

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**

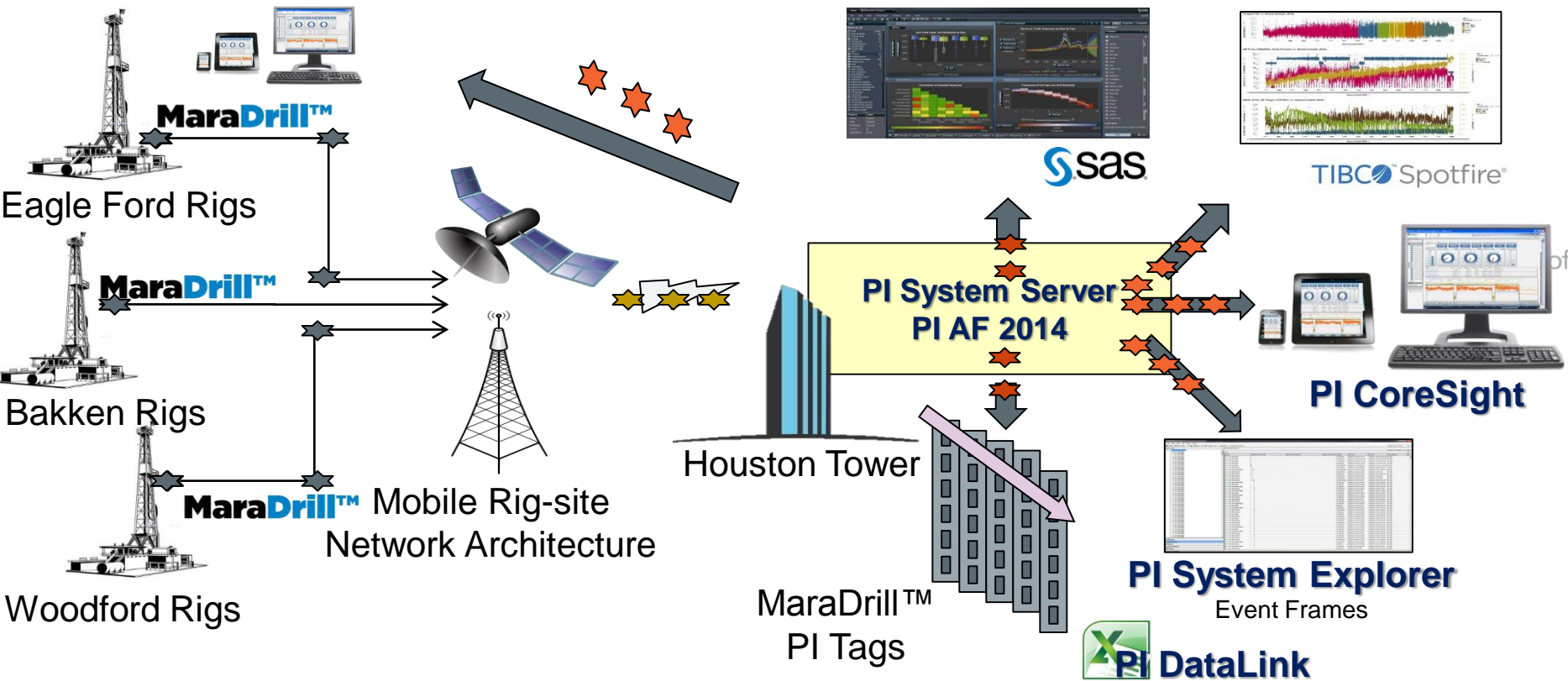


Agenda

- Brief Update on MaraDrill 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

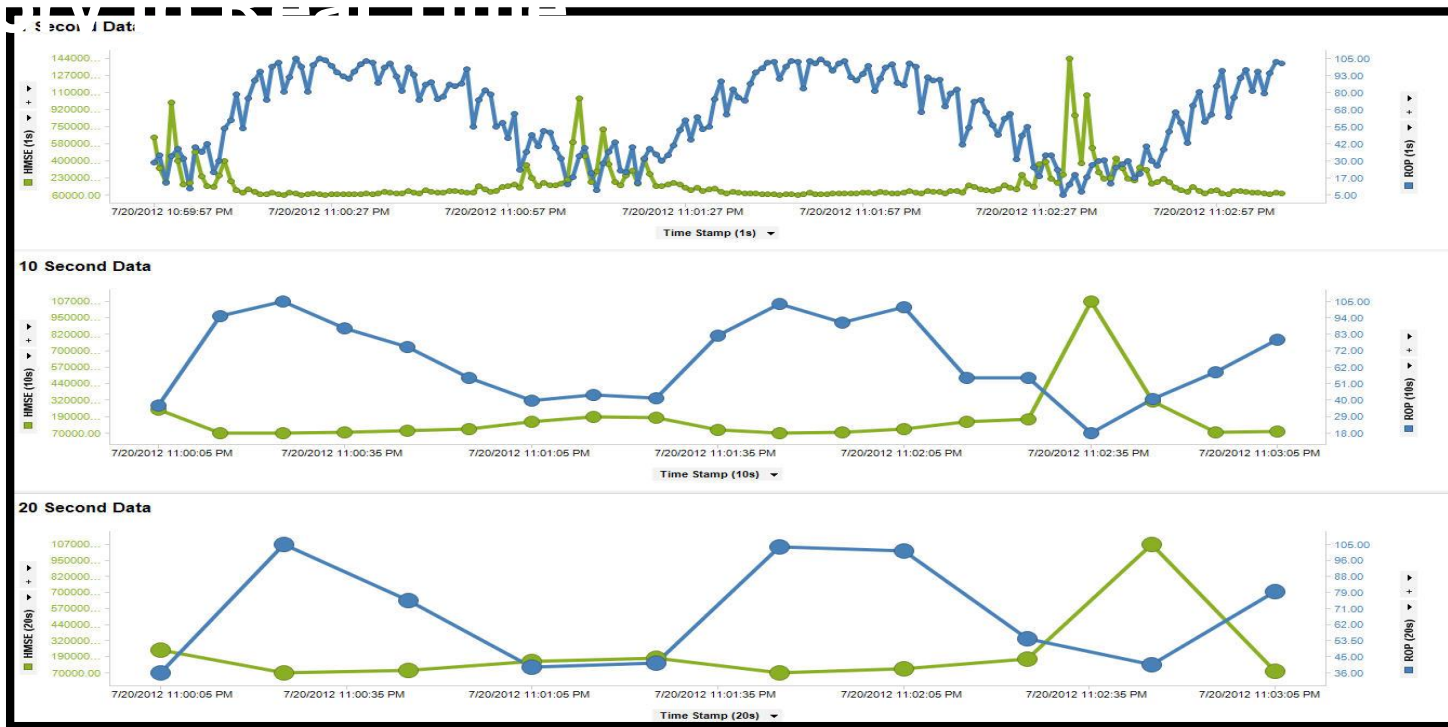
Torque – kFt*Lbs

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



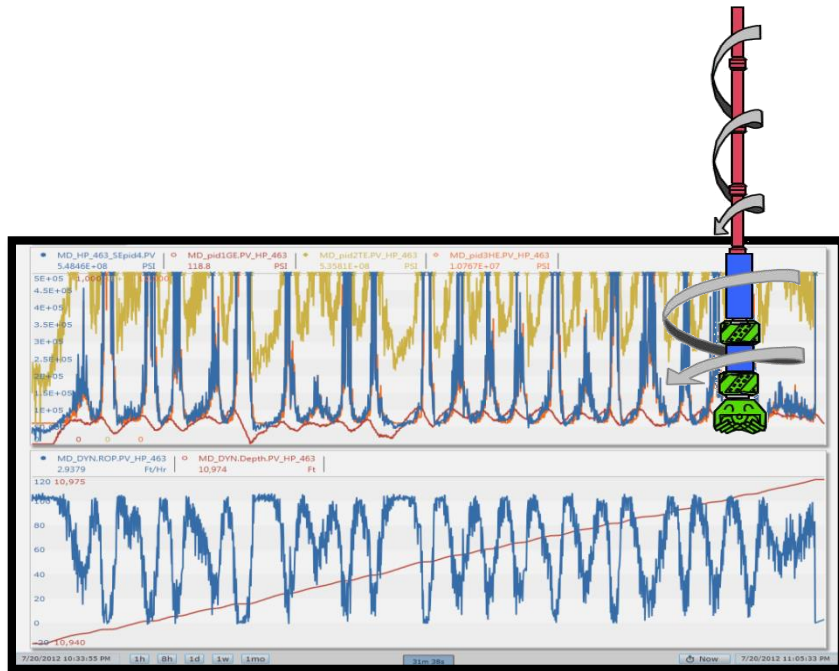
“Perfect” drilling

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

The screenshot displays the 'PI UI Template v6 (Coresight) - TIBCO Spotfire' application. The interface is divided into several sections:

- Control Panel:** Located on the left, it features the MaraDrill™ logo and a button labeled 'Step 0 (Optional)'. Below this are links for 'Control Panel Instructions' and 'PIs Analysis Instructions'. A red circle highlights the 'Step 0 (Optional)' button, with an orange arrow pointing to the text 'Enables integration with PI data from PI Coresight'.
- Estimated Number of Records to be Retrieved:** A box showing '1,036,812'.
- Comments:** A text area for user notes.
- Step 1 - Select Rig:** A dropdown menu with options: 306, 430, 455, and KCS.
- Step 2 - Select Time Frame:** Includes 'Start Time' (1/1/2013 12:00:00 AM), 'Time Interval' (1 second(s)), and 'End Time' (1/2/2013 12:00:01 AM).
- Step 3 - Select Tags:** A section for selecting parameters. It includes 'MaraDrill™ State', 'Hydraulic Tags', 'Manually Entered Parameters', and 'Dynamic Tags'. Below these are four 'PID Loop' sections (PID Loop 1 to PID Loop 4) with dropdown menus for various tags like 'Gravitational E Alarm HI', 'Torsional E Alarm LO', 'Hydraulic E PV', etc.
- Step 4 & 5 - Press Buttons to Run Query and Load Data:** Includes 'Step 4', 'Step 5', and a 'Clear Selections' button.
- Right Sidebar:** Contains links: 'View PI Data Table >>', 'Go To Power Curve Analysis >>', 'Go to Analysis by Depth / Time >>', and 'Go to PIDs Analysis >>'. A red circle highlights these links, with an orange arrow pointing to the text 'Guided analytics'.

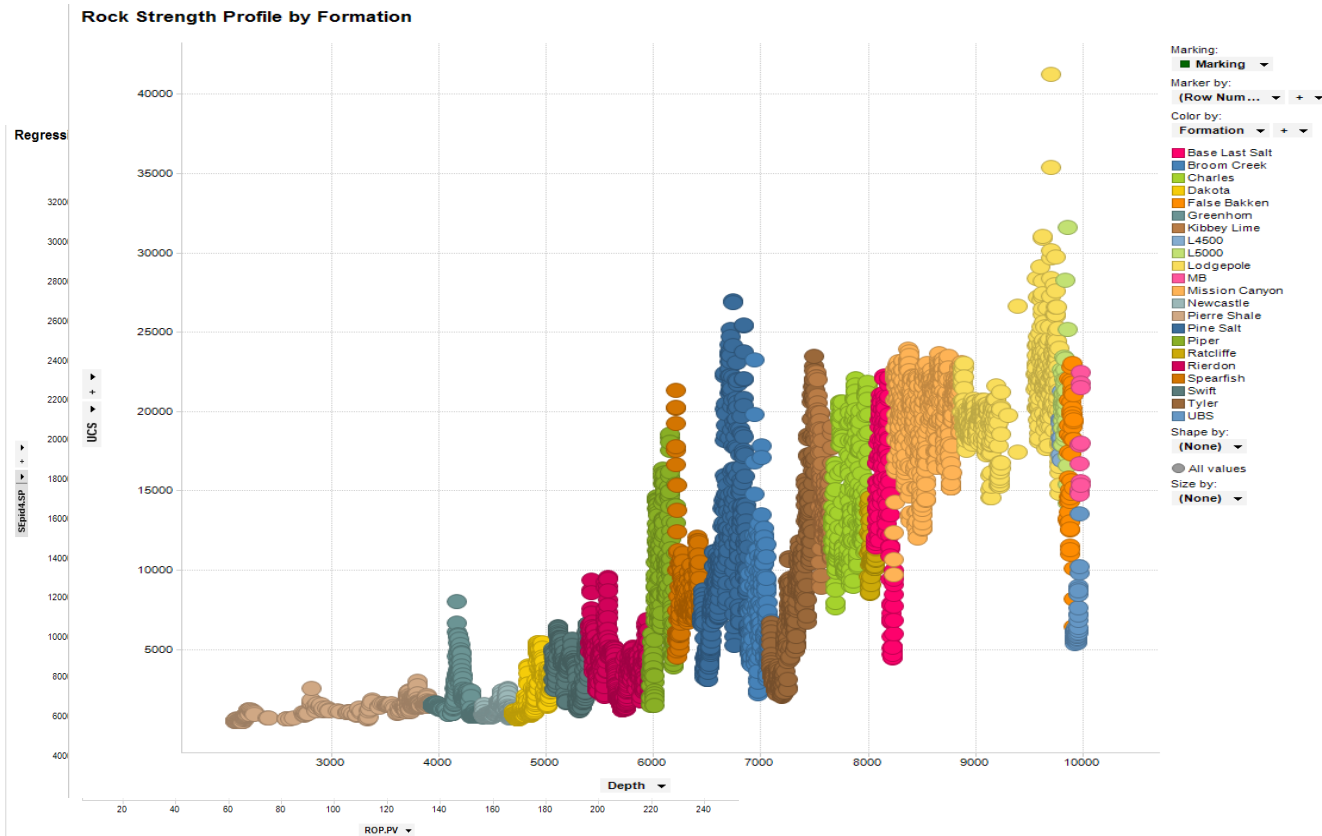
The bottom status bar shows 'Online' and '440 of 440 rows | 0 marked | 45 columns | pivot (Pivot)'.

Enables integration with PI data from PI Coresight

Guided analytics

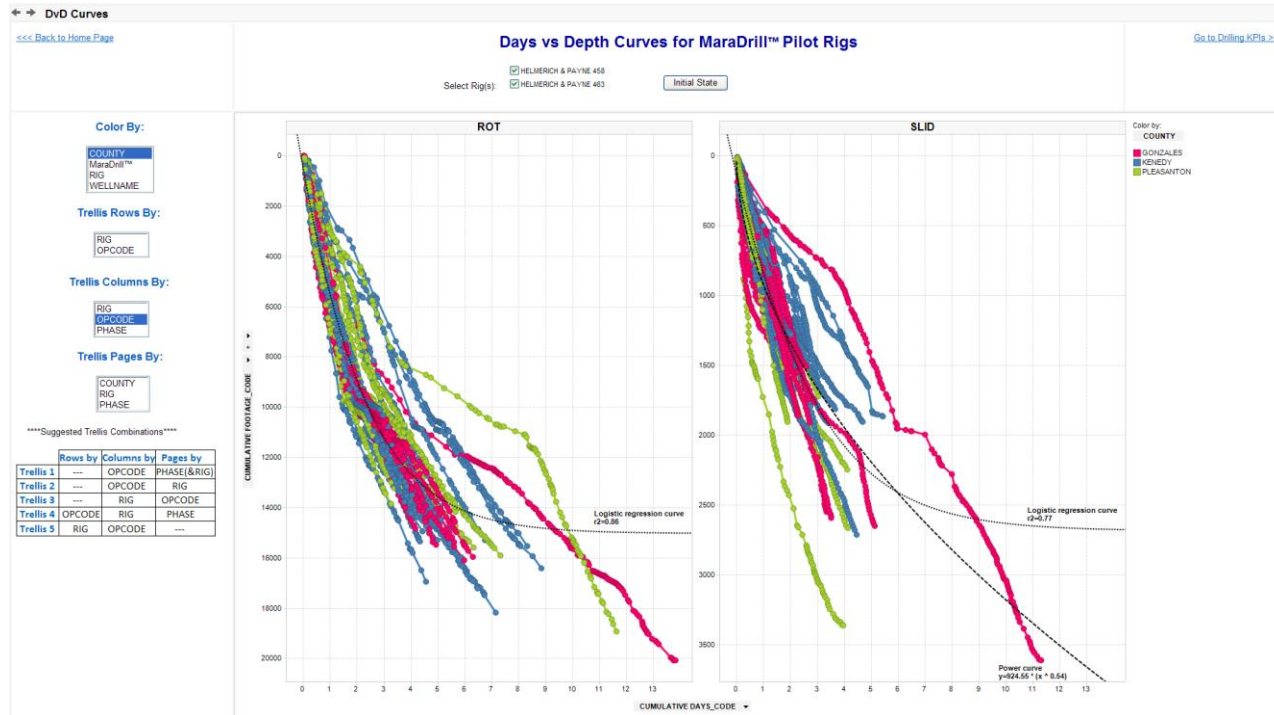
Post-Well Science Using MaraDrill™ Data in SpotFire

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

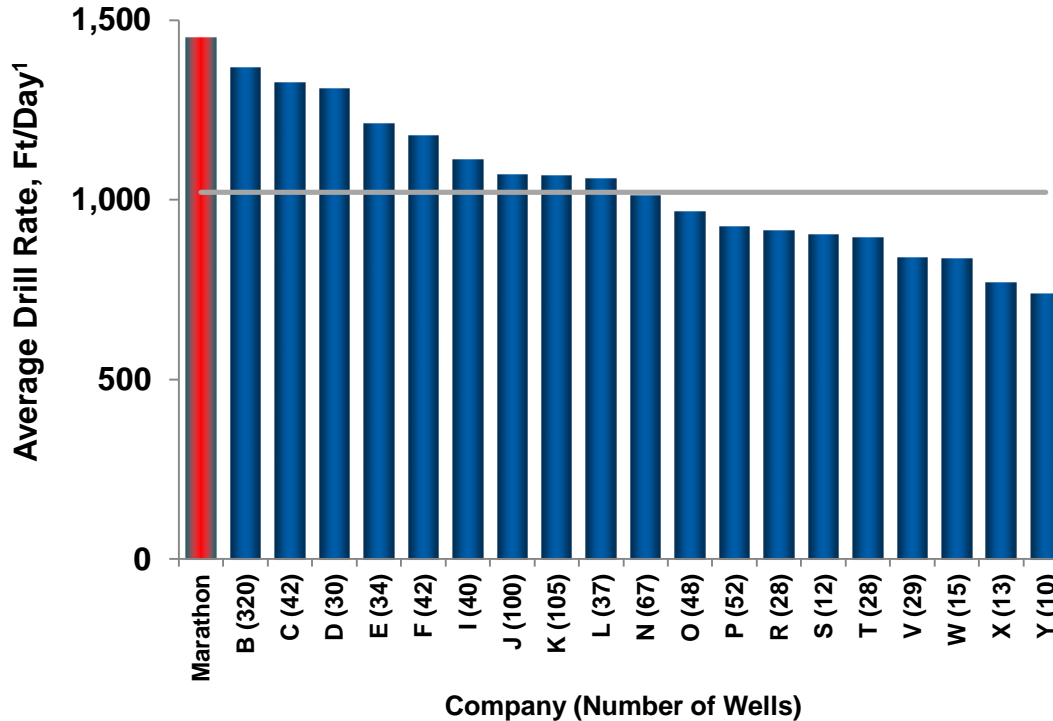
Black = MD, Teal = No MD



Driller's Display in Dog House



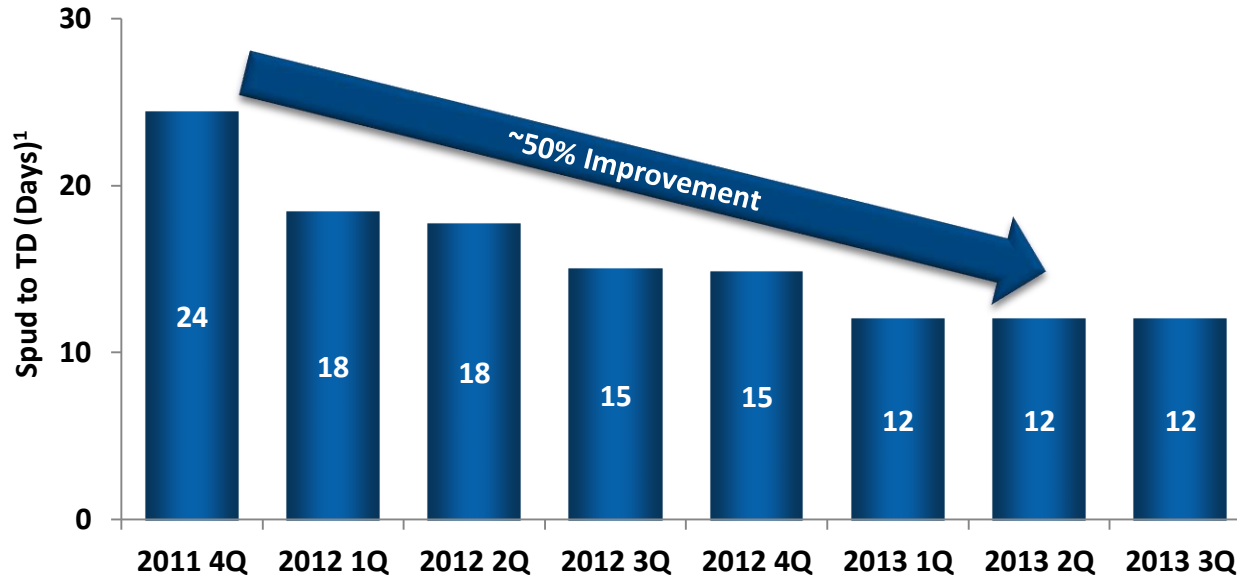
Continuous Improvement in Rate of Penetration (ROP)



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

¹Competitor 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.

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Drilling Performance Analytics

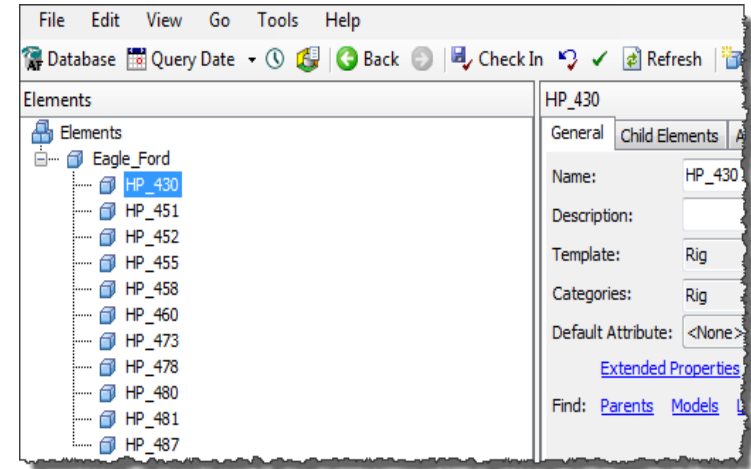
Minimizing the cost of and time to first production

- 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

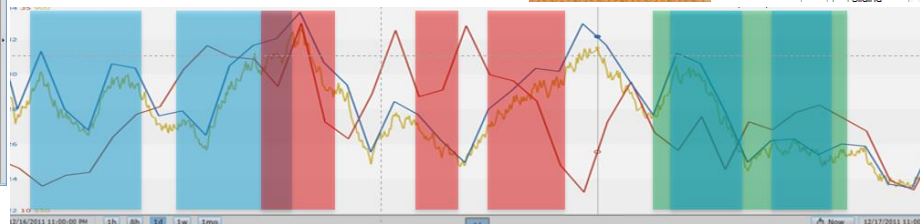
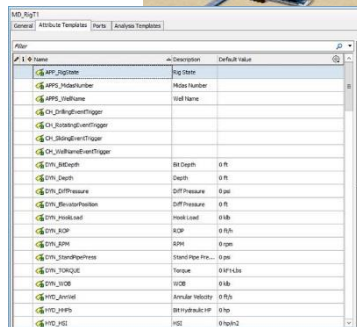


Rigs and Wells

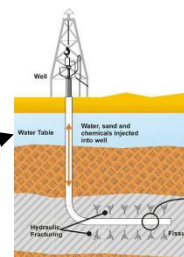
Drilling Rig 1



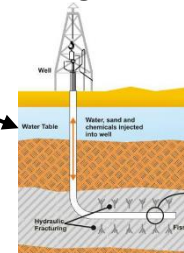
AF Element



Well 1



Well 2



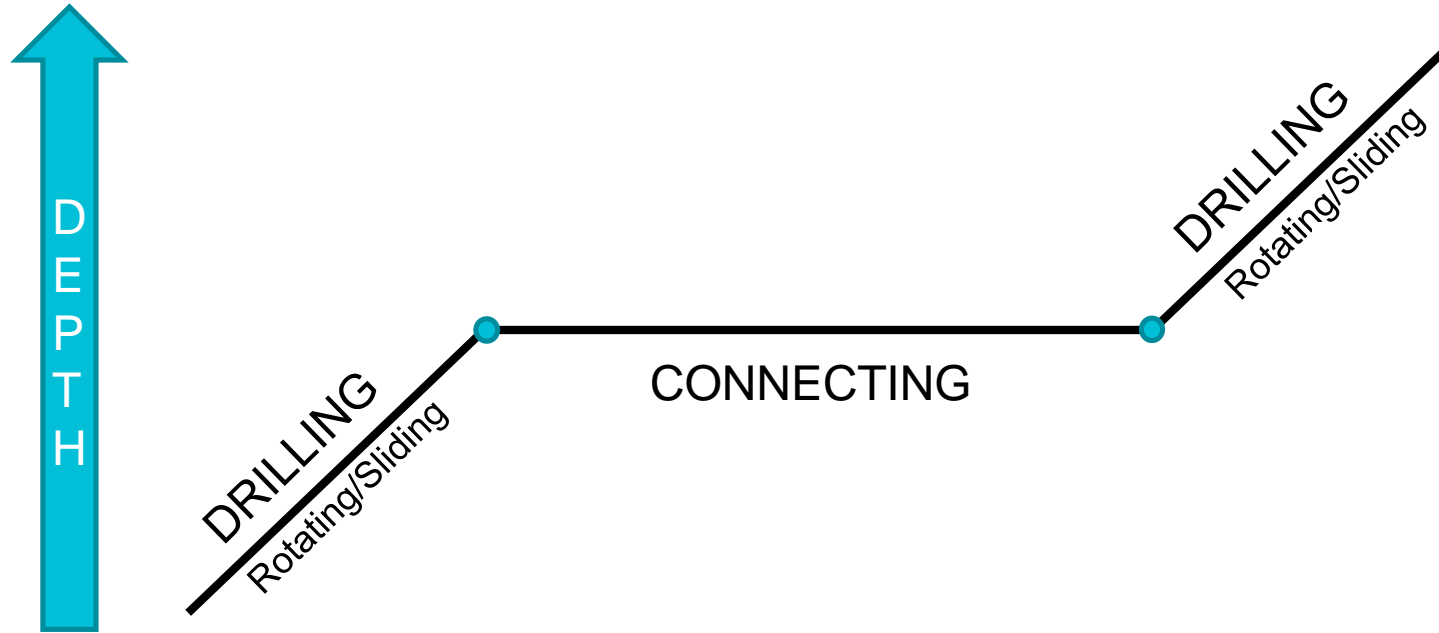
Event Frames

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	24:00:33	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 AM
Sliding	0:35:04	5/7/2014 8:40:20 AM	5/7/2014 9:15:24 AM

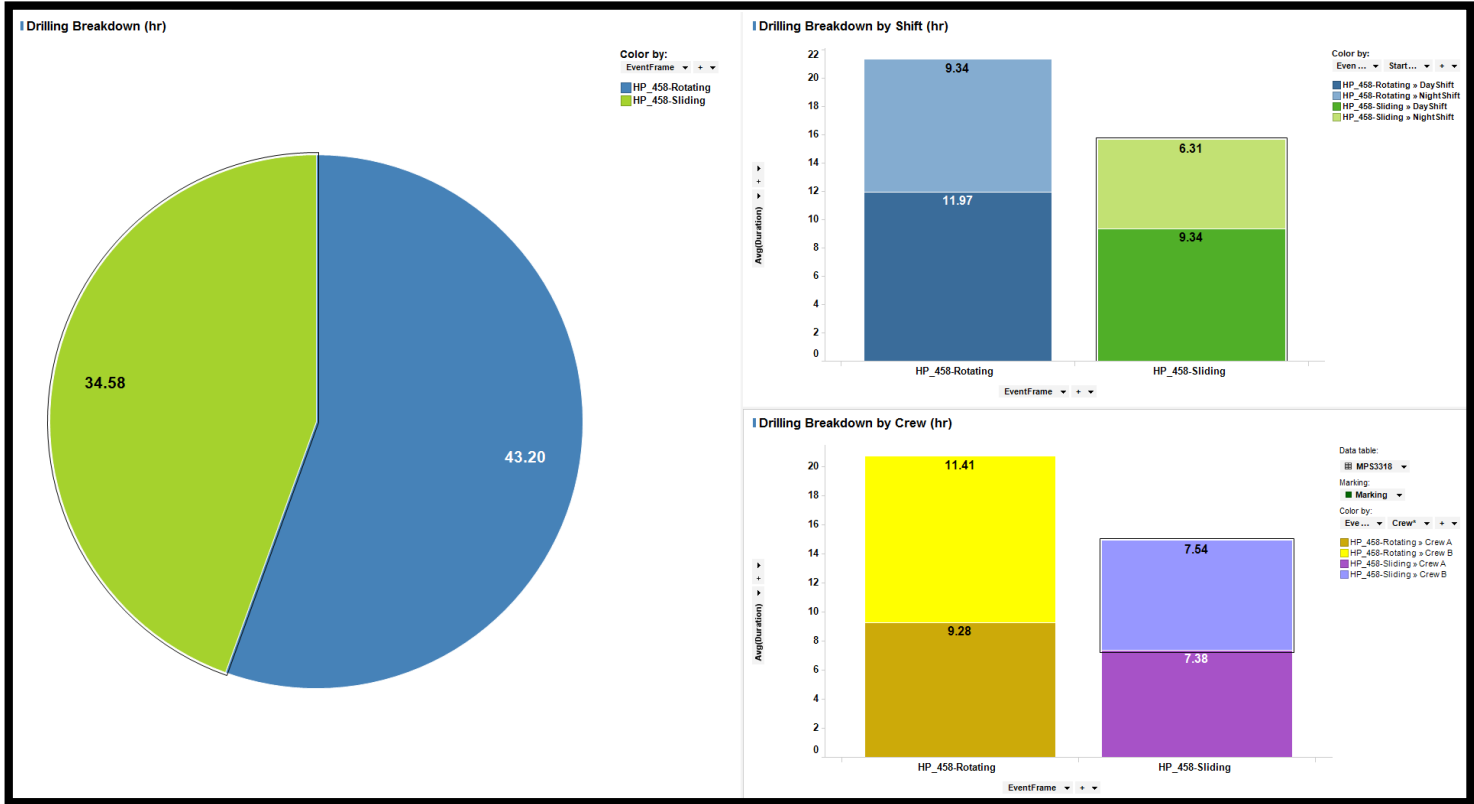
Major Drilling Events



PI Coresight with PI Event Frames Example



Spotfire Shift & Crew Comparison From PI AF



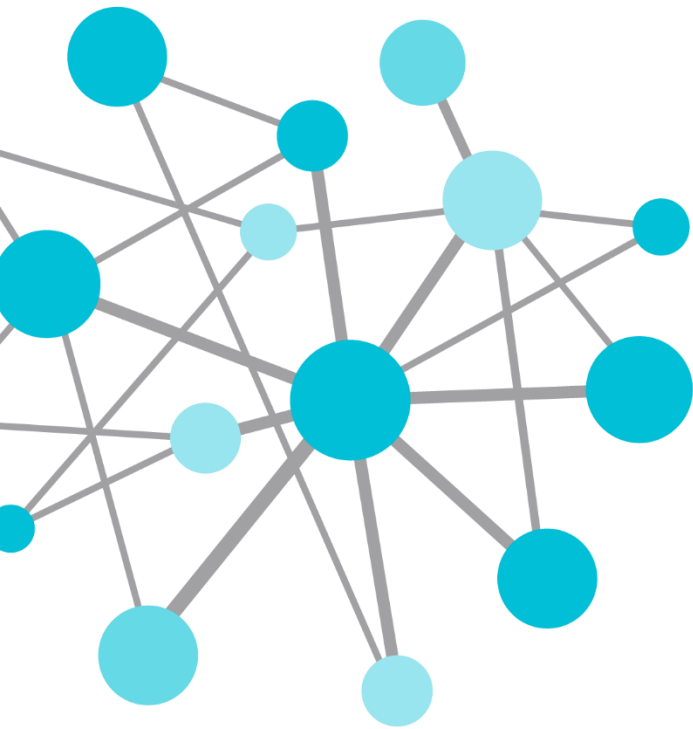
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Value Now, Value Over Time with the PI System

- 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™ has been rolled out across 25 rigs – Transformed Our Drilling
- Excited About the Use of New PI System Functionality

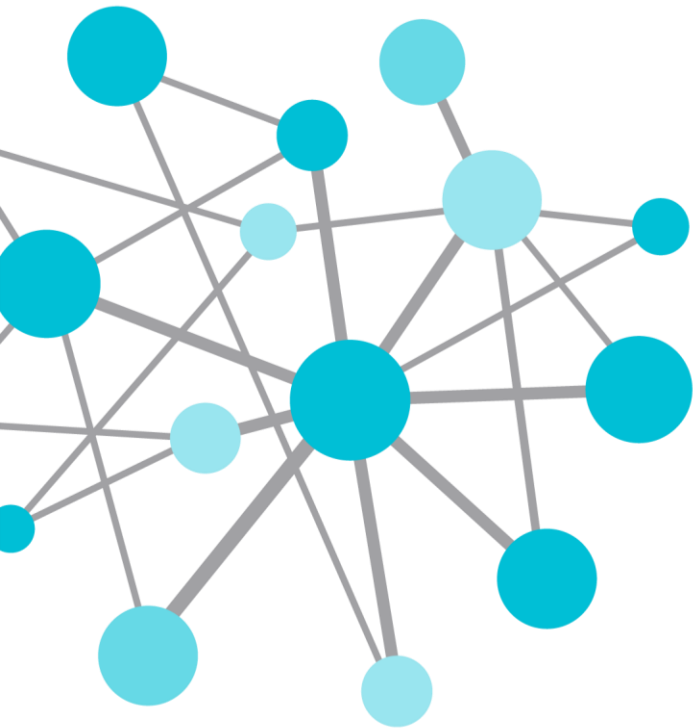


Questions

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



**Please state your name
and your company**



THANK
YOU

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