Normalizing Print configurations

Press Ctrl + L for full screen display

COLORSOURCE

Normalizing Print configurations

1. A must for repeatable results
2. How to specify a print standard
3. The particular case of ISO12647 print standards
4. Method for matching an existing print standard
5. Method for creating a new print standard

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A must for repeatable results

Printing CMYK or N-Colors without a well specified, documented and recorded production print standard is impossible:

1. Impossible to print same colors on each press if the aim colors production standard is not properly specified,
2. Impossible to re-print later with same colors if the aim colors production standard is not properly specified.

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A must for repeatable results

Two main parameters for each ink:

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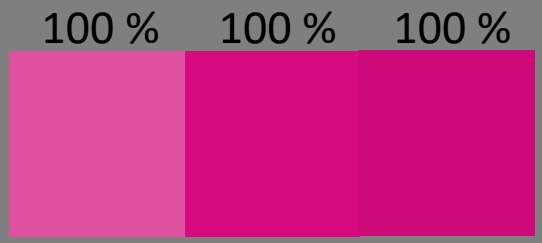
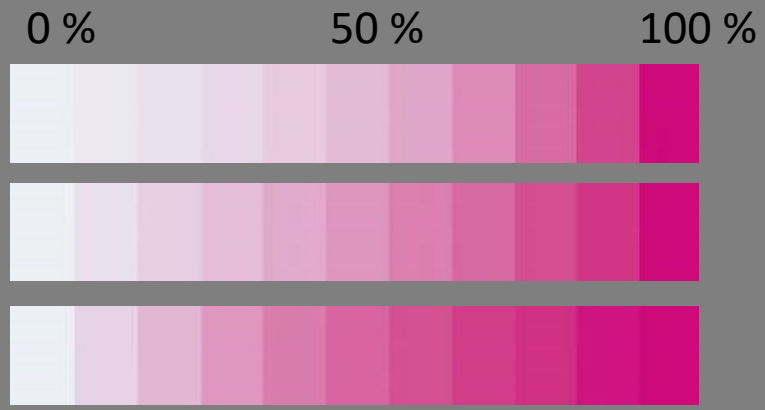
A must for repeatable results

Two main parameters for each ink:

1. Solid Lab color of each ink:



2. TVI curve of each ink from 0 to 100%:



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A must for repeatable results

Expanding to N inks print processes:

Solid inks colors AND their respective TVI curves,

are the main parameters determining the final print job colors.

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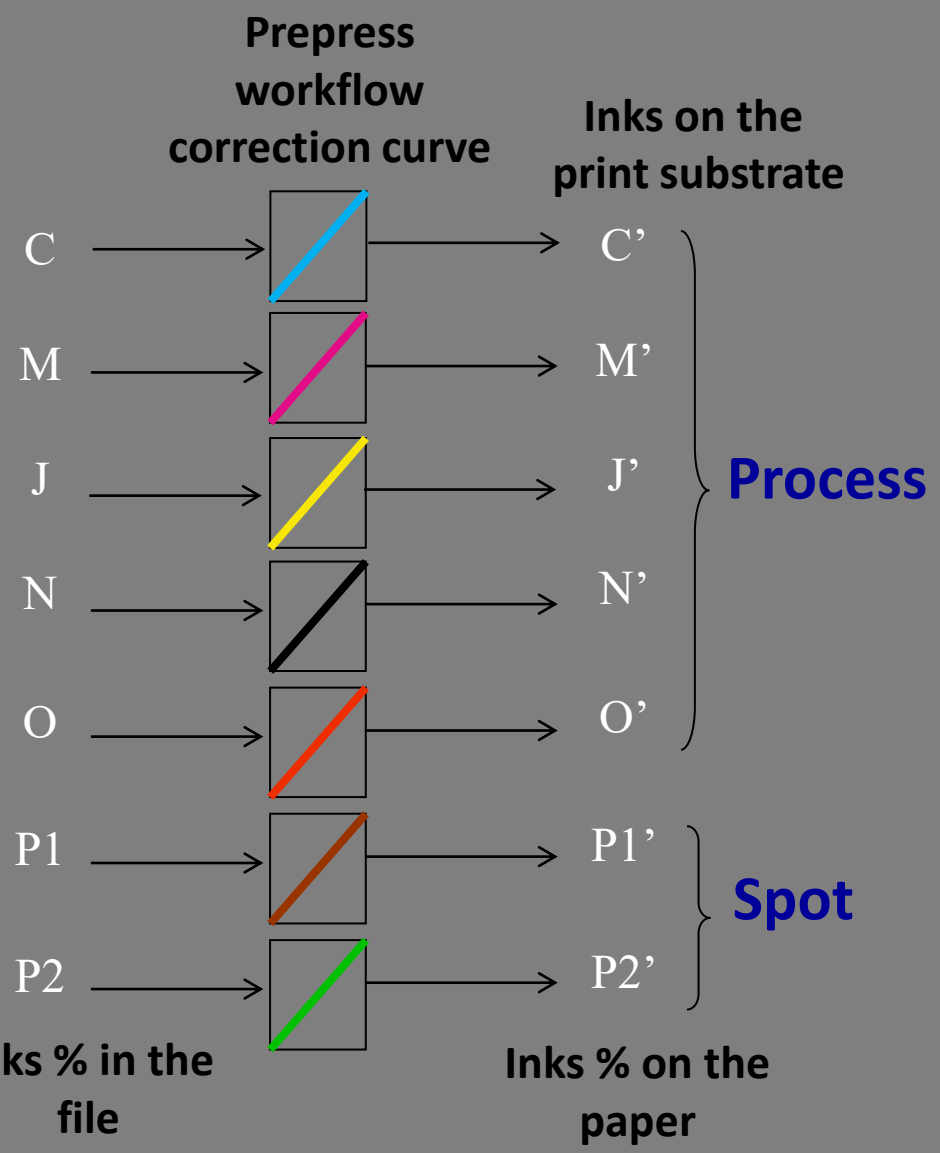
A must for repeatable results

Expanding to N inks:

File color separated over N inks (= P + S):

- **P « process colors »:**
E.g.: CMYK or CMYK + Orange, or C, P185, Y, Reflex Blue: Used for color separating the original images

- **S spot colors:**
Also named « special tints » or « named tints ».



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How to specify a print standard

1. Print technology (Offset, Gravure, Flexography etc.),
2. Type of print media and color of the print media,
3. Ink sequence order,
4. **C.I.E. Lab D50 2° solid color of each ink,**
5. Screening parameters (definition, angles, AM or FM.),
6. **TVI curve of each ink,**
7. For wet offset: C.I.E. lab D50 2° color of each inks superimposition of interest,
8. Acceptation tolerances for the job.

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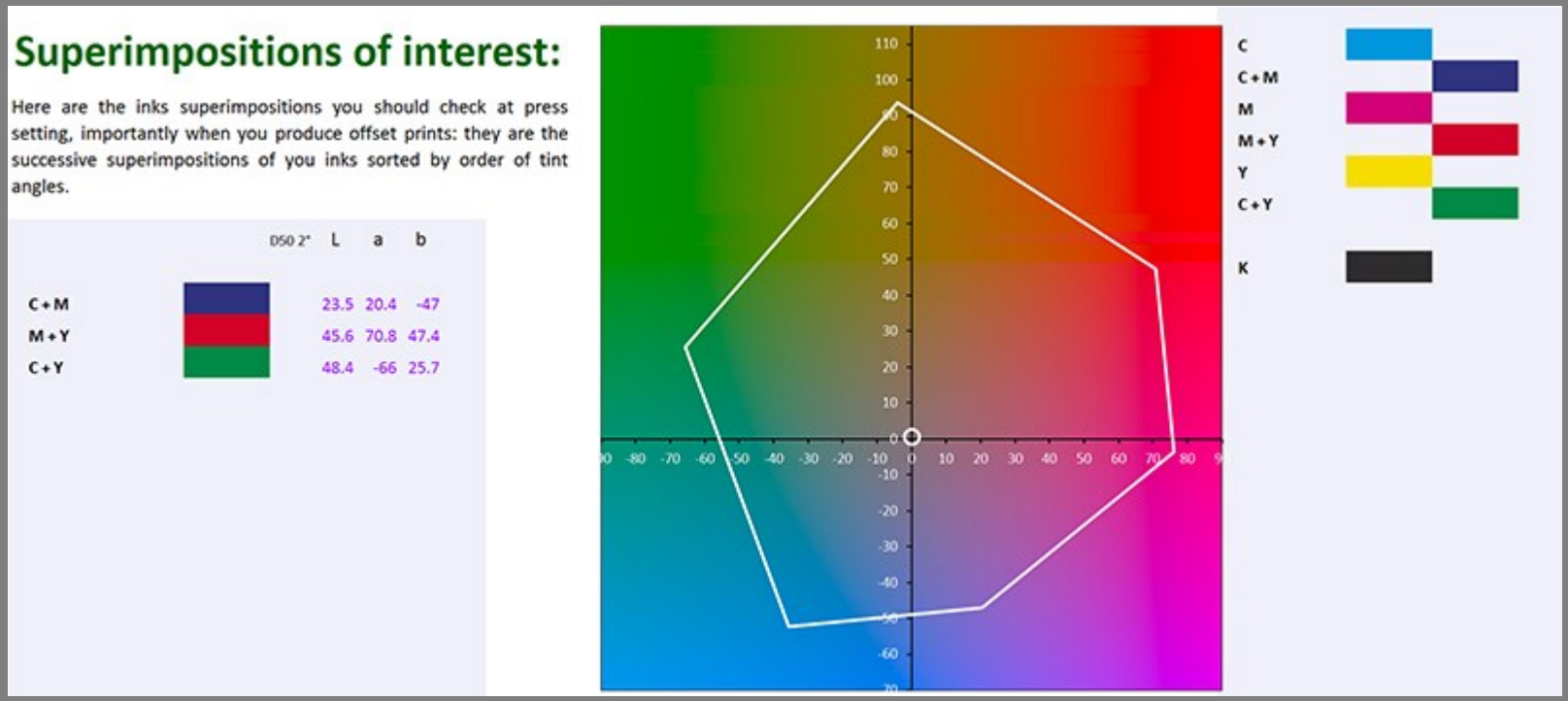
How to specify a print standard when economically possible

1. Print technology (Offset, Gravure, Flexography etc.),
2. Type of print media and ~~color~~ spectral reflectance of the print media,
3. Ink sequence order,
4. ~~C.I.E. Lab D50 2° solid color of each ink,~~ Spectral reflectance of each solid ink (e.g. Pantone),
5. Screening parameters,
6. TVI curve of each ink,
7. For wet offset: C.I.E. lab D50 2° color of each inks superimposition of interest,
8. Acceptation tolerances for the job.

COLORSOURCE

How to specify a print standard

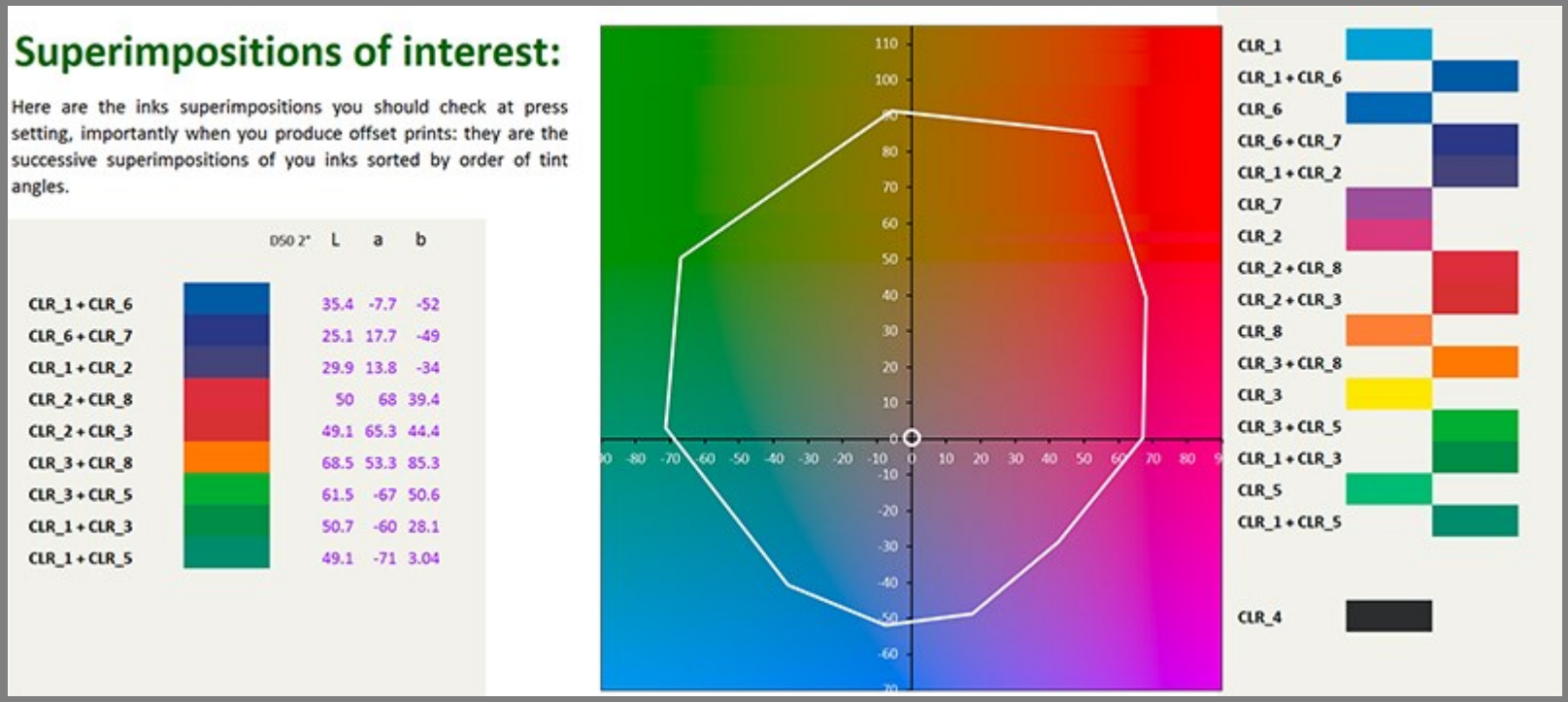
When printing wet offset, specifying the colors of the inks superimpositions is compulsory (Using greasy inks sometimes causes superimposition problems when printing)



COLORSOURCE

How to specify a print standard

When printing wet offset, specifying the colors of the inks superimpositions is compulsory (Using greasy inks sometimes causes superimposition problems when printing)



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The particular case of ISO12647 print standards

Because it is mandatory creating and documenting a print standard for producing any commercial print run, in order to insure getting the same colors at each reprint,

… it can be convenient everybody does use the same print standards for major traditional CMYK print configurations.

Hence the specification of the ISO12647-x standards for classical CMYK print technologies on mainstream print medias.

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The particular case of ISO12647 print standards

ISO 12647-2: Production of color separations and print works using CMYK Offset technology for publishing applications.

ISO 12647-3: Production of color separations and print works using CMYK Offset technology for newspapers printing.

ISO 12647-4: Production of color separations and print works using CMYK Gravure technology for publishing applications.

ISO 12647-5: Production of color separations and print works using CMYK Silk printing technology.

ISO 12647-6: Production of color separations and print works using CMYK Flexographic technology.

ISO 12647-7: Production and control of CMYK color proofs.

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The particular case of ISO12647 print standards

For each classical CMYK print technology and for each mainstream print media, ISO12647 specifies:

1. The generic C.I.E. Lab D50 2° color of the media,
2. The print sequence order: (K, C, M, Y for ISO),
3. The C.I.E. Lab D50 2° color of each solid ink,
4. Classical (AM) or stochastic (FM) screening characteristics,
5. The TVI curve of each ink:
   E.g. Fogra A, B, C, D, E or F aim TVI curves for offset prints,
6. Lab D50 2° colors of superimpositions (C+M), (C+Y), (M+Y),
7. DE76 tolerances for les paper, solids and trappings,
8. Tolerances for colors and TVI curves.

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The particular case of ISO12647 print standards

Benefits of ISO 12647:

1. Simple, well documented and cost effective calibration standards that produce good results for standard CMYK print applications,
2. Avoid the Print House making its presses CMYK ICC profiles when using offset or gravure technologies. (Publishing only)
3. Good methodology that can easily be used for creating private CMYK or N colors printing standards.
   … And this is almost always necessary for high-end CMYK printing applications and for Packaging applications.

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The particular case of ISO12647 print standards

Inconveniencies of ISO12647:

1. Not the best you can do when printing CMYK:
   But this is not the purpose of ISO standardization.
2. ISO 12647 specify tolerances using the obsolete Delta E76 color difference assessment (1976…)
3. Normalizing billions of different print configurations is impossible (Sets of N inks, sets of N TVI curve, ink sequences, print medias, screenings, print processes…).

See: 2021_POINT_ABOUT_ISO_12647_STANDARDS.pdf

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Method for matching an existing print standard

Three steps:

1. Determine each ink solid density that allows optimal matching of the aim C.I.E. Lab D50 2° solid color specified by the print standard,
2. Measure the average TVI curve of each ink printed with above optimal density,
3. Deduce from these measurements the necessary TVI correction curve for each ink, and program these correction curves into the prepress workflow.

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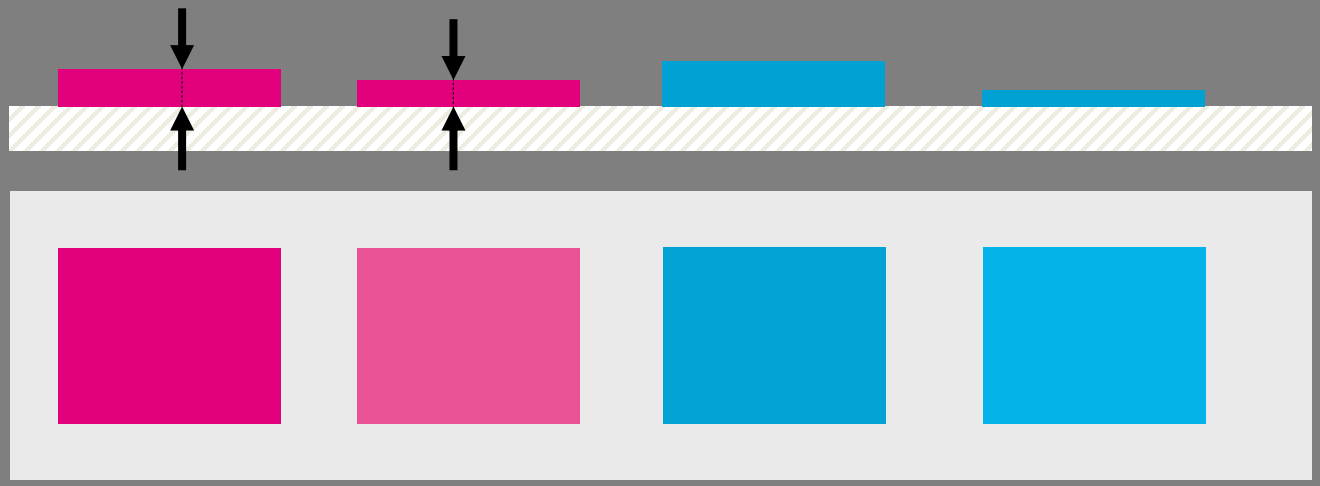
Method for matching an existing print standard

Match each standard's specified solid ink color 1/10

With offset or flexographic printing, each solid ink color depends on the ink's thickness and the media:



« Solid ink Lab color » only makes sense for a given ink thickness on a given media.

COLORSOURCE

Method for matching an existing print standard

Match each standard's specified solid ink color 2/10

There is no standard CMYK print density:
Because standard CMYK inks and papers spectral reflection curves cannot be normalized (Or their costs would be prohibitive).

The « Good print density » of each ink is the density allowing getting best possible visual match with the aim color specified by the standard.

Moreover this « Good print density » may change permanently, according to:

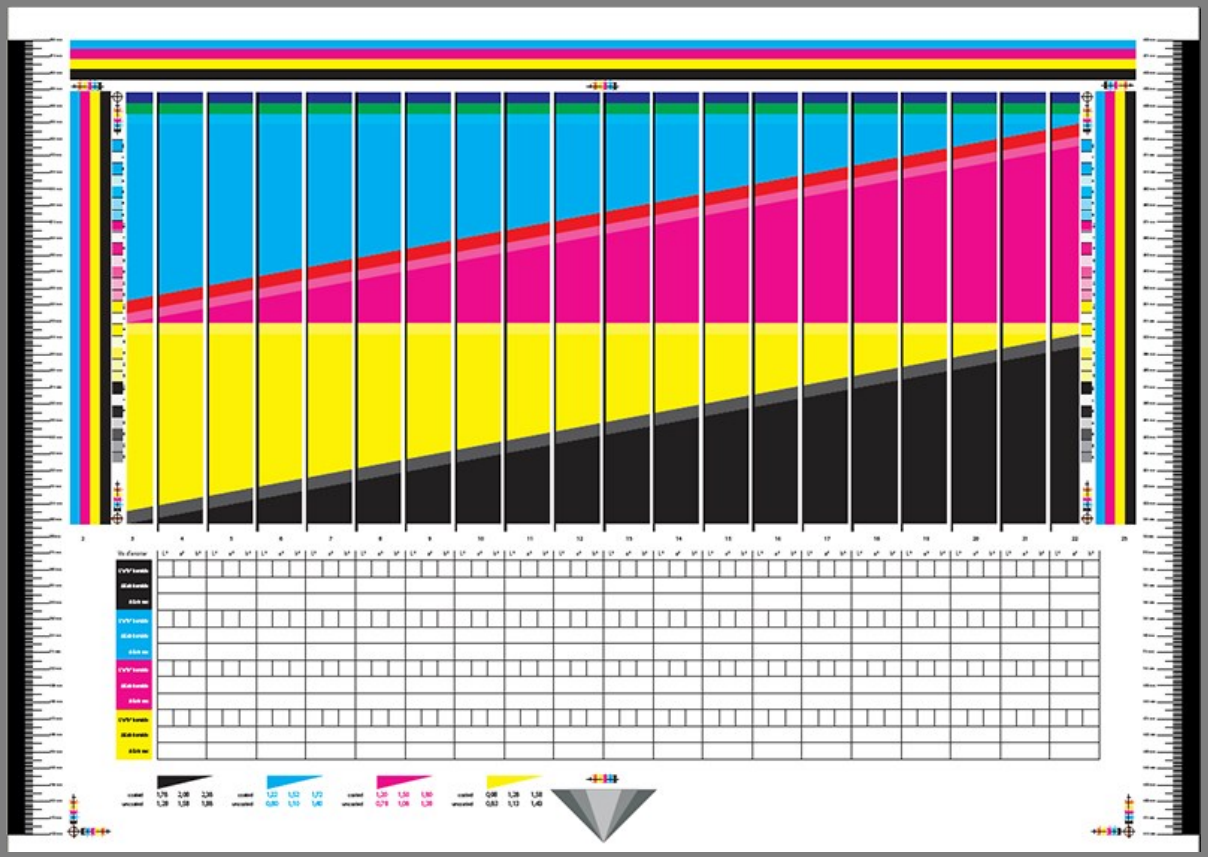
- The reference and the production batch of the media,
- The reference and the production batch of the ink.

COLORSOURCE

Method for matching an existing print standard

Match each standard's specified solid ink color 3/10

Prehistoric method: Multiplying test print forms



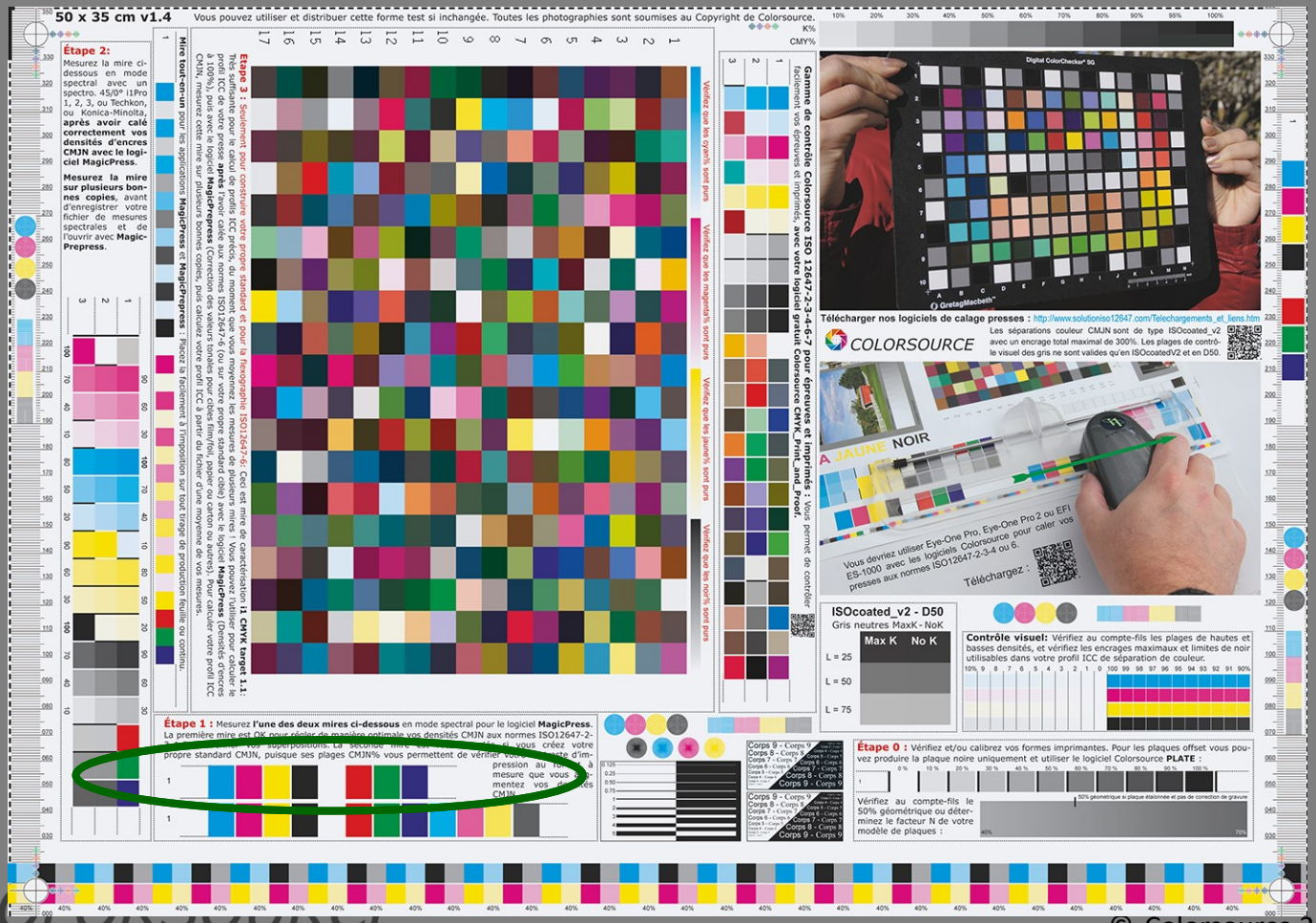
Example of a test form designed for manual search of optimal print densities, by impression with constant ink segments aperture on offset presses.

COLORSOURCE

Method for matching an existing print standard

Match each standard's specified solid ink color 4/10

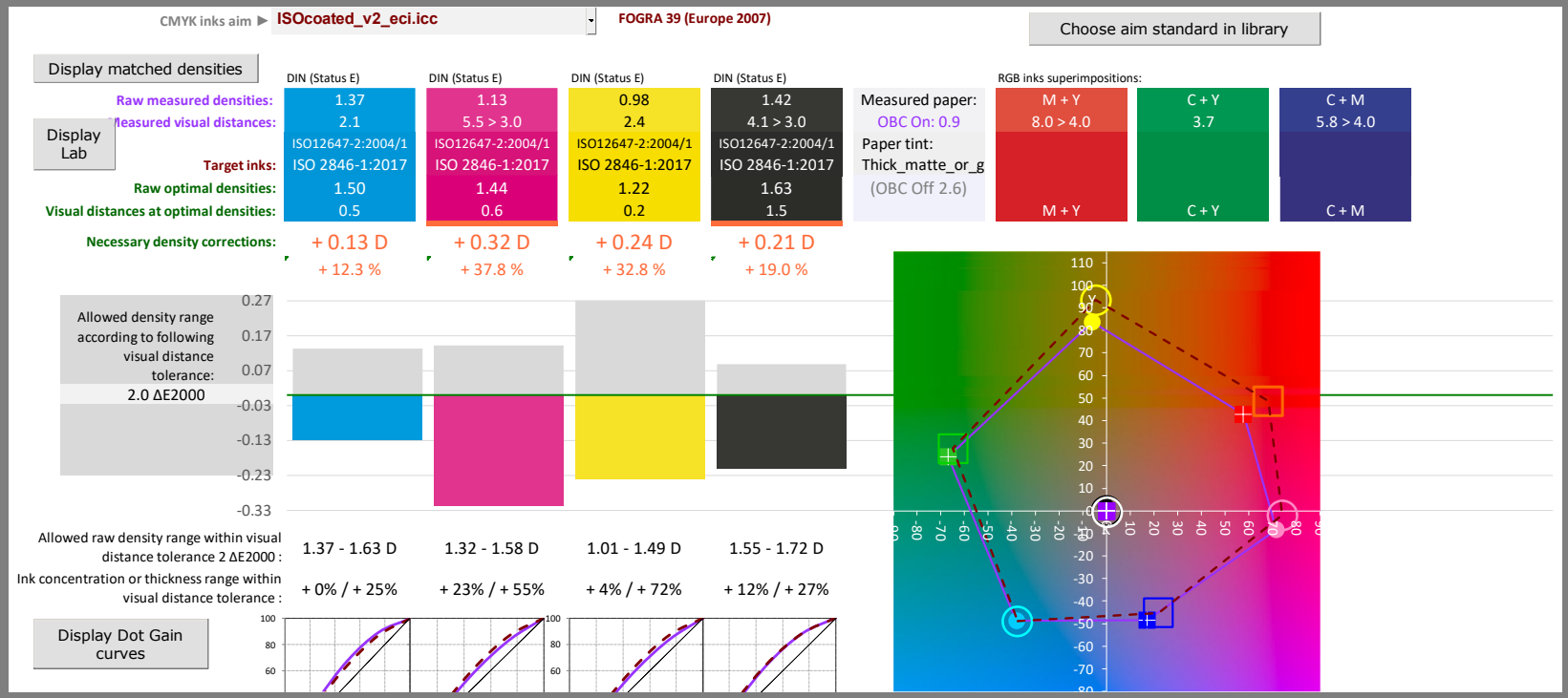
Modern method: Use smart software with a spectrophotometer



Method for matching an existing print standard

Match each standard's specified solid ink color 5/10

Modern method: Color science allows computing the density corrections to be made for matching the standard aim colors as well as possible:

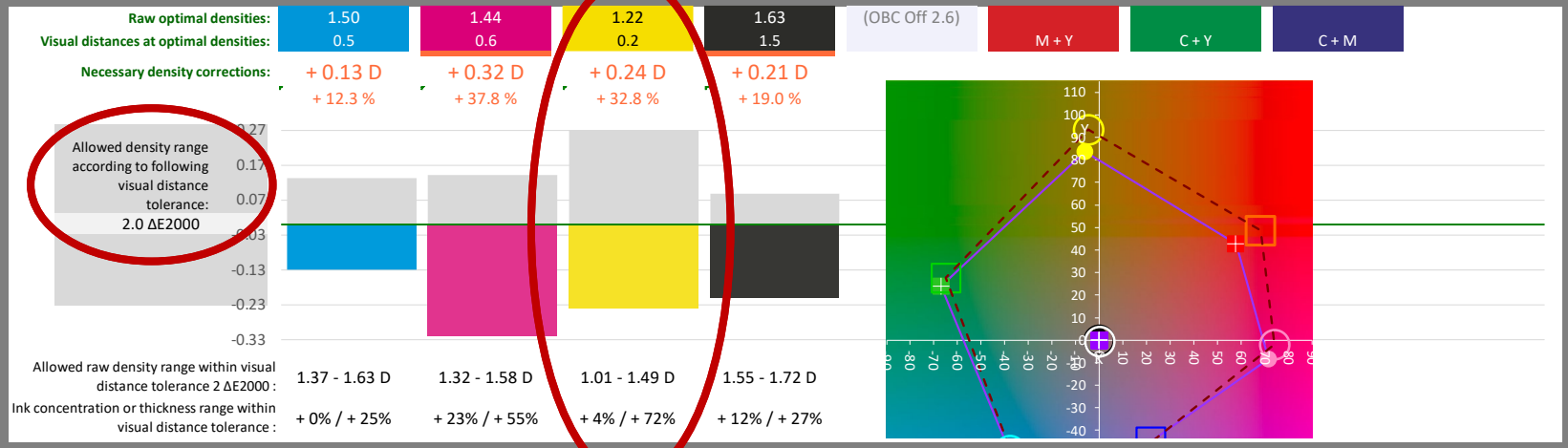


COLORSOURCE

Method for matching an existing print standard

Match each standard's specified solid ink color 6/10

Results that have important practical consequences:



For a low 2 ΔE2000 tolerance, you can print YELLOW between 104% and 172% of the measured yellow ink thickness, i.e. make a 65% ink thickness change!

The raw yellow ink dot gain, hence the necessary TVI correction curve for the yellow ink, will be quite different for both extremes. This shows that printing Yellow with low ΔE tolerances is not enough.

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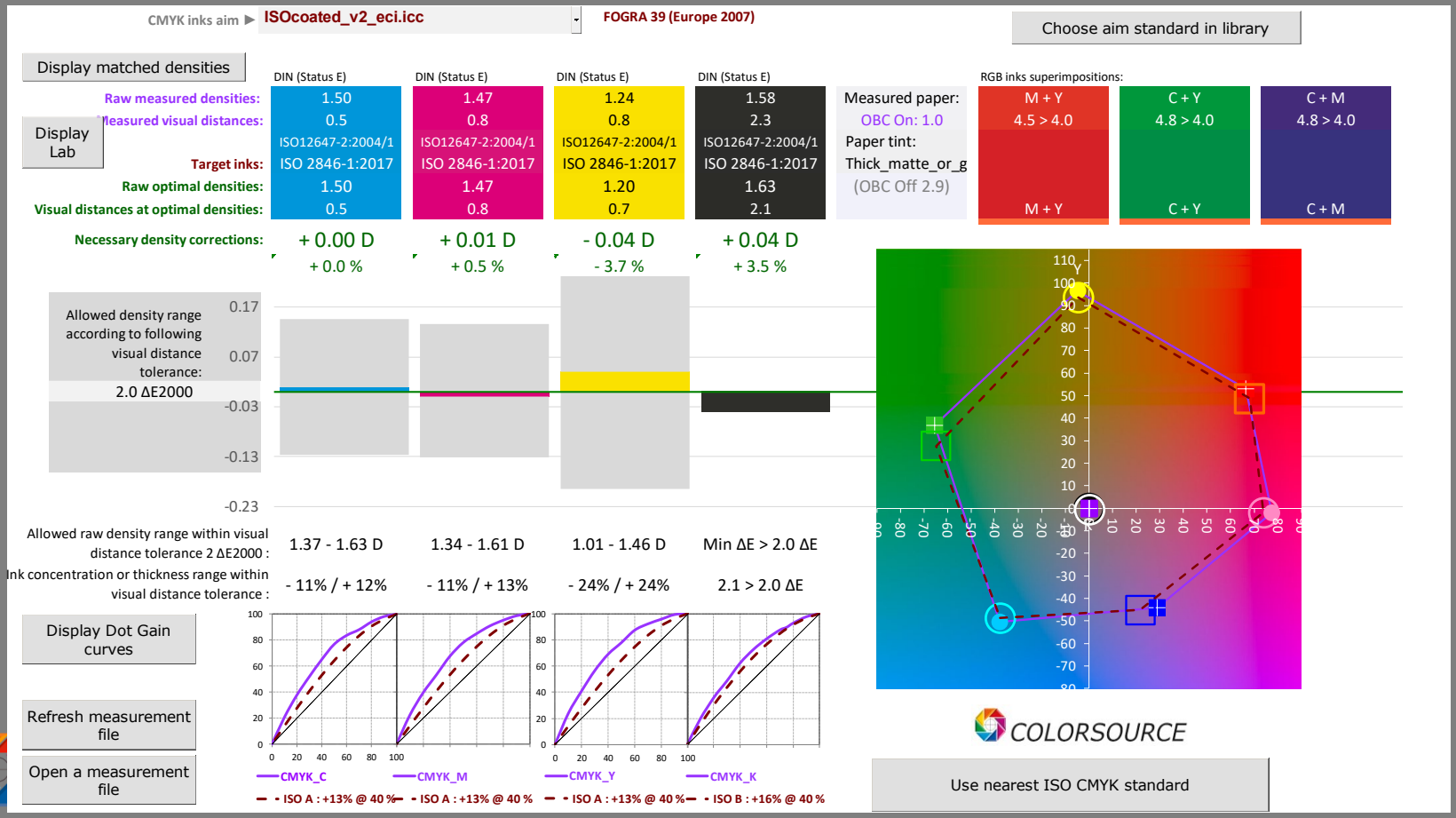
Method for matching an existing print standard

Match each standard's specified solid ink color 7/10

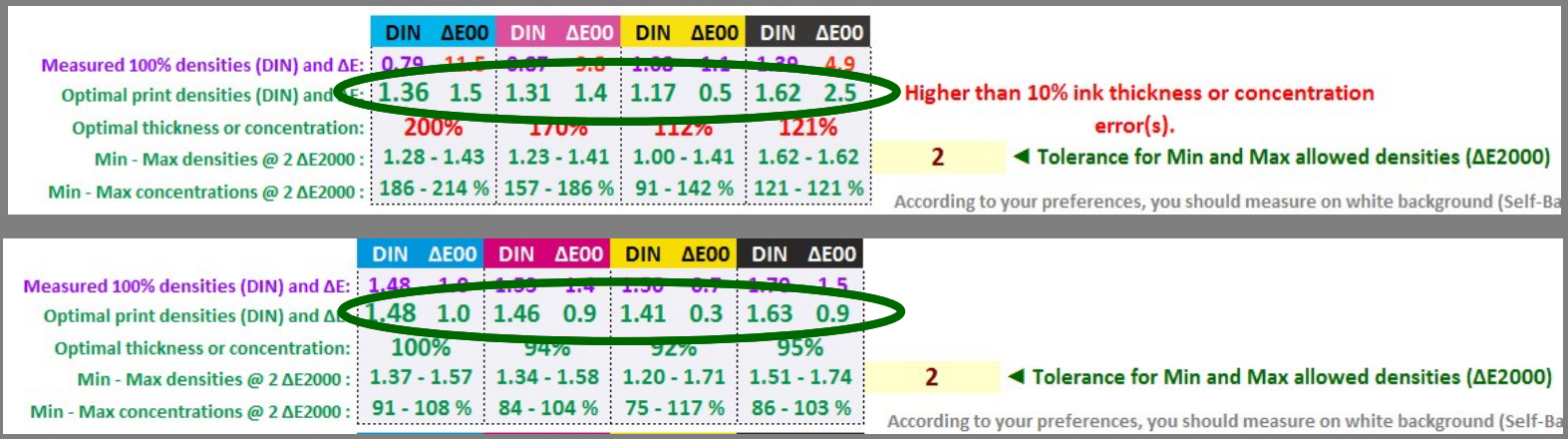
On a modern offset press, measuring two sheets is enough, the second one being used for control:



Method for matching an existing print standard

Match each standard's specified solid ink color 8/10

The optimal C, M, Y 100% densities computed for a same Fogra 39 target may be very different depending on the reference and production batch of the CMYK inks and paper:



	DIN	ΔE00	DIN	ΔE00	DIN	ΔE00	DIN	ΔE00	
Measured 100% densities (DIN) and ΔE:	0.79	11.5	0.87	9.8	1.08	11.1	1.39	4.9	
Optimal print densities (DIN) and ΔE:	1.36	1.5	1.31	1.4	1.17	0.5	1.62	2.5	Higher than 10% ink thickness or concentration error(s).
Optimal thickness or concentration:	200%		170%		112%		121%		
Min - Max densities @ 2 ΔE2000 :	1.28 - 1.43		1.23 - 1.41		1.00 - 1.41		1.62 - 1.62		2 ◄ Tolerance for Min and Max allowed densities (ΔE2000)
Min - Max concentrations @ 2 ΔE2000 :	186 - 214 %		157 - 186 %		91 - 142 %		121 - 121 %		According to your preferences, you should measure on white background (Self-Ba

	DIN	ΔE00	DIN	ΔE00	DIN	ΔE00	DIN	ΔE00	
Measured 100% densities (DIN) and ΔE:	1.48	1.0	1.53	1.4	1.36	0.7	1.70	1.5	
Optimal print densities (DIN) and ΔE:	1.48	1.0	1.46	0.9	1.41	0.3	1.63	0.9	
Optimal thickness or concentration:	100%		94%		92%		95%		
Min - Max densities @ 2 ΔE2000 :	1.37 - 1.57		1.34 - 1.58		1.20 - 1.71		1.51 - 1.74		2 ◄ Tolerance for Min and Max allowed densities (ΔE2000)
Min - Max concentrations @ 2 ΔE2000 :	91 - 108 %		84 - 104 %		75 - 117 %		86 - 103 %		According to your preferences, you should measure on white background (Self-Ba

Consequence: Forget about press-room densitometers!
Moreover modern scanning spectrophotometers are cheaper.

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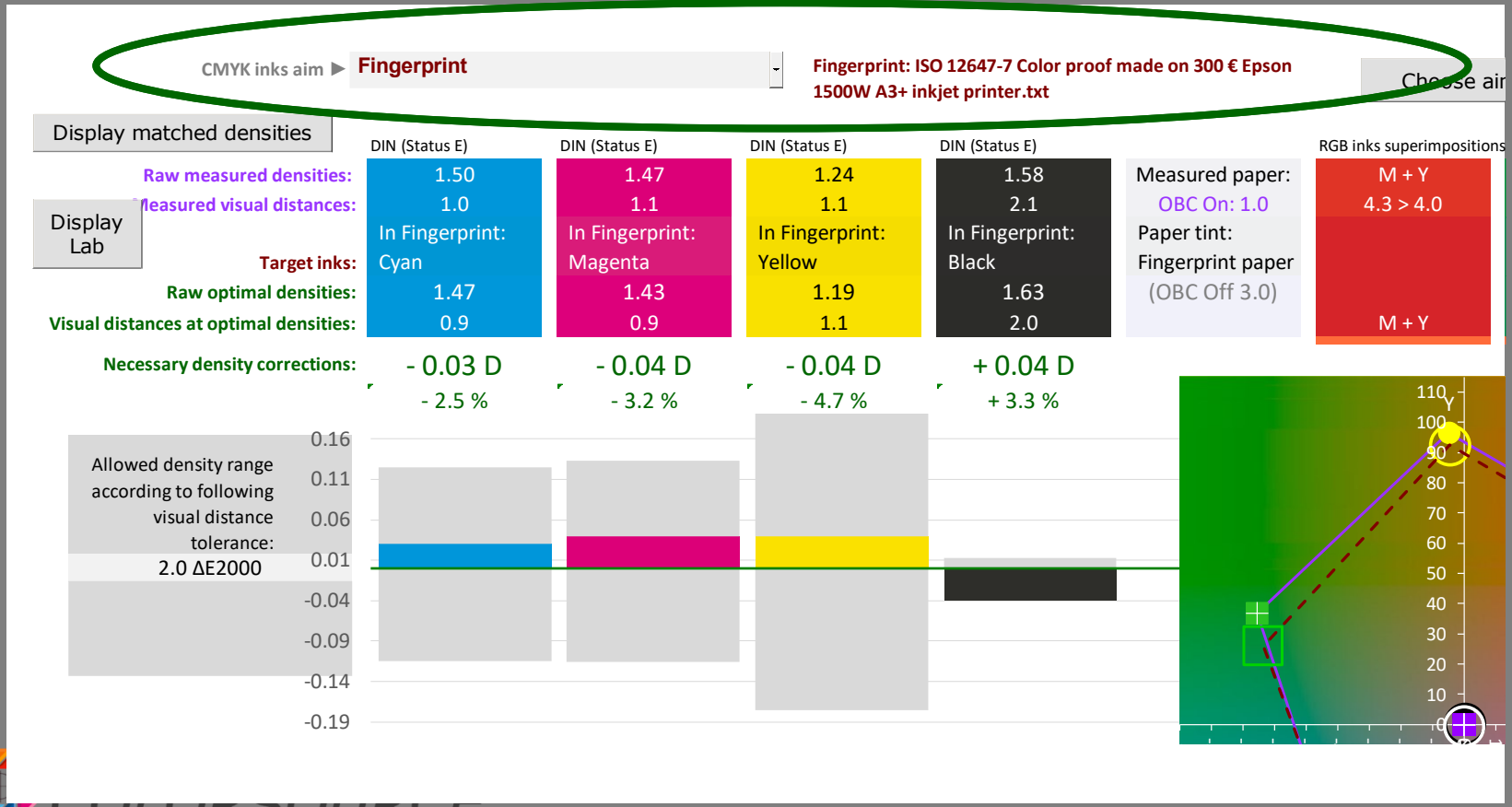
Method for matching an existing print standard

Match each standard's specified solid ink color 9/10

If needed, match the Fogra 39 approved color proof rather than the Fogra 39 standard:

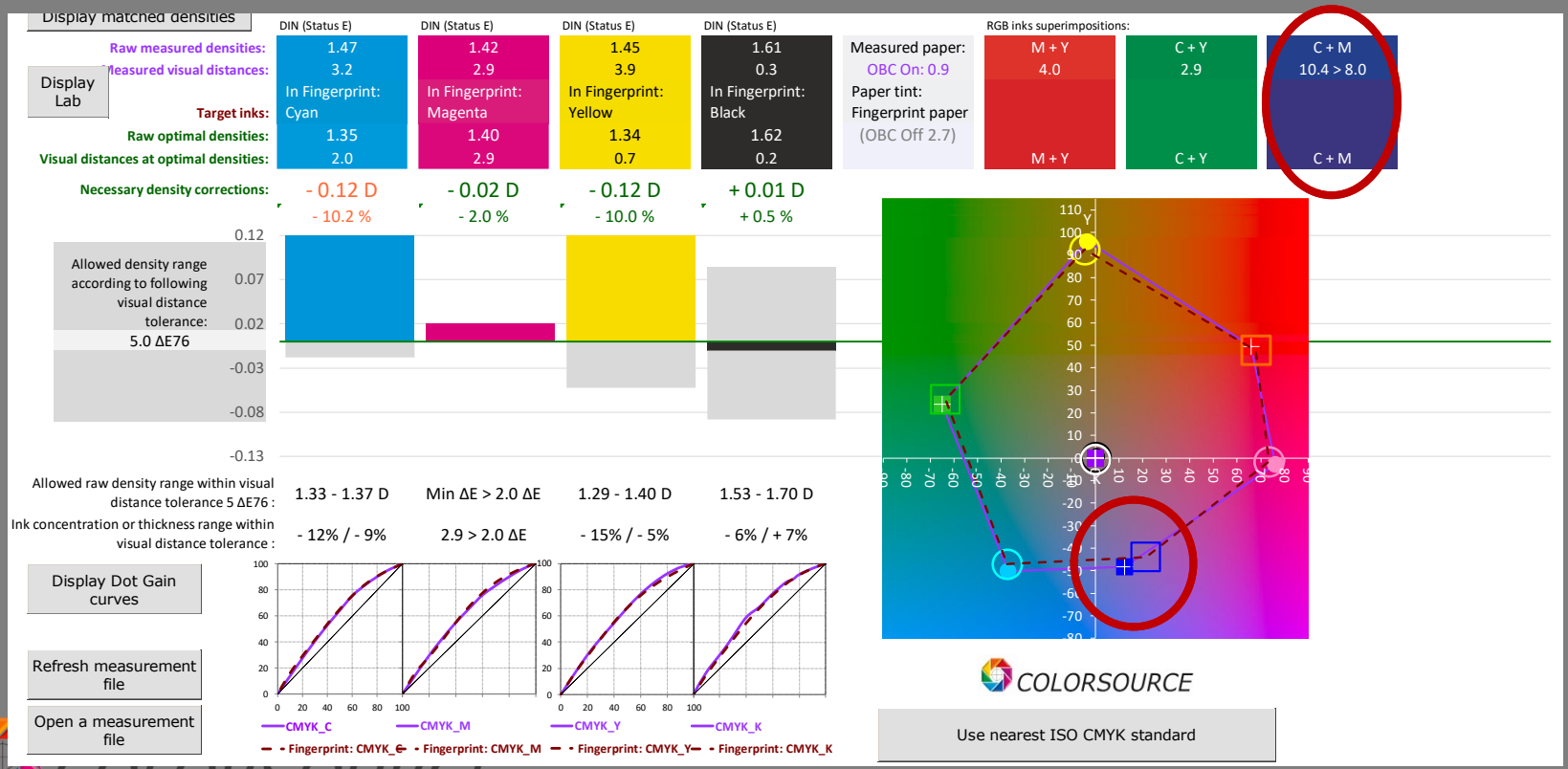


Method for matching an existing print standard

Match each standard's specified solid ink color 10/10

Check the inks superimpositions colors when solid colors are matched:

For example hereafter, trapping problem found on (C + M):



Method for matching an existing print standard

1/5 Match each ink aim TVI curve

After you have set each solid ink at its optimal print density:

1. Measure each ink average TVI curve on a few copies,
2. Compute each ink correction curve, with taking into account if necessary the existing correction curves on the workflow that have been used for printing the measured print run,
3. Program into the prepress workflow your new correction curves.

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Method for matching an existing print standard

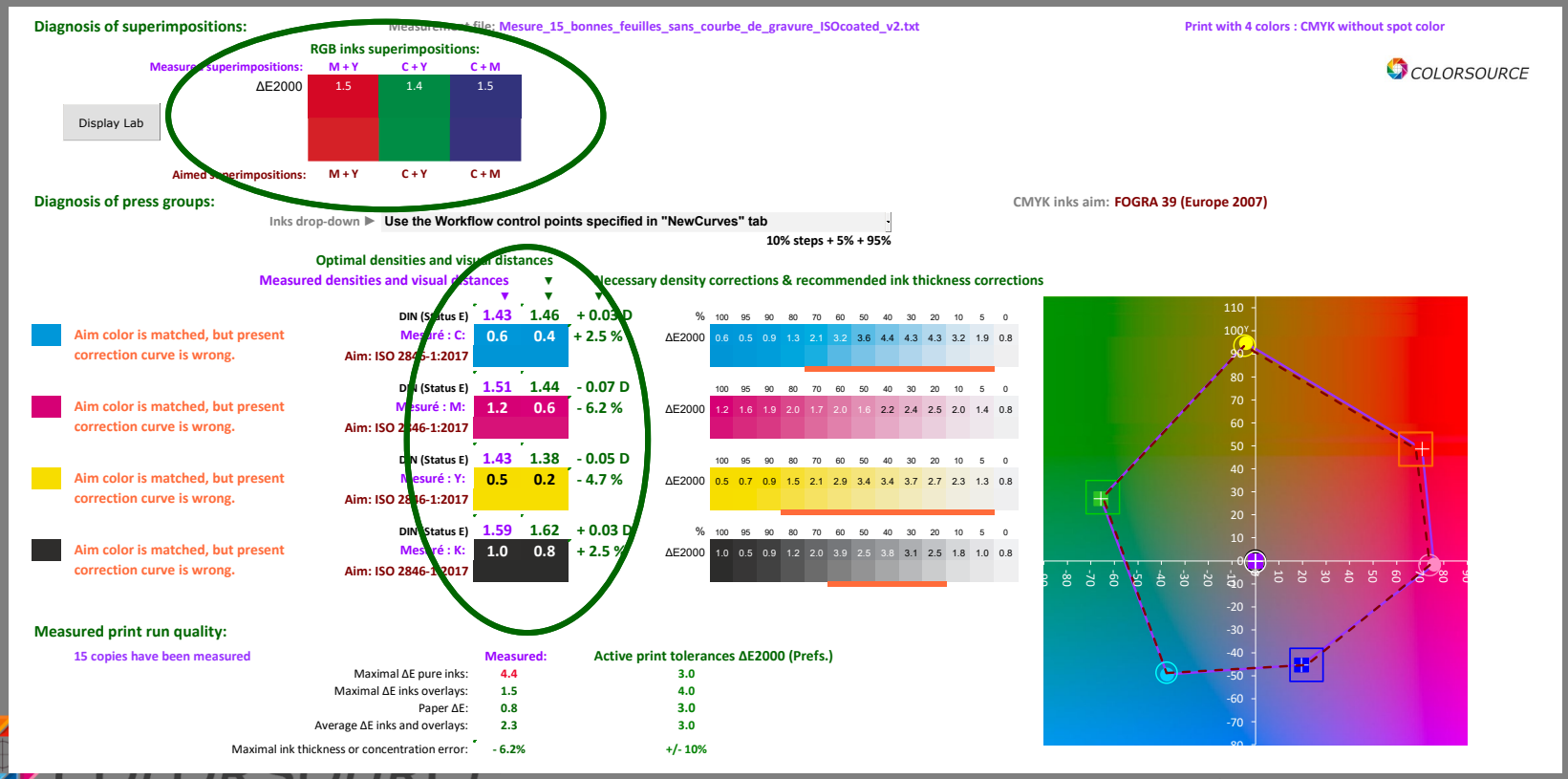
2/5 Match each ink aim TVI curve

Sample CMYK % charts with RGB superimposition control patches:

Method for matching an existing print standard

3/5 Match each ink aim TVI curve

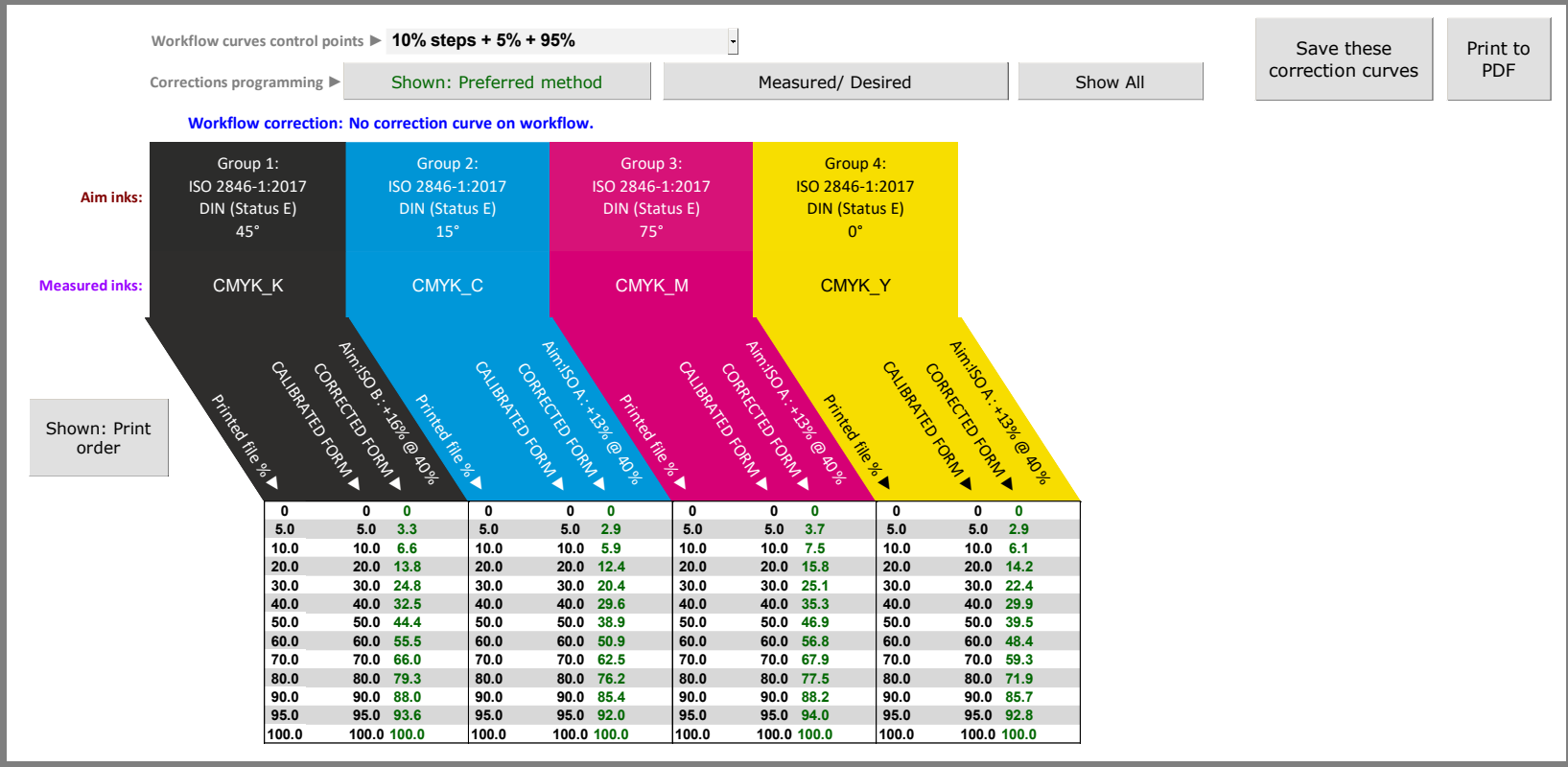
Example: Average CMYK% chart measurement of 15 copies. Check the average solid colors and their superimpositions do match the standard:



Method for matching an existing print standard

4/5 Match each ink aim TVI curve

Average CMYK% chart measurement of 15 copies:
Input the CMYK TVI compensation curves in the workflow



Printed file %	CALIBRATED FORM	CORRECTED FORM	Aim:ISO B : +16% @ 40%
0	0	0	
5.0	5.0	3.3	
10.0	10.0	6.6	
20.0	20.0	13.8	
30.0	30.0	24.8	
40.0	40.0	32.5	
50.0	50.0	44.4	
60.0	60.0	55.5	
70.0	70.0	66.0	
80.0	80.0	79.3	
90.0	90.0	88.0	
95.0	95.0	93.6	
100.0	100.0	100.0	

Printed file %	CALIBRATED FORM	CORRECTED FORM	Aim:ISO A : +13% @ 40%
0	0	0	
5.0	5.0	2.9	
10.0	10.0	5.9	
20.0	20.0	12.4	
30.0	30.0	20.4	
40.0	40.0	29.6	
50.0	50.0	38.9	
60.0	60.0	50.9	
70.0	70.0	62.5	
80.0	80.0	76.2	
90.0	90.0	85.4	
95.0	95.0	92.0	
100.0	100.0	100.0	

Printed file %	CALIBRATED FORM	CORRECTED FORM	Aim:ISO A : +13% @ 40%
0	0	0	
5.0	5.0	3.7	
10.0	10.0	7.5	
20.0	20.0	15.8	
30.0	30.0	25.1	
40.0	40.0	35.3	
50.0	50.0	46.9	
60.0	60.0	56.8	
70.0	70.0	67.9	
80.0	80.0	77.5	
90.0	90.0	88.2	
95.0	95.0	94.0	
100.0	100.0	100.0	

Printed file %	CALIBRATED FORM	CORRECTED FORM	Aim:ISO A : +13% @ 40%
0	0	0	
5.0	5.0	2.9	
10.0	10.0	6.1	
20.0	20.0	14.2	
30.0	30.0	22.4	
40.0	40.0	29.9	
50.0	50.0	39.5	
60.0	60.0	48.4	
70.0	70.0	59.3	
80.0	80.0	71.9	
90.0	90.0	85.7	
95.0	95.0	92.8	
100.0	100.0	100.0	

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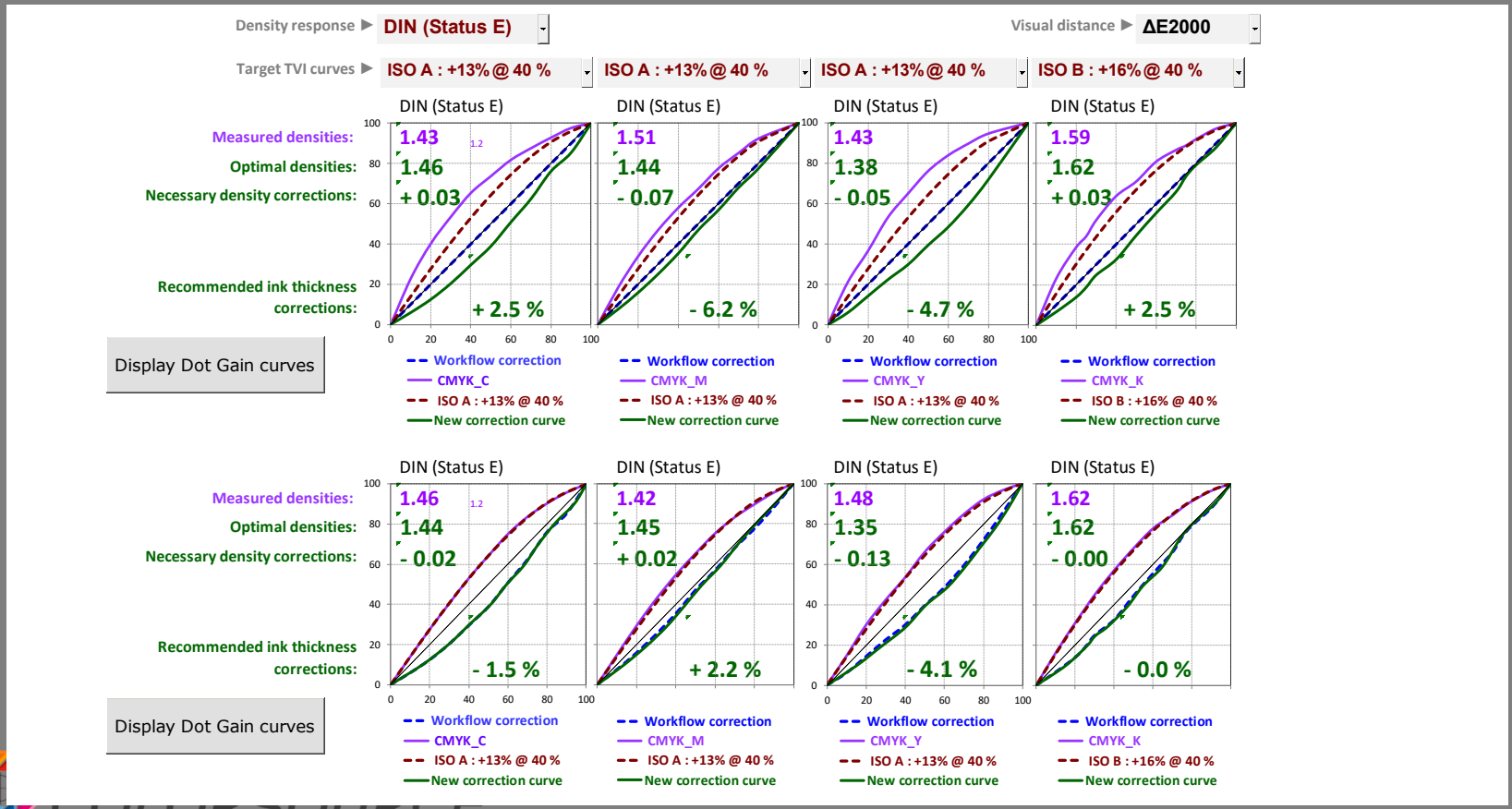
Method for matching an existing print standard

5/5 Match each ink aim TVI curve

Check the correction curves (facultative), by reprinting the test form using these correction curves:



Method for matching an existing print standard

Characterize the calibrated press by an ICC profile

Not essential when you set a press matching ISO12647-2 (Offset publishing), 12647-3 (Newspaper), or 12647-4 (Gravure publishing).
You can use free CMYK ICC profiles available on the web, with optimizing if needed their inks settings and gamut mappings.

But calibrated press characterization stays necessary when printing ISO 12647-6 (Flexography on paper, corrugated or film/foil)
Because there are so many flexographic screenings and anilox gravures that a same CMYK press calibration may lead to a number of significantly different color responses.

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Method for creating a new print standard

Five steps, almost always necessary for Packaging applications:

1. Make a well designed specific test form,
2. Choose on the press each ink print density (Which will determine your standard's aim solid Lab colors),
3. Measure each ink's average dot gain in above retained printing conditions,
4. Choose your aim TVI curve for each ink, and program the necessary correction curves in the workflow,
5. Establish the N-colors ICC profile that characterizes the ideally calibrated press and document the new standard you have created.

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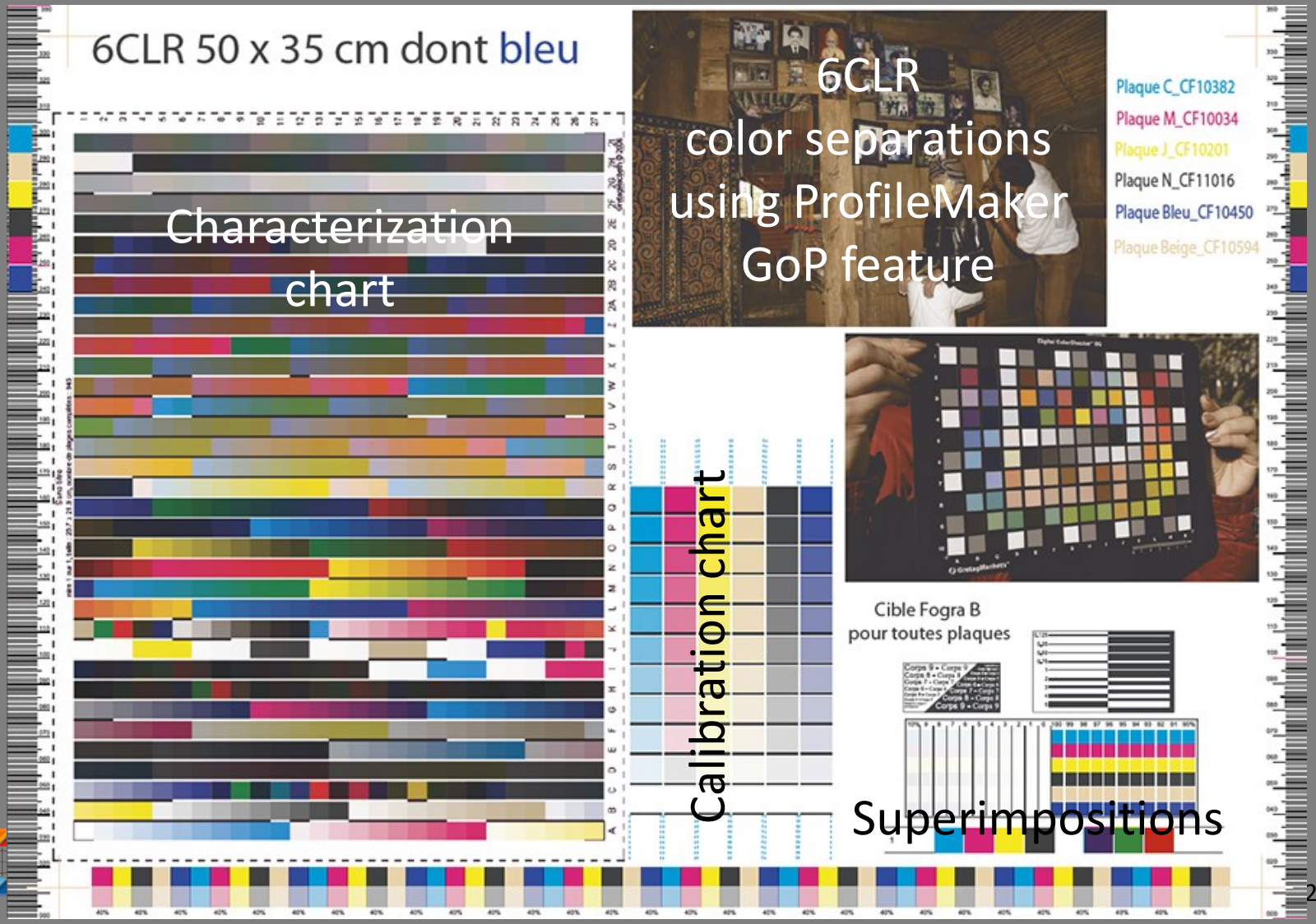
Method for creating a new print standard

1. A well designed test form (« Fingerprint ») is enough:



Method for creating a new print standard

2. Choose the inks solid colors:

Example with offset printing: Use the maximal possible inks thicknesses in order to maximize the color gamut.

Practical limits: How much too far can we go?

Depending on each media, a too high ink thickness produces a too high dot gain i.e. a too low print contrast.

Solution: For each ink, use the maximal possible ink thickness in order to maximize the color gamut, while constantly monitoring the ink print contrast.

Because the correction curves, even if they can do it, are not intended for correcting abnormally high dot gains: Beware of print stability and potential banding problems, if matching your standard requires using very strong TVI correction curves!

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Method for creating a new print standard

2. Choose the inks solid colors:

Example with offset printing:

If your print configuration is using a CMY inks base, retain final CMY ink thicknesses that do produce:

- A green that is green,
- A red that is red,
- And a blue that is blue…

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Method for creating a new print standard

2. Choose the inks solid colors:

If one or more inks are conventional spot colors such as PANTONE or other inks, the colors to be matched for these inks at 100% are specified by the spectral (or at least Lab) values of the Vendor's electronic color chart.

In this case, the "good density" of an ink is that allowing to ensure the minimum visual distance from the shade specified by the electronic color chart.

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Method for creating a new print standard

3. Choose the standard inks TVI curves:

Generally you can use a same arbitrary aim TVI curve for all the inks of your print standard.

This arbitrary target TVI curve should not be too far from the press native uncorrected TVI curves.

This in order not to require too strong correction curves on the prepress workflow.

So that the aim dot gains are chosen higher for a fine or stochastic screening or for low quality paper than standard AM screenings on high quality coated papers.

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Method for creating a new print standard

4. Characterize the calibrated press:

Reprint the N-color test form, with the appropriate TVI correction curves computed for the N inks,

Measure the calibrated press characterization chart on a few copies, and then average these characterization measurement files,

Compute from this averaged characterization measurement file the calibrated press RAW N-colors ICC profile.

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Method for creating a new print standard

5. Normalize and document the print standard:

The average printed characterization chart (« average press fingerprint ») never perfectly matches the ideal aim standard that was initially chosen:

- Residual Delta E's achieved on solid inks are not 0,
- The aimed TVI curves are never matched perfectly.

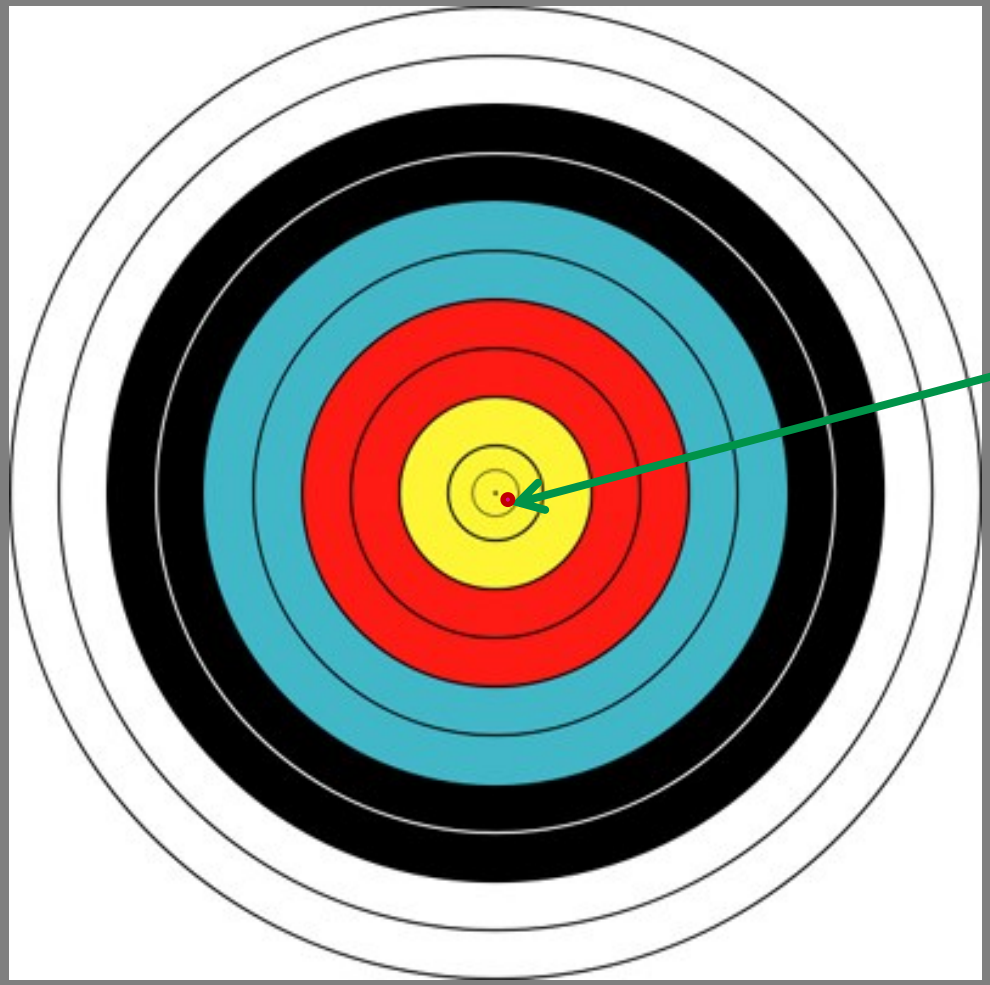
Colorsource free ICC_Normalize application allows normalizing the RAW calibrated press ICC profile, in order to compute the ICC profile we would have got if the Fingerprint would have perfectly matched the standard.

ICC_Normalize application allows you as well publishing and documenting the newly created standard with all technical information needed for repro, proofing, prepress and print works.

COLORSOURCE

Method for creating a new print standard

5. Normalize and document the print standard:



The printed
« Fingerprint »…

…is always slightly different from the initially aimed target.

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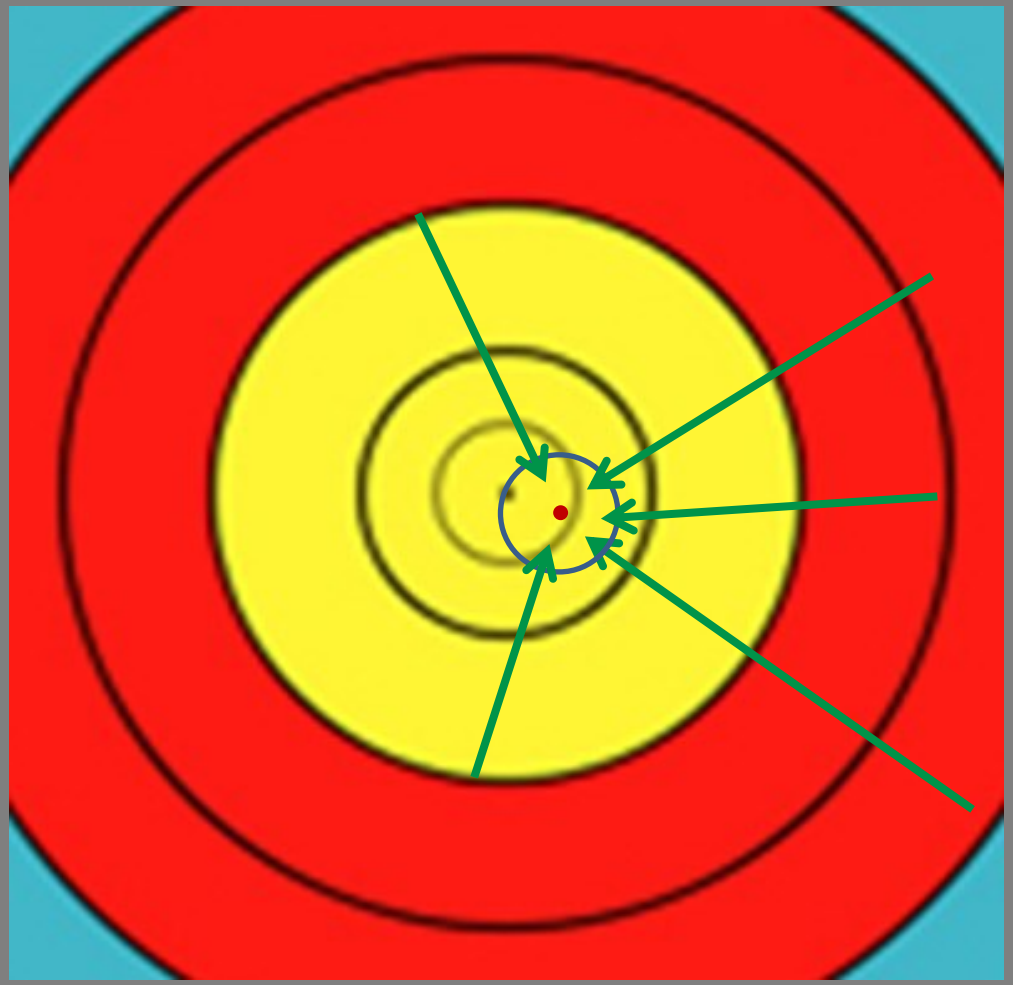
Method for creating a new print standard

5. Normalize and document the print standard:



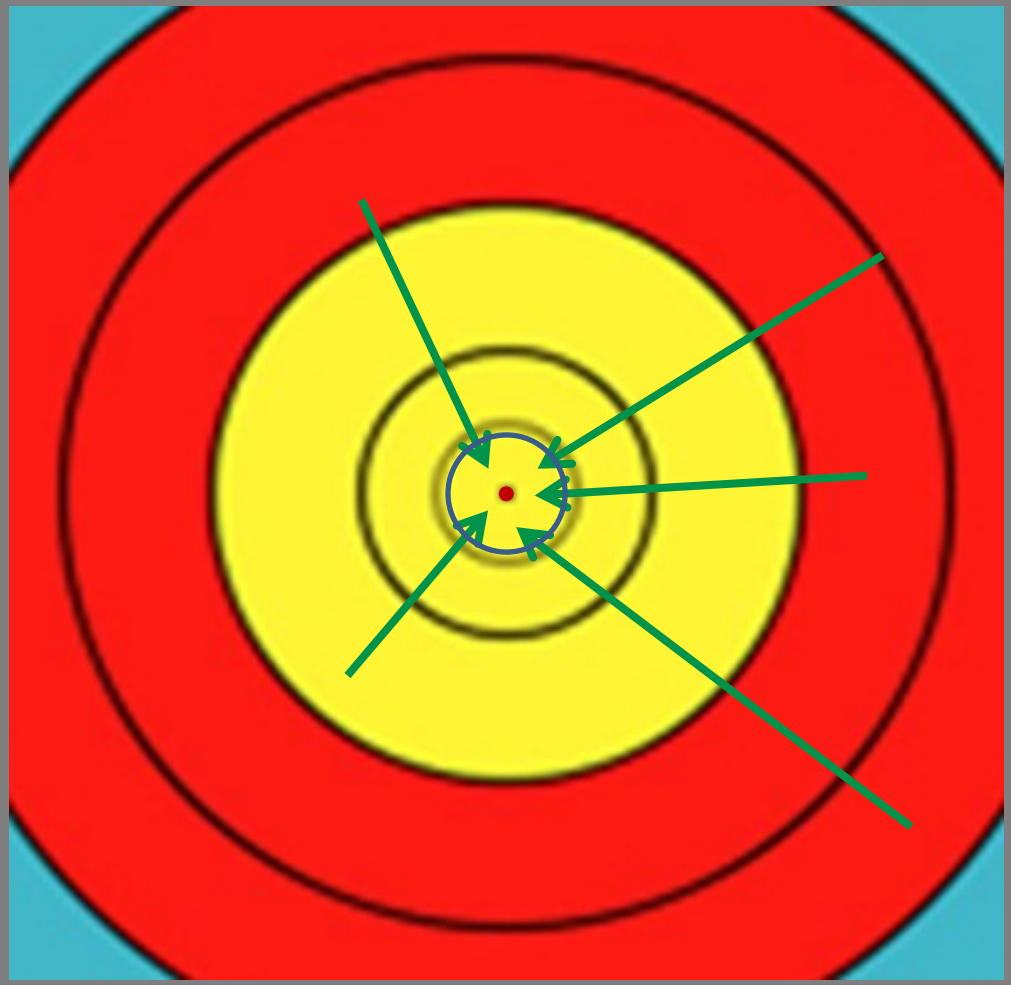
If the ICC profile is not normalized…

…all print and reprint works will aim aside of the target.

COLORSOURCE

Method for creating a new print standard

5. Normalize and document the print standard:



With a normalized and well documented print standard, everybody does aim the right target,

which minimizes color dispersions between prints and reprints, and the color dispersions between all involved presses and print houses.

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Conclusions

Matching ISO12647 or any other standard is quite fast and easy, and only requires using inexpensive tools.

Being able to match existing print standards is a pre requisite know-how, before you can create your own print standards, which is necessary for many printing applications.

More information about ISO12647 CMYK standards: https://www.color-source.net/en/Colorsource_news.htm

Colorsource software for setting and controlling proof and print works: https://www.iso12647solution.com/

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