

Oxygen XRay Step by Step

14 October, 2008

OctoNus Software



1 Content

OXYGEN XRAY STEP BY STEP	1
1 CONTENT	2
2 INSTRUCTION.....	3
STEP 1. LOAD PHOTOS	3
STEP 2. CREATE 3D MODELS MANUALLY OR AUTOMATICALLY	4
<i>Start tool Photo checker to create 3D models</i>	<i>4</i>
<i>Create stone 3D model.....</i>	<i>5</i>
<i>Create inclusions 3D models.....</i>	<i>7</i>
STEP 3. MANUALLY CHECKING XRAY DATA, ADD AND REMOVE INCLUSIONS	10
<i>Checking inclusions.....</i>	<i>10</i>
<i>Delete incorrect inclusions.....</i>	<i>11</i>
<i>Add new inclusions.....</i>	<i>13</i>
STEP 4. SPECIFY INCLUSIONS TYPE	15
<i>Inclusions clarity</i>	<i>15</i>
<i>Sandwiches.....</i>	<i>16</i>
STEP 5. ALLOCATE DIAMONDS	19
3 APPENDIX. CREATING STL 3D MODELS BY THE CTAN PROGRAM	23
CREATING STL 3D MODELS BY THE CTAN PROGRAM.....	23
<i>Manual creating STL 3D models.....</i>	<i>23</i>
<i>Automatic creating STL 3D models.....</i>	<i>28</i>
SETTINGS FOR MANUAL CREATION STL MODELS IN THE CTAN PROGRAM	29
SETTINGS FOR AUTOMATIC CREATION STL MODELS IN THE CTAN PROGRAM	30
4 APPENDIX. EDIT APPRAISER UTILITY	34



2 Instruction

The Oxygen XRay is software developed to work with X-Ray data. The Oxygen XRay program uses X-Ray data and creates 3D model manually or automatically, allows to analyze inclusions, allocates diamonds and evaluates prices of solutions.

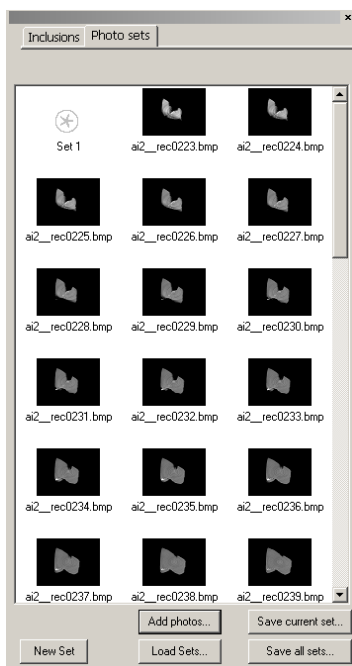
To allocate diamonds follow the instruction:

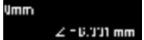
- Step 1. Load XRay photos
- Step 2. Create 3D models manually or automatically
- Step 3. Manually checking XRay data, add and remove inclusions
- Step 4. Specifying inclusions type
- Step 5. Allocate diamonds

Step 1. Load photos

Load XRay photos:

- Select tab **Photo Sets** in the **Microscope** working mode
- Press button **Add photos..**



Warning! The photos with XRay data should be without **Scale and labels** . Turn off **Scale and labels** option while getting XRay photos in XRay Scan System.

If need to delete Photo set:

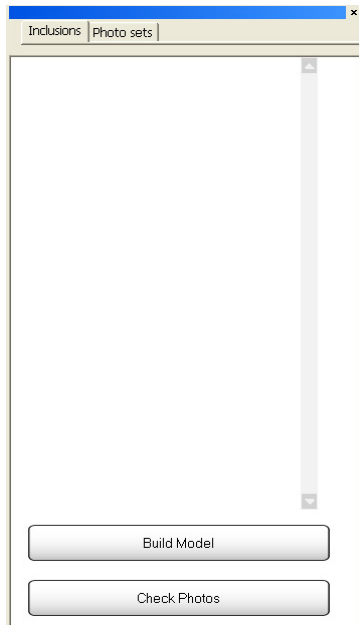
- Select  Set 1
- Press key **Delete** on keyboard



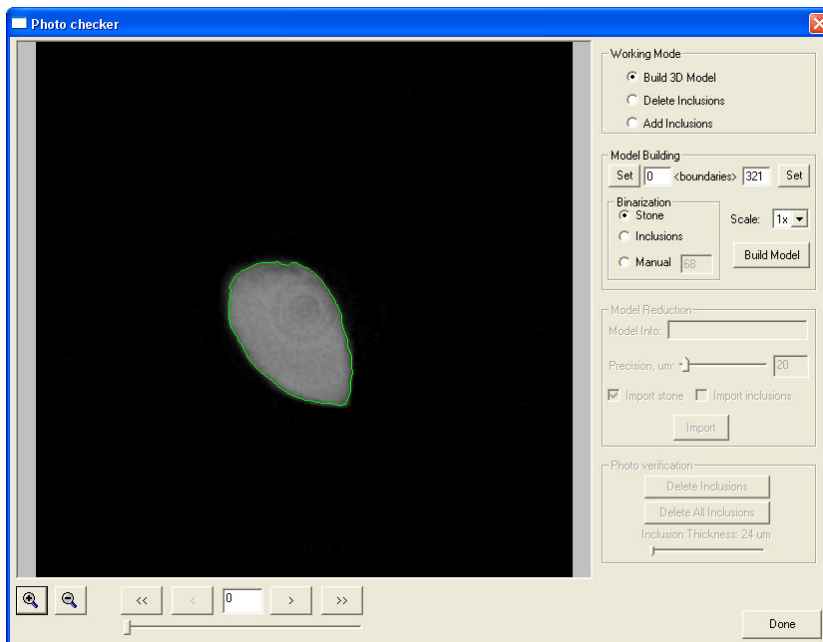
Step 2. Create 3D models manually or automatically

Start tool Photo checker to create 3D models

1. Press button **Build Model** in the tab **Inclusions**



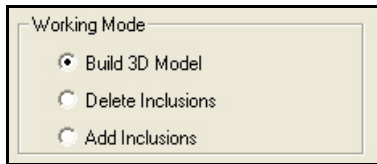
2. **Photo checker** dialog appears



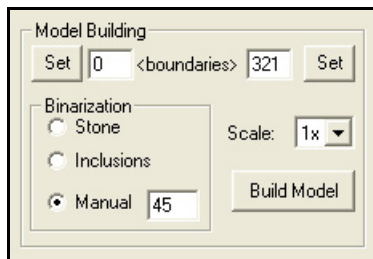


Create stone 3D model

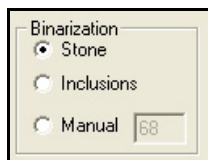
1. Radio button **Build 3D Model** should be selected in the section **Working mode**



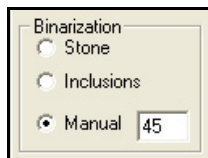
2. Select boundaries in the section **Model Building** if it is required:
 - a. Select start photo and press button **Set** on the left side
 - b. Select end photo and press button **Set** on the right side



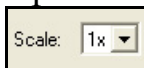
3. Select threshold mode in the section **Binarization**
 - a. To use automatic threshold select **Stone** option in the section **Binarization**



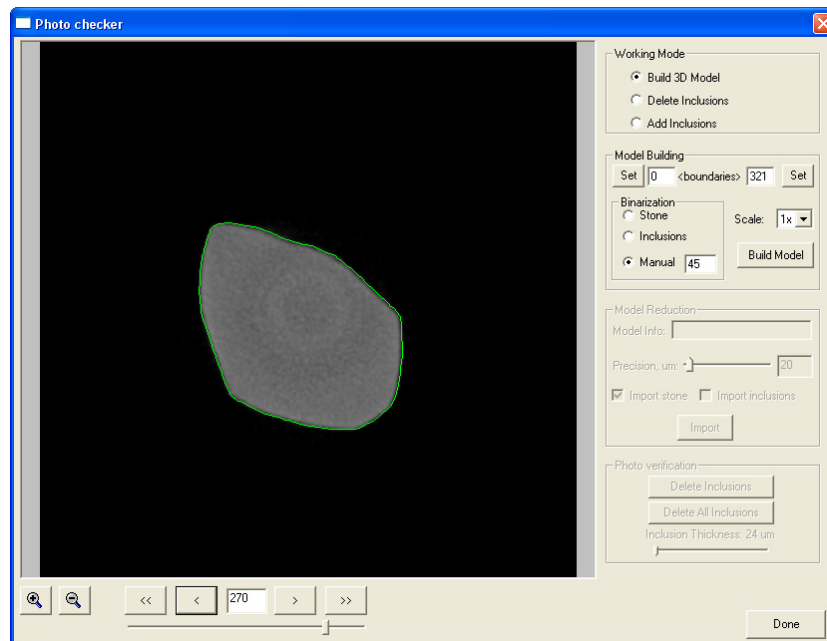
- b. To use custom threshold select **Manual** option and set the value









4. Option **Scale** allows to reduce size of photos before start building model



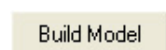
- Go through images and check that selected threshold value and boundaries are acceptable:



Note. To check photos:

- Use **Left** and **Right** arrows on keyboard or buttons  and  arrows to navigate between photos
- To start/stop slide show press buttons  and 
- Zoom with buttons   or mouse wheel

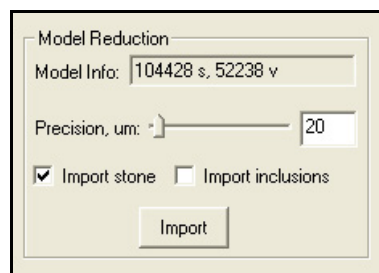
- Press button **Build Model** to start model building process



- The building process is proceeding



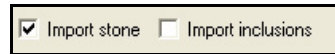
- Section **Model reduction** will become active when building process is finished



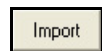


9. Select desired **Precision, um**

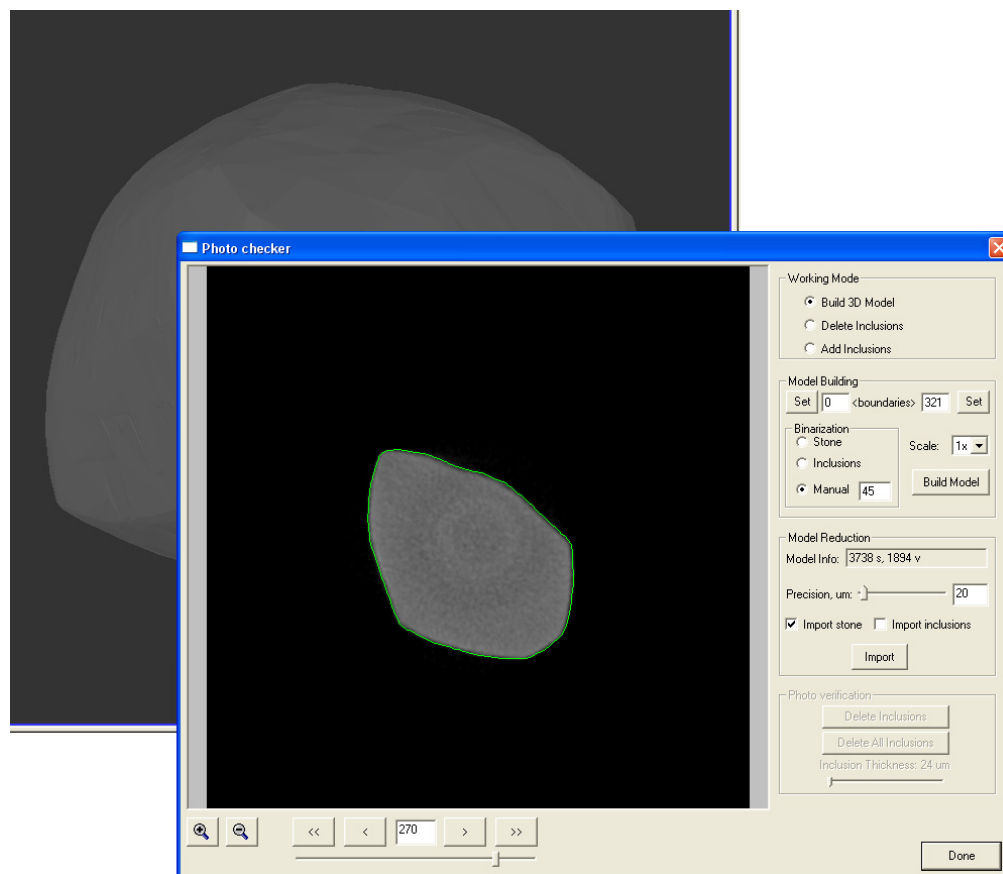
10. **Import stone** option should be selected



11. Press button **Import** to import stone model

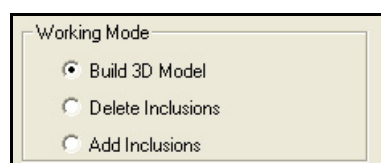


12. Stone model is ready. See it in Scene



Create inclusions 3D models

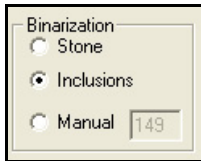
1. Radio button **Build 3D Model** should be selected in the section **Working mode**



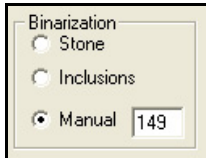
2. Select threshold mode in the section **Binarization**



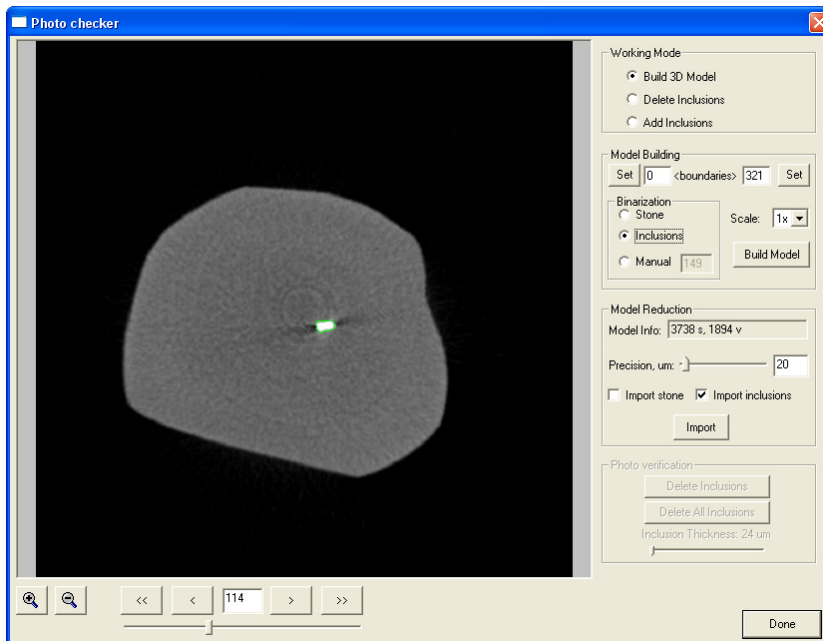
a. To use automatic threshold select **Inclusion** option



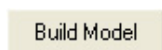
b. To use custom threshold select **Manual** option and set the value



3. Go through images and check that selected threshold are acceptable

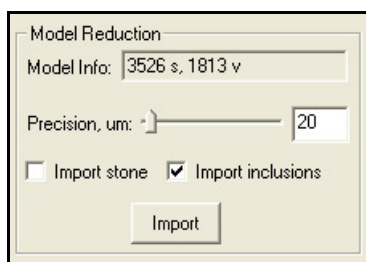


4. Press button **Build Model** to build inclusions models



5. Import inclusions models:

a. **Import inclusions** option should be selected in the section **Model Reduction**





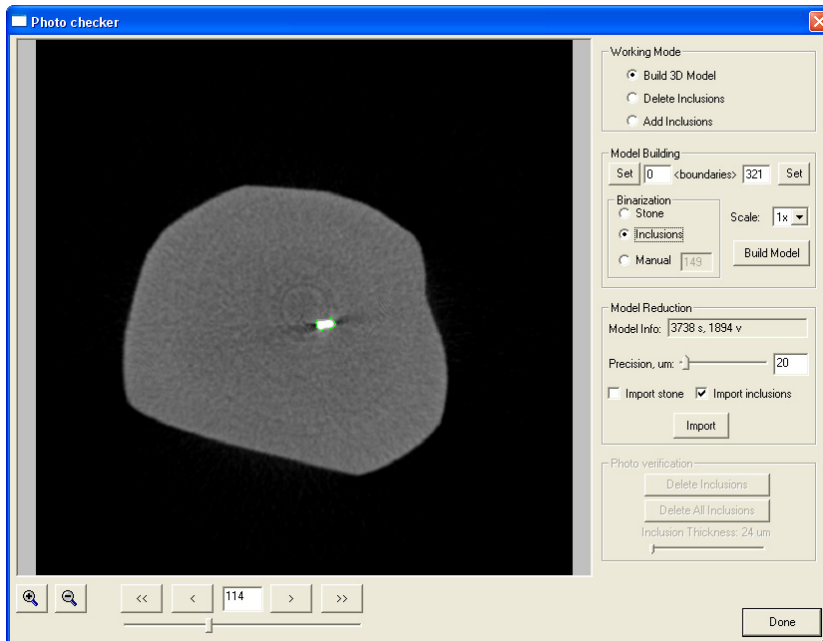
b. Select desired **Precision, um**

c. Press button **Import** to import inclusions models.

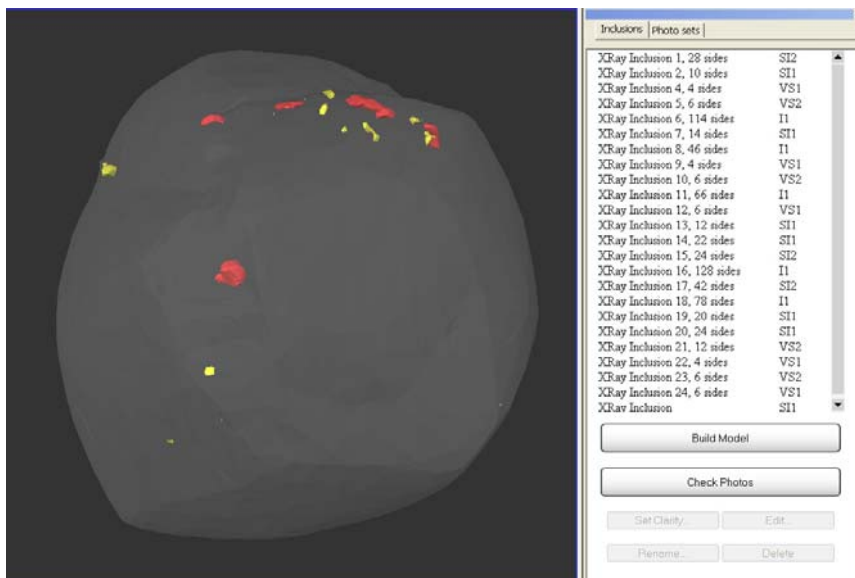


d. Inclusions models are ready

6. Press button **Done** in the **Photo checker** dialog



7. Model and inclusions are created





Step 3. Manually checking XRay data, add and remove inclusions

Warning. Please do the manual checking XRay data, add and remove incorrect inclusions!



Checking inclusions

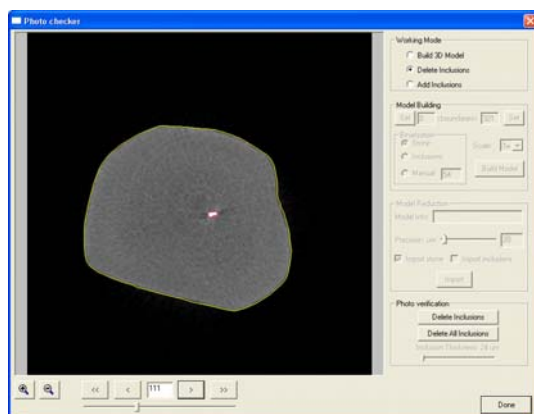
1. Press button Check Photos in the tab Inclusions



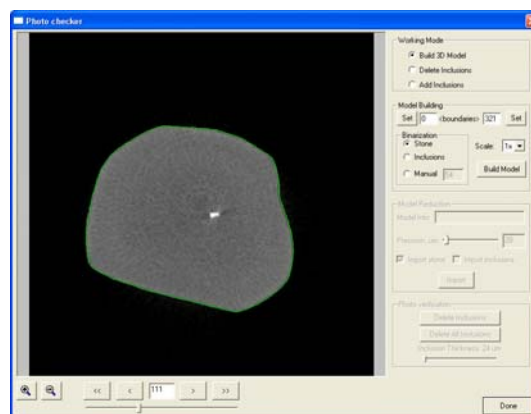
2. Dialog window **Photo checker** opens

The window **Photo checker** includes:

- XRay photo of stone profile with yellow contour around (in working modes **Add Inclusions** and **Delete Inclusions**)
- XRay photo of stone profile with green contour around (in working mode **Build 3D Model**)
- Inclusions on photo marked by red contours (in working modes **Add Inclusions** and **Delete Inclusions**)
- Zoom In  and Zoom Out  buttons
- Navigation control
- Working mode section, Binarization section and etc

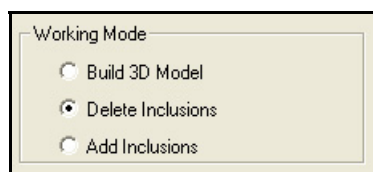


Working mode Delete Inclusions. Contours are yellow and red









Working mode Build 3D Model. Contour is green

3. Select mode **Delete inclusions** or **Add Inclusions** in the section **Working mode** to check, remove or add inclusions manually.

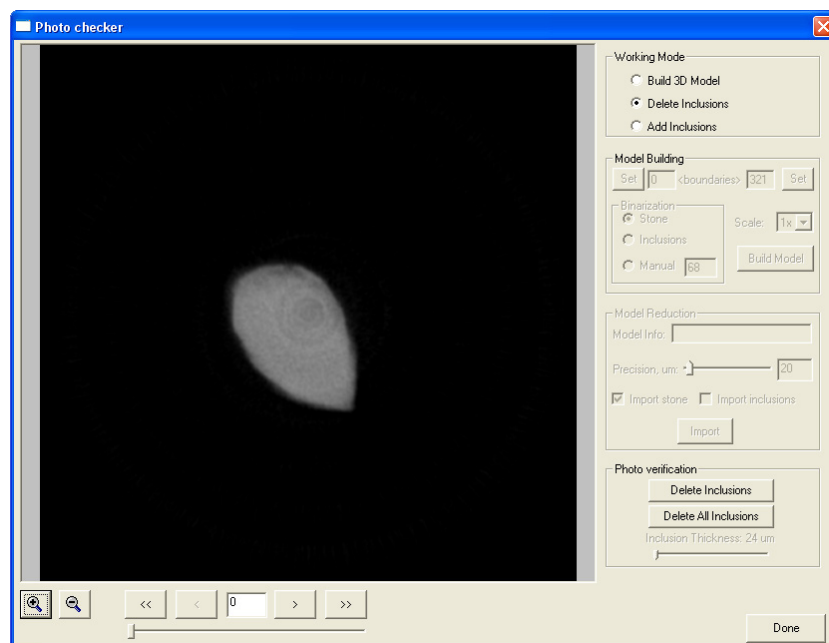


To check photos with inclusion:

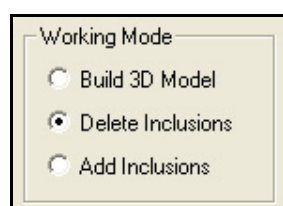
- Use **Left** and **Right** arrows on keyboard or buttons  and  arrows to navigate between photos
- To start/stop slide show press buttons  and 
- Zoom with buttons   or mouse wheel

Delete incorrect inclusions

- Press button **Check Photos** in the tab **Inclusions** and open dialog **Photo checker**

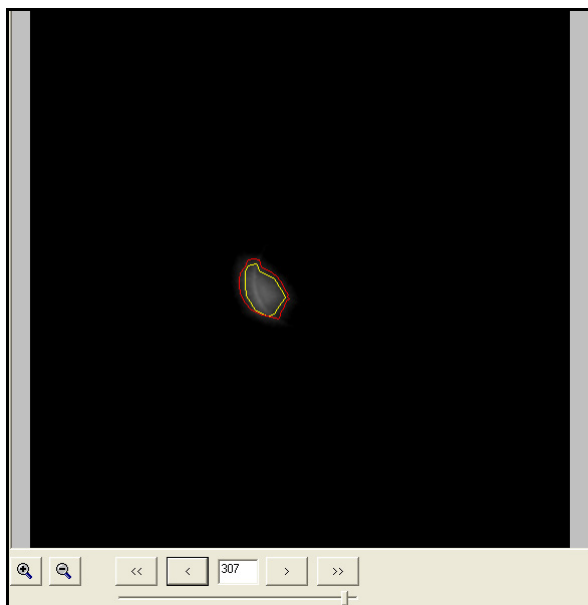


- Option **Delete Inclusions** should be selected in the section **Working mode**

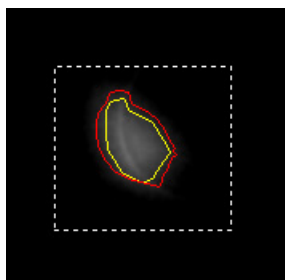




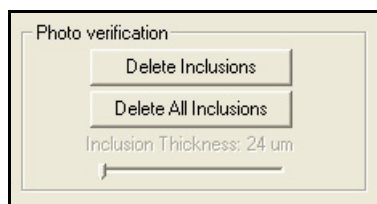
- Find incorrect inclusion which needs to delete. For example, inclusions red contour is outside of stone's yellow contour:



- Click and hold left mouse button and select incorrect inclusion by *Bounding box*:



- Press button **Delete inclusion** in the section **Photo verification** or press key **Delete** on keyboard



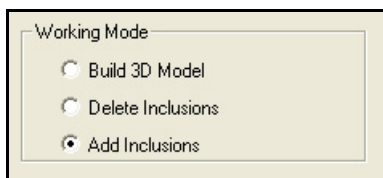
*Note. Button **Delete All inclusion** allows to delete all inclusions*

- Check all photos and delete other incorrect inclusions
- Press **Done**

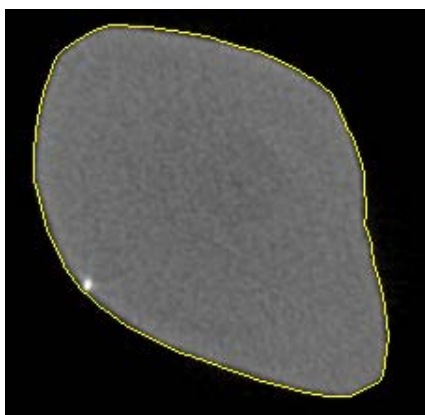


Add new inclusions

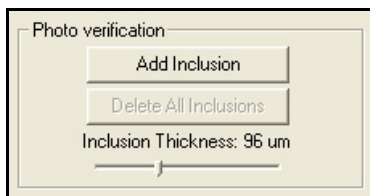
1. Press button **Check Photos** in the tab **Inclusions** and open dialog **Photo checker**
2. Select **Add Inclusions** in the section **Working mode**



3. Find inclusion to add it

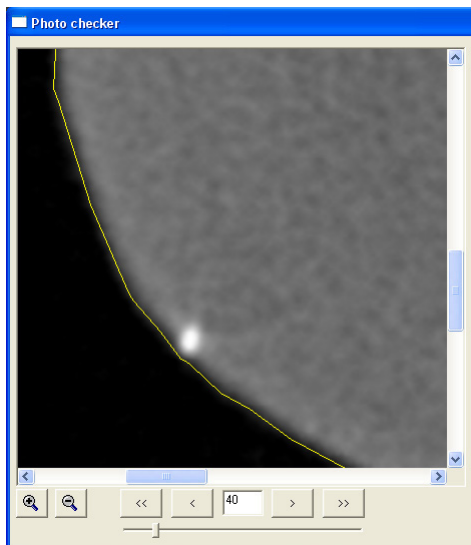


4. Set inclusion **Thickness** in the section **Photo verification**



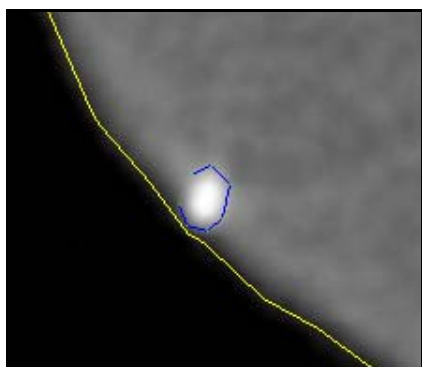


5. Zoom inclusion with button

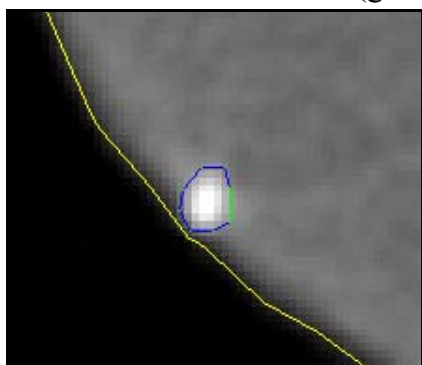


6. Specify inclusion contour:

- Left mouse button clicks will add vertices to the contour.
- If move cursor near some vertex cursor will change and you can drag and drop vertex with left mouse button, right mouse button clicks behind the vertices will remove them



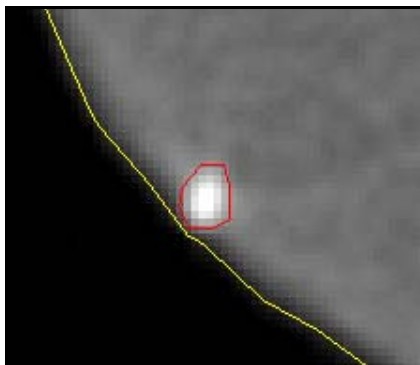
- To enclosure contour by left mouse button double click, vertices will be added to the nearest side (green highlighting) after that operation



7. Press button **Add Inclusion** or **A** button on keyboard to add inclusion.

Add Inclusion

8. New inclusion is ready



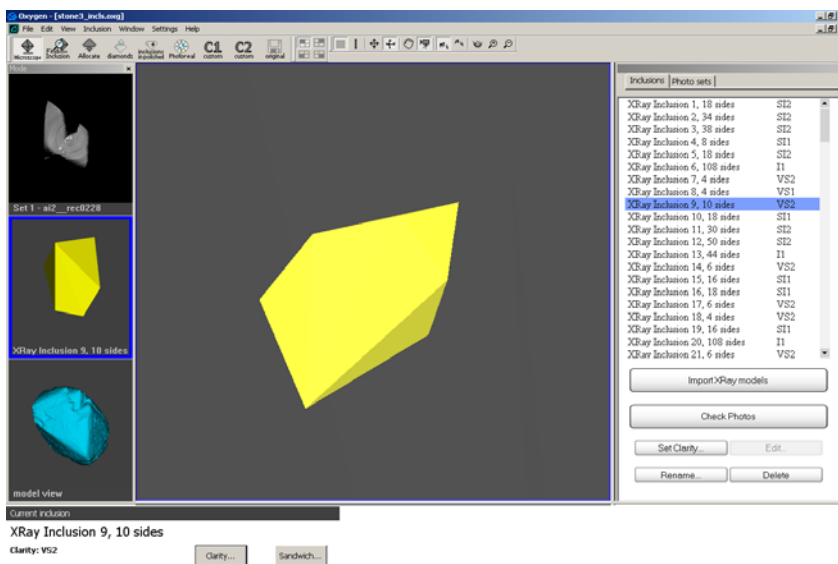
Step 4. Specify inclusions type

This step is optional.

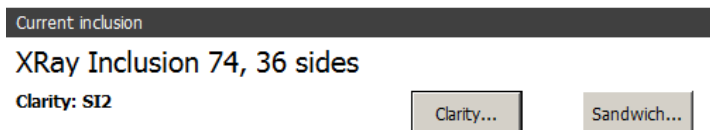
Inclusions clarity

Specify inclusions clarity if it necessary.

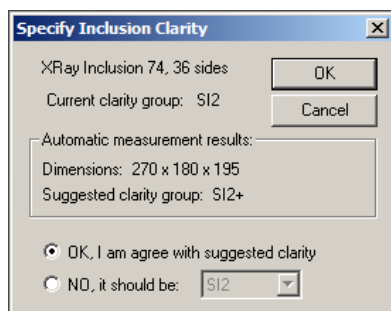
- Select desired inclusion in the tab **Inclusions**
- Select working mode **Inclusion**. Press second button from top in the left panel



- Press button **Clarity**



- Panel Specify Inclusion Clarity appears



Note. In this panel the program check the status of the inclusion. In appropriate cases program advises to leave the clarity intact (in these cases user should not change clarity according to size-based clarity but should leave the value that was specified in the **Make sandwich** window).

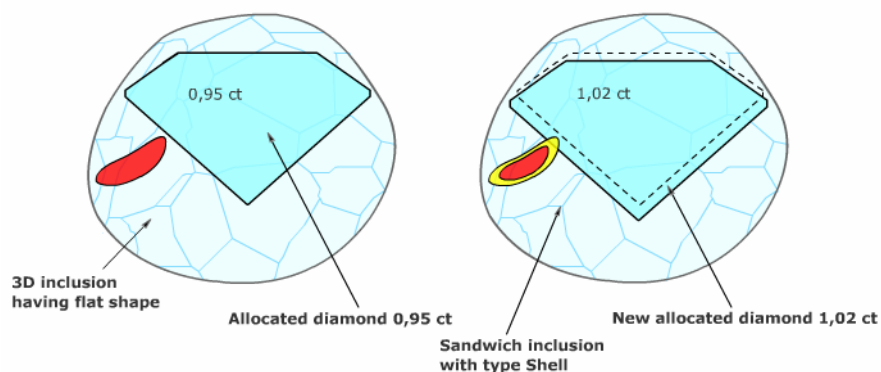
- To specify desired inclusions clarity select **NO, it should be**

Sandwiches

Use Sandwiches if diamond contains big inclusions. Sandwich feature allows to divide inclusion into parts and set different allocation options for every part separately.



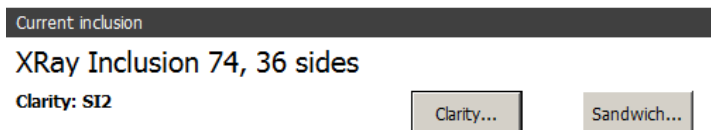
Sandwich allows to get new allocated diamond with more weight.



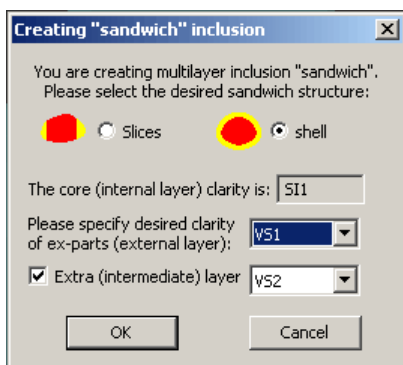
We recommend using sandwiches only for cracks. Usually only cracks are allowed to be on a surface of polished diamond.

To create sandwich:

- Select desired inclusion
- Click button **Sandwich...**



- Panel **Creating sandwich inclusion** appears



- Select type of sandwich: **Slices** and **Shell**. **Shell** sandwich feature is extended with ability to create an extra medium layer **Double** sandwich.
- Press **OK**

When sandwich is created the Ex-parts are automatically assigned with the desired clarity (clarity that user selected in the **Make sandwich** window).

After creation of sandwich **Slices** you can manually control its structure that gives you additional flexibility in diamond allocation.

The Cutting planes of sandwich are displayed in this version as saw-edged circles.

To modify the geometry of created inclusion parts:

- Select the desired ex-part of the sandwich in the inclusion list; the corresponding sandwich part and its Circle-saw will be highlighted.
- Select **Hand** button in the **toolbox** to activate object movement mode.
- Rotate/move the circle by mouse drag into desired position (the movement occurs if you press and hold the Shift button while drag mouse)
- When the Circle-saw is in the desired position press Recall button under **Make sandwich** button. This button will recut sandwich according to new position of planes

Select the desired ex-part and press **Remove inclusion** to remove a layer of sandwich. (This operation will not remove this part of inclusion but will join it back to the inclusion core part.



To add additional sandwich layer select the **Core** inclusion and press **Add Layer** button. The new cut-plane is always created near the first cut-plane with the same cutting direction.

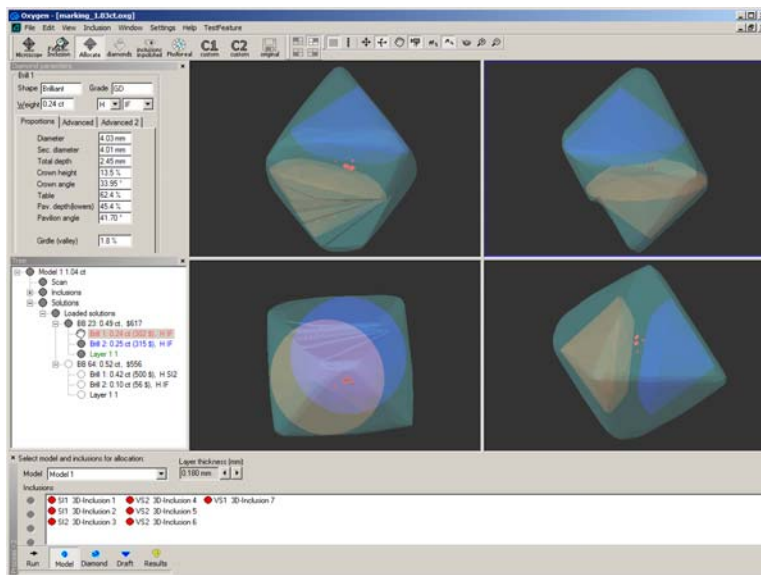
To return back to single inclusion (undo sandwich) select the desired sandwich (**Core** part) and click **Make sandwich** again. You will be asked for confirmation.

There are two more buttons on the Inclusion locator panel that helps to work with sandwich: **Zoom** and **Normal**. **Zoom** button puts the selected inclusion in the center of scenes and magnifies the view to so inclusion fits the screen. It is also turns of the rough visualization. **Normal** button applies the normal scale of view and turns on rough visualization.

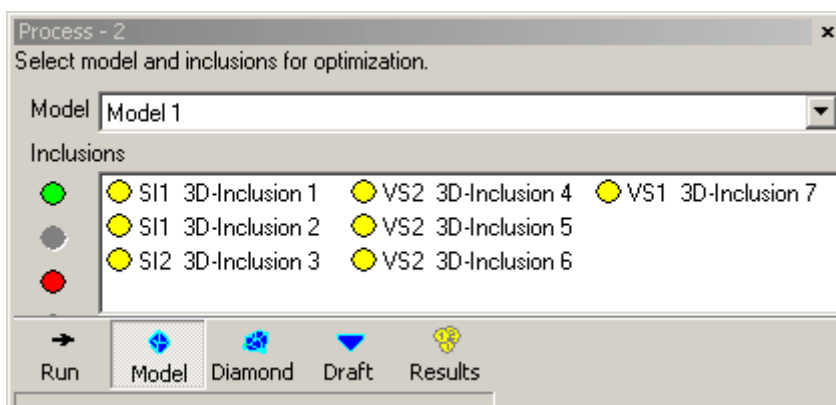
The sandwich feature allows SI3/I1/I2 layers.

Step 5. Allocate diamonds

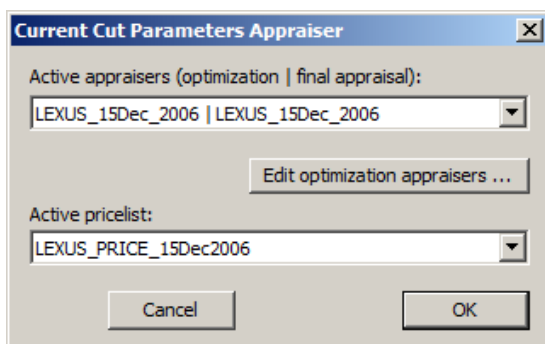
1. Switch to **Allocate** working mode



2. See **Process** panel in the bottom or call it from menu **View/Show Process**
3. Select desired allocation modes for inclusions on the **Model** tab:
 - **Green inclusion** - This inclusion is allowed to be inside the allocated diamond, the only price of affected diamond is considered.
 - **Yellow** - Smart option. Allocation algorithm considers both options (when inclusion is inside and outside of allocated diamond).
 - **Red** - Inclusion is not allowed to be inside allocated diamonds.

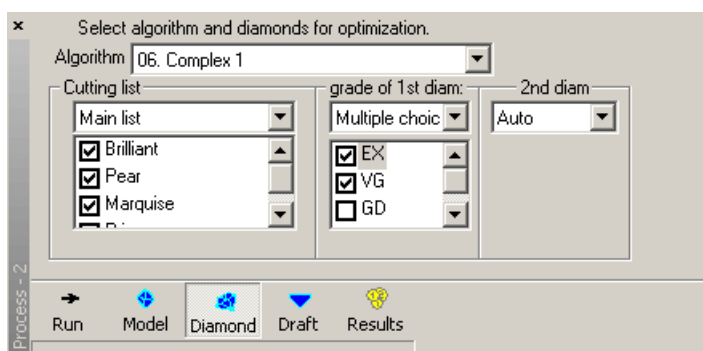


4. Select **Active appraiser** from menu **Settings/ Select Active appraiser...**



*Note. To edit optimization appraiser data use **Edi appraiser utility** (see section 3.3 Edit appraiser utility)*

5. Select process options: algorithm, cutting lists and grade:
 - Open tab **Diamond**



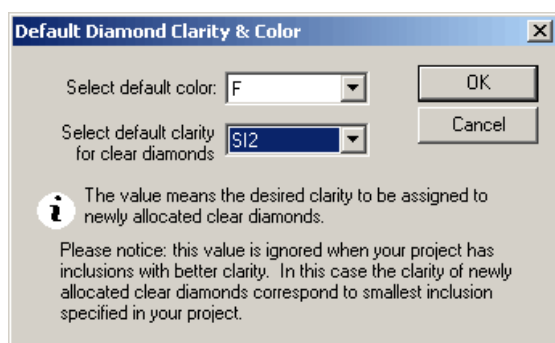
- Select **Algorithm**

Note. 06.Complex and 06.Single algorithms work especially efficient with several inclusions in yellow smart mode. These algorithms select different cuttings from lists and make multiple choices for the 1st diamond quality

- Select **Cutting list** or desired shape for diamonds in allocation. There are brilliant, marquise, oval, pear, princess, emerald, flander, happy8, baguette, heart and external cut shapes of diamonds
- Set **grade**: Auto, Excellent, Very Good and etc.

6. Set Default diamond color and clarity:

- Open **Default diamond color** panel from menu **Settings**

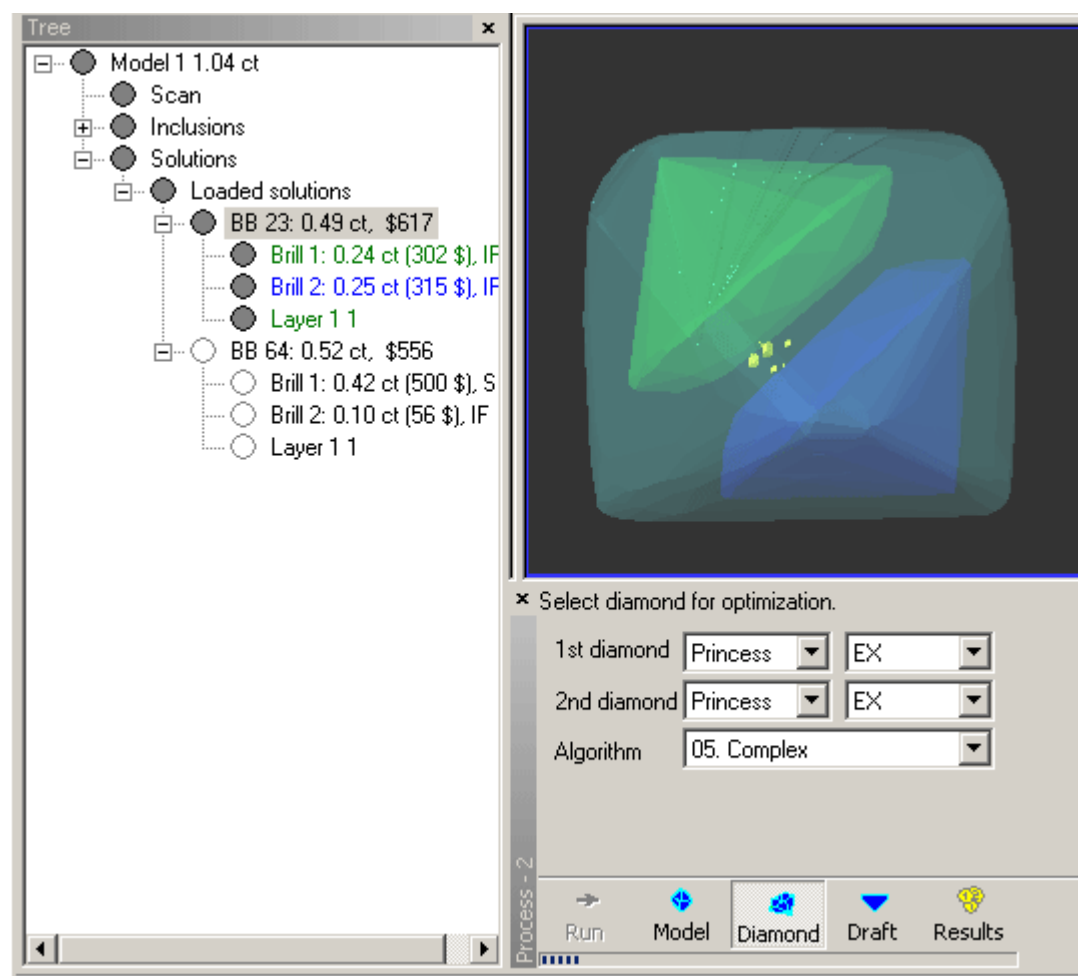


- Select a color and clarity that will be assigned for future allocated diamonds

Note. *This command affects only further allocated diamonds and not affects diamonds that are already allocated.*

7. Press button **Run**

8. The program starts allocating new solutions



9. Wait

10. Newly allocated diamonds appear in **Tree** panel

The screenshot displays a software interface with two main panels. On the left is the 'Tree' panel, which shows a hierarchical structure of solutions. The root node is 'Model 1 1.04 ct'. Underneath it are 'Scan', 'Inclusions', and 'Solutions'. The 'Solutions' node is expanded to show 'Loaded solutions' and 'Group 1'. Under 'Loaded solutions', there are two main entries: 'BB 23: 0.49 ct, \$617' and 'BB 64: 0.52 ct, \$556'. Each has sub-entries for 'Brill 1', 'Brill 2', and 'Layer 1 1'. Under 'Group 1', 'PP 1: 0.65 ct, \$1499' is selected and highlighted in blue. Below it are 'Prince 1: 0.54 ct (1350 \$)' and 'Prince 2: 0.11 ct (149 \$)', followed by 'Layer 1 1'. A list of 'PP' entries (PP 2 to PP 12) follows, each with its weight and price. On the right is a diamond optimization panel. It features a 3D visualization of a diamond with green and blue facets. Below the visualization is a section titled 'Select diamond for optimization.' with three rows of controls: '1st diamond' (Princess, EX), '2nd diamond' (Princess, EX), and 'Algorithm' (05. Complex). At the bottom, there is a 'Process - 2' label and a row of buttons: 'Run', 'Model', 'Diamond' (highlighted), 'Draft', and 'Results'.



3 Appendix. Creating STL 3D models by the CTan program

The Oxygen XRay is a software can work with 3D models created by *CTan* program, *SkyScan* system. The *CTan* program uses X-Ray data and creates STL 3D model manually or automatically. Oxygen XRay software loads its 3D models, allows to analyze inclusions, allocates diamonds and evaluates prices of solutions.

Creating STL 3D models by the CTan program


To create STL 3D models from XRay data use the program *CTan* of *SkyScan* company.

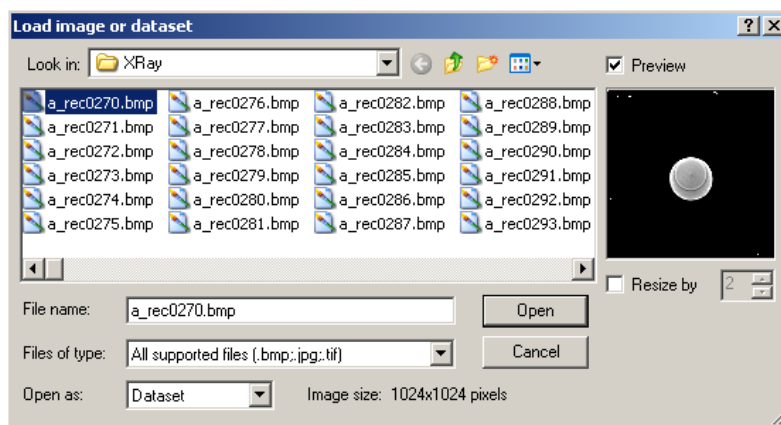
Note. Download extended *CTan* documentation here:

http://www.skyscan.be/next/CTan_UserManual.pdf

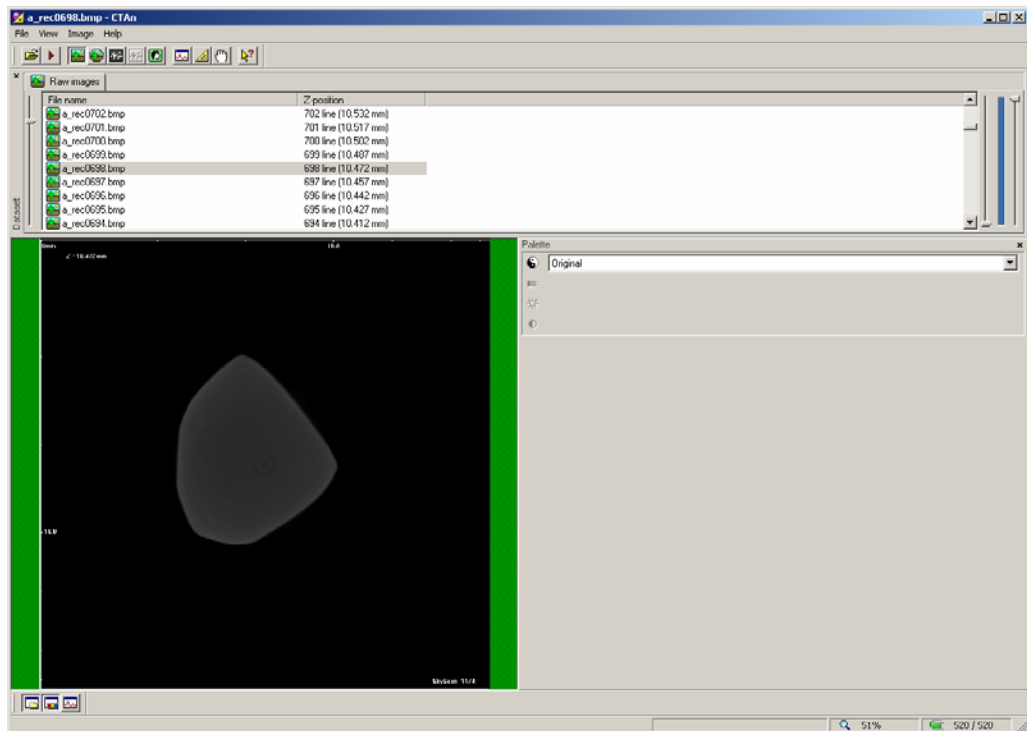
Use **manual** and **automatic** ways to create STL 3D models.

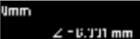
Manual creating STL 3D models



1. Start **CTan** program
2. **Make settings** if you first time use the **CTan** program (see section below **Settings for Manual creation STL models in the CTan program**)
3. Load *images dataset*
 - Press button  or select **File\Open...**
 - Select one image from a dataset

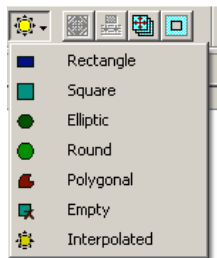


- Select **Dataset** in the **Open as..** section to load the whole dataset
- Press button **Open**
- Images dataset is loaded into the program



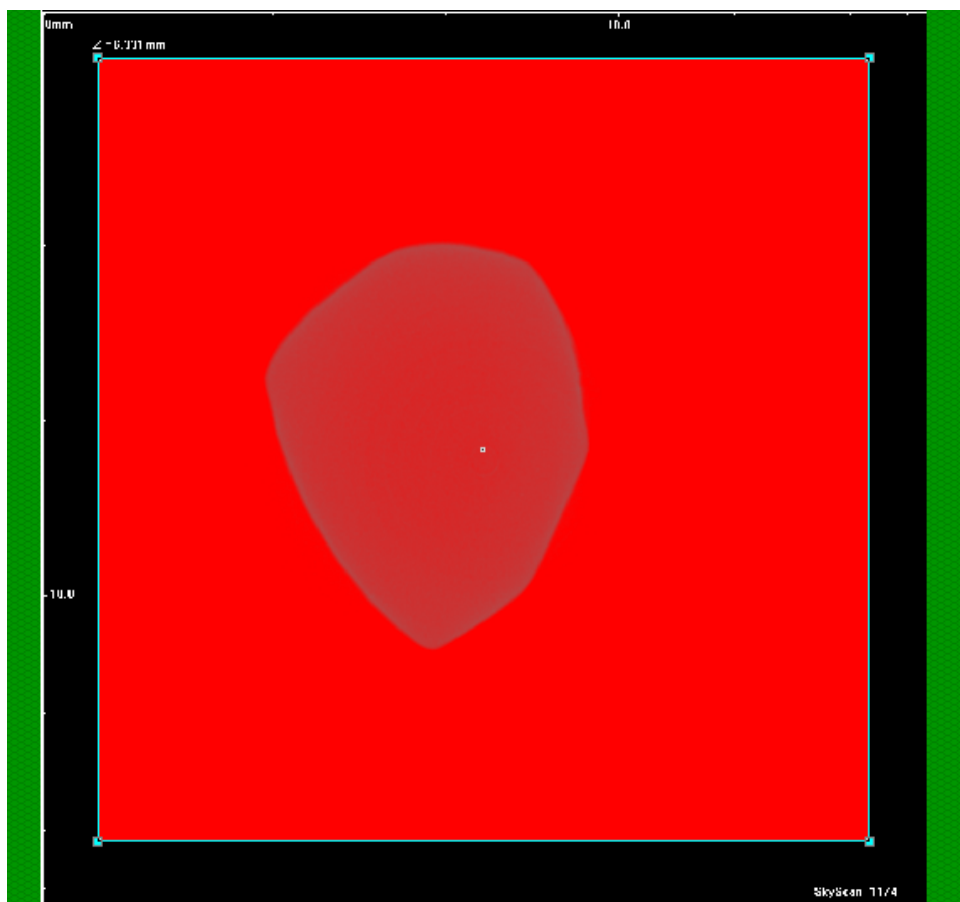
4. If labels  are on images of your dataset Set *Region Of Interest (ROI)* to avoid there processing

- Press button 
- Press button 
- Select **Rectangle**



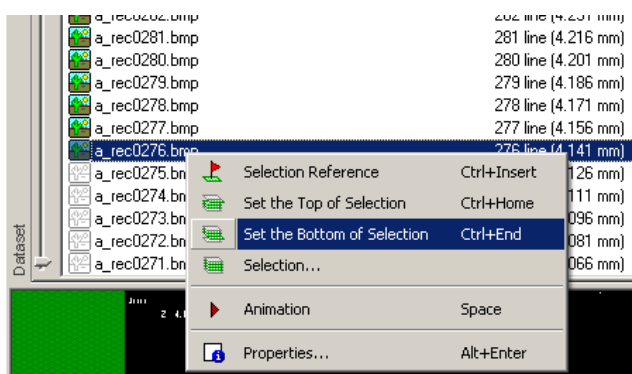


- Set desirable ROI



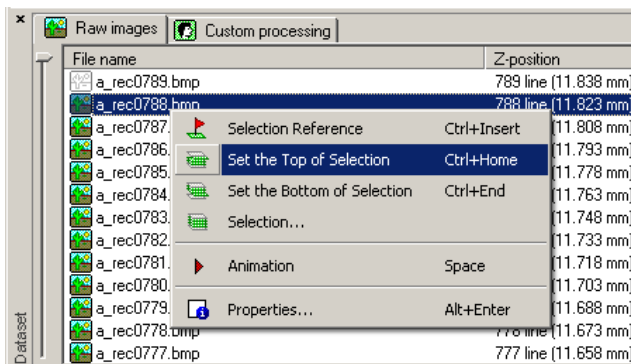
Tip. It's better to turn off Scale and labels option in Nrecon

5. Select image to *start processing*, for example, to skip holder images
 - Make **Right** mouse click
 - Choose **Set Bottom of selection** option from pop-up menu




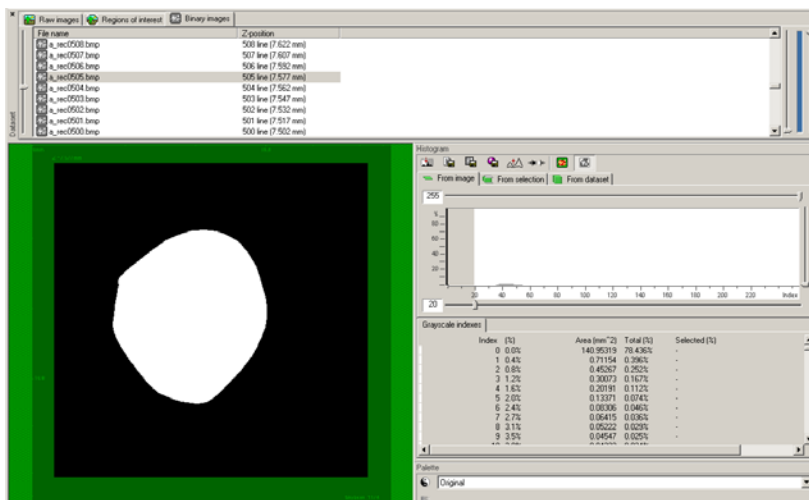
6. Select image to *end processing*



- Make **Right** mouse click
- Choose **Set Top of Selection** option from pop-up menu



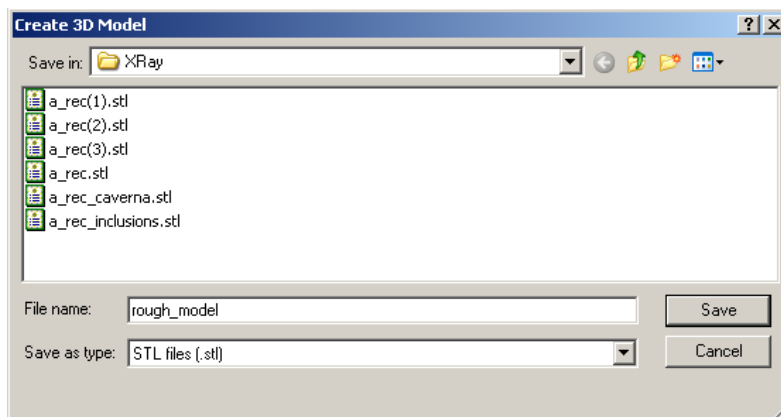
7. Create STL 3D model of rough

- Switch to binary processing mode 
- Set low and high threshold values in the panel **Histogram**: set stone white and background black



- Go through images to check that you select acceptable threshold values
 - To check automatically press button  in the main toolbar
 - To check manually view different images in the dataset
- Press button  in the panel **Histogram** to create STL

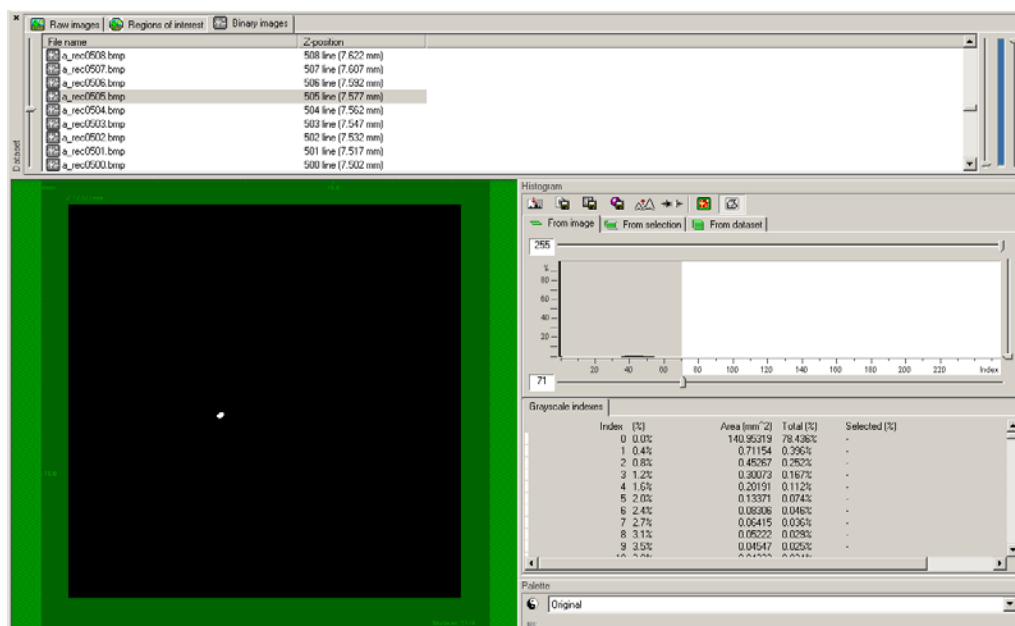
- Set STL filename and press button **Save**





- Wait  while STL model of rough is ready

8. Create STL 3D model of inclusions

- Select tab **Binary image**
- Set low and high threshold values in the panel **Histogram**: set inclusions white and background black.




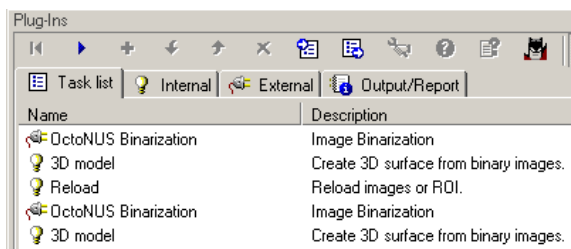
- Go through images to check that you select acceptable threshold values.
 - To check automatically press button  in the main toolbar
 - To check manually view different images in the dataset
- Press button  in the panel **Histogram** to create STL
- Set STL filename and press button **Save**
- Wait while STL model of inclusions is ready


Automatic creating STL 3D models

OctoNus plug-ins allow to create 3D models of rough and its inclusions automatically.

Note. OctoNus plug-ins are protected and work with Oxygen XRay HASP key only.

1. Copy *noise.ctp* file to **CTan/Plugins** to use OctoNus plug-ins (if folder Plugins doesn't exist create it).
2. Start **CTan** program
3. **Make settings if you first time use the CTan program (see section below Settings for Automatic creation STL models in the CTan program)**
4. Load images dataset (see section **Manual creating STL 3D models / p.3**)
5. Press button  to switch into **Custom processing mode**
6. Select tab **Task List** in panel **Plug-in**

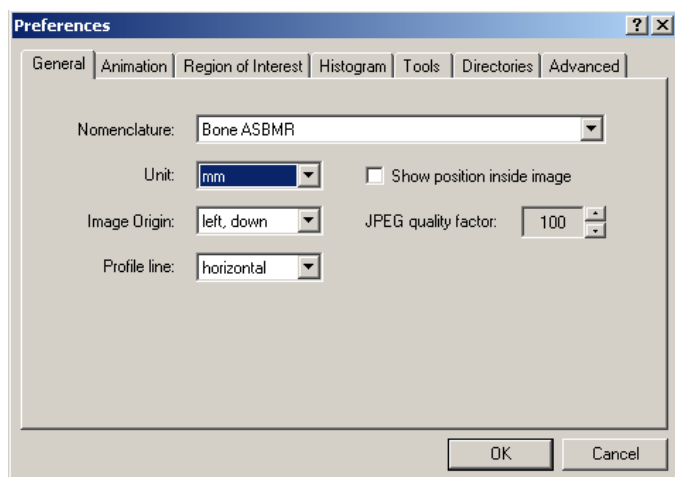


7. Press button  to run plug-ins
8. Wait while STL models are ready
9. Ready STL models are available in the folder with images dataset. STL file with next to last index contains rough 3D model, file with last index – inclusions 3D models.

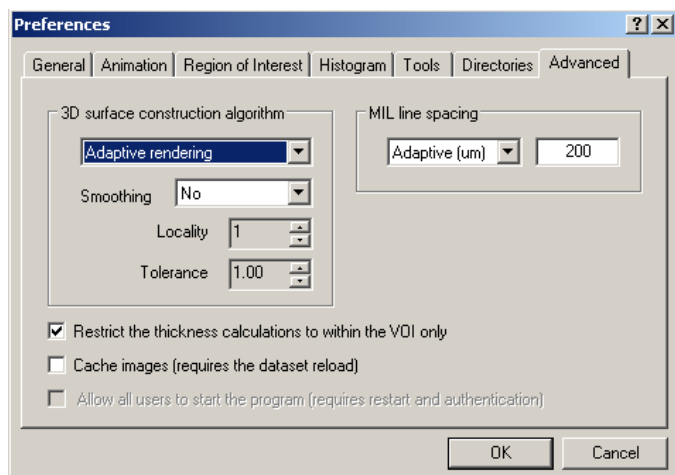


Settings for Manual creation STL models in the CTan program

- Open panel **Preferences** from menu **File / Preferences**
- Open tab **General**. Set *mm* in the section **Unit**



- Open tab **Advanced**. Set *Adaptive rendering* in the section **3D surface construction algorithm**

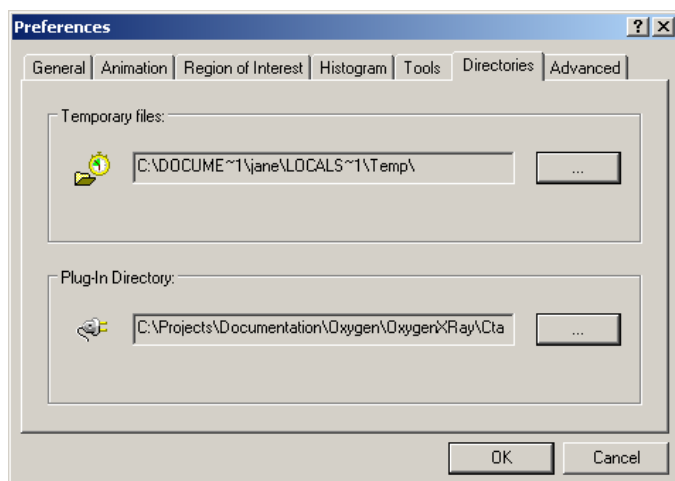




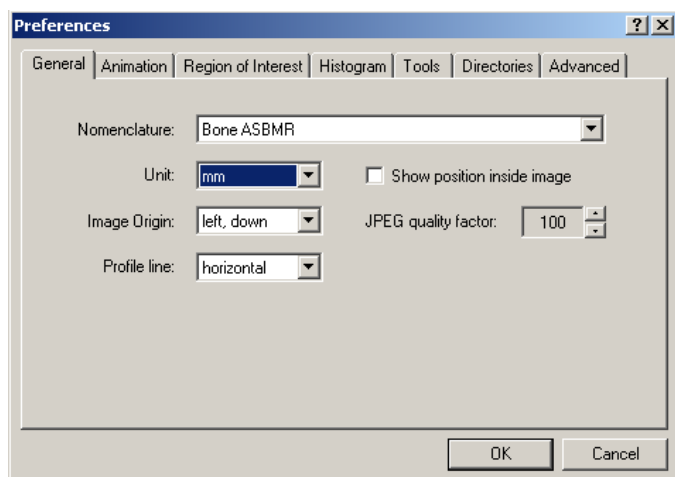
Settings for Automatic creation STL models in the CTan program

Note. OctoNus plug-ins are protected and work with Oxygen XRay HASP key only.

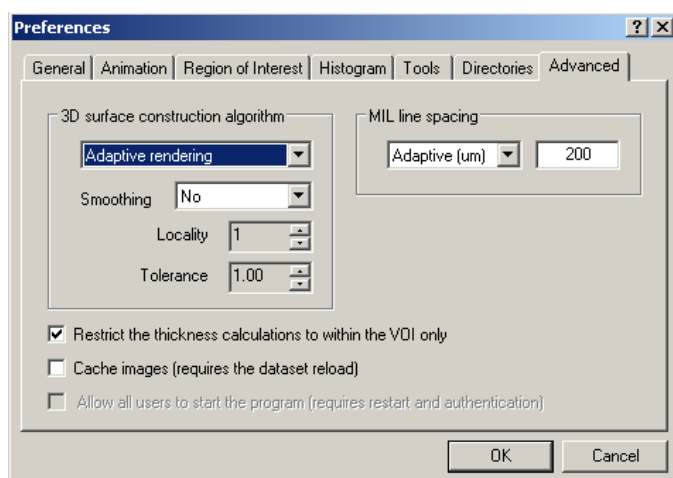
1. Open panel **Preferences** from menu **File / Preferences**
2. Open tab **Directories**. Set path to plug-in the section **Plug-in Directory**




3. Open tab **General**. Set *mm* in the section **Unit**

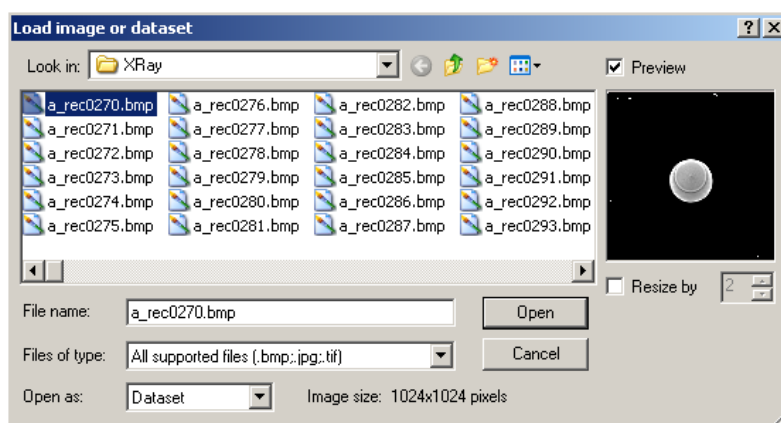


4. Open tab **Advanced**. Set *Adaptive rendering* in the section **3D surface construction algorithm**

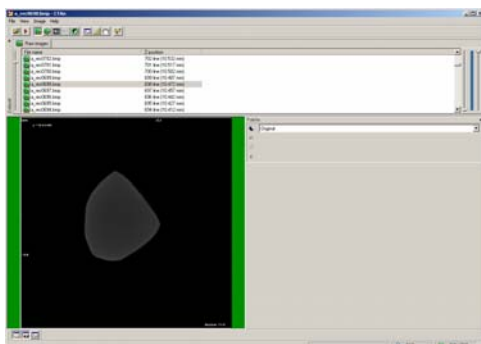



5. Load images dataset

- Press button  or select menu **File\Open...**
- Select one image from a dataset

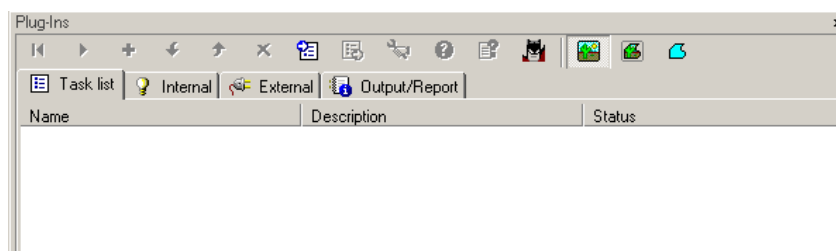


- Select **Dataset** in the **Open as..** section to load the whole dataset
- Press button **Open**
- Images dataset is loaded into the program

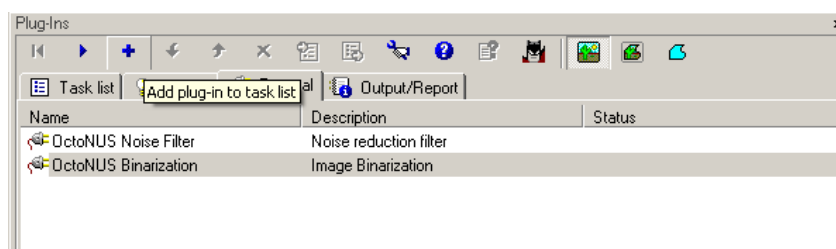


6. Switch to custom processing mode 

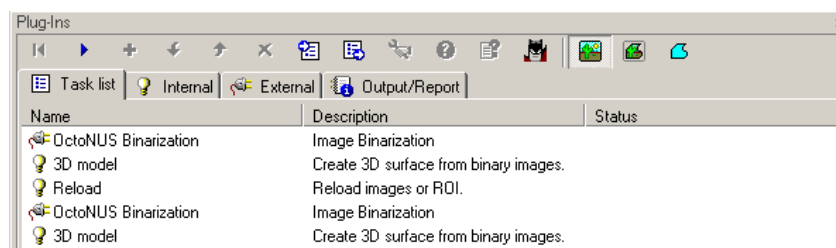
7. Select tab **Task List** in panel **Plug-ins**
8. Remove all plug-ins



9. Select tab **External**
10. Load **Binarization** plug-in twice
 - Select **Binarization**
 - Press button “+” twice

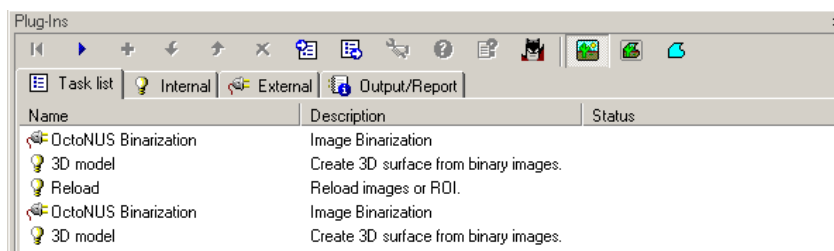


11. Select tab **Internal**
12. Load **3D model** plug-in twice:
 - Select **3D model**
 - Press button “+” twice
13. Load **Reload** plug-in
 - Select **Reload**
 - Press button “+” once
14. Set operations in the right order:

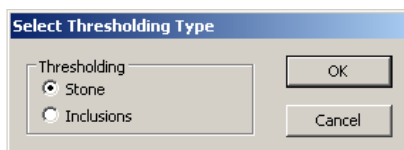


15. Set operation properties

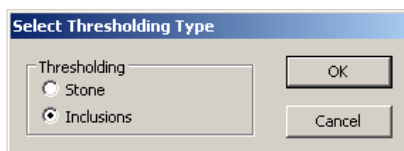
- Double click to plug-ins in the tab **Task List**



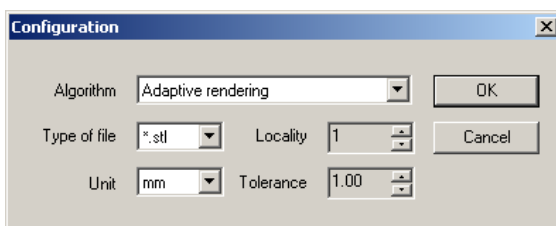
- Set to First **Binarization**: stone



- Set to Second **Binarization**: inclusions



- Set to **3D model**:
 - **Algorithm**: Adaptive Rendering
 - **Type of file**: *.stl
 - **Unit**: mm

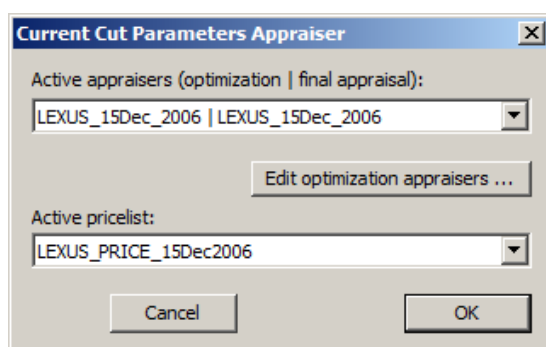


4 Appendix. Edit appraiser utility

Edit appraiser utility modifies an appraiser data.

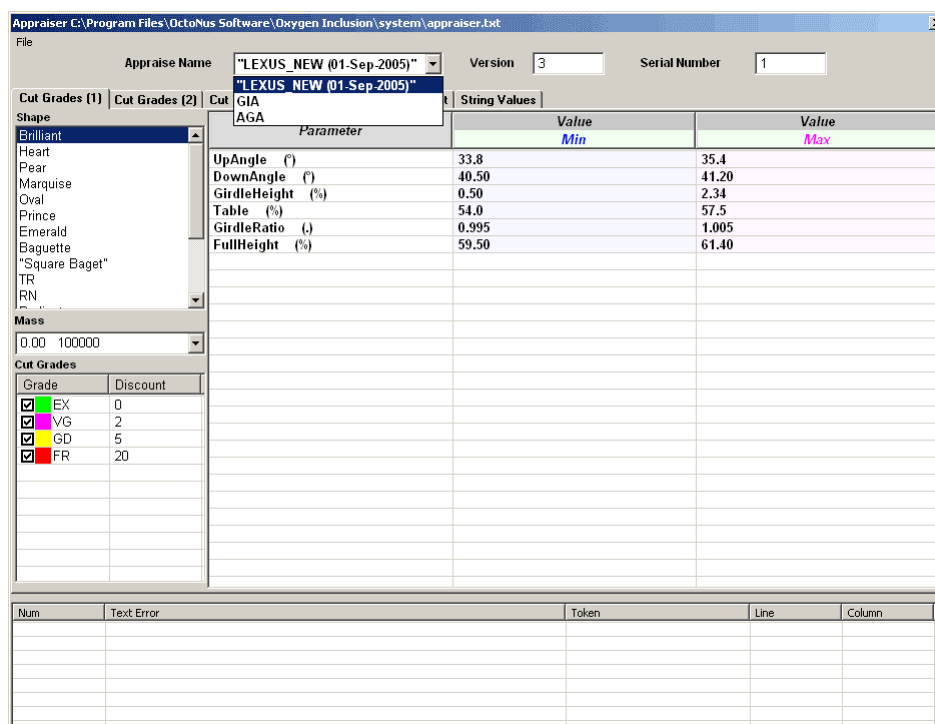
To call **Edit appraiser utility**:

- Open panel **Current Cut parameters appraiser** from menu **Settings/ Select active appraiser**
- Press button **Edit optimization appraisers...**



To change appraisers data:

- Select an appraiser from list **Appraise Name**





Fixed cuts used in allocation. Its proportions are used in the beginning of allocation process.

To edit **Fixed cuts** proportions:

- Select tab **Fixedcut**
- Select cut from panel **Shape**
- Change values in table **Fixedcut Name - Parameters**

Cut Grades [1] Cut Grades [2] Cut Grades [3] Cut Grades [4] Fixedcut String Values					
Shape	Fixedcut Name	UpAngle (°)	GirdleHeight (%)	Table (%)	DownAngle (°)
Baguette	Ideal	41.1	56.1	38.7	0.0001
"Square Baget"	Parker	25.5	55.9	40.9	0.0001
TR	Tolkowsky	34.5	53.0	40.75	0.0001
RN	Practical	33.2	56.0	40.8	0.0001
Radiant	Scand	34.5	57.5	40.75	0.0001
DCA	Eulitz	33.6	56.5	40.8	1.5
SPCUSHION					
painted_C_P					
"Square Emerald"					
Triangle					
Brilliant Pear Oval Marquise					
Brilliant Pear Oval Marquise					
Brilliant					
Brilliant					
Brilliant					
Pear					
Heart					
Oval					
Marquise					
Prince					
Emerald Radiant					
Brilliant					
Brilliant					
Brilliant					
Brilliant					
Brilliant					
Brilliant					
Pear Marquise					
Happy8 Flanders					
Prince					
Baguette					
Emerald					
Oval					
Heart					