

“Factory Geosteering”. Challenges and solutions.

Sergey Lebedev – Adaga Solutions Ltd., Anton Shirshov – Geosteering Ltd.

Summary

Nowadays Geosteering is way different than it was even a few years ago. LWD portfolio now is reinforced with deep and extra deep electromagnetic propagation methods providing radius of investigation up to 30m significantly decreasing uncertainties and maximizing the value. Internationally, the overall trend for Geosteering in last several years consists of 3 main components:

- More real-time measurements in BHA
- Measurements are more advanced and deeper
- Multiscale data integration for more accurate 3D structural modeling

As a result, we can see a great number of success stories worldwide proving extra value generated by hi-tear Geosteering technology. But here we want to draw your attention to projects which are out of this hi-tear trend but not of less importance especially during recession times. We want to talk about hi-volume “factory drilling” projects and answer the question “How can we steer better with limited measurements and budget? Is it only Gamma enough?”.

We would like to share a valuable experience and lessons learned we got while completing one of such projects. Particularly we would like to share techniques and tricks proved to be most efficient while Geosteering in “factory mode”.

Theory / Method / Workflow

Geosteering is a discipline where people, measurements and software makes it possible to place a horizontal well inside target in real-time. General geosteering strategy on high-tear projects is to reduce uncertainties and increase efficiency by utilizing more advanced LWD measurements. This of course requires bigger investments on drilling stage but it will be economically justified by better production, later water brake and etc. Such approach is absolutely right and proved by a great number of success stories including the ones presented on this workshop.

So we know that we can do better with better measurement but the question we raising is **can we do better with GR only if we have to?** This is about handling high-volume project.

A 5-month project consisted of 50 wells with 500-700m length of horizontal sections. One Geosteering job lasted 7-10 days including landing. Hence the activity was about 10 wells a month with 3-5 wells at the same time. Average ROP was 30 m/h. The objective was to deliver horizontal wells with 80% NTG without any delays in ROP related to Geosteering decision. Measurements were limited to GR; geosteering team was limited to 4 geologists.

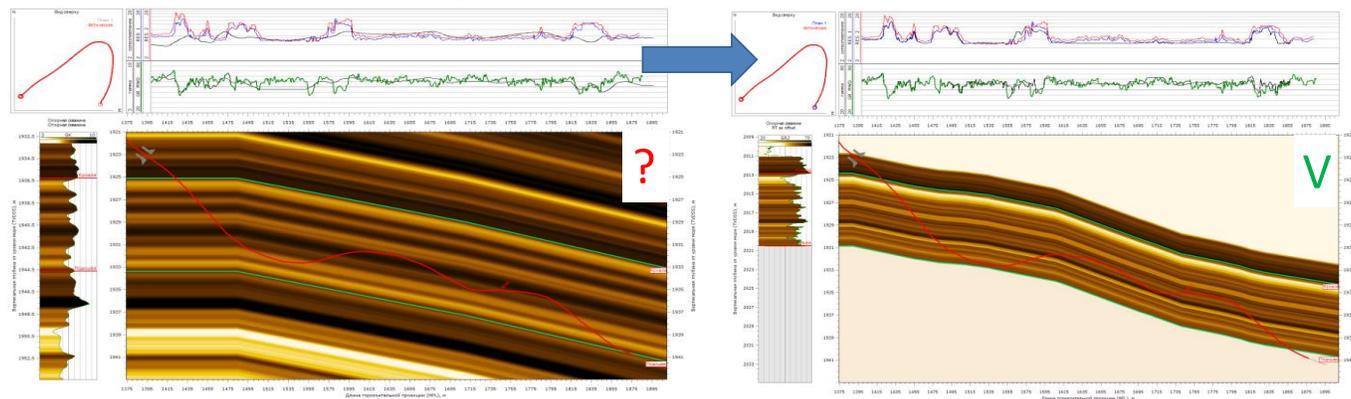
High-volume projects have another economical model based on lean and fast performance at minimal cost. For geosteering it means strictly limited amount of people and measurements (GR or GR+RES). The extreme version of high-volume project we call “Factory drilling project”.

Obviously if you have conventional non-azimuthal measurements you have the only one tool to use – “Model-Compare-Update” (correlating synthetic and RT curves).

Also, if geosteering geologist is overloaded (3-5 wells at the same time), he has to use those synthetic curves really efficient. We have tried different “tricks” and now want to share with you the most efficient ones. We also want to warn you to avoid the common mistakes.

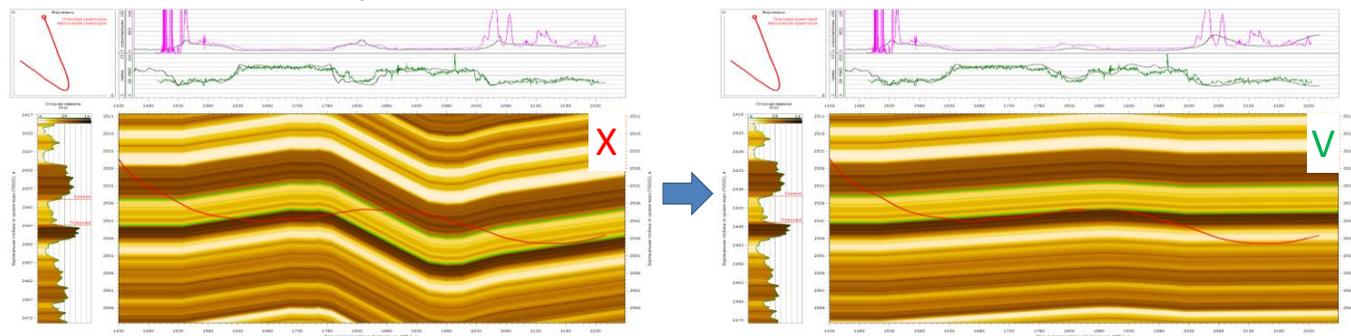
Results, Observations, Conclusions

As you can see from project conditions one geologist has to handle 3-5 wells simultaneously and also pay attention to pre- and post-jobs. Which means the geologist has to be extremely efficient and use only quick, reliable and effective techniques.



Creating “repeat-section”.

At this example (left picture) you can see a quite weak correlation of the RT and synthetic logs. Very difficult to estimate the formation dip, because with different dips the correlation is equally bad. Obviously the formation does not correlate any more with the offset well due to lateral change. But due to deep landing we have stratigraphically crossed almost the entire formation, and we can now use this part of borehole as a “new offset well” and create “repeat section”. As you can see from right picture the correlation is much better and we can accurately estimate the dip.



Common mistake – “over correlation”

This is the most common mistake from “model-compare-update” method users. Looking at the left example you can see the perfect correlation but does the structure make any sense? The dip is changing from -1.5 to +5 deg. What geosteering recommendation would you give at those points? The right question to ask would be “if there any simpler structure would give the acceptable correlation?”. The correct answer is on the right picture with the dip from – 0.6 to 0.5 deg. **The main objective is not to provide a perfect curve matching, the main objective is to provide correct geosteering recommendation.**

The two recommended “to DO’s” and “DO NOT’s”.

DO:

- Consider multiple scenarios
- Create “repeat section”

DO NOT:

- Over correlate
- Stick to one geosteering scenario