Intelligent Field Development Plan (iFDP)

Paradigm Shift towards Digital Transformation for Dragon Oil

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Dragon Oil

Schlumberger

Outline

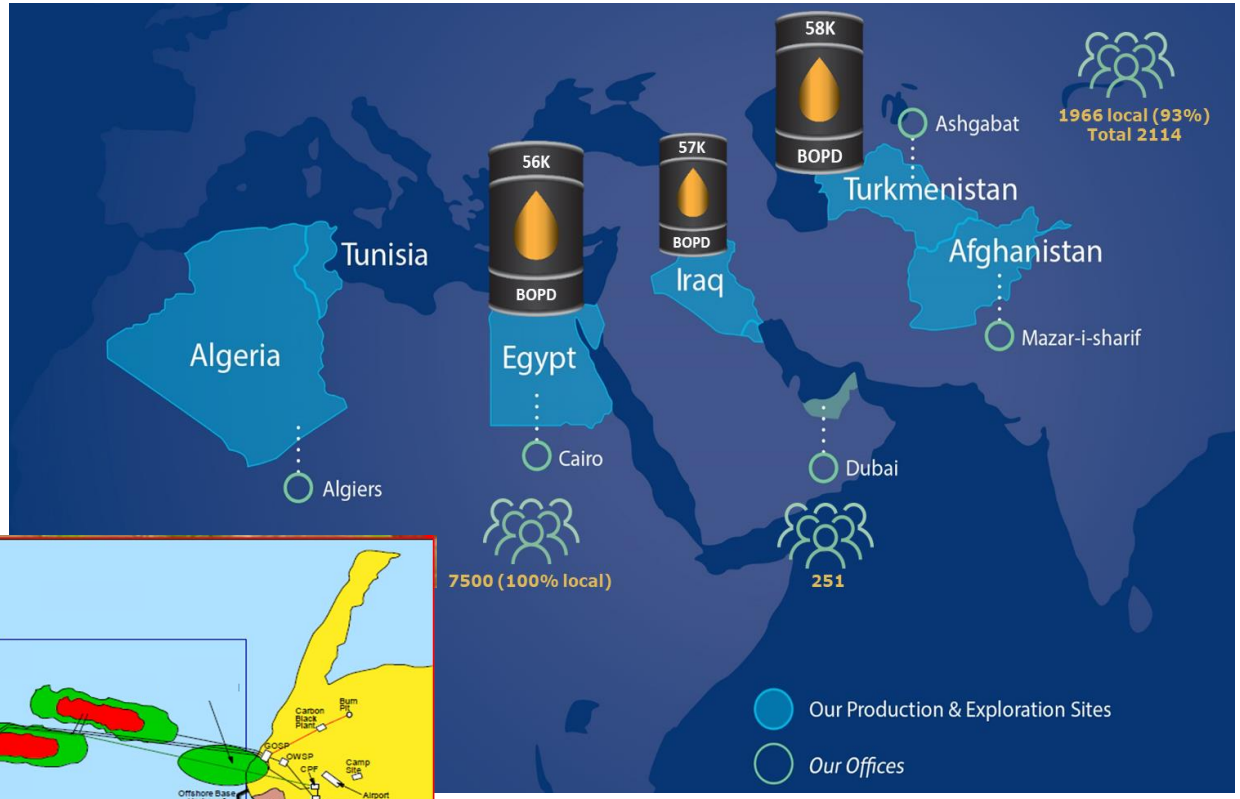
- Overview – Dragon Oil
- Challenges & KPIs
- Solution Orchestration in DELFI
- Implementation Examples
- Results & Impacts

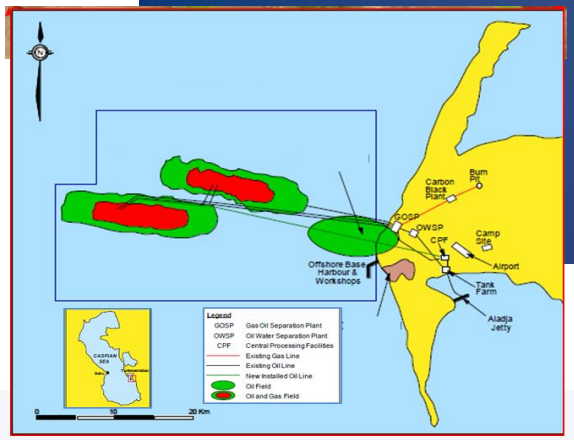
Dragon Oil

is an international oil and gas company with an established history and strong track record across the Middle East, North Africa and Caspian regions.

~140,000
barrels of oil production per day

~1 billion
barrels of equivalent of resource base





2 oilfields
Located in offshore in water depth of 10-30m.

Challenges & KPIs

Challenges

Subsurface

Poor recovery due to high **reservoir complexity**

Complex reservoir **fluids types**

Challenging reservoir **water dynamics**

Complex well placement in **stacked & patchy sands**

Productivity

Large model size with **long** runtimes

Time consuming **simulation & modeling workflows**

Operationalization

Lack of **model operationalization**

Fast **outdating models**

KPI

FDP lifecycle < 6 months

Efficiency gain > 75%

Production losses < 60%

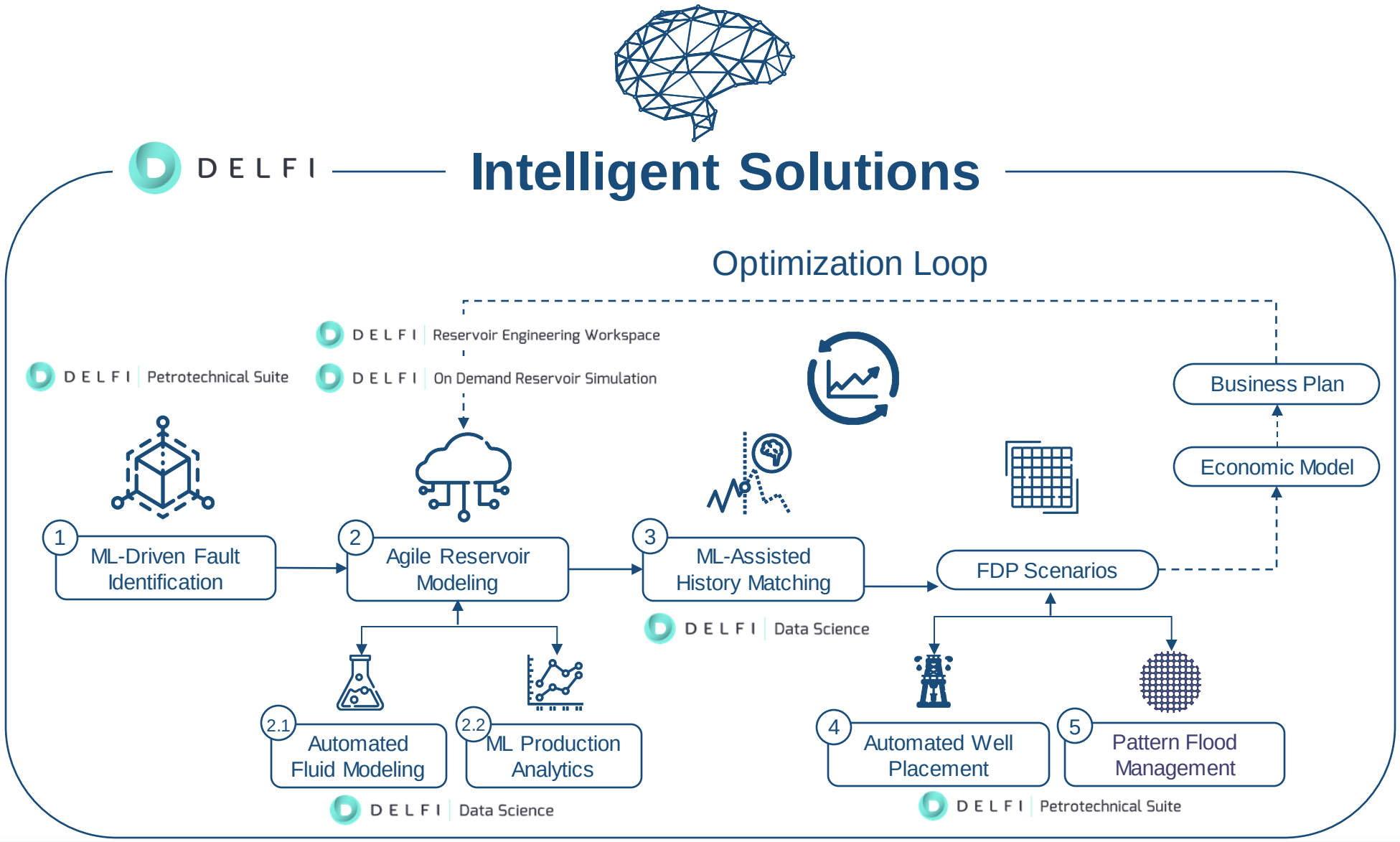
Solution Orchestration in DELFI

5X

faster runs in DELFI compared to on premise setup (3,860 CPU hours).

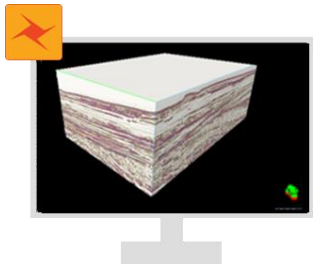
Hours

from **days** to **hours** in the cloud regardless of model complexity.



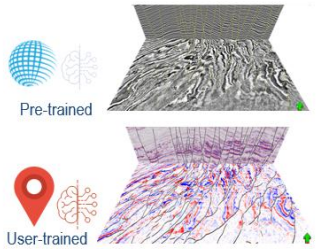
ML-Driven Fault Identification

1 Data Ingestion



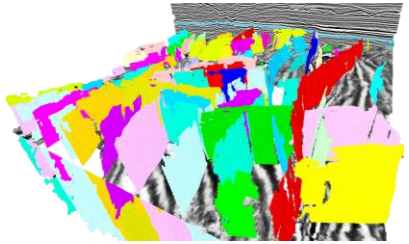
Performant seismic data access

2 Seismic Fault Detection



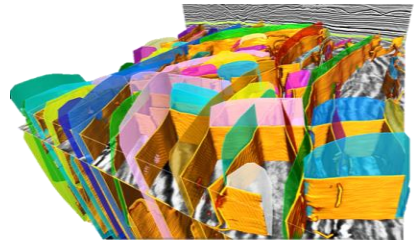
Geoscientist-driven Machine Learning

3 Fault Extraction & Segmentation



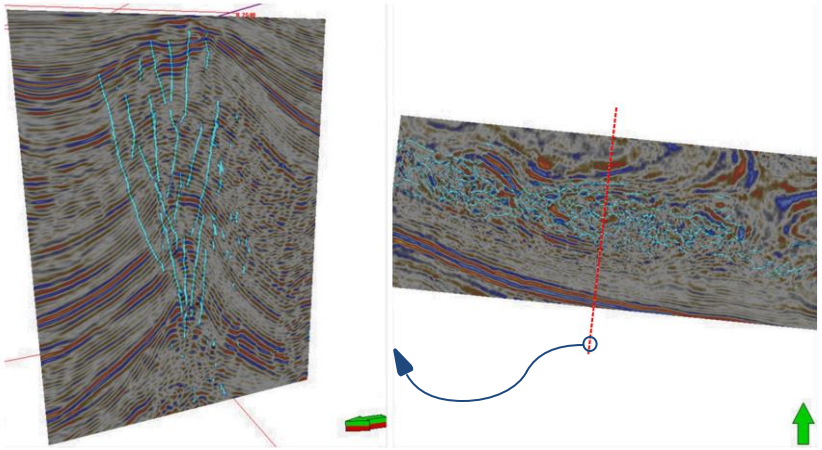
Reduced daunting fault picking process

4 Fault Framework

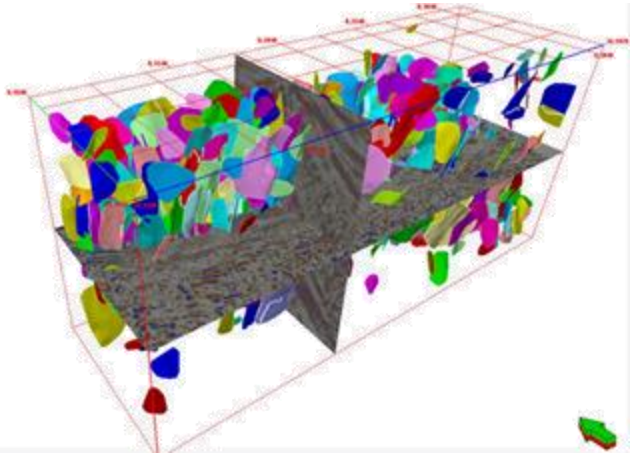


Connected directly to modeling workflows

The "*n*" iteration of ML fault prediction results (cross-section)

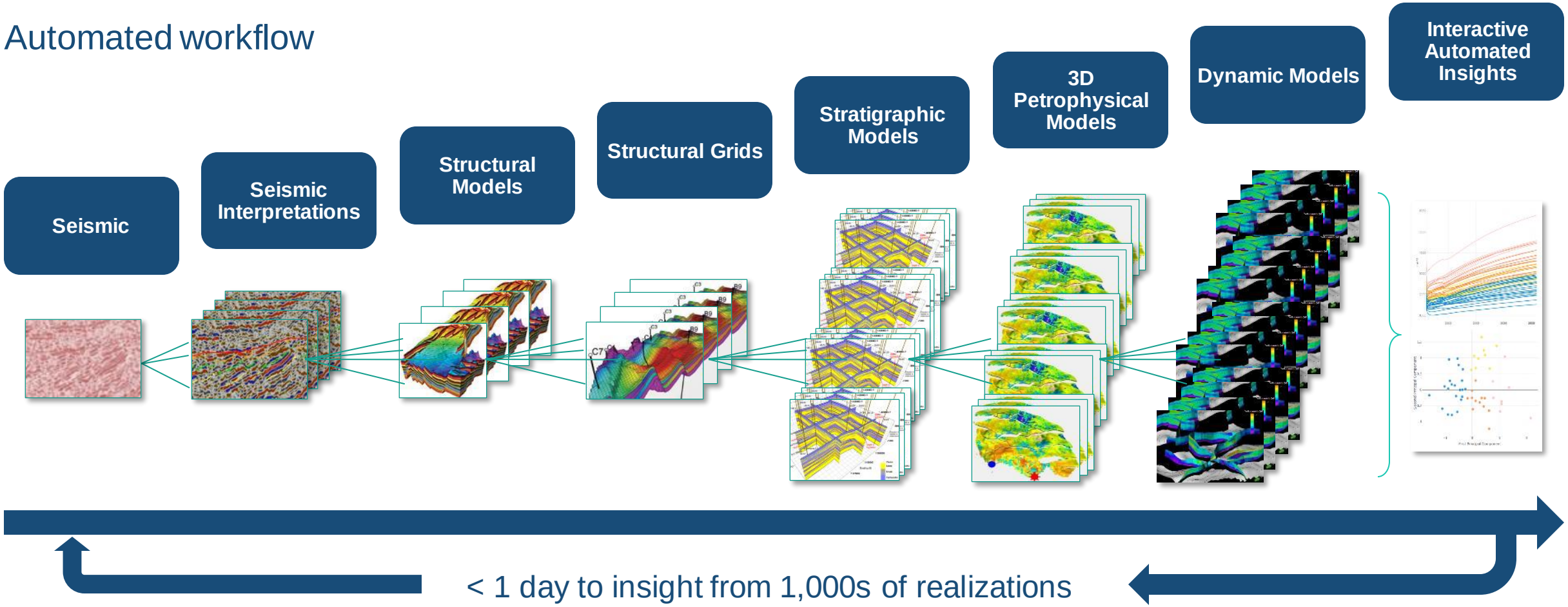


Fault modeling after "*n*" iterations using ML



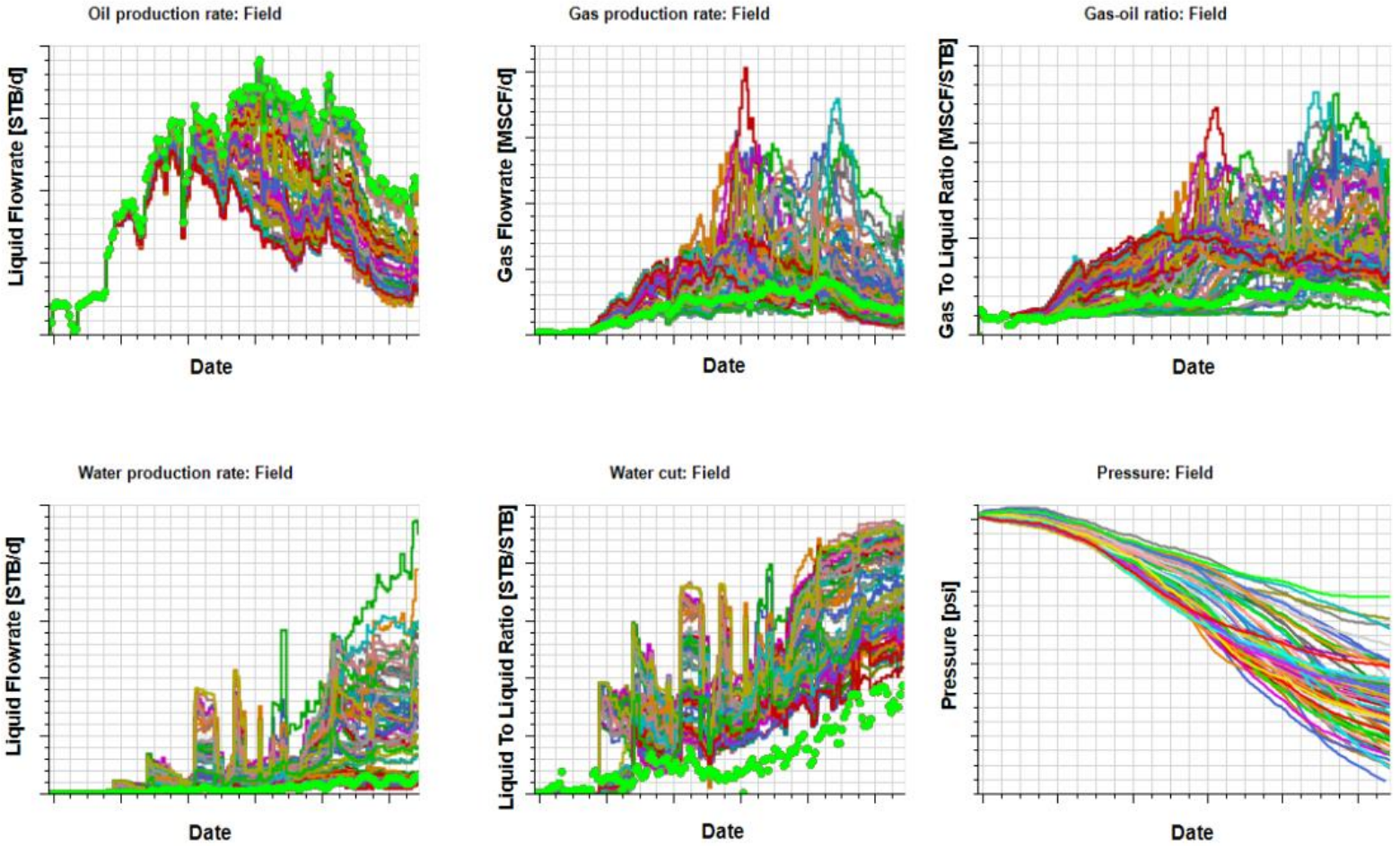
Agile Reservoir Modeling (ARM)

Automated workflow



< 1 day to insight from 1,000s of realizations

Uncertainty Screening using ARM



5X

faster runs in DELFI compared to on premise setup

> 2,000

realizations launched per reservoir on average in DELFI.

3-4weeks

average **timeframe** to produce history matched models

~3,860

CPU hours of simulations in DELFI for all reservoir models in **4-5 months**

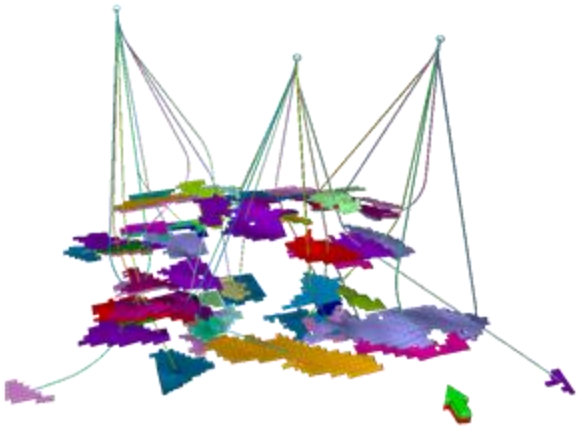
1.5years

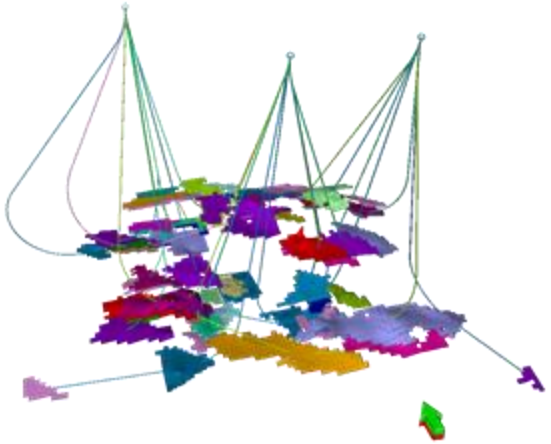
of 24/7 simulations required using current on-premise set up

Automated Well Placement

Separate production

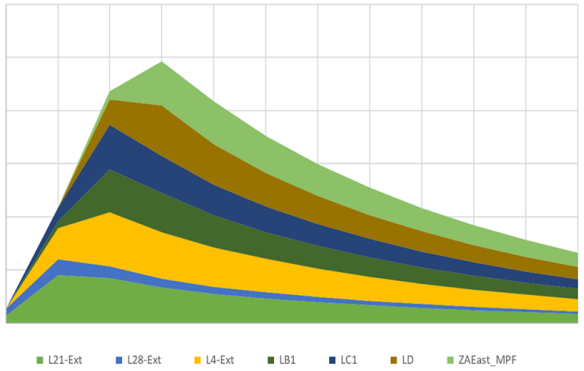
Well design optimization **targeted at each reservoir** individually.





Commingled production

Well design optimization targeted at **all reservoir targets** together.



Optimized FDP Profiles

Development plans were updated with **new infill wells**.

~60 new infill wells proposed using **unique workflow** tailored for Dragon Oil's reservoirs.

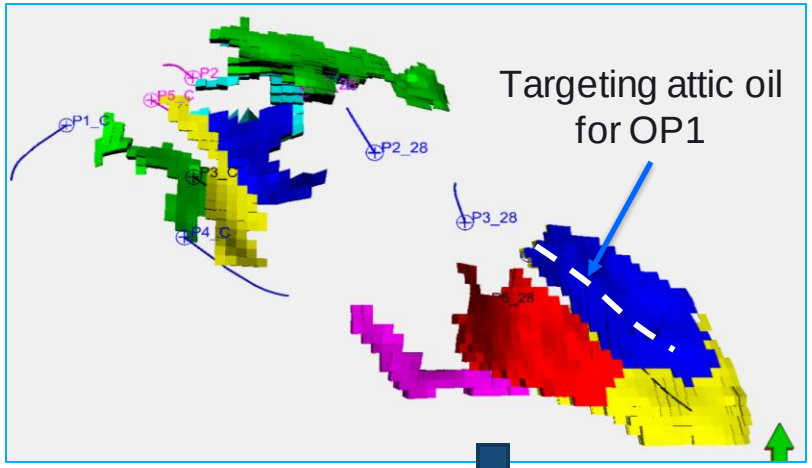
Optimized **sidetrack trajectory** of a new well that is producing with high oil production and low water cut for the last **9 months**.

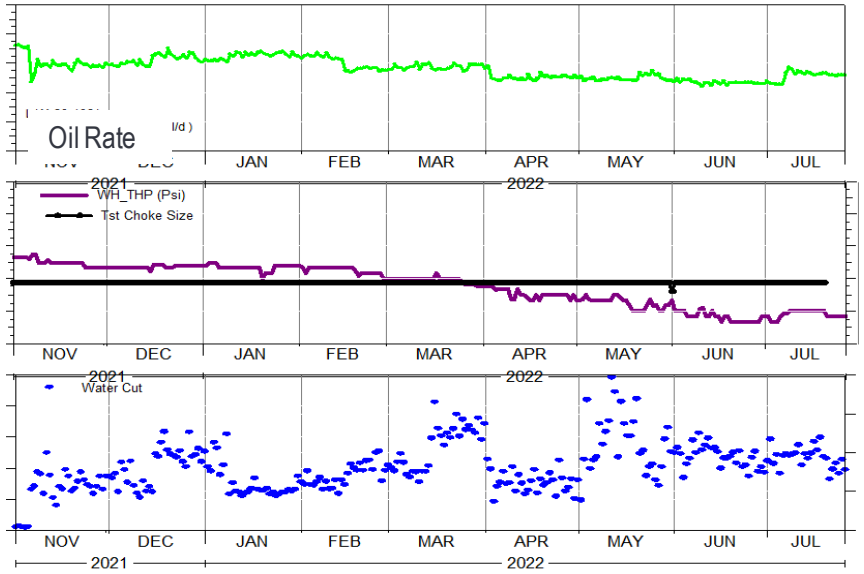
Optimized a **twin well** location that was revived and producing with **very low** water cut for more than **6 months.**

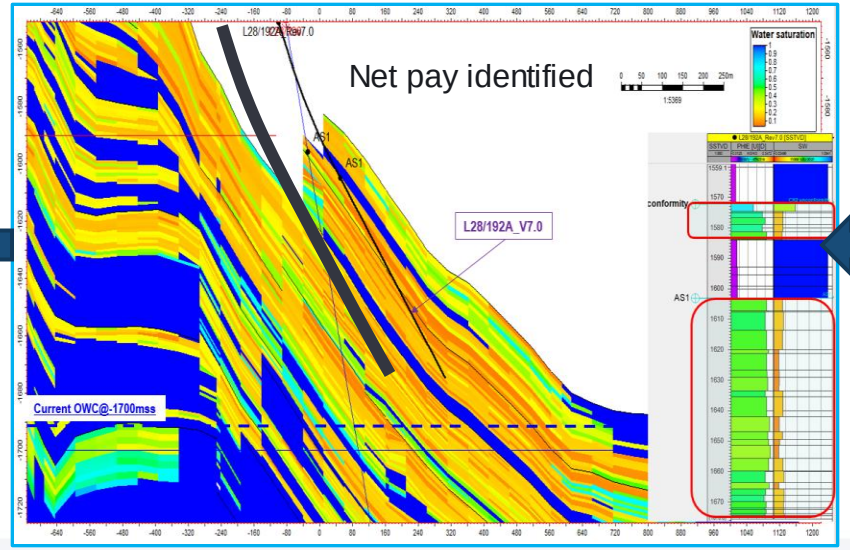
Automated workflows enabled screening new infill wells in **hours** compared to **weeks** using conventional approaches.

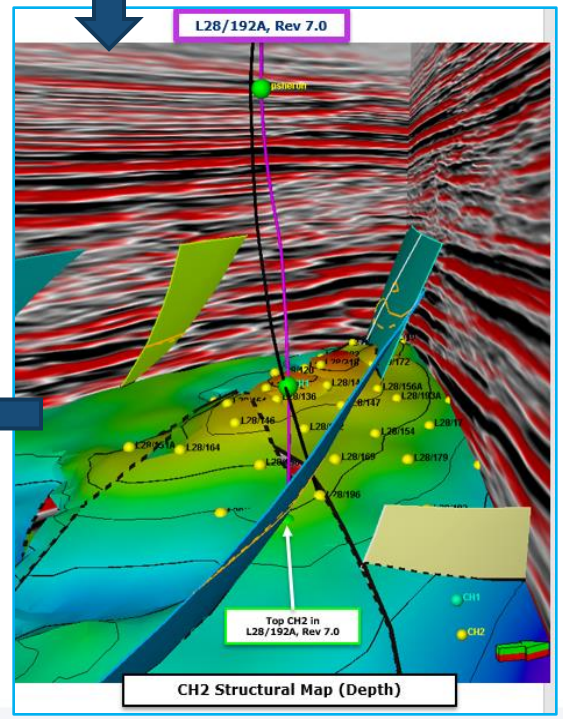
Implementation 1: Sidetrack

- The well location was proposed from one of DELFI dynamic models.
- Sidetrack the well OP1 into Zone A.
- Completion of open-hole to TD with 75-degree inclination.
- Well put “online” in 2021 with initial rate 1600 stbd.



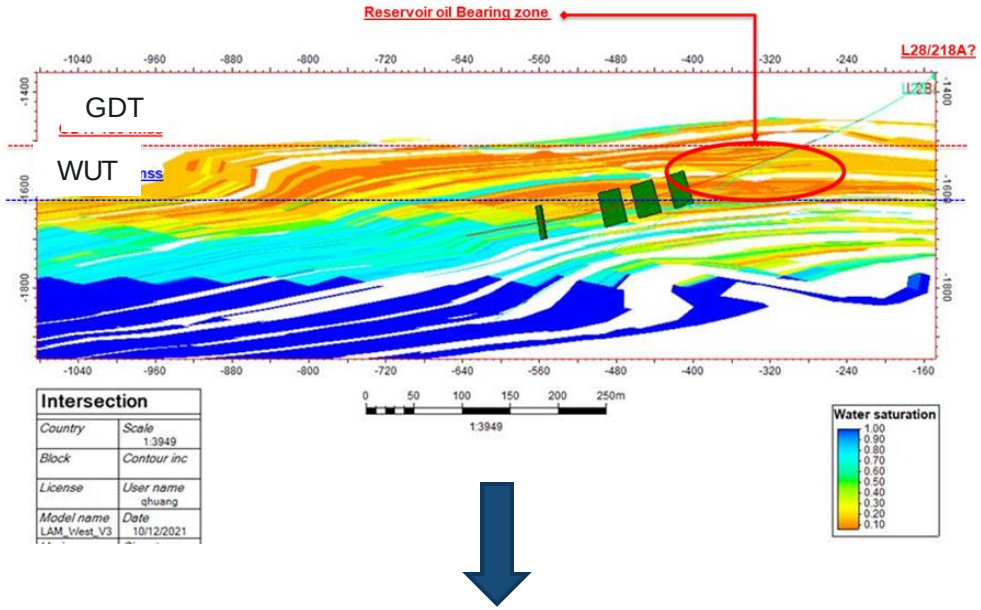


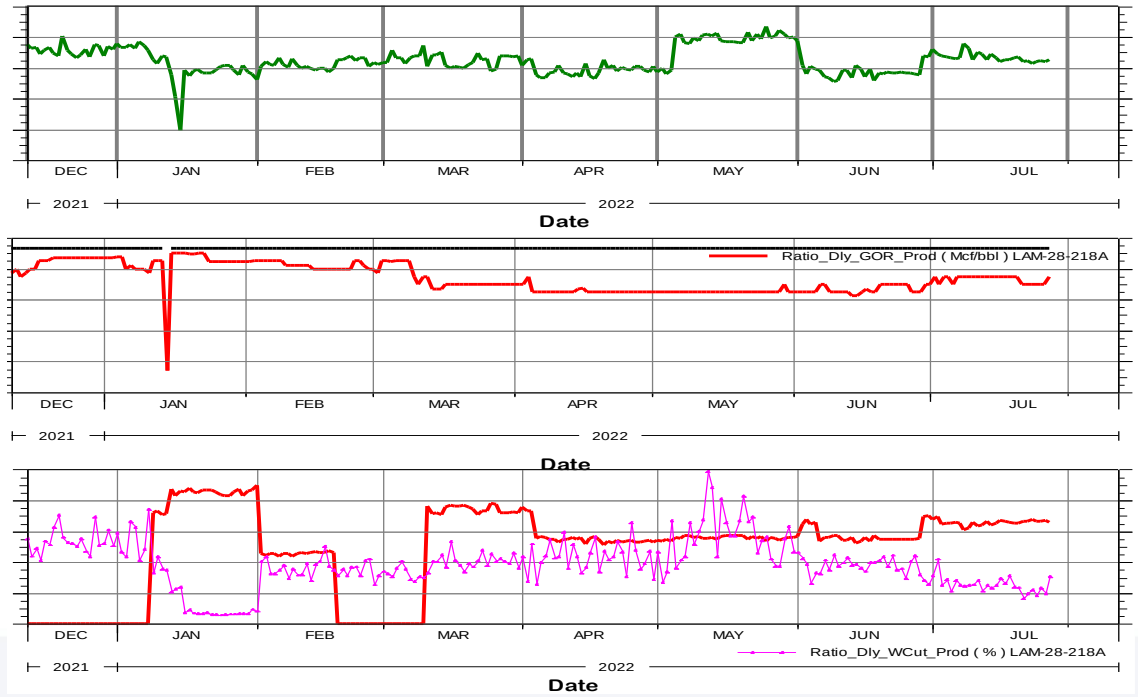


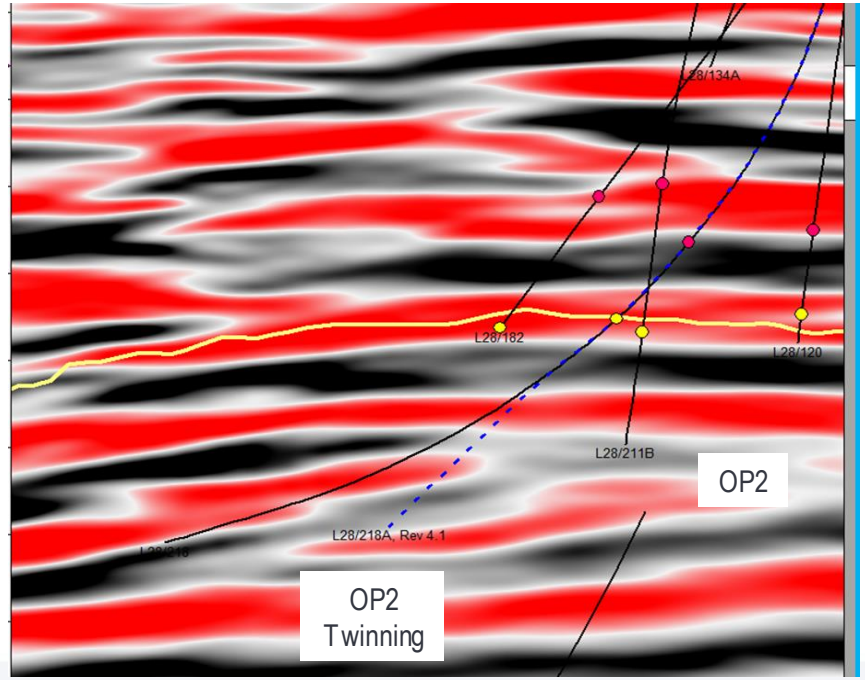


Implementation 2: Infill drilling

- Well OP2 showed water breakthrough 70% and sand production, shut in.
- Mobile oil was identified for the same wellbore; water from bottom hole.
- DELFI model proposed to twin the well in the upper interval of the same reservoir.
- Well was revived after twinning with **very low water cut** for more **than 6 months.**







Results & Impacts

Objectives

Drastically reduce FDP lifecycle from over 3 years to under 6 months

Identify “sweet spots” to place high-productive wells on the first try

Operationalize the models to start seeing immediate business impacts

Leveraging DELFI’s cloud & AI/ML capabilities to unlock value

Results

Accurate and reliable **reservoir models** for **all 9 reservoirs –** first time ever in the history of Dragon Oil**.**

Optimal FDPs for all reservoirs targeting **highest NPV** via infill drilling, waterflood, gas injection, gas lift etc.

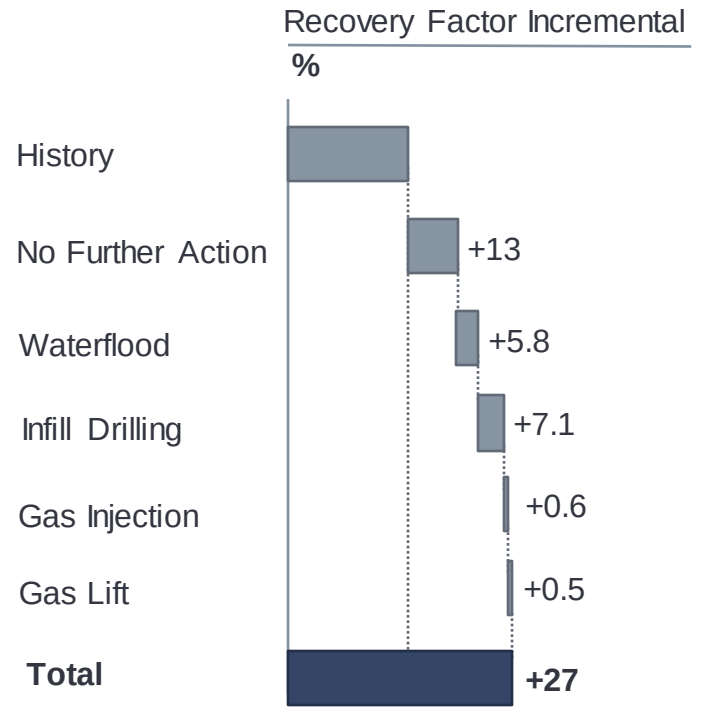
~60 new infill wells proposed using **unique workflow** tailored for Dragon Oil’s reservoirs.

Optimized **sidetrack trajectory** of a new well that is producing with high oil production and low water cut for the last **9 months**.

Optimized a **twin well** location that was revived and producing with very **low water cut** for more than **6 months**.

Extensive application of **DELFI technologies & AI/ML workflows** to drive efficiency and extract new insights.

Reservoir X – FDP Activities



Acknowledgement

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