Key partner in Design Process Innovation

Optimizing Production: Integrated Field Surveillance & Cost Efficient Analytical Tool Approach (DEJ Event – 29th Sept, 2015)

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- Introduction
- What is, Why & When do we optimize field production
- Field Performance KPIs
- Production Improvement & Optimization Structure
- Data & Analytical/Numerical Analysis
- Integrated Workflow (Cost Efficient Tool)
- Field Example Case
- Results
- Conclusion

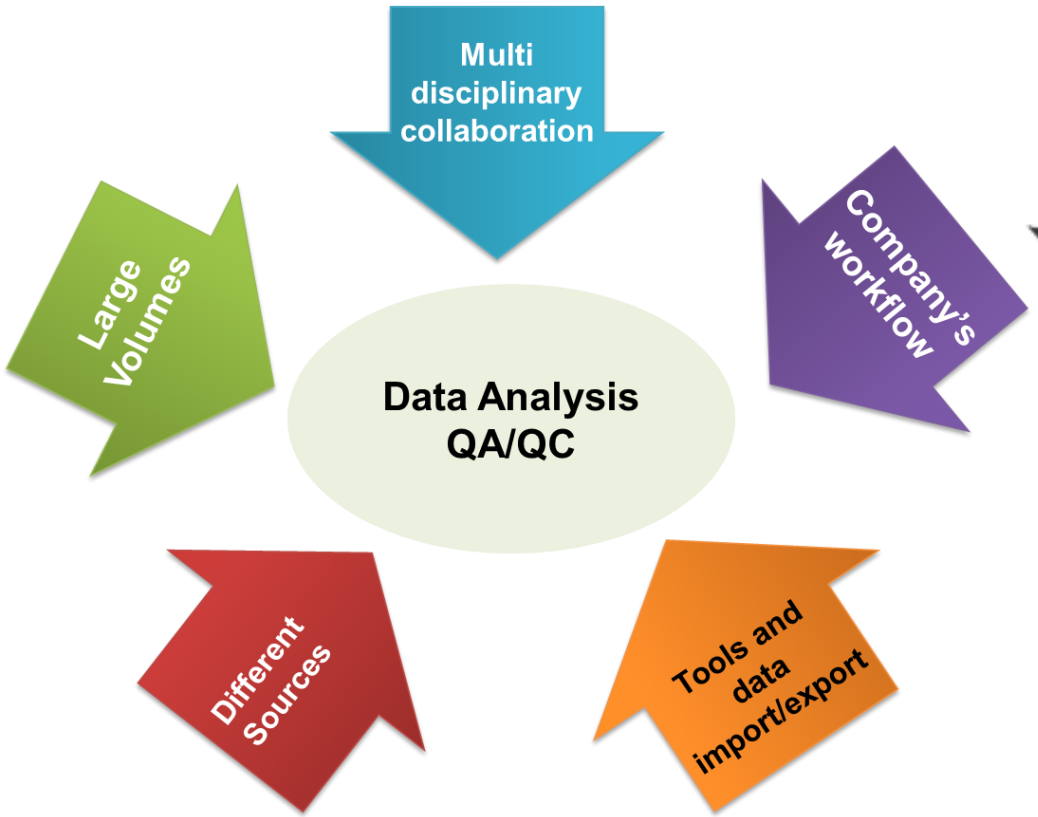
Introduction

> Energy CEOs can't control market factors such as the world's economic health or global oil supply, but can change how they respond to market conditions, such as getting the most out ***of technology investments***, more effective use of partnerships and diversity strategies."
>
> *PWC survey with Oil&Gas CEO's*

The survey also revealed that nearly 80% of respondents agreed that digital technologies are creating value for their companies when it comes to data analysis and operational efficiency.

Introduction

- At present day, a data manager or subsurface professional (PE, RE, Prod Eng…) spends a lot of time to QA/QC production data
- Key issues - data sources, import/export, volumes, company's workflow, tools (analytical & numerical) and multi-disciplinary collaboration

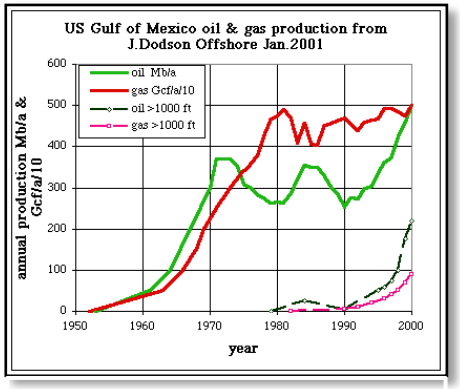


A single oil or gas field can generate a terabyte (1,024 gigabytes) of data every day. An oil and gas engineer spends from one-third or **60 percent of his time on data mining.**

What is, Why & When

Save time & Reduce costs

Optimize asset's facility performance



Increase production

Production optimization could mean…

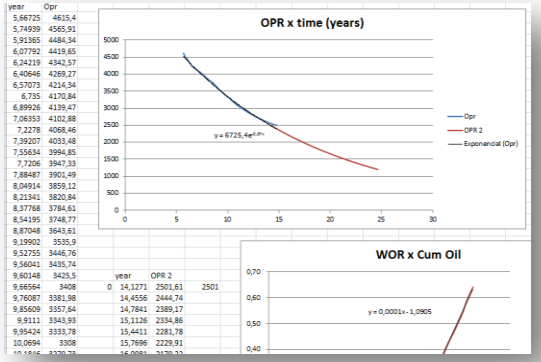
Reduce operational risks

Maximize return of investment

Field Performance KPIs

Resources

- Man hour time
- Associated cost

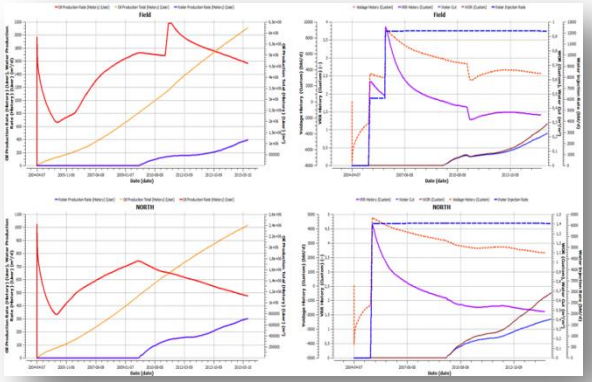


Data

- QA/QC time
- Frequency (automated/manual)

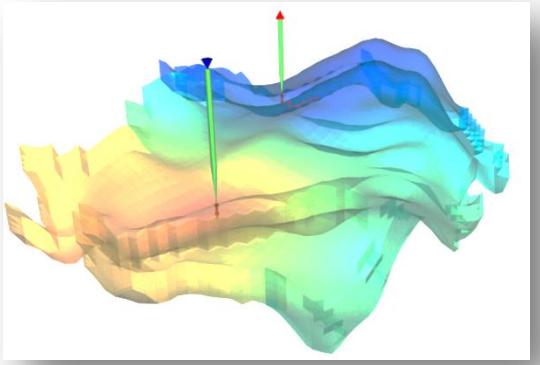
ROI

$$$???



Field Operations

- Reservoir surveillance and management:
  - Waterflood performance
  - Pressure responses
  - Voidage (VRR, VR)
- Well head and separator
- Chokes and valves



Field Prod / Inj

- Prod/Inj (Cumulative / Instantaneous)
- WOR, WC, GOR
- Prod/Inj well communication

Improvement & Optimization Structure

Production Improvement and Optimization

Data Management:
- I.T.
- Size & storage
- Technology & Tools
- End-users

Operation:
- Facility maintenance
- Well workover
- Water flooding
- EOR/IOR
- Gas lift
- Seismic 3D/4D
- PWRI

Integrated Platform – Workflow

Workflows:
- Numerical
- Analytical

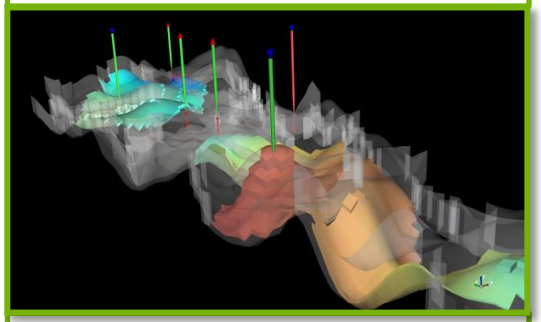
Tools
- Reservoir Simulation
- Surveillance
- Production forecast
- Data Analysis
- Production allocation
- Reporting

Multidisciplinary Collaboration
- Asset Manager
- Operation manager
- Subsurface team
  - G&G
  - RE / PE
  - Production eng.

Digital Oilfield - IO

Data & Analytical/Numerical Analysis

Numerical Analysis



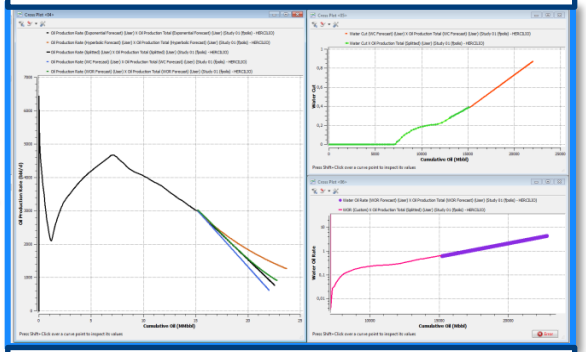
- Reservoir Modelling
- Simulation
- Characterization
- History Matching
- Production Network Optimization

Integration!!!

Objectives:

- Enhance integration (Single environment for all data)
- Minimize Data QA/QC process
- Improve/Optimize production
- Save time & cost

Analytical Tools

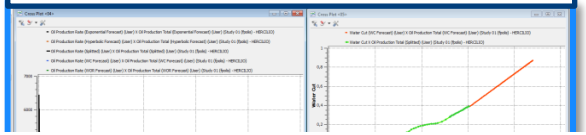


- Field surveillance
- Production forecasting
- Waterflood performance
- Material balance
- ….

Data & Analytical/Numerical Analysis

Numerical Analysis

Analytical Tools



Why not?

> *Poor data management costs major oil & gas producers up to 22% of their annual income*

Can we help you?

- integration (Single environment for all data)
- Data QA/QC
- Optimize production

NO?!

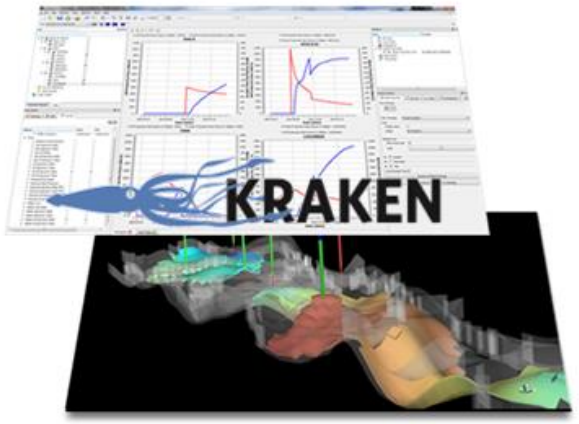
Are you achieving this objective ???

Integrated Workflow (Cost Efficient Tool)

Field

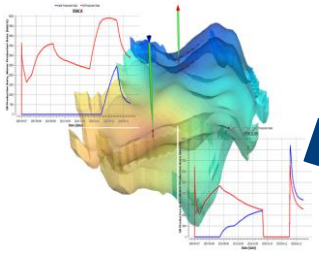
Real time data acquisition

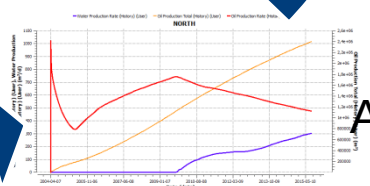
Data Analysis, QA/QC



Decision Makers

Numerical Models

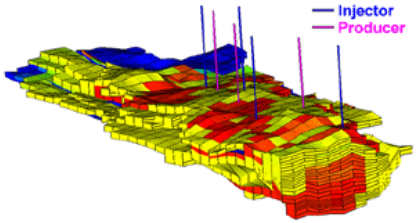




Analytical Studies

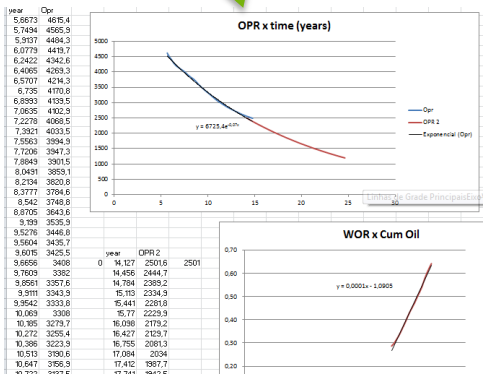
Integrated Workflow (Cost Efficient Tool)

Field data

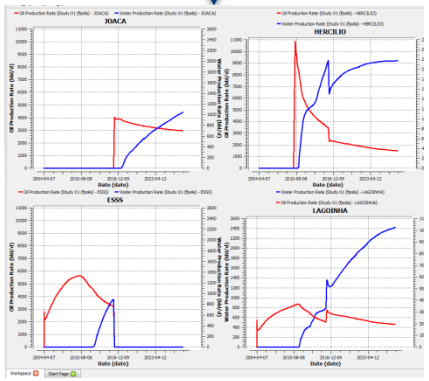


Simulated data

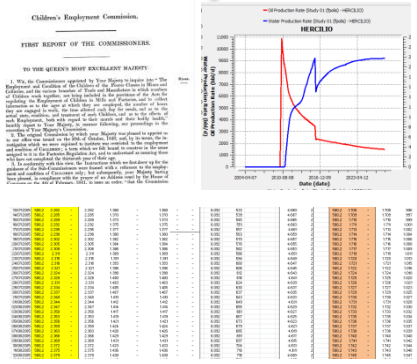
Report



- Analytical forecasts
- Plots, interpolations, macros
- Well level, block level and field level
- …..



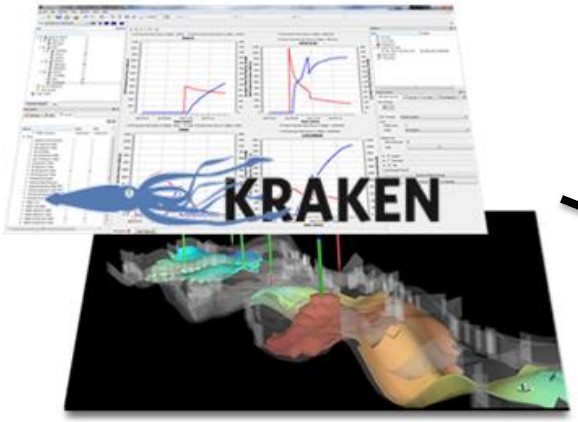
- 3D visualization & plots
- Model modification
- Numerical forecast
- History matching
- …..



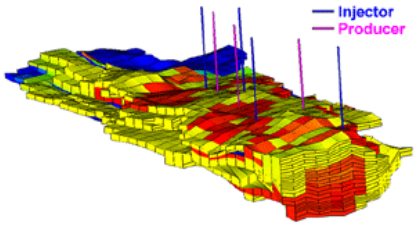
- Text
- Plots, graphs
- Spreadsheets
- Presentation
- Lots of manual work
- ….

Integrated Workflow (Cost Efficient Tool)

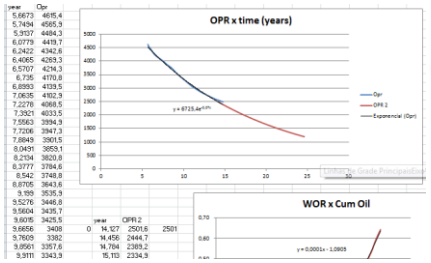
Field Data



Report



Simulated data

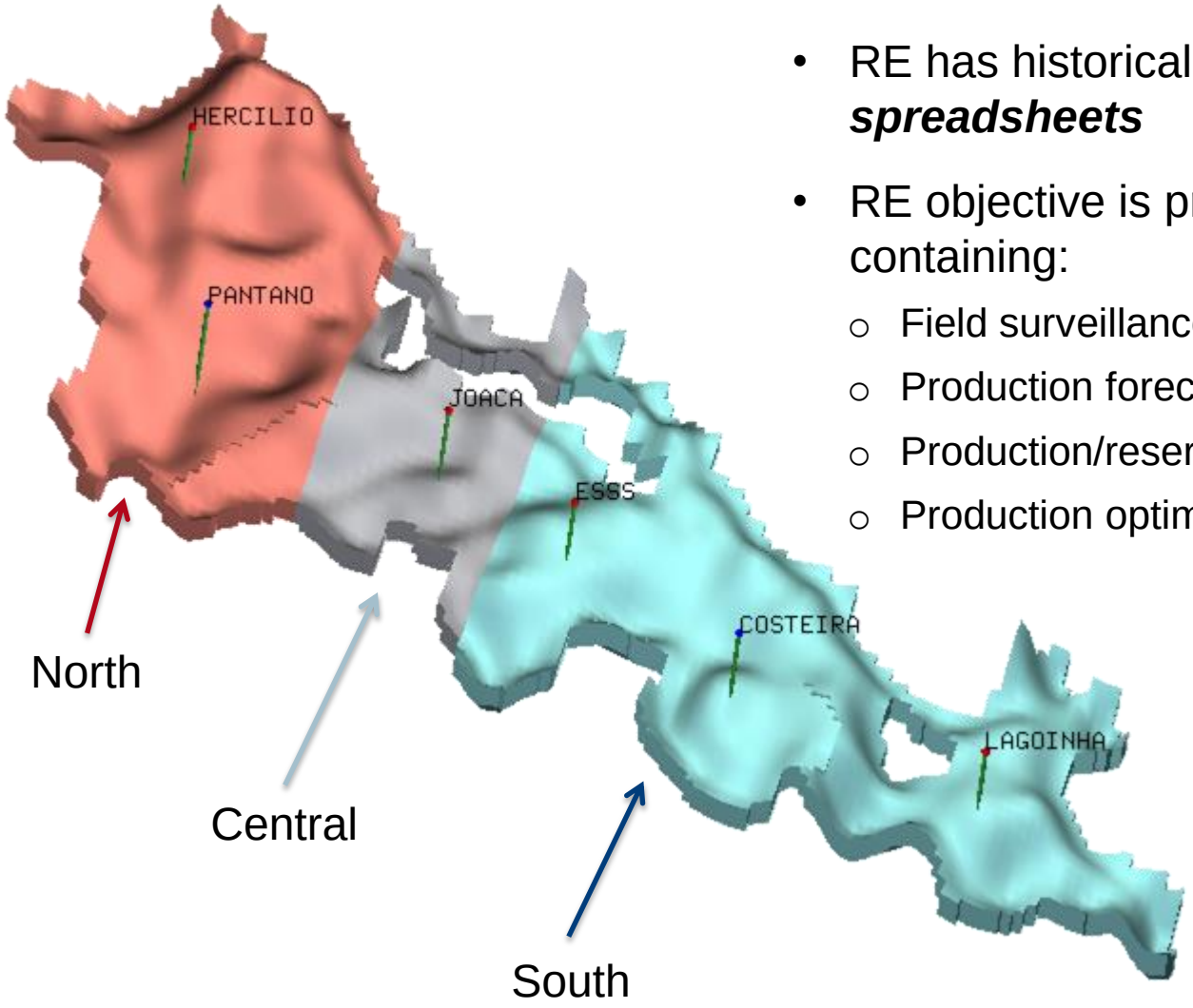


Other sources data

- Data QA/QC
- Numerical & Analytical production forecasts
- Plots, interpolations, macros
- Field surveillance - well, block and field levels
- 2D/3D visualization
- Model modification and multiple simulation comparison
- History matching

- Plots, graphs
- Spreadsheets
- Automated data extraction
- Automated report generation

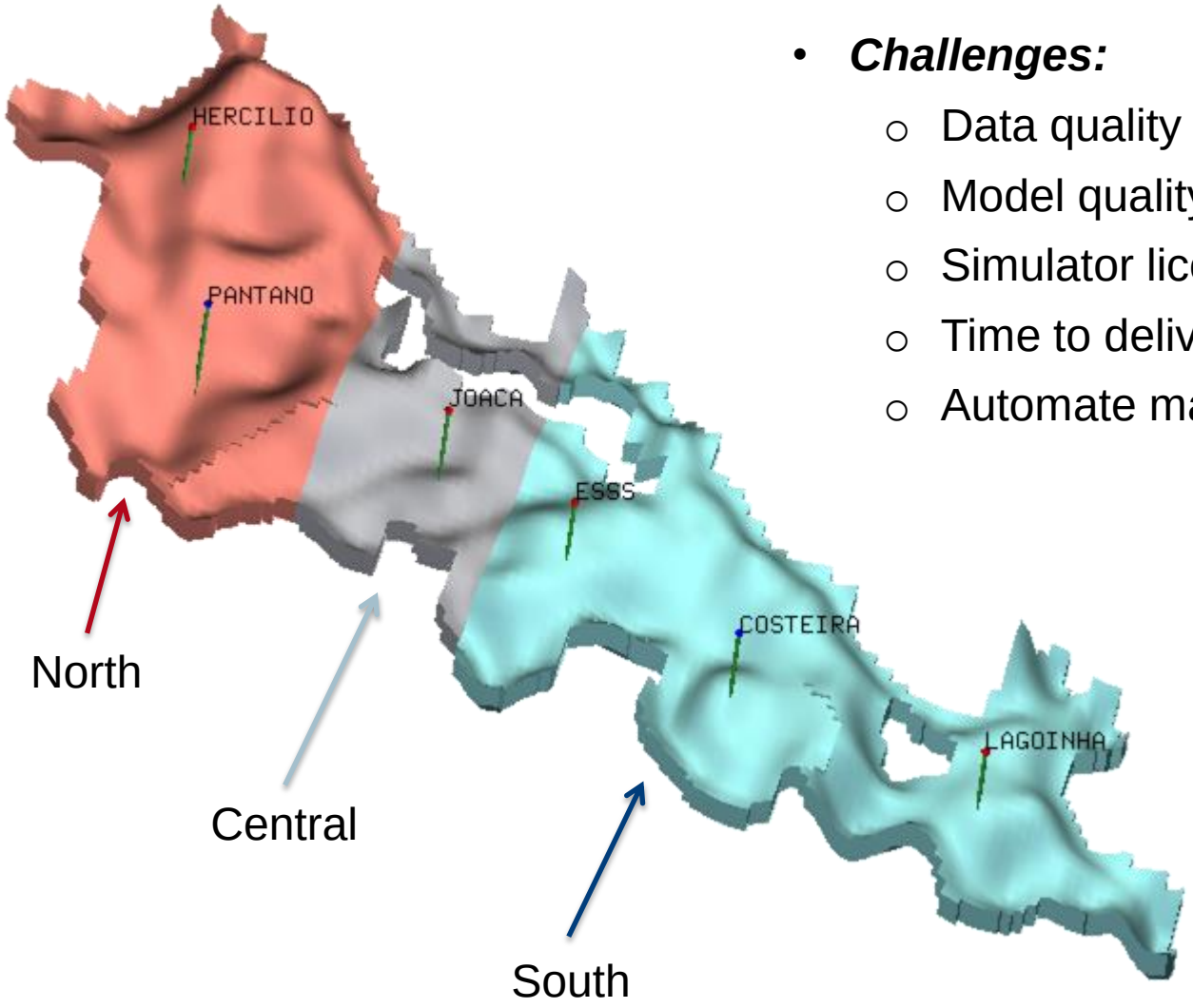
Case Study



- RE has a reservoir model run in a ***Reservoir Simulator***
- RE has historical data from the field in ***spreadsheets***
- RE objective is provide management a ***report*** containing:
  - Field surveillance performance KPIs
  - Production forecast (Numerical vs. Analytical)
  - Production/reservoir analysis
  - Production optimization recommendation

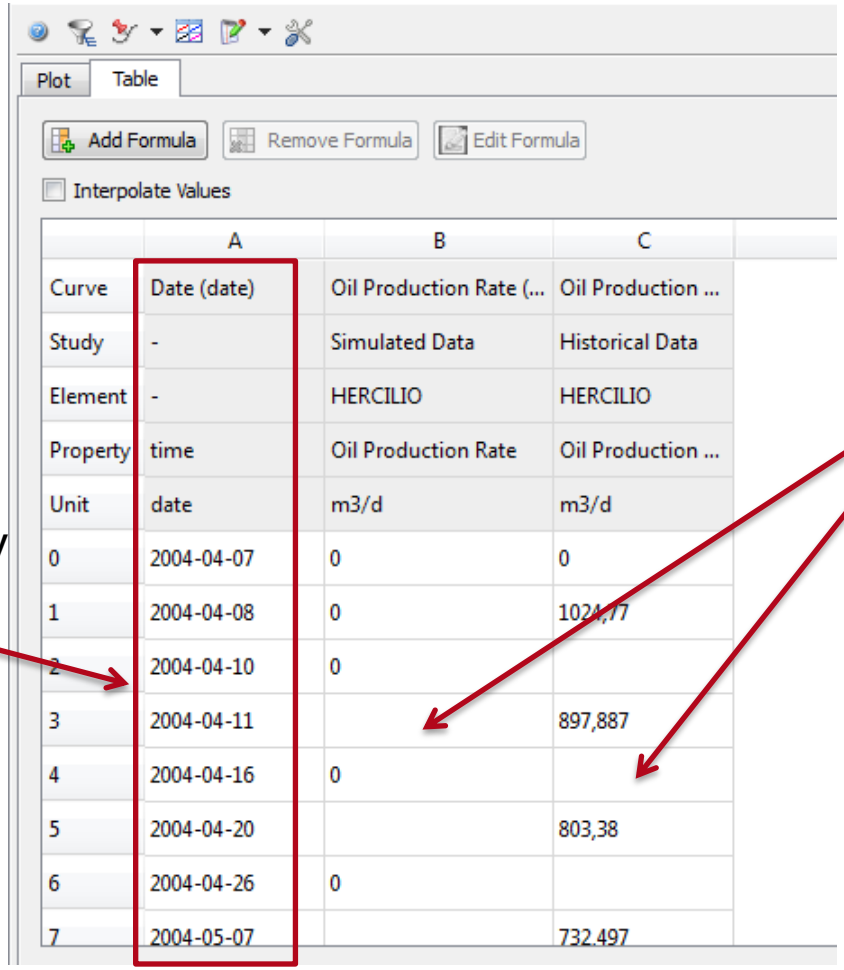
Case Study

- ***Task Deadline: 1 Week***
  - On or before COB – Friday.
- ***Challenges:***
  - Data quality
  - Model quality
  - Simulator license availability
  - Time to deliver
  - Automate manual processes



Case Study

- 1st step:
  - Import data from different sources and QA/QC (Field, block and well levels)
    - What is the sampling frequency needed (monthly, daily, weekly)



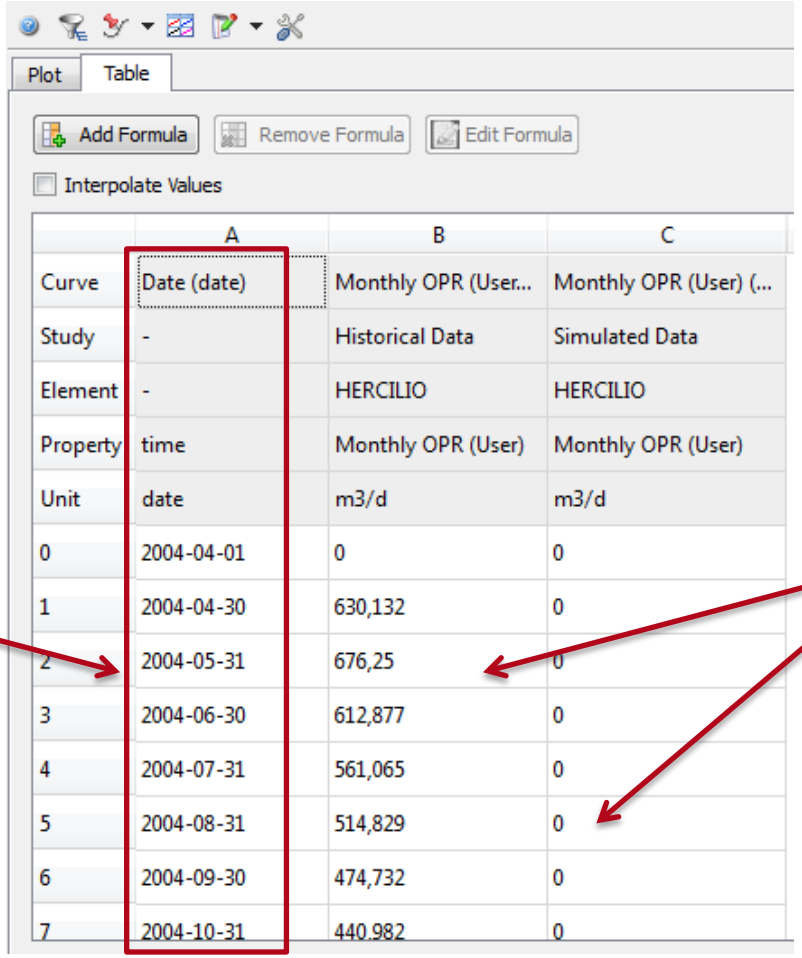
	A	B	C
Curve	Date (date)	Oil Production Rate (...	Oil Production ...
Study	-	Simulated Data	Historical Data
Element	-	HERCILIO	HERCILIO
Property	time	Oil Production Rate	Oil Production ...
Unit	date	m3/d	m3/d
0	2004-04-07	0	0
1	2004-04-08	0	1024,77
2	2004-04-10	0	
3	2004-04-11		897,887
4	2004-04-16	0	
5	2004-04-20		803,38
6	2004-04-26	0	
7	2004-05-07		732,497

Dates are randomly distributed

Data sampling from history and simulation does not match

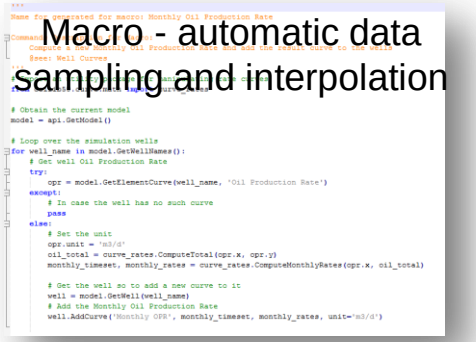
Case Study

- 1st step:
  - Import data from different sources and QA/QC (Field, block and well levels)
    - What is the sampling frequency needed (monthly, daily, weekly)



	A	B	C
Curve	Date (date)	Monthly OPR (User...	Monthly OPR (User) (...
Study	-	Historical Data	Simulated Data
Element	-	HERCILIO	HERCILIO
Property	time	Monthly OPR (User)	Monthly OPR (User)
Unit	date	m3/d	m3/d
0	2004-04-01	0	0
1	2004-04-30	630,132	0
2	2004-05-31	676,25	0
3	2004-06-30	612,877	0
4	2004-07-31	561,065	0
5	2004-08-31	514,829	0
6	2004-09-30	474,732	0
7	2004-10-31	440,982	0

Dates are monthly distributed

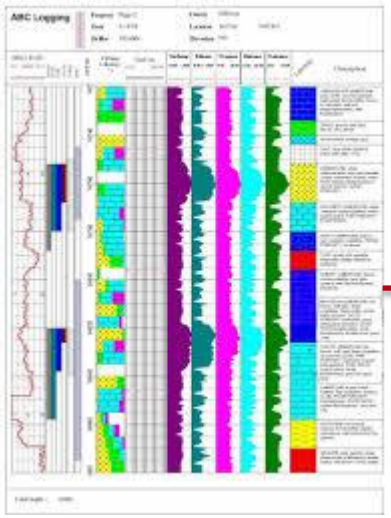


Macro - automatic data sampling and interpolation

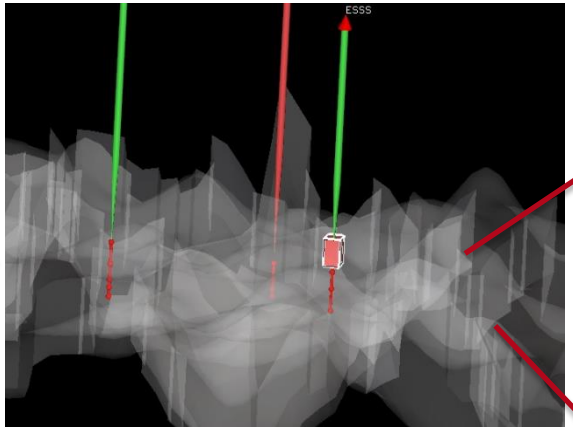
Interpolations were done to guarantee sampling compatibility

Case Study

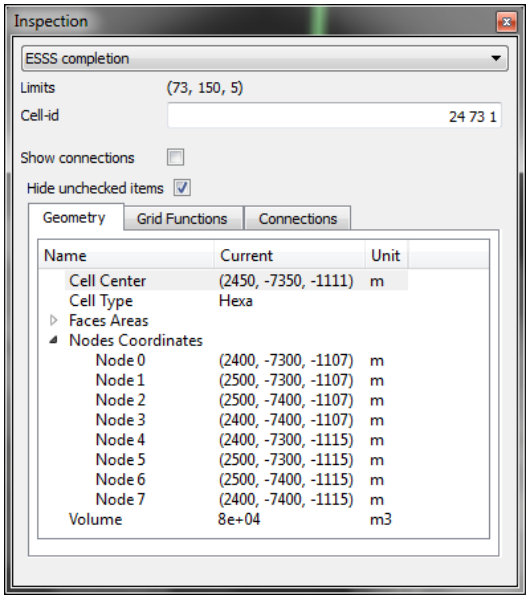
- 2nd step:
  - Simulation Model QC
    - Well position and perforation QC (logs vs. grids)



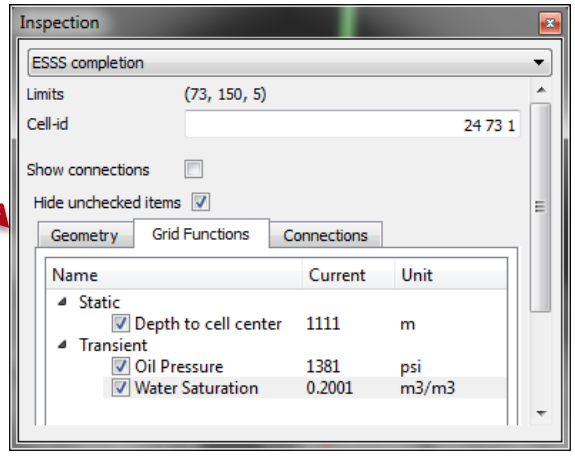
Well log



Simulation model –
Well completion selected



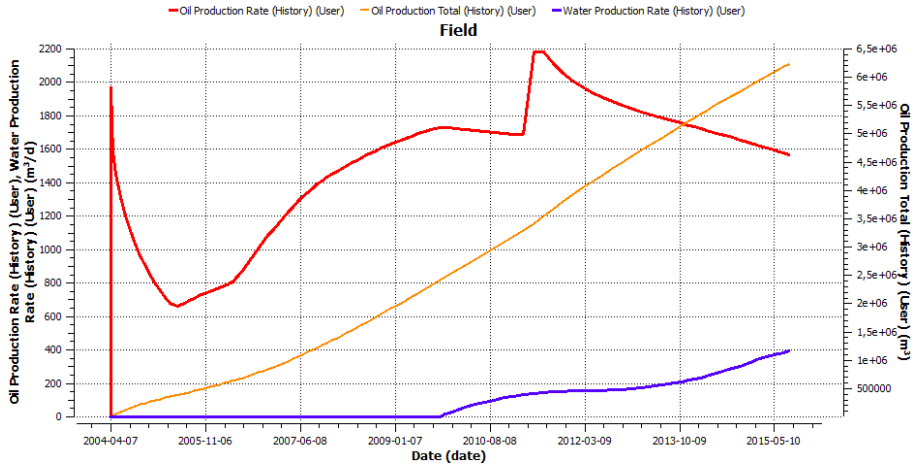
Geometric inspection

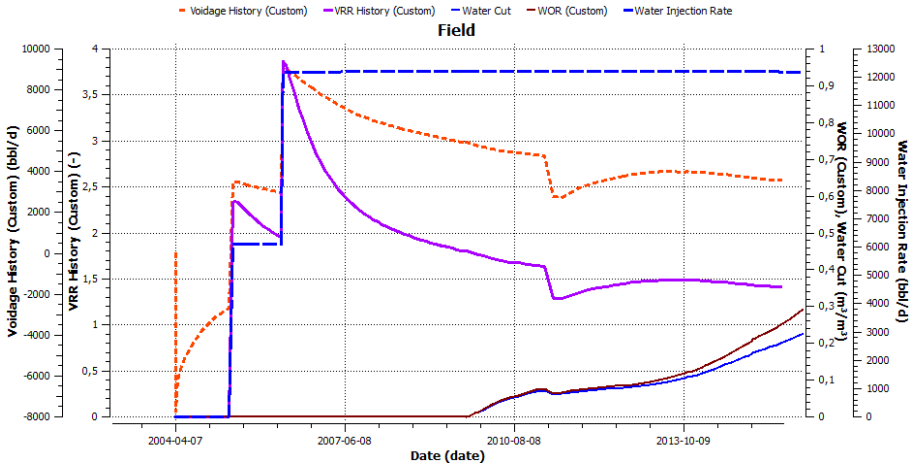


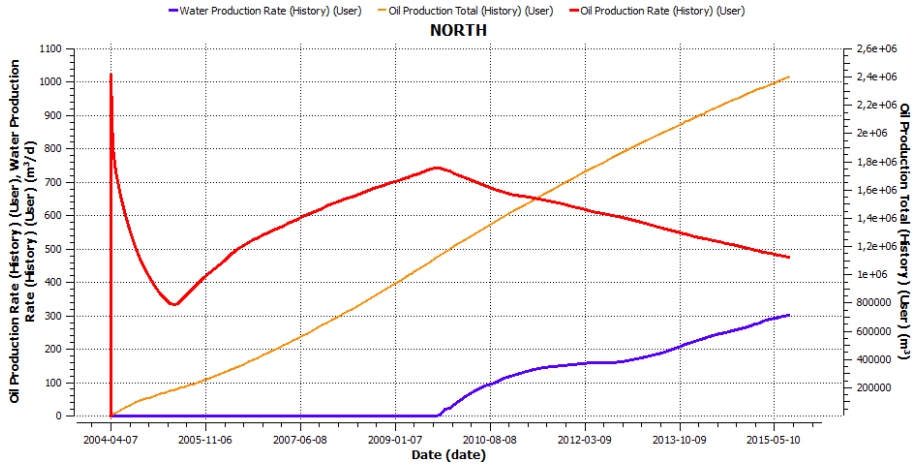
Property inspection

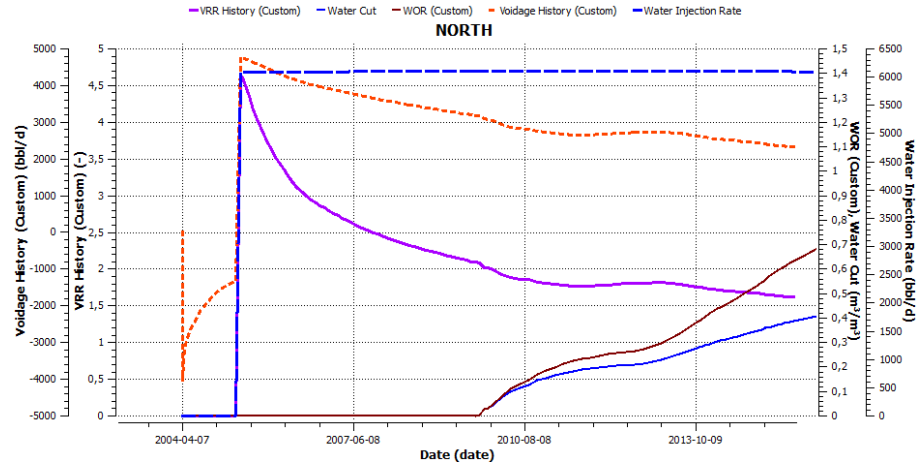
Case Study

- 3rd step:
  - Field surveillance and KPIs
    - Well, Block and field levels



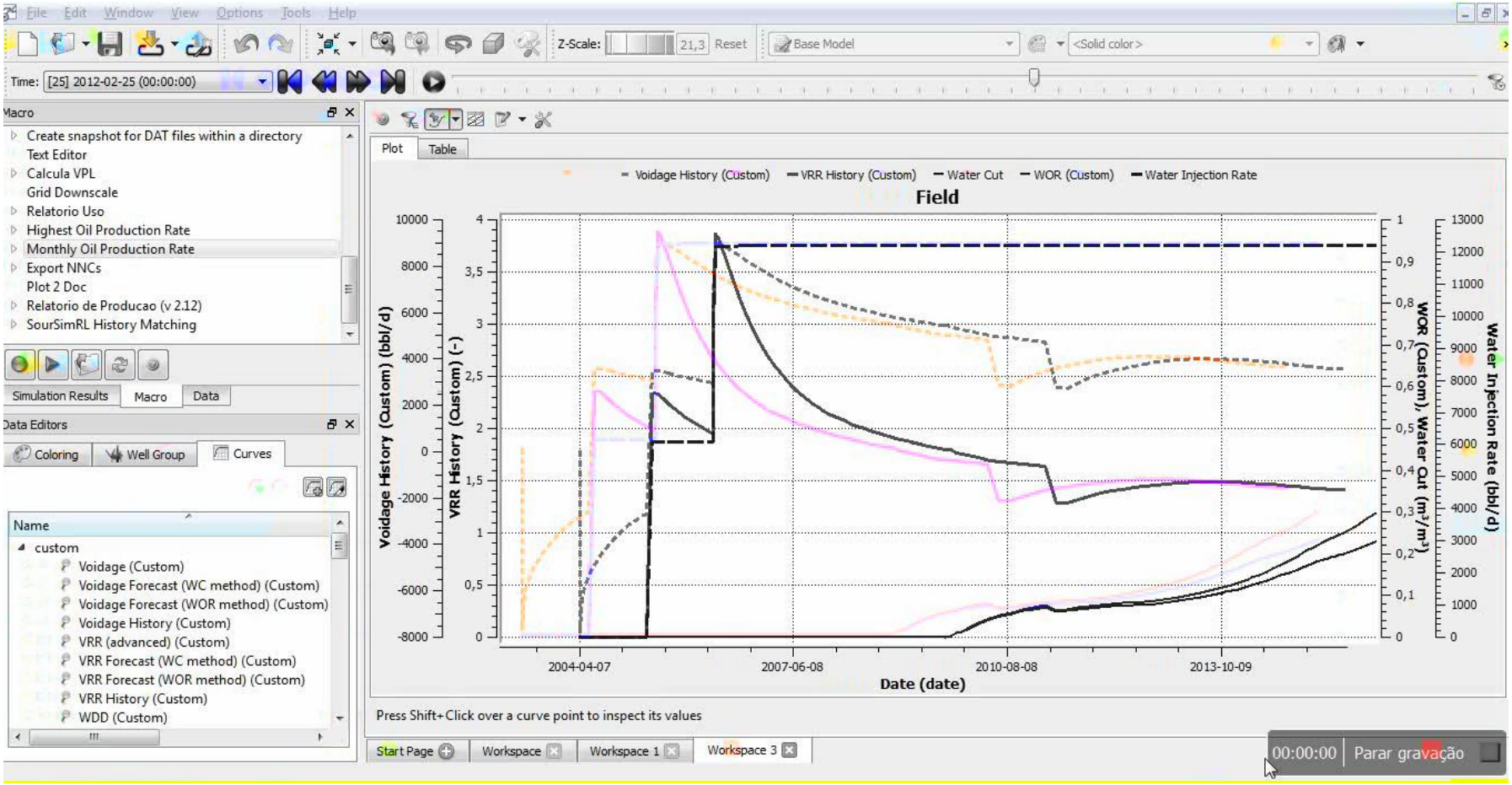






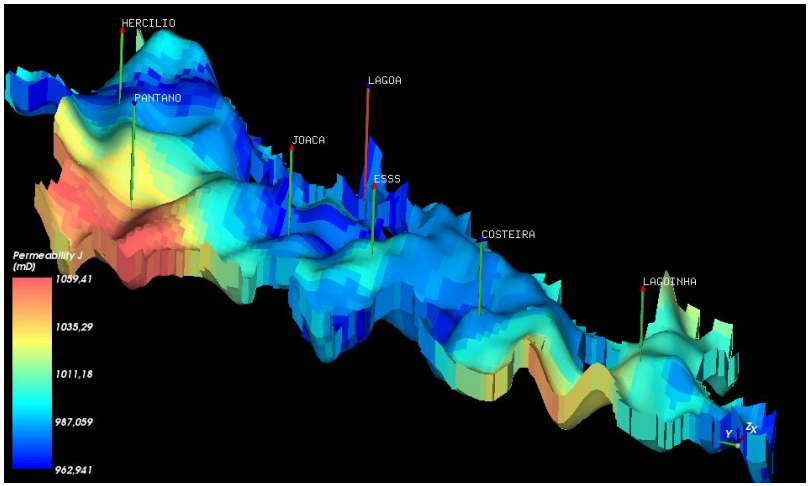
Case Study

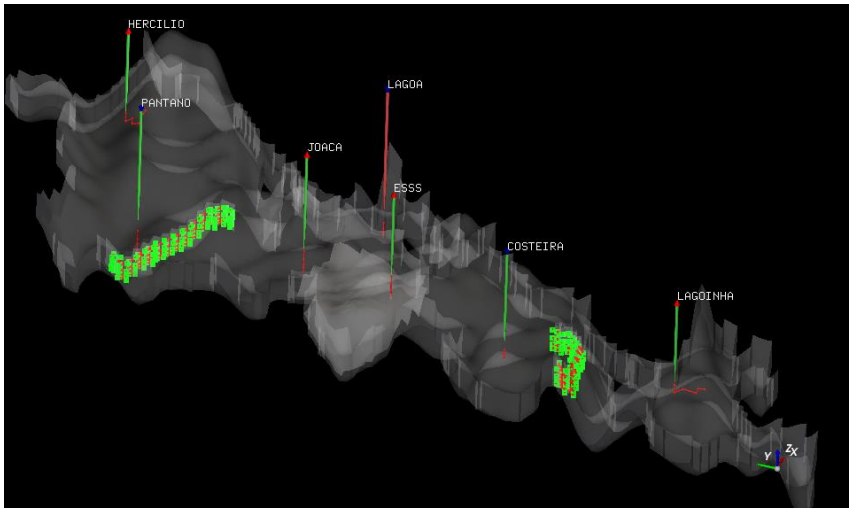
- 4th step:
  - Generate production forecast (Numerical vs. Analytical)
    - Well, block and field levels

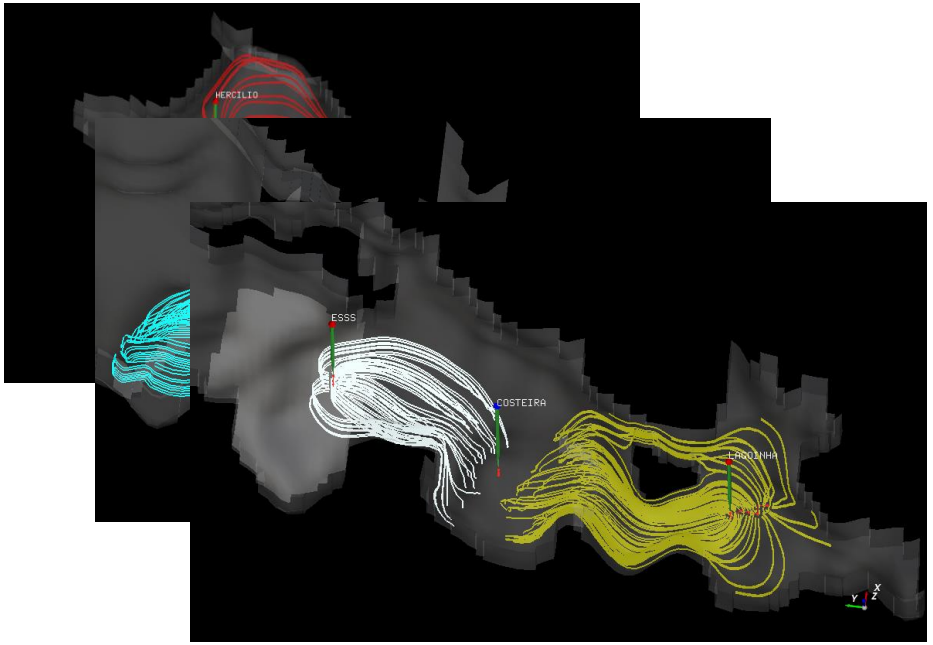


Case Study

- 5th step:
  - Production reservoir analysis
    - Fault system
    - 3D rock/fluid properties
    - Streamlines (Prod. / Inj. relation)

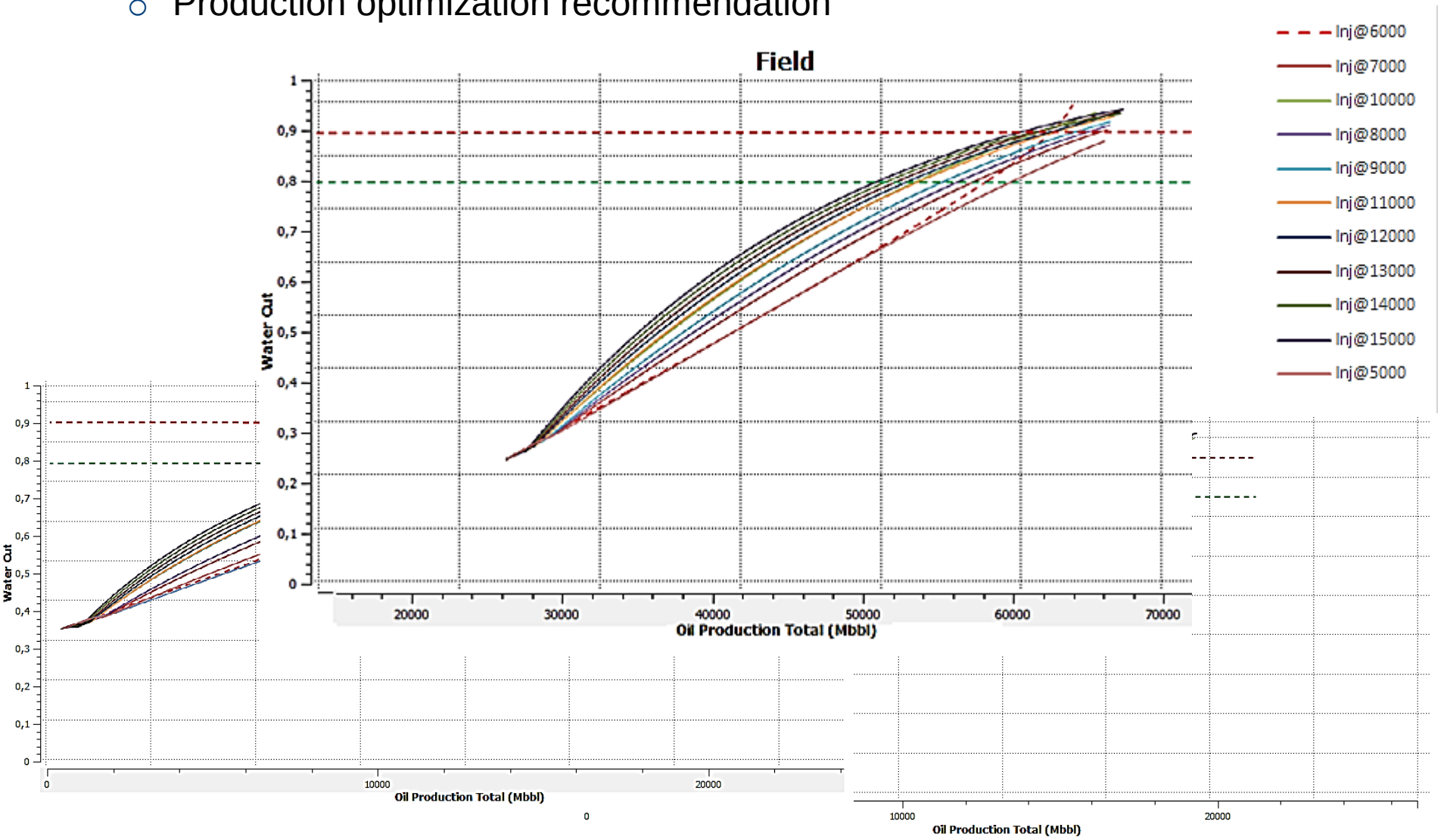






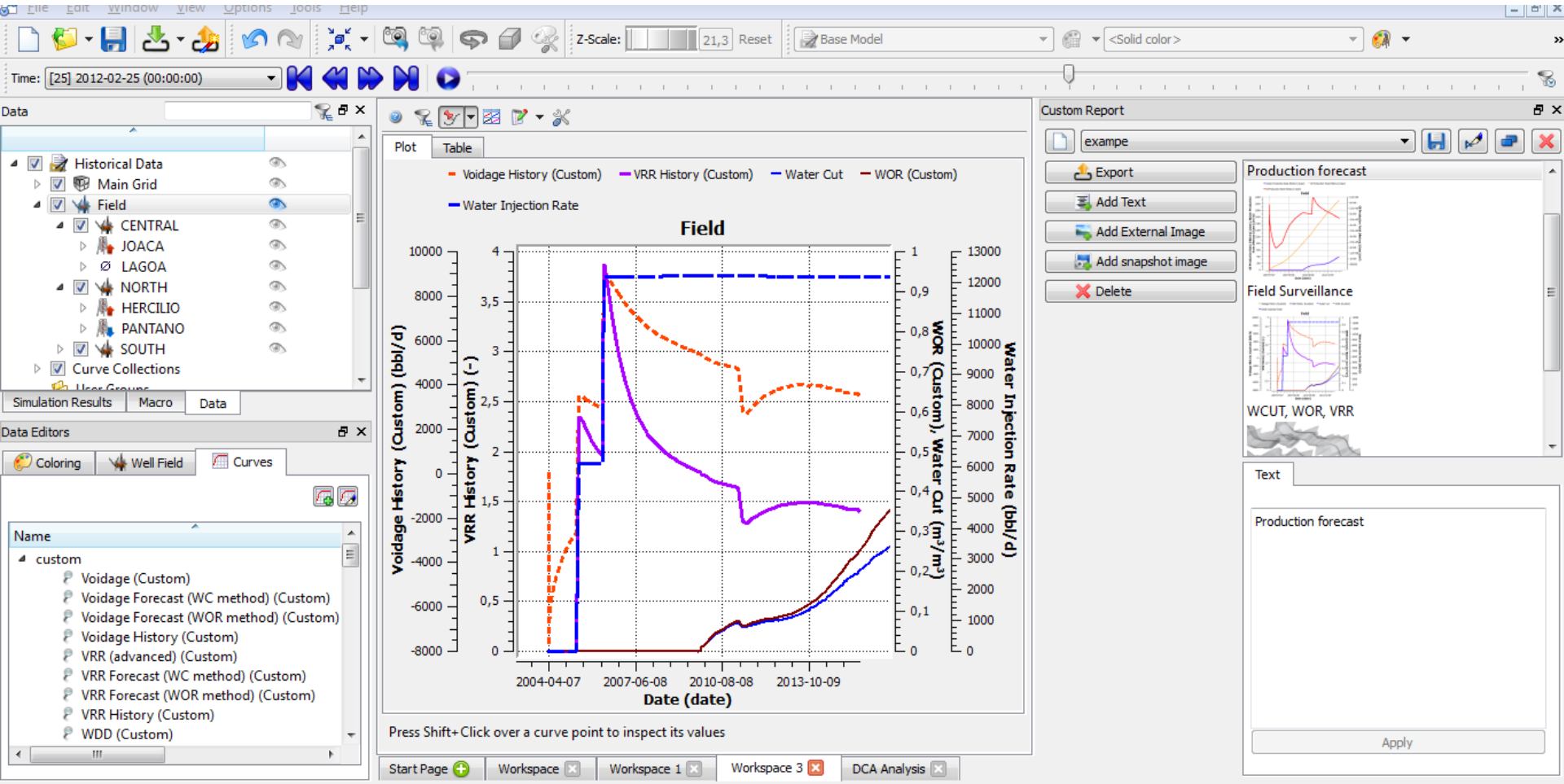
Case Study

- 6th step:
  - Production optimization recommendation

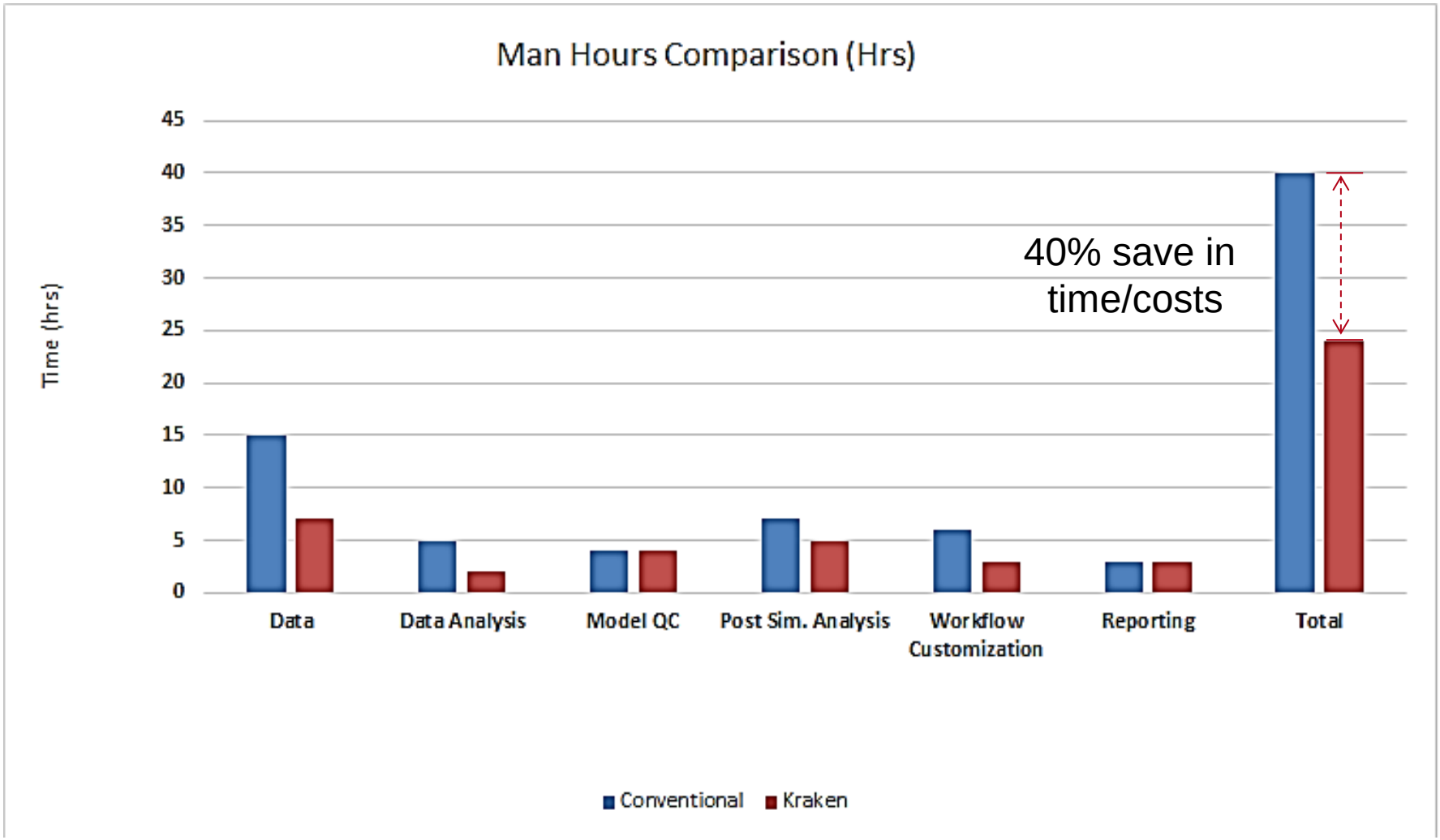


Case Study

- 7th step:
  - Report creation for asset management



Conclusion


Man Hours Comparison (Hrs)
Time (hrs)
45
40
35
30
25
20
15
10
5
0
40% save in time/costs
Data
Data Analysis
Model QC
Post Sim. Analysis
Workflow Customization
Reporting
Total
Conventional
Kraken

Why must things be so complicated ????

Yeah, did it way before the deadline and within budget.. Should I go play golf?

Any questions ?