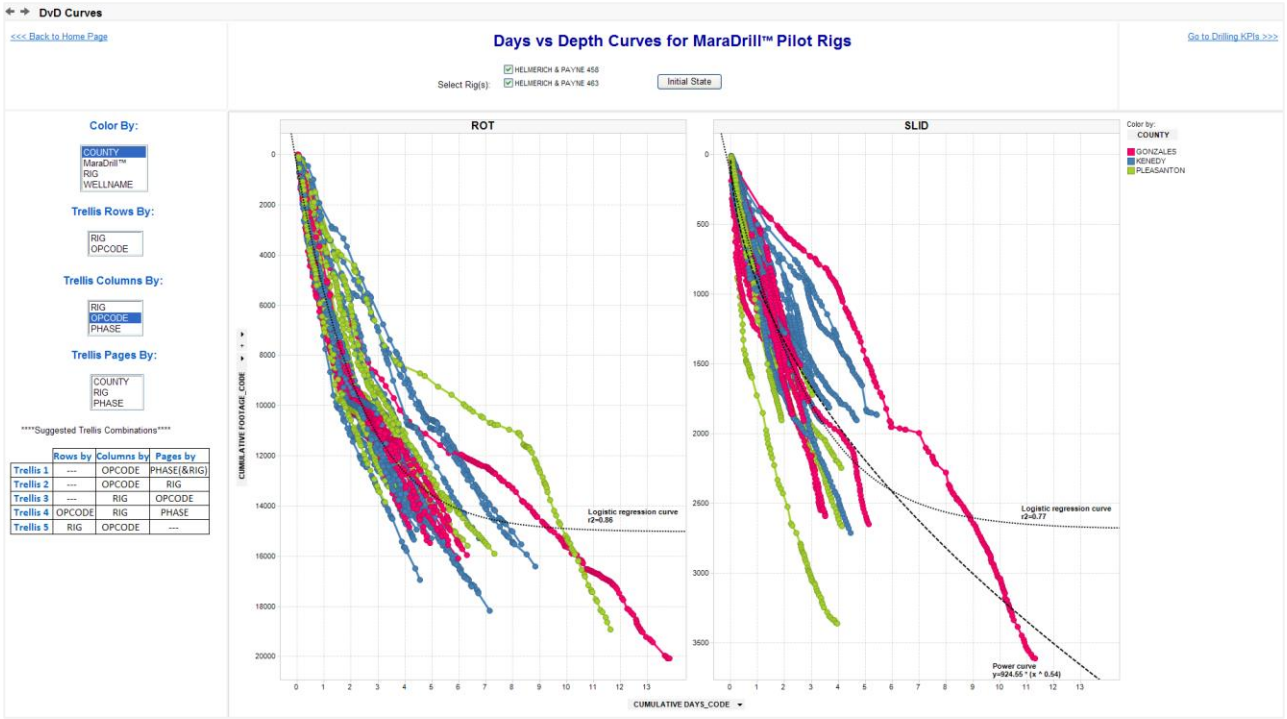
Guided analytics

# 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

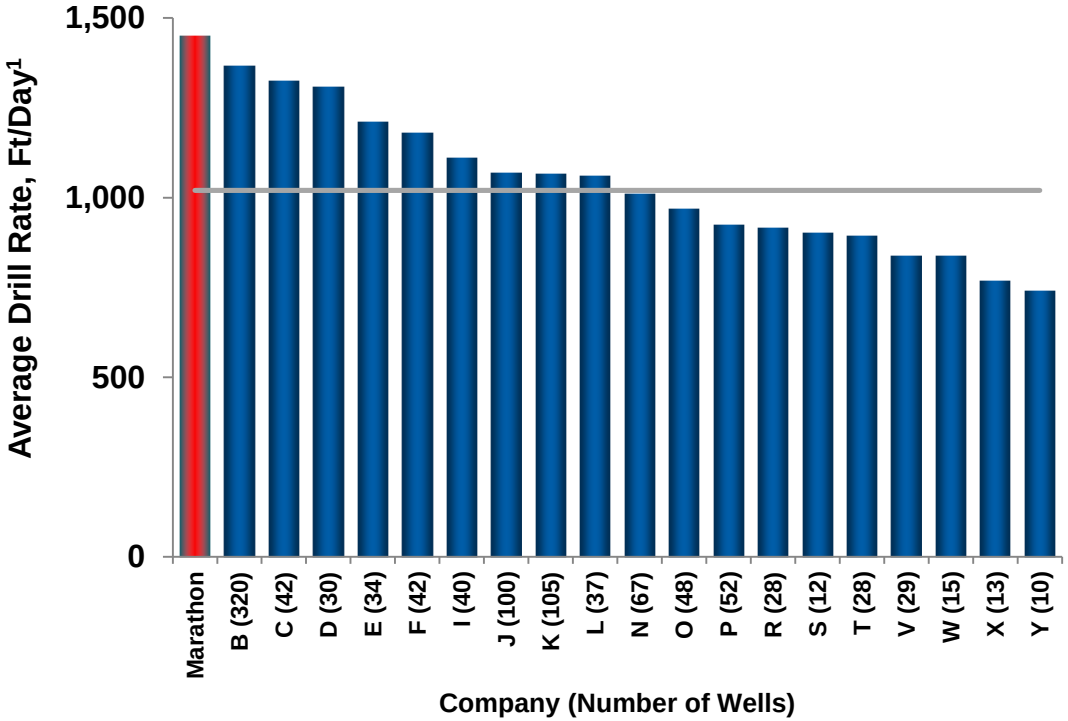


# Days vs Depth Curves for MaraDrill™ Rigs
# Black = MD, Teal = No MD



# Driller's Display in Dog House

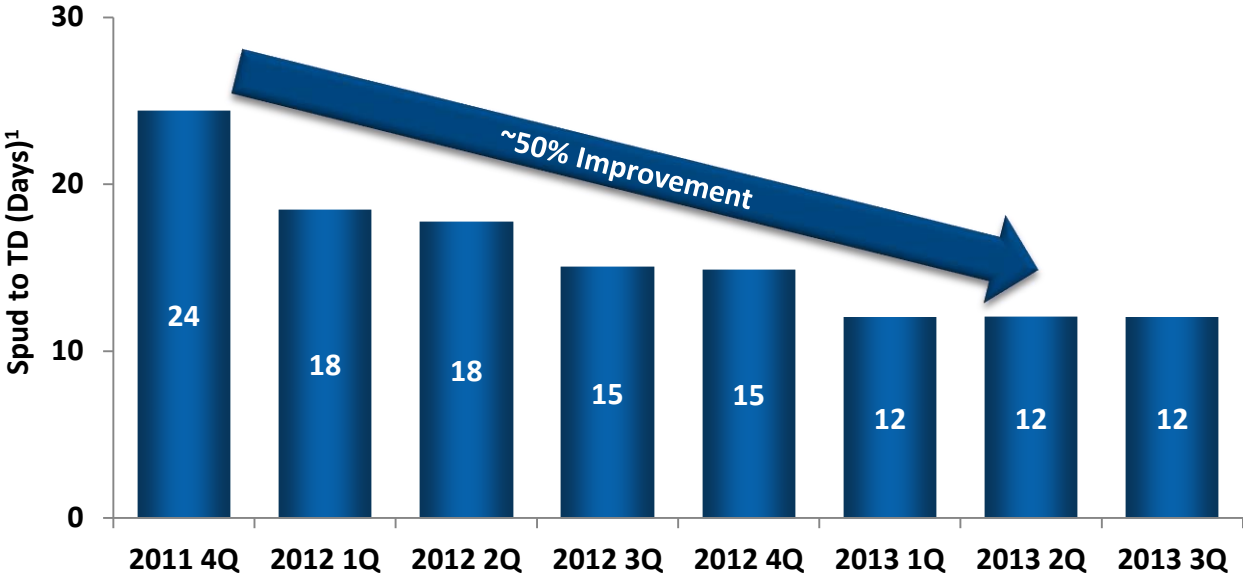

# Continuous Improvement in Rate of Penetration (ROP)




| | Ft/Day | TD |
|---|---|---|
| Competitor Average | 1,020 | 16,483 |
| MRO Average | 1,450 | 17,297 |

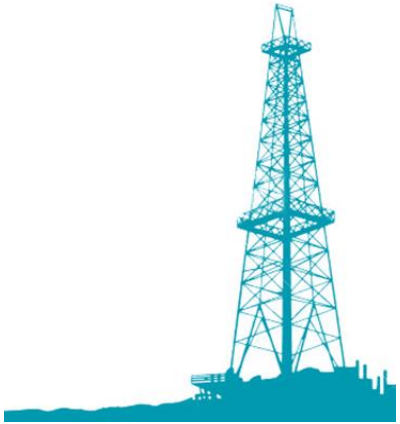
[1]*Competitor Data Source: IHS – Drilling Wire; Wells drilled 2013 YTD (Oct) across Karnes, Wilson, Bee, Atascosa, Live Oak, McMullen, Gonzales, Lavaca and Dewitt Counties; Includes companies with at least 10 wells (AXAS, BHP, BHP, CHK, COP, CRK, EOG, FCX, FST, Geosouthern, HUNT OIL, MUR, PVA, PXD, PXP, Sea Eagle Ford, SFY, STO, TLM)*

# Eagle Ford Drilling – Spud to Total Depth




*Note: Spud to TD Days: MRO-op wells, excludes pilot holes and wells with intermediate casing.*

# Agenda



- Brief Update on MaraDrill tm
- Using PI 2014 for Drilling Performance Analytics
- Concluding Remarks

# Drilling Performance Analytics

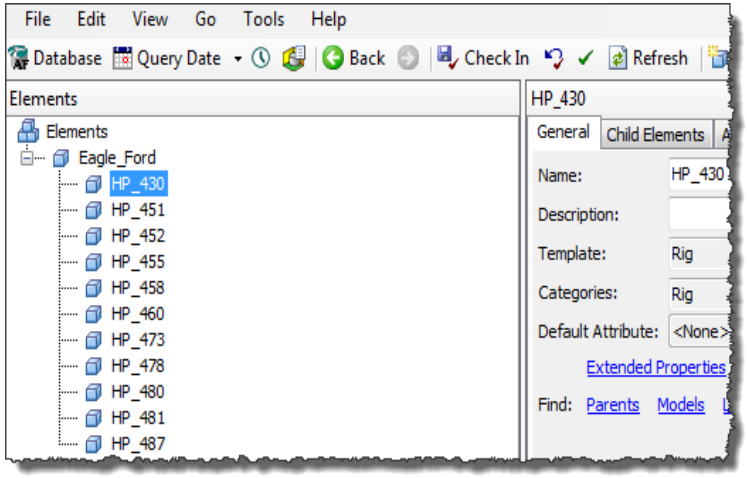
## Minimizing the cost of and time to first production

- The Problems we are trying to solve:
  - What are the sources of drilling idle time?
  - Which company and crew are best-in-class and why?
  - Which rigs are our top performers and why?

Improve drilling performance and optimization with improved drilling analytics and visualization with real-time data and information in context

# PI AF and PI EF for Drilling

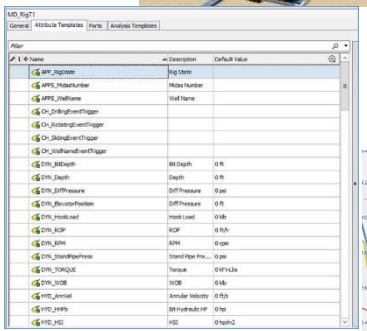
- **Rig**
  - 20 to 30 Measurements – 1second (or less) resolution (PI System tags)
- **Well**
  - Drilling 3 to 4 weeks
  - Completion 2 months
- **PI AF Element**
  - Use for the Rig
- **PI Event Frames**
  - Use for the Wells
  - Each parent Event Frame is a Well



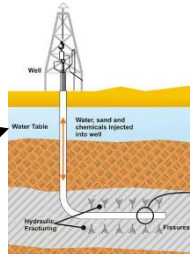
# Rigs and Wells

Drilling Rig 1

AF Element



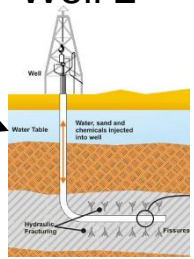
Well 1




Event Frames

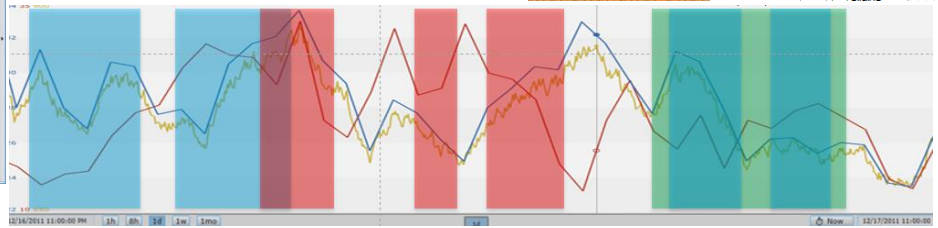
| | | | |
|---|---|---|---|
| Well 1 | 24:11:41:12 | 4/1/2014 2:00:00 AM | 4/25/2014 1:41:12 PM |
| Sliding | 0:19:00 | 4/1/2014 2:40:00 PM | 4/1/2014 2:59:00 PM |
| Rotary ... | 4:40:38 | 4/1/2014 3:33:45 PM | 4/1/2014 8:14:23 PM |
| Sliding | 0:28:30 | 4/1/2014 5:23:04 PM | 4/1/2014 5:51:34 PM |
| 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 |
| Sliding | 0:18:09 | 4/14/2014 8:41:25 AM | 4/14/2014 8:59:34 AM |

Well 2

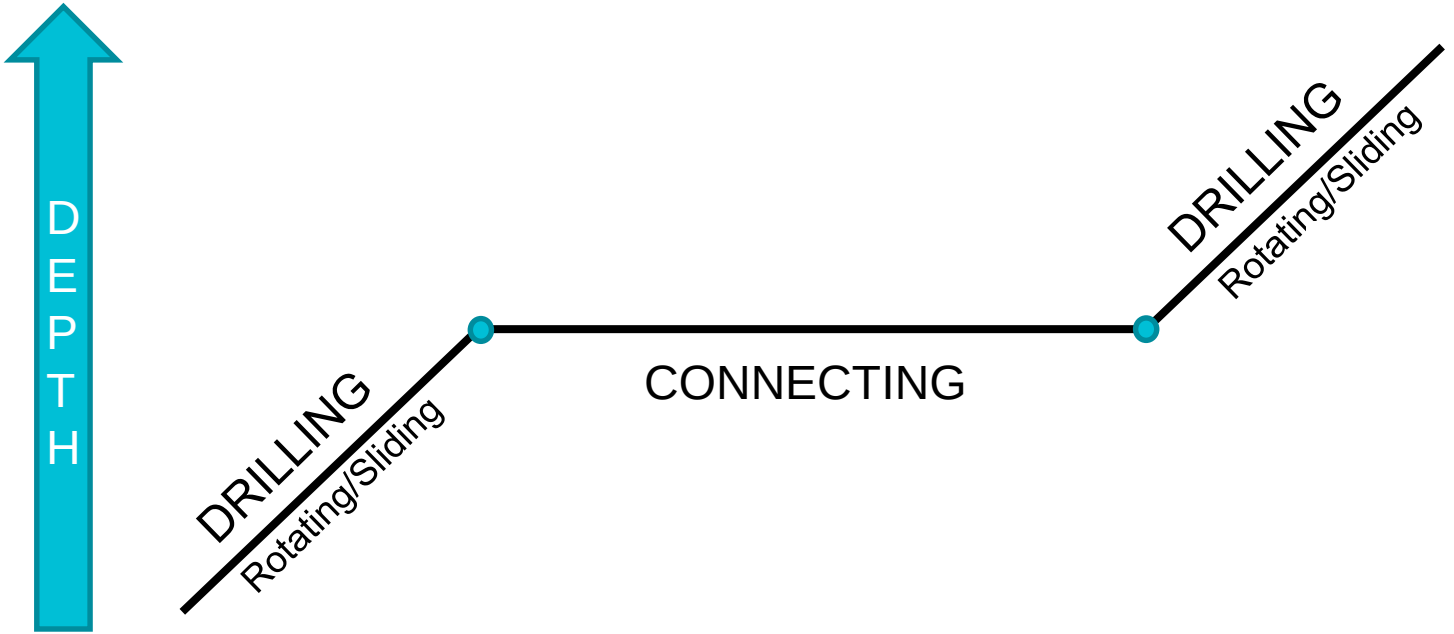



Event Frames

| | | | |
|---|---|---|---|
| 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 |

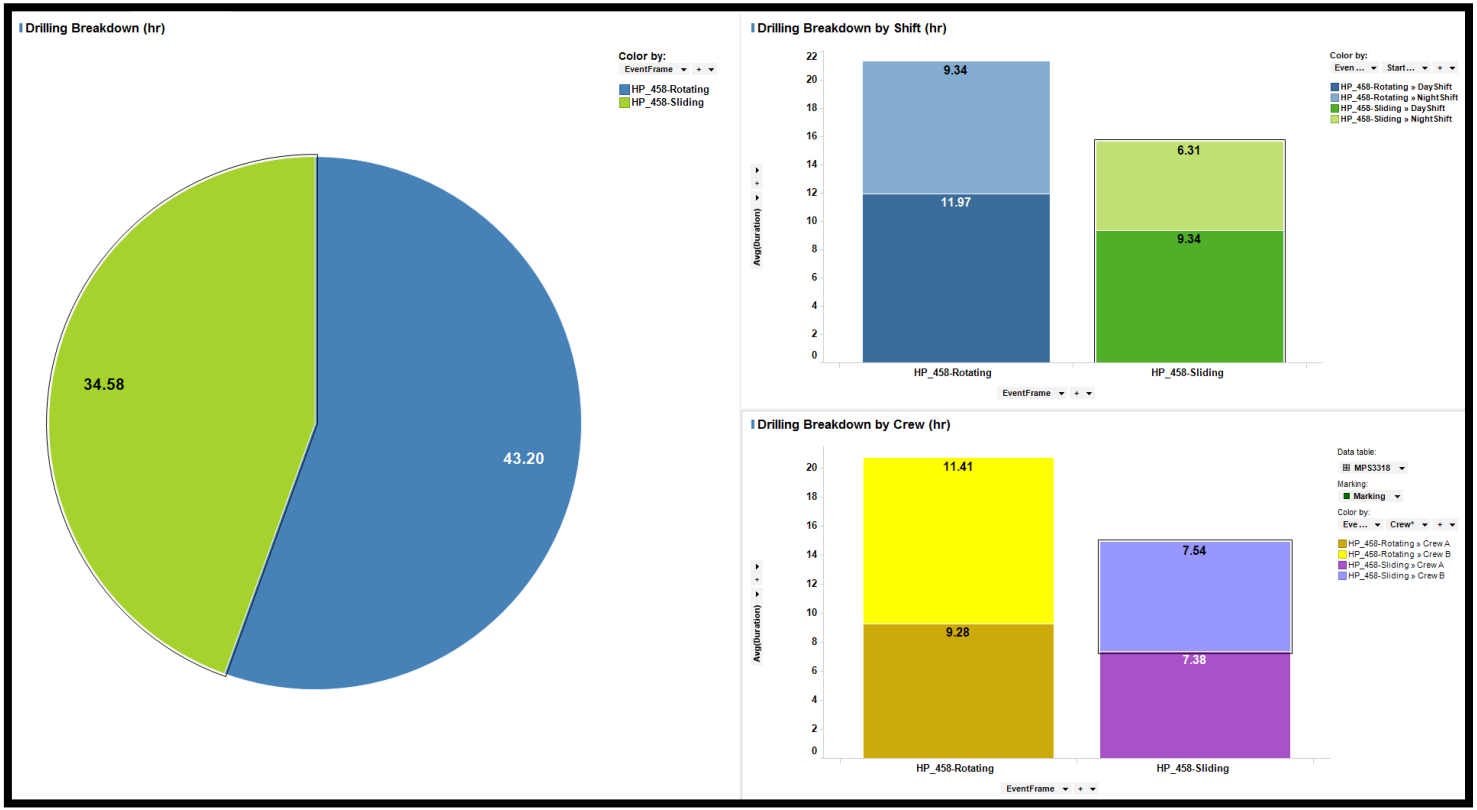


# Major Drilling Events

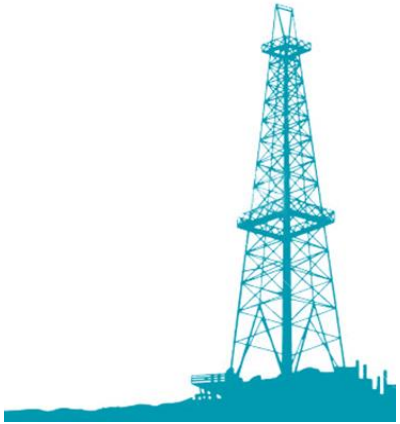


# PI Coresight with PI Event Frames Example

# Spotfire Shift & Crew Comparison From PI AF



# Agenda



- Brief Update on MaraDrill tm
- Using PI 2014  for Drilling Performance Analytics
- Concluding Remarks

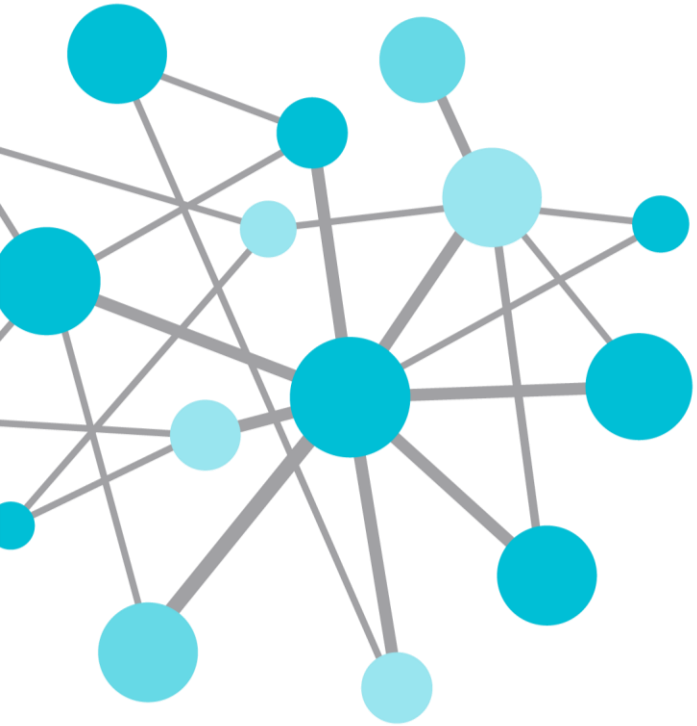
# Value Now, Value Over Time with the PI System

- 25+ years & Continuing to Find Incremental Value –“Future proofing” of our PI System Infrastructure Investment
- Using Features of PI 2014 – very powerful and strong value proposition
- MaraDrill™ has been rolled out across 25 rigs – Transformed Our Drilling
- Excited About the Use of New PI System Functionality

# Questions

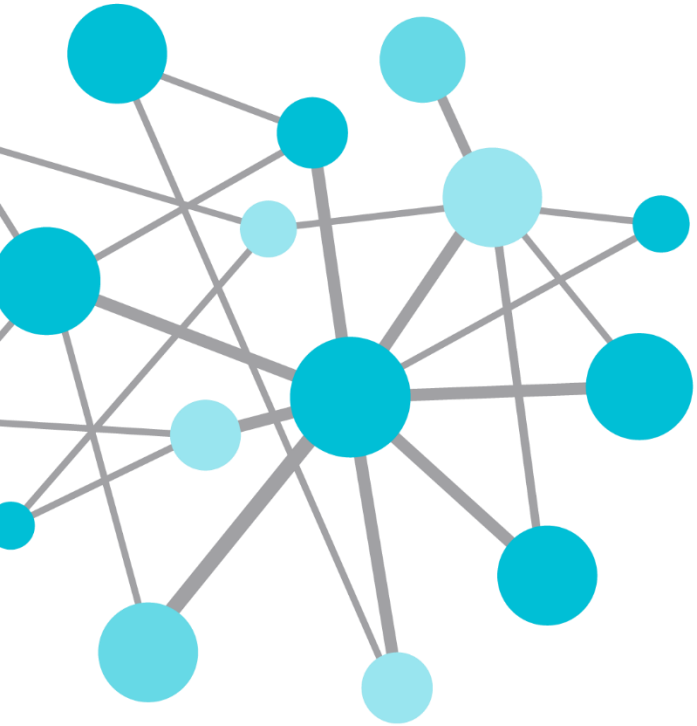
**Please wait for the microphone** before asking your question

**Please state your name** and your company



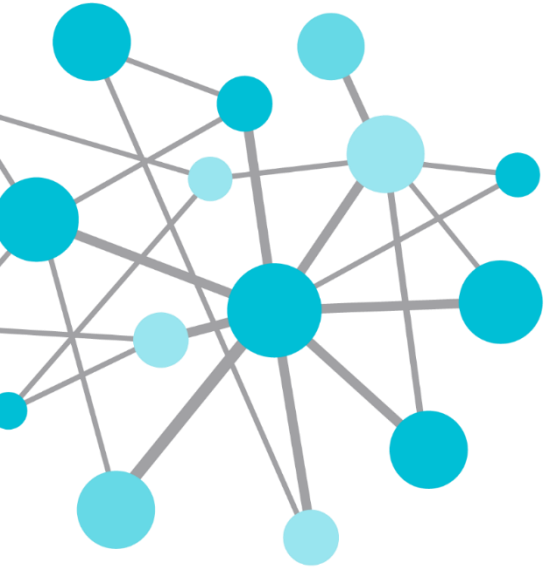
# THANK YOU

Brought to you by OSIsoft.



# Ken Startz

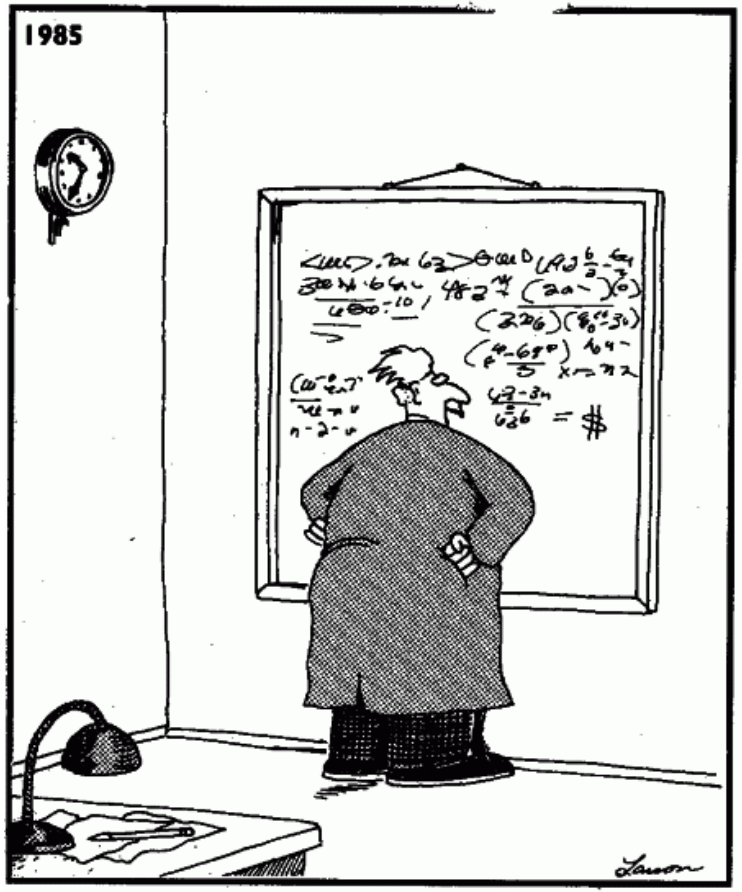
KLStartz@MarathonOil.Com
Advanced Senior Business Analyst
Marathon Oil Company



# Troubleshooting Operational Aspects of Well Drilling and Completion Using the PI System

Presented by **Ales Soudek**

**Yung Wallace**



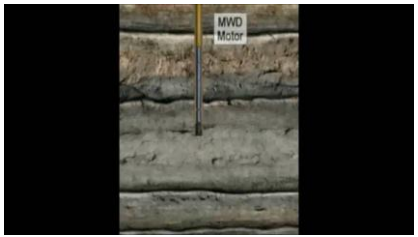

Einstein discovers that time is actually money.

# Business Challenge

- High Cost - $80,000/d to $1,000,000/d
- Reduce Drilling/Completion Days
  - Drilling – 20 to 25 days
  - Completion – 50 to 70 days
- Current focus – Depth Based Analysis
- Compare Shifts, Crews, Drilling Outfits
- Noise in the Data

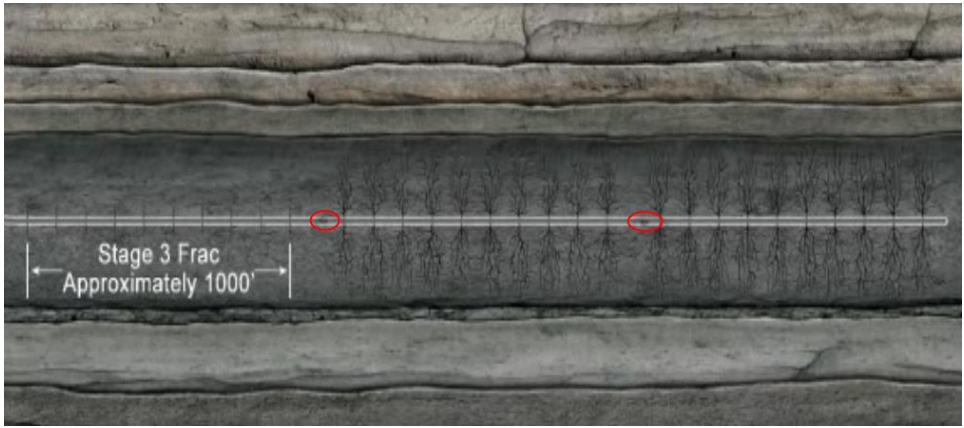
# Background and Terminology

- Stick-Slip
- Rotating Drilling
- Sliding
- Tripping In/Out
- On/Off Bottom
- Other Types of Events …



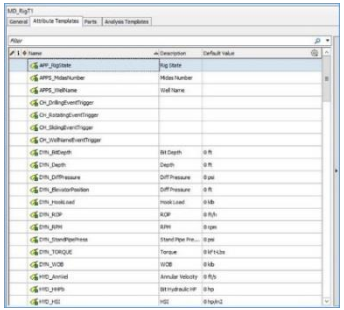
# Completion - Fracking

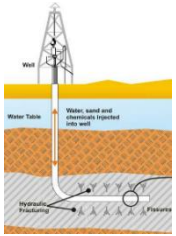
- Process
  - Blast
  - High Pressure Fluid
  - Plug
- Stages
  - Typically 1000 ft



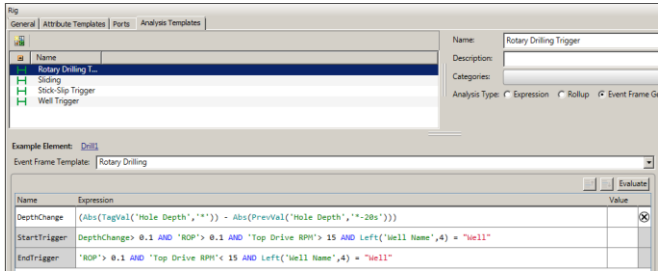
# The Approach

- PI AF Elements
  - Rigs
- PI Event Frames
  - Wells
- PI Asset Based Analytics
  - Triggers for Well Events





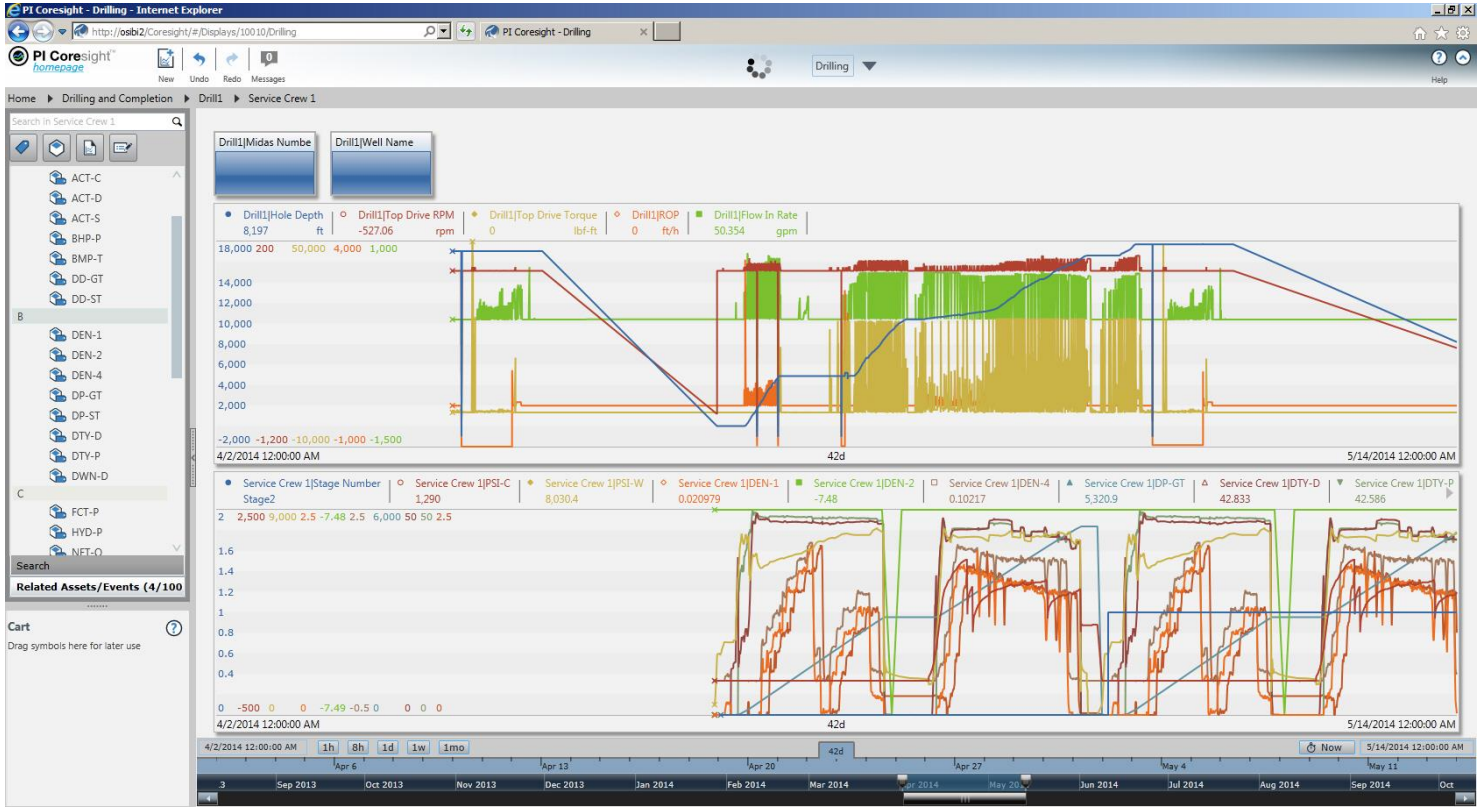




# Results

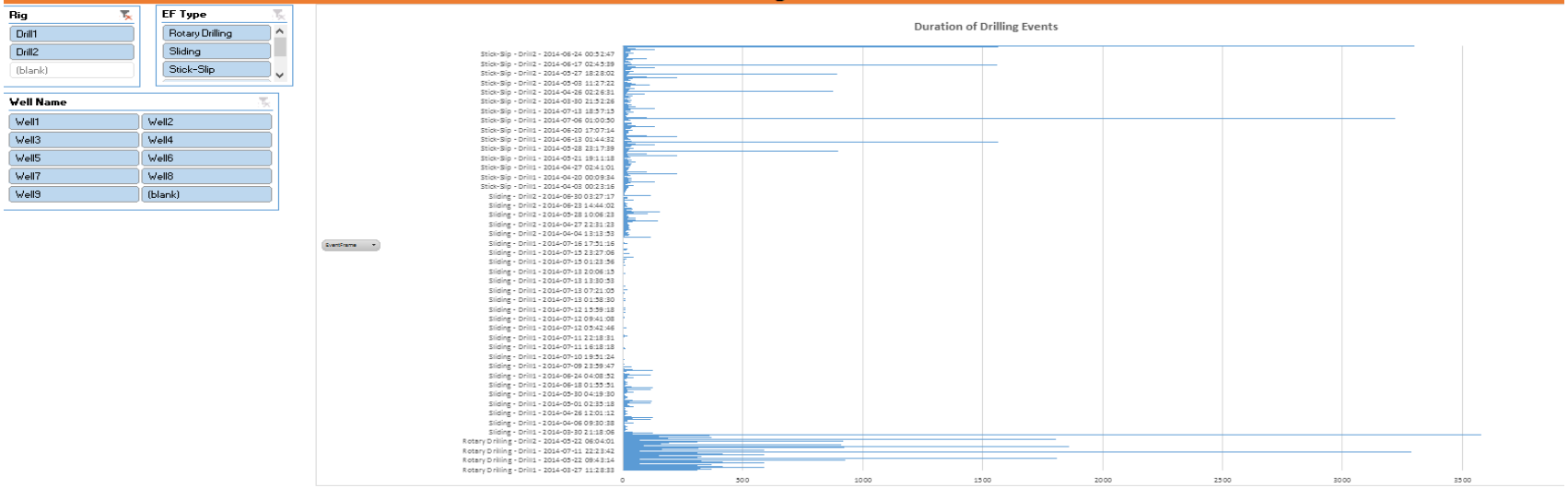
- Analyzing Results
  - PI Coresight
  - Microsoft PowerView
  - PI DataLink

# PI Coresight



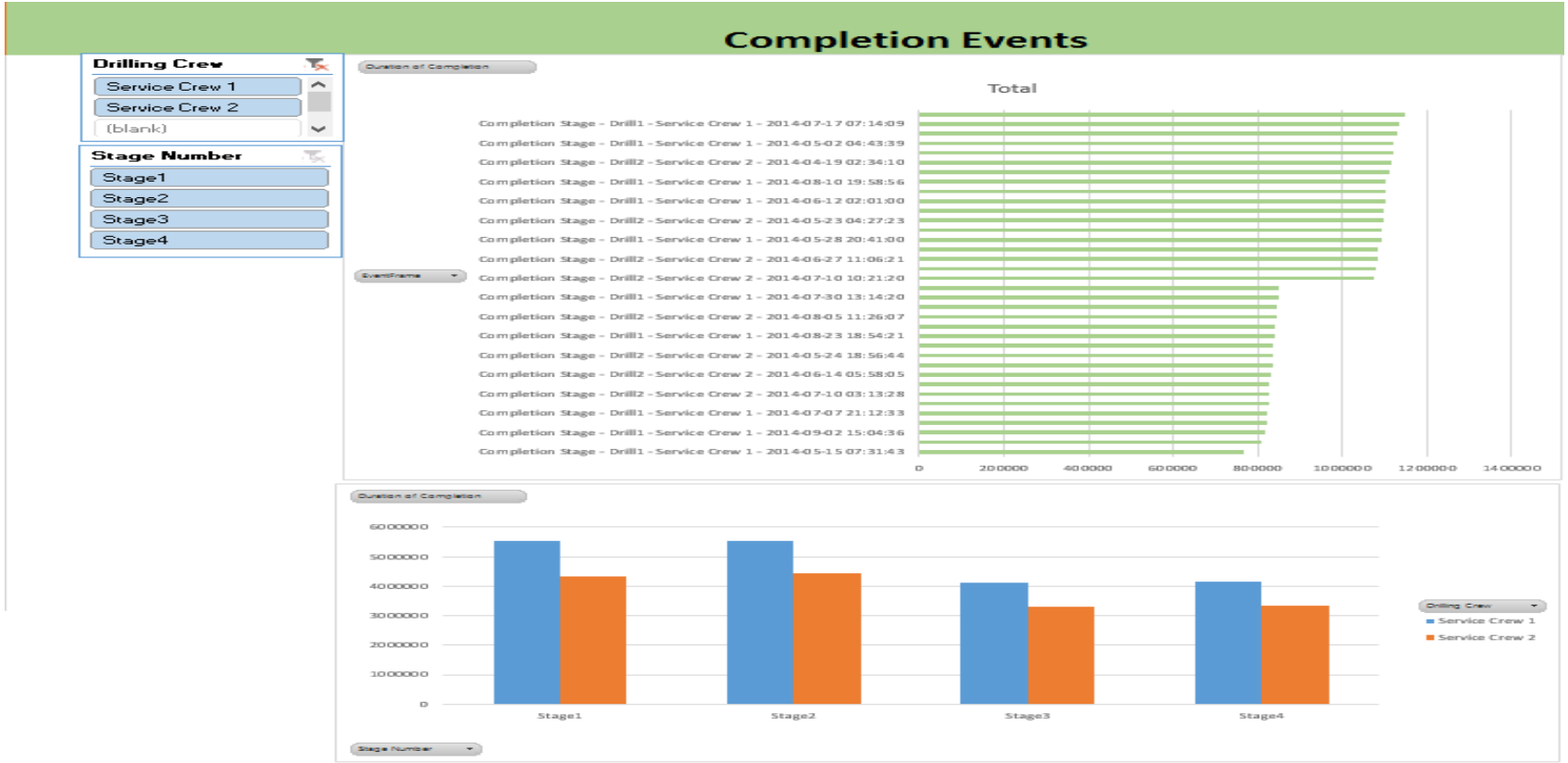
# Overview of Drilling Events

## Drilling Events

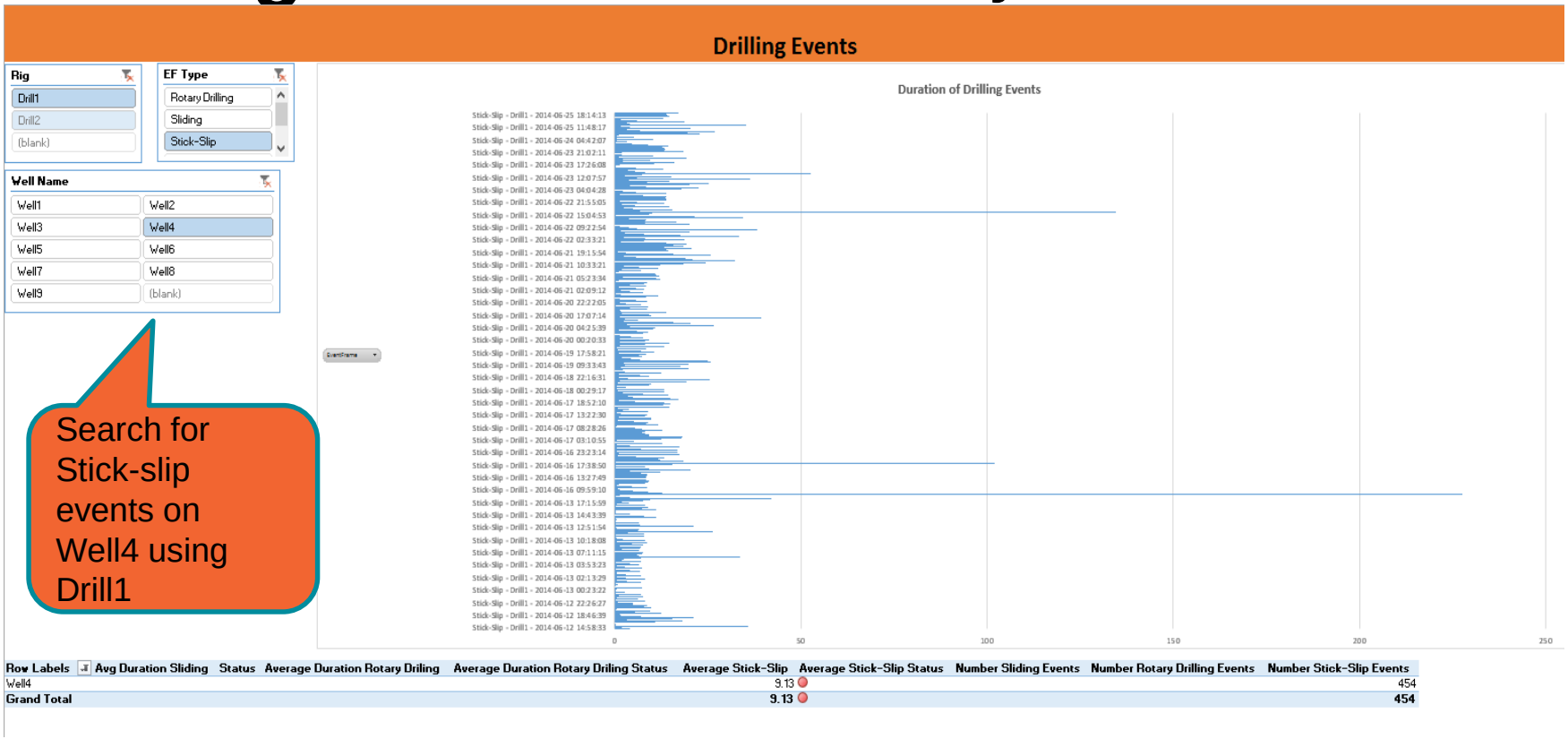



| Row Labels | Avg Duration Sliding | Status | Average Duration Rotary Drilling | Average Duration Rotary Drilling Status | Average Stick-Slip | Average Stick-Slip Status | Number Sliding Events | Number Rotary Drilling Events | Number Stick-Slip Events |
|---|---|---|---|---|---|---|---|---|---|
| Well1 | 4.7 | | 72.7 | | 8.13 | | 375 | 102 | 439 |
| Well2 | 4.69 | | 70.82 | | 8.31 | | 407 | 106 | 448 |
| Well3 | 4.84 | | 97.74 | | 14.6 | | 333 | 104 | 456 |
| Well4 | 4.71 | | 70.35 | | 9.13 | | 361 | 98 | 454 |
| Well5 | 0.88 | | 99.7 | | 16.14 | | 3425 | 106 | 460 |
| Well6 | 6.03 | | 77.41 | | 5.43 | | 181 | 77 | 114 |
| Well7 | 7.76 | | 60.71 | | 10.67 | | 236 | 91 | 423 |
| Well8 | 8.25 | | 95.89 | | 14.48 | | 221 | 98 | 461 |
| Well9 | 4.22 | | 110.91 | | 19.29 | | 381 | 104 | 455 |
| (blank) | 1.58 | | | | | | 1 | | |
| **Grand Total** | **2.76** | | **84.61** | | **12.5** | | **5921** | **886** | **3710** |

# Overview of Completion Events



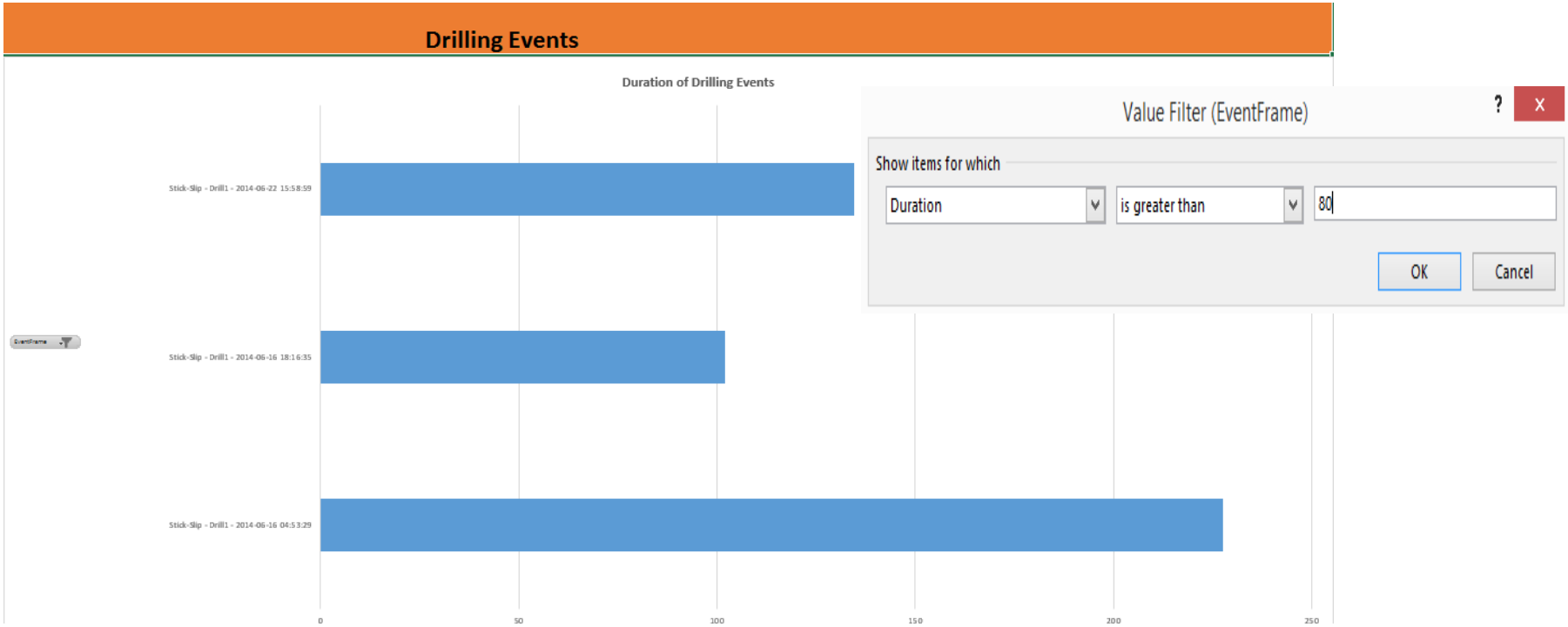
# Drilling Event – Ad hoc Analysis



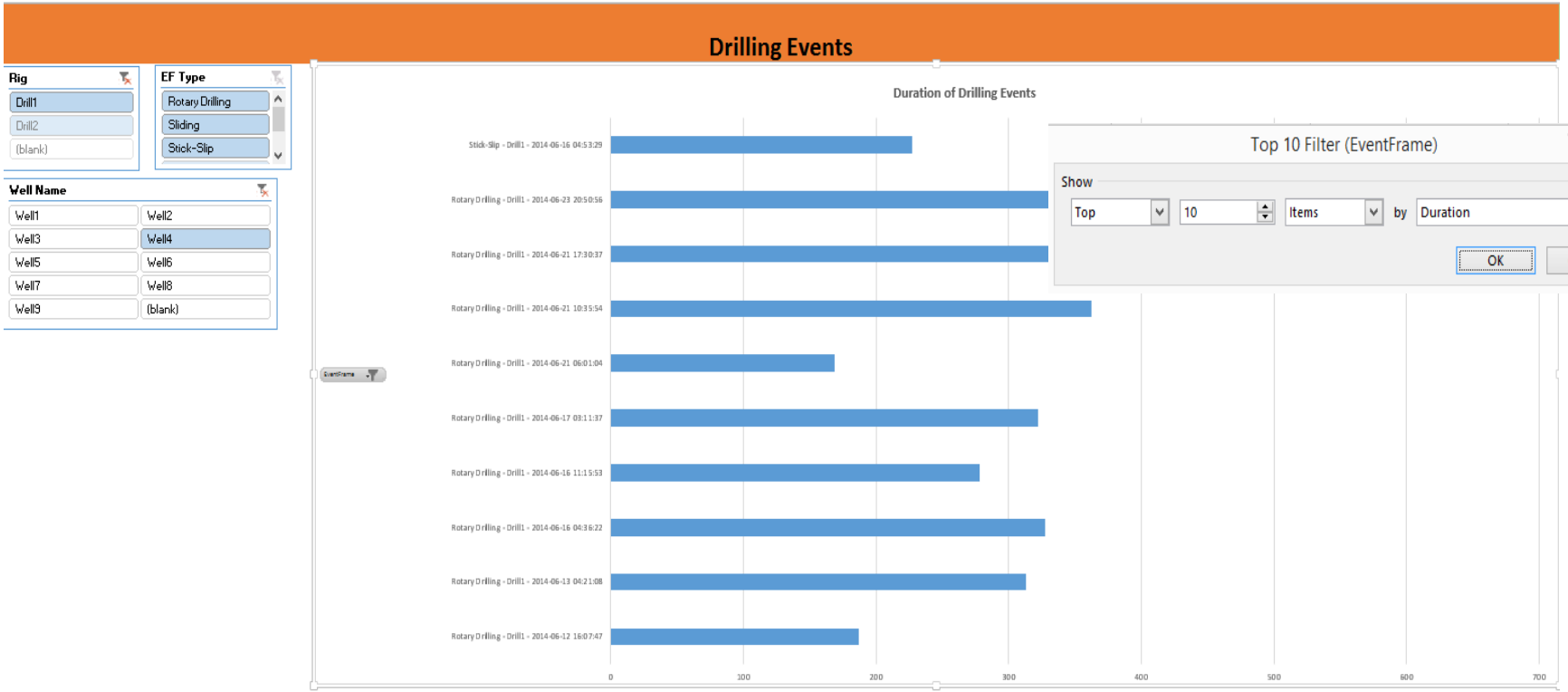

Search for Stick-slip events on Well4 using Drill1

| Row Labels | Avg Duration Sliding | Status | Average Duration Rotary Driling | Average Duration Rotary Driling Status | Average Stick-Slip | Average Stick-Slip Status | Number Sliding Events | Number Rotary Drilling Events | Number Stick-Slip Events |
|---|---|---|---|---|---|---|---|---|---|
| Well4 | | | | | 9.13 | | | | 454 |
| **Grand Total** | | | | | **9.13** | | | | **454** |

# Drilling Event – Search based on Duration

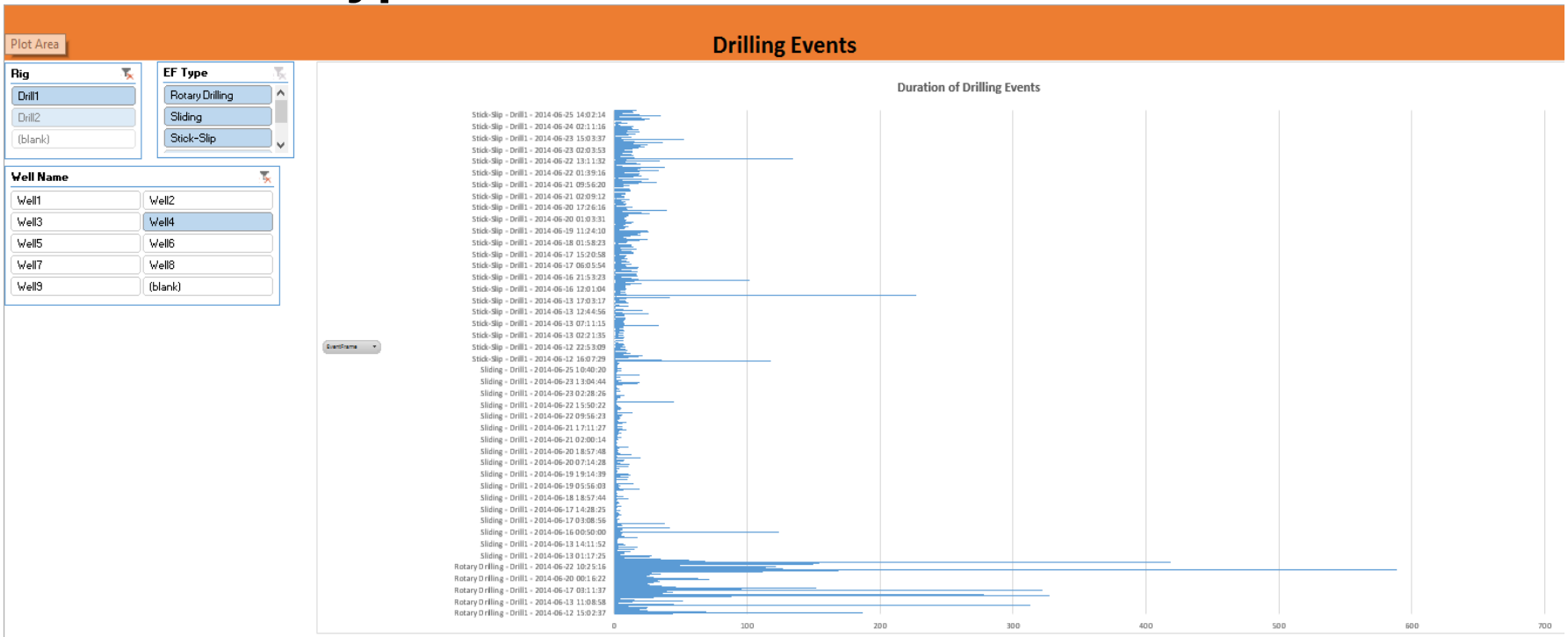


# Drilling Event – Search based on top 10 events



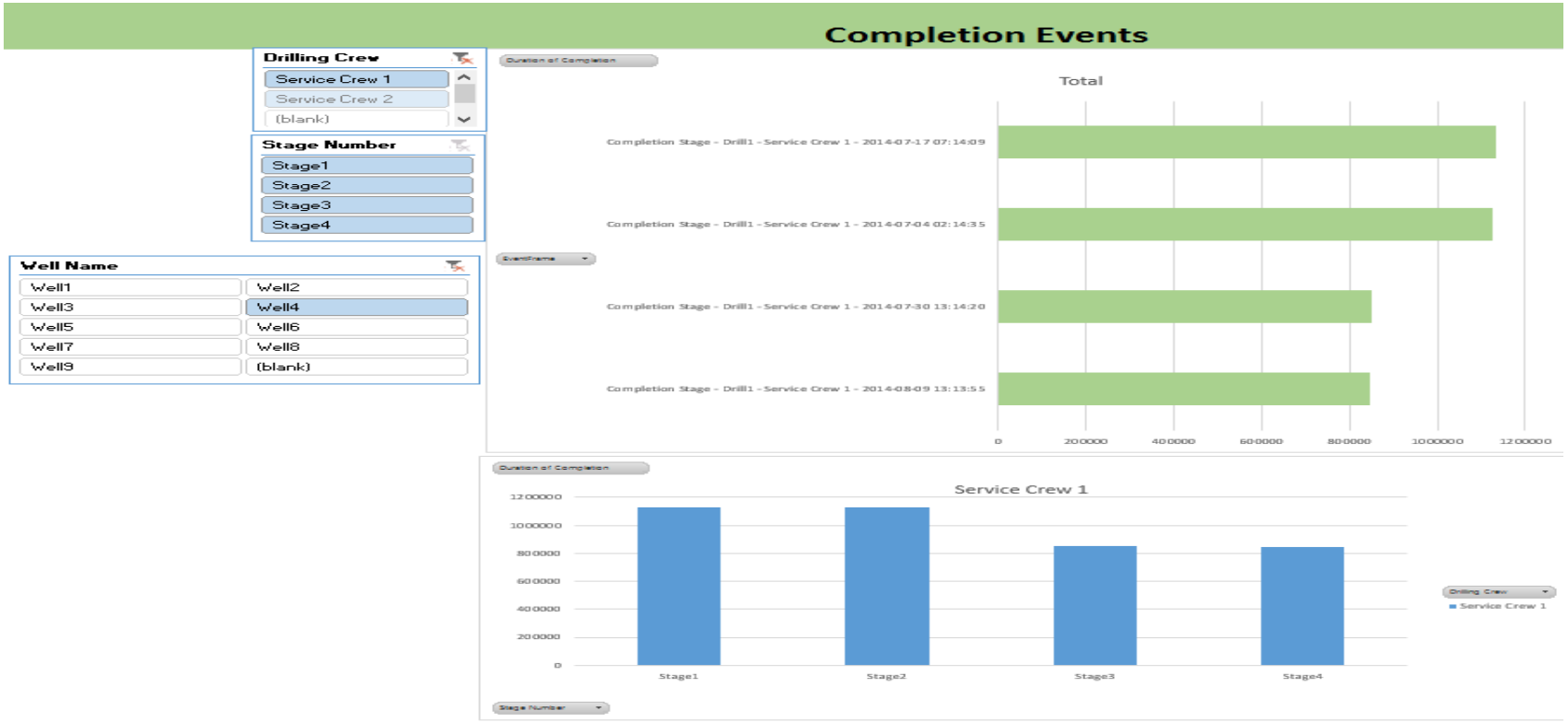

| Row Labels | Avg Duration Sliding | Status | Average Duration Rotary Drilling | Average Duration Rotary Drilling Status | Average Stick-Slip | Average Stick-Slip Status | Number Sliding Events | Number Rotary Drilling Events | Number Stick-Slip Events |
|---|---|---|---|---|---|---|---|---|---|
| Well4 | 4.71 | | 70.35 | | 9.13 | | 361 | 98 | 454 |
| **Grand Total** | **4.71** | | **70.35** | | **9.13** | | **361** | **98** | **454** |

# Drilling Event – Calculate the average duration for each event type




| Row Labels | Avg Duration Sliding | Status | Average Duration Rotary Driling | Average Duration Rotary Driling Status | Average Stick-Slip | Average Stick-Slip Status | Number Sliding Events | Number Rotary Drilling Events | Number Stick-Slip Events |
|---|---|---|---|---|---|---|---|---|---|
| Well4 | 4.71 | | 70.35 | | 9.13 | | 361 | 98 | 454 |
| **Grand Total** | **4.71** | | **70.35** | | **9.13** | | **361** | **98** | **454** |

# Completion Event – Search for completion events on a Well

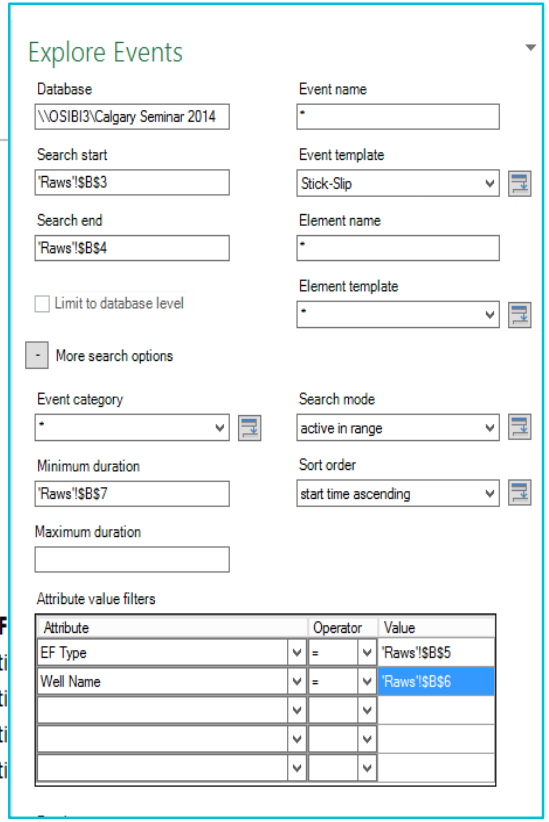


# PI DataLink

## Sample Drilling Report

| | |
|---|---|
| Start Time | *-500d |
| End Time | * |
| EF Type | Stick-Slip |
| Well Name | Well3 |
| Duration | 5 |

| Event name | Start time | End time | Duration | Event template | Primary element | EF Type | Drilling Crew | EF |
|---|---|---|---|---|---|---|---|---|
| Stick-Slip - Drill1 - 2014-06-03 16:01: | 03-Jun-14 16:01:15 | 05-Jun-14 23:02:27 | 2 7:01:12 | Stick-Slip | Drill1 | Stick-Slip | Service Crev | Sti |
| Stick-Slip - Drill1 - 2014-06-02 00:48: | 02-Jun-14 00:48:27 | 03-Jun-14 02:55:19 | 1 2:06:52 | Stick-Slip | Drill1 | Stick-Slip | Service Crev | Sti |
| Stick-Slip - Drill1 - 2014-05-26 21:39: | 26-May-14 21:39:18 | 27-May-14 12:35:38 | 0 14:56:20 | Stick-Slip | Drill1 | Stick-Slip | Service Crev | Sti |
| Stick-Slip - Drill1 - 2014-05-22 14:31: | 22-May-14 14:31:13 | 24-May-14 20:07:28 | 2 5:36:15 | Stick-Slip | Drill1 | Stick-Slip | Service Crev | Sti |



# Future Plans

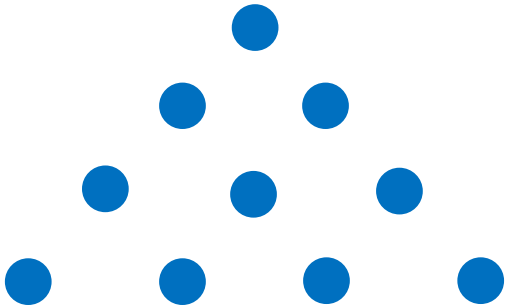
- Expand PI Event Frames Template
- Expand Analyses
- Create Performance KPIs

# Conclusion

- Ability to Analyze Operations
  - Event Frames
  - Analytics
  - BI Tools
- Shorten time for Drilling and Completions

# Yearly Puzzle

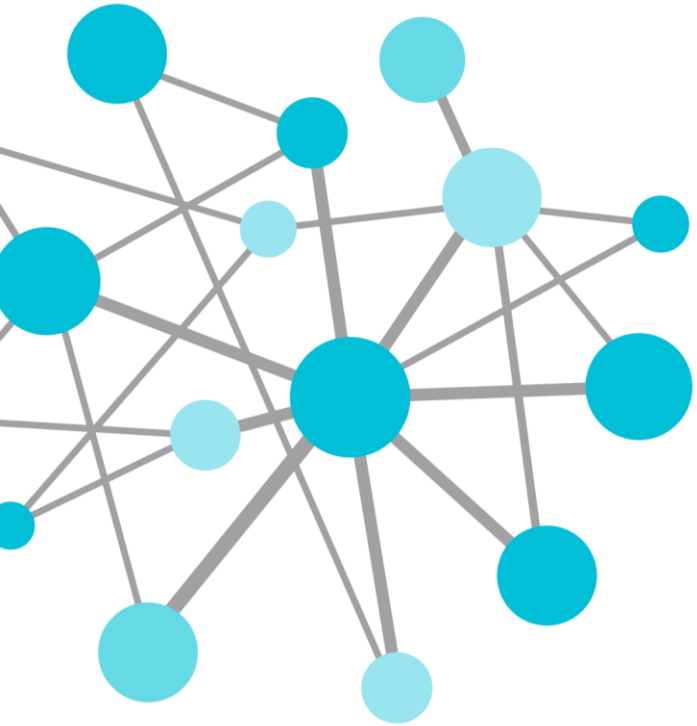
“Move 3 dots to turn the triangle upside down."



# Questions

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

**Please state your name** and your company



# THANK YOU

Brought to you by OSIsoft.

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# Segment Overview

- Introduction and Context
- The Integrated Value Chain
- Update on Key E&P Interfaces & Connectors
- Advanced Analytics and Visualization
- Concluding Remarks and Q&A

# Questions

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

**Please state your name** and your company

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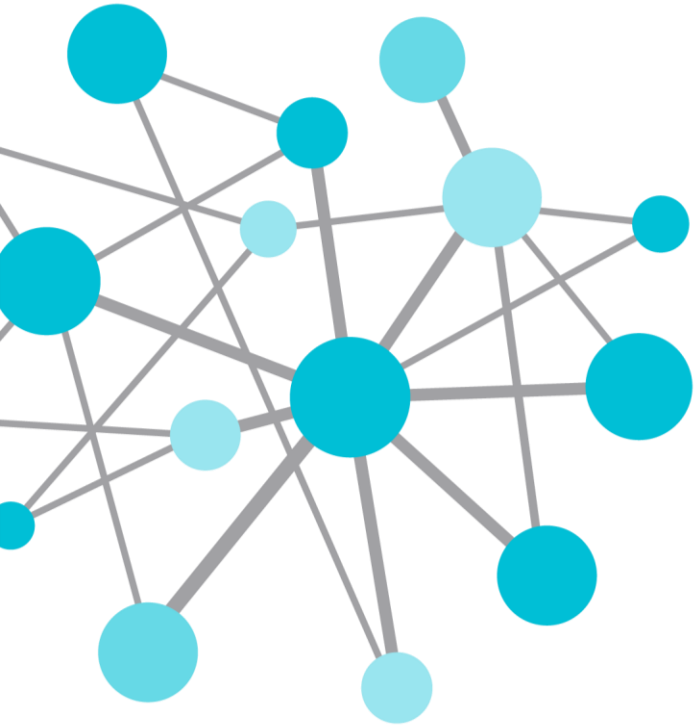

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