

Diamond Color Optimization

Process flow

Today available:



Colored diamonds on the market usually have many negative phenomena: dark zones and pale zones. Sometimes diamond cutters have no idea now to optimize color by smart cutting.

Optical phenomena modeling



Photos in Lab conditions

Approximate DC models

It was not possible to remove these diamonds from their settings. However an approximate 3D modeling clearly shows that a saturated princess cut and a worse radiant cut can be polished from a diamond with the same spectrum.

Process flow

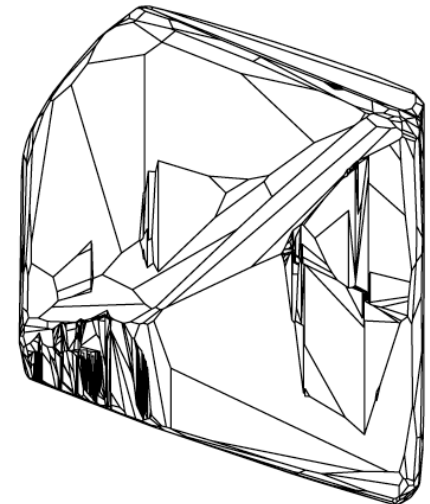
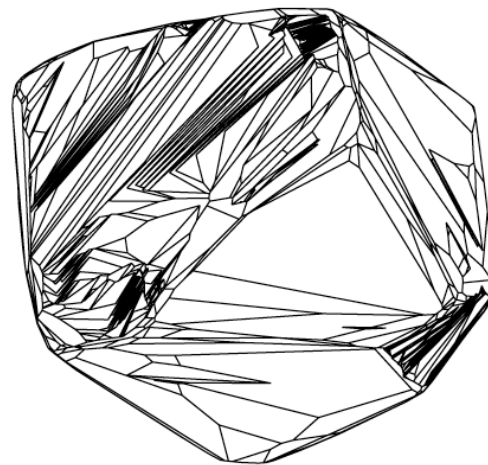
1. Preparation of a rough diamond
2. Rough scanning and allocation
3. Shape and size preliminary considerations
4. Taking pictures and obtaining their RGB data
5. Recording transmission spectra
6. Calculations of absorption spectra
7. Importing spectrum into DiamCalc. Spectrum adjustment
8. Preliminary shapes color check
9. Optimization by color metrics
10. Expert consideration of optimization results
11. Final allocation and final decision
12. Documenting of the final stone

Preparation of a rough diamond

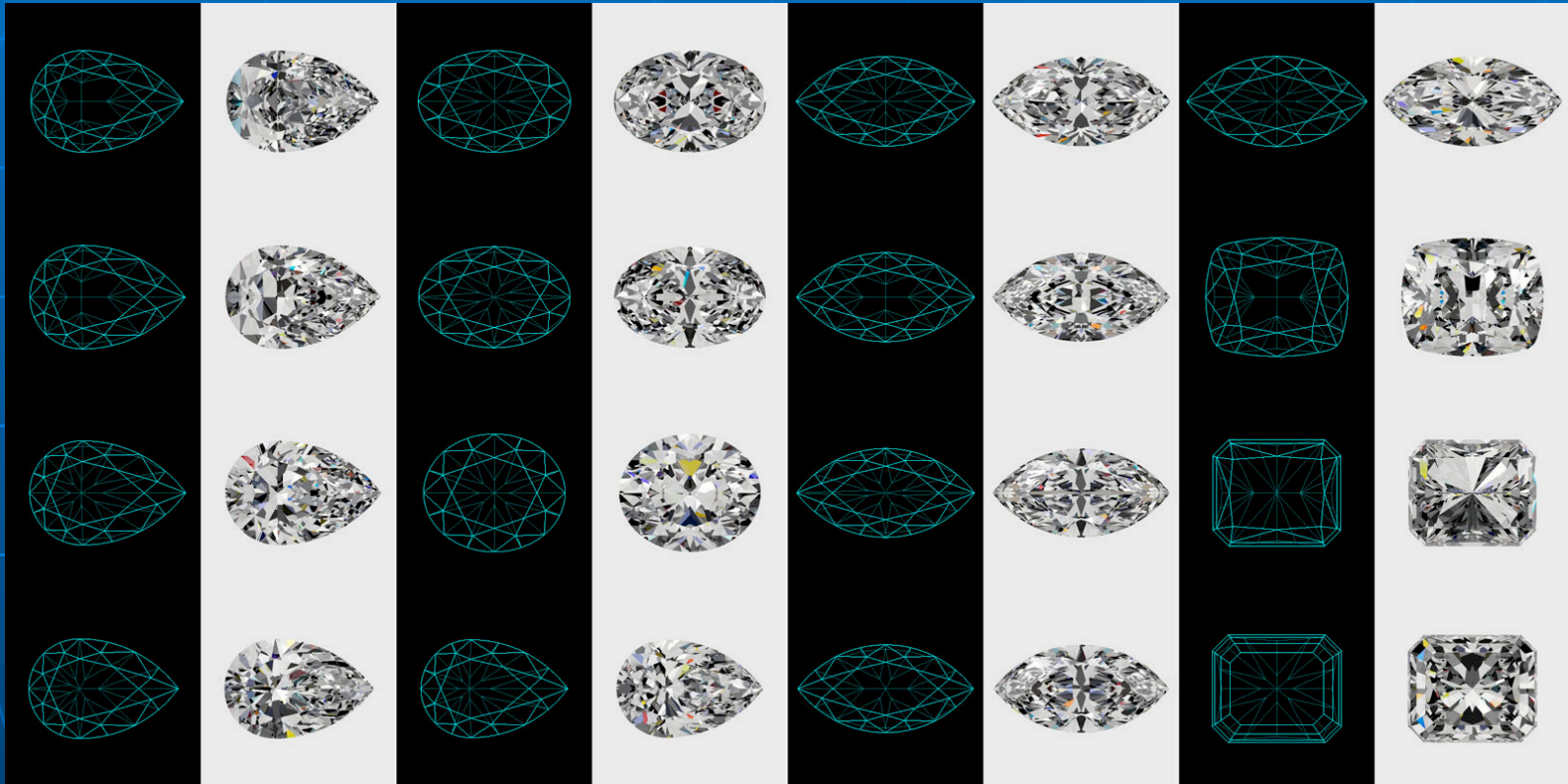
- Visual observation
- Color distribution study
- Polishing windows
- Control of windows

Rough scanning and allocation

- Helium diamond model construction
- Check of model accuracy
- Inclusions allocation
- Polished diamonds allocation
- Choosing one or two prospective shapes



Library of shapes



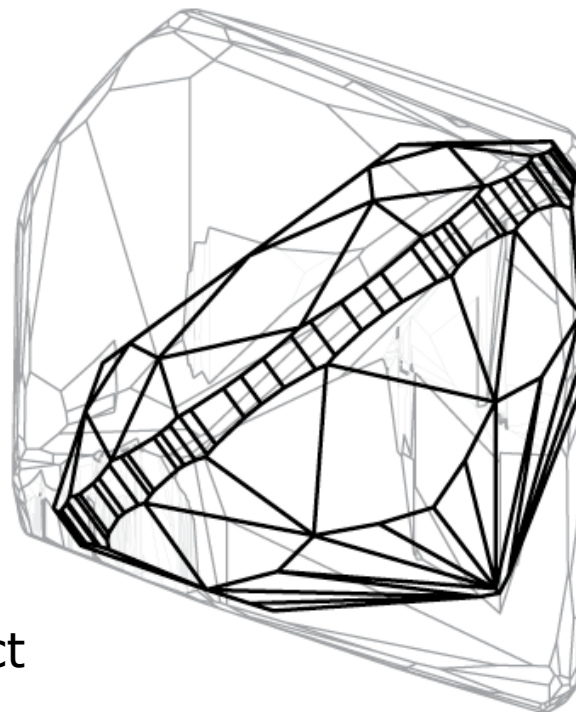
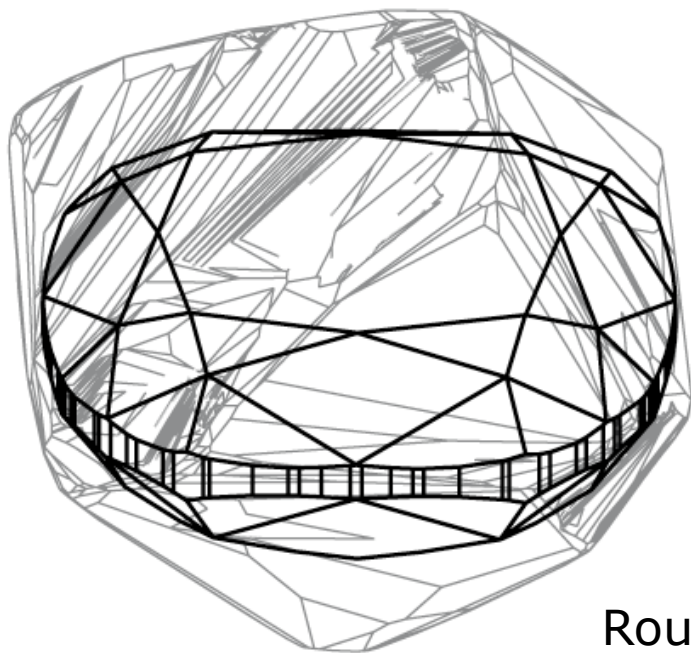
[Designer Cuts gallery](#) [DiamCalc Internal Cuts gallery](#) [External Cuts gallery \(DII\)](#)

<http://www.octonus.com/oct/gallery/external.php>

Cushions examples



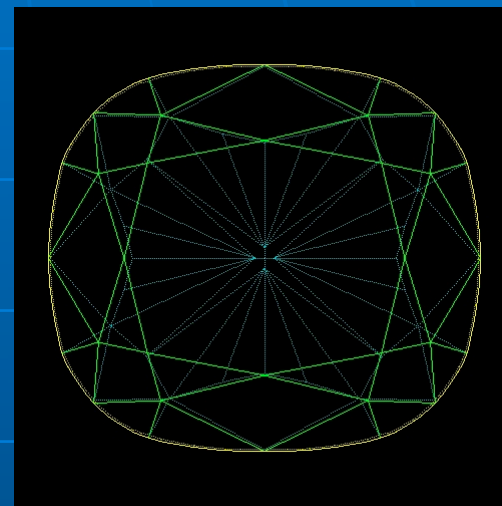
Polished diamonds allocation



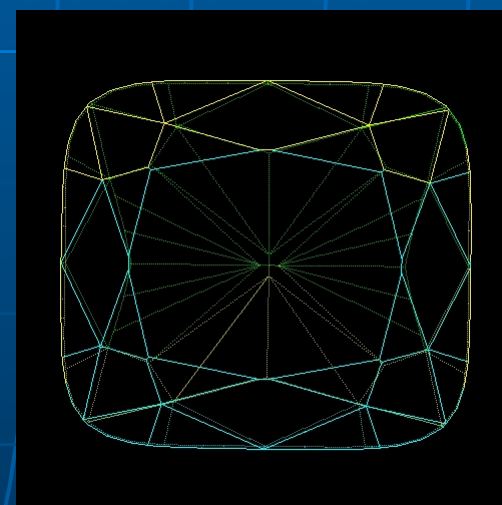
Rough 5.00 ct
Polished 2.93 ct

Two different cushions

Cushion
2.93ct



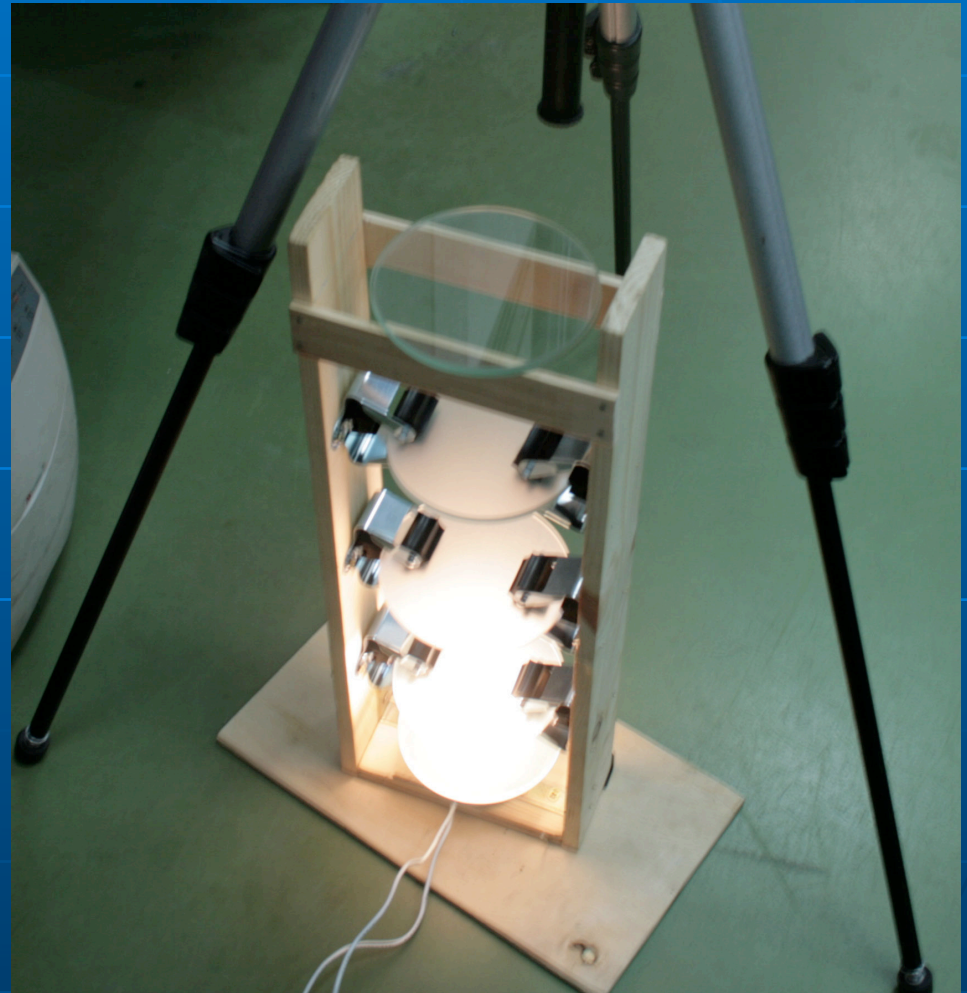
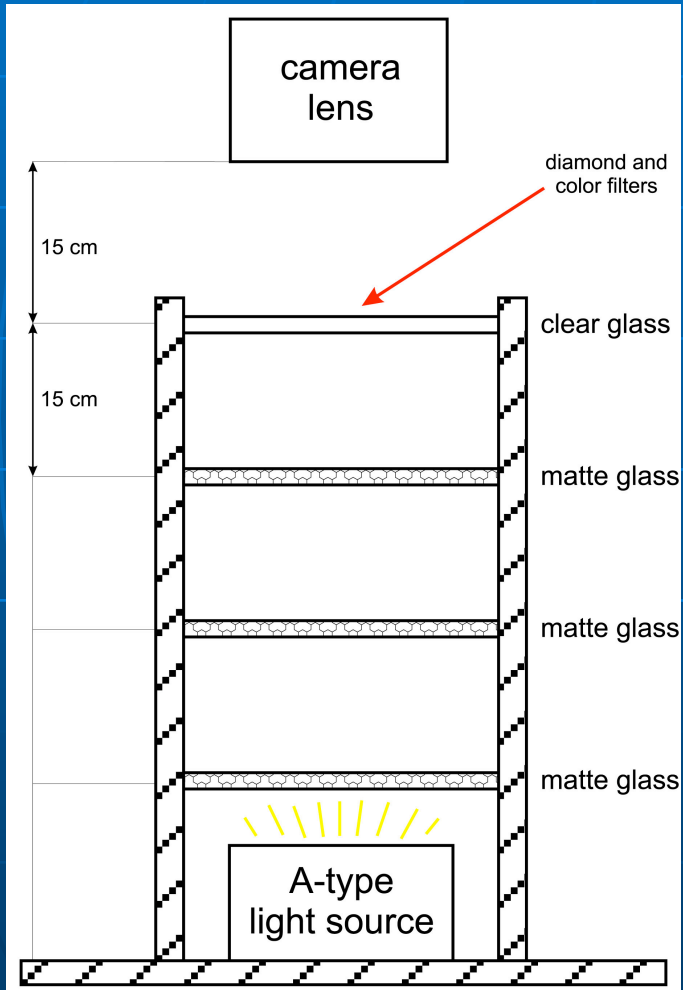
Cushion
3.00ct



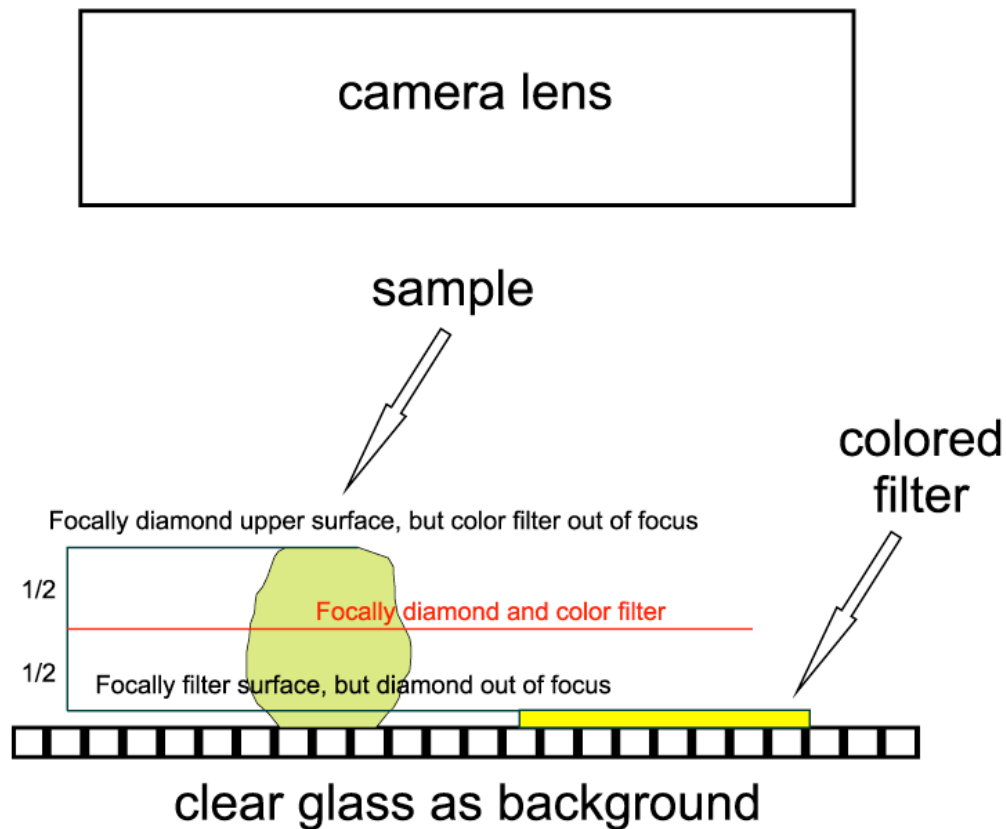
Taking pictures and obtaining their RGB data

- Use of a light table
- Stone and camera positions
- Background color correction
- Camera settings
- Picture quality check
- Obtaining stone/background RGB pairs in Adobe PhotoShop

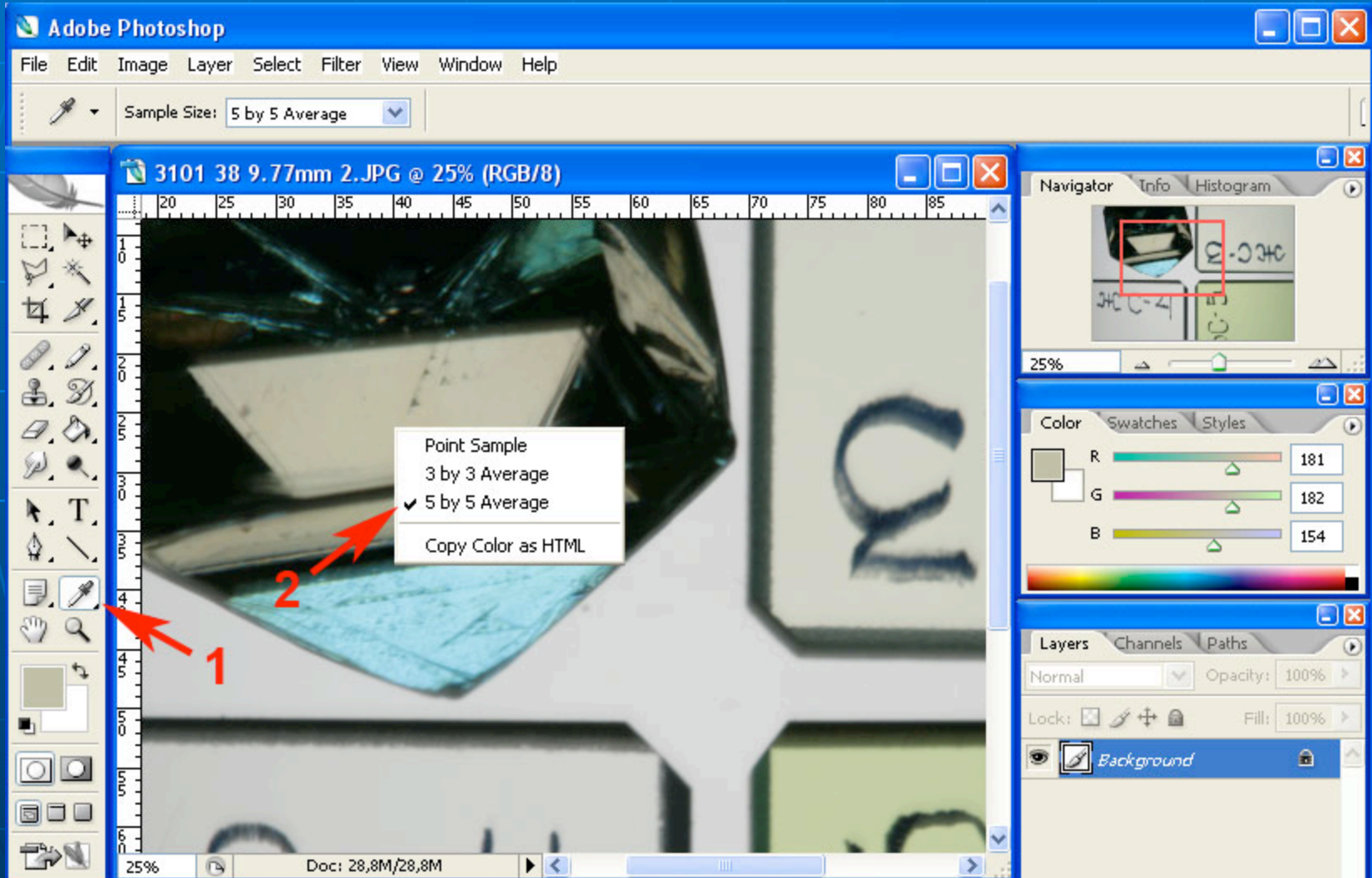
Use of light table



Stone and camera positions



Stone/background RGB pairs

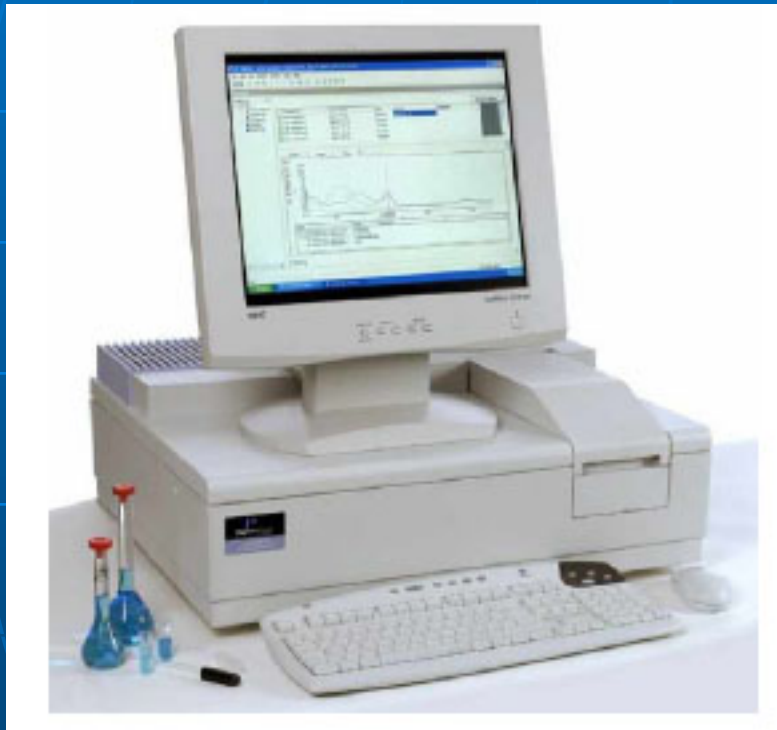


Recording transmission spectra

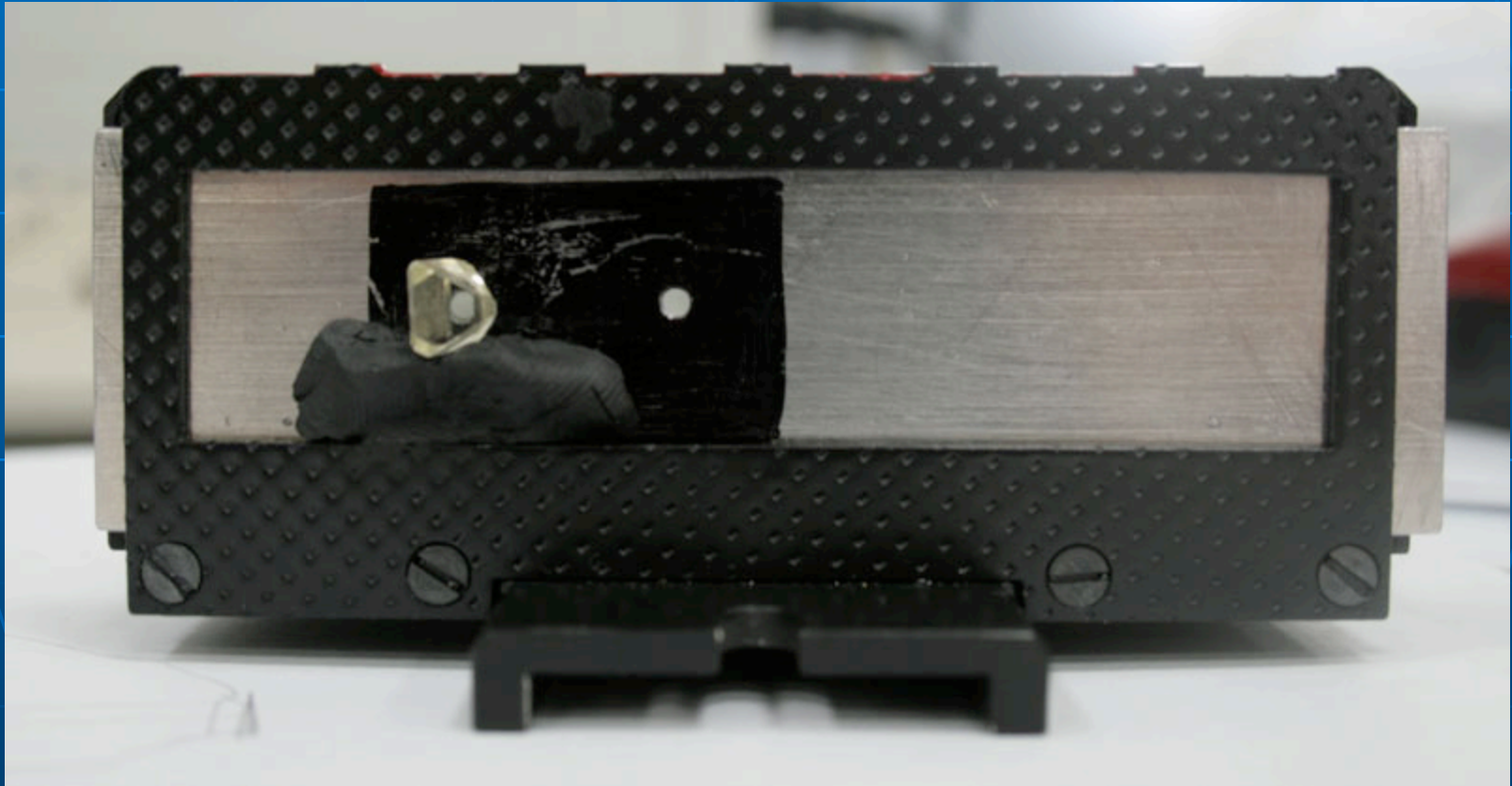
- Spectrometer settings
- Reference spectrum recording
- Sample directions 1 and 2 transmission spectra recording
- Calculation of sample transmission 1 and 2 spectra
- Visual check of spectral curves

Visible range spectrometers

Lambda 35
or
SF-56A

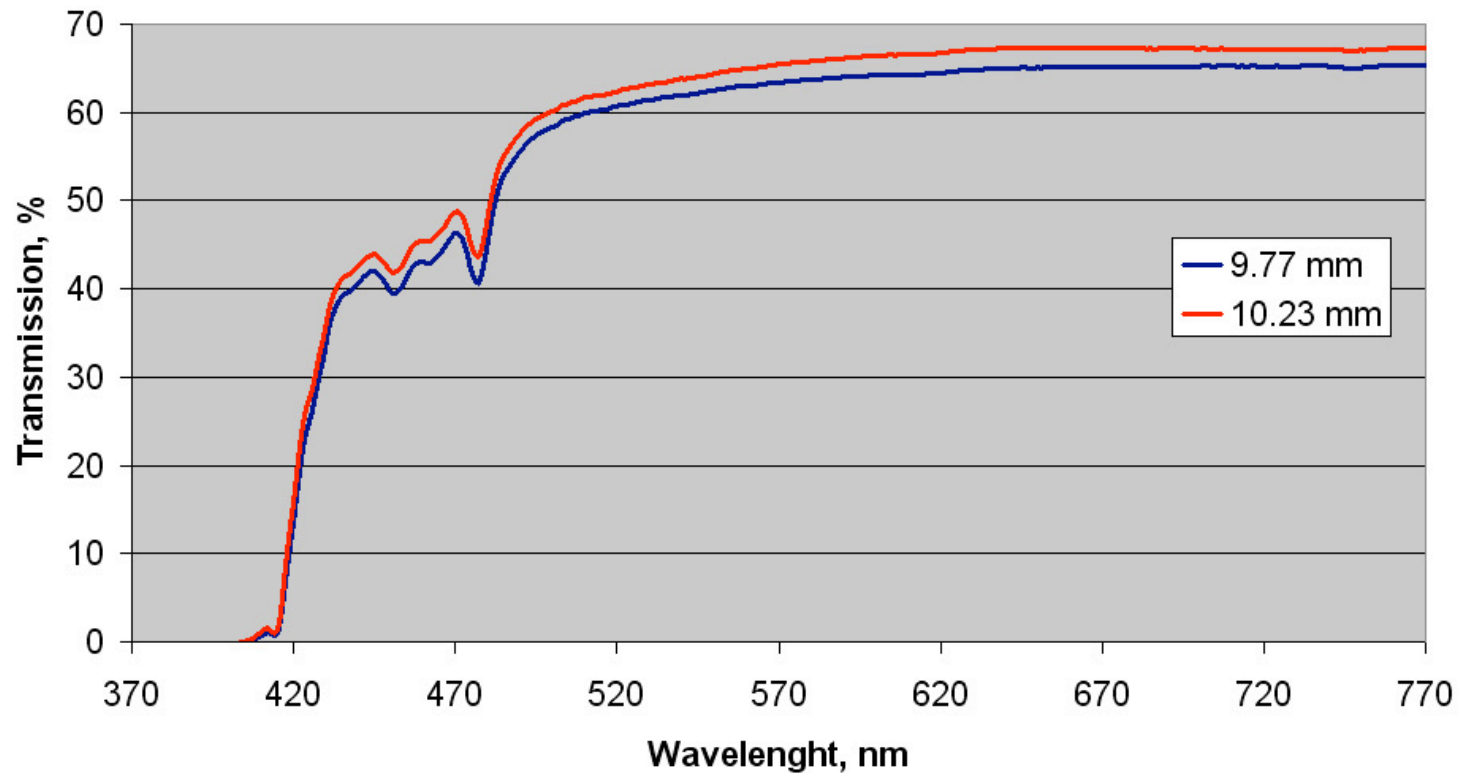


Sample position on the holder



Sample directions 1 and 2 transmission spectra recording

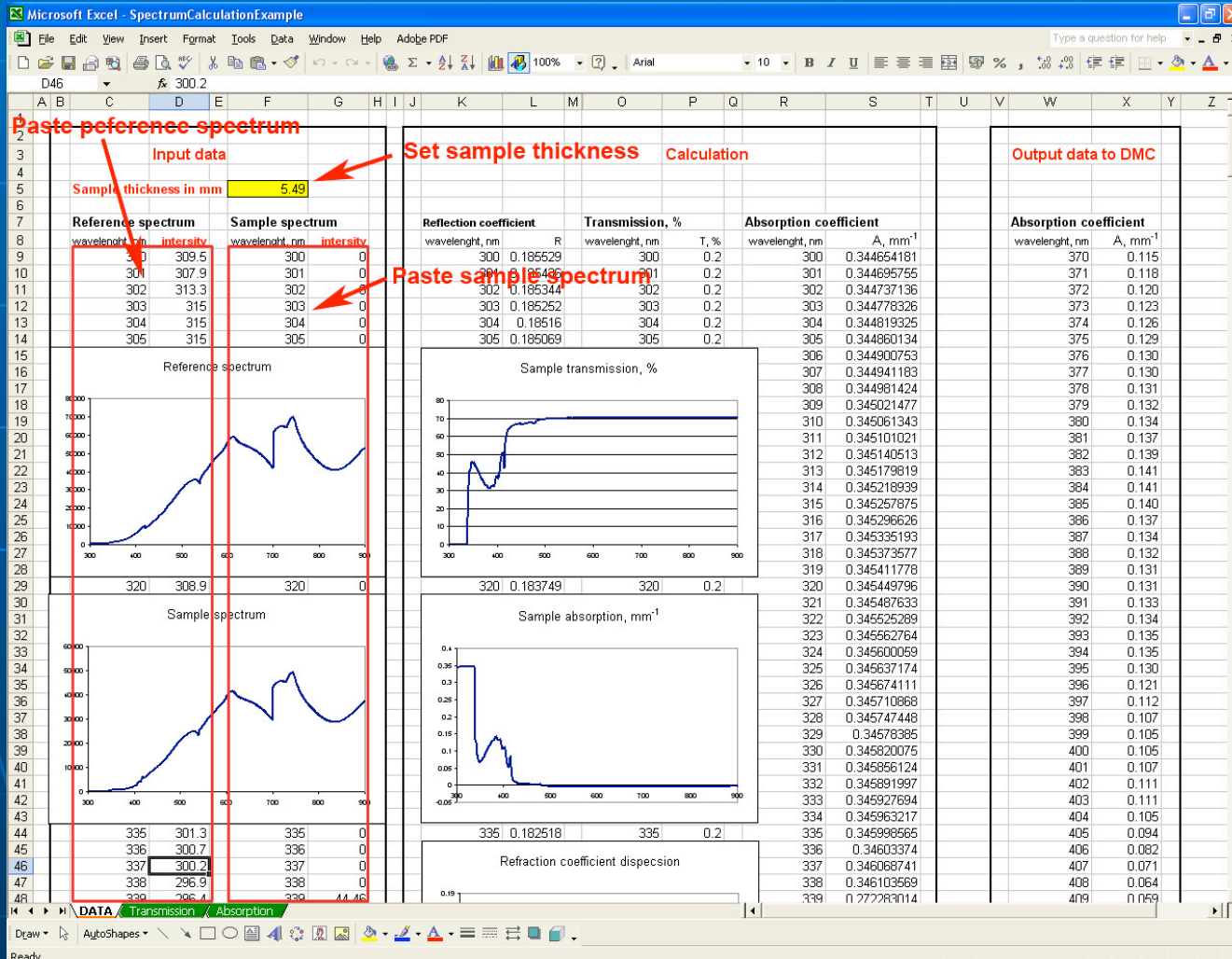
N3101 38 transmission spectra



Calculations of absorption spectra

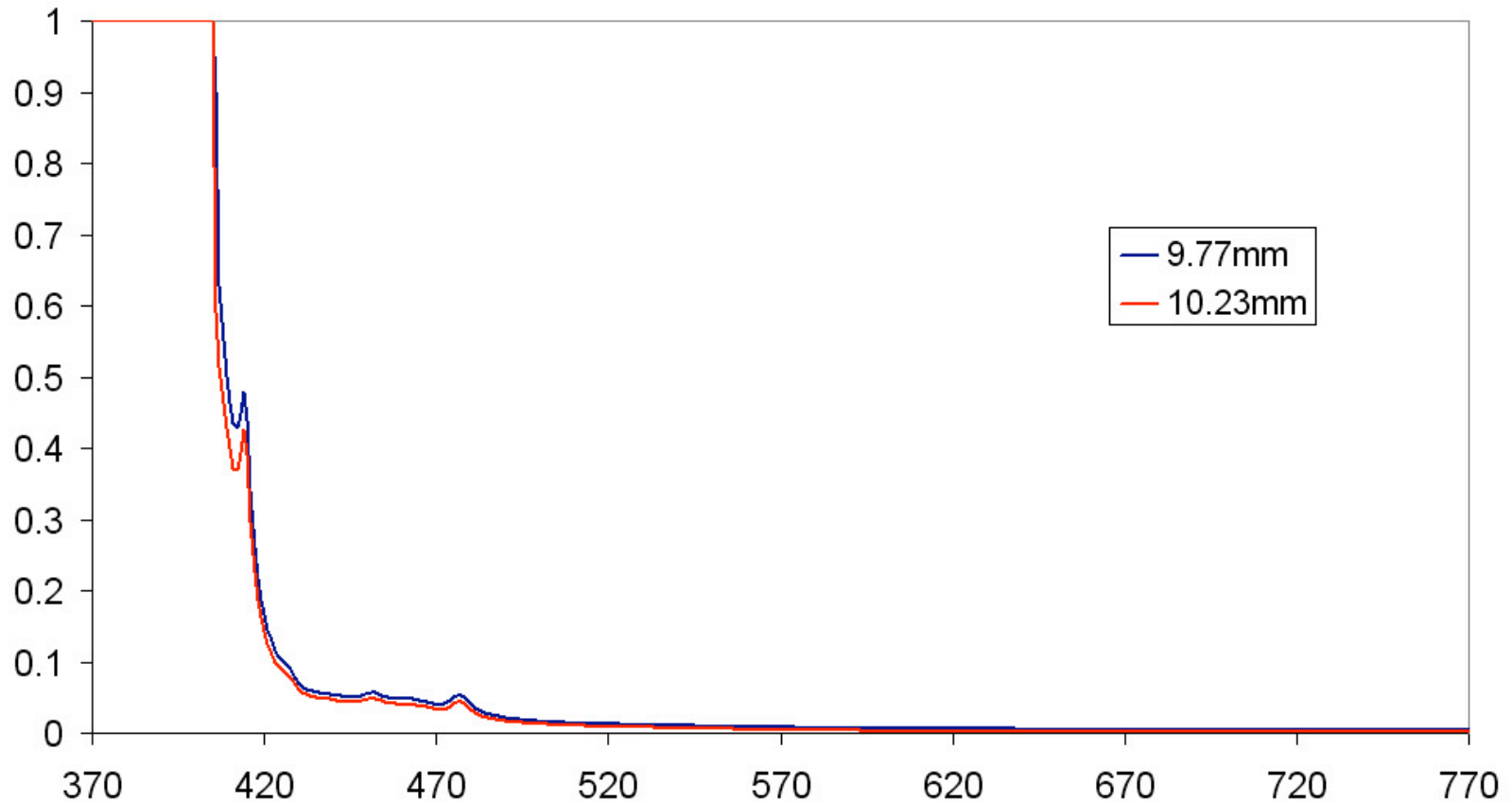
- Import transmission file to the Microsoft Excel template
- Input sample thickness
- Visual check and comparison of absorption spectra
- Saving .txt absorption files
- Importing spectrum into DiamCalc

Calculation of sample absorption 1 and 2 spectra

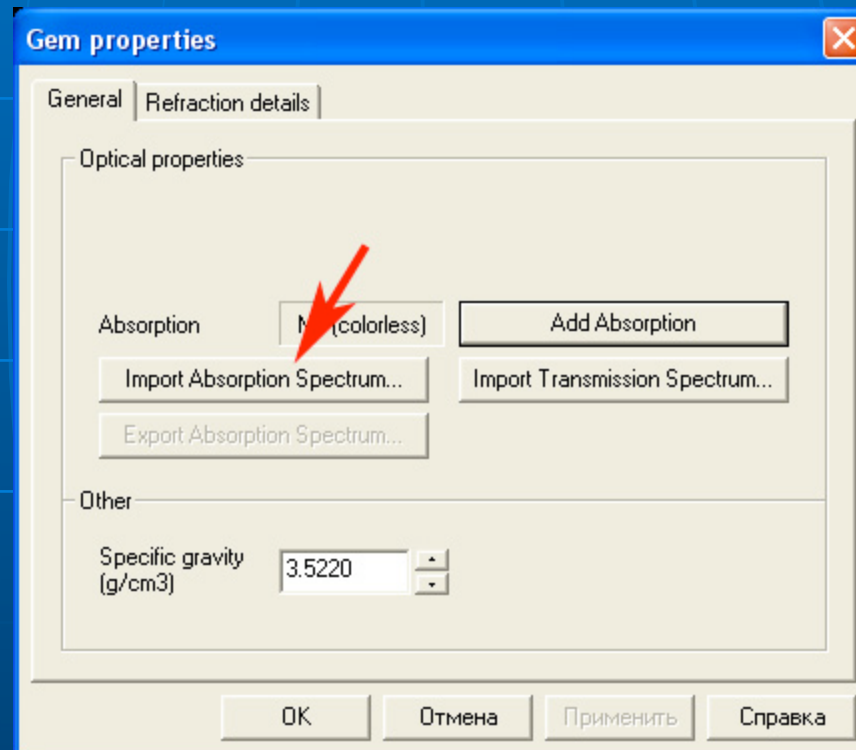


Visual check and comparison of absorption spectra

N3101 38 14.31ct Diamond Spectra



Importing spectrum into DiamCalc

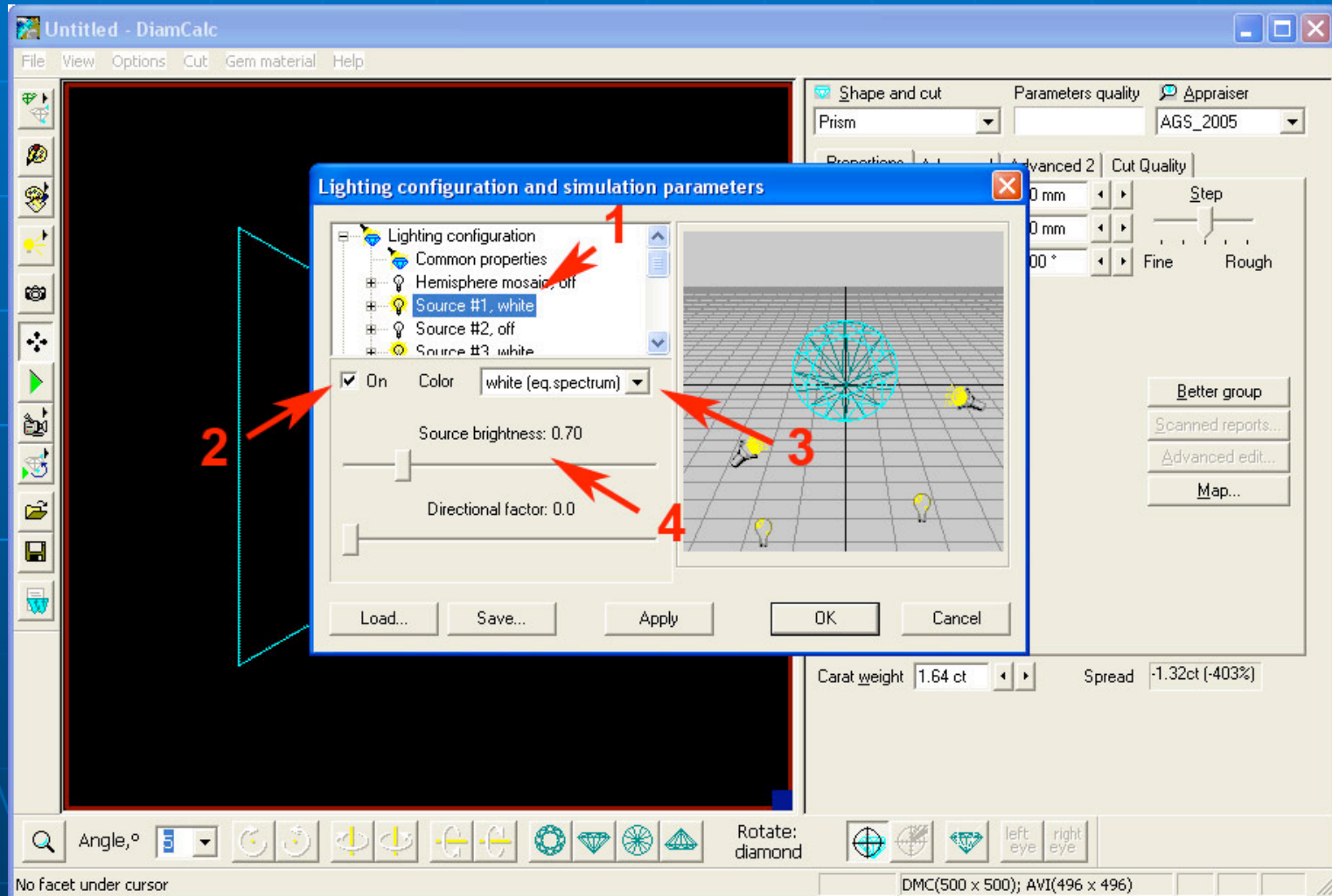


DiamCalc plate model verification.

Spectrum adjustment

- DC transmission illumination mode
- Lighting conditions and eye color adaptation
- Prism thickness
- Color information panel
- Plate and background RGB coordinates
- Light brightness adjustment with photo RGB
- Spectrum adjustment
- Prism and photo color verification
- Selecting between spectra 1 and 2

DC transmission illumination mode



Color information panel

The screenshot displays the DiamCalc software interface. A 'Selected color information' dialog box is open, showing a color wheel and a table of color data. The main window shows a diamond model and various toolbars.

Selected color information

Press right mouse button on model image to get color information

CIE-Luv	74.51	0.86	21.38
Luv Saturation	0.29		
Luv Chroma	21.40		
XYZ	0.456	0.475	0.347
xyY	0.357	0.372	0.475
XYZ Saturation	0.185		
CIE-Lab	74.51	-5.34	15.44
Lab Chroma	16.34		
Hunter-Lab	68.92	-2.57	18.35
HSV	0.179	0.167	0.722
RGB	181	184	153
Munsell	8.97YR	V 7.30	C10.09

Normalize Close

Carat weight: 2.68 ct ◀ ▶ Spread: 2.35ct (-718%)

Angle, ° 101 ◀ ▶ Rotate: diamond left eye right eye

For Help, press F1 DMC(500 x 500); AVI(496 x 496)

Spectrum adjustment

The screenshot shows the DiamCalc software interface. The main window is titled "Untitled - DiamCalc" and has a menu bar with "File", "View", "Options", "Cut", "Gem material", and "Help". The main workspace displays a 3D model of a diamond. A "Gem properties" dialog box is open, showing the "Absorption" tab. The dialog box contains a "Baseline" field set to 0.005 and a "Multiply coefficient" field set to 1.00000. Below these fields is a "Spectrum:" section with a table and a graph. The table lists wave numbers and absorption values, and the graph plots absorption against wavelength in nanometers. The graph shows a sharp peak at approximately 415 nm, labeled "absorption". The dialog box also has "OK", "Отмена", "Применить", and "Справка" buttons. The background software interface includes a "Shape and cut" panel with "Prism" selected, "Parameters quality" set to "AGS_2005", and various adjustment controls for proportions and cut quality. The status bar at the bottom shows "Angle, °" set to 30, "Rotate: diamond", and "DMC(500 x 500); AVI(496 x 496)".

Shape and cut: Prism, Parameters quality: AGS_2005

Proportions: 6.00 mm, 9.77 mm, 60.00 °

Cut Quality: Step, Fine, Rough

Better group, Scanned reports..., Advanced edit..., Map...

Spread: -2.35ct (-718%)

Angle, °: 30

Rotate: diamond

DMC(500 x 500); AVI(496 x 496)

For Help, press F1

Gem properties

General | Refraction details | Absorption

Baseline: 0.005 | Multiply coefficient: 1.00000 | Multiply

Spectrum:

wave	absorption
370	0.500
371	0.500
372	0.500
373	0.500
374	0.500
375	0.500
376	0.500
377	0.500
378	0.500
379	0.500
380	0.500

absorption

0.5
0.4
0.3
0.2
0.1
0.0

400 500 600 700 λ nm

OK | Отмена | Применить | Справка

Prism and photo color verification

The top screenshot shows Adobe Photoshop with a diamond image at 200% zoom. A red arrow points from the diamond's color to the Photoshop Color panel, which displays RGB values: R=181, G=182, B=154. The bottom screenshot shows the DiamCalc 'Selected color information' dialog box. A red arrow points from the 'yellow' color swatch in the color wheel to the RGB values: R=181, G=184, B=153. The dialog also lists various colorimetric data including CIE-Luv, XYZ, and Hunter-Lab values.

Colorimetric Data	Value 1	Value 2	Value 3
CIE-Luv	74.51	0.86	21.38
Luv Saturation	0.29		
Luv Chroma	21.39		
XYZ	0.456	0.475	0.347
xyY	0.357	0.372	0.475
XYZ Saturation	0.185		
CIE-Lab	74.51	-5.34	15.44
Lab Chroma	16.34		
Hunter-Lab	68.92	-2.57	18.35
HSV	0.179	0.167	0.722
RGB	181	184	153
Munsell	8.97YR	V 7.30	C10.09

Prism RGB verification

The top screenshot shows Adobe Photoshop with a diamond image at 100% zoom. A red arrow points from the diamond's color to the Photoshop Color panel, which displays RGB values: R=210, G=210, B=210. The bottom screenshot shows the DiamCalc 'DiamCalc Model background RGB' dialog box. A red arrow points from the 'background RGB' label to the value '211-211-211'. The dialog also includes a 'Spectrum' graph showing absorption values across a wavelength range from 400 to 700 nm.

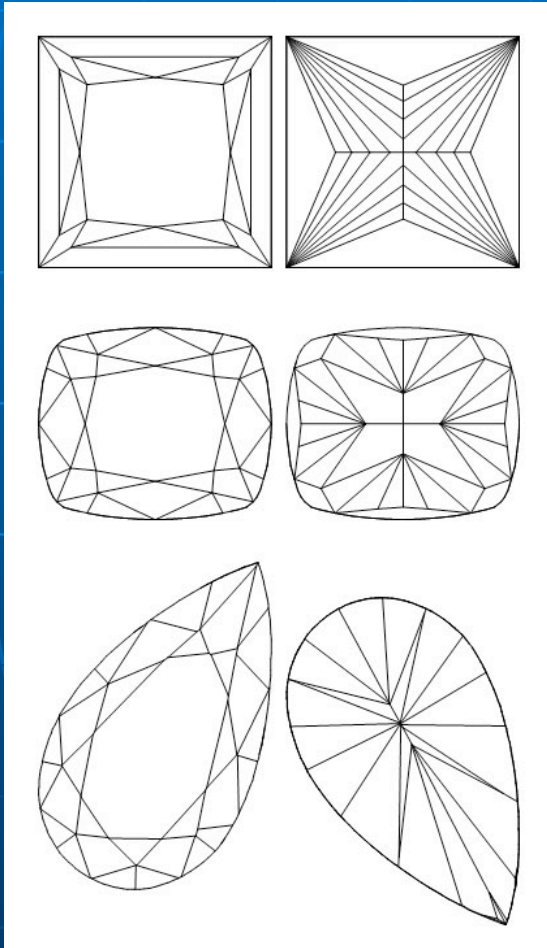
Wave (nm)	Absorption
370	0.495
371	0.495
372	0.495
373	0.495
374	0.495
375	0.495
376	0.495
377	0.495
378	0.495
379	0.495
380	0.495

Background RGB verification

Preliminary shapes color check

- Standard and external parametrical cuts
- ASCII cuts import
- Standard lighting conditions
- DiamCalc color statistics panel
- Manual proportions adjustment
- Selecting cuts for computer optimization

Standard, external parametrical cuts and ASCII cuts



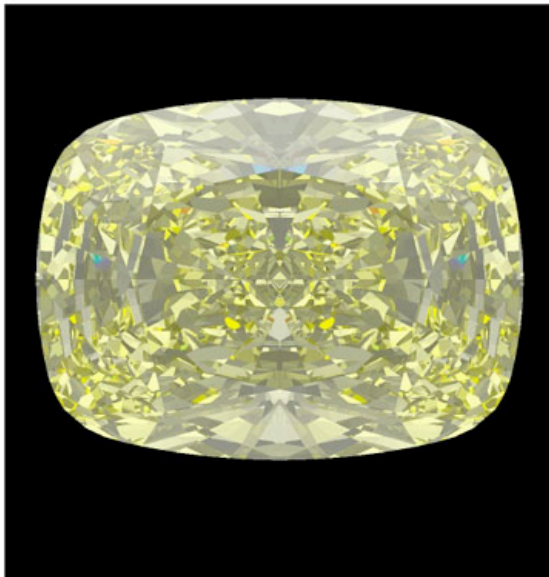
standard

external

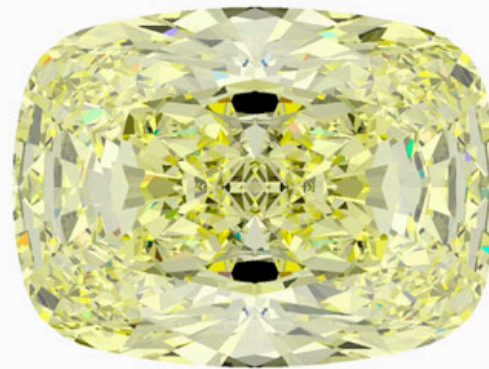
ASCII

Standard lighting conditions

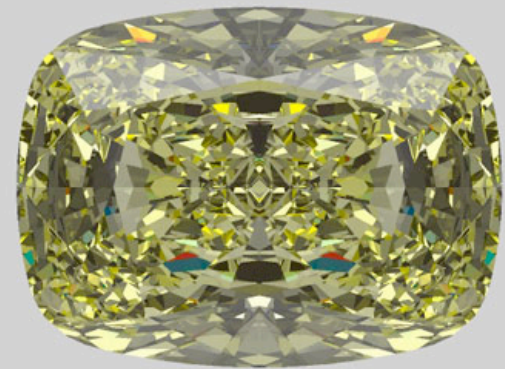
**Dialite
black BG**



Jewelry Shop



**Gretag Macbeth
Judge II**



DiamCalc color statistics panel

The screenshot shows the DiamCalc software interface. The main window displays a 3D model of a yellow diamond. A 'Diamond color statistics' panel is open, showing two histograms of lightness (S vs lightness) and a list of statistical data.

Diamond color statistics panel data:

- Sq. weight
- Filter hues
- Clusters
- Rays stat
- CAM: Old CIECAM97s
- Gistogram: XYZ Q:S LS(uv) J:S LChr(uv)
- Munsell
- HSV
- Fix scale L: 110 S: 1.1
- Grid number L: 50 S: 50
- Gamma: 0.5
- Lightness: 73.608 sigma: 15.444
- Saturation: 0.506 sigma: 0.192
- L x S: 37.398 sigma: 17.202
- Largest cluster: square 1.068
- L: 76.251 S: 0.239, Grey
- Vivid: 0.1% Intense: 4.5%
- Fancy: 31.8% Deep: 25.2%
- Light: 12.4% Dark: 14.8% Grey: 11.2%
- Overall mark - Fancy

Buttons: OK, Refresh, Cancel

Choosing proportions to be optimized

- For parametrical cuts
- For ASCII cuts
- Selection of optimization ranges and steps

Choosing proportions to be optimized and to be fixed for parametrical cuts

For internal DiamCalc cuts main proportions for optimization are:

- pavilion angle
- crown angle
- table diameter
- lower facets depth

For external DiamCalc cuts:

- pavilion front angle and pavilion flank angle (or Moon facet angle and Moon rotate angle for Oval cut)
- pavilion angle
- crown angle
- table diameter
- lower facets depth

Choosing proportions to be optimized and to be fixed for ASCII cuts

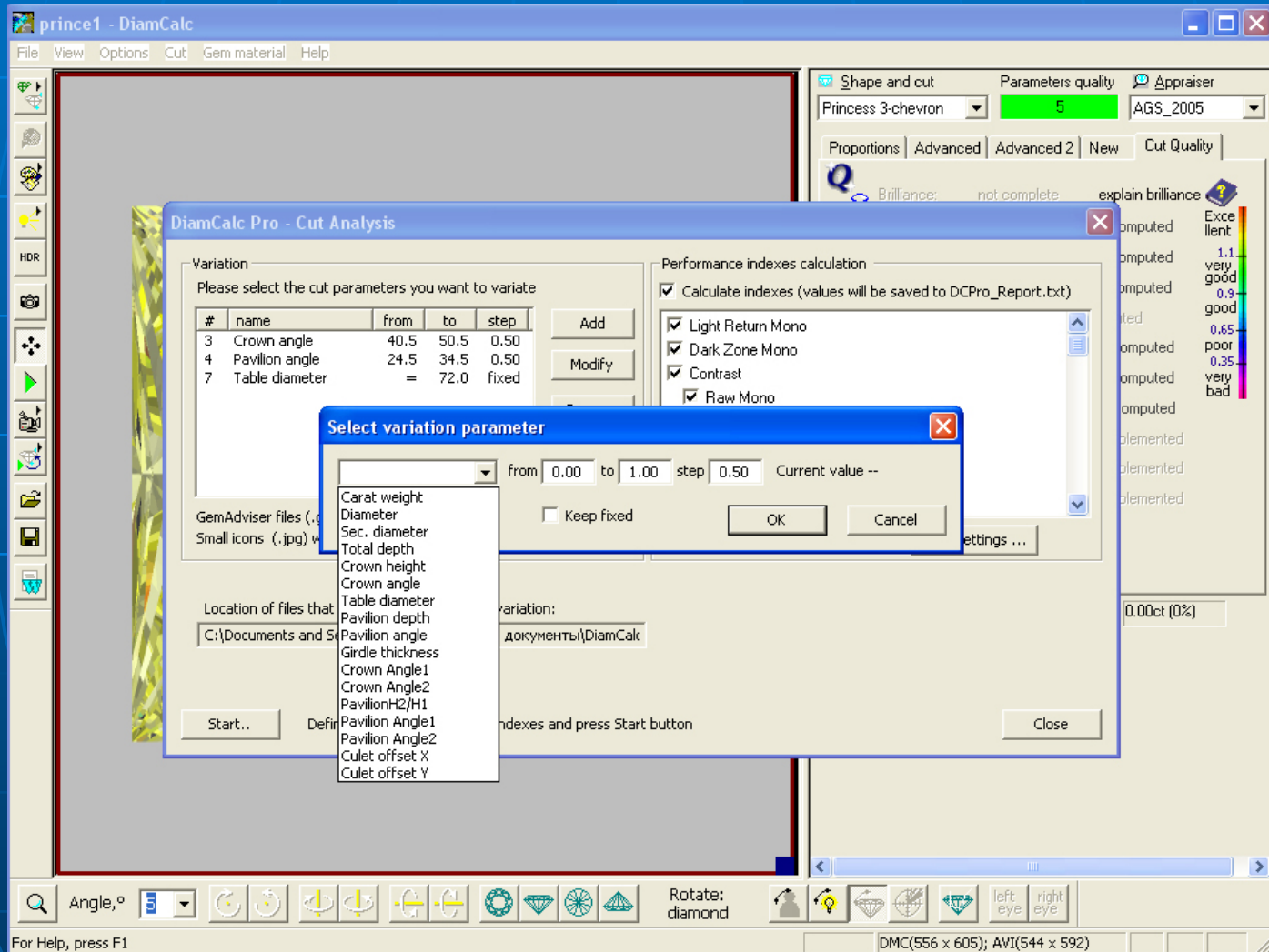
ASCII cuts are not parametrical and DiamCalc allows changing:

- pavilion height
- crown height
- girdle thickness

Optimization by color metrics

- DiamCalc optimization panel settings
- DiamCalc color metrics
- Optimization time
- Optimization results table
- Graphical representation of optimization results

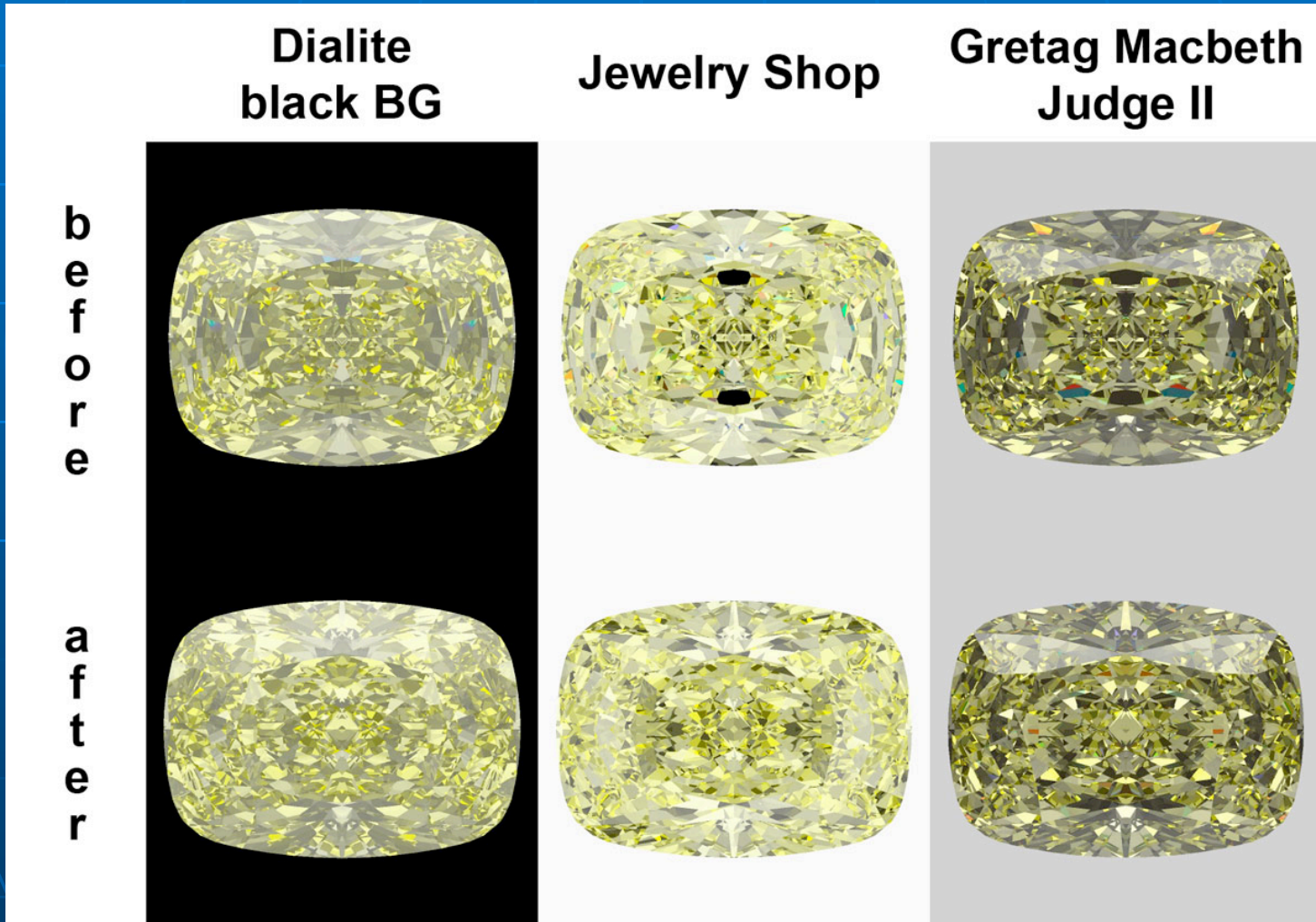
DiamCalc optimization panel settings



Expert consideration of optimization results

- Selecting extremum points of optimization results
- Work with rendering images
- Check in various standard lighting conditions
- Tilting and movie options
- Negative optical effects
- New parameters for computer optimization

Lighting conditions



Second stage of computer optimization

- Microanalyses parameters
- Graphical representation of optimization results
- Work with rendering images

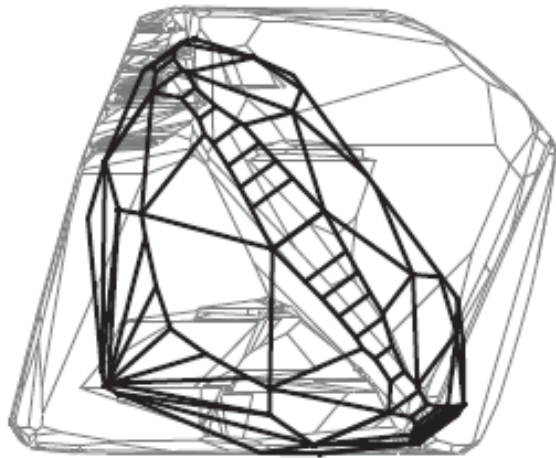
Fixing one proportions set

- Check in different lightings
- Check movie and tilting
- Check optical phenomena
- Check proportions, angles and azimuths
- Export to ASCII file

Final allocation

- Rough optimization with fixed proportions
- Expert check of the new plan
- Cutting instructions and final plan report

Importing optimized DiamCalc cut to Pacor Client



Front view



Top view

Rough 5.00 ct
Optimized cushion 3.03 ct

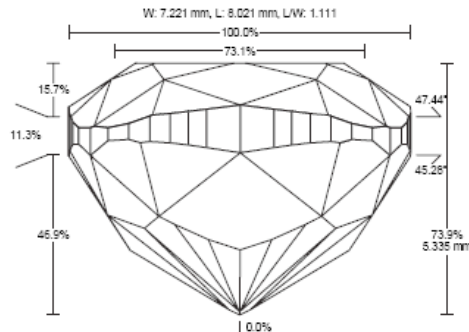
Final cutting report

60002 2 5.00ct
General information

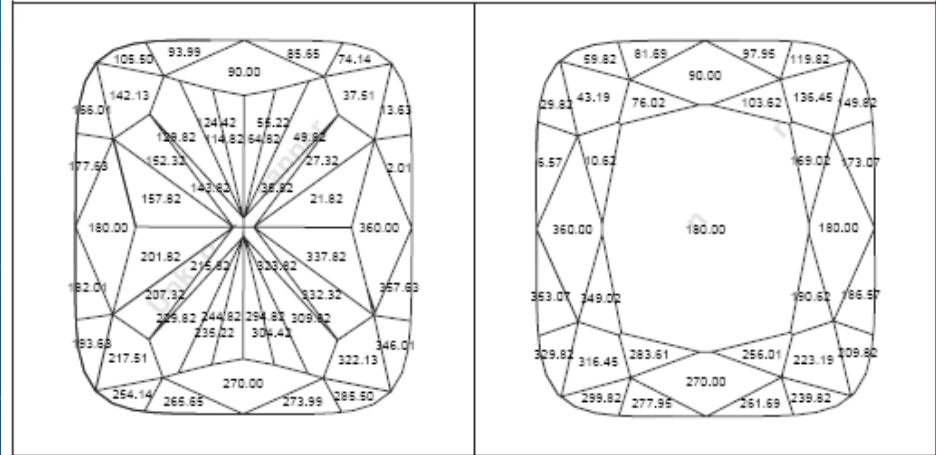
Model	Cushion
Report date	11.12.2007
Weight, ct	3.00, 3.0000
Width, mm	7.221
Length, mm	8.021
L/W ratio	1.111
Total height	5.335 mm, 73.87 %

Main parameters

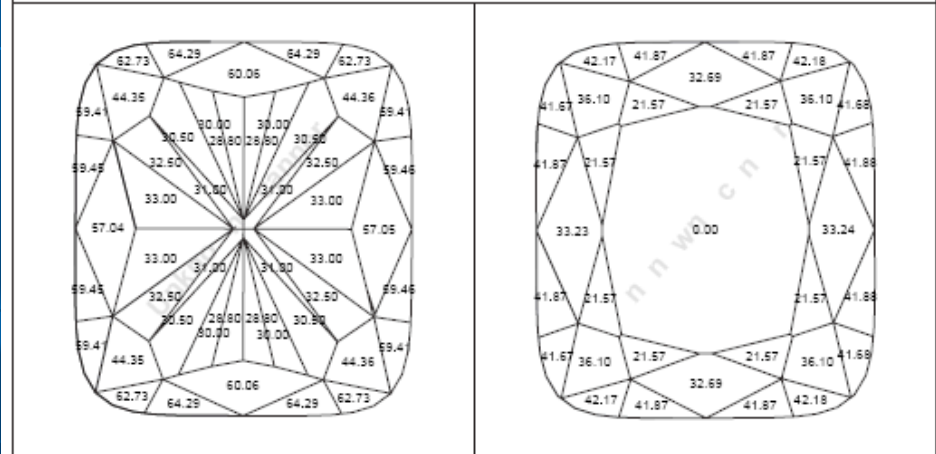
Pavilion depth	%	46.93
	mm	3.389
Crown height	%	16.87
	mm	1.131
Table	%	73.06
	mm	5.838
Culet	%	0.00
	mm	0.000
Girdle thickness: Bezel	%	11.27
Girdle thickness: Valley	%	3.74
Girdle thickness: Bezel	mm	0.814
Girdle thickness: Valley	mm	0.270



Facets' azimuths and slope angles



Pavilion and crown views of the diamond with indication of facets' azimuth angles



Pavilion and crown views of the diamond with indication of facets' slope angles

Principles of diamond color grading

These two charts illustrate color appearances at two locations in the yellow hue range: "cooler" colors toward the yellow/greenish yellow hue boundary and "warmer" ones toward the yellow/orangy yellow hue boundary. Yellow diamonds occur in some of the highest levels of saturation of any colored diamond. Unlike the other charts in

D-Z
Fancy Light
Fancy
Fancy Intense
Fancy Vivid
Fancy Dark
Fancy Deep

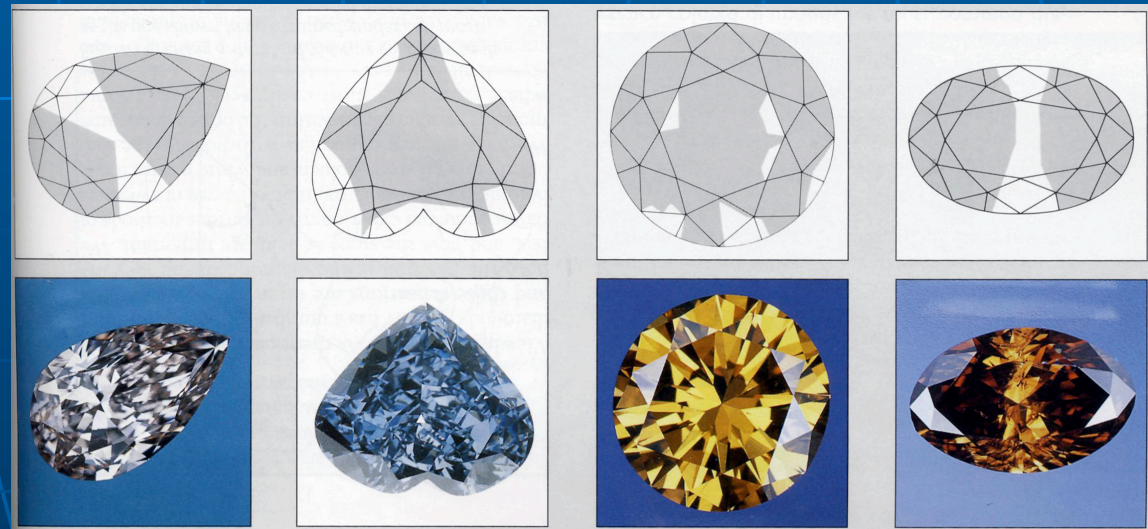
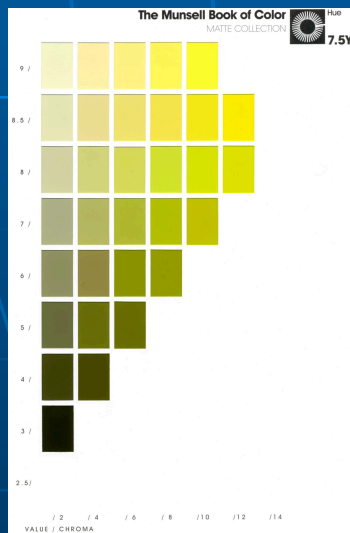
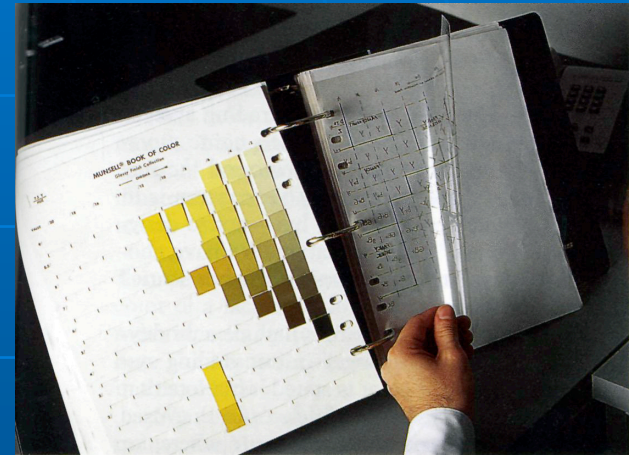
Faint
Very Light
Light
Fancy Light
Fancy
Fancy Intense
Fancy Vivid
Fancy Dark
Fancy Deep
Fancy Purplish Red

Similar to diamonds in the orangy red and red hues, diamonds in the purple/red (most commonly, purplish pink) hue occur in a wide range of tones and reach their highest saturation at darker tones. Unlike the majority of pink diamonds in the orangy red hue, these colors have an afterglow, which can last

Faint
Very Light
Light
Fancy Light
Fancy
Fancy Intense
Fancy Vivid
Fancy Dark
Fancy Deep

Blue diamonds occur in a relatively narrow saturation range, typically toward the neutral core of color space, but they vary widely in tone. They reach their highest saturation at medium to dark tones, which are toward the lower right of the chart. The diamonds in the column on the

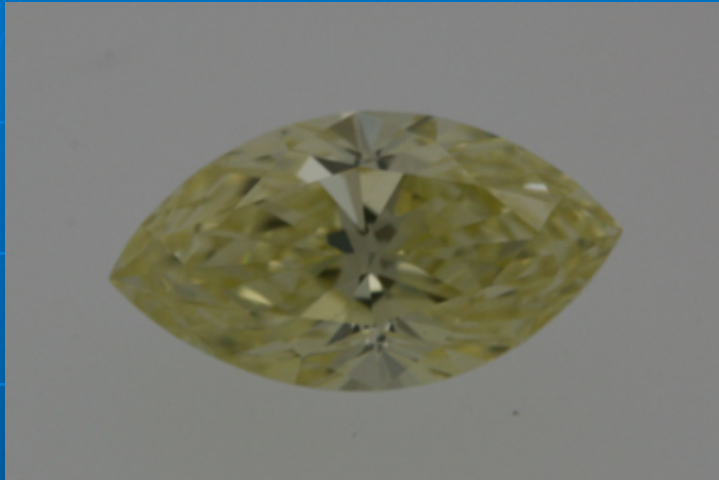
Color grading in a Lab



Documenting of the final stone

- Polished stone scan
- Photo in the light box
- Polished stone DiamCalc model
- Gemological laboratory report
- Documenting all deviations from the plan

Final stone at different lights



Meda lightbox



G M Judge II black BG



G M Judge II white BG



G M Judge II black BG

Main advantages of color optimization

Better color appearance

Avoid negative optical phenomena

Better color grade

Better yield

Predictable results

Control from planning to final stage

Modeling of existent negative phenomena