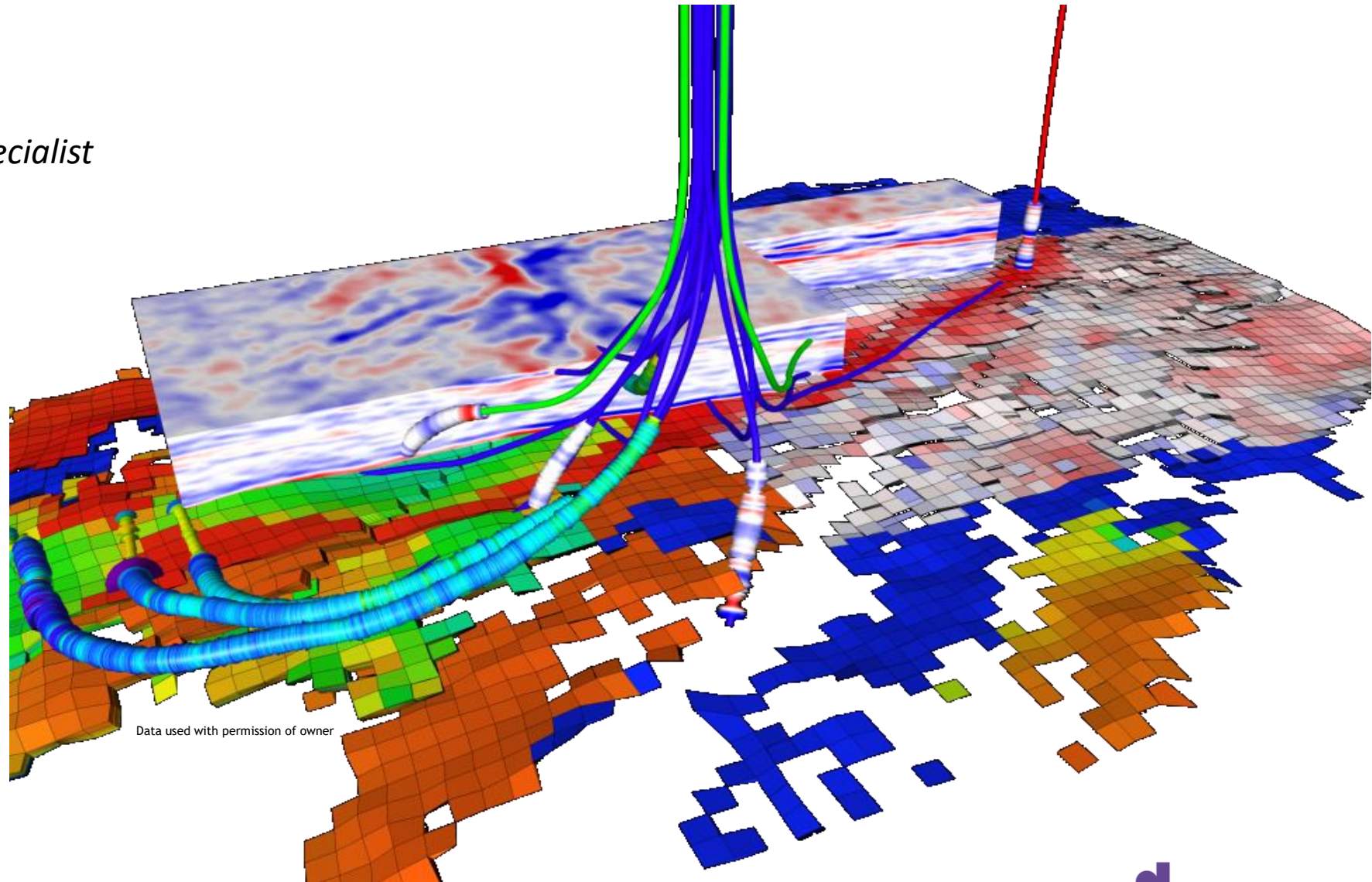


Integrated Quantitative Analysis of Time-lapse seismic data using CoViz 4D

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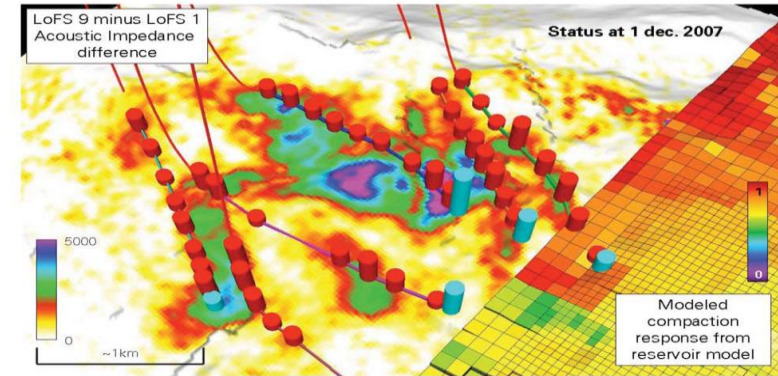
Introduction

- **Time Lapse Seismic Analysis**
 - Diverse data integration is key
 - Increase in variety and volume of data - “Big Data”
 - Requirement to make faster more effective decisions
 - Need to utilize the best tools and latest technology
- **CoViz 4D ®**
 - Provides rapid access to diverse data
 - Qualitative interpretation in a 4D dynamic environment
 - Quantitative analysis between data types across all time steps

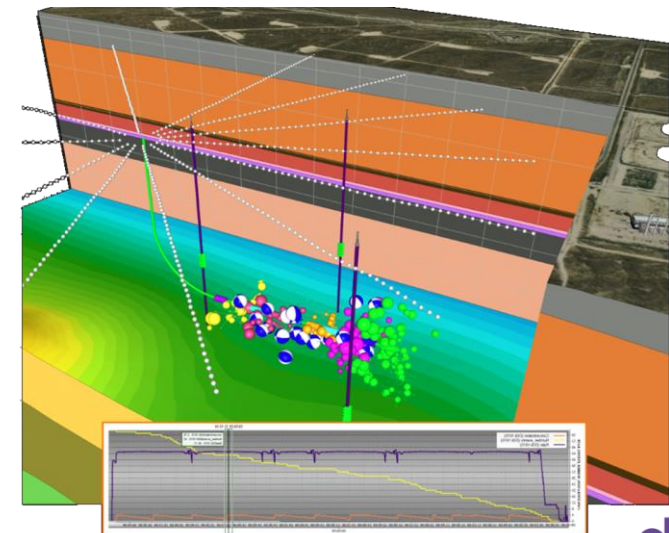


Data Requirements

- **Diverse 4D Data Integration**
 - 2D-3D-4D seismic, attribute maps
 - Dynamic simulation models
 - Well data, completions, fluid rates, DAS/DTS
 - Tracers, InSAR, microseismic, LIDAR
 - Implicit time steps or groups with single stamp
 - Integrated 4D space for decision-making



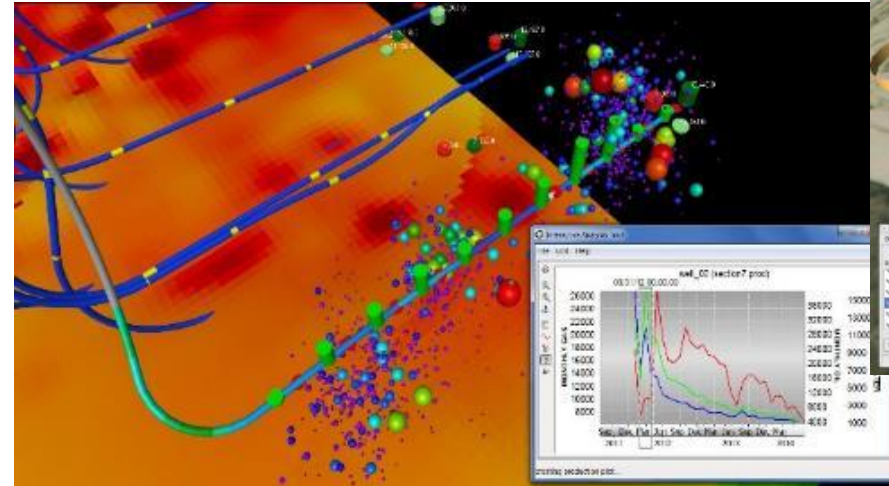
From “Continuous seismic surveillance of Valhall Field” by Jean-Paul van Gestel, et al, SEG Leading Edge, 2008.



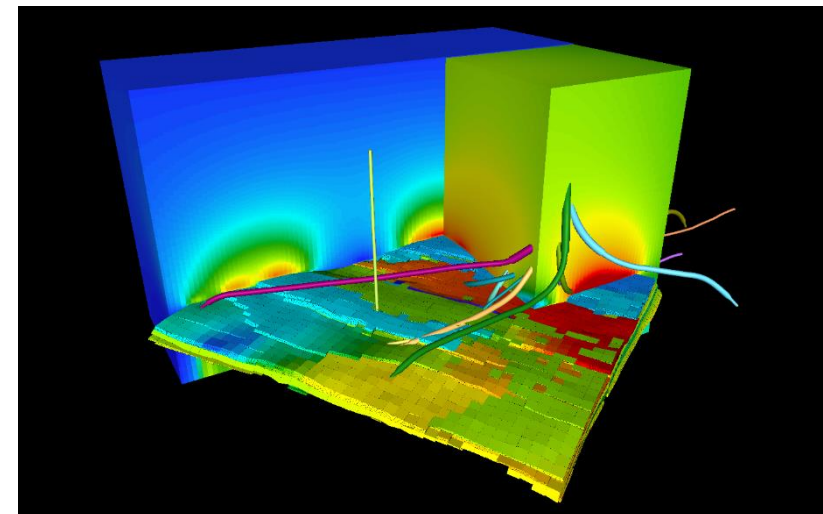
4D Quantitative Workflows

4D Quantitative Workflows

- Import of attributes
- 4D Statistical analysis
- Sim2Seis
- Assisted History Matching (AHM)
- 4D Geomechanics
- Extensible, customizable, accessible
- Not a “Black Box”



Data courtesy of RMOTC and USDOE



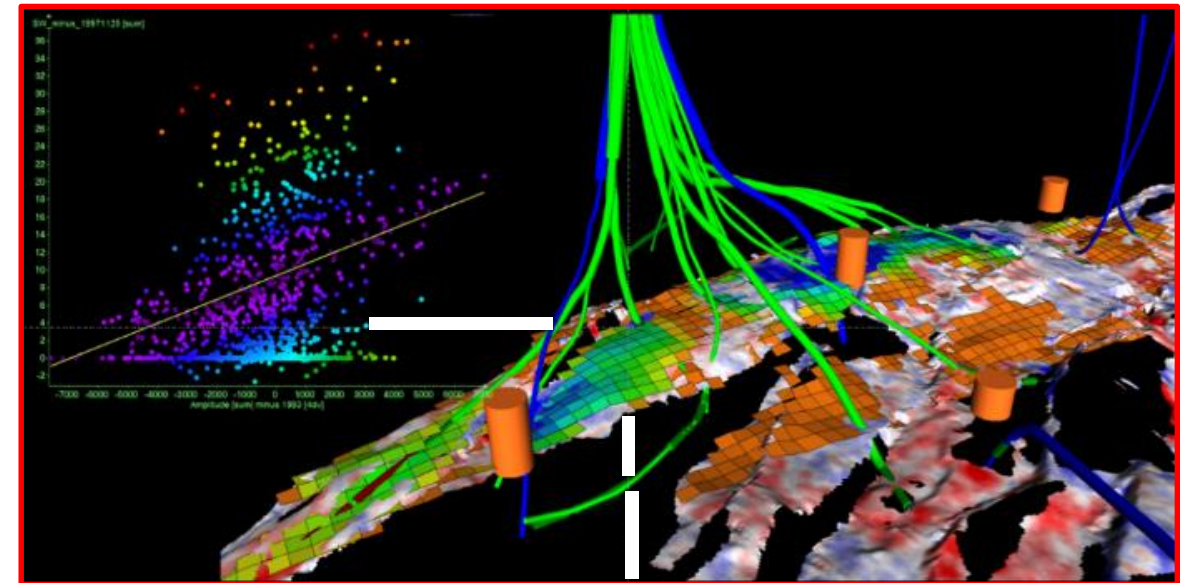
4D Seismic Analysis

- **Visual Comparison**

- 4D Seismic and Simulation
- Incorporate production information
- Mismatch between datasets

- **4D Dynamic Analysis**

- Compare data of diverse geometries
- Interactive investigation
- Quantitative identification of anomalies

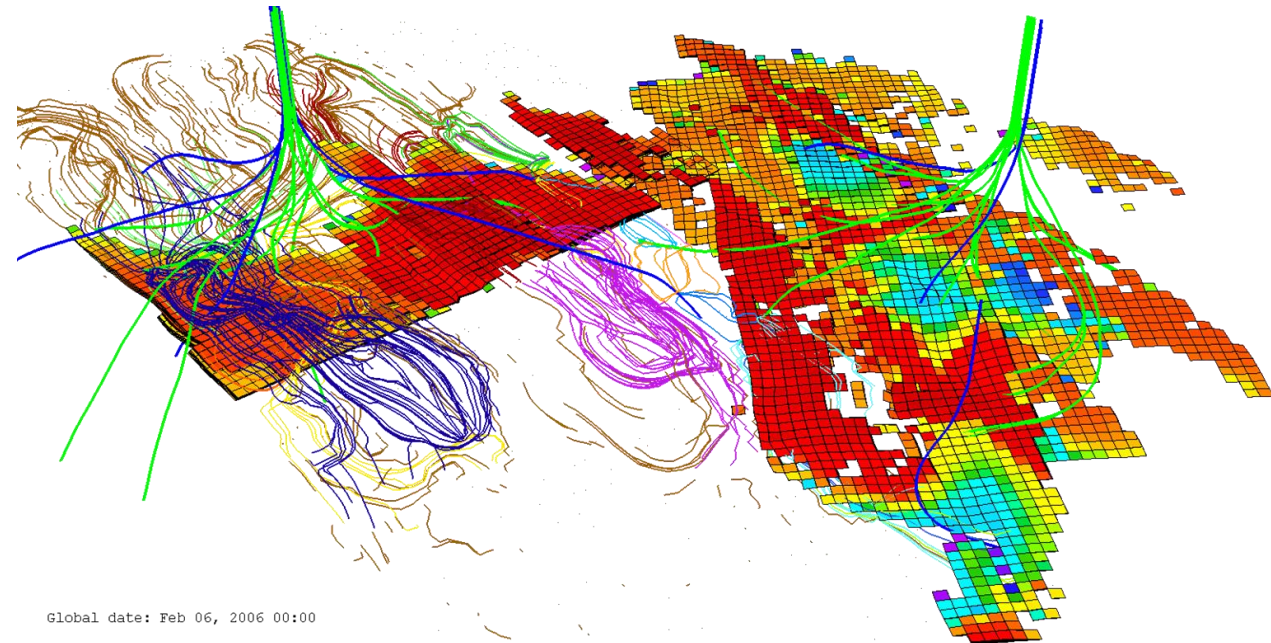


➤ *Ultimately leads to improved production and optimized reservoir management*



Summary

- Wide variety of 4D reservoir data types
- Visual 4D data integration
- Integrated quantitative analysis
- Customizable workflows / functionality
 - Developers and Python Toolkits
 - Links to third party and open source solutions
 - Access to Machine Learning / Data Science



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