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Optimizing Underbalanced Coiled Tubing Drilling Geosteering Through Robotic Surface Logging

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Abstract

Reservoir characterization while geosteering is a key factor in achieving optimum lateral placement; this can be achieved through the utilization of logging while drilling (LWD) and mud logging technologies. However, when drilling underbalanced coiled tubing (UBCTD) laterals, there are limited geosteering capabilities that are available in the market. Therefore, utilizing a 4IR solution that incorporates automatic rock cutting sampling and collection is a promising approach to address the limited geosteering capabilities of UBCTD.

In this work, we present a noninvasive, efficient 4IR solution by utilizing a robotic surface logging unit that is connected to the rig flowline to determine the elemental characteristics of rock cuttings in real time. The system cleans and dries the rock cuttings, then analyzes the sample using a laser-induced breakdown spectroscopy system to identify the rock cutting elements and minerals. The system then wirelessly transmits the results to the end user, enabling efficient real-time geosteering decisions to improve the lateral net-to-gross/pay placement.

The results demonstrate the strong capabilities of the robotic surface logging in accelerating the rock cutting collection and extraction time, yielding a real-time solution, and delivery in comparison to the conventional labor-intensive operation that is not capable of matching the high rate of penetration while drilling UBCTD laterals. In addition, the laser-induced breakdown spectroscopy system is integrated with an optical imaging device on the rock cuttings; the results of the analysis are dynamically and wirelessly delivered to the end user for geosteering purposes; this drastically increased the rate of delivery of the data to ultimately match the speed of the operation.

Given the limited number of available technologies, this 4IR solution plays an instrumental role in advancing reservoir characterization while attending UBCTD laterals. This technology serves as a guide to UBCTD operations by supporting real-time formation evaluation.