Polykod

PolyPrime

User Guide

Creating a Prime Report

Version: 2.1.1

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Introduction

This document illustrates the entire workflow for generating a report based on Prime Analysis results, starting from input data quality control and concluding with the compilation of a final list. This list encompasses a comprehensive diagnosis of the entire asset and its individual wells, along with recommendations for subsequent geological and technical operations, drilling, etc.

PolyPrime is a plugin for the PolyGon software.

For more detailed information on this comprehensive tool for the analysis and interpretation of dynamic flow rate and pressure data during the development of oil and gas fields, please follow the link https://polykod.ru/polygon/.

PolyGon software operating platform

Scope of Application and Benefits of Prime Analysis

Prime Analysis is a workflow centered around a set of high-level development performance metrics, generated by the PolyPrime software based on production history data (such as flow rates, pressures, PTA, and PLT).

Prime Analysis focuses on mature reserves underperforming in terms of production and/or pressure targets due to well integrity issues, poor reservoir connectivity, reservoir heterogeneity, or an inaccurate understanding of reservoir properties in the area. It serves as the primary tool for selecting prospective zones for infill drilling, optimizing waterflooding operations, and identifying candidate wells for well interventions and production logging surveys.

The scope of application and benefits of Prime Analysis are presented in Table 1 and Figure 1.

Table 1 – Application of Prime Analysis

Development Analysis	Well Intervention Planning
Assessment of current recovery and recovery rates	Selection of candidates for well interventions (water shut-off, stimulation, hydraulic fracturing)
Evaluation of the reservoir pressure maintenance system efficiency	Recommendations for well testing (PLT, PTA, PCT)
Assessment of development target productivity and potential for its enhancement	Optimization of the pressure maintenance system
Evaluation of sweep efficiency (non-productive production/injection, incomplete reserve involvement)	Well operating regime planning

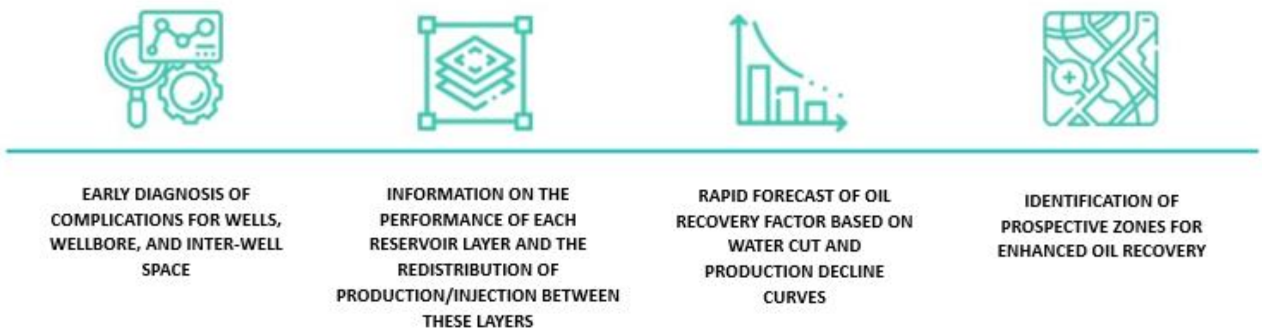


Fig. 1 – Benefits of Prime Analysis

One of the key features of Prime Analysis is its high degree of automation. This accelerates the data processing workflow, enhances the accuracy of the results, and significantly reduces the workload for the specialist, who previously had to perform all operations manually.

Furthermore, the Prime Analysis package provides a user-friendly interface for data handling, making it easy to use for oil and gas industry professionals.

User Proficiency Level

The following criteria are defined for the User:

• knowledge of the general principles behind the generation of the Prime Analysis web report and its purpose;

• possession of comprehensive information regarding the asset under analysis;

• proficiency in working with the PolyGon software interface;

• ability to generate analytical reporting based on Prime Analysis.

Stages of compiling a Prime Report

Stage 1 – Analysis of the quality of imported field data.

Stage 2 – Creating a project in PolyGon and populating it with information.

Stage 3 – Preparation of the input Excel file "PolyGon_wells_import".

Stage 4 – Generation of the input Excel file "PRIME_Input" and its subsequent population.

Stage 5 – Generation of the Prime Report.

These stages are described in Sections 1 through 5.

1. Input data

The primary prerequisite for successfully generating a Prime Analysis report is the availability of complete and reliable information about the subject asset. This information will be analyzed by the User and entered into the corresponding input Excel files and the PolyGon software.

Source data for the analysis can include common field database formats (such as KIS ARMITS, OFM, ResView, NGT, etc.), as well as specialized formats compliant with corporate standards. Production/injection data and well stock parameters can be exported, for instance, from an NGT project in the required format with annual or monthly timesteps (a 1-year timestep is typically used). Annual average reservoir pressure values for producers, injectors, and observation wells can be obtained from a pressure database.

Two primary methods are available for data input into the PolyGon software: the first is direct data entry within the application, and the second is the use of specific input Excel files named "PolyGon_Input" and "PRIME_Input". Both methods have their advantages and can be utilized to achieve the desired objectives, depending on the User's specific needs.

The parameters that can be entered into the PolyGon software are listed in Tables 1.1 and 1.2.

Table 1.1 – PVT parameters

<table>
<tr><th colspan="2">PVT parameters</th></tr>
<tr><td>Viscosity (μ)</td><td rowspan="4">of oil, water, gas</td></tr>
<tr><td>Density (ρ)</td></tr>
<tr><td>Formation Volume Factor (B)</td></tr>
<tr><td>Compressibility (c)</td></tr>
<tr><td colspan="2">Solution Gas-Oil Ratio (Rs)</td></tr>
<tr><td colspan="2">Bubble Point Pressure (Pb)</td></tr>
<tr><td colspan="2">Water Salinity</td></tr>
<tr><td colspan="2">Temperature (T)</td></tr>
</table>

Table 1.2 –RPM Properties

RPM Properties	
Current Gas Saturation (Sg)	Oil + Gas
Critical Gas Saturation (Sgr)	
Residual Oil Saturation to Gas Displacement (Sorg)	
Relative Permeability to Gas (Krgo)	
Relative Permeability to Oil (Krog)	
Residual Oil Saturation (Sorw)	Dead Oil + Water
Critical Water Saturation (Swc)	
Initial Water Saturation (Swi)	
Current Water Saturation (Sw)	
Relative Permeability to Oil (Krow)	
Relative Permeability to Water (Krwo)	
Critical Gas Saturation (Sgc)	Gas + Water
Initial Water Saturation (Swi)	
Relative Permeability to Gas (Krgw)	
Relative Permeability to Water (Krwg)	

Additionally, the following parameters are entered in the "Maps" data tree:

- Reference Depth;
- GOC (Gas-Oil Contact);
- WOC (Water-Oil Contact).

The parameters entered into the «PolyGon_wells_import» and «PRIME_Input», Excel files are described in Sections 3 and 4.

Furthermore, there is a set of parameters that provide descriptive information about the asset under analysis. These parameters are specified in the «PRIME_Input» input file within the Asset Summary and "FDP" (Field Development Plan) sheets.

1.1. Input data quality analysis

Analyzing the quality of imported field data is crucial for presenting an accurate picture of the subject asset's condition.

<u>The information subject to analysis includes</u>: esign documentation, production history, rock properties, PVT properties, reserves, relative permeability data, all well test results, and pressure performance data (Fig.1.1.1).

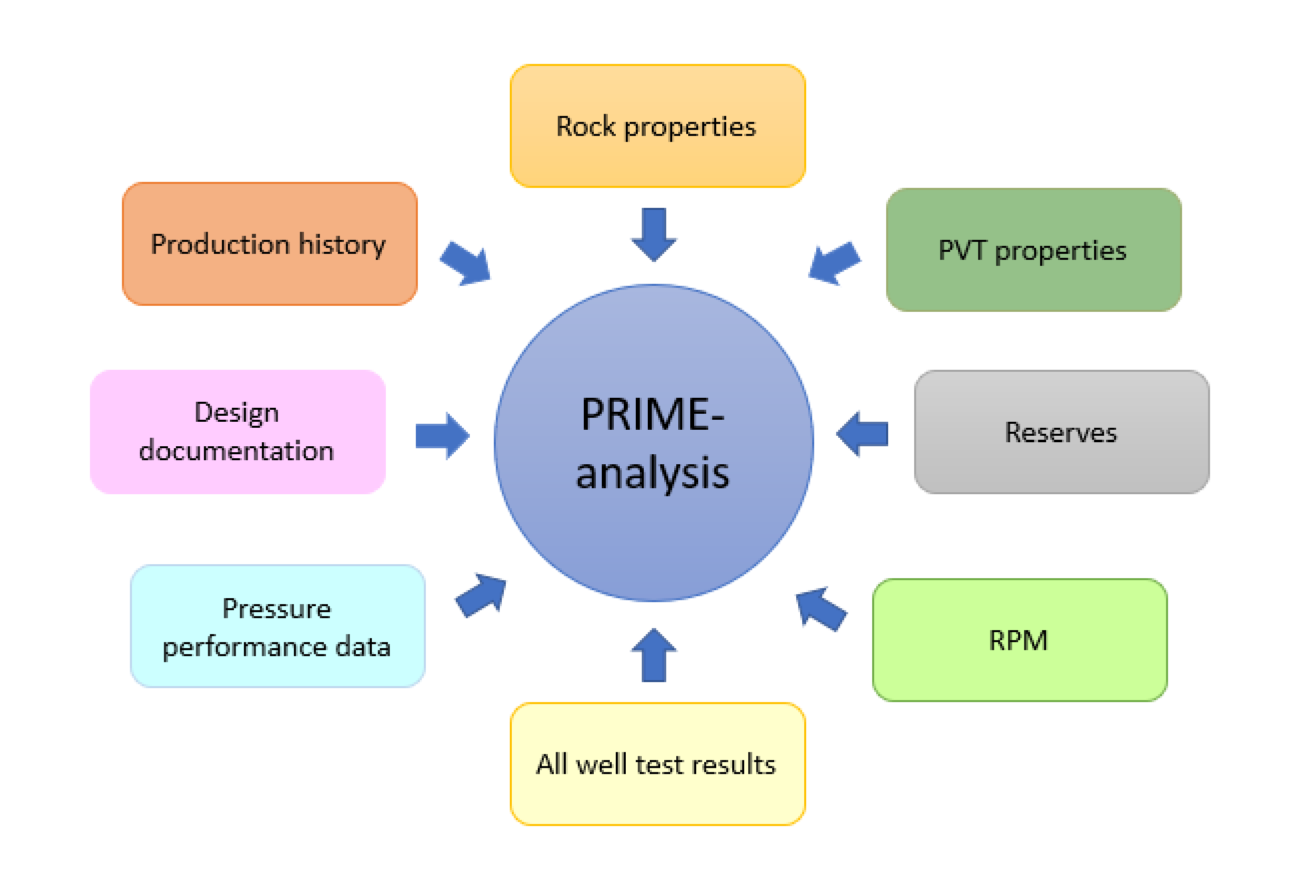


Fig. 1.1.1 – Analyzed information

When populating the input file, it is essential to verify the quality of the imported data to enhance the accuracy and reliability of the analysis results and to optimize the computational processes performed by the PolyGon software.

The input Excel file must not contain:

- negative or duplicate values for pressures and flow rates;
- data gaps ("#N/A");

- duplicate dates;
- presence of symbols or alphabetical characters in numerical data fields;
- active data filters.

It is recommended to use the well-based chart visualization tool in the "Sensors" section of the PolyGon software as a means to identify erroneous values. This allows for the prompt detection of any data anomalies and the implementation of corrective measures, thereby ensuring more accurate calculation results.

It is crucial to verify that bottomhole pressure values do not precede the corresponding flow rate values; otherwise, an error will occur in the productivity calculations, leading to the termination of the Prime Analysis process (Fig. 1.1.2).

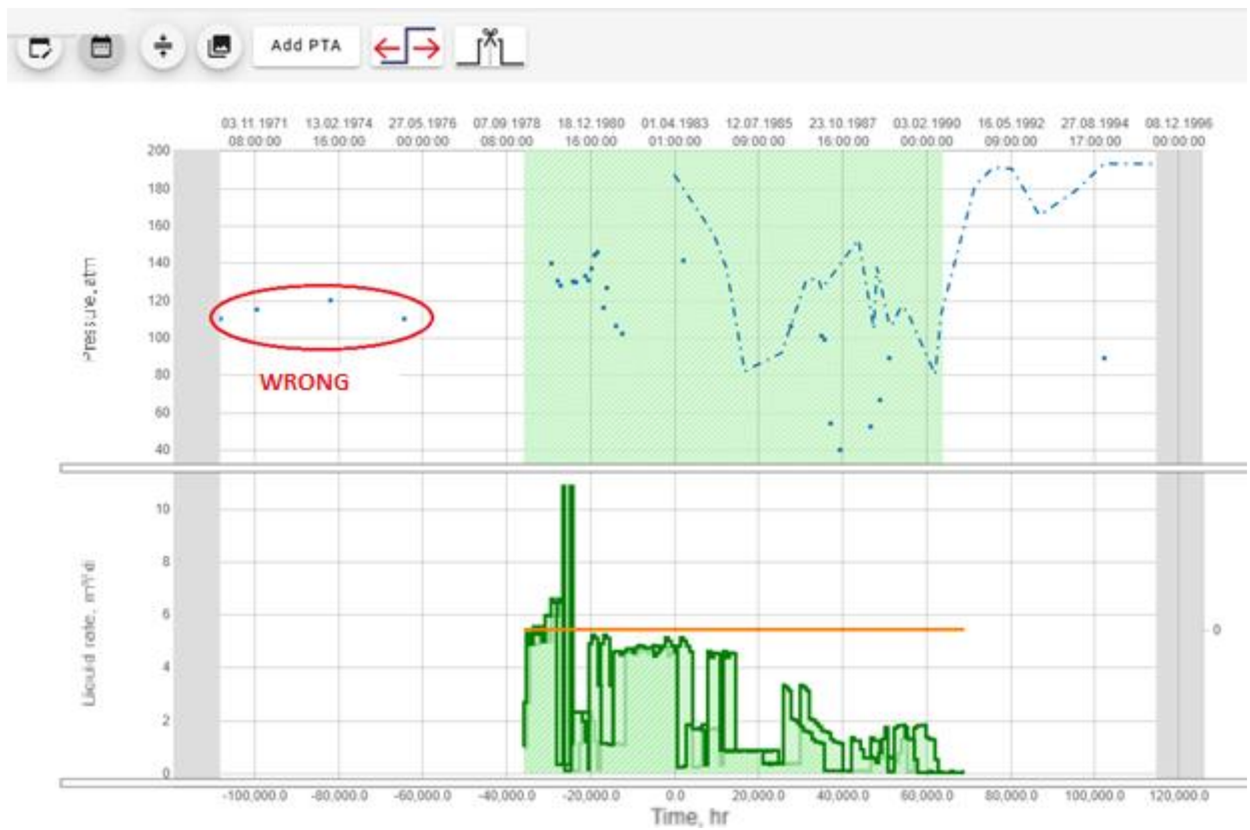


Fig. 1.1.2 – Example of erroneous data with bottomhole pressure readings preceding flow rate values

In such a case, as shown in Fig. 1.1.2, it is necessary to verify whether bottomhole pressure measurements were indeed taken after well drilling but before the well was brought on stream.

Furthermore, attention should be paid to the possibility of incorrect reservoir and/or bottomhole pressure values being specified in the "PolyGon_input" file (Fig. 1.1.3).

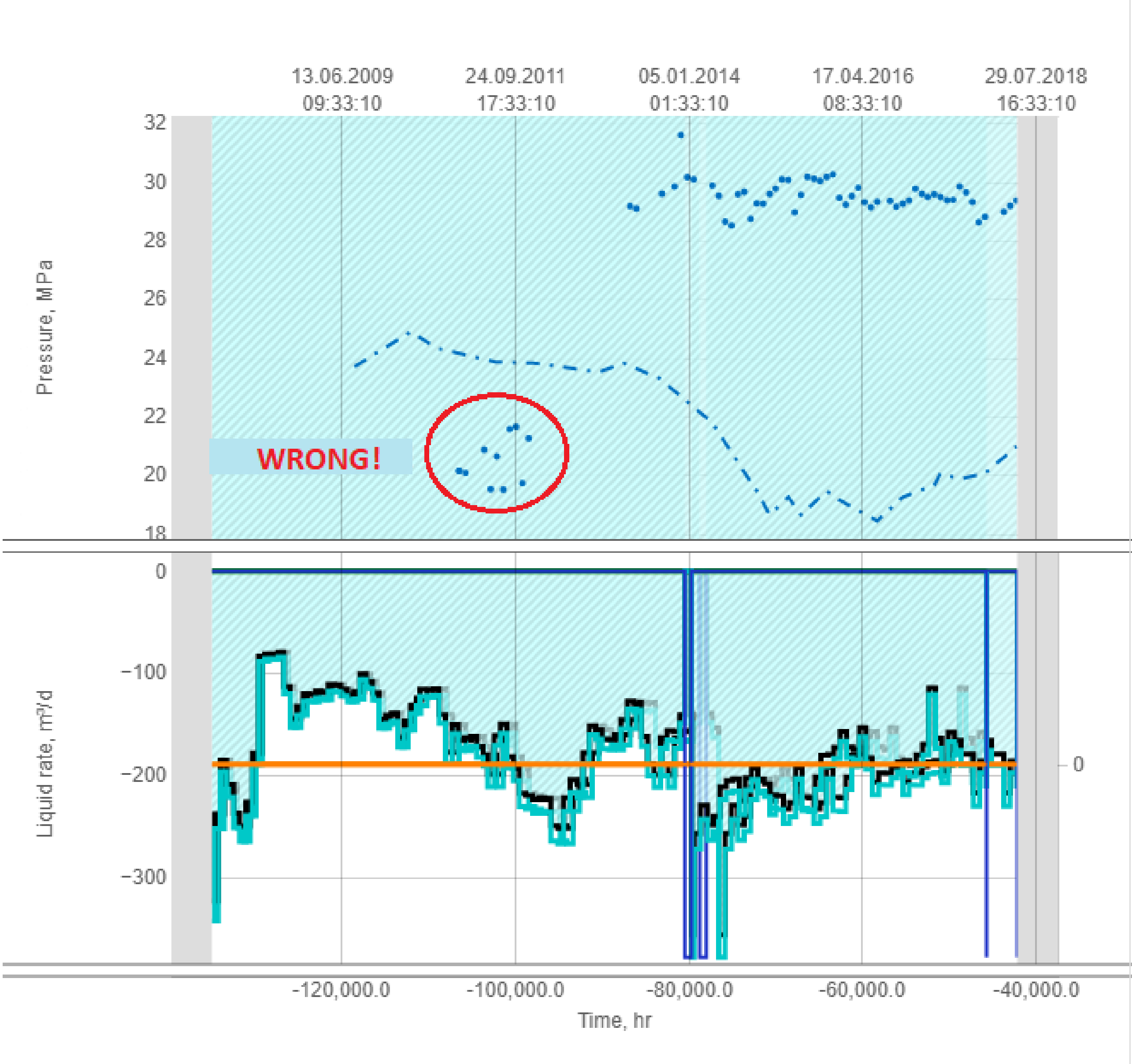


Fig. 1.1.3 – Example of incorrect bottomhole pressure values in an injection well

Parameter loading must be performed for the respective study assets/zones.

Note: In Figures 1.1.2–1.1.3, dots represent bottomhole pressure, and the dashed line represents reservoir pressure.

After populating the "PolyGon_input" file, an automatic validation of the input well log interpretation data for correctness is performed, followed by data interpolation. Once the file is loaded into the PolyGon software, the same file must be exported back from PolyGon. In the resulting Excel file, data requiring attention will be highlighted:

- **Yellow highlighting** indicates interpolated values. Missing values are interpolated using data from adjacent wells.
- **Orange highlighting** flags values that could not be interpolated. These are missing data points for which interpolation failed due to insufficient information.
- **Red highlighting** signals an error. The data contain negative values or fall outside the valid range defined in the PolyGon software for that specific property.

2. Creating a project in PolyGon software

Step Two – Creating a Project in the PolyGon Software and Populating it with Data.

The user must log in to the PolyGon software (Fig. 2.1) using their personal account and create a project for the asset under analysis.

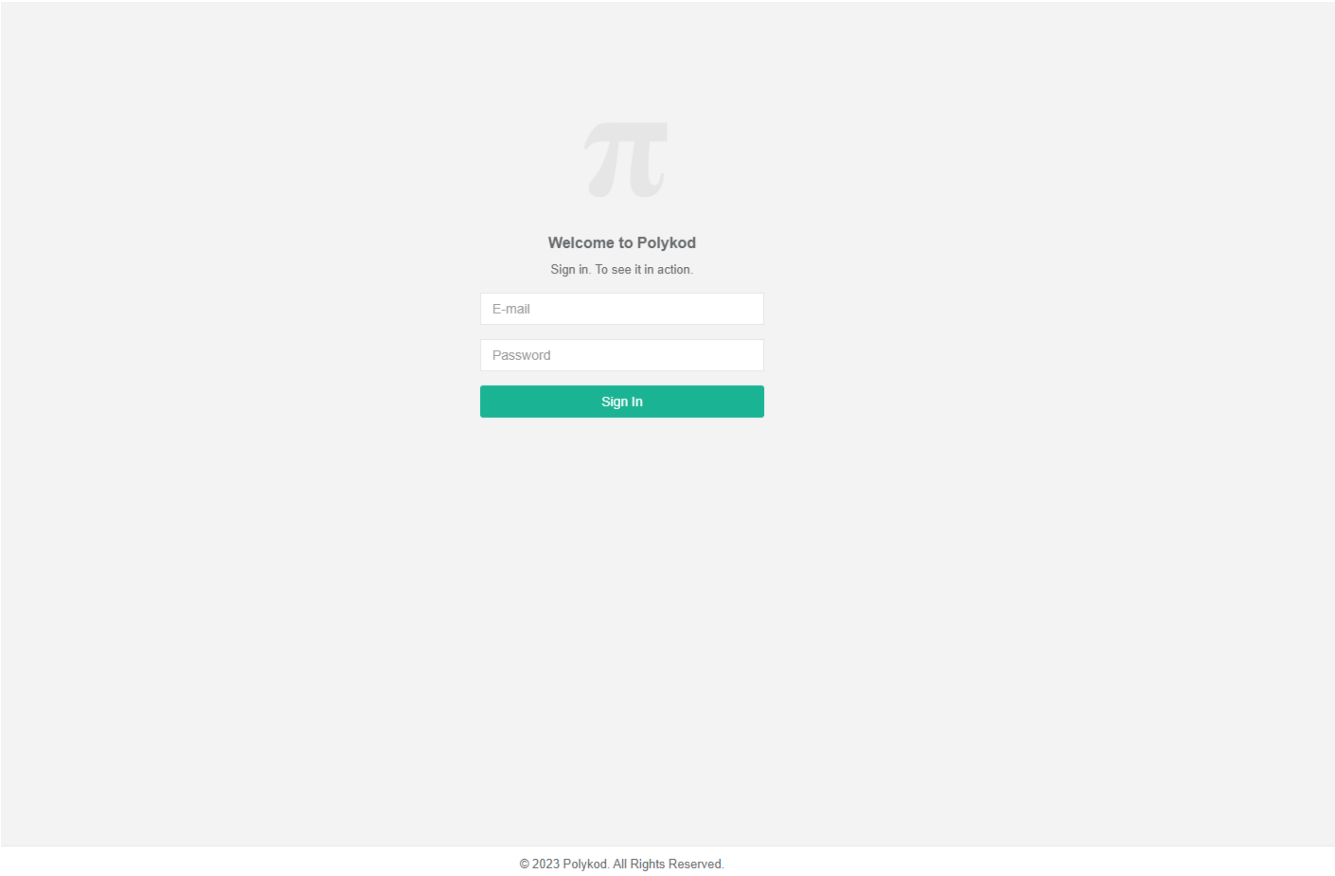


Fig. 2.1 – Authorization in PolyGon software

Note: A full description of the PolyGon software interface and functionality can be found at this link https://wiki–polygon.polykod.com.

2.1. Description of the "Explorer" tab

When opening the PolyGon software, the user is taken to the workspace of the "Explorer" tab, which provides a graphical interface for accessing and managing files, folders, and projects (Fig. 2.1.1).

Fig. 2.1.1 – The work area of the "Explorer" line of the PolyGon software

Using the "Explorer," the user can create a new project or open an existing one. The workspace interface has the following structure:

1 – Explorer tree, which allows for navigation through the content;

2 – Area for managing existing data;

3 – Area for creating projects, folders, and uploading files.

Thus, the user is able to store projects and files in an organized manner within the internal environment of the PolyGon software.

2.2. Создание проекта по анализируемому объекту

To create a project in the PolyGon software, the user must:

Select a folder in the Explorer tree (on the left) where the project will be stored.

Select the "New Project" tab in the right part of the interface.

Fill in the fields.

Click the "Create Project" button.

Descriptions of the project fields are provided in Table 2.2.1.

Table 2.2.1 – Project fields

Field Name	Description	Possible Values	Mandatory
Project Name	The name of the project. This will be displayed in the software interface.	Letters, numbers, and other symbols.	Yes
Units	The default unit set to be used for the project. Any individual unit of measurement can be modified later during project work.	Metric Field Russian	Yes
Project ID	A unique project identifier.	Letters, numbers, and other symbols.	No
Project Date	The date the project was executed.	Numeric values	No
Company	The client company commissioning the study.	Letters, numbers, and other symbols.	No
Country	The country where the asset is located or the country of the client.	Letters, numbers, and other symbols.	No
Asset	The name of the hydrocarbon field/asset.	Letters, numbers, and other symbols.	No
Focal Point	The service company employee responsible for client communication.	Letters, numbers, and other symbols.	No
Focal Point Email	The email address of the focal point.	Letters, numbers, and other symbols.	No
Analyst	The service company employee performing the interpretation. This field is pre-populated with profile data but can be modified.	Letters, numbers, and other symbols.	No
Analyst Email	The email address of the analyst.	Letters, numbers, and other symbols.	No
Contractor	The company executing the project (service company).	Letters, numbers, and other symbols.	No

Comments	Any comments related to the project.	Letters, numbers, and other symbols.	No

he user can also:

Select the unit system to be used in the project.

Add comments to the project.

Note: Descriptions of the unit systems are provided at the following links:

- metric and field: https://nafta.wiki
- russian: https://nafta.wiki

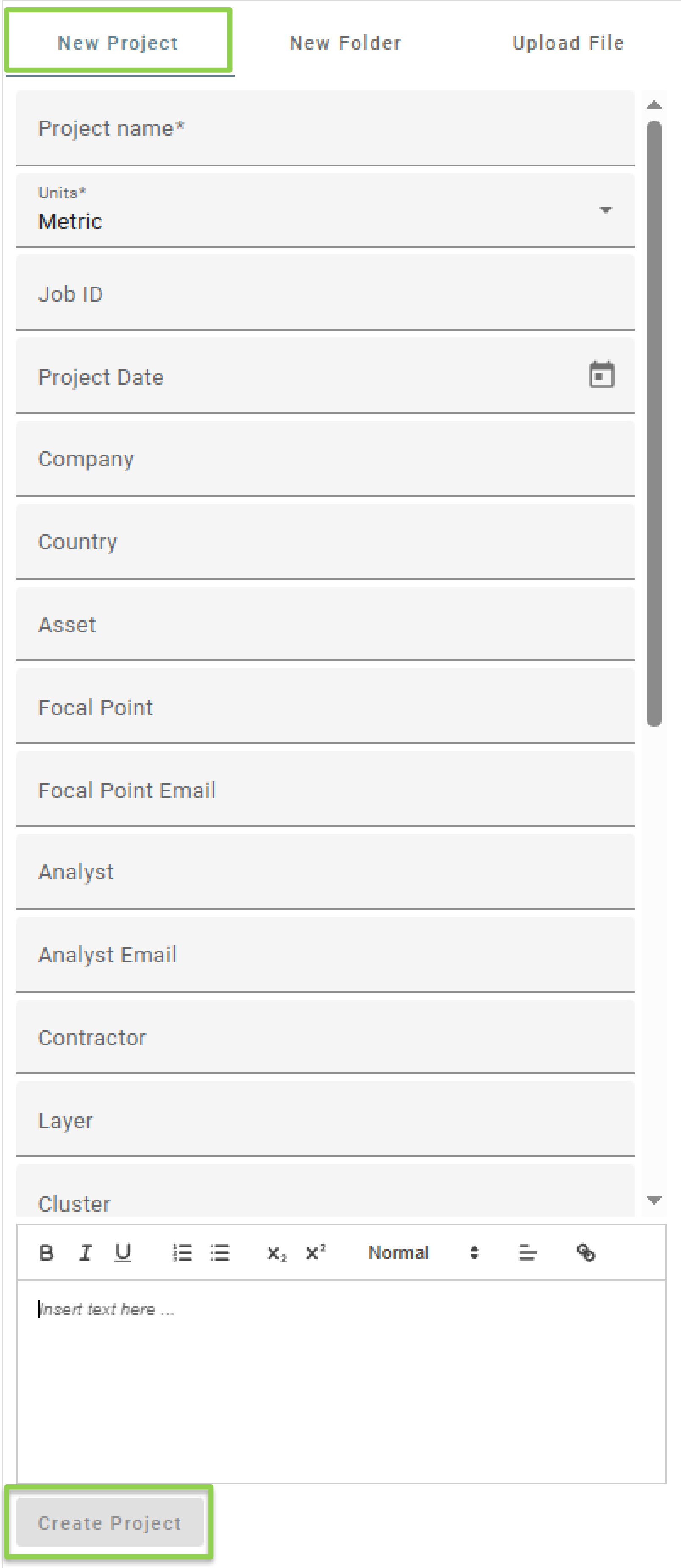


Fig. 2.2.1 – New Project Creation Window

2.3. Opening a project

The user can open a project by selecting it in the Explorer tree.

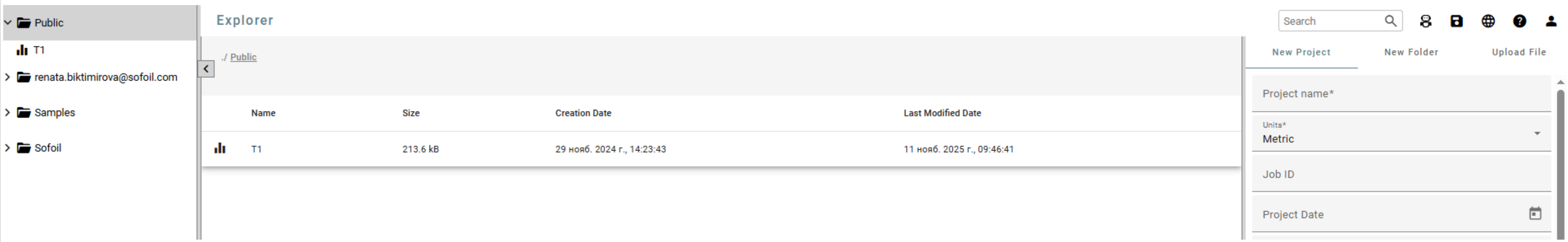


Fig. 2.3.1 – The PolyGon Explorer window

The user can upload a file to a project by following these steps:

- Navigate to the "Upload File" tab in the right part of the interface.
- Click the "Select File" button and choose a file from the local machine.
- Click the "Upload File" button.

Files uploaded to the project will be displayed in the central part of the workspace.

Once a project is opened, a "Calculations Page" tab will become available to the user in the workspace header, next to the "Explorer" tab.

To proceed with performing calculations, the user needs to switch to the "Calculations Page" tab.

2.4. Description of the "Calculations Page" tab

After creating and selecting a project, the User can go to the working page (Fig. 2.4.1).

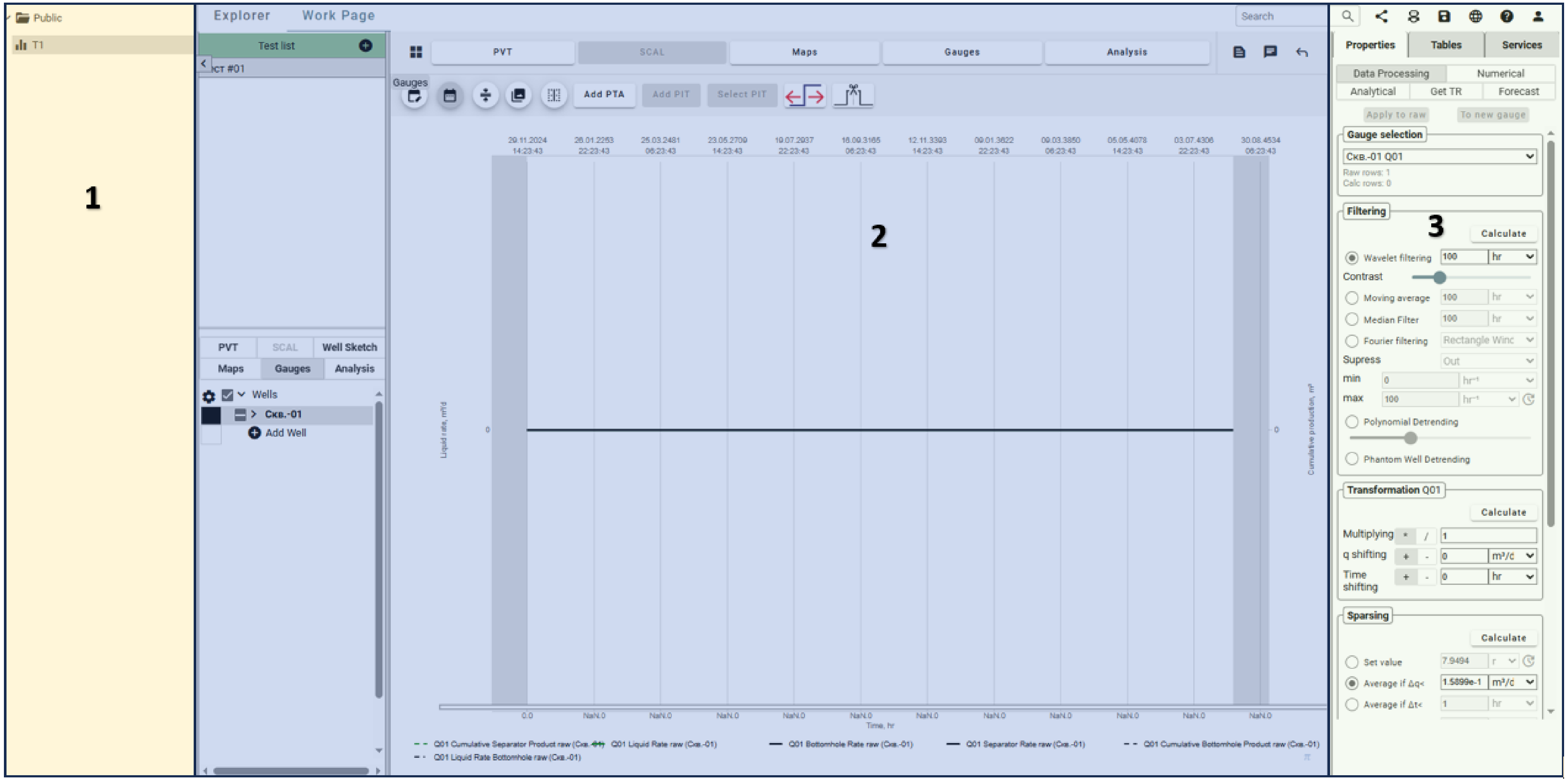


Fig. 2.4.1 – Window for data preparation and numerical calculations in PolyGon software

The **Calculation Page** is the primary workspace for data analysis and interpretation.

This page consists of three main panels:

1. Project Data Management.
2. Graphing.
3. Calculations, Tables, and Plugins Management.

Within the **Project Data Management** panel, data is organized in a tree structure under the following tabs:

1. PVT – Defining fluid properties.
2. SCAL – Defining relative permeability curves.
3. Maps – Creating reservoirs and defining their properties.
4. Sensors – Creating wells and sensors; importing production data (rates, pressure, temperature, etc.).
5. Analysis – Creating various types of studies (e.g., well tests).

Furthermore, within a project, the user can create multiple independent test cases.

The Calculations, Tables, and Plugins Management panel provides the user with various data operations.

The Graphing panel is designed for visualizing charts and plots. The user has access to the following graph types:

1. PVT – Fluid properties plots.
2. SCAL – Relative permeability curves.
3. Maps – Reservoir property maps.
4. Sensors – Time-series plots for various sensors on a linear time scale.
5. Analysis – Analytical plots (e.g., type curves, diagnostic plots).

The following section describes the process of using the interface elements required to generate a final report for the object under study.

To successfully complete this process, the following tabs in the PolyGon software must be populated: **PVT, SCAL, Maps, and Sensors**. These can be filled in either manually or automatically via the input Excel file PolyGon_Input.xlsx. The **Analysis** tab is not used for the Prime Analysis calculation.

2.4.1. PVT properties

In order to define the fluid properties, the user needs to open the "PVT" tab in the left-hand panel of the interface (Fig. 2.4.1.1).

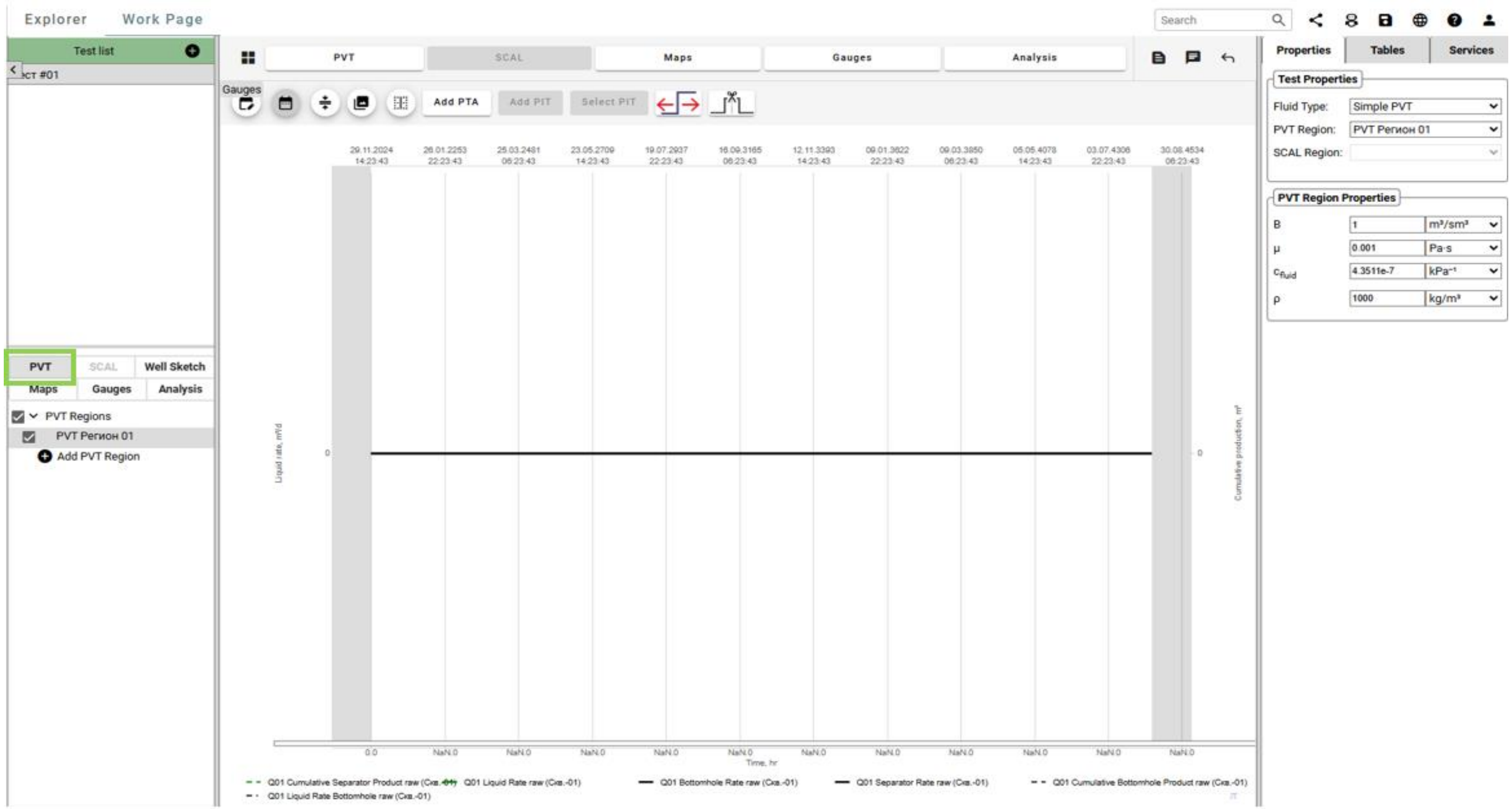


Fig. 2.4.1.1 – The PolyGon software "PVT" window

2.4.1.1. Fluid Type Selection

The user can select the fluid type to be used for analytical calculations.

The fluid type is selected in the **"Properties"** tab, within the **"Test Settings"** section located in the right panel of the interface.

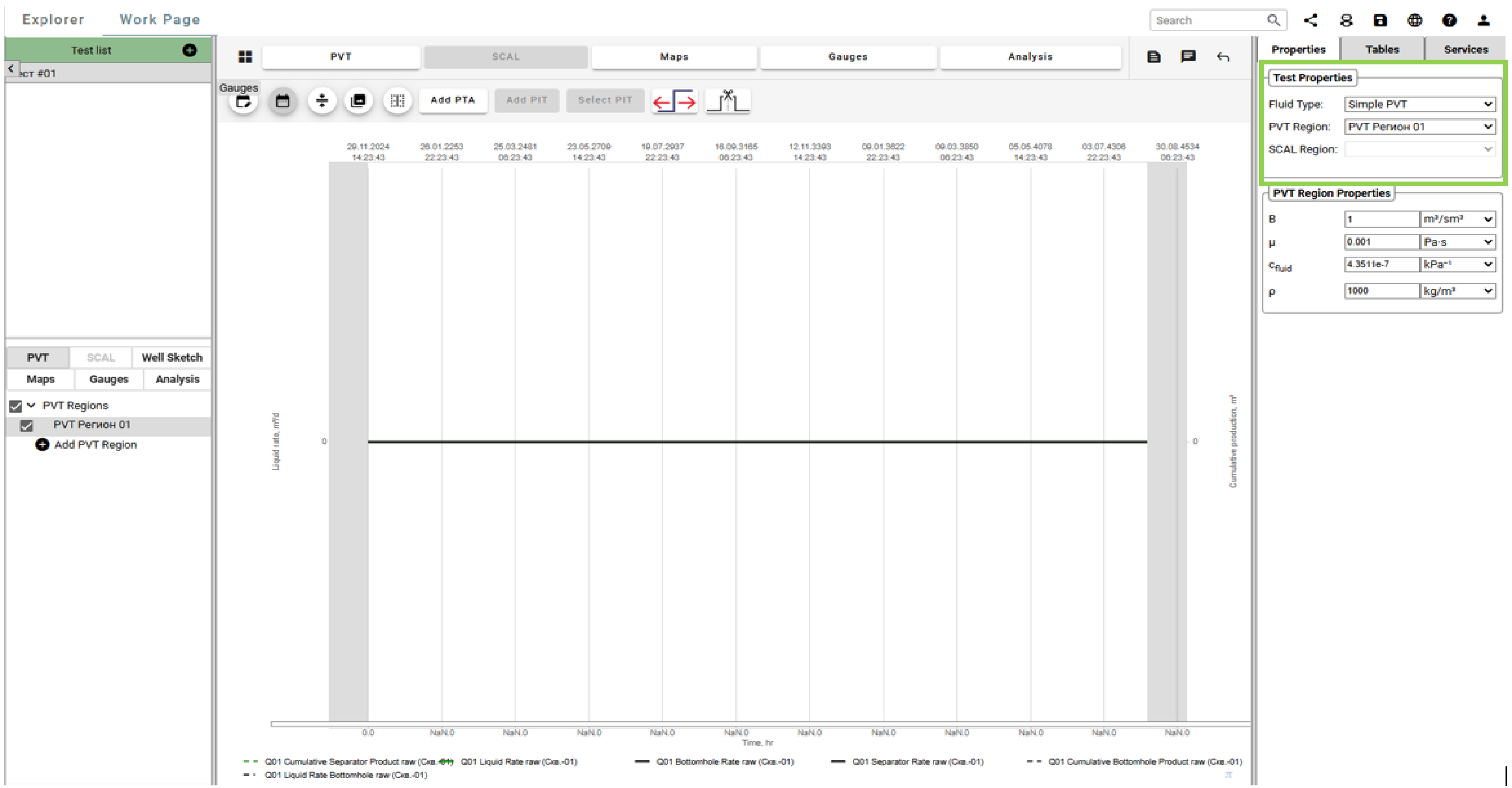


Fig. 2.4.1.1.1 – Properties of PVT test PolyGon software

The following fluid types are available to the user:

- Simple PVT
- Water
- Gas
- Dead Oil
- Oil–Gas
- Oil–Water
- Oil–Water–Gas

When the user selects a specific fluid type, a warning window will appear (Fig. 2.4.1.1.2). The user can click "OK" to confirm the correct fluid type has been selected.

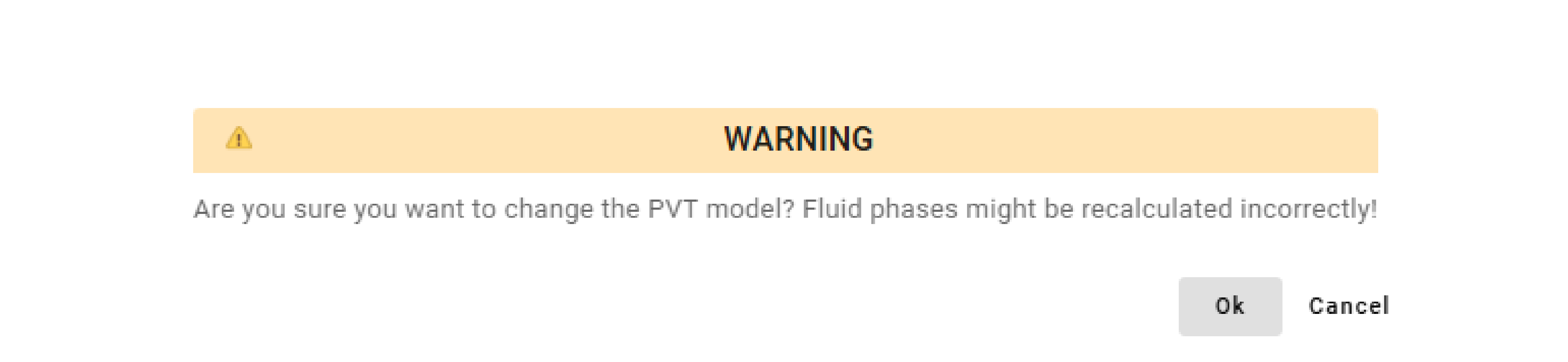


Fig. 2.4.1.1.2 – Warning window when selecting a PVT model

Note: At their discretion, the user can create multiple PVT regions within a single project by clicking the "Add PVT Region" button, located at the bottom of the PVT data tree (Figure 2.4.1.1.3). Multiple PVT regions may be created, for instance, for a multi-zone reservoir**.**

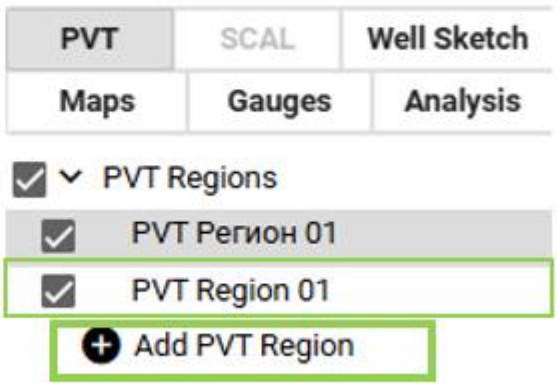


Fig. 2.4.1.1.3 – Adding a PVT region

2.4.1.2. PVT Region Settings

Fluid properties are defined in the right panel of the interface, under the "Properties" tab within the "PVT Region Settings" section.

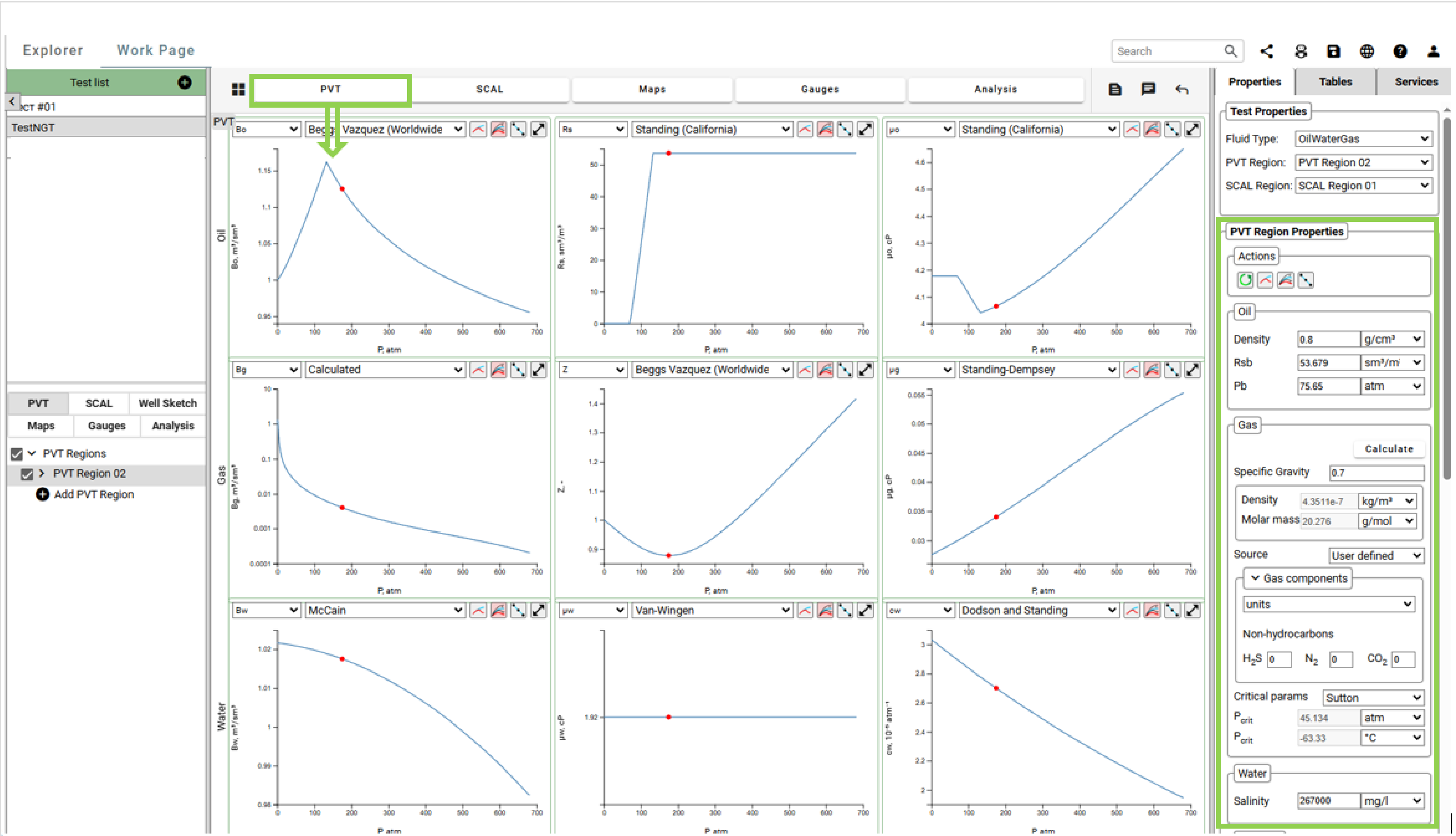


Fig. 2.4.1.2.1 – Main parameters of PVT region properties

The Simple PVT model allows the user to define the following parameters:

- Fluid Formation Volume Factor
- Fluid Viscosity
- Fluid Compressibility
- Fluid Density

For the **Water** model, the following parameter is available:

- Salinity

For the **Gas** model, the following parameter is available:

- Relative to air

For the **Dead Oil** model, the following parameter is available:

- Oil Density

For the **Saturated Oil (Oil-Gas)** model, the following parameters are available:

- Density
- Gas-Oil Ratio (GOR) at Bubble-Point Pressure
- Bubble-Point Pressure

For multiphase models (**Dead Oil-Water**, **Oil-Water-Gas**), fluid properties are defined for each phase individually.

Note: At this stage, the user can also preview PVT plots before the final calculation. To do this, click and hold the left mouse button on the "PVT" button in the top panel of the workspace, then drag it to the center of the screen to display the graphs.

2.4.1.3. Calculation of Fluid Property Correlations

For all fluid types except for the Simple PVT model, the user can calculate the correlation of fluid property changes versus pressure at a specified temperature.

To calculate the correlation, the user must:

- Define the fluid properties.
- Set the pressure grid parameters.

The grid parameters are specified in the "Pressure" and "Temperature" sub-sections within the "PVT Region Settings" panel on the right side of the interface (Fig. 2.4.1.3.1)

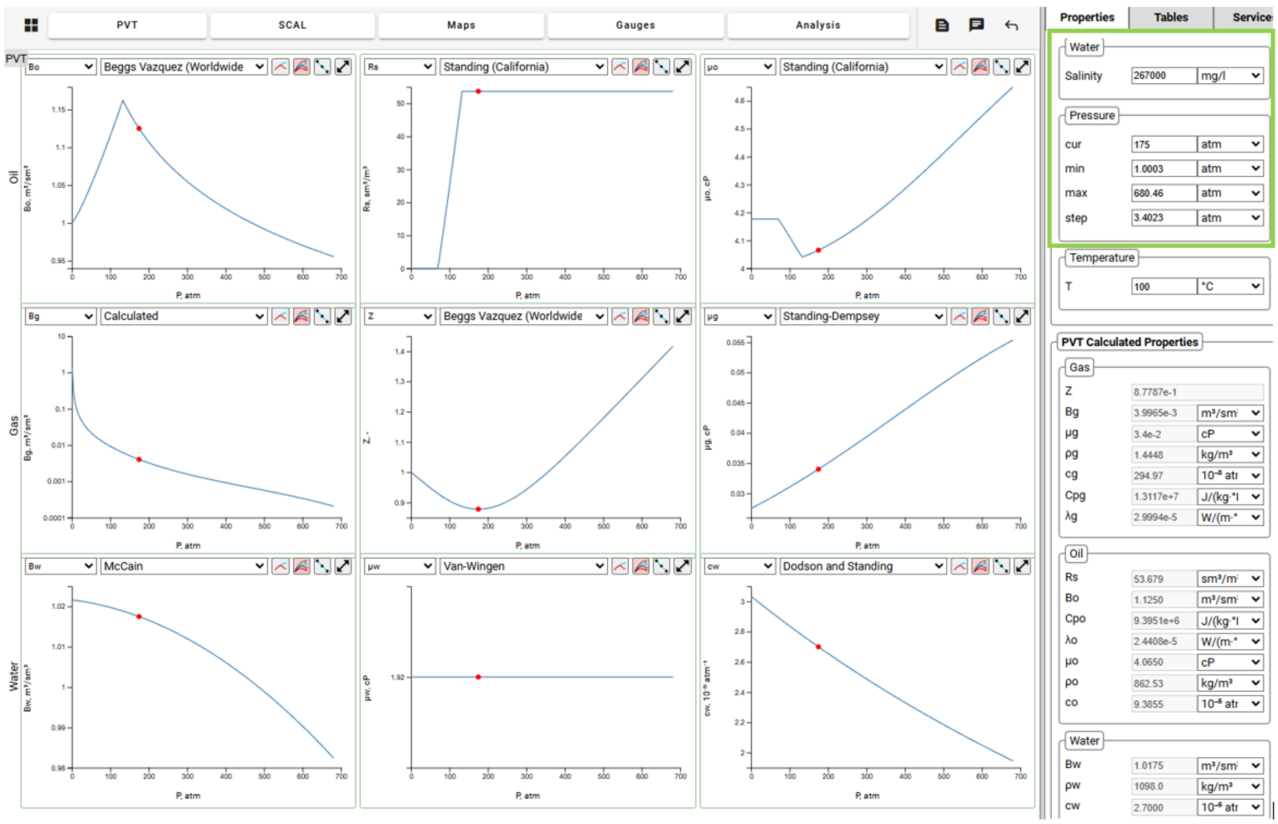


Fig. 2.4.1.3.1 – Change in pressure and temperature of the PVT region

- Click the “Simulation” button (Fig. 2.4.1.3.2).

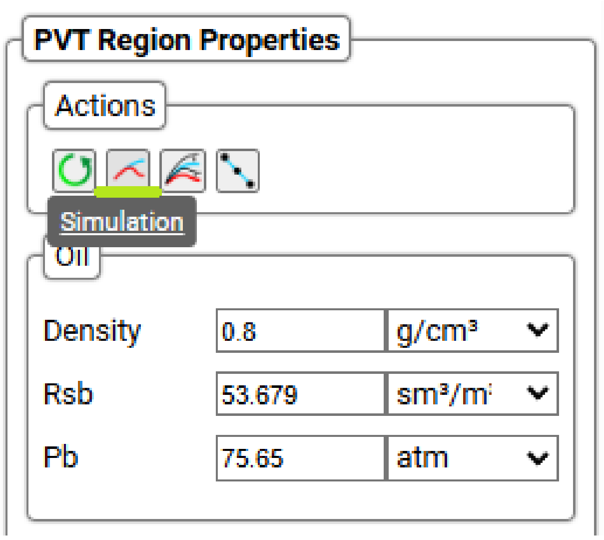


Рис. 2.4.1.3.2 – Симуляция PVT региона

After clicking the simulation button, adjusted curves of parameter changes versus pressure over the specified range at the given temperature will be generated. The results will be recorded in the "calc" table.

Note: This section is provided for informational purposes and may be skipped.

The user can then proceed to input laboratory data on fluid property changes.

2.4.1.4. Calculation and property selection for inputting laboratory data

The user must switch to the **"Tables"** tab in the right panel of the interface. This will open the table of fluid property changes versus pressure (Fig. 2.4.1.4.1).

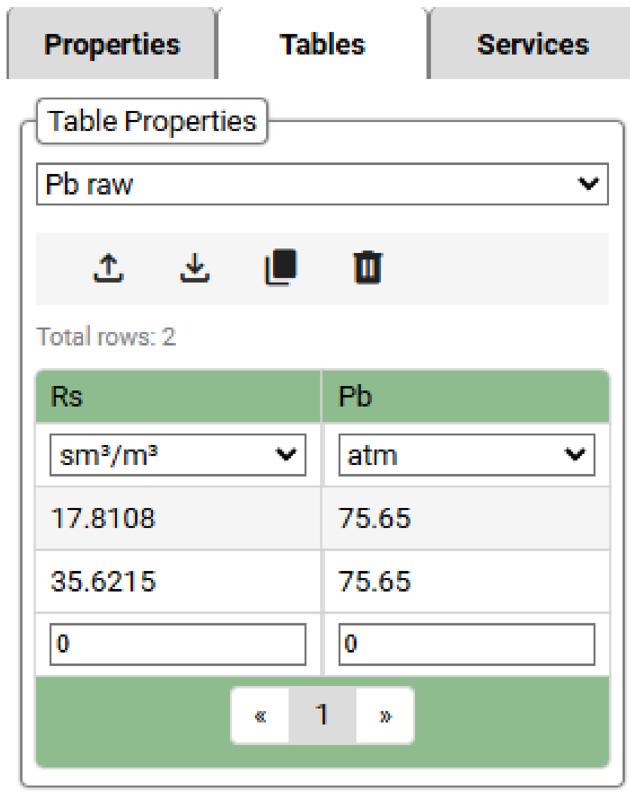


Fig. 2.4.1.4.1 – Fluid property vs. pressure table

The fluid property for which information will be entered can be selected in two ways (Fig. 2.4.1.4.2):

- using the drop-down list above the table within the "Properties" section in the right panel of the interface;
- using the tree structure under the "PVT" tab in the left panel of the interface.

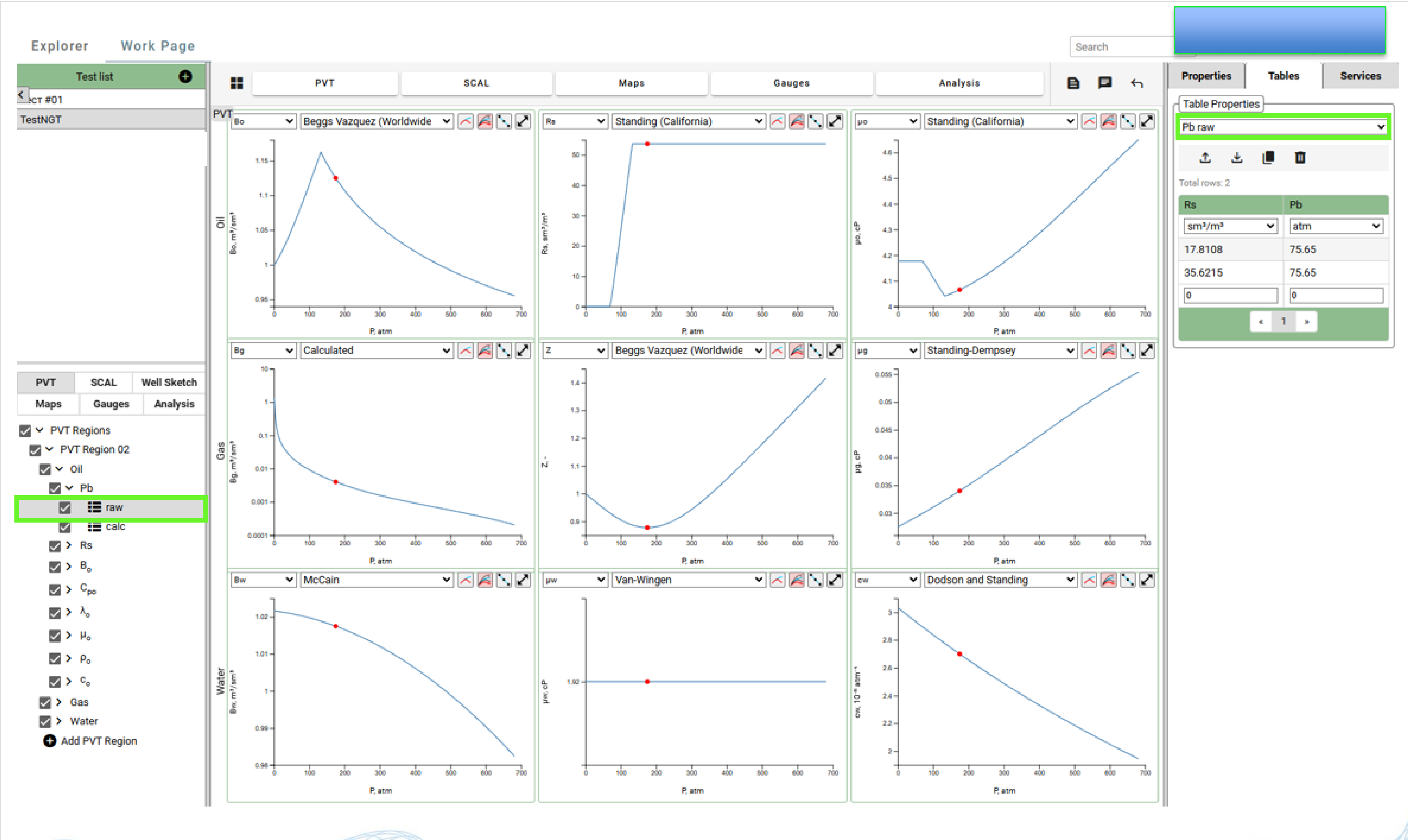


Fig. 2.4.1.4.2 – PVT Fluid Property Selection

There are two ways to input fluid properties data:

- Entering data from the keyboard (Fig. 2.4.1.4.3);
- Importing information for one property (Fig. 2.4.1.4.4).

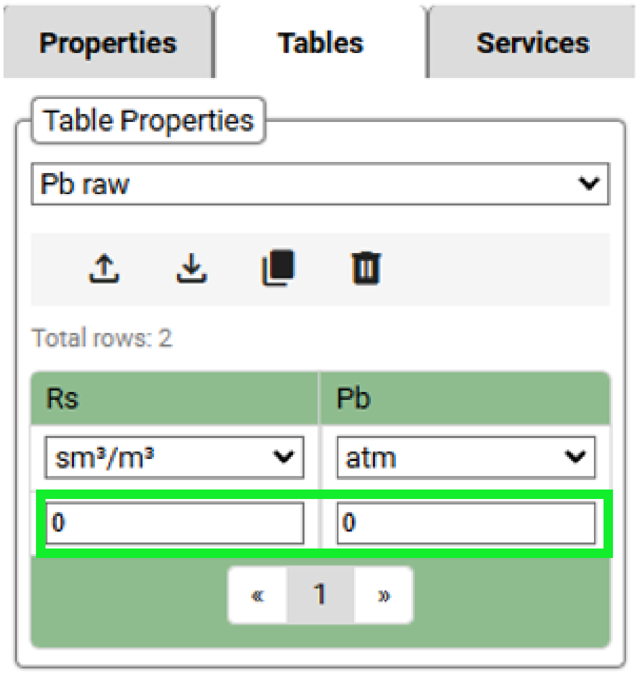


Fig. 2.4.1.4.3 – PVT Table Data Entry

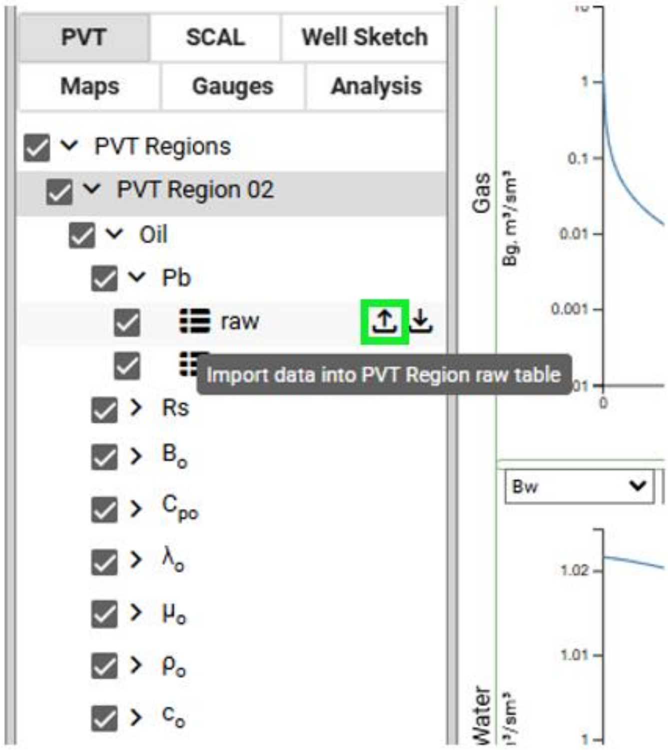


Fig. 2.4.1.4.4 – Import of a PVT Properties Table

How to Import Data into PolyGon Software:

1. Click the "Import data into PVT Region raw table" button (Fig. 2.4.1.4.4).
2. A dialog box will open, allowing you to either load a data file or copy and paste the data into the designated area (Fig. 2.4.1.4.5).
3. Select the desired action: "Append" (to add the data to the existing records) or "Rewrite" (to overwrite the current data). Click the corresponding button (Fig. 2.4.1.4.6).

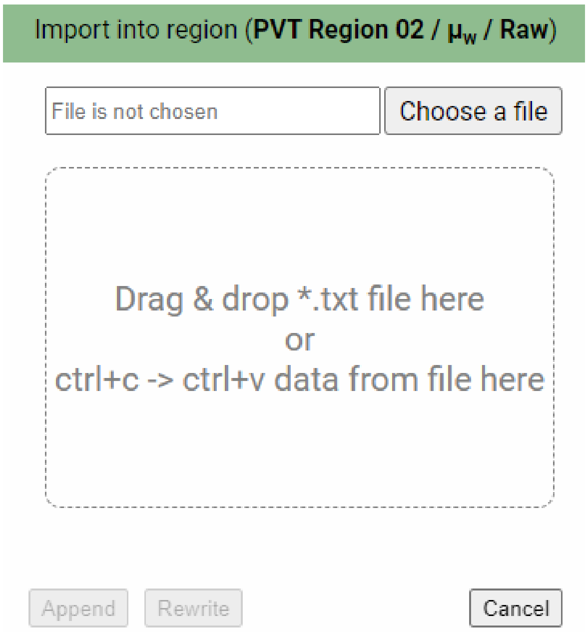


Рис. 2.4.1.4.5 – Окно импорта

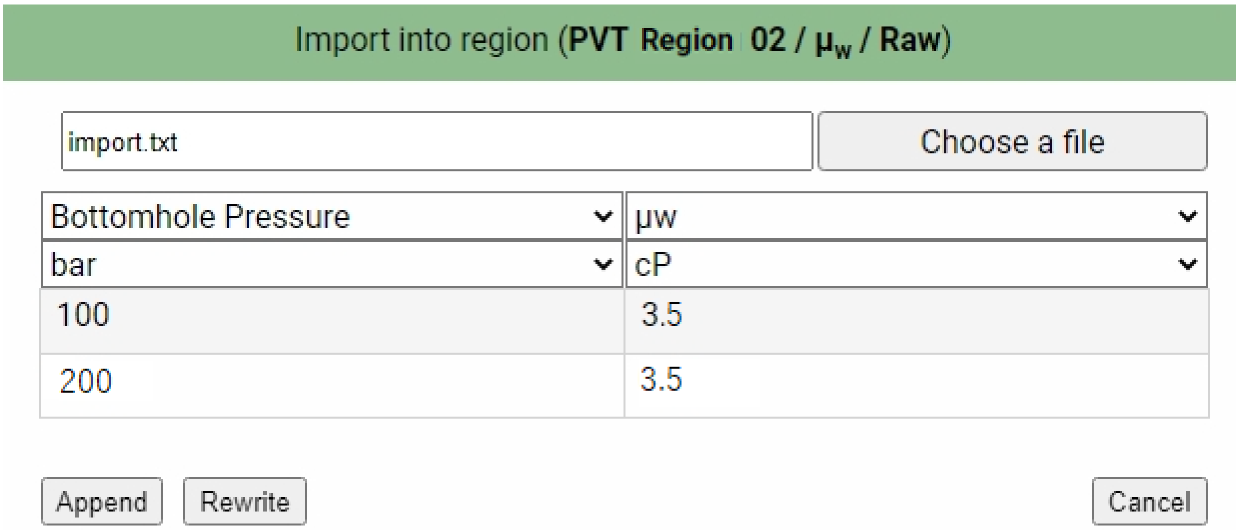


Fig. 2.4.1.4.6 – Data uploaded to the import window

When populating the main PVT parameters table, the user must enter two pressure values: 100 atm and 200 atm, while keeping the values of other parameters constant (e.g., viscosity). This procedure must be repeated for each parameter (Fig. 2.4.1.4.7). It is required to define constants and ensure the correct calculation of PVT properties.

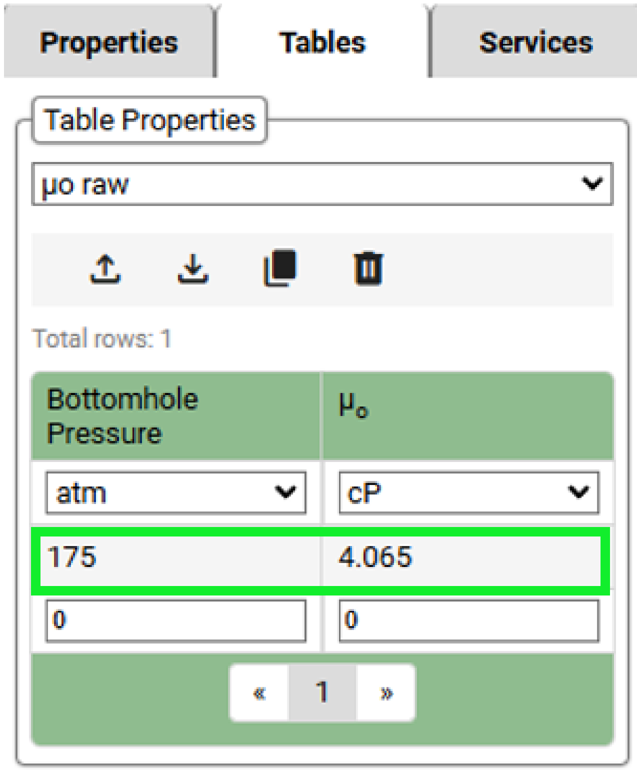


Fig. 2.4.1.4.7 – Entering PVT Properties via Keyboard

The user can also import information on the variation of multiple properties into the "raw" tables from a text file (Fig. 2.4.1.4.8).

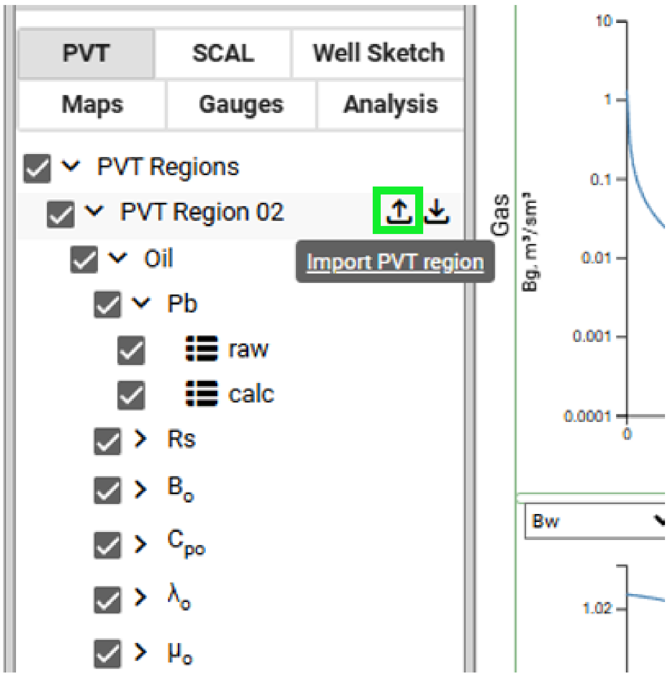


Fig. 2.4.1.4.8 – Import of a PVT Property Group Table

2.4.1.5. Вывод графиков PVT

Пользователь может просмотреть рассчитанные графики. Для этого он должен включить отображение графиков PVT, вызвав их с помощью нажатия и перемещения кнопки PVT в верхней части интерфейса в центр экрана (рис. 2.4.1.5.1).

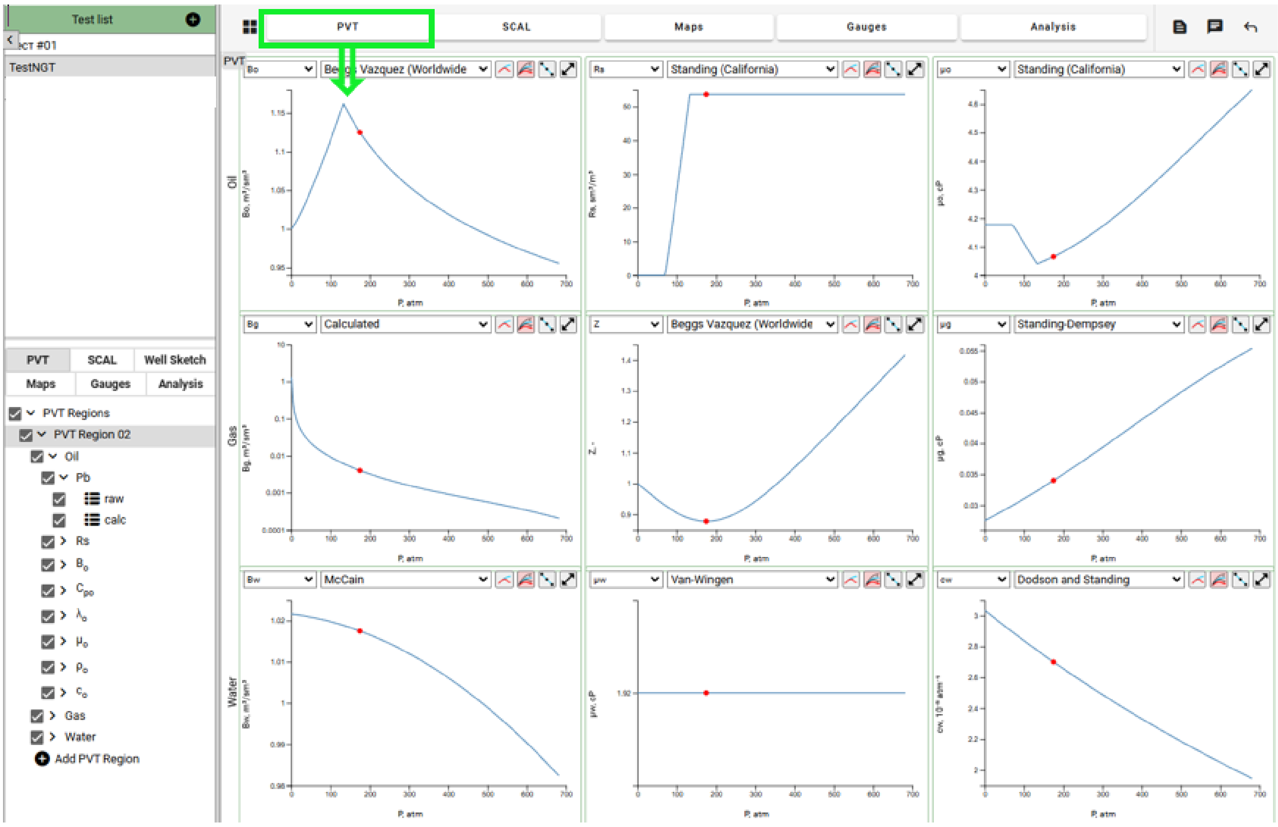


Рис. 2.4.1.5.1 – Графики изменения свойств PVT

На графиках отображается информация о том PVT регионе, который выбран в дереве «PVT» левой части интерфейса.

2.4.1.6. Calculating Correlations for Laboratory Data (Simulation and Interpolation)

After entering data into the "raw" table, the User can match the correlation for how fluid properties change with pressure at a given temperature.

In this case, the User must perform the following steps:

- Click the "Simulation" button next to a parameter, for example, the gas-oil ratio (Rs) (Fig. 2.4.1.6.1). This step can be skipped if all necessary parameters are already available;
- Click the **"Interpolation"** button for all parameters previously entered into the "raw" table (Fig. 2.4.1.6.2). Alternatively, interpolation can be performed individually on each graph. This function allows for re-interpolation of only the modified parameters while preserving the already calculated values of the other parameters.

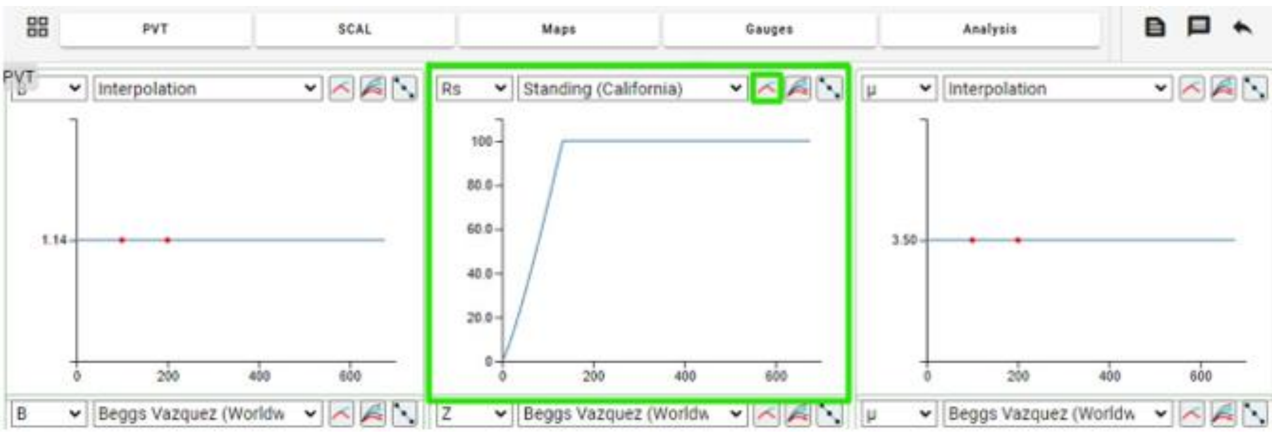


Fig. 2.4.1.6.1 – Simulation of the Gas-Oil Ratio (Rs) Parameter

Note:

• **Simulation** can be used to model experimental conditions and estimate expected outcomes. This can help reduce the time and cost associated with conducting actual experiments, as well as improve the understanding of processes and devices based on laboratory parameters.

• **Data Interpolation** is used to obtain intermediate values between existing data points. This can be useful when it is necessary to determine values at points that were not directly measured but can be calculated based on the available data.

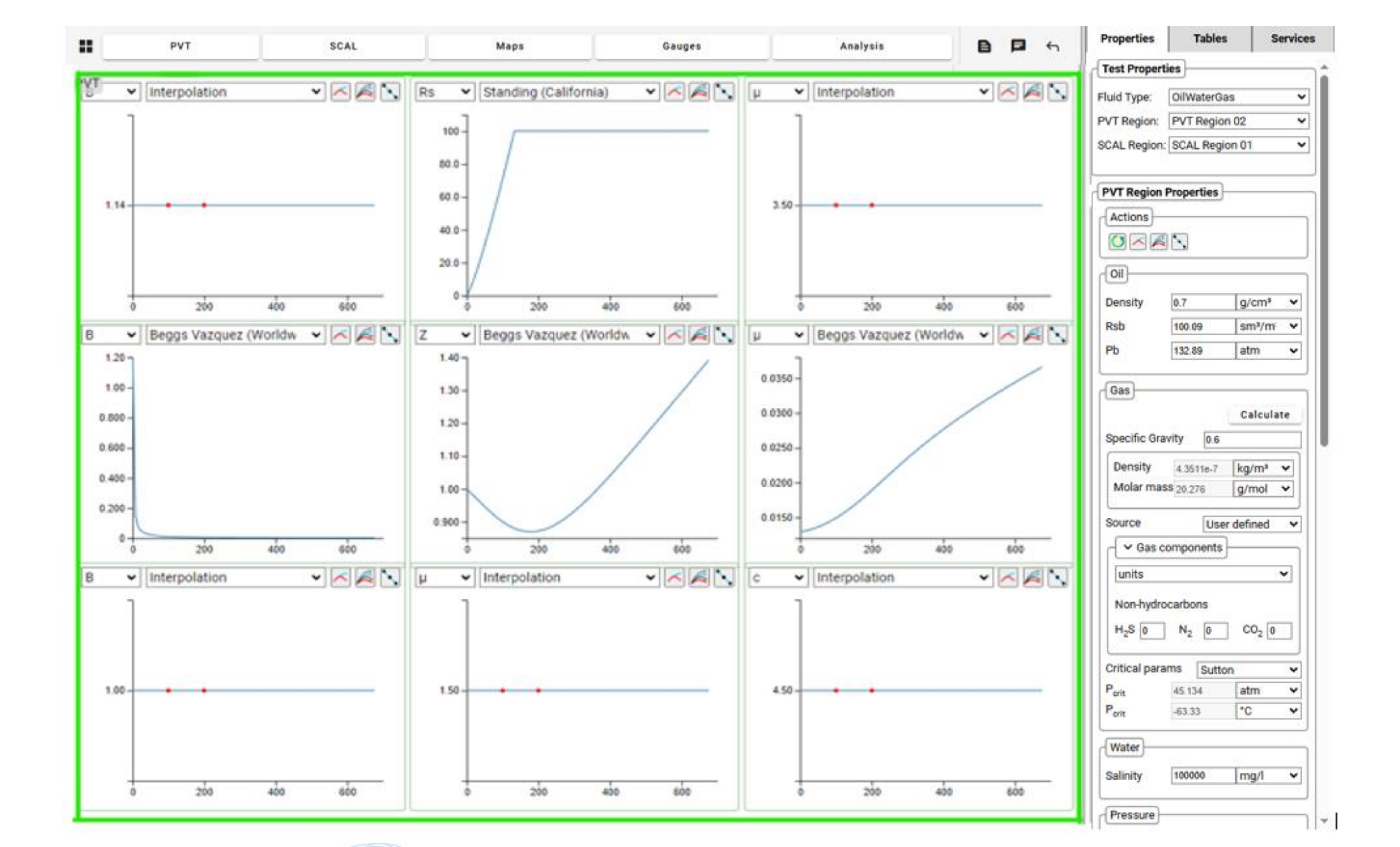


Fig. 2.4.1.6.2 – **Result of PVT Property Parameter Interpolation**

2.4.2. SCAL

To work in the "SCAL" tab, the User must first select a multiphase fluid type in the "Properties" tab of the PolyGon PVT software window. This is because relative permeability settings are only available when a fluid type implying two or more phases is selected. Afterward, switch to the "SCAL" tab on the left side of the interface (Fig. 2.4.2.1). Alternatively, the relative permeability plots can be displayed immediately by clicking and dragging the "SCAL" button from the top of the interface to the center of the screen.

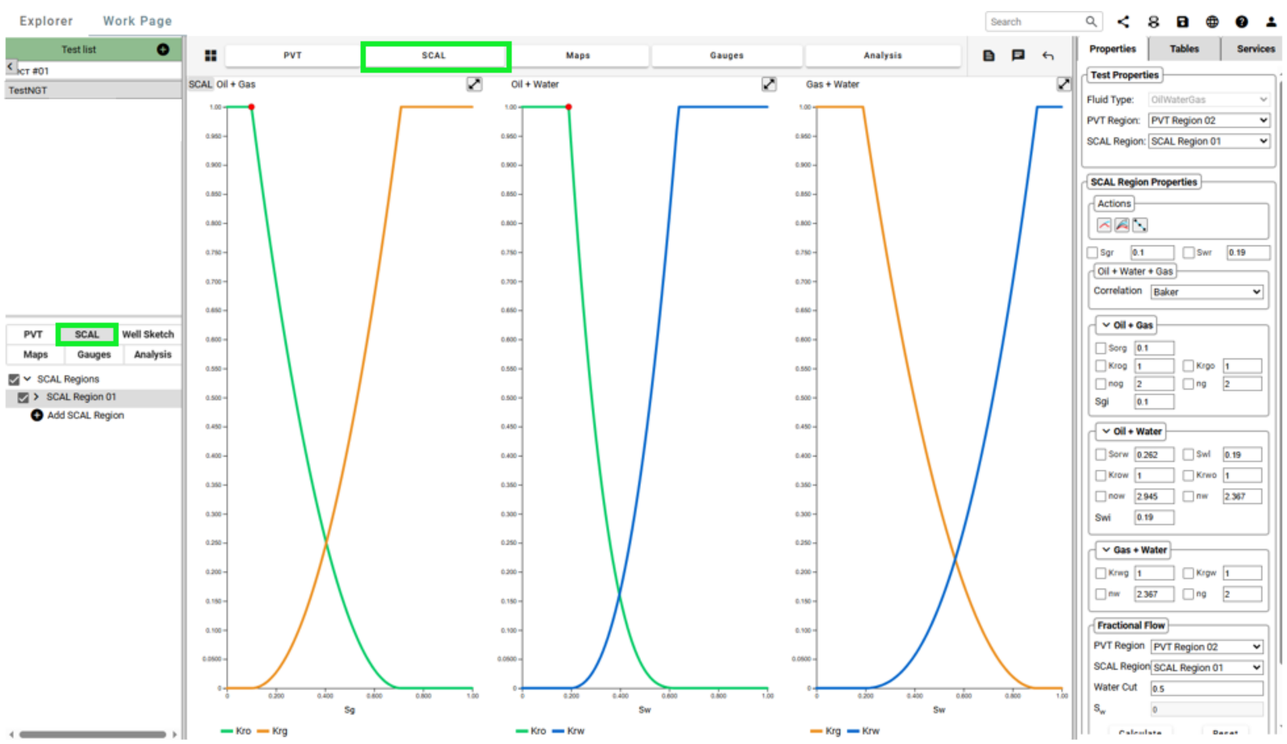


Fig. 2.4.2.1 – Simulated Relative Permeability Curves for the SCAL Region

Depending on the number of phases in the model, tables of relative permeability versus saturation will be calculated.

The following types of relative permeability are available to the User (in this case, an Oil-Water-Gas model is assumed):

- Oil + Gas
- Oil + Water
- Gas + Water

The number of simulated relative permeability curves is displayed in the "SCAL" tab on the left side of the interface (Fig. 2.4.2.2).

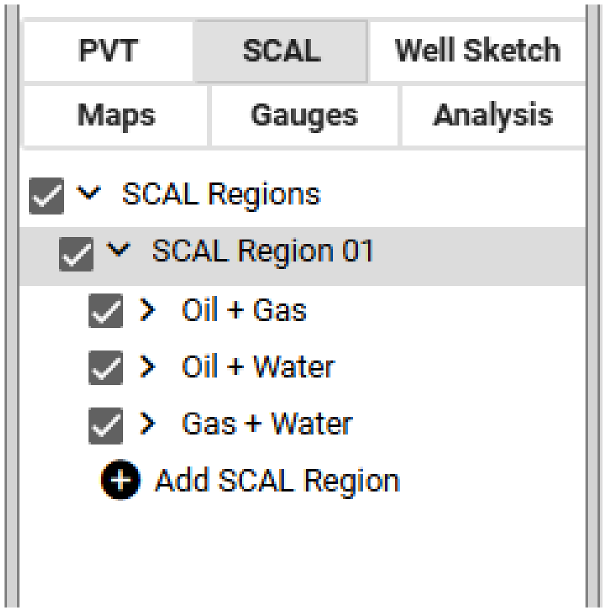


Fig. 2.4.2.2 – Simulated SCAL Region Relative Permeabilities

2.4.2.1. Calculation of Relative Permeability from Laboratory Data

To perform numerical calculations, the User must enter laboratory data on fluid properties. This can be done in two ways:

- Manual data entry into the empty cells at the bottom of the table via keyboard (Fig. 2.4.2.1.1);
- Importing relative permeability variation data into the "raw" table for the required property from a text file (Fig. 2.4.2.1.2).

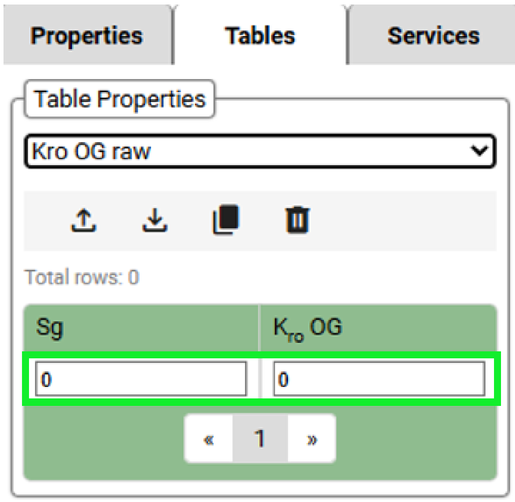


Fig. 2.4.2.1.1 – Entering Data into the Table

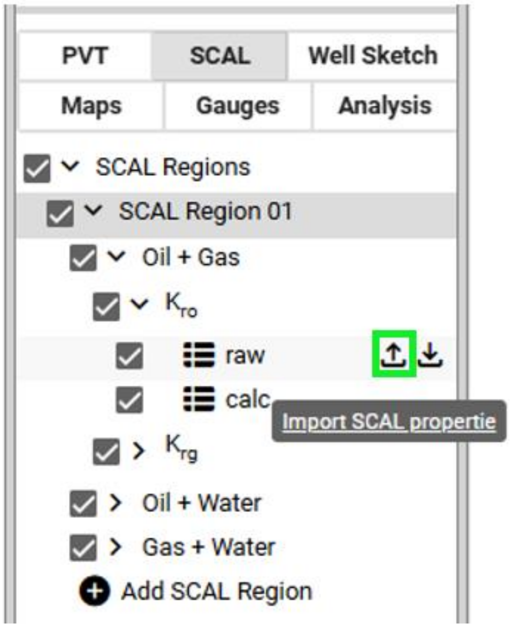


Fig. 2.4.2.1.2 – Importing Relative Permeability Variation Data into the Table

Также Пользователь может импортировать данные об изменении нескольких относительных фазовых проницаемостей в таблицы «raw» из текстового файла (рис. 2.4.2.1.3).

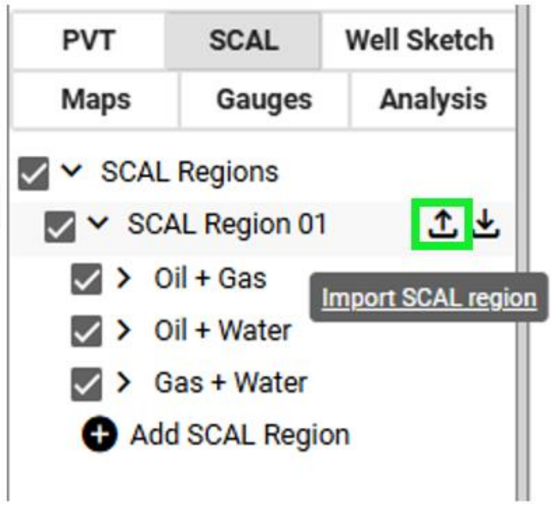


Fig. 2.4.2.1.3 – Importing Multiple Relative Permeability Variation Datasets

Note: For more detailed information on the data import process, please refer to section 2.4.1.4 (see Fig. 2.4.1.4.4 – 2.4.1.4.6).

After importing the relative permeability data, the data points with the entered values will appear on the plots (Fig. 2.4.2.1.4). These points must then be interpolated using the "Interpolation" button (Fig. 2.4.2.1.5).

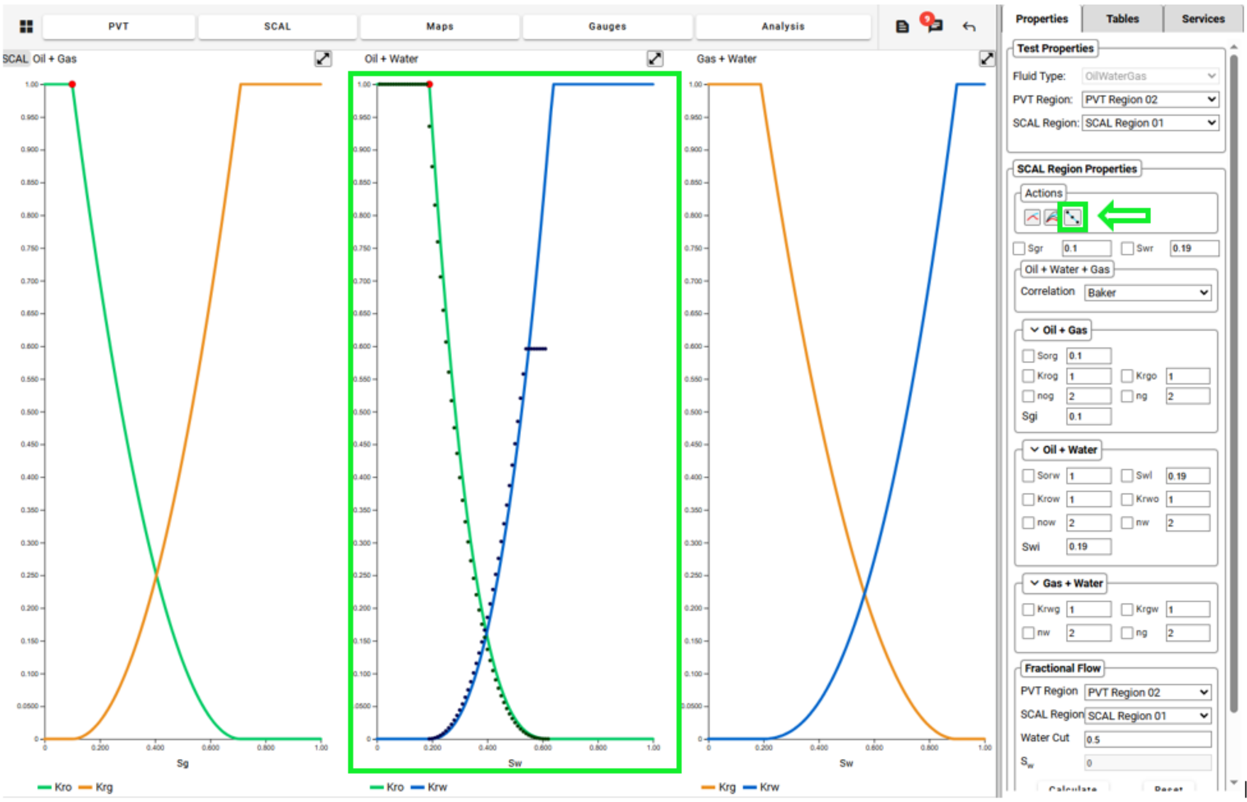


Fig. 2.4.2.1.4 – Entered Relative Permeability Data Points (Dead Oil + Water)

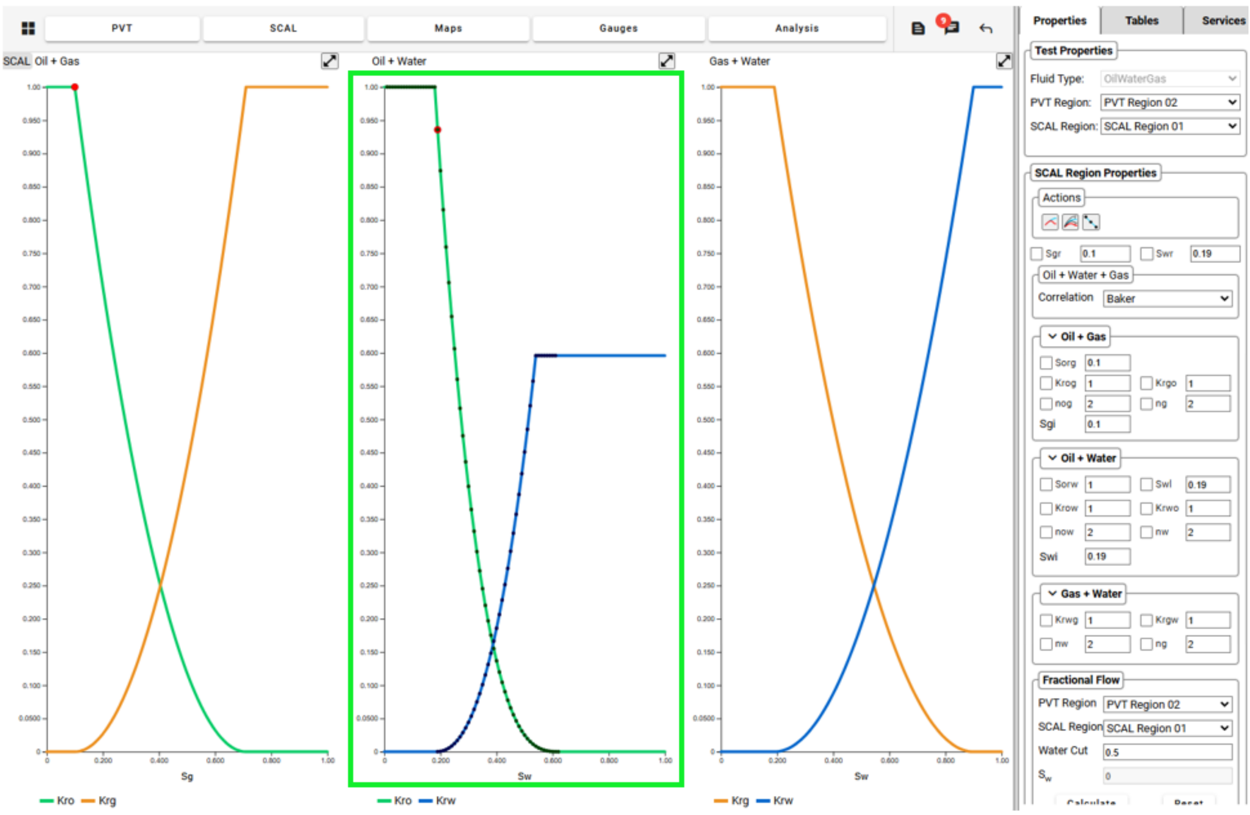


Fig. 2.4.2.1.5 – Interpolated Relative Permeability Data (Dead Oil + Water)

2.4.2.2. Entering Key Relative Permeability Parameters

For each relative permeability pair, it is necessary to specify the key parameters in the "Properties" tab located on the right side of the interface. These parameters will be included in the generated Prime report.

The description of the key relative permeability properties for different systems is presented below:

– **"Oil + Gas"** System

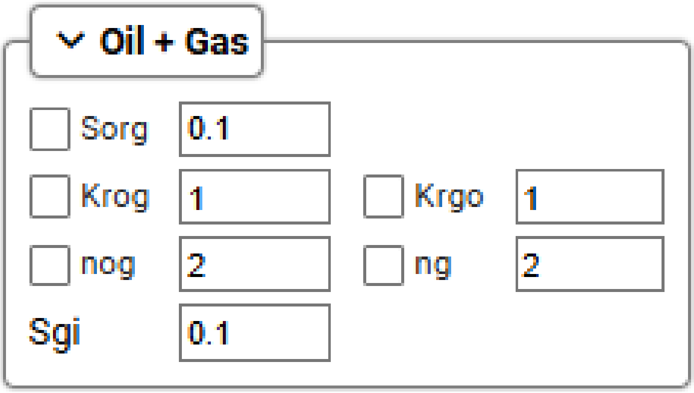


Fig. 2.4.2.2.1 – Key Relative Permeability Properties in the Oil-Gas System

Sorg – Residual oil saturation to gas sweep;

Krog – Oil-gas relative permeability.

nog – oil relative permeability curvature to gas displacement.

Sgr– Critical gas saturation.

Krgo – Oil-Gas relative permeability.

ng – gas relative permeability curvature to oil displacement.

Sg – Current gas saturation.

Note: The checkboxes located in each key relative permeability properties block are redundant and not required.

– **Dead Oil - Water** System

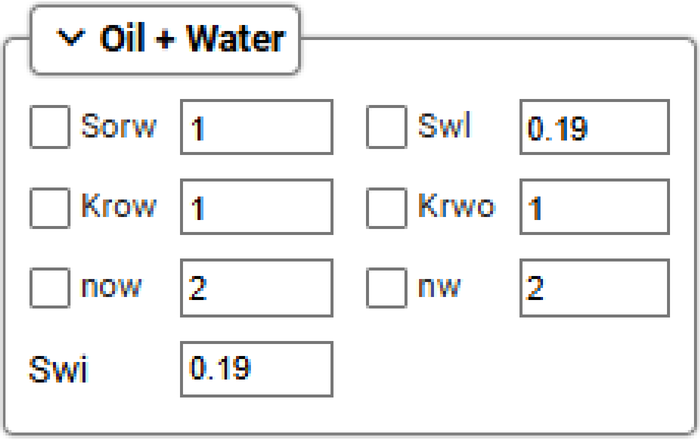


Рис. 2.4.2.2.2 – Key Relative Permeability Properties in the Oil-Water System

Sorw – Residual oil saturation to water sweep.

Krow – Oil-water relative permeability.

now – oil relative permeability curvature to water displacement.

Swc – Critical water saturation.

Krwo – Water-oil relative permeability.

nw – water relative permeability curvature to oil displacement.

Swi – Initial water saturation.

Sw– Connate water saturation.

– система «**Газ + Вода**»

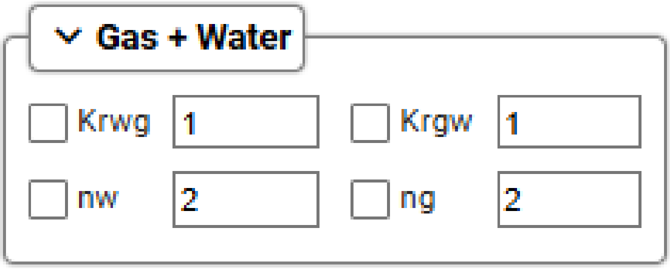


Рис. 2.4.2.2.3 – Основные свойства ОФП в системе «Газ + Вода»

Sgc – Critical gas saturation.

Krgw – Gas relative permeability.

ng – gas relative permeability curvature to water displacement (link to formula).

Krwg – Water relative permeability.

nw – water relative permeability curvature to gas displacement (link to formula).

Swi – Initial water saturation.

urthermore, several correlations for predicting three-phase relative permeability from two-phase data are provided (Fig. 2.4.2.2.4). In most cases, the Baker correlation is used as the default value.

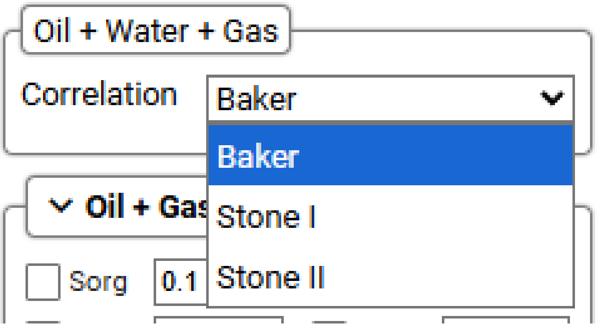


Fig. 2.4.2.2.4 – Relative Permeability Correlation Selection

An example of the overall view of the entered key relative permeability parameters is shown in the fig.2.4.2.2.5.

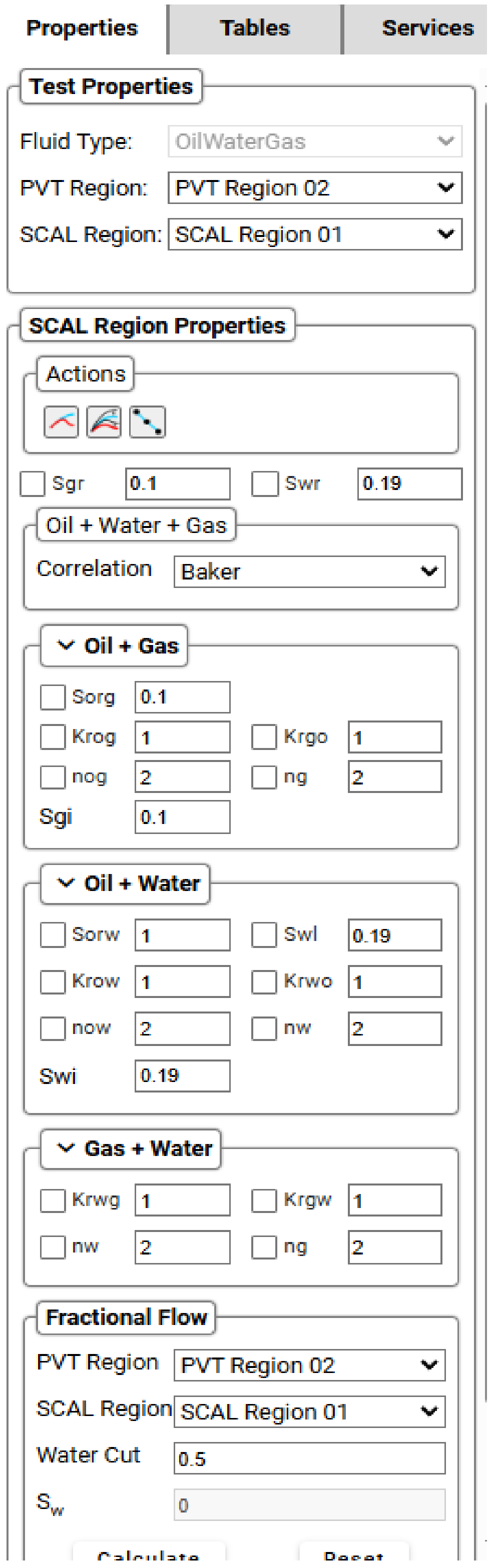


Fig. 2.4.2.2.5 – Example of an Overview of Entered Key Relative Permeability Property Values

2.4.3. Maps

Maps for the analyzed asset are generated automatically by the PolyGon software based on the well coordinates previously entered manually by the User in the "PolyGon_wells_import" input Excel file.

The User can navigate to the "Maps" window by dragging the "Maps" button from the top of the interface to the center of the screen (Fig. 2.4.3.1).

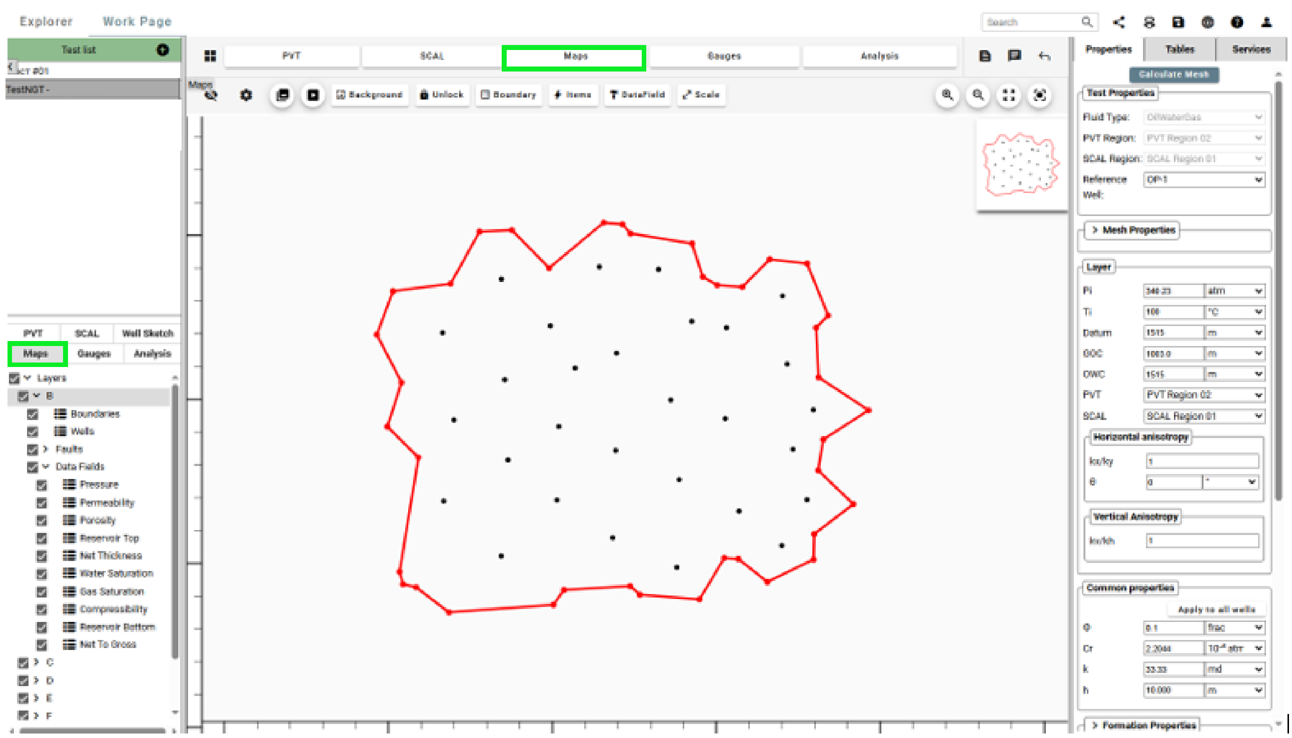


Fig. 2.4.3.1 – Maps Window in PolyGon Software

Background images for various map types can be selected and loaded using the "Background" button (Fig. 2.4.3.2)

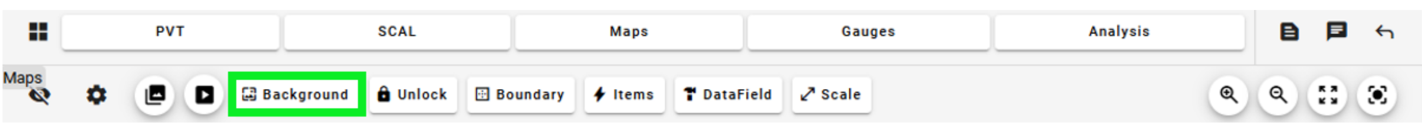


Fig. 2.4.3.2 – "Background" button

Subsequently, one or several new background images can be uploaded to the repository and activated (Fig.2.4.3.3).

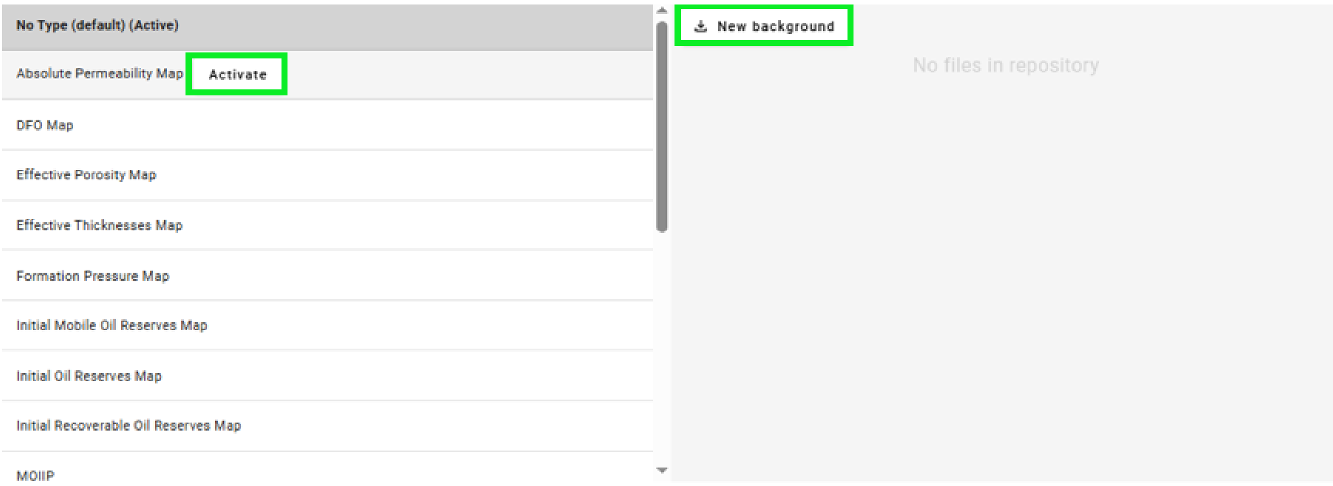


Fig. 2.4.3.3 – Loading and Selecting a Background

Additionally, in PolyGon software, the "Unlock" tool can be used to move, stretch, and compress the background image (Fig. 2.4.3.4).

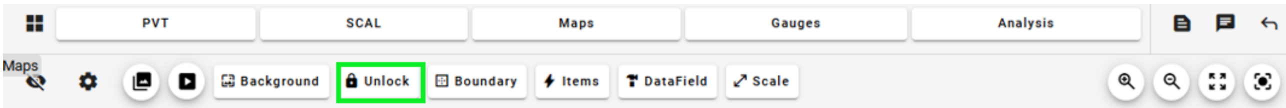


Fig. 2.4.3.4 – Background Modification

Note: Types of maps that can be generated by the PolyGon software:

– Structure Maps;

– Initial Reserves Maps (STOIIP, Mobile OIIP, Recoverable OIIP);

– Remaining Reserves Maps (OIP, Mobile OIP, Recoverable OIP, Drainable Remaining Oil, Drainable Remaining Oil, Profitable Remaining Oil Reserves);

– Depletion Maps;

– Recovery Maps;

– Production Maps (Instantaneous, Cumulative);

– Formation Pressure Maps;

– Productivity Maps;

– Interventions Maps

– Property Maps (Absolute Permeability; Absolute Permeability; Total Thickness; Effective Thickness; Transmissivity; Net-To-Gross; Shaleness; Formation Bottom);

– Proposed Drilling Maps;

– User-defined maps.

2.4.4. Gauges

Well gauges for the analyzed formation are automatically generated by the PolyGon software based on pressure, production/injection rate data previously entered manually by the User in the "PolyGon_wells_import" Excel input file.

To perform Prime analysis, the User must verify the pressure and rate data for all wells in the analyzed formation. This step is carried out in the " Gauges " window (Fig. 2.4.4.1).

Fig. 2.4.4.1 – Window « Gauges » software PolyGon

Note: To display well data charts, left-click, hold, and drag the "Gauges" button from the top toolbar of the workspace to the center of the screen.

For each well, the user can add multiple gauges of different types. To add a gauges, the user must navigate to the "Gauges" tab in the left panel of the interface. Expand the well node in the tree structure for which you want to add a gauges and click the "Add Gauges" button. After clicking the button, a dropdown list of available gauges will be presented to the user (Fig. 2.4.4.2).

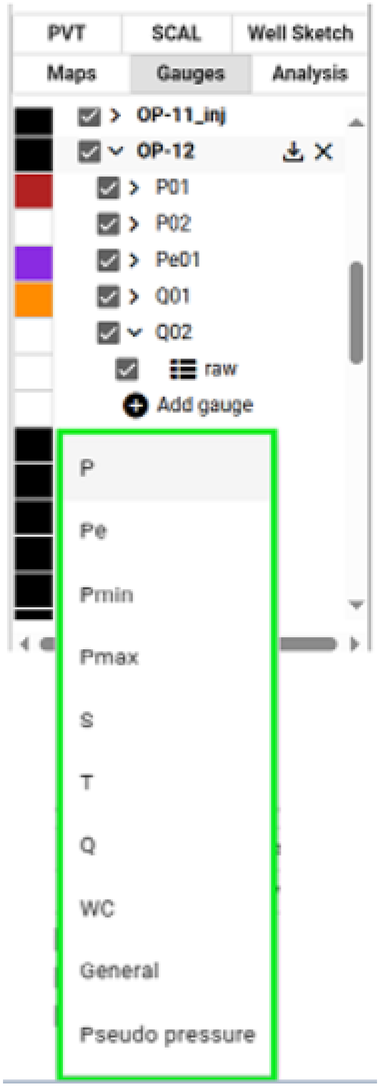


Fig. 2.4.4.2 – Adding Gauges to a Well

Gauges:

P02 – Wellhead Pressure (WHP);

P01 – Bottomhole Pressure (BHP);

Pe01 – Reservoir Pressure;

Q01 – Production / Injection Rate;

Q02 – Well Operating Time;

P – Bottomhole Pressure (BHP);

Pe – Reservoir Pressure;

Pmin – Minimum Pressure;

Pmax – Maximum Pressure;

S – Skin Factor;

T – Temperature;

q – Flow Rate;

WC – Water Cut;

General –

Pseudo pressure.

Note. The following sensors are used in Prime Analysis: P01, Pe01, Q01, Q02.

2.4.4.1. Data Correction

- In the charts within the Gauges window, an analyst may identify incorrect outlier values for pressure or production/injection rates (Fig. 2.4.4.1.1). In this case, the user should first double-check the accuracy of the data entered in the import file:
- If an incorrect value was accidentally entered in the import file, it can be corrected based on the original source files;
- If the data matches the source, the outlier should be removed, as it is most likely a metrological error (a measurement error).

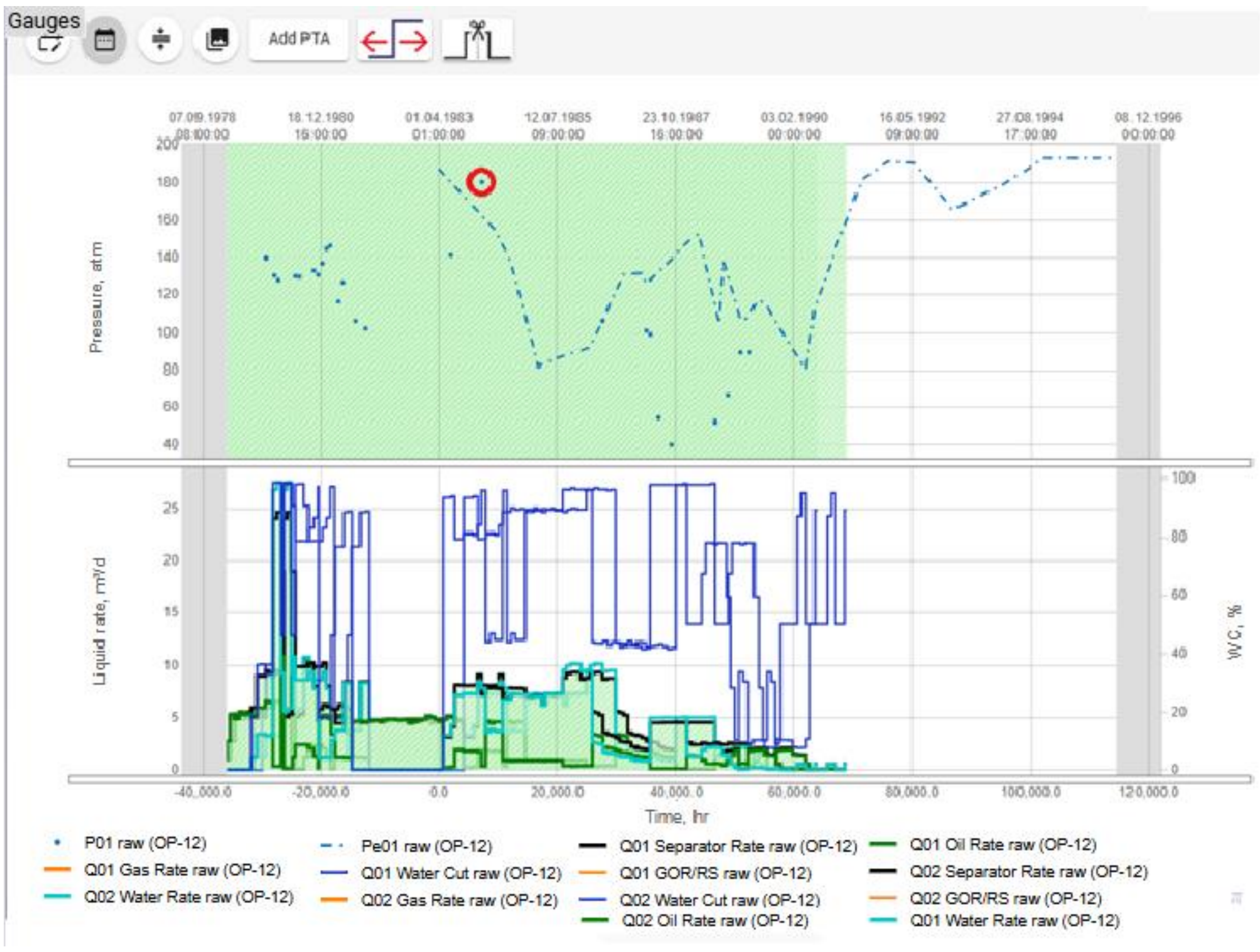


Fig. 2.4.4.1.1 – Example of an Invalid Value (BHP)

Pressure or production/injection rate data can be restored or deleted using two methods:

- **The first method** involves making direct changes to the "PolyGon_wells_import" input file. Afterward, the user can reload the file into the PolyGon software and populate the relevant "PVT," "SCAL" and "Maps" tabs with data;
- **The second method** involves using the editing tools within the PolyGon software (Fig. 2.4.4.1.2).

Fig. 2.4.4.1.2 – PolyGon Software Editing Tools

To restore a value using the editing tools, the user should hover the cursor over the outlier value. The relative time, parameter value, calendar date, and calendar time will be displayed in the bottom-right section of the Sensors window. This information can be used to locate the corresponding entry in the properties table and correct the invalid parameter value (Fig. 2.4.4.1.3).

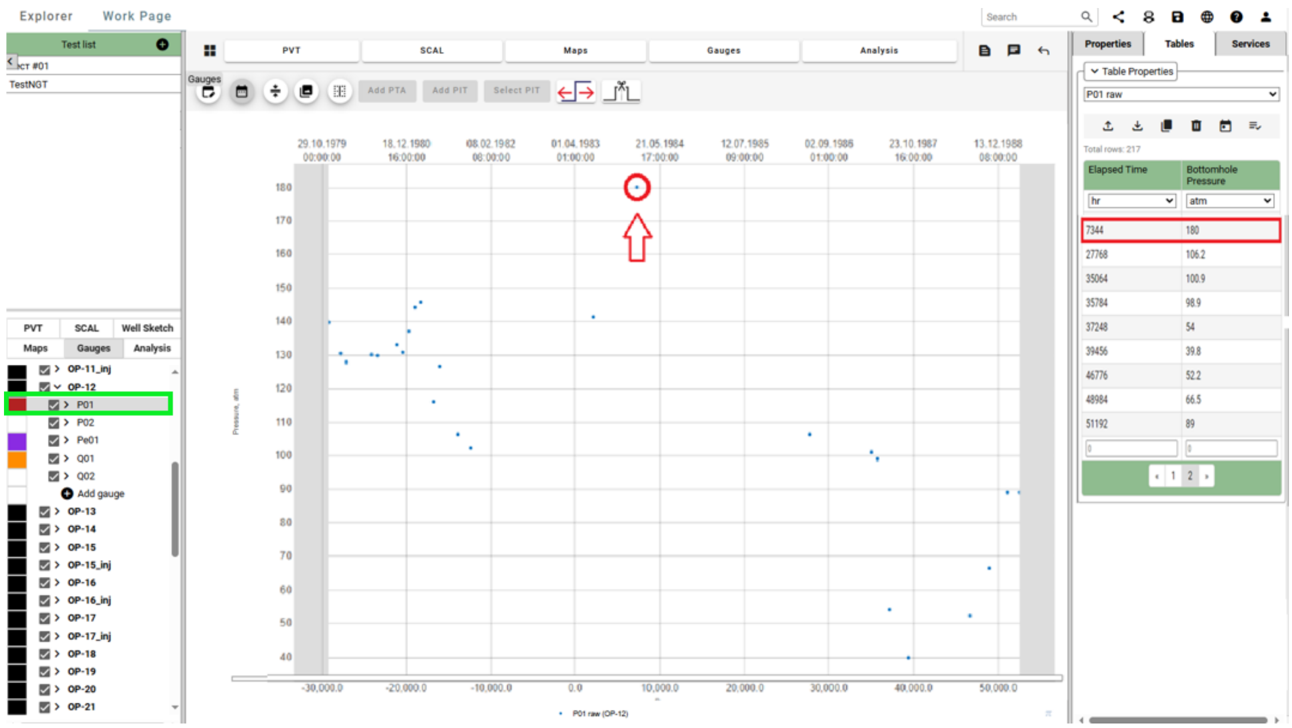


Fig. 2.4.4.1.3 – Restoring the True Parameter Value

To delete outlier values, the user can utilize one of three methods:

- Click the "X" in the row of the invalid value within the properties table;
- Zoom in on the undesired data region and then use the **"Crop In"** tool
- Using the **"Set Workspace"** and **"Crop In"** tools, select and delete the undesired data region (Fig. 2.4.4.1.4 – 2.4.4.1.5).

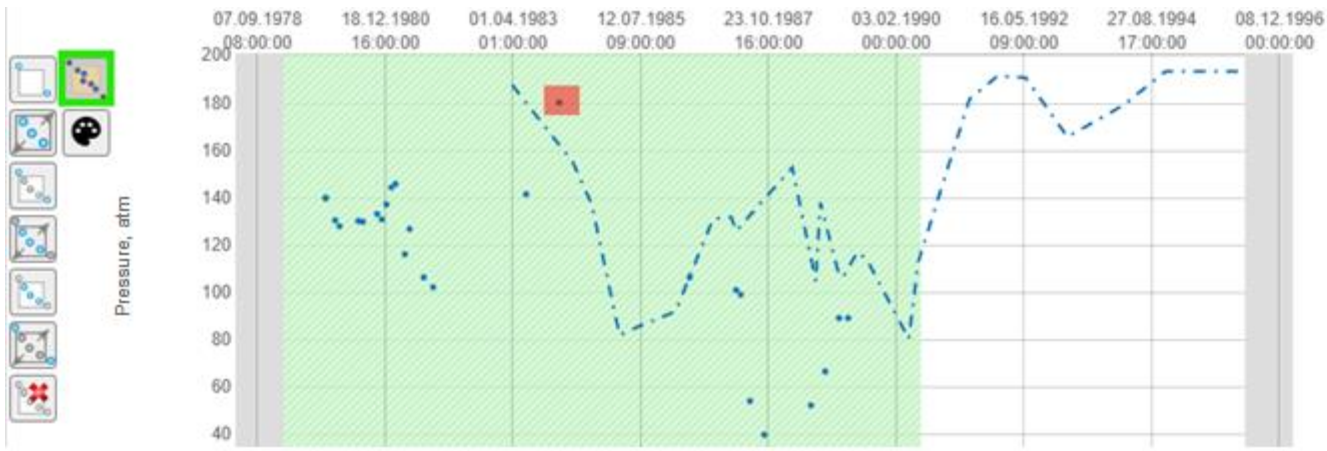


Fig. 2.4.4.1.4 – Selecting Invalid Values

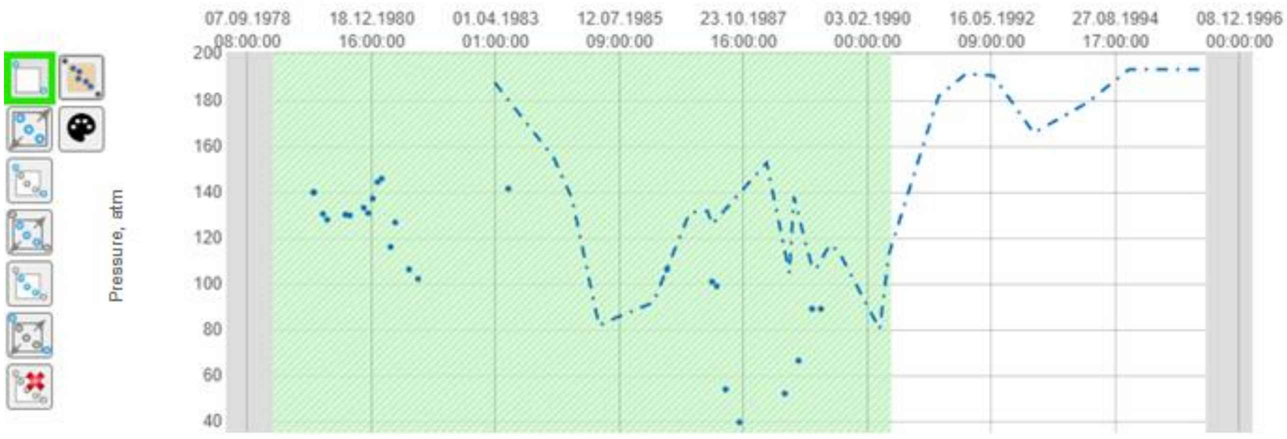


Fig. 2.4.4.1.5 – Deleting Invalid Values

The user can also undo the last operation by clicking the "Undo last operation" button (Fig. 2.4.4.1.6).

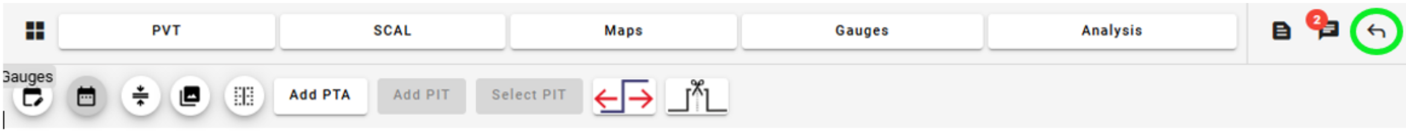


Fig. 2.4.4.1.6 – Undo Last Action

2.4.4.2. Populating Reservoir Properties by Well

To populate parameters such as water saturation (Sw), well trajectory, porosity, permeability, and net pay thickness, the user must navigate to each well and open the "Properties" and "Numerical Model" tabs within the "Well Logs" section (fig. 2.4.4.2.1).

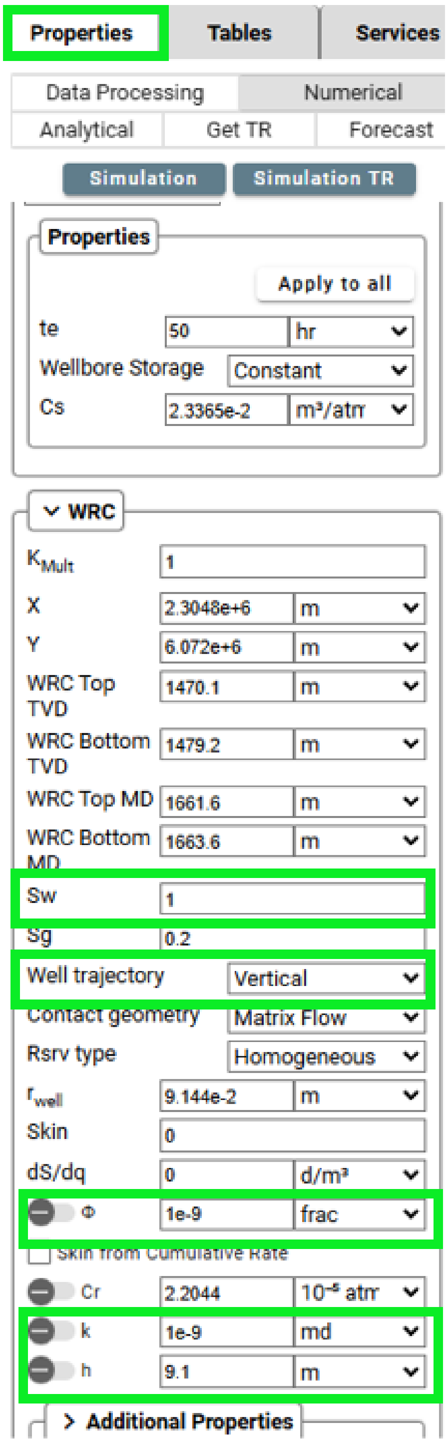


Рис. 2.4.4.2.1 – Populating selected parameters in the tab «Numerical»

2.4.5. Analysis

The "Analysis" window is not used in Prime Analysis.

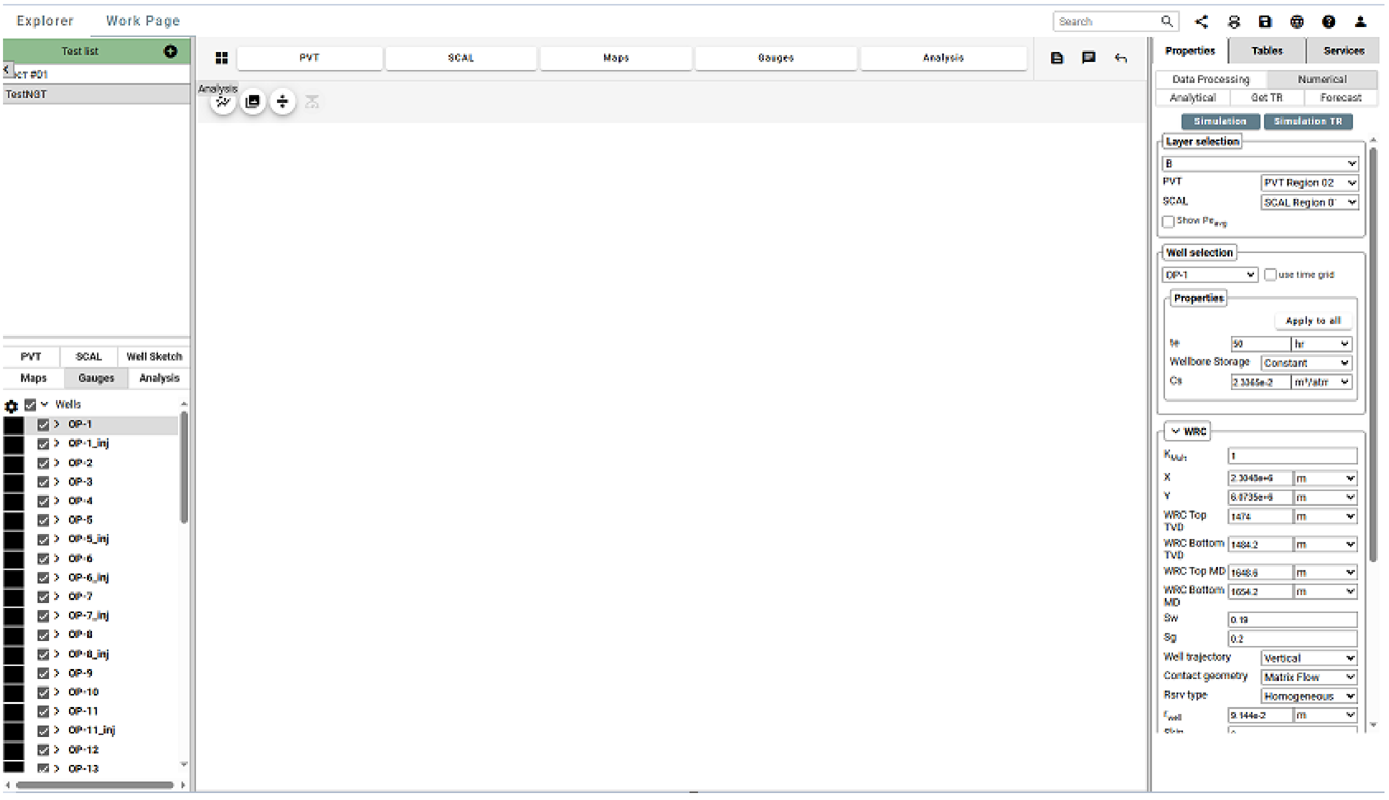


Fig. 2.4.5.1 – The "Analysis" Window in the PolyGon Software

3. Input file «PolyGon_Input»

Step Three – the user prepares the input Excel file named «PolyGon_Input». This file consists of eight sheets: DEPTHS, RATES, WELL XY, PRESSURE, PVT, SCAL, OH DATA, BOUNDARIES.

Note:

– In this guide, the default name for the input file containing data on flow rates, pressures, and well coordinates is "PolyGon_Input". However, the user may assign any other filename they find more convenient or easier to remember.

– In the Excel files, numerical values must use a period as the decimal separator.

3.1. The DEPTHS Sheet

The DEPTHS sheet contains information on the formation name, the absolute depth of the Oil-Water Contact (OWC), the Gas-Oil Contact (GOC), and the reference depth (DATUM) (Fig. 3.1.1).

	A	B	C	D	E	F
1	Form. Unit	OWC (TVD)	GOC (TVD)	DATUM		
2	name	m	m	m		
3	1	2	3	4		
4	A1	1694	1003.01	1694		
5	A2	1758	1003.01	1758		
6						
7						

DEPTHS | RATES | ...

Fig. 3.1.1 – Example of a Completed DEPTHS Sheet

3.2. The RATES Sheet

The RATES sheet contains information on the well number, the date from the start of operation, the production or injection operating time, and the monthly production/injection rates for oil, gas, water, liquid, as well as water injection and gas injection volumes (рис. 3.2.1).

	A	B	C	D	E	F	G	H	I	J
1	**Well ID**	**Date**	**Prod. Time**	**Inj. Time**	**Oil Rate**	**Gas Rate**	**Water Rate**	**Liquid Rate**	**Water Injection Rate**	**Gas Injection Rate**
2	**num**	**dd.mm.yyyy**	**hrs**	**hrs**	**m3/d**	**m3/d**	**m3/d**	**m3/d**	**m3/d**	**m3/d**
3	1	01.12.1970	96	0	0.50	0.00	9.00	0.00	0.00	0.00
4	1	01.01.1971	744	0	0.10	0.00	1.77	0.00	0.00	0.00
5	1	01.02.1971	672	0	0.07	0.00	1.29	0.00	0.00	0.00
6	1	01.03.1971	744	0	0.55	0.00	22.68	0.00	0.00	0.00
7	1	01.04.1971	360	0	0.07	0.00	3.13	0.00	0.00	0.00
8	1	01.05.1971	144	0	0.17	0.00	7.83	0.00	0.00	0.00
9	1	01.06.1971	720	0	0.10	0.00	4.70	0.00	0.00	0.00
10	1	01.07.1971	744	0	1.16	0.00	0.00	0.00	0.00	0.00
11	1	01.08.1971	744	0	1.16	0.00	0.00	0.00	0.00	0.00
12	1	01.09.1971	720	0	1.17	0.00	0.00	0.00	0.00	0.00
13	1	01.10.1971	744	0	23.13	0.00	0.00	0.00	0.00	0.00
14	1	01.11.1971	648	0	23.11	0.00	0.00	0.00	0.00	0.00

RATES | WELL XY | PRESSURE

Fig. 3.2.1 – Example of a Completed RATES Sheet

Note. The first row of the table contains the column headers, and the second row provides the corresponding units of measurement for each column.

3.3. The WELL XY Sheet

The WELL XY sheet is used by the user to input the coordinates of all wells in the field, as well as the name of the formation the well is perforated into (Fig. 3.3.1).

	A	B	C	D	E	F	G	H	I	J	K
1	Well ID	Form. Un	X1	Y1	X2	Y2				X1, Y1	Formation top crossing coordinates
2	num	name	m	m	m	m				X2, Y2	Coordinates of horizontal wells toe (= X1,Y1 in case of vertical/slanted wells)
3	1	2	3	4	5	6					
4	1	A1	3725	1225	3725	1225					
5	1	A2	3725	1225	3725	1225					
6	2	A1	1881	1020	1881	1020					
7	2	A2	1881	1020	1881	1020					
8	3	A1	2481	2967	2481	2967					
9	3	A2	2481	2967	2481	2967					
10	4	A1	1483	1017	1483	1017					
11	4	A2	1483	1017	1483	1017					
12	5	A2	1233	1568	1300	1601					
13											

RATES | WELL XY | PRESSURE | PVT | SCAL | OH DATA | BOUNDAR ...

Fig. 3.3.1 – Example of a Completed WELL XY Sheet

Note: X1, Y1 represent the formation top intersection point, while X2, Y2 represent the formation bottom intersection point or the well bottomhole location. For a vertical well, these coordinate pairs are identical X1=X2, Y1=Y2.

3.4. The PRESSURE Sheet

The PRESSURE sheet (Fig. 3.4.1) contains the following parameters: well identifier (Well ID), date since the start of well operations (Date), and measured bottomhole pressure (BHP), reservoir pressure (Pe), and tubing head pressure (THP).

	A	B	C	D	E
1	**Well ID**	**Date**	**Pe**	**BHP**	**THP**
2	**num**	**dd.mm.yyyy**	**atm**	**atm**	**atm**
3	1	01.08.2023	120.00	175.00	
4	1	01.09.2023			
5	1	01.10.2023			
6	1	01.11.2023			
7	1	01.12.2023			
8	1	01.01.2024		158.70	
9	1	01.02.2024			
10	1	01.03.2024			
11	1	01.04.2024	172.10		
12	1	01.05.2024			
13	1	01.06.2024	99.30		
14	1	01.07.2024		125.60	
15	1	01.08.2024			
16	1	01.09.2024			
17	1	01.10.2024		177.80	
18	1	01.11.2024			
19	1	01.12.2024			
20	1	01.01.2025	141.20	113.30	
21					
22					

DEPTHS | RATES | WELL XY | PRESSURE | PVT | OI

Fig. 3.4.1 – Example of a Completed PRESSURE Sheet

Note: tubing head pressure (THP) data is currently not included in the Prime Analysis.

3.5. The PVT Sheet

The PVT sheet (Fig. 3.5.1) includes the following parameters:

B_o – Oil formation volume factor,

c_o – Oil compressibility,

mu_o – Oil viscosity,

pho_o – Oil density,

B_w – Water formation volume factor,

c_w – Water compressibility,

mu_w – Water viscosity,

pho_w – Water density,

Salinity – Salinity,

B_g – Gas formation volume factor,

c_g – Gas compressibility,

mu_g – Gas viscosity,

pho_g– Gas density,

Pb – Bubble-point pressure,

Rs – Solution gas-oil ratio at bubble-point pressure,

Pi – Initial reservoir pressure.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Form. Unit	Type	B_o	c_o	mu_o	pho_o	B_w	c_w	mu_w	pho_w	Salinity	B_g	c_g	mu_g	pho_g	Pb	Rs	Pi
2	name	name	rm3/sm3	1/atm	cP	kg/m3	rm3/sm3	1/atm	cP	kg/m3	ppk	rm3/sm3	1/atm	cP	kg/m3	atm	m3/m3	atm
3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
4	Layer 01	Oil_Water_Gas	1	0.00	0.49	725.18	1.02	0.00	0.29	981.82	10.00	0.00	0.00	0.03	229.15	132.89	100.09	340.23
5																		

DEPTHS | RATES | WELL XY | PRESSURE | PVT | OH DATA | SCAL | ...

Fig. 3.5.1 – Example of a Completed PVT Sheet

For multiphase models (e.g., Oil-Water, Oil-Water-Gas), fluid properties are defined for each phase.

3.6. The SCAL Sheet

The SCAL sheet (Fig. 3.6.1) includes the following parameters:

Sorw – Residual oil saturation to water sweep;

Swc – Critical water saturation;

Swl – Residual water saturation;

Swi – Initial water saturation;

Krow – Oil relative permeability in oil-water system;

Krwo – Water relative permeability in oil-water system;

Now – Corey exponent for Krow;

Nw – Corey exponent for Krwg;

Sorg – Residual oil saturation to gas displacement;

Sgc – Critical gas saturation;

Sgi – Initial gas saturation;

Krog – Oil relative permeability in oil-gas system;

Krgo – Gas relative permeability in oil-gas system;

Nog – Corey exponent for Krog;

Ng – Corey exponent for Krgo;

OW RP – Oil-Water relative permeability set;

OG RP – Oil-Gas relative permeability set;

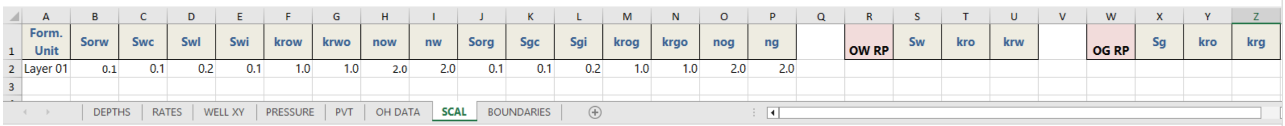
Sw – Water saturation;

Kro – Oil relative permeability;

Krw – Water relative permeability;

Sg – Gas saturation;

Krg – Gas relative permeability.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	Form. Unit	Sorw	Swc	Swl	Swi	krow	krwo	now	nw	Sorg	Sgc	Sgi	krog	krgo	nog	ng		OW RP	Sw	kro	krw		OG RP	Sg	kro	krg
2	Layer 01	0.1	0.1	0.2	0.1	1.0	1.0	2.0	2.0	0.1	0.1	0.2	1.0	1.0	2.0	2.0										
3																										

DEPTHS | RATES | WELL XY | PRESSURE | PVT | OH DATA | SCAL | BOUNDARIES

Рис. 3.6.1 – Пример заполнения листа SCAL

3.7. The "OH DATA" sheet

The "OH DATA" sheet (Fig. 3.7.1) contains well log data.* The following parameters are entered into the table on this sheet: well name (Well ID, reservoir name (Form. Unit), reservoir top and bottom (TVD and MD), net pay (Heff), porosity (Poro), permeability (Perm), shale content (Sheleness), water saturation (Swi), completion factor (kmult), skin, and facies number (Facies).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Well ID	Form. Unit	Top (TVD	Bot (TVD	Heff	Poro	Perm	Swi	Shaleness	Top (MD	Bot (MD	Kmult	Skin	Facies
2	num	name	m	m	m	p.u.	md	frac	frac	m	m	frac	frac	frac
3	1	2	3	4	5	6	7	8	9	10	11	12	13	14
4	1	A1	1778.58	1783.600	4.356	15.126	137.870	1.000	0.116	1879.410	1885.010	1.000	0.000	1.000
5	1	A2	1788.38	1797.520	7.439	16.723	163.098	0.534	0.143	1891.210	1901.010	1.000	0.000	1.000
6	2	A1	1774.97	1780.400	4.764	16.354	63.267	1.000	0.119	1817.500	1823.300	1.000	0.000	1.000
7	2	A2	1785.68	1795.220	7.763	16.774	81.957	0.263	0.152	1828.900	1838.900	1.000	0.000	1.000
8	3	A1	1821.51	1827.510	5.188	15.879	46.745	1.000	0.120	1821.510	1827.510	1.000	0.000	1.000
9	3	A2	1783.79	1794.080	8.411	16.547	73.996	0.261	0.161	1833.310	1844.510	1.000	0.000	1.000
10	4	A1	1770.95	1776.350	4.590	14.286	21.721	1.000	0.144	1830.640	1837.040	1.000	0.000	1.000
11	4	A2	1781.37	1789.950	6.960	17.478	75.705	0.250	0.159	1842.840	1853.040	1.000	0.000	1.000
12	5	A1	1789.04	1794.410	4.670	16.010	65.859	1.000	0.129	2105.420	2111.420	1.000	0.000	1.000
13	5	A2	1816.45	1846.190	23.749	11.763	13.156	0.700	0.166	2136.020	2169.020	1.000	0.000	1.000
14	6	A1	1782.95	1788.330	4.725	15.542	67.469	1.000	0.112	1974.070	1980.270	1.000	0.000	1.000
15	6	A2	1793.09	1805.000	9.808	16.118	44.509	0.506	0.151	1986.270	1999.470	1.000	0.000	1.000
16	7	A1	1809.97	1840.560	24.555	12.535	59.479	0.583	0.163	2005.270	2040.070	1.000	0.000	1.000
17	7	A2	1788.57	1793.960	4.673	15.098	65.186	1.000	0.133	1860.390	1866.190	1.000	0.000	1.000

RATES | WELL XY | PRESSURE | PVT | SCAL | OH DATA | BOUNDARIES

Fig. 3.7.1 – Example of the "OH DATA" Sheet Completion

3.8. The "BOUNDARIES" sheet

The "BOUNDARIES" sheet (Fig. 3.8.1) is used for the User to input the boundary coordinates of all formations.

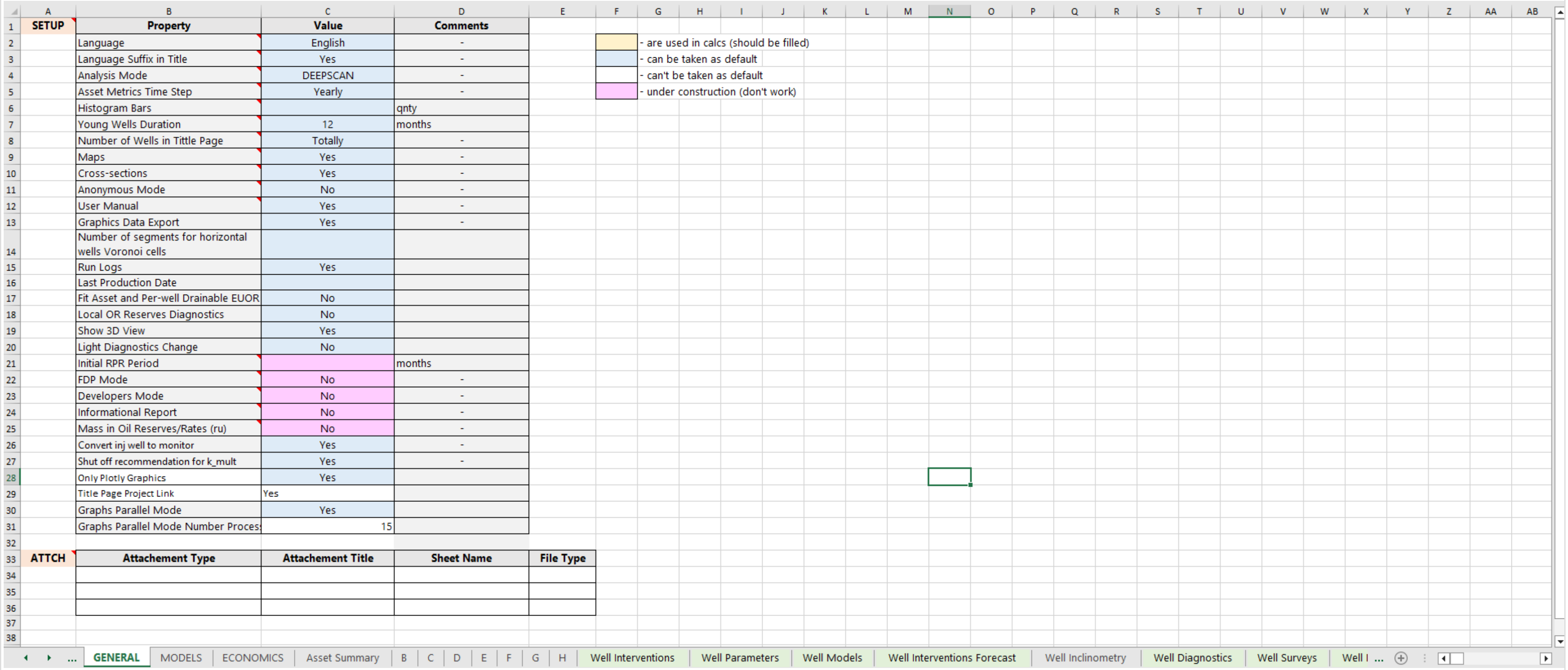
	A	B	C	D	E	F	G	H	I	J
1	Layer	X	Y		Layer	X	Y			
2	name	m	m		name	m	m			
3	A1	2508.09	3489.97		A2	2508.092	3489.969			
4		2832.94	3465.91			2832.937	3465.906			
5		3031.45	3273.41			3031.453	3273.405			
6		3151.77	2948.56			3151.766	2948.56			
7		3283.38	3029.78			3283.381	3029.783			
8		3440.52	2930.51			3440.518	2930.513			
9		3702.35	2765.25			3702.353	2765.249			
10		3915.75	2509.42			3915.754	2509.418			
11		4012	2220.67			4012.004	2220.667			
12		4119.8	1804.98			4119.797	1804.977			
13		4167.2	1491.51			4167.199	1491.512			
14		4239.07	1170.4			4239.066	1170.402			
15		4225.3	905.868			4225.304	905.868			
16		4014.29	763.662			4014.289	763.6619			
17		3760.46	791.186			3760.459	791.1858			
18		3431.7	861.524			3431.704	861.5242			
19		3090.72	905.868			3090.715	905.868			
20		2906.74	908.396			2906.737	908.3956			
21		2675.45	871.6			2675.447	871.5995			
22		2541.4	798.007			2541.404	798.0072			
23		2358.3	649.07			2358.299	649.0705			
24		2104.23	480.859			2104.231	480.8595			

RATES | WELL XY | PRESSURE | PVT | SCAL | OH DATA | BOUNDARIES

Fig. 3.8.1 – Example of the "BOUNDARIES" Sheet Completion

4. The input file «PRIME_Input»

The fourth step in creating a web report is the generation of an input Excel file and its subsequent completion.



SETUP	Property	Value	Comments
	Language	English	-
	Language Suffix in Title	Yes	-
	Analysis Mode	DEEPSCAN	-
	Asset Metrics Time Step	Yearly	-
	Histogram Bars		qnty
	Young Wells Duration	12	months
	Number of Wells in Tittle Page	Totally	-
	Maps	Yes	-
	Cross-sections	Yes	-
	Anonymous Mode	No	-
	User Manual	Yes	-
	Graphics Data Export	Yes	-
	Number of segments for horizontal wells Voronoi cells		
	Run Logs	Yes	
	Last Production Date		
	Fit Asset and Per-well Drainable EUOR	No	
	Local OR Reserves Diagnostics	No	
	Show 3D View	Yes	
	Light Diagnostics Change	No	
	Initial RPR Period		months
	FDP Mode	No	-
	Developers Mode	No	-
	Informational Report	No	-
	Mass in Oil Reserves/Rates (ru)	No	-
	Convert inj well to monitor	Yes	-
	Shut off recommendation for k_mult	Yes	-
	Only Plotly Graphics	Yes	
	Title Page Project Link	Yes	
	Graphs Parallel Mode	Yes	
	Graphs Parallel Mode Number Proces	15	

ATTCH	Attachement Type	Attachement Title	Sheet Name	File Type

- are used in calcs (should be filled)
- can be taken as default
- can't be taken as default
- under construction (don't work)

GENERAL | MODELS | ECONOMICS | Asset Summary | B | C | D | E | F | G | H | Well Interventions | Well Parameters | Well Models | Well Interventions Forecast | Well Inclinometry | Well Diagnostics | Well Surveys | Well I ...

Fig. 4.1– The "PRIME_Input" input file

4.1. Input File Template Generation

After loading a file with primary well data and analyzed formation properties into the PolyGon software, the User can generate the "PRIME_Input" Excel input file template. To do this, it is necessary to:

- Navigate to the "Services" tab on the right side of the interface;
- In the right-hand window, select "Prime_plugin_new_input";
- Click the "Run" button (Fig. 4.1.1).

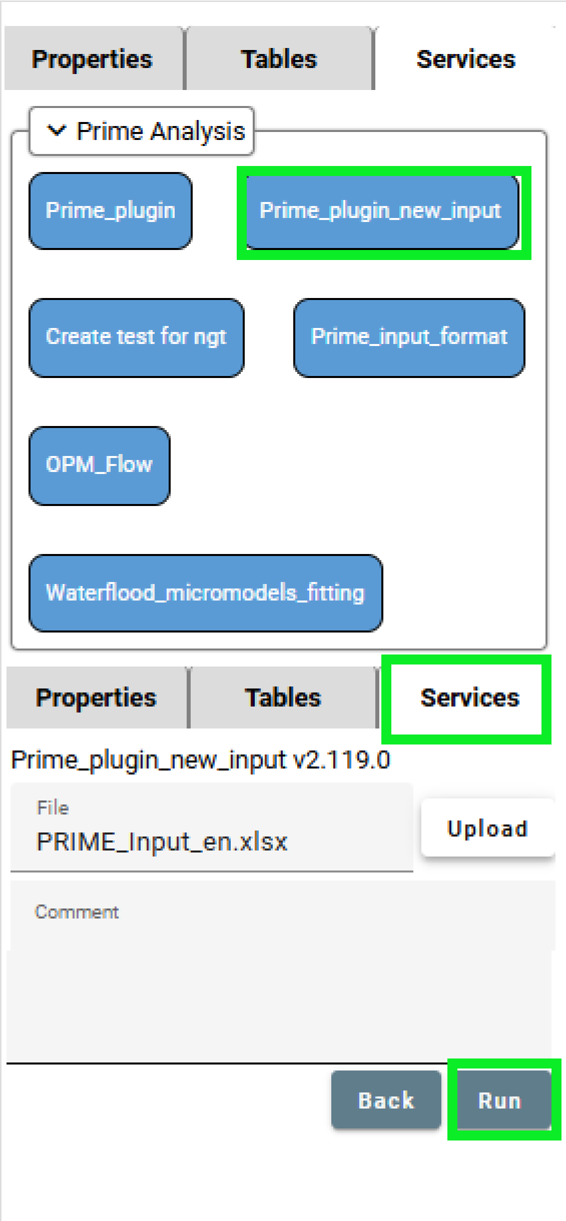


Рис. 4.1.1 – Генерация входного файла

Afterwards, a file (Fig. 4.1.2) will be generated in the message dialog box within the Notifications section, which must be downloaded.

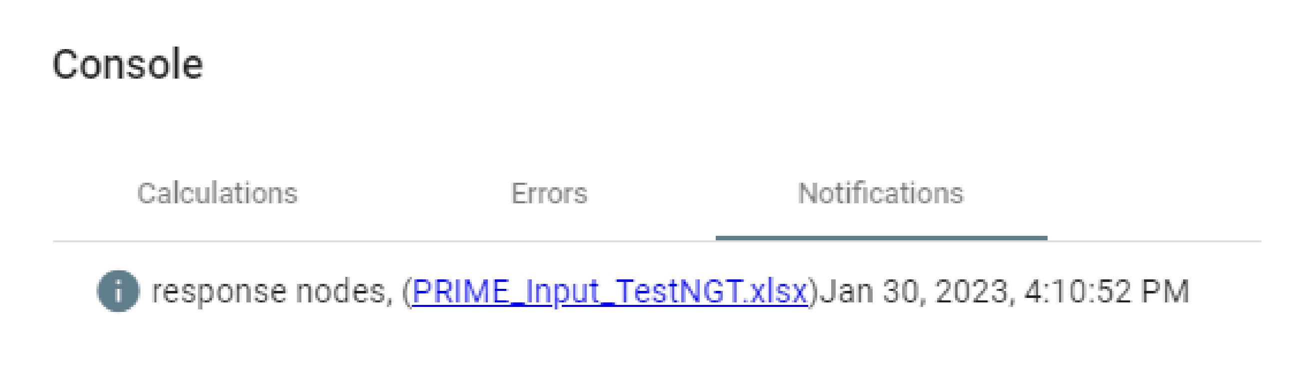


Fig. 4.1.2 – The "Messages" window

This template will already contain all the necessary sheets with the well names that the User previously specified in the "PolyGon_Input" Excel file.

Note:

The input file name consists of:

- A fixed part ("PRIME_Input_");
- A variable part ("TestNGT"), which changes depending on the test name specified in the PolyGon software.

4.2. Filling Out the "PRIME_Input" Input File

In this section, you will find a detailed description of the sheets in the "PRIME_Input" Excel file that the User must fill out manually. Each sheet contains required fields to be completed, and it is important to carefully follow the instructions for each field.

Before proceeding with the file, ensure that you have correctly filled in all required fields.

Note: It is prohibited to change the names of the sheets in the input Excel file.

4.2.1. Calculation Parameters

This section provides a description of the GENERAL, MODELS, and ECONOMICS sheets.

GENERAL – information on the general and forecast parameters of the studied asset.

MODELS – information on the model parameters of the studied asset.

ECONOMICS – information on the economic indicators of the studied asset.

4.2.1.1. GENERAL

The **GENERAL** sheet (Fig. 4.2.1.1.1) contains information on:

- General field parameters (**SETUP**);
- orecasting parameters (**CUT_OFFS)**;
- Appendix pages **(APPDX)**.

SETUP	Property	Value	Comments
	Language	English	-
	Language Suffix in Title	Yes	-
	Analysis Mode	DEEPSCAN	-
	Asset Metrics Time Step	Yearly	-
	Histogram Bars		qnty
	Young Wells Duration	12	months
	Number of Wells in Tittle Page	Totally	-
	Maps	Yes	-
	Cross-sections	Yes	-
	Anonymous Mode	No	-
	User Manual	Yes	-
	Graphics Data Export	Yes	-
	Number of segments for horizontal wells Voronoi cells		
	Run Logs	Yes	
	Last Production Date		
	Fit Asset and Per-well Drainable EUOR	No	
	Local OR Reserves Diagnostics	No	
	Show 3D View	Yes	
	Light Diagnostics Change	No	
	Initial RPR Period		months
	FDP Mode	No	-
	Developers Mode	No	-
	Informational Report	No	-
	Mass in Oil Reserves/Rates (ru)	No	-
	Convert inj well to monitor	Yes	-
	Shut off recommendation for k_mult	Yes	-
	Only Plotly Graphics	Yes	
	Title Page Project Link	Yes	
	Graphs Parallel Mode	Yes	
	Graphs Parallel Mode Number Proces	15	

(yellow)	- are used in calcs (should be filled)
(light blue)	- can be taken as default
(white)	- can't be taken as default
(pink)	- under construction (don't work)

ATTCH	Attachement Type	Attachement Title	Sheet Name	File Type

Fig. 4.2.1.1.1 – The GENERAL Sheet

Note: Fields highlighted in yellow are used in calculations (must be filled in), while fields highlighted in light blue can be left as defaults.

4.2.1.1.1. SETUP

The SETUP table consists of three columns: property, value, and comments.

The property column contains the following information:

- Language – report language (Russian/English);
- Language Suffix in Title – adding a language suffix to the project (Yes/No);
- Analysis Mode – analysis mode (Prescan/Midscan/Deepscan);
- Asset Metrics Time Step – display of full-field metrics: by months, quarters, years;
- Histogram Bars – number of bins in histograms in the statistics section;
- Young Wells Duration – duration of young well production (default: 12 months);
- Number of Wells in Tittle Page – number of wells displayed on the title page;
- Maps – maps page (Yes/No; user-defined maps are always displayed);
- Cross–sections – cross-sections page (Yes/No; user-defined cross-sections are always displayed);
- Anonymous Mode – report anonymization mode (Yes/No);
- User Manual – display of the user manual in the report (Yes/No);
- Graphics Data Export – a button appears in Plotly graphs/figures to export an Excel file with the graph data (Yes/No);
- Number of segments for horizontal wells Voronoi cells – controls the number of segments into which a horizontal well is divided when constructing the Voronoi grid (typically ranges from 5 to 15);
- Run Logs – appearance of notes and warnings in the report Appendix (Yes/No);
- Last Production Date – allows setting the date up to which production data will be truncated in the report;
- Fit Asset and Per-well Drainable EUOR – reconcile recoverable reserves for the asset with the sum of recoverable reserves for all wells (Yes/No);
- Local OR Reserves Diagnostics – generating an Arps hyperbolic decline curve based on remaining recoverable reserves (Yes/No)
- Show 3D View – creating 3D images in the report (Yes/No);
- Initial RPR Period – period for initial recoverable reserves multiple (duration of the first period);
- FDP Mode – mode with project indicators (Yes/No);
- Developers Mode – developer mode intended for testing (Yes/No);

- Informational Report – informational report (Yes/No);
- Mass in Oil Reserves/Rates (ru) – oil reserves and production in mass units (tons), only if the Russian measurement system is selected (Yes/No).

In the value column, the user can manually enter data or select from available options in a drop-down list. However, it is important to note that in columns with drop-down lists, manually adding custom remarks is not recommended. This is because such remarks may affect the correctness of the Prime report calculation and lead to errors. The user is advised to use only the options provided in the drop-down list to ensure reliable results.

In the comments column, the User can only enter information manually.

Property	Value	Comments
Language	English	-
Language Suffix in Title	Yes	-
Analysis Mode	DEEPSCAN	-
Asset Metrics Time Step	Yearly	-
Histogram Bars		qnty
Young Wells Duration	12	months
Number of Wells in Tittle Page	Totally	-
Maps	Yes	-
Cross-sections	Yes	-
Anonymous Mode	No	-
User Manual	Yes	-
Graphics Data Export	Yes	-
Number of segments for horizontal wells Voronoi cells		
Run Logs	Yes	
Last Production Date		
Fit Asset and Per-well Drainable EUOR	No	
Local OR Reserves Diagnostics	No	
Show 3D View	Yes	
Light Diagnostics Change	No	
Initial RPR Period		months
FDP Mode	No	-
Developers Mode	No	-
Informational Report	No	-
Mass in Oil Reserves/Rates (ru)	No	-

Fig. 4.2.1.1.1.1 – Example of the SETUP Table Completion

Note: Selecting "Yes/No" in the value column affects the generation of specific pages and metrics in the web report.

4.2.1.1.2. APPDX

In the ATTCH table (Fig. 4.2.1.1.2.1), the User specifies the page title (Attachment Title), file names (Sheet Name), and file extensions (Extension).

ATTCH	Attachement Type	Attachement Title	Sheet Name	File Type
	PRIME Report	PRIME Report	Report	*.pdf

Fig. 4.2.1.1.2.1 – Example of the ATTCH Table Completion

The User must attach the actual files in a newly created sheet (Fig. 4.2.1.1.2.2), whose name must match the file name (Sheet Name).

ATTCH	Attachement Type	Attachement Title	Sheet Name	File Type
	PRIME Report	PRIME Report	Report	*.pdf

PetroCup Config | Ipr PetroCup | Pump Info | Surface facilities | GENERAL | Report | MODELS

Fig. 4.2.1.1.2.2 – Additional Sheet for Filling Out the ATTCH Table

Note:

– The User can fill out the APPDX table multiple times, provided that the file extensions and the names of the sheets containing the attached appendices are correctly specified.

– Files may have the following extensions: pdf, html, png, svg, docx.

4.2.1.2. MODELS

The **MODELS** sheet (Fig. 4.2.1.2.1) contains information on:

- Forecast parameters for decline curve analysis (DCA), water-oil ratio (WOR), and other **CUT_OFFS**
- Forecast parameters for waterflood micromodels **MCRMOD**
- Forecast parameters for recovery diagnostics **RES.DIAG**;
- Parameters for the average well productivity index model by phase **PI;**
- Parameters for the material balance model **MBAL;**
- Parameters for the inflow performance relationship model **IPR**;
- Parameters for the capacitance-resistance model **CRM**.

4.2.1.2.1. CUT_OFFS

The CUT_OFFS table presents forecast parameters for decline curve analysis (DCA), water-oil ratio (WOR), and other models.

The calculation stops when the forecast time (mathematical limit) is reached.

The property column (Fig. 4.2.1.2.1) contains the following fixed information:

- Lifetime – forecast period;
- Minimum Oil Production Rate – minimum oil rate at which the economic production limit is reached;
- Minimum Gas Production Rate – minimum gas rate at which the economic production limit is reached;
- Maximum Watercut – maximum water cut value at which the economic production limit is reached;
- Maximum GOR – maximum gas-oil ratio;
- Minimum BHP – minimum bottomhole pressure;
- Target VRR – target voidage replacement ratio;
- Target VRR for Under-compensated Asset – target voidage replacement ratio for an under-compensated reservoir.

CUT_OFFS	Property	Value	Unit
	Lifetime	100	yrs
	Minimum Oil Production Rate	2.5	m3/d
	Minimum Gas Production Rate	10	m3/d
	Maximum Watercut	98	%
	Maximum GOR	3000	m3/m3
	Minimum BHP	3000	kPa
	Target VRR	110	%
	Target VRR for Under-compensate	130	%

Ашп. 4.2.1.2.1.1 – Example of the CUT_OFFS Table Completion

Note: In the unit column, the user can enter data manually or select from the options provided in the drop-down list. However, it is important to note that in columns with drop-down lists, it is not recommended to enter units of measurement that are not listed. This may adversely affect the accuracy of the calculations in the Prime report and lead to errors. It is recommended to select only the available options from the provided list to ensure reliable results.

4.2.1.2.2. MCRMOD

The MCRMOD table (Fig. 4.2.1.2.2.1) lists waterflood micromodels that can be assigned by an analyst for automatic calculation in a 3D simulator using characteristic parameters for a group of wells and for individual wells.

The Model column contains the names of the waterflood micromodel options available to the analyst:

- **EWD4 –** Areal waterflood model with aquifer support from 4 sides – simulates water influx for an average well in a pattern from all sides;
- **EWD2 –** Areal waterflood model with aquifer support from 2 sides – simulates water influx for an average well in a pattern from two sides;
- **EWD1 –** Areal waterflood model with aquifer support from 1 side – simulates water influx for an average well in a pattern from one side;
- **RWD9 –** Nine-spot waterflood pattern – simulates water influx for an average producer at the center of a square pattern with injectors at the corners and midpoints of the sides;
- **RWD7 –** Seven-spot waterflood pattern – simulates water influx for an average producer at the center of a hexagonal pattern with injectors at the corners;
- **RWD5 –** Five-spot waterflood pattern – simulates water influx for an average producer at the center of a square pattern with injectors at the corners;
- **RWD4 –** Four-spot waterflood pattern – simulates water influx for an average producer at the center of a square pattern with injectors at two corners and the midpoint of the opposite side;
- **RWD3 –** Three-spot waterflood pattern – simulates water influx for an average producer at the center of a square pattern with two injectors at opposite corners;
- **DLWD1 –** Single-line drive waterflood model – simulates water influx from an injector row;
- **SLWD1 –** Staggered line drive waterflood model – simulates water influx from injector rows where producers are staggered in a checkerboard pattern;
- **DLWD3 –** Triple-line drive waterflood model – simulates water influx from an injector row for three rows of producers;

- **DWD –** Dipole waterflood model – simulates water influx only from the nearest injector;
- **BWD –** Bottom water drive model – simulates water coning or bottom water influx.

The Model column also includes the following options:

- **Calc Well Micromodels** – Calculate well-level micromodels;
- **Auto-calculate Swi** – Automatically calculate initial water saturation. Yes - via FracFlow using initial well water cuts; No - Use the value from PolyGon;
- **Calc Well Drilling Micromodels** – Calculate well-level micromodels for newly drilled wells.

In the Show column, the User can select whether to include a particular forecast model in the analysis.

In the Color column, the User can select a color for displaying a specific micromodel in diagnostic plots.

MCRMOD	Model	Show	Color	Comment
	EWD4	No	default	Edge Water Drive (from 4 sides)
	EWD2	No	default	Edge Water Drive (from 2 sides)
	EWD1	No	default	Edge Water Drive (from 1 side)
	RWD9	No	default	Regular Water Drive (Regular 9 spot)
	RWD7	No	default	Regular Water Drive (Regular 7 spot)
	RWD5	Yes	default	Regular Water Drive (Regular 5 spot)
	RWD4	No	default	Regular Water Drive (Regular 4 spot)
	RWD3	No	default	Regular Water Drive (Regular 3 spot)
	SLWD1	Yes	default	Linear Water Drive (Staggered Line Drive)
	DLWD1	No	default	Linear Water Drive (Direct Line Drive)
	DLWD3	No	default	Linear Water Drive (Direct Line Drive - 3 rows)
	DWD	Yes	default	Dipole Water Drive
	BWD	Yes	default	Bottom Water Drive
	Calc Well Micromodels	No	-	
	Auto-calculate Swi	No	-	
	Calc Well Drilling Micromodels	No		

Fig. 4.2.1.2.2.1 – MCRMOD Table

4.2.1.2.3. Production Performance Diagnostics Parameters (Forecast) - RES.DIAG

The **RES.DIAG** table (Fig. 4.2.1.2.3.1) provides fields for entering the following parameters for the DCA (Decline Curve Analysis), WOR (Water-Oil Ratio), P_e (Reservoir Pressure Depletion), WOR_inj (Water-Oil Ratio during Waterflooding), J_oil (Oil Productivity Index), and J_water (Water Productivity Index) models:

- **Training Start** – start date of the training dataset;
- **Training Finish** – end date of the training dataset;
- **Valid. Start** – start date of the validation dataset;
- **Valid. Finish** – end date of the validation dataset;
- **q_L** – liquid rate (m^3/day);
- **q_inj** – injection rate (m^3/day);
- **Pwf** – bottomhole pressure (kPa);
- **Jt** – productivity index (m^3/day/kPa);
- **GOR/Rs** – gas-oil ratio to solution gas-oil ratio ratio (fraction).
- **Drain. Oil Model** – column for specifying initial drainable oil reserves in case of a user-selected forecast model (m^3).
- **Profit. Oil Model** – column for specifying initial profitable drainable oil reserves in case of a user-selected forecast model (m^3).

In the Show column, the User can select whether to include a particular forecast model in the analysis.

In the q_L, q_inj, Pwf, Jt, GOR/Rs columns, the User can select units of measurement from a drop-down list.

RES.DIAG	Model	Show	Forecast Priority	Training Start	Training Finish	Valid. Start	Valid. Finish	qL	q_inj	Pwf	Jt	GOR/Rs	Drain. Oil Model	Profit. Oil Model
				dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	m3/d	m3/d	atm	cmd/atm	frac	m3	m3
	DCA (Arps-Hyp)	Yes	Yes	01.03.2017	01.12.2023			-	-	-	-	-		
	WOR (FracFlow)	Yes	No	01.04.2023	01.12.2023				-	-	-	-		
	WOR (Linear)	Yes	No	01.04.2023	01.12.2023				-	-	-	-		
	Pe (Linear)	Yes	No	01.12.2020	01.12.2023			-	-					
	Pe (Log)	Yes	No	01.12.2020	01.12.2023			-	-					
	WOR_inj	No	No						-	-	-	-		
	PWIR	Yes	No	01.02.2022	01.12.2023			-		-	-	-		

Fig. 4.2.1.2.3.1– RES.DIAG Table

4.2.1.2.4. Average Well Productivity Index (PI) Model Parameters

The **PI** table (Fig. 4.2.1.2.4.1) contains parameters for inputting data for average well productivity index models:

- **J_oil –** average well oil productivity index model;
- **J_water** – average well water productivity index model;
- **J_inj** – average well injectivity index model;
- **Training Start** – training dataset start date;
- **Training Finish** – training dataset end date;
- **Valid. Start** – validation dataset start date;
- **Valid. Finish** – validation dataset end date;
- **Skin** – skin factor.

PI	Model	Show	Training Start	Training Finish	Valid. Start	Valid. Finish	skin
			dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	frac
	J_oil	Yes	01.01.2013	01.01.2019			
	J_water	Yes	01.12.2009	01.12.2019			
	J_inj	Yes					

Fig. 4.2.1.2.4.1 –PI Table

4.2.1.2.5. MBAL Material Balance Model Parameters

The **MCRMOD** table (рис. 4.2.1.2.5.1) contains parameters for inputting data for material balance models:

- **Training Start** – training dataset start date;
- **Training Finish** – training dataset end date;
- **Valid. Start** – validation dataset start date;
- **Valid. Finish** – validation dataset end date;
- **Vϕ** – total pore volume (m³);
- **Pi** – nitial reservoir pressure (atm).

MBAL	Model	Show	Training Start	Training Finish	Valid. Start	Valid. Finish	Pi	Vφ
			dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	atm	m3
	Mbal General	Yes	01.12.2018	01.12.2022				
	Mbal	Yes						

Fig. 4.2.1.2.5.1 – MBAL Table

4.2.1.2.6. IPR Model Parameters

The **IPR** table (Fig. 4.2.1.2.6.1) provides fields for entering the following parameters for inflow performance relationships:

- **Training Start** – training dataset start date;
- **Training Finish** – training dataset end date;
- **Valid. Start** – validation dataset start date;
- **Valid. Finish** – validation dataset end date;
- **P_e** – reservoir pressure;
- **a** – model parameter {0<a<1};
- **qo max** – maximum oil rate;
- **Wells** – well stock (entire, old, young);
- **Color** – PR curve color (by default, curves are plotted in different colors).

In the Show column, the User can select whether to include a particular IPR model in the analysis.

In the P_e , qo max, Wells and Color columns, the User can also select the required parameters from a drop-down list.

IPR	Model	Show	Training Start	Training Finish	Valid. Start	Valid. Finish	Pe	a	qO max	Wells	Color
			dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	atm	frac	m3/d	-	-
	IPR	No	01.09.2017	01.10.2017						all	red
	IPR	No	01.12.2018	01.04.2019						old	blue
	IPR	No	01.03.2020	01.05.2020						young	purple

Fig. 4.2.1.2.6.1 –IPR table

4.2.1.2.7. CRM Parameters

The **CRM** table (Fig. 4.2.1.2.7.1) provides fields for entering the following parameters for the Capacitance-Resistance Model (CRM):

- **Training Start** – training dataset start date;
- **Training Finish** – training dataset end date;
- **Valid. Start** – validation dataset start date;
- **Valid. Finish** – validation dataset end date;
- **Pi** – initial reservoir pressure (atm);
- **tau (τ)** – time constant related to well productivity (hours);
- **Jt** – productivity index (m^3/day/atm);
- **gti** – initial subsurface flow rate (m^3/day);
- **wf** – weight for total injection impact on total production (fraction);
- **wpwf** – weight for bottomhole pressure residual (fraction);
- **wpe** – weight for reservoir pressure residual (fraction).

CRM	Model	Show	Training Start	Training Finish	Valid. Start	Valid. Finish	Pi	tau	Jt	qti	wf	wpwf	wpe
			dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	atm	hr	cmd/atm	m3/d	frac	frac	frac
	ICRMQ	No											
	ICRMP	No											

Fig. 4.2.1.2.7.1–CRM table

4.2.1.3. ECONOMICS

The **ECONOMICS** sheet contains information on:

- Economic forecast parameters (**FRCST**)
- Hydrocarbon prices adopted by the company (**PRICES**)
- Hydrocarbon production taxes (**TAXES**)
- Operating expenditures (**OPEX**)
- Capital expenditures (**CAPEX**)
- Unit production/injection costs (**COGS**)
- Economic model parameters for sidetracking (**BWE**)
- Economic model parameters for infill drilling (**INFILL**)
- Economic model parameters for well workovers (**WORKOV**)

Note: Fields highlighted in yellow are used in calculations (must be filled in), while fields highlighted in light blue can be accepted as defaults or filled in after the initial generation of the web report.

4.2.1.3.1. Economic Forecast Parameters FRCST

The **FRCST** table (Fig. 4.2.1.3.1.1) consists of four columns: property, symbol, value, and unit.

В столбце свойств прописана следующая информация:

- Forecast Lifetime – Forecast period;
- Expected Profitability Index – The company's expected PI (Profitability Index) value used as the profitability criterion;
- Exchanges (1 in whole history) – Currency conversion: Dollar/Ruble ($/₽) or Ruble/Dollar (₽/$);
- Budget – Budget for all cost types;
- Decision Metric – Decision-making metric.

In the value column, the User must specify all parameters.

In the unit column, the User can select the required units of measurement from a drop-down list.

FRCST	Property	Symbol	Value	Unit
	Forecast Lifetime	t	10	yrs
	Expected Profitability Index	PI	1.2	frac
	Exchanges (1 in whole history)	-	90	₽/$
	Budget	-	64980000	₽
	Decision Metric	-	PI	

Fig. 4.2.1.3.1.1 –FRCST Table

- Capital Expenditure for Injection (CAPEX) – capital costs for water injection;
- Capital Expenditure for Production (CAPEX) – capital costs for fluid production;
- Capital Expenditure for Infrastructure – capital costs for infrastructure;
- Cost of Goods Sold for Injection – unit costs for water injection;
- Cost of Goods Sold for Production – unit costs for fluid production;
- Dollar Exchange Rate – US dollar exchange rate.

4.2.1.3.2. Hydrocarbon Price Parameters Adopted by the Company (PRICES)

The **PRICES** table (Fig. 4.2.1.3.2.1) consists of four columns: property, symbol, value, and unit of measurement.

PRICES	Property	Symbol	Value	Unit
	Current Oil Price	PO	39900	₽/m3
	Current Gas Price	PG		₽/1000 m3
	Historical Oil Price (initial)	POi	39900	₽/m3
	Historical Gas Price (initial)	PGi		₽/1000 m3

Fig. 4.2.1.3.2.1 – PRICES Table

The property column contains the following information:

- Current Oil Price – current WTI crude oil price (or internal price);
- Current Gas Price – current natural gas price;
- Historical Oil Price (initial) – WTI crude oil price at the start of field development (or internal price);
- Historical Gas Price (initial) – natural gas price at the start of field development.

In the unit column, the User can select the required units of measurement from a drop-down list.

4.2.1.3.3. Hydrocarbon Production Tax Parameters (TAXES)

The **TAXES** table (Fig. 4.2.1.3.3.1) consists of four columns: property, symbol, value, and unit of measurement.

TAXES	Property	Symbol	Value	Unit
	Extraction Tax	Textract	78.83458647	%
	Income Tax	Tincome	20	%
	Oil Extraction Tax (RUS)	TOE		₽/ton
	Gas Extraction Tax (RUS)	TGE		₽/1000 m3
	Price Coefficient (RUS)	Kprice		frac
	Production Specificity Coefficient (RUS)	Kspec		₽/ton
	Annual Per-well Tax	Twell	0	₽/well/yr
	Discount Rate	RDiscount	0.14	frac
	Financing Rate	RFin	0.14	frac

Fig. 4.2.1.3.3.1– TAXES Table

В столбце свойств прописана следующая информация:

- Extraction Tax – Mineral Extraction Tax;
- Income Tax – Value Added Tax;
- Oil Extraction Tax (RUS);
- Gas Extraction Tax (RUS);
- Price Coefficient (RUS);
- Production Specificity Coefficient (RUS);
- Annual Per-well Tax;
- Discount Rate;
- Financing.

In the unit column, the User can select the required units of measurement from a drop-down list.

4.2.1.3.4. Operating Expenditure Parameters (OPEX)

The **OPEX** table (Fig. 4.2.1.3.4.1) consists of four columns: property, symbol, value, and unit of measurement.

OPEX	Property	Symbol	Value	Unit
	Operating Expenses	OPEX	210145.2055	₽/d
	Per-well Operating Expenses	OPEXwell		₽/well/d
	Per-well Operating Expenses (Production)	OPEXwellprod		₽/well/yr
	Per-well Operating Expenses (Injection)	OPEXwellinj		₽/well/yr

Fig. 4.2.1.3.4.1 – OPEX Table

The property column contains the following information:

- Operating Expenses – Daily operating expenses;
- Per-well Operating Expenses – Annual operating expenses per well;
- Per-well Operating Expenses (Production) – Annual operating expenses per producer;
- Per-well Operating Expenses (Injection) – Annual operating expenses per injector;

In the unit column, the User can select the required units of measurement from a drop-down list.

4.2.1.3.5. Unit Production/Injection Cost Parameters (COGS)

The **COGS** table (Fig. 4.2.1.3.5.1) consists of four columns: property, symbol, value, and unit of measurement.

COGS	Property	Symbol	Value	Unit
	Cost of Goods Sold for Injection	COGS↓	38	₽/m3
	Cost of Goods Sold for Liquid Production	COGSL↑	57	₽/m3
	Cost of Goods Sold for Oil Production	COGSO↑	95	₽/m3
	Cost of Goods Sold for Gas Production	COGSG↑		₽/1000 m3

Fig. 4.2.1.3.5.1 – COGS Table

The property column contains the following information:

- Cost of Goods Sold for Injection – Unit water injection costs;
- Cost of Goods Sold for Liquid Production – Unit liquid production costs;
- Cost of Goods Sold for Oil Production – Unit oil production costs;
- Cost of Goods Sold for Gas Production – Unit gas production costs.

In the unit column, the User can select the required units of measurement from a drop-down list.

4.2.1.3.6. Waterflood Economic Model Parameters (BWE)

The **BWE** table (Fig. 4.2.1.3.6.1) consists of three columns: property, value, and unit of measurement.

BWE	Property	Symbol	Value	Unit
	Maximum Field Injection Rate (Asset)	Qmax↓	3073.1	m3/d
	Field Injection Rate Step	ΔqW↓	100	m3/d
	Per-well Injection Losses	<qW↓>1,LOSS	0	%
	Per-well Production Losses	<qL↑>1,LOSS	0	%
	Arps DCA Model Parameter	b	0.6	frac
	Current Formation Pressure in Producers	<Pe↑>	158.42	atm
	Current Formation Pressure in Injectors	<Pe↓>	180.37	atm
	Current Field-Average PI in Producers	J↑		cmd/atm
	Current Field-Average PI in Injectors	J↓		cmd/atm
	Perforated Layer's Depth (TVD)	ZPerf		m
	Current Recoverable Oil	OR		m3
	Number of Oil Producers	NOP		qnty
	Current Watercut	Yw		%
	Current Per-well Water Injection Rate	<qW↓>1		m3/d
	Current Per-well Liquid Production Rate	<qL↑>1		m3/d

Fig. 4.2.1.3.6.1 – WBE Table

The property column contains the following information:

- Maximum Field Injection Rate (Asset) – Maximum considered water injection rate for the asset;
- Field Injection Rate Step – Injection rate step size;
- Per–well Injection Losses – Water injection loss (per well);
- Per–well Production Losses – Fluid production loss (per well);
- Arps DCA Model Parameter (b) – Parameter b in Arps decline models;
- Current Formation Pressure in Producers – Current reservoir pressure at producers;
- Current Formation Pressure in Injectors – Current reservoir pressure at injectors;
- Current Field–Average PI in Producers – Current average productivity index for producers;
- Current Field–Average PI in Injectors – Current average productivity index for injectors;
- Perforated Layer's Depth (TVD) – True vertical depth (TVD) of the target perforated interval;
- Current Recoverable Oil – Current remaining recoverable oil reserves;
- Number of Oil Producers – Current number of oil producers;
- Current Watercut – Current water cut;

- Current Per–well Water Injection Rate – Current water injection rate (per well);
- Current Per–well Liquid Production Rate – Current liquid production rate (per well).

In the value column, the User must populate the empty fields.

In the unit column, the User can select the required units of measurement from a drop-down list.

4.2.1.3.7. Economic Model Parameters for Infill Drilling (INFILL)

The **INFILL** table (Fig. 4.2.1.3.7.1) consists of three columns: property, value, and unit of measurement.

INFILL	Property	Symbol	Value	Unit
	Arps DCA Model Parameter	b		frac
	Initial Per-well Oil Production Rate	<qOi↑>1		m3/d
	Stolen Oil Reserves by New Wells	ORStolen		%
	Mobilization of Slanted Well Drilling Rig		5605000	₽
	Mobilization of Horizontal Well Drilling Rig		11200500	₽
	Mobilization of Slanted Well Sidetrack Drilling Rig		33003000	₽
	Mobilization of Horizontal Well Sidetrack Drilling Rig		32300000	₽
	Cost of Vertical Passage		22990	₽/m
	Cost of Horizontal Passage		22990	₽/m
	Cost of Vertical Sidetrack Passage		22990	₽/m
	Cost of Horizontal Sidetrack Passage		62700	₽/m

Fig. 4.2.1.3.7.1 –INFILL Table

The property column contains the following information:

- Arps DCA Model Parameter – Parameter *b* in the Arps decline model;
- Initial Per-well Oil Production Rate;
- Stolen Oil Reserves by New Wells;
- Mobilization of Slanted Well Drilling Rig;
- Mobilization of Horizontal Well Drilling Rig;
- Mobilization of Slanted Well Sidetrack Drilling Rig;
- Mobilization of Horizontal Well Sidetrack Drilling Rig;
- Cost of Vertical Passage;
- Cost of Horizontal Passage;
- Cost of Vertical Sidetrack Passage;
- Cost of Horizontal Sidetrack Passage.

4.2.1.3.8. Economic Model Parameters for Well Workovers (WORKOVER)

The **WORKOVER** table (Fig. 4.2.1.3.8.1) consists of three columns: property, value, and unit of measurement.

INFILL	Property	Symbol	Value	Unit
	Arps DCA Model Parameter	b		frac
	Initial Per-well Oil Production Rate	<qOi↑>1		m3/d
	Stolen Oil Reserves by New Wells	ORStolen		%
	Mobilization of Slanted Well Drilling Rig		5605000	₽
	Mobilization of Horizontal Well Drilling Rig		11200500	₽
	Mobilization of Slanted Well Sidetrack Drilling Rig		33003000	₽
	Mobilization of Horizontal Well Sidetrack Drilling Rig		32300000	₽
	Cost of Vertical Passage		22990	₽/m
	Cost of Horizontal Passage		22990	₽/m
	Cost of Vertical Sidetrack Passage		22990	₽/m
	Cost of Horizontal Sidetrack Passage		62700	₽/m

Fig. 4.2.1.3.8.1 – WORKOVER Table

В столбце свойств прописана следующая информация:

- Production Well Workover Cost;
- Injection Well Workover Cost;
- Shut-in Well Restart Cost;
- Fracturing – Hydraulic fracturing (HF);
- Production to Injection Conversion Cost;
- Production to Monitor Well Conversion Cost;
- P&A of Producer Well Cost;
- Stimulating Cost;
- Min δPwf For Thief Water Injection;
- Move to other Layer Cost;
- Conveyance .

4.2.2. Field Development Plan Parameters (FDP)

The **FDP** sheet (Fig. 4.2.2.1) contains information on:

- Surface infrastructure parameters **FDP_SURF**;
- Additional field development project parameters (in case there is no table with project indicators) **FDP_ADD**;
- Project indicator parameters **FDP**.

FDP_SURF	Property	Count	Gross Capacity	Unit
	Operational Environment	On-shore plane	-	-
	Well Clusters	3	10	qnty
	Gathering Booster Pumps	2	3500	m3/d
	Production Processing Plants	1	10000	m3/d
	Injection Booster Pumps	3	5000	m3/d
	Water Supply	2	5000	m3/d

FDP_ADD	Property	Value	Unit	Comment
	Number of Project Producers	25	qnty	
	Average Initial Oil Production Rat	50	m3/d	

FDP	Date	N_p	N_i	$q_O^{\uparrow}$	$q_G^{\uparrow}$	$q_W^{\uparrow}$	$q_W^{\downarrow}$	$\langle Pe^{\uparrow} \rangle$	$\langle P_{wf}^{\uparrow} \rangle$
	yrs	qnty	qnty	m^3/d	m^3/d	m^3/d	m^3/d	kPa	kPa
	2004	5	0	25000	1875000	0	0	13000	9000
	2005	5	1	29700	2227500	300	15000	12900	9500
	2006	7	3	28286	2121429	286	50000	12750	9100
	2007	12	5	30083	2256250	1583	75000	12500	8600
	2008	15	5	28500	2137500	1500	100000	12300	8800
	2009	20	5	27900	2092500	2100	120000	12000	9000
	2010	22	8	41818	3136364	3636	150000	12000	8000
	2011	25	8	43200	3240000	4800	175000	11800	7800
	2012	25	10	37400	2805000	6600	200000	11750	7600
	2013	25	10	30400	2280000	7600	245000	10500	7700
	2014	25	10	27000	2025000	9000	250000	10300	7000
	2015	25	11	22100	1657500	11900	300000	10000	6900
	2016	25	11	14000	1050000	14000	320000	10000	6600
	2017	25	11	8800	660000	13200	310000	9500	6800
	2018	25	12	5600	420000	14400	300000	9300	6200
	2019	25	12	3500	262500	10500	300000	9200	6000
	2020	25	12	2000	150000	8000	250000	9000	6000
	2021	25	12	1080	81000	6120	200000	8900	5900
	2022	25	12	780	58500	5220	180000	8700	5800

Fig. 4.2.2.1 – The FDP Sheet

4.2.2.1. Surface Infrastructure Parameters (FDP_SURF)

The **FDP_SURF** table (Fig. 4.2.2.1.1) consists of four columns: property, count, gross capacity, and unit of measurement.

The property column contains the following information:

- Operational Environment – onshore/offshore;
- Well Clusters;
- Gathering Booster Pumps – gathering booster pump stations;
- Production Processing Plants – production processing facilities;
- Injection Booster Pumps – injection booster pump stations;
- Water Supply – water supply system.

In the count and gross capacity columns, the User must specify the surface infrastructure parameters. In the unit column, the required units of measurement must be selected from a drop-down list.

FDP_SURF	Property	Count	Gross Capacity	Unit
	Operational Environment	On-shore plane	-	-
	Well Clusters	3	10	qnty
	Gathering Booster Pumps	2	3500	m3/d
	Production Processing Plants	1	10000	m3/d
	Injection Booster Pumps	3	5000	m3/d
	Water Supply	2	5000	m3/d

Fig. 4.2.2.1.1 –FDP_SURF Table

4.2.2.2. Additional Field Development Project Parameters (FDP_ADD)

The **FDP_ADD** table (Fig. 4.2.2.2.1) consists of four columns: property, value, unit of measurement, and comment.

The property column contains the following information:

- Number of Project Producers – number of planned/project production wells;
- Average Initial Oil Production Rate.

In the value column, the User must specify the values.

In the unit column, the User can select the required units of measurement from a drop-down list, and in the comment column – leave comments.

FDP_ADD	Property	Value	Unit	Comment
	Number of Project Producers	25	qnty	
	Average Initial Oil Production Rat	50	m3/d	

Fig. 4.2.2.2.1 – FDP_ADD Table

4.2.2.3. Project Indicator Parameters (FDP)

The **FDP** table (Fig. 4.2.2.3.1) consists of the following parameters specified by the User:

Date;

Np – number of production wells;

Ni – number of injection wells;

q_O↑ – oil production rate;

q_G↑ – gas production rate;

q_W↑ – water production rate;

q_W↓ – water injection rate;

<Pe↑> – average reservoir pressure;

<P_{wf}↑> – average bottomhole pressure.

FDP	Date	N_p	N_i	q_O↑	q_G↑	q_W↑	q_W↓	<Pe↑>	<P_{wf}↑>
	yrs	qnty	qnty	m^3/d	m^3/d	m^3/d	m^3/d	kPa	kPa
	2004	5	0	25000	1875000	0	0	13000	9000
	2005	5	1	29700	2227500	300	15000	12900	9500
	2006	7	3	28286	2121429	286	50000	12750	9100
	2007	12	5	30083	2256250	1583	75000	12500	8600
	2008	15	5	28500	2137500	1500	100000	12300	8800
	2009	20	5	27900	2092500	2100	120000	12000	9000
	2010	22	8	41818	3136364	3636	150000	12000	8000
	2011	25	8	43200	3240000	4800	175000	11800	7800
	2012	25	10	37400	2805000	6600	200000	11750	7600
	2013	25	10	30400	2280000	7600	245000	10500	7700
	2014	25	10	27000	2025000	9000	250000	10300	7000
	2015	25	11	22100	1657500	11900	300000	10000	6900
	2016	25	11	14000	1050000	14000	320000	10000	6600
	2017	25	11	8800	660000	13200	310000	9500	6800
	2018	25	12	5600	420000	14400	300000	9300	6200
	2019	25	12	3500	262500	10500	300000	9200	6000
	2020	25	12	2000	150000	8000	250000	9000	6000
	2021	25	12	1080	81000	6120	200000	8900	5900
	2022	25	12	780	58500	5220	180000	8700	5800

Fig. 4.2.2.3.1 – FDP Table

4.2.3. Asset Parameters

This section provides a description of the Asset Summary, Asset Parameters, Asset Diagnostics, and Asset Recommendations sheets.

Asset Summary – summary information on the studied asset;

Asset Parameters – parameters of the studied asset;

Surface Facilities – asset infrastructure information;

Asset Diagnostics – diagnostics of the studied asset;

Asset Recommendations – recommendations for the studied asset;

Geological Model – porosity and permeability parameter information

4.2.3.1. Asset Summary

The **Asset Summary** sheet contains information on the following parameters:

- Reserves and reserves value **RESERV**;
- Production **PROD**;
- Reservoir rock **ROCK**;
- Fluid **FLUID**;
- Surface infrastructure **SURF**.

Note: Fields highlighted in yellow are used in calculations (must be filled in); fields highlighted in light blue can be accepted as defaults or filled in after the initial generation of the web report; fields highlighted in white cannot be accepted as defaults, but calculations can proceed without these values; fields highlighted in purple are not used in calculations in the current version.

4.2.3.1.1. Reserves and Reserves Value Parameters (RESERV)

The **RESERV** table (Fig. 4.2.3.1.1.1) consists of four columns: property, value, unit of measurement, and comment).

The property column contains the following information:

- STOIIP – Stock Tank Oil Initially In Place for the studied asset;
- EUORF – Expected Ultimate Oil Recovery Factor;
- STOIIP_vol – Volumetric Stock Tank Oil Initially In Place;
- STGIIP_free – Free Gas Initially In Place (if no data, only solution gas (STOIIP * Rs) is considered);
- EUGRF – Expected Ultimate Gas Recovery Factor (if no data, it is set equal to the Expected Ultimate Oil Recovery Factor);
- Minimum Per-well Oil Reserves for Drilling – Minimum oil reserves per well for drilling.

In the value column, the User must specify the values.

In the unit column, the User can select the required units of measurement from a drop-down list, and in the comment column – leave comments.

RESERV	Property	Value	Unit	Comment
	STOIIP	11200000	m3	from MDP
	EUORF	43	%	from MDP
	STOIIP_vol		m3	volatile oil reserves
	STGIIP_free		m3	free gas reserves
	EUGRF		%	
	Minimum Per-well Oil Reserves for Drilling		m3	

Fig. 4.2.3.1.1.1 – RESERV Table

4.2.3.1.2. Production Parameters (PROD)

The PROD table (Fig. 4.2.3.1.2.1) consists of four columns: property, value, unit of measurement, and comment).

The property column lists the following:

- Recovery Method;
- Lifting Mechanism.

In the "value" column, the User can select the recovery method and artificial lift method from a drop-down list. If none of the proposed methods are suitable for the studied asset, the User can specify the relevant information in the comments section.

PROD	Property	Value	Unit	Comment
	Recovery Method	Water flooding	-	In other case fill this
	Lifting Mechanism	ESP	-	In other case fill this

Fig. 4.2.3.1.2.1 – PROD Table

Classification of Recovery Methods:

- Natural Depletion;
- Water flooding;
- Gas flooding;
- WAG flooding – water-alternating-gas injectio;
- Chemical EOR – chemical enhanced oil recovery;
- Other;
- N/A – not specified.

Classification of Artificial Lift Methods:

- Natural Lift;
- Artifical Gas Lift;
- SRP – sucker rod pump;
- ESP – electric submersible pump;
- Hydraulic Pump;
- Swab – swabbing;
- Other;
- N/A – not specified.

4.2.3.1.3. Reservoir Rock Parameters (ROCK)

The **ROCK** table (Fig. 4.2.3.1.3.1) consists of four columns: property, value, unit of measurement, and comment.

The property column contains the following information:

- Deposit Structure – structural trap type;
- Rock Type;
- Geological Period;
- Depositional Environment;
- Reservoir Homogeneity;
- Vertical Homogeneity;
- Fault Development – fault structure;
- Aquifer Type and Strength;
- Reservoir Gas Conditions;
- Hydrocarbon Reserves Uncertainty;
- Average Surface Elevation;
- Net–To–Gross;
- Number of Layers – layering coefficient;
- Oil Column Thickness;
- Gas Column Thickness;
- Water Column Thickness;
- Net Oil Pay Area;
- Net Gas Pay Area;
- Net Pay Area Length (along);
- Net Pay Area Length (across);
- Aquifer Volume;
- Initial Formation Pressure;
- Initial Formation Temperature;
- Porosity cut–off;
- Shaliness;
- Neutral Layer Depth;

- Neutral layer Temperature – neutral layer temperature (average annual temperature at the field location);
- Average Formation Top;
- Average Formation Thickness;
- Effective Formation Porosity;
- Pore Compressibility;
- Absolute Permeability;
- Vertical–to–Horizontal Perm Ratio – anisotropy;
- Skin-factor;
- Region Thermal Gradient;
- Hydrostatic Pressure Gradient.

In the value and unit columns, the User can either enter data manually or select the required parameters and units of measurement from drop-down lists; in the comment column – leave comments.

ROCK	Property	Value	Unit	Comment
	Deposit Structure	Anticline	-	In other case fill this
	Rock Type	Sandstone	-	In other case fill this
	Geological Period	Cretaceous	-	In other case fill this
	Depositional Environment	Other	-	In other case fill this
	Reservoir Homogeneity	Matrix	-	In other case fill this
	Vertical Homogeneity	Dissected	-	In other case fill this
	Fault Development	Faulted	-	In other case fill this
	Aquifer Type and Strength	N/A	-	In other case fill this
	Reservoir Gas Conditions	Black Oil	-	In other case fill this
	Hydrocarbon Reserves Uncertainty	1P = Proven P90	-	In other case fill this
	Average Surface Elevation	15	m	above sea
	Net-To-Gross	0.827146481	frac	
	Number of Layers	1.5	qnty	
	Oil Column Thickness	22.5	m	
	Gas Column Thickness		m	
	Water Column Thickness	5	m	
	Net Oil Pay Area	1000000	m2	
	Net Gas Pay Area		m2	
	Net Pay Area Length (along)		m	
	Net Pay Area Length (across)		m	
	Aquifer Volume	1000000	m3	
	Initial Formation Pressure	18000	kPa	
	Initial Formation Temperature	55	*C	
	Porosity cut-off	0.1	p.u. (%)	
	Shaliness	5	%	
	Neutral Layer Depth	15	m	TVDss
	Neutral Layer Temperature	10	*C	
	Average Formation Top	1785.23	m	TVDss
	Average Formation Thickness	47.415	m	TVDss
	Effective Formation Porosity	0.155317037	frac	
	Pore Compressibility		1/atm	
	Absolute Permeability	74.70306944	md	
	Vertical-to-Horizontal Perm Ratio	0.1	frac	
	Skin-factor		frac	
	Region Thermal Gradient		*C/100m	
	Hydrostatic Pressure Gradient		atm/100m	

Fig. 4.2.3.1.3.1 – ROCK Table

Classification by Structural Trap Type:

- Anticline;
- Stratigraphic;
- Normal Fault;
- Thrust Fault;
- Other;
- N/A – not applicable.

Classification by Rock Type:

- Conglomerates;
- Sandstone;
- Siltstone;
- Shales;
- Mudstone;
- Claystone;
- Argillite;
- Wackestone;
- Packstone;
- Grainstone;
- Boundstone;
- Crystalline Limestone;
- Crystalline Dolomite;
- Igneous;
- Metamorphic;
- Other;
- N/A – not applicable.

Classification by Geological Period:

- Archean EON;
- Proterozoic EON;
- Cambrian;
- Ordovician;
- Silurian;
- Devonian;
- Carboniferous;
- Permian;
- Triassic;
- Jurassic;
- Cretaceous;
- Paleogene;
- Neogene;

- Quaternary;
- Other;
- N/A – not applicable.

Classification by Depositional Environment:

- Alluval;
- Atolian;
- Fluvial;
- Lacustrine
- Deltaic;
- Tidal;
- Lagoonal;
- Beach;
- Lake;
- Shallow water marine environment;
- Deep water marine environment;
- Reef;
- Evaporite;
- Glacial;
- Volcanic;
- Other;
- N/A – not applicable.

Classification by Reservoir Homogeneity:

- Matrix – homogeneous reservoir;
- Fissured – micro-fractured;
- Fractured;
- Faulted;
- Compartmentalized;
- N/A – not applicable.

Classification by Aquifer Type and Strength:

- Edge / Poor;
- Edge / Strong;

- Bottom / Poor;
- Bottom / Strong;
- No aquifer;
- Other;
- N/A – not applicable.

Classification by Reservoir Gas Conditions:

- Black Oil;
- Volatile Oil;
- Gas Cap;
- Oil–Rim;
- Retrograde Gas Condensate;
- Wet Gas;
- Dry Gas;
- Other;
- N/A – not applicable.

Classification by Fault Structure:

- Faulted – faulted reservoir;
- Compartmentalized – compartmentalized into homogeneous blocks with impermeable faults;
- Other;
- N/A – not applicable.

Classification by Vertical Homogeneity:

- Uniform;
- Dissected;
- Other;
- N/A – not applicable.

The classification of Hydrocarbon Reserves Uncertainty is available at the link http://nafta.wiki/Hydrocarbon+Reserves+Classification

4.2.3.1.4. Fluid Parameters (FLUID)

The **FLUID** table (Fig. 4.2.3.1.4.1) consists of four columns: property, total, unit of measurement, and comment.

The property column lists the following:

- Solution CGR – condensate-gas ratio;
- Dew Point Pressure;
- Sulfur Content.

In the total and unit columns, the User can either enter data manually or select the required parameters and units of measurement from drop-down lists; in the comment column – leave comments.

FLUID	Property	Total	Unit	Comment
	Solution CGR		m3/m3	Rv
	Dew Point Pressure	11100	kPa	Pd
	Sulfur Content	0.21	%	

Fig. 4.2.3.1.4.1 – FLUID Table

4.2.3.1.5. Surface Infrastructure Parameters (SURF)

The **SURF** table (Fig. 4.2.3.1.5.1) consists of five columns: property, count, gross capacity, free capacity, and unit of measurement.

The property column contains the following information:

- Operational Environment – onshore/offshore;
- Well Clusters;
- Gathering Booster Pumps gathering booster pump stations;
- Production Processing Plants – production processing facilities;
- Injection Booster Pumps – injection booster pump stations;
- Water Supply – water supply system.

In the remaining columns, the User must specify the surface infrastructure parameters.

SURF	Property	Count	Gross Capacity	Free Capacity	Unit
	Operational Environment	On-shore plane	-	-	-
	Well Clusters	3	10	3	qnty
	Gathering Booster Pumps	2	3500	1200	m3/d
	Production Processing Plants	1	10000	2000	m3/d
	Injection Booster Pumps	3	5000	1000	m3/d
	Water Supply	2	5000	1000	m3/d

Fig. 4.2.3.1.5.1 – SURF Table

4.2.3.2. Asset Parameters

The **Asset Parameters** sheet (Fig. 4.2.3.2.1) contains information on:

- Development periods **STAGE**;
- A list of micromodels **Yw_MOD**;
- Rate and cumulative production values for water and liquid for various waterflood models, such as **EWD, LWD, DWD.**

STAGE	#	Start date	End date	Comment
	1	01.03.1961	01.02.1966	Natural Lift
	2	01.02.1966	01.12.1986	Starting waterflooding
	3	01.12.1986	01.09.2007	Green production
	4	01.09.2007	01.07.2018	Brown production
	5	01.07.2018	01.03.2020	Mature production

UMOD	Model	Abbr.	STOIIP	EUORF	H	Use
	-	-	m3	frac	m	-
	Edge-Water Drive	EDW	419090	0.663	18	Yes
	Liner Water Drive 1	LWD1	419090	0.636	18	Yes
	Dipole Water Drive	DWD	419090	0.601	18	Yes
	Linear Water Drive	LWD3	3769800	0.646	18	Yes

UFM1	qW	qL	qinj	QW	QL	Qinj
	m3/d	m3/d	m3/d	m3	m3	m3
	0	0		0	0	
	0	45.22		0.1	16505.3	
	0	45.22		0.2	33010.6	
	0	45.22		0.3	49561.1	
	0	45.22		0.4	66066.4	
	0	45.22		0.4	82571.7	
	0	45.22		0.5	99077	
	0	45.22		0.6	115628	
	0	45.22		0.6	132133	
	0	45.22		0.7	148638	
	0	45.22		0.8	165143	
	0	45.22		1	181694	
	0.07	45.22		10.2	198199	
	10.21	45.22		1509.2	214705	
	23.92	45.22		8708.4	231210	
	29.77	45.22		18933.4	247760	
	32.87	45.22		3055.6	264266	
	35.04	45.22		43075.3	280771	
	36.59	45.22		56234.7	297276	
	37.7	45.22		69889.7	313827	
	38.55	45.22		83851.5	330332	
	39.22	45.22		98082.3	346837	
	39.79	45.22		112532	363343	
	40.29	45.22		127213	379893	
	40.71	45.22		142017	396399	
	41.06	45.22		156956	412904	
	41.38	45.22		172019	429409	
	41.66	45.22		187231	445960	

Fig. 4.2.3.2.1 – The Asset Parameters Sheet

4.2.3.2.1. Development Stages (STAGE)

The **STAGE** table (Fig. 4.2.3.2.1.1) consists of four columns: stage number (#), stage period (start date, end date), and comment.

The division into stages is performed by the User through analysis of the asset's overall development history plots and is entered into the comment column.

STAGE	#	Start date	End date	Comment
	1	01.03.1961	01.02.1966	Natural Lift
	2	01.02.1966	01.12.1986	Starting waterflooding
	3	01.12.1986	01.09.2007	Green production
	4	01.09.2007	01.07.2018	Brown production
	5	01.07.2018	01.03.2020	Mature production

Fig. 4.2.3.2.1.1 –STAGE Table

4.2.3.2.2. User-Defined Micromodels List (UMOD)

The **UMOD** table (Fig. 4.2.3.2.2.1) consists of six columns: model curve name (model), abbreviation (abbr.), stock tank oil initially in place (STOIIP), expected ultimate oil recovery factor (EUORF), average net pay thickness (H), and whether to use this model in calculations (use).

In the model column, the User specifies the waterflood model, and in the abbr. column, its abbreviation is entered.

Using the drop-down list in the use column, the User can include (yes) or exclude (no) one or several water cut model curves from the analysis.

UMOD	Model	Abbr.	STOIIP	EUORF	H	Use
	-	-	m3	frac	m	-
	Edge-Water Drive	EDW	419090	0.663	18	Yes
	Liner Water Drive 1	LWD1	419090	0.636	18	Yes
	Dipole Water Drive	DWD	419090	0.601	18	Yes
	Linear Water Drive	LWD3	3769800	0.646	18	Yes

Fig. 4.2.3.2.2.1 UMOD Table

Note: The User can specify any type of waterflood model for the studied asset in addition to those shown in Figure 4.2.3.2.2.1.

4.2.3.2.3. Example of the Micromodeling Table Completion

o the right of the micromodels list table (UMOD), individual tables are provided for each model.

For example, consider the areal waterflood model (EWD), into whose table the analyst must enter the following parameters:

q_w – water production rate;

q_L – liquid production rate;

q_{inj} – water injection rate;

Q_w – cumulative water production;

Q_L – cumulative liquid production;

Q_{inj} – cumulative water injection.

UFM1	qW	qL	qinj	QW	QL	Qinj
	m3/d	m3/d	m3/d	m3	m3	m3
	0	0		0	0	
	0	45.22		0.1	16505.3	
	0	45.22		0.2	33010.6	
	0	45.22		0.3	49561.1	
	0	45.22		0.4	66066.4	
	0	45.22		0.4	82571.7	
	0	45.22		0.5	99077	
	0	45.22		0.6	115628	
	0	45.22		0.6	132133	
	0	45.22		0.7	148638	
	0	45.22		0.8	165143	
	0	45.22		1	181694	
	0.07	45.22		10.2	198199	
	10.21	45.22		1509.2	214705	
	23.92	45.22		8708.4	231210	
	29.77	45.22		18933.4	247760	
	32.87	45.22		3055.6	264266	
	35.04	45.22		43075.3	280771	
	36.59	45.22		56234.7	297276	

Fig. 4.2.3.2.3.1 – Example of the UFM1 Table Completion

Note: The water and liquid rate and cumulative production data used to generate model water cut curves are simulated on a 3D reservoir simulator.

4.2.3.3. Surface facilities

The Surface Facilities sheet (Fig. 4.2.3.3.1) contains information on:

- Well pads **Clusters**;
- **Cluster Test Separator**;
- **Water Injection Cluster Manifold;**
- **Production Separator;**
- **Oil Production Plant;**
- **Oil Depot;**
- Water distribution manifold **Splitter;**
- Water injection pump station **WCPS;**
- **Water Supply.**

4.2.3.3.1. Clusters

The **Clusters** table (Fig. 4.2.3.3.1.1) consists of 11 columns:

- X, Y – pad coordinates;
- producer restriction water – pad water production constraint;
- producer restriction oil – pad oil production constraint;
- producer restriction gas – pad gas production constraint;
- injector restriction water – pad water injection constraint;
- injector restriction gas – pad gas injection constraint;
- Total slots – total number of well slots on the pad;
- Production Separator name – name of the production separator this pad is connected to;
- Splitter name – name of the water distribution manifold this pad is connected to.

Clusters	Name	X	Y	producer restr	producer restr	producer restr	injector restric	injector restric	Total slots	Production S	Splitter name
	–	m	m	m^3/d	m^3/d	m^3/d	m^3/d	m^3/d	int	–	–
	Cluster 1	7282	9681	0	0	0	0	0	1	Booster pump	

Fig. 4.2.3.3.1.1– Clusters Table

4.2.3.3.2. Cluster Test Separator

The **Cluster Test Separator** table (Fig. 4.2.3.3.2.1) consists of 4 columns:

- Name – name of the group flow separator to which the wells on the pad belong;
- X, Y – separator coordinates;
- Clusters name – name of the well pad.

Cluster Test Separa	Name	X	Y	Clusters name
	-	m	m	-
	GFS Cluster 1	7282	9681	Cluster 1

Fig. 4.2.3.3.2.1 –Cluster Test Separator Table

4.2.3.3.3. Water Injection Cluster Manifold

The **Water Injection Cluster Manifold** table (Fig. 4.2.3.3.3.1) consists of 4 columns:

- Name – name of the water injection cluster manifold to which the wells on the pad belong;
- X, Y – manifold coordinates;
- Clusters name – name of the well pad.

Water Injection Cl	Name	X	Y	Clusters name
	-	m	m	-
	WICM Cluster 4	7631	9451	Cluster 4

Fig. 4.2.3.3.3.1– Water Injection Cluster Manifold Table

4.2.3.3.4. Production Separator

The **Production Separator** table (Fig. 4.2.3.3.4.1) consists of 4 columns:

- Name – name of the production separator to which the well pads belong;
- X, Y – separator coordinates;
- restriction liquid – liquid handling constraint for the separator;
- Oil Production Plant name – name of the oil processing facility this separator is connected to.

Production Separator	Name	X	Y	restriction liquid	Oil Production Plant name
	-	m	m	m^3/d	-
	Booster pump	8432	8641	4000	OPP

Fig. 4.2.3.3.4.1–Production Separator Table

4.2.3.3.5. Oil Production Plant

The **Oil Production Plant** table (Fig. 4.2.3.3.5.1) consists of 4 columns:

- Name – name of the Oil production plant;
- X, Y – OPP coordinates;
- Oil Depot name.

Oil Production Plant	Name	X	Y	Oil Depot name
	-	m	m	-
	OPP	10199	10131	

Fig. 4.2.3.3.5.1–Oil Production Plant Table

4.2.3.3.6. Oil Depot

The **Oil Depot** table (Fig. 4.2.3.3.6.1) consists of 3 columns:

- Name – name of the oil depot to which the Oil production plant belongs;
- X, Y – depot coordinates;

Oil Depot	Name	X	Y
	-	m	m
	Oil Depot 1	8532	8641

Fig. 4.2.3.3.6.1– Oil Depot Table

4.2.3.3.7. Splitter

The **Splitter** table (Fig. 4.2.3.3.7.1) consists of 4 columns:

- Name – name of the water distribution manifold;
- X, Y – Splitter coordinates;
- WCPS name – name of the water injection pump station.

Splitter	Name	X	Y	WCPS name
	-	m	m	-
	Splitter	8532	8641	WCPS

Fig. 4.2.3.3.7.1–Splitter Table

4.2.3.3.8. WCPS

The **WCPS** table (Fig. 4.2.3.3.8.1) consists of 4 columns:

- Name – name of the water injection pump station;
- X, Y – station coordinates;
- Production Separator name – name of the production separator this station is connected to;
- Water Supply name – name of the water supply source this station is connected to.

WCPS	Name	X	Y	Production Separator name	Water Supply name
	-	m	m	-	-
	WCPS	8618	8641	Booster pump	Water supply

Fig. 4.2.3.3.8.1– WCPS Table

4.2.3.3.9. Water Supply

The **Water Supply** table (Fig. 4.2.3.3.9.1) consists of 4 columns:

- Name – name of the water supply source;
- X, Y – source coordinates;
- restriction liquid – water supply constraint.

Water Supply	Name	X	Y	restriction liquid
	-	m	m	
	Water supply	8708	8641	0

Fig. 4.2.3.3.9.1– Water Supply Table

4.2.3.4. Asset Diagnostics

The **Asset Diagnostics** sheet contains an object diagnostic table (Fig. 4.2.3.4.1), which is manually completed by the User.

Diagnostics and Justification are entered for a series of parameters:

Oil Depletion (MDP) – oil recovery factor (according to the field development plan);

Drainable Oil Reserves;

Non-drainable Oil Reserves;

Profitable Oil Reserves;

Non-profitable Oil Reserves;

Reserves Energy;

Water Production Profile;

Gas Production Profile;

Injection Performance;

Productivity Index – Injectivity Index;

Well Status & Conditions.

ASSET	#	Diagnostics Chapter	Diagnostics	Justification
	1	Oil Depletion (MDP)		
	2	Drainable Oil Reserves		
	3	Non-drainable Oil Reserves		
	4	Profitable Oil Reserves		
	5	Non-profitable Oil Reserves		
	6	Reserves Energy		
	7	Water Production Profile		
	8	Gas Production Profile		
	9	Injection Performance		
	10	Productivity Index		
	11	Injectivity Index		
	12	Well Status & Conditions		

Fig. 4.2.3.4.1 – Table ASSET

4.2.3.5. Asset Recomendations

Table A.RECOM (Figure 4.2.3.5.1) is divided into recommendations for Production Enhancement, Surveillance, and Study, and consists of four columns: Activity, Objectives, Justifications, and Recommendations

Production enhancement:

1. **Infill drilling**;
    1.1. Production infilling – Production Infill Drilling;
    1.2. Injection infilling – Injection Infill Drilling;
2. **Reservoir WO** – Well Interventions;
    2.1. Productivity workover (Stimulation/Reperforation/Radial drilling/frac);
    2.2. Water shut–off – Water Shut-Off Operations;
    2.3. Add perforations to the new reservoirs – Perforating New Zones (Reperforation);
    2.4. Conversions – Well Conversions:
    - producer → injection;
    - injection → producer.
3. **Production targets** – Production/Injection Rate Optimization;
    3.1. Production lift setting – Artificial Lift Parameter Adjustment;
    3.2. Injection chokes – Injection Well Choking;
    3.3. Recompletion Workover;
4. **Integrity workover** – Well Integrity Workover;
    4.1. Completion WO (Workover);
    4.2. Casing WO (Workover)
5. **Surface facilities**;
    5.1. Production gathering: Cluster, Separator, Booster;
    3.2. Water injection: Cluster, Booster.

Surveillance:

6. Single–well pressure test – PTA;
7. Cross–well interference;
8. Production Cased–Hole Logging – PLT;
9. Integrity Cased–Hole Logging.

Further Analysis (Study):

10. Exploration drilling;
11. Core study;
12. PVT Study – PVT (Pressure-Volume-Temperature) Fluid Analysis;
13. Well–by–Well analysis –Prime.

A.RECOM	#	Activity	Objectives	Recommendations	Justifications
	Production enhancement				
	1	Infill drilling			
	1.1.	Production infilling	Accelerate production in drainable oil reserves area; Involvement of non-drainable oil reserves		
	1.2.	Injection infilling	Formation pressure increasing in low pressure area		
	2	Reservoir WO			
	2.1.	Productivity workover (Stimulation/Reperforation/Radial drilling/frac)	Increase well productivity		
	2.2.	Water shut-off	Decrease thief water production / injection		
	2.3.	Add perforations to the new reservoirs	Increase sweep efficiency		
	2.4.	Conversions	-		
		- prod → injection	Increase formation pressure		
		- injection → prod	Involvement of non-drainable oil reserves		
	3	Production targets			
	3.1.	Production lift setting	Change production rate		
	3.2.	Injection chokes	Change injection rate		
	3.3.	Recompletion Workover	Change production/injection rate in wider range		
	4	Integrity workover			
	4.1.	Completion WO			
	4.2.	Casing WO			
	5	Surface facilities			
	5.1.	Production gathering: Cluster, Separator, Booster			
	5.2.	Water injection: Cluster, Booster			
	Surveillance				
	6	Single-well pressure test			
	7	Cross-well interference			
	8	Production Cased-Hole Logging			
	9	Integrity Cased-Hole Logging			
	Study				
	10	Exploration drilling			
	11	Core study			
	12	PVT Study			
	13	Well-by-Well analysis (Prime)			

Fig. 4.2.3.5.1 – Table A.RECOM

4.2.3.6 Geological Model Porosity-Permeability Fitting Customization Page

The **Geological Model** table (Figure 4.2.3.6.1) consists of nine columns: Formation Unit, Model Curve Name, Smoothing, Permeability (k1, k2), Adjustable Model Parameters (m1, m2, b), and Smoothing Window Size.

Using the drop-down list in the **Model** column, the User can select the desired fitting model:

Dual-component power law – dual-component power-law permeability mode;

Power law – power-law permeability model;

Exponential – exponential permeability model.

POROPERM	Form. Unit	Model	Smoothing	k1	m1	k2	m2	b	Window Size
				-	-	-	-	-	-
		Dual-component power law	No						
		Power law	No						
		Exponential	No						

Fig. 4.2.3.6.1– Table Geological Model

4.2.4. Well Parameters Section

This section provides a description of the following sheets: Well Parameters, Well Models, Well Interventions, Well Interventions Forecast, Planned Interventions, Well Diagnostics, Well Surveys, Hydrodynamic Logging, Well Drilling, Well Inclinometry, Well Trajectory.

Well Parameters – Data on the well parameters of the field under study;

Well Models – Parameters of well-specific models;

Well Interventions – Information on performed well interventions, including workovers, geophysical surveys, and production logging conducted on the field's wells;

Well Interventions Forecast – Detailed information on intervention jobs on the field's wells;

Planned Interventions – Information on planned intervention jobs on the field's wells;

Well Diagnostics – Diagnostics for each well of the field under study;

Well Surveys – Information on surveys and tests conducted on the field's wells;

Hydrodynamic Logging – Information on performed PLT on the field's wells;

Well Drilling – Information on planned new wells for the field;

Well Inclinometry – Information on the directional survey data for the field's wells;

Well Trajectory – Information on the trajectory of the field's wells.

4.2.4.1. Well Parameters

The **Well Parameters** sheet contains a table with parameters for each well in the PROPS field (Fig. 4.2.4.1.1):

- Well ID – Well identifier/name;
- Well Type – Producer/Injector/Observation;
- Current Status;
- Current Status Date – Date of the current status establishment (DD.MM.YYYY);
- MDT – Formation pressure result obtained from MDT measurements;
- MDT Date – Date of MDT survey;
- Cluster – Well cluster where the well is located;
- Parent Well – Parent well (main borehole), for side-tracks or multilateral completions.

PROP	#	Well ID	Well Type	Current Statu	Current Status Dat	MDT	MDT Date	Cluste	Parent Well
	-	-	-	-	dd.mm.yyyy	atm	dd.mm.yyyy	-	
	1	OP-1ST	Producer	On stream	01.01.2011			K1	OP-1
	2	OP-2	Producer	P&A	01.01.2011			K2	
	3	OP-3	Producer	Converted	01.01.1998			K2	
	4	OP-4	Injector	On stream	01.01.1998			K2	
	5	OP-5	Injector	Put on conservation	01.01.2021			K1	
	6	OP-6	Injector	Shifted	01.01.1977			K1	

Fif. 4.2.4.1.1 – Table PROPS

Well Status Classification:

On stream – In production;

Converted –producer to injector or vice versa;

Shifted – Zone change to a different reservoir;

P&A – Plugged and abandoned;

Monitor well – Observation well;

Put on conservation – Shut-in and preserved.

4.2.4.2. Well Models

The **Well Models** sheet (Figure 4.2.4.2.1) contains well-specific information on:

- Forecasted parameters for recovery diagnostics **RES.DIAG**;
- Parameters for the Inflow Performance Relationship model **IPR**;
- Parameters for the Productivity Index model **PI;**
- Parameters for the Material Balance model **MBAL.**

The User can refresh their knowledge on correctly populating the **RES.DIAG**, **IPR**, **PI**, and **MBAL** tables by referring to Section 4.2.1.2. This section provides a detailed description of these tables, allowing the User to revisit the necessary information.

RES.DIAG	Well ID	Model	Show	Forecast Priori	Training Sta	Training Fin	Valid. Star	Valid. Finis	qL	Pwf	Jt	GOR/Rs	Pwf_cut-of	Drain. Oil Moc	Profit. Oil Moc	
					dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	m3/d	atm	cmd/atm	frac	atm	m3	m3	Single Auto Training
	OP-1	DCA (Arps-Hyp)	Yes	Yes	01.01.2017	01.01.2020	01.02.2020	01.04.2022								Yes
	OP-1	WOR (FracFlow)	Yes	No	01.04.2019	01.06.2021	01.06.2021	01.05.2022								Yes
	OP-1	WOR (Linear)	Yes	No	01.04.2019	01.06.2021	01.06.2021	01.05.2022								Yes
	OP-1	Pe (Linear)	Yes	No	01.10.2018	01.07.2020	01.0.7.2020	01.05.2022								Yes
	OP-1	Pe (Log)	Yes	No	01.10.2018	01.07.2020	01.0.7.2020	01.05.2022								Yes
	OP-2	DCA (Arps-Hyp)	Yes	Yes	01.0.6.2021	01.09.2021	01.09.2021	01.09.2022								Yes
	OP-2	WOR (FracFlow)	Yes	No	01.01.2016	01.02.2017	01.02.2017	01.02.2018								Yes
	OP-2	WOR (Linear)	Yes	No	01.01.2016	01.02.2017	01.02.2017	01.02.2018								Yes
	OP-2	Pe (Linear)	Yes	No	01.0.6.2021	01.09.2021	01.09.2021	01.09.2022								Yes
	OP-2	Pe (Log)	Yes	No	01.0.6.2021	01.09.2021	01.09.2021	01.09.2022								Yes

IPR	Well ID	Model	Show	Training Start	Training Finish	Pe	a	qO max	Wells	Color
				dd.mm.yyyy	dd.mm.yyyy	atm	-	m3/d	-	-
	OP-1	IPR	Yes	01.06.2021	01.09.2021				old	red
	OP-2	IPR	Yes	01.01.2016	01.04.2016				old	blue
		IPR	Yes						old	purple
		IPR	Yes						old	red
		IPR	Yes						old	blue
		IPR	Yes						old	purple

PI	Well ID	Model	Show	Training Start	Training Finish	Valid. Start	Valid. Finish	skin
				dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	frac
	OP-1		Yes	10.1.2018	7.1.2020	01.0.7.2020	5.1.2022	
	OP-2		Yes	01.0.6.2021	9.1.2021	9.1.2021	9.1.2022	
			Yes					
			Yes					

MBAL	Well ID	Model	Show	Training Start	Training Finish	Valid. Start	Valid. Finish	Pi	Vφ
				dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	atm	m3
	OP-1	Mbal	Yes	10.1.2018	7.1.2020	01.0.7.2020	5.1.2022		
	OP-2	Mbal	Yes	01.0.6.2021	9.1.2021	9.1.2021	9.1.2022		
		Mbal	Yes						
		Mbal	Yes						

Fig. 4.2.4.2.1 – Sheet of Well Models

4.2.4.3. Well Interventions

The well intervention table **INTRV** (Fig. 4.2.4.3.1) consists of 6 columns:

- Well ID – Well identifier/name;
- Date – Date of the performed well intervention job;
- Interventions – Well Intervention Type:
    - Drilling;
    - Put on stream;
    - Perforating;
    - Sidetracking;
    - Water shut-off;
    - Gas shut-off;
    - P&A;
    - Put on conservation;
    - Converting to Injection;
    - Converting to Injection;
    - Move to other Layer)
    - Start flowing
    - PLT;
    - PTA;
    - Repairing;
    - Fracturing;
    - Shut-in due to technical reasons;
    - Shut-in due to high watercut;
    - Other.
- Type – Intervention type: Invasive/ Survey;
- Interval – Reservoir interval targeted by the intervention;
- Description – Work description.

Note: The Invasive type encompasses all intervention jobs that significantly impact well productivity enhancement.

INTRV	#	Well ID	Date	Interventions	Type	Top (MD)	Bottom (MD	Description
	-	-	dd.mm.yyyy	-	-	m	m	-
	1	OP-2	1.1.1989	Drilling	Invasive	1796.00	1802.00	Первичная перфорация
	2	OP-2	1.1.1989	Drilling	Invasive	1812.00	1826.00	Первичная перфорация
	3	OP-2	1.1.1990	Water shut-off	Invasive	1794.00	1806.00	РИР
	4	OP-4	1.1.1990	Fracturing	Invasive	1790.00	1802.00	ГРП на глубине пласта А2 (MD)
	5	OP-4	1.1.1992	P&A	Invasive	–	–	Ликвидация
	6	OP-2	1.1.1992	P&A	Invasive	–	–	Ликвидация
	7	OP-3	1.1.1996	Perforating	Invasive	1812.00	1828.00	Перфорация на А1
	8	OP-7	1.1.1997	Converting to Injection	Invasive	–	–	Перевод под закачку
	9	OP-9	1.1.2004	Stimulating	Invasive	1955.00	1958.00	Стимуляция
	10	OP-12	1.1.2004	PLT	Survey			ПГИ

Fig. 4.2.4.3.1– Table INTRV

4.2.4.4. Well Interventions Forecast

The well intervention table **INTRV.FRC** (Figure 4.2.4.4.1) consists of 12 columns:

- Well ID – Well identifier/name;
- Intervention Type – Well Intervention Type (Fracturing, Move to other Layer, Perforating, Sidetracking);
- Form. Unit – Formation Unit name;
- Top (MD) – Formation top (Measured Depth);
- Bottom (MD) – Formation bottom (Measured Depth);
- q0 – Forecasted initial oil rate;
- b – ARPS model parameter (decline exponent);
- OR – Ultimate Oil Recovery;
- Yw – Forecasted water cut;
- J – Forecasted Productivity Index;
- Xf – Hydraulic fracture half-length;
- Hf – Hydraulic fracture height.

Well ID	Intervention Type	Form. Unit	Top(MD)	Bottom(MD)	q0	b	OR	Yw	J	Xf	Hf
-	-	-	m	m	m3/d	frac	m3	%	cmd/atm	m	m
OP-2	Fracturing	B	1810	1830						19.2958	12
OP-2	Fracturing	D	1950	1975						22.5797	12
OP-3	Fracturing	B	1812	1835						18.5072	12

Fig. 4.2.4.4.1 – Table INTRV.FRC

4.2.4.5. Well Diagnostics

The **Well Diagnostics** section presents the **ASSET** diagnostic table (Fig. 4.2.4.5.1) for each well in the field, based on a series of parameters:

- Well ID – Well identifier/name;
- Formation Units;
- Diagnostics Chapter;
- Justification;
- Recommendations (Surveys) – Survey recommendations;
- Justification (Surveys) – Justification for surveys (regarding studies);
- Recommendations (WO) – Workover recommendations;
- Justification (WO) – Justification for workovers;

In this table, the User can add their own recommendations and justifications after analyzing the field's diagnostic metrics.

ASSET	#	Well ID	Formation Units	Diagnostics Chapter	Diagnostics	Justification	Recommendations (Surveys)	Justification (Surveys)	Recommendations (WO)	Justification (WO)
	1	OP-1	B	Oil Depletion (MDP)						
	2	OP-1	D	Drainable Oil Reserves						
	3	OP-1	B	Oil Depletion (MDP)						
	4	OP-1	D	Profitable Oil Reserves						
	5	OP-1	B	Non-profitable Oil Reserves						
	6	OP-1	D	Reserves Energy						
	7	OP-1	B	Water Production Profile						
	8	OP-1	D	Gas Production Profile						
	9	OP-1	B	Injection Performance						
	10	OP-1	D	Productivity Index						
	11	OP-1	B	Injectivity Index						
	12	OP-1	D	Well Status & Conditions						

Fig. 4.2.4.5.1– Table ASSET

4.2.4.6. Well Surveys

The **Well Surveys** section contains tables of surveys conducted on the field's wells: **PLT** (Fig. 4.2.4.6.1) and **PTA** (Fig. 4.2.4.6.2).

The table of conducted **Production Logging (PLT)** surveys (Fig. 4.2.4.6.1) consists of 11 columns:

- Well ID – Well name;
- Date – Survey date;
- Form. Unit – Formation Unit name;
- Top (MD) – Interval top (Measured Depth);
- Bottom (MD) – Interval bottom (Measured Depth);
- qO – Oil flow rate based on survey results;
- qW – Water flow rate based on survey results;
- qG – Gas flow rate based on survey results;
- Casing condition – Intact, Leaky;
- Annular circulation (Yes/No);
- Comments.

PLT	Well ID	Date	Form. Unit	Top (MD)	Bottom (MD)	qO	qW	qG	Casing condition	Annular circulation	Comments
	-	dd.mm.yyyy	-	m	m	m3/d	m3/d	m3/d	-	-	-
	OP-10	16.07.2008	F	1755.8	1756.8	1.351	0.049		Intact	No	
	OP-10	23.04.2012	B	1733.8	1735	1.30317	0.67133		Intact	No	
	OP-10	23.04.2012	F	1755.2	1757.5	2.32683	1.19867		Intact	No	
	OP-9	25.03.1987	G	1715.2	1716.8	10.45	0.55		Intact	No	
	OP-9	23.09.1987	G	1714.8	1717.2	9.8	0.2		Intact	No	
	OP-9	29.11.1990	G	1715.6	1717.2	0	0		Intact	No	до замера скважина простаивала
	OP-9	26.02.1997	G	1714.8	1716.4	0	0		Intact	No	интервалом перфорации, доходит до глубины 1719 м. Нарушение герметичности
	OP-9	19.10.2005	B	1683	1683.8	2.142	0.714		Intact	No	
	OP-9	19.10.2005	G	1716	1716.8	2.358	0.786		Intact	No	
	OP-9	19.04.2006							Leaky	No	негерметичность НКТ
	OP-9	11.07.2008	B	1683.6	1684	1.488	0.496		Intact	No	
	OP-9	11.07.2008	G	1713	1717.2	4.512	1.504		Intact	Yes	жидкости по пласту с глубины 1726 м к интервалу перфораций. ЭК герметична.

Fig. 4.2.4.6.1– Table PLT

The table of conducted **Pressure Transient Analysis (PTA)** surveys (Figure 4.2.4.6.2) consists of 23 columns:

- Well ID – Well name;
- Type Survey – Buildup, Drawdown, Injection Fall-off;
- Date – Survey date;
- Form. Unit – Formation Unit name;
- qL – Liquid flow rate;
- Pe – Reservoir pressure;
- J – Productivity Index;
- Vdrain – Drainage volume;
- Rdrain – Drainage radius;
- Skin – Skin factor;
- k – Permeability;
- kh – conductivity;
- σ – hydraulic conductivity;
- Xf – Fracture half-length;
- L – Fracture length;
- Comments;
- ϕ – Porosity;
- rw – Wellbore radius;
- h – Perforated/Test interval thickness;
- Fluid type;
- B – Formation volume factor;
- µ – Viscosity;
- Ct – Total compressibility.

PTA	Well II	Type Surve	Date	Form. U	qL	Pe	J	Vdrain	Rdra	Skii	k	kh	σ	Xf	L	omme	ϕ	rw	h	Fluid t	B	µ	ct
	-	-	dd.mm.yyyy	-	m3/d	atm	cmd/atm	m3	m	frac.	mD	mD*m	mD·m/cP	m	m	-	frac.	m	m	-	rm3/sm3	cP	atm^-1
	OP-3	BUT	31.07.2007		11	116.1	0.208		138	-0.68	5.5		0.905										
	OP-1	PFO	22.01.2022		170	179	19.2			5	2348		5244						13.4	Water			
	OP-3	PBU	26.01.2022		8	34	0.64			-1.7			89						4.6	Oil			

Fig. 4.2.4.6.2– Table PTA

4.2.4.7. Hydrodynamic Logging

The **Hydrodynamic Logging** section presents a table of conducted Well Logging (PTA) data for the field's wells (Fig. 4.2.4.7.1). The following parameters are defined within it:

- Well ID – Well identifier/name;
- Form. Unit – Name of the target formation;
- Top (TVD) – Formation top (True Vertical Depth);
- Bot (TVD)– Formation bottom (True Vertical Depth);
- Top (MD) – Formation top (Measured Depth);
- Bot (MD) – Formation bottom (Measured Depth);
- Pe – Measured formation pressure;
- Sw – Water saturation;
- dPcf – Differential pressure from capillary forces;
- Pwf min – Minimum allowable flowing bottomhole pressure;
- Perforated (Yes/No).

Well ID	Form. Unit	Top (TVD)	Bot (TVD)	Top (MD)	Bot (MD)	Pe	sw	dPcf	Pwf min	Perforated
-	-	m	m	m	m	atm	frac	kPa/m	atm	-
OP-1	B	1820	1840	2100	2135	264	0.19			да

Fig. 4.2.4.7.1– Table **Hydrodynamic Logging**

4.2.4.8. Well Drilling

The **Well Drilling** section presents a table of planned wells, **WELLS** (Fig. 4.2.4.8.1). The following parameters are defined within it:

- Well ID – Well identifier/name;
- Well Type – Producer, Injector, Monitor well;
- Form. Unit – Well ID – Well identifier/name;
- X1, Y1 – Coordinates of the well entry point into the target formation;
- X2, Y2 – Coordinates of the well bottomhole;
- Fracturing – Hydraulic fracturing planned after drilling (Yes/No).

WELLS	Well ID	Well Type	Form. Unit	X1	Y1	X2	Y2	Fracturing
	-	-	-	m	m	m	m	-
	OP-20	Monitor well	B	1234	1234	1234	1234	Yes

Fig. 4.2.4.8.1 – Table WELLS

4.2.4.9. Well Inclinometry

The **Well Inclinometry** section presents a table with well directional survey data (Fig. 4.2.4.9.1). It contains 5 columns with the following parameters:

- Well ID – Well identifier/name;
- Depth – Survey depth;
- Slant – Inclination angle (Deviation);
- Azimuth;
- Magnetic declination.

WELLS	Well ID	Well Type	Form. Unit	X1	Y1	X2	Y2	Fracturing
	-	-	-	m	m	m	m	-
	OP-20	Monitor well	B	1234	1234	1234	1234	Yes

Fig. 4.2.4.9.1 – Table Well Inclinometry

4.2.4.10. Well Trajectory

The **Well Trajectory** section presents a table containing well trajectory data (Fig. 4.2.4.10.1). It consists of 5 columns with the following parameters:

- Well ID – Well identifier/name;
- X – X-coordinate;
- Y – Y-coordinate;
- Depth (MD) – Measured Depth (MD) at the survey point;
- Depth (TVD) – True Vertical Depth (TVD) at the survey point.

Well ID	X	Y	Depth(MD)	Depth(TVD)
-	m	m	m	m

Fig. 4.2.4.10.1 – Table Well Trajectory

4.2.5. User Appendices

This section provides a description of the **Maps.1**, **Cross-sections.1**, and **PRESENTATION** sheets.

Maps. 1 – Contains a map of the field under study;

Cross–sections. 1 – Contains a cross-section of the field under study;

PRESENTATION – A table containing the names of the sheets to be included in the presentation.

4.2.5.1. Maps. 1

The **Maps.1** sheet allows for the import/upload of user-defined maps (Fig. 4.2.5.1.1).

The user must enter the map title in the **TITLE** table.

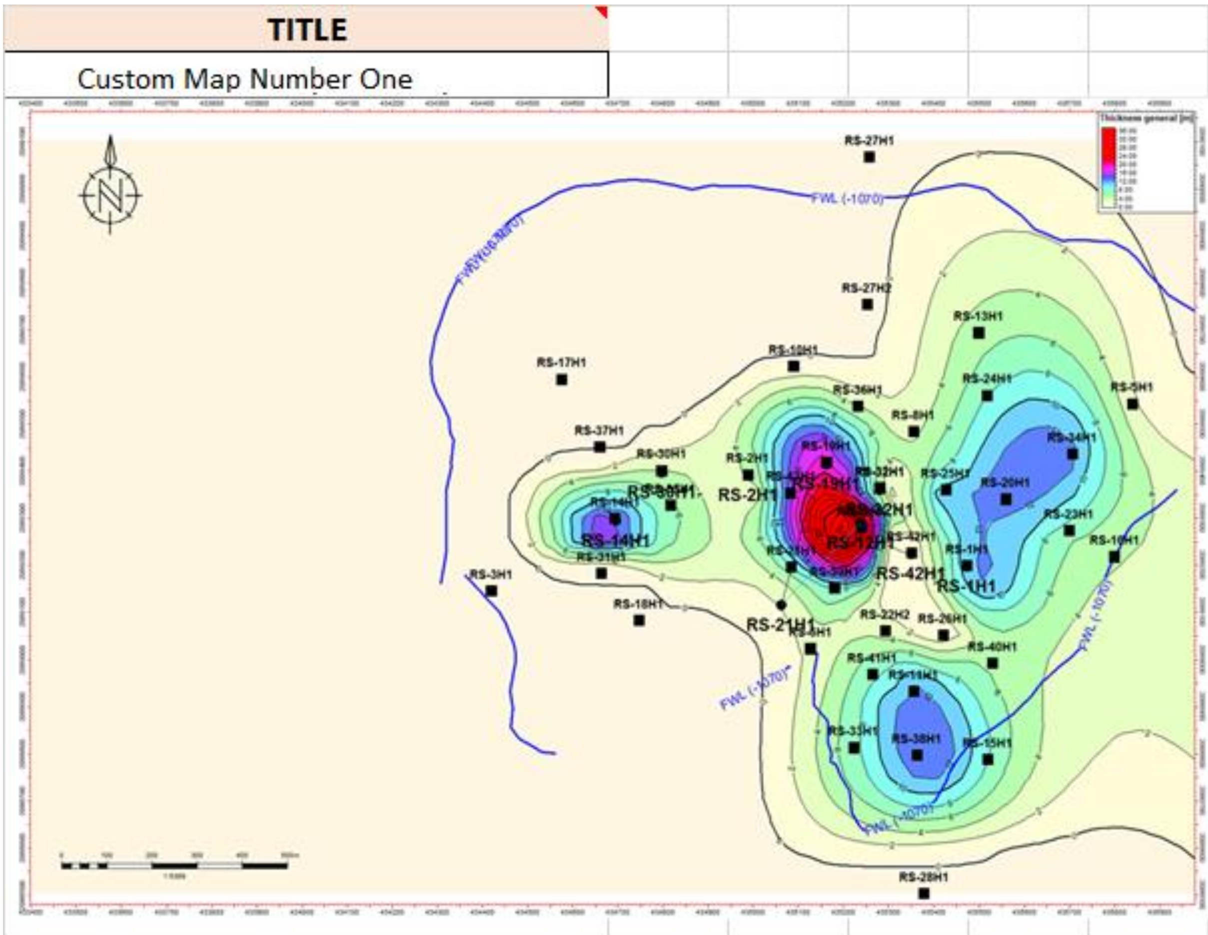


Fig. 4.2.5.1.1 – Sheet Formatting Example Maps. 1

Note:

The User can create additional sheets in the Excel file to include images with various types of maps. To ensure organization and structure, it is recommended to number each sheet by adding a dot between the word "Maps" and the sheet number. This will help easily track the order and relationship between different map types.

4.2.5.2. Cross–sections. 1

In the **Cross-sections**.1 sheet, the User can upload an image with an asset cross-section (Fig. 4.2.5.2.1).

In the **TITLE** table, the User must enter the title for the cross-section image.

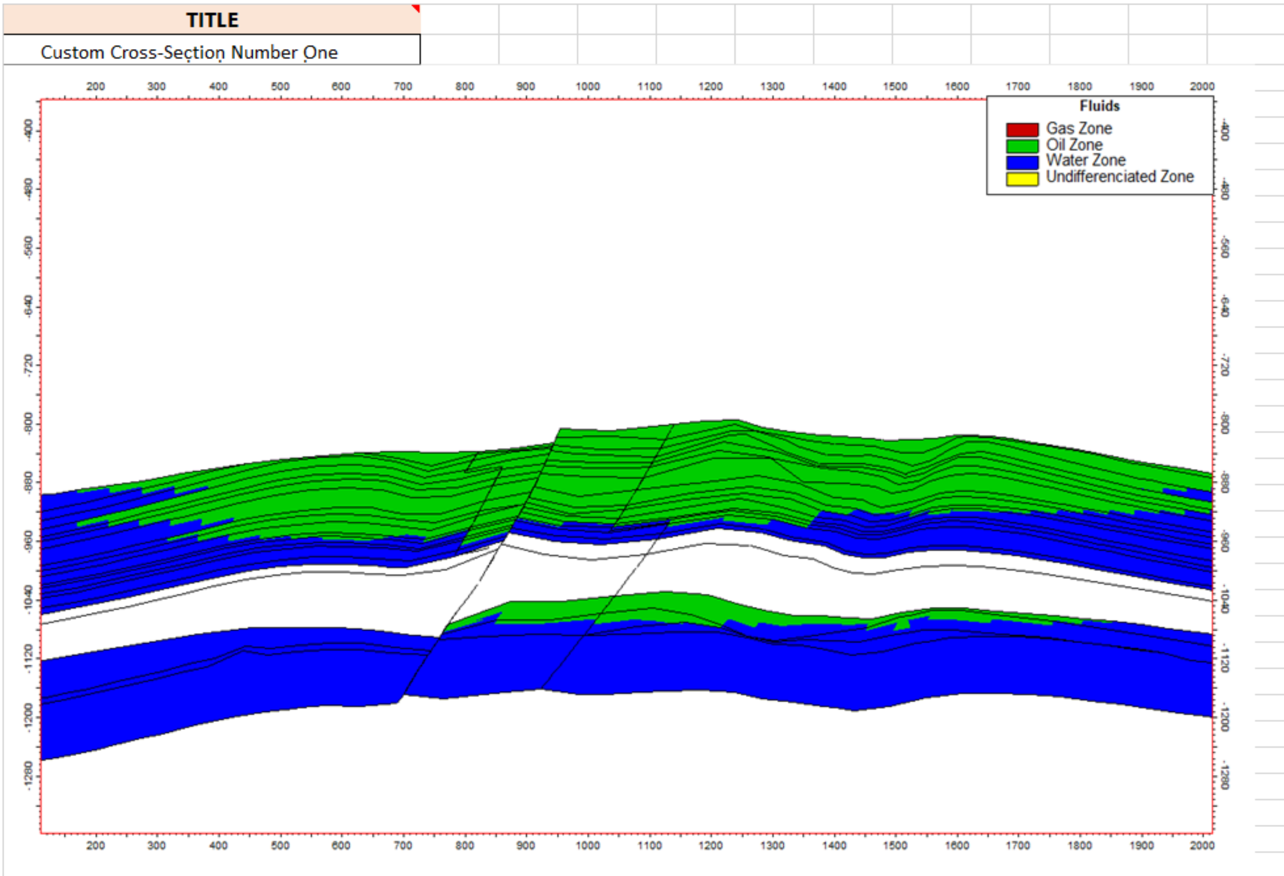


Fig. 4.2.5.2.1 – Sheet Formatting Example Cross–sections. 1

Note:

The User can create additional sheets in the Excel file to include images with various types of cross-sections. To ensure organization and structure, it is recommended to number each sheet by adding a dot between the word "Cross-sections" and the sheet number. This will help easily track the order and relationship between different cross-section types.

4.2.5.2. Cross–sections. 1

In the **Cross-sections**.1 sheet, the User can upload an image with an asset cross-section (Fig. 4.2.5.2.1).

In the **TITLE** table, the User must enter the title for the cross-section image..

Page Index
1.2.
3.1.1.
6.1.

Fig. 4.2.5.2.1 – Sheet Formatting Example Cross–sections. 1

Note:

The User can create additional sheets in the Excel file to include images with various types of cross-sections. To ensure organization and structure, it is recommended to number each sheet by adding a dot between the word "Cross-sections" and the sheet number. This will help easily track the order and relationship between different cross-section types.

5. Prime Report Generation

The final step is the generation of the Prime Report. To do this, the User must load the "PRIME_Input" Excel input file into the PolyGon software as follows:

1) Navigate to the "Services" tab;

2) Select "Prime_plugin_new_input" from the drop-down window;

3) Load the "PRIME_Input" Excel file by selecting it from the local machine;

4) Click the "Run" button.

Fig. 5.1 – Loading the "PRIME_Input" Input File

After running the process, the User can view the progress of the Prime plugin's mathematical calculation in the PolyGon software by clicking on the messages icon (Fig. 5.2).

Fig. 5.2 – Window «Calculations»

To stop the calculation, the User can click on the red square in the window «Calculations» (Fig. 5.3).

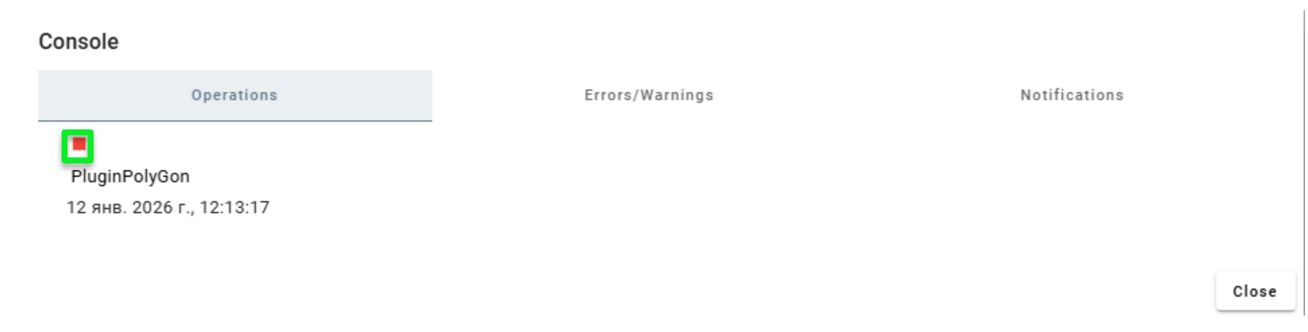


Fig. 5.3 – Window «Calculations»

Various types of errors may occur during the calculation. They are primarily related to incorrect entries in the "PRIME_Input" input file.

The Errors window serves as an aid in troubleshooting these errors (Fig. 5.4).

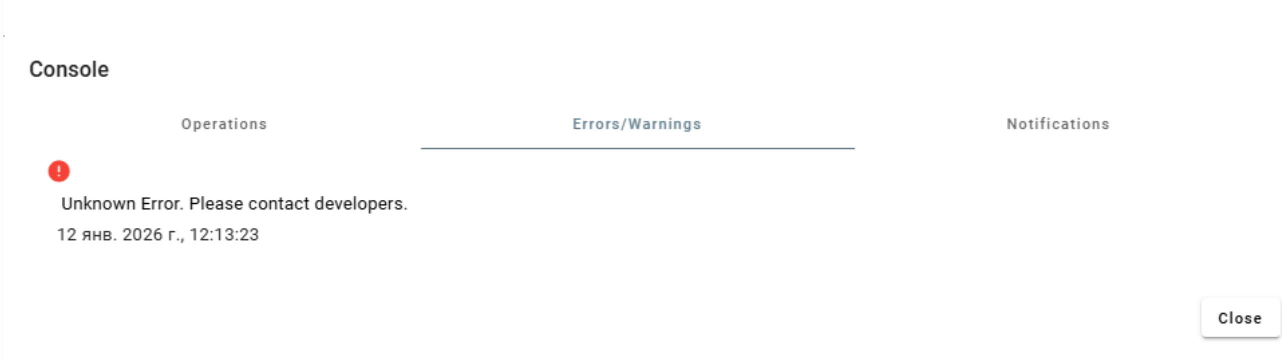


Fig. 5.4 – Window «Errors»

Subsequently, if all errors have been resolved, a ready-to-use file in "Zip" format should be generated in the Notifications window (Fig. 5.5).

This archive must be downloaded, extracted, and the "index" HTML page inside it opened to access the Prime report (see sections 5.2 – 5.3). Altrnatively, if pop-up windows are enabled in the browser, the Prime report will open automatically in a new tab.

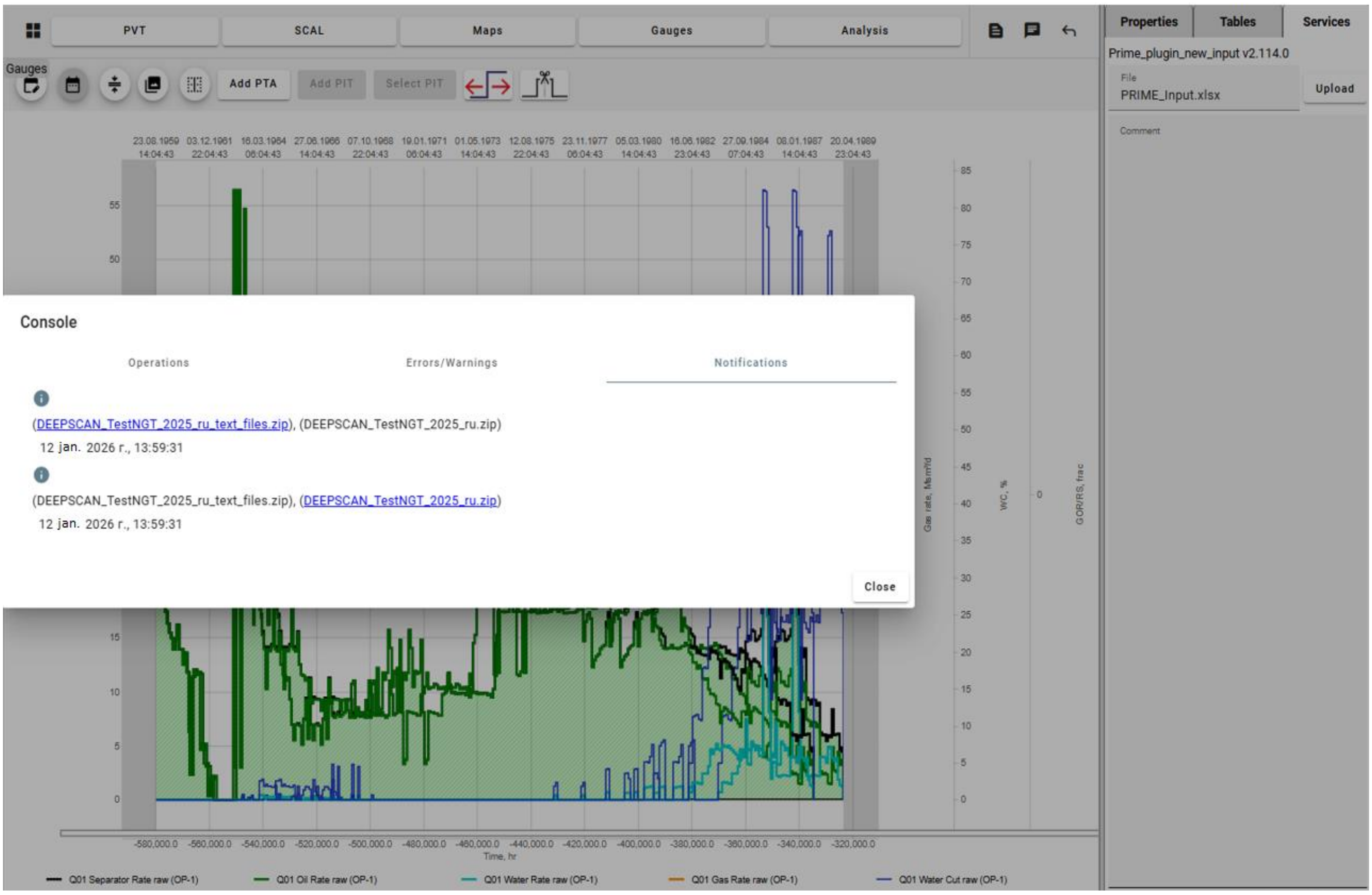


Fig. 5.5 – Window «Notifications»

5.1. Location of the Generated Prime Report

To view the location of the generated Prime report, you can use the Project Explorer (Fig. 5.1.1).

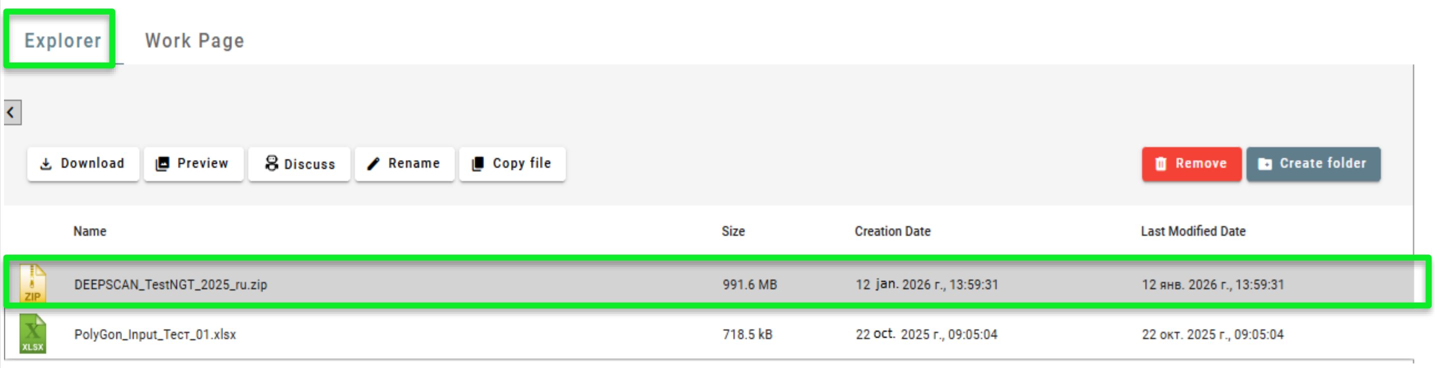


Fig. 5.1.1 – Window «Explorer»

Furthermore, the Explorer can be used to store input Excel files, map overlays, and other files related to the analyzed asset. To upload files to the Explorer, the User must:

1. Navigate to the "Upload File" tab in the upper-right corner of the interface;
2. Drag and drop or select a file from the desired folder on the local machine;
3. Click the "Upload" button (Fig. 5.1.2).

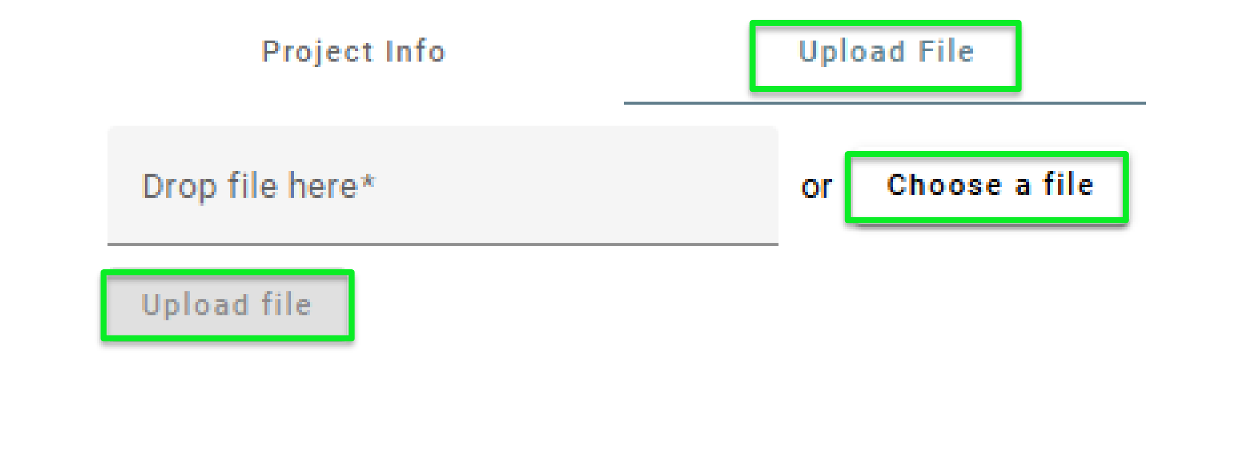


Fig. 5.1.2 – Uploading Files to the Project

5.2. Saving the Prime Report to the Local Computer

The generated Prime report can be downloaded in two ways:

1) Click the link in the Notifications window (Fig. 5.2.1);

Fig. 5.2.1 – The generated Prime report in the Notifications window

2) Navigate to the "Explorer" tab and click the "Download" button (Fig.5.2.2).

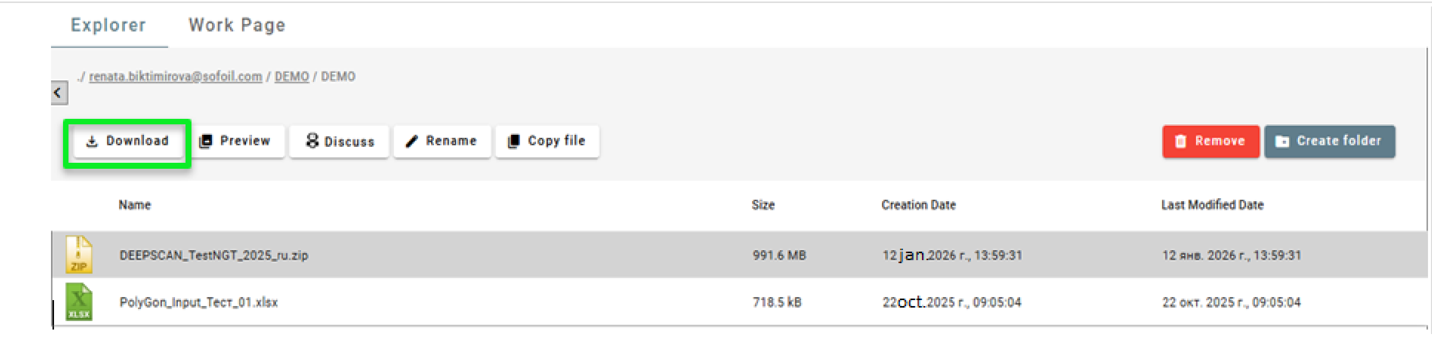


Fig. 5.2.2 – The generated Prime report in the Explorer tab

The downloaded "Zip" format report will appear in the "Downloads" folder on your PC and needs to be extracted into a folder with files (Fig.5.2.3).

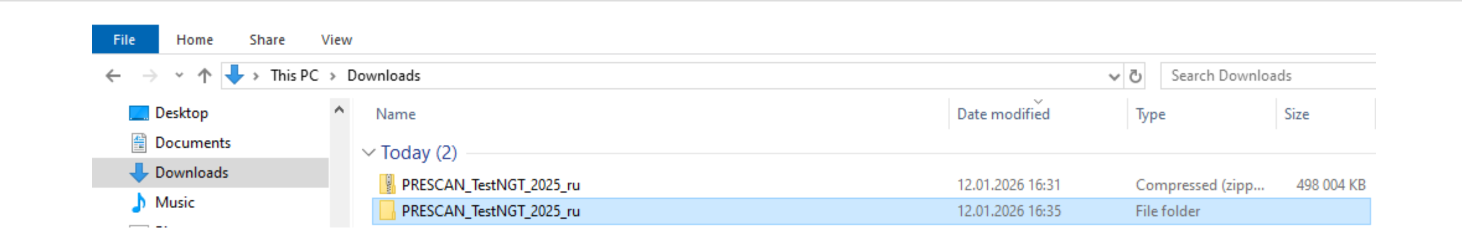


Fig. 5.2.3 – The Downloaded Prime Report

If the Zip archive is not extracted, an error will occur when attempting to view the Prime report.

5.3. Prime Report Visualization

Просмотреть готовый Прайм–отчет по анализированному объекту Пользователь может двумя способами:

1) открыть html–страницу «index» в разархивированной папке Прайм–отчета (рис. 5.3.1).

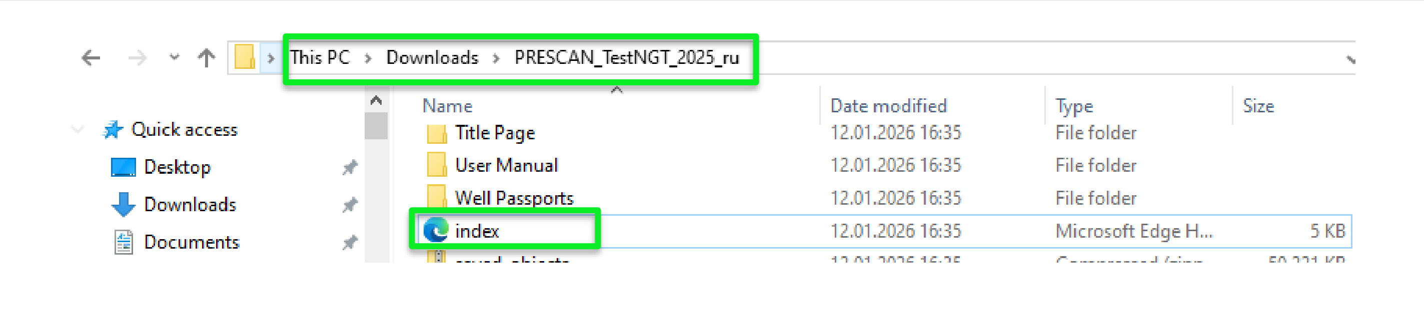


Fig. 5.3.1 – The "index" HTML Page

2) select the zip file in the project explorer and click the "Preview" button (Fig.5.3.2).

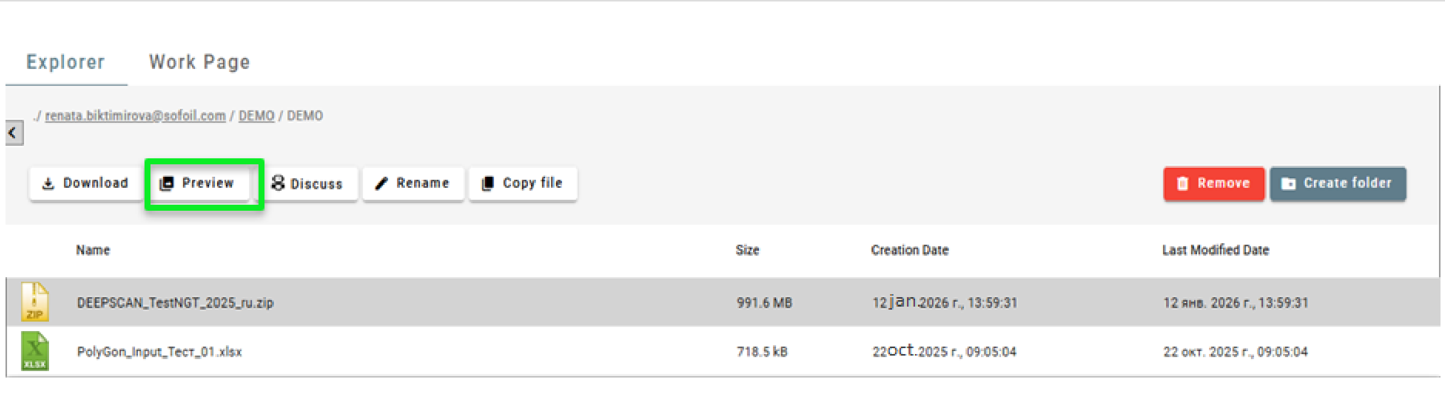


Fig. 5.3.2 – The "Preview" Button

When one of these methods is executed, a new browser window will open with the title of the Prime report for the analyzed asset (Fig. 5.3.3).

Fig. 5.3.3 – Prime Report Title Page

A description of the Prime report sections is provided in a separate document, the "User Manual" (https://polykod.ru/polyprime/user–manual–report)

5.4. **Additional Features**

Furthermore, the PolyGon software includes additional file management functions: projects can be copied, renamed, deleted, saved, and loaded.

To copy a project, the User must:

1. Navigate to the project folder;
2. Select the desired project;
3. Click the "Copy" and "Paste" buttons (Fig.5.4.1).

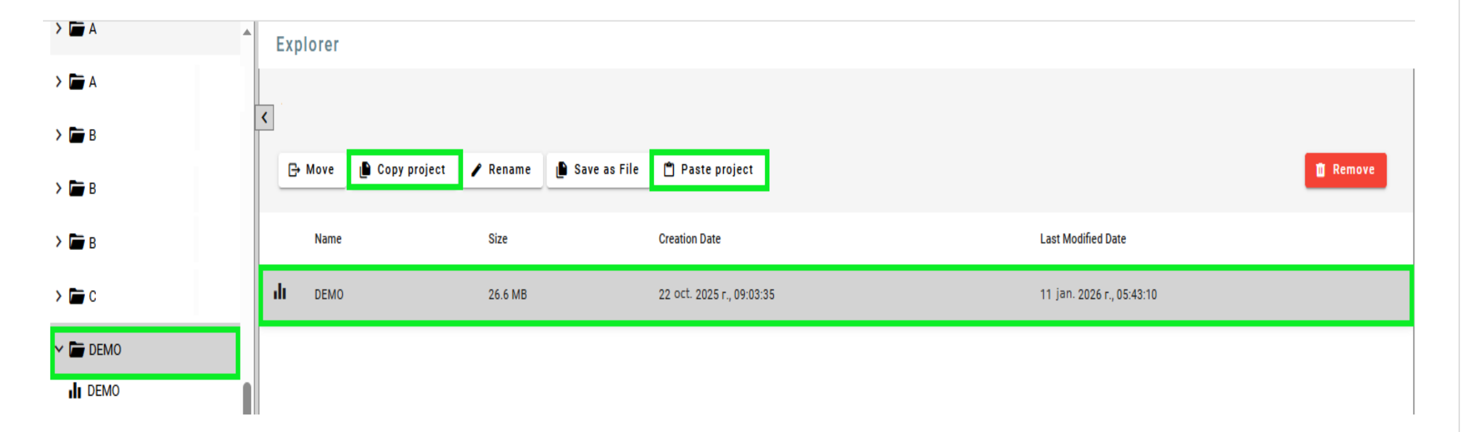


Fig. 5.4.1 – The "Copy" Button

A previously copied or created project can be renamed by clicking the "Rename" button (Fig.5.4.2):

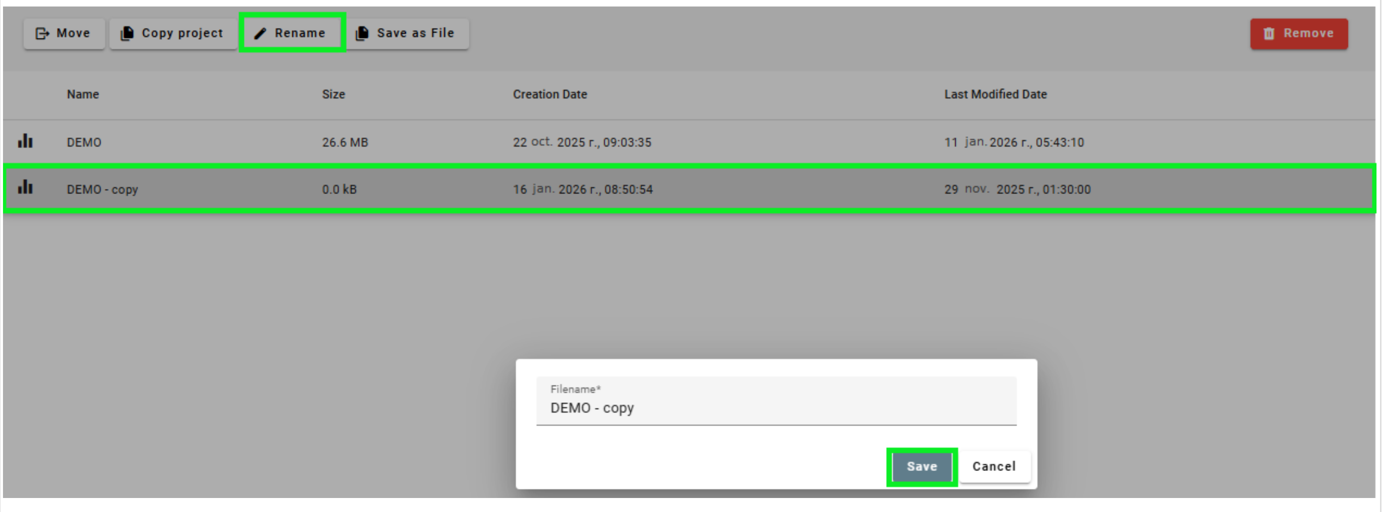


Fig. 5.4.2 – The "Rename" Button

To save a project and maintain the integrity of the main project, the "Save as Project" button in the PolyGon software can be used. It allows saving the project in ".pkd2" format to a specified folder (Fig. 5.4.3). This function is also intended for sharing the project with other Users.

Fig. 5.4.3 – The "Save as Project" Button

The "Load as Project" button allows the User to load a project into a specific folder within the PolyGon software.

To "Load as Project", the User must:

1. Navigate to the folder of the desired project;
2. Select the project in ".pkd2" format in the Explorer;
3. Click the "Move" button (Fig.5.4.4);
4. Choose the load location;
5. Click the "Paste project" button (Fig.5.4.5).

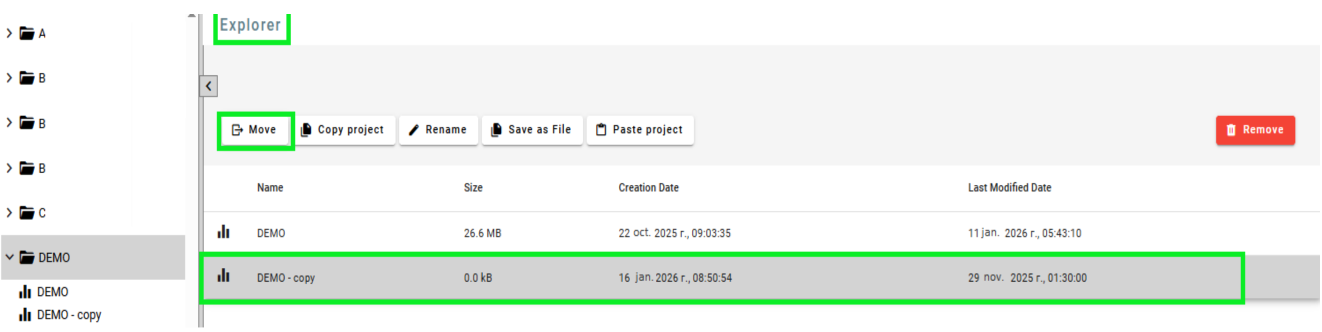


Fig. 5.4.4 – The "Save as Project" Button

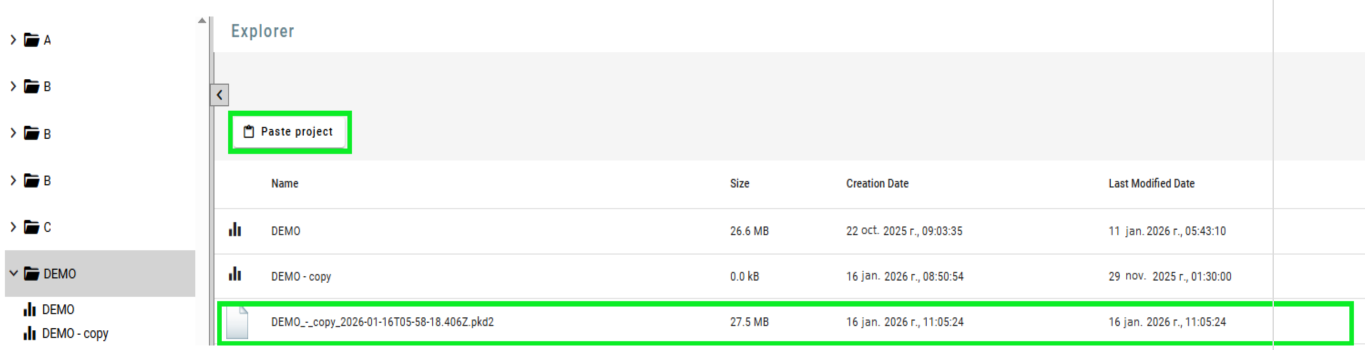


Fig. 5.4.4 – Selecting the Project Save Location

Additionally, the User can delete unnecessary files from folders using the "Delete" button.