

MEPO Multiple Realization Optimizer

Make optimal reservoir decisions—fast

APPLICATIONS

- Probabilistic, multiple realization approach for optimized decision making and risk mitigation
- Optimizing field development plans, well-injection strategies, gas-lift and EOR strategies, and number and location of wells
- Assisted history matching
- Uncertainty assessment

FEATURES AND BENEFITS

- Automation of any modeling and simulation workflow
- Evaluation of the full range of development options
- Quick quantification of uncertainty and response parameter contributions
- Unrivalled history matching capabilities
- Robust production forecasting, incorporating subsurface uncertainty
- Efficient well-screening functionality

As the complexity of fields intensifies and margins tighten, making optimal field development decisions and understanding risks is critical. Reservoir simulations are a key tool in this process. Managing uncertainties in the geomodel and organizing the hundreds or thousands of simulations required to test possible predictive development scenarios is a challenge.

The MEPO* multiple realization optimizer works in conjunction with simulation engines using a powerful run management system—enabling you to achieve better and faster results. By bringing science, structure, and objectivity to simulation projects, the MEPO optimizer enables geoscientists and engineers to evaluate the full range of options, to fully understand and manage development and production challenges.

Multiple realization workflows

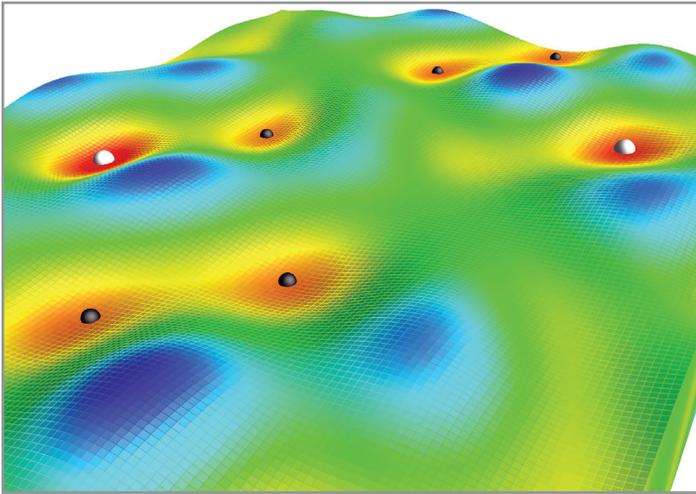
Computer modeling of oilfield processes is widely used to understand and predict how reservoirs, wells, pipeline networks, and fluids will behave as fields are developed and produced. While they are valuable tools for testing multiple development plans and predicting potential problems, they inherently deal with single-case scenarios.

Making decisions based on a single model realization is unlikely to optimize either project income or cost, which is why SPE guidelines recommend developing multiple realizations for production forecasts. E&P companies using multiple realization workflows for their decision making report up to a 20% improvement of the net present value (NPV) in their projects.



The MEPO optimizer provides multiple realization workflows.

MEPO Multiple Realization Optimizer



The MEPO global optimizers find multiple solutions covering the full search space.

The MEPO optimizer facilitates easy generation of a set of alternative, credible, and dynamic reservoir descriptions, and provides a range of tools to optimize decisions. You can optimize any reservoir model for any objective, including cumulative production, number of wells, NPV, injection volumes, gas lift, and enhanced oil recovery.

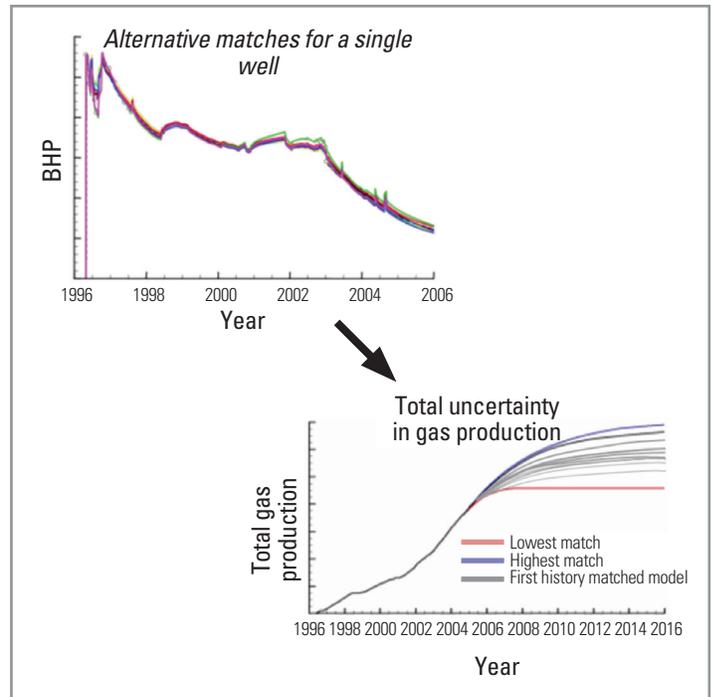
Probabilistic production forecasts

A primary benefit of the MEPO multiple realization approach is more robust and reliable production forecasts. Instead of basing predictions on a single base case, the MEPO approach generates a range of alternative predictions, all honoring the uncertainties of the model or the production history, within the user-defined ranges. These models are then run in prediction mode, yielding an envelope of possible outcomes from which accurate P10/P50/P90 forecasts can be extracted with quantifiable reliability.

Accelerated history matching

Calibrating the simulation model to the observed production history is an essential first step when dealing with fields on production. Due to the difficulty of getting good quality matches for all parameters, this history matching process inherently has multiple solutions and is notoriously time consuming. The MEPO optimizer produces significantly better quality matches and typically reduces project turnover time from months to weeks—or weeks to days. Its global optimization technology supports discovery of multiple plausible alternative-match solutions.

The MEPO optimizer provides a structured history matching approach, in which a wide range of parameters are considered simultaneously to produce more geologically realistic solutions. This reduces the need to introduce physically impossible or geologically unreasonable artifacts to achieve a good match. Taking alternative credible model realizations into account introduces a new dimension to production planning and forecasting: less guesswork and assumptions, more objectivity and trustworthiness.



Find multiple alternative history matches—when used to forecast future behavior, these models demonstrate the true range of outcomes for the reservoir.

Production plateau optimization

Any parameter output from a simulation model can be treated as an optimization objective by the MEPO optimizer. Often, the goal of reservoir management is simply to maximize cumulative hydrocarbon production, but other factors such as minimizing water cut or injection on specific wells can also be important objectives. The MEPO optimizer can calculate plateau length from a simulation profile, and use this as the optimization objective—finding the best strategy to keep the field on production plateau for as long as possible.

Well screening

The MEPO well-screening functionality is designed to simplify and accelerate well-location studies. Wells are evaluated based on performance indicators along the well path, such as reservoir permeability and oil saturation, allowing rapid screening of hundreds of well locations without having to run full-field simulations. Based on these results, the most promising locations are then tested in full reservoir simulations to verify and refine the location and well geometry.

Optimization under uncertainty

Clearly, there is uncertainty associated with most decisions proposed by geoscientists and petroleum engineers. The overall uncertainty is often large as it accumulates from numerous disciplines. Although eliminating uncertainty is almost impossible, the MEPO optimizer gives you the tools to understand and manage it. Users can undertake rigorous optimization under uncertainty to make optimal decisions for field development plans, drainage strategies, and well placements with a clear understanding of uncertainties.

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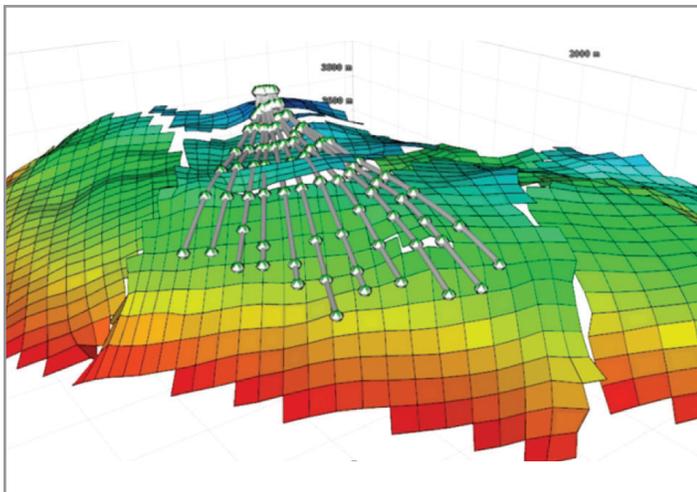
Proxy modeling

Proxy models make it possible to explore a large number of parameter combinations quickly, and are extremely useful tools to supplement full numerical reservoir or production simulations. Proxy models can be used in an analysis context to reveal parameter relationships, both in an optimization context to rapidly search for promising solutions, and in a result-processing context to derive result distribution functions and probability percentiles.

The main challenge when using proxies is to achieve sufficient correspondence between proxy models and the full simulation model. This correlation must be strong for both simulation runs included when deriving proxies, and a wider set of parameter combinations. To meet the requirement of solid predictive power, the MEPO optimizer features a comprehensive set of proxy approaches: polynomial regression (response surface) models, kriging and neural networks, plus capabilities to transparently analyze and evaluate proxy model qualities and predictability.

Full range of optimization problems solved

Different problems require different optimization approaches—for example, while some homogeneous reservoirs can be adequately matched with a proxy model approach, others require something more robust, such as an evolution strategy or genetic algorithm method. Experience shows that there is no single optimization method that will solve all reservoir problems. This is why the MEPO optimizer provides a full range of global optimization techniques, so that you have the full set of options available for any reservoir optimization challenge.



Well screening within the MEPO optimizer.

The MEPO optimizer is fully compatible with the ECLIPSE* industry-reference simulator and the INTERSECT[†] next-generation reservoir simulator, as well as many proprietary oil company simulators. It can also be used on steady state and dynamic flow models (the PIPESIM* production system analysis software and OLGA* multiphase flow simulator) and economic calculations (Merak* petroleum economic evaluation and decline analysis software).

Petrel integration

The MEPO Link plug-in allows engineers to implement tightly integrated workflows driven by the MEPO optimizer in conjunction with the Petrel* E&P software platform, and the ECLIPSE and INTERSECT reservoir simulators. The plug-in enables reservoir engineers to work in concert with geoscientists to use reservoir input data consistently and reliably. Geological parameters key to history matching flow models—such as fault positions and transmissibilities—can be varied with guaranteed consistency between static and dynamic flow models. This workflow also results in significant time savings by automating the process of varying all relevant parameters.



The advanced graphical data analysis tools of the MEPO optimizer make understanding your reservoir simpler.

MEPO Multiple Realization Optimizer

Advanced graphical data analysis tools

In addition to providing easy access to powerful uncertainty analysis and optimization techniques, the MEPO optimizer also provides an extensive graphical data-analysis toolkit. As it runs, the optimizer builds a database of simulation results that can be evaluated and analyzed in a variety of ways. This provides better understanding of input data and simulation results, and how relationships between input parameters affect reservoir and flow behavior.

Better decisions—faster

The MEPO optimizer enables you to spend less time and simulation resources on basic data preparation and case management, and instead use your time for evaluating development and production options. Combining simple-to-understand workflows with advanced technology, the MEPO optimizer makes it easy to understand uncertainties, mitigate risk, and make better, faster reservoir-management decisions.

E-mail sisinfo@slb.com or contact your local Schlumberger representative to learn more.

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