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Accurate, Reliable and Safe method to determine Free Drill Pipe Point - Case Studies from two horizontal wells in a CBM field

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Abstract

There are significant drilling challenges in reservoirs that are subject to various Geomechanical stress regimes associated with overpressures, tectonic stress, and depletion. Despite efforts to mitigate stuck-pipe occurrences, drilling problems leading to stuck-pipe still occur. When conventional techniques used to free the drill string are ineffective, wireline logs are often being used to determine the stuck depth of the drilling assembly and to release the string above the free point. The Halliburton Free Point Tool (HFPT) works on principle of electromagnetic measurements. A continuous log is acquired, in two passes; one with and one without stress applied to the drill pipe. A comparison of the two passes, determines the depth of free pipe.

In a CBM field operated by a Reliance Industries Ltd (RIL), there were two horizontal wells wherein the drill pipes were stuck in the lateral sections. Several conventional techniques like overpull, torque, jarring, circulation etc. were attempted to free the pipe but were unsuccessful. Even a Drill Collar Severing Tool (DCST) was attempted but didn't yield any result. Initially conventional FPIT Logs were also recorded in these wells, however they did not work beyond 60 degree of deviation due to non-transmission of Stretch and torque.

Finally, the HFPT was deployed in these two wells for determining the free points. In India so far this technology was used till the well deviation of 60 degree. However for first time this tool was deployed in RIL's Horizontal wells, where free point was successfully detected in lateral section with 100% data repeatability.

This paper discusses details of the logging operations and interpretation of the data to determine the free point.

Introduction

Free point determination and pipe recovery operations are an integral part of drilling operations. The location of the 100% stuck pipe and the 100% free pipe are the desired information, especially when expensive bottom hole assemblies (BHA) and Logging While Drilling (LWD) tools are a part of the drilling string. The legacy wireline free point tools require many station measurements to determine the 100% free point and the 100% stuck point. These station measurements not only consume rig time but could create potential HSE events because the strain gauge technology requires the pipe to pulled or torqued, above the neutral weight condition at each station. In deviated or horizontal wells, the stuck point could be in different layers or different formations. Moreover, there is no need to use slips (Anchors) or any other mechanical locking devices to clamp the tool to the pipe, as required by the conventional strain gauge tools.

The HFPT is a reliable and safe technology to determine the stuck point and free point. The basic procedure includes one down-log pass, during which the pipe is in neutral weight condition. While the logging tool is on bottom or several meters below the estimated free point depth, the pipe is stretched and then returned to neutral weight condition, followed by an up-log pass.

In this paper, we discuss two horizontal wells from a CBM field. In the first well the drill string and BHA was stuck comprising of 6-7 Heavy Weight Drill Pipe (HWDP), 2 drill collars, jar and bit. It was suspected that the stuck point could be either in a Sand layer or a Coal Seam. Several conventional techniques were attempted, including conventional free point locator tool, Drill Collar Severing Tool (DCST) and string shot for back off. None of these techniques yielded positive results. In the second well, the drill pipe along with complete LWD BHA got stuck while drilling through the lateral section in coal. Similar conventional techniques were attempted, but did not achieve the desired results. A decision was made to mobilize and deploy the HFPT in both these wells to determine the free point. In both the wells, HFPT was run with pump down head and tractor. A Side entry sub was used for wireline entry in drill pipe for running HFPT. No fishing has been carried out in these wells yet.

Operational Procedure

Well # 1

The first well is the Well # 1 wherein the max deviation was 93.13°@ 998.84m depth. The HFPT tool string was run using pump down head and the free point observed at 926 m (Dev 85.24°).

The HFPT Tool was conveyed with wireline as long as it could descent due to gravity (around 65° or so). Further in few attempts with pump down facility, the tool could descent to 1100 m. The HFPT survey was recorded from 1020 m to 770 m with 3 different passes.

1. 1st Pass (Magnetization): Logging pass while pulling up the tool.

2. 2nd Pass (Base Log): Normal recording to acquire Free Point log after magnetization.

3. 3rd Pass (Stretched pass): Log acquired after work out on drill string after demagnetization.

Based on the comparison of magnetic field separation between the 3 passes, free point was determined at 926 m where maximum separation could be observed.

Snapshots of the TVD report are shown in Fig 1.

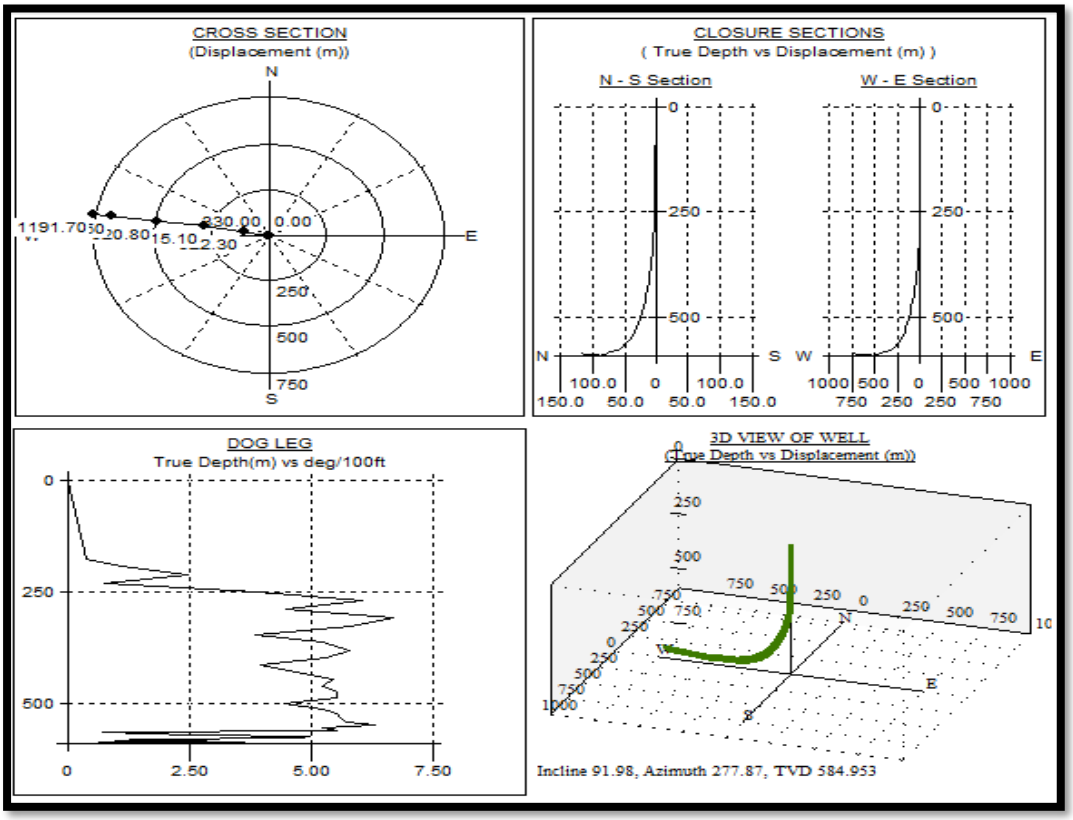

Fig 1: Well # 1 deviation report

Log interpretation for Well # 1

The Log passes are shown in Fig 2. The FP curve us presented in scale 0-20m. The green curve shows the base line pass and red curve shows the demagnetisation pass after pipe stretch and work out. Both the curves overlap below 926 m. This means that the stretch is not reaching below 926 m. Above 926m the separation in the curves indicate that the magnetised pipe property has been changed by applying stretch and stress created by pulling the drill pipe.

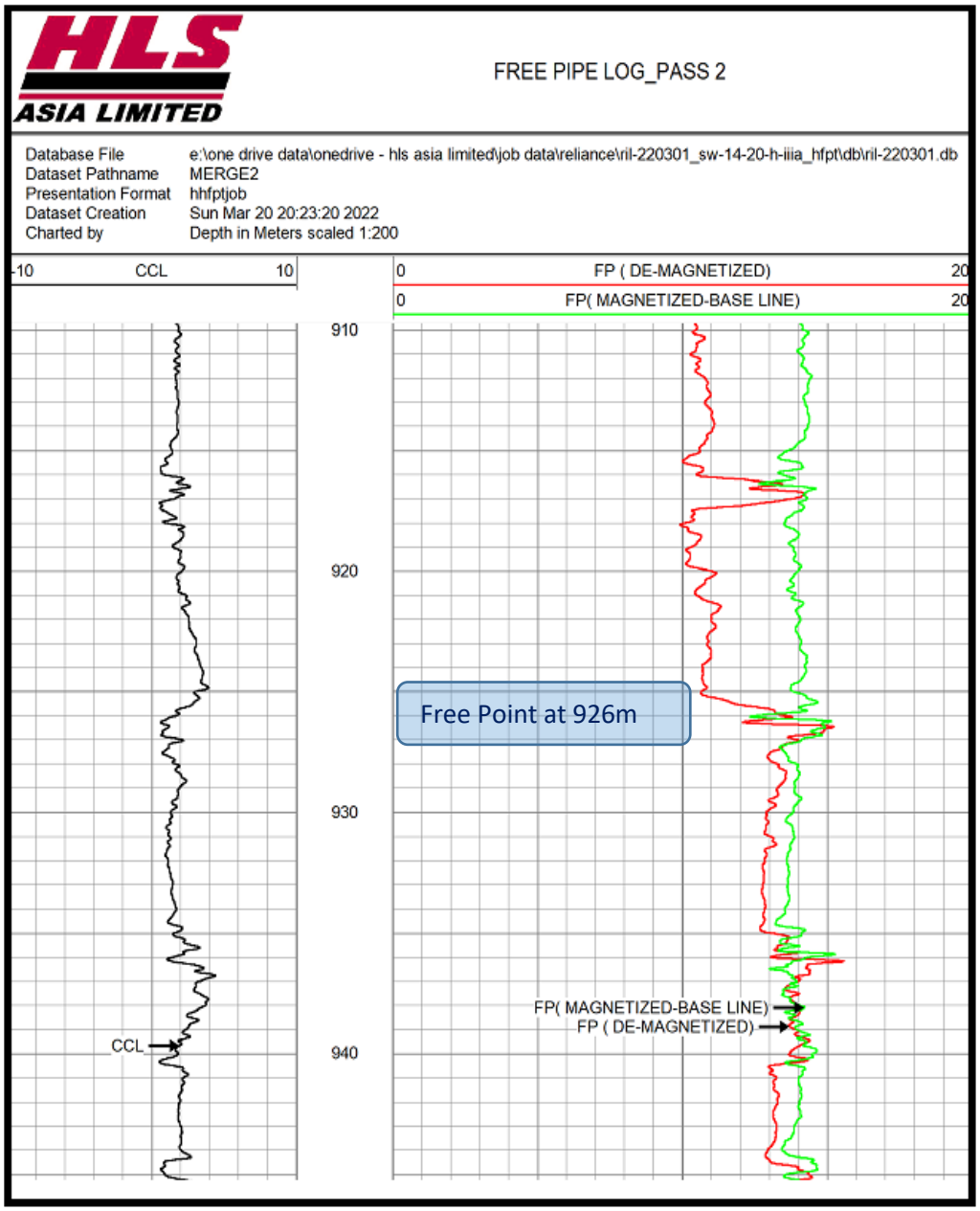

Fig 2: Free point observed at 926 m (Red- Demagnetising FP curve, Green- Base line FP curve)

Well # 2

In the second well (Well # 2), the tool couldn't descent with pump down head below 730m (TD-973, dev 88.96 m @730 m). Then a dummy run was attempted, and this too got held up at 730m. Finally, it was decided to run HFPT with tractor. The dummy was attempted with centralizers and with tractor at 832m, Then HFPT was run and got held up at 832 m.

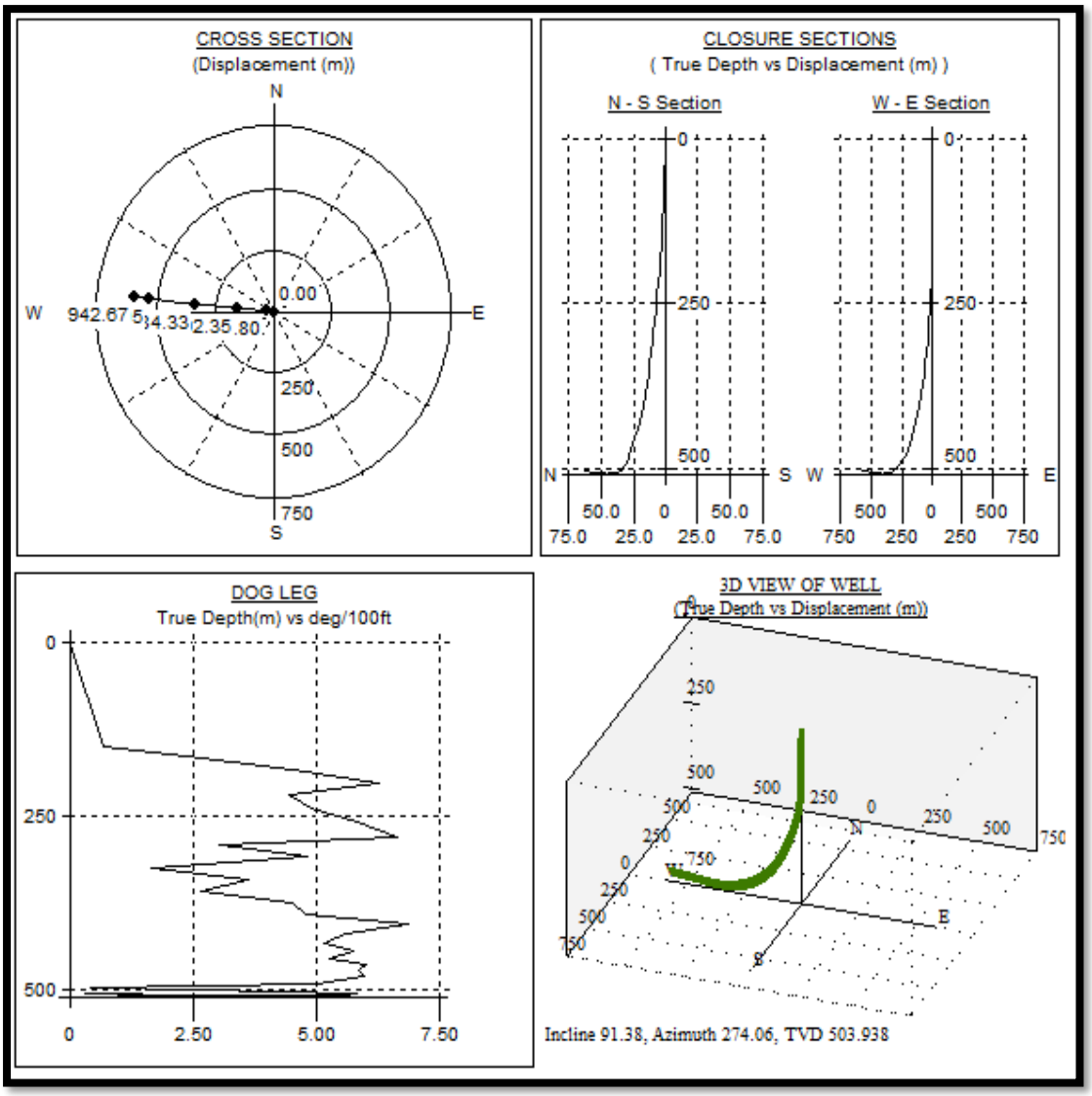

Fig: 3 Well # 2 deviation report

Following data recording steps was followed for determining free point:

1. 1st Pass (Magnetization): Logging pass while pulling up the tool.
2. 2nd Pass (Base Log): Normal recording to acquire Free Point log after magnetization.
3. 3rd Pass (Stretched pass): Log acquired after work out on drill string after demagnetization.

Log interpretation for Well # 2

The FP curve are presented in scale 0-20m. The green curve shows the base line pass and red curve shows the demagnetisation pass after pipe stretch and work out. Both the curves overlap below 755 m. This indicates that the stretch is not reaching below 755 m. Above 755 m the separation in the curves show the magnetised pipe property has been changed by applying stretch and stress created by pulling the drill pipe.

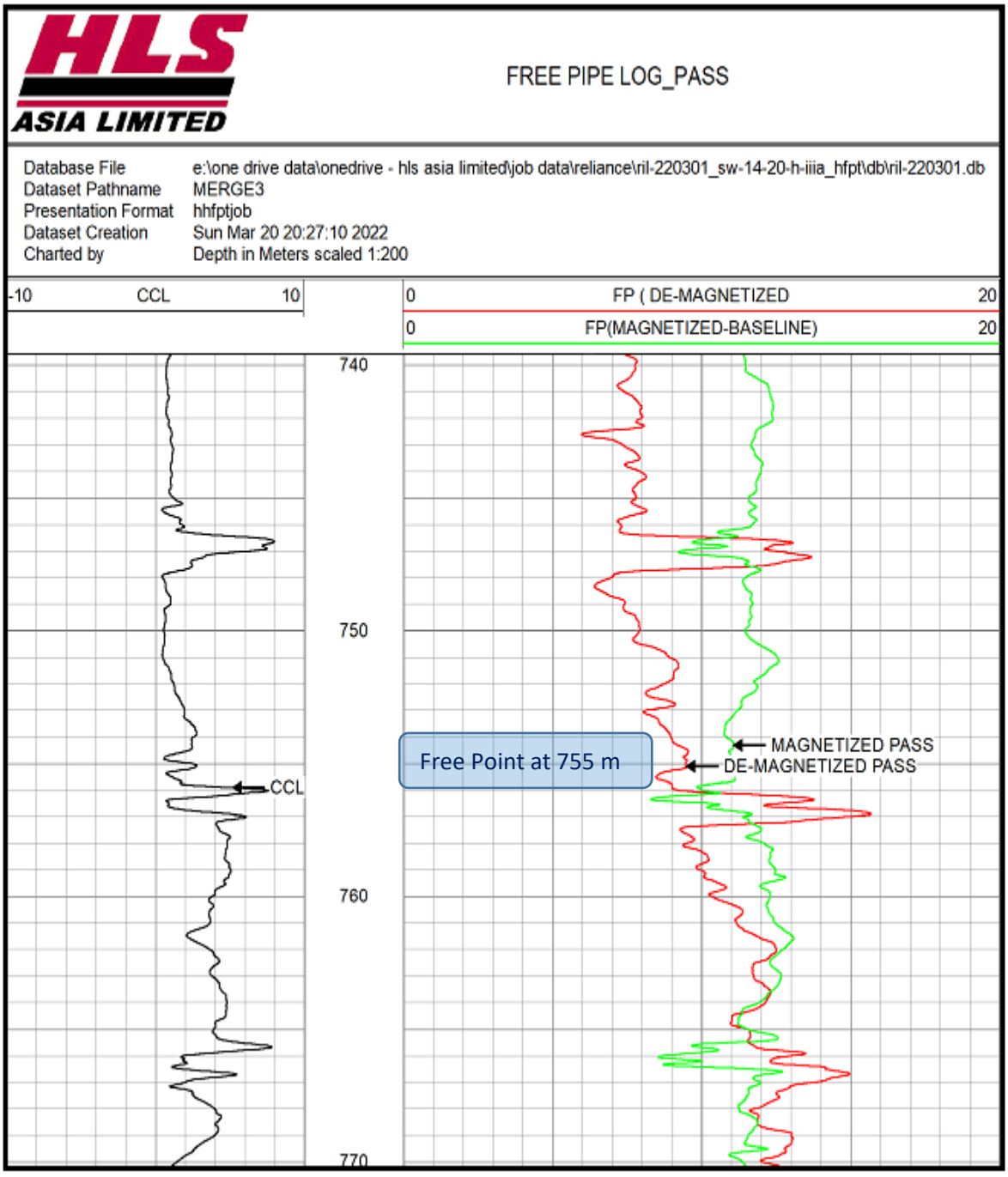

Fig4: Free point observed at 755 m (Red- Demagnetising FP curve, Green- Base line FP curve)

No fishing has been carried out in these wells yet.

Conclusion

Halliburton free point tool was deployed in two horizontal wells in CBM field. The tool was conveyed with pump down and tractor with 100% data repeatability. This technology provides improved safety at the wellsite because the pipe is stretched just for a short time prior to a logging pass. Determination of free pipe and stuck pipe is done by overlaying the two logging passes. There is no need to use slips or any other mechanical locking devices to clamp the tool to the pipe, as required by the conventional tools. The continuous log of free pipe/ stuck pipe can be correlated with other logs to determine the depth of pipe sticking. This is most accurate, reliable cost effective and safe technology, and can be deployed in highly deviated and horizontal wells.

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