



# Application Note #4 ([Rev. a](#))

## Using PatchTool for IDEAlliance MONITOR proofing certification

### 1. Introduction

#### 1.1. What is IDEAlliance?

Formed in 1996 and originally called the Graphics Communication Association, IDEAlliance, which stands for International Digital Enterprise Alliance, is a membership organization dedicated to the digital imaging, printing, and publishing fields. It develops technical specifications and processes, and promotes them through seminars, trade shows and publications.

IDEAlliance is separated in working groups and committees. Among those, the Print Properties Working Group is responsible for developing specifications for the print industry; these specifications include the G7 process and the off-press and monitor proofing systems. The GRACoL (General Requirements and Applications for Commercial Offset Lithography) committee maintains guidelines for commercial printing and was particularly involved with the Print Properties Working Group in developing the characterization data for coated #1 paper on sheetfed offset presses. Formed informally in 1974 by a group of concerned industry experts, SWOP (Specifications for Web Offset Publications) first published a specification for web printing of publications in 1986. It merged with IDEAlliance in 2005, where it stands as a committee. The SWOP committee, also in conjunction with the Print Properties Working Group, has recently completed characterization data sets for two grades of paper dedicated for web offset, grade #3 (such as Fortune Gloss), and grade #5 (groundwood).

<http://www.idealliance.org>

<http://www.gracol.org>

<http://www.swop.org>

Other constituents of IDEAlliance include the GRACoL Network organization and the DISC (Digital Image Submission Criteria) Working Group

#### 1.2. What is IDEAlliance proofing certification?

Proofing certification as promoted by IDEAlliance covers two aspects of the prepress tasks: proofing printer certification and monitor certification. Printer proofing certification is making sure that one can reproduce, using a medium to large format office printer, what a final press run will look like; this is also called a **hard proof**, a **proof print**, or a **match print**. Monitor proofing is making sure that the colors displayed on a monitor are accurate relative to the colors printed on the **press**, and thus also accurate relative to those on the proofing printer.

With a certified monitor, one can use its proofing printer for what it is designed, getting a proof only once you are satisfied with what you see on your display, and not as an iterative, imprecise and time-consuming method based on making changes on your monitor and looking at their effect on the print.

This application note covers how to use PatchTool to facilitate monitor proofing certification. Please consult Application Note #3 for how to use PatchTool to facilitate printer proofing certification.

### 1.3. Can I use a similar procedure to check the accuracy of my monitor?

Of course! What we want to check here is how the “real” colors in our images are represented on our monitor. Since most images are saved in CMYK or RGB, which are device-dependent color spaces, sending this data to the monitor requires a mix of translation and calibration, which is done in two parts.

The first part requires a characterization of the file data, in the form of an ICC profile, which is used to convert CMYK or RGB data to a reference, device-independent, space, such as L\*a\*b\* D50, which is called the Profile Connection Space (PCS) in ICC terminology. This profile can either be attached to a file or assigned to it, as a working space, in an image editing application such as Photoshop or any other application which supports color-management.

The second part is another ICC profile which takes the color values from the PCS and converts them to the device-dependent RGB values of the monitor. This second profile is what you generate when calibrating your display.

The IDEAlliance characterization files contain both device-dependent (CMYK) and device-independent (L\*a\*b\*) data. We can thus use the L\*a\*b\* data directly, and process it through the monitor ICC profile, where it should be accurate, in theory! Because we have the device-independent data, there is no need to use the CMYK data.

Any L\*a\*b\* or XYZ reference file can be used for such a check, even a list build using a word processor or a spreadsheet application. Please consult *Appendix-A PatchTool plain text formats for color data* of the [PatchTool Help](#) manual for more information on how to make such a file.

The advantage of using the IDEAlliance data is that their accuracy requirements are well defined; it is thus easy to determine GO/NO-GO conditions, even if nothing prevents you of using more stringent or lenient tolerances, smaller or larger lists, etc.

### 1.4. How does this certification fit with the G7 process?

In the recent past, and , still now, more often than not, validating a printing press was done by establishing its Tone Value Increase (TVI) curve, i.e. the dot gain, by measuring the densities of the primary inks at various percentages of ink coverage (For example: 25%, 50%, 75%, and solid). The TVI reflects how an ink spreads on the paper and is used to correct how the printing plate is manufactured. Once the densities were on target, a press was SWOP or GRACoL certified only after standard images were printed and judged by trained “certified” observers. Because of the inherent variability in human observers, IDEAlliance has developed a new validation program based essentially on measured colorimetric accuracy; it is called the *G7 Proof-to-Print Process*, which comprises calibration, printing, and proofing process control methods.

The pre-G7 rationale was that once the individual ink densities and the TVI curves were correct, the grays should be neutral. The essential problem with this approach is that the human visual system is very sensitive to gray balance, and measuring dot gain is one step away from visual perception, which combines all ink channels in order to make gray out of it. In comparison, the G7 process first step is to obtain a perceptual linear gray ramp by matching well defined Neutral Print Density Curves (NPDC) for three-color gray and black.

The individual ink densities and dot-gain curves are thus not used or required in this process, but are nonetheless considered useful as a basic press quality-control method. Of course, not everyone agrees with the concept, particularly, in Europe, and time will tell how it is accepted. In any case, the G7 process has the advantage of putting perception, or how the final product is judged by the user, as a measured specification.

Once a press is validated numerically using the G7 process, it is only fitting to use similar “number-based” validation tools for monitor and printer proofing. For this reason, IDEAlliance has determined absolute colorimetric references for all the patches of the standard IT8.7/4 target; these references, called characterization data, were obtained by measuring, averaging and tweaking “ideal” reproduction obtained from real presses on three paper types. Please note that this is an ongoing process and the requirements and specification may change as users get more experience.

### 1.5. Is my home-made monitor certification official?

IDEAlliance has defined a set of requirements which need to be met in order to receive their approval. In terms of color-measuring instrumentation, these requirements are:

- i- The measurements shall be performed with an X-Rite Eye-One Pro spectrophotometer.
- ii- The Eye-One shall be “qualified” by IDEAlliance, meaning that it has to be within a certain tolerance relative to a secondary reference, such as the PR-650 spectroradiometer from Photo Research.

Does this mean that you cannot use another instrument, such as a Spyder3, an Eye-One Display2, a DTP94 (i.e. Monaco Optix), or any other instrument to check compliance? In a strict sense, no, but in practice, you will get a good assessment of your workflow as long as your measuring instrument is within its calibration requirements (Please check the BabelColor Web site to see which instruments are currently supported by PatchTool).

Why will I still get useful info? Well, let’s first assume you have an Eye-One Pro which is not “qualified”. This instrument will still be within the inter-instrument agreement range of all Eye-One Pros manufactured by X-Rite. In practice, this means that you should, statistically, see a slight increase in the measured errors relative to the official IDEAlliance values. In some cases, this increase will push your measured values outside the tolerance limits set out by IDEAlliance. If the discrepancy is larger than the inter-instrument agreement value (stated as  $1,0 \Delta E^*_{max}$ , CIE94), then you have a good hint that your process would not be certifiable. If the error is less than the inter-instrument value, then you have a pretty good system which could likely pass official certification.

If using an instrument other than the Eye-One Pro, the difference between your measurements and those made with a “qualified” unit is likely to be higher than what it would be if you used the certified instrument. By how much? This is hard to nail down since most manufacturers specify inter-instrument accuracy (of the same brand and model), and never specify “absolute” accuracy. It could well happen that your process accuracy is so good that the errors are still within the requirements. It could also happen that the monitor is off in one direction and that the measuring instrument is off in the other direction, thus cancelling each other, but this is not highly probable.

The advantages of doing this certification check yourself are:

- i- To better understand the certification process while improving your system’s performance.
- ii- To increase confidence when seeking official certification, and minimize the associated cost.
- iii- To be able to regularly check if your monitor is stable and within its requirements.

## 2. Using PatchTool for monitor proofing certification

The certification is obtained by measuring, on your monitor, all the color patches of a standard IT8.7/4 target, and comparing the measurements against IDEAlliance reference data. The reference data is available for three paper types:

- i- GRACoL Commercial, Grade 1, Coated (Ex.: Luster Gloss)
- ii- SWOP High End Publication, Grade 3, Coated (Ex.: Fortune Gloss)
- iii- SWOP Publication, Grade 5, Coated (Ex.: Monterey Gloss)

The characterization files are available in the “IDEAlliance\_files” folder located within the PatchTool application folder (As a shortcut, use the “**File/Open Sample Files/IDEAlliance Files...**” menu). These files can also be downloaded from the [IDEAlliance Web site](#).

The **monitor** proofing requirements are ([PROOFING CERTIFICATION PROCESS v16.pdf](#)):

		Criteria		Requirement	
1	Display uniformity as per ISO 12646			YES	
2	Display Luminance			160 ± 10 cd/m <sup>2</sup>	
3	Color-difference formula			CIEDE2000	
4	IT8.7/4	4.1	Average of all patches	Average ΔE ≤ 2.0	
		4.2	95 <sup>th</sup> percentile	Maximum ΔE ≤ 6.0	
		4.3	Solid CMY patches	ΔE ≤ 7.0	
		4.4	Overprint RGB patches	ΔE ≤ 7.0	
		4.5	50/40/40 Gray	L*	-2.0 ≤ ΔL* ≤ 2.0
				a*	-1.0 ≤ Δa* ≤ 1.0
				b*	-2.0 ≤ Δb* ≤ 2.0
		4.6	Paper White	L*	-2.0 ≤ ΔL* ≤ 2.0
				a*	-1.0 ≤ Δa* ≤ 1.0
b*	-2.0 ≤ Δb* ≤ 2.0				

ISO 12646 (*Graphic technology — Displays for colour proofing — Characteristics and viewing conditions*) covers practical monitor requirements such as white point and black point chromaticity accuracy, luminance uniformity, ambient illumination conditions, geometric accuracy, etc. You will find additional information on ISO 12646 in the [BabelColor CT&A Help](#) file; look in the “*Technical data/Spectral tools description/ISO 3664+ tools description*” section.

The 95<sup>th</sup> percentile criteria of the IT8.7/4 target means that 95% of the patches shall have a color difference of less than 6.0. Of course, the criteria for the solid and overprint patches, the 50/40/40 gray and the white patch must also be met, which means that these patches will also be within the 95<sup>th</sup> percentile.

**Note:** The requirements shown in the table above are different than the ones specified for printer proofing certification. In particular, the color-difference formula specified here is CIEDE2000, whereas the CIELAB formula is specified for printers. Also, the acceptable errors for the average, the CMY solids, the RGB overprints and the 50/40/40 gray are not the same.

The next sections describe how PatchTool can be used to analyze the color of the IT8.7/4 target patches on your monitor.

## 2.1. Factors which can affect display measurements

As with any technical measurement, there is a list of things you should be aware of in order to obtain the best assessment of the display performance. The following points should be used as a checklist before doing the measurements, or when analyzing the results.

### Instruments and displays are not created equal

The various instruments available for color measurements on displays are essentially of two types: colorimeters or spectrophotometers. There are pros and cons for each type of instrument. Some will prefer the colorimeter because of the perceived (and sometimes real) increased stability of the measured data. However, colorimeters can be more susceptible to changes in monitor design features such as the specific characteristics of the display primaries. A colorimeter which worked well with CRTs will not necessarily be accurate with LCD displays. Various brands and models of LCDs also use very different filters and/ or light sources which can easily affect a colorimeter's calibration; this is a problem with wide gamut LCD monitors which use a green filter quite different than the ones used in smaller gamut monitors.

When you couple the different instrument optical layouts with the numerous display types, you are bound to witness quite diverse results. For example, instruments with different Field-Of-Views (FOV) will provide different values when measuring LCD monitors with dissimilar and non-isotropic angular spread. You could well obtain matching results between instruments for some displays and non-matching results for others. For instance, on some displays, we have measured blacker black levels with a spectrophotometer than with a colorimeter.

### Specifications do not give the complete story

Most instruments are specified in term of inter-instrument accuracy relative to a master instrument located at the manufacturer's plant. This inter-instrument accuracy also does not even apply between different models of the same manufacturer. So we are far from being able to compare instruments based on absolute specifications; in particular, you will have a (very) hard time finding absolute chromaticity accuracy for emission measurements.

### Your display is NOT uniform across its surface

If you calibrate your display by placing the instrument at a certain position and in a given orientation, use the same position and orientation to make a display check (see also *Measurements on LCD displays with an Eye-One* at the [end](#) of this section). A display white point and its brightness do vary across its surface. There are sections of standards ISO 12646 and ISO 3664 dedicated to these non-uniformities (available from their Web site: <http://www.iso.org>):

ISO 12646: "Graphic technology -- Displays for colour proofing -- Characteristics and viewing conditions"

ISO 3664: "Viewing conditions - Graphic Technology and Photography"

According to ISO 12646, it is acceptable to have up to 10% brightness non-uniformity within a centered rectangular zone which covers 25% of the display area. Higher end monitors will exhibit a better uniformity than this, but the difference can still be significant (remember that we are often looking at color differences of one or two Delta-E here).

### Your display needs to be stable before making measurements

Whether it is a CRT or a LCD, open your monitor for at least one hour before doing critical measurements (and calibration of course!). Make sure any screen saver is disabled before leaving your system unattended. If a variation in white level is detected while doing a measurement, you will be prompted by PatchTool, and have the choice to continue or discard the measurements.

### Your colorimeter/spectrophotometer needs to be temperature-stabilized before making measurements

All optical sensors are subject to electronic noise. This noise varies with the instrument's temperature, usually increasing as the temperature goes up. When calibrating, you are, in effect, indicating to the instrument's firmware to subtract the present noise from all future measurements. To minimize any increase in noise, you should thus let your instrument stabilize by placing it anywhere on your display while your display stabilizes. This procedure was found to be effective by IDEAlliance while they were developing their monitor proofing certification process.

### **A display profile is matched to its hardware settings**

When you make a display profile, you are asked to set a White Point and brightness level. This adjustment is made automatically on high end systems but remains a manual task for many users. In any case, these hardware adjustments are linked to the resulting profile as well as to the graphic card Look-Up-Table (LUT), and sometimes also to the display LUTs if so equipped. See the next point for additional information on LUTs.

This means that if you select a different profile to check, you should make sure that the hardware settings correspond to this other profile. Since these settings are often manually adjusted and not recorded, there is little chance of getting the system back to the correct setting. On the plus side, we often make many profiles with the same White Point and brightness values, changing only software settings between each profile.

### **A display profile is matched to a computer's graphics card Look-Up-Tables (LUT)**

Profile calibration software use the graphics card built-in LUTs as a mean to provide neutral grays and to adjust the gamma response. Higher end monitors also have LUTs built into the monitors itself; these LUTs work in tandem with the graphics card LUTs to provide smoother tones over a large dynamic range. However, monitor LUTs are not common, and require profiling applications made specifically for such displays.

The monitor calibration (i.e. White Point and LUTs) is the first step of all display calibration procedures; because it is hardware based, it will also benefit non-color-managed applications. The display profile is then built on top of the calibrated monitor; it is thus linked to a given LUT set, and needs to be changed whenever a different profile is selected. In Windows, while the default display profile is loaded at start-up, the LUTs are not. A third party application is required, and this program is usually automatically launched at start-up; *Logo Calibration Loader* (GretagMacbeth), *ColorVisionStartup* (Datacolor) and *basICColor display4 VideoLUT Loader* (Color Solutions) are such applications. Because loading the LUTs require a dedicated third-party application, changing a Windows profile on the fly, using the display properties for instance, will not update the LUTs. For Windows XP users, there is a simple solution in the form of a small control panel, named *Color*, which can correctly assign a profile and load the corresponding LUTs without rebooting; this add-on has to be downloaded separately from the Microsoft Web site: [Color Control Panel Applet for Windows XP](#). On a Mac, changing a display profile automatically changes the LUTs. However, for all platforms, you will need a dedicated application to load monitor LUTs.

### **Measurements are not the same unless the data processing is the same**

Many profiling applications incorporate a quick profile verification procedure. The verification measurements can be presented as a graph, a data table with an average error, or a before/after image. You should be aware that when you see RGB input data, they usually mean RGB in the monitor space. Their measurements may be in D50, if presented in  $L^*a^*b^*$ , but may also be RAW emission chromaticities, relative to the actual display White, which cannot be directly compared to reference data based on standard Illuminants (a Chromatic Adaptation Transform (CAT) is required for such a comparison). These validation procedures are not well documented and can only be understood by a detailed analysis. In such conditions, it becomes hazardous to compare measurements made with different programs. This is why you will find a complete description of PatchTool's data processing in Appendix B of the [PatchTool Help](#) manual; at least you will know where PatchTool's measurements come from.

### **ICC profiles and Color Management Modules (CMM) are not created equal**

The content of an ICC profile varies depending on the application which generated it. You may be offered many options on what you want inside your profile. You can often select between a matrix profile and one based on LUTs, which can significantly increase a profile size, but can also offer better precision. There are also many decisions made by the program's creators, for which you have no control. For instance, a profile creator may add some additional profile features (tags or other content) that can only be used by its other products. What will the default rendering intent be? How many different intents will be embedded?

To make things even more difficult to control, a given profile may or may not be handled in the same way for some intents and BPC settings by different CMM (also called color engines, such as Adobe ACE, Apple ColorSync, Microsoft ICM, lcms, and Argyl). For example, how will Black Point Compensation (BPC) be handled for the different intents?

### Control the display environment

A strong overhead light or a nearby desk lamp will likely leak light into your darker shades measurements. In any case, whenever possible, you should work in a dimly lit environment in order to fully appreciate your display output and minimize errors due to external light contamination. Also try to maintain a uniform room temperature, which can affect the display's response.

### Measurements on LCD displays with an Eye-One Pro

While making emission measurements with an Eye-One Pro on an LCD display, it was noticed that different Luminance and Correlated Color Temperature (CCT) values were obtained, depending on the instrument's position on the display. Luminance variations by as much as 10% were measured for the same display area when rotating the spectroradiometer by 90 degrees. This problem affects Eye-One Pros with manufacturing revisions A, B, and C (shown as REV A, REV B, REV C on the instruments). According to our own measurements on a REV D unit, this problem has essentially disappeared; this has been confirmed by other owners of REV D Eye-One Pros.

The problem with earlier units is related to the polarization of the light emitted from the display. In an LCD display, the intensity of each pixel is controlled by rotating the light's polarization state between crossed polarizers, and the light coming out is linearly polarized (often at a 45 degree angle). To check this, look at your display using a photographic polarizing filter (or polarizing sunglasses), and rotate it slowly; you should see maximum and minimum transmission for angular positions separated by 90 degrees. The display light is not seen differently by the human eye whether it is polarized or not, since we only perceive the light intensity; however, polarization can affect an instrument reading.

In order to obtain reproducible and valid measurements, we recommend making all measurements with the instrument placed at the same angle that was used for calibration. If calibration is done with the instrument suspended in its cradle, as shown in the illustrations below, all subsequent measurements should be done with the Eye-One placed vertically. It is acceptable to make measurements with the instrument turned 180 degrees from its calibration position, so that it is still vertical, as shown in the illustration on the left. Accordingly, in such a case, measurements should not be done with the instrument positioned horizontally, or at an angle, as shown in the illustration on the right.



**Note:** "Older" CRT displays do not emit polarized light and are thus not susceptible to errors due to instrument orientation. As for the Eye-One Display and the Spyder2 colorimeters, their simpler optical layout makes them immune to this effect.

After what you read in the previous pages, we are sure you will feel gratified when a display check shows a low average error, since you know that such an outcome is conditional to the understanding and control of many parameters, and that not much is required to push the results out of an acceptable zone.

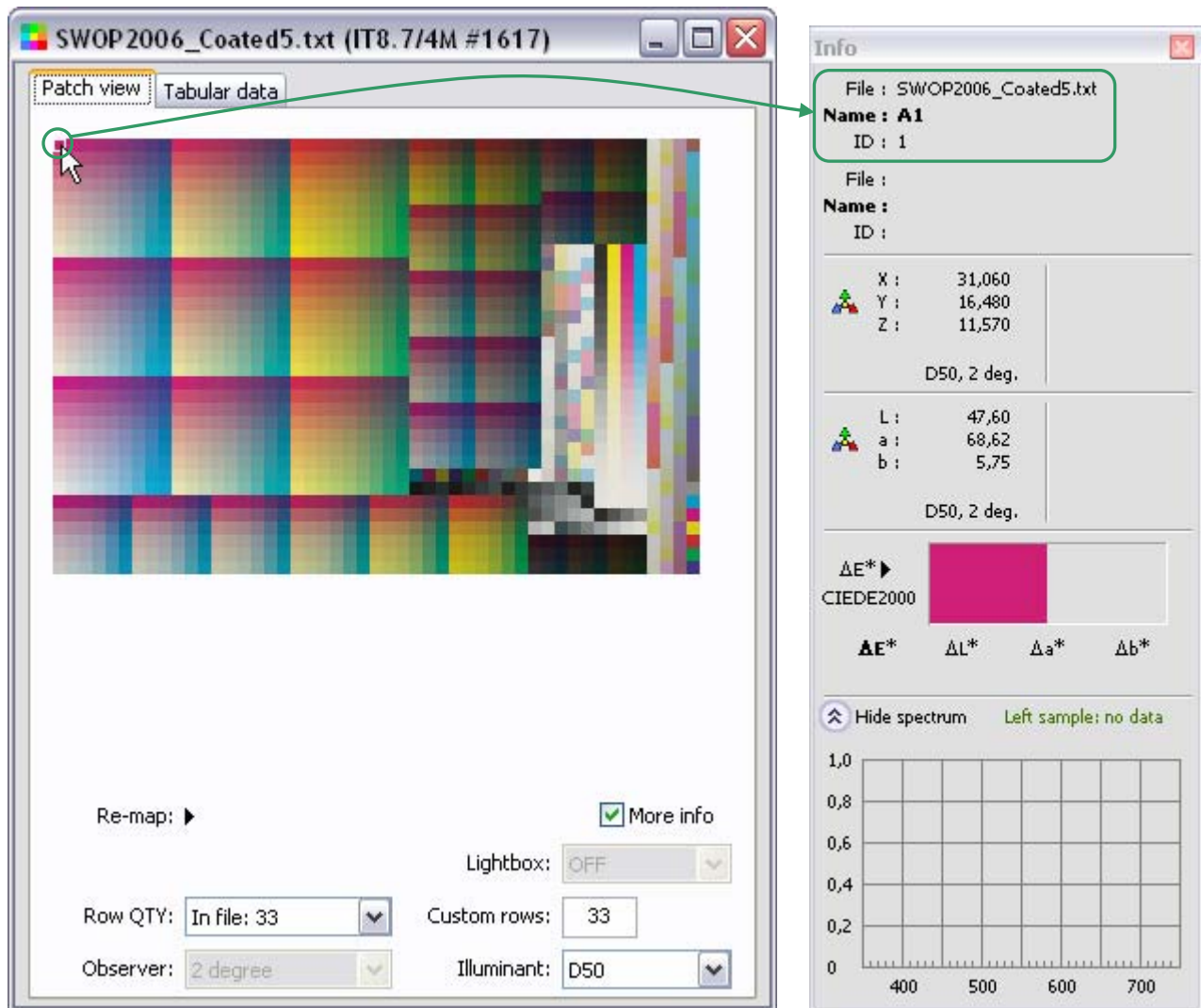
## 2.2. Opening the IT8.7/4 target reference file

In PatchTool, open the reference data file corresponding to your workflow (As a shortcut, use the “**File/Open Sample Files/IDEAlliance Files...**” menu):

- i- Coated 1: **GRACoL2006\_Coated1.txt**
- ii- Coated 3: **SWOP2006\_Coated3.txt**
- iii- Coated 5: **SWOP2006\_Coated5.txt**

These are text files saved under the CGATS format. They show, for each patch, their ID, Name, CMYK values, and XYZ plus  $L^*a^*b^*$  values in D50. PatchTool will import the chart from the XYZ data. When opening the file, you will be asked to select an Illuminant and Observer; select D50 and the 2 degree Observer. Once opened, the file appears as shown below.

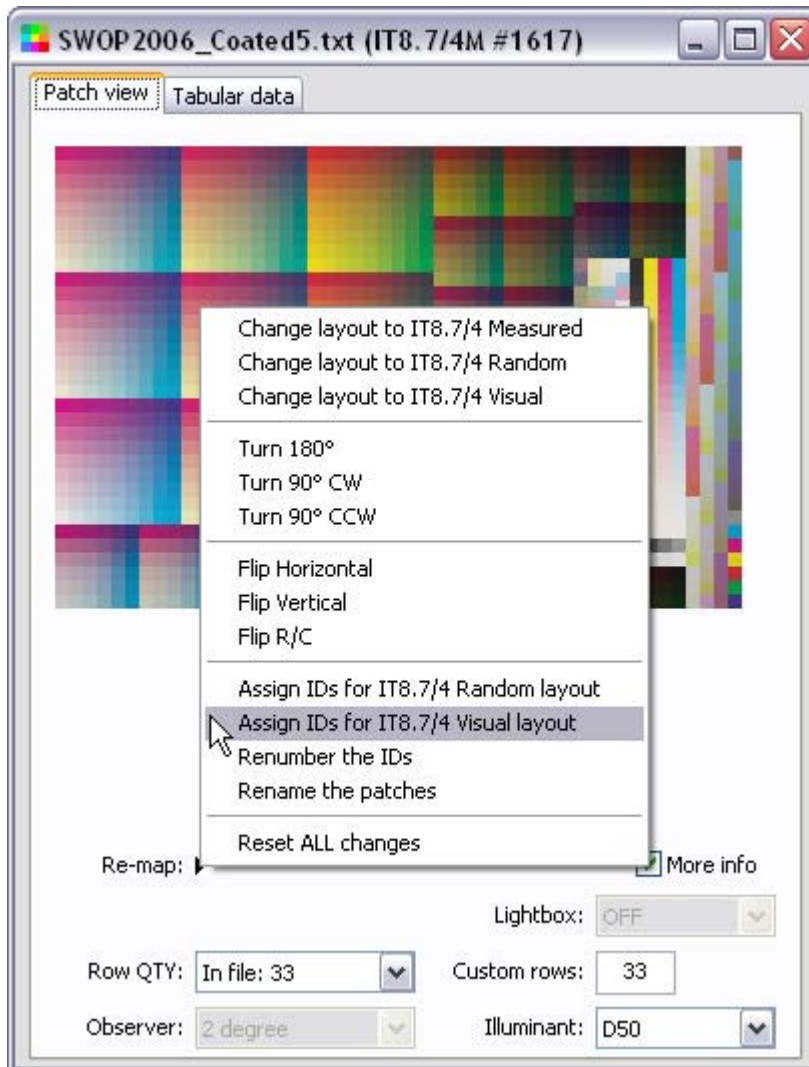
**Important:** A certification report absolutely requires one of the above files, or one of the other IT8.7/4 reference files provided in PatchTool’s IDEAlliance folder. If files with other names are used, the “**Cert. report**” button will not appear in the “**Stats**” tab of the Compare window. If you know that your file is valid, but it has been renamed, you can always rename it again!



When moving the mouse pointer over the patches and looking at the patches ID in PatchTool’s “Info” window, you may notice that the IDs are sequential, starting at 1 on the upper-left, and increasing when going down, and to the right. These IDs are shown as they were saved in the file; however this numbering does not correspond to the



standard IT8.7/4 IDs for this layout. This is not a problem as we can easily assign the IDs using the “Re-map” menu, as shown here:

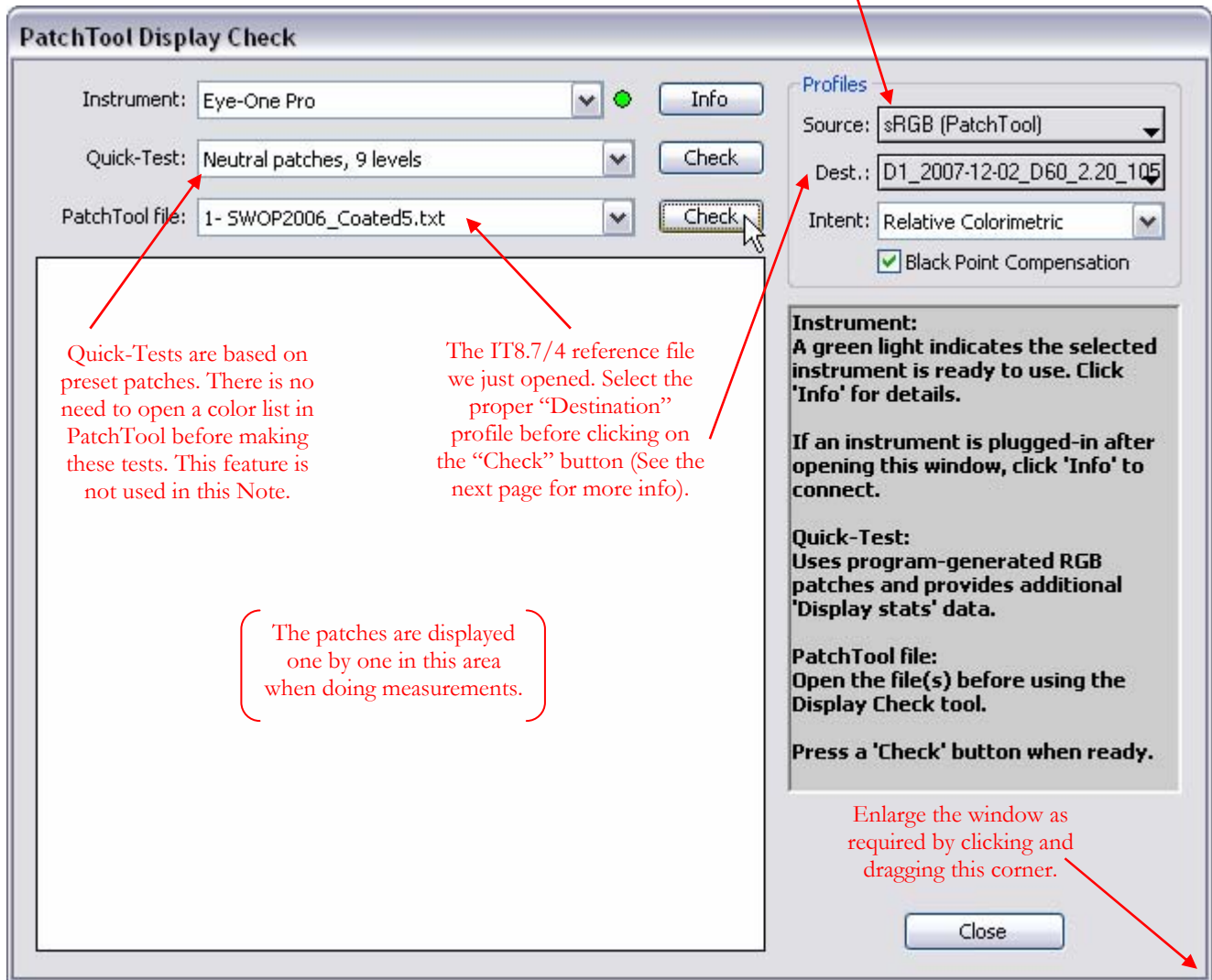


This re-assignment is important if you want, or need, to change the target layout, and is required by PatchTool in order to identify specific patches when generating the certification report. In the example above, we know that we have the visual layout and we thus assign the IDs for this layout. Once the IDs are assigned, you can easily switch between the random and visual layout using the “Re-map” menu.

### 2.3. Measuring patches on your monitor using PatchTool’s “Display Check” tool

With your reference file now opened, open the Display Check tool window using the “Tools/Display Check...” menu.

A source profile needs to be specified only for “Quick-Test” measurements.  
For PatchTool files, the source is the file L\*a\*b\* data.



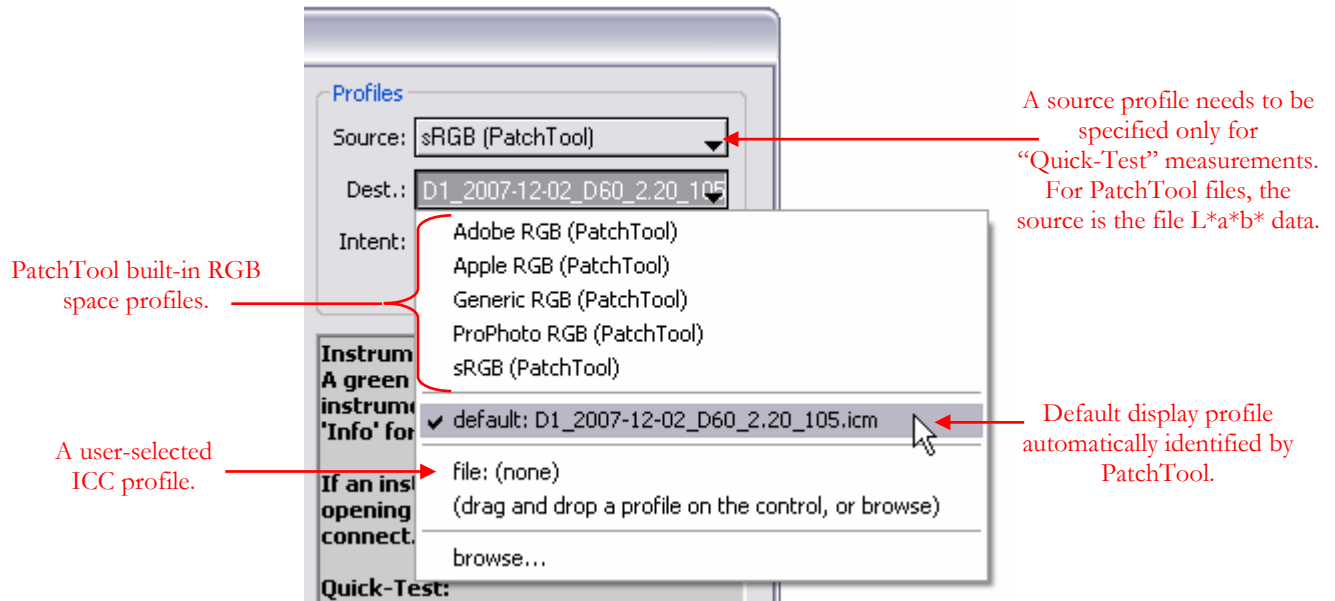
The supported instruments are:

Instrument	Manufacturer	Type	Web site
Eye-One Display Eye-One Display 2	X-Rite	colorimeter	<a href="http://www.xrite.com">http://www.xrite.com</a>
Eye-One Pro	X-Rite	spectrocolorimeter	<a href="http://www.xrite.com">http://www.xrite.com</a>
Spyder2	Datacolor	colorimeter	<a href="http://www.datacolor.com">http://www.datacolor.com</a>

A green light besides the instrument selection menu indicates the instrument is recognized and ready to use. A red light indicates the instrument is not available. Clicking on the “Info” button will show you more information on the instrument. If your instrument is connected but shown as not available, you can click on the “Info” button to attempt a reconnect; this is useful if the instrument was disconnected while using the Display Check tool.

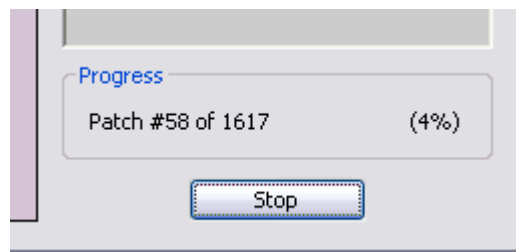
Unless you want to do a specific test, select the default display profile as the “Destination” profile. This profile is automatically identified by PatchTool. Also select the rendering intent and the Black Point Compensation setting, if applicable.

**Important:** PatchTool will NOT load the graphics card or monitor LUTs corresponding to a selected profile. Make sure the LUTs corresponding to the selected profile are loaded and that the [display settings](#) (R, G, and B channels and the display brightness) are appropriate for this profile. In particular, for Windows computers, the LUTs are NOT updated when the display profile is changed using the display properties dialog. A dedicated [LUT loading application](#), or a reboot, is required.



**Important:** Because of the large number of patches that need to be measured, you should disable any screen saver program and power saver utility before starting the measuring sequence. The measuring sequence can be stopped at any time; however, all data will be lost. About 41 minutes were needed to measure all IT8.7/4 patches with an Eye-One Pro on a four years old Windows XP system.

You can now resize and re-center the Display Check window, then click on the “Check” button besides the “PatchTool file” menu, and follow the screen instructions. You can track the measurement progress by looking at the current patch number and completion percentage appearing in the Display Check window.



### **Additional notes on display measurements processing**

In all display measurements, the display White Point (WP) is ALWAYS measured, since this is the white to which the user's eyes will most likely adapt (we assume minimal "interference" from external light sources here, i.e. low ambient light levels). All other colors are then seen relative to this White Point. The White Point may correspond to the Illuminant of standard RGB spaces, D50 or D65, but, for LCD displays, it will often be the "natural" White Point of the display, i.e. whatever the "as manufactured" White Point is. This situation is simply due to the fact that most LCD displays do not have the capabilities, which come at a cost, to adjust their white without compromising the smoothness of the tones. In addition, you will often see displays of the same model with different natural White Points.

Now, since we want to compare the measured data with reference data based on (very likely) a different White Point, we need to convert the data so that it matches the reference Illuminant. In PatchTool, this is done using a Bradford Chromatic Adaptation Transform (CAT) which converts the measured data from the measured display White Point (WP-Display) to D50. Please note that the measured spectral data is also processed in this way, through a CAT matrix, in order to obtain the proper Relative Colorimetric color in the PCS.

This workflow is identical to the one used in a Proofing RoundUp based on the IDEAlliance certification program: *IPA Proofing RoundUP Results 2007*; "Appendix K — Methodology for Calculation and Normalization of Monitor Colorimetry" The document can be purchased from the IPA Web site: <http://www.ipa.org> .

The above document recommends pro-rating the XYZ display measurements by the ratio of the **target** (here D50) White Point XYZ coordinates over the **display** White Point XYZ coordinates. This pro-rating method is better known as the "wrong Van Kries" method, which is a CAT method most likely proposed because of its mathematical simplicity. In comparison, the Bradford CAT used in PatchTool is considered more accurate for the same task (in the scientific literature).

Because any display measurement needs to be chromatically adapted in order to be compared to a reference, the original unprocessed data may be difficult or impossible to get back once the Compare window is opened. For this reason, and if you have a need for such data, it is recommended to save the RAW data whenever a measurement sequence is completed.

Please consult "*Appendix B - PatchTool Color Management*" of the [PatchTool Help](#) file for more info.

**Important:** The RAW file should be kept by those who intend to process the measured data in their own application (i.e. not in PatchTool). This file is not required for most users, and the simplest method to record the Display Check data is to save (Export) the Compare file with at least the "ID", "Name", "CMYK", "L\*a\*b\*", and "Spectrum" (if available) data fields. The exported Compare file can then be reopened in PatchTool and you will be able to analyze the data as if you just measured it.

#### 2.4. IT8.7/4 target certification (Requirements 2, 3 and 4)

Once the monitor measurements are completed, you are asked if you want to save the RAW measurements. We recommend doing so if you are interested in processing these measurements yourself afterwards, as we discussed in the previous section. A “Compare” window similar to the one below then opens; each patch is in fact two triangles which represent the reference and the measured value for each patch.

The number besides the “L” is the White Point Luminance, in cd/m<sup>2</sup> (Requirement 2).

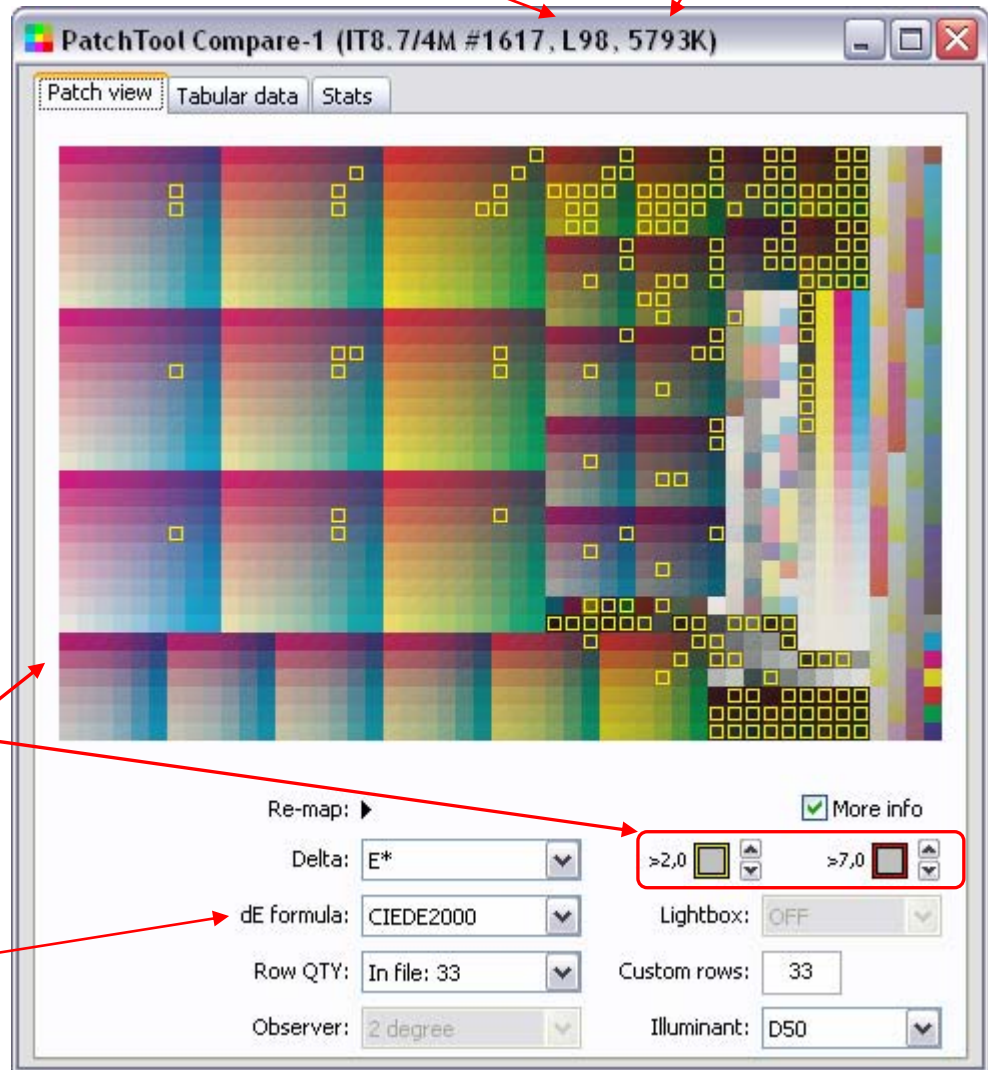
The White Point Luminance Correlated Color Temperature (CCT), in kelvin.

Each square is made of two triangular patches. A colored border is drawn when the color difference between the patches exceeds the selected thresholds.



A yellow border indicates that the sample patch has a DeltaE\* difference, relative to the reference patch, larger than the user-set lower threshold of 2,0 but smaller or equal to 7,0. A red border would indicate a color-difference larger than 7,0, but there are no patches over this threshold.

CIEDE2000 color-difference formula (Requirement 3).

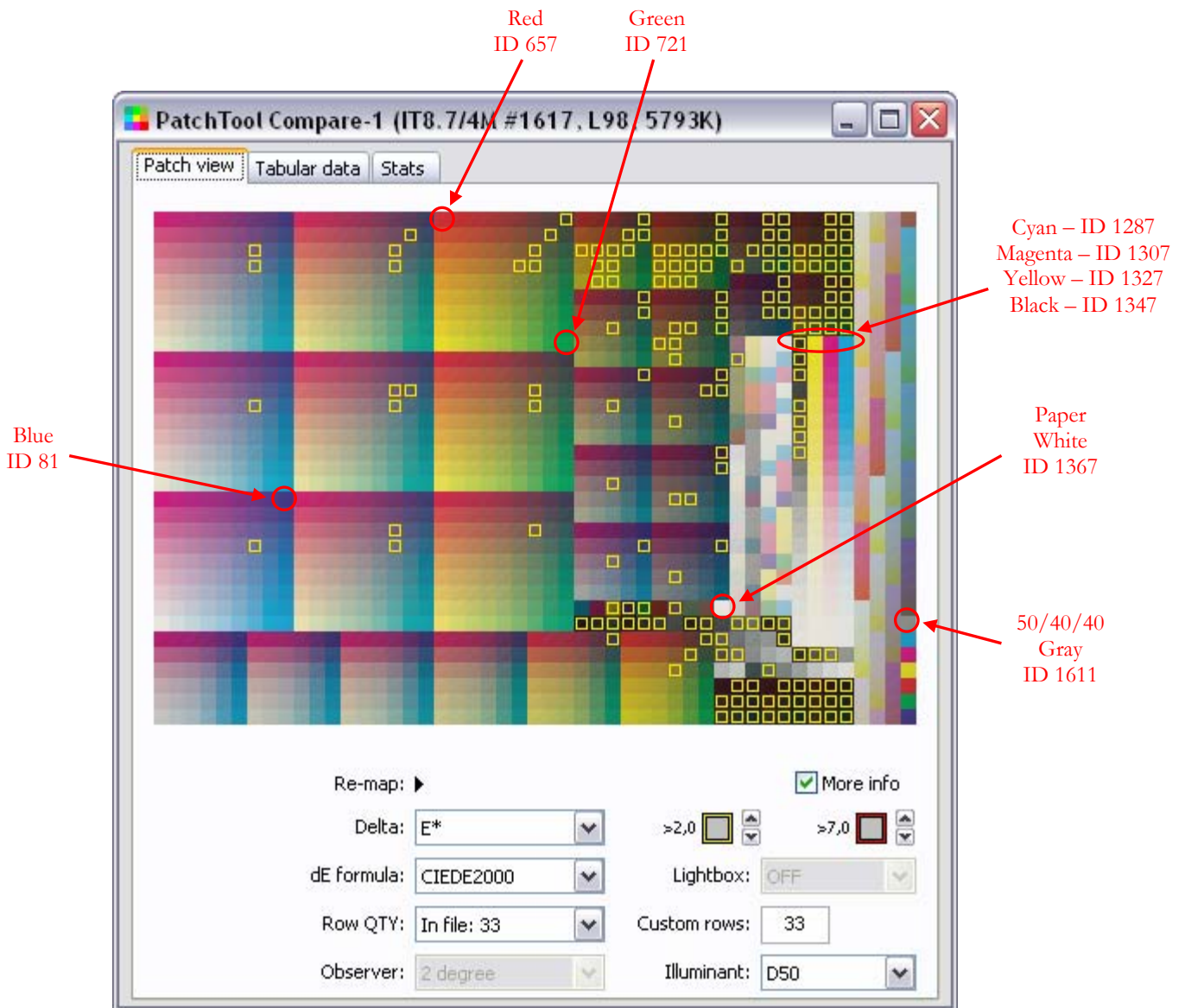


A rapid glance at this window tells us that we most certainly pass the requirement for an average color-difference of 2,0 Delta-E\* CIEDE2000 (Requirement 4.1) since the number of patches with a difference larger than this set threshold is low. We also see that there are no patches with a difference larger than 7,0, the requirement for the CMY solids (Requirement 4.3) and RGB overprints (Requirement 4.4).

The monitor luminance (Requirement 2) can be found in five places: in the log text of the main PatchTool window, in the RAW data file (if saved; look for the XYZ\_Y or the XY\_Y\_CAPY value in the White point section at the end of the file), in the “Compare” window title (the number besides the “L”), in the [certification report](#), and in the exported Compare file.

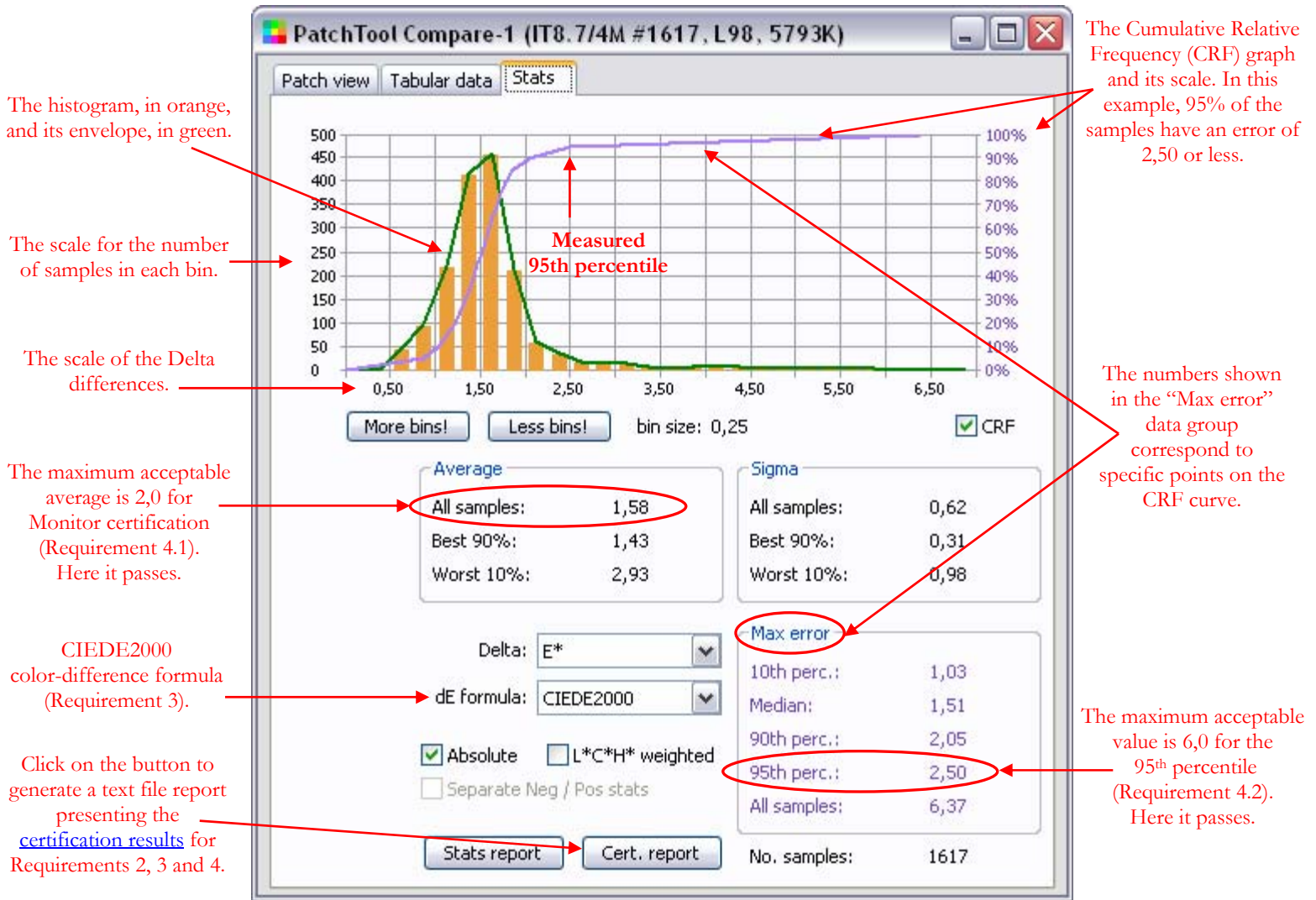
You can see the color-difference for individual patches by moving over each patch with the mouse, while looking at the “Info” window. The patches’ locations for the CMTK solids, the RGB overprints, the 50/40/40 gray, and the paper white are shown below for the visual layout. Make sure you select the same color-difference formula for the Info window as the one selected in the file window (CIEDE2000), since they are selected and computed independently.

**Important:** Proper assignment of the IT8.7/4 patches’ ID is essential in order to obtain a valid [certification report](#). If, after opening the characterization file from IDEAlliance, you did not re-assign the reference IDs to the ones of the IT8.7/4 Visual layout, then the patch IDs will not correspond to the numbers shown below. Nonetheless, you can still assign the IDs in the Compare window using the “Re-map” menu.



You will notice a “Stats” tab in the Compare window, which is not present in the windows of single files; select this tab to see statistical data on the differences between the two files. This is shown on the next page.

An example of Monitor proofing statistics:



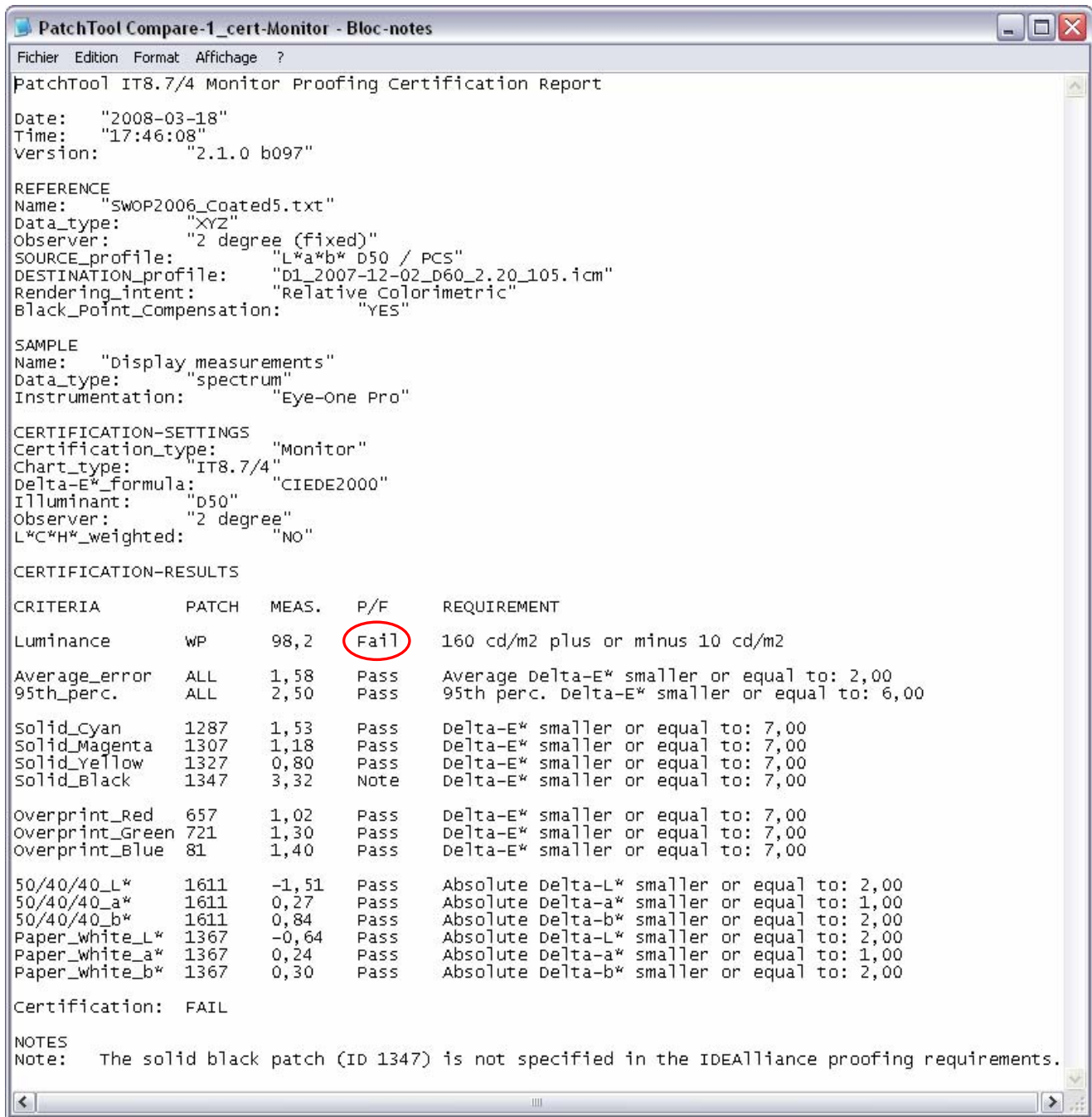
You may want to increase the number of "bins" used to display the statistics. You should also select the "CRF" checkbox, which stands for "Cumulative Relative Frequency". The CRF is the number of patches which have an error smaller or equal to the value shown on the "X" axis.

The numbers which are of interest for this certification are the "Average" for "All samples" and the "Max error" for the "95th percentile". Make sure Delta-E\* is selected as the color-difference criteria and that CIEDE2000 is selected as the color-difference formula ("dE formula"), in order to comply with Requirement 3.

With Delta-E\* selected, all errors are positive, and the CRF curve corresponds to the numbers shown in the "Max error" data group. Please consult the PatchTool Help manual for more information on the relation between the "CRF" curve, the "Absolute" and "Separate Neg / Pos stats" checkboxes, and the "Max error" values.

In the screenshot above, we see that the average error for all samples is 1,58, meeting Requirement 4.1 (Max.=2,0). We also see that the maximum error for the 95th percentile is 2,50, well within Requirement 4.2 (Max.=6,0).

You can generate a report that covers Requirements 2, 3, and 4 by clicking on the “**Cert. report**” button of the “**Stats**” tab. The saved file is in Tab-delimited text format and can be opened with any word-processor or spreadsheet application. The report corresponding to the measurements of the previous pages is shown below:



This report shows that we pass all requirements except “Luminance”, measured at 98,2 cd/m<sup>2</sup>. The luminance “failure” is not a surprise in this case since this monitor was calibrated, by choice, with a nominal White Point luminance of 100 cd/m<sup>2</sup>, because we find the 160 cd/m<sup>2</sup> requirement too high for our working environment. Colorimetrically, this monitor passes certification!

**Important:** We strongly recommend saving the Compare file; this can be done with the “File/Save / Export...” menu or by clicking on the “Export” button. We recommend selecting at least the “ID”, “Name”, “CMYK”, “L\*a\*b\*”, and “Spectrum” (if available) data fields in the export dialog; this will ensure that all the reference and measurement data is properly saved. Reopening this Compare file in PatchTool will then enable you to analyze the data as if you just measured it.



### 3. Conclusion

Most of the IDEAlliance requirements for certifying a monitor are simple, but processing the data in order to verify compliance is computer-intensive. As we have seen, PatchTool facilitates this task so that anyone can verify how their monitor meets the colorimetric requirements. Of course, unless you use “qualified” measuring instruments, this verification cannot be construed as an official IDEAlliance certification, but it does provide a very good assessment of your monitor’s calibration state. In addition, when performed on a regular basis, it is a simple method to track your equipment’s performance.

#### Revision History

**Rev. a (April 2009):** The text was revised to correspond to PatchTool Version-2.6. The Internet links were updated.

**First release (March 2008)**

#### The BabelColor Company

Founded in 2003, *The BabelColor Company* is dedicated to the development and sale of specialized color translation software and color tools. It also provides color consulting services for the professional and industrial markets.

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