

# **Diamond Calculator 3.0**

## Documentation

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OctoNus Software

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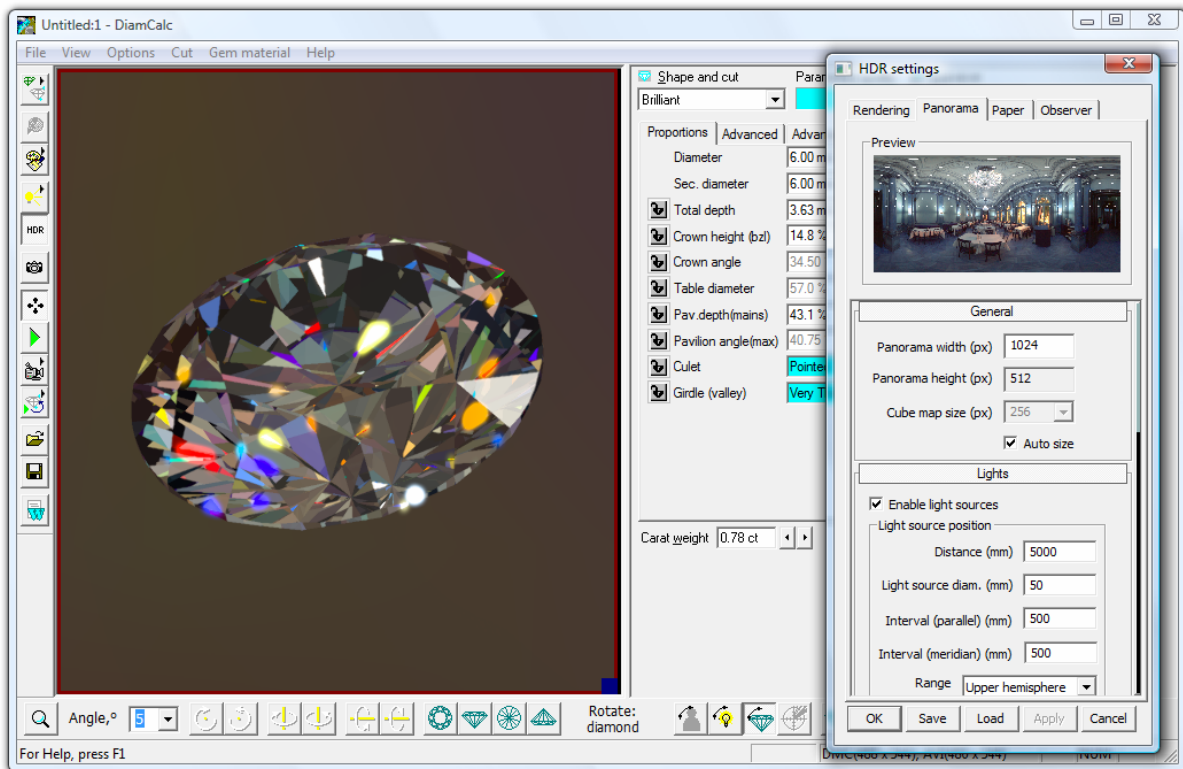
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## 2 What is DiamCalc and who benefit from it

DiamCalc is a system for cut gemstones modeling, which enables the precise calculation of the diamond weight and determination of cut proportions. The real (photorealistic) image of a polished diamond created by the system makes it possible to determine the cut properties that cannot be measured and to find the optimal combination of cut parameters that would provide the best perception (brilliance, fire, scintillation etc.) of the stone.



No photograph can show the sparkle and brightness of a real diamond. Until now; DiamCalc3.0 (DC3) has High Dynamic Range (HDR) imaging that shows the intense sparkles on your computer screen by reproducing the flares or bloom that we see in real diamonds. Bright sparkles often appear to be larger than the facet they emanate from, even extending outside the edge of the diamond.



Scintillation is the last great frontier of diamond cut studies. Regular ray tracing software and lab grading systems have failed to model scintillation and capture this «bloom» factor. Now buyers and sellers can realistically show a client, or visualize a distant diamond themselves before buying it. They can see just how it will look as they rock it from side to side in their own environment and even make promotional

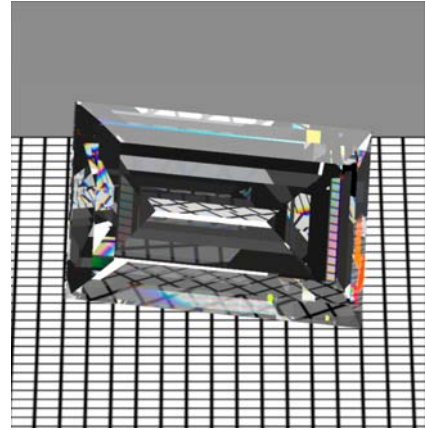
videos for individual diamonds. [Please see the examples of Demo Movies](#)



DiamCalc's High Dynamic Range lighting can come from a variety of panoramas such as a ball room, forest or hillside so anyone can see how the diamond will look in each of these environments. Jewelers of the future will no doubt import panoramic images of their own sales floor into DiamCalc.

The result of new technologies is the highly photorealistic images reflecting both non-trivial optical properties of gemstones and compound features of environment as shown here where the diamond is positioned above a virtual sheet of paper with a grid pattern.

The Diamond calculator is designed for jewelers, diamond graders, sale specialists dealing with diamonds and diamond jewelry, for companies active in designing special cuts, manufacturers and technologists.





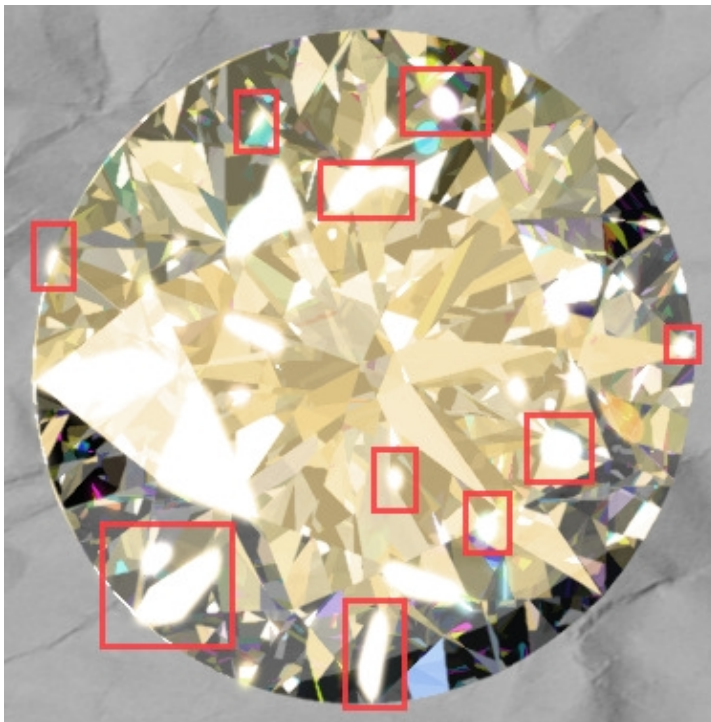
### 3 What is new in the DiamCalc 3.0 ?

#### 3.1 New features in the photorealistic rendering mode

- Light bloom or flare effect
- Lighting with external high dynamic range panorama (HDR)
- Lighting with generated panorama (zones and light sources)
- Paper sheet environment
- Observer model

#### Bloom effect

The bloom or flare effect produces fringes of light around very bright objects in an image, as stressed by the red squares in the actual rendering screenshot below:



The physical basis of bloom is that lenses (including those in our eyes) can never focus perfectly in the real world. Under normal circumstances, these focus imperfections are not noticeable, but an intensely bright light source will cause the imperfections to become visible. As a result, the image of the bright light appears to spread (bleeds) beyond its actual borders.

Depending on the background colour or shade, the bloom can appear to extend outside the edges of the diamond.

#### Lighting panorama with high dynamic range (HDR)

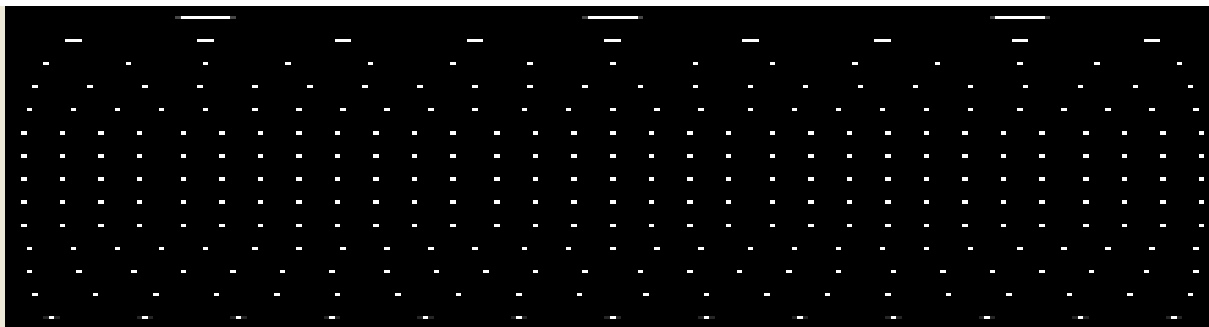




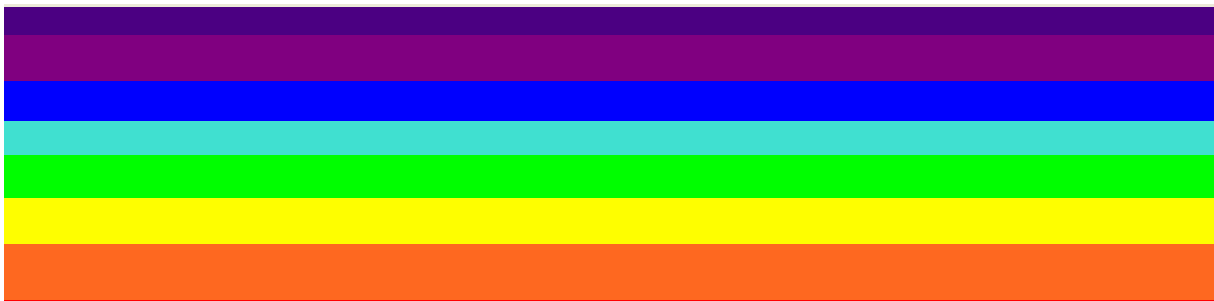
A lighting environment can be defined by a high dynamic range panorama (also referred to as HDR panorama). Luminance or radiance observed in the real world can usually be stored in special high dynamic range images that correspond to actual physical values. This additional information makes high dynamic range images that are different to traditional digital images that may appear on a monitor or on a paper print. For example in the photo image above the bright parts of the sky radiate much more light than is seen in a regular photograph, and such intense light sources can create a bloom or flare in a gemstone.

### **Lighting with generated panorama (zones and light sources)**

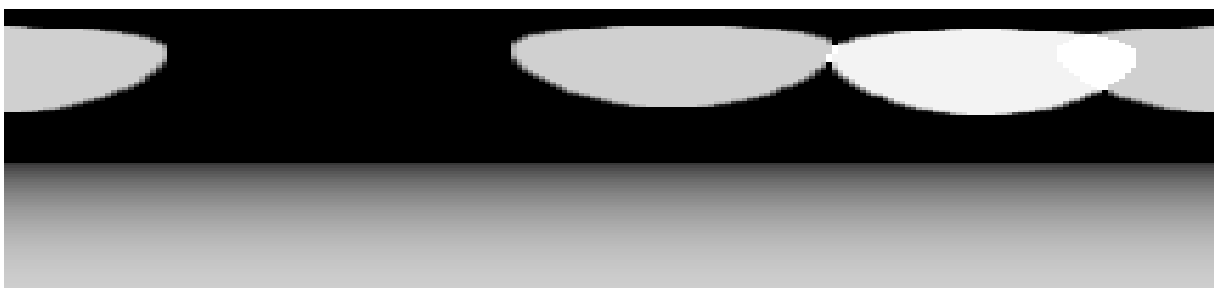
Panoramas with different light sources can be generated by specifying the size and quantity of light sources.



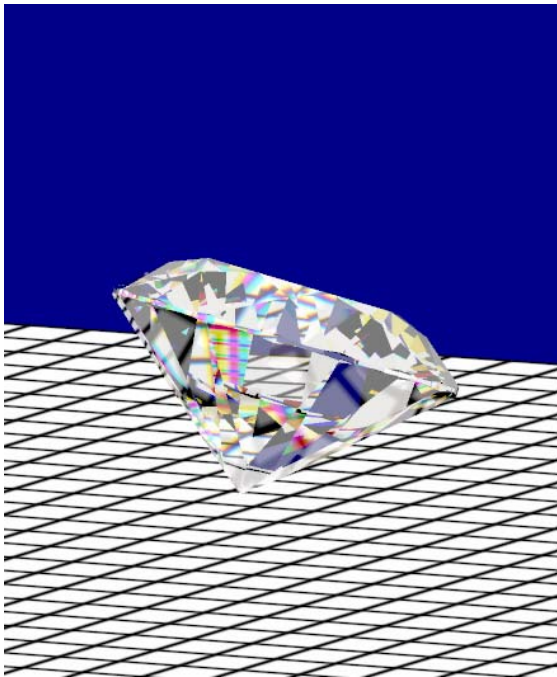
Panoramas with colored zones (up to 8 zones) can also be generated.



A panorama for the «Office» lighting environment can also be generated.







### Paper sheet environment

A paper sheet can be rendered either using an external texture or one that is generated in a grid-style. In the latter case, you can customize grid settings, paper color, size and other options.

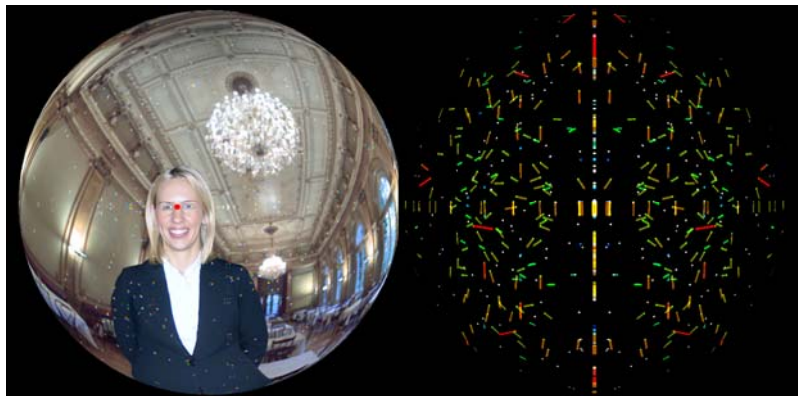
### Observer model

DiamCalc 3.0 supports a 2D observer model. The observer model consists of two parts: the observer head and the observer body. This observer model design allows simulation of a head inclined above a gem being observed. You can set up the observer height, eye position, shoulder position, head incline angle and mask parameters.

## 3.2 ETAS images

Additional features in new version of DiamCalc include ETAS images (effective total angular size) which at a glance give a good indication of where a diamond can gather light that creates brightness and sparkle. The image on the left shows an ETAS image from the diamonds perspective overlain on the HDR image of the observer placed inside a ballroom. The image on the right is a DETAS image for an emerald cut that shows the dynamic probability to see a sparkle as the diamond is rocked through a small range of north south motion.

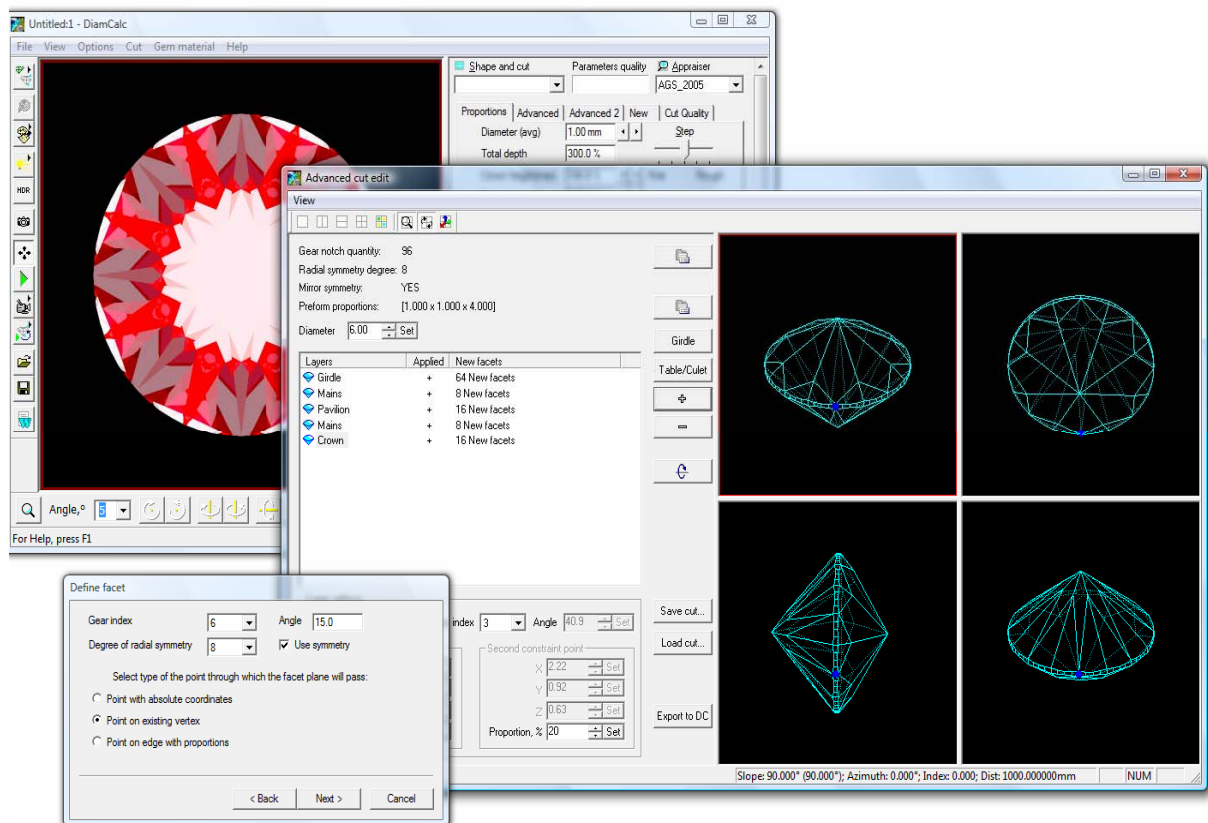
ETAS is the basic functional tool for the quantification of the basic light performance responses calculated by DiamCalc3. But DiamCalc3 takes this a further stage by computing for two eyes and other observer specific variables such as pupil size and viewing distance. Dynamic ETAS (DETAS) is a metric for quantification of scintillation.



## 3.3 Cut Designer tool builds variable models

For companies active in designing special cuts such as many Sightholders, Tiffany and Swarovski, the new cut designer tool enables the creation of parametric models with tied proportions; each and parameters can be varied. This overcomes a problem in

previous computer aided design software that required the laborious creation of separate models for every new proportion set.

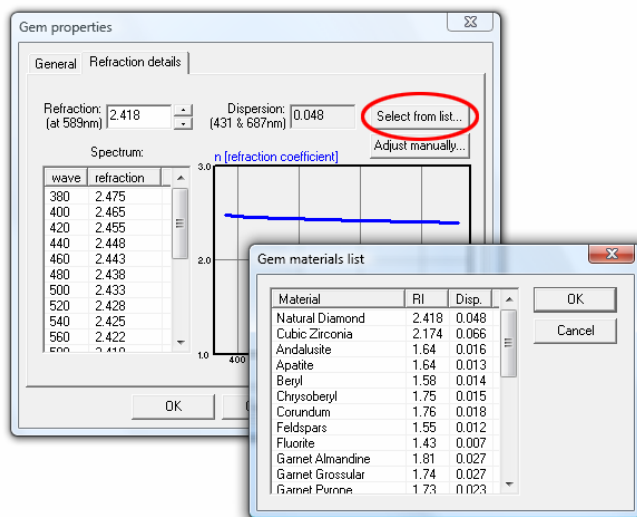


### 3.4 Simulation algorithm for stereoscopic photorealistic view of diamond is improved

Algorithm used in simulation of stereoscopic photorealistic view of diamond has been found incorrect in some cases (this algorithm is implemented when "Observer\Head and eyes\Brain picture\Smart bright" option is selected and also when "Light return stereo" Cut Quality index is computed). So the computation was redesigned and the photorealistic image in the mentioned mode and "Light return stereo" index values will differ from those obtained in older versions.

### 3.5 Added Natural Diamond and Cubic Zirconia to the list of materials for setting refraction in Gem properties

Open panel Gem properties from menu Gem Material -> View / Modify properties... Press button Select from list... The panel Gem material list will open. Where you can find new materials.



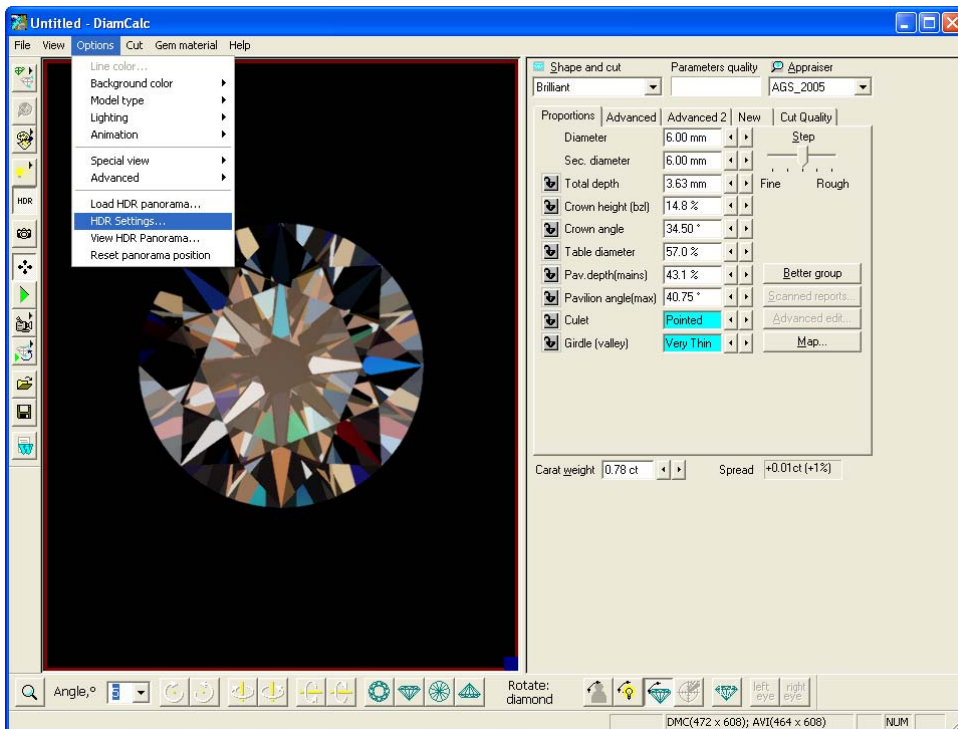
### 3.6 Added the new GIA appraiser for Brilliant cut. It is named GIA\_PCT\_2006

This appraiser provides estimation of the overall cut quality, using several cut parameters simultaneously, namely Pavilion, Crown and Table. The parameters that are taken into account during stone appraisal are displayed in gray, red or green color. The red color means that it is necessary to decrease the parameter value to get to a better group, the green color suggests to increase the parameter value. There is also a special button «Better group» that changes all parameters of the stone to move it to a nearest better group. Organization of this appraiser is similar to AGS\_2005.

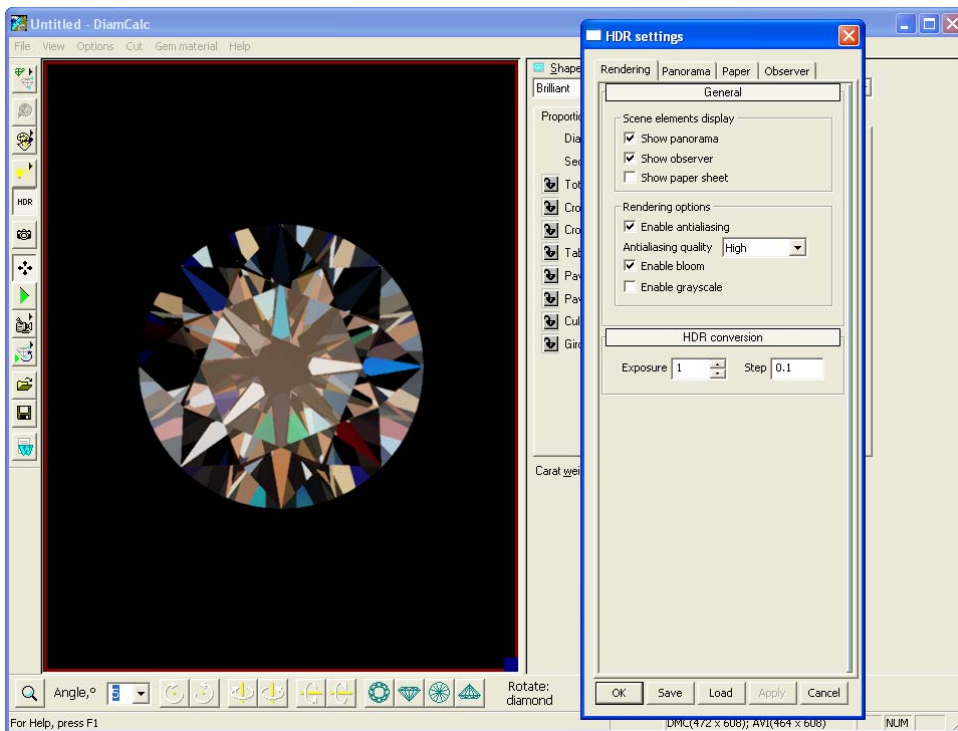
## 4 New photorealistic HDR rendering options

### 4.1 Getting started with new photorealistic rendering options

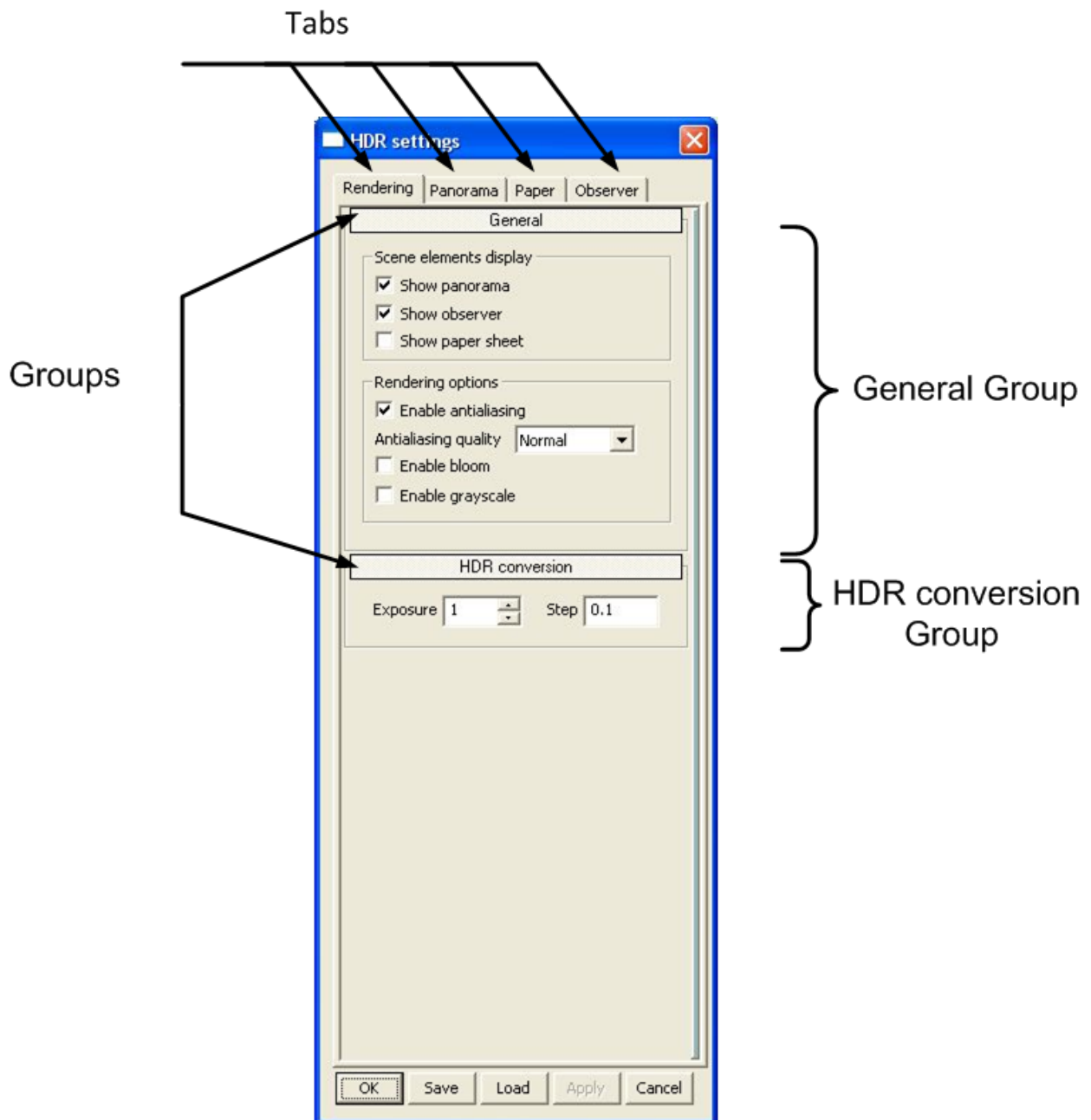
To configure and set the rendering mode options, select Options->HDR Settings, as shown in the screen shot below:



Once Options->HDR Settings is selected, the new dialog box appears to the right:



The HDR Settings dialog consists of **Tabs** and **Groups**:



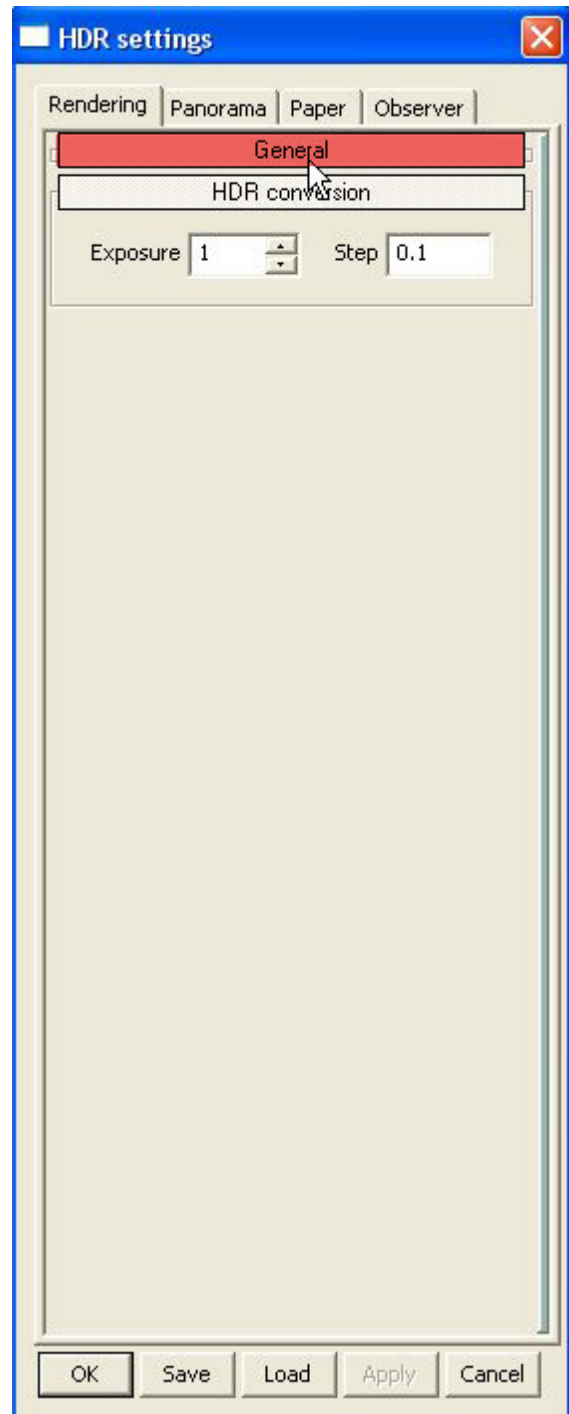
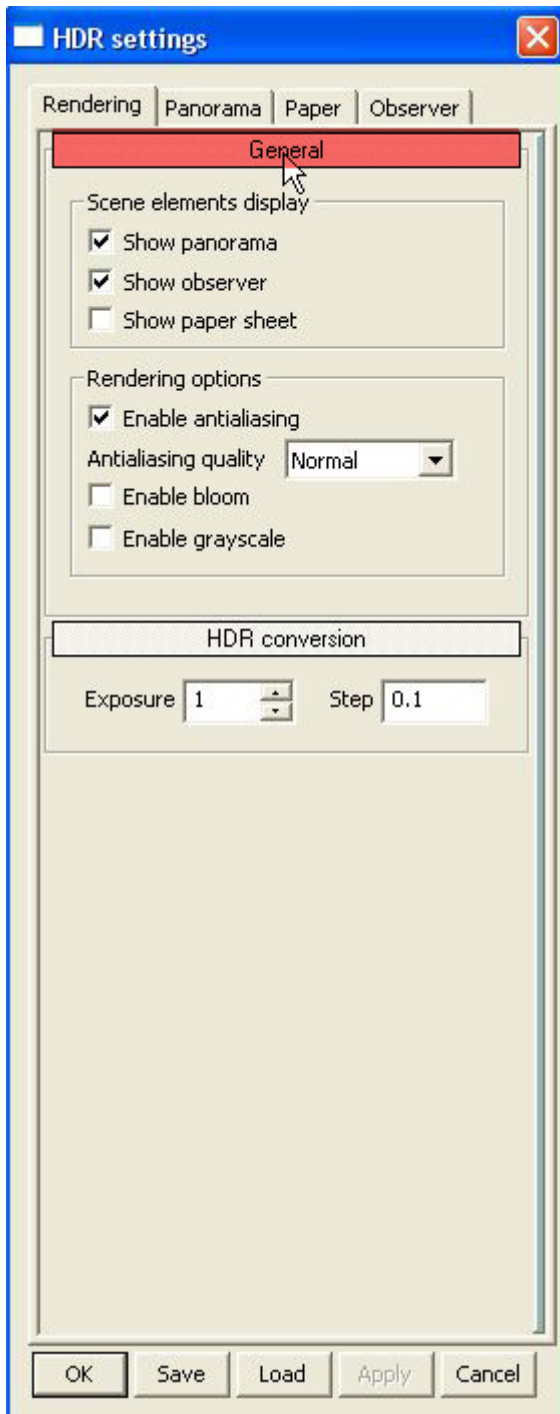
There are four tabs in the HDR Settings dialog, as listed below:

- Rendering
- Panorama
- Paper
- Observer

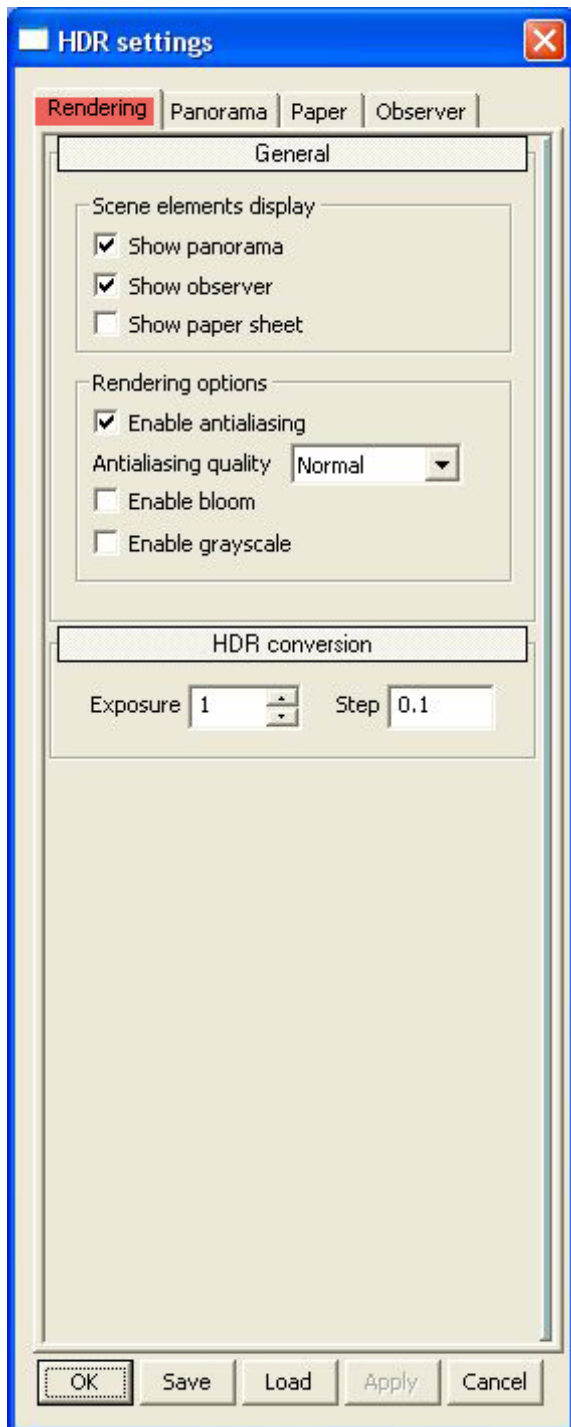


Every tab has its own groups. For example, the groups for the Rendering tab are shown in the screen shot above.

You can hide/show a group by clicking on its title. That is, clicking a title of the group being shown makes the group area collapse; clicking a hidden group title makes the group area appear again, as shown below:

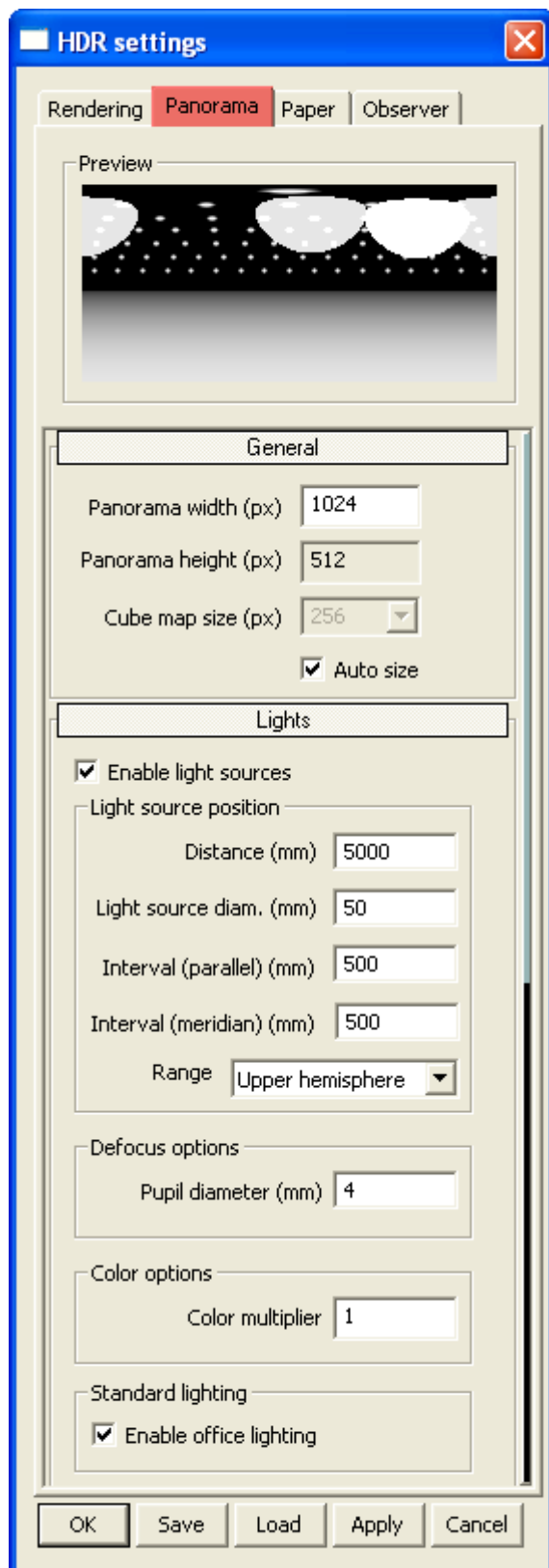


## 4.2 The Rendering tab



In the Rendering tab, you can disable or enable showing several effects, such as bloom or anti-aliasing (Smoothing the jagged appearance of diagonal lines in a bitmapped image). To show an effect just checks the appropriate field.

### 4.3 The Panorama tab



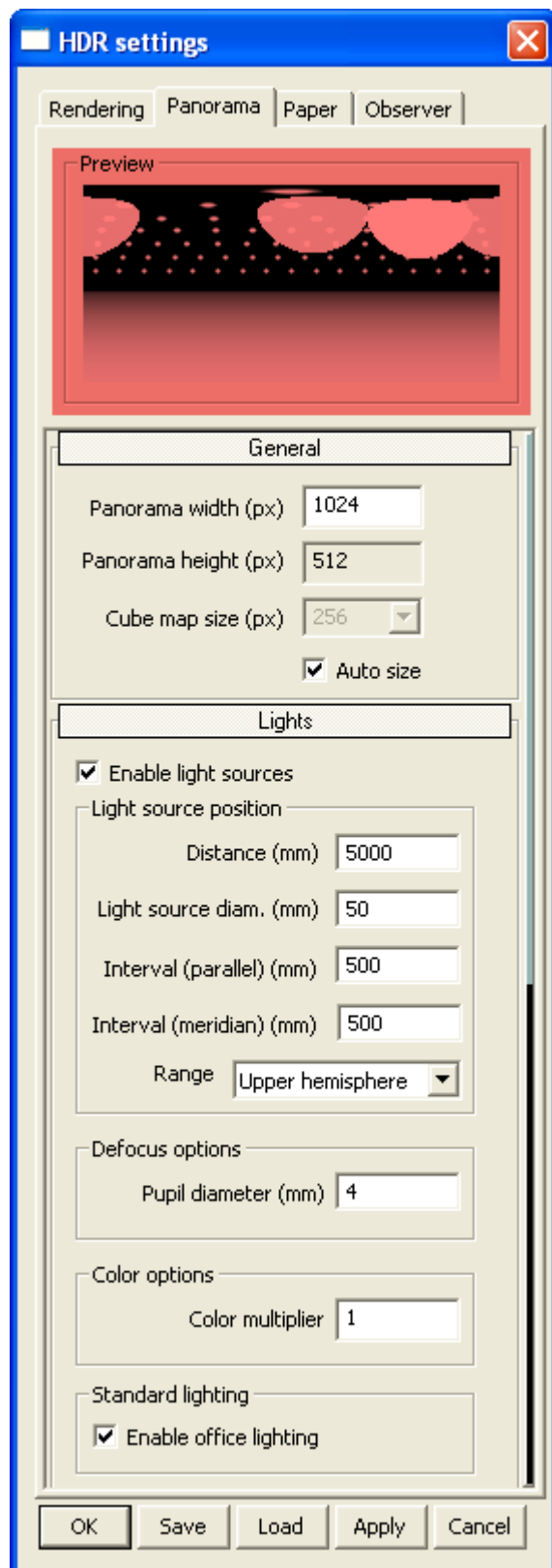
The Panorama tab consists of a preview window which is always shown at the top and several groups below. These groups below can be scrolled up and down for the Panorama (and observer) tab groups using a very narrow pale blue bar on the right.

More detailed explanations of the preview window and the Panorama tab groups follow:



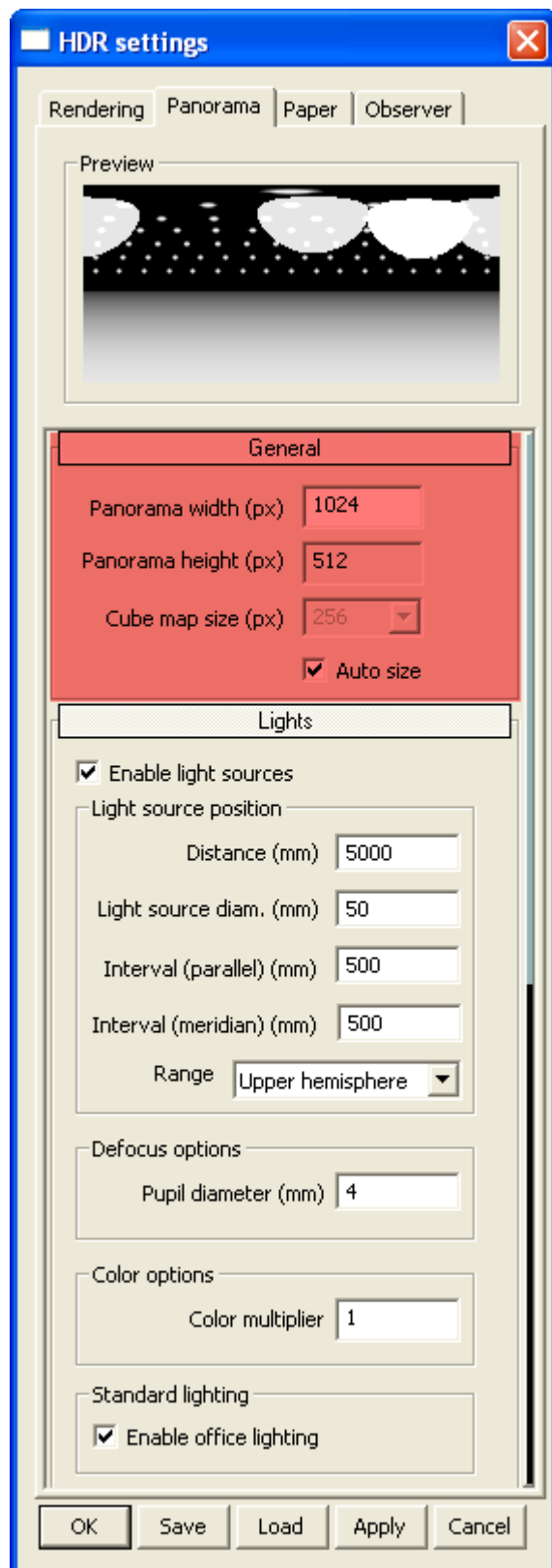
## The Preview window

The Preview window allows you to see the current panorama, either a loaded one or a generated one, or both overlain together.



## The General group

The General group allows you to set the panorama size.



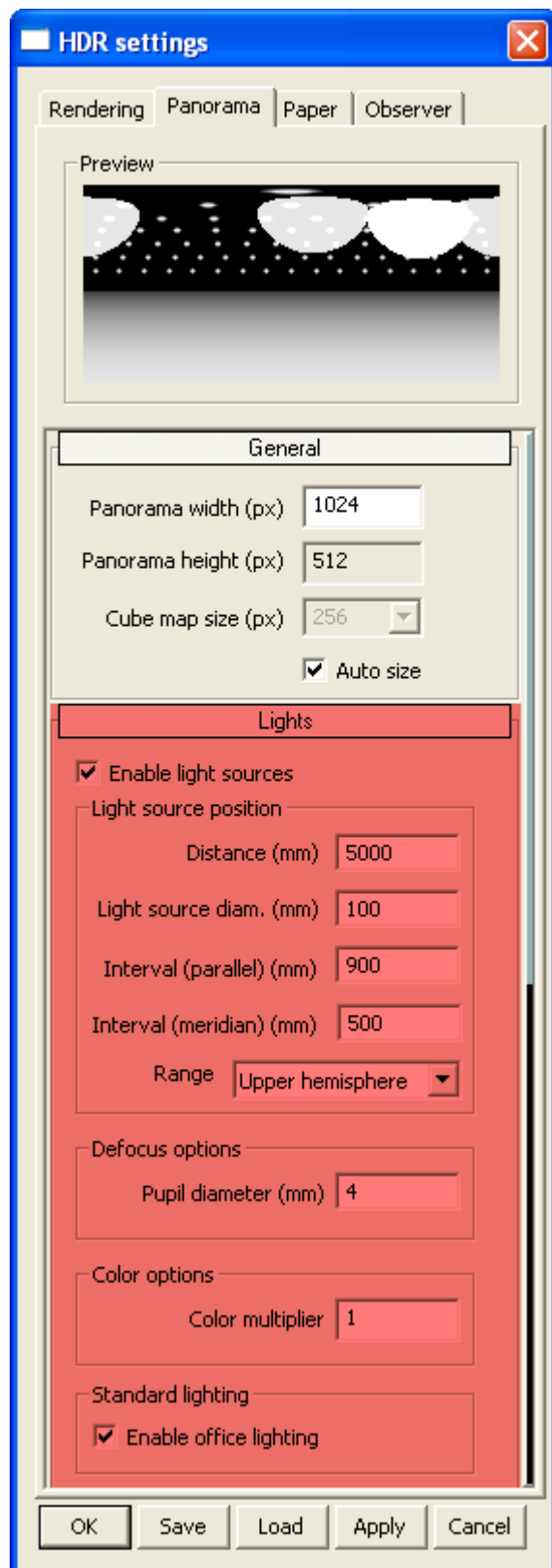
## The Lights group

First check the box **Enables light sources** in the group parameters.

Once the **Enable light sources** check box is checked, you can generate light sources for the panorama. You can specify the light sources diameter and intervals between them. In accordance with your data input, the light sources will be placed all over the sphere automatically. Unfortunately it is not possible to choose light source positions individually, although you can choose whether to distribute light sources over the upper hemisphere only or the entire panorama.

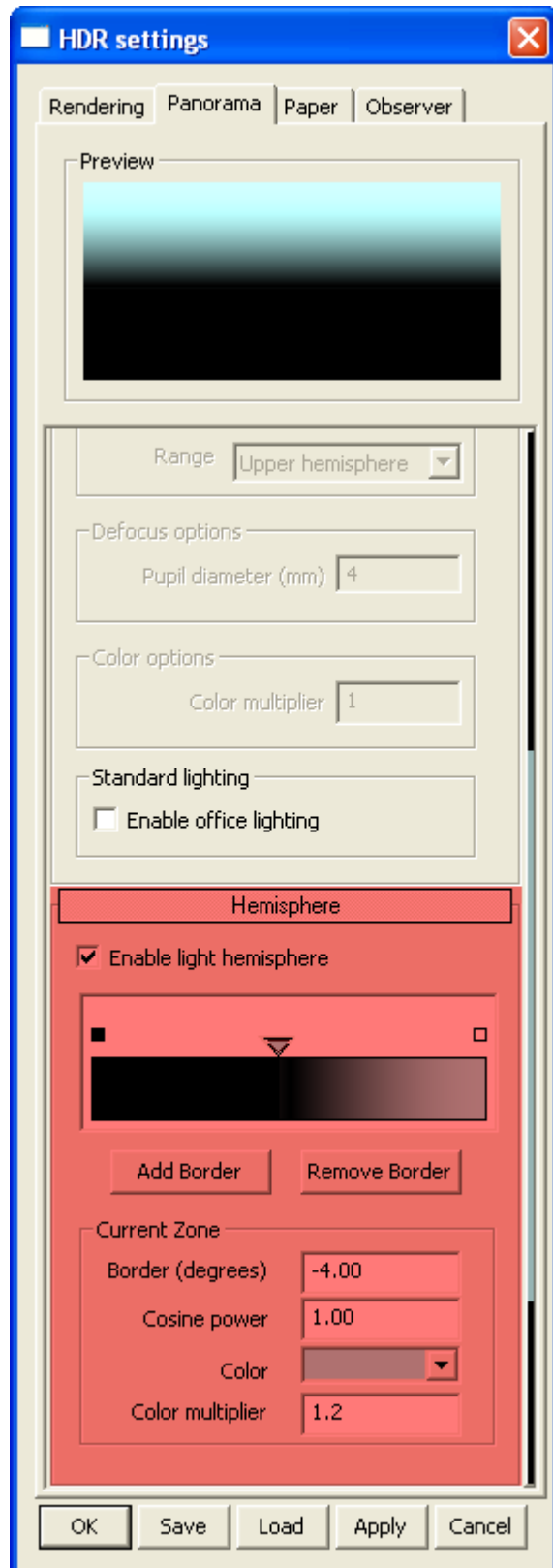
You can also specify light sources blurring parameters and color multiplier.

Under **Standard lighting** subgroup you can specify if any of the standard lighting presets should be used.



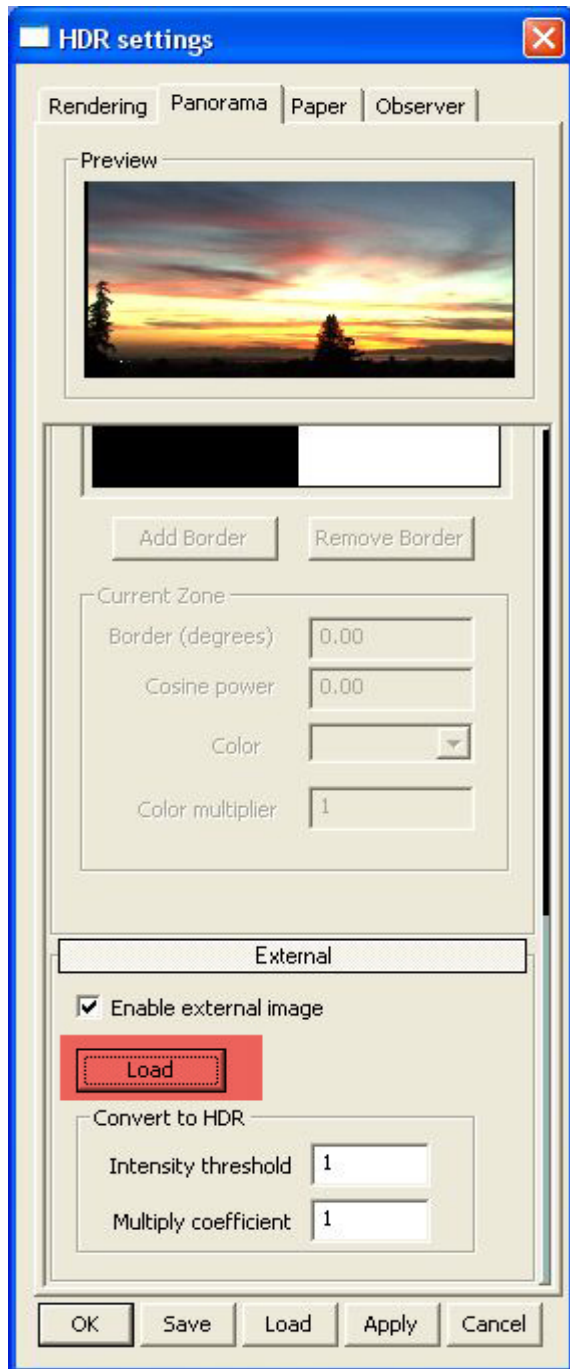
## The Hemisphere group

The Hemisphere group contains the **Enable light hemisphere** check box as its first element, which is initially unchecked. Checking the **Enable light hemisphere** check box allows generation of a synthetic panorama consisting of zones, as discussed later in the Zones Tutorial.

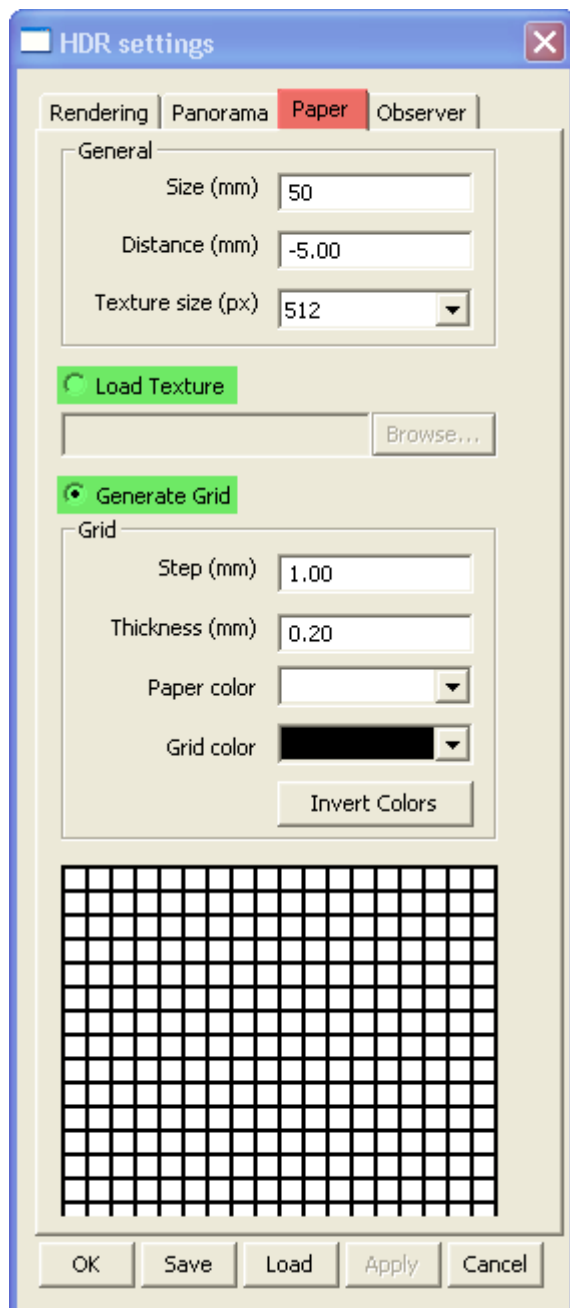


## The External group

An **external high dynamic range panorama** can be loaded here. Check **Enable external image** and press the **Load** button (this button marked red on screenshot), then you can load any .hdr file:



#### 4.4 The Paper tab



In this tab, you can adjust the properties and the look of the paper texture.

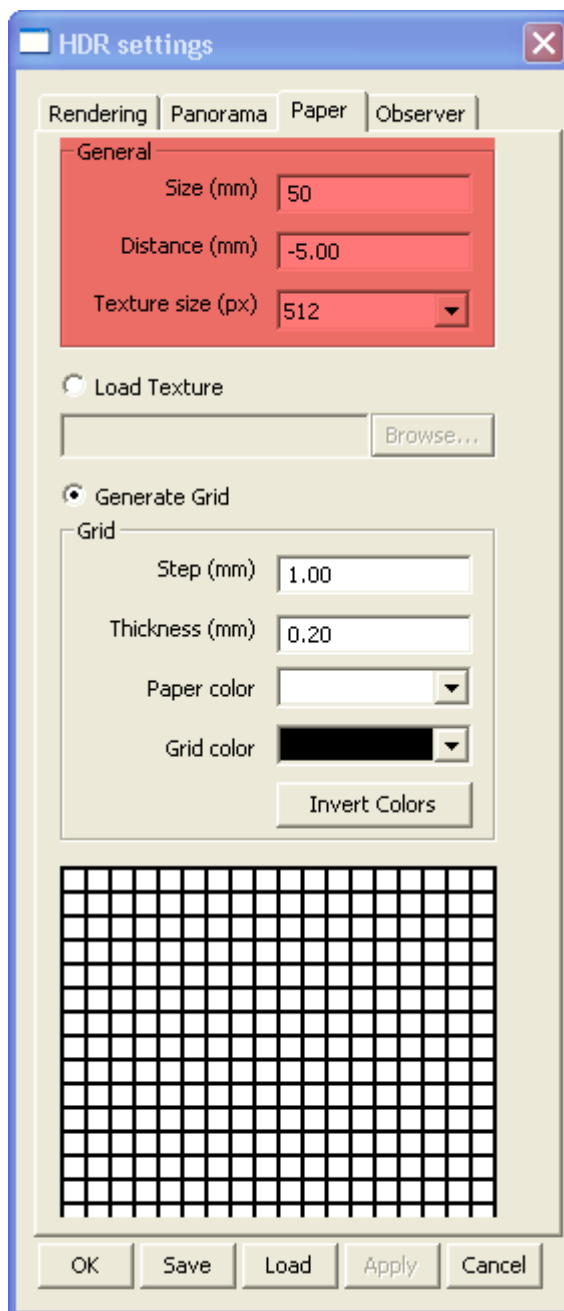
The dialog lets you to choose whether you want to use an existing picture of a real paper sheet or generate an artificial grid. The selection buttons highlighted green in the screenshot allow you to switch these two modes: if the **Load Texture** button is checked, a provided external picture will be used as the paper texture. If you prefer to use an artificially generated squared paper imitation grid as the paper texture, check the **Generate Grid** button.

The **General** settings group allows you to adjust the paper sheet options, as it appears in the rendering window.

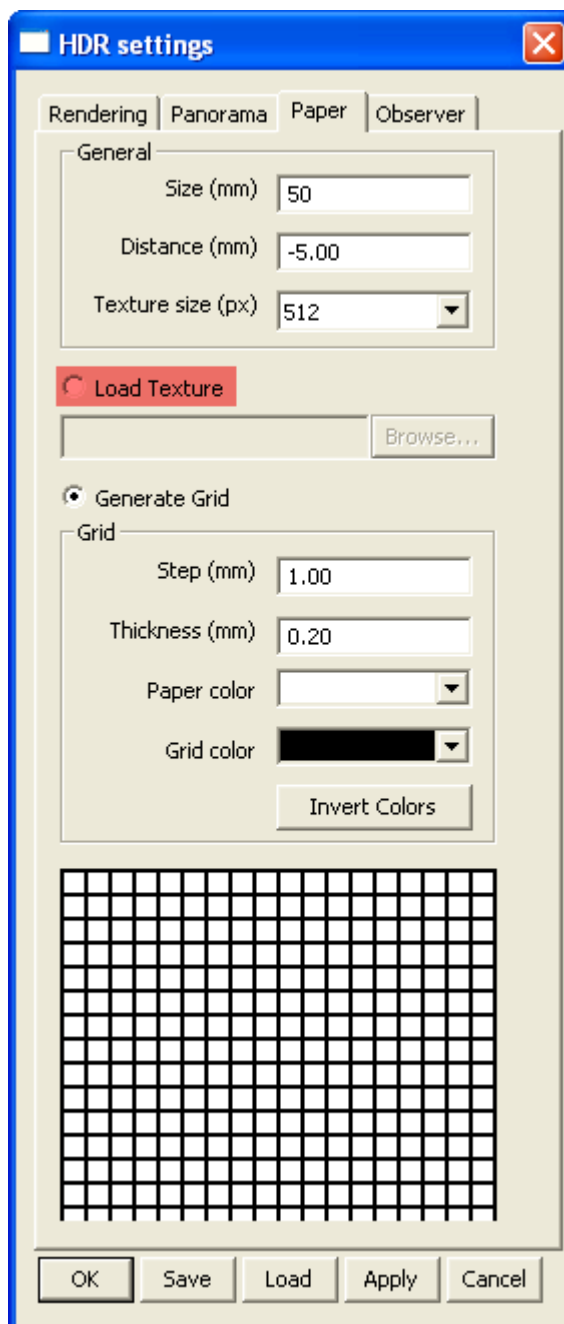
The **Size** setting affects the size of the paper rectangle.

**Distance** determines the paper offset relative to the gemstone position. A negative value of  $-n$  mm moves the paper  $n$  millimeters behind the gemstone. For instance, the value of  $-5.00$  shown in the screenshot, places the paper five millimeters behind the stone.

The **Texture size** setting determines how big the paper texture will be. The bigger texture — the more details (providing the original image is at least as big as the selected texture size, in case of external picture use).



To load a texture, check **Load Texture**:



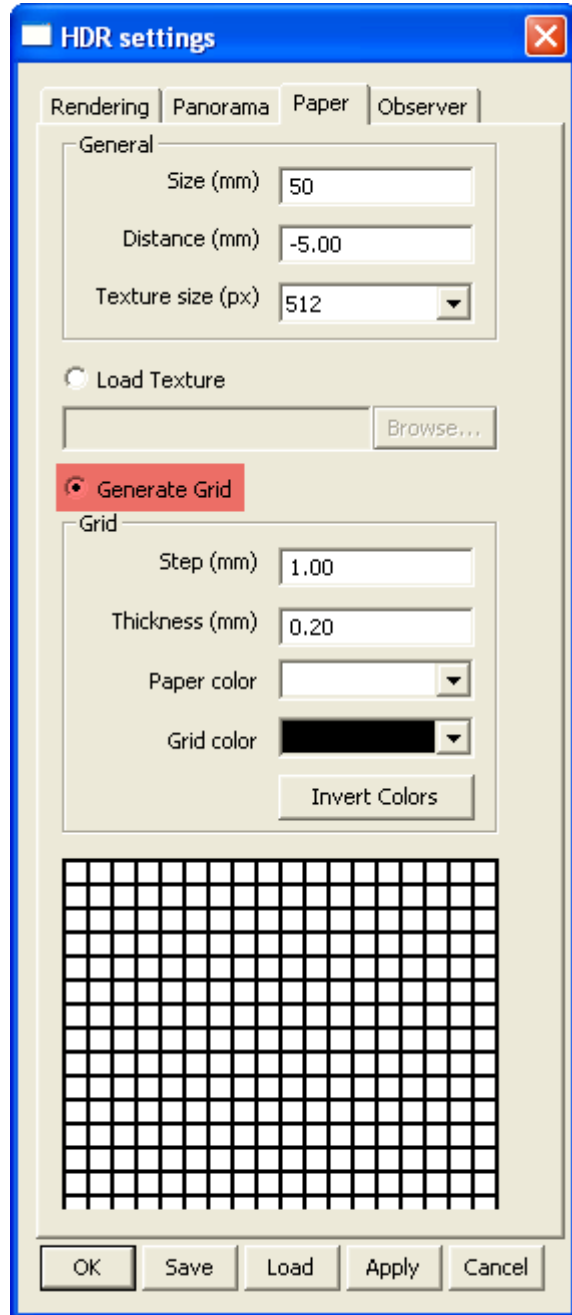


The **Browse** button is enabled now, so you can press it and select the desired paper image from your disk. The supported file format is HDR, or High Dynamic Range image.

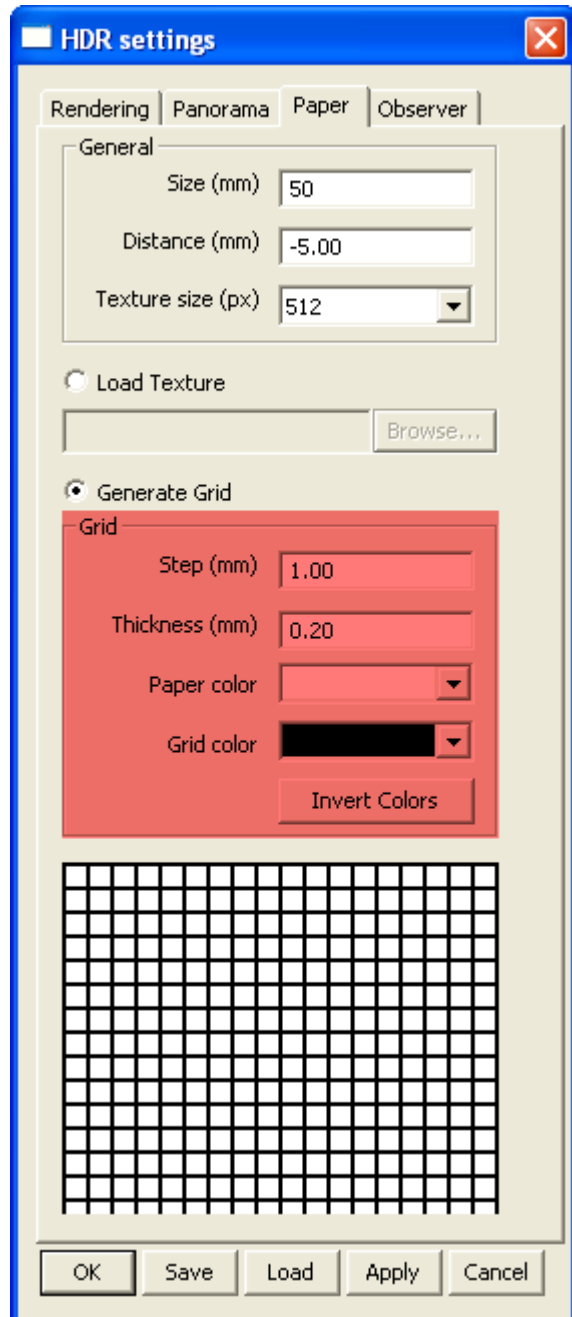




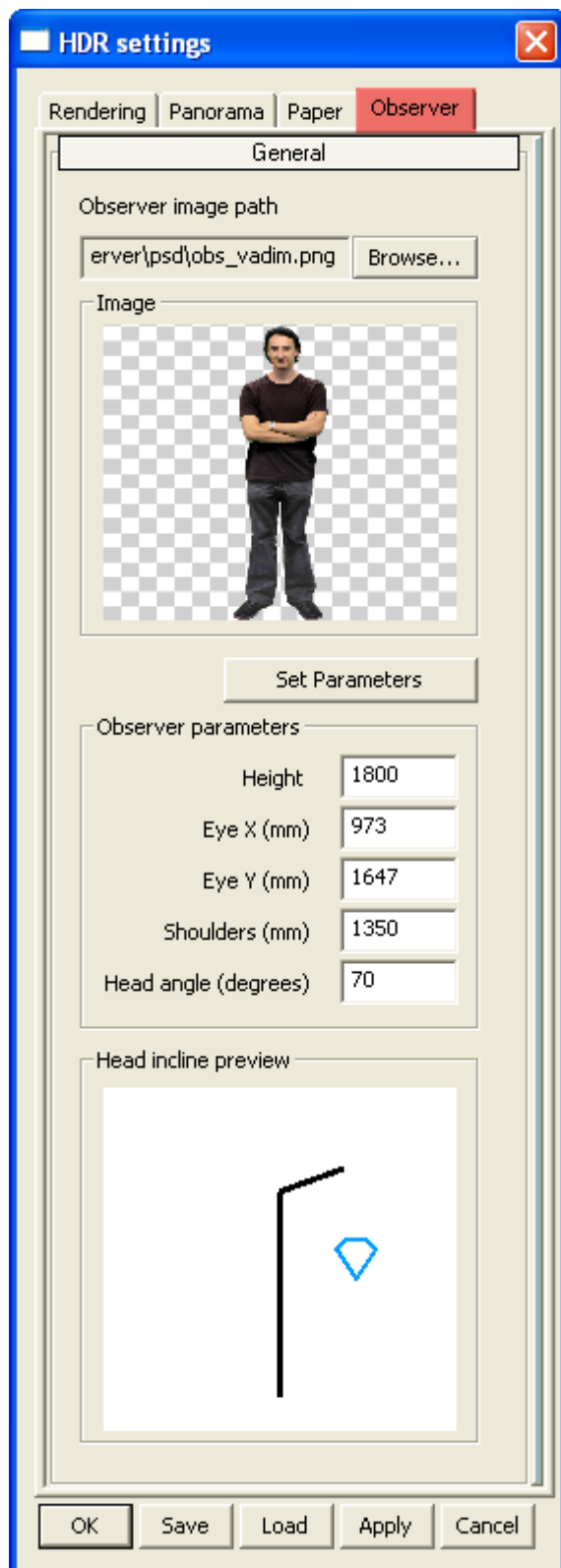
To generate a squared paper imitation grid, check **Generate Grid**:



Set the grid options:

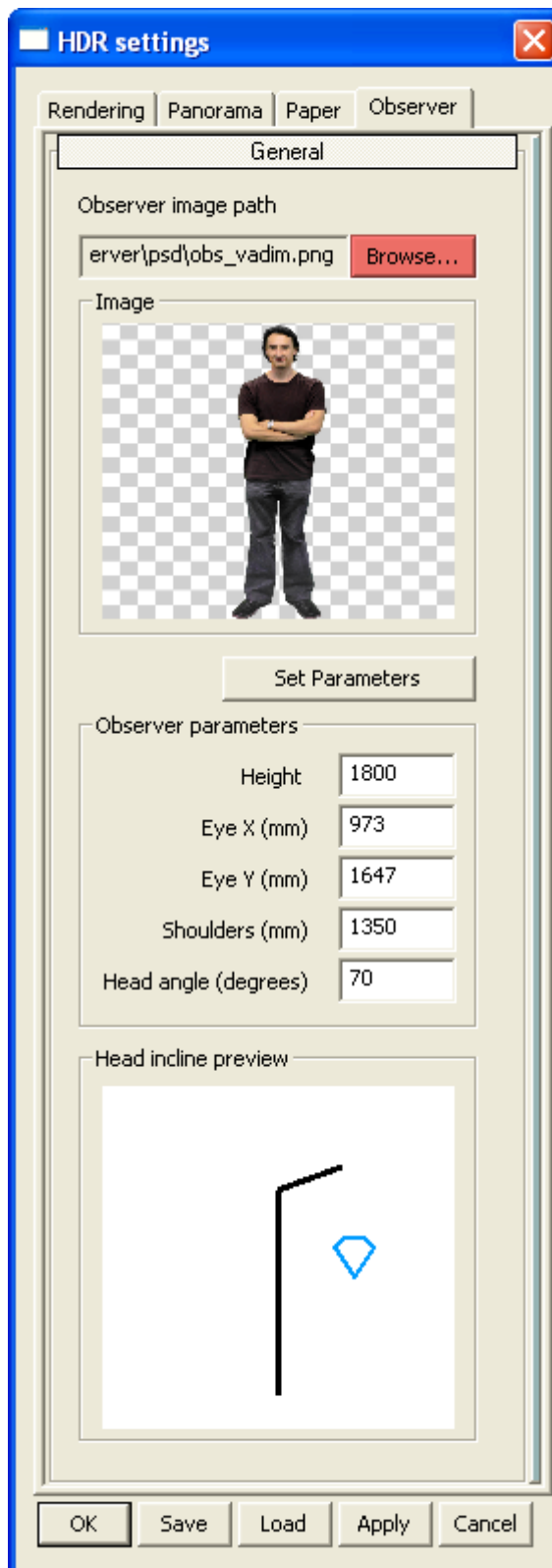


## 4.5 The Observer tab

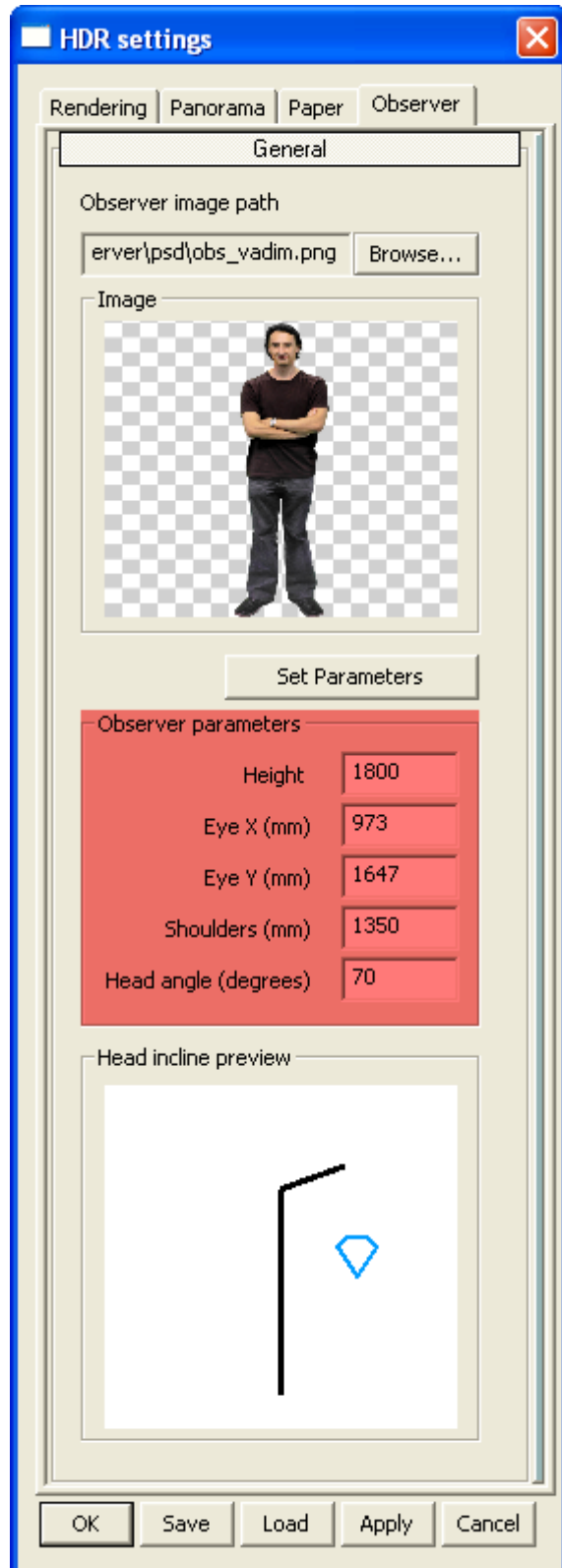


The Observer tab contains controls responsible for the observer image, position and posture parameters, as well as the eyes position and shoulder line setting.

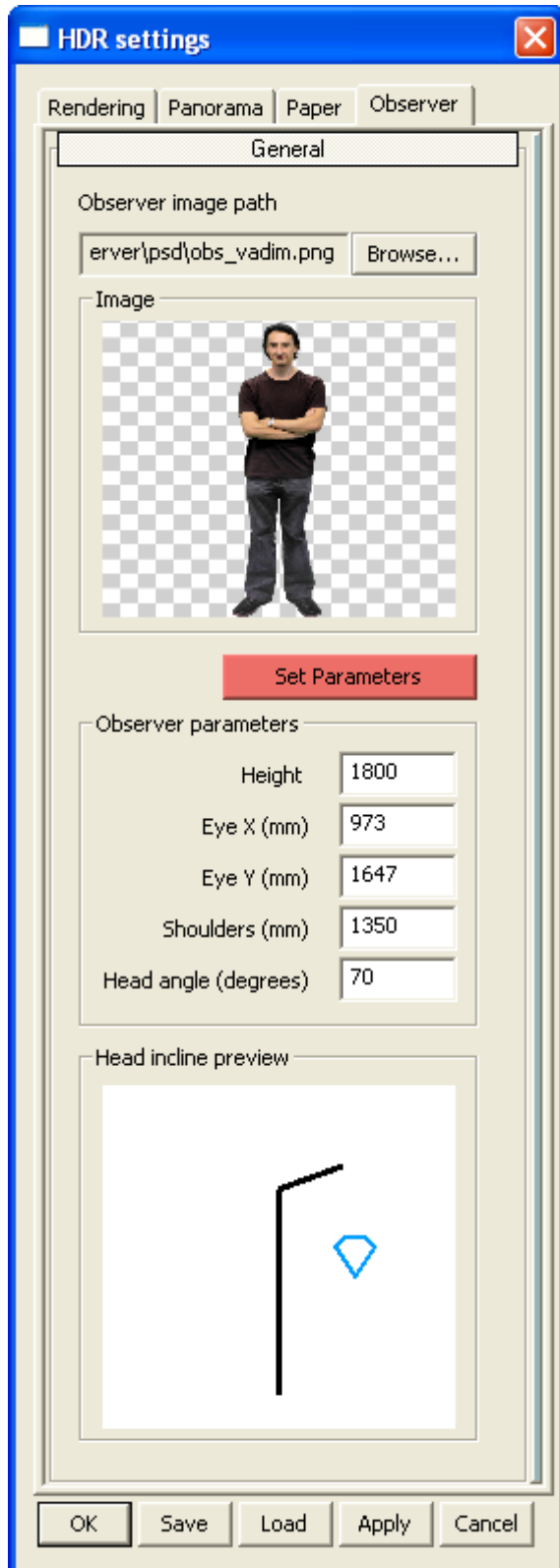
To load an external observer picture, press **Browse** and choose a PNG file:



To set observer parameters, such as the observer height, eyes position, shoulder line position and head incline angle, you can use the **Observer parameters** group:

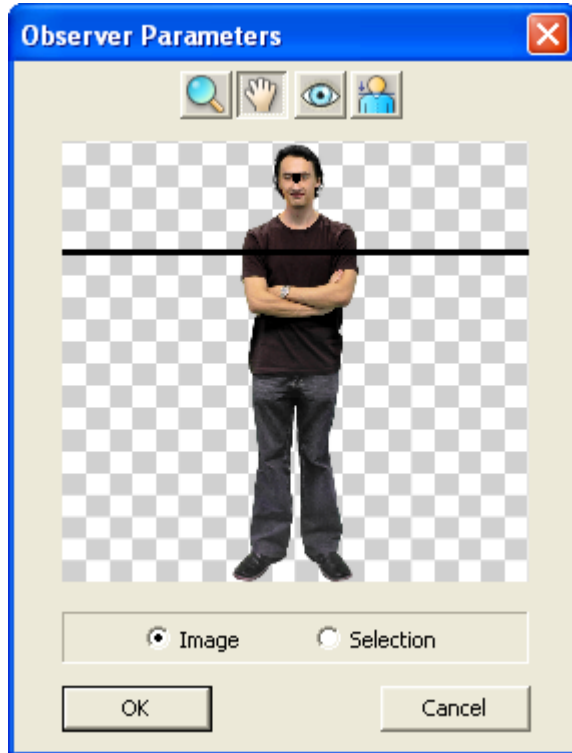


Alternatively, you can press the **Set Parameters** button and use an intuitive graphical dialog to set these parameters:

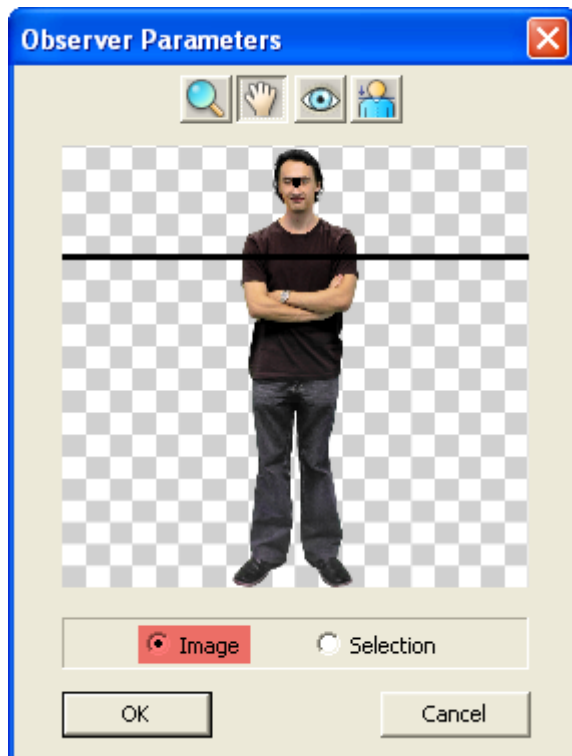




Here is the dialog:

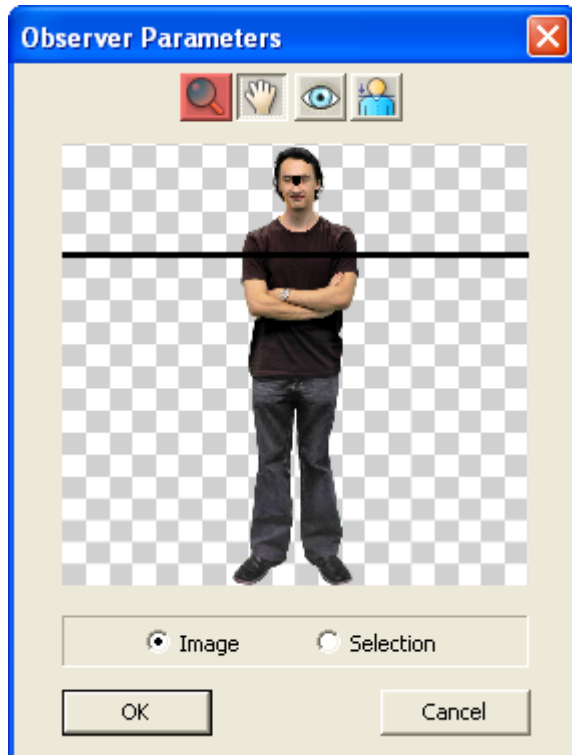


Make sure you're in **Image** mode:

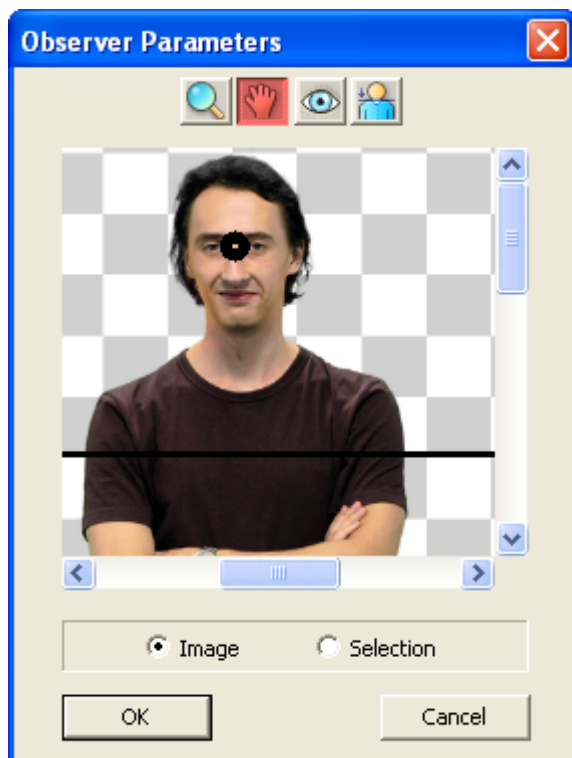




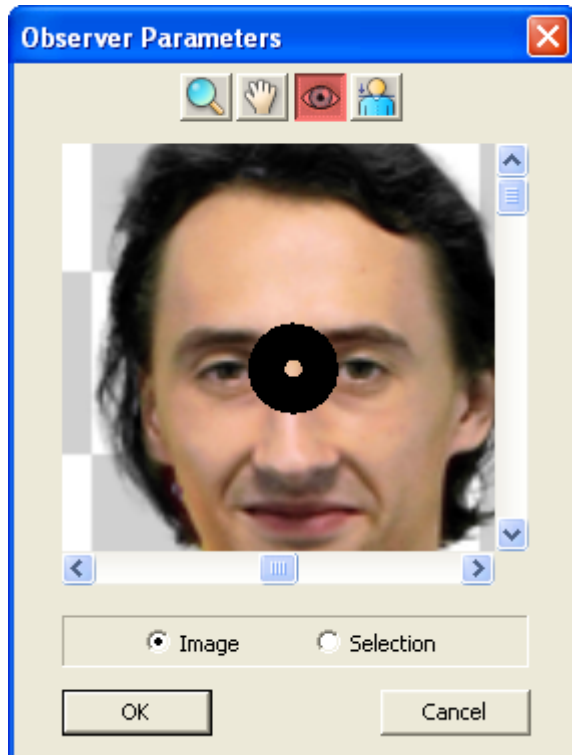
You can zoom in and out by checking the zoom button and then clicking on a point of interest on the observer image to zoom. Left click zooms in, while right click zooms out:



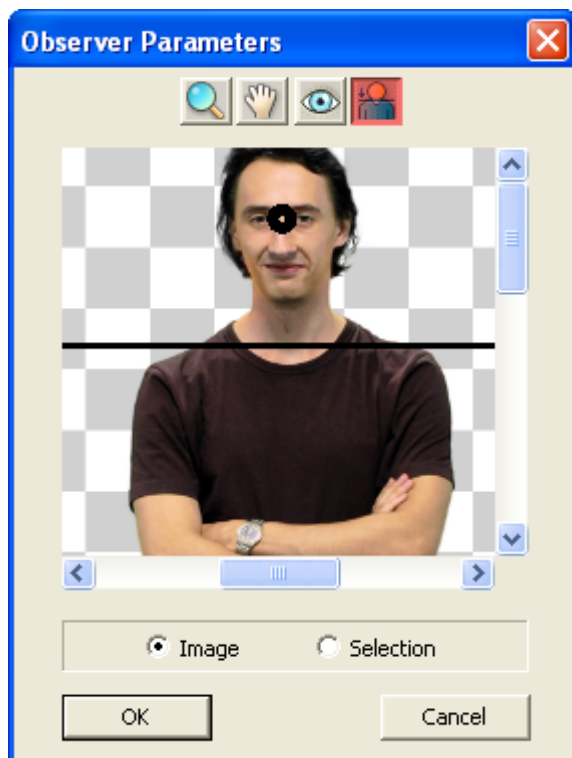
For free-hand image scrolling, use the button with a hand icon:



To set the eyes position, press the eye-labeled button and left click on the specific point on the observer image where you want the eye point to be placed (normally this point should be between the eyes of the observer):

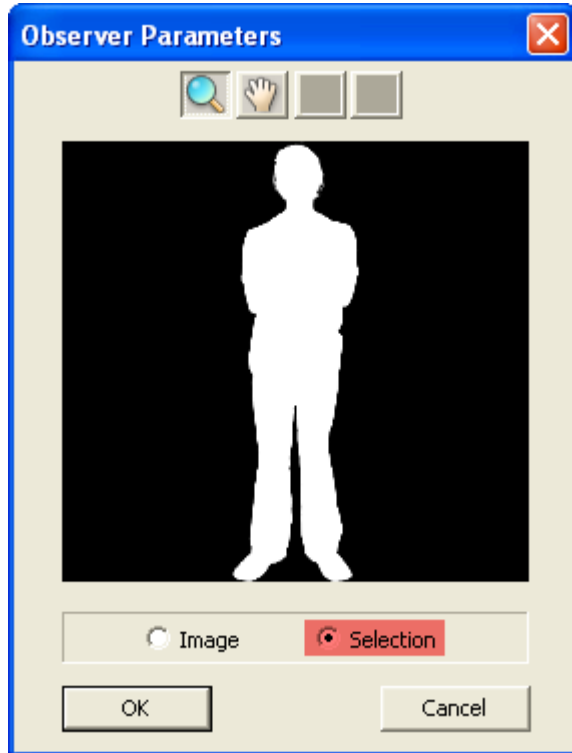


To set shoulders position, press the button with a shoulder line pictogram and place the line (by left clicking on the observer image) where the shoulders should be:





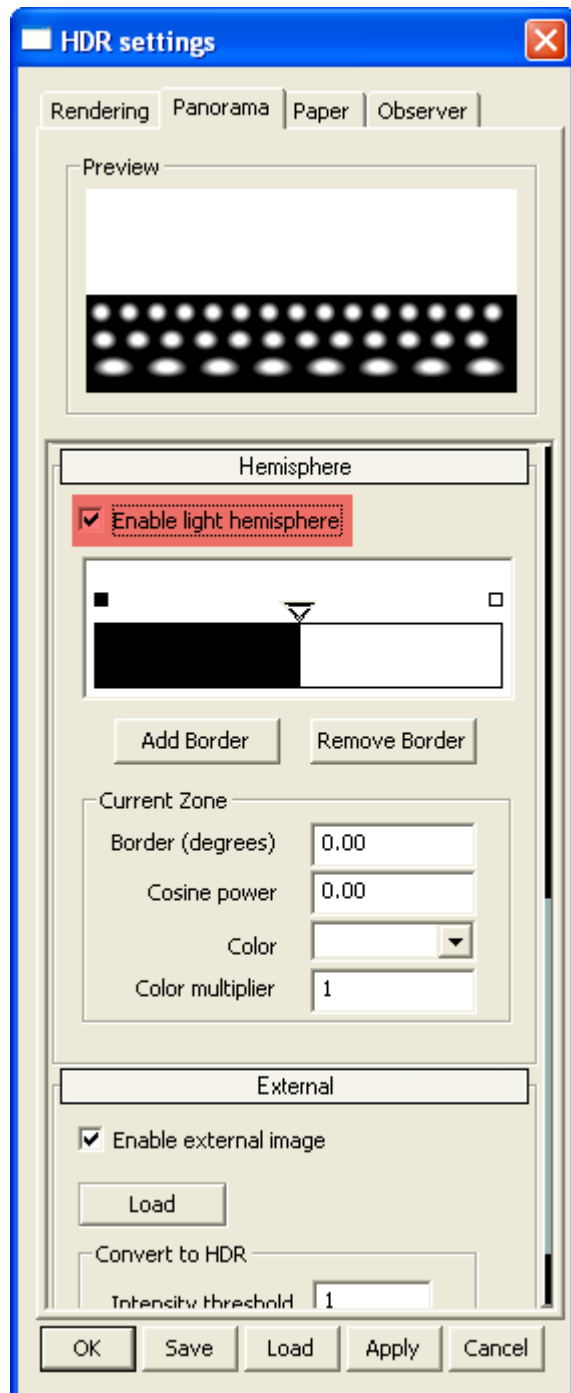
You can learn about the current image transparency mask by choosing the **Selection** mode. This should be particularly handy for BMP images:



## 4.6 Making a synthetic panorama with zones

### Step 1: Beginning

Check the **Enable light hemisphere** check box in the Panorama tab, Hemisphere group. The left side of this dialogue box is the lower part of the hemisphere and the right side is the upper zenith:

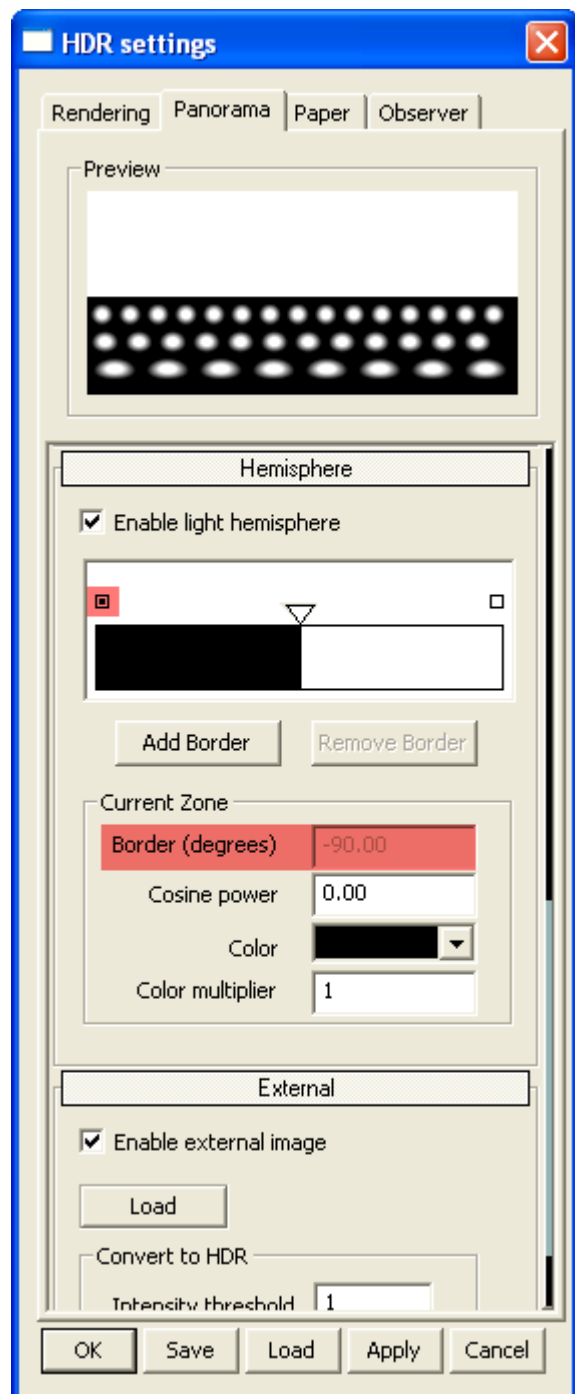


## Step 2. Configuring the leftmost zone

There are two zones available by default: the one on the right and the one on the left.

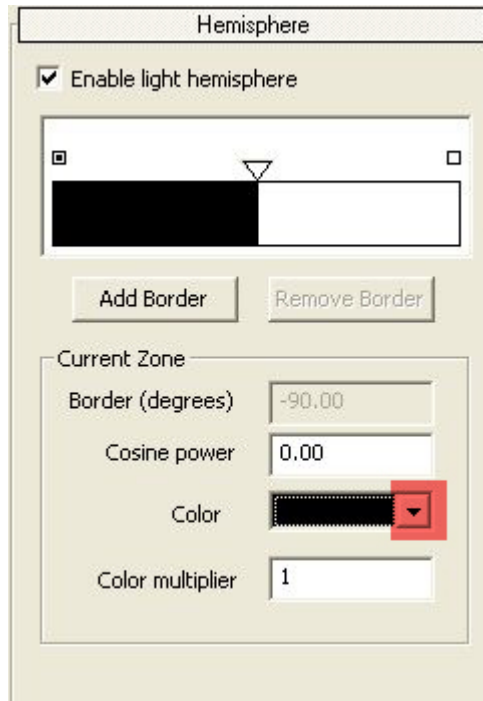
To select the leftmost zone, click the square on the left edge of zones control:

The **Current Zone** subgroup below the zones control represents parameter values for the currently selected zone: **Border**, **Cosine power**, **Color** and **Color multiplier**.

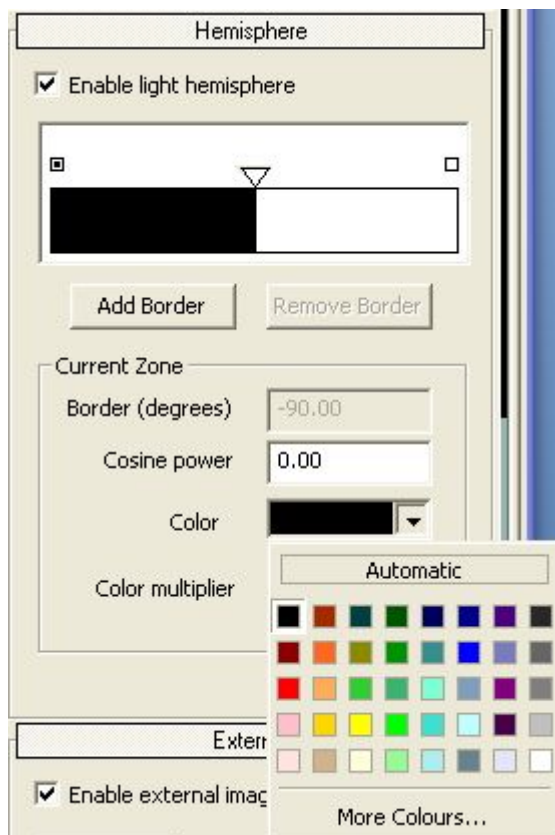


As you can see by selecting the leftmost zone square, this zone border is fixed: the **Border (degrees)** parameter is set to -90.0 degrees and you cannot change this value. You can change **Cosine power**, **Color** and **Color multiplier** for the leftmost zone.

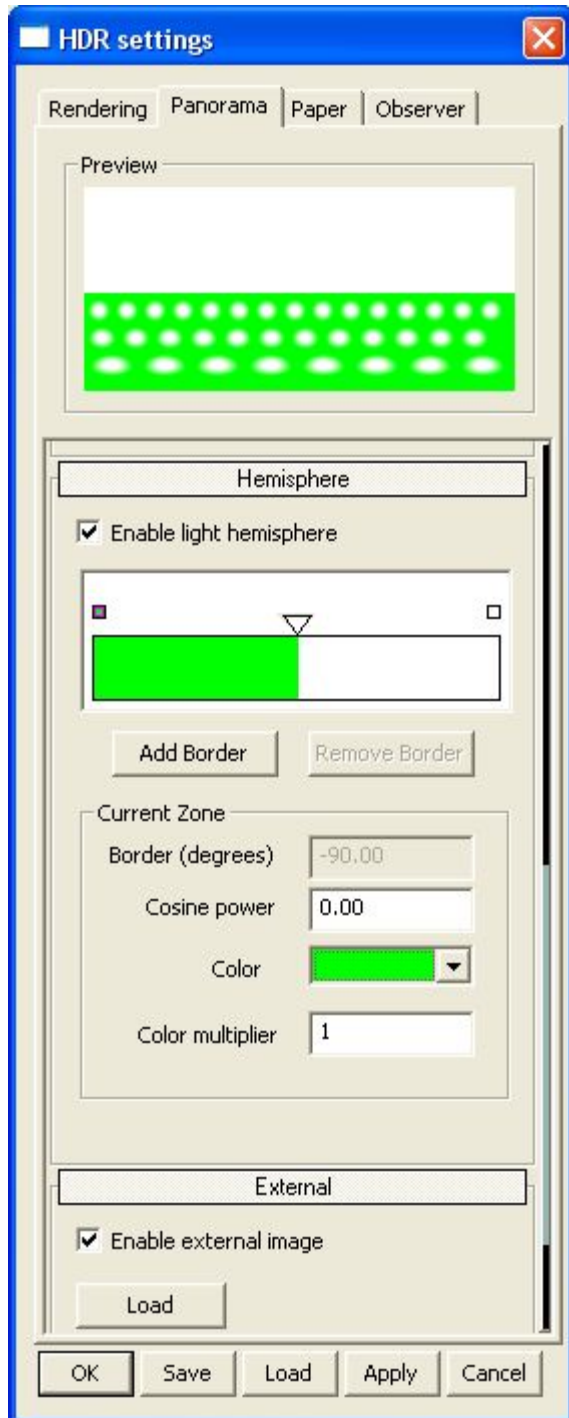
For example, to change the color of the zone, press the drop-down list arrow for the **Color** parameter:



Clicking the arrow will open the color picker window:

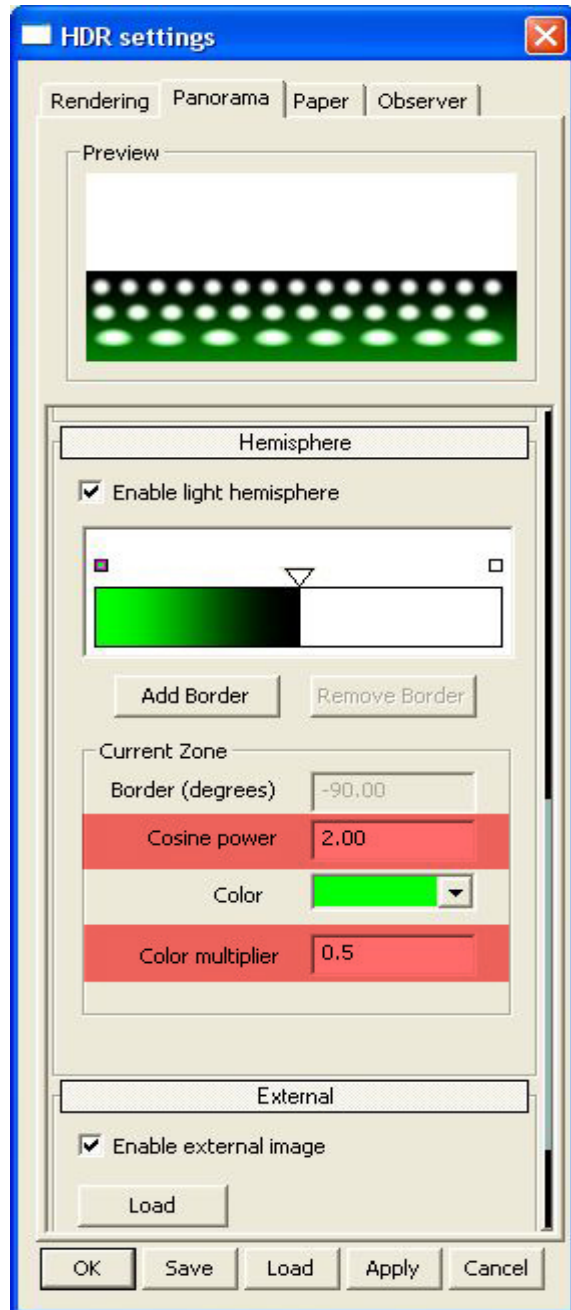


In the color picker window, you can choose the zone color you want. The screenshot below illustrates the green color chosen for the leftmost zone:



In addition to the ability of changing the zone color, you may want to change the value of either Cosine power or Color multiplier, or both.

To change the appropriate parameter value, type a modified value in the corresponding box:

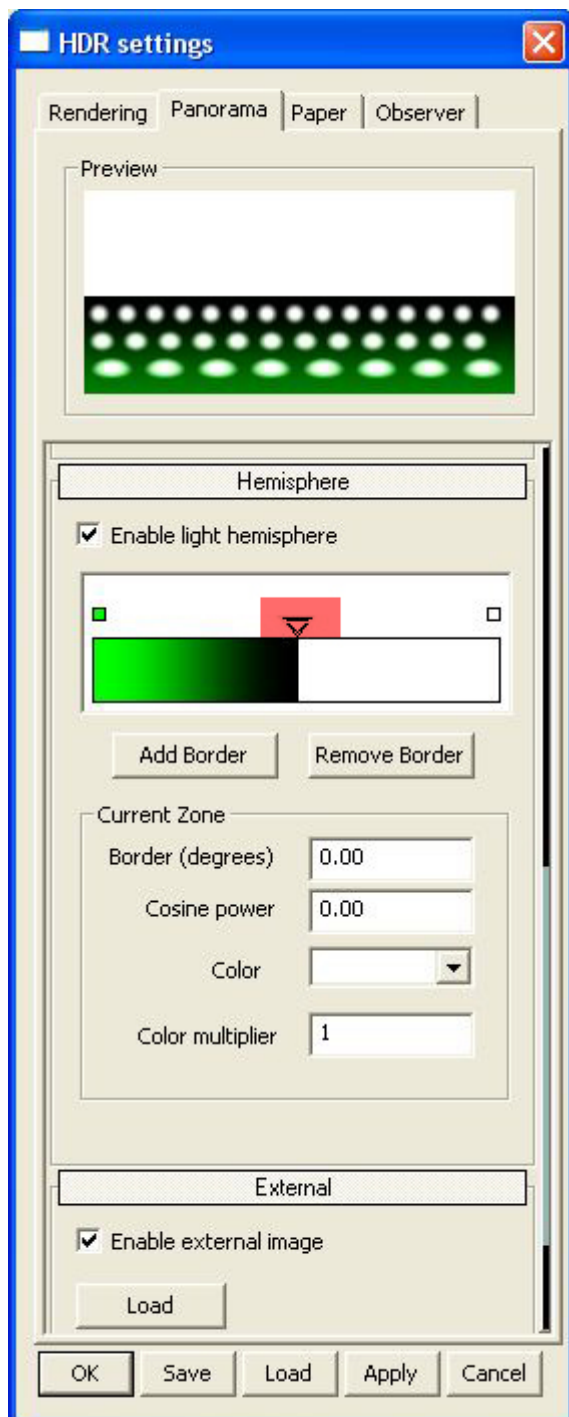


With the new values for **Cosine power** and **Color multiplier** parameters submitted, you can instantly see their impact on the panorama presented in the Preview window at the top of the Panorama tab.



### Step 3. Configuring an inner zone

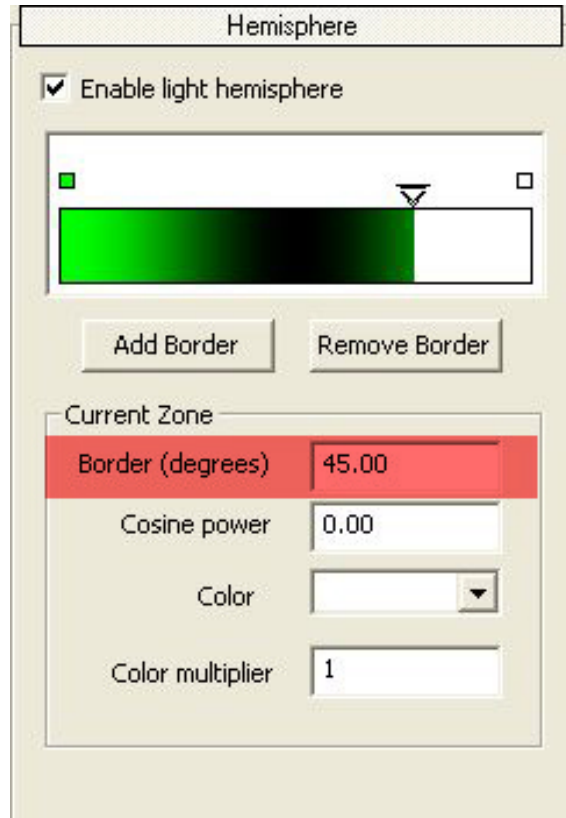
To select an inner zone, click the arrow at the middle of zones control:



In the **Current Zone** subgroup, you can see the parameters values for the zone selected. Setting up inner zone parameters is similar to that of the leftmost zone, described in the previous section.

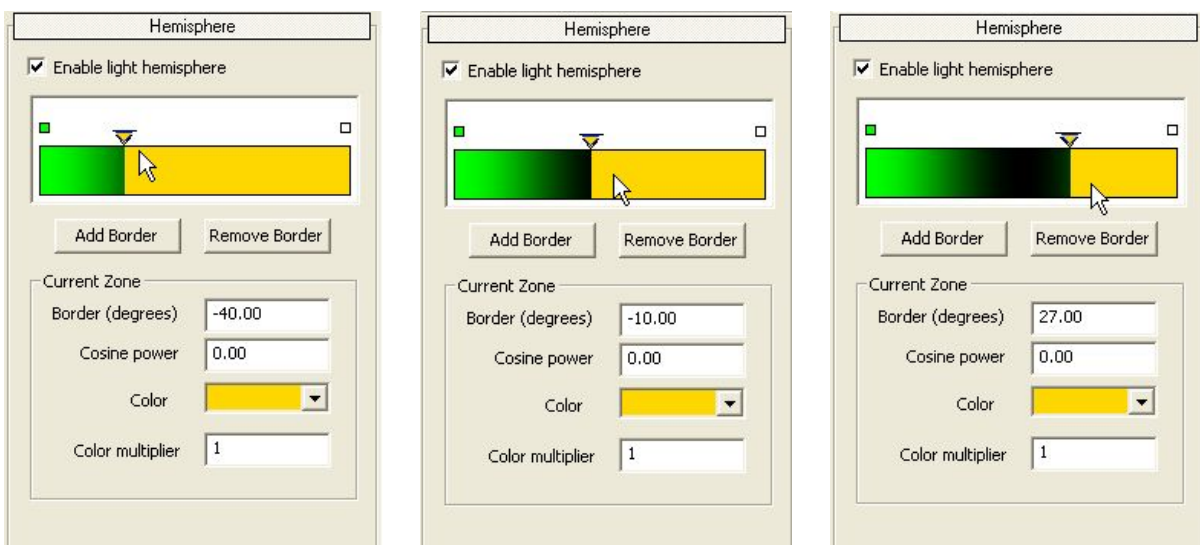
There are two ways of changing the angle of the inner zone border. The first way is to type the value between -90 and 90 degrees into the text box:

When a new value for the Border parameter is entered, you can see the inner zone arrow automatically change its position on the zones control.



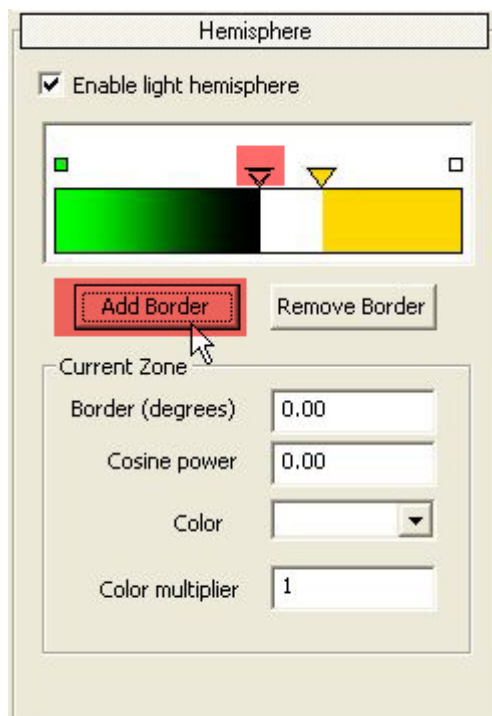
You can achieve the same effect in a different way. Select the inner zone arrow and drag it to the new preferred position. You can just click on the zone you want and hold the mouse button down while moving the mouse cursor to a position where you want the zone to be placed:

The **Borders (degrees)** field displays its new value automatically.



## Step 4. Adding new zones

To add a new zone to the panorama, press **Add Border** button:



As the result of pressing the **Add Border** button, you will see a new arrow appear in the middle of the zones control.

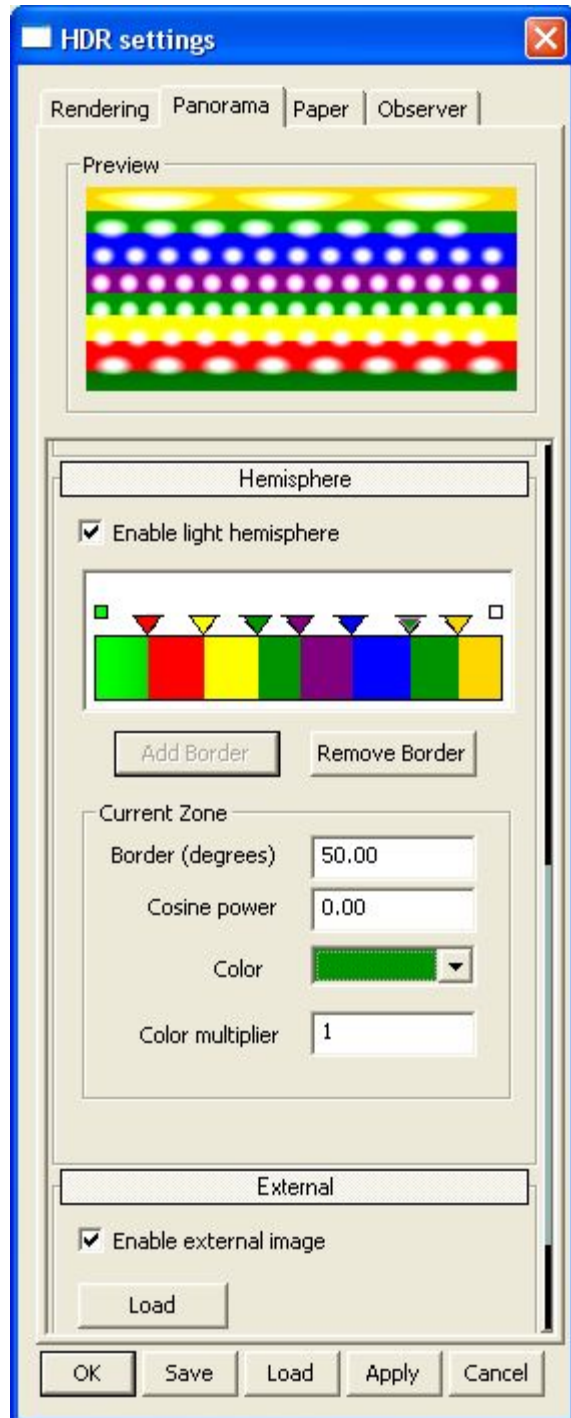


All new zones appear in 0.0 degrees position with white color and the default values for cosine power and color multiplier parameters. The new arrow is selected by default, so that you can instantly proceed with configuring this zone's parameters, as discussed in step 3.

You can change the selected zone at any time by choosing an arrow corresponding to the zone you need to adjust.

If you press **Add Border** button twice or several times while not changing arrow positions, the new arrow will be placed above the one added before.

The maximum number of zones is 8:

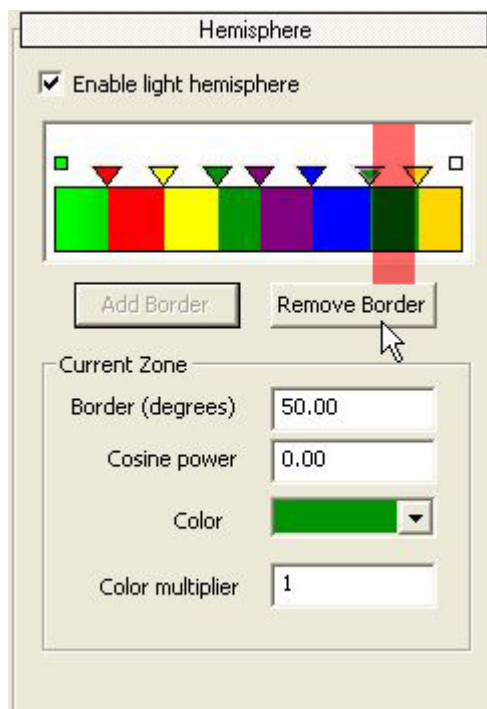
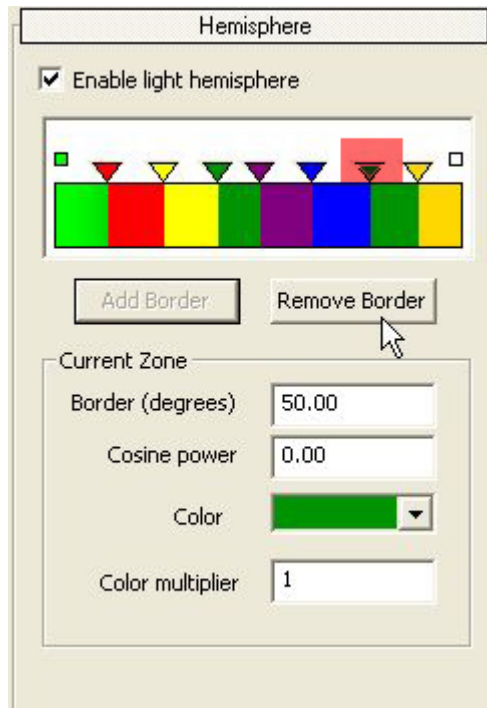


## Step 5. Removing the zone

To remove the zone, you should first select the zone you want to remove.

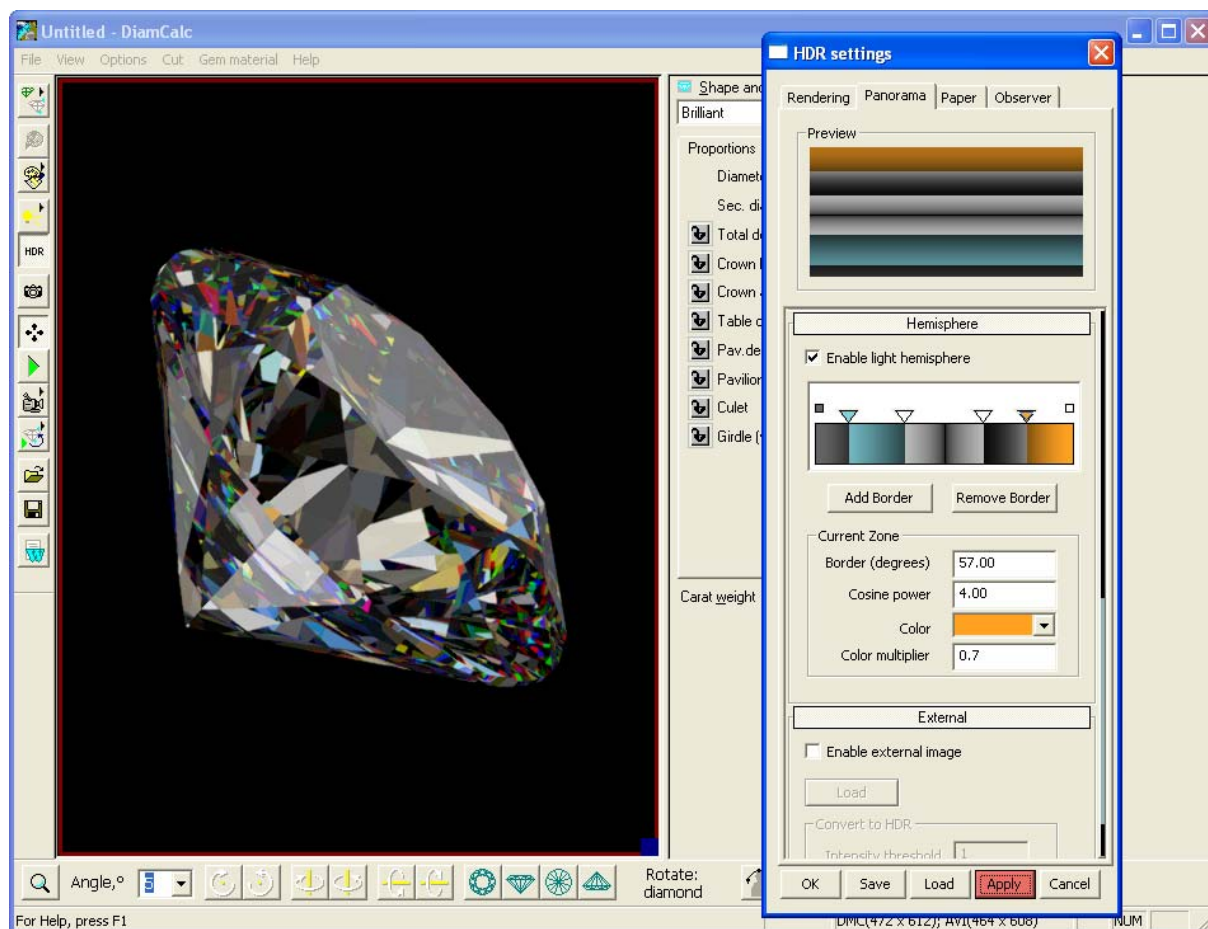
To select a zone, choose the corresponding arrow or left click on the zone area. Make sure the zone you want to remove is selected: the arrow changes its appearance to bold and the Current Zone subgroup contains the color of the zone you have chosen. After selecting the zone desired for removal, press Remove Border button. The zone will be removed.

You can remove all zones except for the leftmost zone (i.e. the one that has its border fixed to -90 degrees).

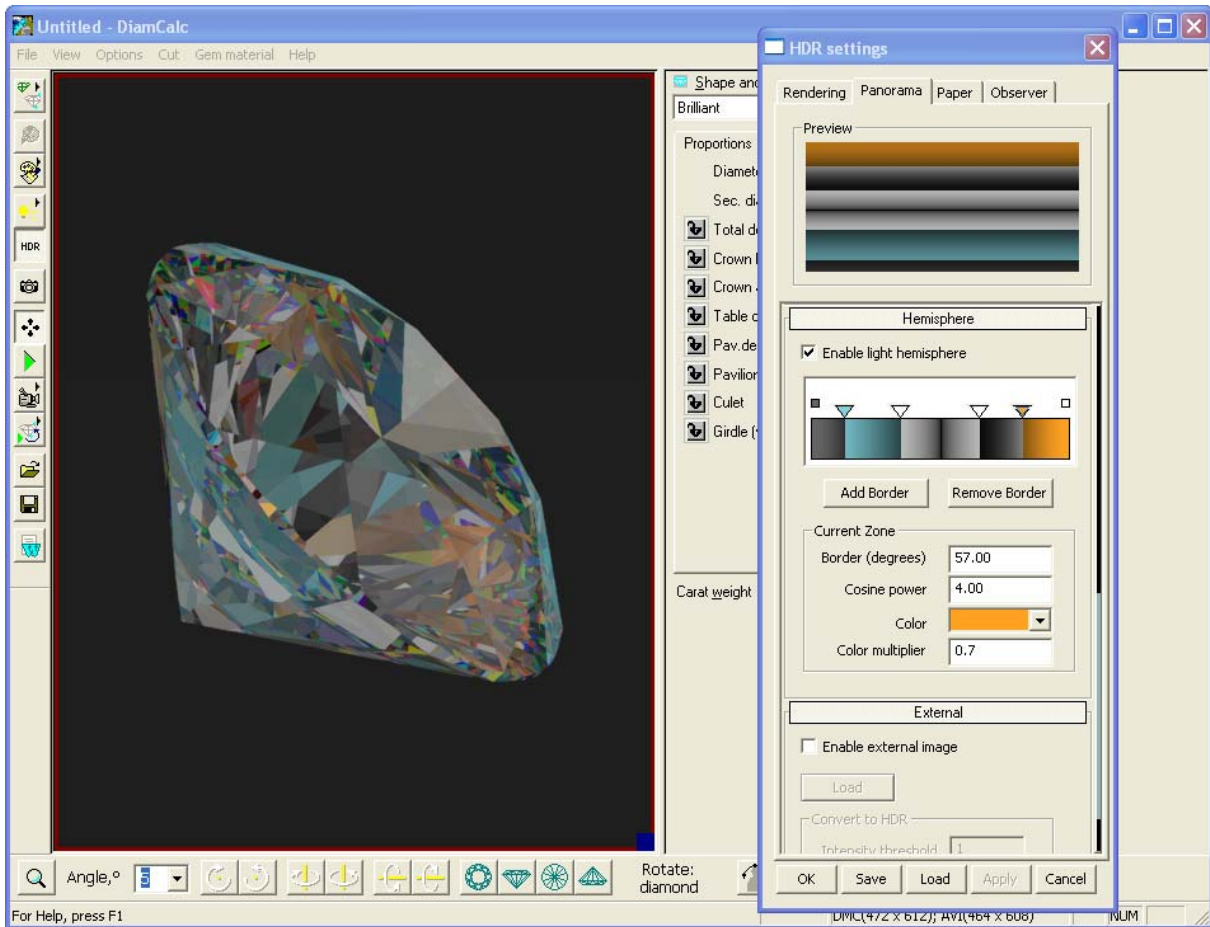


## Step 6. Viewing the created panorama with the diamond

Press **Apply** button at the bottom of the HDR Settings dialog to generate the panorama:



You can see the diamond rendered using the generated panorama in the main application window:





## 5 Creating High dynamic range (HDR) panorama by third-party software

You can create high dynamic range panorama for DiamCalc using any editor, which supports 32-bit per channel color mode.

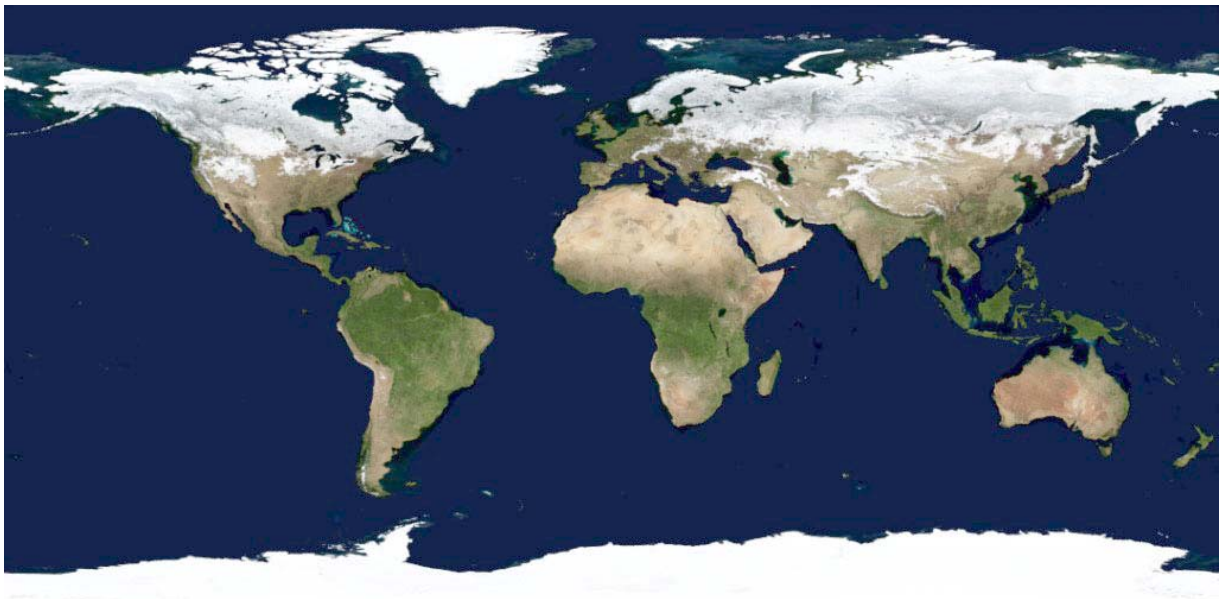
For example, you can use:

- Adobe Photoshop CS3 Extended (<http://www.adobe.com/downloads/>)
- Adobe Photoshop CS (<http://www.adobe.com/downloads/>)
- Artizen HDR (<http://www.supportingcomputers.net/>)

### 5.1 *The idea of mapping an image onto the sphere*

The panorama image used for DiamCalc 3.0 needs to be in what's known as «equidistant cylindrical projection», more commonly called a «cylindrical map». The image is wrapped onto the sphere.

We load the image like this:



And we get the environment of the diamond (diamond is somewhere inside this sphere):

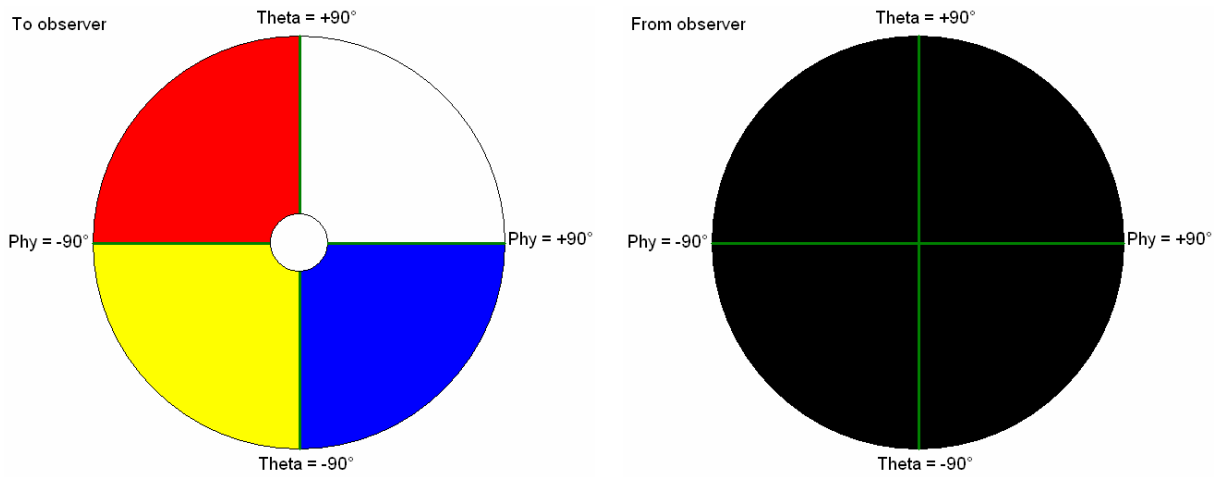






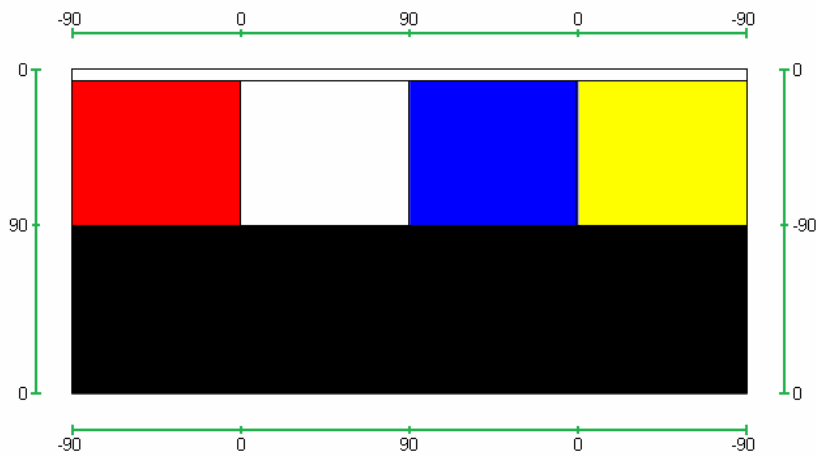
Here is an example of creating your own HDR panorama.

1. The top hemisphere should look like this:
2. And the bottom hemisphere is black:

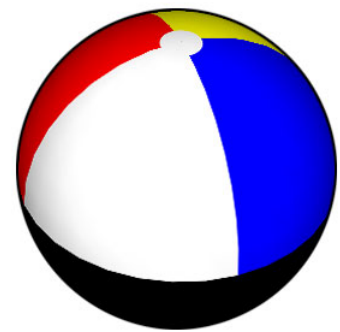


\*(green lines show the axis)

3. Then the panorama image will be:

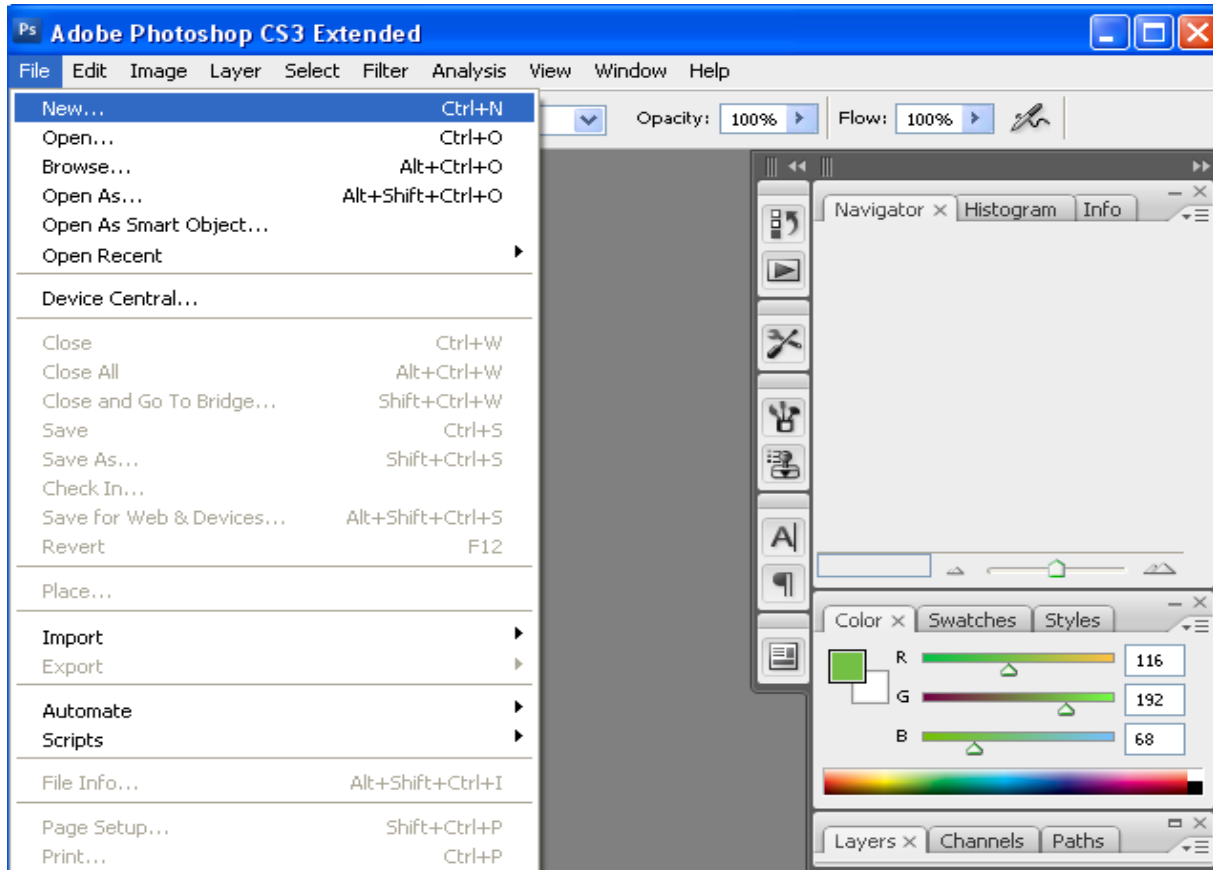


4. When your image wrap the sphere, it looks like this:



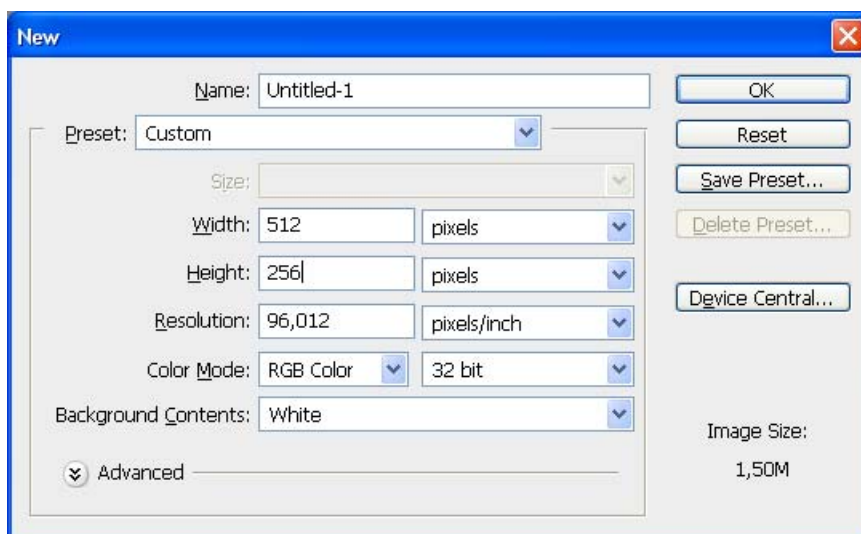
## 5.2 Adobe Photoshop CS3 Extended

Choose **File->New** from the menu panel



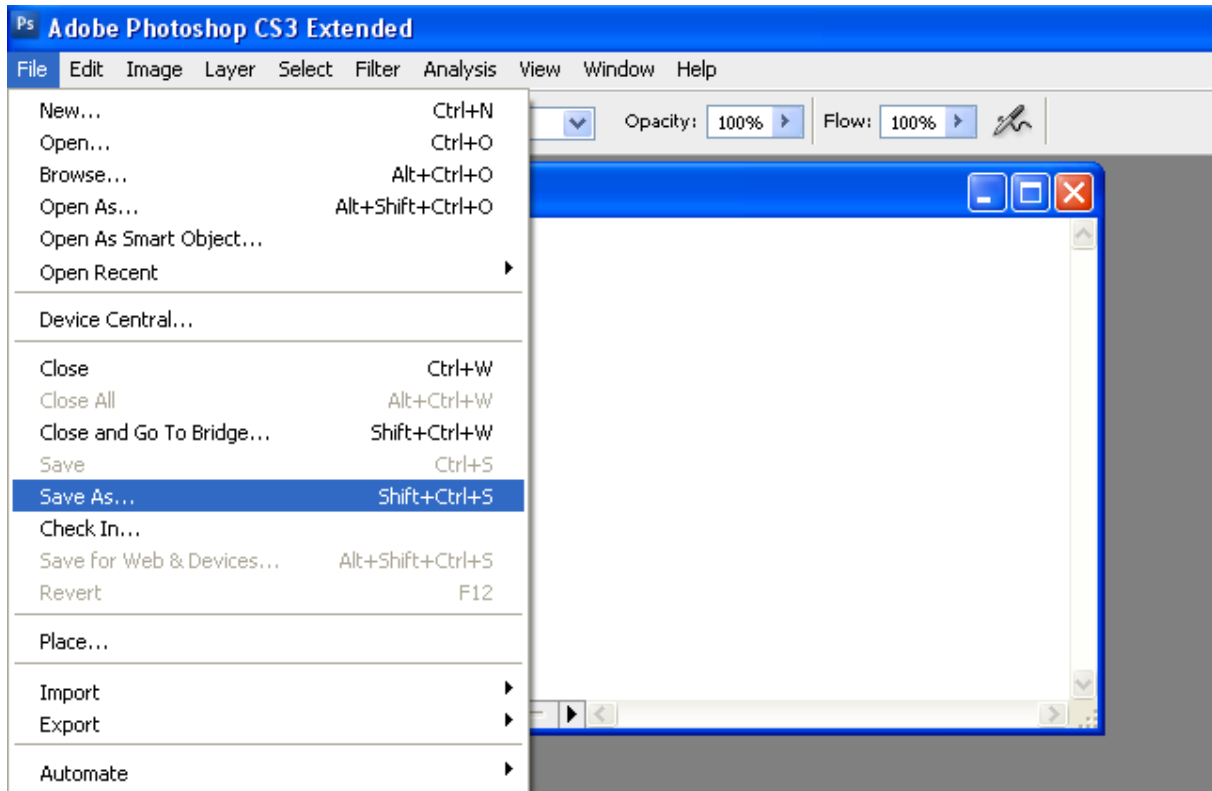
The dialog box with new image options will appear. Here you should change width and heights. Remember that height should be two times less than weight, but of them should be power of 2 (such as 1024x512, 512x256, etc.)

Then, be sure that Color Mode is set to **RGB Color** and **32 bit**

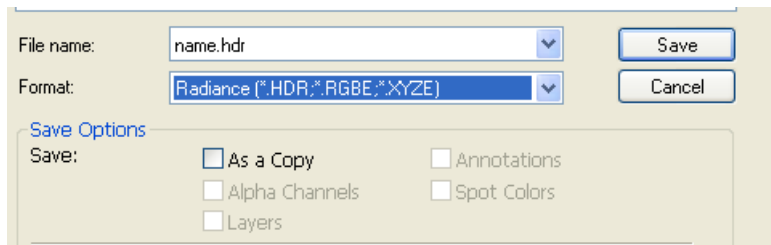


The blank image will appear and you can edit it.

When you finished editing, you should save it in HDR file format. Choose **File->Save as...** from the menu panel.



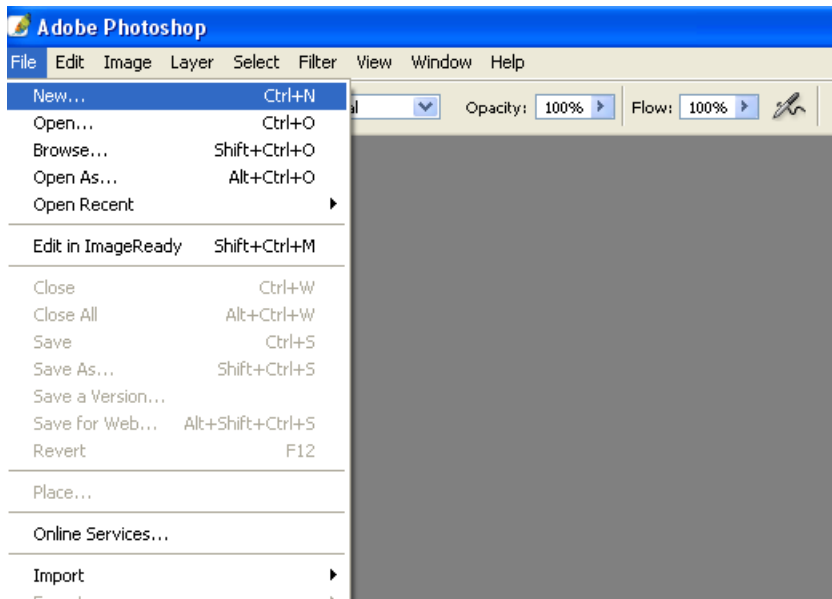
The dialog of all supported formats will appear. Make sure, that HDR file format was chosen. For being sure, type **.hdr** at the end of the filename.



### 5.3 Adobe Photoshop CS

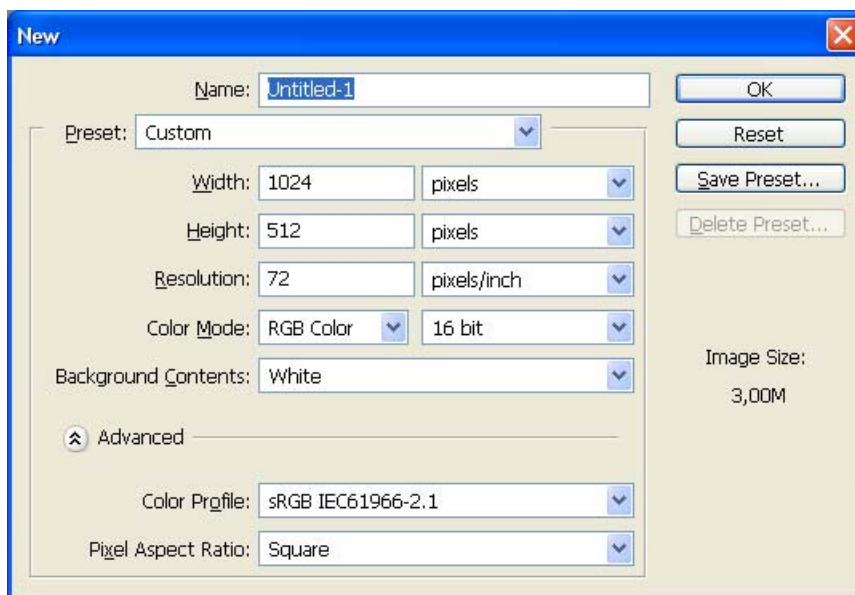
Formally Adobe Photoshop CS can't create 32-bit per channel images, but you can create 16-bit HDR and work with it (most of the time it will work correctly, but for better result use Adobe Photoshop CS3 or other software, which can create 32-bit per channel images).

Choose **File->New** from the menu panel



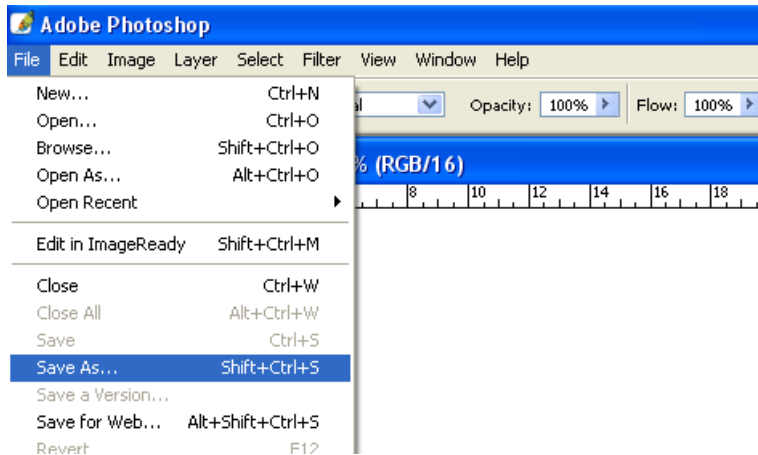
The dialog box with new image options will appear. Here you should change width and heights. Remember that height should be two times less than weight, but of them should be power of 2 (such as 1024x512, 512x256, etc)

Then, be sure that Color Mode is set to RGB Color and 16 bit

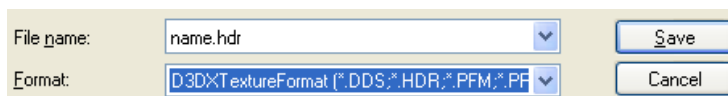


The blank image will appear and you can edit it

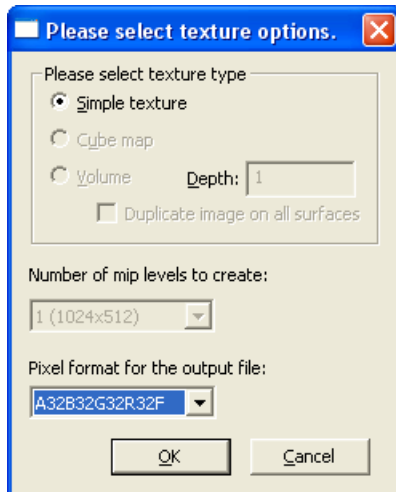
When you finished editing, you should save it in HDR file format. Choose **File->Save as...** from the menu panel



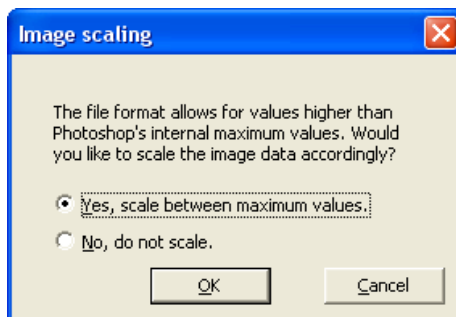
The dialog of all supported formats will appear. Make sure, that HDR file format was chosen. In Adobe Photoshop CS you should type .hdr at the end of the filename. If you forgot to do it .dds format will be set by default and it won't work with DiamCalc 3.0.



When you click **Save** button the dialog will appear. **Pixel format for the output file** should be **A32B32G32R32F**. Then press **OK**

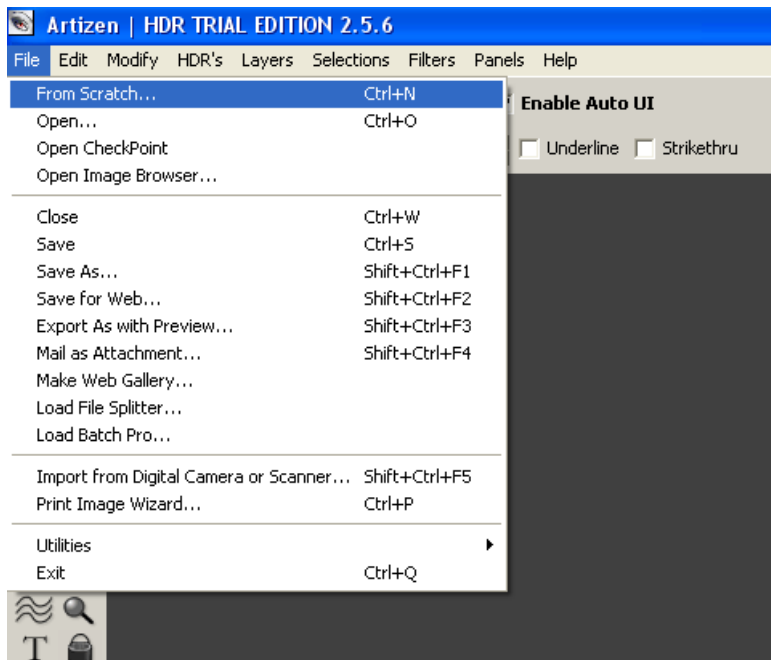


In the next dialog choose **Yes, scale between maximum values**

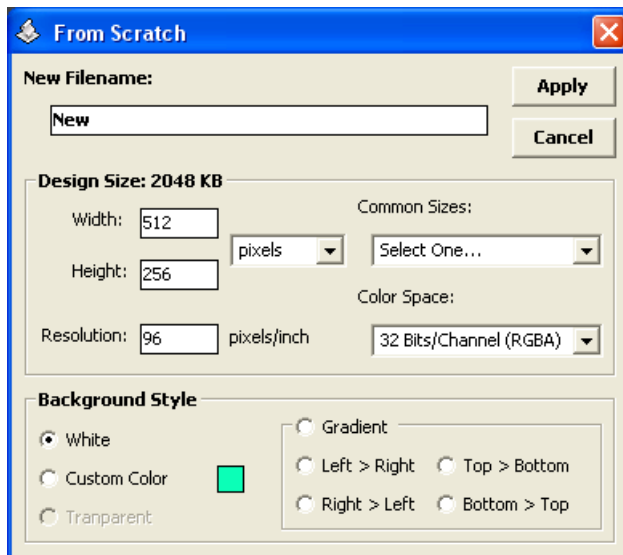


## 5.4 Artizen HDR

Choose **File->From Scratch..**

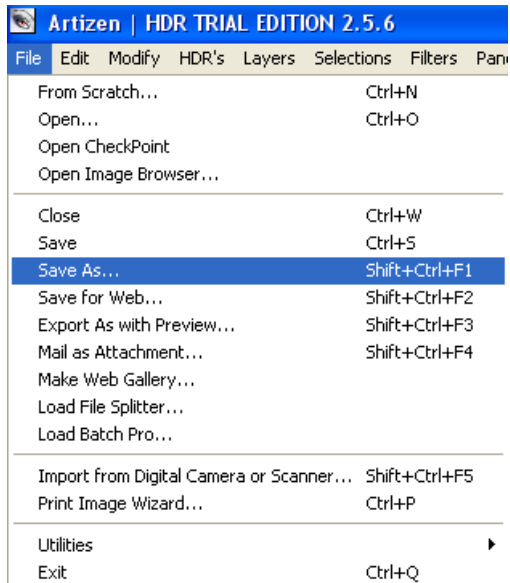


In the following dialog set **Width**, **Height** and **Color Space**. Remember that height should be two times less than weight, but of them should be power of 2 (such as 1024x512, 512x256, etc.). Color space should be **32 Bits/Channel (RGBA)**

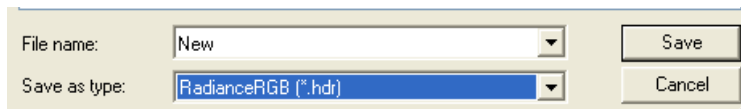


The blank image will appear and you can edit it

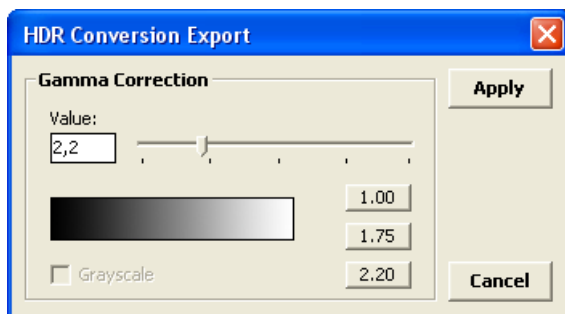
When you finished editing, you should save it in HDR file format. Choose **File->Save as...** from the menu panel



The dialog of all supported formats will appear. Make sure, that HDR file format was chosen. Press **Save** button.



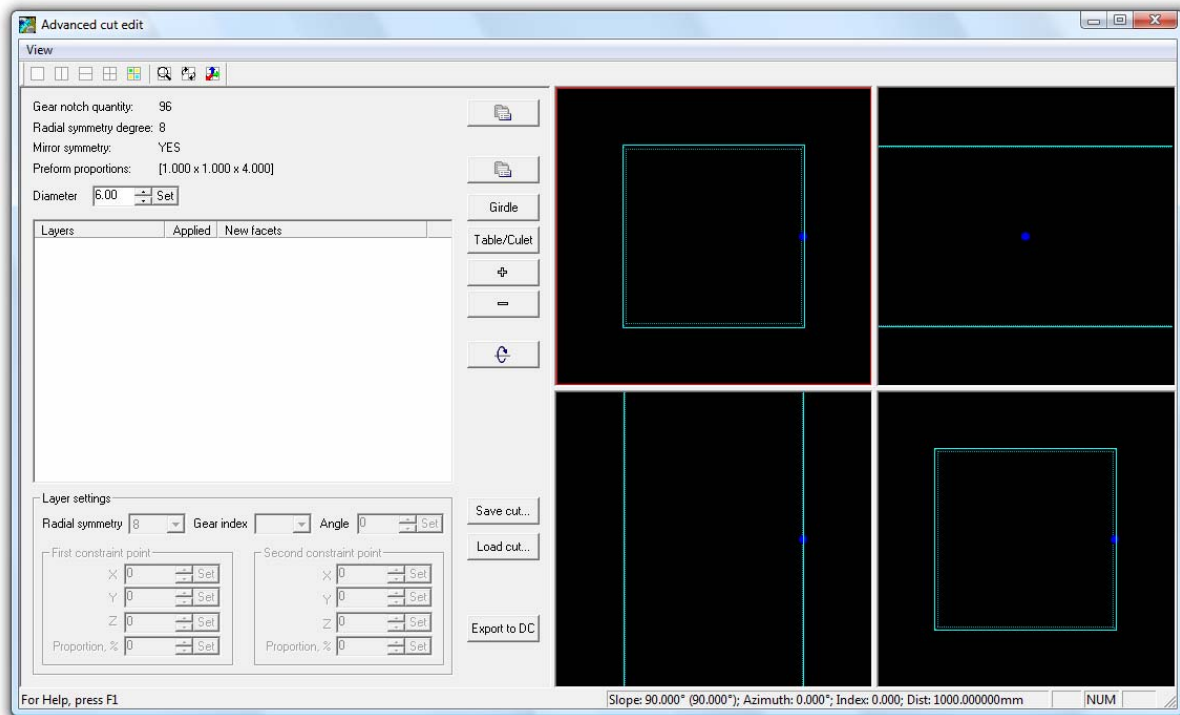
Then you should set **Gamma Correction** to 2.2 and click **Apply** button



## 6 Creating Cuts with Cut Designer

### 6.1 Getting started with Cut Designer

Open panel Advanced cut edit from menu Cut / Cut designer... The Utility allows constructing different types of cuts. There are Cut editor dialog window on the left side and model view on the right side.



The panel on the top allows switching different types of the model view:



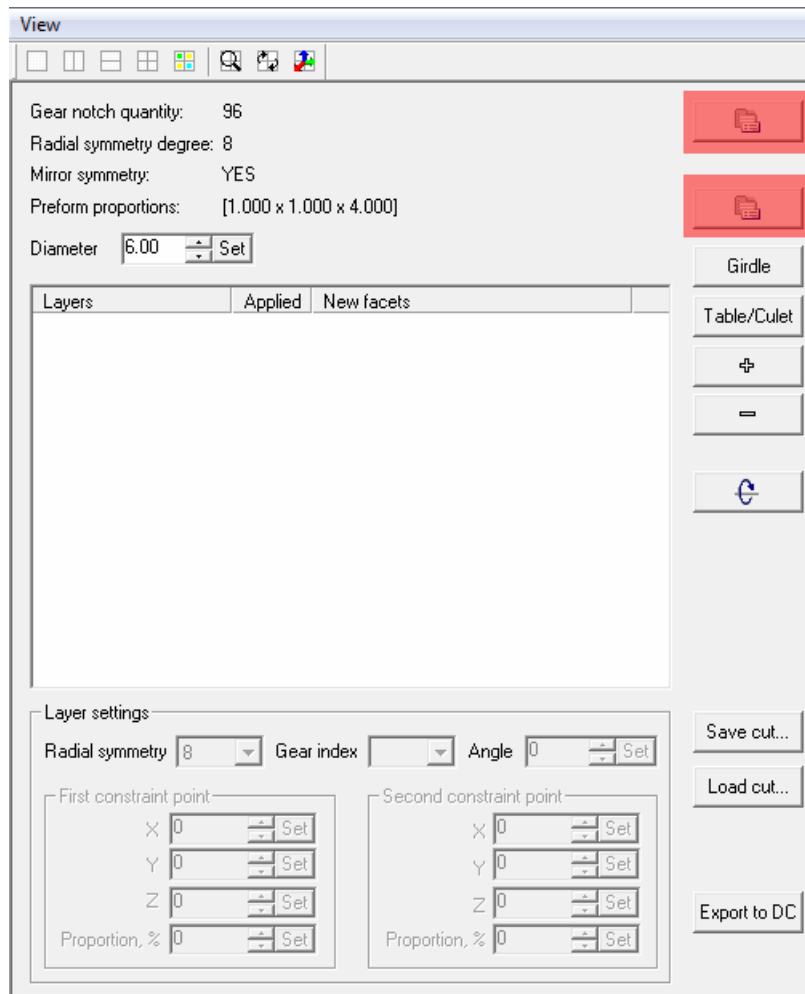
- Remove all splits of the model view
- Split model view in two (vertical)
- Split model view in two (horizontal)
- Split model view in four
- Synchronize zoom factor in All view during change
- Rotate all view synchronously
- Show coordinate system axes in all views



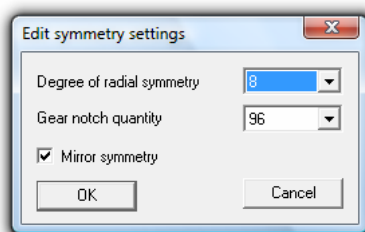
The general settings of cut are displayed on the left top side of the panel below.

- Gear notch quantity
- Radial symmetry degree
- Mirror symmetry
- Preform proportions

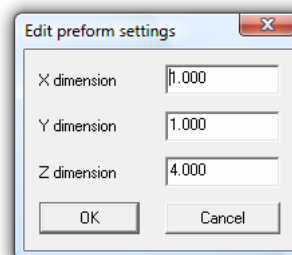
You can change general settings in the panels Edit symmetry settings and Edit preform Settings (witch opened with buttons marked as red on the picture below):



Symmetry settings panel:



Preform settings panel:



You can set diameter on the top of panel.

Buttons Girdle, +, -, Table/Culet allow constructing facets. You can save cut, load cut and export to DC on the bottom of panel.

Please see the examples of creating Round brilliant, Princess and Gabrielle below.

## 6.2 Creating Brilliant cut

### General settings (as defaults)

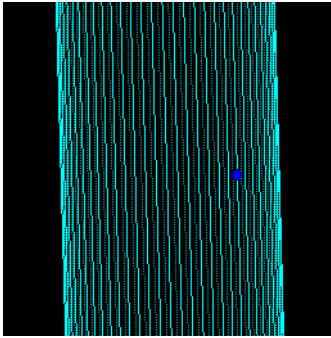
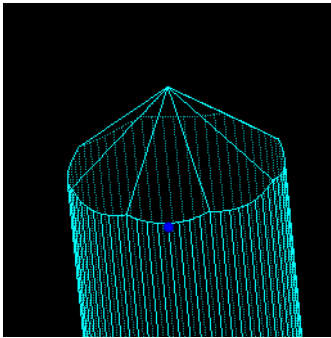
Edit Symmetry Settings:

- Degree of radial symmetry: **8**
- Gear notch quantity: **96**
- Mirror symmetry: **YES**

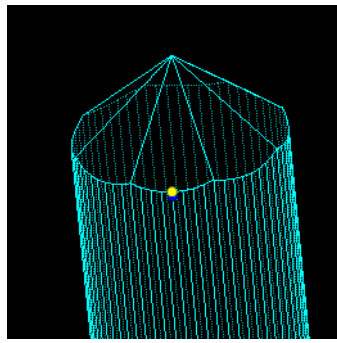
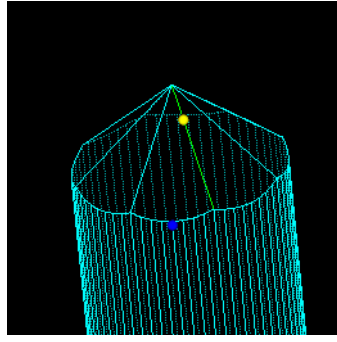
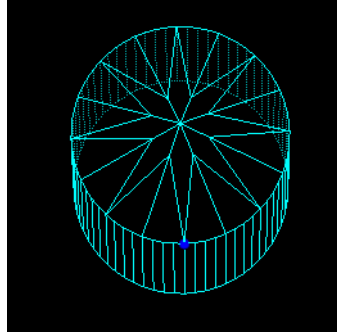
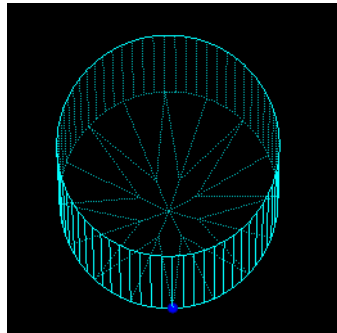
Edit Preform Settings:

- X dimension: **1**
- Y dimension: **1**
- Z dimension: **4**

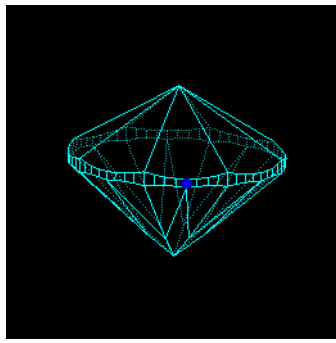
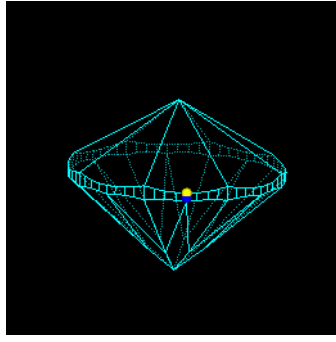
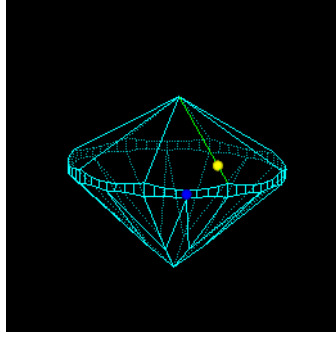
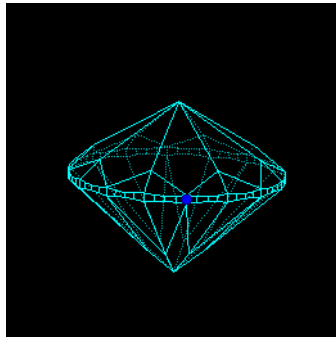
### Cutting Steps

Step	Result
<p>1</p> <div data-bbox="252 1010 389 1061" style="border: 1px dashed gray; padding: 2px; display: inline-block;">Girdle</div> <ul style="list-style-type: none"> <li>• Gear index: <b>1</b></li> <li>• Degree of radial symmetry: <b>32</b></li> </ul>	
<p>2</p> <div data-bbox="252 1373 389 1424" style="border: 1px dashed gray; padding: 2px; display: inline-block;">+</div> + Mains <ul style="list-style-type: none"> <li>• Gear index: <b>0</b></li> <li>• Angle: <b>41</b></li> <li>• Degree of radial symmetry: <b>8</b></li> </ul>	

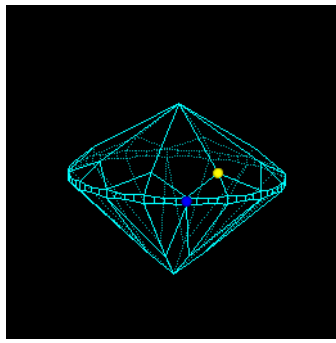
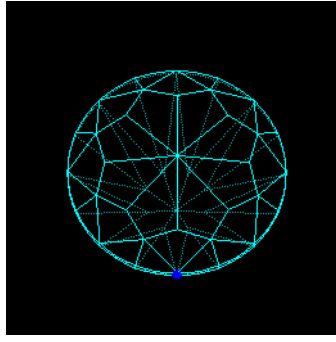
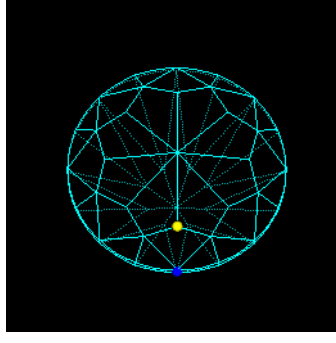
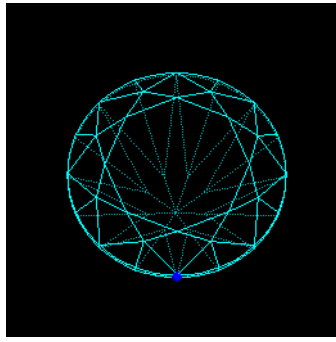


3	<div data-bbox="252 246 386 295" data-label="Image"> </div> <p>+ Facet through two points</p> <ul style="list-style-type: none"> <li>• Gear index: <b>3</b></li> <li>• Degree of radial symmetry: <b>8</b></li> <li>• Use symmetry: <b>YES</b></li> <li>• 1st pt. Point on existing vertex.</li> </ul> <p>Select the vertex marked by blue point. Put on yellow point:</p>	
	<ul style="list-style-type: none"> <li>• 2nd pt. Point on edge with proportions.</li> </ul> <p>Select the edge point marked with yellow (Proportion value is about 70%):</p>	
	<p>Facets are ready:</p>	
4	<div data-bbox="252 1339 386 1388" data-label="Image"> </div>	



5	<div data-bbox="252 241 389 295" style="border: 1px solid black; padding: 2px; display: inline-block;">+</div> + Mains <ul style="list-style-type: none"> <li>• Gear index: <b>0</b></li> <li>• Angle: <b>33</b></li> </ul> Degree of radial symmetry: <b>8</b>	
6	<div data-bbox="252 609 389 663" style="border: 1px solid black; padding: 2px; display: inline-block;">+</div> + Facet through two points <ul style="list-style-type: none"> <li>• Gear index: <b>3</b></li> <li>• Degree of radial symmetry: <b>8</b></li> <li>• Use symmetry: <b>YES</b></li> <li>• 1st pt. Point on existing vertex.</li> </ul> Select the vertex marked by blue point. Put on yellow point:	
	<ul style="list-style-type: none"> <li>• 2nd pt. Point on edge with proportions.</li> </ul> Select the edge point marked with yellow (Proportion value is about 20%):	
	Facets are ready.	



7	<div data-bbox="252 241 389 295" style="border: 1px dashed black; padding: 2px; display: inline-block;">+</div> + Facet through one point <ul style="list-style-type: none"> <li>• Gear index: <b>6</b></li> <li>• Angle: <b>15</b></li> <li>• Degree of radial symmetry: <b>8</b></li> <li>• Use symmetry: <b>YES</b></li> </ul> Point on existing vertex Select the vertex marked with yellow:	
	Facets are ready.	
8	<div data-bbox="252 976 389 1030" style="border: 1px dashed black; padding: 2px; display: inline-block;">Table/Culet</div> + Point on existing vertex  Select the vertex marked with yellow:	
	Table is ready.	



- 9 Return to the 2nd step (Mains, 8 facets) and change Z-coordinate of First constraint point to **0.05**

Layer settings

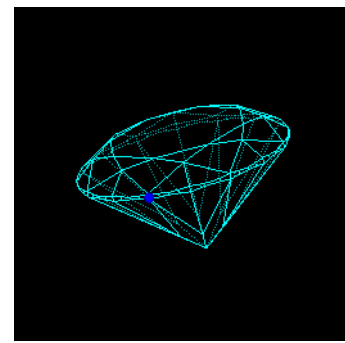
Radial symmetry: 8 Gear index: 0 Angle: 41.0 Set

First constraint point:

X: 3.00 Set  
Y: 0.00 Set  
Z: 0.05 Set  
Proportion, %: 0 Set

Second constraint point:

X: 0.00 Set  
Y: 0.00 Set  
Z: 0.00 Set  
Proportion, %: 0 Set

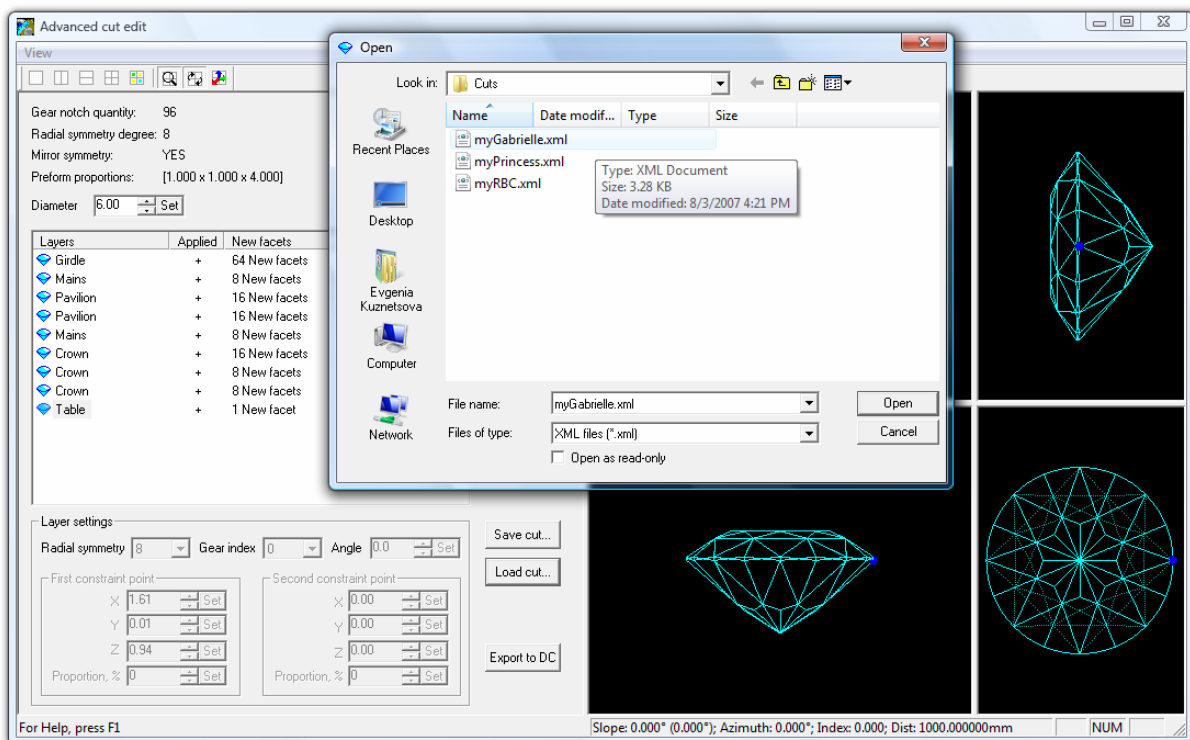


The cut is ready. Press button

### 6.3 Save Cut, Load cut and Export to DC.

You can save, load and export created cuts. Press button Save cut..The cut will be saved in xml format. The xml file you be able to store or send via e-mail.

Press button Load cut..to open saved cut.



Press button Export to DC. Type a name for new cut and press Ok.

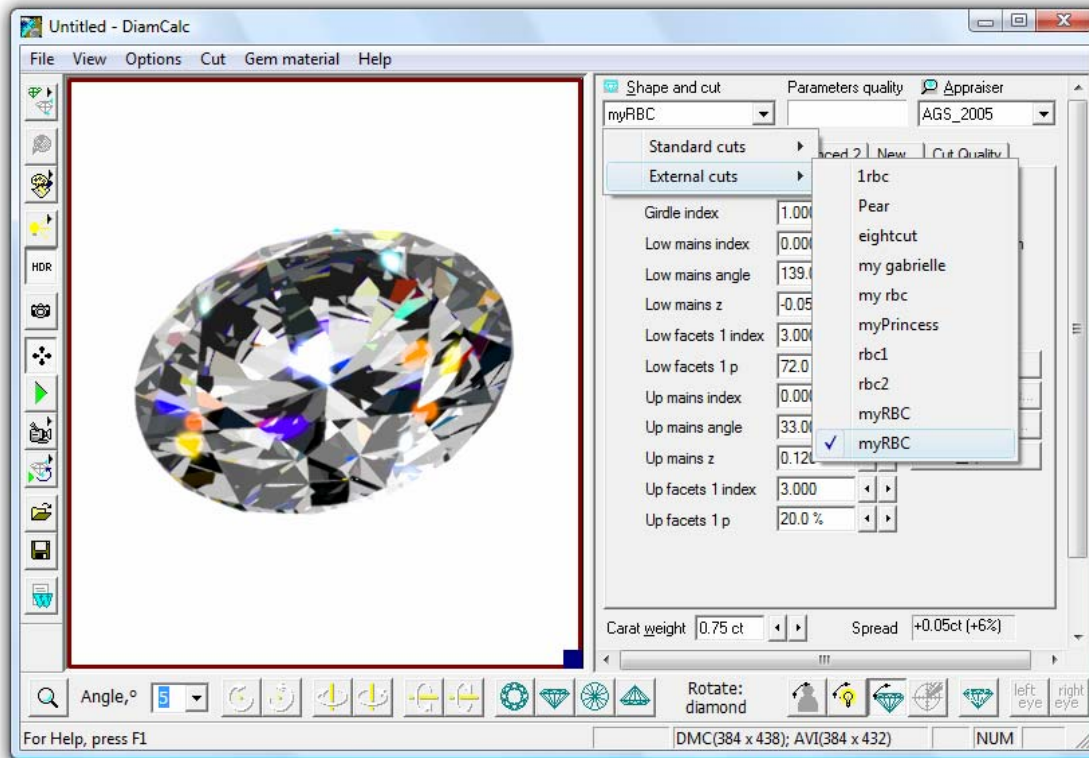
Name

Enter Cutting Name: myRBC

OK Cancel

The Cut Designer will be closed and you can explore created cut in DiamCalc (see screenshot below).

New cuts from Cut designer you can find in the external cut list.



If you need addition information about exported cuts please open panel Parametric cuts info from menu Cut. Exported cuts from Cut Designer are included in the GingemaUser.dll

Visible cut name	Cut name for appraiser	ID	Module name
Heart	Heart	{C3A527D4-1198-4CEF-BD65-824429DDCF8C}	DiamCalc.exe
Marquise	Marquise	{FE68C6ED-1C29-11D4-8C66-00105A711E33}	DiamCalc.exe
Oval	Oval	{FE68C6EE-1C29-11D4-8C66-00105A711E33}	DiamCalc.exe
Pear	Pear	{FE68C6EF-1C29-11D4-8C66-00105A711E33}	DiamCalc.exe
Princess 2-chevron	Princess	{FE68C6F0-1C29-11D4-8C66-00105A711E33}	DiamCalc.exe
Princess 3-chevron	Princess 3s	{7E9CA5C6-ACCD-4851-839A-2BA1AB105C78}	DiamCalc.exe
Prism	Prism	{0984E6B1-FA0A-4DCD-9B0F-26342A574E60}	DiamCalc.exe
Radiant	Radiant	{6C2C8945-8300-433E-A197-E139E94E5BCE}	DiamCalc.exe
Marquise_wBT.P...	Marquise_wBT.P24C32	{B128D821-71B9-46C8-A6FE-C6E6D19E0DD2}	MarquiseWBT_P24C...
MoonMarquise.P...	MoonMarquise.P34C32	{06C6CD36-2318-4E24-8B85-42A18B0BE444}	MoonMarquise_P34...
MoonMarquise.P...	MoonMarquise.P36C32	{80A4B5F6-9EBB-4BD2-9FA8-98F413EB0833}	MoonMarquise_P36...
MoonMarquise_...	MoonMarquise_wBT.P...	{EA7BE78E-20B2-47F6-89C1-A7CF243999E6}	MoonMarquiseWBT...
MoonMarquise_...	MoonMarquise_wBT.P...	{EF87513E-480B-41AF-B15A-362DA2950272}	MoonMarquiseWBT...
MoonOval.P36C32	MoonOval.P36C32	{F1E2BCCA-181F-450C-88A2-4E88A9D4D962}	MoonOval_P36C32.dll
MoonOval_wBT....	MoonOval_wBT.P36C32	{41644482-C736-4E98-9489-36E27E1D0663}	MoonOvalWBT_P36...
MoonPear_wBT....	MoonPear_wBT.P32C32	{15D55151-28DA-4782-9EC1-E2903F2464DF}	MoonPearWBT_P32...
MoonPear_wBT....	MoonPear_wBT.P36C32	{B868970A-4790-47C8-94EC-7397D95A4E10}	MoonPearWBT_P36...
MoonPear_wBT....	MoonPear_wBT.P36C32	{465FADDC-6A40-485C-984F-857C9C58C8E0}	MoonPearWBT_P36...
Octagon-Emeral...	Octagon-Emerald.P32...	{F091487A-9DFD-4E8C-A86E-61E455A76DF9}	OctagonEmerald_P...
Octagon.P32C24	Octagon.P32C24	{B300D832-4AA8-4402-B587-89D6744526FA}	Octagon_P32C24.dll
Oval_wBT.P24C32	Oval_wBT.P24C32	{CD9C9B98-82D0-4583-B6CE-53E912233536}	OvalWBT_P24C32.dll
Pear	Pear	{FE68C6E2-1C29-11D4-8C66-00105A711E33}	Pear.dll
Pear_wBT.P24C32	Pear_wBT.P24C32	{C3C1A347-D4B9-490C-A469-7852D53915FE}	PearWBT_P24C32.dll
Radiant P28C24	Radiant P28C24	{C2E71CD2-3CEB-4E4A-9F49-0AE0D4F3C184}	Radiant_P28C24.dll
myPrincess	myPrincess	{EE94B57C-564F-4538-BC12-99D5722BD20E}	GingemaUser.dll

## 6.4 Creating Princess cut

### General settings

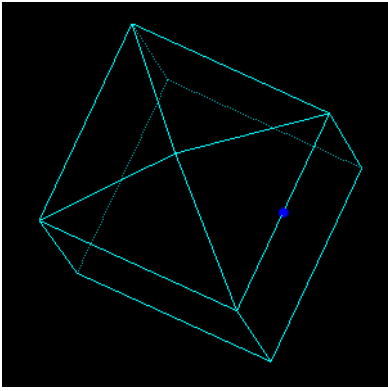
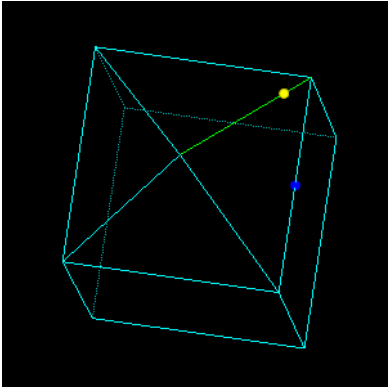
Edit Symmetry Settings:

- Degree of radial symmetry: **4**
- Gear notch quantity: **120**
- Mirror symmetry: **YES**

Edit Preform Settings:

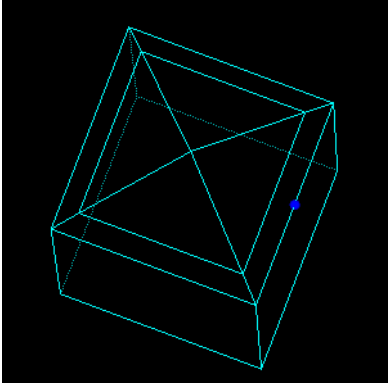

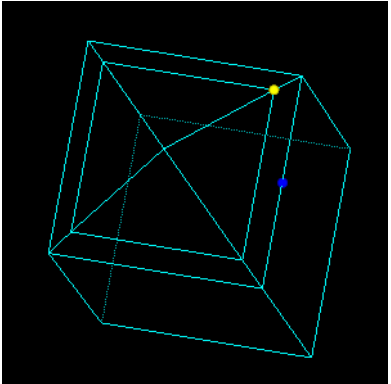
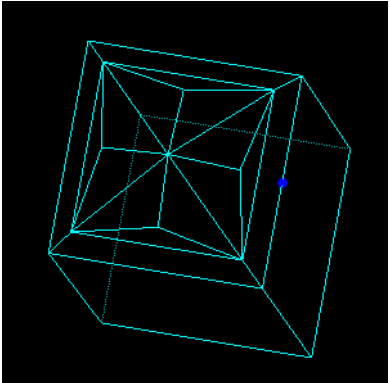
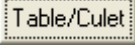
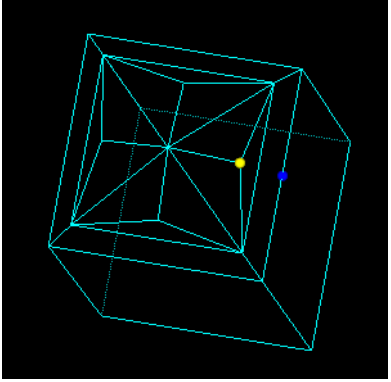
- X dimension: **1**
- Y dimension: **1**
- Z dimension: **4**

### Cutting Steps

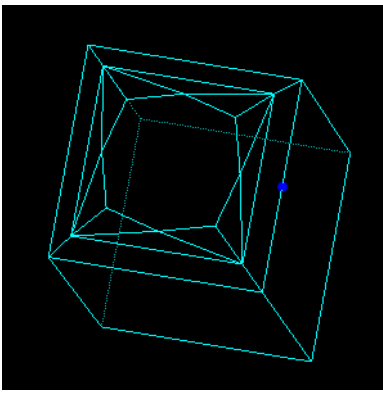

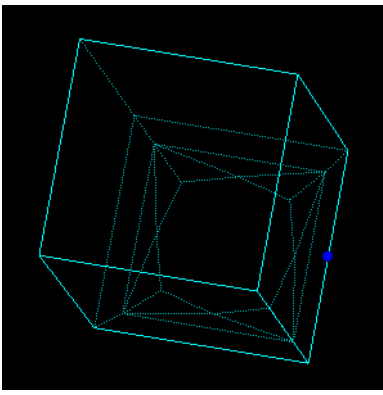

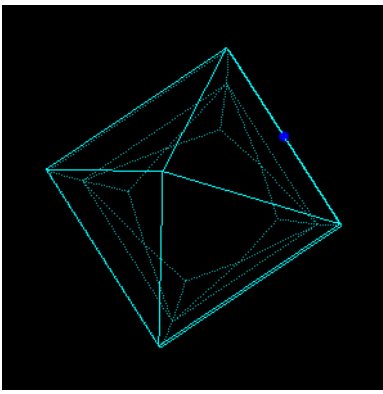

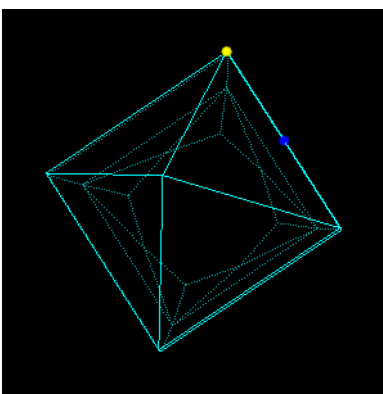
Step	Result
<p>1</p> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 5px;">+</div> + Mains <ul style="list-style-type: none"> <li>• Gear index: <b>0</b></li> <li>• Angle: <b>45</b></li> <li>• Degree of radial symmetry: <b>4</b></li> </ul>	
<p>2</p> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 5px;">+</div> + Facet through one point <ul style="list-style-type: none"> <li>• Gear index: <b>0</b></li> <li>• Angle: <b>40</b></li> <li>• Degree of radial symmetry: <b>4</b></li> <li>• Use symmetry: <b>YES</b></li> <li>• Point on edge with proportions</li> </ul> <p>Select the edge point marked with yellow (Proportion value is about <b>20%</b>):</p>	



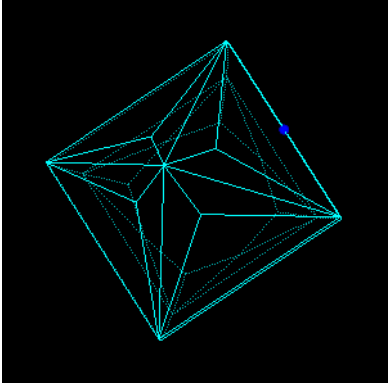

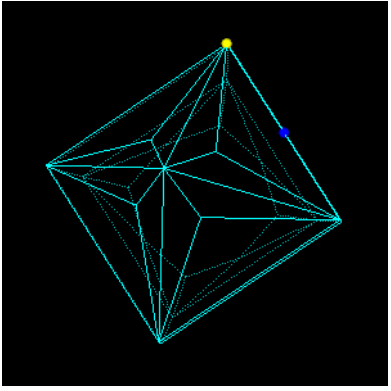
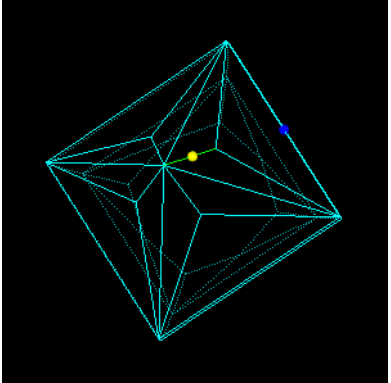
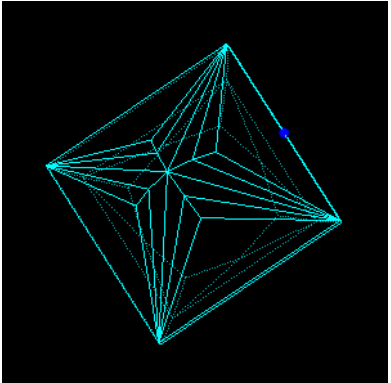


	<p>Facets are ready.</p>	
3	<p> + Facet through one point</p> <ul style="list-style-type: none"> <li>• Gear index: <b>5</b></li> <li>• Angle: <b>20</b></li> <li>• Degree of radial symmetry: <b>4</b></li> <li>• Use symmetry: <b>YES</b></li> <li>• Point on existing vertex</li> </ul> <p>Select the vertex marked with yellow:</p>	
	<p>Facets are ready.</p>	
4	<p> + Point on existing vertex</p> <p>Select the vertex marked with yellow:</p>	

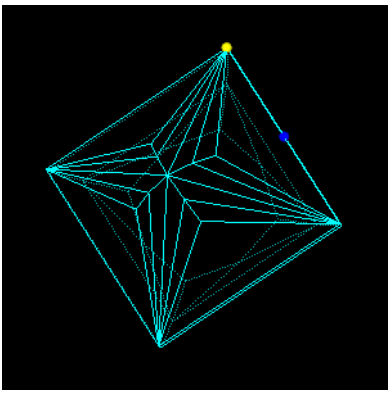
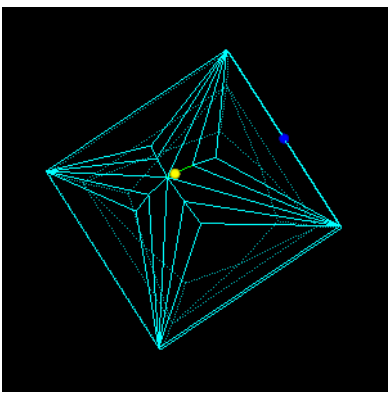
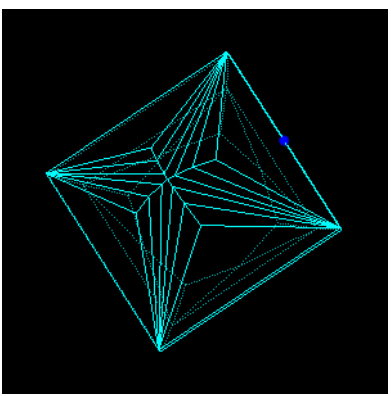
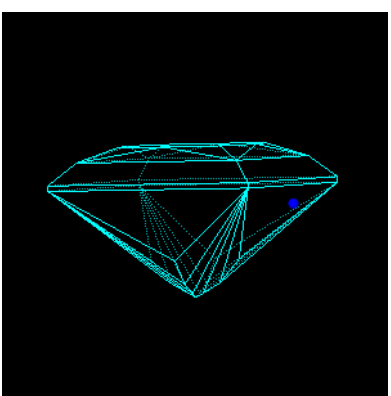


	<p>Table is ready.</p>	
		
5	 + Mains <ul style="list-style-type: none"> <li>• Gear index: <b>0</b></li> <li>• Angle: <b>50</b></li> <li>• Degree of radial symmetry: <b>4</b></li> </ul>	
6	 + Facet through one point <ul style="list-style-type: none"> <li>• Gear index: <b>1</b></li> <li>• Angle: <b>47.5</b></li> <li>• Degree of radial symmetry: <b>4</b></li> <li>• Use symmetry: <b>YES</b></li> <li>• Point on existing vertex</li> </ul> <p>Select the vertex marked with yellow:</p>	



	<p>Facets are ready.</p>	
7	<p> + Facet through two points</p> <ul style="list-style-type: none"> <li>• Gear index: <b>14</b></li> <li>• Degree of radial symmetry: <b>4</b></li> <li>• Use symmetry: <b>YES</b></li> <li>• <b>1st pt.</b> Point on existing vertex</li> </ul> <p>Select the vertex marked with yellow:</p>	
	<ul style="list-style-type: none"> <li>• <b>2nd pt.</b> Point on edge with proportions</li> </ul> <p>Select the edge point marked with yellow (Proportion value is about <b>45%</b>):</p>	
	<p>Facets are ready.</p>	



8	<div data-bbox="240 241 379 297" style="border: 1px solid black; padding: 2px; display: inline-block;">+</div> + Facet through two points <ul style="list-style-type: none"> <li>• Gear index: <b>15</b></li> <li>• Degree of radial symmetry: <b>4</b></li> <li>• Use symmetry: <b>YES</b></li> <li>• <b>1st pt.</b> Point on existing vertex</li> </ul> <p>Select the vertex marked with yellow:</p>	
	<ul style="list-style-type: none"> <li>• <b>2nd pt.</b> Point on edge with proportions</li> </ul> <p>Select the edge point marked with yellow (Proportion value is about <b>70%</b>):</p>	
	Facets are ready.	
9	<p>Z-coordinate fixing:</p> <p>Return to the 1st step (Mains, 4 facets) and change Z-coordinate of First constraint point to <b>-0.65</b>.</p> <p>Return to the 5th step (Mains, 4 facets) and change Z-coordinate of First constraint point to <b>-0.50</b>.</p>	

The cut is ready.

## 6.5 Creating Gabrielle cut

### General settings

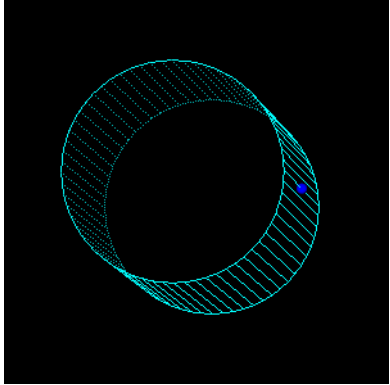
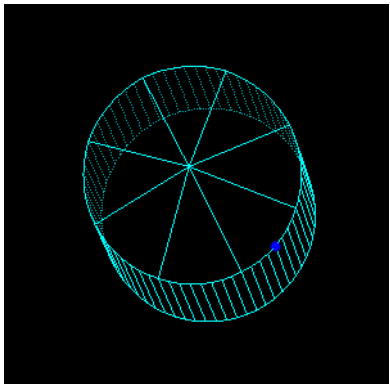
Edit Symmetry Settings:

- Degree of radial symmetry: **8**
- Gear notch quantity: **96**
- Mirror symmetry: **YES**

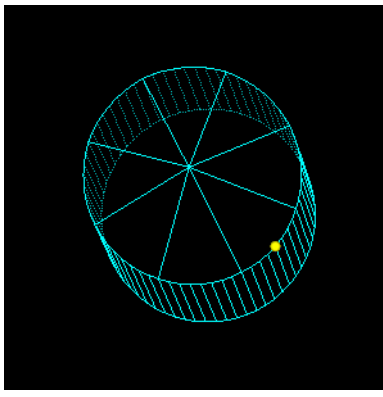
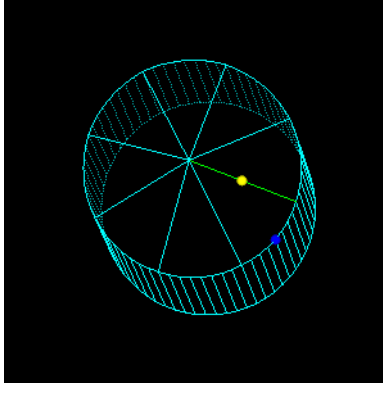
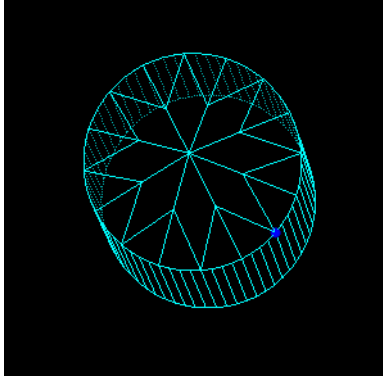
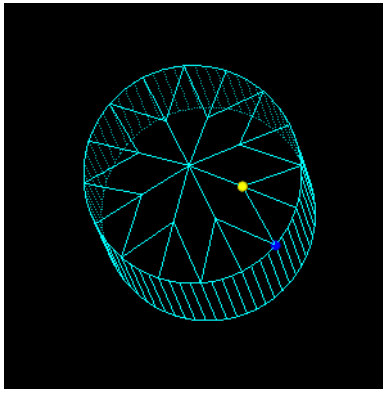
Edit Preform Settings:

- X dimension: **1**
- Y dimension: **1**
- Z dimension: **4**

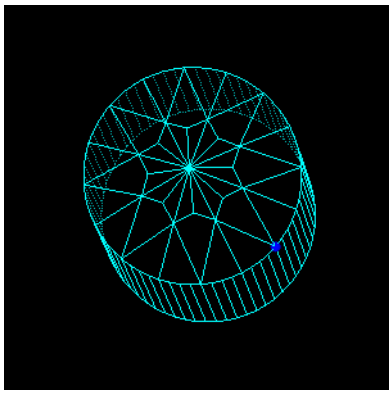

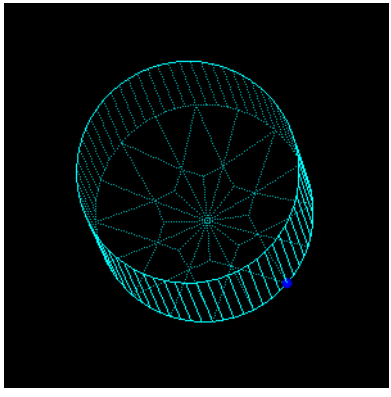

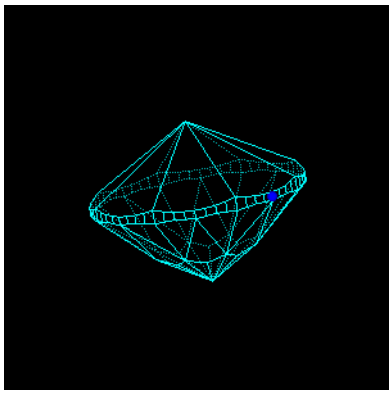

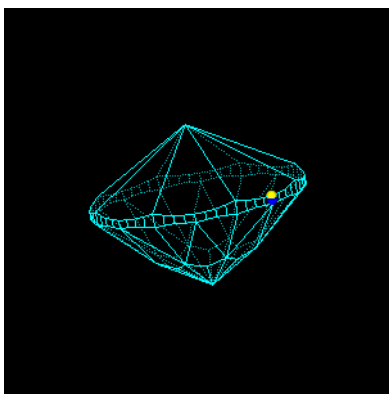
### Cutting Steps

Step	Result
<p>1</p> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">Girdle</div> <ul style="list-style-type: none"> <li>• Gear index: <b>1</b></li> <li>• Degree of radial symmetry: <b>32</b></li> </ul>	
<p>2</p> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">+</div> + Mains <ul style="list-style-type: none"> <li>• Gear index: <b>0</b></li> <li>• Angle: <b>41</b></li> <li>• Degree of radial symmetry: <b>8</b></li> </ul>	

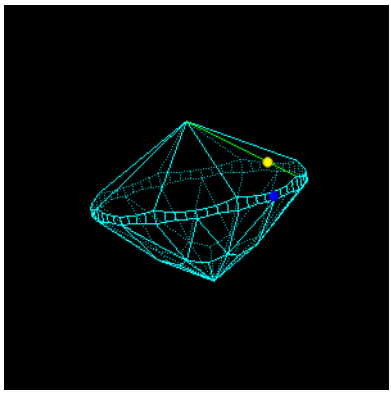
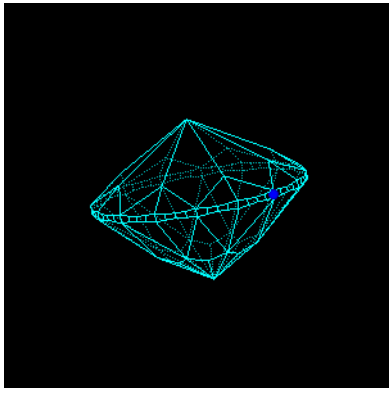
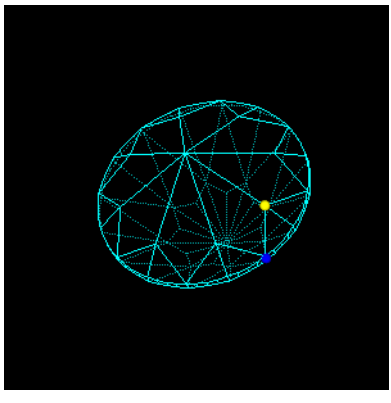
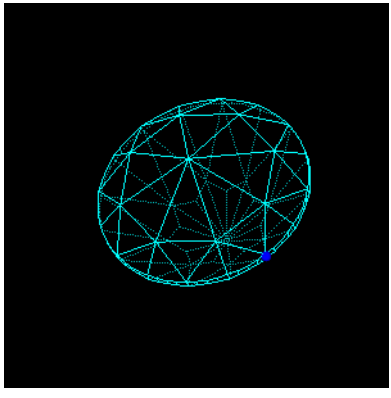


3	<div data-bbox="272 241 408 297" style="border: 1px dashed gray; padding: 2px; display: inline-block;">+</div> + Facet through two points <ul style="list-style-type: none"> <li>• Gear index: <b>3</b></li> <li>• Degree of radial symmetry: <b>8</b></li> <li>• Use symmetry: <b>YES</b></li> <li>• 1st pt. Point on existing vertex</li> </ul> Select the vertex marked with yellow:	
	<b>2nd pt.</b> Point on edge with proportions.  Select the edge point marked with yellow (Proportion value is about <b>50%</b> ):	
	Facets are ready.	
4	<div data-bbox="272 1487 408 1543" style="border: 1px dashed gray; padding: 2px; display: inline-block;">+</div> + Facet through one point <ul style="list-style-type: none"> <li>• Gear index: <b>2</b></li> <li>• Angle: <b>33</b></li> <li>• Degree of radial symmetry: <b>8</b></li> <li>• Use symmetry: <b>YES</b></li> <li>• Point on existing vertex</li> </ul> Select the vertex marked with yellow:	



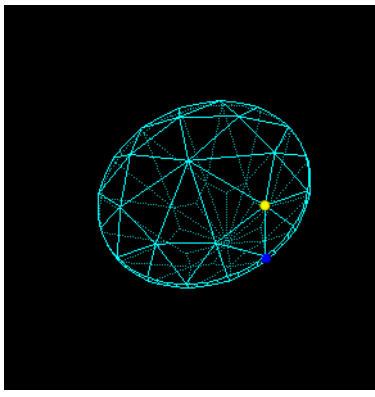
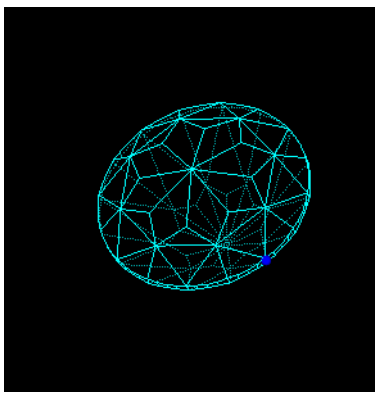
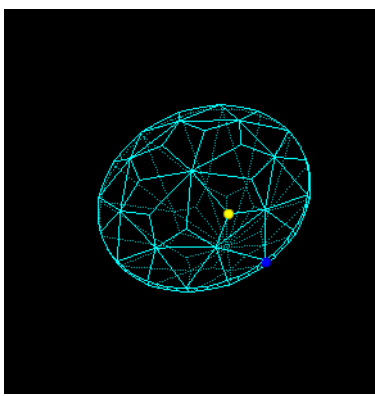
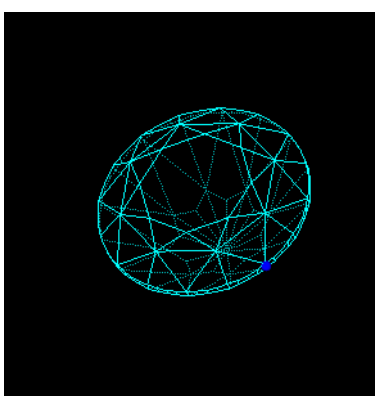
	<p>Facets are ready.</p>	
5		
6	 + Mains <ul style="list-style-type: none"> <li>• Gear index: <b>0</b></li> <li>• Angle: <b>33</b></li> <li>• Degree of radial symmetry: <b>8</b></li> </ul>	
7	 + Facet through two points <ul style="list-style-type: none"> <li>• Gear index: <b>3</b></li> <li>• Degree of radial symmetry: <b>8</b></li> <li>• Use symmetry: <b>YES</b></li> <li>• <b>1st pt.</b> Point on existing vertex</li> </ul> <p>Select the vertex marked with yellow:</p>	



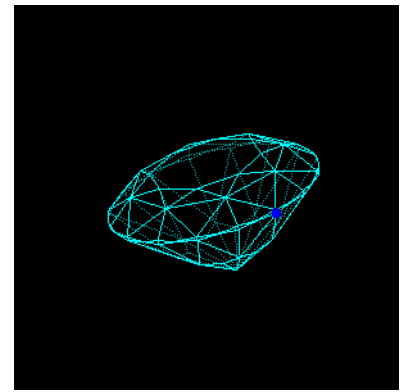
	<ul style="list-style-type: none"> <li>• <b>2nd pt.</b> Point on edge with proportions</li> </ul> <p>Select the edge point marked with yellow (Proportion value is about <b>25%</b>):</p>	
	<p>Facets are ready.</p>	
8	<div style="border: 1px solid black; padding: 2px; display: inline-block;">+</div> + Facet through one point <ul style="list-style-type: none"> <li>• Gear index: <b>0</b></li> <li>• Angle: <b>25</b></li> <li>• Degree of radial symmetry: <b>8</b></li> <li>• Use symmetry: <b>YES</b></li> <li>• Point on existing vertex</li> </ul> <p>Select the vertex marked with yellow:</p>	
	<p>Facets are ready.</p>	



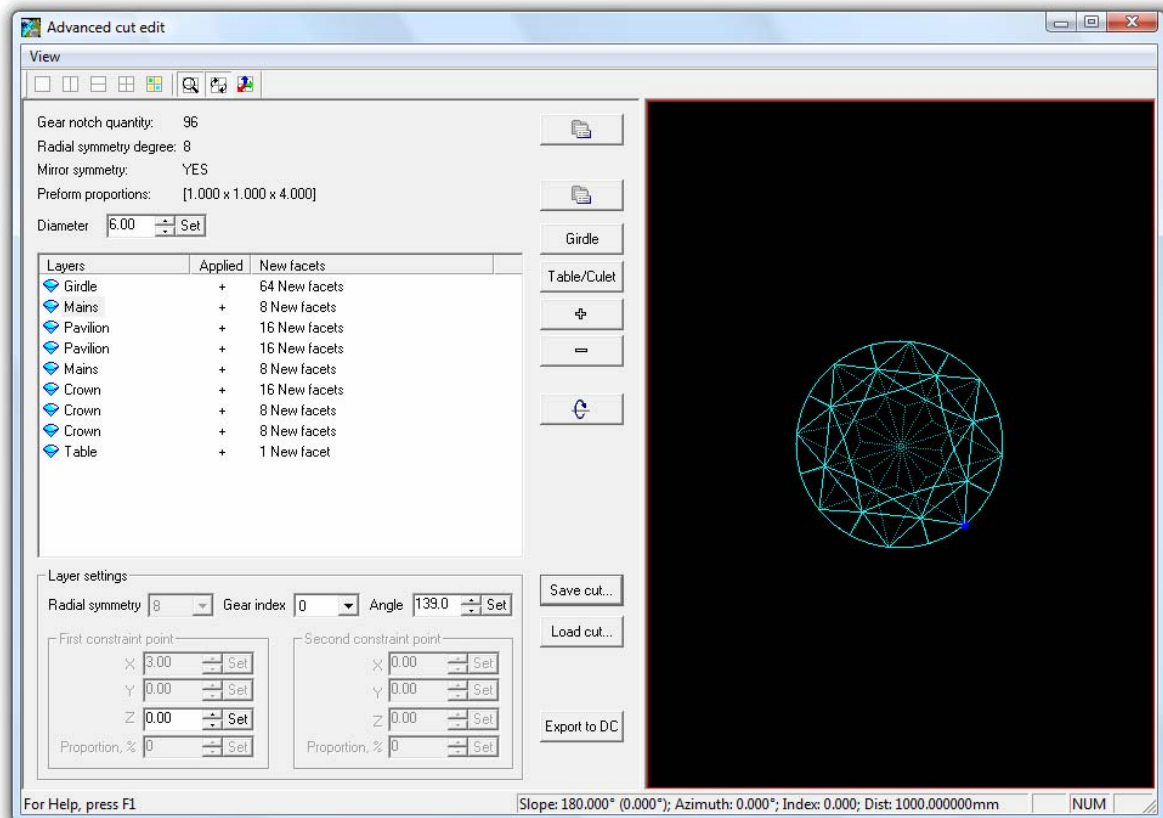


9	<div data-bbox="272 241 408 293" style="border: 1px dashed gray; padding: 2px; display: inline-block;">+</div> + Facet through one point <ul style="list-style-type: none"> <li>• Gear index: <b>6</b></li> <li>• Angle: <b>16</b></li> <li>• Degree of radial symmetry: <b>8</b></li> <li>• Use symmetry: <b>YES</b></li> <li>• Point on existing vertex</li> </ul> Select the vertex marked with yellow:	
	Facets are ready.	
10	<div data-bbox="272 1066 408 1122" style="border: 1px dashed gray; padding: 2px; display: inline-block;">Table/Culet</div> + Point on existing vertex <p>Select the vertex marked with yellow:</p>	
	Table is ready.	

11 Return to the 2nd step (Mains, 8 facets) and change Z-coordinate of First constraint point to **0.05**



The cut is ready.



## 7 Estimating the mass of the stone and calculating cut parameters

DiamCalc allows to estimate the mass of the stone by entering known proportions and calculate different cut parameters one from another.

Experts and dealers usually use formulas, tables, or calculators to estimate the mass of mounted diamonds. These methods often give approximate results, as they can take into account only a predefined set of parameters. DiamCalc allows to perform calculation making full use of any set of proportions that can be measured in a given case.

A similar problem exists in diamond marking. DiamCalc provides a unique opportunity to estimate parameters of a future diamond as precisely as the available data allows.

### 7.1 Mass estimation. Setting diamond parameters

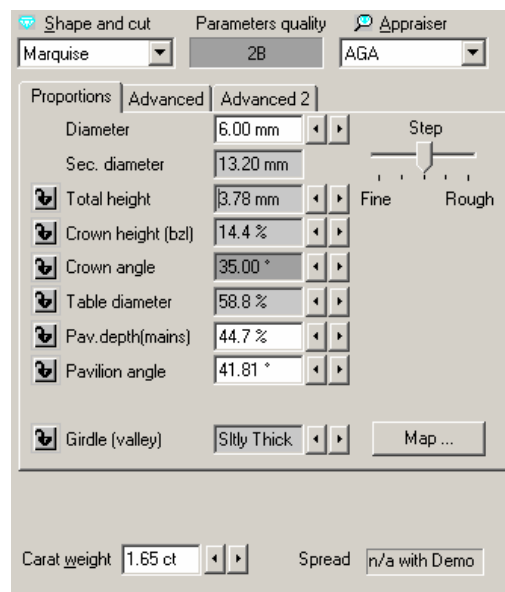
To estimate the diamond mass with DiamCalc, one should choose a cut style and input the main parameters (e.g. the diameter). The stone mass is promptly displayed in the relevant field. The other parameters should be specified for more accurate weight estimation.

Let us see how it is done. Start DiamCalc and look at the panel with parameters. All parameters have some values. Marquise cut is selected initially (see «Shape and cut» drop-down box). Initial diameter of the stone is 6.00 mm (assume this is what we need). Now we can enter all parameters that we know to describe the diamond as precisely as possible. To change a parameter, select a value in the corresponding box by the mouse and type in a new value, pressing Enter at the end.

For example, let us set a different value for the total height. Select a field right to «Total height» caption. At this moment, the panel with diamond parameters should look like the following:

The screenshot displays the 'Parameters' panel in DiamCalc. At the top, there are three dropdown menus: 'Shape and cut' (Marquise), 'Parameters quality' (2B), and 'Appraiser' (AGA). Below these are three tabs: 'Proportions', 'Advanced', and 'Advanced 2'. The 'Proportions' tab is active, showing a list of parameters with input fields and arrow buttons for adjustment. The 'Total height' field is selected, showing a value of 3.67 mm. Other parameters include Diameter (6.00 mm), Sec. diameter (13.20 mm), Crown height (bzl) (14.0%), Crown angle (35.00°), Table diameter (60.0%), Pav. depth (mains) (43.5%), Pavilion angle (41.00°), and Girdle (valley) (Slightly Thick). At the bottom, there are fields for 'Carat weight' (1.61 ct) and 'Spread' (n/a with Demo).

As one can see, the current value of the diamond's total height is 3.67 mm (or 61.2% of the diameter), and the mass is 1.61 ct. Now when the «Total Height» value is selected on the panel above, type 3.78 on the keyboard to increase the total height to 3.78 mm (or 63.0% of the diameter). Press Enter key. DiamCalc will recalculate all parameters and the panel with parameters will look like:



Note that the diameter remains the same (6 mm), both crown and pavilion heights have increased proportionally to accommodate to a total height increase, and the mass has been recalculated using a new piece of information: 1.65 ct.

Other parameters can be changed the same way: select the corresponding value, enter a new one from the keyboard and press Enter key.

## 7.2 How to get additional information on a parameter

If the meaning of some parameter is not clear, move mouse cursor to the corresponding box and leave it there, not pressing any keys or buttons. In couple of seconds, a hint with the description of the parameter will pop up.

For instance, moving the mouse cursor to the value of «Sec. diameter» parameter will produce the following effect:



## 8 Support for different cuts and parameters

DiamCalc supports all main cut types and allows to view or change a large set of parameters, including advanced ones.

DiamCalc Standard supports 13 main cut types. There is a set of cut parameters (diameter, crown height, ...) which are common for all cuts. Also there are some advanced cut-specific parameters, which allow to handle some rare cuts (for example, old round cuts).

Note. The free demo-version of DiamCalc supports Marquise cut only. Although the demo-version is fully functional, some cut-specific parameters (e.g. advanced parameters of Brilliant diamonds - see below) cannot be seen in the demo-version.

### 8.1 Working with different cuts

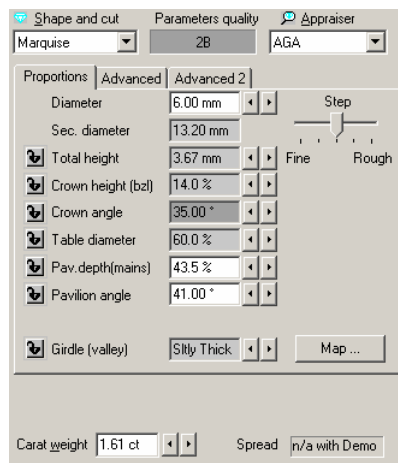
DiamCalc Standard supports the following cut types: Baguette, Brilliant, Emerald, Flanders, Happy-8, Heart, Marquise, Oval, Pear, Princess 2-chevron, Princess 3-chevron, Prism and Radiant


The current shape is shown in «Shape and cut» drop-down box. Setting a desired cut type is the first thing that should be done when parameters of a new diamond are entered. To change a cut type, click «Shape and cut» box with a mouse. A list of possible values appear. Clicking on a cut type in this list will select this cut. A diamond image in the left half of Diamond Calculator window will change, displaying a diamond of a newly selected cut.


### 8.2 Working with cut parameters

DiamCalc displays cut parameters in a parameter panel, which is located in the right half of the application's window.

A notebook-like structure has three tabs: Proportions, Advanced and Advanced2. Proportions tab holds most common parameters, such as diamond diameter, total height, etc. Most values can be adjusted to describe the stone more precisely. If only some proportions are known, DiamCalc assigns reasonable estimates for parameters that cannot be measured.



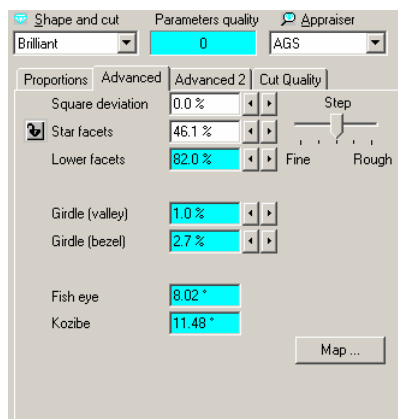
There are two different methods of changing parameter's value. First, a new value can be entered directly from the keyboard. To do this, select a chosen parameter value with the mouse, type in a new value, and press Enter key at the end. The other method is to use  buttons that are on the right of each parameter which value can be changed. Note that a slider named «Step» allows to tune the amount by which those buttons

change the value. For example, when the slider is average (default) positions,  buttons change the diameter by 0.1 mm; when it is in the «Fine» position, those same buttons change the diameter by 0.01 mm.

See also «Selecting measurement units and parameters to show» section that describes how to change presentation of some parameters: select one of available measurement units, choose one of similar parameters («dual» parameters), etc.

### 8.3 Advanced parameters (old cuts, etc)

The parameters on Advanced page of parameter panel usually depend on the current cut. Let us examine parameters that are available for Brilliant cut diamonds.



### 8.4 Advanced parameters (old cuts, etc)

In addition some predefined parameters values («fixed cuts») can be used to change the diamond proportion. With the menu Diamond → Fixed cut you will be presented with the list of «fixed cuts» available for the selected diamond shape. For example, if you want to see «Parker» brilliant model you should select «brilliant» shape and then call Diamond → Fixed cut → Parker menu. «Fixed cut» affects all the cut parameters except the diameter. «Fixed cuts» are stored in the appraiser data file (see the topic «Appraising diamonds quality and pricing diamonds») as a text, so parameter values can be modified and new fixed cuts can be defined as well.



## 9 Finding unknown parameters. Parameter fixing

DiamCalc allows to recover values of diamond proportions that cannot be measured directly (e.g. because stone is mounted).

Diamond Calculator was designed to give maximum flexibility in a wide range of situations. Mounted stones can be difficult for direct measuring, and in different cases some parameters may or may not be available.

Another challenge is to estimate a parameter in a diamond that does not exist yet, given proportions of a rough diamond, a semi-cut diamond or a polished diamond that will be re-cut. With Diamond Calculator, this task is as easy as the previous one. Any set of existing limitations can be entered into DiamCalc to find missing parameters of a future diamond without any tables or formulas.

### 9.1 Ways to estimate unknown parameters

The simplest way to estimate unknown parameters with DiamCalc is just to enter all known values. DiamCalc will produce a reasonable estimation of other parameters.

In practice, the process can be a bit longer due to the fact that the parameters can affect each other. For example, changing crown angle will lead to a change of either the table diameter or the crown height. Relationships between parameters can be quite complex. To neutralize this effect, it may be required to adjust parameter's value once more after it was automatically recalculated due to a change of another parameter. One more option of handling this problem is parameter fixing (see below).

Another way to find parameters that cannot be measured directly is to examine the diamond image produced by DiamCalc, adjusting parameters until the computer image looks similar to the real stone. See section on controlling visual representation of the stone for more information.

Note, that a computing-intensive Photoreal mode is the most suitable for the purpose, so that a powerful enough computer is required to quickly display the image when parameters are changing.

### 9.2 Parameter fixing

Some parameters have a small button with a lock on it on the left of the parameter's name. These Lock buttons allow to fix the parameter value to avoid an accidental change or a change due to interrelation between parameters.

Example of using Lock buttons (measuring parameters of mounted diamonds).

The user measures diameter and total height of the diamond and enters them in Diamond Calculator, then fixes total depth with Lock button. After that, measuring the crown height and entering it into the software will cause an automatic adjustment of current pavilion depth and girdle thickness in such a way that the total height will not change.

Parameter fixing is also very useful in diamond marking for maximizing the diamond mass with respect to restrictions imposed by a diamond with old cut, a semi-cut diamond, or a rough diamond.



Note. If a proportion allows a choice of units of millimeters or percents of diameter, only the value in percents will be fixed when Lock button is checked, even if a value in millimeters is displayed currently.



## 10 Selecting measurement units and parameters to show

DiamCalc allows to choose the most convenient representation form or measurement units for some parameters. Diamond Calculator presents options of parameters' units of measurement, when applicable (e.g. linear size can be expressed in millimeters or as a percentage of the diameter). Another way to customize DiamCalc is to select one of several similar parameters. See examples below for more details.

### 10.1 Selecting units of measurement

By default, size parameters are presented as a ratio of the corresponding value to the diameter. In some situations, other units, e.g. millimeters, can be more useful. The user can choose measurement units for each particular parameter.

To do this, point the mouse cursor to the parameter value and click right mouse button. A menu appears, allowing to see available units and select one of them:



The menu above was produced by pointing the mouse to the value of «Total height» parameter and pressing the right mouse button. A check mark shows that the current unit of measurement is percents of the diameter. If «millimeters» is selected from the menu, a value will be recalculated and shown in a new format.

When values of parameters are entered from the keyboard, units of measurement can be specified along with values. When a string like «1.1 %» or «0.02 mm» is typed, DiamCalc recognizes what is the value and what is the unit of measurement and change them if needed. If only a number is typed, DiamCalc applies the current unit of measurement.

### 10.2 Dual parameters

It is possible to use different presentations for some parameters. For instance, a slightly oval shape of the girdle can be described by two diameters, minimum and maximum. Alternatively, it can be specified by maximum diameter and deviation (brilliant cut) or ratio of maximum and minimum diameters (fancy cuts).

To choose a presentation option of such a parameter, point the mouse cursor to the parameter's name and click right mouse button. A menu appears, allowing to select a presentation option:



The picture above was taken when the mouse cursor was over «Sec. diameter» field and the right mouse button was pressed. As you see, a menu allows to select between



showing maximum and minimum diameters or just one diameter and ratio of diameters.

There are other dual parameters:

- Girdle square deviation <-> Alternative diameter (measured at direction  $45^\circ$ );
- Star facet length <-> Table picture square-likeness.

There is also a similar way to choose mass precision: 2 digits after decimal point <-> 4 digits.

## 11 Importing/exporting external cut designs and diamond 3D-models


DiamCalc allows users to import cut designs and 3D-models of real stones generated with another software (note, this feature is available only for the registered users). This includes cut designs made with GemCad software and several other software and diamond 3D-models obtained with Sarin machines and OctoNus diamond scanners. If the model is convex you can adjust the size of the model, crown, pavilion and girdle heights, table and culet offsets and position of every facet.

- The following file formats are supported, please read the next section for more information:
- [Gemcad](#) ASCII format. You can design your own diamond shape or get one of the 3700 unique faceting designs from the [DataVue2](#) library and see its appearance with the DiamCalc.
- AutoDesk Drawing Exchange Format (DXF). This format is also popular and you can find cut design files in the Internet saved with this format.
- OctoNus MMD format. File of this type contains 3D-model of the real stone that is built by OctoNus diamond scanners like Helium and Oxygen. For details about these products please visit our web-site: <http://www.octonus.com>
- Sarin Web Viewer files (\*.srn). File of this type contains 3D-model of the real stone that is built with several type of the Sarin machines.
- Stereo Lithography (STL) format. DiamCalc supports ASCII and binary versions of this format.

You can import model by choosing appropriate command in the menu Cut → Import Cut or you can simply drag and drop the file with the model into the DiamCalc window from Windows Explorer.

### 11.1 Importing diamond 3D-model from Sarin Web Viewer file (\*.srn)

There are several ways you can receive .srn-files to your computer:

- Sarin users, who own a DiaMension or DiaScan machine have a possibility to pack their information pertaining to a specific stone into a Sarin file (.srn). Please refer to Sarin web site to get information about the necessary software updates:  <http://www.sarin.com/viewer/>
- RapNet Members ([www.diamonds.net](http://www.diamonds.net)) When searching for diamonds you may select the check «Display stones with Sarin data only» in the bottom of the Diamond Search Form. In the Search Results click on the «Sarin» picture in the desired row. You will be prompted to install Sarin Web Viewer. Once the Sarin Web is Viewer installed you will be presented with information about selected diamond: Click «Save...» button in the upper part of viewer. You will be notified about the name and location of the file saved. Keep in mind the file title in order to open it with the DiamCalc.



- Of course you can receive .srn files to your computer from your partners and friends via e-mail, on diskettes etc.

In the DiamCalc use the menu command Cut → Import cut → From Sarin file

You will be presented with «Open file» dialog allowing you to select file you want to import.

⇒ *By default the initial folder is the folder where the Sarin Web Viewer saves downloaded files. If you want to change the default folder then modify the folder in the parameter «Sarin files folder» of the registry key:*

*HKEY\_CURRENT\_USER\Software\OctoNus Software\DiamCalc\Settings*

Select the desired file and click «Open». If the model is imported successfully you can work with it as usual. It is assumed that the model in SRN file is convex. If the model is not convex, some of its parts may be cut off.

### **11.2 Importing and exporting models from (to) DXF files**

In the DiamCalc use the menu command Cut → Import cut → From AutoDesk DXF file

You will be presented with «Open file» dialog allowing you to select file you want to import.

⇒ *The limited support of the DXF format is implemented in the DiamCalc (only «Mesh» type data is supported). This means that there is no guaranty that an arbitrary dxf file will be imported into the DiamCalc, but we successfully imported all diamond dxf-files we download from several sites.*

Select the desired file and click «Open». If the model is imported successfully you can work with it as usual. It is assumed that the model in DXF file is convex. If the model is not convex, some of its parts may be cut off. Here is the link to web- resource with a great number of downloads of free DXF cut models: [www.3dlapidary.com](http://www.3dlapidary.com)

With the menu command Cut → Export cut → To AutoDesk DXF file you can save any cutting you have in the DiamCalc (including imported models) to this format and then work with this file in the desired 3D software (AutoCad, 3Dstudio Max etc).


### **11.3 Importing and exporting cut designs from (to) GemCad ASCII files**

In the DiamCalc use the menu command Cut → Import cut → From GemCad ASCII file

You will be presented with «Open file» dialog allowing you to select file you want to import. Select the desired file and click «Open». If the model is imported successfully you can work with it as usual. It is assumed that the model in ASCII file is convex.

With the menu command Cut → Export cut → To GemCad ASCII file you can save any cutting you have in the DiamCalc (including imported models) to this format and then work with this file in the GemCad software.

Please note, that the coordinate system of GemCad does not match the coordinate system of DiamCalc. DiamCalc uses common right-hand coordinate system, while GemCad uses left-hand coordinate system. The X axis in DiamCalc goes to the right,



and Y axis goes up by default. Sides' azimuths and indices are calculated from the X axis, so the side with zero azimuth appears on the right.

Please also note, that GemCad software can't handle models that exceed the cube 2x2x2 mm in size. It simply cuts off the model by such a cube. You may want to reduce the model diameter before export so that it fits a 2x2x2 mm cube.

### ***11.4 Importing and exporting models from (to) STL files***

In the DiamCalc use the menu command Cut → Import cut → From STL file

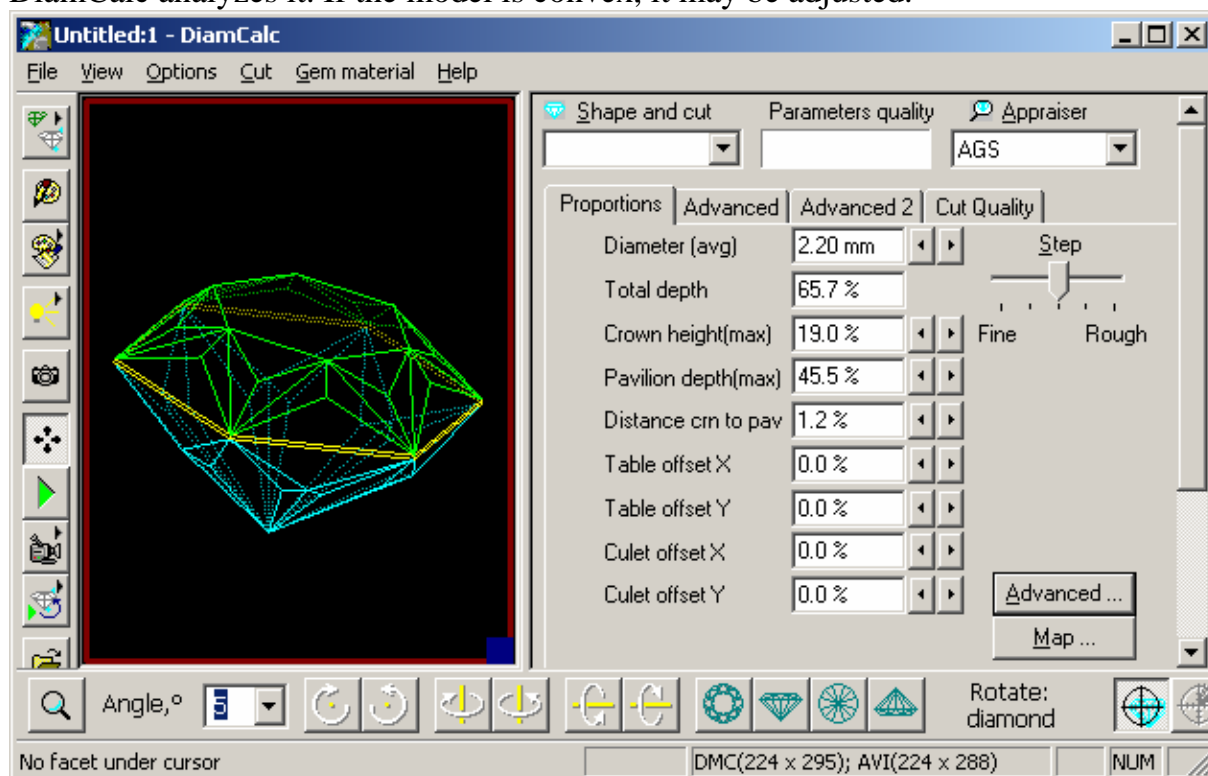
You will be presented with «Open file» dialog allowing you to select file you want to import.

Select the desired file and click «Open». If the model is imported successfully you can work with it as usual. It is assumed that the model in STL file is convex. If the model is not convex, the program will build convex hull of all vertices of the model.

With the menu command Cut → Export cut → To binary STL file... and To ascii STL file... you can save any cutting you have in the DiamCalc (including imported models) to this format and then work with this file in the desired 3D software.

## 12 Adjusting shape of arbitrary imported 3D model of the diamond

DiamCalc allows users to import cut designs and 3D-models of real stones generated with another software. When the new model is imported using Cut → Import cut menu DiamCalc analyzes it. If the model is convex, it may be adjusted.



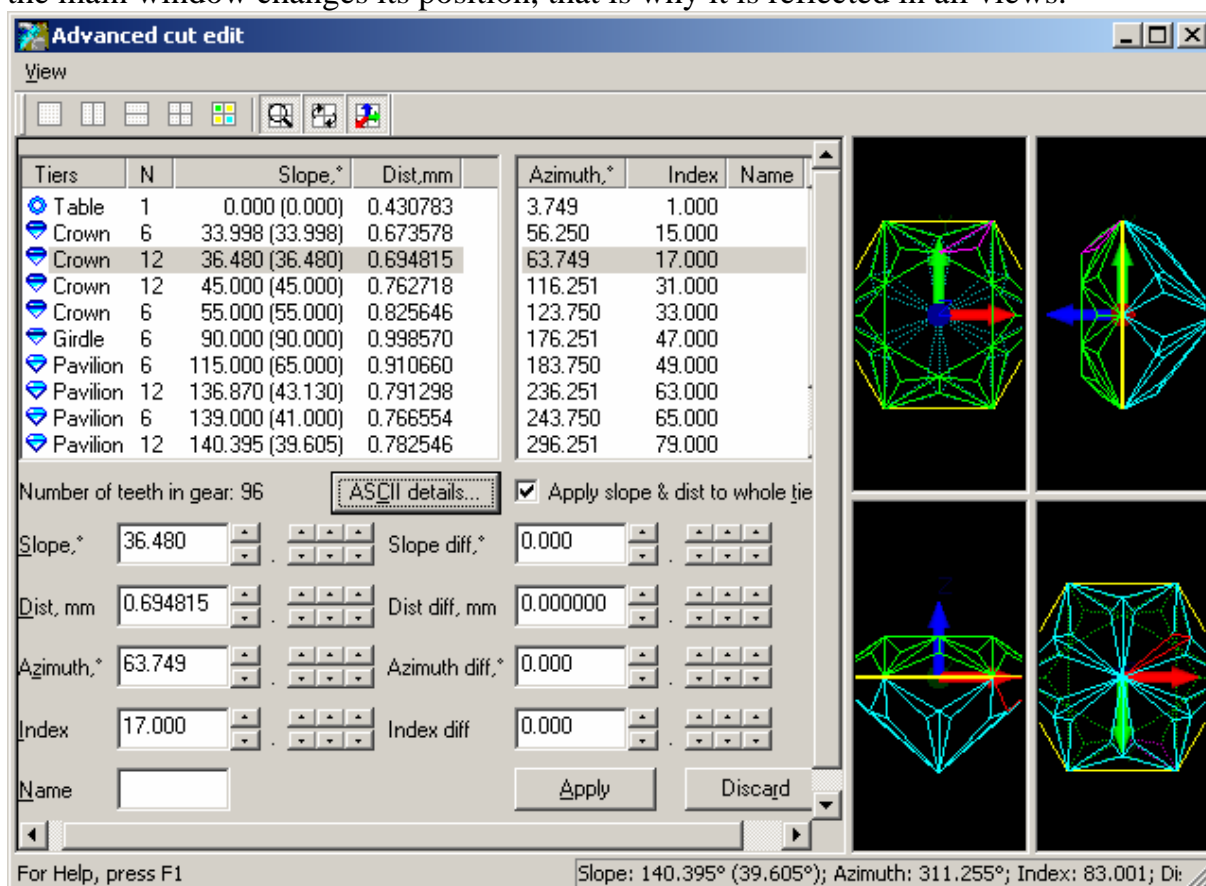
If the model is convex you can adjust the following parameters in the main window: diameter of the model, crown height, pavilion height, distance between crown and pavilion, table offset, culet offset.

DiamCalc calculates 360 diameters of the model with the step of half a degree and takes the average value as the primary diameter. DiamCalc distinguishes crown, girdle and pavilion facets and remembers the type of each facet. Then it calculates the maximum height of the crown and pavilion as the difference between the highest and the lowest vertex among crown and pavilion facets respectively. It calculates the height of the whole model as well. The distance between crown and pavilion is the difference between the height of the whole model and heights of crown and pavilion. That is why, by the way, this distance may appear negative, if the highest vertex of pavilion is higher than the lowest vertex of the crown (assuming that crown itself is placed above pavilion). This may happen on real cuts. Thus DiamCalc calculates the minimum girdle height and maximum crown and pavilion heights. After the girdle is analyzed, the whole model is shifted along vertical (Z) axis to put its center of the mass in the center of the girdle.

The values of table and culet offset parameters are not estimated during import of the model and they are always set to zero at first. Later you may adjust the offsets with these parameters.

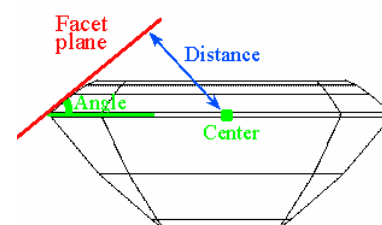
Along with global model parameters like crown and pavilion heights that apply to the whole model, DiamCalc supports local parameters that allow to adjust each facet. Local parameters describe the deviations of each side from the whole model. These deviations do not depend on global parameters. Press the «Advanced» button on the tab with global parameters to open the window for detailed editing of the model.

This window may show up to four views of the model. These views may be rotated (with left mouse button), shifted (with right mouse button) and scaled (with mouse wheel) synchronously and independently. All these transformations apply only to the position of the camera that shows the model from the main window, but they don't change the position of the model itself. On the other hand, the rotation of the model in the main window changes its position, that is why it is reflected in all views.



DiamCalc automatically divides all facets of the model into tiers, similarly to GemCad. The tier comprises facets with identical slope angle and distance parameters. The «Advanced» window shows the list of all tiers and the list of all facets within the tier. The facet selected in the list is highlighted on the model. The local parameters of the facet are slope angle, distance, azimuth angle (or gear index). The advanced window allows adjusting of the facet position by adjusting its parameters.

DiamCalc shows deviations of these parameters from initial model as well as the resulting values. When you alter the position of facets the model on the screen is changed instantly, but the global parameters are not recalculated. In order to change the initial model permanently, use the «Apply» button.





It will substitute the initial model with the current model and all global parameters will be recalculated from a scratch. You may discard the changes in local parameters by the «Discard» button. This will reset the position of all facets and zero all local parameters.

It is not recommended to adjust global and local parameters simultaneously, because local parameters describe absolute deviation of the facet from the current model. If you change the whole model via global parameter, these deviations will become incorrect, which will result in incorrect model shape.



## 13 Visual presentation of a diamond

DiamCalc supports different types of visual presentation of diamonds, allowing to produce realistic views of a stone.

DiamCalc supports several different types of diamond images. A diamond can be seen from different angles or even from two different positions simultaneously. Each diamond view can be further customized to produce even better visual impression.

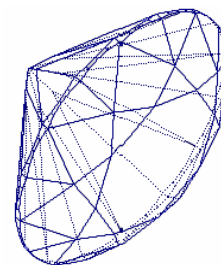
### 13.1 Model types (wireframe and rendering modes)

An image of the diamond is displayed in the left part of DiamCalc main window. Depending on purpose, various types of the model image can be used:

#### Draft mode (wireframe)

This mode shows the diamond as a three-dimensional framework. Visible and invisible edges are seen as solid and dashed lines, respectively. Facets are now drawn, color and illumination is not taken into account. This option is useful for the visual determination of proportions. This mode is the default one.

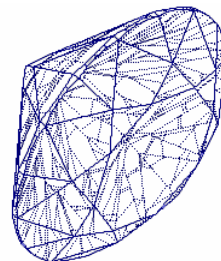
To select Draft mode when another model type is currently chosen, use Draft command from Options → Model type menu.



#### Draft modes with reflection

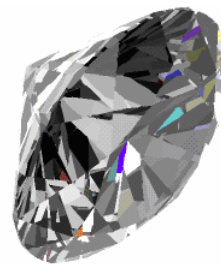
These modes are similar to the previous option, but they also show which edges and facets would be seen through the diamond surface with regard to edge refraction and reflection. There are two modes in this category: «Draft + reflection» and «Draft + double reflection». The difference between them is that they take into account one or two reflections of the light, respectively.

To set one of draft modes with reflection and refraction, select «Draft + reflection» or «Draft + double reflection» commands from Options → Model type menu.



#### Photoreal mode (rendering mode)

This mode simulates the real diamond under certain lighting conditions and considering the particular properties of a diamond specimen. Sometimes, a photoreal image is very similar to the photograph of the real diamond. From this image, one can judge about the appearance of the polished diamond and select unknown parameters by comparison of the real diamond to the computer model.



To select Draft mode, use Draft command from Options → Model type menu.

Note. All models except Draft (especially «photoreal» mode) require significant calculating power, so images can be slow to redraw on less powerful computer

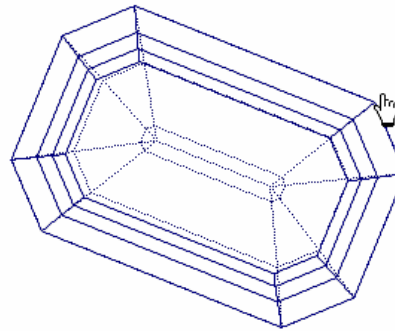
systems. At least Pentium II, Celeron or comparable processor is recommended. All types of models can be seen on a slower system as well, but you may experience a significant delay when the image is redrawn. In these cases, it is recommended to set Draft model type, change all parameters you want to modify, rotate the diamond to the position that you want to inspect, and set a view mode other than Draft only then. With this method, only one slow redrawing is required and you avoid delays after each change of diamond parameters and position.

Note. A pair of stereo glasses (one with red filter for the left eye and blue filter for the right eye) is required to view model in Red-Blue Stereo mode. Without such glasses, the image in Stereo mode cannot be seen meaningfully.

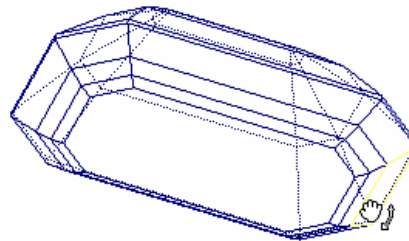
### 13.2 Setting diamond position

DiamCalc allows to easily reposition the diamond with the mouse to view it from a different angle. To do this, press the left mouse button anywhere on the model.

Note the position of the mouse cursor above - it is the place where mouse button was pressed.



To move the diamond, simply move the mouse in the direction where you want to rotate it, holding the button. After diamond is moved to the desired position, release mouse button. On the screenshot below, mouse cursor is where the button was released:



As you see, moving the mouse in vertical direction looks like «dragging» the diamond around horizontal axis. Moving the mouse in another direction would cause a different rotation. Such operation can be repeated, and the diamond can be set to any position after several steps.

There is another tool for moving the diamond: the movement panel. It can be called by Movement panel command in View menu. The movement panel allows to specify by which angle the diamond should be rotated, and perform the rotation by one of six buttons (one for each direction).

Use mouse wheel to change the scale of the diamond.



### **13.3 Setting one or two simultaneous views of a diamond**

DiamCalc can show two simultaneous views of the same diamond taken from different angles. To do this, use Split command in View menu. A horizontal bar will appear, letting to split the diamond image into two panes.

When there are two images, each one can be tuned separately: e.g. one can hold a frame model of the diamond and the other view can be a photoreal model.

A split line between two models can be moved at any time by mouse, changing sizes of the images. Also, two images can be converted back to a single one by moving the split line to the top or to the bottom, decreasing the size of one image to zero.

### **13.4 Selection of a light source**

DiamCalc can imitate various light sources. This option is available for Photoreal model type only, as Draft model types do not take illumination into account.

To change a type of lighting, use Options-Lighting menu, and then select a desired type. The following common types of lighting may be turned on in the photoreal mode:

- «Dialite» - One scattered light source located above the diamond.
- «Jewelry Shop» - The main scattered light source above the diamond and several auxiliary point sources directed from different sides.
- «Disco»
- «Office» - Lighting similar to office.
- «Incandescent lamp»

The Options → Special View menu contains a list of special lightings.

The DiamCalc also gives you a possibility to adjust the lighting with the «Customize...» option of the light menu. Select this option and you will be presented with the panel that allows you to configure number of sources, location, size, brightness and other characteristics of each light source.

## 14 Cut Quality Estimation

### 14.1 Leakage of Light in Diamonds and Its Estimation

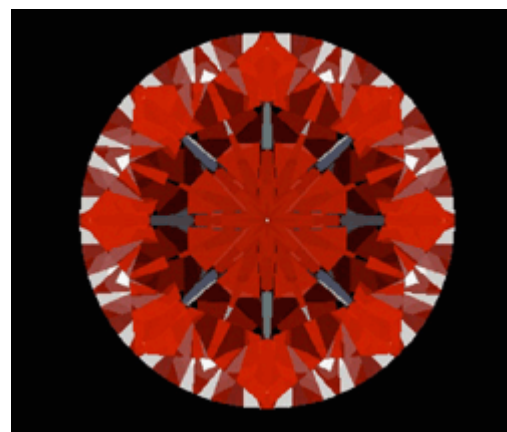
In a diamond, there are some regions that do not return light towards the observer's eye. If we trace those rays connecting the eye with the regions that show no brilliance, we'll find out that some of these rays leave the diamond through its crown but do not propagate towards the source of illumination. Another portion of these rays leaves the diamond through its pavilion, giving rise to the phenomenon called leakage. The third portion of these rays becomes screened by the observer's head or body, giving rise to the effect known as NailHead.

All the three effects cause the observer to see dark, non-illuminated regions in the diamond. Analyzing the leakage and the NailHead effect allows one to reveal such regions of the diamond, which are dark regardless of the type of illumination. It is especially important to determine the parameters of the diamond, for which these dark regions combine into large zones. In such a case, the observer easily notices an abrupt decrease in the local contrast.

It is possible to observe the regions of leakage by placing the diamond into a Firescope that illuminates the stone with white light from the side of its pavilion.



**Photo made with the Firescope**



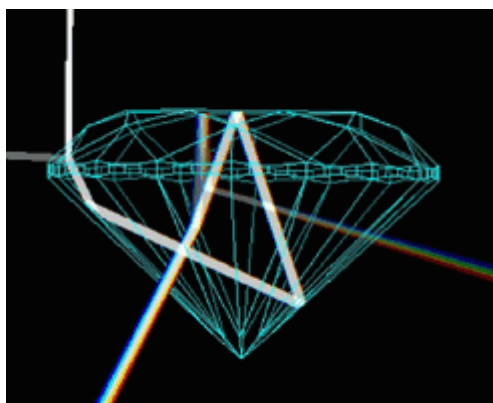
**Model of the same diamond, using illumination of the Firescope type**

White regions can be seen here and there. Therefore, a light ray passes through these regions from under the diamond to the observer's eye. If such a diamond was mounted into a jewel, we would see the mounting through these regions and would never see any light originating from the illumination source. Therefore, the more leakage regions the diamond contains (and the stronger the leakage effect), the fewer the regions of the diamond, capable of reflecting the illumination into the observer's eye, and the worse the cut quality of the stone.

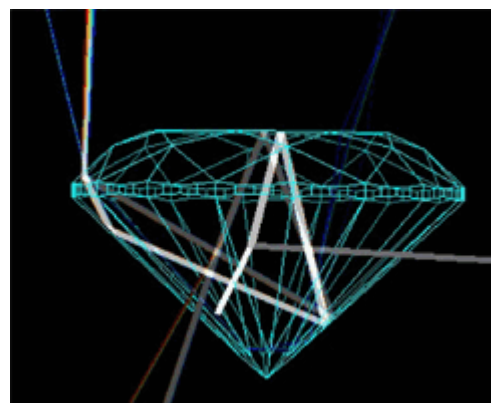
Theoretically, it is possible to imagine such a location of the illumination source, from which a light ray enters the diamond and splits into multiple rays there, some of these leaving the diamond towards the observer's eye. However, these rays can be only



secondary (not primary) ones, which are either quenched due to polishing or become so weak upon leaving the stone that the observer will not perceive them as bright light.

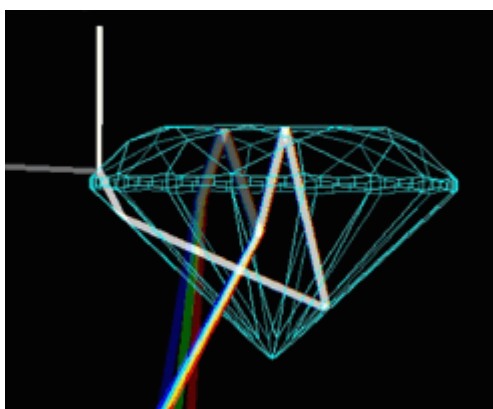


Ray path through a white region

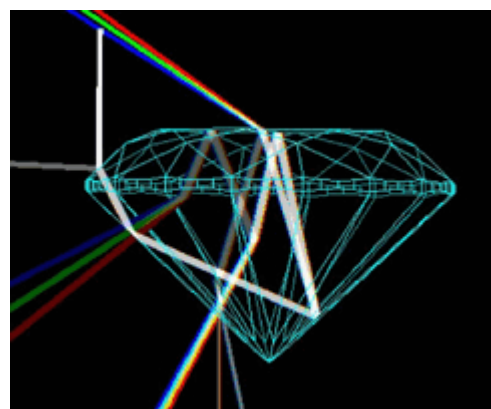


Ray path through a gray region

Besides the white regions, it is possible to notice some gray regions in the stone observed. These regions show partial leakage of light. In other words, some rays leave the diamond through its pavilion, while the other ones leave it through the crown. If a ray originating from the illumination source passes through such a region, the partial leakage attenuates the ray and only a portion of the original ray reaches the observer's eye. This can be demonstrated by tracing the ray as it passes through the white and gray regions:



Ray path through a white region

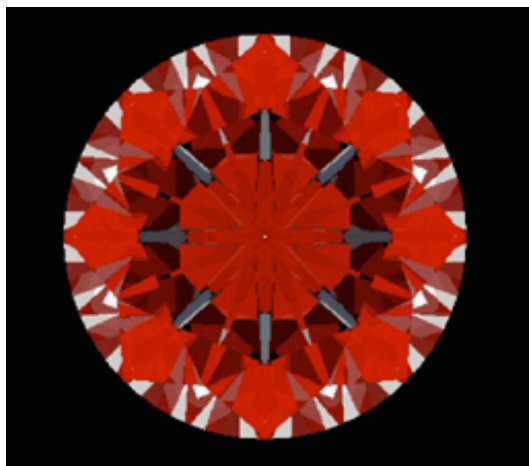


Ray path through a gray region

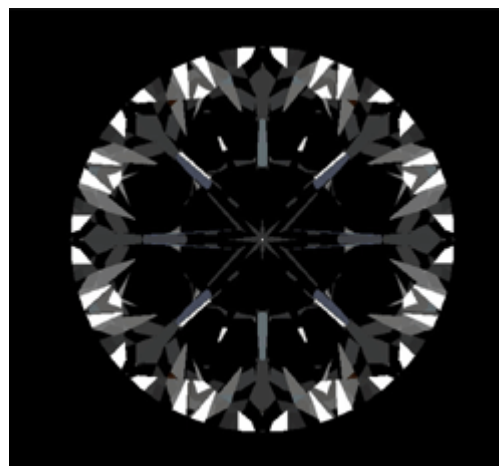
To reveal those dark regions caused by light leakage, that is, the regions, which remain dark upon arbitrary daylight illumination of a collet-set stone a model of Leakage-type illumination has been built. The model is a hemisphere located below the pavilion of the diamond and extends up to the girdle plane (upper edge of the girdle). Thus, the model takes into account those rays leaving the stone through its pavilion or girdle. Those zones of the diamond looking bright upon the Leakage-type illumination will be dark upon usual illumination.

To some extent, this kind of illumination is similar to the illumination from below, used in the Firescope. The main difference between these is the fact that the Leakage-

type illumination reveals only light leakage. Therefore, those regions of the stone looking pink under the Firescope illumination are gray under the Leakage-type illumination.



**Firescope-type illumination**

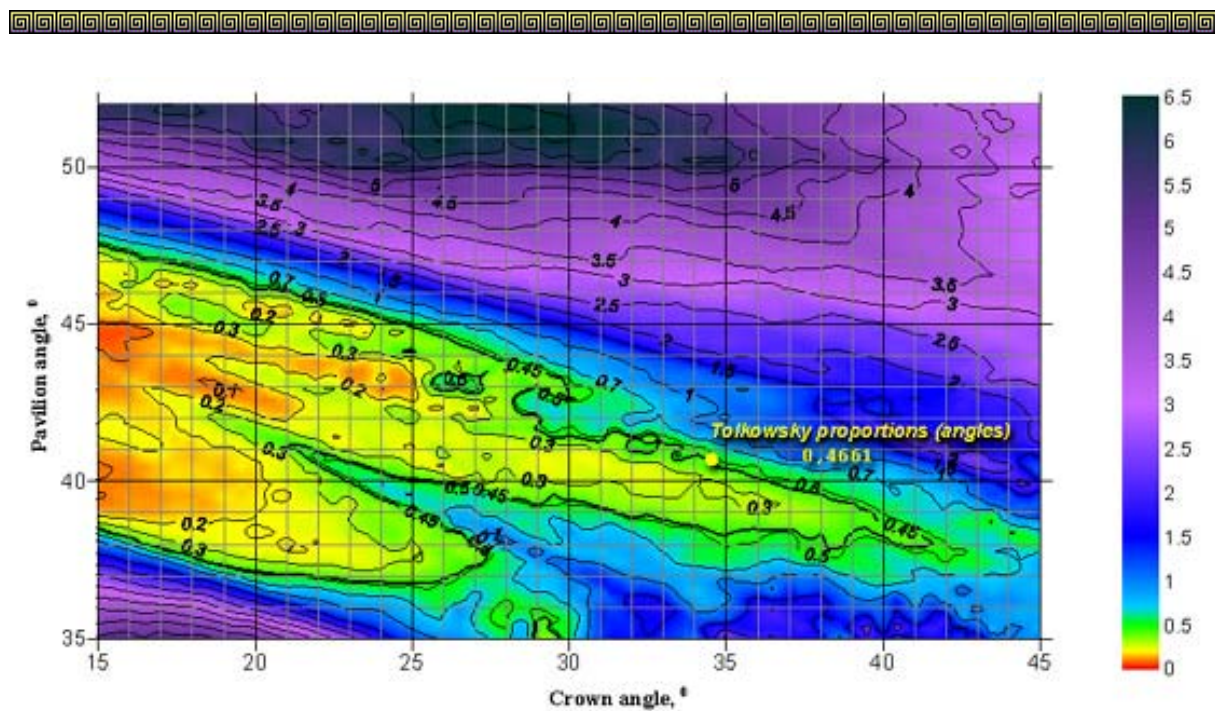


**Leakage-type illumination**

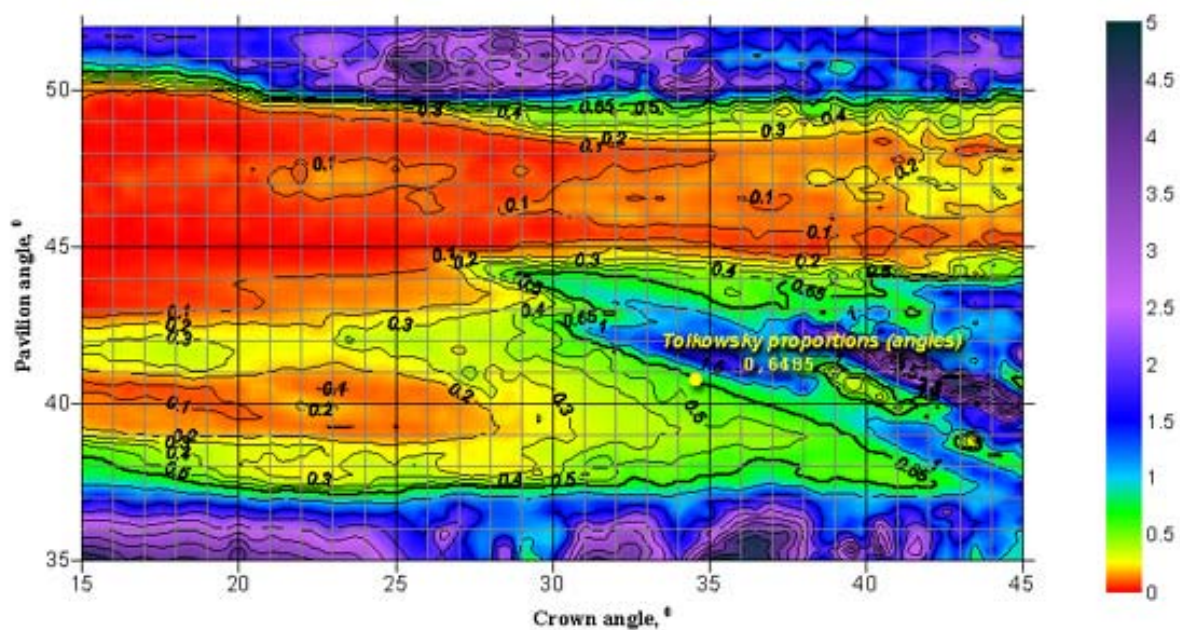
In order to analyze the cut quality of the diamond and the accuracy of its proportions, it is reasonable to quantitatively estimate the leakage of light. We propose the following way of doing that. The leakage is estimated as the subjective brightness of light that returns to the observer's eye in the case when the illumination of the diamond is of the Leakage type. Here we use a model of photo objective (diameter 150 mm, distance to diamond 60 cm) as a viewer. Here we not take into account human stereoview. We suggest calling this viewer a «Photoreceptor».

Since there are some stones that show considerable leakage primarily through the table, we calculated two leakage types: through the whole crown of the diamond (plot 1) and through the table solely (plot 2). Those portions of the plots characterized by large leakage values represent undesirable proportions of the stone, that is, those cut parameters causing considerable leakage of light either through the crown or through the table.

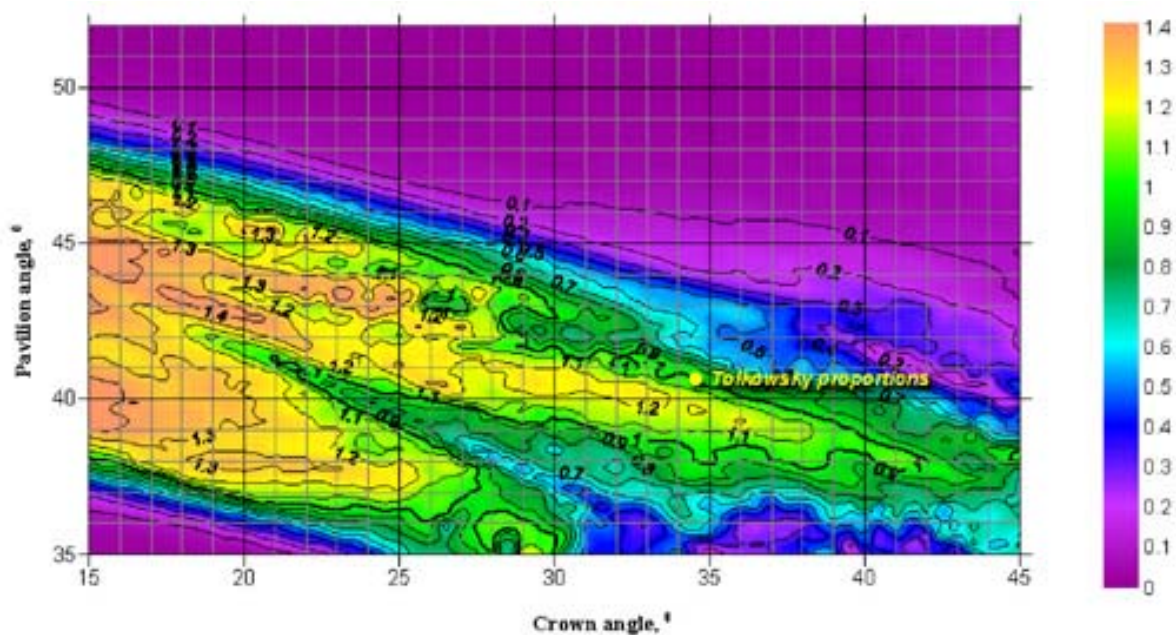
When analyzing these plots, it turns out that they are quite similar to plots of diamond's Light Return. This fact is absolutely reasonable, because the Light Return through the crown and the light leakage through the pavilion should be interrelated. At the same time, some differences can be noticed, the most interesting one corresponding to the region close to the Tolkowsky's cut parameters (slightly upper on the plot than these). This region looks good from the point of view of Light Return but much worse from the point of view of light leakage. When studying gems belonging to this cut parameter range, one can notice that their Light Return is high only in the «crown looks to the observer» position. When swinging such a stone, its Light Return appears to be lower than that of a diamond cut in accordance with the Tolkowsky's parameters.



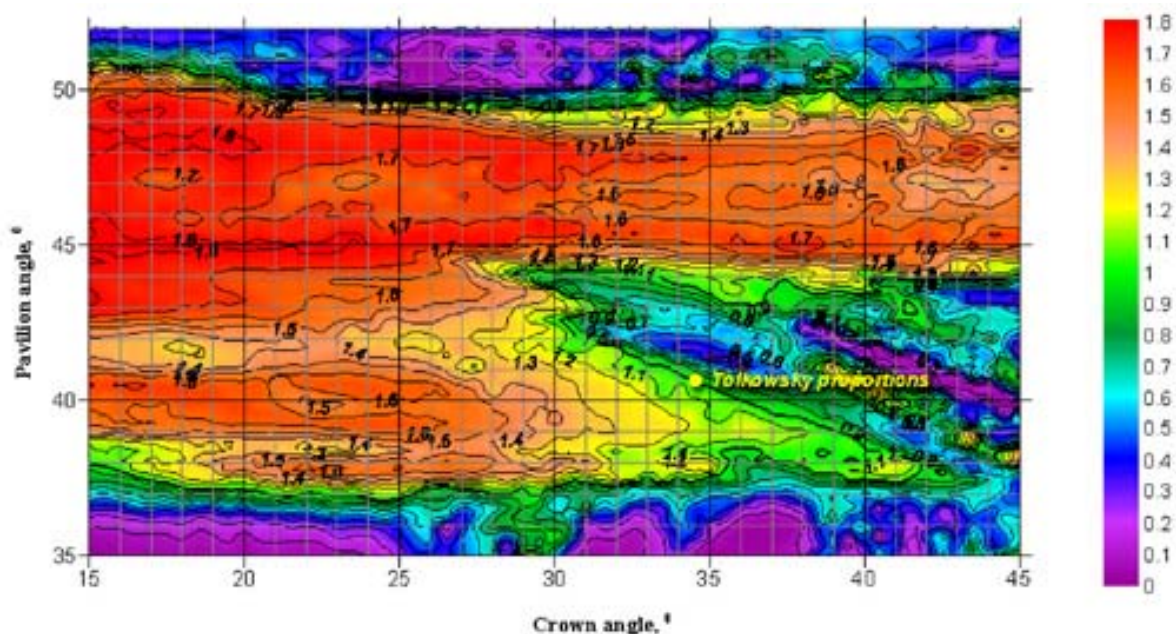
Plot 1. Light leakage through the crown of a round brilliant cut diamond with a table spread of 57% and a girdle thickness of 1% as a function of the crown angle and the pavilion angle. The distance between the photoreceptor and the diamond is 60 cm. The plot is based on the image observed by photoreceptor. The diamond is oriented so that the table looks towards the observer. The larger the leakage value plotted, the stronger the leakage effect and the lower the quality of the diamond.



Plot 2. Light leakage through the table of a round brilliant cut diamond with a table spread of 57% and a girdle thickness of 1% as a function of the crown angle and the pavilion angle. The distance between the photoreceptor and the diamond is 60 cm. The plot is based on the image observed by the photoreceptor. The diamond is oriented so that the table looks towards the observer. The larger the leakage value plotted, the stronger the leakage effect and the lower the quality of the diamond.



Plot 3. Adapted leakage calculated for the table of a round brilliant cut diamond with a table spread of 57%. The position of the stone is static; photoreceptor.



Plot 4. Adapted leakage calculated for the crown of a round brilliant cut diamond with a table spread of 57%. The position of the stone is static; photoreceptor.

When studying the effect of light leakage, an inversion function was introduced, which is required to adequately take into account the leakage during the geometric averaging. So, the stronger the leakage, the smaller the leakage measure supplied to the averaging procedure. Only in this case the geometrical averaging will cull out those stones showing strong leakage of light. Another purpose of using the inversion function is correct normalization of the leakage value with respect to the Tolkowsky's cut



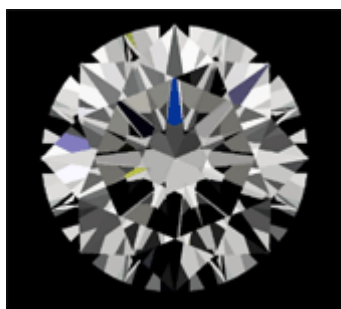


parameters. The leakage value for these parameters should be 1. Otherwise, a mismatch arises between modeling light return and other effects, violating the resultant brilliance function that takes into account both the brilliance and effects.

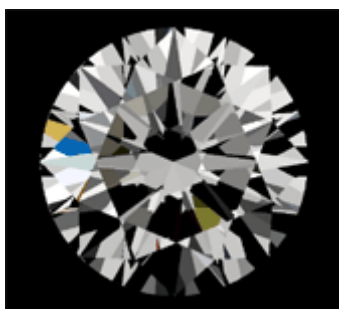
We propose to refer to the value of leakage, obtained with the use of the subjective grading and inversion functions, as **the adapted leakage**.

### **14.2 Stereoview: Stereovision and evaluation of leakage**

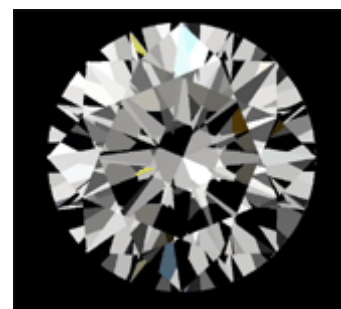
The human nature of seeing is stereoscopic. When we look at an object by two eyes, each eye sees its own picture, and these pictures are different one from another.



**The flat image of a diamond in the «fase-up» position. This is the way as a photocamera «sees»**



**The same diamond observed by the left eye**



**The same diamond observed by the right eye**

Human brain transforms two pictures into stereoscopic one. How does it happen? Is it correct that the brain observes the same picture as the photocamera does? Actually work of the brain on the creating of one stereoscopic image from two initial ones is not a simple averaging of two pictures. The image in the brain can be absolutely different from the average picture seen by the right and left eye correspondingly as well as from the image seen by the «photoreceptor» where the image is the result of observation along one direction.

Considering this phenomenon in application to the leakage of light in diamonds, we face the task how to evaluate areas in diamonds, in which one eye sees the leakage and the other eye does not. In other words what will be in the human brain when one eye observes the white area while the other eye sees the dark one. In this case the human brain will see the white area. When at least one eye sees leakage then the resulting image is also perceived as leakage. For the white background the situation is opposite - the brain feels the black section as the result of superpositioning two pictures.

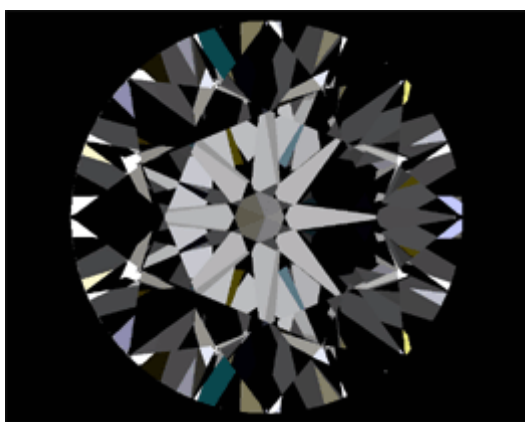
Another consideration is the case of partial leakage areas in a diamond. On the figures shown below there's a partial leakage under the table seen by the right and by the left eye correspondingly in the «Leakage» model of illumination:

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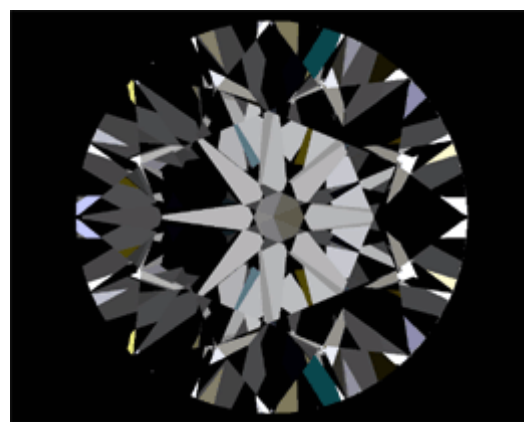
the image seen by the «photoreceptor» where the image is the result of observation along one direction.

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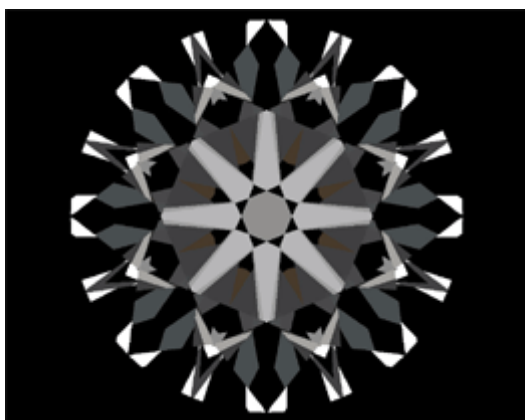
Another consideration is the case of partial leakage areas in a diamond. On the figures shown below there's a partial leakage under the table seen by the right and by the left eye correspondingly in the «Leakage» model of illumination:



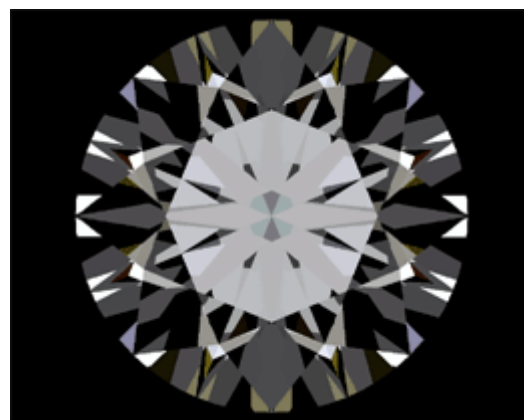
**Picture for the left eye in the «Leakage» illumination**



**Picture for the right eye in the «Leakage» illumination**



**The average picture: weak partial leakage under the table**



**The result of stereo effect calculation: moderate leakage under the table**

Literally all the modern conceptions of the diamond cut investigations will bring to the conclusion that the result leakage through the table is negligible for this diamond. It can be shown in the Firescope or in the «Leakage» illumination for the average position of the stone.

Taking into account stereovision effect lets us conclude that the result leakage seen by the brain through the table will be more considerable:

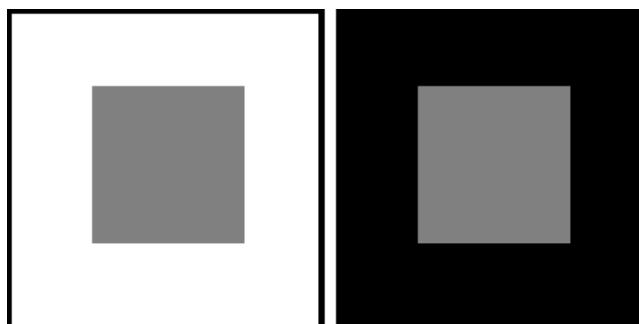
These examples show the work of stereo mode applied in this software. It evaluates the leakage of light from the point of view the real observer - the human head with stereovision.

### **14.3 Taking into account the features of human perception**

The necessity of taking into account the psychophysiological factors of human perception of the appearance of a diamond has changed the modeling methods used in gemological studies. In particular, a number of special functions, such as subjective brightness, subjective grading, and weighed geometric average, have been introduced.

#### **Subjective brightness function**

If an observer is provided with a number of grayscale color samples and asked to select such a gray tone that equally differs from white and from black, he faces a considerable difficulty, because estimating the relative value of two considerable color differences is based solely on a subjective impression. However, the required gray tone can be determined by averaging the subjective estimations of a few observers. Then, the same method can be applied to the two color ranges obtained (the first is from black to middle-gray; the second is from middle-gray to white). As a result, a uniform-contrast scale of luminosity (subjective brightness) can be built. This was one of the methods used to define a grayscale in Munsell's color space. One of the first formulas to determine this scale was the square root of the brightness (intensity),  $V = \sqrt{Y}$ . It is worth noting that a power law is suitable not only for defining subjective visual scales, but also for describing the human perception of sound intensity and some other characteristics. In other words, to make the human perception twice stronger, the intensity of the external action should be increased 4 times. In 1964 CIE approved a cube root formula,  $V = 25 \cdot \sqrt[3]{Y} - 17$  which well fits the Munsell's square-root luminosity scale for Y ranging from 1 to 100. These formulas do not take into account adaptation of the observer's eye to the background. At the same time, the background level strongly affects the subjective brightness of an object. You may feel it by comparing two gray squares of the same intensity, surrounded by a black and a white background. On the basis of experimental results obtained by Kaneko, Takanashi, and Semmelroth, it has been shown that the following formulas are more adequate for calculating the subjective brightness of an object, depending on the background level:

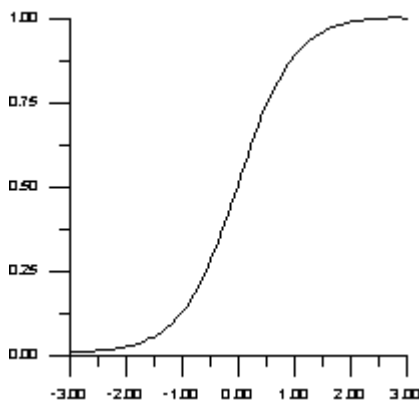


$\begin{cases} V = Y^m + k(Y - Y_{BG})^n, Y \geq Y_{BG}; \\ V = Y^m - k(Y - Y_{BG})^n, Y < Y_{BG}. \end{cases}$  where  $V$  is the subjective brightness (or luminosity) of the object;  $Y$  is the intensity (luminance) of the object;  $Y_{BG}$  is the intensity (luminance) of the background that surround the object;  $m$ ,  $n$ , and  $k$  are coefficients that determine the relative contributions of human stimuli. It is empirical fact that the most appropriate values of the latter coefficients are the following:  $m=0.4$ ,  $n=0.2$ , and  $k=0.65$ .

We used a slightly modified version of the above formulas to estimate the brilliance of a diamond and leakage of light in it.

### Subjective grading function

People usually grade various phenomena using a discrete set of categories (such as «bad», «good», «perfect», etc.) rather than percent scale or another continuous measure. It can be said that people have natural bias towards discrete grading of phenomena, even if the physical characteristics of these phenomena change continuously. That's why we have introduced a so-called three-step Grading Sigmoid as a measure of human rating of phenomena studied. The conventional sigmoid function often used in mathematics (see the plot below) represents only two levels, while people use at least three levels to grade events. So, we had to slightly generalize the sigmoid function for our purposes.



$$f(x) = \frac{1}{1 + e^{-ax}}$$

### Weighed geometric average function

When modeling a grading procedure of a cut diamond, it is not enough to take into account only a single static position of the stone. This is because a real observer would view the diamond from different sides. Therefore, we performed all the necessary computations for 15 orientations of the stone (it was rotated by 30 degrees around its axis) and then used weighed geometric averaging. The latter procedure reflects human perception more adequately than arithmetical averaging does. The geometrical averaging takes into account two key features of human perception.

The first feature is highlighting some bad views of the stone under study. This means that if the observer notices a bad perspective while changing the stone orientation, the negative impression may last even after the perspective is changed to a more advantageous one. The human perception tends to grade this stone as bad. So, the

geometric averaging makes it possible to adequately grade those stones looking bad in some orientations and prevents the negative rating from being compensated by advantageous perspectives. Such compensation may easily occur if one uses arithmetical averaging.

The second key feature of human perception is that when grading a stone the observer pay more attention to the «crown up» position. The larger the deviation of the stone orientation from the position when the crown looks exactly towards the observer, the less the «subjective weight» of this orientation in overall grading. Therefore, we made the geometric averaging weighed by taking into account the deviation angle of the diamond from the «crown towards the observer» orientation. The resultant averaging function looked as follows:

$$f(x) = \left( \prod_i x_i^{\cos(\alpha_i)} \right)^{\frac{1}{\sum_j \cos(\alpha_j)}}$$

#### 14.4 Brilliance

Below there are all definitions of «Brilliance» that we could find so far (1), our considerations why so many definitions do exist (2), and two definitions of «Brilliance» that match our understanding of this phenomenon (3). This material is a part of our future article devoted to Brilliance and we will be grateful if you share your considerations, concerns and comments.

##### Definitions of «Brilliance»

- GIA Diamond Dictionary, 3rd edition: Intensity of the internal and external reflections of white light from the crown of a polished diamond or other gemstone. Hardness, refractive index, reflectivity, polish, luster, and proportions all affect a gemstone's brilliance.
- Diamond Grading ABC by V. Pagel-Theisen, 11th edition: External brilliance - luster, produced by reflection of light on the surface of the facets; Internal brilliance - refraction and total reflection of light on the pavilion facets; Dispersive brilliance - splitting of scattering of light into its spectral colors = the dispersion which evokes the «fire» or «life» in a brilliant; Scintillation brilliance - the «sparkle» of the stone when moved, caused by light reflections of the light source.
- Dodson's definition (1978): A measure of the light that, entering the crown of the stone, is scattered out of the crown facets.
- «Professional Jeweler» (July 1998) Light Return/Brilliance. The amount of light returned to the eye, or brilliance, depends on how well the diamond in question reflects and refracts light. This includes dispersed wavelengths, which are reflected from the internal surfaces of a diamond and returned to the eye.

- <http://www.pricescop.com>: Brilliance is the most important feature of a beautiful diamond. At the simplest level, brilliance is reduced if light leaks out the back of a diamond. In a more complex analysis, the direction that light enters and leaves the top of a diamond becomes very important. A very deep pavilion diamond returns light straight back to the viewer, so in fact when you look face onto the table your head blocks the light and the diamond looks dull. Some diamonds that are too shallow suffer a similar problem (with a different cause).

## Discussion

It is well known in gemology and trade that the diamond appearance is described in terms of Brilliance, Scintillation and Fire. These three parts describe the diamond appearance completely.

Literature review and comparison of trade opinions show that the «Brilliance» term is not clearly defined and there is no one generally accepted definition.

Probably about 50 years ago the word «Brilliance» was used as ultimate description of the diamond appearance. At that time it was a synonymous with «Beauty». Evolution of ideas was led to separation of «Fire» as a characteristic of colored part of Brilliance and after that to separation of «Scintillation» what characterized a moving diamond. All that remained after separation of these two properties is known today as «Brilliance».

At present time there are three different ideas of brilliance:

1. Diamond beauty (as 50 years ago);
2. Diamond beauty minus Scintillation minus Fire;
3. Light Return (sometimes including external luster or sometimes taking into account internal reflections only).

**Here we are posting two following definitions of «Brilliance» for your suggestions**

### First definition

Brilliance is the characteristic of a diamond, which remains when we «take» all its appearance and «subtract» Scintillation and Fire. The human eye will see Brilliance as combination of white, gray and black zones for motionless diamond ( i.e. colored zones are eliminated).

### Second definition

The phenomenon called Brilliance consists of two parts. The first one is based on comprehension of primary/initial/incipient brightness and contrast of diamond image (motionless photo-shots taken from different positions). The second part consists of posterior/subsequent traditional comprehension of some phenomena as negative or positive (like «Fish-Eye», «Nail Head», «Leakage», thick girdle, symmetry deviations, Tolkovsky pattern, «Ideal Cut»).

This second part appeared due to attempts to grade the first part of Brilliance and to interpret it by viewing many diamonds. And nowadays the members of the contemporary market have in their memory a set of standard images, which people have already associated with positive or negative emotions.

Perhaps to evaluate Brilliance objectively the first part would be well enough, but it would not be enough for a human subjective evaluation because a human mind could hardly grade/calibrate it. It is easier for a human brain to grade/evaluate Fire of Scintillation because under fixed illumination conditions one can easily count «two flashes» or «four bright sparkles during motion» or «no one colored facet». Seemingly the attempt to replace «Brilliance» by «Light Return» is bound up with the very need to grade.

Comprehension of the first part of Brilliance depends on sex and age of people. Comprehension of the second part of Brilliance depends on the environment/culture where people grow. As a consequence the comprehension of the second part of Brilliance will vary for different nations, times, social groups, etc. This phenomenon is similar to tastes (like preferences of types of clothes, wine, women, men, cars, books .... etc).

### **14.5 Light Return**

In the Diamond Cut Study the light return was measured under different lighting conditions. However, this takes a lot of time. In this Gem Adviser demo the light return is computed for single lighting.

To learn how the specific of the human perception is considered in Light Return estimation please read this article:

[Taking into account the features of human perception](#)

To learn more about the difference between «mono» and «stereo» modes please read this article:

[Stereovision: Stereovision and evaluation of leakage](#)

To read more about the Light Return please refer to the following materials:


[Diamond cut study on www.cutstudy.com](http://www.cutstudy.com)

### **14.6 Contrast**

This is an estimate of subjective perception of diamond's picture in some lighting surround by a human eye, namely is the image more or less "contrast". It is essentially the cumulative length of visible borders between differently colored zones on the image multiplied by differences across these borders both in brightness and chromaticity. Additional reduction of contrast is introduced to take into account the low-contrast perception of very small details of an image such as very small virtual facets that have no potential for our eyes to resolve sparkles or contrasting zones.

### **14.7 Dark Zone**

Dark Zone is an estimate of size and the negative effect of dark zones seen within a diamond. Dark Zones occur when we see parts of a diamond where we cannot see any



brighter lights in the surrounding space around the diamond. This part of space is essentially when we can see through to the pavilion-side hemisphere, and the space occupied by implied observer's head and body. The lower the Dark Zone number of a diamond the more probably it will look dark or have unattractive area for a typical observer. Very small and frequent Dark Zones contribute to contrast, very large dark zones detract.

### **14.8 Fish Eye**

Fish Eye is a reflection of the girdle on the pavilion facets visible in the face-up examination of a diamond with a very small pavilion angle. It is one of the optical effects like Kozibe, Nail Head and etc. For example a round brilliant that needs more than  $5^\circ$  of tilt to see the girdle will be graded Very Good 1.00, and if the tilt is more than  $0.1^\circ$  and less than  $5^\circ$  it will be graded as Good 0.75. Less tilt than  $0.1^\circ$  receives Poor 0.50.

### **14.9 ETAS**

ETAS (Effective Total Angular Size of a diamond) is an estimate of the probability for a small light source to be seen through the diamond

Fire is an estimate of probability for colored dispersed light to be seen due to chromatic dispersion of the light source caused by the crystal.

DETAS (Dynamic ETAS) is an estimate related to ETAS but it considers a diamond in motion, namely being tilted to small angles. While tilting, a diamond "scans" the space around it, thus increasing the probability to see a light source.

ETAS, Fire and DETAS are all compared to a 6mm diameter Tolkowsky diamond.



## 15 Working with the different types of gemstones

DiamCalc allows to work not just with diamonds but also perform the calculations and get photo-realistic images of the different gemstones, like emerald, CZ, etc. The 3Dcalc users have the opportunity to change manually gem material characteristics according to external information available about a certain stone. Lately user can work with the adjusted material characters by loading them from saved and collected files.

### 15.1 Select the type of gemstone

The menu command «Gem» presents you with the list of «built-in» types of gemstones. For the time being the following built-in materials are available: colorless diamond, emerald (2 types), CZ.

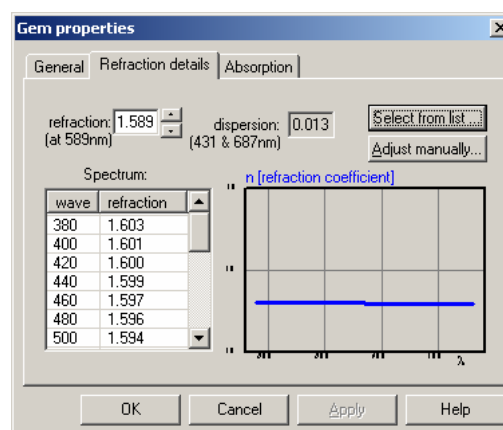
### 15.2 Adjust the gem material characteristics

The menu command «Gem/Properties» presents you with the panel to adjust gem characteristics (in the demo version it works in the read-only mode).

The «General» tab allows you to define the material density and select if the gem is colored or colorless.

The menu command «Gem/Properties» presents you with the panel to adjust gem characteristics (in the demo version it works in the read-only mode).

The «General» tab allows you to define the material density and select if the gem is colored or colorless.



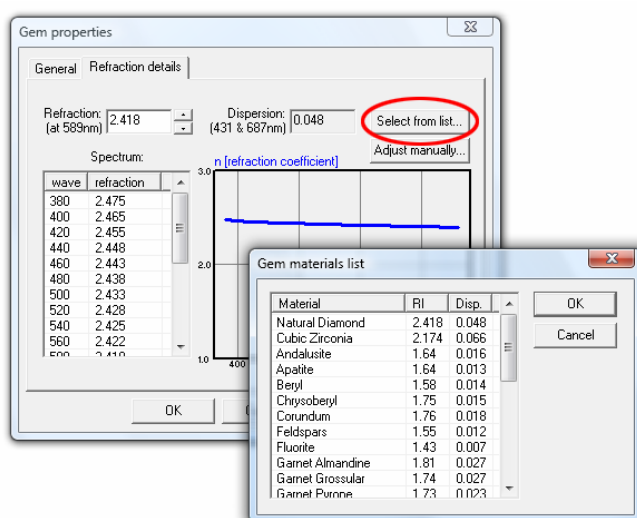
The «Refraction» tab allows you to adjust gem refraction. The most right way to adjust the refraction to simulate specific gem is to input the RI value at each wavelength using the «spectrum» grid (see picture below). When you change just the «refraction» parameter then the arithmetical difference you want to supply is added to all RI values in the spectra. The dispersion in this case isn't changed. This allows you to adjust quickly and conveniently gem properties for groups of analogous materials that has almost the same dispersion and different RI. If you haven't whole-spectrum RI data then you may approximate required RI values basing on a couple of values you have. After pressing «Adjust manually...» button you can supply arbitrary RI and dispersion values and the DiamCalc will make the linear approximation to meet the specified requirements. The button «Select from list...» presents you with a list of (RI and dispersion) pairs corresponding to most gem materials. However, by selecting the

desired gem material type from this menu you affect only the refractive features of the material, but the absorption and specific gravity stay unchanged after this action.

The «absorption» tab (for colored gems) has the same structure as «refraction» tab. It displays the spectrum of absorption on a diagram and allows you to modify it. The absorption values must be adjusted for 1mm thickness.

### **15.3 Natural Diamond and Cubic Zirconia in the list of materials for setting refraction in Gem properties**

Open panel Gem properties from menu Gem Material -> View / Modify properties... Press button Select from list... The panel Gem material list will open. Where you can find new materials.



### **15.4 Visible adsorption spectra and DiamCalc-files of colored gem materials**

Download it from our web-site:

[http://www.octonus.com/oct/projects/adsorbition\\_spectra.phtml](http://www.octonus.com/oct/projects/adsorbition_spectra.phtml)

## 16 Appraising diamonds quality and pricing diamonds

OctoNus Diamond Calculator has two major features that help to evaluate diamonds:

- Appraising diamond quality and quality of particular diamond parameters (girdle size, pavilion angle, etc.)
- Pricing diamonds basing on price lists with discounts for diamond shape, cu quality, color and clarity

By default, the DiamCalc does not display price. To enable or disable price display use menu command View → Prices

There are several built-in systems of diamond grading («appraisers»): AGS, HRD, GIA, AGA and Russian TU. Moreover, the data of appraisers is stored as a text and can be edited, so you can change criteria of appraising diamonds or even add your own grading scheme.

Price lists are also stored as a text, so they can be customized, including possible discounts for diamond shape, color and clarity. Also, there is a free DBFCONV utility which provides a way to use Rapaport price lists with Diamond Calculator.

**DISCLAIMER.** The numerical representation of grading systems used by DiamCalc is not an official data of the corresponding bodies. Although the data was intended to describe HRD, GIA, AGA and Russian TU grading systems as precise as possible, some ambiguities or differences with the official data might exist. OctoNus Software recommends that you check appraiser data and modify it as necessary before using it to grade diamonds for commercial purposes.

**DISCLAIMER.** The price lists supplied with DiamCalc are sample ones. Although they are similar to real price lists used in the diamond industry, OctoNus Software does not guarantee that you can buy or sell diamonds at the price that was calculated by DiamCalc on the basis of the supplied price lists. OctoNus Software recommends that you verify price list data and modify it as necessary before using them for appraising diamonds for commercial purposes.

You can see «How DiamCalc grades diamonds» for exact criteria of diamond grading provided by DiamCalc.

«How DiamCalc prices diamonds» explains how the price is calculated depending on diamond color, clarity, shape and other parameters.

### 16.1 How DiamCalc grades diamonds

When a diamond data is entered, DiamCalc uses a selected grading system («appraiser») to grade each diamond parameter according to tables below. Depending on parameter value, it is given a grade (different grading systems have different quality groups). Then the quality of the diamond cut is calculated as the worst of quality groups of all individual parameters.

This data is contained in Appraise.txt file in the folder where DiamCalc is installed.

There are two kinds of data tables: appraiser tables and translation tables.

Appraiser tables shows how each individual parameter is graded. They contain following columns: parameter name, as it is listed in Appraise.txt file; the meaning of the parameter; and one column that lists a range of that parameter for each quality group.

Translation tables give a numerical equivalent for quality groups of some parameters, for instance, they could define a «thick» girdle as having size between 4.75 and 6.25 percents of the diameter.

Tables are ordered by grading system, then by cut. The following systems and cuts are implemented:

- HRD system: Brilliant cut;
- GIA system: Brilliant cut;
- AGA system: Brilliant (different tables for diamonds less than 0.5 ct or 0.5 ct. and more), Pear, Heart, Oval, Marquise, Prince, Emerald and Radiant.

## ***16.2 How DiamCalc prices diamonds***

DiamCalc can estimate a price of the diamond taking into account the mass of the diamond, its cut, color, clarity, quality of cut and a user-defined discount.

The following method is used:

- Base price per carat is calculated with price lists using mass group, cut, color and clarity.
- A discount for cut quality is taken (cut quality is determined by «DiamCalc Appraisers Description»).
- The final price is calculated on the basis of base price per carat, mass, discount for quality of cut and user discount.

Price lists are stored in text files. The main file is Price.txt which is located in the folder where DiamCalc is installed. The shipped version of Price.txt file does not contain price lists itself, but rather has references to OctBrill.txt file (it is located in the System subfolder and lists prices for Brilliant cut) and OctPear.txt file (it is also in System subfolder and contains prices for Pear cut).

Price.txt file also specifies that the price for diamonds of other shapes is a half of the price of the Brilliant cut diamonds with similar other parameters. For the details of individual file formats, see the links below. Note that there are three price list files in the shipped version of the software (Price.txt, System\OctBrill.txt and System\OctPear.txt), but formats of the last two are essentially the same.

## 17 Creating diamond reports

### 17.1 Creating a Diamond Grading Report

Diamond Calculator can create a diamond grading report. This feature requires that MS Word 95, MS Word 97 or later is installed. To create a report select in menu command File → Report (Export to Word)... MS Word will be started, and a new document created. You can view the report or print it from Word as usual. A report describes cut, proportions and contains a schematic image of the diamond:

DIAMOND grading  
REPORT

Report No. \_\_\_\_\_

Shape: **Marquise**  
 Weight: **1.61 ct.**  
 Dimensions: **Max. 13.20 Min. 6.00 x Dep. 3.67 mm**  
 Total Depth: **61.22 %**  
 Table: **60.00 %**  
 Girdle thickness: **Slightly Thick**  
 Culet: \_\_\_\_\_

Crown Height: **14.00 %**  
 Crown Angle: **35.00 °**  
 Pavilion Height: **43.46 %**  
 Pavilion Angle: **41.00 °**

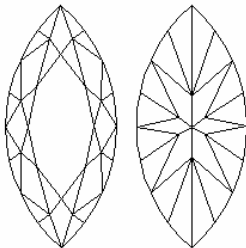
CUTTING/PROPORTIONS GRADE: **2B**  
 according to AGA appraising system.

GIA COLOR: **H**

D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	
Colorless				Near Colorless				Faintly tinted				Very Light Yellow				Light Yellow				Yellow			

GIA CLARITY: **VS1**

F	IF	VVS1	VVS2	VVS3	VSI	S1	S2	I1	I2	I3	
Flawless		Very very slight inclusions		Very slight inclusions		Small inclusions					
Internally Flawless											



Laboratory Director

Date: September 10 1999

This report is generated with OctoNus Diamond Calculator. <http://www.gemology.ru/octonus>

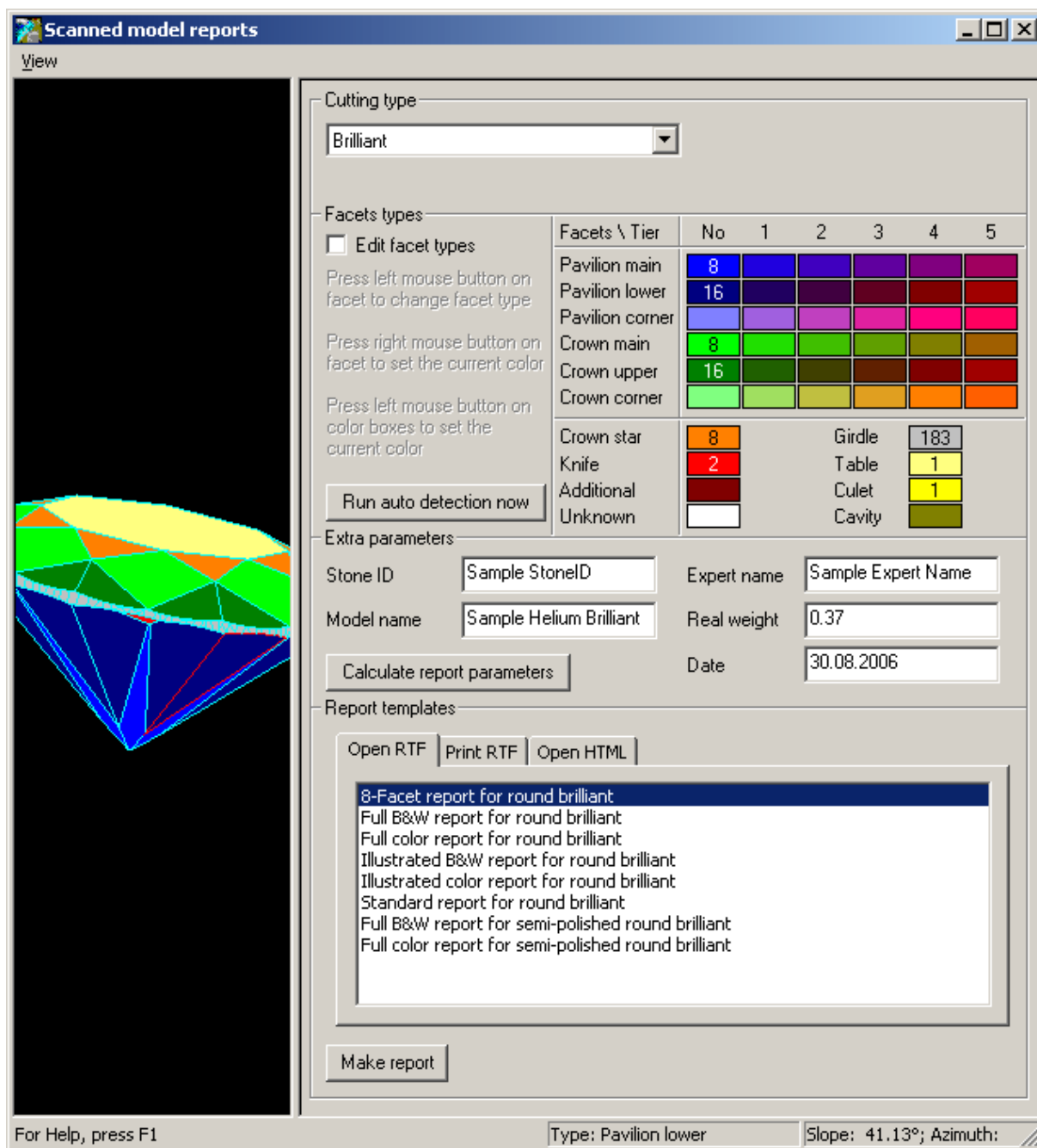
### 17.2 Creating reports for scanned polished diamonds

The OctoNus Helium software can export a 3D model of the scanned diamond and its parameters to the DiamCalc's DMC file. DiamCalc can read such files and display the scanned model and its parameters. DiamCalc can generate the same reports on scanned diamond as Helium does using the data provided by the Helium. For more information about Helium please visit our web-site at <http://www.octonus.com/oct/products/>. If the loaded file contains the scanned diamond parameters, some of them will be displayed on the «Advanced» and «Advanced 2» tabs:

Proportions	Advanced	Advanced 2
Diameter (min)		4.76 mm
Diameter (max)		4.79 mm
Total height		56.9 %
Crown height(avg)		11.5 %
Pavilion height(avg)		42.7 %
Girdle bezel(avg)		2.9 %
Girdle bone(avg)		3.3 %
Girdle valley(avg)		1.6 %
Table (avg)		64.0 %
Culet (avg)		0.6 %

When you work with scanned or imported 3D model a special button «Scanned reports» becomes enabled. This button is located to the right of parameters list. It invokes a new window that allows creating reports for 3D models of diamonds obtained by OctoNus scanners as well as for any other imported 3D model. The DiamCalc installation contains a set of sample stones with different cuttings scanned on Helium. They are placed in the SAMPLE\_STONES subfolder.

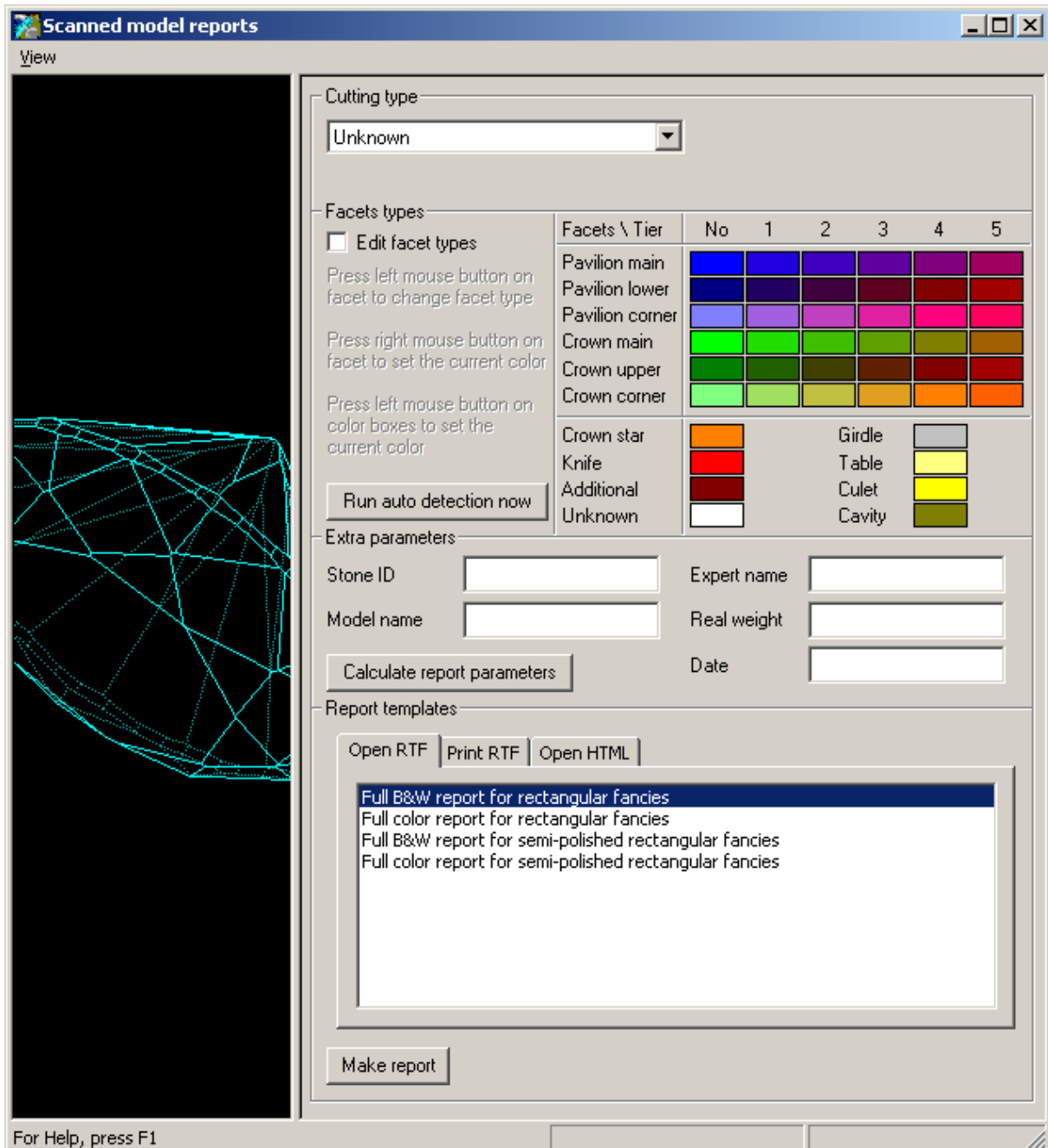
If you loaded the DMC file that was created by Helium, the window for reports will look similar to this:




The cutting type of the model is already defined; all facets of the model are colored according to their types. Generally you will not need to alter these. You may adjust

extra parameters like «Model name». In order to make a report choose report template from the list and press the «Make report» button. RTF reports require MS Word to be installed. If you choose report from «Open RTF» tab the DiamCalc 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.

If you imported 3D model or loaded DMC file that doesn't have report data yet, the window for reports will look similar to this:





At first specify correct cutting using drop-down list. Please note, that there are different sets of report templates for different cuttings. The list on the screen will show templates available for the selected cutting. Then you will need to specify types of each facet so that the software will be able to calculate stone parameters. Check the «Edit facet types» checkbox. If it is the first time when you begin to edit facet types on this stone the DiamCalc will try to detect facet types automatically (the same is done when you press the «Run auto detection now» button). Verify that all facets are colored correctly and adjust colors where necessary. Refer to sample stones included with DiamCalc to see how different cuttings should be colored.

In the window with the model left mouse button rotates the model, right mouse button moves the model, mouse wheel changes zoom. In the edit mode (when «Edit facet types» is checked) use the table of colors to choose the facet type. Press left mouse button on the facet and its type will be changed to the currently selected. Press right mouse button on the facet and the currently selected color will switch to the color of this facet. Color boxes in the table show the quantity of facets of the given type. It may be useful as a quick check, e.g. it is known that the full round brilliant cut should have 8 main facets and 16 halves.

Once you specified types of all facets enter values for extra parameters that you need and press «Calculate report parameters button». DiamCalc will measure stone parameters based on the Cutting type and facet types that you provided. In order to see the result, choose report template from the list and press the «Make report» button.

⇒ *For more detailed step-by-step instruction of making report for a model obtained by Sarin scanner see DiamCalc Howto document section «Make report for a model obtained by Sarin scanner» or visit internet page*

*<http://www.octonus.com/oct/products/3dcalc/standard/key/23.phtml>*

The DiamCalc installation contains a set of report templates for different cuttings. They are placed in the REPORTS subfolder. You may customize provided RTF report templates in MS Word or create your own taking existing templates as examples. Please note that MS Word report templates should be saved in RTF format. HTML report templates also may be customized. Use your favorite HTML editor for it. Here is an example of how the «Illustrated color report for round brilliant» looks like.



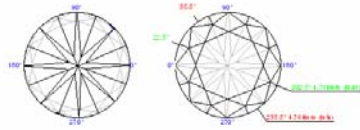
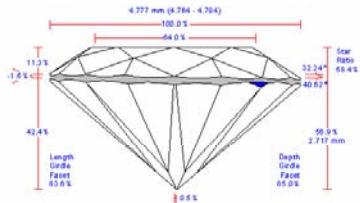
**DIAMCALC ILLUSTRATED REPORT**

Polished Brilliant

Model: Simple  
 Expert name: Makoed A.G.  
 Report date: 07.09.2006  
 Real weight, ct: 0.37, 0.3796  
 Calculated weight, ct: 4.777 (4.764-4.794) x 2.717 /0.019  
 Measurements, mm: Spread: 0.03 ct, 8.38%

**Average values, mm**

Total height	Crown height	Pavilion depth	Table	Culet	Bezel	Girdle Bone	Valley
2.717	0.538	2.027	3.060	0.025	-0.070	-0.139	-0.157



Appraiser title: GIA  
 Overall cut quality: N/A  
 Overall symmetry quality: PR

<b>Symmetry</b>	
<b>Polish</b>	
<b>Color</b>	
<b>Clarity</b>	
<b>Fluorescence</b>	

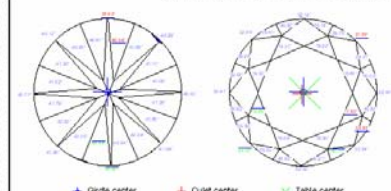
Parameter	Avg	Min	Max	Dev	Cut	Sym
Diameter, mm	4.777	4.764	4.794	0.02%	E-VG	EX
Crown angle, °	32.24	31.05	33.55	1.50	G	VG
Pavilion angle, °	40.62	39.63	41.47	1.84	N/A	VG
Total height, %	56.88				N/A	-
Crown height, %	11.27	10.38	12.32	1.94	N/A	VG
Pavilion depth, %	42.44	40.67	43.68	3.01	G	FR
Table, %	64.05	63.84	64.15	0.31	F	EX
Culet, %	0.53	0.35	0.63	0.28	E-VG	EX
Girdle Bezel, %	-1.47	-1.96	-1.16	0.80	N/A	EX
Girdle Bone, %	-2.91	-3.68	-1.68	1.99	-	VG
Girdle Valley, %	-3.28	-3.80	-2.91	0.89	N/A	EX
Star	58.39	54.01	63.15	9.14	-	-
Upper ratio, %	41.61	45.39	36.85	9.14	-	-
Star angle, °	18.79	17.63	19.85	2.21	GO	-
Upper girdle angle, °	39.91	38.83	41.11	2.28	-	GO
Lower girdle angle / Halves angle, °	41.53	40.54	42.44	1.91	-	VG
Twist, °	1.38	0.03	3.61	3.58	-	VG
Crown height, mm	0.538	0.496	0.589	0.093	-	-
Pavilion depth, mm	2.027	1.943	2.087	0.144	-	-
Table, mm	3.060	3.050	3.064	0.015	-	-
Culet, mm	0.025	0.017	0.030	0.013	-	-
Girdle Bezel, mm	-0.070	-0.094	-0.055	0.038	-	-
Girdle Bone, mm	-0.139	-0.176	-0.090	0.095	-	-
Girdle Valley, mm	-0.157	-0.181	-0.139	0.042	-	-

**Measurement as per Octonius theory**

Crown angle, °	32.24	31.80	32.42	0.62	-	-
Pavilion angle, °	40.62	40.52	40.82	0.31	-	-
Fish eye effect, °			3.53	G	-	-
Culet through Crown Bezel, °			25.30	E-VG	-	-

**Parameters**

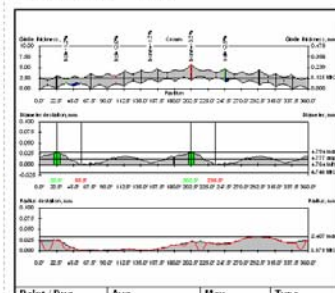
	1	2	3	4	5	6	7	8
Dev. azimuthal deviation from ideal	0.00	0.00	0.15	1.58	1.30	0.36	0.11	0.03
Crown azimuthal deviation from ideal	0.04	0.81	-0.38	-0.42	-2.31	1.24	0.08	3.22
Pavilion pairing	-1.27	-1.49	-2.05	-0.65	-1.03	-1.14	-0.84	-2.94
Pavilion pairing	-1.42	-4.24	-0.80	-2.93	-0.23	-1.85	-1.72	-0.43
Pavilion pairing	-0.18	2.07	-1.37	-0.78	0.88	-0.35	0.35	-0.41
Pavilion pairing	0.10	-1.29	0.97	-0.60	0.16	-0.35	-0.16	0.17



**Offset by table axis**

Girdle-Culet	1.51 ± 0.26, %	0.072 ± 0.012, mm
Girdle-Table	1.28 ± 0.23, %	0.060 ± 0.011, mm
Table-Culet	1.83 ± 0.27, %	0.087 ± 0.013, mm

1	2	3	4	5	6	7	8
4.783	4.772	4.775	4.775				
32.41	32.54	32.14	31.05	32.44	32.24	32.52	32.55
40.33	40.29	39.63	40.12	40.71	41.36	41.47	41.04
12.32	12.13	11.54	10.77	10.38	10.45	10.95	11.58
41.65	40.67	41.95	42.83	43.48	43.68	43.05	42.18
64.07	64.15	64.14	63.84				
-1.43	-1.16	-1.96	-1.76	-1.35	-1.27	-1.17	-1.70
-2.96	-3.42	-3.44	-1.68	-3.68	-2.91	-3.44	-1.73
-2.99	-2.95	-3.42	-3.54	-3.44	-3.43	-3.19	-3.06
3.68	3.80	2.91	2.94	3.44	3.59	3.06	3.04
54.55	57.84	60.63	59.79	63.15	60.26	57.78	54.01
45.36	42.16	39.37	41.21	36.85	39.74	42.22	45.99
18.32	19.37	19.22	18.60	17.63	18.30	18.04	19.85
39.58	39.20	39.61	40.30	40.18	39.70	39.31	40.03
40.83	39.83	41.11	40.21	40.92	39.53	39.39	39.82
41.00	41.11	41.06	40.54	40.61	40.95	41.30	41.52
41.79	42.22	42.39	42.44	42.24	42.04	41.80	41.36
0.04	0.73	0.54	2.00	3.61	0.88	0.03	3.19
0.589	0.580	0.551	0.515	0.496	0.499	0.523	0.553
1.990	1.943	2.004	2.046	2.077	2.087	2.057	2.015
3.061	3.064	3.064	3.050				
-0.068	-0.055	-0.084	-0.084	-0.055	-0.060	-0.056	-0.091
-0.141	-0.163	-0.164	-0.090	-0.176	-0.139	-0.154	-0.093
-0.143	-0.141	-0.163	-0.169	-0.164	-0.164	-0.153	-0.146
-0.178	-0.181	-0.139	-0.140	-0.164	-0.171	-0.146	-0.145
32.42	32.39	32.33	31.80				
40.52	40.62	40.55	40.58				



**Paint / Dug**

Crown, °	-1.50	-4.24	
Crown, notches	0.4, Small	1.1	Painting
Pavilion, °	-0.30	-2.07	
Pavilion, notches	0.1, Absent	0.6	

More examples of new DiamCalc reports for Helium and Sarin scanned polished brilliants on the web-site:

<http://www.octonus.com/oct/products/3dcalc/standard/reports-dc-rbc.phtml>

## 18 Diamond Calculator FAQ

### ***18.1 I can not make a change of 1/10 degree while modifying ASCII file. Is there a way to refine the change?***

You may enter the desired value directly. Press Enter to apply the changes.

### ***18.2 How do I place a movie recorded by the DiamCalc on a web site?***

The DiamCalc allows exporting of the generated movies into common AVI format. Moreover, during export you may choose the desired codec from the list of codecs installed in your system for encoding your movie. Thus you may share your movies with everyone through your web site. If you want the movie to play directly on your web-page without explicit download of the file you may convert AVI file into animated GIF format with third-party programs. In this case we recommend saving the source AVI file without compression to avoid artifacts caused by lossy compression.

### ***18.3 How can I make fancy color photoreal pictures with DiamCalc?***

The present version of DiamCalc allows to select from two predefined colors (choose menu item Gem material → Standard types), but you may enter arbitrary absorption spectrum (Gem material → View/Modify properties). In the «Gem properties» on the «General» tab click the «Add» button. This will add an «Absorption» tab that allows to specify the absorption spectrum. You need to know absorption characteristics of your stone to get accurate results (see section Adjust the gem material characteristics). We are planning to enlarge the list of predefined materials in future versions of DiamCalc.

### ***18.4 What is spread?***

The spread is parameter showing the difference between the weight of the given diamond and the weight of the «standard diamond». The «standard diamond» has the same area as the given diamond but Tolkowsky proportions with the medium girdle thickness. The spread parameter tells you if your diamond looks more or less massive than it really is. The spread parameter also works with fancy shapes comparing them with round «standard diamond». The spread indication is available only in the registered version.

### ***18.5 What is AGS spread?***

$$NW = C (6.47 / D)^3$$

**C** - weight of diamond (ct)

**D** - diameter of diamond (mm)

6.47 - diameter in mm of diamond with weight 1 ct and Tolkowsky proportions



### **18.6 What is gamma correction?**

As human eye perception of the brightness is not linear with the light intensity (in fact, it is close to «Gamma function») the modern monitors use the nonlinear pixel brightness to compensate this behavior and let the human to see computer colors having uniform brightness. For the most monitors the factor of that compensation (gamma) is about 2. For this case gamma correction in the DiamCalc should be 0.5. However, it may differ for different monitors (particularly it depends on the monitor's control settings and settings of the video adapter driver), so you may adjust this parameter in the DiamCalc. We are planning to add a utility letting the user to define and adjust this value looking at test pictures in the future.

### **18.7 What is the accuracy of the DiamCalc mass estimation?**

For convex shapes it is completely accurate. However, you should mention the following things:

- In order to estimate the stone weight correctly you have to know the exact value of specific gravity of the gem material.
- The real stone always slightly differ from the model that was used for cutting because accuracy of cutting process is limited (another reason - the real stone can have extra facets or omitted facets especially on the girdle).

If you have suspicions about specific file then you may send to us this file and your suspicions and we will analyze it.

### **18.8 Why does the DiamCalc valley girdle measurement produce negative values for very thin and extremely thin girdles, which does not match any charts?**

The charts usually contain bezel girdle measurement and DiamCalc takes it for a basis, while valley girdle measurement is calculated using mathematical model of the brilliant cut. An average stone with regular brilliant proportions has a valley girdle about 1.6-1.7 less than bezel girdle. Of course, the real stone can't have negative measurements, but DiamCalc doesn't discard negative results of computations in order not to lose information (to indicate how really thin it is).

### **18.9 How to open GemCad GEM files in DiamCalc?**

Unfortunately, the format of the GemCad GEM files is not open, but you can load them in GemCad and then save in ASCII format. To import GemCad ASCII files use menu command Cut → Import cut → From GemCad ASC file.

### **18.10 How can I contact the DiamCalc support?**

If you have any problems with the DiamCalc or have any suggestions for its improvements you may always send a message from our web-site:

<http://www.octonus.com/oct/support/SubmitTicket.phtml>

## 19 Purchase DC3 and upgrade from DC2

If you have a Hasp version of DiamCalc - simply download the latest DC3 version from here [http://www.octonus.com/oct/download/diam\\_demo\\_down.phtml](http://www.octonus.com/oct/download/diam_demo_down.phtml) Your upgrade is **free**. That key is the one shown in the picture.

If you have a downloaded version of DiamCalc2.x without a HASP key then please click this link <http://www.ideal-scope.com/formmail/dcupgrade.html> add your



company information and registration key number that you can find by opening DC2 and clicking on Help (top right) and then Registration Info.... (Please copy and paste the key #'s to avoid errors). After Key confirmation OctoNus will send you an email with an Ideal-scope.com link where for **\$85** plus delivery you can pay by secure credit card payment for delivery of the hasp key - shown on the bottom. (This covers the cost and handling of the

key - the upgrade is essentially free).

If you wish to upgrade from DC2.x Hasp version to DC3Pro then go to [www.ideal-scope.com](http://www.ideal-scope.com) Meanwhile please post your old DC2 long hasp key to Ideal-scope 110-114 Canterbury Road, Canterbury, 3126 Australia and you will be eligible for a \$295 discounted upgrade at \$3,700 including a new DC3 hasp key.

**New DC3pro is available for \$3,950** at [www.ideal-scope.com](http://www.ideal-scope.com)

**Any DC3 version can be upgraded for \$3,650 by simply filling out the form at <http://www.ideal-scope.com/formmail/dcupgrade.html> & updating your program from [http://www.octonus.com/oct/download/diam\\_demo\\_down.phtml](http://www.octonus.com/oct/download/diam_demo_down.phtml)**

**Additional DC3 licenses can be purchased for \$395 from [http://www.ideal-scope.com/cart\\_zoom\\_item.asp?Id=12&ShowAdd=Y](http://www.ideal-scope.com/cart_zoom_item.asp?Id=12&ShowAdd=Y)**

All software should be downloaded from the latest most recent versions are here: [http://www.octonus.com/oct/download/diam\\_demo\\_down.phtml](http://www.octonus.com/oct/download/diam_demo_down.phtml)



## 20 Appendix

For additional documentation on DiamCalc, refer to OctoNus Software Web pages. The main page of DiamCalc is <http://www.octonus.com/oct/products/3dcalc/standard/>. Additionally, there are information on understanding and modifying of diamond appraising criteria and price lists that are used by DiamCalc. Look there for up-to-date information related to DiamCalc.

Over the coming months [www.OctoNus.com](http://www.OctoNus.com) will launch help group Forums and Video Tutorials to answer FAQ's. We invite you to participate.

The OctoNus DiamCalc team wishes you great productivity from the new tools added to DiamCalc. We also welcome feedback and suggestions for improvements.