AVTOMATIKA-VEKTOR

www.a-vektor.ru

The saw cut optimization software SawsOptimization

Version 3.0

Basic and Professional

10.07.2018

Table of contents

1. Program purpose

The program SawsOptimization is designed for industrial and planning engineers of sawmill production and is a tool for sawing optimization and achieving the maximum useful output. The program has convenient and flexible settings and intuitively clear interface which greatly facilitates learning the program work.

The basic functionality of the program is to calculate the optimal sawing schedules based on the following data:

- Log size
- Required size of sawn timber and its price
- Sawmill equipment characteristics.

On the basis of these data the program offers the sawing schedules that can be implemented on this equipment and provide the maximum output or the maximum cost of the product. It also allow to calculate the volume and cost of the finished product and waste.

Changes in version 3.0

The previous version of the program SawsOptimization 2.3 is well-known to many sawmill operators and has gained wide popularity in Russia and the countries of the former USSR. SawsOptimization 2.3 users will find the following improvements in the new version of the program:

- Advanced options for adjusting sawing profiles and equipment settings including additional settings for sawing and shaping machines, saws and cutters; additional equipment profiles (Carousel, Linck, SAB, 3-pass sawing); the dependence of the saw width on the kurf thickness.
- Special sawing modes: board without a core, sawing with fixed thickness of the side boards on the edge, sawing timber with a false core (only in the Professional version).
- Improved optimization engine gives better results compared to version 2.3 in some cases.
- Advanced options for operations with sawing schedules: manual creation and editing, saving-reading, applying an arbitrary sawing schedule to a log of arbitrary size, selection of the optimal diameter for a sawing schedule.
- Automatic calculation of the sawing sizes depending on final moisture in accordance with GOST (State Standard) 6782-1.75.

In addition to the basic version there is version 3.0 Professional designed to optimize the sawmill cycle, starting with the log sorting in large enterprises and having the following extra options:

- Functions for planning engineers: group optimization for logs of different diameters, general specification of the product output for the entire sawlog volume, planning and optimization for achieving the required product output by cross-sections.
- Optimization taking into account the log sweep.
- Optimization of log sorting by sawing schedules for achieving the maximum product output.
- Integration with the “smart” log sorting OptiGrade and the program for optimal log positioning in the wood workshop OptiSaw.

2. Single-user and network program versions

The program can be delivered with a single-user or network key.

The single-user key does not limit the possibility to install/transfer the program to different computers, but it can be used only on the single computer at the same time.

The network version implies the key installation on any server/constantly working computer which makes it possible for all users to run the program from any computers connected to the enterprise's local network.

System requirements

SawsOptimization has the following minimum software and hardware requirements:

- 32 or 64-bit OS Windows 10 / 8.1 / 8 / 7 / 2008 / Vista
- Standard USB-port (for the network version – on PC used as a network key server)
- Hard drive space available ~ 150 MB

Network version setup

Network version setup includes the following components:

- Network key server (GLDS.msi)
- SawsOptimization installer

Network key server is installed on any server/ constantly working computer, the key is installed on the same computer.

SawsOptimization is installed on users' computers connected to the same local network where the server is installed.

To use the network version as a local one (when both program and network key server are installed on one and the same computer), press "Yes" answering the questions "Network key server is installed on this computer" when installing SawsOptimization.

When you start the program, it should automatically see the key. In case if it does not:

- Open the web-interface of the network key server in the web-browser using the following address http://localhost:3185 (or http://[server address]:3185 if the network key server is installed on the remote computer) and make sure the server works and sees the key
- Open the file gnclient.ini in the program's fold and check:

- in the line ip_name = 127.0.0.1 ip-address of the key server should be displayed
- in the line PORT = 3186 the port number should coincide with License server port you see in the web-interface
- similarly in the line MESSAGE_PORT = 3187 the port number should coincide with Server message port

3. Working with the program: size setting

The main window of the program is shown in Figure 1.

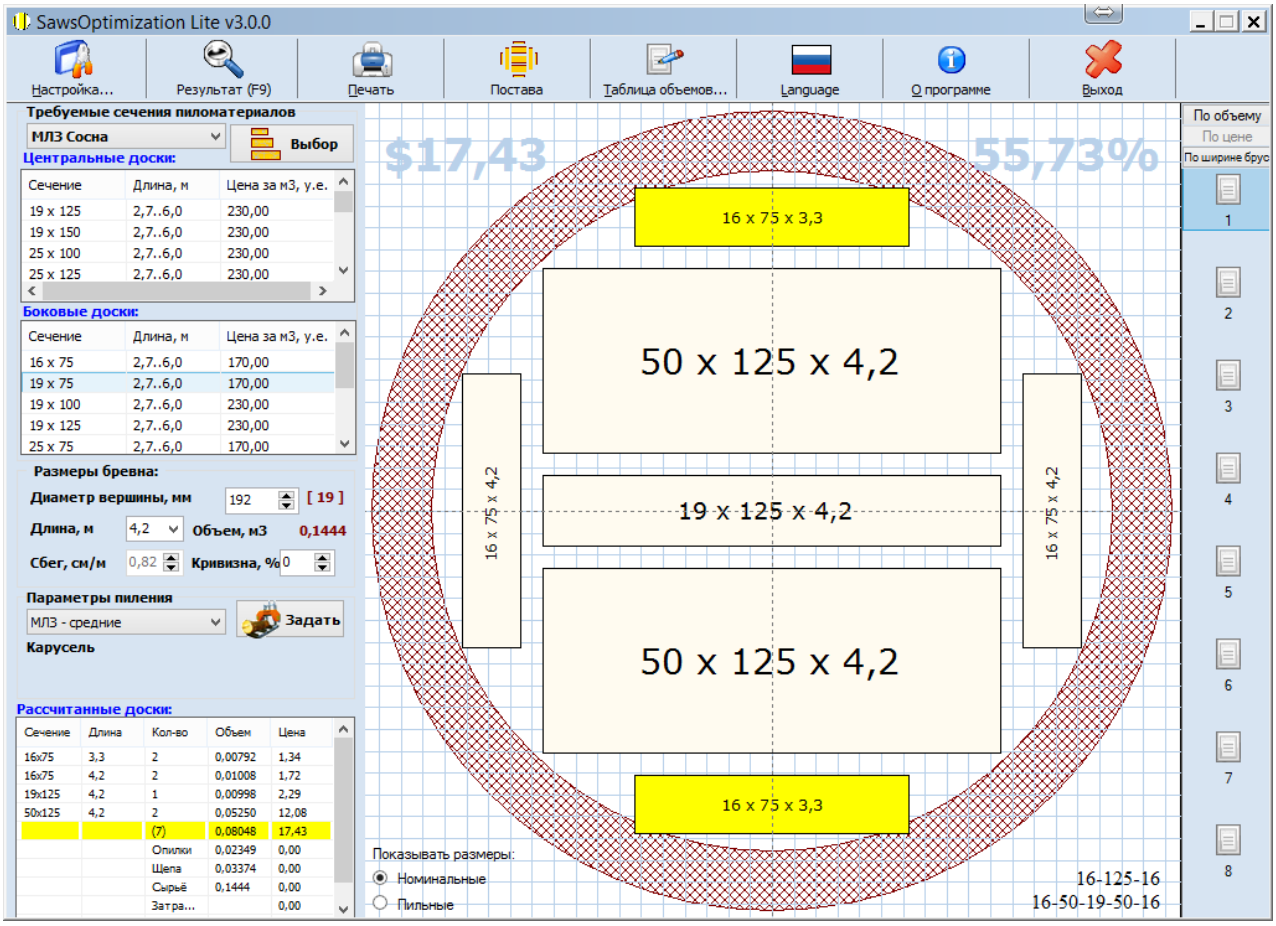
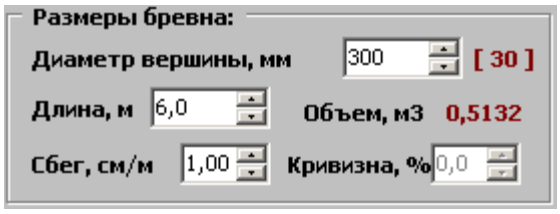


Fig. 01. The main window of the program.

To start working with the program you need:

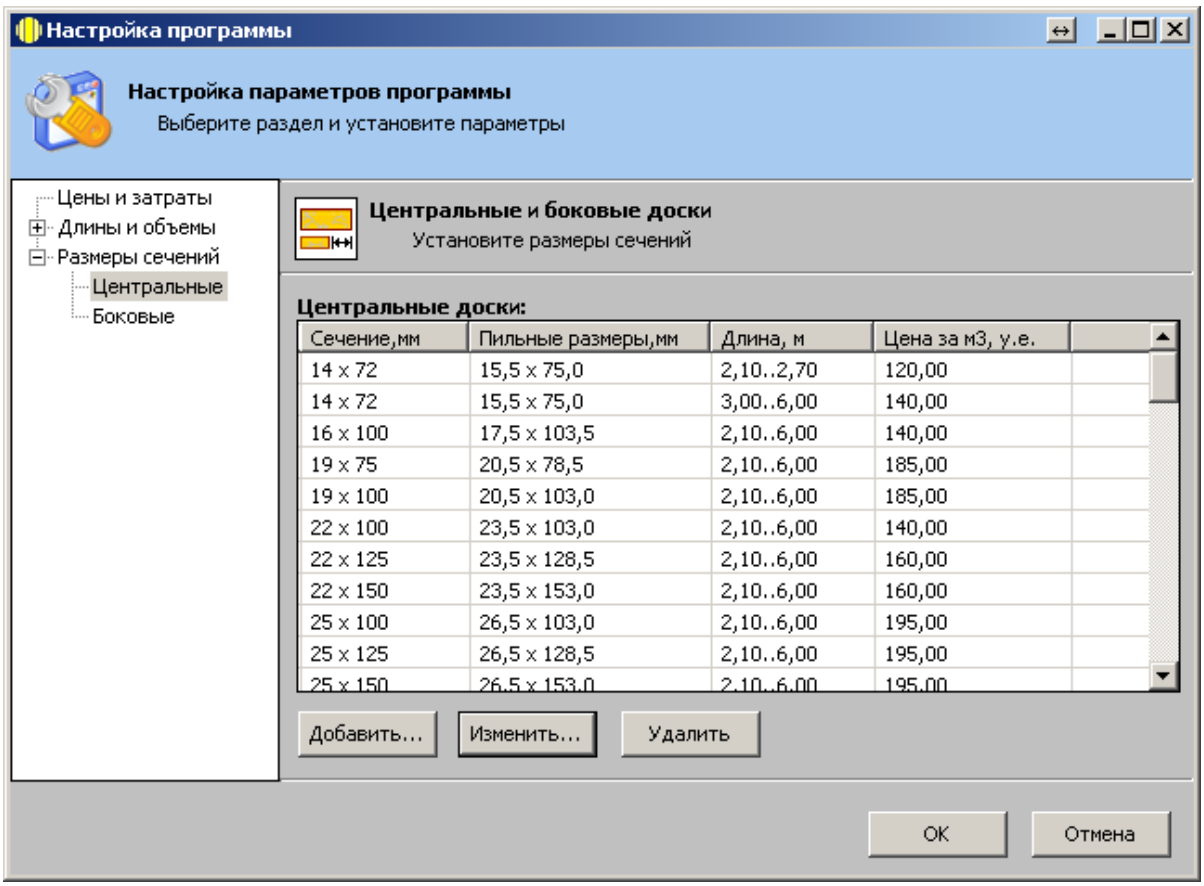
- Select and set equipment profile
- Enter sawn timber sizes and prices
- Check and change the following program settings: wood raw material and waste costs, log and board lengths used, volume calculation method, volumetric table (GOST (State Standard) 2708-75).

Log size is set in the main window of the program, the log volume is calculated automatically on the basis of GOST (State Standard) P52117-2003, GOST 2708-75, GOST P54365-2011 in accordance with the settings specified in the section "Log Parameters" – "Lengths and Volumes". If the volume is calculated on the basis of GOST 2708-75 – "Volumetric table", then the corresponding value of the taper is calculated automatically.

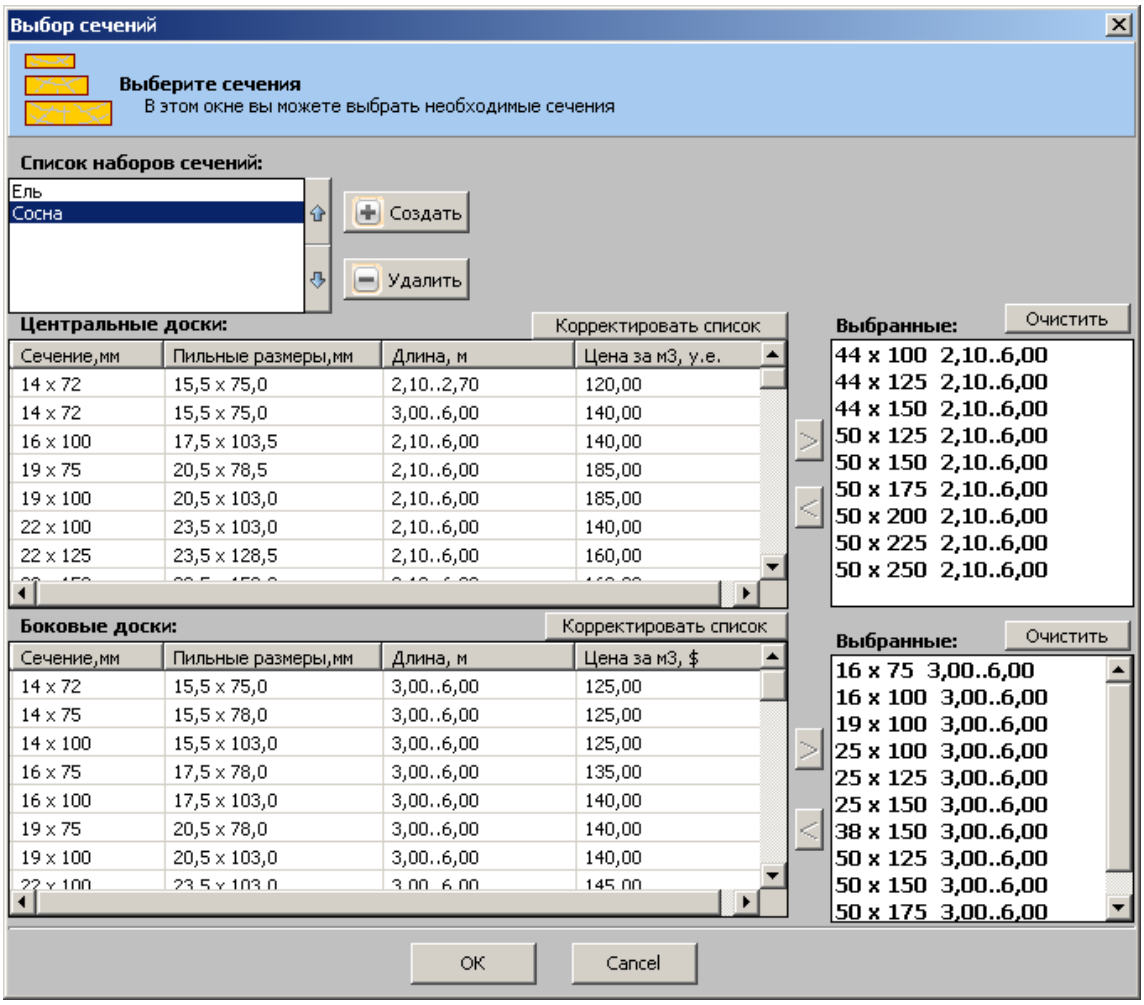


Sawn timber size

In the program settings a list of central and side boards sizes is set and saved. For a cross-section both nominal and sawing size (taking shrinkage into account) are set. Here you can also enter the cost of 1 cubic meter of the set cross-section and length sawn timber. If the price per 1 cubic meter of boards of different length but one cross-section differs, then create two (or several) records for one cross-section with different lengths and prices.



The program allows you to select (by using the button > or double-clicking) and save "Cross-sections sets" from the general list of board sizes.



Thus, to calculate the required sawing schedule it is enough to select one of the "Cross-section sets" or create a new one.

The cross-sections the program will calculate are displayed in the main window.

4. Sawmill equipment parameters

To calculate the optimal cut scheme on equipment with specified characteristics, you need to select the equipment profile from the list. You can do it in the main window of the "Sawing parameters" section.

You can see and set the detailed characteristics of each profile by pressing the button 

The sawing parameters configurator supports the generalized types "Cant", "Back-breaking" as well as the binding of the scheme for the most popular types of sawing lines: 2-frame flow (or multisaw frame), shaping line, chipper canter line, "Scandinavian" scheme, Carousel, 3-pass sawing.

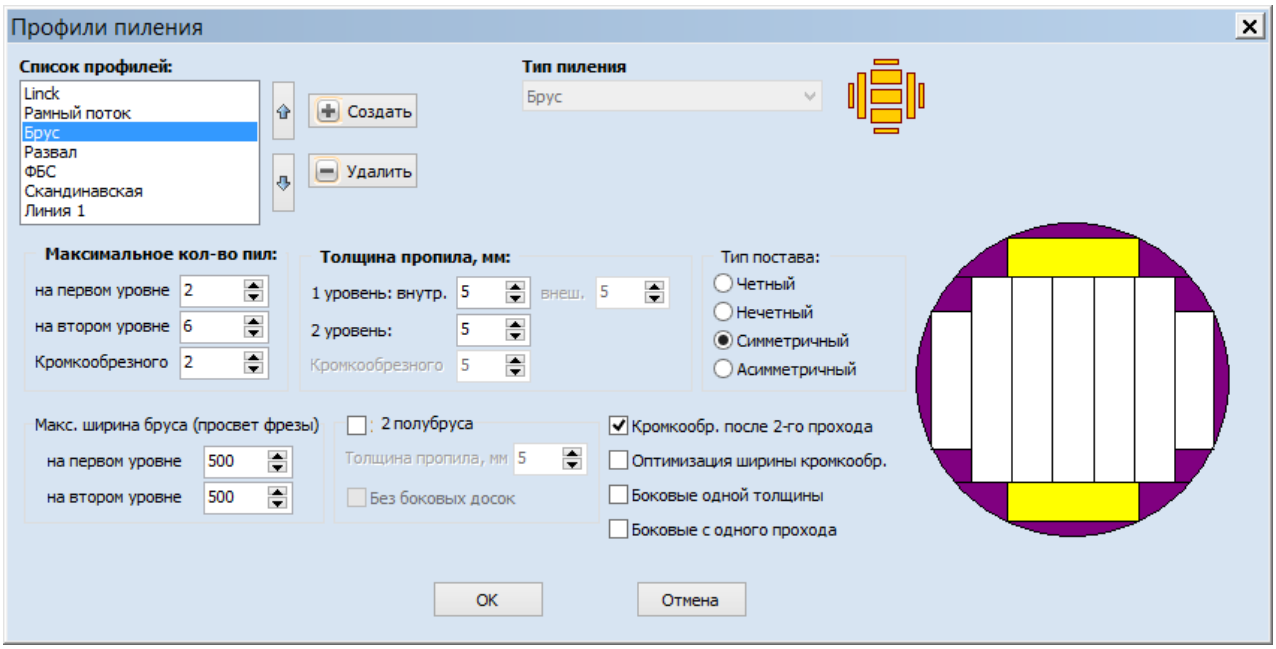


Fig. Generalized profile "Cant".

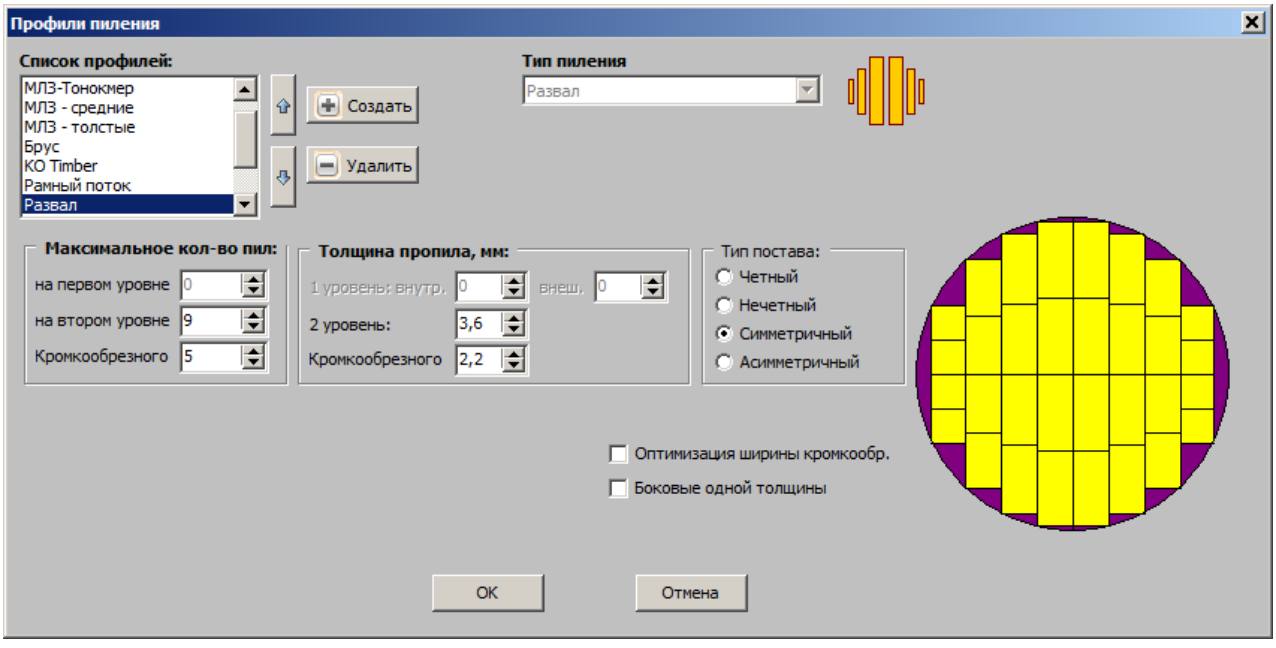


Fig. Generalized profile "Back-breaking".

More detailed setting of equipment parameters is possible with reference to a specific sawing line layout.

The scheme of each sawing line type clearly shows the sawing process stage by stage. By clicking on each element of the sawing line, you can see and change its characteristics.

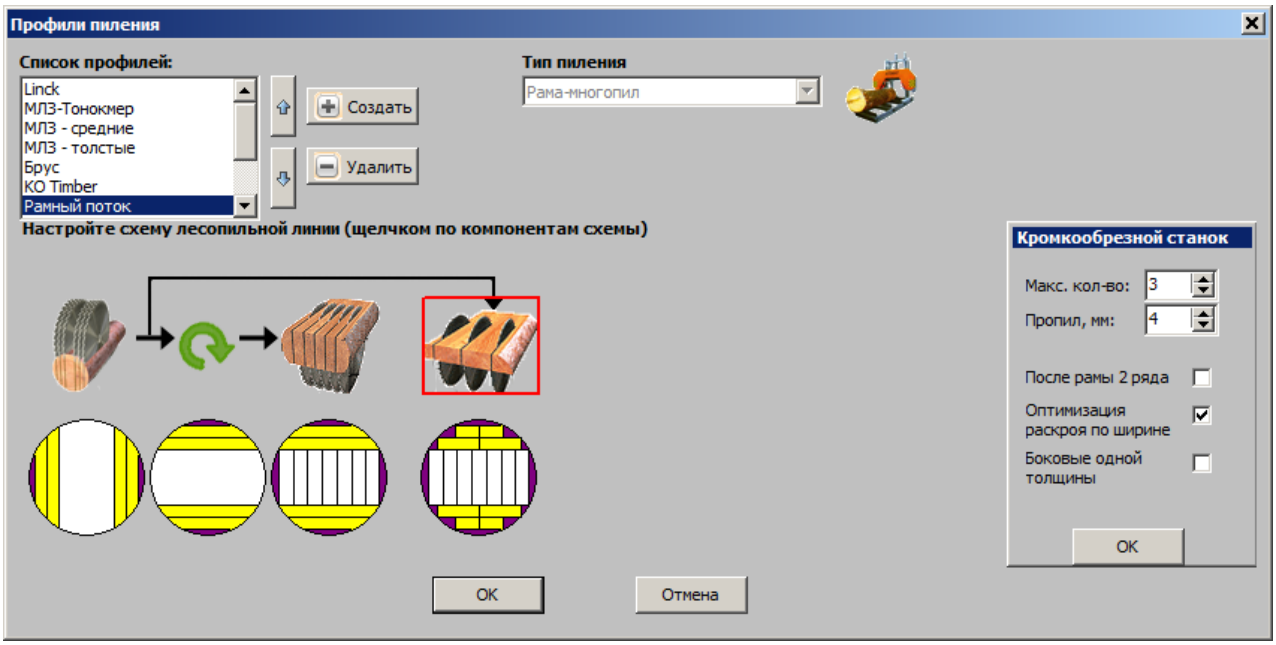


Fig. Edger parameters in the frame flow scheme

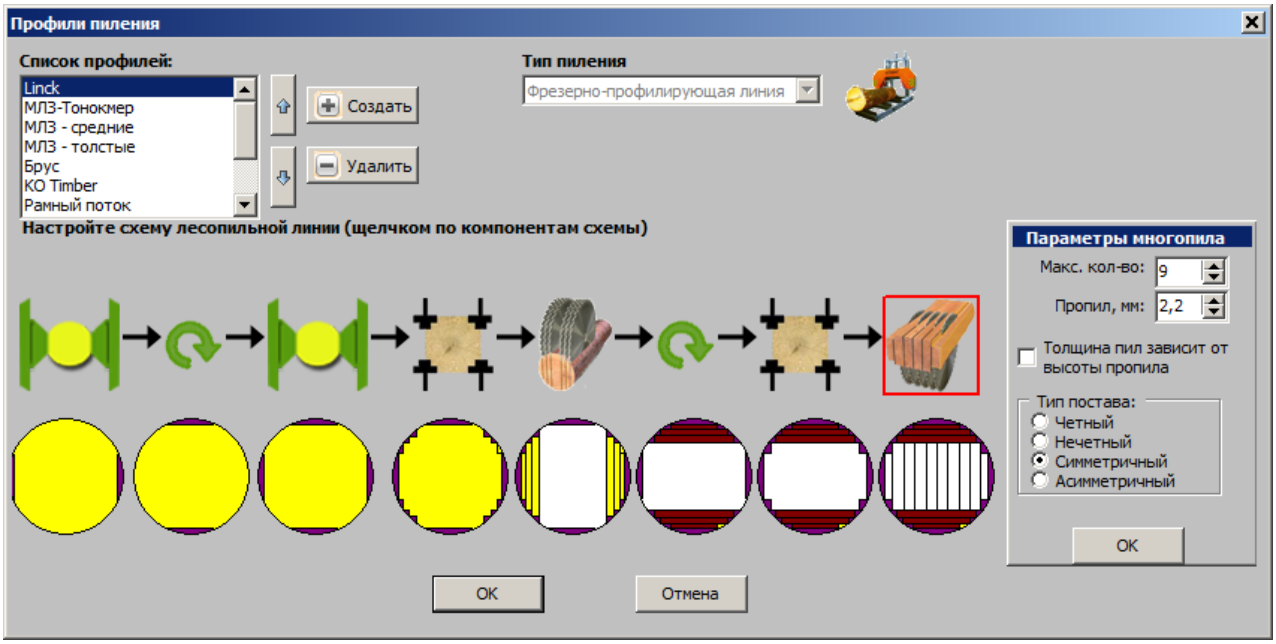


Fig. Multisaw parameters in Linck line scheme

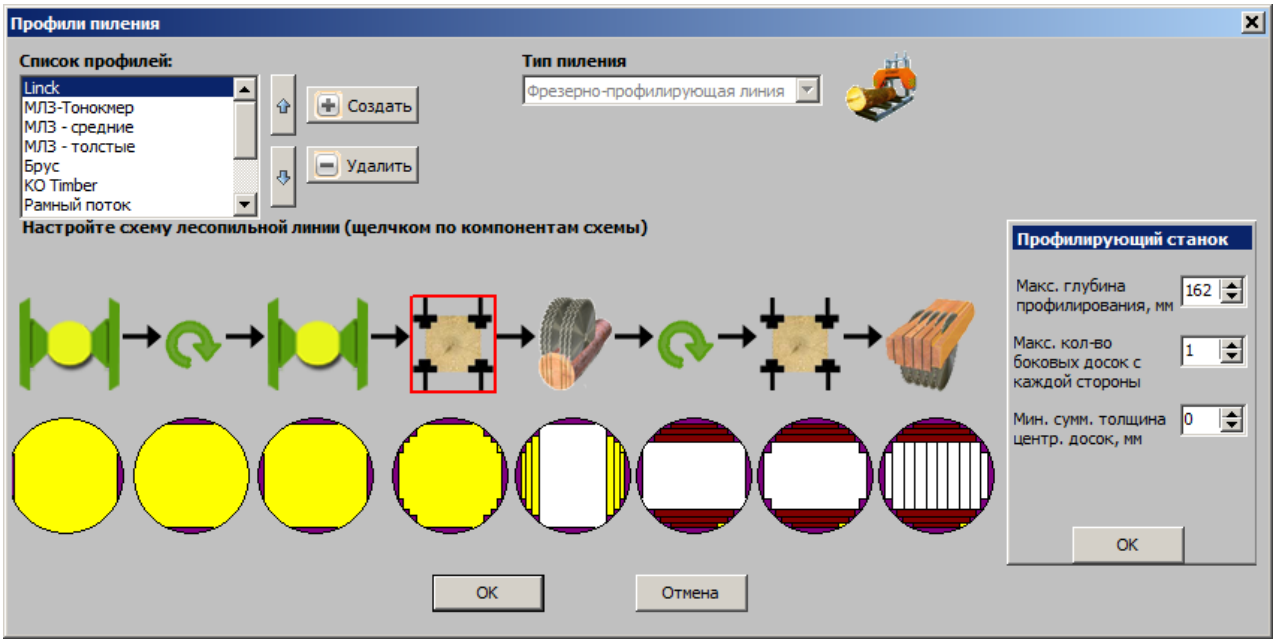
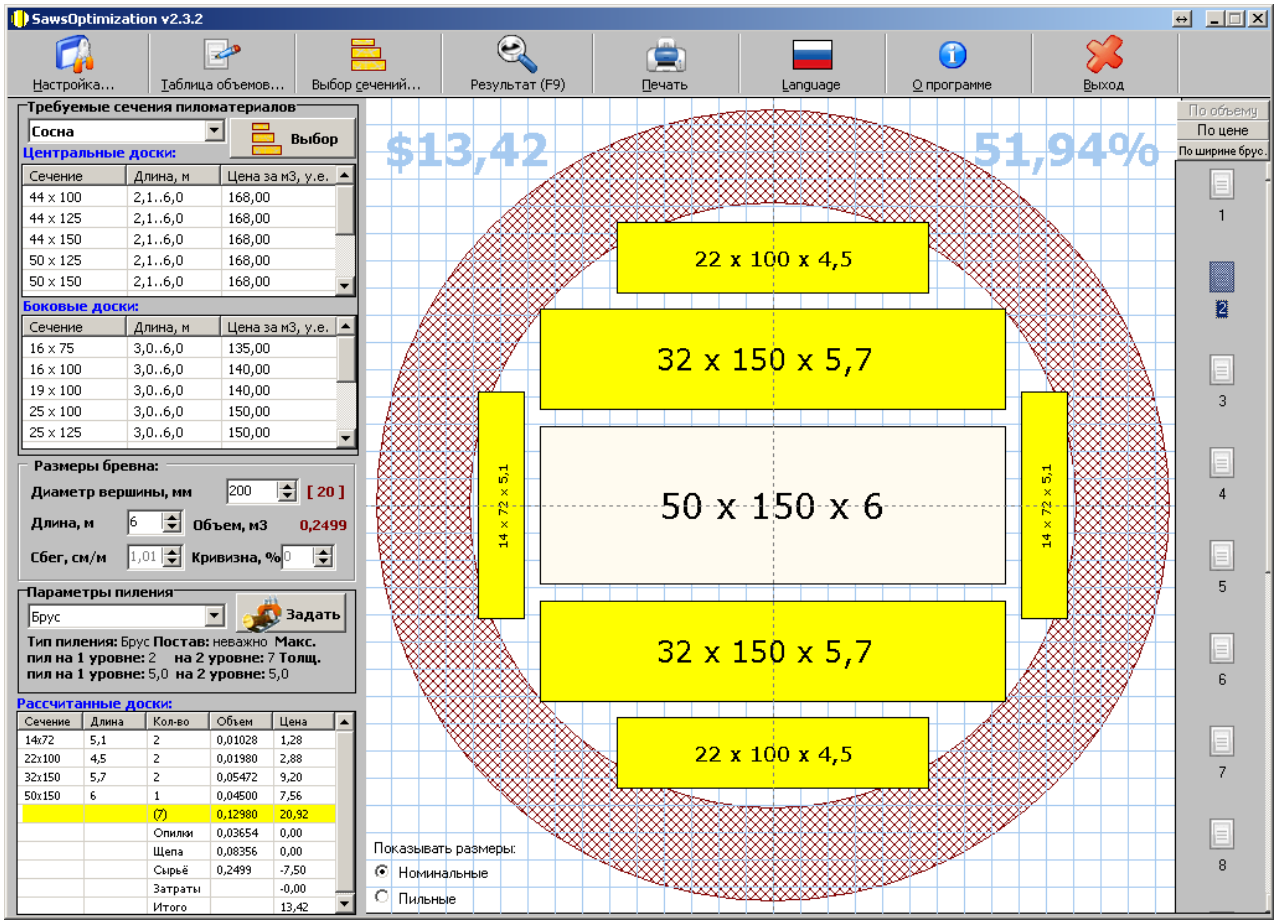


Fig. Shaping machine parameters in Linck line scheme

5. Sawing schedule calculation

When you click on the “Result” button in the main window (or use F9 on the keyboard), the program calculates the cut schemes for the selected log sizes, cross-section set and equipment profile.

As a result, the program will offer you several optimal cutting options. To see them, click on the buttons 1, 2, 3… in the right part of the window (or use up and down arrows on the keyboard).



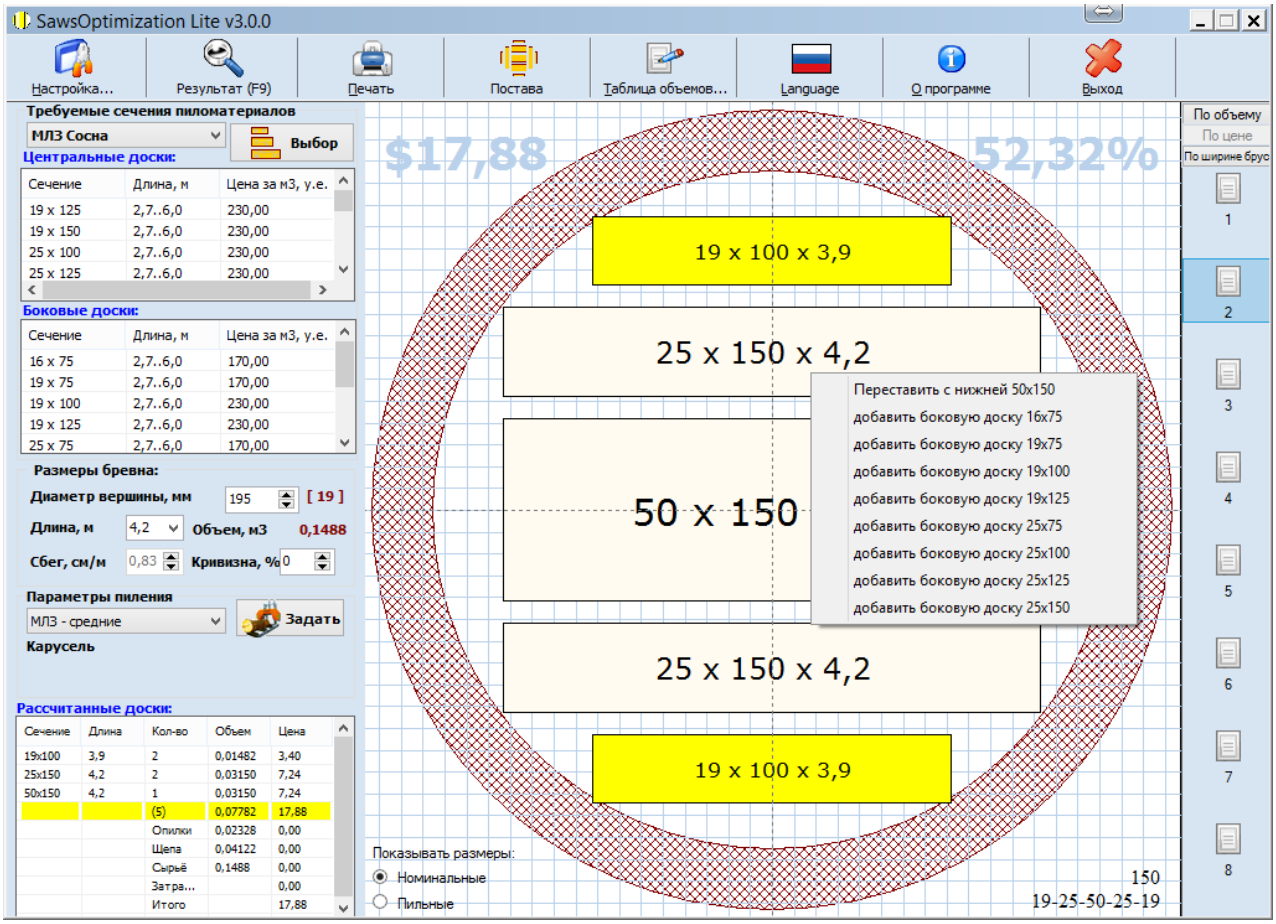
At first the program offers optimal sawing schedules sorted by the output volume. The buttons in the upper right part of the window allow you to get the optimal results sorted by product price or by width of the cant part.

In the picture of the calculated sawing schedule the boards with wane are highlighted in yellow – only “clean” length (length without wane) of such boards is displayed in the picture. In addition, at the top of the image there are product price and the useful output in percentage.

6. Operations with the sawing schedules

Manual editing

After *right*-clicking in the log area, the context menu pops up allowing you to create or correct the sawing schedule manually.



This menu allows:

- Delete the board you clicked on
- Replace it with a board of different cross-section (from the selected cross-section set)
- Rearrange the central boards of different thickness
- Add a new board from the side you clicked on
- Symmetrically line up the central board

Applying sawing schedule to the log of arbitrary size

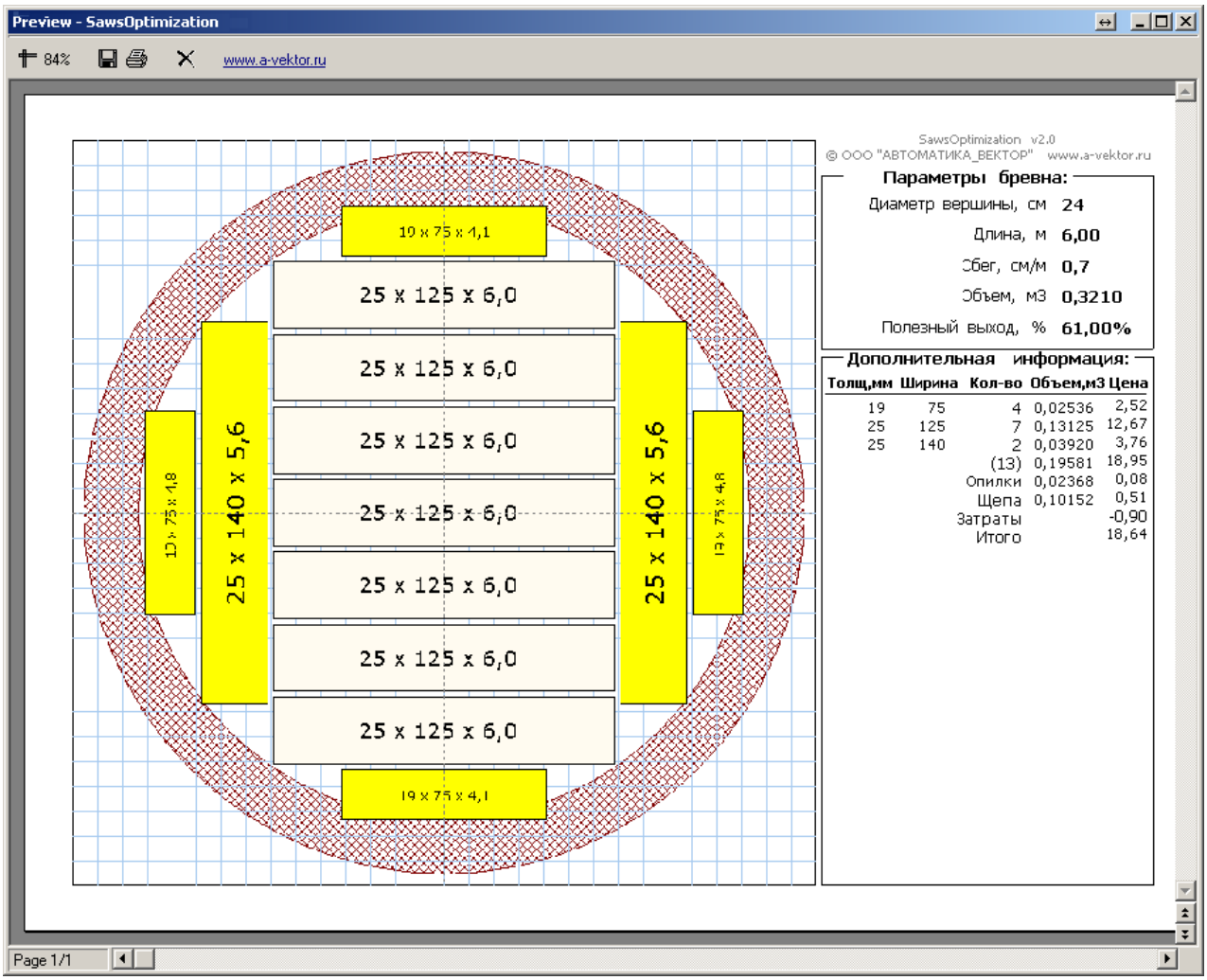
Changing any log dimension (diameter, length, taper) you can see how the set sawing schedule will fit this log.

Sawing schedule menu

"Optimal diameter" selects the optimal log diameter for a given sawing schedule.
Saving the sawing schedule to file and reading from file.

7. Results printing

In order to print the sawing schedule calculated by the program, you need to click on the "Print" button on the toolbar. A preview window will open.



In this window the calculated sawing schedule is graphically displayed. The initial data is shown to the right of the image: log parameters (nominal diameter, length and volume, taper and useful output in percentage) together with information on this sawing schedule boards total number and volume. If you click on the button with the printer icon in this window, the displayed sheet will be printed.

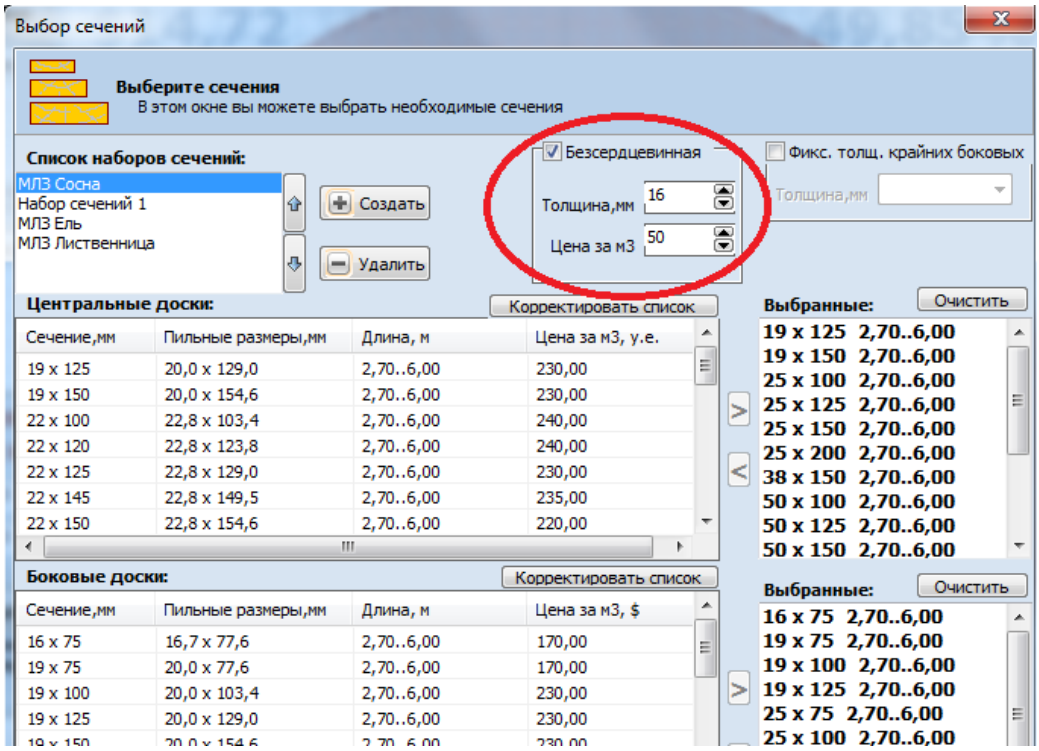
When you open another sawing schedule in the "Print" window (if line and cross-section set configuration was not changed), the previous sawing schedule will remain on the 2nd page. You can simply switch between them using the buttons Ctrl-PgDn, Ctrl-PgUp (or  in the lower right corner). Thus, it is possible to compare and print the results for logs of different size simultaneously. Up to 5 last versions can be saved. But if you display a result with a different line configuration or cross-sections set, all previous results are removed.

8. Special sawing modes

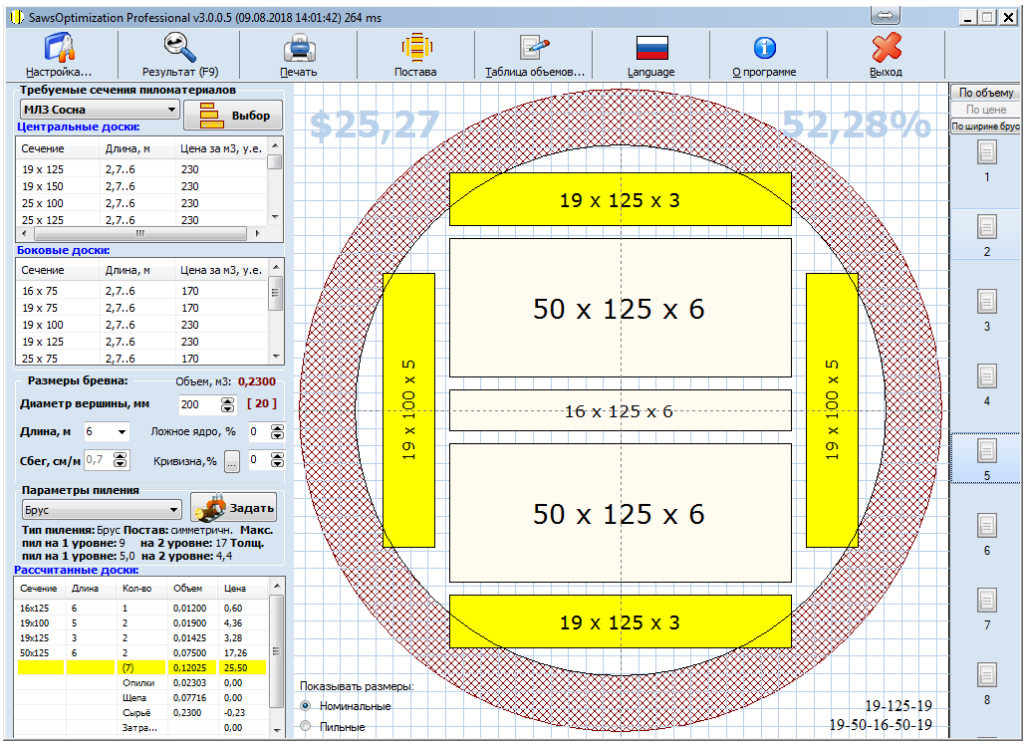
Board without a core

In this mode, when sawing a half-timber, the core is cut in the central board of set width.

This mode is activated by a tick in the cross-section selection window. Its settings are also made there.

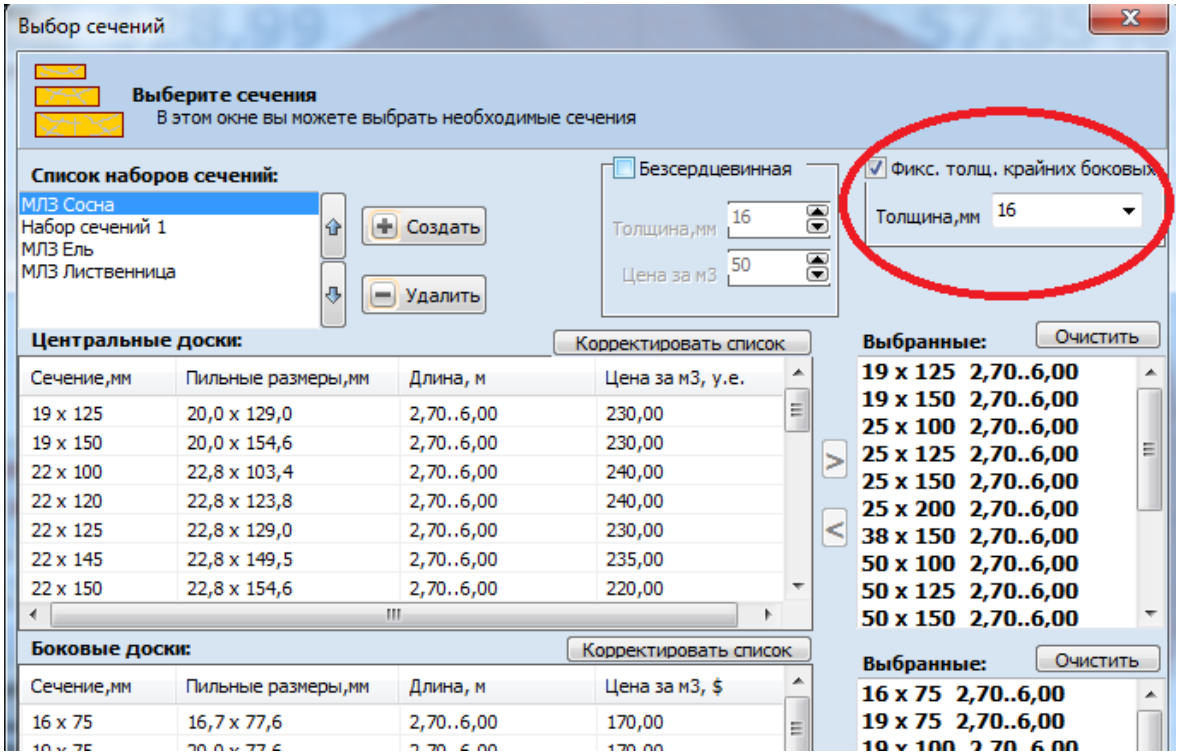


The result of the optimization in the board without a core mode.

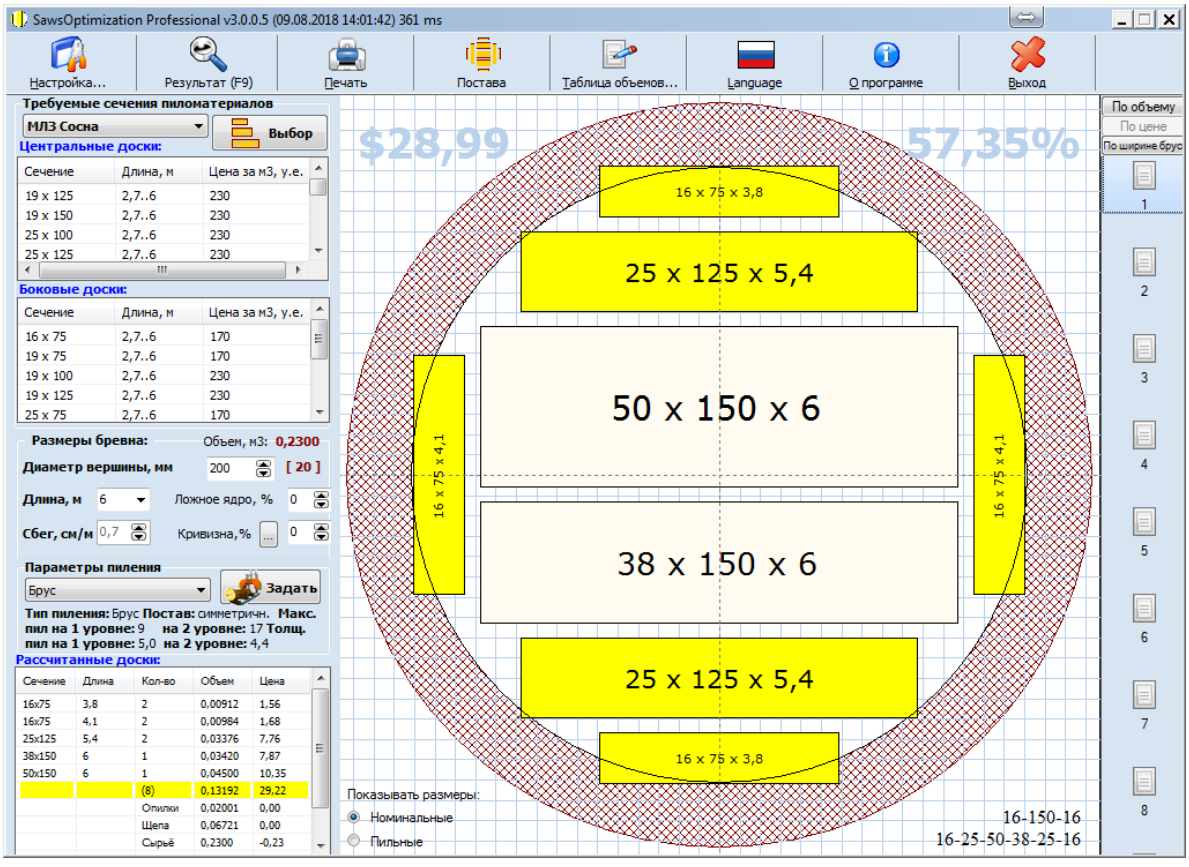


Sawing with fixed thickness of the side boards on the edge

In this mode side boards on the edge with fixed thickness only are selected. This mode is also activated by a tick in the cross-section selection window.



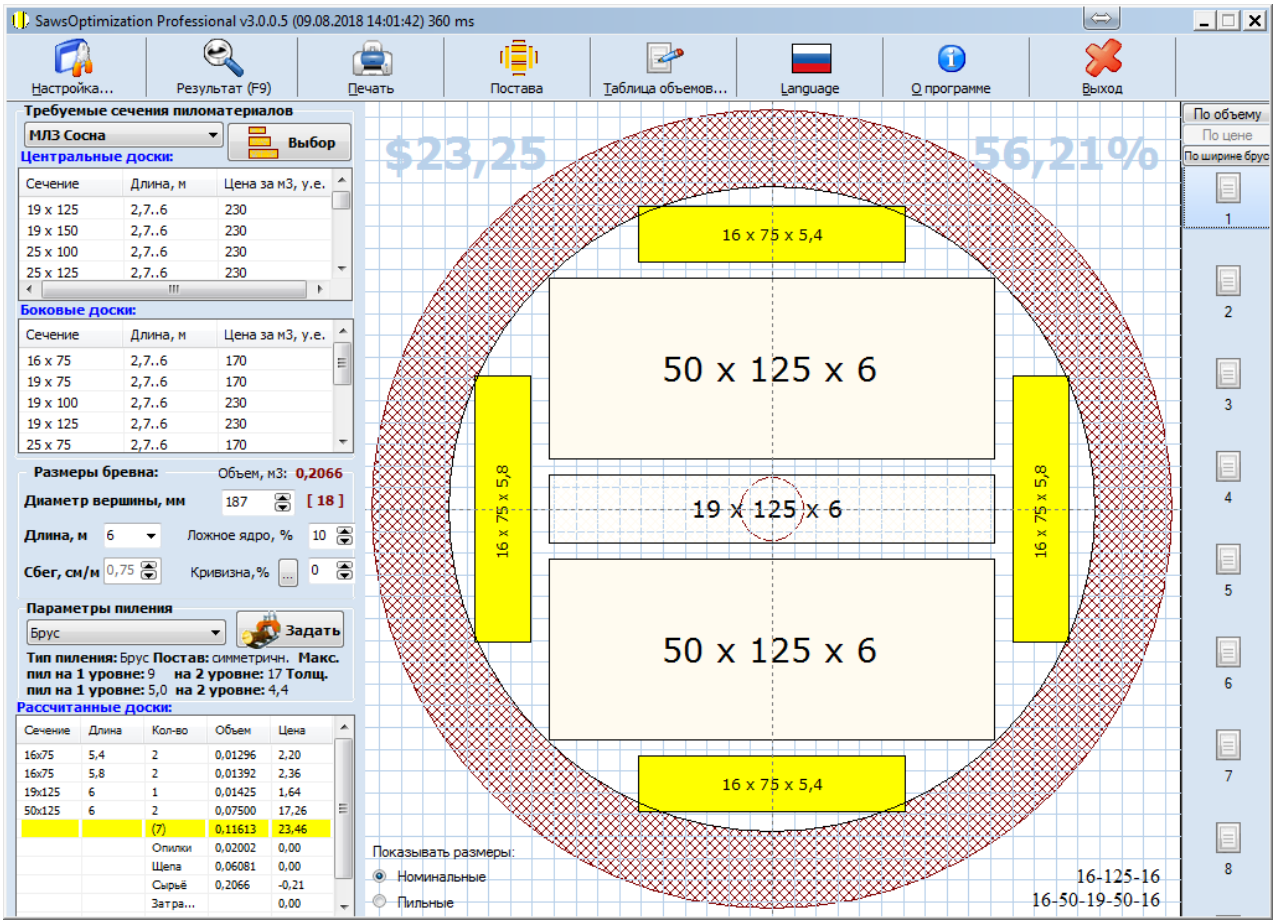
The result of the optimization with fixed thickness of the side boards on the edge = 16 mm.



Sawing timber with a false core

(this function is available only in the Professional version)

When sawing timber with a false core, the cost of such timber is considered to be lower and is specified in the settings of the section “Prices and costs” as a percentage of the basic material cost. The false core size is set in the main window of the program as a percentage of the top diameter. Optimization is conducted by price.



Optimization taking into account log curvature

(this function is available only in the Professional version)

This mode allows you to estimate the output when sawing logs with a curvature.

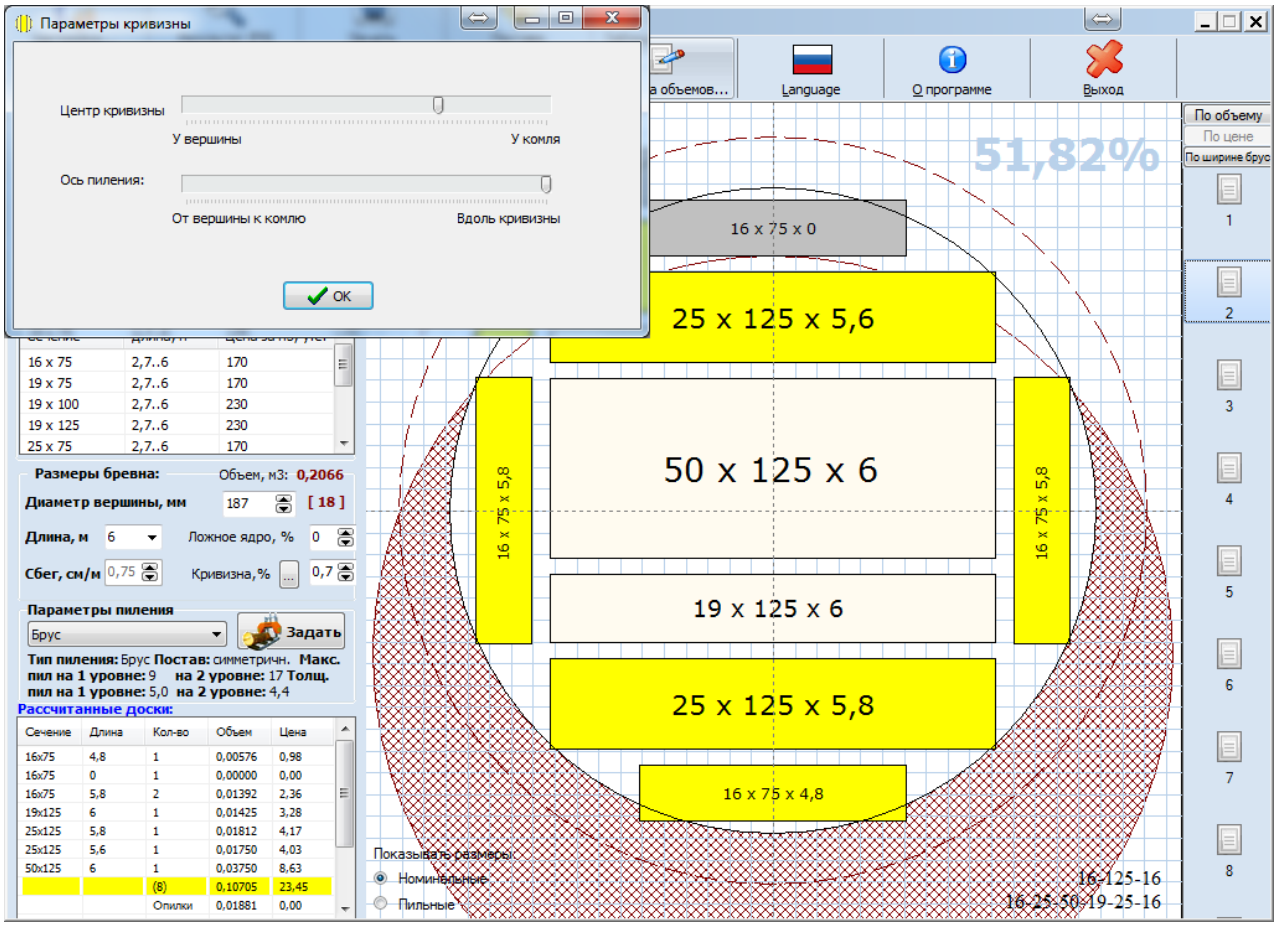
In practice, the result of sawing logs with a curvature depends on both the individual parameters of the log and the positioning of the log. For optimal sorting on the sawing schedule and optimal log positioning AVTOMATIKA-VEKTOR offers special programs Optigrade and OptiSaw (see Section 11 for more details) based on the exact geometry of the log received from the 3D Scanner.

In SawsOptimization the optimization of an abstract log with given numeric parameters is performed. When modelling, the following log parameters are set:

- curvature size in %,
- curvature center position along the log's length relative to the top and butt.

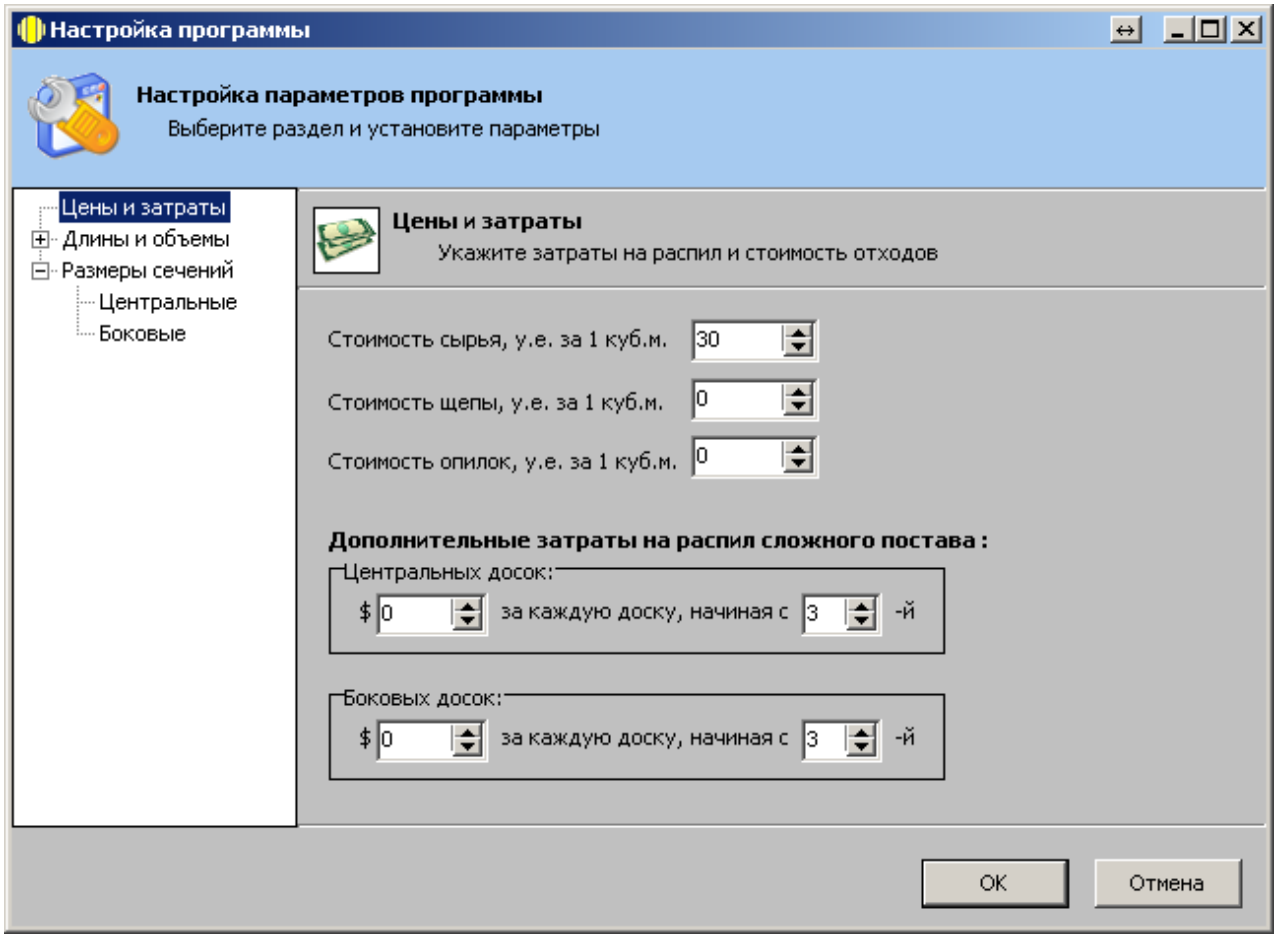
Log feeding is considered to be "by a hump up", sawing axis direction is selected as an intermediate between the extreme values – from the top center to the curvature center ("along the curvature") or to the butt center ("from top to butt").

The picture shows the clean face length for all boards; for a log – cross-sections of the top and butt; and the dotted line shows the log cross-section on the curvature center. Changing any parameters related to sawing taking into account log curvature, you can immediately see the change in the result.



9. Program settings

Prices and costs



In this section you can enter the parameters that will be taken into account when calculating the optimal output by price – cost of the raw materials, chips, sawdust as well as the cost for cutting.

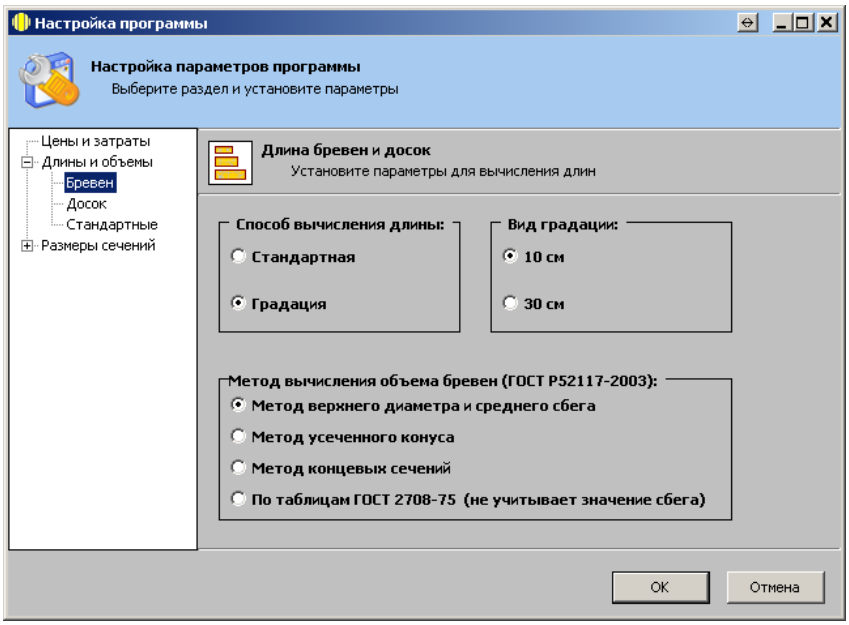
You need to enter the costs in program settings in order to take into account that cutting with a large number of boards of small cross-sections is more expensive. The proposed cost accounting method assumes that the additional costs for cutting a complex sawing schedule increase in proportion to the number of boards (separately for central and side boards). If necessary, at the request of the customer the cost accounting method can be modified in accordance with the method proposed by the customer.

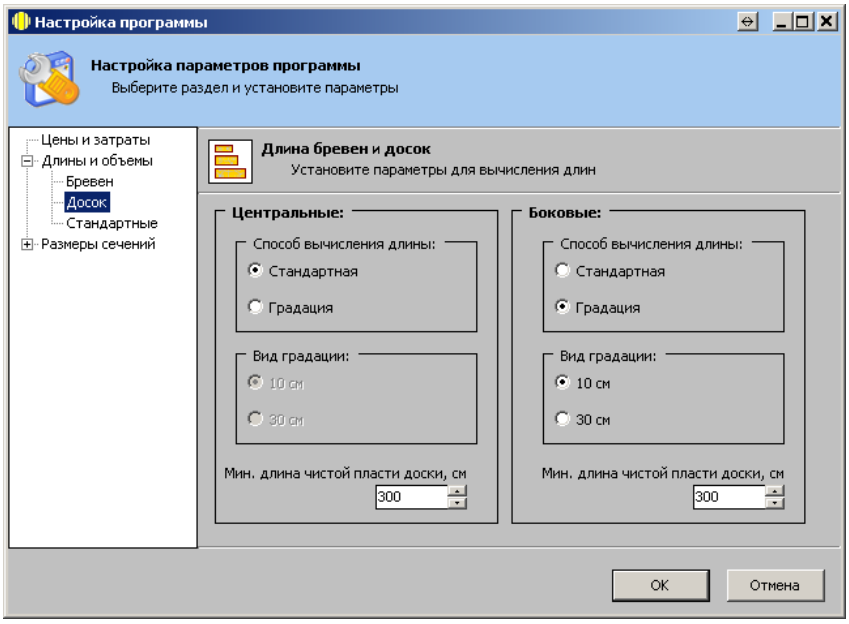
Lengths and volumes

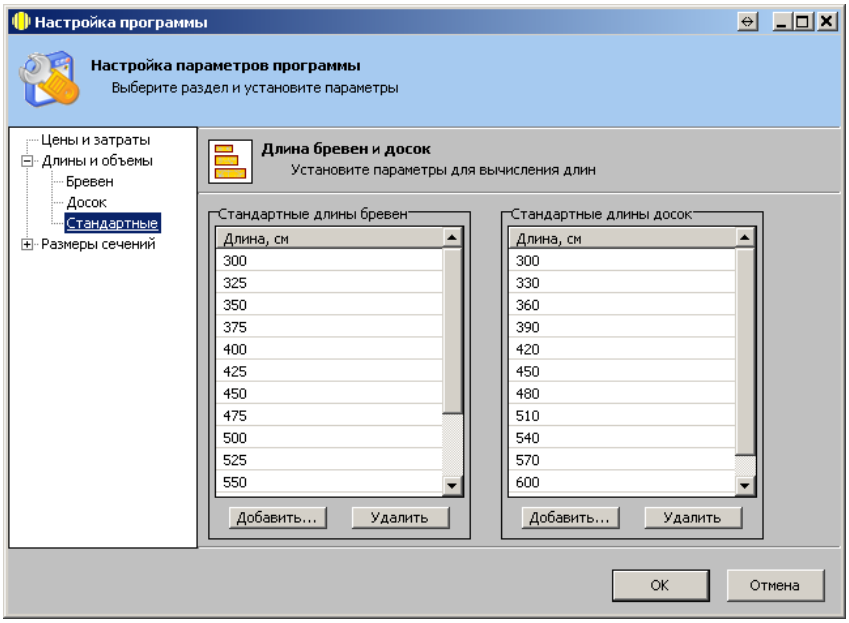
You can set the method for calculating the lengths of logs and boards, as well as select the method for calculating the volume of logs according to GOST (State Standard) R52117-2003.

To calculate the nominal length, you can use the standard length or gradation. When you use the standard length, the actual log length is reduced to the maximum possible standard length, not exceeding the actual length.

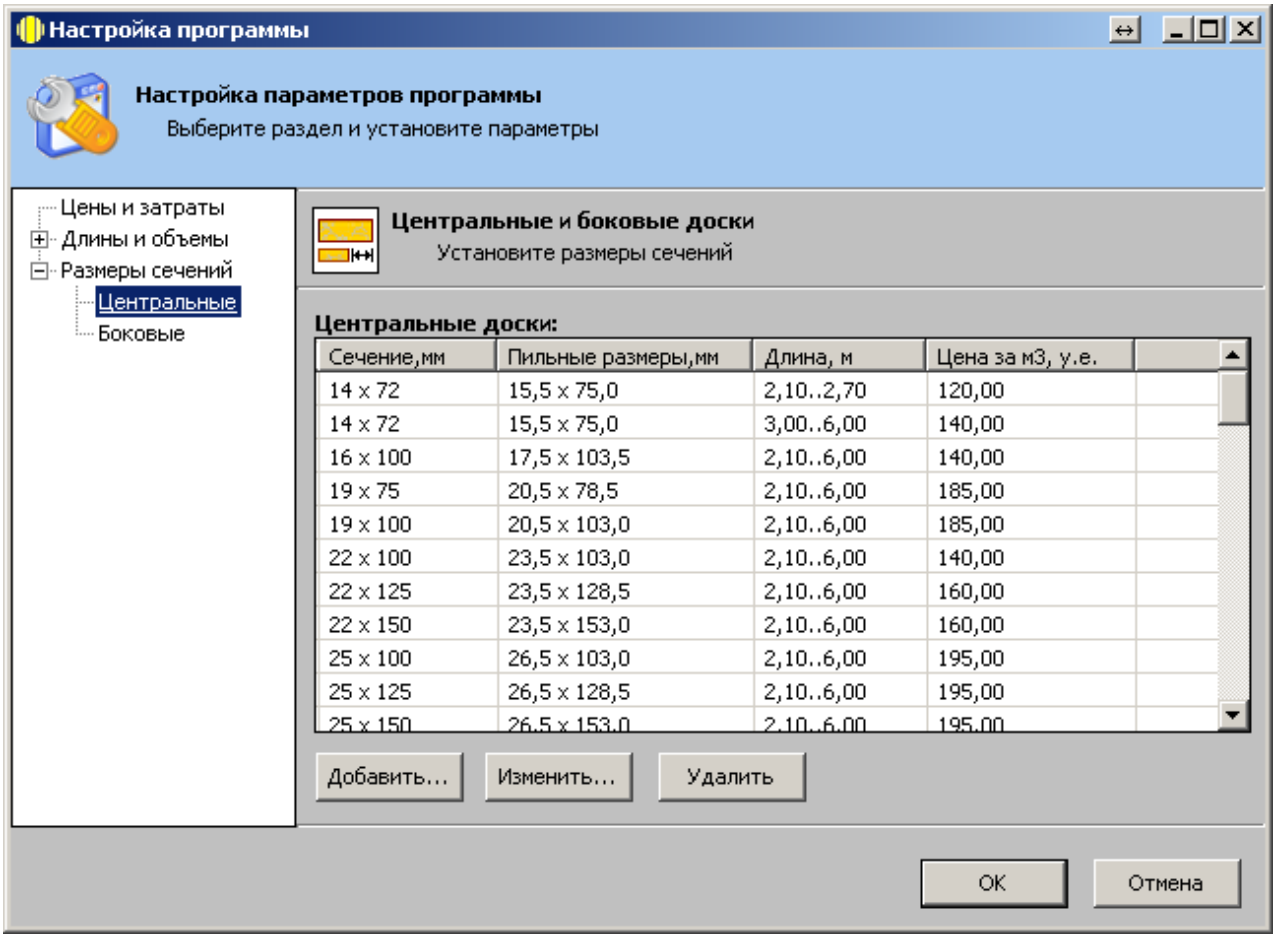
When you use gradation, a part of the actual length which includes as many segments (equal in length to the gradation step) as possible is taken as the nominal one.







Cross-section sizes



Directories of central and side boards cross-sections. When filling, the program takes into account that one value of the nominal thickness (width) must correspond to one value of the sawing thickness (width).

“Volumetric table”

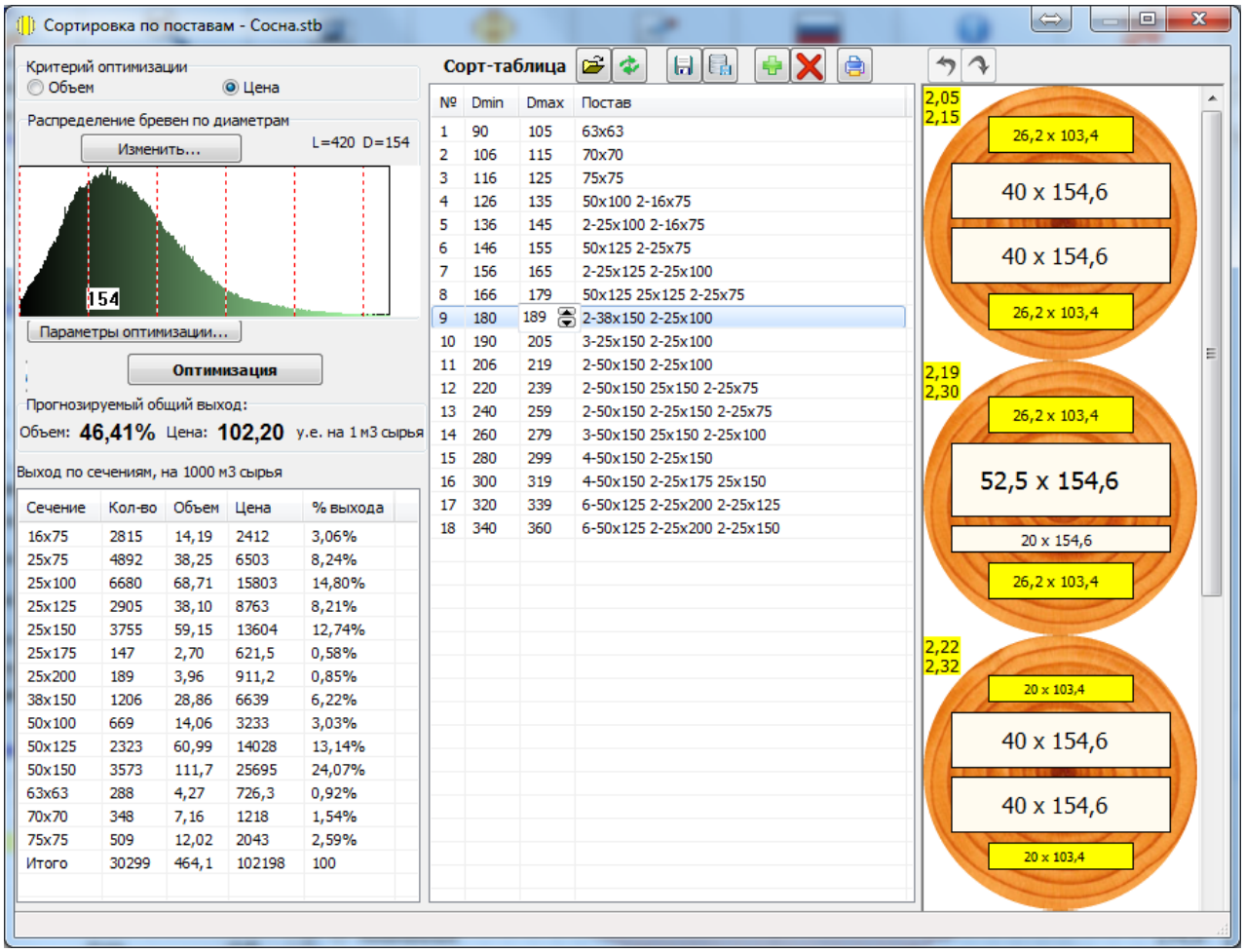
The “Volume table” button displays the “Volumetric table” according to GOST (State Standard) P54365-2011 or GOST (State Standard) 2708-75 depending on the settings applied in the section “Log parameters” – “Lengths and volumes”. The cursor is automatically positioned in the table’s line corresponding to the current size of the log.

Saving settings and directories

System settings are stored in the SawsOptimizer.ini file, directories are in the Data catalog. It is recommended to backup these files.

10. Sorting by sawing schedules

(this function is available only in the Professional version)



This mode shows:

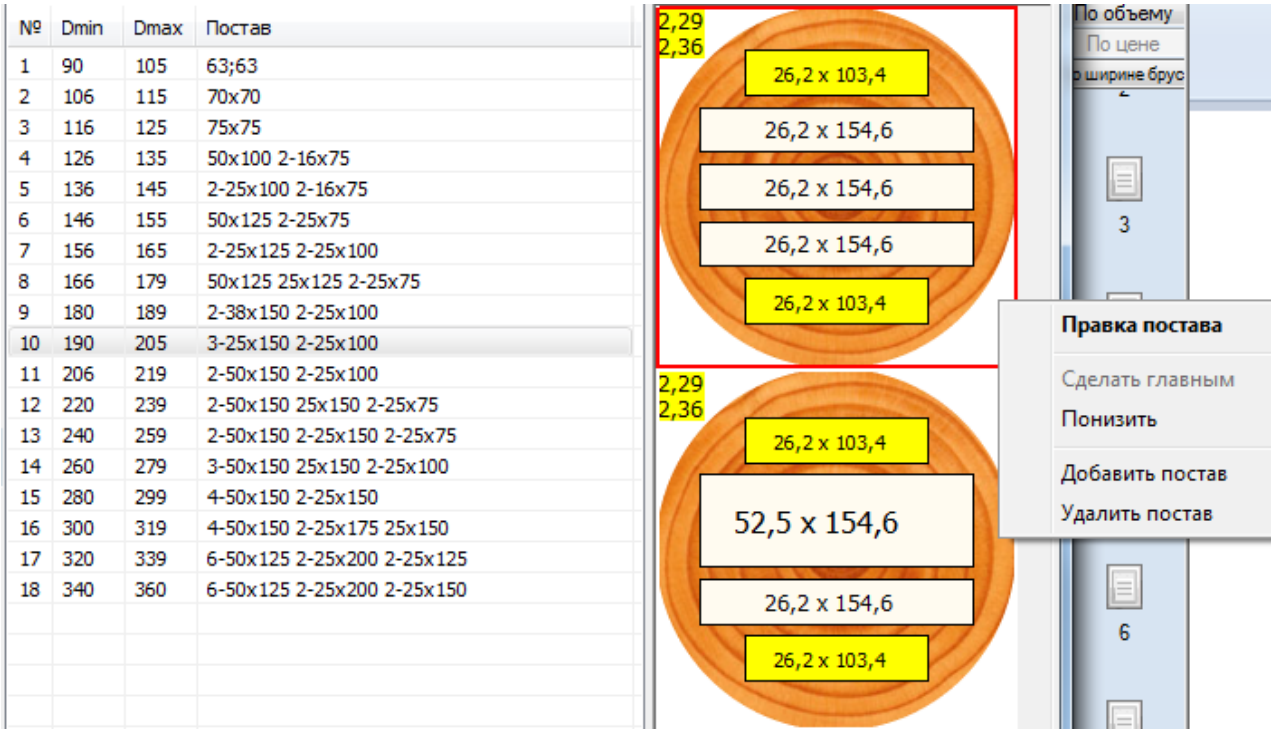
- Log sorting table by diameter;
- Each line of the sorting table is assigned a list of calculated sawing schedules ;
- Data on the log distribution by diameter;
- Calculated values of the total output by volume and price when sawing the set raw timber using the set sawing schedules;
- Calculation the output of different cross-sections sawn timber.

Operations with the log sorting table

- Changing the boundaries of diameter groups: click on the required group; when the arrow appears, change the maximum diameter. If the group has already been assigned a sawing schedule, the output will be automatically recalculated.
- Delete or add the line: buttons
- Open the sorting table from the file:
- Reopen the table (cancel the changes)
- Save the sorting table together with the set sawing schedules:

- in the file: 
- in the database  (only in the Professional Plus version – see section 9 "Interaction with software for log sorting and wood workshop")

Operations with the sawing schedules



Operations with the sawing schedules menu is called up by clicking on the right mouse button in the sawing schedules window.

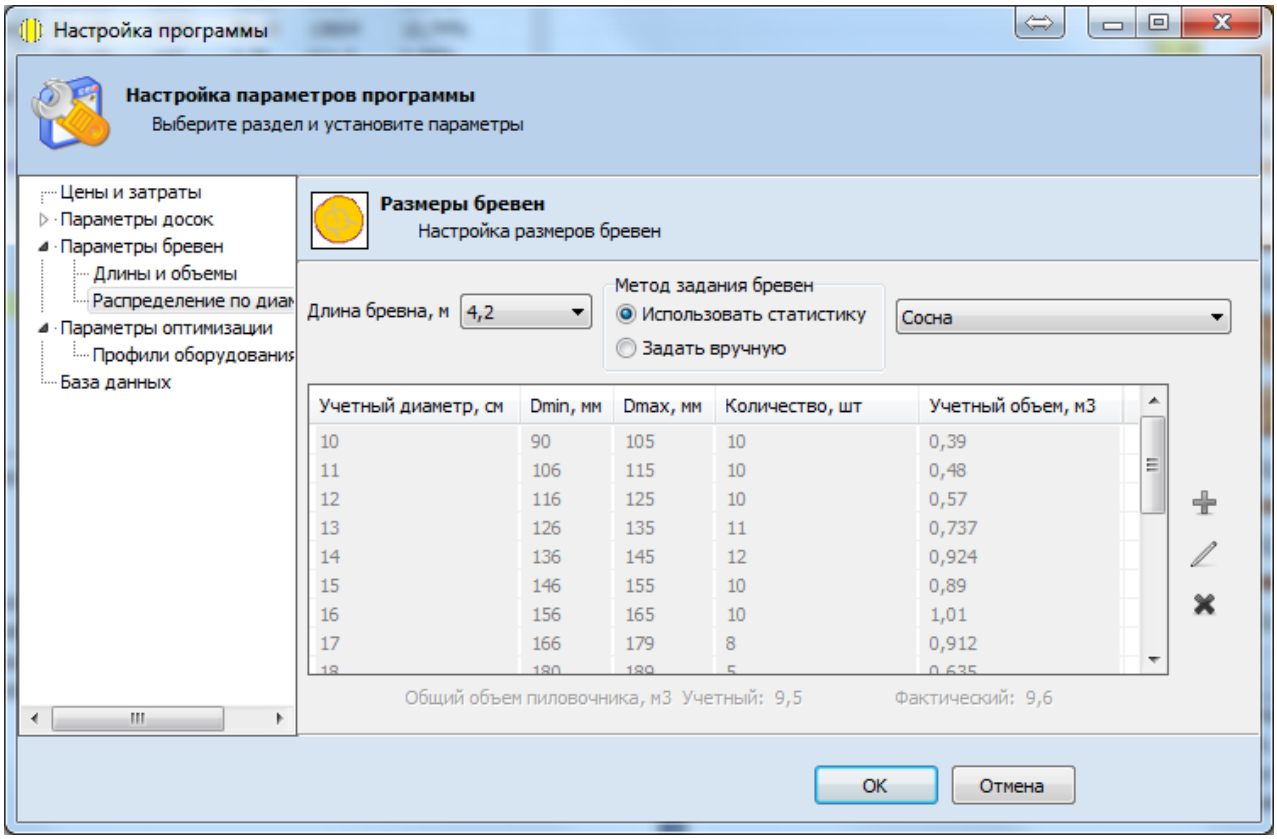
- Edit a sawing schedule: allows to change the current sawing schedule. Clicking on this button will take you to the main window of the program where you will be able to use both manual editing and automatic recalculation. In order to return to the "Sorting by sawing schedules" window use the "Save and return" buttons or "Return without saving".
- Set as the main sawing schedule: several sawing schedules can correspond to each group of the log diameters, the upper in the list is considered to be the "main" one. When calculating the output, it is considered that the main sawing schedule is used to saw each diameter.
- Downgrade: changes the position of the sawing schedule with the next in the list.
- Add a sawing schedule: the mechanism for adding a new sawing schedule is similar to editing the existing one – you go to the main program window where you can calculate a sawing schedule or compose it manually.
- Delete the sawing schedule.

Sorting logs by diameters

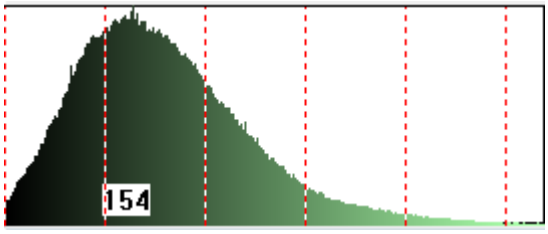
There are 2 methods to set the logs distribution:

1) Using the statistics on raw material distribution by diameters and other dimensional factors (taper, curvature) received from the sorting. For the sortings which use AVTOMATIKA-VEKTOR software these data can be collected automatically.

2) Set the number of logs for each diameters group manually.



Set log distribution is displayed in the window of sorting by sawing schedules in the form of a histogram the numerical value corresponds to the diameter which accounts for the maximum number of logs.



Optimization of sawing schedules and diameter groups

The purpose of optimization is to obtain the maximum output by volume or price as well as to obtain the output by cross-sections within the necessary limits.

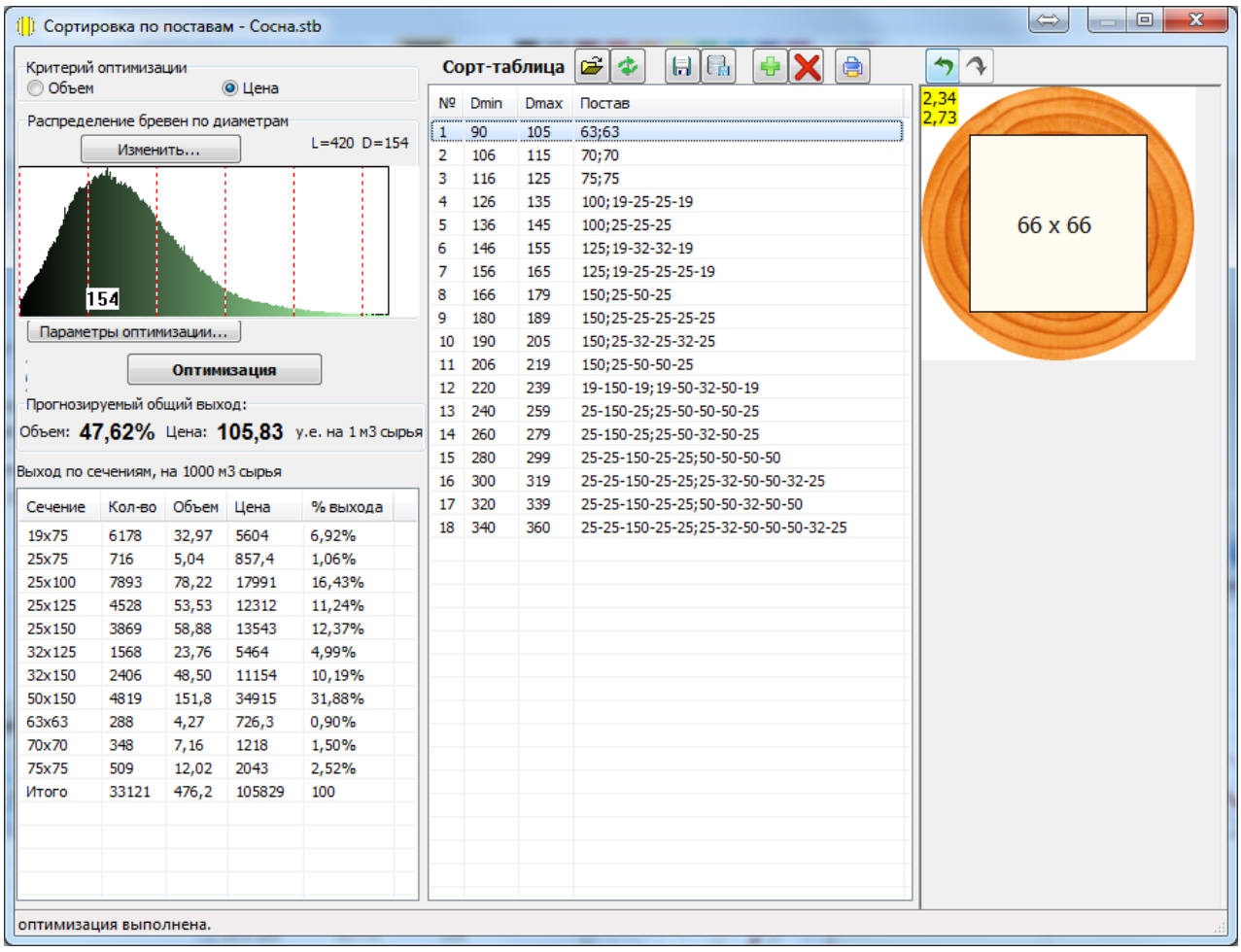
Manual optimization

When you change the main sawing schedule for each diameter group as well as change the boundaries of log diameter groups; total output, price and output by cross-sections are automatically recalculated, so you can choose the best option according to the required criteria.

Automatic optimization

Pressing the “Optimization” button starts the recalculation of results for all diameter groups in the sorting table.

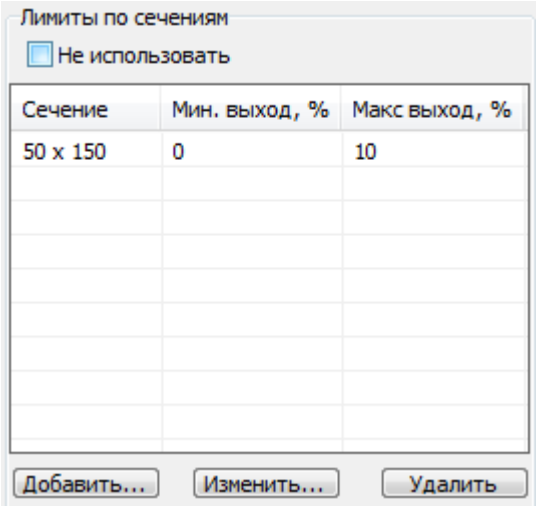
Depending on the number of cross-sections and the complexity of the optimization criteria, the calculation can take a long time.

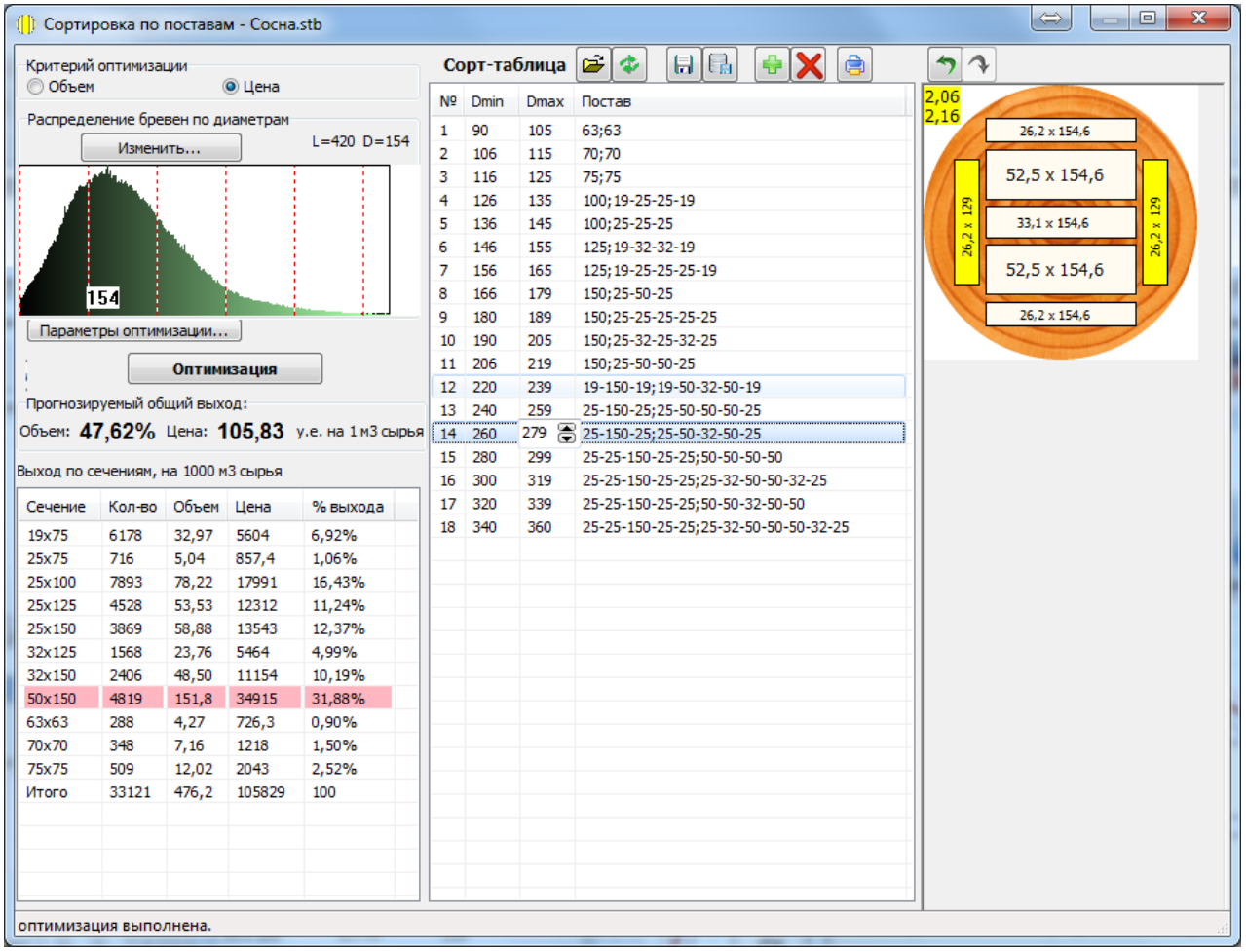


Optimization in order to achieve the required output by cross-sections

In section "Optimization parameters" – "Cross-section limits" you can set the desired output by individual cross-sections.

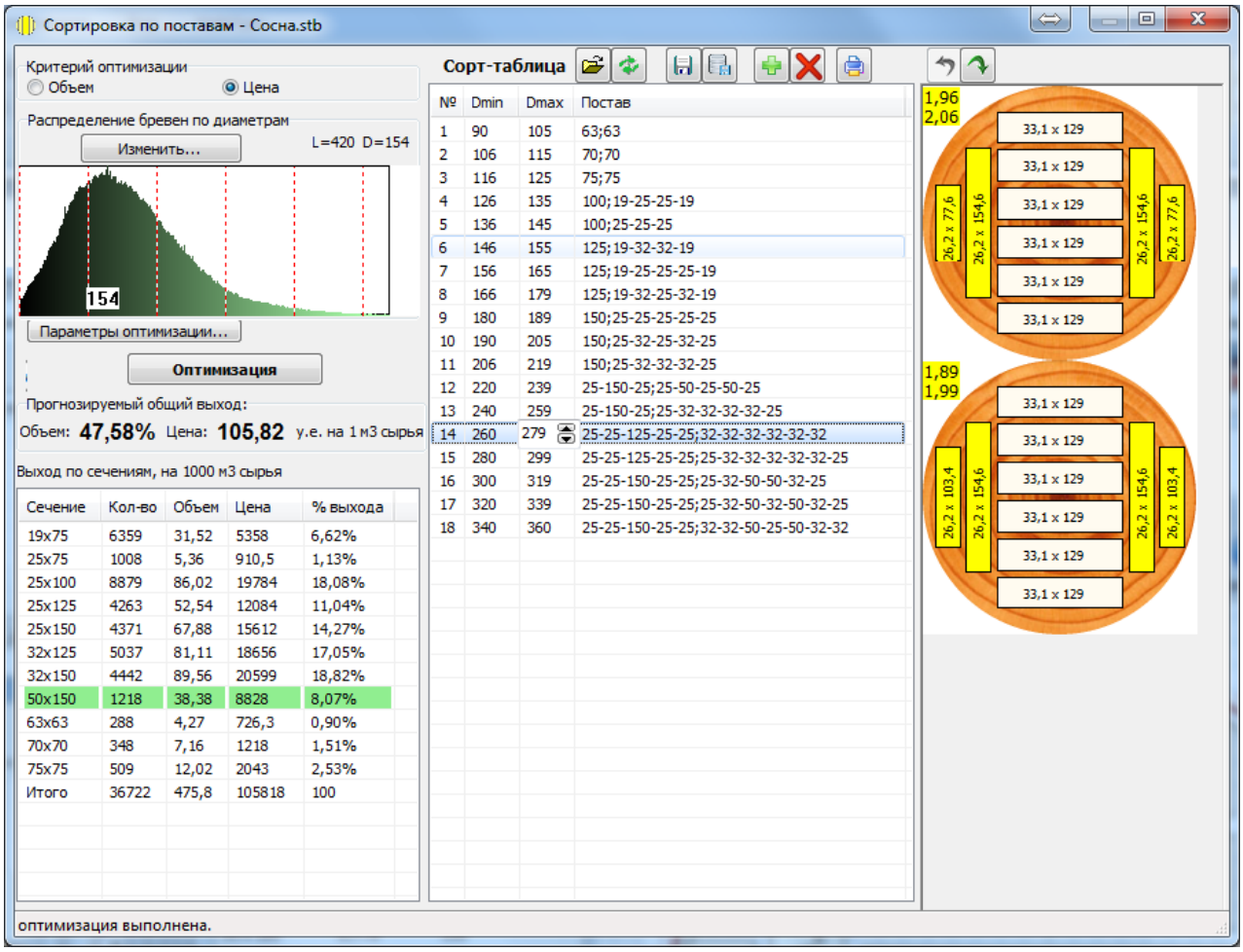
For instance, in the example from the previous screenshot we are not satisfied with that 31.88% of the total output falls on a 50x150 cross-section. We will set a limit for this cross-section - no more than 10%. To activate this limitation, we need to uncheck the box "do not use".





The cross-section we are interested in is highlighted in red which means that the limitations set on it are not followed.

Rerun the optimization.



As a result of optimization we got the output of cross-section 50x150 in the required limits, and the total output fell insignificantly.

Comparing results before and after optimization

The buttons Undo-Redo  allow you to go back to the previous results and compare the results before and after the optimization.

Report printing

The button  allows you to display a report containing the sorting table with sawing schedules, the expected total output and output by cross-sections. On separate pages there are sawing schedules for all log diameters. The report can be printed or saved as PDF-file.

11. Interaction with software for log sorting and wood workshop

The program SawsOptimization, version Professional Plus, works in a complex and maintains a single database with other products of AVTOMATIKA-VEKTOR:

- ☆ Program for "traditional" log sorting LSort: the opportunity to get the statistics of raw materials distribution by diameters and other dimensional factors (taper, curvature, length) form the sorting and use it in calculations.
- ☆ Program for "smart" log sorting OptiGrade based on the scanner Vektor-3D. Compared with the traditional method of sorting based on the top diameter, "smart sorting" can significantly increase the output due to the fact that it takes into account both the intended cutting methods and the exact 3D-model of each log, which takes into account all its individual characteristics, such as taper, curvature and ovality.
- ☆ Program for optimal log positioning in wood workshop OptiSaw. Based on the 3D-model of log obtained from the scanner Vektor-3D at the entrance to the wooden workshop and the known sawing schedule, the program OptiSaw controls the log rotation and positioning in order to reduce the wane presence and to get the maximum output.

Launch parameters

In order to integrate the program with other software (in particular, with software for log sorting and counting developed by AVTOMATIKA VEKTOR), when you start the SawsOptimization program, you can send it a line of parameters like this:

```
-d=220 -l=5.3 -sbeg=0.9 -ByPrice -profile="Frame flow" -set="Set 1"
```

Here:

`-d=220`	log diameter, mm
`-l=5.3`	log length, m
`-sbeg=0.9`	Taper, cm/m
`-ByPrice`	Optimization by price (otherwise by volume)
`-profile="Frame flow"`	equipment profile name
`-set="Set 1"`	cross-section set name

When you start with these parameters, the program will automatically calculate the corresponding sawing schedule. If one copy of the program is already being started, then a new copy will not be created, the calculation will be done by the running copy.

Contacts

AVTOMATIKA-VEKTOR is a leading Russian company developing and introducing the automated sawmill control systems.

The company's flagship products are the family of log scanners “Vektor” and the automatic system of boards sorting “RuScan”.

You can get the information on technical solutions proposed by us on the web-site www.a-vektor.ru

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