




Oxygen Microscope 3.3

User manual

29 December, 2011
OctoNus Software

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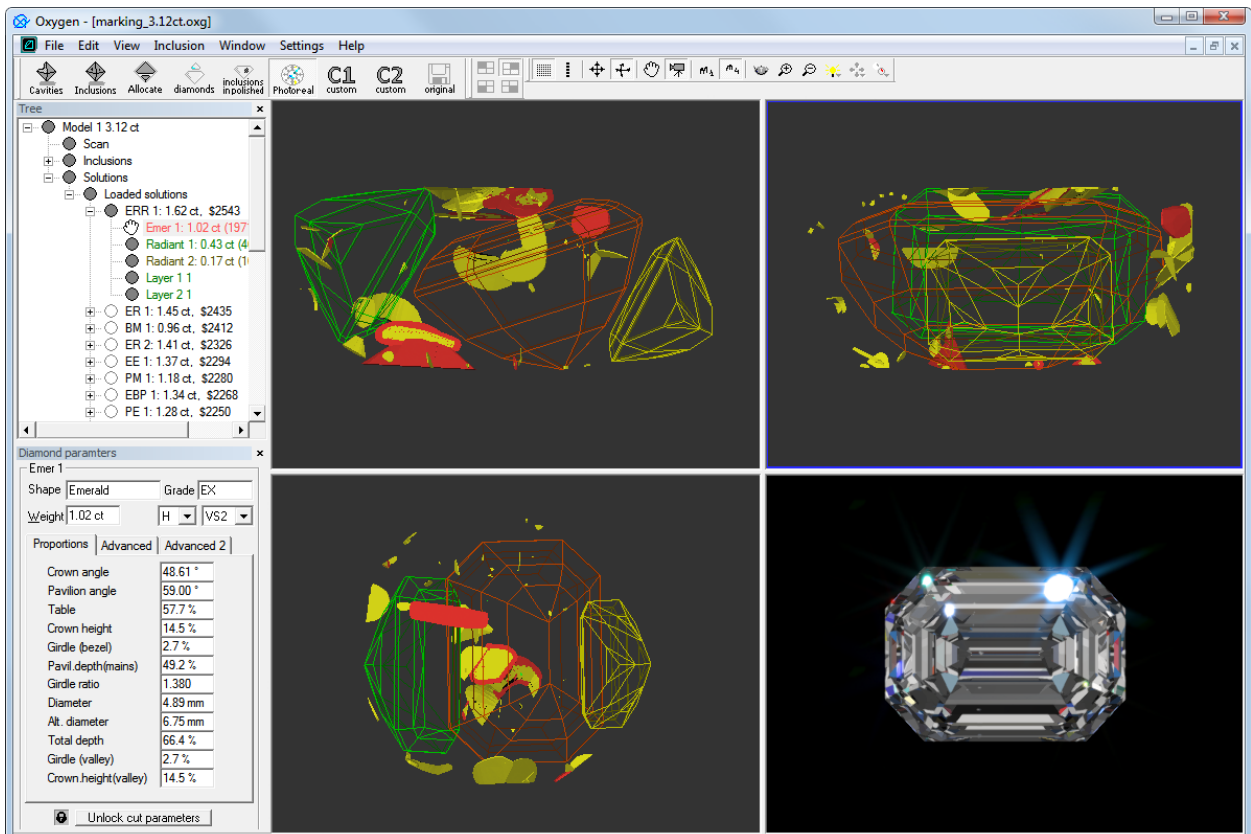


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2 Getting started

2.1 What is Oxygen Microscope and who benefit

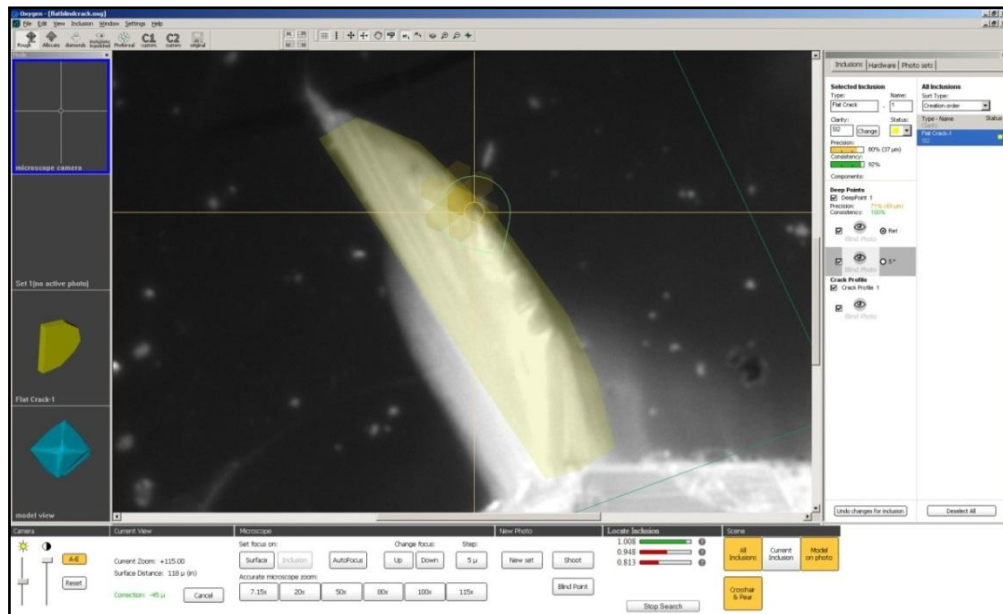
The Oxygen Microscope is software developed to work with [M-Box](#) (microscope). The system uses projects created by [Helium Rough](#). Oxygen Microscope allows creating photos of rough by microscope; defining any type of inclusions, exploring and working with the diamond cutting solutions, allocate diamonds, evaluating the prices of the different possible solutions and quality of the polished diamonds and creating Customer and Polish reports, very defined and customized.



The Oxygen Microscope is designed for diamond cutters and sale specialists dealing with rough diamonds, manufacturers and technologists. The software can be used for training and education. This system is beneficial for factory production and process control.

2.2 Main features

1. Special algorithms for Pin Point inclusions, 3D inclusion, Clouds, Flat cracks, Curved cracks, Blind cracks and Cavities.



2. Automatic Clouds and Cavities allocation
3. 5 axes control for multi axes manually moving of rough. Inclusions can be picked and placed from any window located at any place (except the place where the stone is glued)
4. HDR photorealistic visualization of allocated diamonds and inner inclusions with its textures
5. Different lighting options for transparent and opaque inclusions
6. Inclusion from VVS to I3 can be mapped
7. Cavities can be scanned and mapped
8. Magnification up to 60x / 115x
9. User friendly GUI and ergonomically designed control board
10. LAN configurable. Can be networked with Helium Rough and other Oxygen/Pacor terminals
11. Quick inclusion placement and very quick pay back time
12. View the model of rough diamond and its inclusions
13. Allocate diamonds with 17 optimization algorithms and explore solutions in different visualization modes
14. Export selected allocated diamond in DMC file in parametrical mode that further allows modifying and optimising the parameters of cutting in the DiamCalc software: DiamCalc, DiamCalc Cut Designer, DiamCalc Pro and DiamCalc Color. Import modified DMC file back into its original Oxygen solution.
15. Export allocated diamonds and its inclusions with textures into DiamCalc
16. Evaluate the prices of allocation variants and clarity of polished diamond with an appraiser in the program
17. Customer and Polish reports, very defined and customized
18. Modifying appraiser

Oxygen documentation

2.3 System requirements

Operating system	Microsoft Windows XP or later.
Computer and processor	Intel Core 2 Duo / Intel Core i7, i5, Core 2 Quad or AMD Atlon64-X2 is recommended for faster calculations and better visualization
Memory	512 megabytes (MB) of RAM or greater. 2 Gb or more is recommended to work with photos
Hard disk	100 megabytes (MB) of available hard-disk space. If you plan to keep your projects with photographs longtime you may need large HD (100 -200 Gb or more)
Display	High-color Super VGA 1600 x 1200 x 24bit. 1920 x 1200 x 24bit or higher resolution monitor is recommended for convenient work.
Video card	VGA card with OpenGL support NVIDIA GeForce 6600 or higher, ATI X1300 or higher are required to enable HDR rendering* (see section HDR photorealistic diamond and inclusions visualization). We recommend to use at least NVIDIA GeForce 6800, ATI X1600.
Other	Logitech MX Revolution mouse is recommended

*The HDR photorealistic diamond and inclusions visualization requires Graphics hardware supporting specific features. Please test your GPU (Graphics hardware) with [DiamCalc – Graphics Compatibility Evaluator](#) utility. This utility will attempt to render a reference data set in order to check if your Graphics hardware is compatible with new OctoNus HDR rendering engine. Even if you get negative test result the non-HDR visualization will be available in the program. Most of existing Windows computers is compatible with non-HDR OctoNus rendering engine.

For optimal performance of automatic allocation of cavities we recommend to use:

1. MZ16 System with 1.0x objective: 110x magnification
2. Z16 System with 2.0x objective: 80x magnification
3. M205A System with 1.0x objective: 115x magnification

3 What is new in Oxygen Microscope 3.3?

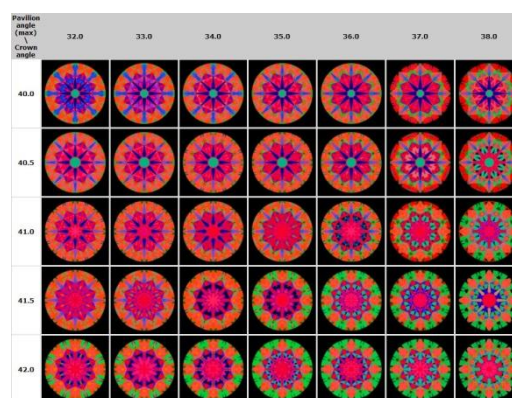
3.1 New Export and Import of DMC files

New Oxygen version 3.3 exports allocated diamond cut into DMC file in parametrical mode that further allows modifying and optimising the parameters of cutting in the DiamCalc software: DiamCalc, DiamCalc Cut Designer, DiamCalc Pro and DiamCalc Color. DMC cutting with improved proportions could be imported back into the Oxygen solution. Previous Oxygen versions save allocated diamond cut into DMC in the form of a polyhedron only.

New feature of export / import is especially useful for work with fancy colored cuts.

In the beginning of optimization process, a preliminary solution is allocated in the Oxygen. Then allocated diamond from the Oxygen is passed into the DiamCalc Software for analysing and optimizing its colour.

DiamCalc provides possibility to study reflection and refractive powers of a cut; view the cut in different illuminations (a wider set of possible illuminations than in the Photoreal mode of the Oxygen application); generate light propagation patterns; calculate qualitative properties such as light return, fire, scintillation; simulate cut external appearance within a particular environment like panorama; perform diamond proportion for certain spectrum; etc.



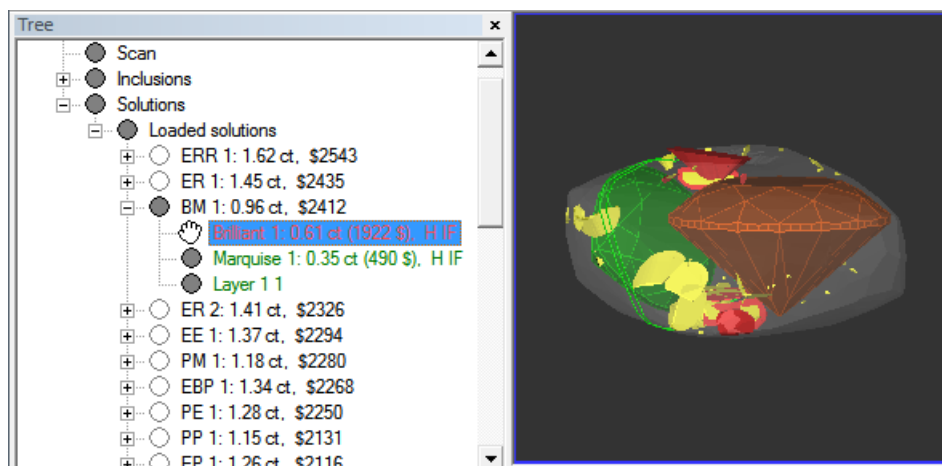
If, in the course of operation with a polished diamond in the DiamCalc software, its optical behavior was improved, then the modified cut saved in the DMC format that can be imported back into its original Oxygen solution. In the Oxygen a final optimization of polished diamond is performed (finding maximum of weight for obtained proportions).

Similarly, optimization can employ authoring cuts generated in DiamCalc CutDesigner.

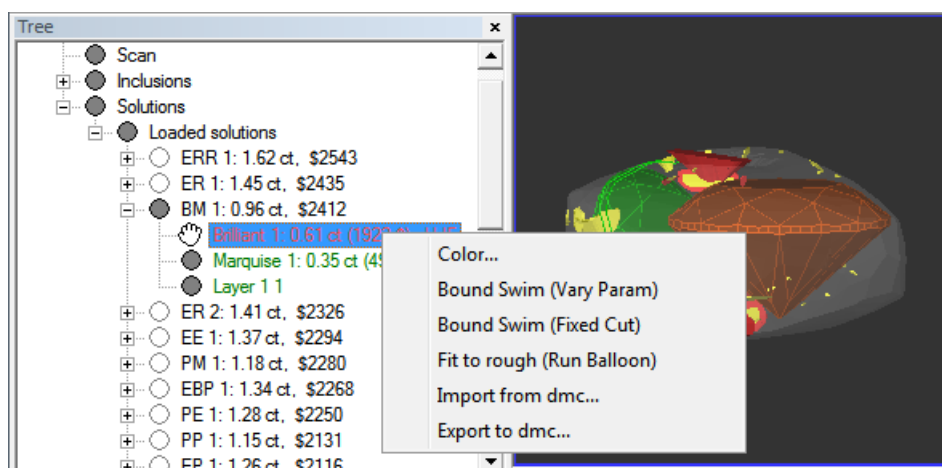
DMC Export/Import options are available from context menu in a Tree of solutions.

To make export to DMC from context menu:

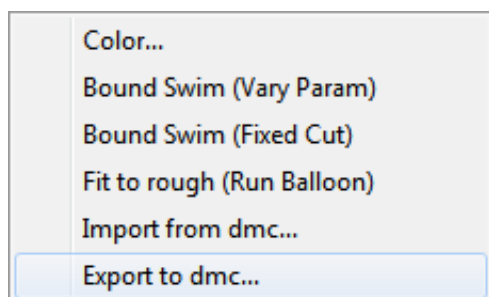
- Select a polished diamond in the solution from **Tree** of solutions



- Right-click on selected diamond



- Choose in context menu **Export to dmc...**



- Save **DMC** file

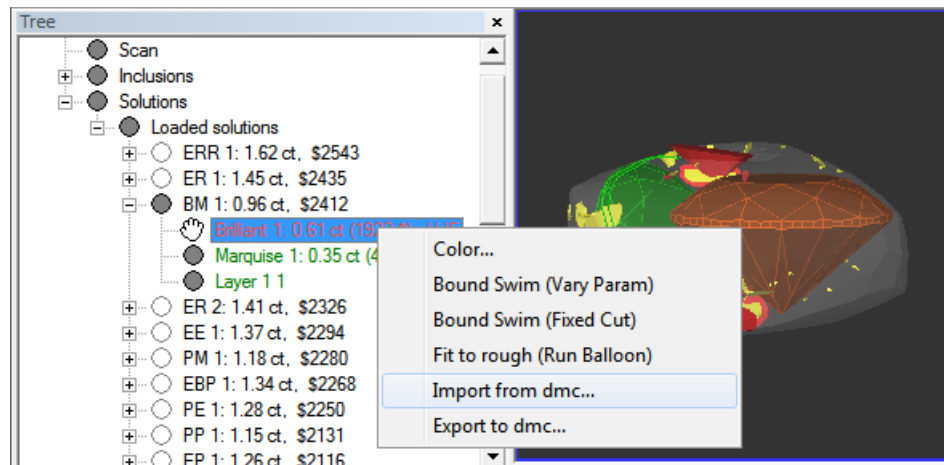
It is also possible to make export to DMC from main menu **File / Export /Diamond to dmc file...** Read details in documentation for previous version Oxygen 3.0

http://www.octonus.com/oct/products/oxygen/microscope/history_3_3.phtml#4

Oxygen documentation

To import DMC file from context menu:

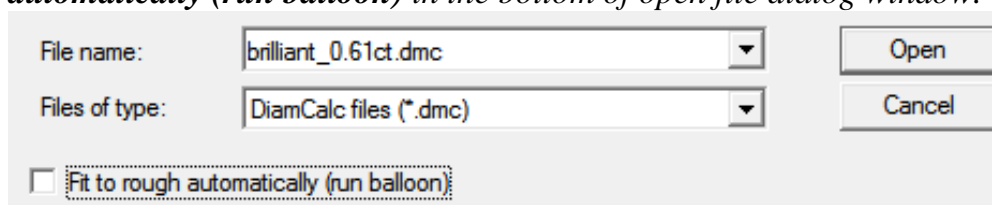
- Select an original polished diamond in the **Tree** that will be replaced by a modified diamond
- Right-click on selected diamond
- Choose in context menu **Import from dmc...**



- Select **DMC** file and press **Open**



- The simple local optimization process for an imported cut is launched automatically with the optimization method **Balloon**.
Note. In case you do not need to run **Balloon**, unselect checkbox **Fix to rough automatically (run balloon)** in the bottom of open file dialog window.



- For further local optimization use algorithm **Bound Swim (Fixed Cut)** or **Bound Swim (Vary Param)**. **Bound Swim (Fixed Cut)** performs local optimization of diamond location to find the maximum price keeping the original proportion with no change. **Bound Swim (Vary Param)** additionally tries different proportions.

3.2 More precise definition of diamond density

Oxygen 3.3 uses a more precise value of the Diamond Density, **3.51524** g/cm³. It leads to more precise calculation of the weights of polished diamonds. The Density value of **3.522** g/cm³ was used in the previous versions of the software.

Warning: Weights of diamonds allocated in previous versions of the program are not recalculated automatically!

3.3 Reports update

New program has refined methods of calculation of cut parameters. In particular, calculations of Height for of Girdle and Pavilion are updated. The values of parameters can be found in Polish reports, that generate in menu **File / Create polish report...** A detailed description of modifications in calculations can be found on the page with the Helium Polish 5.4 documentation

http://www.octonus.com/oct/products/helium/polish/history-helium5_4.html#heights

3.4 Linked appraiser. Update active appraiser

A linked appraiser is an appraiser with ranges for any parameter determined by the values of the parameter from a **DMC** file from the diamond defined by user.

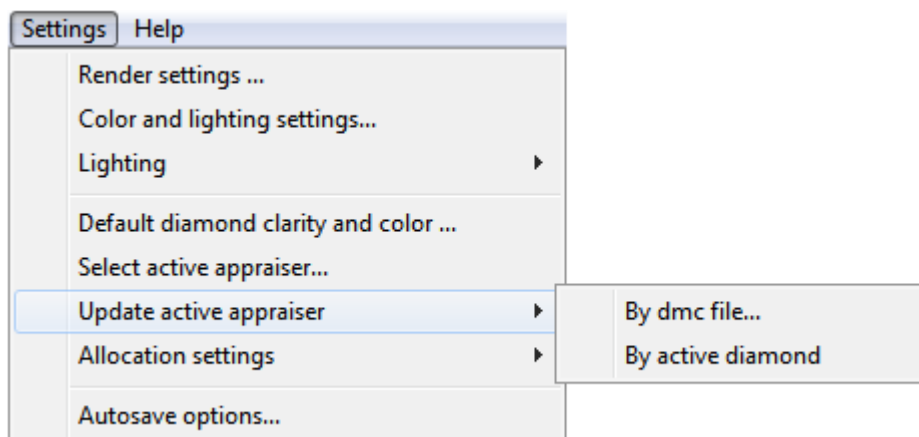
For example:

```
[cut]
Name: Brilliant
Quality: EX VG GD FR
Parameters: \
UpAngle (°) \
GirdleHeight_GIA (%) \
Optimize: Table Table Table \
DownAngleLevel0 Pavilion Pavilion \
DownAngleLevel1 UpHeight_GIA UpHeight_GIA \
GirdleHeight GirdleHeight_GIA GirdleHeight_GIA \
UpAngle UpAngle UpAngle_uHFix \
DownAngle DownAngle DownAngle \
GirdleRatio GirdleRatio GirdleRatio \
UpAngleLevel0 UpAngle UpAngle \
DiamondBase: /file Name.dmc
DiamondStart: /file Name.dmc
Mass: 0.00 100000 \
-0.5 0.5 -0.1 0.2 \
-1.0 1.0 -0.3 0.5 \
-1.5 1.5 -1.0 1.0 \
-2.0 2.0 -2.0 3.0 \
[end]
```

In the example above the file *Name.dmc* in the lines `DiamondBase` and `DiamondStart` is defined as the base and start diamond, and appraising will be executed with linking to this file.

Suppose that the crown angle value in *Name.dmc* is **35.0** degrees. Then the diamond, after optimization, gets an **EX** grade within the range **-0.5** to **0.5** (i.e. from **34.5** to **35.5**), gets a **VG** grade within the range **-1.0** to **0.8** (i.e. from **34.0** to **36.0**) and so on. The new version of Oxygen allows changing this base file interactively from the application.

The **Settings / Update active appraiser** menu offers two options: **By dmc file...** and **By active diamond**.



First option **By dmc file...** allows to select a desired **DMC** file with parameter values known to you. This operation changes the current appraiser and further allocations, and appraising will be done according to this new appraiser.

It is possible to select any diamond in the **Tree** of solutions (thereby the operator renders the diamond active) and then update the appraiser to that active diamond by choosing second option **By active diamond**. From then on, appraising will proceed relative to the diamond selected.

3.5 Smoother lighting control

The behaviour of the lighting control knob was adjusted. Now turning the knob will lead to more smooth and intuitive change of lighting intensity, when looking directly with human eyes. This feature uses non-linear conversion of knob rotation angle to lighting brightness. It is turned on by default.

3.6 Bugfix

The new version includes a number of corrections regarding enhanced application reliability in the modules of inclusion withdrawal, search for new directions, and report generation.

4 Workspace

4.1 Open project

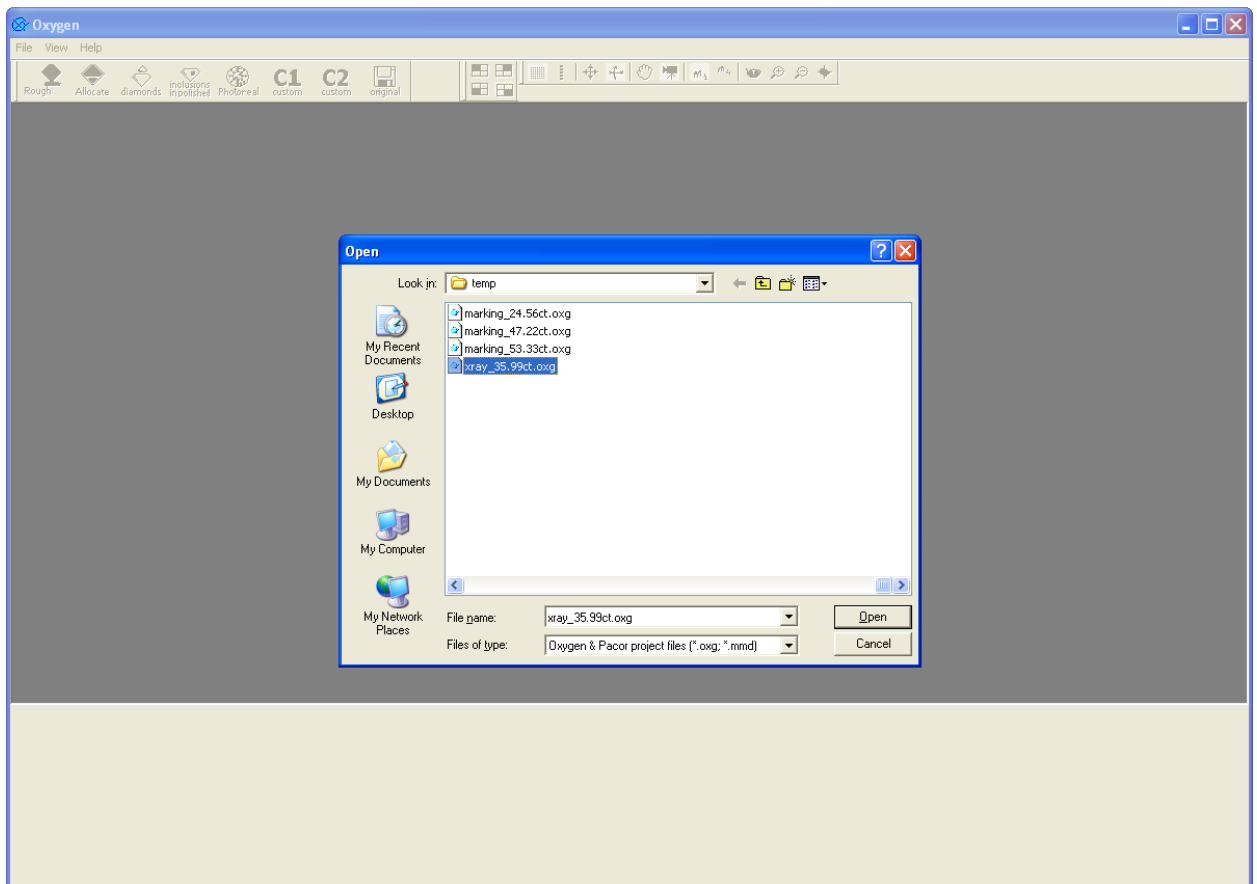
To start working with Oxygen Microscope open file with project. The projects can include 3d models of rough, inclusions models and solutions. Oxygen projects also include working modes, Scene setting and etc.

The follow types of projects are supported:

- Oxygen projects - *.oxg
- Pacor projects - *.mmd
- Helium Rough projects - *.mmd

To open project / file:

- Start the program
- Open file from the **Open** dialog window



- To open another file use **File/Open** menu or **Drag and drop**

4.2 Different working modes

There are six standard *working modes* in the Oxygen Microscope:

- **Cavities**
- **Inclusions**
- **Allocate**
- **Diamonds**
- **inclusions in polished**
- **Photoreal**

The modes allow to activate different workspaces of the program with its objects visualization and layout of panels.



C1 and **C2** are user-definable working modes. The program allows to define your own working mode as a set of the desired panels and a type of object visualization. **C1** and **C2** modes are saved in the registry.

If you have file with saved modes **C1** and **C2** it is loaded automatically. The loaded modes are available through the button **original**.

*Note. Find Inclusion mode is obsolete. Please use new **Microscope** mode.*

Cavities and Inclusions modes

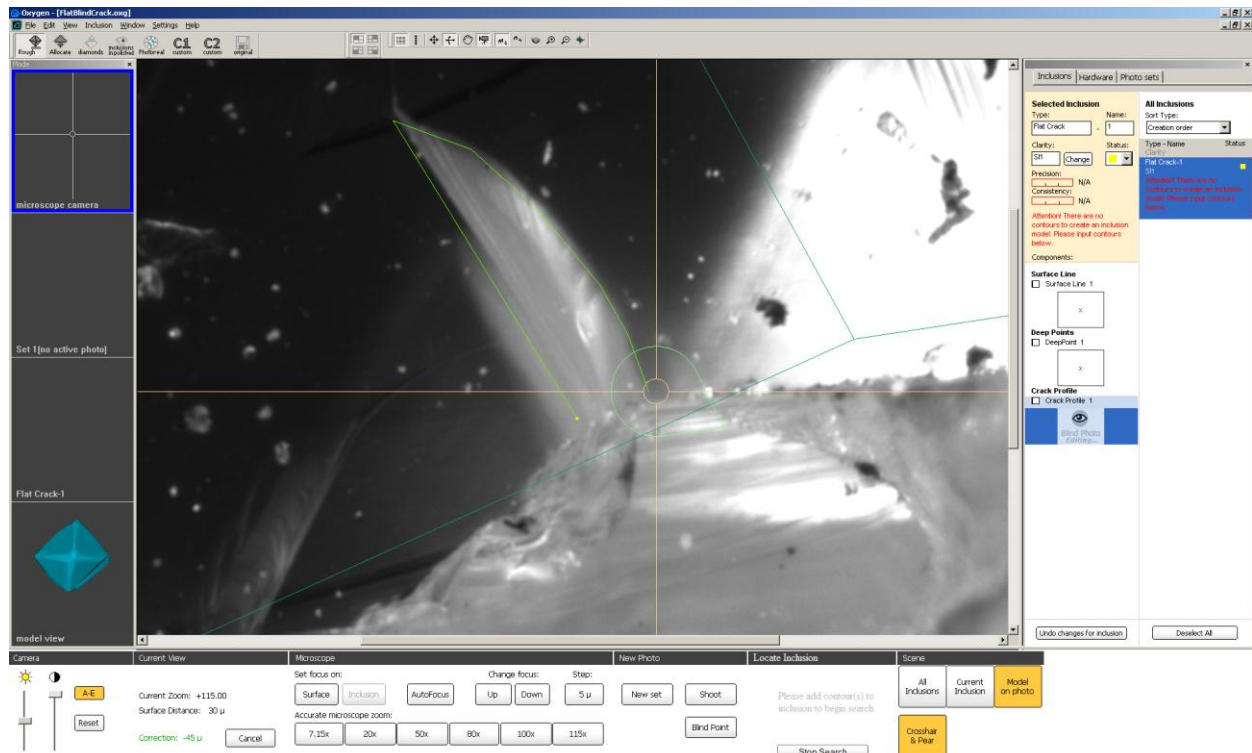
The **Cavities** and **Inclusions** modes are designed for:

- view rough diamonds in a microscope
- control microscope and camera
- make photos by a microscope camera
- explore photos
- create Cavities automatically or manually in **Cavities** mode
- create 3D inclusions, Points, Cracks and Clouds in **Inclusions** mode
- modify and delete cavities and inclusions
- estimate precisions and consistency of inclusions
- view diamond model and inclusions models

There are four views available:

- **Microscope camera**
- **Photo view**
- **Inclusion view**
- **Model view** (standard, the same as in previous versions Oxygen Inclusion)

To use these modes select button **Cavities** (default) or **Inclusions** on the top toolbar:

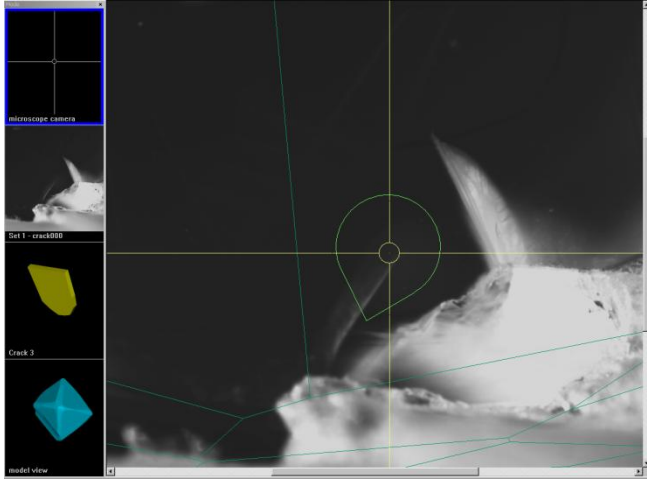


There are **controls panel** on the right side of the screen. The **controls panel** includes tree tabs:

- **Inclusions** - to create or edit inclusions
- **Hardware** - to control the microscope and camera
- **Photo Sets** - to load, view and select photos

Microscope camera mode

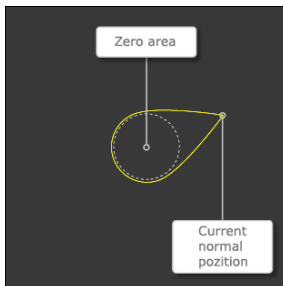
The **Microscope camera** mode allows to create photos of inclusions and cracks inside the stone. To use this mode select button **Microscope camera** on the left panel.



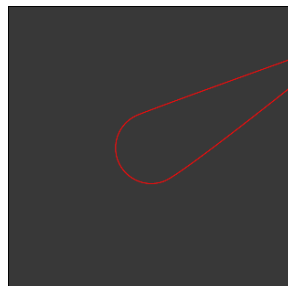
There is live camera view in the center of the screen allows to observe rough, 3d model over the rough and **Indicator Pear** of the current facet's slope.

The **Indicator Pear** has three colors: green, yellow and red.

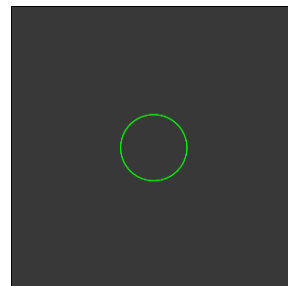
- **Green** - fine orientation for creating Inclusions contours
- **Yellow** - good facet orientation
- **Red** - orientation of facet is not recommended to make contours



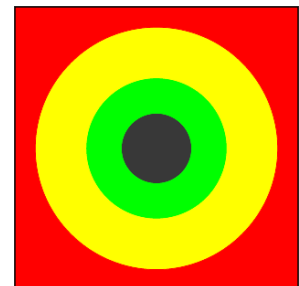
The Pear is a curve line cover circle in the center of Scene and current normal position. The Tail of Pear is always directed to the normal.



The length of Pear depends on the angle between the normal to the current facet of a diamond and direction of operator view. Then an angle is too big the Tail of Pear might go out the Scene.



Length of Pear become short or long as leveling of facet. When the facet has normal view Pear shape changes into Circle.

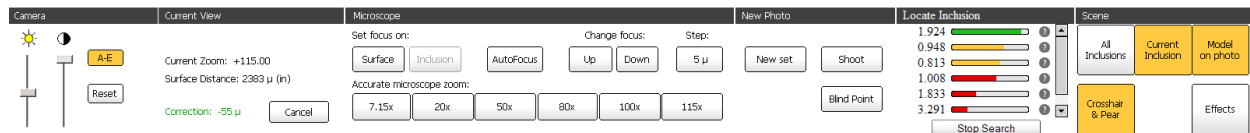


The color of Pear depends on the angle of normal deviation.

- More than 25 degree – red
- From 10 to 25 degree – yellow
- Less 10 degree - green

The panels on the bottom allow:

- set brightness and contrast
- adjust focus on surface
- set focus on surface of 3d model
- AutoFocus on the real surface of rough or inclusion
- set focus on inclusion
- accurate set microscope zoom
- make photos



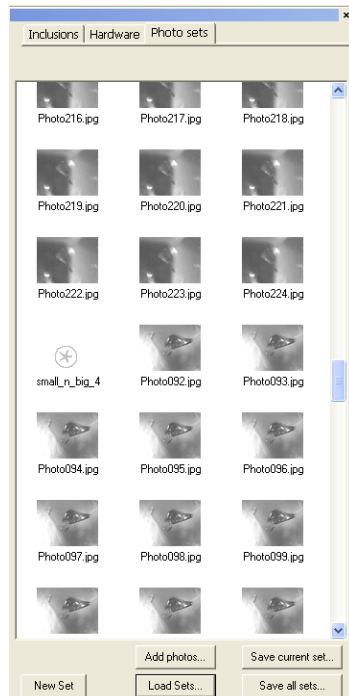
The Microscope and Camera are controlled in the **Hardware** tab on the right side of the screen.

Photo view mode

The **Photo view** mode allows to view and select photos for creating inclusion.

The photos obtained from microscope saved in *Photo Sets*. Photo set is a folder with photos.

To work with Photo sets select tab **Photo Sets**:



To create Photo set use button **New Set**.

Note. It is recommended to group photos in Photo sets by themes: inclusions, cracks, clouds and etc.

To load Photo sets:

- Select tab **Photo sets**

- Press key **Load Sets** in the bottom
- Select some folders with photos
- Photos will be loaded into tab **Photo Sets**
- The set might be one or several: Set1, Set2 и etc.

To save in JPG format:

- Click on **Save current set** or **save all sets**
- Choose **.bmp** or **.jpg** format

Note. Which format is proper for you?

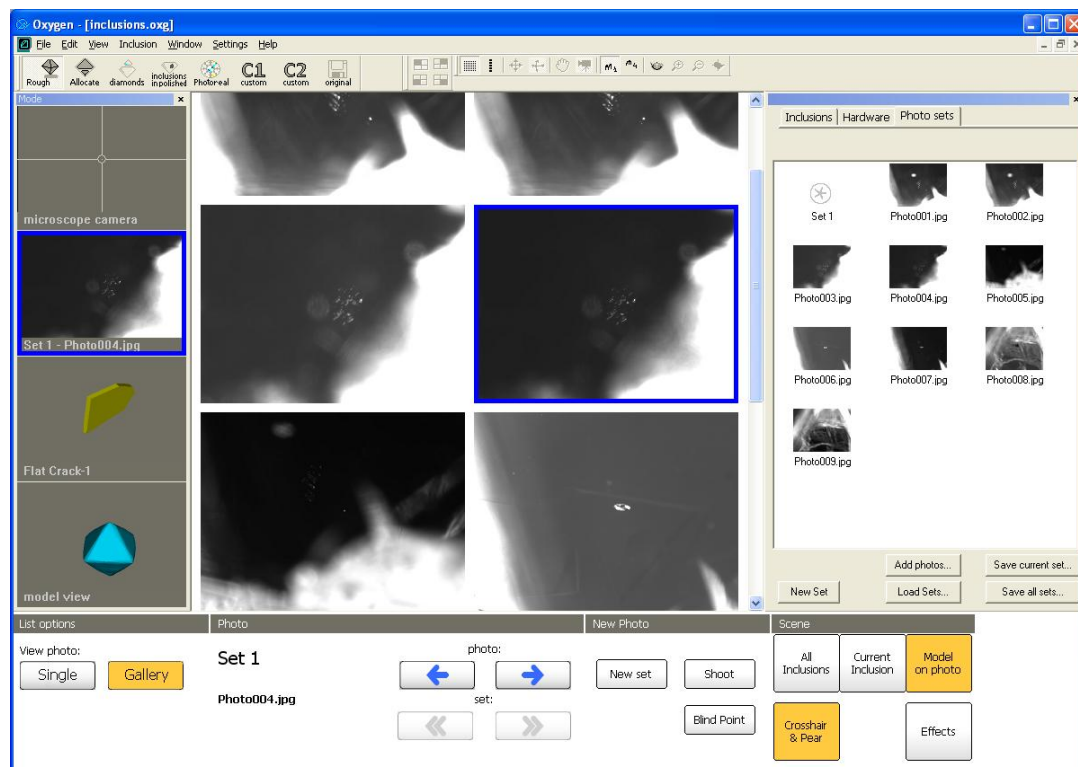
MBox Images saved in JPG format have size 10 times less than images in bmp format. Using of JPG format can save you up to 90% of disk space. It should be noticed that JPG image compression is not lossless and slightly affects the image quality.

We believe that the level of compression used in the Oxygen software keeps enough good image quality required to work with inclusions and therefore we generally recommend to use JPG format, especially if you store images for long time or send them through the Internet or local network.

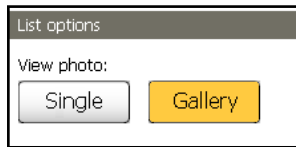
If you don't care about the size of images and want to use lossless image format than you may prefer to use bmp.

To explore photos in a gallery:

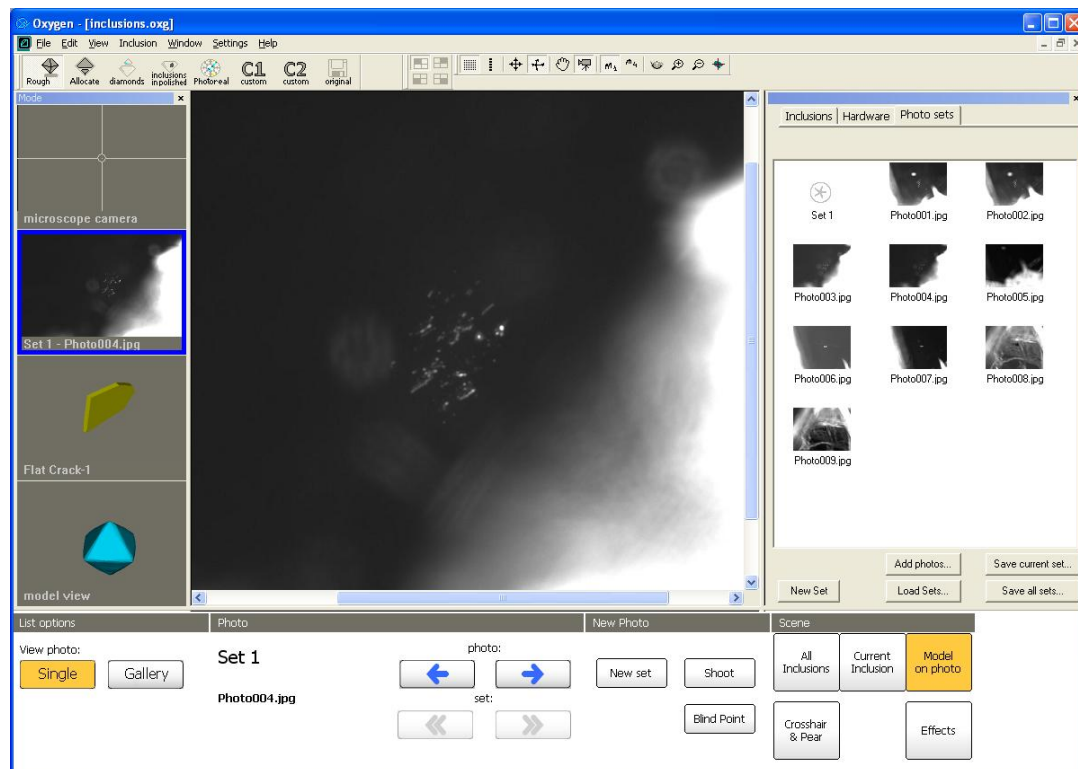
- Select a photo



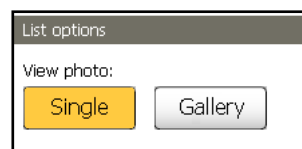
- Double click selected photo or press button Single



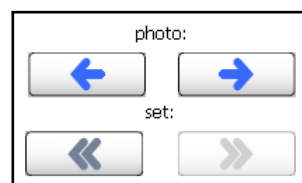
- The photo will be enlarged



- To switch back to the gallery press button **Gallery**



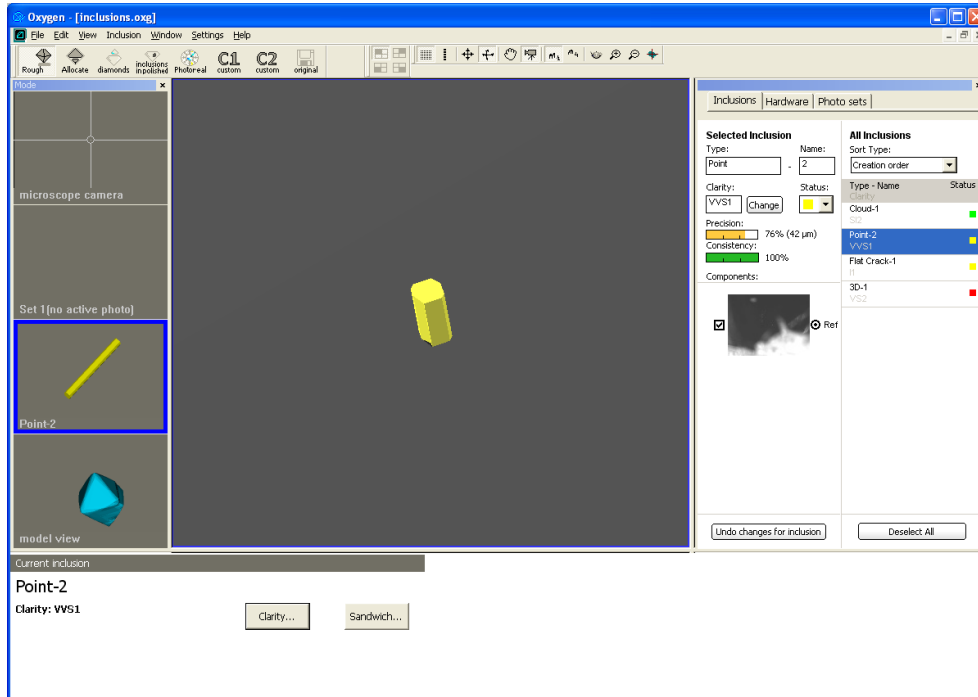
- To list photos use buttons



- To list photos by mouse
 - press and hold left mouse button
 - hold and move mouse on Scene
 - the photos will be changing like a movie

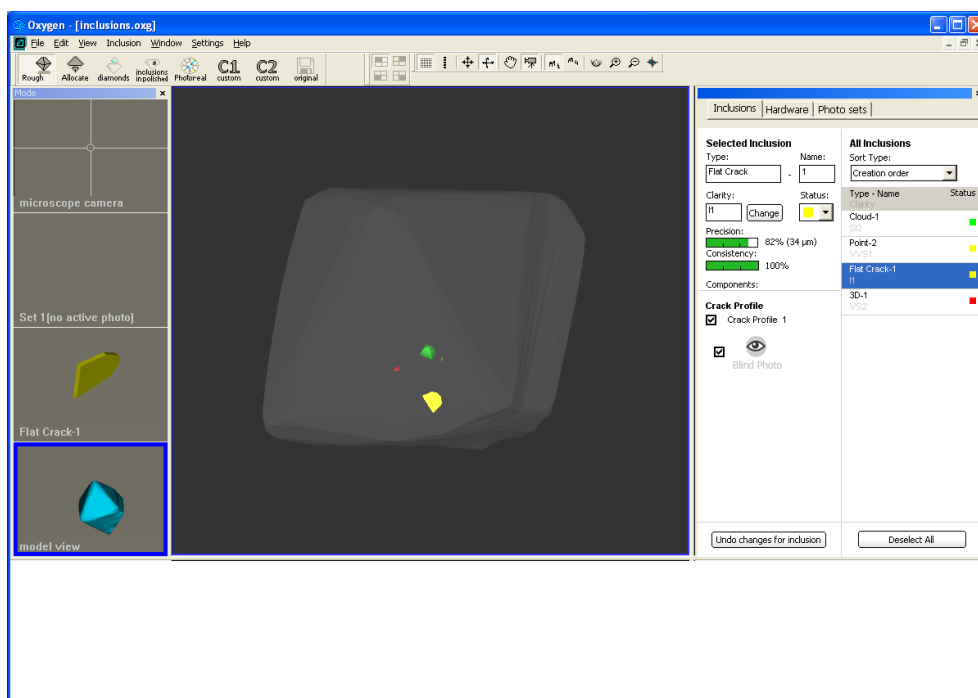
Inclusions mode

Inclusions mode allows to view selected inclusion or cavity in large size. The buttons **Clarity...** and **Sandwich...** allows to change clarity and make sandwiches. They are available in **Inclusions** mode only.



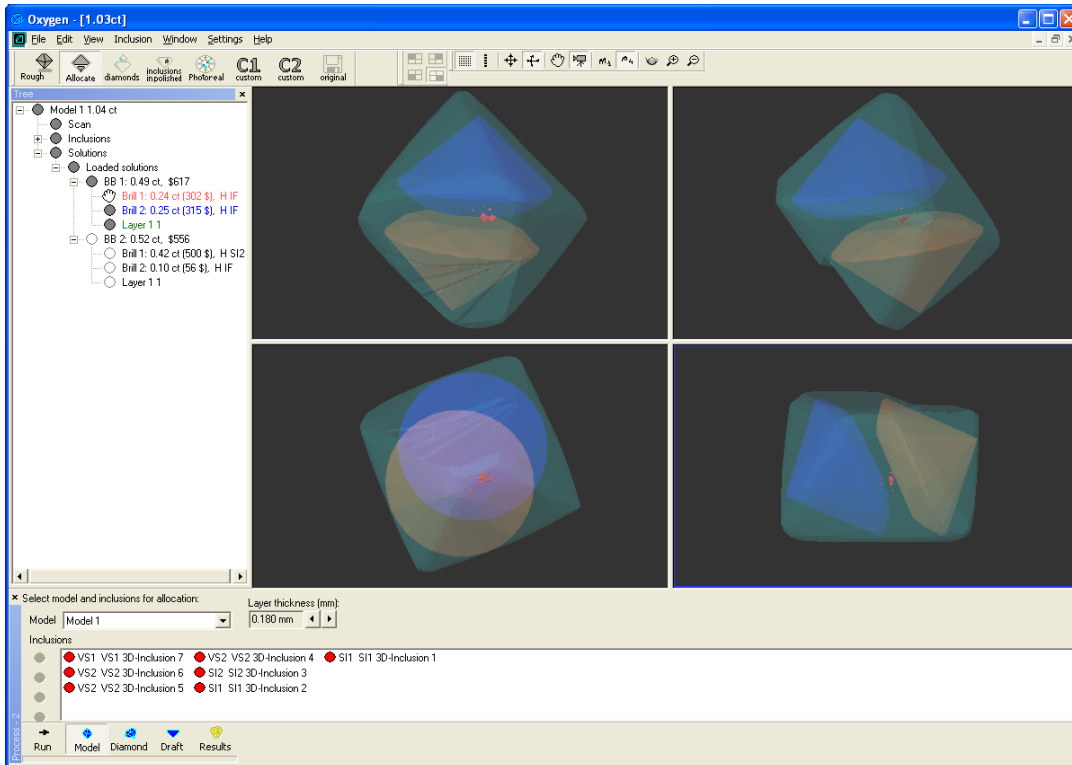
Model view mode

Model view mode provides standard view of rough model with cavities and inclusions. Cavities are cut from rough model and do not participate in further processes.

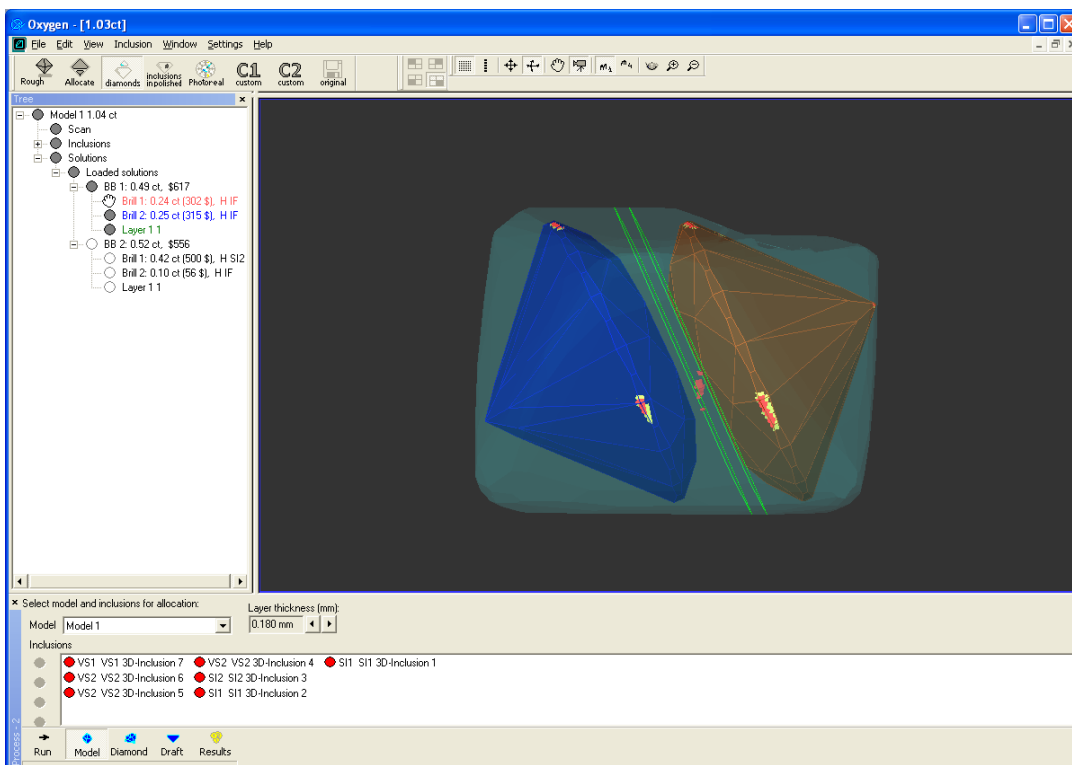


Allocate mode

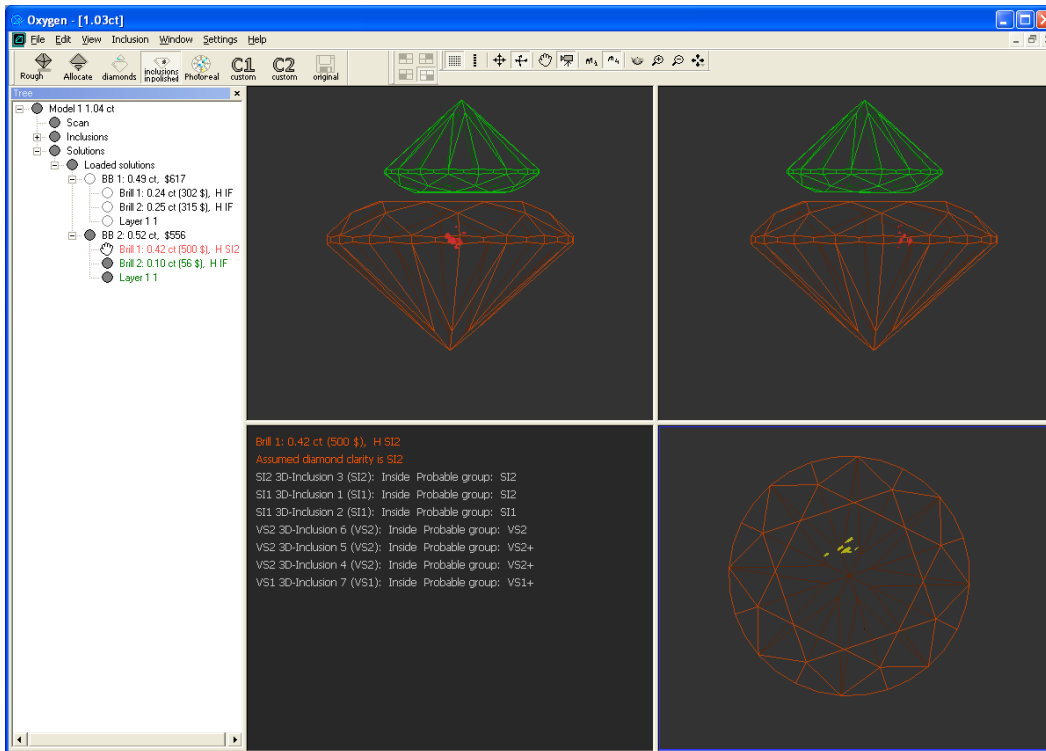
The **Allocate** mode allows to find and view solutions for rough diamonds. **Tree** panel on the left shows solution list, diamonds and saw layers.



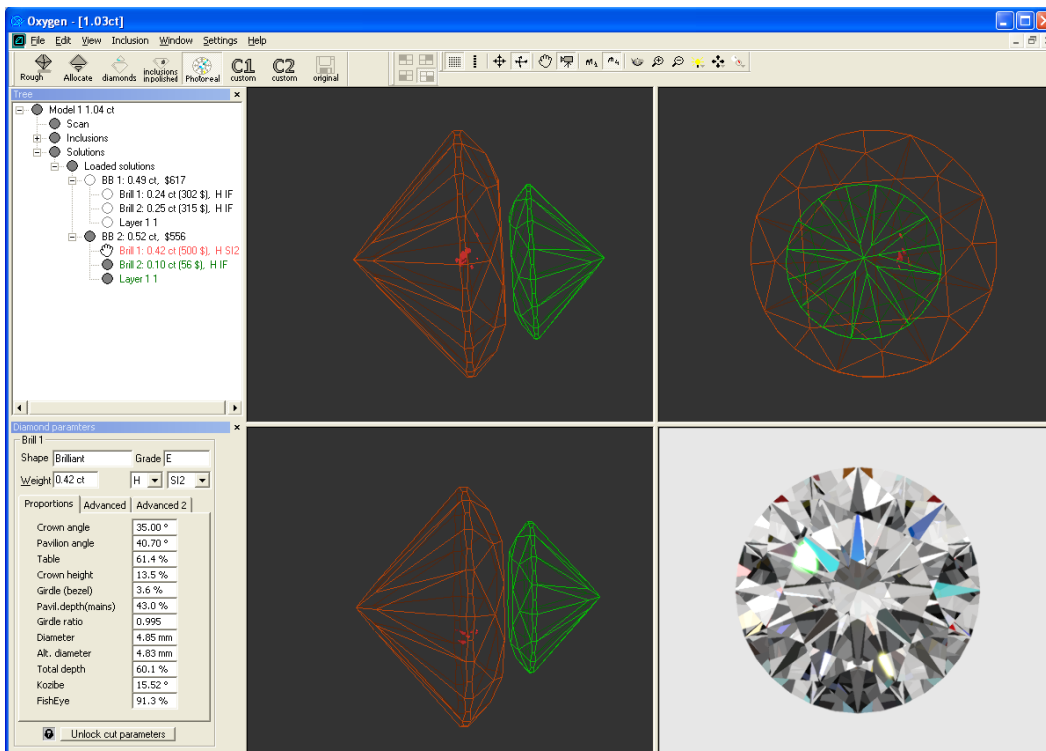
Diamonds mode



Inclusion in polished mode



Photorealistic image mode (DiamCalc style of image)

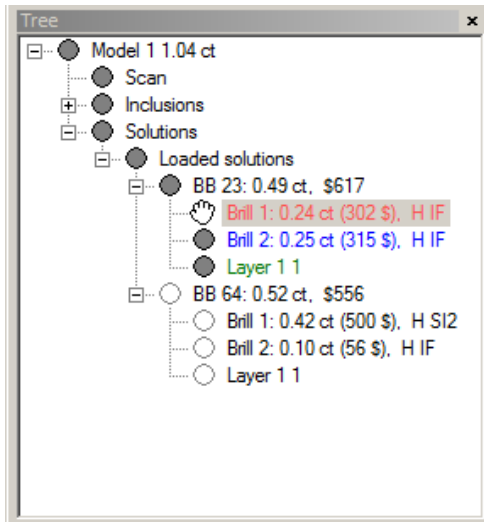


Read details in the section **HDR photorealistic diamond and inclusions visualization**

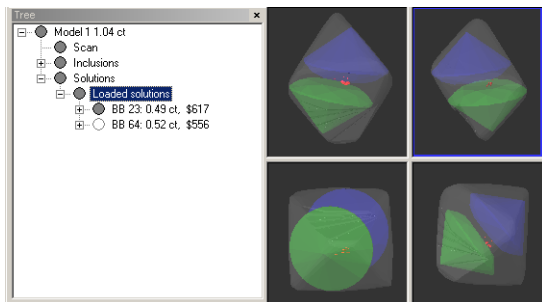
4.3 Tree panel

Tree panel is the list with all solutions, rough diamond model, polished diamonds, inclusions and etc.

The **Tree** panel is designed to show and control all objects of the project. **Tree** panel is available in the **Solutions**, **Diamonds**, **Inclusions** and **Photoreal** modes.

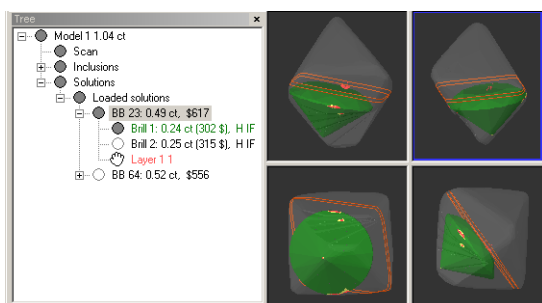


To show solutions list click over **Solutions** in **Tree** panel:



By default you see only one solution in Scene at a time - the solution you selected in **Tree**.

To show solutions expand it on Tree. Solutions include allocated diamonds and saw layers.



To hide any object of solution use **Alt click**.

To show / hide inclusions:

- Expand inclusions in **Tree** panel
- Click over different inclusions in **Tree** panel



- Inclusion is highlighted (becomes more bright) in the scenes



- To hide this inclusion in scenes (not shown) click mouse over the **gray circle** icon near the inclusion and hold **Alt** key the same time
- The inclusion is hidden (the icon becomes hollow circle)

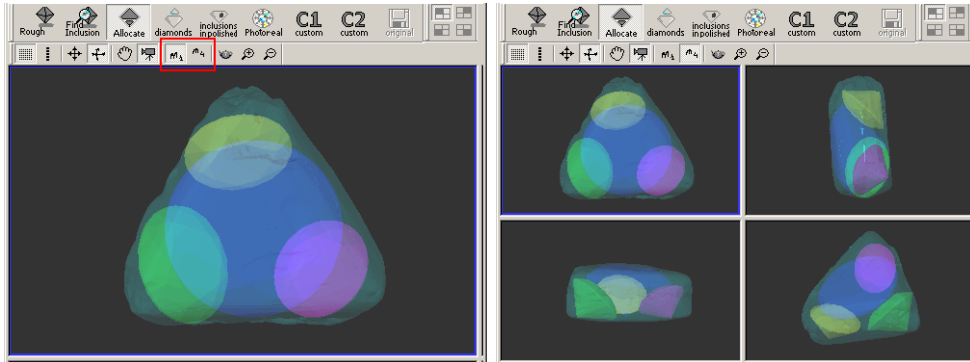


- Next Alt-click over it will make inclusion visible again

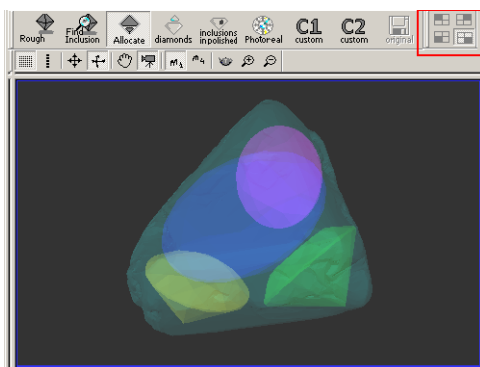


4.4 Single view and 4-views Scene modes

To switch between single view and 4-views Scene mode use buttons **m1** and **m4**



To switch between Four Scenes use button



4.5 Move and Zoom options

To control objects in Scene use the instruments **move**, **rotate**, **zoom in**, and **zoom out** from the toolbox:



The default tool in the scene is **Rotate**.

- to rotate objects in Scene press left mouse button and move mouse
- to move the scene hold **Shift** button
- to Zoom In/Out hold **Ctrl** button

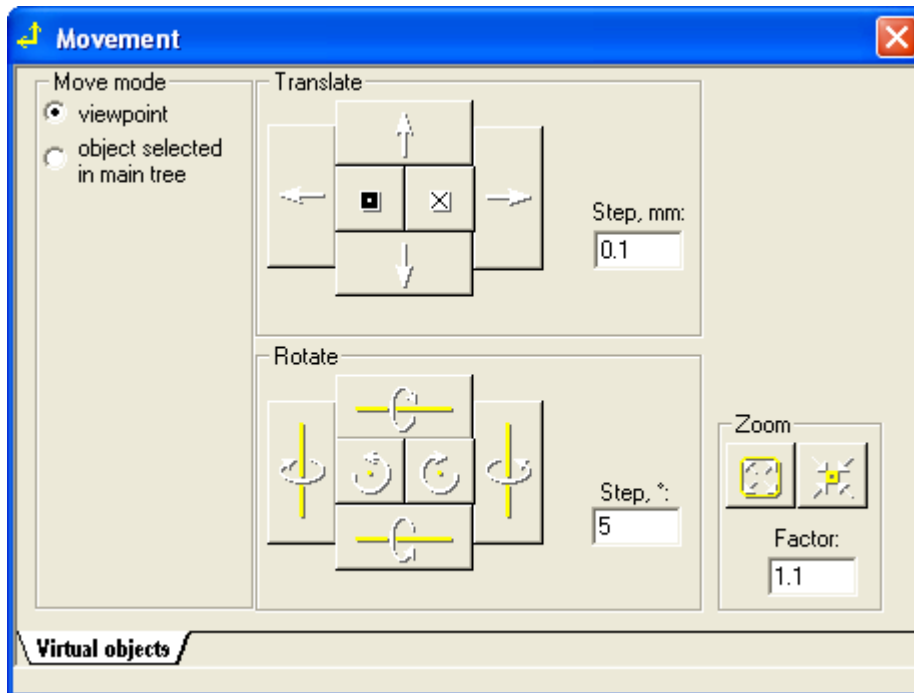
Select **View/Show toolbox text** from menu to show big size buttons with its titles.



4.6 Movement panel

The **Movement** panel allows precisely set distance, angle and zoom steps for any object on the scene.

To open panel select from menu **View / Movement**



To move objects:

- Select **Move mode**:
 - Viewpoint
 - Object selected in main tree
- Move objects with button in **Translate** section
- Rotate objects with button in **Rotate** section

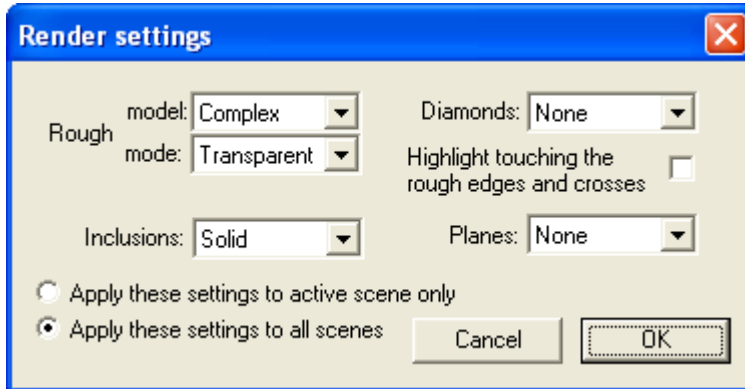
4.7 Scene render settings

There are different styles of object visualization:

- Wire-frame (lines)
- Solid
- Transparent
- Refracted (for inclusions).

The visualization scheme is changed automatically when you switch the working mode. However, it is possible to adjust visualization style for one or all scenes according to your momentary needs:

- Click **Tea-pot** button  to adjust visualization mode

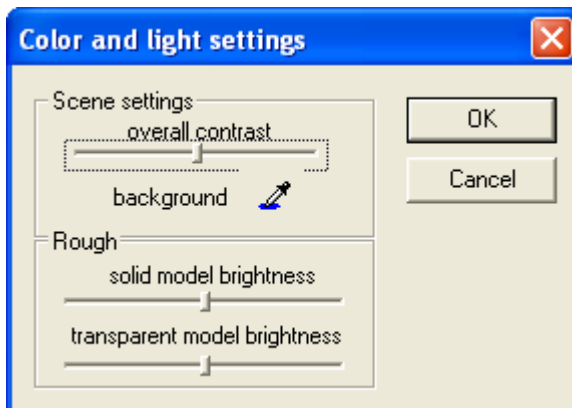


- Select the desired visualization styles for objects in the **Render settings** panel
- Optionally select **Apply these settings to active scene only** or **Apply these settings to all scenes**
- Press **OK**.


4.8 Color and light settings

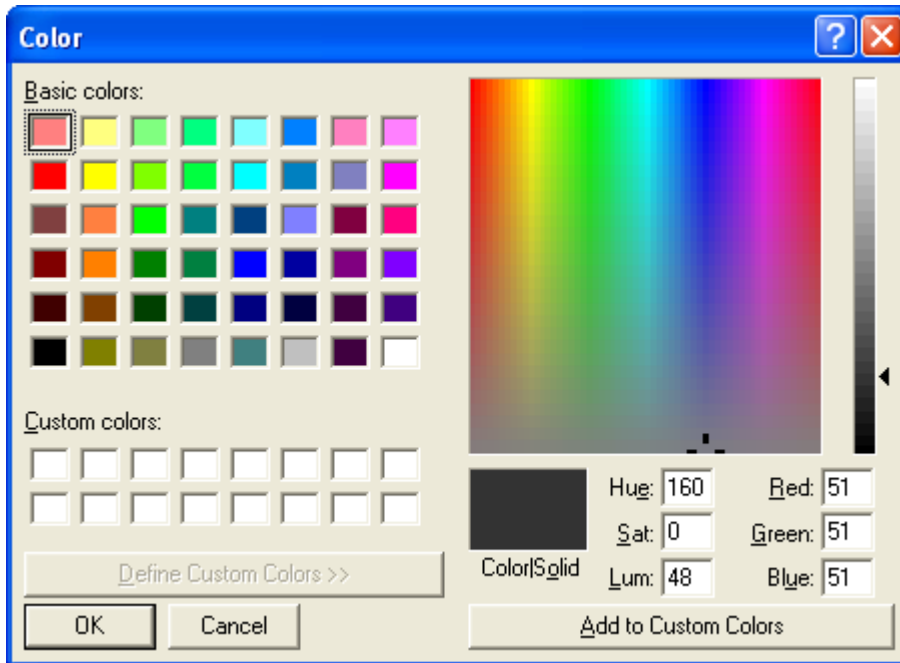
To change color and light settings:

- Open panel from menu **Settings / Color and light settings**
- Adjust contrast of Scene and brightness of rough models



To set the color of the background

- Press button  in the panel **Color and light settings**
- Select color in the **Color** panel



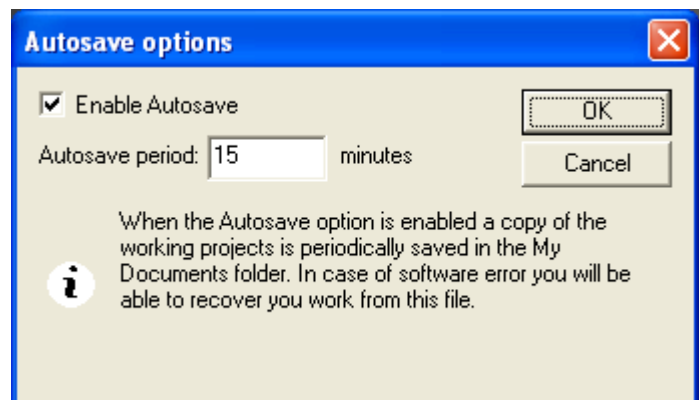
- Press **Ok**

To change color of a rough or a diamond:

- Click right mouse button on it in **Tree** panel
- Open **Color...**

4.9 Autosave file option

The option allows to save oxg file automatically. When Autosave option is enabled a copy of working project is saved periodically in file ******_Autosave** in the folder **My Documents**. In case of software unexpected error you will be able to recover your work.



To switch on / off Autosave option and make Autosave settings:

- Open panel **AutoSave options** from menu **Settings / Autosave options...**
- Check / uncheck section **Enable Autosave**

5 Creating Inclusions

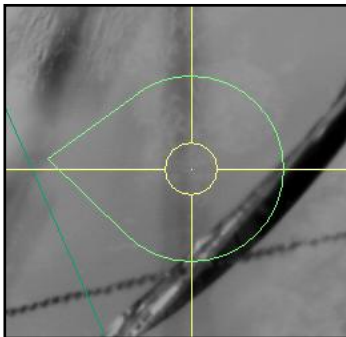
Oxygen software allows creating all types of inclusions Point, 3D, Clouds, Flat cracks, Curved cracks and others. Modern Context based interface is easy and comfortable.

5.1 Adjusting focus on surface

We recommend to adjust focus on surface every time you create new contour of inclusion from some new facet. It allows to get more accurate result of constructing inclusion.

To adjust focus on surface:

1. Look in your microscope and find an inclusion
2. Try to find the facet position where *Indicator Pear* is green or yellow



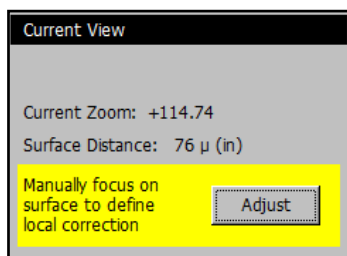
3. Set focus on the surface of 3D model of stone via button **Surface**



4. Press button **AutoFocus** or change the focus position manually if a picture in a microscope is blurring (See section **Auto focus**)



5. Press button **Adjust** to define a local correction of focus on surface



Now you are ready to create an inclusion's contour.

5.2 Point Inclusions

The Oxygen Microscope creates *Point Inclusions* by one photo or several photos from different directions. Use Point Inclusion tool in case of small inclusions with simple shape full fit in a field of depth.

Procedure outline

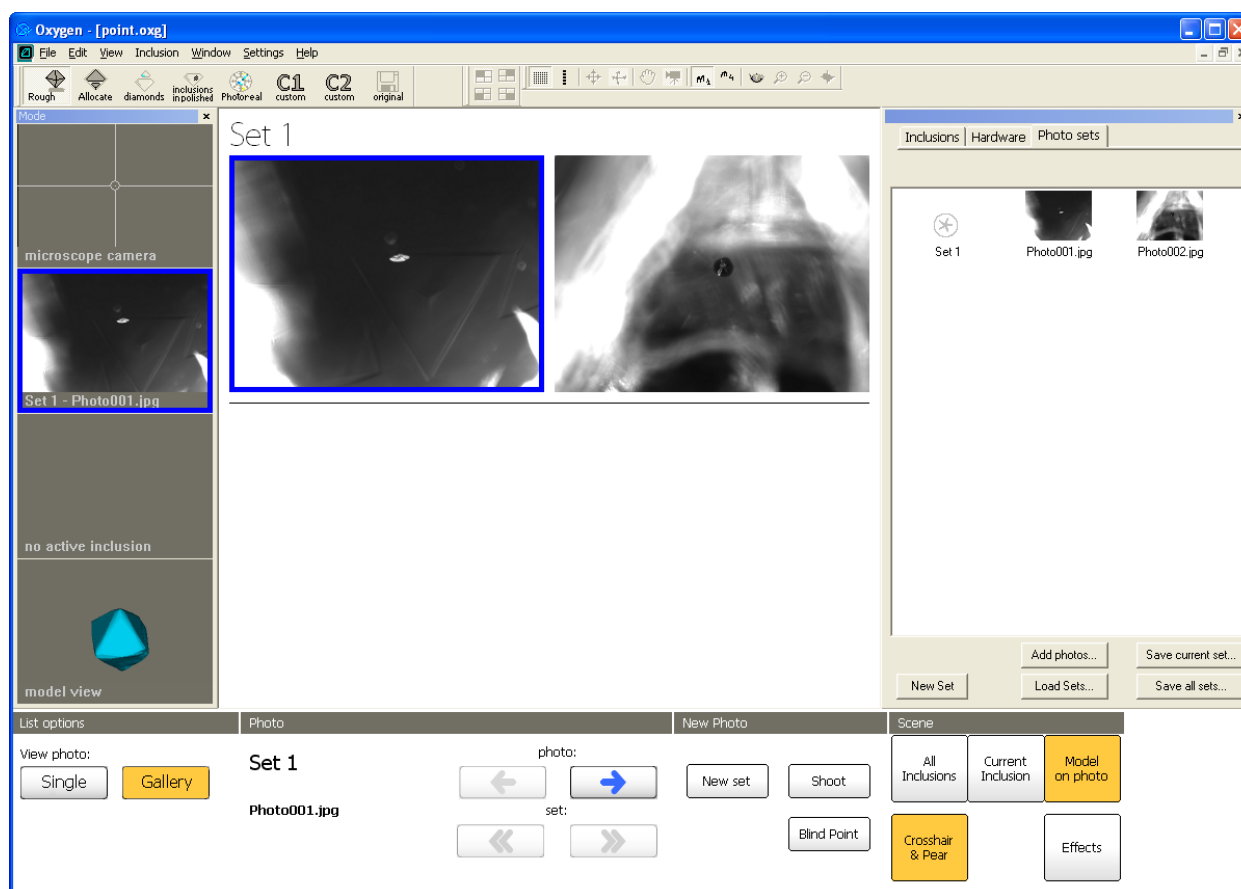
- Step 1. Making one or two photos from different directions
- Step 2. Creating a contour from one direction
- Step 3. Creating a contour from second direction
- Step 4. Verifying visual shape of inclusion
- Step 5. Recommendation

Download example .oxg file with photos:

<http://www.octonus.com/oct/download/files/oxygen/SamplePoint.zip>

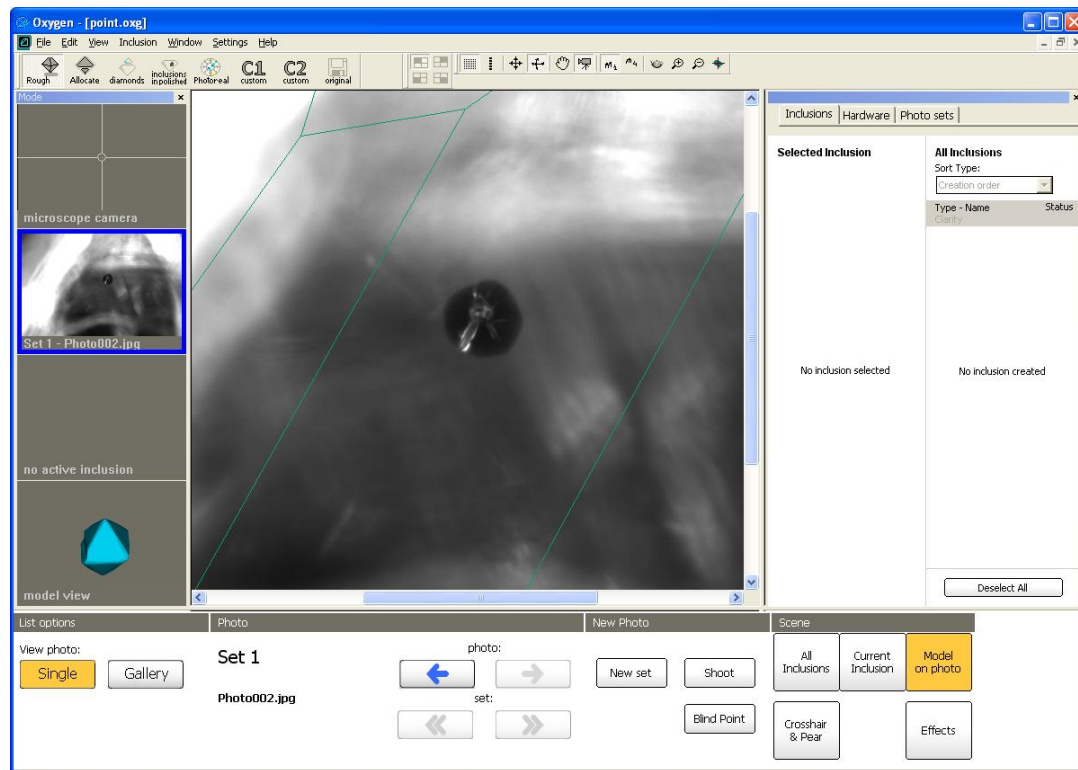
Step 1. Making one ore two photos from different direction

Make at least one photo of a point. Make several photos from different directions to create more precise Point Inclusion.

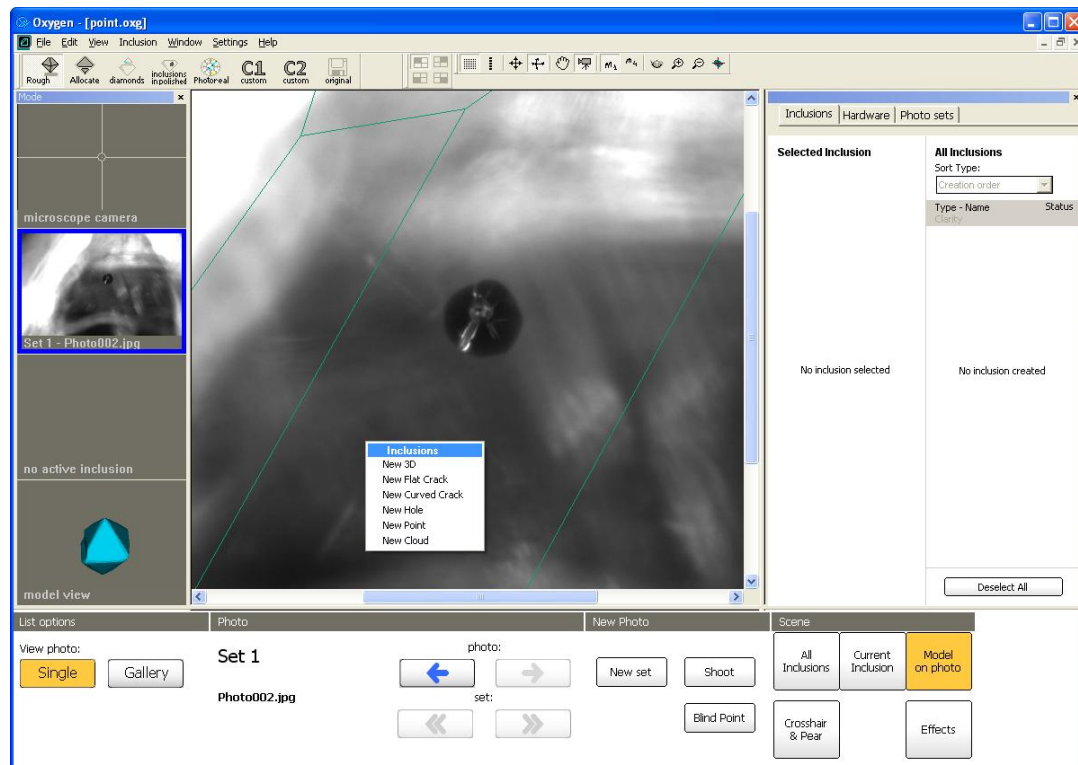


Step 2. Creating a contour from one direction

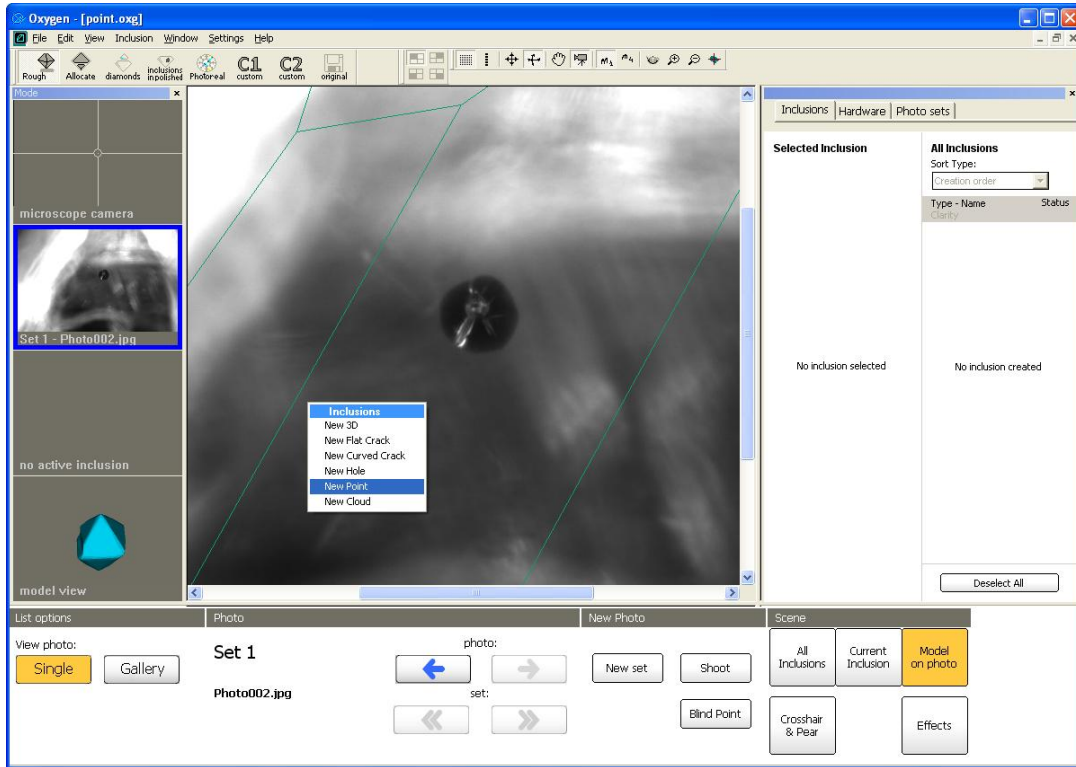
- Select one photo of point and zoom it



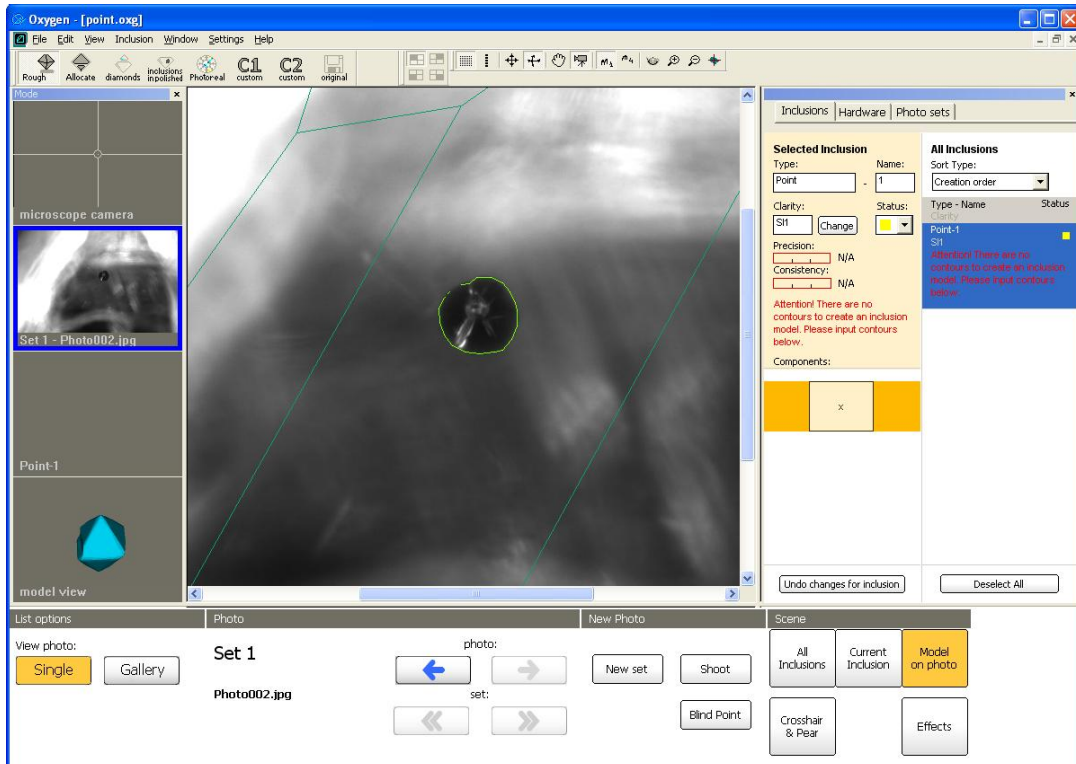
- Right click mouse on Scene to open context menu



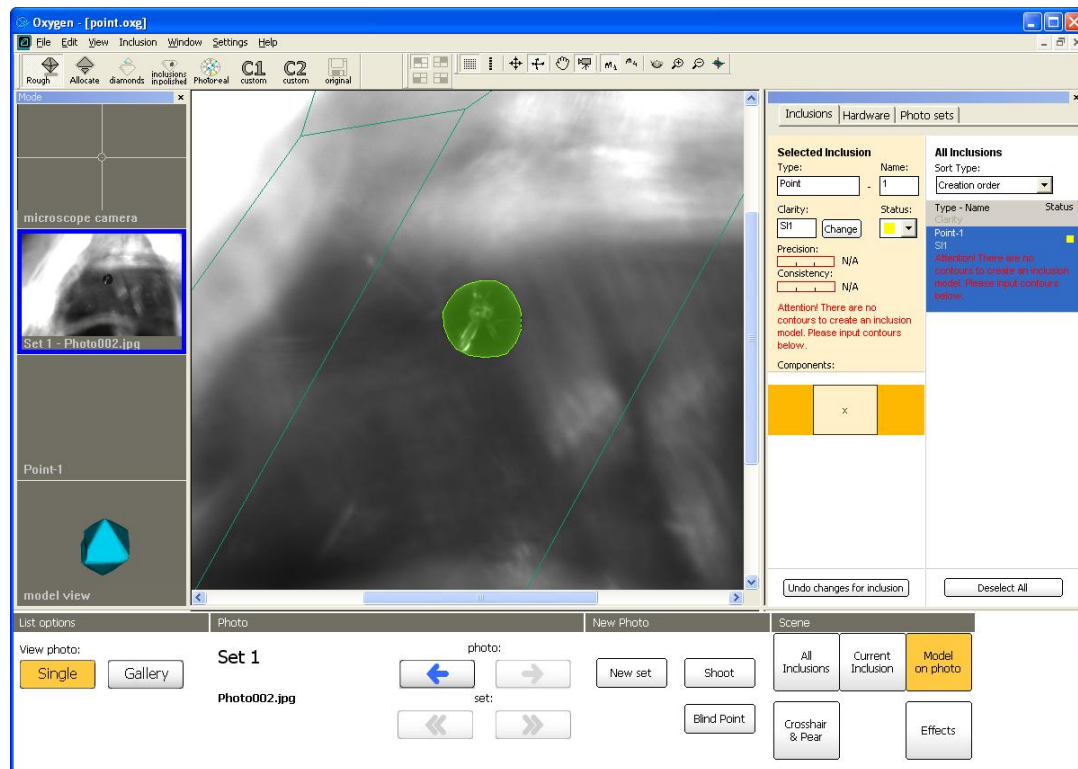
- Select **New Point** in context menu



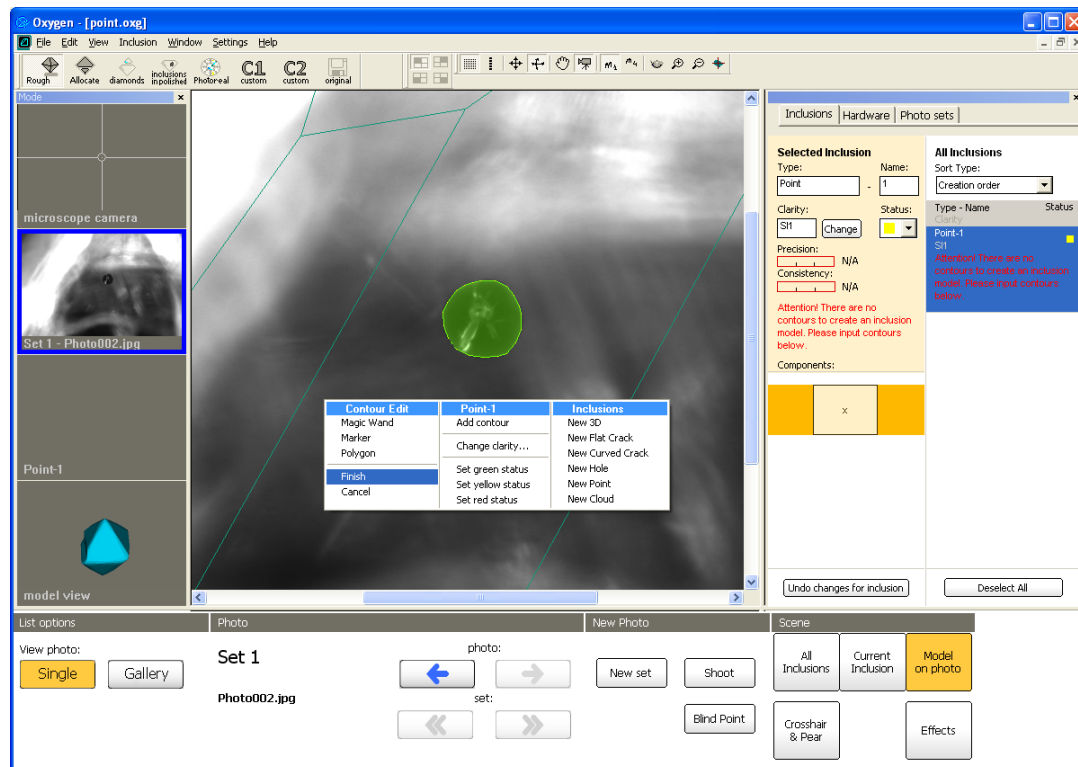
- Draw contour of point



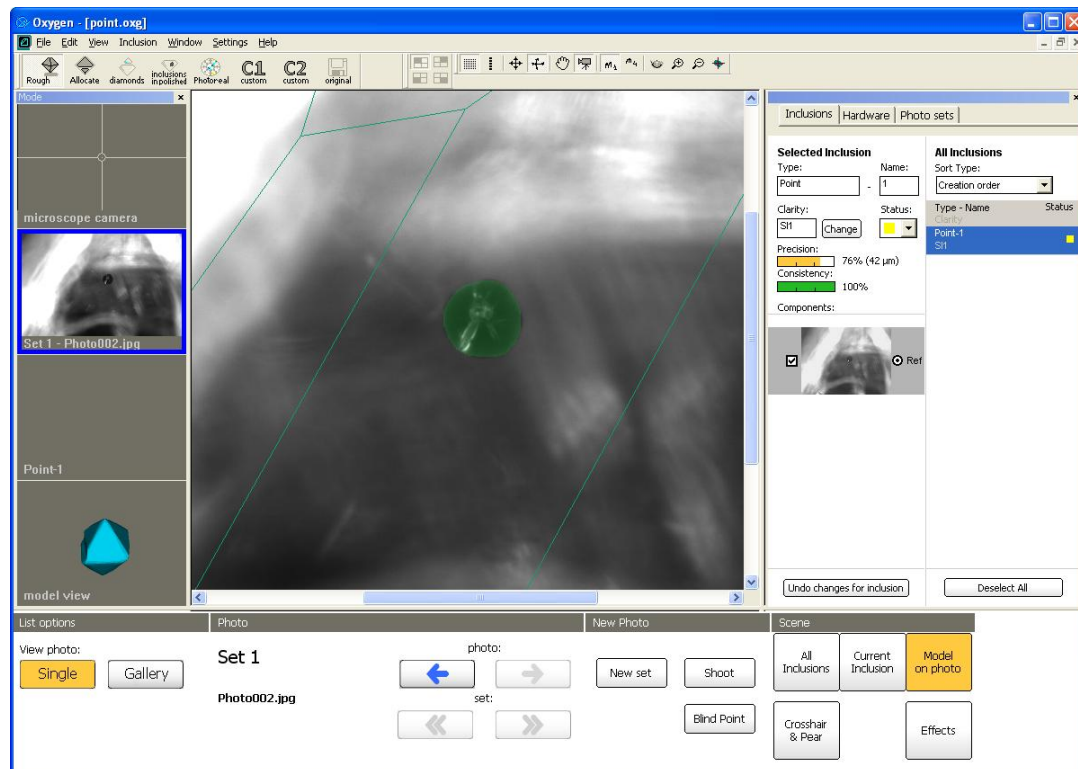
- Enclose contour by double click:



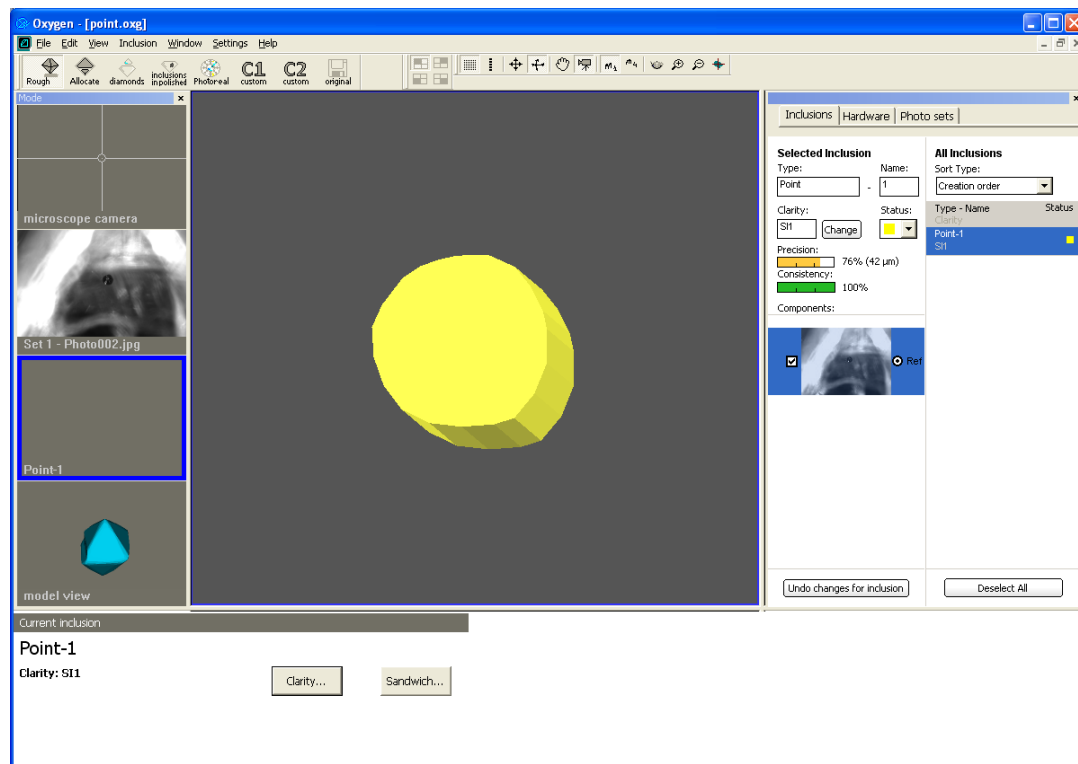
- Perform contour with right and left mouse buttons
- Then contour is ready right click mouse and select **Finish** in context menu



- The first contour is ready.

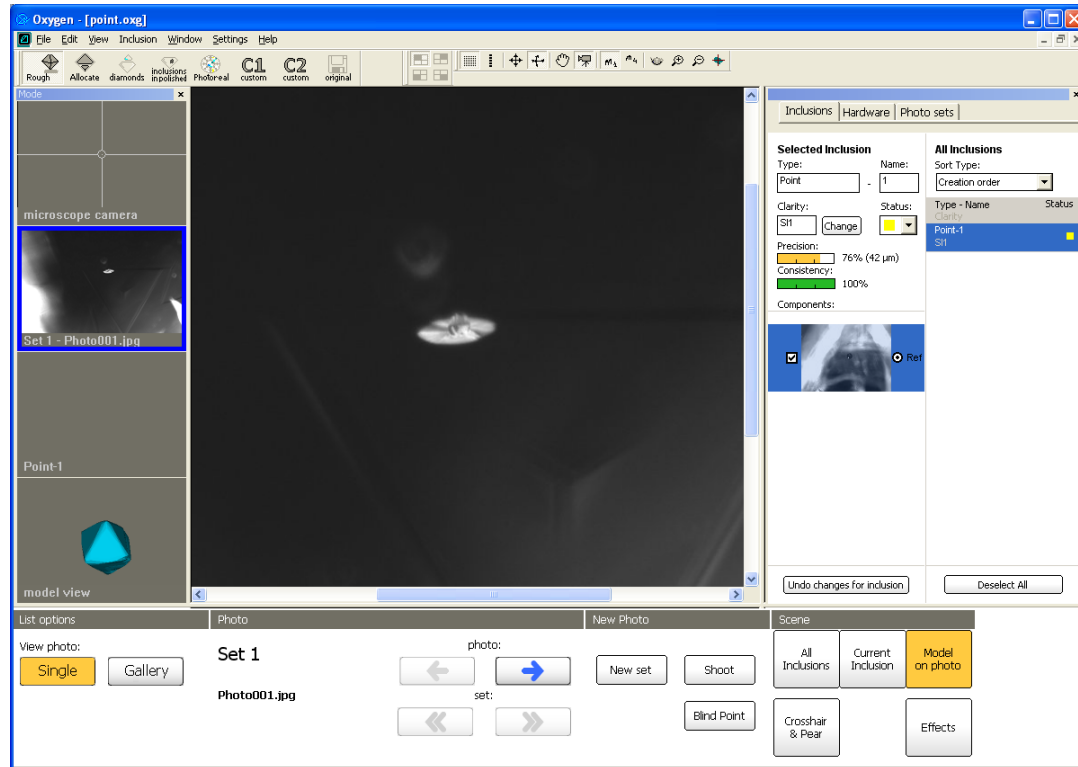


- See 3D model of inclusion created by one contour

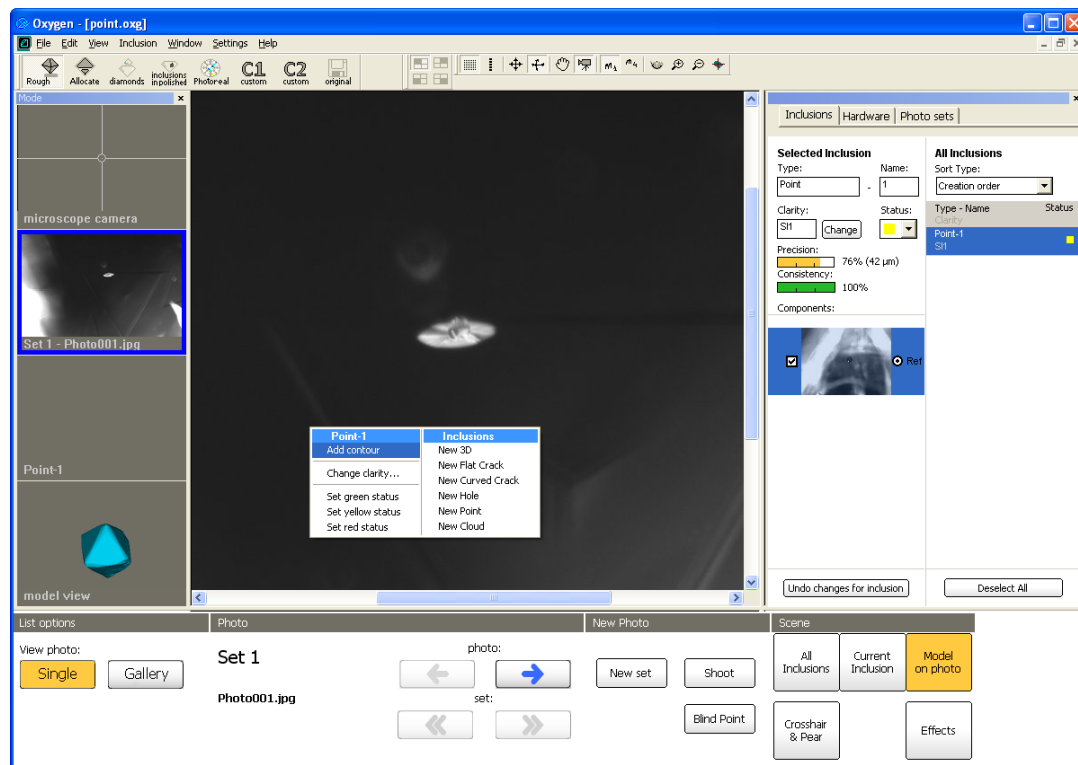


Step 3. Creating a contour from second direction

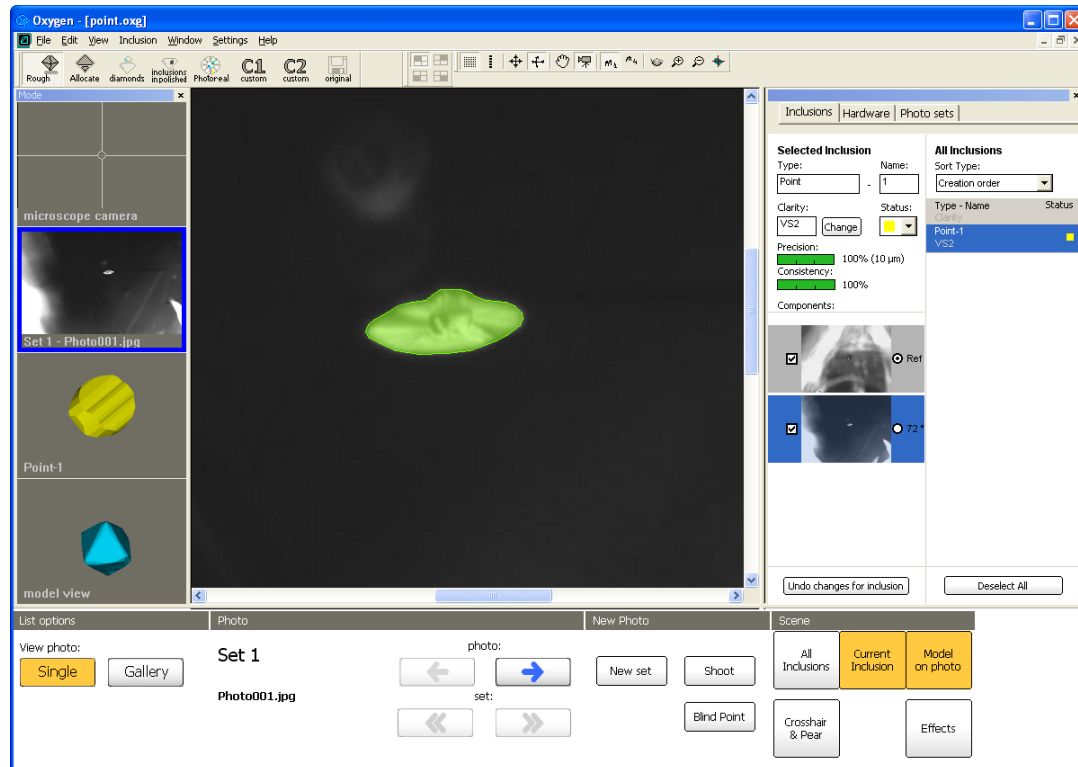
- Select photo of point from another direction



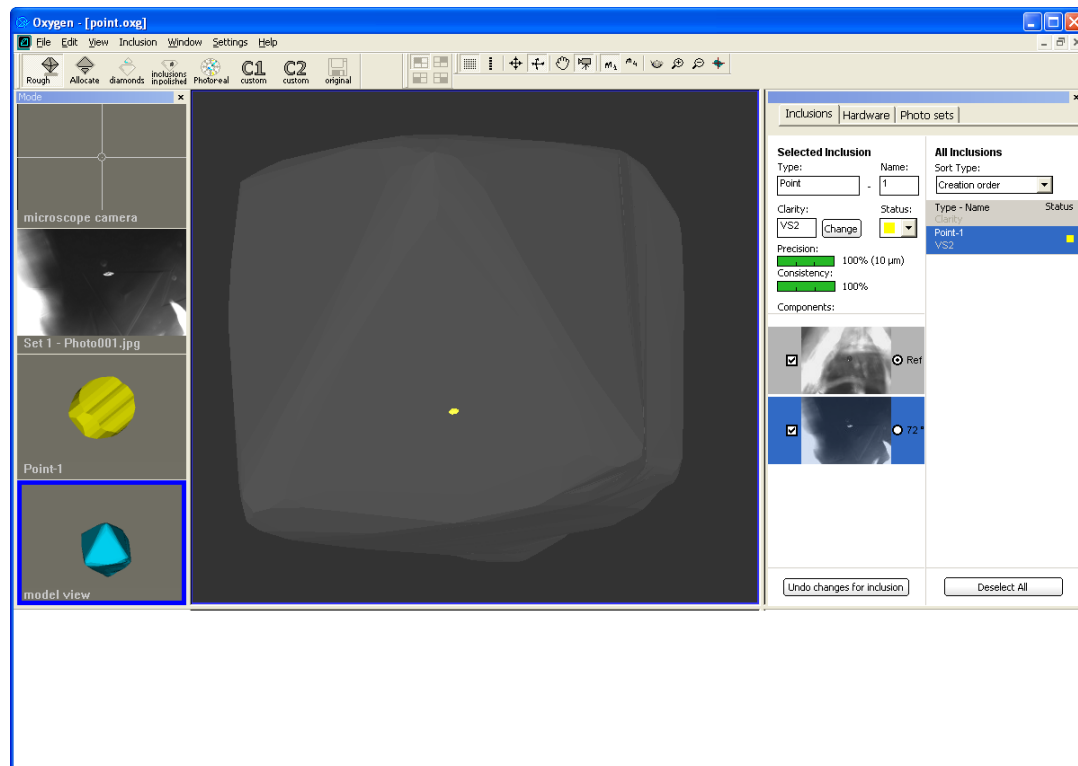
- Right click mouse in Scene and select **Add contour** in the section **Point-1**



- Make second contour the same way as first contour



- Point inclusion is ready

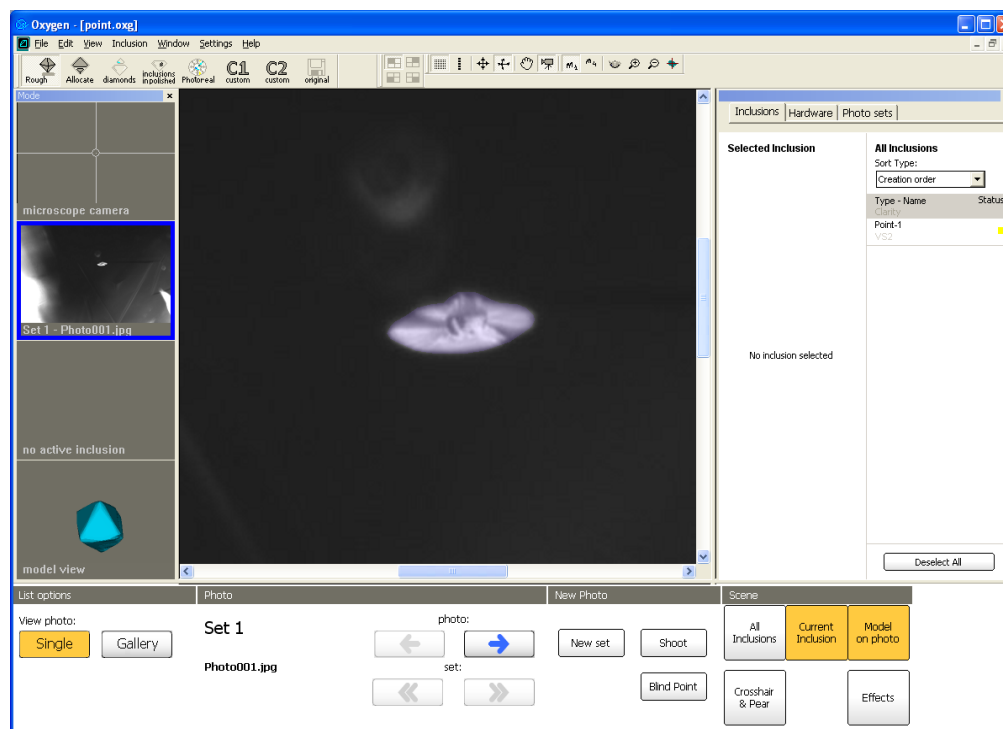
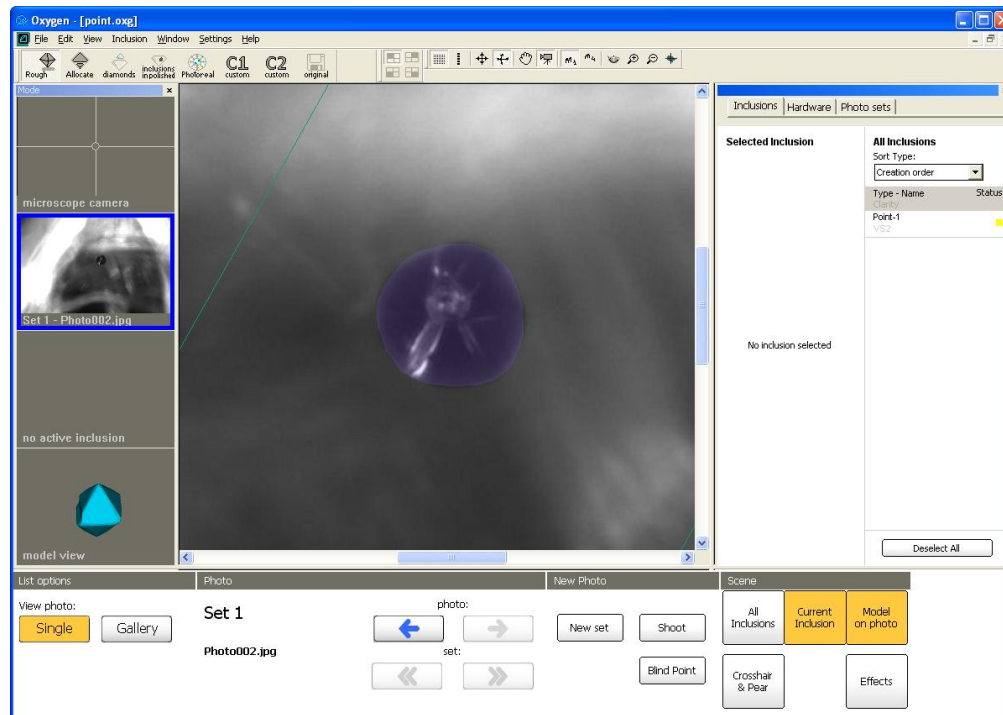


- Check inclusion **Precision, Consistency and Clarity**

Step 4. Verifying visual shape of inclusion

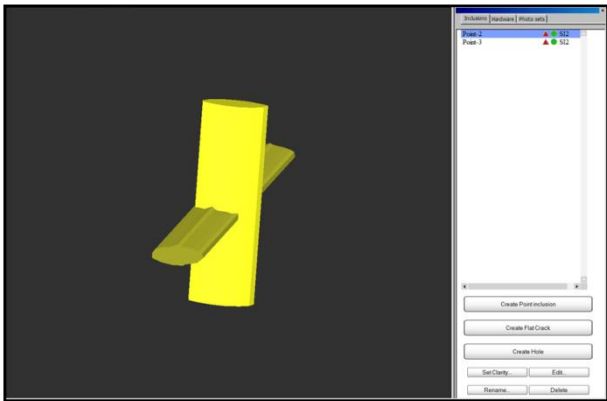
To verify visual shape of Point inclusion:

- Press button **Current inclusion** in the bottom panel to see its silhouette over the photo.
- Press button **Deselect All** which allows to unselect all inclusions
- List photos and see inclusions lilac silhouette over the photos



Step 5. Recommendation

We recommend to use several contours from different directions to create more precise Point Inclusion!



Two cylinders of one inclusion created with two different photos, zoom 50x (M-Box MZ 16A)




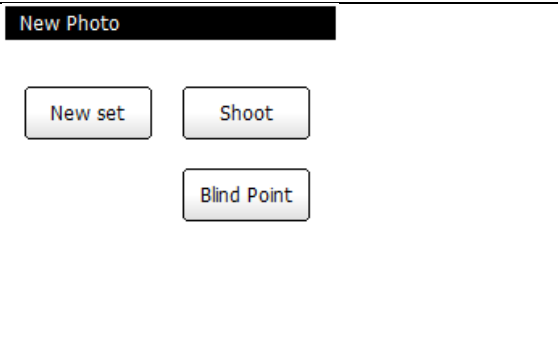
Final model of inclusion created by intersection of two cylinders obtained with two different photos, zoom 50x (M-Box MZ 16A)

5.3 Blind method for creating Point inclusions and Deep points

The *Blind method* allows to create **Point inclusions** and **Deep points of Cracks, 3D and Cavities** without creating a photo. The method is very fast and accurate.

To create **Point inclusion** by Blind method:

- Switch into **Inclusions** mode and activate **Microscope camera** view
- Be sure that **no one of inclusions is selected in Inclusions panel on the right side**
- Place the center of inclusion under the microscope crosshair
- Focus on the inclusion
- Press **Point** button on the M-box keyboard or **Blind point** button in the panel New Photo in the bottom of the screen.

Point button on the M-box keyboard	Blind point button in the panel New Photo in the bottom of the screen.
	



- Point inclusion will be created

The Deep points in Cracks, 3D and Cavities can be created the same way. Use this feature for inclusion refinement if verification shows that inclusion is not built accurate.

To create **Deep point** by Blind method:

- Switch into **Inclusions** mode and activate **Microscope camera** view
- But be sure that **inclusion Cracks, 3D or Cavity selected in Inclusions panel.**
- Place the center of inclusion under the microscope crosshair
- Focus on the desired deep point
- Press **Point** button on the M-box keyboard or **Blind point** button in the panel New Photo in the bottom of the screen.
- Deep point will be created

*So, if no one inclusion is selected button **Point** creates new Point inclusion; and if Crack or Cavity Inclusion are selected button **Point** creates new Deep point for selected inclusion.*

5.4 3D Inclusions

Tool 3D Inclusions is designed to create 3D inclusion models for large inclusions with complex shape and size more than field of depth.

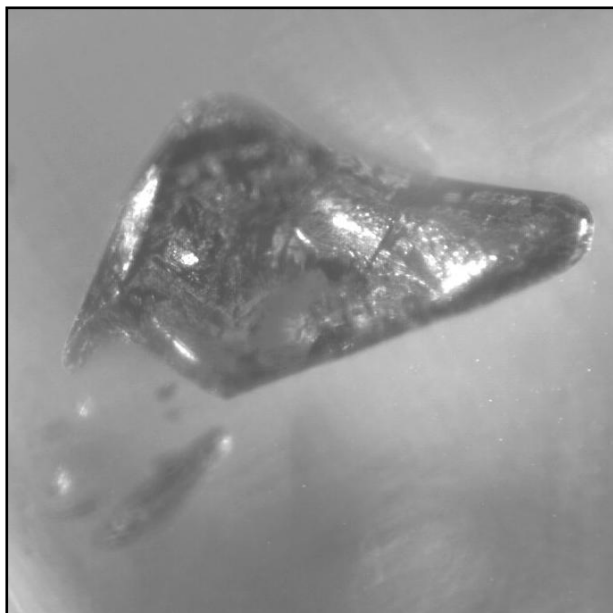
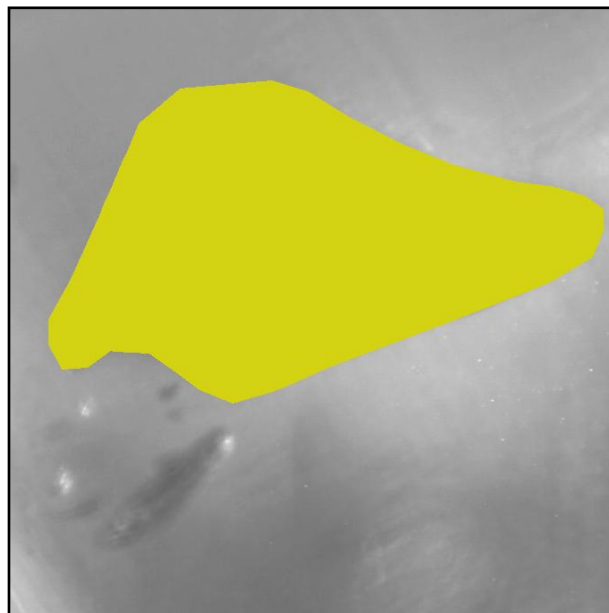


Photo of Large 3D inclusion



Oxygen 3D Inclusion model

Algorithm of constructing 3D inclusion is different from algorithm of Point inclusions. Cylinder is created by 3D inclusion's contour and cut only from one side closed to observer, because the observer can not see what is beyond field of depth for large inclusions, is there inclusion or not.

In case of Point inclusions cylinder is cut from two sides. The length of cylinder is equal a field of depth (see Appendixes).

The method of constructing 3D inclusions is similar to Clouds. The example below can be also used for creating Clouds.

Procedure outline

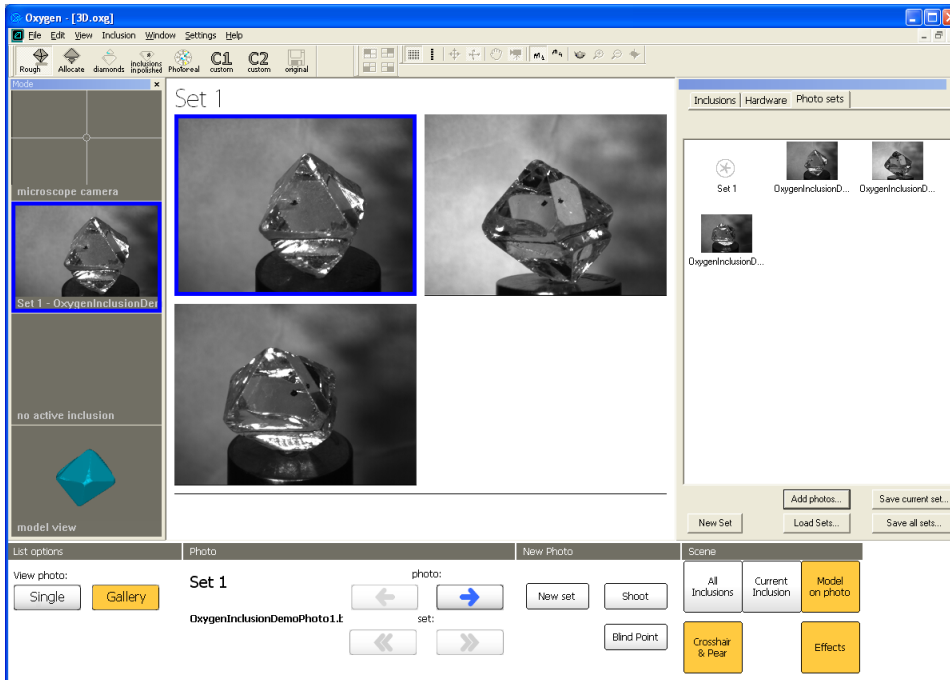
- Step 1. Making photos
- Step 2. Creating a contour from one direction
- Step 3. Creating a contour from second direction
- Step 4. Verifying inclusion

Download example .oxg file with photos:

<http://www.octonus.com/oct/download/files/oxygen/Sample3D.zip>

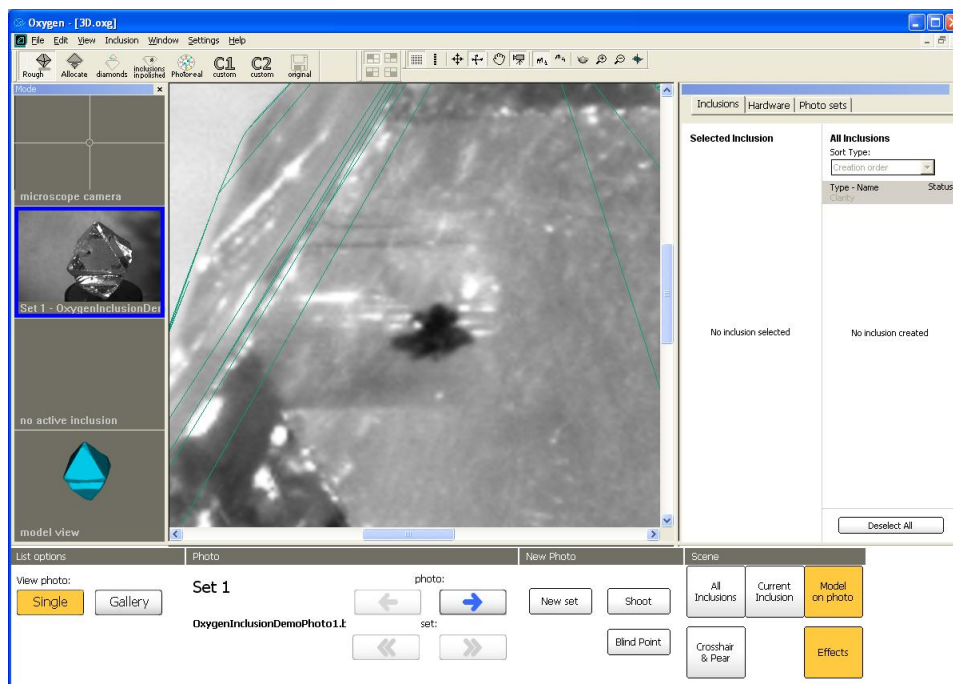
Step 1. Making photos

Make at least two photos of 3D inclusion from different directions for creating inclusion. We recommend to make additional photos from other direction for verification



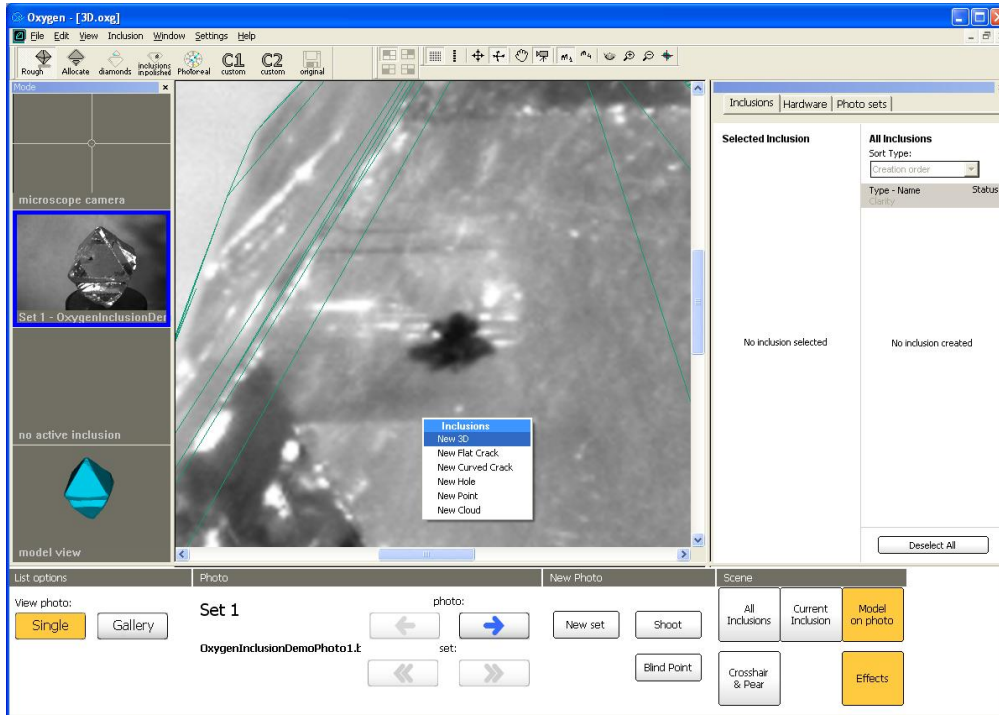
Step 2. Creating a contour from one direction

- Select one photo of 3D inclusion and zoom it

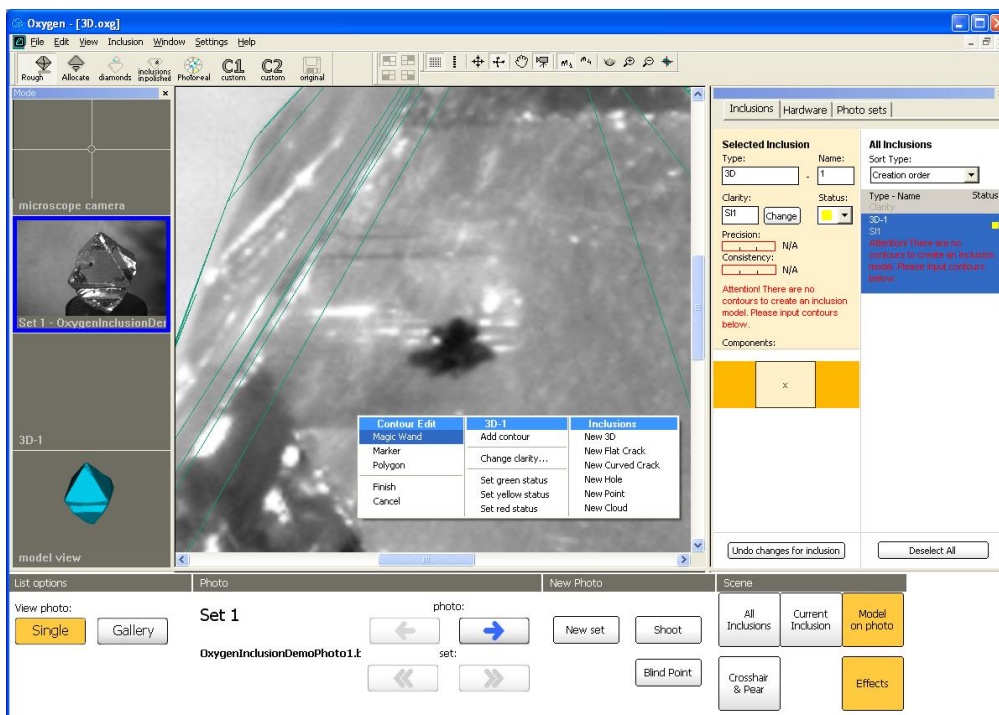


Note. To improve the photo **Auto Contrast** effect is switched on in this example

- Right click mouse on Scene to open context menu and select **New 3D Oxygen** documentation

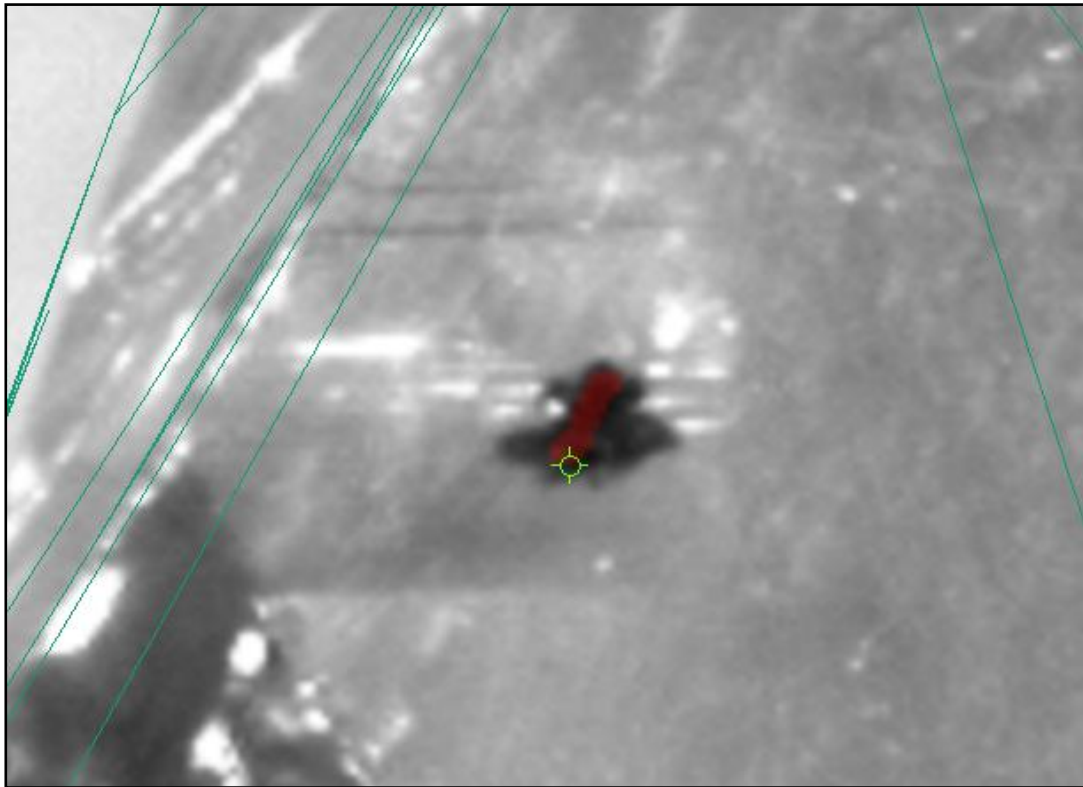


- For more comfortable work choose proper tool for creating contour. For this example of 3D we recommend to use Magic Wand tool. Right click mouse on Scene and select **Magic Wand** on context menu:

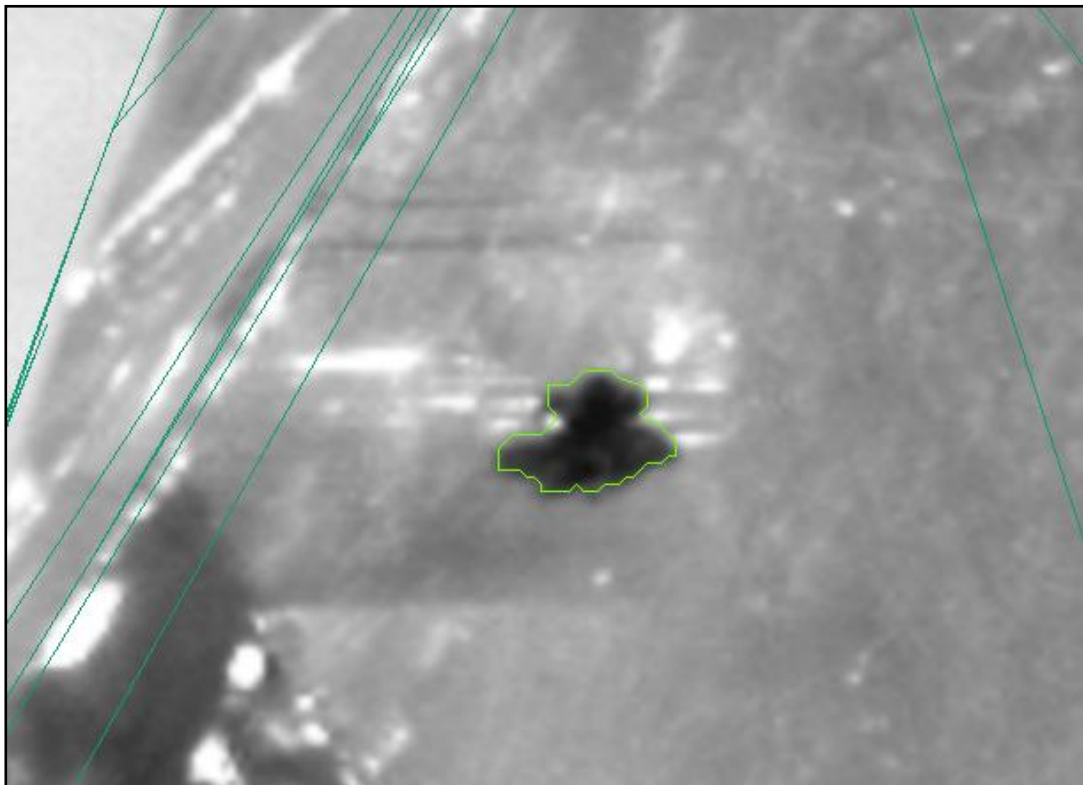




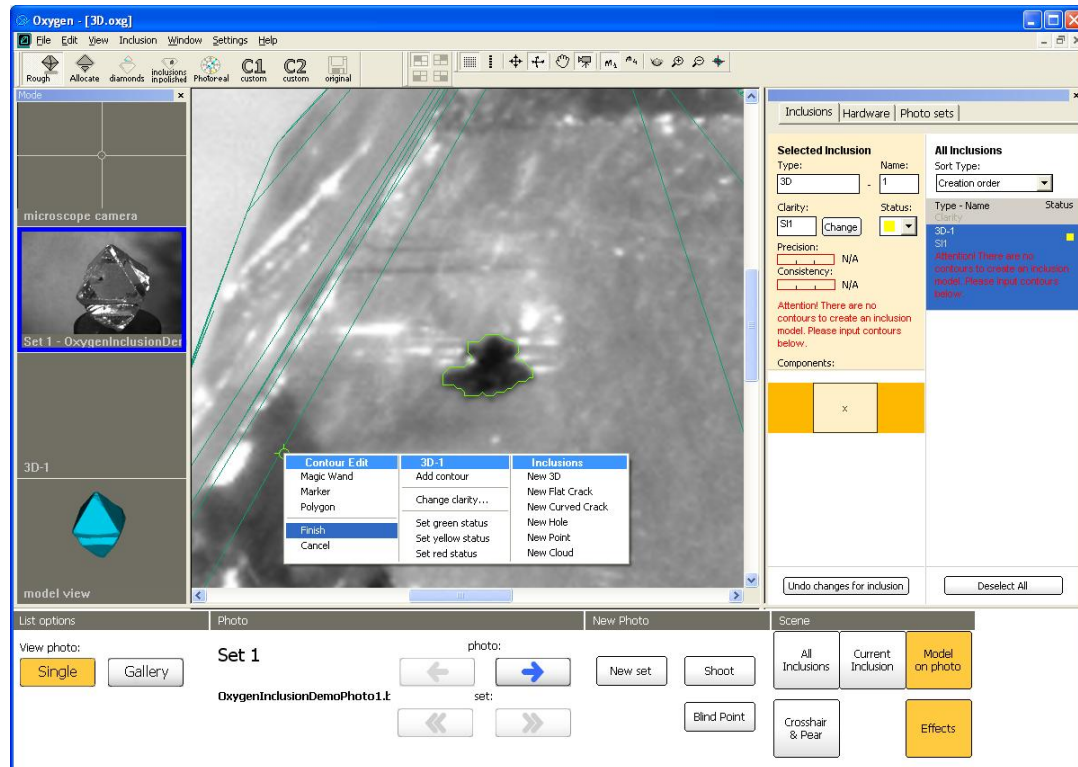
- Use instrument **Magic Wand** to create inclusion contour:



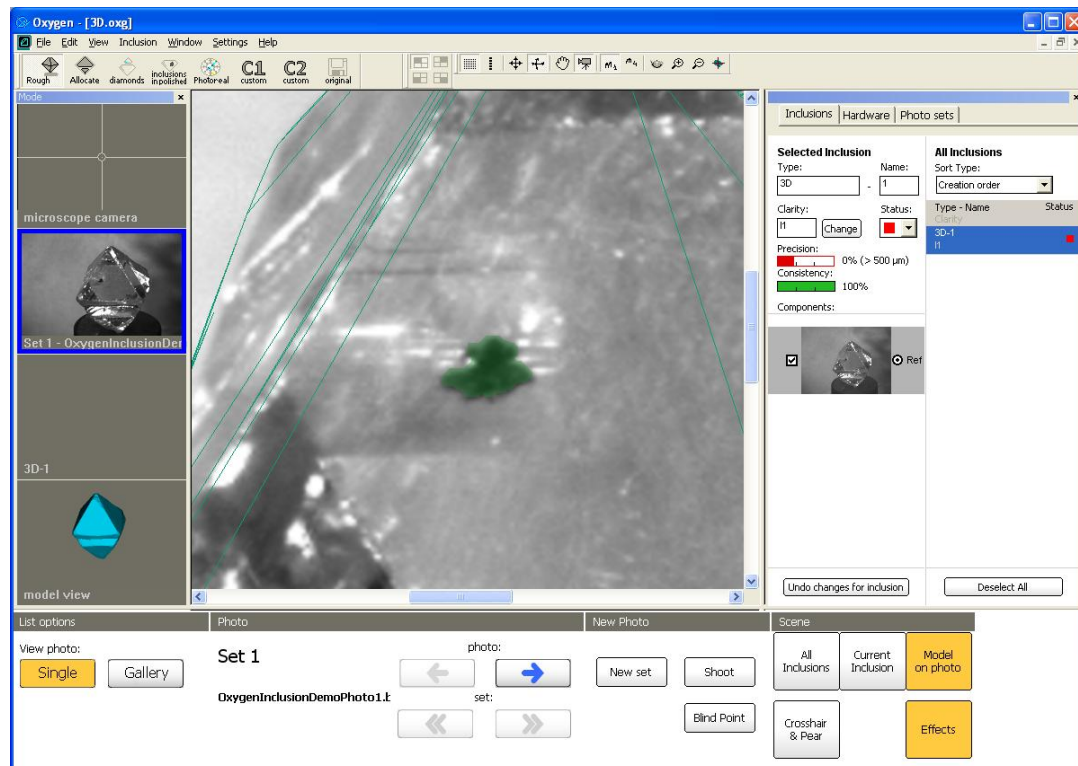
- Then you release mouse button the contour is created automatically:



- Finish contour with context menu

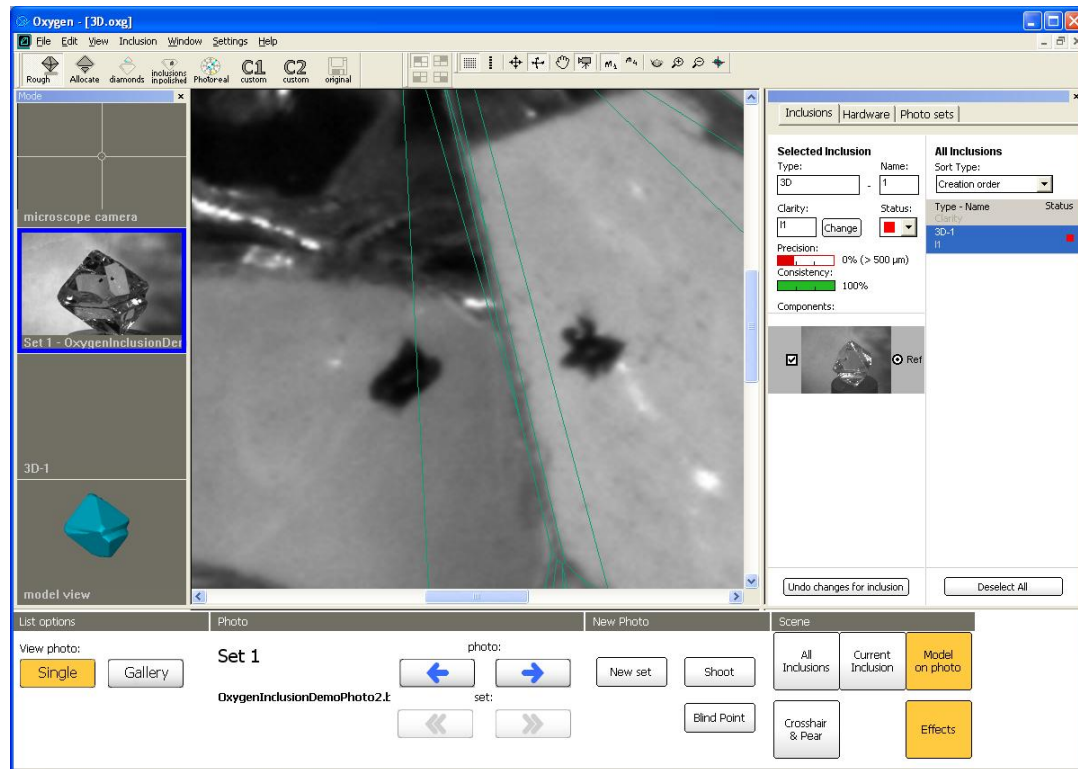


- The first contour is ready.

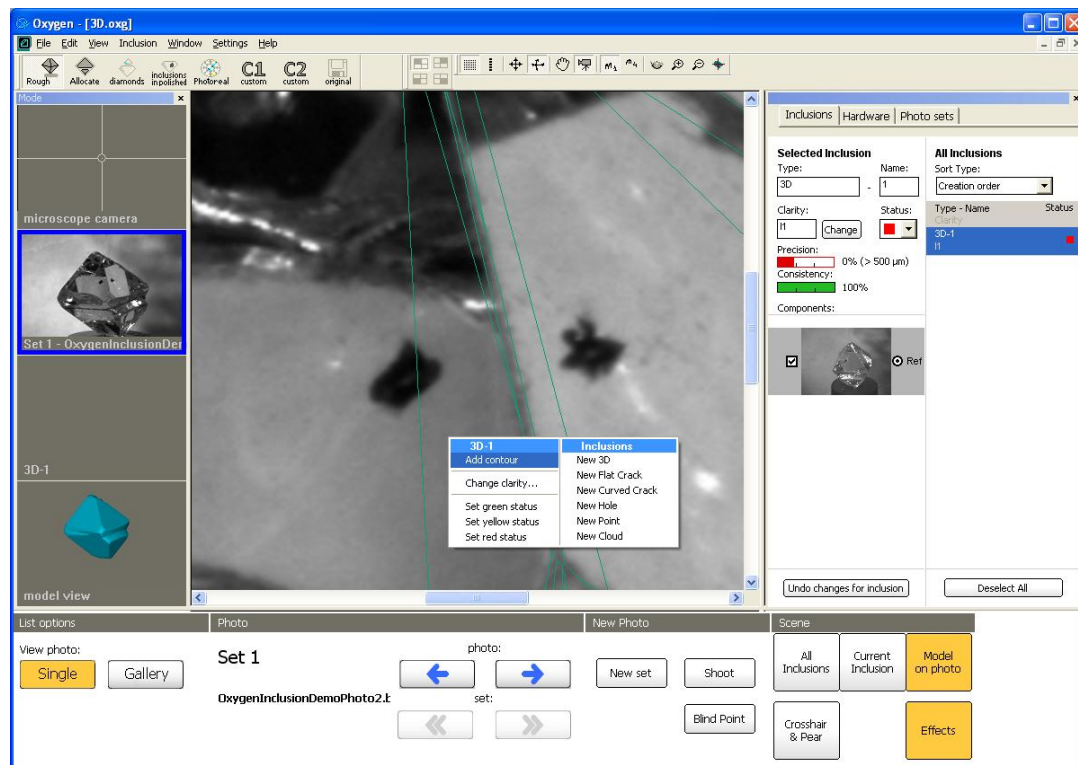


Step 3. Creating a contour from second direction

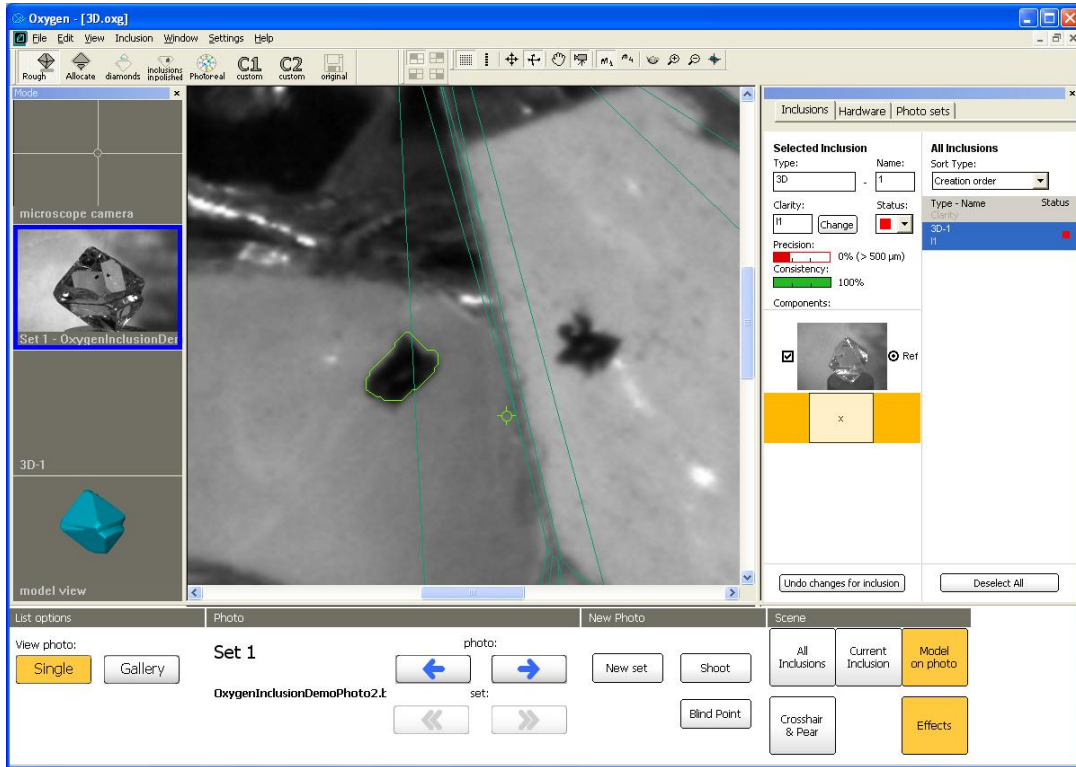
- Select photo of 3D inclusion from another direction



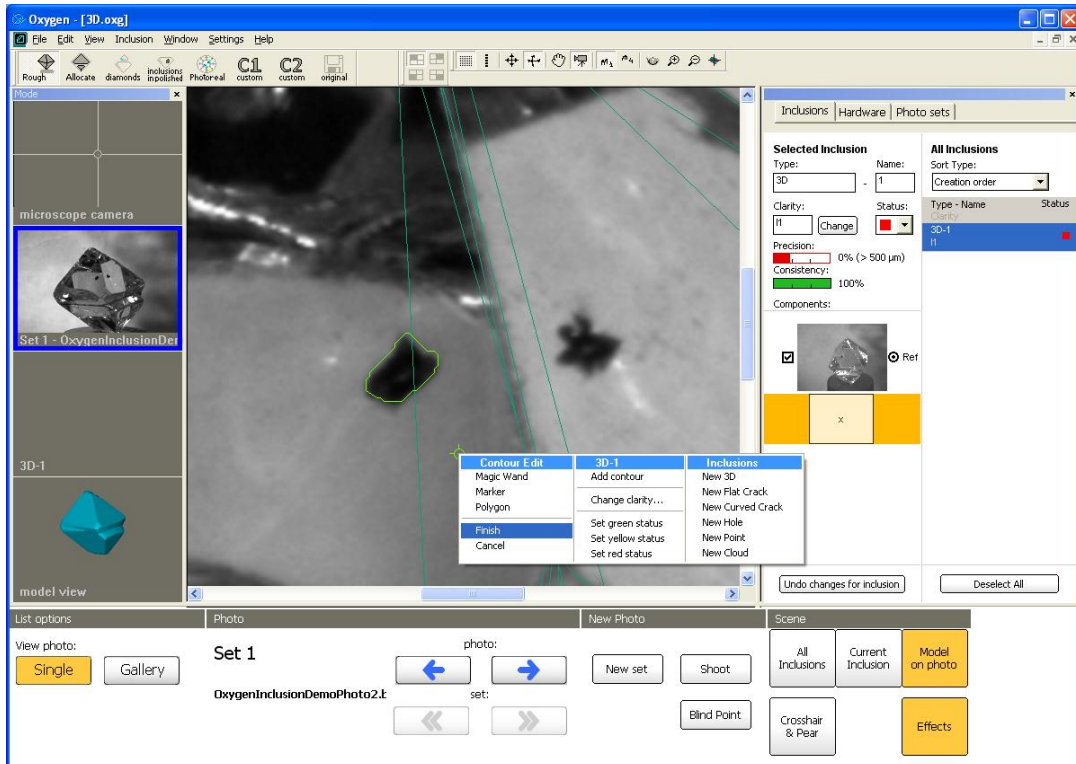
- Right click mouse in Scene and select **Add contour** in context menu



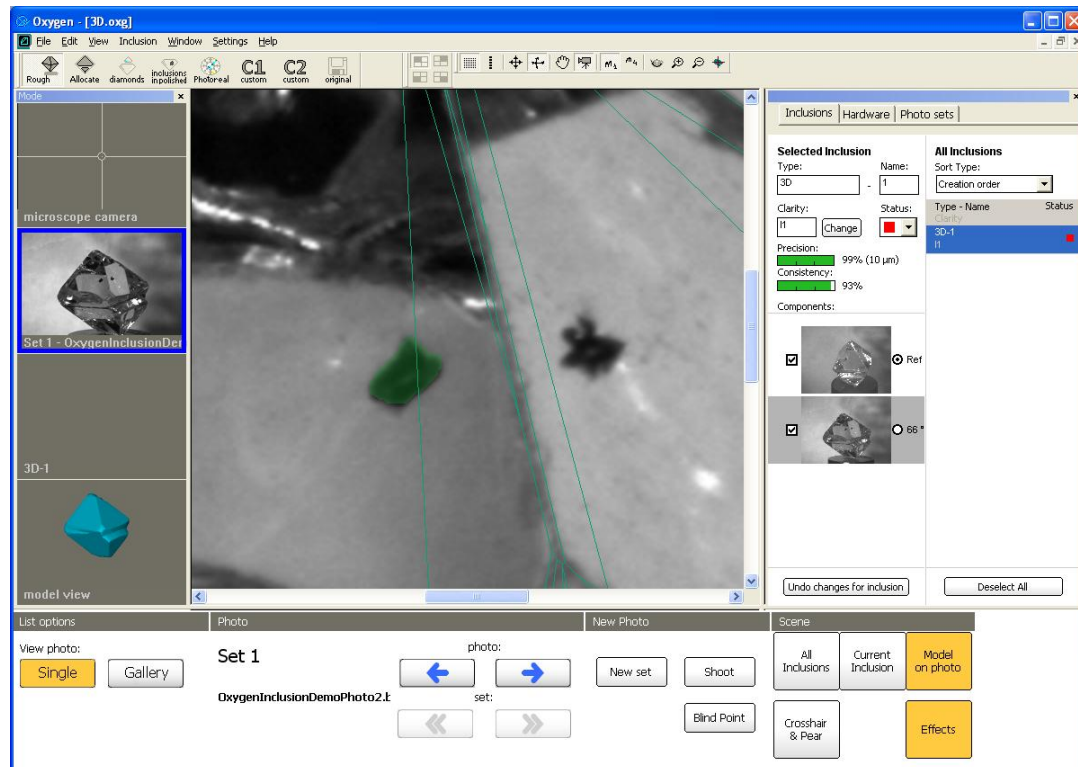
- Make second contour with **Magic Wand** tool



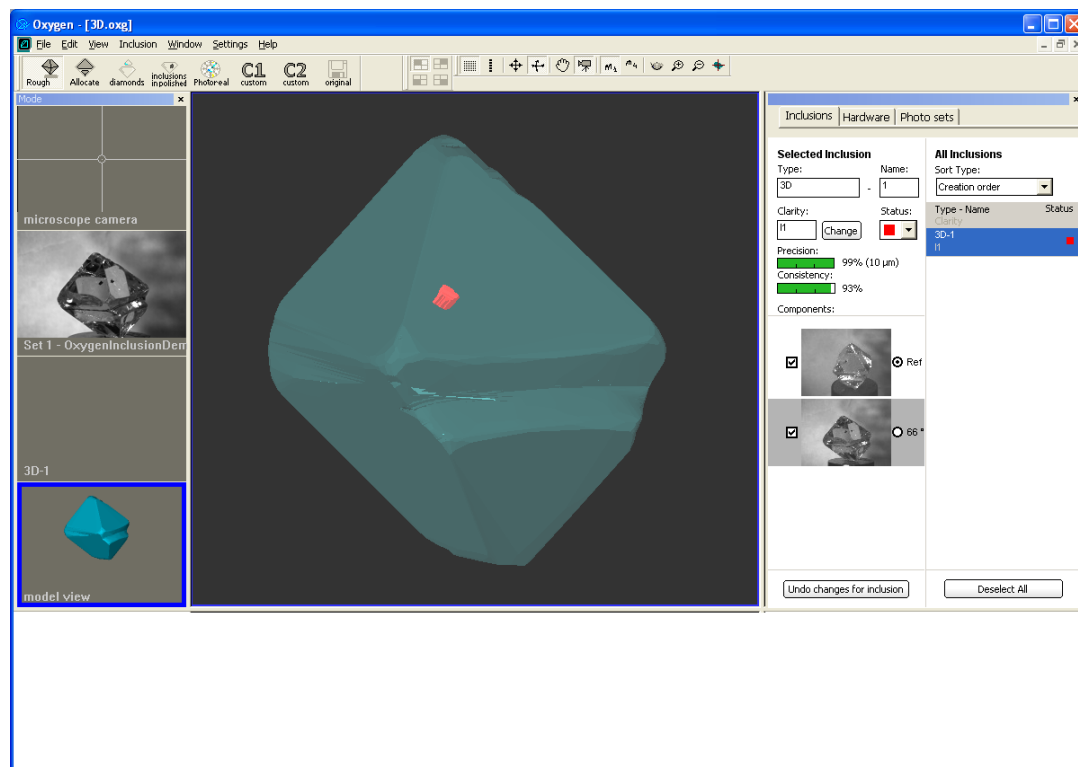
- Finish contour with context menu



- The second contour is completed

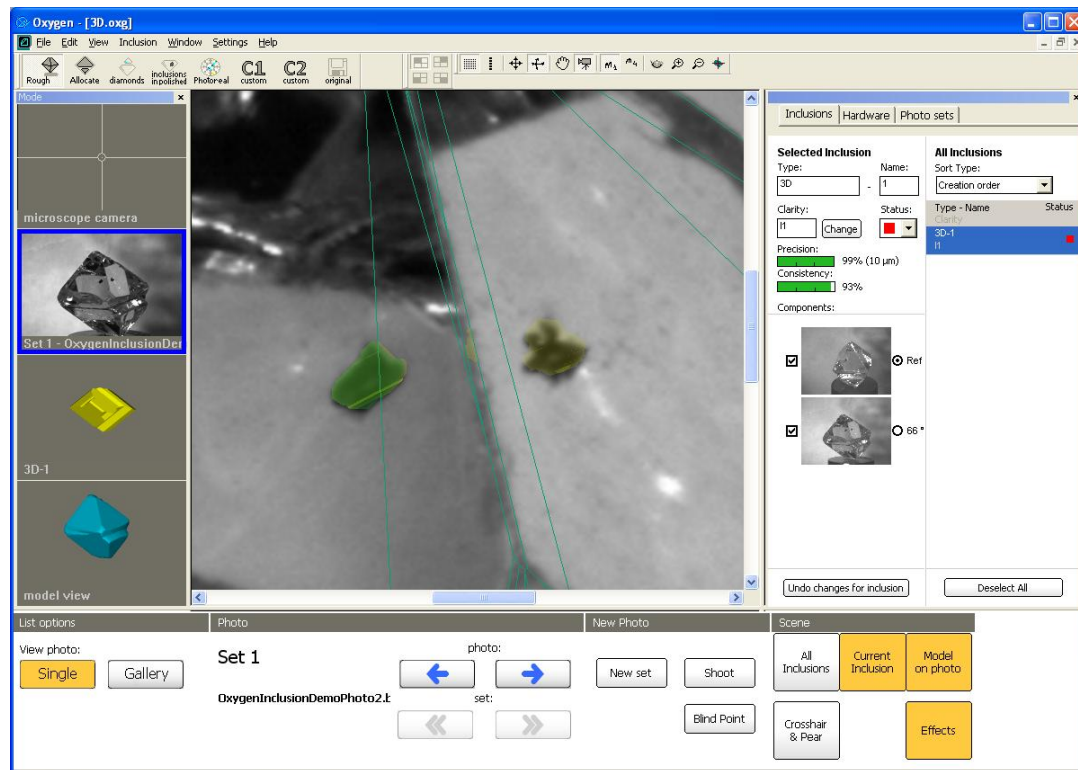


- 3D inclusion is ready

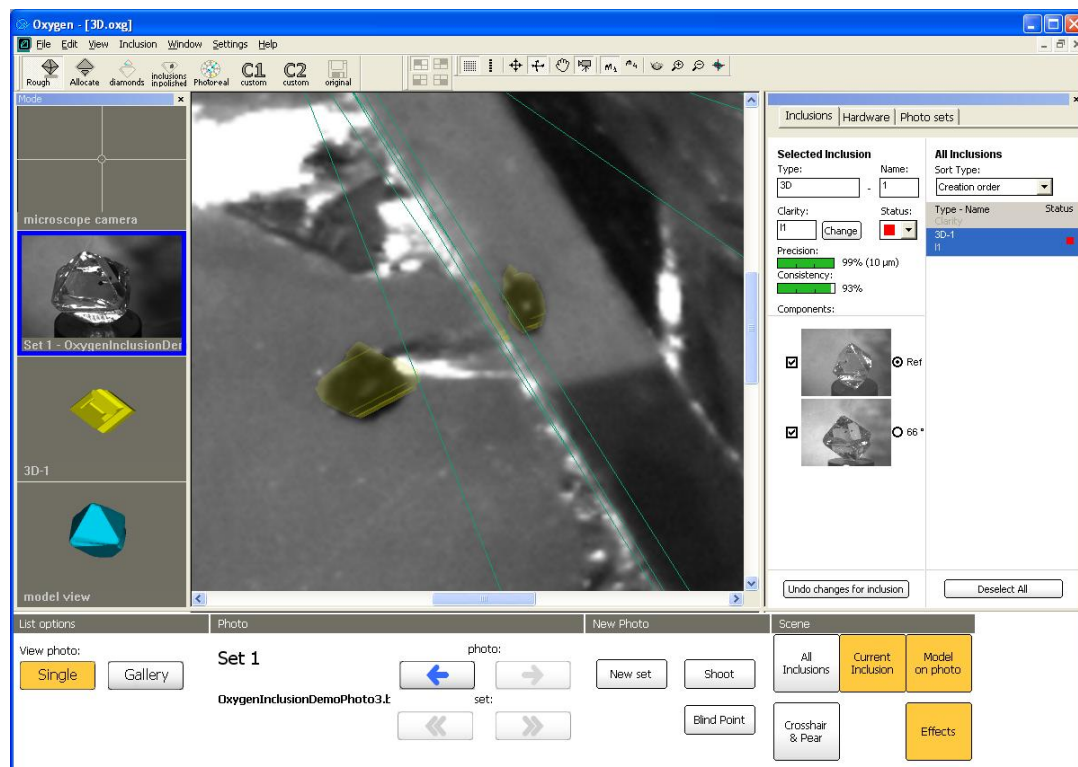


Step 4. Verifying inclusion

- Press button **Current inclusion** to see inclusion's silhouette over the photo.



- Verify its shape from another direction



5.5 Clouds

The method construction of Cloud inclusions is similar to 3D inclusions. Actually the example below can be used for creating 3D inclusions. But 3D and Clouds inclusions have different photorealistic rendering in the allocated diamonds (see section HDR photorealistic diamond and inclusions visualization).

Note. Future versions will also have different Clarity estimation for 3D and Cloud type of inclusions.

Procedure outline

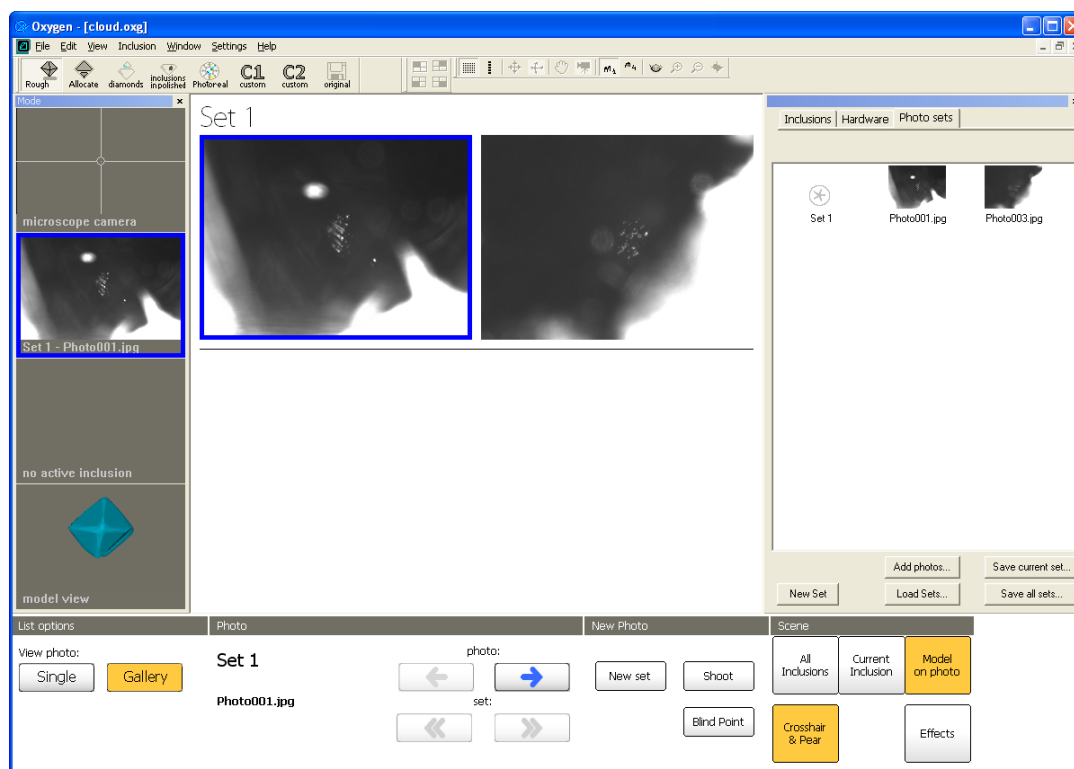
- Step 1. Making two photo from different direction
- Step 2. Creating a contour from one direction
- Step 3. Creating a contour from second direction
- Step 4. Verifying inclusion

Download example, oxg file with photos:

<http://www.octonus.com/oct/download/files/oxygen/SampleCloud.zip>

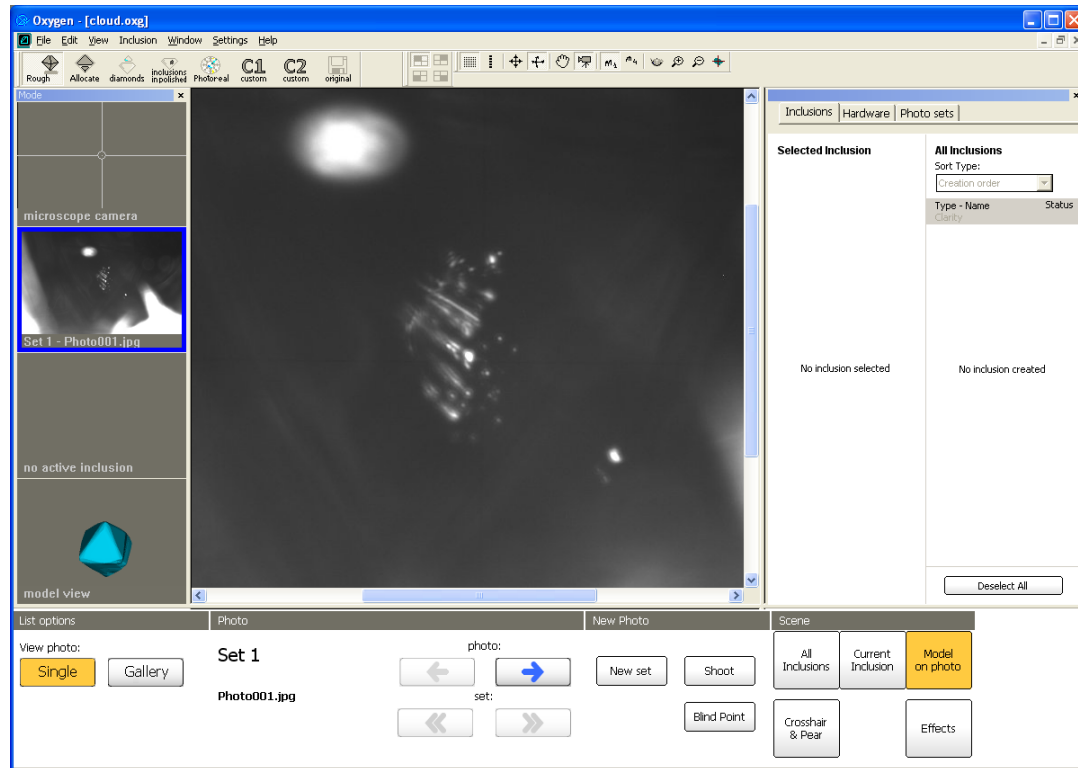
Step 1. Making two photo from different direction

Make at least two photos of a cloud from different directions. Try to focus on the nearest side of cloud to observer.

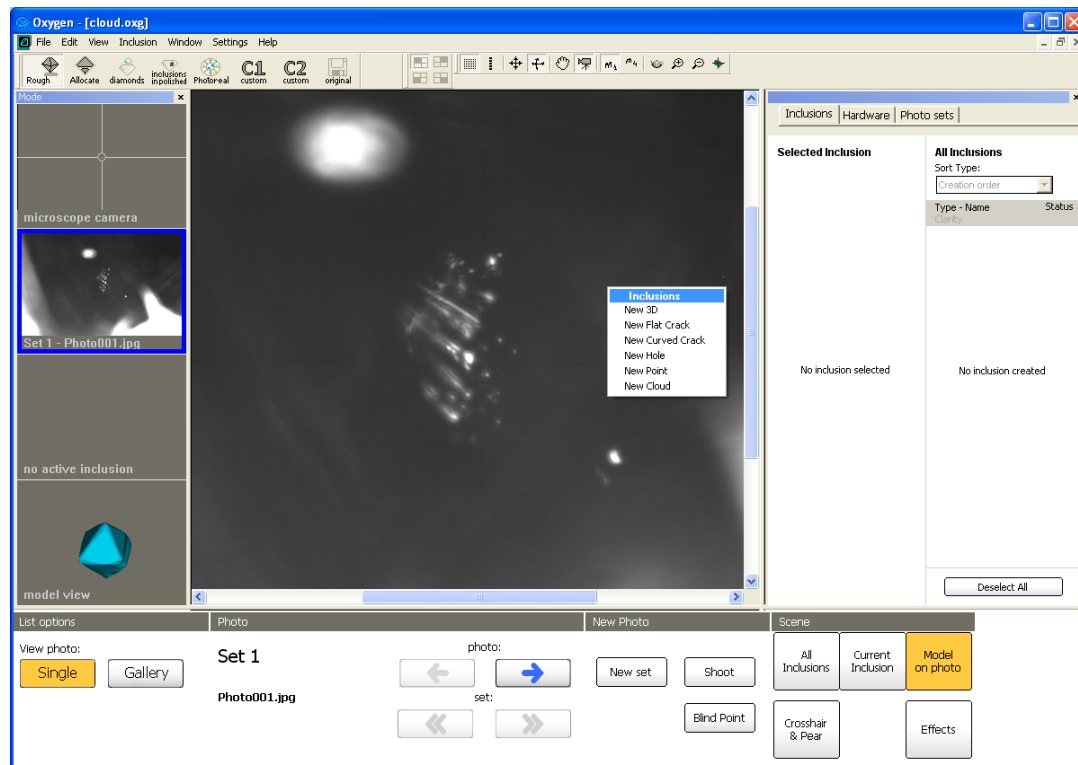


Step 2. Creating a contour from one direction

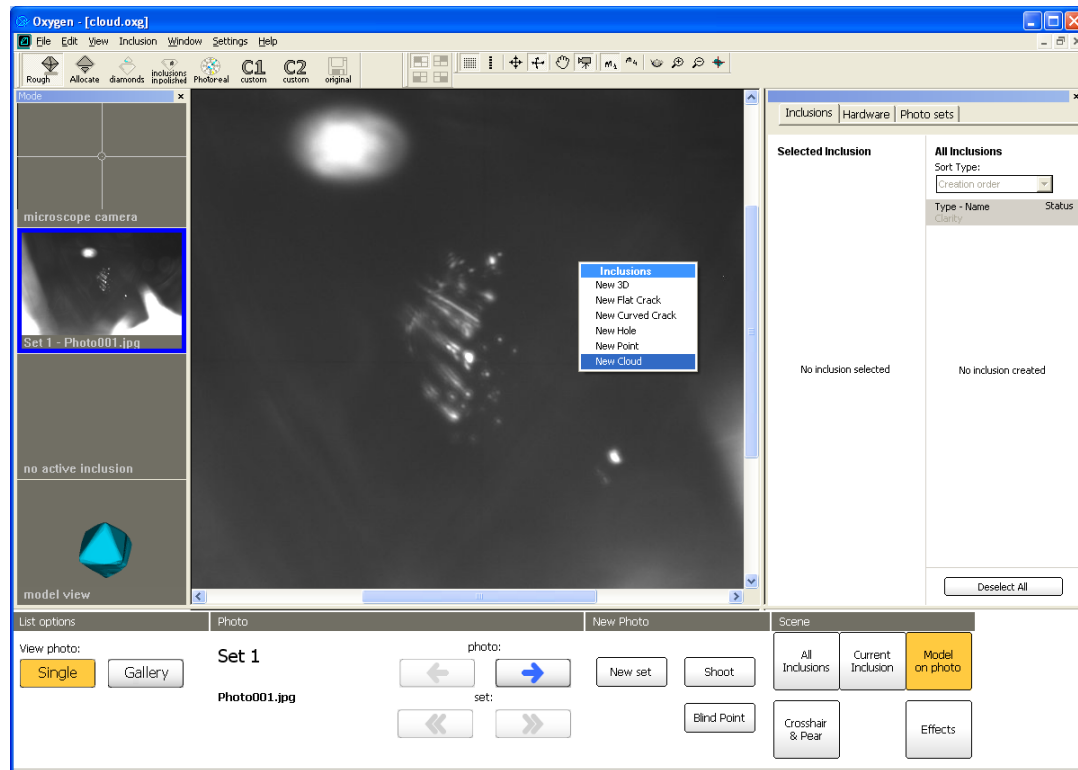
- Select one photo of cloud and zoom it



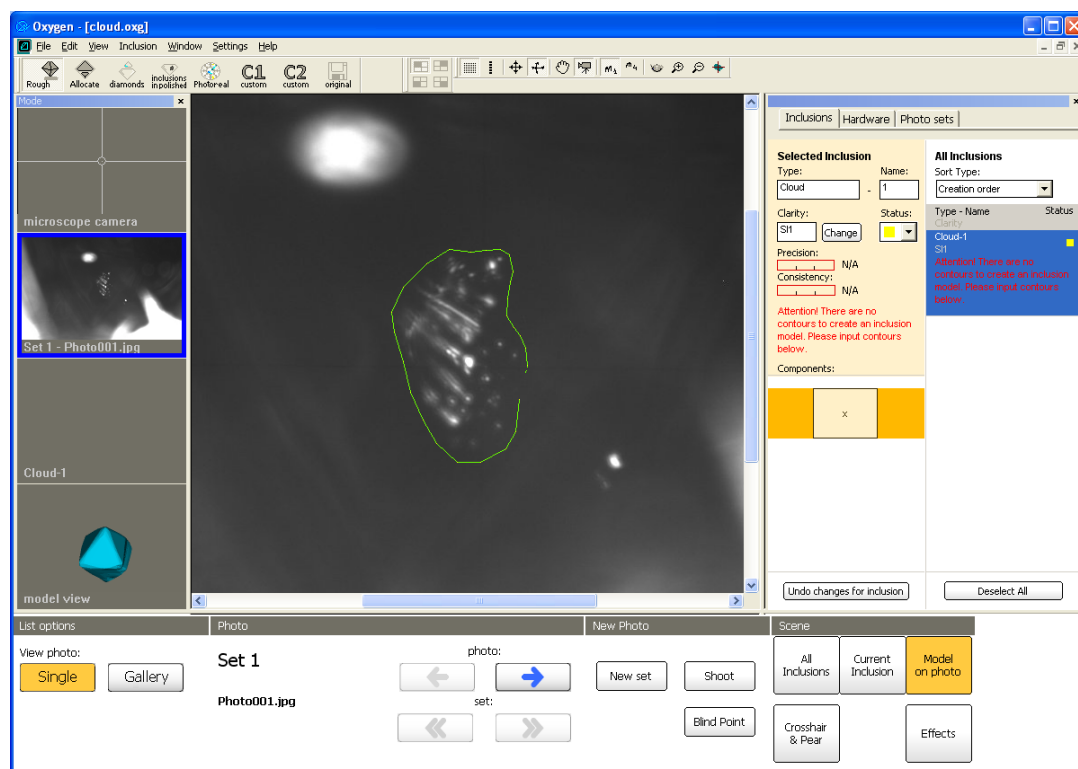
- Right click mouse on Scene to open context menu



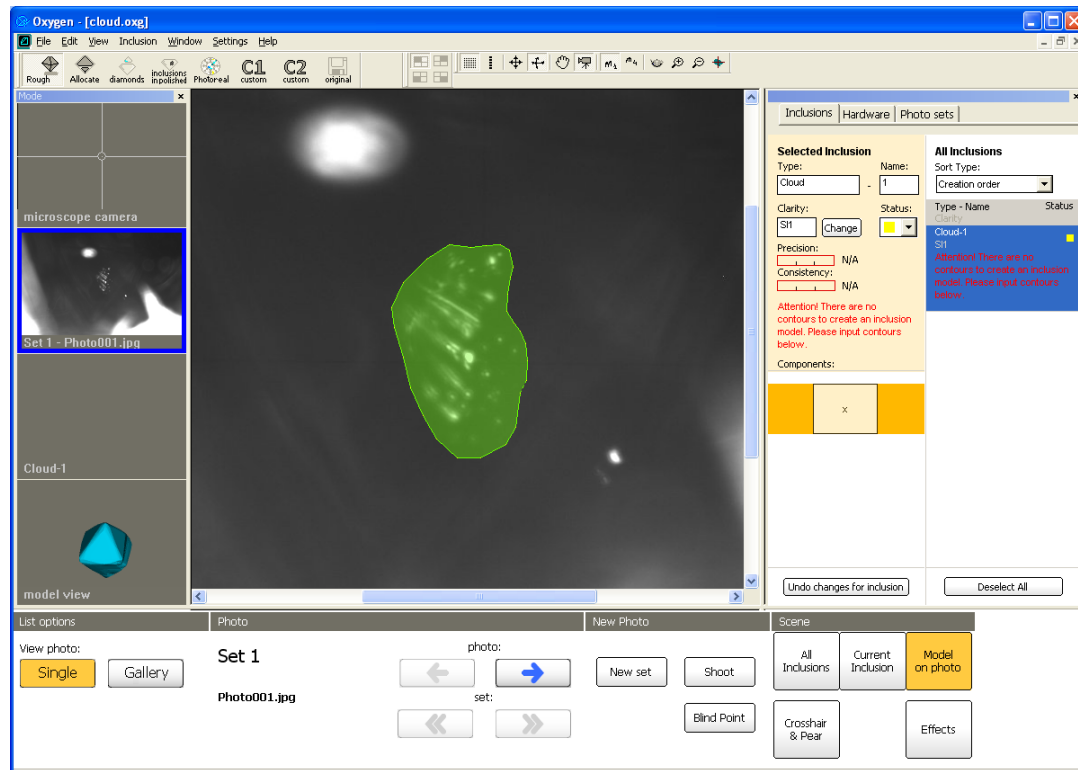
- Select **New Cloud** in context menu



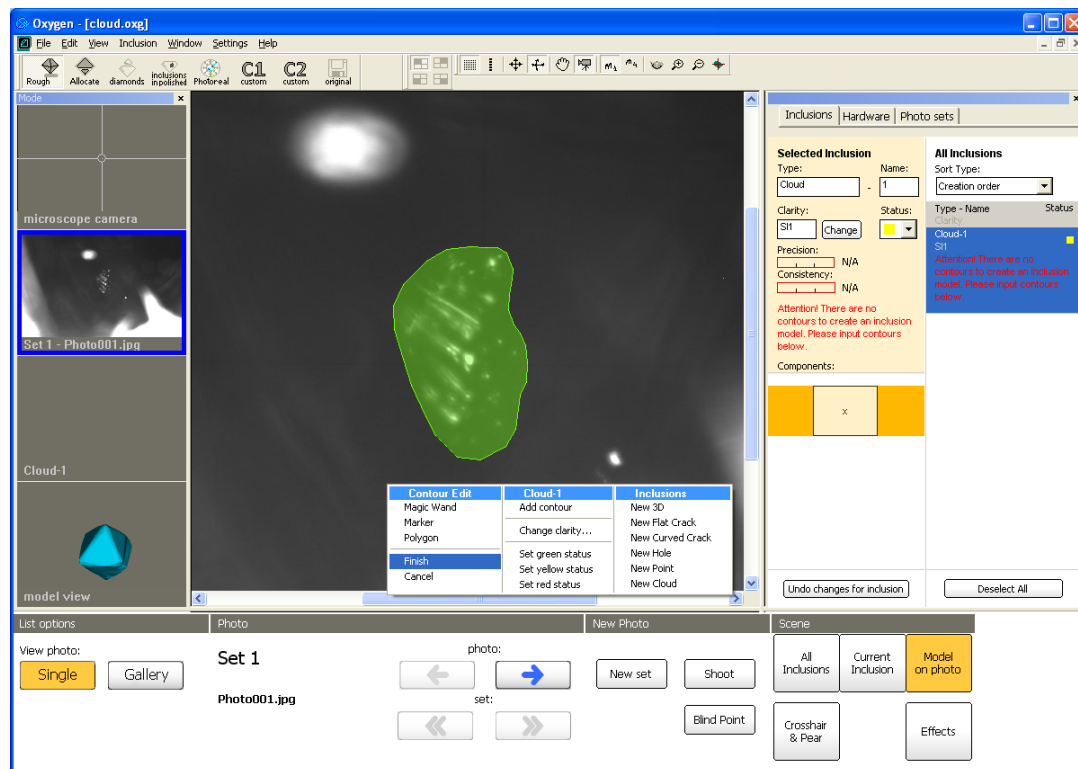
- Draw contour of cloud with left click



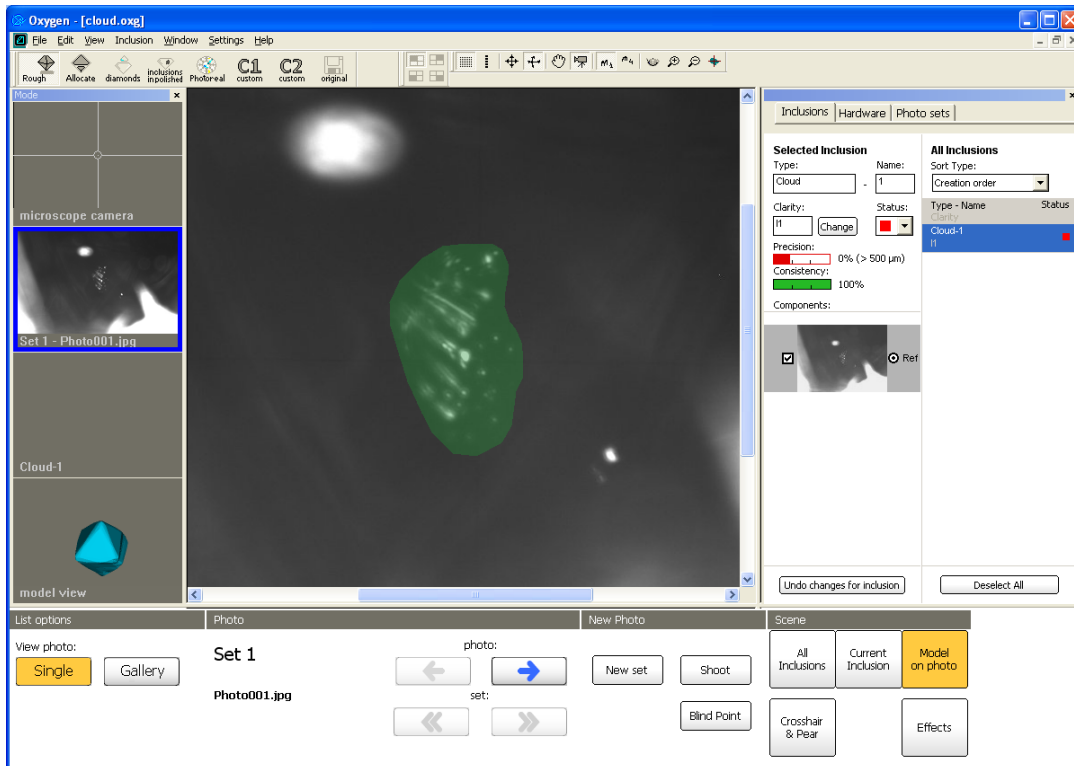
- Enclose contour by double click



- Perform contour with right and left mouse buttons
- Then contour is ready right click mouse and select **Finish** in context menu

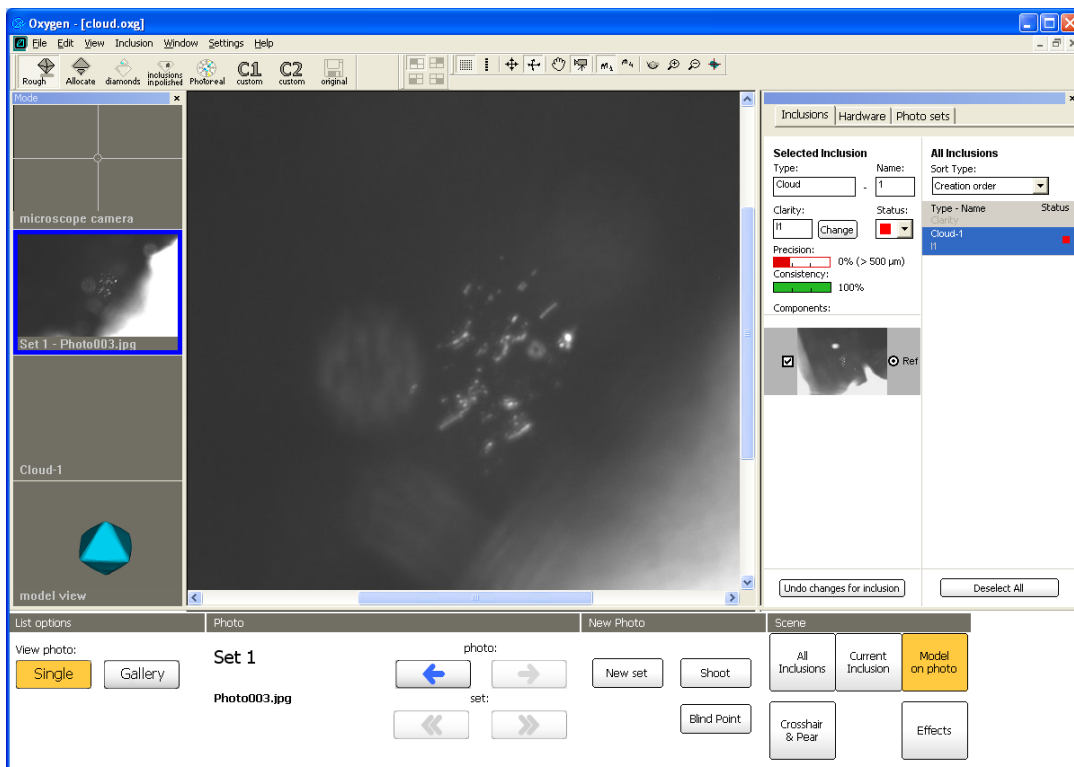


- The one contour is ready.

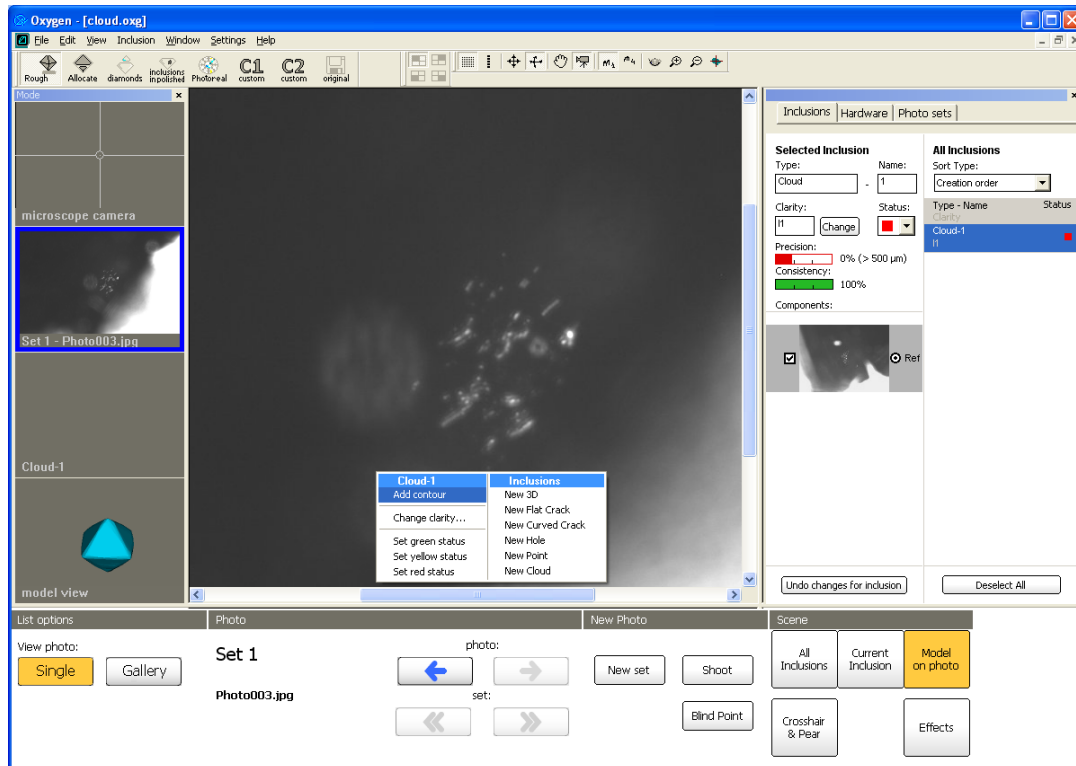


Step 3. Creating a contour from second direction

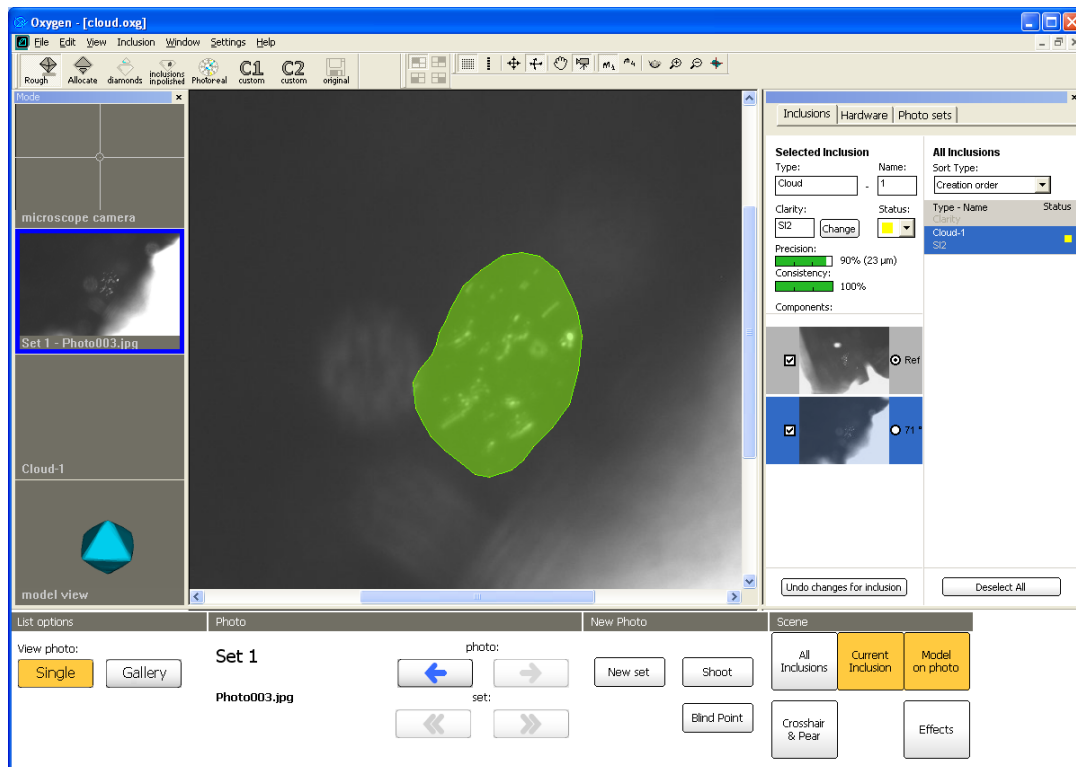
- Select photo of cloud from another direction



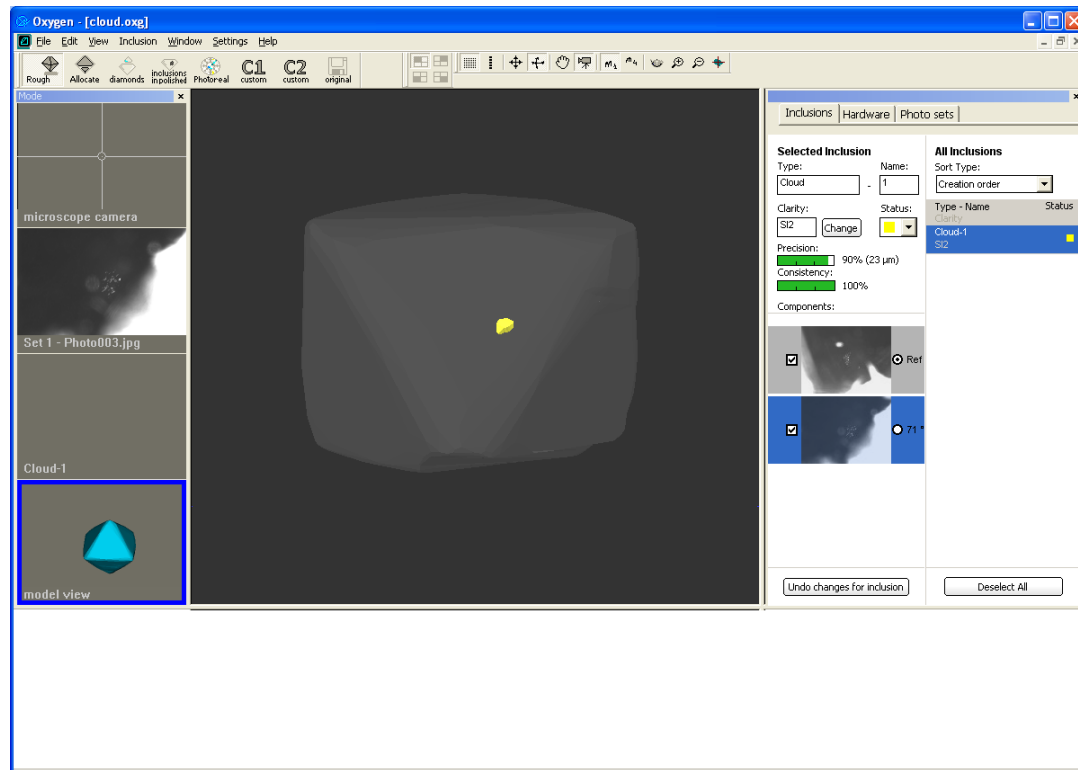
- Right click mouse in Scene and select **Add contour** in context menu



- Make second contour the same way

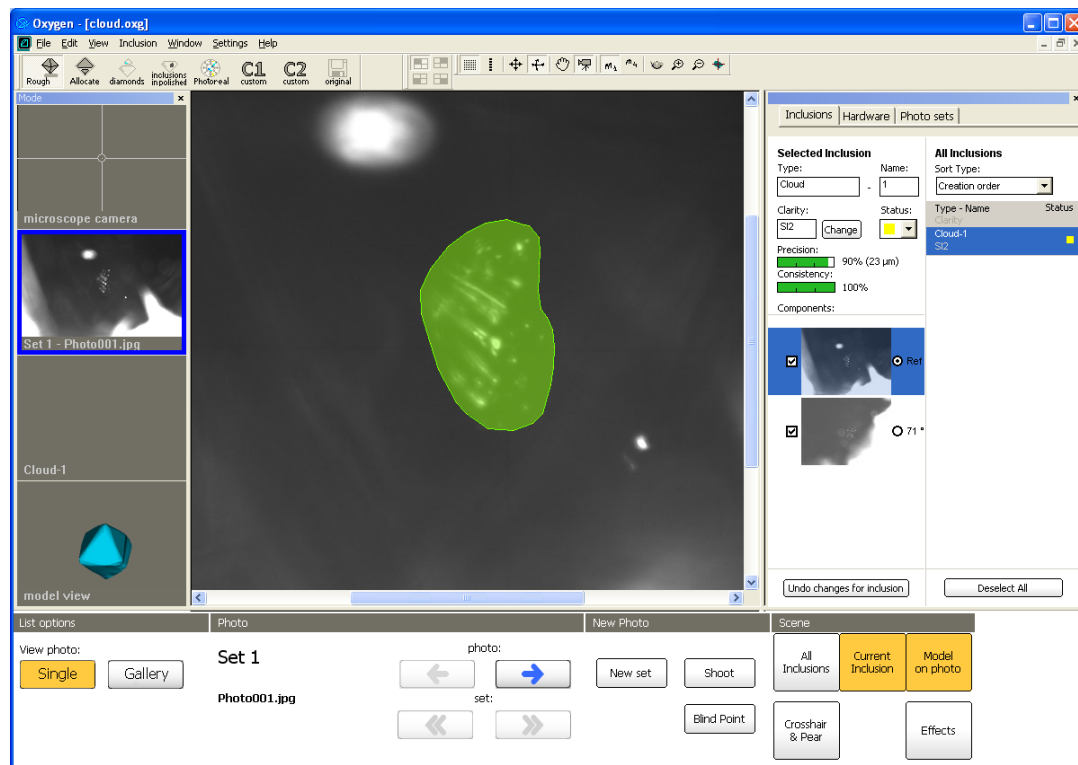


- The Cloud inclusion is ready.

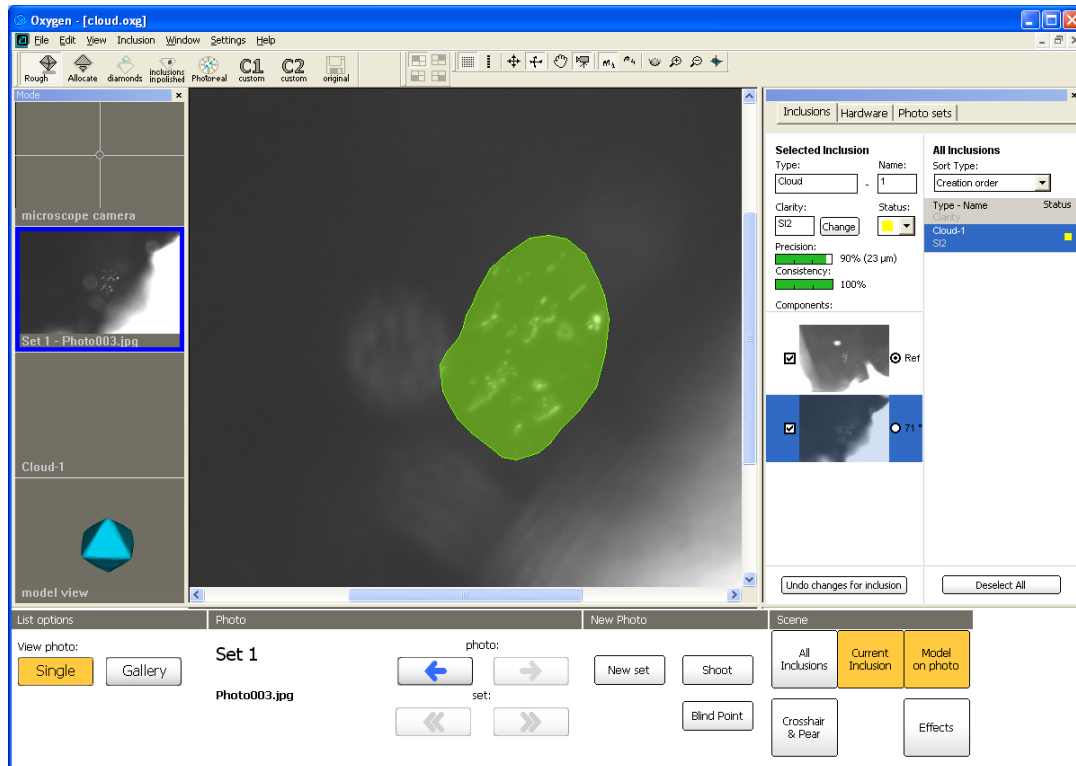


Step 4. Verifying inclusion

- Press button **Current inclusion** to see inclusion silhouette over the photo.



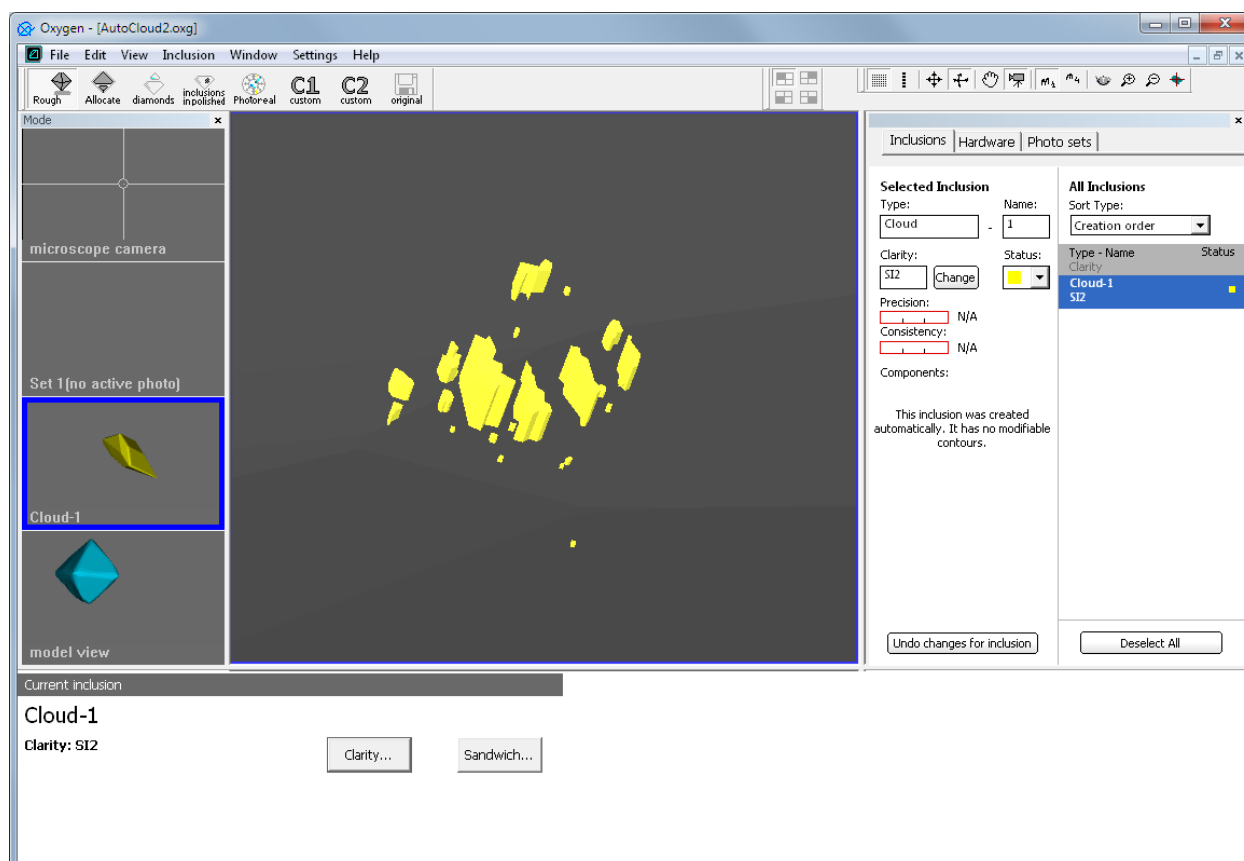
- Verify its shape from another direction



- Correct contours if need

5.6 Automatic clouds

Automatic cloud allocation feature is available since version 3.1. The feature is designed for automatic fast plotting of large groups of point inclusions. Plotting large point clouds like the one you can see on the screenshots below can be extremely time-consuming. With this new feature plotting is done automatically so all you have to do to allocate a cloud is to make a few mouse clicks.



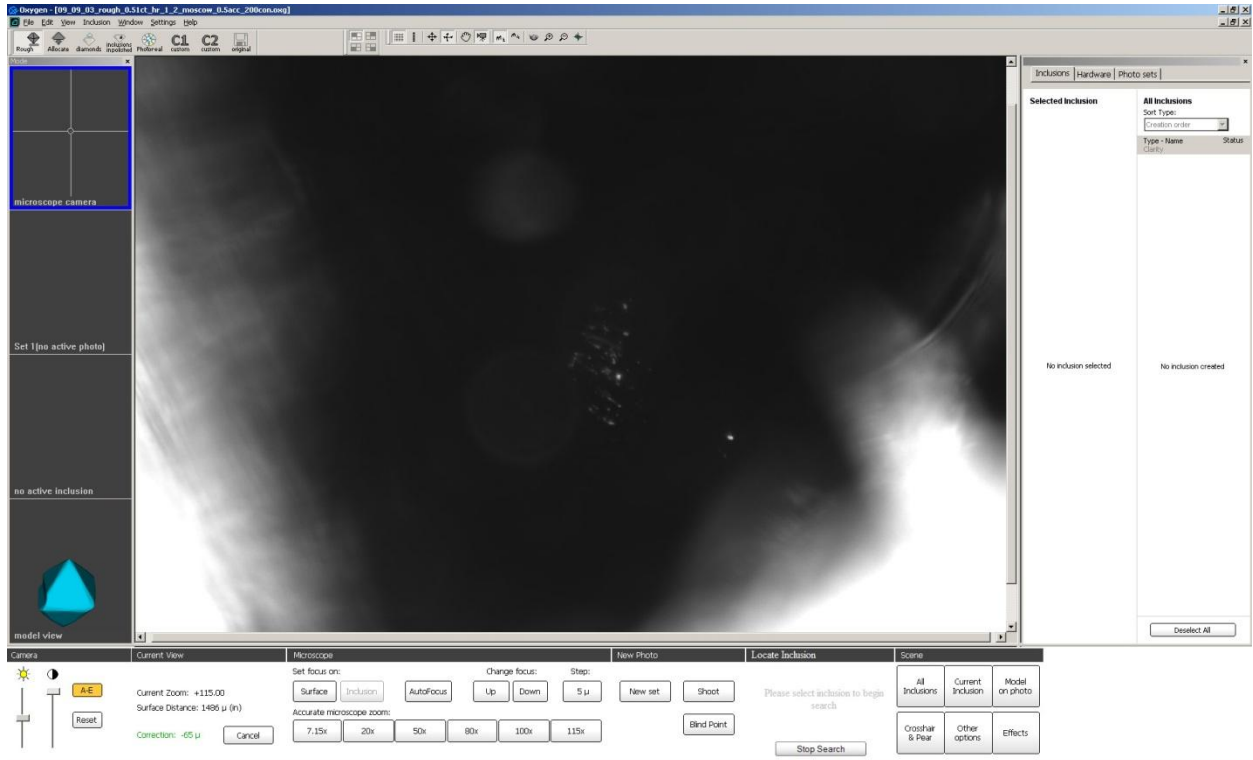
The follow section describes how to create a cloud automatically

Procedure outline:

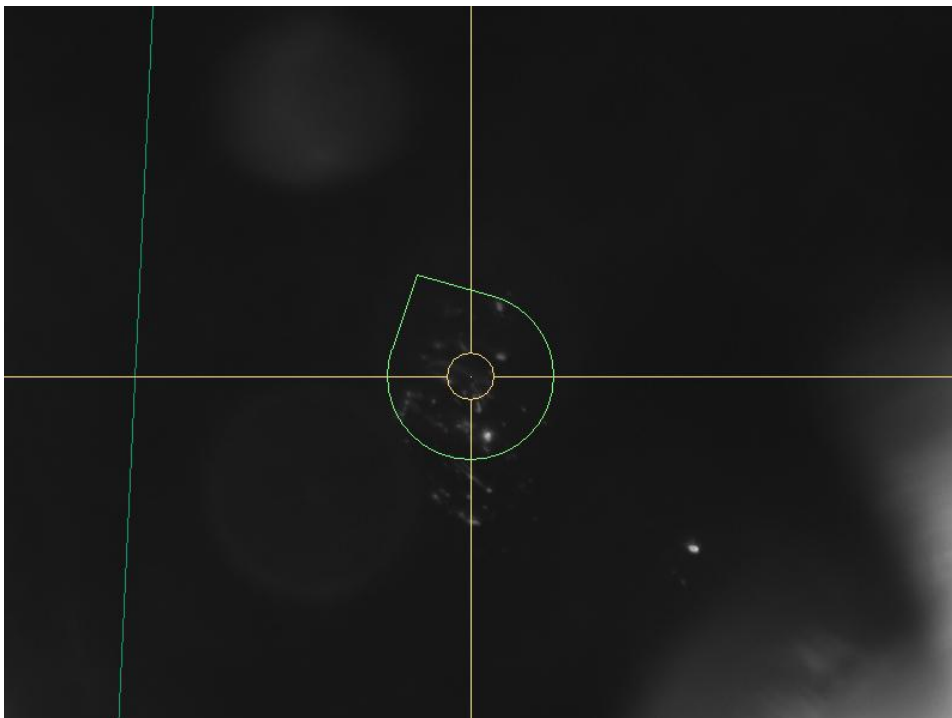
- Step 1. Set cloud position in microscope
- Step 2. Define cloud contour
- Step 3. Set starting position
- Step 4. Set terminal position
- Step 5. Automatic allocation of cloud
- Step 6. Cloud visualization

Step 1. Set cloud position in microscope

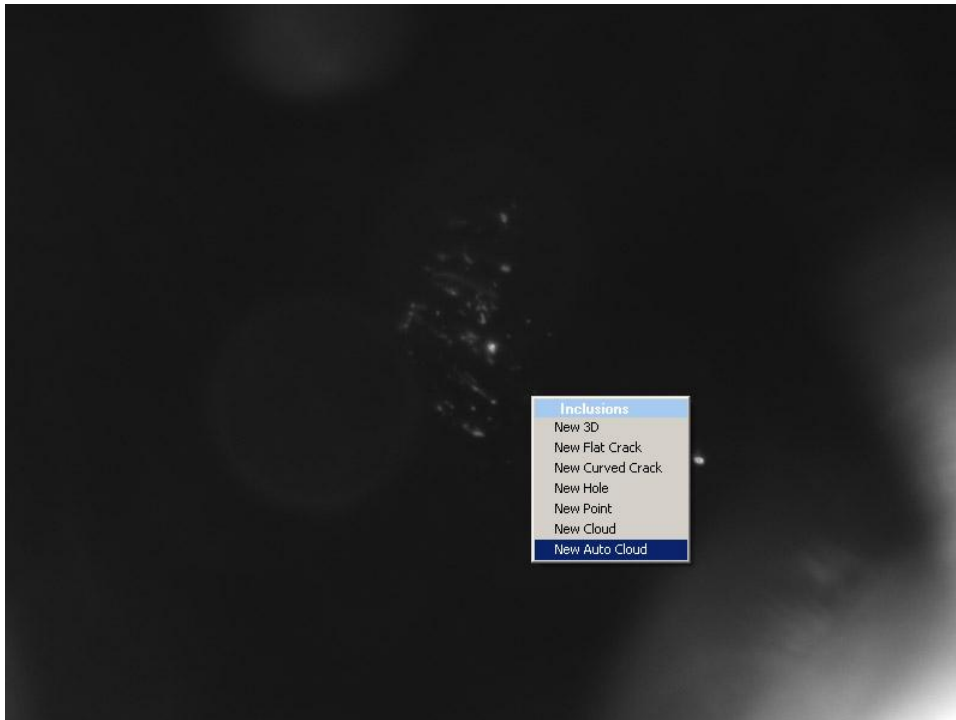
1. Switch to **Microscope camera** mode and focus on the central part of the cloud



2. Make sure you have chosen an optimal view direction - green pear at the center of the screen. You will not be able to change view direction during auto cloud creation, only focus can be changed.



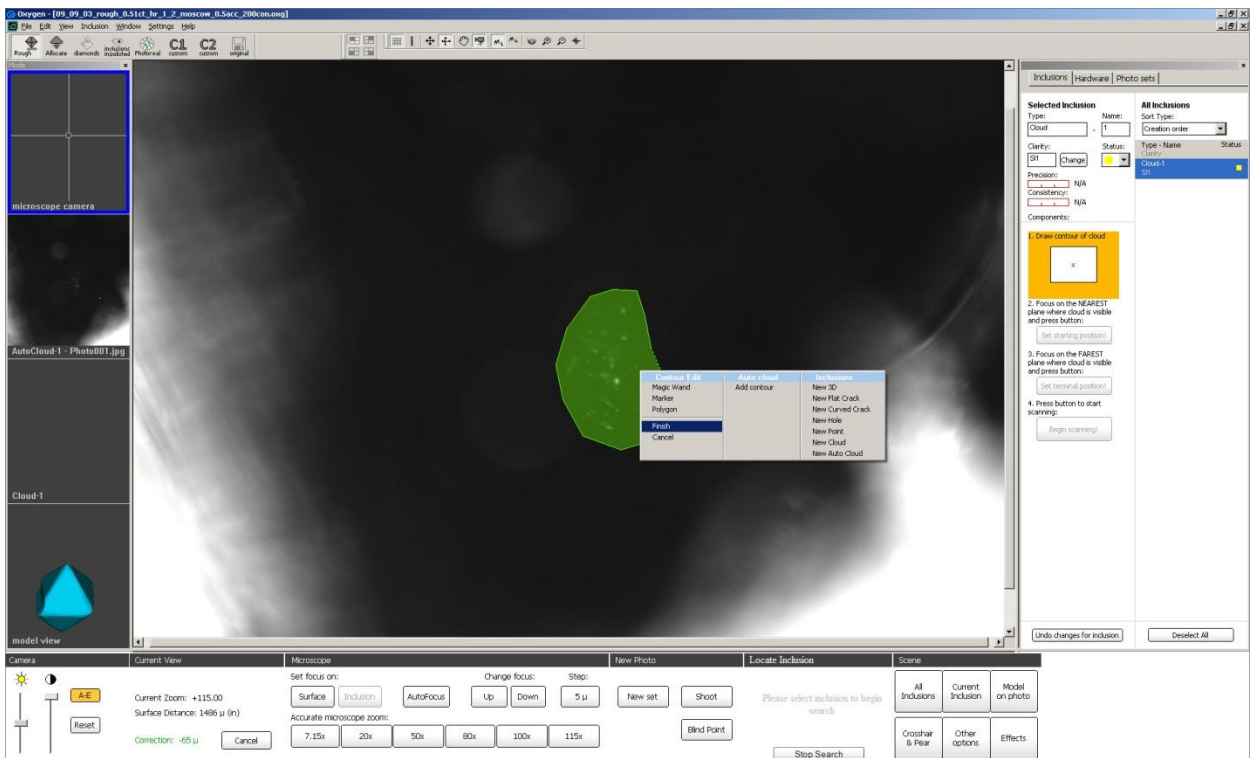
3. Select **New Auto Cloud** item from the context menu



Note. New Auto Cloud item appears in context menu only in Microscope camera mode

Step 2. Define cloud contour

Define cloud contour as shown on the screenshot below

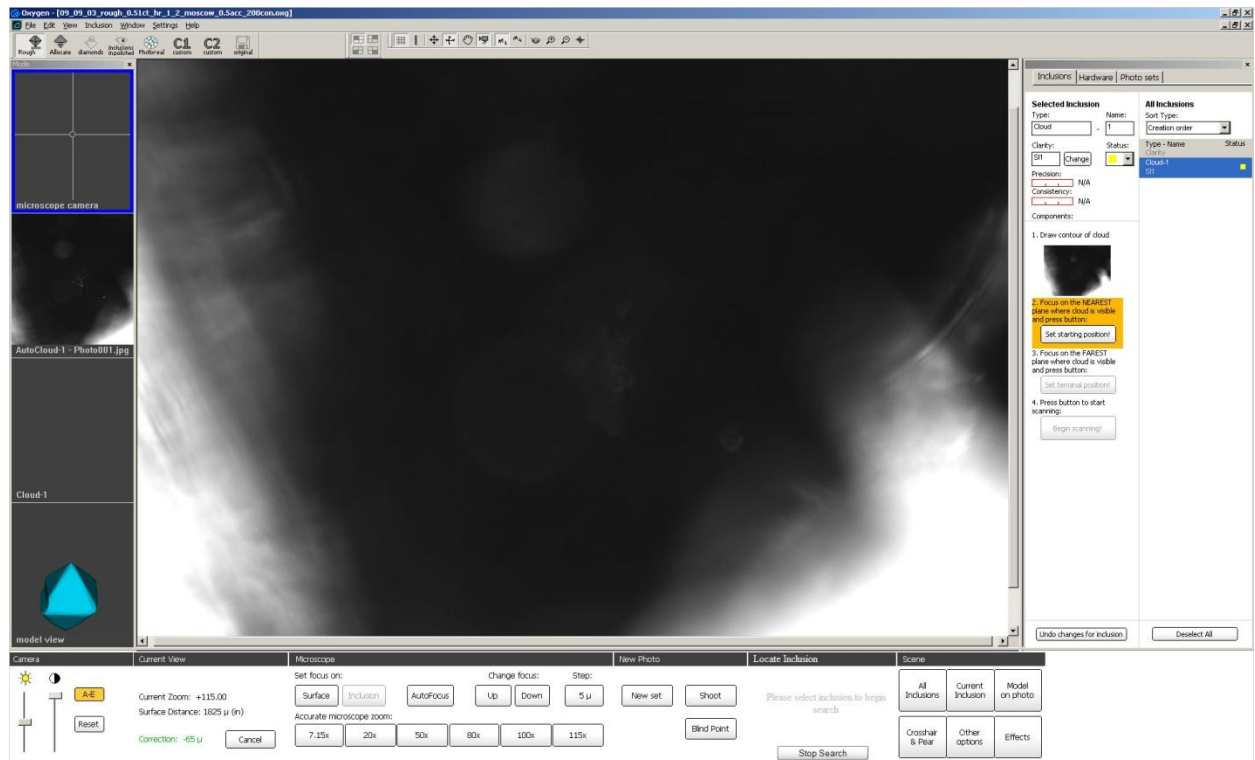


Step 3. Set starting position

Now specify starting position for scanning:

1. Focus on the beginning of the cloud

We recommend to find the point of the cloud that is nearest to the stone surface and focus on it



2. Press button **Set starting position!** at the **Inclusions** panel

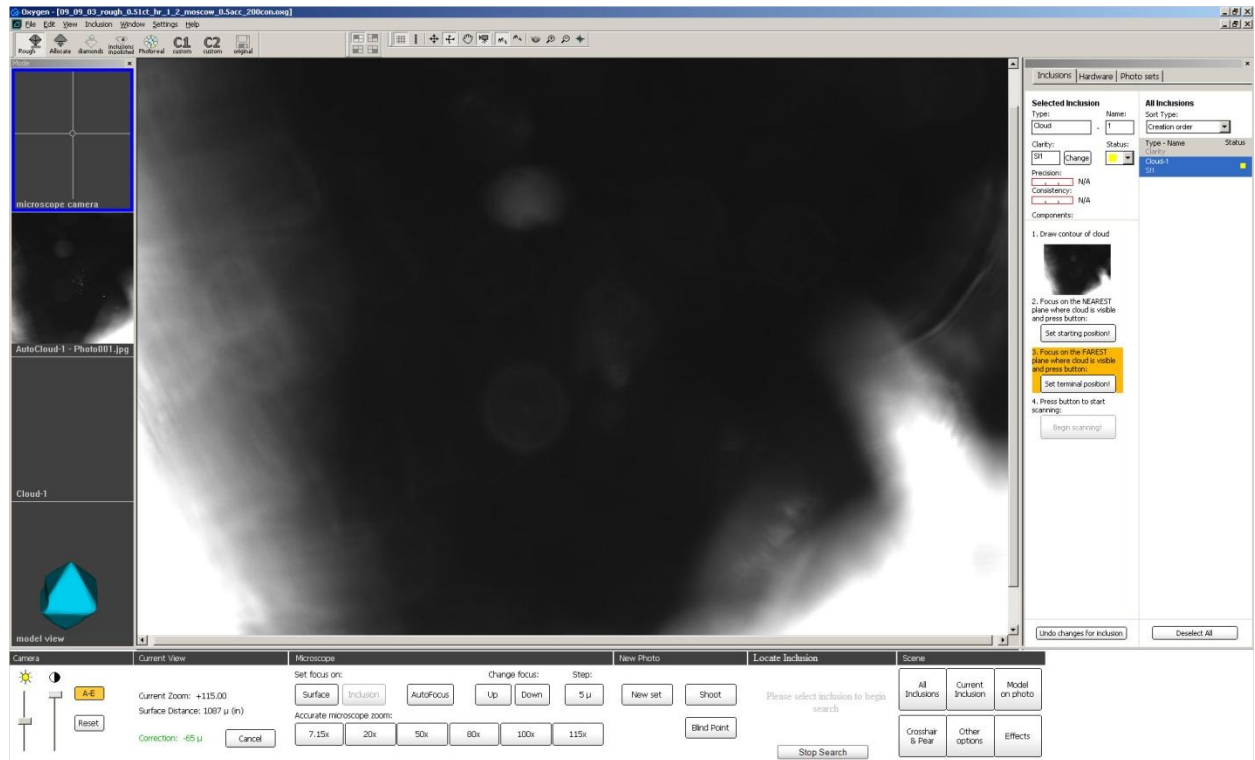


***Note:** Do not change the translation stage position and do not rotate the stone during step 3 and all the next steps. If you moved or rotated the stone during autocloud creation, an error message would be shown and you would have to enter all the components for autocloud once more. To do it, first click on the thumbnail of cloud contour on the right panel, then repeat the procedure of autocloud allocation from the first step.*

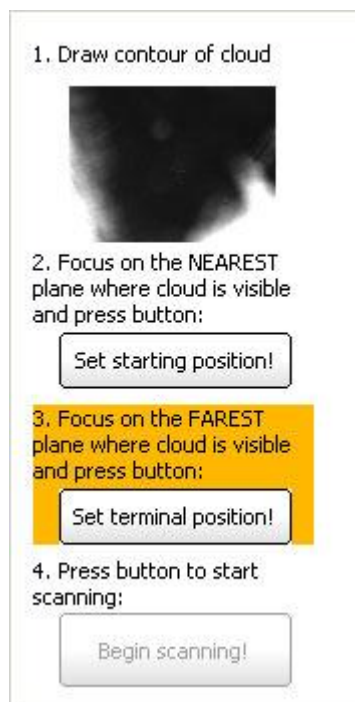
Step 4. Set terminal position

In the same way specify terminal position of the scanning:

1. Find the deepest point of the cloud and focus on it



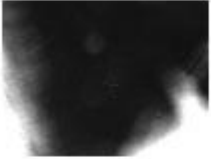
2. Press button **Set terminal position!** in the **Inclusions** panel



Step 5. Automatic allocation of cloud

Now press **Begin scanning!** button and wait

1. Draw contour of cloud



2. Focus on the NEAREST plane where cloud is visible and press button:

Set starting position!

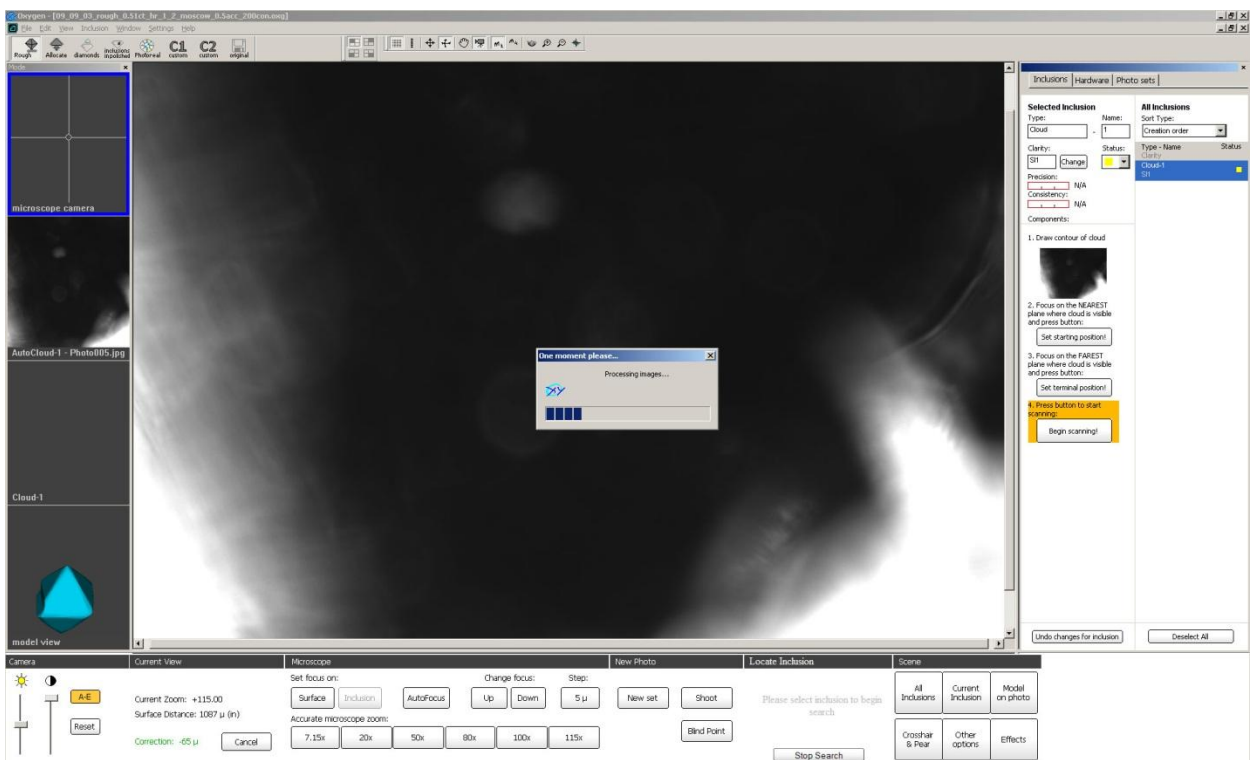
3. Focus on the FAREST plane where cloud is visible and press button:

Set terminal position!

4. Press button to start scanning:

Begin scanning!

Progress window will be shown to indicate the process of cloud allocation. Allocation process may take from 10 seconds up to 1-2 minutes depending on the cloud size and computer configuration

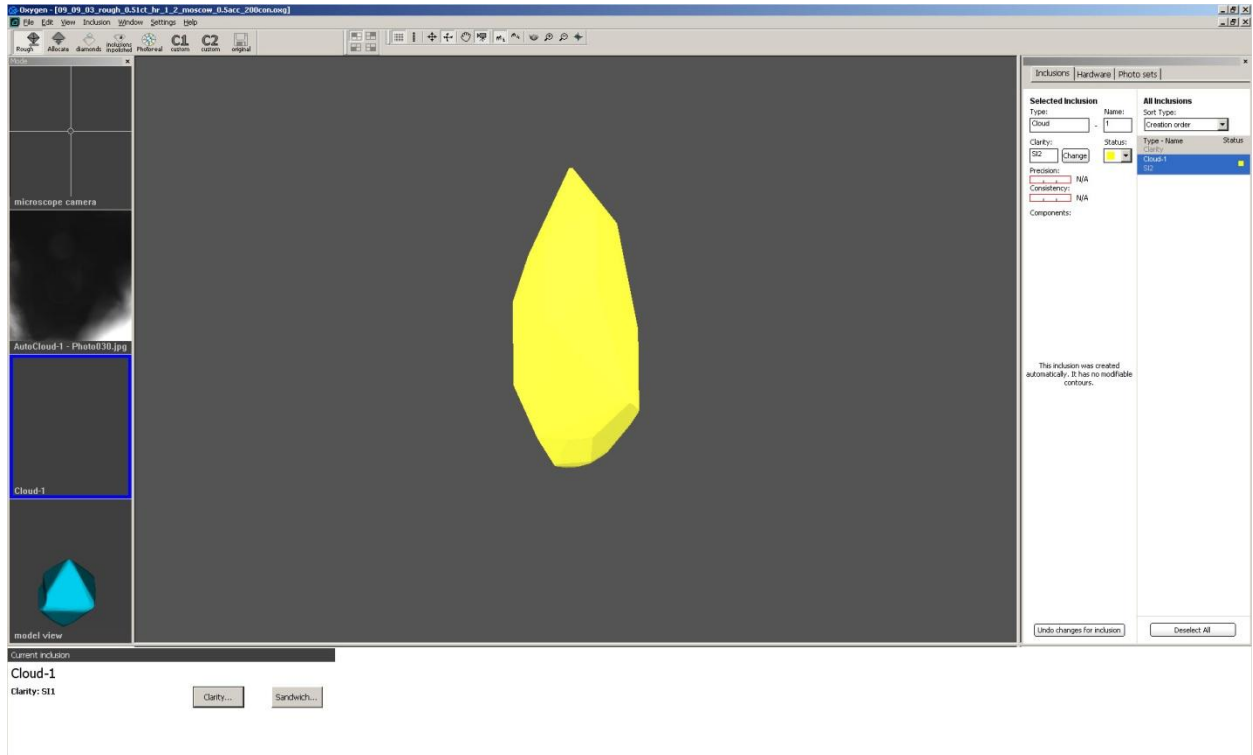


The screenshot shows the Oxygen software interface during the cloud allocation process. The main window displays a large, dark, irregularly shaped cloud. A progress window titled "Use moment please..." is overlaid on the cloud, indicating "Processing images...". The interface includes a menu bar, a toolbar, and a sidebar with various controls and a "Selected Inclusion" panel on the right. The "Selected Inclusion" panel shows the following details:

- Type: Cloud
- Name: 1
- Set Type: Creation order
- Clarity: [Change]
- Status: [Change]
- Precision: N/A
- Consistency: N/A
- Components:
 - 1. Draw contour of cloud
 - 2. Focus on the NEAREST plane where cloud is visible and press button: [Set starting position!]
 - 3. Focus on the FAREST plane where cloud is visible and press button: [Set terminal position!]
 - 4. Press button to start scanning: [Begin scanning!]

Step 6. Cloud visualization

After finishing allocation process inclusion model of cloud is ready

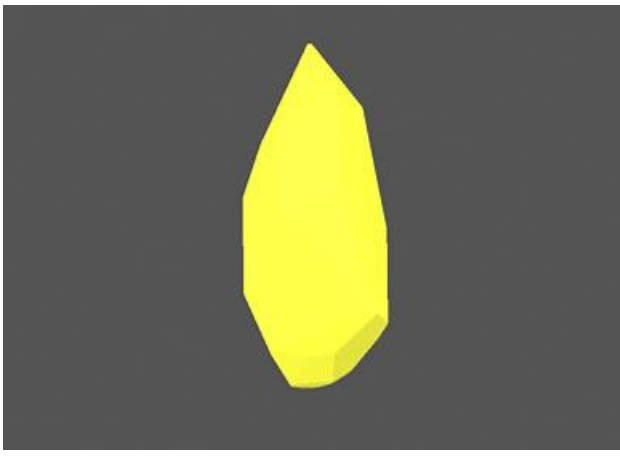
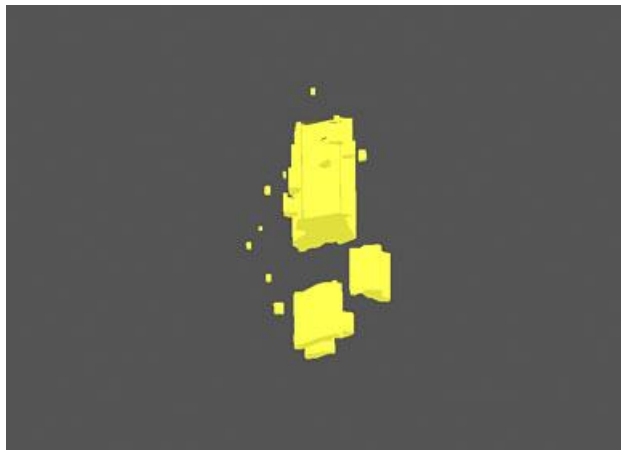


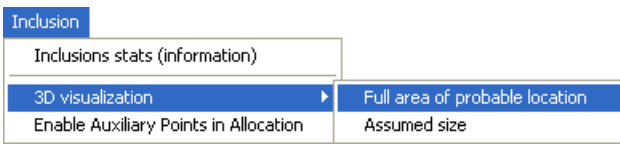



3D models visualization

3D model of allocated cloud inclusion can be observed in two modes:

- Full area of probable location of the cloud
- Assumed size

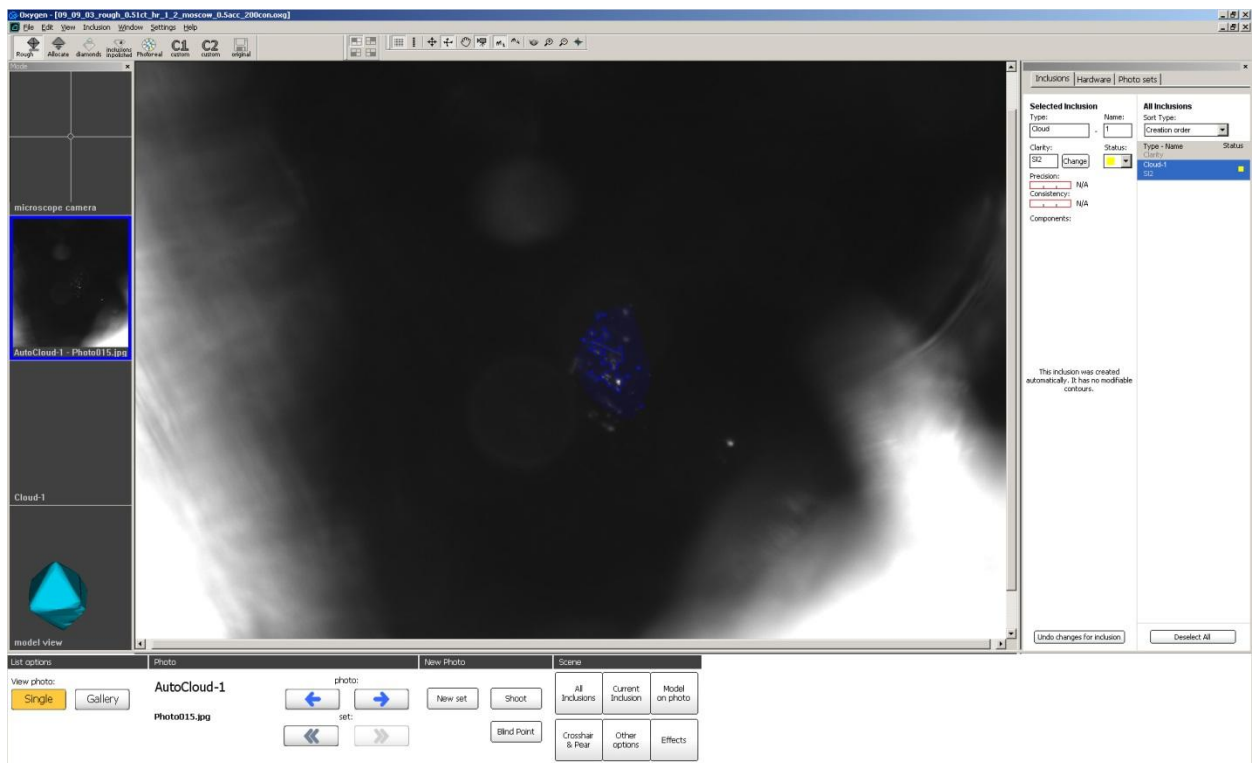
Full area of probable location of the cloud	Assumed size
Cloud is shown as one inclusion	Cloud is shown as a set of point inclusions
	

<p>To see cloud in <i>full area size mode</i> select from menu Inclusion / 3D Visualization / Full area of probable location</p> 	<p>To see cloud in <i>assumed size mode</i> select from menu Inclusion / 3D Visualization / Assumed size</p> 
---	--

Visualization inclusion of contours

To see cloud on photos:

1. Switch to **Photo sets** tab
2. Find photos that have been taken during the cloud scanning

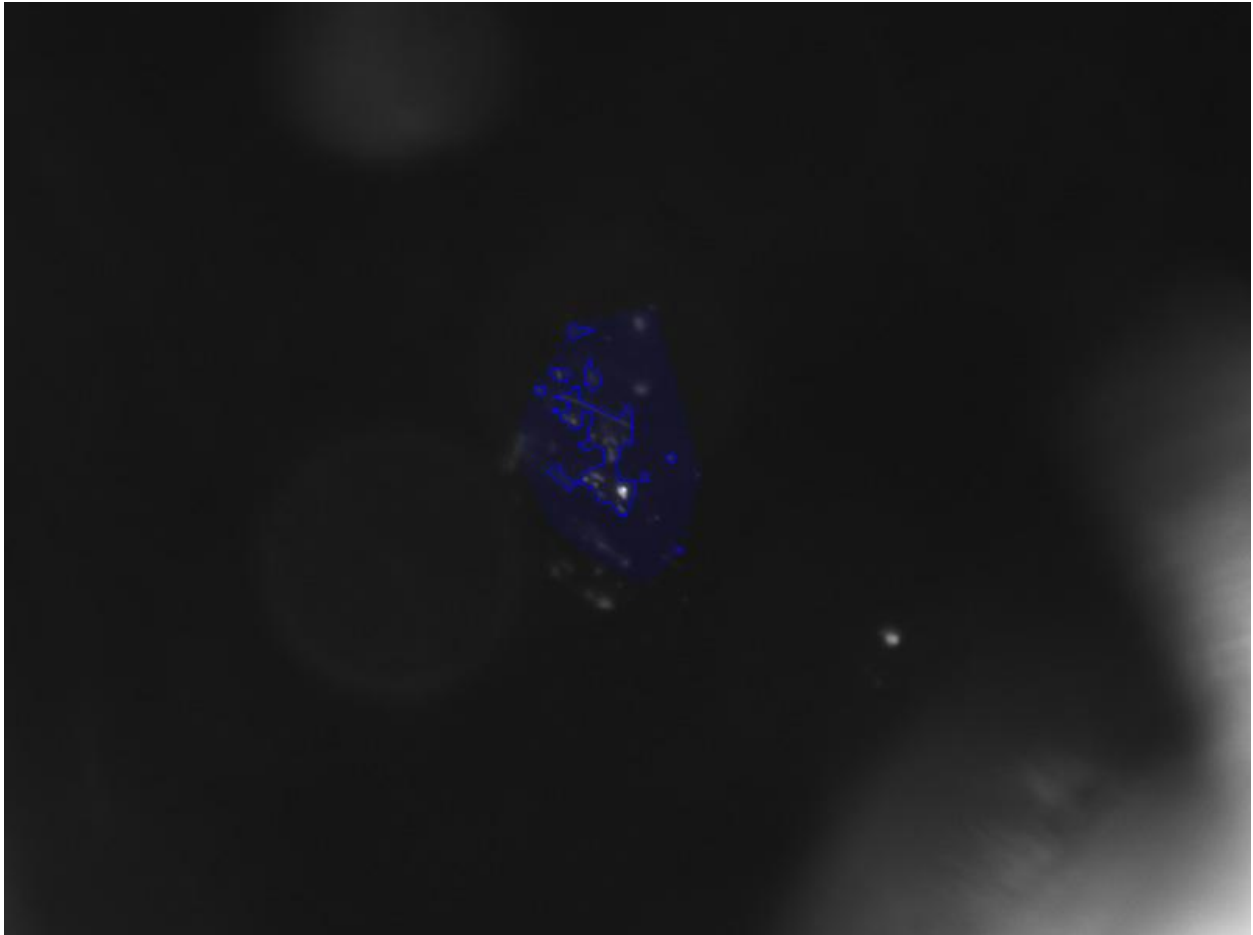


3. In the center of the screen see the allocation results.



Oxygen displays:

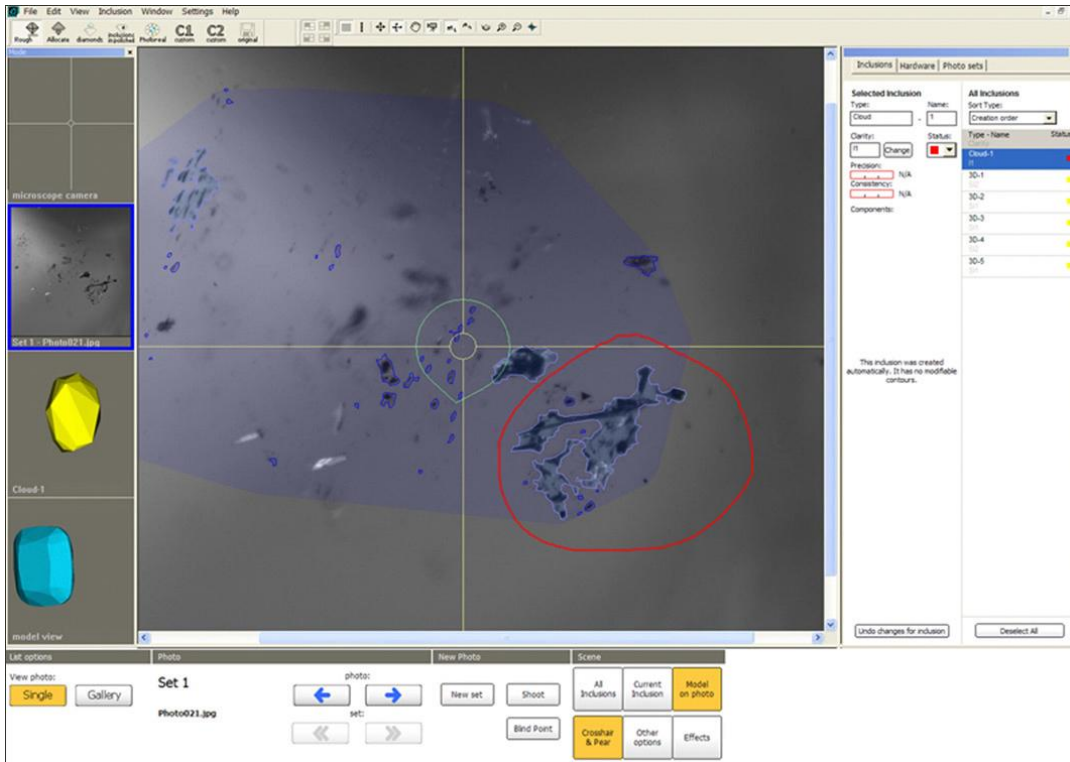
- reprojection of cloud 3D model that will be used for optimization by **blue, transparent** (see on screenshot below)
- contours of cloud points by **blue** contours (see on screenshot below)
- contours of 3D inclusions found during cloud allocation by **light-purple contours** (see on screenshot in the next section Splitting cloud parts)



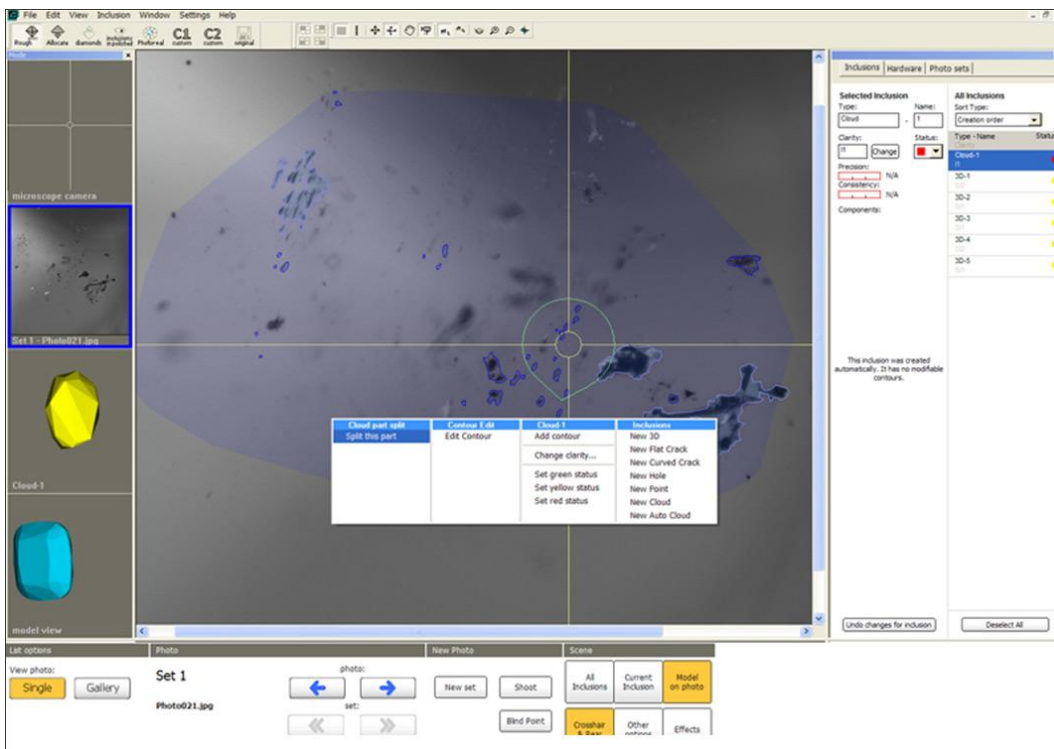
We recommend to look through all cloud photos and make sure that all cloud points are allocated correctly

5.7 Splitting cloud parts

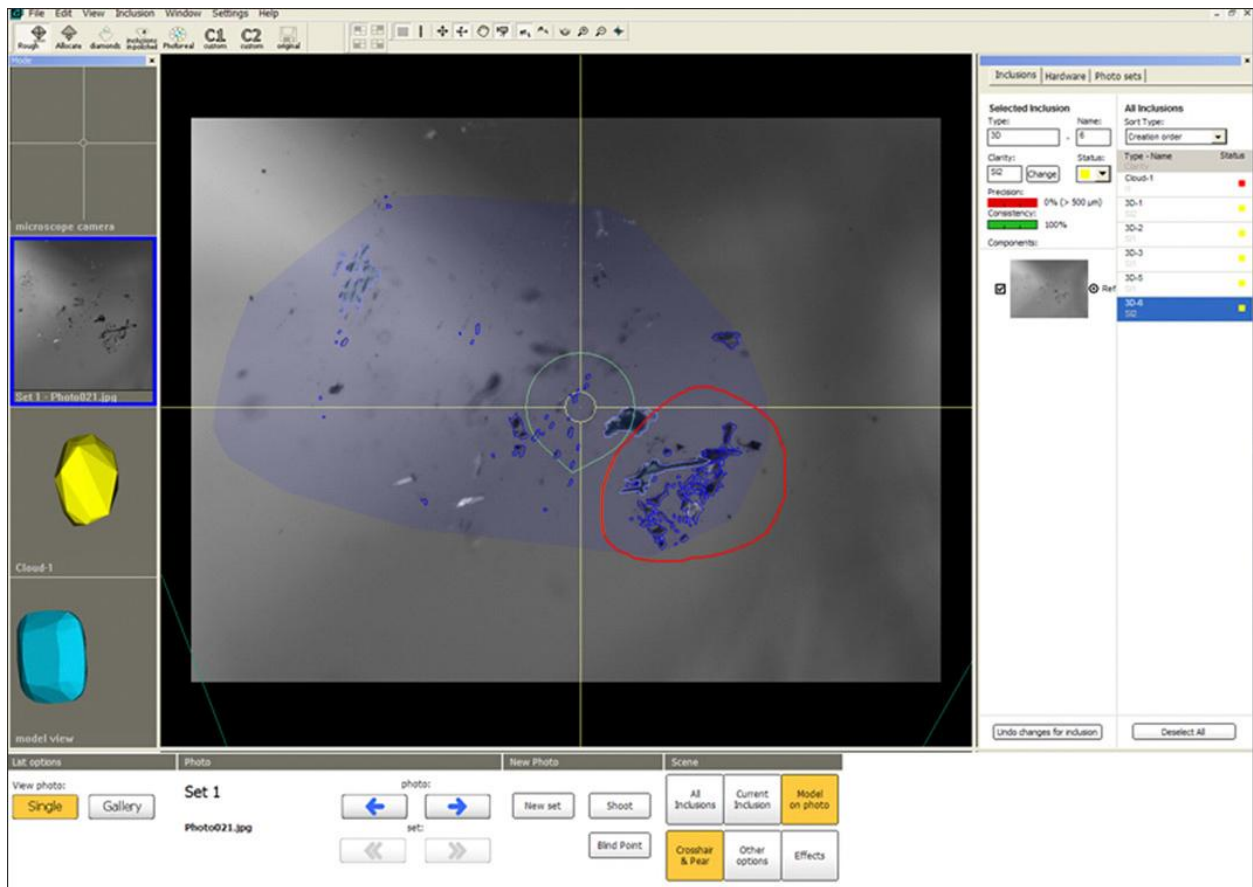
In case some cloud points are located close to each other an automatic allocation tool can accidentally merge them. On the screenshot below you can see that a number of cloud points have been merged into one large 3D inclusion.



In such case please right-click on the cloud part and choose **Split this part** item in the context menu:



Oxygen will try to split an inclusion into smaller parts.
Splitting procedure results can be seen on the screenshot below.





5.8 Flat Cracks

The system allows constructing Flat Crack inclusions.

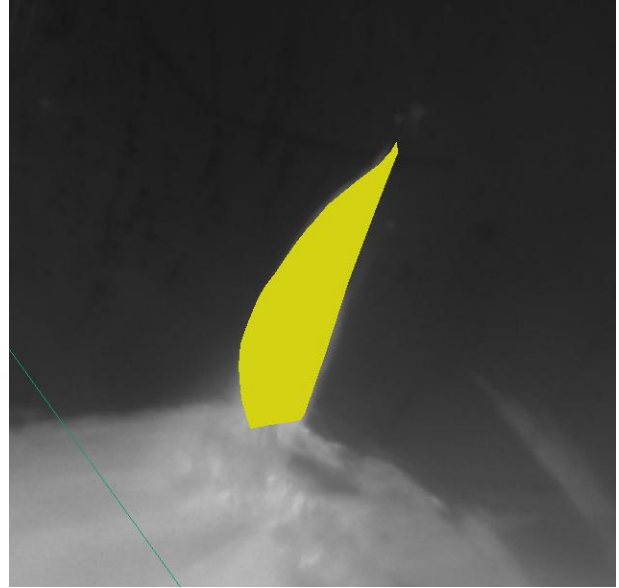
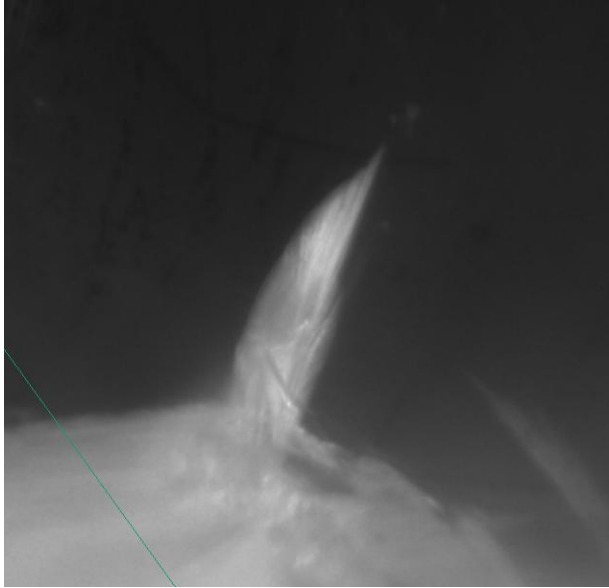


Photo of Flat crack

Oxygen 3D model of Flat crack

The new context based method for creating Flat Cracks is available.

Procedure outline

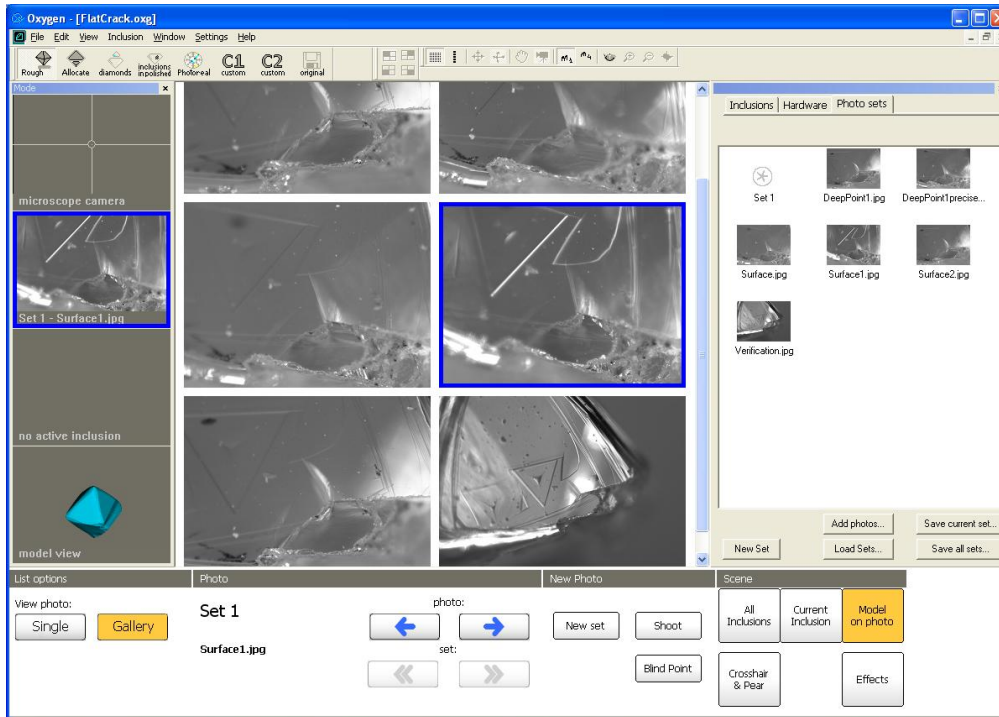
- Step 1. Making photos
- Step 2. Creating surface line
- Step 3. Creating deep points
- Step 4. Creating crack profile
- Step 5. Verifying crack

Download example .oxg file with photos:

<http://www.octonus.com/oct/download/files/oxygen/SampleFlatCrack.zip>

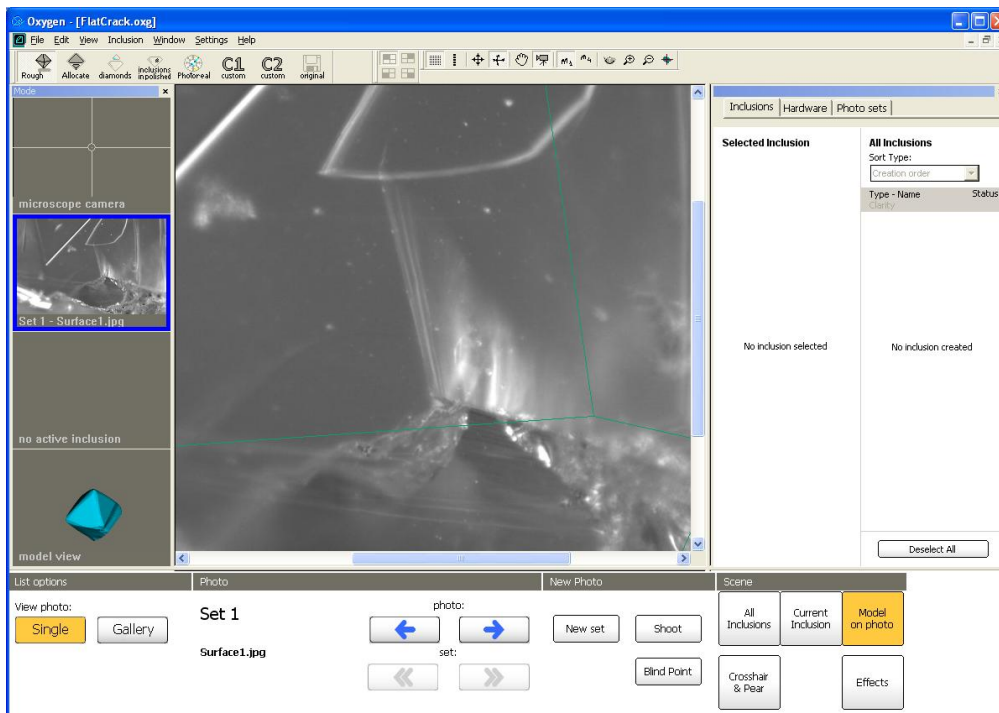
Step 1. Making photos

Make photos containing: surface line, crack profile and one or several deep points of crack. We recommend make at least one other photo for verification.

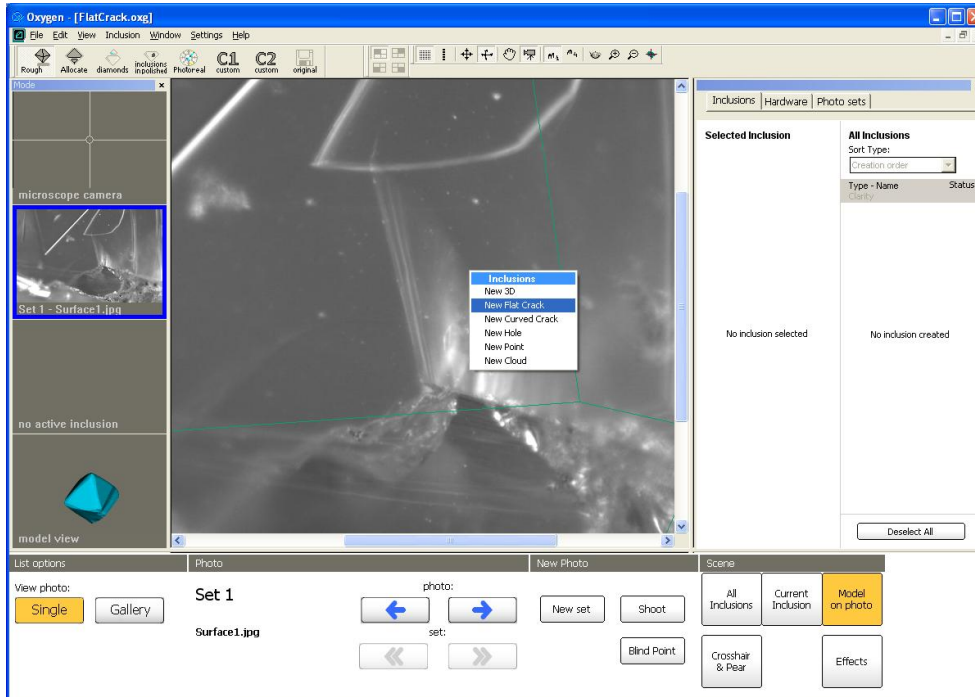


Step 2. Creating surface line

- Select a photo with surface line

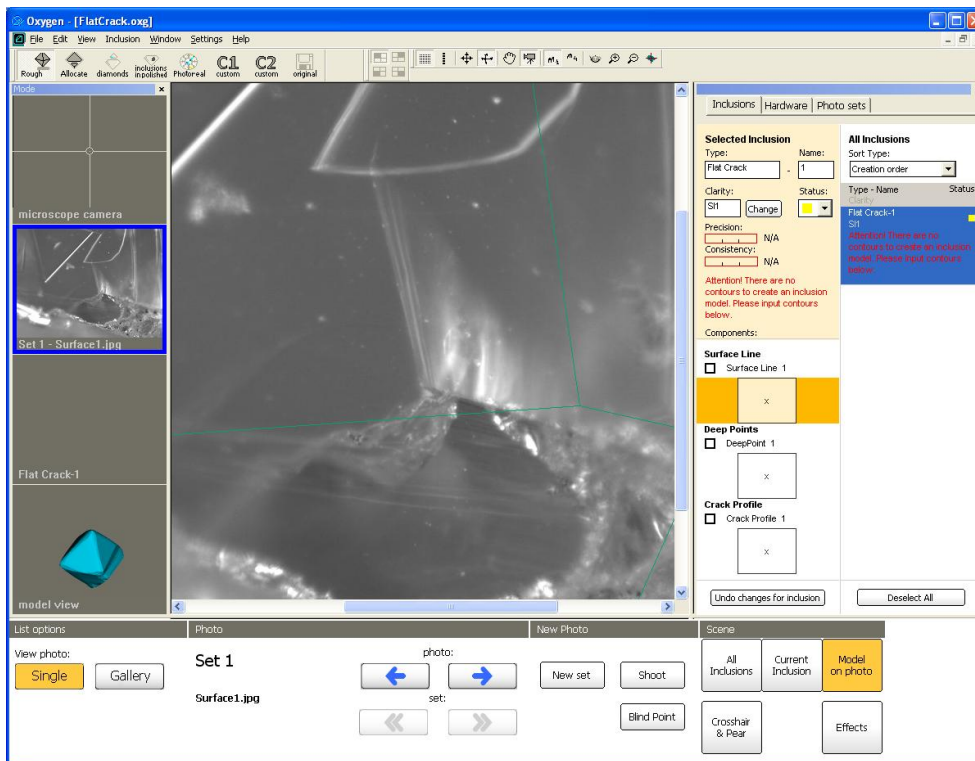


- Right click mouse on Scene to open context menu and select **New Flat Crack**

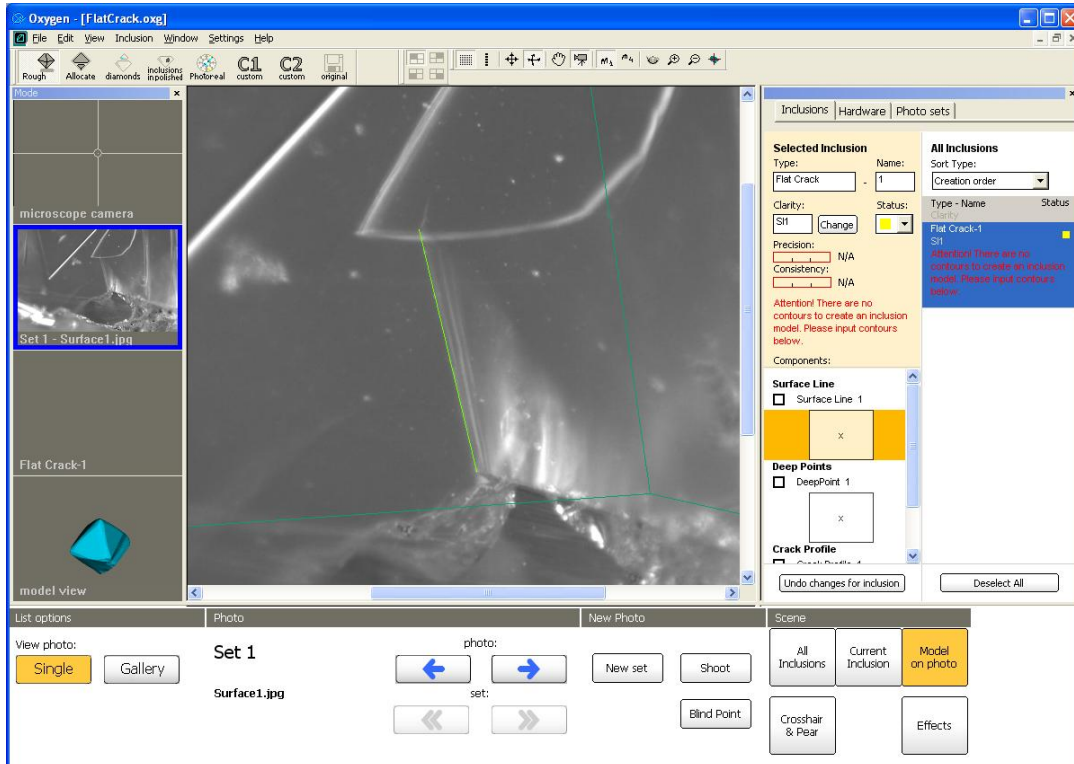


- To create Flat crack you must create at least:
 - one Surface line, one Deep point and one Crack profile
 - or two Surface lines and one Crack profile
 - or tree Deep points and one Crack profile

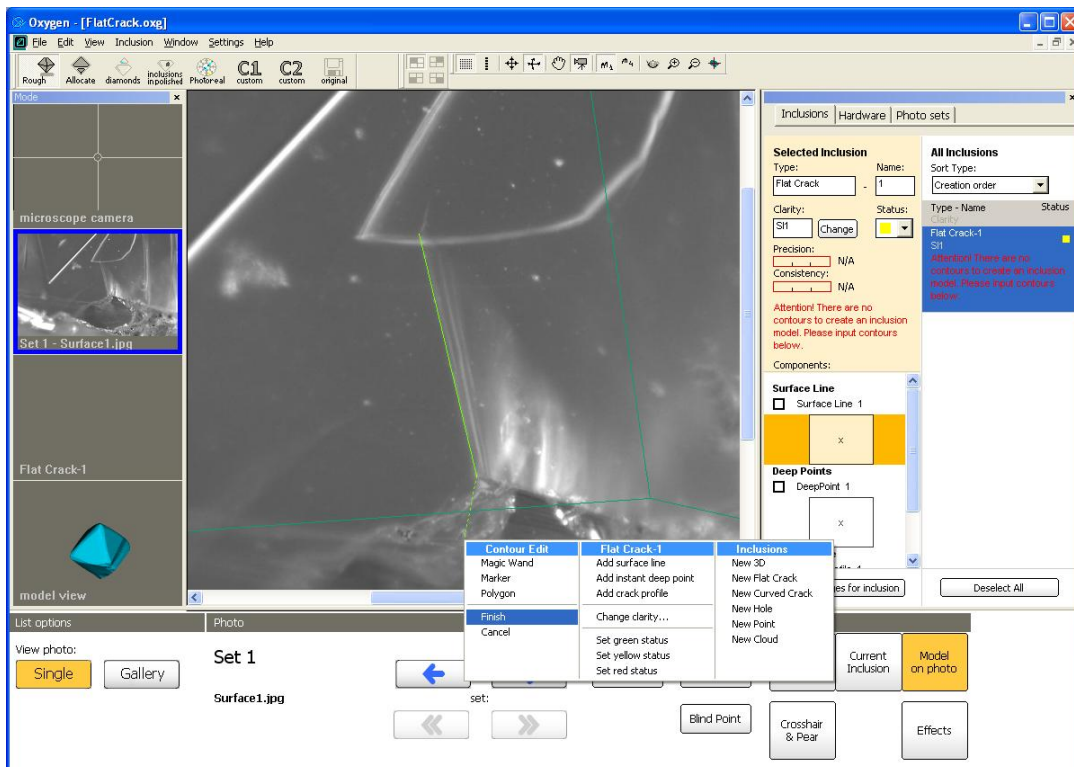
By default the program suggest to create one Surface line, one Deep point and one Crack profile:



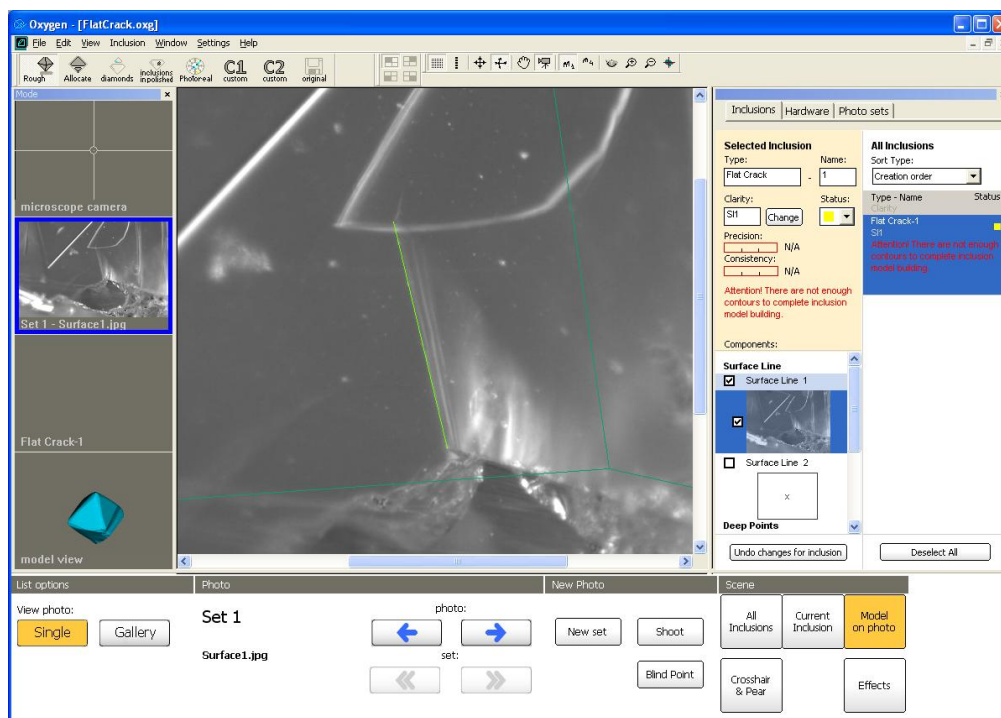
- Draw surface line



- Then line is ready right click mouse and select **Finish** in context menu

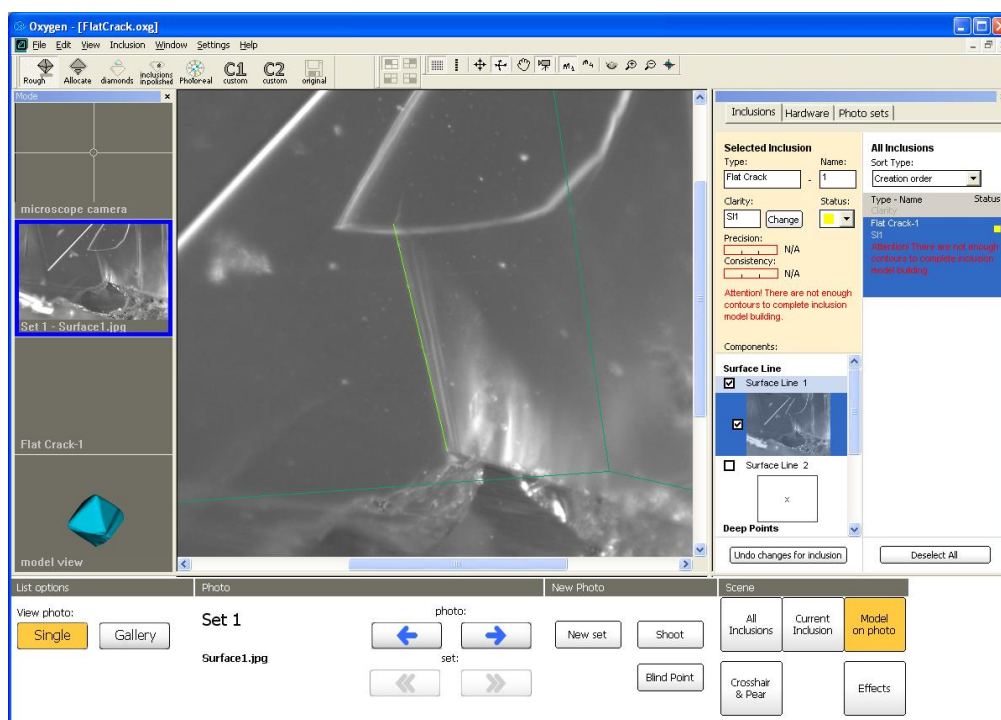


- The Surface line is ready.

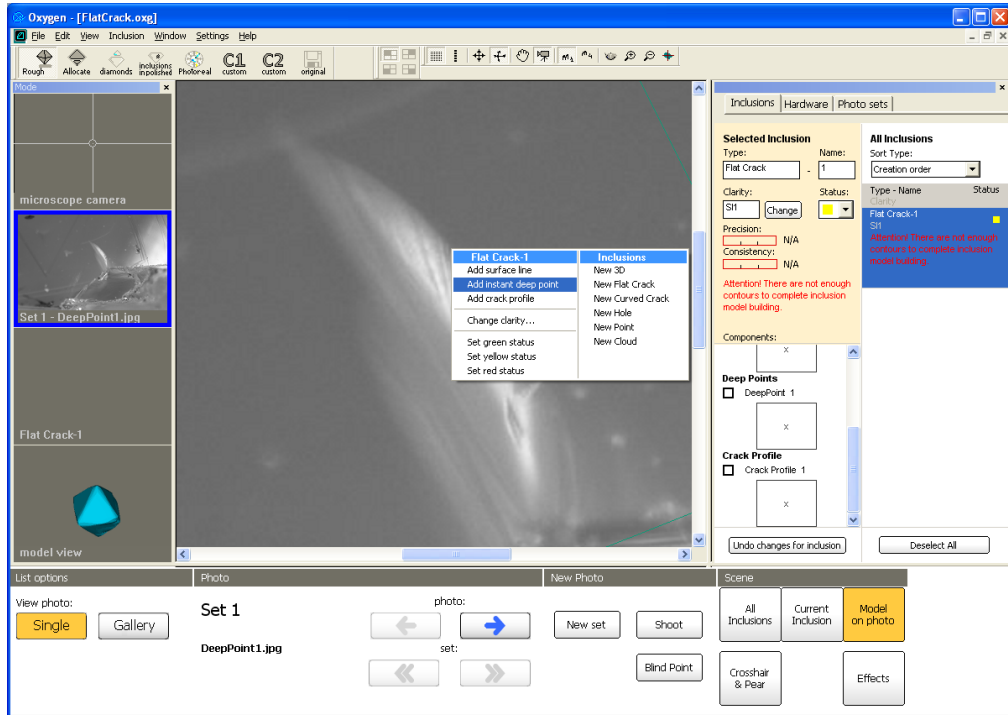


Step 3. Creating deep points

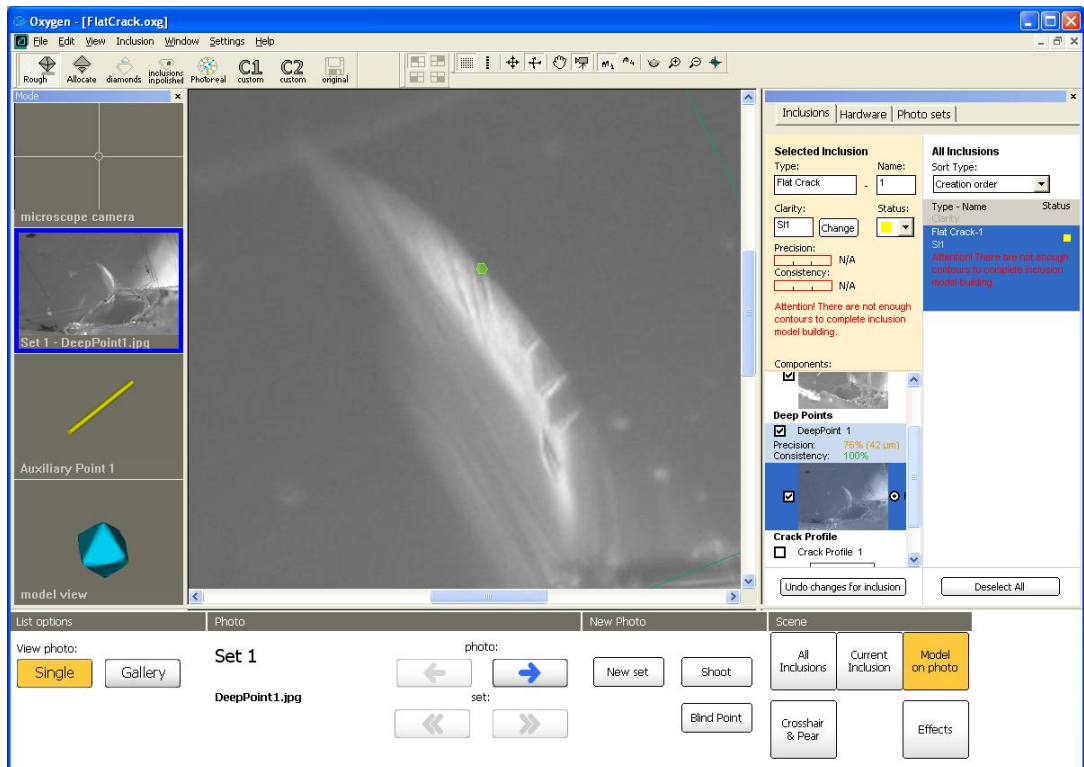
- To create deep point:
 - Select inclusion component **Deep point**
 - Select photo with deep point and zoom it



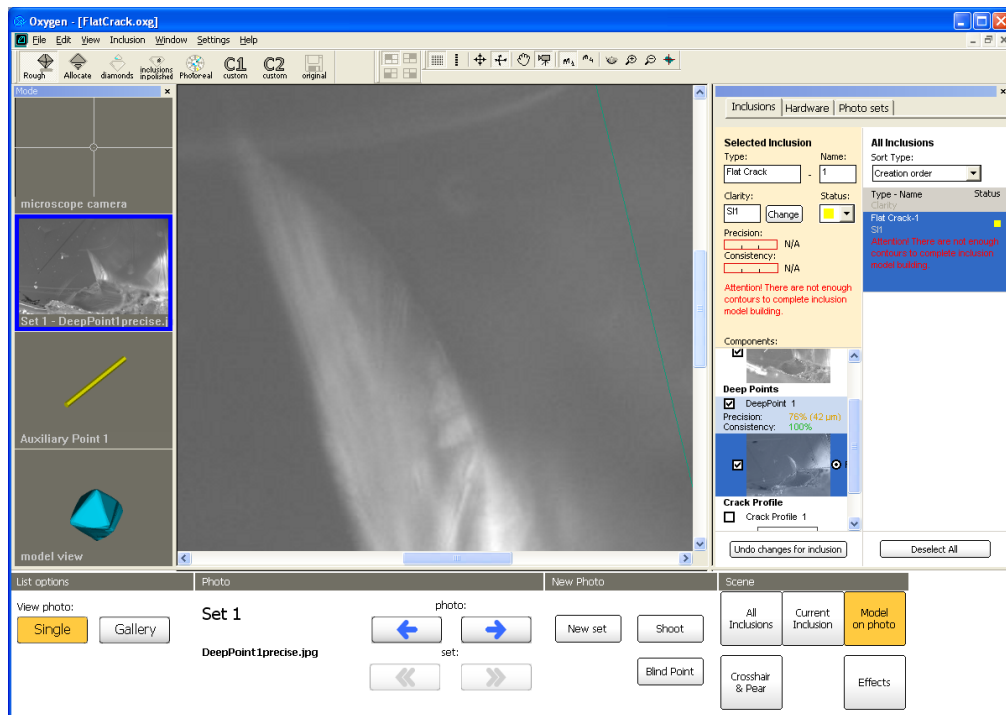
- Right click mouse in Scene in place where you want to create Deep point and select **Add instant deep point** in context menu



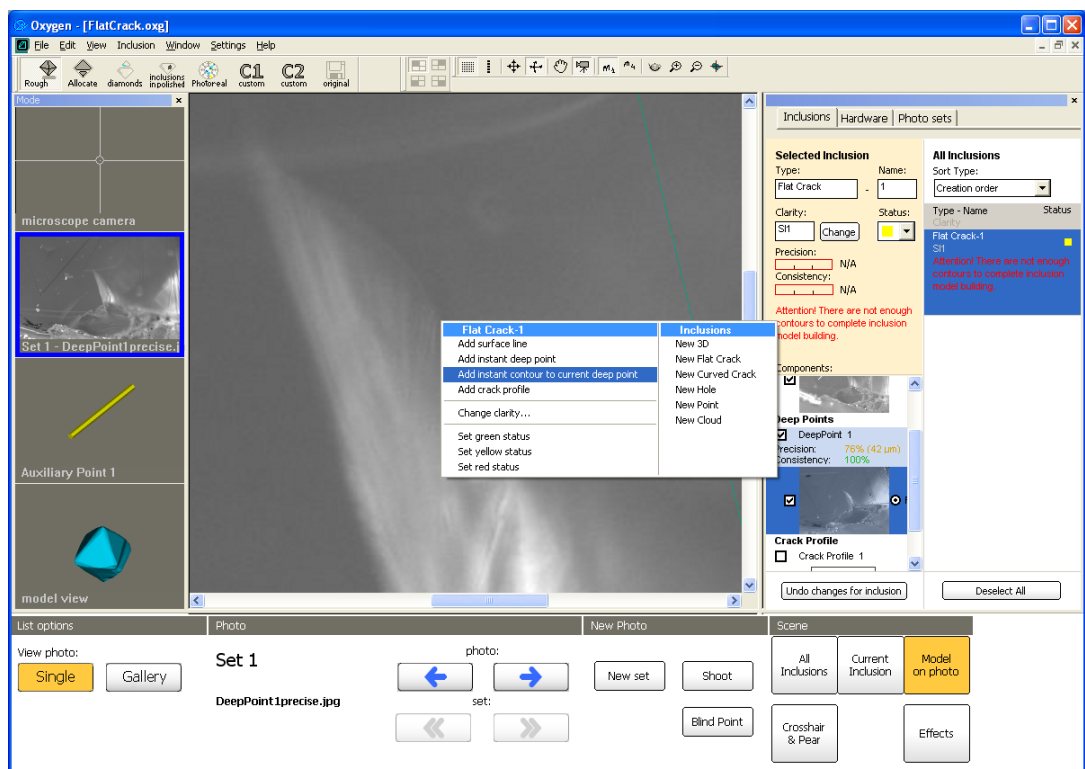
- The Deep point is ready



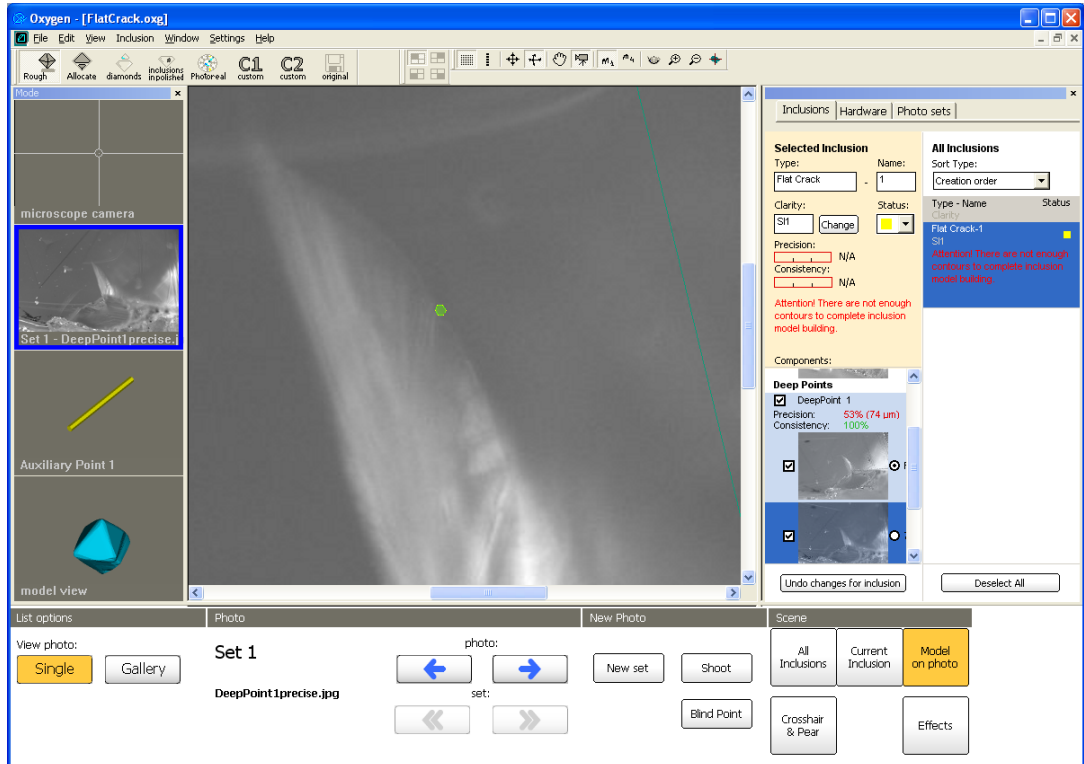
- To precise deep point
 - Be sure **DeepPoint 1** component is selected in the inclusions panel
 - Select photo from other direction



- Right click mouse in Scene in place where you want to create precise deep point and select **Add instant contour to current deep point**

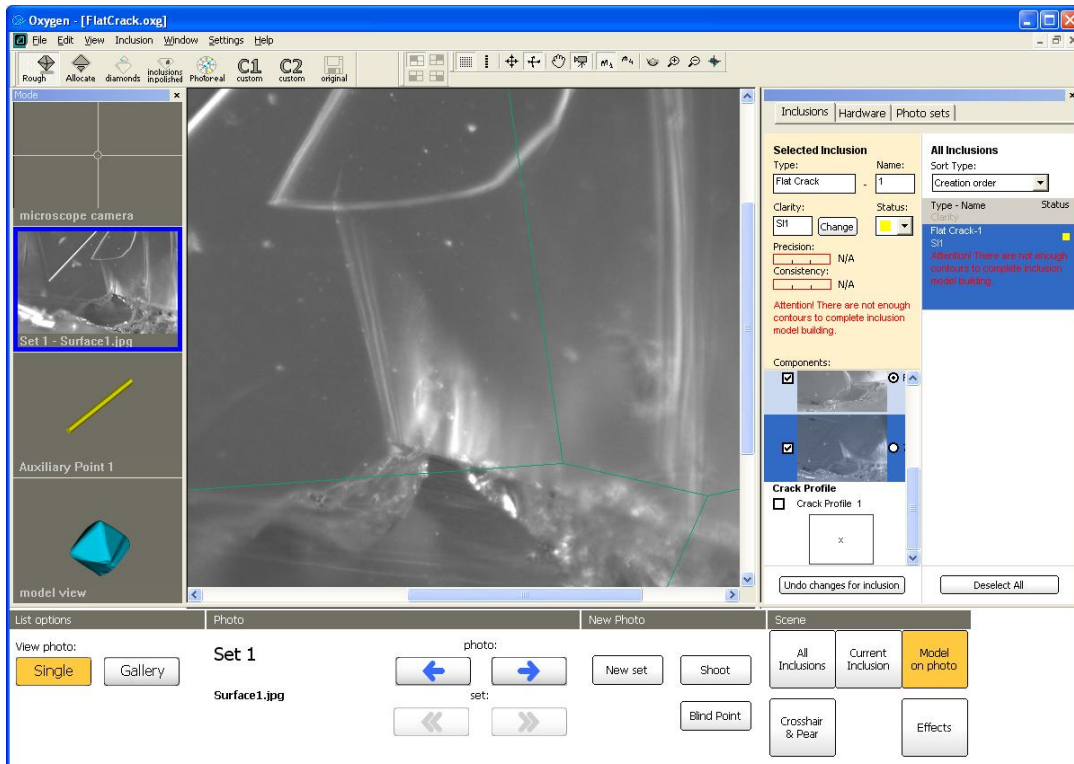


- Deep point is precisised

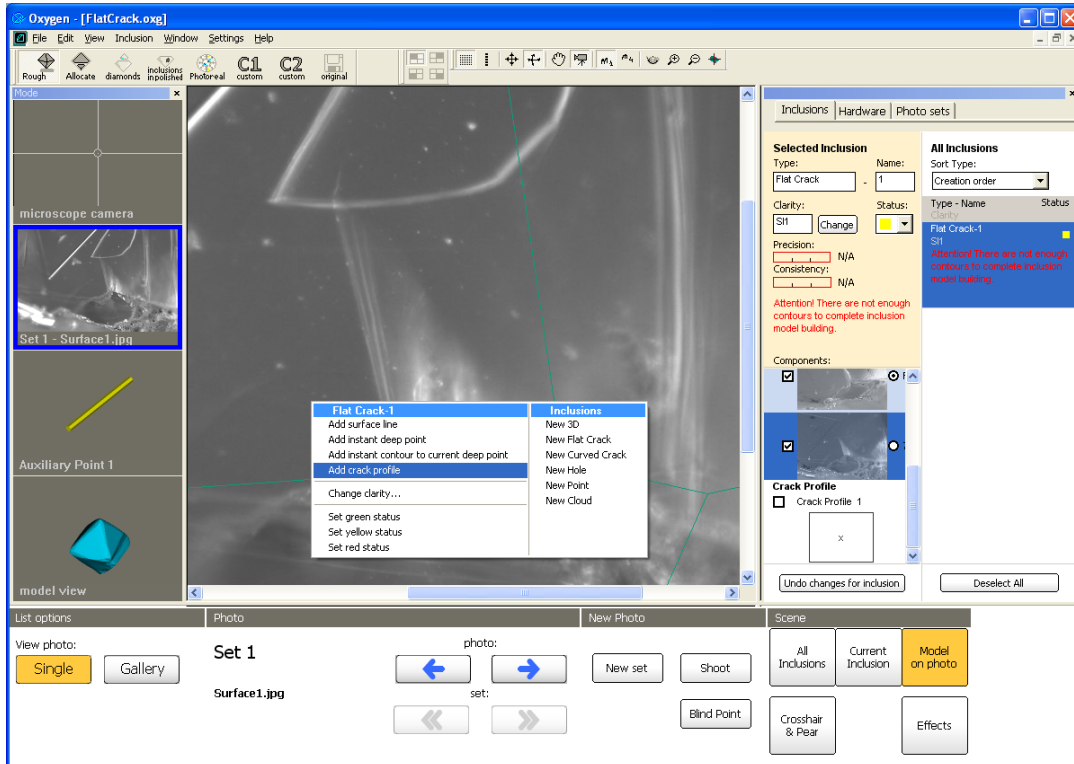


Step 4. Creating crack profile

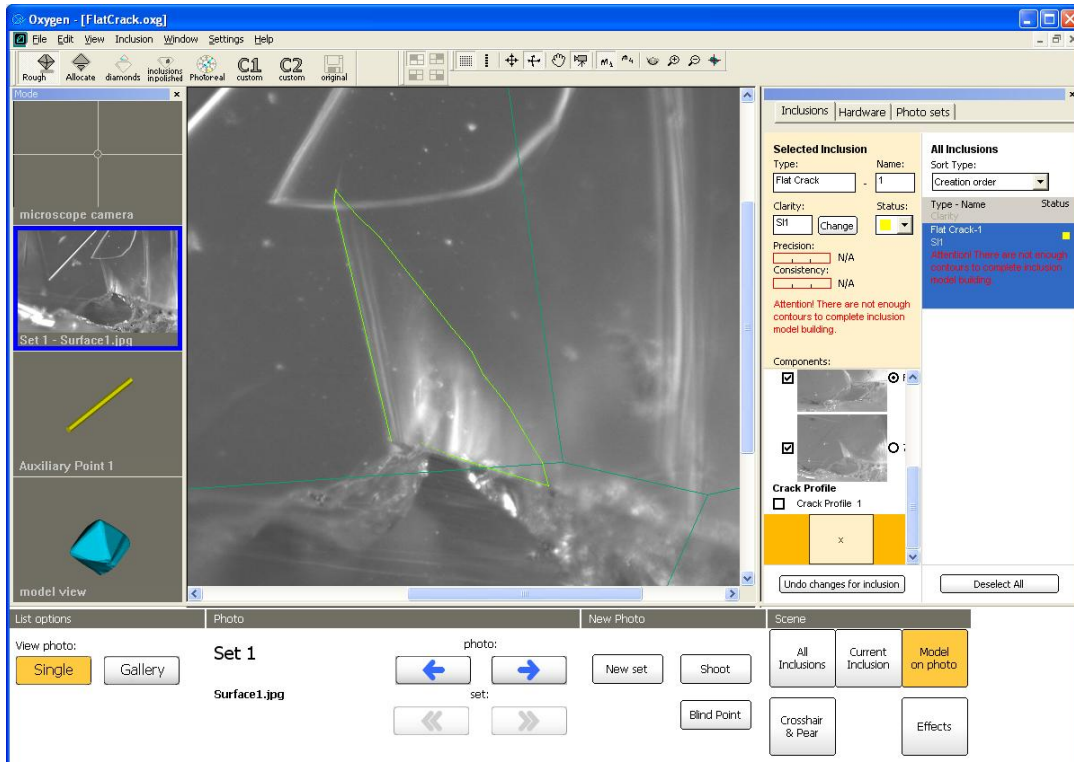
- Select photo with crack profile



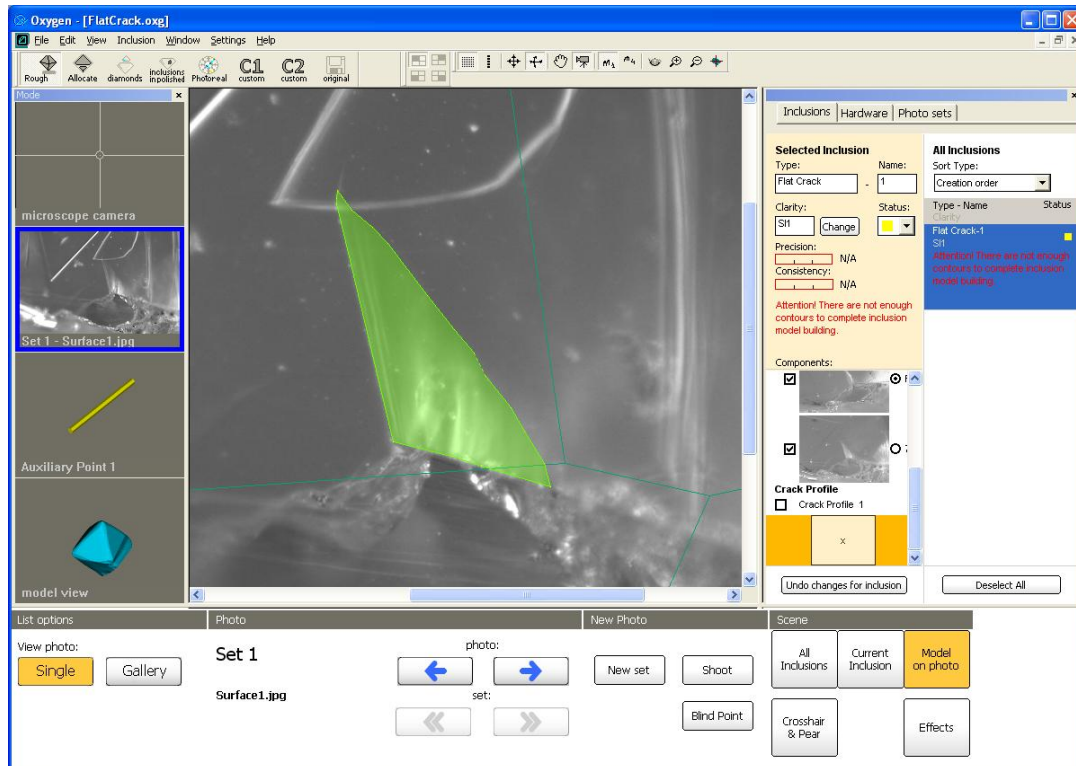
- Right click mouse on Scene to open context menu and select **Add crack profile**



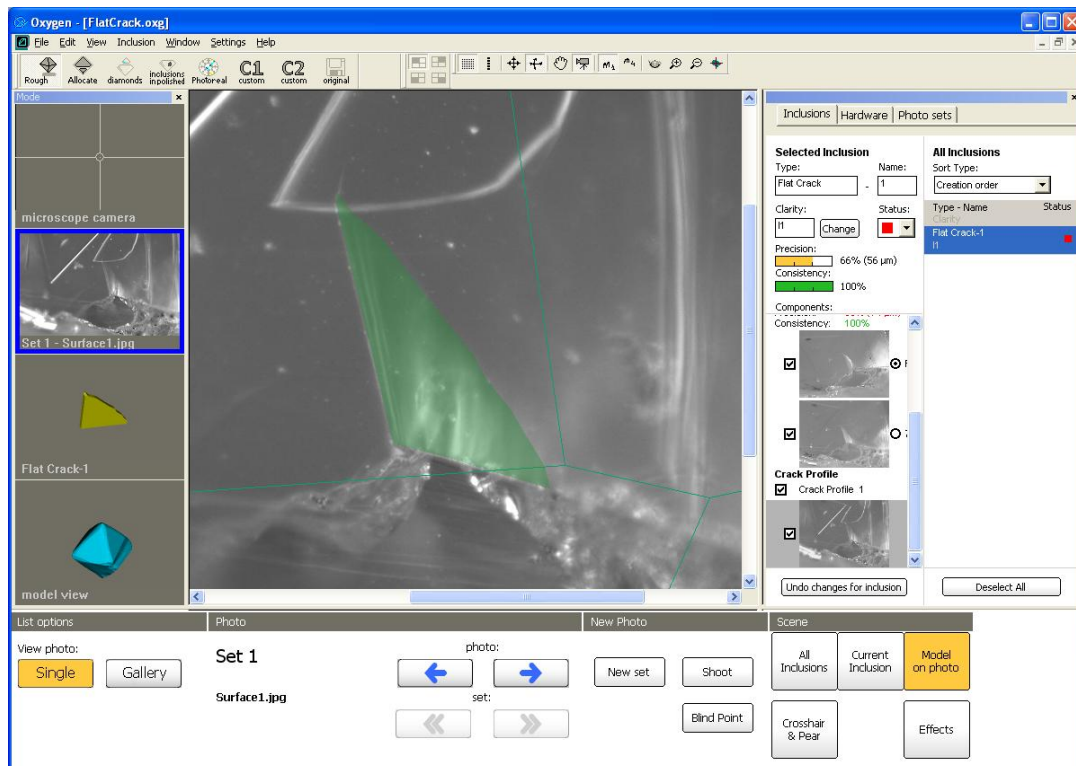
- Draw crack profile



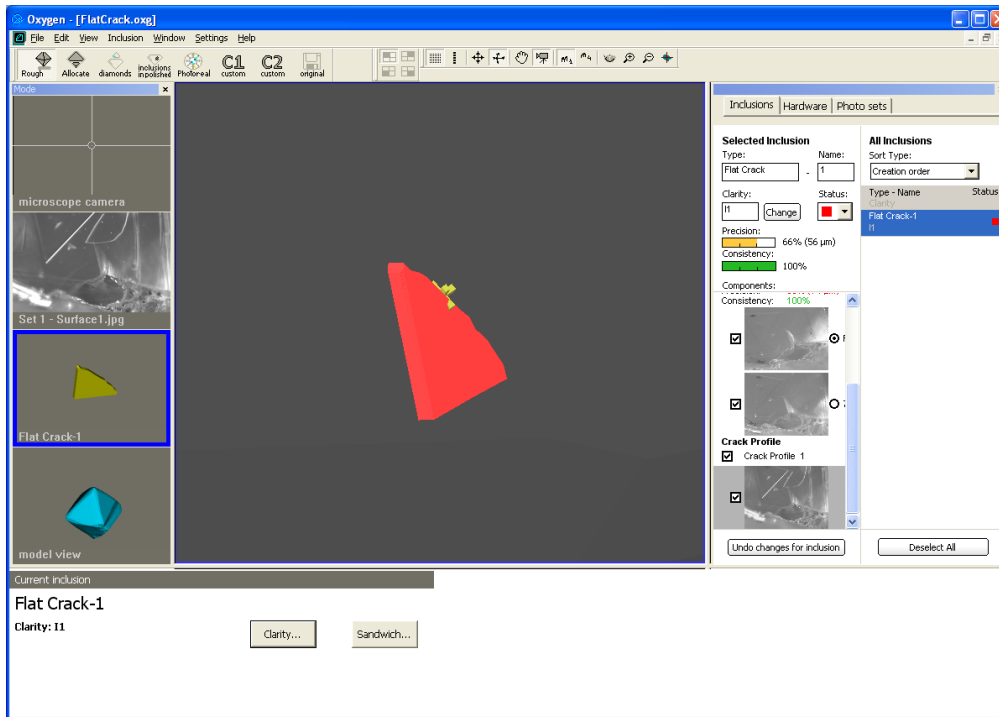
- Enclose contour with double click and perform it if need.



- Finish contour with context menu
- The Crack profile is completed

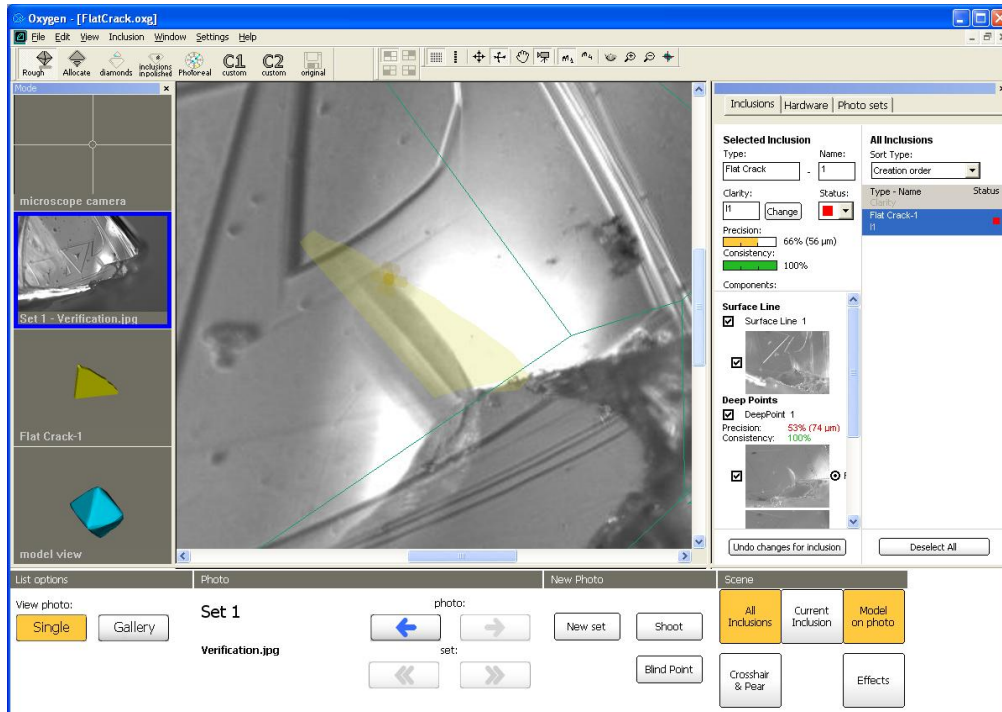


- Flat Crack inclusion is ready.



Step 5. Verifying inclusion

Compare photos with new created crack model over the photo.



Modify contours, add more deep points if need.

5.9 Curved cracks

New Oxygen Microscope tool allows constructing surface Curved cracks.

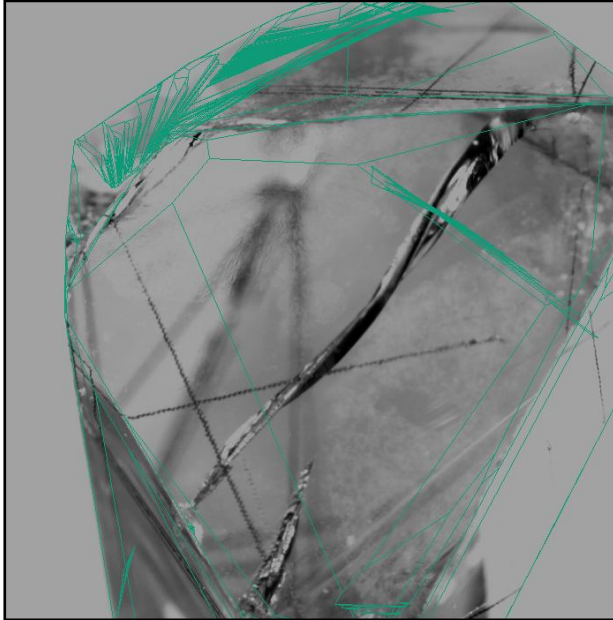
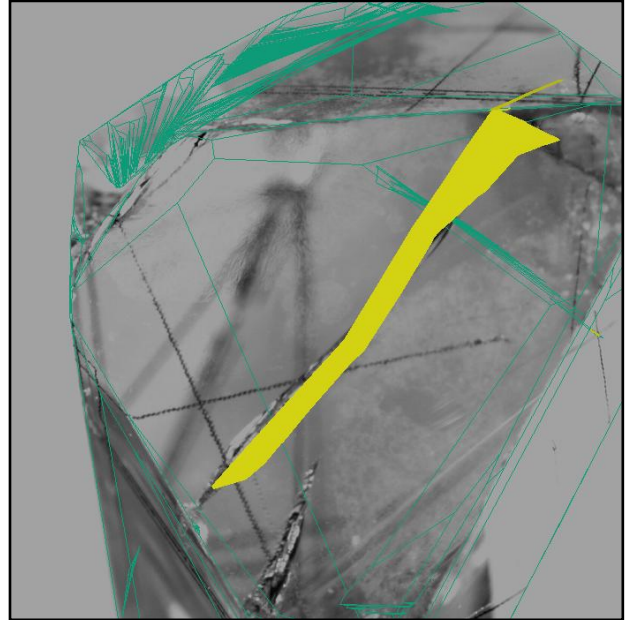
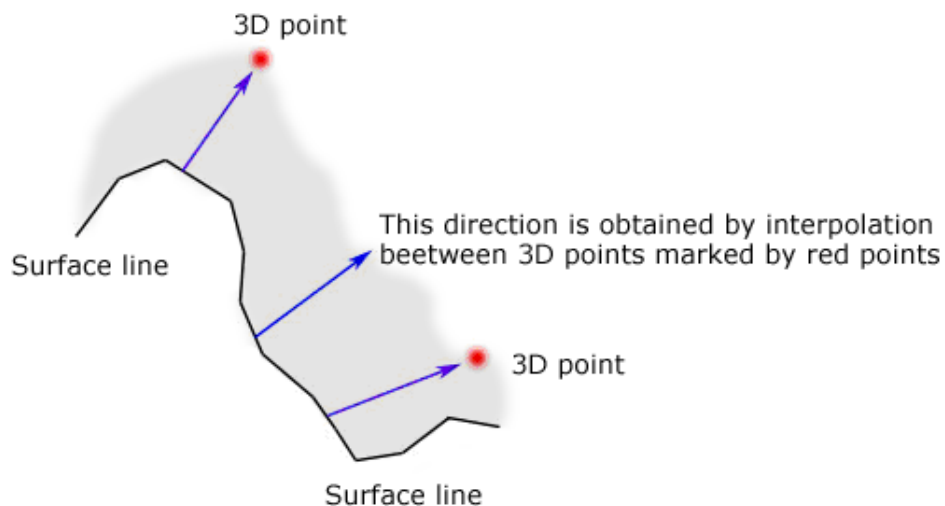


Photo of Curved crack



Oxygen 3D model of Curved crack

Algorithm constructs a shape of curved crack by surface line and 3D points. The perpendiculars are put from 3D points in the deep of stone to Surface line. The other directions are constructed by interpolation (see illustration below). The final crack shape is defined by crack's Outline.



Procedure outline

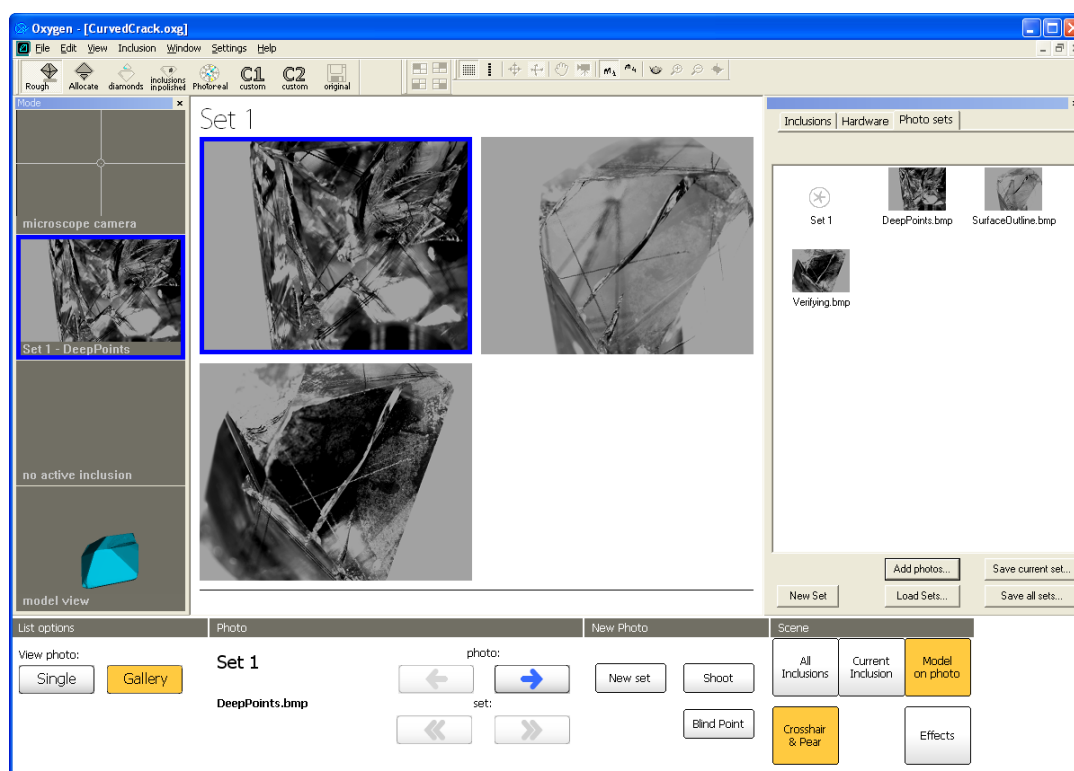
- Step 1. Making photos
- Step 2. Creating surface line
- Step 3. Creating crack profile
- Step 4. Creating deep points
- Step 5. Verifying inclusion

Download example .oxg file with photos:

<http://www.octonus.com/oct/download/files/oxygen/SampleCurvedCrack.zip>

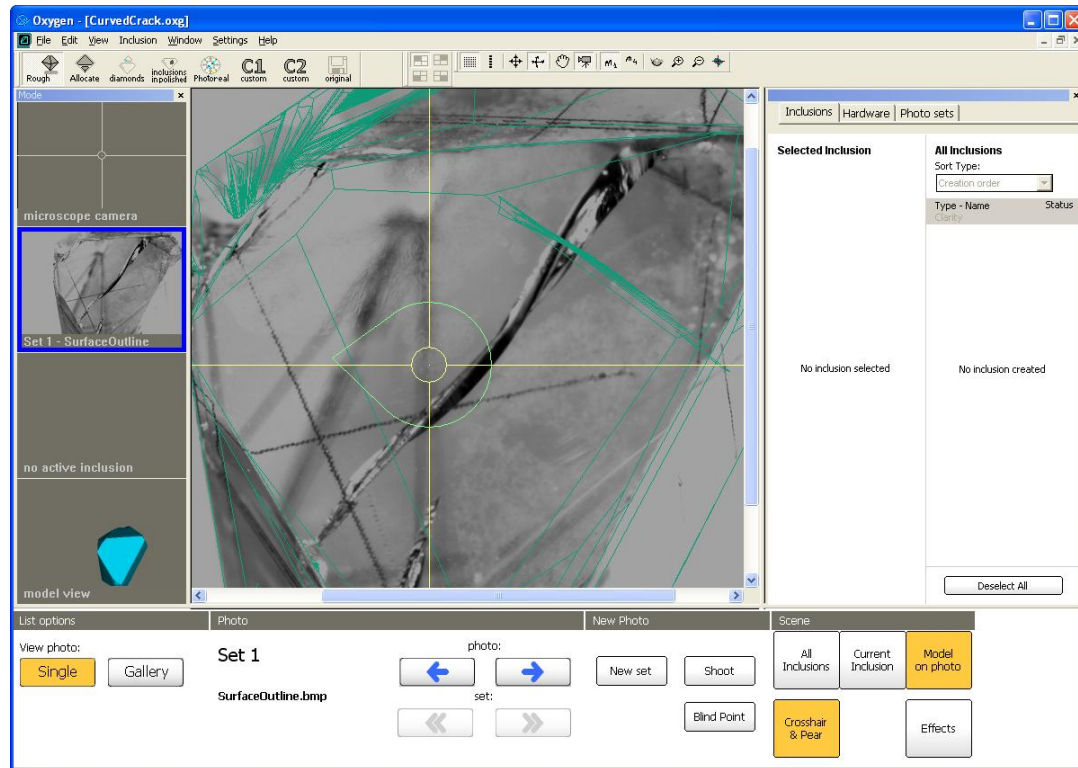
Step 1. Making photos

Make photos. The set of photos should contain: Surface line, Crack outline and Several deep points of crack. We recommend make at least one additional photo from different direction for verification

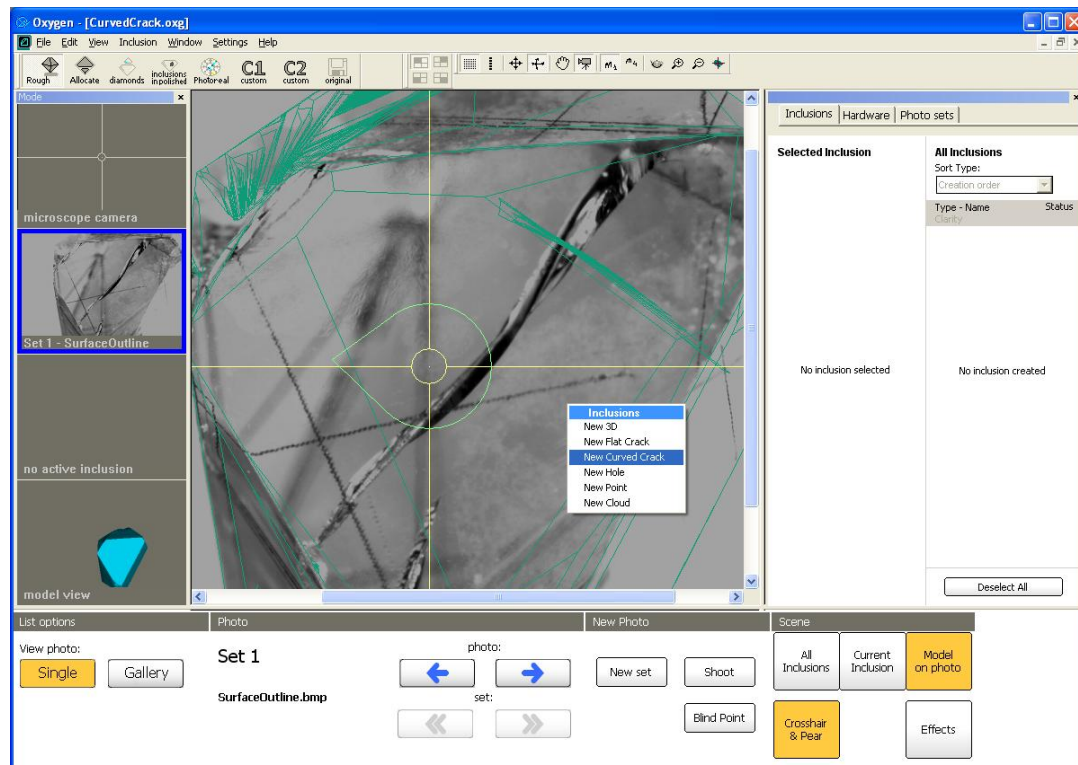


Step 2. Creating surface line

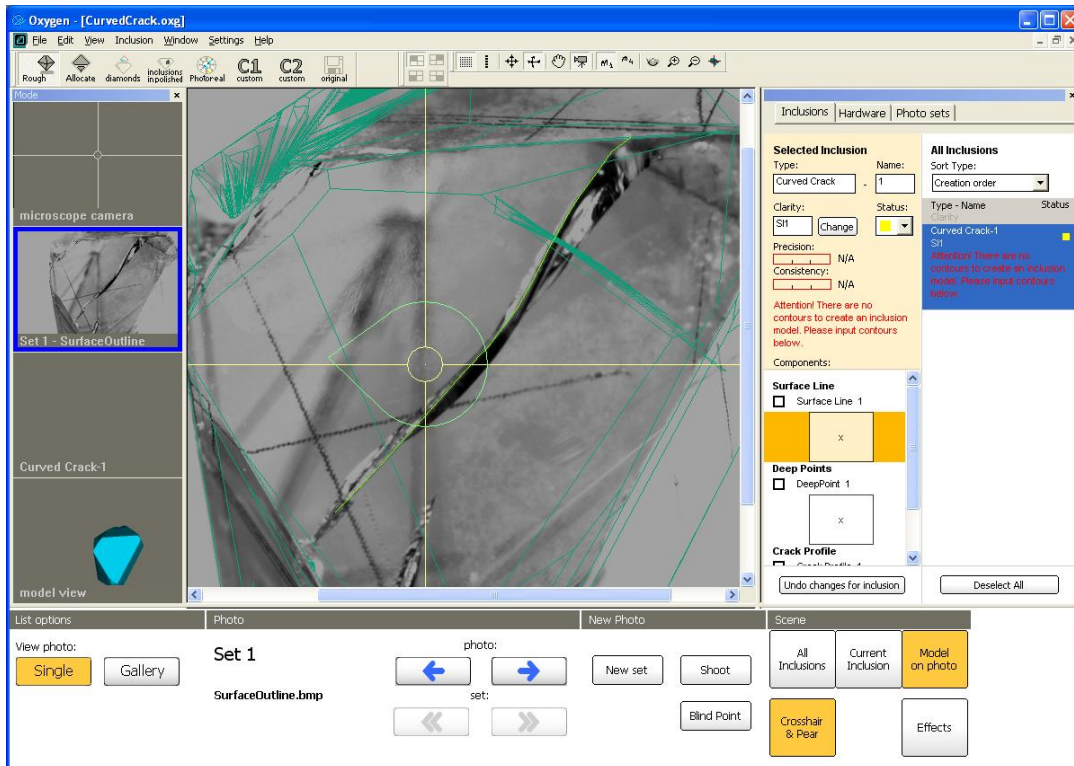
- Select a photo with Surface line



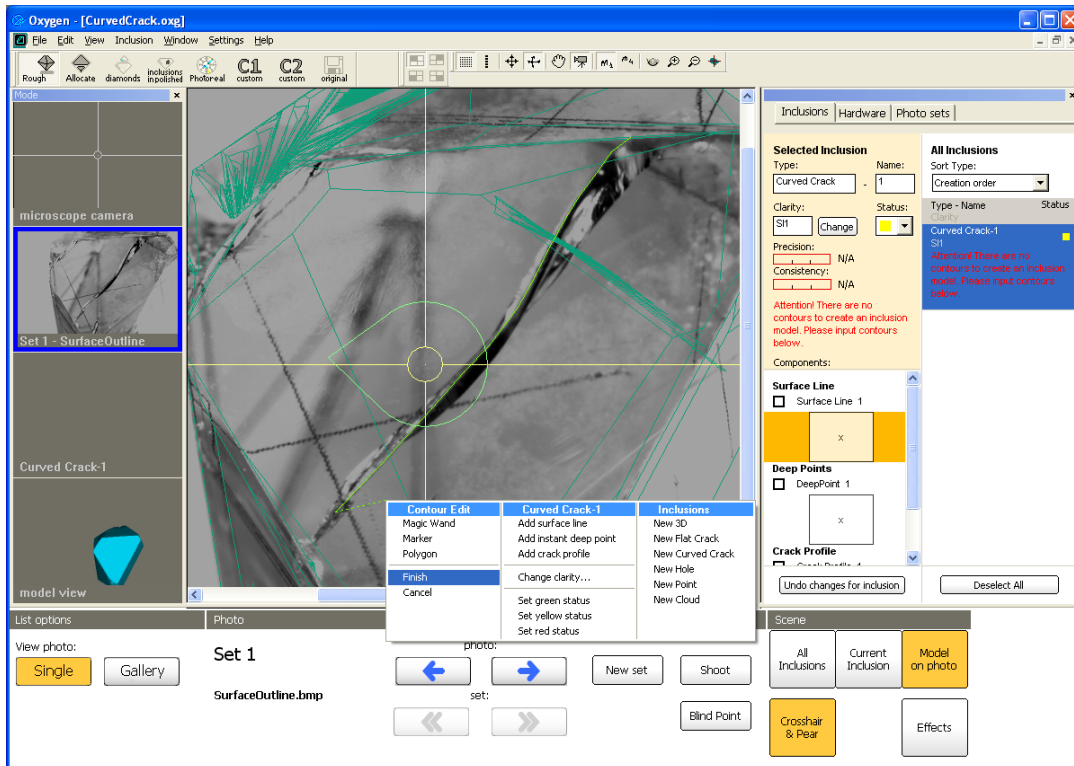
- Right click mouse on Scene to open context menu and select **New Curved Crack**



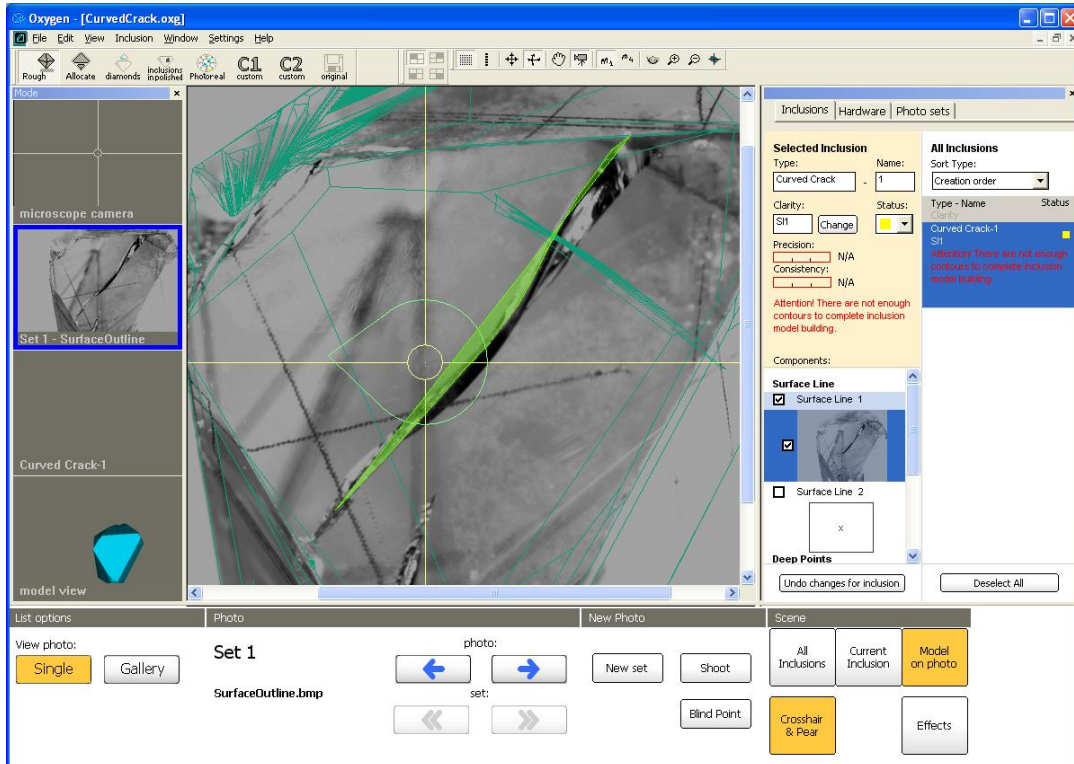
- Draw surface line



- Then line is ready right click mouse and select **Finish** in context menu

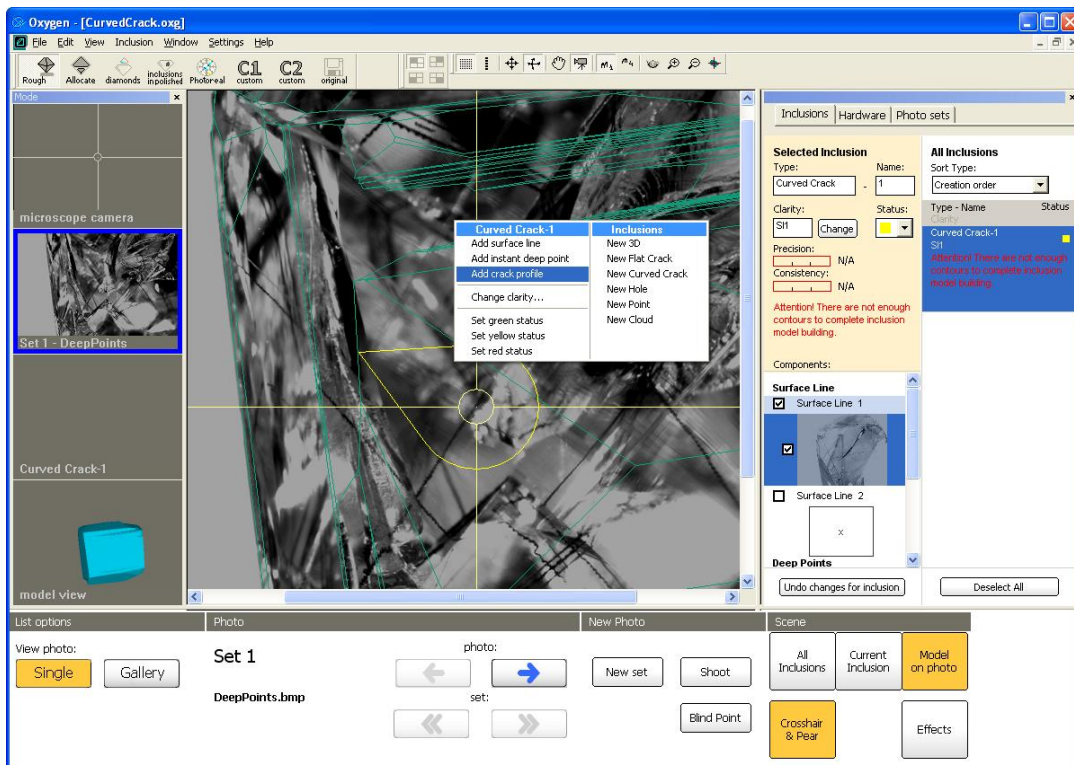


- The Surface line is ready.

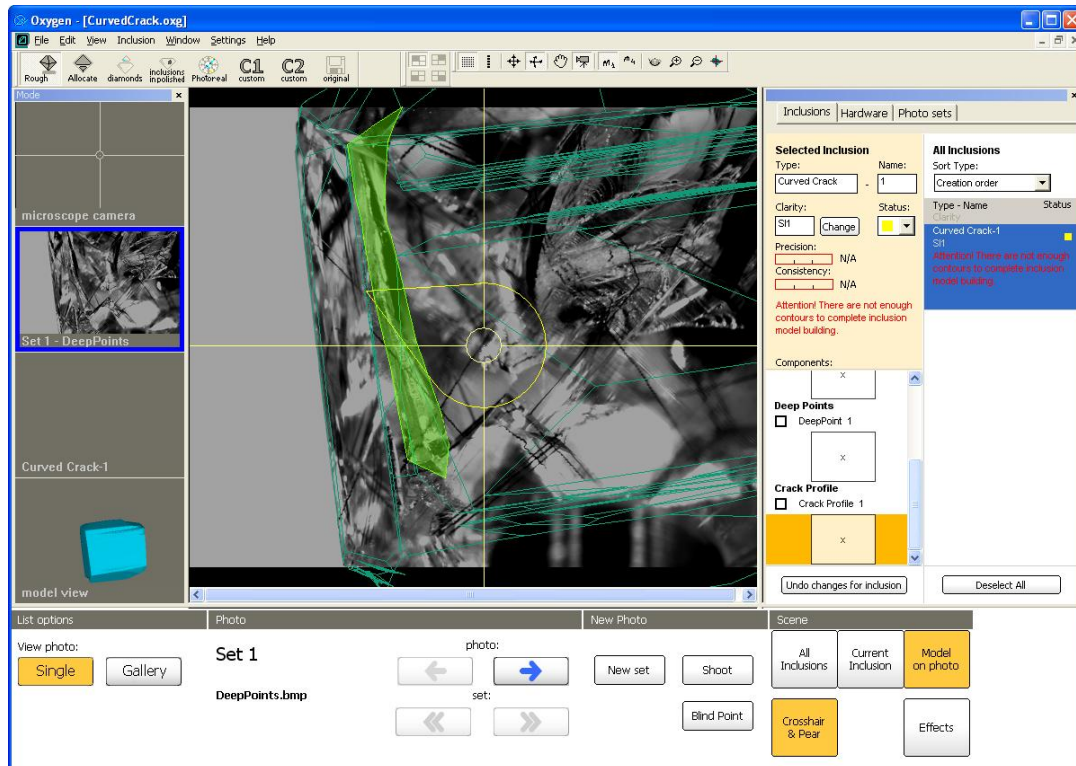


Step 3. Creating crack profile

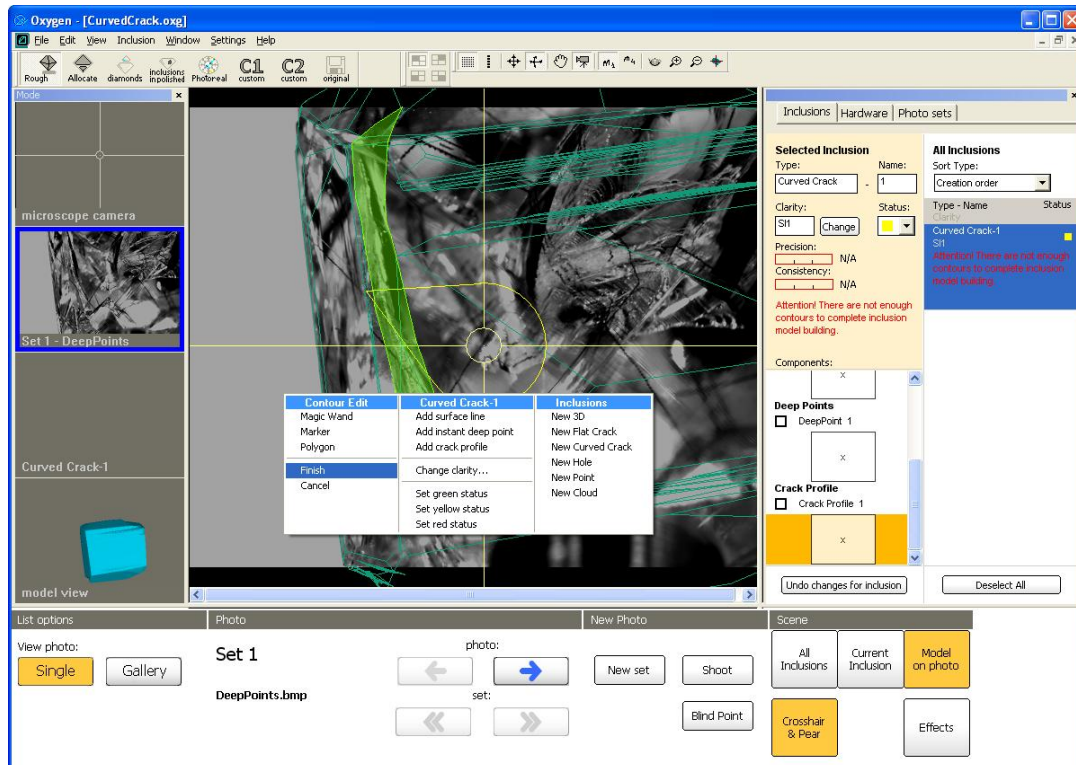
- Select photo with crack profile.
- Right click mouse on Scene to open context menu and select **Add crack profile**



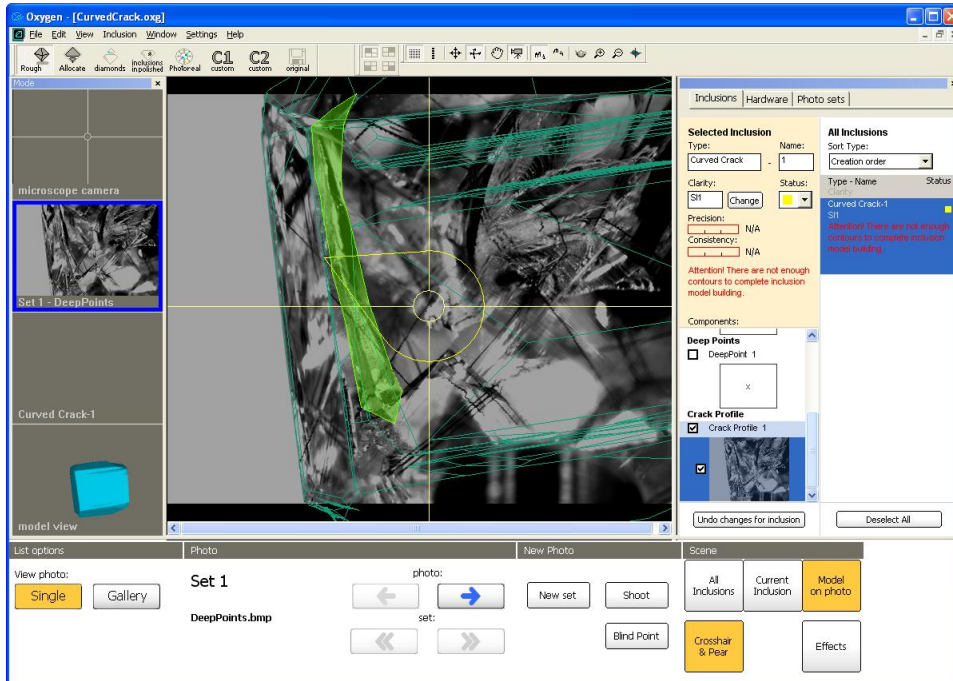
- Draw crack profile and enclose contour with double click



- Perform contour if need
- Finish contour with context menu



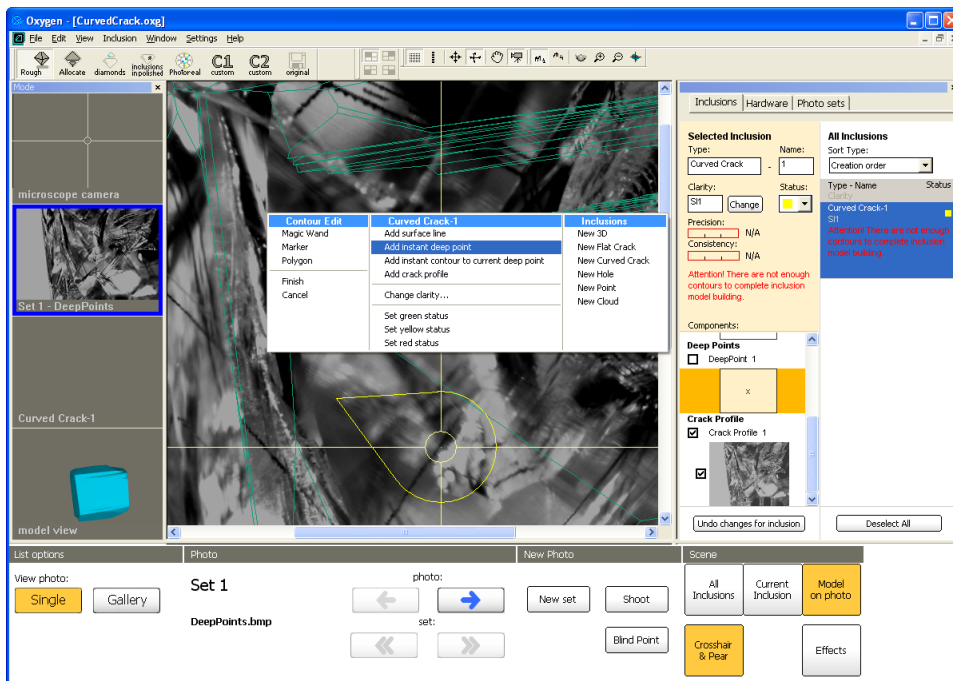
- Crack profile is ready



Step 4. Creating deep points

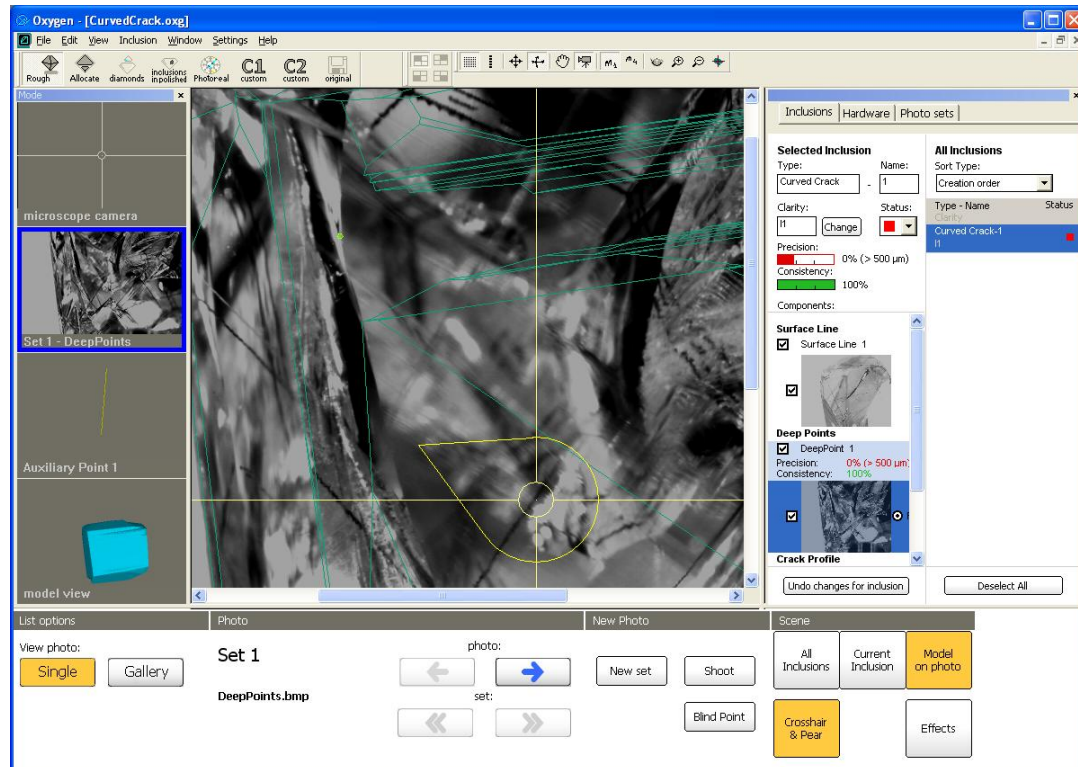
We recommend to create several deep points to make shape of crack more precise.
Create deep point:

- Select photo with deep point
- Right click mouse in Scene in place where you want to create Deep point and select **Add instant deep point** in context menu

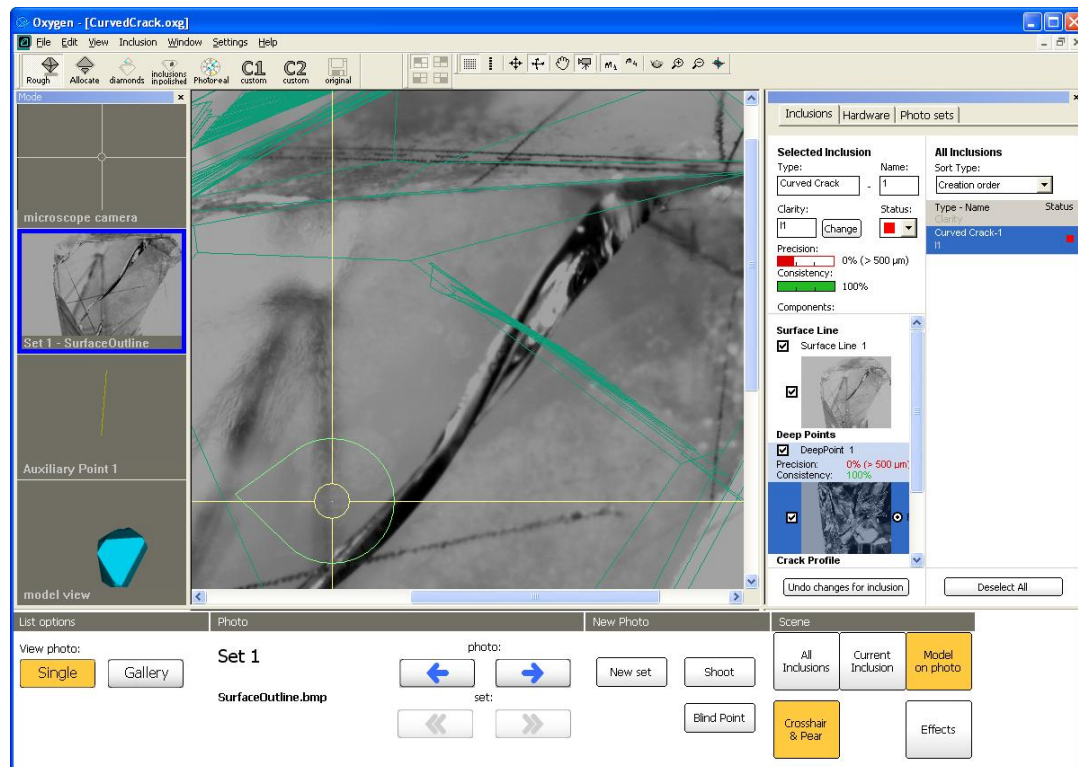


Add precise contour to Deep point:

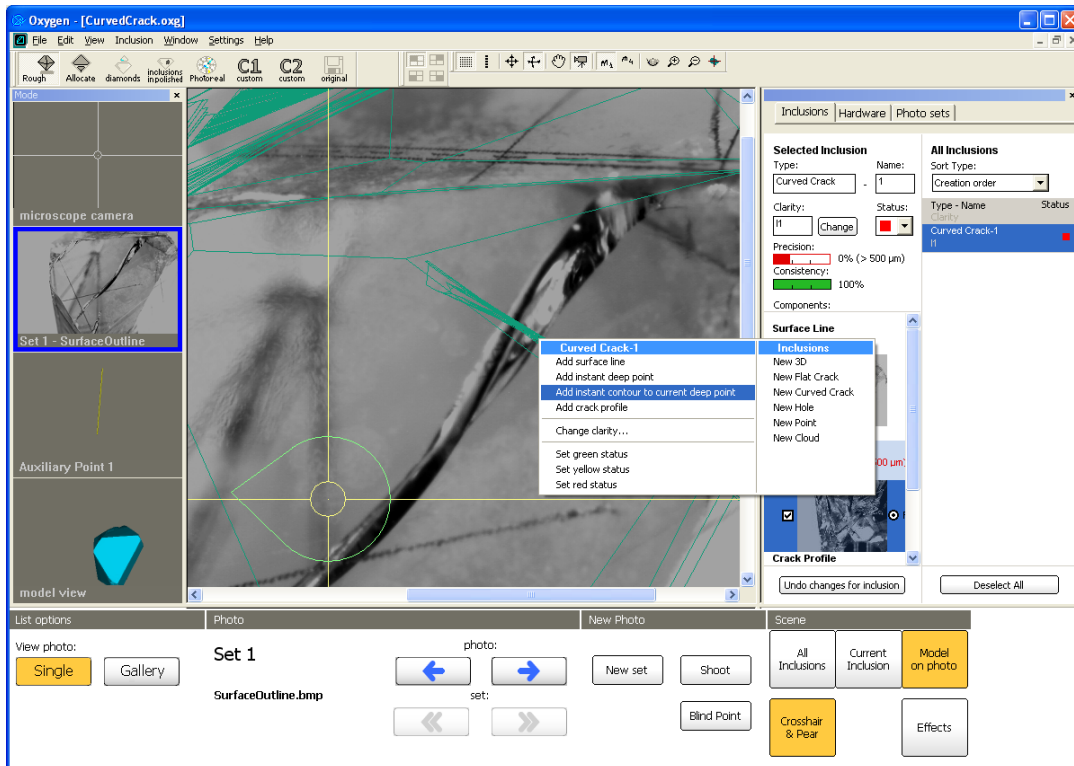
- Be sure you selected **DeepPoint 1** component in the panel **Inclusions**



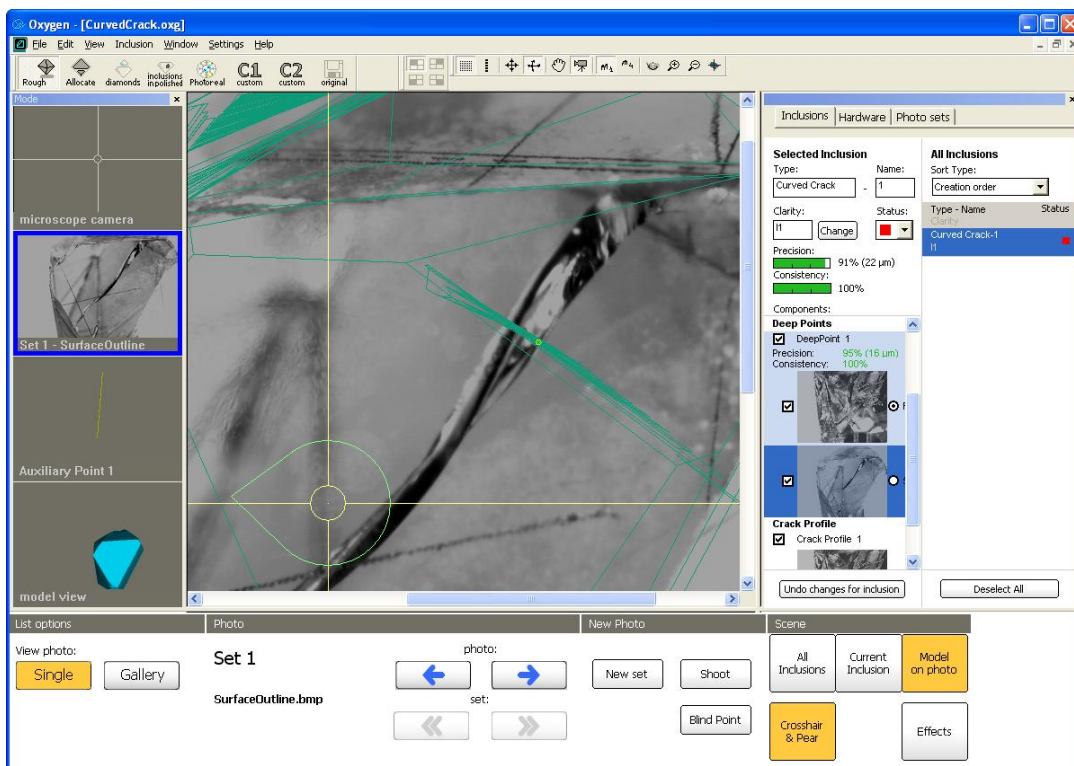
- Select photo from other direction



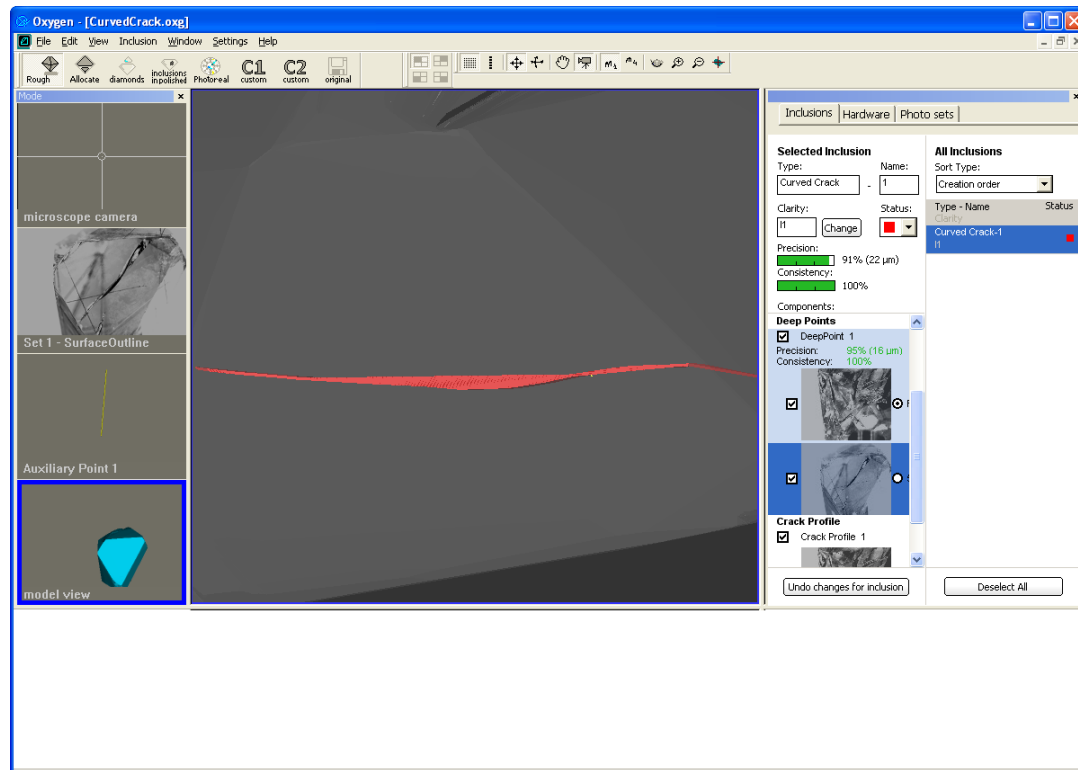
- Right click mouse in Scene in place where you want to create precise contour for Deep point and select **Add instant contour to current deep point**



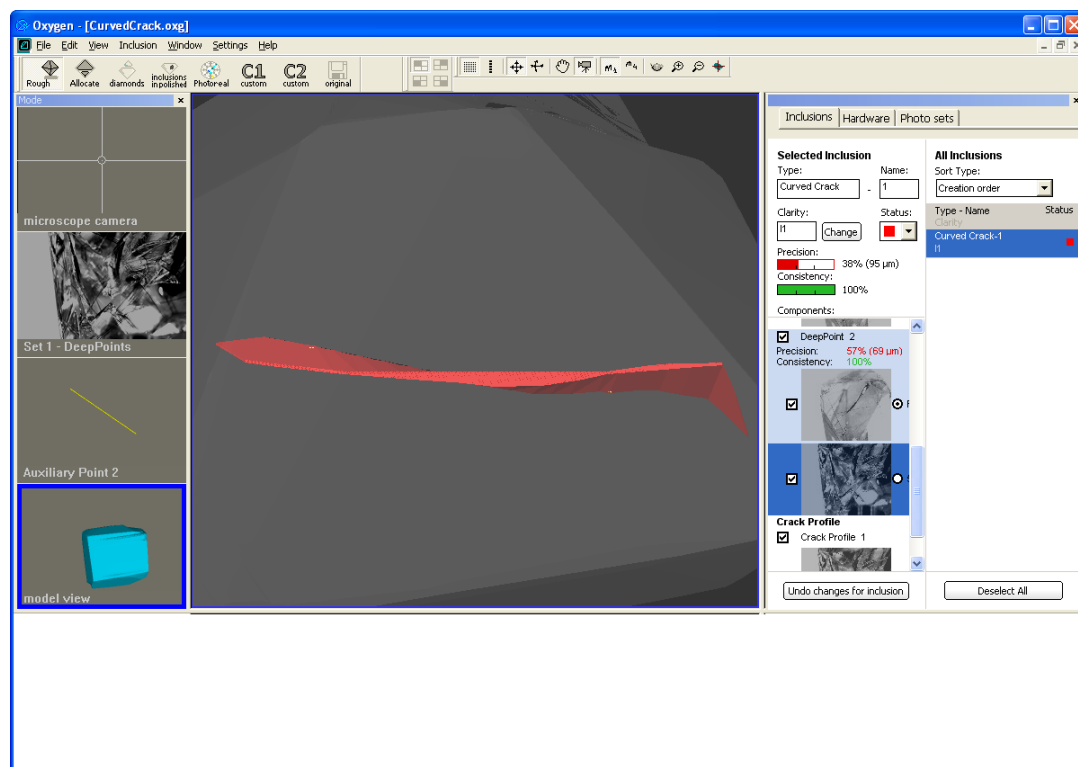
- Deep point is ready and precise



- Now Curved crack looks like the follow



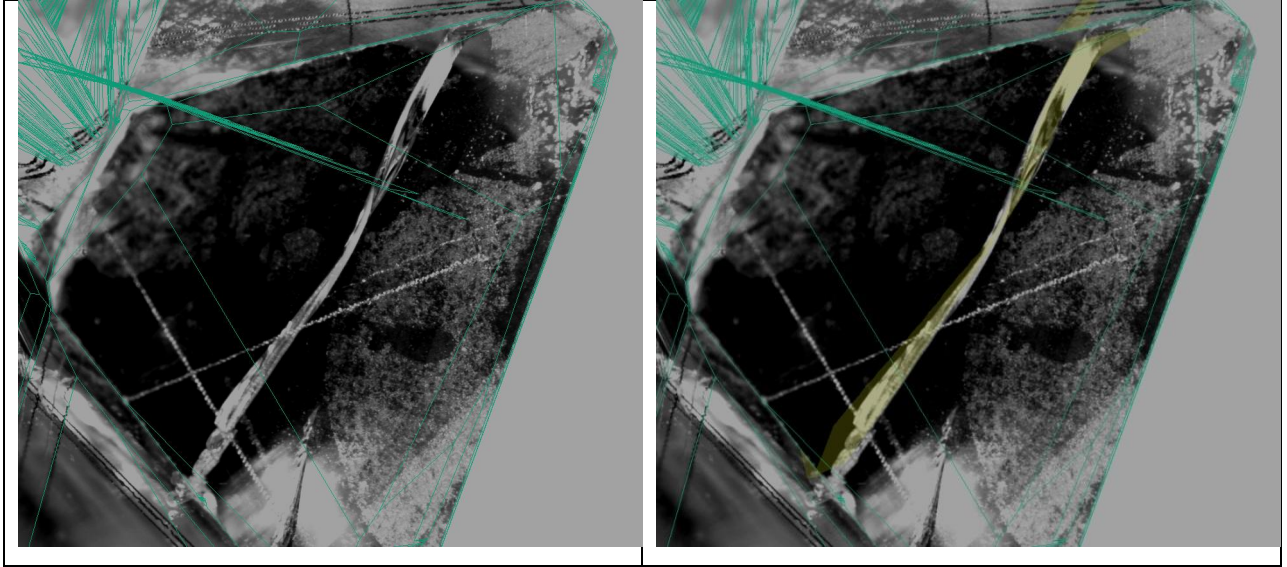
- Add more Deep points the same way
- Now crack looks like following





Step 5. Verifying inclusion

Compare photo with new created crack model over the photo.



Modify contours, add more deep points if need.

5.10 Blind method for creating Cracks

Blind method for creating Flat and Curved Cracks is available. The method allows to create cracks looking into Oxygen Microscope and adjusting lighting for every blind point of crack profile which is not possible in case of creating crack profile by one photo. The new possibility is especially useful for thin transparent edges of crack visible through microscope.

The new method allows using blind photos and real photos data together.

There is a small step-by-step example of creating blind crack.

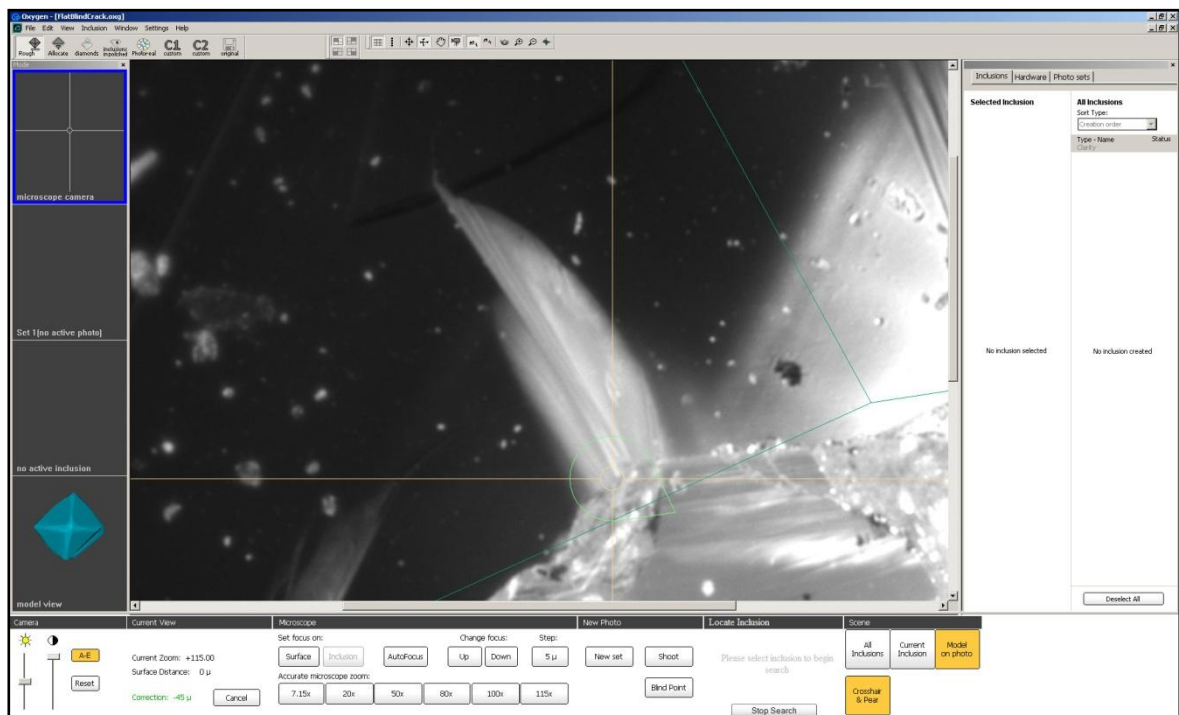
Procedure outline

- Step 1. Starting creating flat blind crack
- Step 2. Walking around crack profile
- Step 3. Creating deep points

Step 1. Starting creating flat blind crack

To start create a blind crack:

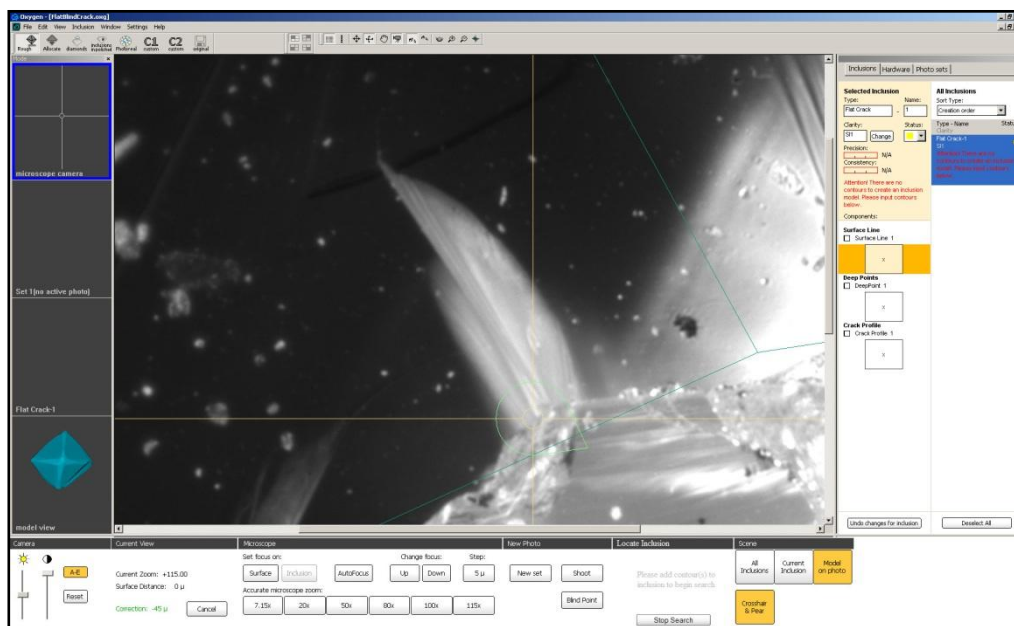
- Switch on Microscope camera mode and find a crack via microscope.



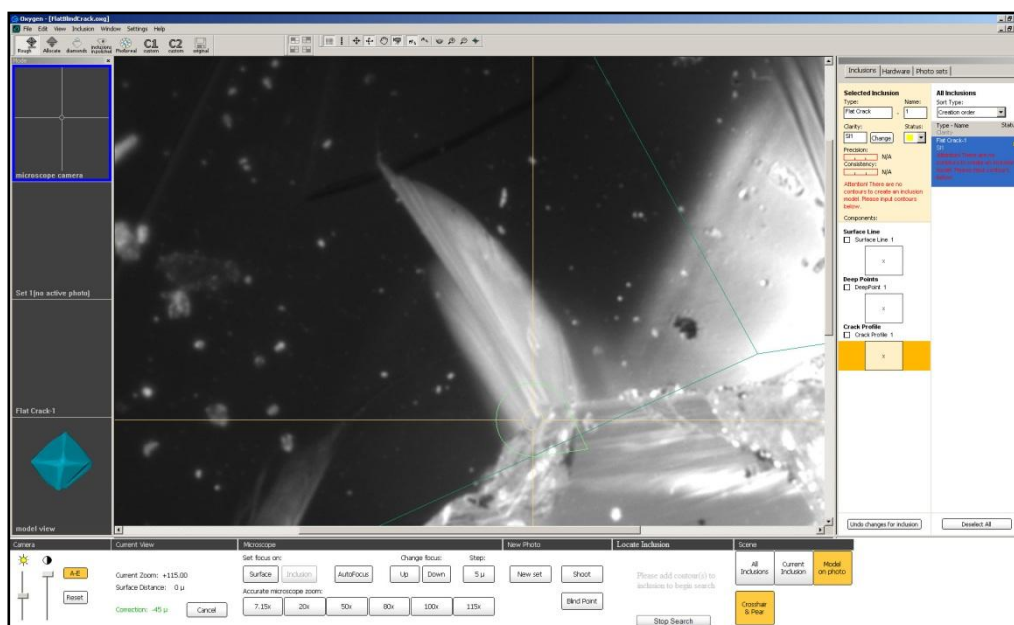
- Right click mouse on Scene to open context menu and select **New Flat Crack**



Note. Don't make any more clicks on Scene. If you click it accidentally the method of creating Flat Crack by photos will be activated. And blind method will not be preceded.



- Select **Crack profile** inclusion component in the **Inclusion** panel



Step 2. Walking around crack profile

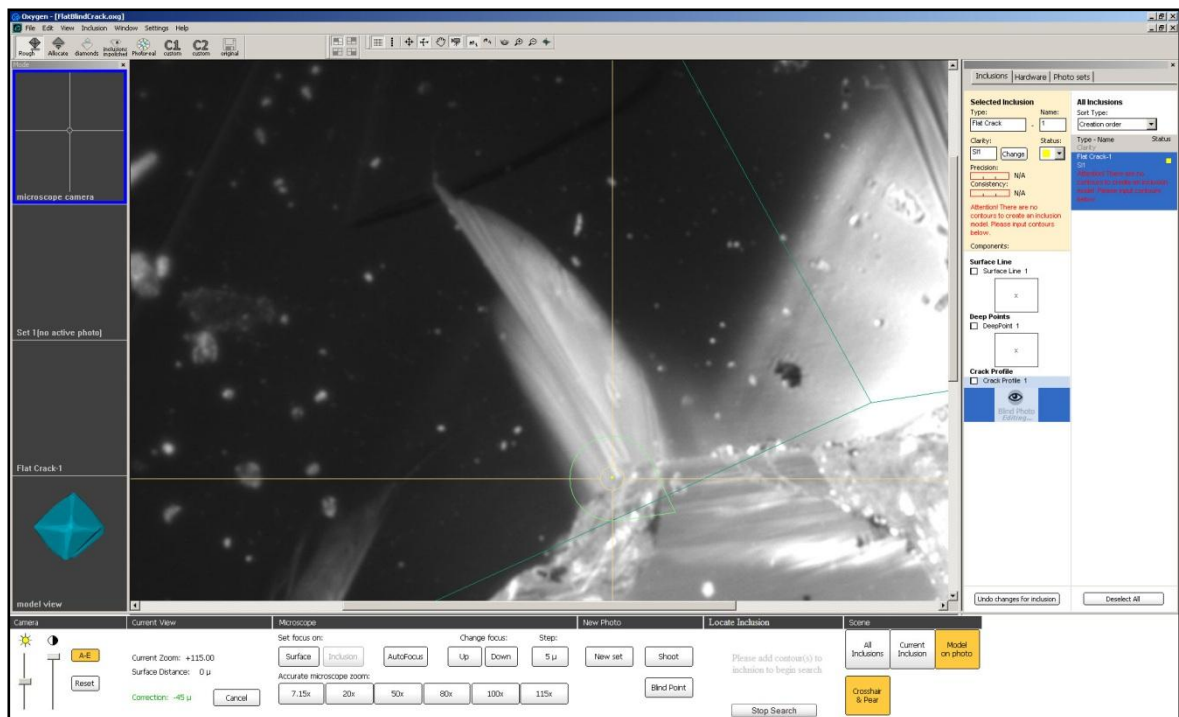
To create crack profile:

- Look into your microscope on the crack
- Place the center of focused point of crack under the microscope crosshair. It can be point on Surface of the crack or in the Deep of the crack
- Focus on point under the microscope crosshair
- Press **Point** button on the M-box mouse, M-box keyboard or **Blind point** button in the panel **New Photo** in the bottom of the screen.

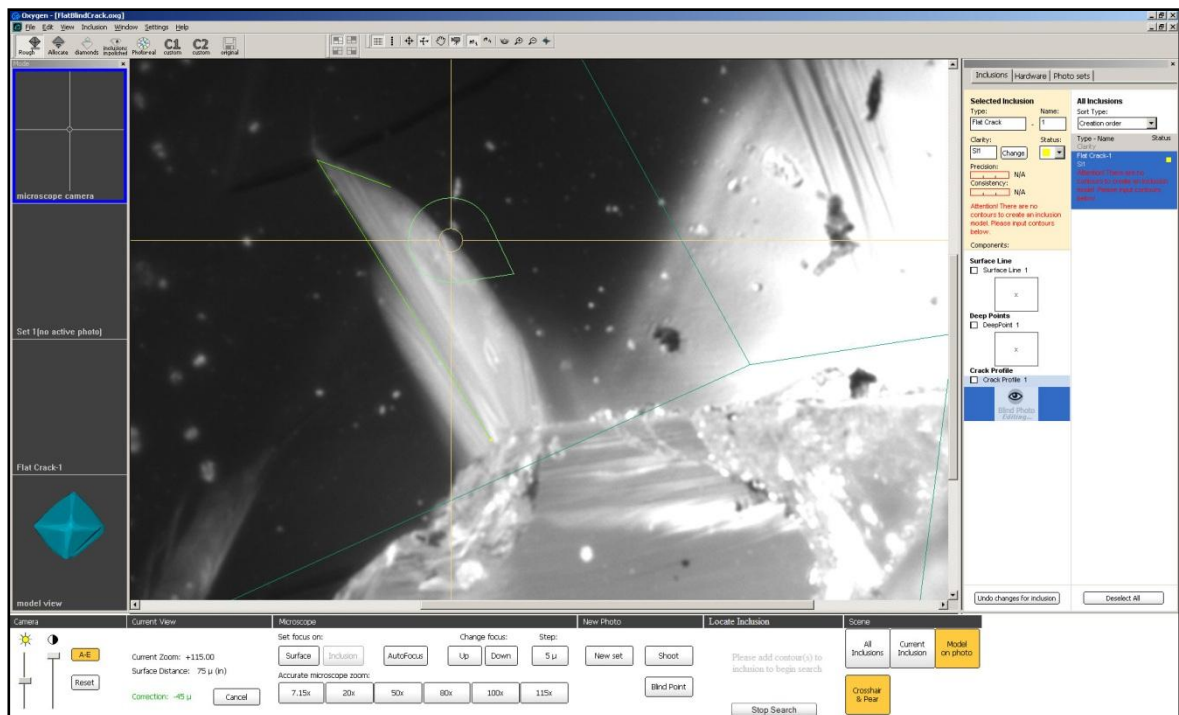
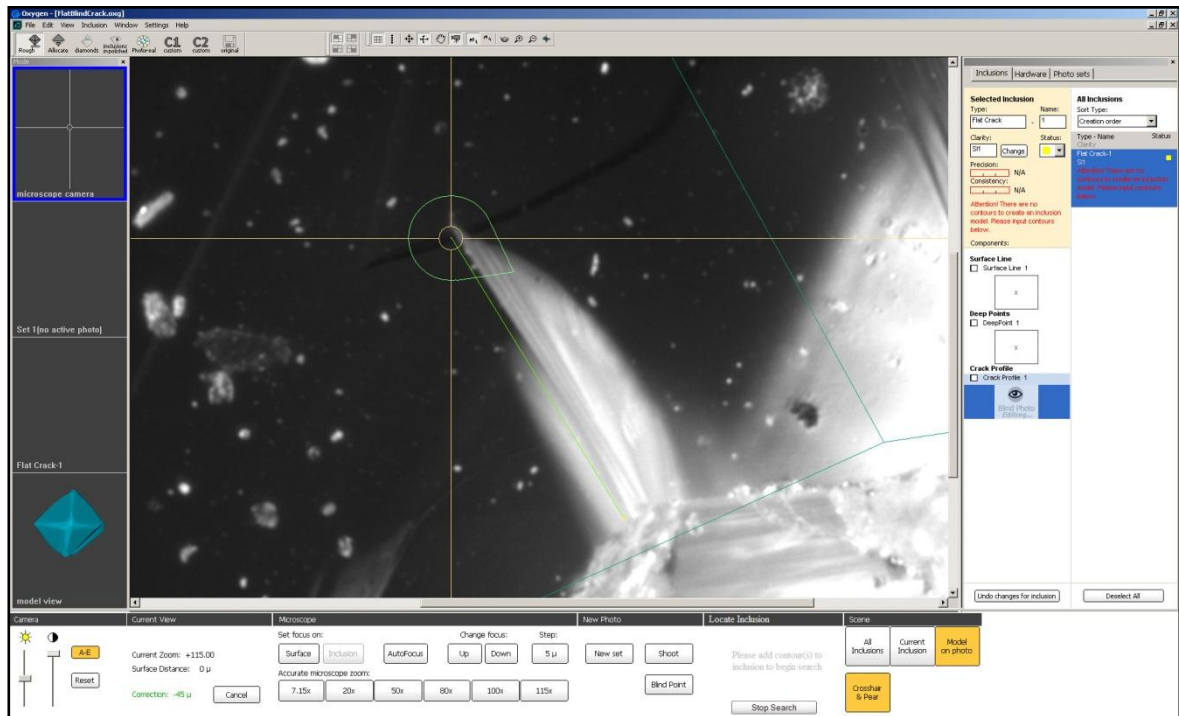
New Photo

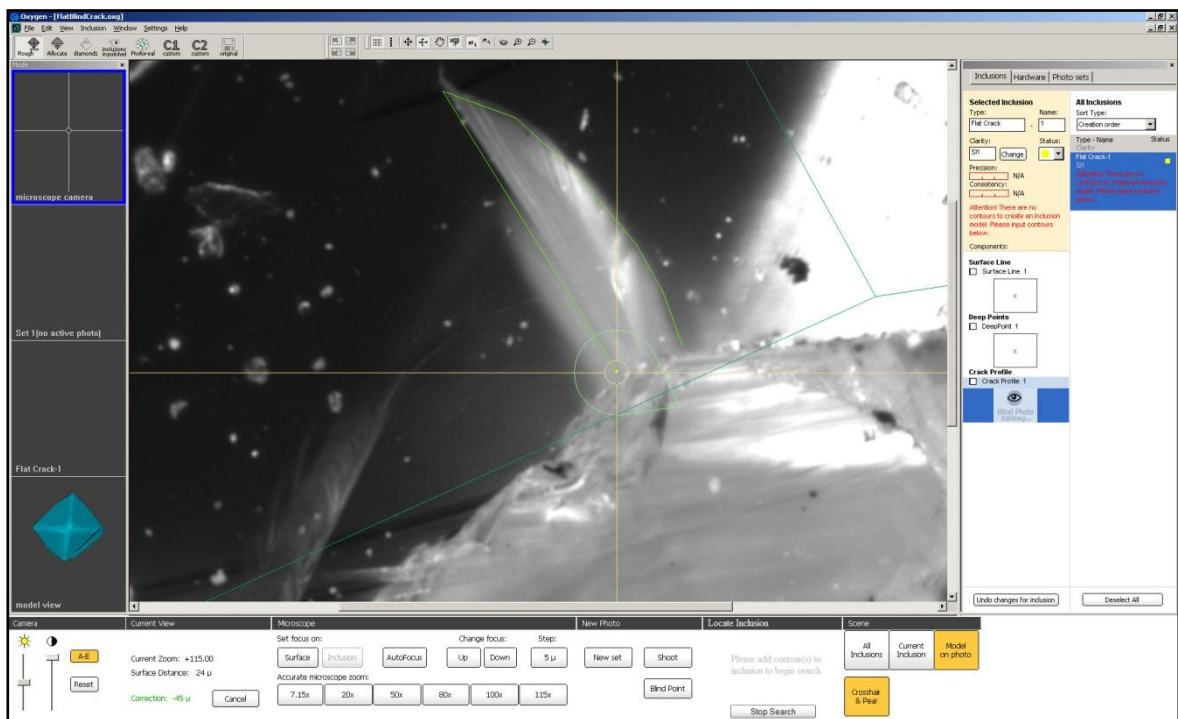
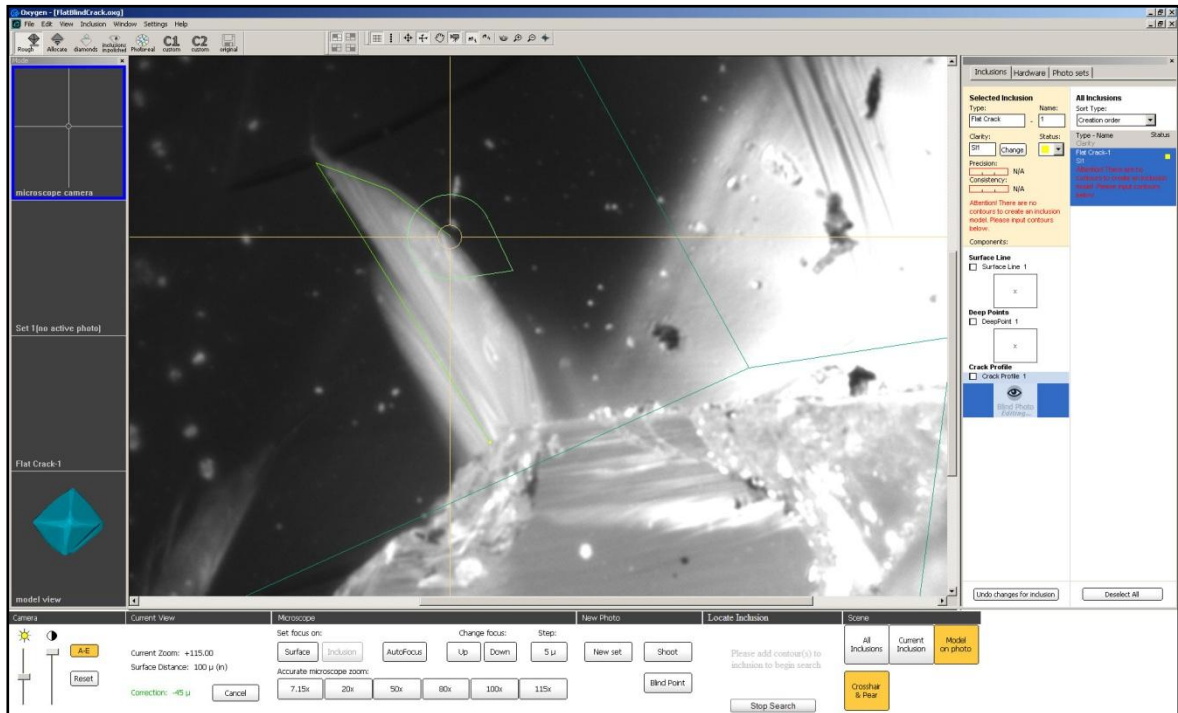


- Point will be added into Crack profile



- Now walk around the crack and make more blind points the same way. Every time you should focus on point under the microscope crosshair and adjust lighting for better visibility of crack edges:





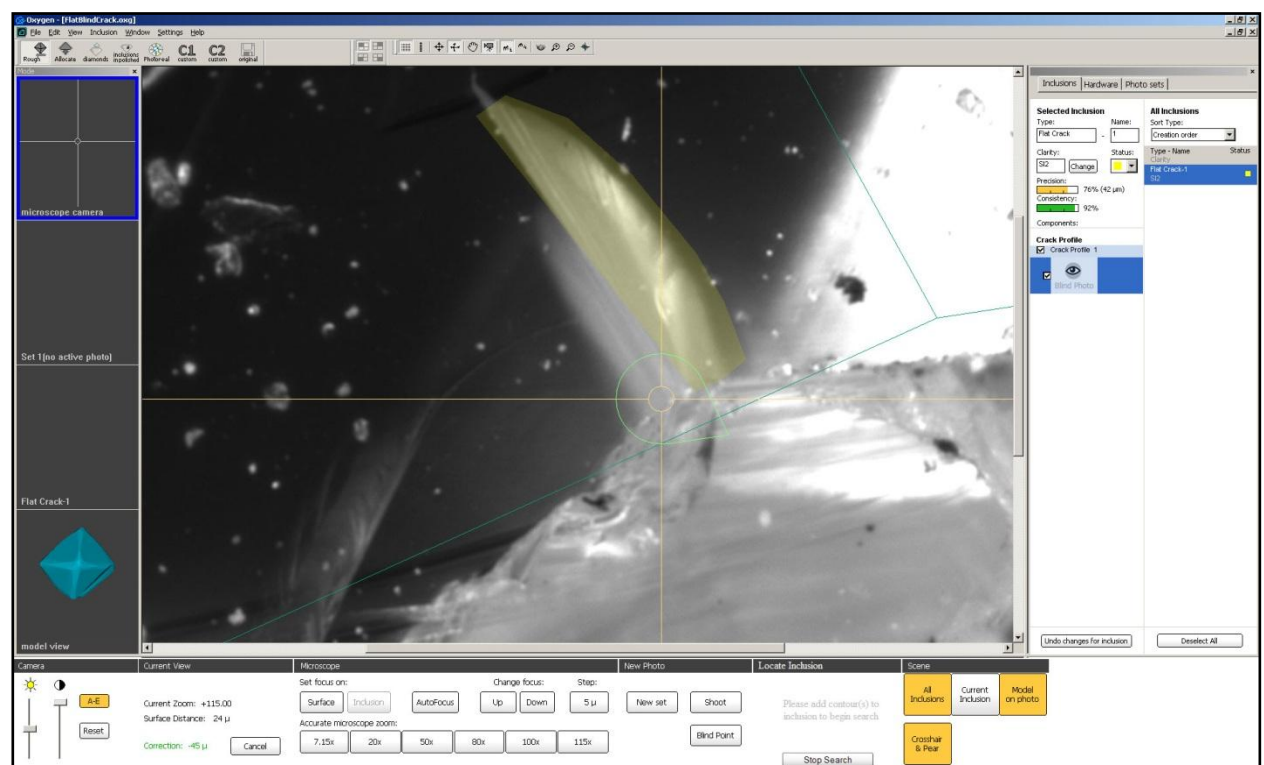
- Create at least 3 points or more for Crack profile to make a Flat Crack

- To delete last created blind point right click mouse on Scene and select in context menu **Delete last crack point**

Flat Crack-2	Inclusions
Add surface line	New 3D
Add deep point	New Flat Crack
Add crack profile	New Curved Crack
Finish blind crack profile	New Hole
Cancel blind crack profile	New Point
Delete last crack point	New Cloud
Change clarity...	
Set green status	
Set yellow status	
Set red status	

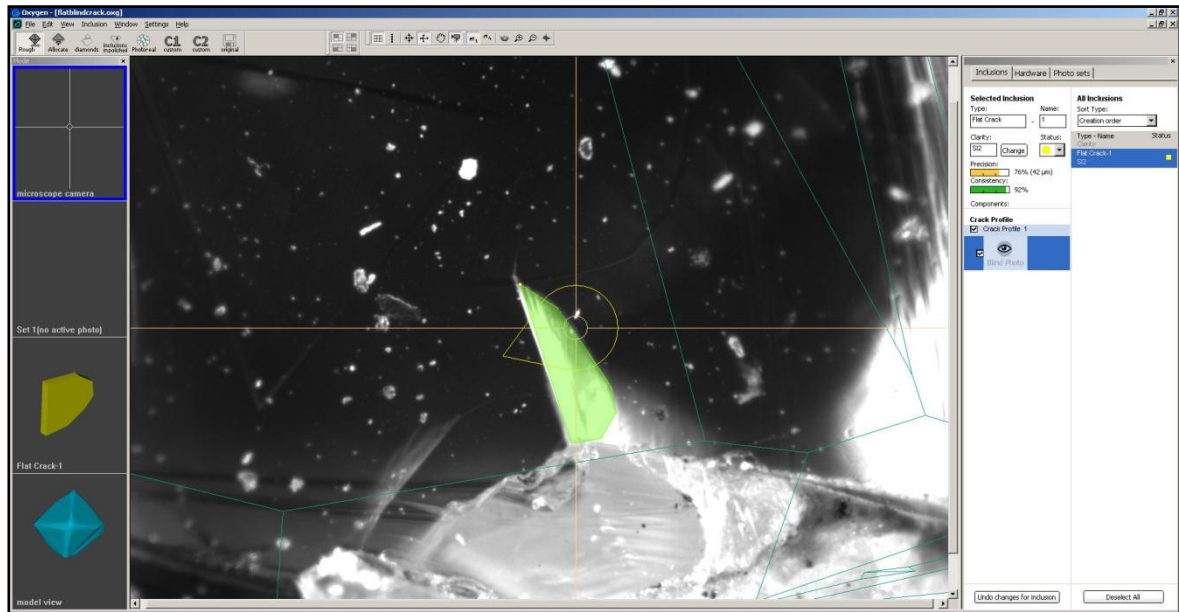
Note. To delete blind points use right + left mouse button click

- Then you finish walking around the crack profile the contour will be enclosed and computer will make a sound. To see transparent crack model over the photo switch on button **All inclusions** or **Current inclusion** on the bottom of screen on section **Scene**.

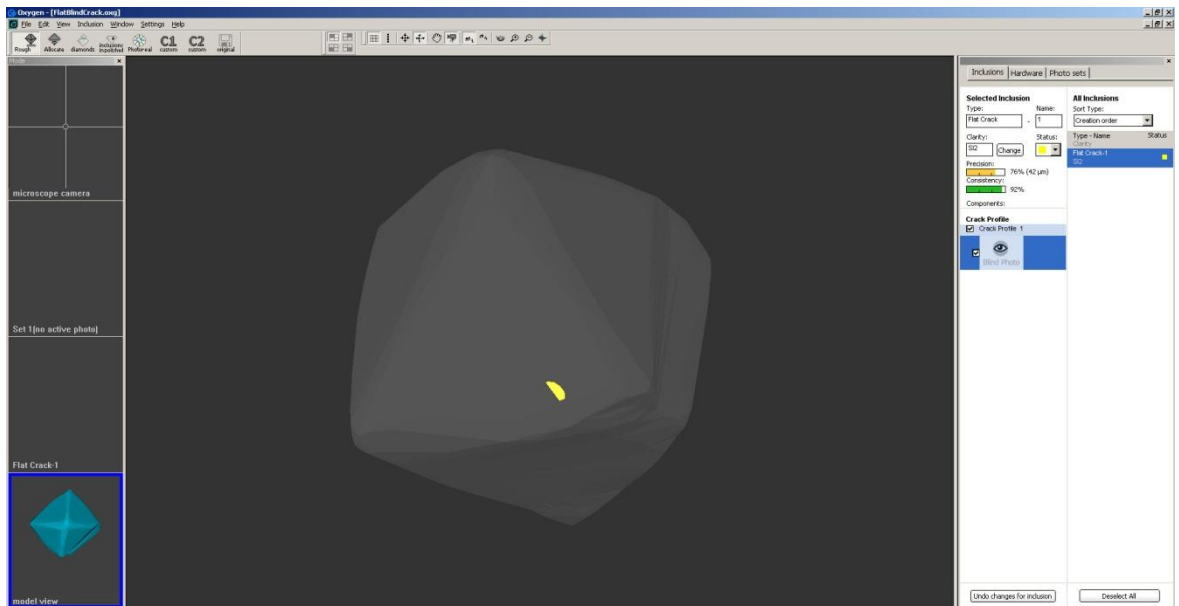


Note. It is possible to enclose and finish contour manually. Right click mouse on Scene and select in context menu **Finish blind crack profile**

- Check crack profile contour from some other direction

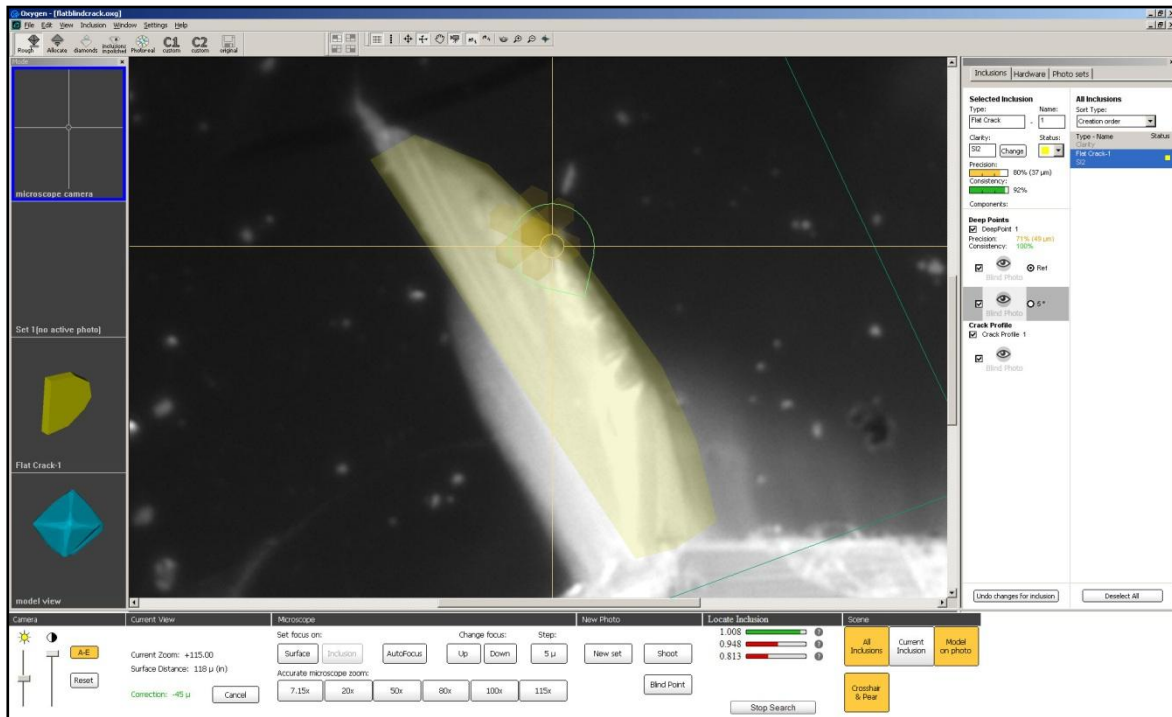


- Flat blind crack is ready



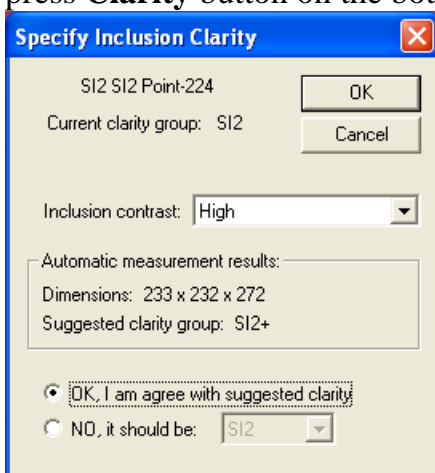
Step 3. Creating deep points

For better accuracy of crack inclusion create one or several deep points with precise contours.



5.11 Inclusion clarity and contrast

Clarity is assigned to inclusion automatically and is based on inclusion type and size. Though, you can change clarity manually. Switch into **Inclusion** mode on left panel and press **Clarity** button on the bottom pane:



Contrast characteristic of inclusion affects the **Inclusion clarity** assigned by automatic algorithms.

The contrast grade affects to:

Suggested clarity group in the **Specify inclusion clarity** window

Assumed diamond clarity in automatic diamond clarity estimation in **inclusion in polished** mode

By default cracks receive **Medium** contrast, clouds receive **Low** contrast, all other types - **High** contrast.

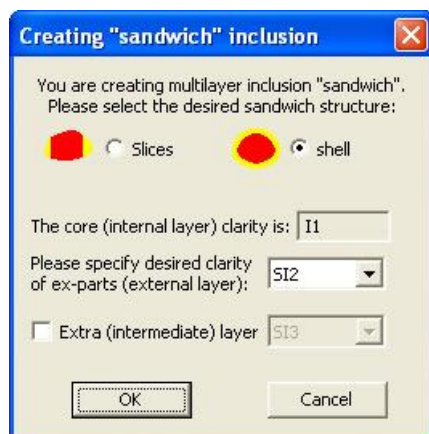
If you need to change contrast of some inclusion manually, right click on inclusion in Scene and select **Change clarity...**

5.12 Sandwich

Sandwich feature allows to find allocation options having parts of big inclusion inside polished diamonds.



To create sandwich select the desired inclusion and click button **Make sandwich** in the **Rough / Inclusions** mode.

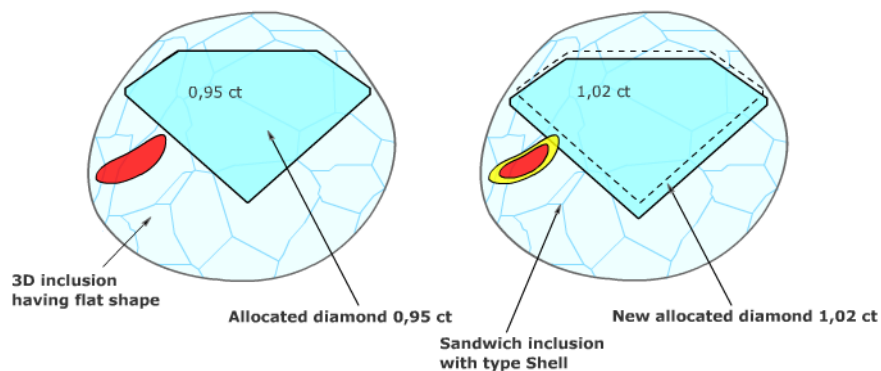


There are two different types of sandwich: **Slices** and **Shell**.

Shell sandwich feature is extended with ability to create an extra medium layer **Double sandwich**. When sandwich is created the Ex-parts are automatically assigned with the desired clarity (clarity that user selected in the **Make sandwich** window).

Slice type of sandwiches is obsolete and will be removed in the next version. In the current version you can create slice sandwiches but the option of manual geometry modification is not available.

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



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

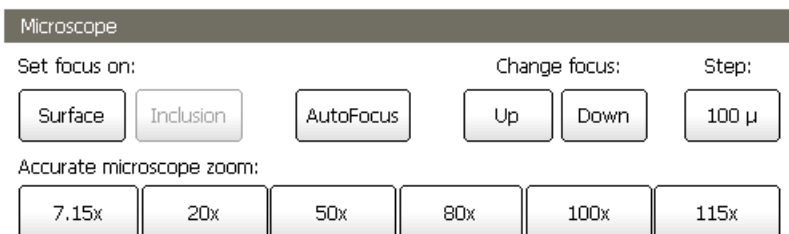
The sandwich feature allows SI3/I1/I2 layers.

5.13 Auto focus

AutoFocus button allows to focus on the real surface of rough or on the inclusion automatically.

The program moves the focus in the area of several depths of field and searches for the sharpest image near the crosshair. The analyzed image area is 100 pixels around crosshair; the focus scanning area is about 15 depth of field.

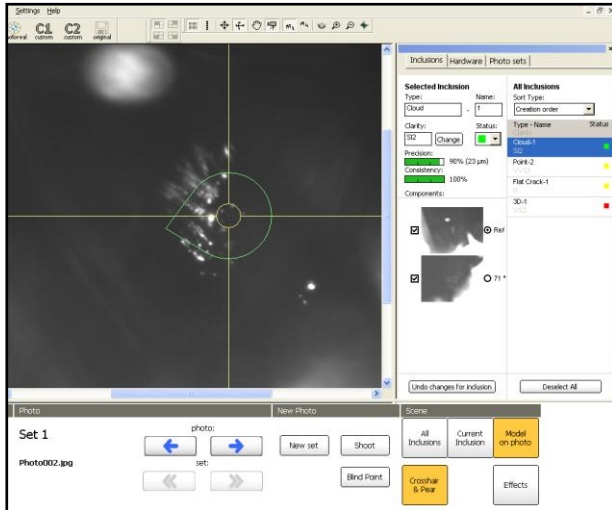
Use **[Ctrl-A]** hot key for AutoFocus, this key sequence can be also assigned to some button of Logitech MX Revolution mouse.



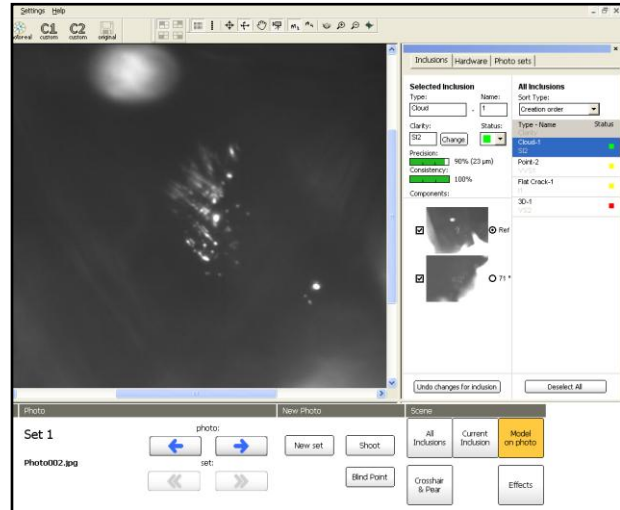
5.14 Crosshair & Pear button



Crosshair & Pear button allows to switch On / Off *crosshair* and *pear indicator* on Scene.



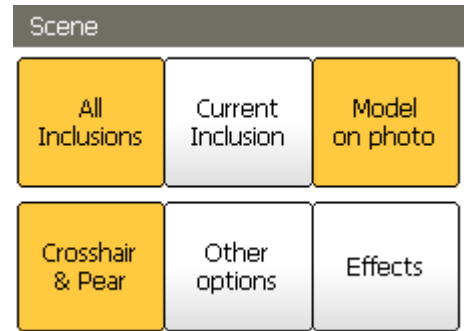
Crosshair & Pear button switched On



Crosshair & Pear button switched Off

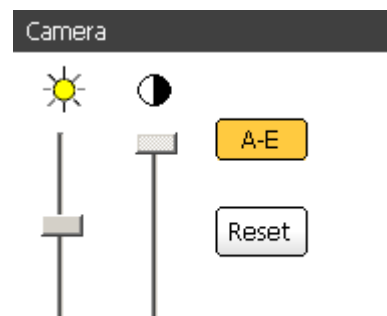
5.15 Effects

The button **Effects** in the right bottom allows to activate Auto-Contrast and other visual effects helping to see inclusions and crack borders clearly on the photographs with low contrast and imperfections.



5.16 Auto Exposure

The new option Auto Exposure is available in the **Microscope camera** mode. To switch on Auto-Exposure press button A-E in the section **Camera**



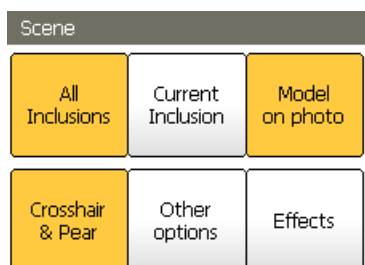
5.17 Extra options for inclusion visualization

The new visualization options are available: **Set color of inclusions and contours**, **Show only inclusions in Focus** and **Hide inclusions contour**.

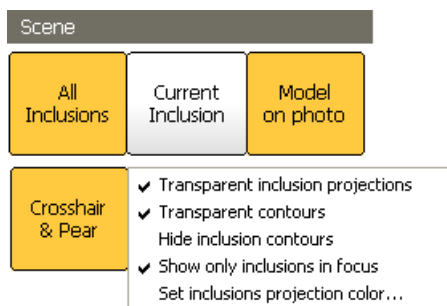
Also it is possible to define **transparency of inclusions projections** and **transparency of contours**.

To use new extra options:

1. Press new button **Other options** in the bottom panel of **Scene**



2. Select or unselect an option from list

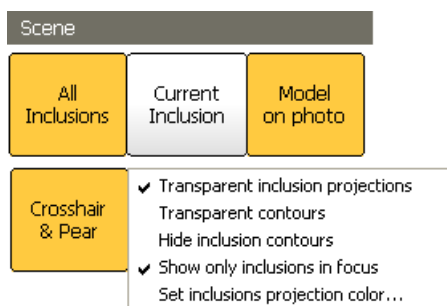


To show *Inclusion projections* use buttons **All inclusions** or **Current inclusion**.

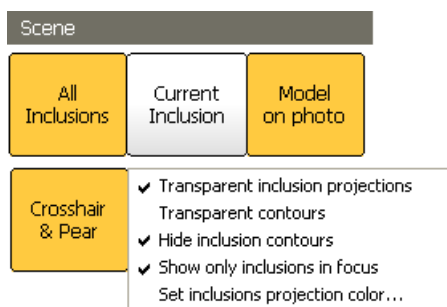
Option **Transparent inclusion projections** regulates transparency of inclusions. Transparent projections are helpful when you need to see contours of real inclusion on the photo under its projection. If you want to stress inclusions on strongly-contrast photo, use opaque mode.

Contours are shown on photos in places you input inclusion components. By default, contours are highlighted with transparent **green for active inclusion** or **purple for other inclusions**.

To set opaque mode of inclusions contours unselect **Transparent contours**:



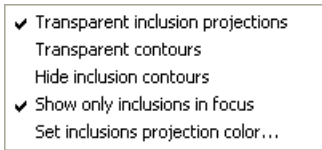
To hide inclusions contours select **Hide inclusion contours**.



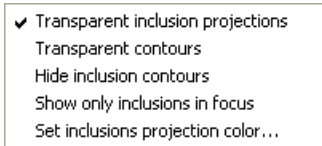
Option **Show only inclusions in focus** affects method of inclusions are shown on photos. On the photo below there are some inclusions are evident - *in depth of field*. And others inclusions are blurred strongly - *unfocused*.



To avoid showing unfocused inclusions check **Show only inclusions in focus**.



To see all of the inclusions in spite of their visibility on the photo uncheck **Show only inclusions in focus**.



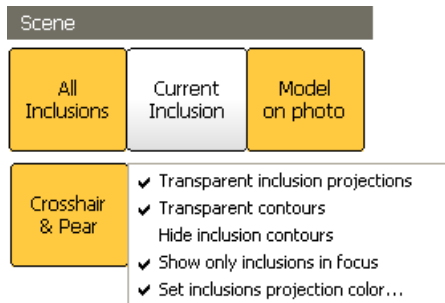
Here is an example of focused and unfocused inclusions and variants of its representation:

<p>Two types of inclusions, in focus and not in focus</p>	<p>To highlight inclusions in focus: select Show only inclusions in focus in list and press button All inclusions</p>	<p>To highlight both types of inclusions in focus and not in focus: unselect Show only inclusions in focus in list</p>

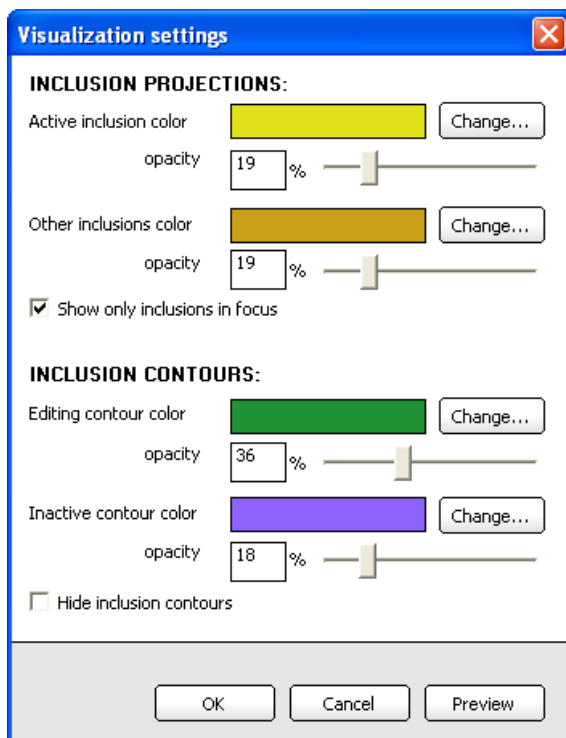
Note. Show only inclusions in focus option is effective only for MBox photos. Helium photos do not contain information about focus, so keep this option off if you work with Helium photos.

To set color of inclusions and contours on Scene:

1. Press button **Other options** and select in list **Set inclusions projection color...**



2. **Visualization settings** window opens

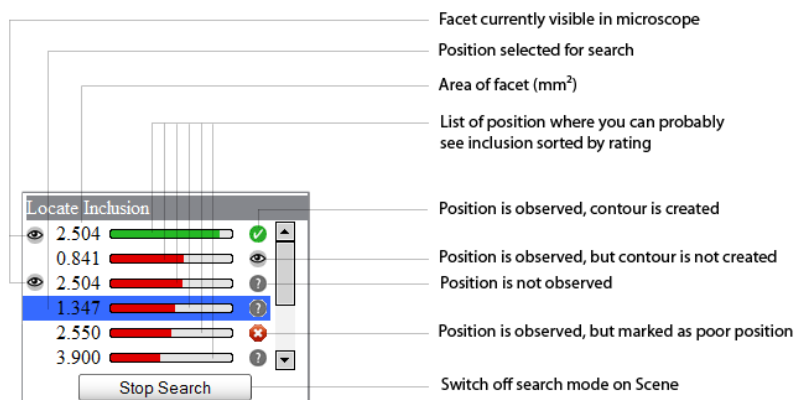


5.18 Locate Inclusion Tool

Locate Inclusion tool allows to find easy and precisely the places where Inclusions could be found. This feature makes a forecast of the positions profits where inclusion contours can be created. The estimations are based on angles and sizes of the facets. They are shown in the panel via green, yellow and red colour and length of indicators. Green and yellow as usual reveal the optimal positions for making contours.

Locate Inclusion works in **Microscope** mode only. In current version Locate Inclusion works with Point Inclusions and with Points in Flat Cracks.

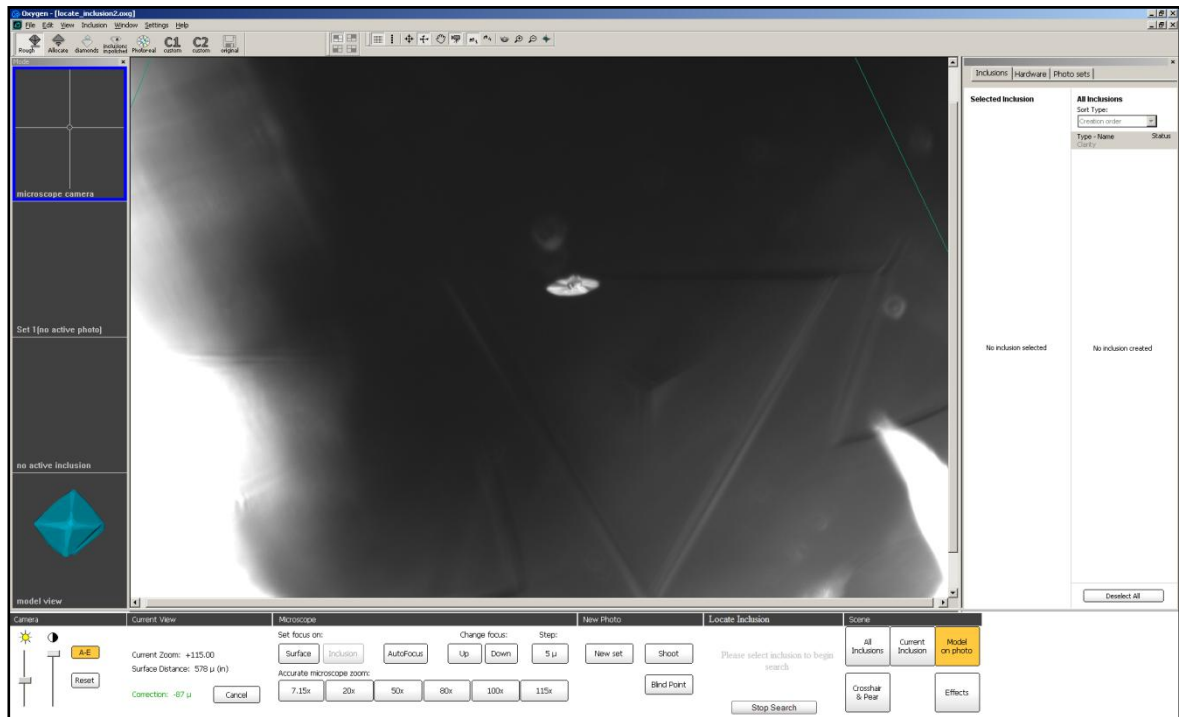
There is a small description of **Locate Inclusion** panel on the picture.



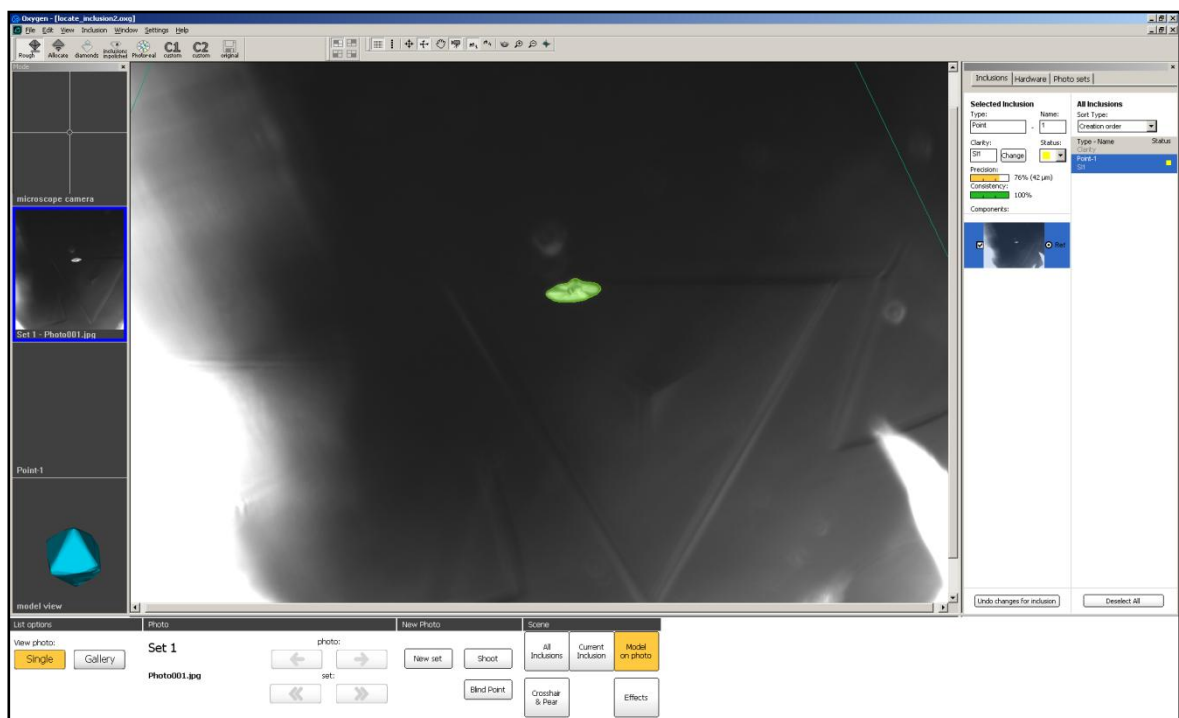
The **Locate Inclusion** panel is available on the right bottom corner of the program. It becomes active every time when you can use this feature: when you select ready inclusion in the list or when you find new contours for new inclusion. Please read the example how to locate point inclusion in the section below.

Example. Locating Point inclusion

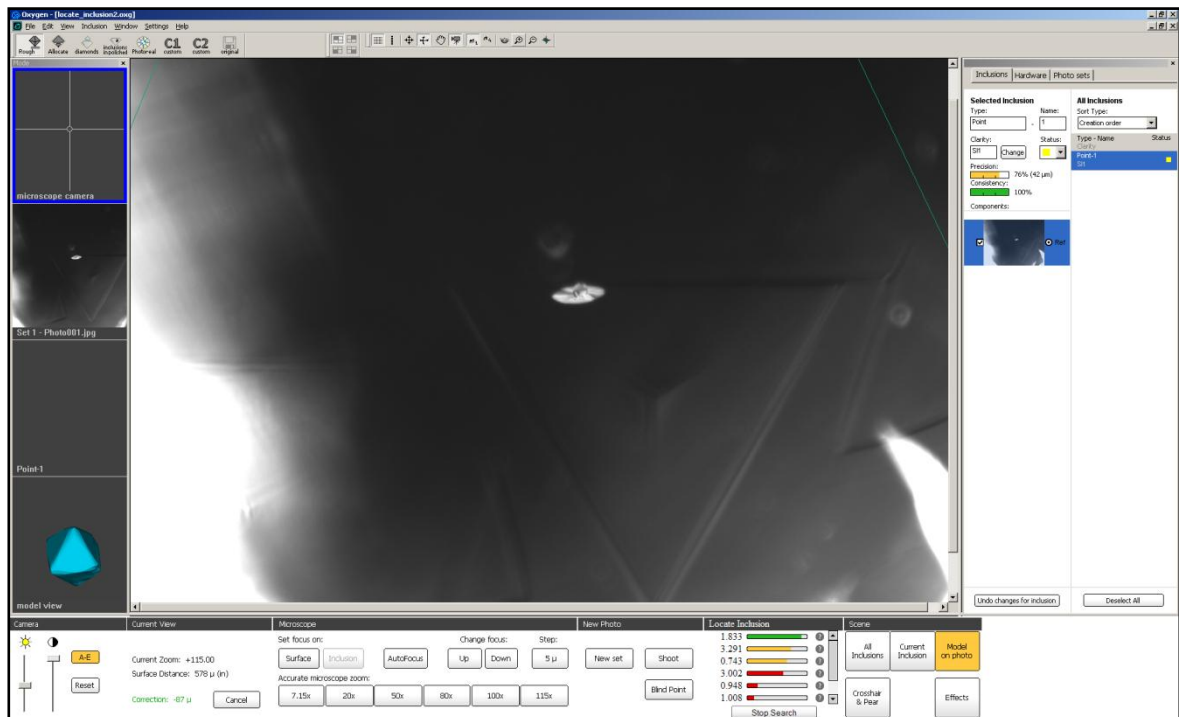
- Select a facet with point inclusion via microscope
- Adjust focus on surface
- Focus on an inclusion



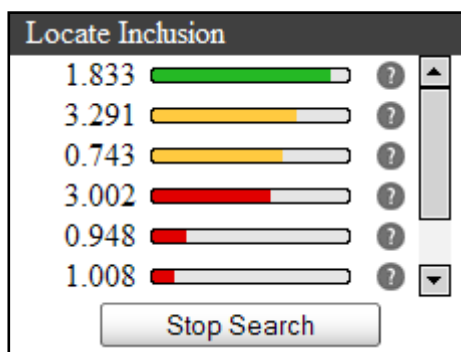
- Make first contour



- Switch on into **Microscope camera** mode



When the first contour is ready the panel **Locate Inclusions** will be active and show perspective positions* where you can probably see inclusion.

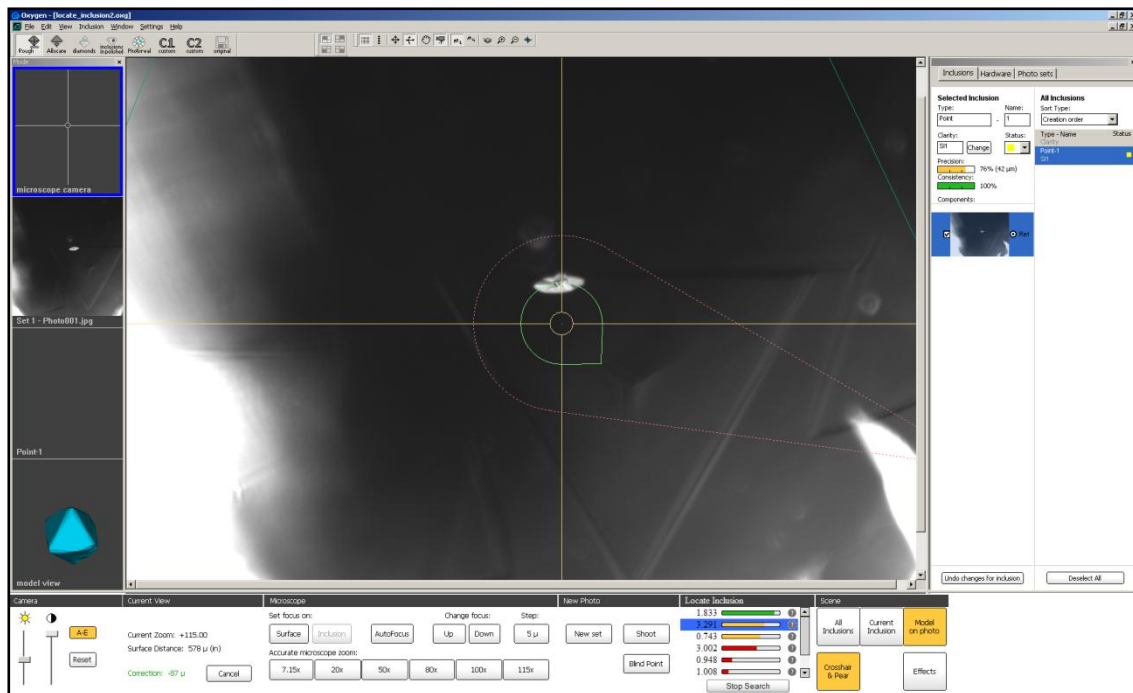


*The indicators of positions show its profits by colour and length, square of facets and status. Status of positions can be following:

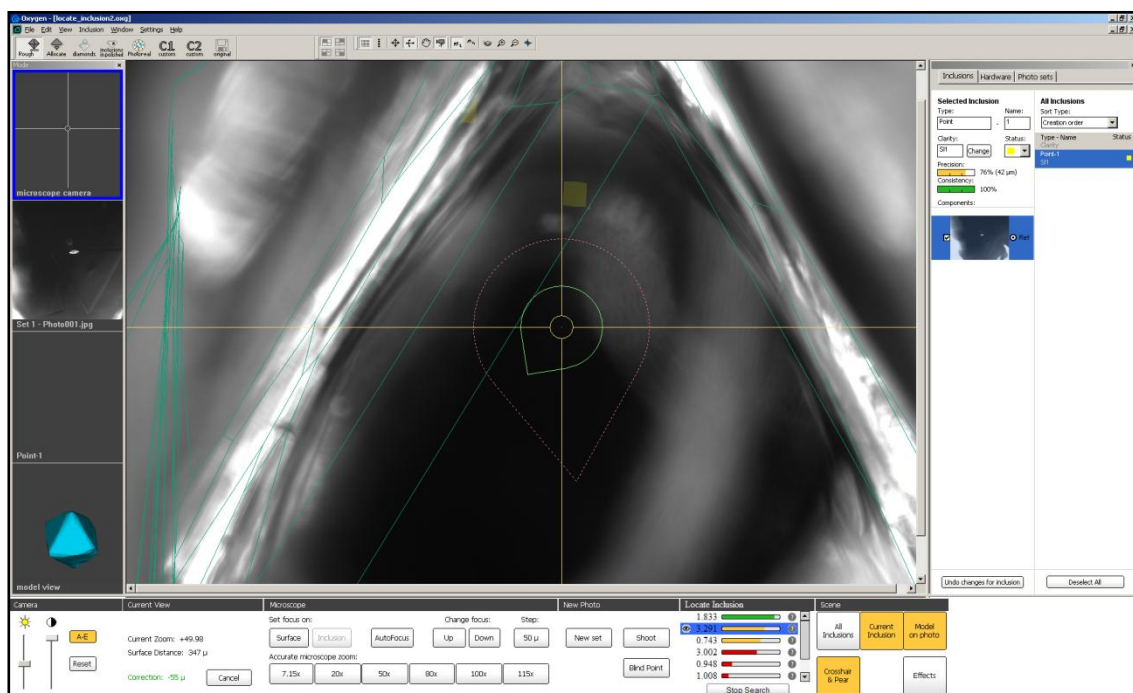
- ❓ not observed
- 👁️ observed, but contour was not created
- ✅ observed, contour created
- ❌ observed, but marked as poor position

Crosshair
& Pear

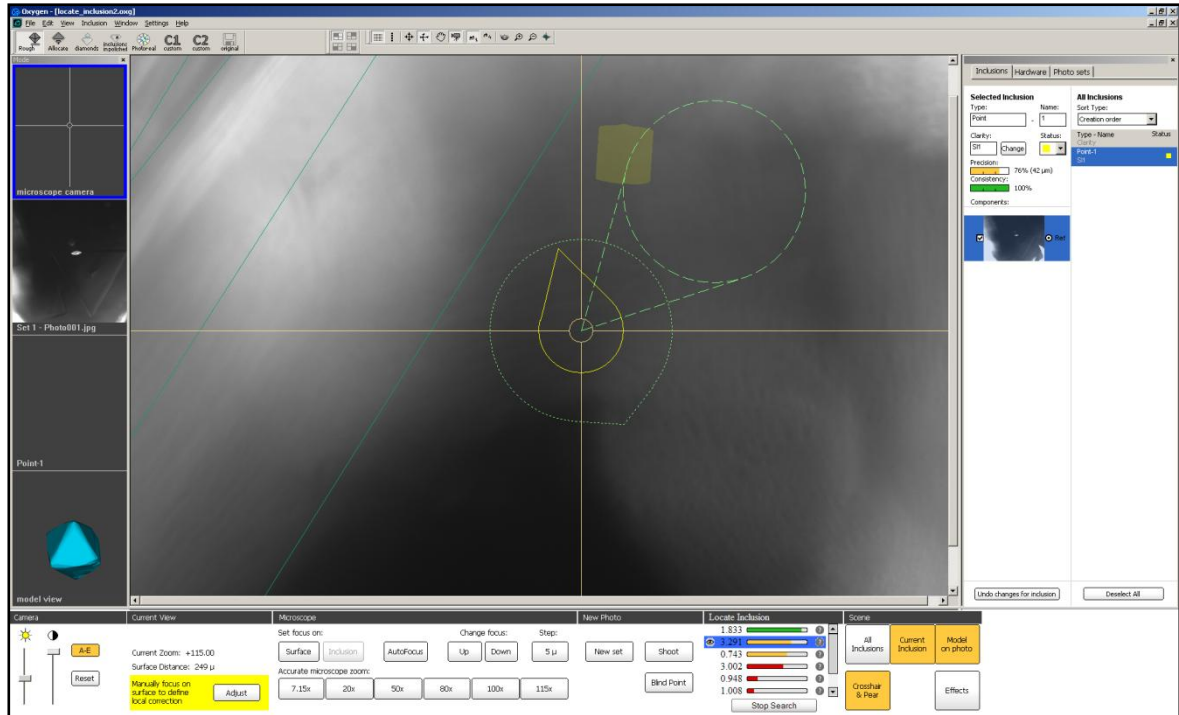
- Switch on **Crosshair & Pear** button
- Select one of the positions in **Locate Inclusion** panel. New second circle-pear indicator marked as red color in the picture below will appear around first circle-pear indicator marked as green color. This indicator shows the direction to position for next inclusion contour.



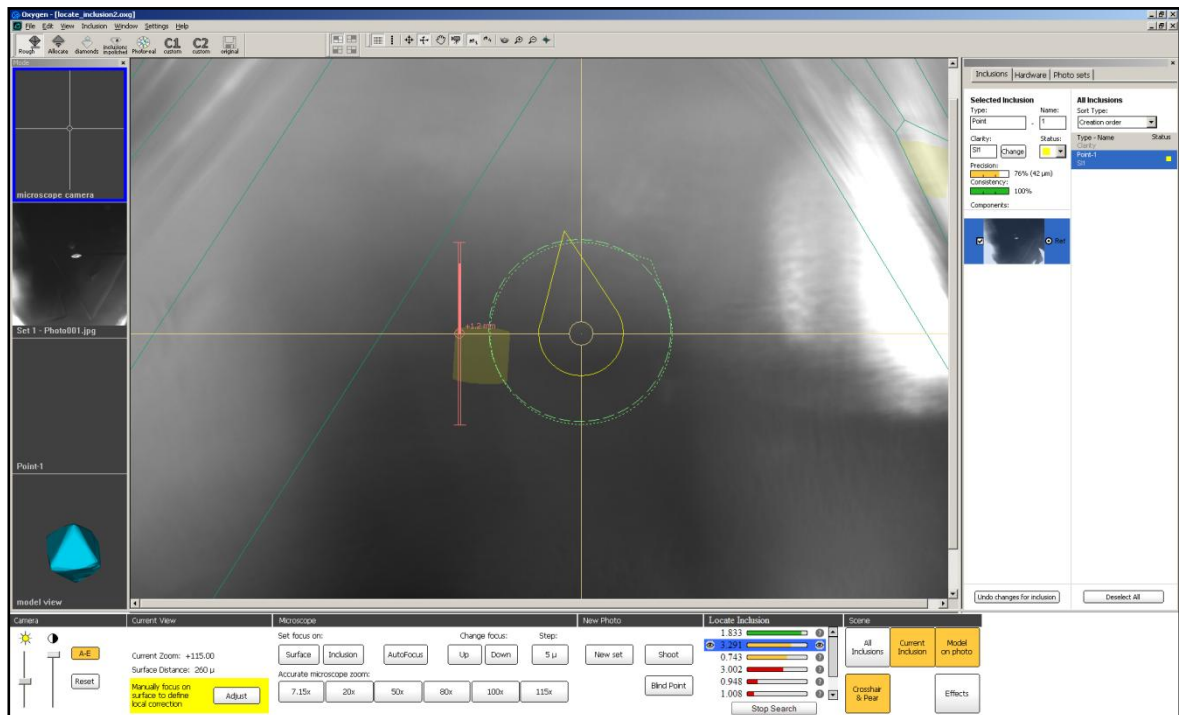
- Rotate the stone by handle and look for the second circle-pear indicator. Try to make second circle-pear indicator more rounds.



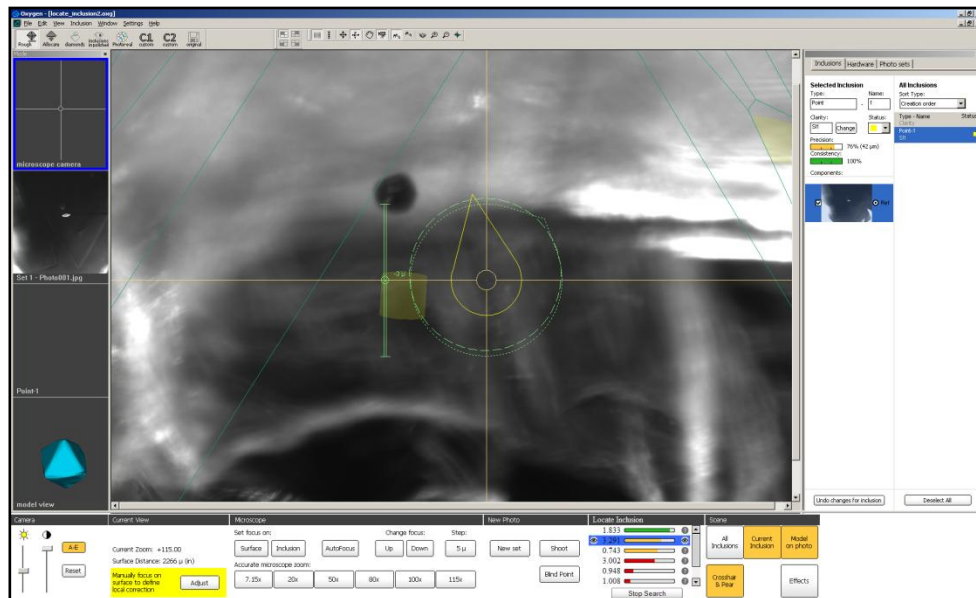
- Rotate stones until second circle-pear indicator became green and green dashed lines appeared. Green lines show the next direction.
- Move stone by handle in the horizontal plane until third circle indicator will appears.



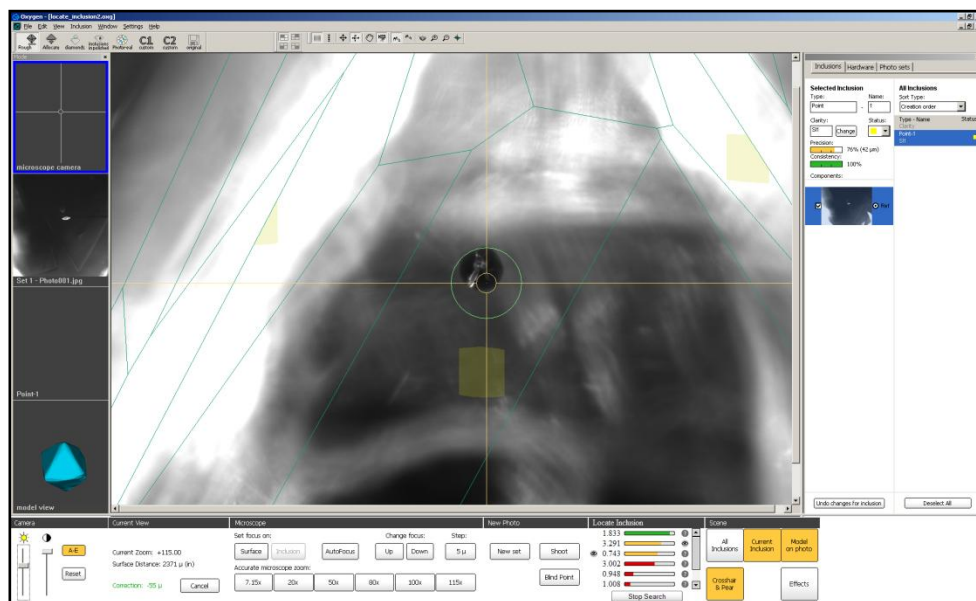
- Try to combine it with second circle-pear indicator



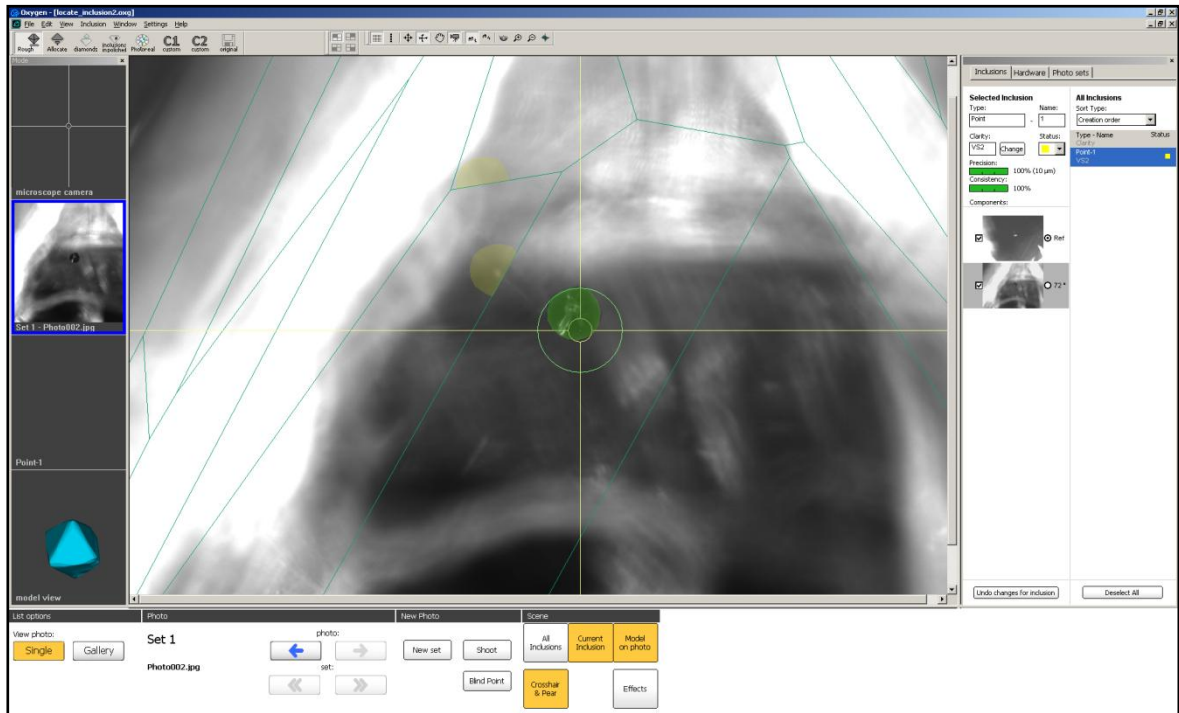
- See the picture of two circles combined together. Focus on the inclusion with vertical line indicator:
 - To focus on inclusion automatically press button **Inclusion** in the bottom panel **Microscope** section **Set focus on**
 - To focus on inclusion manually use button **Up** and **Down** in the bottom panel **Microscope** with suitable step. Or use **MBox mouse**.



- The navigation is completed:
 - If you are not able to see inclusion click on the corresponding question mark to set status of this position as poor, then select another position.
 - If you can see inclusion: adjust focus on surface, try to set pear indicator to green, focus on inclusion again and so on)



- Create new inclusion contour



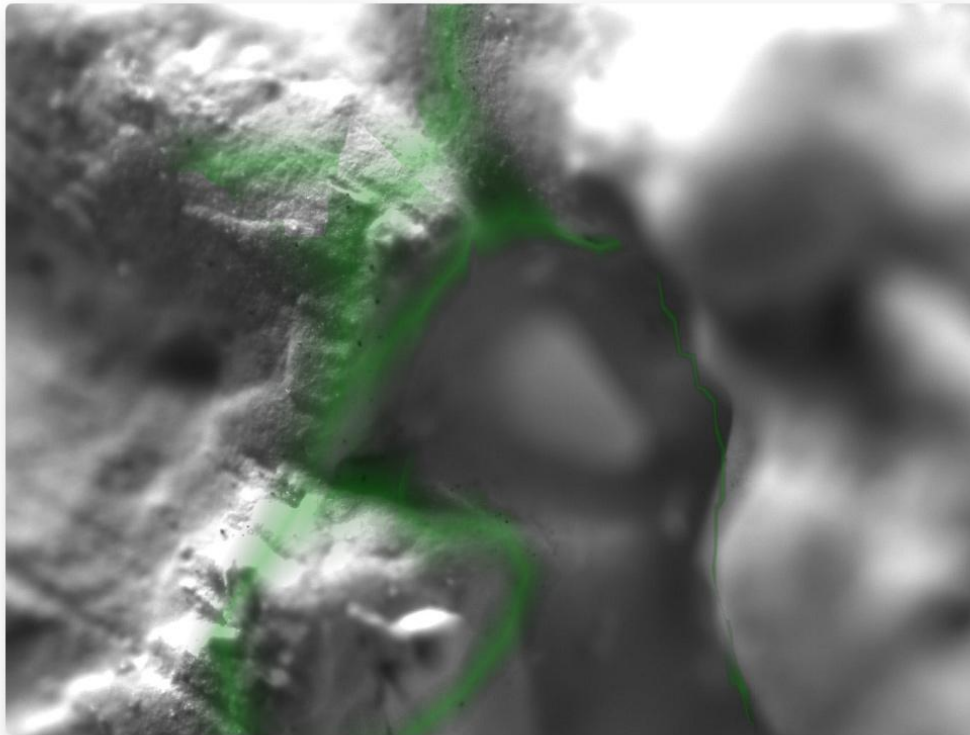
- The new inclusion is ready



6 Creating Cavities

Oxygen software allows creating different types of cavities.

Laser mapping system might not detect pin hole cavity located on the top of scanned diamond. The Oxygen software allows mapping this type of cavities by photos with different focus from MBox or photos from Helium Rough with deep depths of field.



There are three method for creating Cavities:

- Automatic creating cavities
- Manual creating cavities
- Cavities created by Helium Rough photos with deep depths of field

Automatic creating cavities. New cavity allocation tool allows creating surface's cavities automatically.

Manual creating cavities. This method needs at least two photos with different focus. One photo on the base of Cavity and second photo in the deep of Cavity.

Cavities created by Helium Rough photos. In case of photos with deep depths of field it needs at least two photos from different direction in the deep of Cavity for creating a cavity.

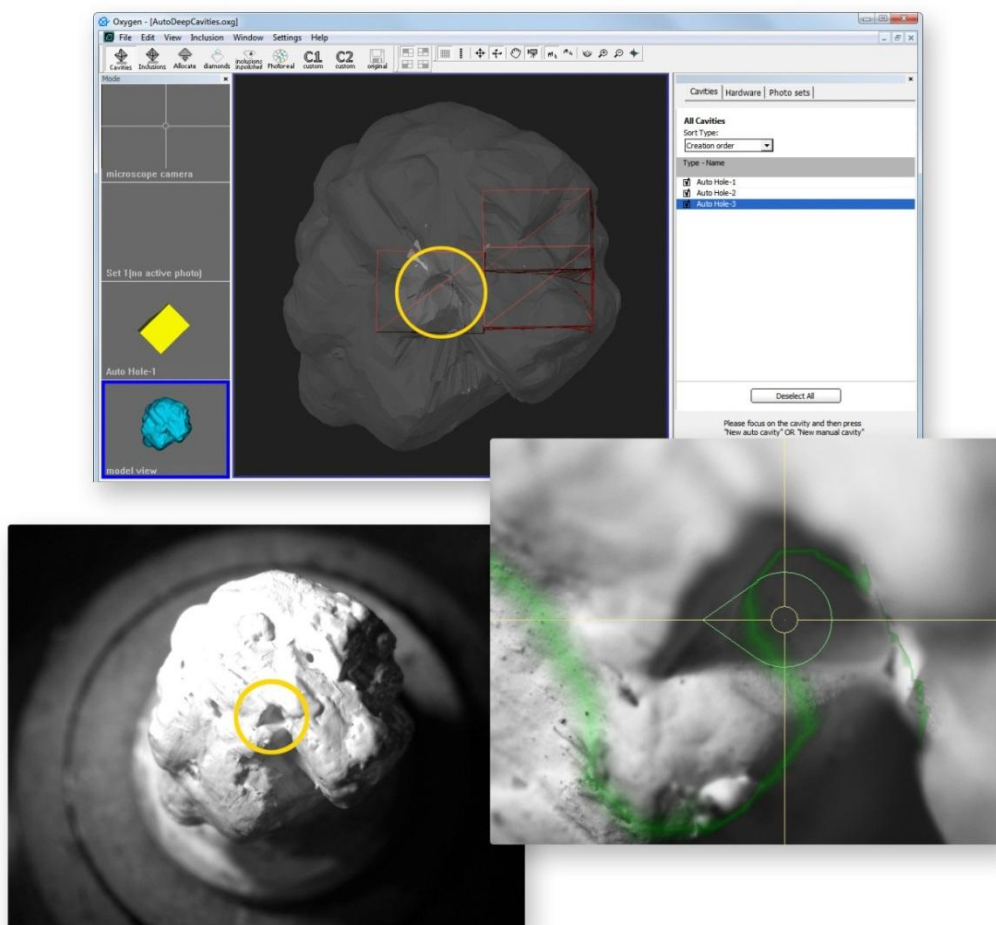
Note. Since the new version 3.2 all cavities are cut off from the 3d model of rough and do not look likes inclusions any more in allocation and diamonds working modes.

Study examples of creating cavities below.

Oxygen documentation

6.1 Automatic creating cavities

Automatic cavity's allocation tool allows creating surface's cavities that have not been detected by standard Shadow and LM methods and do it automatically. The new tool contains easy-to-use and convenient interface, works fast and accurate. After 3D model of cavity is created it will be cut off from the 3D model of rough diamond. The 3D model of rough became more precise now.



See the movie of automatic creating of cavities:

<http://www.octonus.com/oct/products/oxygen/movies/cavites/index.html>

Download example .oxg file:

<http://www.octonus.com/oct/download/files/oxygen/SampleAutoDeepCavities.zip>

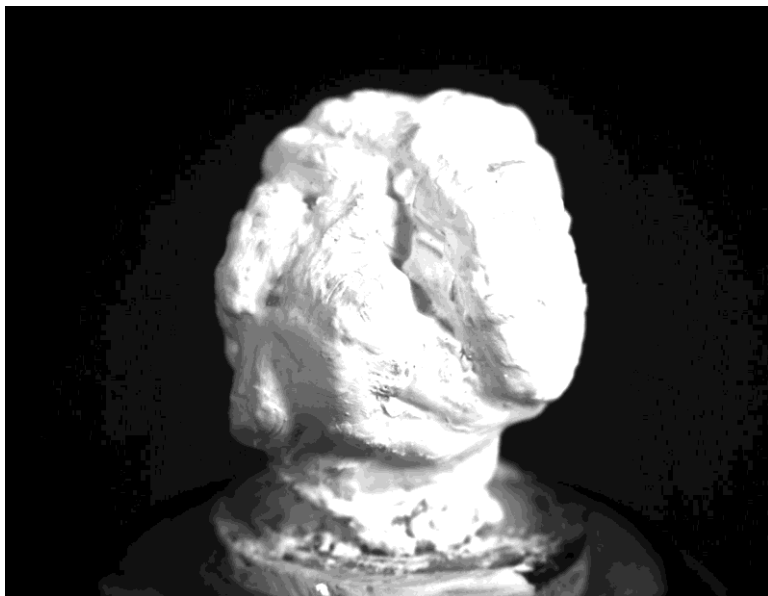
Procedure outline

- Step 1. Painting stone in white
- Step 2. Locating a cavity in Microscope
- Step 3. Automatic building of cavity
- Step 4. Verifying cavity's shape by photos
- Step 5. Creating large or long cavities



Step 1. Painting stone in white

1) Paint or cover rough diamond with microscopic powder before start working with new cavity automatic allocation option.



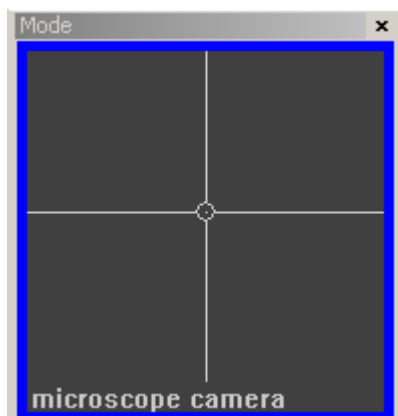
2) Put painted rough diamond into microscope.

Step 2. Locating a cavity in microscope

1) Switch to new **Cavities** mode



2) Activate **Microscope camera** view





3) Locate a cavity



4) Focus on area near surface of cavity. We recommend using magnifications from **50x**.



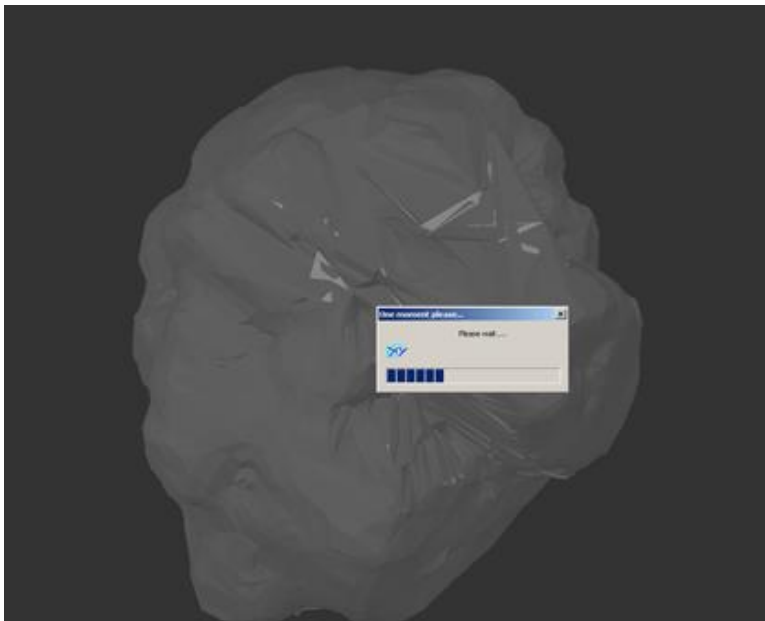
Step 3. Automatic building of cavity

1) Right-click on Scene and select **New Auto Cavity** in the context menu or press **New auto cavity** button in right panel.



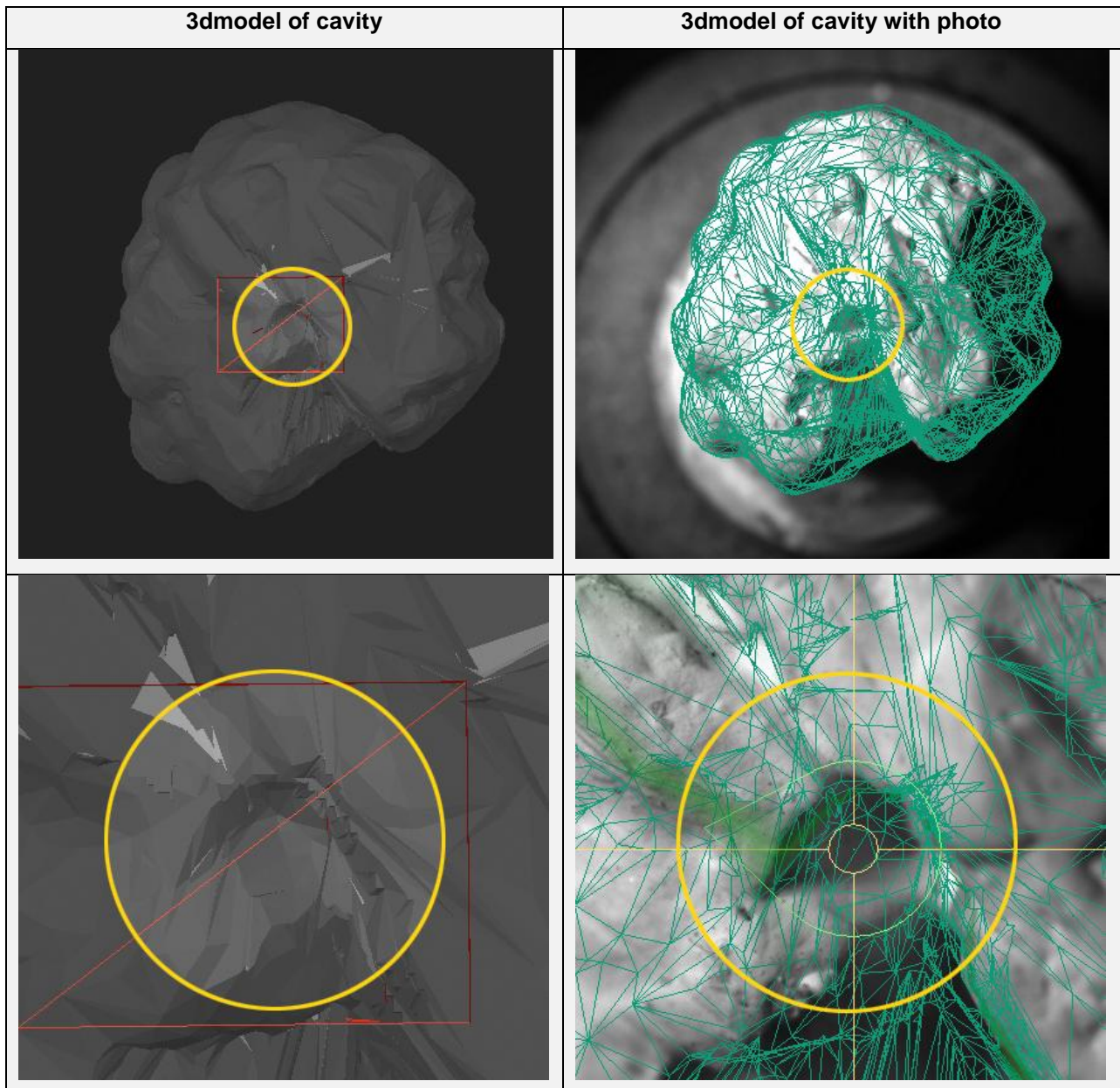
It is possible getting error message: *Please decrease the light brightness or flickering effects may occur.* See descriptions and suggestions below in the section [Possible error message](#).

2) Wait until scanning is finished.

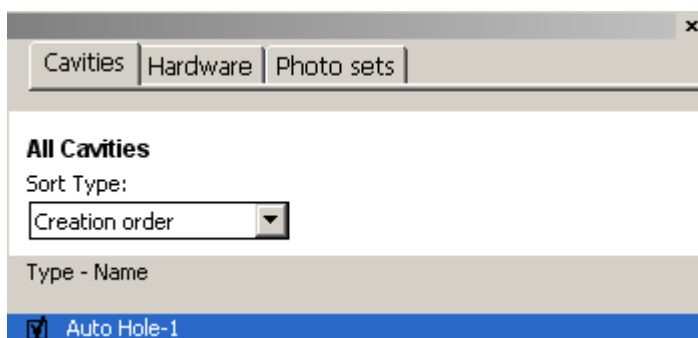




3) Then cavity is ready its 3d model will be cut off from the 3D model of rough diamond automatically.

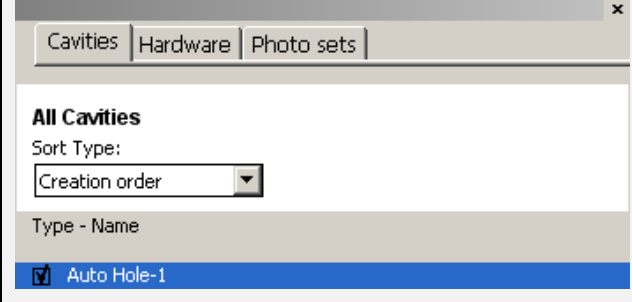
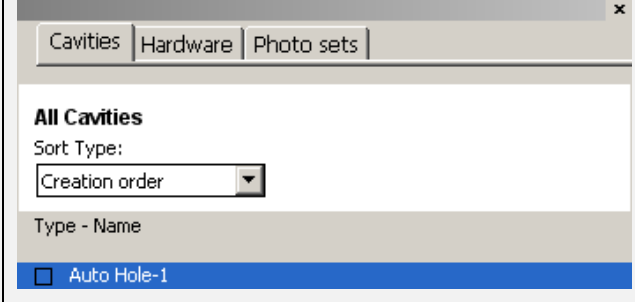
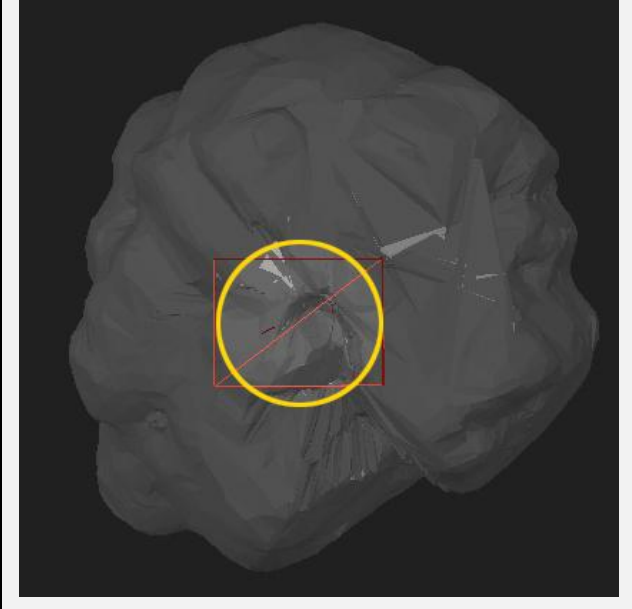
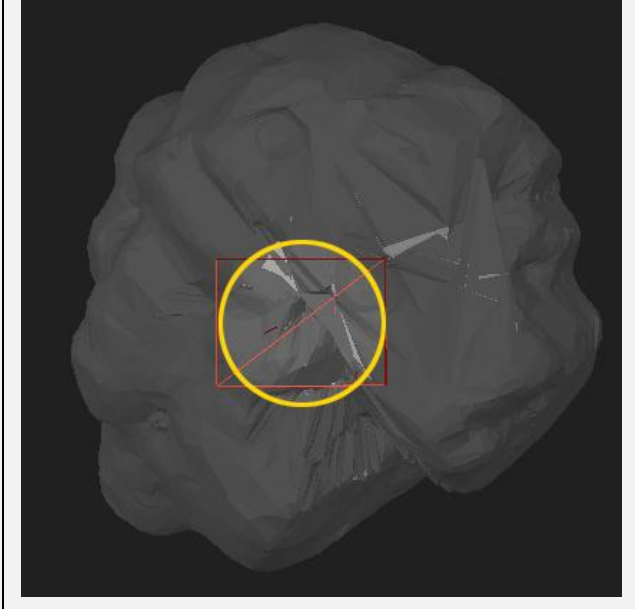


4) New cavity appears in cavities list. To disable or enable cavity use checkboxes:





Disabled 3D models of cavities are not cut off from the rough model and don not affect solutions during allocation.

<p>Enabled 3D model of cavity is cut off from the rough model</p>	<p>Disabled 3D model of cavity is not cut off from the rough model and does not affect solutions during allocation. However, 3D model of disabled cavity is still visible in 3D view in Cavities working mode (red lines)</p>
 <p>The screenshot shows a software window titled 'Cavities' with tabs for 'Cavities', 'Hardware', and 'Photo sets'. Under 'All Cavities', the 'Sort Type' is set to 'Creation order'. A table lists 'Auto Hole-1' with a checked checkbox.</p>	 <p>The screenshot shows the same software window. The checkbox for 'Auto Hole-1' is unchecked.</p>
 <p>A 3D model of a mechanical part with a central cavity. A yellow circle highlights the cavity, and a red square with a diagonal line is overlaid on it, indicating it is cut off from the model.</p>	 <p>The same 3D model as in the left panel. The yellow circle and red square with a diagonal line are still present, but the cavity is now visible through the model, indicating it is not cut off.</p>

Step 4. Verifying cavity's shape by photos

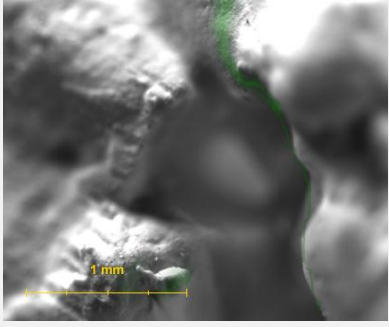
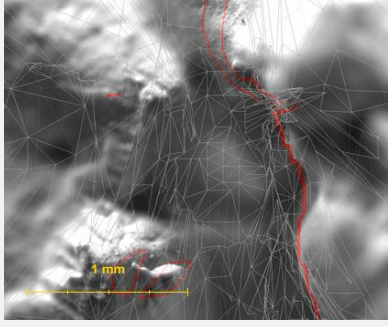
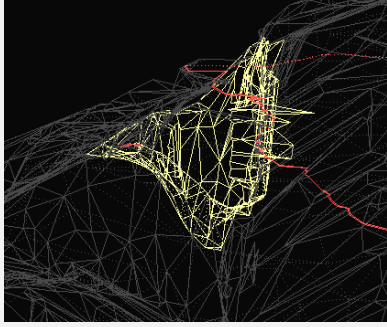
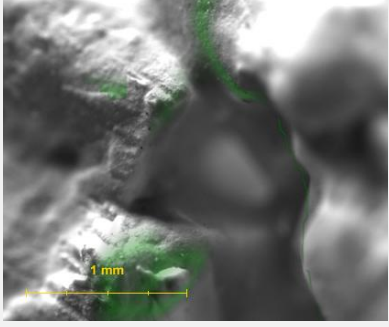
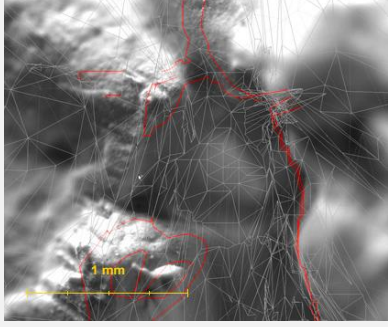
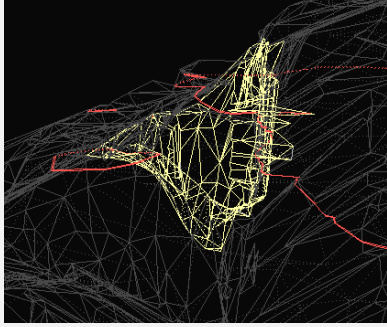
After cavity is built examine shape of the cavity with *cavity visualization* option. Cavity visualization allows to make sure that cavities on the stone surface are created correctly.

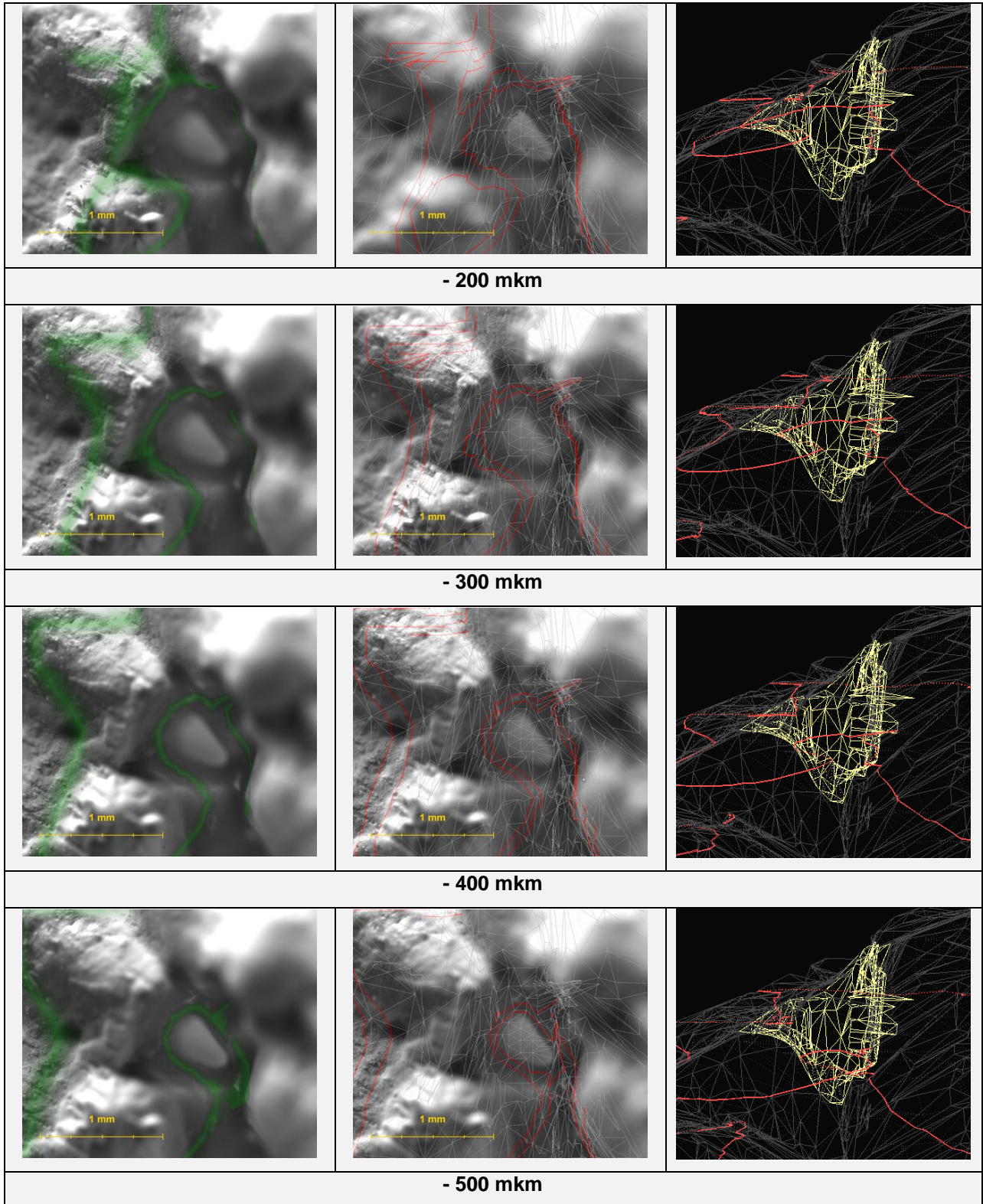
To verify auto cavity's shape:

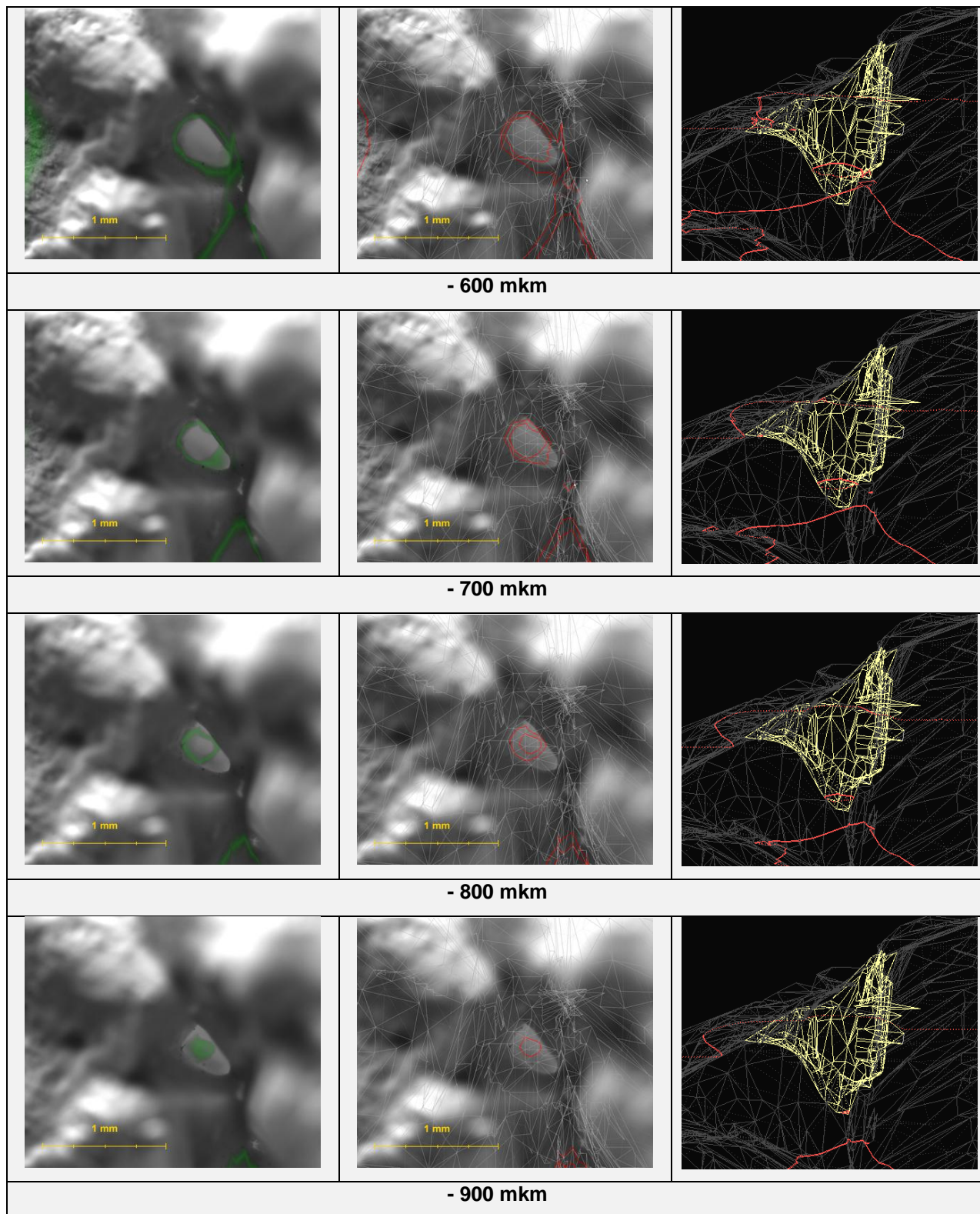
- 1) Make active **Microscope camera** view and select an examined cavity in the list of cavities.
- 2) Focus on cavity near surface of the rough diamond. We recommend using the magnification factor that has been used for cavity allocation.
- 3) Start gradually changing focus of the microscope beginning from the topmost part of the cavity until the deepest part of the cavity is reached. We recommend using **50 mkm** step during cavity verification procedure.

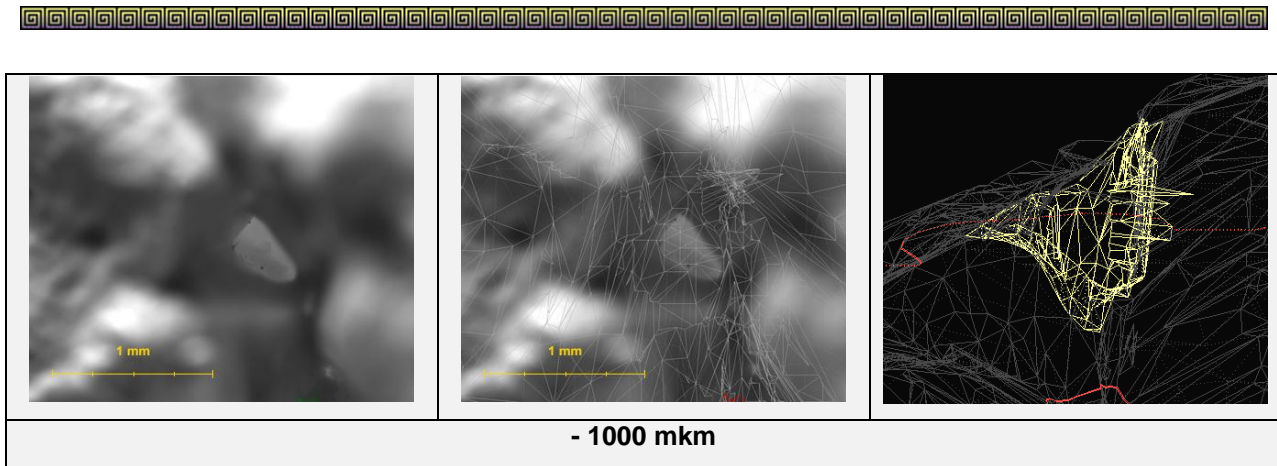
Cavity is displayed as a slice of the cavity surface for each focus position. Green areas marked on images correspond to the intersection of camera focus area with the cavity surface model.

In case of cavity is created correctly green mask on an image coincides with sharp details. See example on the table:

Green mask on an image coincides with sharp details (plane of field of depth 96 mkm)	Red layer on the Pacor model corresponds to the green mask on the left picture (plane of field of depth 96 mkm)	Side view, the position of red layer on the Pacor model corresponds to the green mask on the left picture
		
0 mkm		
		
- 100 mkm		

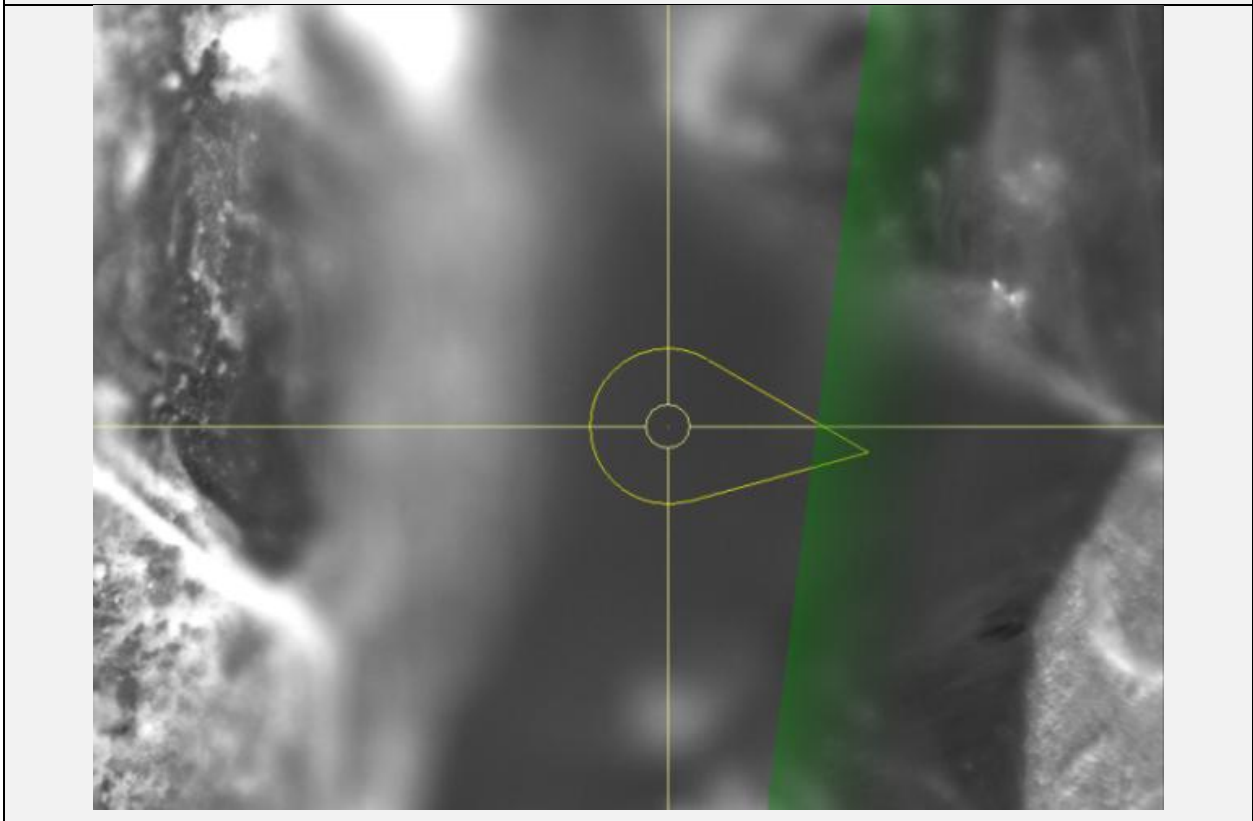






However, in case of cavity model is incorrect green mask would not be considered with sharp details. See an example of incorrect cavity allocation.

This figure demonstrates an error in cavity allocation. It can be seen that sharp area of the image is located near the left border of the image, while cavity slice mask is at the image center

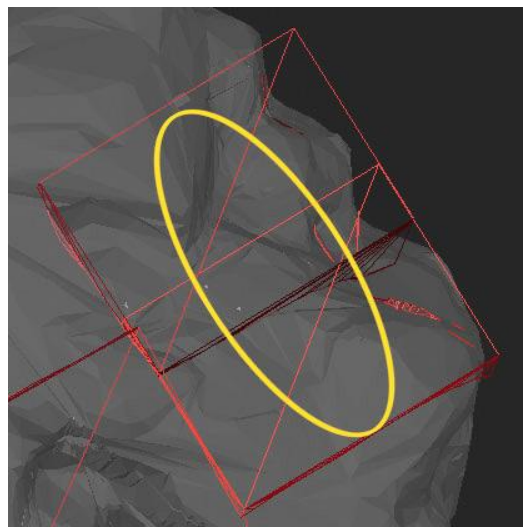


If auto cavity model is incorrect we recommend to disable the problematic cavity and perform building of cavity manually.

Step 5. Creating large or long cavities

To create large or long cavity do procedure of automatic building several times for covering full area of hole. In the result all 3d models of auto-cavities will be assembled together automatically and will be cut off from 3d model of rough diamond.

On the right 3D models of two cavities forms one large cavity



List of recommended M-Box systems and magnifications

For optimal performance of Automatic Cavity Allocation we recommend to use:

1. MZ16 System with 1.0x objective: 110x magnification
2. Z16 System with 2.0x objective: 80x magnification
3. M205A System with 1.0x objective: 115x magnification

Possible Error's message

For systems without hardware camera synchronization fine-tuning the light for automatic cavity allocation may be tricky. In case of getting repetitive **Please decrease the light brightness or flickering effects may occur** error messages try to:

1. Turn off all the illumination except for front light illumination
2. In case you are using multiple front light lamps try to turn off all of them except for just one lamp
3. Decrease front light illumination brightness using m-box keyboard

IMPORTANT: Notice that for systems without hardware camera synchronization automatic cavity allocation tool requires fairly dull illumination. Repetitive error messages **Please decrease the light brightness or flickering effects may occur** are not a software bug but rather a physical limitation. So in case you face this error message please be patient and keep reducing front light brightness until cavity allocation starts normally.

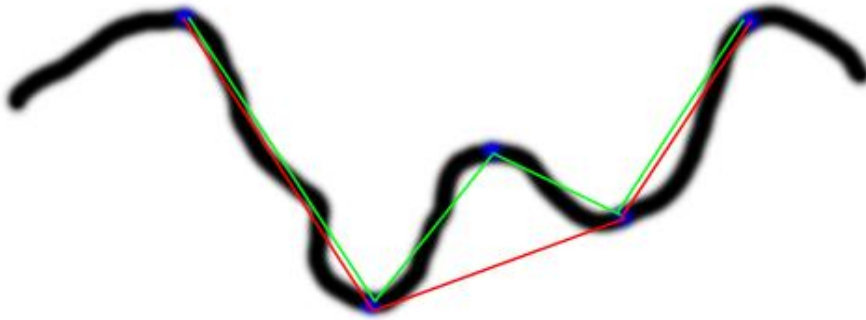
This error may occur for systems with hardware synchronization. However typically it means that you just have to decrease front light illumination brightness slightly.



6.2 Manual creating cavity

If automatic creating of cavity is failed the software allows creating convex and non convex cavities manually.

The algorithm since version 2.2 creating the follow type of non convex cavity. It is available for photos from M-box only.

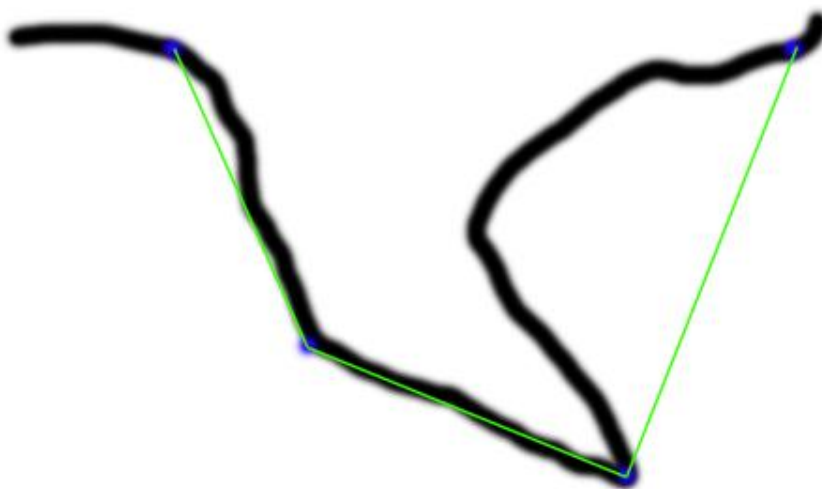


Black line is a Real Cavity surface, side view

Red line is the Cavity convex surface constructed by old algorithm

Green line is the Cavity non convex surface constructed by new algorithm since version 2.2

At this time the follow type of cavity shape can not be created by the program:



Black line is a Real Cavity surface, side view

Green line is the Cavity surface constructed by the program

Here is an example of creating cavity by photos.

Download an example .oxg file:

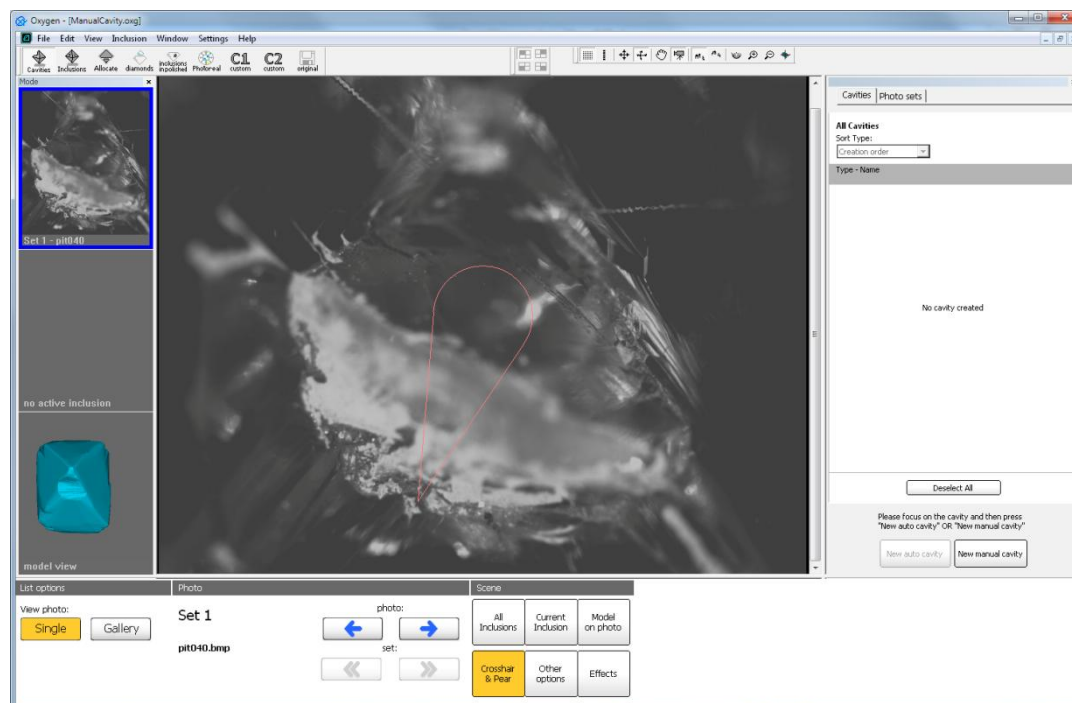
<http://www.octonus.com/oct/download/files/oxygen/SampleManualCavity.zip>

Procedure outline

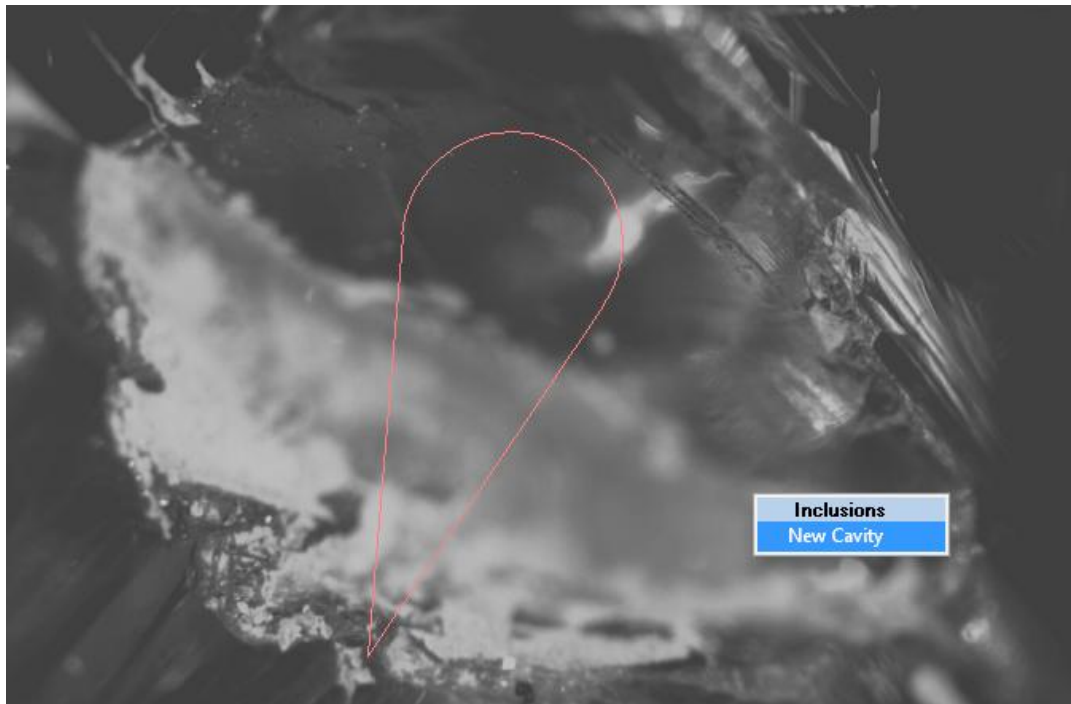
- Step 1. Creating Cavity base
- Step 2. Creating Deep point or ridge

Step 1. Creating Cavity base

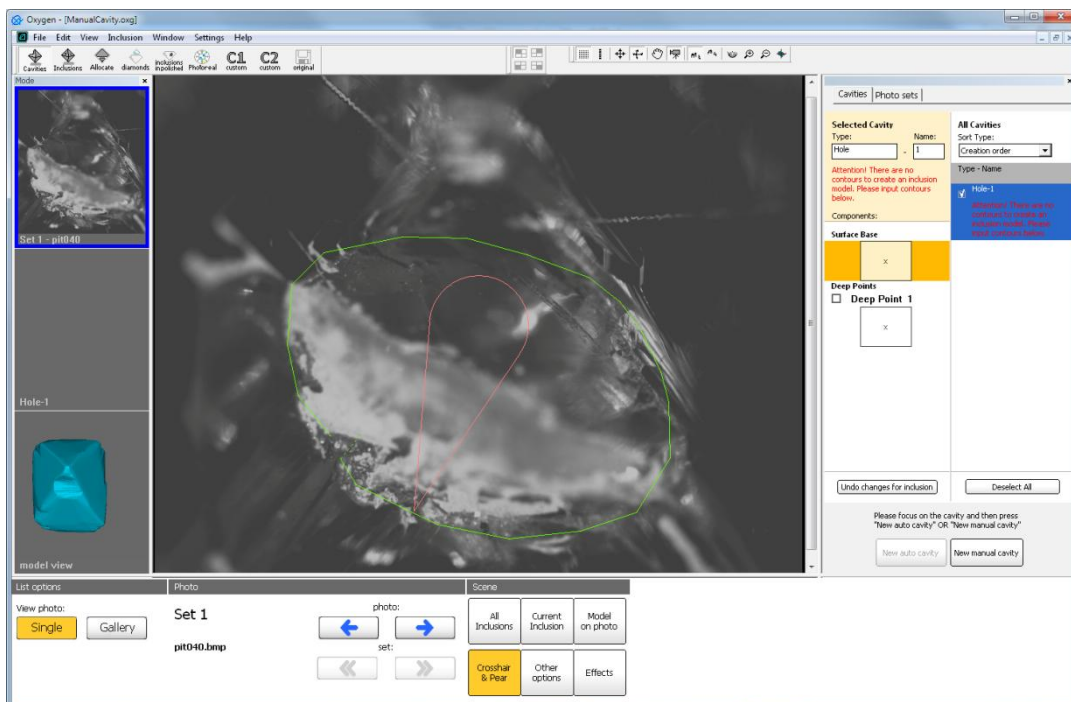
- Select photo for creating Cavity base and zoom it



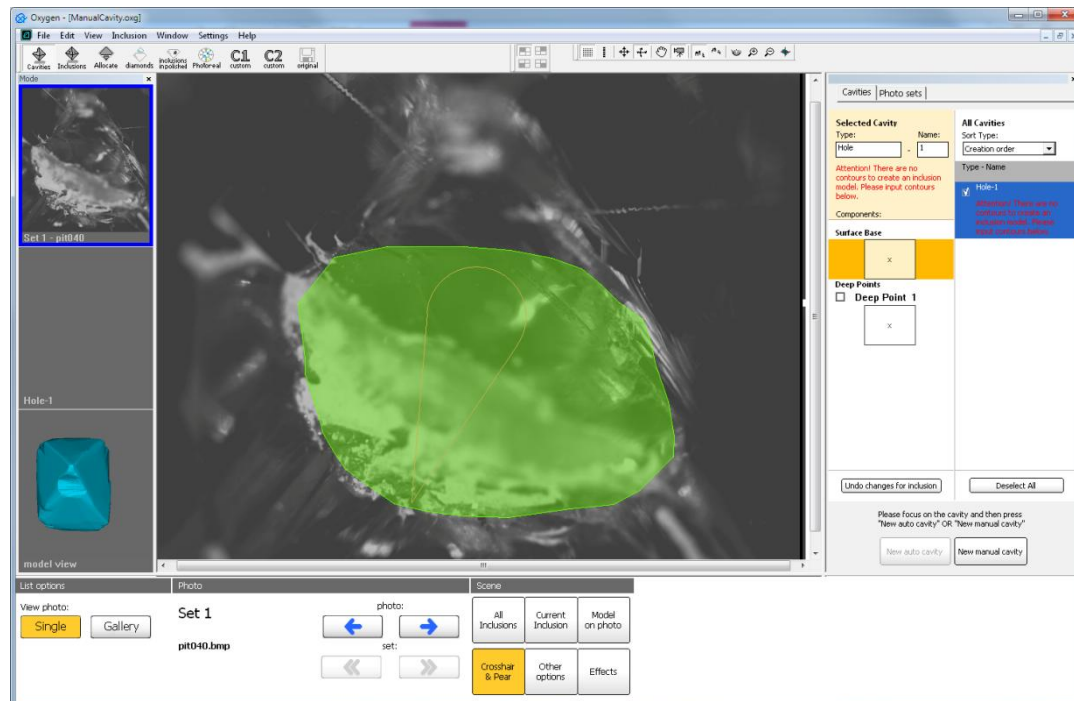
- Right click mouse on Scene to open context menu and select **New Cavity**



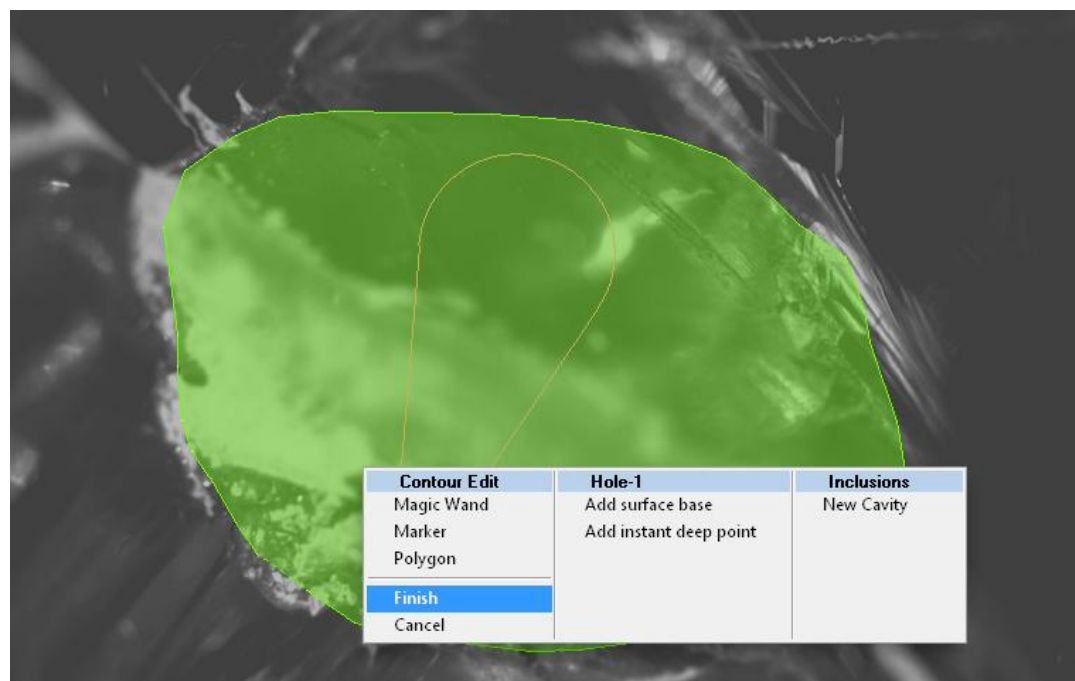
- Draw Surface base



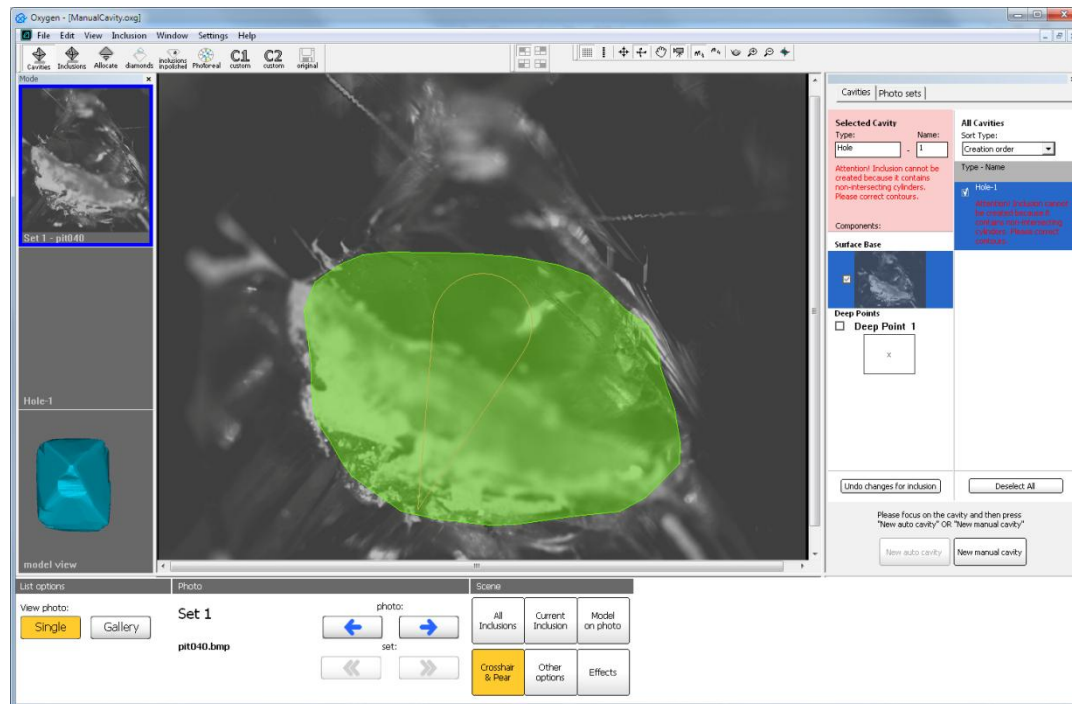
- Enclose contour by double click:



- Perform contour with right and left mouse button
- Then contour is ready right click mouse and select **Finish** in context menu

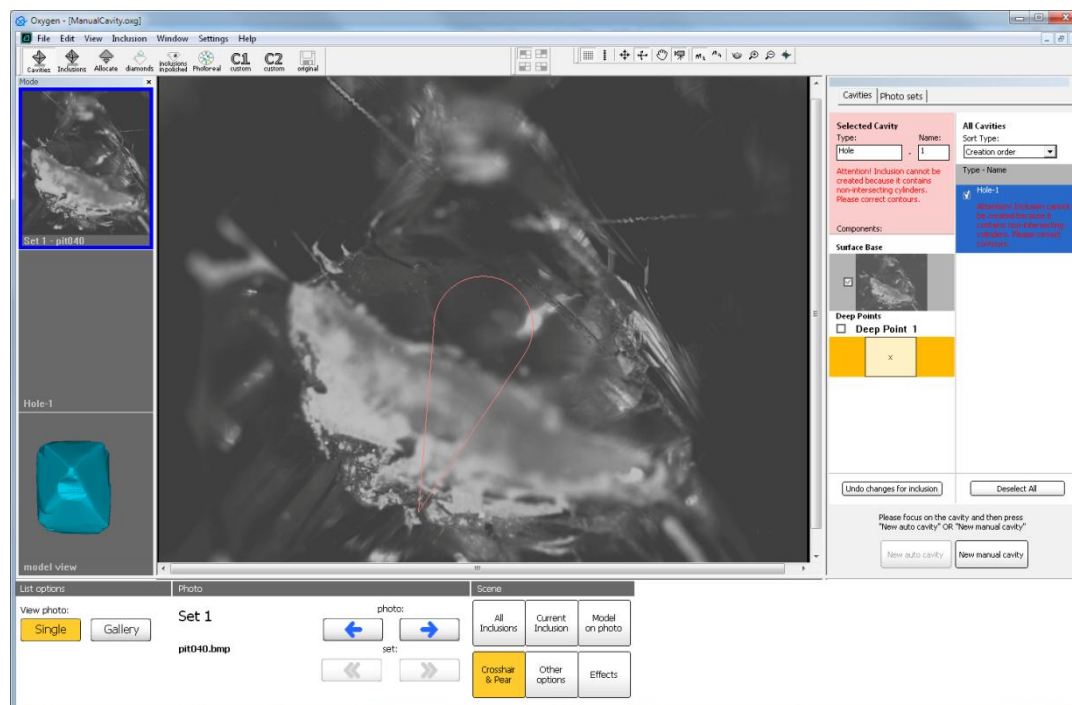


- The **Cavity base** is ready

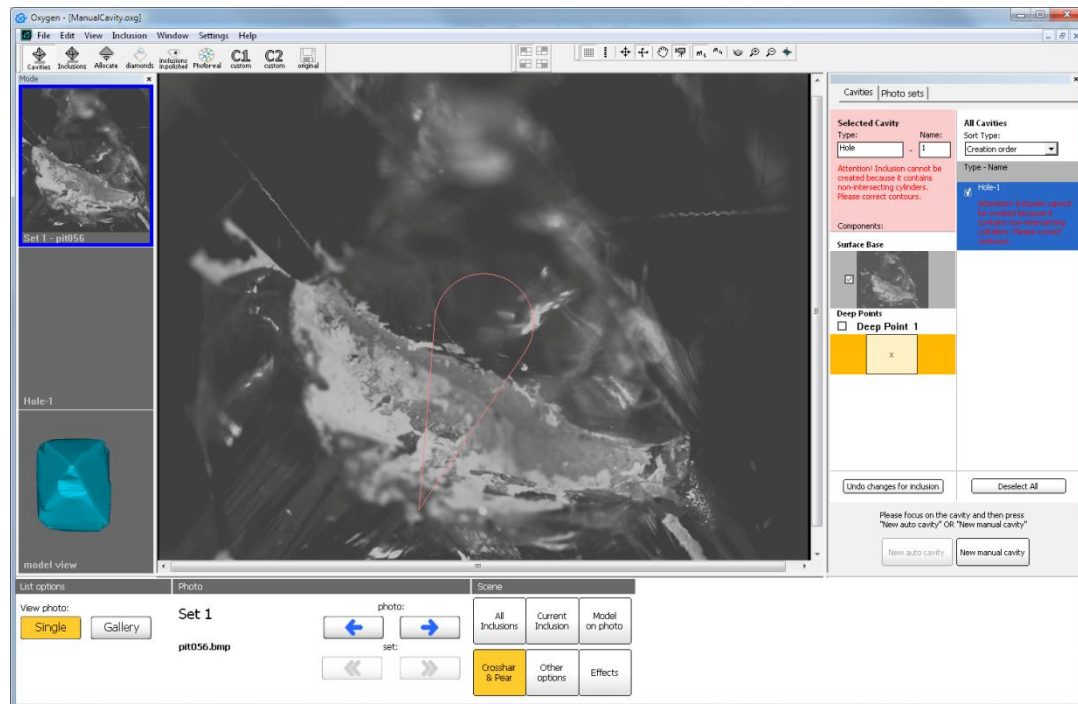


Step 2. Creating Deep point or ridge

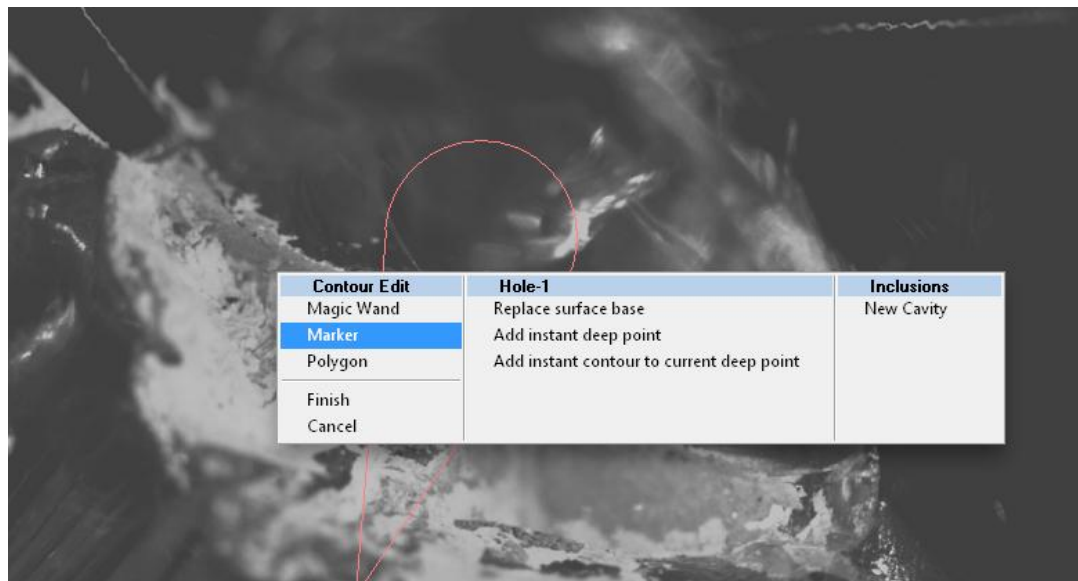
- Select inclusions component **Deep point** in the panel **Inclusion** / section **Components**



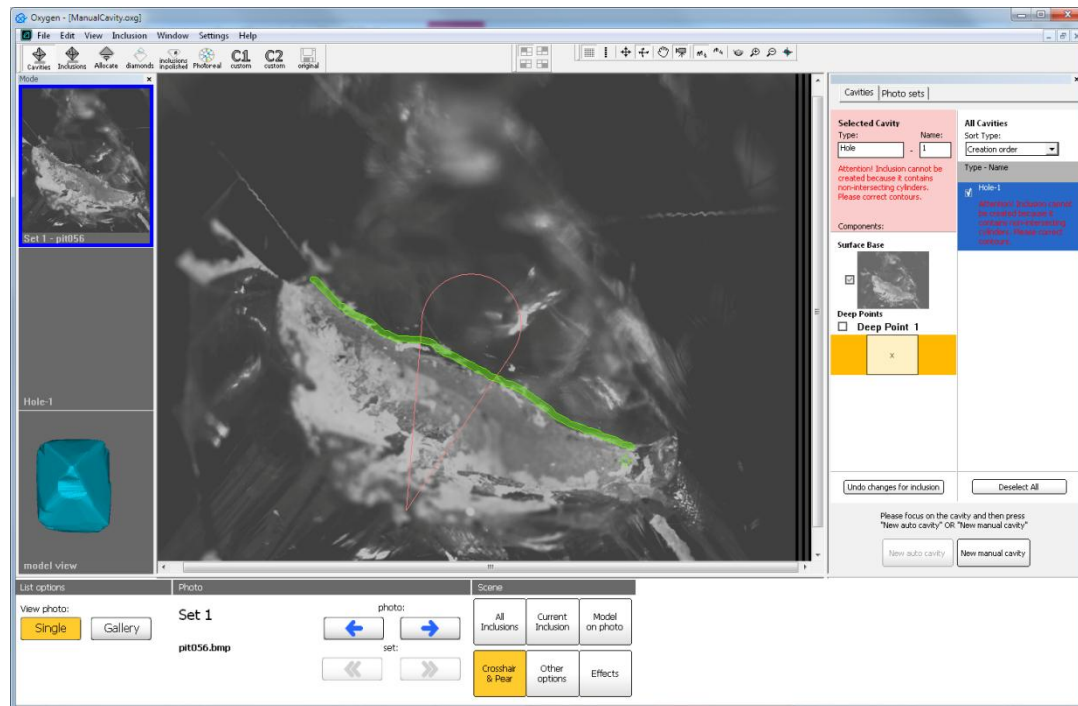
- Select a photo in the depth of hole.



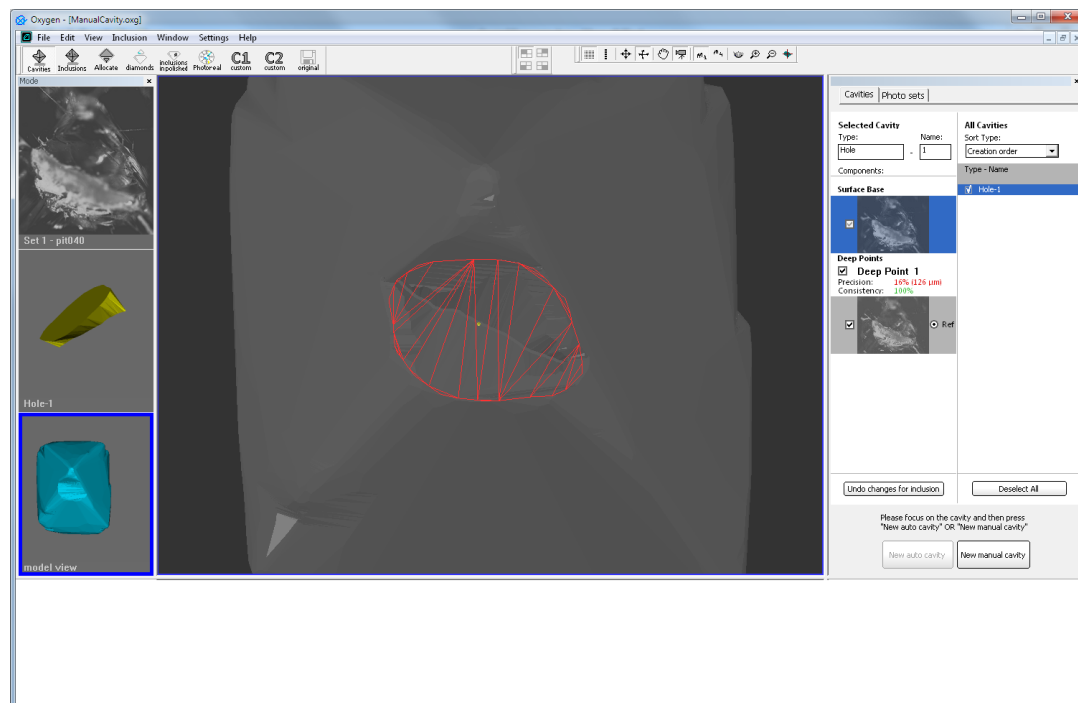
- There is a ridge in this example. In this case select tool **Marker** in context menu



- Draw a ridge

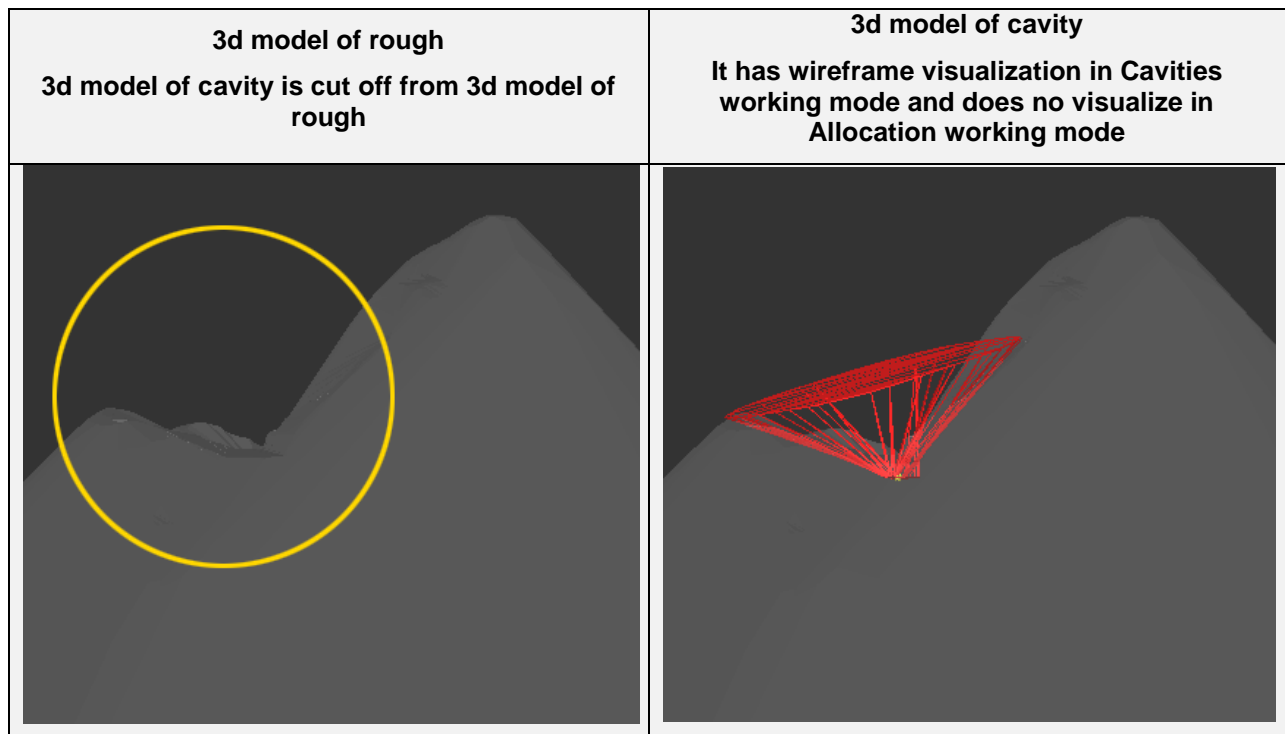


- Finish contour with context menu
- Manual cavity is ready





- Created 3D model of Cavity inclusion is cut off from the 3D model of rough.



6.3 Creating cavities with photos from Helium Rough

The Manual Cavity's method allows creating Cavities by photos from Helium Rough or Oxygen Microscope with deep depths of field.

Procedure outline

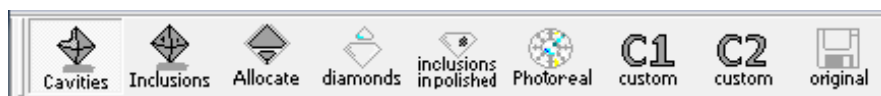
- Step 3. Loading set of photos from Helium Rough
- Step 4. Creating Cavity base
- Step 5. Creating Deep point by photos from different directions

Download example .oxg file with photos:

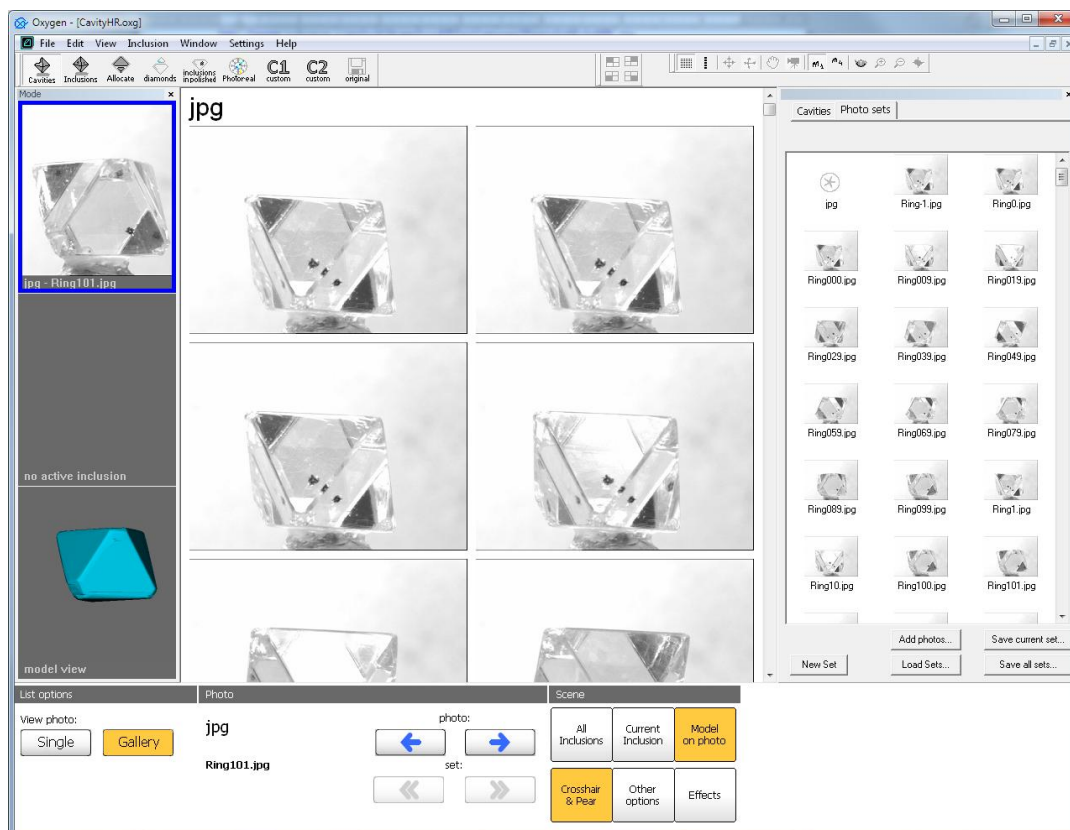
<http://www.octonus.com/oct/download/files/oxygen/SampleCavityHeliumRough.zip>

Step 1. Loading set of photos from Helium Rough

- Select **Cavities** working mode

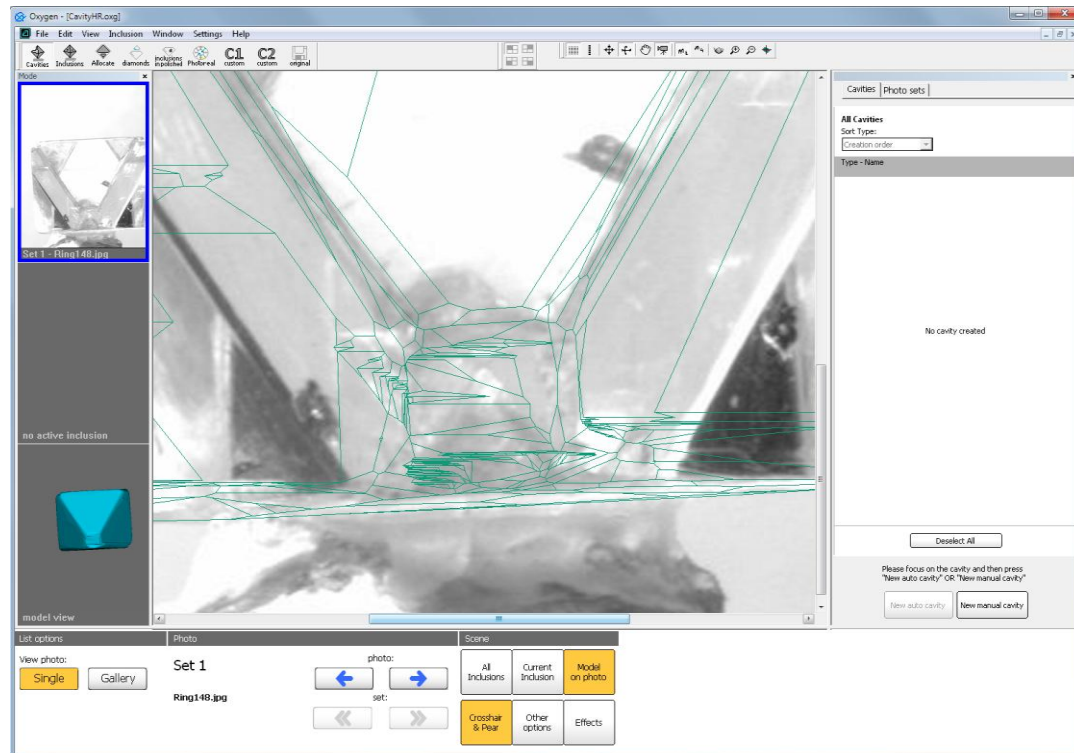


- Load set of photos from Helium Rough.

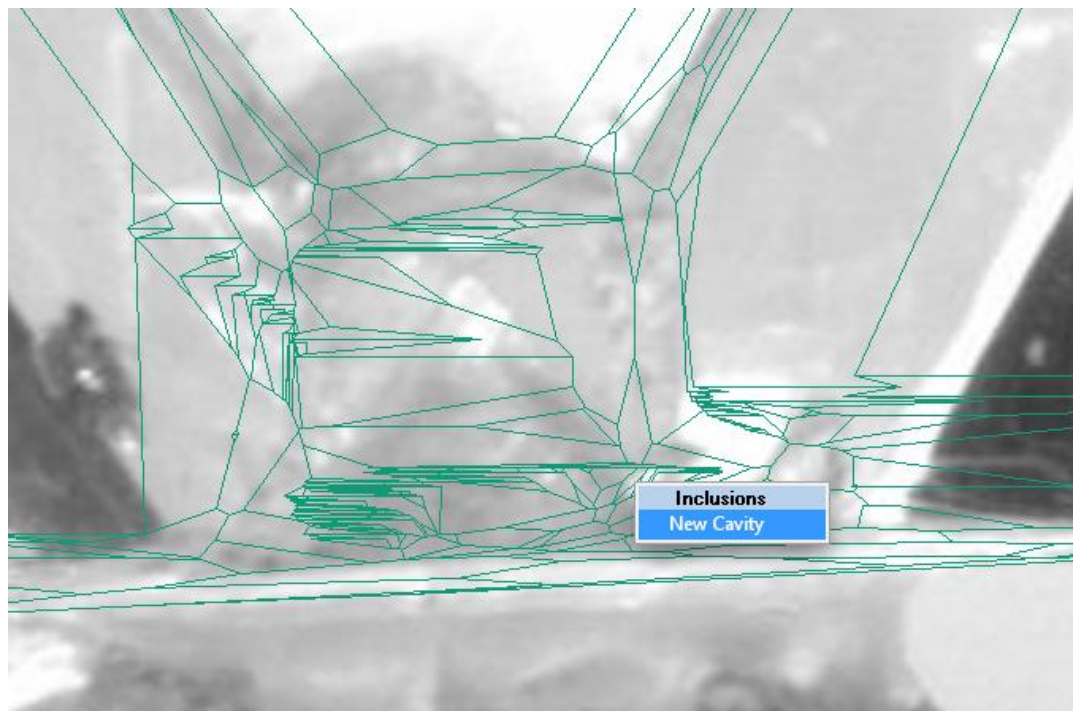


Step 2. Creating Cavity base

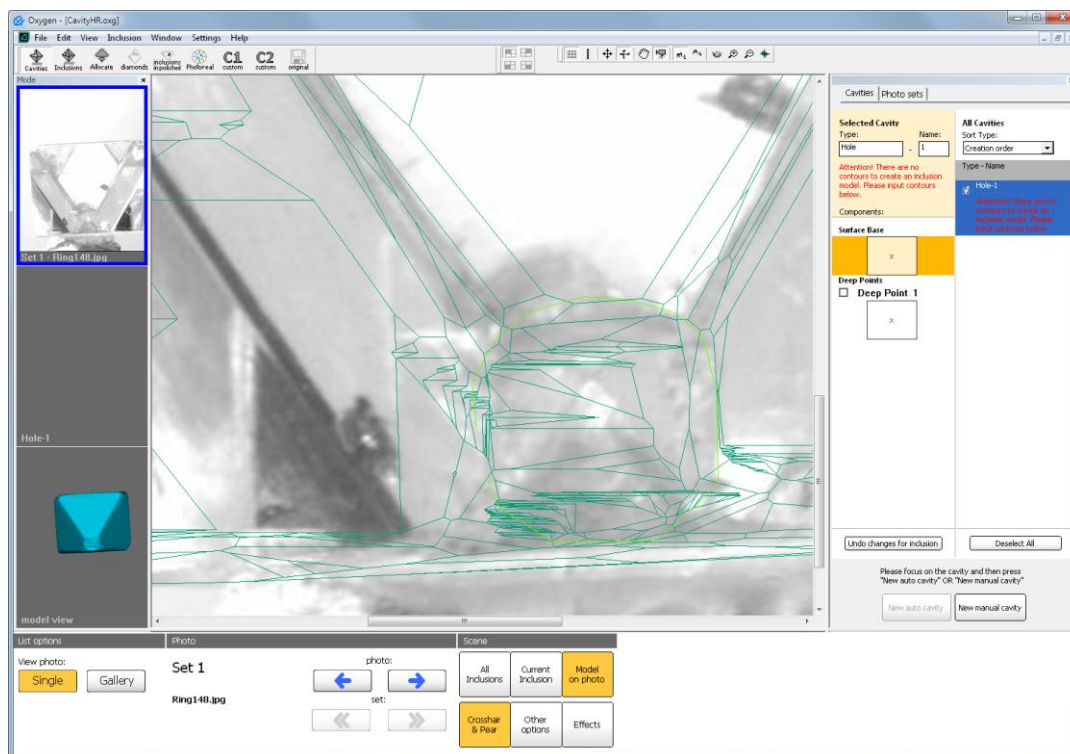
- Select photo for creating Cavity base and zoom it



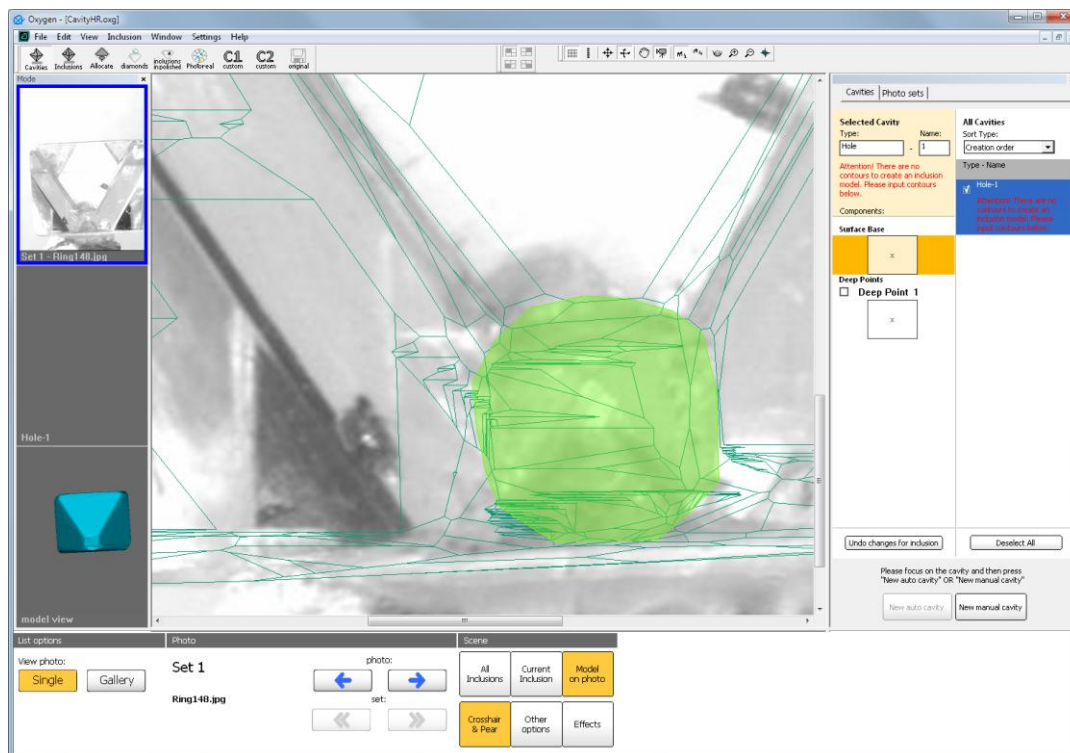
- Right click mouse on Scene to open context menu and select **New Cavity**



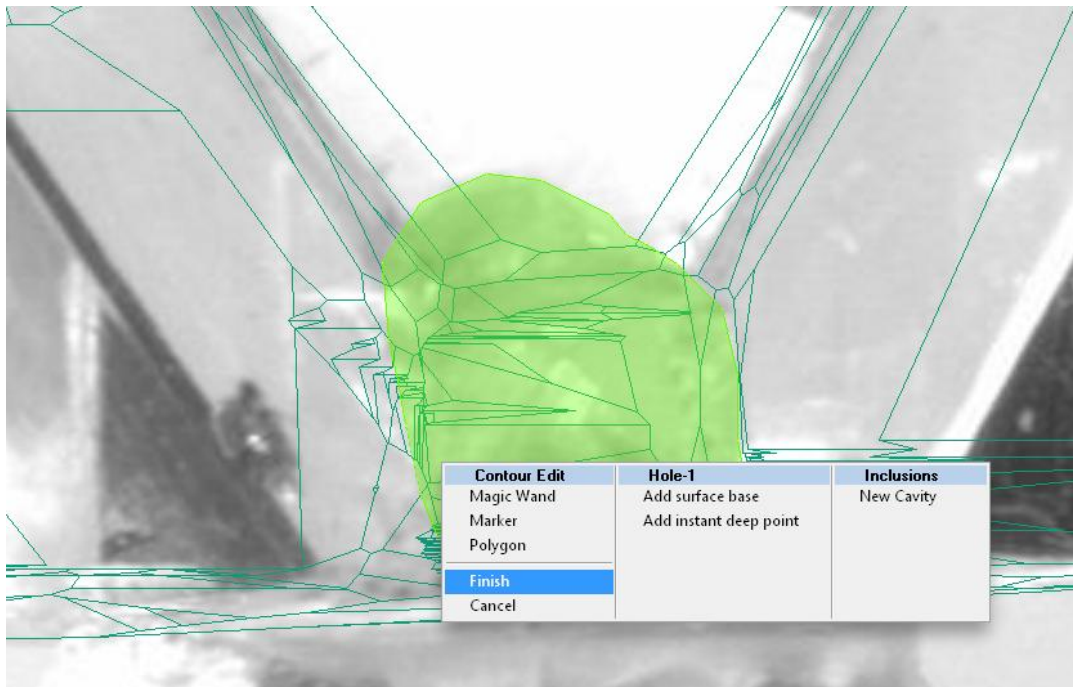
- Draw Surface base



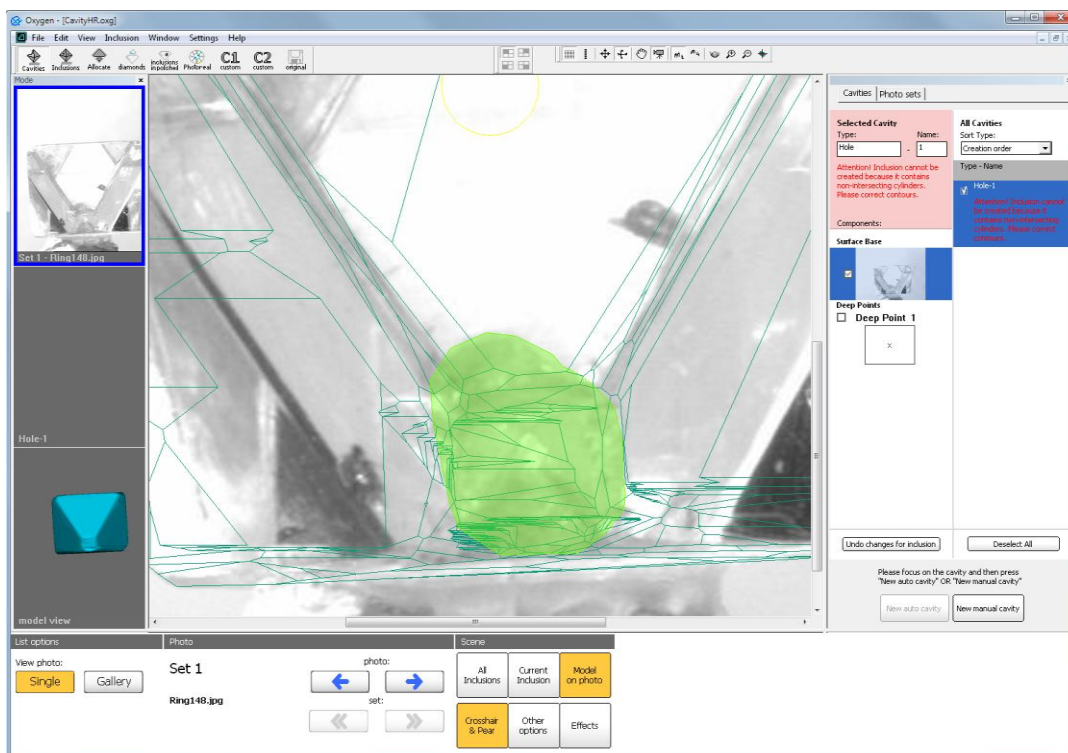
- Enclose contour by double click:



- Perform contour with right and left mouse button
- Then contour is ready right click mouse and select **Finish** in context menu



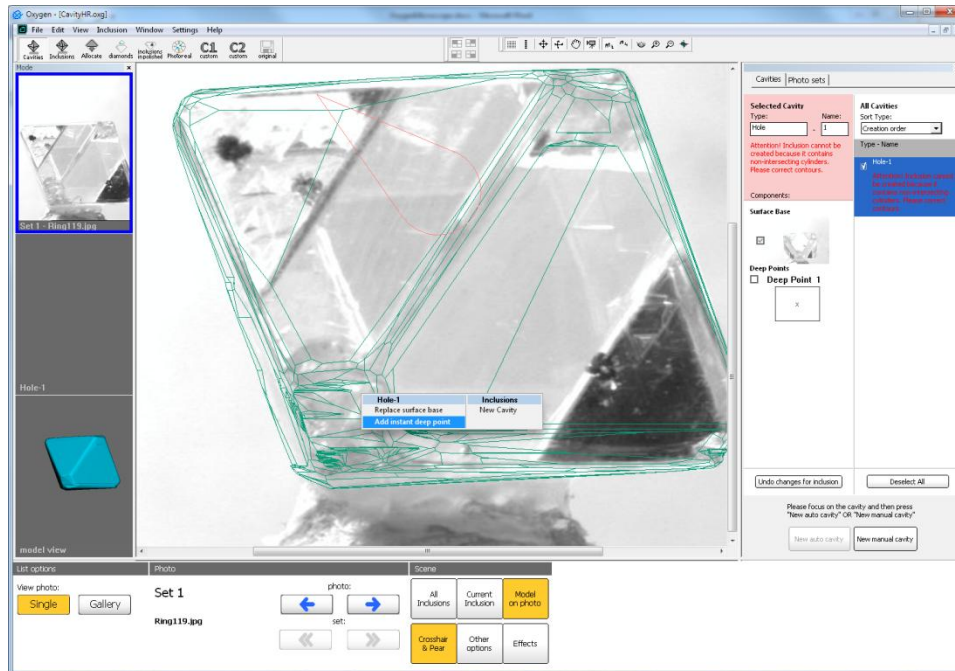
- The **Cavity** base is ready



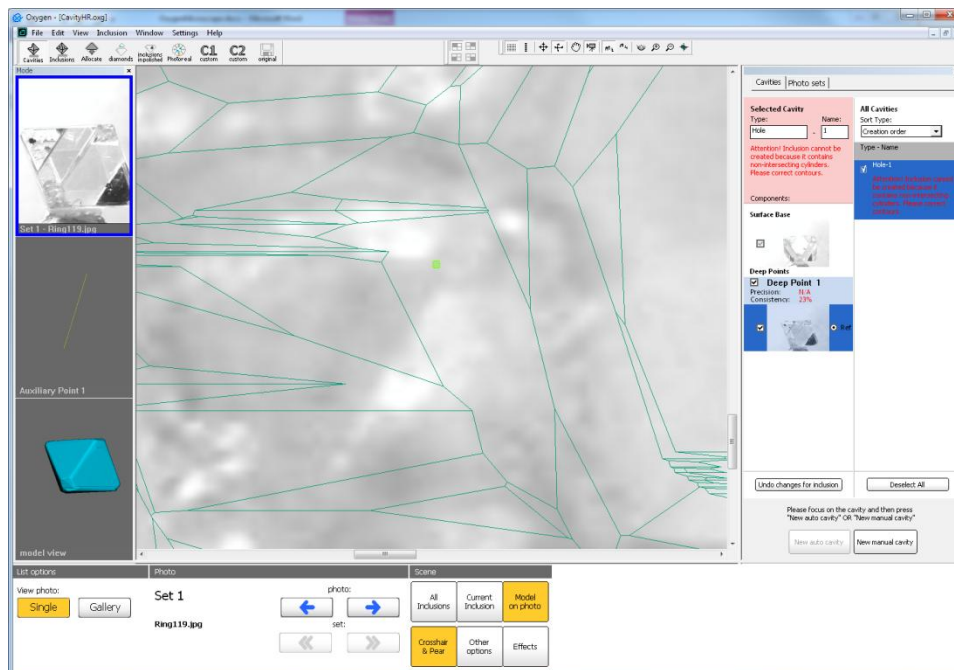
Step 3. Creating Deep point by photos from different directions

To create deep point on Helium Rough photos you should use it at least two photos from different directions.

- Select one photo with deep point
- Right click mouse in Scene in place where you want to create Deep point and select **Add instant deep point** in context menu

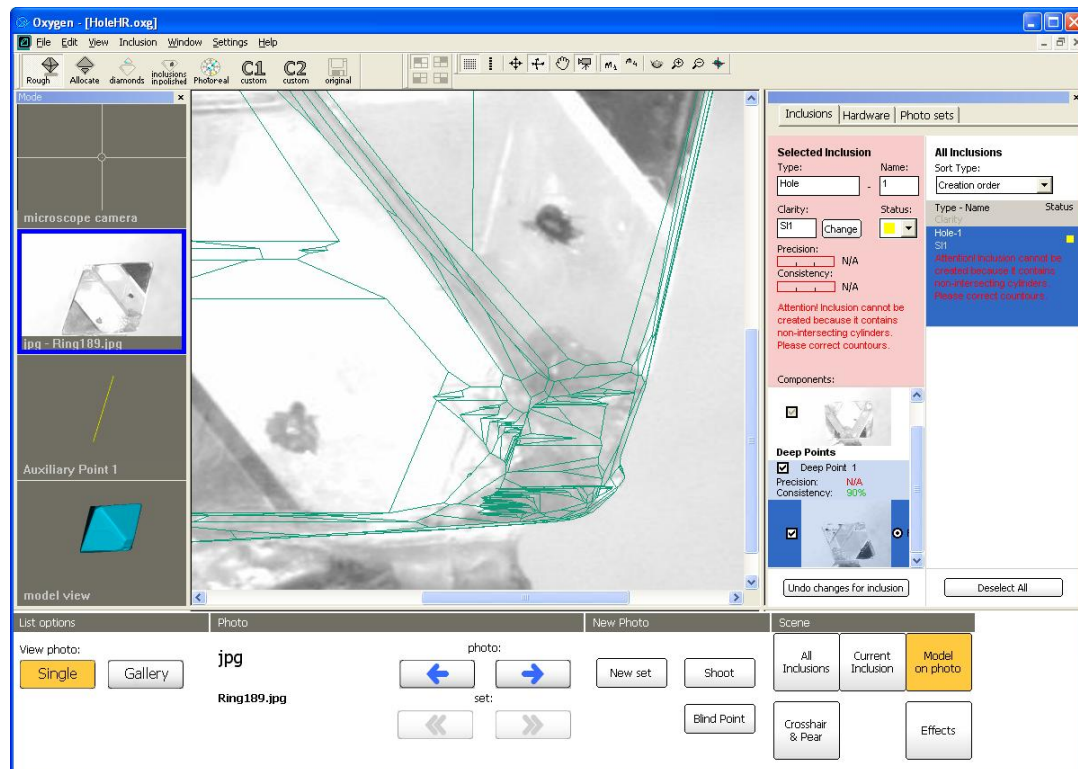


- Deep point is created but Cavity is not ready.

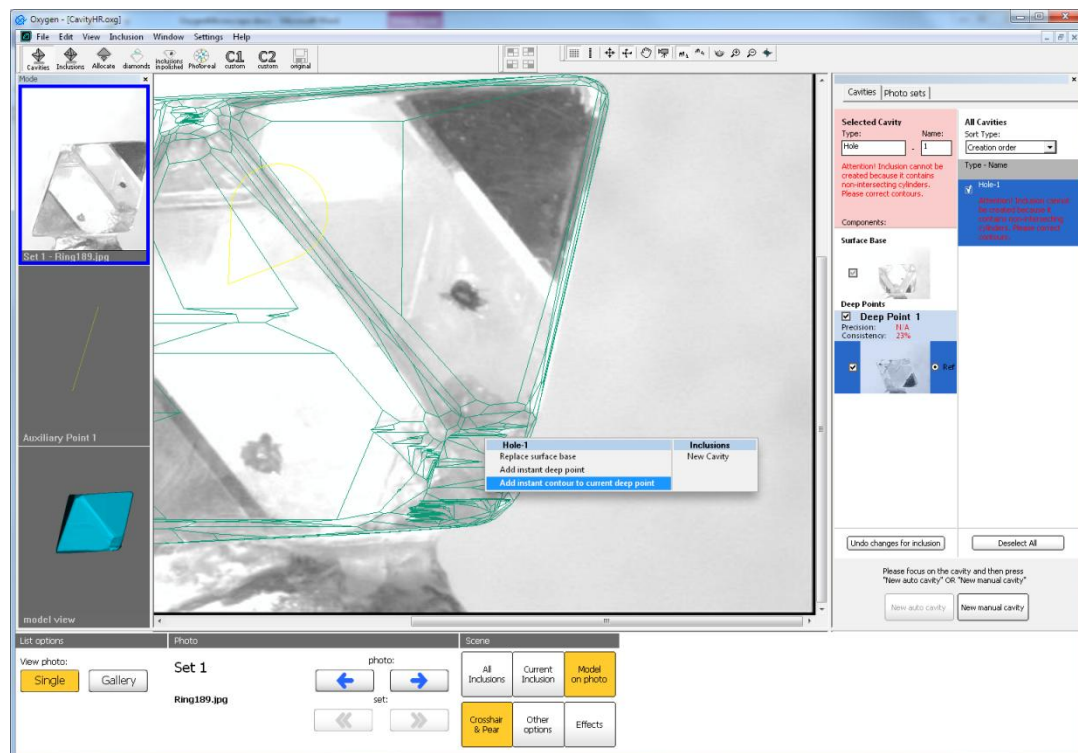


It needs to precise Deep point from other direction.

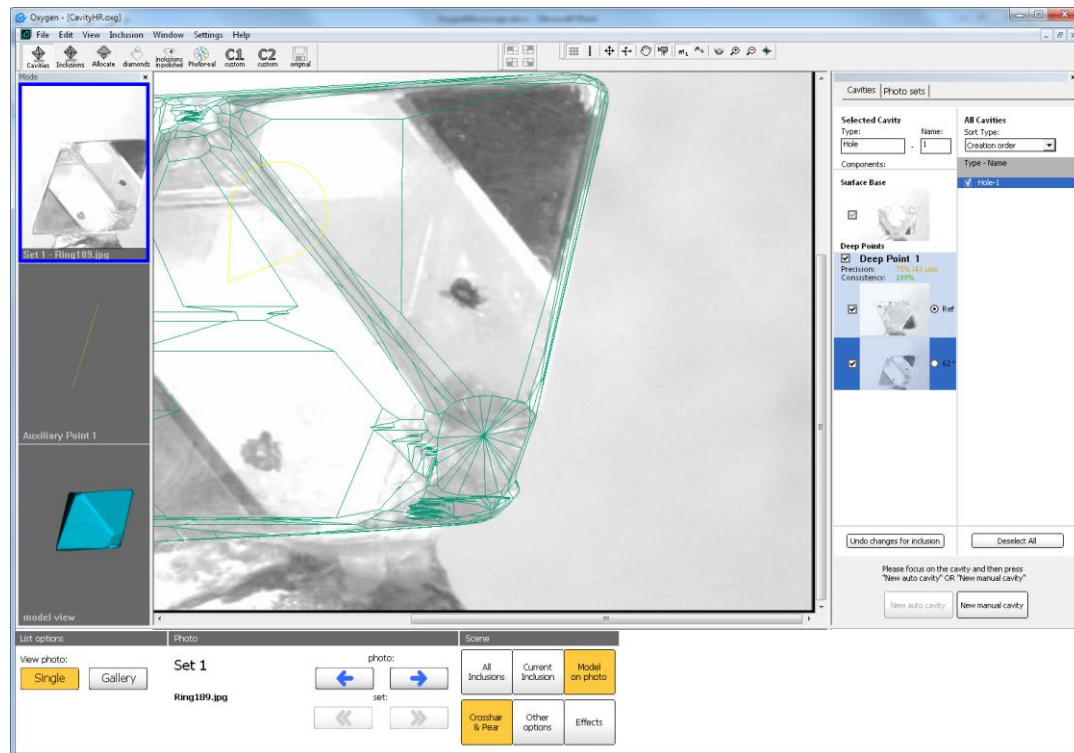
- Select photo from other direction



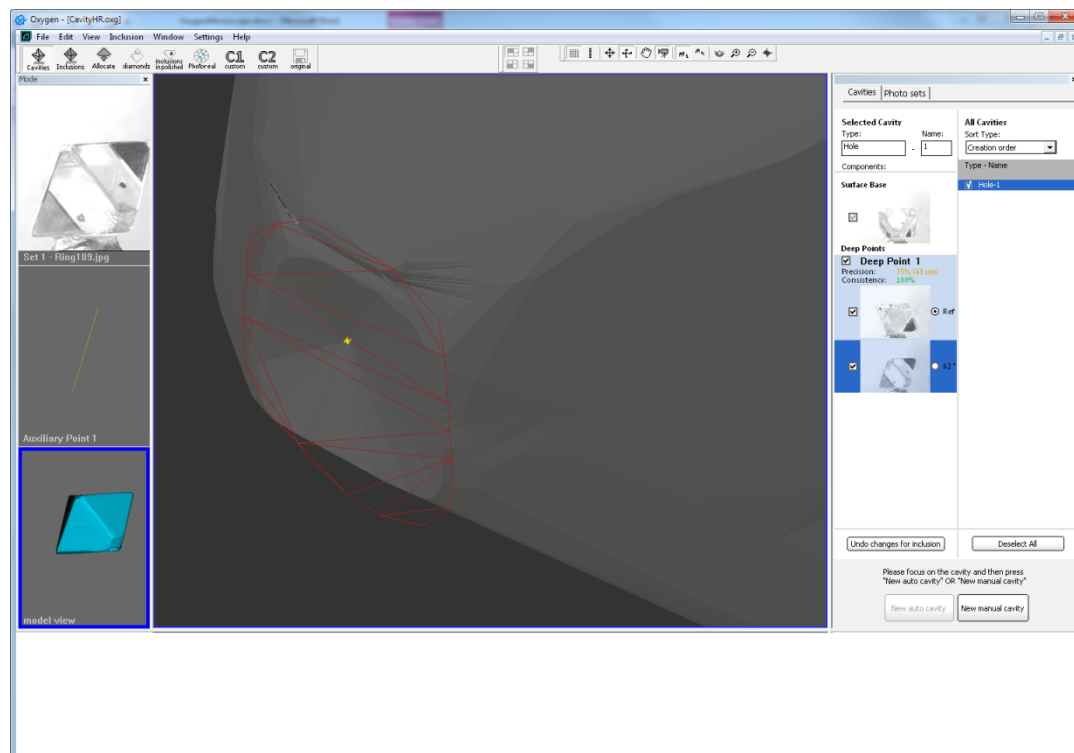
- Right click mouse in Scene in place where you want to create Deep point and select **Add instant contour to current deep point** in context menu



- The Deep point is completed



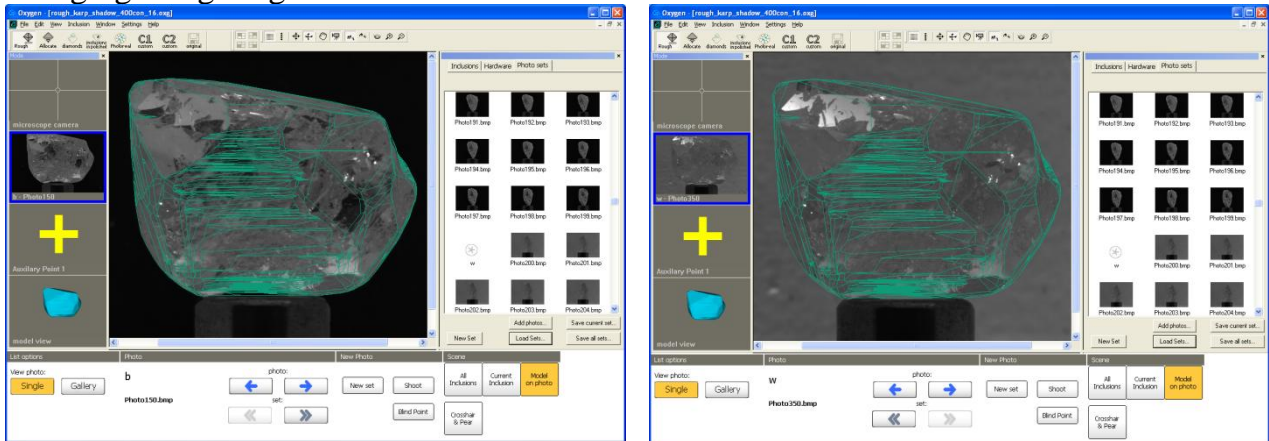
- Cavity is ready. The 3d model of Cavity is applied to the 3d model of rough diamond and will be taken into account while allocation.



Note. It is not possible to activate / deactivate manual cavity as automatic cavity.

6.4 Changing photo sets of HR photos without changing number of photos

Changing photo sets of HR photos without changing number of photos is available. So, if Photo set is changed the stone will remain in the same position. It provides an effect of changing of lighting in Scene:



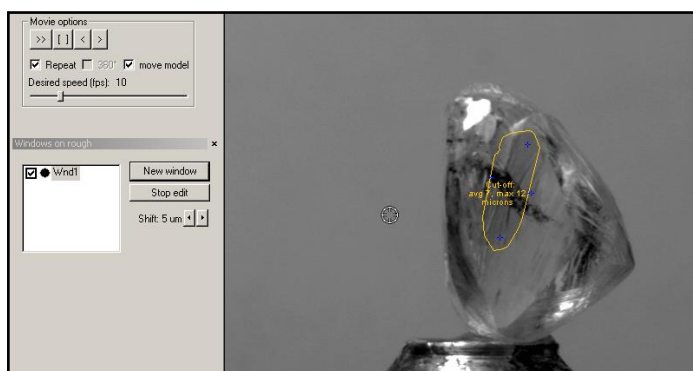
Set 1. Dark lighting

Set 2. Light lighting

7 Creating virtual «windows» on the model

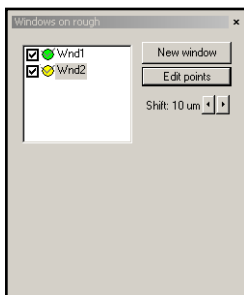
The option is assigned to improve a work with the localization of inclusions. It helps to ignore superfluous edges on flat facets or «windows» of rough during localization (in the case if these edges are present on model and aren't present in reality). So operator can create virtual «windows» in the places of superfluous edges and through the windows localize inclusions more exactly. Often non-existent in reality edges on facets of the model distort 3D model of inclusion if operator creates the inclusion using contour which intersects this non-existent edges. Read the description how to create virtual «window».

1. Open mmd-project or oxg-file. Load set of photos.
2. Select one of the photos from the list in the **Photo collection** panel. You will see this photo in the first scene of program. Select **M1** mode for convenience of work.
3. Find «window» on rough:
 - a. Using rotation of stone by mouse in the scene find window on diamond. To rotate photo of stone press and hold the left button of mouse. To rotate stone continuously tick on **Repeat** before rotation.
4. Tick on **Model over photo** and check that facet of real window is not good and has superfluous edges that prevent localization of inclusions and can result in incorrect position of inclusion after localization.
5. Find good photo and position for creation of virtual «window».
6. In the panel **Windows on rough** click on the **New window**. You will see sight on the place of cursor. Mark points (3 and more) by left click where you want to create window (plane of window goes through these points). Try to set points a little far from border of real window. For checking use tick «Model over photo».
7. Work with points:
 - a. Operator can move points. Set sight cursor on the pint, you will see the cross, press and hold the left button of mouse and move the point.
 - b. Operator can delete points. Press and hold Shift button on keyboard and move sight cursor to the point. When you see cross with «-» then click by the left button of mouse and delete point.
8. Create points again. Information on the plane means depth of cutting by the plane: average and maximal depth. Operator can increase or decrease depth of plane using arrows in the panel **Windows on rough** (step is 5 microns).

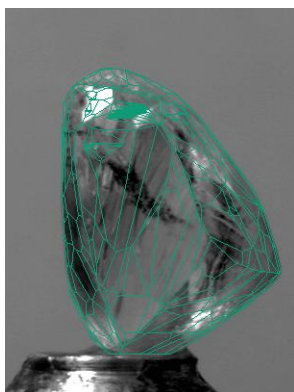


9. After finding good position of window plane press **Stop edit** button. You will see color of window in the panel **Window rough**. Color depends on depth. Green color of window is optimal depth (average depth less than 10 microns), yellow is

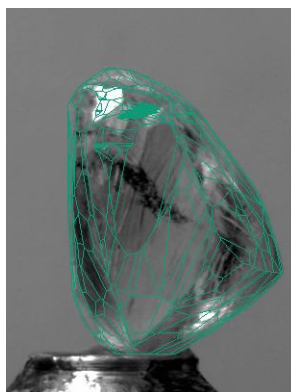
permissible depth (10-30 microns), red is inadmissible depth (more than 30 microns) – cutting of model is blocked.



10. Tick on **Model over photo** in the panel **Photo collection** and check created virtual window.



Without virtual «window»



With virtual «window»

Inclusion should be easily accessible via this window. Otherwise press **Edit points** in the panel **Windows on rough** and correct points.

11. So you create virtual windows on the model of rough diamond. Using these windows operator has possibility to locate inclusions with high accuracy.

8 Diamonds allocation

8.1 Appraiser and pricelist

Operations with optimization algorithms require correct appraiser and pricelists according to manufacture needs.

Read document describes how to load appraisers to program, structure and options of appraiser, allows creating and customizing appraiser for any types of cuttings:

http://www.octonus.com/oct/download/files/Appraisers_creation_and_customization.pdf

And read the same document for pricelists here:

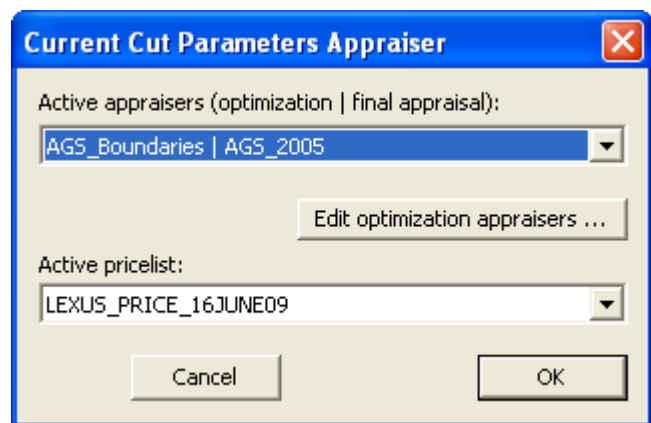
http://www.octonus.com/oct/download/files/Pricelists_creation_and_customization.pdf

8.2 Select appraiser and pricelist

Open menu **Settings / Select active appraiser...** Select desired appraiser and pricelist.

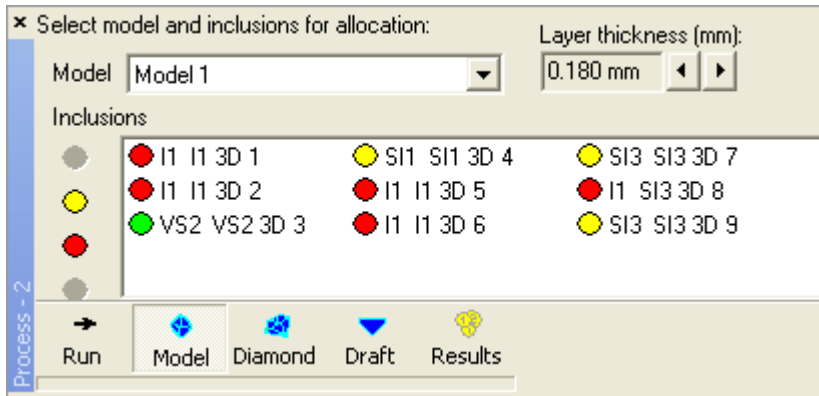
The active appraiser impacts on the options of desired cut quality group in allocation. (**View/Show process tab Diamond**).

It also affects the cut quality group displayed in the **Diamond parameter** panel.

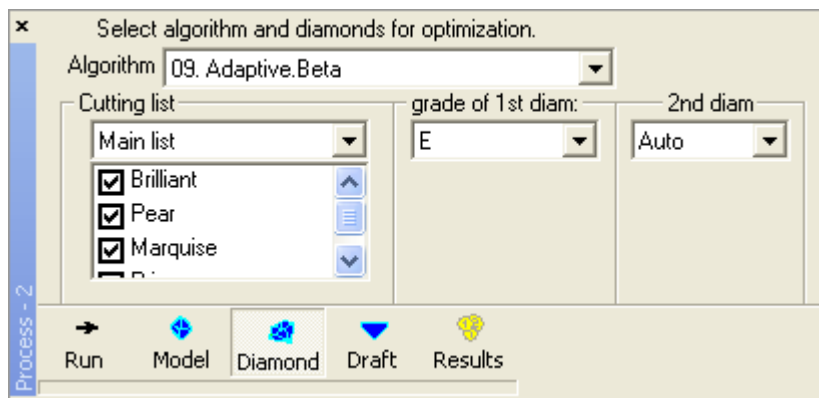


8.3 Allocate diamonds

1. To allocate diamond switch to **Allocate** working mode
2. Call **Process** panel from menu **View/Show Process**
3. On the tab **Model**
4. Select desired allocation mode for inclusions:
 - **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.



5. Open **Diamond** tab
6. Select Algorithm

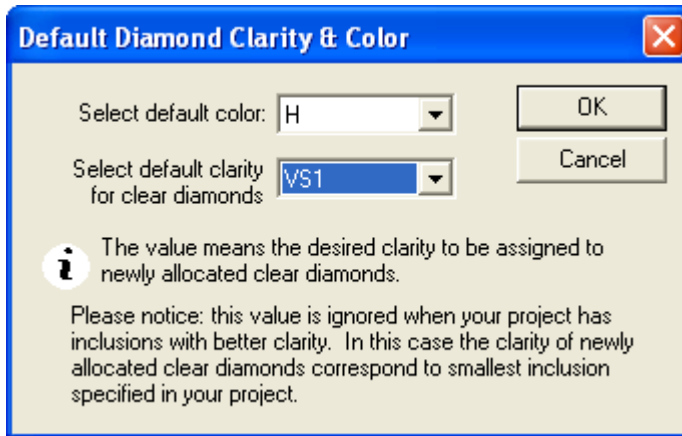


Complex and Single algorithms work especially efficient with several inclusions in yellow smart mode. These algorithms select different cuttings from lists and make multiple choices for the 1st diamond quality

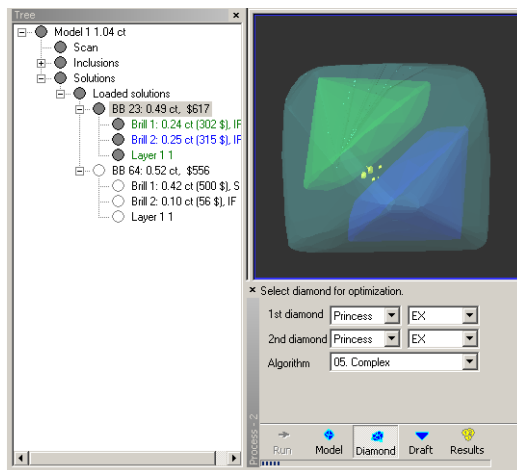
7. Select desired shape for each diamonds in allocation. There are brilliant, marquise, oval, pear, princess, emerald, flander, happy8, baguette and heart shapes of diamond
8. Set cut grade quality for diamond parameters: Auto, Excellent, Very Good and etc.

*Note. It is possible changing the active appraiser from menu **Settings/Select active appraiser***

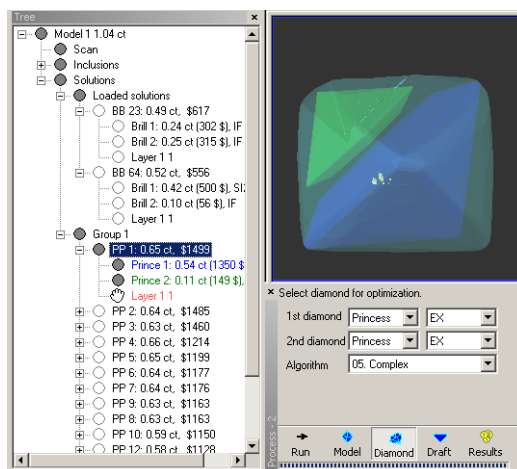
9. Open **Default diamond color** panel from menu **Settings**



10. Select the color that will be assigned for allocated diamonds.
11. Press button **Run**
12. The program start allocating new solutions



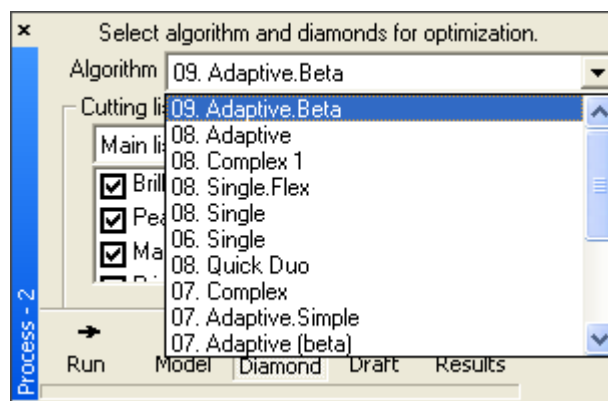
13. After while newly allocated diamonds appear in the **Tree** panel. A new **Group** of solutions is created every time you run allocations.



8.4 Optimization algorithms

Currently total list of algorithms is following (17 algorithms):

09. Adaptive. Beta	06. Smart C1
08. Complex 1	06. Complex 1
08. Single.Flex	06. Semicut
08. Adaptive	06. Semicut (final)
08. Single	05. Adaptive
06. Single	05. Complex
08. Quick Duo	05. Complex 1 (37.5)
07. Complex	07. Adaptive.Simple
07. Adaptive (beta)	



Single - allocates one diamond in solution

Single Flex is better for allocating one diamond in rough with flat shape

Complex и **Adaptive** are the most common algorithms for finding two diamonds in solution

Adaptive be able to find better solution than **Complex** but **Adaptive** works longer time

Quick Duo is quick algorithm for allocating two diamonds

Complex and **Single** algorithms work especially efficient with several inclusions in yellow smart mode

Semicut is better for semi-cuts

8.5 Diamond parameter panel

There are diamond weight, shape, proportion grade and general proportions parameters: size, depth, table and etc.

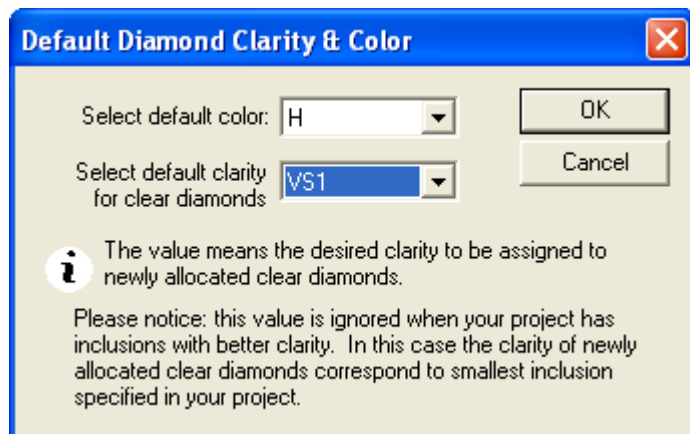
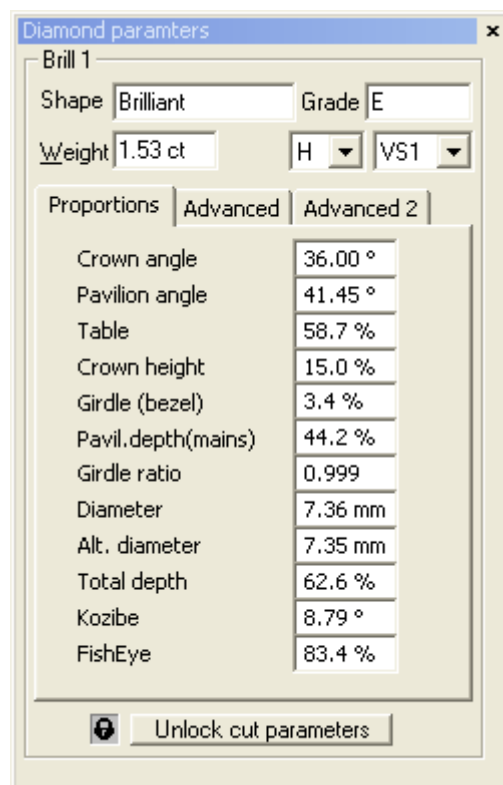
You can set colour and clarity for any diamond.

The new values of colour and clarity are also displayed in the **Tree** panel.

8.6 Default diamond color panel

There is **Default diamond color** option (see menu **Settings/Default diamond clarity and color**). You may select the color that will be assigned to allocated diamonds. In this panel the program check the status of the inclusion. In appropriate cases program advices 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).

Note: this command affects only further allocated diamonds and not affects diamonds that are already allocated.

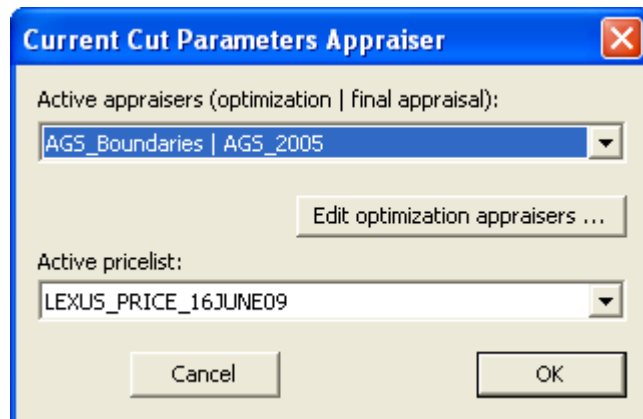


8.7 Edit appraiser utility

Edit appraiser utility allows to modify an appraiser data.

To call **Edit appraiser utility**:

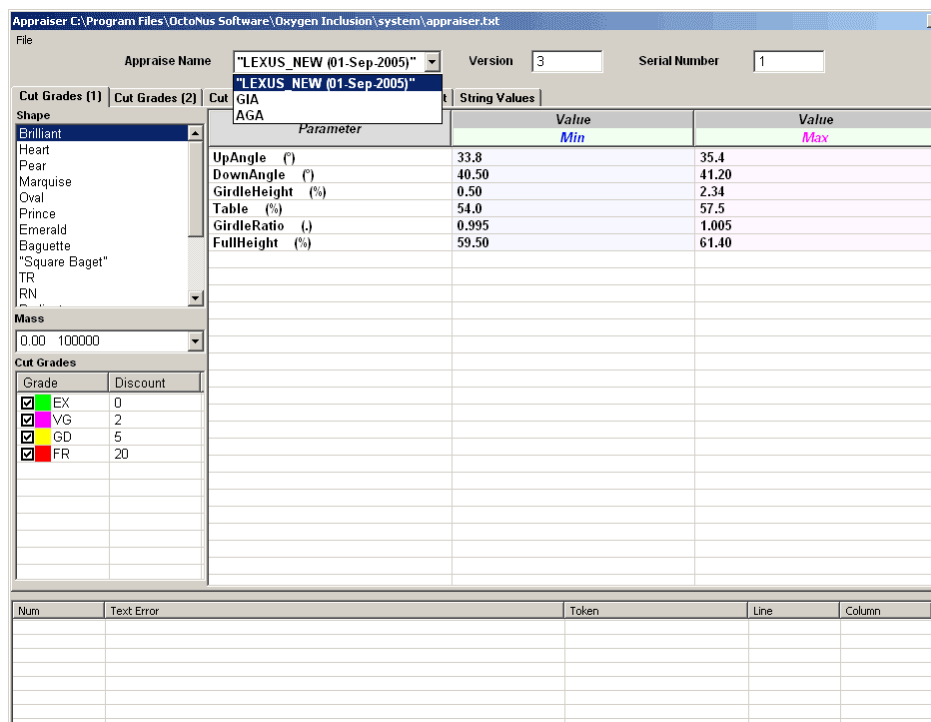
- Open panel **Current Cut parameters appraiser** from menu **Settings/ Select active appraiser**



- Press button **Edit optimization appraisers...**

To change appraiser data:

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



- Select cut from panel **Shape**



Cut Grades (1) Cut Grades (2) Cut Grades (3) Cut Grades (4) Fixedcut String Values					
Shape	Cut Grade	Value		Value	
		Min	Max	Min	Max
Brilliant	EX	54.0	57.5		
Heart	VG	53.5	60.5		
Pear	GD	53.0	62.5		
Marquise	FR	52.5	64.5		
Oval					
Prince					
Emerald					
Baguette					
"Square Baget"					
TR					
RN					
Radiant					
DCA					
SPCUSHION					
Mass					
0.00 100000					
Parameters					
UpAngle (°)					
DownAngle (°)					
GirdleHeight (%)					
Table (%)					
GirdleRatio (.)					
FullHeight (%)					

- Or select tab **Cut Grades (3)**
- Change values in the table **Parameter – Cut Grade:**

Cut Grades (1) Cut Grades (2) Cut Grades (3) Cut Grades (4) Fixedcut String Values										
Shape	Parameter	EX		VG		GD		FR		G
		Min	Max	Min	Max	Min	Max	Min	Max	
Brilliant	UpAngle (°)	33.8	35.4	32.7	35.8	32.2	36.4	31.0	38.4	
Heart	DownAngle (°)	40.50	41.20	40.20	41.50	40.00	41.90	39.50	42.50	
Pear	GirdleHeight (%)	0.50	2.34	0.40	2.44	0.30	3.00	0.20	4.50	
Marquise	Table (%)	54.0	57.5	53.5	60.5	53.0	62.5	52.5	64.5	
Oval	GirdleRatio (.)	0.995	1.005	0.993	1.007	0.993	1.007	0.982	1.018	
Prince	FullHeight (%)	59.50	61.40	59.20	62.40	58.00	63.80	56.80	65.80	
Emerald										
Baguette										
"Square Baget"										
TR										
RN										
Radiant										
DCA										
SPCUSHION										
painted_C_P										
"Square Emerald"										
Triangle										

- Or select tab **Cut Grades (4)**
- Change values in the table **Cut grade – Parameter:**

Cut Grades (1) Cut Grades (2) Cut Grades (3) Cut Grades (4) Fixedcut String Values								
Shape	Cut Grade	FullHeight (%)	FullHeight (%)	UpHeight_GIA (%)	UpHeight_GIA (%)	DownHeight_GIA (%)	DownHeight_GIA (%)	G
		Min	Max	Min	Max	Min	Max	
Brilliant	EX	64.0	68.5	11.5	14.2	47.0	51.8	2.3
Heart	VG	62.0	71.5	11.0	15.2	45.0	53.8	2.1
Pear	GD	60.0	73.5	10.0	16.2	43.0	55.8	1.8
Marquise	FR	58.0	75.5	9.0	17.7	41.0	57.8	1.6
Oval								
Prince								
Emerald								
Baguette								
"Square Baget"								
TR								
RN								
Radiant								
DCA								
SPCUSHION								
painted_C_P								
"Square Emerald"								
Triangle								

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**

Shape	Fixedcut Name	UpAngle (°)	GirdleHeight (%)	Table (%)	DownAngle (°)
Baguette					
"Square Baget"					
TR	Ideal	41.1	56.1	38.7	0.0001
RN	Parker	25.5	55.9	40.9	0.0001
Radiant	Tolkowsky	34.5	53.0	40.75	0.0001
DCA	Practical	33.2	56.0	40.8	0.0001
SPCUSHION	Scand	34.5	57.5	40.75	0.0001
painted_C_P	Eulitz	33.6	56.5	40.8	1.5
"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					

8.8 Linked appraiser. Update active appraiser

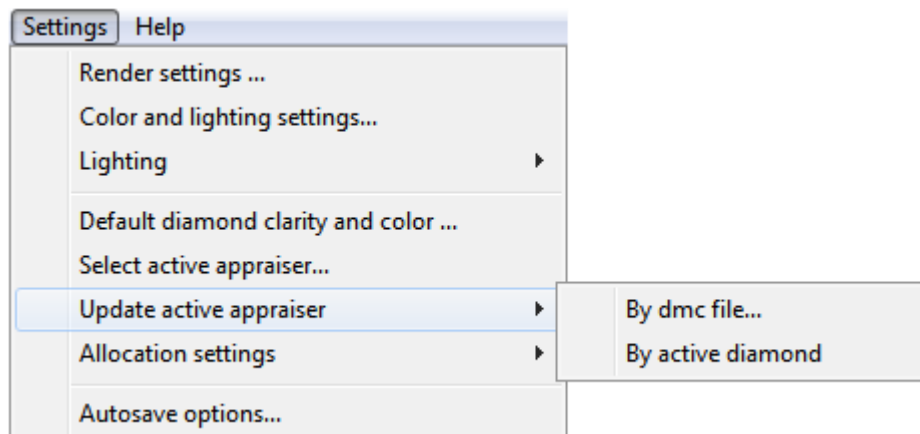
A linked appraiser is an appraiser with ranges for any parameter determined by the values of the parameter from a **DMC** file from the diamond defined by user.

For example:

```
[cut]
Name: Brilliant
Quality: EX VG GD FR
Parameters: \
UpAngle (°) \
GirdleHeight_GIA (%) \
Optimize: Table Table Table \
DownAngleLevel0 Pavilion Pavilion \
DownAngleLevel1 UpHeight_GIA UpHeight_GIA \
GirdleHeight GirdleHeight_GIA GirdleHeight_GIA \
UpAngle UpAngle UpAngle_uHFix \
DownAngle DownAngle DownAngle \
GirdleRatio GirdleRatio GirdleRatio \
UpAngleLevel0 UpAngle UpAngle \
DiamondBase: /file Name.dmc
DiamondStart: /file Name.dmc
Mass: 0.00 100000 \
-0.5 0.5 -0.1 0.2 \
-1.0 1.0 -0.3 0.5 \
-1.5 1.5 -1.0 1.0 \
-2.0 2.0 -2.0 3.0 \
[end]
```

In the example above the file *Name.dmc* in the lines `DiamondBase` and `DiamondStart` is defined as the base and start diamond, and appraising will be executed with linking to this file.

Suppose that the crown angle value in *Name.dmc* is **35.0** degrees. Then the diamond, after optimization, gets an **EX** grade within the range **-0.5** to **0.5** (i.e. from **34.5** to **35.5**), gets a **VG** grade within the range **-1.0** to **0.8** (i.e. from **34.0** to **36.0**) and so on. The new version of Oxygen allows changing this base file interactively from the application. The **Settings / Update active appraiser** menu offers two options: **By dmc file...** and **By active diamond**.



First option **By dmc file...** allows to select a desired **DMC** file with parameter values known to you. This operation changes the current appraiser and further allocations, and appraising will be done according to this new appraiser.

It is possible to select any diamond in the **Tree** of solutions (thereby the operator renders the diamond active) and then update the appraiser to that active diamond by choosing second option **By active diamond**. From then on, appraising will proceed relative to the diamond selected.

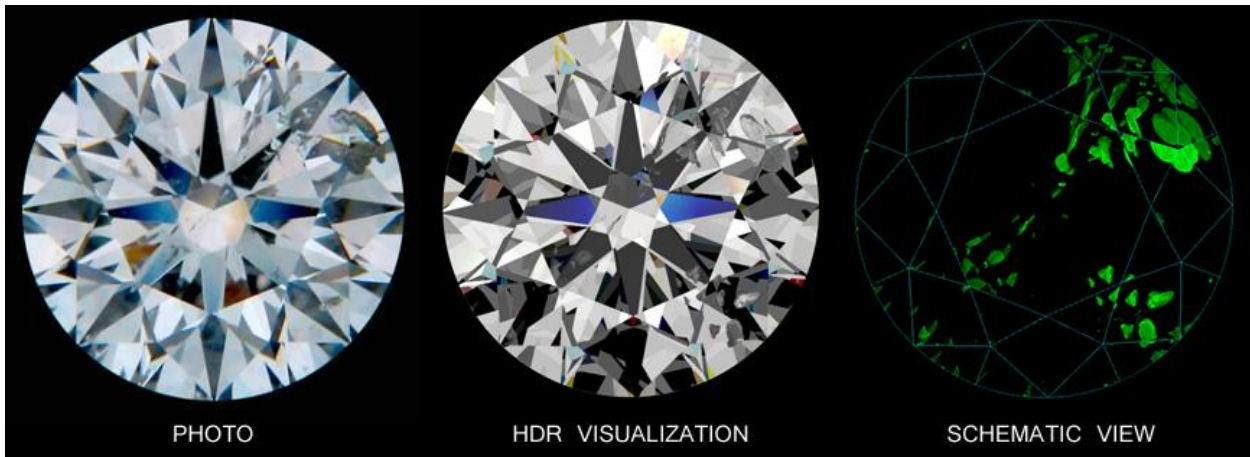
8.9 More precise definition of diamond density

Oxygen since version 3.3 uses a more precise value of the Diamond Density, **3.51524** g/cm³. It leads to more precise calculation of the weights of polished diamonds. The Density value of **3.522** g/cm³ was used in the previous versions of the software.

Warning: Weights of diamonds allocated in previous versions of the program are not recalculated automatically!

9 HDR photorealistic diamond and inclusions visualization

The **Photorealistic** mode allows to make *HDR photorealistic visualization* of allocated diamonds and inner inclusions.



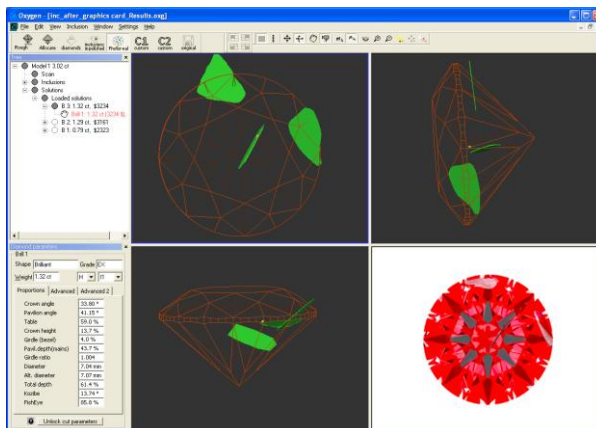
Now all the standard lightings - **Office**, **Disco**, **IdealScope**, **ASET** and other are available in the HDR photorealistic mode. We have also added two new HDR-specific lightings, namely **HDR Default** and **HDR Disco II**, to emphasize the benefits of the HDR visualization.

To view a photorealistic image of an allocated diamond with inclusions inside:

- Load photos used for constructing inclusions. They are needed for more realistic rendering





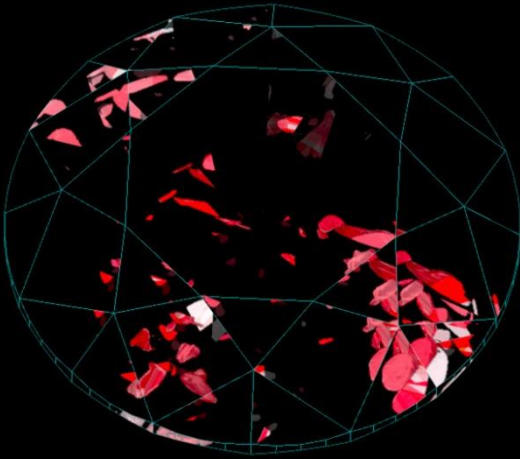
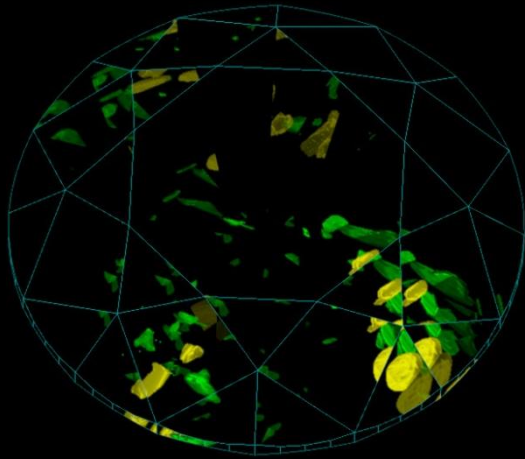
- Press button Photoreal on Toolbar to switch on Photorealistic mode
- Select a diamond in the tree of solutions
- See a photorealistic diamond image in the right bottom corner




Warning! The HDR photorealistic diamond and inclusions visualization requires Graphics hardware supporting specific features. Please test your GPU (Graphics hardware) with [DiamCalc – Graphics Compatibility Evaluator](#) utility. This utility will attempt to render a reference data set in order to check if your Graphics hardware is compatible with new OctoNus HDR rendering engine. Even if you get negative test result the non-HDR visualization will be available in the program. Most of existing Windows computers is compatible with non-HDR OctoNus rendering engine.

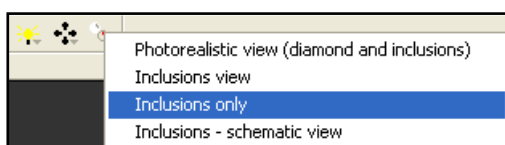
Types of inclusions visualization

There are four types of inclusions visualization available in the program:

	
<p>Photorealistic view (diamond and inclusions)</p>	<p>Inclusions view (increased contrast for enhanced inclusions visibility)</p>
	
<p>Inclusions only</p>	<p>Inclusions – schematic view (with status of inclusion in allocation process)</p>

To select type of inclusions visualization:

- Press button  in the top panel
- Select type of inclusions visualization from the list

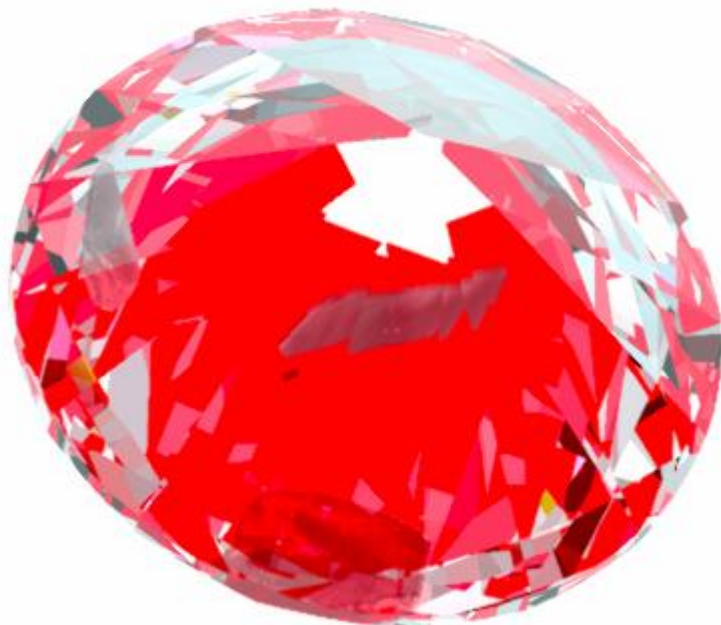




Inclusions texture

If photos used for inclusions construction are loaded into the project, inclusions texture will be created. Textures allow to make more realistic inclusions visualization.

Inclusions with texture:



Inclusions without texture:



Download the example, oxg file with photos:

<http://www.octonus.com/oct/download/files/oxygen/SampleInclusionsRendering.zip>

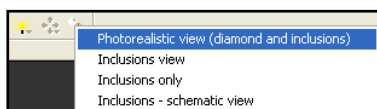
Lighting


The follow lightings are available: **Office, Disco, IdealScope, HDR Default, HDR Disco II, ASET, Heart and Arrows, AI Gilbertson + Wight, DarkField and Office without dispersion.**

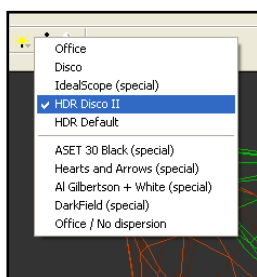
The HDR photorealistic visualization requires Graphics hardware supporting specific feature. Please test you GPU (Graphics hardware) with [DiamCalc – Graphics Compatibility Evaluator](#) utility. This utility will attempt to render a reference data set in order to check if your Graphics hardware is compatible with new OctoNus HDR rendering engine. Even if you get negative test result the non-HDR visualization will be available in the program. Most of existing Windows computers is compatible with non-HDR OctoNus rendering engine.

To see lighting:

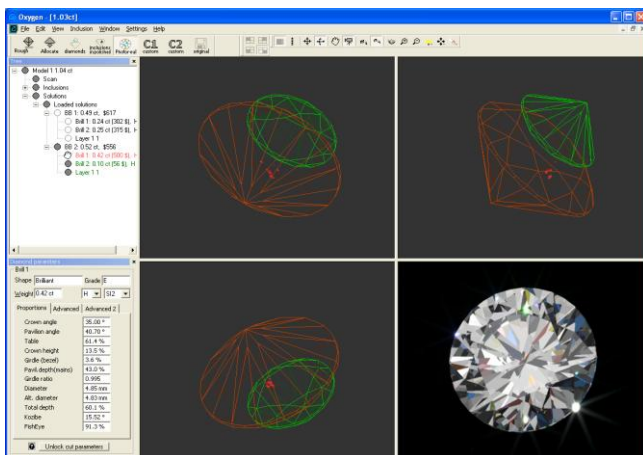
- Be sure you selected **Photorealistic view** type of inclusion visualization (*lighting affects other visualization modes as well, but it might be harder to notice there*)



- Press button  in the top panel
- Select lighting from the list

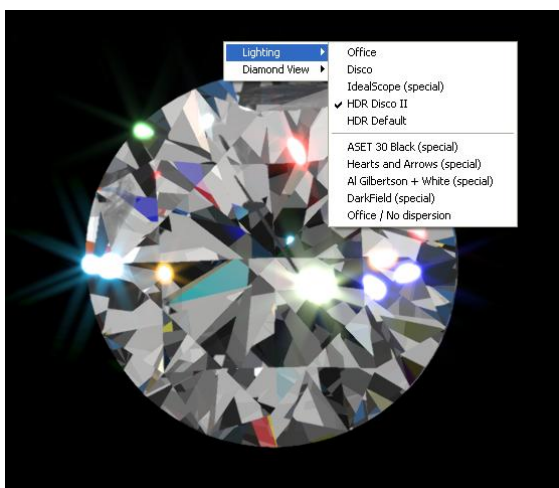


- See photorealistic visualization of a future diamond:



HDR default + Inclusions	HDR Disco II + Inclusions	Dark Field (special)
		

*Note. Use context menu to easy change **Lighting** and **Diamond view**. Right click mouse in Scene and select settings:*

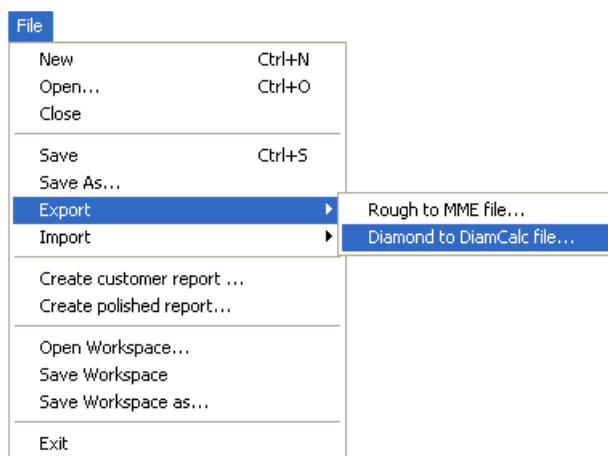


Export of allocated diamonds with inclusions and Helium Polish scanned models into DiamCalc files

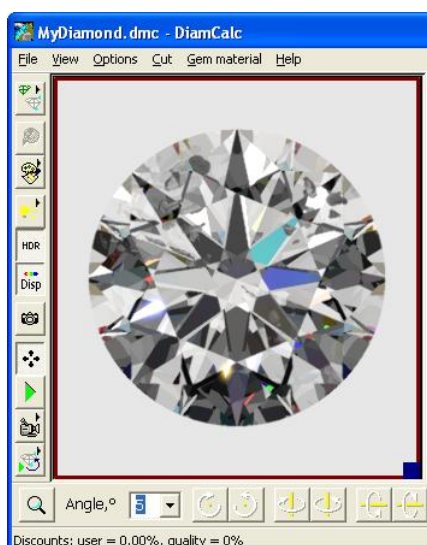
Oxygen allows to make export of allocated polished diamond with its inclusions and textures and Helium Polish scanned models into DiamCalc file.

To make export of polished diamond to DiamCalc file:

1. Select Polished diamond in the list of Oxygen solutions
*To export HP scanned model instead of Solution diamond deselect any allocated diamond in the Tree, for example click on item **Scan** in the Tree*
2. Select from menu **File / Export / Diamond to dmc file...**



3. Save file
4. Open your DMC file with inclusions in DiamCalc



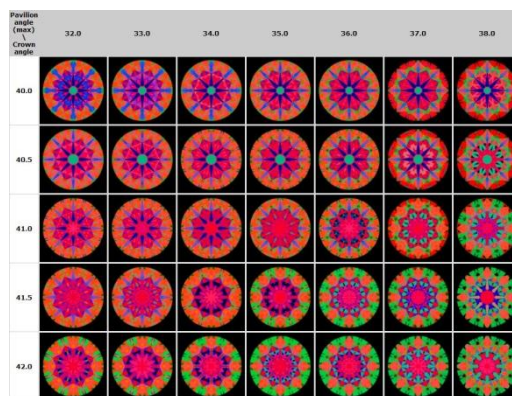
10 Export / Import of DMC files

Oxygen since version 3.3 exports allocated diamond cut into DMC file in parametrical mode that further allows modifying and optimising the parameters of cutting in the DiamCalc software: DiamCalc, DiamCalc Cut Designer, DiamCalc Pro and DiamCalc Color. DMC cutting with improved proportions could be imported back into the Oxygen solution. Previous Oxygen versions save allocated diamond cut into DMC in the form of a polyhedron only.

New feature of export / import is especially useful for work with fancy colored cuts.

In the beginning of optimization process, a preliminary solution is allocated in the Oxygen. Then allocated diamond from the Oxygen is passed into the DiamCalc Software for analysing and optimizing its colour.

DiamCalc provides possibility to study reflection and refractive powers of a cut; view the cut in different illuminations (a wider set of possible illuminations than in the Photoreal mode of the Oxygen application); generate light propagation patterns; calculate qualitative properties such as light return, fire, scintillation; simulate cut external appearance within a particular environment like panorama; perform diamond proportion for certain spectrum; etc.



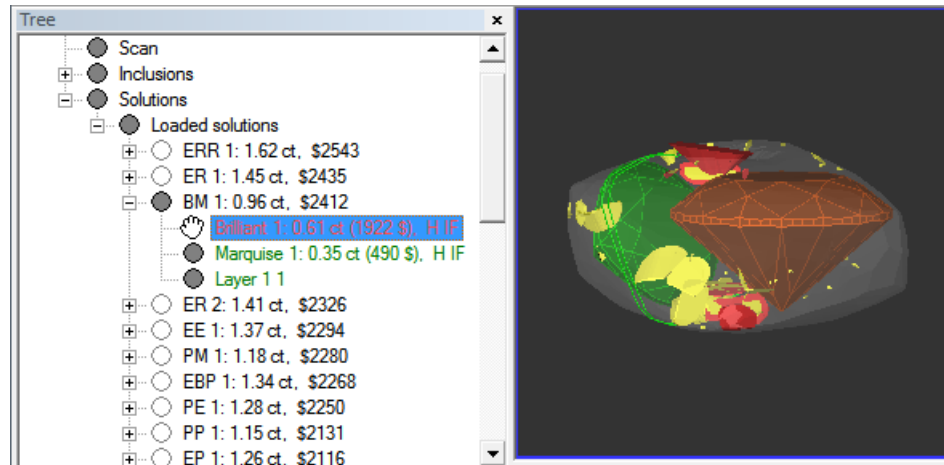
If, in the course of operation with a polished diamond in the DiamCalc software, its optical behavior was improved, then the modified cut saved in the DMC format that can be imported back into its original Oxygen solution. In the Oxygen a final optimization of polished diamond is performed (finding maximum of weight for obtained proportions).

Similarly, optimization can employ authoring cuts generated in DiamCalc CutDesigner.

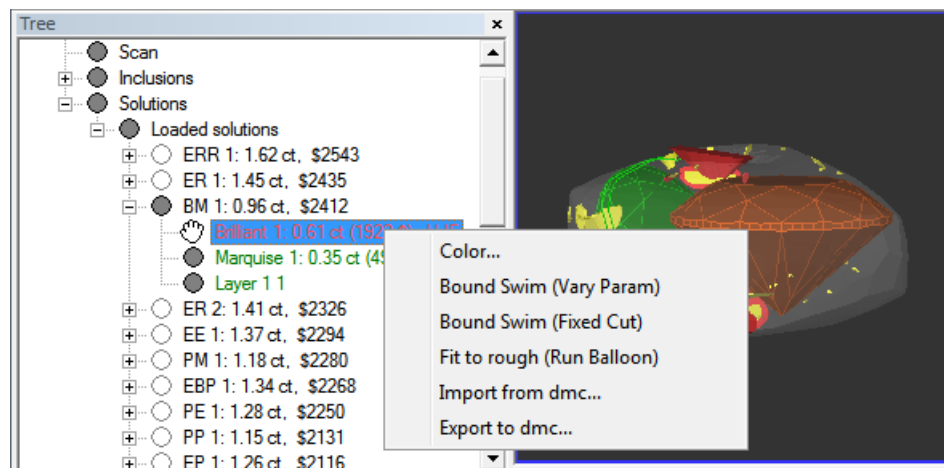
DMC Export/Import options are available from context menu in a Tree of solutions.

To make export to DMC from context menu:

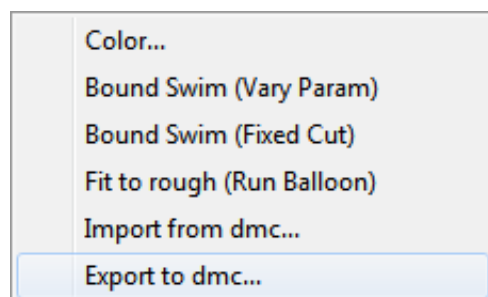
- Select a polished diamond in the solution from **Tree** of solutions



- Right-click on selected diamond



- Choose in context menu **Export to dmc...**

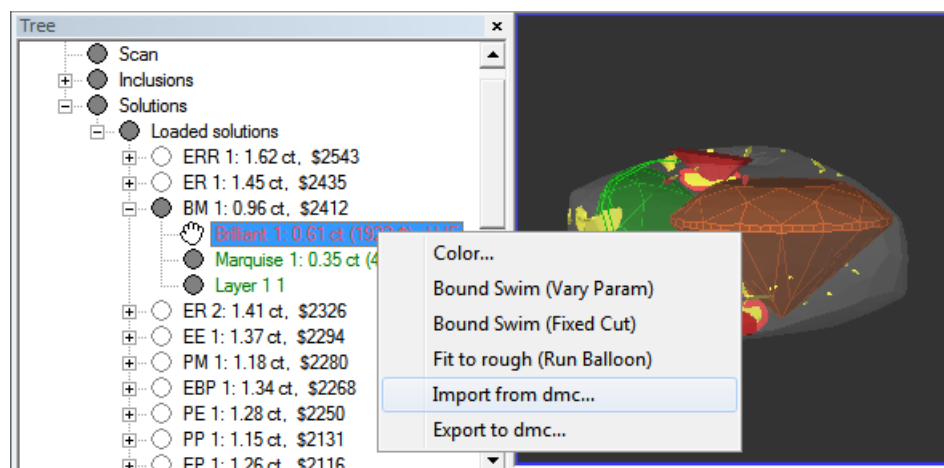


- Save **DMC** file

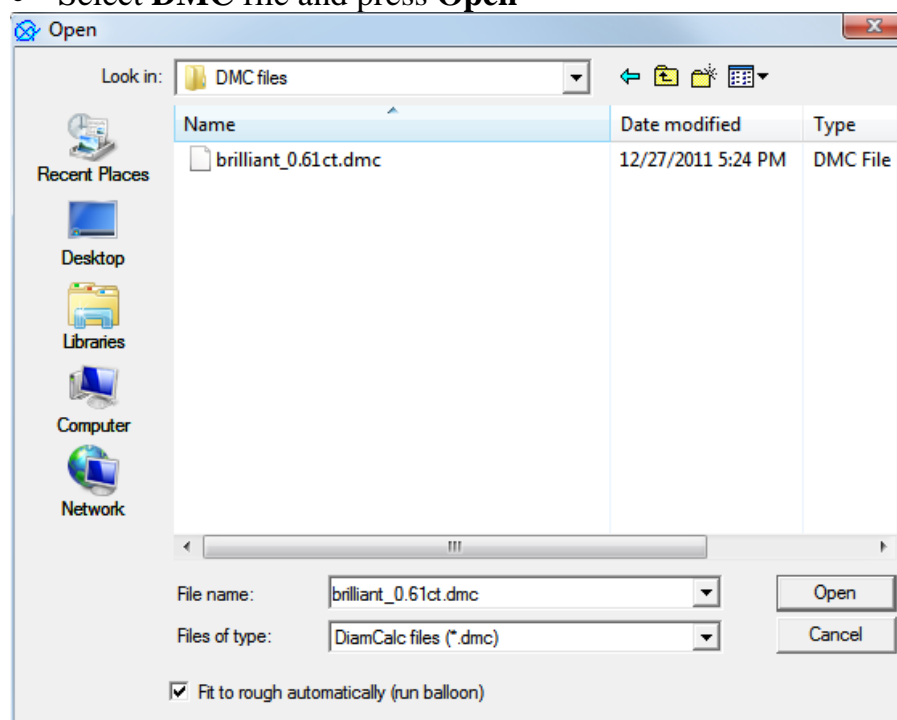
It is also possible to make export to DMC from main menu **File / Export /Diamond to dmc file...** See details in section **HDR photorealistic diamond and inclusions visualization / Export of allocated diamonds with inclusions and Helium Polish scanned models into DiamCalc files**

To import **DMC** file from context menu:

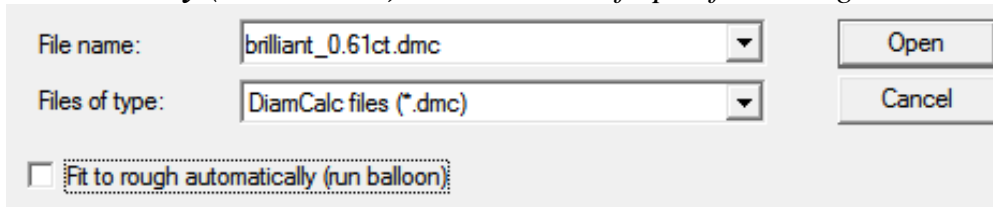
- Select an original polished diamond in the **Tree** that will be replaced by a modified diamond
- Right-click on selected diamond
- Choose in context menu **Import from dmc...**



- Select **DMC** file and press **Open**



- The simple local optimization process for an imported cut is launched automatically with the optimization method **Balloon**.
*Note. In case you do not need to run **Balloon**, unselect checkbox **Fix to rough automatically (run balloon)** in the bottom of open file dialog window.*



- For further local optimization use algorithm **Bound Swim (Fixed Cut)** or **Bound Swim (Vary Param)**. **Bound Swim (Fixed Cut)** performs local optimization of diamond location to find the maximum price keeping the original proportion with no change. **Bound Swim (Vary Param)** additionally tries different proportions.

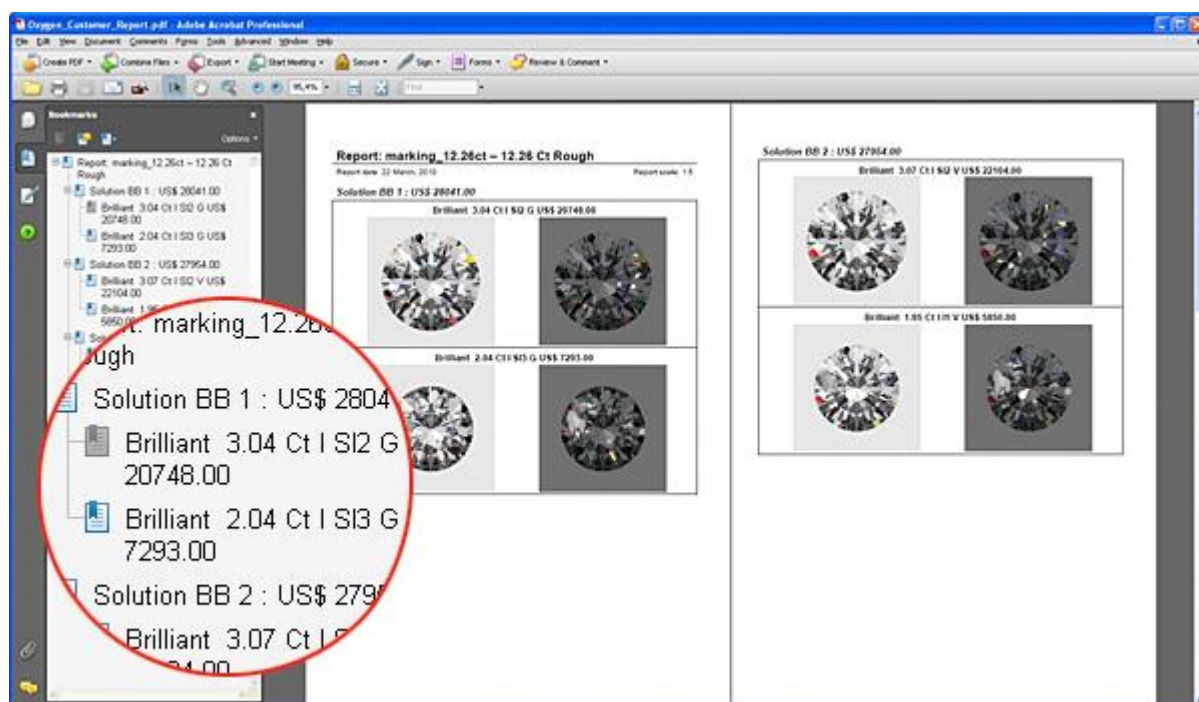
11 Creating reports

Oxygen Software allows creating MS Word reports for Oxygen solutions and for allocated diamonds. There are *Oxygen Customer reports* and *Oxygen Polish reports*. Oxygen Polish reports are available in HTML format also.

Oxygen Customer report

Oxygen Customer report is a report with Oxygen solutions list. It contains a lot of options defined by user, like different oxygen lighting for images, size of published pictures and etc.

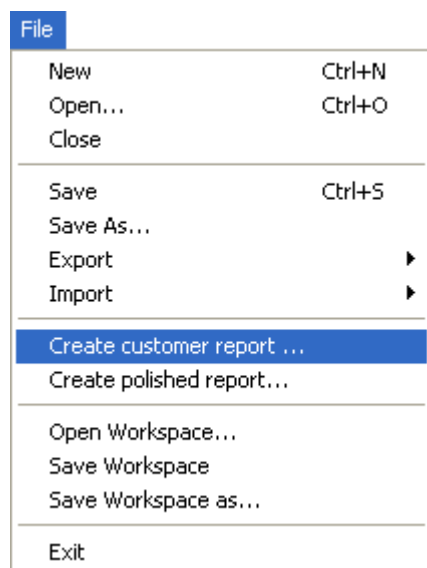
Please see example of new report:



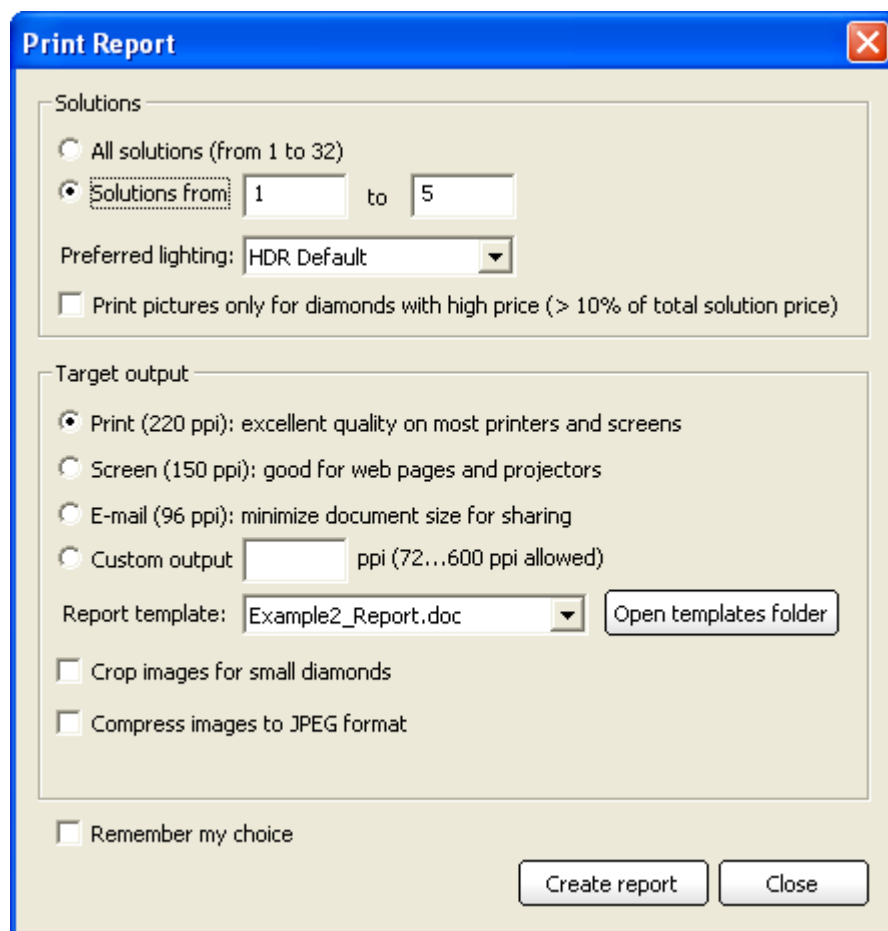
[Download Oxygen Customer Report \(PDF\)](#)

To create Oxygen Customer reports:

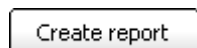
1. Select from menu **File / Create customer report...**



2. Select report options in **Print report** window



3. To create report press button **Create report**



4. For every printing report you can customize the following options:

a) Print all solutions or a number of solutions:

- To print all solutions select radio button **All solutions (from ... to ...)**. Full amount of existing solutions is written automatically in brackets.
- To print a number of solutions select radio button **Solutions from ... to ...** and fill in the numbers **from** and **to**.

b) Select preferred lighting in listbox **Preferred lighting**.

***Preferred lighting** is a lighting used for pictures in report templates. Only the pictures in template marked as type **PreferredLighting** or not marked at all will be lighted with selected light; the others will be lighted as it is written in template (see section **Oxygen Customer reports** for details).*

c) Select checkbox **Print pictures only for diamonds with high price** if you do not want to include diamonds with low price into the report.

***Note.** If this checkbox is unchecked all the diamond will be printed in report.*

d) Select one of three predefined print qualities or input your preferences.

We recommend to use:

- Print quality **220 ppi** for printing
- Screen quality **150 ppi** to view report on the monitor, projector or to upload on site
- and E-mail quality **96 ppi** to send report on e-mail

Or select **Custom output** checkbox and input your own ppi in text field.

e) All available templates are shown in **Report template** listbox. How to get the default set of templates is described below.

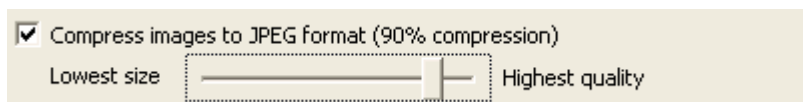
f) To see the images of small diamonds with small size and images of large diamonds with big size use checkbox **Crop images for small diamonds**.



Note. Size of the drawn diamond itself is not changed. Only white margins are cut.

If checkbox **Crop images for small diamonds** is unchecked all the pictures have same size.

g) **Compress images to JPEG format** checkbox can be used to reduce document size by compressing the images. Select **Compress images to JPEG format** checkbox to activate the slider of JPEG quality. Move slider mark to left side to make worse quality and less document size. Move slider mark to right side to make better quality and bigger document size.



Uncheck **Compress images to JPEG format** to get images with the maximum best quality.


h) **Remember my choice** checkbox is available in the bottom of the dialog window. Check it to remember current settings for the next reports. If you are experimenting with settings and do not want to use current settings next time uncheck it.

Report templates are placed in the **CustomerReportTemplates** folder. The general path is:

[Application Data]\OctoNus Software\CustomerReportTemplates

For example in default Windows XP installation the path is:

C:\Documents and Settings\All Users\Application Data\OctoNus Software\CustomerReportTemplates

To open folder **CustomerReportTemplates** press button  in **Print report** window.

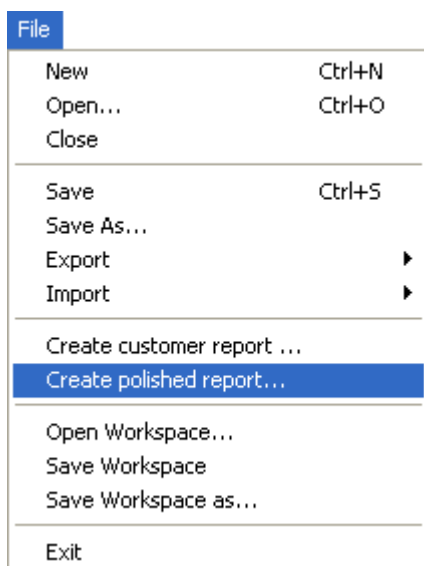
Customer Reports templates are easy customized, read details in section **Customizing Oxygen Customer Reports**

Oxygen Polish reports

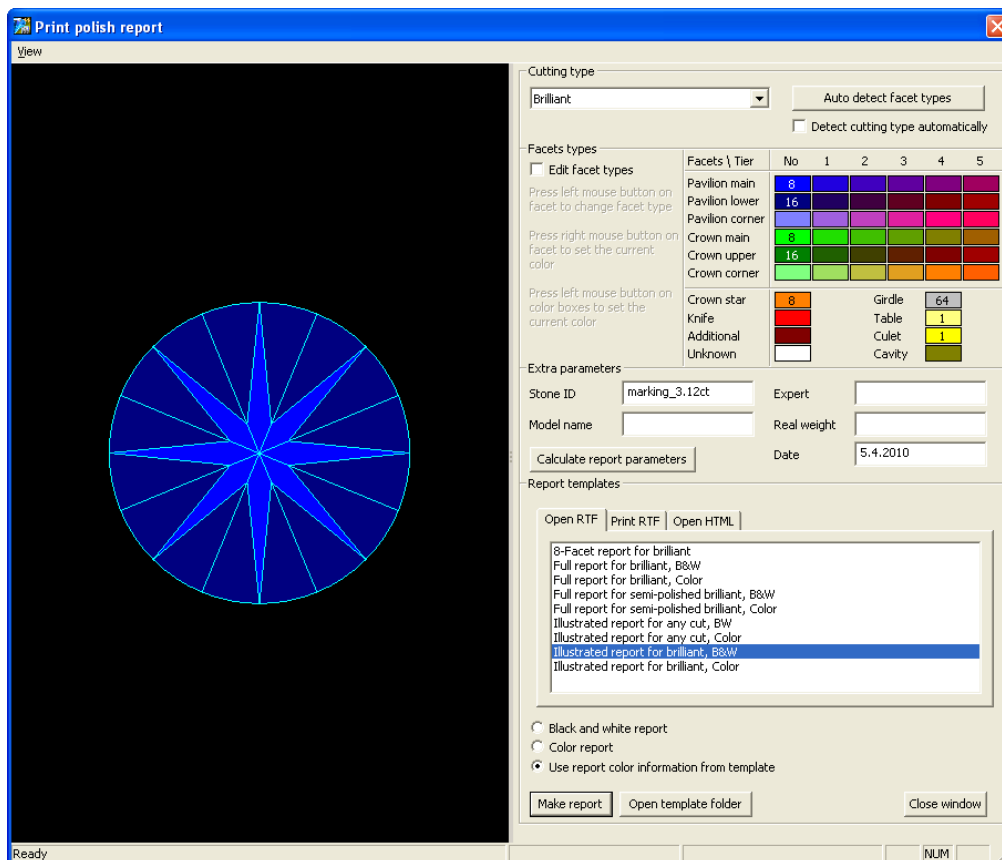
Oxygen Polish reports are available for allocated diamond and Helium Polish scanned models. It is the same reports as in Helium Polish or DiamCalc.

To create Oxygen Polish report:

1. Select Polished diamond in the list of Oxygen solutions
*To use Helium Polish scanned model instead of allocated diamond deselect any allocated diamond in the Tree, for example click on item **Scan** in the Tree*
2. Select from menu **File / Create polished report...**



3. Print polish report window opens



4. Select type of report in the section **Reports templates**.

- If you choose report from **Open RTF** tab the Oxygen will fill the chosen template with report parameters and pictures and launch MS Word.
- If you choose report from **Print RTF** tab the filled report will be sent to default printer and MS Word will close.
- Reports from **Open HTML** tab will be shown in your default browser.

All available templates are shown in these tabs. How to get the default templates set is described below.

5. Select color of report:

- **Black and white:** images in generated report will be grayscaled
- **Color:** report will be generated with color images
- **Use report color information from template:** report template includes color information in it. With this option report will be generated with color settings, stated in selected template. Other options ignore color information in template. If template is not contain color information and this option is chosen, report will be generated in color (see section **Customizing Oxygen / DiamCalc Polish report** for details).

6. Press button **Make report** to create report



7. When the dialog opens, the cutting type of the model is defined automatically and all facets of the model are colored according to their types. Generally you will not need to **Oxygen documentation**

alter them. If cutting type seemed to be defined wrong, you can choose proper cutting type in listbox **Cutting type**. Click button **Auto detect facet types** to assign facet types according to selected cutting. If checkbox **Detect cutting type automatically** is checked, the cutting type will be defined automatically before assigning facet types, manually selected type will be overwritten.



Check **Edit facet types** checkbox if cutting is set properly but facets types seem to be wrong.

Set facet type:

- Click on color you want in color table on the right panel in section **Facet types**
- Click on facet you want to recolor

Another way to set facet type:

- Right-click on right-colored facet
- Left-click on wrong-colored facet
- It will change its color to the first facet's color

Facets types		Facets \ Tier	No	1	2	3	4	5
<input checked="" type="checkbox"/> Edit facet types Press left mouse button on facet to change facet type Press right mouse button on facet to set the current color Press left mouse button on color boxes to set the current color	Pavilion main	8	Blue	Blue	Purple	Purple	Purple	Purple
	Pavilion lower	16	Dark Blue	Dark Blue	Dark Purple	Dark Purple	Dark Purple	Dark Purple
	Pavilion corner		Light Blue	Light Blue	Light Purple	Light Purple	Light Purple	Light Purple
	Crown main	8	Green	Green	Olive	Olive	Olive	Olive
	Crown upper	16	Dark Green	Dark Green	Dark Olive	Dark Olive	Dark Olive	Dark Olive
	Crown corner		Light Green	Light Green	Light Olive	Light Olive	Light Olive	Light Olive
	Crown star	8	Orange	Orange	Light Orange	Light Orange	Light Orange	Light Orange
	Knife		Red	Red				
	Additional		Dark Red	Dark Red				
	Unknown		White	White				
	Girdle				32			
	Table					1		
	Culet						Yellow	
	Cavity							Olive

Uncheck **Edit facet types** checkbox to fix facet types.


Adjust extra parameters like **Model name** and **Expert name** also.

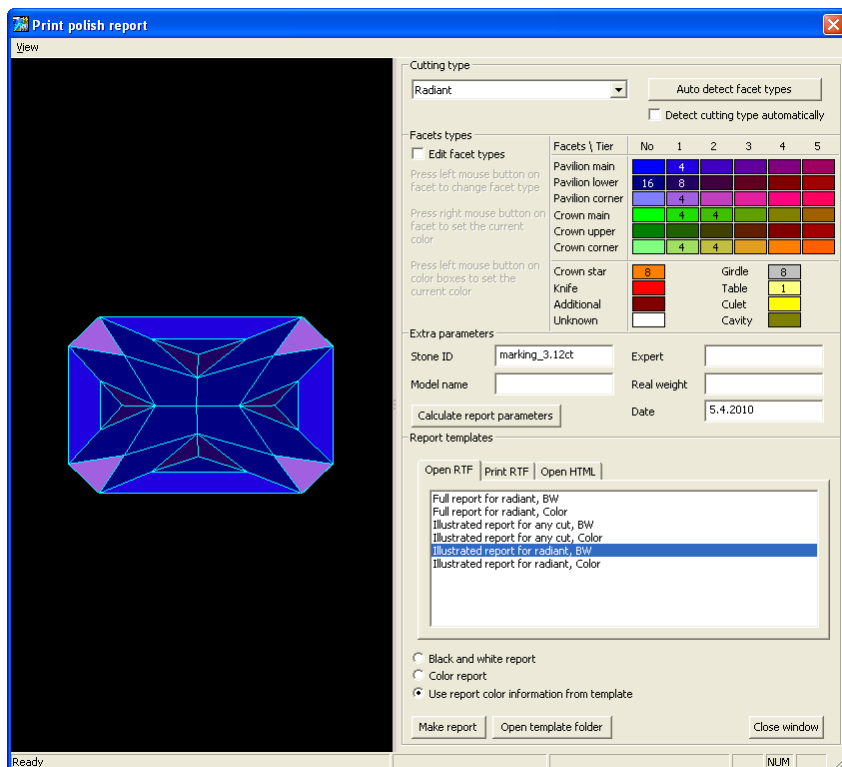
Oxygen software allows creating reports based on templates in the MS Word rich-text format **RTF** and **HTML** formats. Report templates are placed in the **PolishReportTemplates** folder. The general path is:

[Application Data]\OctoNus Software\PolishReportTemplates

For example in default Windows XP installation the path is:

C:\Documents and Settings\All Users\Application Data\OctoNus Software\PolishReportTemplates

To open folder **PolishReportTemplates** press button  in **Print polish report** dialog window.



OctoNus Software offer an utility for installing set of templates:

<http://www.octonus.com/download/reports/OctoNusReportTemplateSetup.exe>

There are both templates for Customer reports and Polish reports. Download and run this exe, then follow its instructions to install default set of templates.

Oxygen users can take these templates and customize them for their needs or create new templates.

*It is possible to convert the old type report templates with .ini files from previous DiamCalc and Helium programs for use with new programs. **PolishReportsFormatConverter.exe** utility converts these old templates into the new format and save them to template folder.*

Customization of Oxygen Polish reports is not the same like it was in the Helium Polish. It is easy. **INI** files not need any more. Read details in section **Customizing Oxygen / DiamCalc Polish report**

12 Customizing Oxygen Customer reports

Oxygen Customer report is a list of solutions, annotated with some additional information: report creation date, rough stone ID, rough weight and scale of diamonds images in the report. Every solution is represented as a table; it contains general information about solution and its diamonds. Every diamond is represented as a table also, it contains diamond information.

Formatting of solutions, diamonds and other report items are defined in template file.

Report templates are placed in the **CustomerReportTemplates** folder. The general path is:

[Application Data]\OctoNus Software\CustomerReportTemplates

For example in default Windows XP installation the path is:

C:\Documents and Settings\All Users\Application Data\OctoNus Software\CustomerReportTemplates

To open folder **CustomerReportTemplates** press button  in **Print report** window.

Print Report

Solutions

All solutions (from 1 to 32)

Solutions from: to

Preferred lighting:

Print pictures only for diamonds with high price (> 10% of total solution price)

Target output

Print (220 ppi): excellent quality on most printers and screens

Screen (150 ppi): good for web pages and projectors

E-mail (96 ppi): minimize document size for sharing

Custom output ppi (72...600 ppi allowed)

Report template:

Crop images for small diamonds

Compress images to JPEG format

Remember my choice

Template file is a **.doc** or **.rtf** file. Selected template file is scanned by software during report generation: the table of solutions is cloned for all the solutions, and table of diamonds is cloned for all diamonds in all solutions. The tables are marked with special bookmarks in a special manner. Properties of solution and diamond, placed in these tables, are also marked with special bookmark.

There is a full list of all available bookmarks. Use any of these bookmarks, but **SOLUTIONTABLE**, **DIAMONDTABLE** and **DIAMONDPLACEINSOLUTIONTABLE** are necessary.

REPORTDATE – date when report is generated. It should be placed outside of solution and diamond tables.

ROUGHID – ID of rough stone. It should be placed outside of solution and diamond tables.

ROUGHWEIGHT – weight of rough stone, in carats. It should be placed outside of solution and diamond tables.

REPORTSCALE – scale of images presented in the report, as compared with the original diamond size. It should be placed outside of solution and diamond tables.

SOLUTIONTABLE – this bookmark is required. It marks 1 or more symbols in the first cell of Solutions table (first cell is a cell placed in the first row in the first column). With this bookmark, report generator understands which of template elements is a solution table.

SOLUTIONNAME – name of solution. It should be placed in solution table.

SOLUTIONPRICE – full solution price. It should be placed in solution table.

DIAMONDPLACEINSOLUTIONTABLE – this bookmark is required. It marks the place in solution table row, where diamond table will be placed. Diamond table should be placed in a single row of solution table. This row with formatting will be copied for every diamond table of solution. The bookmark should be placed in this single row.

DIAMONDTABLE – this bookmark is required. It marks 1 or more symbols in the first cell of the Diamond table. Diamond table should be placed in a single row of solution table. This row with formatting will be copied for every diamond table of solution.

DIAMONDCUTTING – name of cutting of diamond. It should be placed in diamond table.

DIAMONDWEIGHT – weight of diamond, in carats. It should be placed in diamond table.

DIAMONDCLARITY – clarity of diamond. It should be placed in diamond table.

DIAMONDCOLOR – diamond color. It should be placed in diamond table.

DIAMONDGRADE – grade of diamond. It should be placed in diamond table.

DIAMONDPRICE – price of diamond. It should be placed in diamond table.

DIAMONDPIC1, DIAMONDPIC2, ..., DIAMONDPIC9 – image of diamond, in a scale pointed by REPORTSCALE bookmark. The scale is chosen as the biggest possible. Note, that image has a predefined physical size 30% of page width, so provide enough place for it in the diamond table.

For **DIAMONDPIC N** , where **N** is a number in range **1...9**, is possible to customize parameters of diamond image, such as lighting, position and mode. Customization is performed according to content of the correspondent bookmark. The text between start and end of the corresponding bookmark is analyzed, and diamond image is generated with specified properties from a fixed list. Properties should be listed in arbitrary order, delimited with space, comma or semicolon.

For example:

[Inclusions; Top; HDR Default](#)

There is a list of all possible properties below. Words are case-sensitive.

Image type:

- Photorealistic
- Inclusions
- InclusionsOnly
- InclusionsSchematic

Diamond position:

- Top
- Pavilion
- TableUp
- TableDown

Lighting:

- Office
- Disco
- IdealScope
- ASET30Black
- HeartsAndArrows
- AlGilbertsonWhite

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- 
- DarkField
 - OfficeNoDispersion
 - HDRDiscoII
 - HDRDefault
 - PreferredLighting

Special value [PreferredLighting](#) means that lighting can be selected in the Reports dialog from menu **File / Create customer report...**).

If any property of image is not specified then the default value is used. Default values are [Photorealistic](#), [Top](#), [PreferredLighting](#).

13 Customizing Oxygen / DiamCalc Polish reports

13.1 Introduction

Oxygen software allows creating reports based on templates in the MS Word rich-text format **RTF** and **HTML** formats. Report templates are placed in the **PolishReportTemplates** folder. The general path is:

[Application Data]\OctoNus Software\PolishReportTemplates

For example in default Windows XP installation the path is:

C:\Documents and Settings\All Users\Application Data\OctoNus Software\PolishReportTemplates

To open folder **PolishReportTemplates** press button  in **Print polish report** dialog window.

OctoNus Software offer an utility for installing set of templates:

<http://www.octonus.com/download/reports/OctoNusReportTemplateSetup.exe>

There are both templates for Customer reports and Polish reports. Download and run this exe, then follow its instructions to install default set of templates.

Oxygen users can take these templates and customize them for their needs or create new templates.

*It is possible to convert the old type report templates with .ini files from previous DiamCalc and Helium programs for use with new programs. **PolishReportsFormatConverter.exe** utility converts these old templates into the new format and save them to template folder.*

*Download **PolishReportsFormatConverter.exe** utility:*

<http://www.octonus.com/download/PolishReportsFormatConverter.exe>

Customization of Oxygen Polish reports is not the same like it was in the Helium Polish. It is easy. **INI** files not need any more.

13.2 Using RTF report templates

RTF file defines appearance of the generated report. The main idea is that the RTF file is a template for the report. During report creation Oxygen software searches the RTF file for specific bookmarks and replaces them with parameter values. All known bookmarks will be replaced with the corresponding parameter values. All unknown bookmarks will be left intact. If some parameter value is not available, the corresponding bookmark will be left intact. If you don't want to see some parameter's value in the report, just remove

the corresponding bookmark. For example, the text in the file marked with the bookmark **TOTAL_DEPTH_MM** will be replaced with the total height of the diamond in millimeters. Make sure that all bookmark names are written in capital letters. If it is necessary to put the same parameter's value several times in the report, you may use the following technique. RTF file can not contain two bookmarks with the same names. So add a **_COPY_N** suffix to the primary bookmark's name, for example, **TOTAL_DEPTH_MM_COPY_1**. Thus, both bookmarks **TOTAL_DEPTH_MM** and **TOTAL_DEPTH_MM_COPY_1** will be replaced with the value of the same parameter – the total height of the diamond in millimeters.

To see the list of all available bookmarks in a file, to add and delete them you may use MS Word. Open RTF file in it and choose menu **Insert/Bookmark..** Write bookmark name and click button **Add**. The bookmark will be added to the list.

For polish report templates, all the service bookmarks can be divided into four groups:

Group 1. General properties for the whole document

Avery report should contain one special bookmark named **GENERAL_PROPERTIES**, where properties are included: name of the template, cutting type, etc. After report generation this bookmark with its contents is deleted. This bookmark only helps to generate report. Its format is described in section (i). Bookmark should contain text in described format.

Group 2. Parameters Bookmarks for computable values, such as girdle diameter, in mm or %. Bookmark may contain any text; it will be replaced with calculated value during report generation.

Group 3. Pictures Bookmarks for pictures, such as symmetry plot. Bookmark may contain any text; it will be replaced with a proper picture during report generation.

Group 4. Customizable pictures Bookmarks for customizable pictures. There are 4 types of view for customizable pictures:

- [POLISH_MODEL_REPORT](#)
- [POLISH_ANGLES_REPORT](#)
- [POLISH_SIDES_REPORT](#)
- [PROFILE_VIEW_REPORT](#)

Bookmarks of customizable pictures can contain options. Its format is described in section (ii).

i) General properties for the whole document

A special bookmark **GENERAL_PROPERTIES** is necessary to generate RTF report. In this bookmark, main properties of template are numbered, such as template name, cutting type, and some others (they will be described below). The bookmark can be placed

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anywhere in document; we recommend to place it at the end of the document in order user can see document formatting not paying much attention on this service thing. Properties of bookmark are listed one by one *without spaces*, delimited with semicolon. An example of **GENERAL_PROPERTIES** bookmark contents:

```
[ReportType=PolishRTF;VisibleName=Standart report for
Brilliant;CuttingType=Brilliant;ColorReport=0;
Pictures=POLISH_MODEL_REPORT_PAV_VIEW,
POLISH_MODEL_REPORT_CRN_VIEW]
```

ReportType

This option is mandatory. It is a mark which shows that this document is a template. For polish reports, its value should be [PolishRTF](#). Other possible value is [PolishHTML](#) for HTML reports.

VisibleName

This option is mandatory. It specifies the name, which is shown in a list of templates in Polish report dialog in Oxygen.

CuttingType

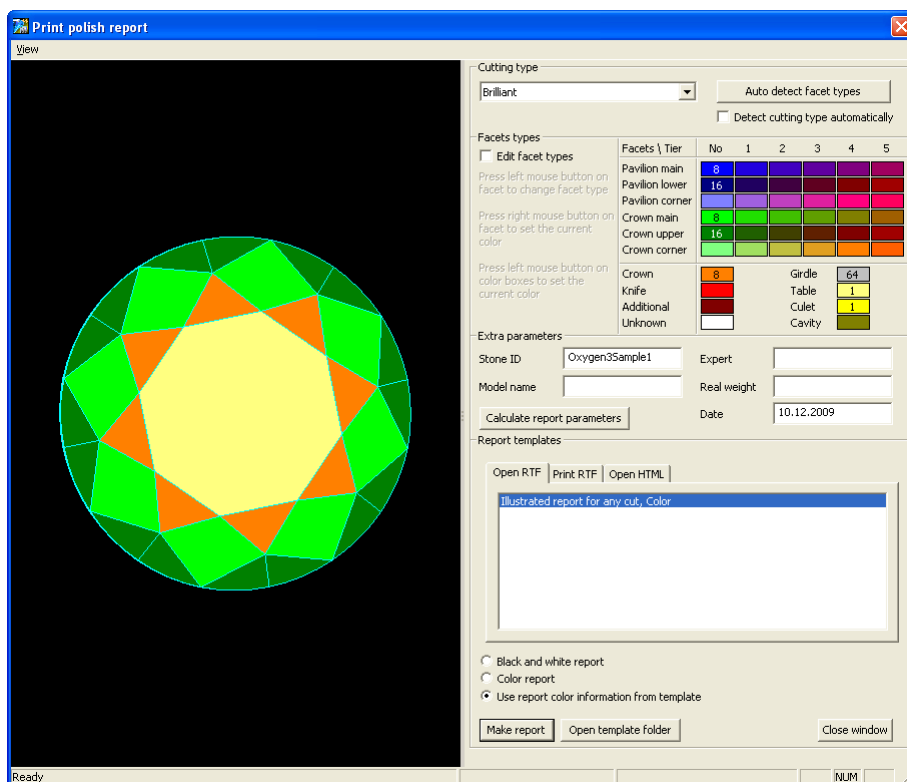
This option is mandatory. It specifies cutting type, for which the template is available. It identifies the cutting for which this report template is made. Different cuttings may have different set of parameters and different meaning of the same parameters. That is why it may be necessary to make report templates for each type of the cutting. [CuttingType](#) value can be one of the following:

- [BRILLIANT](#) - brilliant
- [FANCYROUND](#) - oval, marquise, pear
- [FANCYPRINCE](#) - princess
- [FANCYSTEP CUT](#) - emerald, stepcuts
- [CUSHION](#) - cushion
- [RADIANT](#) - radiant
- [SQUARERADIANT](#) - square radiant
- [ALL](#) - any type of cutting

ColorReport

This option is optional. It specifies the type of report. [ColorReport](#) value can be *1* - for *color* reports or *0* - for *black-and-white* reports.

However, in Polish reports dialog in Oxygen possible to create *color* report, *black-and-white* report or *use report color information from template*. See bottom of section **Report templates** in the dialog window **Print polish report**:



Picture

This option is optional. It is used for listing of bookmarks for pictures that require additional attributes - customizable pictures. Bookmarks names should be listed one by one without spaces and delimited by comma. Attributes themselves should be written in corresponding bookmark. In the above example, it is shown that at bookmarks **POLISH_MODEL_REPORT_PAV_VIEW** and **POLISH_MODEL_REPORT_CRN_VIEW** additional attributes of pictures are placed.

ii) Customizable pictures

Picture bookmarks with additional attributes should contain text with attributes in format **Name=Value**, listed one by one *without spaces*, delimited with semicolon. For example:

```
[PictureID=POLISH_MODEL_REPORT;X=0;Y=0;Z=180;InvisibleEdges=1;
VisibleSidesInColor=0;VisibleEdgesColorR=0;VisibleEdgesColorG=0;
VisibleEdgesColorB=0;InvisibleEdgesColorR=192;InvisibleEdgesColorG=192;
InvisibleEdgesColorB=192]
```

Attributes names are fixed and values are specified by user.



PictureID

This attribute is mandatory. It can have one of the following values written in capital letters:

- POLISH_MODEL_REPORT
- POLISH_ANGLES_REPORT
- POLISH_SIDES_REPORT
- PROFILE_VIEW_REPORT

Picture with the **POLISH_MODEL_REPORT** value contains a simple model of the polished diamond without inscriptions above it. Picture attributes allow to specify whether to draw invisible edges or not, orientation of the model, color and aspect ratio of the picture.

Picture with the **POLISH_ANGLES_REPORT** value contains a model of the polished diamond with facet angles inscribed above the model. Picture attributes allow to specify the orientation of the model, what angles to write, font size, aspect ratio and color of the picture.

Picture with the **POLISH_SIDES_REPORT** value contains a model of the semi-polished diamond with information about all facets inscribed above the model. Picture attributes allow to specify the orientation of the model, what information to write (angles/heights), precision, font size, aspect ratio and color of the picture.

Picture with the **PROFILE_VIEW_REPORT** value contains a side view of the model of the polished diamond with the values of basic parameters inscribed above the model. Picture attributes allow to specify the font size, aspect ratio and color of the picture.

X, Y, Z

These attributes are optional. If such key is not specified it is assumed to be zero. It is the angle of rotation of the 3D model around X, Y, Z axis in degrees before making the final image. This attribute allows to create various views of the same model.

InvisibleEdges

This attribute is optional. It specifies the way of drawing invisible edges of the 3D model. Possible values are:

0 – invisible edges are not drawn

1 – invisible edges are drawn without refraction

2 – invisible edges are drawn taking refraction of the light into consideration

If this key is not specified it is assumed to be equal to 1.

VisibleSidesInColor

This attribute is optional. It specifies the way of coloring of visible edges.

Possible values are:

0 – black and white scheme. For example, extra facets will be drawn in gray color

1 – color scheme (for example, extra facets will be drawn in blue color).

If this key is not specified it is assumed to be equal to 0.



VisibleEdgesColorR, VisibleEdgesColorG, VisibleEdgesColorB

These attributes are optional. If such key is not specified it is assumed to be zero. They specify the RGB color for drawing visible edges of the 3D model.

InvisibleEdgesColorR, InvisibleEdgesColorG, InvisibleEdgesColorB

These attributes are optional. If such key is not specified it is assumed to be zero. They specify the RGB color for drawing invisible edges of the 3D model. 6

AspectRatioX, AspectRatioY

These attributes are optional. If such key is not specified it is assumed to be zero. They specify the desired proportions of the generated picture. If the actual proportions of the picture differ from the specified, blank margins are added.

PavilionView

This attribute specifies orientation of the model.

Possible values are:

- 0 – Crown view
- 1 – Pavilion view

If this key is not specified it is assumed to be equal to 1.

PictureType

This attribute specifies the way of drawing the picture.

If [PictureID=POLISH_ANGLES_REPORT](#) then possible values for parameter [PictureType](#) are:

- 0 – invisible edges are drawn taking refraction into account, slope angles of main facets are written near facets;
- 1 – invisible edges are not drawn, slope angles of all facets are written;
- 2 - invisible edges are not drawn, azimuth angles of all facets are written;
- 3 - invisible edges are not drawn, deviation of slope angles from the average are written;
- 4 - invisible edges are not drawn, deviation of azimuth angles from ideal are written;
- 5 - invisible edges are not drawn, slope angles of main facets are written near facets together with the maximum inscribed circle and section of the model with the plane in which the circle lies;
- 6 - invisible edges are not drawn, slope angles of main facets are written above facets together with the maximum inscribed circle and section of the model with the plane in which the circle lies.

If [PictureID=POLISH_SIDES_REPORT](#) then possible values for parameter [PictureType](#) are:

- 0 – slope angles of all facets are drawn;
- 1- azimuth angles of all facets are drawn;
- 2 – heights in % of all facets are drawn;
- 3 - heights in mm of all facets are drawn.

Colored

This attribute is optional. Default value: 0. The program generates black and white pictures if it is 0 and colored otherwise.

FontSize

This attribute is optional. Default value: 100. This parameter adjusts the font height on the picture. It specifies the ratio between desired and default font size. For example, if FontSize=200, all text on the picture will be twice higher than default.

Precision

This attribute is optional. Default value: 2. This parameter is applicable to pictures with [PictureID=POLISH_SIDES_REPORT](#). It specifies the number of decimal digits used when writing facet angles or heights.

TitleLengthGirdleFacet, TitleDepthGirdleFacet

These attributes are optional. They specify the text that will be written on the picture above the corresponding parameter values. When the font size is large the default text may appear too big to fit the picture and you may want to change it.

13.3 Using HTML report templates

The HTML file defines the appearance of the generated report. During report creation Oxygen software searches the HTML file for specific bookmarks and replaces them with parameter values. In HTML file, bookmark is `<a>` tag with name attribute specifying bookmark name.

The bookmarks descriptions are similar as in RTF report templates. As in RTF polish report templates, all the service bookmarks can be divided into four groups:

Group 1. General properties for the whole document

Avery report should contain one special bookmark named **GENERAL_PROPERTIES**, where properties are included: name of the template, cutting type, etc. After report generation this bookmark with its contents will be deleted. This bookmark only helps to generate report. Its format will be described in section (i). Bookmark should contain text in this format. This bookmark can be placed anywhere in document, for example before closing `</body>` tag.

Group 2. Parameters

Bookmarks for computable values, such as girdle diameter, in mm or %. Bookmark may contain any text, it will be replaced with calculated value during report generation.

Group 3. Pictures

Bookmarks for pictures, such as symmetry plot. Bookmark will be replaced with a proper picture during report generation. Bookmark should contain picture generation options, such as size and file name. Its format will be described in section (iii).

Group 4. Customizable pictures

Bookmarks for customizable pictures. There are 4 types of customizable pictures:

- [POLISH_MODEL_REPORT](#)
- [POLISH_ANGLES_REPORT](#)
- [POLISH_SIDES_REPORT](#)
- [PROFILE_VIEW_REPORT](#)

Bookmarks of customizable pictures can contain options. Its format is described in section (ii).

i) General properties of the whole document

A special bookmark **GENERAL_PROPERTIES** is necessary to generate HTML report. In this bookmark, main properties of template are numbered, such as template name, cutting type, and some others..

ReportType

This option is mandatory. It is a mark which shows that this document is a template. For polish reports, its value should be [PolishHTML](#). Other possible value is [PolishRTF](#) for RTF reports.

VisibleName

This option is mandatory. It specifies the name, which is shown in a list of templates in Polish report dialog in Oxygen.

CuttingType

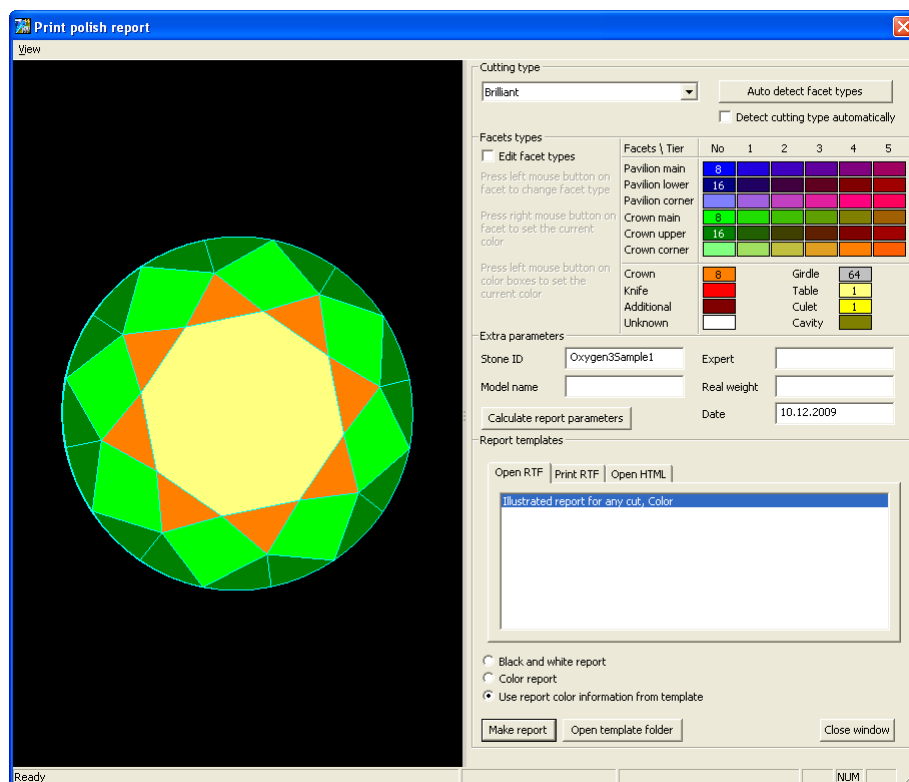
This option is mandatory. It specifies cutting type, for which the template is available. It identifies the cutting for which this report template is made. Different cuttings may have different set of parameters and different meaning of the same parameters. That is why it may be necessary to make report templates for each type of the cutting. [CuttingType](#) value can be one of the following:

- [BRILLIANT](#) - brilliant
- [FANCYROUND](#) - oval, marquise, pear
- [FANCYPRINCE](#) - princess
- [FANCYSTEP CUT](#) - emerald, stepcuts
- [CUSHION](#) - cushion
- [RADIANT](#) - radiant
- [SQUARERADIANT](#) - square radiant
- [ALL](#) - any type of cutting

ColorReport

This option is optional. It specifies the type of report. [ColorReport](#) value can be *1* - for *color* reports or *0* - for *black-and-white* reports.

However, in Polish reports dialog in Oxygen possible to create *color* report, *black-and-white report* or *use report color information from template*. See bottom of section **Report templates** in the dialog window **Print polish report**:



Picture option is optional. It is used for listing of bookmarks for pictures that require additional attributes - customizable pictures. Bookmarks names should be listened one by one without spaces and delimited by comma.

Executable option is optional. In this option an external program can be specified, which opens HTML files. After generation, report will be opened with this program. If no program is stated or the option is absent, the default HTML browser is used.

AutoResultPathParam, **AutoResultPathPrefix**, **AutoResultPathSuffix** options are optional. After report generation, it will be saved in a folder name **<AutoResultPathPrefix >_< AutoResultPathParam >_< AutoResultPathSuffix >** where **<AutoResultPathParam>** means value of bookmark, which is stated in this option, and **<AutoResultPathPrefix>** and **<AutoResultPathSuffix>** mean their values.

For example,

```
AutoResultPathParam=STONE_ID;AutoResultPathPrefix=html;
```

```
AutoResultPathSuffix=report
```

will generate report for stone with STONE_ID = 3_CARAT_BRILLIANT in folder **html_3_CARAT_BRILLIANT_report**.

ResultPath option is optional. If no one of the above options **AutoResultPathParam**, **AutoResultPathPrefix**, **AutoResult** are stated, the path which is in this option is used.

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StaticFiles option is optional. In HTML template `` tags can be used. If such files are local, i.e. they are places in the same folder with template file, they will be copied to result folder. In this option such files names are listed one by one without spaces, delimited with comma.

For example, **GENERAL_PROPERTIES** bookmark:

```
<a name=GENERAL_PROPERTIES>
[ReportType=PolishHtml; VisibleName=Standard report for brilliant;
CuttingType=Brilliant;Executable=;
ResultPath=Html_Polish_Brilliant;AutoResultPathParam=STONE_ID;
AutoResultPathPrefix=html_;AutoResultPathSuffix=; StaticFiles=imageGirdle.gif,
imageCulet.gif,imageTable.gif,imageMIC.gif,link.gif,                ga.gif;
Pictures=POLISH_ANGLES_REPORT_PAV_ANGLES,
POLISH_ANGLES_REPORT_CRN_ANGLES]
</a>
```

It is similar to the same in section Using RTF report template.

ii) Customizable pictures

Picture bookmarks with additional attributes should contain text with attributes in format `Name=Value`, listed one by one without spaces, delimited with semicolon. The list of attributes and their names is the same as in RTF format, plus three attributes which can be used with all types of report pictures:

FileNameEMF, FileNameBMP, FileNamePNG or FileNameGIF

These keys are optional. It should have the file name for the picture in the Windows Bitmap Format (BMP) or Portable Network Graphics Format (PNG) or Graphics Interchange Format (GIF). The Oxygen software creates uncompressed true-color BMP images, compressed true-color PNG images and compressed 8-bit color GIF images. If this key is not specified, the corresponding file will not be created or updated. If this key is specified, two more keys should be specified also: Width, Height.

Width, Height

These keys should be specified if the `FileNameBMP`, `FileNamePNG` or `FileNameGIF` key is present. They specify the maximum width and height of the raster image with the report picture in pixels. The actual picture will fit into the given dimensions preserving the aspect ratio.

iii) Other pictures

The following three attributes should be used with common report pictures, they are similar to the same values of customizable pictures options:



FileNameEMF, FileNameBMP, FileNamePNG or FileNameGIF

These keys are optional. It should have the file name for the picture in the Windows Bitmap Format (BMP) or Portable Network Graphics Format (PNG) or Graphics Interchange Format (GIF). The Helium software creates uncompressed true-color BMP images, compressed true-color PNG images and compressed 8-bit color GIF images. If this key is not specified, the corresponding file will not be created or updated. If this key is specified, two more keys should be specified also: Width, Height.

Width, Height

These keys should be specified if the FileNameBMP or FileNamePNG or FileNameGIF key is present. They specify the maximum width and height of the raster image with the report picture in pixels. The actual picture will fit into the given dimensions preserving the aspect ratio. For example, a bookmark [PLOT_GIRDLE_SYMMETRY](#) for picture may look:

```
<a name="PLOT_GIRDLE_SYMMETRY">  
[FileNamePNG=PLOT_GIRDLE_SYMMETRY.png;Width=250;Height=500]</a>
```

14 Using Logitech MX Revolution mouse to work with MBox

Logitech MX Revolution mouse allows to work with MBox comfortable and increase productivity.

The mouse provides quick access to the main options: Zoom, Focus on Front Surface, Increase / Decrease Step and Speed and other.

*Note. Mouse control for MBox works only in **microscope camera mode** and you should also move the mouse into the video area.*

To access all features you need to install the **SetPoint** software from Logitech and configure mouse with the software as explained below.



Note. Please use at least version 4.4 of SetPoint software. If you have older version - please download the new version from Logitech site (<http://www.logitech.com/index.cfm/428/130&cl=roeu,en>)

Focus

Use the **Wheel** to move the focus. One **rotation click** moves focus according the current focus step displayed in the bottom panel. For this function you don't need to make any special assignment in SetPoint software.



Focus step

To switch focus step with the mouse assign **Tilt** of **Wheel** mouse button in the SetPoint software

« , » / **comma** key - for the **left tilt wheel** button (decrease step/speed)

« . » / **dot** key - for the **right tilt wheel** mouse button (increase step/speed)



Focus on front Surface

Search button may be assigned for the Focus on front Surface with the corresponding keystroke **Ctrl-F**



Microscope zoom control

Side Wheel may be used for microscope zoom control. Configure the **Side Wheel** as **multiple keystrokes** in the SetPoint software. The optimal configuration:

- **Ctrl-Q** = Zoom In (next fixed zoom)
- **Ctrl-W** = Zoom Out (next fixed zoom)
- **Ctrl-E** = Max/Min Zoom. First goes to Max zoom. From the Max Zoom goes to Min Zoom value

Fixed zoom positions have the same values as zoom buttons on the bottom panel. It depends on the MBox type.



Photo

To make Photo assign **forward** mouse button with the corresponding keystroke **Ctrl-I**



Blind point

To make Blind point assign **backward** mouse button with the corresponding keystroke **Ctrl-B**



**Complete list of the keystrokes for Microscope/camera mode:**

- « , » and « • » / **comma** and **dot** - change focus step
- **Ctrl-F** = Focus on front surface

- **Ctrl-Q** or **Ctrl-H** = Zoom In (next fixed zoom)
- **Ctrl-W** or **Ctrl-K** = Zoom Out (next fixed zoom)
- **Ctrl-E** = Max / Min Zoom. First goes to Max zoom. From the Max Zoom goes to Min zoom value
- **Ctrl-R** = Max Zoom
- **Ctrl-T** = Min Zoom

- **Ctrl-I** = Make photo
- **Ctrl-B** = Blind shot

15 Stereo mode

15.1 Hardware requirements for 3D-Stereo mode

- Graphics card supporting OpenGL quad-buffered stereo*;
- LCD shutter glasses compatible with the selected graphics card;
- CRT display with good frequency characteristics (Display should support at least 1280*1024*100Hz mode). 100-150 Hz vertical frequency is recommended to work with shutter-glasses.

*Please notice that only few graphics cards support this mode. Typically professional series GPU support this mode.

Please read carefully the card technical specifications and/or consult the technical specialist to determine if the specific card is capable of the OpenGL quad-buffered stereo mode.

The full-screen stereo mode provided by NVIDIA for GeForce GPUs is not the native OpenGL quad-buffered stereo mode, the current Oxygen is NOT able to produce stereo image with this mode.

We have tested the 3D-Stereo mode of Oxygen with the following hardware configuration:

- Pentium4 2.6 GHz with 512 Mb RAM;
- NVIDIA Quadro FX 1100 graphics card;
- 3DS-GS LCD shutter-glasses (by STEL Company).

Disclaimer: We cannot guarantee you the correct work of arbitrary hardware configuration in 3D-Stereo mode. Please try this at your own risk. The use of configuration similar to the specified above should increase your chance of success. We are not able to give you support for configuring your Stereo-3D equipment. Please refer to the equipment manufacturer support resources.

15.2 Starting Oxygen Inclusion in 3D-Stereo mode

Once you successfully configured your 3D-Stereo hardware you may try to start Oxygen in Stereo mode.

Step 1. Check your 3D equipment with test and software shipped with equipment vendors. Please be sure that your hardware correctly works with OpenGL quad-buffered stereo mode.

Step 2. Create shortcut for StereoOxygen: Click Windows menu Start / All programs find the Oxygen Inclusion icon and right-click it with mouse. In the popup menu click **Create shortcut** option. You should see the newly created shortcut **Oxygen Inclusion (2)**. With right click edit the properties of this shortcut. On the **General** tab edit the title for example **Oxygen Inclusion Stereo**), on the **Shortcut** tab change the **Target** string: add the /GLStereo string after the program path. Typically the **Target** looks as C:\Program Files\OctoNus Software\Oxygen Inclusion\oxygen.exe and after modification should be like this: C:\Program Files\OctoNus Software\Oxygen Inclusion\oxygen.exe /GLStereo.

Step 3. Run the **Oxygen Inclusion Stereo** shortcut. Without shutter-glasses the image should look blurred. With shutter-glasses the image should look truly three-dimensional. Adjust the stereo separation option for photos (**stereo dist** parameter in photo panel). If you have 400 photographs per full 360° rotation then value 3 or 4 produces optimal

stereo depth. Try positive and negative number and you will understand what sign is correct for your series of photographs.

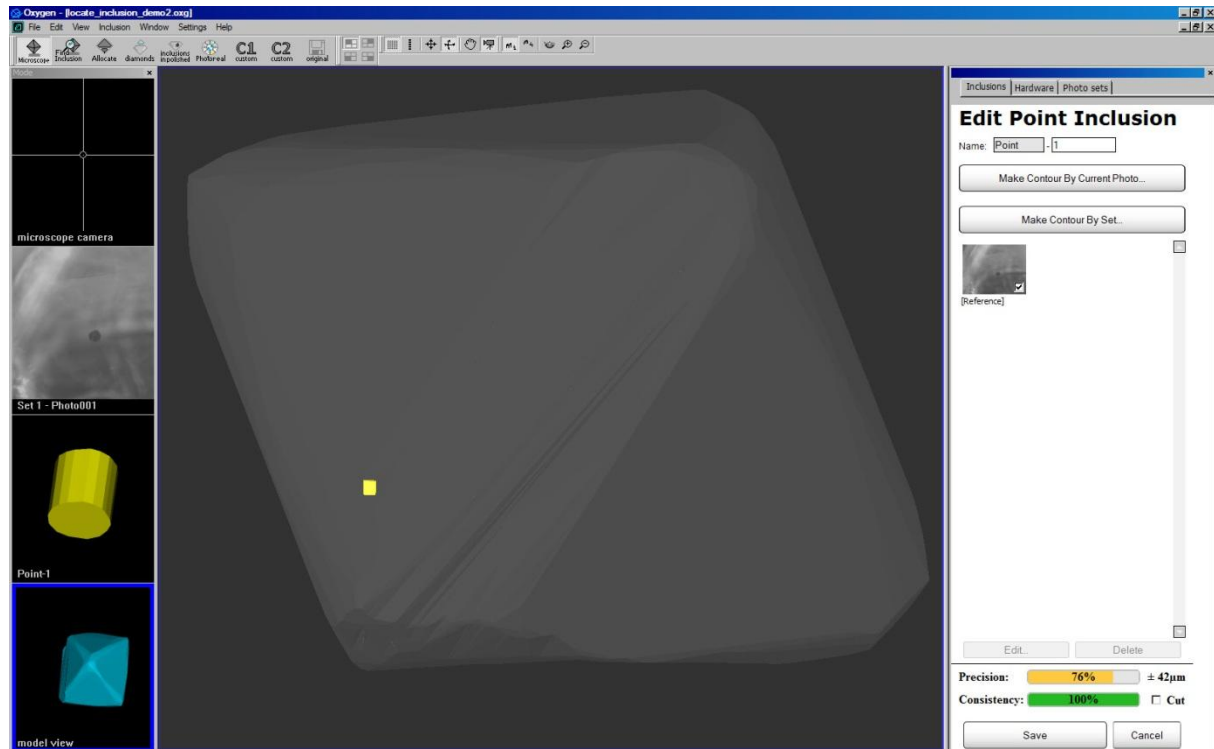
*You need to click [$>$] or [$<$] buttons after new stereo dist is typed to refresh the stereo-image.

15.3 Tips

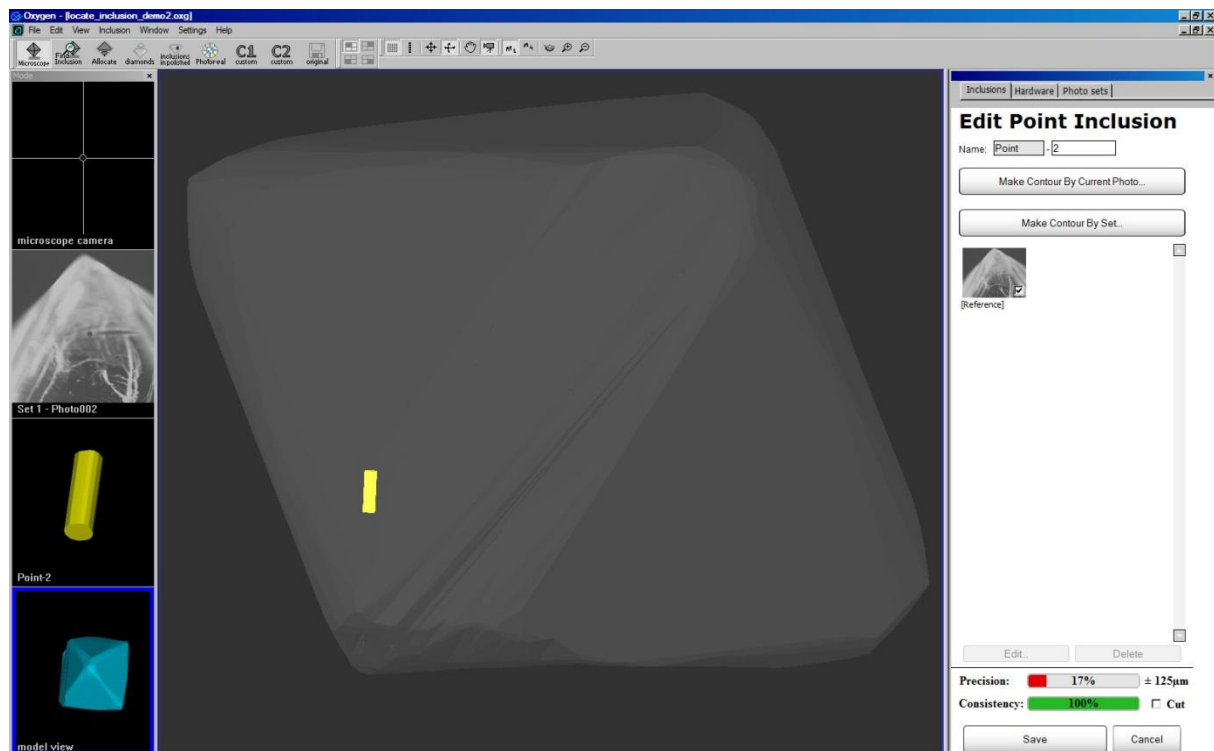
- Stereo mode in OpenGL may be initially disabled. To enable it for nVidia Quadro *** cards please find this option here:
Control Panel/Display/Settings/Advanced/Quadro FX ***/ .. /Additional OpenGL Settings, Enable stereo in OpenGL option.
- If you use system with 2 displays (for example one LCD and one CRT) make the Display you plan to use for stereo as primary. In 2-display system the stereo image is displayed only on the primary display. The secondary display shows only mono (left-eye) image. For NVIDIA cards you can find this setting here:
Control Panel / Display / Settings / Advanced / Quadro FX *** / nView Display Settings.

16 Appendixes

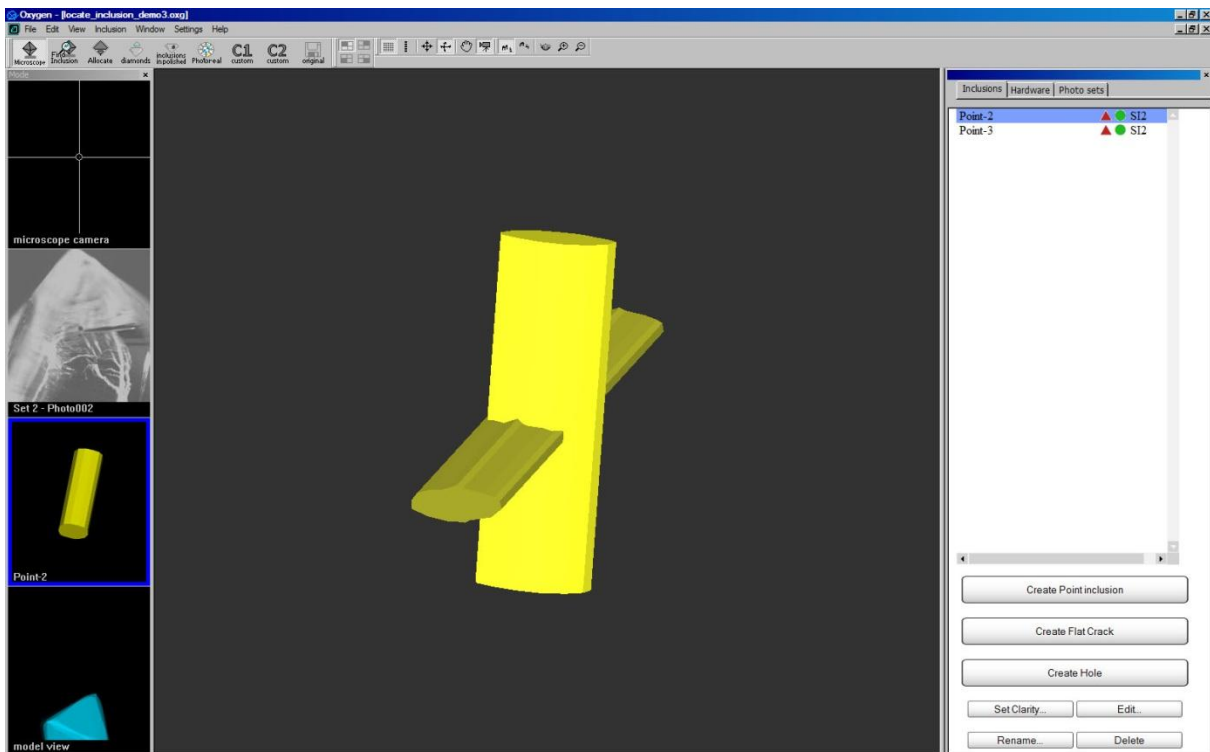
16.1 Model with inclusion via one photo, zoom 115x (M-Box MZ 16A)



16.2 Model with inclusion via one photo, zoom 50x (M-Box MZ 16A)



16.3 Two cylinders of one inclusion created with two different photos, zoom 50x (M-Box MZ 16A)



16.4 Final model of inclusion created by intersection of two cylinders obtained with two different photos, zoom 50x (M-Box MZ 16A)

