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Digital Pulsed Neutron on Slickline Provides Real-Time Oil Saturation, Saving at Least One Day per Well

Performing both mechanical intervention services and sigma logging, LIVE digital slickline services improve efficiency and safety of rigless operations, Mexico

CHALLENGE
Improve the efficiency and safety of mechanical intervention operations that required switching from a slickline unit to a different service provider with a wireline unit for saturation monitoring.

SOLUTION
Deploy digital pulsed neutron (DPN) component of LIVE PL* digital slickline production logging services from the same slickline unit by the same crew to provide real-time reservoir saturation monitoring.

RESULTS
- Saved one day or more per well intervention operation by running both the intervention and the sigma logging from the same slickline unit.
- Better informed operations in this mature field with real-time reservoir saturation monitoring and accurate depth control.
- Significantly improved operational safety by avoiding wireline sticking risk and simplifying pressure control.

Multiple rigs for well intervention and logging

An operator in Mexico was employing sigma logging for saturation monitoring in a mature field with hundreds of wells. The oil-bearing reservoir has a good-porosity sand with high formation salinity.

The operator normally used a conventional slickline unit to perform mechanical intervention work and would then switch to a wireline unit for the sigma logging operation. If perforating or additional intervention was needed afterward, the unit would be switched back to a slickline one. Although the slickline units provided the convenience of rigless operations, that work can be done only during daylight hours, which limits operational hours. A further delay was incurred because different service providers were used, requiring unit change out. Simple sigma logging operations were typically taking two to three days to complete.

In addition to the operational efficiency challenge, the wells in this mature field often have wax or paraffin. Running a sigma logging tool on wireline cable presents high risk of the cable sticking in the wax or paraffin, necessitating a fishing operation.

The DPN log compares well in Track 4 with the previous sigma log acquired on wireline in 2012, including borehole fluid changes, but also clearly indicates that the gas-filled annulus is now empty.
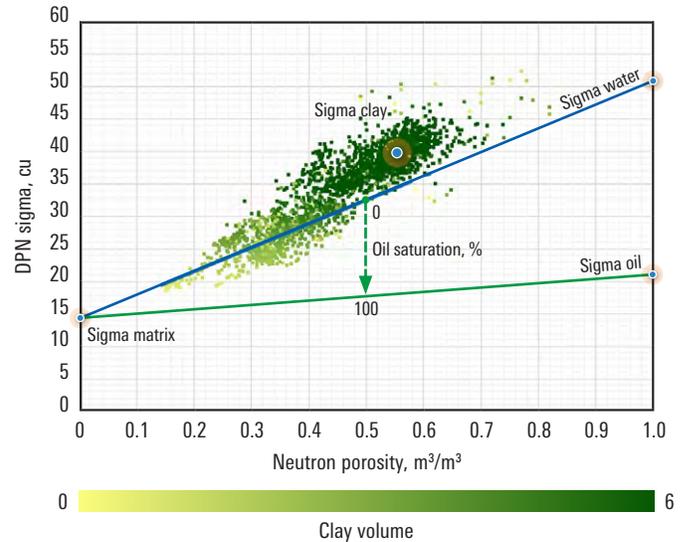
Slickline

Real-time digital pulsed neutron logging from LIVE digital slickline services

Schlumberger recommended using LIVE PL digital production logging services to run DPN sigma logging to provide real-time reservoir saturation monitoring without having to switch to a wireline unit. The dual-burst, high-output pulsed neutron generator (PNG) of DPN service is applied with adaptive timing to eliminate the need for environmental correction. The resulting high-quality sigma log supports the determination of water/oil/gas contacts, identification of the gas contact prior to perforating, and time-lapse reservoir monitoring.

All LIVE* digital slickline services are performed with standard slickline unit and pressure control equipment. The integral coating of the cable enables two-way digital communication during deployment with accurate depth control. This compatibility enables using the same slickline unit and crew for both intervention and production logging to leverage the operational simplicity, efficiency, and economy while providing the confidence of real-time logging data.

Informed, safer operations that save at least one day per well

Not having to switch from slickline to wireline units—and potentially back to slickline—saved one day or more of operating time per well while enabling better-informed interventions with greater operational safety from simplified pressure control and reduced fishing risk.

> "Digital slickline is the technology that we are looking for. When it comes to cost and time efficiency, reduced risks, digital slickline offers broader range of services. We are willing to work more with digital slickline, not only for sigma measurement but also for further activities such as perforations, PLT, etc."
>
> Head of Well Completion
> Operator

Crossplotting the formation sigma from DPN service versus neutron porosity with a built-in graphical parameter selection for the sigma-based water saturation equation enables users to quickly identify the zone of interest and apply the real-time interpretation in decision making.

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