FDIR OUTPERFORMS MSA SURVEY CORRECTION SOFTWARE

CASE STUDY

INNOVATIVE SOLUTIONS

Industry-Standard Validation Process - Validates the Accuracy of Any Survey Correction Software

Fault, Detection, Isolation and Recovery (FDIR) – 4th Generation Survey Correction Software

Multi-Station Analysis (MSA) – Various 3rd Generation Survey Correction Software Companies

BENEFITS:

- Ensures the Accuracy of Survey Correction Software
- Compare Actual vs Stated Accuracy
- Ensure Validity of AC Scans

MISSION

Historically, in the industry, there has been a tendency to categorize all survey correction software that utilize the Multi-Station Analysis (MSA) approach as more or less equivalent. To this point, the industry has lacked a rigorous method to determine the accuracy of survey correction software. However, when one operator was evaluating survey correction providers, they inquired about a certification process to authenticate the differences in accuracy level between survey correction software providers. It is from this request that an Advisory Panel, consisting of the survey management subject matter experts from five major oil & gas operators, was convened to evaluate the Survey Correction Software Validation Procedure.

PROCESS

Proving the validity of a survey correction software has been notoriously difficult due to the unknown nature of a well's actual bottom hole location. One of the methods used previously has been to run additional instrumentation such as a second MWD tool or gyroscope and compare the results. The issue with such a method is that each of the instruments contain a combination of systematic, random and possibly gross errors that will impact the process. This makes it extremely difficult to determine which instrument is "correct".

To overcome this, the Survey Correction Software Validation Procedure was designed to simulate the process of injecting an unknown, randomly generated amount of error into a perfectly undisturbed set of survey data. The undisturbed survey data is used to calculate the Known Wellbore Position while the Corrupted Wellbore Position is calculated based on the error-injected surveys. A 3rd party proctor will generate the Corrupted Wellbore Position and deliver this set of surveys to the survey correction provider who is oblivious to the amount or nature of injected error. The survey correction provider will then process the surveys for the well through their software and return the Corrected Wellbore Position to the 3rd Party Proctor. When comparing the Corrected Wellbore Position to the Known Wellbore Position, the remaining discrepancy is purely Survey Correction Error. Through this process, it can be determined if the survey correction provider is able to achieve the accuracy level claimed in the error model. For this operator, four wells with varying azimuthal directions were distributed to several of the industry's most prominent survey correction providers. The results of which are tabulated in Chart 1.

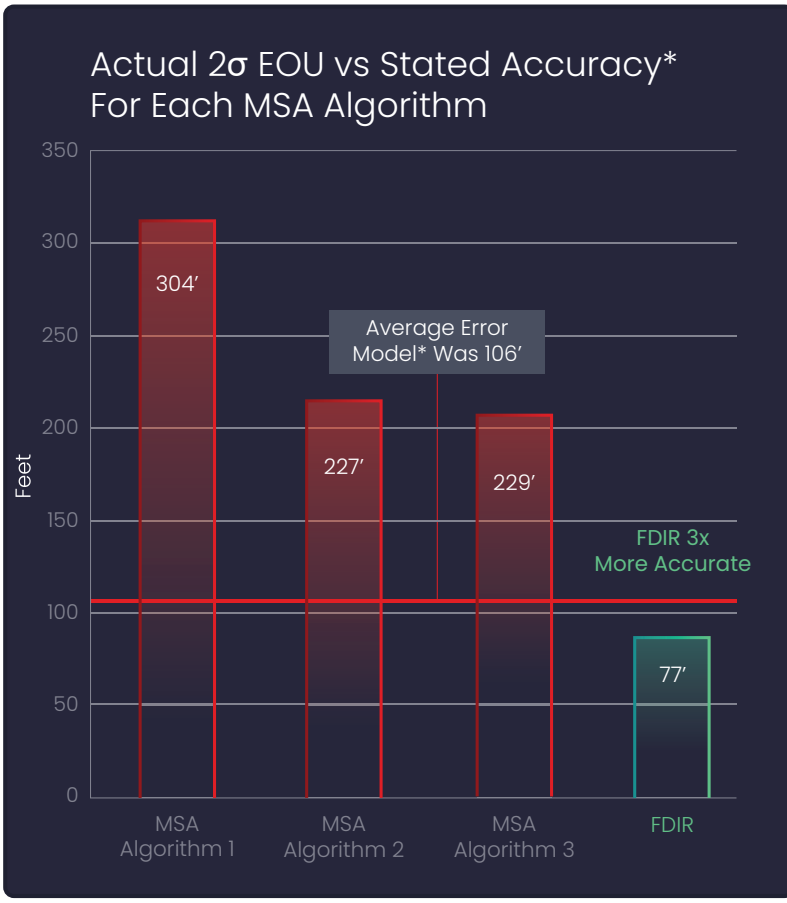

Chart 1

*MWD + FDIR + MS Error Model
Past Performance is not a guarantee of future results. Results may vary.

RESULTS

Chart 1 shows the average two standard deviation (2σ) Survey Correction Error for the four well study for each of the survey correction providers compared to the stated accuracy from the error model. Superior QC's FDIR was the only survey correction provider that was able to achieve the stated accuracy level and is more than 3x more accurate than the other survey correction providers.

Additionally, on a well-by-well basis, Superior QC's FDIR was the only survey correction software that was able to meet the stated accuracy level for all four wells in varying azimuthal directions, including in the East/West exclusion zone (Chart 2). The advantage that FDIR has is that it can correct all 27 error sources in real-time which other MSA algorithms are unable to accomplish. Upon completion of this test, the company is exclusively using FDIR software going forward.

Only FDIR Achieved Stated EOU Accuracy on All Wells

Test Well #	Data Type	Well Azimuth (deg)	Difference to True BHL (ft)				Error Model EOU 2σ half-width† (ft)
			MSA Algorithm 1	MSA Algorithm 2	MSA Algorithm 3	FDIR	
1	Simulated	90	212	139	53	2	113
2	Simulated	0	133	95	135	48	90
3	Simulated	90	176	17	6	7	113
4	Simulated	60	48	149	159	53	106

Chart 2

*MWD + FDIR + MS Error Model
Past Performance is not a guarantee of future results. Results may vary.

FDIR automatically solves all possible error sources in real-time which eliminates human input and improves processing times. Two of the MSA algorithms tested did not validate convergence or declination which are common error sources.

FDIR PROCESSING TIME WAS EIGHT MINUTES PER WELL

Excluding time spent requesting direction on whether to process Sag corrections, would have been four minutes per well

Company 2 processing time was 1 2/3 hours per well

The software used by Company 3 and Company 4 do not have built in automation to validate grid convergence or declination errors which would have resulted in much larger errors.