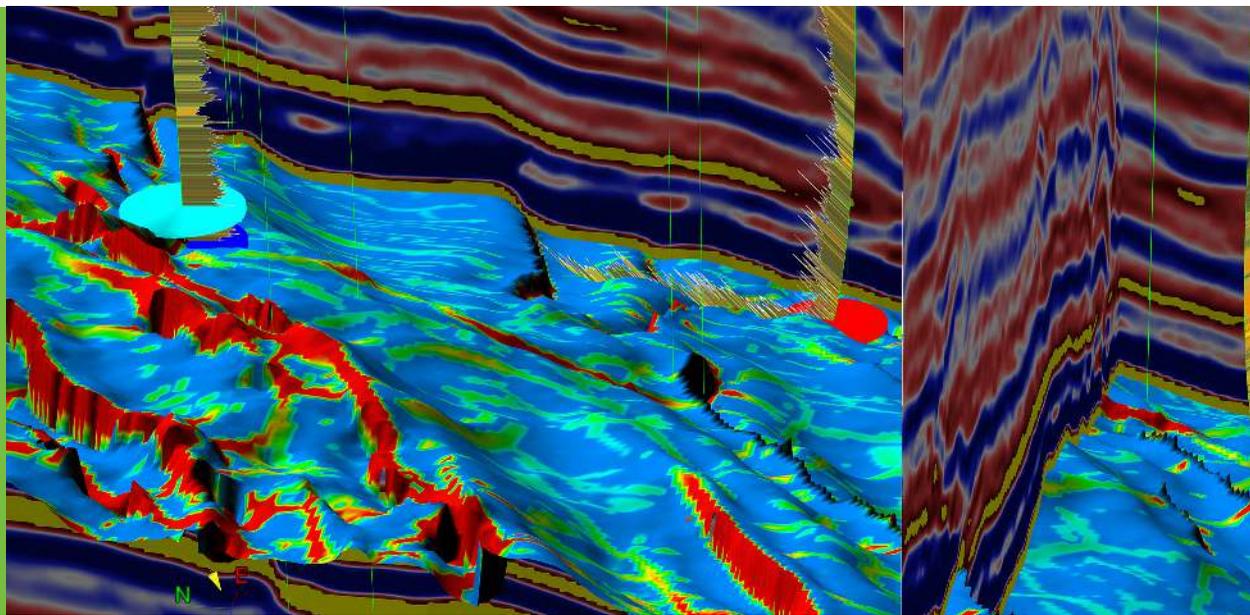drillinginfo

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Finding Optimal Well Completion Parameters with DI Transform

How to Build Energy Models to Increase Well Production and ROI

E&P companies are often faced with a time-consuming, guess-and-check process when determining how to improve their drilling and completion strategies in a play. Many factors go into producing a high-performing well, which means that simply drilling in the highest-quality acreage is not a guarantee of success. Completion engineering practices are just as important as geology in most unconventional plays. Prioritizing investments in different completion strategies to focus on those that generate the largest returns is even more challenging when oil prices fluctuate.

Before DI Transform, engineers relied on a bivariate approach using cross-plots to identify relationships between completion parameters and oil production. Unfortunately, cross-plots are usually insufficient for benchmarking best practices or for discerning meaningful relationships with production because there is too much noise in the data. That noise is due to differences between wells in terms of where and how they were drilled and how they were completed. For example, a cross-plot can tell you the number of stages the best wells used, but it may also indicate that some of the worst wells used the same number of stages as the best wells. This renders the data basically useless. A bivariate model simply cannot provide an engineer with actionable information.
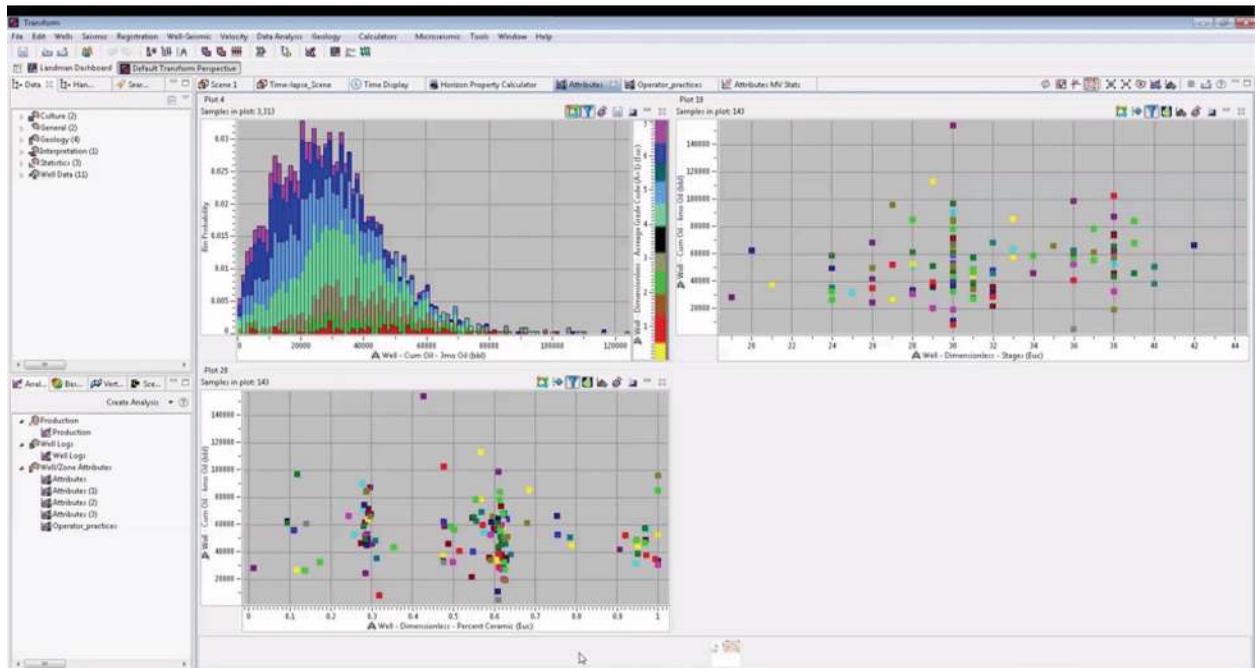
CHALLENGE
How do I find optimal well completion parameters? How do I determine which investment is the better strategy? How can I maximize my production and ROI?

SOLUTION
Using DI Transform, E&P companies can employ a multivariate approach to determine optimal completion parameters.

PRODUCTS USED
DI Transform

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Cross-plot data is difficult to use for identifying effect on production.

CUSTOMER SOLUTION WITH A MULTIVARIATE APPROACH

Using DI Transform, E&P companies can employ a multivariate approach to determine optimal completion parameters. In this example, we used the DI Transform multivariate non-linear regression tool to build a model that predicts cumulative oil volume for the first six months of production based on the lateral length of the well, percentage of ceramic proppant, maximum fluid injection rate, pounds of proppant per foot, number of stages used to complete the well, and a reservoir quality metric extracted to each well location from a geologic map. The tool takes a cloud of cross-plot data and identifies the fundamental relationship between each variable and six-month cumulative oil by filtering out the effects of all other model parameters. This enables an engineer to easily understand the effect that any single completion parameter has on production.

In this example, we focus on the number of completion stages and the percentage of ceramic proppant used in the completion. The model predicts that using 45 rather than 28 stages would result in 38,000 more barrels of oil production over the first six months of the well. Similarly, using 90% ceramic proppant rather than 25% would result in 20,000

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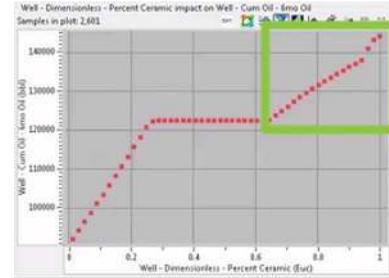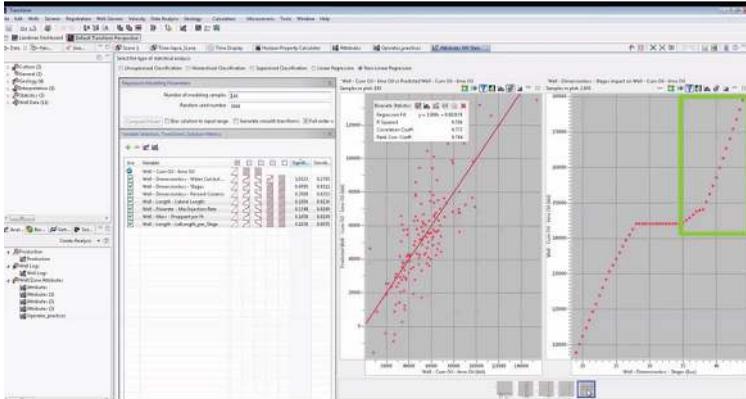
Impact of the percent ceramic on six month cumulative oil production.

Impact of the number of stages on six month cumulative oil production.

additional barrels of oil over the first six months. Although both methods will increase production, what approach makes the best financial sense, especially with fluctuating oil prices?

Let's assume that it costs $60,000 to complete a stage that uses 25% ceramic and $100,000 to complete a stage that uses 90% ceramic. For a planned well, increasing the number of stages from 28 to 45 will cost approximately $1,020,000 using 25% ceramic proppant. However, the additional stages will increase revenue by the end of the first six months by $2,280,000 when oil sells at $60 per barrel, or by $1,520,000 if it sells at $40 per barrel. In either price scenario, investing in additional stages increases the ROI.

In contrast, completing only 28 stages but investing in 90% ceramic proppant will cost $1,120,000 and bring in $1,200,000 additional revenue within the first six months at $60 per barrel, or $800,000 at $40 per barrel. The ROI is only positive when oil sells for more than $56 per barrel. Based on this analysis, a safer and more profitable decision is to invest in extra stages.

Investment Option	NPV $60 per barrel oil	NPV $40 per barrel oil	Breakeven Oil Price
45 vs. 28 Completion Stages	$1,260,000	$500,000	$27
90% vs. 25% Ceramic Proppant	$80,000	-$320,000	$56

Net present value after six months as a function of oil price (discount rate = 0).

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CONCLUSION

DI Transform makes it easy to answer a hard question: which completion methods are the most important for designing the best well? In this example, the DI Transform model predicted that the best opportunity for boosting production came from investing in additional completion stages. Financial analysis confirmed that additional stages provided a better ROI under a wider range of oil prices than investment in additional ceramic proppant.

Determining an ideal drilling strategy used to take weeks and lots of guesswork, which often resulted in huge amounts of lost time and money. With DI Transform, E&P companies can quickly and easily utilize multivariate analytics to uncover hidden relationships in their data and use those insights to design a smart completion strategy that maximizes returns.

PROACTIVE   **EFFICIENT**   **COMPETITIVE**

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