



# **SPE Workshop: Adaptive Approach in Integrated Reservoir Modelling and Simulation in the Age of Digitalisation**

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## **Application of Real Time Petrophysics via Artificial Intelligence for Open Hole Standalone Screen Completion Strategy in Multi-Stack Reservoirs Field**

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# Introduction

## Problem Statement

Drilling and Completion operation in multi-stack reservoirs field nowadays required fast log interpretation and decision making to embark cost-efficient operation especially if it completed in open hole environment

## Solution

To utilized a machine learning application for Well log data artificial intelligence (AI) that is designed fit for purpose to conduct real-time petrophysical evaluation while drilling as mean to provide seamless decision making after well reached final total depth (FTD).

## Outline



**Methodology &  
Process**



**Result &  
Observations**



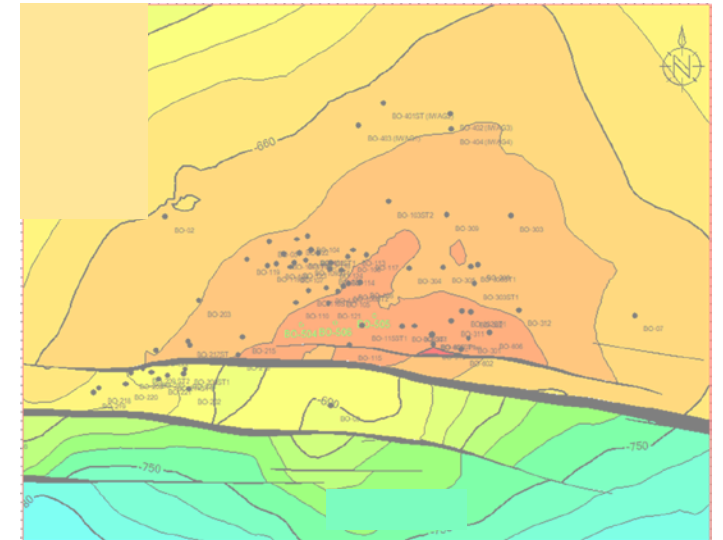
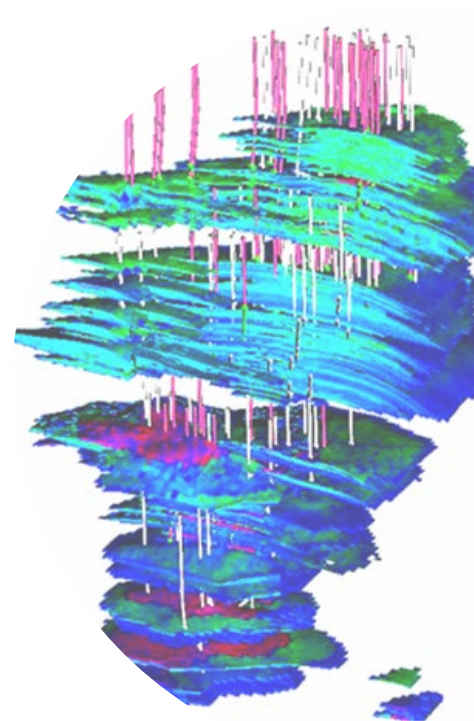
**Value  
Creation**



**Conclusion**

# Field Background

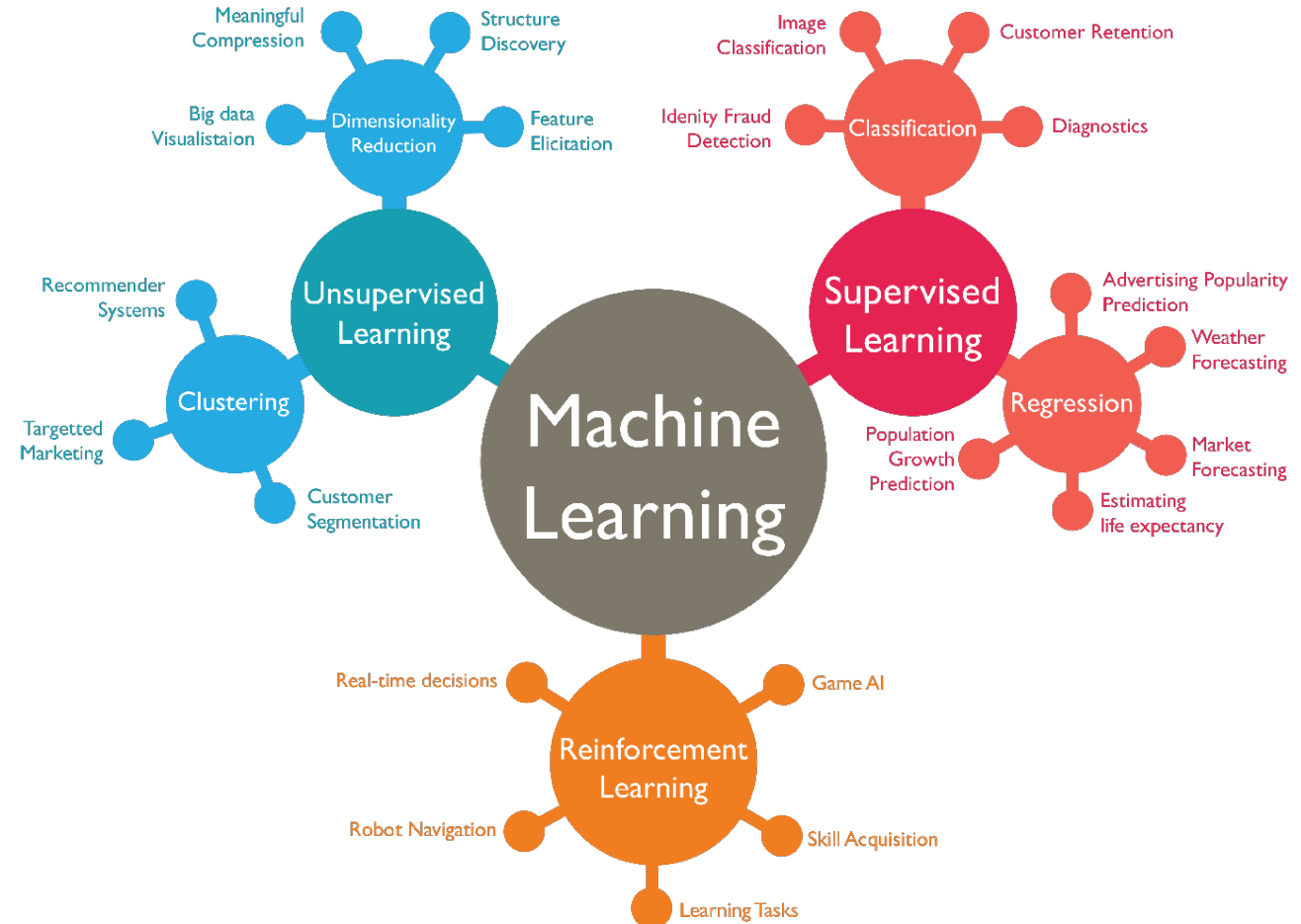
- Field B is located 40km off the coast of Sarawak, offshore Malaysia.
- Major Reservoir in Field B is known to be viscous multistacked Reservoir group with strong water drive at >30 per cent current RF.
- Latest development with new infill (8 wells) was completed in May 2024.
- Infill campaign expect to improve by 4 per cent field RF.



# Methodology and Process

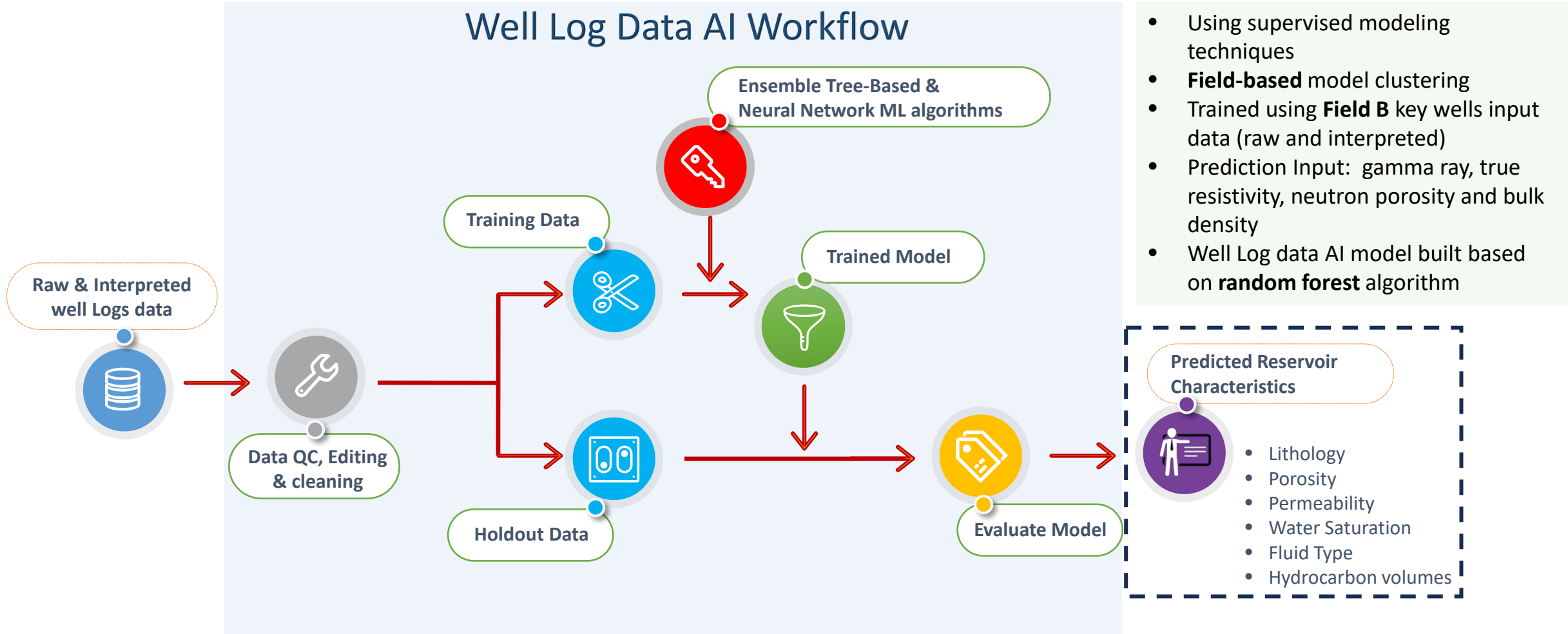
## What is Machine Learning?

1. Machine Learning (ML) is a subset of artificial intelligence (AI) where computer algorithms learn from data provided to perform certain tasks and gradually improve its accuracy.
2. Three types of ML;
  - i. Supervised ML: algorithm learns from a labelled training dataset.
  - ii. Unsupervised ML: algorithm learns from unsorted or unlabelled dataset
  - iii. Reinforced ML: algorithm gradually learns from trial and error.



# Methodology and Process

## Well Log Data AI Workflow



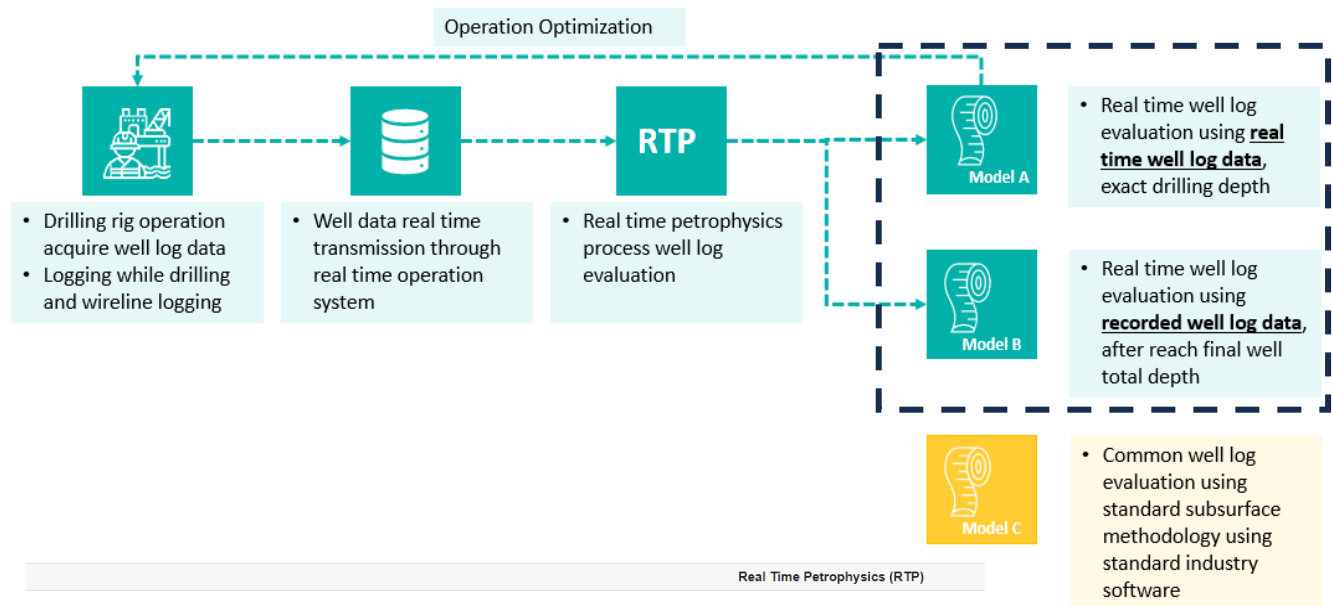
- Using supervised modeling techniques
- **Field-based** model clustering
- Trained using **Field B** key wells input data (raw and interpreted)
- Prediction Input: gamma ray, true resistivity, neutron porosity and bulk density
- Well Log data AI model built based on **random forest** algorithm

- Predicted Reservoir Characteristics**
- Lithology
  - Porosity
  - Permeability
  - Water Saturation
  - Fluid Type
  - Hydrocarbon volumes

# Methodology and Process

- Well log data AI is capable of **Real-time petrophysics prediction** by leveraging on open hole raw logs as input.
- Integration with real-time drilling data transmission from Drilling Rig and python services as backend system architecture.
- Generated 2 automatic models based on AI (Model A & B).
- Model C is generated using standard subsurface methodology via standard industry software.
- Real-time output: lithology, porosity, permeability, water saturation, fluid type and hydrocarbon volume.

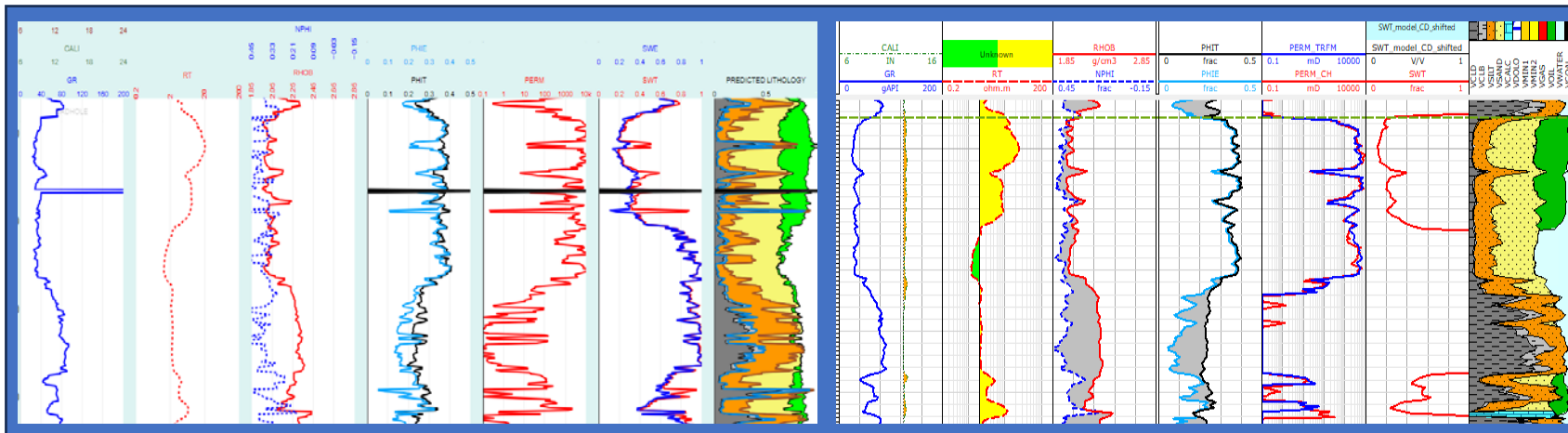
- Real-time well log prediction by AI (Model A) is accessible by all team members using the same display interface as real-time data transmission.
- Team members able to view lithology and fluid contact to decide sand screen and swell packer placement immediately for Open Hole Standalone Screen (OHSAS) purpose.
- The interface is web-based and developed in-house by the Company



# Result and Observation

Model A (Well log data AI using real time data)

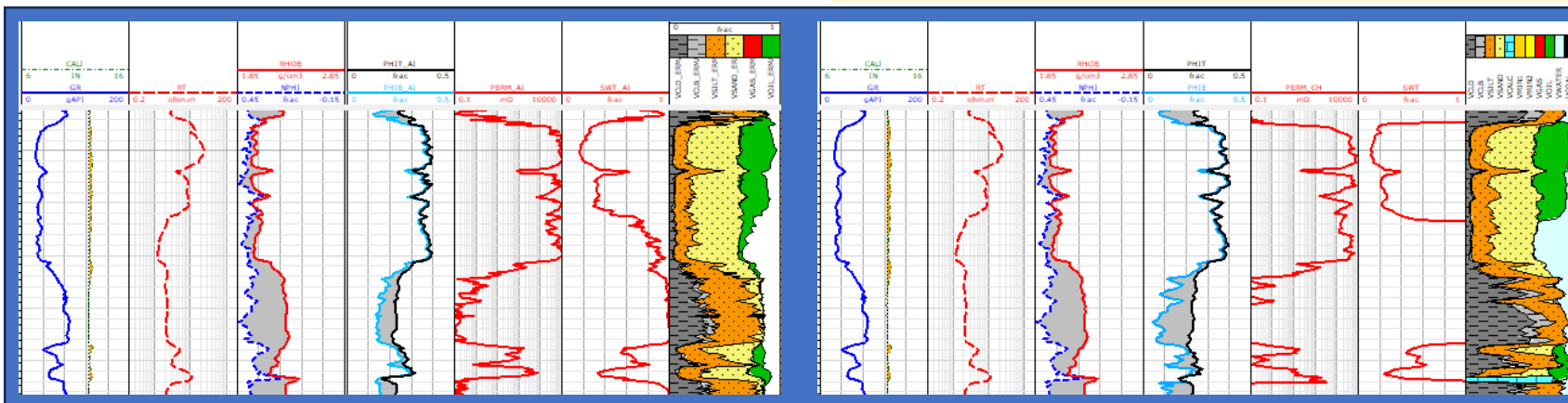
Model C (Common Well log evaluation using recorded data)



1. Model A show almost similar well log evaluation result with Model C despite of slightly difference in real time data input.
2. Model A was utilized as decision making for **screen & swell packer placement** in OHSAS to embark fast operation and cost saving.

Model B (Well log data AI using recorded data)

Model C (Common Well log evaluation using recorded data)

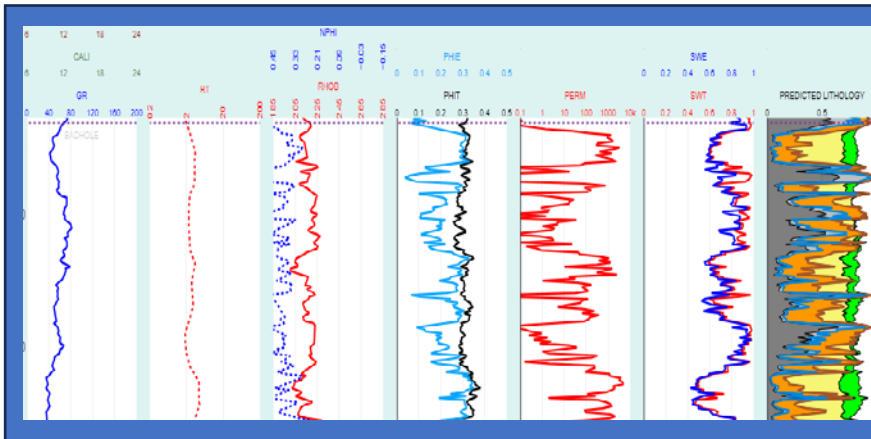


1. Model B show almost similar well log evaluation result with Model C.
2. Model B was generated after the well reach FTD and can be exported and viewed in standard industry software.

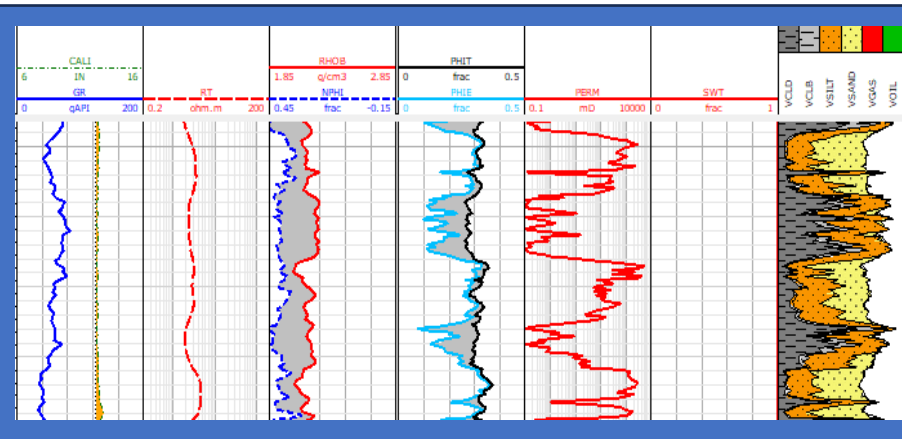


# Result and Observation

Model A (Well log data AI using real time data)



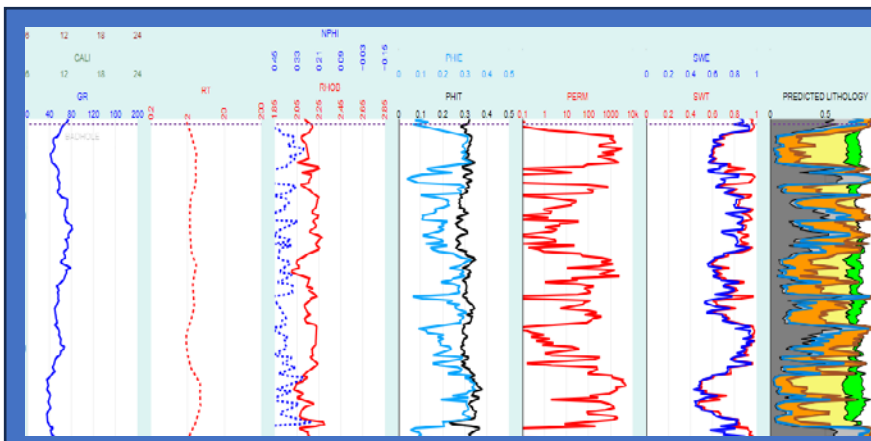
Model C (Common Well log evaluation using recorded data)



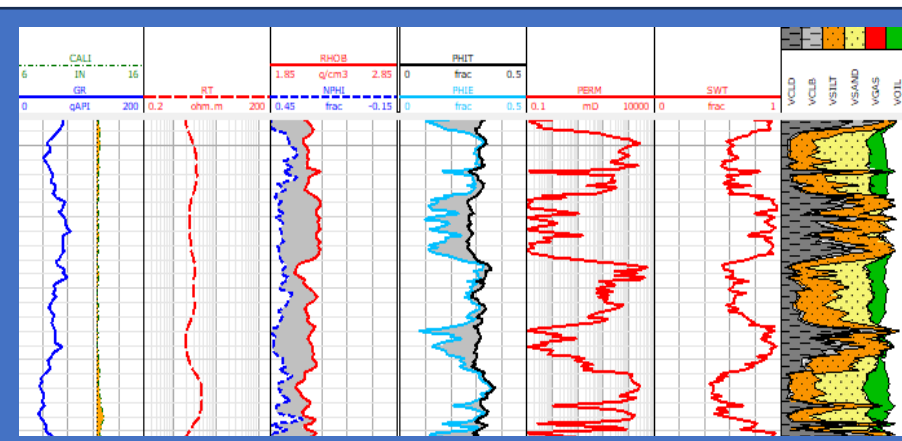
## Preliminary

1. Model A well log evaluation result show upside potential of **oil column** compared to Model C in the first well of recent Drilling Campaign.
2. Model C well log evaluation is based on the prognosis which indicate the zone is water bearing.

Model A (Well log data AI using real time data)



Model C (Common Well log evaluation using recorded data)



## Final

1. The present of oil column is **valid** post-verification with gas analysis, cutting and oil show in mud log.
2. Model C well log evaluation then is revised to follow the prediction from Model A.
3. Model A is proven robust for **upside potential identification**

# Value Creation and Conclusion



## Rig Time Saving

- ❑ Estimated time saving up to 1 operating day per well
- ❑ Total Cost Saving of **USD 360,000**



## Upside Potential Identification

- ❑ Evaluate all reservoirs without missing any single opportunities
- ❑ At least 2 reservoirs indicate new significant oil column



## Business Process Efficiency

- ❑ Facilitates collaboration with other discipline
- ❑ Help critical decision making (screen placement) for open hole completion strategy



## Digital & Automation

- ❑ Accelerating digital development and adoption
- ❑ Contribute to industry blueprint of digital invention

## Conclusion

Well log data AI has been proven work in managing well log evaluation in multi-stack reservoirs and has demonstrated significant value creation in term of time and resource.



[Open]



# Thank You / Question

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