Best practices to transform user stories into practical and evergreen user recommendations

• Bringing the best value of the technology to our users through continuous deployment
• Example of collaboration: from targeted requirement ‘efficiently clean up well tops’ to the delivery of the feature integrated in user story for users community
• Deploying new technology: challenges of geo-cellular grids for the user experience
• Conclusion & acknowledgement
5 keys to maximize impact thru continuous deployment

- Collect feedback from BU users
- Analyze how to best address feedback
- Share consolidated feedback with SLB
- Prioritize the main needs
- Interface to bring the best value to our users

Adoption of new technology if proven and visible incremental value

Update Chevron requirements
Assess SLB's prototype

Needs discussed in CVX-SLB technical workshops

Recommendation to use the best of current version

Update Chevron technical requirements

Keep best practices evergreen

Interface to bring the best value to our users
VBM increases accuracy of geological models

Volume based modeling (VBM) technology:

- **Effective field development plans** use clear understanding of the subsurface. An accurate and uncompromised geological model is a critical input but has historically required some simplification for simulation.

- **Structurally and stratigraphically complex reservoirs** can now be modeled with greater accuracy in the Petrel E&P software platform and sent directly to our next-generation INTERSECT high-resolution reservoir simulator without compromising on geological detail.


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Best practices to use VBM efficiently

VBM is more sensitive to imperfect data
Ideally: fairly densely picked data, which may have an impact on projects timeline

VBM requires thorough QC
Steps are sequential and may require computation time to run: decrease number of iterations by validating each step

VBM requires memory and large computation time when refining volume (not linear)

VBM steps requires less user interaction but offers less flexibility (options and editing tools)
Focusing collaboration on value adding tools

What is the problem?

Well tops are usually considered hard data for structural modeling: bad well tops will lead to noticeable artifacts. VBM is sensitive to the quality of the input. Cleaning up well tops is tedious: click-intensive and time consuming.
What is the problem?

What is the best solution to resolve the problem?

Looking for a flexible way to clean up well tops:

• Can use automated methods
• Can be refined using manual tools
‘Used in geomod’ is now an attribute on well tops.
  ✓ Can be interactively displayed in the viewer, including filtering
  ✓ Can be used in Calculator
  ✓ Can be manually edited in the viewer
Focusing collaboration on value adding tools

What is the problem?

What is the best solution to resolve the problem?

How to optimize the implementation delivered for end users?

To make this available to users:

- Identify the best flow (automatic detection of bad points first, then list available tools for manual selection, highlighting use cases)
- Produce workflows
- Document process
Focusing collaboration on value adding tools

• Some numbers:
  – ~24,000 wells
  – 9 horizon tops
  – ~175,000 well tops
  – ~1500 well tops are ‘ignored’ in the final model
• Clean up:
  – Manual selection: ~45 s/well
  – Automated selection: ~10 min in total. Deals with 90+% of ‘bad’ tops
• Modeling:
  – Use well tops as ‘well tops’ (hard constraints): 6 min+4 min
  – Use well tops as ‘input’ (soft constraints): 2.5 min+1 min
Understanding user experience when deploying new technology

Figure 1. Structural modeling and gridding workflows.
Understanding user experience when deploying new technology

<table>
<thead>
<tr>
<th>Stairstepped grids</th>
<th>Pillar grids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Few user interaction</td>
<td>Editing is required; error-prone: cannot be automated easily</td>
</tr>
<tr>
<td>Not compatible with all processes, little editing option</td>
<td>Mature and well supported across applications</td>
</tr>
<tr>
<td>Deals with complex configurations</td>
<td>Can represent only simplified geology, may imply distortion</td>
</tr>
</tbody>
</table>

Courtesy of Chevron Petrel Help
QC is key

• Thoroughly check the VBM structural model
• Visually inspect the grid produced in Petrel
• Confirm expected dynamic behavior with streamlines/flow simulator

All the steps need to be checked:
• Simplify your VBM structural model: remove crossing, dying faults, ‘verticalize’ dipping faults in contact with others, possibly removing faults with small displacement
• Create and edit pillars: pillars only between top and bottom. Edit edge of the faults. Check skeletons.
• Make sure the distance around the faults is large enough to account for possible horizon points ‘on the wrong side’, especially after editing pillars. Minimum curvature may provide better results.
• Visually inspect the grid produced in Petrel
• Confirm expected dynamic behavior with streamlines/flow simulator

Courtesy of Alvaro Rey and Suksang Kang
Opening thoughts

VBM is a fundamental technology which could have a wider footprint
– Pillar grids are still the recommended default
– Needs to be less ‘modeler oriented’
  • Less parameters
  • More editing tools
  • Strong core supporting sparser interpretation
– Continue integration with dynamic workflows
  • Open API
  • Leveraging INTERSECT power
– Progress integration with modern digital methods
  • Leveraging the cloud: reduce computation time/impact on users?
  • Automatic set up to use interpretation coming from machine learning algorithms
  • Integration on DELFI platform
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