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## Abstract

*Real time and direct measurements* are nowadays the key strategic drivers for formation evaluation. Immediate availability of crucial information is needed while drilling, to improve safety, drilling practices, geosteering, optimal pays targeting, reservoir characterization and evaluation. Logging while drilling indirect but continuous downhole measurements have to be integrated with direct advanced mud logging practices, drilling parameter analysis and sensing capabilities.

Integration can be a reality thanks to robotic, automation and data analytics, the emerging paradigms of the 4<sup>th</sup> industry revolution.

In this work we outline how technology is currently mature to perform a quantum leap at the rig site on the way rock cuttings and fluids could be separated, cleaned, sampled, measured in a robotized, mostly unmanned, automatic way, to increase sampling representativeness, measurements quality, operations safety and value of data.

Advanced mud logging practices today allow direct measurements on cuttings of most of the petrophysical parameters classically available only from cores, months after a well was drilled. Compressional and shear wave velocities, grain and bulk densities, mechanical modula, porosity, permeability, nuclear magnetic resonance, elemental analysis from X-ray fluorescence, mineralogy from X-ray diffractometry, spectral gamma ray, etc., are today a reality on cuttings. Similarly, nowadays the amount of information obtainable through the numerical rock approach is very impressive, deriving petrophysical properties from computation of 3D imaging of the porous space from cuttings.

Huge margins of improvement on automation exist in the way fluids and cuttings are currently manually sampled at the shale shaker, cleaned, selected, prepared, and all those measurements performed at the rig site or in the lab. Underbalance drilling practices and industrial process engineering give us possible insights on how a continuous stream of cuttings, water, gases, hydrocarbons, could be automatically separated, weighted, and possibly on line sampled, analyzed and analytically measured. In this work we present an overview of the most current and promising best practices using existing technologies, highlighting the vision of a potential way forward to integrate those into an automatic robotic platform with a workflow of mainstream and advanced activities at the rig site and data streaming to the headquarters. In this context it is crucial to have collaborative R&D integration efforts led by oil companies, synergistically supported by logging, drilling, and mudlogging technological providers.