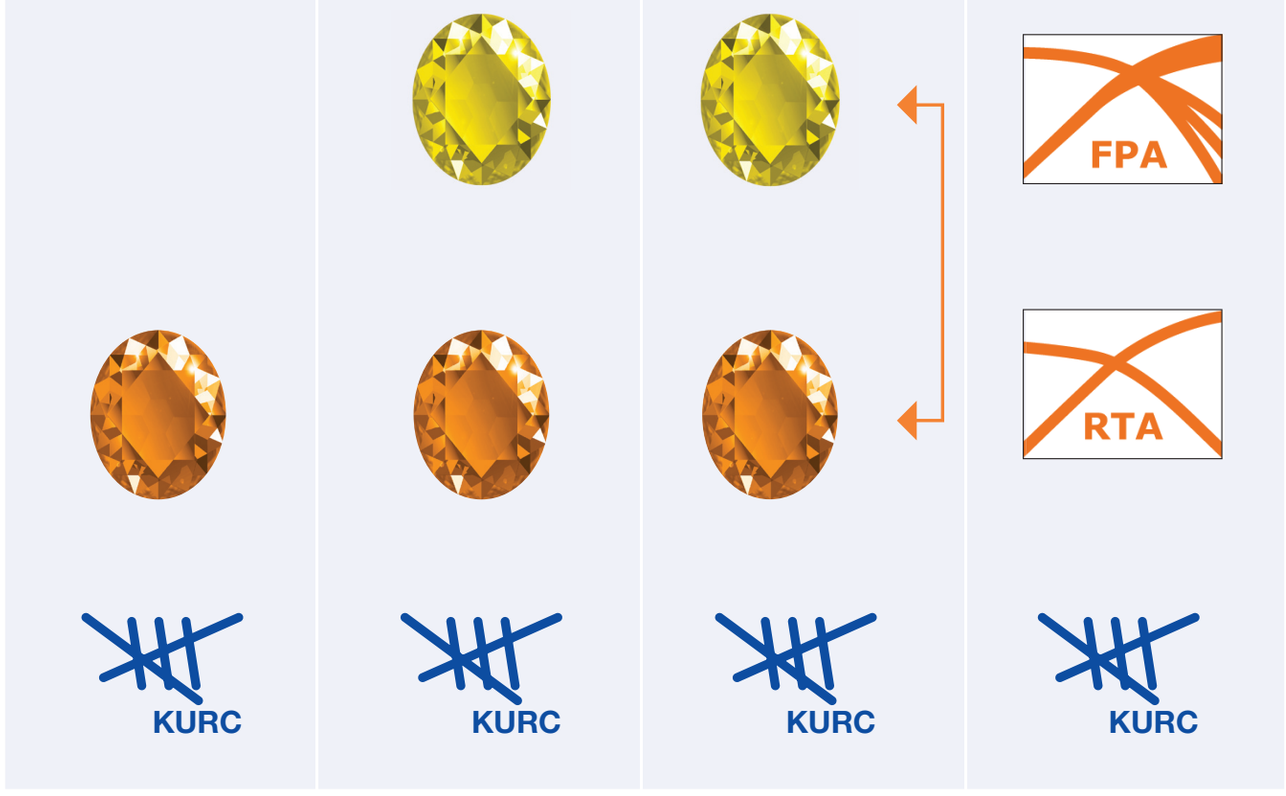
Unconventional Resources

KAPPA

The need for rigorous physics in Unconventional Resources



In the dash to gas it has been tempting to use or to ‘bend’ traditional methods to fit reality in the belief that some answer is better than none.

The KAPPA approach is to remain true to technical rigour, understanding the real physics as far as possible. Then to produce a roadmap of tool development culminating in the planned release of an integrated unconventional resources workflow that can be trusted.

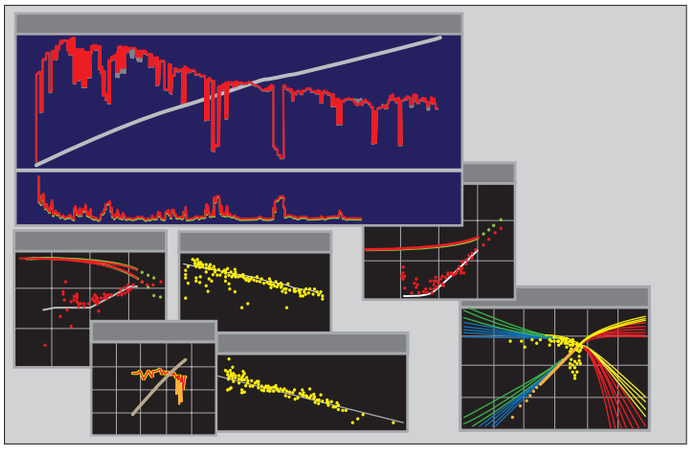
Unconventional Resources bring their own unique technical issues, there are hundreds, sometimes thousands of wells to deal with, often with limited human resources.

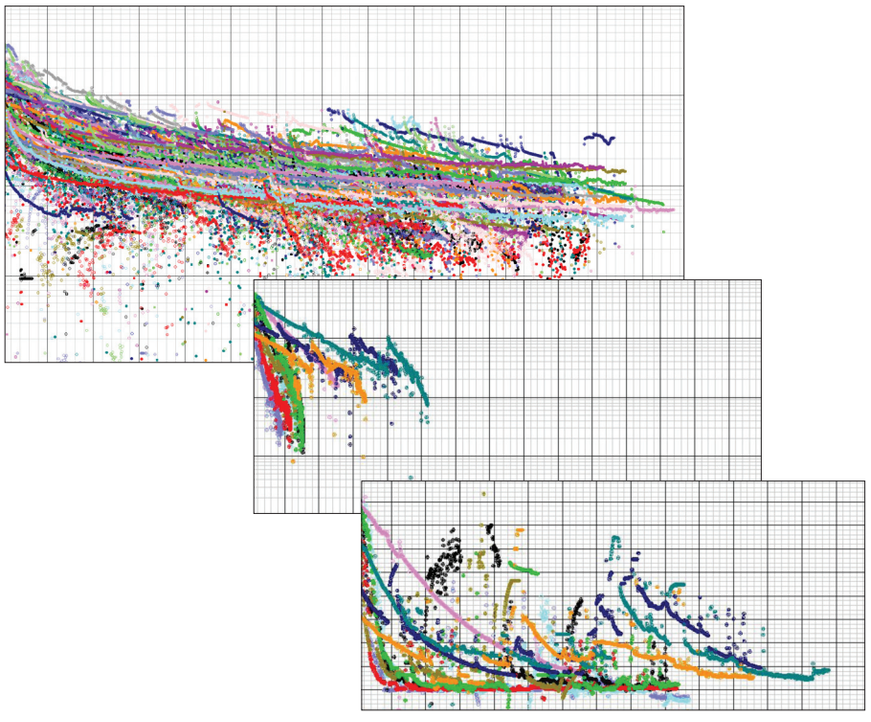
Extreme pressure gradients and consequent nonlinearities, exotic flow regimes and complex, sometimes unknown well geometries mean it is now common knowledge that conventional decline techniques are irrelevant when modeling and analysing Unconventional Resources.

Long-term deviation from conventional methods can lead to dramatic errors in production forecasts and the technical evaluation of reserves.

This document outlines the KAPPA development plan, the tools currently available and the planned commercial development milestones.

Topaze NL and Citrine





Topaze NL

An industry standard decline analysis software, globally there are over 2000 active licenses of Topaze NL offering an extensive analytical and non-linear numerical model library allowing users to create reliable history matches and forecasts.

Topaze NL is routinely used by clients in Unconventional Resources for precise single well modeling. This model is then used as a proxy for multiple wells within the field.

An important development will be the connection to Citrine and the ability of the two modules to share forecasts. By doing this the rigorous physics modeling in Topaze NL will be simply propagated to the multiple wells ‘of type’ in the wider field model offered in Citrine.

Citrine

DeGolyer & MacNaughton and KAPPA have been collaborating to produce a tool for the rapid load of mass public, client or simulation sources for processing of multiwell data. Originally a D&M development, Citrine is particularly suited to the Unconventional Resource workflow.

Using visualization, trend identification and multiwell comparison the user can fully understand and interpret field performance using diagnostics and decline curve analysis. An option generates a statistical curve that can then be used as a type well for decline analysis on a wider scale. Citrine will also be able to transfer single well data to Topaze NL, retrieve the analytical or numerical forecast from Topaze NL and use it as a seed for multiwell analysis and forecast. For members of the KAPPA consortium on unconventional resources (KURC), Topaze NL will be able to transfer back to Citrine the simulations of the KURC models.

Historical data, model results and EUR can be exported to Excel for use in industry standard databases for P10/P50/P90 forecasts.

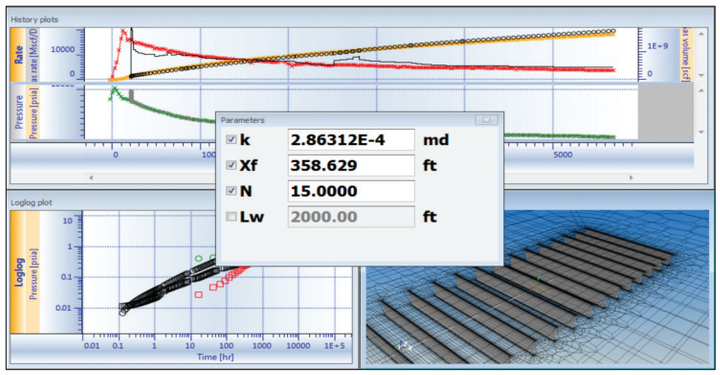
NEW! in 2015

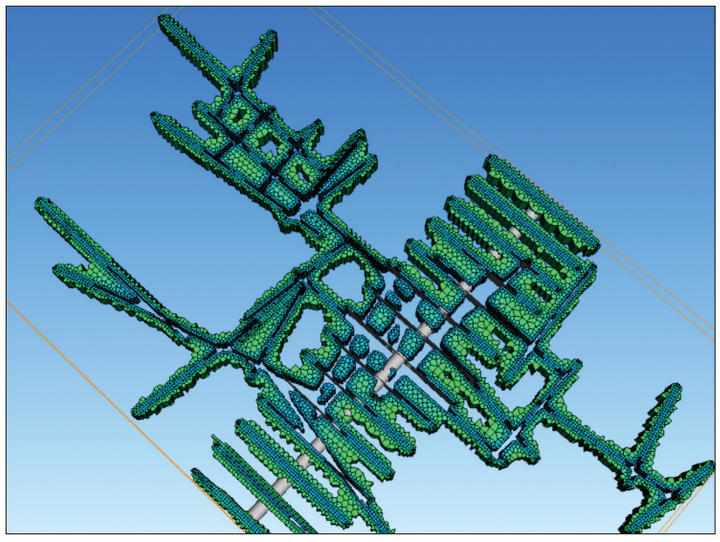
Field Production Analysis + Rate Transient Analysis
FPA + RTA (KURC option)

FPA

RTA

KURC





FPA + RTA (KURC option)

KAPPA software is undergoing a major rewrite to port to .NET. This will bring a greater connectivity between the KAPPA modules and, equally important, to third party workflows.

Topaze NL will become the Generation 5 Rate Transient Analysis (RTA) module of the KAPPA workstation. In this migration RTA will feed precise and technically rigorous analytical and numerical models to the Field Production Analysis (FPA) module for multiwell full-field analysis, reserves and forecasting. In doing this the FPA module will replace Citrine.

Members of the KURC will have a seamless connection to the KURC app under this environment for a limited period before the KURC facilities become universally available offering the complete workflow for Unconventional Resources.

KURC app

The KURC app is the result of the KAPPA Unconventional Resources Consortium software development. Driven from Topaze NL and available exclusively to KURC members for a limited period, the app provides a workflow for single well modeling from quick log-log diagnostics to define permeability, the number of fractures and fracture length, through to fast specific analytical models for simplified geometries (SRV and bounded tri-linear) through to the most comprehensive numerical non-linear model for the complete diffusion and geometry solution.

Coming developments include further enhancements to the Discrete Fracture Networks (DFN), statistical analysis and non-linear regression on numerical models.

Training:
Unconventional Resources Analysis and Processing (URAP)

- For engineers involved in the analysis, reserves and forecasting of unconventional reservoirs.

- Pre-requisite knowledge and experience in transient and production analysis strongly recommended.

The URAP course builds on knowledge and experience gained in conventional transient and production analysis and deals with the advanced functionality in the KAPPA suite to handle the exotic flow regimes, extreme PVT and complex geometries found in unconventional wells.

In addition to a rigorous approach to single well modeling the course deals with the practical issues of handling hundreds of wells with limited resources. Examples at the well and field level will be worked ‘hands on’ from simple diagnostics leading to estimates of permeability, the number of fractures and their length through to the most complex models handling discrete fracture networks (DFN).

Pre-requisites to attend the course

To attend the URAP it is strongly advised you have a good working knowledge of Transient and or Production (Rate Transient) Analysis and six months practical experience. To check that you are ready to attend the URAP course please try the self-assessment test on the KAPPA website. If you are an experienced PTA engineer but are not familiar with Saphir NL or Topaze NL we can arrange a free demonstration copy of the software to assist you in your preparation prior to the course. Please contact tcs@kappaeng.com for assistance.

Software usage

The use of the software will be taught at an advanced level as part of this course. It is essential that attendees have attained a good working knowledge of Saphir NL and/or Topaze NL prior to registering for this course.

Refresher

Using a real field case, a very brief review of user knowledge and a revision of key principles to correct any misconceptions and to prepare for our indepth look at unconventional resource analysis and process tools.

PVT

A review of the particular PVT issues encountered in ultra tight reservoirs that affect diffusion including compressibility and viscosity, pressure dependent permeability and porosity, use of pseudo pressures in shale gas, desorption in coal seam gas (CSG)/coal bed methane (CBM).

Minifrac analysis

Developing a consistent workflow combining the G-function plot with derivatives to define the leakoff behavior and the closure pressure. Including after closure analysis (ACA).

Diagnostics

Use of different flow regimes; linear, SRV and infinite acting (or not!) to arrive at approximations for permeability, fracture length and fracture number.

Analytical modeling

Model geometries from SRV bounded and tri-linear, simple and complex multi-frac horizontal well models including DFN.

Numerical modeling

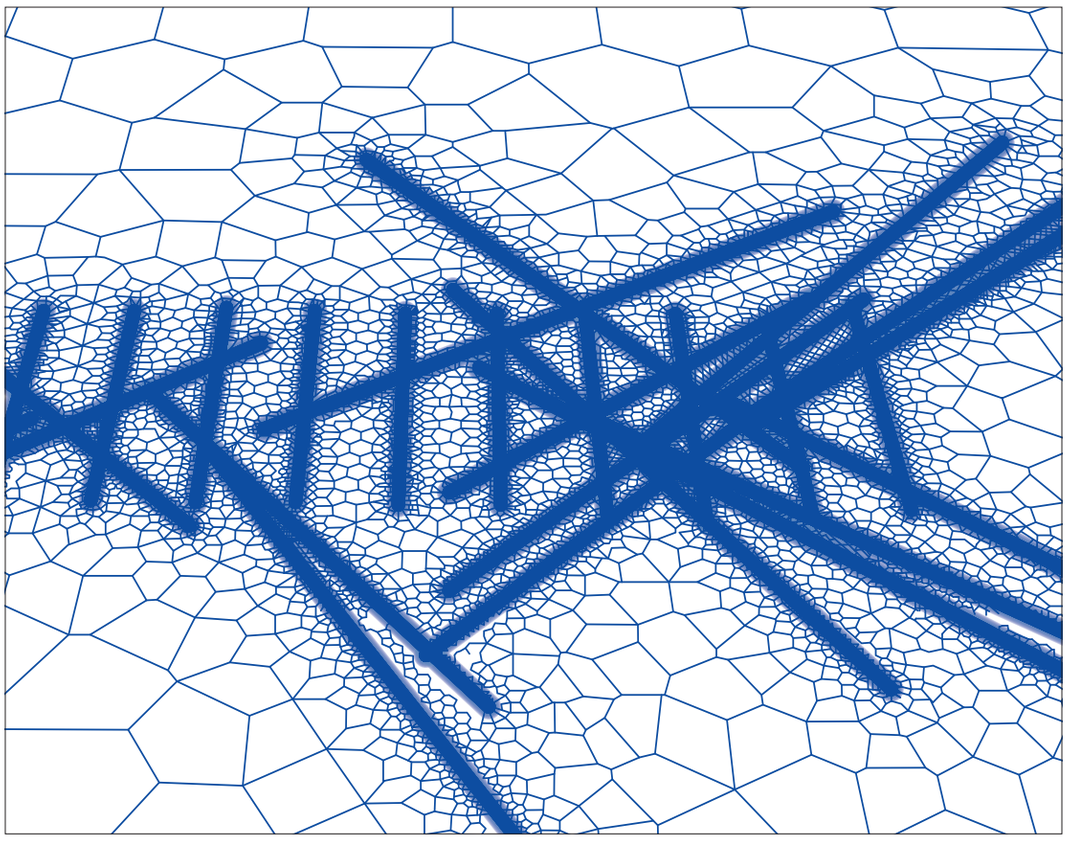
Using the same model steps as with the analytical process but solved numerically with complete PVT to arrive at a precise model for reserves and forecasting.

Multiwell processing

Multiple well load into Citrine from database or public source. Taking the single well model and extending by proxy to arrive at the full field model. Statistical processing to arrive at P10/P50/P90

The KAPPA Unconventional Resources Consortium

KURC



A venture to bring together expertise and data from across the UR business with the objective of developing more rigorous tools and methods.

The not-for-profit KAPPA Consortium on Unconventional Resources (KURC) started in July 2011 and is planned to reach its conclusion by the end of 2013. Amongst the deliverables are:

- Exclusive access to the developed KURC application for three years from feature release.
- Technical input and voting rights on development priorities
- One free Ecrin suite license for the duration of the KURC
- Interpretation of one set of unconventional data
- 25 participating companies from across the UR sector including NOC's, IOC's and the major Service Companies.

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