



RN



ROSNEFT

HIGH-TECH UPSTREAM
ENGINEERING SOFTWARE






HIGH-TECH SOFTWARE LINE OF ROSNEFT
OIL COMPANY



APPLICATION



RN GEOSIM

 **1 bln**
CELLS IN GRID

 **500+ km²**
SIMULATION AREA

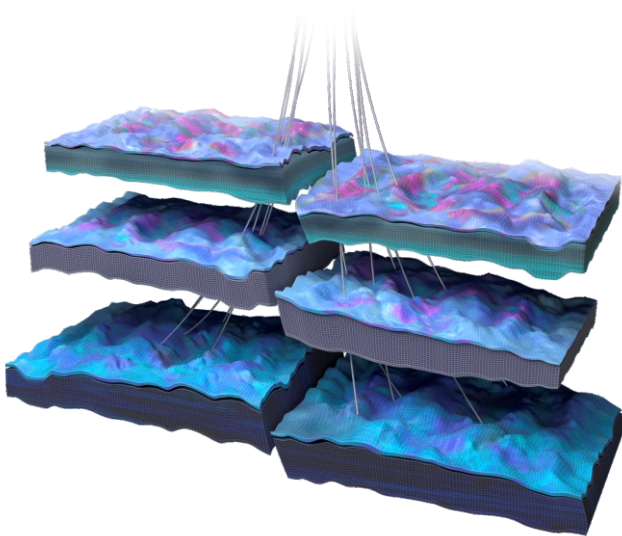
DESCRIPTION

RN-GEOSIM is a modern software product for 3D geological modeling and analysis of hydrocarbon deposits. It provides a wide range of functionalities to solve the most complex geological modeling tasks.

RN-GEOSIM offers a full range of geomodeling tools: interactive visualization, data import and data management, well section correlation, structural and fault modeling, facies and petrophysical 3D modeling, reserves calculation, reporting.

BENEFITS

- ✓ High-performance computing
- ✓ Modeling of giant fields
- ✓ Unified database and multi-user mode
- ✓ Multi-well log automatic correlation
- ✓ Repeatable and fully traceable workflow management
- ✓ Fast and flexible data access
- ✓ Universal any-fault modeling
- ✓ Corner point s-grids up to 10^9 elements
- ✓ All-known and custom geostatistics algorithms
- ✓ Automatic workflow creation
- ✓ Seamless all product line integration
- ✓ Listed in the Unified Register of Russian Software
- ✓ Linux version is available



3D RESERVOIR MODEL

PLANS

- ✓ Complex tectonics modeling
- ✓ Modeling templates
- ✓ MPS Images templates
- ✓ Stratigraphic associations
- ✓ RN-GEOSIM as IT Service
- ✓ Modeling algorithms list expansion
- ✓ Full-featured reporting

HYDRODYNAMIC MODELING



RN KIM

 **500+**
USERS

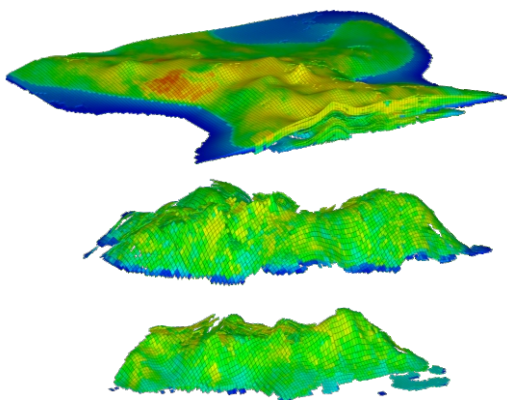
 **1 500+**
MODELS PER YEAR

DESCRIPTION

RN-KIM is a high performance solution for 3D hydrodynamic modeling of green and brown field development.

RN-KIM provides a full modeling cycle from creating a hydrodynamic model to auto-adaptation to actual data and multivariate calculations of predictive options in full-scale and sector modeling.

The simulator implements a number of highly-demanded options for simulating "complex" well intervention and waterflooding optimization (WAG, polymer flooding, tracer studies), solution for BlackOil/VaporOil models.



HYDRODYNAMIC MODEL OF
PRIOBSKOYE FIELD

BENEFITS

- ✓ Formats compatibility: Eclipse, Tempest, tNavigator
- ✓ SPE tests compliance
- ✓ Accurate hydraulic fracture model
- ✓ Certificate of Conformity
- ✓ Support for modern computing architectures (cluster systems, graphics accelerators) – up to 24 times on 32 cluster nodes
- ✓ Cross-platform calculations on Windows and Linux x64
- ✓ Possibility of extending modeling functionality using Python-API
- ✓ HDF5 format support for access to calculation results
- ✓ High-performance 3D capable of visualizing HDM up to 1 billion active cells
- ✓ Integration with reservoir-well-surface modeling software of IPM Suite from Petroleum Experts
- ✓ Listed in the Unified Register of Russian Software

PLANS

- ✓ Compositional version development (combination with Network option, version for cluster systems)
- ✓ Accounting for secondary fracturing with PEBI grids
- ✓ Accounting for the influence of the rock stress-strain state on the reservoir properties
- ✓ Quick calculation of hydraulic fracture parameters with RN-GRID and RN-SIGMA
- ✓ Integration with PLT and well test results

GEOMECHANICAL MODELING



RN SIGMA



100+
DATA ANALYSIS
METHODS

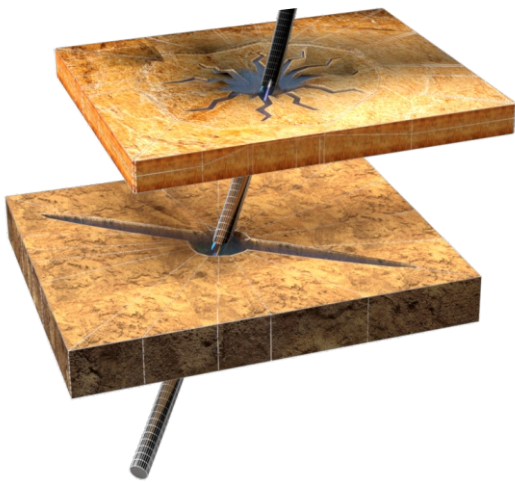


150+
USERS

DESCRIPTION

RN-SIGMA is a geomechanical modeling software for inclined and horizontal wellbore stability analysis.

RN-SIGMA offers a full-set of geomechanical modeling tools for data collection, analysis and pre-processing, 1D geomechanical models construction and data exchange, prediction of geological drilling complications, trajectory and well design optimization, safe mud density window calculation.



BENEFITS

Every algorithm in RN-SIGMA is based on world's best practices.

RN-SIGMA includes all necessary algorithms and interface solutions for complex geomechanical wellbore stability modeling. It also includes some actual non-standard functionality (elastic anisotropy, temperature etc).

- ✓ Full cycle of wellbore stability geomechanical modeling
- ✓ Custom templates for typical multiple well processing routines
- ✓ Customized user algorithms in Python
- ✓ User defined processing routines
- ✓ Additional non-standard extensions
- ✓ Easy to use and learn interface
- ✓ Seamless product line integration
- ✓ Listed in the Unified Register of Russian Software
- ✓ Linux version is available

WELL DRILLING RISKS

PLANS

- ✓ Geomechanical 3D well modeling
- ✓ Geomechanical 4D field modeling
- ✓ Assessment of reservoir compaction and day surface subsidence
- ✓ Drilling hydraulics

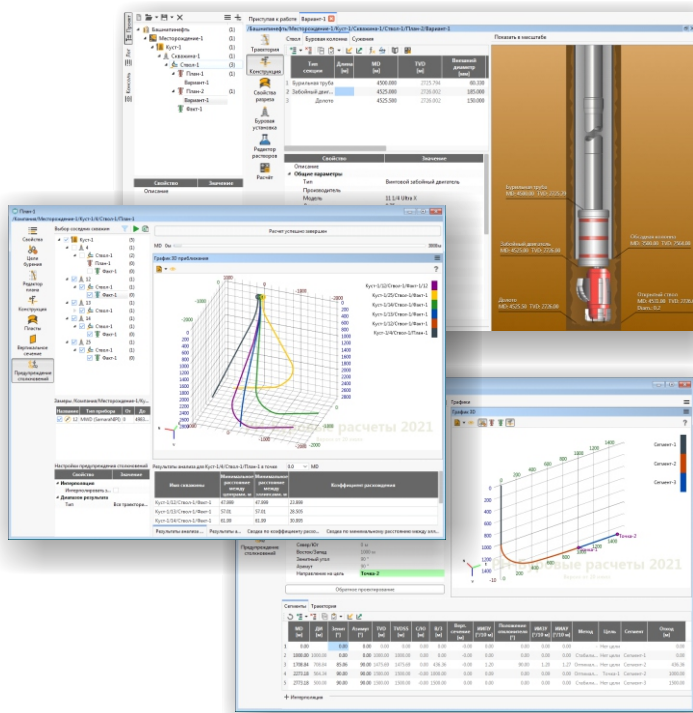
WELL DESIGN AND CONSTRUCTION



RN DRILLING CALCULATIONS

DESCRIPTION

RN-DRILLING CALCULATIONS is software for engineering calculations and mathematical modeling of technological processes for solving problems of well design and construction.



100+
MODELS
AND ALGORITHMS

3400+
ITEMS IN THE DRILLING
EQUIPMENT CATALOG

BENEFITS

- ✓ High performance computing core
- ✓ Convenient tools for determining drilling targets, the location of wells and well pads
- ✓ Wellbore trajectory calculation using 2D and 3D methods
- ✓ Trajectory intersection risk analysis with support for ISCWSA
- ✓ Geodetic and magnetic calculators
- ✓ T&D calculation, calculation of hydraulics for process flow during well construction
- ✓ Calculation of cuttings removal, flushing
- ✓ Modeling of cementing and drill string centering
- ✓ Calculation of properties and LCM selection
- ✓ Linux version is available

WELLBORE TRAJECTORY CALCULATION

PLANS

- ✓ T&D calculation using "Stiff String" class model
- ✓ Sticking and reciprocation prediction
- ✓ BHA vibration tendency calculation

GEOSTEERING



RN HORIZON+

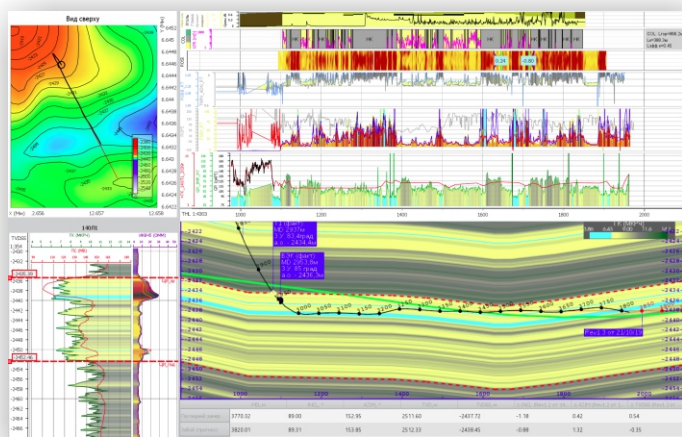
 **120+**
USERS

 **2 000+**
COMPLEX WELLS PER
YEAR

DESCRIPTION

RN-HORIZON+ is a software tool for geological support for drilling of horizontal wells and sidetracks. It implements state-of-the-art techniques for rapid importing of initial project data from various sources, building 3D geosteering model, updating the model in real time based on actual drilling data, identifying structural grid angles and predicting drilling direction at any time followed by automatic formatting and sending reports.

As a comprehensive solution, RN-HORIZON+ contains tools for geosteering complementary tasks, such as interactive well correlation, image and mud logging interpretation, advanced well log calculator, structural surfaces manager, etc.



GEOSTEERING MODEL IN RN-HORIZON+

PLANS

- ✓ New geosteering methods
- ✓ Fast trajectory calculation
- ✓ Automated well completion placement

BENEFITS

- ✓ All geosteering related tools incorporated into single software
- ✓ Real-time well data and model update using WITSML
- ✓ Solving related tasks: analyzing images, mud logs, building wells correlation scheme, etc
- ✓ Automated all reports generation and delivery
- ✓ Multi-well 3D algorithms for modeling stratum structure and properties
- ✓ Parallel multi-user geosteering projects access
- ✓ Advanced analytics with embedded Python interpreter
- ✓ Seamless all product line integration
- ✓ Listed in the Unified Register of Russian Software
- ✓ Linux version is available

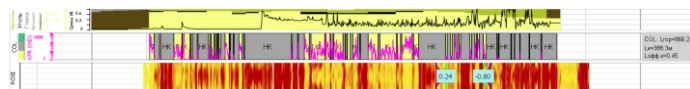


IMAGE LOG INTERPRETATION IN RN-HORIZON+

- ✓ Distributed platform for storage and managing geosteering projects
- ✓ Light version of RN-HORIZON+ for displaying and administering geosteering projects on the go
- ✓ Visualization of 3D geosteering models
- ✓ Smart geosteering assistant based on machine learning technologies

HYDRAULIC FRACTURING MODELING



RN-GRID

 **600+**
USERS

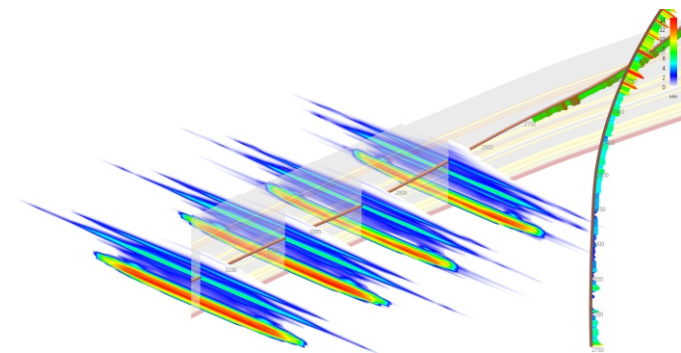
 **33 000+**
SUCCESSFUL JOBS

DESCRIPTION

RN-GRID is a new-generation hydraulic fracturing modeling software, created to be convenient, accurate and prompt. We have incorporated experience of hundreds of hydraulic fracturing engineers.

RN-GRID covers the whole process of designing, performing and analyzing hydraulic fracturing operation, offers limitless treatment data import and visualization, convenient engineering analysis tools, smart geomechanic modeling, test injection analyses, treatment data matching, fracture geometry and production prediction, databases of fracturing fluids, proppants, casing and tubing.

RN-GRID single project file stores multiple wells, well logs, fracturing design variants, historical treatment data and fracture analyses.



MULTI-STAGE HYDRAULIC FRACTURING ON
A HORIZONTAL WELL

BENEFITS

State-of-the-art RN-GRID Planar3D model most accurately describes complex hydraulic fracture geometry. It makes RN-GRID significantly superior to foreign analogues, most of which use simplified approaches.

- ✓ Fully-implicit geomechanic and hydrodynamic solution
- ✓ Stratified geomechanic model
- ✓ Multiple fluids and proppants
- ✓ Proppant settling, bridging and mobilization
- ✓ Time and pressure-dependent fluid rheology
- ✓ Acid and acid-proppant fracturing
- ✓ Poroelasticity and fracture interference
- ✓ Rich leakoff models
- ✓ Optimization for recent multi-core CPU hardware (AVX2)
- ✓ Full software product line integration
- ✓ Listed in the Unified Register of Russian Software
- ✓ Linux version is available

PLANS

- ✓ Advanced interactive editing and 3D visualization of well geomechanics and construction
- ✓ Improved simulation speed
- ✓ Integration with the hydrodynamic simulator to calculate the initial production rate

MODELING COILED TUBING OPERATIONS



RN VECTOR



50+
ALGORITHMS OF
CT CALCULATIONS



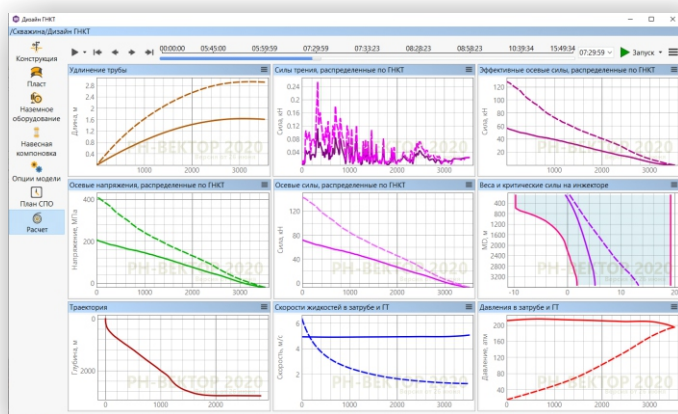
120+
USERS

DESCRIPTION

RN-VECTOR is an industrial software for mathematical modeling and analysis of coiled tubing (CT) technological operations.

Coiled tubing is used in oil and gas wells to perform a variety of technological operations: borehole flushing and bottomhole normalization, inflow induction and well development, milling of restrictions to restore the flow area, fishing operations, installation and drilling of cement bridges and packer plugs, acid treatments, geophysical surveys, hydro-sandblasting perforation and others.

Coiled tubing simulator is used in oil and gas industry for planning, managing and analysis of the CT technology application.



RIH/POOH SIMULATION IN RN-VECTOR

BENEFITS

- ✓ CT load and buckling calculations
- ✓ CT stresses are affected by CT and wellbore hydraulics
- ✓ CT critical stress calculation
- ✓ Multiphase hydraulics and solids transport
- ✓ Calculation of CT metal fatigue wear
- ✓ Visual representation and editing of all the equipment input parameters and the RIH/POOH plan
- ✓ Accounting for the reservoir inflow or fluid loss
- ✓ Influence of temperature effects on CT
- ✓ Quasi-steady hydraulics calculation
- ✓ Listed in the Unified Register of Russian Software
- ✓ Linux version is available

PLANS

- ✓ Calculating an optimal mode of borehole flushing
- ✓ Stiff string modeling
- ✓ CT assembly optimization
- ✓ RIH/POOH visualization
- ✓ Calculators for buckling load and fatigue express assessment

REAL-TIME DATA VISUALIZATION



RN-VISOR



50+
METHODS OF DATA
VISUALIZATION

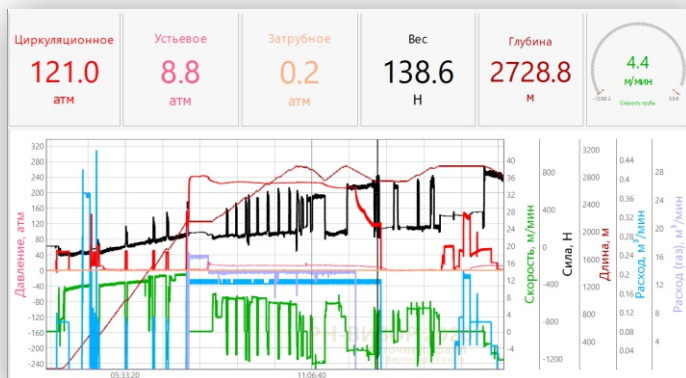


1 500+
PERFORMED
OPERATIONS

DESCRIPTION

RN-VISOR is a real-time data acquisition, processing and visualization software installed on the control station of coiled tubing/hydraulic fracturing fleet.

RN-VISOR provides collection of the combined data flow from COM and TCP ports and data formats OPC DA, OPC UA and S7 Communication on the control station, its initial filtering, correction and processing according to user-defined formulas and scripts, data storage, visualization of coiled tubing or hydraulic fracturing operations and data transmission in a user-friendly mode.



BENEFITS

- ✓ Convenient user settings for text input data flow parsing to adapt to various control data flow protocols
- ✓ Unlimited input data channels
- ✓ Various customizable graphs and scales visualization templates
- ✓ Custom Python-based calculated channels
- ✓ Original input text data storage for instant reparsing
- ✓ Customizable channels threshold warnings
- ✓ Convenient data and visualization export to various graphical formats
- ✓ Automatic data stitching after shutdown
- ✓ Calculation of limit curves for safe conditions of CT operation and recalculation of the current position of operating parameters using actual data
- ✓ Injection parameters forecast (calculation of fluid friction in coiled tubing and well, bottomhole pressure, net pressure for hydraulic fracturing)
- ✓ Listed in the Unified Register of Russian Software
- ✓ Linux version is available

DATA VISUALIZATION IN RN-VISOR

PLANS

- ✓ Visualization of injection stage position in coiled tubing and wellbore
- ✓ Real time calculation of CT running time
- ✓ Optimization of indicator visualization and more options for customizing graphs
- ✓ Custom and embedded data export templates

DOWNHOLE EQUIPMENT MODELING



RN-ROSPUMP



120 000+
DESIGNS



15 000+
MODELS
OF EQUIPMENT

DESCRIPTION

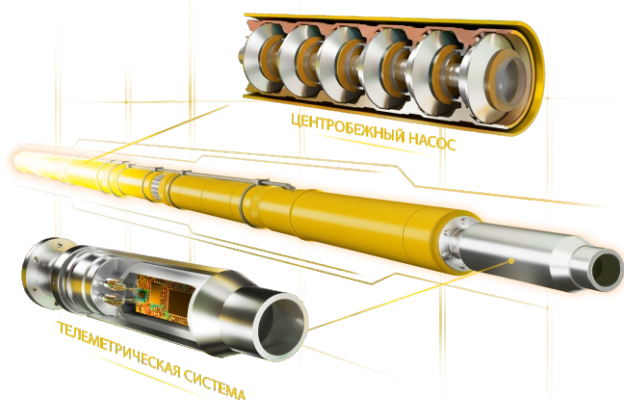
RN-ROSPUMP is a complex software product designed to calculate and analyze the parameters of producing wells. RN-ROSPUMP can help to create designs for wells equipped by electric submersible pumps (ESPs) or sucker rod pumps (SRPs), or even for natural flow wells.

RN-ROSPUMP allows analyzing well operation, as well as carrying out a node-wise analysis of energy costs.

BENEFITS

RN-ROSPUMP offers wide adjustment possibilities to tailor the tool for the needs of virtually any company/field of application. The application settings embrace PVT correlation sets, MS Excel data importing, the user-accessible part of the equipment catalog and report forms, etc.

RN-ROSPUMP helps to provide the energy-efficient operation of the mechanized well stock.



OPTIMAL INSTALLATION DESIGN

PLANS

- ✓ Packaging strength calculation
- ✓ Optimization of SRP selection algorithms
- ✓ Modeling of SRP with submersible straight drive
- ✓ Accounting for additional equipment

RN-VEGA

200+
USERS

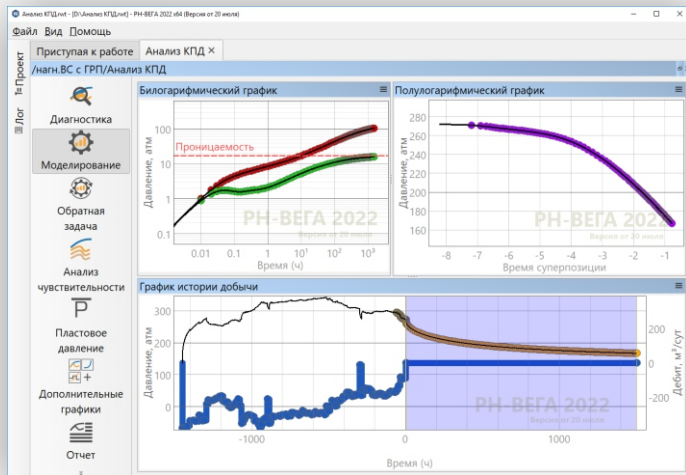
3000+
TESTS PER YEAR

DESCRIPTION

RN-VEGA is a software product for analysis and interpretation of well tests.

RN-VEGA implements modern methods for interpreting all types of well tests: pressure buildup curve, pressure drawdown curve, decline curve analysis, IPR curve, gas well testing, slug tests, interference analysis*.

RN-VEGA provides all stages of well testing: design, data import and preprocessing, interpretation using forward and inverse modeling, report generation.



BENEFITS

- ✓ High-speed and accurate mathematical core
- ✓ More than 5000 models for calculating wellstream with various reservoir and boundary configurations
- ✓ Support for all types of well tests
- ✓ Auto-interpretation of well testing in steady and unsteady conditions using ML
- ✓ Unique method for interpreting decline curve analysis on horizontal wells with multi-stage hydraulic fracturing taking into account GUB
- ✓ 10+ multiphase flow models for pressure calculation
- ✓ Highly accurate method for calculating the speed of sound in the annulus
- ✓ Automatic calculation of average reservoir pressure
- ✓ Linux version is available

WELL TEST, PRESSURE BUILDUP ANALYSIS

PLANS

- ✓ Expanding well model list, boundaries and algorithms for calculating pressure along the wellbore
- ✓ Expanding gas well testing models
- ✓ Automatic data preprocessing followed by automatic interpretation
- ✓ Gas well test interpretation for condensate wells

MANAGEMENT OF FIELD DEVELOPMENT



RN KIN

 **3 000+**
USERS

 **100+**
MODULES

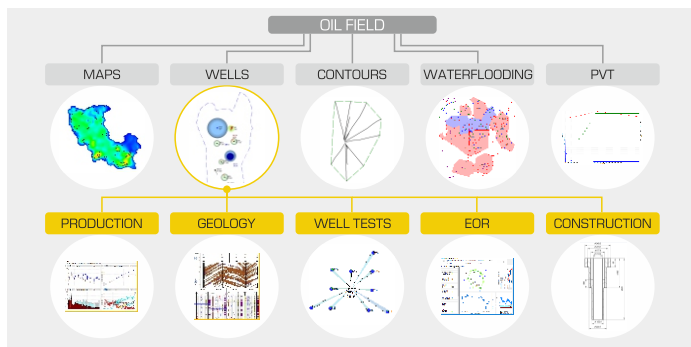
DESCRIPTION

RN-KIN has a wide range of functionality required by petroleum engineers and uses advanced technologies to manage field development and modeling.

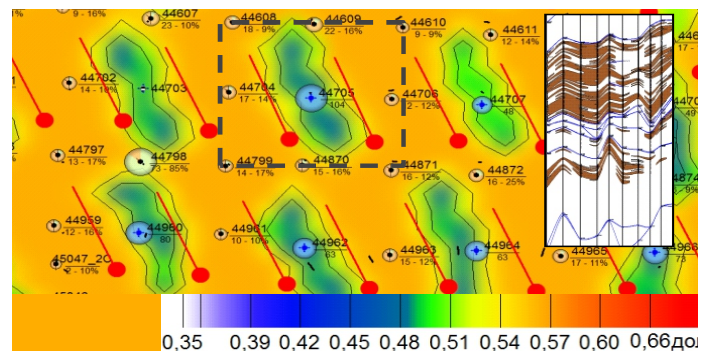
This software package allows analyzing the recovery of reserves, selecting interventions and workover, planning well surveys, optimizing the reservoir pressure maintenance system, reducing capital costs and designing development systems.

BENEFITS

- ✓ All-in-One Database for G&G and production data, workover operations, well tests and logs
- ✓ High-speed software
- ✓ 5 minute analysis of base production by the field
- ✓ Automatic selection of candidates for intervention and workover
- ✓ Express assessment of reserve recovery
- ✓ Analysis of RPM system efficiency



RN-KIN DATABASE



OIL SATURATION MAP IN RN-KIN

PLANS

- ✓ Well survey digital service
- ✓ Field development management based on machine learning

TECHNOLOGICAL PROCESS MODELING



RN SIMTEP

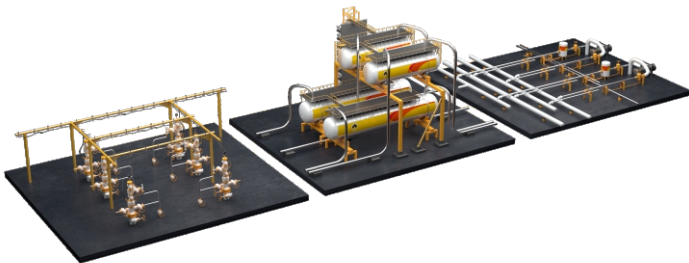
 **500+**
OF PROCESSING
AREAS

 **100 000 km**
OF PIPELINES

DESCRIPTION




RN-SIMTEP is a software package for modeling technological processes of transportation, treatment and primary processing of well products. It is designed to solve problems at the stage of oil fields design and operation.

RN-SIMTEP allows calculating the phase state and PVT properties of hydrocarbon systems, performing hydraulic calculations of multi-phase flows in pipelines, analyzing the risks of complications, and modeling processes and equipment for oil, water and gas treatment.












JOINT SIMULATION OF PROCESSES IN OIL GATHERING,
PROCESSING AND TRANSPORTATION SYSTEM

PLANS

-  Modeling absorption/adsorption, amine treatment
-  Modeling settling equipment, FWKO
-  Inhibition modeling

BENEFITS

Mathematical models of RN-SIMTEP are based on advanced and most accurate methods. They include:

-  Determination of PVT properties based on compositional and black oil models
-  Models of phase equilibrium "oil-gas-water" to take into account gas solubility in water and liquid in gas
-  Calculation of multiphase flow parameters in pipeline networks
-  Modeling of oil and gas treatment facilities (separation, heat transfer, transportation equipment)
-  Joint simulation of processes in oil gathering, processing and transportation system
-  Modeling in steady-state and quasi-dynamic modes
-  Risk analysis for surface facilities: corrosion, ARPD, hydrating, scale
-  Optimization of surface facilities operation modes
-  Listed in the Unified Register of Russian Software

HIGH-TECH SOFTWARE LINE OF ROSNEFT OIL COMPANY



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