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All about PANTONE and else spot colors in 2023

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Specifying PANTONE or else spot colors:

For controlling a PANTONE solid printed ink, it is not enough checking its perceived color is consistent with a PANTONE swatch book in standard lighting environment.

In other words, it is not enough checking the solid PANTONE L*a*b* D50 color measured on the print is very close to its reference L*a*b* **D50** color measured on a PANTONE swatch book.

And this for following reasons:

1. It is impossible to print two swatch books with identical colors for each one of the hundreds of swatches.

2. Therefore, a spot color cannot be specified by a sample tint printed on a swatch book, but **must be its reference measurements in a digital library**.

These reference measurements have the advantage of being **reproducible** and **unalterable over time**. They are specified by **PANTONE** – or by any other well-known swatch books manufacturer such as **RAL**, **HKS**, **SUN** or else.

3. But specifying a PANTONE tint only by its apparent L*a*b* color (under D50 or other light source) is still insufficient: The appropriate specification of a spot color must allow predicting its apparent color not only with standard **D50** lighting, but also with any other arbitrary light source.

So that a well-designed tints' library must specify each reference tint by its full spectral reflectance curve in visible wavelengths.

Example of incompletely specified PANTONE tints: Each PANTONE solid color (hereafter Solid Coated swatches) is specified only by its apparent Lab color in **D50** lighting:

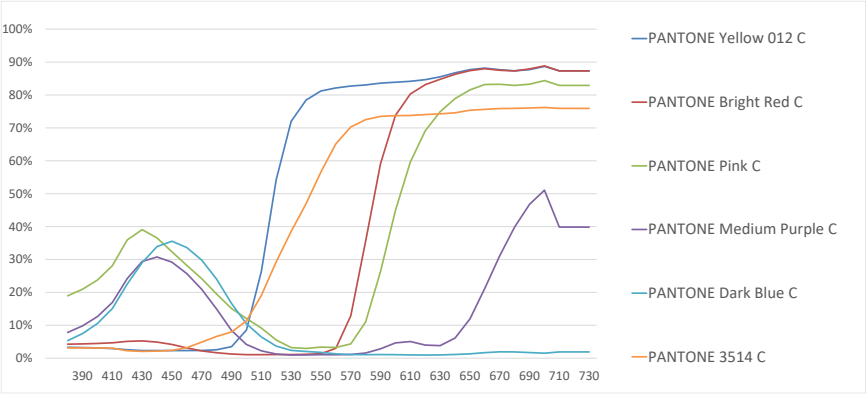
	380 L	390 a	400 b
PANTONE Yellow 012 C	87.55	2.18	109
PANTONE Bright Red C	57.47	72.5	61.7
PANTONE Pink C	51	72.7	-16
PANTONE Medium Purple C	20.89	50.2	-59
PANTONE Dark Blue C	20.84	29.2	-69
PANTONE 3514 C	78.97	14.4	91.8

Example of a properly specified PANTONE tints: Each PANTONE solid color is specified below by its 36 light reflectance values in visible wavelengths ranging from 380 to 730 nm in steps of 10 nm:

	380 L	390 a	400 b	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730
PANTONE Yellow 012 C	0.033	0.03	0.03	0.03	0.0257	0	0	0	0	0	0	0	0.1	0.3	0.5	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.873
PANTONE Bright Red C	0.043	0.04	0.04	0.05	0.051	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.6	0.7	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.873
PANTONE Pink C	0.19	0.21	0.24	0.28	0.3593	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0	0	0	0	0	0.1	0.3	0.4	0.6	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.829
PANTONE Medium Purple C	0.078	0.1	0.13	0.17	0.2418	0.3	0.3	0.3	0.3	0.2	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0.1	0.1	0.2	0.3	0.4	0.5	0.5	0.4	0.4	0.398
PANTONE Dark Blue C	0.053	0.07	0.11	0.15	0.2253	0.3	0.3	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.019
PANTONE 3514 C	0.031	0.03	0.03	0.03	0.0224	0	0	0	0	0	0.1	0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.759

Here, the library specifying each shade by its visible reflectance curve, makes it possible to know not only its apparent color under **D50** light source, but also with any other light source.

For example, we can calculate for any PANTONE swatch specified above: Its apparent color with **D50** lighting (Graphic Industries standard), its apparent color with **F11** lighting (fluorescent lighting of supermarkets), and its apparent color with **A** lighting (light of standard incandescent bulbs).



Specifying the tints of a graphic charter:

Failing to specify its visible reflectance curve (the only complete information), any tint of a graphic charter must be specified **at least by its apparent color under standard D50 lighting**. This will not allow anticipating its apparent color on the shelves of a supermarket, but has the merit of being at least one known apparent color, unalterable over time, and reproducible under any arbitrary lighting, including the standard **D50** lighting.

Spot color specified by a known swatch name: (for example, PANTONE 3514 C)

If a tint is specified by a name belonging to a well-known swatch book such as **PANTONE**, **HKS**, **RAL**, **SUN** or else, each actor in the graphic process must use the according spectral digital library, in order to get the reference values of the hue.

For greater security and simplicity, the graphic charter should be accompanied by a simple Excel file containing the list of tints of the graphic charter with their names and respective spectral reflectance values.

Knowing the reference spectral reflectance of a named tint allows all actors of the graphic production process to do their job correctly:

1. **Check whether a perceived color on a PANTONE or else swatch book** complies with its official spectral values in its reference library.
   This matters for the **Designer**, who cannot trust the colors he perceives on a **PANTONE** swatch book unless he can control this swatch by measuring it,
2. **Formulate the ink properly**: Using the reference reflectance curve of PANTONE 3514 C is compulsory for **formulating** this ink properly, if necessary, by using an ink formulation software.
   This matters for the **print house**, that must be able to match properly the spot color specified by his customer, whether this special ink is manufactured in-house or by an external ink supplier,
3. **Check that this ink has been properly formulated AND printed with optimal density**:
   This matters for the **press conductor**, the **printing manufacturer** and the **customer**, who must be able to check the printed solid spot color does comply with its reference specification. For example, check that PANTONE 3514 C solid ink's measured spectral reflectance is consistent with that specified by the up-to-date PANTONE Coated digital library. (As of February 2023, **PANTONE Solid Coated-V4.CxF**).

Since each actor of the graphic production process is needing the up-to-date reference PANTONE spectral library when a PANTONE color is involved, this document will explain you how to download all up-to-date PANTONE spectral libraries free of charge, and how to use them in practice.

Original spot color specified by a private tint name: (e.g., Cartier Red, Klein Blue, Vuitton Brown)

If a shade of a graphic charter is an original tint that is not part of any standard swatch book, it must also be specified by its visible spectral reflectance curve, which allows predicting its apparent color under any light source. For example, its apparent color under standard **D50** daylight, but also its apparent color under the **F11** fluorescent illumination of a supermarket.

Note that formulating any original spot color specified by a tint name and its reflectance curve costs no more than formulating a PANTONE spot color. The use of standard swatch books by Designers ... has become the least creative approach today, and is not even economical.

Simulating a spot color control on a digital printer:

Principles for simulating spot color on a digital printer:

Because any digital printer, such as inkjet, is using its own primary inks, it generally cannot use special inks other than those intended by its manufacturer.

The digital printer therefore always uses its own inks:

- For simulating all screened tones and spot colors that will be printed on a traditional printing press (This is color proofing),
- For simulating another digital printer (This is color harmonization of a machine pool),
- For reproducing originals (This is photographic printing using printer's maximal color gamut),
- Or for reproducing the colors we perceive on a monitor (This is monitor hard or soft copy),

Whatever its use, any **digital printer is therefore simulating the apparent colors of spot colors using its own primary inks**, as perceived under standard **D50** light or else arbitrary light source. This applies as well when you simulate a spot color on a CMYK printing press.

- On a good paper, almost all modern inkjet printers can simulate, using their own C'M'Y'K' primary inks, the apparent colors of all CMYK screened tone printed by traditional CMYK offset or rotogravure presses.
- Modern inkjet printers can also simulate the apparent colors of many vivid coated PANTONE tints. If the printer (or press) is using more than four primary CMYK inks (e.g., CMYK + orange, green and purple inks), it can simulate a larger number of PANTONE (or else) spot colors, without too large visual distances, thanks to an enhanced color gamut.

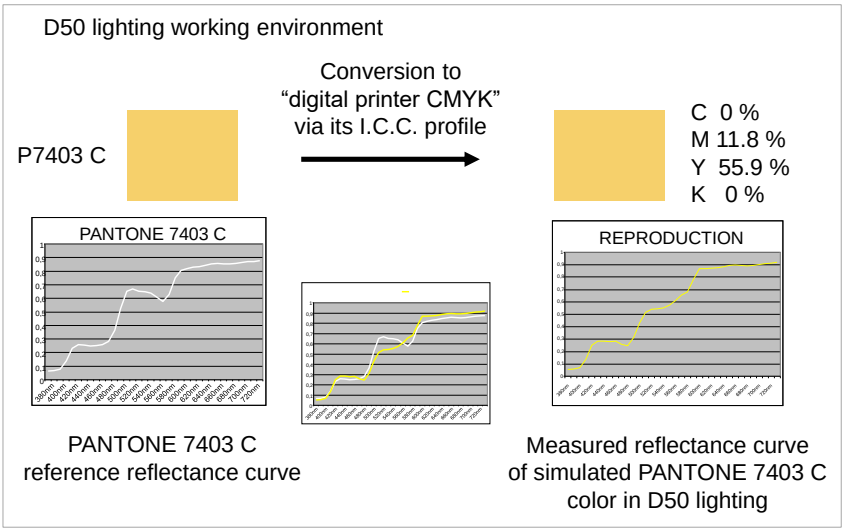
However, even if a printer uses many primary inks, the spectral reflectance of a simulated PANTONE tint will typically be very different from its reference reflectance. The apparent color of a PANTONE reference will therefore be properly simulated only for a specific light source. In another lighting environment, this simulated printed color will become different from the original PANTONE apparent color.

Therefore, for controlling a simulated spot color on a digital print, it is enough to measure its apparent C.I.E. Lab color, and then check the visual distance between this measured Lab color and its reference L'a'b' color calculated from its spectral reference values.

When color proofing, if there is a significant difference due to a simulated PANTONE color being outside the inkjet printer' color gamut, this does not necessarily matter, as long as the final PANTONE in the print house does match the reference specified by the **PANTONE** digital library…

Example of simulating a PANTONE 7403 C tint on a digital printer:

The reproduction is called "**metameric**", that means "sensitive to lighting", because the spectral reflectance curves of the original and its reproduction are different:



Printing a spot color on a printing press:

Any public or private spot color is therefore correctly specified by a name, and the associated numeric values of its visible reflectance curve.

Classic mistakes when printing or checking spot colors on a printing press:

Oddly, few Designers, print manufacturers and printers know how to control a solid PANTONE color, and if necessary, diagnose the origin of a bad print; and this can be extremely expensive.

An anthology of errors too often found in the field at all stages of the graphic production process, that are sometimes quite surrealistic:

- **A tint of a graphic charter** ... **is unknown**, due to its specification by CMYK or RGB values specified in some unknown RGB or CMYK color space. Of course, a tint of a graphic charter should never be specified by CMYK or RGB values, because the same CMYK screened tone will produce different apparent colors depending on each printing process.
- **Specifying the tint by its apparent C.I.E. Lab color under D50 lighting, but forgetting to specify its spectral reflectance curve**. In this case it will be impossible formulating this tint without metamerism: Two print houses will be allowed to use very different ink formulations, that will produce the right apparent color in D50 lighting, but completely different colors under the F11 fluorescent lighting of a supermarket ...
- **The Designer trusts the color he perceives on his printed swatch book, without having controlled his lighting**...

- **The Designer trusts the color he perceives on his own printed swatch book, without having checked that the swatch has been properly formulated and printed on his swatch book**. In practice, the perceived color on a swatch book can only be trusted by measuring it, and checking it does match its digital reference values in its reference library.
- **The PANTONE ink's manufacturer** formulates this ink not aiming at the spectral reflectance specified by the reference library, but the reflectance he has measured on his own very poorly printed swatch book (Yes, we have seen this 😉)
- **The printer or print manufacturer** sets the solid PANTONE ink density on the press "by eye", by visually comparing it to their own PANTONE swatch book, very different from that of the **Designer** (And errors always add...). And this, moreover, without even controlling the lighting environment on the press...
- **The PANTONE ink's manufacturer formulates the ink for a paper different from that which will be used for printing**,
- **The PANTONE ink's manufacturer properly formulates the ink using as he always should the spectral reflectance found in his up-to-date PANTONE reference library**, but very strangely, since the creation of the graphic charter, **PANTONE** have modified the spectral reflectance values recorded in their reference library, rather than creating a new reference for this new spectral reflectance! So, there can be significant visual differences for a same PANTONE reference depending on the date of the reference library file! (Yes, we have seen this 😉)

  For this reason, **any properly specified graphic charter should be accompanied by an Excel file specifying the name and spectral reflectance values of each tint at the moment this graphic charter was created**.

How to control spot colors printed on a printing press:

1.5 ΔE2000 or narrower tolerance for solid printed spot colors if frequently requested by customers. Because the hue of a solid ink ONLY depends on the amount of ink-per-unit-area laid on the paper (for example, the apparent color only depends on the ink's thickness when offset printing). So that it is much easier ensuring consistent printing of a solid spot color than of a CMYK benday. It is therefore natural for customers to be demanding, especially since using special inks in addition to the CMYK process inks is more expensive.

For properly printing a solid PANTONE ink (or any other 100% spot color), you need:

1. **The ink to be properly formulated**: Taking into account its spectral reflectance specification (present in the up-to-date digital reference library and/or better: specified by the graphic charter), and the spectral reflectance of the paper on which this ink will be printed,
2. **The ink to be printed using appropriate density**: Indeed, the color of the ink varies according to its thickness on the paper (offset, flexo) and / or according to its pigment concentration (gravure).

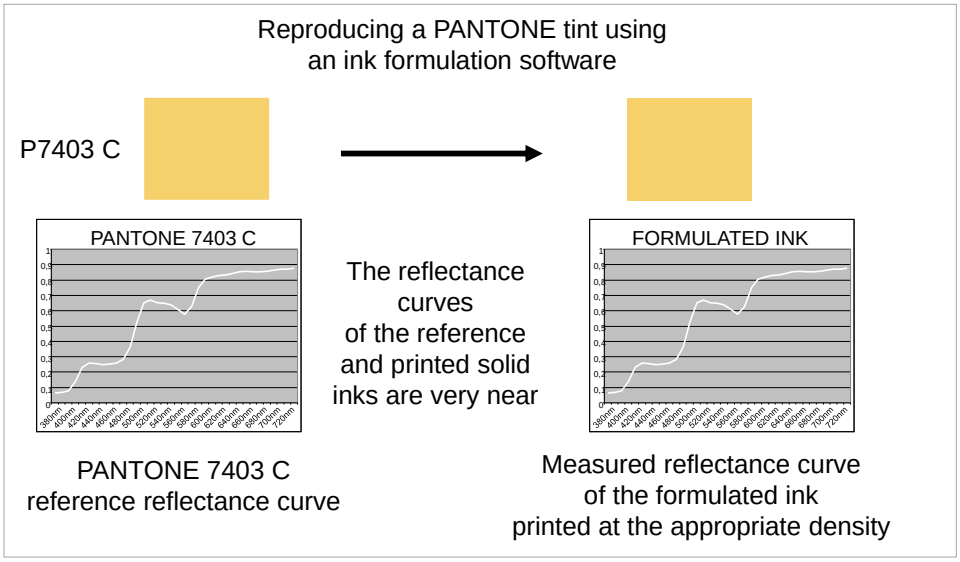
   The right density of a special ink is the one that allows matching best the reference target color.

   Note that when offset printing, the aim color must be reached with a reasonable ink thickness, otherwise there will be printability concerns; For this purpose, the ink's pigment concentration must be sufficient.

Example of checking a solid PANTONE 7403 C ink on a printing press:

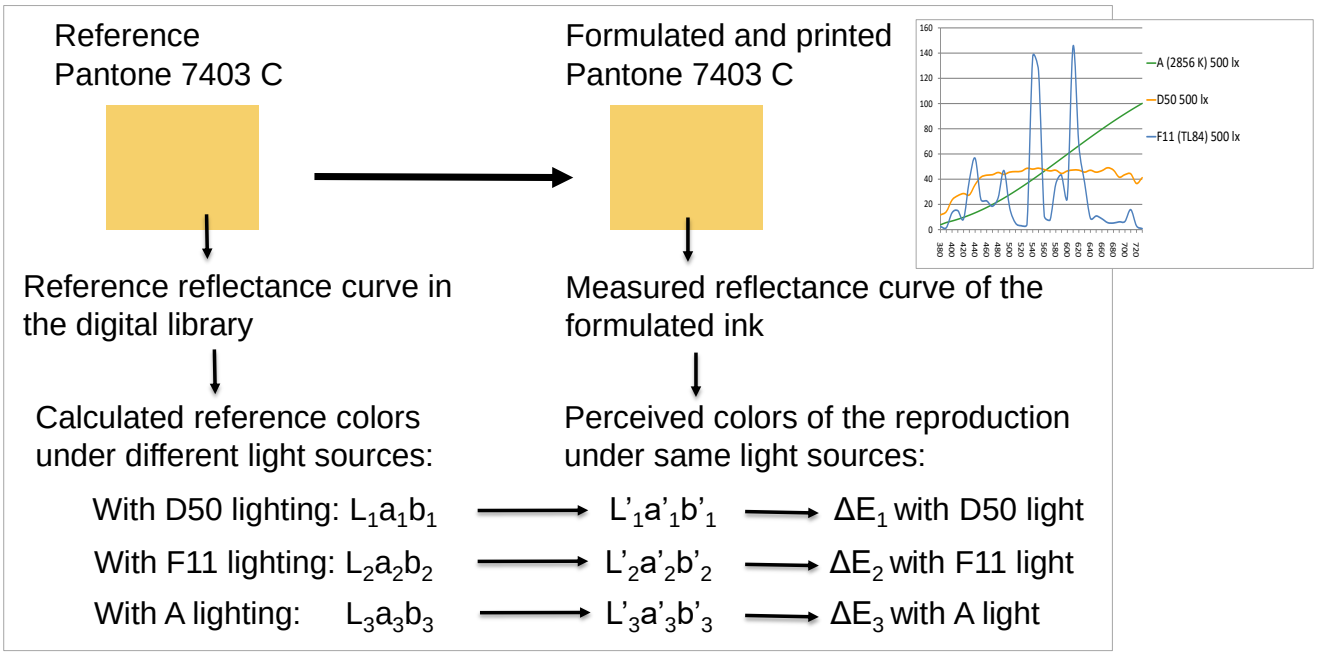
The 7403 C will be OK if well formulated and printed at the right density. In this case the reflectance curve measured on the spot color will be very close to its reflectance curve in the reference digital library.

This color reproduction is said "**non-metameric**", i.e., insensitive to the lighting: Under these conditions the apparent colors of the reference spot color and its printed reproduction will remain very close regardless of the lighting used:



Because the reflectance curves of the reference spot color and its printed reproduction will always be slightly different (nothing is perfect), a pragmatic and effective quality control consists into checking that these slight reflectance differences do not cause too large visual deviations between the reference ink and its reproduction, whichever lighting is used.

For this purpose, the three arbitrary light sources **A** (incandescent bulbs), **D50** (5004 K daylight) and **F11** (TL84 fluorescence) are often chosen, because they have very different light emission spectra that do cause significant metamerism when the ink is poorly formulated:



COLORSOURCE

SPOT_Color_Manager for optimizing PANTONE inks densities on printing presses and for controlling printed PANTONE inks:

For checking PANTONE or else special inks EVEN BEFORE installing them on a press, Colorsource has developed **SPOT_Color_Manager** software application.

Operating principles for checking special inks:

For any special ink, **SPOT_Color_Manager** is using:

1. The spectral measurement (in self-backing mode) of the paper that will be printed,
2. The spectral measurement of the solid special ink to be tested, measured at any density on this paper,
3. The reference spectral measurement of this ink in the reference ink's library.

From these three spectral measurements, **SPOT_Color_Manager** computes and displays:

a. The **optimal printing density** and **density correction** that will allow the special ink to print with the apparent color as close as possible to its reference color in **D50** lighting, and the ΔE2000 (or else) visual distance that will be achieved when using this optimal density. If the remaining visual discrepancy is predicted to keep too important, it means the ink formulation is bad: Do not use it on the press.

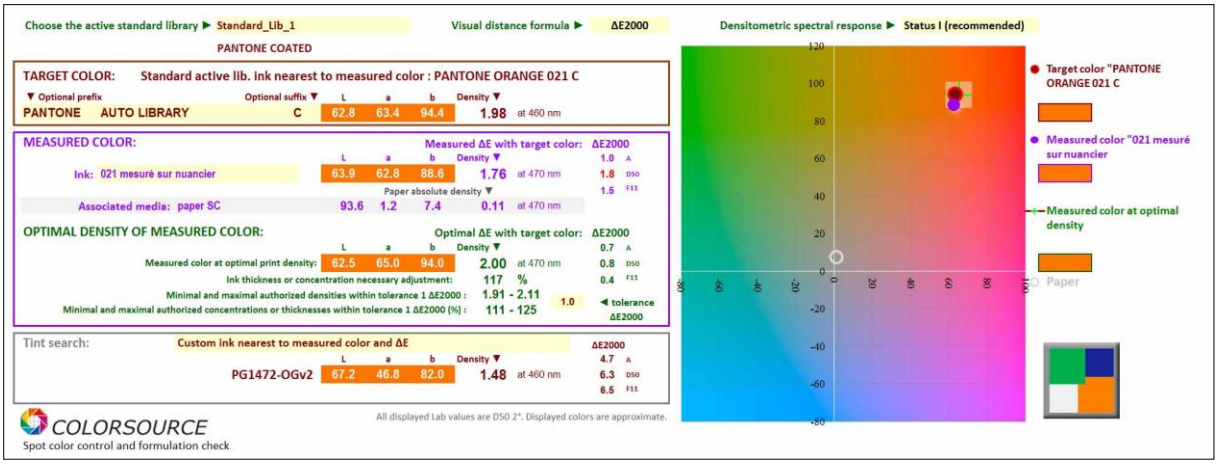
b. The **ink's thickness correction that will allow reaching the optimal density**, for offset printers. If it is necessary to increase too much the ink thickness, it may mean that the pigment concentration of the formulated ink is too low.

c. The **ink pigment concentration's correction that will allow reaching the optimal density**, for rotogravure printers.

d. The **ΔE2000** (or else) **visual deviation which will be achieved at optimal density** in **A** lighting (incandescent bulb). If this visual discrepancy is too important, it means the ink formulation is bad: Do not use it on the press.

e. The **ΔE2000** (or else) **visual deviation which will be achieved at optimum density** in **F11** illumination. If this visual discrepancy is too important, it means the ink formulation is bad: Do not use it on the press.

Example: Checking the formulation of a PANTONE Orange 021 C measured on a commercial swatch book:



SPOT_Color_Manager displays above:

1. The measured ink **C.I.E. Lab D50 2°** apparent color and its paper relative print density (**1.76** above),
2. The ΔE2000 (or else) visual distances between the measured and reference, under **D50**, **A** and **F11** illuminants (i.e., **1.0**, **1.8** and **1.5** ΔE2000 on above example), for checking the measured ink formulation quality controlling its metamerism.
3. The measured ink **optimal print density** (i.e., **2.00** on above example) that ensures getting minimal ΔE2000 visual distance from the reference color under D50 lighting; and the minimal and maximal allowed print densities for within a freely chosen **ΔE** tolerance (i.e., **1.91** to **2.11 D** on above example for **1.0** ΔE2000 chosen tolerance),
4. The requested **pigment concentration correction** if you do not want or cannot play on the measured ink's thickness for correcting the print density (e.g., **117%** i.e., **x 1.17** on above example),
5. The **minimal and maximal allowed pigment concentration** if you do not want or cannot play on the measured ink thickness for correcting the print density (i.e., **111%** to **125%** on above example for **1.0** ΔE2000 chosen tolerance),
6. The measured ink minimal visual distances under **D50**, **A** and **F11** illuminants when printing the ink at recommended optimal print density (i.e., **0.7**, **0.8** and **0.4** ΔE2000 on above example).

How to get your PANTONE spectral reference libraries for free:

Proper use of special inks requires that each involved actor reliably knows the spectral reflectance of any PANTONE reference involved in a graphic production process.

a. The **Designer** must be able to check the color he perceives on his swatch book is compliant. He must therefore know at least the Lab color of this swatch in **D50** lighting. And even better its reference reflectance curve, if he needs checking on his monitor the apparent colors of this PANTONE reference under different lightings, for Packaging applications,

b. The **printer** or his **ink's provider** must know each PANTONE reference spectral reflectance and that of the paper that will be printed, for formulating each ink properly,

c. The **printer** must know each PANTONE reference spectral reflectance, for calculating each optimal print density and checking the metamerism between each formulated ink and its reference,

d. The **customer** or his **agent** must be able to check the final quality of the work performed by the printer.

In practice, each PANTONE reference spectral reflectance is the only interesting information* that **PANTONE** can provide, since all other data are derived from it:

i. The apparent color under any arbitrary lighting (and therefore the sensitivity of apparent color to lighting changes),

ii. The RGB value to be addressed to any monitor for displaying this apparent color via the monitor's I.C.C. profile, and displaying visual alert for colors outside the monitor's color gamut,

iii. The RGB, CMYK or N-CLR values to be addressed to any digital printer or press for best simulation of this apparent color via the I.C.C. profile of the printer, and displaying a visual alert for colors outside the printer's color gamut,

(*) Plus, possibly, the spectral reflectance of the paper or other medium for which they are specified ...

Brief history of PANTONE colors in graphic industries:

With the advent of modern universal, efficient and inexpensive color management tools in 1995:

PANTONE commercial and technical offer became rather uninteresting, and even detrimental to quality in the Graphic Industries. Indeed, **PANTONE** do not own the colors they publish, nor their spectral reflectance curves, but only the arbitrary name they assign to each tint. However, **PANTONE** claimed to bring a guarantee of quality to Graphic Industries for the reproduction of spot colors, but did not provide at the time any reliable technical information on the published colors, nor did verify or guarantee the quality of the derived **PANTONE** licenses offered by their many licensees:

- The color swatches printed on the commercial **PANTONE** swatch books depended on each printed copy, (This has not changed), but users had, at the time, no way to check these colors,
- Different ink formulation software on the market did not use the same reference PANTONE spectral reflectance, leading to the formulation of different hues for the same PANTONE reference. Was this reference data only published by **PANTONE**? **GretagMacbeth**, who at the time provided the best ink formulation software, had great difficulty in obtaining reliable technical data from **PANTONE**.

In addition, each desktop publishing software user indirectly paid the same **PANTONE** license for each one of his DTP applications: **Quark XPress**, **Adobe Photoshop**, **Adobe Illustrator** etc. But here again, **PANTONE** was content to collect their royalties without carrying out any serious quality control:

- The same PANTONE reference generally had different C.I.E. Lab colors in each **PANTONE** licensed DTP application (When these applications were able to use Lab values...)
- The same PANTONE reference received different RGB equivalents and different CMYK equivalents in each **PANTONE** licensed DTP application, these values being very fanciful.

As a result, a same page could then contain the same PANTONE reference in several locations with very different Lab, RGB or CMYK equivalents depending on its origin before it was imported into the page... This produced in the same page and for the same PANTONE reference, different colors on the final digital or traditional CMYK print.

The "**PANTONE Certified**" PostScript RIPs (one more **PANTONE** license...) were supposed to correct this problem: When printing, in order to ignore the various Lab, CMYK or RGB values assigned to the same PANTONE color by each "**PANTONE certified**" DTP application, the "**PANTONE certified**" PostScript RIP assigned to each named tint detected in the page, a same value, independent of all the fanciful Lab or CMYK or RGB values associated in the page with that name.
But despite everything, the "PANTONE certified" RIPs, if they did unify the colors of a same **PANTONE** reference in a document, very often printed … a same **wrong** color 😉

As a result, because of the lack of seriousness of "PANTONE certifications" at the time, relayed by DTP software under PANTONE license (XPress, Adobe, ESKO...) and by "PANTONE certified" PostScript Rip's marketing, we had much more quality problems for printing a solid spot color than a CMYK screened tone on a well-calibrated printer or press!

As usual in Graphic Industries, there was a lot of talks about "Quality" and "Certifications", but all this was just a vast smokescreen!

The excellent solution proposed by GretagMacbeth in 2002: Kill PANTONE!

In year 2000, **PANTONE** found a way to significantly change the spectral reflectance of many common references, resulting in very large visual deviations, and this without even informing their customers. Of course, modifying these tints would have required creating new PANTONE specific references, in order to avoid any confusion.

But PANTONE allowed themselves changing many colors without creating new references, so that we could no longer know if a **PANTONE** reference referred to the colors specified before or after year 2000!

Exasperated by this complete lack of rigor and by the smokescreen cleverly maintained by **PANTONE** in terms of technical specifications, which was a constant source of production problems – and which also forced the end users to constantly buy new swatch books without having any way to control them – **GretagMacbeth** proposed to the graphic industries the following excellent solution:

1. A freeware **available for Mac and PC** (**i1Share** application) would allow any actor in the graphic process to create, transmit, receive and use color palettes in a universal and royalty-free spectral format (The **CxF** format, for **Color eXchange Format**), allowing to encode all public or private color palettes with the spectral values necessary for their formulation.
    - These spectral palettes could mix PANTONE and/or private named colors obtained by measuring samples in nature (color sampling), or by other creative means,
    - The classic graphic art PANTONE libraries were available free of charge for all users of **i1Pro** spectrophotometer, and costed about 50 €uros for other users of **i1Share** freeware.
    - The PANTONE reference spectral values supplied by **GretagMacbeth** were perfectly consistent with all their measuring instruments, and usable directly by their excellent ink formulation software, and consistent with the no-less excellent **ProfileMaker** Packaging application allowing reliable and fast desktop publishing using one to ten primary inks with or without CMYK base.
    - The apparent colors of all swatch books (in standard **D50 lighting**) could be exported free of charge to all standard DTP applications of graphic industries. (If necessary, via a freely chosen I.C.C. profile, if the application yet did not understand Lab colors),
    - **CxF** format tint palettes could also easily be saved in **CGATS** text format via by exporting their names and associated spectral reflectance in **Excel** format.
    - Spectral color palettes coded in CGATS files format could also be converted to **CxF** using **ProfileMaker**'s **MeasureTool** module.
2. A **free SDK** (Software Development Kit) available for **Mac** and **PC** allowed all software manufacturers such as **Adobe**, **ESKO**, **Quark**, **Freehand**, **Corel**, **Microsoft**, **Apple**, **PostScript RIP manufacturers**...) to easily import all color palettes in **CxF** format in their applications - with low development costs -, and also save their own color palettes into **CxF** format.
   And **CxF** format being based on XML, it would moreover be easily extensible, while maintaining backward compatibility with any existing application. (By the way this would also allow **Adobe** to finally become consistent on PANTONE swatch books within their own software applications...)

A Road Show was then organized in Europe and the United States, for convincing the major suppliers and contractors of the market to adopt this reliable, open and universal industrial solution finally ensuring error-free communication of graphic charters.

But the major suppliers (the same ones who had claimed to provide open solutions against the proprietary repro solutions!), were careful not to do anything: It was better for them keeping a captive clientele, ... and therefore as little informed as possible.

As for the Clients, they remind me of what my grandmother, born in the 19th century, often said: You can't make a donkey drink when he is not thirsty!

The right way to work with spot colors:

Fortunately, even if nothing was done by Suppliers to simplify the work of users through the direct use of color palettes and graphic charts in an open and universal spectral format, any properly trained professional could long ago work properly at all stages of graphic production process, thanks to standard and inexpensive I.C.C. color management tools:

- Free **i1Share** software (and even **ColorShop** software since 1995) allows any Designer to control his lighting, and check the apparent **D50** color of any PANTONE reference present on his swatch book. Anyway, every Designer needs a spectrophotometer, at least for calibrating his monitors, check lightings, and measure his own color samples for creating his own original spot colors.

- It is easy to manually enter the name of any PANTONE or else spot color into DTP applications, and associate it with the **D50 2°** Lab color calculated from its spectral reference values, which is displayed by many free applications, including **i1Share**.

- **ColorPicker** module of **ProfileMaker** software, even without a dongle, has long made it possible to calculate the best CMYK or N-Color equivalent of any spot color, even when this spot color is not printable: In this case **ColorPicker** calculates the CMYK or N-Color value ensuring the simulation of the PANTONE color with the smallest possible visual distance.

- With **ColorPicker** license, you can automate this process for libraries of several thousand spot colors (in spectral or colorimetric **CGATS** or **CxF v1** format), and export a text file listing the name of each color and its best possible CMYK or N-Color equivalent.
  And many PostScript RIPs already knew how to import and use this text file for optimizing the simulation of any named color present in the documents to be printed. This type of function is essential on any PostScript RIP, because any public or private spot color must be programmable into the RIP. Some modern PostScript RIPs emulate the **ColorPicker** algorithm which allows them to automatically calculate, from a single reference color or spectrum associated to each named color, the best CMYK or N-Color equivalent of this spot color, by using the I.C.C. profile associated with the paper being used.

- Finally, for printing and controlling properly a PANTONE or else special ink on a printing press, **SPOT_Color_Manager** application allows to do the job using a simple **i1Pro** spectrophotometer, even before installing the ink on the press (Calculation of the ink's optimal printing density, and visual distances under **D50** lighting, **A** and **F11**, for control of metamerism).

  Colorsource had developed **SPOT_Color_Manager** application, because the only other valid solution existing at the time on the market was **GretagMacbeth SpectroEye** pressroom spectrophotometer with its PANTONE optional libraries. **SpectroEye** was an excellent solution ... but quite expensive, and unsuitable for fast press calibration charts measurement. Whereas a simple and inexpensive **i1Pro** connected to a PC with the appropriate software applications, did solve all the problems of any print house in a more productive way.
  SPOT_Color_Manager with **i1Pro**, **i1Pro 2** or **i1Pro 3** remains today a much cheaper solution than pressroom spectrophotometers.

In conclusion of this paragraph, it should be stressed, once again, that a well-trained user has always been able to obtain excellent results at the lowest cost, while poorly trained users, who too often rely on bogus "certifications", always had, and will always have, problems.

Convenient retrieval of up-to-date PANTONE reference spectral libraries:

Using the PANTONE spectral libraries published by GretagMacbeth

For a long time, the most reliable PANTONE spectral libraries were provided by **GretagMacbeth**, which at the time also provided the best ink formulation software.

In this regard, I remember a training course I carried out end 2006 for a French agri-food company that had beautiful packaging printed in rotogravure in France, United States, Canada and Japan.

One of their concerns with their service providers was that the same PANTONE reference of each package was printed with completely different colors in the different countries. They would easily have obtained better results by printing flat CMYK screened tones!

Actually, the only packaging produced correctly were those made in Japan, with PANTONE solid colors very well simulated on the color proofs, and then perfectly formulated and printed without metamerism.

The Japanese suppliers were, which we verified by many measurements, the only ones to use, not swatch books or else poorly printed color samples, but the spectral reference measurements published by **GretagMacbeth**, quite consistent with all their color management tools and pressroom spectrophotometers.

The obvious solution was to communicate to all repro houses and printers involved in each country, no longer PANTONE references or perishable and imperfect printed samples, but the appropriate digital graphic charters in **CxF** format. My industrial customers also bought the necessary tools to be able to check by themselves all the packaging batches upon receipt. This was much better than getting smoked!

PANTONE reference spectral libraries after the sale of GretagMacbeth to X-Rite:

After the sale of **GretagMacbeth** to X-Rite - by its main shareholder who wanted to take a well-deserved golden retirement at over 75 years old - **X-Rite** released a new version of the **CxF** format (**CxF v3**) which was no longer royalty-free, and incompatible with the original royalty-free **CxF** format.

The PANTONE spectral libraries and associated ink formulation software were taken over by **X-Rite** to replace their existing products. These PANTONE spectral reference libraries for formulation could be downloaded easily and free of charge from the **X-Rite** website in **CxF v3** format.

Colorsource therefore published the free **CxFv3_to_CGATS** utility that allowed any user to convert the **CxF v3** format to more classic and universal **CGATS** text format, which has the merit of being compatible with many color management applications of major practical interest.

This free **CxFv3_to_CGATS** utility, for opening and converting **CxF v3** color palettes to **CGATS** text format, is now replaced by our free **Magic_Proof_&_Print_Control** application dedicated to check color proofs of all kinds, and also allows everyone using **CxF** format (**CxF v3**) color libraries.

PANTONE reference spectral libraries after the acquisition of PANTONE by X-Rite:

X-Rite then bought **PANTONE** (What's the point of killing a goose that lays the golden eggs!), and released a new software that was both inexpensive and convenient for all users: the **PANTONE Color Manager** application.

Although offering significantly poorer features than **i1Share** freeware, **PANTONE Color Manager** offers the advantage of making up-to-date PANTONE libraries available to all players in the graphics industries.

Thanks to **PANTONE Color Manager**, each PANTONE spectral library can be easily downloaded, updated and/or supplemented on the internet, and exported in **CxF v3** format, which is easy to open and export in **CGATS** text format using free Colorsource software, in order to be able to use it with a very wide range of third-party software.

- **PANTONE Color Manager** can be used free of charge in demonstration for 30 days,
- The connection to the PC of an **i1Pro** family spectrophotometer validates the use of **PANTONE Color Manager** even after the expiry of the 30 days trial,
- **PANTONE Color Manager** license was also offered at low cost to the few professionals who did not have an **i1Pro** or **i1Pro 2** spectrophotometer somewhere.

PANTONE reference spectral libraries since November 2022:

Any truly professional user has long been able to create (or recreate) all their PANTONE (or else) spot colors in their DTP applications and PostScript RIPs, by replacing the original fancy values with reliable values directly from the PANTONE reference libraries used for the ink formulation downstream.

But apparently **PANTONE** have decided since end 2022 to sell us this data. (Not even sell us: rent you all years along?)

And to rent you PANTONE reference data apparently ... Very incomplete, since basic subscriptions offer libraries in colorimetric form, and not in their spectral form which is essential for serious quality control, or for simulation of their apparent colors depending on the lighting environment!

And apparently, it becomes a little difficult for users to find **PANTONE Color Manager** demo software, on **PANTONE** or **X-Rite** websites.

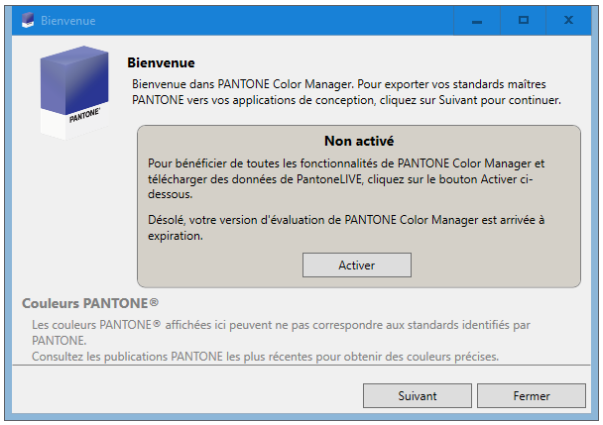
That's why Colorsource makes it available to you on its software download page. Of course, all qualified **i1Pro**, **i1Pro 2** and **i1Pro 3** users should be able to continue using their **PANTONE Color Manager** license to update their **PANTONE** libraries on the internet, as they have always done!

Convenient use of PANTONE Color Manager application for retrieving and updating your reference PANTONE spectral libraries:

Install **PANTONE Color Manager** software (**demo version v.2.4.0.76** on the Colorsource website),

Install **i1Profiler** application (That will receive all PANTONE spectral library exports in **CxF v3** format),

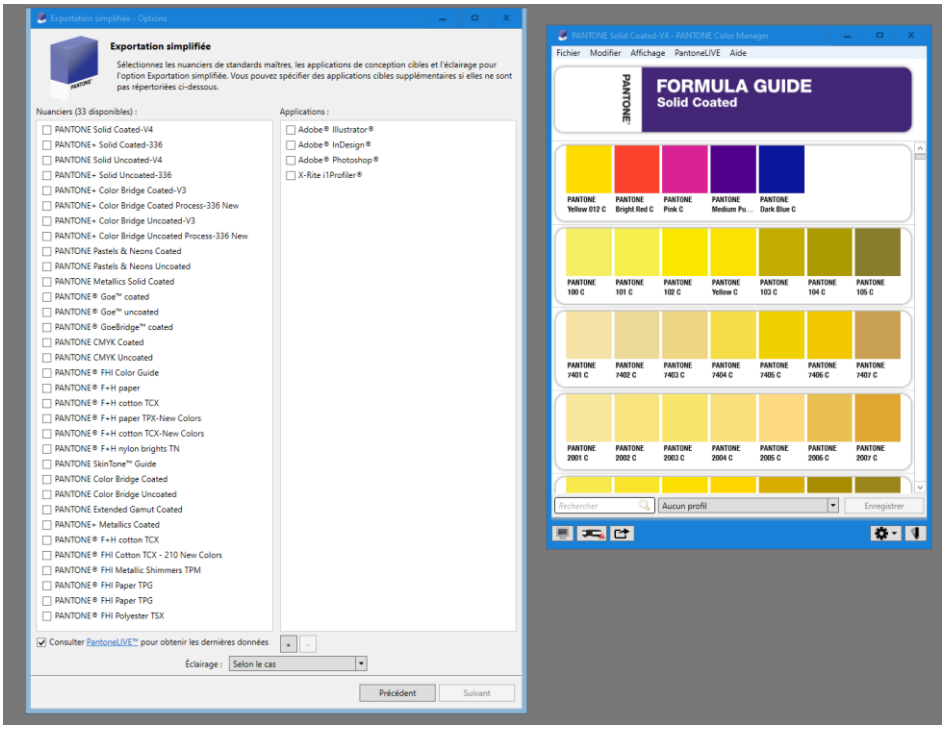
Launch **PANTONE Color Manager** software:



If **PANTONE Color Manager** has never been installed on your PC, it offers launching in 30 days demo mode.

Otherwise, click **Activate**: The software offers you to enter your alphanumeric operating key, if you own it, and looks as well for the presence of an original **i1Pro**, **i1Pro 2** or **i1Pro 3** connected via USB to your PC, which will always activate your software in the absence of any operating key.

Once your **i1Pro** is detected, **PANTONE Color Manager** typically displays two windows as follows:



The **Simplified Export** window (above left) can be closed and can be re-displayed at any time using the **File/Simplified Export**... menu of the **main window** (above right).

This **Simplified Export** window allows you to select part or all of the up-to-date PANTONE libraries, and export them to **Illustrator**, **Photoshop**, and **InDesign** in .**acb** format (Adobe Color Book), so that the correct C.I.E. Lab color is assigned to each PANTONE reference when you open one of these exported swatch books in each of these applications.

Of course, choose here **Lighting**: **D50 2°** since any C.I.E. Lab color in any classic I.C.C. compatible DTP application is implicitly a **D50 2°** apparent color, according to I.C.C. standard specifications.

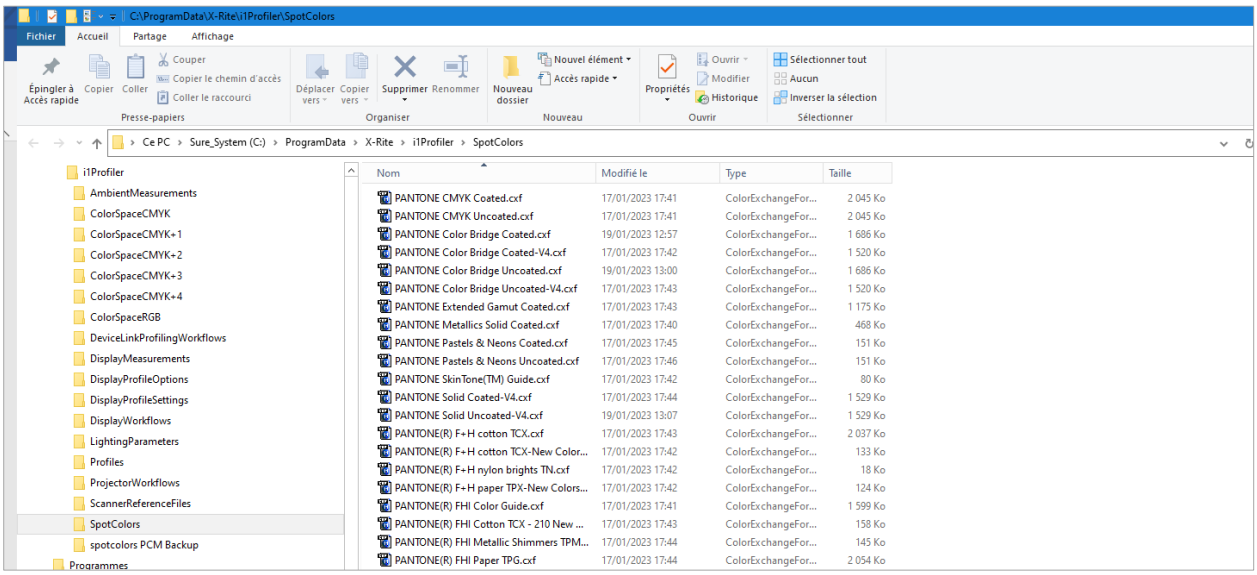
The **Simplified Export** window also offers exporting of all or part of the updated PANTONE libraries to **i1Profiler** software in **CxF** (**CxF v3**) format and in spectral form; and this is THE specification of interest for any Professional who needs printing or controlling a PANTONE swatch on a commercial print or on a swatch book.

However, this function for fast and automated export of all PANTONE libraries seems to no longer work to date (Tested with Windows 10 64-bit in February 2023).
But don't worry: you can still update and export all PANTONE spectral libraries one by one (as with older versions of **PANTONE Color Manager**), by following these steps:

1. Choose the first swatch book: **View/Swatch book/PANTONE/PANTONE+ Solid Coated-V4**,
2. Export this swatch book to **i1Profiler**: **File/Export/X-Rite i1Profiler**,
3. Then choose following swatch book: **Ctrl + Shift + Right** or **View/Swatch book/PANTONE/PANTONE+ Solid Coated-336**,
4. Export this swatch book to **i1Profiler**: **File/Export/X-Rite i1Profiler**... Etc.

If a PANTONE swatch book chosen from the list is obsolete, **PANTONE Color Manager** let you know, and does not allow exporting it in any form.

You can successively export all your updated **PANTONE** swatch books in **CxF v3** format from **PANTONE Color Manager** to **i1Profiler**'s **SpotColors** folder:



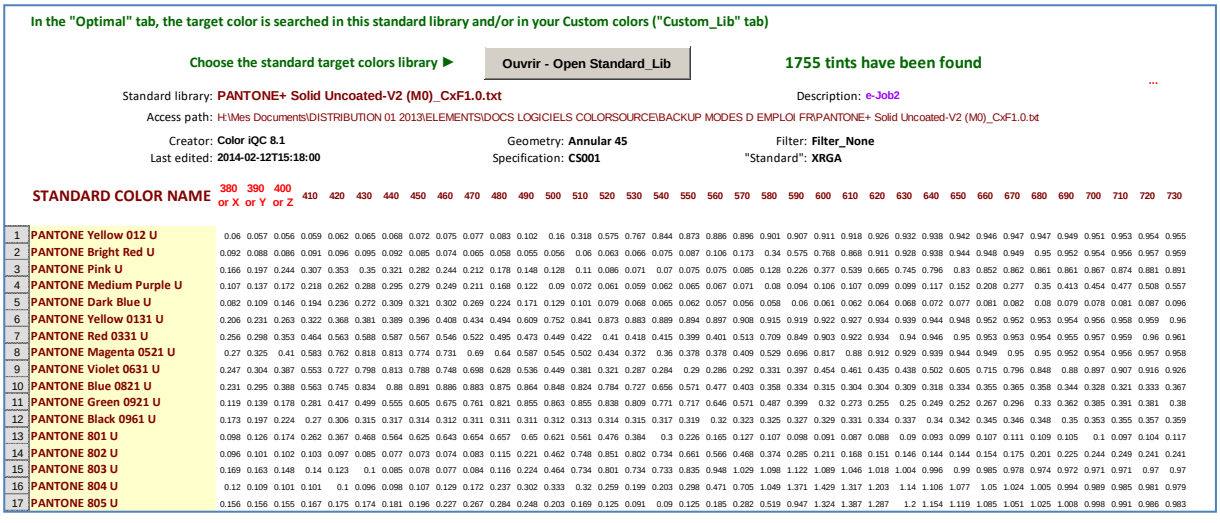
As for all **i1Profiler** work folders, **SpotColors** folder is located in a hidden Windows folder: For accessing it by navigating in Windows Explorer, see, if necessary, our manual at following link:
https://www.iso12647solution.com/Applications_downloads/How_to_measure_your_color_proofs_and_press_control_bars_with_i1Pro,_i1Pro_2_or_i1Pro_3.pdf

You can also directly open **i1Profiler** spectral libraries' **folder** by clicking the following link in this PDF:
C:\ProgramData\X-Rite\i1Profiler\SpotColors

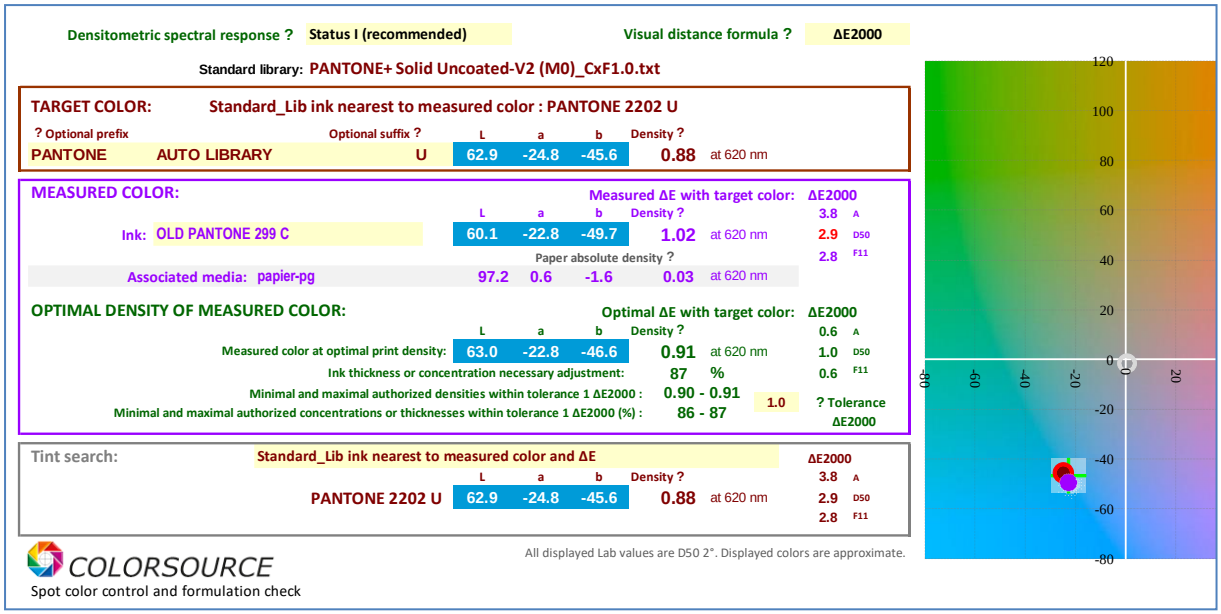
A few convenient uses of CGATS reference ink's libraries:

Using CGATS spectral libraries with Colorsource SPOT_Color_Manager application:

Any **PANTONE** library in **CxF v3** format converted to **CGATS** format using our free **Magic_Proof_&_Print_Control** application, can be opened by **SPOT_Color_Manager** as a standard aim spectra's library.
By the way, we will probably release in 2023 an upgraded version of **SPOT_Color_Manager** opening directly the **CxF v3** format inks libraries.

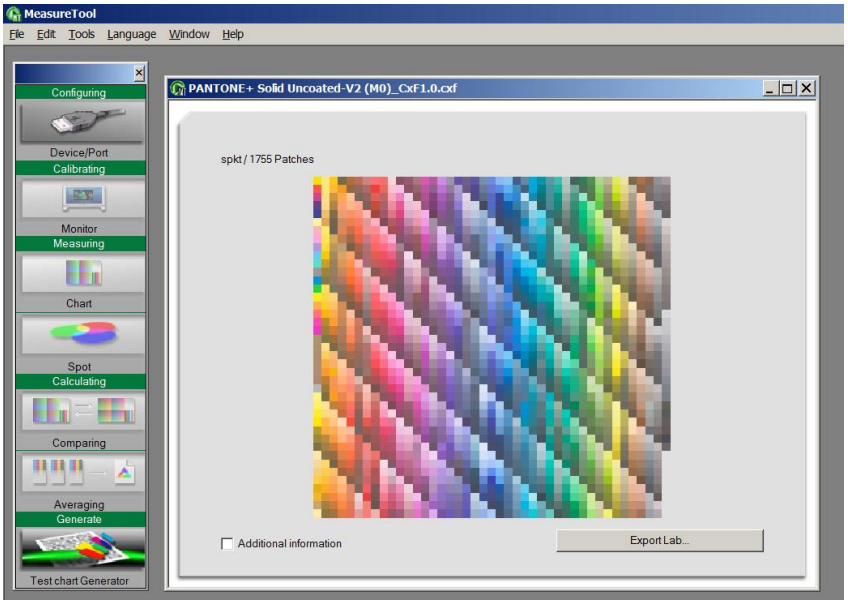


E.g., controlling PANTONE 2202 U measured swatch:



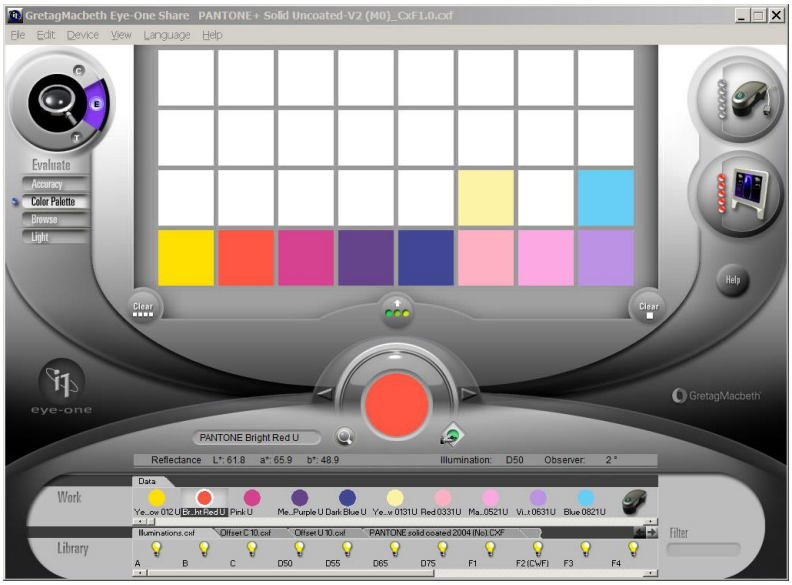
Using CGATS format ink's libraries with ProfileMaker's MeasureTool Module:

Any PANTONE or else spectral library in **CGATS** text format can be dragged and dropped onto **MeasureTool** main window:



If you own a **ProfileMaker** license, you can save to **CxF v1.0** format compatible with the excellent **i1Share** freeware: Make **File /Save As**... and then choose Color Exchange Format as the file type (. **CxF**)

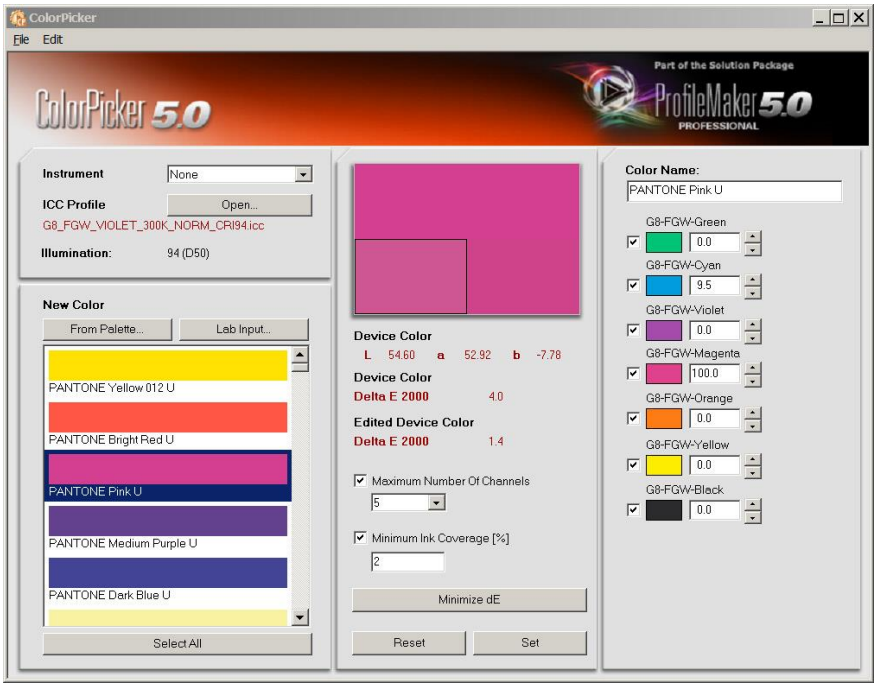
For example, from modern 2023 **PANTONE Solid Coated-V4.cxf** file in **CxF v3** format, converted to **CGATS** format **PANTONE Solid Coated-V4.txt** using free **Magic_Proof_&_Print_Control** application, you save a **PANTONE Solid Coated-V4_CxFv1.CxF** file, which can be opened with **i1Share**.



You can also install your PANTONE 2023 libraries in the appropriate **i1Share** installation subfolder, at the room of the old PANTONE 2004 libraries, so that you can automatically search for the PANTONE references closest to any measured tint.

Using CGATS format ink's libraries with ProfileMaker's ColorPicker Module:

ColorPicker allows you displaying the best CMYK or N-Color equivalent of any modern PANTONE or else spot color: Drag and drop directly onto **ColorPicker** color palette area any PANTONE or else spectral library, after you have converted it to CGATS text format (You could also drag and drop a CxFv1 format file):



Normally, a same PANTONE reference should never have its spectral reflectance changed over time, but it turns out that in practice some PANTONE tints ... have historically kept the same name with changing spectral reflectance.

An exercise for you: Check the color changes between **i1Share** 2004 libraries in **CxF v1.0** format and the modern **CxF v3** libraries.

COLORSOURCE

Pending production issues in 2023 with PANTONE and else spot colors:

While it has long been possible to display and print accurately the apparent color of any solid PANTONE or else spot color, it remains almost impossible (in 2023!) to display or print accurately a simple vignette of that tint to the paper white, or to anticipate the superimposition of this tint on another spot color or CMYK screened tone.

Indeed, the colors of a vignette screened by steps of 10% depend considerably on the printing technology (Offset, gravure, Flexo ...), the dithering, the paper, the ink 's viscosity, etc.

So that the only rational and productive way for making reliable color separations, soft proofs and hard proofs, with one or more special inks, with or without CMYK base, still remains today to:

1. Make a calibration print run on the press with the N inks, in order to optimize and specify a valid N-Colors printing standard (Aims C.I.E. Lab colors of the solid inks, spectral reflectance of each ink under these conditions, TVI curve of each ink, colors of the overlays etc.),
2. Save and publish this N-Colors printing standard,
3. Make a N-Colors I.C.C. profile of the press calibrated according to this print standard,
4. Use this N-Colors I.C.C. profile upstream with DTP applications for producing the color separations and the according soft and hard proofs.

And all this was achievable in excellent conditions ... **20 years ago**:

- **ProfileMaker** software **Packaging** version allowed minimizing the cost of the press calibration print runs, by avoiding making a new calibration run when changing a special ink reference,
- **Photoshop** plug-ins made by **GretagMacbeth** allowed using the N-Colors I.C.C. profiles (one to ten inks) for making excellent color separations, and then compute soft and hard color proofs from these N-Colors separations.
  These plug-ins were due to be only a temporary solution, until all classic DTP applications of the market would offer using not only the RGB and CMYK I.C.C. profiles, but also the N-Colors I.C.C. profiles.

What about 20 years later?

- **ProfileMaker** software was no longer developed by **X-Rite** after the acquisition of **GretagMacbeth**. It has been replaced by **i1Profiler** software.
  i1Profiler is far less flexible to use: it is much more designed for digital printing than for printing presses.
  And as far as we know, **ProfileMaker** is not even sold anymore.
- **Photoshop** plug-ins for easy and reliable desktop publishing upstream N-Colors presses using the market standard desktop publishing applications, have also disappeared.
  And as far as we know, NONE of the classic desktop publishing applications today can use I.C.C. profiles other than RGB and CMYK!
  For example, the display of a 7 layers colors separation with Photoshop is still awful, because Photoshop cannot use a press 7-colors I.C.C. profile for soft proofing.

  All this when, for example, even the standard **Windows XP CMS** and the royalty-free **Little CMS** (I.C.C. engines for software developers), can perfectly use N-Colors I.C.C. profiles!

  Actually, for developing a desktop publishing application that can use CMYK I.C.C. profiles and cannot use N-Color profiles I.C.C., you have to do it on purpose!

So, everything happened as if your desktop publishing solution providers had shared the market:

- To **Adobe**, the desktop publishing market of four-color CMYK editing, with a few accompanying colors, if necessary,
- To **Esko**, (belonging to the same American group as X-Rite and PANTONE ...) the desktop publishing solutions intended for packaging, which to our knowledge do not and cannot not even use the standard N-Colors I.C.C. profiles!
  So that the clients we have audited often discover their polychrome color separations ... when printing them on their press, because they cannot trust their color proofs. Which is quite often far too late...

So, we believe there was no real progress in color management field for the last twenty years, and we even found a significant regression in the quality of the production tools available to users.

ONLY in Graphic Industries you can see technology and progress walking backwards!

End users are now paying all year long for software upgrades without any interest for quality and productivity. And they often have no choice but buy and pay for these useless upgrades, when they don't have to rent these poor solutions year-round.

What are the trade associations doing to defend their interests against suppliers who are increasingly abusing their dominant position, without even offering decent solutions?

Some of them are just trying to sell you more certifications 😉

COLORSOURCE

Summary of applications to install on PC to work well with your PANTONE or else spot colors:

Colorsource Software Download Page
and X-Rite PANTONE Color Manager software in demo version:

https://www.iso12647solution.com/Downloads_and_links.htm

i1Profiler software: Receives PANTONE spectral libraries in **CxF v3** format, exported by **PANTONE Color Manager** software:

https://www.xrite.com/fr-fr/service-support/downloads/i/**i1Profiler**-i1publish_v3_3_0

Convenient and interesting auxiliary software:

ProfileMaker software whose **MeasureTool** and **ColorPicker** modules offer valuable functions, even in demonstration mode (without operating key):

https://www.xrite.com/service-support/downloads/P/ **ProfileMaker**_v5_0_10

i1Share Software:

https://www.xrite.com/service-support/downloads/I/i1Share_v1_4

Caution: For proper functioning of **i1Share** on modern Windows 64-bit versions, see the **Troubleshooting and frequently asked questions** section of **SPOT_Color_Manager** user's manual at link:

https://www.color-source.net/INSTALLEURS_US/SPOT_Color_Manager_users_guide.pdf

Magic_Proof_&_Print_Control **PLATE** **MagicPress** **MagicPrepress** **SPOT_Color_Manager**