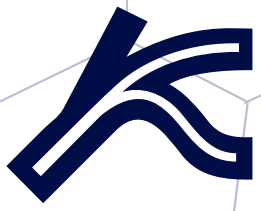


KAPPA

‘Everything should be made as simple as possible, but not simpler’

-Albert Einstein

Microsoft CERTIFIED Partner

DYNAMIC DATA: A DEFINITION

Whenever a fluid is produced or injected into the reservoir, the diffusion produces changes in pressure and temperature that may be recorded in various places. Combine this data with the production and/or injection rates and we have what we call Dynamic Data. Analysis and modeling of this data leads to a better understanding of the reservoir dynamics and the well performance, which in turn allows decision making and proper forecasting.

We need static data (seismic, logs, etc), but until we start to physically move the fluid in the reservoir and measure the response we cannot get the dynamic information that will allow us to model and predict the value of what we have.

Not so many years ago, such dynamic information was almost exclusively provided by specific field operations (well tests), that would determine important reservoir characteristics such as well productivity and sometimes reservoir boundaries, in an area around the well that depended on the duration of such operations.

For KAPPA it was the time of Saphir, our Pressure Transient Analysis software.

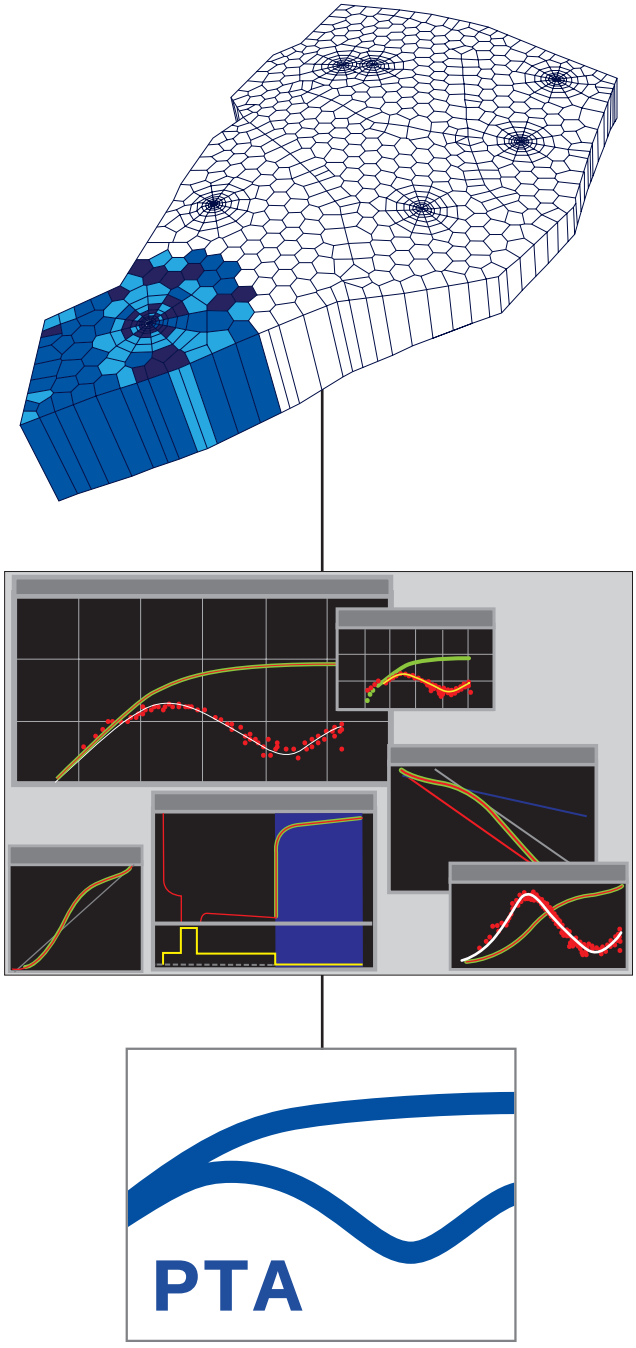
Today, safety and economics combined with technological developments mean that we need and are actually able to acquire, analyze, visualize and model on any scale in terms of time and dimension. We have to make use of whatever data we can get to piece together the dynamic model. Couple this with the fact that reservoirs are of increasing physical complexity, data-flow can be enormous and economics or lack of resources can limit the time spent on processing and analysis and there was a need to develop an integrated tool suite to visualize, organize and analyze dynamic data on any scale or complexity.

For KAPPA it is the time of Ecrin, the integrated engineering workstation, the surveillance tool KAPPA Server and the visualization tool KAPPA Viz.

The KAPPA suite offers a workflow from the simplest near wellbore analytical analysis to the most complex full-field numerical cases with exotic geometry and fluids. Adopted by almost all IOCs, NOCs, Service Companies and Independents the KAPPA suite is simple to use, robust and subject to an aggressive technical development program that will see it continue to develop fit for purpose tools integrated with third party workflows and massive data that face the industry.

KAPPA is 25 years old, privately owned, fiercely independent and totally committed to technical development.

Saphir:
Pressure Transient Analysis (PTA)



FEATURES

- Industry standard for Pressure Transient Analysis (PTA)
- More than 3000 active licenses worldwide
- Extensive analytical model library
- Integrated numerical model with non-linearity
- Seamless connection to KAPPA Server and other analysis modules
- Test design, QAQC and sensitivity analysis
- Deconvolution and minifrac

Saphir, the Pressure Transient (PTA) module of the Ecrin workstation, is the industry standard with over 3000 active installations. With a methodology based, since its origin, on the Bourdet derivative, Saphir offers an extensive and growing analytical model library. The Voronoi numerical model has been developed to handle the increasing complexity of producing wells, solving exactly the multi-phase and complex geometry cases for multiple wells and layers.

Saphir connects seamlessly with the PDG surveillance tool KAPPA server and other components of Ecrin, including the Production Analysis (PA) module Topaze and allowing, through sector extraction, the run and analysis of a full-field 3D/3-phase sectors in Rubis (HM).

Recent developments include advanced work on minifrac analysis, multiple probe formation tests and deconvolution. Deconvolution, by linking build-ups separated in time, allows the user to see much further into the reservoir than could be achieved by a single build-up.

'Generally we re-consider our software choices every five years. We have now been using Saphir for more than twenty years and we will certainly not change as long as you keep your enhancements, your development speed and your support as they are.'

'We are glad to see that KAPPA has not changed its technical focus since Saphir became the industry standard.'

'When you released your first numerical model in Saphir ten years ago I thought it was just a gimmick. Now I cannot imagine what I would do without it.'

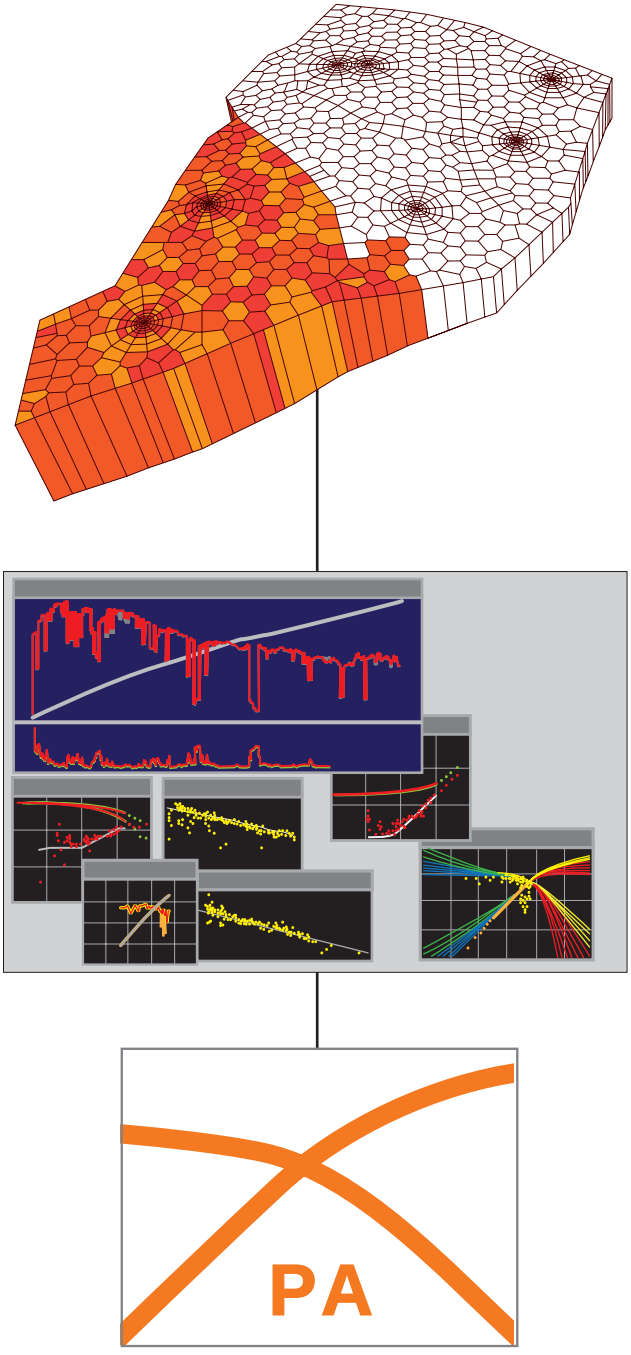
'Saphir is by far the most popular software among our reservoir engineers.'

'Saphir? It just works.'

LEARN MORE

ANALYZE

Topaze:
Production Analysis (PA)



FEATURES

- 1400 active licenses
- Unconventional Resource modeling
- Multiwell capability
- Seamless connection to KAPPA Server and other analysis modules
- Extensive analytical model library
- Integrated numerical model with non-linearity

Moving deeper into the reservoir and typically making use of low resolution, low frequency data Production Analysis (PA) has recently come of age. Evolving from empirical decline curve methods to modern methodology that shares much with pressure transient analysis (PTA). With over 1300 commercial licenses Topaze, the Ecrin PA module, offers single and multi-well analytical and numerical analysis leading to reserves and production forecasting from the most simple to most complex multiphase case.

The abundance of data from permanent gauges has meant that users are able to obtain answers that were previously only available from transient tests. This information has the advantage that it is available at no extra cost and with no deferred production. As the long-term production is modeled, the evolution in time of the well productivity may also be quantified. Finally, forecasting is based on a real model as opposed to an empirical function.

Unique features include a total compatibility with the Ecrin PTA module (Saphir) data and models, an extensive analytical model catalog and a unique numerical capability that allows reliable history matching and forecasting, even in the case of shale gas and CBM produced by fractured horizontal wells. Its multiwell capability allows very fast full-field decline analysis and forecasting. A field production profile generator is also integrated.

'With decent rate data, permanent gauge pressure data and Topaze I can make the data dance.'

'Other tools process bulk data efficiently, but when I need to be sure my analysis is not based on any old line I use Topaze to be really sure of the model.'

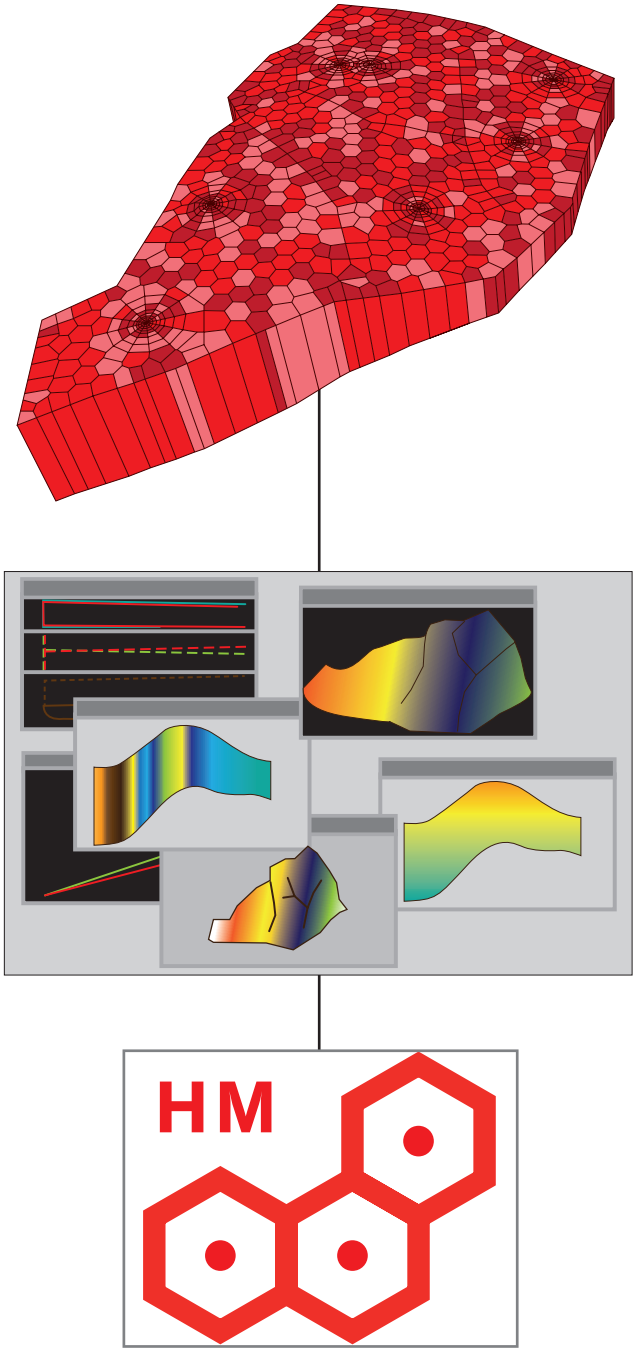
'You may not like what you see, but the data is the data and it is telling you what is happening. If that is the model then, like it or not, you have to live with it. The data never lies.'

'Why should I be surprised when the rates and the pressures tell me the same thing? It is the same reservoir. Just a different scale and way of looking at things.'

LEARN MORE

ANALYZE

Rubis:
History Matching (HM)



FEATURES

- Simple, interactive 3D click and draw build process
- Automatic gridding
- Full compatibility with Saphir, Topaze and Amethyste modules
- Direct PDG (KAPPA Server) data link
- GRDECL and CMG import
- Build and run in minutes
- Sectors run from Pressure Transient Analysis (Saphir)

Rubis, the full-field numerical module of the Ecrin workstation, offers the specialist and non-specialist alike, an easily built click-and-draw model in minutes as opposed to hours or days. Multiple forecasts, reserves and investigation of possible intervention opportunities can be run and history matched in a very short time frame.

Rubis sits between single cell material balance and massive simulation models. It replaces neither, but does much of the work of both. It offers full-field, 3D, multiwell, multiphase with gravity capability. It was developed after seeing engineers labor with spreadsheets or conventional simulators to solve day-to-day problems.

The basic premise is that the grid is a necessary evil that should not dominate the problem solving process, so it is built automatically. Of real interest is the physical problem we want to simulate. We want this to be complex enough to reproduce the main drives of the reservoir that will affect production, but simple enough to be run with a very short time cycle that is usable; in hours, not days.

Recent developments in Rubis have focused on unconventional resources with multiple-fracture horizontal wells and wells with arbitrary trajectories; the Wriggly wells.

'Just before lunch the reservoir manager walked in and asked me to run a few scenarios for the next well placement. I had the answers on his table by close of business that day.'

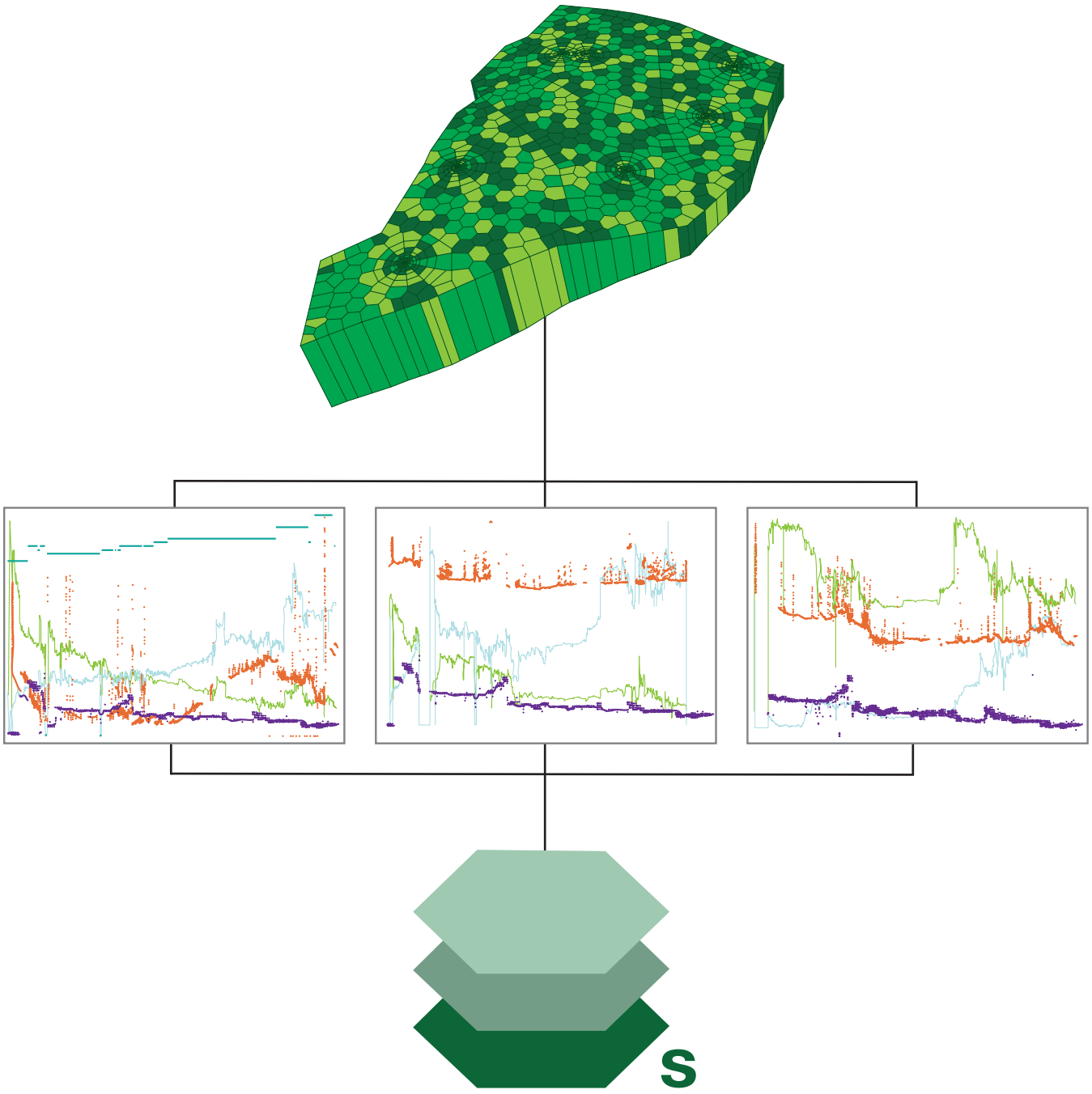
'I will never use Rubis to replace my current model. It has taken so long to build it makes little sense to do so. What I can do though is run my cases in Rubis and it gets me very close to what I think is happening. This drastically saves time in advancing the full model.'

'I should not say this, but working with Rubis is fun. It is the way it should be.'

LEARN MORE

ANALYZE

KAPPA Server (Ks):
Reservoir surveillance of Dynamic Data



FEATURES

- Extensive global deployment
- Unlimited gauge and data capability
- Seamless connection to KAPPA workstation analysis modules
- Mathpack, alarms and auto-update
- Automatic PBU identification and rate allocation
- Smart filtering and de-noising
- Shared data, object and analysis environment

Permanent gauges are a wonderful, data-rich witness of reservoir behavior, but without organization they only add to the end-user feeling of data overload and at best the ROI will be limited.

KAPPA Server addresses the issue of capturing massive PDG data in a useable, smart-filtered form for transient/production analysis and history matching. It automates, alarms and connects seamlessly with KAPPA workstation and third party platforms and workflows helping to transform PDG data into valuable information such as productivity, wellbore performance, reserves and forecasts in a seamless environment.

KAPPA server represents the next generation of massive dynamic data management and replaces Diamant Master.

'Since we installed the system we have not needed to perform a single planned shut-in'.

'This has become the eyes of the reservoir'

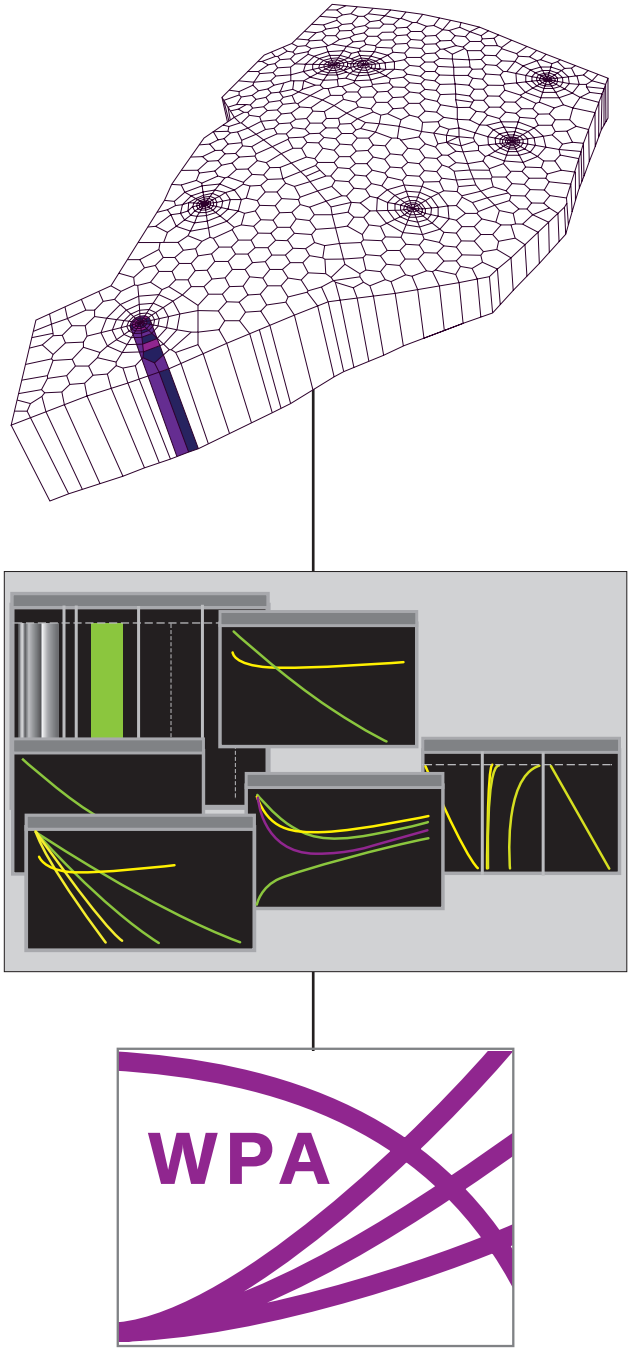
'We thought this would all be about build-ups, it is, but it has also given us an unexpected visualization on the interconnectivity of wells'

'The flow of data we get from Diamant Master is of strategic value to our business'.

LEARN MORE

ORGANIZE

Amethyste:
Well Performance Analysis (WPA)



FEATURES

- Seamless connection to other workstation analysis modules
- Multiple models and sensitivities
- Well sketch
- …free!

The Well Performance Analysis (WPA) module (Amethyste) is seamlessly integrated in the workflow to simplify processes involving wellbore modeling and IPR calculations. Although there are some fine packages on the market the WPA module was developed to speed up and allow unique workflows and to ensure a consistency of approach. The WPA module is free of charge, included with the package

The WPA module corrects for less than optimal gauge placement, including at surface. It allows full drag and drop, back-and-forth integration with PTA, PA and HM (Saphir, Topaze and Rubis) where it can be run dynamically with complete control and without blind table interpolation.

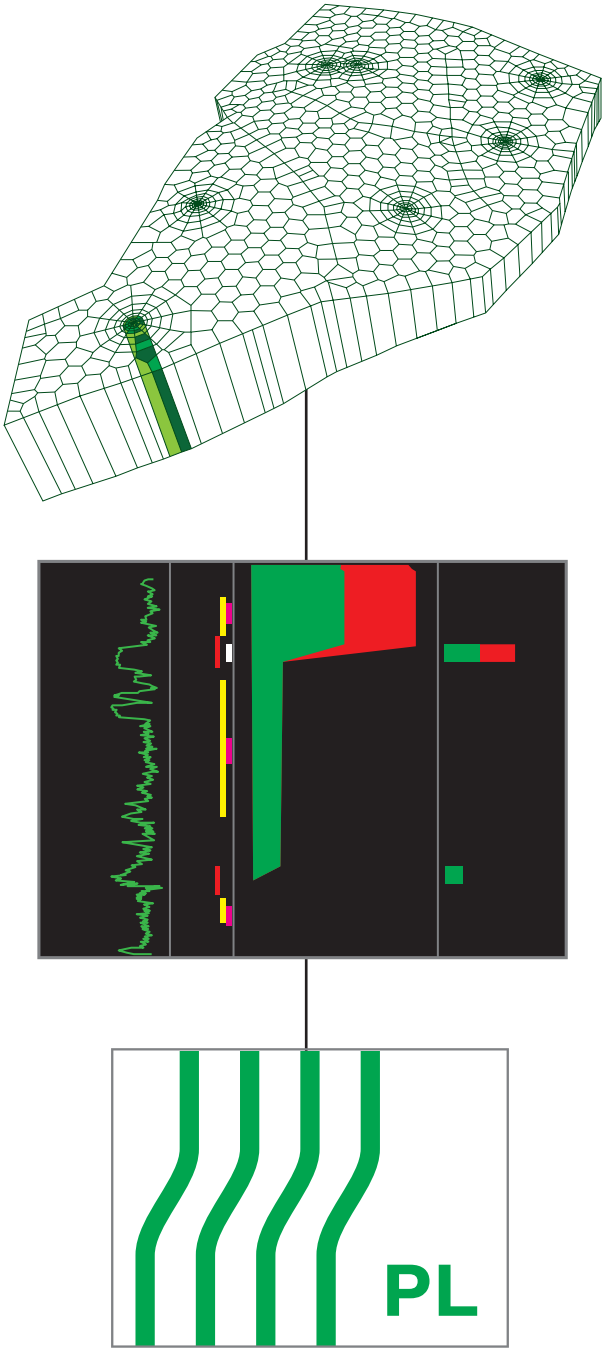
Multiple pressure drop models may be defined and compared with unlimited sensitivity studies. User data can be added to the model for comparison. Correlation between resulting rates and the sensitivity parameters can then be displayed, as can the evolution of the productivity index as a function of the time as the reservoir starts to deplete.

Wellbore and flow line can be treated independently or together. A well sketch is available for graphical display using a library of pre-defined completion components. Lift curves can be generated in Eclipse™ format for third party software.

LEARN MORE

ANALYZE

Emeraude:
Production Log Interpretation (PL)



FEATURES

- Industry standard PL platform
- Used by all major service companies and most major OPCOs
- Full multi-probe tool MPT (MAPS™ and FSI™) capability
- Choice of processing; zoned and continuous
- Temperature quantitative interpretation
- Pulsed Neutron (PNL) interpretation
- No black boxes

With over 1,100 active licenses, KAPPA Emeraude is the industry standard software platform for production log interpretation, shared between all major service companies, most operating companies and independent contractors worldwide. Data from any PL string can be analyzed; from the simplest injector to the most complex multi-probe strings run in multiphase horizontal wells.

Recent years have seen a step change in the complexity of wells with multiple zones, phases and deviation ranging from vertical to horizontal. This has led to the development of esoteric logging tools with multiple arrays attempting to describe complex flow regimes by giving a spatial mapping of the flow characteristics. Masses of data are created that need visualization, QA/QC and analysis. It is not a straightforward process. It is easy to succumb to the temptation of a 'black box' that will do some clever statistical stuff to produce a solution that matches perfectly all data to hand. With the complexity of the physical problem, and the simplicity of the models, a perfect match only means that a trick is used internally by means of additional degrees of freedom, not necessarily obvious to the user. Production log interpretation is not rate measurement. The key to the process is in the name: Interpretation. Engineers interpret, machines do not. The engineer must control the software not the other way around.

Emeraude offers the user the choice of both zoned and continuous processing. Data from the simplest injector string to the most complex multiprobe tools (MPT), such as Schlumberger FSI™ and GE Sondex MAPS™, are handled in an open, streamlined workflow with an unparalleled range of tools for displaying, editing and handling data. There are no 'black boxes' no hidden processing. Recent additions include an 'energy' temperature model to simulate reservoir thermal behavior; this can be applied to steam injection tests, leak detection design and DTS data interpretation. Additional options include multi-rate PL and SIP, water saturation (PNL) monitoring, permeability correction, formation test QA/QC and multilayer rate export to Saphir.

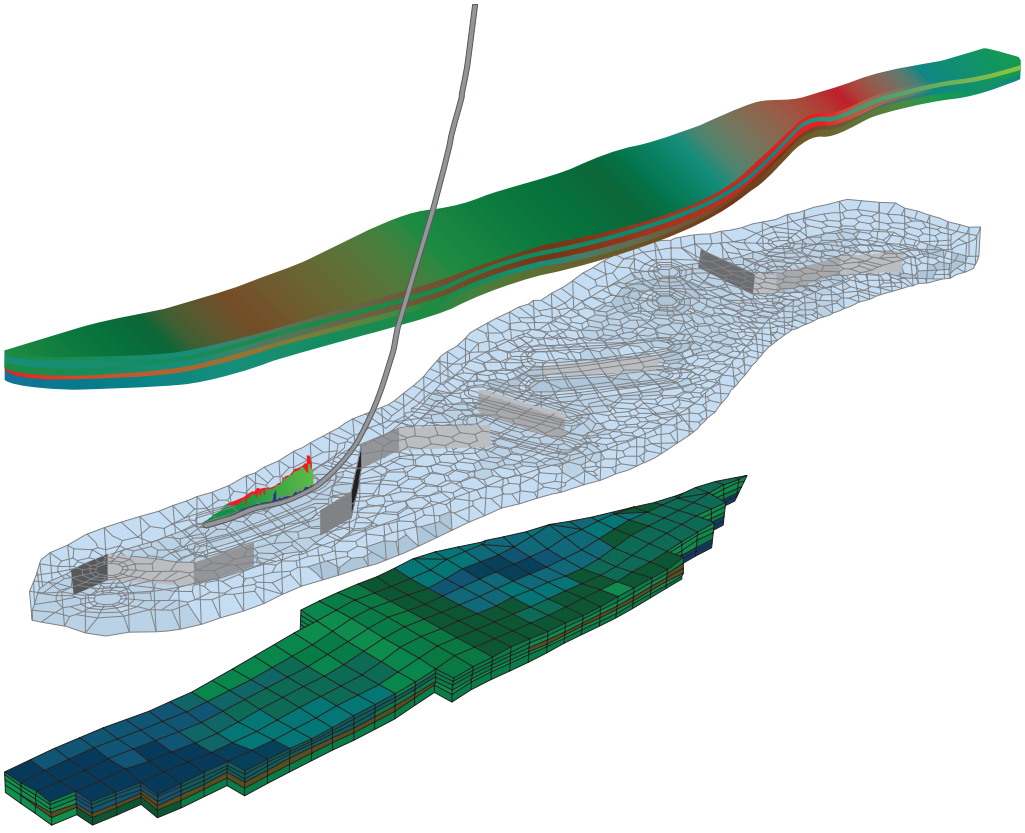
'Having the software on my workstation has meant service companies know I can look very closely at the data. It has meant a significant increase in log analysis quality. It is now a common platform of communication between us.'

'The continuous processing is something some clients insist upon. I really did not want to purchase and learn another package. Now I have the choice of processing in one software.'

LEARN MORE

ANALYZE

KAPPA Viz (Kv):
Visualization and Collaboration



viz

FEATURES

- 3D visualization of any reservoir and well object from the seismic block through to wells, simulations and logs.
- Collaboration in virtual rooms
- Massive objects handled over narrow bandwidths
- Animation of time dependent properties
- Works on Windows™ and iPad™

KAPPA-Viz is the virtual visual meeting place for any 3D object generated by KAPPA or any third party application. This Client-Server solution offers virtual rooms where Giga or Terrabyte objects can be shared between PC and iPad users over an intranet or very narrow internet bandwidths.

KAPPA-Viz can handle objects of any size and format from any source. KAPPA objects, such as numerical models from Rubis, Topaze and Saphir, or production logs from Emeraude are imported by a single drag-drop either locally from Ecrin or from KAPPA Server. Third party objects, such as seismic blocks, geomodels, simulations and logs are handled by a series of plug-ins. The massive processing is handled on the KAPPA-Viz server, the manipulation and visualization is handled 'light and local'.

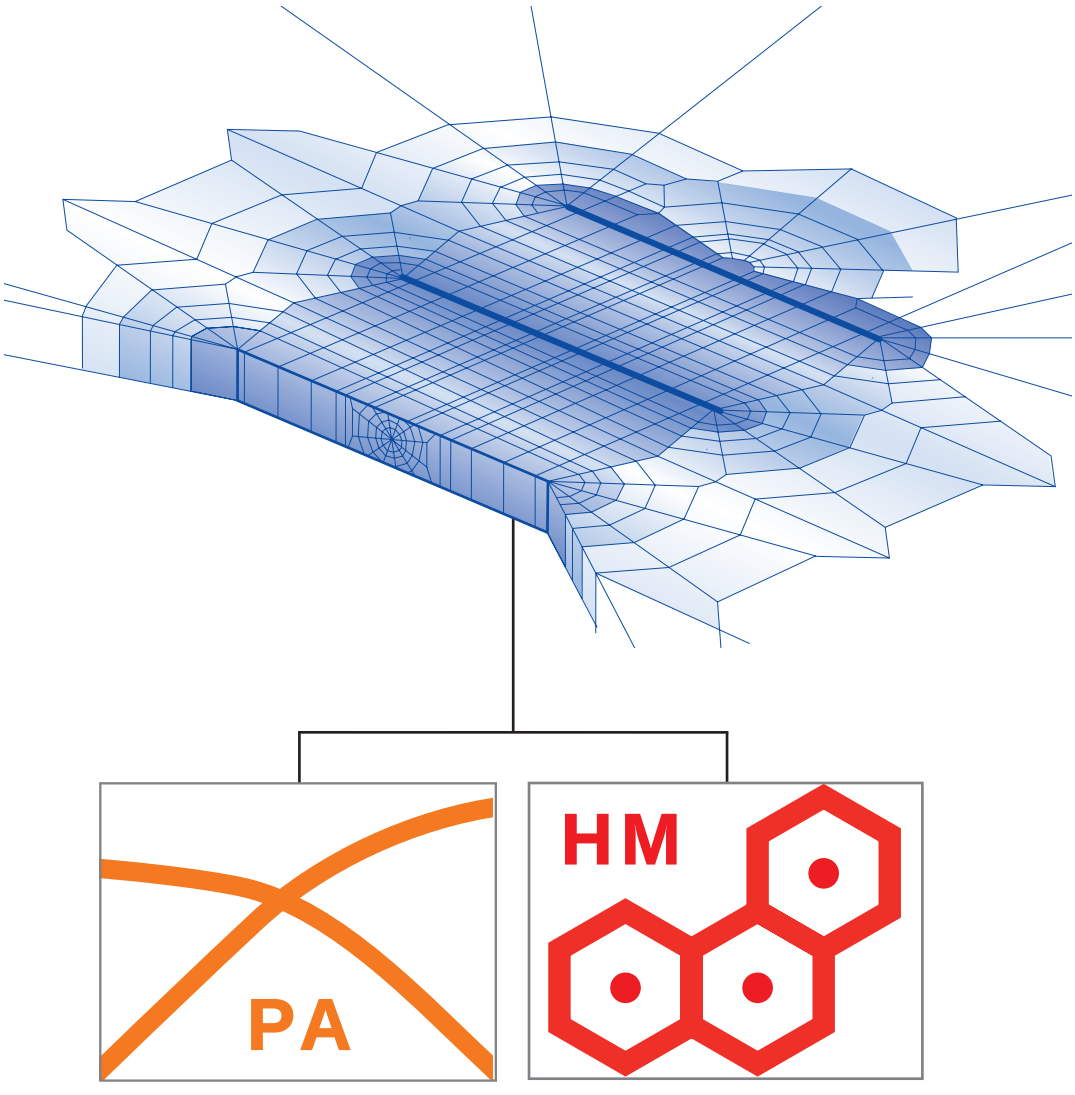
When a new object is imported, whatever the size, KAPPA-Viz will create a low-resolution 3D rendering. In the hands of the user this allows smooth manipulation of the actual massive object. It is simplified as much as possible, but no further. There is just sufficient information to manipulate the object in 3D, although many orders of magnitude more data are held in store that is equally accessible and useable. When the manipulation ceases the full high resolution image is populated by the server and immediately presented to the user.

Users, wherever they are, enter virtual rooms where they can share, overlay, manipulate and animate any object or objects describing the reservoir in real time on iPad or PC. When the object is a KAPPA analysis a handle appears on the relevant well(s) that opens the corresponding analysis on a click or touch.

LEARN MORE

VISUALIZE

Unconventional resources



FEATURES

- Shale gas, shale oil and CBM
- Analytical horizontal multifrac models
- Numerical non-linear model
- KAPPA Unconventional Resources Consortium (KURC)

Unconventional Resources occur in ultra-tight formations in which we need to create a large interface area by massive fracing. Simultaneously the PVT behaviour is exotic with extreme pressure gradients and compressibility changes. 'All' the industry needs to do is model these mechanisms to accurately book reserves and predict production.

KAPPA is the first to admit it does not have all the answers. Nobody has.

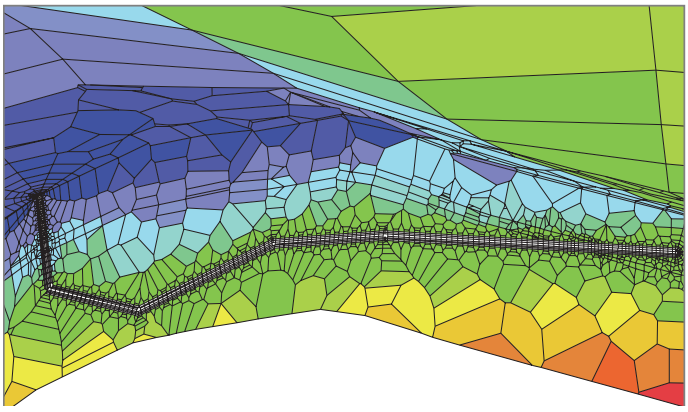
Unconventional Resource modeling is a key R&D focus for KAPPA. Currently available in the suite are both analytical and numerical horizontal fractured well models. The latter includes adaptive superfine gridding and non-linearity. However, to believe that what exists now is the model on which to base all future predictions would be foolish.

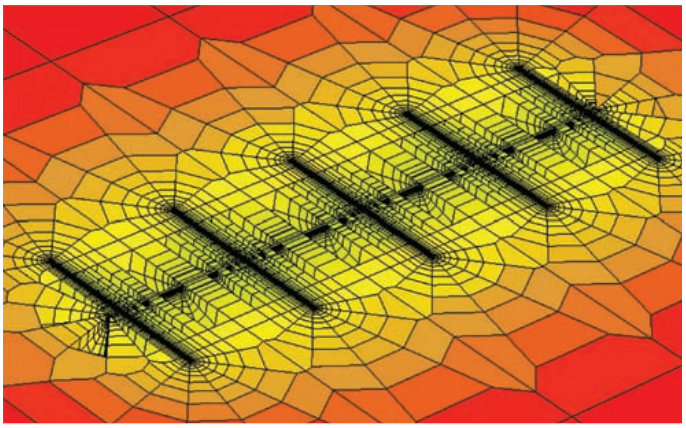
Research is underway in partnership with more than twenty of the major OPCOs and Service Companies in the KAPPA Unconventional Resources Consortium (KURC). This is a not-for-profit group that has brought together the best experience and practise in the industry to move the development of tools forward and test them against real data as it becomes available. Membership of the consortium brings a three-year exclusivity on developments.

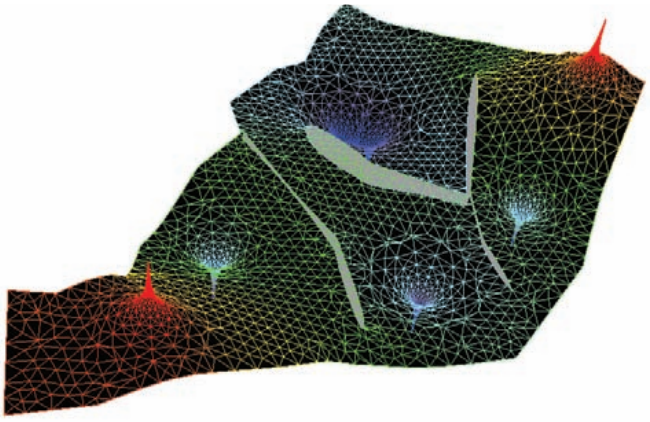
LEARN MORE

ANALYZE

Numerical modeling at the heart of the KAPPA suite







FEATURES

- Interactive build tools
- Automatic grid
- Flexible, coherent upscaling on any time scale (PTA/PA/full field)
- Horizontal well model; any trajectory, any layering

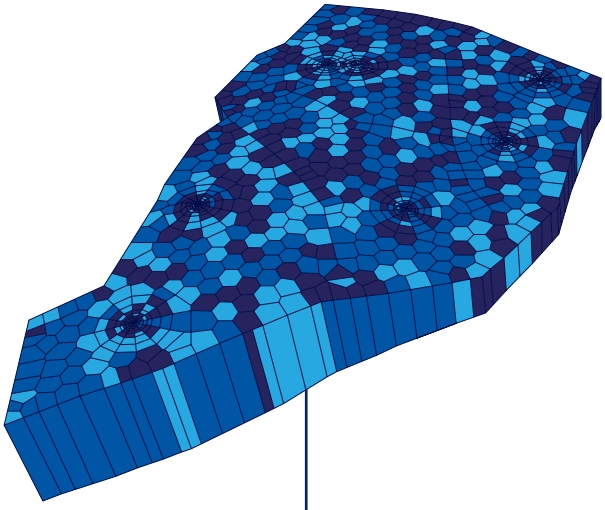
A numerical model should be quick and intuitive to build, allowing users to solve day-to-day problems without deep specialist simulation knowledge. Developed at the core of the workstation the automatic unstructured Voronoi grid tips conventional model building on its head. The model is simple to build using interactive geometry tools or by importing from geomodelers. The grid is then filled automatically into the created space, freeing the mind to concentrate on the physical problem with a turn around of minutes rather than hours or days.

By using flexible upscaling the same grid can be used at the different time scales demanded by transient, production and full field analysis. This, for example, allows the user to grab a sector from the full field model for transient analysis or transfer the model between various analyses by seamless drag-drop.

Using the same grid we can therefore progressively see from extremely close to the wellbore, as in a formation test or unconventional resource analysis, progressively deeper into the reservoir to observe the effect of other wells and the boundaries, all with perfect coherence.

In the latest development the Voronoi grid has been adapted to extreme geometries to enable the analysis of true horizontal wells. The wriggly well model handles any well trajectory across any stratigraphy.

Training, consulting and support



ws

s

viz

COURSES

- Foundation Pressure Transient and Production Analysis
- Advanced Pressure Transient and Production Analysis
- Foundation Production Logging
- Horizontal well log interpretation
- Unconventional Resources
- Data management and workflow
- Model building and problem solving

SUPPORT

- Free training
- Live web tools
- Forum and workflow videos
- Extensive example catalogue
- Dynamic Data Analysis book (free to download)

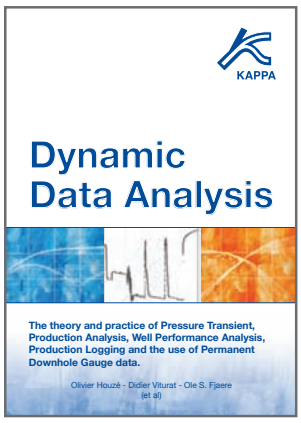
KAPPA trains and consults in Dynamic Data Analysis; namely transient and production analysis, production log analysis, data management, modeling and history matching. Public courses are delivered worldwide. KAPPA also trains hundreds of engineers every year in client specific in-house courses and workshops.

The KAPPA aim is to provide practical training that offers sufficient theory to understand the subject and the tools to perform useful work immediately after the course. KAPPA trainers are all experienced practitioners in their fields and selected to get the message across with clarity and, bearing in mind we are in the commercial world, with a need to produce a real return on the training dollar.

Clients have access to software support through extensive contextual help in the application, our regional offices, web collaboration tools, interactive videos on the web, free workflow training courses and forums.

If you do not have time to make the analysis or would like a second opinion on a case, our consultants are some of the most experienced in their field in the industry and are available for short or long term interventions anywhere in the world, or simply on the end of the telephone.

For more information on the theory and practice of Dynamic Data Analysis download the KAPPA DDA book from **www.kappaeng.com**



We ask clients to register on our website to keep them informed. We do not spam and we zealously protect your identity.

LEARN MORE

LEARN

www.kappaeng.com

Corporate office

France - Sophia Antipolis
Support and Development
KAPPA Engineering SA
TEL: +33 4 8986 9600
support@kappaeng.com

Sales, Training and Consulting

UK - Reigate
KAPPA TCS Ltd
TEL: +44 1737 245444
sales@kappaeng.com
tcs@kappaeng.com

Regional offices

USA & Latin America - Houston
KAPPA North America Inc.
TEL: +1 713 772 5694

Middle East Asia - Bahrain
KAPPA MEA W.L.L.
TEL: +973 17 229 803

Russia - St Petersburg
KAPPA FSU OOO
TEL: +7 812 332 2005