



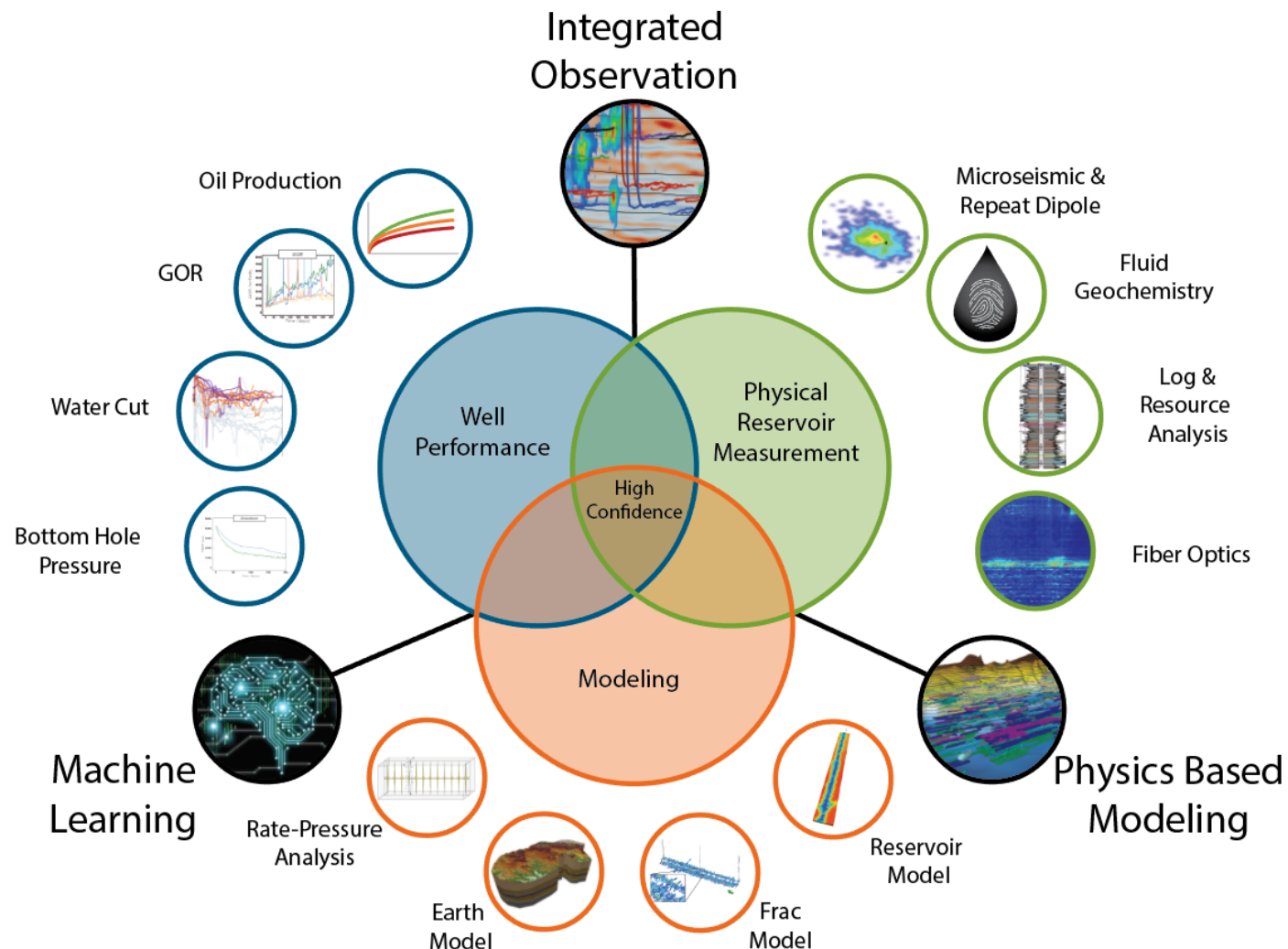
Evolving Integration Ecosystems

**Matthew Davis
Chris Christofferson
Jerome Bellian**

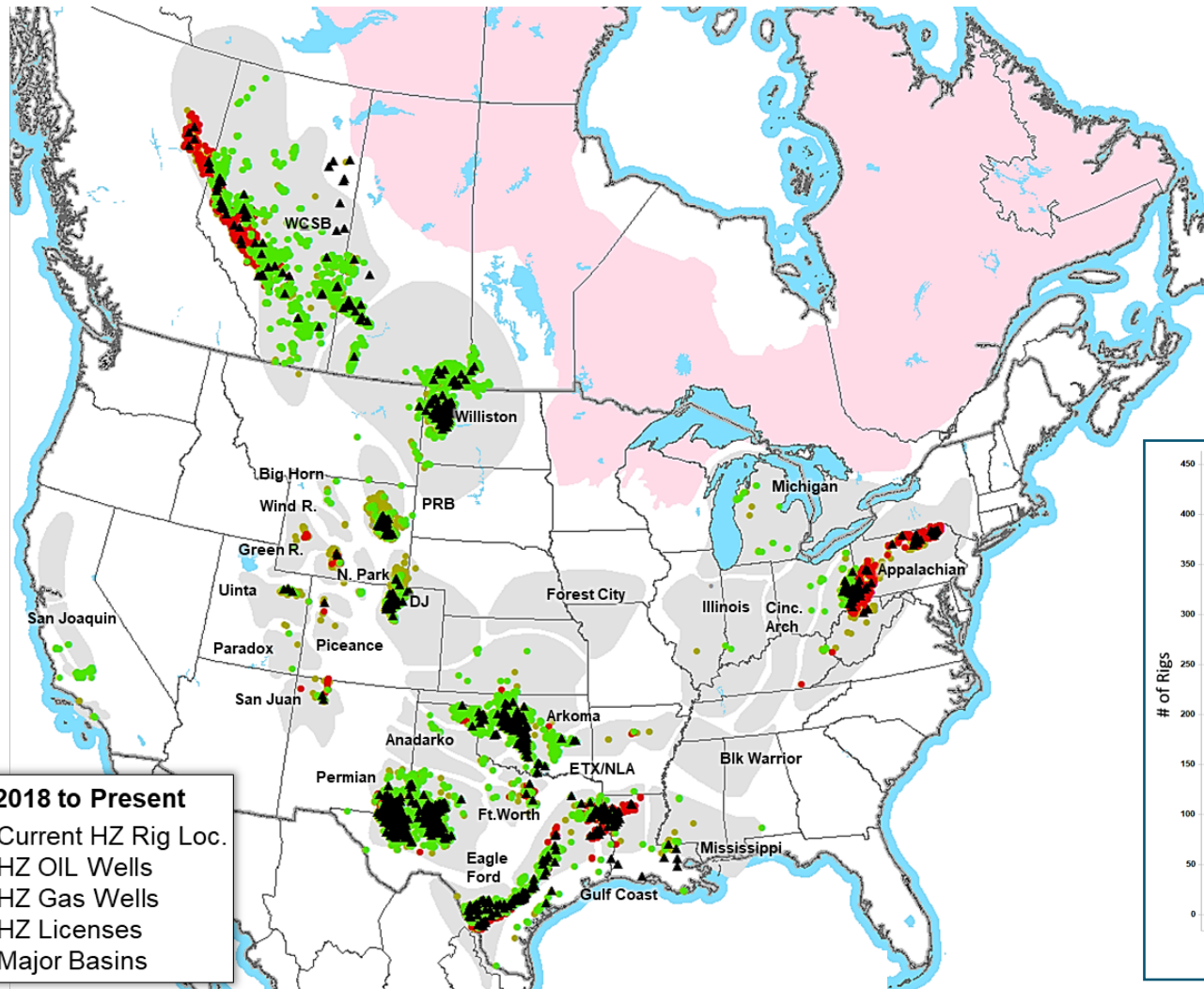
encana

The Venn of Integration

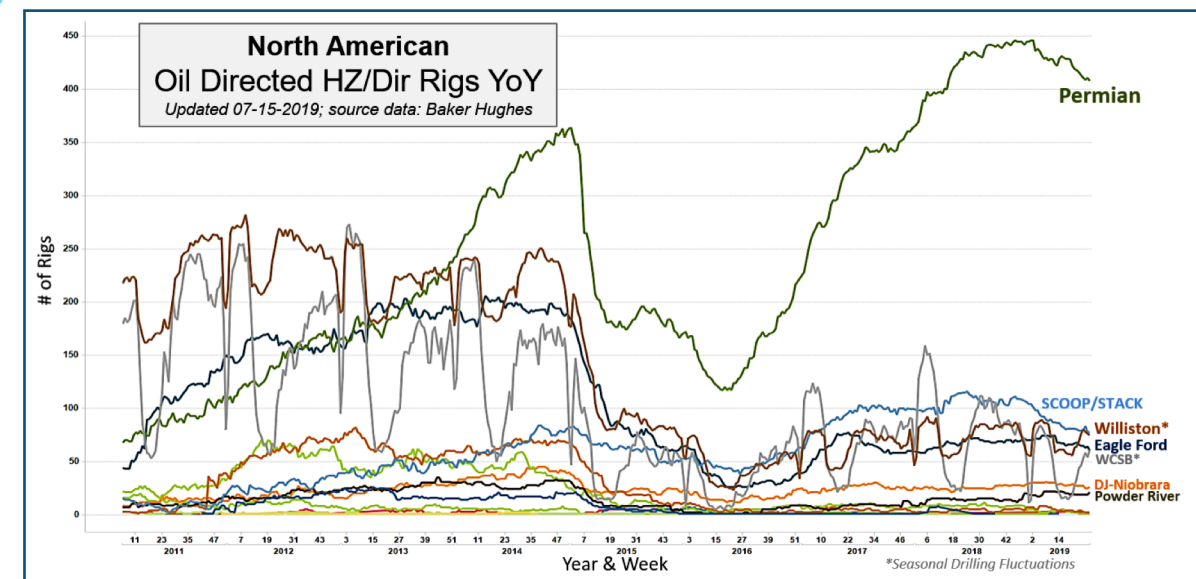
- Evolution of Thought
- Integration of Multiple Workflows
- Visual, Analytical, Computational
- Prediction Based



The Scale of North American Data



- October 2018 - 2019: 11.2 – 12.4 MMBO/day
- Recon Industry Activity
- Quantify Well Performance Drivers

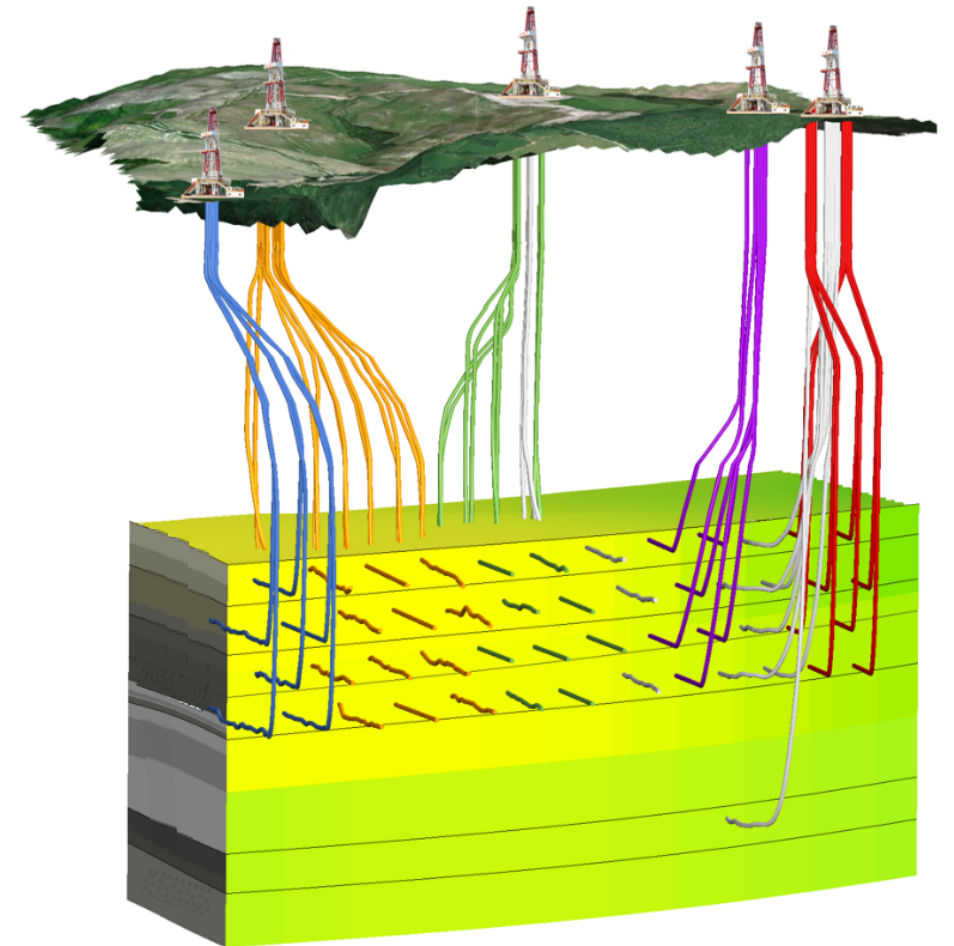


Cube Development

- Higher Recovery from Stacked Pay Reservoirs
- Highly Efficient, Repetitive, Agile Development
- Data Driven Development Approach



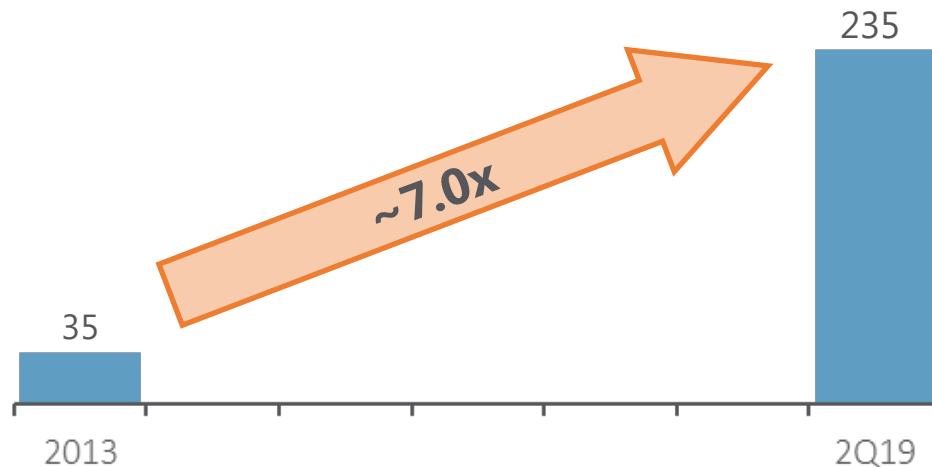
Cube Development Maximizes Recovery and Efficiency



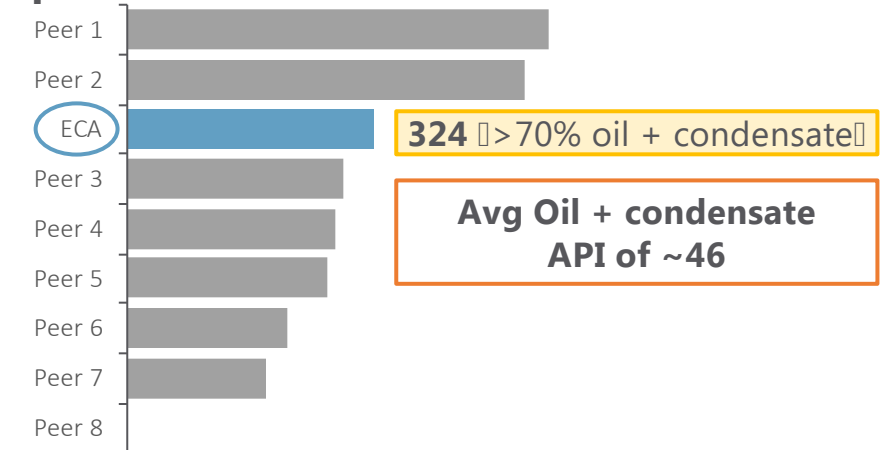
Top North American Producer

- **Multi-basin leader in unconventional development**
 - Amongst the largest E&P producers in North America
- **Transitioned to a quality, liquids-focused portfolio**
 - ~7.0x oil & condensate production growth since 2013
 - ~\$13B in divestitures since 2013 (China & Arkoma in 2019)

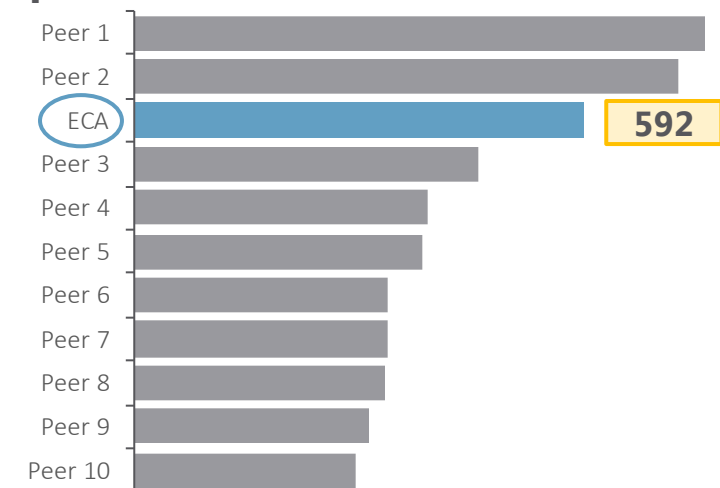
Transformational Oil & Condensate Growth ¹ Mbbbls/d



Liquids Production Mbbbls/d ²



Equivalent Production MBOE/d ²



¹ Reportable oil & condensate production.

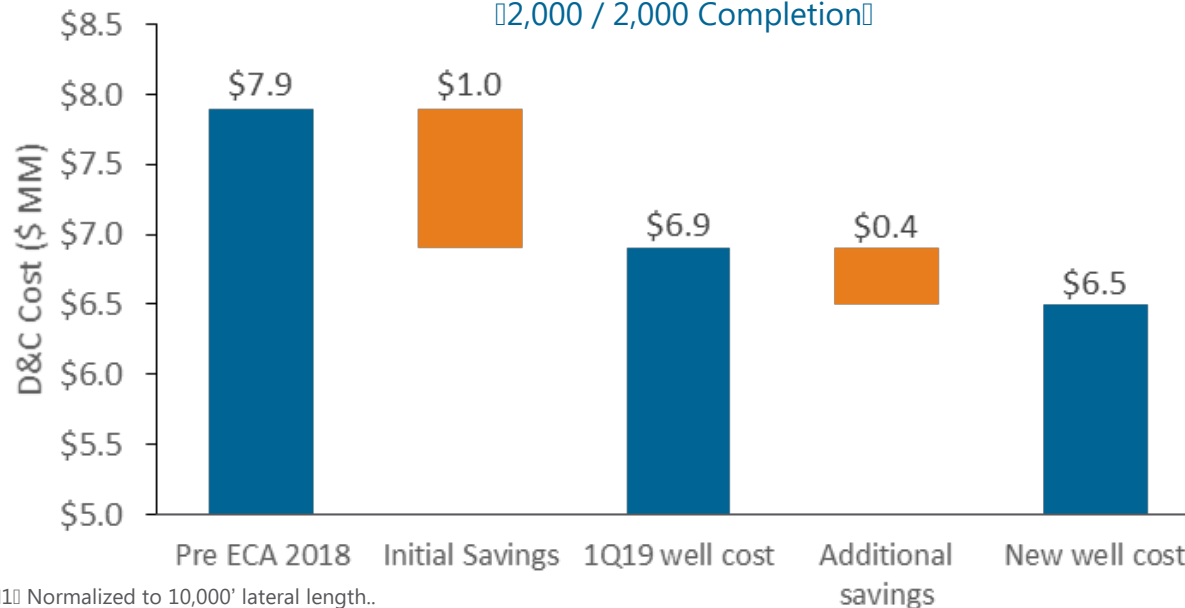
² Peer data is reported 1Q19 net production from public filings. ECA reflects 2Q19 reportable production volumes. Peers include APA, APC, CLR, COG, CXO, DVN, EOG, MRO, NBL, PXD. Liquids production peers exclude CLR and CXO as they report 2-stream production.

STACK Delivering Consistent Results at Lower Costs

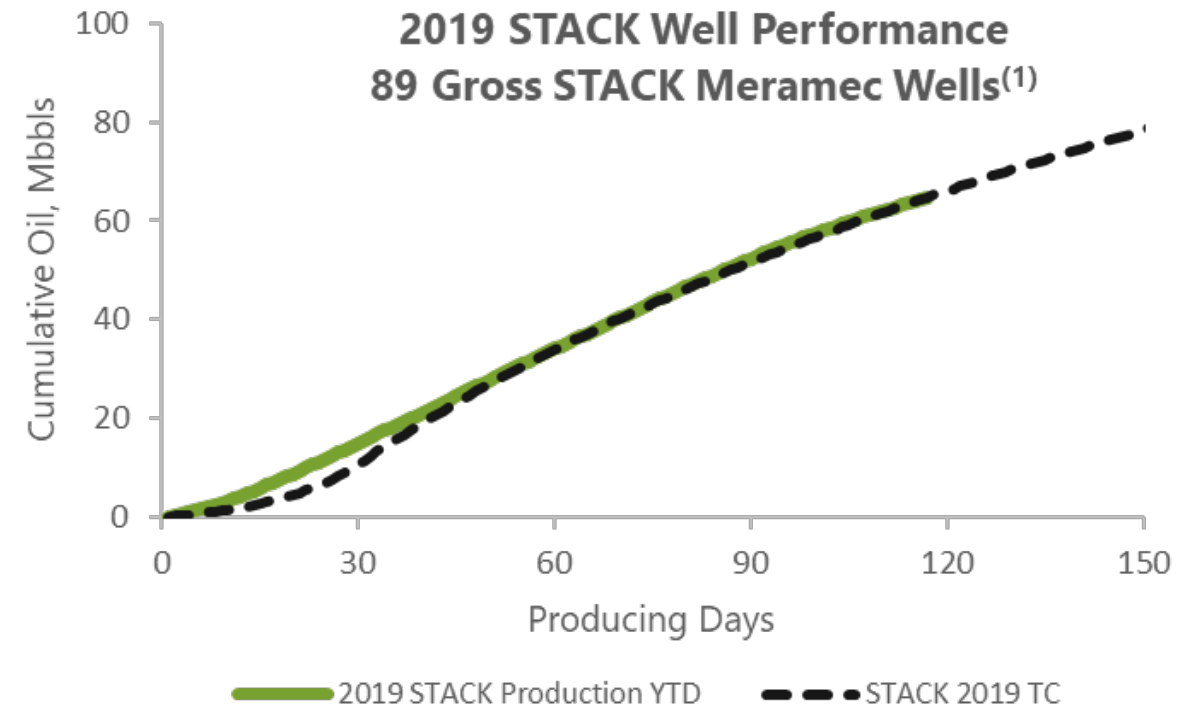
- Stages & slurry volumes pumped per day up 58% & 37%, respectively, over 1Q19
- Continuing to optimize completion & well spacing for maximum DSU value
- Infill development delivering >50% IRR

Identified Additional STACK Well Cost Savings

□ 2,000 / 2,000 Completion □

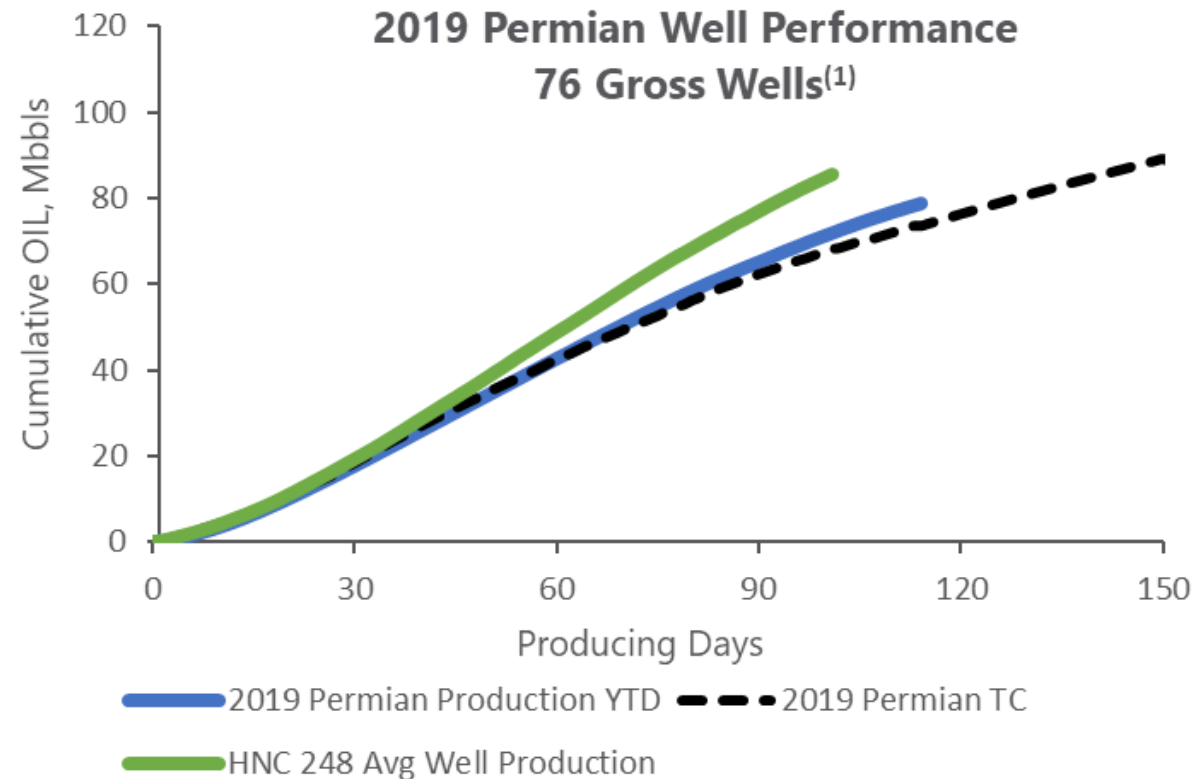


□ 1 □ Normalized to 10,000' lateral length..



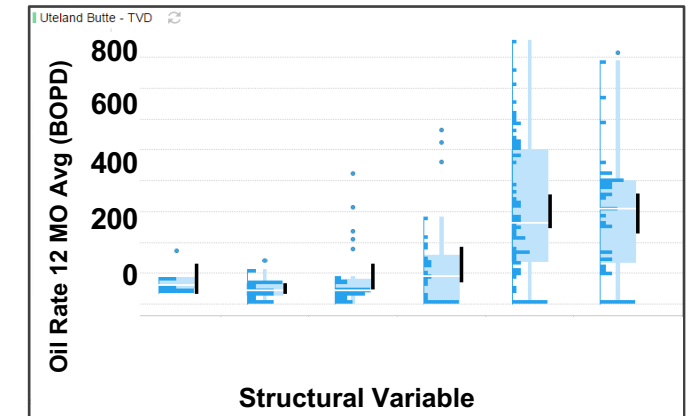
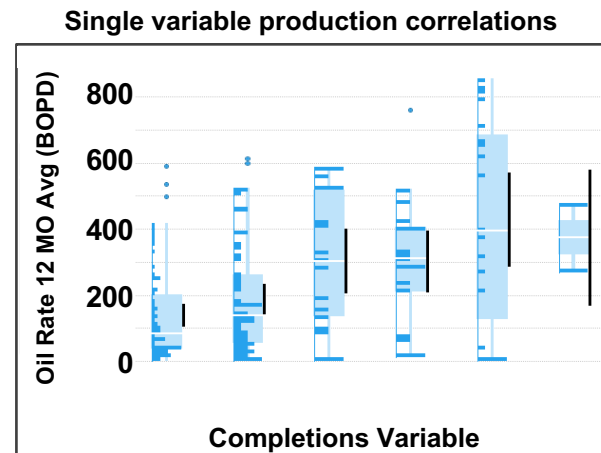
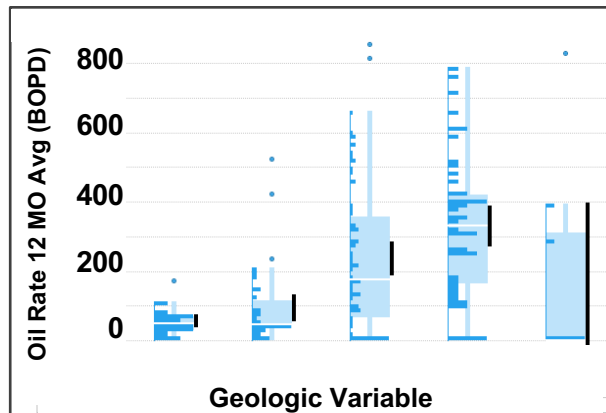
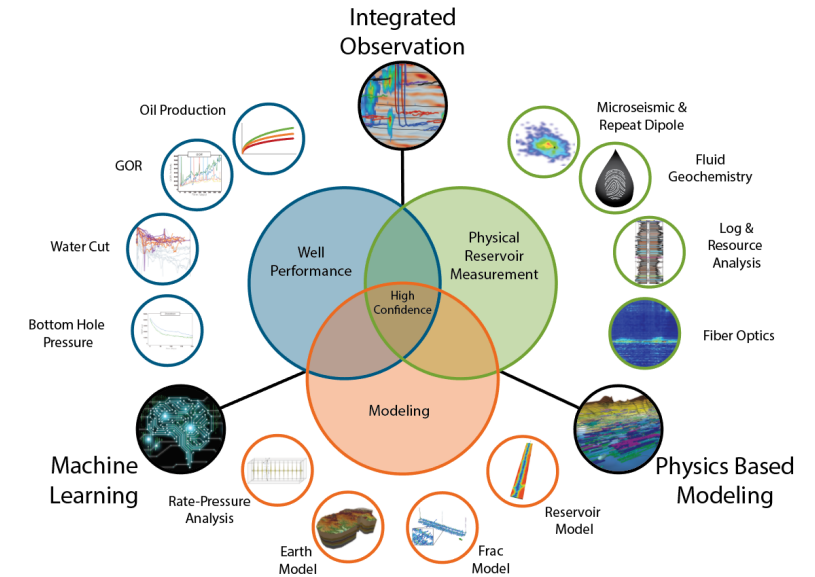
Permian

- **HNC 248 Cube: 14-wells set record ~17 Mbbbls/d after 60 days**
 - ~1,400 BOE/d average rate per well after 90 days
- **Continued growth expected in 2H19**
 - On track to meet full year 2019 expectations
 - Oil & condensate volumes +11% QoQ to 67.5 Mbbbls/d in 2Q19
- **Leading Permian Basin operator**
 - Best in class cycle time performance
 - Record pump efficiency: 25 days with >20hrs/d
- **Strong realized pricing**
 - Preferred API blend
 - Market diversification creating value



Visions of Architecture and Integration

- Earth Models incorporate Venn-Based workflows
- Enables Encana to observe key basins in new ways
- Serves as the foundation for physical and analytical models
- Used to assess opportunity, discover, and more effectively predict

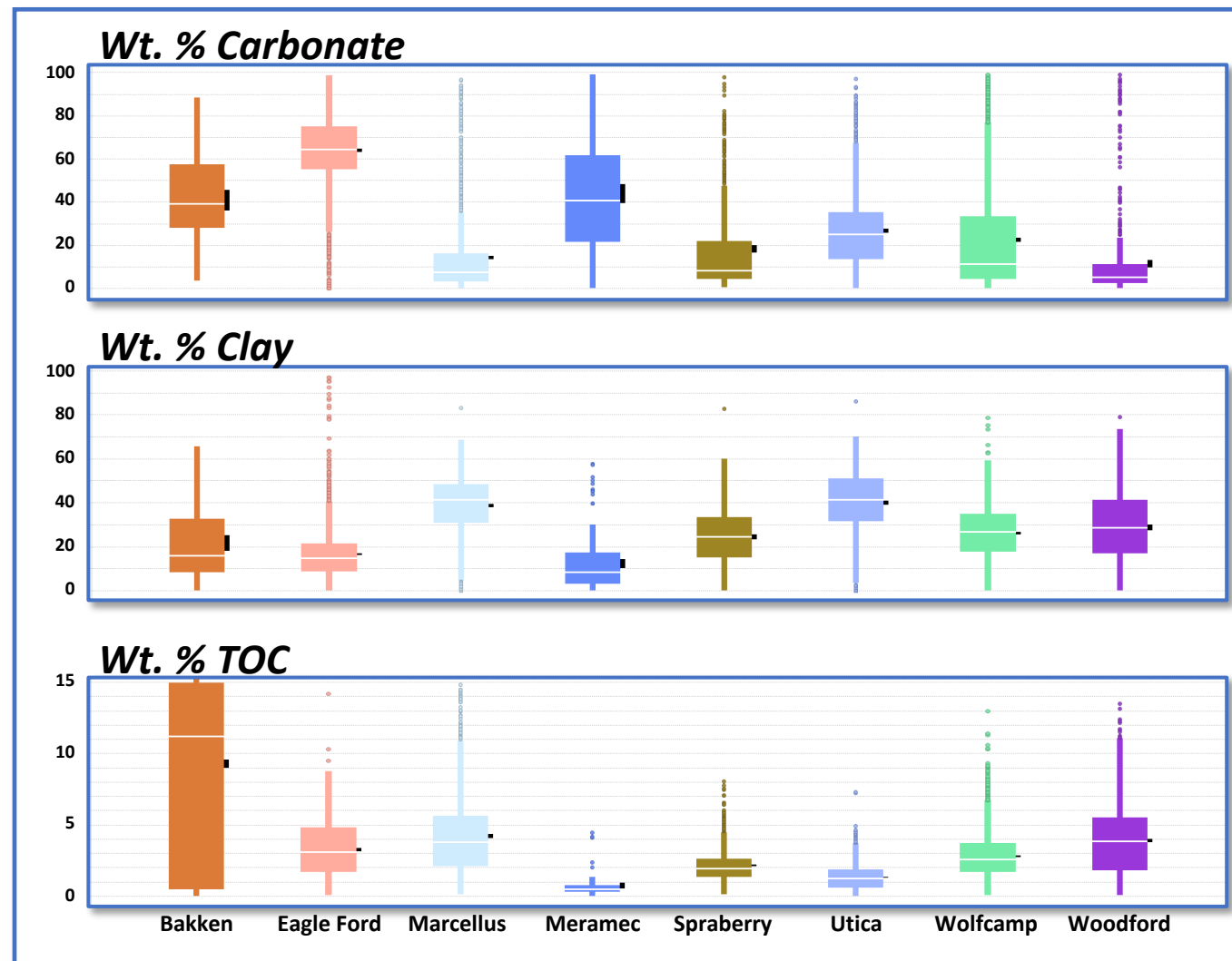


Defying Traditional Play Concepts

- Broad range of reservoir parameters
- High quality rock data

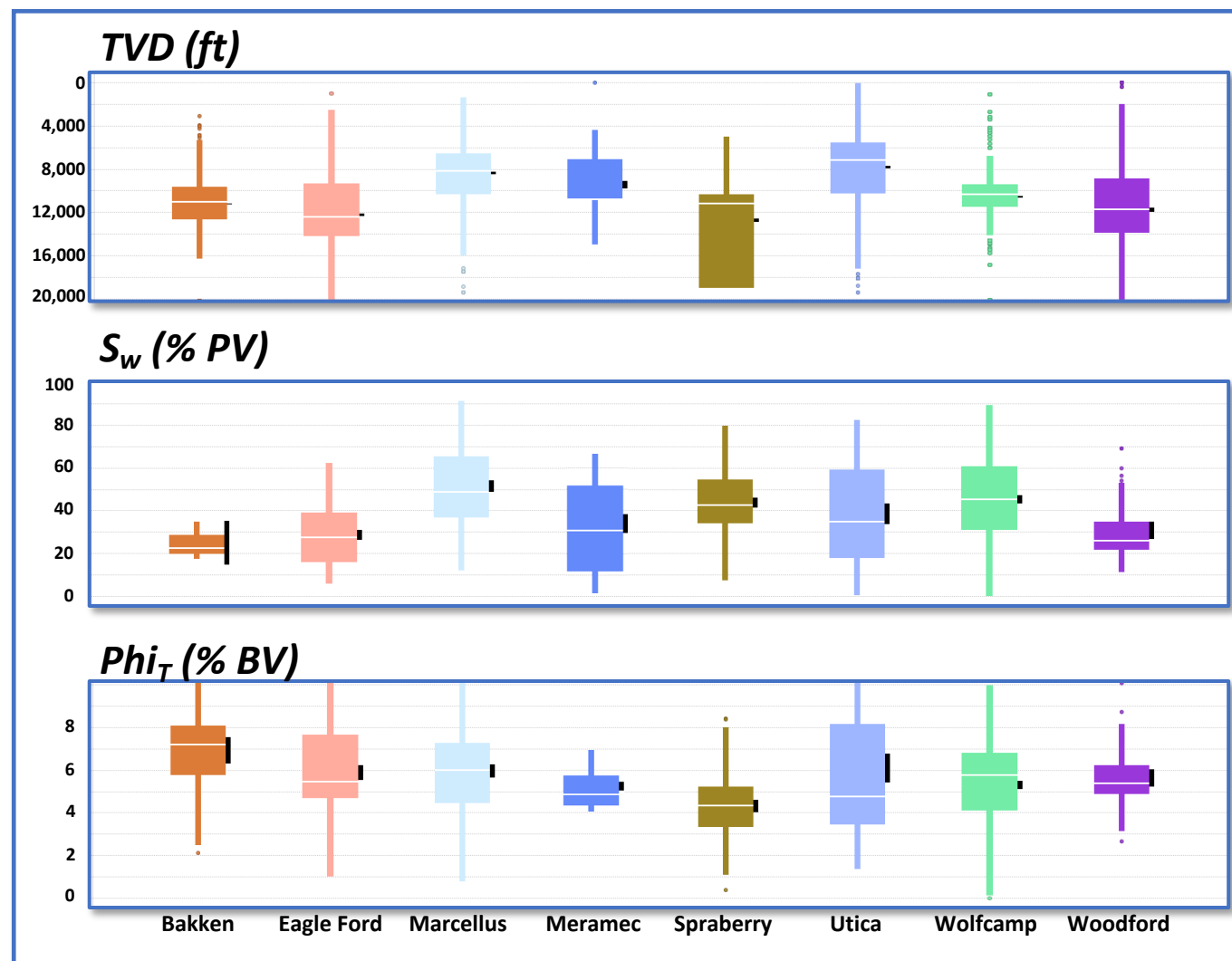
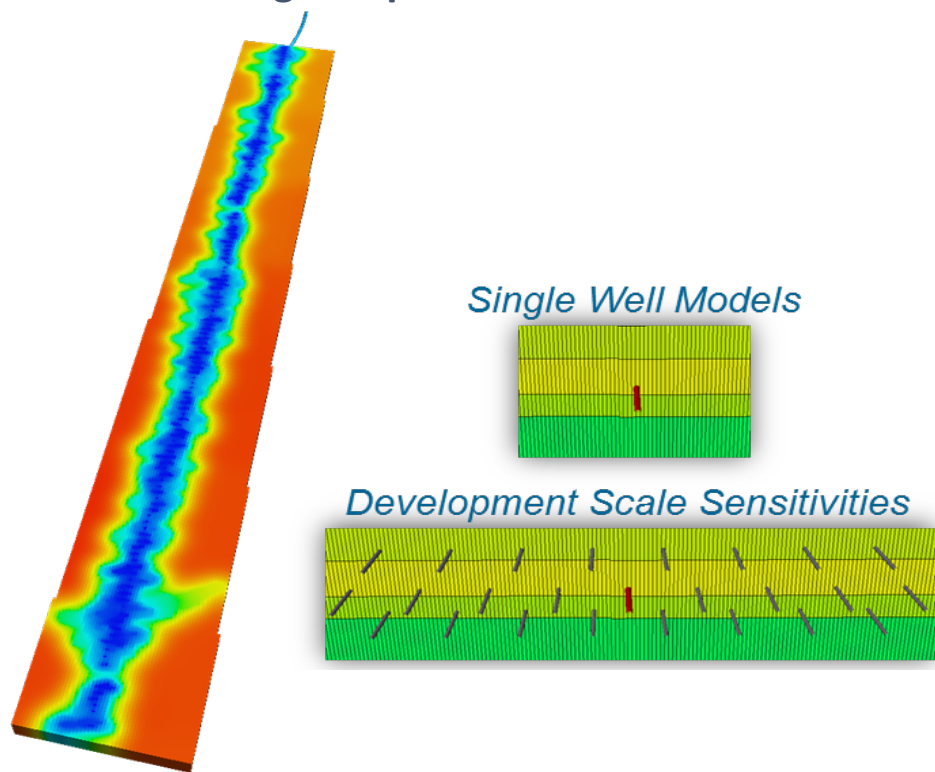


Encana 500' Coring Run



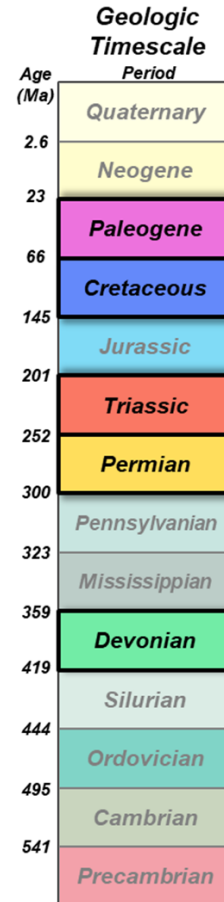
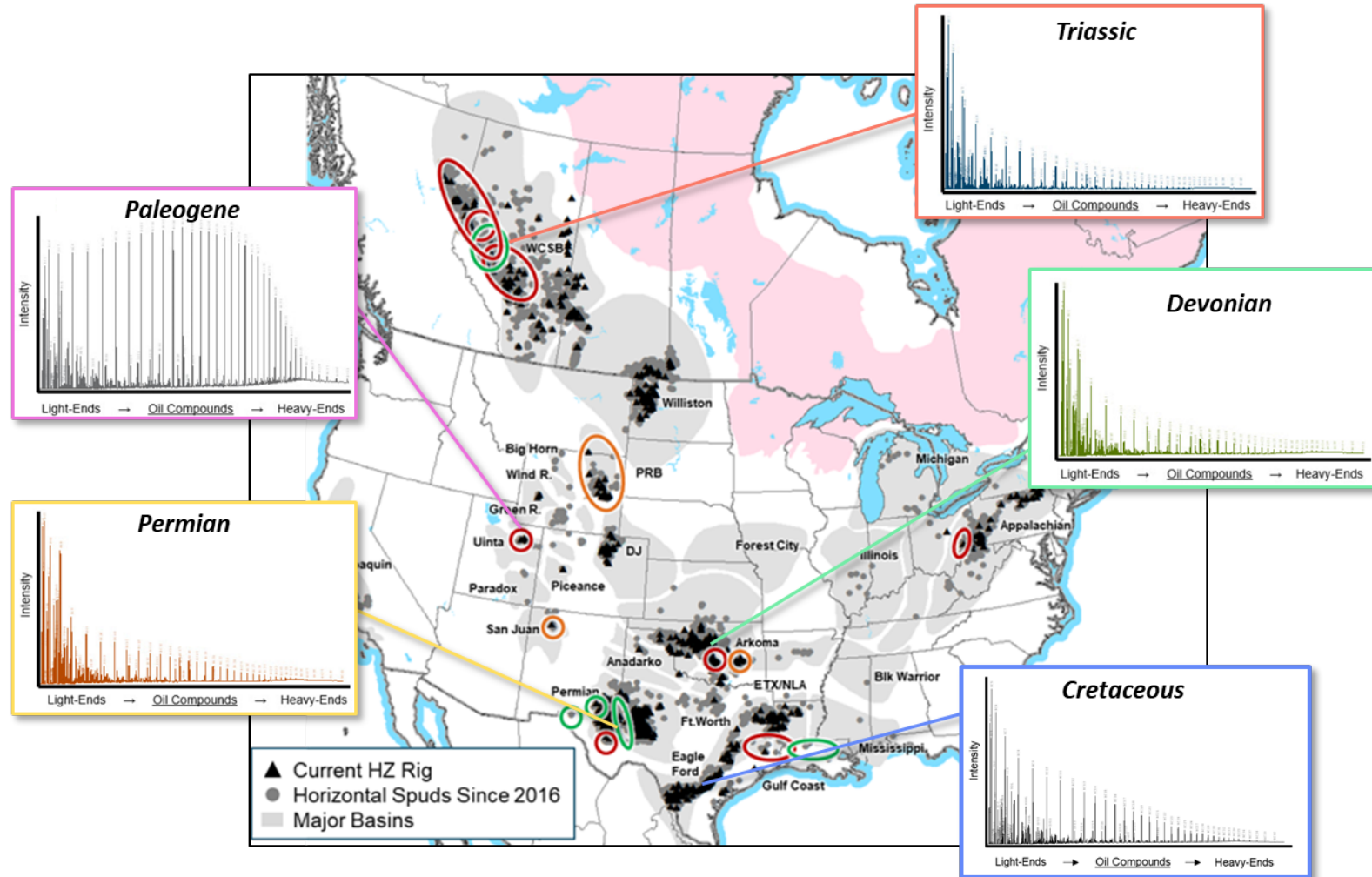
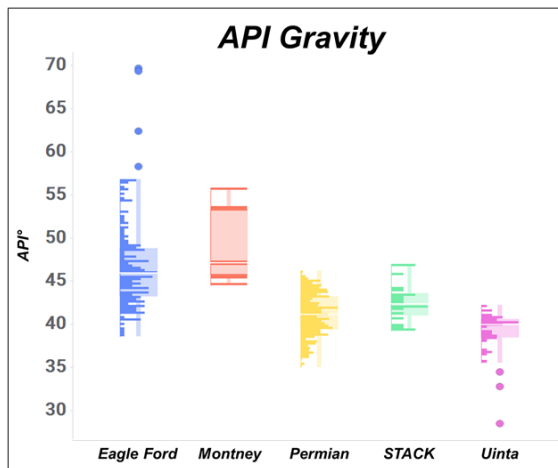
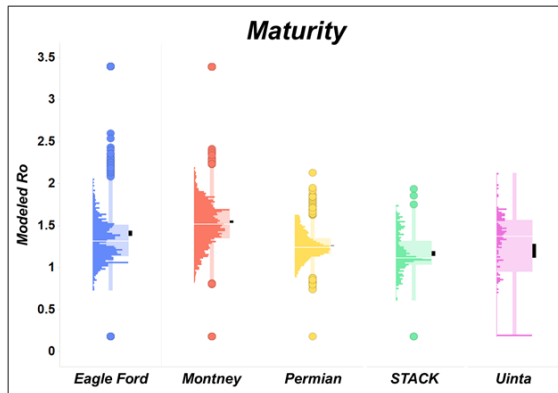
Defying Traditional Play Concepts

- Physical models rarely explain the system
- Big Data and Analytical approach required for understanding and prediction



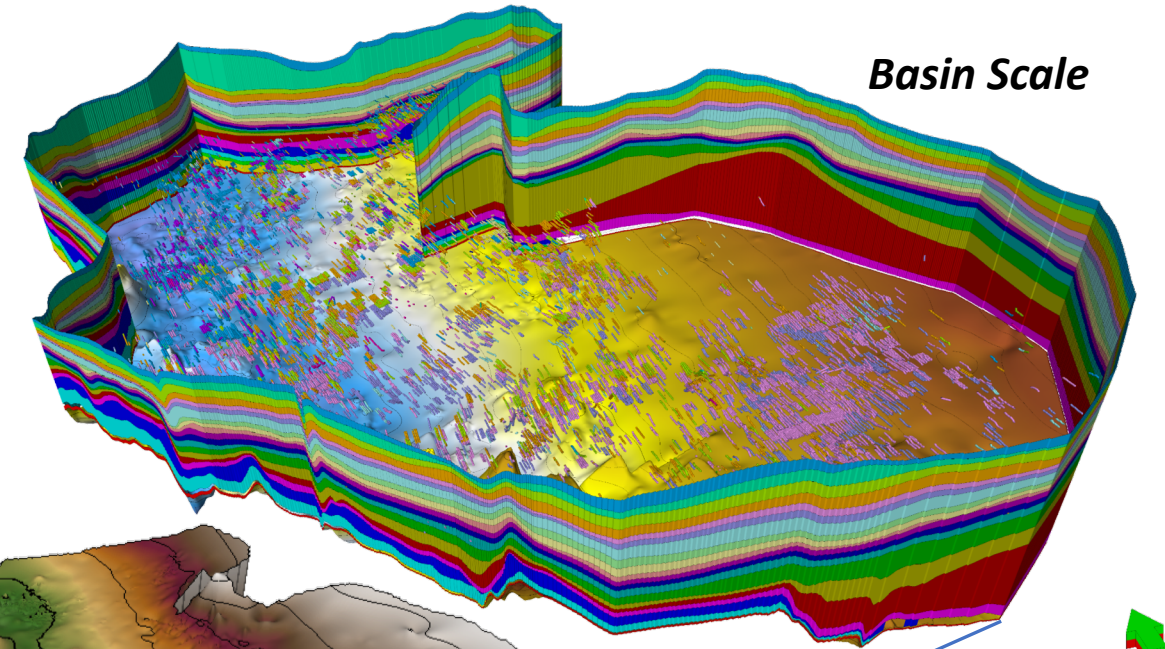
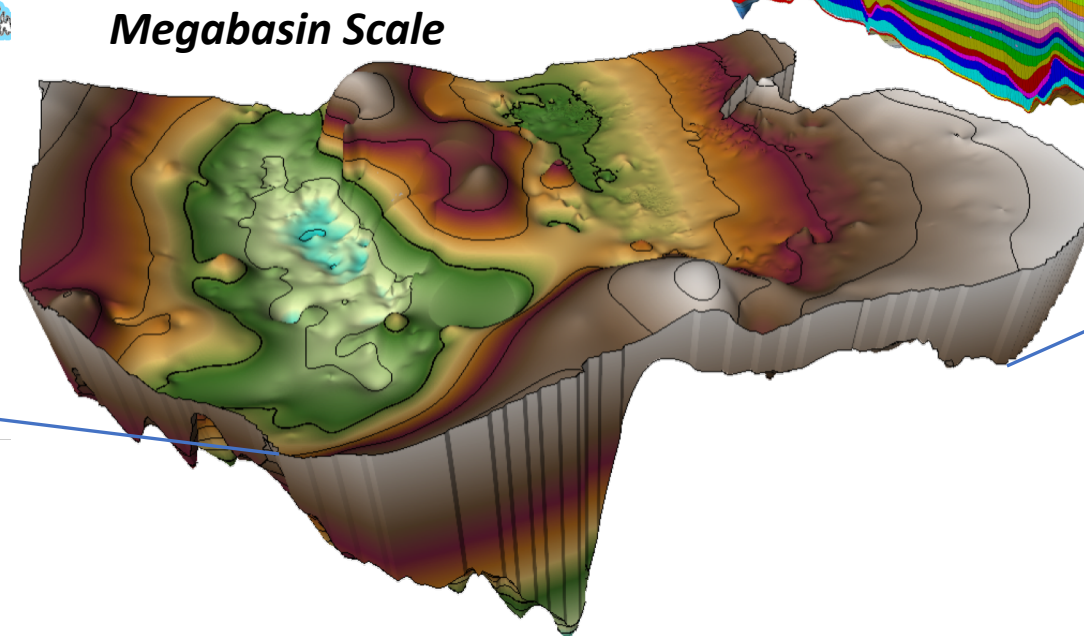
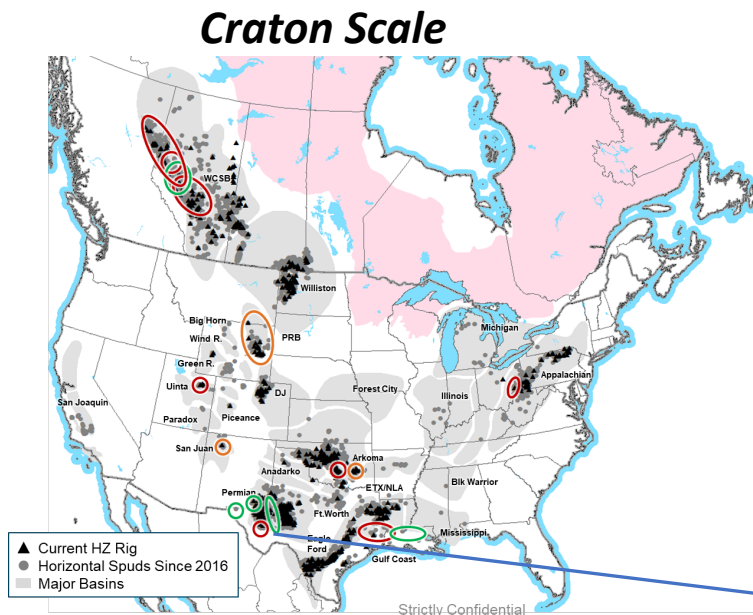
Variability of Petroleum Systems

- Similar maturities
- Variable oil characteristics



Structural Modeling at the Cratonic Scale

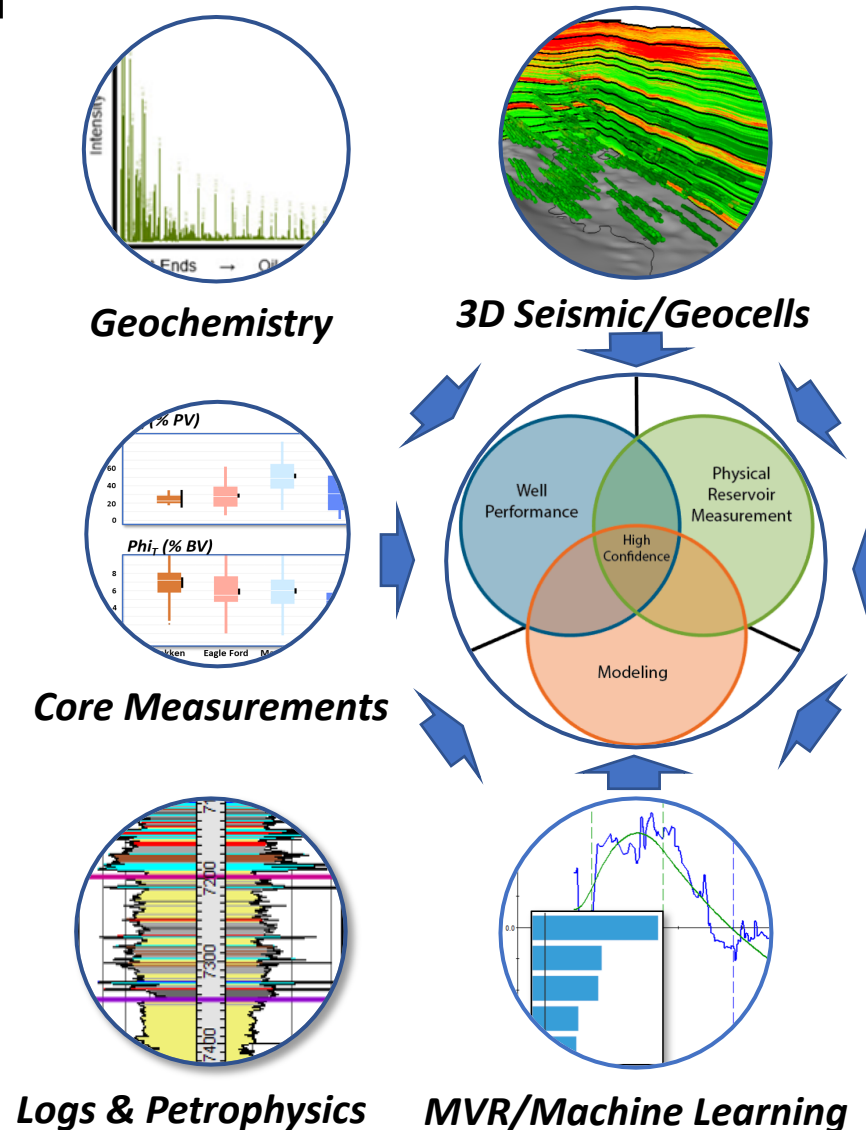
- Macroscopic subsurface data integration and imaging
- Precision from the craton to individual basins and pads



>11,000
Horizontal Wells

Earth Model Components

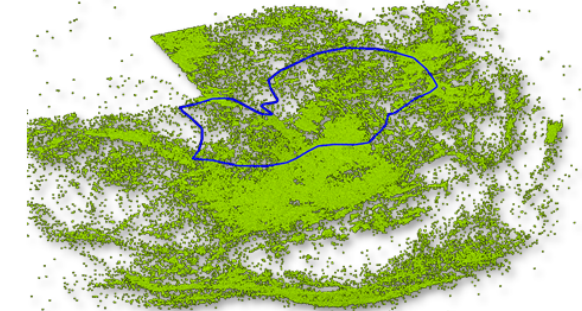
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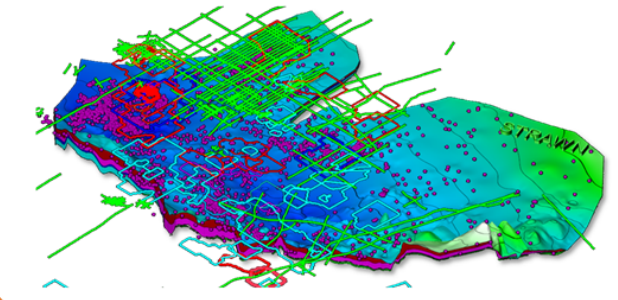
Basin Scale Earth Modelling



Big Data Interpretation Techniques



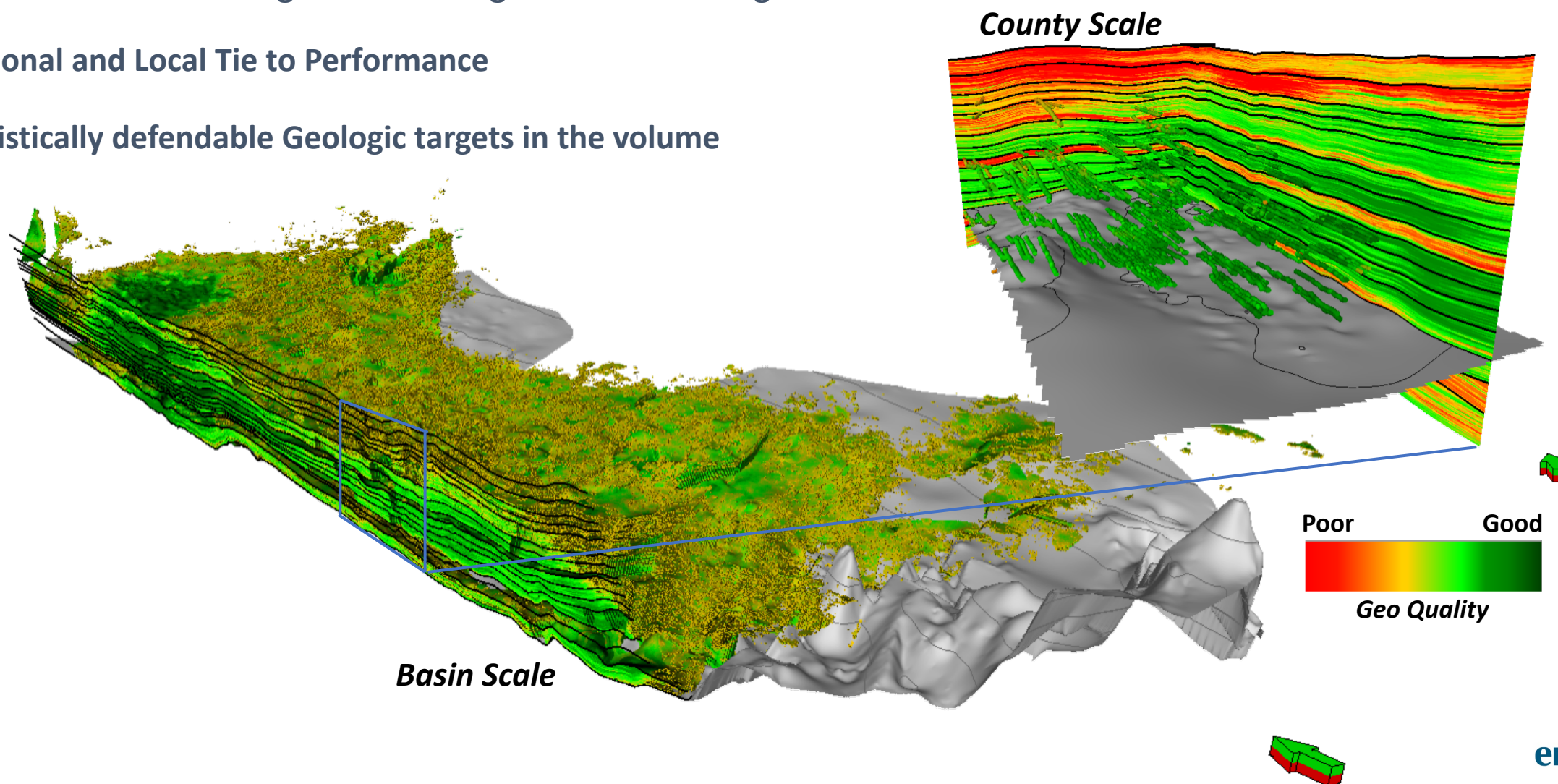
Massive Industry Datasets



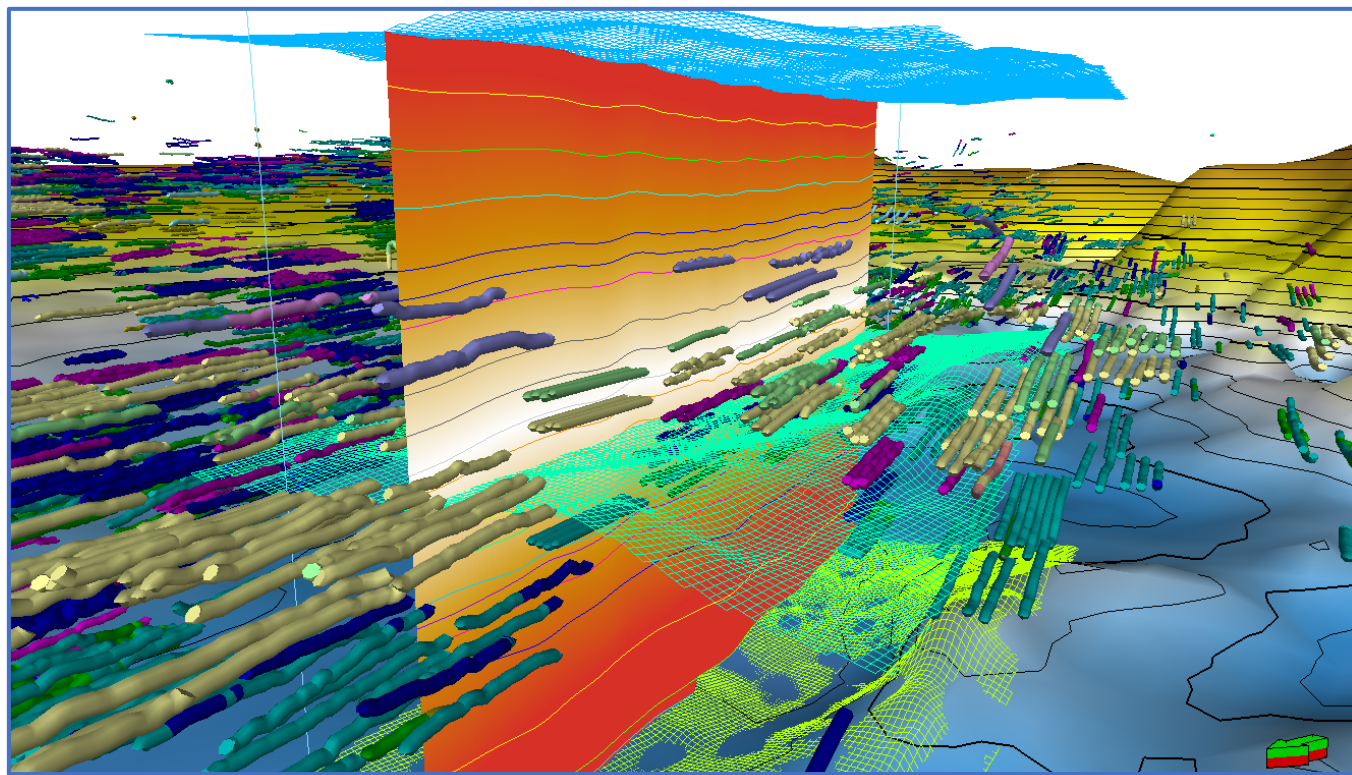
Detailed Encana Datasets

Constructing a Development Tool

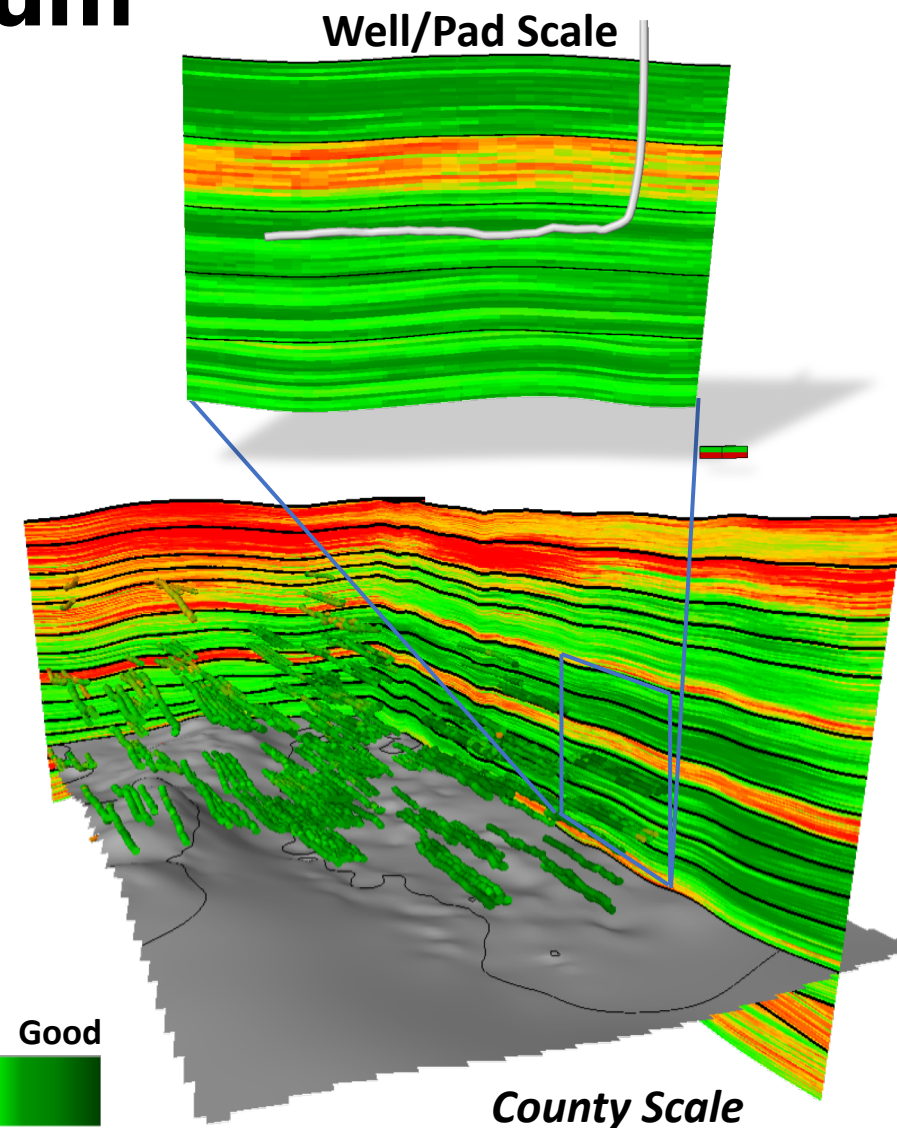
- Predictive Basin Model generated using Machine Learning
- Regional and Local Tie to Performance
- Statistically defensible Geologic targets in the volume



Interpretation Outside the Vacuum



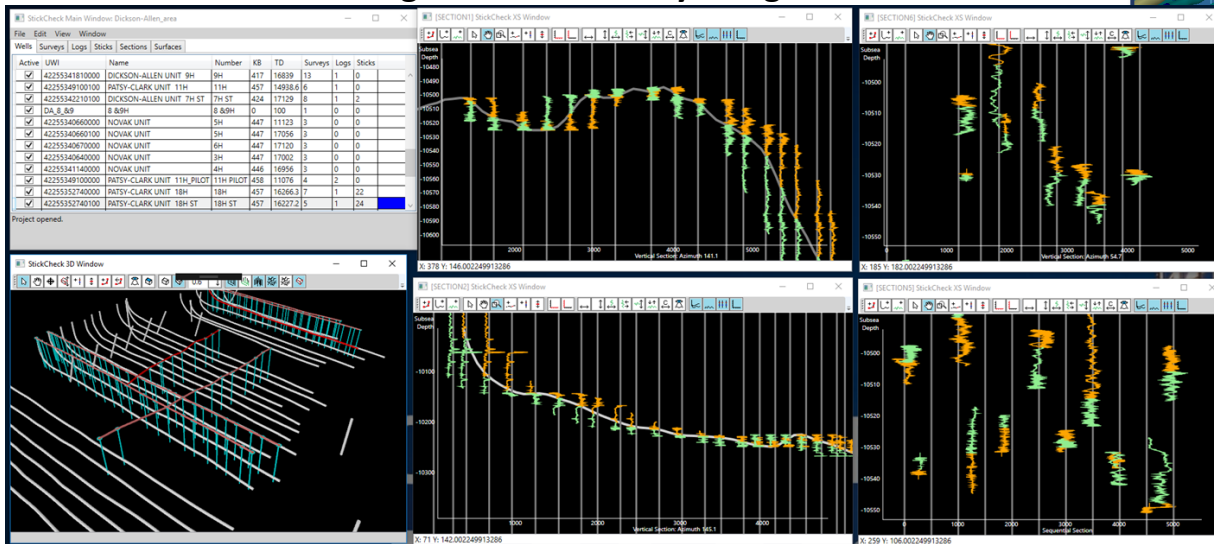
- All well activity in the volume
- All observable data co-visualized and related
- Reservoir quality is the integration of all relevant drivers



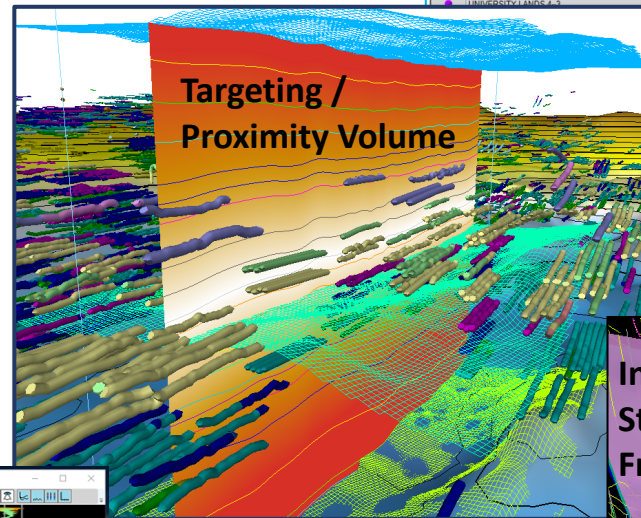
The Petrel Partnership

- Adaptive / Evolving Open Platform
- Numerous specific enhancement requests for ECA
 - >20 Specific Improvements in 3 years
 - Still challenged with Geosteering workflows
- Loading data into Studio is still a big challenge

3-D Pad Scale Geosteering Tool: Invented by Doug Andersen



Midland

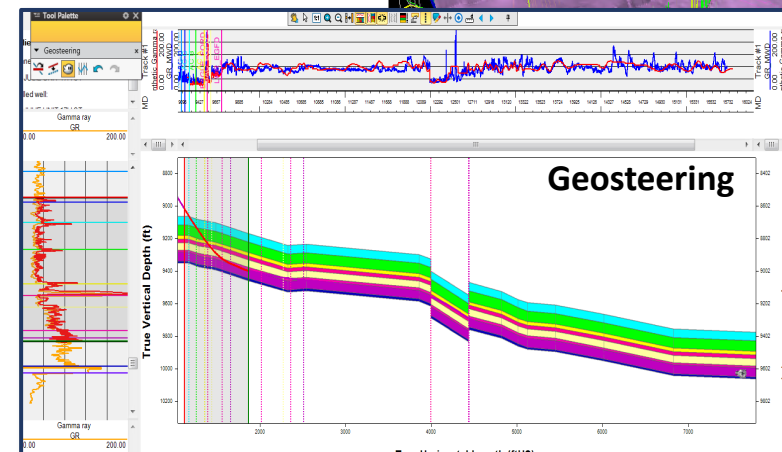


Well Data Browser

Studio Database

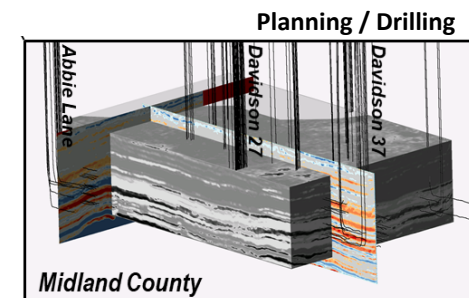
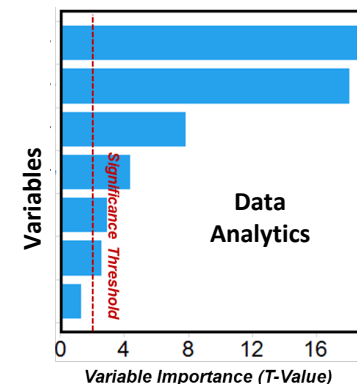
Eagle Ford

Integrated Structural Framework

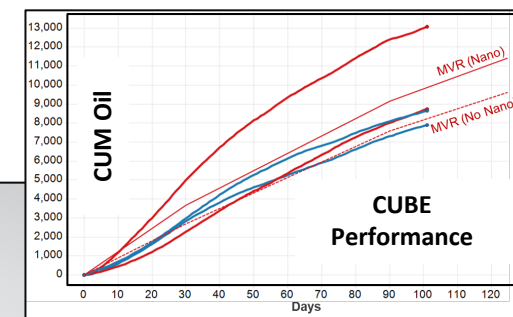
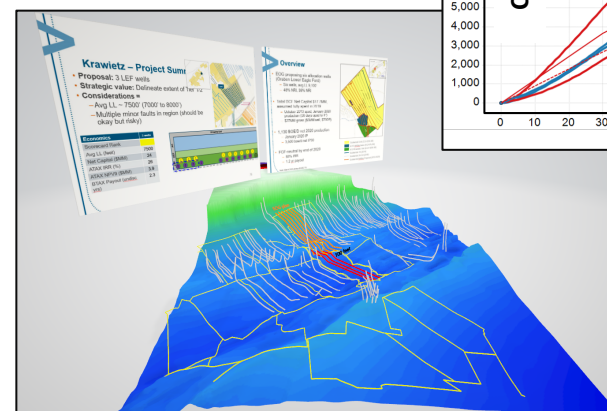


The Impact of Petrel on the Business

- The Earth Model is the foundation of ECA Analytics
- Precision Geosteering is accredited with significant cycle time savings
 - >5,000' in 1 day
 - Significant reduction in bit trips
 - Used to plan and execute every well in the Midland Basin
 - Facilitates significant improvements to interactions between drillers and geoscientists
- Studio and Target workflows track all competitor activity
 - Permian, Eagle Ford, Mid Continent, and WCSB volumes active and evolving
 - Competitor analysis and evaluation in all plays
- The Volumetric Workflow models full cycle Development
 - Progressive development models used to calculate and model Dynamic Inventory
 - Workflows serve as the foundation for acreage valuations



3-D Pad Lookbacks



Backup

Abstract

Transforming the Ecosystem of Integration: A Journey into the Volumetric Assessment of North America and the Venn Approach to Reservoir Characterization and Discovery.

North American horizontal drilling, hydraulic stimulation, and unconventional oil extraction has transformed the global energy landscape and has proven economically viable across a broad range of geologic settings, rock types, fluid windows, and pressure gradients. The traditional concepts of permeability, pressure, and fluid viscosity limitations for unconventional systems simply have not proven true. Oil commonly flows from under-pressured shale reservoirs, low API and even waxy crudes produce in numerous settings, and unconventional hydrocarbon systems exist in Ordovician through Miocene reservoirs. New tools are required to understand, explain, and predict performance from these complex systems. Geology and production data must be integrated with wellbore design and completion parameters at the cratonic scale. Historically, non-Petrel based workflows created nonautomated and disconnected datasets not bound to the three-dimensional architecture of the earth. As a result, very few analytical models exist to understand and predict key drivers and limitations for well productivity at the sub-basin, basin, and continental scales. Encana has embarked upon an ambitious Studio and Petrel based campaign to construct the volumetric architecture of North America, integrate all observed and calculated subsurface data with all engineering data, and deploy a Venn based approach to observation, analytics, and physical modeling while maintaining the precision of horizontal targeting workflows.