CutLog®

Module: Sawlog sorting optimization

User guide

http://www.cutlog.com

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***CutLog*® -** Module Sawlog sorting optimization
User guide

Content

1. Introduction

Sawlog sorting optimization (SSO) is additional module to CutLog™. For details about CutLog's functionality please refer to CutLog user guide.

2. Module – Sawlog sorting optimization

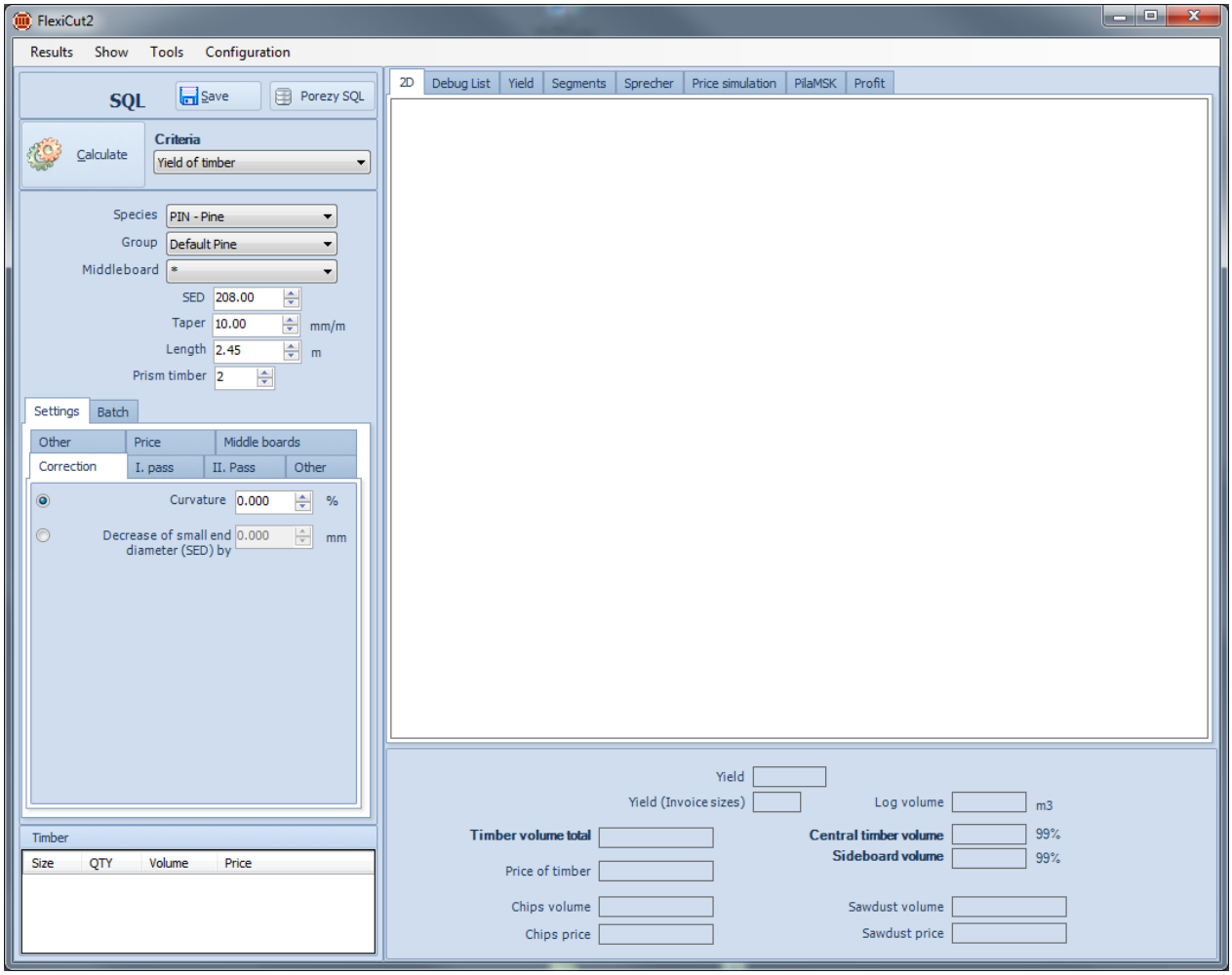
This module is available as standalone additional functionality of CutLog software. For working with SSO is necessary to have CutLog already installed.

In case, that you already have bought CutLog, it is necessary to have new software license key. License for SSO is not transferrable from one CutLog license to other.

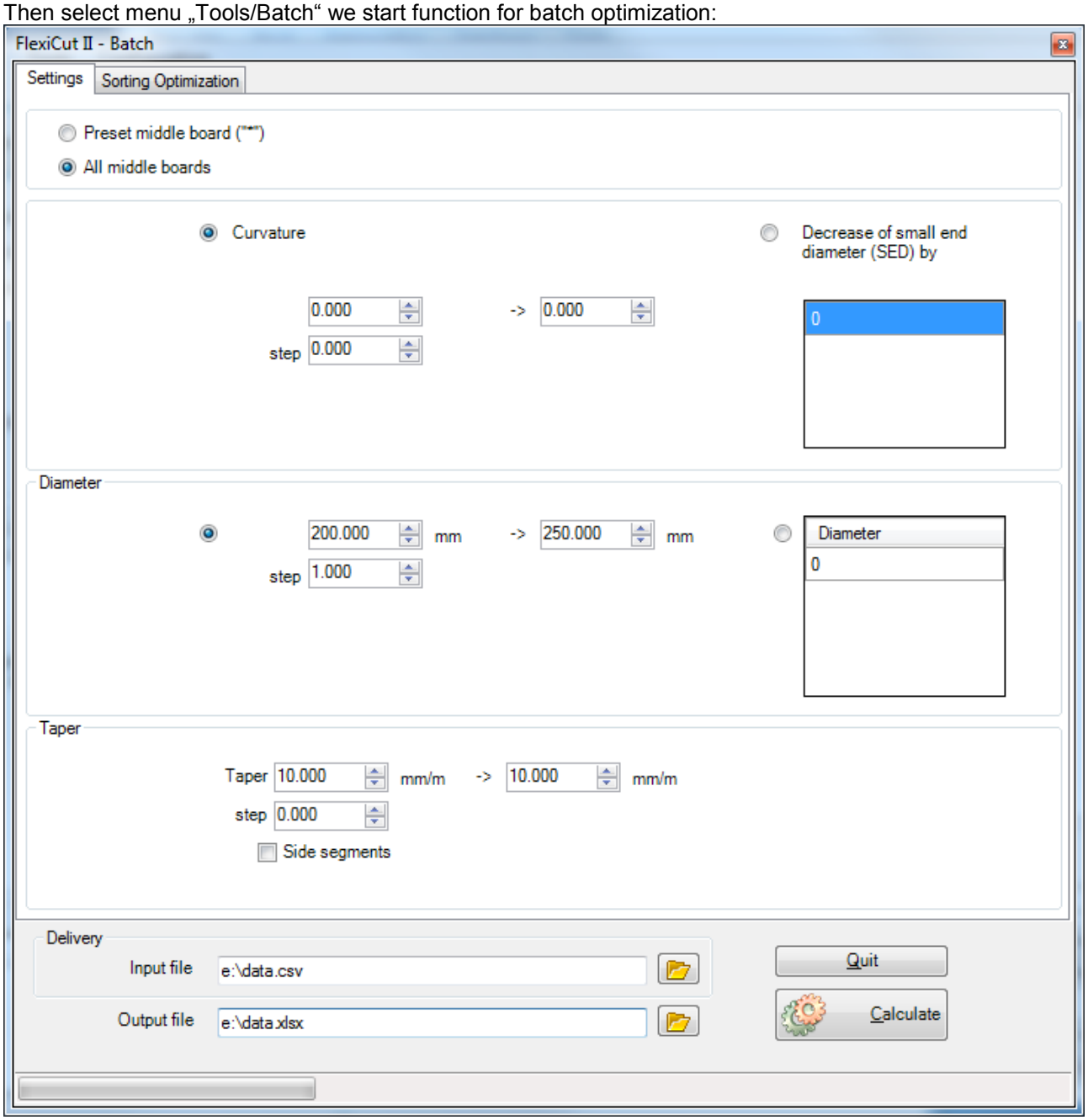
3. Precalculation

Before SSO itself, is necessary to prepare appropriate data. Input data for SSO are prepared in optimization function ***FlexiCut2.***

In first step is necessary to set parameters in FlexiCut2 (the same way, you are working every day). For example:



Then select menu „Tools/Batch“ we start function for batch optimization:



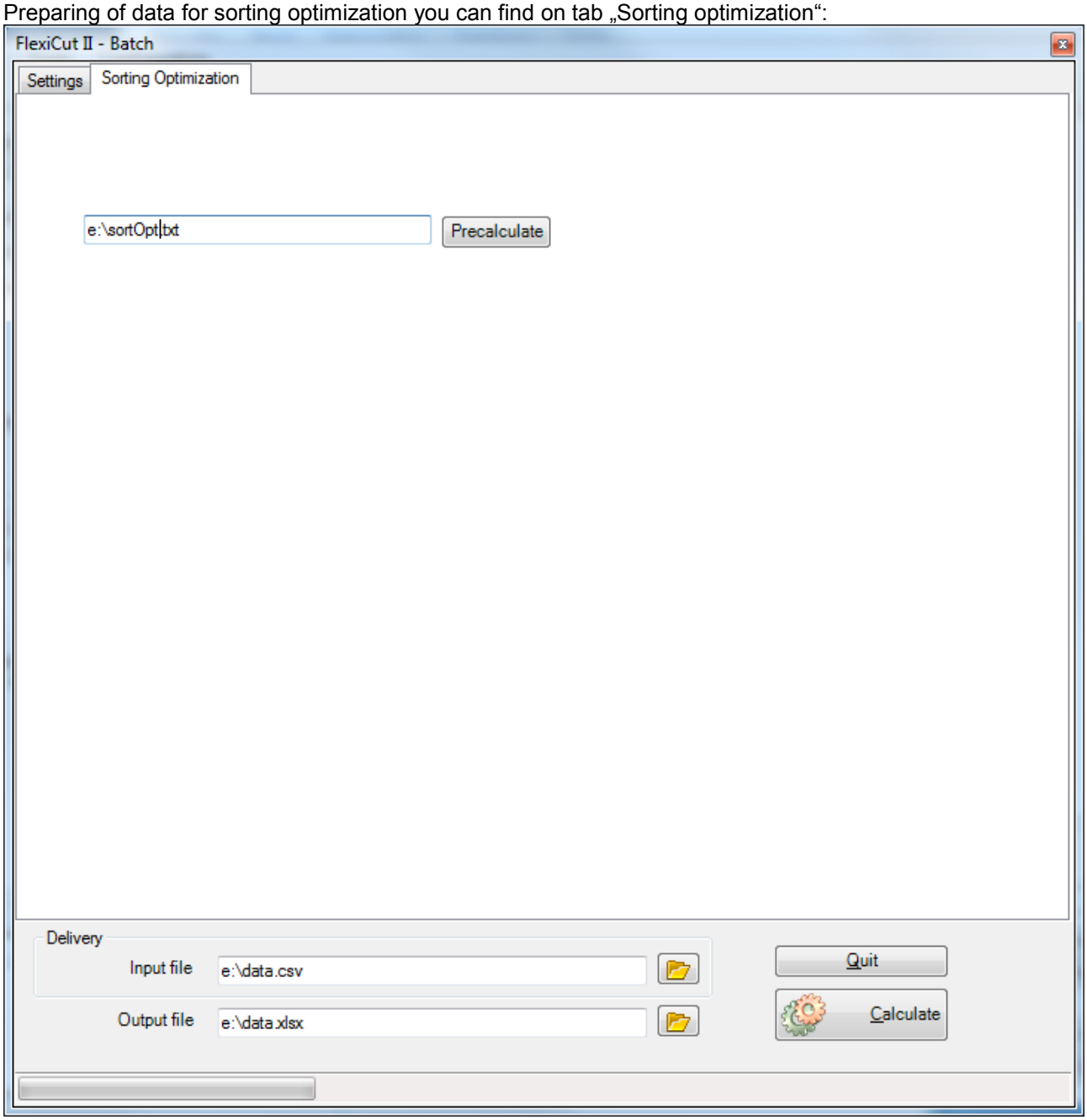
We have set optimization for diameters 200mm to 250mm with step of 1mm.

Here we can choose the way, how middle boards will be selected into results:

„Preset middle board“ – optimization will be run only on board selected in main FlexiCut2 screen. So it can be either „*“ for the best middle board or selected.

„All middle boards“ into batch process will be added all middle boards also. It means, that optimization will be made for each middle board separately for combination *diameter-curvature-taper*. ***This choice is reccomended***.

Preparing of data for sorting optimization you can find on tab „Sorting optimization“:



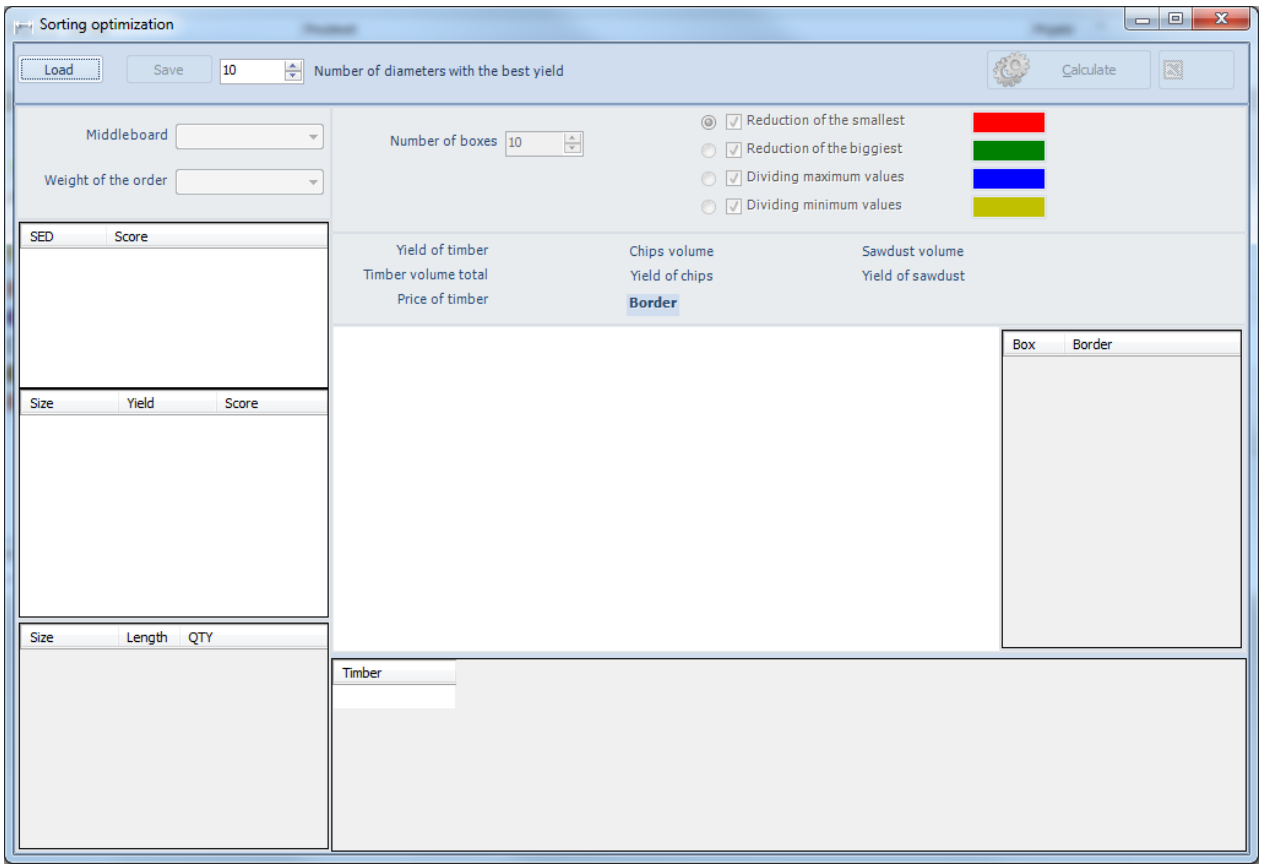
On the second tab we just set output filename and press „Precalculate button“. Resulted file is input file into sorting optimization function.

4. Sawlog sorting optimization

This module can be found in menu „`Tools / Sorting optimization`“.

Optimisation itself consist from two steps:

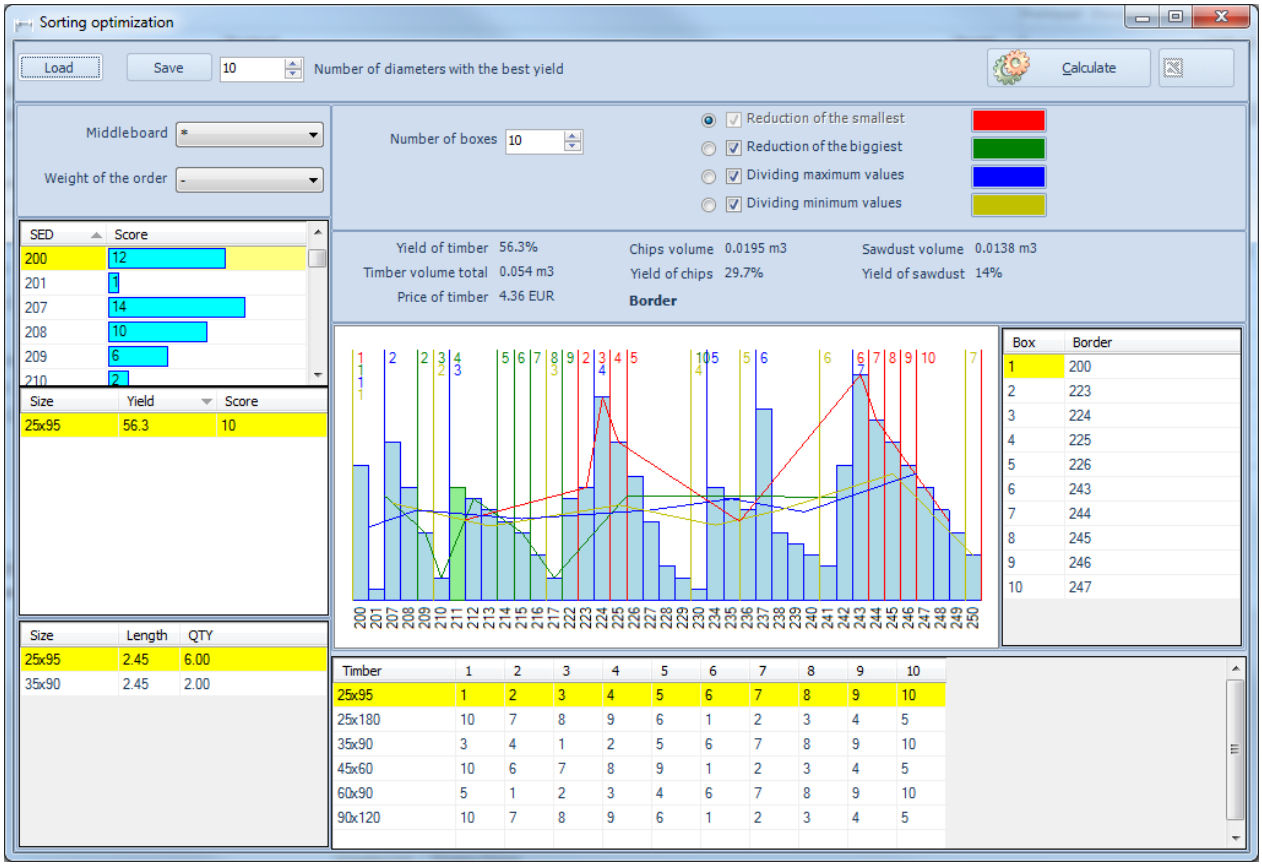
1. Proposition of sorting boxes
2. For each middle board making order of boxes by priority from where is appropriate to take sawlogs for production



For the beginning is necessary to load file, which has been precalculated in previous step in FlexiCut2's batch export or file saved from this function/

Important: Button save is intended for saving boxes settings together with input data.

After loading of file, you get this screen:



In the left panel on top there is list where is on each line diameter (SED) and appropriate score (counting of score is described later). Mouse click on column header you can resort lines base on that column.

Below diameter list (in case, that middle board is chosen: „*“) is list of timber sizes, which are included in resulted score. There is board size, yield for selected diameter and score. List is sorted base on yield of listed timbers.

Bottom table on left. There are all boards, which you get by sawing of selected diameter and selected middle boards.
For example as result of sawing for diameter 200mm, middle board 25x95 you get listed boards (see Picture above)

On the left side there is list of algorithms for making borders between sorting boxes. There are four possible algorithms:

1. Reduction of the smallest
2. Reduction of the biggest
3. Dividing maximum values
4. Dividing minimum values

All will be described later. For each algorithm you can show borders (checkboxes near to each type) or select which of them will be modified by user (which results). In addition double-click on particular color field, you can change color of box borders.

“Number of boxes” field means number of sorting boxes.

Below are the results for selected diameter and middle board (Yield, Timber volume, Chips volume…)

Below results you can find chart. On X axis there is log diameter (SED – small end diameter) and on Y axis is score (described later). Also optimization on selected number of boxes is made and marked on chart

together with numbers, base on selected algorithms. For each optimization method are joined average score values in particular boxes. Each sorting optimization is shown by different color and can be hidden.

Under chart is important table. Base on selected algorithm you can see one row for each middle board.
In one column you can see sorting boxes numbered from 1 to requested value.
So, for particular middle board you have numbered boxes from 1 to 'n' = number of boxes.
It means, that box with number 1 has the best average yield for particular timber. Then box number 2 has the second best yield… In practice this means, that for producing of particular timber is the best to take sawlogs from sorting box with number '1', then from box with number '2' etc…

Button [SAVE] you can use for saving results into file. There is also input data saved into output file. So In saved file is everything: input data and sorting boxes borders. You can load that file later and continue with working on it.

Proposed borders of sorting boxes is possible to change manually:

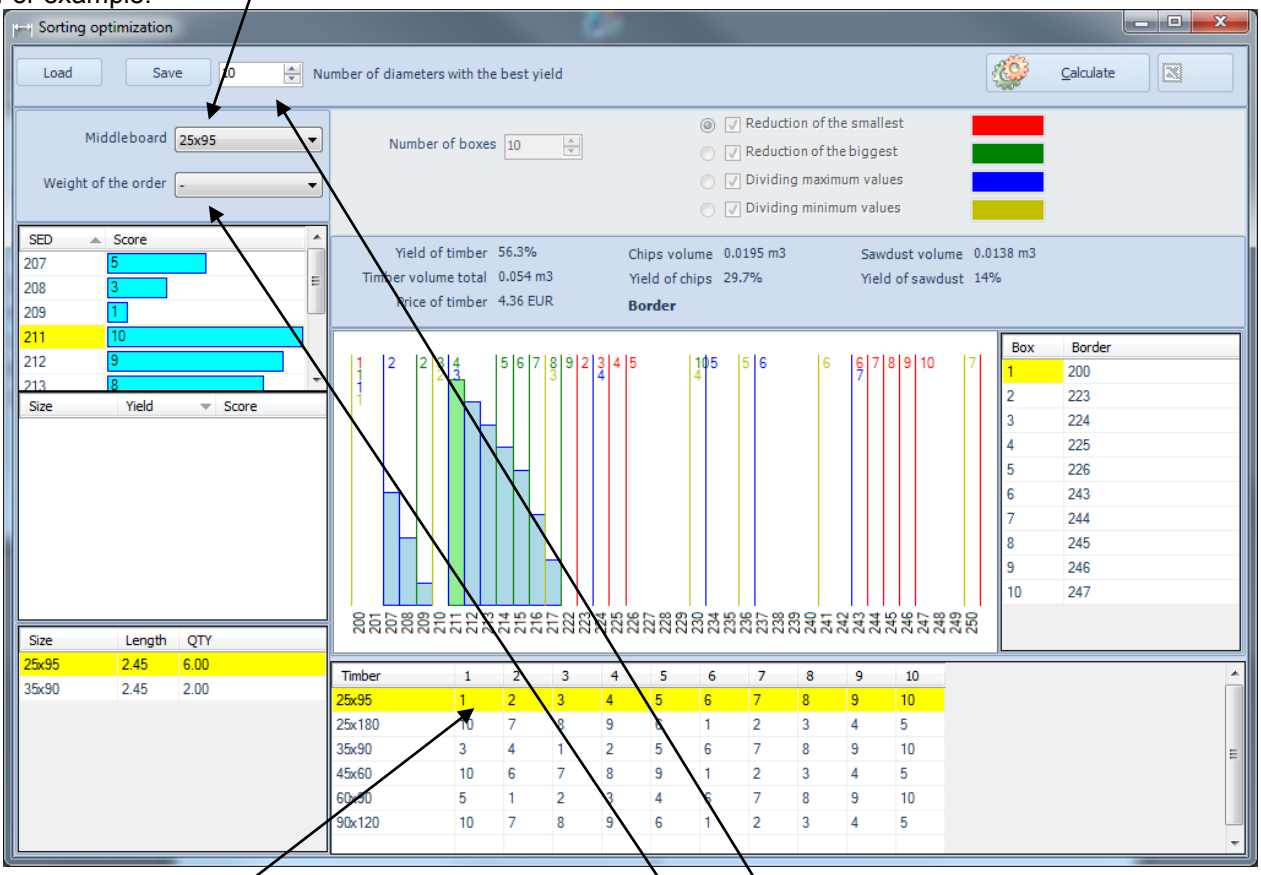
1. By moving mouse cursor in chart, you can see green line below it. With it you can move borders. Split or join boxes.
2. You are editing only boxes, which are part of selected optimization algorithm.
3. You can move borders between boxes. After changing boxes also bottom table is recalculated.
4. You can join two boxes. Just press mouse right click and select Join.
5. Existing box is possible to split. Just press mouse right-click inside the box and choose „split". Instead of this you can use „double-click" inside the box.
6. You are modifying boxes belonging to selected optimization algorithm.

Second option to change borders:
On the right side of chart is table with box numbers and borders. You can directly change borders there. Of course within borders of previous and next box.

After editing of boxes is automatically recalculated bottom table.

Above of list of diameters, there is field, where you can choose particular middle board score. (star - * - means cumulative score for all middle boards)

For example:



Picture shows 10 diameters, which has the best yield for middle board 25x95. There is also percentage yield shown in chart.

There is visible only selected number of diameters. (In this case it is 10)
From the bottom table is clear, that for selected optimization (= reduction smallest) is the most optimal box #1, which has the best score (the best average yield). Then it is box #7 etc.

You can take in account also “importance” of boards by size, by selecting order number. Will be explained latter when score counting will be discussed.

4.1. Score

All optimizations works base on score counted from input data.
Score for any diameter is counted this way:

For selected middle board are all diameters sorted by yield of timber from the best yield to lowest values.
Then are scored assigned to each diameter from the biggiest value to zero. Biggiest value is the value entered into field "*Number of diameters with the best yield*". For example, for value '5' in mentioned fields.
(here can enter in account "importance" or weight of board. Each score can be multiplied by importance factor, see next chapter)

Middle board	Small end diameter (SED)	Timber yield	score
12x30	201	38,9	**5**
12x30	200	38,7	**4**
12x30	202	38,5	**3**
12x30	203	38,2	**2**
12x30	204	37,9	**1**
12x30	206	37,7	**0**
12x30	212	37,6	**0**
12x30	205	37,5	**0**
12x30	211	37,5	**0**
12x30	207	37,4	**0**
12x30	213	37,3	**0**
12x30	208	37,1	**0**
12x30	214	37	**0**
12x30	209	36,7	**0**
12x30	215	36,7	**0**
12x30	217	36,5	**0**
12x30	210	36,4	**0**
12x30	216	36,4	**0**
12x30	218	36,2	**0**
12x30	224	36,1	**0**

This way is calculated score for all middle boards.
For particular diameters are score values ***cumulated.***

In case, that for some diameters is yield the same, then biggiest score is assigned to lower diameter. It means, that table above is sorted by yield (from the biggiest to lowest) and by diameter (from lower to bigger).

Greater score means, that it is more universal diameter for different sizes of timber.

4.2. Influence of "weight" or importance of boards on score

In default sort optimization counting has each board the same importance. For example board size produced once a year has influence on board produced every day, in meaning of sorting optimization. This is not always good. For this you have possibility to take this importance/weight into an account. So score counter in previous page can be multiplied by appropriate "factor of occurence", How it is counted?

For example, your daily board production:
10x20... 20m^3
10x25... 30m^3

Then board factor for 10x20 is = 20/(20+30) = 20/50 = 0,4
And for 10x25 je = 30/(20+30) = 30/50 = 0,6

So appropriate score in table for board 10x20 is multiplied by 0,4 and for board 10,25 is multiplied by 0,6

After this are score tables counted together base on diameter and further optimizations are made.

This quantities are entered into CutLog as orders.

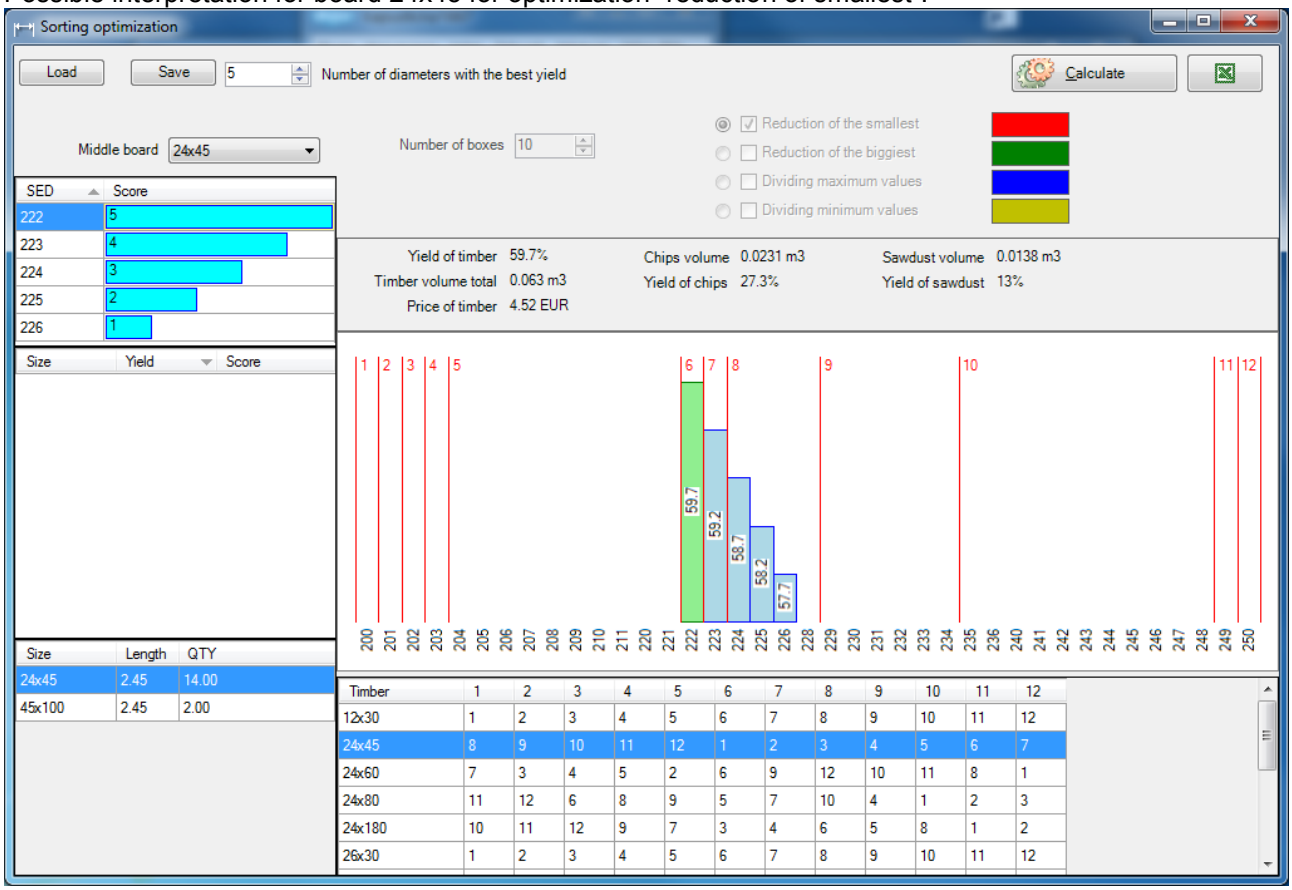
However, if you want to use orders for sorting optimization as factor modification, then order must meet some requirements:

1. Wood species of order has to be the same as wood species used in precalculation whithin FlexiCut2 function
2. Board sizes counted from batch function in FlexiCut2 must be all presented in order and must have non zero quantity

Only when these conditions are met then particular order can be choosen.

4.3. Interpretation

Possible interpretation for board 24x45 for optimization “reduction of smallest”:



For production of board “24x45” is the best to use sawlogs with diameters 222, 223, 224, 225 and 226mm. (five diameters with the best yield).

But, after sorting into 10 boxes. You should use for producing boards 24x45 box #6 then box #7, then box #8 etc. see picture above.

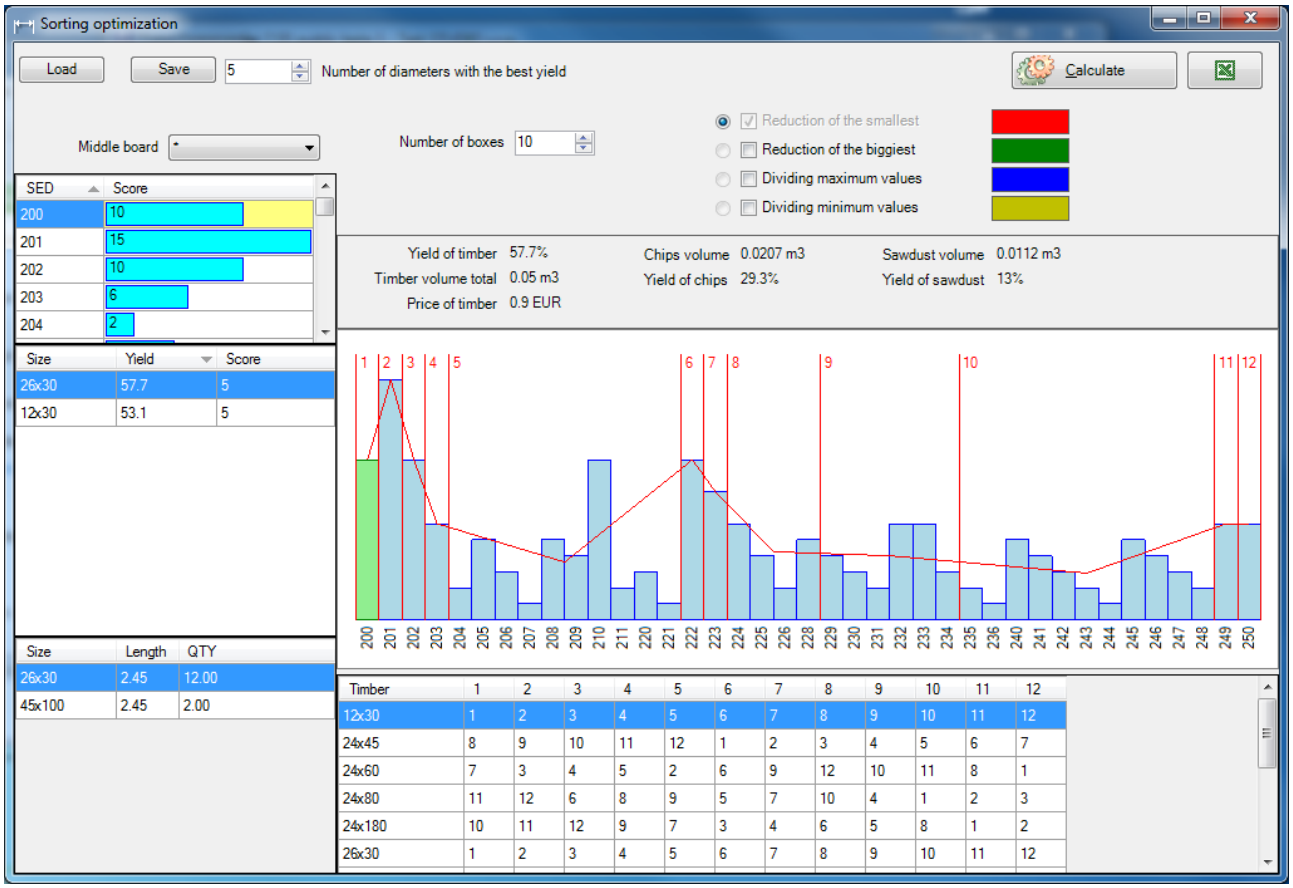
This prioriting of boxes for particular board is counted base on average yield for particular middle board within sorting box. For all diameters in box available for particular middle board, not only first five diameters. Then are all boxes sorted by counted average yield in box. Box with the biggiest average yield has the biggiest priority (= number 1), box with second biggiest average yield will be number #2 etc…

In the picture above there are only first five diameters, because those was important for optimization. But for counting of box priority for particular middle board are taken all data from precalculation.

4.4. Optimization

There are four different methods of optimization. It is up to user, which optimization method he will choose. All results can be modified base on user needs. User can also save the results for later use.

Reduction of the smallest



Assumption: Diameters with greater score, should be sorting separately and diameters with the lower scores can be merged into one sorting box.

Method:

Let's take chart similar to previous picture. On the beginning of optimization there is number of boxes equal to number of available diameters for which we have input data (created from FlexiCut2 optimization). Our task is reduce number of boxes to requested value.

In each iteration we split two boxes into one. (remove one box). Iterations are repeated until number of boxes are not on requested value.

STEP 1

Box (diameter)	***Score***	***Contains diameters***
205	9	*205*
206	3	*206*
207	4	*207*
213	2	*213*
214	***1***	***214***
218	5	*218*

1. We find box with the lowest score. In our case it is 214
2. For particular box (214) we found neighbor box, which has lowe score. In our example it is box (= diameter) 213
3. New sorting box will contain sawlog diameters 213 and 214 and new average score will be 1.5
4. *(steps 1 – 3) are repeated until number of boxes is not equal the value we need*

(further steps are for illustration, how optimization works)

STEP 2

Box (diameter)	***Score***	***Contains diameters***
205	9	*205*
206	3	*206*
207	4	*207*
213	***1,5***	***213,214***
218	5	*218*

5. We found box (=diameter) with the lowest score, in our case it is 213
6. For this box (213) we found neighbor box, which has lower score, it is box 207 (score = 4)
7. New box, will contain diameter (=boxes) 213, 214 a 207, new scóre will be average = 2,333 (average of score 213,214 a 207)

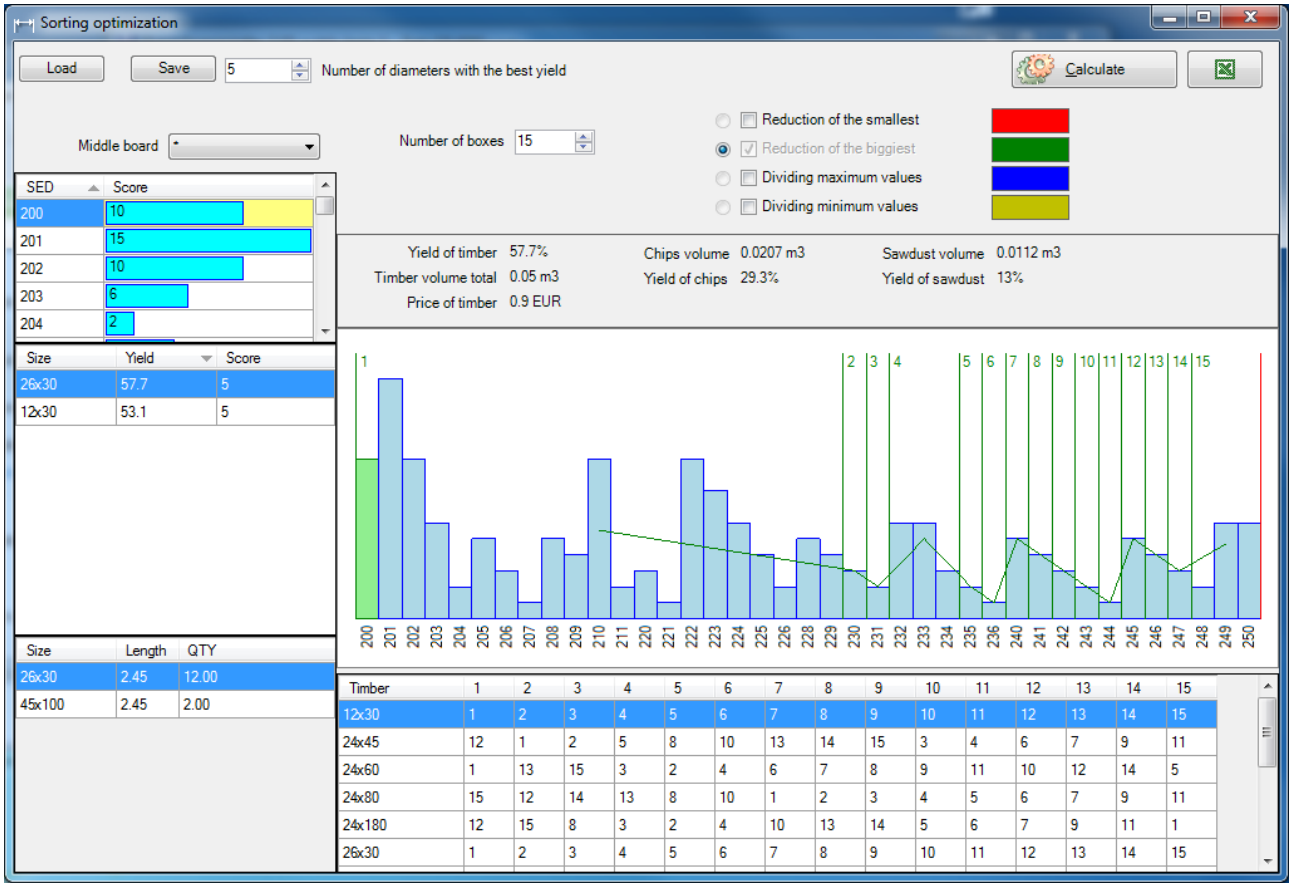
STEP 3

Box (diameter)	***Score***	***Contains diameters***
205	9	*205*
206	3	*206*
207	2,333	*207,213,214*
218	5	*218*

Results ar 4 sorting boxes:

Box number	***Diameter from***
1	205
2	206
3	207
4	218

Reduction of the biggiest



Assumption: Diameters with greater score can be cumulated. This way is preserved greater average yield.

Method:

Let's take chart similar to previous picture. On the beginning of optimization there is number of boxes equal to number of available diameters for which we have input data (created from FlexiCut2 optimization). Our task is reduce number of boxes to requested value.

In each iteration we split two boxes into one. (remove one box). Iterations are repeated until number of boxes are not on requested value.

STEP 1

Box (diameter)	***Score***	***Contains diameters***
205	***9***	***205***
206	3	*206*
207	4	*207*
213	2	*213*
214	1	*214*
218	5	*218*

1. We find box (diameter) with the greatest score. In our case it is 205
2. For this box (205) we find neighbor box, whith greater score. It is box 206.
3. New box will contain diameters 205 and 206 and new score will be 6 (it is average value from score 9 and 3).
4. *(steps 1 – 3) are repeated until number of boxes is not equal the value we need*

(further steps are for illustration, how optimization works)

STEP 2

Box (diameter)	***Score***	***Contains diameters***
205	***6***	***205, 206***
207	4	*207*
213	2	*213*
214	1	*214*
218	5	*218*

5. We found box with the greatest score. It is 205.
6. For this box we foung neighbor box with greater score. It is box 207 (score = 4)
7. New box will contain diameter (205, 206, 207) and new score will be average = 5.33

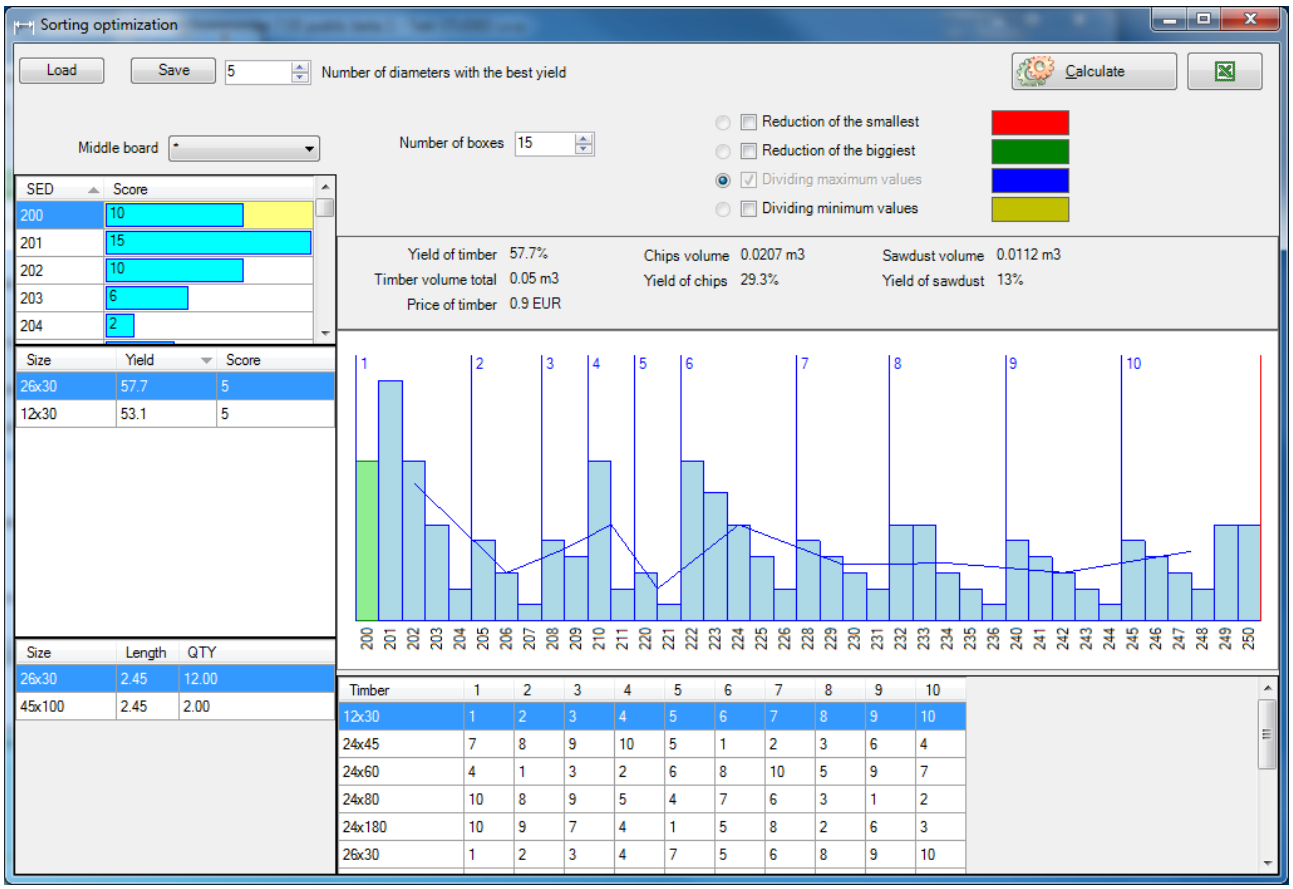
STEP 3

Box (diameter)	***Score***	***Contains diameters***
205	5,333	*205, 206, 207*
213	2	*213*
214	1	*214*
218	5	*218*

Results are 4 boxy:

Box number	***Diameter from***
1	205
2	213
3	214
4	218

Dividing maximum values



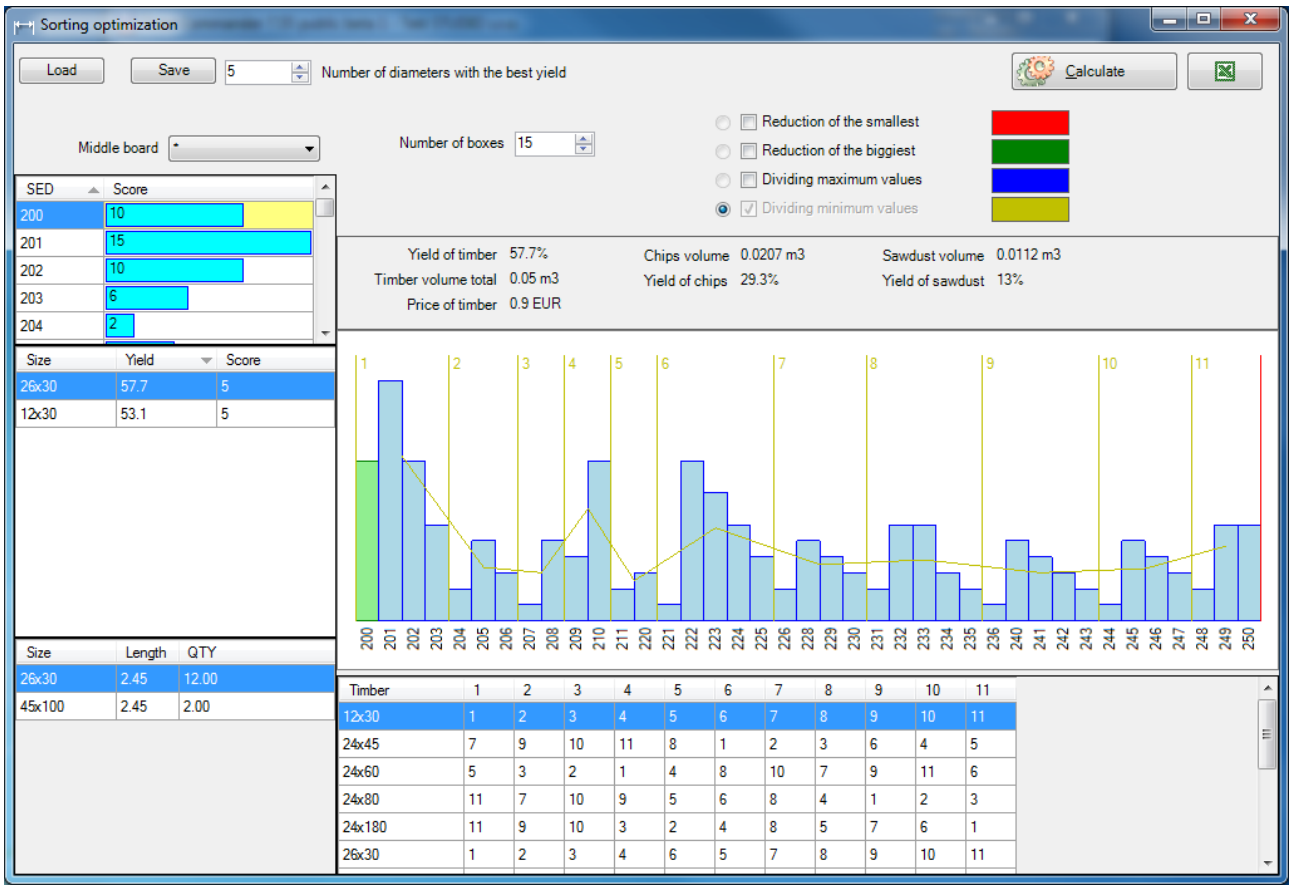
This optimization makes border between boxes on local maximum score (peak).
For example, in case of box *i* is it's score greater than score of box*i-1* and greater than score of box *i+1*, Special case is, that score of box *i+1* (*i+2*…*i+n*) is the same as score of box *i* but greater than *i+n+1*. Then border of box is set on first diameter – box *i*.

It means, that maximum number of boxes is equal to number of those 'peaks'.

Let's take number of peaks = ***m***. While is number of boxes lower (***x***), then previous box number ***i*** belongs to new box with number ***f*** (from interval ***1 – x***), where ***f = i * (x / m).***

It means, that in first step we found all peaks, where are borders of sorting boxes. Then base on needs are boxes merged.

Dividing minimum values



This optimization makes border between boxes on local minimum of score.

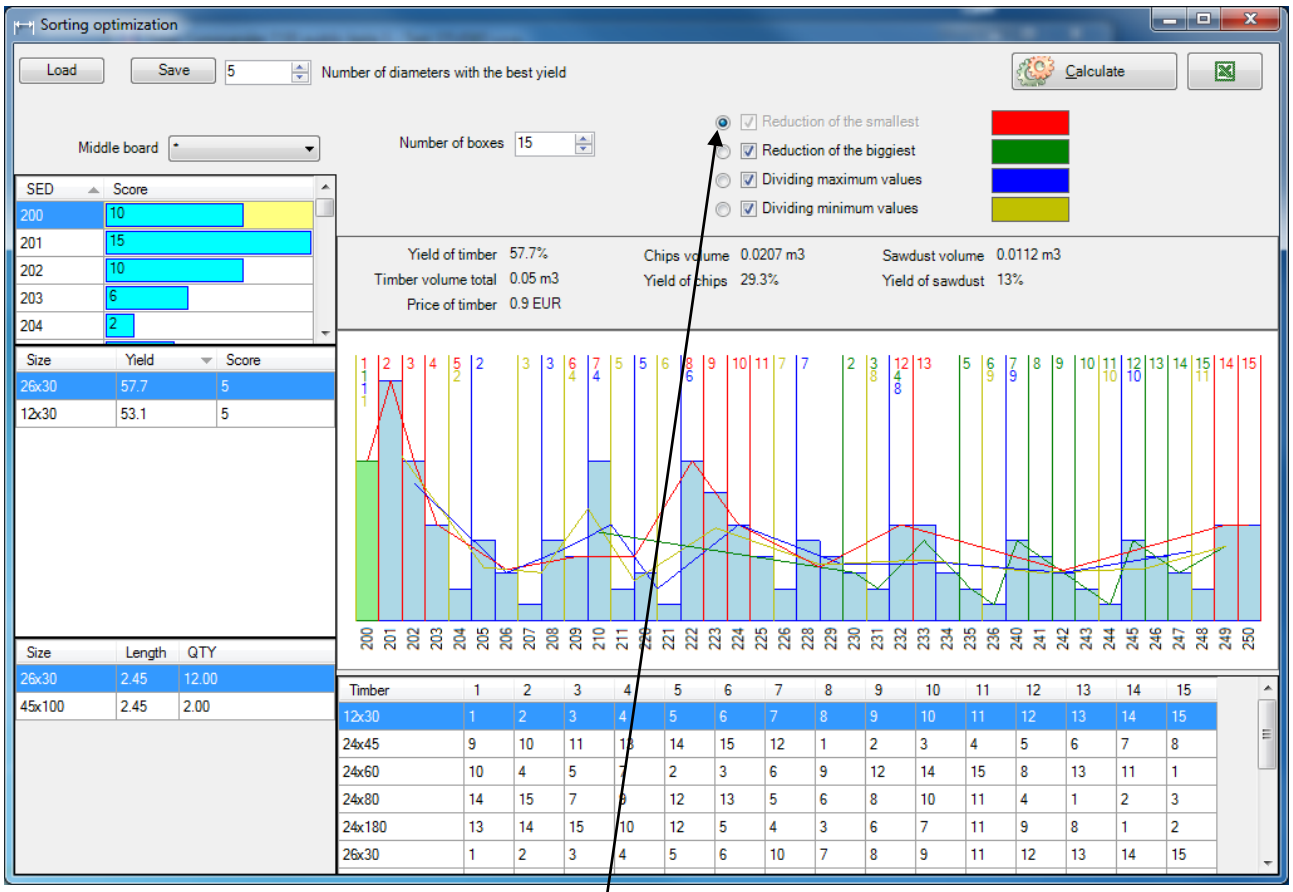
For example, in case of box *i* is it's score lower than score of box*i-1* and lower than score of box *i+1*, Special case is, that score of box *i+1* (*i+2*…*i+n*) is the same as score of box *i* but lower than *i+n+1*. Then border of box is set on first diameter – box *i*.

It means, that maximum of boxes is equal to number of those 'lows'

Let's take number of minims = ***m***. While is number of boxes lower (***x***), then previous box number ***i*** belongs to new box with number ***f*** (from interval ***1 – x***), where ***f = i * (x / m).***

It means, that in first step we found all minims, where are borders of sorting boxes. Then base on needs are boxes merged.

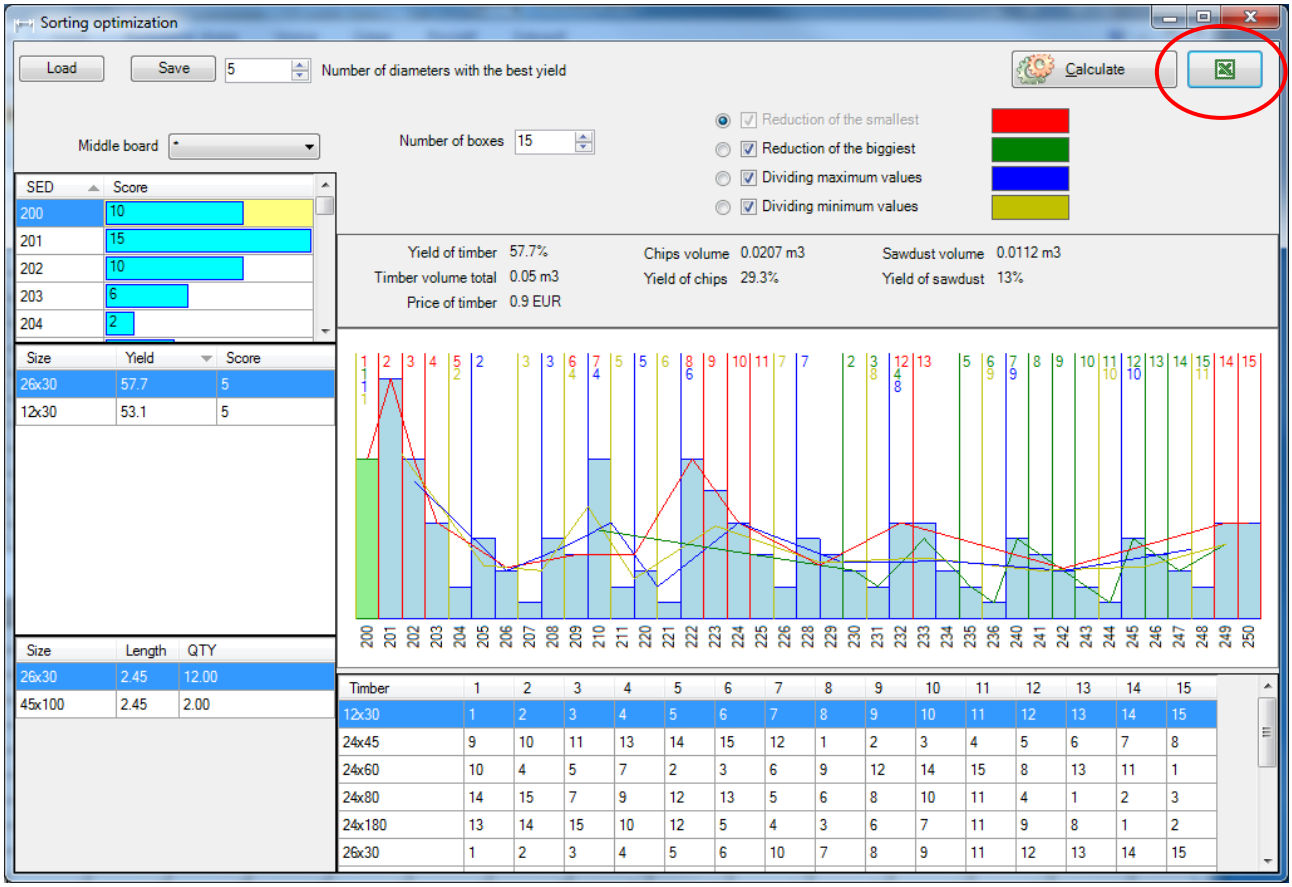
Cummulative results



In case, that all results are shown, then we have in one chart all optimizations shown in different colors. Double-click on color field you can change color for particular optimization. Modifying of boxes and lower table is bind to optimization, which is selected….

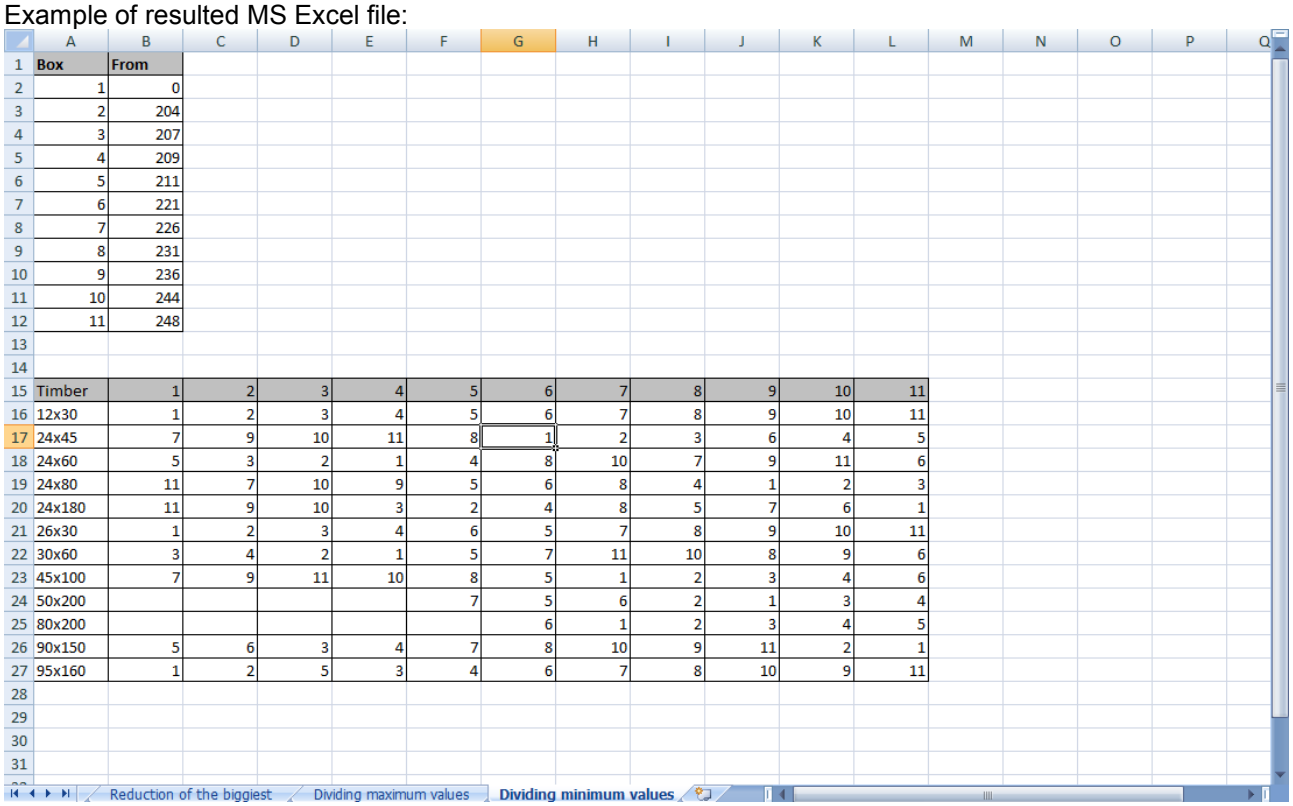
5. Export results

Results of optimization can be exported into MS Excel:



After press button [X] you are prompted for output file name.

Example of resulted MS Excel file:



Box	From
1	0
2	204
3	207
4	209
5	211
6	221
7	226
8	231
9	236
10	244
11	248

Timber	1	2	3	4	5	6	7	8	9	10	11
12x30	1	2	3	4	5	6	7	8	9	10	11
24x45	7	9	10	11	8	1	2	3	6	4	5
24x60	5	3	2	1	4	8	10	7	9	11	6
24x80	11	7	10	9	5	6	8	4	1	2	3
24x180	11	9	10	3	2	4	8	5	7	6	1
26x30	1	2	3	4	6	5	7	8	9	10	11
30x60	3	4	2	1	5	7	11	10	8	9	6
45x100	7	9	11	10	8	5	1	2	3	4	6
50x200					7	5	6	2	1	3	4
80x200						6	1	2	3	4	5
90x150	5	6	3	4	7	8	10	9	11	2	1
95x160	1	2	5	3	4	6	7	8	10	9	11

Reduction of the biggiest | Dividing maximum values | Dividing minimum values

You can see, that for each optimization method there is separate sheet.
Firstly, there is table, where you have sorting boxes. For each sorting box you have started sawlog diameter.

Below is table, where is for each middle board assigned particular box by priority.
So for example, base on image above. For timber 24x45 is the best to take sawlogs from box #6, where are sawlogs with diameters 221mm -225mm (or 225.9999, as you wish ☺)

Of course, base on selected optimization you get different results. It is base on your opinion and technology, which one to choose.

6. System requirements

System requirements are the same as requirements for CutLog software.

For running and using of software is necessary to fulfill some base requirements.
Systems base on Windows 95 and 98 are not supported, because they are obsolete.

Hardware – minimum requirements:

(base on Windows 2000 professional and .NET Framework 2.0 Redistributable)

Processor:	Pentium compatible processor 133 MHz or newer
RAM:	minimum 64MB
Hard Disk:	2GB
VGA:	1024x768 a greater resolution. At least 256 colors

Hardware – recommended:

(base on Windows XP professional system and .NET Framework 2.0 Redistributable)

Processor:	Pentium compatible processor 1 GHz or newer
RAM:	minimum 128MB
Hard Disk:	2GB
VGA:	1024x768 and greater resolution. At least 32 bit colors

Operating system:

Windows 2000 and newer
Windows 7 is recommended (32 or 64 bit versions)
CutLog software is compatible with Windows 7 and it can be used on both – 32 and 64 bit versions of system.

Others: For exporting into MS Excel, it is necessary to hav MS Office installed , or at least MS Excel

Links:

.NET framework 2.0 requirements:
http://msdn.microsoft.com/netframework/technologyinfo/sysreqs/default.aspx

Windows 2000 System requirements:
http://www.microsoft.com/windows2000/professional/evaluation/sysreqs/default.asp

Windows XP Professional system requirements:
http://www.microsoft.com/windowsxp/pro/evaluation/sysreqs.mspx

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Microsoft .NET Framework Version 2.0 Redistributable Package (x86)
http://www.microsoft.com/downloads/details.aspx?FamilyID=0856eacb-4362-4b0d-8edd-aab15c5e04f5&DisplayLang=en

Microsoft .NET Framework Version 2.0 Redistributable Package (x64)
http://www.microsoft.com/downloads/details.aspx?FamilyID=b44a0000-acf8-4fa1-affb-40e78d788b00&DisplayLang=en

Microsoft .NET Framework Version 2.0 Redistributable Package (IA64)
http://www.microsoft.com/downloads/details.aspx?FamilyID=53c2548b-bec7-4ab4-8cbe-33e07cfc83a7&DisplayLang=en