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Optimization of a Reservoir Driven Field Development Plan in Unconventionals

J. Chalupsky* (Schlumberger), A. Torres (Schlumberger), L. Cruces (Schlumberger)

Summary

Optimizing a FDP in unconventionals requires different scales of understanding: a)how to optimize the reservoir contact that a well has with the target, b) how to optimize the hydraulic fracture model. c) the subsurface understanding has to translate to the surface.
The only way to approach a truly optimal FDP is through a reservoir-driven approach that forces cross-disciplinary understanding and optimization.

Introduction

Optimizing a Field Development Plan (FDP) in unconventionals requires different scales of understanding. First, a look at how to optimize the reservoir contact that a well has with the target. Second, there needs to be a combined approach to understanding how to optimize the hydraulic fracture model. Third, the subsurface understanding has to translate to the surface.

Before optimization can effectively occur, an understanding of both the reservoir subsurface and ground level surface need to be joined to reach the central goal of guaranteeing maximum recovery for the lowest cost without the expensive trial-and-error approach that circumnavigates modeling.

To go from hydraulic fracture optimization to surface production there must be a link to reservoir engineering to understand how fluid flows from these propped hydraulic fractures, as this will indicate not only drainage radius of a producer (thus affecting well spacing) but also the economics of this well and the surface implications (pipeline planning/capacity, drilling rig mobilization, etc.) to the production engineer.

Method and/or Theory

The focus of this work is on completion design, and the approach to optimizing a FDP in unconventionals. The technology that help us in the analysis was Petrel, a seismic to simulation platform, Numeric High-Resolution Reservoir Simulator, high resolution numeric simulator which is purposed in this case to the complexities in unconventionals, and, a workflow inside of Petrel, called Kinetix Shale, which introduces a new, discipline when discussing unconventionals, the completion engineer. Kinetix Shale simulator provides the ability to the completion engineer to model the interaction of the hydraulic fracture with the existing geology, geomechanics, and, natural fractures.

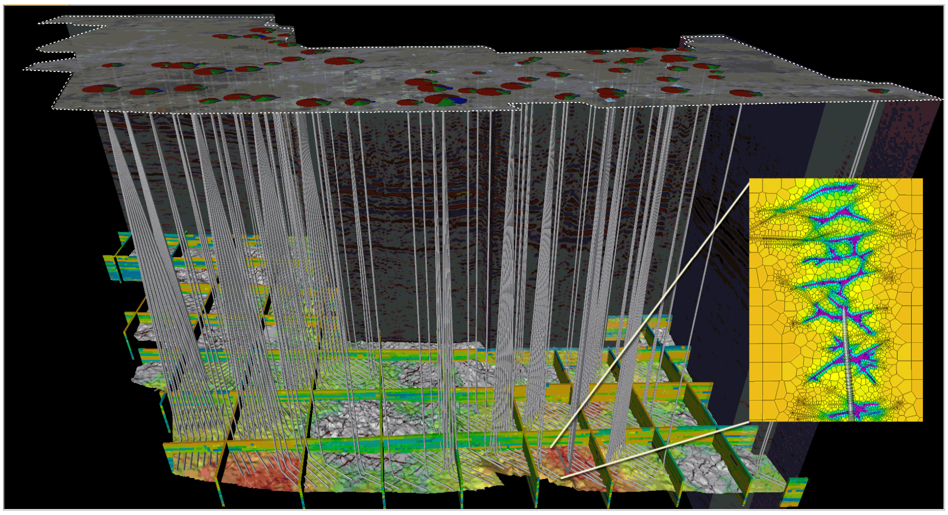
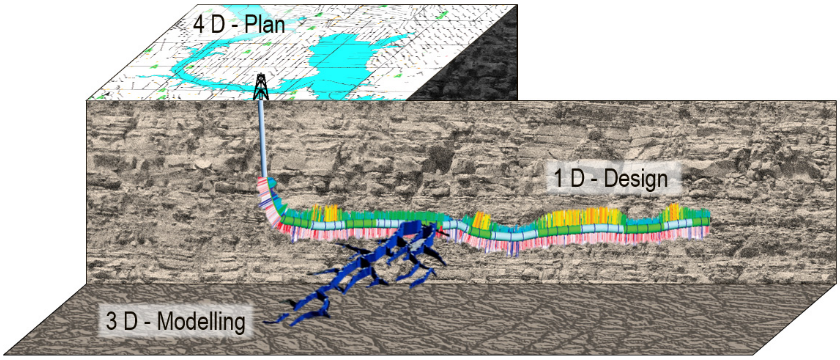


Figure 1 *Resulting FDP from the integrated approach incorporating different tools in a reservoir characterization driven analysis.*

Example

Through Kinetix Shale, the stimulation design optimized by the completion engineer can be extended to the reservoir engineer by creating and simulating a 3D simulation grid, which can be used to understand well deliverability, drainage from the reservoir, and well spacing. This understanding, coupled with surface considerations is what is used to fuel an optimal field development plan.



Conclusions

Throughout this workflow, we have seen how the optimal FDP is only achieved in a multi-disciplinary environment, where the completion engineer working with the petrophysicist can assess and select the optimal connection to the reservoir through an engineered perforation strategy. Where the completion engineer utilizes the geology, geomechanics, and Kinetix Shale simulator in order to model and optimize the hydraulic fracture design. And where through different technologies, the hydraulic fracture understanding translates to a simulation model powered by a high-resolution simulator in order to update the FDP efficiently.
The only way to approach a truly optimal FDP is through a reservoir-driven approach that forces cross-disciplinary understanding and optimization.

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