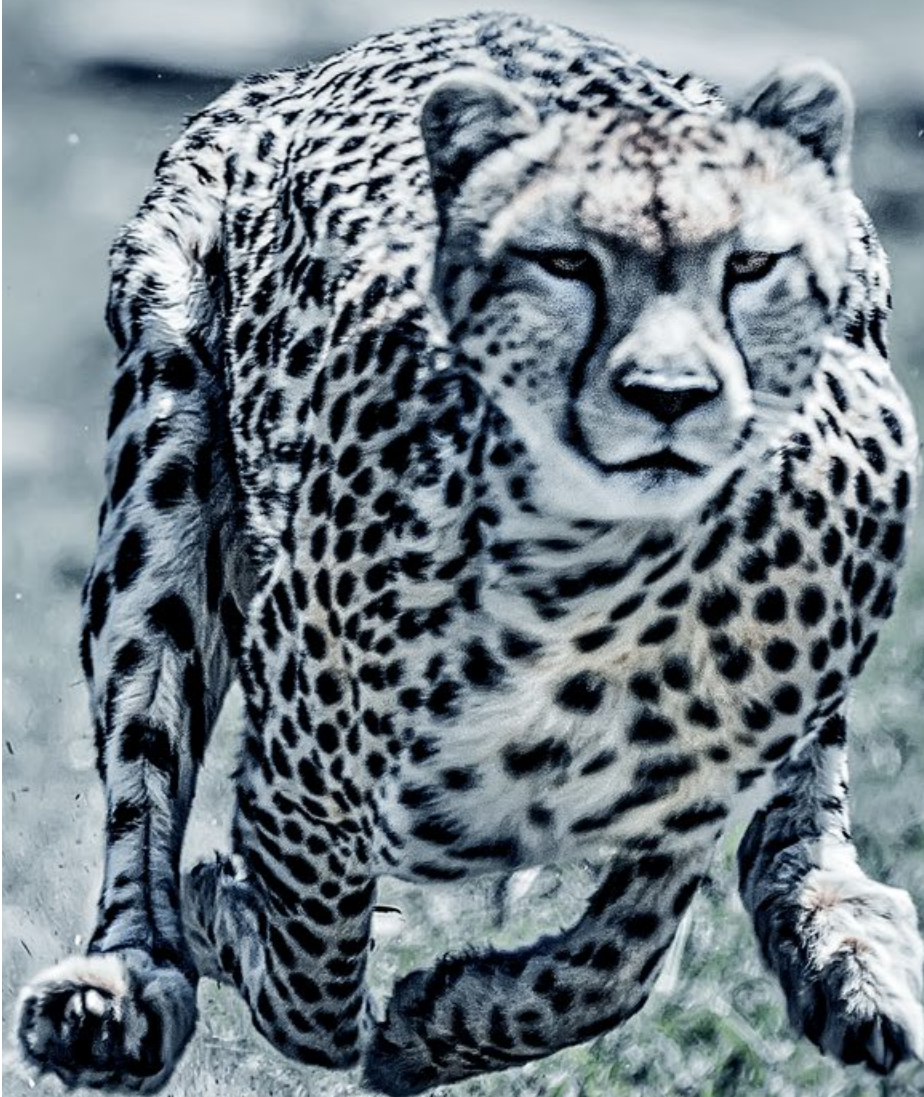# SenEx – SENSITIVITY EXPLORER

The Future of (Assisted) History Matching

FAST, FOCUSED, FLEXIBLE, FORWARD THINKING

The SenEx (Sensitivity Explorer) assisted history matching software improves the history match quality at well-level and significantly speeds up turnaround time.

It leads to high-quality, geologically consistent and calibrated reservoir models with typically less than 20 iterations, no matter how many parameters to tune, no matter how many wells to match, and no matter how long the history to match.

SENEX IS BASED ON ANALYTICAL ALGORITHMS RATHER THAN EXPERIMENTAL DESIGN

SENEX - HOW IT WORKS

There is no trial-and-error in SenEx. SenEx applies advanced mathematical techniques to compute sensitivities analytically, hence efficiently and fast. It focuses on the grid block level, therefore eliminates the need for box multipliers, leading to geologically sound and consistent models.

WILL SENEX IMPROVE YOUR HISTORY MATCH? YES.

WILL SENEX REPLACE EXPERT RESERVOIR ENGINEERS? NO.

But SenEx helps save experts' time during matching freeing them up for other mission-critical tasks. Using SenEx is easy to use and flexible to fit into most history matching workflows.
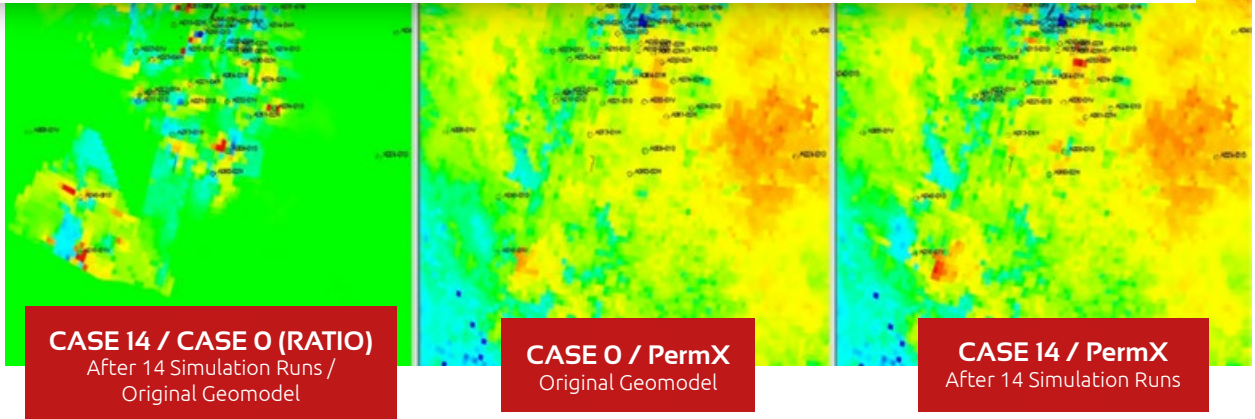
ACHIEVE A HISTORY MATCH WITH TYPICALLY LESS THAN 20 ITERATIONS. NO MATTER HOW BIG THE MODEL, HOW MANY WELLS AND HOW LONG THE HISTORY TO MATCH.
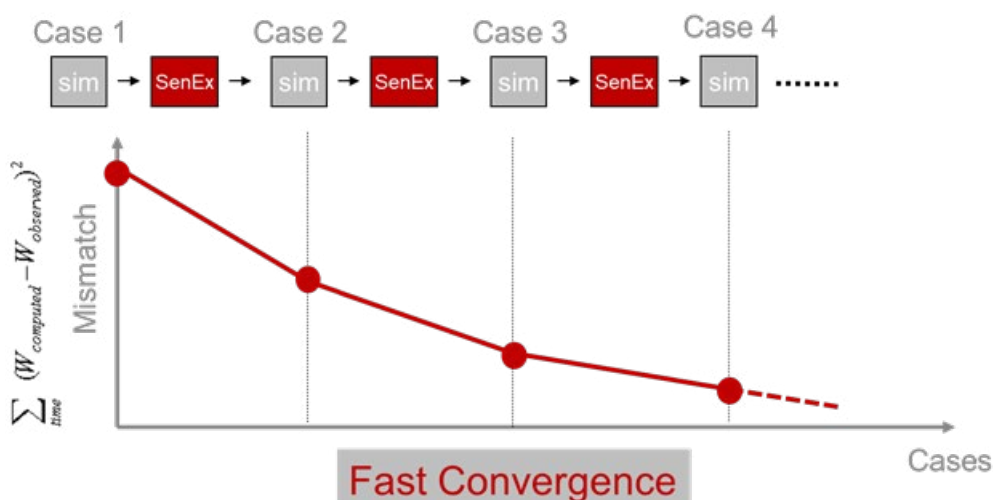
Only few iterations required to achieve a high-quality match.

WHAT MAKES THE DIFFERENCE?

Most history matching tools compute sensitivities by repeatedly running the simulator while varying the parameters. The number of required simulation runs increases dramatically as the number of parameters to be evaluated is increased.

CASE 14 / CASE 0 (RATIO)
After 14 Simulation Runs /
Original Geomodel

CASE 0 / PermX
Original Geomodel

CASE 14 / PermX
After 14 Simulation Runs

SenEx IS DIFFERENT

It treats every rock property at every grid block as individual parameter and analytically calculates how they affect the history match in a given simulation run. All sensitivities are calculated using only one (!) simulation run.

Based on these analytical sensitivities, SenEx captures what grid block properties need to be changed, where, and how, in order to improve the history match quickly. The changes are kept minimal: only as needed. This leads to geologically sound and consistent models.

WHY SenEx?

⌐ Reduces drastically the turnaround time of history matching reservoir models
⌐ Achieves superior well-level history-match quality with typically less than 20 iterations
⌐ Generates geologically sound and consistent reservoir models
⌐ Works at the grid block level eliminating the need for "box multipliers"
⌐ Supports various black-oil reservoir simulators

SENEX COMPUTES THE SENSITIVITIES OF ALL PROPERTIES OF YOUR RESERVOIR MODEL

SENEX Case14
SENEX Case 0
Manual HM

SENEX KEEPS THE CHANGES TO A MINIMUM. ONLY AS NEEDED.
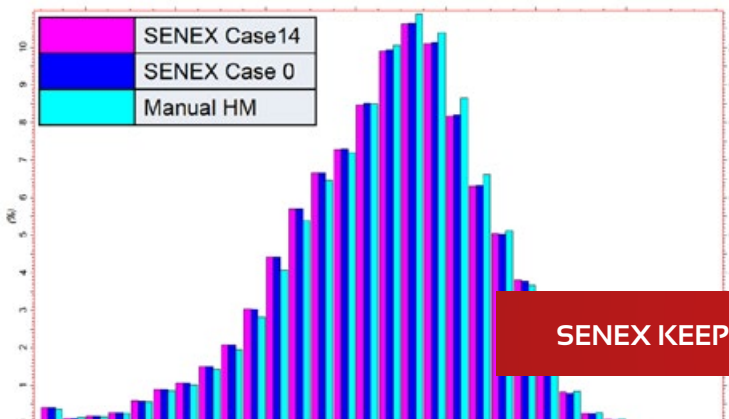
Permeability histograms remain largely unchanged

UNEQUALLED PERFORMANCE

SenEx MODULES

SenEx BASE
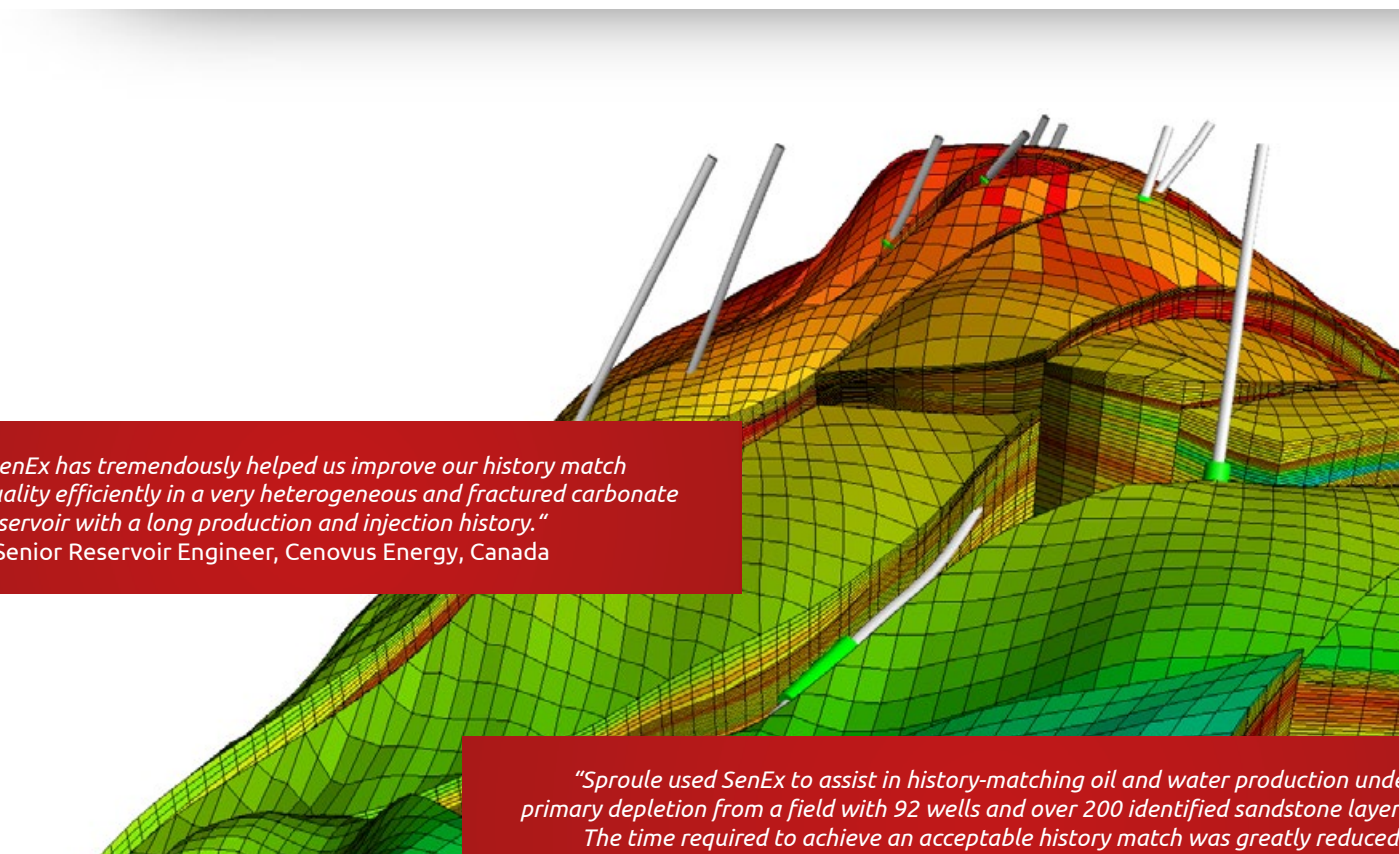The basic module for the sensitivity analysis

SenEx DUAL
The additional module for the sensitivity analysis of fractured reservoirs

SenEx GUI
The graphical user interface providing the workflow, easy objective function definition, parameter specifications & modifications and a flexible auto-loop function

KEY PUBLICATIONS

⌐ History-Matching with Sensitivity-Based Parameter Modifications at Grid-Block Level (SPE-131627)
Computer Assisted History Matching – A Field Example (SPE-165979)

⌐ Enhancing Reservoir Understanding in Mature Fields: Adjoint-State Method Applied in a Semi-Synthetic Model (SPE-184951)
Advanced Assisted History Matching of a Large Mature Oil Field Based on a Huge Number of Grid-Block Level Parameters and Saturation Functions (SPE-192780)

„SenEx has tremendously helped us improve our history match quality efficiently in a very heterogeneous and fractured carbonate reservoir with a long production and injection history."
– Senior Reservoir Engineer, Cenovus Energy, Canada

"Sproule used SenEx to assist in history-matching oil and water production under primary depletion from a field with 92 wells and over 200 identified sandstone layers. The time required to achieve an acceptable history match was greatly reduced."
– Senior Reservoir Engineer, Sproule Associates, Canada

ABOUT HOT

HOT Reservoir Solutions consolidates the HOT Energy Group's software development and licensing expertise.

Our flagship product SenEx (Sensitivity Explorer) is a game-changer for assisted history matching. High-quality, geologically consistent history matched models are achieved with less than 20 iterations, no matter how many parameters to tune, how many wells and how long the history to match.

SenEx has been developed continuously over more than a decade and applied successfully in numerous field studies in different parts of the world.

The HOT Energy Group is a technology driven, multidisciplinary and independent organisation. With more than three decades of specialist experience in the subsurface domain, HOT's disruptive innovations, pioneering workflows and integrated solutions help to minimise exploration and field development risks.

BENEFIT FROM OUR RESERVOIR SIMULATION TOOLS AND SERVICES

WE...

- ⌐ …license (perpetual or rental) our SenEx assisted history matching software package. Experience yourself the power of SenEx helping you achieving a high-quality well-level history match in a short time.
- ⌐ …support you with your reservoir modelling exercise guiding you through your history matching challenge.
- ⌐ …run your simulation case utilizing SenEx to achieve a high-quality well-level history match. All you need to do is to provide us your case, then relax and enjoy the results. SenEx experts will do the job for you!
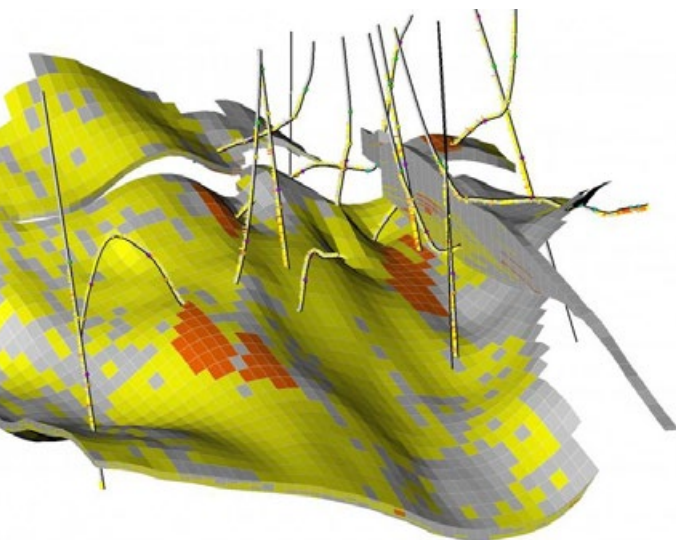
THE WAY TO YOUR SENEX EXPERIENCE

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