Applied Analytics for Digital Enterprises

Presentation on
O&G Subsurface Solutions

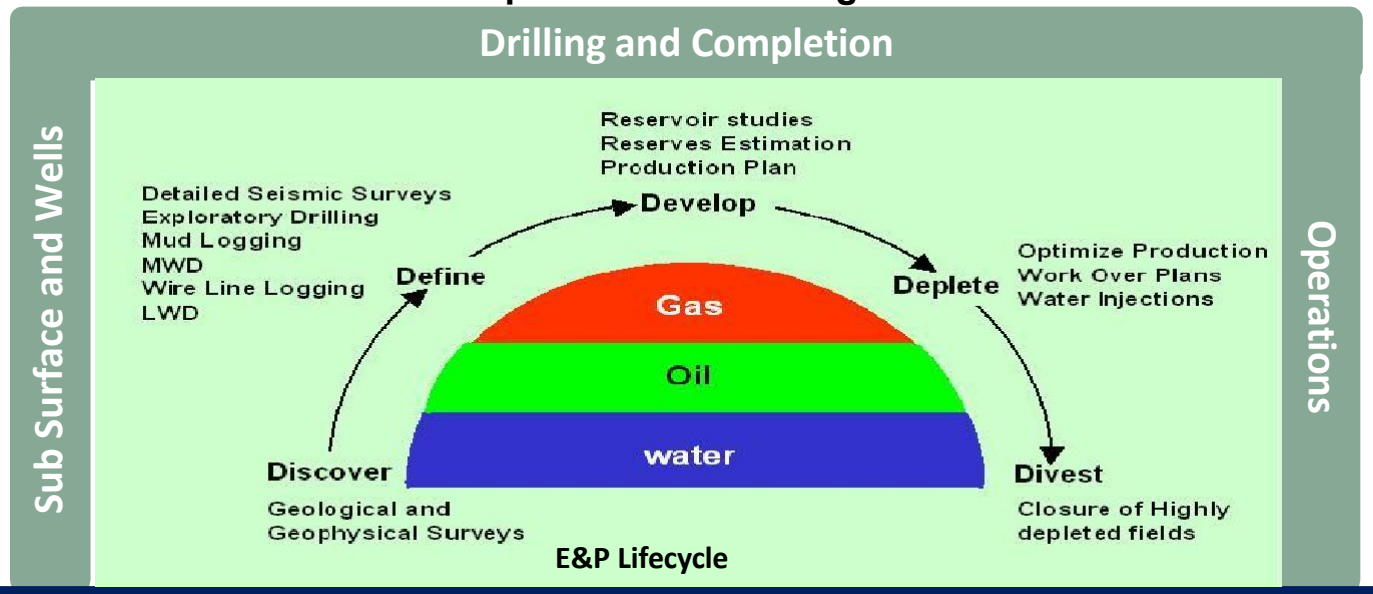
Agenda

- Brief on Subsurface Solutions
  - UDA - Upstream Data Analyzer on SAP HANA
  - DrillNet - Drilling Data Visualization and Analytics using Open Stack/Tableau, Pre-Drill Models - Drill Parameters (Mud Prediction) from Offset Wells
  - EDM - E&P Data Manager/E&P Logs Splicing, Merging, Visualization and Analytics using Open Stack
- Other Areas
  - Oil Spill Monitoring
  - Well Integrity Events Pattern Risk Modelling
  - Pipeline Incident Analysis
  - Drilling Automation Mapper

Key Digital Solution Areas

Real-time drilling consoles for mud, pump, drill assembly , well integrity and pit / tank monitoring.

"Instant visualization & predictive analysis of well logs"



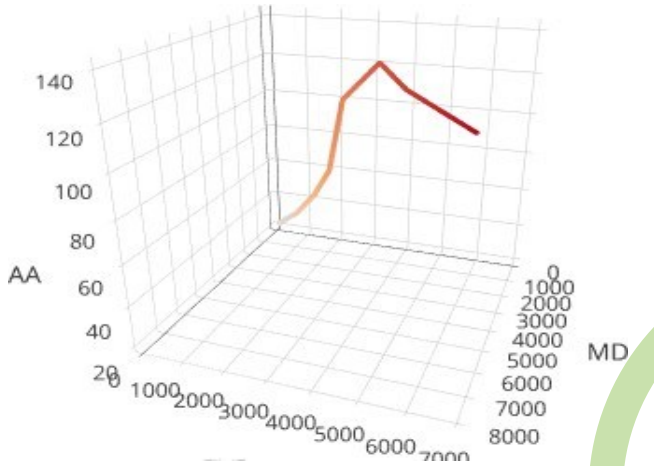
- **Real-time Data integration**
- **Well Monitoring**

"Analytics as a Service" Frameworks

- **Upstream Data Analyzer (UDA)**
- **Driller's Data Network (DrillNet) – WITS/WITSML enabled**
- **E&P Logs Analyzer**
- **Drilling parameter - Prediction from Offset Wells**
- **Prediction of O&G Production and Forecasts – Decline & P/Z Analysis & PRODML Solutions**

- **Oil Spill Incident Analysis**
- **Multi Wells Log Data Clustering and analysis**
- **Well Integrity Events Pattern Risk Modeling**
- **Pipeline Incident Analysis**

Our E&P Digital Solution Accelerators

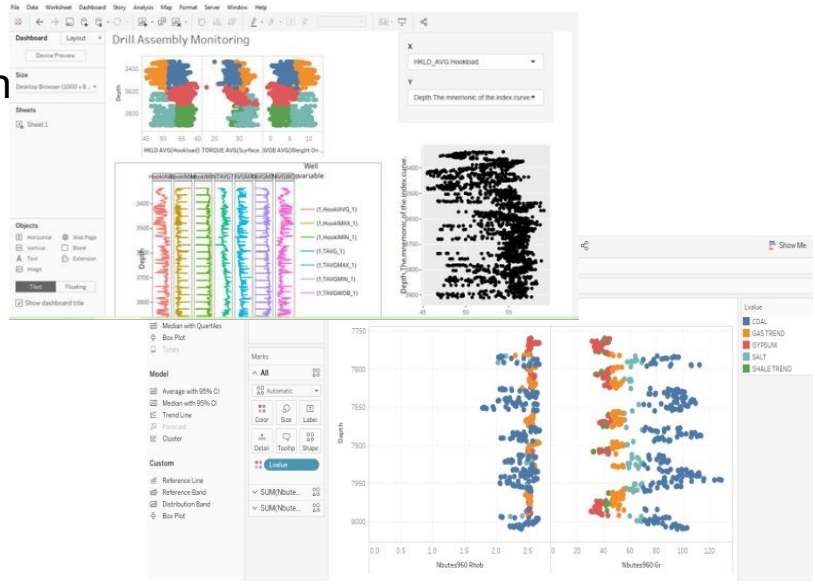


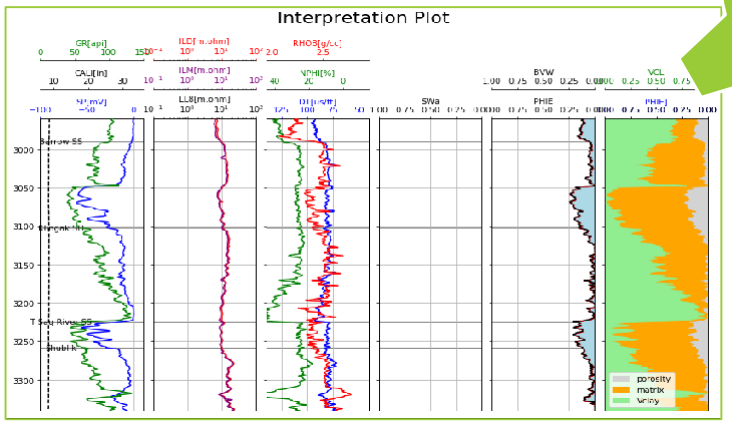
Ready Subsurface Solutions on top of Tableau

2D/3D Modelling using Plotly and Tableau

Expertise in **Visual Analytics** using **Tableau + R/Python + H20 + KNIME** integration

Ready Data Visualization and Analysis Plug-ins (UDA, DrillNet and E&P Logs Analyzer)





Solutions focusing on E&P Data

A.SAP HANA certified solution **"Upstream Data Analyzer (UDA)"** – which helps in instant visualization as well as predictive analysis of logs from upstream operations.

- *LAS logs from 30+ sites for lithology pattern analysis using a full SAP stack*
- *Supports structured as well as unstructured data sources*
- *Supports AI/ML algorithms for NPT reduction strategies*

A."Driller's Data Network (DrillNet)" to address the need for real-time dashboards for drilling consoles for mud, pump, drill assembly, well integrity and pit/tank monitoring.

- *Handles real-time sub-surface data from drilling*
- *Allows real-time as well batch wise visualization as well as analytics*
- *Enables visibility to well parameters, such as mud properties, pump pressure, casing pressure and gains &losses*

➢ **"E&P Logs Analyzer"** to address the need to automate as well as apply AI/ML models into E&P/upstream logs in real-time as well as in batch mode

- *Handles E&P data logs – LAS, WITS/WITSML, PRODML, RESQML,*
- *Allows real-time as well batch wise visualization as well as multi-log analysis*
- *Supports AI/ML algorithms for operational decision making*

Upstream Data Analyzer (UDA)

INDUSTRY/LoB

Oil and Gas/Upstream

HIGHLIGHTS

- ✓ SAP Certified Solution
- ✓ Ready implementation framework to perform advanced analytics on upstream oil & gas data
- ✓ Combined data-to-insights process managing structured and unstructured data sources
- ✓ SAP HANA as primary database for fast data processing, analysis and reporting
- ✓ Private/Public cloud deployment
- ✓ SAP SFP technical validation
- ✓ Referenced in IDC publications

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SUMMARY

Upstream Data Analyzer (UDA) solution from Greenojo acts as an upstream data-to-insights(D2I) platform based on SAP HANA, upon which well engineering rule-sets are applied for prediction of sub-surface characteristics and operations related to drilling and completion. G&G operational users can visualize E&P logs and perform advanced analytics instantly to understand lithology patterns, bottlenecks and deviations which impact drilling operations. Efficient data-to-insights process at an aggregated level results in improved drilling and reduce drilling cost per meter.

SOLUTION

- Ready implementation framework to perform advanced analytics on upstream oil & gas data
- Solution can be plugged in as part of Digital Oil Field (DOF) strategy for an upstream oil & gas firm
- It supports application of AI/ML algorithms for NPT reduction strategies. Uses prediction and forecasting models for sub-surface characteristics, drilling plans, production, etc.
- Flexibility to be deployed on clients' private cloud for enterprise access as well as access at the offshore project sites.

BUSINESS VALUE

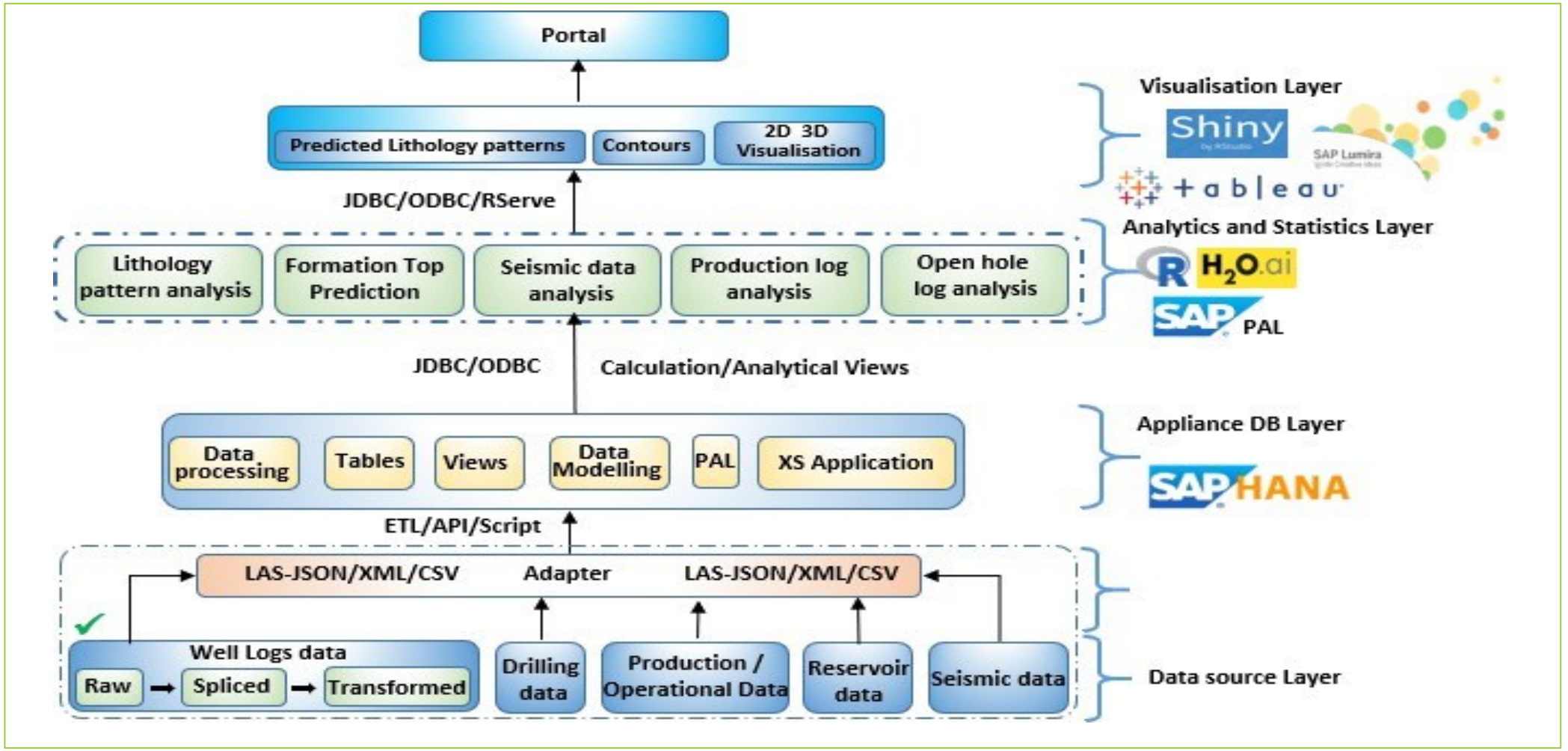
- Using the solution leads up to 50-60% reduction of NPT (non-productive time) factor "waiting time" related to drilling operations
- Customers can analyze several terabytes of data from multiple E&P data clusters instantly such as from seismic, drilling, well logging, reservoir and production scenarios
- Usage shows significant decrease in the time needed for analysis and reporting of upstream logs for sub-surface patterns.

Increased efficiencies in E&P data analytics

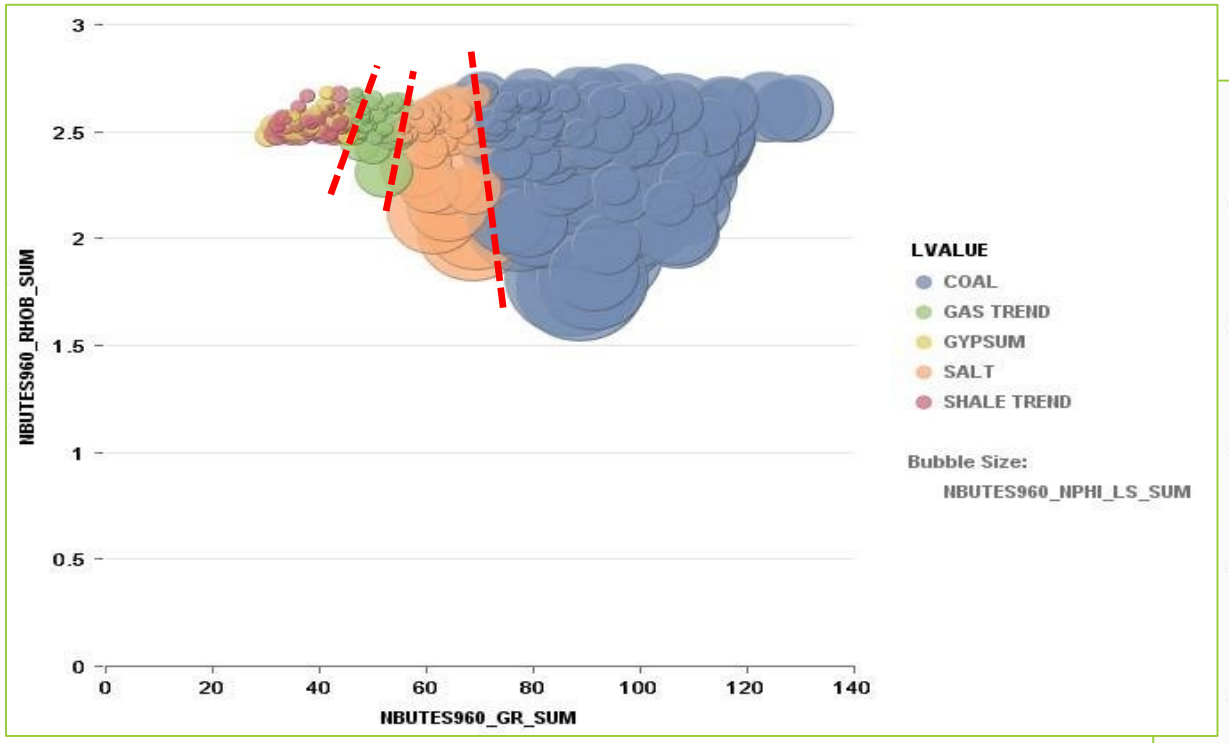
30-35% savings on processing cost

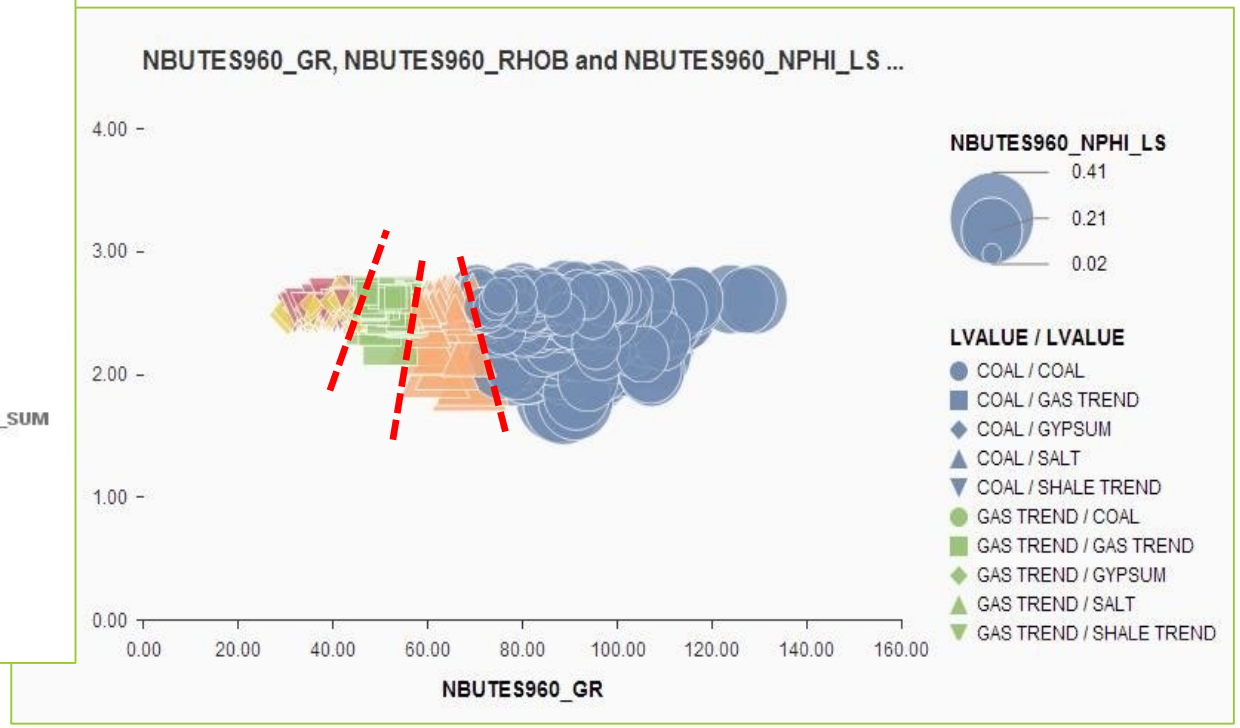
50-60% improved NPT for "waiting time" factor

UDA (Upstream Data Analyzer)

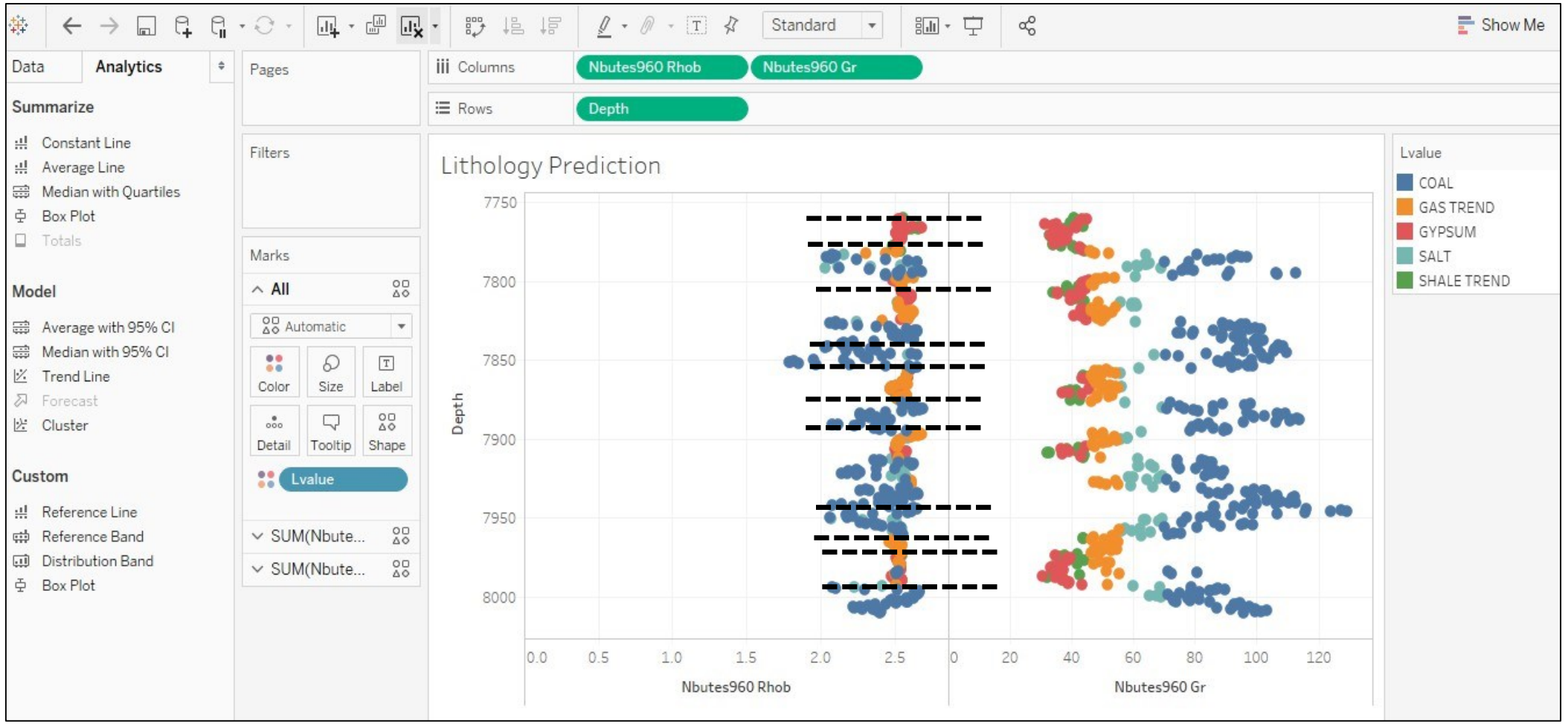


UDA/Snapshot - Well Log Analysis (1/3)

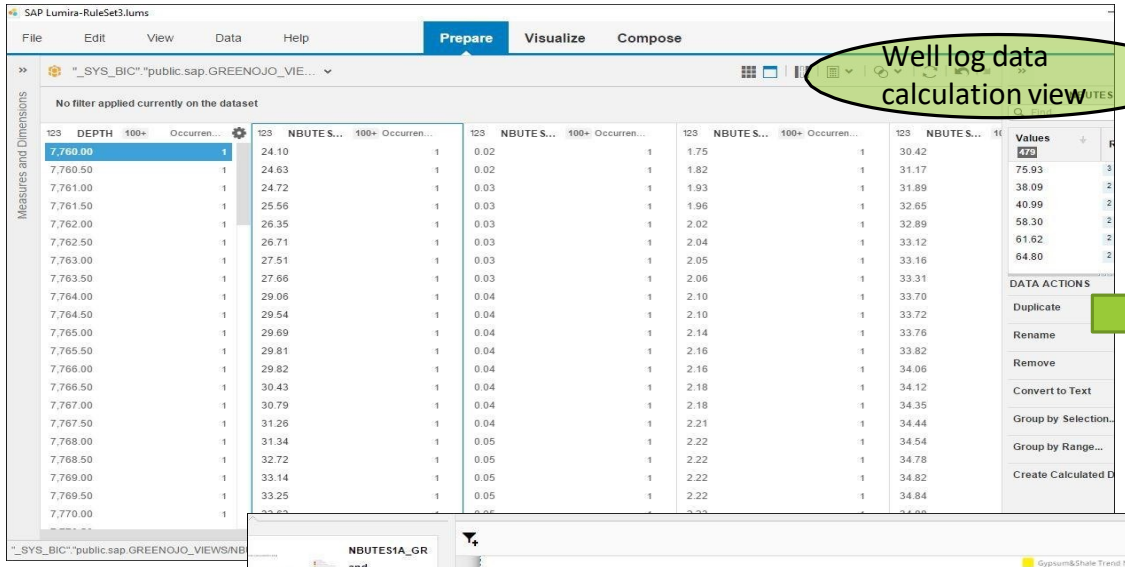




UDA/Snapshot - Well Log Analysis (2/3)

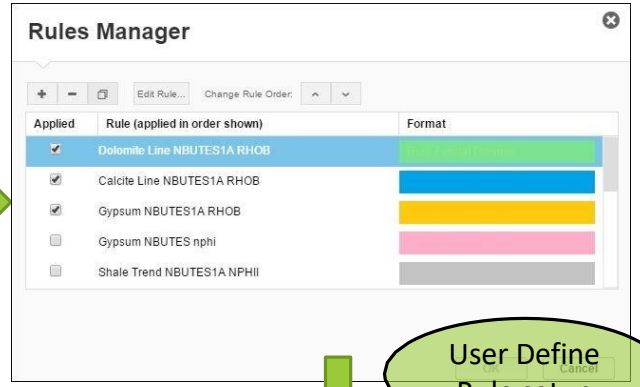


UDA/Snapshot - Well Log Analysis (3/3)

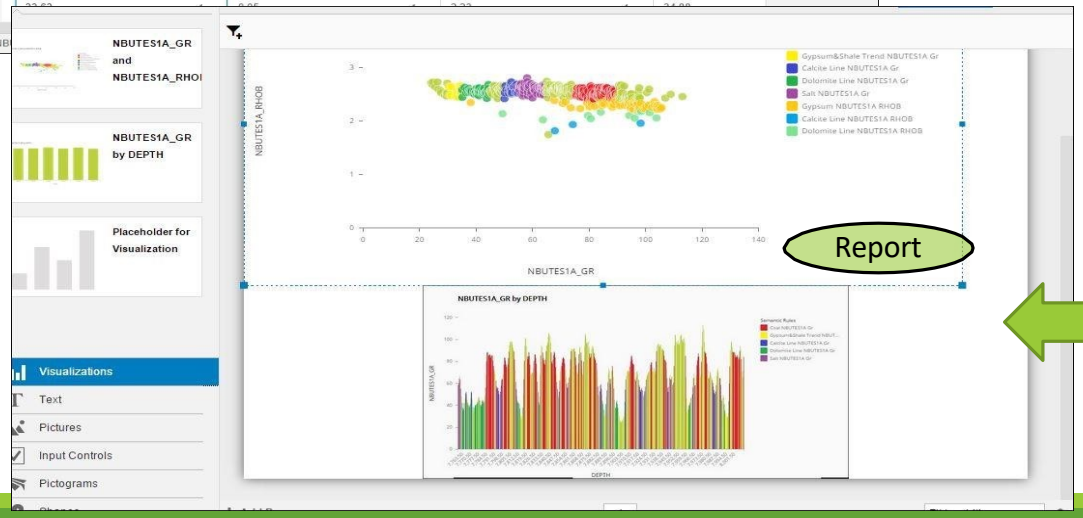


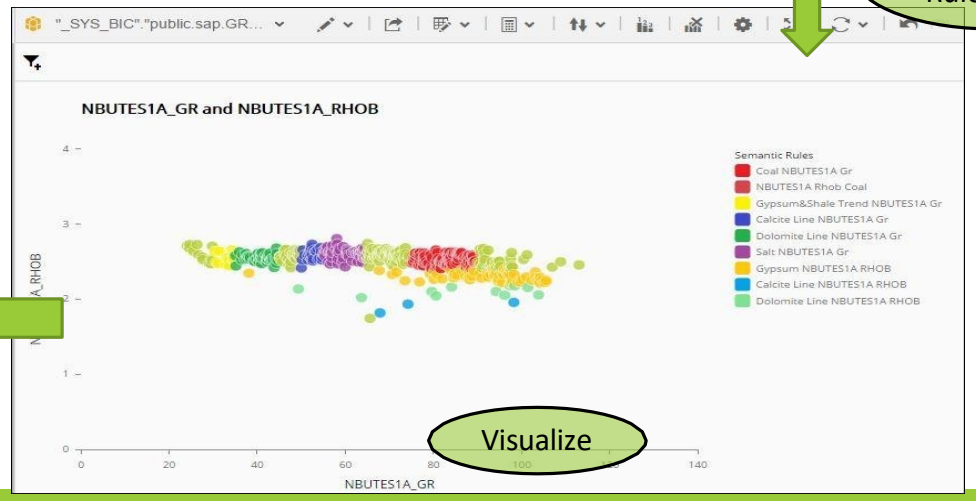
Rule set

Lithology	GR	RHOB
Coal	75-90	1.3-1.5
Gypsum	30-45	2.2-2.4
Calcite Line	50-60	1.8-2.0
Dolomite Line	35-45	2-2.2
Shale Trend	30-45	2.2-2.4
Gas Trend	45-55	2-2.2
Anhydrite	0-15	2.8-3
Salt	55-65	2-2.2



User Define Rule setup





DrillNet (Driller's Data Network)

INDUSTRY/LoB

Oil and Gas/Upstream

HIGHLIGHTS

- ✓ Enables "think down-hole" approach in an era of data overload.
- ✓ Ready implementation framework to perform advanced drilling data
- ✓ Combined data-to-insights process managing WITS, WITSML and LAS sources
- ✓ Private/Public cloud deployment
- ✓ Customer Validations
- ✓ Easily Plugged in as part of Digital Oil Field (DOF) strategy of the firm

SUMMARY

Driller's Data Network (DrillNet) solution from Greenojo acts as a real-time console for sub-surface drilling operations. This solution eases measurement and control of well parameters, specifically, mud properties, pump pressure, casing pressure and gains & losses. It manages voluminous data visualization and data integration with G&G and drilling systems. DrillNet helps to perform 2D/3D visualizations and analytics to understand current downhole conditions through valuable information rather than raw data as needed for effective collaboration.

SOLUTION

- Enables real-time visibility through a driller's dashboard
- Provides real-time 2D/3D visualization
- Enables visibility to real-time measurement of well parameters, such as mud properties, pump pressure, casing pressure and gains &losses.
- Ability to visualize and predict current or possible NPT conditions

BUSINESS VALUE

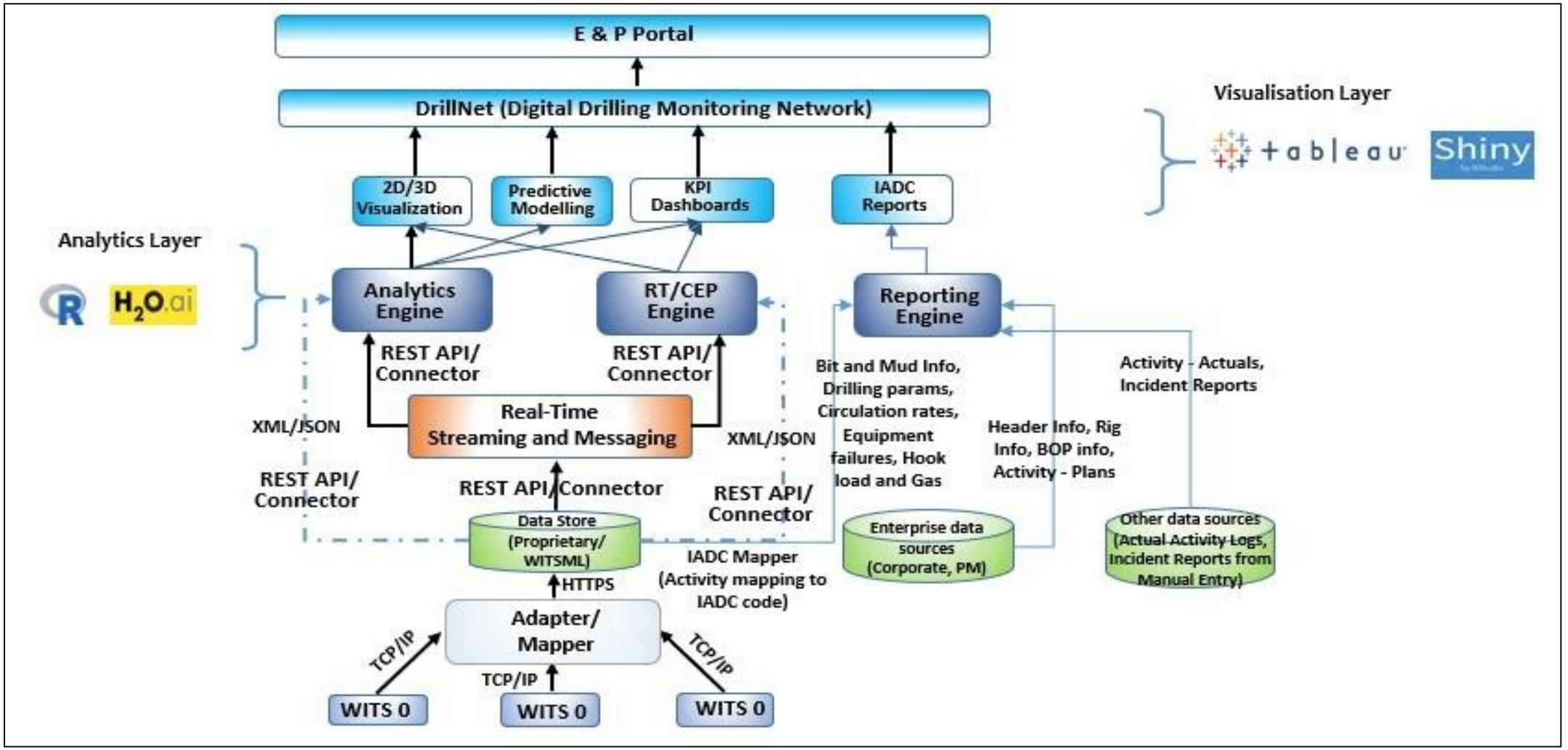
- Real time data usage for drilling decisions
- Better Data QC & improving the quality of real time data through seamless data sharing
- Better Collaboration among Drilling and SS&W – data and information and process flows (CVP process) well planning , design and construction

Increased efficiencies in drilling data analytics

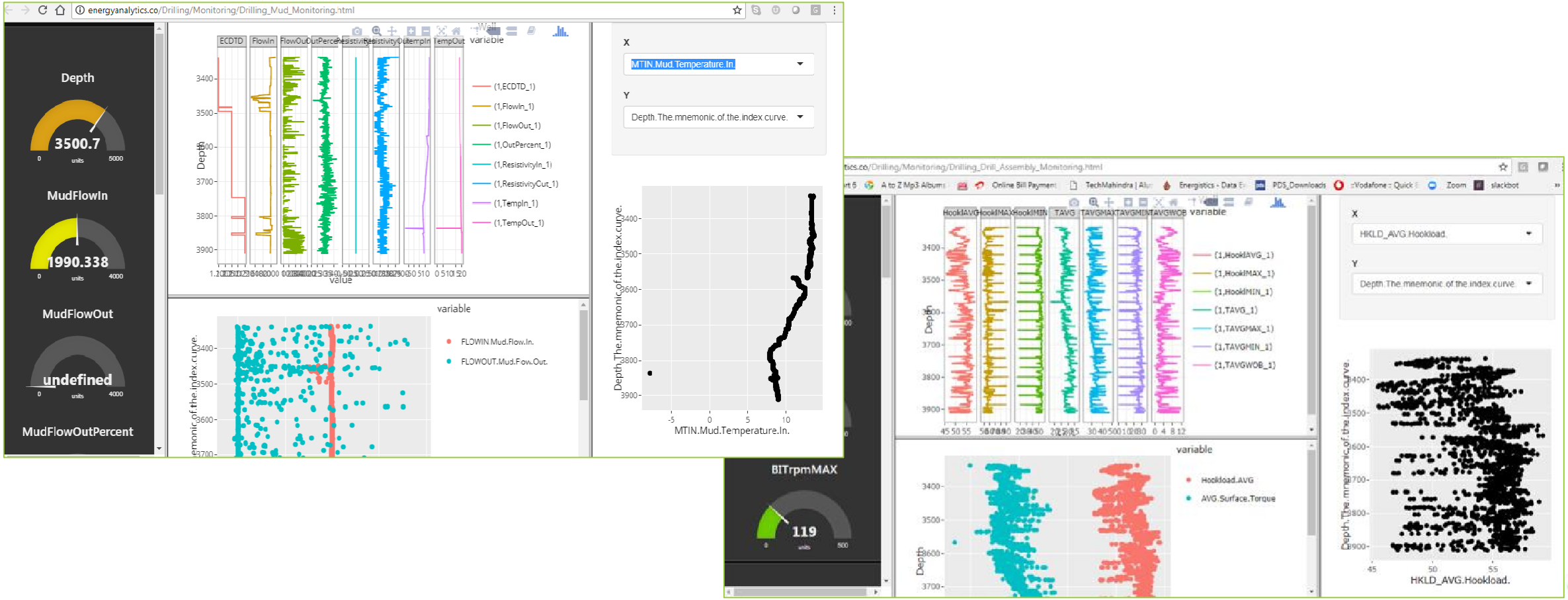
25-30% savings on processing cost

30-40% improved in Drilling NPT

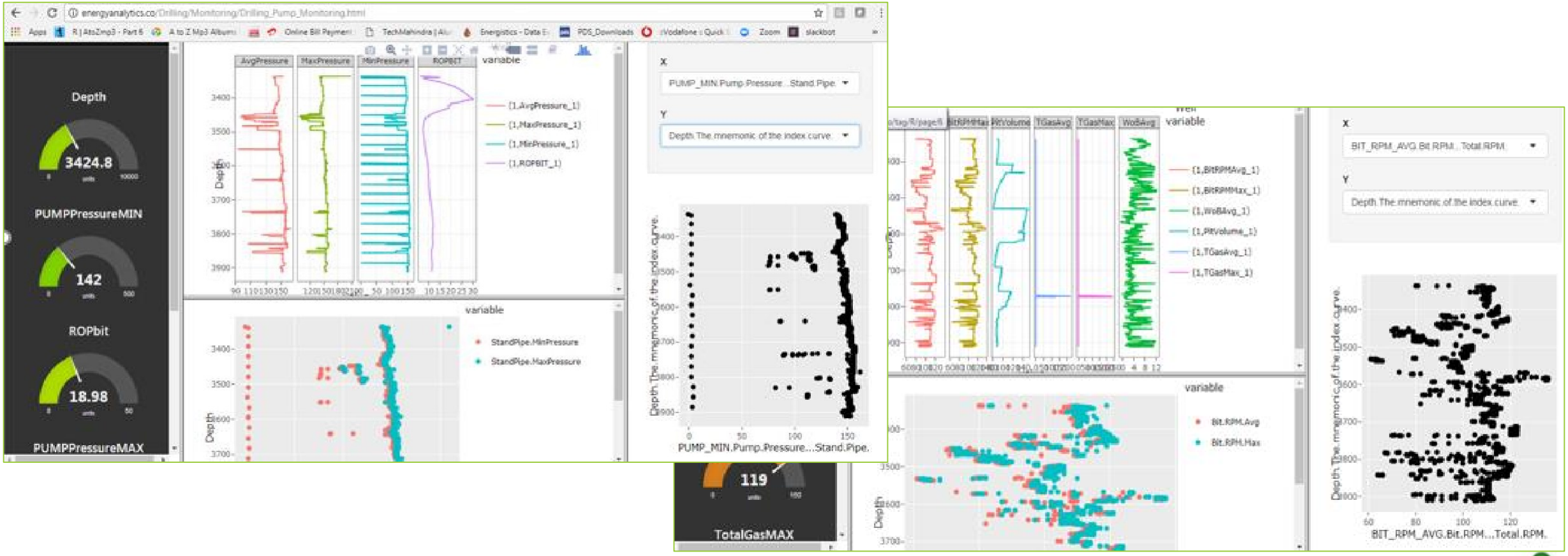
DrillNet (Driller's Data Network)



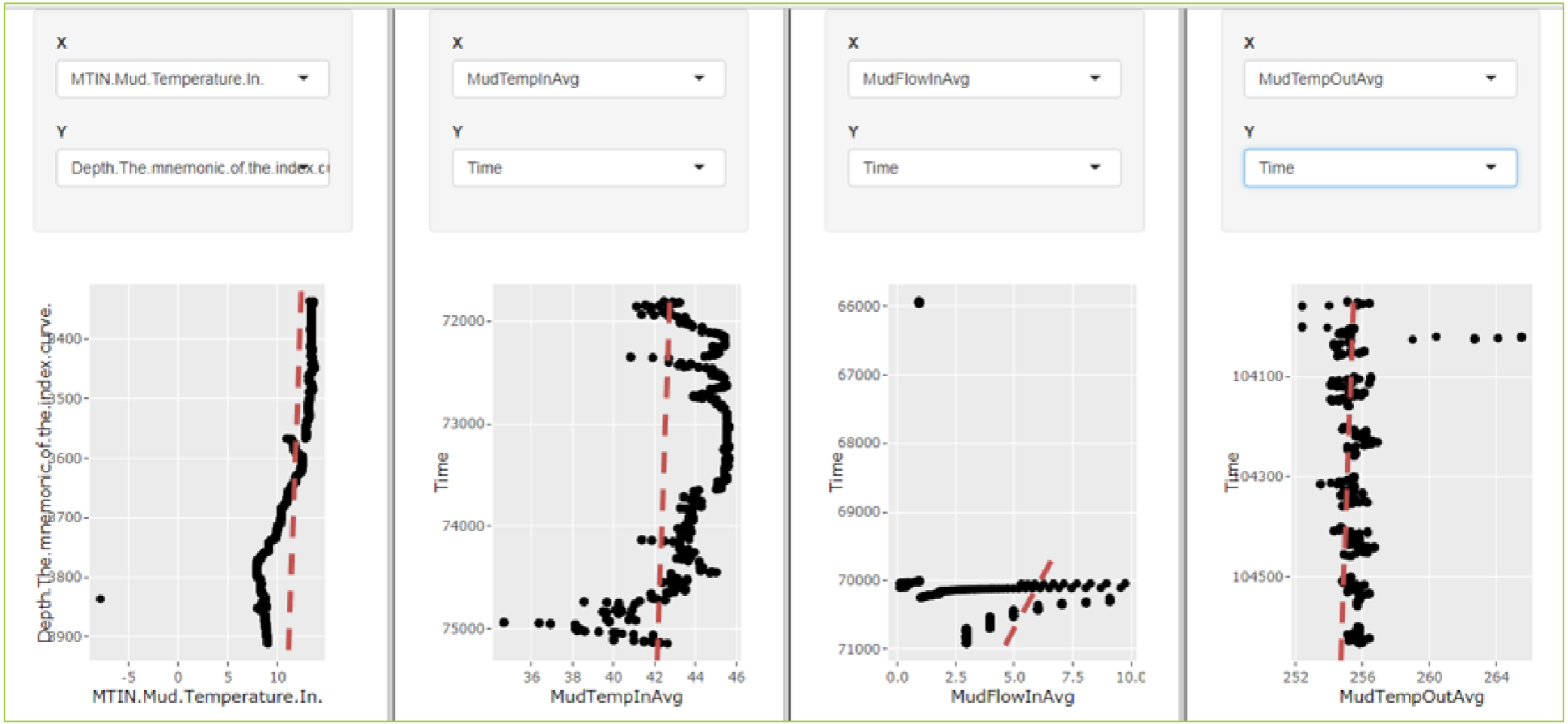
DrillNet/Snapshot - WITS/WITSML Analysis (1/4)



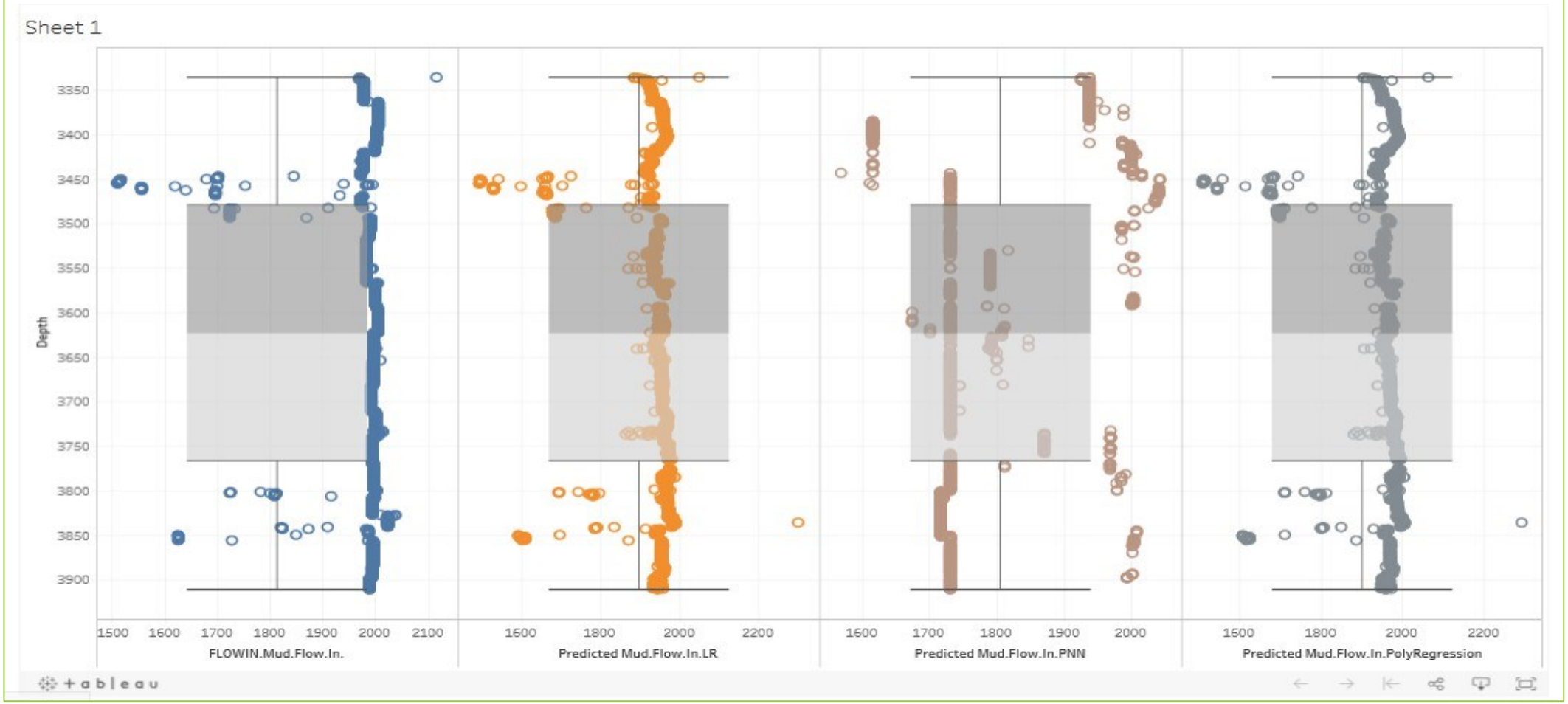
DrillNet/Snapshot - WITS/WITSML Analysis (2/4)



DrillNet/Snapshot - WITS/WITSML Analysis (3/4)



Mud Flow In/Out Prediction for NPT (4/4)



EDM - E&P Data Management

INDUSTRY/LoB

Oil and Gas/Upstream

HIGHLIGHTS

- ✓ Enables “E&P log analysis” from multiple logs spread across structured as well as unstructured data sets
- ✓ Ready implementation framework to perform advanced 2D/3D visualization as well as AI/ML based model predictions
- ✓ Combined data-to-insights process managing LAS, WITS, WITSML, PRODML, RESQML, SEGY sources
- ✓ Private/Public cloud deployment option is available
- ✓ Customer Validations

SUMMARY

- EDM/E&P Logs Analyzer solution from Greenojo acts as a real-time console for sub-surface data visualization as well as analysis of different types of logs in their native formats. This solution supports in splicing and merging of LAS files. eases measurement and control of sub-surface parameters (relates to well log, drilling, production, reservoir) and manages to perform 2D/3D visualizations to understand ground conditions.

SOLUTION

- Ready implementation framework to perform digitization of LAS (Splicing, Merging, etc.) WITS data logs.
- The architecture allows to perform advanced 2D/3D visualization as well as AI/ML based model predictions against each log
- It supports application of AI/ML algorithms for forecasting and prediction of operational interventions
- Allows flexibility to be deployed on clients’ private cloud for enterprise access as well as access at the offshore project sites.

BUSINESS VALUE

- On-demand/ 24*7 real-time/batch mode availability for multiple logs visualization as well interpretation by G&G team
- In-built AI/ML algorithms as a service for prediction modelling on logs in their native formats
- Get the solution plugged in as part of Digital Oil Field (DOF) strategy of the firm

Increased efficiencies in log data analytics

Significant savings on data processing cost

On-demand/24*7 availability of logs interpretation

EDM - Key Features

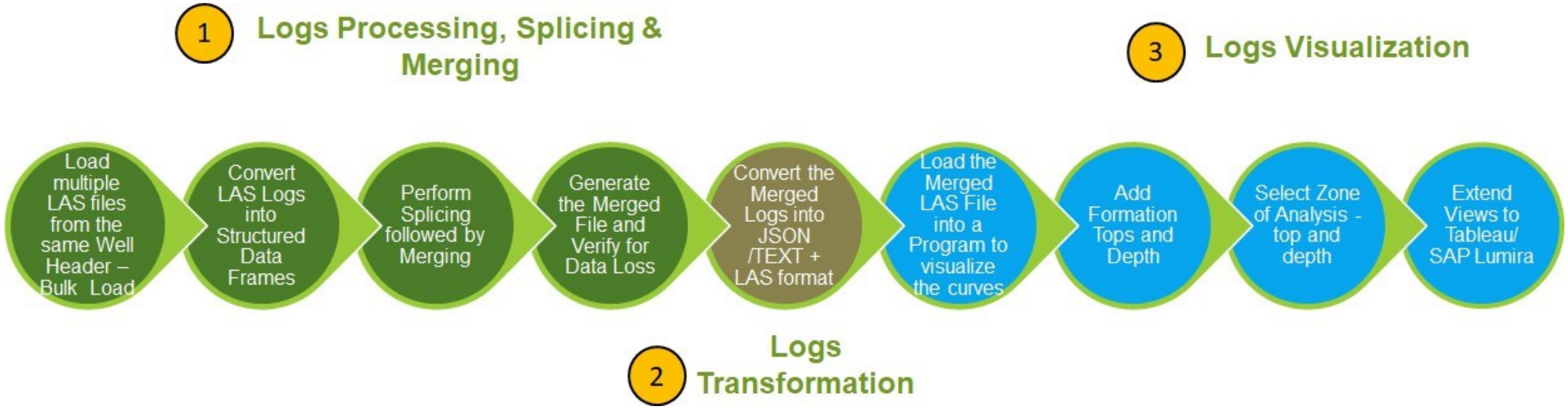
Adapters built in R/Python for SEGY, LAS, WITS, WITSML , PRODML, RESQML, etc.

Automation Scripts for Routine tasks like Splicing, Merging, Data Transformation

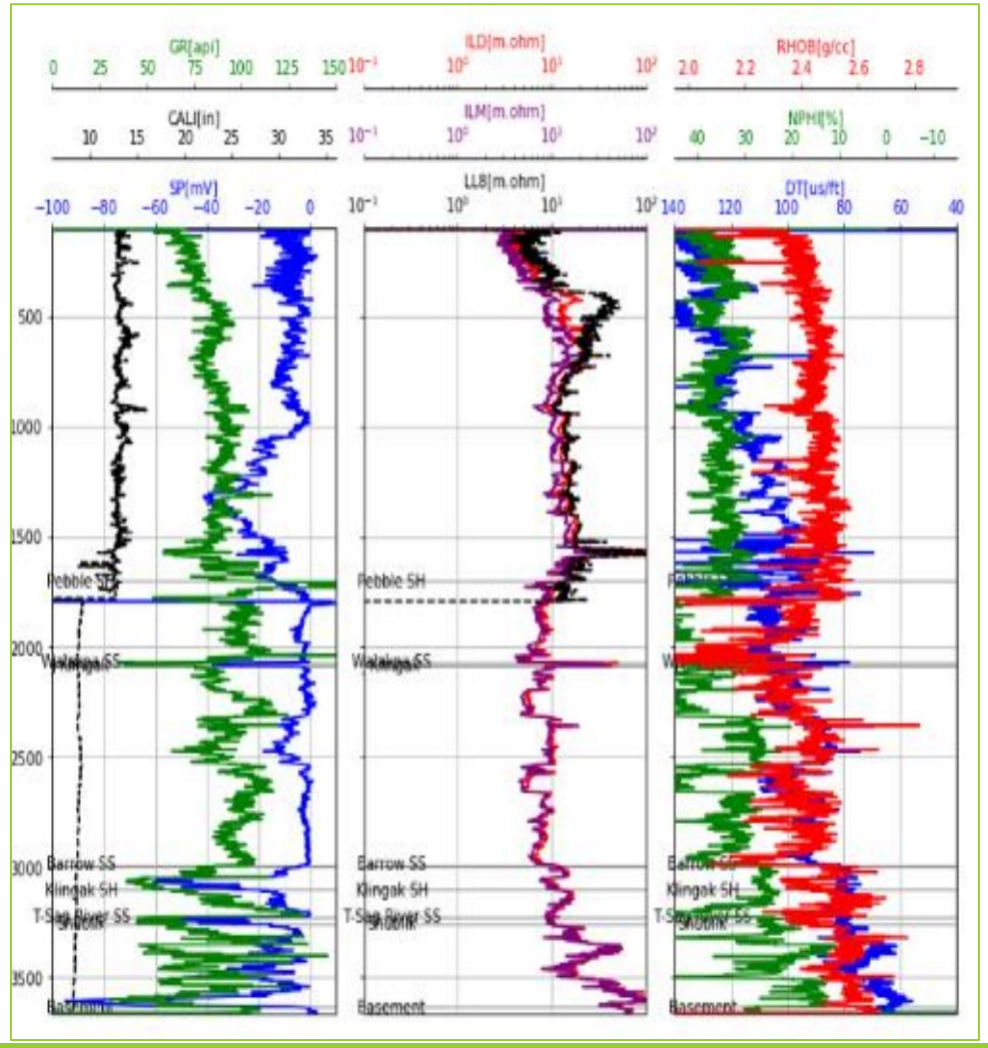
Acts as a plug-in for Enterprise Scale of Logs Visualization and Analytics on SAP HANA

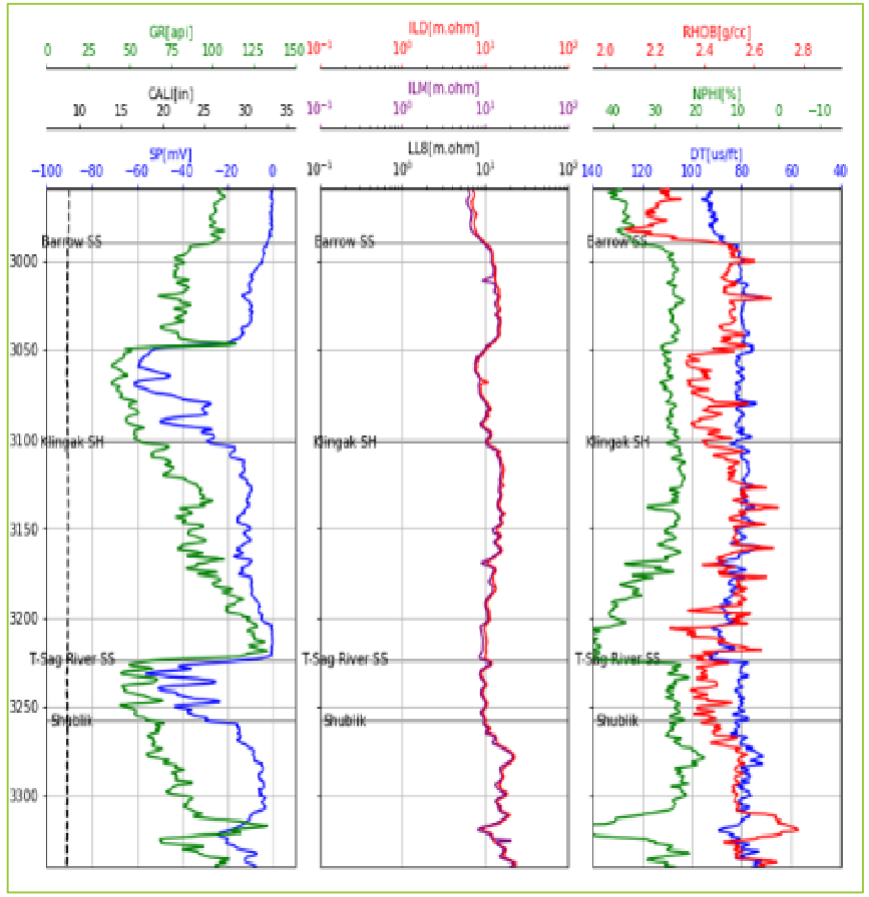
E&P Logs Visualization extensions for Tableau, SAP Lumira, Spotfire, etc.

EDM/Well Logs Digitization

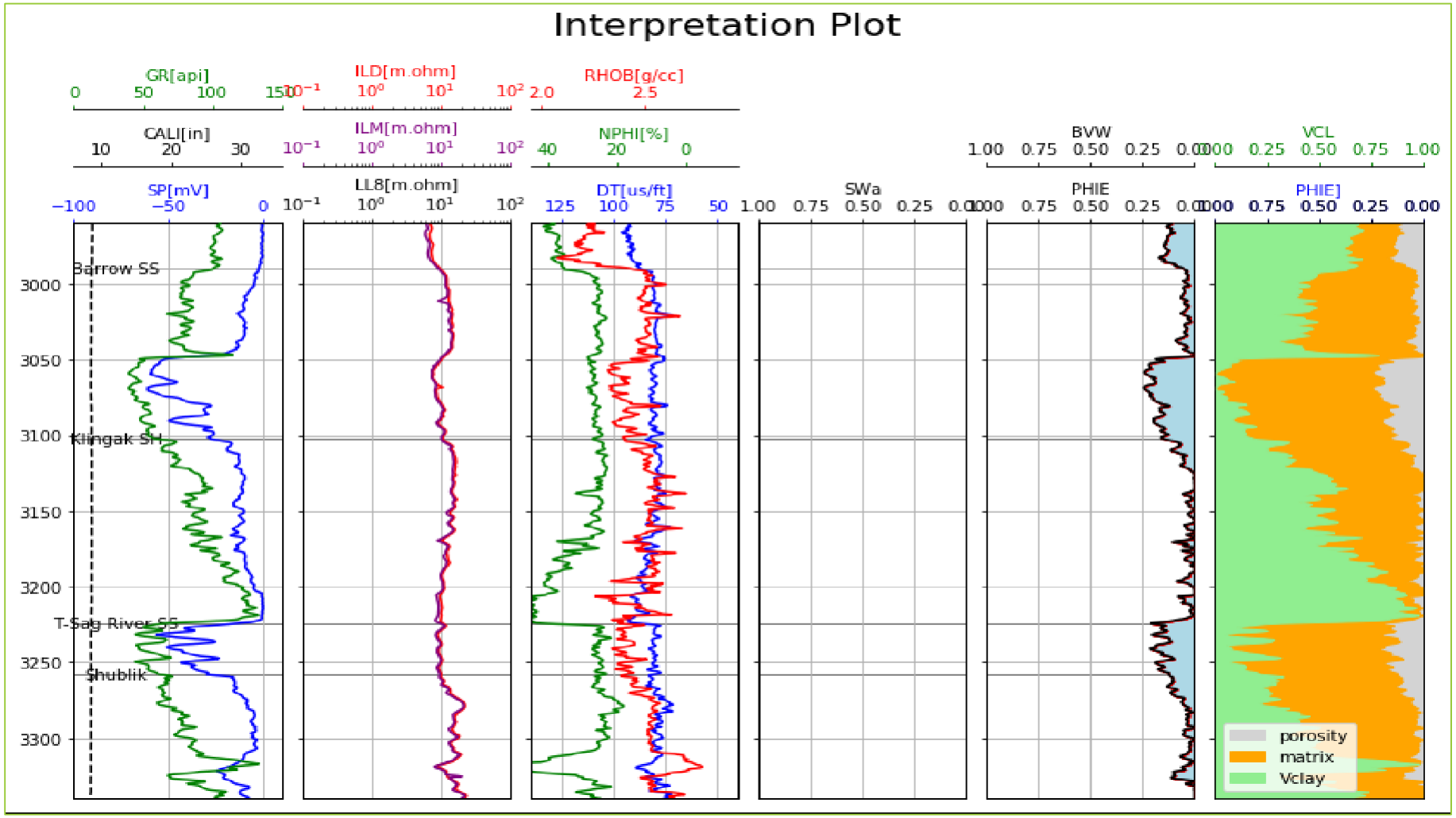


EDM/Snapshot - LAS Analysis (1/4)

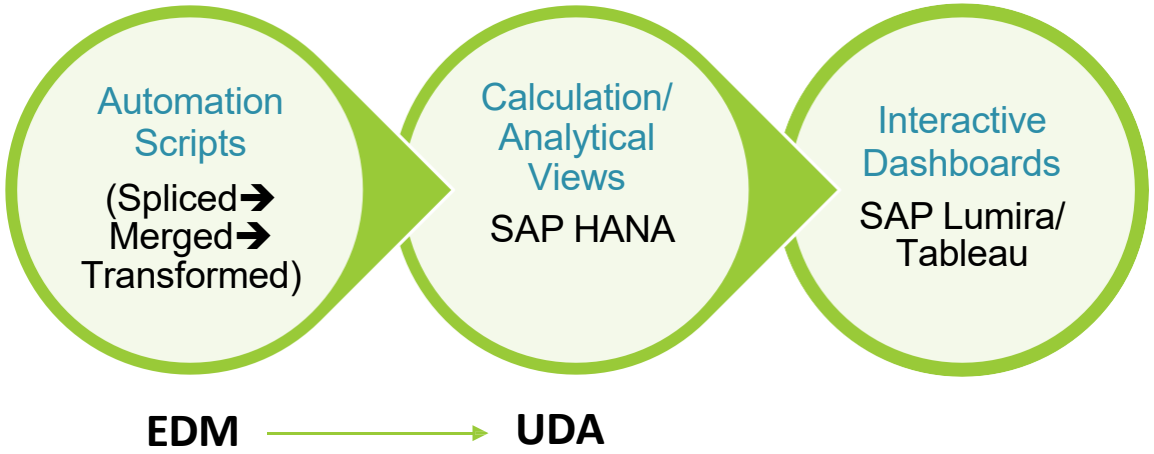


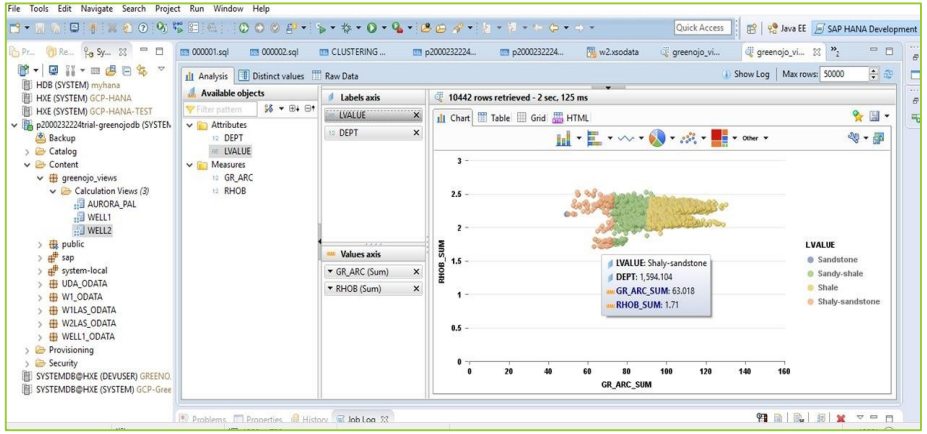


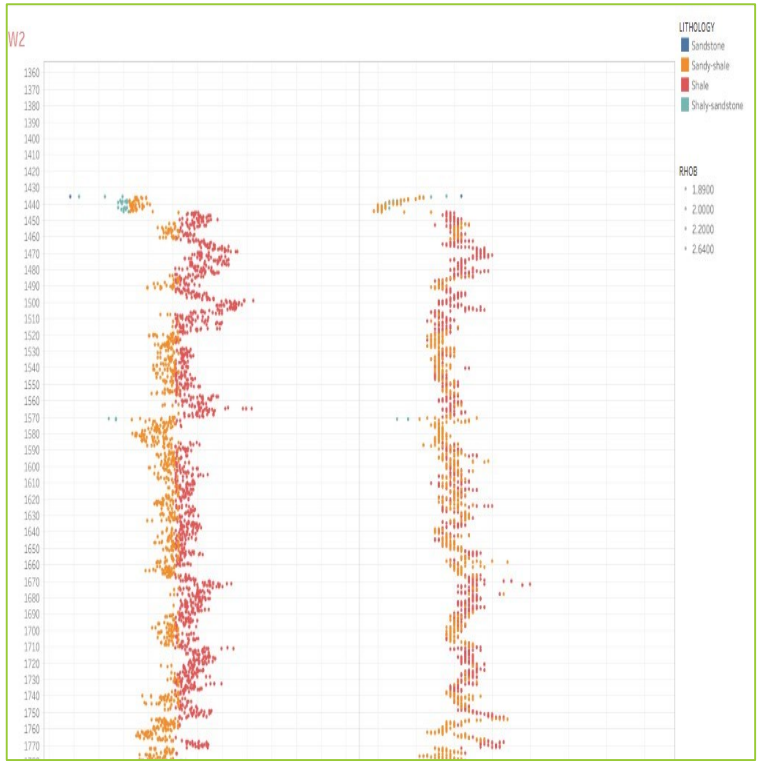
EDM/Snapshot - LAS Analysis (2/4)



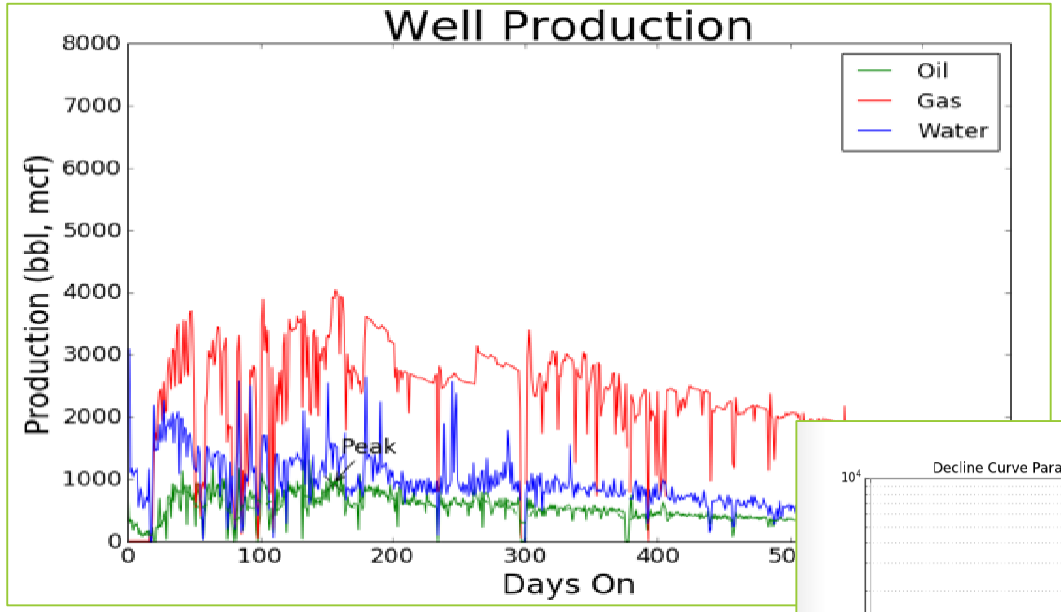
EDM/Validating Spliced LAS Files in Tableau (3/4)

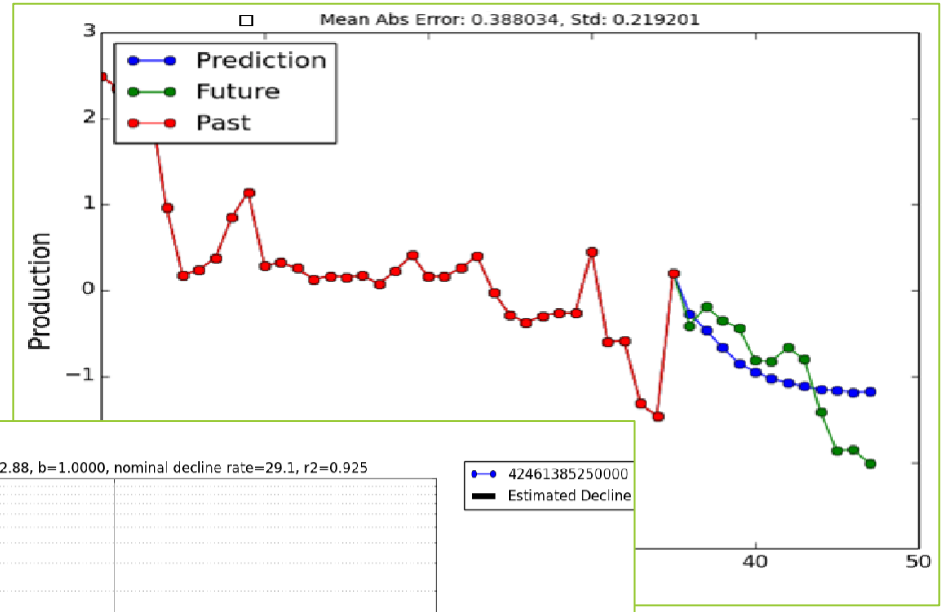


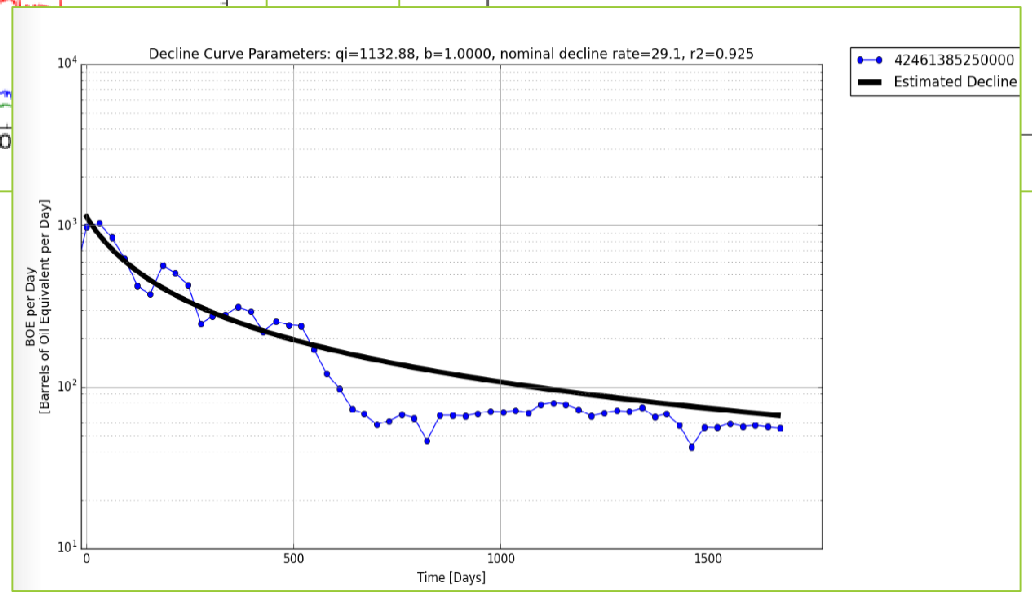




EDM/Snapshot - Production Analysis (4/4)

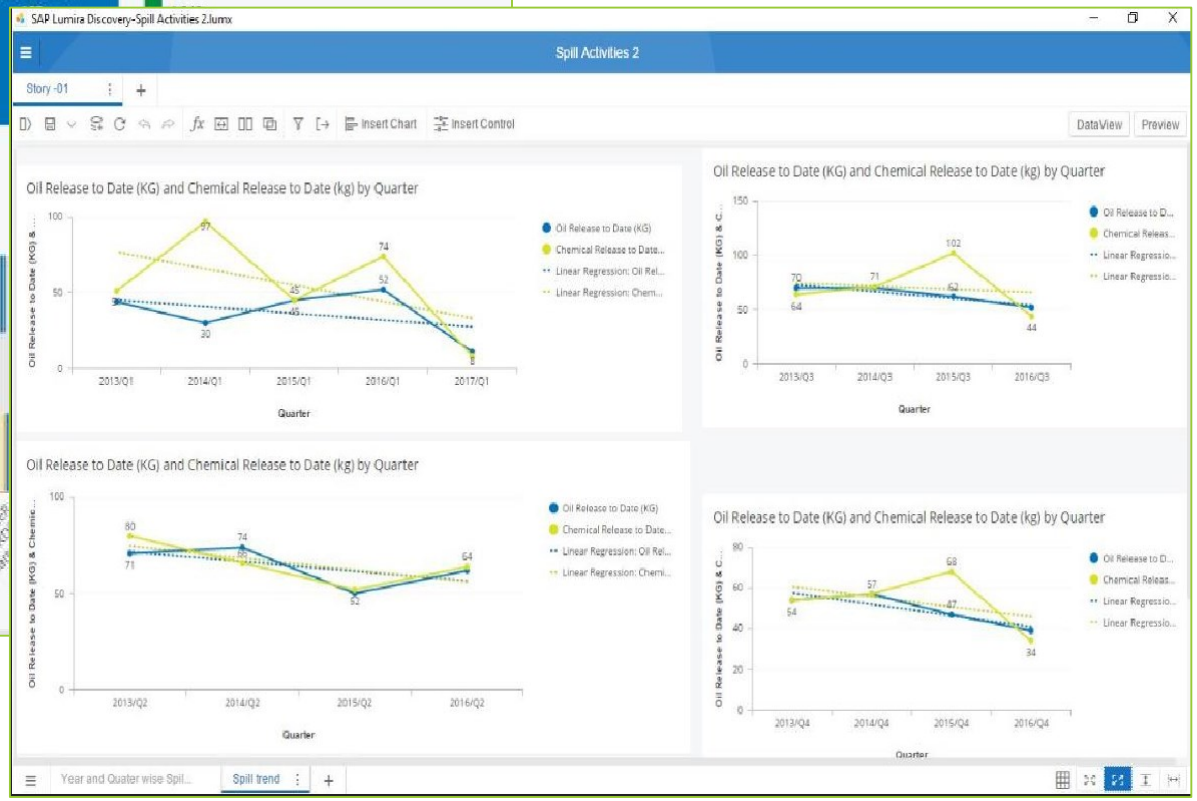




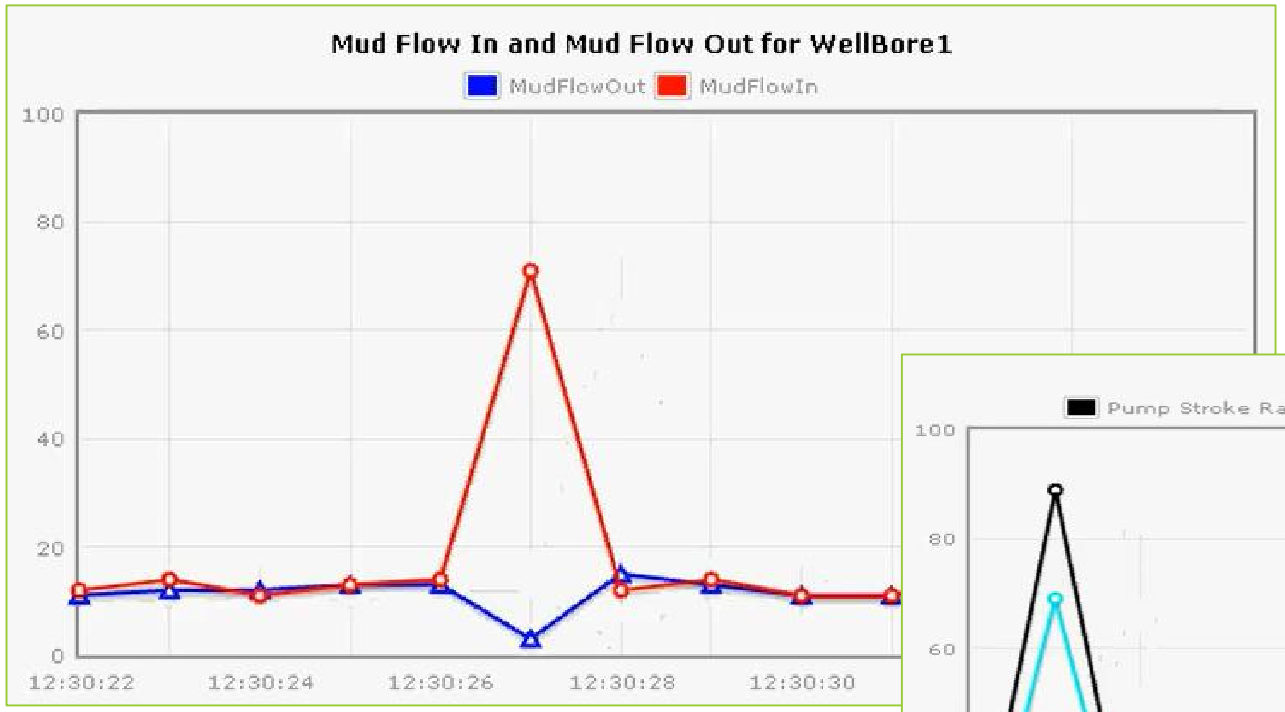


Other Solutions - Oil and Gas Vertical

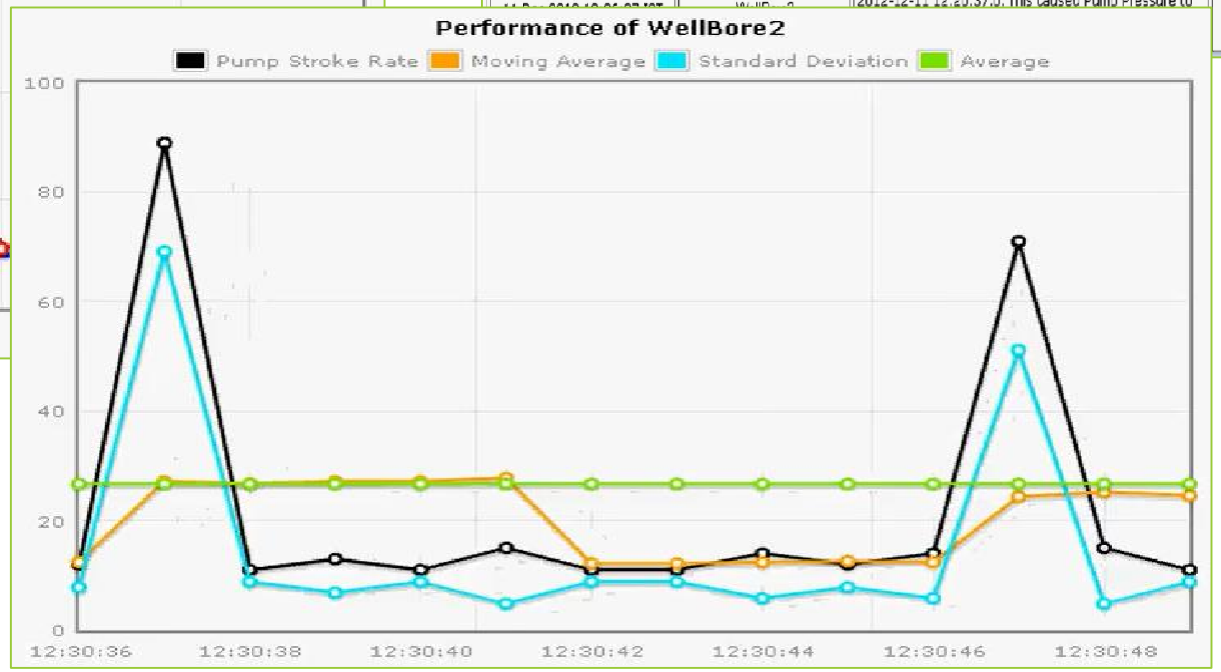
Other Solutions -
Oil Spill Incident Analysis



Other Solutions -
Real-time Monitoring for Well Integrity



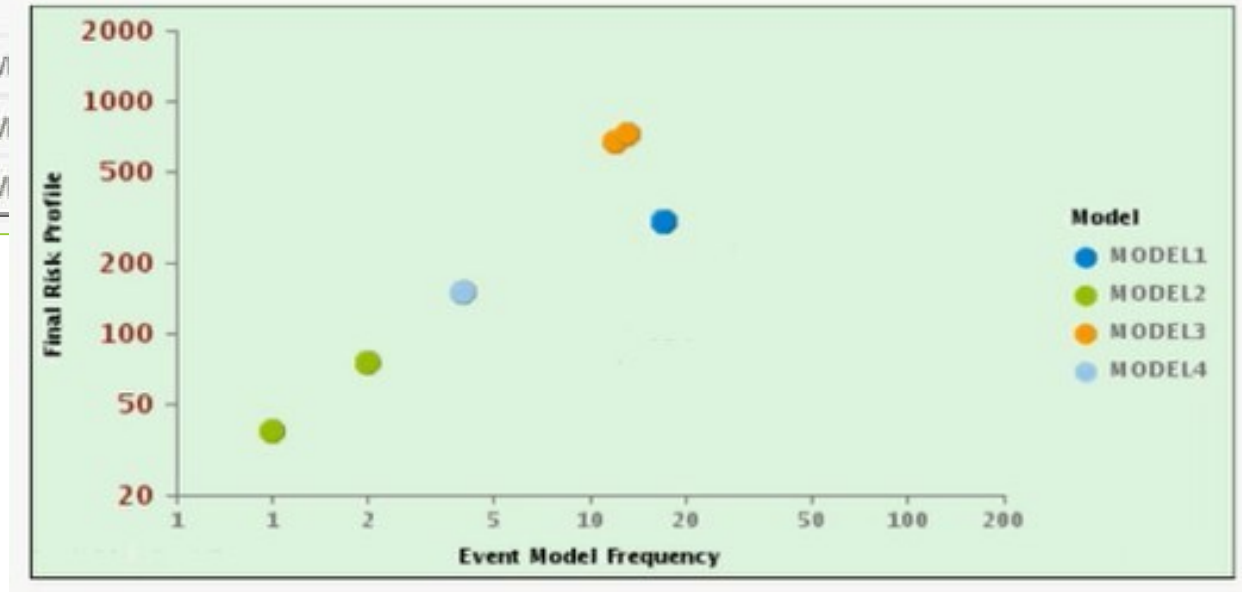
Timestamp	Source	Description	Action
11 Dec 2012 12:34:17 IST	WellBore5	Total Gas Volume exceeded the threshold value of 10 at 2012-12-11 12:34:17.0. This caused Pump Pressure to exceed the threshold value of 15 at 2012-12-11 12:26:07.0	View Details / Send e-mail
11 Dec 2012 12:26:17 IST	WellBore2	Total Gas Volume exceeded the threshold value of 10 at 2012-12-11 12:25:17.0. This caused Pump Pressure to exceed the threshold value of 15 at 2012-12-11 12:26:27.0	View Details / Send e-mail
11 Dec 2012 12:26:17 IST	WellBore5	Total Gas Volume exceeded the threshold value of 10 at 2012-12-11 12:25:17.0. This caused Pump Pressure to exceed the threshold value of 15 at 2012-12-11 12:26:27.0	View Details / Send e-mail
		Total Gas Volume exceeded the threshold value of 10 at 2012-12-11 12:25:37.0. This caused Pump Pressure to	View Details / Send e-mail



Other Solutions -
Well Integrity Events Pattern Risk Modelling

Event Model Frequency and Risk Profile

Model No	Event Model	Well API	Well Bore ID	Event Model Frequency	Final Risk Profile
MODEL1	EVPARAM05,EVPARAM06,	55130000090000	55130000090001	17	306
MODEL2	EVPARAM07,EVPARAM04,EVPARAM08,EVPARAM01,EVPARAM02,EVPARAM03,	55130000090000	55130000090002	2	76
MODEL3	EVPARAM05,EVPARAM06,EVPARAM07,EVPARAM04,EVPARAM08,EVPARAM01,EVPARAM02,EVPAR/	55130000090000	55130000090002	12	672
MODEL4	EVPARAM05,EVPARAM06,EVPARAM04,EVPARAM01,EVPARAM02,EVPARAM03,	55130000090000	55130000090002	4	152
MODEL1	EVPARAM05,EVPARAM06,				306
MODEL2	EVPARAM07,EVPARAM04,EVPARAM08,EV				38
MODEL3	EVPARAM05,EVPARAM06,EVPARAM07,EV				726
MODEL4	EVPARAM05,EVPARAM06,EVPARAM04,EV				152



Drilling Automation Mapper– Operations Processes identification

1	IS BIT EITHER MOVING UP / DOWN	YES	BIT MOVING DOWN	YES	BIT DEPTH SAME AS MEASURED	YES	IS BIT ROTATING	YES	ROTARY DRILLING				
2	IS BIT EITHER MOVING UP / DOWN	YES	BIT MOVING DOWN	YES	BIT DEPTH SAME AS MEASURED	YES	IS BIT ROTATING	NO	SLIDE DRILLING				
3	IS BIT EITHER MOVING UP / DOWN	YES	BIT MOVING DOWN	YES	BIT DEPTH SAME AS MEASURED	NO	IS BIT ROTATING	YES	IS BIT ROTATING WITH PUMPING	YES	REAM IN		
4	IS BIT EITHER MOVING UP / DOWN	YES	BIT MOVING DOWN	YES	BIT DEPTH SAME AS MEASURED	NO	IS BIT ROTATING	YES	IS BIT ROTATING WITH PUMPING	NO	TRIP IN ROTATING		
5	IS BIT EITHER MOVING UP / DOWN	YES	BIT MOVING DOWN	YES	BIT DEPTH SAME AS MEASURED	NO	IS BIT ROTATING	NO	IS THE SYSTEM PUMPING	YES	TRIP IN PUMPING		
6	IS BIT EITHER MOVING UP / DOWN	YES	BIT MOVING DOWN	YES	BIT DEPTH SAME AS MEASURED	NO	IS BIT ROTATING	NO	IS THE SYSTEM PUMPING	NO	TRIP IN		
7	IS BIT EITHER MOVING UP / DOWN	YES	BIT MOVING DOWN	NO	IS THE BIT ROTATING	YES	IS BIT ROTATING WITH PUMPING	YES	BACK REAM				
8	IS BIT EITHER MOVING UP / DOWN	YES	BIT MOVING DOWN	NO	IS THE BIT ROTATING	YES	IS BIT ROTATING WITH PUMPING	NO	TRIP OUT ROTATING				
9	IS BIT EITHER MOVING UP / DOWN	YES	BIT MOVING DOWN	NO	IS THE BIT ROTATING	NO	IS THE SYSTEM PUMPING	YES	TRIP OUT PUMPING				
10	IS BIT EITHER MOVING UP / DOWN	YES	BIT MOVING DOWN	NO	IS THE BIT ROTATING	NO	IS THE SYSTEM PUMPING	NO	TRIP OUT				
11	IS BIT EITHER MOVING UP / DOWN	NO	IS BHA ROTAING	YES	IS BHA PUMPING	YES	ROTATING + PUMPING						
12	IS BIT EITHER MOVING UP / DOWN	NO	ROTAING	YES	IS BHA PUMPING	NO	ROTATING						
13	IS BIT EITHER MOVING UP / DOWN	NO	ROTAING	NO	IS BHA PUMPING	YES	PUMPING						
14	IS BIT EITHER MOVING UP / DOWN	NO	ROTAING	NO	IS BHA PUMPING	NO	IS BHA IN SLIPS	YES	IN SLIPS				
15	IS BIT EITHER MOVING UP / DOWN	NO	IS BHA ROTAING	NO	IS BHA PUMPING	NO	IS BHA IN SLIPS	NO	IS THE DATA AVAILABE FOR ALL	YES	DOES THE DATA MAKE SENSE	YES	STATIONARY
16	IS BIT EITHER MOVING UP / DOWN	NO	IS BHA ROTAING	NO	IS BHA PUMPING	NO	IS BHA IN SLIPS	NO	IS THE DATA AVAILABE FOR ALL	YES	DOES THE DATA MAKE SENSE	NO	UNKNOWN
17	IS BIT EITHER MOVING UP / DOWN	NO	IS BHA ROTAING	NO	IS BHA PUMPING	NO	IS BHA IN SLIPS	NO	IS THE DATA AVAILABE FOR ALL	NO	IS DATA AVAILABLE FOR	YES	ABSCENT / DATA LOSS
18	IS BIT EITHER MOVING UP / DOWN	NO	IS BHA ROTAING	NO	IS BHA PUMPING	NO	IS BHA IN SLIPS	NO	IS THE DATA AVAILABE FOR ALL	NO	IS DATA AVAILABLE FOR	NO	DATA GAP / LOSS

Thank You

Greenojo provides Automation, Analytics and AI solutions to enterprise customers

For RFPs, Solutions and Sales/Partner enquiries, connect us at - sales@greenojo.com