ColorLab Reference Manual

ColorLab Version: 2.8

1 Introduction

ColorLab was designed for internal testing, debugging and developing and is always a 'project in work'. It contains many tools and functions to work with colorimetric and spectral measurement data. The public version of ColorLab provides a basic set of tools and some additional tools for special purposes that we explitely want to give to the public. For ProfileMaker owners more functionality is provided and automatically activated when ColorLab detects that a ProfileMaker dongle is attached to your computer. Yet more functions exist but are not available outside of our labs.

2 Concept

ColorLab is working on documents, which can be loaded, modified and saved. A document is a set of colors based on pixels (images) or color patches. The list of supported image file formats includes JPEG and TIFF and perhaps more. Colorpatches are stored in ASCII text files that are used by ProfileMaker and similar applications to store and excange color (measurement) data.

The functions of ColorLab divide roughly into three categories, each having an own menu in the menu bar:

- *Filters* are comparable to PhotoShop filters. They apply to the current document and normally transform the document content. Mode changes are implemented as filters as well. Filters can also add or remove data or can convert between raster image data and spot colors.
- *Tools* act on the current document, but are no filters. A common case are informational functions like histogram display. However, some tools would logically fit into the filter category as well.
- *Special* tools are independent from the current document or apply to multiple documents.

3 Document Windows

The document window shows the data type (aka color space), the number of patches/pixels and the values of the color under the mouse cursor (CIE-Lab D50/2° for spectral data).

- The last value (d=...) is the delta to the current reference color. You may set a color to reference with ¡Option¿-click.
- You may disable the pipette function by pressing ¡Option¿. Doing this you may move the mouse out of the window without changing the focussed patch.
- Double clicking opens a modal dialog where you can edit the color values. For spectral data a window will be opens showing the spectral distribution.
- Patches are selected and deselected by clicking while presssing the Control key. If the set of selected patches forms a rectangle (ie one or more rows or columns), it can be moved using the mouse. You get no visual feedback while moving, and the Undo command does not work for move operations. Clicking somewhere outside of the selected area clears the seletcion.
- When you drop a file into a document window, that file is opened and replaces the current content of the window without asking for confirmation.
- Most functions will work on images as for sets of color patches!
- Tab key toggles (nearly) full screen view

4 File Menu

As the data might contain very sensitive data, there is NO Save function overwriting an opened file for security reasons. You have to use Save As to explicitly overwrite files.

4.1 New

Opens an empty document window.

4.2 Open

Reads a document from a file. If the file is one of the supported raster image formats (TIFF, JPEG, PNG), the document is pixel based. If the file is a text file in the IT8 like format which is used by other LOGO applications for reference ansd measurement data, or if it is CxF, the document will contain color patches. Note that ColorLab has no native document file type.

4.3 Open Special

All files in the folder ’OpenSpecial’ in the ColorLab folder will be displayed in the submenu Open special. Use this for frequently used documents.

4.4 Open Recent

Recently opened files appear here.

4.5 Close

Closes the front window. Pressing ¡Option¿ will close all windows.

4.6 Save as

Saves the front window in the standard file file format. (TIFF for images, ASCII for color patches and spectral data).

4.7 Export

Saving in different formats (ASCII text, CxF or TIFF). Not available for image data.

4.8 Info

Gives information on the front document. If the document is a testchart, the number if rows can be changed.

4.9 Revert

Reloads the last saved version.

4.10 Duplicate

Open a new document with a duplicate of the data.

4.11 Switch to reference

If the current document contains both measurement and reference data, switches to the reference data (and looses the measurement data).

4.12 Quit

Enjoyed?

5 Edit Menu

5.1 Undo

Undoes the last (significant) change on the front window. All filter actions and most other modifications can be undone. Repeated Undo switches back and forth.

5.2 Cut, Copy, Paste

Cut and Copy act on the selected patches. The data is hold int the clipboard as ASCII text in an IT8-like format and can thus transferred from/to text editors. Cut and Copy have no effect on pixel based documents (but Paste has). In dialogs with edit text items CopyPaste will work as usual.

5.3 New Patches

Replaces the document content by a specified number of new patches.

5.4 Add One Patch

Adds one patch.

5.5 Delete

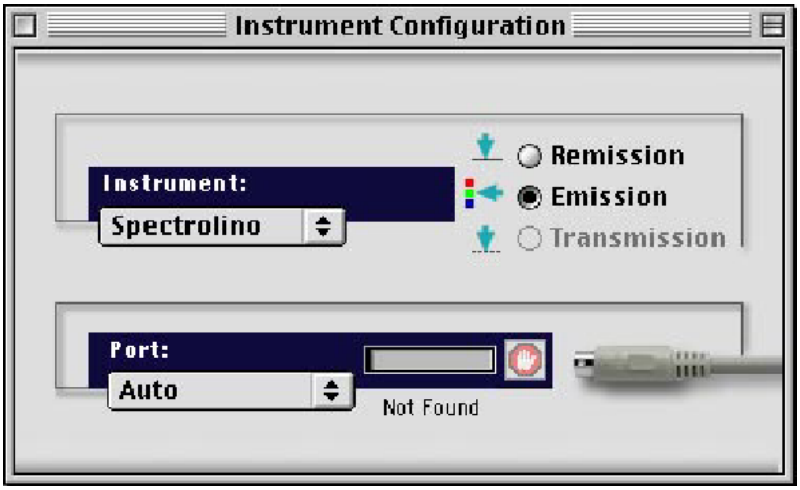
Removes the selected patches.

5.6 Rename

Lets you enter a name for the selected patch.

5.7 Instrument Configuration

All Tools using measurement devices use this configuration.



5.8 Settings

- Image limit: The size in both dimensions, to which large images are downscaled when loaded.

6 Filter Menu

6.1 Switch to filter

Brings the filter of the front document to the front.

6.2 Measure

Measure the testchart with the configured device. If it is disabled, please check the mode of the front window and the device configuration.

6.3 Mode menu

Converts between typical color types. Conversion between colorimetric data is based on well known standard formulas. Conversions to/from device dependant type are reasonable default conversions. If you need to convert between device specific data, use the ICC transformastion filters. Conversion to/from density are estimated.

6.4 Colorimetry menu

Filters in this menu have in common that they act on colorimetric color data (Lab, XYZ, ...) and that they do not change the color space.

6.4.1 Colorimetric Interpretation

Measurement devices give us absolute measurement data. Dependant of the use of the data there are different interpretations:

Relative lightness scales the data in XYZ, so that the lightness of the 'whitest' patch will match Y=L=100.

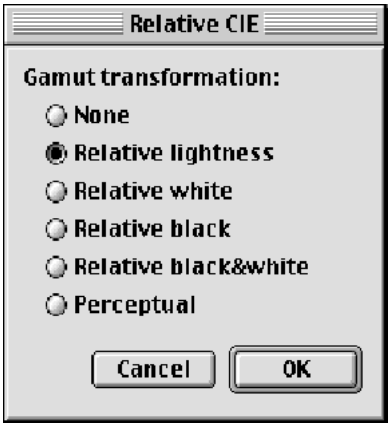
Relative white scales the data in XYZ, so that the 'whitest' patch will match white.

Relative black scales so that the darkest point of the data will match black (proprietary).

Relative black&white does both.

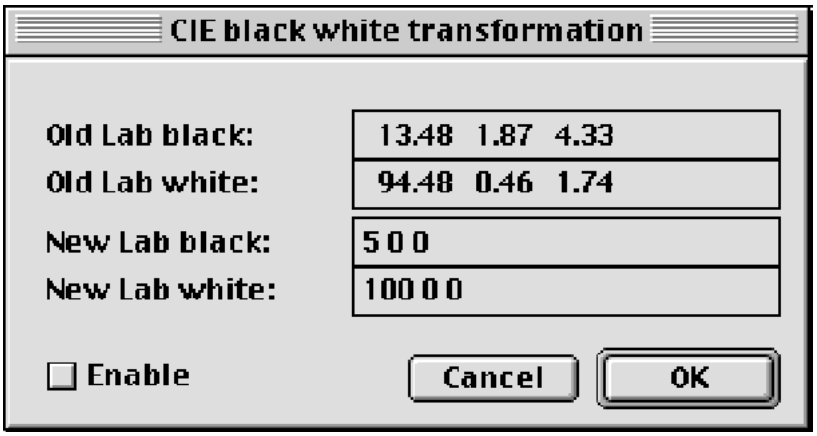
Perceptual also scales to black and white using a proprietary technology matching the human perception.

von Kries Chromatic adaption 



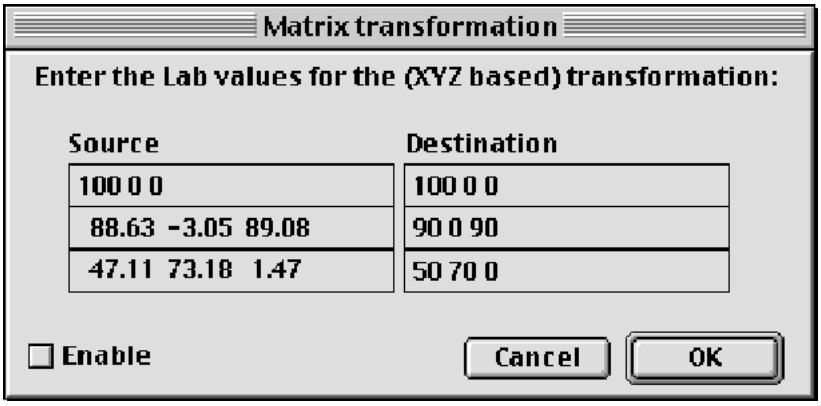
6.4.2 CIE black white

Performs a scaling in XYZ so with predefined source and destination blackpoints/whitepoints.



6.4.3 CIE matrix

Performs an XYZ matrix conversion, defined by three color transformation points in Lab.



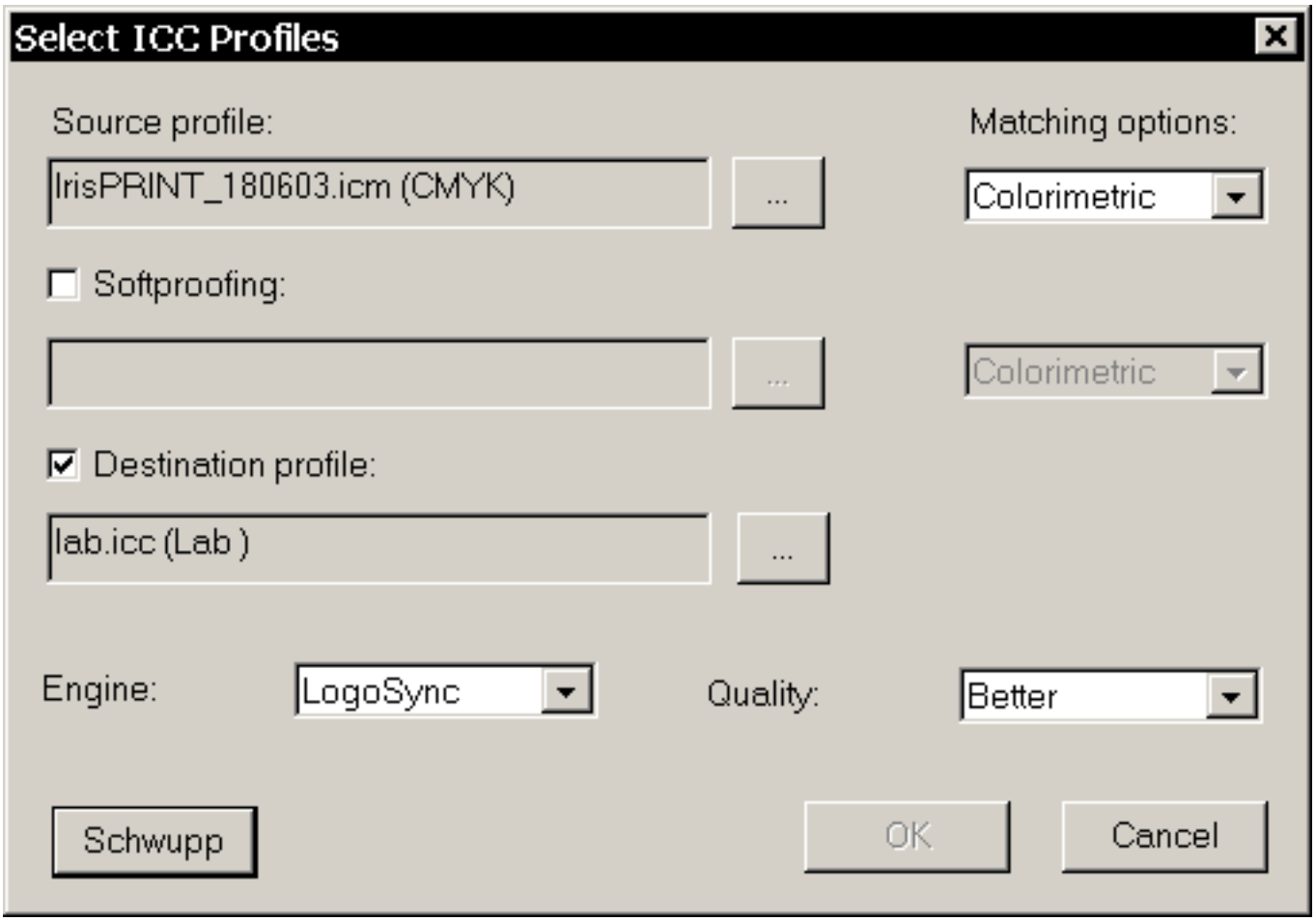
6.4.4 Gamut distance

Calculates the distance of each patch to the gamut border of a second testchart. The result is a gray testchart, the gray values are representing the distance to the gamut border in the direction of the gamut center. All colors inside of the gamut have the distance 0.

6.4.5 Real Colors

Filters all real colors, that is all colors where the *xy* representation lies inside the so called show sole.

6.5 ICC Profile conversion



Performs Color transformations based on ICC profiles. This item replaces all the items previousely found under the ICC menu. You can choose

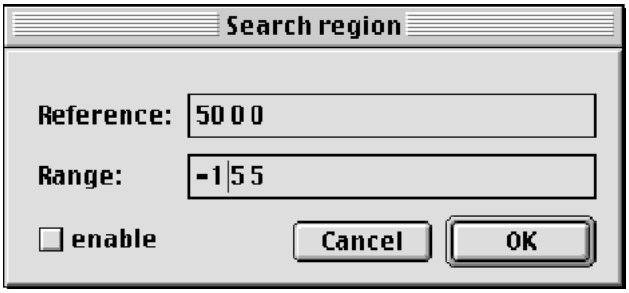
- A source (input) profile
- A destination profile (optional)
- A soft proof profile (optional)
- One or two rendering intents
- The CMM to be used (either LogoSync or the OS specific)

- The quality. With LogoSync, this parameter decides if a link table is to be used to speed up operation.

6.6 Others

6.6.1 Find region

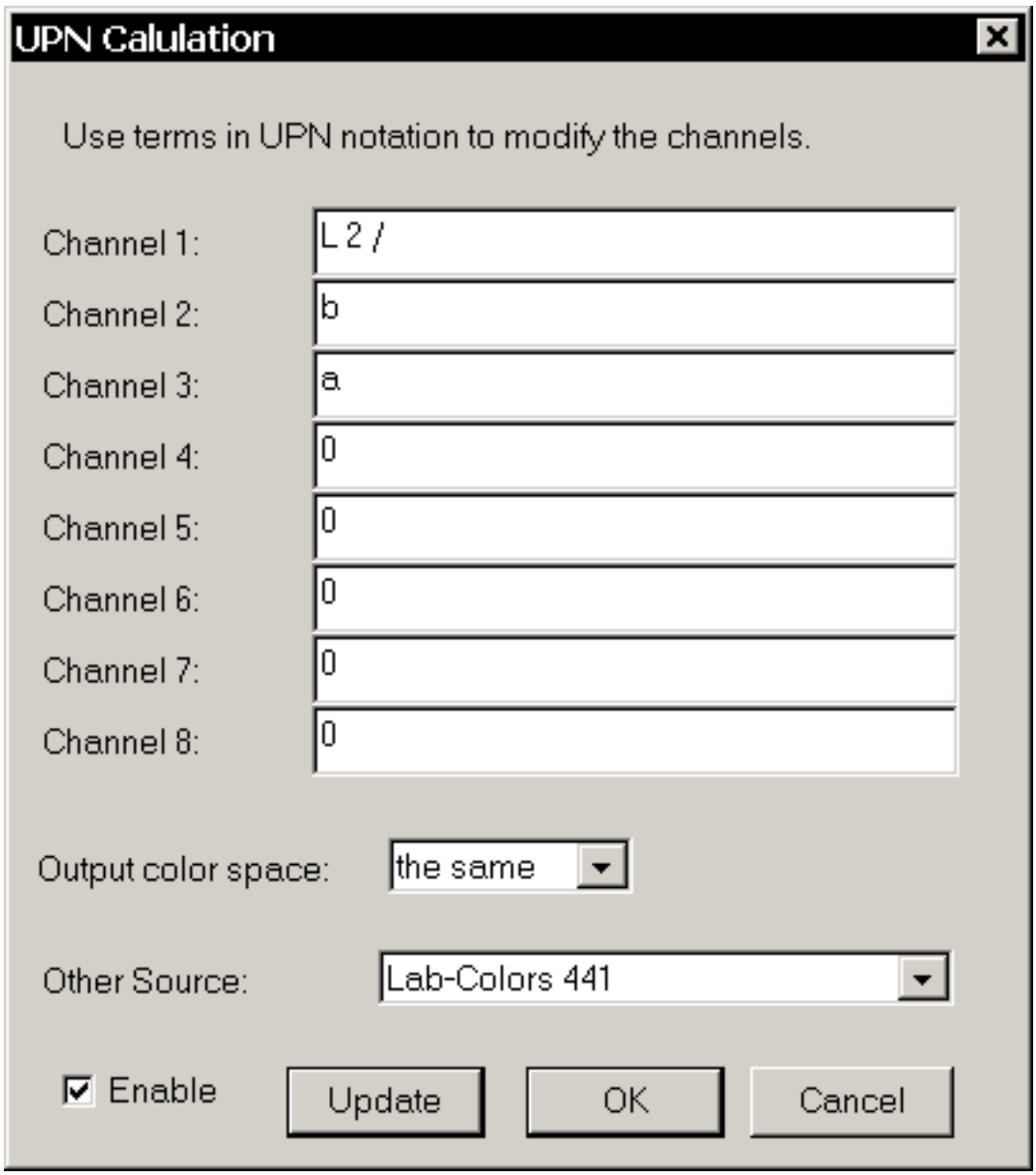
Searches for all colors in a region around a a reference color. Defining the range as a single values will search inside its radius. You may also define a value for each component (components with negative values will be ignored). Example: You want to search for all colors in an Lab testchart where a,b are inside [-5,5], L should be ignored. You have to enter '0 0 0 ' as reference and '-1 5 5' as distance.



6.6.2 UPN calculation

For each component you may enter an UPN expression. See UPN Calculator (8.6) for details. The color values are referred to as $x0$, $x1$ and so on or as letters that identify the respective quantity, eg L, a, b. You can also access the values of another source with $y0$ etc. The example acts on Lab colors, divides L by 2 and swaps a and b, for whatever reason.

Easy when you are used to UPN otherwise forget it...

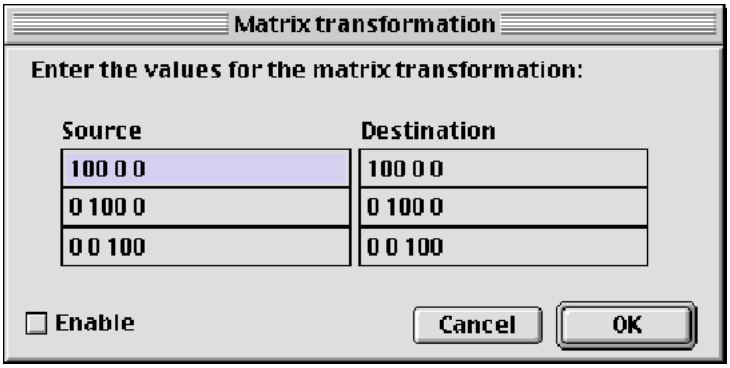


6.6.3 Edit colors

I hope you will manage it without help.

6.6.4 Matrix conversion

Performs a 3x3 matrix conversion defined by three transformation points. Similar to CIE Matrix (6.4.3), but applies to any 3-channel color space and the anchor points are interpreted in that color space (not neccessarily Lab).



6.6.5 Linearization

Performs a linearization based on a linearization data file. You can create such a file from measured data using the Testcharts2Curves tool (**??**).

6.6.6 Normalize spectral emission

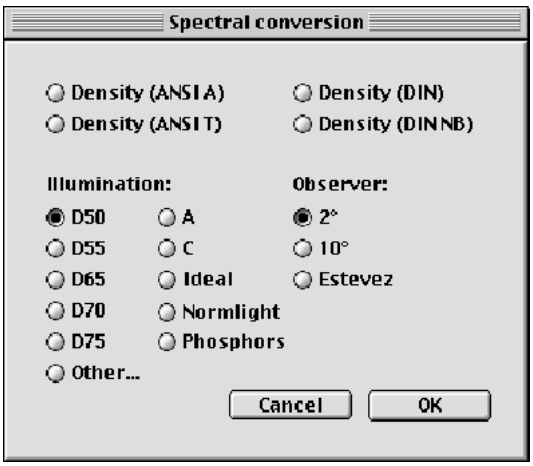
Scales spectral data so, that the Y value will be 100, when the data is converted to XYZ. Needed because emission data often comes randomly scaled.

6.7 Conversion

Filters in the Conversion menu typically convert between data types using special methods (unlike mode changes, which are standard conversions).

6.7.1 CIE colors

Transformation from spectral data to CIE (and density). You may enter Illumination (also file based custom illumination!) and Observer.

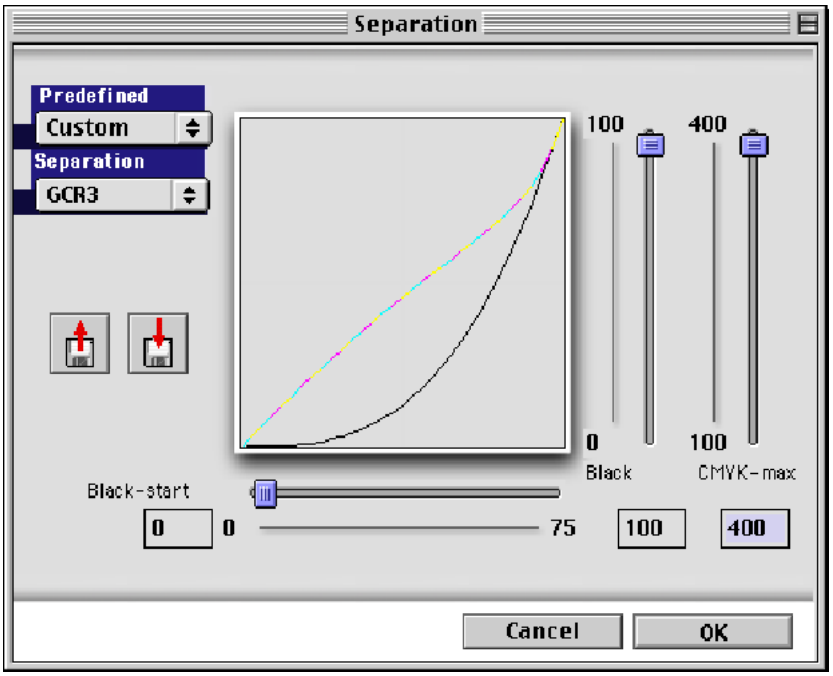


6.7.2 Spectrals

Calculates spectral data, which converts (nearly) to the original colors. The spectral data is of course not uniqely determined. In this model, it is a combination of three basic spectral curves. You can choose between a few sets of basic curves.

6.7.3 Separation

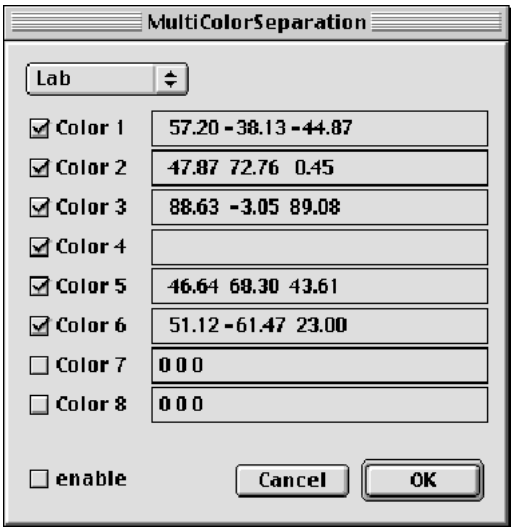
Separates CMY to CMYK.



6.7.4 MultiColorSeparation

This filter allows converting from any colorspace (CMY,RGB,CMYK recommended) to multichannel colors. You have to define the colors of the colorants. You may do this in different color spaces, in general you will use the Lab measurement values of the inks. You may easily switch colors on/off using the checkboxes, the filter will use all checked colors in their

order of appearance.



Remarks:

1. The first three colors (primaries) will be mapped to the CMY(K) primaries of the source color, so that separating CMY(K) colors to multicolors will not touch the primary curves. Example: CMY (50,0,0) -¿ CMYRG (50,0,0,0,0) Attention: The consequence of this great feature is, that your primaries have to match cyan-magenta-yellow, even in that sequence (MultiColorSeparation from CMY to CYMRG -note the exchange of M and Y- will fail)!
2. Leaving ONE enabled color field completely blank will use this channel as black channel. Separating CMYK-¿Multichannel will use this channel to pass the black.
3. All additional colors (means all colorants after the first three ones) will only be used close to the gamut border of the primaries. This ensures maximum quality inside of the 'standard' gamut.
4. Extracolors will be used in dependance of their hue, so their maximum might not appear where you expect it.
5. If you use a red color as an extracolor, do not expect to find 100

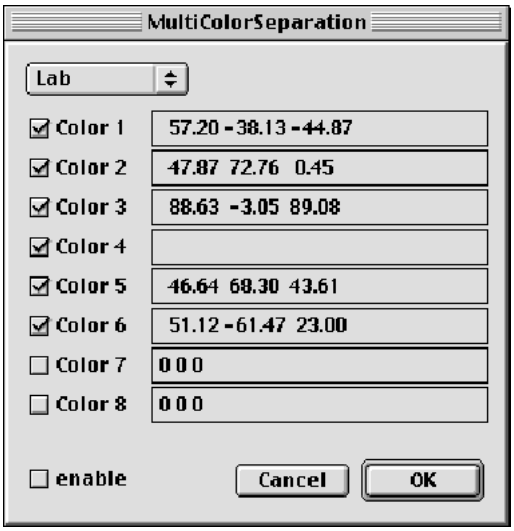
Example: You have a output system with the extra color red and green and want to take advantage of them even for CMYK input:

- Measure your inks cyan,magenta,yellow,red and green.
- Enter the Lab values for C,M,Y into the color fields 1,2,3.
- Leave field 4 blank to bypass black as fourth channel.
- Enter the Lab values of red and green into the color fields 5 and 6.

- Enable the colors 1-6.
- Start the filter.
- You will get a ’6CLR’ testchart (displayed in gray), the patches contain the percentage of each colorant to be printed.

6.7.5 MultiColor2CIE

As it is hard to read the values of the multicolors you may convert from multichannel to CIE to get a rough preview. Just enter the Lab values of the colorants into the fields. Often they are the same as the Lab values you entered in the ’MultiColorSeparation’ (except black).



The filter will do a simple transformation using a linearized, subtractive mixing method based on XYZ. Note that an exact transformation from multichannel to CIE requires much more information than the primaries. If you have a valid ICC-Profile for your multichannel data, you may use the ICC filter methods for transformation. (Unfortunately most Multi-ChannelProfiles I saw are of very, very poor quality. I hope I do it better some day!) Hint: You may use this filter also for CMY and CMYK! Example: You want to get a preview of the multichannel testchart from the example of the MultiColorSeparation (see above).

- Enter the values of cyan,magenta,yellow,black,red and green into the fields (in this sequence!). Note that you should enter the Lab measurement values for black!
- Start the filter
- You will get a CIE based testchart containing Lab values for each patch. Of course, this testchart will be displayed in color!

6.8 Layout

Filters in the Layout menu change the layout of testcharts or convert between testcharts and raster images or create new testcharts and images.

6.8.1 Swap rows/columns

It does what it says.

6.8.2 Mirror

Mirrors left to right and vice versa. Combine it with Swap rows/columns to mirror vertically.

6.8.3 Delete Near Patches

Sets all patches to white that are inside of the radius of a patch from another testchart. Used to delete nearly redundant patches when generating new testcharts.

6.8.4 Select Patches

Replaces the color values of each patch by that of the nearest neighbour that can be found in an external document, which must be the same color space. You have to specify this document under *Source*. If you specify in addition a *Destination*, the patches are taken from there. When it is done, it prints the maximal deviation found when searching for the neares neighbour.

This tool is commonly used to extract subsets of measurement data from a large testchart, where the subset is defined by a smaller testchart. The current document defines the smaller testchart, the source file defines the larger testchart, the destination file defines the measurement data that belongs to the large testchart. The maximum deviation should be less then 0.01. If it is larger, the small testchart is not a subset of the large one, and you know better then me what you want. If the data is intended as input for ICC color management, you may combine this with the 2nd use described below.

Another use is to eliminate small deviations which can occur after layout changes of testcharts via image file formats. The newly layouted testchart is the current document and the original layout is the source file.

6.8.5 Add calibration colors

Extends a testchart by a frame of calibration colors. These might be evaluated by are more intelligent tool.

6.8.6 Remove calibration colors

Removes frame patches.

6.8.7 Chaotify

Shuffles patches around so that vertically neighboured patches differ largely. Needed for gapless i1 targets.

6.8.8 Testchart Standard

Converts color patches to an image format containing space between the patches, a dotted border,...

6.8.9 Testchart Strips

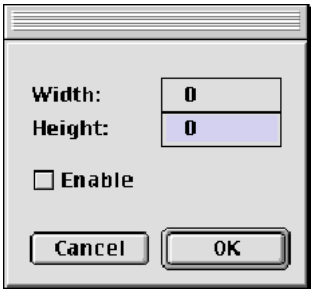
Converts to an image format for the stripreader DTP41.

6.8.10 Testchart Define

A more elaborated testchart generator for different measurement instruments.

6.8.11 Spot colors

Resamples images and spot color data to a different resolution. Only works for rectangular data.



6.8.12 Image

Resamples to pixel based data. Only works for rectangular data.

7 Tools Menu

7.1 IT8 to Rect Format

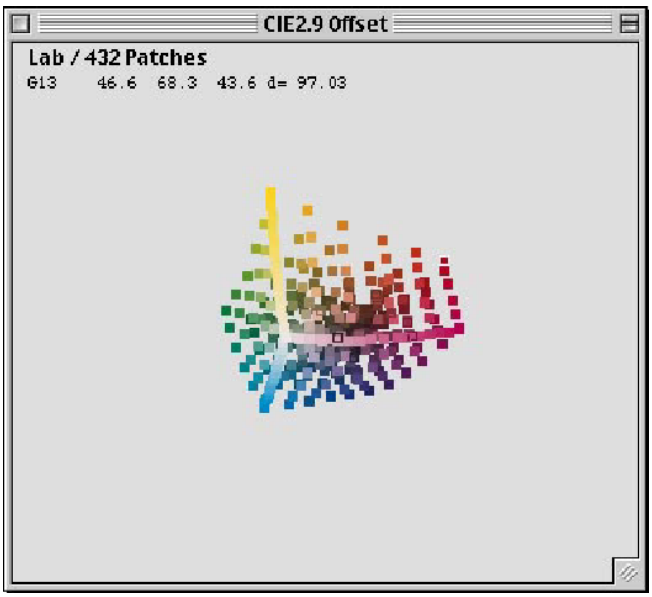
As the IT8 formats (input and output targets) are not rectangular, you cannot not easily save them in TIFF format. Use this tool to fill the gaps with gray!

7.2 Sort

Sorts the patches by their components (¡Option¿ sorts inverse).

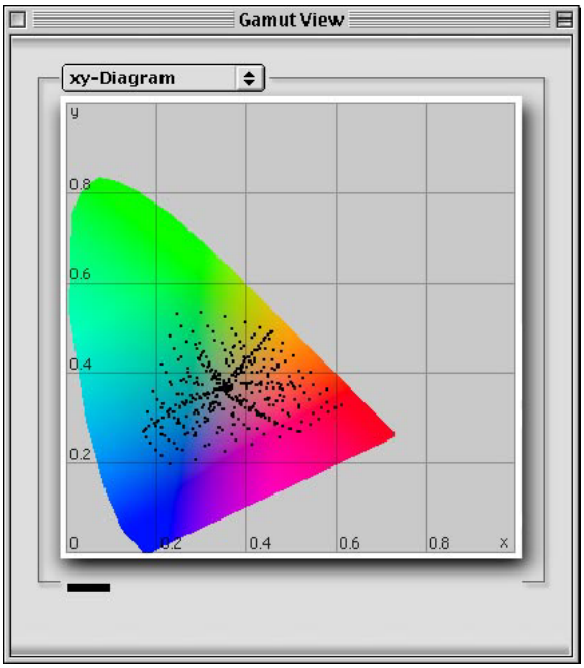
7.3 3D View

Shows the data in 3D. You may rotate the data using the mouse.



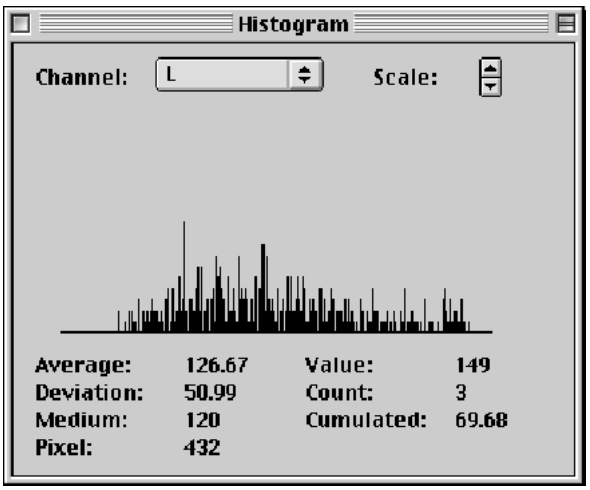
7.4 Show gamut

Shows the colors in ab, uv and xy diagrams.



7.5 Show Histogram

Shows the histograms for the components.



7.6 Show Redundance

Marks (selects) duplicate patches. Helpful when creating and merging testcharts. To remove reduncancies, apply the Delete command on the selected patches.

7.7 Calc Neighbour Distance

Calculates the distance between vertical neighbours and replaces the content with gray patches which reflect the distance. Logically, the column length reduces by one.

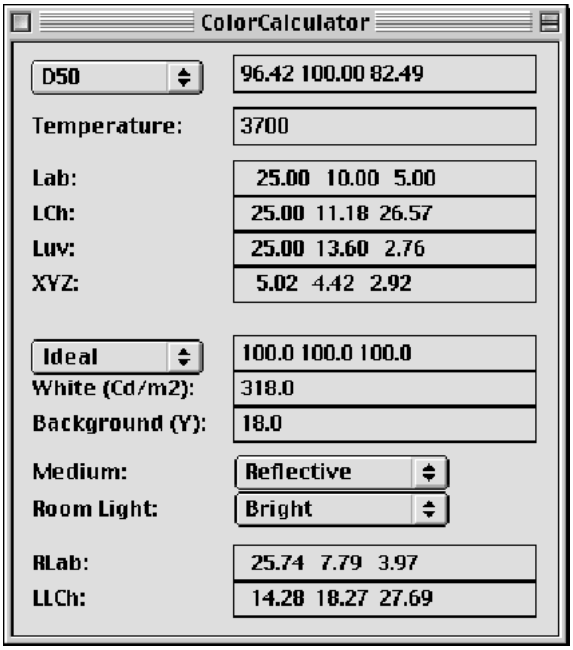
7.8 ICC-profile statistics

Calculates a statistic on the profile integrity (perceptual rendering). Press ¡Option¿ for absolute rendering.

8 Special Menu

8.1 Color Calculator

Transformation between common CIE color spaces and some color appearance models.

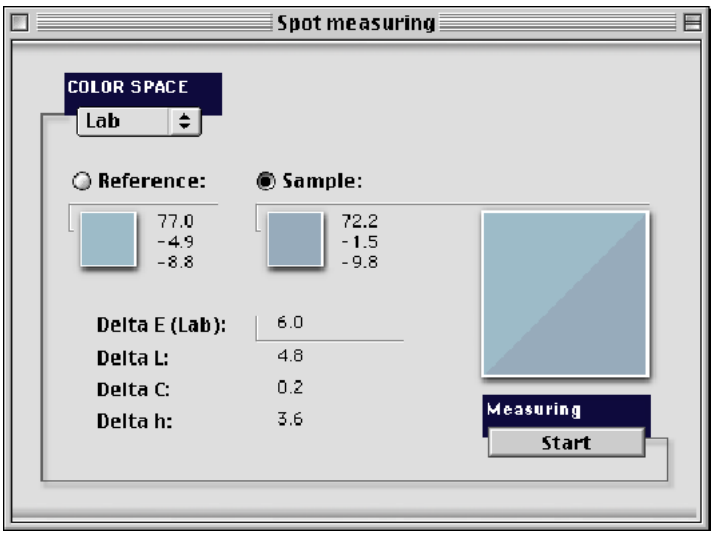


8.2 Handy measure tool

Subject to change Connects to the measurement instrument (according to your device configuration) and takes single measurements, which you can either perform by presing the Measure button or by pressing the button on the instrument if it has one. The measurement data is sent to the current document (or the one that was last current) which contains CIE or spectral data. The window displays the name of the document where the data will go to.

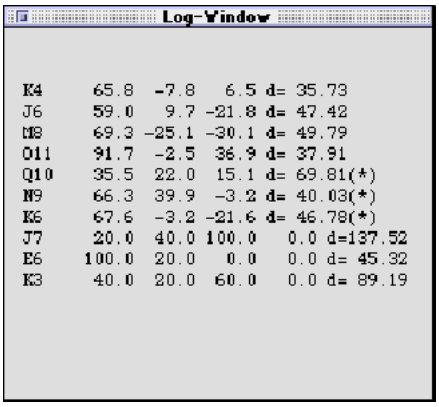
8.3 Spot Measuring

Measures and compares colors with the configured instrument.



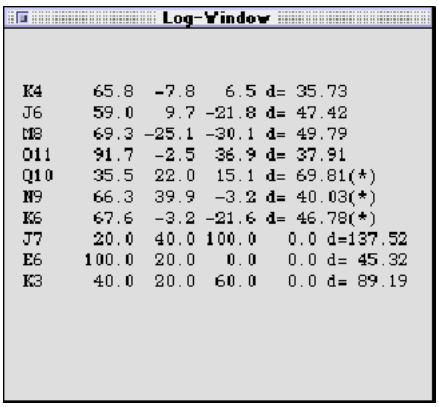
8.4 New Log-Window

Opens a window logging the patch values when you click on a patch. This function is not available in the Windows version, but the logging output goes always into the main window.



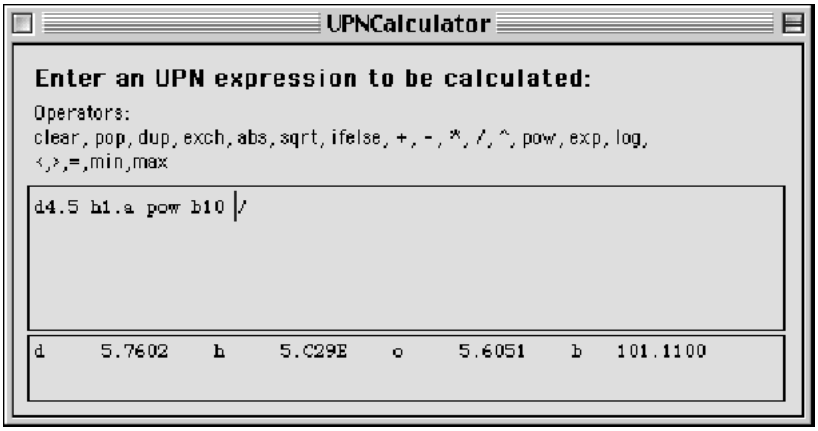
8.5 New Graphic Window

Opens a window that can displays vector graphics. Some tools produce graphics in the topmost graphic window.



8.6 UPN-Calculator

Powerful calculator if you are confirm to UPN notation. It's somehow like the PostScript language, with a stack and operators. This one also supports binary,octal and hexadecimal format WITH PUNCTATION!!!



Example: "`d4.5 h1.a pow b10 /`" calculates $4.5^{1.625}/2$

There is also a filter version of the UPN calculator which lets you directly apply expressions to color data (see 6.6.2).

8.7 Function plotter

Under construction

8.8 Gamma Tester

A simple tool to determine the gamma of your display.

8.9 Color Dependancy

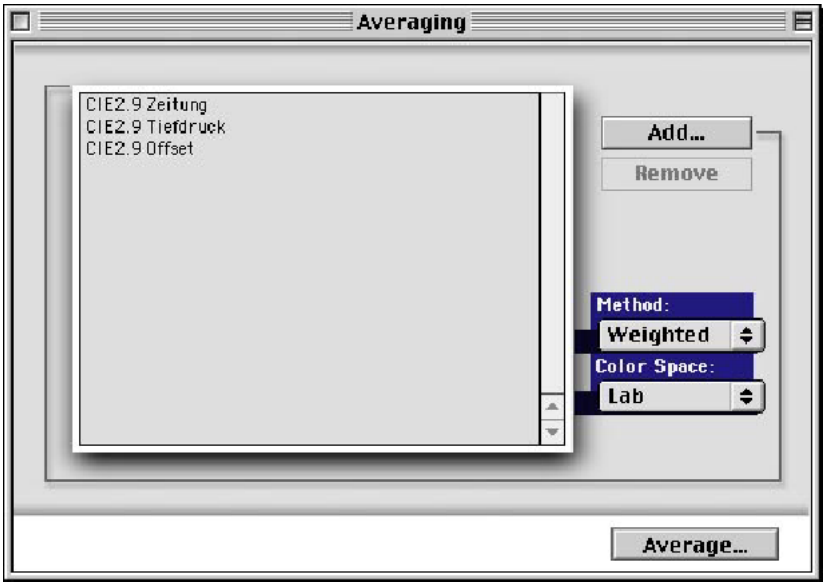
For each color, a point at (x,y) is drawn, where x is the value of the selected channel of the color in the first document and y is the same for the second document. Use it to examine dependancies/correlations between the components of different data sets.

8.10 Calibration Tester

Displays the status of the display systems gamma curves and lets you save them.

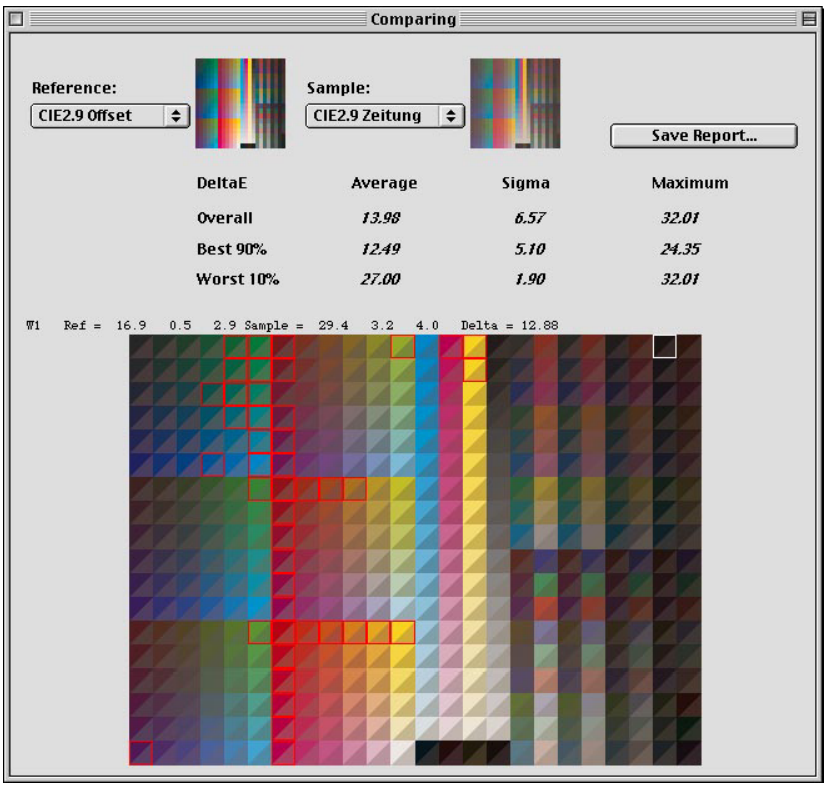
8.11 Averaging

Averages several testcharts of the same format. See Profilemaker documentation for details.



8.12 Comparing

Opens a window where you can switch between the open documents giving you statistics instantly. (Similar to Compare with). See Profilemaker documentation for details.



8.13 Plug-Ins

Proprietary.

9 Windows Menu

You may switch between all nonmodal, named windows using this menu.

10 Automating

10.1 LUA

Beginning with versions around 2.8.6, ColorLab supports the language LUA. LUA is an interpreted programming language with a syntax similar to C, though not identical to C.

LUA is Copyright 2003 Tecgraf, PUC-Rio.

See www.lua.org for details and documentation.

From within a LUA program you can access and modify ColorLab objects, like documents and colors. A document (or a document window) is represented by a userdata type. A color is represented by a table (kind of array in LUA) of numbers. Color spaces are identified as strings, for instance ¨CMYK¨ or ¨Lab"'. A color patch in a document is identified by it's index.

10.1.1 currentdoc

Usage: doc = currentdoc()

Returns the currently active document.

10.1.2 gettitle

Usage: title = gettitle(doc)

returns the title of a document as a string.

10.1.3 getdatatype

Usage: datatype = getdatatype(doc)

returns the color space aka data type of a document.

10.1.4 getcount

Usage: n = getcount(doc)

returns the number of color patches in a document.

10.1.5 getchannels

Usage: n = getchannels(doc) or n = getchannels(datatype)

returns the number of channels of a document's color space or of a color space.

10.1.6 settitle

Usage: settitle(doc, title)

Sets the title of a document.

10.1.7 getcolor

Usage: getcolor(doc, i, c)

Returns in c the values of the patch with index i.

10.1.8 setcolor

Usage: setcolor(doc, i, c)

Sets the values of the patch with index i.

10.1.9 getselection

Usage: state = getselection(doc, i

Returns a boolean that indicating the selection state of the patch with index i.

10.1.10 setselection

Usage: setselection(doc, i, state)

Selects or deselcts the patch with index i.

10.1.11 newdoc

Usage: doc = newdoc(datatype, count, height [,title])

Creates a new document. If title is specified, a window is opened, otherwise not.

10.1.12 doc

Usage: doc = finddoc(title)

Returns a document with that title.

10.1.13 replacedoc

Usage: replacedoc(old, new)

Replaces the content of a document. Note: All references to *old* become invalid. Typically, you use this function if you previousley created a new doc without a window.

10.1.14 getname

Usage: name = getname(doc, i)

returns the name of the patch with index i.

10.1.15 setname

Usage: setname(doc, i, name)

Sets the name of the patch with index i.

10.1.16 logoscript

Usage: logoscript(text)

Executes a LogoScript text. Hands off!

10.1.17 menucmd

Usage: menucmd(name)

Submits a mouse click on the menu item with that name.

10.1.18 open

Usage: open(filename)

Opens a document from that file.

10.1.19 export

Usage: export(doc, filename)

Saves the document into a file.

10.1.20 close

Usage: close(doc)

Closes a document.

11 Problems

This section lists known bugs and other unexpected or unsatisfactory features.

11.1 Cancelling a filter clears the undo buffer

That means, when you open a filter dialog on a document which has been modified before and is thus ”undoable”, and you cancel the filter, you can no longer undo the previous action. The reason is that the filter - though cancelled - occupies the undo buffer.

11.2 Real Colors

The tolerance value isn't considered correctly in the Real Colors filter (6.4.5).

11.3 Log Window disappears

(Windows version only) Sometimes the log window disappears and is replaced with a uniform gray area.

11.4 No true 16 bit support for raster images

ColorLab can read 16 bit images, but it converts the data internally into 8 bit when it loads an image.

11.5 ColorLab is not a full featured image processor

It has no optimized display algorithms and no memory management in order to handle large images. One consequence is that large images are downscaled to a limit of 800 times 800 when they are loaded. You can change the limit in the Settings dialog. You can however create images of any size in ColorLab.

Another consequence is that most filters are slow when applied to images.

11.6 Poor handling of reference data

When you have opened open a file that contains measurement as well as referecne data (eg CMYK values), you can use Switch to Reference to get the reference values, but that's it. This is the minimum functionality needed so that you have a chance to get the reference values at all without hacking. Note that all functions that impact the layout (moving patches around etc) have no knowledge about the existence of reference data...