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
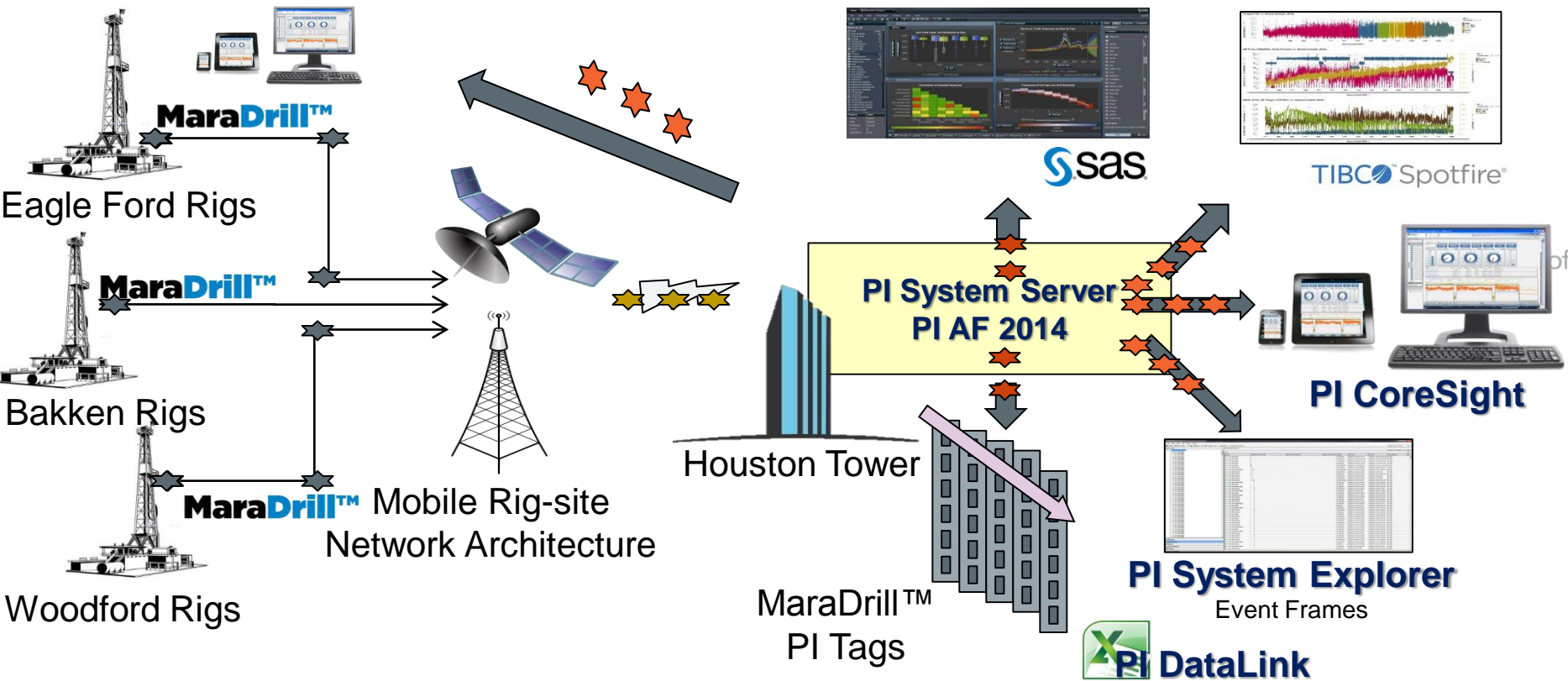
Presented by **Ken Startz – Marathon Oil**

Agenda

- Brief Update on MaraDrill ™

- Using PI 2014 for Drilling Performance Analytics

- Concluding Remarks

Data Workflow – Collaboration & Guidance at the Drill Site

Eagle Ford Rigs

Bakken Rigs

Woodford Rigs

Mobile Rig-site
Network Architecture

Houston Tower

MaraDrill™
PI Tags

PI System Server
PI AF 2014

SAS

TIBCO Spotfire

PI CoreSight

PI System Explorer
Event Frames

PI DataLink

Common Drilling Data Tags
Engineering Units

ROP = Rate of Penetration – Ft / Hr
WOB = Weight on Bit – K Pounds
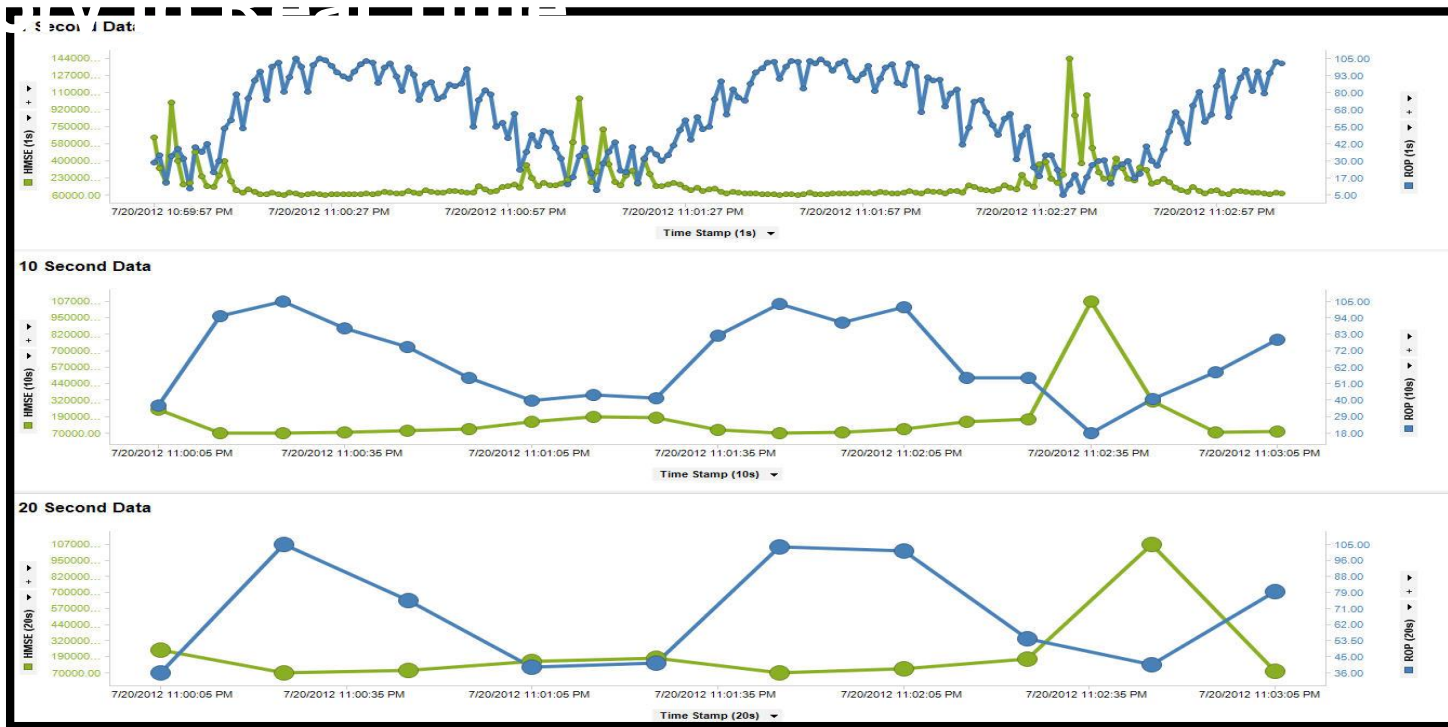RPM = Revolutions per Minute – RPM
Mud Flow Rate – GPM
Torque – kFt*Lbs

Need 1 second time stamp resolution!

Importance of <1 second data

MaraDrill™

Other vendors

Rig Display

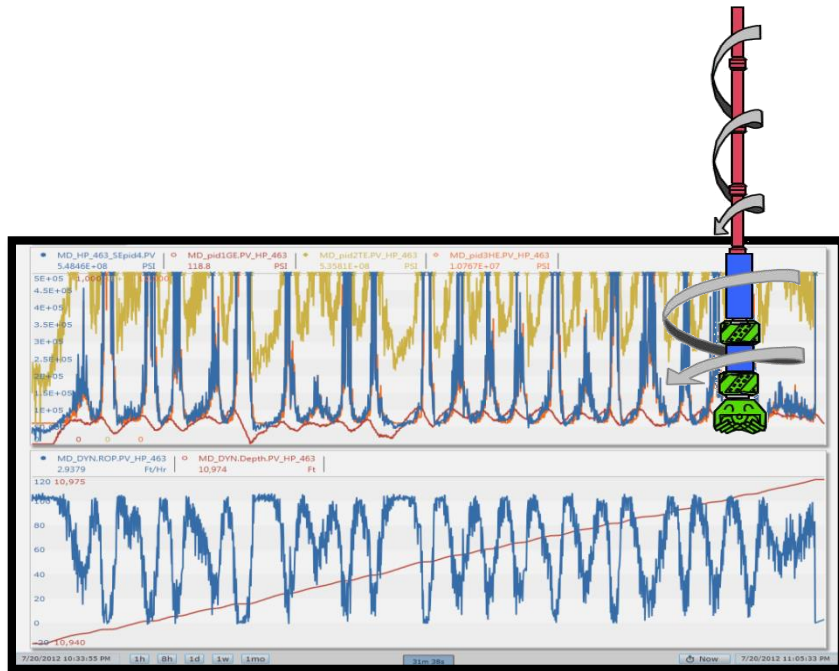# PI Coresight – Stick-Slip Identification- Eagle Ford Rig

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

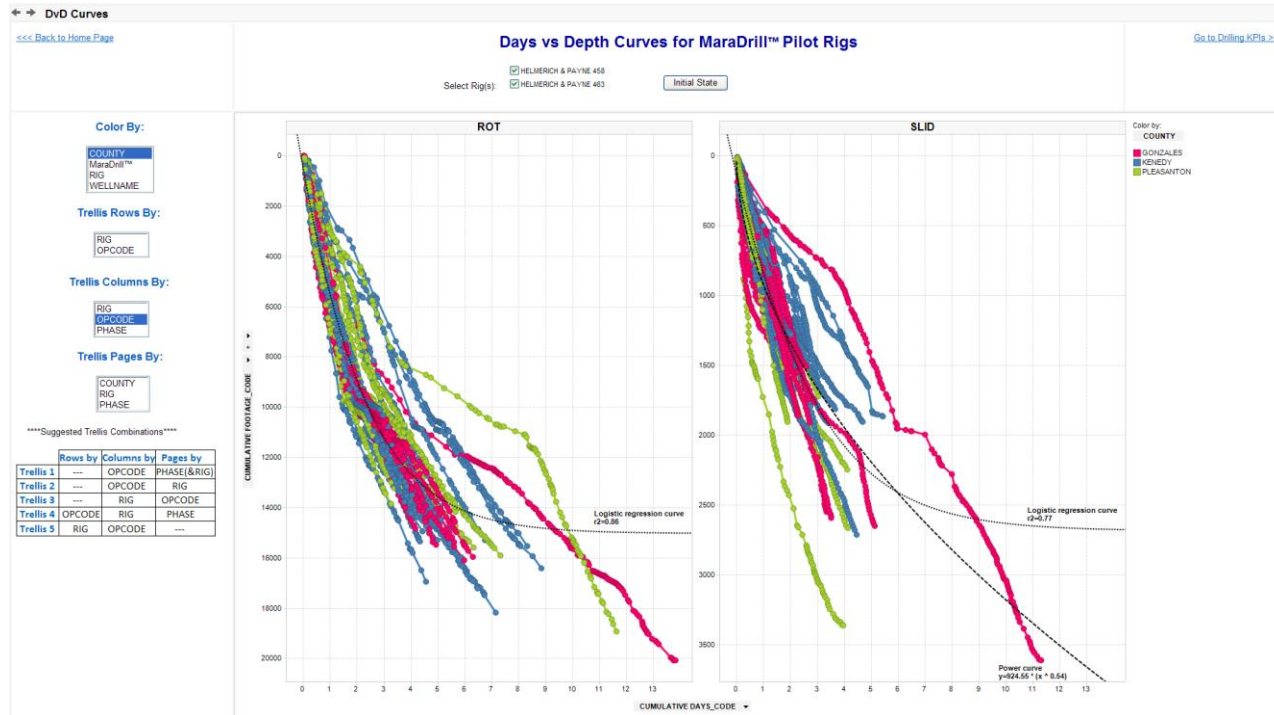Modeling the rock strength & predicting ROP's on subsequent wells in the area to improve logistics and planning
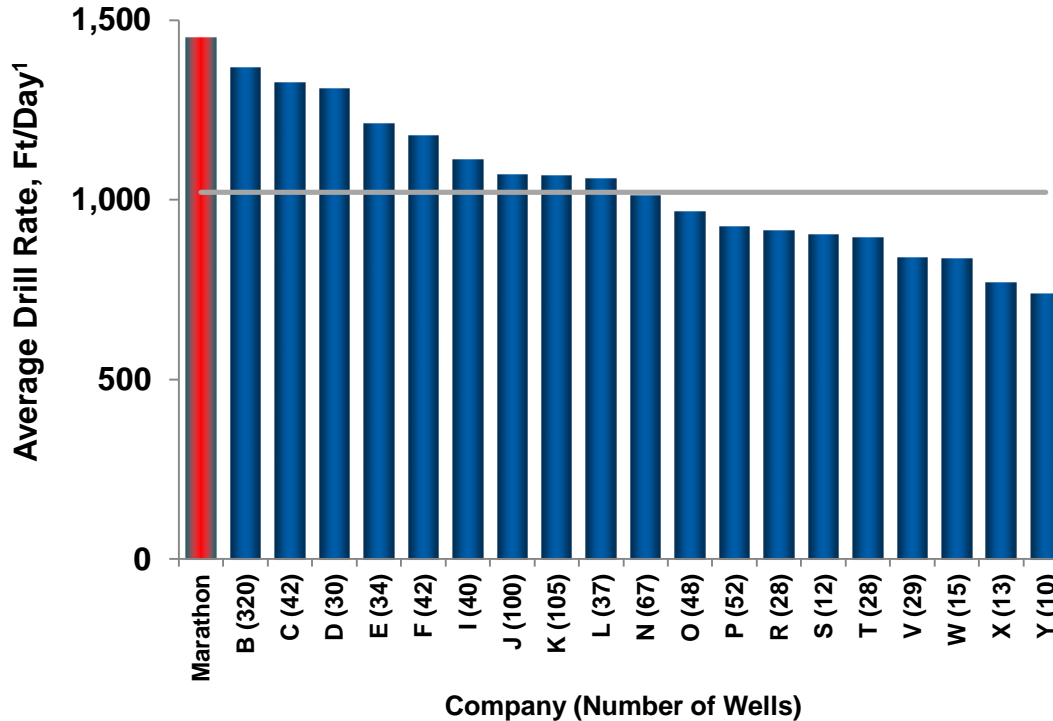

Rock Strength Profile by Formation
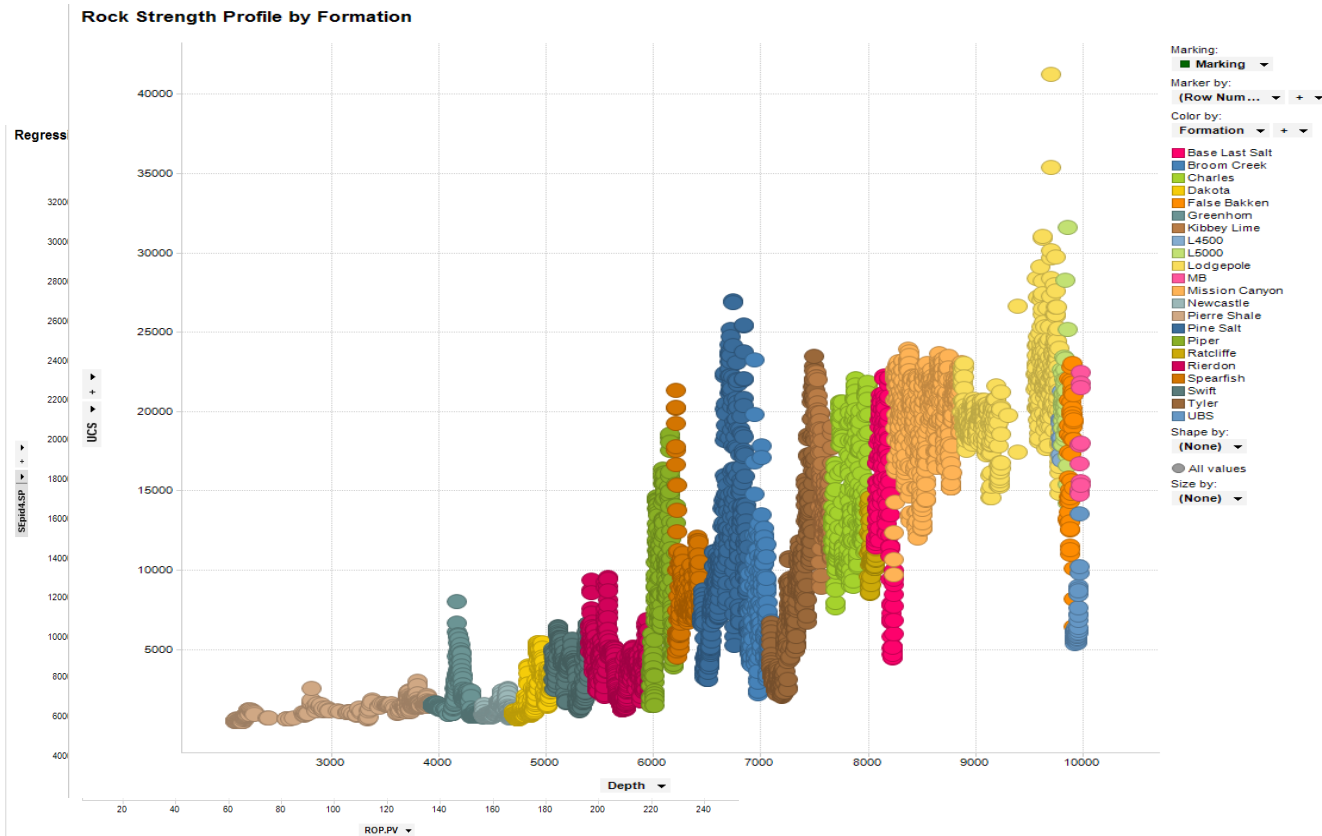
Days vs Depth Curves for MaraDrill™ Rigs
Black = MD, Teal = No MD

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

Chart: Spud to TD (Days)[1] by quarter

Quarter	Spud to TD (Days)
2011 4Q	24
2012 1Q	18
2012 2Q	18
2012 3Q	15
2012 4Q	15
2013 1Q	12
2013 2Q	12
2013 3Q	12

~50% Improvement
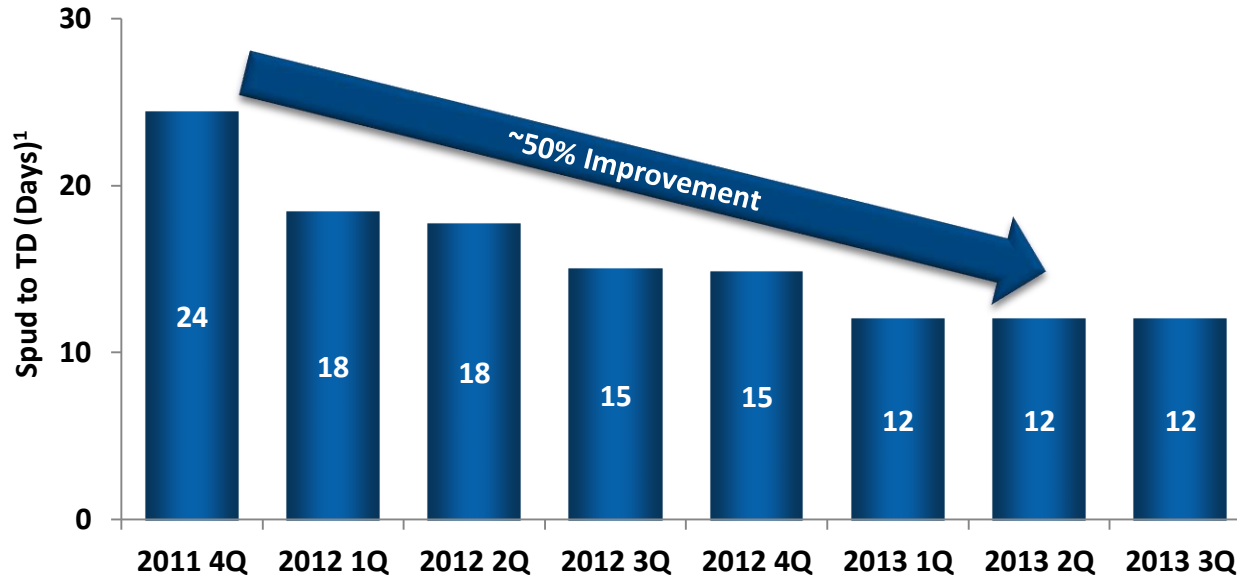
Note: Spud to TD Days: MRO-op wells, excludes pilot holes and wells with intermediate casing.

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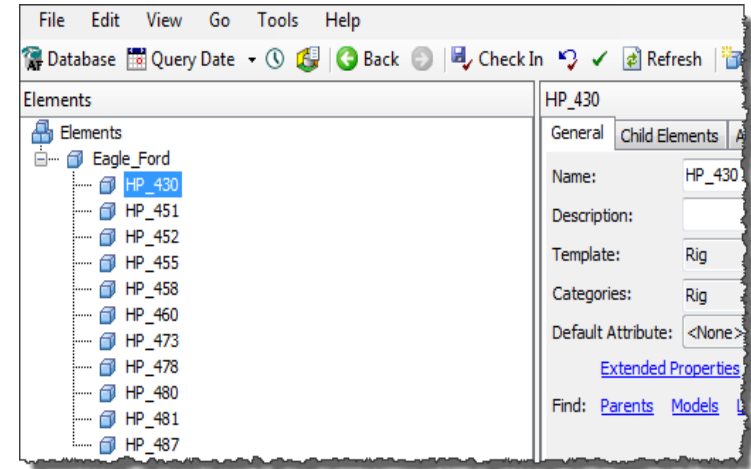# Drilling Performance Analytics

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**
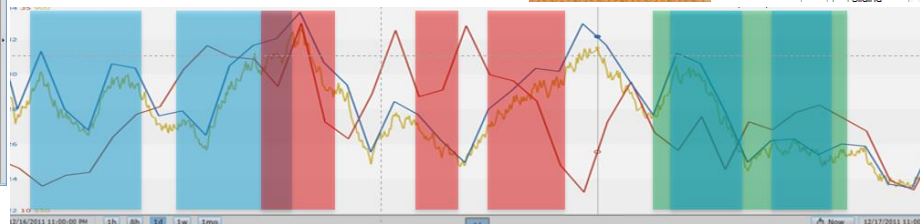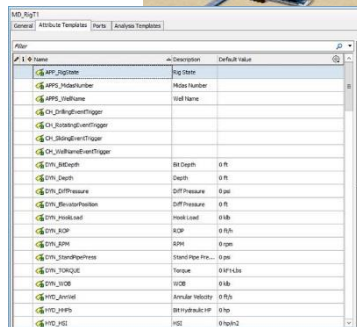 - Use for the Wells
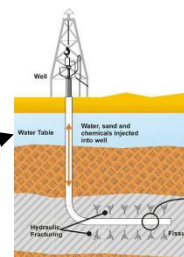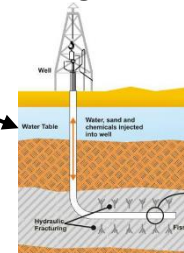 - Each parent Event Frame is a Well

Rigs and Wells

Well 1

Drilling Rig 1

Event Frames

AF Element

Well 2

Event Frames

Major Drilling Events

DEPTH
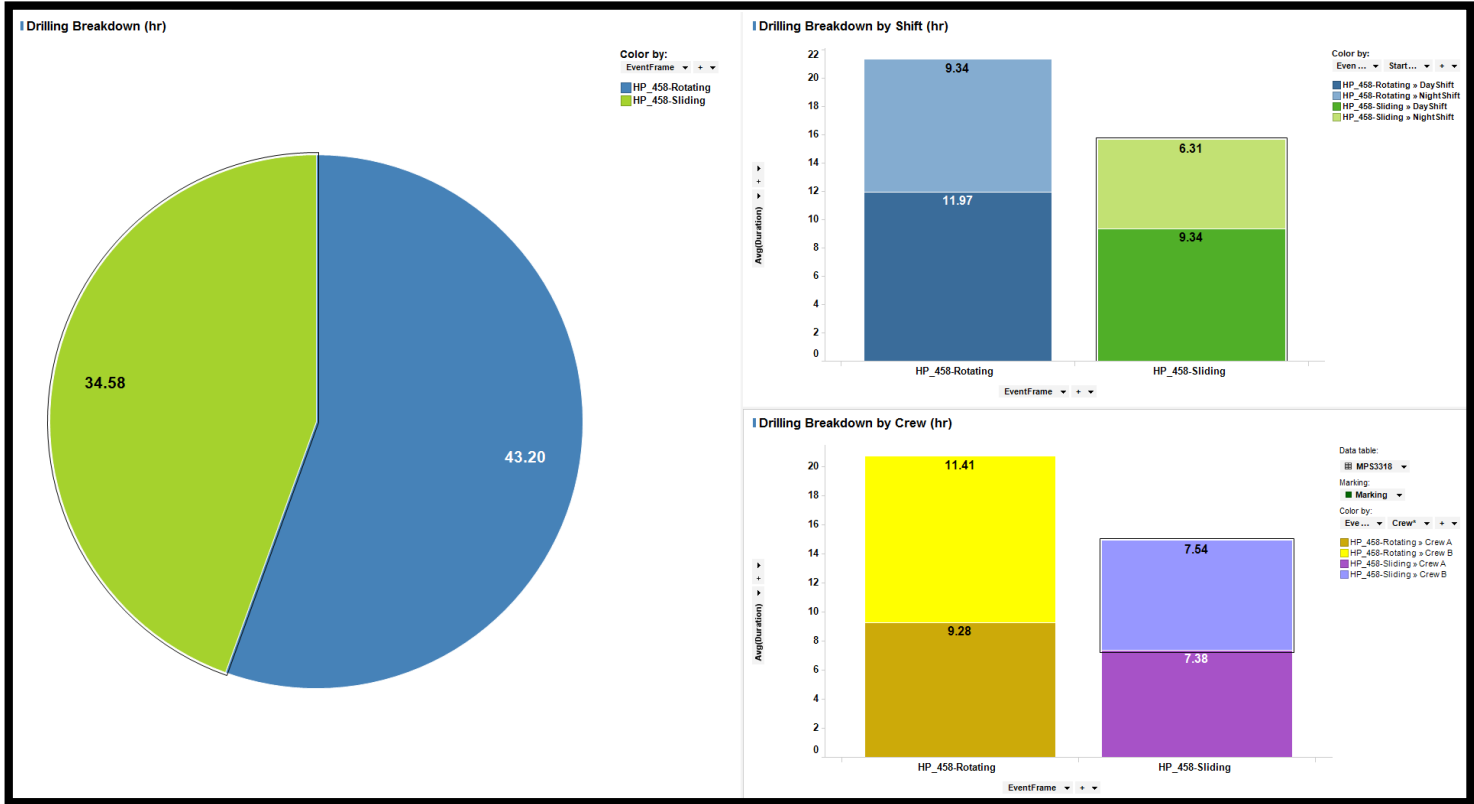
DRILLING
Rotating/Sliding

CONNECTING

DRILLING
Rotating/Sliding

PI Coresight with PI Event Frames Example

# Spotfire Shift & Crew Comparison From PI AF

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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^{TM} has been rolled out across 25 rigs – Transformed Our Drilling

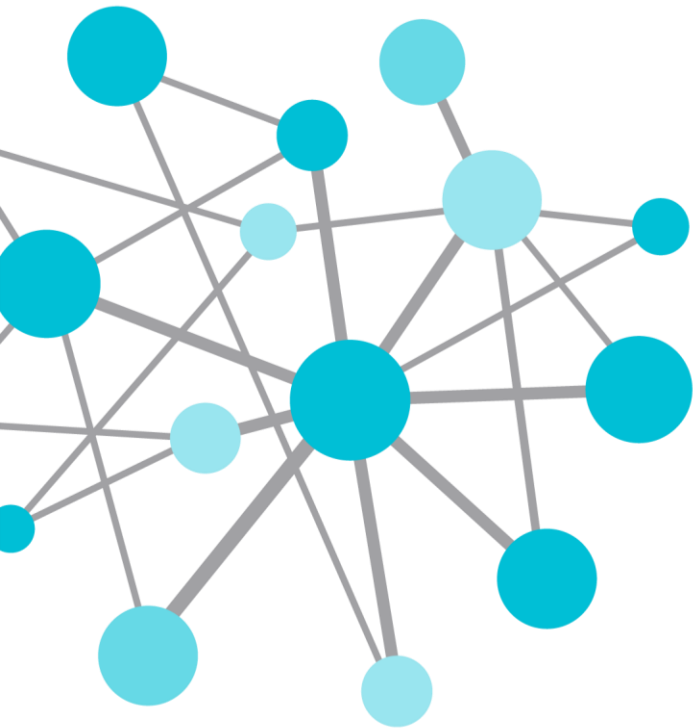- Excited About the Use of New PI System Functionality
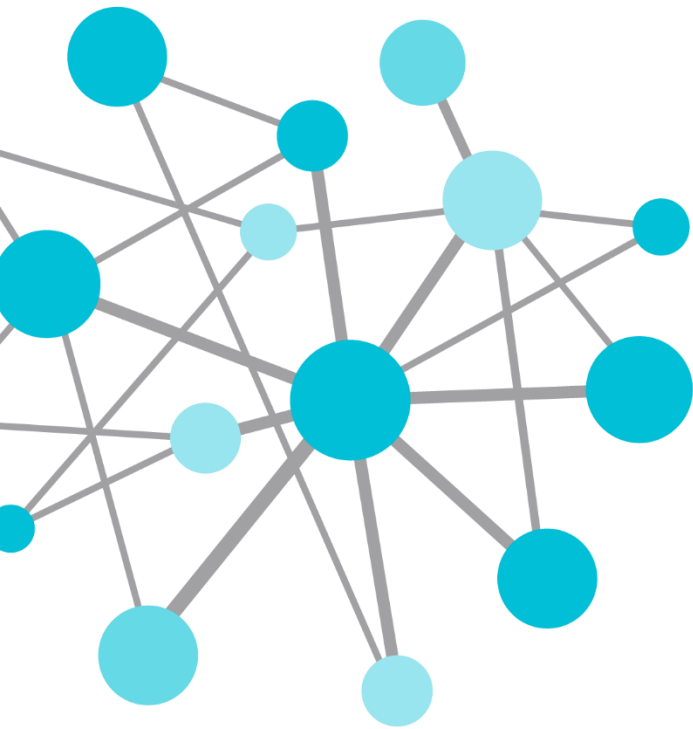
Questions

Please wait for the microphone before asking your question

Please state your name and your company

THANK YOU

Brought to you by **OSI**soft.

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Marathon Oil Company