ROSNEFT

HIGH-TECH UPSTREAM ENGINEERING SOFTWARE

HIGH-TECH SOFTWARE LINE OF ROSNEFT OIL COMPANY

ROSNEFT

APPLICATION

GEOLOGICAL MODELING
3D-modeling and analysis of hydrocarbon deposits

MODELING COILED TUBING OPERATIONS
Modeling and analysis of coiled tubing operations

PETROPHYSICAL MODELING
and well logging integration

REAL-TIME DATA VISUALIZATION
Data acquisition, processing and visualization on the control station of coiled tubing/hydraulic fracturing fleet

HYDRODYNAMIC MODELING
3D digital modeling of development processes for all types of fields

DOWNHOLE EQUIPMENT MODELING
Selection, modeling and analysis of downhole equipment for production wells

GEOMECHANICAL MODELING
Geomechanical modeling and stability analysis while drilling

WELL TESTS
Well test interpretation using forward and inverse modeling, production forecast

WELL DESIGN AND CONSTRUCTION
Engineering calculations for well design, construction and reconstruction

MANAGEMENT OF FIELD DEVELOPMENT
Modeling and development of oil and gas fields

GEOSTEERING
Geological drilling support for horizontal wells and sidetracks

TECHNOLOGICAL PROCESS MODELING
Modeling of technological process of transportation, treatment and product primary processing

HYDRAULIC FRACTURING MODELING
Engineering calculations for hydraulic fracturing modeling and analysis

HYDROGEOLOGY PROJECT MANAGEMENT
Comprehensive support for hydrogeological projects

GEOLOGICAL MODELING

ROSNEFT

RN GEOSIM

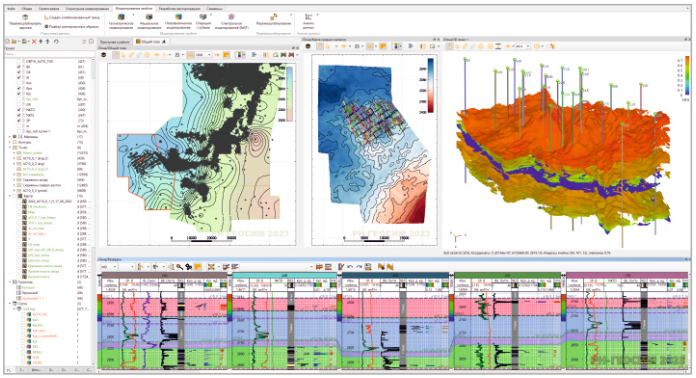
1 bln
CELLS IN GRID

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 features to solve the most complex geological modeling tasks.

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



3D GEOLOGICAL MODEL IN RN–GEOSIM

BENEFITS

- A full set of geomodeling tools
- "Seismic and hydrodynamics for geologists" within one project
- High–performance computing
- Universal any–fault modeling
- All–known and unconventional geostatistics algorithms
- Automatic workflow creation
- 3 click update of the geological model
- Object modeling and multipoint statistics
- Importing data of arbitrary formats
- Additional tools for well log/well log interpretation results curves
- Certified by the State Commission on Mineral Reserves
- Listed in the Unified Register of Russian Software
- Linux version available

PLANS

- Expert review of models
- Support for large and extra–large models
- Analysis of model stability to new data
- Automatic construction of a 3D geological model
- Interactive workshop
- Drilling support
- Basin modeling

PETROPHYSICAL MODELING AND WELL LOGGING INTEGRATION

ROSNEFT

RN PETROLOG

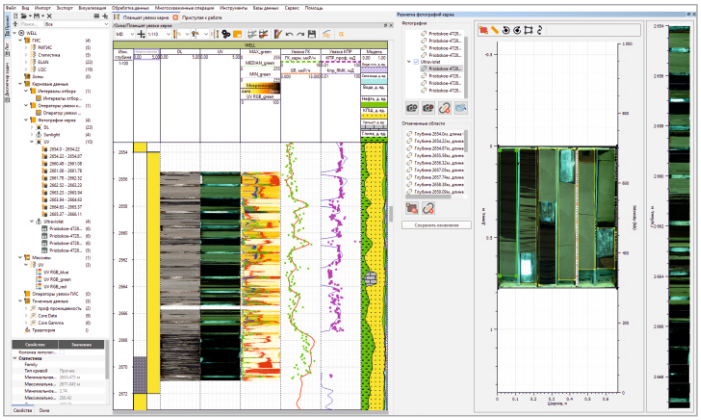
100+ ALGORITHMS

250+ USERS

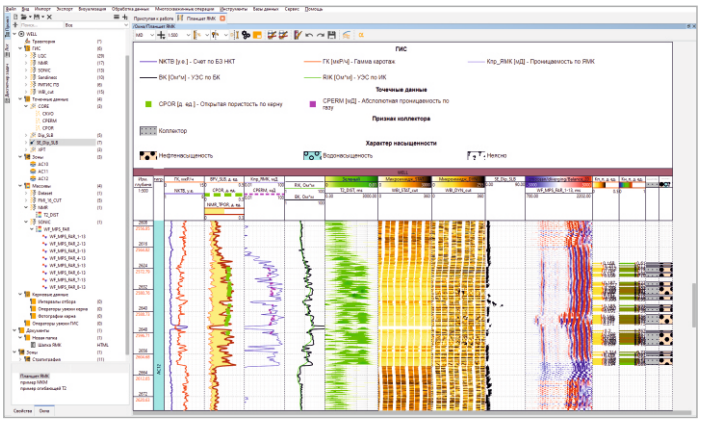
DESCRIPTION

RN–PETROLOG is a comprehensive tool for solving relevant tasks of petrophysical modeling and well logging and core data interpretation.

RN–PETROLOG is optimized for multi–well calculations and convenient data management. It is integrated both into the corporate line and with third–party software. RN–PETROLOG offers a rich set of modules for performing both routine and non–standard operations.



EXAMPLE OF CORE DATA MATCHING



EXAMPLE OF WORKING WITH ADVANCED WELL LOGGING COMPLEX

BENEFITS

- A full cycle of well log interpretation
- Import of all data types (LAS, DLIS, XML, xlsx, txt,...)
- Multiple tools for data management
- High performance and wide–ranging graphics tablet capabilities
- Multi–well calculations
- Automated calculations
- Embedded Python scripting with customized features
- Data calculator for quick calculations
- Data exchange with other software (RN–KIN, Techlog, PRIME)
- Interpretation of specific well logs (NMR, FWS, microimages)
- Visual programming module to construct interpretation graphs
- Embedded well log digitizer and the library for well log–based modeling
- Multiple features for importing and managing core photos

PLANS

- Data exchange with corporate software
- Petroelastic modeling
- FWS data processing
- PNL data interpretation
- PLT data interpretation
- Data inversion of laterologs

HYDRODYNAMIC MODELING

ROSNEFT

RN KIM

500+
USERS

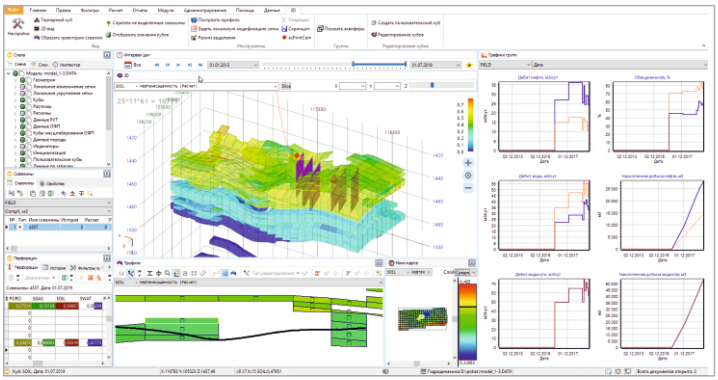
1 500+
MODELS PER YEAR

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 hydrody–namic 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 SIMULATOR MAIN WINDOW

BENEFITS

- Formats compatibility: Eclipse, Tempest, tNavigator
- Accurate hydraulic fracture model
- SPE tests compliance
- 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

- Injection–induced fracture growth in length and height
- Local refining using Voronoi diagrams (PEBI)
- Miscible displacement using the Todd–Longstaff model during CO2 injection
- Black Oil thermal option
- Quick calculation of hydraulic fracture parameters with RN–GRID
- Non–isothermal composition option

GEOMECHANICAL MODELING

ROSNEFT

RN SIGMA

100+
DATA ANALYSIS METHODS

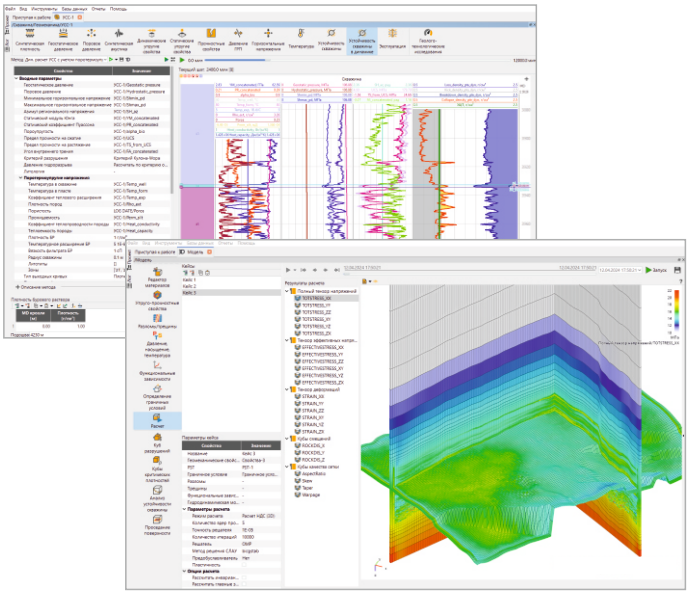
180+
USERS

DESCRIPTION

RN–SIGMA 1D is a software product for 1D geomechanical model construction and solving the tasks of inclined and horizontal wellbore stability.

RN–SIGMA 3D/4D is a software product for constructing 3D geomechanical and reservoir stress state models, as well as solving 4D tasks of coupled hydrodynamics and geomechanics.

All algorithms in RN–SIGMA 1D and RN–SIGMA 3D/4D are based on world's best practices. The set of tools allows performing a full cycle of work on data acquisition, analyzing and pre–processing, constructing 1D and 3D models of geomechanical properties and stresses, predicting drilling complications due to geological factors, optimizing a well trajectory and design, calculating a safe mud window, and also accounting for the reservoir stress–strain state effect on field development.



1D and 3D/4D GEOMECHANICAL MODELING

BENEFITS

- Full cycle of wellbore stability modeling
- Accounting for poroelasticity, elastic anisotropy, temperature, osmosis, viscoelasticity in 1D modeling
- Multi–well calculations
- Solutions to unconventional tasks: injection–induced fracturing, cement ring stability, sand production, fracture reactivation
- Clustering based on a random data set
- RN–SIGMA 1D and RN–SIGMA 3D/4D project coupling
- RN–SIGMA 3D/4D contains all the features of RN–SIGMA 1D
- Assessment of day surface subsidence
- User algorithms in Python
- Listed in the Unified Register of Russian Software
- Linux version is available

PLANS

- Cement stone stability under cyclic loading
- Mud effect on rock strength
- Optimization of RN–SIGMA 3D/4D core
- RN–SIGMA 3D/4D cluster version

WELL DESIGN AND CONSTRUCTION

ROSNEFT

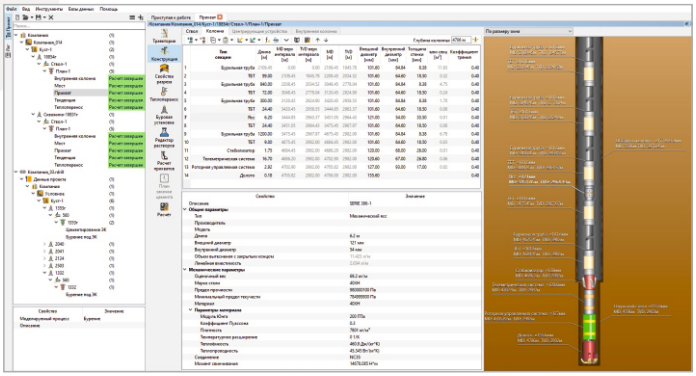
RN DRILLING CALCULATIONS

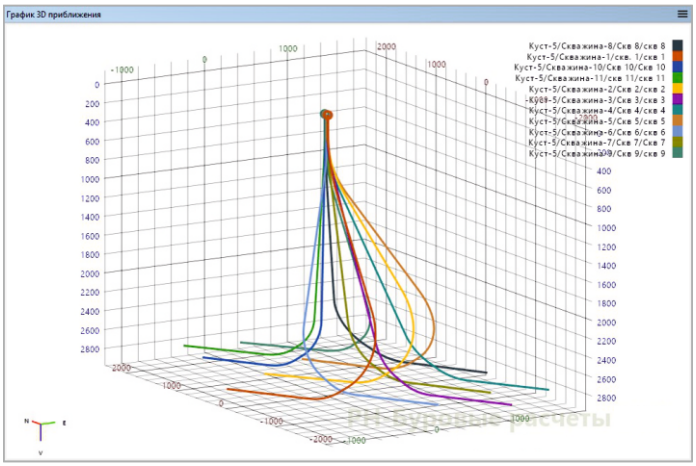
200+
USERS

3 400+
ITEMS IN THE DRILLING EQUIPMENT CATALOG

DESCRIPTION

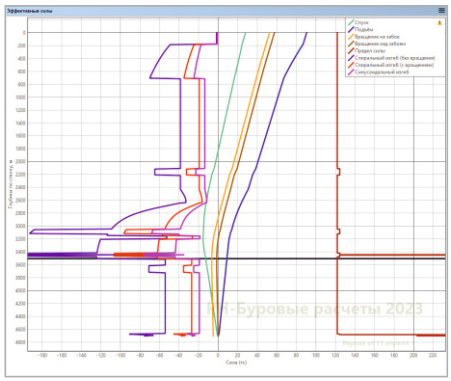
RN–DRILLING CALCULATIONS is software for engineering calculations and mathematical modeling of technological processes for solving tasks of well design and construction.

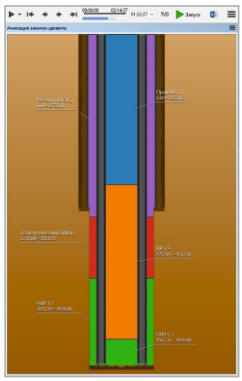




BENEFITS

- A comprehensive solution that combines all types of engineering calculations for well design and construction
- State–of–the–art models and algorithms
- User–friendly interface
- Multitasking with multiple windows/monitors
- Working with multiple projects
- Linux version is available





EXAMPLES OF ENGINEERING CALCULATIONS

PLANS

- 3D modeling of mud–to–cement conversion
- Casing calculation for excess pressure (internal, external)
- Casing flotation
- Accounting for rheological properties of mud at different temperatures
- The algorithm for raw data quality control of MWD accelerometers and magnetometers
- SCC
- MSA
- BHA sag calculation based on the detailed BHA model analysis to correct the inclination angle
- Client–server version

GEOSTEERING

ROSNEFT

RN HORIZON+

120+
USERS

3 000+
COMPLEX WELLS PER YEAR

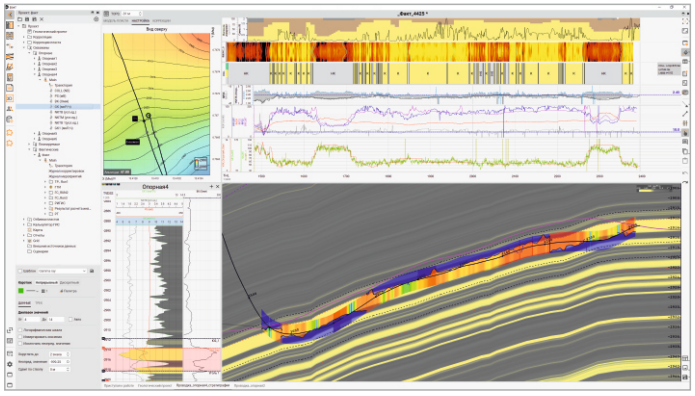
DESCRIPTION

RN–HORIZON+ is a software tool for geological support for drilling of horizontal wells and sidetracks. It implements state–of–the–art techniques for quick 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.

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
- Multi–well 3D algorithms for modeling stratum structure and reservoir 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



GEOSTEERING MODEL IN RN–HORIZON+

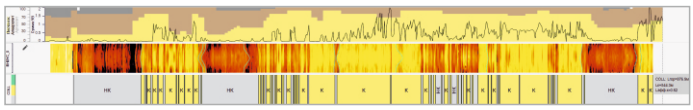


IMAGE LOG INTERPRETATION IN RN–HORIZON+

PLANS

- New geosteering methods
- Quick trajectory calculation
- Setting up a geosteering model accounting for multiple reference wells
- Distributed storage system for geosteering projects
- Automated support for drilling horizontal wellbores with minimal human intervention
- WITSML client upgrade

HYDRAULIC FRACTURING MODELING

ROSNEFT

RN GRID

600+
USERS

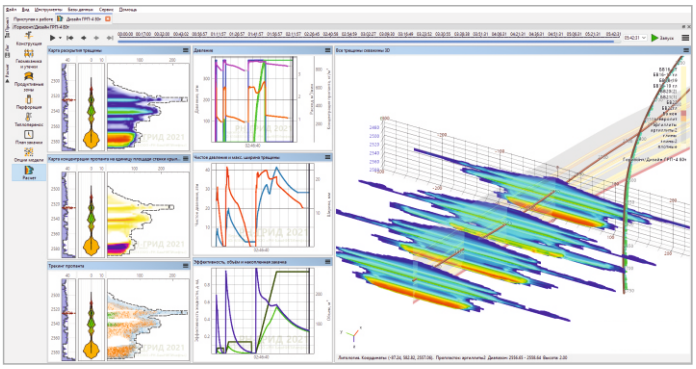
15 000+
SUCCESSFUL JOBS PER YEAR

DESCRIPTION

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

RN–GRID provides all the necessary engineering tools for hydraulic fracturing design and support: limitless treatment data import and visualization, geomechanical modeling of the reservoir, diagnostic injection analysis, simulation and analysis of actual frac jobs using an extensive database of process fluids and proppants.

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



MULTI–STAGE HYDRAULIC FRACTURING ON A HORIZONTAL WELL

BENEFITS

The mathematical model of RN–GRID is based on the cutting–edge Planar3D concept, which allows the most accurate description of complex fracture geometry during hydraulic fracturing. It makes RN–GRID significantly superior to foreign analogues, most of which use simplified methods.

- 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
- Advanced 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

- Improved simulation speed
- Hydraulic fracturing using viscoplastic fluids
- Horizontal fracture modeling
- Hydraulic fracturing in shallow objects
- Foam hydraulic fracturing

MODELING COILED TUBING OPERATIONS

ROSNEFT

RN VECTOR

50+
ALGORITHMS
OF CT CALCULATIONS

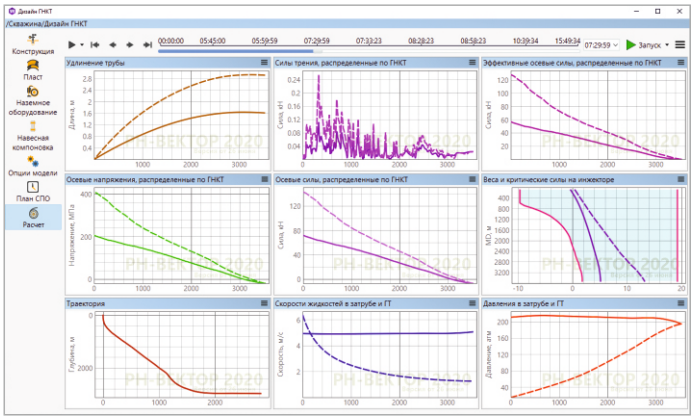
120+
USERS

DESCRIPTION

RN–VECTOR is an industrial software solution 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
- Accounting for hydraulics effect on CT stress state
- CT critical stress calculation
- Calculation of 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
- 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 drilling calculations
- CT assembly optimization
- RIH/POOH visualization
- Calculators for buckling load and fatigue express assessment

REAL-TIME DATA VISUALIZATION

ROSNEFT

RN VISOR

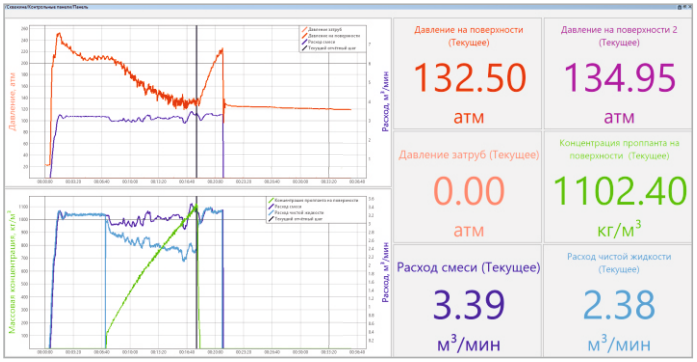
50+
METHODS OF DATA VISUALIZATION

1 500+
PERFORMED OPERATIONS

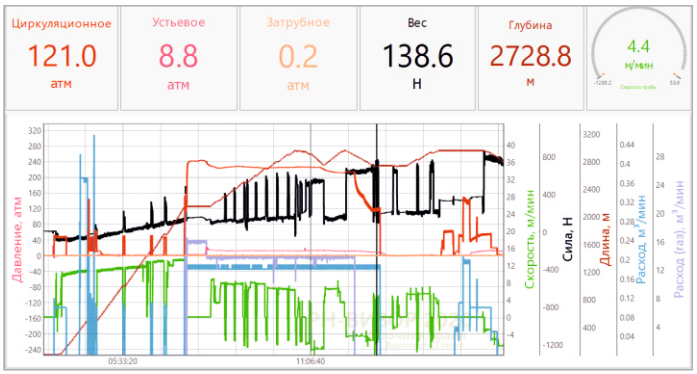
DESCRIPTION

RN–VISOR is 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.



HYDRAULIC FRACTURING GRAPHS



CT GRAPHS

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 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

PLANS

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

DOWNHOLE EQUIPMENT MODELING

ROSNEFT

RN ROSPUMP

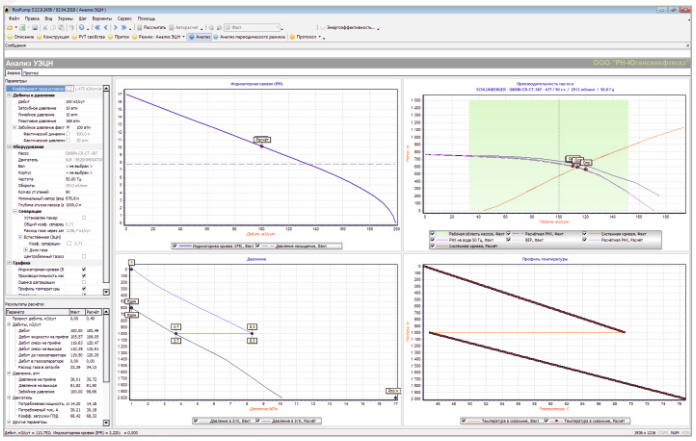
120 000+ DESIGNS

15 000+ EQUIPMENT MODELS

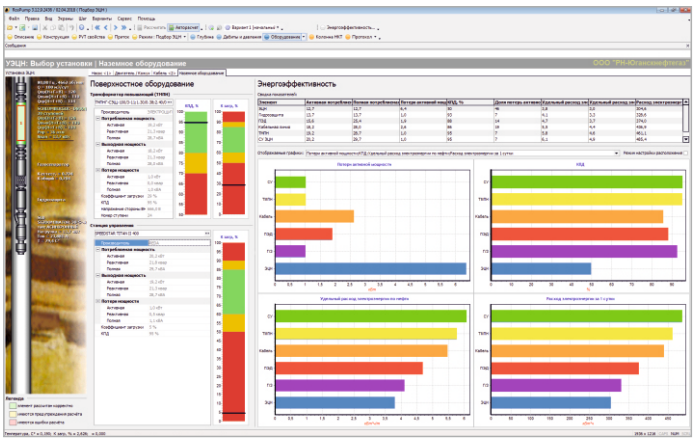
DESCRIPTION

RN–ROSPUMP is a software product designed to calculate and analyze the parameters of producing wells. RN–ROSPUMP can help to create designs for wells equipped with electric submersible pumps (ESP) or sucker rod pumps (SRP), as well as for natural flow wells.

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



ESP SYSTEM ANALYSIS



ESP ENERGY EFFICIENCY ANALYSIS

BENEFITS

RN–ROSPUMP offers wide adjustment possibilities to tailor the tool for the needs of 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.

- Designs automation
- Using the latest hydrodynamic models
- PVT correlations for any oil
- Wellbore curvature control in the pump setting interval and equipment running–in section
- Assessment of design energy efficiency
- ESP assembly design
- Periodic well modeling
- Accounting for complications

PLANS

- Optimization of SRP selection algorithms
- Modeling of complications
- Accounting for additional equipment

WELL TESTS

ROSNEFT

RN VEGA

200+ USERS

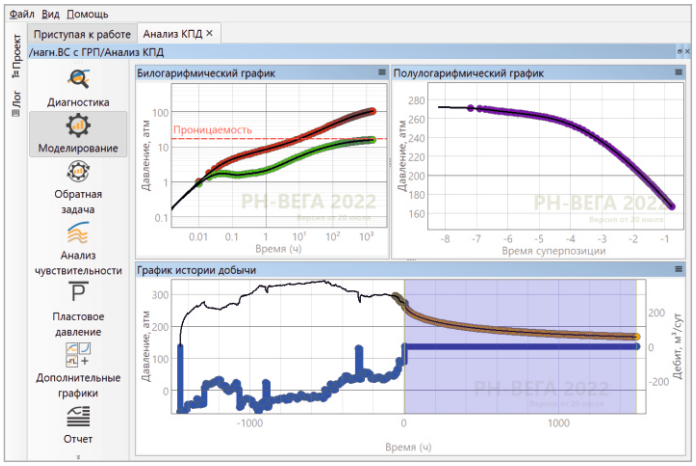
3 000+ TESTS PER YEAR

DESCRIPTION

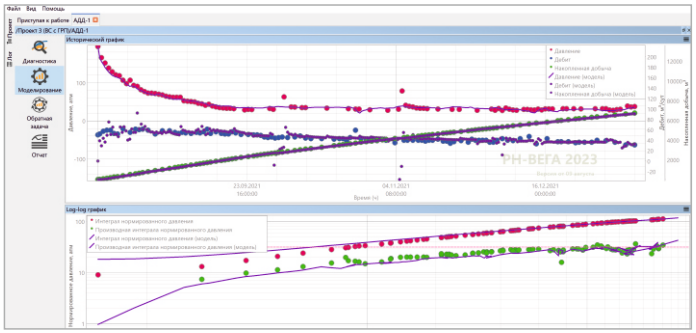
RN–VEGA is a software product for analysis and interpretation of well tests.

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: data import and preprocessing, modeling, solving an optimization task, report generation.



WELL TEST ANALYSIS PRESSURE BUILDUP CURVE



FLOW RATE AND PRESSURE ANALYSIS

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 accounting for PLT
- 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

PLANS

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

MANAGEMENT OF FIELD DEVELOPMENT

ROSNEFT

RN-KIN

3 000+ USERS

100+ MODULES

DESCRIPTION

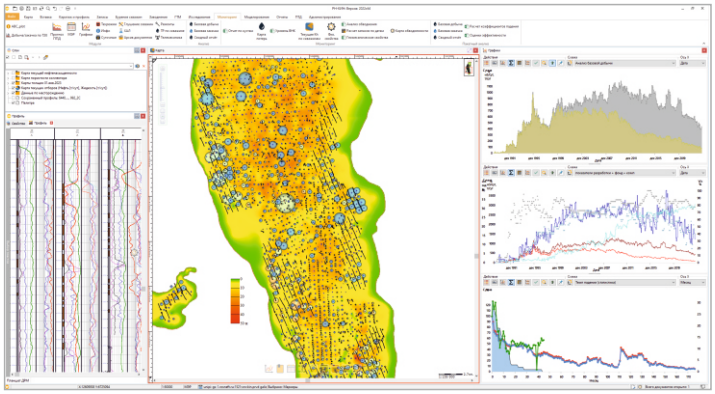
RN–KIN has a wide range of features required by petroleum engineers and uses advanced technologies to manage field development and modeling.

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

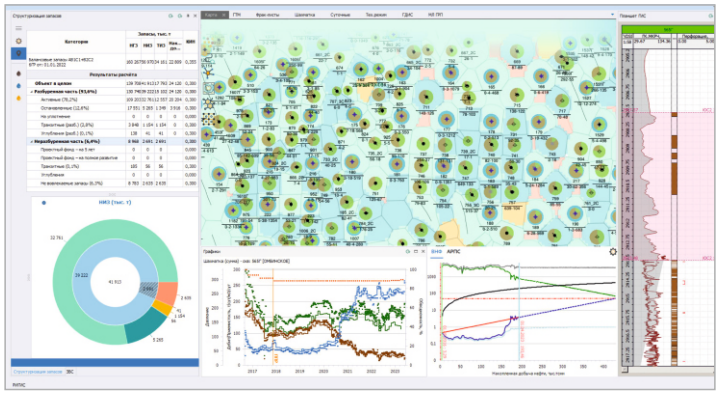
RN–KIN provides storage of all geological data on wells and production facilities of oil and gas fields: coordinates of wells and well pads, well operating modes, field development indicators, geological contours, structural maps and maps of reservoir properties, reservoir and well surveys. An integrated system of geological data quality control allows organizing the process of continuous monitoring and updating a unified database.

BENEFITS

- All–in–one database for G&G and production data, workover and intervention, well tests and logs, design solutions
- High–speed software
- 5 minute analysis of base production by the field
- Automatic selection of candidates for workover and intervention
- Quick assessment of reserve recovery
- Analysis of RPM system efficiency



MAP OF INITIAL NET PAY AND FIELD DEVELOPMENT INDICATORS



FIELD DEVELOPMENT ANALYSIS

PLANS

- Well survey digital service
- Integration of digital solutions for conceptual engineering and surface facilities
- Economic assessment service integration for projects
- Smart assistant based on LLM models
- Embedded BPMS system

HYDROGEOLOGY PROJECT MANAGEMENT

ROSNEFT

RN AQUA

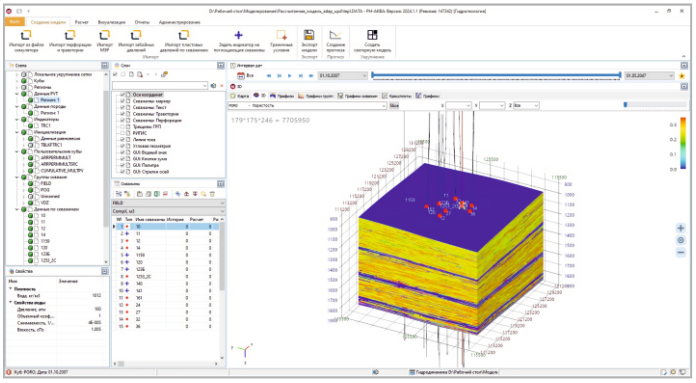
150+
USERS

50+
ALGORITHMS AND METHODS

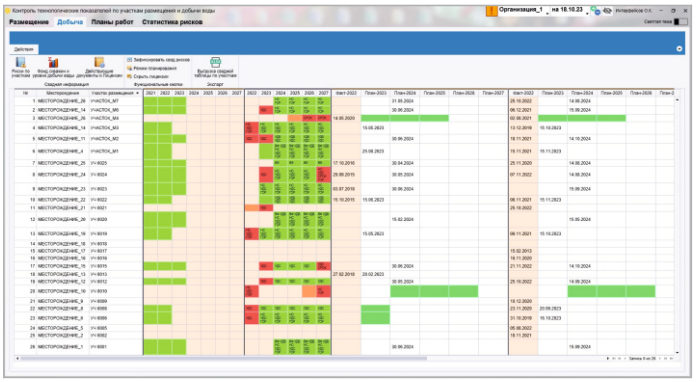
DESCRIPTION

RN–AQUA is a software solution for hydrogeological projects support, designed to apply an integrated approach to ground–water resource management during development and operation.

RN–AQUA has a full set of tools to solve hydrogeological tasks and provides digitalization of hydrogeology project manage–ment and design.



3D MODEL OF AQUIFERS



RISK ANALYSIS

BENEFITS

- Comprehensive solution for project management and design in hydrogeology
- Risk analysis of technological parameters deviation
- Processing of experimental filtration studies
- Creation and maintenance of hydrogeology databases
- Hydrodynamic modeling of aquifers
- Hydrogeochemical calculations
- Groundwater resources assessment
- Hydrogeological knowledge base
- Automated generation of design and reporting documentation in accordance with the requirements of government agencies

PLANS

- ML for hydrogeological forecasts
- Modeling sanitary control zones of water intakes, accounting for filtration rates and natural groundwater flow
- Research/monitoring program creation and analysis of its implementation
- Electronic system for work monitoring
- Mobile application for field work

TECHNOLOGICAL PROCESS MODELING

ROSNEFT

RN SIMTEP

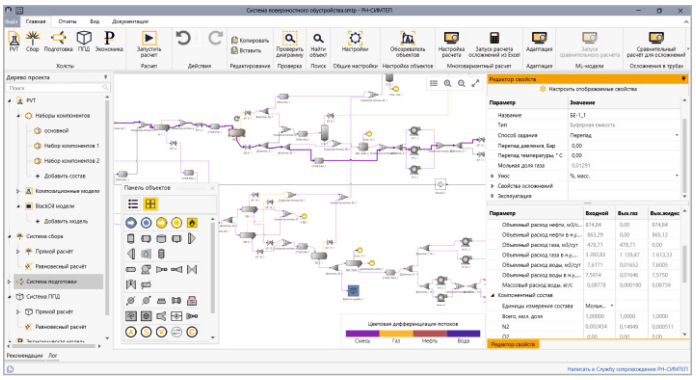
500+
OF PROCESSING AREAS

100 000 km
OF PIPELINES

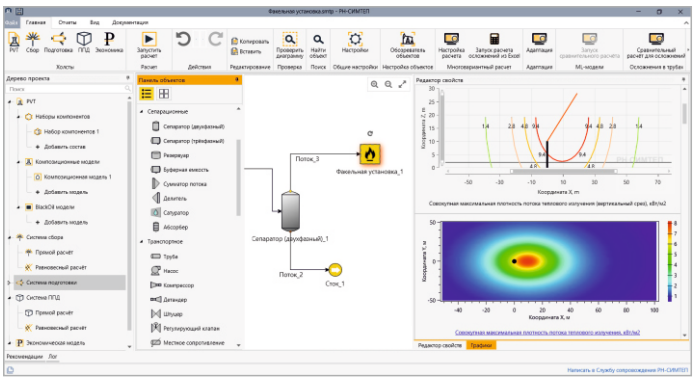
ОПИСАНИЕ

RN–SIMTEP is a software package for modeling technological processes of transportation, treatment and primary process–ing of well products. It is designed to solve tasks 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.



UNIFIED ENVIRONMENT FOR MODELING TREATMENT AND TRANSPORTATION SYSTEMS



MODELING OF COMPLEX INSTALLATIONS AND UNITS

ПРЕИМУЩЕСТВА

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

- Joint simulation of processes in oil gathering, treatment and transportation system
- Risk analysis for surface facilities: corrosion, ARPD, hydrating, scale
- Estimation of hydrate inhibitor consumption at each object of the flowsheet
- Optimization of surface facilities operation modes
- Parametric and forecast calculations
- Modeling of oil and gas treatment facilities, including complex devices (absorbers/adsorbers, amine treatment units, settling equipment)
- Calculation of multiphase flow parameters in pipeline networks of any configuration
- Heat and environmental calculations for flares
- Pipeline strength calculations accounting for hydraulics
- 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
- Listed in the Unified Register of Russian Software

ПЛАНЫ

- Modeling of gas and oil wells
- Calculation of reservoir energy based on material balance
- Calculation of objects based on VFP tables
- Linking of external libraries

HIGH-TECH SOFTWARE LINE OF ROSNEFT OIL COMPANY

RN-GEOSIM
GEOLOGICAL MODELING

RN-PETROLOG
PETROPHYSICAL MODELING

RN-KIM
HYDRODYNAMIC MODELING

RN-SIGMA
GEOMECHANICAL MODELING

RN-DRILLING CALCULATIONS
WELL DESIGN AND CONSTRUCTION

RN-HORIZON+
GEOSTEERING

RN-GRID
HYDRAULIC FRACTURING MODELING

RN-VECTOR
MODELING AND ANALYSIS OF COILED TUBING OPERATIONS

RN-VISOR
REAL-TIME DATA VISUALIZATION

RN-ROSPUMP
DOWNHOLE EQUIPMENT MODELING

RN-VEGA
WELL TESTING

RN-KIN
MANAGEMENT OF FIELD DEVELOPMENT

RN-AQUA
HYDROGEOLOGICAL MODELING

RN-SIMTEP
TECHNOLOGICAL PROCESS MODELING

www.rn.digital/en