

Characterization

3rd C

Presented by: David Hunter

#3 Characterization (ICC Profile Creation)

Third of the 5 C's of Color Control

Capture — assess instrumentation capabilities

Calibration- make device consistent to itself & over time

Characterization — define device gamuts & create profile

Conversion — map one gamut to another in the workflow

Conformance — verify new results and meet expectations

#3 Characterization (ICC Profile Creation)

Steps:

1. Verify Printer is stable and consistent, calibrated and ink limit
2. Qualify substrates- Print target on all important substrates
 - *Use ChromaChecker substrate qualifier to group substrates per EF*
3. Choose Characterization software
4. Choose profile target (IT8 7/5) compatible w/capture device
5. Print multiple times immediately after calibration done
6. Measure multiple targets, compare differences, average
7. Create ICC Profile using correct settings
 - *Defining Black replacement of CMY, Black start, TAC limit*

Characterization (ICC Profile Creation)

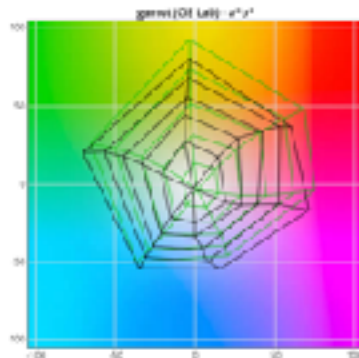
Characterization process is demanding- Requires:

- Ensuring printing devices are precise and repeatable
 - Assess/grouping effect of paper stock on color result
 - Using ICC Profile creation software to create profile(s)
 - Understand how to configure ICC profiles in workflow
-
- **Benefits-** More accurate result over any type of calibration

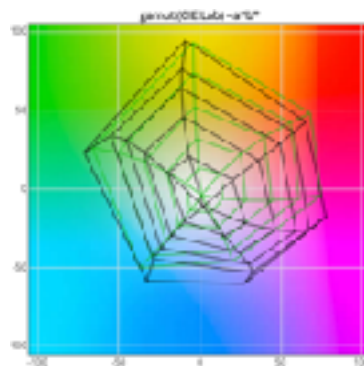
Characterization (ICC Profile Creation)

Defines Color Space of Printing Condition

- Defines gamut (range of color) of ink, substrate, calibration



C M Y K
3. 62. 19. 0



C M Y K
3. 62. 19. 0



Characterization (ICC Profile Creation)

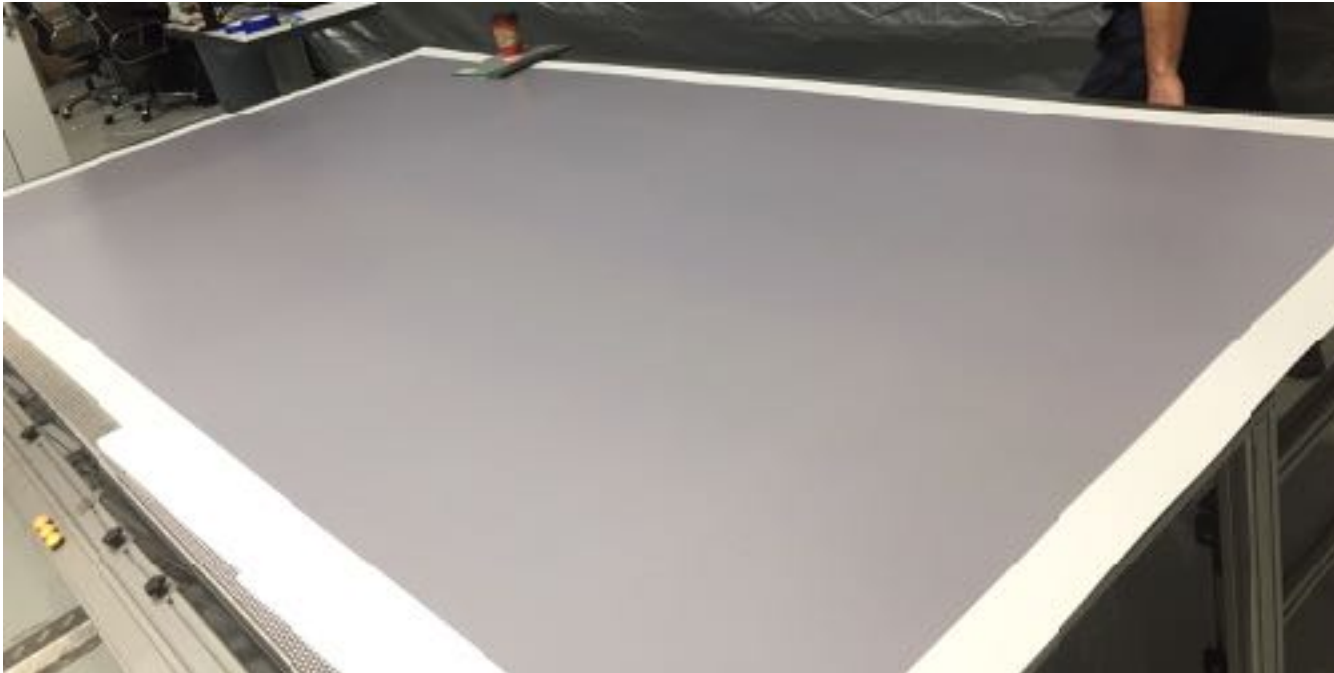
Defines Color Space of Printing Condition

- Each device speaks a different language- define language
- Defines gamut (range of color) of ink, substrate, calibration
- Each substrate affects printed gamut/condition
- Qualify most frequently used substrates:
 - *Determine substrates that share similar color gamut*
 - *Reduces number of profiles to create, easier to manage*
 - *Relevant to E-Factor, tighter tolerance the more profiles*

Characterization Steps

Baseline Printing devices

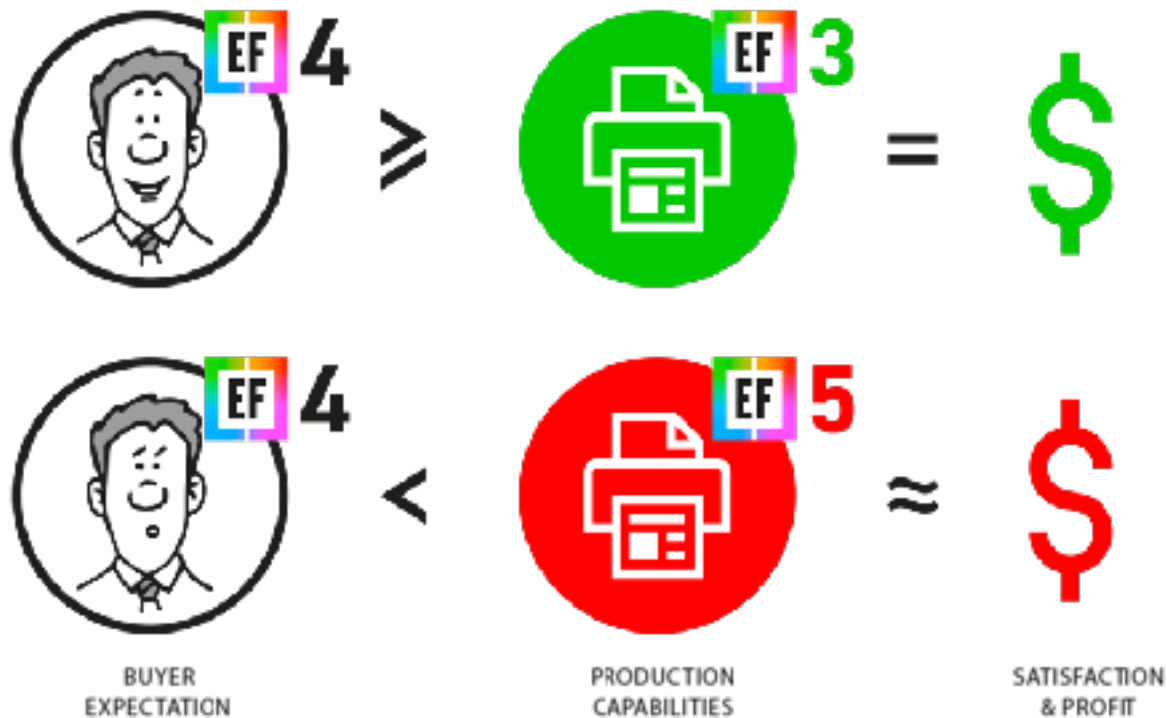
- Understand variation of printer by baselining
- Within Page Uniformity, Between Page, Between Job
- Fix any mechanically induced variations before profiling



Conformance- is it Salable?

Summary/Result of all 5 C's - is the print salable?

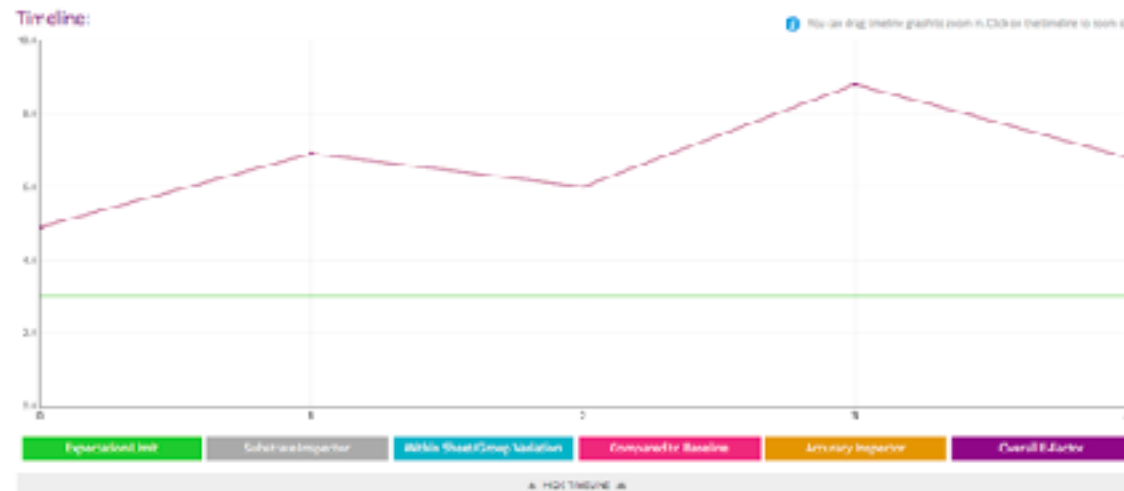
- Does Print meet customer expectations (E-Factor)?
- Provide Job reports proving to customer job success



Qualifying Substrate Color affect on Print

Steps:

1. Qualify substrates- Print target on all important substrates
 - Use ChromaChecker substrate qualifier to group substrates per EF



File List:

Measurement	#Items	Created	68	68
T167H_HFemGosof	5	2011-10-201007	68	68
T167H_Only.vst	5	2011-10-201451	68	68
T167H_HighClassPharm.vst	5	2011-10-201451	60	60
L167H_Thermal.vst	5	2011-10-201142	52	52
T167H_Kindus.vst	5	2011-10-201346	49	49
Silic-coat.vst				

Qualifying Substrate Color affect on Print

Steps:

1. Qualify substrates- Print target on all important substrates
 - Use ChromaChecker substrate qualifier to group substrates per EF

Print Condition Qualifier

EF =

Mode

Files:

Filename	Backing	Measure d.	Mode
TC1617_U_U_BPharm0100s.cof	white	M0	production
TC1617_H_Polycof	white	M0	production
TC1617_H_HighGLusaPharm.cof	white	M0	production
TC1617_U_U_Thermal01.cof	white	M0	production
TC1617_H_Kimura.cof	white	M0	production

Qualifying Substrate Color affect on Print

Steps:

1. Qualify substrates- Print target on all important substrates
 - Use ChromaChecker substrate qualifier to group substrates per EF

Print Condition Qualifier

Device: Printer Audit
Track: Compare Printing Substrates
Number of files: 5
Number of groups: 3

EF = ΔE threshold:
Mode:

Group qualification

Group	File	CRPC	max. ΔE	avg. ΔE	std. dev. ΔE
Group 1:		CRPC			
2	TC1617_H_Polyof	CRPC4			
Group 2:		CRPC	max. ΔE	avg. ΔE	std. dev. ΔE
1	TC1617_H_HPSemGlass.of	CRPC3	2.60	2.60	0.00
3	TC1617_H_HgtGlassPharma.of	CRPC4	2.60	2.60	0.00
Group 3:		CRPC	max. ΔE	avg. ΔE	std. dev. ΔE
4	TC1617_H_Thermal.of	CRPC3	2.91	2.91	0.00
5	TC1617_H_Kmlura.of	CRPC4	2.91	2.91	0.00

Qualifying Substrate Color affect on Print

Steps:

1. Qualify substrates- Print target on all important substrates
 - Use ChromaChecker substrate qualifier to group substrates per EF

Print Condition Qualifier

Device: Printer Audit
Track: Compare Printing Substrates
Number of files: 5
Number of groups: 1



ΔE threshold:

Mode:

Calculate

Group qualification

Group 1:		CRPC	max. ΔE	avg. ΔE	std. dev. ΔE
2	TC1517_H_Poly.tif	CRPC4	5.04	4.42	0.49
3	TC1517_H_Higl GlassPrint.tif	CRPC4	3.86	3.72	0.37
1	TC1517_H_HP5em Glass.tif	CRPC5	4.33	3.42	0.79
4	TC1517_H_Thermal.tif	CRPC5	4.45	3.27	0.79
5	TC1517_H_Kindara.tif	CRPC4	5.04	3.75	0.68

Qualifying Substrate Color affect on Print

Steps:

1. Qualify substrates- Print target on all important substrates
 - Use ChromaChecker substrate qualifier to group substrates per EF

Print Condition Qualifier

Device:	Printer Audit
Topic:	Compare Printing Substrates
Number of files:	5
Number of groups:	5
EF =  = ΔC threshold:	2.0
Mode:	Auto

Group qualification

Group 1:		CRPC
1	T11A12_H4PC-00100101	CRPC
Group 2:		CRPC
2	T11A12_H4PC-00100102	CRPC
Group 3:		CRPC
3	T11A12_H4PC-00100103	CRPC
Group 4:		CRPC
4	T11A12_H4PC-00100104	CRPC
Group 5:		CRPC
5	T11A12_H4PC-00100105	CRPC

Characterization (ICC Profile Creation)

Steps:

1. Qualify substrates- Print target on all important substrates
 - *Use ChromaChecker substrate qualifier to group substrates per EF*
2. Choose Characterization software to use: ChromaChecker

Characterization (ICC Profile Creation)

Steps:

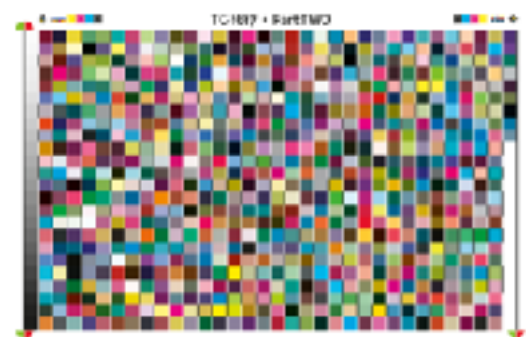
1. Qualify substrates- Print target on all important substrates
 - *Use ChromaChecker substrate qualifier to group substrates per EF*
2. Choose Characterization software (ChromaChecker)
3. Choose print target (IT8 7/5) compatible w/capture device



iSIS & FD9 target



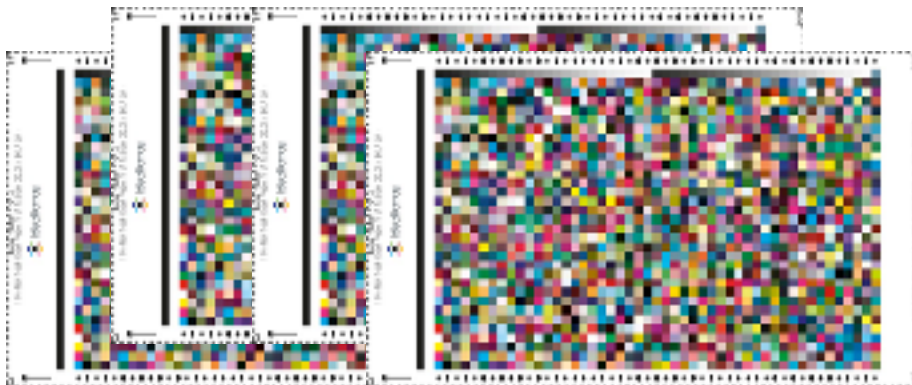
i1iO & Barbieri target



Characterization (ICC Profile Creation)

Steps:

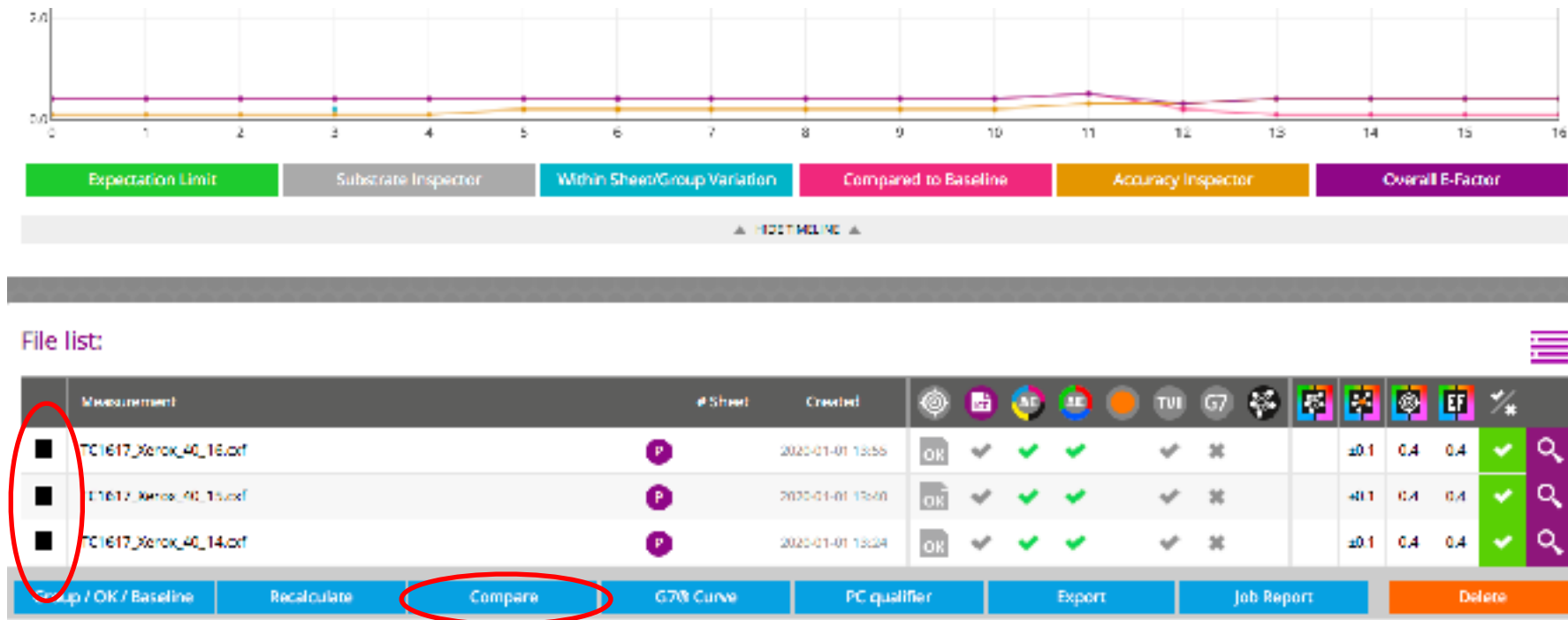
1. Qualify substrates- Print target on all important substrates
 - *Use ChromaChecker substrate qualifier to group substrates per EF*
2. Choose Characterization software (ChromaChecker)
3. Choose print target (IT8 7/5) compatible w/capture device
4. Print multiple times immediately after calibration done
 1. Ensure color management turned off in RIP, Record Calibrations



Characterization (ICC Profile Creation)

Steps:

5. Measure multiple targets, **Compare** differences, Average

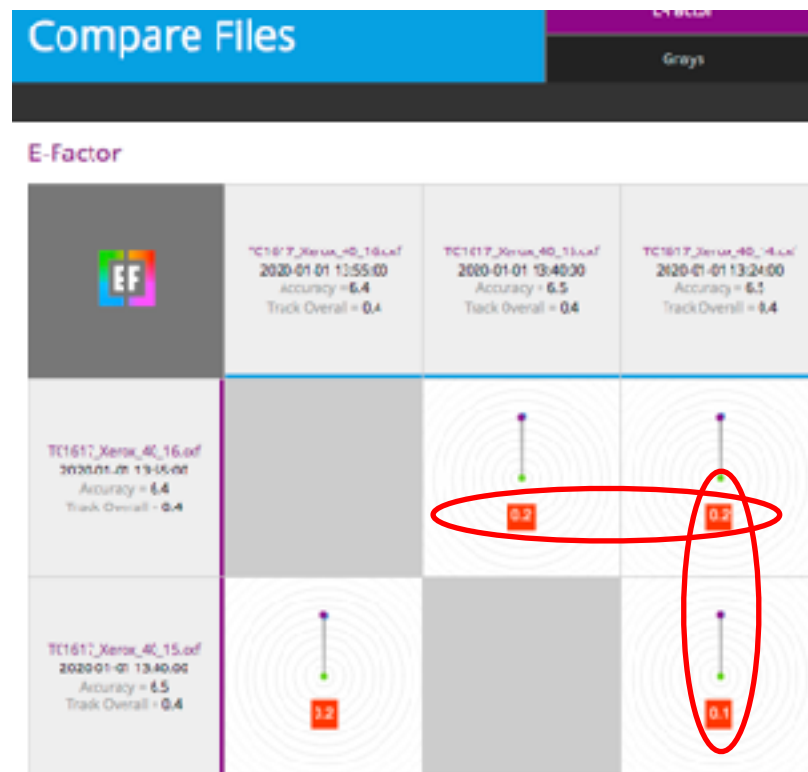


Characterization (ICC Profile Creation)

Steps:

5. Measure multiple targets, **Compare differences**

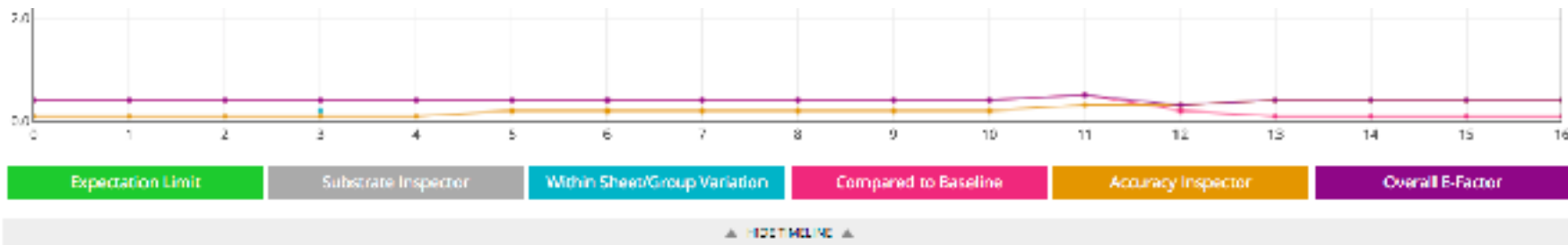
All values are within acceptable E-Factor values= .2



Characterization (ICC Profile Creation)

Steps:

5. Measure multiple targets, Compare differences, **Average**
*Choose **Group**- it will average all measurements*



File list:

Measurement	# Sheet	Created	OR	SD	SE	TUI	G7	±0.1	0.4	0.4	✓	🔍
TC1617_Xerox_40_16.cof	P	2020-01-01 13:55	OR	✓	✓	✓	✗	±0.1	0.4	0.4	✓	🔍
TC1617_Xerox_40_15.cof	P	2020-01-01 13:40	OR	✓	✓	✓	✗	±0.1	0.4	0.4	✓	🔍
TC1617_Xerox_40_14.cof	P	2020-01-01 13:24	OR	✓	✓	✓	✗	±0.1	0.4	0.4	✓	🔍

Buttons: Group / OK / Baseline, Recalculate, Compare, G7 Curve, PC qualifier, Export, Job Report, Delete

Characterization (ICC Profile Creation)

Steps:

5. Measure multiple targets, Compare differences, **Average**
Name Group- Confirm

New Group

Group name: Flag:

Baseline

Create variation baseline
 Set as current baseline

OK Sheet

OK Sheet
 Set as current OK sheet

Global / track specific

Make global OK Sheet / Baseline

Group files:

File name	Backing	Max. cond.	Mode
TC1617_Xerox_40_11.pdf	white	ND	production
TC1617_Xerox_40_11.pdf	white	ND	production
TC1617_Xerox_40_14.pdf	white	ND	production
TC1617_Xerox_40_11.pdf	white	ND	production

Characterization (ICC Profile Creation)

Steps:

6. Create ICC Profile for given print condition (substrate)

Click on magnifying glass:

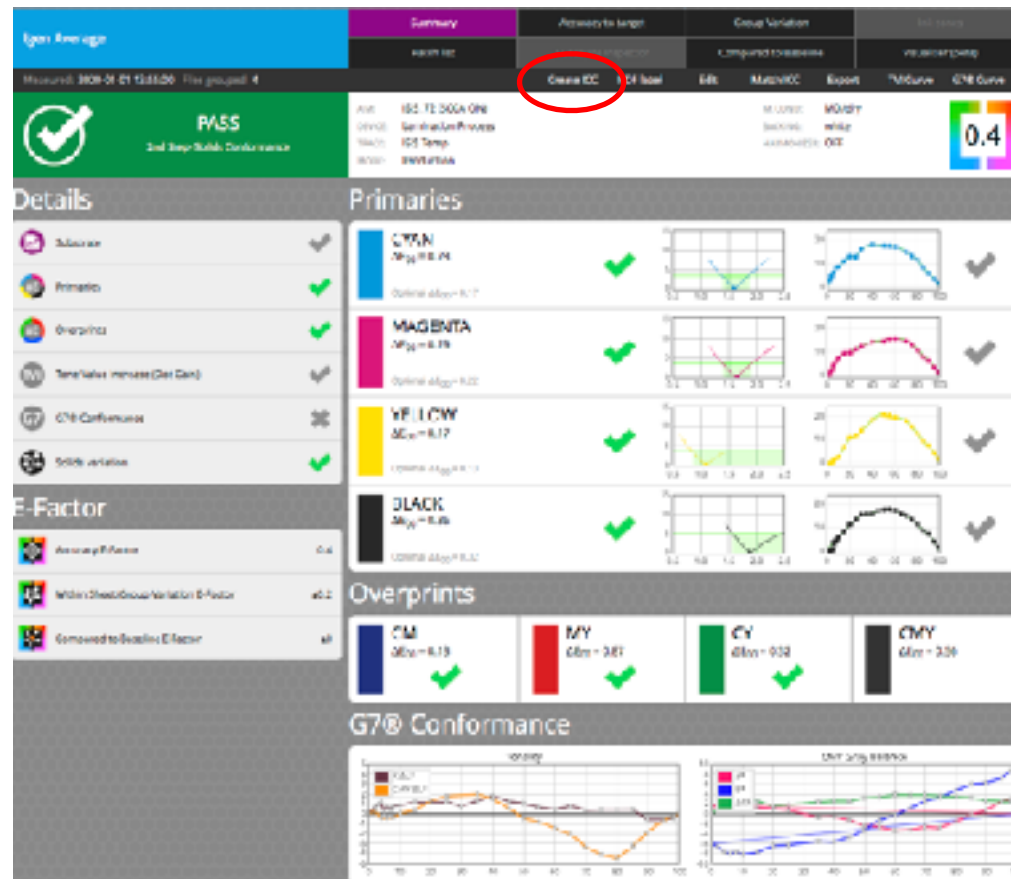
File list:

Measurement	# Sheet	Created	OK	uE	uE	TVI	G7								
IC1817_Acrox_01_16.cdf	P	2020-01-01 13:55	OK	✓	✓	✓	✓	✗			±0.1	0.4	0.4	✓	
Igen Average	P	2020-01-01 13:55	OK	✓	✓	✓	✓	✗	✓		±0.2	±0	0.4	0.4	✓

Characterization (ICC Profile Creation)

Steps:

6. Create ICC Profile for given print condition (substrate)



Characterization (ICC Profile Creation)

Steps:

6. Create ICC Profile for given print condition (substrate)
*Customize ICC Profile settings if necessary- **Export ICC Profile***

The screenshot displays the ChromaChecker software interface for ICC profile creation. The top navigation bar includes tabs for 'Igen Average', 'Summary', 'Accuracy to target', 'Group Variation', and 'Ink zones'. Below this, a secondary bar contains 'Patch list', 'Substrate Inspector', 'Compare to Baseline', and 'Visualizer (beta)'. A status bar shows 'Measured: 2020-01-01 13:55:00 Files grouped: 4' and buttons for 'Create ICC', 'PDF label', 'Edit', 'Match ICC', 'Expert', 'TNT Curve', and 'G7B Curve'. The main content area shows print parameters: 'INK: (SCCA DN)', 'M. COND: M0 /dry', 'DEVICE: Lamination Process', 'BACKING: white', 'TRACE: ISIS Temp', 'HARMONIZER: OFF', and 'MODE: Production'. A color calibration chart with the value '0.4' is visible. Below the parameters is the 'Export ICC' section, titled 'ICC creation parameters'. It contains three columns of input fields: 'Ink Limit' (Total Ink Limit: 290), 'Black' (Start Black: 10, Max Black: 80, Black Intensity: 80), and 'GCR' (GCR Neutral: 80, GCR Color: 80). A purple 'EXPORT' button is circled in red. To the right of the button is a thumbnail of the resulting ICC profile, 'Igen_Coated.icc', which features a color calibration chart.

ICC Profile Inspector (Optional Assessments)

Evaluate Many Aspects of ICC Profiles



- Gamut Size

Profile built-in info

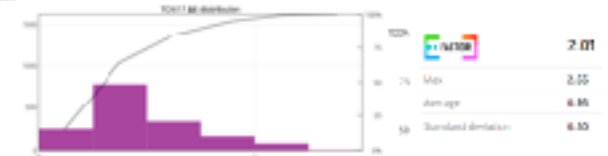
Profile class	Output device profile
Color space	CMYK (4 channels)
Connection space	Lab (3 channels)
Gamut volume	520,270

- Profile Match Integrity (LAB Round trip calculation)

 FACTOR	0.77
Max	2.09
Average	0.20
Standard deviation	0.28

- Profile Comparisons- Gamut and Color Rendering

Difference between the two ICC Profiles



- More... Review ICC Profile Inspector

ICC Profile Inspector

Characterization Summary

Planning and Execution is Critical for Success

- Qualify how many profiles to create based on substrates
- Choose correct target for print
- Choose correct measurement device- same as for QC
- Measure multiple targets precisely
- Compare measurements, make sure they are precise
- Create ICC Profile, evaluate integrity
- Next, you will load in your workflow conversion tools

Qualifying Multiple Similar Printers/Paper


























Multiple Printers- Same Substrate- Multiple Profiles?

- Share one profile across 10+ printers
- Only need one workflow sending to all 10+ printers
- Only need to maintain one ICC Profile
- Perform normal maintenance to keep consistency
- Measure each printer every 4 hours to ensure conformance

Making Multiple Printers Match

Ensure Printer Settings are Identical

- Print profile target on each printer
- Measure all targets with same or similar instrument
- Compare all results- if any are out of E-Factor- Recheck

Easy mode ΔE 2000	Baltoro_Loaded_Dec2020	Baltoro_GP_Boise28	Baltoro_IL_Boise28	Baltoro_SignalHII_NeroPaper	Baltoro_Newville_4_8	Baltoro_Summer_Uncoated
Baltoro_Loaded_Dec2020		 E-factor 10.43 Max 12.52 Average 5.34 Std. dev. 2.87 Details	 E-factor 10.27 Max 12.82 Average 4.43 Std. dev. 3.01 Details	 E-factor 12.00 Max 15.77 Average 5.20 Std. dev. 3.43 Details	 E-factor 11.52 Max 15.13 Average 4.95 Std. dev. 3.22 Details	 E-factor 11.75 Max 15.08 Average 4.84 Std. dev. 3.38 Details
Baltoro_GP_Boise28	 E-factor 10.43 Max 12.52 Average 5.34 Std. dev. 2.87 Details		 E-factor 3.20 Max 4.37 Average 2.11 Std. dev. 0.68 Details	 E-factor 3.85 Max 6.47 Average 1.97 Std. dev. 0.91 Details	 E-factor 3.30 Max 7.04 Average 1.90 Std. dev. 0.85 Details	 E-factor 5.27 Max 7.60 Average 3.07 Std. dev. 1.25 Details
Baltoro_IL_Boise28	 E-factor 10.27 Max 12.82 Average 4.43 Std. dev. 3.01 Details	 E-factor 3.20 Max 4.37 Average 2.11 Std. dev. 0.68 Details		 E-factor 3.10 Max 6.35 Average 1.71 Std. dev. 0.77 Details	 E-factor 2.24 Max 6.63 Average 1.10 Std. dev. 0.66 Details	 E-factor 3.20 Max 5.85 Average 1.60 Std. dev. 0.88 Details
Baltoro_SignalHII_NeroPaper	 E-factor 12.00 Max 15.77 Average 5.20 Std. dev. 3.43 Details	 E-factor 3.85 Max 6.47 Average 1.97 Std. dev. 0.91 Details	 E-factor 3.10 Max 6.35 Average 1.71 Std. dev. 0.77 Details		 E-factor 2.00 Max 6.23 Average 1.21 Std. dev. 0.50 Details	 E-factor 2.90 Max 4.42 Average 1.80 Std. dev. 0.61 Details
Baltoro_Newville_4_8	 E-factor 11.52 Max 15.13 Average 4.95 Std. dev. 3.22 Details	 E-factor 3.30 Max 7.04 Average 1.90 Std. dev. 0.85 Details	 E-factor 2.24 Max 6.63 Average 1.10 Std. dev. 0.66 Details	 E-factor 2.00 Max 6.23 Average 1.21 Std. dev. 0.50 Details		 E-factor 2.60 Max 6.91 Average 1.50 Std. dev. 0.65 Details



Conversion 4th C

Presented by: David Hunter

STEPS TO DEFINING PROCESS DISCIPLINE

How to meet or exceed E-Factor?

Fourth of the 5 C's of Color Control

Capture — assess instrumentation capabilities

Calibration- make device consistent to itself & over time

Characterization — define device gamut and create profile

Conversion — map one gamut to another in the workflow

Conformance — verify new results and meet expectations

Conversion Requirements- RIP or Server

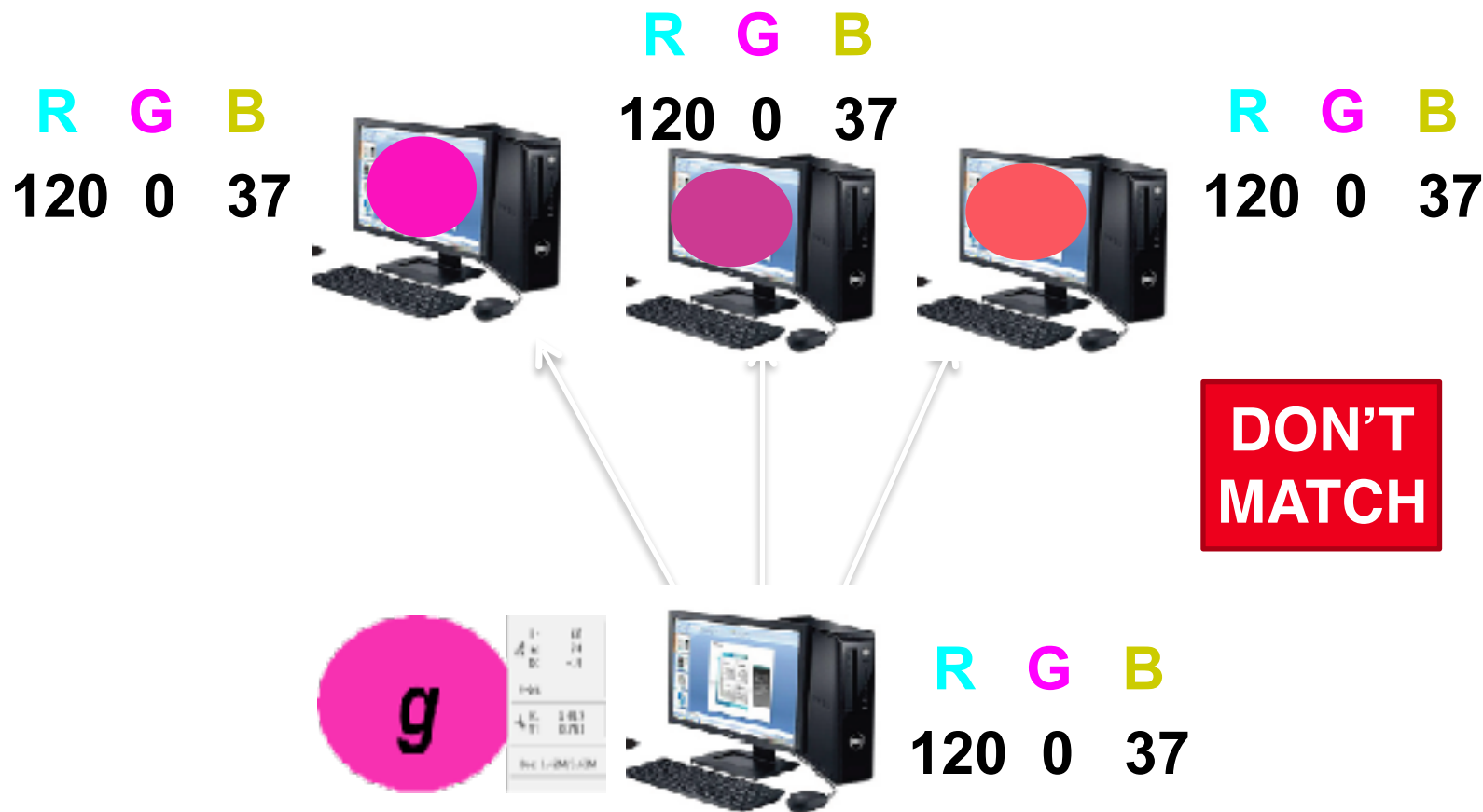
Make Conversion work... Requires Workflow software:

- Software that performs conversion (RIP, Color Server)
 - *Choose Rendering Intent, Black Point Compensation, CMM*
- Defined Input/Source ICC Profile: RGB, CMYK, nColor
- Defined Output/Destination ICC Profile: RGB, CMYK, nColor
- Spot Color Conversion- need “Named color” LUT support
- Direction analogy, have to know where file is starting from to know how to get it (convert) to the destination

Problem- Conversion of Colors

Every Device Renders Color Differently

- Need to Convert to using custom ICC Profiles



Problem- Conversion of Colors

Every Device Renders Color Differently

- Need to Convert to different ICC Profiles



Problem- Conversion of Color Pages/Images

Characterization Defines Gamuts (Languages): Convert

- If No Conversion- Color is *different*, every printer *different*
- Goal- Reproduce the Original Color? or Maximize Color?



C M Y K
3, 62, 19, 0



C M Y K
3, 62, 19, 0

**DON'T
MATCH**



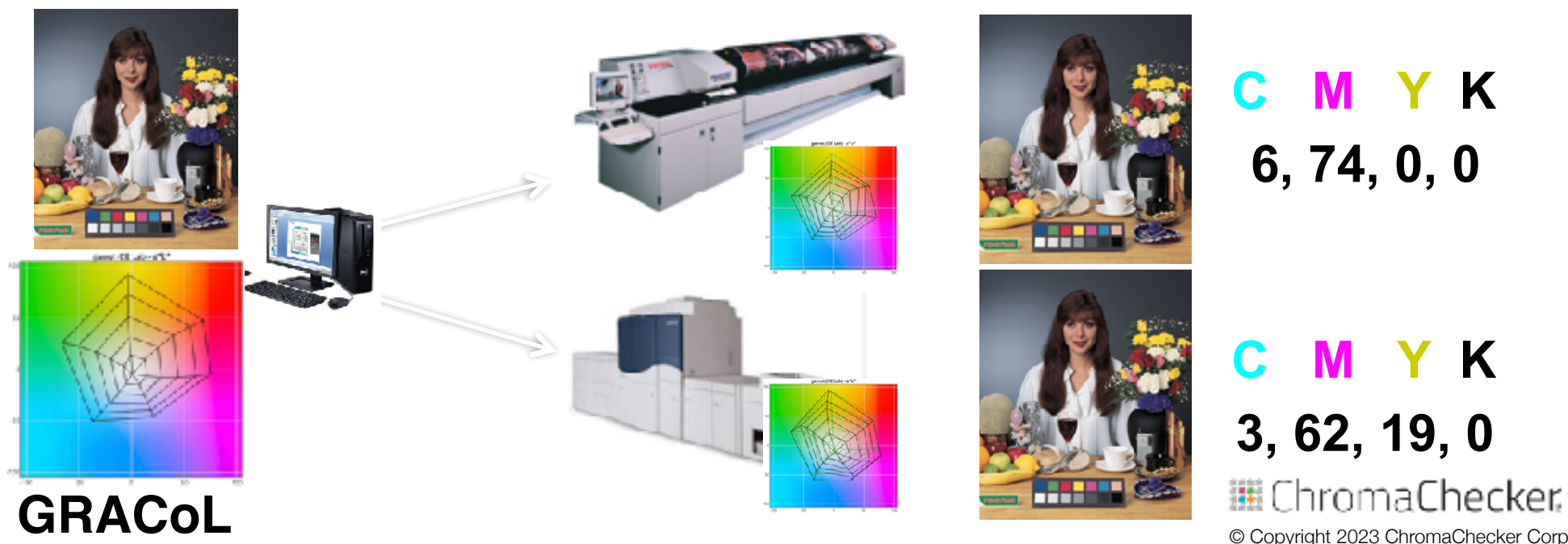
C M Y K
3, 62, 19, 0



Conversion of Pages- Strategic Issues

1. Determine Color Goals- Maximize Gamut, or Match?

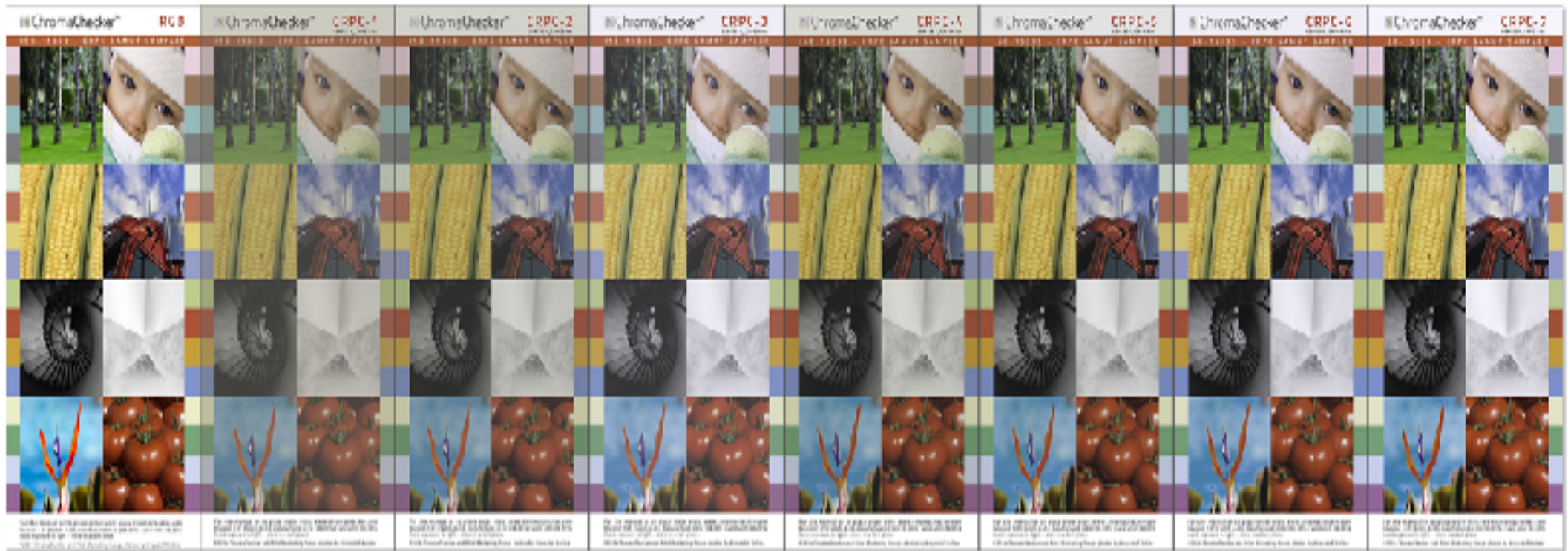
- Shared Visual Appearance (G7 Gray, Tonality) for all printers
- Color Match between printers
- Mix- Different settings to accommodate both options



Shared Visual (Common Color) Appearance

Maximize Gamut for Each Printer (Keep G7 Compliance)

- G7 Gray, Tonality provides a common appearance
- Paper is the fifth color in four color printing



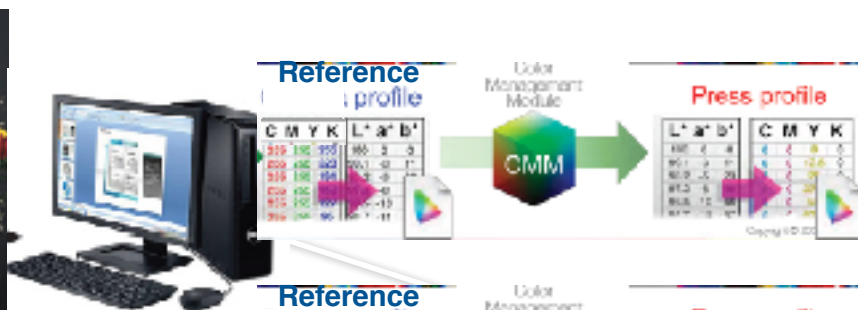
Details = Conversion of Images and PDFs

Characterization Defines Gamuts (Languages): Convert

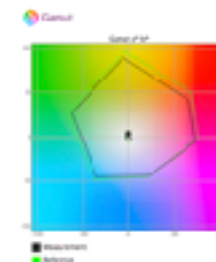
- Goal- Maximize the Original Colors

Input/Source Profile

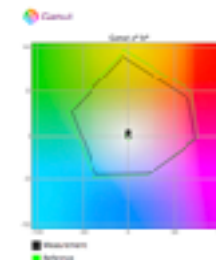
Output/Destination Profile



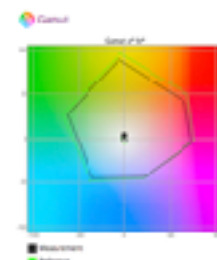
Vutek



iGen



Large
Gamut
Profile



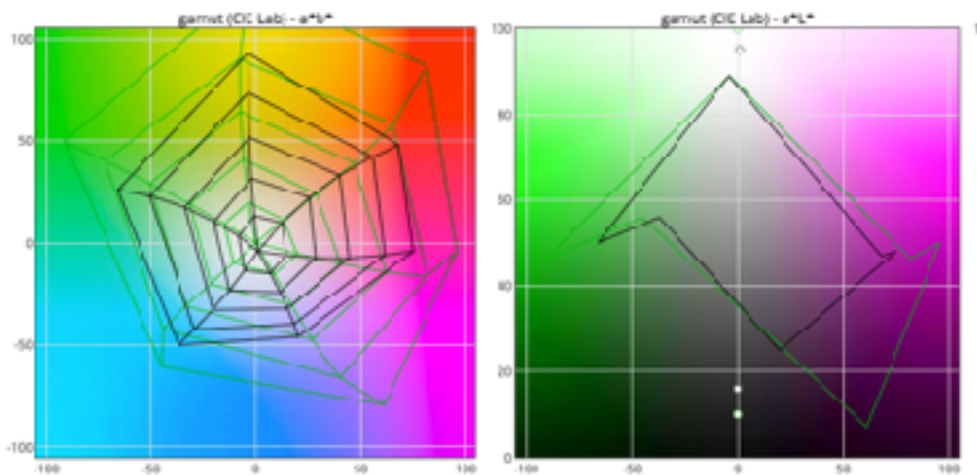
Two Popular Large Gamut CMYK Profiles

Use as INPUT Profile to Maximize Print Result

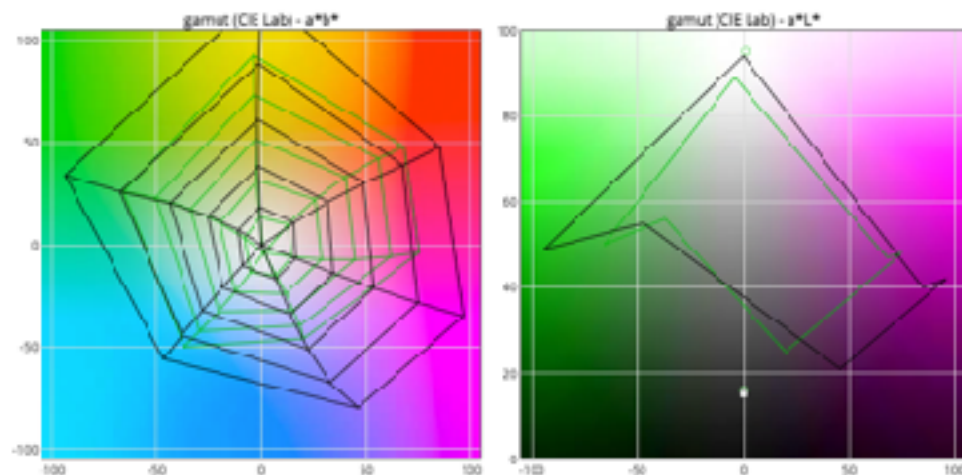
- ChromaChecker Wide Gamut (G7 Compliant)
- Idealliance PrintWide (G7 Compliant)



Gamut



Gamut



Assign Wide Gamut CMYK to Existing CMYK

Use as INPUT Profile to Maximize Print Result

- ChromaChecker Wide Gamut or PrintWide (G7 Compliant)



Two Popular Large Gamut CMYK Profiles



50%



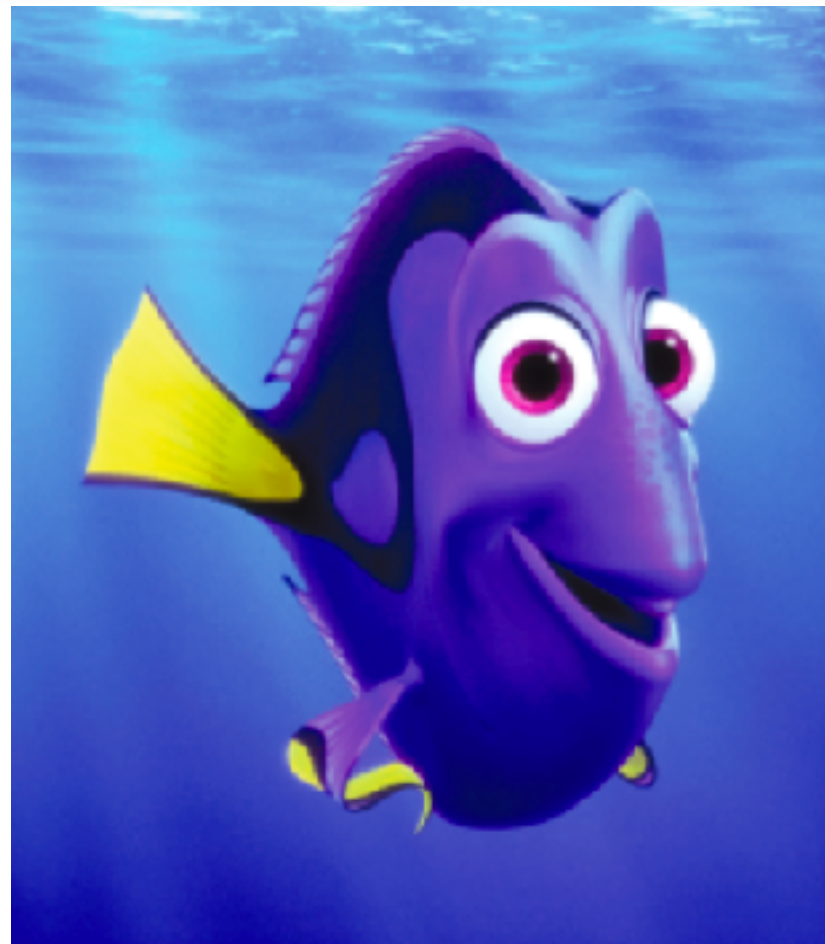
RPC8 V3 Hunter Wide Gamut (8bpc)



Two Popular Large Gamut CMYK Profiles



Original CMYK (USWebSWOP)



Assign PrintWide CMYK

Two Popular Large Gamut CMYK Profiles



Original CMYK (USWebSWOP)



Assign ChromaChecker Wide

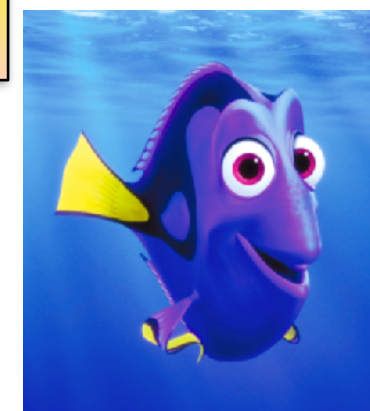
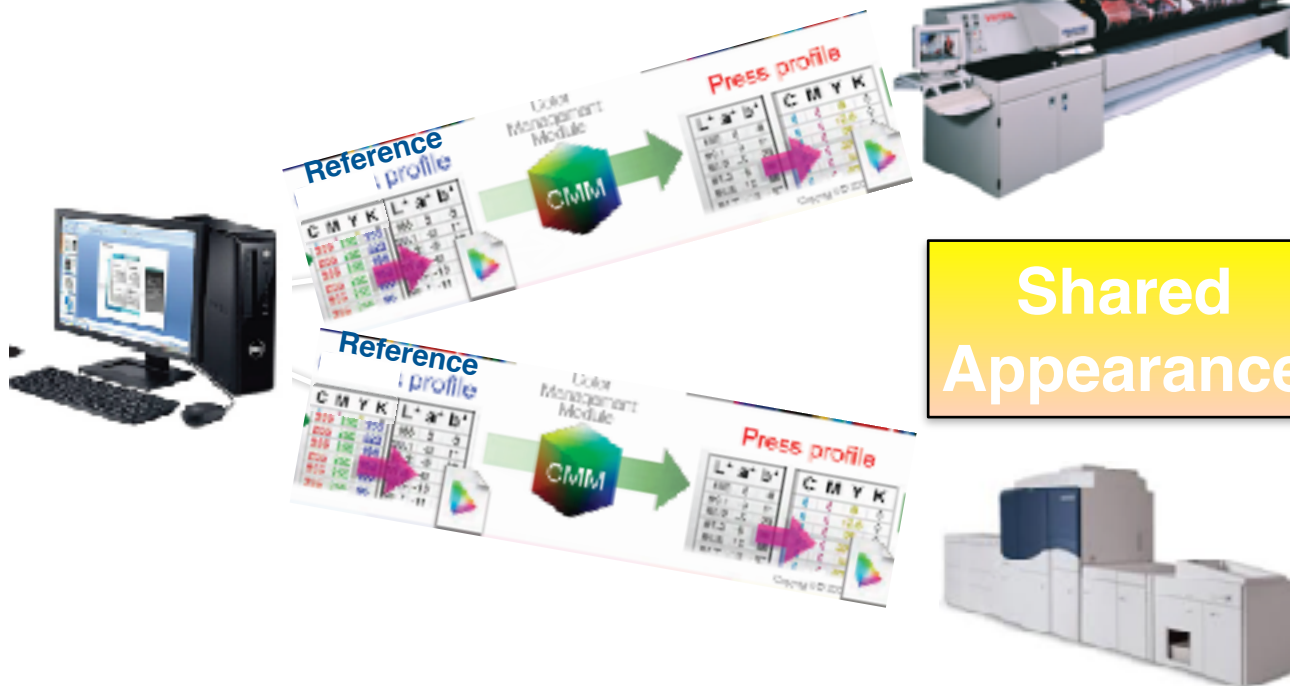
Maximize Color Conversion for Pages

Goal- Maximize Original Color

**DON'T
MATCH**



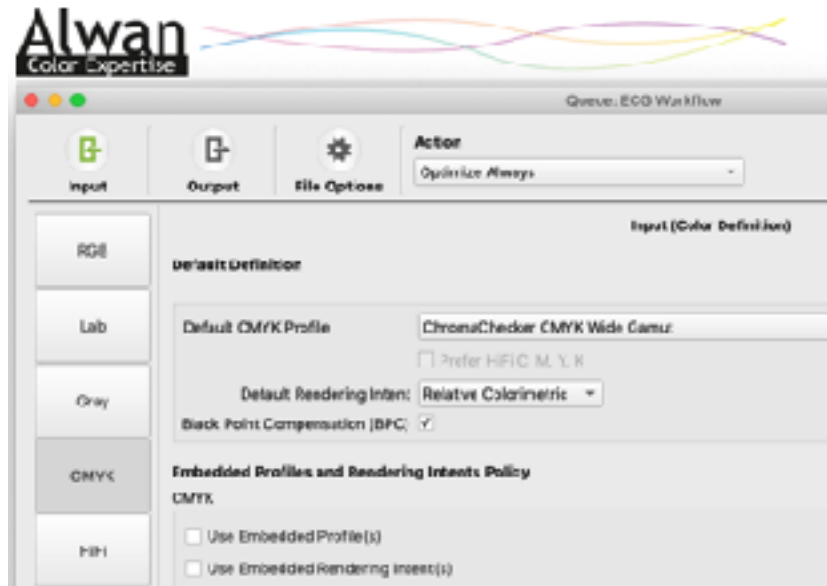
**Assign Large
Gamut Profile**



Steps:

Maximize Gamut

- Need Original files in correct Large Gamut Color Space
- Assign- not Convert: into Large Gamut Color Space
 - Essentially give new definitions for CMYK values
- Easily done using Color Server



BPC- ON
Embedded- OFF

How to Maximize Printer Gamut:

When Configuring Printer to be ICC Profiled:

- Calibrate, linearize and ink limit to maximum chroma
 - Ensure Overprints do not “hook”
- Create ICC Profile for output printer

In Workflow: (RIP or Color Server)

- Set Input/Source Profile: CMYK Large Gamut
- Set Output/Destination Profile: Above printer profile

Result: Printer will be G7 Compliant, good hue angles

Color Matching- Simulation Procedures

Goal Match Original Colors

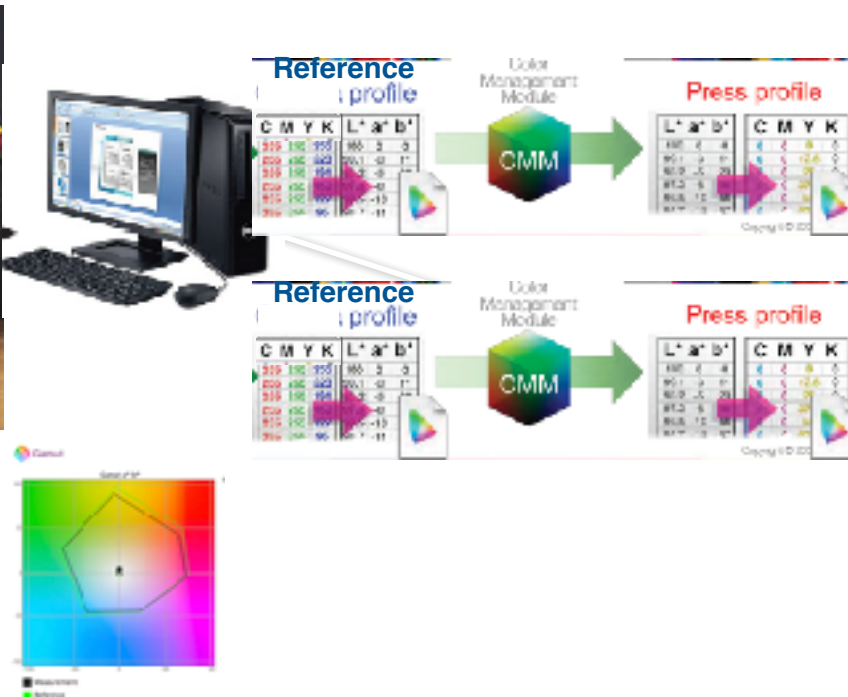
- Simulate GRACoL- Output gamut larger than GRACoL

Input/Source Profile

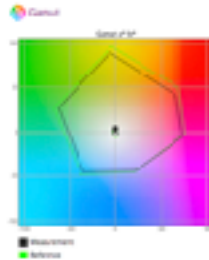
Output/Destination Profile



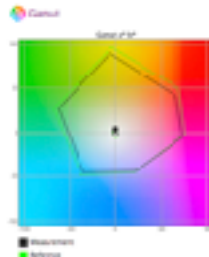
GRACoL Profile



Vutek



iGen



Color Match Conversion of Pages

Match Color- Output Gamut larger then Reference Gamut

- Goal- Reproduce the Original Color

GRACoL



C M Y K
3, 62, 19, 0



C M Y K
10, 53, 9, 0

**DO
MATCH**



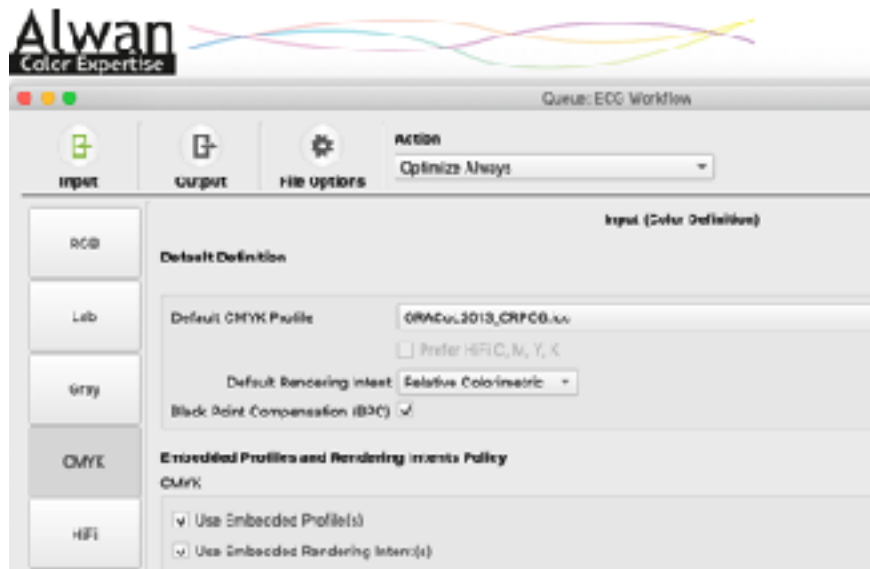
C M Y K
6, 74, 11, 0



Steps:

Match Gamut

- Need Original files in correct Reference Gamut Color Space
- Assign- not Convert: into Reference Gamut Color Space
 - Essentially give new definitions for CMYK values
- Easily done using Color Server



BPC- ON
Embedded- ON

How to Match Printer Gamut:

When Configuring Printer to be ICC Profiled:

- Calibrate, linearize & ink limit to values larger than GRACoL
- Create ICC Profile for output printer

In Workflow: (RIP or Color Server)

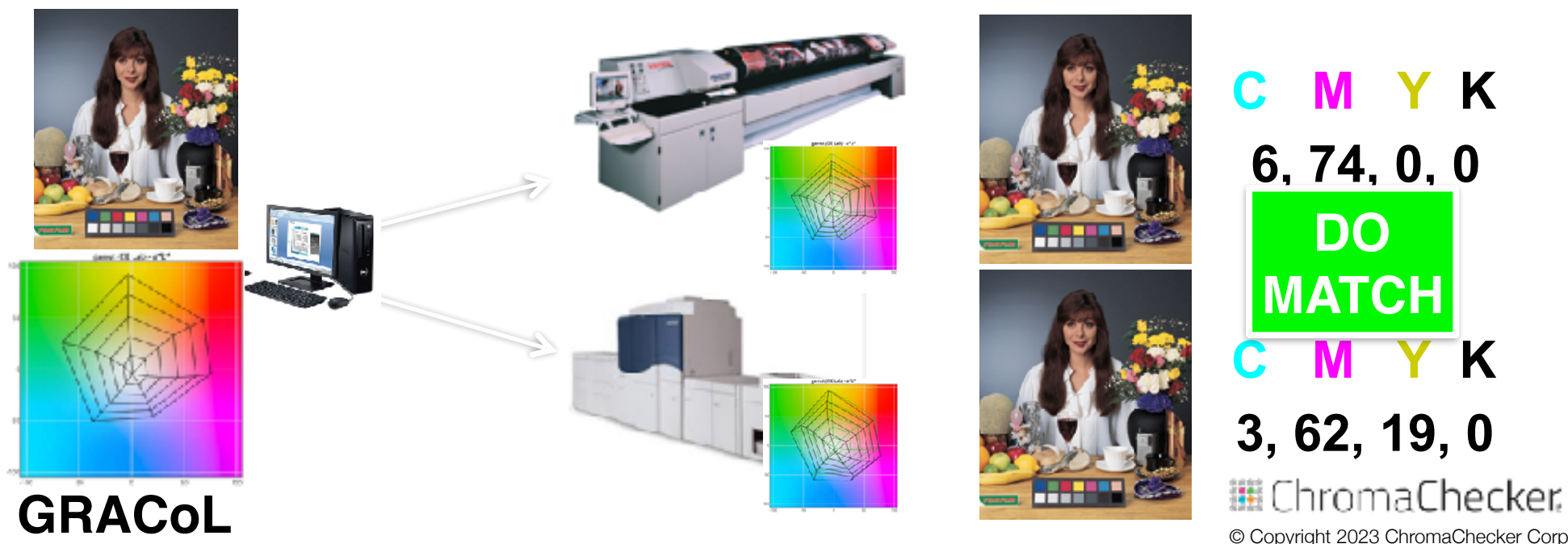
- Set Input/Source Profile: Reference Gamut (GRACoL)
- Set Output/Destination Profile: Above printer profile
- Rendering Intent: Colorimetric/Hybrid/Absolute (paper)

Result: Printer will be G7 Compliant, good hue angles

Color Conversions- Pages vs Brand Colors

Converting from current space to desired print space

- Convert pages and images- Process conversions
- Convert brand colors- Named colors in look up table (LUT)
- Workflow/RIP function, some support, some don't



Brand Color Conversions

Do NOT manage Brand Colors as CMYK values...

- Unless you are only printing to one printer/substrate
- Colors will not match on other printers (even same model)



Brand Color Conversions

Make Brand Colors as “Named” Colors (own spot)

- Give Brand colors specific names: Coke Red
- Workflow uses Look Up Table to substitute device CMYK
- Software creates Look Up Table:

Virtual Spot Print

Tracking LUTs Assets

Library: BestDev2 ICC profile: GMDot2013_CRP05 M. color: MD All 2016 Threshold 2

Export

File format: DDATE Lab + CMYK + deviation

Color list

ID	Name	Original L*a*b*			Color	Predicted best practices			GMDot2013_CRP05				All 2016
		L*	a*	b*		L*	a*	b*	Cyan	Magenta	Yellow	Black	
01	BBVIslandBlue	33.27	15.84	-56		31.95	6.51	-45.55	97.21	76.51	0.56	0.07	1.82
02	BBV_MyBBVBlue	43.60	21	68		41.86	16.24	46.11	120.00	38.73	0.56	3.63	3.14
03	BBV08Blue	32.89	16.35	-26.81		31.83	16.11	38.12	120.00	100.00	0.56	16.39	3.11
05	BBV13Blue	52.23	-1.42	-22.39		51.49	0.93	-27.19	12.94	40.78	0.56	0.00	27.8
06	BBV04Yellow	83.21	-4.85	83.74		84.85	2.46	82.71	3.00	3.48	14.12	0.00	1.28
010	BBV_FarSelected	50.67	15.4	12.7		49.43	13.25	15.89	3.00	98.37	108.90	0.00	1.05
08	BBVWhiteRed	45.5	68.21	41.40		46.59	66.65	41.40	3.00	100.00	88.28	2.75	17.7
02	BBV04Yellow	88.41	-4.98	57.52		88.85	-4.19	52.71	3.85	0.00	108.90	0.00	1.80
004	BBV_FX_Orange	61.71	48.11	11.14		61.84	21.79	12.45	3.00	68.14	95.60	0.07	8.95
09	BBV04Black	-14.59	-1.35	5.7		14.89	1.61	-4.68	34.71	68.97	28.68	81.46	8.17
012	BBV_MagentaRed	37.2	-6.6	14.3		37.79	-6.68	14.86	3.00	68.76	96.47	14.13	6.07
07	BBV13Grey	86.4	-1.27	-0.79		86.49	-2.24	-1.18	16.47	3.90	1.11	0.00	6.58
011	BBV04Grey	38.84	-1.67	-0.31		38.71	-2.24	-2.59	61.96	49.86	47.46	12.51	6.25
04	BBV04White	92.15	-0.29	-0.31		96.21	0.33	-0.62	3.24	2.75	1.96	0.00	6.23
004	BBV_FarSelected	48.81	-27.89	-15.84		49.94	-25.51	-15.13	19.61	15.98	0.71	6.21	6.23
010	BBV_CS CoolGrey1	89.5	8.23	-2.16		86.51	0.25	-0.08	18.04	15.33	17.25	0.00	67.4
001	BBV_FX_WhiteGrey1	64.65	8.13	-3.1		64.79	0.85	-3.31	16.08	39.84	18.74	5.11	67.1
001	BBV_FX_WhiteGrey1	46.01	-1.15	-4.74		46.95	-0.68	-4.07	14.11	48.14	20.03	13.91	6.84

Out of Gamut

Brand Color Conversions

Ensure Key Brand Colors are in Printer Gamut

- Printer can only make so many colors, substrate is key

Virtual Spot Print

Tracking LUTs Assets

Library: BestDry2 ICC profile: DMCs12013_CRP16 M. color: M0 ΔE 2000 Threshold 2

Export

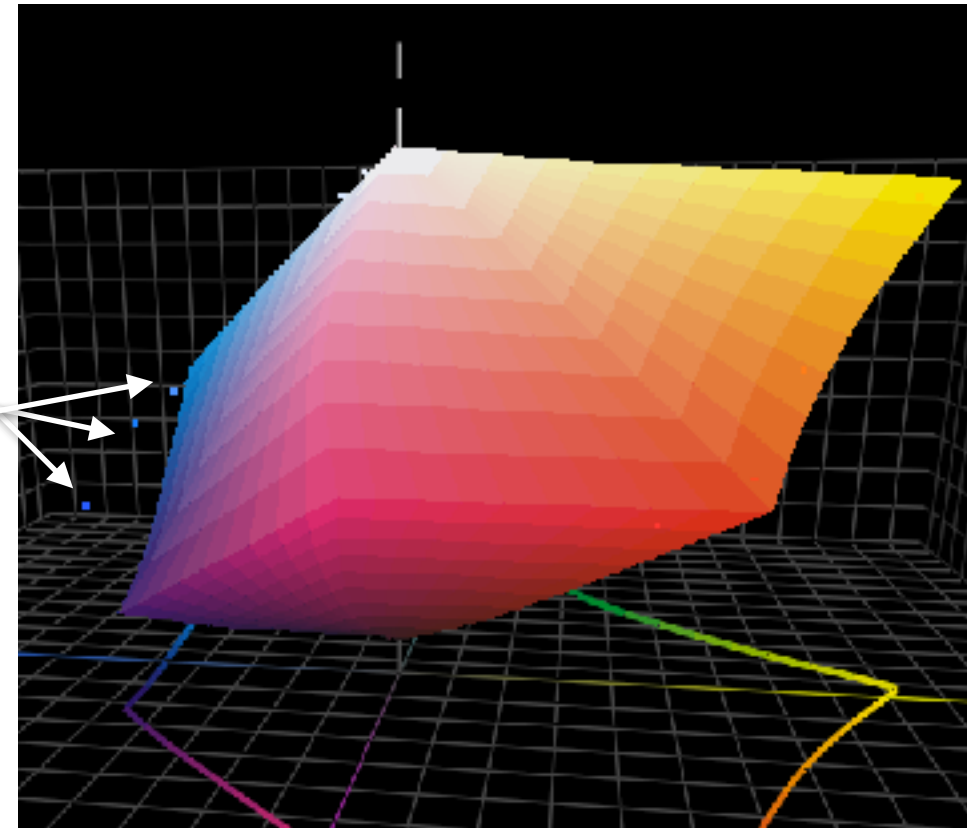
File format: D50ATS Lab + CMYK + deviation

Done Download

Color list

ID	Name	Original L*a*b*			Predicted Reconstruction			DMC12013_CRP16				ΔE 2000
		L*	a*	b*	L*	a*	b*	Cyan	Magenta	Yellow	Black	
01	BBV_VibrantBlue	33.71	15.84	-96	31.85	6.51	-45.15	97.21	76.51	0.50	0.02	1.82
02	BBV_MyBBVBlue	43.60	28	88	41.86	16.26	-46.11	130.00	38.73	0.06	3.63	3.24
03	BBV08Blue	30.89	16.80	-92.83	31.83	16.11	-38.42	130.00	100.30	0.06	30.39	3.41
05	BBV13Blue	32.23	-1.42	-42.99	31.49	3.93	-37.59	12.94	-40.78	0.06	0.06	2.18

Out of Gamut



Brand Color Steps

Make Brand Colors Match

- Ensure Brand Colors are set up as “Named Colors”
 - Some Color Server software can automate
- Ensure Brand Colors are in gamut of output device(s)
- Ensure Workflow can import “Named Color” List
 - Some workflows have 28 color limitation
- Export Named Color List to import into RIP/Color Server

The screenshot shows the 'Virtual Spot Print' software interface. At the top, there are tabs for 'Tracking', 'LUTs', and 'Assets'. Below the tabs, there is a 'Statistics' section with a table showing 18 samples (14 in gamut) with an average of 1.14 and 1.7. An 'Export' menu is open, showing options like 'COATS CMYK', 'COATS Lab', and 'COATS Lab - CMYK'. Below the menu, there is a 'Color List' section with a table of color data.

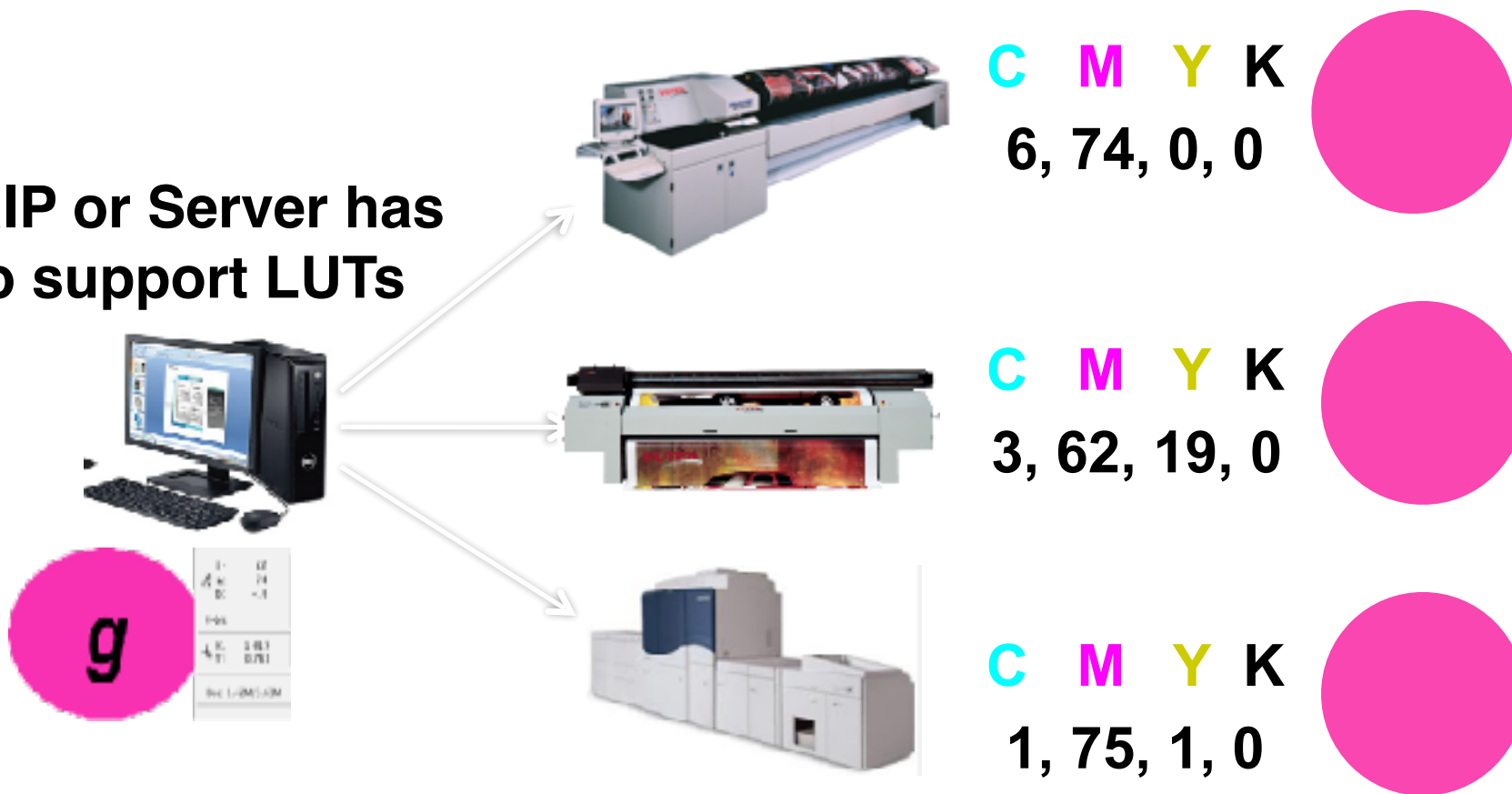
Color	Original Pantone	Estimated Reproduction	CMYK2003, CMYK	ΔE (D50)				
	L*	a*	b*	Cyan	Magenta	Yellow	Black	
P1	10.44	16.19	48.54	97.25	28.17	0.00	0.00	1.80
P4	39.12	34.26	47.71	00.00	51.17	0.00	9.17	5.52

Conversion of Brand Colors

Spot Color Look Up Table (LUT)

- Renders Brand color (Lab) to device CMYK values

RIP or Server has to support LUTs



Conversion Summary

Planning and Execution is Critical for Success

- Determine printers will render full gamut, vs simulation
- Ensure Customer Supplied files are in Correct Gamut
 - Wide Gamut for Maximizing Color
 - Reference Color for Matching Color
 - Named Colors for brand critical
- Optimize your ICC Profile Procedures
- Configure your workflows for Optimum Conversions
- Verify Results, Different Tracks for different conditions



Conformance

5th C

Presented by: David Hunter

STEPS TO DEFINING PROCESS DISCIPLINE

How to meet or exceed E-Factor?

Fifth of the 5 C's of Color Control

Capture — assess instrumentation capabilities

Calibration- make device consistent to itself & over time

Characterization — define device gamut and create profile

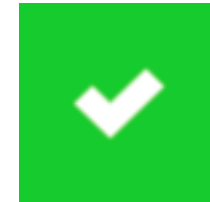
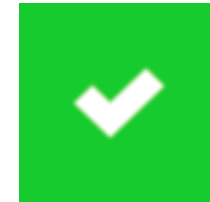
Conversion — map one gamut to another in the workflow

Conformance — verify new results and meet expectations

Conformance of Workflow

Assess that Salable color is Manufactured

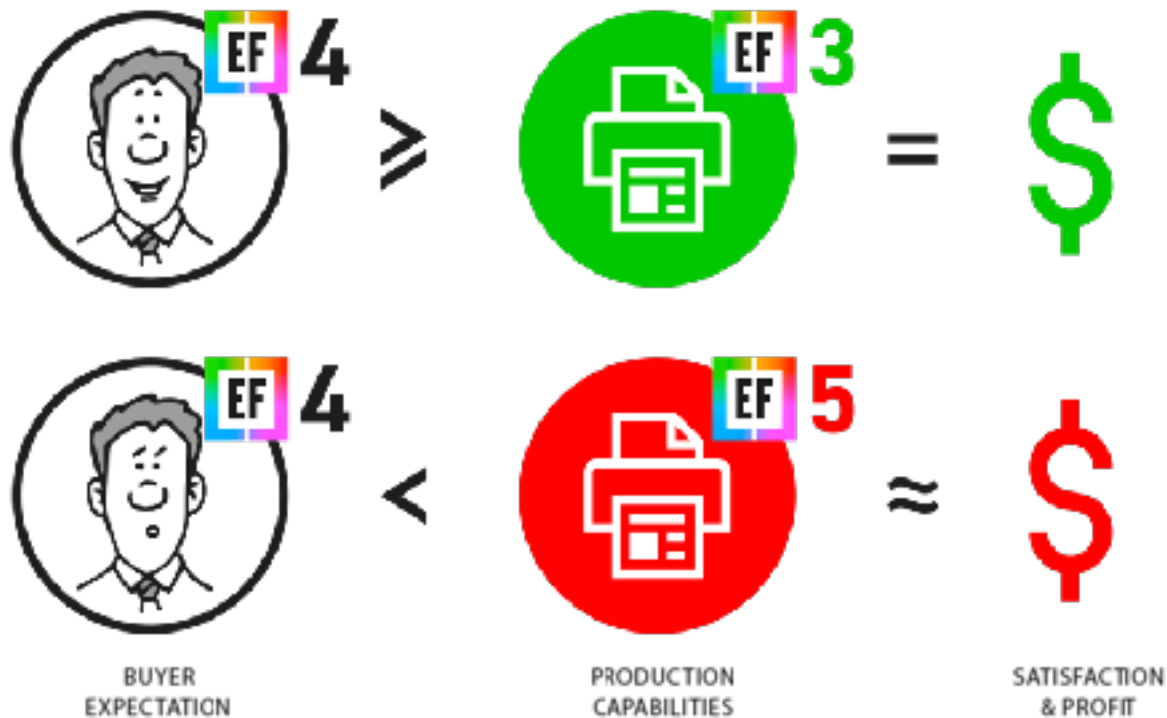
- Goal- Reproduce the Original Color



Conformance- is it Salable?

Summary/Result of all 5 C's - is the print salable?

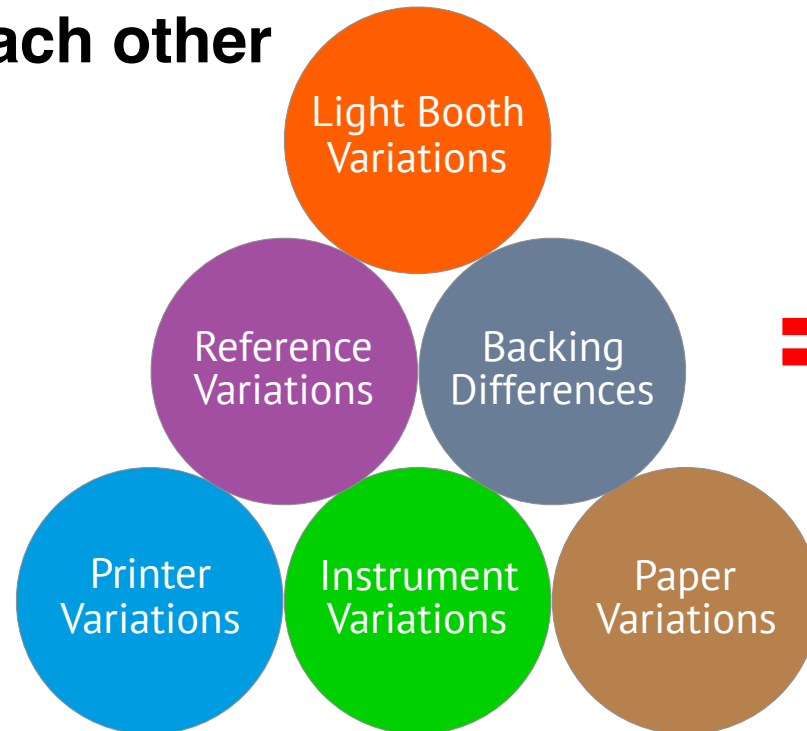
- Does Print meet customer expectations (E-Factor)?
- Provide Job reports proving to customer job success



Each Variable Stacks on Top of Each Other

Cumulative Process:

- Each Workflow Component is tracked using ΔE or **E-Factor**
- **They all stack on each other**



$$\text{or } 12 \text{ EF}$$
$$= 8 \text{ EF}$$
$$\text{or } 5 \text{ EF}$$

Salable Print Manufacturing

Road Map to Analytics Based Print Manufacturing

GRAPHIC ARTS

PRINT MANUFACTURING

SUBJECTIVE PERSONAL-BASED JUDGMENT

METRIC-BASED JUDGMENT SCIENTIFIC

VISUAL ASSESSMENT • COMPARATIVE COLOR MEASUREMENT • ADVANCED COLOR CONFORMANCE



VISUAL

Personal perception-based comparison to physical standard

- no knowledge required
- expensive and time-consuming personal supervision
- dependent on the person
- lighting conditions related
- uncontrolled metamerism

EF = 9+

BASIC INSTRUMENTAL

Instrument-based comparison to physical standard

- numerically expressed color differences
- expensive and time-consuming personal supervision
- uncontrolled metamerism
- initial swatch-book inaccuracy

EF = 6-8

COLORIMETRIC AIM

Instrument-based comparison to colorimetric standard

- numerically expressed color differences
- stable color definition
- exchangeable color definition
- the possibility of remote control

EF = 4-5

SPECTRAL AIM

Instrument-based comparison to spectral standard

- numerically expressed color differences
- spot colors, SCTV, CxF/X-4 compliant
- exchangeable color definition
- lighting condition

EF = 2-3

EPSON PROOFER

Track name	Files	Tools	Substrate	EF	Reference Printing Condition	EF	Details
<input type="checkbox"/> Coated	315 files	3.0	Epson inline Sub	0.1	GRACoL2013_CRPC6	2.1	
<input type="checkbox"/> Uncoated	21 files	3.0	Epson inline		GRACoL2013UNC_CRPC6	2.0	

SHOW HIDDEN SETUP ASSISTANT

HP INDIGO 09

Track name	Files	Tools	Substrate	EF	Reference Printing Condition	EF	Details
<input type="checkbox"/> Coated	24 files	3.0			SCCA_GRA_MLX14_1_HPE6	2.0	
<input type="checkbox"/> Uncoated	4 files	3.0			SCCA_OKAverage	2.5	
<input type="checkbox"/> Indigo Baseline	7 files	3.0			SCCA_GlobalHPIndigoTarget_v2	1.7	

SHOW HIDDEN SETUP ASSISTANT

CANON_ARIZONA 360

Track name	Files	Tools	Substrate	EF	Reference Printing Condition	EF	Details
<input type="checkbox"/> Coated	1 file	4.0		3.0	GRACoL2013_CRPC6	3.4	
<input type="checkbox"/> Canon_Arizona_Full Gamut	3 files	4.0			SCCA_Arizona360_Styrene_V316_1 bit	0.5	

SHOW HIDDEN SETUP ASSISTANT

MANROLAND

Track name	Files	Tools	Substrate	EF	Reference Printing Condition	EF	Details
<input type="checkbox"/> Coated	15 files	4.0	ARC1 (the ribbon)	1.2	SCCA_GRAoL2013_CRPC6	3.6	
<input type="checkbox"/> PP film	9 files	5.0			SCCA_CGATS21_CRPC6	3.8	
<input type="checkbox"/> Metalized (printed white)	14 files	6.0			SCCA_CGATS21_CRPC6	4.0	
<input type="checkbox"/> Uncoated Offset	33 files	6.0			SCCA_GRAoL2013UNC_CRPC6	6.1	

SHOW HIDDEN SETUP ASSISTANT

EPSON PROOFER

Track name	Files	Quality	Tools	Substrate	EP	Reference Printing Condition	EP	Details
<input type="checkbox"/> Coated	315 files	3.0		epson inline SUB	0.1	GRACoL2013_CRPC6	2.1	
<input type="checkbox"/> Uncoated	21 files	3.0		Epson inline	0.3	GRACoL2013UNC_CRPC3	2.0	

SHOW HIDDEN SETUP ASSISTANT

HP INDIGO 09

Track name	Files	Quality	Tools	Substrate	EP	Reference Printing Condition	EP	Details
<input type="checkbox"/> Coated	24 files	3.0		High-Gloss	0.5	SCCA GRACoL2013_INPC6	2.0	
<input type="checkbox"/> Uncoated	4 files	3.0		Coagor_Smooth_text	0.3	SCCA OKAverage	2.5	
<input type="checkbox"/> Indigo Baseline	7 files	3.0		PVC	1.2	SCCA GlobalHPIndigoTarget_v2	1.7	

SHOW HIDDEN SETUP ASSISTANT

CANON_ARIZONA 360

Track name	Files	Quality	Tools	Substrate	EP	Reference Printing Condition	EP	Details
<input type="checkbox"/> Coated	1 file	4.0		Textile Banner	1.7	GRACoL2013_CRPC6	3.4	
<input type="checkbox"/> Canon_Arizona_Full Gamut	3 files	4.0		Water Resistant Matte Canvas 375	0.3	SCCA Arizona360_Styrene_V316_1 bit	0.5	

SHOW HIDDEN SETUP ASSISTANT

MANROLAND

Track name	Files	Quality	Tools	Substrate	EP	Reference Printing Condition	EP	Details
<input type="checkbox"/> Coated	15 files	4.0		ABC Litho House	1.2	SCCA GRACoL2013_CRPC6	3.6	
<input type="checkbox"/> PP film	9 files	5.0		Film Ultra-white Glass	0.3	SCCA CGATS21_CRPC5	3.8	
<input type="checkbox"/> Metalized (printed white)	14 files	6.0		MW 24	1.7	SCCA CGATS21_CRPC6	4.0	
<input type="checkbox"/> Uncoated Offset	33 files	6.0		Williamsburg Offset	0.3	SCCA GRACoL2013UNC_CRPC3	6.1	

SHOW HIDDEN SETUP ASSISTANT

EPSON PROOFER

Track name	Files	Score	Tools	Substrate	EP	Reference Printing Condition	EP	Details
<input type="checkbox"/> Coated	815 files	3.0		epson inline SUB	0.1	GRACoL2013_CRPC6	2.1	
<input type="checkbox"/> Uncoated	21 files	3.0		Epson inline	0.3	GRACoL2013UNC_CRPC3	2.0	

SHOW HIDDEN SETUP ASSISTANT

HP INDIGO 09

Track name	Files	Score	Tools	Substrate	EP	Reference Printing Condition	EP	Details
<input type="checkbox"/> Coated	24 files	3.0		High-Gloss	0.5	SCCA_GRA_ML_0114_1_HPE_6	2.0	
<input type="checkbox"/> Uncoated	4 files	3.0		Coagor_Smooth_text	0.3	SCCA_OKAverage	2.5	
<input type="checkbox"/> Indigo Baseline	7 files	3.0		PVC	1.2	SCCA_GlobalHPIndigoTarget_v2	1.7	

SHOW HIDDEN SETUP ASSISTANT

CANON_ARIZONA 360

Track name	Files	Score	Tools	Substrate	EP	Reference Printing Condition	EP	Details
<input type="checkbox"/> Coated	1 file	4.0		Textile Banner	1.7	GRACoL2013_CRPC6	3.4	
<input type="checkbox"/> Canon_Arizona_Full Gamut	3 files	4.0		Water Resistant Matte Canvas 375	0.3	SCCA_Arizona360_Styrene_V316_1 bit	0.5	

SHOW HIDDEN SETUP ASSISTANT

MANROLAND

Track name	Files	Score	Tools	Substrate	EP	Reference Printing Condition	EP	Details
<input type="checkbox"/> Coated	15 files	4.0		ABC Litho House	1.2	SCCA_GRAoL2013_CRPC6	9.3	
<input type="checkbox"/> PP film	9 files	5.0		Film Ultra-white Glass	0.3	SCCA_CGATS21_CRPC5	3.8	
<input type="checkbox"/> Metalized (printed white)	14 files	6.0		MW 24	1.7	SCCA_CGATS21_CRPC6	4.0	
<input type="checkbox"/> Uncoated Offset	33 files	6.0		Williamsburg Offset	0.3	SCCA_GRAoL2013UNC_CRPC3	6.1	

SHOW HIDDEN SETUP ASSISTANT

EPSON PROOFER

Track name	Files	Score	Tools	Substrate	EP	Reference Printing Condition	EP	Details
<input type="checkbox"/> Coated	815 files	3.0		epson inline SUB	0.1	GRACoL2013_CRPC6	2.1	
<input type="checkbox"/> Uncoated	21 files	3.0		Epson inline	0.3	GRACoL2013UNC_CRPC3	2.0	

SHOW HIDDEN SETUP ASSISTANT

HP INDIGO 09

Track name	Files	Score	Tools	Substrate	EP	Reference Printing Condition	EP	Details
<input type="checkbox"/> Coated	24 files	3.0		High-Gloss	0.5	SCCA_GRA_ML_0114_1_HPE_6	2.0	
<input type="checkbox"/> Uncoated	4 files	3.0		Coagor_Smooth_text	0.3	SCCA_OKAverage	2.5	
<input type="checkbox"/> Indigo Baseline	7 files	3.0		PVC	1.2	SCCA_GlobalHPIndigoTarget_v2	1.7	

SHOW HIDDEN SETUP ASSISTANT

CANON_ARIZONA 360

Track name	Files	Score	Tools	Substrate	EP	Reference Printing Condition	EP	Details
<input type="checkbox"/> Coated	1 file	4.0		Textile Banner	1.7	GRACoL2013_CRPC6	3.4	
<input type="checkbox"/> Canon_Arizona_Full Gamut	3 files	4.0		Water Resistant Matte Canvas 375	0.3	SCCA_Arizona360_Styrene_V316_1 bit	0.5	

SHOW HIDDEN SETUP ASSISTANT

MANROLAND

Track name	Files	Score	Tools	Substrate	EP	Reference Printing Condition	EP	Details
<input type="checkbox"/> Coated	15 files	4.0		ABC Litho House	4.3	SCCA_GRAoL2013_CRPC6	9.3	
<input type="checkbox"/> PP film	9 files	5.0		Film Ultra-white Glass	0.3	SCCA_CGATS21_CRPC5	3.8	
<input type="checkbox"/> Metalized (printed white)	14 files	6.0		MW 24	1.7	SCCA_CGATS21_CRPC6	4.0	
<input type="checkbox"/> Uncoated Offset	33 files	6.0		Williamsburg Offset	0.3	SCCA_GRAoL2013UNC_CRPC3	6.1	

SHOW HIDDEN SETUP ASSISTANT

EPSON PROOFER

Track name	Files	Score	Tools	Substrate	EF	Reference Printing Condition	EF	Details
<input type="checkbox"/> Coated	815 files	3.0		epson inline SUB	0.1	GRACoL2013_CRPC6	2.1	
<input type="checkbox"/> Uncoated	21 files	3.0		Epson inline	0.3	GRACoL2013UNC_CRPC3	2.0	

SHOW HIDDEN SETUP ASSISTANT

HP INDIGO 09

Track name	Files	Score	Tools	Substrate	EF	Reference Printing Condition	EF	Details
<input type="checkbox"/> Coated	24 files	3.0		High-Gloss	0.5	SCCA_GRA_ML_0114_1_HPE_6	2.0	
<input type="checkbox"/> Uncoated	4 files	3.0		Coagor_Smooth_text	0.3	SCCA_OKAverage	2.5	
<input type="checkbox"/> Indigo Baseline	7 files	3.0		PVC	1.2	SCCA_GlobalHPIndigoTarget_v2	1.7	

SHOW HIDDEN SETUP ASSISTANT

CANON_ARIZONA 360

Track name	Files	Score	Tools	Substrate	EF	Reference Printing Condition	EF	Details
<input type="checkbox"/> Coated	1 file	4.0		Textile Banner	1.7	GRACoL2013_CRPC6	3.4	
<input type="checkbox"/> Canon_Arizona_Full Gamut	3 files	4.0		Water Resistant Matte Canvas 375	0.3	SCCA_Arizona360_Styrene_V316_1 bit	0.5	

SHOW HIDDEN SETUP ASSISTANT

MANROLAND

Track name	Files	Score	Tools	Substrate	EF	Reference Printing Condition	EF	Details
<input type="checkbox"/> Coated	15 files	4.0		ABC Litho House	4.3	SCCA_GRAoL2013_CRPC6	9.3	
<input type="checkbox"/> PP film	9 files	5.0		Film Ultra-white Glass	0.3	SCCA_CGATS21_CRPC5	3.8	
<input type="checkbox"/> Metalized (printed white)	14 files	6.0		MW 24	1.7	SCCA_CGATS21_CRPC6	4.0	
<input type="checkbox"/> Uncoated Offset	33 files	6.0		Williamsburg Offset	0.3	SCCA_GRAoL2013UNC_CRPC3	6.1	

SHOW HIDDEN SETUP ASSISTANT



Color Control

Define Conformance

Presented by: David Hunter

5 C'S OF COLOR CONTROL AGENDA

Process Discipline for each color printer

Conformance — assess where your printers are at...

Capture — assess instrumentation capabilities

Calibration — make device consistent to itself & over time

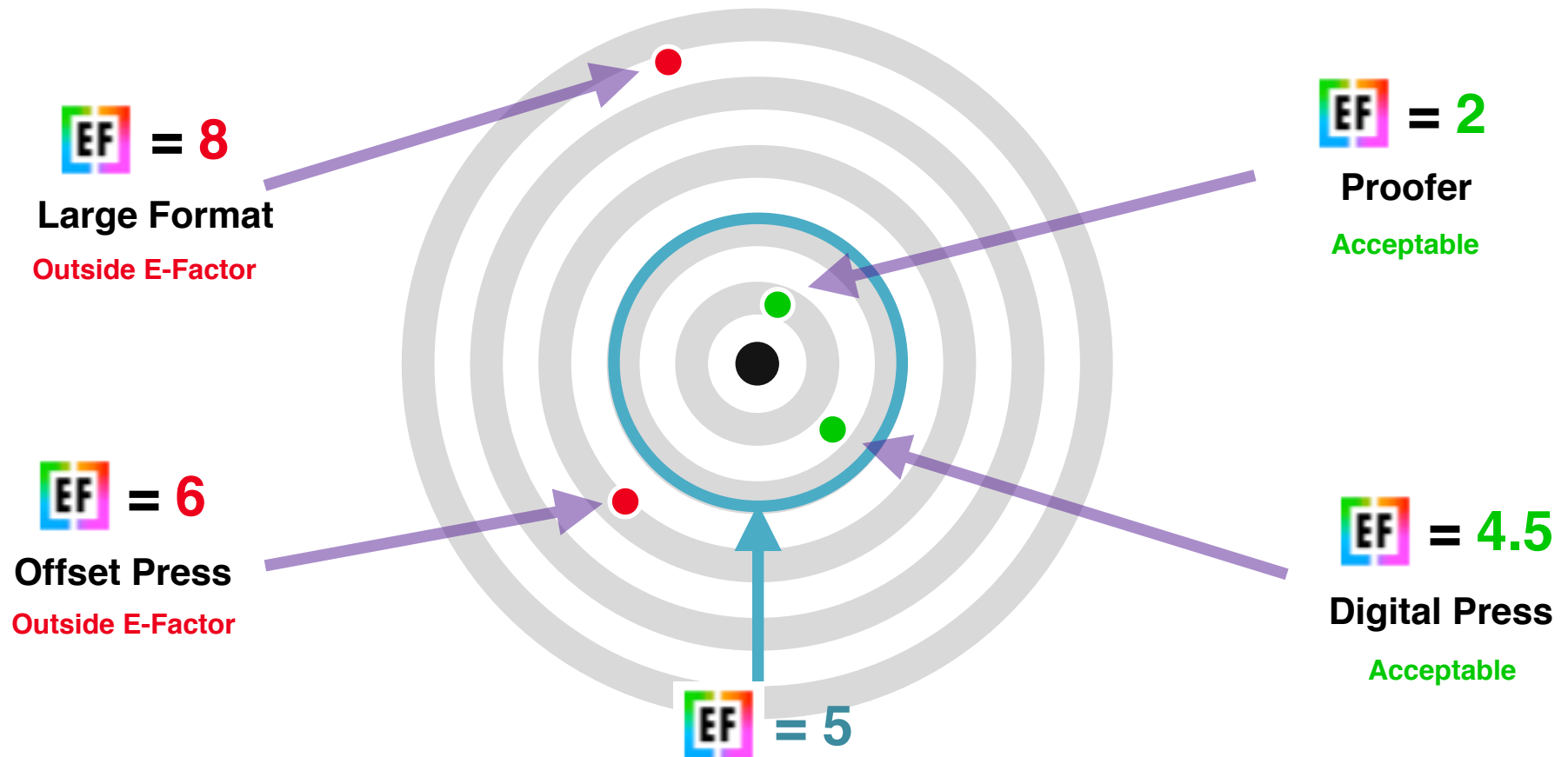
Characterization — define device gamut and create profile

Conversion — map one gamut to another in the workflow

Conformance — verify new results and meet expectations

HOW CLOSE IS "CLOSE ENOUGH"?

What's your color "match" Expectation Factor



Expectation Factor **EF** is the distance from the bullseye which is salable

Conformance Expectations

Quantify Color Expectations

- Baseline how printing devices are performing
- Visually understand where printers are at today
- Determine if you need to improve any of them
- Look at 5C's to improve printers if required
- Prioritize resources based on expectations

Conformance Expectations

Baseline Kit Purpose

- Visual images to assess color expectations
 - Compare to GRACoL* and to one another
- Easily measure using CC Capture
 - Will assess E-Factor and G7 compliance
 - Works with most measurement instruments
 - Works on Mac or Windows
- Includes PDF (to print) and software to measure

* Requires E-Factor Exercise (\$99) to compare to GRACoL

Conformance Expectations

Baseline Printing Devices

- Register and Download Benchmark App and files
- Print ChromaChecker PDF out on all printers
 - Use Normal Production settings
- Measure using CC Capture
- Record E-Factor value at top
- Lower E-Factor- closer to GRACoL
- Compare to one another



Determine Conformance Expectations

Visually compare prints to one another

- EF number shows how different from GRACoL*



Proofer

EF = 2



Large
Format

EF = 8



Digital
Press

EF = 4.5



GRACoL
Sample

Included with
E-Factor Exercise
\$99

ChromaChecker

© Copyright 2023 ChromaChecker Corp

Determine Expectations

Compare prints to reference and one another

- E-Factor Difference to GRACoL



Determine E-Factor: Expectations

Factors to Consider

- Different customers have different expectations
- Evaluate how satisfied current customers are
- Nothing wrong with having high E-Factor if salable
- Start with higher E-Factor, reduce if necessary
 - Don't set the bar too hard to begin with
 - Will lose support of operators and staff
 - Need to provide more time, tools, training to lower

