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Integrating and Quantifying the Impact of Fault Position Uncertainty on Hydrocarbon Volumes Estimates and Production Forecasts

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ABSTRACT

It is generally admitted that uncertainty exists in all aspects of the subsurface. The propagation of that uncertainty across the E&P spectrum and the quantification of its impact on reservoir assessment constitute a pre-requisite to ensure economic viability of a project.

Among the different possible sources of uncertainties, accurately determining and positioning the faults along the process of characterization of oil and gas reservoirs is key. Faults often determine the extent of the reservoir and its dynamic compartmentalization. However, the exact delineation of fault surfaces is often difficult to assess. Indeed, the exact identification of faults surfaces is dependent on the quality of the seismic data and remains sometimes interpreter-dependent. It is possible, considering a given fault, for interpreters to propose multiple interpretations and thus cover the range of possible uncertainties related to fault position. Finally, uncertainty on fault position could also be related to time-to-depth conversion.

The 3D geo-model constitutes the centrepiece of any integrated uncertainty study as it numerically combines data from petrophysical analysis, seismic and geologic interpretation with geological concepts. Along this process, integrating uncertainty related to fault position and its impact on reserve assessment and on dynamic behaviour of the field remains challenging. The main reason is that, until now, it has been technically tedious to modify a fault model and the associated reservoir grid once it is computed and still preserve the integrity of the structure. The 3D grid generally has to be reconstructed manually.

This presentation will demonstrate a new approach, based on the UVT-transform, which makes possible to stochastically simulate a complete structural model including multiple horizons and faults, while keeping the integrity of the seismic interpretations. By considering uncertainty envelops around faults and horizons, both structural and geological models are automatically updated enabling the quantification of the impact of interpretation and time-to-depth conversion uncertainty on reservoir volumes and connectivity, and thus on production forecasts.