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Casing Wear: Prediction, Monitoring, Analysis and Management in the Culzean Field

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Abstract

This paper will present predicted vs. measured wear for six wells that were analysed in the Culzean field, which is a high-pressure, high-temperature (HPHT) gas condensate field located in the central North Sea. The focus rests on the casing wear prediction, monitoring and analysing process and within that, especially on how to make use of offset well data to improve the accuracy of casing wear predictions.

The three major inputs to successfully predict casing wear are: Trajectory & tortuosity, wear factor and required rotating operations. All those were calibrated based on field measurements (High-resolution gyro, MFCL (Multi-Finger-Caliper-Log) and automatically recorded rig mechanics data), to improve the prediction quality for the next section and/or well. The simulations were done using an advanced stiff-string model featuring a 3D mesh that distinguishes the influence of different contact type and geometry on the wear groove shape. The "single MFCL interpretation method", in which the wear is measured against the most probable elliptical casing shape and herby allowing wear interpretation with only one MFCL log and avoiding bias error, was applied. (Aichinger, 2016)

For the six wells that were analysed the prediction of the largest wear peak per well section was compared to the measurement. In the planning phase (before any survey data was available) the mean absolute error on the wear groove depth was +/- 0.018 [in] (+/- 0.46 [mm]), the maximum error was + 0.045 [in] (+ 1.1 [mm]). The error of the results is summarized in Figure 10 and laid out in detail in Figure 9. Generally, the predictions are accurate enough to be able to manage casing wear effectively. In this case, the maximum allowable wear on the intermediate casing was extremely limited to ensure proper well integrity in case of a well full of gas event while drilling an HTHP reservoir.

This paper should provide help to engineers who seek to improve the accuracy of casing wear prediction and hence improve casing wear management. It presents a new way of anticipating tortuosity based on offset well data and it offers a suggestion on how to deal with MFCL measurement error during wear factor calibration and wear prediction.

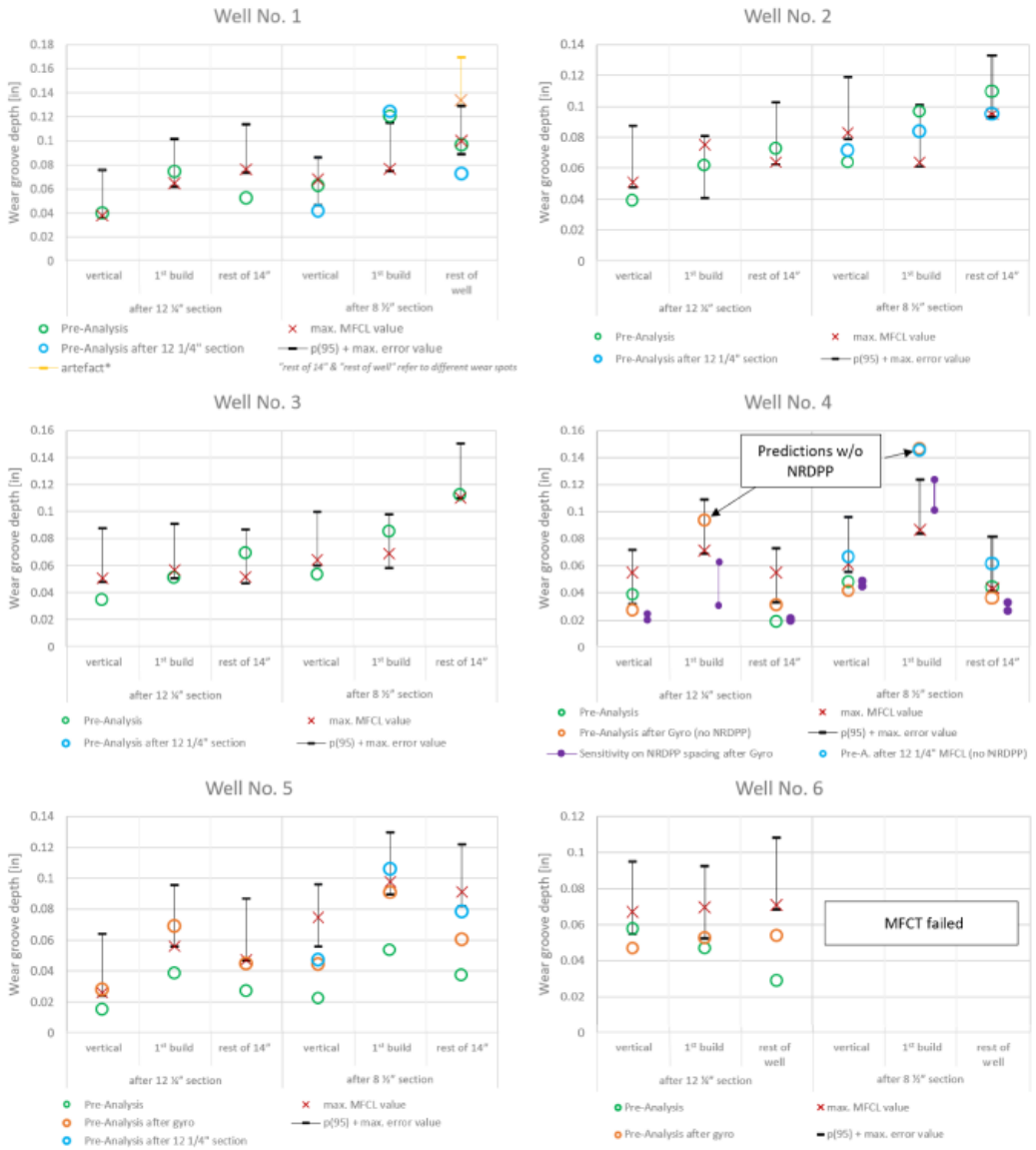

Figure 9—Wear prediction results against MFCL measured wear

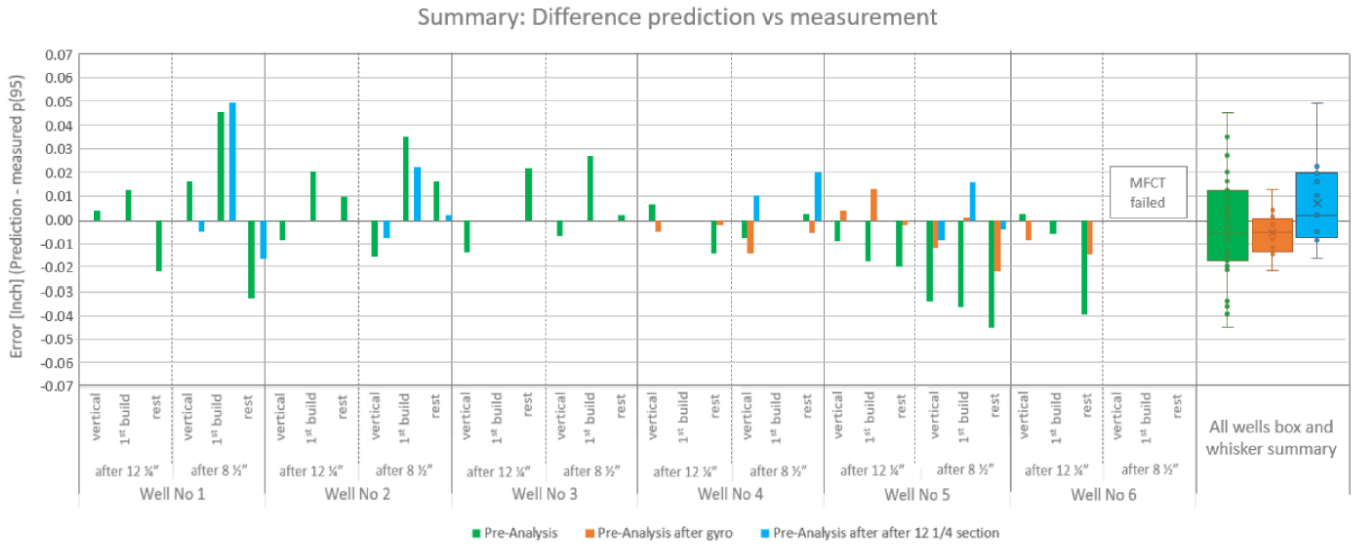

Figure 10—Wear prediction results against MFCL measured wear - Summary

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