

Analytical Formation Sampling During Drilling Using OPAL – On Surface Petrophysical Analytical Logging

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Abstract

The OPAL system is a new petrophysical measurement tool. OPAL is measuring the drilling cuttings circulated up, collected and analyzed while drilling the well. The OPAL is a standalone unmanned unit collecting drill cuttings from the possum belly (Shale Shaker) and analyzes them. OPAL collects the slurry of drilling mud with cuttings and processes it in a close system. Sensors integrated into OPAL permit a continuous data stream of measurements analogous to logging or LWD. Examples of such will be displayed in addition to measurements intrinsic to direct and derived properties such as the Flow density curve, which is an indicator for well cleaning monitoring and quality control of measurements.

First example will compare OPAL in comparison to MWD/LWD logs. Sensors integrated into OPAL measure:

- Total & Spectral Gamma Ray Activity
- Resistivity
- Density

The response of slow moving drilling cuttings produces high quality statistical measurements as the sensors are in direct contact with the cuttings. This will result in a better delineation in most reservoirs in comparison to MWD/LWD logs.

The second example compares the real time OPAL GR measurement to the earlier recorded MWD/LWD GR in a horizontal well. It illustrates the bit entering a shale layer. The variance is indicative of the well bore cleaning capacity of the mud system and the difference is a direct measure of the precipitation rate of the clays which are left to precipitate in the bore hole. This is an early ‘stuck pipe warning’ indicator. This effect is confirmed by the decrease in the OPAL Flow Density curve. Other drilling issues can also be predicted using OPAL such as liquid loss or lost circulation.

The OPAL system has the capability to collect drill cuttings automatically without human intervention. This automated sample catching device is designed to continuously sample the drill cuttings flow by extracting a small portion of the cuttings effluent stream using a computer controlled sampling by lagged rate of penetration. OPAL continuously samples the drill cuttings stream and prepares – a pseudo core like sample in the storage cup. This ‘Mini Core’ is a system that produces a wash sample in the cup which is a layered, scaled reflection of the formation stratigraphic sequence. This Mini core can be vialled and stored in vial books.

In addition to the sequence sampled drill cuttings and their associated inline measurements the formation gasses can be presented using the Differential Gas Detector. This allows the light, medium and heavy gas components to be sampled and displayed simultaneously. Supplementary detectors and their inputs can be integrated into the data collection as required.