Expanded Gamut Shoot-Out: Real Systems, Real Results

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COLOR20

get the answers here

SGIA

Advancing Graphic Communications

PRINTING INDUSTRIES OF AMERICA

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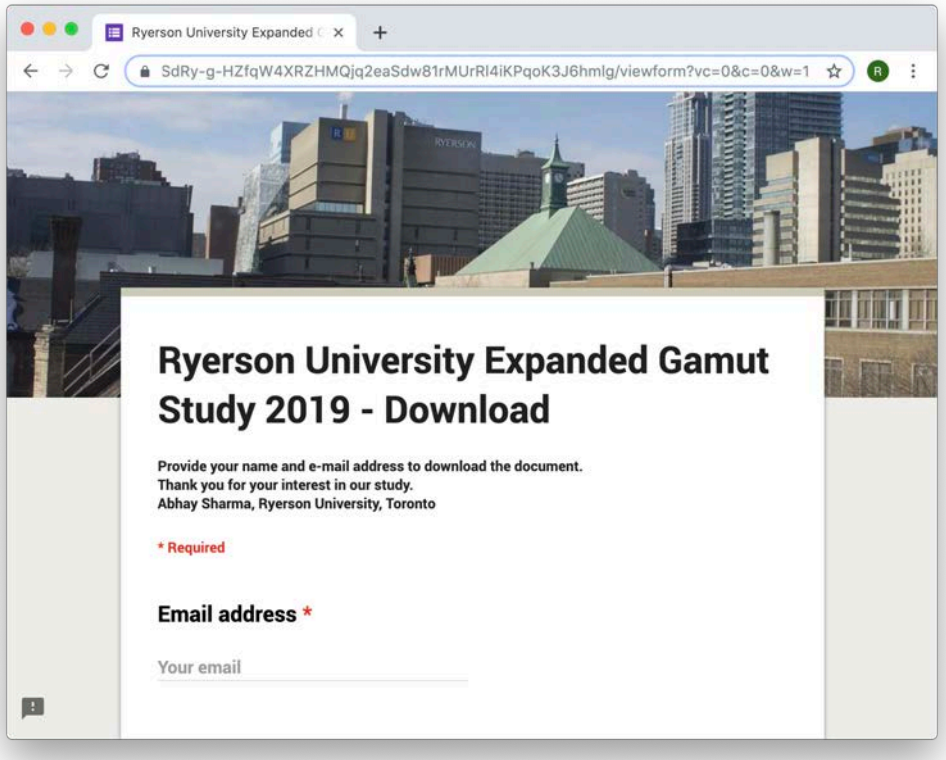
Comprehensive Report – 450+ downloads

tinyurl.com/ExpandedGamut



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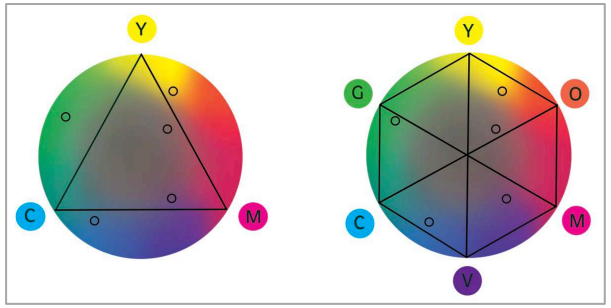
Agenda – Expanded Gamut

- Why do we need Expanded Gamut?
- What is Expanded Gamut? (CMYK-OGV)
- Use cases – Spot Colors vs Images
- Printing Spot Colors with Kodak Spotless (KSS)
- Increased Accuracy
- Using only 3 inks
- Print all spot colors, without spot color inks
- How do I implement EG?
- Issues with Adobe and Pantone
- Flexo testing in 2020



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PANTONE 109 C

Vendors and Participants

Software Solutions

1. Alwan – Toolbox, ColorHub
2. CGS ORIS – X GAMUT
3. ColorLogic – ColorAnt, CoPrA, ZePrA
4. GMG Color – OpenColor, ColorServer
5. Heidelberg – Prinect ColorToolbox
6. Kodak – Kodak Spotless Software, Prinergy

PDF Editor

- Hybrid Software - PACKZ (pronounced “packs”)

RIP/DFE

- efi Fiery XF (Command WorkStation) – Epson P9000
- SmartStream Production Pro – HP Indigo 7900

Color Management Solutions

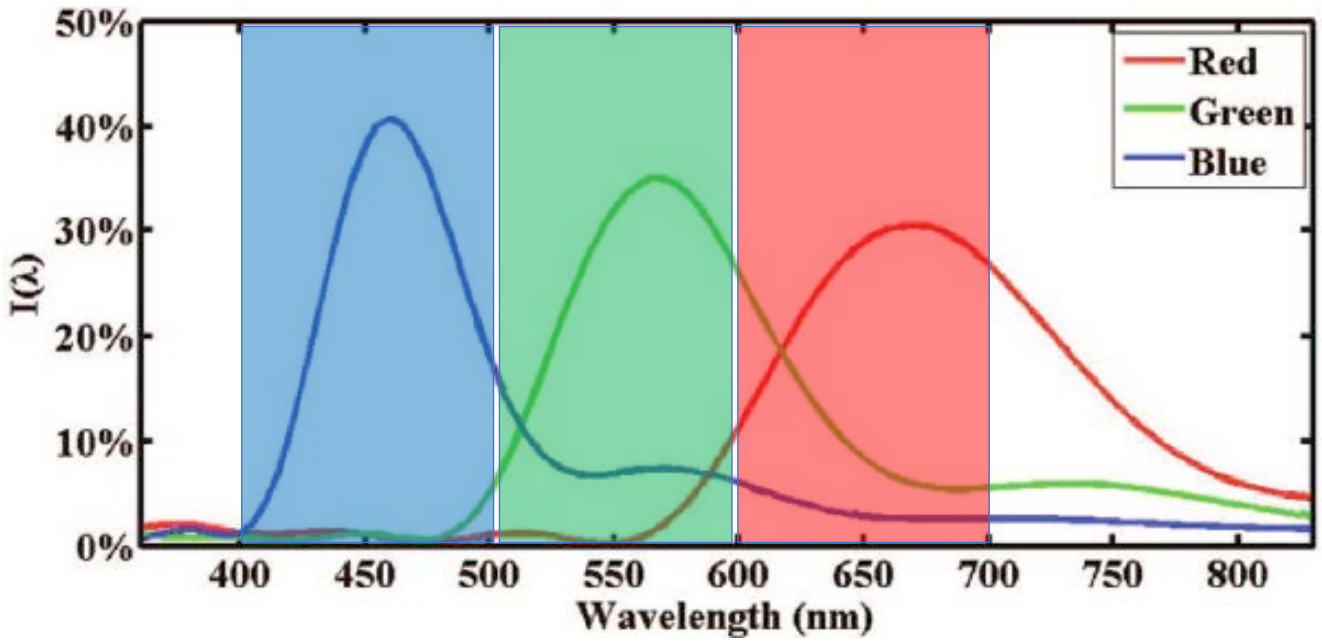
- X-Rite i1Profiler

Expanded Gamut Tools

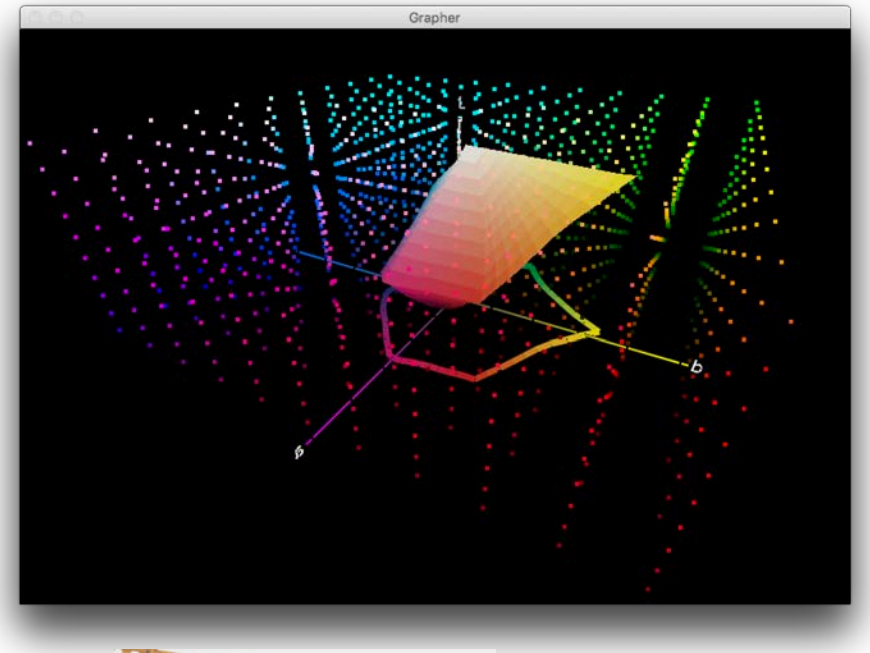
- PANTONE Color Manager, Adobe Acrobat Pro, Adobe Photoshop

Why do we need Expanded Gamut?
- because imaging systems are imperfect

Printing inks and dyes



CMYK color gamut is small



Color negative film

What are the Use Cases for Expanded Gamut?

✓ 1. Spot Colors

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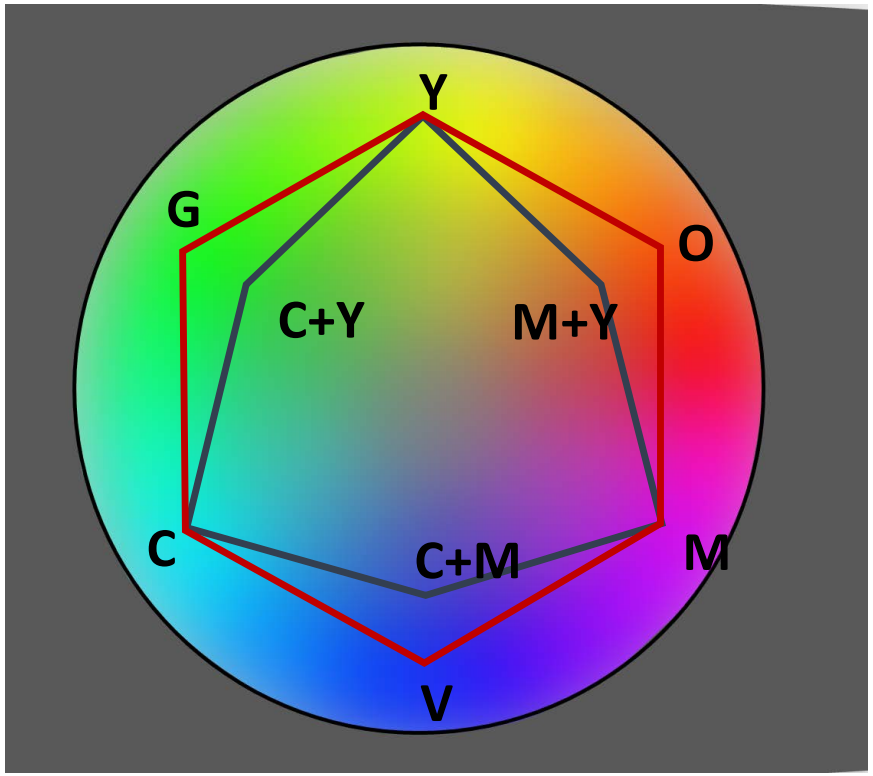
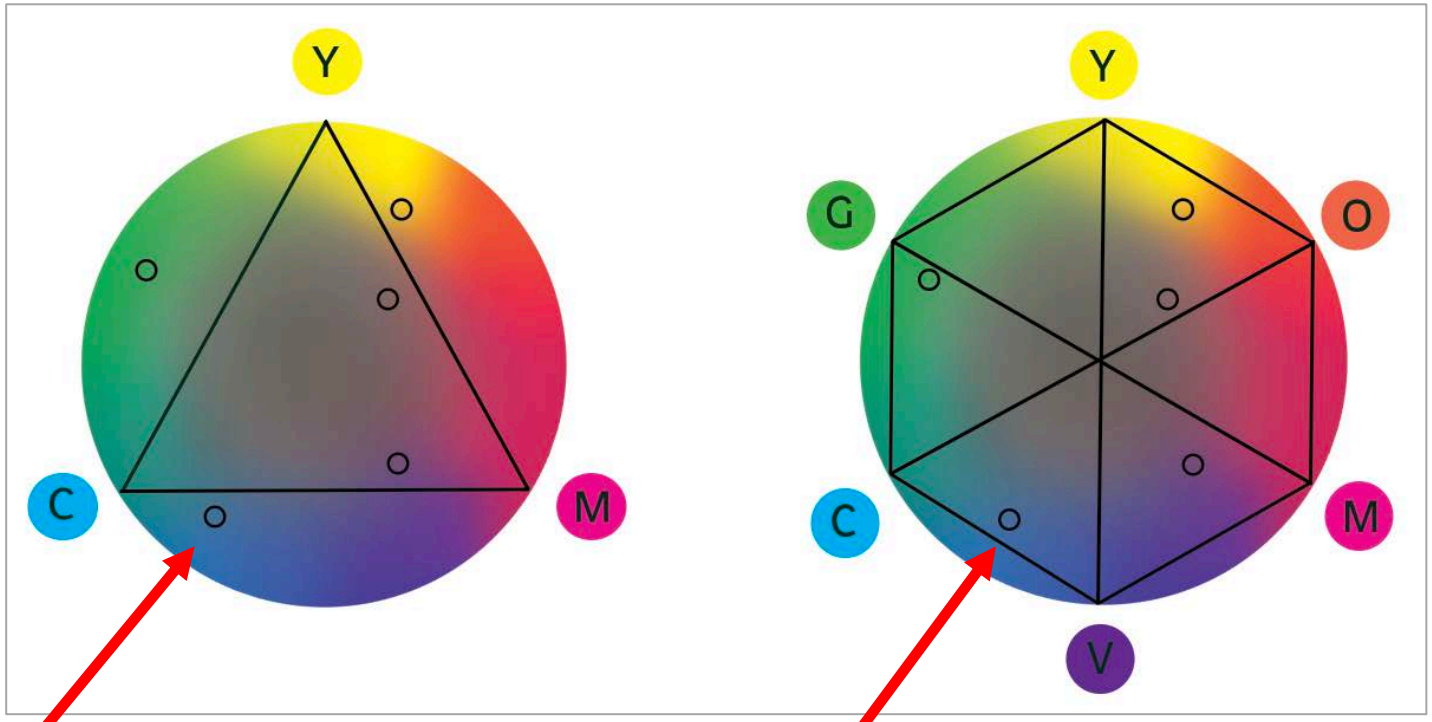
Expanded gamut is most urgently needed in spot color reproduction for labels and package printing.

2. Images

Orange, Green, Violet - expands the colorspace





Colors are out of gamut

More colors are in-gamut of a CMYK-OGV print process

HP Indigo 7900 – Alpharetta, Atlanta

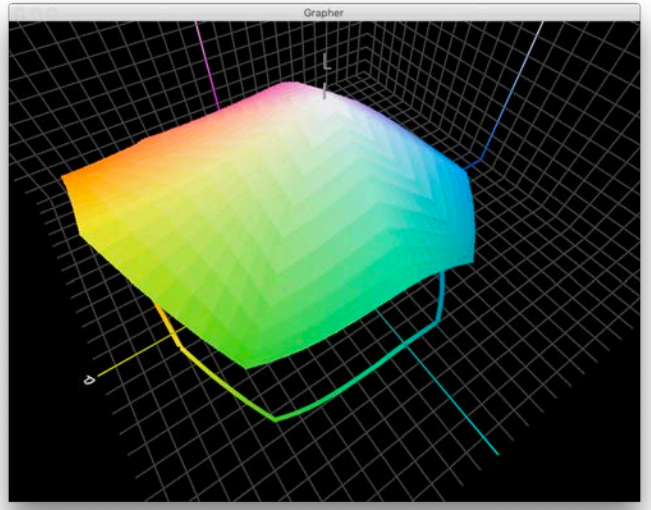
7 stations in the HP Indigo 7900

Epson SureColor P9000 (C-M-Y-K) and (O-G-V)

The Epson SureColor P9000 with CMYK + OGV

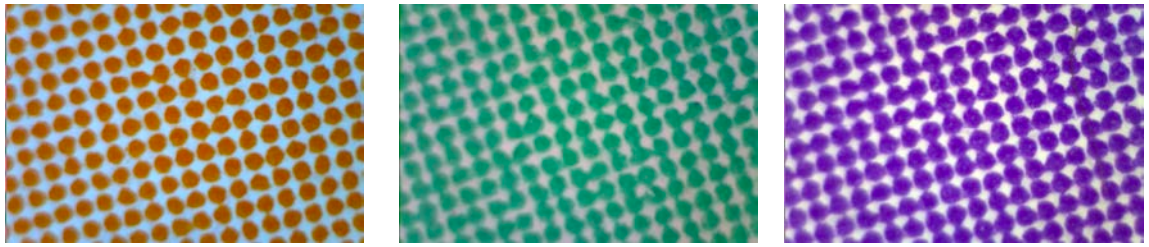
CMYK – OGV ink set

Epson SureColor P9000

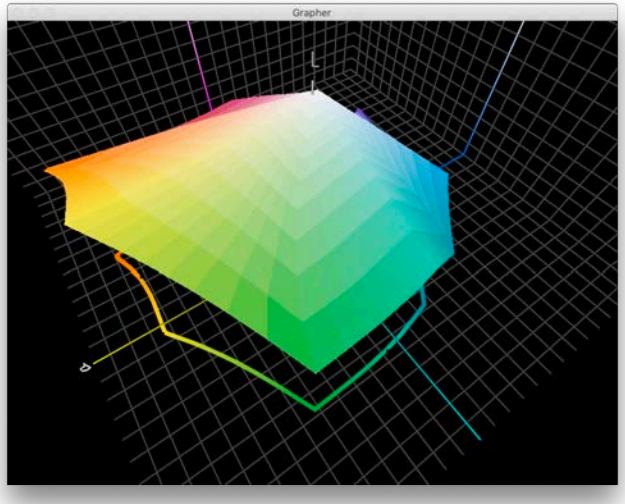


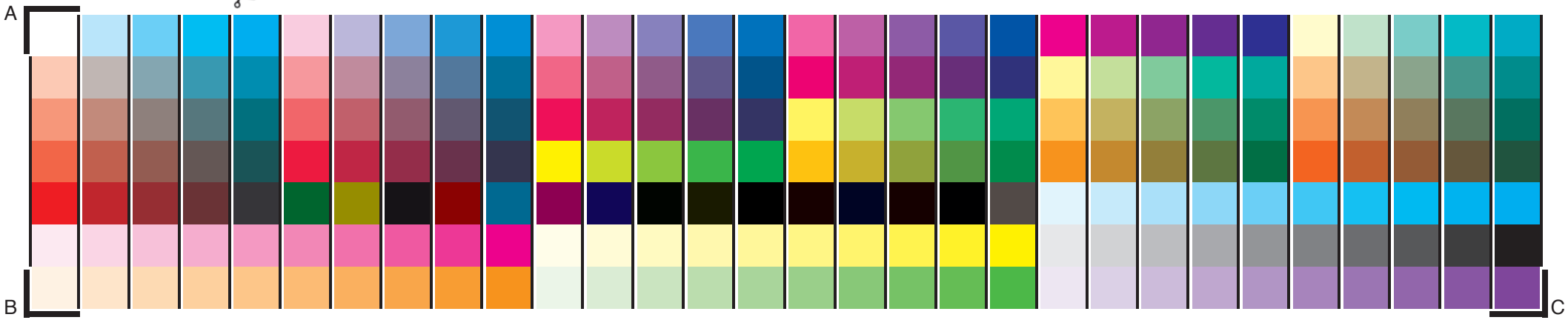
Microscopy reveals the OGV inks which increases the color gamut

HP Indigo 7900



2 mm



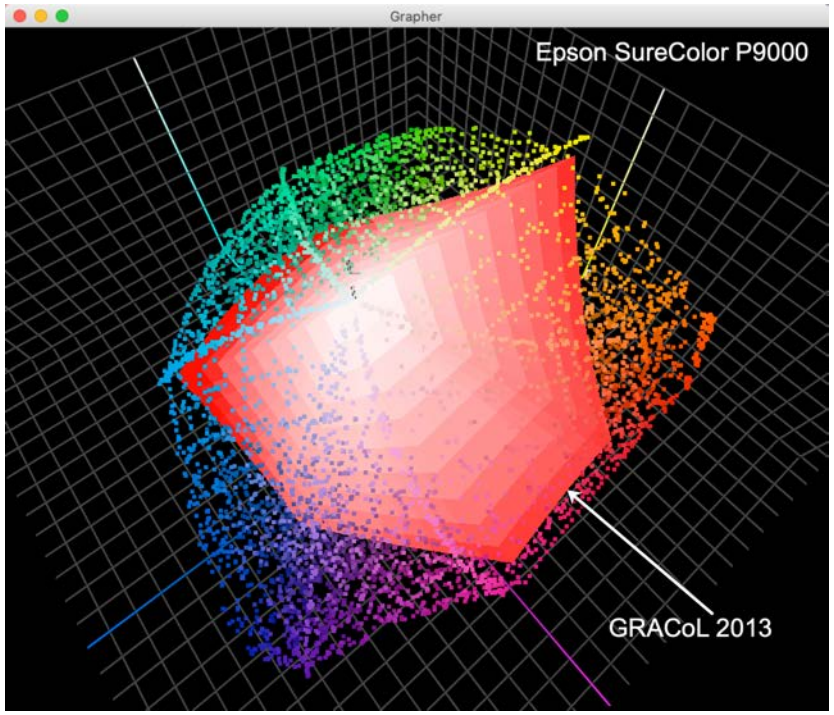


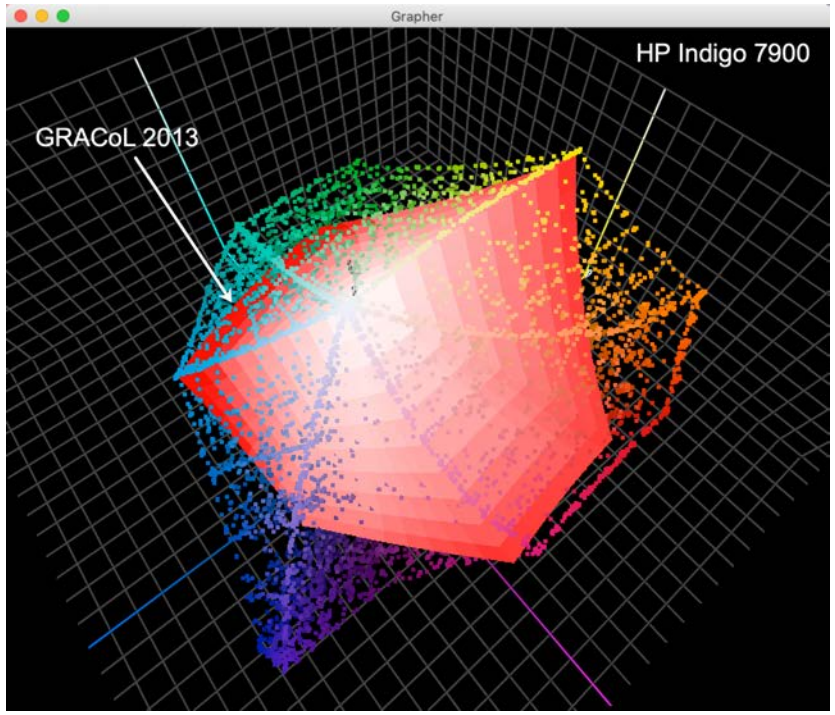
In EG we use CMYK-OGV to make all the other colors

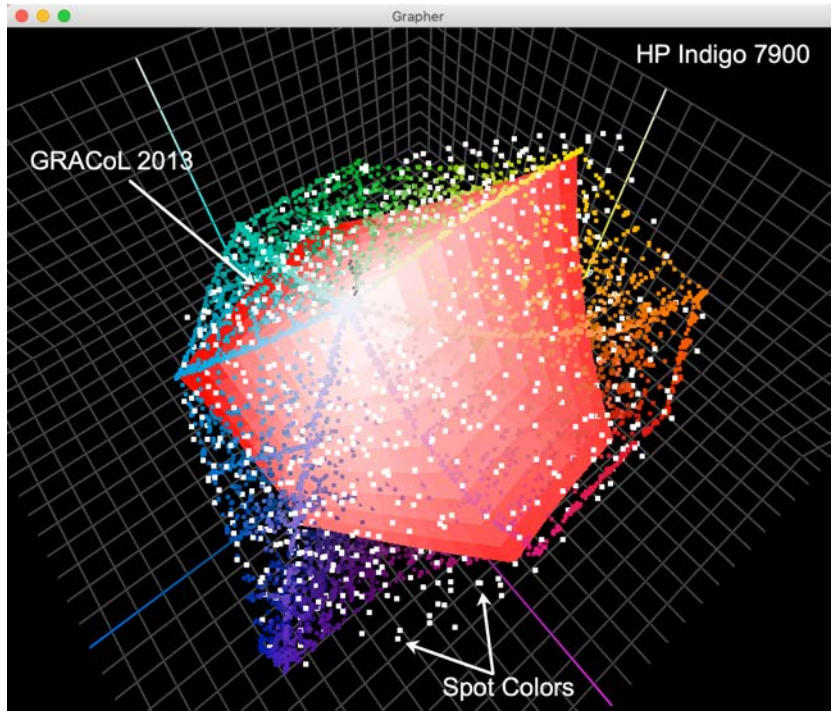
Page: 1/1
Color Space: CMYKOGV
Chart Name: QualityControl_7CLR

Device Name: IO
Creation Date: 11:51:48 30-4-2019

CMYK-OGV is bigger than GRACoL and SWOP?





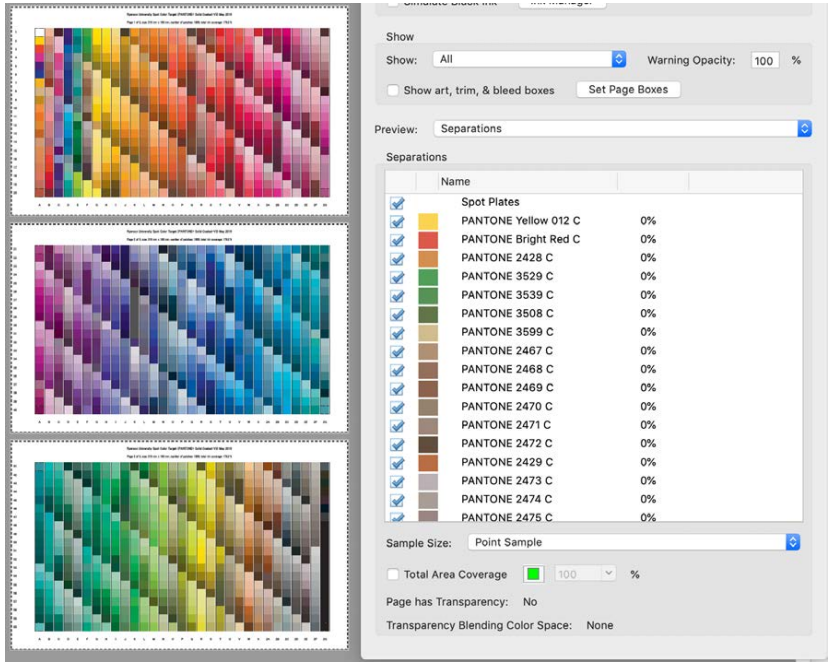


- The Epson P9000 is bigger than GRACoL 2013
- The HP Indigo is bigger than GRACoL 2013
- Most PANTONE spot colors are realizable

Overview……

We took 1846 values of the PANTONE+ Solid Coated library

Put them into a 3-page pdf (using CGS ORIS X GAMUT)

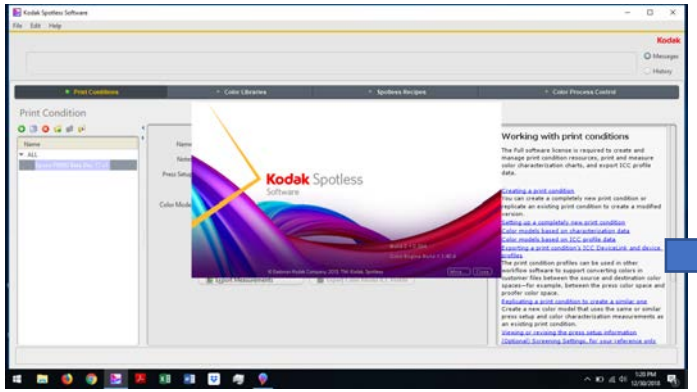


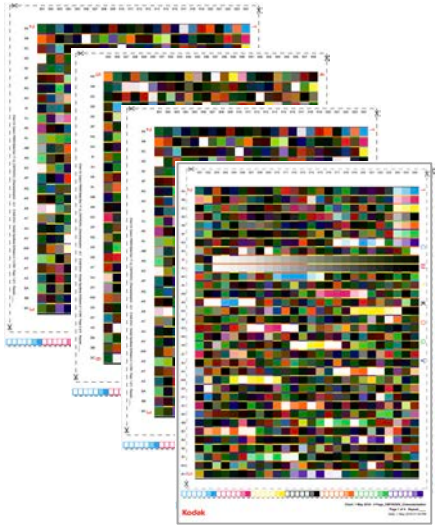
Printed using Alwan, CGS ORIS, ColorLogic, GMG Color, Heidelberg, Kodak

Epson SureColor P9000 (CMYK-OGV)

HP Indigo 7900 (CMYK-OGV)

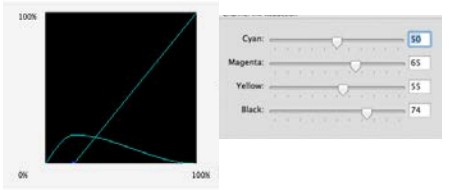
Printing PANTONE+ Solid Coated in CMYKOGV





4-page chart i1iO format

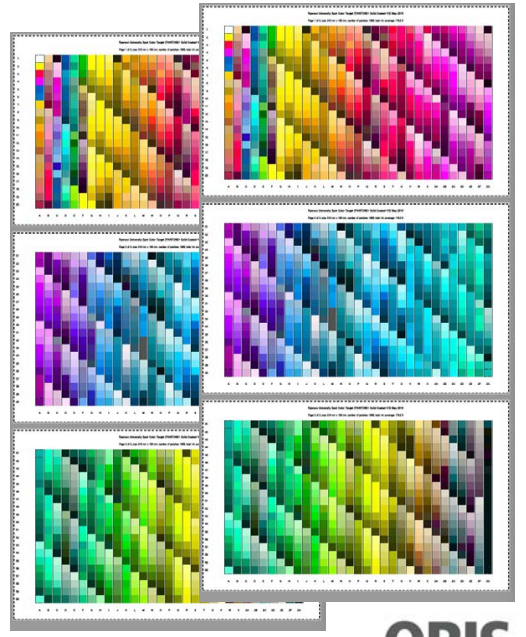
Epson SureColor P9000 CE



Name	Recipe (CMYKOGV %)	Target L*a*b*
PANTONE 2415 C	36.2 99.0 0.0 5.2 0.0 0.0 0.0	36.11 64.15 -23.61
PANTONE 2425 C	0.0 98.9 0.0 40.7 0.0 0.0 98.6	29.74 55.01 -18.17
PANTONE 243 C	0.0 26.0 0.0 0.0 0.0 0.0 6.9	80.67 24.89 -14.18
PANTONE 244 C	0.0 35.4 0.0 0.0 0.0 0.0 17.0	73.60 36.48 -20.42
PANTONE 245 C	0.0 45.8 0.0 0.0 0.0 0.0 27.6	66.50 47.05 -26.13
PANTONE 246 C	0.0 74.1 0.0 0.0 0.0 0.0 57.4	49.00 71.35 -33.52
PANTONE 247 C	0.0 79.4 0.0 0.1 0.0 0.0 66.9	45.20 69.70 -31.89
PANTONE 248 C	35.9 92.1 0.0 0.0 0.0 0.0 0.0	40.13 62.35 -28.29
PANTONE 249 C	32.5 85.7 0.0 44.7 0.0 0.0 0.0	32.96 44.66 -18.43
PANTONE 7646 C	0.0 43.5 2.5 43.9 0.0 0.0 0.0	53.35 27.30 -4.09

PANTONE

CMYKOGV



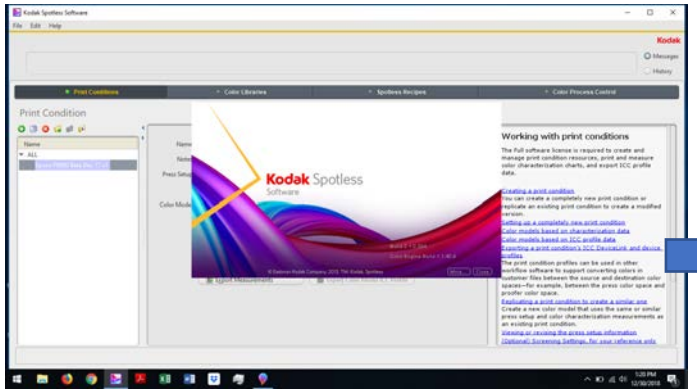
Note: i1Pro2 is same as above

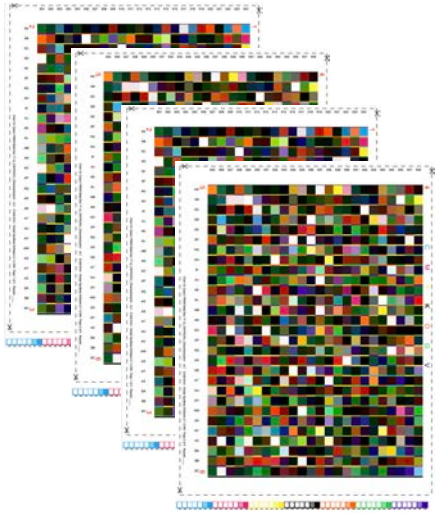
PANTONE+ Solid Coated-V3.cxf

CIEDE2000 for 1846 PANTONE+ Solid Coated library

ORIS X GAMUT

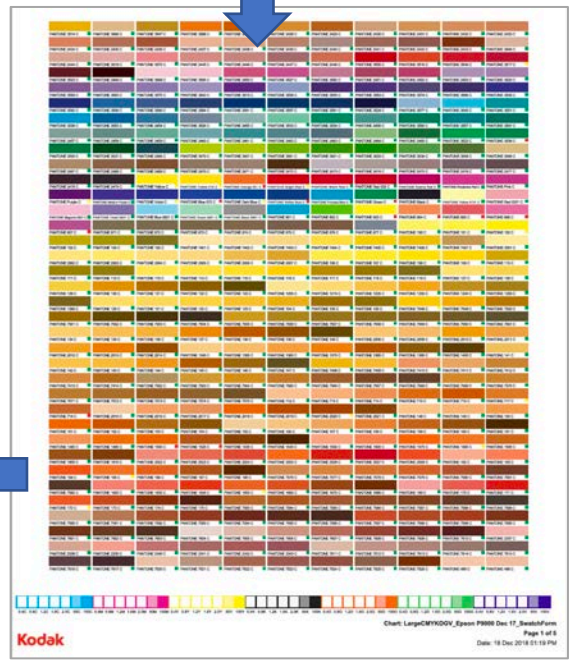
Real Results with Kodak Spotless



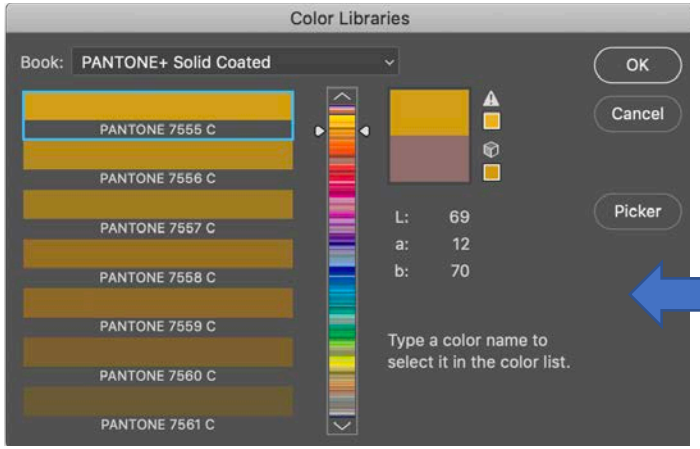


Epson SureColor P9000

Name	Recipe (CMYKOGV %)	Target L*a*b*
PANTONE 2415 C	36.2 99.0 0.0 5.2 0.0 0.0 0.0	36.11 64.15 -23.61
PANTONE 2425 C	0.0 98.9 0.0 40.7 0.0 0.0 98.6	29.74 55.01 -18.17
PANTONE 243 C	0.0 26.0 0.0 0.0 0.0 0.0 6.9	80.67 24.89 -14.18
PANTONE 244 C	0.0 35.4 0.0 0.0 0.0 0.0 17.0	73.60 36.48 -20.42
PANTONE 245 C	0.0 45.8 0.0 0.0 0.0 0.0 27.6	66.50 47.05 -26.13
PANTONE 246 C	0.0 74.1 0.0 0.0 0.0 0.0 57.4	49.00 71.35 -33.52
PANTONE 247 C	0.0 79.4 0.0 0.1 0.0 0.0 66.9	45.20 69.70 -31.89
PANTONE 248 C	35.9 92.1 0.0 0.0 0.0 0.0 0.0	40.13 62.35 -28.29
PANTONE 249 C	32.5 85.7 0.0 44.7 0.0 0.0 0.0	32.96 44.66 -18.43
PANTONE 7646 C	0.0 43.5 2.5 43.9 0.0 0.0 0.0	53.35 27.30 -4.09



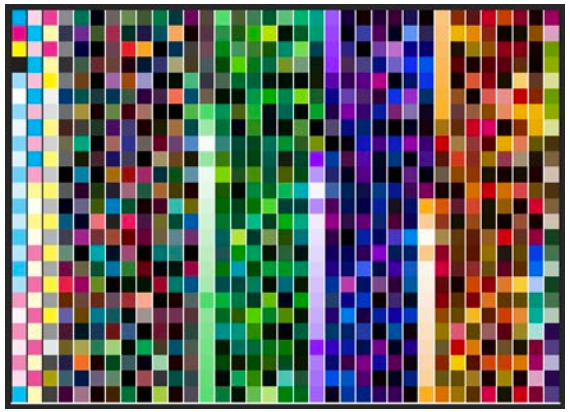
Photoshop CC 2018



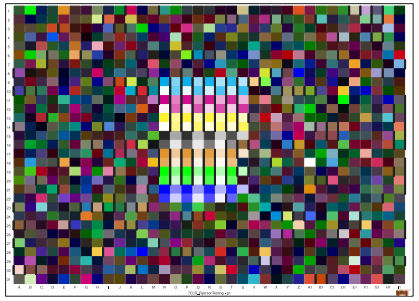
Spot color	CIEDE2000
PANTONE 7555 C	0.54

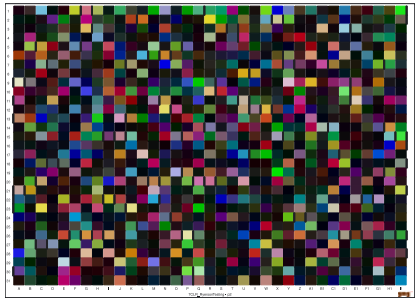
With permission and thanks to William Li, Stephen Zmetana, Kodak

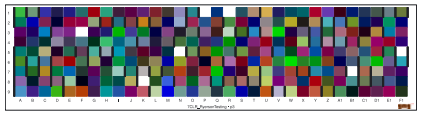
Charts can vary between vendors



AlwanHydra_7C_875p_ProfilingChart_Xrite_iO
1 page!







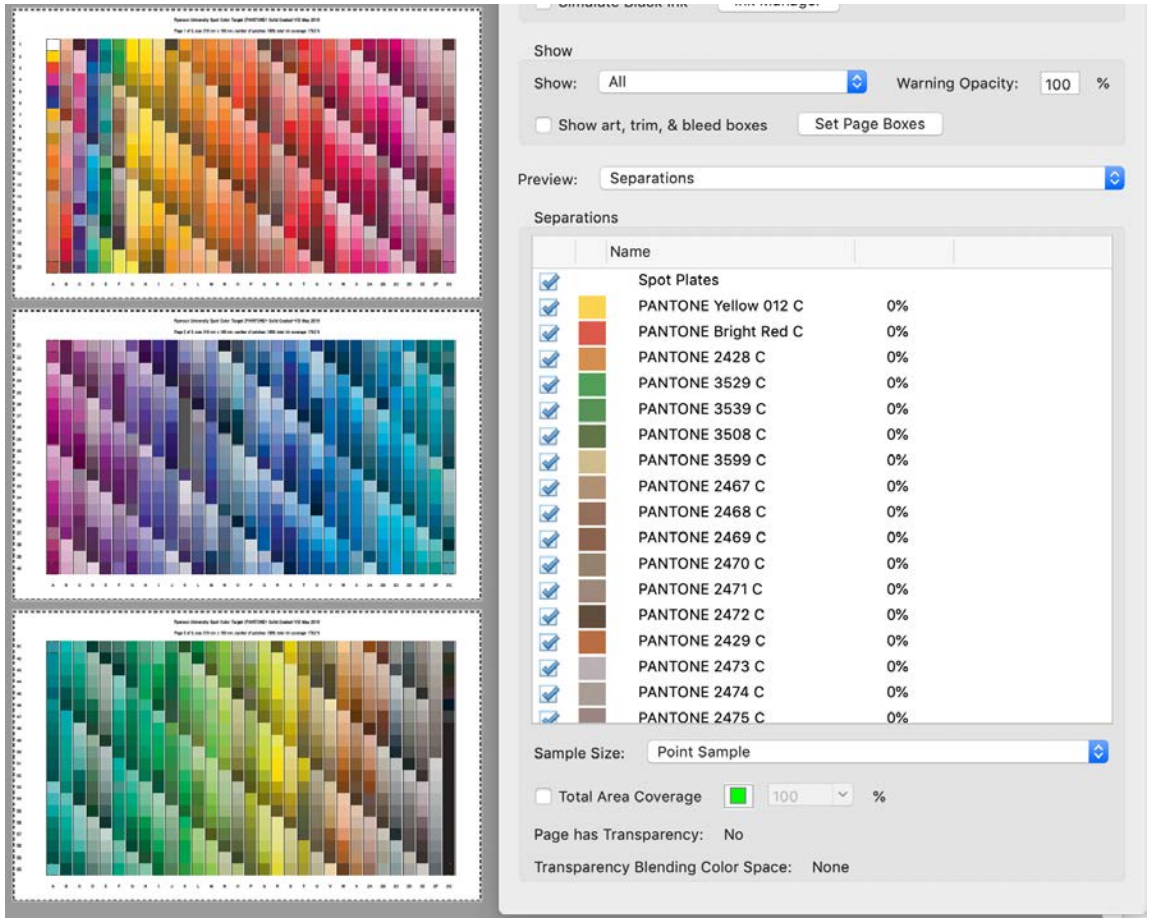
GMG OpenColor 2.2.1
2.5 pages

Kodak Spotless
KSS 2.01
4 pages

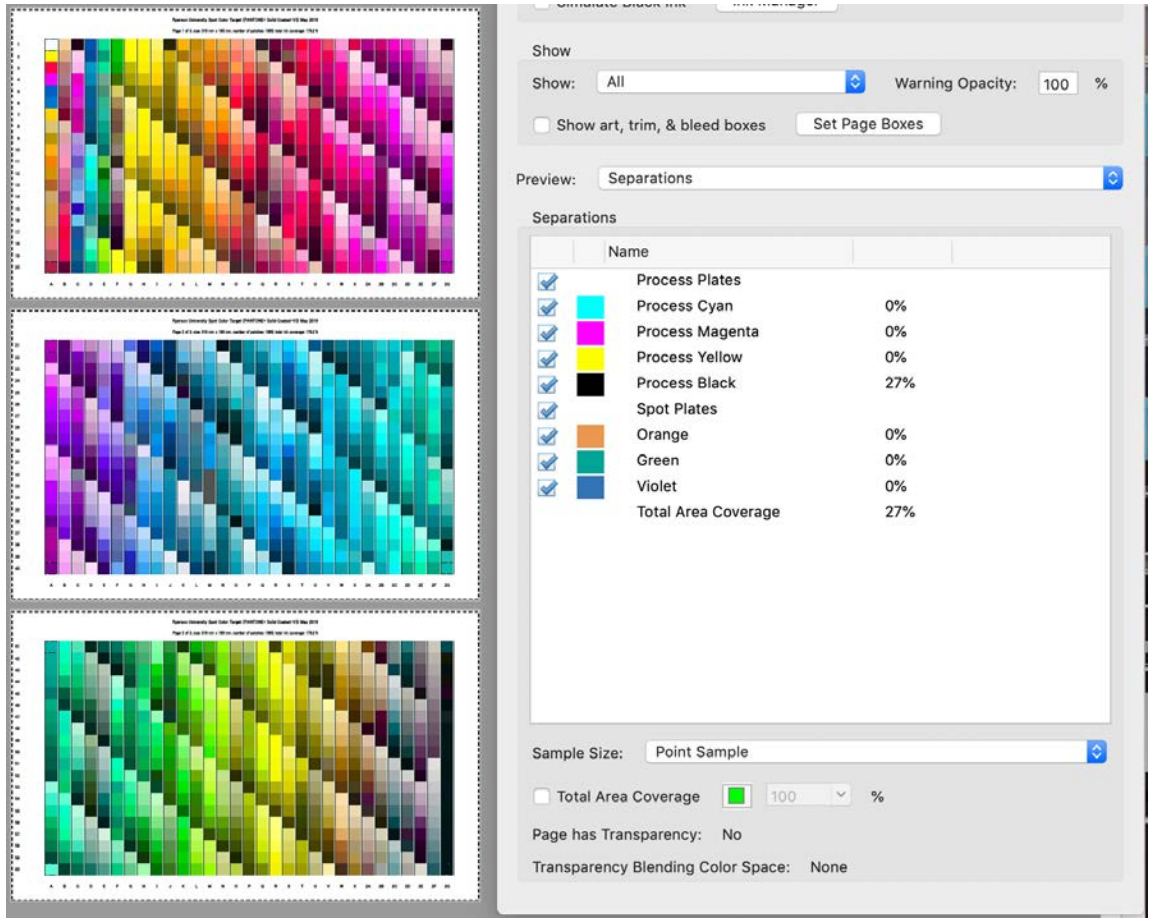
There is no IT8.7/4 standard yet.

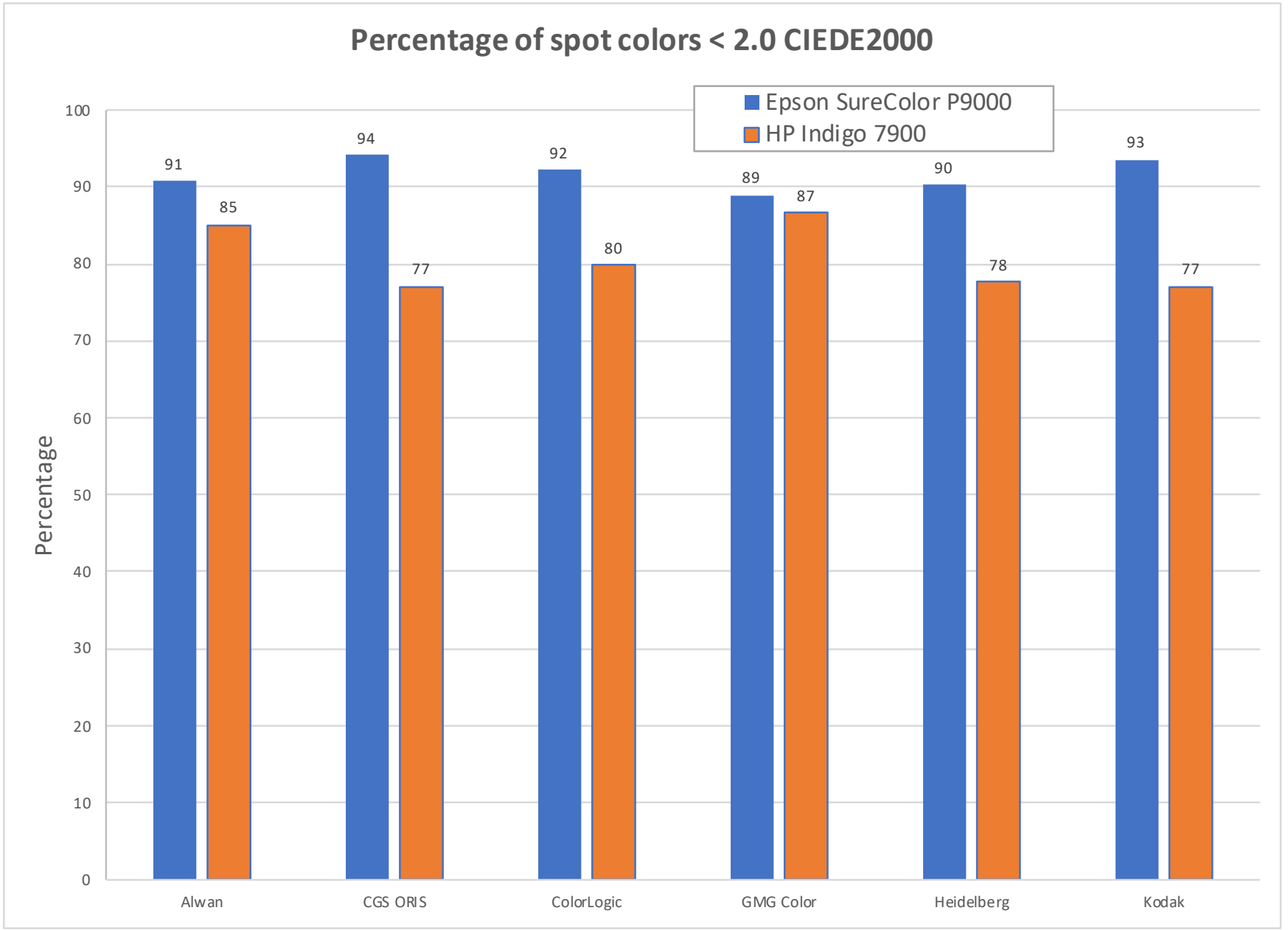
Converting spot channels to CMYK-OGV

If we have a file like this…



…we can convert it into inking values.





PANTONE+ Solid Coated Library

Epson P9000 – 89-94%
HP Indigo – 77-87%

- Devices have an expanded gamut – inks, paper, printing
- Charts are able to capture the gamut
- Software is able to make a valid recipe
- Stable printing process

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ORIS X Gamut

- 127 C is a yellow, made from Y and O.
- If drift – same color!

Spot Color Correction

File: ogram Files (x86)\CGS\Common Files\CTuner Setups\PDF color correction\Walk Through April 8\Spotcolor\PANTONE+ Solid Coated-V3_M2.scgx — New... Browse...

Device profile: :\Program Files (x86)\CGS\Common Files\CTuner Setups\PDF color correction\Walk Through April 8\Measurement\Measurement 11 March v1.txt — Info Browse...

Comment: D50 2° Measurement methode UV cut filter (M2)

Tolerances — Strict: 0. Standard: 0.

Search: 127 < > 1/1867 selected

Color	Info	L	a	b	C	M	Y	K	Or	Gr	Vi	Opacity	Level	dE2000	Strict	Std.
PANTONE 117 C	S	66.2	11.9	78.6	0.0	0.0	75.8	16.6	16.3	0.0	0.0	0.0	1	2.19		
PANTONE 118 C	S	58.1	9.0	66.3	0.0	0.0	71.7	28.6	16.7	0.0	0.0	0.0	1	1.10		
PANTONE 119 C	S	49.7	2.4	45.8	0.0	0.0	66.9	49.1	6.5	0.0	0.0	0.0	1	0.48		
PANTONE 127 C	S	88.3	-0.9	56.7	0.0	0.0	47.6	0.0	8.7	0.0	0.0	0.0	1	0.47		
PANTONE 128 C	S	86.2	1.9	67.5	0.0	0.0	54.5	0.0	11.6	0.0	0.0	0.0	1	0.96		
PANTONE 129 C	S	84.8	3.9	71.9	0.0	0.0	57.2	2.5	12.7	0.0	0.0	0.0	1	1.56		
PANTONE 130 C	S	75.3	22.1	82.9	0.0	0.0	54.9	3.9	30.0	0.0	0.0	0.0	1	1.50		

-- Import spot color -- | Import ORIS CxF Cloud | Overprint | Calculate

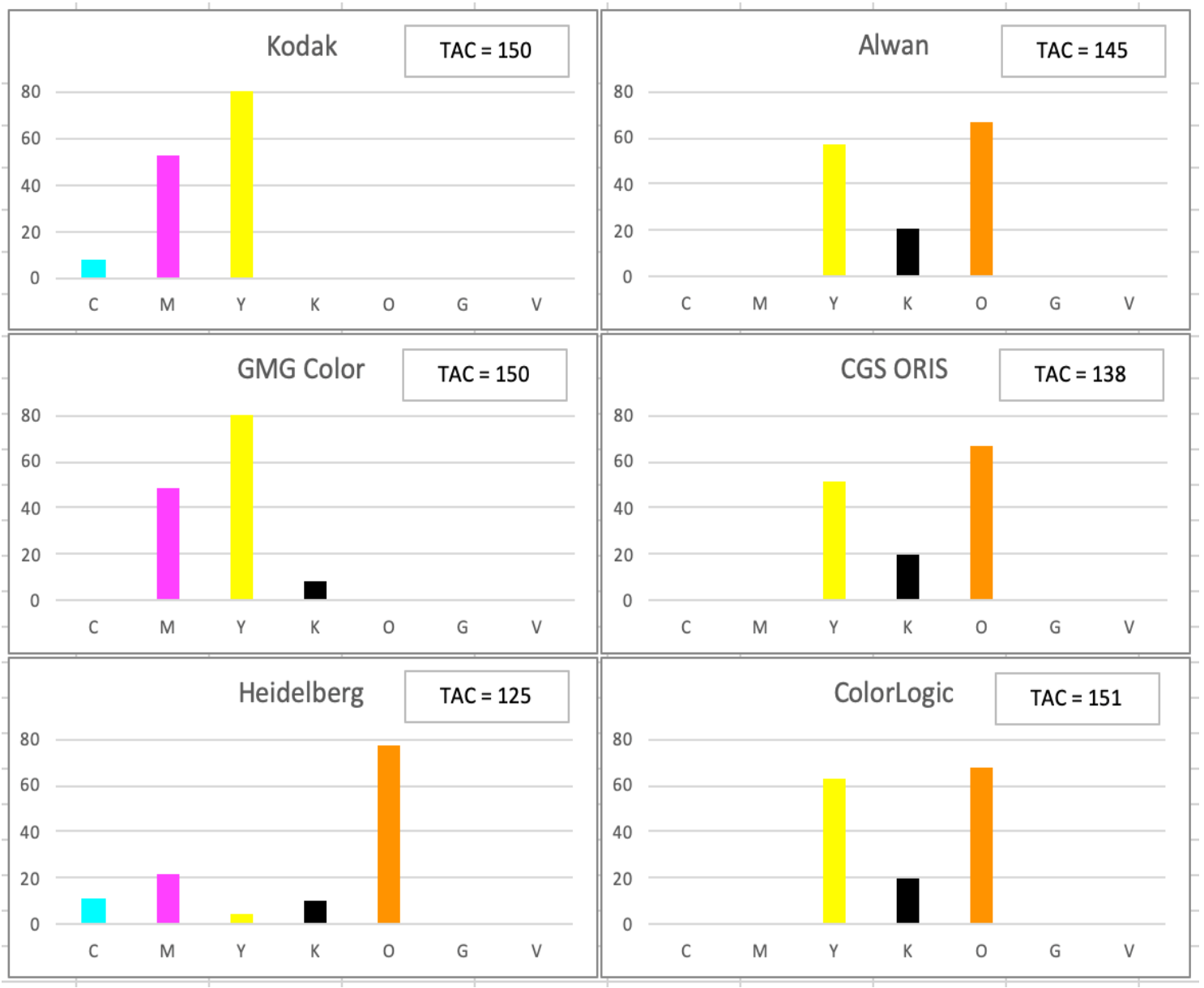
Spot Color: New... | Duplicate... | Change... | Dot gain | Define spot colors visually | Delete | Rename... | Gradation... | Delete dot gain | Create CxF/X4 color wedge

All Spot Colors: Optimize iteratively | Optimize | Optimize multichannel | Dot gain | Create swatchbook | Control measurement... | Refine | Reset

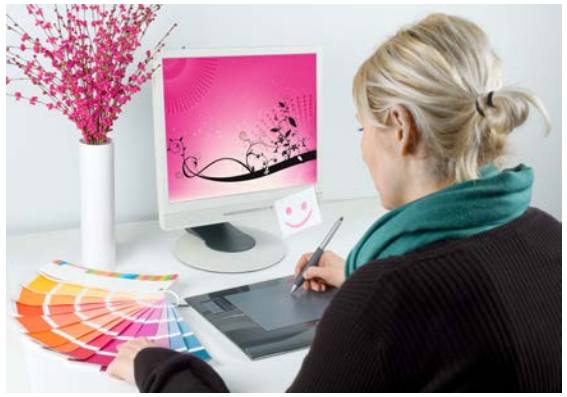
Save | Save as... | OK | Cancel | Help

Analysis of Inking Values

- Redundancy – GCR/UCR for 7-colors!
- Alwan, CGS ORIS, ColorLogic used Orange
- Kodak and GMG Color used CMYK
- Heidelberg used 5 colorants
- All mixes made the same color
- Stability on conventional press
- Digital printing there are click charges

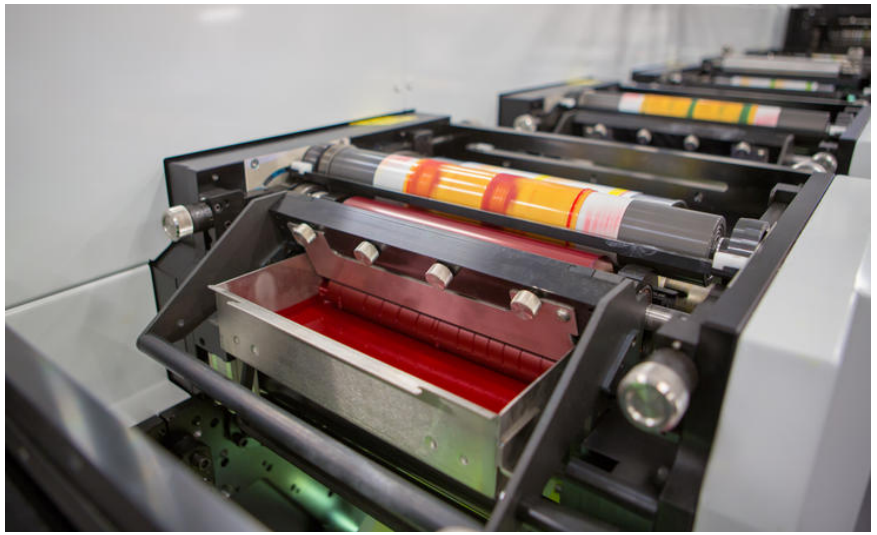


Printing with a spot color ink – you can't be serious!



- The designer selects a spot color.
- Ink is ordered and formulated for the customer job.
- The ink quantity needs to be estimated and match the run length.
- We wait until we have received the ink to print the job.
- The customer cannot increase the print run – not enough ink.
- The ink is put into its own printing unit.
- After the job, the unit is washed up, ink change for next spot color.
- Left over ink is stored, in case customer needs this color again!
- Need same swatch book as designer.
- You can't be serious?

Reduce washup and press changes in package printing



Expanded Gamut printing allows for a new fixed palette of CMYK-OGV inks that become the “process colors”. The fixed CMYK-OGV stays in the press, we only change plates, and the designer can select from any spot color they want….

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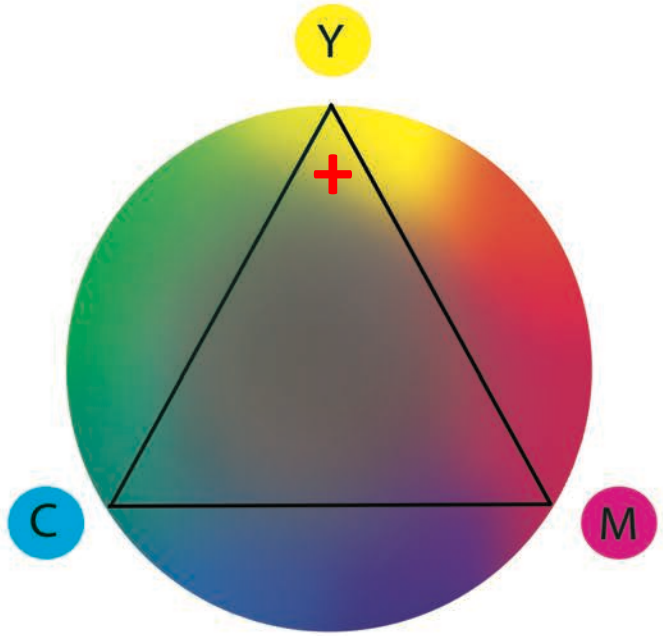
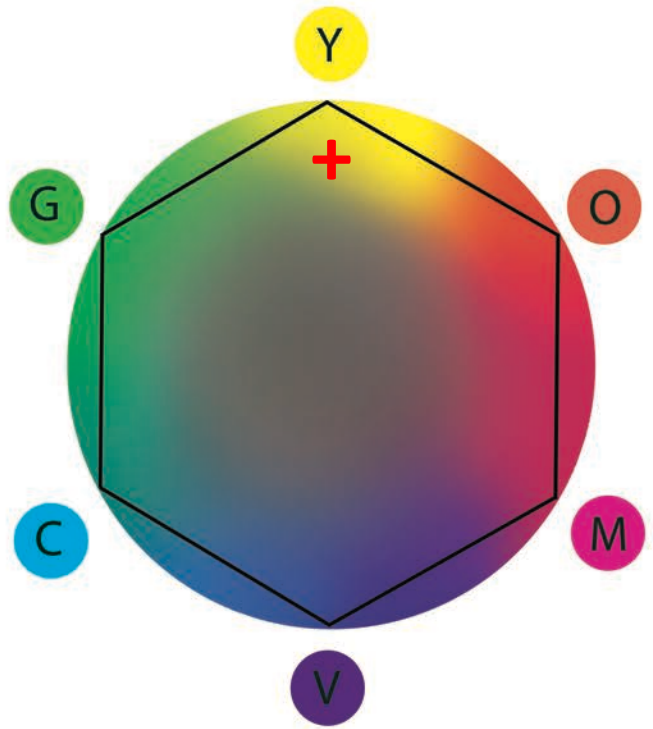
Selling EG to your press operator……
“I can’t control 4 inks, how can I control 7!”

In EG no color needs all 7 inks at the same time.

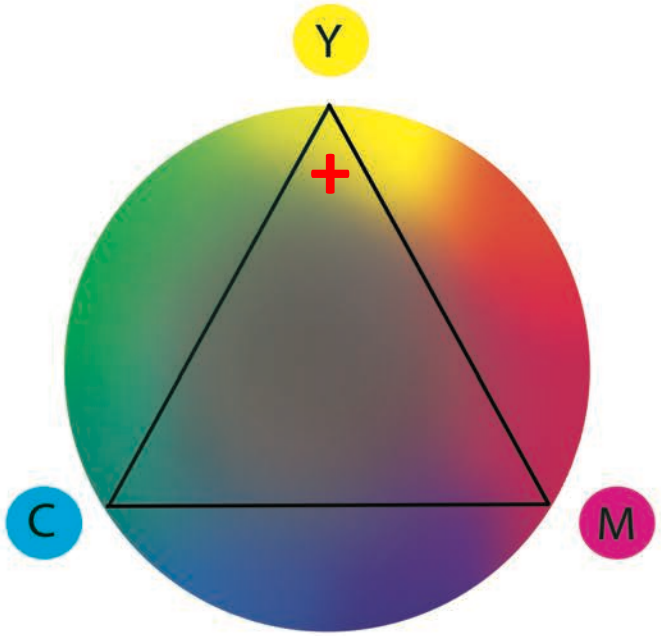
In EG maximum 3 inks are used.

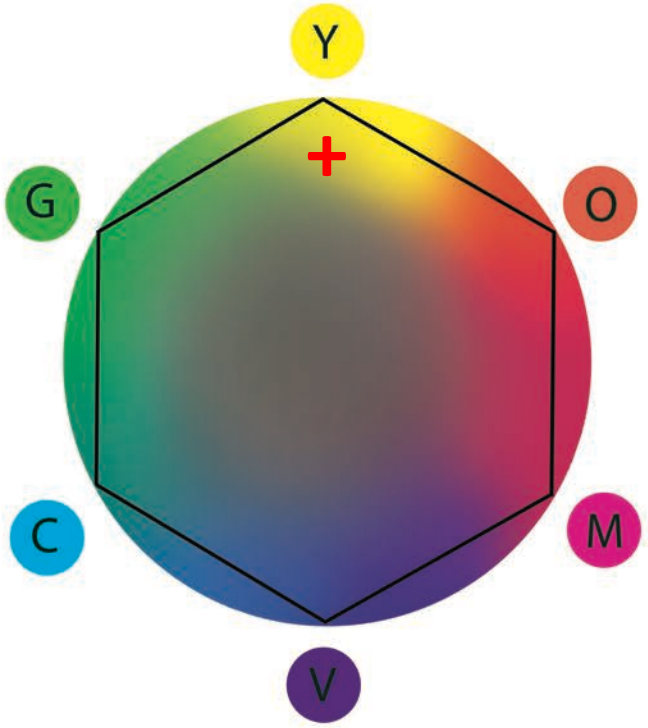
And, the 2 or 3 inks are closer to the required color, so press drift has minimal visual effect.



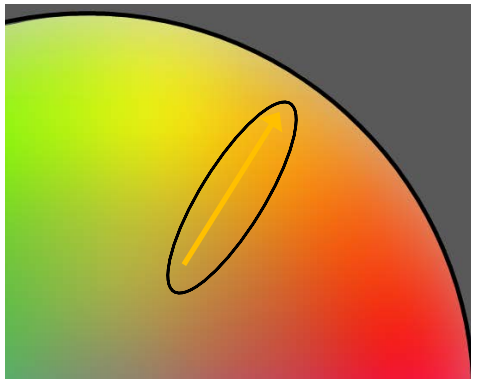


CMYK-OGV printing is easier to control

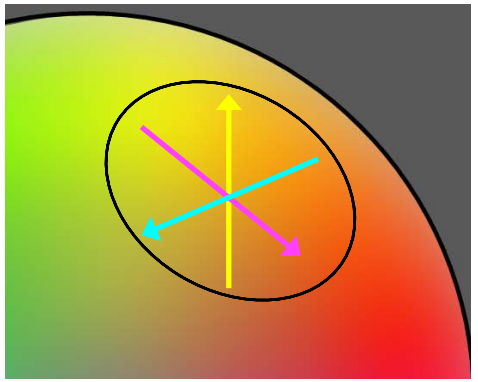




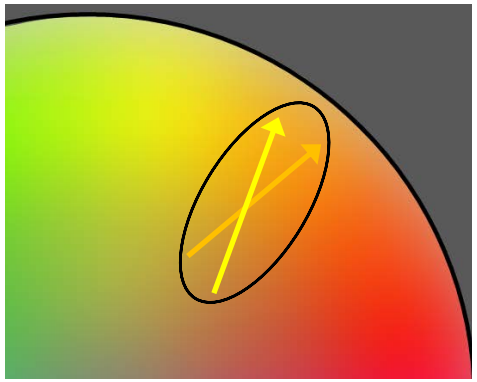
Single spot color ink



CMYK overprint



CMYK-OGV overprint

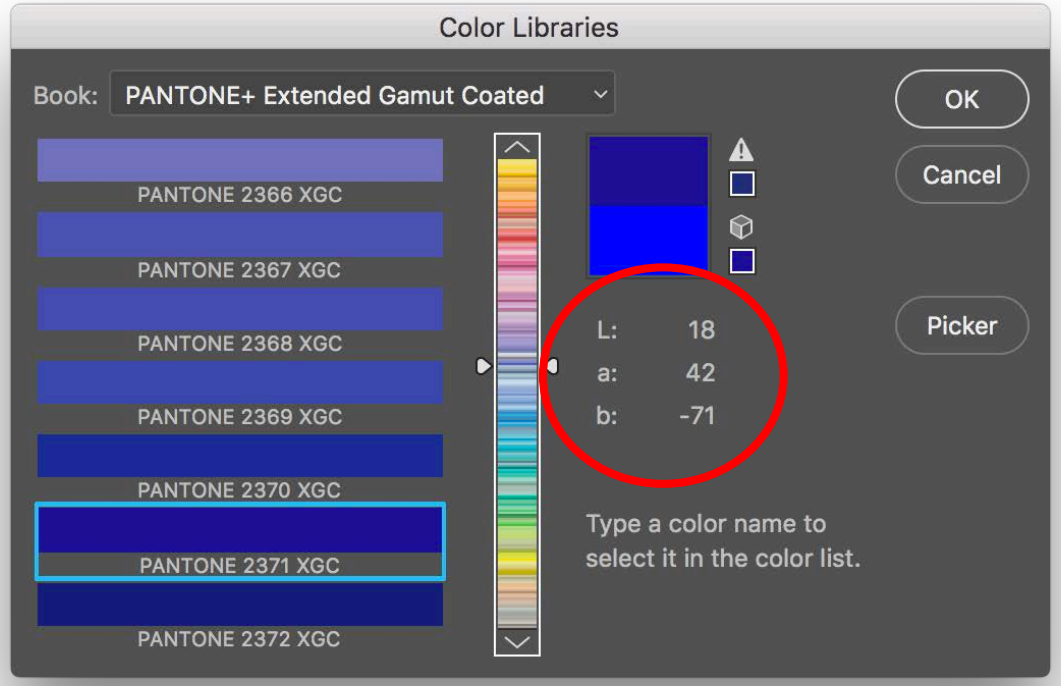


A single spot color ink may vary only in density, causing minimal shift.
A CMYK overprint can vary, causing huge hue and saturation shifts.
CMYK-OGV uses only nearest 2-3 colorants causing minimal hue shift.

Accuracy of PANTONE+ EXTENDED GAMUT Guide

I measured PANTONE 2371 C in an EXTENDED GAMUT Guide with a SpectroDens4, and the L*a*b* value measured from the swatch book agrees with Photoshop to 0.73 CIEDE2000!!!!

…and every swatch in the whole book is made from 3 inks only




CMYK - OGV
AS-2
AS-2
CMYK + Spot
CMYK

CMYK – OGV
7 “process” colors

No ink changes

Comco Cadet
narrow-web flexo
press

Ryerson University

Benefits of Expanded Gamut Printing for Spot **C**olors

- More spot colors in gamut
- Less spot color inks/inventory
- Less wash up time
- Ganging up jobs
- Better control on press
- Ink savings
- Higher accuracy

We are sitting on a revolution in printing

Important Statement

“An expanded gamut system can avoid the overhead of printing with spot color inks, and replace them with a fixed set of expanded gamut inks while still achieving the customer's requested color."

Barbara Braun-Metz, CEO, ColorLogic GmbH

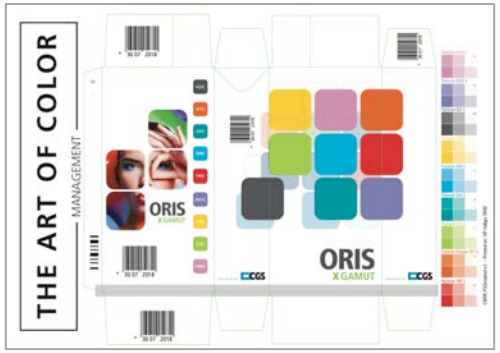
What do I need to implement EG?

Inkjet Proofers

Commercial Edition EG inks

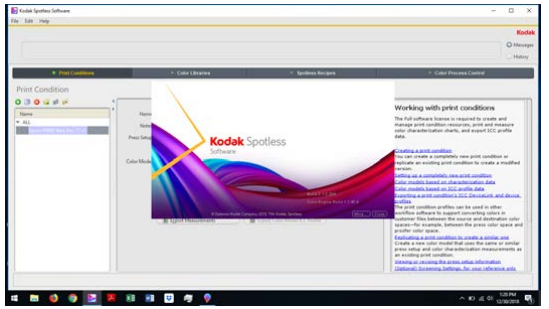
Epson SureColor P9000

Label Printing Package Printing



ORIS X GAMUT

Software

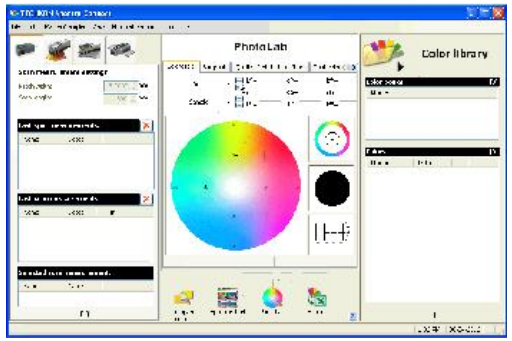


Kodak Spotless

PANTONE EXTENDED GAMUT Guide

SpectroDens4 Spectro Connect

SpectroDens4



Spectro Connect 2.7

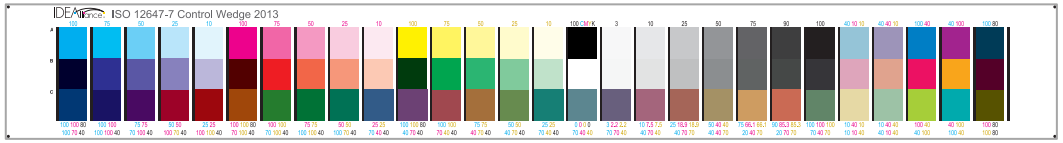
Ryerson University Study 2019 and 2020

Fogra Multicolor Forum 2018 and January, 2020

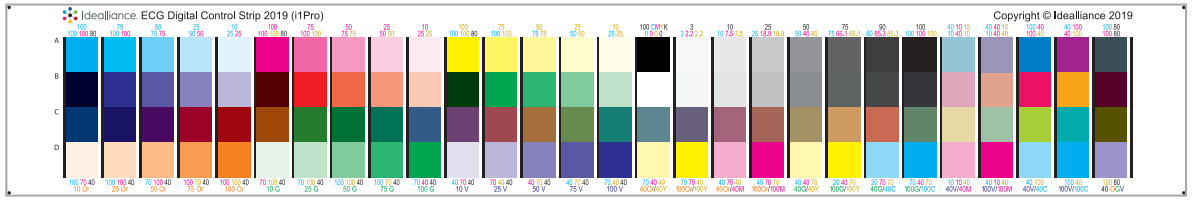
Idealliance Control Strips

Idealliance 2-row Control Strip 2009 - CMYK

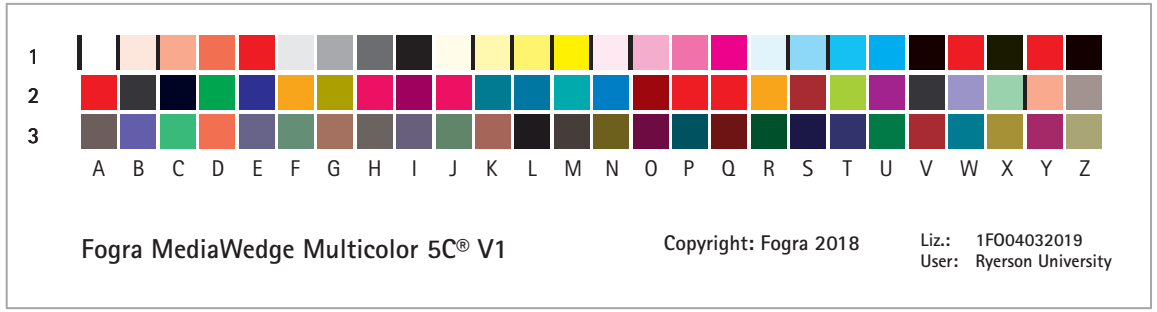
Idealliance 3-row Control Strip 2013 – CMYK

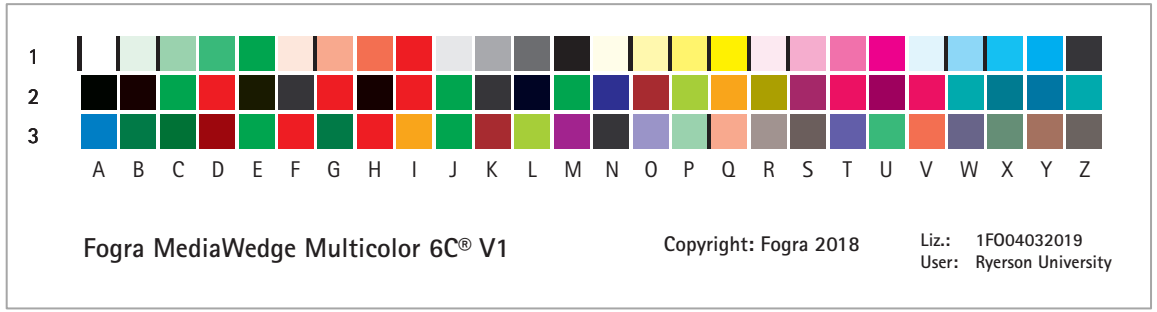


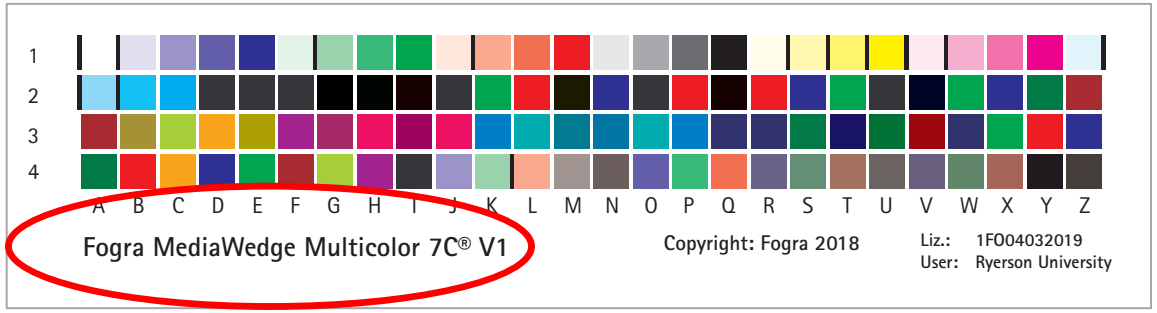
Idealliance ECG Digital Control Strip 2019 – CMYK OGV



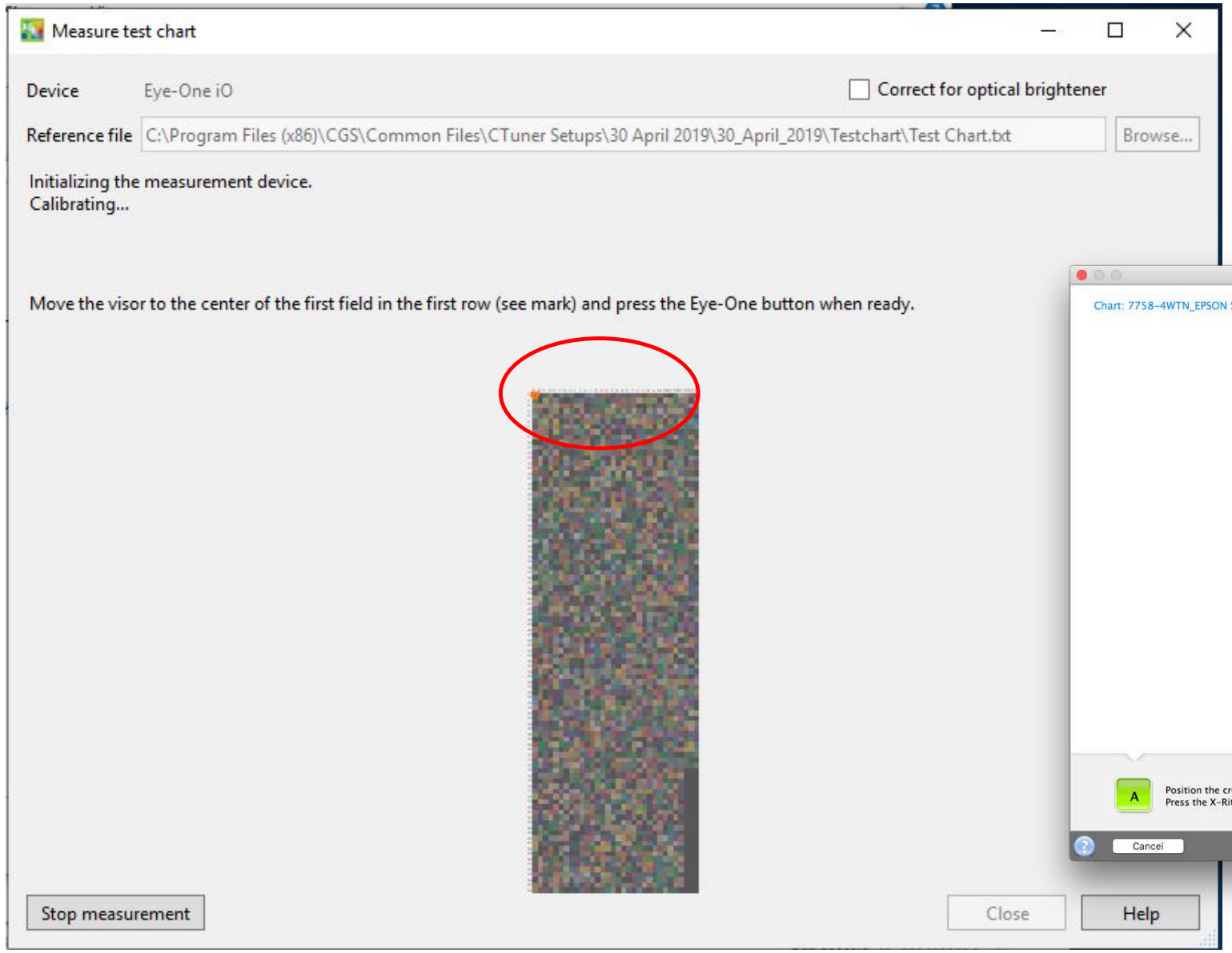
Fogra Media Wedges

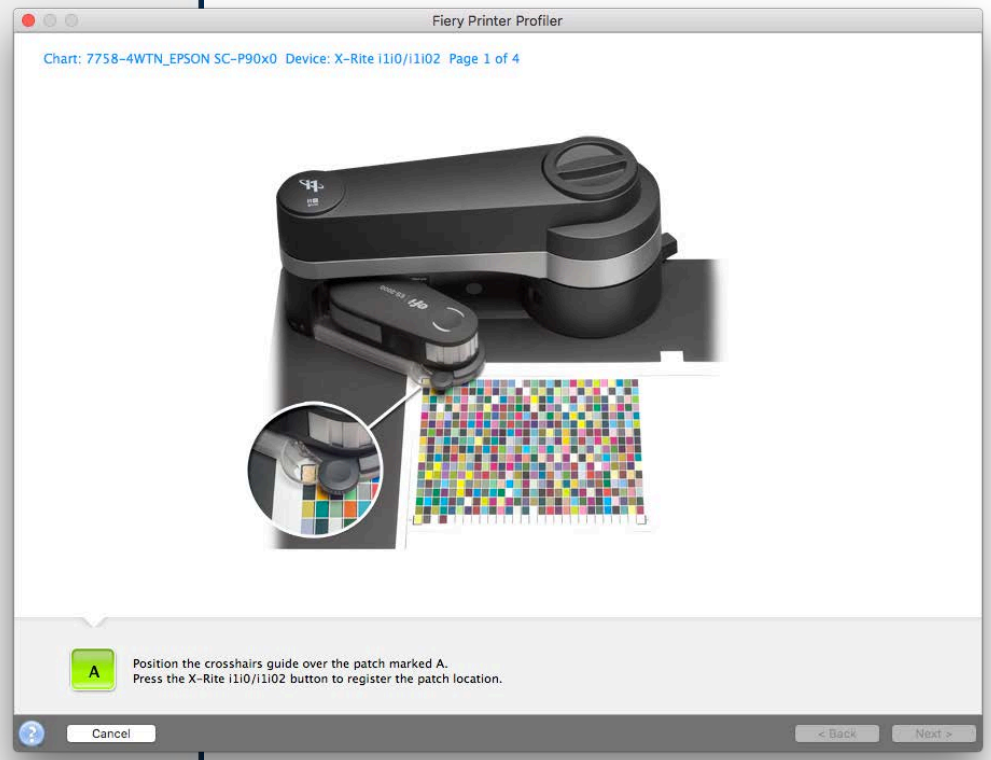






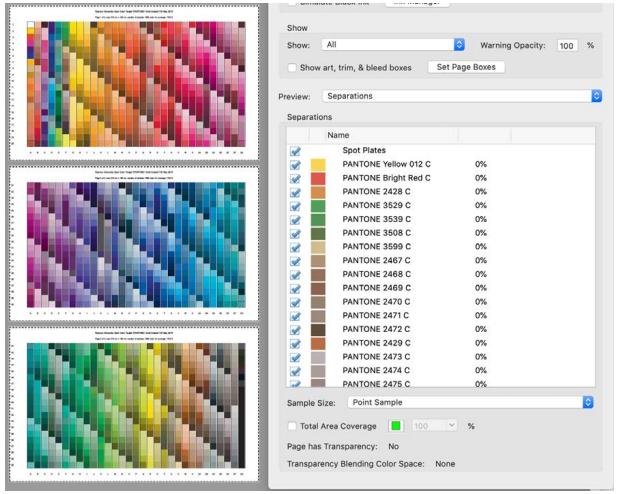
User Experience

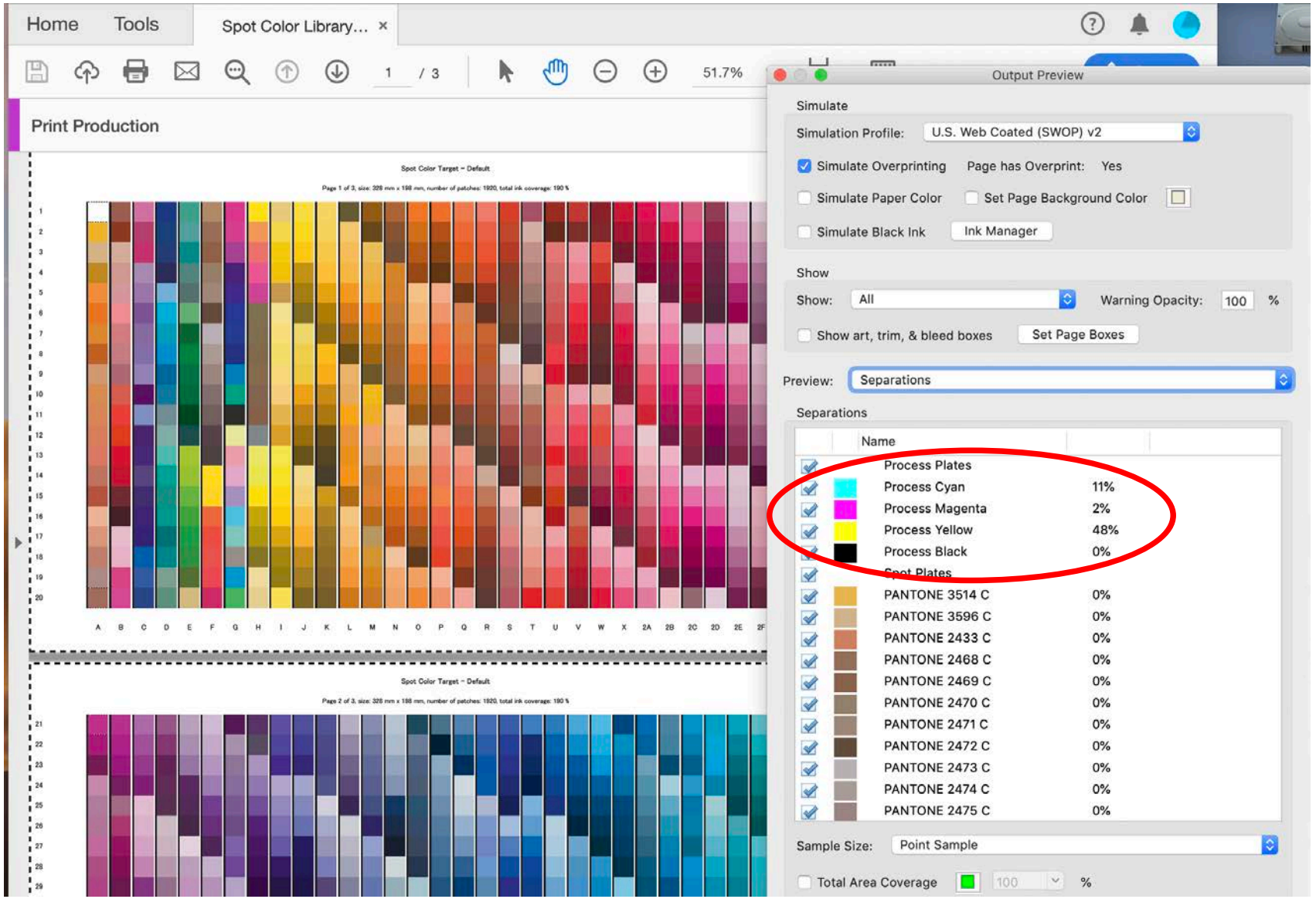


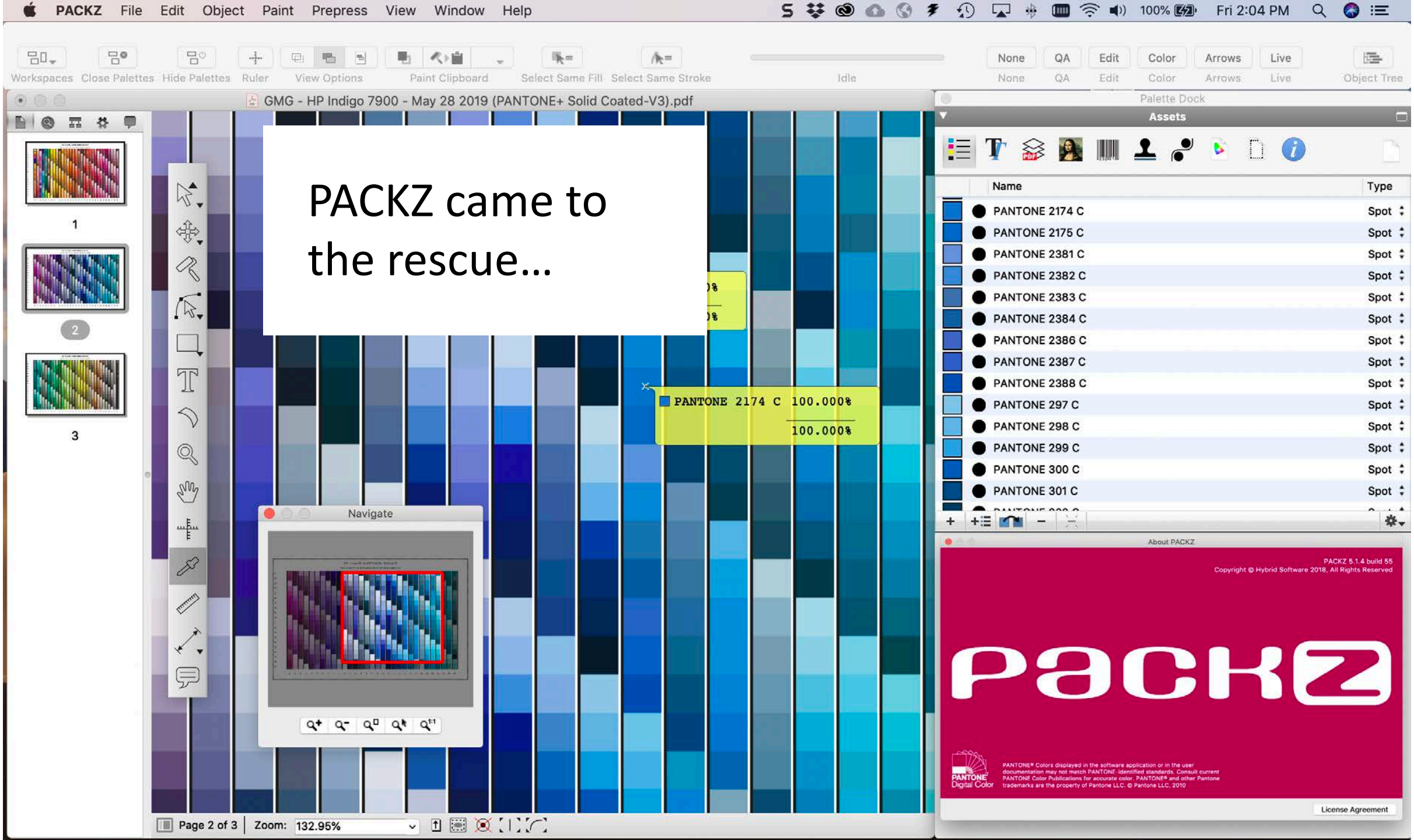


Acrobat Pro cannot show all spot channels!!!!

- Acrobat Pro can only show ~ 30 spot color names.
- The cursor for other spot channels shows CMYK.

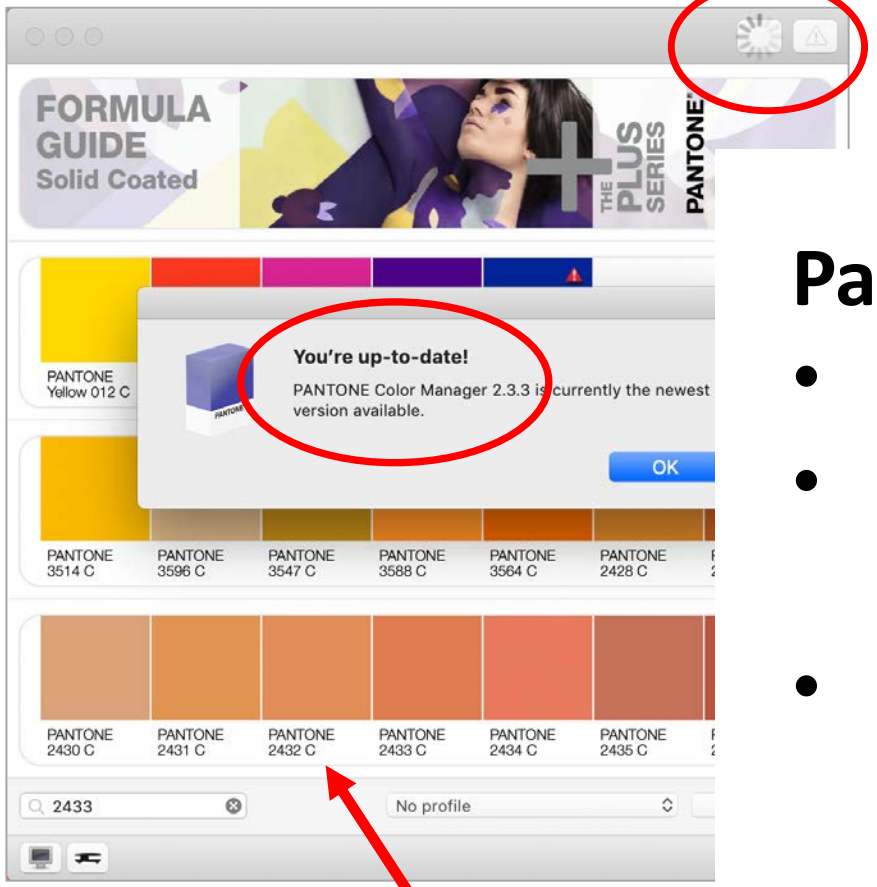


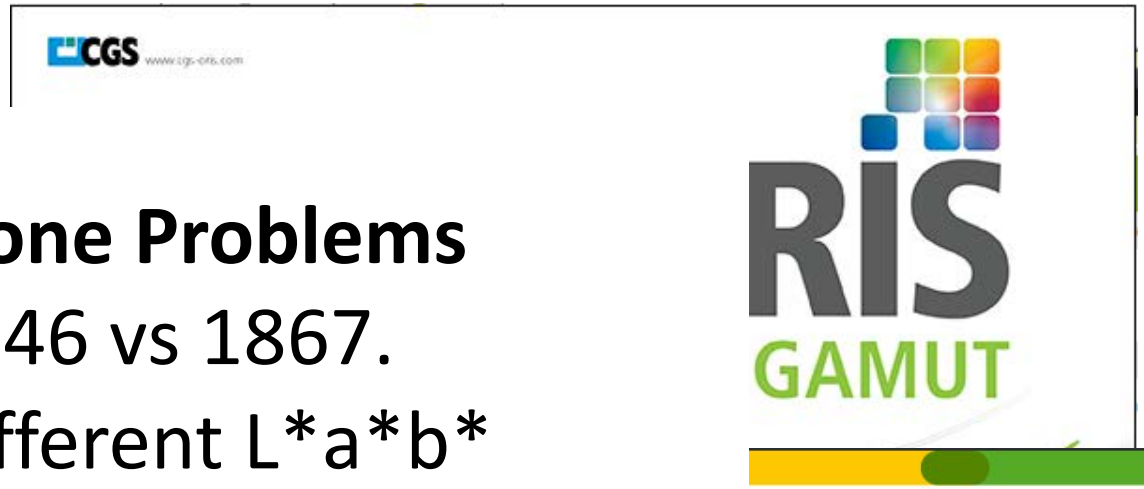



PACKZ came to the rescue…
PACKZ File Edit Object Paint Prepress View Window Help
Workspaces Close Palettes Hide Palettes Ruler View Options Paint Clipboard Select Same Fill Select Same Stroke Idle
None QA Edit Color Arrows Live Object Tree
GMG - HP Indigo 7900 - May 28 2019 (PANTONE+ Solid Coated-V3).pdf
Palette Dock
Assets
Name
Type
PANTONE 2174 C Spot
PANTONE 2175 C Spot
PANTONE 2381 C Spot
PANTONE 2382 C Spot
PANTONE 2383 C Spot
PANTONE 2384 C Spot
PANTONE 2386 C Spot
PANTONE 2387 C Spot
PANTONE 2388 C Spot
PANTONE 297 C Spot
PANTONE 298 C Spot
PANTONE 299 C Spot
PANTONE 300 C Spot
PANTONE 301 C Spot
PANTONE 2174 C 100.000%
100.000%
Navigate
About PACKZ
PACKZ 5.1.4 build 55
Copyright © Hybrid Software 2018, All Rights Reserved
PACKZ
PANTONE Digital Color
License Agreement
Page 2 of 3
Zoom: 132.95%

PANTONE Color Manager ($99)

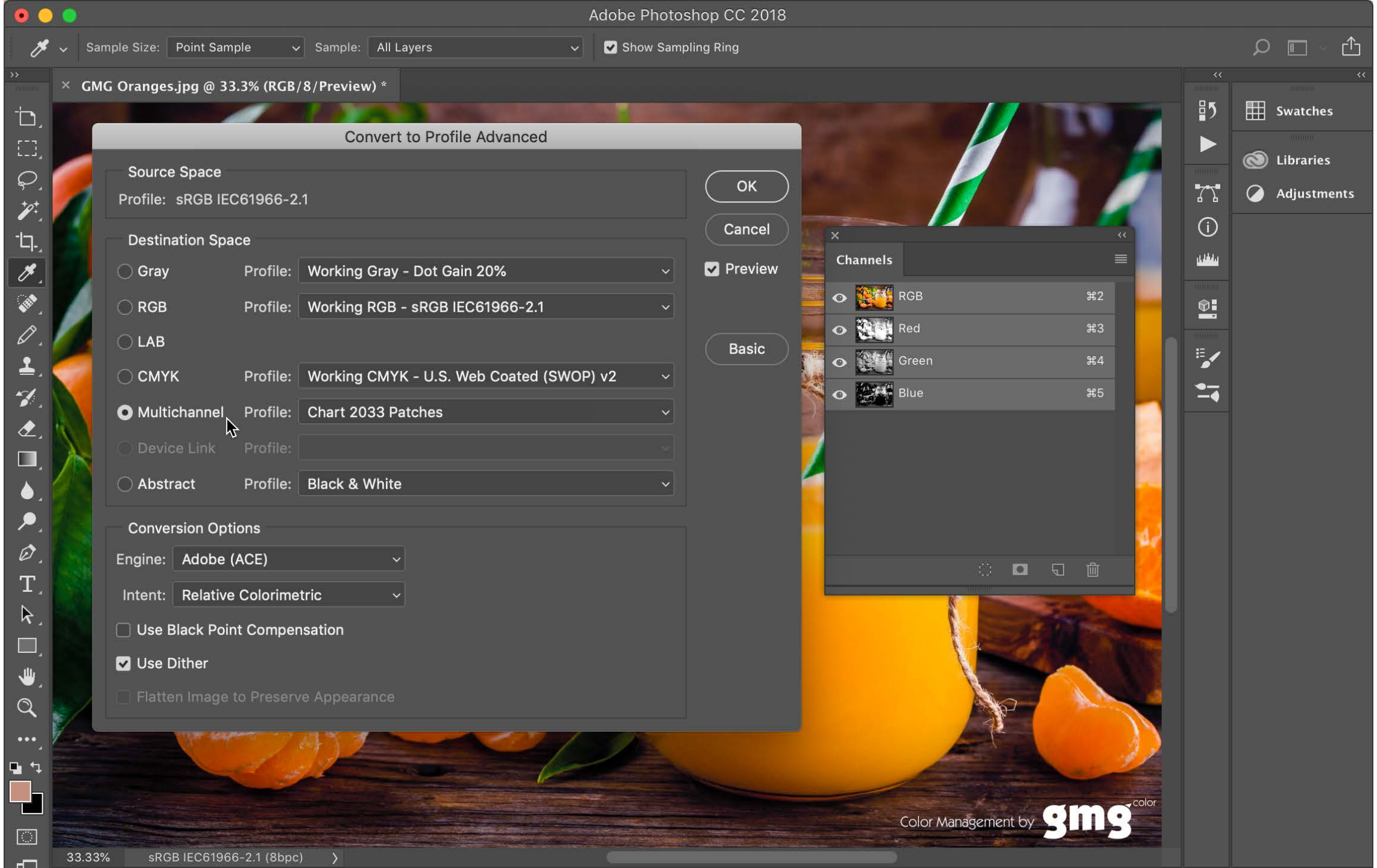
Vendor Licenced Libraries





Pantone Problems

- 1846 vs 1867.
- Different L*a*b* values.
- Color Manager has a bug and never finishes updating!



Courtesy Erik Schmitt, GMG Americas

Thank you to the companies in our study

- ALWAN
- CGS ORIS *
- ColorLogic
- GMG Color
- Heidelberg
- Kodak

* Provided tool for use in study

Acknowledgements

Advisors - Roger Breton, Marc Levine, John Seymour, Bill Pope

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Epson – Roy Bohnen

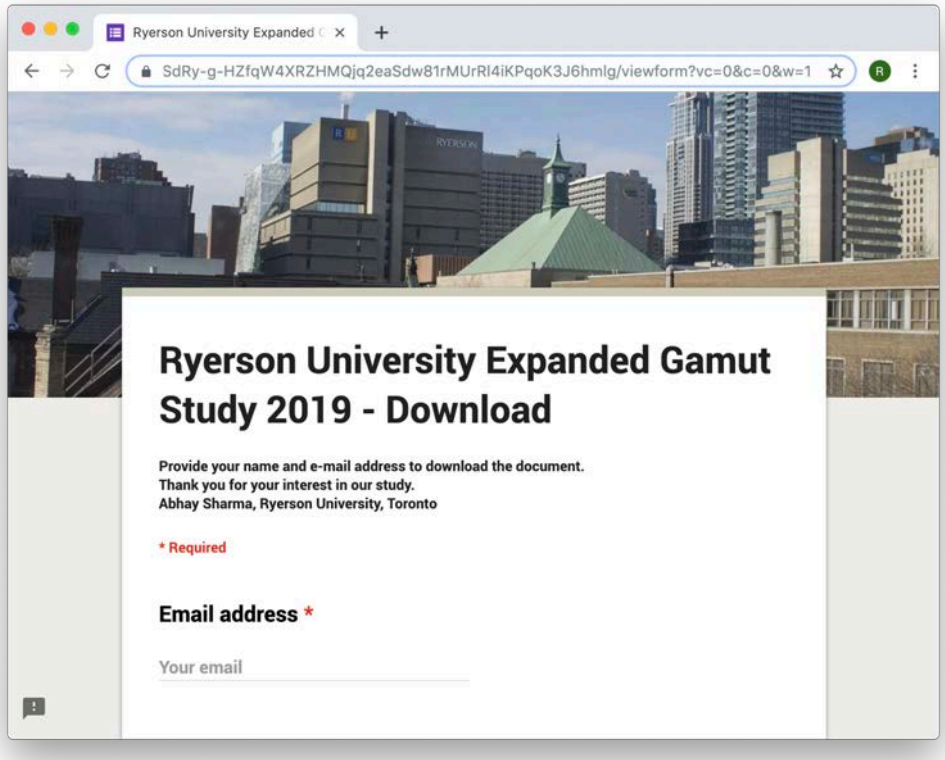
X-Rite – Ray Cheydleur, Jay Kelbley, Jason Campbell

Printing Industries of America – Joe Marin, Jim Workman

All our participants, vendors and partners

Thank you

tinyurl.com/ExpandedGamut



COLOR20

get the answers here

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Advancing Graphic Communications
PRINTING INDUSTRIES OF AMERICA

Abhay Sharma

Ryerson University